Mountaineer Power Plant

Notice of Intent to Comply With the Site-Specific Alternative to Initiation of Closure

CCR Unit – Bottom Ash Pond

As required by 40 CFR 257.103(f)(1)(ix)(A), this is a notification that on November 30, 2020 Mountaineer Power Plant (Mountaineer Plant) submitted a site-specific alternative to initiation of closure due to development of alternative capacity infeasible to US EPA. The submission has been placed in Mountaineer Plant's operating record and posted to the CCR Rule Compliance Data and Information website.

American Electric Power
1 Riverside Plaza
Columbus, OH 43215
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November 30, 2020

Submitted Electronically via Email

Mr. Andrew R. Wheeler, EPA Administrator
Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Mail Code 5304-P
Washington, DC 20460

RE: Appalachian Power Company
Mountaineer Power Plant Alternative Closure Demonstration

Dear Administrator Wheeler,

Appalachian Power Company (APCO) Mountaineer Power Plant (Mountaineer Plant) hereby submits this request to the U.S. Environmental Protection Agency (EPA) for approval of a site-specific alternative deadline to initiate closure pursuant to 40 C.F.R. § 257.103(f)(1) for the Bottom Ash Pond located at the Mountaineer Plant near New Haven, West Virginia. Mountaineer Plant is requesting an extension pursuant to 40 C.F.R. § 257.103(f)(1) to allow the Bottom Ash Pond to continue to receive CCR and non-CCR wastestreams after April 11, 2021, such that retrofits can be completed. Enclosed is a demonstration prepared by American Electric Power and Worley that addresses all of the criteria in 40 C.F.R. § 257.103(f)(1)(i)-(iii) and contains the documentation required by 40 C.F.R. § 257.103(f)(1)(iv). As allowed by the agency, in lieu of hard copies of these documents, electronic files were submitted to Kirsten Hillyer, Frank Behan, and Richard Huggins via email. A separate cover letter and confidential copy of Appendix C is being submitted in hard copy by overnight mail. If you have any questions regarding this submittal, please contact me at 614-716-2281 or damiller@aep.com.

Sincerely,

David A. Miller

David A. Miller, P.E.
Director, Land Environment & Remediation Services
Environmental Services Division

Attachments

cc: Kirsten Hillyer – USEPA
Frank Behan – USEPA
Richard Huggins – USEPA

BOUNDLESS ENERGY

Appalachian Power Company

Mountaineer Plant

Demonstration Request to Develop Alternative Disposal Capacity for the Bottom Ash Pond CCR Unit

Prepared by:

American Electric Power Service Corporation
1 Riverside Plaza
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and

Worley
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Submitted

11/30/2020

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Professional Engineer's Certification

I certify, as a Professional Engineer in the State of West Virginia, that the information in this document was assembled under my direct supervisory control and is accurate as of the date of my signature. This report is not intended or represented to be suitable for reuse without the specific verification or adaptation by the engineer.

DAVID ANTHONY MILLER

Printed Name of Registered Professional Engineer

David Anthony Miller

Signature

22663	WEST VIRGINIA	11.30.2020
Registration No.	**Registration State**	**Date**

INTRODUCTION

American Electric Power Service Corporation (AEP) as agent for its affiliate, Appalachian Power Company (APCO), the owner and operator of the Mountaineer Plant, seeks EPA approval under 40 CFR 257.103(f) (1) - *"Development of Alternate Capacity Infeasible"* for the coal combustion residuals (CCR) surface impoundment located at Mountaineer Plant (1347 Graham Station Road, Mason County, Letart, West Virginia). APCO seeks to establish a site-specific compliance deadline to continue to receive CCR wastestreams in the bottom ash pond (BAP CCR Unit) until March 31, 2022 while the generating unit is converted to dry ash handling. Non-CCR wastestreams will continue to be routed to the unlined BAP until January 9, 2023. The east and west basins of the BAP CCR Unit will be sequentially closed by removal and converted to lined wastewater ponds for the non-CCR wastestreams. Tank-based systems will provide chemical treatment for the non-CCR wastestreams to assure continued compliance with the requirements of the facility's wastewater discharge permit. Closure of the BAP CCR Unit will be completed by July 21, 2023.This document will demonstrate that the CCR and/or non-CCR wastestreams must continue to be managed in the CCR surface impoundments because no alternative disposal capacity is available on or off-site and it is technically infeasible to complete the measures necessary to provide alternative disposal capacity either on-site or off-site by April 11, 2021.

OVERVIEW OF MOUNTAINEER PLANT AND AFFECTED CCR UNITS

The Mountaineer Plant, located in Mason County, is bounded by Little Broad Run to the west and the Ohio River to the East. The plant is approximately two miles east of New Haven, West Virginia. The Mountaineer Plant began operations in 1980 as a coal-fired generating power plant with a net generating capacity of 1300 megawatts. Throughout the life of the generating plant, CCR material has been generated. To manage the wet bottom ash and wastewater generated from the plant, the Mountaineer Plant operates one active CCR surface impoundment with two basins called the east and the west bottom ash ponds (collectively, the "BAP CCR Unit"). The BAP CCR Unit is located on the south side of the plant adjacent to and on the west side of West Virginia Route 62 (Graham Station Road) as shown in **Figure 1**. The Unit is already equipped to manage flyash on a dry basis, and flyash is disposed of at the CCR landfill on the site.

The east and west basins of the BAP CCR Unit are utilized in alternating fashion, with one pond generally receiving wastestreams while the other pond is being cleaned out. Separately diked ponds receive the treated wastewaters leaving the BAP CCR Unit. The BAP CCR Unit decant flows to the east or west Wastewater pond, then to the Reclaim pond and/or the Clearwater pond. These ponds provide serial finishing and treatment of wastewaters prior to discharge from the Clearwater pond, where water flows to the Ohio River through Outfall 001 as authorized by West Virginia National Pollutant Discharge Elimination System (NPDES) Permit No. WV0048500.

The total surface area of the Mountaineer BAP CCR Unit is approximately 28 acres. The east and west ponds have a combined normal reservoir volume of 345 acre-feet and a maximum reservoir volume of 491 acre-feet. The Mountaineer BAP CCR Unit is unlined and was constructed between 1978 and 1980 with diked embankments on the north, east, and west sides. The south side is incised.

The BAP CCR Unit is separated by a splitter dike that was designed and constructed of homogenous material from soil borrowed from the site. The bottom of the BAP CCR Unit was constructed with approximately three feet of clay from offsite borrow areas to control seepage. The perimeter dike around the BAP CCR Unit and adjacent Wastewater, Reclaim and Clearwater ponds

is approximately 7600 linear feet with an approximate width of 30 feet. The inboard and outboard slopes are 2.5 (H) to 1 (V).

Groundwater at the unit is monitored in accordance with an assessment monitoring program, following the requirements of 40 CFR 257.95 in the CCR rule. Statistically significant levels above the lithium groundwater protection standards have been observed. The BAP CCR Unit has completed the characterization of the release per the requirements of 40 CFR 257.95 and 257.96, and the Selection of Remedy per the requirements of 40 CFR 257.97 is ongoing by the engineer of record. Groundwater samples from each monitoring well are analyzed for all parameters in appendix IV of the CCR rule during the first monitoring event of the annual monitoring cycle. During the two subsequent events in the annual cycle, samples from each well are analyzed for all parameters in appendix III and those parameters in appendix IV that were detected during the first sampling event in the cycle. Analytical results for each constituent at each monitoring well are compared to corresponding groundwater protection standards according to statistical procedures and performance standards specified in 40 CFR 257.93(f) and 40 CFR 257.93(g).

SATISFACTION OF THE CRITERIA IN 40 CFR §257.101(f)(1) FOR THE BAP CCR Unit

WORK PLAN

To demonstrate that the criteria in 40 C.F.R. § 257.103(f)(1)(i) and (ii) have been met, the following is a workplan, consisting of the elements required by § 257.103(f)(1)(iv)(A). Specifically, this workplan documents that there is no alternative capacity available on or off-site for each of the CCR and/or non-CCR wastestreams that are managed in the BAP CCR Unit and discusses the options considered for obtaining alternative disposal capacity. As discussed in more detail below, AEP has elected to convert to dry bottom ash handling at the Mountaineer Plant. The workplan provides a detailed schedule for the conversion project, including a narrative description of the schedule and an update on the progress already made toward obtaining the alternative capacity. In addition, the narrative includes an analysis of the site-specific conditions that led to the decision to convert to dry bottom ash handling and an analysis of the adverse impact to plant operations if the Mountaineer Plant were no longer able to use the CCR surface impoundments.

Section One - Narrative Description of How Alternative Capacity will be Developed

From the regulatory text § 257.103(f)(1)(iv)(A)(1)

> *(1) A written narrative discussing the options considered both on and off-site to obtain alternative capacity for each CCR and/or non-CCR wastestreams, the technical infeasibility of obtaining alternative capacity prior to April 11, 2021, and the option selected and justification for the alternative capacity selected. The narrative must also include all of the following:*
>
> *(i) An in-depth analysis of the site and any site-specific conditions that led to the decision to select the alternative capacity being developed;*
> *(ii) An analysis of the adverse impact to plant operations if the CCR surface impoundment in question were to no longer be available for use; and*
> *(iii) A detailed explanation and justification for the amount of time being requested and how it is the fastest technically feasible time to complete the development of the alternative capacity;*

Existing On and Off-site Disposal Capacity Evaluation

The Mountaineer Plant does not currently have an existing alternate pond that meets the liner requirements of EPA's CCR regulation, and considerable modifications to plant equipment, facilities, and processes will be necessary before the Mountaineer Plant can cease placing CCR and non-CCR wastestreams into the BAP CCR Unit. Likewise, considerable modifications and new equipment would be necessary to transport CCR and non-CCR wastestreams to an off-site disposal facility, if one were available. Currently, no known off-site facilities are available that are capable of processing the wastestreams generated by the Mountaineer Plant.

CCR Wastestreams:

The BAP CCR Unit receives approximately 2.2 million gallons a day (MGD) of sluiced water containing bottom ash.

In terms of on-site alternative disposal capacity; there are no other CCR surface impoundments that are available to dispose of the CCR materials. In order to develop this capacity refer to Table 3 and the timing required to do so; the current approach is the fastest feasible alternative which is to convert the Unit to dry bottom ash handling and utilize the existing landfill. The sheer volume which will need to be handled on a daily basis makes off-site disposal of wet ash impractical. 2.2 MGD of bottom ash sluice flows equates to approximately 9,130 tons per day of sluiced water and would require 457 trucks per day (or one truck every three minutes) twenty four hours per day seven days per week to haul off and dispose. There are currently no facilities to collect and load this wastestream into tankers for transport, and construction of such facilities to manage these flows on a temporary basis would interfere with the activities needed to comply with the new requirements of both the CCR and ELG rules. The increase in traffic associated with such an operation on the plant site poses significant safety risks and is impossible to achieve. The most likely facility type capable of managing industrial wastewaters are publicly-owned or private treatment works, underground injection wells, or publicly available waste management facilities capable of solidifying liquid wastes for disposal in a landfill. Given the volume and characteristics of the CCR wastestream, increases in permitted capacity or other modifications to the permitted pretreatment programs of a public or private wastewater treatment facility would likely be required to manage this flow, if one were available.

AEP evaluated each CCR wastestream placed in the BAP CCR Unit at the Mountaineer Plant. For the reasons discussed above, and in Table 1 below, the following CCR wastestreams must continue to be placed in the BAP CCR Unit due to lack of alternative capacity both on and off-site.

Table 1: Mountaineer Plant CCR Wastestreams

CCR Wastestream	Average Flow (gpd)	Current Configuration	AEP Notes
Bottom Ash	2,200,000	Bottom ash is currently sluiced to the BAP CCR Unit, where it is temporarily stored until removed, dewatered and beneficially reused or disposed of on-site in a CCR compliant landfill.	Bottom ash wastestream cannot be removed from the BAPs until new Under Hopper Drag Chain (UHCD) dry bottom ash system is installed allowing ash to be collected and transported to the onsite landfill. This wastestream will cease in March 2022. The number of trucks per day to transport this wastestream off-site for disposal was calculated as follow: 2.2 million gallons per day * 8.3 pounds per gallon = 18,260,000 pounds / 2000 pounds per ton = 9,130 tons per day / 20 tons per truck = 456.5 → 457 trucks per day

Non-CCR Wastestreams:

Approximately 8.5 MGD of various non-CCR wastestreams are sent to the BAP CCR Unit. These wastewater streams include coal pile runoff, limestone and gypsum area runoff, fly ash silo sump water, pyrites transfer water, various low volume wastestreams (wash down of the plant areas) to plant drains and sumps, and storm water runoff.

There are no alternate ponds on the site, including the existing wastewater, reclaim, and clearwater ponds downstream of the bottom ash ponds, that can accept these waststreams nor is there the existing infrastructure to deliver the wastestreams to a different location. Re-routing these flows to another on-site pond would decrease the settling time, increase loadings to the ponds, and require permitting equivalent to the permitting required for the selected alternative. A hydraulic analysis was performed to verify whether the non-CCR wastestreams could be rerouted from a treatment perspective. The ideal solids settling rate is 0.05 gpm/sqft or less, with the recommendation that it not exceed 0.10 gpm/sqft. At the design peak instantaneous flow of 30,000 gpm, the settling rate would be approximately 0.14 and 0.095 gpm/sqft for the 9-acre east and 12-acre west wastewater ponds, respectively. With these settling rates well above the ideal rate, there would be an increased risk for solids carryover to the clearwater and reclaim ponds that could result in violations of the NPDES discharge limits, as well as negatively impact the wear on other systems at the plant which are fed from the reclaim pond. Even if the treatment efficiency were not an issue, rerouting the non-CCR wastestreams would require temporary re-configuration of the existing infrastructure and additional time to engineer, design, procure and construct. Additional construction to reroute these flows to the new tank based chemical treatment system would also be required. Allowing the existing delivery systems to be maintained thus expedites the compliance schedule. Therefore, APCO has selected a compliance option that allows the existing non-CCR wastestreams to be discharged to the existing ponds and receive treatment in the current existing treatment path through the bottom ash ponds to ensure and maintain compliance with current NPDES permit limits. In addition, once the bottom ash ponds are closed and converted to lined wastewater ponds the majority of these non-CCR wastesteams will be routed through the new mix tanks, which will be constructed in parallel with the new East wastewater pond, to allow for enhanced solids settling. Relative to off-site disposal capacity and

similar to bottom ash, the sheer volume which will need to be handled on a daily basis makes this impractical. 8.5 MGD equates to approximately 35,192 tons per day of non-CCR wastestreams and would require 1,760 trucks per day (more than one truck leaving the plant site every minute of every day) to haul off and dispose of. There are currently no facilities to collect and load these wastestreams into tankers for transport, and construction of such facilities to manage these flows on a temporary basis would interfere with the activities needed to comply with the new requirements of both the CCR and ELG rules. The increase in traffic associated with such an operation on the plant site poses significant safety risks and is impossible to achieve. The most likely facility type capable of managing industrial wastewaters are publicly-owned or private treatment works, underground injection wells, or publicly available waste management facilities capable of solidifying liquid wastes for disposal in a landfill. Given the volume and characteristics of the non-CCR wastestreams, increases in permitted capacity or other modifications to the permitted pretreatment programs of a public or private wastewater treatment facility would likely be required to manage this flow, if one were available.

AEP evaluated each non-CCR wastestream placed in the BAP CCR Unit at Mountaineer. For the reasons discussed above, and in Table 2 below, each of the following non-CCR wastestreams must continue to be placed in the BAP CCR Unit due to lack of alternative capacity both on and off-site.

Table 2: Mountaineer Plant non-CCR Wastestreams

Non-CCR Wastestream	Average Flow (gpd)	Current Configuration	AEP Notes
Coal Pile Runoff Ponds (includes Limestone & Gypsum Area Runoff) and Storm Water Sump	200,000 plus 180,000 gallons from Storm Water Sump	Flows to the existing BAP CCR Unit	The BAP CCR Unit provides treatment for these non-CCR wastestreams (primarily solids settling) to allow them to meet the NPDES discharge limits and no alternative capacity exists for treatment until the WWP is completed and the new chemical mix tank
North and South Fly Ash Silo Sumps	3,100,000	Flows to the existing BAP CCR Unit	

Non-CCR Wastestream	Average Flow (gpd)	Current Configuration	AEP Notes
Turbine Room Sump	3,700,000	Flows to the existing BAP CCR Unit	systems are installed and operational. The number of trucks per day to transport these wastestreams off-site for disposal was calculated as follows: 380,000 gallons per day * 8.3 pounds per gallon = 3,154,000 pounds / 2000 pounds per ton = 1577 tons per day / 20 tons per truck = 78.85 → 79 trucks per day 3,100,000 gallons per day * 8.3 pounds per gallon = 25,730,000 pounds / 2000 pounds per ton = 12,865 tons per day / 20 tons per truck = 643.25 → 644 trucks per day 3,700,000 gallons per day * 8.3 pounds per gallon = 30,710,000 pounds / 2000 pounds per ton = 15,355 tons per day / 20 tons per truck = 767.75 → 768 trucks per day
Pyrite Transfer Water	1,300,000	Sluiced to the existing BAP CCR Unit	Pyrite material will be sluiced to the new East Settling Pond Forebay before being dewatered and transported to the onsite landfill. The number of trucks per day to transport this wastestream off-site for disposal was calculated as follow: 1,300,000 gallons per day * 8.3 pounds per gallon = 10,790,000 pounds / 2000 pounds per ton = 5,395 tons per day / 20 tons per truck = 269.75 → 270 trucks per day.

i) Alternatives for Disposal Capacity

In order to comply with the CCR rule, AEP performed an evaluation (beginning in 2017 and completed in 2018) of alternative disposal capacity options at the Mountaineer Plant for both

CCR and non-CCR wastestreams that are managed in the BAP CCR Unit. The evaluation determined the feasibility of options to achieve CCR compliance requirements. Feasible options were evaluated by balancing the technology, performance, schedule duration, other risk factors, and considered potential Effluent Limitation Guidelines (ELG) compliance alternatives.

The options considered for alternative disposal capacity of the wastestreams currently routed to the BAP CCR Unit are summarized in **Table 3** below.

Table 3: Alternatives for Disposal Capacity

Alternative Capacity Technology	Estimated Implementation Time (Months)	Feasible at the Mountaineer Plant?	Selected?	AEP Notes
Conversion to dry handling	21	Yes	Yes	Adequate space is available at the site to install equipment necessary for a dry bottom ash conversion. This alternate has a similar compliance schedule to the other alternatives considered and allows for compliance with ELG rules.
New CCR surface impoundment	38 to 72	No	No	New CCR impoundment alone does not provide compliance with the ELG rules. Not feasible due to the time required for siting, permitting, engineering and design, and construction of the new impoundment. Past AEP projects experienced a range from 38-72 months before waste could be placed in the new impoundment and thus was not further pursued.
Retrofit a portion of CCR surface impoundment to a CCR compliant liner system	31.5	Yes	No	Retrofitting a portion of the pond alone will not bring the facility into compliance with the ELG rule without additional water recycle systems that have an uncertain impact on the plant water balance; the dry ash handling systems have a similar compliance schedule.
Repurpose a portion of CCR surface impoundment to a lined pond for non-CCR wastestreams	29	Yes	Yes	This alternative was selected for the Mountaineer Plant since the existing BAP complex currently handles the existing non-CCR wastestreams and provides the treatment capacity required to comply with the facility's NPDES permit. These ponds will be closed by removal and converted to lined wastewater ponds.

Alternative Capacity Technology	Estimated Implementation Time (Months)	Feasible at the Mountaineer Plant?	Selected?	AEP Notes
Multiple technology system	21 to 29	Yes	Yes	This alternative was selected for the Mountaineer Plant since the existing BAP CCR Unit has the capacity to receive the non-CCR wastestreams once it is closed and converted to lined wastewater ponds. Dry handling of the bottom ash (21 months) and repurposing the ponds to receive non-CCR wastestreams (29 months) will provide the necessary compliance needs on the fastest feasible schedule for the site balancing both CCR and ELG rule requirements.
Off-Site Disposal	N/A	No	No	As EPA explained in the preamble of the 2015 rule, it is not possible for sites that sluice CCR material to an impoundment to eliminate the impoundment and dispose of the material offsite. See 80 Fed. Reg. 21,301, 21,423 (Apr. 17, 2015) It is infeasible to collect, transport, and provide offsite treatment of the large volume of CCR and non-CCR wastestreams currently routed to the BAP CCR Unit without considerable modifications and new equipment necessary to transport CCR and non-CCR wastestreams to an off-site disposal facility, if one were available.
Temporary treatment system	Not Defined	No	No	These systems are not proven for reliable long-term management of high volume CCR materials in the industry and would not realistically provide the required non-CCR wastewater storage capacity to replace the BAP CCR Unit. Temporary treatment systems to manage the CCR and non-CCR wastestreams for Mountaineer Plant would require a chemical feed system, chemical mix tanks, clarifiers, and a filtration system. Based on the flow rates, the number and size of clarifiers required to handle these streams outside of the BAP CCR Unit would range from 2 to 4, 140 foot diameter tanks based upon typical and max flow characteristics. The size of this temporary system is well beyond any type of rental units that are available in the market.

Based on the decision to convert to a dry ash handling system at the Mountaineer Plant, AEP evaluated potential options for compliance with both the CCR and ELG rules as noted in **Table 4** below.

Table 4: Alternatives Considered for CCR Wastestreams

System	Technology	Practicability or Feasibility for the Mountaineer Plant
Bottom Ash	Under Hopper Drag Chain Conveyor System	Feasible
Bottom Ash	Remote Drag Chain Conveyor System	Feasible. Challenging to add remote pumps and power supply for recirculation not required with other options. Risk associated with managing plant water balance.
Bottom Ash	Dry Belt/Tray Conveying System	Feasible
Bottom Ash	Pneumatic Conveying System	Feasible
Bottom Ash	Vibratory Conveying System	Not practicable; requires frequent labor intensive maintenance and no longer industry standard practice for bottom ash (replaced by remote conveyors for similar costs)
Bottom Ash	Remote Settling Basins	Not practicable; requires frequent labor intensive maintenance and both water balance and safety concerns. Challenging to add remote pumps and power supply for recirculation that is not required with other options.
Bottom Ash	Remote Dewatering Bins	Not practicable; requires frequent labor intensive maintenance and no longer industry standard practice for bottom ash (option replaced by remote conveyors for similar costs)
Bottom Ash	Closed Loop Recirculation System	Not practicable; risks associated with managing plant water balance.

Timeframe for delivering dry ash handling alternatives were determined to be equivalent and not a factor in the final selection.

Based on the evaluation of alternative disposal options, AEP selected the following options for compliance at the Mountaineer Plant:

- Converting from wet bottom ash system to dry handling system, using a under hopper drag chain conveyor (UHDC).
- Closure of the BAP CCR Unit by removal.
- Installing new non-CCR wastewater settling ponds within the footprint of the BAP CCR Unit.

This alternative and strategy can be implemented in the least amount of time of the alternatives evaluated and accommodates the unique site features such as quantity of wastestreams and the lack of off-site disposal facilities. This alternative complies with both the CCR and ELG rules at the Mountaineer Plant.

AEP contracted with Worley to provide engineering, design and procurement services for the selected alternative disposal option. The conceptual design stage of the projects has been completed and includes the following scope:

- Dry Bottom Ash Handling System
  - Installation of an UHDC and associated equipment to collect and dewater bottom ash.
  - Installation of concrete ash bunker to collect and temporarily store CCR material from the UHDC.
  - Installation of a sump at new ash bunker to collect storm water or excess quench water and return to ash hopper pit sump.
  - Material from ash bunker to be hauled to Mountaineer landfill for disposal or be sold for beneficial reuse.

- Bottom Ash Pond Closure by Removal
  - All CCR material within the existing BAP CCR Unit will be removed via dewatering and mechanical excavation. All CCR material will either be hauled to the Mountaineer landfill for disposal or beneficially reused. Work will be completed sequentially in the East and West basins.
  - A third-party engineer will independently certify the removal of CCR upon completion. Certification will be performed in phases across the entire BAP CCR Unit.
  - After certification of removal of all CCR within a given area of the existing BAP CCR Unit, construction of the new non-CCR wastewater Settling Ponds will proceed.

- New Non-CCR Wastewater Ponds
  - The new (14-acre) lined East Settling Pond will be constructed within the footprint of the existing East basin of the BAP CCR Unit, to treat non-CCR wastestreams generated at the plant. The East Settling Pond will discharge to the existing East Wastewater Pond, which will continue to discharge (in series) to the existing Reclaim Pond, Clearwater Pond, and the Ohio River through West Virginia NPDES Permit No. WV0048500 Outfall 001.
  - The new (14-acre) lined West Settling Pond will be constructed within the footprint of the existing West basin of the BAP CCR Unit, to treat non-CCR wastestreams generated at the plant. The West Settling Pond will discharge to the existing West Wastewater Pond, which will continue to discharge (in series) to the existing Reclaim Pond, Clearwater Pond, and the Ohio River through NPDES Outfall 001.
  - Installation of tank-based chemical treatment system with appropriate retention time to provide proper mixing of chemicals to facilitate settling to meet plant discharge requirements at the new Non-CCR wastewater ponds as necessary to meet plant discharge requirements.

Appendix A includes a site plan showing the existing and future configurations after rerouting of non-CCR wastewater and removal of CCR from the BAP CCR Unit. The existing and future water balances are included in **Appendix B**.

ii) Impact to Plant Operations if Alternative Capacity Not Obtained

If the Mountaineer Plant were required to immediately cease the placement of CCR and non-CCR wastestreams into the BAP CCR Unit, which is necessary for handling more than 10 MGD of CCR and non-CCR wastestreams, and initiate closure, AEP would have to temporarily or permanently cease power production at the Mountaineer Plant. Idling or closure of the Mountaineer Plant would stop the production of CCR wastestreams and some non-CCR wastestreams, but would not eliminate the need for handling other non-CCR wastestreams, such as coal pile runoff and low volume wastewater from various water collection sumps from around the plant. The BAP CCR Unit is integral in receiving and treating these flows as required to meet the NPDES discharge limits. Therefore, the need for uninterrupted non-CCR wastestream capacity in the BAP CCR Unit will be necessary for a significant amount of time until alternate capacity from the new wastewater ponds is available. Put simply, the BAP CCR Unit will be unable to immediately cease operation even if the Mountaineer Plant immediately discontinued the combustion of coal and production of CCR wastestreams.

The immediate forced cessation of power production at the Mountaineer Plant could cause serious local power delivery constraints and more regional reliability concerns in the affected states. If other coal-fired facilities in these or neighboring states are also forced to cease power production, the consequences could be serious. For example, according to the Energy Information Administration's Electric Power Annual for 2019, coal-fired units provided the following percentages of electricity generation in 2018 and 2019, in the midwestern states where AEP's units operate:

Utility Scale Generation from Coal – 2018•

State	Total Utility Scale Generation (Thousands MWh)	Utility Scale Generation from Coal (Thousands MWh)	Percentage of Utility Scale Generation from Coal
Indiana	113,460	77,455	68.3%
Kentucky	78,804	59,168	75.1%
Ohio	126,185	58,727	46.5%
West Virginia	67,249	62,039	92.3%

- Data from *Electric Power Annual 201*9, Tables 3.7 and 3.8, Energy Information Administration, eia.gov/electricity/annual/pdf/epa.gov (last referenced October 26, 2020).

Utility Scale Generation from Coal – 2019•

State	Total Utility Scale Generation (Thousands MWh)	Utility Scale Generation from Coal (Thousands MWh)	Percentage of Utility Scale Generation from Coal
Indiana	102,505	60,762	59.3%
Kentucky	71,804	51,714	72.0%
Ohio	120,001	46,765	39.0%
West Virginia	63,926	58,182	91.0%

- Data from *Electric Power Annual 201*9, Tables 3.7 and 3.8, Energy Information Administration, eia.gov/electricity/annual/pdf/epa.gov (last referenced October 26, 2020).

As shown in these tables, West Virginia in particular is heavily dependent on coal-fired units for the vast majority of electricity produced in the state. Simultaneous immediate closure of a significant portion of the coal-fired capacity in these states could destabilize the electricity grid and would not be in the public's best interest.

iii) Justification for Time Needed to Complete Development of Alternative Capacity Approach

The schedule for developing alternative disposal capacity is described in more detail in Section 3. As the schedule shows, AEP has already undertaken significant planning and implementation steps towards ceasing the receipt of CCR and non-CCR wastestreams within the BAP CCR Unit. Finalization of the both the CCR and ELG rules impacts APCO's ability as a regulated utility to obtain regulatory approval for the required capital expenditures to comply with both rules. This schedule represents the fastest technically feasible timeframe for compliance at the Mountaineer Plant, and is driven primarily by the need for a major outage to allow for removal of the current sluicing equipment and installation of the new UHDC equipment. The Mountaineer Plant serves the PJM interconnection which manages the grid to provide electricity to 13 states and the District of Columbia. Outages are planned in advance with the Regional Transmission Operator (RTO) to effectively manage the generation capacity footprint. The RTO does not typically allow the Mountaineer Plant much flexibility to adjust these outages or perform them in the non-shoulder months (summer and winter) due to the limited generating capacity during these peak electricity usage times and resulting potential impacts to grid stability. The sequencing and final tie-ins associated with this work as described in the work plan in Section 3 further elaborates on the complexities associated with this option. The Unit must be converted to dry bottom ash handling in order to cease receipt of CCR wastestreams in the current configuration. The total project duration of approximately 29 months from the date AEP initiated detailed design (August 2020) until the date that CCR sluicing is ceased and alternative capacity is provided for non-CCR wastestreams (January 9, 2023) is less than the average multiple technology system timeline of 39.1 months identified in the EPA Final Part A rule.

Section Two – Visual Timeline Depicting the Steps Necessary to Obtain Alternative Capacity

From the regulatory text § 257.103(f)(1)(iv)(A)(2)

> *(2) A detailed schedule of the fastest technically feasible time to complete the measures necessary for alternative capacity to be available including a visual timeline representation. The visual timeline must clearly show all of the following:*
>
> *(i) How each phase and the steps within that phase interact with or are dependent on each other and the other phases;*
> *(ii) All of the steps and phases that can be completed concurrently;*
> *(iii) The total time needed to obtain the alternative capacity and how long each phase and step within each phase will take; and*
> *(iv) At a minimum, the following phases: engineering and design, contractor selection, equipment fabrication and delivery, construction, and start up and implementation.*

Appendix C contains a timeline that illustrates all relevant phases and details the steps necessary for implementation of obtaining Alternative Capacity.

Section Three – Narrative of the Schedule and Timeline to Obtain Alternative Capacity

From the regulatory text § 257.103(f)(1)(iv)(A)(3).

> *(3) A narrative discussion of the schedule and visual timeline representation, which must discuss all of the following:*

(i) Why the length of time for each phase and step is needed and a discussion of the tasks that occur during the specific step;
(ii) Why each phase and step shown on the chart must happen in the order it is occurring;
(iii) The tasks that occur during each of the steps within the phase; and
(iv) Anticipated worker schedules;

The schedule for this project is generally broken down into two major scopes of work: Dry Ash Handling (DAH) System installation and Pond Closure / New Pond Construction.

Dry Ash Handling System

Engineering, Design and Procurement (August 2020 – January 2022)
The conceptual design of the new DAH system has been completed. Equipment procurement for the DAH system to support this project is underway with a forecasted delivery date of the major equipment by January 2022. Detailed design of the DAH System has started and is scheduled to be completed by August 2021.

Contractor Selection (March 2021 – October 2021)
There are 3 Construction (Labor) bid packages that are planned to be developed in parallel with the detailed design efforts. The typical timeframe to competitively bid major labor contracts is six months in accordance with AEP's procurement processes. The first package will be issued for bid in March 2021. Due to capital improvements of this magnitude Regulatory approvals from the West Virginia Public Service and Virginia State Corporation Comisssions are required. Applications for approval are being prepared and will be submitted by the end of January 2021. Proceedings are estimated to be concluded by August 31, 2021. After receipt of regulatory approval the Civil labor contract will be awarded to the selected construction contractors by August 2021. The Structural/Mechanical (S/M) and Electrical, Insturumentaion, and Controls (EIC) construction bid packages are planned to be issued in March and May of 2021 and awarded by August and October of 2021. Civil construction is planned to start immediately following award in August 2021.

Construction (August 2021 – May 2022)
The civil work will include underground utility relocations, excavation and subgrade prep for the ash bunker footings and foundation installation. Once the footings and foundation is poured, the new ash bunker walls will be formed and poured.Similar activities will be performed for the belt transfer conveyor and transfer tower foundations. Soon after the civil work has started the structural/mechanical (S/M) work will start which includes above ground utility relocations inside the Unit, setting of the transfer tower structural steel, assembly and erection of the belt transfer conveyor that will receive the ash from the UHDC conveyors to discharge into the ash bunker. The ash bunker sump pumps will be set and piping ran back to the ash hopper pit sump. Balance of plant piping such as service water, instrument air, plant air, and other systems will be installed. Building penetrations will be made for the UHDC conveyors. The existing ash hopper pit concrete will be saw cut to make additional space required to route the conveyor out from underneath the ash hopper. During this time as much demolition of existing equipment and structural steel that can be performed ahead of the Unit tie-in outage will be completed which includes reinforcing of the existing ash hopper structural steel to accommodate the new UHDC equipment loads.

The electrical/instrumentation and controls contractor (EIC) will mobilize soon after the S/M contractor to begin above ground utility relocations, installation of conduit and cable tray for both power and control cabling to the new equipment mentioned above. New electrical equipment will be set which includes distributed control system cabinets. Once the conduit

and cable tray runs are completed the power and control cabling will be pulled, tested and terminated to the greatest extent possible. A majority of the power feeds and control cables for the UHDC equipment will need to be rolled up and temporarily staged at the ash hopper pit to be completed once the UHDC equipment is erected in place during the tie-in outage.

Although as much work as possible will be performed while the Unit is operating, a significant portion of the work to complete the DAH system equipment installation requires a Unit outage. The outage for the Unit is planned for the Spring of 2022. Once the Unit comes out of service both the S/M and EIC contractors will work two shifts sixty hours per week to complete the outage related activities. The pulverizer door relocation will begin along with the demolition of boiler down comer piping and any remaining equipment in the ash hopper pit area to allow for installation of the collection and dewatering conveyors. The support steel will be set, and the conveyors will be erected. Instrumentation and remaining connections trimmed out both electrically and mechanically to complete the UHDC system installation.

All CCR flows to the BAP CCR Unit will completely cease by March 31, 2022.

Startup and Implementation
Once the system is substantially complete, the AEP startup and commissioning group will begin checkout and functional testing to ensure proper operation once the system is completed and turned over. After the commissioning and check out is complete the system will be turned over to plant operations to perform plant testing and checkout and return the Unit back to service.

Bottom Ash Pond Closure/ New Pond Construction

Engineering and Design (August 2020 – September 2021)
Detailed design for mechanical balance of plant systems for the new settling ponds has started and is planned to be completed by September 2021. The civil design work started in November 2020 and will complete by August 2021. The design of the ponds is dependent upon performing topographic survey and geotechnical investigations to understand subgrade materials at the locations of the new ponds. The investigations will also be used to verify CCR depths at certain locations.

Permitting (November 2020 – December 2021)

Permitting efforts relative to NPDES permit, WV Dam Safety, and air permit determinations with WVDEP necessary to construct the ponds have started and are planned to continue through 2021.

Contractor Selection (August 2021 – June 2022)
There are 3 Construction (Labor) bid packages that are planned to be developed in parallel with the detailed design efforts. The typical timeframe to competitively bid major labor contracts is six months in accordance with AEP's procurement processes. The first package will be issued for bid in August 2021 and awarded to the selected construction contractors by March 2022. The other construction bid packages are planned to be issued in September and December 2021 and awarded by March and June 2022. Pond construction is planned to start immediately following award in March 2022.

Construction (March 2022 – November 2023)
The closure of the BAP CCR Unit and construction of the new East and West Settling Ponds requires specific sequencing in order to complete the work due to the fact that the new ponds

will be located within the existing BAP CCR Unit footprint and need to maintain overall pond operations while including provisions to meet the NPDES discharge permit requirements throughout construction. Final completion of the West pond closure and repurposing activities is dependent upon installation of the DAH system equipment and ceasing CCR flows to the BAP CCR Unit. Steps have been included in the project plan to complete the work as early as possible as shown on the schedule in **Appendix C** and further described in this section.

The BAP CCR Unit is approximately 28 acres. Of this, the existing West basin of the BAP CCR Unit and East basin of the BAP CCR Unit are each approximately 14 acres. The BAP CCR Unit does not receive any significant local storm water run-off from adjacent areas. The BAP CCR Unit will be closed by removal of CCR via dewatering and mechanical excavation.

The removal of ash and contaminated materal will be verified both visually and by analytical testing. When the removal of ash is complete, the contractor will remove an additional one foot of material to confirm removal of CCR. Soil samples, collected from the excavation, will be analyzed for Appendix IV parameters and compared to background soil sample Appendix IV concentrations to ensure that all CCR and contaminated materials have been removed. Additionally, a third-party engineer will perform quality assurance/quality control (QAQC) services to independently verify that all CCR materials are removed.

After CCR removal is complete, the closure by removal will be verified with a minimum of three years of groundwater sampling events per the requirements set forth in the *Implementation of Corrective Action Program* provisions at § 257.98(c). When the groundwater monitoring concentrations do not exceed the groundwater protection standards established at § 257.95(h) utilizing the approved statistical analysis program as determined at § 257.93(f) and (g) for three years, the BAP CCR Unit will be considered closed.

The pond closure work and the construction of the new settling ponds will be performed in phases across two construction seasons during calendar years 2022 and 2023. The phases are shown in the schedule in **Appendix C** and timeframes are based on the estimated volumes of material to be removed as well as the estimated earthwork quantities required for pond closure. These durations are based on an average work schedule of five days per week / ten hours per day and do not take into account delays from periods with significant rain events greater than average or normal for the geographic location.

Phase 1 (East BAP Closure and Repurposing) - The mobilization of the pond closure contractor is planned to start in March 2022 immediately following award of the contract. Once the contractor mobilizes to begin closing the BAP CCR Unit, the contractor will work to complete early site preparation activities including mobilization, installing erosion control, preparing laydown and construction office areas, diverting wastewater inflows from the initial closure and construction work area, and dewatering the work area in preparation for the first phase of CCR removal. The first phase CCR removal will be the East basin of the BAP CCR Unit and will begin in March 2022 and continue through June 2022. During this time all non-CCR streams that are currently routed through the BAP CCR Unit will be flowing through the West basin while pond closure and repuposing takes place in the East basin. Upon certification of closure by removal, construction of the new East Settling Pond will proceed. New subgrade will be established and prepped for the liner installation which is planned to begin in August 2022. At this same time, subgrade prep and installation of the new tank based chemical treatment system will also begin. The construction of the East Settling Pond is scheduled for completion in January 2023 which includes the tank-based chemical treatment equipment and rerouting of non-CCR wastewater piping. Startup and

commissioning activities associated with the tank-based chemical treatment equipment will also be completed in parallel.

Initial operation of the East Settling Pond will be January 09, 2023. At this time, all non-CCR streams will be running through a newly constructed lined wastewater pond.

Phase 2 (West BAP Closure and Repurposing) - The second phase of the BAP closure and new wastewater pond construction scope of work includes similar activities as described above. During this time all non-CCR streams are running through the newly lined East Settling Pond.Closure by removal of the West basin of the BAP CCR Unit will begin in March 2023 and be completed in July 2023. The closure by removal will be certified by a third-party engineer and the records will be posted in the operating record and on the AEP CCR website as appropriate.

Construction of the West Settling Pond will then proceed to be completed and ready for initial operation in November 2023.

At the completion of the CCR removal and pond construction, the temporary construction facilities, laydown areas, and erosion controls will be removed, and these areas will be restored to their pre-construction conditions.

Section Four – Narrative of the Steps Already Taken to Initiate Closure and Obtain Alternative Capacity

From the regulatory text § 257.103(f)(1)(iv)(A)(4).

> *(4) A narrative discussion of the progress the owner or operator has made to obtain alternative capacity for the CCR and/or non-CCR wastestreams. The narrative must discuss all the steps taken, starting from when the owner or operator initiated the design phase up to the steps occurring when the demonstration is being compiled. It must discuss where the facility currently is on the timeline and the efforts that are currently being undertaken to develop alternative capacity.*

As described in Section 1 and as shown in Appendix C, APCO has made considerable progress at the time of this request towards creating alternative disposal capacity for the CCR and non-CCR wastestreams at the Mountaineer Plant that are currently managed in the BAP CCR Unit.

The following major activities have been completed or are in process:

- Conceptual design for all aspects of the project required to achieve the alternate disposal capacity has been completed and detailed design has commenced.
- Dry bottom ash equipment has been specified and is being procured with equipment delivery scheduled.
- Contractors have been engaged to discuss different aspects of the work and identify expected construction timeframes.
- Permitting agencies have been engaged to discuss plans.
- Geotechnical investigations required to support the work have been started and are expected to be completed in 2020

NARRATIVE STRATEGY FOR COMPLIANCE WITH ALL REQUIREMENTS OF 40 CRF 257 SUBPART D

From the regulatory text 40 CFR § 257.103(f)(1)(iv)

(B) To demonstrate that the criteria in paragraph (f)(1)(iii) of this section have been met, the owner or operator must submit all of the following:

> *(1) A certification signed by the owner or operator that the facility is in compliance with all of the requirements of this subpart;*
>
> I hereby certify that, based on my inquiry of those persons who are immediately responsible for compliance with environmental regulations for the Mountaineer Plant, the facility is in compliance with all of the requirements contained in 40 CFR 257 Subpart D – *Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments.*
>
> x David A. Miller
> David A. Miller P.E.
> Director – Land Environmental and Remediation Services

The Mountaineer Plan is maintaining compliance with all requirements of Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. Reports documenting compliance with the rule's provisions, such as location restriction, design criteria, operating criteria, and groundwater monitoring are posted to the AEP public CCR Rule Compliance Data and Information Internet site at the following link: https://aep.com/environment/ccr.

40 CFR § 257.103(f)(1)(iv)(B)*(2) Visual representation of hydrogeologic information at and around the CCR unit(s) that supports the design, construction and installation of the groundwater monitoring system. This includes all of the following:*

> *(i) Map(s) of groundwater monitoring well locations in relation to the CCR unit(s);*
> *(ii) Well construction diagrams and drilling logs for all groundwater monitoring wells; and*
> *(iii) Maps that characterize the direction of groundwater flow accounting for seasonal variations;*

Groundwater monitoring at the Mountaineer CCR units is accomplished using PE-certified groundwater monitoring networks. The BAP network is composed of four upgradient wells and eight downgradient monitoring wells. The LF network is composed of 2 upgradient and 5 downgradient monitoring wells. The complete Groundwater Monitoring Well Network Evaluation (GWMN) Reports are provided in **Appendix D** and include the following:

- A map showing the location of the PE Certified monitoring wells relative to the CCR units is included in the GWMN Report as **Figure 7**
- Boring logs and well construction diagrams are included in *Appendix A*
- A typical groundwater flow direction map is included in the GWMN Report as **Figure 6**

Additionally, four groundwater flow direction maps from monitoring events throughout the different seasons to show seasonal changes are provided in the figures section of this submittal as **Figures 2 – 5** for the BAP, **Figures 6 – 9** for the Landfill.

40 CFR § 257.103(f)(1)(iv)(B)*(3) Constituent concentrations, summarized in table form, at each groundwater monitoring well monitored during each sampling event;*

The most recent Groundwater Monitoring and Corrective Action Reports summarize Appendix III and IV constituent concentrations at each groundwater monitoring well monitored during each sampling event as Table 1 (see **Appendix E**).

40 CFR § 257.103(f)(1)(iv)(B)*(4) A description of site hydrogeology including stratigraphic cross-sections;*

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 unconfined deeper sand zones. Maximum alluvium thickness is approximately 80 to 90 ft and thins westward towards the edges of the valley. Groundwater flow direction within the alluvium is generally towards the Ohio River. However, there are active production wells (East 1, West 1) and firewater supply wells (Well 5, Well 6) at the Site (Figure 3) that withdraw water from the alluvial aquifer. Groundwater flow is influenced towards those wells during pumping conditions.

The Site is adjacent to the Ohio River, and the BAP CCR Unit is located approximately 0.5 miles southwest of the Ohio River. Little Broad Run is immediately adjacent to the west of the BAP CCR Unit. Groundwater flow direction is generally to the northeast and discharges to the Ohio River, although local pumping from Plant operations influences groundwater flow to the north. Groundwater recharge is primarily from precipitation. Despite its proximity, Little Broad Run is generally not connected to groundwater at the Site. The base of Little Broad Run is perched on surficial clay deposits and is at an elevation of 580 to 590 ft amsl, which is approximately 30 to 40 ft above the groundwater table. The Ohio 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 Ohio River at 538 ft amsl.

The complete GWMN Reports for each CCR unit at Mountaineer Plant are provided in **Appendix D** and include a description of site hydrogeology. Strategraphic cross sections are included in the GWMN Report as **Figures 4 and 5** in the BAP report and **Figures 4 – 5B** in the Landfill report.

40 CFR § 257.103(f)(1)(iv)(B)*(5) Any corrective measures assessment conducted as required at § 257.96;*

The BAP is in corrective measures. The Assessment of Corrective Measures Report required by § 257.96 is included in **Appendix F**. The LF is currently in detection monitoring and will transition to an assessment of corrective measures and selection of remedy following requirements in 40 CFR 257.96 and 40 CFR 257.97 and a corrective action program following requirements in 40 CFR 257.98, if necessary.

40 CFR § 257.103(f)(1)(iv)(B)*(6) Any progress reports on corrective action remedy selection and design and the report of final remedy selection required at § 257.97(a);*

The BAP Semi-Annual Progress Reports for Corrective Action Remedy Selection are included in **Appendix G**. The Final Remedy Selection Report has not been completed.

40 CFR § 257.103(f)(1)(iv)(B)*(7) The most recent structural stability assessment required at § 257.73(d); and*

The most recent structural stability assessment required by § 257.73(d) is included in **Appendix H**. This report will be updated every 5 years as required by the CCR rule.

40 CFR § 257.103(f)(1)(iv)(B)*(8) The most recent safety factor assessment required at § 257.73(e).*

The most recent safety factor assessment required by § 257.73(e) is included in **Appendix I**. This report will be updated every 5 years as required by the CCR rule.

CONCLUSION

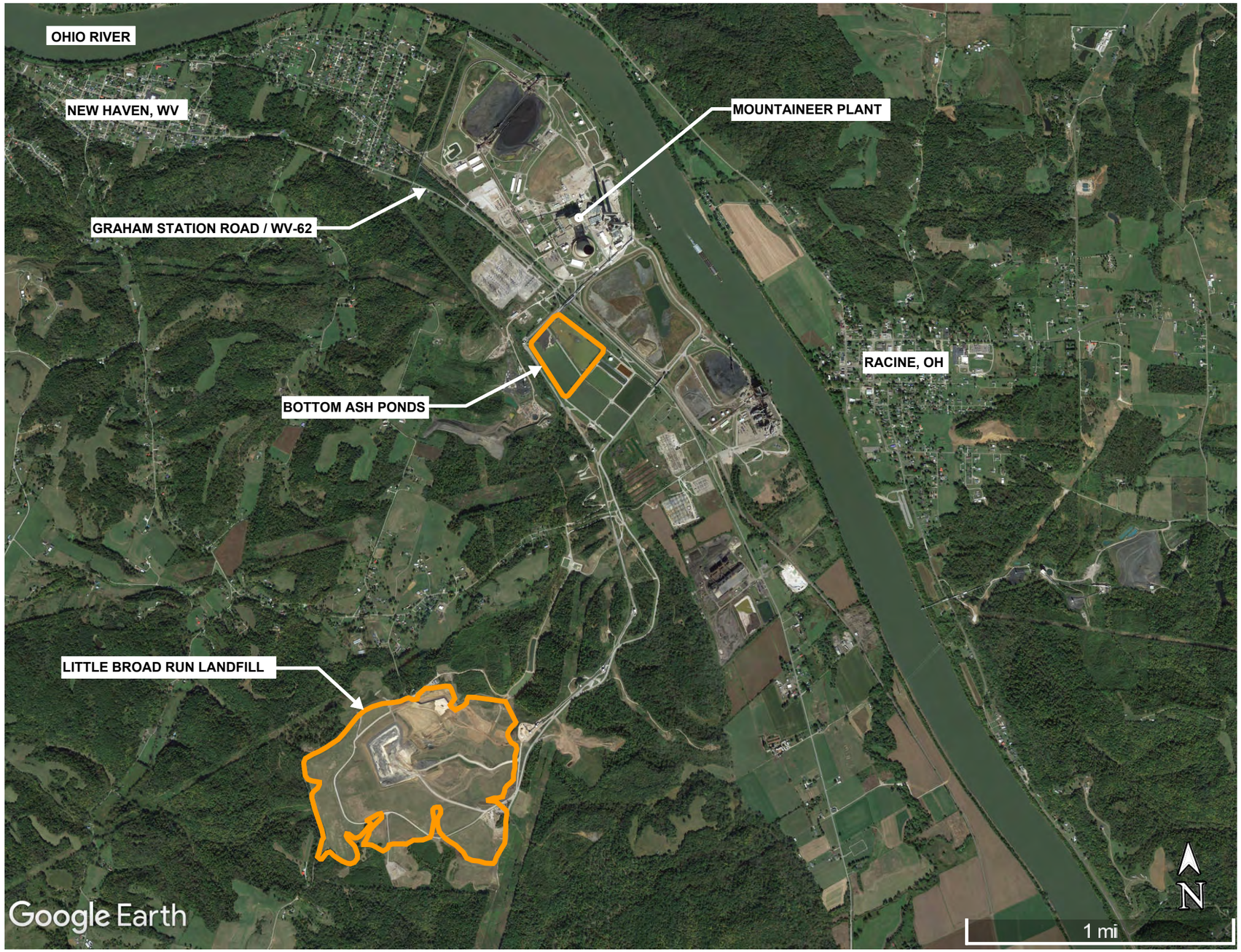
As set forth and allowed by 40 CFR 257.103 – *Alternate Closure Requirements* and specifically 40 CFR 257.103(f)(1) – *Site Specific Alternate to Initiation of Closure Deadline,* the Mountaineer Plant qualifies for the site specific alternate time frame provisions for continuing to receive CCR and non-CCR wastestreams and initiate closure of the CCR surface impoundments. Based upon the information submitted AEP has demonstrated in this application that the soonest the Mountaineer Plant can cease sluicing CCR wastestreams to the BAP CCR Unit is March 31, 2022. Closure by removal and repurposing of the East Bottom Ash Pond (BAP CCR Unit) into a lined settling pond for continued treatment of the non-CCR wastestreams will be completed on January 09, 2023. Closure by removal of the West BAP (BAP CCR Unit) will be completed by July 21, 2023.

Therefore, AEP requests the EPA approve the demonstration to allow additional time beyond April 11, 2021 to develop alternate capacity and grant the alternate deadlines for ceasing receipt of CCR and non-CCR wastestreams and initiating closure.

Figures

Figure 1 – Mountaineer Plant Site Layout
Figure 2-5 – Bottom Ash Pond Seasonal Groundwater Flow Directions
Figure 6-9 – Landfill Seasonal Groundwater Flow Directions

DRAFT



LEGEND:

CCR UNIT BOUNDARY

REV	DATE	DESCRIPTION	DRAWN	CHECKED	REVIEWED	LEAD DESIGNER	ENGINEER/TECH SPEC	LEAD DISC ENGINEER	PROJ ENGR MANAGER
A	17 JUN 20	ISSUED FOR REVIEW	FMW						

Worley energy | chemicals | resources

OneWay

PRELIMINARY STATUS	DATE	INFORMATION ONLY - NOT TO BE USED FOR CONSTRUCTION.
LDE	- -	
APPROVED STATUS	DATE	REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
LDE	- -	

ORIGINATING PERSONNEL	PROFESSIONAL ENGINEER'S SEAL
DRAWN BY	
CHECKED BY	
LEAD DESIGNER	
ENGINEER/TECH SPECIALIST	
PROJECT ENGINEERING MANAGER	

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF
PE: _____ STATE: _____
LIC. NO.: _____ DATE: _____

DATE	NO.	DESCRIPTION	APPD.

REVISIONS

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APPALACHIAN POWER COMPANY

MOUNTAINEER PLANT

NEW HAVEN WEST VIRGINIA

CCR/ELG PROJECT

FIGURE 1

UNIT: DRAWING NUMBER: REV:

SCALE: ENGINEERING

DR:
CH:
SUP:
ENG:
DATE:

APPROVED BY

DOCUMENT PREPARED BY WORLEY

AEP AMERICAN ELECTRIC POWER

AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

PLOT DATE: 2/4/2020
PLOT TIME: 8:17:36 AM
BY: CHS: SSLEVIN

CROSS REFS:

DRAWING NUMBER:

CROSS REFS:

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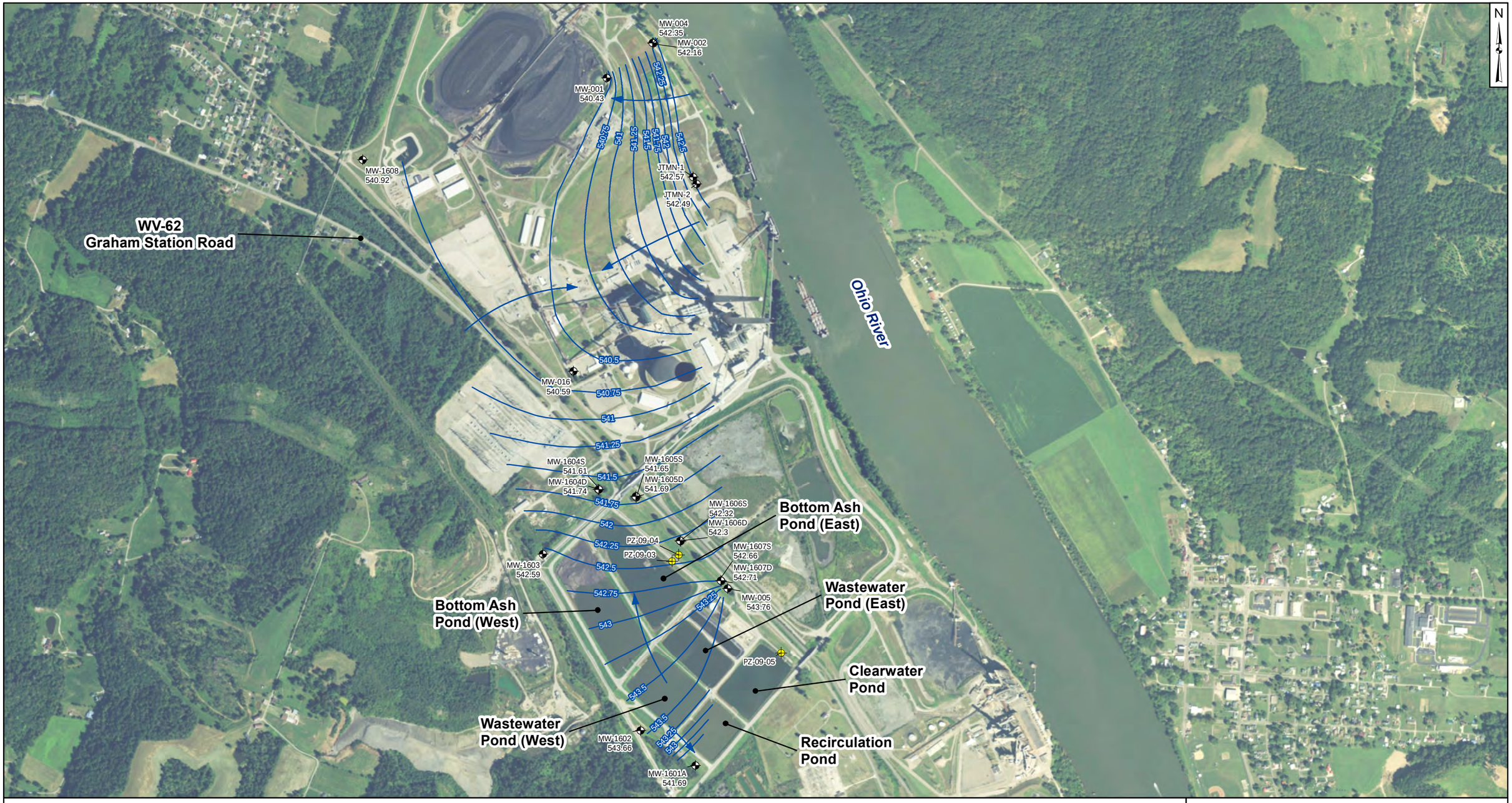
2/4/2020 8:17:36 AM



Legend

- Monitoring Well
- Piezometer
- Groundwater Elevation Contour
- Approximate Groundwater Flow Direction

Notes

- Monitoring well coordinates and water level data (collected on December 19, 2016) provided by AEP.
- Site features based on information available in Ash Pond System-CCR Groundwater Monitoring Well Network Evaluation (Arcadis, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (ft amsl).
- Water levels from piezometers were inconsistent with other local data and not used to create groundwater contours.
- Normal lower pool elevation of the Ohio River at Racine Lock and Dam is 538 ft amsl (USACE).
- Intermittent usage of pumping wells for plant activities impact water levels in the vicinity. Water flow in the vicinity is generally in the northeast direction.

1,000 500 0 1,000 Feet

Potentiometric Surface Map - Uppermost Aquifer December 2016

AEP Mountaineer Generating Plant - Bottom Ash Ponds
Letart, West Virginia

Geosyntec consultants

Columbus, Ohio | 2017/08/04

Figure 2

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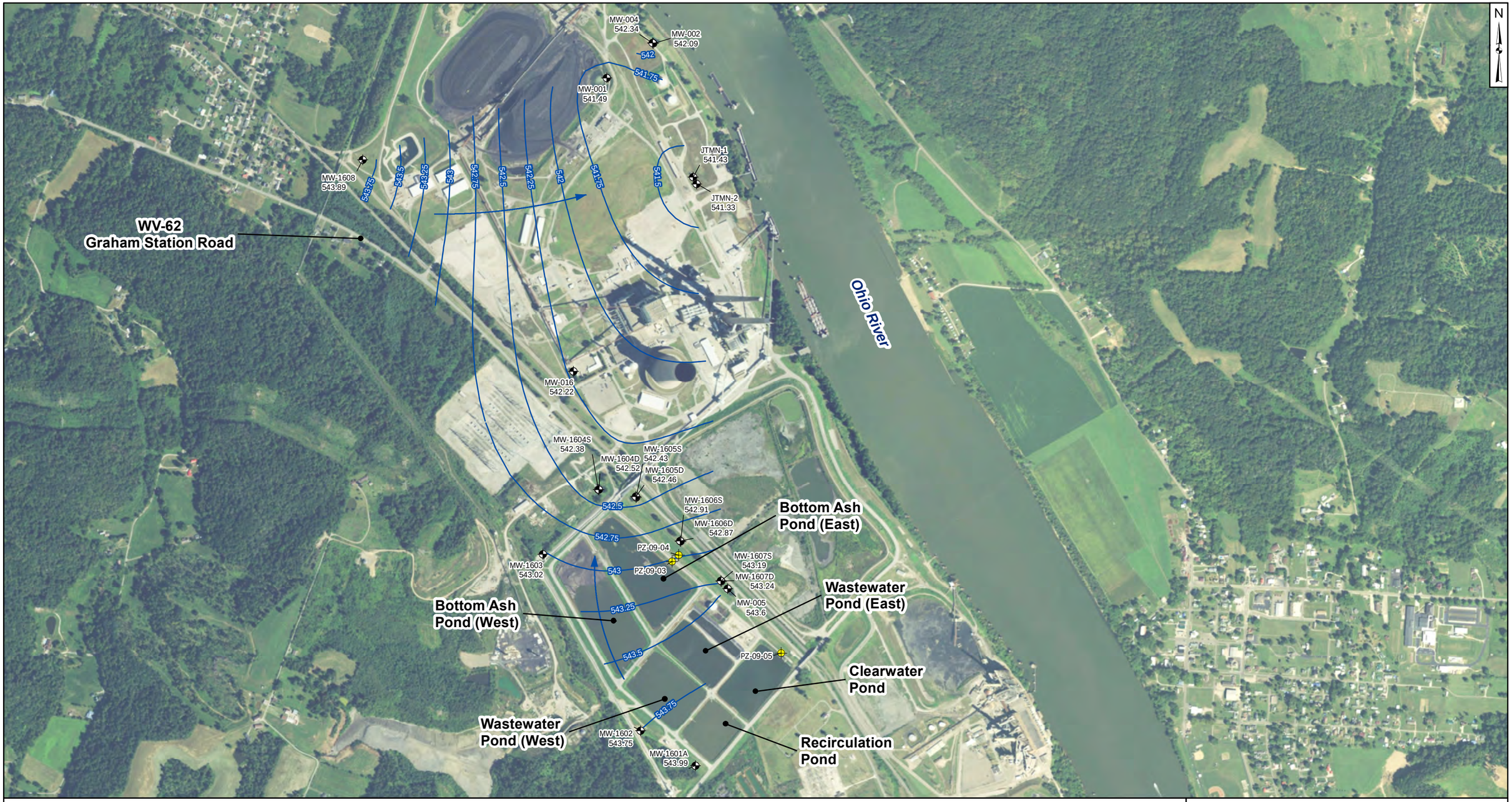

Legend

- Monitoring Well
- Piezometer
- Groundwater Elevation Contour
- Approximate Groundwater Flow Direction

Notes

- Monitoring well coordinates and water level data (collected on March 27, 2017) provided by AEP.
- Site features based on information available in Ash Pond System-CCR Groundwater Monitoring Well Network Evaluation (Arcadis, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level.
- Water levels from piezometers were inconsistent with other local data and not used to create groundwater contours.
- Normal lower pool elevation of the Ohio River at Racine Lock and Dam is 538 ft amsl (USACE).
- Intermittent usage of pumping wells for plant activities impact water levels in the vicinity. Water flow in the vicinity is generally in the northeast direction.

1,000 500 0 1,000 Feet

Potentiometric Surface Map - Uppermost Aquifer March 2017

AEP Mountaineer Generating Plant - Bottom Ash Ponds
Letart, West Virginia

Geosyntec consultants

Columbus, Ohio | 2017/12/28

Figure 3

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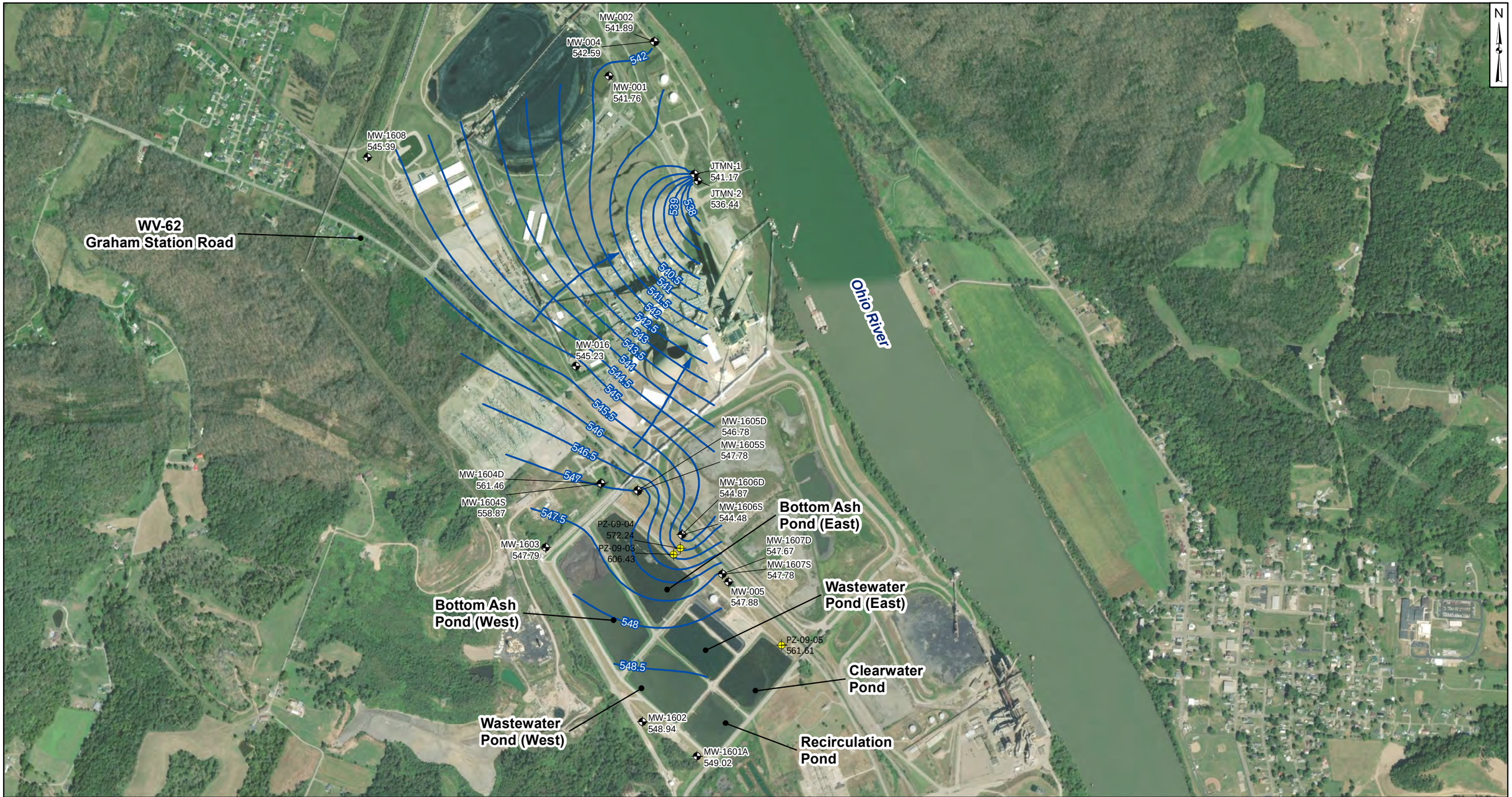

Legend

- Monitoring Well
- Piezometer
- Approximate Groundwater Flow Direction
- Groundwater Elevation Contour

Notes

- Monitoring well coordinates and water level data (collected on June 17,2019) provided by AEP.
- Site features based on information available in Ash Pond System-CCR Groundwater Monitoring Well Network Evaluation (Arcadis, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level.
- Water levels from piezometers were inconsistent with other local data and not used to create groundwater contours.
- Normal lower pool elevation of the Ohio River at Racine Lock and Dam is 539.5 ft amsl (USACE).
- Intermittent usage of pumping wells for plant activities impact water levels in the vicinity. In general, shallow groundwater beneathe the plant flows northeast towards the Ohio River.
- MW-1604S and MW-1604D were not used in contouring due to anomalous/inconsistent readings.

0 250 500 1,000 1,500 Feet

Potentiometric Surface Map - Uppermost Aquifer June 2019

AEP Mountaineer Generating Plant - Bottom Ash Ponds
New Haven, West Virginia

Geosyntec consultants

Columbus, Ohio | 2019/12/31

Figure 4

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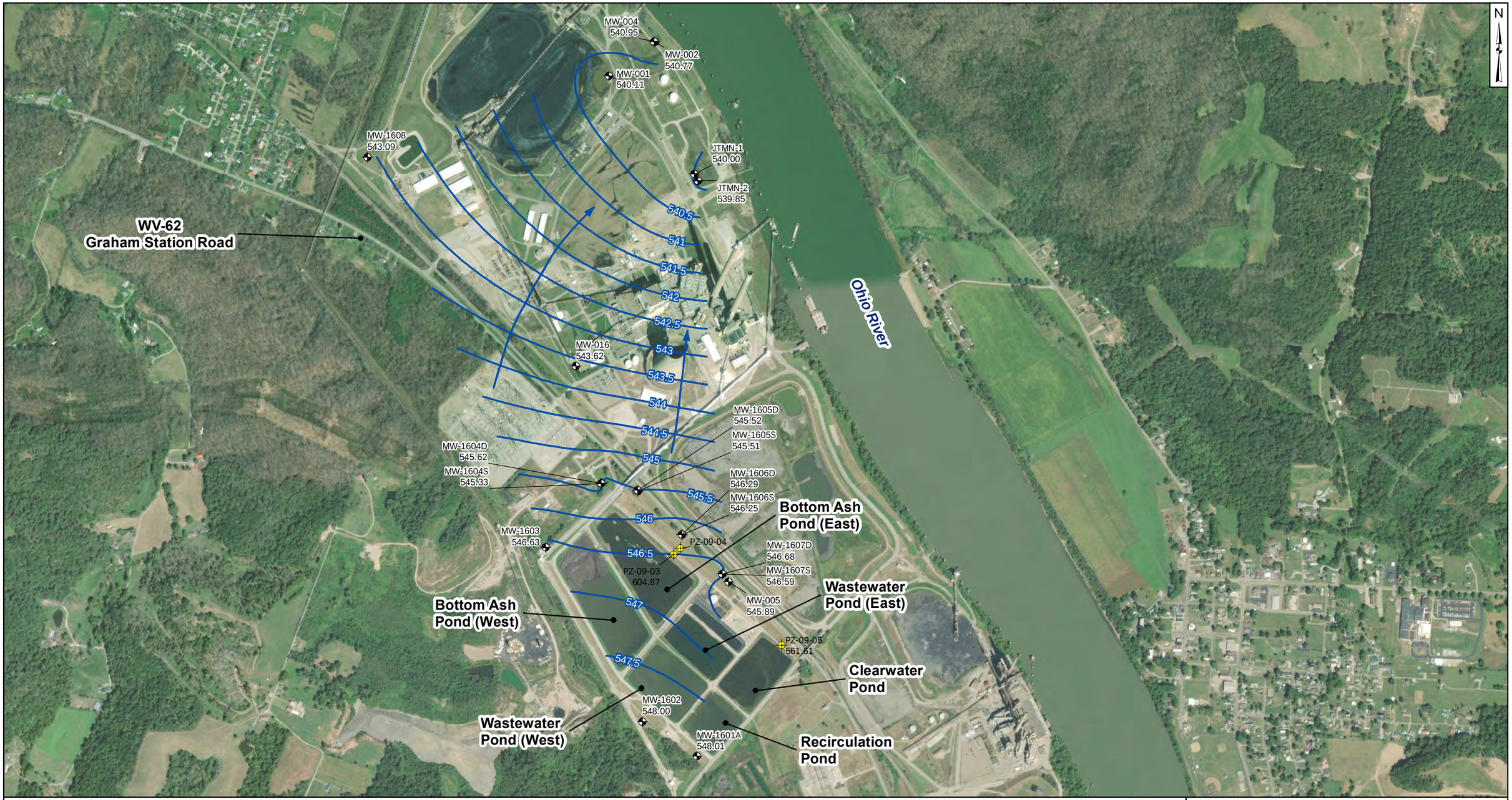

Legend

- Monitoring Well
- Piezometer
- Approximate Groundwater Flow Direction
- Groundwater Elevation Contour

Notes

- Monitoring well coordinates and water level data (collected on September 9, 2019) provided by AEP.
- Site features based on information available in Ash Pond System-CCR Groundwater Monitoring Well Network Evaluation (Arcadis, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level.
- Water levels from piezometers were inconsistent with other local data and not used to create groundwater contours.
- Normal lower pool elevation of the Ohio River at Racine Lock and Dam is 539.5 ft amsl (USACE).
- Intermittent usage of pumping wells for plant activities impact water levels in the vicinity. In general, shallow groundwater beneath the plant flows northeast toward the Ohio River.

0 250 500 1,000 1,500 Feet

Potentiometric Surface Map - Uppermost Aquifer September 2019

AEP Mountaineer Generating Plant - Bottom Ash Ponds
New Haven, West Virginia

Geosyntec consultants

Columbus, Ohio | 2019/12/31

Figure 5

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mountaineer\2019\AEP-Mountaineer_BAP_GW_2019-09.mxd. ARevezzo. 12/31/2019. CHA8423/07/08.

Legend

Monitoring Wells
- Alluvium
- Hydrologic Unit 3
- Hydrologic Unit 4

Groundwater Elevation Contours
- Hydrologic Unit 3
- Approximate Groundwater Flow Direction (Unit 3)
- Hydrologic Unit 4
- Approximate Groundwater Flow Direction (Unit 4)

Notes

- Monitoring well coordinates and water level data (collected on February 20, 2017) provided by AEP.
- Site features based on information available in Little Broad Run Landfill-CCR Groundwater Monitoring Well Network Evaluation (Arcadis, 2016) provided by AEP.
- Water level measurements from MW-25 (screened in shale below Unit 4), MW-37 (hydraulically disconnected from the rest of Unit 3) and MW-38 (screened in alluvium) were not used in groundwater contouring.
- Groundwater elevation units are feet above mean sea level.

750 375 0 750
Feet

Potentiometric Surface Map - Uppermost Aquifer
February 2017

AEP Mountaineer Generating Plant - CCR Landfill
Letart, West Virginia

Geosyntec consultants

Columbus, Ohio | 2018/01/03

Figure 6

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mountaineer\AEP-Mountaineer_LF_GW_2017-02.mxd. ARevezzo. 1/3/2018. CHA8423/07/08.

Legend

Monitoring Wells
- Alluvium
- Hydrologic Unit 3
- Hydrologic Unit 4

Groundwater Elevation Contours
- Approximate Groundwater Flow Direction (Unit 3)
- Hydrologic Unit 3
- Hydrologic Unit 3 (Inferred)
- Approximate Groundwater Flow Direction (Unit 4)
- Hydrologic Unit 4

Notes
- Monitoring well coordinates and water level data (collected on April 8, 2019) provided by AEP.
- Site features based on information available in Little Broad Run Landfill-CCR Groundwater Monitoring Well Network Evaluation (Arcadis, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level.
- Water level measurements from MW-25 (screened in shale below Unit 4), MW-37 (hydraulically disconnected from the rest of Unit 3), and MW-38 (screened in alluvium) were not used in groundwater contouring.
- Groundwater elevation units are feet above mean sea level.

750 375 0 750
Feet

Potentiometric Surface Map - Uppermost Aquifer
April 2019

AEP Mountaineer Generating Plant - CCR Landfill
New Haven, West Virginia

Geosyntec consultants

Columbus, Ohio | 2019/12/11

Figure 7

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mountaineer\2019\AEP-Mountaineer_LF_GW_2019-04.mxd. ARevezzo. 12/11/2019. CHA8423/07/08.

Legend

Monitoring Wells
- Alluvium
- Hydrologic Unit 3
- Hydrologic Unit 4

Groundwater Elevation Contours
- Approximate Groundwater Flow Direction (Unit 3)
- Hydrologic Unit 3
- Approximate Groundwater Flow Direction (Unit 4)
- Hydrologic Unit 4

Notes

- Monitoring well coordinates and water level data (collected on September 9, 2019) provided by AEP.
- Site features based on information available in Little Broad Run Landfill-CCR Groundwater Monitoring Well Network Evaluation (Arcadis, 2016) provided by AEP.
- Water level measurements from MW-25 (screened in shale below Unit 4), MW-37 (hydraulically disconnected from the rest of Unit 3), and MW-38 (screened in alluvium) were not used in ground water contouring.
- Groundwater elevation units are feet above mean sea level.

750 375 0 750 Feet

Potentiometric Surface Map - Uppermost Aquifer September 2019

AEP Mountaineer Generating Plant - CCR Landfill
New Haven, West Virginia

Geosyntec consultants

Columbus, Ohio | 2019/12/31

Figure **8**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mountaineer\2019\AEP-Mountaineer_LF_GW_2019-09.mxd. ARevezzo. 12/31/2019. CHA8423/07/08.

Legend

Monitoring Wells
- Alluvium
- Hydrologic Unit 3
- Hydrologic Unit 4

Groundwater Elevation Contours
- Approximate Groundwater Flow Direction (Unit 3)
- Hydrologic Unit 3
- Hydraulic Unit 3 (Inferred)
- Approximate Groundwater Flow Direction (Unit 4)
- Hydrologic Unit 4

Notes
- Monitoring well coordinates and water level data (collected on November 26, 2018) provided by AEP.
- Site features based on information available in Little Broad Run Landfill-CCR Groundwater Monitoring Well Network Evaluation (Arcadis, 2016) provided by AEP.
- Water level measurements were not collected from MW-25.
- Groundwater elevation units are feet above mean sea level.

750 375 0 750 Feet

Potentiometric Surface Map - Uppermost Aquifer
November 2018

AEP Mountaineer Generating Plant - CCR Landfill
New Haven, West Virginia

Geosyntec consultants

Columbus, Ohio | 2019/01/22

Figure 9

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mountaineer\2018\AEP-Mountaineer_LF_GW_2018-11.mxd. ARevezzo. 1/22/2019. CHA8423/07/08.

Appendix A

Existing and Future Pond Configurations

DRAFT

DRAWING NUMBER: MTP-PR-0-180-EC-SK002-001

CROSS REFS:

NOTES:

1. COORDINATE GRID SHOWN IS PLANT COORDINATE SYSTEM.
2. EXISTING TOPGRAPHIC SURVEY TAKEN FROM AERIAL SURVEY EXPOSED ON MARCH 20, 2012, BY HENDERSON AERIAL SURVEYS INC.
3. EXISTING CONTOURS ARE TIED TO NAVD88 VERTICAL DATUM. LISTED ORIGINAL DESIGN ELEVATIONS ARE IN NGVD29 VERTICAL DATUM.

N 17000
N 16000
E 20000
E 19000
N 18000

NOTE: COOLING TOWER BLOWDOWN, PRETREATMENT SUMPS, AND 16" LANDFILL LEACHATE LINE RE-ROUTED INTO NEW MIX TANKS (NOT SHOWN)

FGD SLUDGE POND

LECHATE SURGE POND

CLEAR WATER POND
OPERATING POOL EL 603

EXISTING POND BOTTOM - EL 594 (TYP)
(TOP OF 3' THICK CLAY LINER)

EAST WASTEWATER POND
OPERATING POOL EL 609

EXISTING COLLECTION WEIR FACILITY

EXISTING POND BOTTOM - EL 594.5 (TYP)
(TOP OF 3' THICK CLAY LINER)

AVERAGE WASTE REMOVAL DEPTH - EL 588
(ASSUMES 1' BELOW TOP OF EXISTING CLAY LINER)

EL 586
EL 584
EL 586
EL 584
EL 586
EL 584
EL 589
EL 590
EL 591

1%+/- FOR LEAK DETECTION (TYP)

EAST SETTLING POND
EXISTING EAST BOTTOM ASH POND CLOSED BY REMOVAL OF WASTE AND REPURPOSED INTO NEW LINED EAST SETTLING POND

PYRITES FOREBAY

EXISTING POND BOTTOM - EL 592 (TYP)
(TOP OF 3' THICK CLAY LINER)

RECLAIM WATER POND
OPERATING POOL EL 603

WEST WASTEWATER POND
OPERATING POOL EL 609

EXISTING POND BOTTOM - EL 592 (TYP)
(TOP OF 3' THICK CLAY LINER)

NEW MIX TANKS (NON-CCR WASTEWATER FLOWS TO BE RE-ROUTED THROUGH MIX TANKS)

SPLITTER BOX (DIVERTS MIX TANK EFFLUENT INTO EAST OR WEST SETTLING PONDS)

EL 596
EL 594
EL 596
EL 594
EL 596
EL 594
EL 596
EL 599
EL 599
EL 599

WEST SETTLING POND
EXISTING WEST BOTTOM ASH POND CLOSED BY REMOVAL OF WASTE AND REPURPOSED INTO NEW LINED WEST SETTLING POND

100 0 100 200 300
SCALE: 1"=100'

REV	DATE	DESCRIPTION	DRAWN	CHECKED	LEAD ENGINEER	LEAD DISC. ENGINEER	PROJECT MANAGER
B	11 MAR 20	ISSUED FOR USE	KJF	FMW	KJF	FMW	JTH
A	21 FEB 20	ISSUED FOR REVIEW	KJF	RES	KJF	FMW	JTH

21-MAY-2020 REVISED TO SHOW 2 PONDS FMW

DATE	NO.	DESCRIPTION	APPD.

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Worley OneW

PRELIMINARY STATUS — DATE
LDE FM WOOD — 21-FEB-20
INFORMATION ONLY - NOT TO BE USED FOR CONSTRUCTION.

APPROVED STATUS — DATE
LDE - -
REPRESENTS REVIEWED AND APPROVED DESIGN; ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.

ORIGINATING PERSONNEL

DRAWN BY: KJF
CHECKED BY:
LEAD DESIGNER: KJ FRITZ
ENGINEER/TECH SPECIALIST: FM WOOD
PROJECT ENGINEERING MANAGER: JT HICKSON

PROFESSIONAL ENGINEER'S SEAL

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF
PE: _____ STATE: _____
LIC. NO.: _____ DATE: _____

APPALACHIAN POWER COMPANY

MOUNTAINEER PLANT

NEW HAVEN — WEST VIRGINIA

CCR/ELG PROJECT

SITE DEVELOPMENT SKETCH POND REPURPOSING AND CLOSURE

UNIT:	DRAWING NUMBER: MTP-PR-0-180-EC-SK002-001	REV:
SCALE: 1"=100'	ENGINEERING	
DR:	APPROVED BY	
CH:		
SUP:	DOCUMENT PREPARED BY WORLEY	
ENG:		
DATE:		

AEP AMERICAN ELECTRIC POWER

AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

PLOT DATE: 5/13/2020
PLOT BY: FMWOOD

CROSS REFS:

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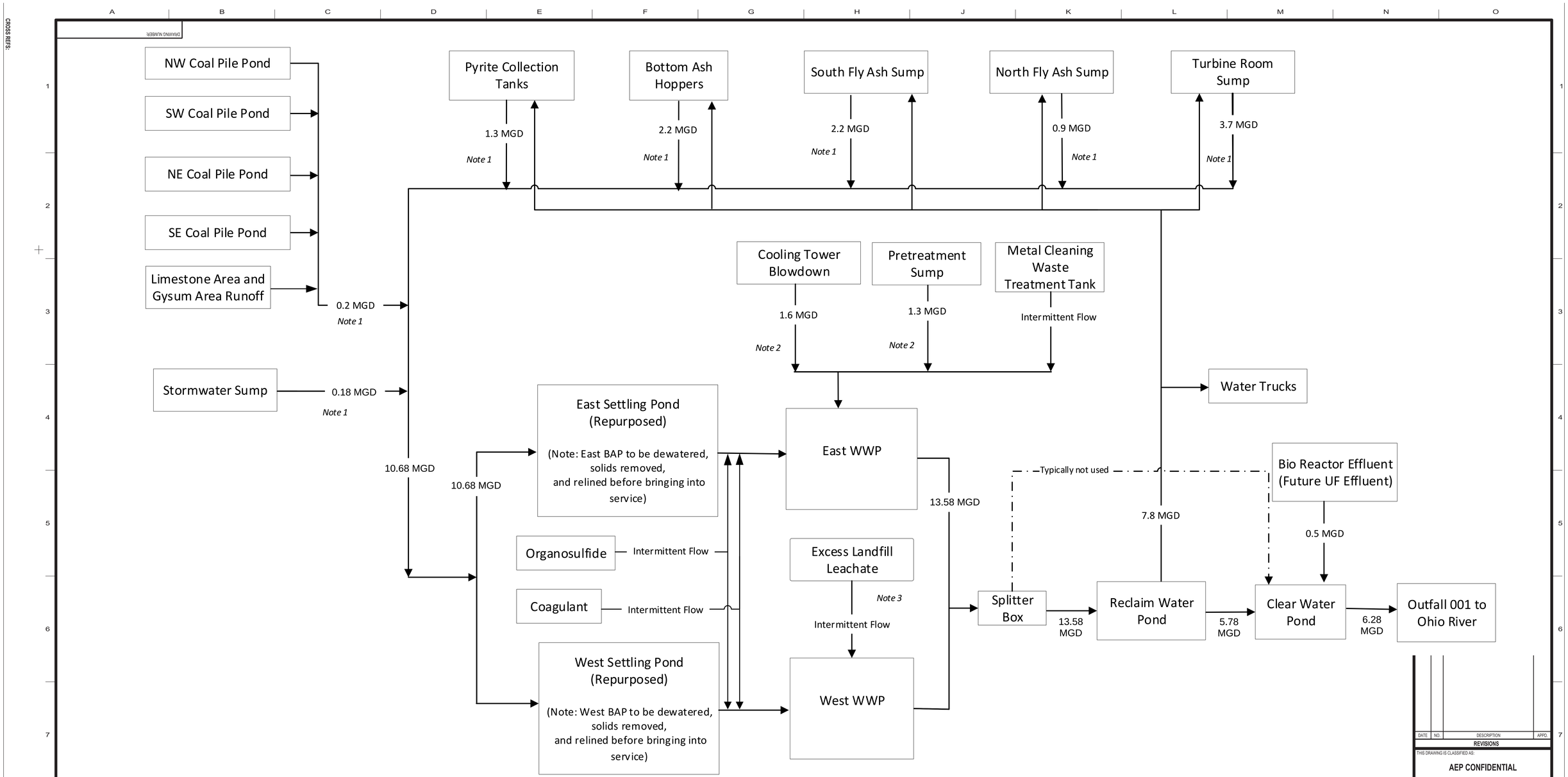
3/11/2020 7:57:51 AM

Appendix B

Existing and Future Water Balances

DRAFT



Notes:
1. All lines currently able to be routed into either East or West BAP.
2. Can discharge into either East or West WWP
3. Typically zero. Leachate typically sent to biological treatment or Leachate Surge Pond
4. Flow rate is documented as average/typical flow

REV	DATE	DESCRIPTION	ORIGINAL	CHECKED	REVIEWED	LEAD DESIGNER	ENGINEER/TECH SPEC	PROJECT ENGINEERING MANAGER	PROJECT MANAGER
C	20 Oct. 2020	ISSUED FOR USE	JF	KD	DF	LR			
B	13 Mar. 2020	ISSUED FOR USE	KD	DF		LR	LR	LR	TM
A	26 Feb. 2020	ISSUED FOR REVIEW	DF			LR	LR	LR	TM

DATE	NO.	DESCRIPTION	APPD.

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ORIGINATING PERSONNEL

DRAWN BY: K. DOBLE
CHECKED BY:
LEAD DESIGNER:
ENGINEER/TECH SPECIALIST: L. REID
PROJECT ENGINEERING MANAGER: T. MILLER

PROFESSIONAL ENGINEER'S SEAL

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF
PE: STATE:
LIC. NO.: DATE:

APPALACHIAN POWER COMPANY

MOUNTAINEER PLANT

NEW HAVEN — WEST VIRGINIA

CCR/ELG PROJECT

EXISTING WATER BALANCE BLOCK FLOW DIAGRAM WATER TREATMENT ENHANCED POND SYSTEM

UNIT: — DRAWING NUMBER: — REV:

SCALE: — ENGINEERING
DR:
CH:
SUP:
ENG:
DATE:
APPROVED BY

DOCUMENT PREPARED BY WORLEY

AEP AMERICAN ELECTRIC POWER

AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

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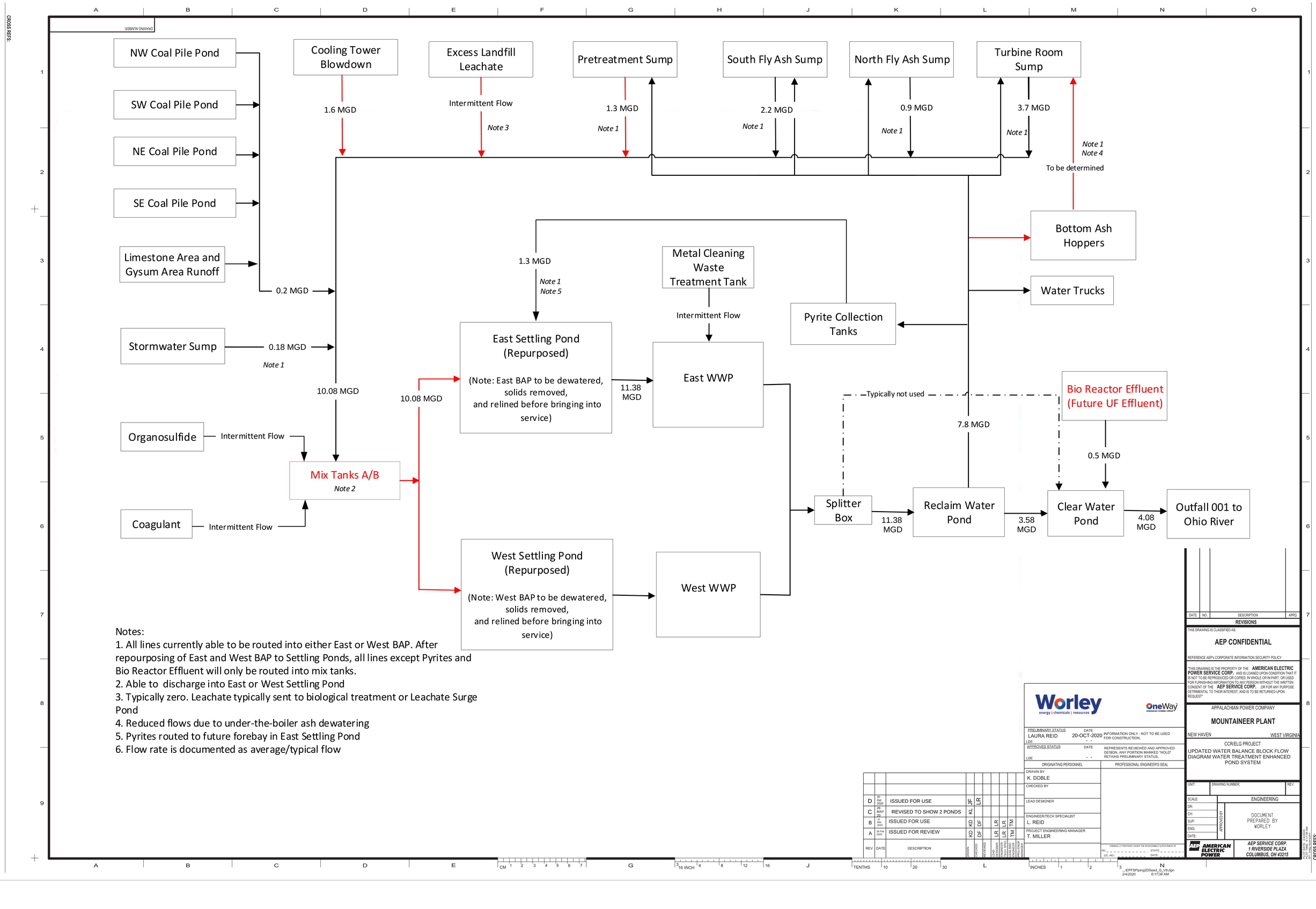

Notes:
1. All lines currently able to be routed into either East or West BAP. After repourposing of East and West BAP to Settling Ponds, all lines except Pyrites and Bio Reactor Effluent will only be routed into mix tanks.
2. Able to discharge into East or West Settling Pond
3. Typically zero. Leachate typically sent to biological treatment or Leachate Surge Pond
4. Reduced flows due to under-the-boiler ash dewatering
5. Pyrites routed to future forebay in East Settling Pond
6. Flow rate is documented as average/typical flow

REV	DATE	DESCRIPTION	DRAWN	CHECKED	REVIEWED	LEAD ENGINEER	TECH SPEC.	PROJECT MANAGER
D	20 Oct 2020	ISSUED FOR USE	JF	LR				
C	29 MAY 20	REVISED TO SHOW 2 PONDS	KL					
B	12 Mar. 2020	ISSUED FOR USE	KD	DF		LR	LR	TM
A	26 Feb 2020	ISSUED FOR REVIEW	KD	DF		LR	LR	TM

DATE	NO.	DESCRIPTION	APPD.

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ORIGINATING PERSONEL — PROFESSIONAL ENGINEER'S SEAL

DRAWN BY: K. DOBLE
CHECKED BY:
LEAD DESIGNER:
ENGINEER/TECH SPECIALIST: L. REID
PROJECT ENGINEERING MANAGER: T. MILLER

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF
PE: _____ STATE: _____
LIC. NO.: _____ DATE: _____

APPALACHIAN POWER COMPANY

MOUNTAINEER PLANT

NEW HAVEN — WEST VIRGINIA

CCR/ELG PROJECT

UPDATED WATER BALANCE BLOCK FLOW DIAGRAM WATER TREATMENT ENHANCED POND SYSTEM

UNIT: — DRAWING NUMBER: — REV:

SCALE: — ENGINEERING
DR:
CH:
SUP:
ENG:
DATE:
APPROVED BY:

DOCUMENT PREPARED BY WORLEY

AEP AMERICAN ELECTRIC POWER

AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

CROSS REFS:

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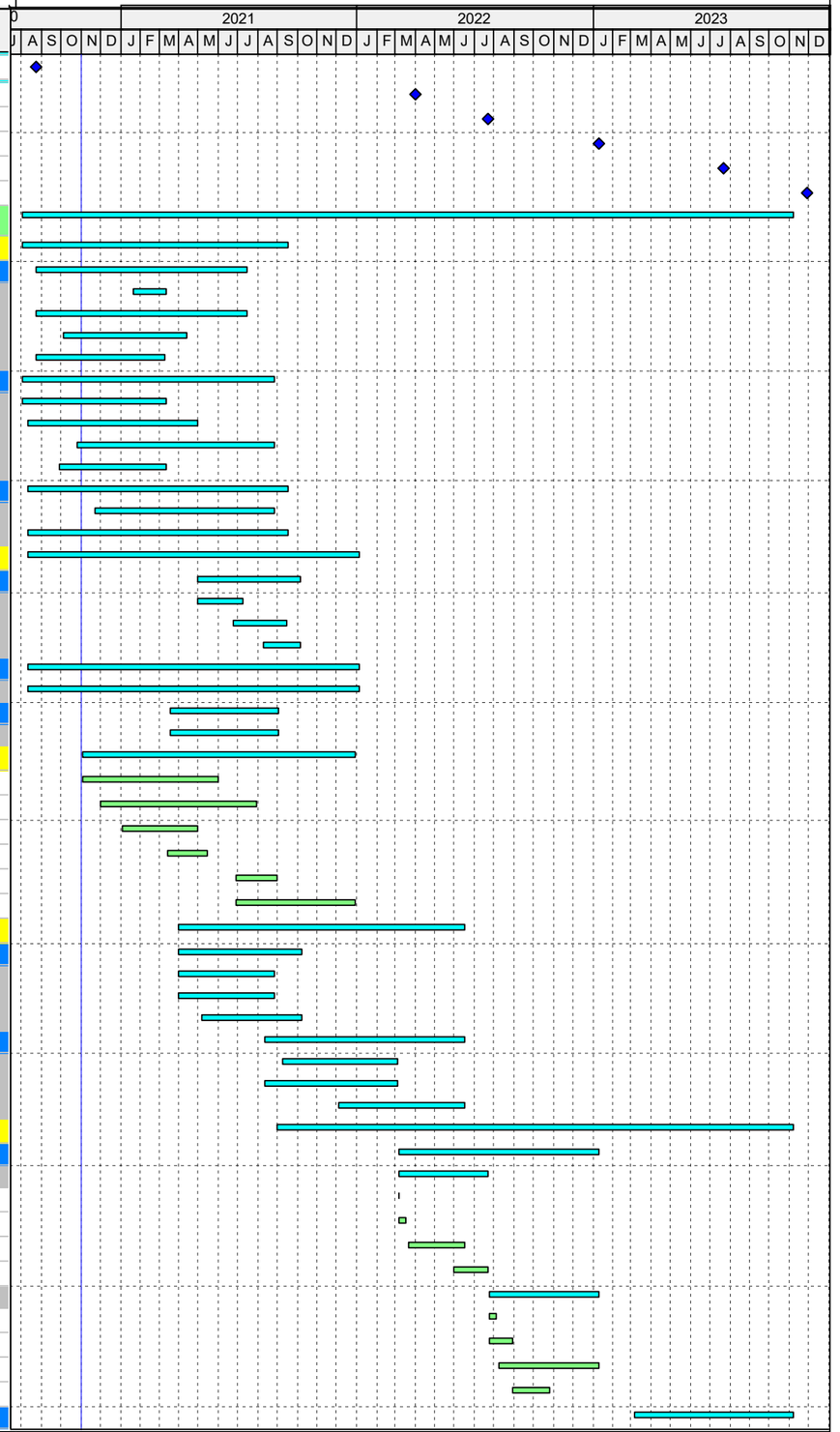
Appendix C

Site-Specific Schedule to Obtain Alternative Capacity

DRAFT

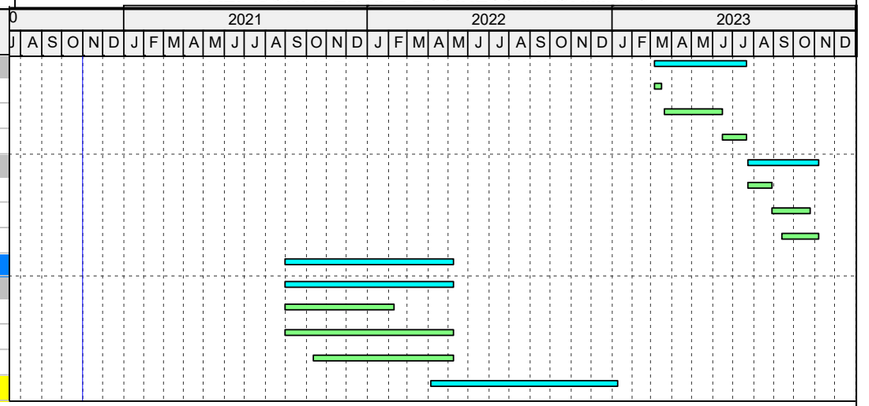
Activity ID	Activity Name	Duration (Months)	Start	Finish
M-00-M-020-SR-G-RPS-A80	AEP Release Engineer and OEM to Complete Detailed Design for CCR Compliance	0.0		24-Aug-20 A
M-BA-M-020-SR-G-RPS-A10	Cease sluicing CCR from Unit 1	0.0		31-Mar-22
M-PR-M-020-SR-G-RPS-A10	3rd Party QA/QC Certification of CCR Materials Removed for East Ash Pond Closure by Removal	0.0		22-Jul-22
M-PR-M-020-SR-G-RPS-A20	Initial Operation of East Settling Pond / All non-CCR Streams Routed through Lined Wastewater Pond (CCR Compliance)	0.0		09-Jan-23
M-PR-M-020-SR-G-RPS-A30	3rd Party QAQC Certification of CCR Materials Removed for West Ash Pond Closure by Removal	0.0		21-Jul-23
M-PR-M-020-SR-G-RPS-A40	Initial Operation of West Settling Pond	0.0		28-Nov-23
Mountaineer Plant		34.1	Aug-20 A	Nov-23
Engineering & Design		11.8	Aug-20 A	Sep-21
Common		9.4	Aug-20 A	Jul-21
Civil / Site Infrastructure		1.5	Jan-21	Mar-21
Byproduct Handling		9.4	Aug-20 A	Jul-21
Mechanical BOP Systems		5.4	Oct-20 A	Apr-21
Electrical BOP Systems		5.7	Aug-20 A	Mar-21
BA Conversion		11.1	Aug-20 A	Aug-21
Civil / Site Infrastructure		6.4	Aug-20 A	Mar-21
Byproduct Handling		7.6	Aug-20 A	Apr-21
Mechanical BOP Systems		8.7	Oct-20 A	Aug-21
Electrical BOP Systems		4.8	Sep-20 A	Mar-21
Pond Repurpose		11.6	Aug-20 A	Sep-21
Civil / Site Infrastructure		7.9	Nov-20	Aug-21
Mechanical BOP Systems		11.6	Aug-20 A	Sep-21
Procurement		14.5	Aug-20 A	Jan-22
Common		4.5	Apr-21	Oct-21
Byproduct Handling		2.0	Apr-21	Jul-21
Mechanical BOP Systems		2.4	Jun-21	Sep-21
Electrical BOP Systems		1.6	Aug-21	Oct-21
BA Conversion		14.5	Aug-20 A	Jan-22
OEM Ash Handling Equipment Engineering / Design / Fabrication / Delivery		14.5	Aug-20 A	Jan-22
Pond Repurpose		4.8	Mar-21	Sep-21
Mechanical BOP Systems		4.8	Mar-21	Sep-21
Permitting		12.0	Nov-20	Dec-21
M-00-L-915-SP-MP-PMT-A70	NPDES (Mountaineer)	6.0	Nov-20	Jun-21
M-00-L-915-SP-MP-PMT-A120	Prepare / Submit CPCN Application & Obtain Regulatory Approval from Public Service Commission	7.0	Dec-20	Jul-21
M-00-L-915-SP-MP-PMT-A90	Air Permit (Mountaineer)	3.4	Jan-21	Apr-21
M-00-L-915-SP-MP-PMT-A40	SWPPP (Mountaineer)	1.8	Mar-21	May-21
M-00-L-915-SP-MP-PMT-A20	Mine Spoil Disposal (Mountaineer)	1.8	Jun-21	Aug-21
M-00-L-915-SP-MP-PMT-A60	Dam/Dike Modifications (Mountaineer)	5.2	Jun-21	Dec-21
Labor Contracts		12.7	Mar-21	Jun-22
Bottom Ash Conversion Labor Contracts		5.5	Mar-21	Oct-21
Civil		4.3	Mar-21	Aug-21
Mechanical / Structural		4.3	Mar-21	Aug-21
Electrical / I&C		4.5	May-21	Oct-21
Pond Repurpose & Closure Labor Contracts		8.9	Aug-21	Jun-22
Civil		5.1	Sep-21	Mar-22
Mechanical / Structural		5.9	Aug-21	Mar-22
Electrical / I&C		5.6	Dec-21	Jun-22
Construction		22.9	Aug-21	Nov-23
East Bottom Ash Pond Closure & Settling Pond Repurpose		8.8	Mar-22	Jan-23
East Bottom Ash Pond Closure		4.0	Mar-22	Jul-22
M-PC-C-100-C-CON-S1-10	Divert pond inflows to West Bottom Ash Pond	0.0	Mar-22	Mar-22
M-PC-C-100-C-CON-S1-30	Dewater East Bottom Ash Pond	0.4	Mar-22	Mar-22
M-PC-C-100-C-CON-S1-40	CCR & Mine Spoil Material Removal from East Bottom Ash Pond	2.6	Mar-22	Jun-22
M-PC-C-100-C-CON-S1-50	QA/QC of CCR Removal	1.6	May-22	Jul-22
East Settling Pond Repurpose		4.8	Jul-22	Jan-23
M-PR-C-100-C-CON-S1-10	Subgrade prep for pond enhancements equipment area (Includes Area Fill)	0.4	Jul-22	Aug-22
M-PR-C-100-C-CON-S1-110	Subgrade prep liner	1.0	Jul-22	Aug-22
M-PR-C-100-C-CON-S1-180	Tank Based Chemical Treatment System Installation	4.4	Aug-22	Jan-23
M-PR-C-100-C-CON-S1-120	Install Liner & Protective Cover (Double Liner, Revetment in Pyrites Area)	1.6	Aug-22	Oct-22
West Bottom Ash Pond Closure & Settling Pond Repurpose		7.1	Mar-23	Nov-23



Current Bar Labels Summary

Milestone

Activity ID	Activity Name	Duration (Months)	Start	Finish
West Bottom Ash Pond Closure		4.0	Mar-23	Jul-23
M-PC-C-100-C-CON-S2-10	Dewater West Bottom Ash Pond	0.4	Mar-23	Mar-23
M-PC-C-100-C-CON-S2-25	CCR Material Removal from West Bottom Ash Pond	2.6	Mar-23	Jun-23
M-PC-C-100-C-CON-S2-30	QA/QC of CCR Removal	1.0	Jun-23	Jul-23
West Settling Pond Repurpose		3.1	Jul-23	Nov-23
M-PR-C-100-C-CON-S1-130	Subgrade prep liner	1.0	Jul-23	Aug-23
M-PR-C-100-C-CON-S1-140	Install Double Liner	1.6	Aug-23	Oct-23
M-PR-C-100-C-CON-S1-150	QA/QC Consultant Prepare West Settling Pond Certification for Operation	1.6	Sep-23	Nov-23
Bottom Ash Conversion Construction		7.2	Aug-21	May-22
Construction U1		7.2	Aug-21	May-22
M-BA-C-492-C-CON-129	Civil (UG Piping Relocations and Installation / Foundations / Ash Bunker)	4.8	Aug-21	Feb-22
M-BA-C-492-M-CON-139	Str / Mech (AG Utility Relos / Conv Steel / Eqpmnt Install / BoP Piping)	7.2	Aug-21	May-22
M-BA-C-492-E-CON-149	Elec / I&C (Conduit & Cable Tray Install / DCS Eqpmnt Install / Pull Power and Control Cabling and Terminate)	6.0	Oct-21	May-22
Tank Based Chemical Treatment & BA Systems Startup & Commissioning		8.0	Apr-22	Jan-23



Current Bar Labels Summary

Milestone

Appendix D

Groundwater Monitoring Well Network Evaluation Reports

DRAFT

ARCADIS Design & Consultancy for natural and built assets

AEP AMERICAN® ELECTRIC POWER

ASH POND SYSTEM-CCR GROUNDWATER MONITORING WELL NETWORK EVALUATION

Mountaineer Plant
Graham Station Road
Mason County
New Haven, West Virginia

October 27, 2016

ASH POND SYSTEM-CCR GROUNDWATER MONITORING WELL NETWORK EVALUATION

Mountaineer Plant, Graham Station Road, Mason County, New Haven, West Virginia

Everett Fortner III, PG
Senior Geologist

Matthew J. Lamb
Project Manager

John Holm, PE
Principal Engineer

Prepared for:

AEP

Prepared by:

Arcadis U.S., Inc.
100 E Campus View Boulevard
Suite 200
Columbus
Ohio 43235-1447
Tel 614 985 9100
Fax 614 985 9170

Our Ref.:

OH015976.0007

Date:

October 27, 2016

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     - 2.2.3 Construction and Operational History 2
     - 2.2.4 Surface Water Control 3
   - 2.3 Previous Investigations 3
   - 2.4 Hydrogeologic Setting 4
     - 2.4.1 Climate and Water Budget 5
     - 2.4.2 Regional and Local Geologic Setting 5
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APPENDICES

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ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power Service Corporation
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
ft	feet
LBR	Little Broad Run

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 bottom ash ponds (BAPs) (CCR Unit) at the AEP Mountaineer Generating Plant (Plant) located on Graham Station Road in New Haven, 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. These 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 BAPs (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 BAPs (east and west BAPs) and the offsite Little Broad Run (LBR) landfill (**Figure 2**). The evaluation of the LBR landfill is not included in this report and will be completed under separate cover.

Initial evaluation of the monitoring well network was completed in late 2015 into February 2016 and included a review of AEP-provided data associated with previously completed subsurface investigation activities in the vicinity of the BAPs, 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. Additional monitoring wells were installed from April through June 2016 to address these data gaps. Drilling activities were performed by a West Virginia-licensed drilling contractor (DLZ) with Arcadis personnel completing borehole logging and well installation oversight. The following report also 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 BAPs in the uppermost aquifer; therefore, the report objective has been met.

2. BACKGROUND INFORMATION

The following section provides background information for the AEP Mountaineer Generating Plant BAPs.

2.1 Facility Location Description

The AEP Mountaineer Generating Plant is located in Mason County, bounded by Little Broad Run to the west and the Ohio River to the east. The Plant is approximately 2 miles east of New Haven, West Virginia. The BAP CCR units are located on the south side of the Plant, adjacent to and on the west side of West Virginia Route 62 (Graham Station Road). The BAPs are located approximately 0.5 miles southwest of the Ohio River (**Figures 1** and **2**).

2.2 Description of Bottom Ash Pond CCR Units

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

2.2.1 Embankment Configuration

The BAP CCR Unit includes two separate west and east BAPs. In general, embankments of the BAPs are constructed of earthen material. North, west and east embankment material is comprised from excavation of the ponds and consist of compacted silty sand with some gravel. The embankment crest widths range from 20 to 45 feet (ft), and are approximately 35 ft or less in height. This corresponds to crest elevations that range from 620 ft above mean sea level (amsl) on the north side of the BAPs. The BAP interior and exterior embankments have crest elevations of approximately 620 ft amsl (Woodward-Clyde, 1985). Embankment slopes are typically graded at horizontal to vertical ratios between 3:1 and 2.5:1 (Shaw, Stone and Webster, 2006).

2.2.2 Area/Volume

The BAPs occupy an estimated combined surface area of approximately 28 acres (EPRI, 1999). Specifically related to the ponds that receive CCR products, the west BAP has a normal pool area of 14.1 acres and the east BAP has a normal pool area of 13.9 acres. The normal reservoir volumes of the west and east BAPs are 193 and 152 acre ft, respectively. The maximum design volumes of the west and east BAPs are 266 and 225 acre ft, respectively (Shaw, Stone, and Webster, 2006).

2.2.3 Construction and Operational History

The AEP Mountaineer Generating Plant is a single-unit coal-fired generating plant and began operations in September 1980. The BAPs were constructed between 1978 and 1980 and were completed when the generating plant became operational. The original configuration is similar to the current configuration (**Figure 3**). All ponds are lined with a 3-ft clay liner with clay derived from offsite borrow areas (Woodward-Clyde, 1985). In 2006, the downstream (i.e. north) embankment of the BAPs was re-

designed to a steeper slope from 3:1 to 2.5:1. This design change was to accommodate the installation of two gypsum conveyors. Modifications to the downstream BAP embankment and installation of the gypsum conveyors were completed by the first half of 2007.

Currently, the BAPs receive all process wastewaters from the Plant via above ground and below ground steel piping. The BAPs are filled in an alternating fashion, with one BAP generally receiving waste streams while the other BAP is being cleaned out. Bottom ash is either used for beneficial re-use or disposed of in the LBR Landfill (EPRI, 1999).

2.2.4 Surface Water Control

The perimeter of the BAPs is graded such that surface runoff is directed away from the ponds. This grading is accomplished by either natural topographic relief or constructed embankments such as the main dike along the northwest side of the BAPs (**Figure 3**).

Surface water flow within the BAPs is controlled by a series of slide gates, corrugated metal pipes, vertical inlets, and overflow concrete channels. Pond elevations are maintained so that surface water flows via gravity or pumping to ponds in the following order: east and west BAPs and subsequently to east and west wastewater ponds, and the reclaim and/or clearwater pond (Woodward-Clyde, 1985). The stage levels of the BAPs are generally maintained no greater than the normal operating levels ranging from 603 to 612 ft amsl (H.C. Nutting, 2009). From the clearwater pond, water flows to the Ohio River through a National Pollutant Discharge Elimination System permitted outfall via underground piping (EPRI, 1999).

2.3 Previous Investigations

Prior to BAP construction, Casagrande Consultants performed site investigations from 1976 to 1977 related to suitability of onsite soils for pond and embankment construction and stability (Casagrande, 1977).

In 1985, Woodward-Clyde Consultants performed an assessment of dam safety for the BAPs (Woodward-Clyde, 1985). This assessment included review of AEP-provided data and previous site investigations and a complete visual inspection of the dikes and secondary structures. The Woodward-Clyde Consultants report concluded that dike and pond condition were satisfactory.

From 1995 through 1998, AEP worked in coordination with Ish, Inc., META Environmental, Inc., HIS GeoTrans, Inc., and the Electric Power Research Institute (EPRI) to evaluate groundwater quality associated with a number of AEP power generating facilities, including the Mountaineer Plant. The primary objectives of these site investigations were to characterize hydrogeology, identify potential contaminant source areas, establish existing groundwater quality, and identify constituents that exceeded West Virginia Groundwater Standards. These studies are described in detail in the report *Groundwater Quality at the Philip Sporn and Mountaineer Power Plants, Mason County, West Virginia* (EPRI, 1999). Field work for these investigations included 19 direct push technology groundwater sampling points, installation and sampling of 5 permanent monitoring wells (MW-001 through MW-005), surface water sampling, and geotechnical soil characterization.

In 2005, GAI Consultants, Inc. performed stability analysis associated with previous mining activities associated with the Redstone Coal (GAI, 2005). As part of this investigation, GAI reviewed existing boring logs and rock cores, performed point load strength testing of core samples, performed stability calculations of mine pillars and ground movement from proposed future mining operations. GAI concluded that the Site is not expected to have adverse impacts from past or future mining of the Redstone Coal.

In 2006, H.C. Nutting Company performed site investigations associated with planned modifications to the main dike in preparation for construction of two gypsum conveyors (H.C. Nutting, 2006a; H.C. Nutting, 2006b). These investigations involved foundation inspections, compaction testing of fill material, geotechnical analysis of soil samples, and concrete testing associated with conveyor construction. Also in 2006, Shaw, Stone, and Webster, Inc. performed stability analysis related to the gypsum conveyor construction (Shaw, Stone, and Webster, 2006). Additional slope stability analyses for the north, west, and east embankments related to the gypsum conveyor construction in 2009 was also performed by Shaw, Stone, and Webster, Inc. The results of this analysis showed that, in general, embankment slopes would be stable under static and seismic loading. However, a blanket drain was recommended at the toe and cut faces of the embankment along gypsum conveyor #2 to prevent saturation and slumping (Shaw, Stone, and Webster, 2009).

H.C. Nutting performed a geotechnical investigation of the BAPs in 2009, specifically related to upstream and downstream embankment slope factors of safety under static and seismic conditions. Field methods involved drilling, logging, and sampling 6 soil borings through select embankments (B-09-01 through B-09-06). 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 piezometers (PZ-09-03, PZ-09-04, and PZ-09-05). This site investigation included numerical slope stability modeling, and concluded that the embankment slopes had adequate factors of safety for both long-term and earthquake stability (H.C. Nutting, 2009).

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 unconfined deeper sand zones. Maximum alluvium thickness is approximately 80 to 90 ft and thins westward towards the edges of the valley. Groundwater flow direction within the alluvium is generally towards the Ohio River. However, there are active production wells (East 1, West 1) and firewater supply wells (Well 5, Well 6) at the Site (**Figure 3**) that withdraw water from the alluvial aquifer. Groundwater flow is influenced towards those wells during pumping conditions.

In the upland areas surrounding the Site, bedrock consists of the Pennsylvanian age sandstones, shales, limestones, and coal of the Monongahela Group. At higher elevations, the hilltops are capped by the Permian age Dunkard Formation, which is lithologically similar to the Monongahela Group. Sandstone and shale of the Monongahela Group immediately underlie alluvial sediments at the Site.

Cross section A-A', which extends through the BAPs further illustrates the geology. The cross section A-A' trends from southwest to northeast as shown on **Figure 4** and is depicted as **Figure 5**. Boring logs and well construction diagrams are included in **Appendix A**.

2.4.1 Climate and Water Budget

The climate of Mason County, West Virginia is characterized as humid continental with an average rainfall of approximately 42 inches annually. The average maximum temperature is 68 ºF and the average minimum temperature is 44 ºF based on information from the 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 Ohio River alluvial plain along the western bank of the Ohio River. Alluvial sediments consist of clay, silt, sand and gravel deposits that generally coarsen downward. In general, shallow clays and silts range in thickness from 10 to 40 ft. Some fill material is present near the Ohio River, which was likely derived from on-site excavations. This fill material varies from silty clay to gravelly sand. Unconsolidated mine wastes can be found in the base of the BAPs and blanketing the BAP embankments in thicknesses ranging from 3 to 7 ft (Shaw, Stone and Webster, 2006; H.C. Nutting, 2009).

Bedrock is present underlying the alluvial deposits near the BAPs, as well as bounding ridges of the Ohio River alluvial valley. The primary regional bedrock units are sedimentary rocks of the Permian age Dunkard Formation and the Pennsylvanian age Monongahela Formation. The depositional environment for these formations is characterized by a gradually subsiding shallow sea with alternating marine and freshwater strata. Sedimentary rocks associated with the Monongahela Formation, which immediately underlie the alluvial sediments beneath the Site, consist 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. The base of the younger Dunkard group, which caps surrounding ridges and is lithologically similar to the Monongahela Formation, is marked by a thick, massive conglomeritic sandstone (EPRI, 1999).

2.4.3 Surface Water and Surface Water Groundwater Interactions

The Site is adjacent to the Ohio River, and the BAPs are located approximately 0.5 miles southwest of the Ohio River. Little Broad Run is immediately adjacent to the west of the BAPs. Groundwater flow direction is generally to the northeast and discharges to the Ohio River, although local pumping from Plant operations influences groundwater flow to the north. Groundwater recharge is primarily from precipitation. Despite its proximity, Little Broad Run is generally not connected to groundwater at the Site. The base of Little Broad Run is perched on surficial clay deposits and is at an elevation of 580 to 590 ft amsl (EPRI, 1999), which is approximately 30 to 40 ft above the groundwater table. The Ohio 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 Ohio River at 538 ft amsl (EPRI, 1999).

2.4.4 Water Users

There are currently five active pumping wells associated with the Plant that extract groundwater from the deep unconsolidated sand and gravel aquifer. Two of these wells (West 1, East 1) are alternately pumped for process water and are located approximately 2,200 feet and 2,600 feet northeast of the BAPs, respectively. At the time of this report, average pumping rates from September 6 through September 26, 2016 for West 1 and East 1 were 566 gallons per minute and 144 gallons per minute, respectively. There are also two pumping wells (Wells 5 and 6) which are used for fire water supply. Well 5 is located approximately 1,200 ft north of the BAPs and Well 6 is located approximately 2,700 feet northwest of the BAPs. A fifth well (Well 4) is used in the plant's wastewater system and is located approximately 2,500 feet northeast of the BAPs. Well location coordinates, production test data, and boring logs for the pumping wells are included in **Appendix A**. The screened intervals for each of these wells is from 63 to 78 feet below ground surface, which is near the base of the alluvial aquifer. There are no potable groundwater wells at the Site.

In 2014, a water well inventory for the Mountaineer Plant indicated information on one other groundwater well located within a 0.5-mile buffer of the Site (Banks, 2014) (**Appendix B**). The well is registered with the United States Geological Survey and is assumed to have been used for monitoring. The well is located approximately 3,700 feet east of the BAPs.

3. GROUNDWATER MONITORING WELL NETWORK EVALUATION

An initial evaluation of the monitoring well network present at the Site was performed in late 2015 into February 2016 to determine if any of the existing wells were viable for continued use as part of the groundwater quality 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. An additional 12 monitor wells were installed in April through June 2016. Monitoring wells included in the monitoring network are designated as up or down gradient. Up gradient monitoring wells represent background groundwater quality and the down gradient monitoring wells were placed down gradient of the CCR unit boundary to monitor water quality.

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 water table elevation in the unconfined sand and gravel deposits, which ranges from approximately 543 to 556 ft amsl in the immediate vicinity of the BAPs. The base elevation of the BAPs (i.e. bottom of clay liner) is estimated to be approximately 586 to 597 ft amsl (Woodward-Clyde, 1985). Based on this information, there appears to be at least 30 ft of separation between the top of the saturated sand and gravel zone and the base of the CCR Unit, which is illustrated in cross section A-A' (**Figure 5**).

The vertical extent of the aquifer likely extends to the base of the unconsolidated deposits in the valley to the bedrock interface. There are no significant clay or silt layers within the aquifer. The saturated thickness of alluvial deposits is at least 20 to 30 ft, and likely greater where alluvial deposits are thickest. The uppermost unconsolidated aquifer appears laterally extensive in all directions around the BAPs. The uppermost aquifer pinches out towards the bedrock valley wall to the west. The soil liner beneath the ponds limits hydraulic connection of the BAPs to the subsurface.

3.1.2 Overall Flow Conditions

Regional groundwater recharge occurs from precipitation infiltration and from leakage from tributary streams crossing the Ohio River floodplain. Bedrock, to a lesser extent, likely contributes recharge of the uppermost unconsolidated aquifer from the west of the Site where the alluvial valley is in contact with the valley wall.

Available groundwater elevations are summarized on **Table 1** for 1997 through 2016. Current groundwater flow conditions that includes influence from groundwater pumping at the Mountaineer Plant was evaluated using the U.S. EPA's Wellhead Analytical Element Model (WhAEM2000) (Kraemer et al.,

2007). Details of the modeling are provided in **Appendix C**. Results of the current understanding of groundwater flow from the model under current pumping conditions and BAP use is shown on **Figure 6**. Groundwater flow direction as depicted is predominantly north to northeast towards the Plant pumping wells and the Ohio River. As presented in **Table 2**, wells included in the monitoring network have been designated as up or down gradient.

Vertical hydraulic gradients in the immediate vicinity of the BAPs are generally upwards. Groundwater elevations measured on September 26, 2016 indicated upward vertical hydraulic gradients ranging from 6.0×10^{-4} ft/ft (MW-1605S/MW-1605D) to 9.9×10^{-3} ft/ft (MW-1604S/MW-1604D). A downward vertical gradient of 1.8×10^{-3} ft/ft was measured at the MW-1606S/MW-1606D well pair.

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 results were used to assist with monitoring well design. The results of this analysis are summarized in **Table 3**, and complete laboratory reports are provided in **Appendix D**. Grain size analysis of samples collected within the final screen intervals indicated sediments were generally poorly-graded sand. Secondary proportions of silt or gravel were found at some boreholes within the final screen intervals.

3.1.4 Hydraulic Conductivity

Hydraulic testing was completed at wells MW-001, MW-002, MW-004, and MW-005 prior to this evaluation in the uppermost unconsolidated aquifer. Estimated hydraulic conductivity based on these slug tests was reported to range from 51 ft per day in sandy sediments to 772 ft per day in gravelly sediments with an overall geometric mean of 237 ft per day, based on site slug testing (EPRI, 1999).

Additional slug tests were performed at newly-installed monitoring wells on June 20-21, 2016. Pneumatic and bail down slug tests were performed on a total of 3 up gradient wells (MW-1601A, MW-1603, and MW-1608) and 4 down gradient wells (well pairs MW-1605S/MW-1605D, MW-1607S/MW-1607D) to provide a more spatial understanding of the hydraulic conductivity distribution within the alluvial sands (i.e. uppermost aquifer). Well construction details for these monitoring wells and all other wells are presented in **Table 2**.

Data-logging pressure transducers were used during these tests in 2016 to monitor water level displacement every 0.5 seconds and in real time. Three pneumatic slug tests were performed at each well except MW-1603, at which a bail down slug test was performed due to equipment issues. Two tests were performed using an identical initial pressure and one test was performed using approximately twice 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.

At MW-1603, three bail-down slug tests were completed. 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.

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 unconfined conditions, as appropriate based on the response. Results of the slug test analyses, including hydraulic conductivity estimates, are summarized in **Table 4** and solution reports with individual curve matches are provided in **Appendix E.**

The hydraulic conductivity estimates from the seven monitoring wells tested had a tight range from 147 ft per day (MW-1605S) to 213 ft per day (MW-1601A). The overall mean hydraulic conductivity estimate was 187 ft per day, while the overall geometric mean was 186 ft per day. Estimated hydraulic conductivity values for all the wells were consistent for a sand and gravel alluvium system and correlate to the geometric mean hydraulic conductivity estimates of the historical hydraulic testing.

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 unconfined sands and gravels. This aquifer is used locally for groundwater supply related to plant operations, but is not known to provide other private or industrial water use in the area.

3.3 Review of Existing Monitoring Well Network

3.3.1 Overview

The Site was visited by Arcadis and AEP personnel on August 12, 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 existing monitoring well network is included as **Table 2**.

The groundwater quality monitoring well network monitors the alluvial aquifer consisting of unconfined sand and gravel defined as the uppermost aquifer. It includes 12 wells installed from April to June 2016. An additional 8 Mountaineer Plant wells, and 3 piezometers, which were present prior to Arcadis initial evaluation, are utilized for the purpose of hydraulic monitoring (**Table 2**). Four well pairs (MW-1604S/MW-1604D, MW-1605S/MW-1605D, MW-1606S/MW-1606D, MW-1607S/MW-1607D) measure vertical flow.

Spatially, the network extends as far up gradient to the south as MW-1601A, and to the north as MW-1608. Down gradient, the network extends immediately down gradient of the BAPs (MW-1604S/MW-1604D through MW-1607S/MW-1607D). Eight existing wells and 3 existing piezometers have been retained in the network for hydraulic monitoring (**Table 2**). 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 late 2015 and in early 2016. Following monitoring well installation described in **Appendix F** of this report, there are no gaps in the monitoring network. Up gradient background water quality is not current and will need to be re-evaluated with analysis results from the new recommended monitoring well network. The recommended monitoring well network is 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 BAPs (up gradient or down gradient), well depth, and well construction. The recommended 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 12 monitoring wells were installed to establish an adequate network. Specifics on field methodology and other documentation on installation of the additional wells in 2016 is provided in **Appendix F**. Monitoring well construction was targeted to monitor the unconfined saturated alluvial sand and gravel, which is identified as the uppermost aquifer. The total groundwater quality monitoring network includes 4 up gradient wells and 8 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 12 groundwater quality wells, 8 wells and 3 piezometers are used to refine the understanding of groundwater flow and hydraulic gradients in the vicinity of the BAPs 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, northeast, and east of the BAPs. These wells include newly-installed wells MW-1604S, MW-1604D, MW-1605S, MW-1605D, and MW-1606S, MW-1606D, MW-1607S, and MW-1607D (**Table 2**). These wells monitor groundwater as it flows north and northeast past the CCR unit boundary. Down gradient wells were installed as shallow and deep well pairs within the uppermost aquifer in order to monitor the entire saturated thickness of the aquifer.

4.1.2 Up Gradient Locations

Up gradient monitoring wells are located southeast, south, and northwest of the BAPs. These wells include newly-installed wells MW-1601A, MW-1602, MW-1603, and MW-1608 (**Table 2**). These wells establish background groundwater quality up gradient of the CCR unit boundary, with the exception of MW-1608. MW-1608 establishes background groundwater quality of groundwater flowing from the bedrock ridge into the Ohio River valley.

4.2 Well Construction

Groundwater quality monitoring wells in the network are constructed of 2-inch Schedule 40 PVC risers with 10 to 15 ft slotted PVC screens. All monitoring wells were installed in general accordance with West Virginia Department of Environmental Protection Title 47 Series 60 Monitoring Well Design Standards dated June 21, 2011 by a state-licensed driller. Installation details and field methods are provided in

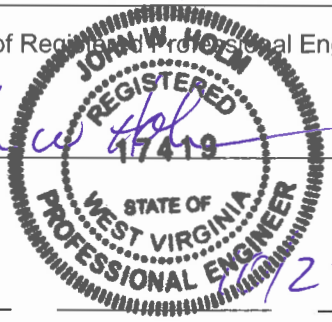
Appendix F. Well construction data for the monitoring well network is summarized on **Table 2**. Boring logs and the monitoring well completion diagrams are provided in **Appendix A**.

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

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TABLES

Table 1
Water Level Data
AEP Mountaineer Generating Plant - Bottom Ash Ponds
New Haven, West Virginia

Well ID	5/1/1997	8/1/1997	12/1/1997	7/1/2008	10/1/2008	1/1/2009	4/1/2009	12/1/2009	3/10/2010	6/10/2010	9/10/2010	12/1/2010	4/1/2011	11/1/2011	6/12/2012	12/17/2012	6/11/2013	12/3/2013	6/10/2014	12/16/2014	6/9/2015	9/26/2016
	GW Elev. [a] ft. amsl	GW Elev. [a] ft. amsl	GW Elev. [a] ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl
Gravel Zone Wells																						
Downgradient																						
MW-001	NA	542.19	542.41	542.20	541.13	541.79	542.69	541.18	545.06	541.51	539.81	542.78	544.6	540.8	540.70	541.75	540.91	540.52	541.66	540.80	541.35	539.25
Sand Zone Wells																						
Upgradient																						
MW-1601A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	544.58
MW-1602	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	544.76
MW-1603	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	543.67
MW-1608	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	541.35
Downgradient																						
MW-002	NA	541.76	542.30	541.87	540.91	541.56	542.73	541.39	545.59	541.43	539.74	542.96	544.79	540.67	540.58	541.84	540.87	540.57	541.5	540.80	541.2	539.95
MW-003	NA	554.86	553.42	NA	NA	NA	NA	NA	NA	NA	545.18	545.06	dry	dry	dry	dry	dry	dry	dry	dry	dry	NA
MW-004	NA	541.65	542.19	541.74	540.79	541.46	542.63	541.26	545.54	541.34	539.71	542.81	544.65	540.59	540.48	541.77	540.76	540.44	541.42	540.67	541.14	540.15
MW-005	NA	556.42	555.05	NA	550.17	548.62	547.57	545.85	547.79	545.84	544.57	544.68	544.3	544.61	544.54	dry	545.14	544.66	545.84	544.17	545.71	NA
MW-016	NA	NA	NA	548.13	546.38	545.37	543.89	541.09	541.09	541.3	540.25	541.45	542.15	542.01	542.03	540.08	543.26	541.62	543.08	541.32	543.30	541.30
JTMN-1	NA	541.80	542.66	541.13	540.10	540.03	541.56	540.48	544.39	540.19	539.06	542.15	542.88	539.63	539.43	540.84	540.42	539.97	540.38	539.93	540.20	539.40
JTMN-2	NA	542.61	543.40	541.35	540.35	540.20	541.50	540.30	544.18	540.04	538.99	541.95	542.77	539.53	539.32	540.65	540.38	539.90	540.30	539.84	540.15	539.24
MW-1604S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	542.54
MW-1604D	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	542.74
MW-1605S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	542.51
MW-1605D	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	542.52
MW-1606S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	543.19
MW-1606D	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	543.15
MW-1607S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	543.52
MW-1607D	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	543.56
Piezometers																						
Downgradient																						
PZ-09-03	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	592.65
PZ-09-04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	572.23
PZ-09-05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	561.61
Sporn Wells [b]																						
MW-006	NA	551.48	551.13	NA	NA	NA	NA	NA	601.00	542.64	541.23	543.08	543.28	541.67	541.17	541.02	542.61	541.83	542.50	541.58	542.18	541.20
MW-008	NA	543.58	544.46	NA	NA	543.94	545.45	543.82	550.26	527.28	542.01	545.23	546.45	542.46	542.03	543.71	542.25	542.52	543.41	542.75	542.62	NA
MW-009	NA	543.48	544.33	535.64	534.40	535.63	537.16	535.78	540.94	536.16	533.90	537.27	538.38	534.39	533.93	535.86	533.97	534.45	536.35	534.75	534.45	540.97
MW-011	NA	557.51	554.95	NA	NA	552.21	551.04	551.46	556.52	570.44	552.17	551.79	552.4	547.43	548.34	547.86	547.05	549.22	550.05	547.99	547.67	NA
MW-013	NA	541.24	541.69	NA	NA	NA	NA	NA	581.21	542.99	540.47	544.18	545.81	540.36	540.82	542.90	540.92	541.22	542.40	541.61	541.41	540.33
MW-014	NA	540.14	541.70	NA	NA	NA	NA	NA	588.44	542.49	540.11	543.97	545.75	540.59	540.12	542.36	540.56	539.84	541.48	541.11	540.83	540.08

Notes:
a. Source: EPRI. June 1999. Groundwater Quality at the Philip Sporn and Mountaineer Power Plants, Mason County, West Virginia
b. Sporn wells used for the simulated groundwater flow model only. Sporn wells are not used for the CCR well network.
Elevation in feet above mean sea level
Unless otherwise noted, water level data collected during AEP well gauging events
amsl - above mean sea level
Elev - elevation
ft - feet
GW - groundwater
NA - not available

Table 2
Well Construction Details
AEP Mountaineer Generating Plant - Bottom Ash Ponds
New Haven, West Virginia

Well ID	Hydraulic Monitoring Only	Location Description to CCR Unit	Northing [a]	Easting [a]	Ground Surface Elevation	Top of Casing Elevation ft amsl	Borehole Depth ft. bls	Date Installed	Screen Material	Well Diameter inches	Top of Screen		Bottom of Screen	
											Depth ft. bls	Elevation ft. amsl	Depth ft. bls	Elevation ft. amsl
Gravel Zone Wells														
Downgradient														
MW-001 [b]	X	North	724542.7	1701713.0	569.18	571.32	38.0	6/18/1997	Sch. 40 PVC	2	27.0	542.18	37.0	532.18
Sand Zone Wells														
Upgradient														
MW-1601A [c]		Southeast	717349.0	1702641.3	607.47	610.66	80.0	6/9/2016	Sch. 40 PVC	2	67.0	540.47	77.0	530.47
MW-1602 [c]		South	717716.0	1702066.2	602.37	605.12	71.6	5/10/2016	Sch. 40 PVC	2	61.0	541.37	71.0	531.37
MW-1603 [c]		Northwest	719560.2	1701042.0	602.92	606.30	76.0	5/4/2016	Sch. 40 PVC	2	60.0	542.92	75.0	527.92
MW-1608 [c]		Northwest	723686.8	1699158.3	587.26	590.65	70.0	6/10/2016	Sch. 40 PVC	2	46.0	541.26	56.0	531.26
Downgradient														
MW-002 [b]	X	North	724901.8	1702197.6	580.82	582.81	73.0	6/24/1997	Sch. 40 PVC	2	60.5	520.32	70.5	510.32
MW-003 [b]	X	Northeast	719921.2	1702260.8	604.90	607.20	43.4	6/25/1997	Sch. 40 PVC	2	32.3	572.60	42.3	562.60
MW-004 [b]	X	North	724909.9	1702190.5	581.08	583.13	48.2	6/30/1997	Sch. 40 PVC	2	37.6	543.48	47.6	533.48
MW-005 [b]	X	East	719196.9	1702976.0	591.00	593.19	50.0	7/1/1997	Sch. 40 PVC	2	37.7	553.30	47.7	543.30
MW-016 [d]	X	North	721475.5	1701361.3	586.82	588.61	82.0	6/17/2008	Sch. 40 PVC	2	67.5	519.32	77.5	509.32
JTMN-1 [d]	X	North	723507.5	1702616.8	582.17	583.67	76.6	7/19/1990	Sch. 40 PVC	2	56.7	525.47	75.7	506.47
JTMN-2 [d]	X	North	723436.8	1702653.5	582.16	584.06	77.8	7/18/1990	Sch. 40 PVC	2	57.9	524.26	76.9	505.26
MW-1604S [c]		North	720233.9	1701624.2	595.48	598.07	60.0	5/2/2016	Sch. 40 PVC	2	49.0	546.48	59.0	536.48
MW-1604D [c]		North	720238.0	1701629.1	595.59	598.22	80.0	4/27/2016	Sch. 40 PVC	2	69.0	526.59	79.0	516.59
MW-1605S [c]		Northeast	720156.3	1702018.3	588.51	590.86	59.5	5/12/2016	Sch. 40 PVC	2	49.0	539.51	59.0	529.51
MW-1605D [c]		Northeast	720161.4	1702015.6	588.51	591.01	80.0	5/11/2016	Sch. 40 PVC	2	69.0	519.51	79.0	509.51
MW-1606S [c]		Northeast	719693.3	1702486.4	587.28	590.15	56.0	5/18/2016	Sch. 40 PVC	2	45.0	542.28	55.0	532.28
MW-1606D [c]		Northeast	719697.7	1702482.4	587.25	590.10	76.0	5/16/2016	Sch. 40 PVC	2	65.0	522.25	75.0	512.25
MW-1607S [c]		East	719276.0	1702912.2	590.79	593.99	60.0	5/26/2016	Sch. 40 PVC	2	50.0	540.79	60.0	530.79
MW-1607D [c]		East	719279.7	1702908.9	590.75	593.93	80.0	5/19/2016	Sch. 40 PVC	2	70.0	520.75	80.0	510.75
Piezometers														
Downgradient														
PZ-09-03 [e]	X	Northeast	719485.3	1702397.3	621.60	621.17	50.4	2/17/2009	Sch. 40 PVC	1.5	5.0	616.60	50.4	571.20
PZ-09-04 [e]	X	Northeast	719550.1	1702466.6	597.10	596.64	25.0	2/19/2009	Sch. 40 PVC	1.5	5.0	592.10	24.8	572.30
PZ-09-05 [e]	X	Southeast	718527.3	1703537.3	611.70	610.74	50.2	2/18/2009	Sch. 40 PVC	1.5	5.0	606.70	50.2	561.50
Sporn Wells [f]														
MW-006 [b]		East	720299.8	1704227.1	601.31	601.57	96.0	7/8/1997	Sch. 40 PVC	2	81.1	520.21	91.1	510.21
MW-008 [b]		East	718959.9	1704700.6	NA	NA	34.9	7/22/1997	Sch. 40 PVC	2	23.8	NA	33.8	NA
MW-009 [b]		Southeast	718372.3	1704868.0	574.98	576.55	54.5	7/15/1997	Sch. 40 PVC	2	42.3	532.68	52.3	522.68
MW-011 [b]		Southeast	717710.5	1704997.8	NA	NA	50.0	7/23/1997	Sch. 40 PVC	2	36.3	NA	46.3	NA
MW-013 [b]		East	718802.7	1705591.5	579.48	581.51	50.5	7/30/1997	Sch. 40 PVC	2	39.5	539.98	49.5	529.98
MW-014 [b]		East	718936.5	1705374.9	586.89	588.89	61.0	7/30/1997	Sch. 40 PVC	2	49.7	537.19	59.7	527.19

Notes:
a. 1983 West Virginia State Planar Coordinates
b. Source: EPRI. June 1999. Groundwater Quality at the Philip Sporn and Mountaineer Power Plants, Mason County, West Virginia
c. Source: AEP survey, September 2016
d. Source: AEP-provided boring logs
e. Source: H.C. Nutting. March 2009. Geotechnical Engineering Report. AEP Mountaineer Bottom Ash Pond Complex. Appendix A
f. Sporn wells used for the simulated groundwater flow model only. Sporn wells are not used for the CCR well network.
amsl - above mean sea level
bls - below land surface
ft - feet
NA - not available

Table 3
Grain Size Analysis Summary
AEP Mountaineer Generating Plant - Bottom Ash Ponds
New Haven, West Virginia

		Grain Size Analysis					
Sample ID	**Depth feet**	**% Gravel**	**% Sand**	**% Silt**	**% Clay**	**USCS Classification**	**Moisture Content %**
Sand Zone Wells							
Upgradient							
MW-1601A	66-76	8.9	89.2	1.3	0.5	(SP) POORLY-GRADED SAND	4.8
MW-1602	61-71	4.4	92.2	2.1	1.3	(SP) POORLY-GRADED SAND	17.9
MW-1603	60-75	24.1	71.2	3.8	0.8	(SP) POORLY-GRADED SAND with GRAVEL	15.7
MW-1608	46-56	10.5	84.5	2.2	2.8	(SP) POORLY-GRADED SAND	13.6
Downgradient							
MW-1604S	49-59	4.2	91.1	2.4	2.3	(SP) POORLY-GRADED SAND	17.4
MW-1604D	69-79	8.4	86.0	3.5	2.0	(SP-SM) POORLY-GRADED SAND with SILT	15.2
MW-1605S	49-59	8.6	85.7	4.4	1.3	(SP-SM) POORLY-GRADED SAND with SILT	18.1
MW-1605D	69-79	9.1	85.2	5.6	0.1	(SP-SM) POORLY-GRADED SAND with SILT	16.1
MW-1606S	45-55	7.9	88.5	1.9	1.6	(SP) POORLY-GRADED SAND	22.5
MW-1606D	65-75	14.0	82.9	1.7	1.4	(SP) POORLY-GRADED SAND	15.4
MW-1607S	56-60	23.2	76.2	0.1	0.5	(SP) POORLY-GRADED SAND with GRAVEL	17.6
MW-1607D	70-80	21.5	77.4	0.7	0.4	(SP) POORLY-GRADED SAND with GRAVEL	27.9

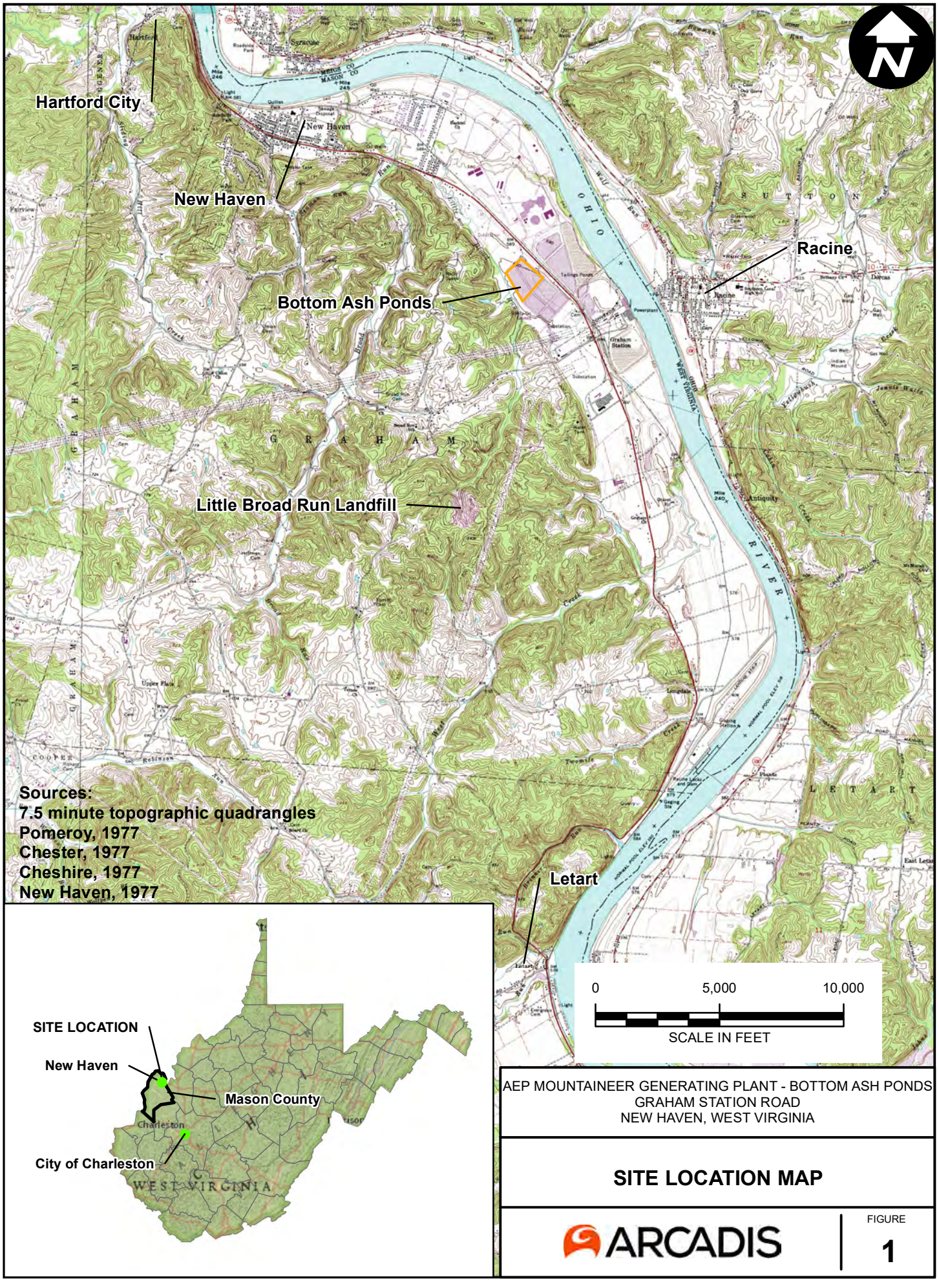
Notes:
Samples were collected from April to June 2016 and submitted to AEP Dolan Civil Engineeering Laboratory
USCS - Unified Soil Classification System

Table 4
Slug Testing Results Summary
AEP Mountaineer Generating Plant - Bottom Ash Ponds
New Haven, West Virginia

Well ID	Screen Interval ft bgs	Screened Interval USCS Classification	Slug Test Type	Hydraulic Conductivity ft/day	Hydraulic Conductivity cm/sec
Sand Zone Wells					
Upgradient					
MW-1601A	67-77	(SP) POORLY-GRADED SAND	Pneumatic - Rising Head	213	7.5E-02
MW-1603	60-75	(SP) POORLY-GRADED SAND with GRAVEL	Bail down - Rising head	201	7.1E-02
MW-1608	46-56	(SP) POORLY-GRADED SAND	Pneumatic - Rising Head	204	7.2E-02
Downgradient					
MW-1605S	49-59	(SP-SM) POORLY-GRADED SAND with SILT	Pneumatic - Rising Head	147	5.2E-02
MW-1605D	69-79	(SP-SM) POORLY-GRADED SAND with SILT	Pneumatic - Rising Head	190	6.7E-02
MW-1607S	50-60	(SP) POORLY-GRADED SAND with GRAVEL	Pneumatic - Rising Head	187	6.6E-02
MW-1607D	70-80	(SP) POORLY-GRADED SAND with GRAVEL	Pneumatic - Rising Head	167	5.9E-02
			Slug Test Overall Mean	**187**	**6.6E-02**
			Slug Test Overall Geometric Mean	**186**	**6.6E-02**
			Slug Test Minimum	**147**	**5.2E-02**
			Slug Test Maximum	**213**	**7.5E-02**

Notes:
All slug tests completed on June 20-21, 2016
Slug test analyses performed using Springer-Gelhar (1991) analytical solution for underdamped responses
Reference: Springer, R.K. and L.W. Gelhar, 1991. Characterization of large-scale aquifer heterogeneity in glacial outwash by analysis of slug tests with oscillatory response, Cape Cod, Massachusetts, U.S. Geol. Surv. Water Res. Invest. Rep. 91-4034, pp. 36-40
bgs - below ground surface
cm/sec - centimeters per second
ft - feet
USCS - Unified Soil Classification System

FIGURES



AEP MOUNTAINEER GENERATING PLANT - BOTTOM ASH PONDS
GRAHAM STATION ROAD
NEW HAVEN, WEST VIRGINIA

SITE LOCATION MAP

ARCADIS

FIGURE
1

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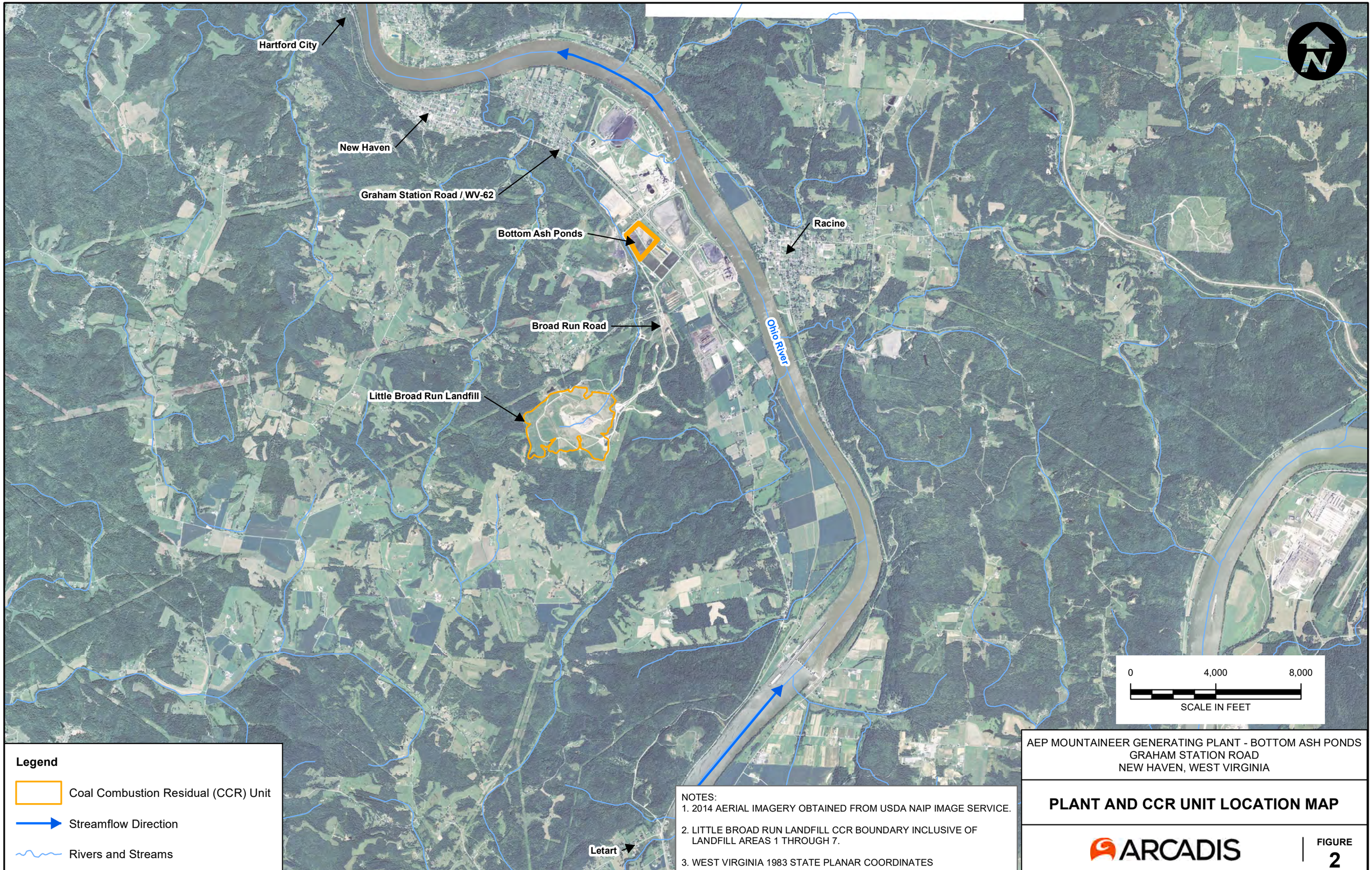

Legend

- Coal Combustion Residual (CCR) Unit
- Streamflow Direction
- Rivers and Streams

NOTES:
1. 2014 AERIAL IMAGERY OBTAINED FROM USDA NAIP IMAGE SERVICE.
2. LITTLE BROAD RUN LANDFILL CCR BOUNDARY INCLUSIVE OF LANDFILL AREAS 1 THROUGH 7.
3. WEST VIRGINIA 1983 STATE PLANAR COORDINATES

AEP MOUNTAINEER GENERATING PLANT - BOTTOM ASH PONDS
GRAHAM STATION ROAD
NEW HAVEN, 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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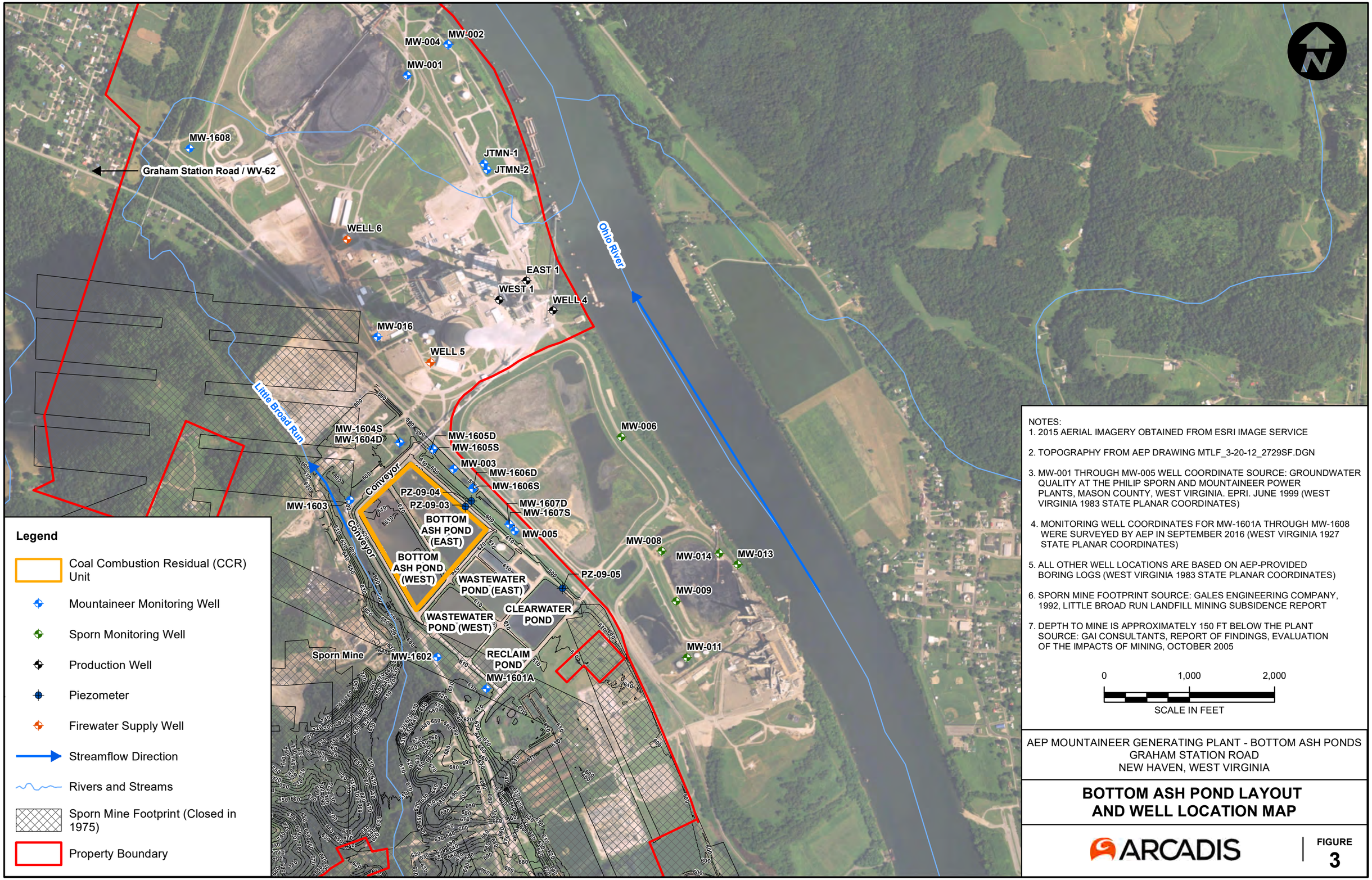


NOTES:
1. 2015 AERIAL IMAGERY OBTAINED FROM ESRI IMAGE SERVICE

2. TOPOGRAPHY FROM AEP DRAWING MTLF_3-20-12_2729SF.DGN

3. MW-001 THROUGH MW-005 WELL COORDINATE SOURCE: GROUNDWATER QUALITY AT THE PHILIP SPORN AND MOUNTAINEER POWER PLANTS, MASON COUNTY, WEST VIRGINIA. EPRI. JUNE 1999 (WEST VIRGINIA 1983 STATE PLANAR COORDINATES)

4. MONITORING WELL COORDINATES FOR MW-1601A THROUGH MW-1608 WERE SURVEYED BY AEP IN SEPTEMBER 2016 (WEST VIRGINIA 1927 STATE PLANAR COORDINATES)

5. ALL OTHER WELL LOCATIONS ARE BASED ON AEP-PROVIDED BORING LOGS (WEST VIRGINIA 1983 STATE PLANAR COORDINATES)

6. SPORN MINE FOOTPRINT SOURCE: GALES ENGINEERING COMPANY, 1992, LITTLE BROAD RUN LANDFILL MINING SUBSIDENCE REPORT

7. DEPTH TO MINE IS APPROXIMATELY 150 FT BELOW THE PLANT SOURCE: GAI CONSULTANTS, REPORT OF FINDINGS, EVALUATION OF THE IMPACTS OF MINING, OCTOBER 2005

0 1,000 2,000
SCALE IN FEET

AEP MOUNTAINEER GENERATING PLANT - BOTTOM ASH PONDS
GRAHAM STATION ROAD
NEW HAVEN, WEST VIRGINIA

BOTTOM ASH POND LAYOUT AND WELL LOCATION MAP

ARCADIS

FIGURE
3

City: CITRIX Div/Group: IM/DV Created By: K.Ives Last Saved By: webb
OH015976.0009.00001 (Mountaineer Ash Pond)
Z:\GISPROJECTS_ENV\AEP\MountaineerMXD\Ash Pond Report\Updated September 2016\F3_ Mtr Ash Pond Layout And Well Location Map.mxd 10/4/2016 8:29:16 AM

MW-002
MW-004
MW-001
MW-1608
Graham Station Road / WV-62
JTMN-1
JTMN-2
WELL 6
Ohio River
EAST 1
WEST 1
WELL 4
MW-016
WELL 5
Little Broad Run
MW-1604D
MW-1604S
MW-1605S
MW-1605D
MW-003
MW-1606D
MW-1606S
PZ-09-04
A'
MW-1603
Conveyor
BOTTOM ASH POND (EAST)
PZ-09-03
MW-1607S
MW-1607D
MW-005
BOTTOM ASH POND (WEST)
405
406
A
WASTEWATER POND (EAST)
PZ-09-05
CLEARWATER POND
WASTEWATER POND (WEST)
MW-1602
RECLAIM POND
MW-1601A
Sporn Mine
MW-006
MW-008
MW-014
MW-013
MW-009
MW-011

Legend

- Coal Combustion Residual (CCR) Unit
- Mountaineer Monitoring Well
- Sporn Monitoring Well
- Production Well
- Firewater Supply Well
- Soil Boring Location
- Piezometer
- Cross Section Location
- Streamflow Direction
- Rivers and Streams

NOTES:
1. 2015 AERIAL IMAGERY OBTAINED FROM ESRI IMAGE SERVICE
2. TOPOGRAPHY FROM AEP DRAWING MTLF_3-20-12_2729SF.DGN
3. MW-001 THROUGH MW-005 WELL COORDINATE SOURCE: GROUNDWATER QUALITY AT THE PHILIP SPORN AND MOUNTAINEER POWER PLANTS, MASON COUNTY, WEST VIRGINIA. EPRI. JUNE 1999 (WEST VIRGINIA 1983 STATE PLANAR COORDINATES)
4. MONITORING WELL COORDINATES FOR MW-1601A THROUGH MW-1608 WERE SURVEYED BY AEP IN SEPTEMBER 2016 (WEST VIRGINIA 1927 STATE PLANAR COORDINATES)
5. ALL OTHER WELL LOCATIONS ARE BASED ON AEP-PROVIDED BORING LOGS (WEST VIRGINIA 1983 STATE PLANAR COORDINATES)

0 1,000 2,000
SCALE IN FEET

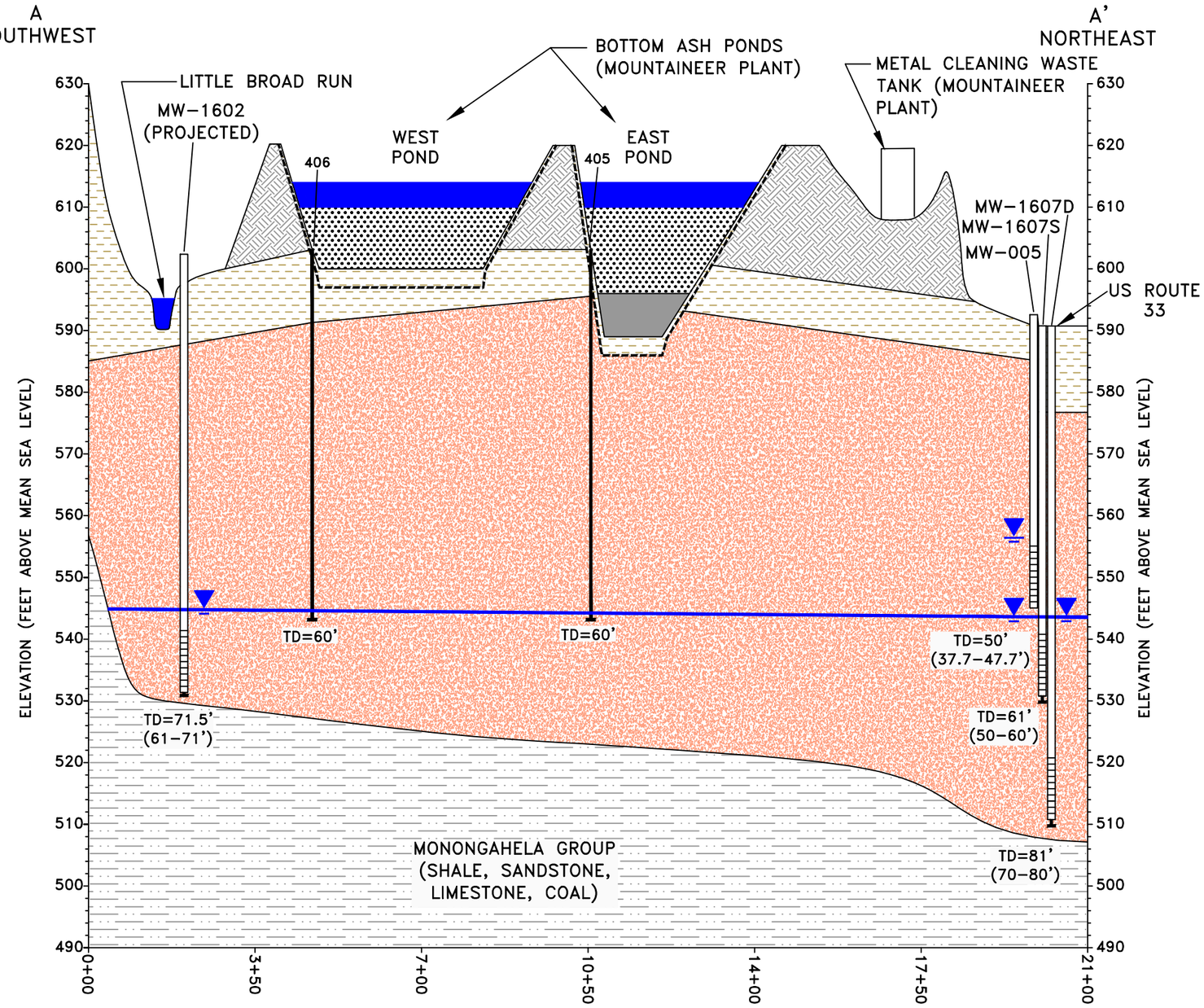
AEP MOUNTAINEER GENERATING PLANT - BOTTOM ASH PONDS
GRAHAM STATION ROAD
NEW HAVEN, WEST VIRGINIA

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)
Z:\GISPROJECTS_ENV\AEP\Mountaineer\MXD\Ash Pond Report\Updated September 2016\F4_ Mtr Ash Pond Layout Cross Sections_topo2.mxd 10/5/2016 11:55:27 AM



LEGEND

- BOTTOM ASH
- FILL
- MINE WASTE
- CLAY
- SAND/SAND AND GRAVEL (INCREASING GRAIN SIZE AND GRAVEL CONTENT WITH DEPTH)
- BEDROCK – MONONGAHELA GROUP OF PENNSYLVANIAN-AGE

MW-5 — MONITORING WELL IDENTIFICATION
WELL (DASHED WHERE INFERRED)
WELL SCREEN (DASHED WHERE INFERRED)
BOTTOM OF BORING
405 — SOIL BORING IDENTIFICATION
SOIL BORING

TD=60' TOTAL DEPTH IN FEET
( ) WELL SCREEN DEPTH IN FEET
WATER TABLE ELEVATION BASED ON MEASURED WATER LEVELS ON 9/26/2016
WATER LEVEL – MAXIMUM OBSERVED, MAY 1997 – SEPTEMBER 2016
3-FEET CLAY LINER

VERTICAL SCALE: 1-INCH = 20-FEET
HORIZONTAL SCALE: AS SHOWN

NOTE: 1. BASE OF BOTTOM ASH PONDS BASED ON AEP DWG. No. 1-3018A-7.

REFERENCE: CROSS SECTION MODIFIED FROM EPRI, 1999.

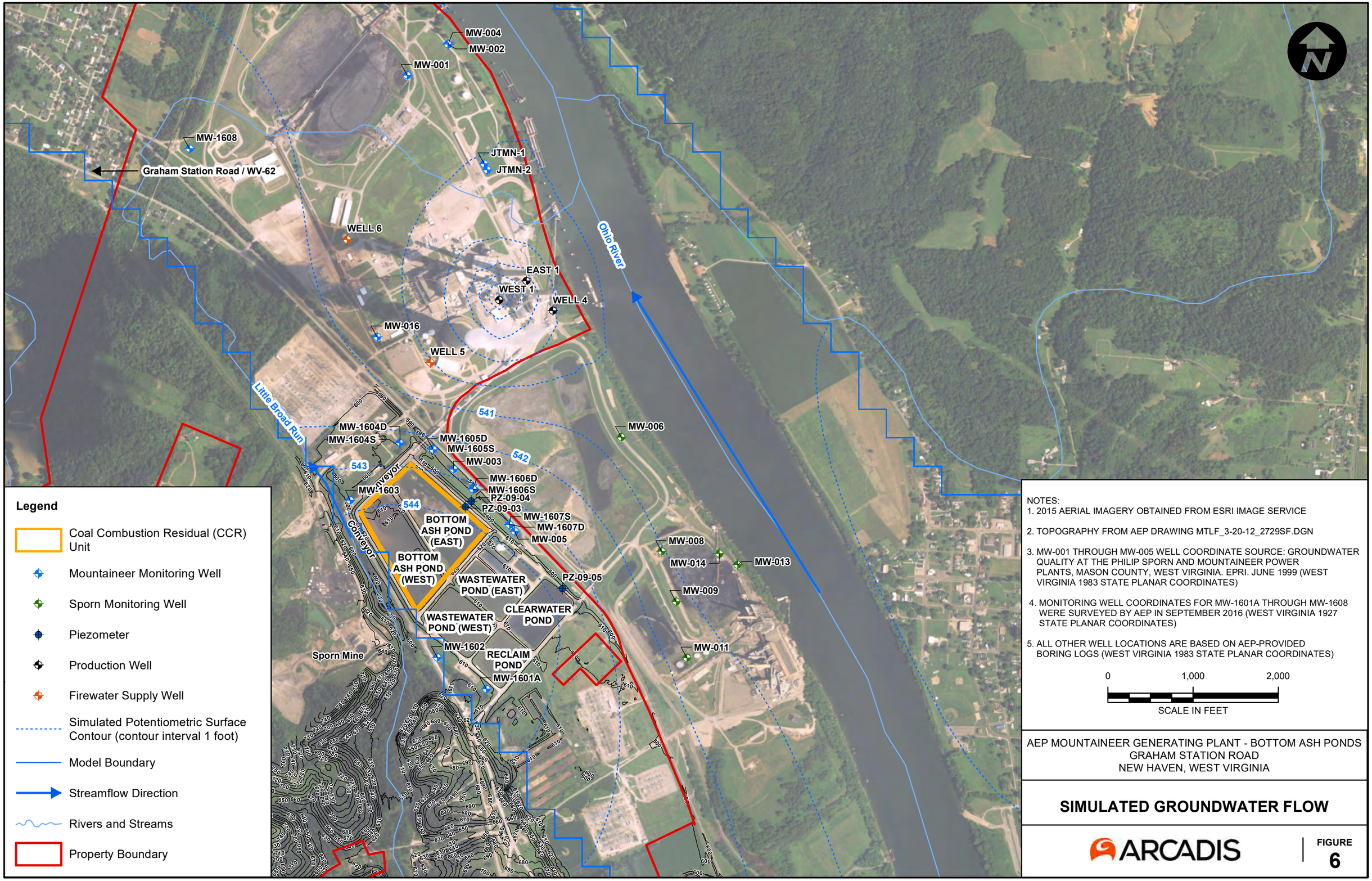
AEP MOUNTAINEER GENERATING PLANT - BOTTOM ASH PONDS
GRAHAM STATION ROAD
NEW HAVEN, WEST VIRGINIA

CROSS SECTION A-A'

ARCADIS Design & Consultancy for natural and built assets

FIGURE 5

PLOTTED: 10/5/2016 2:55 PM BY: SMITH, BOB
LAYOUT: CS A-A SAVED: 10/5/2016 1:58 PM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ACAD.CTB
G:\ENVCAD\Columbus-OH\ACTIVE\015976 - AEP MOUNTAINEER\0009\0001 - ASH PONDS\OH015976-MTR-ASHPOND-2016CS.dwg
XREFS:



Legend

- Coal Combustion Residual (CCR) Unit
- Mountaineer Monitoring Well
- Sporn Monitoring Well
- Piezometer
- Production Well
- Firewater Supply Well
- Simulated Potentiometric Surface Contour (contour interval 1 foot)
- Model Boundary
- Streamflow Direction
- Rivers and Streams
- Property Boundary

NOTES:
1. 2015 AERIAL IMAGERY OBTAINED FROM ESRI IMAGE SERVICE
2. TOPOGRAPHY FROM AEP DRAWING MTLF_3-20-12_2729SF.DGN
3. MW-001 THROUGH MW-005 WELL COORDINATE SOURCE: GROUNDWATER QUALITY AT THE PHILIP SPORN AND MOUNTAINEER POWER PLANTS, MASON COUNTY, WEST VIRGINIA. EPRI. JUNE 1999 (WEST VIRGINIA 1983 STATE PLANAR COORDINATES)
4. MONITORING WELL COORDINATES FOR MW-1601A THROUGH MW-1608 WERE SURVEYED BY AEP IN SEPTEMBER 2016 (WEST VIRGINIA 1927 STATE PLANAR COORDINATES)
5. ALL OTHER WELL LOCATIONS ARE BASED ON AEP-PROVIDED BORING LOGS (WEST VIRGINIA 1983 STATE PLANAR COORDINATES)

0 1,000 2,000

SCALE IN FEET

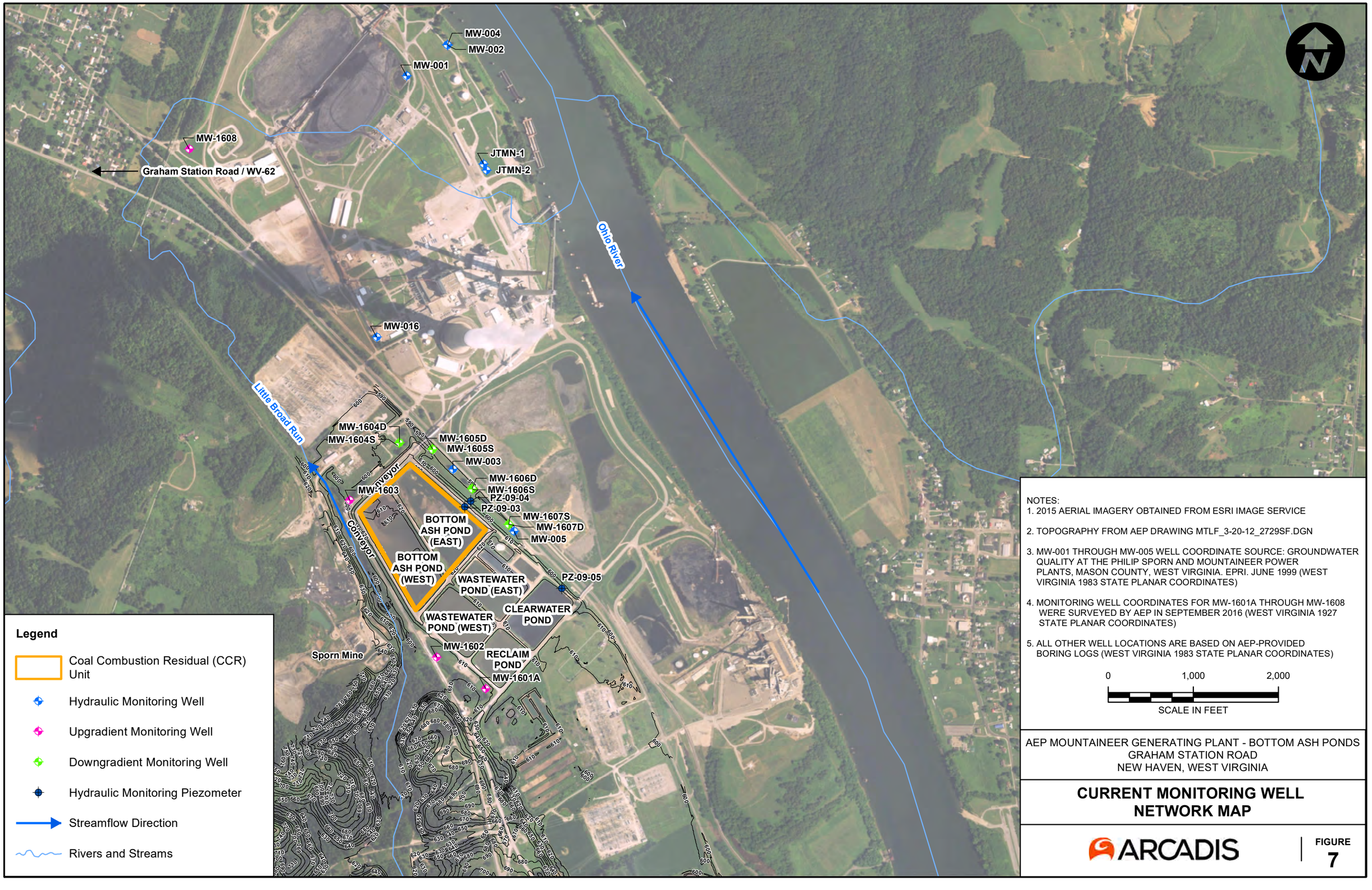
AEP MOUNTAINEER GENERATING PLANT - BOTTOM ASH PONDS
GRAHAM STATION ROAD
NEW HAVEN, WEST VIRGINIA

SIMULATED GROUNDWATER FLOW

ARCADIS

FIGURE 6

City: CITRIX Div/Group: IM/DV Created By: K.Ives Last Saved By: webb
OH015976.0009.00001 (Mountaineer Ash Pond)
Z:\GISPROJECTS_ENVVAEP\Mountaineer\MXD\Ash Pond Report\Updated September 2016\F6_ Mtr Ash Pond Simulated GW Flow.mxd 10/7/2016 11:19:33 AM



NOTES:
1. 2015 AERIAL IMAGERY OBTAINED FROM ESRI IMAGE SERVICE

2. TOPOGRAPHY FROM AEP DRAWING MTLF_3-20-12_2729SF.DGN

3. MW-001 THROUGH MW-005 WELL COORDINATE SOURCE: GROUNDWATER QUALITY AT THE PHILIP SPORN AND MOUNTAINEER POWER PLANTS, MASON COUNTY, WEST VIRGINIA. EPRI. JUNE 1999 (WEST VIRGINIA 1983 STATE PLANAR COORDINATES)

4. MONITORING WELL COORDINATES FOR MW-1601A THROUGH MW-1608 WERE SURVEYED BY AEP IN SEPTEMBER 2016 (WEST VIRGINIA 1927 STATE PLANAR COORDINATES)

5. ALL OTHER WELL LOCATIONS ARE BASED ON AEP-PROVIDED BORING LOGS (WEST VIRGINIA 1983 STATE PLANAR COORDINATES)

0 1,000 2,000

SCALE IN FEET

AEP MOUNTAINEER GENERATING PLANT - BOTTOM ASH PONDS
GRAHAM STATION ROAD
NEW HAVEN, 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\AEP\MountaineerMXD\Ash Pond Report\Updated September 2016\F7_ Mtr Ash Pond Current Monitoring Well Network.mxd 10/5/2016 12:14:13 PM

APPENDIX A

Boring/Well Construction Logs

ARCADIS

Casagrande Consultants 1977

Soil Boring Logs

**401 to 415, 505, 506, 513, 514,
701 to 703, 801 to 803**

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company Appalachian Power Company

Project Project 1301 - Ash Ponds

Location of Boring:	
Water Level	47'
Time	
Date	1-24-77

Boring No. 401 Date 1-21-77 Sheet 1 of 3

Type of Boring Auger Rig B-50

Casing used _____ Size _____ Drilling mud used _____

Boring begun 1-21-77 Boring completed 1-24-77

Ground Elevation 596.14' referred to _____ Datum

Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					0		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					1		
					2		
					3		
					4		
	1	3.5-5	5/6/10	14"	5		Medium brown clayey silty sand.
					6		
					7		
					8		
					9		
	2	8.5-10	5/5/5	6"	10		Same as sample number 1.
					11		
					12		
					13		
					14		
	3	13.5-15	5/6/6	6"	15		Same as sample number 1 but more sandy.
					16		
					17		
					18		
					19		
	4	18.5-20	16/17/18	4"	20		Sand and gravel. Large gravel in end of spoon.
					1		

Engineer _____

AEPMTP-000448

FORM CE-5
REV. 3/74

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 401 Date 1-24-77 Sheet 2 of 3
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					20		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					21		
					22		
					23		
					24		
	5	23.5-25	19/25/24	10"	25		Medium brown coarse sand and gravel.
					26		
					27		
					28		
					29		
	6	28.5-29.5	45/60	6"	30		Dense sand and gravel.
					31		
					32		
					33		
					34		
	7	33.5-35	14/17/21	10"	35		More sand.
					36		
					37		
					38		
					39		
	8	38.5-40	13/16/17	12"	40		Same as sample number 7.
					1		

Engineer _____

AEPMTP-000449

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 401 Date 1-24-77 Sheet 3 of 3
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Dat
Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					40		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					41		
					42		
					43		
					44		
	9	43.5-45	15/19/25	14"	45		Wet medium brown sand and gravel.
					46		
					47		Water
					48		
					49		
	10	48.5-50	15/20/21	16"	50		More sandy.
					51		
					52		Washed out 3' plug in augers.
					53		
					54		
	11	53.5-55	16/23/29	8"	55		Same as sample number 10.
					56		
					57		Washed out 2' plug in augers.
					58		
					59		
	12	58.5-60	32/16/23	10"	60		Medium brown sand and gravel w/sandstone fragments
							Stopped hole at 60.0' 1-24-77
					1		

Engineer _____

AEPMTP-000450

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company Appalachian Power Company

Project Project 1301 - Proposed Ash Pond Area

Location of Boring:	
Water Level	45.5'
Time	
Date	

Boring No. 402 Date 10-28-76 Sheet 1 of 3
Type of Boring Auger Rig B-61
Casing used _____ Size _____ Drilling mud used _____
Boring begun 10-28-76 Boring completed 10-28-76
Ground Elevation 597.40' referred to _____ Datum
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					0		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					1		
					2		
					3		
	1	3-4.5	4/4/6	17"	4		Medium brown clayey silt.
					5		
					6		
					7		
					8		
	2	8-9.5	3/4/5	13"	9		Same as sample number 1.
					10		
					11		
					12		
					13		
	3	13-14.5	3/4/4	13"	14		Medium brown clayey fine sand.
					15		
					16		
					17		
					18		
	4	18-19.5	3/9/10	14"	19		Same as sample number 3
					20		
					21		

Engineer _____

AEPMTP-000451

FORM CE-5.
REV. 3/74

AMERICAN ELECTRIC POWER

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	45.5'
Time	
Date	

Boring No. 402 Date 10-28-76 Sheet 2 of 3

Type of Boring _____ Rig _____

Casing used _____ Size _____ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION: Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					20		
					21		
					22		
					23		
	5	23-24.5	7/7/5	12"	24		Medium brown sand and gravel.
					25		
					26		
					27		
					28		
	6	28-29.5	7/8/10	13"	29		Medium brown sand w/trace of gravel.
					30		
					31		
					32		
					33		
	7	33-34.5	10/14/17	14"	34		Same as sample number 6 w/more gravel.
					35		
					36		
					37		
					38		
	8	38-39.5	9/15/13	1"	39		Same as sample number 6 - Large gravel in end of spoon.
					40		
					1		

Engineer _____

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	45.5
Time	
Date	

Boring No. 402 Date 10-28-76 Sheet 3 of 3
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: Roush and REitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					40		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					41		
					42		
					43		
	9	43-44.5	9/6/8	-	44		No recovery.
					45		Water
					46		
					47		
					48		
	10	48-49.5	6/9/11	13"	49		Medium brown sand w/trace of gravel.
					50		
					51		
					52		
					53		
	11	53-54.5	7/8/10	12"	54		Same as sample number 10.
					55		
					56		
					57		
					58		
	12	58-59.5	8/11/12	11"	59		Same as sample number 10 Stopped hole at 59.5' 10-28-76
					60		
					1		

Engineer _____

AEPMTP-000453

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company Appalachian Power Company

Project Project 1301 - Proposed Ash Pond Area

Location of Boring:	
Water Level	50.5
Time	
Date	

Boring No. 403 Date 10-29-76 Sheet 1 of 3
Type of Boring Auger Rig B-61
Casing used _____ Size _____ Drilling mud used _____
Boring begun 10-29-76 Boring completed 10-29-76
Ground Elevation 591.09 referred to _____ Datum
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					0		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					1		
					2		
					3		
	1	3-4.5	4/5/7	17"	4		Medium brown clayey silt.
					5		
					6		
					7		
					8		
	2	8-9.5	4/3/4	13"	9		Same as sample number 1.
					/0		
					/1		
					/2		
					/3		
	3	13-14.5	6/7/6	13"	/4		Same as sample number 1. Medium brown, medium grain sand and gravel.
					/5		
					/6		
					/7		
					/8		
	4	18-19.5	4/5/5	12"	/9		Same as sample number 3 w/less gravel.
					20		
					1		

Engineer _____

AEPMTP-000454

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	50.5
Time	
Date	

Boring No. 403 Date 10-29-76 Sheet 2 of 3
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					20		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					21		
					22		
					23		
	5	23-24.5	5/5/4	12"	24		Medium brown, medium grain sand w/trace of gravel.
					25		
					26		
					27		
					28		
	6	28-29.5	4/5/7	12"	29		Same as sample number 5 w/medium and fine grain gravel.
					30		
					31		
					32		
					33		
	7	33-34.5	6/6/8	12"	34		Same as sample number 5 w/more gravel.
					35		
					36		
					37		
					38		
	8	38--39.5	5/8/12	13"	39		Same as sample number 7.
					40		
					1		

Engineer _____

AEPMTP-000455

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	50.5
Time	
Date	

Boring No. 403 Date 10-29-76 Sheet 3 of 3
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					40		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					41		
					42		
					43		
	9	43-44.5	8/13/14	14"	44		Light brown.medium grain sand w/trace of gravel.
					45		
					46		
					47		
					48		
	10	48-49.5	9/15/19	15"	49		Medium brown sand and gravel.
					50		Water
					51		
					52		
					53		
	11	53-54.5	7/10/13	0	54		No recovery.
					55		
					56		
					57		
					58		
	12	58-59.5	8/11/12	13"	59		Medium and dark brown sand and gravel.
					60		Stopped hole at 59.5
					1		10-29-76

Engineer _____

AEPMTP-000456

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company Appalachian Power Company

Project Project 1301 - Proposed Ash Pond Area

Location of Boring:	
Water Level	47.0'
Time	
Date	

Boring No. 404 Date 10-28-76 Sheet 1 of 3
Type of Boring Auger Rig B-61
Casing used _____ Size _____ Drilling mud used _____
Boring begun 10-28-76 Boring completed 10-28-76
Ground Elevation 600.27' referred to _____ Datum
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					0		Boring off set about 15' east because of corn field.
					1		
					2		
					3		
	1	3-4.5	3/4/6	17"	4		Medium brown silty clay.
					5		
					6		
					7		
					8		
	2	8-9.5	3/6/8	13"	9		Same as sample number 1.
					10		
					11		
					12		
					13		
	3	13-14.5	3/4/6	7"	14		Medium brown clayey sand.
					15		
					16		
					17		
					18		
	4	18-19.5	6/5/8	12"	19		Medium brown sand and gravel.
					20		
					1		

Engineer _____

AEPMTP-000457

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	47.0'
Time	
Date	

Boring No. 404 Date 10-28-76 Sheet 2 of 3
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					20		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					21		
					22		
					23		
	5	23-24.5	5/9/9	12"	24		Medium brown fine sand and gravel.
					25		
					26		
					27		
					28		
	6	28-29.5	11/6/5	11"	29		Same as sample number 5.
					30		
					31		
					32		
					33		
	7	33-34.5	4/5/5	7"	34		Medium brown fine sand w/trace of gravel.
					35		
					36		
					37		
					38		
	8	38-39.5	12/12/11	14"	39		Same as sample number 7 w/light brown sand
					40		
					1		

Engineer _____

AEPMTP-000458

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	47.0'
Time	
Date	

Boring No. 404 Date 10-28-76 Sheet 3 of 3

Type of Boring _____ Rig _____

Casing used _____ Size _____ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					40		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					41		
					42		
					43		
	9	43-44.5	5/8/13	13"	44		Medium brown fine sand w/trace of gravel.
					45		
					46		
					47		Water
					48		
	10	48-49.5	4/6/9	14"	49		Same as sample number 9.
					50		
					51		
					52		
					53		
	11	53-54.5	3/4/6	18"	54		Same as sample number 9 w/medium grain sand.
					55		
					56		
					57		
					58		
	12	58-59.5	4/7/8	-	59		No recovery.
					60		Stopped hole at 59.5'
					1		10-28-76

Engineer _____

AEPMTP-000459

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company Appalachian Power Company

Project Project 1301 - Ash Pond

Location of Boring:	
Water Level	51.0'
Time	
Date	1-24-77

Boring No. 405 Date 1-24-77 Sheet 1 of 3
Type of Boring Auger Rig B-50
Casing used _____ Size _____ Drilling mud used _____
Boring begun 1-24-77 Boring completed 1-25-77
Ground Elevation 603.14 referred to _____ Datum
Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					0		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					1		
					2		
					3		
					4		
	1	3.5-5	2/4/3	5"	5		Fragments of clay with silt.
					6		
					7		
					8		
					9		
	2	8.5-10	5/6/7	8"	10		Brown sand.
					11		
					12		
					13		
					14		
	3	13.5-15	7/8/9	7"	15		Same as sample number 2 w/some larger grains.
					16		
					17		
					18		
					19		
	4	18.5-20	4/4/7	6"	20		Same as sample number 3.
					21		

Engineer _____

AEPMTP-000460

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 405 Date 1-24-77 Sheet 2 of 3
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datu
Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					20		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					21		
					22		
					23		
					24		
	5	23.5–25	4/4/8	6"	25		Light brown sand.
					26		
					27		
					28		
					29		
	6	28.5–30	6/8/7	5"	30		Larger grain sand with small gravel light brown.
					31		
					32		
					33		
					34		
	7	33.5–35	8/11/11	6"	35		Medium grain sand - light brown.
					36		
					37		
					38		
					39		
	8	38.5–40	11/11/15	6"	40		Gravely sand - light brown.
					1		

Engineer _____

AEPMTP-000461

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 405 Date 1-25-77 Sheet 3 of 3
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					40		
					41		
					42		
					43		
					44		
	9	43.5-45	4/7/6	5"	45		Same as sample number 8 with more gravel.
					46		
					47		
					48		
					49		
	10	48.5-50	9/9/11	8"	50		Small gravel with some sand.
					51		Water
					52		
					53		
					54		
	11	53.5-55	4/7/8	10"	55		Brown medium grain sand.
					56		
					57		
					58		
					59		
	12	58.5-60	4/4/7	8"	60		Fine medium brown sand. Stopped hole at 60.0' 1-25-77
					1		

Engineer _____

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company Appalachian Power Company

Project Project 1301 - Ash Pond

Location of Boring:	
Water Level	51.0'
Time	
Date	

Boring No. 406 Date 1-25-77 Sheet 1 of 3

Type of Boring Auger Rig B-50

Casing used _____ Size _____ Drilling mud used _____

Boring begun 1-25-77 Boring completed 1-25-77

Ground Elevation 603.14 referred to _____ Dat

Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					0		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					1		
					2		
					3		
	1	3.5-5	3/ 5/7	18"	4		Silty clay.
					5		
					6		
					7		
					8		
	2	8.5-10	3/ 4/5	8"	9		Same as sample number 1.
					10		
					11		
					12		
					13		
					14		
	3	13.5-15	5/ 6/7	6"	15		Light brown sand.
					16		
					17		
					18		
					19		
	4	18.5-20	4/ 4/6	8"	20		Medium grain sand with trace of small gravel.
					21		

Engineer _____

REV. 3/74

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 406 Date 1-25-77 Sheet 2 of 3

Type of Boring _____ Rig _____

Casing used _____ Size _____ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____

_____ Dat

Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					20		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					21		
					22		
					23		
					24		
	5	23.5-25	5/6/7	9"	25		Light brown medium grain sand.
					26		
					27		
					28		
					29		
	6	28.5-30	5/6/7	6"	30		Same as sample number 5 w/larger grain.
					31		
					32		
					33		
					34		
	7	33.5-35	10/12/12	6"	35		Light brown to light gray sand.
					36		
					37		
					38		
					39		
	8	38.5-40	8/12/16	10"	40		Same as sample number 7.
					1		

Engineer _____

AEPMTP-000464

FORM GL-5
REV. 3/74

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 406 Date 1-25-77 Sheet 3 of 3

Type of Boring _____ Rig _____

Casing used _____ Size _____ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Dat

Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					40		Soil type, color, texture, consistency, sampler driving notes blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					41		
					42		
					43		
					44		
	9	43.5-45	18/18/22	9"	45		Same as sample number 8.
					46		
					47		
					48		
					49		
	10	48.5-50	10/17/32	6"	50		Medium brown sand w/trace of coal.
					51		Water
					52		
					53		
					54		
	11	53.5-55	10/14/12	5"	55		Grayish gravely sand.
					56		
					57		
					58		
					59		
	12	58.5-60	14/16/17		60		Small gravely sand (dark)
					1		Stopped hole at 60'
							Engineer _____

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company Appalachian Power Company

Project Project 1301 - Proposed Ash Pond Area

Location of Boring:	
Water Level	Dry
Time	
Date	

Boring No. 407 Date 10-27-76 Sheet 1 of 3
Type of Boring Auger Rig B-61
Casing used _____ Size _____ Drilling mud used _____
Boring begun 10-27-76 Boring completed 10-27-76
Ground Elevation 613.27' referred to _____ Datum
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					0		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					1		
					2		
					3		
	1	3-4.5	3/4/3	8"	4		Medium coarse and brown sand.
					5		
					6		
					7		
					8		
	2	8-9.5	3/3/3	8"	9		Same as sample number 1.
					10		
					11		
					12		
					13		
	3	13-14.5	3/4/6	12"	14		Same as sample number1.
					15		
					16		
					17		
					18		
	4	18-19.5	11/7/6	14"	19		Same as sample number 1.
					20		
					21		

Engineer _____

AEPMTP-000466

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 407 Date 10-27-76 Sheet 2 of 3

Type of Boring _____ Rig _____

Casing used _____ Size _____ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					20		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					21		
					22		
					23		
	5	23-24.5	6/6/7	10"	24		Medium brown and medium coarse sand.
					25		
					26		
					27		
					28		
	6	28-29.5	6/7/9	12"	29		Fine medium brown sand.
					30		
					31		
					32		
					33		
	7	33-34.5	9/10/15	12"	34		First six tenths fine sand. Second six tenths sand with small gravel.
					35		
					36		
					37		
					38		
	8	38-39.5	17/19/16	12"	39		Sand and small gravel.
					40		
					1		

Engineer _____

AEPMTP-000467

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 407 Date 10-27-76 Sheet 3 of 3
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					40		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					41		
					42		
					43		Ran through bolder.
	9	43-44.5	30/50/2	6"	44		Sand with larger gravel.
					45		
					46		
					47		
					48		
	10	48-49.5	15/20/24	12"	49		First six tenths sand. Second six tenths sand and gravel.
					50		
					51		
					52		
					53		
	11	53-54.5	13/20/18	14"	54		Sand with small gravel.
					55		
					56		
					57		
					58		
	12	58-59.5	20/18/22	14"	59		Same as sample number 11. Stopped hole at 59.5' 10-27-76
					60		
					1		

Engineer _____

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company Appalachian Power Company

Project Project 1301 - Proposed Ash Pond Area

Location of Boring:	
Water Level	59.5
Time	
Date	

Boring No. 408 Date 10-27-76 Sheet 1 of 3
Type of Boring Auger Rig B-61
Casing used _____ Size _____ Drilling mud used _____
Boring begun 10-27-76 Boring completed 10-28-76
Ground Elevation 608.06' referred to _____ Datum
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					0		Boring offset about 40' because of corn field
					1		
					2		
					3		
	1	3-4.5	3/4/4	8"	4		Medium brown fine sand w/trace of gravel.
					5		
					6		
					7		
					8		
	2	8-9.5	3/4/4	18"	9		Same as sample number 1.
					10		
					11		
					12		
					13		
	3	13-14.5	3/3/5	14"	14		Same as sample number 1.
					15		
					16		
					17		
					18		
	4	18-19.5	4/3/3	12"	19		Same as sample number 1.
					20		
					21		

Engineer _____

AEPMTP-000469

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 408 Date 10-27-76 Sheet 2 of 3
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					20		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					21		
					22		
					23		
	5	23-24.5	3/4/5	8"	24		Medium brown fine sand.
					25		
					26		
					27		
					28		
	6	28-29.5	8/12/14	14"	29		Light brown fine sand w/some gravel.
					30		
					31		
					32		
					33		
	7	33-34.5	12/14/20	18"	34		Light brown coarse sand w/some gravel.
					35		
					36		
					37		
					38		
	8	38-39.5	8/8/6	14"	39		Light brown coarse sand and gravel.
					40		
					1		

Engineer _____

AEPMTP-000470

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 408 Date 10-27-76 Sheet 3 of 3
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					40		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					41		
					42		
					43		
	9	43-44.5	15/30/34	18"	44		Light brown sand and gravel.
					45		
					46		
					47		
					48		
	10	48-49.5	20/29/21	18"	49		Light brown coarse sand w/some gravel.
					50		
					51		
					52		
					53		
	11	53-54.5	10/11/10	14"	54		Light brown fine sand.
					55		
					56		
					57		
					58		
	12	58-59.5	5/6/6	12"	59		Coarse medium brown sand.
							Water
					60		Stopped hole at 59.5
							10-28-76
					1		

Engineer _____

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company Appalachian Power Company

Project Project 1301 - Proposed Ash Pond Area

Location of Boring:	
Water Level	51.5
Time	
Date	

Boring No. 410 Date 10-26-76 Sheet 1 of 3
Type of Boring Auger Rig B-61
Casing used _____ Size _____ Drilling mud used _____
Boring begun 10-26-76 Boring completed 10-26-76
Ground Elevation 604.65 referred to _____ Datum
Field Party: Roush and Retimire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					0		Boring offset 5' east.
					1		
					2		
					3		
	1	3-4.5	2/4/4	5"	4		Medium brown fine sand.
					5		
					6		
					7		
					8		
	2	8-9.5	3/4/5	12"	9		Same as sample number 1 w/light colored sand.
					10		
					11		
					12		
					13		
	3	13-14.5	5/5/6	14"	14		Same as sample number 2.
					15		
					16		
					17		
					18		
	4	18-19.5	6/7/8	14"	19		Same as sample number 2 w/some gravel.
					20		
					21		

Engineer _____

AEPMTP-000472

FORM CE-5
REV. 3/74

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 410 Date 10-22-76 Sheet 2 of 3
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: Roush and REitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION: Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					20		
					21		
					22		
					23		
	5	23-24.5	8/10/11	14"	24		Medium brown sand and gravel.
					25		
					26		
					27		
					28		
	6	28-29.5	8/8/8	13"	29		Same as sample number 5.
					30		
					31		
					32		
					33		
	7	33-34.5	6/9/12	15"	34		Same as sample number 5.
					35		
					36		
					37		
					38		
	8	38-39.5	6/10/12	13"	39		Same as sampl e number 5.
					40		
					1		

Engineer _____

AEPMTP-000473

FORM CE-6
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	51.5'
Time	
Date	

Boring No. 410 Date 10-26-76 Sheet 3 of 3
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					40		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					41		
					42		
					43		
	9	43-44.5	12/17/16	8"	44		Medium brown sand w/trace of gravel.
					45		
					46		
					47		
					48		
	10	48-49.5	5/10/14	13"	49		Same as sample number 9.
					50		
					51		
					52		Water
					53		
	11	53-54.5	7/10/19	17"	54		Same as sample number 9 w/more gravel.
					55		
					56		
					57		
					58		
	12	58-59.5	14/13/13	16"	59		Same as sample number 11. Stopped hole at 59.5 10-26-76
					60		
					1		

Engineer _____

AEPMTP-000474

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company Appalachian Power Company

Project Project 1301 - Proposed Ash Pond Area

Location of Boring:	
Water Level	55'
Time	
Date	

Boring No. 411 Date 10-27 76 Sheet 1 of 3
Type of Boring Auger Rig B-61
Casing used _____ Size _____ Drilling mud used _____
Boring begun 10-22-76 Boring completed 10-26-76
Ground Elevation 607.25 referred to _____ Datum
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					0		Moved boring 5' north
					1		
					2		
					3		
	1	3-4.5	3/4/4	14"	4		Medium brown fine sand.
					5		
					6		
					7		
					8		
	2	8-9.5	3/4/4	12"	9		Same as sample number 1.
					10		
					11		
					12		
					13		
	3	13-14.5	8/3/5	14"	14		Same as sample number 1.
					15		
					16		
					17		
					18		
	4	18-19.5	5/5/5	12"	19		Same as sample number 1.
					20		
					21		

Engineer _____

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	55'
Time	
Date	

Boring No. 411 Date 10-26-76 Sheet 2 of 3
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION: Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					20		
					21		
					22		
					23		
	5	23-24.5	7/5/4	8"	24		Medium brown fine sand.
					25		
					26		
					27		
					28		
	6	28-29.5	5/4/5	5"	29		Light brown fine sand.
					30		
					31		
					32		
					33		
	7	33-34.5	6/8/5	8"	34		Medium brown sand w/trace of gravel.
					35		
					36		
					37		
					38		
	8	38-39.5	4/5/5	10"	39		Light brown fine sand.
					40		
					1		

Engineer _____

AEPMTP-000476

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	55'
Time	
Date	

Boring No. 411 Date 10-26-76 Sheet 3 of 3
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					40		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					41		
					42		
					43		
	9	43-44.5	8/9/13	14"	44		Medium brown sand and gravel.
					45		
					46		
					47		
					48		
	10	48-49.5	5/6/11	13"	49		Same as sample number 9 w/less gravel.
					50		
					51		
					52		
					53		
	11	53-54.5	6/9/12	13"	54		Same as sample number 9
					55		Water
					56		
					57		
					58		
	12	58-59.5	8/6/6	15"	59		Same sample number 9.
					60		Stopped hole at 59.5'
					1		10-26-76

Engineer _____

AEPMTP-000477

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company Appalachian Power Company

Project Project 1301 - Ash Ponds

Location of Boring:	
Water Level	52.0'
Time	
Date	1-26-77

Boring No. 412 Date 1-26-77 Sheet 1 of 3
Type of Boring Auger Rig B-50
Casing used _____ Size _____ Drilling mud used _____
Boring begun 1-26-77 Boring completed 1-27-77
Ground Elevation 600.49' referred to _____ Datum
Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					0		
					1		
					2		
					3		
					4		
	1	3.5-5	10/11/15	18"	5		Sandy, silty clay.
					6		
					7		
					8		
					9		
	2	8.5-10	7/8/8	8"	10		Red sand - medium grain.
					11		
					12		
					13		
					14		
	3	13.5-15	3/4/7	9"	15		Medium grain brown sand.
					16		
					17		
					18		
					19		
	4	18.5-20	3/4/3	5"	20		Fine grain brown sand
					21		

Engineer _____

AEPMTP-000478

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 412 Date 1-26-77 Sheet 2 of

Type of Boring _____ Rig _____

Casing used _____ Size _____ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____

Field Party: King and Smtihson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					20		Soil type, color, texture, consistency, sampler driving note blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					21		
					22		
					23		
					24		
	5	23.5-25	11/7/7	6"	25		Medium grain sand - light brown.
					26		
					27		
					28		
					29		
	6	28.5-30	4/3/3	9"	30		Medium to fine grain sand.
					31		
					32		
					33		
					34		
	7	33.5-35	6/6/6	8"	35		Same as sample number 6.
					36		
					37		
					38		
					39		
	8	38.5-40	8/11/10	6"	40		Medium grain sand w/one large gravel.
					1		

Engineer _____

AEPMTP-000479

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 412 Date 1-27-77 Sheet 3 of

Type of Boring _____ Rig _____

Casing used _____ Size _____ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____

Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					40		Soil type, color, texture, consistency, sampler driving not blows per foot on casing, depths wash water lost, observe fluctuations in water level, notes on drilling ease, etc.
					41		
					42		
					43		
					44		
	9	43.5-45	10/9/15	7"	45		Medium grain sand - light brown
							Trace of coal.
					46		
					47		
					48		
					49		
	10	48.5-50	9/12/15	7"	50		Same as sample number 9 w/no coal.
					51		
					52		Water
					53		
					54		
	11	53.5-55	8/9/8	12"	55		Medium grain sand.
					56		
					57		
					58		
					59		
	12	58.5-60	16/9/11	-0-	60		No recovery.
					1		Stopped hole at 60.0'
							1-27-77

Engineer _____

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company Appalachian Power Company

Project Project 1301 - Ash Pond Area

Location of Boring:	
Water Level	50'
Time	
Date	

Boring No. 413 Date 3-3-77 Sheet 1 of 3
Type of Boring Auger Rig B-50
Casing used _____ Size _____ Drilling mud used _____
Boring begun 3-3-77 Boring completed 3-3-77
Ground Elevation _____ referred to _____ Datum
Field Party: Smithson and Smith

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					0		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					1		
					2		
					3		
	1	3.5-5	5/5/6	6"	4		Medium brown sand w/small pea gravel.
					5		
					6		
					7		
					8		
	2	8.5-10	4/3/4	7"	9		Same as sample number 1.
					10		
					11		
					12		
					13		
	3	13.5-15	5/3/4	9"	14		Medium brown sand w/legnite.
					15		
					16		
					17		
					18		
	4	18.5-20	4/7/8	10"	19		Medium brown sand w/some pea gravel.
					20		
					21		

Engineer _____

FORM C2-5
REV. 3/74

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No 413 Date 3-3-77 Sheet 2 of 3
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: Smithson and Smith

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					20		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					21		
					22		
					23		
	5	23.5-25	7/6/7	8"	24		Medium brown sand w/trace of pea gravel.
					25		
					26		
					27		
					28		
	6	28.5-30	6/7/6	7"	29		Same as sample number 5.
					30		
					31		
					32		
					33		
	7	33.5-35	9/12/12	11"	34		Medium brown medium coarse sand and gravel.
					35		
					36		
					37		
					38		
	8	38.5-40	6/8/11	12"	39		Same as sample number 7.
					40		
					1		

Engineer _____

AEPMTP-000482

FORM CE 5
REV. 3/74

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 413 Date 3-3-77 Sheet 3 of 3
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: Smithson and Smith

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					40		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					41		
					42		
					43		
	9	43.5-45	12/15/14	15"	44		Light brown sand and gravel.
					45		Very small claylike seam. Light brown sand and gravel.
					46		
					47		
					48		
	10	48.5-50	18/26/24	10"	49		Dark brown silty sand and gravel.
					50		Water
					51		
					52		
					53		
	11	53.5-55	10/12/11	12"	54		Light brown fine sand w/trace of gravel.
					55		
					56		
					57		
					58		
	12	58.5-60	5/8/10	9"	59		Dark brown silty sand.
					60		Stopped hole at 60.0' 3-3-77
					1		

Engineer _____

AEPMTP-000483

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company Appalachian Power Company

Project Project 1301 - Ash Pond ARea

Location of Boring:	
Water Level	48'
Time	
Date	

Boring No. 414 Date 3-3-77 Sheet 1 of 3
Type of Boring Auger Rig B-50
Casing used _____ Size _____ Drilling mud used _____
Boring begun 3-3-77 Boring completed 3-3-77
Ground Elevation _____ referred to _____ Datum
Field Party: Smithson and Smith

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					0		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					1		
					2		
					3		
	1	3.5-5	4/7/10	12"	4		Light brown silty clay.
					5		
					6		
					7		
					8		
	2	8.5-10	4/4/5	8"	9		Medium brown, medium silty sand.
					10		
					11		
					12		
					13		
	3	13.5-15	5/4/4	7"	14		Same as sample number 2 w/trace of pea gravel.
					15		
					16		
					17		
					18		
	4	18.5-20	6/5/5	10"	19		Same as sample number 3.
					20		
					1		

Engineer _____

AEPMTP-000484

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 414 Date 3-3-77 Sheet 2 of 3
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: Smithson and Smith

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					20		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					21		
					22		
					23		
	5	23.5-25	7/8/8	11"	24		Medium brown coarse sand and pea gravel.
					25		
					26		
					27		
					28		
	6	28.5-30	8/8/9	9"	29		Light brown fine sand.
					30		
					31		
					32		
					33		
	7	33.5-35	8/8/10	13"	34		Medium brown coarse sand and gravel (pea)
					35		
					36		
					37		
					38		
	8	38.5-40	8/10/10	8"	39		Same as sample number 7.
					40		
					1		

Engineer _____

AEPMTP-000485

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 414 Date 3-3-77 Sheet 3 of 3
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datu
Field Party: Smithson and Smith

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					40		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					41		
					42		
					43		
	9	43.5-45	5/6/8	10"	44		Dark brown medium to coarse sand and pea gravel.
					45		
					46		
					47		
					48		Water
	10	48.5-50	10/13/14	14"	49		Medium brown silty sand and pea gravel.
					50		
					51		
					52		
					53		
	11	53.5-55	11/8/10	4"	54		Medium silty sand w/gravel.
					55		
					56		
					57		
					58		
	12	58.5-60	15/19/20	10"	59		Medium brown fine to medium coarse sand.
					60		Stopped hole at 60.0'
					1		3-3-77

Engineer _____

AEPMTP-000486

REV. 3/74

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company Appalachian Power Company

Project Project 1301 - ASh Pond Area

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 415 Date 3-8-77 Sheet 1 of _____
Type of Boring Auger Rig B-61
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation 3-8-77 referred to 3-8-77 Datu
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					0		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					1		
					2		
					3		
	1	3-4.5	2/4/4	14"	4		Medium brown clayey silt.
					5		
					6		
					7		
					8		
	2	8-9.5	4/5/7	13"	9		Medium brown clayey silt.
					/0		Medium brown sand.
					/1		
					/2		
					/3		
	3	13-14.5	3/4/6	8"	/4		Medium brown, medium grain sand
					/5		
					/6		
					/7		
					/8		
	4	18-19.5	2/3/5	8"	/9		Medium brown sand.
					20		
					1		

Engineer _____

AEPMTP-000487

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 415 Date 3-8-77 Sheet 2 of 3

Type of Boring _____ Rig _____

Casing used _____ Size _____ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____

_____ Dat

Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					20		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					21		
					22		
					23		
	5	23-24.5	3/4/7	15"	24		Medium brown sand w/trace of pea gravel.
					25		
					26		
					27		
					28		
	6	28-29.5	5/8/8	13"	29		Same as sample number 5 w/more pea gravel.
					30		Medium brown coarse sand and pea gravel.
					31		
					32		
					33		
	7	33-34.5	6/10/12	14"	34		Medium brown sand and pea gravel.
					35		
					36		
					37		
					38		
	8	38-39.5	10/22/28	16"	39		Medium and medium brown coarse sand and gravel.
					40		Medium brown medium coarse sand and pea gravel w/trace of large gravel.
					1		

Engineer _____

AEPMTP-000488

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 415 Date 3-8-77 Sheet 3 of _

Type of Boring _____ Rig _____

Casing used _____ Size _____ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____

_____ Da

Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION (Soil type, color, texture, consistency, sampler driving notes blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.)
					40		
					41		
					42		
					43		
	9	43-44.5	10/12/14	13"	44		Medium brown gravely sand.
					45		
					46		
					47		
					48		
	10	48-49.5	11/13/15	14"	49		Medium brown sand and pea gravel. Water
					50		
					51		
					52		
					53		
	11	53-54.5	10/12/13	10"	54		Medium brown sand with pea gravel and lignite.
					55		
					56		
					57		
					58		
	12	58-59.5	11/12/15	11"	59		Medium brown coarse sand and pea gravel.
					60		Stopped hole at 59.5' 3-8-77
					1		

Engineer _____

AEPMTP-000489

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company Appalachian Power Company

Project Project 1301 - Conveyor

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 505 Date 11-17-76 Sheet 1 of 4

Type of Boring Auger Rig B-61

Casing used _____ Size _____ Drilling mud used _____

Boring begun 11-17-76 Boring completed 11-18-76

Ground Elevation 586.9' referred to _____ Datum

Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					0		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					1		
					2		
					3		
	1	3-4.5	2/3/6	10"	4		Medium brown clay silt.
					5		
					6		
					7		
					8		
	2	8-9.5	2/3/5	8"	9		Top .3 medium brown silt remainder medium brown very wet pure silt.
					10		
					11		
					12		
					13		
	3	13-14.5	2/2/5	6"	14		Same as sample number 2.
					15		
					16		
					17		
					18		
	4	18-19.5	15/17/23	8"	19		Medium grain brown sand with gravel some broken gravel.
					20		
					1		

Engineer _____

AEPMTP-000490

FORM CE-5
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AMERICAN ELECTRIC POWER SERVICE

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 505 Date 11-17-76 Sheet 2 of 4
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					20		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					21		
					22		
					23		
	5	23-24.5	16/18/22	10"	24		Sand and gravel with more smaller gravel.
					25		
					26		
					27		
					28		
	6	28-29.5	15/17/18	10"	29		Light to medium brown sand with medium amount of gravel.
					30		
					31		
					32		
					33		
	7	33-34.5	13/11/12	8"	34		Same as sample number 6.
					35		
					36		
					37		
					38		
	8	38-39.5	13/14/18	10"	39		Fine to medium grain sand with gravel. Some broken gravel.
					40		
					1		

Engineer _____

AEPMTP-000491

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 505 Date 11-17-76 Sheet 3 of 4
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: Roush & Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					40		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					41		
					42		
					43		Water
	9	43-44.5	13/18/15	6"	44		Sand with small amount of small gravel.
					45		
					46		
					47		
					48		
	10	48-49.5	11/13/11	6"	49		Large grain sand with traces of larger gravel.
					50		
					51		
					52		
					53		
	11	53-54.5	11/11/13	6"	54		Top.3 large grain sand Remainder small to medium grain sand.
					55		
					56		
					57		
					58		
	12	58-59.5	11/13/15	10"	59		Medium to dark sand with small amount of gravel with traces of coal in the top of spoon.
					60		
					1		

Engineer _____

AEPMTP-000492

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AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 505 Date 11-18-76 Sheet 4 of 4
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					60		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					61		
					62		
					63		
	13	63-64.5	11/22/36	6"	64		Medium brown and grain sand with a few gravels.
					65		
					66		
					67		
					68		
	14	68-69.5	11/12/13	6"	69		Medium brown with large grain sand with some gravel.
					70		
					71		
					72		
					73		
	15	73-74.5	11/12/14	0	74		No recovery.
					75		
					76		
					77		
					78		
	16	78-79.5	65/2	0	79		Large gravel in end of spoon
					80		Rock Stopped hole at 80.6'
					1		

Engineer _____

AEPMTP-000493

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company Appalachian Power Company

Project Project 1301 - Conveyor

Location of Boring:	
Water Level	37.5
Time	
Date	

Boring No. 506 Date 11-17-76 Sheet 1 of 4
Type of Boring Auger Rig B-61
Casing used _____ Size _____ Drilling mud used _____
Boring begun 11-17-76 Boring completed 11-17-76
Ground Elevation 579.43' referred to _____ Datum
Field Party: Roush and REitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					0		Elevation changed about 1' lower.
					1		
					2		
					3		
	1	3-4.5	2/4/4	6"	4		Dark brown pure silt.
					5		
					6		
					7		
					8		
	2	8-9.5	6/2/3	6"	9		Top 2 dark brown silt Remainder medium grain brown sand with small pieces of gravel.
					10		
					11		
					12		
					13		
	3	13-14.5	14/18/21	8"	14		Fine grain light brown sand with some small gravel.
					15		
					16		
					17		
					18		
	4	18-19.5	15/23/24	2"	19		Gravel with medium grain dark brown sand - one fragments of broken sandstone.
					20		
					21		

Engineer _____

AEPMTP-000494

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 506 Date 11-17-76 Sheet 2 of 4
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					20		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					21		
					22		
					23		
	5	23-24.5	24/31/39	12"	24		Medium and light brown sand and gravel.
					25		
					26		
					27		
					28		
	6	28-29.5	26/56/50/.3	12"	29		Same as sample number 5 w/large gravels in spoon.
					30		
					31		
					32		
					33		
	7	33-34.5	28/30/33	13"	34		Same as sample number 5.
					35		
					36		
					37		Water
					38		
	8	38-39.5	16/10/10	4"	39		Medium brown sand and gravel.
					40		
					1		

Engineer _____

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 506 Date 11-17-76 Sheet 3 of 4
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					40		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					41		
					42		
					43		
	9	43-44.5	11/10/13	7"	44		Medium brown sand and gravel.
					45		
					46		
					47		
					48		
	10	48-49.5	10/22/34	6"	49		Medium brown, dark brown sand and small gravel w/traces of coal.
					50		
					51		
					52		
					53		
	11	53-54.5	13/15/18	5"	54		Medium brown sand and gravel.
					55		
					56		
					57		
					58		
	12	58-59.5	17/13/14	7"	59		Same as sample number 11 w/small gravel.
					60		
					1		

Engineer _____

AEPMTP-000496

FORM CE-5
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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 506 Date 11-17-76 Sheet 4 of 4
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					60		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					61		
					62		
					63		
	13	63 -64.5	15/24/30	14"	64		Medium brown sand and gravel.
					65		
					66		
					67		
					68		
	14	68-69.5	12/19/23	9"	69		Same as sample number 13.
					70		
					71		
					72		
					73		
	15	73-74.5	17/26/24	6"	74		Same as sample number 13.
					75		Stopped hole at 75.6'
					76		11-17-76
					77		
					78		
					79		
					80		
					1		

Engineer _____

AEPMTP-000497

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company Appalachian Power Company

Project Project 1301 - Coal Handling

Location of Boring:	
Water Level	33.5
Time	
Date	2-3-77

Boring No. 513 Date 2-3-77 Sheet 1 of 4

Type of Boring Auger Rig B-50

Casing used _____ Size _____ Drilling mud used _____

Boring begun 2-3-77 Boring completed 2-3-77

Ground Elevation 573.73 referred to _____ Datum

Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					0		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					1		
					2		
					3		
	1	3.5-5	5/6/8	13"	4		Medium light and medium brown mottled silty clay.
					5		
					6		
					7		
					8		
	2	8.5-10	5/12/17	18"	9		Very stiff mottled brown silty clay.
					10		
					11		
					12		
					13		
	3	13.5-15	5/9/12	18"	14		Very stiff mottled brown silty clay.
					15		
					16		
					17		
					18		
	4	18.5-20	4/8/12	18"	19		Same as sample number 3.
					20		
					1		

Engineer _____

AEPMTP-000498

FORM CE-5
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AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	33.5
Time	
Date	

Boring No. 513 Date 2-3-77 Sheet 2 of 4
Type of Boring Auger Rig B-50
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					20		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					21		
					22		
					23		
	5	23-24.5	3/4/5	18"	24		Loose medium brown silty sand.
					25		
					26		
					27		
					28		
	6	25-29.5	23/24/25	14"	29		Dense medium brown gray sand w/trace of silt.
					30		
					31		
					32		
					33		Water
	7	33.5-35	8/12/11	10"	34		Medium brown to medium gray sand w/trace of silt.
					35		
					36		
					37		
					38		
	8	38.5-40	1/1/4	6"	39		Loose medium brown and gray sand w/trace of silt.
					40		
					1		

Engineer _____

AEPMTP-000499

FORM CE-5
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AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	33.5
Time	
Date	2-3-77

Boring No. 513 Date 2-3-77 Sheet 3 of 4
Type of Boring Auger Rig B-50
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					40		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					41		
					42		
					43		
	9	43.5-45	5/7/9	0	44		Sand and gray wash water.
					45		
					46		
					47		
					48		
	10	48.5-50	5/9/11	4"	49		Medium brown sand and gravel.
					50		
					51		
					52		
					53		
	11	53.5-55	9/14/16	8"	54		Dense medium brown gray sand w/trace of silt.
					55		
					56		
					57		
					58		
	12	58.5-60	12/20/25	10"	59		Dense medium brown, gray sand.
					60		
					1		

Engineer _____

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	33.5
Time	
Date	2-3-77

Boring No. 513 Date 2-3-77 Sheet 4 of 4
Type of Boring Auger Rig B-50
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					60		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					61		
					62		
					63		
	13	63.5-65	13/23/27	6"	64		Very dense medium brown and gray sand w/trace of silt.
					65		
					66		
					67		
					68		
	14	68.5-70	11/18/60	12"	69		Same as sample number 13. .2 gray sandstone in end of tube.
					70		
					1		Stopped hole at 70.0'
					2		2-3-77
					3		
					4		
					5		
					6		
					7		
					8		
					9		
					0		
					1		

Engineer _____

AEPMTP-000501

FORM CE-5
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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company Appalachian Power Company

Project Project 1301- Coal Yard

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 514 Date 2-4-77 Sheet 1 of 4

Type of Boring Auger Rig B-50

Casing used _____ Size _____ Drilling mud used _____

Boring begun 2-4-77 Boring completed 2-4-77

Ground Elevation 573.09 referred to _____ Datum

Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					0		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					1		
					2		
					3		
					4		
	1	3.5-5	5/9/13	12"	5		Mottled light brown and rusty sandy silty clay w/rock fragments. Very stiff - dry -
					6		
					7		
					8		
					9		
	2	8.5-10	11/22/27	14"	10		Medium brown silty clayey sand w/gravel, dense-dry
					11		
					12		
					13		
					14		
	3	13.5-15	15/20/19	12"	15		Medium brown coarse sand and gravel, - dense-dry-
					16		
					17		
					18		
					19		
	4	18.5-20	15/16/20	10"	20		Medium brown coarse sand and gravel. dense - dry
					21		

Engineer _____

AEPMTP-000502

FORM CE-5
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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 514 Date 2-4-77 Sheet 2 of 4
Type of Boring Auger Rig B-50
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					20		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					21		
					22		
					23		
					24		
	5	23.5-25	19/19/20	8"	25		Medium brown sand and gravel dense and dry
					26		
					27		
					28		
					29		
	6	28.5-30	7/9/15	6"	30		Medium brown damp sand and gravel - medium -
					31		
					32		
					33		
					34		Water
	7	33.5-35	12/15/13	6"	35		Medium brown wet - sand and gravel. - medium -
					36		
					37		
					38		
					39		
	8	38.5-40	4/6/7	5"	40		Medium brown gravelly sand - wet -
					1		

Engineer _____

AEPMTP-000503

FORM CE-5
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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 514 Date 2-4-77 Sheet 3 of 4
Type of Boring Auger Rig B-50
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					40		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					41		
					42		
					43		
					44		Washed out plug 2'
	9	43.5-45	7/14/15	-0-	45		- Lost sample -
					46		
					47		
					48		
					49		
	10	48.5-50	11/18/21	7"	50		Medium brown sand and gravel Dense - wet
					51		
					52		
					53		
					54		
	11	53.5-55	6/8/12	12"	55		Medium brown fine to medium sand
					56		
					57		
					58		
					59		
	12	58.5-60	13/25/17	-0-	60		Washed out plug 2' Lost sample
					1		

Engineer _____

AEPMTP-000504

FORM CE-5
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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 514 Date 2-4-77 Sheet 4 of 4
Type of Boring Auger Rig B-50
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					60		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					61		Augers settled down after drilling 6"
					62		
					63		
					64		
	13	63.5-65	12/22/23	-0-	65		No recovery. * Used stiff spring.
					66		
					67		
					68		
					69		
	14	68.5-70	24/30/80/.4	8"	70		Medium brown sand and gravel w/trace of sandstone fragments in end of spoon.
					71		
					72		Stopped hole at 70' 2-4-77
					73		
					74		
					75		
					76		
					77		
					78		
					79		
					80		
					1		

Engineer _____

AEPMTP-000505

FORM CE-5
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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company Appalachian Power Company

Project Project 1301 - Flyash Pipe Bridge

Location of Boring:	
Water Level	40.0'
Time	
Date	2-4-77

Boring No. 701 Date 2-4-77 Sheet 1 of 5

Type of Boring Auger Rig B-50

Casing used _____ Size _____ Drilling mud used _____

Boring begun 2-4-77 Boring completed 2-9-77

Ground Elevation 584.92 referred to _____ Datum

Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					0		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					1		
					2		
					3		
	1	3.5-5	6/9/12	15"	4		Silty medium brown to gray clay.
					5		
					6		
					7		
					8		
					9		
	2	8.5-10	5/5/8	8"	10		Sandy silt.
					11		
					12		
					13		
					14		
	3	13.5-15	5/9/7	8"	15		Medium grain brown sand and silt.
					16		
					17		
					18		
					19		
	4	18.5-20	15/20/22	11"	20		Medium grain sand w/trace of gravel.
					21		

Engineer _____

AEPMTP-000506

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 701 Date 2-7-77 Sheet 2 of 5

Type of Boring _____ Rig _____

Casing used _____ Size _____ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					20		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					21		
					22		
					23		
					24		
	5	23.5-25	8/13/17	9"	25		Fine sand w/trace of coal and some gravel.
					26		
					27		
					28		
					29		
	6	28.5-30	7/8/11	8"	30		Medium grain sand w/small gravel.
					31		
					32		
					33		
					34		
	7	33.5-35	5/6/8	12"	35		Medium grain sand - medium brown
					36		
					37		
					38		
					39		
	8	38.5-40	4/9/11	18"	40		Light brown medium grain sand. Water at 40.0'
					1		

Engineer _____

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 701 Date 2-8-77 Sheet 3 of 5
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					40		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					41		
					42		
					43		
					44		
	9	43.5-45	4/6/7	-0-	45		No recovery.
					46		
					47		
					48		
					49		
	10	48.5-50	2/4/7	3"	50		Medium grain sand w/small gravel.
					51		
					52		
					53		
					54		
	11	53.5-55	17/12/15	16"	55		Medium grain sand w/several large gravel.
					56		
					57		
					58		
					59		
	12	58.5-60	6/12/16	8"	60		Medium grain sand w/small gravel.
					1		

Engineer _____

AEPMTP-000508

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 701 Date 2-8-77 Sheet 5 of 5

Type of Boring _____ Rig _____

Casing used _____ Size _____ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					80		Auger refusal at 80.5'
					81		Started coring at 80.5'
					82		
					83		
					84		
	Core	80.5-90.5		7.6'	85		Gray coarse grain sandstone.
					86		
					87		
					88		
					89		
					90		Stopped hole at 90.5'
					91		2-8-77
					92		
					93		
					94		
					95		
					96		
					97		
					98		
					99		
					100		
					1		

Engineer _____

AEPMTP-000509

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company Appalachian Power Company

Project Project 1301 - Fly ash Pond

Location of Boring:	
Water Level	39.0
Time	
Date	2-1-77

Boring No. 703 Date 2--1-77 Sheet 1 of 5
Type of Boring Auger Rig B-50
Casing used _____ Size _____ Drilling mud used _____
Boring begun 2-1-77 Boring completed 2-2-77
Ground Elevation 567.70 referred to _____ Datu
Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					0		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					1		
					2		
					3		
					4		
	1	3.5-5	5/7/7	16"	5		Silty clay.
					6		
					7		
					8		
					9		
	2	8.5-10	3/4/5	12"	10		Sandy, silty clay.
					11		
					12		
					13		
					14		
	3	13.5-15	1/3/3	12"	15		Sandy clay.
					16		
					17		
					18		
					19		
	4	18.5-20	13/22/19	5"	20		Sand and medium large gravel. Trace of coal.
					1		

Engineer _____

AEPMTP-000510

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	39.0
Time	
Date	2-1-77

Boring No. 703 Date 2-1-77 Sheet 2 of 5
Type of Boring Auger Rig B-50
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed 1 _____
Ground Elevation _____ referred to _____ Datum
Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					20		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					21		
					22		
					23		
					24		
	5	23.5-25	10/15/18	8"	25		Medium grain sand, light gray.
					26		
					27		
					28		
					29		
	6	28.5-30	7/8/11	5"	30		Medium grain sand w/trace of coal.
					31		
					32		
					33		
	7	33.5-35	5/6/10	7"	34		Medium grain sand, medium brown.
					35		
					36		
					37		
					38		
					39		Water
	8	38.5-40	5/5/5	8"	40		Same as sample number 7.
					1		

Engineer _____

AEPMTP-000511

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	2-1-77

Boring No. 703 Date 2-1-77 Sheet 3 of 5
Type of Boring Auger Rig B-50
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					40		
					41		
					42		
					43		
					44		
	9	43.5-45	4/6/7	1"	45		Washed out. Two large gravels and medium grain sand.
					46		
					47		
					48		
	10	48.5-50	5/4/6	10"	49		Same as sample number 9.
					50		
					51		
					52		
					53		
					54		
	11	53.5-55	8/8/10	10"	55		Smaller gravel - medium grain sand.
					56		
					57		
					58		
					59		
	12	58.5-60	15/20/22	8"	60		Medium brown - medium grain sand.
					1		

Engineer _____

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	39.0
Time	
Date	

Boring No. 703 Date 2-1-77 Sheet 4 of 5
Type of Boring auger Rig B-50
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					60		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					61		
					62		
					63		
					64		
	13	63.5-65	7/6/14	5"	65		Several large gravel and medium grain sand.
					66		
					67		
					68		
					69		
	14	68.5-70	15/20/22	10"	70		Medium grain sand w/trace of gravel and shale.
					71		
					72		
					73		
					74		
	15	73.5-75	12/12/14	9"	75		Large grain sand and small gravel.
					76		
					77		
					78		
					79		
	16	78.5-80	56/20/17	10"	80		Same
					1		

Engineer _____

AEPMTP-000513

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 703 Date 2-1-77 Sheet 5 of 5
Type of Boring Auger Rig B-50
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datum
Field Party: King and Smithson

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					80		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					81		
					82		Rock
					83		
					84		
	Run #1	82.7-92.7		10.0	85		82.7' started coring.
					86		
					87		
					88		
					89		
					90		
					91		All sandstone core 100% recovery.
					92		
					93		Stopped coring at 92.7' 2-2-77
					94		
					95		
					96		
					97		
					98		
					99		
					100		
					1		

Engineer _____

AEPMTP-000514

REV. 3/74

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company Appalachian Power Company

Project Project 1301 - Truck Bridge Crossing

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 801 Date 3-16-77 Sheet 1 of 5
Type of Boring Auger Rig B-61
Casing used _____ Size _____ Drilling mud used _____
Boring begun 3-16-77 Boring completed 3-16-77
Ground Elevation 594.95 referred to _____ Datum
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					0		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					1		
					2		
					3		
	1	2.5-4	21/24/27	15"	4		Black fly ash and dark brown sand and gravel. (Fill)
					5		
					6		
					7		
					8		
	2	7.5-9	1/4/5	13"	9		Dark fill brown sand and gravel.
					/0		Medium brown clayey silt.
					/1		
					/2		
					/3		
	3	12.5-14	2/3/4	14"	/4		Medium brown clayey, sandy silt.
					/5		
					/6		
					/7		
					/8		
	4	17.5-19	3/4/5	16"	/9		Medium brown clayey sand.
					20		
					1		

Engineer _____

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 801 Date 3-16-77 Sheet 2 of 5
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____
_____ Datu
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					20		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					21		
					22		
					23		
	5	22.5-24	10/15/17	15"	24		Medium brown gravely sand.
					25		
					26		
					27		
					28		
	6	27.5-29	8/13/17	16"	29		Same as sample number 5.
					30		
					31		
					32		
					33		
	7	32.5-34	5/6/9	15"	34		Medium brown sand w/trace of gravel.
					35		
					36		
					37		
					38		
	8	37.5-39	6/8/11	14"	39		Medium brown sand.
							Water
					40		
					1		

Engineer _____

AEPMTP-000516

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 801 Date 3-16-77 Sheet 3 of _

Type of Boring _____ Rig _____

Casing used _____ Size _____ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____

_____ Da

Field Party: _____

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					40		Soil type, color, texture, consistency, sampler driving notes blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					41		
					42		
					43		
	9	42.5-44	2/3/4	13"	44		Medium brown sand w/trace of gravel.
					45		
					46		
					47		
					48		
	10	47.5-49	6/7/8	1"	49		Same as sample number 9.
					50		
					51		
					52		
					53		
	11	52.5-54	4/4/7	2"	54		Same as sample number 9.
					55		
					56		
					57		
					58		
	12	57.5-59	7/12/13	14"	59		Medium brown sand.
					60		
					1		

Engineer _____

AEPMTP-000517

REV. 3/74

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 801 Date 3-16-77 Sheet 4 of 5

Type of Boring _____ Rig _____

Casing used _____ Size _____ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____

_____ Dat

Field Party: Roush and Reitimre

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					60		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					61		
					62		
					63		
	13	62.5-64	8/9/13	13"	64		Medium brown sand.
					65		
					66		
					67		
					68		
	14	67.5-69	8/10/12	10"	69		Same
					70		
					71		
					72		
					73		
	15	72.5-74	4/8/13	11"	74		Same
					75		
					76		
					77		
					78		
	16	77.5-79	10/26/27	12"	79		Same
					80		
					1		

Engineer _____

AEPMTP-000518

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 801 Date 3-16-77 Sheet 5 of 5
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datu
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
							Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
	17	82.5-84	12/18/21	6"			Medium brown sand and gravel.
							Auger refusal at 86.8'
							Stopped hole at 86.8'
							3-16-77

Engineer _____

AEPMTP-000519

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company Appalachian Power Company

Project Project 1301 - Truck Bridge Crossing

Location of Boring:	
Water Level	34.5
Time	
Date	

Boring No. 802 Date 3-17-77 Sheet 1 of 4
Type of Boring Auger Rig B-61
Casing used _____ Size _____ Drilling mud used _____
Boring begun 3-17-77 Boring completed 3-17-77
Ground Elevation 588.46 referred to _____ Dat
Field Party: Roush and Rietmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					0		Soil type, color, texture, consistency, sampler driving notes blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					1		
					2		
					3		
					4		
	1	3.5-5	5/8/8	17"	5		Medium brown and gray clayey silt.
					6		
					7		
					8		
					9		
	2	8.5-10	3/4/5	16"	10		Medium brown and gray sandy, clayey silt.
					11		
					12		
					13		
					14		
	3	13.5-15	2/5/6	14"	15		Medium brown clayey sand.
					16		
					17		
					18		
					19		
	4	18.5-20	7/8/11	8"	20		Medium brown gravely sand.
					21		

Engineer _____

AEPMTP-000520

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	34.5
Time	
Date	

Boring No. 802 Date 3-17-77 Sheet 2 of 4
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____
_____ Dat
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					20		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					21		
					22		
					23		
					24		
	5	23.5-25	5/7/10	14"	25		Medium brown sand - fine grain
					26		
					27		
					28		
					29		
	6	28.5-30	3/7/9	14"	30		Same as sample number 5 fine grain.
					31		
					32		
					33		
					34		
	7	33.5-35	13/14/13	15"	35		Same as sample number 5 w/medium and coarse grain sand.
					36		
					37		
					38		
					39		
	8	38.5-40	4/7/8	13"	40		Same as sample number 5 w/medium and coarse grain sand.
					1		

Engineer _____

REV. 3/74

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	34.5
Time	
Date	

Boring No. 802 Date 3-17-77 Sheet 3 of 4
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Datu
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					40		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					41		
					42		
					43		
					44		
	9	43.5-45	3/5/6	13"	45		Medium brown sand - medium and coarse grain.
					46		
					47		
					48		
					49		
	10	48.5-50	6/8/10	14"	50		Same as sample number 9, medium grain.
					51		
					52		
					53		
					54		
	11	53.5-55	5/6/10	12"	55		Same as sample number 10 - medium grain.
					56		
					57		
					58		
					59		
	12	58.5-60	8/10/14	13"	60		Same as sample number 11 - medium grain.
					1		

Engineer _____

AEPMTP-000522

FORM CE-5
REV. 3/74

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	34.5
Time	
Date	

Boring No. 802 Date 3-17-77 Sheet 4 of 4
Type of Boring _____ Rig _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring completed _____
Ground Elevation _____ referred to _____ Dat
Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					60		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					61		
					62		
					63		
					64		
	13	63.5-65	13/14/17	13"	65		Medium brown sand - fine grain - medium coarse grain.
					66		
					67		
					68		
					69		
	14	68.5-70	5/8/12	12"	70		Same as sample number 13 - medium and coarse grain.
					71		
					72		
					73		
					74		
	15	73.5-75	8/15/22	15"	75		Same as sample number 13 - medium grain.
					76		
					77		
					78		
					79		
	16	78.5-80	9/14/20	14"	80		Same as sample number 13 - medium and coarse grain.
					1		
							Auger refusal at 82.5'

Engineer _____

AEPMTP-000523

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company Appalachian Power Company

Project Project 1301 - Truck Bridge Crossing

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 803 Date 3-15-77 Sheet 1 of _____

Type of Boring Auger Rig B-61

Casing used _____ Size _____ Drilling mud used _____

Boring begun 3-15-77 Boring completed 3-16-77

Ground Elevation _____ referred to _____ Dat

Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					0		*Boring offset about 25' east because of power lines.
					1		
					2		
					3		
	1	2.5-4	3/4/6	14"	4		Medium brown clayey silt.
					5		
					6		
					7		
					8		
	2	7.5-9	4/5/5	13"	9		Medium brown, medium grain, gravely sand.
					/0		
					/1		
					/2		
					/3		
	3	12.5-14	4/4/5	7"	/4		Same as sample number 2 w/fine and medium grain sand.
					/5		
					/6		
					/7		
					/8		
	4	17.5-19	5/6/7	14"	/9		Medium brown sand and gravel.
					20		
					1		

Engineer _____

AEPMTP-000524

REV. 3-74

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 803 Date 3-15-77 Sheet 2 of 5

Type of Boring _____ Rig _____

Casing used _____ Size _____ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
							Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					20		
					21		
					22		
					23		
	5	22.5-24	10/11/13	12"	24		Medium brown sand and gravel.
					25		
					26		
					27		
					28		
	6	27.5-29	6/8/6	1"	29		Medium brown gravely sand.
					30		
					31		
					32		
					33		
	7	32.5-34	8/10/5	6"	34		Medium brown, medium grain gravely sand.
					35		
					36		
					37		
					38		
	8	37.5-39	5/6/8	14"	39		Same
					40		
					1		

Engineer _____

AEPMTP-000525

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 803 Date 3-15-77 Sheet 3 of 5

Type of Boring _____ Rig _____

Casing used _____ Size _____ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____

_____ Datu

Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					40		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					41		
					42		
					43		
	9	42.5-44	5/4/6	13"	44		Medium brown, medium coarse grain gravely sand.
					45		
					46		
					47		
					48		
	10	47.5-49	7/8/10	12"	49		Medium brown, coarse grain sand w/some gravel.
					50		
					51		
					52		
	11	52.5-54	6/8/12	6"	53		Same as sample number 10 w/medium grain sand trace of gravel.
					54		
					55		
					56		
					57		
	12	57.5-59	8/10/12	7"	58		Same
					59		
					60		
					1		

Engineer _____

AEPMTP-000526

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company Appalachian Power Company

Project Project 1301 - Truck Bridge Crossing

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 803 Date 3-15-77 Sheet 4 of ___

Type of Boring _____ Rig _____

Casing used _____ Size _____ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Dat

Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					60		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					61		
					62		
					63		
	13	62.5-64	7/11/15	6"	64		Medium brown coarse grain gravelly sand.
					65		
					66		
					67		
					68		
	14	67.5-69	13/17/25	5"	69		Medium brown fine sand.
					70		
					71		
					72		
					73		
	15	72.5-74	6/9/13	13"	74		Same
					75		
					76		
					77		
					78		
	16	77.5-79	8/13/20	13"	79		Same - medium grain.
					80		
					1		

Engineer _____

AEPMTP-000527

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. _____

Company _____

Project _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No 803 Date 3-15-77 Sheet 5 of _

Type of Boring _____ Rig _____

Casing used _____ Size _____ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____

_____ Da

Field Party: Roush and Reitmire

Depth of Casing, ft.	Sample No.	Sample depth from-to (in feet)	Standard Penetration Resistance Blows/Foot	Tot. length of recov. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
					80		Soil type, color, texture, consistency, sampler driving notes blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
					81		
					82		
					83		
	17	82.5-84	8/10/22	1"	84		Medium brown gravelly sand.
					85		
					86		
					87		
					88		
	18	87.3-87.4	50/.1	-	89		Hit rock at 86.8'
							No recovery
					90		Started coring at 87.6'
					91		100' recovery.
							8.0' of +.4 core
					92		
	Run #1	87.6-97.6		10.0	93		10.0' medium gray medium grain hard sandstone.
					94		
					95		
					96		
					97		
					98		Stopped hole at 97.6'
							3-16-77
					99		
					100		
					1		

Engineer _____

ARCADIS

AEP 1990, 1996, 1997, 2001, 2008

Monitoring Well Boring Logs

MW-001 to MW-16, 96-01 to 96-06, 96-101 to 96-110, JTMN-1, JTMN-2

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 724,498.7 E 1,733,165.9**

GROUND ELEVATION **569.2** SYSTEM **State Plane using NAD27**

Water Level, ft	▽ **24.9**	▼	▼
TIME			
DATE	**6-18-97**		

BORING NO. **001** DATE **7/23/15** SHEET **1** OF **2**

BORING START **6/18/97** BORING FINISH **6/18/97**

PIEZOMETER TYPE WELL TYPE **OW**

HGT. RISER ABOVE GROUND **2.14** DIA **2**

DEPTH TO TOP OF WELL SCREEN **27.0** BOTTOM **37**

WELL DEVELOPMENT **YES** BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-WEB** RIG **BK-81**

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	1.5	3.0	4-5-4	1.0				ML	**Road gravel, grass and fill material** **SILTY SAND** Dark, yellow, brown, 10yr 4\2, with minor cl- silty clay at base, also gravel and limestone aggregate, dry, no contamination no odor, 80% sand, 20% silt, fine to medium grain.		
2	SS	6.5	8.0	4-3-3	1.5		5		SM	**SILTY CLAY** Dark yellow, brown, 10 yr 4\2, >50 % fines, 80% clay, 20% silt, dry, no contamination, poorly graded, CL grades into SM medium sand, 10yr 4\2, <15% gravel, well sorted, 95% sand, medium to fine 25% silt, moist, black streaking interbedded, no contamination, grades to CL.		
3	SS	11.5	13.0	1-2-3	.7		10		CL	**silty clay** Moderate yellow brown, 10 yr 5\4, 80% clay, 20% silty, moist, slight plasticity, no contamination, no odor, grades into SM @15'		11' TO 13' SHELBY TUBE TAKEN 6-25-97.
4	SS	16.5	18.0	1-3-4	.7		15		SM	**MODERATE BROWN 5 YR 4\4 SILTY SAND** 95 % sand, 5% silt and gravel. Sand well washed, medium to fine grain, sub-rounded, no contamin ation, no odor, moist.		18.5 TOP OF SEAL

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 ROGERS**

AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **001** DATE **7/23/15** SHEET **2** OF **2**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/18/97** BORING FINISH **6/18/97**

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
5	ST	21.5	23.5		.7					**MATTER BROWN 5YR 4\4 SILTY SAND** 85 % Sand, 15% silt, moist, sand is medium to fine grain, quartz sub-rounded, with minor clay.		SHELBY TUBE TAKEN TO MUCH GRAVEL NO GOOD.
6	SS	26.5	28.0	3-4-9	1.5		25		SW	**DARK YELLOW BROWN 10 YR 4\2 TO MODERATE BROWN 5YR 4\2 GRAVELLY SAND** Well graded sand, <15% gravel, 90% sand, course to fine grain, well graded, quartz sub-rounded, wet, no odor, no contamination.		27.0 TOP OF SCREEN.
7	SS	31.5	33.0	7-12-11	1.5		30			**DARK YELLOW BROWN 10 YR 4\2 MODERATE BROWN 5YR3\4 GRAVELLY SAND** Well graded, <15 % gravel, 90% sand, course to fine grain, quartz sub-rounded while gravel is sub-angular to sub-rounded, wet, no contamination, no odor, grades into ml @ 35'.		GRAIN SIZE ANALYSIS SAMPLE COLLECTED.
8	SS	36.5	38.0	4-6-4	.9		35		ML SM	**LIGHT BROWN 5 YR5\6 CLAYEY SILT** Interval grading in SM. **PALE YELLOW BROWN 10YR6\2 SAND** 60% sand, fine grain, 40% silty\clay grading into SM, silty sand, 80% sand with minor gravel 20% silty and clay, wet, no odor, no visible contamination.		37.0 BOTTOM OF SCREEN 37.5 BOTTOM OF SAND.

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 724,857.8 E 1,733,650.5**

GROUND ELEVATION **580.8** SYSTEM **State Plane using NAD27**

Water Level, ft	▽ 37.8	▼	▼
TIME			
DATE	6-25-97		

BORING NO. **002** DATE **7/23/15** SHEET **1** OF **4**

BORING START **6/19/97** BORING FINISH **6/24/97**

PIEZOMETER TYPE WELL TYPE **OW**

HGT. RISER ABOVE GROUND **1.99** DIA **2**

DEPTH TO TOP OF WELL SCREEN **60.5** BOTTOM **70.5**

WELL DEVELOPMENT **YES** BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-WEB** RIG **BK-81**

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	1.6	3.1	4-11-11	1.4				ML	**FILL MATERIAL, GRASS AND GRAVEL WITH TOP SOIL**		
									CL	**MODERATE BROWN 5YR4\4 SANDY SILT** 60% silt, 40 % sand, minor clay, sub-rounded with quartz gravels 1/2-3/4", dry, no contamination.		
2	SS	6.6	8.1	4-4-3	1.5		5			**MODERATE BROWN 5YR4\4 SANDY SILT** 60% silt, 40% sand grading to ML, 60% silt, 30% clay, 10% sand ? in gravel (quartz) to CL, dark yellow brown 10 yr4\2, 70% clay, 20% silt, 10% sand, sand fine grain, minor gravel and black interbedded clay, moist, no contamination.		
									CL	**10 YR5\4 MODERATE YELLOW BROWN SILTY CLAY** 90% clay, 10% silt, minor sand, clay very stiff, light gray interbeds with some root zones, moist, no contamination, no odor.		
3	SS	11.6	13.1	3-5-6	1.1		10					
4	SS	16.6	18.1	3-4-5	1.5		15			**MODERATE YELLOW BROWN 10YR5\4 SILTY CLAY** 90% clay, 10% silt, minor sand, very still, with light gray to black interbedded root zones, moist, no contamination, no odor, some mica present.		

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 ROGERS**

AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **002** DATE **7/23/15** SHEET **2** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/19/97** BORING FINISH **6/24/97**

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
5	SS	21.6	23.1	2-1-3	1.5		25		SC	**MODERATE BROWN TO LIGHT BROWN 10 YR 5\4 TO 5YR 4\4 SANDY CLAY** 60% clay, 40% sand fine grain, mica and quartz , clay moderate stiff, moist, interbedded with CL from above 6" at 22.0 to 22.6, moist, no contamination, no odor.		
6	SS	26.6	28.1	1-1-2	1.5				SC	**MODERATE YELLOW BROWN 10YR5\4 SILTY CLAY** 80% clay, 20% silt, minor sand-very fine grain, moist, interbedded of black material, very minor , stiff clay, sand is mica and quartz, no contamination, no odor.		
7	SS	31.6	33.1	1-1-1	0		30					
8	SS	34.6	36.1	1-1-2	1.5				SC	**MODERATE BROWN 5YR4\4 SANDY CLAY** 60% clay, 40% sand, clay moderate stiff, sand fine grain , mica and quartz, with iron coloring at base, very red minor black (organic ?), sample wet at base.		Sample wet at base (perched).
9	SS	36.6	38.1	1-1-1	1.5		35		SW	**LIGHT BROWN 5YR 5\6 SANDY CLAY** 60% clay, 40% sand from 36.6 to 36.9 grades to SM clayey silty sand, light brown 5yr5\6 , 80% sand, 20% silt\clay, sand is quartz, mica, fine grain, grading to reddish brown 10r 4\6 at base, moist.		
10	SS	41.6	43.1	1-8-13	1.5		40			**LIGHT BROWN 5YR 6\6 SILTY CLAYEY SAND** 80% sand, 20% silt\clay, same as above from 41.6-42.3, 42.3-42.7, the color change to dark yellow orange 10yr6\6 to SC sandy , medium gray n5 40% clay 60% sand, clay is moderate stiff, wet, sand is quartz, mica, fine grain, wet, grading into sw at 1.8 -2' well graded sand, dark yellow brown 10yr4\2 medium to coarse sand 90% sand, 10% silt\clay, sand quartz, sub-rounded, wet. m=sc		Water in sample. Will add water inside augers. Water in sample.
							45		SW			

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **002** DATE **7/23/15** SHEET **3** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/19/97** BORING FINISH **6/24/97**

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
11	SS	46.6	48.1	11-12-14	1.5					**MODERATE YELLOW BROWN SAND** Well graded, 95% sand, 5% silt, minor clay sand coarse to fine with gravel quartz, granite(?), minor silt, no clay, wet, no contamination.		
12	SS	51.6	53.1	5-6-7	.2		50			**PALE YELLOW BROWN 10 YR 6\2 SAND** Well graded, 95% sand, 5% silt\minor clay, quartz, sand medium to fine grain 51.6-52.4 grades medium coarse sand of quartz, granite(?) with gravel and clay, fine sand, light brown 5yr 5\6 to moderate brown 5yr4\4 from 52.4-52.7, grades into medium sand. 95% sand with 5% 52.7-53.1 silty\clay, wet, no contimination.		54.1 Top of seal.
13	SS	56.6	58.1	6-6-7	1.3		55		SP	**DARK YELLOW BROWN 10YR 4\2 SAND** 95% sand, 5% silt\clay, sand is medium to fine grain with quartz, sandstone grains(quartzite, wet, no contamination.		57.9 Top of sand.
14	SS	61.6	63.1	5-5-10	1.5		60			**PALE YELLOW BROWN SAND** Poorly graded, 98% sand, 2% silt, sand is clean to white, fine grain , sand has some rounded, medium grain , mostly sub-angular, wet, no contamination.		60.5 Top of screen. Grain size analysis sample cllected.
15	SS	66.6	68.1	8-4-5	.9		65		SW	**BROWN GRAY 5YR 4\1 SAND** Well graded, 100% sand from fine to coarse with gravel, sand is quartz, quartzite gravel with angular gneiss pieces, wet, little to no fines-clay, sand is sub-rounded, large quartzite gravel in bottom of spoon, no contimiantion.		
							70					70.5 Bottom of screen

Continued Next Page

AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **002** DATE **7/23/15** SHEET **4** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/19/97** BORING FINISH **6/24/97**

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	71.7	71.9	50/.2	.2					**LIGHT GRAY SANDSTONE N7** Medium grain sand, friable at top of sample, competent at base, loosely cemented, quartz grain , sub-angular to sub-rounded, dry. Auger return includes sub-angular cobbles and gravel of granite, quartzite, gneiss from bottom of borehole.		71.8 Bottom of sand. Approximately 200 gallons water injected into bore hole during augering.

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 719,877.2 E 1,733,713.7**

GROUND ELEVATION **604.9** SYSTEM **State Plane using NAD27**

Water Level, ft	▽ **31.9**	▼	▼
TIME			
DATE	**6-26-97**		

BORING NO. **003** DATE **7/23/15** SHEET **1** OF **2**

BORING START **6/25/97** BORING FINISH **6/25/97**

PIEZOMETER TYPE WELL TYPE **OW**

HGT. RISER ABOVE GROUND **2.30** DIA **2**

DEPTH TO TOP OF WELL SCREEN **32.3** BOTTOM **42.3**

WELL DEVELOPMENT **YES** BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-WEB** RIG **BK-81**

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	1.5	3.0	3-5-6	1.5				ML	**GRAYISH ORANGE TO DARK YELLOW ORANGE 10YR\7\2 TO 10YR 6/6 SILTY CLAY** 80% clay, 20% silt, dry, mottled, some mica, iron, staining possibly, no cantamination.		
2	SS	6.5	8.0	3-2-4	1.5		5			**GRAYISH ORANGE 10YR 7\4 SILTY CLAY** 70% clay, 30% silt, moist, clay content decrease with depth, mottled, iron staining, mica no contamination.		
3	SS	11.5	13.0	2-2-3	1.5		10		CL	**MODERATE YELLOW BROWN 10YR 5\4 SILTY CLAY** 90% clay, 10% silt, increase in clay, moist to minor water, some mica, no contamination.		Perched water.
4	SS	16.5	18.0	5-6-8	1.1		15		SW	**MODERATE YELLOW 10yr 5\4 BROWN SAND** Well graded, 95% sand, 5% silt, some coarse grain gravel, sand is medium to coarse, sub-rounded, quartz, dry , no contamination.		

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 ROGERS**

AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **003** DATE **7/23/15** SHEET **2** OF **2**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/25/97** BORING FINISH **6/25/97**

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
5	SS	21.5	23.0	8-9-9	1.2					**MODERATE YELLOWISH BROWN 10YR 5\4 SAND** 95% sand, 5% silt\fine sand, some coarse gravel of quartzite\granite, sand is medium to coarse grain quartz, dry, subrounded, no contamination.		
6	SS	26.5	28.0	4-4-5	1.2		25			**DARK YELLOW BROWN 10YR 4\2 SILTY SAND** 95% sand, 5% silt, sand sand medium to coarse minor silt, sand rounded to sub-rounded quartz, minor mica, some gravel, moist, sand increase in sorting, no comtamination.		25.3 Top of seal. 28.1 Top of sand.
7	SS	31.5	33.0	3-2-3	1.2		30		SM	**DARK YELLOW BROWN 10YR 4\2 SILTY SAND** 95% sand, 5% silt, no gravel, sand fine to medium, poorly graded, wet, no contamination, SW at bottom sand.		32.3 Top of screen.
8	SS	33.0	34.5	2-2-2	1.5					**DARK YELLOW BROWN 10YR 4\2 SILTY SAND** 95% sand, 5% silt, sand is fine to medium quartz, some mica, poorly graded, n0o contamination.		Grain size analysis sample 35.3-36.8
9	SS	36.5	38.0	1-1-2	1.4		35			**DARK YELLOW BROWN 10YR 4\2 SILTY SAND** 95% sand, 5% silt, sand medium to fine grain quartz, where poorly graded.		
10	SS	41.5	43.0	7-10-7	1.5		40			**DARK YELLOW BROWN 10YR 4\2 SILTY SAND** 95% sand, 5% silt, sand medium to fine , quartz, wet, poorly graded and uniform grain size, no contamination.		100 gallons of water used in augers. Filled augers with water. 42.4 Bottom of screen. 43.4 Bottom of sand. Advance augers to 43.4 to install screen.

AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 724,865.9 E 1,733,643.4**

GROUND ELEVATION **581.1** SYSTEM **State Plane using NAD27**

Water Level, ft	▽ **37.6**	▼	▼
TIME			
DATE	**6-30-97**		

BORING NO. **004** DATE **7/23/15** SHEET **1** OF **3**

BORING START **6/26/97** BORING FINISH **6/30/97**

PIEZOMETER TYPE WELL TYPE **OW**

HGT. RISER ABOVE GROUND **2.05** DIA **2**

DEPTH TO TOP OF WELL SCREEN **37.6** BOTTOM **47.6**

WELL DEVELOPMENT **YES** BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-WEB** RIG **BK-81**

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
							5					
							10					
							15					

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 ROGERS**

AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

BORING NO. **004** DATE **7/23/15** SHEET **2** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/26/97** BORING FINISH **6/30/97**

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	ST	26.0	28.0				25					26.0 Shelby tube.
							30					30.0 Top of seal.
												32.8 Top of sand.
							35					37.6 Top of screen.
2	SS	41.5	43.0	4-6-7	1.5		40		SC	**MEDIUM GRAY N5 CLAYEY SAND** 60% sand, 40 % clay, clay slight plasticity, sand is medium to fine , quartz, mica, wet, well sorted.		
3	SS	43.5	45.0	8-13-21	1.2		45		SW	**DARK YELLOW BROWN 10YR 4\2 BROWN SAND** Well greaded, sand is medium to coarse, 90% sand, 10 % silt\clay, sand quartz, sub-angular, wet, no contamination.		Grain size analysis 43.5-45.0

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AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

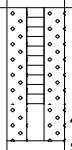
AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **004** DATE **7/23/15** SHEET **3** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/26/97** BORING FINISH **6/30/97**

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
												47.6 Bottom of screen. 48.2 Bottom of sand.

AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 719,152.8 E 1,734,428.9**

GROUND ELEVATION **591.0** SYSTEM **State Plane using NAD27**

Water Level, ft	▽ 33.8	▼	▼
TIME			
DATE	7-2-97		

BORING NO. **005** DATE **7/23/15** SHEET **1** OF **3**

BORING START **7/1/97** BORING FINISH **7/1/97**

PIEZOMETER TYPE WELL TYPE **OW**

HGT. RISER ABOVE GROUND **2.19** DIA **2**

DEPTH TO TOP OF WELL SCREEN **37.7** BOTTOM **47.7**

WELL DEVELOPMENT **YES** BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-WEB** RIG **BK-81**

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
									ML	**GRASS, ORGANIC MATTER** **SOILS, SILT, FINE SAND**		
1	SS	2.0	3.5	3-3-4	1.1				ML	**DARK YELLOW, ORANGE 10YR 6/6 CLAYEY SILT** 60 % silt 40 % clay, silty v-fine grain, mottled, root, some of black organic, iron stain, dark , no contamination.		
2	ST	7.0	9.0		2.0		5		SC	**Sample from bottom of shelby tube** **MOTTLED YELLOW BROWN 10YR 5/4 CLAYEY SAND** 80% sand, 20% silt/sand, moist, sand is fine grain w/ subrounded quartz, no contamination.		
3	ST	12.0	14.0		1.8		10		SM	**Sample from bottom of shelby tube** **MOTTLED YELLOW BROWN 10 YR 5/4 CLAYEY SAND** 90% sand 10% silt/clay, moist, sand is fine to medium grain subrounded, quartz, no contamination.		
4	SS	18.5	20.0	6-6-7	1.25		15		SW	**MOTTLED YELLOW BROWN 10YR 5/4 SAND** Well graded 95% sand, 5% silt, sand is medium to coarse grain quartz subrounded, moist, no contamination, some gravel is granite.		

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 ROGERS**

AEP_EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **005** DATE **7/23/15** SHEET **2** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **7/1/97** BORING FINISH **7/1/97**

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
5	SS	23.5	25.0	2-1-2	1.4		25		SP	**MOTTLED YELLOW BROWN 10YR 5/4 SAND** Poorly grade, 95% sand, 5% silt, sand is medium to fine grain , very well sorted, moist, sand subrounded quartz, no contamination, stringers of coal .25" thick at 22.7'.		
6	SS	28.5	30.0	3-4-5	1.5		30		SW SP	**DARK YELLOW ORANGE 10YR 6/6 SAND** Well graded sand, 95 % sand, 5% silt, medium to coarse with fine interbedded rounded quartz, grades into SP, poorly graded sand DARK YELLOW ORANGE 10YR 6/6 SAND, 95 % sand 5% silt, sand is medium to fine grain , well sorted, subrounded quartz, wet.		29.7 Top of seal.
7	SS	33.5	35.0	2-3-4	1.2		35		SW	**DARK YELLOW ORANGE 10YR 6/6 SAND** Well graded, 95% sand, 5% fine sand, sand is medium to coarse, well rounded, quartz, wet, stringers of coal at bottom of spoon 33.5', no contamination.		33.5 Top of sand. Rods wet 34.5. Adding water to augers 125 gallons.
8	SS	38.5	40.0	3-4-4	1.5		40		SM	**SM/SW MODERATE YELLOW BROWN 10YR 5/4 SILTY SAND, TO WELL GRADED SAND** 100% sand, fine to coarse, w\minor gravel, sand is subrounded quartz, wet, no contamination.		37.7 Top of screen.
9	SS	43.5	45.0	3-4-7	1.4		45		SP	**MODERATE YELLOW BROWN 10YR 5/4 SAND** 100% sand, medium grain, well sorted quartz, subrounded to rounded, wet, no contamination, minor clay at bottom 1/2".		
11	SS	45.0	46.5	4-4-6	1.5					**MODERATE YELLOW BROWN SAND** Poorly		Sample 10 grain size

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **005** DATE **7/23/15** SHEET **3** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **7/1/97** BORING FINISH **7/1/97**

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
10	SS	48.5	50.0	4-4-6	1.5		50			graded, 100% sand, medium grain quartz, including gravel layers, wet, no contamination. **MODERATE YELLOW BROWN 10YR 5/4 SAND** Medium grain, quartz, well rounded to subrounded, wet, no visible contamination.		analysis from 45.5-47.0 47.7 Bottom of screen. 48.8 Bottom of sand.

AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 720,255.7 E 1,735,680.0**

GROUND ELEVATION **601.3** SYSTEM **State Plane using NAD27**

Water Level, ft	▽ 50.3	▼ 61.0	▼ 70.0
TIME			
DATE	7-29-97	7-7-97	7-8-97

BORING NO. **006** DATE **7/23/15** SHEET **1** OF **4**

BORING START **7/1/97** BORING FINISH **7/8/97**

PIEZOMETER TYPE WELL TYPE **OW**

HGT. RISER ABOVE GROUND **0.26** DIA **2**

DEPTH TO TOP OF WELL SCREEN **81.1** BOTTOM **91.1**

WELL DEVELOPMENT **YES** BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-WEB** RIG **BK-81**

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
										ASPHALT, BOTTOM ASH, GRAVEL ROAD BED		
1	SS	6.0	7.5	18-22-24	1.5		5		SW	**LIGHT BROWN 5YR 5/6 SILTY SAND** Well graded, fill, 90% sand, 10% silt, fine sand, sand is medium to coarse, with gravel, quartz, subrounded, no contamination, dry.		
2	SS	7.5	9.0	9-15-13	1.5							
3	SS	9.0	10.5	9-13-15	1.5							
4	SS	10.5	12.0	7-9-9	1.5		10			**LIGHT BROWN 5YR 5/6 SAND** Well graded, fill, 95% sand, 5% silt, sand is medium to coarse with gravel, quartz, dry no contamination.		
5	SS	12.0	13.5	7-9-11	1.4				SM	**DARK YELLOW BROWN 10YR 4/2 SILTY SAND** 95% sand, 5% silty, minor gravel, sand is quartz dry, no contamination, fill ?.		
6	SS	13.5	15.0	9-10-12	1.4					**LIGHT BROWN 5YR 5/6 SILTY SAND/GRAVEL** 90% sand, 10% silt, sand medium grain.		
7	SS	15.0	16.5	7-9-13	1.5		15			**MODERATE YELLOW BROWN 10YR 5/4 SILTY CLAY TO CLAYEY SILT** 10% clay, 90% silt, fine grain , minor sand, dry, no contamination.		
8	SS	16.5	18.0	7-9-10	1.8							
9	SS	18.0	19.5	5-5-11	1.5							
10	SS	19.5	21.0	6-9-9	1.5							

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 ROGERS**

AEP_EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **006** DATE **7/23/15** SHEET **2** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **7/1/97** BORING FINISH **7/8/97**

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
11	SS	21.0	22.5	4-6-7	1.3							
12	SS	22.5	24.0	5-7-11	1.5							
13	SS	24.0	25.5	9-10-9	1.5		25					
14	SS	25.5	27.0	7-7-8	1.4							
15	SS	27.0	28.5	5-8-9	1.3							
16	SS	28.5	30.0	5-5-6	1.5		30					
17	SS	30.0	31.5	6-7-8	1.5							
18	SS	31.5	33.0	4-6-9	1.5							
19	SS	33.0	34.5	5-5-8	1.3							
20	SS	34.5	36.0	3-6-9	1.5		35					
21	SS	36.0	37.5	3-3-6	1.5							
22	SS	37.5	39.0	3-3-5	1.5							
23	SS	39.0	40.5	3-4-6	1.5		40					
24	SS	40.5	42.0	4-4-6	1.5							
25	SS	42.0	43.5	2-4-4	1.5							
26	SS	43.5	45.0	3-3-3	1.5							
27	SS	45.0	46.5	1-2-2	1.4		45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

BORING NO. **006** DATE **7/23/15** SHEET **3** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **7/1/97** BORING FINISH **7/8/97**

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
28	SS	46.5	48.0	2-3-4	1.5							
29	SS	48.0	49.5	3-3-4	1.5							
30	SS	49.5	51.0	1-2-3	1.5		50					
31	SS	51.0	52.5	3-4-4	1.5							
32	SS	52.5	54.0	1-1-2	1.5							52.5 Wet.
33	SS	54.0	55.5	2-3-4	1.5							53.2 Wet zone.
34	SS	55.5	57.0	2-3-3	1.5		55					
35	SS	57.0	58.5	1-3-3	1.5							
36	SS	58.5	60.0	3-3-4	1.56							
37	SS	60.0	61.5	3-4-4	1.5		60					
38	SS	61.5	63.0	1-2-4	1.5							62.2 Wet at 62.2-63.0
39	SS	63.0	64.5	3-4-5	1.5							
40	SS	64.5	66.0	3-3-3	1.5		65					
41	SS	66.0	67.5	3-3-4	1.5							66 Wet .2" zone.
42	SS	67.5	69.0	3-4-4	1.5							
43	SS	69.0	70.5	3-4-4	1.5		70					
44	SS	70.5	72.0	1-4-4	1.5							

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AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **006** DATE **7/23/15** SHEET **4** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **7/1/97** BORING FINISH **7/8/97**

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
45	SS	72.0	73.5	1-3-4	1.5							
46	SS	73.5	75.0	4-4-5	1.5							73.6 Top of seal.
47	SS	75.0	76.5	4-4-5	1.5		75					
48	SS	76.5	78.0	4-4-5	1.5							77.0 Top of sand.
49	SS	78.0	79.5	2-3-3	1.5							78.5 Wet sand.
50	SS	79.5	81.0	2-5-9	1.5		80					79.5 Water in sand base (80.8-81.0) water added to augers.
51	SS	81.0	82.5	11-11-11	1.5							81.1 Top of screen.
52	SS	82.5	84.0	9-11-11	.9							
53	SS	84.0	85.5	12-12-12	1.5		85					
54	SS	85.5	87.0	8-10-15	1.2							
55	SS	87.0	88.5	7-14-7	1.2							
56	SS	88.5	90.0	7-7-10	1.2		90					
57	SS	90.0	91.5	12-21-17	1.5							Total of 250 gallon of water added to bore hole.
58	SS	91.5	93.0	7-14-14	1.2							91.1 Bottom of screen.
59	SS	93.0	94.5	16-29-50/.2	1.1							93.7 Bottom of sand.
							95					

AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 718,915.8 E 1,736,153.5**

GROUND ELEVATION SYSTEM **State Plane using NAD27**

Water Level, ft	**13.8**		
TIME			
DATE	**7-21-97**		

BORING NO. **008** DATE **7/23/15** SHEET **1** OF **2**

BORING START **7/14/97** BORING FINISH **7/22/97**

PIEZOMETER TYPE WELL TYPE **OW**

HGT. RISER ABOVE GROUND **2.10** DIA **2**

DEPTH TO TOP OF WELL SCREEN **23.8** BOTTOM **33.8**

WELL DEVELOPMENT **YES** BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-WEB** RIG **BK-81**

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	1.9	3.4	4-3-2	.7				CL	**ORGANIC MATERIAL, GRASS, WEEDS, ROOT ZONE IN SILTY CLAY AND CLAYEY SILT**		
									CL	**MODERATE BROWN 5YR 4/4 SILTY CLAY** 90% clay, 10% silt, dry, some organics, roots zone, no contamination.		
2	SS	6.9	8.4	4-2-3	1.5		5			**MODERATE BROWN 5YR 4/4 TO YELLOW ORANGE 10YR 6/6 SILTY CLAY** 90% clay, 10 % silt, grading to no silt and yellow color at base, mica, dry to top moist at bottom , purged water, no visible contamination.		
3	SS	11.9	13.4	4-3-2	1.4		10		CL	**MODERATE BROWN-DARK YELLOW ORANGE 5YR 4/4 TO 10YR 6/6 SILTY CLAY**		
									SM	From above grading into SM at 12.6. **MODERATE BROWN 5YR 3/4 CLAYEY SAND** 70% sand, 30% clay, sand is v-fine grain quartz, moist no contamination.		
4	SS	16.9	18.4	2-2-1	1.2		15			**MODERATE YELLOW BROWN 10YR 5/4 CLAYEY/SILT SAND** 80% sand, 20% clay, moist,sand is v-fine grain, quartz, mica flakes, no visible contamination.		16.0 Top of seal.

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 ROGERS**

AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **008** DATE **7/23/15** SHEET **2** OF **2**

PROJECT **EPRI GROUND WATER STUDY** BORING START **7/14/97** BORING FINISH **7/22/97**

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
5	SS	21.9	23.4	1-1-1	1.5					**MODERATE YELLOW BROWN 10YR 5/4 CLAYEY/SILTY SAND** 80% sand, 20% clay, sand is v-fine grain, quartz with some silty and clay, sand is wet and contains mica, no visible contamination.		21.4 Top of sand.
												23.8 Top of screen.
6	SS	26.9	28.4	1-1-2	1.5		25			**MODERATE YELLOW BROWN 10YR 5/4 SILTY/CLAYEY SAND** 80%sand, 20% clay/silt grading to 90% sand, 10% silt at base, fine sand at bottom of spoon, quartz, mica(minor) no visible contamination.		Wet.
							30					
7	SS	31.9	33.4	3-1-2	1.3					**MODERATE BROWN 5YR 4/4 SILTY SAND** 95% sand, 5% silt, sand is fine grading to medium at 32.3', quartz, f's par, mica flakes, wet, no visible contamination.		31.9 Grain sized analysis.
8	SS	33.4	34.9	2-2-4	1.1					**MODERATE BROWN 5YR 4/4 SILTY SAND** 95%sand, 5% silt, sand is fine to medium grain, quartz, subrounded, wet, no contamination, then fine sand and clay at base.		33.8 Bottom of screen.
												34.9 Bottom of sand.
												39.9 Added water to augers.

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 718,328.2 E 1,736,320.9**

GROUND ELEVATION **575.0** SYSTEM **State Plane using NAD27**

Water Level, ft	**25.6**		
TIME			
DATE	**7-17-97**		

BORING NO. **009** DATE **7/23/15** SHEET **1** OF **3**

BORING START **7/15/97** BORING FINISH **7/15/97**

PIEZOMETER TYPE WELL TYPE **OW**

HGT. RISER ABOVE GROUND **1.57** DIA **2**

DEPTH TO TOP OF WELL SCREEN **42.3** BOTTOM **52.3**

WELL DEVELOPMENT **YES** BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-WEB-JCM** RIG **BK-81**

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
										ASH		
1	SS	1.9	3.4	4-4-4	1.5					**FLY ASH** With coal stringers, some clay,interbedded, dry, compact.		
							5					
2	SS	6.9	8.4	8-7-5	1.5				CL	**MODERATE YELLOW BROWN 10YR 5/4 SILTY SAND** 95% sand, 5% silt, sand medium grain with quartz grading into CL SILTY CLAY DARK GRAY N3, v-fine grain, stiff, 90% , clay, 10% silt moist, no combinations.		
							10					
3	SS	11.9	13.4	2-2-3	1.4					**MODERATE YELLOW 10YR 5/4 BROWN SILTY SAND** 95% sand, 5% silt, sand is medium to fine grades into CL SILTY CLAY DARK GRAY N3, v-fine grain with some silty, 90% clay, 10% silt, moist, moderately stiff, no contamination.		
							15					
4	SS	16.9	18.4	2-2-2	1.5					**MODERATE YELLOW BROWN 10YR 5/4 SILTY CLAY** 90% clay, 10% silt, very stiff, wet, no visible contamination, trace of black organics.		

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 ROGERS**

AEP_EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **009** DATE **7/23/15** SHEET **2** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **7/15/97** BORING FINISH **7/15/97**

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
5	SS	21.9	23.4	2-2-1	1.5					**MODERATE YELLOW BROWN 10YR 5/4 SILTY CLAY** 70% clay, 30% silty/sand, fine to medium grain at bottom, wet, no contamination, clay is little stiff.		22.4 Sandy zone.
6	SS	26.9	28.4	1-2-2	1.5		25			**DARK GRAY N3 SILTY CLAY** 90% clay, 10% silt, very stiff, moist.		
7	SS	31.9	33.4	1-2-1	1.5		30			**DARK GRAY N3 SILTY CLAY** 70% clay 30% silt, fine sand, wet throughout, sand v-fine grain with interbedded in section, no visible contamination.		
8	SS	36.9	38.4	1-1-1	1.5		35			**DARK GRAY N3 SILTY CLAY** 90% clay, 10% silt, moist, clay is v-stiff, trace of black organic material.		34.8 Top of seal. 38.5 Top of sand.
9	SS	42.9	44.4	8-17-27	1.5		40		GM	**MEDIUM DARK GRAY N4 SILTY GRAVEL** 60% gravel, 40% sand/silty, gravel subrounded, quartz, quartzite wet, no contamination.		41.9-43.9 Shelby tube 800 PSi, 20 sec., 42.3 Top of screen.
							45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

BORING NO. **009** DATE **7/23/15** SHEET **3** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **7/15/97** BORING FINISH **7/15/97**

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
10	SS	46.9	48.4	15-15-10	1.5		50			**MEDIUM DARK GRAY N4** 60% gravel, 40% sand/silt, gravel is quartz, subrounded, sand is fine to coarse, wet, quartzite, wet, no contamiantion.		46.9-48.4 Grain size analysis.
11	SS	51.9	53.4	10-15-20	1.5					**MEDIUM DARK GRAY N4 SILTY SANDY GRAVEL** 60% gravel, 40% sand/silt, gravel is subrounded, quartzite, quartzite, other rock, sand medium to coarse, with silt, quartz subrounded, wet, no contamination.		52.3 Bottom of screen.
												54.5 Bottom of sand.

AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 717,666.4 E 1,736,450.7**

GROUND ELEVATION SYSTEM **State Plane using NAD27**

Water Level, ft	**32.0**		
TIME			
DATE	**7-24-97**		

BORING NO. **011** DATE **7/23/15** SHEET **1** OF **3**

BORING START **7/22/97** BORING FINISH **7/23/97**

PIEZOMETER TYPE WELL TYPE **OW**

HGT. RISER ABOVE GROUND **2.39** DIA **2**

DEPTH TO TOP OF WELL SCREEN **36.3** BOTTOM **46.3**

WELL DEVELOPMENT **YES** BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-WEB** RIG **BK-81**

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	1.5	3.0	6-8-8	.8				ML	**GRASS, OM,ML, SILT, GRAYISH ORANGE, 10YR 7/4** Dry.		
										MEDIUM DARK GRAY N4 ASH V-fine grain, dry, no contamination, ash is very dusty, coarse, bottom ash 1.8-2.4		
2	SS	6.5	8.0	7-7-10	1.3		5			**MEDIUM DARK GRAY N4 ASH** V-fine-fine sandy texture, dry at top moist at base.		
3	SS	11.5	13.0	5-3-5	1.4		10			**DARK GRAY N4 ASH/BOTTOM ASH** V-fine sand texture, dry throughout with thin coal layers, no contamination.		
4	SS	16.5	18.0	4-5-10	1.5		15			**SAME AS ABOVE 16.5-17.0**		
									CL	**MODERATE YELLOW BROWN 10YR 5/4 SILTY CLAY** Clay is moderately stiff with silt and fine sand, interbedded, moist, no contaminate.		

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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 ROGER**

AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **011** DATE **7/23/15** SHEET **2** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **7/22/97** BORING FINISH **7/23/97**

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
5	SS	21.5	23.0	5-5-5	1.5					**BROWNISH GRAY 5YR 4/1 BOTTOM ASH** Fine sand texture, moist, includes coal, no contamination.		
6	SS	26.5	28.0	3-2-5	1.5		25			**MEDIUM DARK GRAY N4 BOTTOM ASH** V-fine to fine sand texture, some cinders, wet, no visible contamination.		28.2 Top of seal.
7	SS	31.5	33.0	3-2-2	1.5		30		GM	**MODERATE YELLOW BROWN 10YR 5/4 SILTY SAND** 90% sand, 10% silty, and clay, wet, sand fine grain, quartz, no contamination.		34.0 Top of sand.
8	SS	36.5	38.0	4-2-2	1.2		35			**SAME AS ABOVE**		36.3 Top of screen.
9	SS	41.5	43.0	4-2-2	1.3		40			**MODERATE YELLOW BROWN 10YR 5/4 CLAYEY SAND** 70% sand, 30% clay, sand fine to medium grain, quartz, subrounded, wet, no visible contamination.		41.5-43.0 Grain size analysis.
							45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **011** DATE **7/23/15** SHEET **3** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **7/22/97** BORING FINISH **7/23/97**

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
10	SS	46.5	48.0	8-11-12	1.5					**CL DARK YELLOW ORANGE 10YR 6/6 SILTY CLAY** 90% clay, 10% silt, wet. **MODERATE BROWN 5YR 4/4 SILTY SAND** 80% sand, 20% silt/clay, sand medium to coarse grain with some gravel, subrounded, wet.		46.3 Bottom of screen.
							50					50.0 Bottom of sand.
11	SS	51.5	53.0	12-14-14	1.5				GM	**YELLOW BROWN 10YR 5/4 SILTY SAND** 90% sand, 10% silt, sand medium grain, quartz, wet grading into GM. **MODERATE YELLOW BROWN SANDY GRAVEL** 70% gravel, 30% sand/silt, gravel subrounded, granite, quartzite, sand medium to fine grain, wet, no contamination.		
							55					
12	SS	56.5	58.0	9-7-6	1.2					**MODERATE YELLOW BROWN 10YR 5/4 SANDY/SILTY GRAVEL** 80% gravel, 20% sand /silt, minor clay, gravel is subrounded, quartz, granite, quartzite, sand medium to fine quartz, wet, no contamination.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 718,753.1 E 1,737,045.5**

GROUND ELEVATION **580.0** SYSTEM **State Plane using NAD27**

Water Level, ft	▽ 38.8	▼	▼
TIME			
DATE	7-30-97		

BORING NO. **012** DATE **7/23/15** SHEET **1** OF **4**

BORING START **7/23/97** BORING FINISH **7/29/97**

PIEZOMETER TYPE WELL TYPE **OW**

HGT. RISER ABOVE GROUND **2.02** DIA **2**

DEPTH TO TOP OF WELL SCREEN **62.3** BOTTOM **72.3**

WELL DEVELOPMENT **YES** BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-WEB** RIG **BK-81**

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	3.0	4.5	3-2-2	1.5		5			**MEDIUM DARK GRAY TO GRAY N3-N4** **BOTTOM ASH** Ash dust, some interbedde, dry, top of spoon. **MODERATE YELLOW BROWN**		
2	SS	8.0	9.5	3-3-4	1.5		10					
3	SS	13.0	14.5	1-2-2	1.5		15					
4	SS	18.0	19.5	2-3-3	1.5							

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"

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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 ROGERS**

AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **012** DATE **7/23/15** SHEET **2** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **7/23/97** BORING FINISH **7/29/97**

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
5	SS	23.0	24.5	2-3-3	1.5		25					
6	SS	28.0	29.5	3-3-4	1.5		30					
7	SS	33.0	34.5	2-2-3	1.5		35					
8	SS	38.0	39.5	2-2-2	1.5		40					Spoon wet.
9	SS	43.0	44.5	2-2-2	1.5		45					45.5 Water on rods.

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

BORING NO. **012** DATE **7/23/15** SHEET **3** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **7/23/97** BORING FINISH **7/29/97**

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
10	SS	48.0	49.5	2-3-3	1.5							
11	SS	53.0	54.5	22-24-29	1.3		50					
12	SS	58.0	59.5	17-15-19	1.1		55					57.4 Top of seal.
13	SS	63.0	64.5	10-16-22	1.1		60					61.4 Top of sand. 62.3 Top of screen.
14	SS	68.0	69.5	3-3-5	1.5		65					68.0-69.5 Grain size analysis.
							70					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **012** DATE **7/23/15** SHEET **4** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **7/23/97** BORING FINISH **7/29/97**

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	73.0	74.5	50/.3	.3		75					72.3 Bottom of screen. 73.9 Bottom of sand.

AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 719,504.2 E 1,736,239.5**

GROUND ELEVATION **599.9** SYSTEM **State Plane using NAD27**

Water Level, ft	▽ **22.6**	▼	▼
TIME			
DATE	**12/10/01**		

BORING NO. **MW-015** DATE **7/23/15** SHEET **1** OF **4**

BORING START **12/6/01** BORING FINISH **12/11/01**

PIEZOMETER TYPE **SS** WELL TYPE **OW**

HGT. RISER ABOVE GROUND **1.73** DIA **2**

DEPTH TO TOP OF WELL SCREEN **78.2** BOTTOM **87.2**

WELL DEVELOPMENT BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-REB** RIG **BK-81**

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	1.9	3.4	6-7-8	1.5					**BOTTOM ASH** Dry		Grounding procedures not in use on this boring. This boring used to collect soil samples to determine where to set well. Potable water for drilling from old C E Lab site. Flushed lines for approx. 1 hr before using.
2	SS	6.9	8.4	2-3-3	1.5		5			**LOOSE 5B 7/1 LIGHT BLUISH GRAY FLY ASH** Dry; 0.2' moist area @ 18.0'		
3	SS	11.9	13.4	2-2-2	1.5		10					
4	SS	16.9	18.4	2-2-2	1.5		15					

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"
	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 **MCR**

AEP_EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

BORING NO. **MW-015** DATE **7/23/15** SHEET **2** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **12/6/01** BORING FINISH **12/11/01**

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
5	SS	21.9	23.4	2-3-3	1.5		25			**LOOSE 5B 7/1 LIGHT BLUISH GRAY FLY ASH** Moist throughout, some areas larger grain size than others	▽	SWL @ 22.6' on 12/10/01. This is about 80 hrs since bore hole was disturbed; HSA's to 51.9'. Water coming from saturated fly ash from 6.0' to 43.4'
6	SS	26.9	28.4	1-1-2	1.5					**LOOSE 5B 7/1 LIGHT BLUISH GRAY FLY ASH** Wet		
7	SS	31.9	33.4	2-2-3	1.5		30			**LOOSE 5B 7/1 LIGHT BLUISH GRAY FLY ASH** Moist in some areas, wet in others		
8	SS	36.9	38.4	1-1-1	1.5		35			**LOOSE 5B 7/1 LIGHT BLUISH GRAY FLY ASH** Wet		
9	SS	41.9	43.4	0-0-0	1.5		40			**VERY LOOSE 5B 5/1 MEDIUM BLUISH GRAY FLY ASH** Saturated, very fine		Weight of hammer pushed spoon.
							45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **MW-015** DATE **7/23/15** SHEET **3** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **12/6/01** BORING FINISH **12/11/01**

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
10	SS	46.9	48.4	3-4-6	1.5		50			**STIFF 10YR 5/4 MODERATE YELLOWISH BROWN CLAYEY SILT** 1.5 tsf, moist		
11	SS	51.9	53.4	3-4-5	1.4		55					Started adding drill mud to inside of HSA's to prevent heaving sand @ 51.9'
12	SS	56.9	58.4	2-3-3	1.5		60			**MEDIUM STIFF 10YR 5/4 MODERATE YELLOWISH BROWN CLAYEY SILT** 1.0 tsf, moist		
13	SS	61.9	63.4	2-2-2	1.5		65			**MEDIUM STIFF N5 MEDIUM GRAY CLAYEY SILT** 1.0 tsf, moist		
14	SS	66.9	68.4	2-2-2	1.5		70					

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

BORING NO. **MW-015** DATE **7/23/15** SHEET **4** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **12/6/01** BORING FINISH **12/11/01**

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	71.9	73.4	2-3-3	1.5		75			**LOOSE BROWN & GRAY FINE GRAIN SAND** Wet		
16	SS	76.9	78.3	19-39-50/.4	1.3		80			**VERY DENSE 10YR 5/4 MODERATE YELLOWISH BROWN MEDIUM to COARSE GRAIN SAND** With little gravel		Gravely area @ 77.0'-88.4' (set well)
17	SS	81.9	83.4	30-37-21	1.5		85			**VERY DENSE 10YR 6/6 DARK YELLOWISH ORANGE MEDIUM to COARSE GRAIN SAND** With little gravel		
18	SS	86.9	88.4	11-12-12	1.5		90			**MEDIUM DENSE N5 MEDIUM GRAY MEDIUM to COARSE GRAIN SAND** With trace gravel, wet		
19	SS	91.9	93.4	15-16-17	1.5					**DENSE N5 MEDIUM GRAY MEDIUM to COARSE GRAIN SAND** Wet		
20	SS	94.3	94.5	50/.2	0.2					**N7 LIGHT GRAY SANDSTONE**		Stopped boring at auger and spoon refusal @ 94.5' on 12/11/01. Tremie grouted from 94.5' to grade using approx. 150 gallons of quick grout.

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 721,431.5 E 1,732,814.2**

GROUND ELEVATION **586.8** SYSTEM **State Plane using NAD27**

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **MW-16** DATE **7/23/15** SHEET **1** OF **4**

BORING START **6/17/08** BORING FINISH **6/18/08**

PIEZOMETER TYPE **N/A** WELL TYPE **OW**

HGT. RISER ABOVE GROUND **1.787** DIA **2**

DEPTH TO TOP OF WELL SCREEN **67.5** BOTTOM **77.5**

WELL DEVELOPMENT **Yes/Reclaimer** BACKFILL **Quick Grout**

FIELD PARTY **MCR / ZLR** RIG **D-120**

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
												GROUNDING PROCEDURES IN USE ON THIS BORING; DIGGING PERMIT IN HAND; NO SPT TAKEN @ 1.7' BECAUSE OF POSSIBLE UNDERGROUNDS - CUTTINGS SHOW MOIST SILTY CLAY
1	SPT	6.7	8.2	3-3-6	1.5		5			**STIFF 10YR 6/6 DARK YELLOWISH ORANGE SILTY CLAY** tsf 2.75, moist		
2	SPT	11.7	13.2	1-1-3	1.5		10			**SOFT 5YR 5/6 LIGHT BROWN CLAYEY SILT** tsf 0.5, very moist		
3	SPT	16.7	18.2	10-13-15	1.2		15			**5YR 5/6 LIGHT BROWN FINE to MEDIUM SAND** w/trace of fine gravel, moist		

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

AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

BORING NO. **MW-16** DATE **7/23/15** SHEET **2** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/17/08** BORING FINISH **6/18/08**

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
4	SPT	21.7	23.2	8-10-13	1.1		25					
5	SPT	26.7	28.2	5-8-13	1.2					**MEDIUM DENSE 10YR 5/4 MODERATE YELLOWISH BROWN COARSE SAND** w/trace of fine gravel, moist		
6	SPT	31.7	33.2	6-8-12	.8		30			**MEDIUM DENSE 5YR 6/4 LIGHT BROWN COARSE SAND** w/some coarse gravel, moist		
7	SPT	36.7	38.2	1-3-6	1.2		35			**LOOSE 10YR 4/2 DARK YELLOWISH BROWN SAND** medium moist to wet		SWL = 36.4' 06/18/08 w/ HSA'S @ 36.7' 14 hr READING WATER ON SPOON @ 37.5'; STARTED INDUCING WEAK DRILLING MUD TO INSIDE OF AUGERS TO PREVENT HEAVING SANDS
8	SPT	41.7	43.2	3-4-5	1.2		40			**LOOSE 5 YR 4/4 MODERATE BROWN MEDIUM SAND** w/trace of coarse gravel, wet		
							45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **MW-16** DATE **7/23/15** SHEET **3** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/17/08** BORING FINISH **6/18/08**

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
9	SPT	46.7	48.2	3-3-3	1.5		50			**LOOSE 5YR 4/4 MODERATE BROWN MEDIUM GRAIN SAND** w/trace of fine gravel, wet		
10	SPT	51.7	53.2	2-3-5	1.4		55			**LOOSE 5YR 4/4 MODERATE BROWN MEDIUM GRAIN SAND** w/trace of fine gravel, wet		
11	SPT	56.7	58.2	6-10-15	1.5		60			**MEDIUM DENSE 5YR 3/4 MODERATE BROWN COARSE GRAIN SAND** wet		
12	SPT	61.7	63.2	4-7-12	1.5		65			**MEDIUM DENSE 10YR 5/4 MODERATE YELLOWISH BROWN MEDIUM GRAIN SAND** wet		
13	SPT	66.7	68.2	6-12-15	1.5		70			**MEDIUM DENSE 5YR 5/2 PALE BROWN MEDIUM to COARSE GRAIN SAND** wet		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **MW-16** DATE **7/23/15** SHEET **4** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/17/08** BORING FINISH **6/18/08**

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
14	SPT	71.7	73.2	10-15-17	1.0					**MEDIUM DENSE 10YR 6/2 PALE YELLOWISH BROWN FINE SAND and FINE GRAVEL** wet		
							75					
15	SPT	76.7	78.2	15-18-25	1.3					**DENSE N5 MEDIUM GRAY COARSE SAND** w/some coarse gravel, wet		
							80					
16	SPT	81.7	82.0	50/3	.2					**N6 MEDIUM LIGHT GRAY WEATHERED COARSE GRAIN SANDSTONE**		STOPPED BORING @ 82.0'; INSTALLED 2" MONITORING WELL

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 717,700.5 E 1,735,921.2**

GROUND ELEVATION **592.7** SYSTEM **STATE PLANE**

Water Level, ft	▽ **27.9**	▼	▼
TIME			
DATE	**6-20-96**		

BORING NO. **96-01** DATE **7/23/15** SHEET **1** OF **3**

BORING START **6/14/96** BORING FINISH **6/20/96**

PIEZOMETER TYPE _____ WELL TYPE _____

HGT. RISER ABOVE GROUND _____ DIA _____

DEPTH TO TOP OF WELL SCREEN _____ BOTTOM _____

WELL DEVELOPMENT _____ BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-WEB** RIG **BK-81**

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
		0.0	1.5							**ROAD BASE**		
2	SS	3.0	4.5	11-10-7	1.5				SW	**BLACK BOTTOM ASH** Moist.		
3	SS	5.0	6.5	8-9-11	1.3		5			**YELLOWISH ORANGE GRAVELLY SAND** Dry to moist, 3/4" max size.		
4	SS	8.5	10.0	10-25-30	1.2		10			**BLACK BOTTOM ASH** Moist.		
5	SS	11.7	13.2	11-12-16	1.5					**DARK BROWN SANDY SILT** Moist, v-fine grain sand.		
6	SS	16.7	18.2	7-7-11	1.5		15			**BLACK BOTTOM ASH** Dry.		

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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"
	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 **WEB**

AEP_EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-01** DATE **7/23/15** SHEET **2** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/14/96** BORING FINISH **6/20/96**

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
7	SS	21.7	23.2	7-3-2	1.5		25			**Moist this area**		
8	SS	26.7	28.2	1-1-1	1.5					**Saturated this area**	▽	
9	SS	31.7	33.2	1-2-2	1.5		30		CL	**GREENISH BROWN SANDY CLAY** Saturated, low plasticity.		
10	SS	36.7	38.2	3-2-2	1.2		35		CL	**MULTI-COLORED BROWN SANDY CLAY** Wet to saturated, low plasticity, v-fine sand.		
11	ST	41.7	43.7		0		40					Belive material to soft to pickup in tube.
12	ST	43.7	45.7		0		45					

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AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-01** DATE **7/23/15** SHEET **3** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/14/96** BORING FINISH **6/20/96**

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
							50					
13	SS	51.7	53.2	1-1-2	1.0				CL	**DARK GRAY SANDY CLAY** Saturated, v-fine sand.		Stopped boring at 53.2' grouted from 53.2 to grade with approximately 60 gallons of quick grout.

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 718,158.5 E 1,736,270.7**

GROUND ELEVATION **594.6** SYSTEM **STATE PLANE**

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **96-02** DATE **7/23/15** SHEET **1** OF **3**

BORING START **6/13/96** BORING FINISH **6/13/96**

PIEZOMETER TYPE _____ WELL TYPE _____

HGT. RISER ABOVE GROUND _____ DIA _____

DEPTH TO TOP OF WELL SCREEN _____ BOTTOM _____

WELL DEVELOPMENT _____ BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-WEB** RIG **BK-81**

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	10-12-13	1.2					**GRAY BOTTOM ASH** Dry, with 2 to 3" of sandy clay.		
2	SS	3.0	4.5	10-13-13	1.5					**GRAY BOTTOM ASH** Dry.		
3	SS	5.0	6.5	9-8-7	1.3		5		CL	**LIGHT BROWN CLAY** Dry, medium to high plasticity.		
4	SS	8.5	10.0	16-16-12	1.1		10		GP	**DARK BROWN SAND AND GRAVEL** Dry, 3/4" max size, rounded with some fines.		
5	SS	11.9	13.4	8-10-8	1.4							
6	SS	16.9	18.4	6-11-9	1.3		15			**DARK BROWN SAND AND GRAVEL** Moist, quartz, 1/2" max size, rounded with some fines.		

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"
	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 **WEB**

AEP_EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-02** DATE **7/23/15** SHEET **2** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/13/96** BORING FINISH **6/13/96**

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
7	SS	21.9	23.4	7-7-7	1.3		25			**DARK BROWN SAND AND GRAVEL** Saturated, rounded, 1" max size, quartz with some fines.		
8	SS	26.9	28.4	1-1-2	1.5					**DARK GRAY FLY ASH** Saturated.		
9	SS	31.9	33.4	1-1-1	1.5		30					
10	SS	36.9	38.4	1-1-1	1.5		35					
11	SS	41.9	43.4	4-4-6	1.3		40		CL	**DARK GRAY CLAY** Wet, medium to high plasticity, trace of organic material.		
12	ST	43.9	45.9		1.0		45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-02** DATE **7/23/15** SHEET **3** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/13/96** BORING FINISH **6/13/96**

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
13	ST	46.9	48.9		2.0		50					
14	SS	51.9	53.4	3-3-4	1.5		55					
15	SS	56.9	58.4	1-3-4	1.5							Grouted hole from 58.4' to grade with approximately 75 gallons of quick grout.

AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 718,215.9 E 1,736,382.8**

GROUND ELEVATION **566.9** SYSTEM **STATE PLANE**

Water Level, ft	▽ **22.2**	▼	▼
TIME			
DATE	**6-18-96**		

BORING NO. **96-03** DATE **7/23/15** SHEET **1** OF **3**

BORING START **6/17/96** BORING FINISH **6/18/96**

PIEZOMETER TYPE WELL TYPE

HGT. RISER ABOVE GROUND DIA

DEPTH TO TOP OF WELL SCREEN BOTTOM

WELL DEVELOPMENT BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-WEB** RIG **BK-81**

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	1-2-4	1.3					**GRAY FLY ASH** Moist.		Boring was grouted from grade to 60' w\ 60 gallons of quick grout
2	SS	3.0	4.5	6-5-4	1.5					**GRAY BOTTOM ASH** Moist.		
3	SS	5.0	6.5	3-2-2	1.5		5					
4	SS	8.5	10.0	4-6-6	1.5					**BLACK COAL**		
							10		SC	**LIGHT BROWN SANDY CLAY** Dry to moist, v-fine grain sand.		
5	SS	11.7	13.2	4-3-3	1.5							
									CL	**DARK GRAY CLAY** Wet, medium to hight plasticity, trace of grganic material.		
							15					
6	SS	16.7	18.2	7-1-1	1.5							

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"
	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 **WEB**

AEP_EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-03** DATE **7/23/15** SHEET **2** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/17/96** BORING FINISH **6/18/96**

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
7	ST	21.7	23.7		2.0		25				▽	
8	SS	26.7	28.2	1-1-1	1.5		30					
9	ST	31.7	33.7		2.0		35					
10	SS	36.7	38.2	1-2-2	1.5		40		SP	**DARK GRAY AND BROWN SILTY SAND** Wet to saturated, quartz, fine grain.		
11	SS	41.7	43.2	7-14-19	.6		45		GW	**GRAY SAND AND GRAVEL** Saturated, quartz, 1/2" max size, rounded.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-03** DATE **7/23/15** SHEET **3** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/17/96** BORING FINISH **6/18/96**

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
12	SS	46.7	47.6	37-50/.4	.9					**Brown**		
							50					
13	SS	51.7	53.2	18-19-20	1.5					**Same with 3/4" max size.**		
							55					
14	SS	56.7	57.0	50/.3	.3					**Brown**		
15	SS	59.8	60.0	50/.2	.2		60			**LIGHT GRAY SANDSTONE** Fine grain.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 717,954.5 E 1,735,752.5**

GROUND ELEVATION **593.5** SYSTEM **STATE PLANE**

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **96-04** DATE **7/23/15** SHEET **1** OF **4**

BORING START **6/18/96** BORING FINISH **6/19/96**

PIEZOMETER TYPE _____ WELL TYPE _____

HGT. RISER ABOVE GROUND _____ DIA _____

DEPTH TO TOP OF WELL SCREEN _____ BOTTOM _____

WELL DEVELOPMENT _____ BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-WEB** RIG **BK-81**

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
		0.0								**ROAD BASE**		Grouted boring from 88' to grade w\ 80 gallons of quick grout and placed concrete plug in road bed.
2	SS	3.0	4.5	11-12-13	1.3				SC	**DARK BROWN CLAYEY SAND** Moist, trace of small gravel.		
3	SS	5.0	6.5	11-19-16	1.5		5		SP	**DARK BROWN GRAVELLY SAND** Moist, 1/2" max size, rounded with fines.		
4	SS	8.5	10.0	9-12-10	1.5							
5	SS	11.6	13.1	16-22-17	1.5		10			**BLACK BOTTOM ASH** Moist with 1" layer of silty clay with slight plasticity.		
6	SS	16.6	18.1	9-9-7	.4		15			**DARK BROWN, BLACK CLAYEY SAND** Moist, some organic, may be older road base.		

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"
	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 **WEB**

AEP_EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-04** DATE **7/23/15** SHEET **2** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/18/96** BORING FINISH **6/19/96**

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
7	SS	21.6	23.1	5-5-6	1.5					**BLACK BOTTOM ASH** Saturated.		
										BLACK FLY ASH Saturated.		
8	SS	26.6	28.1	1-2-2	1.2		25					
9	SS	31.6	33.1	1-1-1	1.5		30					
10	SS	36.6	38.1	.2-3-3	1.5		35		CL	**ORANGE AND LIGHT BROWN MOTTLED SILTY CLAY** Wet to saturated, medium to low plasticity.		
11	SS	41.6	43.1	3-3-3	1.5		40			**Same as sample with trace of organic material.**		
							45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-04** DATE **7/23/15** SHEET **3** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/18/96** BORING FINISH **6/19/96**

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
12	ST	46.6	48.6		2.0		50					
13	SS	51.6	53.1	1-1-1	1.5				SC	**GRAY AND BROWN CLAYEY SAND** Wet to saturated, v-fine grain sand, slight to non plasticity.		
14	SS	59.3	60.8	3-3-3	.8		55					
15	SS	64.3	65.8	15-16-2	1.5		60		SP	**DARK BROWN SAND** Saturated, fine grain, with some fines, quartz.		
16	SS	69.3	70.8	8-9-11	1.5		65			**DARK BROWN SAND** Saturated, v-fine grain with some fines, quartz.		
							70		SW	**DARK BROWN SAND** Saturated, quartz.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-04** DATE **7/23/15** SHEET **4** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/18/96** BORING FINISH **6/19/96**

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
17	SS	74.3	75.8	14-14-19	1.5		75					
18	SS	79.3	80.8	8-10-8	1.5		80		SP	**DARK BROWN AND GRAY SAND** Saturated, quartz, fine grain.		
19	SS	84.3	85.1	8-50/.3	.8		85		GW	**BROWN SAND AND GRAVEL** Saturated, quartz, 1/2" max size, rounded.		
20	SS	87.7	87.9	50/.2	.2					**GRAY CLAY SHALE** Dry.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 718,463.6 E 1,736,113.5**

GROUND ELEVATION **597.4** SYSTEM **STATE PLANE**

Water Level, ft	▽ **48.8**	▼	▼
TIME			
DATE	**6-12-96**		

BORING NO. **96-05** DATE **7/23/15** SHEET **1** OF **3**

BORING START **6/12/96** BORING FINISH **6/12/96**

PIEZOMETER TYPE WELL TYPE

HGT. RISER ABOVE GROUND DIA

DEPTH TO TOP OF WELL SCREEN BOTTOM

WELL DEVELOPMENT BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-WEB** RIG **BK-81**

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	14-22-35	1.0					**GRAY BOTTOM ASH**		Boring grouted from grade to 58.2.
2	SS	3.0	4.5	11-12-15	1.2				SP	**DARK BROWN GRAVELLY SAND** Moist, 1/2" max size, some fines.		
										BROWN CLAYEY SILT Moist, slight to non plasticity.		
3	SS	5.0	6.5	10-10-15	1.3		5		SM	**LIGHT BROWN SILTY SAND** Dry, v-fine grain.		
5	SS	8.5	10.0	8-13-15	1.5				SC	**LIGHT AND DARK BROWN CLAYEY SAND** Moist, trace of small gravel.		
6	SS	11.7	13.2	11-11-13	1.2		10		GP	**DARK BROWN CLAYEY SAND AND GRAVEL** Moist, quartz, 3/4" max size, rounded.		
7	SS	16.7	18.2	3-2-4	1.5		15		SM	**LIGHT BROWN SILTY SAND** Moist, v-fine grain sand.		
									CL	**DARK GRAY SILTY CLAY** Wet , medium to low plasticity,trace of organic material.		

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"
	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 **WEB**

AEP_EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-05** DATE **7/23/15** SHEET **2** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/12/96** BORING FINISH **6/12/96**

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
8	SS	21.7	23.2	3-4-6	1.5				CL	**LIGHT BROWN CLAYEY SILTY** Moist to wet, slight plasticity.		
9	SS	26.7	28.2	2-2-1	1.1		25			**GRAY BOTTOM ASH** Saturated.		
10	SS	31.7	33.2	1-2-2	1.3		30		CL	**DARK GRAY CLAY** Wet to saturated, medium to low plasticity, trace of organic.		
11	SS	36.7	38.2	1-1-1	1.5		35			**GRAY FLY ASH** Saturated.		
12	SS	41.7	43.2	1-1-1	1.5		40		CL	**DARK GRAY SILTY CLAY** Moist, low to medium plasticity, trace of organic material.		
							45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-05** DATE **7/23/15** SHEET **3** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/12/96** BORING FINISH **6/12/96**

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
13	SS	46.7	48.2	1-1-2	1.5					**BROWN CLAY** Wet to saturated, medium to low plasticity.	▽	
14	ST	51.7	53.7		2.0		50					
15	SS	56.7	58.2	2-2-3	1.5		55			**DARK GRAY SILTY CLAY** Wet to saturated, low to medium plasticity, trace of v-fine grain sand lens.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 718,519.1 E 1,736,243.1**

GROUND ELEVATION **566.1** SYSTEM **STATE PLANE**

Water Level, ft	▽ **23.6**	▼	▼
TIME			
DATE	**6-18-96**		

BORING NO. **96-06** DATE **7/23/15** SHEET **1** OF **2**

BORING START **6/18/96** BORING FINISH **6/18/96**

PIEZOMETER TYPE WELL TYPE

HGT. RISER ABOVE GROUND DIA

DEPTH TO TOP OF WELL SCREEN BOTTOM

WELL DEVELOPMENT BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-WEB** RIG **BK-81**

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	1-1-4	1.5					**GRAY FLY ASH** Moist.		
2	SS	3.0	4.5	5-6-4	1.5		5					
3	SS	5.0	6.5	3-3-2	1.5					**GRAY BOTTOM ASH** Saturated.		
4	SS	8.5	10.0	5-5-6	1.5		10		CL	**BROWN SILTY CLAY** Moist, low to medium plasticity (DIKE MATERIAL).		
5	SS	11.5	13.0	3-4-2	1.5					**DARK BROWN SILTY CLAY** Saturated, medium to low plasticity, (DIKE MATERIAL).		
6	SS	16.5	18.0	4-4-3	1.5		15		SM	**GRAY SILTY SAND** Saturated, v-fine grain, quartz.		

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"
	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 **WEB**

AEP_EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-06** DATE **7/23/15** SHEET **2** OF **2**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/18/96** BORING FINISH **6/18/96**

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
7	SS	21.5	23.0	1-1-2	1.3		25				▽	
8	SS	26.5	28.0	1-1-1	1.5				CL	**DARK GRAY CLAY** Saturated, medium to low plasticity with v-fine grain sand lens.		
9	SS	31.5	33.0	2-3-3	1.5		30					

AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 720,983.0 E 1,734,516.1**

GROUND ELEVATION **619.0** SYSTEM **STATE PLANE**

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **96-101** DATE **7/23/15** SHEET **1** OF **3**

BORING START **6/5/96** BORING FINISH **6/5/96**

PIEZOMETER TYPE **SS** WELL TYPE

HGT. RISER ABOVE GROUND DIA

DEPTH TO TOP OF WELL SCREEN **24.4** BOTTOM **33.4**

WELL DEVELOPMENT **NO** BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-REB** RIG **BK-81**

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		0.0			0					**No sample taken boring in road way**		
2	SS	3.0	4.5	12-13-16	1.1				SM	**BROWN SILTY GRAVELLY SAND** Dry to moist, 1/2" max size, rounded, quartz.		
3	SS	5.0	6.5	7-9-9	1.2		5					
3	SS	8.5	10.0	3-4-5	1.2				SC	**BROWN CLAYEY SAND** Moist, fine grain with trace of gravel.		
4	SS	11.5	13.0	17-27-38	1.2		10		SM	**BROWN SILTY GRAVELLY SAND** Moist, fine grain, trace of gravel, quartz.		
5	SS	16.5	18.0	12-19-26	1.1		15					

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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"
	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 **REB**

AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-101** DATE **7/23/15** SHEET **2** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/5/96** BORING FINISH **6/5/96**

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
												20.0 Top of seal.
6	SS	21.5	23.0	16-21-27	1.1				SW	**BROWN GRAVELLY SAND** Moist, trace of small gravel, quartz, rounded.		22.0 Top of sand.
7	SS	26.5	28.0	12-20-23	1.2		25		GP	**BROWN SAND AND GRAVEL** Moist to wet, quartz, rounded, 3/4" max size, some fines.		24.4 Top of screen.
8	SS	31.5	33.0	4-5-7	1.1		30		SM	**BROWN SILTY SAND** Moist, 100% fine grain.		
9	ST	33.5	35.5		1.6					**Push 2.0** **Time 5 sec.** **PSI 800**		34.0 Bottom of pipe.
							35		CL	**Top of sample, BROWN SILTY SAND** **Bottom of sample, LIGHT GRAY CLAY** Moist, low to medium plasticity.		34.4 Bottom of screen. 35.0 Bottom of sand.
10	SS	36.5	38.0	4-6-8	1.1							
11	SS	41.5	43.0	4-5-6	1.1		40		SM	**DARK GRAY SILTY SAND** Wet, non to slight plasticity, with reddish brown quartz sand lens.		
12	ST	43.5	45.5		1.5				ML	**PUSH 2.0** **TIME 5 SEC** **PSI 800** **Bottom of sample, Drillers identification fly ash I believe it is a light gray clay**		
							45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-101** DATE **7/23/15** SHEET **3** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/5/96** BORING FINISH **6/5/96**

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
										??????????????????????????????????????		
13	SS	46.5	48.0	7-9-11	1.1				SP	**Top of sample, BROWN SILTY** **BROWN GRAVELLY SAND** Moist, 1/2" max size, rounded, quartz.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 720,707.5 E 1,734,001.7**

GROUND ELEVATION **619.6** SYSTEM **STATE PLANE**

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **96-102** DATE **7/23/15** SHEET **1** OF **3**

BORING START **6/5/96** BORING FINISH **6/5/96**

PIEZOMETER TYPE _____ WELL TYPE _____

HGT. RISER ABOVE GROUND _____ DIA _____

DEPTH TO TOP OF WELL SCREEN _____ BOTTOM _____

WELL DEVELOPMENT _____ BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-REB** RIG **BK-81**

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		0.0			0					**NO SAMPLE TAKEN BORING IN ROAD AUGER CUTTINGS INDICATE BROWN SAND AND GRAVEL**		Boring was grouted from grade to 48.2' with quick grout.
2	SS	3.0	4.5	12-16-19	1.1				SP	**BROWN GRAVELLY SAND** Moist, 1/2" max size, rounder, quartz with fines.		
3	SS	5.0	6.5	17-21-26	1.2		5					
4	SS	8.5	10.0	13-16-19	1.2							
5	SS	11.7	13.2	15-28-32	1.2		10					
6	SS	16.7	18.2	17-21-26	1.2		15					

TYPE OF CASING USED

X	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 **REB**

AEP_EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-102** DATE **7/23/15** SHEET **2** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/5/96** BORING FINISH **6/5/96**

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
7	SS	21.7	23.2	19-21-24	1.1		25			**Sample moist to wet.**		
8	SS	26.7	28.2	9-9-11	1.1				SM	**DARK BROWN SANDY SILT** Moist, non-plastic.		
9	SS	31.7	33.2	3-4-5	1.1		30		SC	**BROWN SANDY CLAY** Moist, low plasticity, with v-fine sand lens.		
10	ST	33.7	35.7		?					**Time 5 sec.** **Push 2.0** **PSI 1000**		
11	SS	36.7	38.2	4-4-5	1.1		35		SM	**BROWN SILTY SAND** Moist, with very fine sand lens.		
12	SS	41.7	43.2	3-5-8	1.1		40		SP	**BROWN GRAVELLY SAND** Moist, 3/4" max size, rounded, quartz.		
							45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-102** DATE **7/23/15** SHEET **3** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/5/96** BORING FINISH **6/5/96**

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
13	SS	46.7	48.2	13-15-21	1.2							

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 719,785.3 E 1,734,133.3**

GROUND ELEVATION **618.0** SYSTEM **STATE PLANE**

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **96-103** DATE **7/23/15** SHEET **1** OF **3**

BORING START **6/4/96** BORING FINISH **6/4/96**

PIEZOMETER TYPE WELL TYPE

HGT. RISER ABOVE GROUND DIA

DEPTH TO TOP OF WELL SCREEN BOTTOM

WELL DEVELOPMENT BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-REB** RIG **BK-81**

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		0.0			0					**NO SAMPLE TAKEN BORING LOCATED IN ROAD CUTTINGS INDICATE BROWN SAND AND GRAVEL.**		Boring grouted from grade to 48.1 w\ 60 gallons of quick grout.
2	SS	3.0	4.5	12-19-24	1.1				SP	**DARK BROWN GRAVELLY SAND** Moist, rounded, quartz, with fines, 3/4" max size.		
3	SS	5.0	6.5	14-17-19	1.2		5					
4	SS	8.5	10.0	17-21-25	1.1							
5	SS	11.6	13.1	19-25-28	1.1		10					
6	SS	16.6	18.1	12-19-25	1.2		15					

TYPE OF CASING USED

X	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 **REB**

AEP_EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-103** DATE **7/23/15** SHEET **2** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/4/96** BORING FINISH **6/4/96**

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
7	SS	21.6	23.1	5-14-21	1.1		25					
8	SS	26.6	28.1	11-17-28	1.2		30					
9	SS	31.6	33.1	8-9-10	1.1		35		CL	**BROWN SILTY CLAY** Moist, with fine grin sand lens, low plasticity.		
10	ST	36.6	38.6		1.6		40		SP	**time 5 sec.** **Push 2.0** **PSI 700** **LIGHT BROWN SAND** Fine grain.		
11	SS	41.6	43.1	4-5-6	1.1		45			**BROWN SAND** Moist, 100% fine grain, with fines.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-103** DATE **7/23/15** SHEET **3** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/4/96** BORING FINISH **6/4/96**

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
12	SS	46.6	48.1	6-6-5	?							

AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 719,229.2 E 1,734,600.2**

GROUND ELEVATION **618.7** SYSTEM **STATE PLANE**

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **96-104** DATE **7/23/15** SHEET **1** OF **3**

BORING START **6/4/96** BORING FINISH **6/4/96**

PIEZOMETER TYPE **SS** WELL TYPE

HGT. RISER ABOVE GROUND DIA

DEPTH TO TOP OF WELL SCREEN **24.1** BOTTOM **33.1**

WELL DEVELOPMENT **NO** BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-REB** RIG **BK-81**

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		2-4-8	1.1				CL	-		
2	SS	3.0	4.5	9-14-18	1.2				SP	**DARK BROWN CLAY** Moist, medium to high plasticity trace of sand.		
3	SS	5.0	6.5	73	1.1		5		GW	**BROWN GRAVELLY SAND** Dry, quartz, 1/2" max, rounded.		
4	SS	8.5	10.0	9-18-25	1.2					**DARK BROWN SAND AND GRAVEL** Dry, quartz, 1/2" max, rounded. **Same as above some fines, moist**		
5	SS	11.7	13.2	19-26-31	1.2		10		SP	**DARK BROWN GRAVELLY SAND** Dry, 3/4" max, rounded, quartz.		
6	SS	16.7	18.2	18-21-26	1.2		15		SC	**DARK BROWN CLAYEY SAND** Moist, trace of gravel.		

TYPE OF CASING USED

X	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 **REB**

AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-104** DATE **7/23/15** SHEET **2** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/4/96** BORING FINISH **6/4/96**

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
												20.4 Top seal.
7	SS	21.7	23.2	17-21-25	1.2				SP	**LIGHT BROWN GRAVELLY SAND** Dry, quartz, 3/4" max, rounded.		22.5 Top of sand.
												24.1 Top of screen.
8	SS	26.7	28.2	4-6-8	1.1		25		CL	**LIGHT BROWN SILTY CLAY** Moist, low to medium plasticity.		
9	ST	31.7	33.7		1.6		30			**PUSH 2.0** **PSI 900** **TIME 6 SEC.** **BROWN CLAYEY SAND** Fine grain?		33.1 Bottom of screen.
							35					34.7 Bottom of sand.
10	SS	36.7	38.2	3-3-5	1.2					**LIGHT BROWN SILTY CLAY** Moist, low to medium plasticity.		
							40					
11	SS	41.7	43.2	4-4-7	1.1				SM	**LIGHT BROWN SILTY SAND** Moist. v-fine grain 100%.		
							45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-104** DATE **7/23/15** SHEET **3** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/4/96** BORING FINISH **6/4/96**

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
12	ST	46.7	48.7		1.5					**PUSH 2.0** **PSI 1200** **TIME 6 SEC.** **DARK BROWN SANDY CLAY** Fine grain.		

AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 718,782.8 E 1,735,084.7**

GROUND ELEVATION **619.3** SYSTEM **STATE PLANE**

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **96-105** DATE **7/23/15** SHEET **1** OF **3**

BORING START **6/3/96** BORING FINISH **6/3/96**

PIEZOMETER TYPE _____ WELL TYPE _____

HGT. RISER ABOVE GROUND _____ DIA _____

DEPTH TO TOP OF WELL SCREEN _____ BOTTOM _____

WELL DEVELOPMENT _____ BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-REB** RIG **BK-81**

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
										No sample taken. Boring located in road bed. Auger cuttings sand and gravel.		Boring grouted from grade to 48.5' with 75 gallons of quick grout
1	SS	3.0	4.5	7-10-11	1.1				SW	**BROWN SAND** Dry, quartz, rounded with trace of gravel.		
2	SS	5.0	6.5	12-16-21	1.2		5			**BROWN GRAVELLY SAND** Dry quartz, rounded, 1/2" max size.		
3	SS	8.5	10.0	9-15-17	1.2					**3/4" max size trace of fines.**		
4	SS	11.5	13.0	9-16-19	1.1		10					
5	SS	16.5	18.0	9-14-17	1.2		15			**Moist**		

TYPE OF CASING USED

X	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 **REB**

AEP_EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-105** DATE **7/23/15** SHEET **2** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/3/96** BORING FINISH **6/3/96**

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
6	SS	21.5	23.0	7-9-14	1.1				SM	**DARK BROWN SILTY SAND** Moist, with trace of small gravel.		
7	SS	26.5	28.0	5-6-7	1.2		25		CL	**BROWN SILTY CLAY** Moist, low to medium plasticity.		
8	ST	31.5	33.5		1.7		30			**PUSH 2.0** **PSI 700** **TIME 8 SEC.**		
9	SS	36.5	38.0	3-3-5	1.1		35					
10	SS	41.5	43.0	4-4-5	1.2		40		SP SC	**LIGHT BROWN CLAYEY SAND** Moist, 100% v-fine grain.		
							45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-105** DATE **7/23/15** SHEET **3** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/3/96** BORING FINISH **6/3/96**

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
11	ST	46.5	48.0		1.8					**TIME 5 SEC** **PSI 800** **PUSH 2.0**		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 719,271.8 E 1,735,858.4**

GROUND ELEVATION **618.9** SYSTEM **STATE PLANE**

Water Level, ft	▽ 60.2	▼	▼
TIME			
DATE	5-28-96		

BORING NO. **96-106** DATE **7/23/15** SHEET **1** OF **3**

BORING START **5/28/96** BORING FINISH **5/28/96**

PIEZOMETER TYPE WELL TYPE

HGT. RISER ABOVE GROUND DIA

DEPTH TO TOP OF WELL SCREEN BOTTOM

WELL DEVELOPMENT BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-REB** RIG **BK-81**

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
										NO SAMPLE TAKEN BORING IN ROAD BED.		
1	SS	3.0	4.5	15-17-21	1.1				GP	**DARK BROWN SAND AND GRAVEL** Moist, 1/2" max, rounded, quartz, some fines.		
2	SS	5.0	6.5	17-24-30	1.1		5			**1" max size**		
3	SS	8.5	10.0	13-17-20	1.2		10			**1/2" max size**		
4	SS	11.5	13.0	11-11-14	1.2		15					
5	SS	16.5	18.0	13-15-17	1.1					**1/2" max size**		

TYPE OF CASING USED

X	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 **REB**

AEP_EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-106** DATE **7/23/15** SHEET **2** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **5/28/96** BORING FINISH **5/28/96**

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
6	SS	21.5	23.0	6-8-10	1.2		25		SC	**BROWN SANDY CLAY** Dry, slight to low plasticity.		
7	SS	26.5	28.0	4-6-6	1.2					**GRAY FLY ASH** Dry.		
8	SS	31.5	33.0	1-1-1	1.2		30			**Saturated**		
9	SS	36.5	38.0	1-1-1	1.2		35					
10	SS	41.5	43.0	1-1-1	1.2		40					
							45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-106** DATE **7/23/15** SHEET **3** OF **3**

PROJECT **EPRI GROUND WATER STUDY** BORING START **5/28/96** BORING FINISH **5/28/96**

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
11	SS	46.5	48.0	3-2-2	1.1		50					
12	SS	51.5	53.0	2-2-2	1.2		55					
13	SS	56.5	58.0	3-4-4	1.2				CL	**DARK GRAY SILTY CLAY** Wet, low to medium plasticity, trace of organic material.		
14	ST	61.5	63.5		1.6		60			**Time 7 sec.** **Push 2.0** **PSI 600** **BROWN SILTY CLAY** Trace of fine sand.	▽	
15	SS	66.5	68.0	3-4-5	1.2		65			**BROWN CLAY** Wet, medium to high plasticity.		Boring grouted from 68.0' to grade with 125 gallons quick grout.

AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 719,691.4 E 1,736,040.0**

GROUND ELEVATION **618.8** SYSTEM **STATE PLANE**

Water Level, ft	▽ 39.1	▼	▼
TIME			
DATE	5-29-96		

BORING NO. **96-107** DATE **7/23/15** SHEET **1** OF **4**

BORING START **5/29/96** BORING FINISH **5/29/96**

PIEZOMETER TYPE _____ WELL TYPE _____

HGT. RISER ABOVE GROUND _____ DIA _____

DEPTH TO TOP OF WELL SCREEN _____ BOTTOM _____

WELL DEVELOPMENT _____ BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-REB** RIG **BK-81**

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
										NO SAMPLE TAKEN BORING IN ROAD BED. AUGER CUTTINGS INDICATE BROWN SAND AND GRAVEL.		Boring was grouted from 73.1 to grade w/approximately 100 gallons of quick grout.
1	SS	3.0	4.5	14-17-21	1.1				GP	**BROWN SAND AND GRAVEL** Moist, quartz, rounded, some fine 3/4' max size.		
2	SS	5.0	6.5	17-21-28	1.2		5					
3	SS	8.5	10.0	14-18-24	1.1					**1/2" max size**		
4	SS	11.6	13.1	13-16-21	1.2		10					
5	SS	16.6	18.1	5-8-10	1.1		15		ML	**BROWN SILT** Moist, non to v-slight plasticity.		

TYPE OF CASING USED

X	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 **REB**

AEP_EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-107** DATE **7/23/15** SHEET **2** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **5/29/96** BORING FINISH **5/29/96**

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
6	SS	21.6	23.1	8-8-11	1.2		25		SM	**Attempted shelby tube lifted rig** **BROWN SILT SAND** Moist, 100% v-fine grain.		
7	SS	26.6	28.1	4-5-9	1.2					**GRAY FLY ASH** Moist.		
8	SS	31.6	33.1	5-8-11	1.2		30			**Saturated**		
9	SS	36.6	38.1	1-1-1	1.1		35				▽	
10	SS	41.6	43.1	1-1-1	1.2		40					
							45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-107** DATE **7/23/15** SHEET **3** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **5/29/96** BORING FINISH **5/29/96**

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
11	SS	46.6	48.1	1-1-1	1.2							
12	SS	51.6	53.1	2-1-1	1.2		50					
13	SS	56.6	58.1	0	1.3		55					Weight of 140# hammer.
14	SS	61.6	63.1	4-7-10	1.2		60		CL	**DARK BROWN CLAY** Moist. medium to high plasticity.		
15	ST	66.6	68.6		1.5		65			**Push 2.0** **Time 5 sec.** **PSI 600** **BROWN CLAY**		
16	SS	71.6	73.1	4-6-7	1.2		70					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-107** DATE **7/23/15** SHEET **4** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **5/29/96** BORING FINISH **5/29/96**

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

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 719,761.8 E 1,736,125.4**

GROUND ELEVATION **603.4** SYSTEM **STATE PLANE**

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **96-108** DATE **7/23/15** SHEET **1** OF **4**

BORING START **6/11/96** BORING FINISH **6/11/96**

PIEZOMETER TYPE **SS** WELL TYPE

HGT. RISER ABOVE GROUND DIA

DEPTH TO TOP OF WELL SCREEN **63.3** BOTTOM **72.3**

WELL DEVELOPMENT **NO** BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-WEB** RIG **BK-81**

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
										No sample road base		
1	SS	3.0	4.5	11-15-16	1.2					**BLACK SAND AND BOTTOM ASH** Moist.		
3	SS	5.0	6.5	12-17-21	1.5		5					
4	SS	8.5	10.0	12-16-29	.9				SC	**DARK BROWN CLAYEY SAND** Moist, with fine sand lens.		
5	SS	11.6	13.1	9-18-22	1.2		10		SP	**DARK BROWN GRAVELLY SAND** Moist, quartz, some fine, 1/2" max size.		
6	SS	16.6	18.1	18-24-21	.8		15		SC	**DARK BROWN CLAYEY SAND** Moist, trace of small gravel and ash.		

TYPE OF CASING USED

X	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 **REB**

AEP_EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-108** DATE **7/23/15** SHEET **2** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/11/96** BORING FINISH **6/11/96**

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
7	SS	21.6	23.1	6-6-8	1.5		25		CL	**LIGHT BROWN SILTY CLAY** Moist, low plasticity.		
8	SS	26.6	28.1	4-4-4	1.0		30			**BLACK BOTTOM ASH** Saturated.		
9	SS	31.6	33.1	2-1-2	1.1		35			**GRAY FLY ASH** Saturated.		
10	SS	36.6	38.1	2-1-1	1.5		40					
11	SS	41.6	43.1	3-5-7	.8		45		CL	**LIGHT GRAY CLAY** Moist to wet, medium to high plasticity.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-108** DATE **7/23/15** SHEET **3** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/11/96** BORING FINISH **6/11/96**

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
12	ST	46.6	48.6		2.0					**PUSH 2.0** **TIME 7 SEC.** **PSI 1000**		
13	SS	51.6	53.1	2-2-3	?		50		CL	**DARK GRAY SILTY CLAY** Wet, low plasticity, trace of organic and sand.		
14	SS	56.6	58.1	2-2-3	1.5		55					57.0 Top of seal.
15	SS	61.6	63.1	3-4-5	1.5		60					60.6 Top of sand. 63.3 Top screen.
16	SS	66.6	68.1	4-4-5	1.5		65					
17	SS	71.6	73.1	4-5-6	1.5		70					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

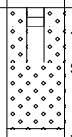
AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-108** DATE **7/23/15** SHEET **4** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/11/96** BORING FINISH **6/11/96**

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
												72.3 Bottom of screen. 74.0 Bottom of sand.

AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 720,227.5 E 1,735,579.0**

GROUND ELEVATION **619.6** SYSTEM **STATE PLANE**

Water Level, ft	▽ **20.5**	▼	▼
TIME			
DATE	**5-30-96**		

BORING NO. **96-109** DATE **7/23/15** SHEET **1** OF **4**

BORING START **5/29/96** BORING FINISH **5/30/96**

PIEZOMETER TYPE WELL TYPE

HGT. RISER ABOVE GROUND DIA

DEPTH TO TOP OF WELL SCREEN BOTTOM

WELL DEVELOPMENT BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-REB** RIG **BK-81**

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
										NO SAMPLE TAKEN BORING LOCATED IN ROAD BASE. AUGER CUTTINGS INDICATE BROWN SAND AND GRAVEL.		Boring grouted from 73.2 to grade with 150 gallons quick grout.
1	SS	3.0	4.5	13-19-24	1.2				GP	**DARK BROWN SAND AND GRAVEL** Moist, 1/2" max size, quartz, rounded, some fines.		
2	SS	5.0	6.5	15-18-21	1.1		5					
3	SS	8.5	10.0	15-18-21	1.2							
4	SS	11.7	13.2	12-13-14	1.0		10		SP	**DARK BROWN SAND** Moist, fine grain.		
5	SS	16.7	18.2	4-5-6	1.1		15		ML	**BROWN SANDY SILT** Moist, non plasticity.		

TYPE OF CASING USED

X	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 **REB**

AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-109** DATE **7/23/15** SHEET **2** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **5/29/96** BORING FINISH **5/30/96**

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
6	SS	21.7	23.2	4-6-8	1.2						▽	
7	ST	26.7	28.7		1.5		25			**Time 10 sec** **PSI 1200** **Push 2.0** **By watching rig psi possible .4 to .5 of fly ash in bottom of tube.** **GRAY FLY ASH** Moist.		
8	ST	31.7	33.2	4-7-10	1.1		30					
9	SS	36.7	38.2	1-1-1	1.2		35			**Saturated**		
10	SS	41.7	43.2	1-1-1	1.2		40					
							45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-109** DATE **7/23/15** SHEET **3** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **5/29/96** BORING FINISH **5/30/96**

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
11	SS	46.7	48.2	1-1-3	?							
12	SS	51.7	66.7	1-1-2	1.2		50					
13	SS	56.7	58.2	1-1-4	1.2		55					
14	SS	61.7	63.2	4-6-8	?		60		CL	**DARK BROWN CLAY** Moist, medium to high plasticity.		
15	ST	66.7	68.7		1.7		65			**Time 8 sec.** **Push 2.0** **PSI 1000** **Material same as sample no. 14**		
							70					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-109** DATE **7/23/15** SHEET **4** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **5/29/96** BORING FINISH **5/30/96**

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
16	SS	71.7	73.2	3-4-5	1.2							

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 720,277.1 E 1,735,665.6**

GROUND ELEVATION **602.3** SYSTEM **STATE PLANE**

Water Level, ft	▽ DRY	▼	▼
TIME			
DATE	**6-10-96**		

BORING NO. **96-110** DATE **7/23/15** SHEET **1** OF **4**

BORING START **6/6/96** BORING FINISH **6/10/96**

PIEZOMETER TYPE **SS** WELL TYPE

HGT. RISER ABOVE GROUND DIA

DEPTH TO TOP OF WELL SCREEN **43.7** BOTTOM **52.7**

WELL DEVELOPMENT **NO** BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-REB** RIG **BK-81**

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
										No sample taken, boring in road.		Grouted grade to 73.1' with approximately 80 gallons.
1	SS	3.0	4.5	13-18-24	1.1					**DARK GRAY BOTTOM ASH** Dry.		
2	SS	5.0	6.5	10-11-14	1.2		5					
3	SS	8.5	10.0	5-7-9	1.1				GP	**DARK BROWN SAND AND GRAVEL** Dry, quartz, rounded, 3/4" max.		
4	SS	11.6	13.1	6-7-10	1.1		10					
5	SS	16.6	18.1	8-10-10	1.2		15		CL	**BROWN CLAY** Dry, low to medium plasticity with trace of v-fine sand.		
6	SS	18.6	20.1	9-11-12	1.2				SC	**Attempted to push tube lifted drill, destroyed end of tube.** **BROWN SANDY CLAY** Moist, low to medium		

TYPE OF CASING USED

X	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 **REB**

AEP_EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-110** DATE **7/23/15** SHEET **2** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/6/96** BORING FINISH **6/10/96**

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
										plasticity with v-fine grain sand lens.		
7	SS	21.6	23.1	5-7-11	1.2					**Grading to more sand**		
		23.6								**Attempted to push tube, top hole broken in tube, pushed approximately 1' lifted rig.**		
9	SS	26.6	28.1	5-7-11	1.2		25			**GRAYISH BROWN SILTY CLAY** Moist, low to medium plasticity.		
10	SS	31.6	33.1	7-10-9	1.3		30		CL	**Could not move or knock tube off to the side of lead auger, pulled augers grouted hole moved approximately three feet down stream to start new hole. No spt taken on new hole untill this point. SWL dry augers to 26.6'. Auger set all weekend at this point.** **REDDISH BROWN CLAY** Dry to moist, medium to high plasticity.		
11	SS	36.6	38.1		1.5		35		CL	**MEDIUM GRAY CLAY** Moist to dry, medium to high plasticity, with odor of organic.		
12	ST	38.6	40.6		2.0					**PUSH 2.0** **PSI 1200** **TIME 6 SEC.** **Top DARK BROWNISH GRAY SANDY CLAY** **Bottom BROWN SANDY CLAY**		39.1 Top of seal.
13	SS	41.6	43.1	3-5-7	1.5		40			**DARK GRAY CLAY** Moist to wet, medium to high plasticity, strong odor of organic.		41.7 Top of sand.
							45					43.7 Top of screen.

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-110** DATE **7/23/15** SHEET **3** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/6/96** BORING FINISH **6/10/96**

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
14	SS	46.6	48.1	3-4-4	1.5					**GRAY BROWN CLAY** Moist to wet, medium to high plasticity, odor of organic with v-fine grain sand lens, water on out side of spoon.		
15	SS	51.6	53.1	3-3-5	1.5		50					52.7 Bottom of screen. 53.3 Bottom of sand.
16	SS	56.6	58.1	3-4-4	1.5		55					
17	ST	58.6	60.6		2.0					**PUSH 2.0** **TIME 7 SEC.** **PSI 770** **DARK GRAY SILTY CLAY**		
18	SS	61.6	63.1		?		60			**DARK GRAY CLAY** Moist to wet, medium to high plasticity, strong odor of organic material.		
19	SS	66.6	68.1	3-4-5	1.5		65					
20	SS	71.6	73.1	4-7-11	1.4		70					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **96-110** DATE **7/23/15** SHEET **4** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **6/6/96** BORING FINISH **6/10/96**

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

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 723,463.5 E 1,734,069.7**

GROUND ELEVATION **582.2** SYSTEM **State Plane using NAD27**

Water Level, ft	▽ **38.0**	▼	▼
TIME			
DATE	**7/19/90**		

BORING NO. **JTMN-1** DATE **7/23/15** SHEET **1** OF **4**

BORING START **7/19/90** BORING FINISH **7/19/90**

PIEZOMETER TYPE WELL TYPE

HGT. RISER ABOVE GROUND **1.5** DIA **2**

DEPTH TO TOP OF WELL SCREEN **56.7** BOTTOM **75.7**

WELL DEVELOPMENT BACKFILL **Benseal**

FIELD PARTY **MCR / JD** RIG **B-61**

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
												20' North of well hub.
1	SS	2.7	4.2	4-8-7	1.4					**BROWN SANDY SILT** Moist, w/some quartz sand (fill)		
2	SS	7.7	9.2	3-3-3	0.9		5					
3	SS	12.7	14.2	4-7-9	1.3		10			**MULTI-COLORED BROWN CLAY** Moist, med to low plasticity		
4	SS	17.7	19.2	4-7-9	1.3		15			w/ trace of very fine sand		

TYPE OF CASING USED

	NQ-2 ROCK CORE	
	6" x 3.25 HSA	
X	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 **JCM**

AEP_EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **JTMN-1** DATE **7/23/15** SHEET **2** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **7/19/90** BORING FINISH **7/19/90**

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
5	SS	22.7	24.2	4-7-9	1.4		25			**BROWN SILTY CLAY** w/ trace of very fine sand, low to medium plasticity		
6	SS	27.7	29.2	3-4-6	1.4							
7	SS	32.7	34.2	3-4-4	1.3		30			**BROWN SAND** Moist to wet, 100% fine grain		
8	SS	37.7	39.2	6-6-10	1.3		35			**BROWN CLAYEY SAND & GRAVEL** Saturated, quartz - 3/4" max size, rounded	▽	
9	SS	42.7	44.2	6-8-10	1.1		40			**BROWN SAND & GRAVEL** Saturated, quartz - 3/4" max size, rounded, w/ trace of fines		
							45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **JTMN-1** DATE **7/23/15** SHEET **3** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **7/19/90** BORING FINISH **7/19/90**

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
10	SS	47.7	49.2	12-16-25	0.4		50			1" max size		
11	SS	52.7	54.2	10-12-16	0.9		55			**BROWN SAND** Saturated, 70% fine grain, w/ some fines		
12	SS	57.7	59.2	10-12-17	1.3		60			**BROWN SAND** Saturated, 90% medium to fine grain		
13	SS	62.7	64.2	12-17-15	0.9		65			**BROWN SAND** Saturated, 80% medium to fine grain quartz, trace of fines		
14	SS	67.7	69.2	17-16-16	1.0		70			**BROWN SILTY SAND** Saturated, quartz, w/ trace of small gravel		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **JTMN-1** DATE **7/23/15** SHEET **4** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **7/19/90** BORING FINISH **7/19/90**

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	72.7	74.2	9-18-19	0.4		75			**BROWN SAND** Saturated, quartz, w/ trace of fines		Auger refusal @ 76.6'. Installed 2" observation well.

AEP EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 723,392.8 E 1,734,106.4**

GROUND ELEVATION **582.2** SYSTEM **State Plane using NAD27**

Water Level, ft	▽ **40.2**	▼	▼
TIME			
DATE	**7/18/90**		

BORING NO. **JTMN-2** DATE **7/23/15** SHEET **1** OF **4**

BORING START **7/17/90** BORING FINISH **7/18/90**

PIEZOMETER TYPE WELL TYPE

HGT. RISER ABOVE GROUND **1.9** DIA **2**

DEPTH TO TOP OF WELL SCREEN **57.9** BOTTOM **76.9**

WELL DEVELOPMENT BACKFILL **Benseal**

FIELD PARTY **MCR / JD** RIG **B-61**

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	2.7	4.2	5-2-12	0		5			**NO RECOVERY - DROVE SPOON ON COBBLES**		100' North of potable well hub.
2	SS	7.7	9.2	2-2-8	0		10			**CONCRETE FRAGMENTS & SAND ON SPOON**		
3	SS	12.7	14.2	4-5-8	0.9		15			**BROWN CLAY** Moist, medium to low plasticity		
4	SS	17.7	19.2	3-5-8	1.0							

TYPE OF CASING USED

	NQ-2 ROCK CORE	
	6" x 3.25 HSA	
X	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 **JCM**

AEP_EPRI_SPORN_MOUNTAINEER.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **JTMN-2** DATE **7/23/15** SHEET **2** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **7/17/90** BORING FINISH **7/18/90**

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
5	SS	22.7	24.2	3-4-7	0		25					
6	SS	27.7	29.2	3-5-4	0.4					**BROWN SILTY SAND** Moist, 100% fine grain		
7	SS	32.7	34.2	4-5-5	1.3		30			**BROWN CLAY** Moist, medium to low plasticity **BROWN SAND** Quartz, 95% fine grain, trace of fines		
8	SS	37.7	39.2	3-5-7	1.3		35			**BROWN CLAYEY SAND** Wet to saturated.		
9	SS	42.7	44.2	10-11-8	1.0		40			**BROWN SAND & GRAVEL** Quartz, rounded, 3/4" max size, w/ fines	▽	Started washing out augers.
							45					

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **JTMN-2** DATE **7/23/15** SHEET **3** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **7/17/90** BORING FINISH **7/18/90**

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
10	SS	47.7	49.2	8-11-11	0.3		50					
11	SS	52.7	54.2	9-14-10	0.5		55					
12	SS	57.7	59.2	7-7-7	0.9		60			**BROWN SAND** Quartz, saturated, trace of gravel		
13	SS	62.7	64.2	8-14-12	1.1		65			**BROWN SAND** Quartz, saturated, trace of gravel, trace of fines		
14	SS	67.7	69.2	7-13-14	1.2		70					

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY _____ BORING NO. **JTMN-2** DATE **7/23/15** SHEET **4** OF **4**

PROJECT **EPRI GROUND WATER STUDY** BORING START **7/17/90** BORING FINISH **7/18/90**

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	72.7	74.2	8-13-16	1.2		75			**BROWN SAND** Saturated		
16	SS	77.7	77.8	50/0.1	0.1					**LIGHT BROWN SANDSTONE**		Auger refusal @ 77.8' Installed 2" observation well.

ARCADIS

AEP 1990, 1996, 1997, 2001, 2008

Monitoring Well Construction Diagrams

MW-001 to MW-16, 96-101, 96-104, 96-108, 96-110, JTMN-1, JTMN-2

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

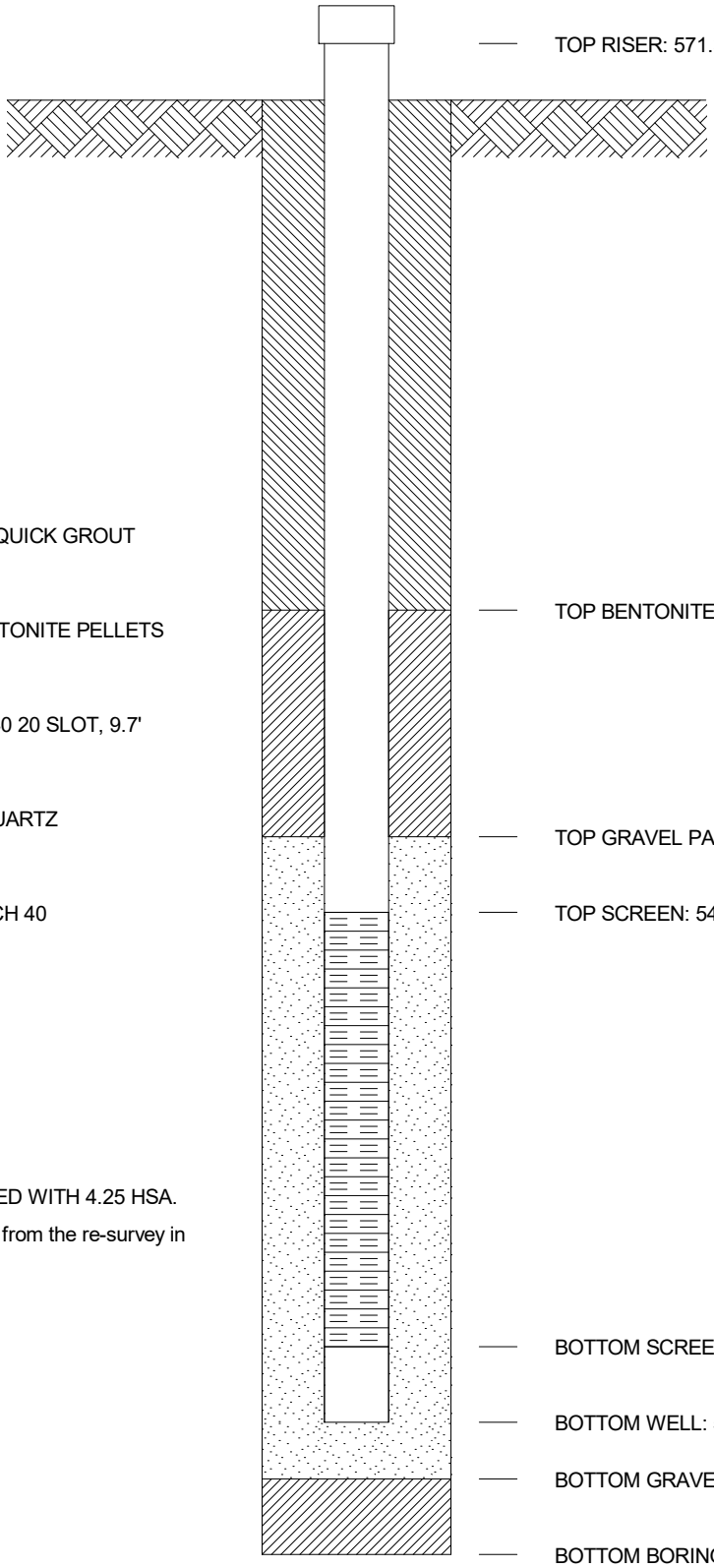
COMPANY _____ WELL No. **MW-001** BORING No. **001** INSTALLED **6/18/97**

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 724,498.7 E 1,733,165.9**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 569.18 FT.



GROUT SEAL: 50 GALLONS QUICK GROUT

BENTONITE SEAL: 125 #BENTONITE PELLETS

SCREEN: 2.0 dia., PVC SCH 40 20 SLOT, 9.7'

GRAVEL PACK: 95 #7@#4 QUARTZ

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH:

PRE-PACK SCREEN. DRILLED WITH 4.25 HSA.

Coordinates and elevations are from the re-survey in June 2008.

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

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

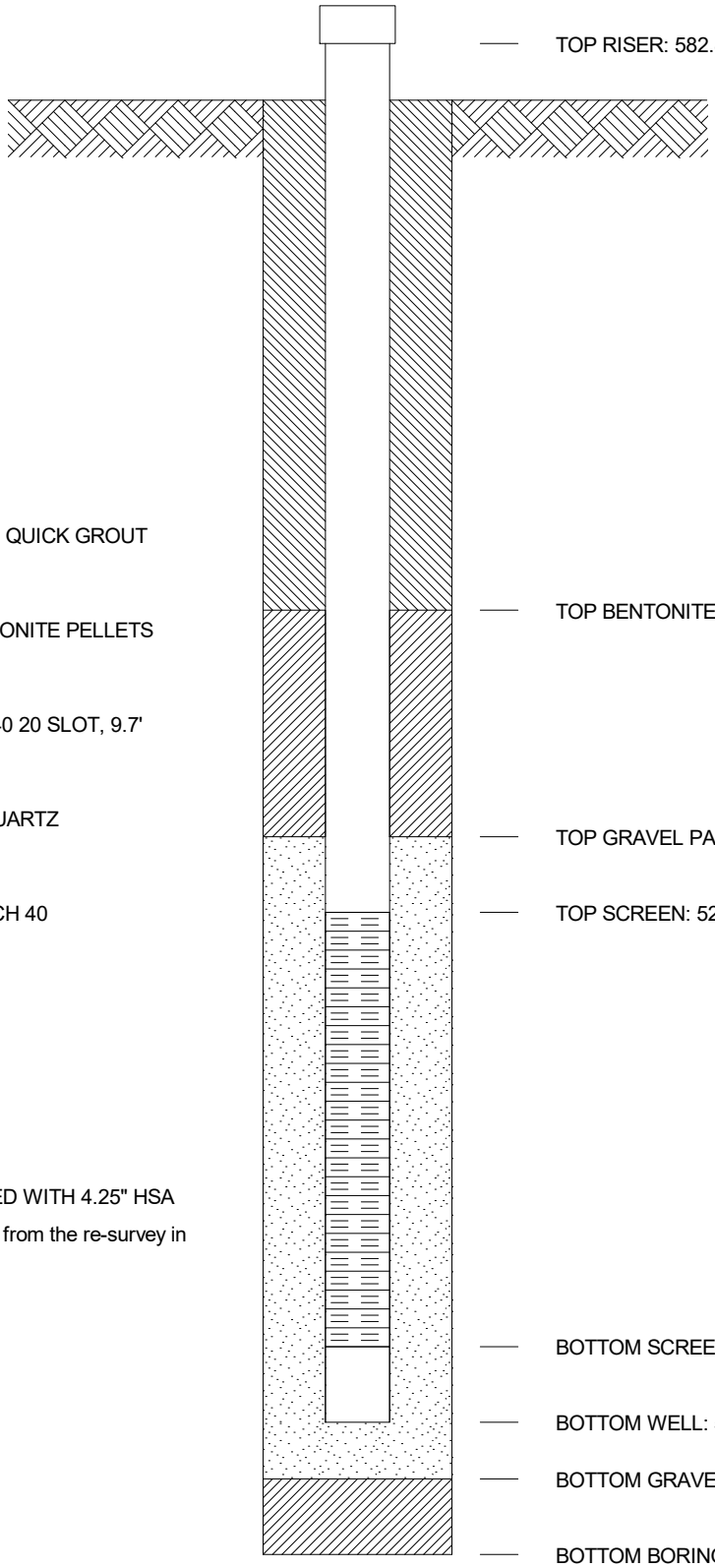
COMPANY _____ WELL No. **MW-002** BORING No. **002** INSTALLED **6/24/97**

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 724,857.8 E 1,733,650.5**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 580.82 FT.



GROUT SEAL: 100 GALLONS QUICK GROUT

BENTONITE SEAL: 25# BENTONITE PELLETS

SCREEN: 2.0 dia., PVC SCH 40 20 SLOT, 9.7'

GRAVEL PACK: 97# 7@#4 QUARTZ

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH:

PRE-PACK SCREEN DRILLED WITH 4.25" HSA

Coordinates and elevations are from the re-survey in June 2008.

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

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

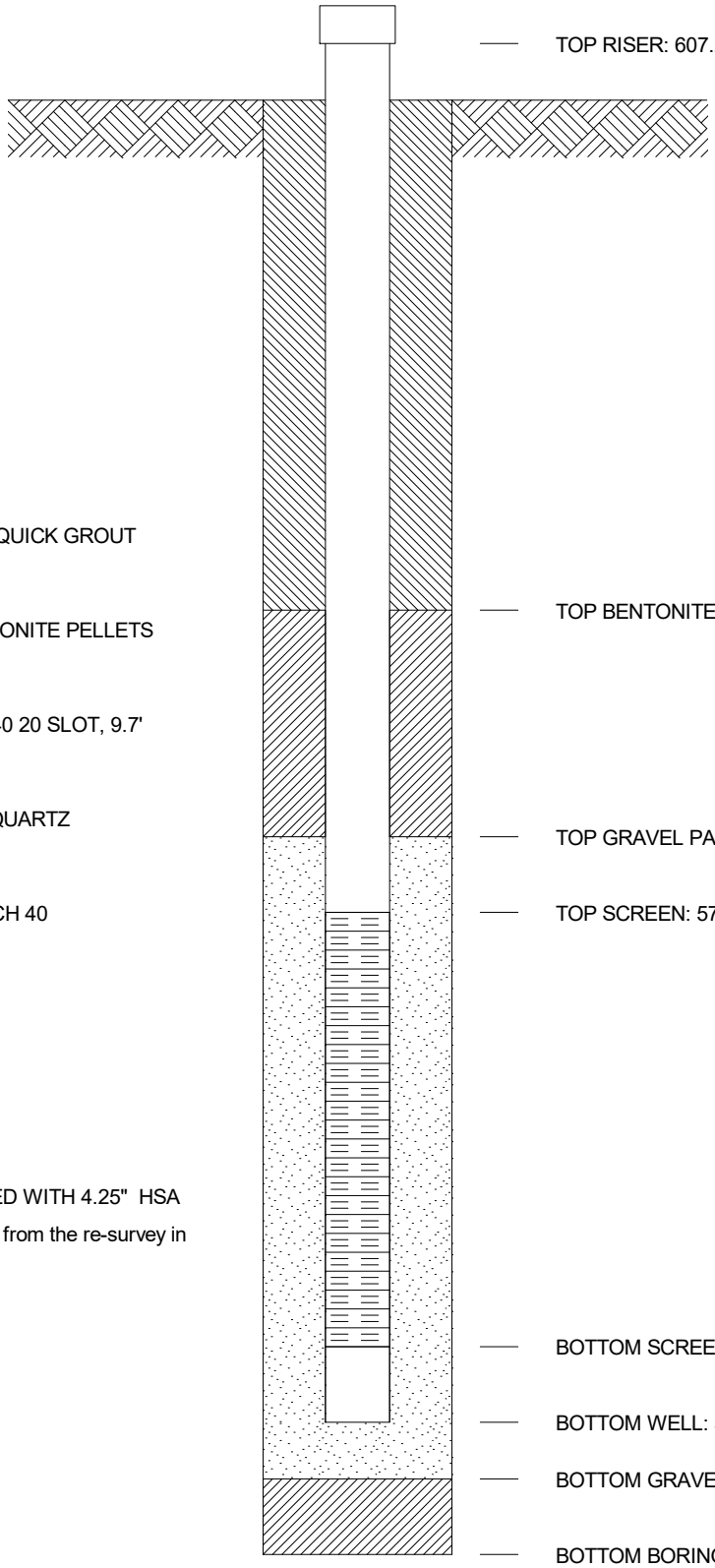
COMPANY _____ WELL No. **MW-003** BORING No. **003** INSTALLED **6/25/97**

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 719,877.2 E 1,733,713.7**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 604.90 FT.



GROUT SEAL: 50 GALLONS QUICK GROUT

BENTONITE SEAL: 70# BENTONITE PELLETS

SCREEN: 2.0 dia., PVC SCH 40 20 SLOT, 9.7'

GRAVEL PACK: 175 #7@#4 QUARTZ

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH:

PRE-PACK SCREEN DRILLED WITH 4.25" HSA

Coordinates and elevations are from the re-survey in June 2008.

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

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

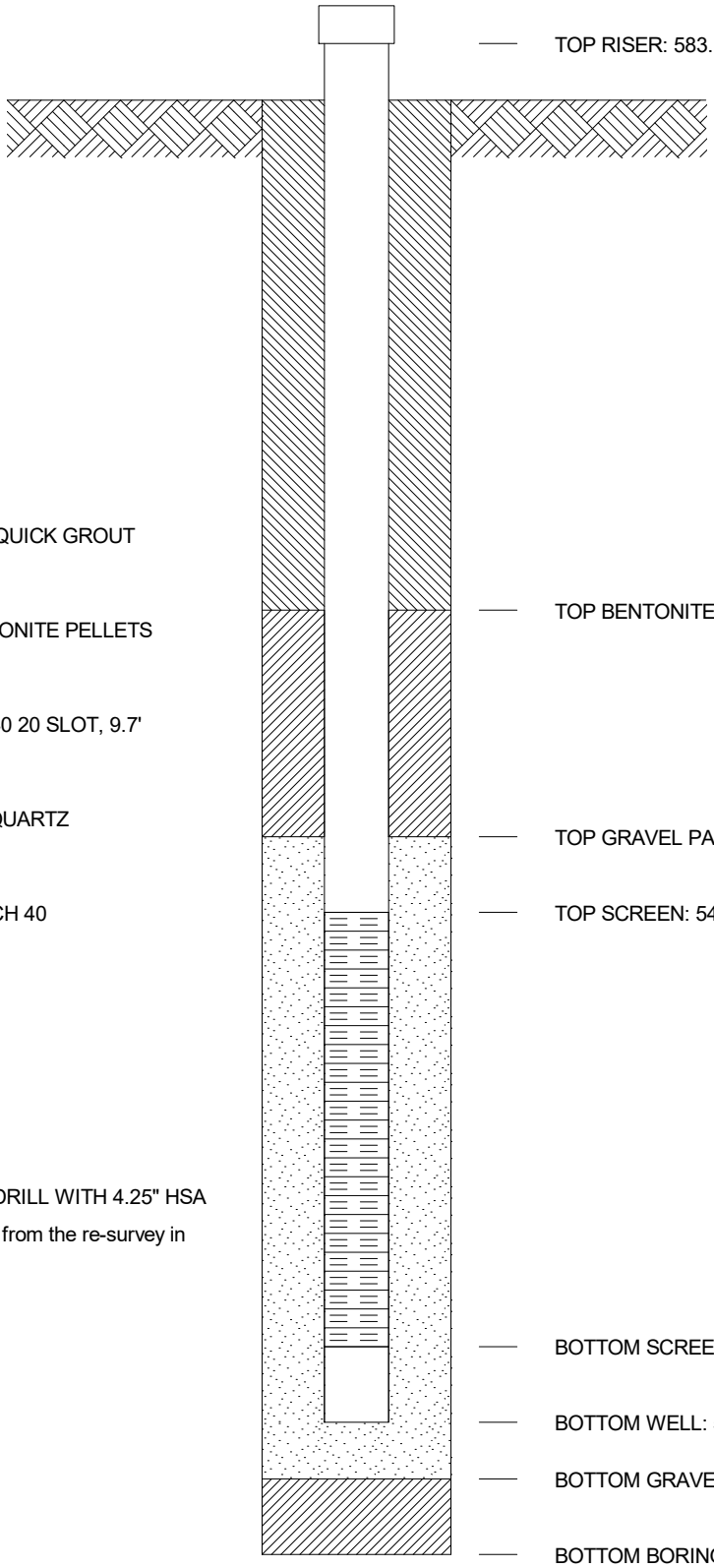
COMPANY _____ WELL No. **MW-004** BORING No. **004** INSTALLED **6/30/97**

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 724,865.9 E 1,733,643.4**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 581.08 FT.



GROUT SEAL: 50 GALLONS QUICK GROUT

BENTONITE SEAL: 50# BENTONITE PELLETS

SCREEN: 2.0 dia., PVC SCH 40 20 SLOT, 9.7'

GRAVEL PACK: 375 #7@#4 QUARTZ

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH:

PRE-PACK SCREEN HOLE DRILL WITH 4.25" HSA

Coordinates and elevations are from the re-survey in June 2008.

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

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

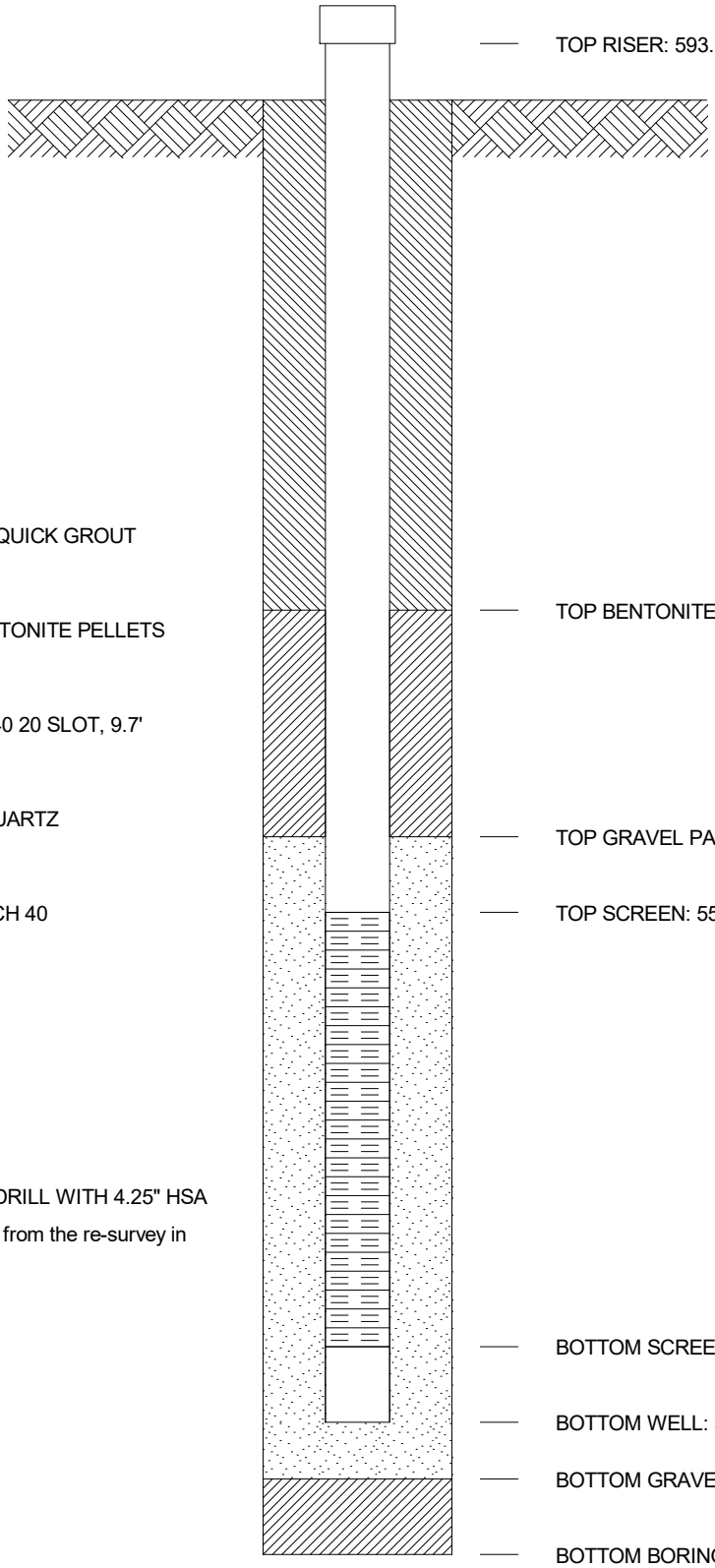
COMPANY _____ WELL No. **MW-005** BORING No. **005** INSTALLED **7/1/97**

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 719,152.8 E 1,734,428.9**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 591.00 FT.



GROUT SEAL: 80 GALLONS QUICK GROUT

BENTONITE SEAL: 150# BENTONITE PELLETS

SCREEN: 2.0 dia., PVC SCH 40 20 SLOT, 9.7'

GRAVEL PACK: 75# 7@#4 QUARTZ

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH:

PRE-PACK SCREEN HOLE DRILL WITH 4.25" HSA

Coordinates and elevations are from the re-survey in June 2008.

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

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

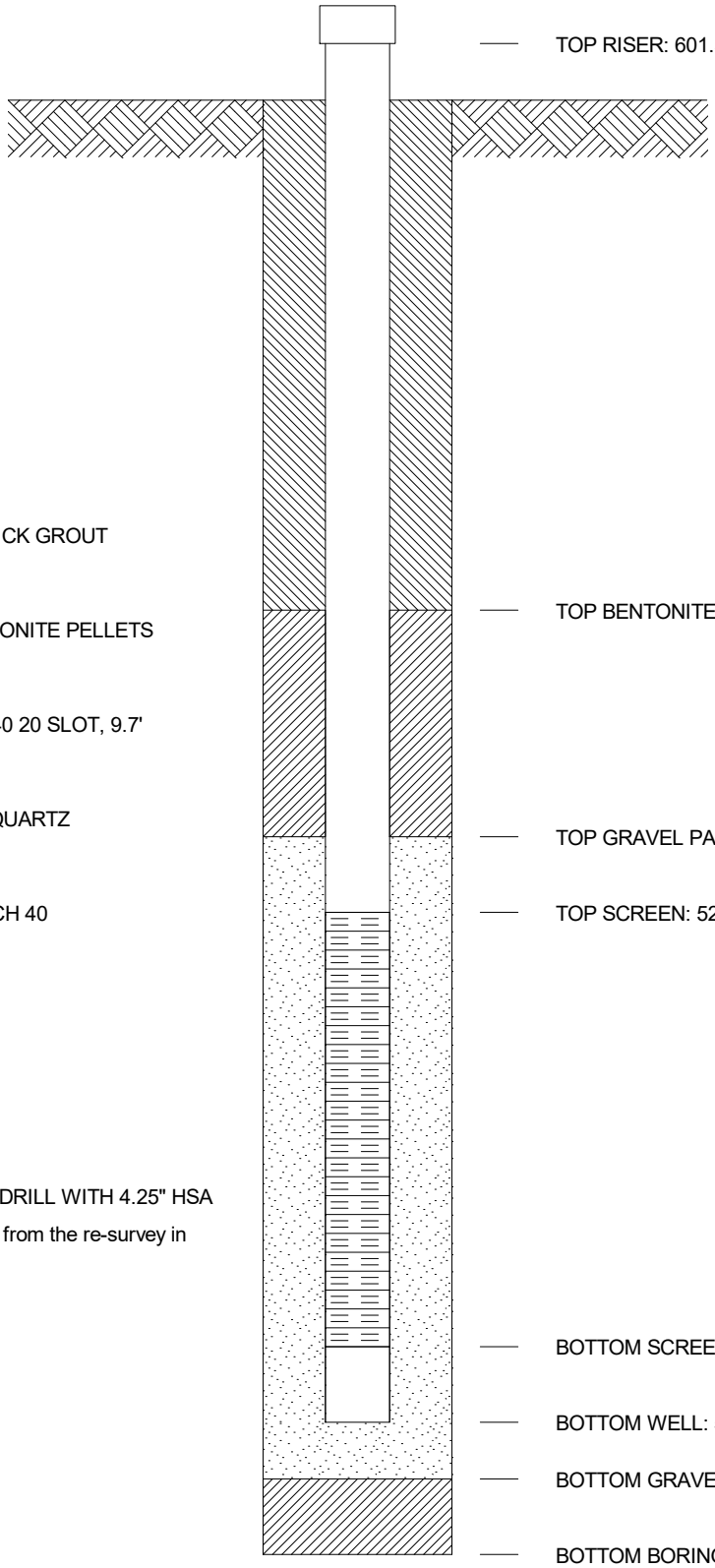
COMPANY _____ WELL No. **MW-006** BORING No. **006** INSTALLED **7/8/97**

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 720,255.7 E 1,735,680.0**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 601.31 FT.



GROUT SEAL: GALLONS QUICK GROUT

BENTONITE SEAL: 80# BENTONITE PELLETS

SCREEN: 2.0 dia., PVC SCH 40 20 SLOT, 9.7'

GRAVEL PACK: 185# 7@#4 QUARTZ

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH:

PRE-PACK SCREEN. HOLE DRILL WITH 4.25" HSA

Coordinates and elevations are from the re-survey in June 2008.

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

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

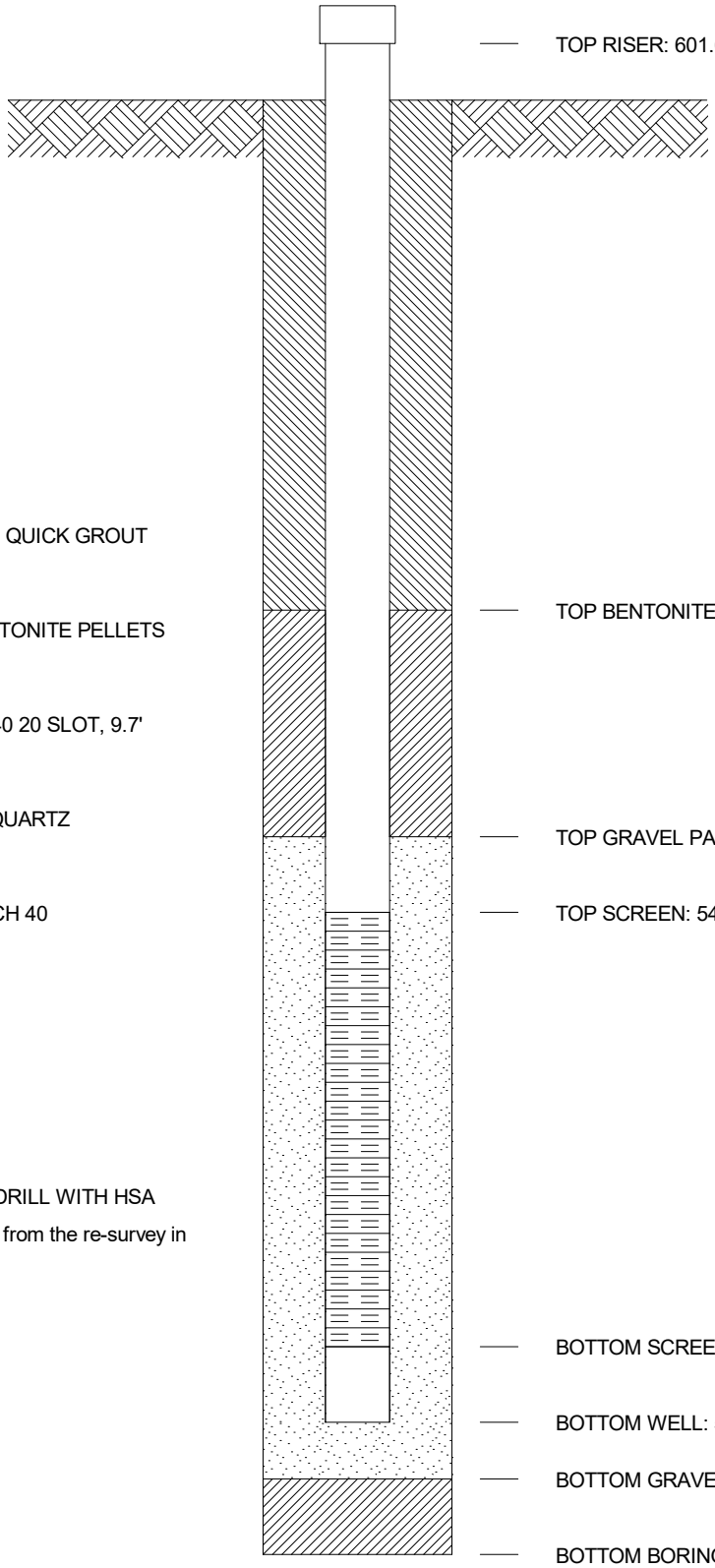
COMPANY _____ WELL No. **MW-007** BORING No. **007** INSTALLED **7/10/97**

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 720,265.1 E 1,735,674.4**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 601.49 FT.



GROUT SEAL: 100 GALLONS QUICK GROUT

BENTONITE SEAL: 100# BENTONITE PELLETS

SCREEN: 2.0 dia., PVC SCH 40 20 SLOT, 9.7'

GRAVEL PACK: 525# 7@#4 QUARTZ

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH:

PRE-PACK SCREEN HOLE DRILL WITH HSA

Coordinates and elevations are from the re-survey in June 2008.

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

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

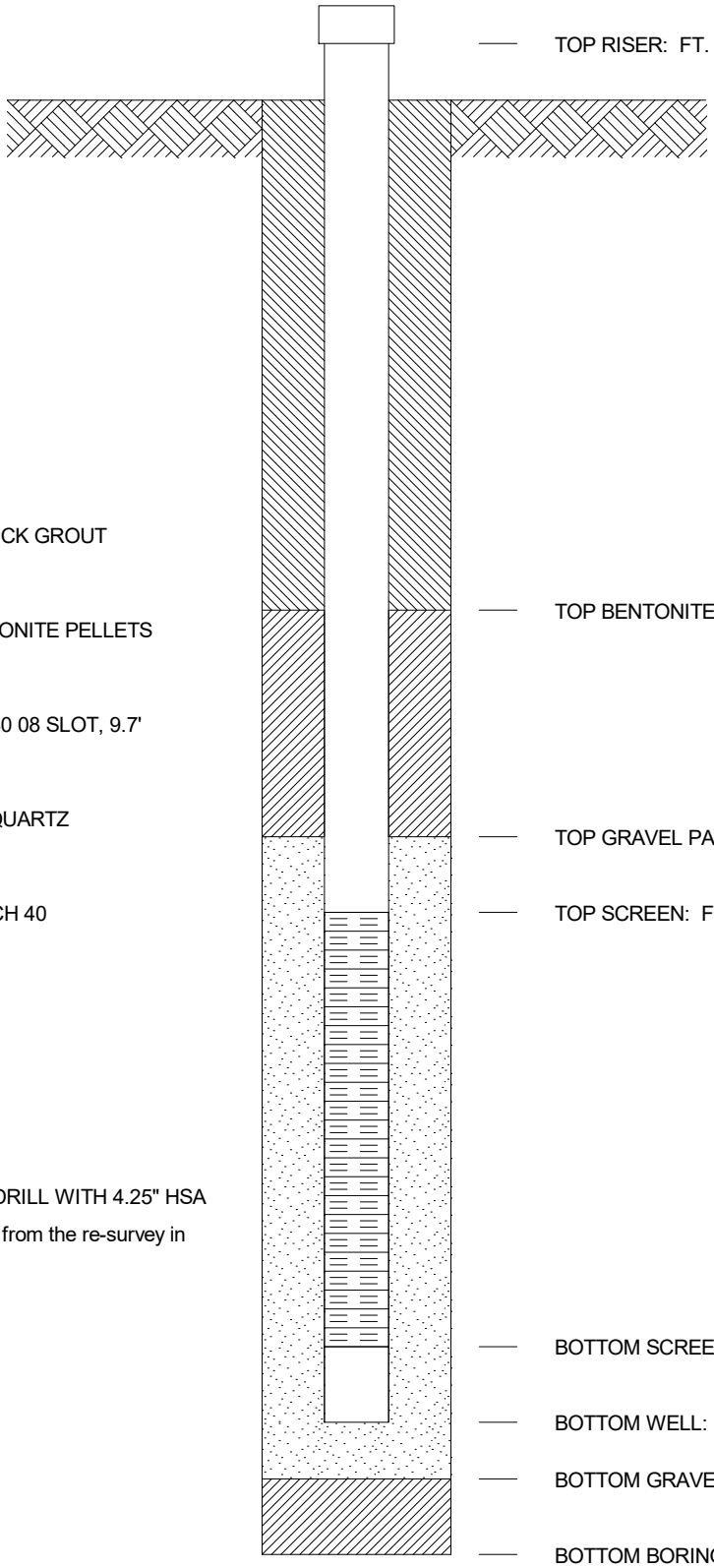
COMPANY _____ WELL No. **MW-008** BORING No. **008** INSTALLED **7/22/97**

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 718,915.8 E 1,736,153.5**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION FT.



GROUT SEAL: GALLONS QUICK GROUT

BENTONITE SEAL: 70# BENTONITE PELLETS

SCREEN: 2.0 dia., PVC SCH 40 08 SLOT, 9.7'

GRAVEL PACK: 360# 7@#4 QUARTZ

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH:

PRE-PACK SCREEN HOLE DRILL WITH 4.25" HSA

Coordinates and elevations are from the re-survey in June 2008.

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

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

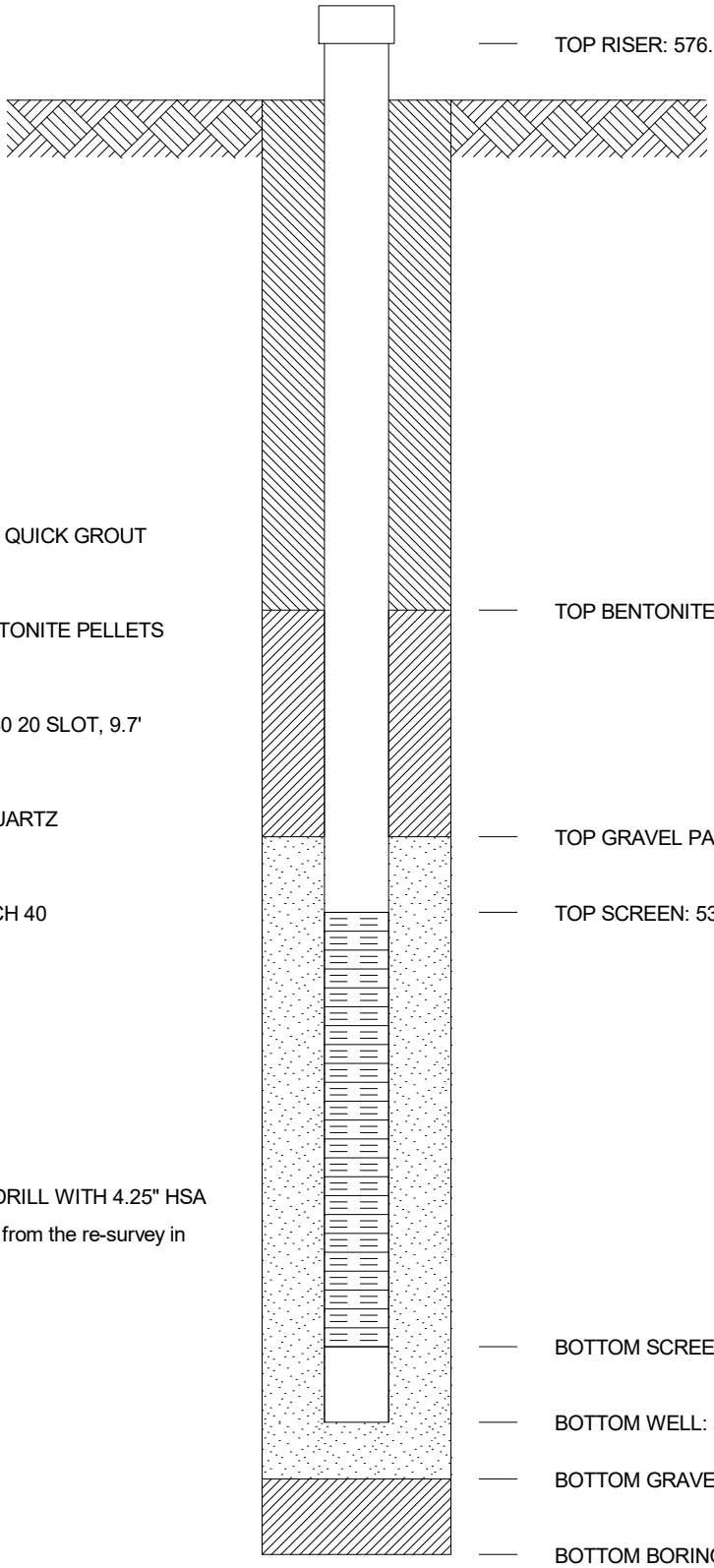
COMPANY _____ WELL No. **MW-009** BORING No. **009** INSTALLED **7/15/97**

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 718,328.2 E 1,736,320.9**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 574.98 FT.



GROUT SEAL: 180 GALLONS QUICK GROUT

BENTONITE SEAL: 100# BENTONITE PELLETS

SCREEN: 2.0 dia., PVC SCH 40 20 SLOT, 9.7'

GRAVEL PACK: 65# 7@#4 QUARTZ

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH:

PRE-PACK SCREEN HOLE DRILL WITH 4.25" HSA

Coordinates and elevations are from the re-survey in June 2008.

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

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

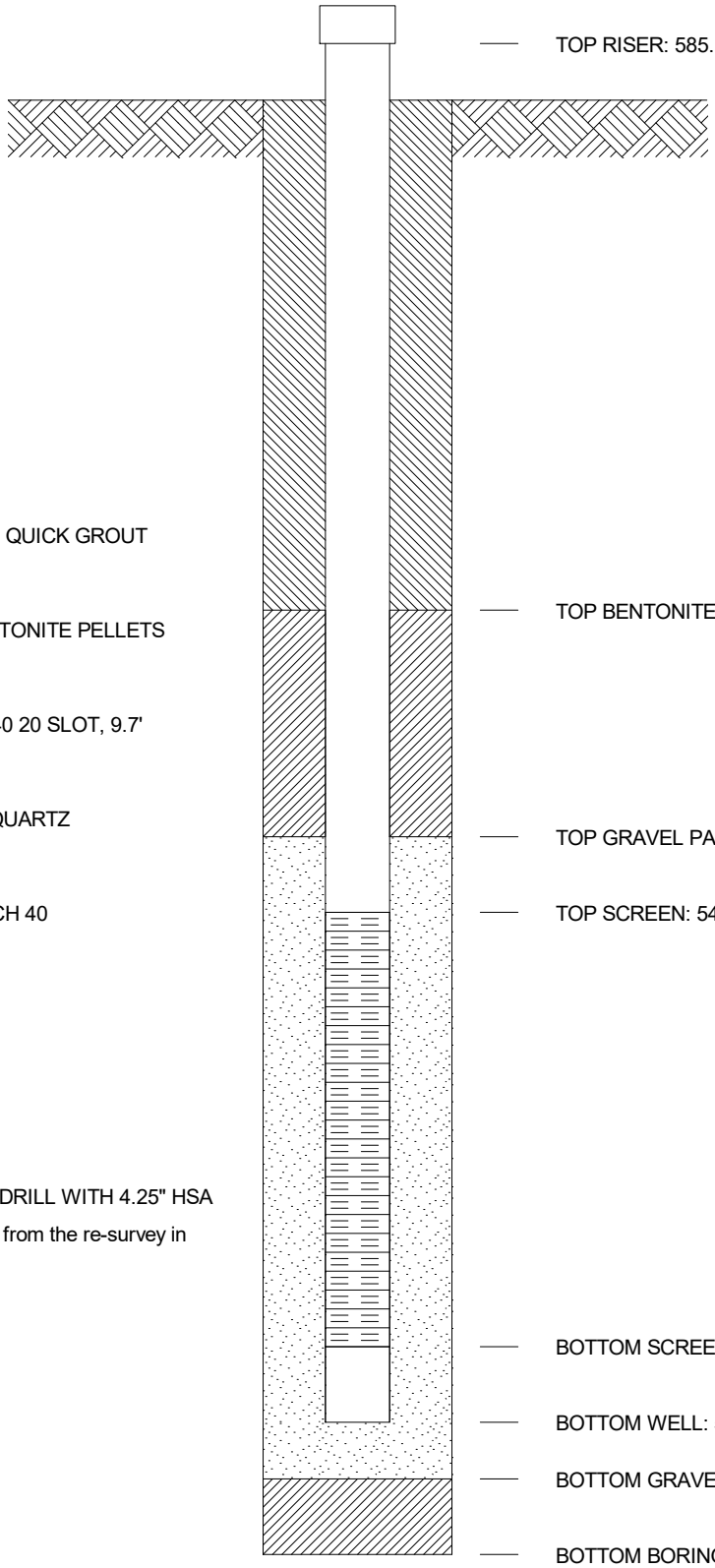
COMPANY _____ WELL No. **MW-010** BORING No. **010** INSTALLED **7/17/97**

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 716,771.2 E 1,738,107.3**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 583.19 FT.



GROUT SEAL: 100 GALLONS QUICK GROUT

BENTONITE SEAL: 100# BENTONITE PELLETS

SCREEN: 2.0 dia., PVC SCH 40 20 SLOT, 9.7'

GRAVEL PACK: 255# 7@#4 QUARTZ

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH:

PRE-PACK SCREEN. HOLE DRILL WITH 4.25" HSA

Coordinates and elevations are from the re-survey in June 2008.

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

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

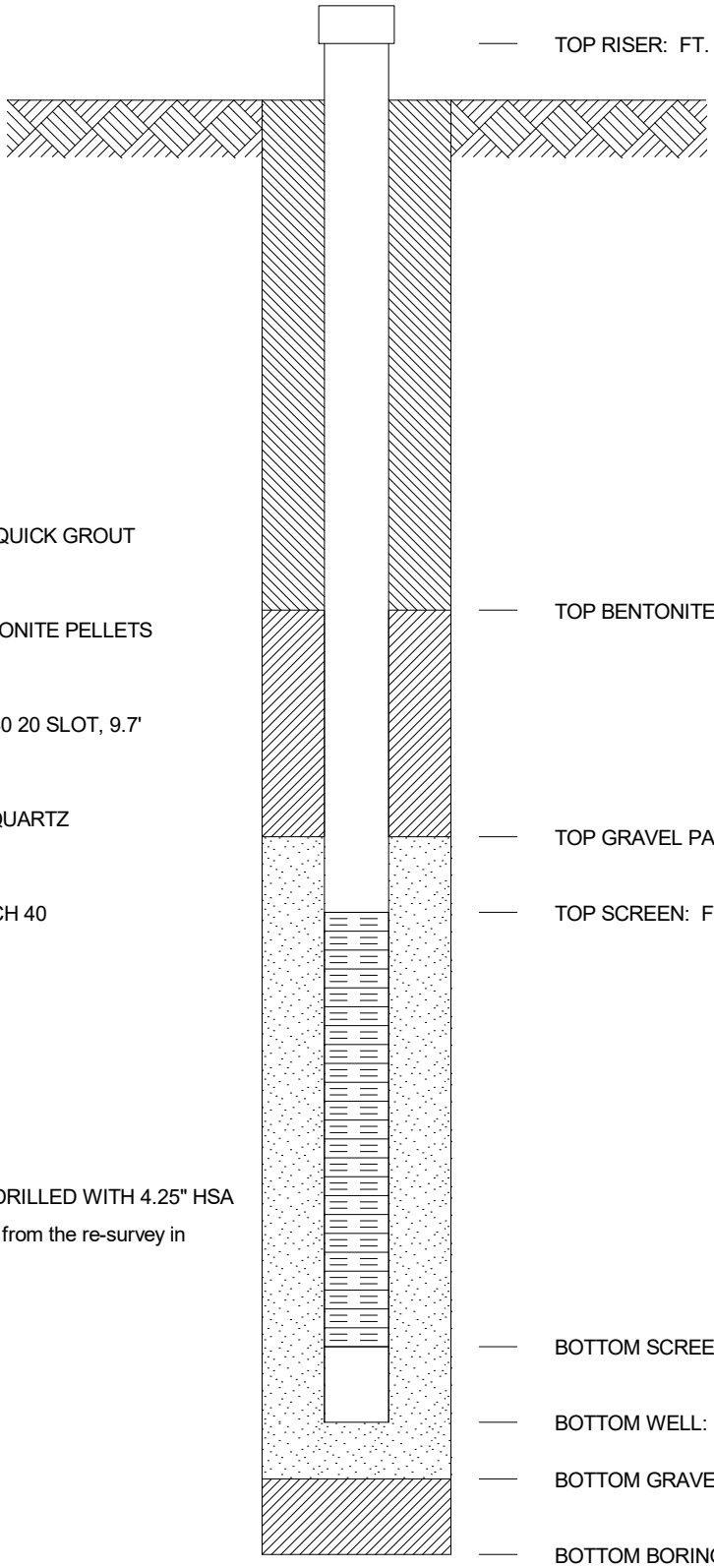
COMPANY _____ WELL No. **MW-011** BORING No. **011** INSTALLED **7/23/97**

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 717,666.4 E 1,736,450.7**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION FT.



GROUT SEAL: 75 GALLONS QUICK GROUT

BENTONITE SEAL: 30# BENTONITE PELLETS

SCREEN: 2.0 dia., PVC SCH 40 20 SLOT, 9.7'

GRAVEL PACK: 330# 7@#4 QUARTZ

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH:

PRE-PACK SCREEN HOLE DRILLED WITH 4.25" HSA

Coordinates and elevations are from the re-survey in June 2008.

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

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

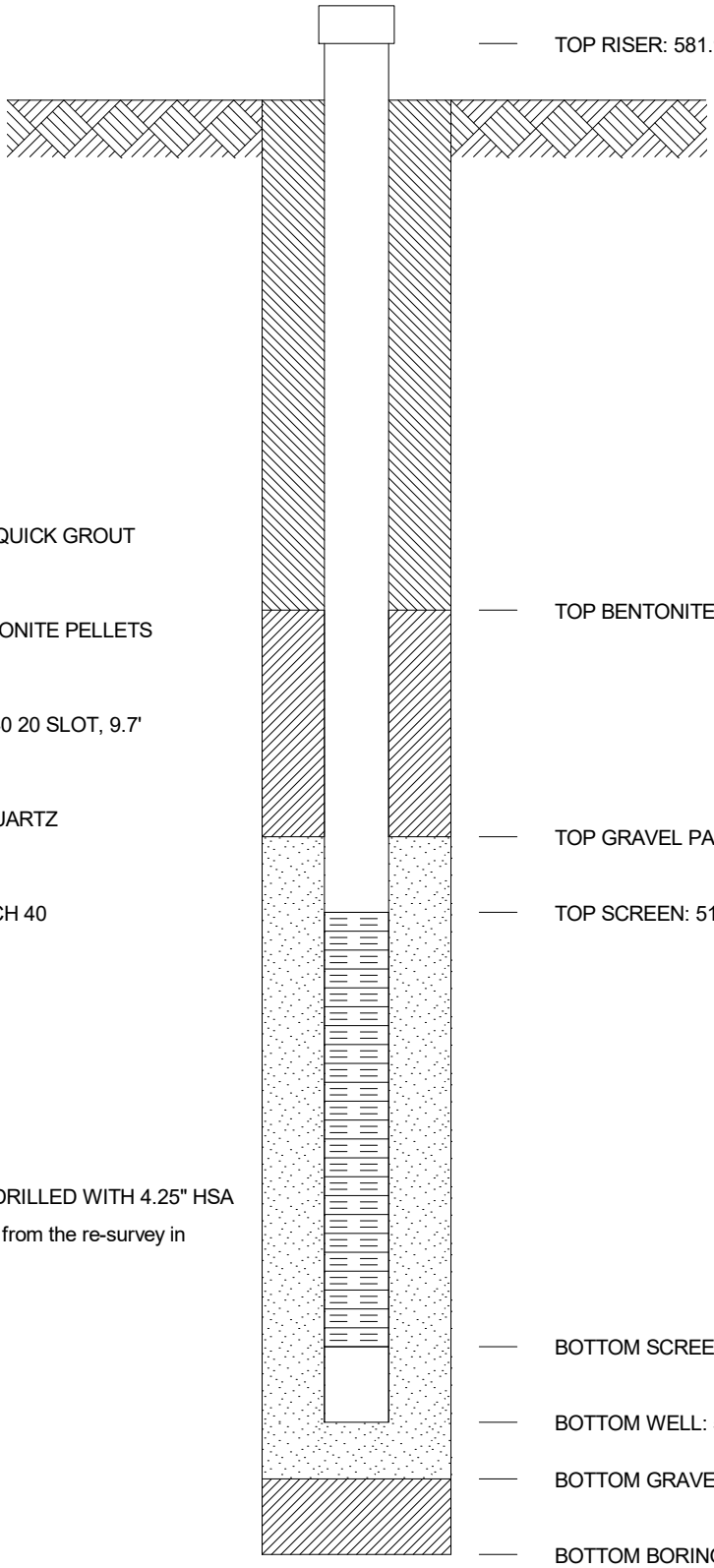
COMPANY _____ WELL No. **MW-012** BORING No. **012** INSTALLED **7/29/97**

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 718,753.1 E 1,737,045.5**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 579.96 FT.



GROUT SEAL: 75 GALLONS QUICK GROUT

BENTONITE SEAL: 40# BENTONITE PELLETS

SCREEN: 2.0 dia., PVC SCH 40 20 SLOT, 9.7'

GRAVEL PACK: 40# 7@#4 QUARTZ

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH:

PRE-PACK SCREEN HOLE DRILLED WITH 4.25" HSA

Coordinates and elevations are from the re-survey in June 2008.

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

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

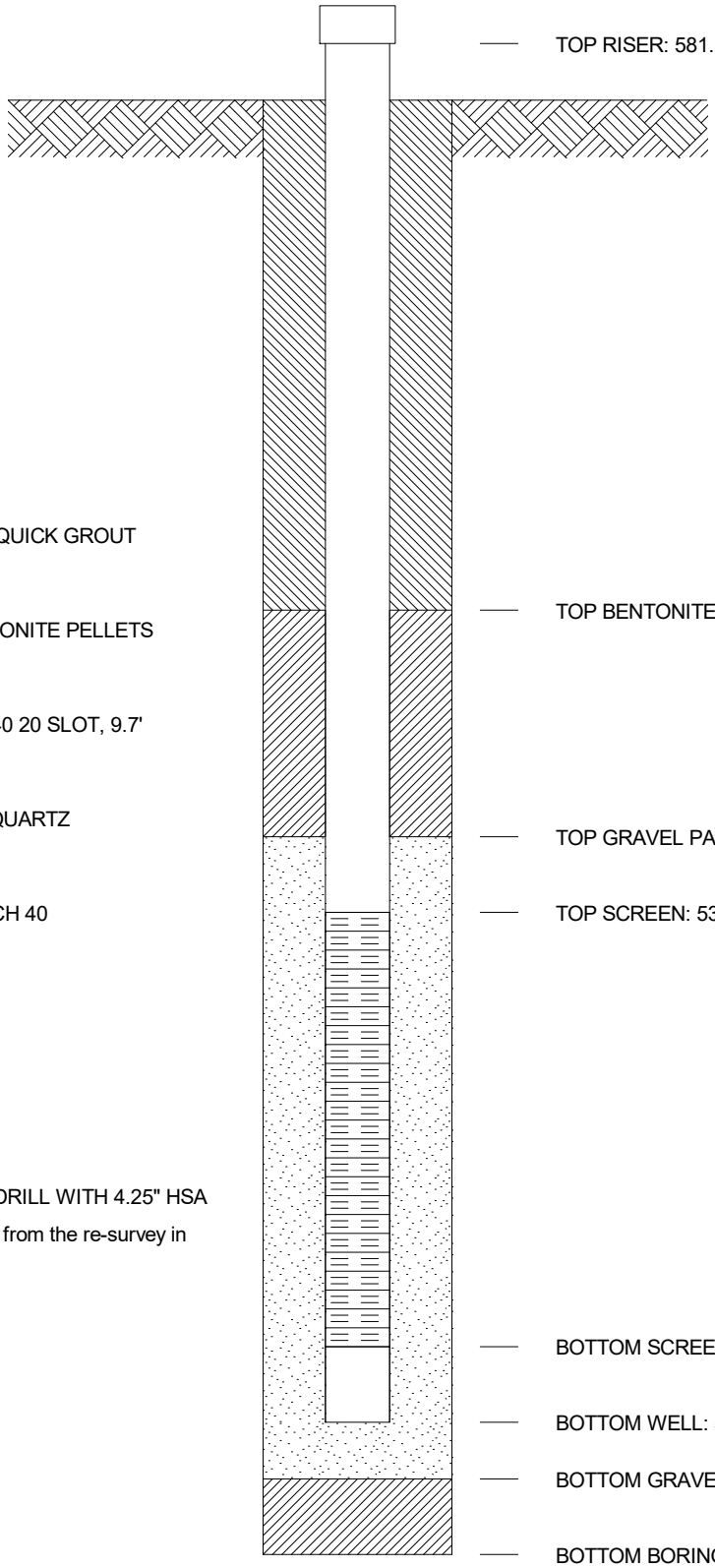
COMPANY _____ WELL No. **MW-013** BORING No. **013** INSTALLED **7/30/97**

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 718,758.6 E 1,737,044.4**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 579.48 FT.



GROUT SEAL: 50 GALLONS QUICK GROUT

BENTONITE SEAL: 85# BENTONITE PELLETS

SCREEN: 2.0 dia., PVC SCH 40 20 SLOT, 9.7'

GRAVEL PACK: 375# 7@#4 QUARTZ

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH:

PRE-PACK SCREEN HOLE DRILL WITH 4.25" HSA

Coordinates and elevations are from the re-survey in June 2008.

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

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

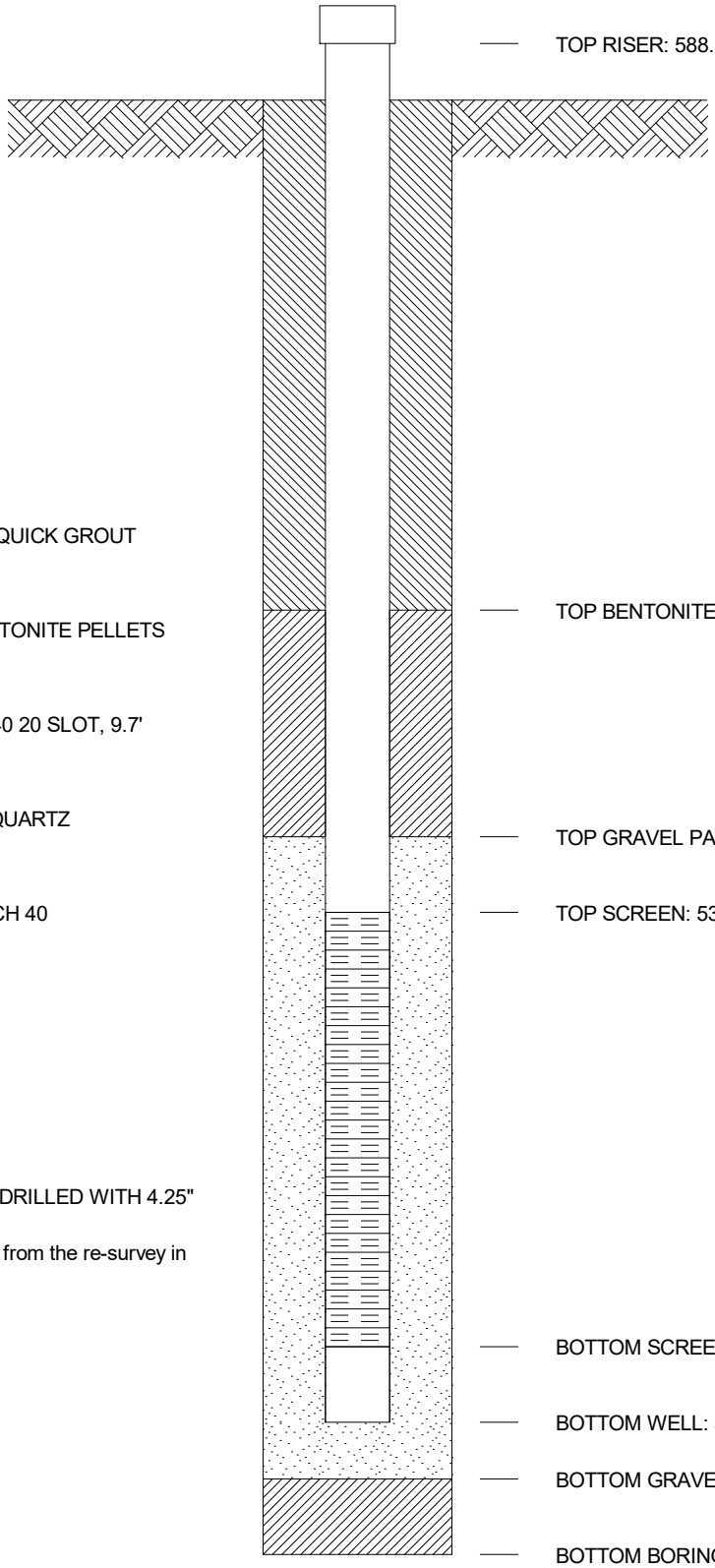
COMPANY _____ WELL No. **MW-014** BORING No. **014** INSTALLED **7/30/97**

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 718,892.4 E 1,736,827.8**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 586.89 FT.



GROUT SEAL: 75 GALLONS QUICK GROUT

BENTONITE SEAL: 100# BENTONITE PELLETS

SCREEN: 2.0 dia., PVC SCH 40 20 SLOT, 9.7'

GRAVEL PACK: 375# 7@#4 QUARTZ

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH:

PRE-PACK SCREEN. HOLE DRILLED WITH 4.25" HSA

Coordinates and elevations are from the re-survey in June 2008.

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

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

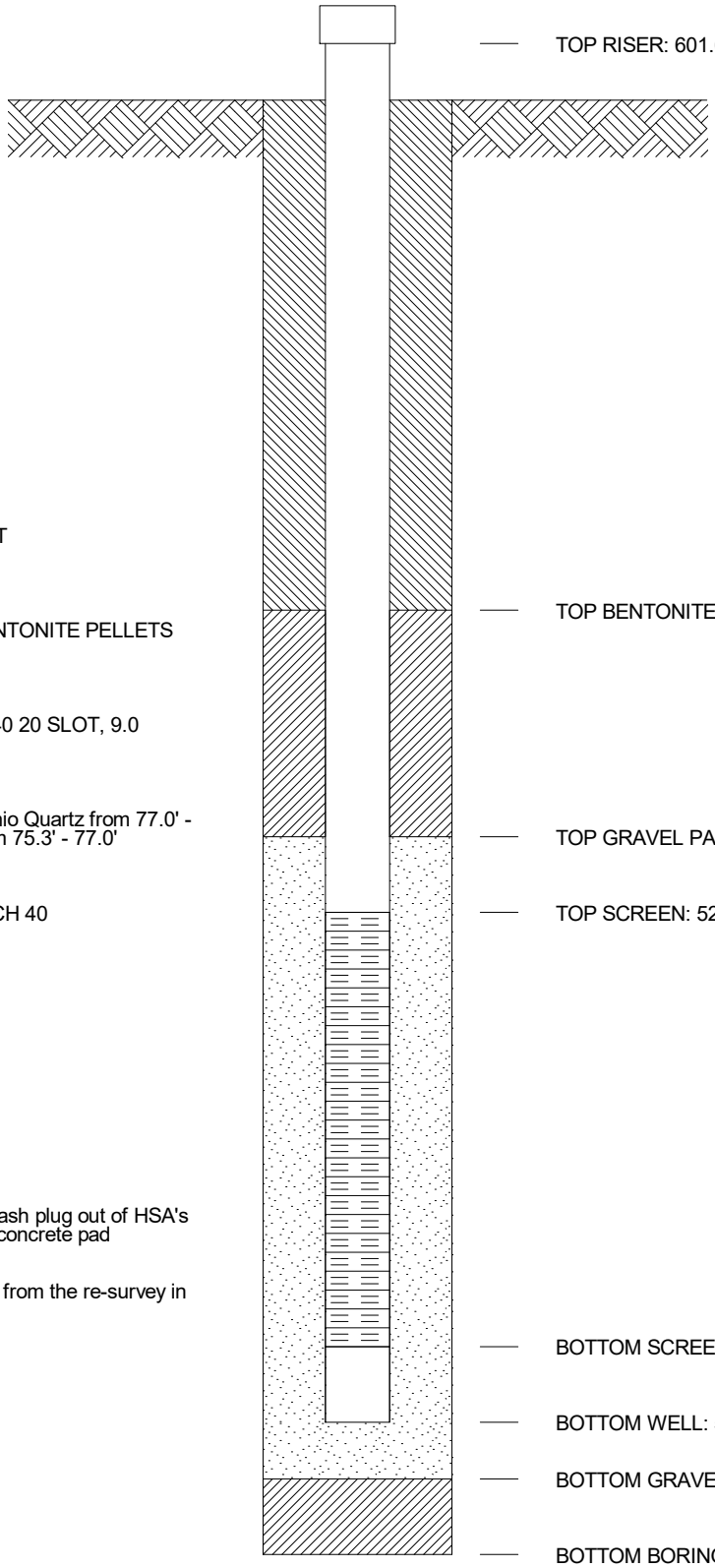
COMPANY _____ WELL No. **MW-015** BORING No. **MW-015** INSTALLED **12/11/01**

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 719,504.2 E 1,736,239.5**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 599.87 FT.



GROUT SEAL: QUICK GROUT

BENTONITE SEAL: 50 lbs BENTONITE PELLETS

SCREEN: 2.0 dia., PVC SCH 40 20 SLOT, 9.0

GRAVEL PACK: 200 lbs #4 Ohio Quartz from 77.0' - 89.6'; 75 lbs #7 Sand from 75.3' - 77.0'

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH:

Installed with 4.25" HSA's
Used 300 gallons of water to wash plug out of HSA's
Set steel protector and poured concrete pad
Grouted from 71.1' to grade

Coordinates and elevations are from the re-survey in June 2008.

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

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

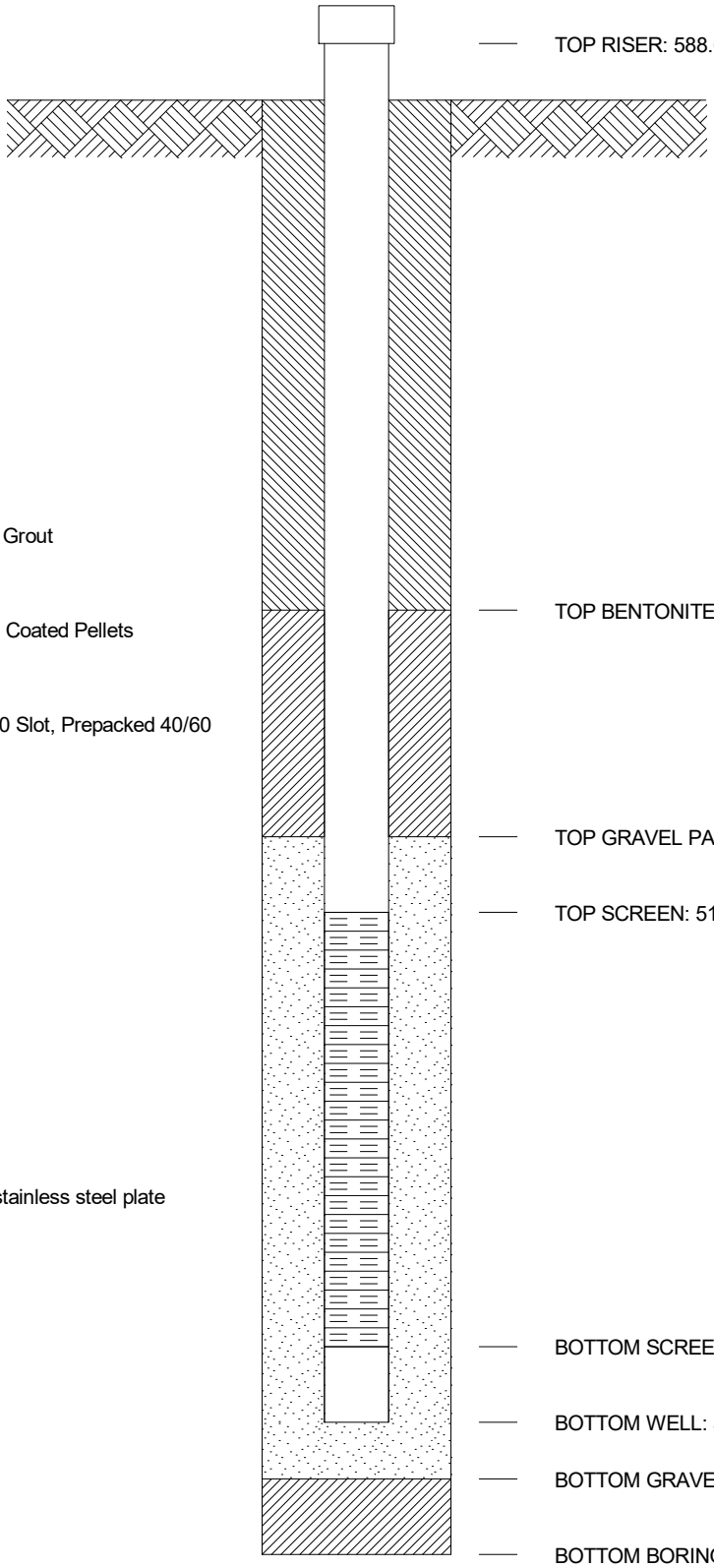
COMPANY _____ WELL No. **M-16** BORING No. **MW-16** INSTALLED **6/18/08**

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 721,431.5 E 1,732,814.2**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 586.82 FT.



GROUT SEAL: 300 gals Quick Grout

BENTONITE SEAL: 80 lbs 3/8" Coated Pellets

SCREEN: 2" dia., Sch 40, 0.010 Slot, Prepacked 40/60 Pack, 10'

GRAVEL PACK: 40/60 Pack

RISER PIPE: 2", dia., Sch 40

SPACERS, DEPTH: N/A

Installed with 6.25' HSA's and stainless steel plate

SWL @ install = 36.7'

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

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

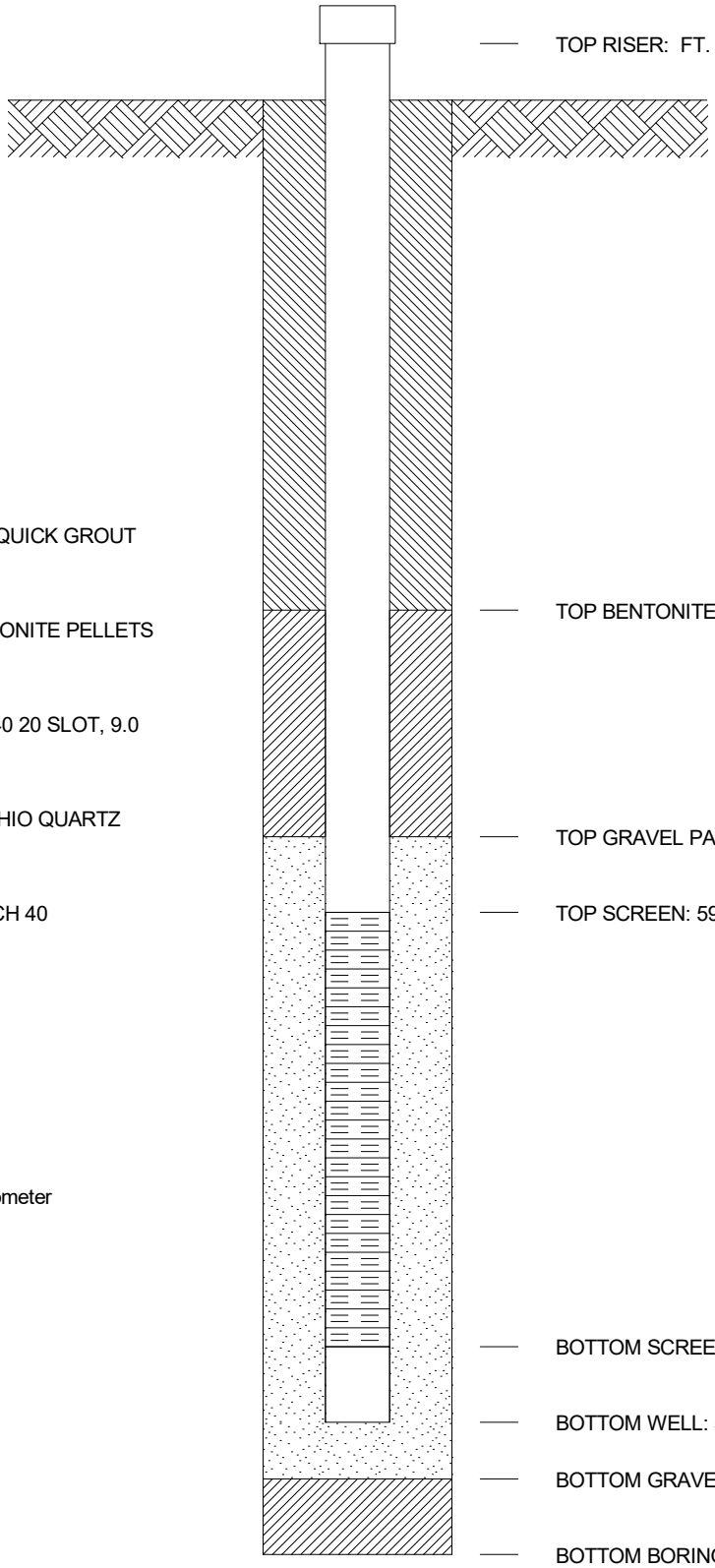
COMPANY _____ WELL No. **96-101** BORING No. **96-101** INSTALLED **6/5/96**

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 720,983.0 E 1,734,516.1**

SYSTEM **STATE PLANE**

GROUND ELEVATION 619.00 FT.



GROUT SEAL: 60 GALLONS QUICK GROUT

BENTONITE SEAL: 50# BENTONITE PELLETS

SCREEN: 1.0 dia., PVC SCH 40 20 SLOT, 9.0

GRAVEL PACK: 400# NO.4 OHIO QUARTZ

RISER PIPE: 1.0, dia., PVC SCH 40

SPACERS, DEPTH:

Flush mounted protector. Piezometer

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

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

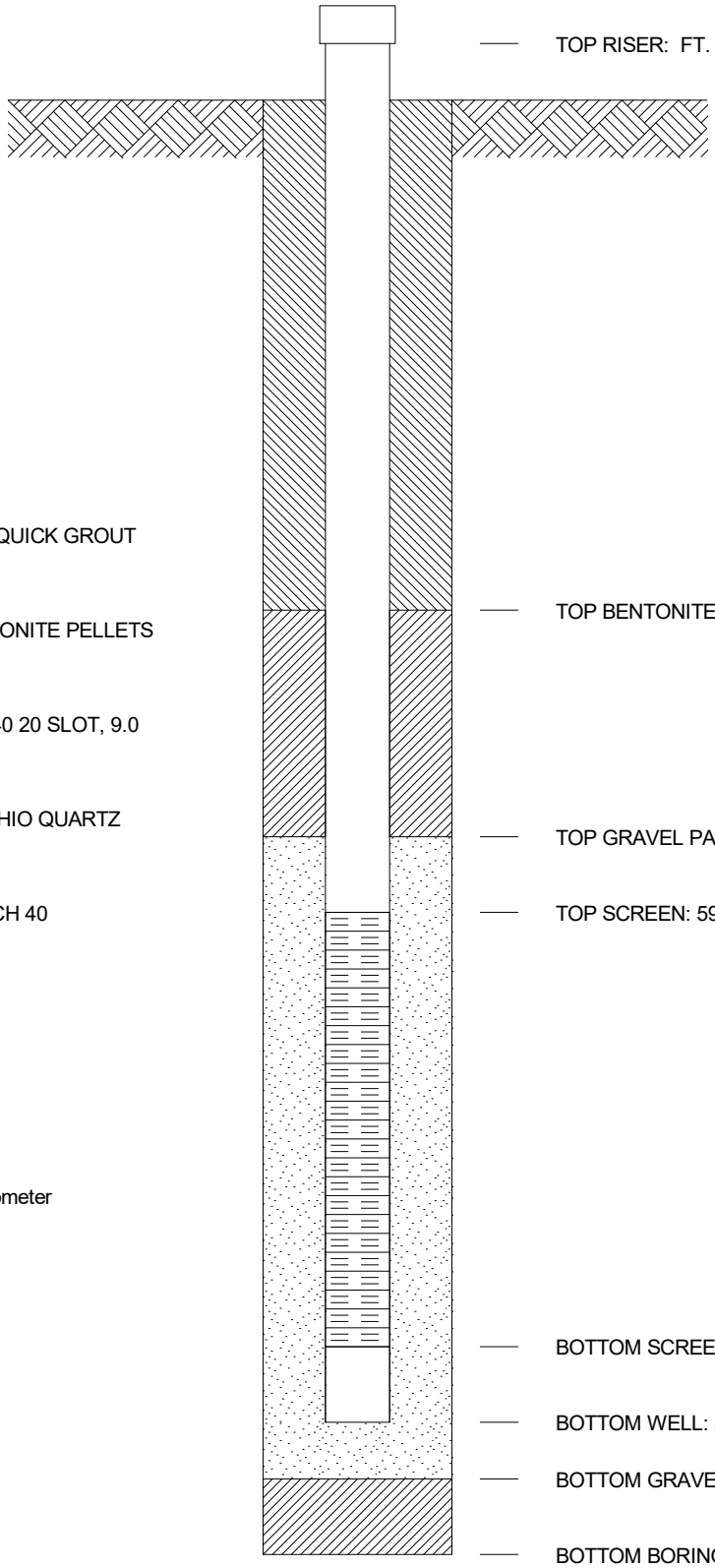
COMPANY _____ WELL No. **96-104** BORING No. **96-104** INSTALLED **6/4/96**

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 719,229.2 E 1,734,600.2**

SYSTEM **STATE PLANE**

GROUND ELEVATION 618.71 FT.



GROUT SEAL: 35 GALLONS QUICK GROUT

BENTONITE SEAL: 50# BENTONITE PELLETS

SCREEN: 1.0 dia., PVC SCH 40 20 SLOT, 9.0

GRAVEL PACK: 350# NO.4 OHIO QUARTZ

RISER PIPE: 1.0, dia., PVC SCH 40

SPACERS, DEPTH:

Flush mounted protector. Piezometer

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

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

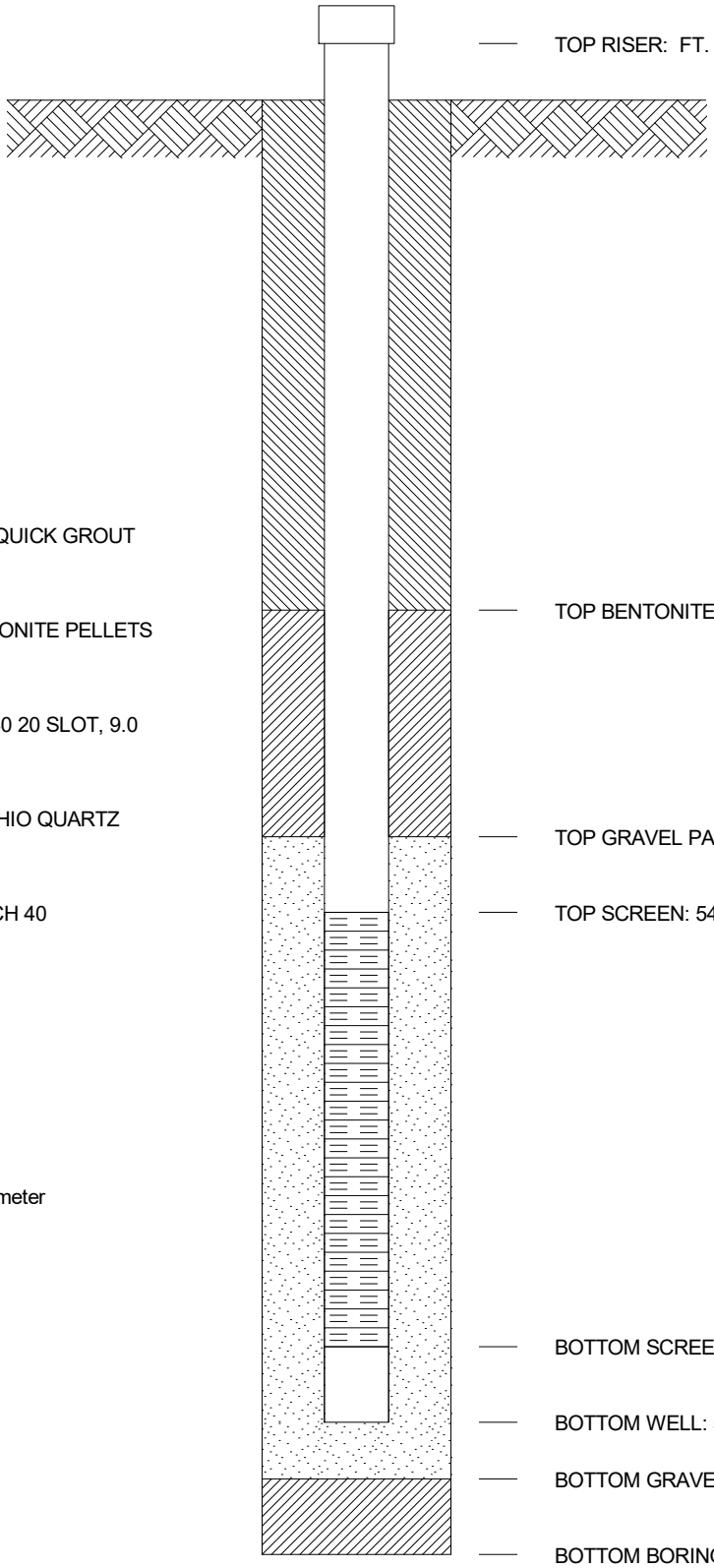
COMPANY _____ WELL No. **96-108** BORING No. **96-108** INSTALLED **6/11/96**

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 719,761.8 E 1,736,125.4**

SYSTEM **STATE PLANE**

GROUND ELEVATION 603.40 FT.



GROUT SEAL: 80 GALLONS QUICK GROUT

BENTONITE SEAL: 50# BENTONITE PELLETS

SCREEN: 1.0 dia., PVC SCH 40 20 SLOT, 9.0

GRAVEL PACK: 250# NO.4 OHIO QUARTZ

RISER PIPE: 1.0, dia., PVC SCH 40

SPACERS, DEPTH:

Flush mounted protector Piezometer

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

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

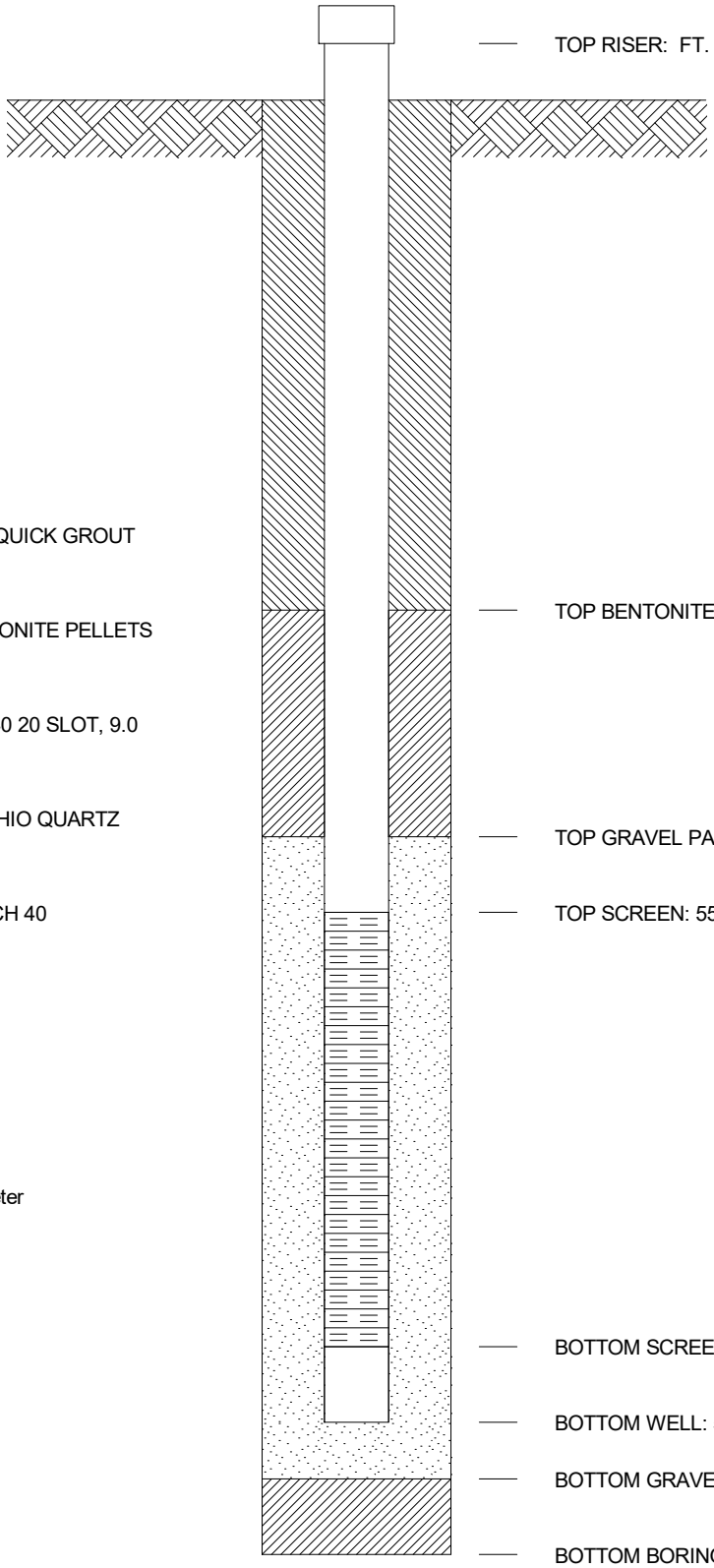
COMPANY _____ WELL No. **96-110** BORING No. **96-110** INSTALLED **6/10/96**

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 720,277.1 E 1,735,665.6**

SYSTEM **STATE PLANE**

GROUND ELEVATION 602.29 FT.



GROUT SEAL: 60 GALLONS QUICK GROUT

BENTONITE SEAL: 50# BENTONITE PELLETS

SCREEN: 1.0 dia., PVC SCH 40 20 SLOT, 9.0

GRAVEL PACK: 300# NO.4 OHIO QUARTZ

RISER PIPE: 1.0, dia., PVC SCH 40

SPACERS, DEPTH:

Flush mount protector Piezometer

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

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

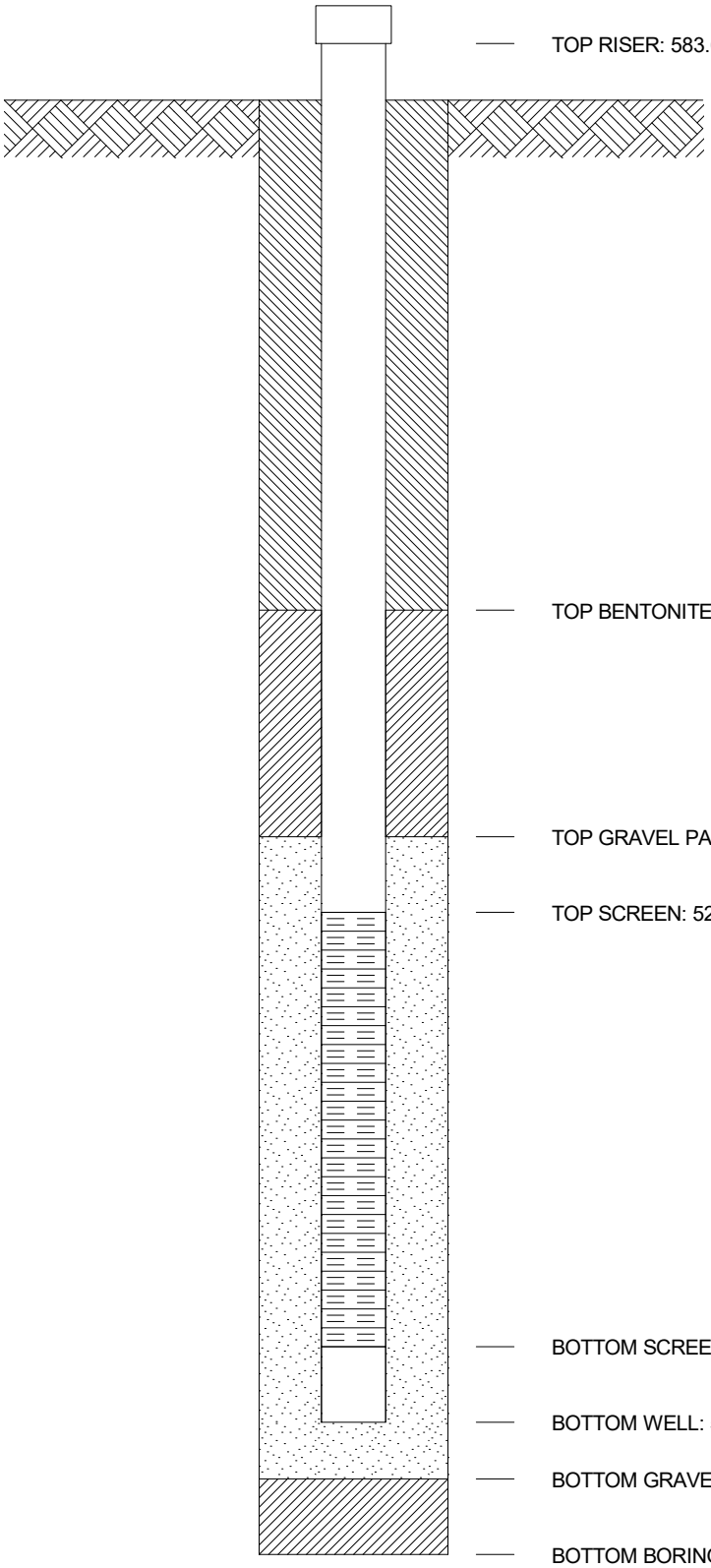
COMPANY _____ WELL No. **JTMN-1** BORING No. **JTMN-1** INSTALLED **7/19/90**

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 723,463.5 E 1,734,069.7**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 582.17 FT.



GROUT SEAL: Benseal

BENTONITE SEAL:

SCREEN: 2.0 dia., 20 slot, 19'

GRAVEL PACK:

RISER PIPE: 2.0, dia.,

SPACERS, DEPTH:

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

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

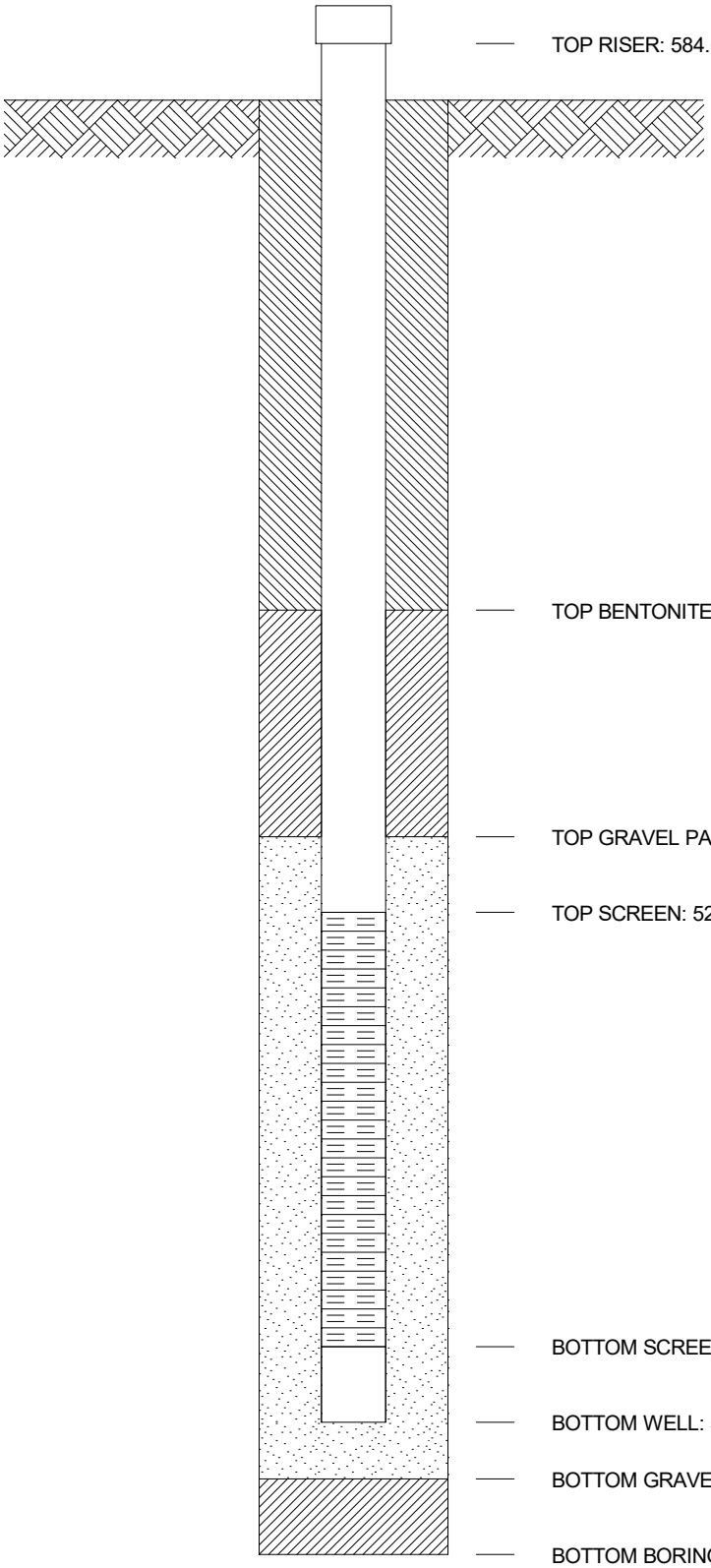
COMPANY _____ WELL No. **JTMN-2** BORING No. **JTMN-2** INSTALLED **7/18/90**

PROJECT **EPRI GROUND WATER STUDY**

COORDINATES **N 723,392.8 E 1,734,106.4**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 582.16 FT.



GROUT SEAL: Benseal

BENTONITE SEAL:

SCREEN: 2.0 dia., 20 slot, 19'

GRAVEL PACK:

RISER PIPE: 2.0, dia.,

SPACERS, DEPTH:

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

ARCADIS

AEP 2008, 2010

Production Well Information

East 1, West 1, Well 4 to Well 6

MOUNTAINEER SUPPLY WELLS

DATUM: NAD27 / NGVD29 WV S **Surveyed: 2/24/2010**

WELL	NORTH	EAST	ELEV.	DESC.	NOTE
EAST 1	722087.67	1734564.25	588.47	WELL PUMP	Top of PVC @ Inspection Hole
			585.91	GROUND	
WEST 1	721864.73	1734247.03	587.32	FGD	Top of Inspection Hole
			585.64	GROUND	
WELL 4	721739.55	1734875.42	583.43	WASTEWATER WELL	Top of Inspection Hole
			581.95	GROUND	
WELL 5	721130.76	1733439.50	589.09	WAREHOUSE	Top of Inspection Hole
			586.64	GROUND	
WELL 6	722576.53	1732461.99	588.45	OLD LAB	Top of Inspection Hole
			587.45	GROUND	

AEP-DOLAN CIVIL LAB

MT PLANT - WELL CONVERSIONS

25 February 2010

INPUT

State Plane, NAD27
4702 - West Virginia South, U.S. Feet

OUTPUT

Geographic, NAD27

EAST 1

1/5

Northing/Y: 722087.67
Easting/X: 1734564.25

Convergence: -0 34 37.84628
Scale Factor: 1.000021856

Latitude: 38 58 45.45449
Longitude: 81 56 01.14811

WEST 1

2/5

Northing/Y: 721864.73
Easting/X: 1734247.03

Convergence: -0 34 40.31173
Scale Factor: 1.000021706

Latitude: 38 58 43.21944
Longitude: 81 56 05.13625

WELL 4

3/5

Northing/Y: 721739.55
Easting/X: 1734875.42

Convergence: -0 34 35.38317
Scale Factor: 1.000021627

Latitude: 38 58 42.04479
Longitude: 81 55 57.16376

WELL 5

4/5

Northing/Y: 721130.76
Easting/X: 1733439.50

Convergence: -0 34 46.57452
Scale Factor: 1.000021213

Latitude: 38 58 35.88458
Longitude: 81 56 15.26701

Remark:

AEP-DOLAN CIVIL LAB

MT PLANT - WELL CONVERSIONS

25 February 2010

INPUT	OUTPUT
State Plane, NAD27 4702 - West Virginia South, U.S. Feet	Geographic, NAD27

WELL 6

5/5

Northing/Y: 722576.53
Easting/X: 1732461.99

Latitude: 38 58 50.07601
Longitude: 81 56 27.82955

Convergence: -0 34 54.34062
Scale Factor: 1.000022168

Remark:

Reynolds, Inc.

6451 Germantown Road * Middletown, Ohio 45042 * Phone: (513) 424-7287

Date: 12/12/2008

Job No.: 68658

PRODUCTION TEST

FGD West Well

Owner: AEP - Mountaineer Plant City: New Haven State: WV

Well No.: FGD West Location: in gravel area

Measured from Top Casing: X Total Depth 77' Inside Diam. 16" Static Level / Standing Water Level 44.70'

Type Well: Gravel Wall X Tubular Rock New X

Old Cleaned Gravel Wall Diam. 30"

Screen: Length 15' Diam. 16" Slot Size 60

Type Stainless Steel-Pipe Size Depth to top 62'

Driven By : Electric Engine Pump Bowl Stages

Length Suction Pipe None X Well Top to Bottom of Suction

Orifice Size 6 By 5 Water discharged 200' from well into pit in building

Well Top to Bottom of Air Line N/A Gauge Reads: Feet Pounds

TIME	INCHES ON ORIFICE	G.P.M.	P.S.I.	AMPS	PUMPING LEVEL (ft)	DRAW DOWN (ft)	SPECIFIC CAPACITY	COMMENTS
8:27 AM					44.70			SWL
9:10 AM	6.0	305						Pump on
9:12 AM					47.50	2.80		
9:14 AM					47.60			
9:17 AM					47.70	3.00		
9:21 AM					47.70			
9:30 AM					47.75			
9:34 AM	6.5	317			47.78	3.08		
9:38 AM					47.81			
9:45 AM					47.83			
9:50 AM					47.86	3.16	100.0	
9:55 AM					47.89			
								Step 2
9:57 AM					49.40			

Tested and Witnessed By Terry Breckenridge Witnessed By For Purchaser

TC during test - 32" above gr.

Date 12/12/2008 Job No. 68658 PAGE: 2 of 3

TIME	INCHES ON ORIFICE	G.P.M.	P.S.I.	AMPS	PUMPING LEVEL (ft)	DRAW DOWN (ft)	SPECIFIC CAPACITY	COMMENTS
9:59 AM	13.5	457			49.35			
10:01 AM					49.36	4.66	98.0	
10:07 AM					49.40			
10:12 AM					49.43			
10:16 AM					49.50			
10:21 AM					49.50	4.80	95.0	
10:28 AM					49.55			
10:32 AM					49.56			
10:35 AM					49.57	4.87	94.0	
10:40 AM								Step 3
10:40 AM	23.5	603						
10:41 AM	24.5	616			51.00	6.30	98.0	
10:43 AM					51.05			
10:45 AM					51.06			
10:52 AM					51.12			
10:55 AM					51.13	6.43	96.0	
11:02 AM					51.18	6.48		
11:08 AM					51.21			
11:09 AM					39.50			FGD East
11:11 AM					51.23			
11:14 AM					51.24	6.54	94.0	
11:20 AM					51.26	6.56		
11:25 AM					51.28			
11:30 AM								Step 4
11:32 AM	30.0	682			51.85	7.15		
11:35 AM					51.98	7.28	94.0	
11:40 AM					52.00	7.30		
11:46 AM					39.70			FGD East
11:50 AM					52.01	7.31		
11:55 AM					52.05	7.35		

Date 12/12/2008 Job No. 68658 Page No. 3 of 3

TIME	INCHES ON ORIFICE	G.P.M.	P.S.I.	AMPS	PUMPING LEVEL (ft)	DRAW DOWN (ft)	SPECIFIC CAPACITY	COMMENTS
12:00 PM					52.07	7.37	92.5	
12:15 PM	30	682			52.13	7.43	91.7	
12:30 PM					52.16	7.46		
12:35 PM					39.80			FGD East
12:45 PM					52.19	7.49		
1:00 PM					52.23	7.53		
1:05 PM					52.23	7.53		
1:09 PM					52.24	7.54		
1:10 PM								Pump off
1:11 PM					45.60	0.90		
1:12 PM					45.60	0.90		
1:13 PM					45.75	1.05		
1:14 PM					40.20			FGD East
1:17 PM					45.70	1.00		
1:18 PM					45.70	1.00		
1:20 PM					45.64	0.94		
1:30 PM					45.50	0.80		
1:37 PM					45.40	0.70		
1:44 PM					45.35	0.65		
2:30 PM					45.12	0.42		
2:35 PM					40.20			FGD East

Reynolds, Inc.

6451 Germantown Road * Middletown, Ohio 45042 * Phone: (513) 424-7287

Date: 12/17/2008

Job No.:

PRODUCTION TEST

FGD East Well

Owner: AEP - Mountaineer Plant City: New Haven State: WV

Well No.: FGD East Location: along railroad tracks

Measured from Ground Level: Total Depth 78' Inside Diam. 16" Static Level / Standing Water Level 45.38'

Type Well: Gravel Wall X Tubular Rock New X

Old Cleaned Gravel Wall Diam. 30"

Screen: Length 15' Diam. 16" Slot Size 60

Type Stainless Steel - Pipe Size Depth to top 63'

Driven By : Electric Engine Pump Bowl Stages

Length Suction Pipe None: X Well Top to Bottom of Suction

Orifice Size By Water Discharged 600' + /- from well into pit in building

Well Top to Bottom of Air Line N/A Gauge Reads: Feet Pounds

TIME	INCHES ON ORIFICE	G.P.M.	P.S.I.	AMPS	PUMPING LEVEL (ft)	DRAW DOWN (ft)	SPECIFIC CAPACITY	COMMENTS
10:30 AM								Stop surging east well
10:52 AM					45.45	+ 0.07		
11:00 AM					45.45	+ 0.07		
11:15 AM					45.40	+ 0.02		
11:25 AM					44.59			FGD West
11:27 AM					45.38	0		SWL
11:30 AM								Pump on
11:31 AM					48.27	2.89		Rate 1
11:32 AM					48.30	2.92		
11:33 AM					48.33	2.95		
11:35 AM					48.35	2.97		
11:40 AM	6.0	305			48.85	3.47		
11:44 AM					48.90	3.52	95	
11:50 AM					49.00	3.62		

Tested and Witnessed By Terry Breckenridge Witnessed By For Purchaser

TC 2.7' above ground

450' + / - north of Ohio Drilling well (original FGD well)

TIME	INCHES ON ORIFICE	G.P.M.	P.S.I.	AMPS	PUMPING LEVEL (ft)	DRAW DOWN (ft)	SPECIFIC CAPACITY	COMMENTS
11:55 AM	5.0	278			49.15	3.77	74	
12:00 PM					49.14	3.76		
12:04 PM					44.60			FGD West
12:10 PM					49.19	3.81		
12:14 PM					49.20	3.82		
12:15 PM								Rate 2
12:19 PM					50.91	5.53		
12:20 PM					50.94	5.56		
12:23 PM	10.5	403			50.97	5.59	72	
12:25 PM					50.97	5.59		
12:29 PM					44.62			FGD West
12:34 PM					51.02	5.64		
12:38 PM					51.04	5.66	71	
12:43 PM					51.05	5.67		
12:50 PM					51.08	5.7		
12:51 PM					44.67			FGD West
12:55 PM					51.10	5.73		
1:00 PM								Rate 3
1:07 PM	23.5	603			54.20	8.82		
1:08 PM					54.20	8.82		
1:10 PM					54.21	8.83		
1:11 PM					47.67			FGD West
1:13 PM					54.22	8.84		
1:18 PM					54.23	8.85		
1:27 PM					54.28	8.9		
1:35 PM					54.30	8.92		
1:40 PM					54.32	8.94		
1:45 PM								Rate 4
1:47 PM	41.5	802			56.88	11.5	70	
1:50 PM					57.92	12.24		
1:52 PM					57.60	12.22		
1:54 PM					57.65	12.27		

TIME	INCHES ON ORIFICE	G.P.M.	P.S.I.	AMPS	PUMPING LEVEL (ft)	DRAW DOWN (ft)	SPECIFIC CAPACITY	COMMENTS
1:57 PM					57.6	12.28		
1:58 PM					44.71			FGD West
2:00 PM					57.69	12.31		
2:04 PM					57.70	12.32	65	
2:06 PM					57.70	12.32		
2:07 PM					57.72	12.34		
2:08 PM	41.5	802			57.71	12.33		
2:10 PM					57.75	12.37		
2:13 PM					57.76	12.38		
2:15 PM								Rate 5
2:19 PM	52.5	902			58.85	13.47	67	
2:22 PM					59.59	14.21		
2:24 PM					59.60	14.22		
2:25 PM					59.60	14.22		
2:27 PM					59.63	14.25		
2:30 PM					59.64	14.26		
2:31 PM					44.73			FGD West
2:40 PM					59.73	14.35		
2:43 PM					59.75	14.37		
2:45 PM								Rate 6
2:47 PM	64.5	1000			60.55	15.17		
2:48 PM					61.20	15.82		
2:50 PM					61.25	15.87		
2:51 PM					44.72			FGD West
2:52 PM					61.28	15.9		
2:54 PM					61.30	15.92		
2:58 PM					61.34	15.96		
3:01 PM					61.35	15.97		
3:05 PM					61.39	16.01		
3:08 PM					61.40	16.02		
3:12 PM					61.41	16.03		
3:14 PM					61.44	16.06	62.5	

Date 12/17/2008 Job No. Page No. Page 4 of 4

TIME	INCHES ON ORIFICE	G.P.M.	P.S.I.	AMPS	PUMPING LEVEL (ft)	DRAW DOWN (ft)	SPECIFIC CAPACITY	COMMENTS
3:15 PM								Pump off
3:16 PM					47.00	1.65		Recovery
3:18 PM					46.70	1.32		
3:19 PM					46.66	1.28		
3:20 PM					46.55	1.17		
3:21 PM					46.53	1.15		
3:22 PM					46.50	1.12		
3:23 PM					46.48	1.1		
3:25 PM					46.41	1.03		
3:30 PM					46.30	0.92		
3:40 PM					44.72			FGD West

Reynolds, Inc.

6451 Germantown Road * Middletown, Ohio 45042 * Phone: (513) 424-7287

Date: 7/8/2008

Job No.: 68570

PRODUCTION TEST

Owner: AEP-Mountaineer Plant City: New Haven State: WV

Well No.: Fire Well #1 Location: 50' +/- from old Fire Well #1 (Abandoned)

Measured from Ground Level: Total Depth Inside Diam. 10 Static Level / Standing Water Level 40.52

Type Well: Gravel Wall 16 Tubular Rock New X

Old Cleaned Gravel Wall Diam. 16"

Screen: Length 15' Diam. 10" PS Slot Size 80

Type Johnson Depth to top 63 (Bel. Gr.)

Driven By : Electric X Engine Pump Bowl Test Pump Stages

Length Suction Pipe None Well Top to Bottom of Suction NA

Orifice Size 6 By 5 Water Discharged 300 from Well into Cooling Tower

Well Top to Bottom of Air Line N/A Gauge Reads: Feet Pounds

TIME	INCHES ON ORIFICE	G.P.M.	P.S.I.	AMPS	PUMPING LEVEL	DRAW DOWN	SPECIFIC CAPACITY	COMMENTS
11:00 AM	6	305			45.22	4.70		
11:10 AM					45.45	4.93		
11:20 AM					45.47	4.95	61.2	
11:30 AM	14	466			49.61	9.09		
11:40 AM					49.59	9.07		
11:50 AM					49.54	9.02	51.8	
12:00 PM	22	584			52.00	11.48		
12:30 PM					52.25	11.73		
1:00 PM					52.30	11.78		
1:30 PM					52.25	11.73	49.8	
								Water clear
								at end of test

Tested and Witnessed By Steve Back Witnessed By For Purchaser

Rev 3/08

DT/CO USE ONLY
DATE RECEIVED
MM DD YY
__ __ __

DATE THE WELL WAS COMPLETED
MM DD YY
07 08 08

PERMIT NO.
DW-_____

STATE OF WEST VIRGINIA WATER WELL COMPLETION REPORT

FORM SW-258
THIS REPORT MUST BE SUBMITTED WITHIN 30 DAYS AFTER WELL IS COMPLETED

FILL IN THIS FORM COMPLETELY
PLEASE PRINT OR TYPE

LOCATION OF WELL
Well Owner: ~~XXXXXXXX~~ AEP ~~XXXXXXXX~~ Mountaineer Power Plant
Street/Road Route 62 County Mason Zip Code 25265-0419

Latitude: 38 Deg 58.603 Min
Longitude: 81 Deg 56.240 Min
Acquired By: [X] GPS [ ] Topo [ ] Other

AREA NAME/LOCATION:
Fire Well #1
Replacement Well

TYPE OF WELL:
[ ] Potable [ ] Public Water Supply
[ ] Geothermal [X] Industrial
[ ] Commercial [ ] Dewatering
[ ] Irrigation [ ] Test/Exploratory
[ ] Other _____

WELL LOG

Depth From (ft.)	Depth To (ft.)	State the kind of formation penetrated, their color, caves, and if water bearing with estimate flow (GPM).
0	3	Top Soil
3	15	Br. sandy clay
	30	Br. sand and gravel
30	35	Same
35	40	Same
40	45	Br. medium sand little gravel
45	60	Br. medium sand
60	78	Br. medium sand little gravel

If additional space is needed, use additional sheets and attach w/permit # at top.

DRILLING METHOD
[X] Cable Tool [ ] Rotary
[ ] Rotary Hammer [ ] Other

Hole Diameter 16 (in)
Total depth 78 (ft)

CASINGS RECORD
MAIN CASING TYPE
[X] Steel [ ] Plastic
[ ] Other _____
Casing Diameter 10 (in)
Wall Thickness 0.365 (in)
Casing Length 63 (ft)

Other Casing or Liner Used
Type [ ] Steel [ ] Plastic
[ ] Other _____
Casing/Liner Diameter _____(in)
Length _____(ft) from _____(ft)
to _____(ft)

SCREEN RECORD - SS
[ ] Not Installed [X] Installed
Material: [ ] Bronze [ ] Plastic
Diameter of screen 10 PS (in)
Slot size 70
Length 15 (ft) from _____(ft)
to _____(ft)

GRAVEL PACK RECORD
Gravel Pack: [✓] Yes [ ] No
From 63 (ft) to 78 (ft)

GROUTING RECORD
Grouting Material:
[X] Cement [ ] Bentonite Clay
Other _____
No. of Bags: Bulk
Installation Method:
Tremic

PUMP INSTALLED
By Driller [X] Yes [ ] No

ESTIMATED WELL YIELD
Estimated at 500 G.P.M
Static Water Level 40.5 (ft)
*Pumping level below land surface
52 (ft) after 2.5 hrs. at
580 G.P.M. (Estimated)
*Note: For Public Water Supply wells please submit required yield and drawdown tests.

WELL HEAD COMPLETION
Casing height above grade 2 (ft)
Type Of Well Cap Baker
Installed: Pitless adaptor

VARIANCE ISSUED [ ] Yes [ ] No
Request Number _____

COMMENTS BY INSTALLER:
New Fire Well #1 -
50' +/- from old Well #1

Old Fire Well #1 abandoned/sealed

I hereby certify that this well has been constructed in accordance with state rules and in conformance with all conditions stated in the above captioned permit, and that the information presented herein is accurate and complete to the best of my knowledge.

Company Name Reynolds, Inc. WV Contractor No. WV0000825
Business Registration No._____ Master Well Driller Certification No. _____
Master Well Driller (print) John Workman
Master Well Driller Signature _____

E SUPERVISOR (SIGNATURE OF DRILLER OR JOURNEYMAN RESPONSIBLE FOR ...TEWORK IF DIFFERENT FROM MASTER DRILLER.)

Journeyman Well Driller Certification No. _____
Journeyman Well Driller (please print)_____
Apprentice and Name (s)_____, _____

Rev 3/08

ST/CO USE ONLY
DATE RECEIVED
MM DD YY
___ ___ ___

DATE THE WELL WAS COMPLETED
MM DD YY
12 10 08

PERMIT NO.
DW-_____

STATE OF WEST VIRGINIA WATER WELL COMPLETION REPORT

FORM SW-258
THIS REPORT MUST BE SUBMITTED WITHIN 30 DAYS AFTER WELL IS COMPLETED

FILL IN THIS FORM COMPLETELY
PLEASE PRINT OR TYPE

LOCATION OF WELL
Well Owner: Last Name American Electric Power ~~XXXXXXX~~ Mountaineer Plant
Street/Road Route 62, New Haven | County Mason | Zip.Code 26265-0419

Latitude: _____ Deg _____ Min _____ Sec
Longitude: _____ Deg _____ Min _____ Sec
Acquired By: [X] GPS [ ] Topo [ ] Other

AREA NAME/LOCATION:
FGD West Well

TYPE OF WELL:
[ ] Potable [ ] Public Water Supply
[ ] Geothermal [X] Industrial
[ ] Commercial [ ] Dewatering
[ ] Irrigation [ ] Test/Exploratory
[ ] Other _____

WELL LOG

Depth From (ft.)	Depth To (ft.)	State the kind of formation penetrated, their color, caves, and if water bearing with estimate flow (GPM).
0	13	Fill (fly ash)
13	52	Sand, Little gravel
52	78	Med- Coarse sand and gravel
78		Clay

If additional space is needed, use additional sheets and attach w/permit # at top.

DRILLING METHOD
[X] Cable Tool [ ] Rotary
[ ] Rotary Hammer [ ] Other
Hole Diameter 30 (in)
Total depth 78 (ft)

CASINGS RECORD
MAIN CASING TYPE
[X] Steel [ ] Plastic
[ ] Other _____
Casing Diameter 16 (in)
Wall Thickness 0.375 (in)
Casing Length 63 (ft)

Other Casing or Liner Used
Type [ ] Steel [ ] Plastic
[ ] Other _____
Casing/Liner Diameter _____ (in)
Length _____ (ft) from _____ (ft) to _____ (ft)

SCREEN RECORD
[ ] Not Installed [X] Installed
Material: [ ] Bronze [X] ~~Plastic~~ SS
Diameter of screen 16 (in)
Slot size 0.06
Length 15 (ft) from 63 ✓ (ft) to 78 (ft)

GRAVEL PACK RECORD
Gravel Pack: [X] Yes [ ] No
From 25 (ft) to 78 (ft)

GROUTING RECORD
Grouting Material:
[X] Cement [ ] Bentonite Clay
Other _____
No. of Bags: Bulk
Installation Method:

PUMP INSTALLED
By Driller [X] Yes [ ] No

ESTIMATED WELL YIELD
Estimated at 850 G.P.M
Static Water Level 44.70 (ft)
*Pumping level below land surface
52.24 (ft) after 4 hrs. at
682 G.P.M. (Estimated)
*Note: For Public Water Supply wells please submit required yield and drawdown tests.

WELL HEAD COMPLETION
Casing height above grade 2 (ft)
Type Of Well Cap Installed: Baker Pitless

VARIANCE ISSUED [ ] Yes [ ] No
Request Number _____

COMMENTS BY INSTALLER:
Pump Test noted above was Step Test at:

317 gpm
457 gpm
616 gpm
682 gpm

I hereby certify that this well has been constructed in accordance with state rules and in conformance with all conditions stated in the above captioned permit, and that the information presented herein is accurate and complete to the best of my knowledge.

Company Name Reynolds, Inc. WV Contractor No. WV 000825
Business Registration No._____ Master Well Driller Certification No. _____
Master Well Driller (print) John Workman
ster Well Driller Signature _____

SITE SUPERVISOR (SIGNATURE OF DRILLER OR JOURNEYMAN RESPONSIBLE FOR SITEWORK IF DIFFERENT FROM MASTER DRILLER.)

Journeyman Well Driller Certification No. _____
Journeyman Well Driller (please print)_____
Apprentice and Name (s)_____, _____

Rev 3/08

ST/CO USE ONLY
ATE RECEIVED
MM DD YY
___ ___ ___

DATE THE WELL WAS COMPLETED
MM DD YY
12 12 08

PERMIT NO.
DW-_____

STATE OF WEST VIRGINIA WATER WELL COMPLETION REPORT

FORM SW-258
THIS REPORT MUST BE SUBMITTED WITHIN 30 DAYS AFTER WELL IS COMPLETED

FILL IN THIS FORM COMPLETELY
PLEASE PRINT OR TYPE

LOCATION OF WELL
Well Owner: Last Name American Electric Power First Name Mountaineer Plant
Street/Road Route 62, New Haven | County Mason | Zip Code 26265-0419

Latitude: _____ Deg _____ Min _____ Sec
Longitude: _____ Deg _____ Min _____ Sec
Acquired By: [X] GPS [ ] Topo [ ] Other

AREA NAME/LOCATION:
FGD East Well

TYPE OF WELL:
[ ] Potable [ ] Public Water Supply
[ ] Geothermal [X] Industrial
[ ] Commercial [ ] Dewatering
[ ] Irrigation [ ] Test/Exploratory
[ ] Other _____

WELL LOG

Depth From (ft.)	Depth To (ft.)	State the kind of formation penetrated, their color, caves, and if water bearing with estimate flow (GPM).
0	12	Fill (sand and gravel)
12	49	Sand, Little gravel
49	78	Med -coarse sand and gravel
78		Clay

If additional space is needed, use additional sheets and attach w/permit # at top.

DRILLING METHOD
[X] Cable Tool [ ] Rotary
[ ] Rotary Hammer [ ] Other
Hole Diameter 30 (in)
Total depth 78 (ft)

CASINGS RECORD
MAIN CASING TYPE
[X] Steel [ ] Plastic
[ ] Other _____
Casing Diameter 16 (in)
Wall Thickness 0.375 (in)
Casing Length 63 (ft)
Other Casing or Liner Used
Type [ ] Steel [ ] Plastic
[ ] Other _____
Casing/Liner Diameter _____ (in)
Length _____ (ft) from _____ (ft)
to _____ (ft)

SCREEN RECORD
[ ] Not Installed [X] Installed
Material: [ ] Bronze [X] SS
Diameter of screen 16"
Slot size 0.06"
Length 15 (ft) from 63 (ft)
to 78 (ft)

GRAVEL PACK RECORD
Gravel Pack: [X] Yes [ ] No
From 25 (ft) to 78 (ft)

GROUTING RECORD
Grouting Material:
[X] Cement [ ] Bentonite Clay
Other _____
No. of Bags: Bulk
Installation Method:

PUMP INSTALLED
By Driller [X] Yes [ ] No

ESTIMATED WELL YIELD
Estimated at 900 G.P.M
Static Water Level 45.38 (ft)
*Pumping level below land surface
61.44 (ft) after 4 hrs. at
1000 G.P.M. (Estimated)
*Note: For Public Water Supply wells please submit required yield and drawdown tests.

WELL HEAD COMPLETION
Casing height above grade 2 (ft)
Type Of Well Cap
Installed: Baker Pitless

VARIANCE ISSUED [ ] Yes [ ] No
Request Number _____

COMMENTS BY INSTALLER:
Pump Test noted above was Step Test at:

278 gpm
403 gpm
603 gpm
802 gpm
902 gpm
1000 gpm

I hereby certify that this well has been constructed in accordance with state rules and in conformance with all conditions stated in the above captioned permit, and that the information presented herein is accurate and complete to the best of my knowledge.

Company Name Reynolds, Inc. WV Contractor No. WV 000825
Business Registration No. _____ Master Well Driller Certification No. _____
Master Well Driller (print) John Workman
Master Well Driller Signature _____

SITE SUPERVISOR (SIGNATURE OF DRILLER OR JOURNEYMAN RESPONSIBLE FOR SITEWORK IF DIFFERENT FROM MASTER DRILLER.)

Journeyman Well Driller Certification No. _____
Journeyman Well Driller (please print) _____
Apprentice and Name (s) _____

ARCADIS

H.C. Nutting Company 2009

Piezometer Construction Diagrams

PZ-09-03 to PZ-09-05

TERRACON PROJECT NO. N2095020

PROJECT MOUNTAINEER BOTTOM ASH POND COMPLEX

SUMMARY ELEVATIONS
(FT. NGVD)

COORDINATES 71944.21 N/1733850.23 E (NAD 27)(NGVD29 WV S)

DATE INSTALLED 02/17/09

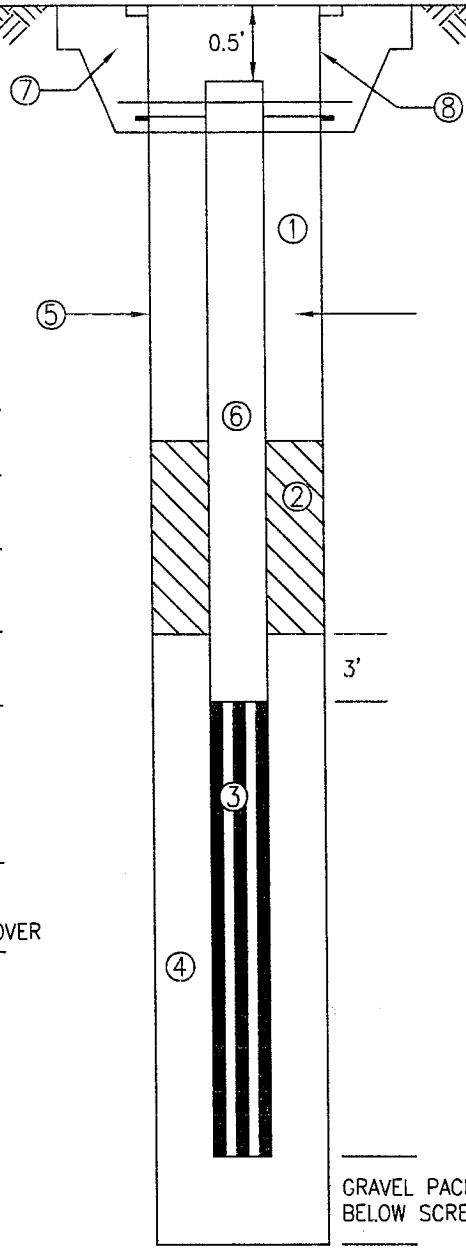
PIEZOMETER NO. PZ-09-03

REF. DATUM PT.:
TOP OF PROTECTIVE
VAULT/GROUND SURFACE

REF. DATUM PT. _____

GROUND SURFACE/TOP OF PAD

GRADE 0' (621.6')



DEPTH (ELEV.)

TOP OF BENTONITE SEAL 1.0' (620.6')

TOP OF GRAVEL PACK 2.0' (619.6')

1 GROUT SEAL MATERIAL: CEMENT BENTONITE

2 BENTONITE SEAL MATERIAL: BENTONITE CHIPS

3 SCREEN SIZE: 0.010" SLOT

4 GRAVEL PACK MATERIAL: #5 QUARTZ SAND

5 BOREHOLE DIAMETER 6" MIN. 7"

6 1.92" DIA. PVC CASING (O.D.)

7 CONCRETE PAD DIMENSIONS: 3'x3'x8" THICK (MIN.)

8 PROTECTIVE STEEL H2 RATED VAULT COVER

TOP OF SCREEN 5.0' (616.6')

BOTTOM OF SCREEN 50.4' (571.2')

BOTTOM OF BLANK SEC. N/A

BOTTOM OF GRAVEL PACK 50.4' (571.2')

BOTTOM OF BOREHOLE 50.4' (571.2')

GRAVEL PACK BELOW SCREEN

NOTE: DEPTHS OF MATERIALS ARE TAKEN FROM TOP OF VAULT/GROUND SURFACE

SCALE: NTS

GEOTECHNICAL ENGINEERING SECTION CIVIL DESIGN STANDARD		REVISION 0		OBSERVATION WELL
APP'D.	DR.	C.K.	DATE	
AMERICAN ELECTRIC POWER SERVICE CORP.			CDS-04A	SH.

AMERICAN ELECTRIC POWER
MOUNTAINEER BOTTOM ASH POND COMPLEX

GEOLOGIST/ENGINEER:

TODD GRIFFITH H.C. NUTTING CO.

TERRACON PROJECT NO. N2095020

PROJECT MOUNTAINEER BOTTOM ASH POND COMPLEX

SUMMARY ELEVATIONS
(FT. NGVD)

COORDINATES 719507.75 N/1733919.28 E (NAD 27)(NGVD29 WV S)

DATE INSTALLED 02/19/09

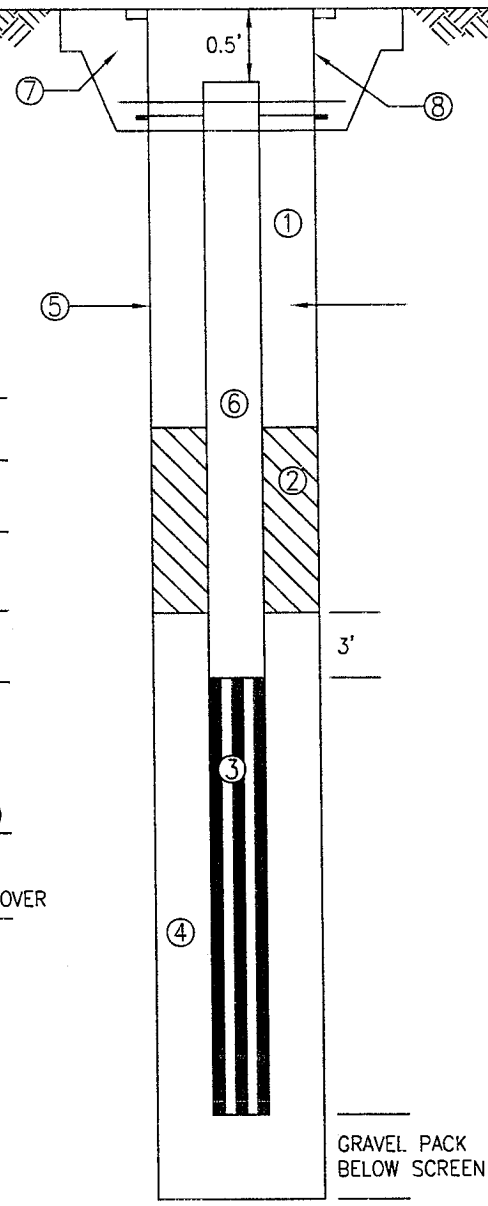
PIEZOMETER NO. PZ-09-04

REF. DATUM PT. _____

REF. DATUM PT.:
TOP OF PROTECTIVE
VAULT/GROUND SURFACE

GROUND SURFACE/TOP OF PAD

GRADE 0' (597.1')



DEPTH (ELEV.)

TOP OF BENTONITE SEAL 1.0' (596.1')

TOP OF GRAVEL PACK 2.0' (595.1')

TOP OF SCREEN 5.0' (592.1')

BOTTOM OF SCREEN 24.8' (572.3')

BOTTOM OF BLANK SEC. N/A

BOTTOM OF GRAVEL PACK 25.0' (572.1')

BOTTOM OF BOREHOLE 25.0' (572.1')

1 GROUT SEAL MATERIAL: CEMENT BENTONITE

2 BENTONITE SEAL MATERIAL: BENTONITE CHIPS

3 SCREEN SIZE: 0.010" SLOT

4 GRAVEL PACK MATERIAL: #5 QUARTZ SAND

5 BOREHOLE DIAMETER 7"
6" MIN.

6 1.92" DIA. PVC CASING (O.D.)

7 CONCRETE PAD DIMENSIONS: 3'x3'x8" THICK (MIN.)

8 PROTECTIVE STEEL H2 RATED VAULT COVER

NOTE: DEPTHS OF MATERIALS ARE TAKEN FROM TOP OF VAULT/GROUND SURFACE

SCALE: NTS

GEOTECHNICAL ENGINEERING SECTION CIVIL DESIGN STANDARD		REVISION 0		OBSERVATION WELL	
APP'D.	DR.	C.K.	DATE		
AMERICAN ELECTRIC POWER SERVICE CORP.				CDS-04A	SH.

AMERICAN ELECTRIC POWER
MOUNTAINEER BOTTOM ASH POND COMPLEX

GEOLOGIST/ENGINEER:

TODD GRIFFITH H.C. NUTTING CO.

TERRACON PROJECT NO. N2095020

PROJECT MOUNTAINEER BOTTOM ASH POND COMPLEX

SUMMARY ELEVATIONS
(FT. NGVD)

COORDINATES 718480.58 N/1734992.79 E (NAD 27)(NGVD29 WV S)

DATE INSTALLED 02/18/09

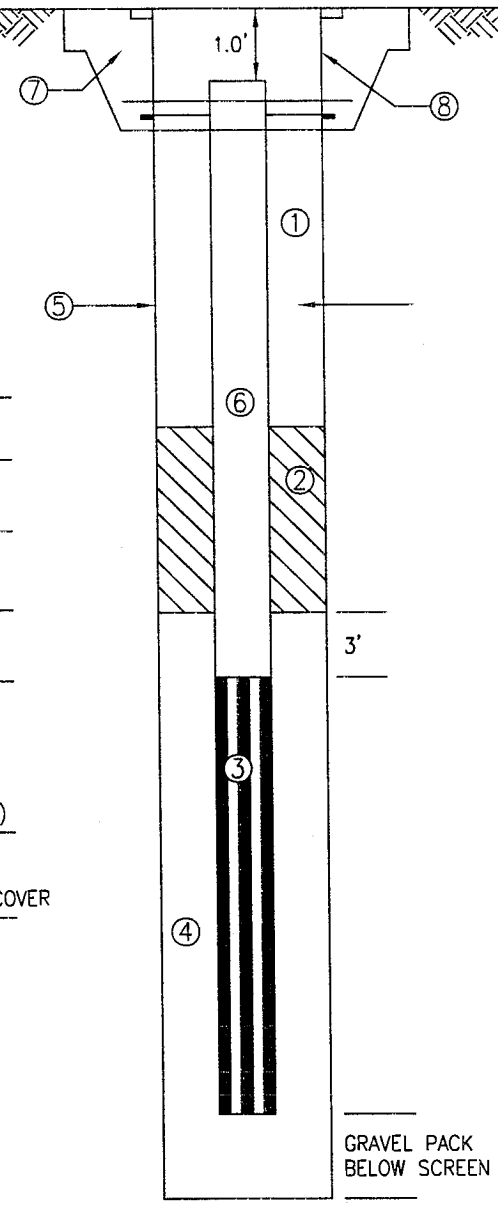
PIEZOMETER NO. PZ-09-05

REF. DATUM PT.:
TOP OF PROTECTIVE
VAULT/GROUND SURFACE

REF. DATUM PT. _____

GROUND SURFACE/TOP OF PAD

GRADE 0' (611.7')



DEPTH (ELEV.)

TOP OF BENTONITE SEAL 1.0' (610.7')

TOP OF GRAVEL PACK 2.0' (609.7')

1 GROUT SEAL MATERIAL: CEMENT BENTONITE

2 BENTONITE SEAL MATERIAL: BENTONITE CHIPS

3 SCREEN SIZE: 0.010" SLOT

4 GRAVEL PACK MATERIAL: #5 QUARTZ SAND

5 BOREHOLE DIAMETER 6" MIN. 7"

6 1.92" DIA. PVC CASING (O.D.)

7 CONCRETE PAD DIMENSIONS: 3'x3'x8" THICK (MIN.)

8 PROTECTIVE STEEL H2 RATED VAULT COVER

TOP OF SCREEN 5.0' (606.7')

BOTTOM OF SCREEN 50.2' (561.5')

BOTTOM OF BLANK SEC. N/A

BOTTOM OF GRAVEL PACK 50.2' (561.5')

BOTTOM OF BOREHOLE 50.2' (561.5')

NOTE: DEPTHS OF MATERIALS ARE TAKEN FROM TOP OF VAULT/GROUND SURFACE

SCALE: NTS

GEOTECHNICAL ENGINEERING SECTION CIVIL DESIGN STANDARD		REVISION 0		OBSERVATION WELL	
APP'D.	DR.	C.K.	DATE		
AMERICAN ELECTRIC POWER SERVICE CORP.				CDS-04A	SH.

AMERICAN ELECTRIC POWER
MOUNTAINEER BOTTOM ASH POND COMPLEX

GEOLOGIST/ENGINEER:

TODD GRIFFITH H.C. NUTTING CO.

ARCADIS

H.C. Nutting Company 2009

Soil Boring Logs

B-09-01, B-09-02, PZ-09-03 to PZ-09-05, B-09-06

LOG OF BORING NO. B-09-01

CLIENT
American Electric Power

SITE
New Haven, West Virginia

PROJECT
Mountaineer Bottom Ash Pond Complex

Boring Location: 719673.518, 1733588.509

Approx. Surface Elev.: 621.5 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N** BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	1 **FILL**, gravel base for roadway 620.5		GP	1	SS	18	27			
	FILL, poorly graded sand, some gravel and silt, fine grained, brown, medium dense to dense, moist		SP	2	SS	18	35	5		
		5	SP	3	SS	18	29			
			SP	4	SS	18	32			
		10	SP	5	SS	18	38	11		
	12.5 609									
	FILL, silty sand, grayish brown to brown, very dense to dense, moist to wet		SM	6	SS	18	53			
		15	SM	7	SS	18	51	8		
			SM	8	SS	18	48			
		20	SM	9	SS	18	49			
	22.5 599									
	FILL, poorly graded sand, some gravel and silt, fine grained, brown to light brown, dense, saturated		SP	10	SS	18	44			
		25	SP	11	SS	18	38	14		
	27.5 594									
	SILTY SAND, very fine to fine grained, some thin sandy silt seams, brown to light brown, medium dense to loose, wet to moist		SM	12	SS	18	12			
		30	SM	13	SS	18	9			

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ 22.5	WD	▼	AB
WL	▽ 22.0	24 hour	▼	
WL				

Terracon

BORING STARTED	2-16-09		
BORING COMPLETED	2-16-09		
RIG	Track	FOREMAN	JW
LOGGED	TAG	JOB #	N2095020

REVISED BORING LOGS MTNEER PLANT BOTTOM ASH.GPJ TERRACON.GDT 3/9/09

LOG OF BORING NO. B-09-01

CLIENT: **American Electric Power**

SITE: **New Haven, West Virginia**

PROJECT: **Mountaineer Bottom Ash Pond Complex**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N** BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	SILTY SAND, very fine to fine grained, some thin sandy silt seams, brown to light brown, medium dense to loose, wet to moist		SM	14	SS	18	9			
		35	SM	15	SS	18	9			
			SM	16	SS	18	11	14		
		40	SM	17	SS	18	8			
			SM	18	SS	18	10			
	45 576.5									
	POORLY GRADED SAND with SILT, brown to dark brown, medium dense to dense, moist to wet	45	SP SM	19	SS	18	25			
			SP SM	20	SS	18	27	8		
		50	SP SM	21	SS	18	54			
	51.5 570									
	BORING COMPLETED									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ 22.5	WD	▼	AB
WL	▼ 22.0	24 hour	▼	
WL				

Terracon

BORING STARTED	2-16-09		
BORING COMPLETED	2-16-09		
RIG	Track	FOREMAN	JW
LOGGED	TAG	JOB #	N2095020

REVISED BORING LOGS_MTNEER PLANT BOTTOM ASH.GPJ_TERRACON.GDT 3/9/09

LOG OF BORING NO. B-09-02

CLIENT
American Electric Power

SITE
New Haven, West Virginia

PROJECT
Mountaineer Bottom Ash Pond Complex

Boring Location: 719744.754, 1733658.992

Approx. Surface Elev.: 594.5 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N** BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	TOPSOIL, lean clay, high organic content, dark brown, very soft, saturated (possible seepage from dike)	0	CL	1	SS	18	4	19		
2	592.5									
	SANDY SILT, fine grained, brown, loose, wet to moist		ML	2	SS	18	9	19		
		5	ML	3	SS	18	7			
			ML	4	SS	18	5			
		10	ML	5	SS	18	6			
			ML	6	SS	14	6			
16	578.5	15	SP SM	7	SS	18	9			
	POORLY GRADED SAND with SILT and GRAVEL, light to dark brown, medium dense to dense, moist		SP SM	8	SS	18	22	6		
		20	SP SM	9	SS	18	14			
			SP SM	10	SS	15	19			
26.5 ▼	568	25	SP SM	11	SS	18	30			
	BORING COMPLETED									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ 0	WD	▼ 26.0	AB
WL	▼		▼	
WL				

Terracon

BORING STARTED	2-18-09		
BORING COMPLETED	2-18-09		
RIG	Track	FOREMAN	JW
LOGGED	TAG	JOB #	N2095020

REVISED BORING LOGS MTNEER PLANT BOTTOM ASH.GPJ TERRACON.GDT 3/9/09

LOG OF BORING NO. PZ-09-03

CLIENT: **American Electric Power**

SITE: **New Haven, West Virginia**

PROJECT: **Mountaineer Bottom Ash Pond Complex**

Boring Location: 719441.213, 1733850.227

Approx. Surface Elev.: 621.5 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N** BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf	
	1 **FILL**, gravel base for roadway — 620.5		SP SM	1	SS	18	26				
	FILL, poorly graded sand with silt, some gravel, brown, medium dense to dense, moist		SP SM	2	SS	18	31	6			
		5	SP SM	3	SS	18	28				
			SP SM	4	SS	18	39				
		10	SP SM	5	SS	18	42				
			SP SM	6	SS	18	49	10			
	▽	15	SP SM	7	SS	18	39				
	17.5 ▽ 604										
	FILL, poorly graded sand, some gravel and silt, fine grained, brown, dense, saturated		SP	8	SS	18	38				
	▼	20	SP	9	SS	18	42				
	22.5 — 599										
	24 **CLAYEY GRAVEL with SAND**, fine sand with rounded gravel, dark gray, medium dense, moist to wet — 597.5		SC	10	SS	18	11				
	LEAN CLAY with SAND, brown to light brown, stiff, moist	25	CL	11	SS	18	12	19		4500*	LL = 29 PI = 10
			CL	12	SS	18	13			3500*	
	30 — 591.5	30	CL ML	13	SS	18	11	20		4500*	LL = 25 PI = 5
	SILTY CLAY with sand, brown to light brown, stiff, moist		CL	1	ST	22					LL = 25

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

**CME 140H SPT automatic hammer
*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ 17.5	WD	▼ 20.2	72
WL	▼ 15.8	2/25	▼	
WL				

Terracon

BORING STARTED	2-16-09		
BORING COMPLETED	2-17-09		
RIG	Track	FOREMAN	JW
LOGGED	TAG	JOB #	N2095020

REVISED BORING LOGS MTNEER PLANT BOTTOM ASH.GPJ TERRACON.GDT 3/9/09

LOG OF BORING NO. PZ-09-03

CLIENT: **American Electric Power**

SITE: **New Haven, West Virginia**

PROJECT: **Mountaineer Bottom Ash Pond Complex**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N** BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf	
	34 587.5		ML								PI = 7
	SILTY SAND, very fine grained, trace gravel, many thin sandy silt seams, brown to light brown, loose to medium dense, moist		SM	14	SS	14	10				
		35	SM	15	SS	18	11				
			SM	16	SS	18	8	13			
		40	SM	17	SS	18	7				
			SM	18	SS	18	8				
		45	SM	19	SS	18	10				
	48.5 573		SM	20	SS	18	12				
	POORLY GRADED GRAVEL with SAND and SILT, subrounded to rounded gravel, brown, loose to medium dense, wet	50	GP	21	SS	18	8	8			
	51.5 570										
	BORING COMPLETED										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

**CME 140H SPT automatic hammer
*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ 17.5	WD	▼ 20.2	72
WL	▼ 15.8	2/25	▼	
WL				

Terracon

BORING STARTED	2-16-09		
BORING COMPLETED	2-17-09		
RIG	Track	FOREMAN	JW
LOGGED	TAG	JOB #	N2095020

REVISED BORING LOGS MTNEER PLANT BOTTOM ASH.GPJ TERRACON.GDT 3/9/09

LOG OF BORING NO. PZ-09-04

CLIENT: **American Electric Power**

SITE: **New Haven, West Virginia**

PROJECT: **Mountaineer Bottom Ash Pond Complex**

Boring Location: 719506.02, 1733919.514

Approx. Surface Elev.: 597 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N** BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	TOPSOIL, saturated		CL	1	SS	11	9			
	2 595									
	SANDY SILT, trace clay, fine to very fine grained, brown, loose, layered, wet		ML	2	SS	18	9	21		
		5	ML	1	ST	24				
			ML	3	SS	18	10			
		10	ML	4	SS	18	5			
			ML	5	SS	18	6	23		
		15	ML	6	SS	18	5			
			ML	7	SS	18	7			
		20	ML	8	SS	18	13			
	21.4 575.5									
	POORLY GRADED GRAVEL with SILT and SAND, subrounded gravel, brown with gray, medium dense to dense, very moist ▼		GP GM	9	SS	12	19	6		
	26.5 570.5	25	GP GM	10	SS	18	43			
	BORING COMPLETE									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ N/E	WD	▼ N/E	AB
WL	▽ N/E	48	▼ 25.5	2/25
WL				

Terracon

BORING STARTED	2-19-09		
BORING COMPLETED	2-19-09		
RIG	Track	FOREMAN	JW
LOGGED	TAG	JOB #	N2095020

REVISED BORING LOGS MTNEER PLANT BOTTOM ASH.GPJ TERRACON.GDT 3/9/09

LOG OF BORING NO. PZ-09-05

CLIENT: **American Electric Power**

SITE: **New Haven, West Virginia**

PROJECT: **Mountaineer Bottom Ash Pond Complex**

Boring Location: 718483.249, 1734990.193

Approx. Surface Elev.: 611.5 ft

GRAPHIC LOG / DESCRIPTION		DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N** BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
0.3	**TOPSOIL** 611									
	FILL, poorly graded sand, some silt and trace fine gravel, fine to medium grained sand, brown, dense, moist		SP	1	SS	18	20			
			SP	2	SS	18	30	4		
5	606.5	5	SP	3	SS	18	10			
	POORLY GRADED SAND trace silt, fine grained, brown, loose to very loose, moist		SP	4	SS	18	5			
		10	SP	5	SS	18	5			
			SP	6	SS	18	4	7		
		15	SP	7	SS	18	3			
			SP	8	SS	13	4			
20	591.5	20	SP	9	SS	18	5			
	POORLY GRADED SAND, trace silt, fine grained, brown, very loose to loose, moist		SP	10	SS	18	3	6		
		25	SP	11	SS	18	6			
			SP	12	SS	18	5			
29	582.5	30	GP	13	SS	18	10			
	POORLY GRADED GRAVEL with SAND, subrounded gravel with fine to coarse sand, brown to dark brown, loose to medium dense, moist									

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ N/E	WD	▽ N/E	AB
WL	▼ N/E	72	▼ N/E	2/25
WL				

Terracon

BORING STARTED			2-18-09
BORING COMPLETED			2-18-09
RIG	Track	FOREMAN	JW
LOGGED	TAG	JOB #	N2095020

REVISED BORING LOGS MTNEER PLANT BOTTOM ASH.GPJ TERRACON.GDT 3/9/09

LOG OF BORING NO. PZ-09-05

CLIENT: American Electric Power

SITE: New Haven, West Virginia

PROJECT: Mountaineer Bottom Ash Pond Complex

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N** BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	35 576.5		GP	14	SS	18	19			
	POORLY GRADED SAND, some gravel, fine to coarse sand, brown, loose to medium dense, moist	35	SP	15	SS	18	10			
			SP	16	SS	18	13			
	40 571.5	40								
	POORLY GRADED SAND with GRAVEL, brown, dense to medium dense, moist		SP	17	SS	18	30	3		
			SP	18	SS	18	20			
		45	SP	19	SS	18	21			
	47.5 564									
	POORLY GRADED SAND, some gravel, fine to medium grained sand, brown to light brown, medium dense, moist		SP	20	SS	18	14	7		
		50	SP	21	SS	18	13			
	51.5 560									
	BORING COMPLETED									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ N/E	WD	▼ N/E	AB
WL	▼ N/E	72	▼ N/E	2/25
WL				

Terracon

BORING STARTED			2-18-09
BORING COMPLETED			2-18-09
RIG	Track	FOREMAN	JW
LOGGED	TAG	JOB #	N2095020

REVISED BORING LOGS MTNEER PLANT BOTTOM ASH.GPJ TERRACON.GDT 3/9/09

LOG OF BORING NO. B-09-06

CLIENT: **American Electric Power**

SITE: **New Haven, West Virginia**

PROJECT: **Mountaineer Bottom Ash Pond Complex**

Boring Location: 718535.672, 1735062.716

Approx. Surface Elev.: 594.5 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N** BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf	TESTS
	0.3 **TOPSOIL** 594		SC	1	SS	14	11				
	FILL, clayey sand, fine to medium grained, organics such as roots fragments throughout, brown, medium dense to loose, moist to wet		SC	2	SS	18	5			2000*	
	3.5 591		CL ML	1	ST	24					
	SILTY CLAY with SAND, fine sand, light brown, medium stiff, moist	5	CL ML	3	SS	18	7	23		2000*	LL = 25 PI = 6
			CL ML	4	SS	18	7	23		2500*	LL = 26 PI = 6
	10.5 584	10	SP	5	SS	18	13				
	POORLY GRADED SAND with GRAVEL fine to coarse sand, some silt, rounded to subrounded gravel, brown, medium dense to loose, moist		SP	6	SS	14	8				
		15	SP	7	SS	14	6				
			SP	8	SS	14	5				
		20	SP	9	SS	14	11				
	22.5 572										
	POORLY GRADED SAND with SILT, brown, medium dense, moist		SP SM	10	SS	18	19	4			
		25	SP SM	11	SS	18	14				
	26.5 568										
	BORING COMPLETED										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

**CME 140H SPT automatic hammer
*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ N/E	WD	▼ AB
WL	▼	24 hour	▼
WL			

Terracon

BORING STARTED	2-18-09		
BORING COMPLETED	2-18-09		
RIG	Track	FOREMAN	JW
LOGGED	TAG	JOB #	N2095020

REVISED BORING LOGS_MTNEER PLANT BOTTOM ASH.GPJ_TERRACON.GDT 3/9/09

ARCADIS

Arcadis 2016

Boring Logs

SB-1601, MW-1601A to MW-1608

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power**

PROJECT **Mountaineer Plant**

COORDINATES **Not Surveyed**

GROUND ELEVATION **NA** SYSTEM **NA**

Water Level, ft	▽ 57.0	▼	▼
TIME			
DATE	5/6/2016		

BORING NO. **SB-1601** DATE **10/05/16** SHEET **1** OF **4**

BORING START **05/05/16** BORING FINISH **05/06/16**

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 **Grout**

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

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
0	NR	0.0	8.0							No recovery, boring was pre-drilled for utility clearance; no samples were taken.		
1	SH	8.0	10.0	0-3-3-1	12		5			Sand, fine to coarse; some silt; little fine gravel, angular to subrounded; trace medium subangular gravel; wet; dark yellowish brown (10YR 4/2).		
2	SS	10.0	12.0	1-1-1-1	12		10			Silt with clay with fine sand; moist; soft; non-plastic; very dark gray (N 3/).		
3	SS	12.0	14.0	0-0-1-1	18					Silt, some clay, some fine sand, trace coal fragments; moist; soft.		
4	SS	14.0	16.0	1-1-2-2	18							
5	SS	16.0	18.0	2-1-1-2	18		15					

TYPE OF CASING USED

	NQ-2 ROCK CORE
NA	6" x 3.25 HSA
NA	9" x 6.25 HSA
NA	HW CASING ADVANCER 4"
NA	NW CASING 3"
NA	SW CASING 6"
NA	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 **J. Wanner**

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1601** DATE **10/05/16** SHEET **2** OF **4**

PROJECT **Mountaineer Plant** BORING START **05/05/16** BORING FINISH **05/06/16**

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
6	SS	18.0	20.0	1-1-1-1	19							
7	SS	20.0	22.0	1-1-2-1	48		20					
8	SS	22.0	24.0	0-1-3-7	21				SM	Silty sand, fine to coarse; moist; loose; yellowish brown (10YR 5/4).		
9	SS	24.0	26.0	4-5-4-5	21		25		ML	Silt, some very fine sand; dry; rapid dilatancy; stratified; gray (5Y 6/1) with 30% iron staining as dark as dusky red (7.5R 3/3).		
10	SS	26.0	28.0	1-1-3-3	18				ML	Silt, trace clay; wet; soft; rapid dilatancy; stratified.		
11	SS	28.0	30.0	1-1-2-2	22					Note: Very finely stratified from 27.8 to 28 feet.		
12	SS	30.0	32.0	1-1-3-9	19		30			Note: Color grades to yellowish brown (10YR 5/6) from 29 to 31 feet.		
13	SS	32.0	34.0	2-2-3-4	17				SP	Note: Color change to gray (N 5/) abrupt upper and lower boundaries from 31 to 31.1 feet.		
14	SS	34.0	36.0	2-4-7-7	12				SP	Sand with silt, some clay; moist; loose; brown (7.5YR 4.3); sand is fine to coarse.		
15	SS	36.0	38.0	5-7-8-7	12		35			Sand, little to some silt; moist; yellowish brown (10YR 5/4); loose; sand is fine to coarse.		
16	SS	38.0	40.0	2-4-5-6	19					Note: Dry from 34 to 36 feet.		
17	SS	40.0	42.0	5-5-6-5	19		40			Note: Dry grades to moist from 36 to 38 feet.		
										Note: Moist from 38 to 44 feet.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1601** DATE **10/05/16** SHEET **3** OF **4**

PROJECT **Mountaineer Plant** BORING START **05/05/16** BORING FINISH **05/06/16**

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
18	SS	42.0	44.0	1-4-5-5	17							
										Note: Slight increase in silt content from 43 to 44 feet.		
19	SS	44.0	46.0	2-4-6-7	13		45					
20	SS	46.0	48.0	5-5-7-7	17							
21	SS	48.0	50.0	8-10-10-10	18					Note: Weakly stratified from 48.5 to 50 feet.		
22	SS	50.0	52.0	6-6-7-8	16		50					
23	SS	52.0	54.0	2-3-8-8	18							
24	SS	54.0	56.0	4-4-5-6	13							
25	SS	56.0	58.0	4-4-6-8	19		55			Note: Trace subrounded medium to coarse gravel, sedimentary very thinly bedded, pitted along bedding at 55.5 feet.		
26	SS	58.0	60.0	2-4-6-4	13					Note: Trace subrounded coal (250 mm diameter, readily disaggregate; broken apart; internal coal appearance is well preserved) at 56.1 feet. Note: Includes little amount of fine subangular gravel from 57.5 to 58 feet. Note: Weakly stratified from 59 to 59.5 feet.	▽	
27	SS	60.0	62.0	2-4-4-6	14		60					
28	SS	62.0	64.0	4-4-4-5	18							
									SP	Sand, fine to medium, little to some silt; moist; loose; yellowish brown (10YR 5/4).		
29	SS	64.0	66.0	5-6-9-10	17							

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1601** DATE **10/05/16** SHEET **4** OF **4**

PROJECT **Mountaineer Plant** BORING START **05/05/16** BORING FINISH **05/06/16**

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
							65					
30	SS	66.0	68.0	5-6-7-8	17					Note: Thin layer of coal fragments up to 10 mm in size). Note: Includes a little amount of fine subrounded gravel from 67 to 68 feet.		
31	SS	68.0	70.0	6-6-5-7	16				GP	Gravel, some sand; moist; loose; gravel is fine to medium, rounded and subrounded.		
32	SS	70.0	71.3	12-15-50/4	16		70		SP	Sand, some silt, little fine to medium gravel; dry; loose; yellowish brown (10YR 5.4); sand is fine to coarse.		
									ML	Silt, little very fine sand; dry; hard; very dark brown (7.5YR 2.5/2). Bedrock, weak, thin plates; looks like shale, but fine party crystals (like mica) are abduct; olive gray (5Y 5/2). Bedrock, weak, thin plates; looks like shale, but fine party crystals (like mica) are abduct; olive gray (5Y 5/2). End of boring at 71.3 feet.		

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LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power**

PROJECT **Mountaineer Plant**

COORDINATES **N 717,305.0 E 1,734,094.2**

GROUND ELEVATION **607.5** SYSTEM **NAD 1927**

Water Level, ft	▽ 63.0	▼	▼
TIME			
DATE	6/8/2016		

BORING NO. **MW-1601A** DATE **10/05/16** SHEET **1** OF **4**

BORING START **06/08/16** BORING FINISH **06/08/16**

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

HGT. RISER ABOVE GROUND **3.19** DIA **2"**

DEPTH TO TOP OF WELL SCREEN **67.0** BOTTOM **77.0**

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

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

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
0	NR	0.0	10.0		0					Straight drill to 10 feet, boring was pre-drilled for utility clearance; no samples were taken.		
							5					
1	SS	10.0	12.0	1-2-4-5	13		10		ML	Silt, some clay, little sand;, dry; firm; massive; 10YR 4/4 to 4/3.		
2	SS	12.0	14.0	3-4-5-5	16							
									CL	Silt with clay and sand; moist; soft.		
3	SS	14.0	16.0	4-5-4-7	13				ML SM	Interbedded sand and clay; dry; loose and soft; sands are fine to coarse; 10YR 4/4; silt/clay layers are silt with clay, some fine sand, dry, soft, black (10YR 2/1).		
4	SS	16.0	18.0	3-4-6-5	14		15					
									SW	Sand, fine to coarse, little silt, trace fine gravel; moist; loose; 10YR 5/4 to 4/4; instratified.		
5	SS	18.0	20.0	2-2-2-3	16					Note: Dry from 18 to 19 feet.		
									SP	Note: Abrupt boundary at 19 feet.		

TYPE OF CASING USED

	NQ-2 ROCK CORE	
NA	6" x 3.25 HSA	
NA	9" x 6.25 HSA	
NA	HW CASING ADVANCER	4"
NA	NW CASING	3"
NA	SW CASING	6"
NA	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 **J. Wanner**

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1601A** DATE **10/05/16** SHEET **2** OF **4**

PROJECT **Mountaineer Plant** BORING START **06/08/16** BORING FINISH **06/08/16**

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
6	SS	20.0	22.0	2-2-2-4	17				SW	Fine sand, some silt, dry; loose; 10YR 5/4.		
									SW	Silty sand; moist; soft; 10YR 4/4.		
										Sand, fine to coarse, little to some silt, trace fine to medium gravel; dry; loose; 10YR 5/4 to 10YR 4/4.		
7	SS	22.0	24.0	1-3-3-3	13					Note: Gravel fraction is subrounded sedimentary and chert, both fine in size from 22 to 26 feet.		
8	SS	24.0	26.0	3-6-8-7	16		25					
9	SS	26.0	28.0	3-5-4-5	14					Note: Some gravel at 26 feet.		
										Note: No gravel at 26.7 to 28 feet.		
10	SS	28.0	30.0	5-6-7-5	18		30					
11	SS	30.0	32.0	4-4-5-6	14							
12	SS	32.0	34.0	1-4-7-6	13							
13	SS	34.0	36.0	3-8-5-8	14		35			Note: Moist at 34.5 feet.		
14	SS	36.0	38.0	3-8-12-12	17					Note: No gravel from 36 to 37 feet.		
										Note: Gravel fraction is fine to medium, subangular to subrounded, from 37 to 38 feet.		
15	SS	38.0	40.0	6-8-6-8	18					Note: Moist from 38 to 38.5 feet.		
16	SS	40.0	42.0	8-12-17-20	17		40		SW	Sand, fine, with silt; dry; loose; brown.		
									SW	Sand, fine to coarse, little to some fine gravel, little to some silt; dry; loose; brown; gravel is subangular to subrounded.		
17	SS	42.0	44.0	10-12-8-12	16					Note: No gravel from 42.5 to 43.5 feet.		
18	SS	44.0	46.0	9-10-12-6	13							
							45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1601A** DATE **10/05/16** SHEET **3** OF **4**

PROJECT **Mountaineer Plant** BORING START **06/08/16** BORING FINISH **06/08/16**

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	SS	46.0	48.0	12-12-15-20	17					Note: Igneous and sedimentary rock types from 46 to 52 feet.		
20	SS	48.0	50.0	12-12-10-12	17		50			Note: Moist from 48 to 50 feet.		
21	SS	50.0	52.0	9-10-14-16	16							
22	SS	52.0	54.0	6-10-13-14	13				SW	Sand with fine gravel, little silt, little amount of medium size gravel; dry; loose; sand is fine to coarse; gravel is subround dominant.		
23	SS	54.0	56.0	14-20-22-11	14		55			Note: Includes trace coarse gravel (subangular igneous, and subrounded sedimentary. from 54 to 56 feet.		
24	SS	56.0	58.0	9-12-14-24	17					Note: Includes trace coarse subrounded gravel from 56 to 60 feet.		
25	SS	58.0	60.0	14-15-20-15	17							
26	SS	60.0	62.0	20-20-14-14	18		60		SW	Sand with silt, little fine gravel; dry; loose; brown; sand is fine to coarse.		
27	SS	62.0	64.0	8-8-8-6	12					Note: Moist from 62 to 62.5 feet.		
28	SS	64.0	66.0	7-9-7-8	14		65		SW	Sand some silt, little fine to medium gravel; loose; weakly stratified. Note: Wet at 63 feet.	▽	
29	SS	66.0	68.0	5-4-3-12	16				SW	Sand, some gravel, fine to medium, little silt, trace coarse rounded gravel; wet; loose; unstratified; brown.		
30	SS	68.0	70.0	1-4-6-9	14					Note: Wet at 68 feet.		
31	SS	70.0	72.0	5-15-15-18	0.9		70		SW	Sand, little to some silt, trace fine gravel; wet; loose; unstratified; sand is very fine to medium dominant.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1601A** DATE **10/05/16** SHEET **4** OF **4**

PROJECT **Mountaineer Plant** BORING START **06/08/16** BORING FINISH **06/08/16**

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	72.0	74.0	NM-NM-NM-NM	0					No sample attempted; heaving sands from 72 to 76 feet.		
33	SS	74.0	76.0	9-12-13-12	0		75					
34	SS	76.0	78.0	3-9-13-13	0.9				SW	Sand with silt, trace fine gravel; wet; loose; brown; sand is fine to medium.		
35	SS	78.0	80.0	9-13-22-23	0.6		80					
										End of boring at 80 feet. See well construction log for development information.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power**

PROJECT **Mountaineer Plant**

COORDINATES **N 717,671.9 E 1,733,519.1**

GROUND ELEVATION **602.4** SYSTEM **NAD 1927**

Water Level, ft	▽ 57.0	▼	▼
TIME			
DATE	5/9/2016		

BORING NO. **MW-1602** DATE **10/05/16** SHEET **1** OF **3**

BORING START **05/09/16** BORING FINISH **05/10/16**

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

HGT. RISER ABOVE GROUND **2.75** DIA **2"**

DEPTH TO TOP OF WELL SCREEN **61.0** BOTTOM **71.0**

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

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

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
0	NR	0.0	10.0		0					Straight drill to 10 feet, boring was pre-drilled for utility clearance; no samples were taken.		
1	SS	10.0	12.0	1-0-0-1	18		10		ML	Silt, trace clay; wet; soft; rapid dilatancy; dark yellowish brown (10YR 4/4).		
2	SS	12.0	14.0	0-3-5-2	18					Note: From 12 to 13 feet wet. Note: From 13 to 15 feet coarsely interbedded with sand, little silt, loose.		
3	SS	14.0	16.0	0-3-3-4	18		15		SP	Sand, little to some silt; loose; dry; yellowish brown (10YR 5/4). Note: From 16 to 26.5 feet dry.		
4	SS	16.0	18.0	2-2-3-3	18							
5	SS	18.0	20.0	3-2-3-3	17		20			Note: At 21 feet trace fine gravel.		
6	SS	20.0	22.0	3-3-5-6	17							

TYPE OF CASING USED

	NQ-2 ROCK CORE
NA	6" x 3.25 HSA
NA	9" x 6.25 HSA
NA	HW CASING ADVANCER 4"
NA	NW CASING 3"
NA	SW CASING 6"
NA	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 **J. Wanner**

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1602** DATE **10/05/16** SHEET **2** OF **3**

PROJECT **Mountaineer Plant** BORING START **05/09/16** BORING FINISH **05/10/16**

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
7	SS	22.0	24.0	1-2-3-5	17					Note: At 22 feet little amount of fine gravel.		
8	SS	24.0	26.0	3-7-10-14	17		25			Note: At 24 feet trace medium subrounded gravel.		
9	SS	26.0	28.0	7-10-10-13	17					Note: From 25.8 to 26 feet little coarse sand.		
10	SS	28.0	30.0	2-3-7-10	17				SP	Sand, little to some silt, little gravel; dry; loose; gravel is fine to medium, angular to subrounded; sand is fine to coarse.		
11	SS	30.0	32.0	2-5-5-8	14		30					
12	SS	32.0	34.0	4-7-7-10	13				SP	Sand, little to some silt; dry; loose; sand is fine to medium.		
13	SS	34.0	36.0	7-11-11-11	18				SP	Sand, fine to coarse, little to some silt, little fine gravel, trace medium gravel; dry; loose. Note: From 32 to 34 feet trace coarse rounded gravel, igneous.		
14	SS	36.0	38.0	7-10-13-16	17		35					
15	SS	38.0	40.0	7-10-13-17	17					Note: At 39 feet, trace coarse rounded gravel, igneous.		
16	SS	40.0	42.0	10-11-13-13	13		40					
17	SS	42.0	44.0	6-10-11-14	19					Note: At 41 feet, trace coarse rounded gravel, igneous.		
18	SS	44.0	46.0	8-10-12-15	14							
19	SS	46.0	48.0	6-9-11-14	16		45					
20	SS	48.0	50.0	6-10-13-16	18							
21	SS	50.0	52.0	9-11-21-27	18		50					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1602** DATE **10/05/16** SHEET **3** OF **3**

PROJECT **Mountaineer Plant** BORING START **05/09/16** BORING FINISH **05/10/16**

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
22	SS	52.0	54.0	10-14-16-17	17					Note: From 51 to 52 feet, includes some fine gravel, angular to subangular. Note: From 52.5 to 53.5 feet includes trace medium subrounded gravel.		
23	SS	54.0	56.0	9-10-10-9	16		55					
24	SS	56.0	58.0	5-2-4-3	18				SP	Sand, little to some silt, little to some fine gravel, trace medium to coarse gravel; dry; loose; sand is fine to coarse. Note: From 57 to 58 feet wet.	▽	
25	SS	58.0	60.0	5-6-6-10	18							
26	SS	60.0	62.0	6-7-7-10	0.8		60					
27	SS	62.0	64.0	8-7-9-11	0					No recovery; driller said drilling conditions have not changed.		
28	SS	64.0	66.0	7-9-13-18	0					Note: From 64 to 66 feet all baskets replaced.		
29	SS	66.0	68.0	8-8-10-12	12		65		SP	Sand, some silt, trace fine rounded gravel; wet; loose; sand is fine to coarse.		
30	SS	68.0	70.0	6-9-8-11								
31	SS	70.0	89.0	3-4-46-50			70			Note: At 69.5 feet, subrounded gravel composed of coal (17 mm in size). Bedrock, competent. End of boring at 71.6 feet. See well construction log for development information.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power**

PROJECT **Mountaineer Plant**

COORDINATES **N 719,516.2 E 1,732,495.0**

GROUND ELEVATION **602.9** SYSTEM **NAD 1927**

Water Level, ft	▽ 57.0	▼	▼
TIME			
DATE	5/3/2016		

BORING NO. **MW-1603** DATE **10/05/16** SHEET **1** OF **4**

BORING START **05/03/16** BORING FINISH **05/04/16**

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

HGT. RISER ABOVE GROUND **3.38** DIA **2"**

DEPTH TO TOP OF WELL SCREEN **60.0** BOTTOM **75.0**

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

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

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
0	NR	0.0	9.0		0					Straight drilled to 9.5 feet, boring was pre-drilled for utility clearance, no samples were taken.		
1	SS	9.0	11.0	1-2-3-3	21		5					
2	SS	11.0	13.0	2-2-3-4	20		10		ML CL ML	Silt, trace clay; dry; rapid dilatancy; brown (7.5YR 4/4). Grades to silt with clay; dry; non-dilatant; non-plastic; brown (7.5YR 4/4).		
									SP			
									CL ML	Sand, fine to medium, trace gravel, trace silt; moist; loose; dark yellowish brown (10YR 4/4).		
										Silt with little to some clay; moist; non-dilatant;		
3	SS	13.0	15.0	3-4-4-5	17				SP	non-plastic; yellowish brown (10YR 5/4).		
									ML	Sand, fine to medium; dry; loose.		
									SP	Silt, some clay; dry; non-dilatant; non-plastic; yellowish brown (10YR 5/4).		
4	SS	15.0	17.0	2-2-2-6	18		15			Sand, fine to coarse, trace gravel, fine to medium, subangular to subrounded, little silt; dry; loose.		
5	SS	17.0	19.0	2-2-4-5	16							
6	SS	19.0	21.0	2-3-3-5	18					Note: From 19 to 21 feet no gravel present; moist.		

TYPE OF CASING USED

	NQ-2 ROCK CORE	
NA	6" x 3.25 HSA	
NA	9" x 6.25 HSA	
NA	HW CASING ADVANCER	4"
NA	NW CASING	3"
NA	SW CASING	6"
NA	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 **J. Wanner**

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1603** DATE **10/05/16** SHEET **2** OF **4**

PROJECT **Mountaineer Plant** BORING START **05/03/16** BORING FINISH **05/04/16**

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
7	SS	21.0	23.0	3-2-4-4	18							
8	SS	23.0	25.0	2-5-8-8	17		25			Note: From 23.3 to 25 feet, includes trace gravel, fine to medium, subangular to subrounded.		
9	SS	25.0	27.0	4-4-5-6	20					Note: From 25 to 27 feet no gravel; moist.		
10	SS	27.0	29.0	4-4-6-8	18					Note: From 26 to 26.3 feet includes some gravel, fine to medium, subangular to subrounded. Note: From 27.5 to 28.5 feet weakly stratified.		
11	SS	29.0	31.0	2-6-7-7	20		30			Note: At 28.5 feet trace very fine coal fragments. Note: From 30 to 30.9 feet includes some fine gravel.		
12	SS	31.0	33.0	4-4-5-7	20							
13	SS	33.0	35.0	6-5-7-11	21					Note: From 33 to 33.6 feet; moist.		
14	SS	35.0	37.0	10-8-10-10	21		35		SW	Fine sand with silt; moist; loose; yellowish brown (10YR 5/4).		
15	SS	37.0	39.0	13-8-10-9	18				SP	Sand, little silt, little gravel; moist; loose; sand is fine to coarse; gravel is fine to medium.		
16	SS	39.0	41.0	5-7-10-10	20		40		SP	Sandy silt, some fine gravel, trace clay; moist; very soft; sand is fine to coarse; dark yellowish brown (10YR 4/4). Gravelly sand; dry; loose; sand is fine to coarse, gravel is fine to medium, both fractions are angular to subrounded.		
17	SS	41.0	43.0	6-9-10-12	17				SP	Sand, fine to medium, little silt; dry; loose; yellowish brown (10YR 5/4).		
18	SS	43.0	45.0	6-11-20-18	21					Note: From 42.6 to 42.9 feet includes some fine to medium gravel; subrounded. Note: From 44 to 44.8 feet includes some fine to medium gravel; round to subrounded.		
19	SS	45.0	47.0	9-12-14-14	20		45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1603** DATE **10/05/16** SHEET **3** OF **4**

PROJECT **Mountaineer Plant** BORING START **05/03/16** BORING FINISH **05/04/16**

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
20	SS	47.0	49.0	10-13-16-18	22					Note: From 46 to 46.9 feet includes some fine to medium gravel, subangular to subrounded.		
21	SS	49.0	51.0	6-7-10-14	18		50			Note: At 48 feet includes fine to medium gravel.		
22	SS	51.0	53.0	13-16-22-25	20					Note: From 50.5 to 51 feet slight increase in silt content.		
23	SS	53.0	55.0	7-9-12-15	20					Note: At 52 feet trace coal fines. Note: At 53 feet moist. Note: From 54.2 to 54.3 feet includes coal fines.		
24	SS	55.0	57.0	10-14-17-23	20		55		SM	Sandy silt, some clay; moist; soft; dark yellowish brown (10YR 4/4).		
25	SS	57.0	59.0	7-6-7-9	18				SP	Sand, little silt; moist; loose; yellowish brown (10YR 5/4). Note: At 57 feet wet.	▽	
26	SS	59.0	61.0	4-5-7-9	19							
27	SS	61.0	63.0	9-13-15-19	0.9		60			Gravelly sand; wet; loose; gravel is fine to medium, sand is fine to coarse; yellowish brown (10YR 5/4).		
28	SS	63.0	65.0	13-27-50/5	24				SP	Sand, little silt; wet; loose; sand is fine to coarse. Note: From 64 to 65 feet heaving sands.		
29	SS	65.0	67.0	10-6-6-9	12		65		GP	Gravel, some coarse sand; wet; loose; gravel is fine to medium, subangular to subrounded dominant; washed.		
30	SS	67.0	69.0	6-6-8-9	0.9				SP	Sand, fine to medium, little silt; wet; loose; yellowish brown (10YR 5/4).		
31	SS	69.0	71.0	6-8-7-8	0.8				SP	Sand with fine gravel, little silt; wet; loose; sand is fine to coarse. Sand with little fine gravel, little silt; wet; loose.		
32	SS	71.0	73.0	4-5-4-5	0.9		70					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1603** DATE **10/05/16** SHEET **4** OF **4**

PROJECT **Mountaineer Plant** BORING START **05/03/16** BORING FINISH **05/04/16**

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	73.0	76.0	4-5-5-6	0.9		75					
										End of boring at 76 feet. See well construction log for development information.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power**

PROJECT **Mountaineer Plant**

COORDINATES **N 720,194.0 E 1,733,082.0**

GROUND ELEVATION **595.6** SYSTEM **NAD 1927**

Water Level, ft	▽ 51.0	▼	▼
TIME			
DATE	4/26/2016		

BORING NO. **MW-1604D** DATE **10/05/16** SHEET **1** OF **4**

BORING START **04/26/16** BORING FINISH **04/26/16**

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

HGT. RISER ABOVE GROUND **2.63** DIA **2"**

DEPTH TO TOP OF WELL SCREEN **69.0** BOTTOM **79.0**

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

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

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
0	NR	0.0	8.8		0					Straight drilled to 8.8 feet, boring was pre-drilled for utility clearance; no samples were taken.		
1	SS	8.8	10.8	2-2-3-3	17		5		SM	Fine sand with silt, trace clay; dry; loose; yellowish brown (10YR 5/4).		
2	SS	10.0	12.0	3-2-3-4	19		10					
3	SS	12.0	14.0	3-1-5-10	18				ML	Silt, little clay, trace fine sand; moist; non-dilatant; non-plastic; yellowish brown (10YR 5/4).		
4	SS	14.0	16.0	9-9-8-9	0.9				SP	Sand, some gravel, little silt; dry; loose; gravel is fine to medium, subrounded to rounded, yellowish brown (10YR 5/4).		
5	SS	16.0	18.0	10-12-11-11	12		15					
6	SS	18.0	20.0	11-11-9-10	14							

TYPE OF CASING USED

	NQ-2 ROCK CORE
NA	6" x 3.25 HSA
NA	9" x 6.25 HSA
NA	HW CASING ADVANCER 4"
NA	NW CASING 3"
NA	SW CASING 6"
NA	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 **J. Wanner**

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1604D** DATE **10/05/16** SHEET **2** OF **4**

PROJECT **Mountaineer Plant** BORING START **04/26/16** BORING FINISH **04/26/16**

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
7	SS	20.0	22.0	8-9-12-12	18							
8	SS	22.0	24.0	5-10-12-13	16							
9	SS	24.0	26.0	7-10-13-14	12		25			Note: At 24 feet wet.		
10	SS	26.0	28.0	8-10-18-22	16				SP	Sand, little fine gravel, little silt; moist; loose; sand is fine to coarse, subangular to rounded; yellowish brown (10YR 5/4).		
11	SS	28.0	30.0	3-10-16-22	18		30					
12	SS	30.0	32.0	11-11-16-22	16							
13	SS	32.0	34.0	10-12-19-17	14					Note: At 32 feet dry.		
14	SS	34.0	36.0	6-11-16-18	18		35					
15	SS	36.0	38.0	8-8-10-12	14							
16	SS	38.0	40.0	6-7-7-10	17							
17	SS	40.0	42.0	7-11-10-19	19		40					
18	SS	42.0	44.0	6-8-14-17	19							
19	SS	44.0	46.0	10-8-8-9	19							
							45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1604D** DATE **10/05/16** SHEET **3** OF **4**

PROJECT **Mountaineer Plant** BORING START **04/26/16** BORING FINISH **04/26/16**

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
20	SS	46.0	48.0	8-10-14-11	19					Note: From 46.3 to 46.45 feet black, fine, soft, organic layer, weak platy structure.		
21	SS	48.0	50.0	5-5-7-10	21				SP	Sand, little silt; moist; loose; sand is very fine to medium; yellowish brown (10YR 5/4).		
22	SS	50.0	52.0	5-8-8-10	21		50			Note: From 51 to 54 feet wet.	▽	
23	SS	52.0	54.0	8-8-10-12	19							
24	SS	54.0	56.0	6-5-6-8	21					Note: From 54 to 55.6 feet color changes to very dark grayish brown (10YR 3/2); wet.		
25	SS	56.0	58.0	4-8-30-42	18		55			Note: From 55.6 to 55.9 feet stratified with little clay, black color.		
									SP	Sand, some silt, trace clay; wet; loose; yellowish brown (10YR 5/4).		
26	SS	58.0	60.0	5-5-10-11	16							
27	SS	60.0	62.0	7-10-12-18	21		60			Note: From 60.9 to 61 feet little fine rounded gravel.		
28	SS	62.0	64.0	9-10-15-16	18					Note: From 61.4 to 61.6 feet is about 25-35% fine black material, possible coal.		
29	SS	64.0	66.0	9-12-15-15	16							
30	SS	66.0	68.0	3-8-10-15	20		65					
31	SS	68.0	70.0	3-8-16-24	20							
32	SS	70.0	72.0	6-20-32-30	20		70			Note: At 69.3 feet color is very dark gray (10YR 3/1). Note: At 69.4 feet color is dark yellowish brown (10YR 4/6). Note: From 70 to 71.7 feet color changes to grayish brown (10YR 5/2).		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1604D** DATE **10/05/16** SHEET **4** OF **4**

PROJECT **Mountaineer Plant** BORING START **04/26/16** BORING FINISH **04/26/16**

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	72.0	74.0	9-14-17-21	21				SM	Silty fine sand; wet; loose; rapid dilatant grades to medium dilatant, yellowish brown (10YR 5/4).		
									SP	Sand, some silt, trace clay; wet; loose; trace fine to medium gravel, subrounded, grayish brown (10YR 5/2).		
34	SS	74.0	76.0	9-14-14-19	17		75					
35	SS	76.0	78.0	4-10-11-18	14							
36	SS	78.0	80.0	6-14-15-17	18		80			End of boring at 80 feet. See well construction log for development information.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power**

PROJECT **Mountaineer Plant**

COORDINATES **N 720,189.8 E 1,733,077.2**

GROUND ELEVATION **595.5** SYSTEM **NAD 1927**

Water Level, ft	▽ 51.0	▼	▼
TIME			
DATE	4/28/2016		

BORING NO. **MW-1604S** DATE **10/05/16** SHEET **1** OF **3**

BORING START **04/28/16** BORING FINISH **04/28/16**

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

HGT. RISER ABOVE GROUND **2.59** DIA **2"**

DEPTH TO TOP OF WELL SCREEN **49.0** BOTTOM **59.0**

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

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

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
0	NR	0.0	49.0		0		5 10 15			Straight drilled from 0 to 49 feet; geologic descriptions adapted from the adjacent boring MW-1604D.		

TYPE OF CASING USED

	NQ-2 ROCK CORE	
NA	6" x 3.25 HSA	
NA	9" x 6.25 HSA	
NA	HW CASING ADVANCER	4"
NA	NW CASING	3"
NA	SW CASING	6"
NA	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 **J. Wanner**

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1604S** DATE **10/05/16** SHEET **2** OF **3**

PROJECT **Mountaineer Plant** BORING START **04/28/16** BORING FINISH **04/28/16**

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
							25					
							30					
							35					
							40					
							45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1604S** DATE **10/05/16** SHEET **3** OF **3**

PROJECT **Mountaineer Plant** BORING START **04/28/16** BORING FINISH **04/28/16**

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
1	SS	49.0	51.0	4-7-10-13	17		50		SP	Sand some silt, trace clay; moist to wet; loose; yellowish brown (10YR 5/4). Note: From 50 to 50.2 feet includes black, fine material likely coal.	▽	
2	SS	51.0	53.0	6-6-11-10	20							
3	SS	53.0	55.0	3-10-25-50/3	24					Note: At 53 feet wet. Note: At 54 feet trace medium subrounded gravel.		
4	SS	55.0	57.0	3-5-9-15	24		55			Note: High blow count cause by heaving sand. Note: From 55 to 60 feet wet.		
5	SS	57.0	60.0	12-15-20-28	24							
							60			End of boring at 60 feet. See well construction log for development information.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power**

PROJECT **Mountaineer Plant**

COORDINATES **N 720,117.3 E 1,733,468.6**

GROUND ELEVATION **588.5** SYSTEM **NAD 1927**

Water Level, ft	▽ 44.0	▼	▼
TIME			
DATE	5/9/2016		

BORING NO. **MW-1605D** DATE **10/05/16** SHEET **1** OF **4**

BORING START **05/09/16** BORING FINISH **05/10/16**

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

HGT. RISER ABOVE GROUND **2.50** DIA **2"**

DEPTH TO TOP OF WELL SCREEN **69.0** BOTTOM **79.0**

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

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

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
0	NR	0.0	8.0		0					Straight Drilled to 8 feet, utility pre-clearance straight drilled; no samples taken.		
1	SS	8.0	10.0	3-3-5-6	24		5		CL CH	Clay with silt; medium to high plasticity; slow dilatancy; dry; soft; brown (10YR 5/3).		
2	SS	10.0	12.0	3-3-4-4	24		10		ML	Silt, little clay; low plasticity; little sand, very fine to fine; moist; soft; yellowish brown (10YR 5/4).		
3	SS	12.0	14.0	1-1-2-3	22				ML	Silt; non-plastic; rapid dilatancy; little sand, very fine; moist; soft; yellowish brown (10YR 5/4).		
4	SS	14.0	16.0	3-3-2-4	22		15					
5	SS	16.0	18.0	1-1-2-3	21				SM	Sand, very fine; and silt; trace gravel, small pebbles, subangular to subround, poorly sorted; wet; yellowish brown (10YR 5/4).		
6	SS	18.0	20.0	1-4-7-10	10				SM	Sand, fine to very coarse; little silt; little gravel, small pebbles, subangular to subround; poorly sorted; dry; brown (7.5Y 5/4).		

TYPE OF CASING USED

	NQ-2 ROCK CORE	
NA	6" x 3.25 HSA	
NA	9" x 6.25 HSA	
NA	HW CASING ADVANCER	4"
NA	NW CASING	3"
NA	SW CASING	6"
NA	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. Darmon**

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1605D** DATE **10/05/16** SHEET **2** OF **4**

PROJECT **Mountaineer Plant** BORING START **05/09/16** BORING FINISH **05/10/16**

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
7	SS	20.0	22.0	10-11-11-11	19							
8	SS	22.0	24.0	7-10-12-10	14				SM	Sand, fine to coarse; little silt; little gravel, small pebbles, subangular to subround; poorly sorted; dry; brown (7.5Y 5/4).		
9	SS	24.0	26.0	10-7-7-9	16		25		SP	Sand, fine to coarse; trace silt; trace gravel, small pebbles, subround; well sorted; dry; yellowish brown (10YR 5/4).		
10	SS	26.0	28.0	4-5-12-7	17				SW	Sand, coarse, some gravel; small to medium pebbles, subangular to subround; poorly sorted; dry; light yellowish brown (10YR 6/4).		
11	SS	28.0	30.0	4-5-6-5	3				SP SP	Sand, medium, subangular to subround; little silt; poorly graded; dark brown (10YR 8/2). Sand, coarse; some gravel; small pebbles, subround; well sorted; dry; light gray (7.5Y 7/3).		
12	SS	30.0	32.0	5-9-10-8	2		30		SP	Sand, medium to coarse, subangular to subround; poorly graded; dry; brown (10YR 5/3).		
13	SS	32.0	34.0	3-4-9-6	17				SP	Sand, fine to medium, subround; poorly graded; dry; yellowish brown (10YR 5/4).		
14	SS	34.0	36.0	2-6-7-6	18		35					
15	SS	36.0	38.0	6-6-6-8	19				SP	Sand, fine to coarse; little gravel; granules to small pebbles; subangular to subround; moderate to poorly graded; dry; yellowish brown (10YR 5/4).		
16	SS	38.0	40.0	5-7-8-9	24							
17	SS	40.0	42.0	5-6-7-8	17		40					
18	SS	42.0	44.0	5-6-7-7	16							
19	SS	44.0	46.0	4-5-6-5	23					Note: From 44 to 46 feet, moist.	▽	
							45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1605D** DATE **10/05/16** SHEET **3** OF **4**

PROJECT **Mountaineer Plant** BORING START **05/09/16** BORING FINISH **05/10/16**

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
20	SS	46.0	48.0	3-5-7-7	24				SP	Sand, fine to coarse; trace gravel, small pebbles, subround; little silt; poorly graded; wet; light yellowish brown (10YR 6/4).		
21	SS	48.0	50.0	NM	0					No Recovery, augers dropped to 49.5 feet overnight due to heaving sands. Sands heaved 10.5 feet into auger.		
22	SS	50.0	52.0	5-11-23-39	24		50		SP	Sand, medium to coarse, subangular to subround; little silt; moderate to poorly graded; wet; light yellowish brown (10YR 6/4).		
23	SS	52.0	54.0	4-7-9-9	5							
24	SS	54.0	56.0	3-3-7-7	14		55					
25	SS	56.0	58.0	7-10-10-9	12							
26	SS	58.0	60.0	9-15-10-11	20					Note: From 59 to 60 feet black discoloration from sand granules.		
27	SS	60.0	62.0	9-10-13-13	24		60		SW	Sand, fine to coarse, angular to subround; little to some silt; well graded; wet; grayish brown (10YR 5/2).		
28	SS	62.0	64.0	9-13-17-6	24				SW	Sand, fine to coarse; trace coal fragments at 62 to 62.5 feet; subangular to subround; poorly sorted; wet; pale brown (10YR 6/3).		
29	SS	64.0	66.0	5-9-4-4	8				SW	Sand, fine to medium; trace to little silt; subround; poorly graded; wet; pale brown (10YR 6/3).		
30	SS	66.0	68.0	9-10-10-19	24		65		SP	Sand, medium to coarse; trace gravel, small pebbles, subangular to subround; well sorted; wet; light gray (10YR 7/2).		
31	SS	68.0	70.0	9-14-22-20	8				SW	Sand, coarse; small pebbles, subround; poorly sorted; wet; very pale brown (10YR 7/4).		
32	SS	70.0	72.0	9-8-8-7	12		70					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1605D** DATE **10/05/16** SHEET **4** OF **4**

PROJECT **Mountaineer Plant** BORING START **05/09/16** BORING FINISH **05/10/16**

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	72.0	74.0	7-8-14-11	14							
34	SS	74.0	76.0	9-21-8-10	20		75					
35	SS	76.0	78.0	10-13-21-10	13				SP	Sand, medium, subround; well sorted; wet; light gray (10YR 7/2).		
36	SS	78.0	80.0	13-14-29-14	16				SW	Sand, coarse; some gravel, small pebbles, subangular to subround; poorly sorted; wet; very pale brown (10YR 7/4).		
							80			End of boring at 80 feet. See well construction log for development information.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power**

PROJECT **Mountaineer Plant**

COORDINATES **N 720,112.2 E 1,733,471.2**

GROUND ELEVATION **588.5** SYSTEM **NAD 1927**

Water Level, ft	▽ 44.0	▼	▼
TIME			
DATE	5/11/2016		

BORING NO. **MW-1605S** DATE **10/05/16** SHEET **1** OF **3**

BORING START **05/11/16** BORING FINISH **05/12/16**

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

HGT. RISER ABOVE GROUND **2.35** DIA **2"**

DEPTH TO TOP OF WELL SCREEN **49.0** BOTTOM **59.0**

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

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

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
0	NR	0.0	48.0				5 10 15			Straight drilled from 0 to 48 feet; geologic descriptions adapted from the adjacent boring MW-1605D.		

TYPE OF CASING USED

	NQ-2 ROCK CORE	
NA	6" x 3.25 HSA	
NA	9" x 6.25 HSA	
NA	HW CASING ADVANCER	4"
NA	NW CASING	3"
NA	SW CASING	6"
NA	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, Darmon**

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1605S** DATE **10/05/16** SHEET **2** OF **3**

PROJECT **Mountaineer Plant** BORING START **05/11/16** BORING FINISH **05/12/16**

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
							25					
							30					
							35					
							40					
							45				▽	

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AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1605S** DATE **10/05/16** SHEET **3** OF **3**

PROJECT **Mountaineer Plant** BORING START **05/11/16** BORING FINISH **05/12/16**

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
1	SS	48.0	50.0	1-2-3-4	16				SP	Sand, medium to coarse; trace to little silt and gravel, small pebbles, subangular to subround; moderate to poorly graded; wet; light yellowish brown (10YR 6/4).		
2	SS	50.0	52.0	1-1-1-2	1		50			Note: Poor recovery caused by drilling equipment failure at 51 feet.		
3	SS	52.0	54.0	5-6-5-5	12				SP	Sand, medium to coarse; trace to little gravel, small pebbles, subangular to subround; little silt; moderate to poorly graded; wet; pale brown (10YR 6/3).		
4	SS	54.0	56.0	5-6-6-3	15		55					
5	SS	56.0	58.0	8-3-3-7	20							
6	SS	58.0	60.0	10-13-50/6	24					End of boring at 59.5 feet spoon refusal. Note: Heaving sand. See well construction log for development information.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power**

PROJECT **Mountaineer Plant**

COORDINATES **N 719,653.7 E 1,733,935.3**

GROUND ELEVATION **587.3** SYSTEM **NAD 1927**

Water Level, ft	▽ 43.0	▼	▼
TIME			
DATE	5/12/2016		

BORING NO. **MW-1606D** DATE **10/05/16** SHEET **1** OF **4**

BORING START **05/12/16** BORING FINISH **05/13/16**

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

HGT. RISER ABOVE GROUND **2.85** DIA **2"**

DEPTH TO TOP OF WELL SCREEN **65.0** BOTTOM **75.0**

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

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

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
0	NR	0.0	8.0							Straight drilled to 8 feet, boring was pre-drilled for utility clearance; no samples were taken.		
1	SS	8.0	10.0	3-3-4-5	25		5		ML	Silt and sand, very fine; non-plastic; non-plastic; no dilatancy; moist; soft; light yellowish brown (10YR 6/4).		
2	SS	10.0	12.0	1-3-5-4	22		10		SC SM	Sand, very fine; little silt; little clay; moist; light yellowish brown (10YR 6/4).		
3	SS	12.0	14.0	3-7-14-21	22							
4	SS	14.0	16.0	6-10-13-8	20				SW	Sand, fine to coarse; little gravel, small to medium pebbles; subround; trace to little silt; well graded; dry; yellowish brown (10YR 5/4).		
5	SS	16.0	18.0	10-13-10-10	17		15					
6	SS	18.0	20.0	6-6-7-10	17							

TYPE OF CASING USED

	NQ-2 ROCK CORE
NA	6" x 3.25 HSA
NA	9" x 6.25 HSA
NA	HW CASING ADVANCER 4"
NA	NW CASING 3"
NA	SW CASING 6"
NA	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. Darmon**

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1606D** DATE **10/05/16** SHEET **2** OF **4**

PROJECT **Mountaineer Plant** BORING START **05/12/16** BORING FINISH **05/13/16**

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
7	SS	20.0	22.0	10-10-7-6	23							
8	SS	22.0	24.0	10-10-13-14	21				SP	Sand, medium to coarse; trace gravel, small pebbles, subround; dry; light yellowish brown (10YR 6/4).		
9	SS	24.0	26.0	6-8-9-8	24		25					
10	SS	26.0	28.0	5-4-3-4	18				SP	Sand, medium to coarse; trace gravel, small pebbles, subround; poorly graded; dry; brownish yellow (10YR 6/6).		
11	SS	28.0	30.0	4-5-4-4	22				SW SP	Sand, fine to coarse, subround; well graded; dry; light yellowish brown (10YR 6/4) with black staining coal (10YR 2/1).		
12	SS	30.0	32.0	4-4-5-6	17		30		SP	Sand, medium to coarse; trace to little gravel, small pebbles, subround; moderate to poorly graded; yellowish brown (10YR 5/4). Note: Stratified with a 1-inch layer of small pebbles.		
13	SS	32.0	34.0	2-2-5-5	24				SW	Sand, medium to coarse; trace gravel, small pebbles, subround; poorly graded; dry; yellowish brown (10YR 5/4).		
14	SS	34.0	36.0	6-6-6-6	22					Sand, medium to coarse; trace gravel, small pebbles, subangular to subround; some coal, highly weathered; stratified; well graded; dry; pale brown (10YR 6/3).		
15	SS	36.0	38.0	0-6-6-6	19		35		SP	Sand, fine to coarse, subround; trace to little silt; poorly graded; dry; yellowish brown (10YR 5/4).		
16	SS	38.0	40.0	2-3-3-2	20							
17	SS	40.0	42.0	2-2-3-5	22		40					
18	SS	42.0	44.0	1-3-5-6	24					Note: From 42 to 43 feet moist. Note: At 43 feet wet.	▽	
19	SS	44.0	46.0	8-9-10-13	24				SP	Sand, medium to coarse, subround; trace to little silt; poorly graded; wet; yellowish brown (10YR 5/4).		
							45			Note: Recovered sample was all heaved		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1606D** DATE **10/05/16** SHEET **3** OF **4**

PROJECT **Mountaineer Plant** BORING START **05/12/16** BORING FINISH **05/13/16**

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
20	SS	46.0	48.0	10-15-23-23	29				SP	sands. Sand, medium to coarse, subround; poorly graded; wet; yellowish brown (10YR 5/4). Note heaving sands.		
21	SS	48.0	50.0	4-4-2-3	13				SP	Sand, fine to coarse, subround; poorly graded; wet; yellowish brown (10YR 5/4).		
22	SS	50.0	52.0	9-9-3-2	16		50		SP	Sand, medium to coarse; trace fine, subangular to subround; poorly graded; wet; yellowish brown (10YR 5/4).		
23	SS	52.0	54.0	3-2-9-9	19				SP	Sand, medium to coarse; trace silt and gravel, small pebbles, subangular to subround; poorly graded; wet; yellowish brown (10YR 5/4).		
24	SS	54.0	56.0	3-9-13-30	24		55					
25	SS	56.0	58.0	9-13-13-3	21				SW	Sand, fine to coarse; little gravel, small to medium pebbles; trace silt, subround; moderate to well graded; wet; yellowish brown (10YR 5/4).		
26	SS	58.0	60.0	10-15-13-14	19				SP	Sand, fine to medium, subround; poorly graded; wet; yellowish brown (10YR 5/4).		
27	SS	60.0	62.0	7-12-15-10	16		60		SP	Sand, medium to coarse, subround; poorly graded; wet; yellowish brown (10YR 5/4).		
28	SS	62.0	64.0	7-10-10-11	24				SP	Sand, medium to coarse; trace gravel, small to medium pebbles, subround; poorly graded; wet; yellowish brown (10YR 5/4).		
29	SS	64.0	66.0	9-12-18-19	19		65					
30	SS	66.0	68.0	7-13-18-32	13				SW	Sand, fine to coarse, subangular to subround; moderate to well graded; wet; light brownish gray (10YR 6/2).		
31	SS	68.0	70.0	8-8-24-7	13				SM	Note: At 60 feet 40% granules to small pebbles.		
32	SS	70.0	72.0	8-23-7-11	19		70		SP	Sand, fine to coarse; some silt; trace clay; well graded; wet; yellowish brown (10YR 5/4).		
									SW	Sand, medium to coarse, subround; poorly graded; wet; yellowish brown (10YR 5/4).		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1606D** DATE **10/05/16** SHEET **4** OF **4**

PROJECT **Mountaineer Plant** BORING START **05/12/16** BORING FINISH **05/13/16**

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
33	SS	72.0	74.0	13-20-22-23	15				SP	Sand and gravel, medium to coarse, small to medium pebbles; subround to round; well graded; wet; yellowish brown (10YR 5/4).		
34	SS	74.0	76.0	14-13-10-10	15		75			Sand, medium to coarse, subround; poorly graded; wet; yellowish brown (10YR 5/4).		
										End of boring at 76 feet. See well construction log for development information.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power**

PROJECT **Mountaineer Plant**

COORDINATES **N 719,649.2 E 1,733,939.3**

GROUND ELEVATION **587.3** SYSTEM **NDA 1927**

Water Level, ft	▽ 43.0	▼	▼
TIME			
DATE	5/17/2016		

BORING NO. **MW-1606S** DATE **10/05/16** SHEET **1** OF **3**

BORING START **05/17/16** BORING FINISH **05/17/16**

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

HGT. RISER ABOVE GROUND **2.87** DIA **2"**

DEPTH TO TOP OF WELL SCREEN **49.0** BOTTOM **59.0**

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

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

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
0	NR	0.0	44.0				5 10 15			Straight drilled from 0 to 44 feet; geologic descriptions adapted from the adjacent boring MW-1606D.		

TYPE OF CASING USED

	NQ-2 ROCK CORE	
NA	6" x 3.25 HSA	
NA	9" x 6.25 HSA	
NA	HW CASING ADVANCER	4"
NA	NW CASING	3"
NA	SW CASING	6"
NA	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. Darmon**

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1606S** DATE **10/05/16** SHEET **2** OF **3**

PROJECT **Mountaineer Plant** BORING START **05/17/16** BORING FINISH **05/17/16**

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
							25					
							30					
							35					
							40					
1	SS	44.0	46.0	5-7-15-15	24		45		SP	Sand, fine to coarse, subround; poorly graded; wet; yellowish brown (10YR 5/4).	▽	

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1606S** DATE **10/05/16** SHEET **3** OF **3**

PROJECT **Mountaineer Plant** BORING START **05/17/16** BORING FINISH **05/17/16**

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
2	SS	46.0	48.0	2-2-5-5	13							
3	SS	48.0	50.0	3-7-11-11	24				SP	Sand, medium to coarse, subround; poorly graded; wet; yellowish brown (10YR 5/4).		
4	SS	50.0	52.0	5-7-7-8	24		50		SP	Sand, fine to coarse, subround; poorly graded; wet; yellowish brown (10YR 5/4).		
5	SS	52.0	54.0	5-5-4-4	18				SP	Sand, fine to coarse; trace silt; trace gravel, small pebbles, subround; poorly graded; wet; yellowish brown (10YR 5/4).		
6	SS	54.0	56.0	10-22-15-22	24		55			Note: From 55 to 56 feet increase small to medium pebbles.		
										End of boring at 56 feet. See well construction log for development information.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power**

PROJECT **Mountaineer Plant**

COORDINATES **N 719,235.7 E 1,734,361.8**

GROUND ELEVATION **590.8** SYSTEM **NAD 1927**

Water Level, ft	▽ 46.0	▼	▼
TIME			
DATE	5/18/2016		

BORING NO. **MW-1607D** DATE **10/05/16** SHEET **1** OF **4**

BORING START **05/18/16** BORING FINISH **05/18/16**

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

HGT. RISER ABOVE GROUND **3.18** DIA **2"**

DEPTH TO TOP OF WELL SCREEN **70.0** BOTTOM **80.0**

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

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

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
0	NR	0.0	8.0		0					Straight drill boring to 8 feet, boring was pre-drilled for utility clearance; no samples were taken.		
1	SS	8.0	10.0	1-2-3-4	24		5		ML	Silt, trace to little clay, non-plastic, none to slow dilatancy; trace sand, very fine; moist; soft; very pale brown (10YR 7/4).		
2	SS	10.0	12.0	1-3-4-4	22		10		SC SM	Sand, very fine to fine; silt; trace to little clay; well graded; moist; light yellowish brown (10YR 6/4).		
3	SS	12.0	14.0	2-4-5-5	20				CL	Clay; little silt; medium to high plasticity; trace to little very fine to fine sand; moist; medium stiff; yellowish brown (10YR 5/4).		
4	SS	14.0	16.0	4-6-8-10	22				SM	Sand and silt; fine; medium to well graded; dry; yellowish brown (10YR 5/4).		
5	SS	16.0	18.0	6-9-10-8	18		15		SW	Sand, medium to coarse; some gravel, small to medium pebbles, little fine, subangular to subround; well graded; dry; yellowish brown (10YR 5/4).		
6	SS	18.0	20.0	6-9-8-11	14					Note: At 19.5 feet coal fines present.		

TYPE OF CASING USED

	NQ-2 ROCK CORE	
NA	6" x 3.25 HSA	
NA	9" x 6.25 HSA	
NA	HW CASING ADVANCER	4"
NA	NW CASING	3"
NA	SW CASING	6"
NA	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. Darmon**

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1607D** DATE **10/05/16** SHEET **2** OF **4**

PROJECT **Mountaineer Plant** BORING START **05/18/16** BORING FINISH **05/18/16**

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
7	SS	20.0	22.0	9-13-13-6	24				SM	Sand and silt; fine to coarse; little to some gravel, small to medium pebbles, subangular to subround; trace clay; well graded; moist; yellowish brown (10YR 5/4).		
8	SS	22.0	24.0	5-5-9-10	19				SP	Sand, medium to coarse; trace silt; subround; poorly graded; dry; yellowish brown (10YR 5/4).		
9	SS	24.0	26.0	8-8-9-6	20		25		SW	Sand, fine to coarse; trace to little silt; subround; well graded; dry; yellowish brown (10YR 5/4).		
10	SS	26.0	28.0	6-5-6-5	24				SW	Sand, fine to coarse; some gravel, angular to subround; trace silt; well graded; dry; yellowish brown (10YR 5/4).		
11	SS	28.0	30.0	5-6-6-5	22							
12	SS	30.0	32.0	4-4-4-6	22		30		SP	Sand, fine to medium, subround; trace silt; poorly graded; dry; brown (10YR 5/3).		
13	SS	32.0	34.0	4-9-9-9	24				SW	Sand, fine to medium; trace coarse gravel; small to medium gravel; pebbles; subangular to subround; dry; brown (10YR 5/3).		
14	SS	34.0	36.0	5-7-9-4	24							
15	SS	36.0	38.0	5-6-6-9	21		35			Note: From 35.8 to 36 feet includes coal.		
									SW	Sand, fine to coarse; trace gravel; small pebbles, subangular to subround; well graded; satinfin <1" thick, pale brown (10YR 6/3).		
16	SS	38.0	40.0	4-6-8-8	18					Note: From 26 to 39 feet includes trace to little amount of coal fragments.		
17	SS	40.0	42.0	4-4-6-8	22		40		SP	Sand, fine to medium, subround: trace to little silt; poorly graded; dry; yellowish brown (10YR 5/4).		
18	SS	42.0	44.0	3-6-8-8	20							
19	SS	44.0	46.0	4-6-7-8	24							
							45			Note: At 46 feet, saturated.	▽	

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1607D** DATE **10/05/16** SHEET **3** OF **4**

PROJECT **Mountaineer Plant** BORING START **05/18/16** BORING FINISH **05/18/16**

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
20	SS	46.0	48.0	1-2-2-8	24				SW	Sand, fine to coarse, subround; well graded; wet; yellowish brown (10YR 5/4).		
21	SS	48.0	50.0	NM	0					No recovery; heaving sands.		
22	SS	50.0	52.0	1-3-7-9	28		50		SP	Sand, medium to coarse; trace to little silt; subround; poorly graded; wet; yellowish brown (10YR 5/4).		
23	SS	52.0	54.0	5-6-9-15	28					Note: At 53.5 feet coal present.		
24	SS	54.0	56.0	7-9-14-15	15				SW	Sand, fine to coarse; little gravel, small pebbles; subround; medium to well graved, dark brown (10YR 7/4).		
25	SS	56.0	58.0	7-10-10-13	13		55		SW	Sand, fine to coarse; trace to little small pebbles, subround; well graded; wet; pale brown (10YR 7/4).		
26	SS	58.0	60.0	5-6-10-11	14							
27	SS	60.0	62.0	6-10-11-13	11		60		SP	Sand, medium to coarse; trace small pebbles, subround; poorly graded; wet; yellowish brown (10YR 5/4).		
28	SS	62.0	64.0	8-10-13-11	0					No recovery.		
29	SS	64.0	66.0	5-10-13-5	15				SP	Sand, medium to coarse; trace fine; trace silt; trace gravel; small to medium pebbles, subround, poorly graded; wet; yellowish brown (10YR 5/4).		
30	SS	66.0	68.0	10-15-20-22	18		65		SP	Sand, medium to coarse, subround; medium to poorly graded; wet; yellowish brown (10YR 5/4).		
31	SS	68.0	70.0	11-15-15-7	20				SW	Sand, fine to very coarse, subround; little to some silt; medium to well graded; wet; light brownish gray (10YR 6/2).		
32	SS	70.0	72.0	2-6-14-14	15		70					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1607D** DATE **10/05/16** SHEET **4** OF **4**

PROJECT **Mountaineer Plant** BORING START **05/18/16** BORING FINISH **05/18/16**

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	72.0	74.0	10-15-18-18	12							
34	SS	74.0	76.0	9-12-12-7	11		75					
35	SS	76.0	78.0	6-6-8-8	24				SP	Sand, medium to coarse, subround; poorly graded; wet; pale brown (10YR 6/3).		
36	SS	78.0	80.0	20-30-22-11	24		80			End of boring at 80 feet. See well construction log for development information.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power**

PROJECT **Mountaineer Plant**

COORDINATES **N 719,232.0 E 1,734,365.1**

GROUND ELEVATION **590.8** SYSTEM **NAD 1927**

Water Level, ft	▽ 46.0	▼	▼
TIME			
DATE	5/26/2016		

BORING NO. **MW-1607S** DATE **10/05/16** SHEET **1** OF **3**

BORING START **05/26/16** BORING FINISH **05/26/16**

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

HGT. RISER ABOVE GROUND **3.20** DIA **2"**

DEPTH TO TOP OF WELL SCREEN **50** BOTTOM **60**

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

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

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
0	NR	0.0	50.0		0		5 10 15			Straight drill boring to 50 feet, boring was pre-drilled for utility clearance; no samples were taken.		

TYPE OF CASING USED

	NQ-2 ROCK CORE	
NA	6" x 3.25 HSA	
NA	9" x 6.25 HSA	
NA	HW CASING ADVANCER	4"
NA	NW CASING	3"
NA	SW CASING	6"
NA	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. Darmon**

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1607S** DATE **10/05/16** SHEET **2** OF **3**

PROJECT **Mountaineer Plant** BORING START **05/26/16** BORING FINISH **05/26/16**

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
							25					
							30					
							35					
							40					
							45				▽	

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1607S** DATE **10/05/16** SHEET **3** OF **3**

PROJECT **Mountaineer Plant** BORING START **05/26/16** BORING FINISH **05/26/16**

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
							50					
1	SS	50.0	52.0	NA	0					Augers dropped 4 foot into hole due to heaving sands, no samples collected.		
2	SS	52.0	54.0	NA	0							
3	SS	54.0	56.0	WOH-WOH-2-2	0		55			No sample collected, no recovery, attempted resample but auger dropped additional 2 feet due to heaving sands.		
4	SS	56.0	58.0	4-5-6-10	15				SW	Sand; fine to coarse; trace to little gravel; small pebbles; subround; moderate to well graded; wet; pale brown (10YR 7/4).		
5	SS	58.0	60.0	5-5	20							
							60			End of boring at 60 feet. See well construction log for development information.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power**

PROJECT **Mountaineer Plant**

COORDINATES **N 723,642.8 E 1,730,611.2**

GROUND ELEVATION **587.3** SYSTEM **NAD 1927**

Water Level, ft	▽ 48.0	▼	▼
TIME			
DATE	6/2/2016		

BORING NO. **MW-1608** DATE **10/05/16** SHEET **1** OF **3**

BORING START **06/02/16** BORING FINISH **06/07/16**

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

HGT. RISER ABOVE GROUND **3.39** DIA **2"**

DEPTH TO TOP OF WELL SCREEN **46.0** BOTTOM **56.0**

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

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

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
0	NR	0.0	12.0		0					Straighted drilled to 12 feet, boring was pre-drilled for utility clearance; no samples were taken.		
							5					
							10					
1	SS	12.0	14.0	5-4-5-5	24				ML	Silt; little clay; trace fine sand; dry; slow dilatancy; (10YR 4/5).		
4	SS	14.0	16.0	3-1-1-2	21				SW	Sand, fine to very fine; loose; dry.		
5	SS	16.0	18.0	1-1-1-3	21		15					
6	SS	18.0	20.0	1-2-4-3	21							

TYPE OF CASING USED

	NQ-2 ROCK CORE	
NA	6" x 3.25 HSA	
NA	9" x 6.25 HSA	
NA	HW CASING ADVANCER	4"
NA	NW CASING	3"
NA	SW CASING	6"
NA	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 **J. Wanner**

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1608** DATE **10/05/16** SHEET **2** OF **3**

PROJECT **Mountaineer Plant** BORING START **06/02/16** BORING FINISH **06/07/16**

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
7	SS	20.0	22.0	14	14							
8	SS	22.0	24.0	7-13-15-14	13				SW	Sand; some gravel; fine to medium; angular; dry; loose; unstratified; gravel is igneous dominant; (10YR 4/3).		
9	SS	24.0	26.0	10-16-14-11	13		25			Note: At 25 feet trace coal and gravel (metamorphic; rounded); foliated.		
10	SS	26.0	28.0	8-12-12-14	17				SW	Sand; some gravel, fine to medium; angular; dominant; little silt; dry; loose; unstratified; gravel is igneous dominant; (10YR 4/3).		
11	SS	28.0	30.0	9-15-12-14	14							
12	SS	30.0	32.0	6-8-9-17	18		30					
13	SS	32.0	34.0	11-10-9-9	20				SW	Sand, fine to coarse; little to some silt; trace gravel, fine to medium, angular to rounded; dry; loose; unstratified; (10YR 4/3).		
14	SS	34.0	36.0	7-10-12-9	24				SW	Sand, fine to coarse; little to some silt; little to some gravel, fine to medium dominant; igneous, sedimentary and metamorphic; rounded dominant; dry; loose; unstratified; (10YR 4/3).		
15	SS	36.0	38.0	10-8-5-6	16		35					
16	SS	38.0	40.0	9-8-11-10	17				SW	Sand; some silt; trace gravel, coarse, round, limestone; dry; loose; unstratified; (10YR 4/3). Note: At 39.5 feet very thin coal fragment layer.		
17	SS	40.0	42.0	5-5-8-8	19		40		SW	Sand; little to some silt; little to some gravel, fine, subrounded; dry; loose; unstratified; (10YR 4/3).		
18	SS	42.0	44.0	7-5-6-5	18				SW	Note: At 42.5 feet, coarse, rounded, igneous gravel. Silty sand; moist; loose; unstratified; (10YR 4/3).		
19	SS	44.0	46.0	2-3-5-3	19					Note: From 44 to 46 feet wet; trace coarse gravel, rounded, igneous.		
							45			Note: Heaving sands.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1608** DATE **10/05/16** SHEET **3** OF **3**

PROJECT **Mountaineer Plant** BORING START **06/02/16** BORING FINISH **06/07/16**

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
20	SS	46.0	48.0	4-4-5-4	17				SW	Sand; little to some silt; some gravel; wet; loose; unstratified; gravel is fine to coarse; fine fraction is fine to rounded; sand is subrounded to round; gravel is igneous to sedimentary; gravel colors range from red and green and brown; (looks like outwash); includes trace coal fragments, up to 2cm in size. Note: From 48 to 49.5 feet wet.	▽	
21	SS	48.0	50.0		17							
22	SS	50.0	52.0	6-8-11-9	16		50		SW	Silty sand; wet; loose; unstratified; sand is fine to medium; brown. Note: From 50 to 52 feet wet; incluse 20% coal material, fragments up to 3cm in size.		
23	SS	52.0	54.0	5-7-7-10	13				SW	Sand with silt; wet; loose; unstratified; sand is fine to coarse grades to fine to medium. Note: At 53.5 feet coal fragments up to 2 cm in size. Note: From 54 to 56 feet wet; no coal fragments.		
24	SS	54.0	56.0	8-11-15-17	13		55					
25	SS	56.0	58.0	11-15-16-13	14				SM	Silt and sand; wet; loose; sand is fine to medium; brown.		
26	SS	58.0	60.0	8-15-18-13	16				SW	Sand with silt; trace gravel; wet; loose; unstratified; sand is fine to coarse; gravel is medium to coarse, subrounded; brown.		
27	SS	60.0	62.0	9-14-16-20	14		60		SW	Silty sand; trace fine gravel; wet; loose; unstratified; sand is fine to coarse; (10YR 4/3).		
28	SS	62.0	64.0	2-12-40-50/2	19							
29	SS	64.0	66.0	20-50/4	24				SW	Recovery was all heaved sand.		
30	SS	66.0	68.0	12-20-25-30	0.9		65		SP	Fine sand with silt; wet; loose; sand is very fine to fine dominant; bottom of recovery includes coarse gravel (chert), subangular; (10YR 5/2).		
31	SS	68.0	70.0	12-15-20-20	17				SW	Note: At 68 feet coursing with depth.		
									SP	Sand and gravel; trace silt; clean-washed interval; wet; loose.		
									SP	Sand with silt; little fine; gravel; wet; loose.		
							70			End of boring at 70 feet. See well construction for development information.		

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ARCADIS

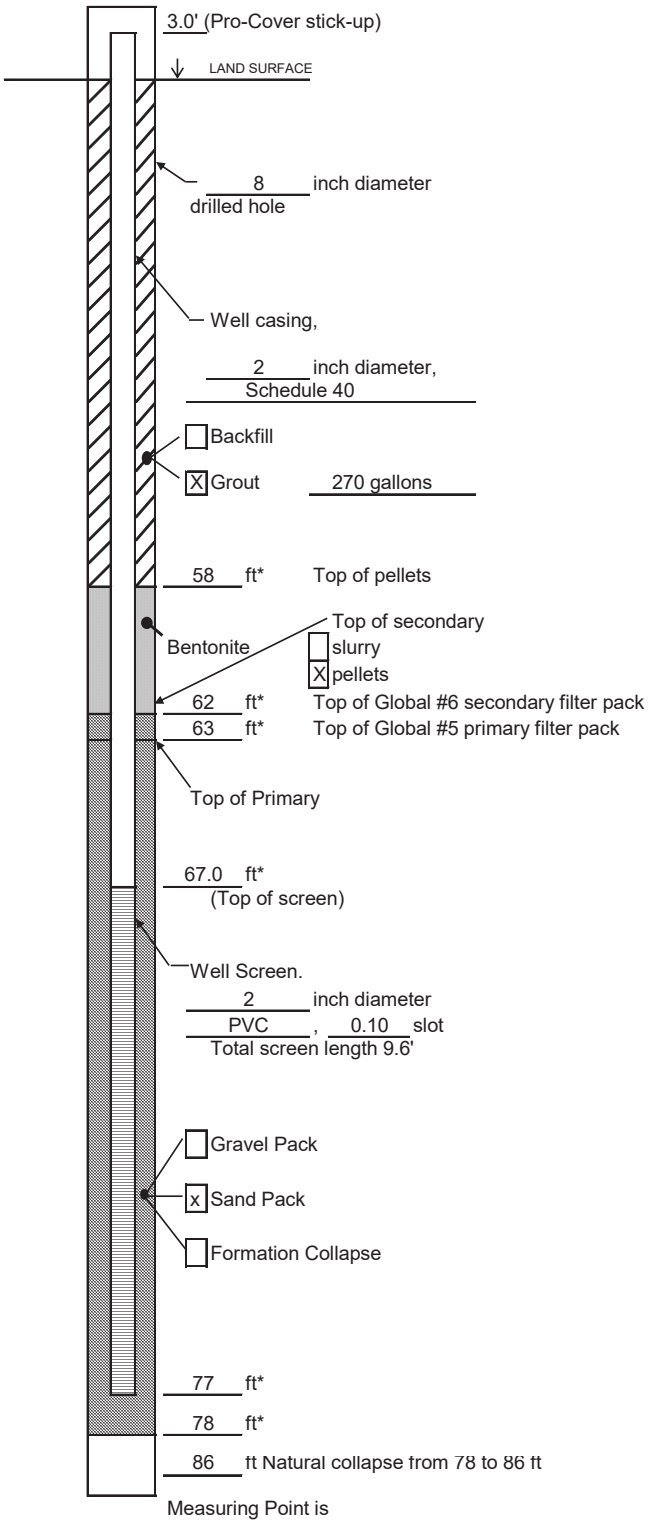
Arcadis 2016

Well Construction Diagrams

MW-1601A to MW-1608

WELL CONSTRUCTION LOG

(Unconsolidated)



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

Project AEP - Mountaineer Well MW-1601A

Town/City New Haven

County Mason County State WV

Permit No. N/A

Land-Surface (LS) Elevation and Datum:

LS: 607.47; TOC: 610.66 feet [X] Surveyed [ ] Estimated

Installation Date(s) 6/9/2016

Drilling Method Hollow Stem Auger

Drilling Contractor DLZ Ohio, Inc.

Drilling Fluid None

Development Technique(s) and Date(s)
Submersible Impeller Pump (6/15/16)

Fluid Loss During Drilling N/A gallons

Water Removed During Development 30 gallons

Static Depth to Water 65.81 feet below M.P.

Pumping Depth to Water 80 feet below M.P.

Pumping Duration NM hours

Yield N/A gpm Date 6/15/2016

Specific Capacity N/A gpm/ft

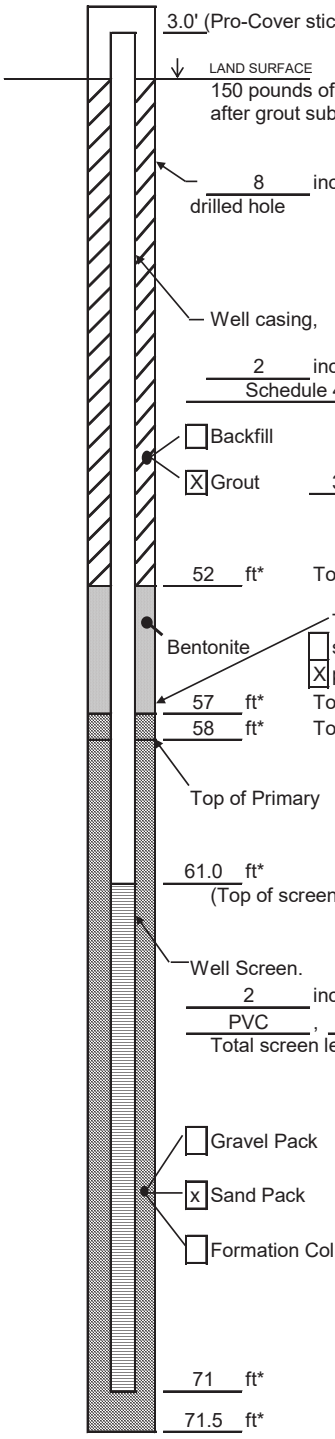
Well Purpose Monitoring well

Remarks Well Installed in the alternate #1 boring at this location.

Prepared by Judd Wanner

WELL CONSTRUCTION LOG

(Unconsolidated)



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

Project AEP - Mountaineer Well MW-1602

Town/City New Haven

County Mason County State WV

Permit No. N/A

Land-Surface (LS) Elevation and Datum:

LS: 602.37; TOC: 605.12 feet [X] Surveyed [ ] Estimated

Installation Date(s) 5/10/2016

Drilling Method Hollow Stem Auger

Drilling Contractor DLZ Ohio, Inc.

Drilling Fluid None

Development Technique(s) and Date(s)

Waterra (6/7/16)

Submersible Impeller Pump (6/15/16)

Fluid Loss During Drilling N/A gallons

Water Removed During Development 37.9 gallons

Static Depth to Water 59.82 feet below M.P.

Pumping Depth to Water 70 feet below M.P.

Pumping Duration NM hours

Yield N/A gpm Date 6/15/2016

Specific Capacity N/A gpm/ft

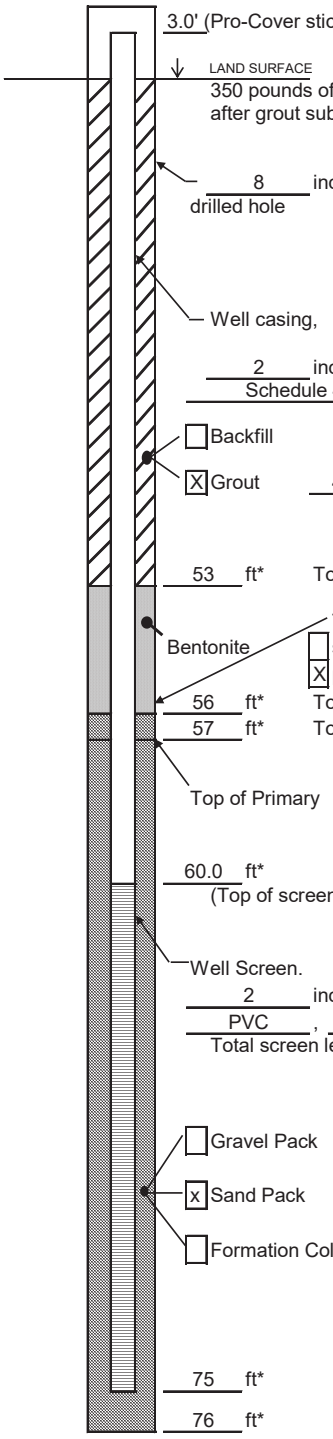
Well Purpose Monitoring well

Remarks

Prepared by Judd Wanner

WELL CONSTRUCTION LOG

(Unconsolidated)



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

Project AEP - Mountaineer Well MW-1603

Town/City New Haven

County Mason County State WV

Permit No. N/A

Land-Surface (LS) Elevation and Datum:

LS: 602.92; TOC: 606.30 feet [X] Surveyed [ ] Estimated

Installation Date(s) 5/4/2016

Drilling Method Hollow Stem Auger

Drilling Contractor DLZ Ohio, Inc.

Drilling Fluid None

Development Technique(s) and Date(s)

Waterra (6/10/16)

Submersible Impeller Pump (6/15/16)

Fluid Loss During Drilling N/A gallons

Water Removed During Development 47.5 gallons

Static Depth to Water 61.35 feet below M.P.

Pumping Depth to Water 79 feet below M.P.

Pumping Duration NM hours

Yield N/A gpm Date 6/15/2016

Specific Capacity N/A gpm/ft

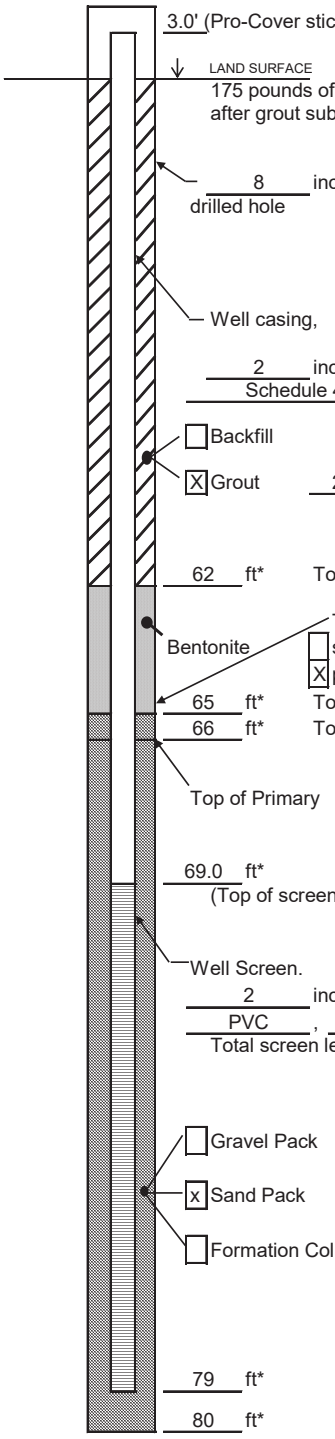
Well Purpose Monitoring well

Remarks

Prepared by Judd Wanner

WELL CONSTRUCTION LOG

(Unconsolidated)



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

Project AEP - Mountaineer Well MW-1604D

Town/City New Haven

County Mason County State WV

Permit No. N/A

Land-Surface (LS) Elevation and Datum:

LS: 595.59; TOC: 598.22 feet [X] Surveyed [ ] Estimated

Installation Date(s) 5/4/2016

Drilling Method Hollow Stem Auger

Drilling Contractor DLZ Ohio, Inc.

Drilling Fluid None

Development Technique(s) and Date(s)
Waterra and Submersible Pump (6/9/16)

Fluid Loss During Drilling N/A gallons

Water Removed During Development 45.1 gallons

Static Depth to Water 54.56 feet below M.P.

Pumping Depth to Water NM feet below M.P.

Pumping Duration NM hours

Yield NM gpm Date 6/9/2016

Specific Capacity NM gpm/ft

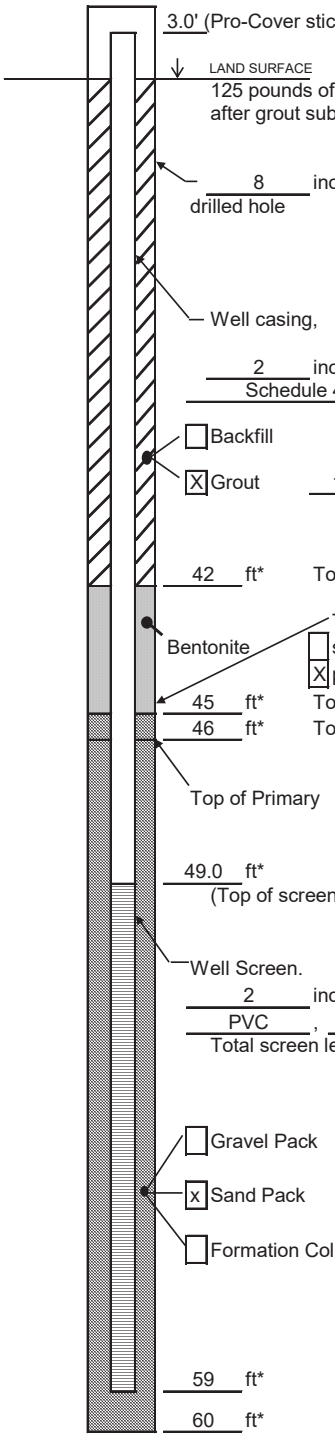
Well Purpose Monitoring well

Remarks Primary filter pack is #5 global sand; secondary filter pack is global #6 sand.

Prepared by Judd Wanner

WELL CONSTRUCTION LOG

(Unconsolidated)



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

Project AEP - Mountaineer Well MW-1604S

Town/City New Haven

County Mason County State WV

Permit No. N/A

Land-Surface (LS) Elevation and Datum:

LS: 595.48; TOC: 598.07 feet [X] Surveyed [ ] Estimated

Installation Date(s) 5/2/2016

Drilling Method Hollow Stem Auger

Drilling Contractor DLZ Ohio, Inc.

Drilling Fluid None

Development Technique(s) and Date(s)

Waterra (6/9/16)

Submersible Impeller Pump (6/16/16)

Fluid Loss During Drilling N/A gallons

Water Removed During Development 30.8 gallons

Static Depth to Water 54.49 feet below M.P.

Pumping Depth to Water 62 feet below M.P.

Pumping Duration NM hours

Yield N/A gpm Date 6/16/2016

Specific Capacity N/A gpm/ft

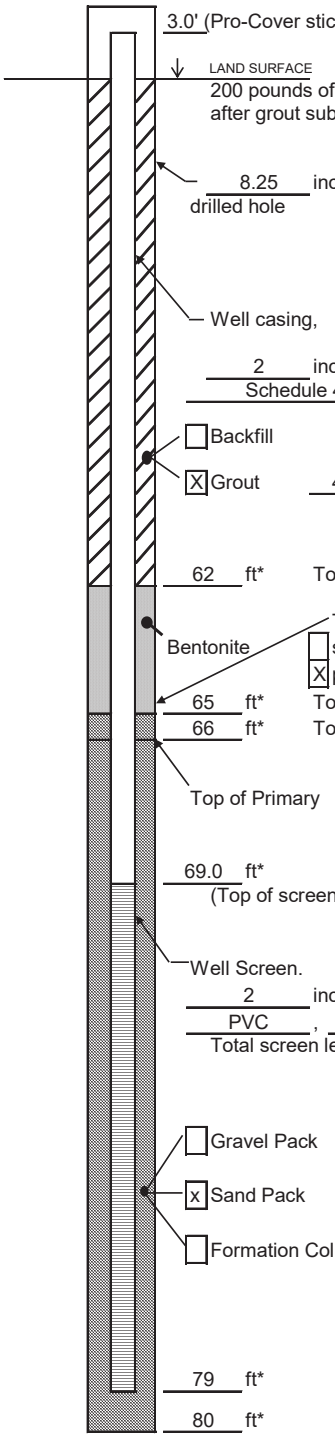
Well Purpose Monitoring well

Remarks

Prepared by Judd Wanner

WELL CONSTRUCTION LOG

(Unconsolidated)



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

Project AEP - Mountaineer Well MW-1605D

Town/City New Haven

County Mason County State WV

Permit No. N/A

Land-Surface (LS) Elevation and Datum:

LS: 588.51; TOC: 591.01 feet [X] Surveyed [ ] Estimated

Installation Date(s) 5-9-16 to 5-11-16

Drilling Method Hollow Stem Auger

Drilling Contractor DLZ Ohio, Inc.

Drilling Fluid Potable water

Development Technique(s) and Date(s)
Waterra and Submersible Pump (6/8/16)

Fluid Loss During Drilling 400 gallons

Water Removed During Development 65 gallons

Static Depth to Water 47.51 feet below M.P.

Pumping Depth to Water NM feet below M.P.

Pumping Duration NM hours

Yield N/A gpm Date 6/8/2016

Specific Capacity N/A gpm/ft

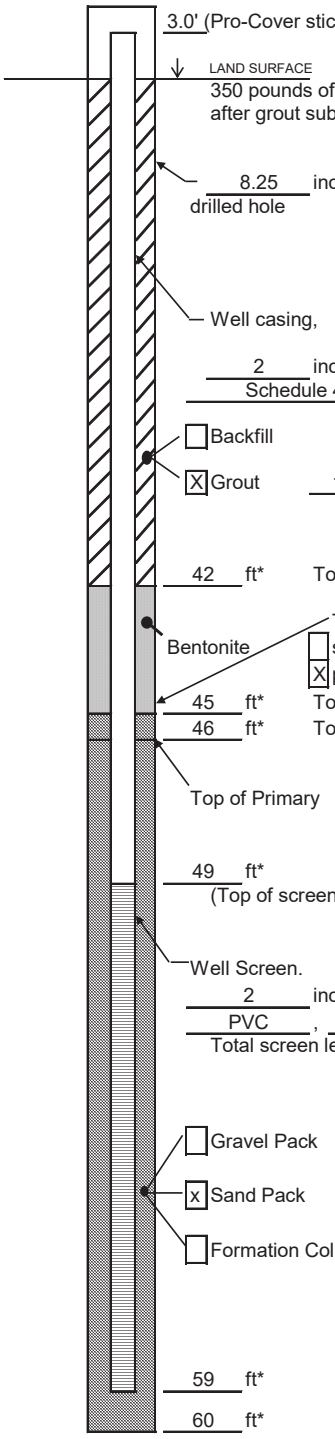
Well Purpose Monitoring well

Remarks

Prepared by Tom Darmon

WELL CONSTRUCTION LOG

(Unconsolidated)



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

Project AEP - Mountaineer Well MW-1605S

Town/City New Haven

County Mason County State WV

Permit No. N/A

Land-Surface (LS) Elevation and Datum:

LS: 588.51; TOC: 590.86 feet [X] Surveyed [ ] Estimated

Installation Date(s) 5/12/2016

Drilling Method Hollow Stem Auger

Drilling Contractor DLZ Ohio, Inc.

Drilling Fluid Potable water

Development Technique(s) and Date(s)

Waterra (6/8/16)

Submersible Impeller Pump (6/16/16)

Fluid Loss During Drilling 200 gallons

Water Removed During Development 36.1 gallons

Static Depth to Water 47.36 feet below M.P.

Pumping Depth to Water 61.5 feet below M.P.

Pumping Duration NM hours

Yield N/A gpm Date 6/16/2016

Specific Capacity N/A gpm/ft

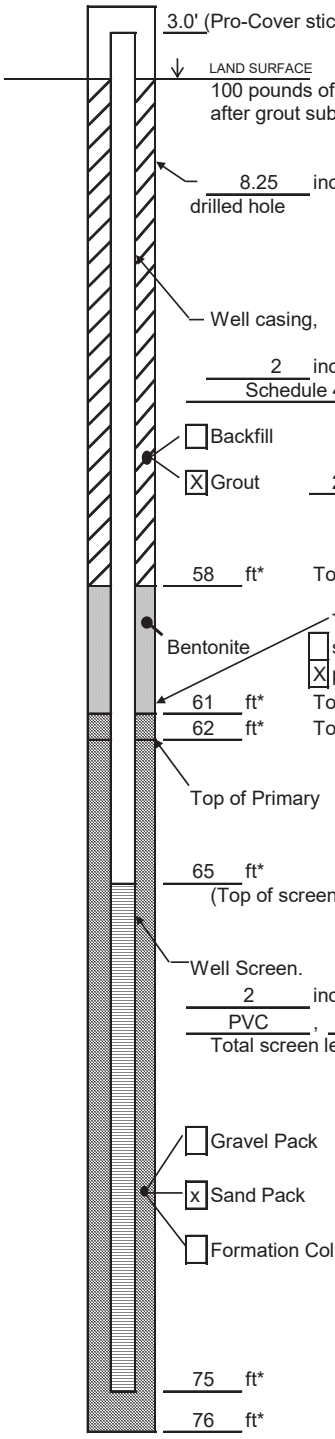
Well Purpose Monitoring well

Remarks Fluid loss due to heaving sand estimated. Removed water could not be quantified to clean out augers.

Prepared by Tom Darmon

WELL CONSTRUCTION LOG

(Unconsolidated)



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

Project AEP - Mountaineer Well MW-1606D

Town/City New Haven

County Mason County State WV

Permit No. N/A

Land-Surface (LS) Elevation and Datum:

LS: 587.25; TOC: 590.10 feet [X] Surveyed [ ] Estimated

Installation Date(s) 5-16-16 to 5-17-16

Drilling Method Hollow Stem Auger

Drilling Contractor DLZ Ohio, Inc.

Drilling Fluid Potable water

Development Technique(s) and Date(s)
Waterra and Submersible Pump (6/9/16)
Submersible Impeller Pump (6/15/16)

Fluid Loss During Drilling 250 gallons

Water Removed During Development 67 gallons

Static Depth to Water 46.03 feet below M.P.

Pumping Depth to Water 77.5 feet below M.P.

Pumping Duration NM hours

Yield N/A gpm Date 6/15/2016

Specific Capacity N/A gpm/ft

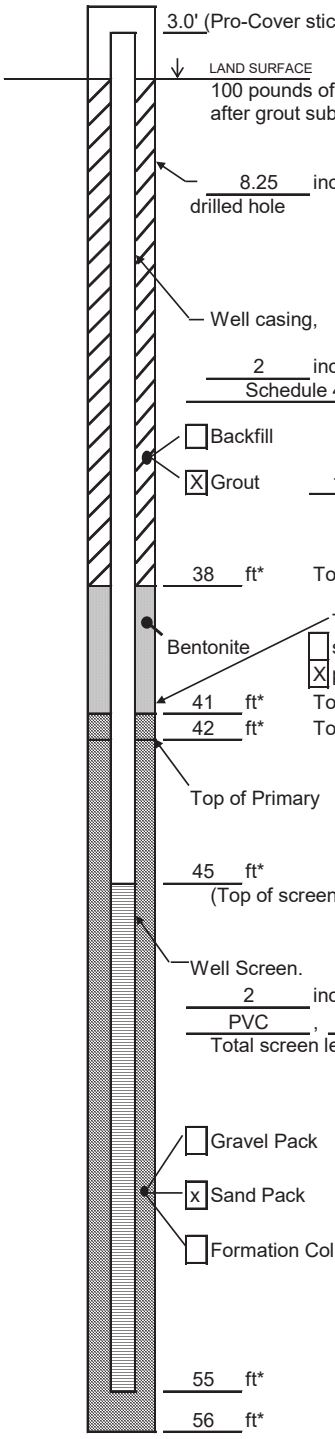
Well Purpose Monitoring well

Remarks

Prepared by Tom Darmon

WELL CONSTRUCTION LOG

(Unconsolidated)



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

Project AEP - Mountaineer Well MW-1606S

Town/City New Haven

County Mason County State WV

Permit No. N/A

Land-Surface (LS) Elevation and Datum:

LS: 587.28; TOC: 590.15 feet [X] Surveyed [ ] Estimated

Installation Date(s) 5/17/16 - 5/18/16

Drilling Method Hollow Stem Auger

Drilling Contractor DLZ Ohio, Inc.

Drilling Fluid None

Development Technique(s) and Date(s)

Waterra (6/8/16)

Submersible Impeller Pump (6/15/16)

Fluid Loss During Drilling 0 gallons

Water Removed During Development 29.5 gallons

Static Depth to Water 46.02 feet below M.P.

Pumping Depth to Water 57 feet below M.P.

Pumping Duration NM hours

Yield N/A gpm Date 6/15/2016

Specific Capacity N/A gpm/ft

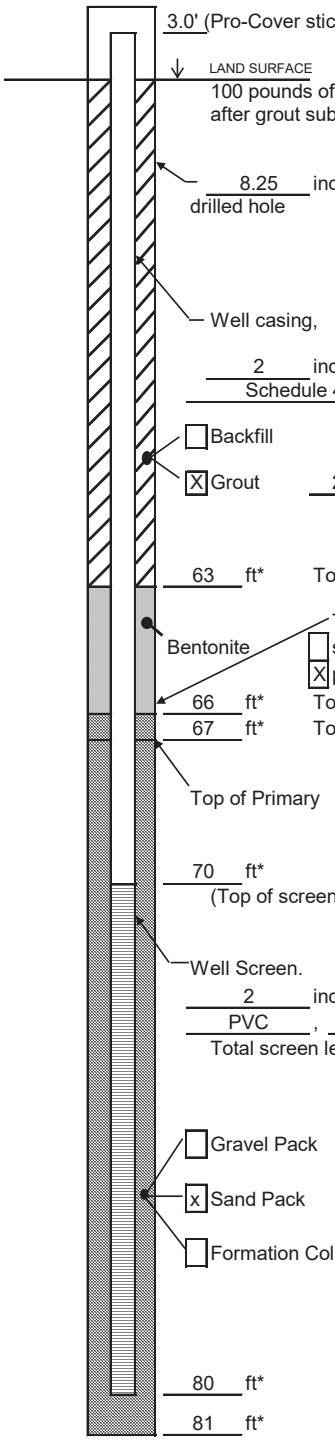
Well Purpose Monitoring well

Remarks

Prepared by Tom Darmon

WELL CONSTRUCTION LOG

(Unconsolidated)



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

Project AEP - Mountaineer Well MW-1607D

Town/City New Haven

County Mason County State WV

Permit No. N/A

Land-Surface (LS) Elevation and Datum:

LS: 590.75; TOC: 593.93 feet [X] Surveyed [ ] Estimated

Installation Date(s) 5/19/2016

Drilling Method Hollow Stem Auger

Drilling Contractor DLZ Ohio, Inc.

Drilling Fluid Portable water

Development Technique(s) and Date(s)
Submersible Impeller Pump (6/15/16)

Fluid Loss During Drilling 300 gallons

Water Removed During Development 8.5 gallons

Static Depth to Water 46.72 feet below M.P.

Pumping Depth to Water 80 feet below M.P.

Pumping Duration NM hours

Yield N/A gpm Date 6/15/2016

Specific Capacity N/A gpm/ft

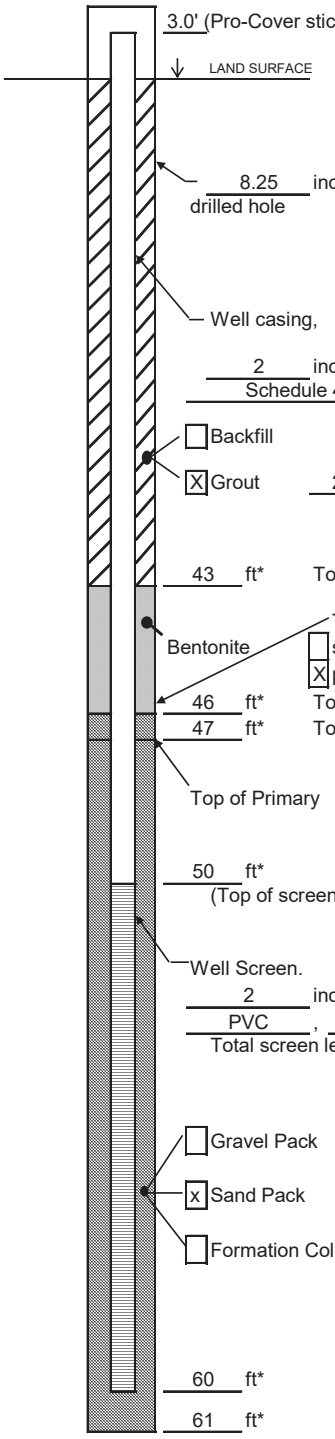
Well Purpose Monitoring well

Remarks Fluid loss due to heaving sand estimated. Removed water could not be quantified to clean out augers.

Prepared by Tom Darmon

WELL CONSTRUCTION LOG

(Unconsolidated)



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

Project AEP - Mountaineer Well MW-1607S

Town/City New Haven

County Mason County State WV

Permit No. N/A

Land-Surface (LS) Elevation and Datum:

LS: 590.79; TOC: 593.99 feet [X] Surveyed [ ] Estimated

Installation Date(s) 5/26/16 - 5/27/16

Drilling Method Hollow Stem Auger

Drilling Contractor DLZ Ohio, Inc.

Drilling Fluid Portable water

Development Technique(s) and Date(s)
Submersible Impeller Pump (6/15/16)

Fluid Loss During Drilling 400 gallons

Water Removed During Development 8.5 gallons

Static Depth to Water 46.56 feet below M.P.

Pumping Depth to Water 60 feet below M.P.

Pumping Duration NM hours

Yield N/A gpm Date 6/15/2016

Specific Capacity N/A gpm/ft

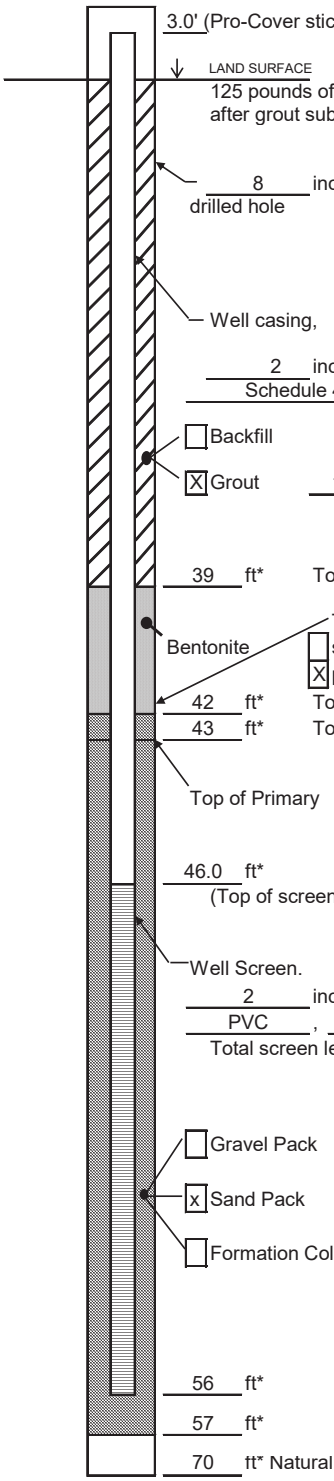
Well Purpose Monitoring well

Remarks Fluid loss due to heaving sand estimated. Removed water could not be quantified to clean out augers.

Prepared by Tom Darmon

WELL CONSTRUCTION LOG

(Unconsolidated)



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

Project AEP - Mountaineer Well MW-1608

Town/City New Haven

County Mason County State WV

Permit No. N/A

Land-Surface (LS) Elevation and Datum:

LS: 587.26; TOC: 590.65 feet [X] Surveyed [ ] Estimated

Installation Date(s) 6/9/16 - 6/10/16

Drilling Method Hollow Stem Auger

Drilling Contractor DLZ Ohio, Inc.

Drilling Fluid None

Development Technique(s) and Date(s)
Submersible Impeller Pump (6/17/16)

Fluid Loss During Drilling N/A gallons

Water Removed During Development 33 gallons

Static Depth to Water 47.66 feet below M.P.

Pumping Depth to Water 60 feet below M.P.

Pumping Duration NM hours

Yield N/A gpm Date 6/17/2016

Specific Capacity N/A gpm/ft

Well Purpose Monitoring well

Remarks

Prepared by Judd Wanner

APPENDIX B

Banks Well Inventory Report

Prepared for:

ARCADIS U.S., INC.-Columbus
630 Plaza Drive, Suite 600
Highlands Ranch, CO 80129

BANKS ENVIRONMENTAL DATA
A DIVISION OF THE BANKS GROUP

Water Well Report

AEP Water Well Inventory

MOUNTAINEER PLANT

1347 GRAHAM STATION ROAD

NEW HAVEN, WV

MASON County

PO #: OH015976.0004

ES-112028

Monday, September 08, 2014

Banks Environmental Data, Inc. - 1601 Rio Grande, Ste. 500 - Austin, TX 78701 - 800.531.5255 P - 512.478.1433 F
www.banksenvdata.com

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Geographic Summary *AEP Water Well Inventory*

Location
MASON County, WV
Target location is 0.131 square miles and has a 1.5 mile perimeter

Coordinates	
Longitude & Latitude in Degrees Minutes Seconds	NA
Longitude & Latitude in Decimal Degrees	NA
X and Y in UTM	NA

Elevation
NA

Zip Codes Searched	
Search Distance	**Zip Codes (historical zip codes included)**
Target Property	25253, 25247, 25264, 25265
0.5 miles	25253, 25247, 25264, 25265

Topos Searched	
Search Distance	**Topo Name**
Target Property	New Haven (1977)
0.5 miles	New Haven (1977)

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Summary Map - 0.5 Mile Buffer

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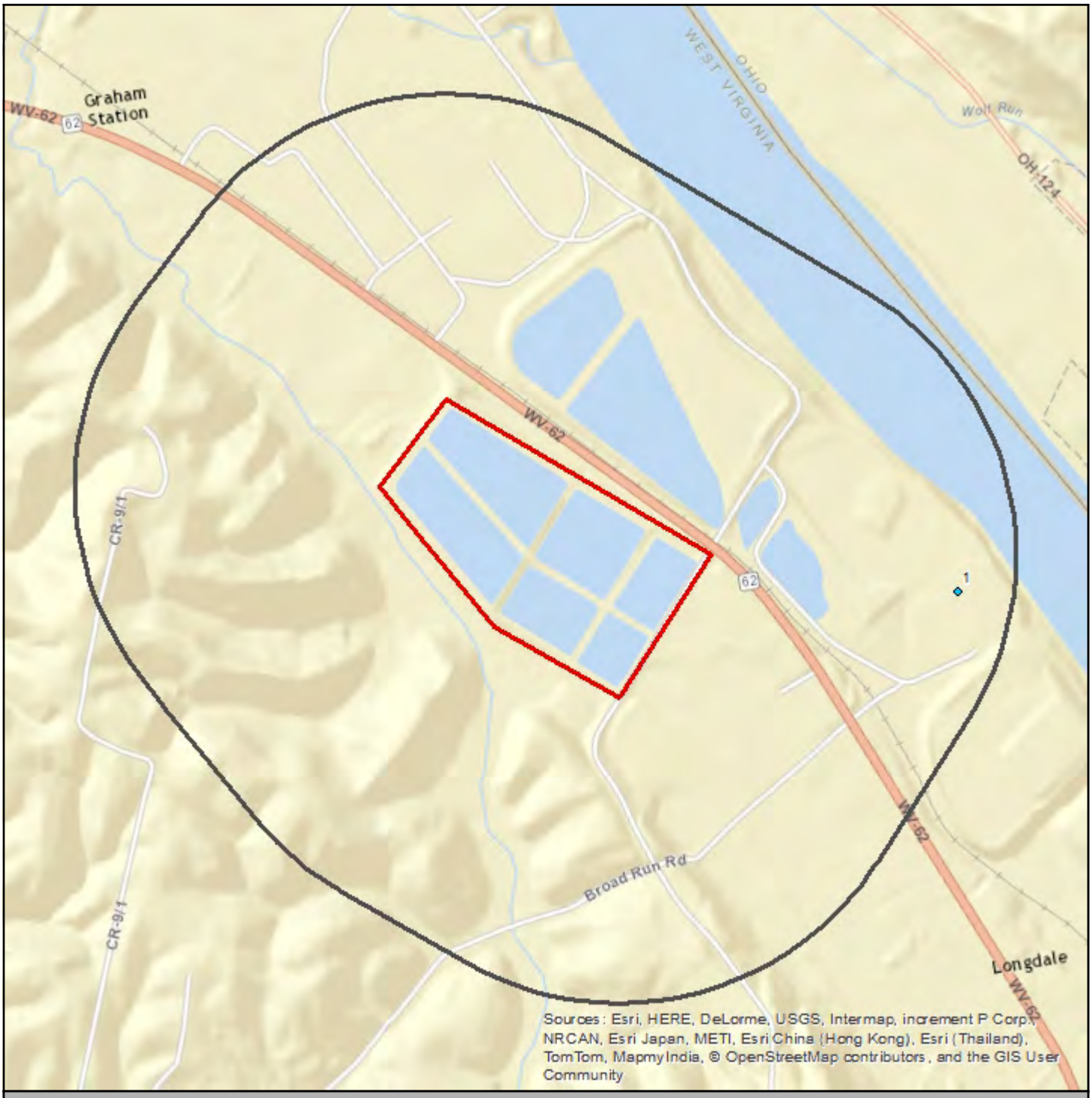


AEP Water Well Inventory

- Well
- Well Cluster
- Target Property
- Search Buffer

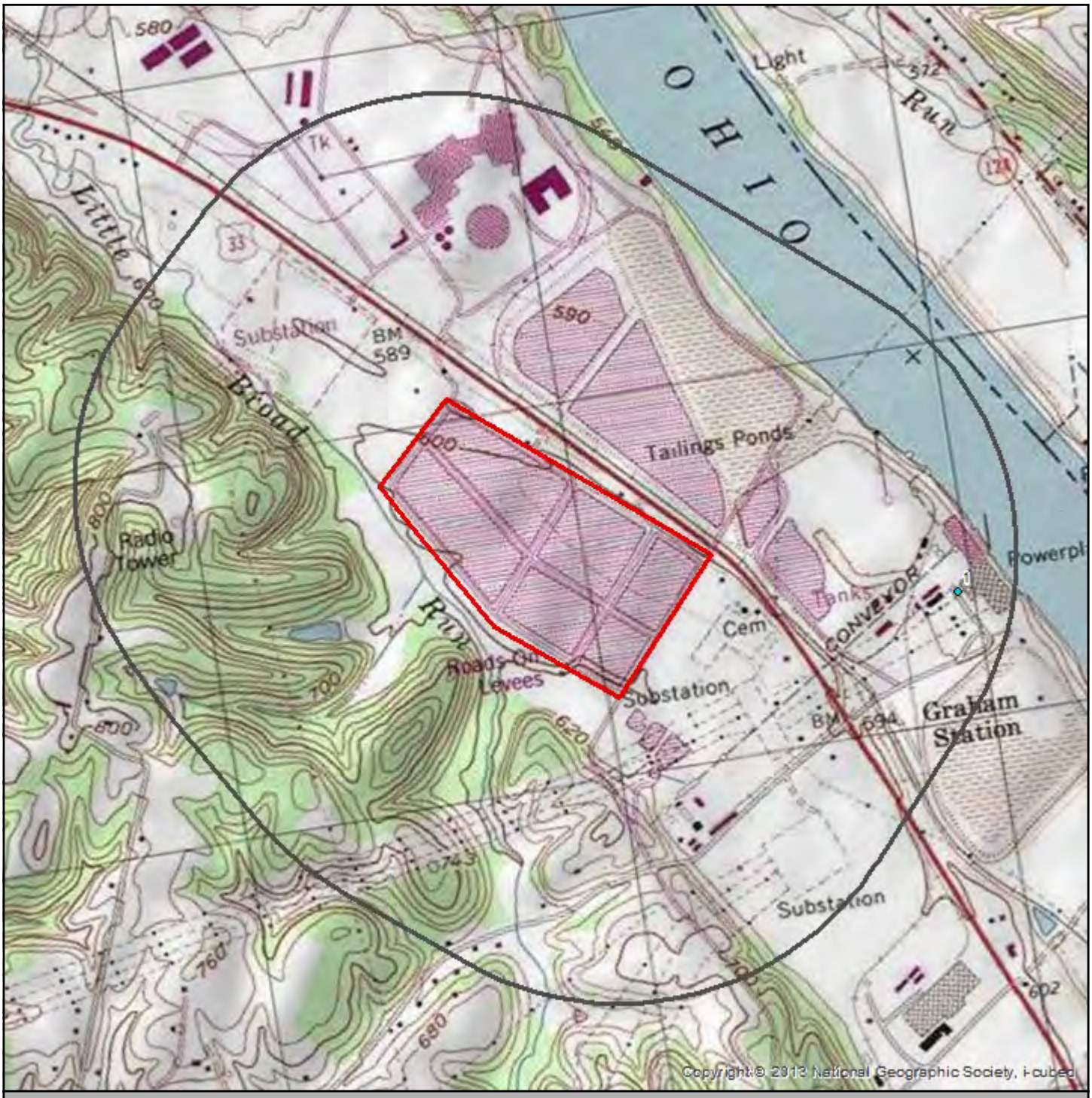
1 : 15,000
1 inch = 0.237 miles
1 inch = 1250 feet
1 centimeter = 0.150 kilometers
1 centimeter = 150 meters

N

Lambert Conformal Conic Projection
1983 North American Datum
First Standard Parallel: 33 0' 00" North
Second Standard Parallel: 45 0' 00" North
Central Meridian: 96 0' 00" West
Latitude of Origin: 39 0' 00" North

Topographic Overlay Map - 0.5 Mile Buffer

BANKS ENVIRONMENTAL DATA
A DIVISION OF THE BANKS GROUP



AEP Water Well Inventory

- Well
- Well Cluster
- Target Property
- Search Buffer

Target Property Quad Name(s)
New Haven (1977)

1 : 15,000
1 inch = 0.237 miles
1 inch = 1250 feet

Lambert Conformal Conic Projection
1983 North American Datum
First Standard Parallel: 33 0' 00" North
Second Standard Parallel: 45 0' 00" North
Central Meridian: 96 0' 00" West
Latitude of Origin: 39 0' 00" North

N

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Current Imagery Overlay Map - 0.5 Mile Buffer

BANKS ENVIRONMENTAL DATA
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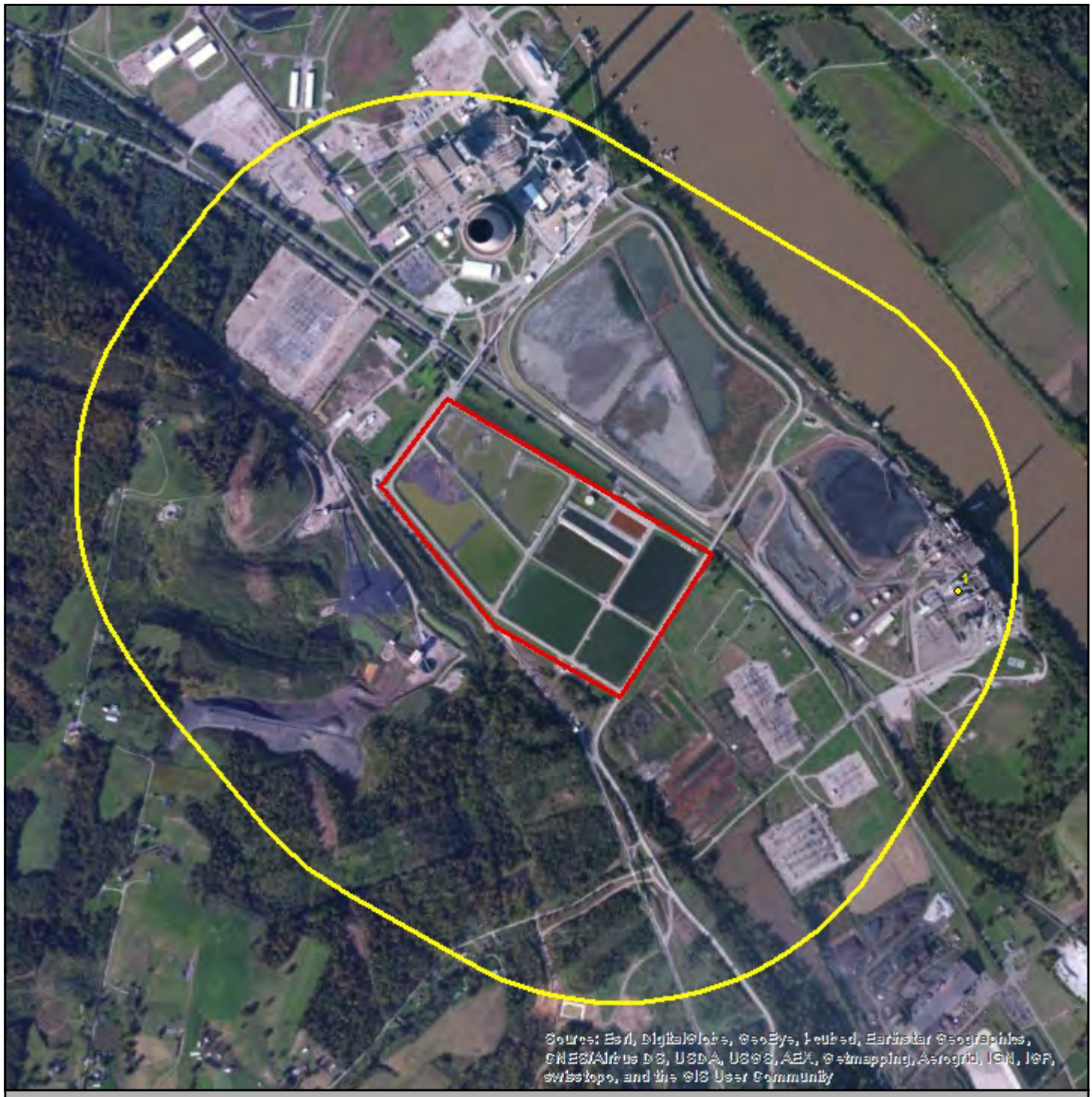

AEP Water Well Inventory

- Well
- Well Cluster
- Target Property
- Search Buffer

1 : 15,000
1 inch = 0.237 miles
1 inch = 1250 feet
1 centimeter = 0.150 kilometers
1 centimeter = 150 meters

N

Lambert Conformal Conic Projection
1983 North American Datum
First Standard Parallel: 33 0' 00" North
Second Standard Parallel: 45 0' 00" North
Central Meridian: 96 0' 00" West
Latitude of Origin: 39 0' 00" North

Water Well Details *AEP Water Well Inventory*

Map ID	Source ID	Dataset	Owner of Well	Type of Well	Depth Drilled	Completion Date	Longitude	Latitude	Elevation	Driller's Logs
1	USGS-385802081552602	WW USGS	USGS	Not Reported	80	01/01/1950	-81.923748	38.967302	585 ft	N/A

Well Summary

Water Well Dataset	# of Wells
WW USGS	1
Total Count	**1**

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Dataset Descriptions and Sources *AEP Water Well Inventory*

Dataset	Source	Dataset Description	Update Schedule	Data Requested	Data Obtained	Data Updated	Source Updated
WV WW - West Virginia Water Wells	West Virginia Department of Health and Human Resources	This dataset contains groundwater well information provided by West Virginia Department of Health and Human Resources.	As requested	N/A	N/A	N/A	N/A
OH WW - Ohio Water Wells	Ohio Department of Natural Resources	This dataset contains all historical water well records searched from Ohio Department of Natural Resources Division of Water	As requested	N/A	N/A	N/A	N/A
WW USGS - USGS Water Wells	U.S. Geological Survey	This dataset contains groundwater well records from the U.S. Geological Survey.	Quarterly	06/30/2014	06/30/2014	07/13/2014	06/30/2014

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Disclaimer *AEP Water Well Inventory*

The Banks Environmental Data Water Well Report was prepared from existing state water well databases and/or additional file data/records research conducted at the state agency and the U.S. Geological Survey. Banks Environmental Data has performed a thorough and diligent search of all groundwater well information provided and recorded. All mapped locations are based on information obtained from the source. Although Banks performs quality assurance and quality control on all research projects, we recognize that any inaccuracies of the records and mapped well locations could possibly be traced to the appropriate regulatory authority or the actual driller. It may be possible that some water well schedules and logs have never been submitted to the regulatory authority by the water driller and, thus, may explain the possible unaccountability of privately drilled wells. It is uncertain if the above listing provides 100% of the existing wells within the area of review. Therefore, Banks Environmental Data cannot fully guarantee the accuracy of the data or well location(s) of those maps and records maintained by the regulatory authorities.

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APPENDIX C

Groundwater Modeling Supporting Information

APPENDIX C – SUPPORTING INFORMATION FOR WELLHEAD ANALYTICAL ELEMENTS MODEL (WHAEM 2000) APPLICATION

Background

The AEP Mountaineer Plant (Plant) has several production wells that extract water from the unconsolidated sand and gravel aquifer system. The extraction of water from these wells depresses groundwater elevations near the wells and affects the groundwater flow patterns in the vicinity of the Mountaineer bottom ash ponds (BAPs). However, the effect of the operation of the production wells on flow patterns in the vicinity of the BAPs was not well understood. To improve the understanding of the effect of the production wells, a groundwater flow modeling study of the area was performed as described in the following sections.

Production Wells

There are currently five active production wells associated with the AEP Mountaineer Plant (**Figure C-1**). Two of the wells (West 1, East 1) are the most used and are pumped for process water. West 1 and East 1 are located approximately 450 feet and 825 feet north east of the Plant cooling tower, respectively. There are also two production wells (Wells 5 and 6) that are used to fill two fire water tanks used for emergency fire suppression and other low-volume water uses. Well 5 is located immediately west of the Plant cooling tower, and Well 6 is located approximately 750 feet northwest of the Plant cooling tower. A fifth well (Well 4) is used in the plant's wastewater system and is located approximately 950 feet east of the Plant cooling tower.

When active, East 1 currently pumps at an approximate rate 150 gallons per minute (gpm), and West 1 currently pumps at rate of approximately 750 gallons per minute (gpm). Average water use may be less when the wells are not pumped continuously. Wells 5 and 6 are not metered and likely pump intermittently for short periods of time as needed. Water use from Well 4 is not recorded and was assumed to be inactive. A plot of recent estimated daily water use (August and September shown on **Figure C-2**.

Groundwater Flow Model

Model Code

The one-dimensional analytical element model, WhAEM2000 (Kraemer et al., 2007) was used to simulate groundwater flow in the vicinity of the Mountaineer Plant. WhAEM2000 uses the principle of superposition of analytic functions to simulate complex hydrologic features such as wells, rivers, recharge zones, and impermeable boundaries. WhAEM2000 was selected because of the ability to simulate these features while still providing the streamlined level of analysis desired for this study.

Model Boundaries

The western and eastern boundaries of the model correspond to the edge of the unconsolidated sand and gravel aquifer extending along the Ohio River (**Figure C-1**). The bedrock surrounding the valley is low-yielding, and the quantities of water moving through the bedrock units are assumed to be insignificant relative to the large quantities of water moving through the sand and gravel aquifer. The northern and southern boundaries of the model were established approximately 13,000 and 17,000 feet from the Mountaineer BAPs, respectively and represent flow lines across which movement of groundwater generally does not occur under natural conditions. Horizontal flow barriers were assigned along the edges of the model to prevent the movement of water into or out of the active model domain.

The bottom of the model was assumed to be at elevation 508 above mean sea level (amsl). This corresponds to the approximate average bottom elevation of the unconsolidated valley-fill sediments as depicted on site geologic cross sections from the Mountaineer and Sporn Plants (EPRI, 1999). The thickness of the aquifer was assumed to be 60 feet based on the position of the lower permeability silt and clay sediments overlying the sand and gravel aquifer near the production wells. Over most of the area of the Mountaineer and Sporn Plants, groundwater elevations are below the overlying silt and clay sediments, and the sand and gravel aquifer is unconfined. The exception is a small area along the Ohio River and beneath the Sporn Plant, where the silt and clay unit thickens and the aquifer becomes confined (EPRI, 1999).

Streams

The Ohio River and its perennial tributaries were simulated using line sinks. The Ohio River was simulated with a line sink with a low resistance (high riverbed conductivity) to simulate a strong connection between the river and the aquifer. A low resistance was assigned to allow substantial quantities of water to flow into and out of the river proportional to the hydraulic gradients between the aquifer and the river. The tributaries, which include Broad Run, Little Broad Run, and West Creek, were simulated with line sinks with a high resistance (low riverbed conductivity), because these streams flow over the top of the silt and clay unit and the connection between the streams and aquifer is much less. The resistance values were adjusted during calibration, and final assigned values were 0.1 feet / feet per day for the Ohio River and 30 feet / feet per day for the Ohio River tributaries. Surface water elevations for the Ohio River were based on site gauging data provided by American Electric Power. Surface water elevations for the tributaries were estimated from United States Geological Survey (USGS) topographic maps and assuming a stream depth of 2 feet. The Ohio River was assigned a water depth of 21 feet based on profiles of the river (EPRI, 1999). The width of the line sinks was based on the width of the streams measured from aerial photographs and according to the guidance provided in Haitjema (2005).

Hydraulic Conductivity

The model was originally assigned a single hydraulic conductivity zone based on the results of two short variable rate tests conducted on the Plant production wells, East 1 and West 1. The variable rate test data were analyzed for hydraulic conductivity using the Nueman (1974) method for unconfined aquifers. An additional estimate of the hydraulic conductivity was made from the specific capacities measured for the wells using methods described in Walton (1962). The hydraulic conductivities estimated from the East 1 and West 1 wells ranged from 346 to 454 feet per day as summarized in **Table C-1**.

Additional hydraulic conductivity information was available in the form of slug tests performed on monitoring wells at both the Mountaineer and Sporn Plants. The slug tests were categorized based on whether the tested monitoring well was screened in a predominantly sand zone or gravelly zone. Hydraulic conductivity ranges estimated from the slug tests are also summarized in **Table C-1**.

During the calibration process, it was necessary to divide the model domain into zones of varying hydraulic conductivity. The first zone encompasses areas where Plant borings indicate the aquifer is gravelly. This zone includes the area around the production wells. The second zone encompasses areas where the aquifer is predominantly sand. This zone includes the area around the Mountaineer and Sporn Plant ponds and a second small area surrounding the Mountaineer Plant coal piles. These areas were assigned a lower hydraulic conductivity to simulate the less permeable nature of the sands relative to the gravelly sediments. The remaining areas of the model were assigned a hydraulic conductivity mid-range of the sand and the gravelly zone hydraulic conductivities. This zone predominantly represents far-field conditions where little information on sediment type or hydraulic conductivities is available. The variable hydraulic conductivity zones were added to the model by creating inhomogeneity zones in the model with unique hydraulic conductivity properties. The final hydraulic conductivities assigned to the model following calibration are depicted on **Figure C-1**.

Recharge

Recharge was also added to the model domain to simulate the infiltration of precipitation into the aquifer. Recharge was added to all areas of the model domain not overlain by the Ohio River. Recharge rates estimated for the lower terraces of the valley fill aquifers along the Ohio River are estimated to range from 6 to 12 inches per year (Kozar and McCoy, 2004). The final calibrated recharge rate used to represent infiltration of precipitation was 12 inches per year.

Zones of enhanced recharge were also added to wetted pond areas at the Mountaineer and Sporn Plants to simulate seepage through the bottom of the ponds. Pond seepage was applied to the model by creating additional inhomogeneities corresponding to the wetted extent of the ponds with unique recharge properties. The pond areas that were assigned unique recharge rates include;

- Mountaineer West BAP
- Mountaineer East BAP
- Mountaineer West Wastewater Pond
- Mountaineer East Wastewater Pond
- Mountaineer Reclaim Water Pond
- Mountaineer Clear Water Pond
- Sporn Wastewater and Fly Ash Pond

Mountaineer and Sporn Plant Ponds

The Mountaineer BAPs typically receive more than 9 million gallons per day (mgd) of water (AEP, 2012). The water exits the BAPs and passes into to the Wastewater Treatment Ponds where it is combined with

additional water from the plant. Water exiting the Wastewater Treatment Ponds passes into to the Reclaim Water Pond. Much of the water in the Reclaim Water Pond is recycled, with the remainder passing through to the Clearwater Pond and then being discharged to the Ohio River. Of the more than 13 mgd that enters the Reclaim Water Pond, approximately 4 to 6 mgd is discharged from the Clearwater Pond into the Ohio River on a typical monthly basis.

The Sporn Fly Ash Pond historically received more than 11 mgd of water (AEP, 2005). Water exiting the pond was discharged into the Ohio River. The pond is no longer actively receiving water due to closure of the Sporn plant, but a small portion of the pond remains filled with water. The Sporn Bottom Ash and Clear Water Ponds historically received more than 2 mgd of water. Water exiting these ponds was also discharged to the Ohio River. These ponds are also no longer active due to the closure of the Sporn plant.

Estimated Pond Seepage

Seepage through the base of the Mountaineer and Sporn ponds was estimated by performing a flow calculation through the low permeability materials at the base of the ponds. Seepage was estimated using the following equation:

$$Q = K\frac{h_s - h_b}{b}A$$

where Q is the flow rate through the bottom of the pond, K is the hydraulic conductivity of the low permeability sediments at the base of the pond, h_s is the water surface elevation of the pond, h_b is the elevation of the bottom of the pond, b is the thickness of the low permeability sediments at the base of the pond, and A is the area of the pond.

The water surface elevations in the ponds were based on measured pond elevations from AEP monthly pond inspection reports. The pond bottom elevations were determined from pond construction drawings and site cross-sections. Construction records (Casagrande Consultants, 1977) indicate that Mountaineer Ponds were constructed with an underlying liner three feet thick and had a design hydraulic conductivity of 6.24×10^{-5} feet per day (2.2×10^{-8} cm/sec). In-situ hydraulic conductivity of the liner material following placement is likely somewhat higher (Woodward-Clye Consultants, 1985). The Sporn Wastewater and Fly Ash Ponds are underlain by a large thickness of ash. The bottom of ash was estimated to be at elevation 561 feet above mean sea level (ft-amsl) from plant geologic cross-sections (EPRI, 1999). For modeling purposes, it was assumed that the ash materials controlled the rate of seepage from the Fly Ash Ponds to the sand and gravel aquifer beneath.

The final hydraulic conductivities assigned to the materials underlying the Mountaineer ponds and the Sporn Fly Ash Pond were based on calibration. The hydraulic conductivities were adjusted within reasonable ranges until the groundwater elevations in monitoring wells near the ponds were approximately reproduced. The calibrated hydraulic conductivities were 3.12×10^{-3} feet per day (1.1×10^{-6} cm/sec) for the liners beneath the Mountaineer ponds and 0.05 feet per day (1.8×10^{-5} cm/sec) for the ash materials beneath the Sporn Fly Ash pond.

The zones of enhanced recharge representing the Mountaineer ponds and the Sporn Fly Ash pond were defined by creating inhomogeneities in the model domain with unique recharge properties. Using the calibrated hydraulic conductivites, the recharge rates assigned to the Mountaineer and Sporn ponds were calculated for the September 2016 model calibration period as summarized in **Table C-2**.

Model Calibration

The model was qualitatively calibrated to a historical groundwater elevation data set to ensure the model is able to accurately simulate groundwater flow conditions. A December 2014 dataset was selected for calibration because the stage of the Ohio River had been stable (i.e. lack of high stage events) for a relatively long period of time prior to the measurement event. Monthly production well flow rates and pond inspection reports were also compiled for this period to define the extraction rates from the production wells and the seepage rates from the Mountaineer and Sporn ponds. The model parameter values discussed in the previous section were adjusted within reasonable ranges until the groundwater elevations were approximately reproduced.

The December 2014 groundwater elevation dataset included water levels from monitoring wells from both the Mountaineer and Sporn Plants. However, data from monitoring wells screened in the silt and clay unit overlying the aquifer and data from the shallow piezometers affected by unsaturated flow were excluded from the calibration simulation. The simulated groundwater elevations from the calibration scenario are depicted on **Figure C-3**.

Simulated groundwater elevations closely approximated measured groundwater elevations. The residuals (difference between the simulation and measured groundwater elevations) were less than one-half of one foot for most monitoring well locations (also depicted on **Figure C-3**), and the number of elevations that were over-simulated (simulated elevations that are greater than measured elevations) is similar to the number of elevation that were under-simulated (simulated elevations are less than measured elevations). The exception was two monitoring wells (MW-009 and MW-011) that have locations and ground surface elevations that are uncertain. Data from these monitoring wells were not used for calibration.

The calculated seepage rates for the ponds under the calibration scenario were relatively small. The seepage rates for all ponds were less than 0.1 mgd, and represent a small fracture of the total volume of flow passing through the ponds. The calibration simulation suggests that groundwater elevations are mounded beneath the Mountaineer ponds. Groundwater flows from the ponds to the cone-of-depression surrounding the East 1 and West 1 production wells. There is also a general component of flow from the boundary with the bedrock surrounding the valley-fill aquifer toward the Ohio River. The exception is near the East 1 and West 1 production wells where the model predicts that the wells induce flow from the Ohio River into the aquifer.

Near Future Groundwater Flow Simulation

Following calibration, a simulation was performed to predict the groundwater flow patterns in the sand and gravel aquifer at the Mountaineer and Sporn under a current or near future normal operating condition. Pertinent assumptions made for the simulation are summarized below;

- The East 1 and West 1 Production Wells are each pumping continuously at 370 gpm each (The East 1 production well pump is planned to be up-graded to have a capacity similar to West 1).
- The Firewater Production Wells (Well 5 and Well 6) will pump at a long-term average rate of 20 gpm each (based on historical average monthly pumping rates).
- The Mountaineer pond water surface elevations are at their normal operating level.
- The Sporn ponds are inactive due to closure of Sporn plant and are completely dry.
- The stage of the Ohio River is similar to the September 26, 2016 stage.

The simulated groundwater elevations under the current or near future condition are depicted on **Figure C-4**. Groundwater flow directions are generally similar to the calibration simulation, though groundwater elevations are somewhat lower in the vicinity of the production wells (due to the greater simulated rate of pumping) and slightly higher in the vicinity of the Mountaineer Ponds (due to the East BAP being full under the near future condition). The flow directions in the vicinity of the Sporn Fly Ash Pond are somewhat more toward the Ohio River, reflecting the closure of the Fly Ash Pond.

The calculated seepage rates for the Mountaineer ponds are in the same range as the calibration simulation, but are slightly different for those ponds that had water levels that were not at the normal operating level during the calibration period. The East BAP was also assumed to be operating during the current or near future condition, whereas this pond was inactive during the calibration simulation. The calculated seepage rates under the current or near future condition are summarized in **Table C-3**.

Similar to the calibration simulation, the model suggests a pattern of diverging flow away from the Mountaineer ponds, with flow being directed towards the Ohio River and the cone-of-depression surrounding the East 1 and West 1 production wells. The groundwater flow directions predicted by this simulation was used to assist in the selection of new monitoring well locations for monitoring of the Mountaineer Plant BAPs. A discussion of the selection of the new monitoring well locations is provided in the main report.

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TABLES

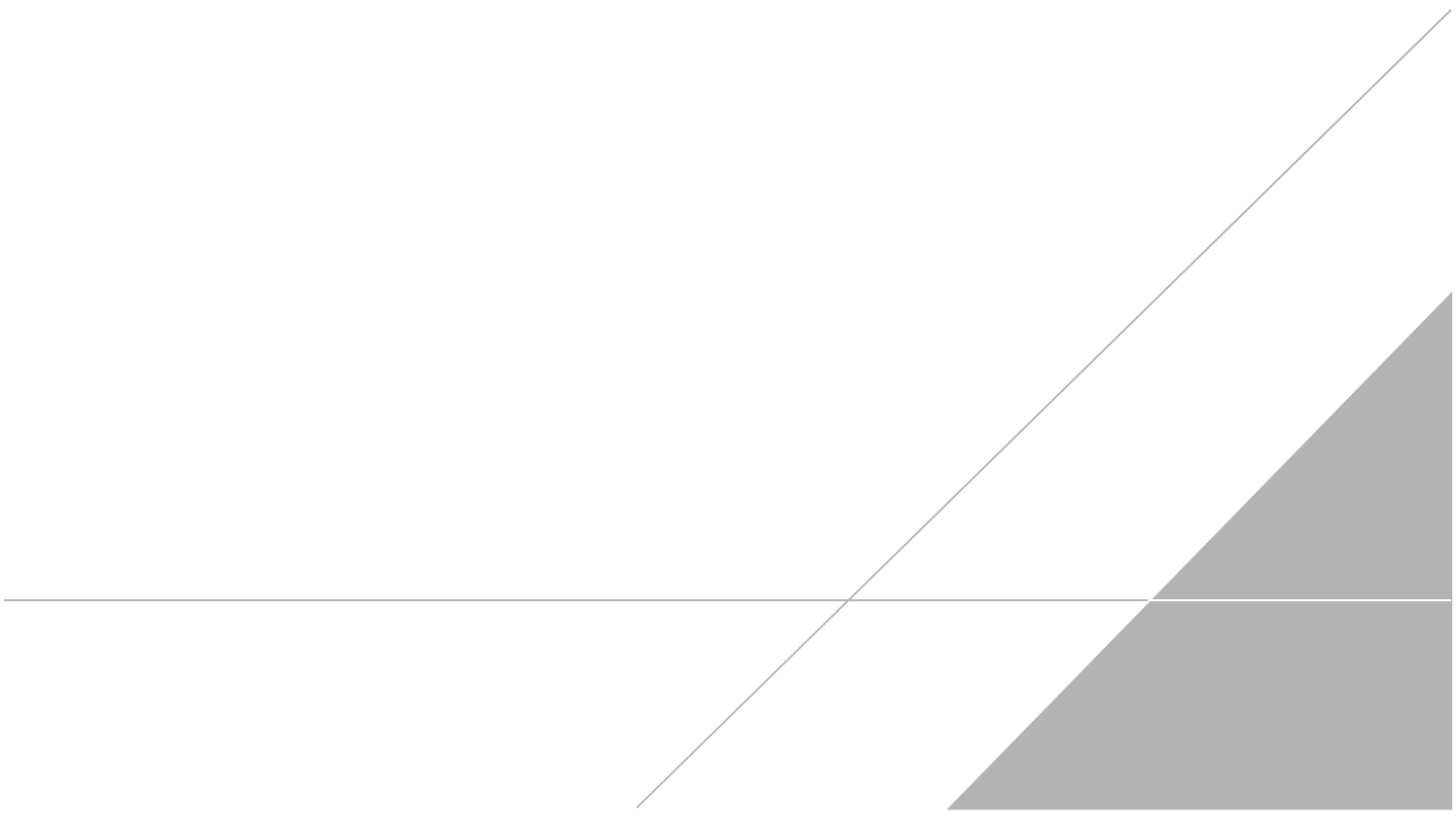


Table C-1
Summary of Hydraulic Conductivity Data
AEP Mountaineer Generating Plant - Bottom Ash Ponds
New Haven, West Virginia

	Transmissivity gpd/ft	Hydraulic Conductivity ft/day	Hydraulic Conductivity cm/sec
Variable Rate Tests			
FGD East 1 (Neuman, 1974)	90,514	367	1.3E-01
FGD East 1 (Walton, 1962)	85,400	346	1.2E-01
FGD West 1 (Neuman, 1974)	106,200	430	1.5E-01
FGD West 1 (Walton, 1962)	112,100	454	1.6E-01
Slug Tests (EPRI, 1999)			
Sporn Plant Slug tests (Sand Zone)		1.2 - 5.7	4.1E-04 - 1.9E-03
Sporn Plant Slug tests (Gravelly Zone)		20 - 333	7.1E-03 - 1.2E-01
Mountaineer Plant Slug tests (Sand Zone)		51- 286	1.8E-02 - 1.0E-01
Mountaineer Plant Slug tests (Gravelly Zone)		772	2.70E-01
Slug Tests (Mountaineer Bottom Ash Pond CCR Monitoring Network Evaluation)			
Mountaineer Plant Slug tests (Sand Zone)		147 - 213	5.2E-02 - 7.5E-02

Notes:
cm/sec - centimeters per second
ft/day - feet per day
gpd/ft - gallons per day per foot

Table C-2
Calculated Pond Seepage Rates - Calibration Simulation
AEP Mountaineer Generating Plant - Bottom Ash Ponds
New Haven, West Virginia

Plant	Mountaineer						Sporn			
Pond Identification	Bottom Ash Pond West	Bottom Ash Pond East	Wastewater Pond West	Wastewater Pond East	Reclaim Pond	Clearwater Pond	Fly Ash Pond North Basin	Fly Ash Pond South Basin	Clearwater Pond	Bottom Ash Pond
Pond Water Surface Elevation (ft-amsl) [a]	612.8	605.8	609.1	606.1	603.3	603.2	601	601	Dry	Dry
Pond Bottom Surface Elevation (ft-amsl) [b]	598	598	592	594.5	592	594	599	599		
Thickness of Low-Permeability Liner Sediments [c,d]	3	3	3	3	3	3	27	27		
Hydraulic Conductivity of Low-Permeability Liner Sediments (ft/day) [e]	3.12E-03	3.12E-03	3.12E-03	3.12E-03	3.12E-03	3.12E-03	5.00E-02	5.00E-02		
Hydraulic Conductivity of Low-Permeability Liner Sediments (cm/sec)	1.10E-06	1.10E-06	1.10E-06	1.10E-06	1.10E-06	1.10E-06	1.76E-05	1.76E-05		
Approximate Wetted Surface Area of Pond (ft^2) [f]	433,700	580,000	367,200	259,900	225,900	312,500	103,300	328,600		
Calculated Seepage Rate (ft^3/day)	6,676	4,705	6,530	3,135	2,655	2,990	383	1,217		
Calculated Seepage Rate (mgd)	0.050	0.035	0.049	0.023	0.020	0.022	0.003	0.009		
Calculated Seepage Rate per ft^2 of lakebed (ft/day)	0.0154	0.0081	0.0178	0.0121	0.0118	0.0096	0.0037	0.0037		
Calculated Seepage Rate per ft^2 of lakebed (inches/year)	67.5	35.6	77.9	52.9	51.5	41.9	16.2	16.2		

Notes:

a. Pond water surface elevations are from Mountaineer and Sporn Plant Monthly Dike Inspection Reports.
b. Pond Bottom surface elevations are from pond design documents and cross-sections (Casagrande Consultants, 1977; EPRI, 1999; Dewberry, 2009).
c. Mountaineer Ash Pond liner thicknesses was designed to be a minimum of 3 feet thick (Casagrande Consultants, 1977).
d. Sporn Fly Ash Pond ash thickness estimated from pond and dike subsurface cross-sections in EPRI, 1999 and Dewberry, 1999.
e. Hydraulic conductivities of low-permeability sediments underlying the ponds was assigned through calibration.
f. Wetted area of ponds estimated from aerial photographs.
cm/sec - centimeters per second
ft-amsl - feet above mean sea level
ft/day - feet per day
ft^2 - square feet
ft^3/day - cubic feet per day
mgd - million gallons per day

Table C-3
Calculated Pond Seepage Rates - Current or Near Future Condition
AEP Mountaineer Generating Plant - Bottom Ash Ponds
New Haven, West Virginia

Plant	Mountaineer						Sporn			
Pond Identification	Bottom Ash Pond West	Bottom Ash Pond East	Wastewater Pond West	Wastewater Pond East	Reclaim Pond	Clearwater Pond	Fly Ash Pond North Basin	Fly Ash Pond South Basin	Clearwater Pond	Bottom Ash Pond
Pond Water Surface Elevation (ft-amsl) [a]	612	612	609	609	603	603	Dry	Dry	Dry	Dry
Pond Bottom Surface Elevation (ft-amsl) [b]	598	598	592	594.5	592	594				
Thickness of Low-Permeability Liner Sediments [c]	3	3	3	3	3	3				
Hydraulic Conductivity of Low-Permeability Liner Sediments (ft/day) [d]	3.12E-03	3.12E-03	3.12E-03	3.12E-03	3.12E-03	3.12E-03				
Hydraulic Conductivity of Low-Permeability Liner Sediments (cm/sec)	1.10E-06	1.10E-06	1.10E-06	1.10E-06	1.10E-06	1.10E-06				
Approximate Wetted Surface Area of Pond (ft^2) [e]	571,600	367,200	367,200	259,900	225,900	312,500				
Calculated Seepage Rate (ft^3/day)	8,322	5,346	6,492	3,919	2,584	2,925				
Calculated Seepage Rate (mgd)	0.062	0.040	0.049	0.029	0.019	0.022				
Calculated Seepage Rate per ft^2 of lakebed (ft/day)	0.015	0.015	0.018	0.015	0.011	0.009				
Calculated Seepage Rate per ft^2 of lakebed (inches/year)	63.8	63.8	77.5	66.1	50.1	41.0				

Notes:

a. Normal operating elevation.

b. Pond Bottom surface elevations are from pond design documents and cross-sections (Casagrande Consultants, 1977; EPRI, 1999).

c. Mountaineer Ash Pond liner thicknesses was designed to be a minimum of 3 feet thick (Casagrande Consultants, 1977).

d. Hydraulic conductivities of low-permeability sediments underlying the ponds was assigned through calibration.

e. Wetted area of ponds estimated from aerial photographs.

cm/sec - centimeters per second

ft-amsl - feet above mean sea level

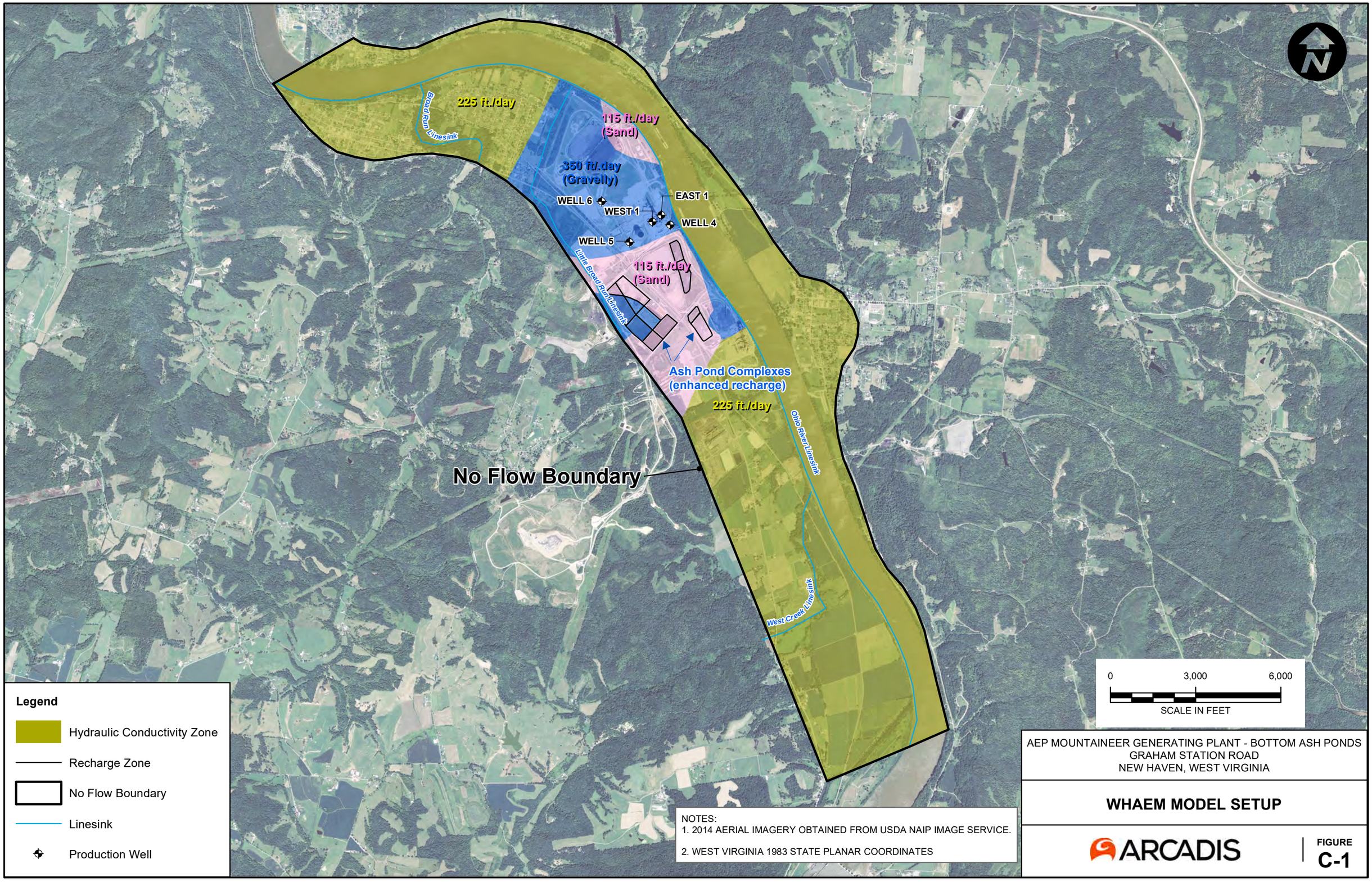
ft/day - feet per day

ft^2 - square feet

ft^3/day - cubic feet per day

mgd - million gallons per day

FIGURES



NOTES:
1. 2014 AERIAL IMAGERY OBTAINED FROM USDA NAIP IMAGE SERVICE.

2. WEST VIRGINIA 1983 STATE PLANAR COORDINATES

AEP MOUNTAINEER GENERATING PLANT - BOTTOM ASH PONDS
GRAHAM STATION ROAD
NEW HAVEN, WEST VIRGINIA

WHAEM MODEL SETUP

ARCADIS

FIGURE
C-1

City: CITRIX Div/Group: IM/DV Created By: K.Ives Last Saved By: webb
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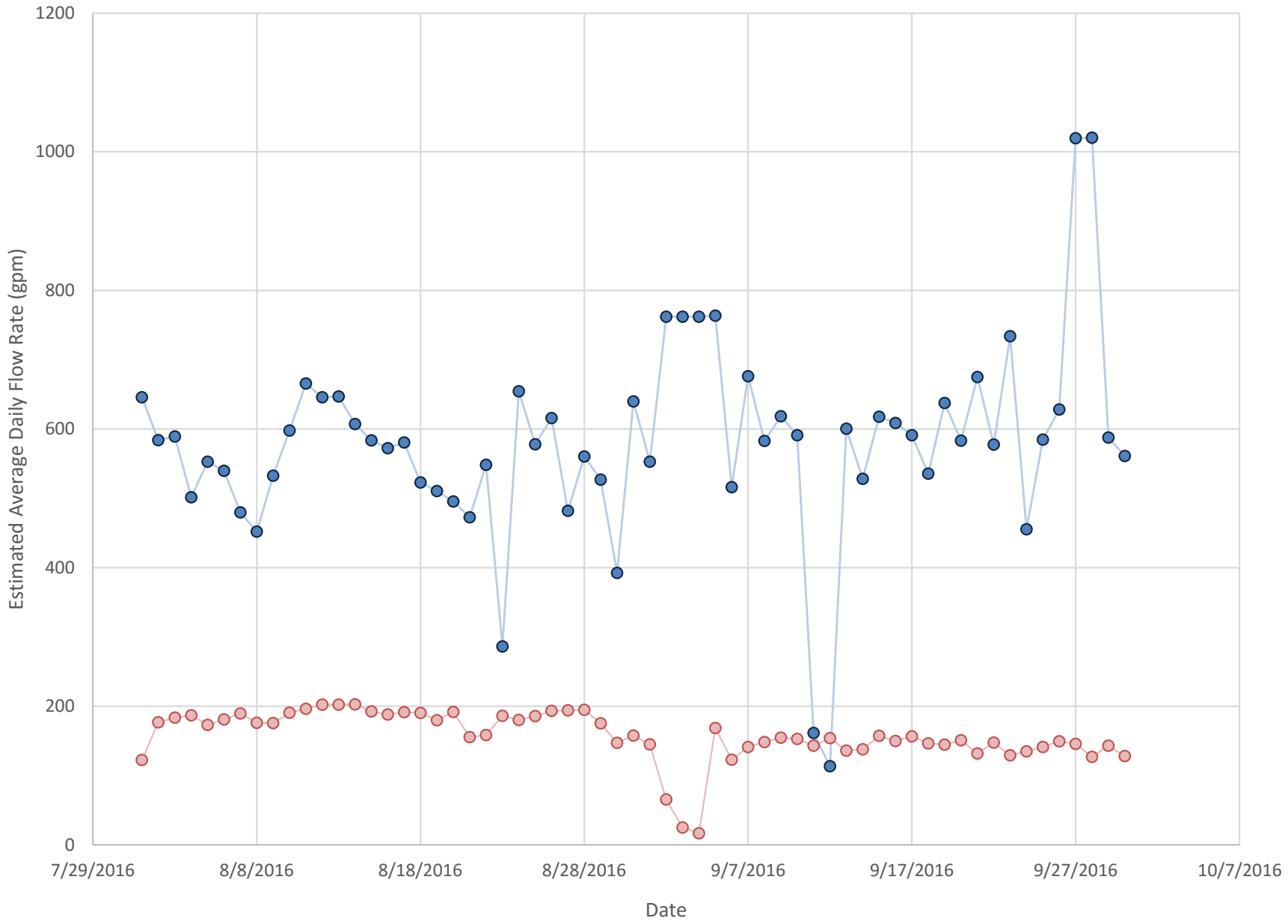
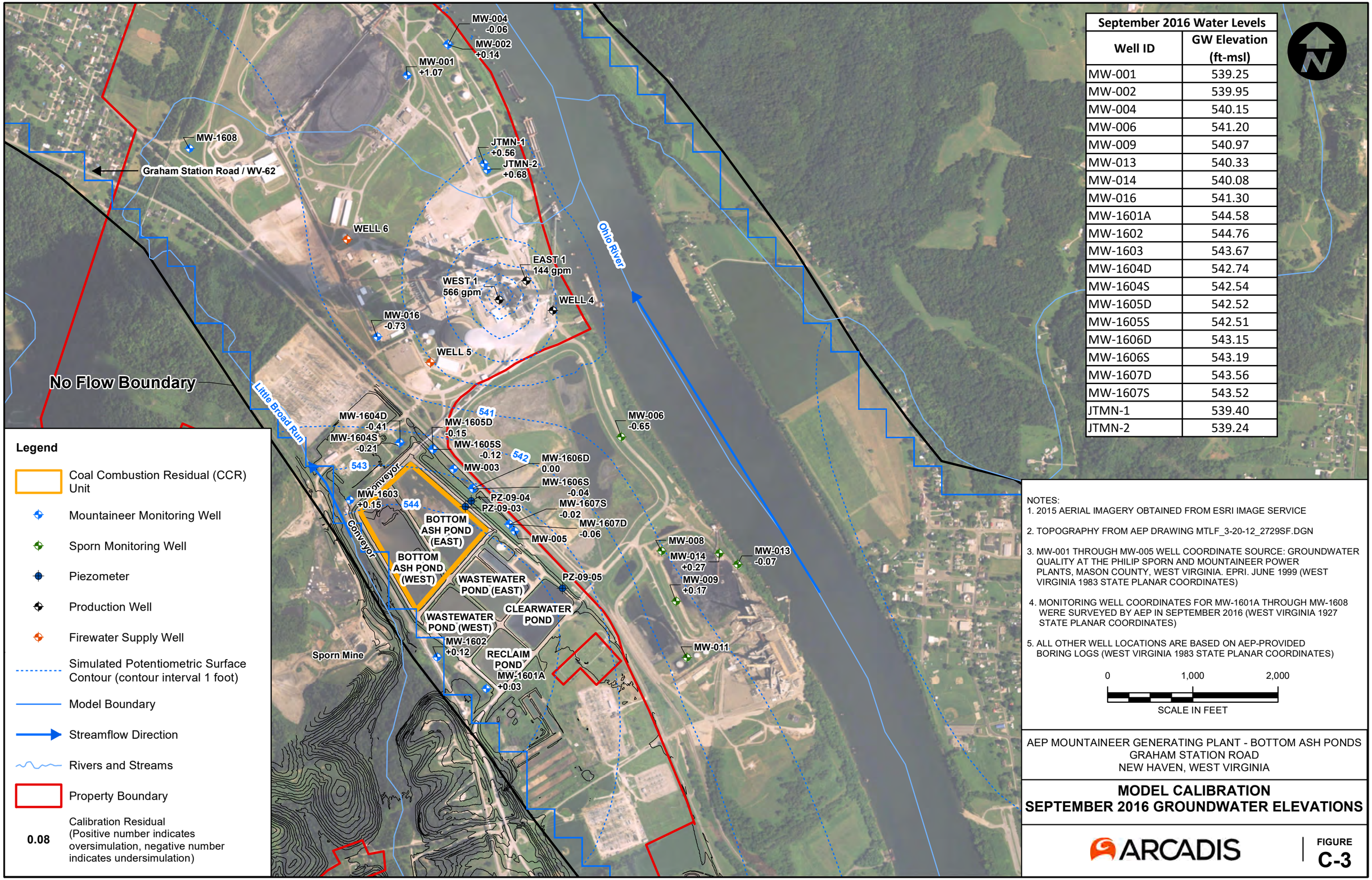
FIGURE C-2. MOUNTAINEER PLANT PRODUCTION WELL RECENT DAILY FLOW RATES





September 2016 Water Levels	
Well ID	GW Elevation (ft-msl)
MW-001	539.25
MW-002	539.95
MW-004	540.15
MW-006	541.20
MW-009	540.97
MW-013	540.33
MW-014	540.08
MW-016	541.30
MW-1601A	544.58
MW-1602	544.76
MW-1603	543.67
MW-1604D	542.74
MW-1604S	542.54
MW-1605D	542.52
MW-1605S	542.51
MW-1606D	543.15
MW-1606S	543.19
MW-1607D	543.56
MW-1607S	543.52
JTMN-1	539.40
JTMN-2	539.24

Legend

- Coal Combustion Residual (CCR) Unit
- Mountaineer Monitoring Well
- Sporn Monitoring Well
- Piezometer
- Production Well
- Firewater Supply Well
- Simulated Potentiometric Surface Contour (contour interval 1 foot)
- Model Boundary
- Streamflow Direction
- Rivers and Streams
- Property Boundary
- 0.08 — Calibration Residual (Positive number indicates oversimulation, negative number indicates undersimulation)

NOTES:
1. 2015 AERIAL IMAGERY OBTAINED FROM ESRI IMAGE SERVICE
2. TOPOGRAPHY FROM AEP DRAWING MTLF_3-20-12_2729SF.DGN
3. MW-001 THROUGH MW-005 WELL COORDINATE SOURCE: GROUNDWATER QUALITY AT THE PHILIP SPORN AND MOUNTAINEER POWER PLANTS, MASON COUNTY, WEST VIRGINIA. EPRI. JUNE 1999 (WEST VIRGINIA 1983 STATE PLANAR COORDINATES)
4. MONITORING WELL COORDINATES FOR MW-1601A THROUGH MW-1608 WERE SURVEYED BY AEP IN SEPTEMBER 2016 (WEST VIRGINIA 1927 STATE PLANAR COORDINATES)
5. ALL OTHER WELL LOCATIONS ARE BASED ON AEP-PROVIDED BORING LOGS (WEST VIRGINIA 1983 STATE PLANAR COORDINATES)

0 1,000 2,000
SCALE IN FEET

AEP MOUNTAINEER GENERATING PLANT - BOTTOM ASH PONDS
GRAHAM STATION ROAD
NEW HAVEN, WEST VIRGINIA

MODEL CALIBRATION
SEPTEMBER 2016 GROUNDWATER ELEVATIONS

ARCADIS

FIGURE
C-3

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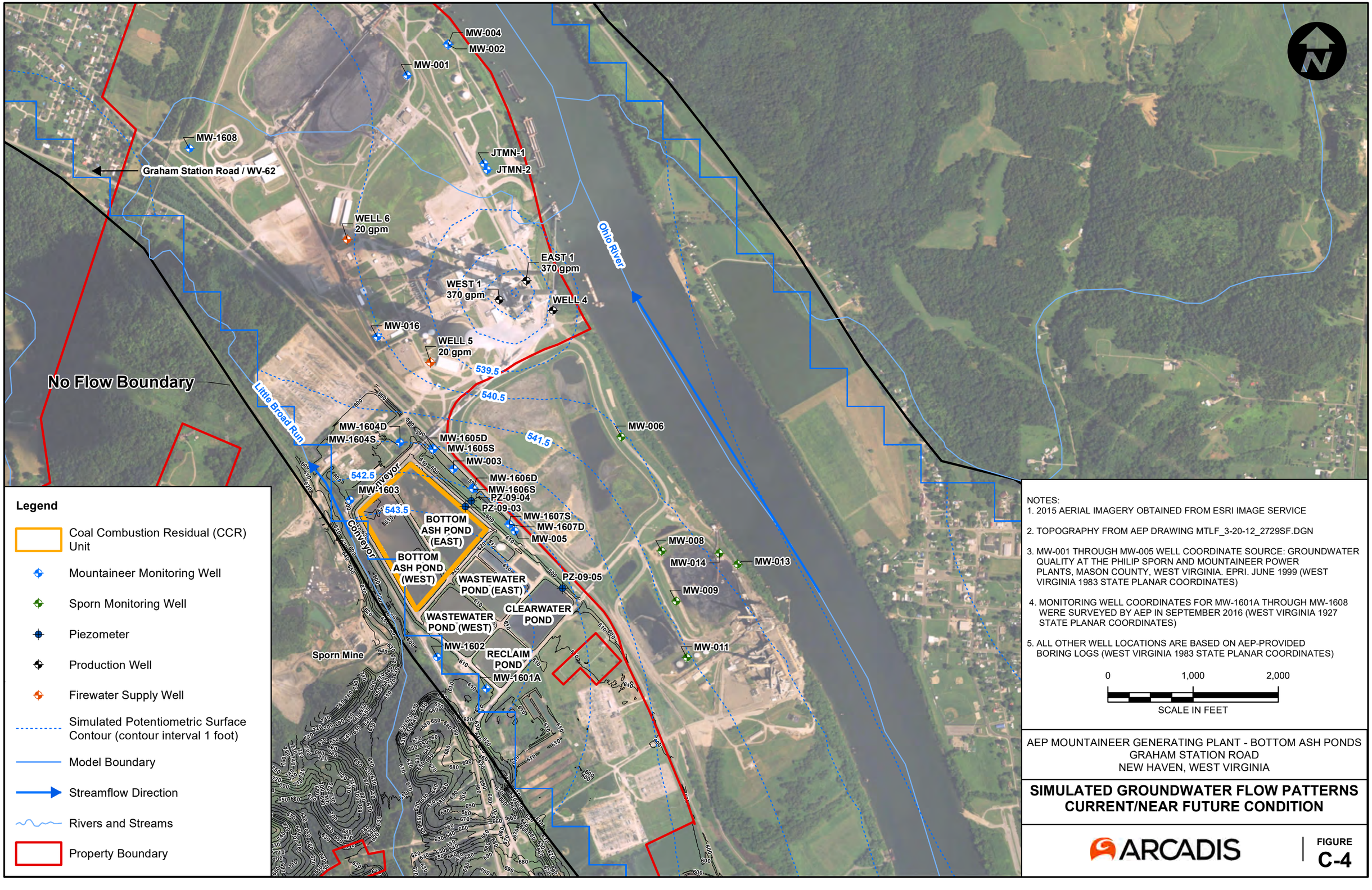

Legend

- Coal Combustion Residual (CCR) Unit
- Mountaineer Monitoring Well
- Sporn Monitoring Well
- Piezometer
- Production Well
- Firewater Supply Well
- Simulated Potentiometric Surface Contour (contour interval 1 foot)
- Model Boundary
- Streamflow Direction
- Rivers and Streams
- Property Boundary

NOTES:
1. 2015 AERIAL IMAGERY OBTAINED FROM ESRI IMAGE SERVICE
2. TOPOGRAPHY FROM AEP DRAWING MTLF_3-20-12_2729SF.DGN
3. MW-001 THROUGH MW-005 WELL COORDINATE SOURCE: GROUNDWATER QUALITY AT THE PHILIP SPORN AND MOUNTAINEER POWER PLANTS, MASON COUNTY, WEST VIRGINIA. EPRI. JUNE 1999 (WEST VIRGINIA 1983 STATE PLANAR COORDINATES)
4. MONITORING WELL COORDINATES FOR MW-1601A THROUGH MW-1608 WERE SURVEYED BY AEP IN SEPTEMBER 2016 (WEST VIRGINIA 1927 STATE PLANAR COORDINATES)
5. ALL OTHER WELL LOCATIONS ARE BASED ON AEP-PROVIDED BORING LOGS (WEST VIRGINIA 1983 STATE PLANAR COORDINATES)

0 1,000 2,000
SCALE IN FEET

AEP MOUNTAINEER GENERATING PLANT - BOTTOM ASH PONDS
GRAHAM STATION ROAD
NEW HAVEN, WEST VIRGINIA

SIMULATED GROUNDWATER FLOW PATTERNS CURRENT/NEAR FUTURE CONDITION

ARCADIS

FIGURE
C-4

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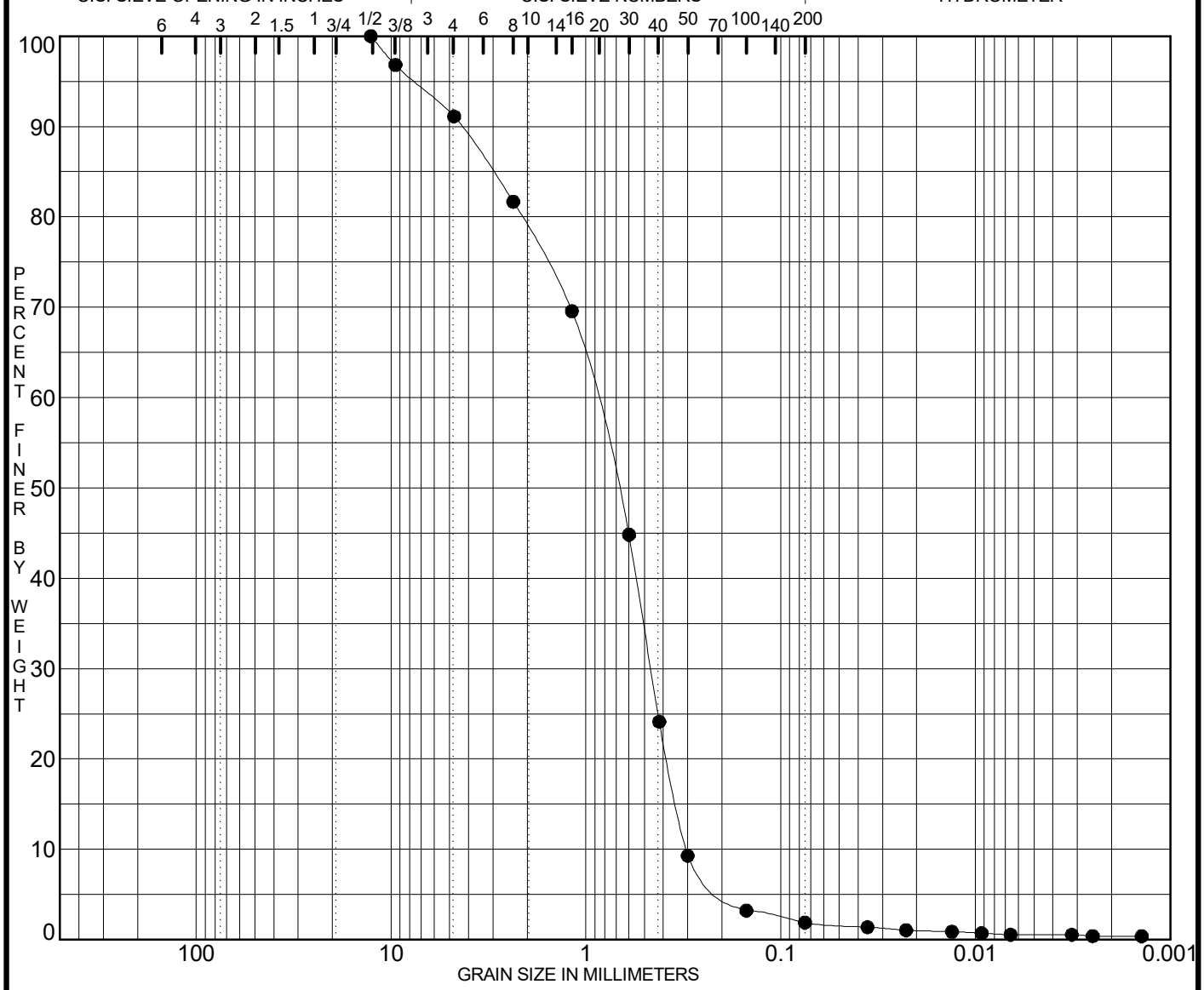
APPENDIX D

Soil Property Testing



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.
● **MW-1601A 66.0-76.0**		**4.8**				
	POORLY GRADED SAND SP					
	ELEVATION					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%clay
● **MW-1601A 66.0-76.0**	**12.700**	**0.908**	**0.465**	**0.305**	**8.9**	**89.2**	**1.3**	**0.5**

PROJECT **Mountaineer CCR Compliance -**

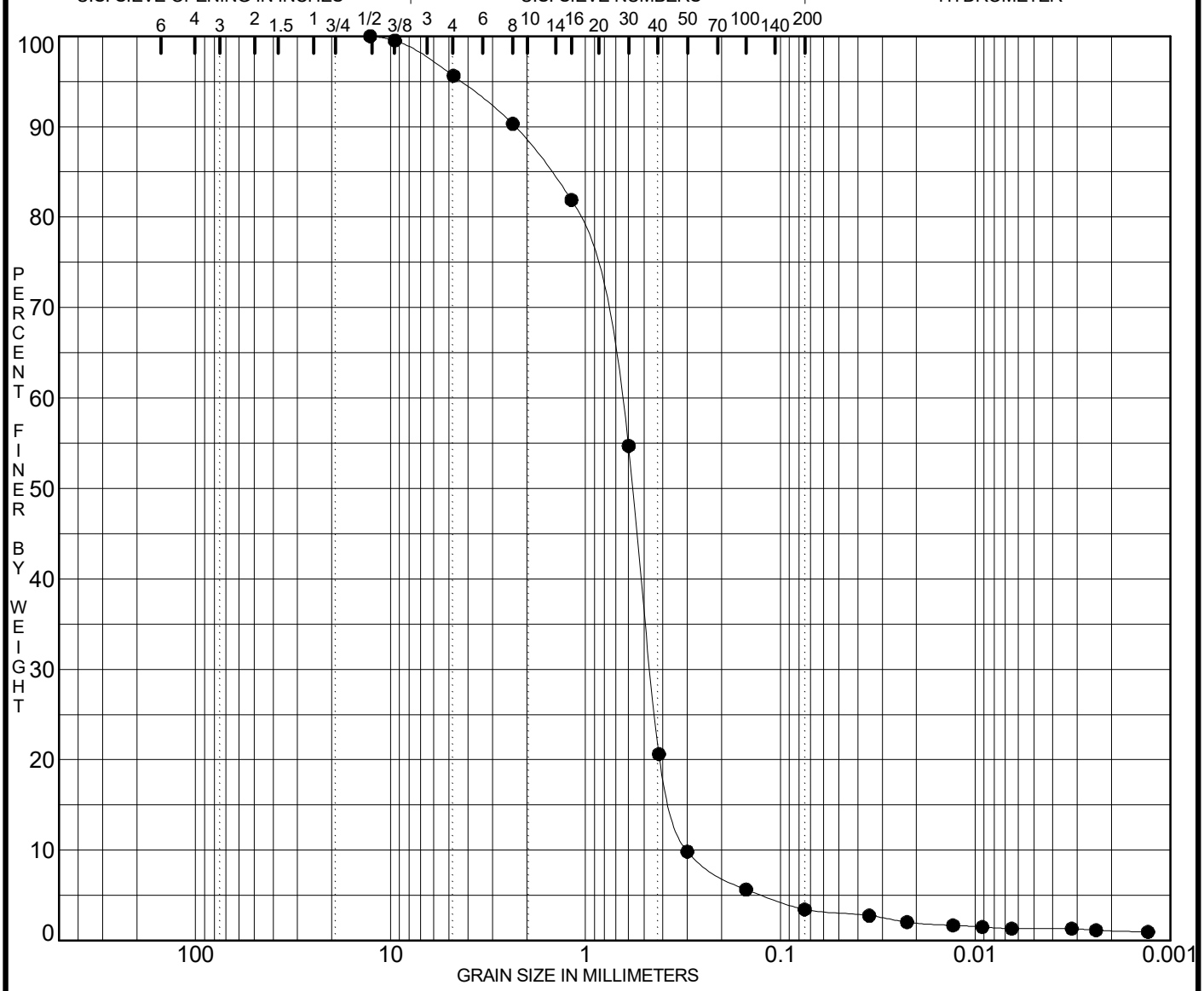
JOB NO.

DATE **7/27/16**

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-1602 61.0-71.0**		**17.9**				
	POORLY GRADED SAND SP					
	ELEVATION					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%clay
● **MW-1602 61.0-71.0**	**12.700**	**0.684**	**0.463**	**0.301**	**4.4**	**92.2**	**2.1**	**1.3**

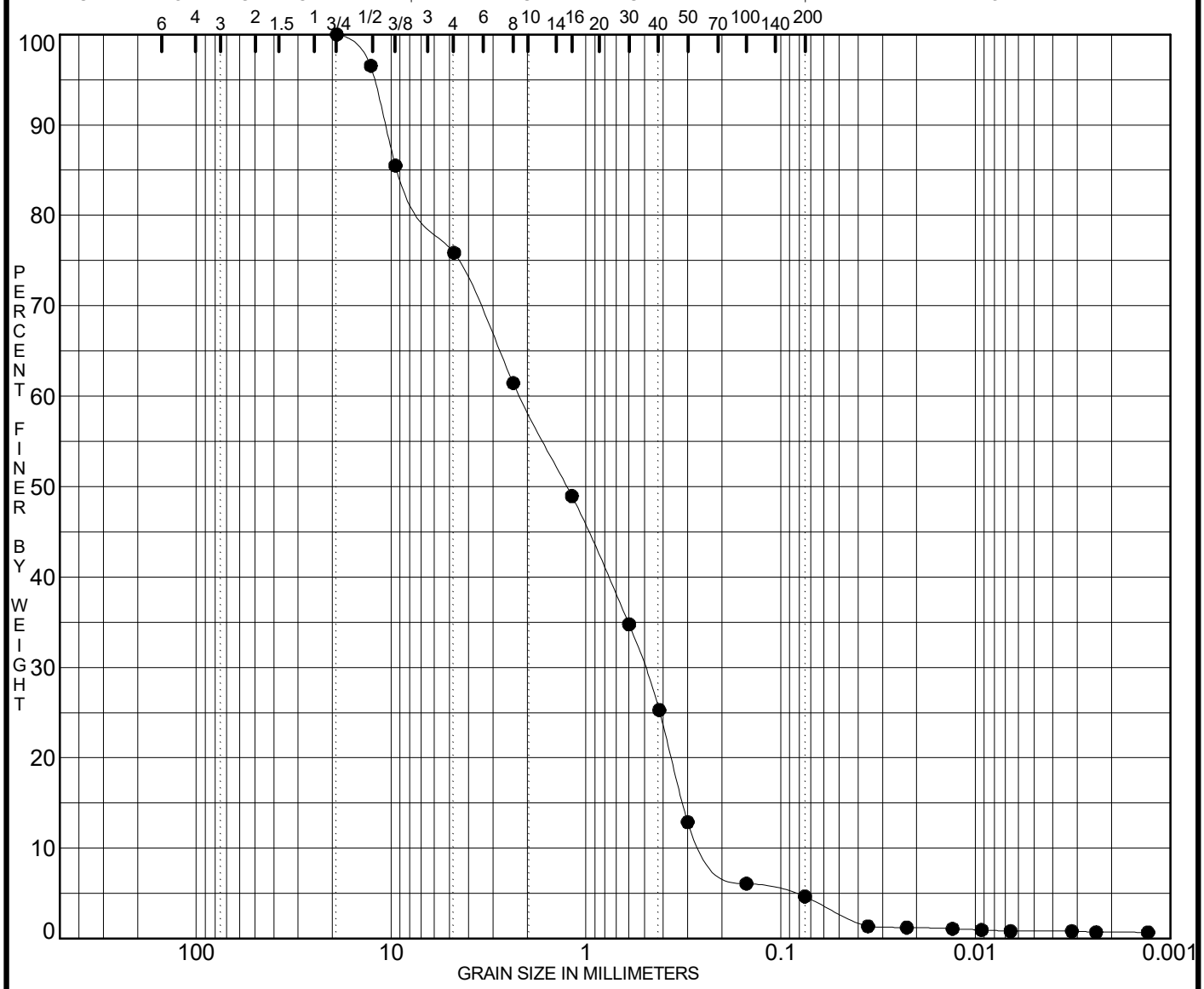
PROJECT **Mountaineer CCR Compliance -** JOB NO.

DATE **7/27/16**

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-1603 60.0-75.0**		**15.7**				
	POORLY GRADED SAND with GRAVEL SP					
	ELEVATION					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%clay
● **MW-1603 60.0-75.0**	**19.000**	**2.178**	**0.501**	**0.224**	**24.1**	**71.2**	**3.8**	**0.8**

PROJECT **Mountaineer CCR Compliance -**

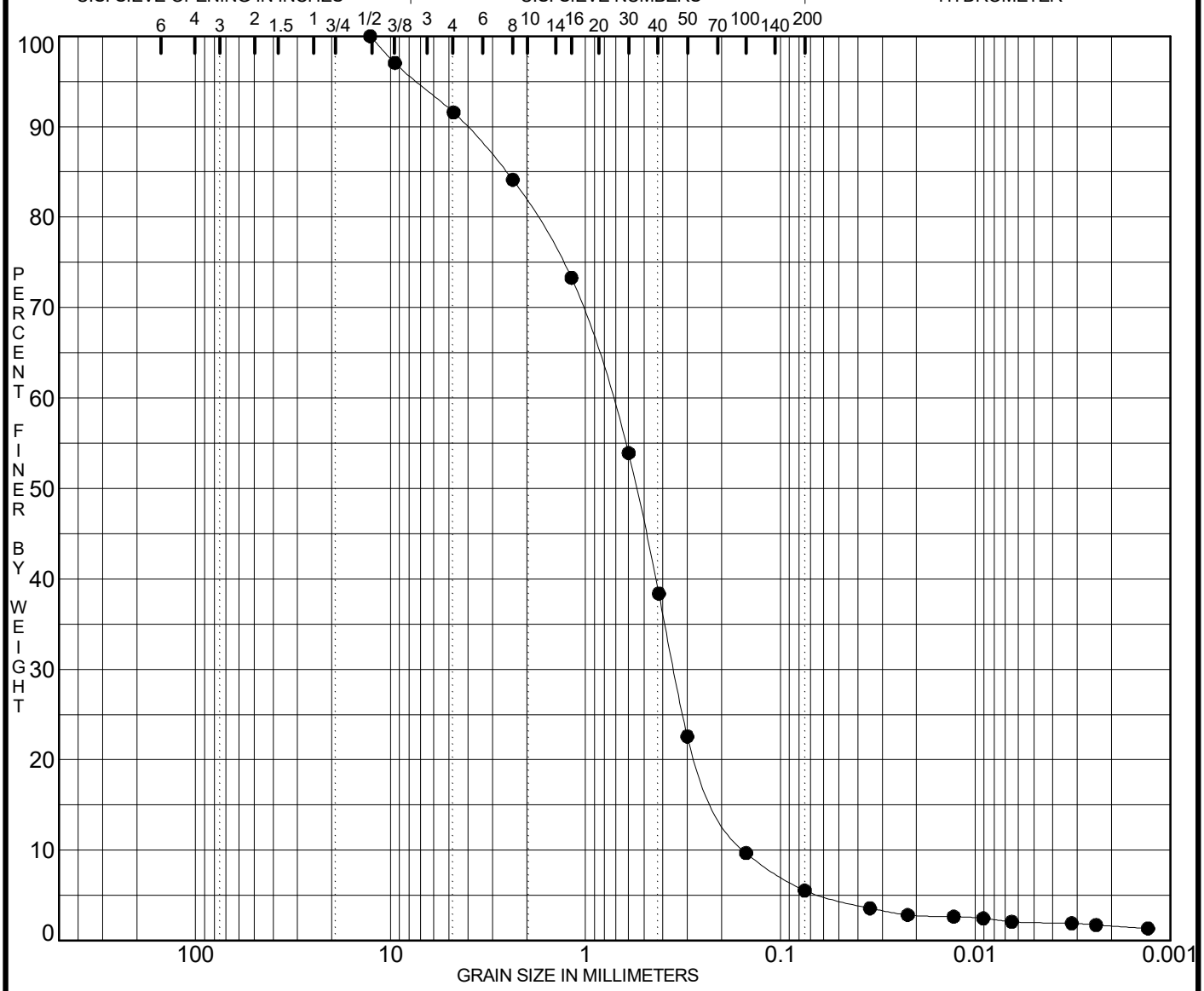
JOB NO.

DATE **7/27/16**

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-1604d 69.0-79.0**		**15.2**	**NP**	**NP**	**NP**	
	POORLY GRADED SAND with SILT SP-SM					
	ELEVATION					

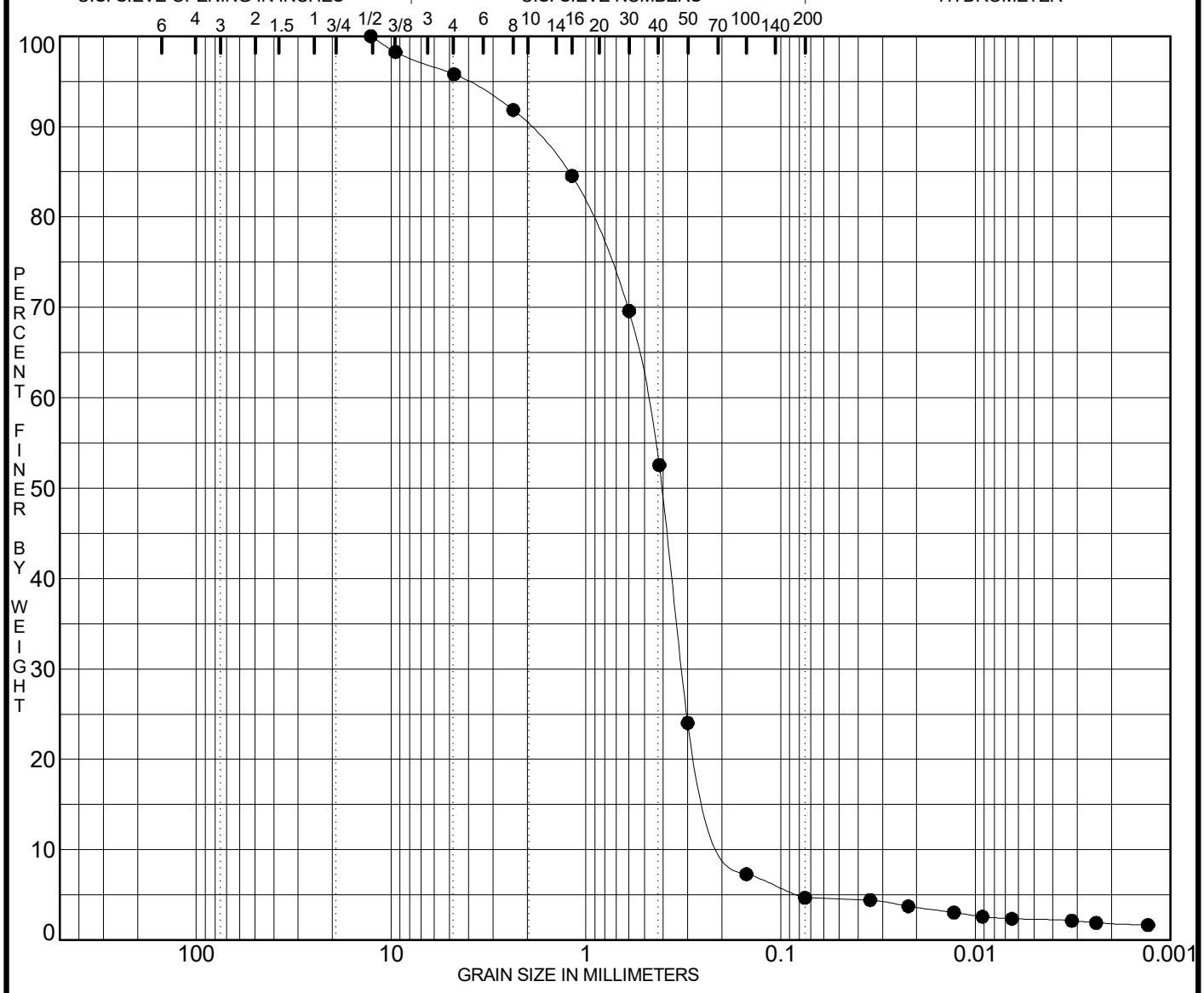
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%clay
● **MW-1604d 69.0-79.0**	**12.700**	**0.742**	**0.351**	**0.153**	**8.4**	**86.0**	**3.5**	**2.0**

PROJECT **Mountaineer CCR Compliance -** JOB NO.

DATE **7/27/16**

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-1604s 49.0-59.0**		**17.4**	**NP**	**NP**	**NP**	
	POORLY GRADED SAND SP					
	ELEVATION					

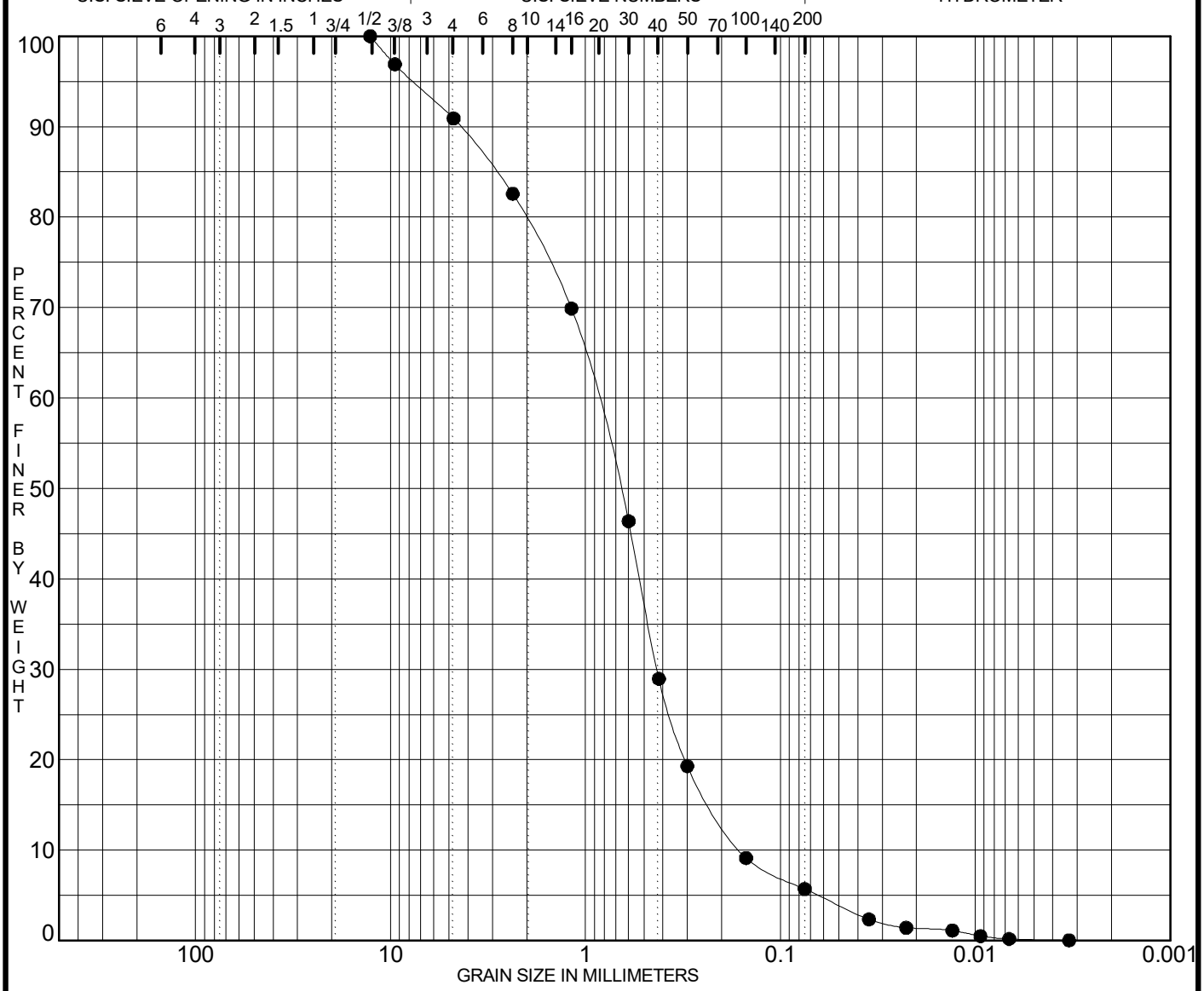
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%clay
● **MW-1604s 49.0-59.0**	**12.700**	**0.491**	**0.322**	**0.168**	**4.2**	**91.1**	**2.4**	**2.3**

PROJECT **Mountaineer CCR Compliance -** JOB NO.

DATE **7/27/16**

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-1605d 69.0-79.0**		**16.1**	**NP**	**NP**	**NP**	
	POORLY GRADED SAND with SILT SP-SM					
	ELEVATION					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%clay
● **MW-1605d 69.0-79.0**	**12.700**	**0.888**	**0.429**	**0.159**	**9.1**	**85.2**	**5.6**	**0.1**

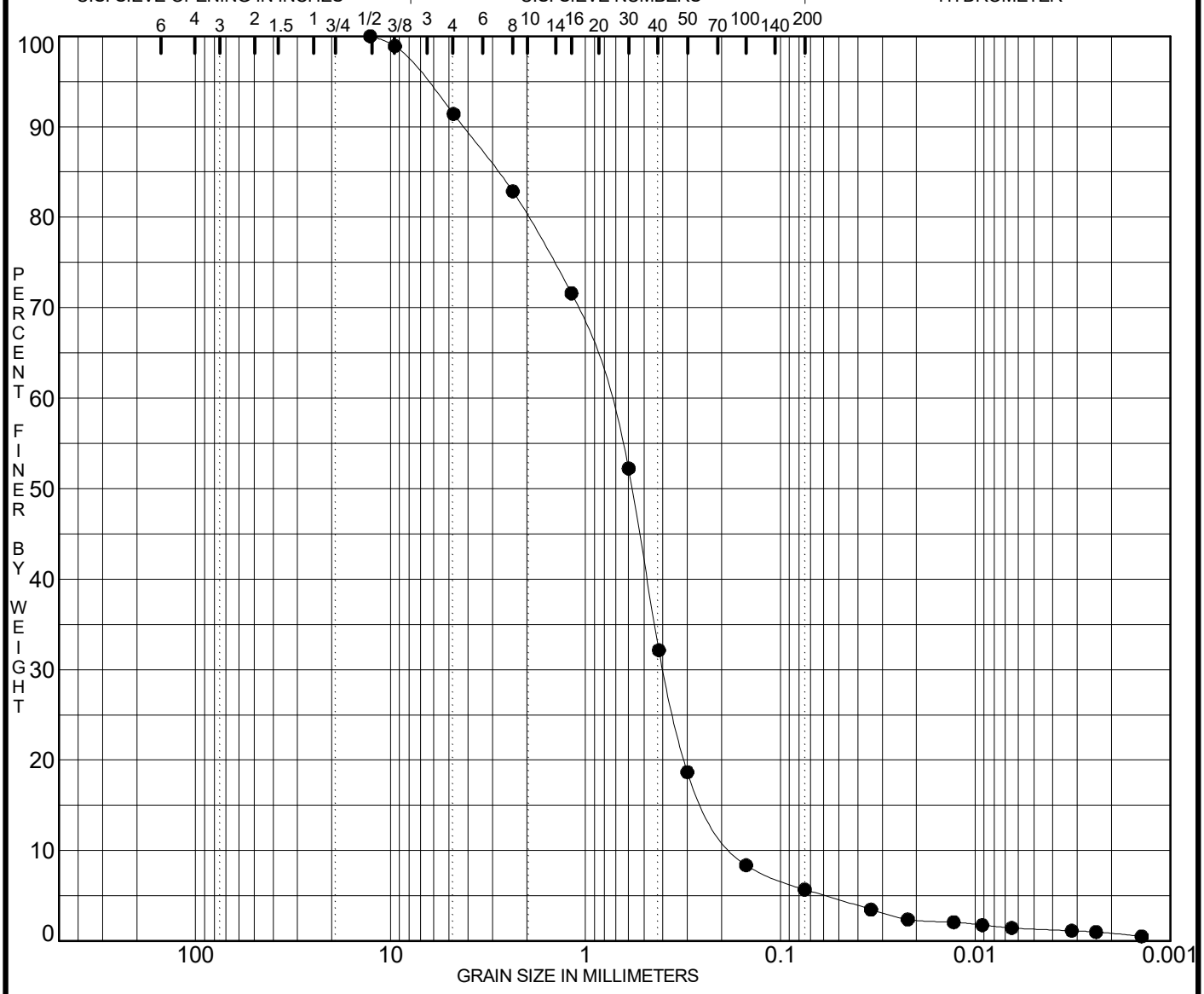
PROJECT **Mountaineer CCR Compliance -**

JOB NO.

DATE **7/27/16**

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-1605s 49.0-59.0**		**18.1**	**NP**	**NP**	**NP**	
	POORLY GRADED SAND with SILT SP-SM					
	ELEVATION					

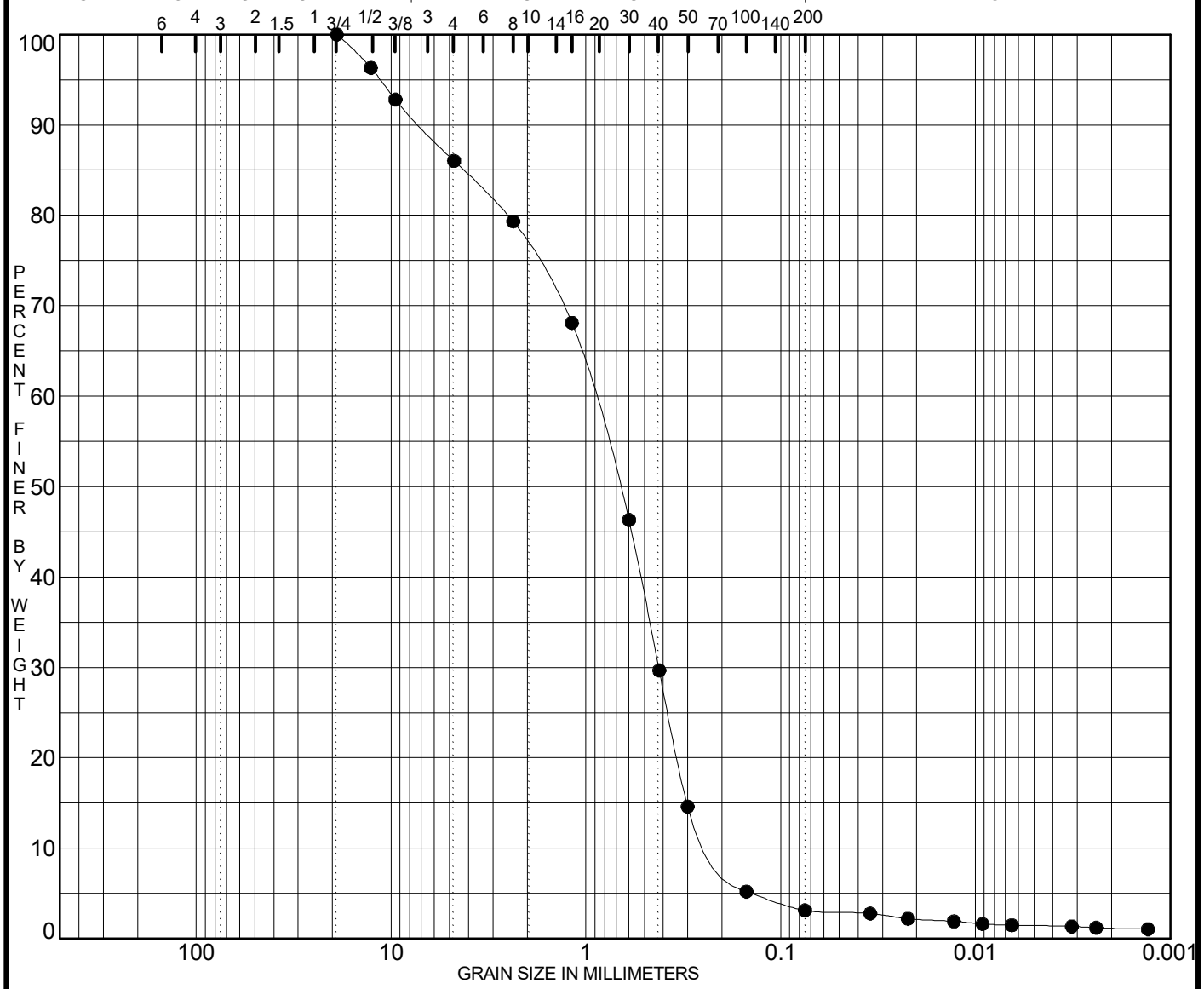
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%clay
● **MW-1605s 49.0-59.0**	**12.700**	**0.787**	**0.398**	**0.167**	**8.6**	**85.7**	**4.4**	**1.3**

PROJECT **Mountaineer CCR Compliance -** JOB NO.

DATE **7/27/16**

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-1606d 65.0-75.0**		**15.4**				
		POORLY GRADED SAND SP					
		ELEVATION					

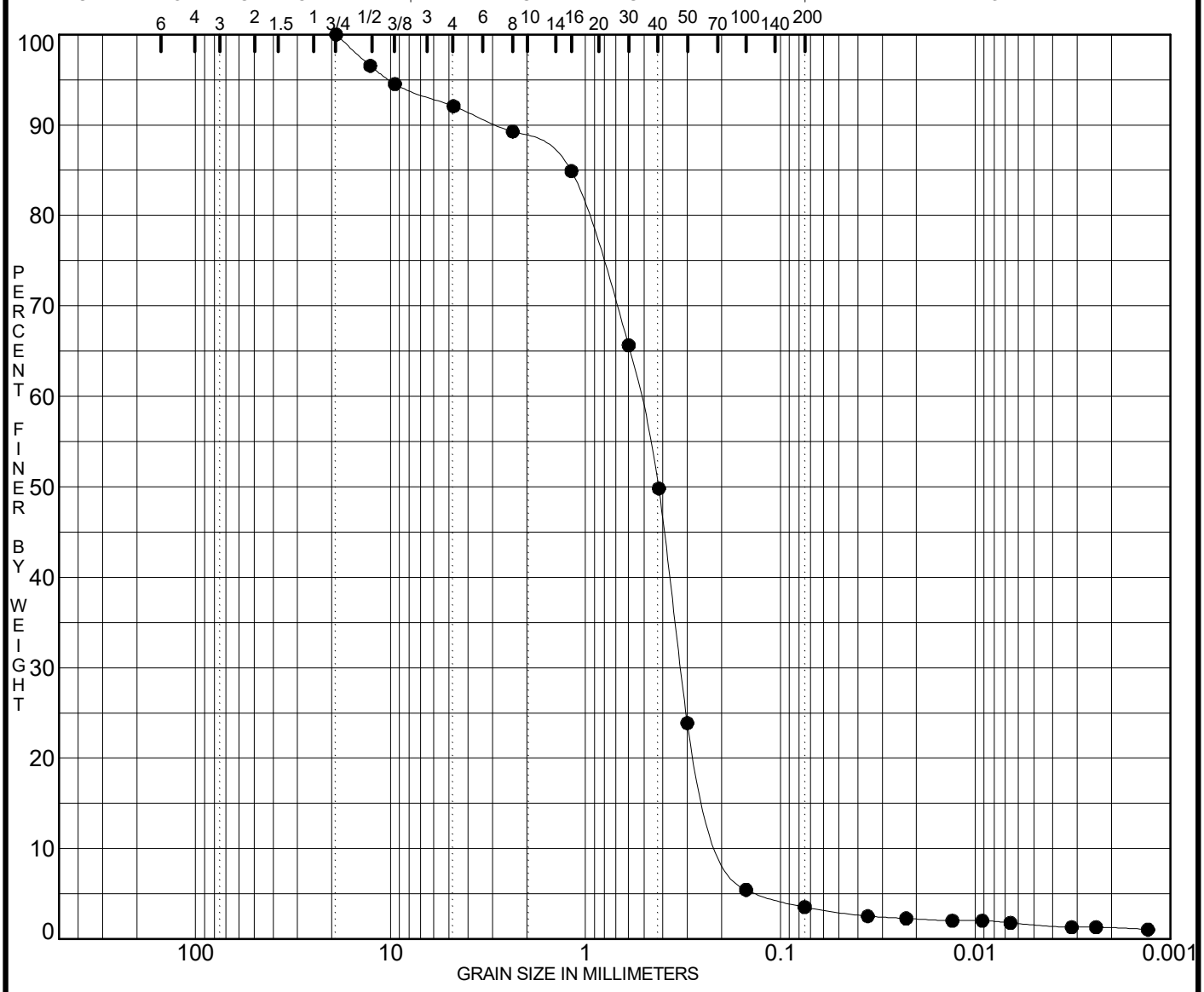
	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%clay
●	**MW-1606d 65.0-75.0**	**19.000**	**0.917**	**0.423**	**0.214**	**14.0**	**82.9**	**1.7**	**1.4**

PROJECT **Mountaineer CCR Compliance -** JOB NO.

DATE **7/27/16**

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-1606s 45.0-55.0		**22.5**	**NP**	**NP**	**NP**	
	POORLY GRADED SAND SP					
	ELEVATION					

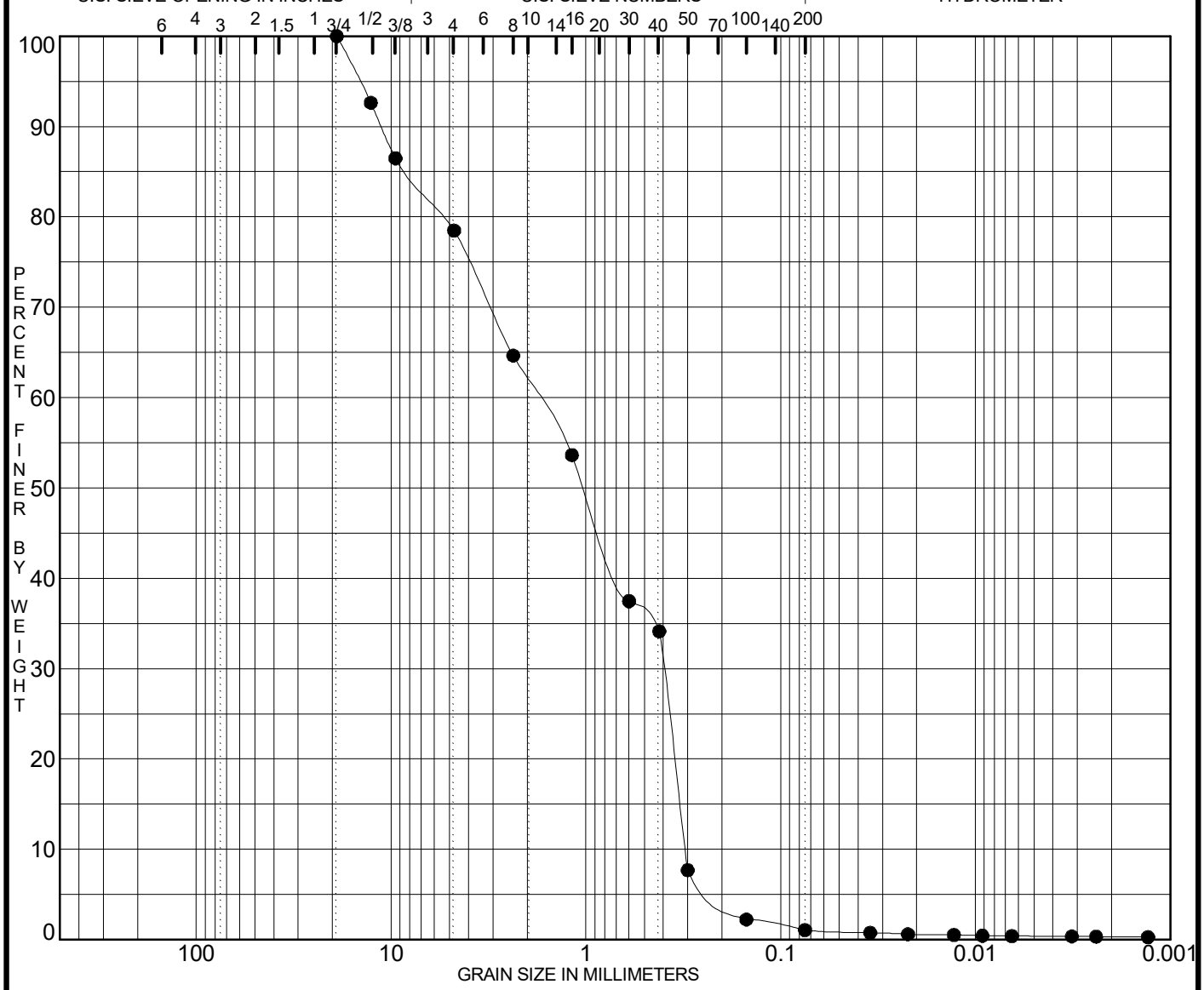
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%clay
MW-1606s 45.0-55.0	**19.000**	**0.528**	**0.325**	**0.178**	**7.9**	**88.5**	**1.9**	**1.6**

PROJECT **Mountaineer CCR Compliance -** JOB NO.

DATE **7/27/16**

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-1607d 70.0-80.0**		**27.9**				
	POORLY GRADED SAND with GRAVEL SP					
	ELEVATION					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%clay
● **MW-1607d 70.0-80.0**	**19.000**	**1.762**	**0.399**	**0.309**	**21.5**	**77.4**	**0.7**	**0.4**

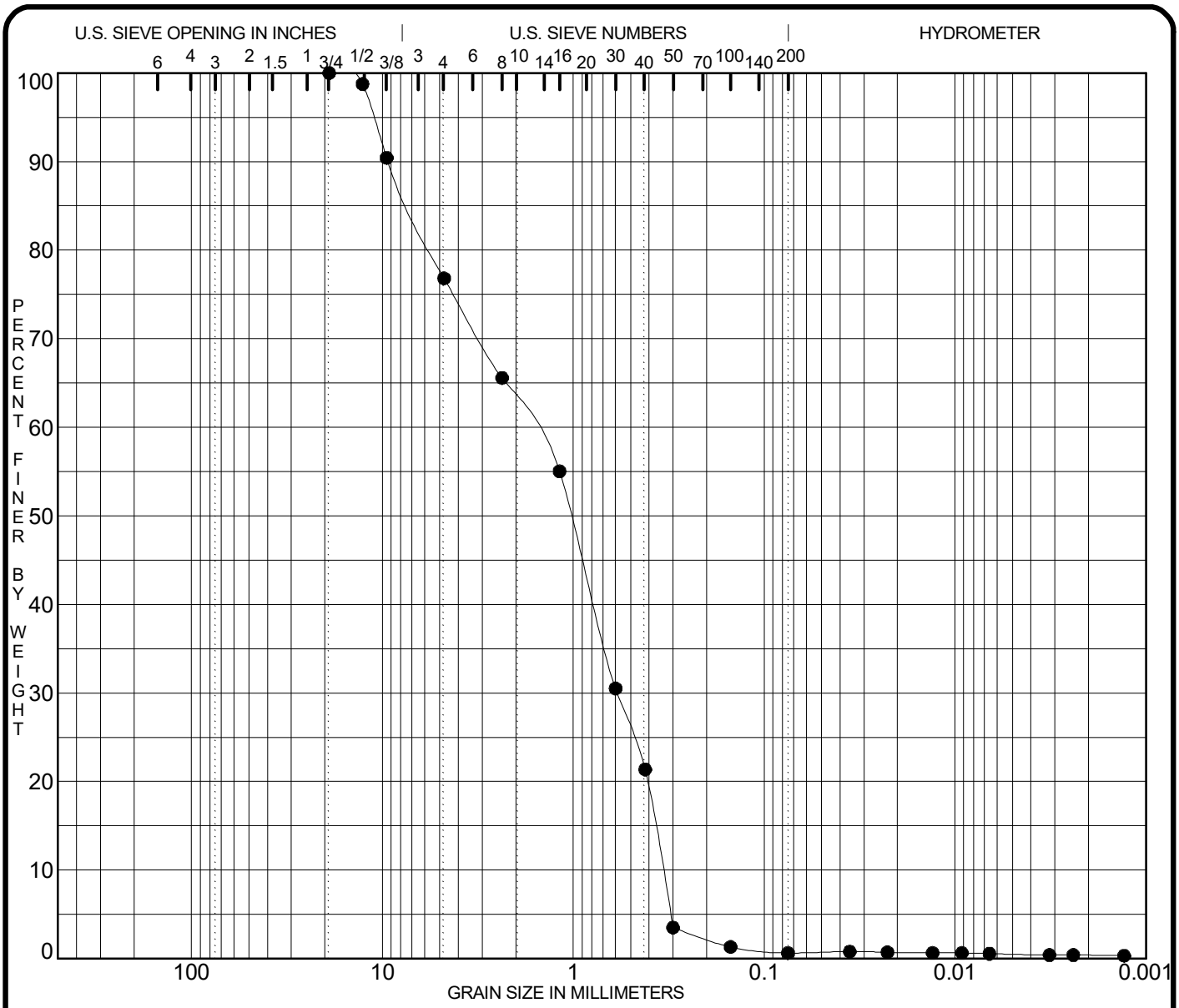
PROJECT **Mountaineer CCR Compliance -**

JOB NO.

DATE **9/29/16**

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-1607s 56.0-60.0**		**17.6**				
	POORLY GRADED SAND with GRAVEL SP					
	ELEVATION					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%clay
● **MW-1607s 56.0-60.0**	**19.000**	**1.636**	**0.588**	**0.339**	**23.2**	**76.2**	**0.1**	**0.5**

PROJECT **Mountaineer CCR Compliance -**

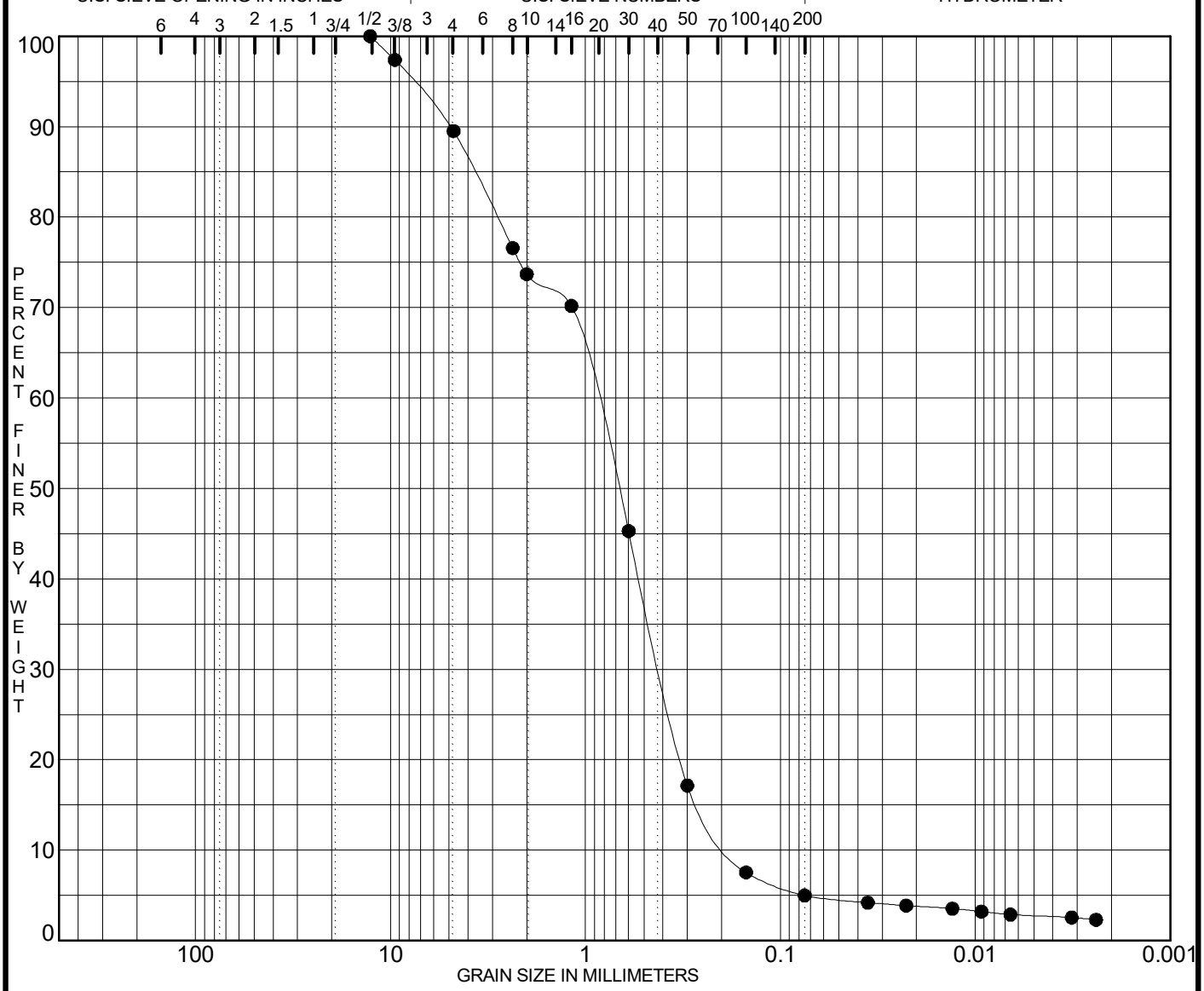
JOB NO.

DATE **9/29/16**

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-1608 46'-56'**		**13.6**				
	POORLY GRADED SAND SP					
	ELEVATION					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%clay
● **MW-1608 46'-56'**	**12.700**	**0.895**	**0.412**	**0.179**	**10.5**	**84.5**	**2.2**	**2.8**

PROJECT **Mountaineer CCR Compliance -** JOB NO.

DATE **7/27/16**

GRADATION CURVES

American Electric Power Service Corp.

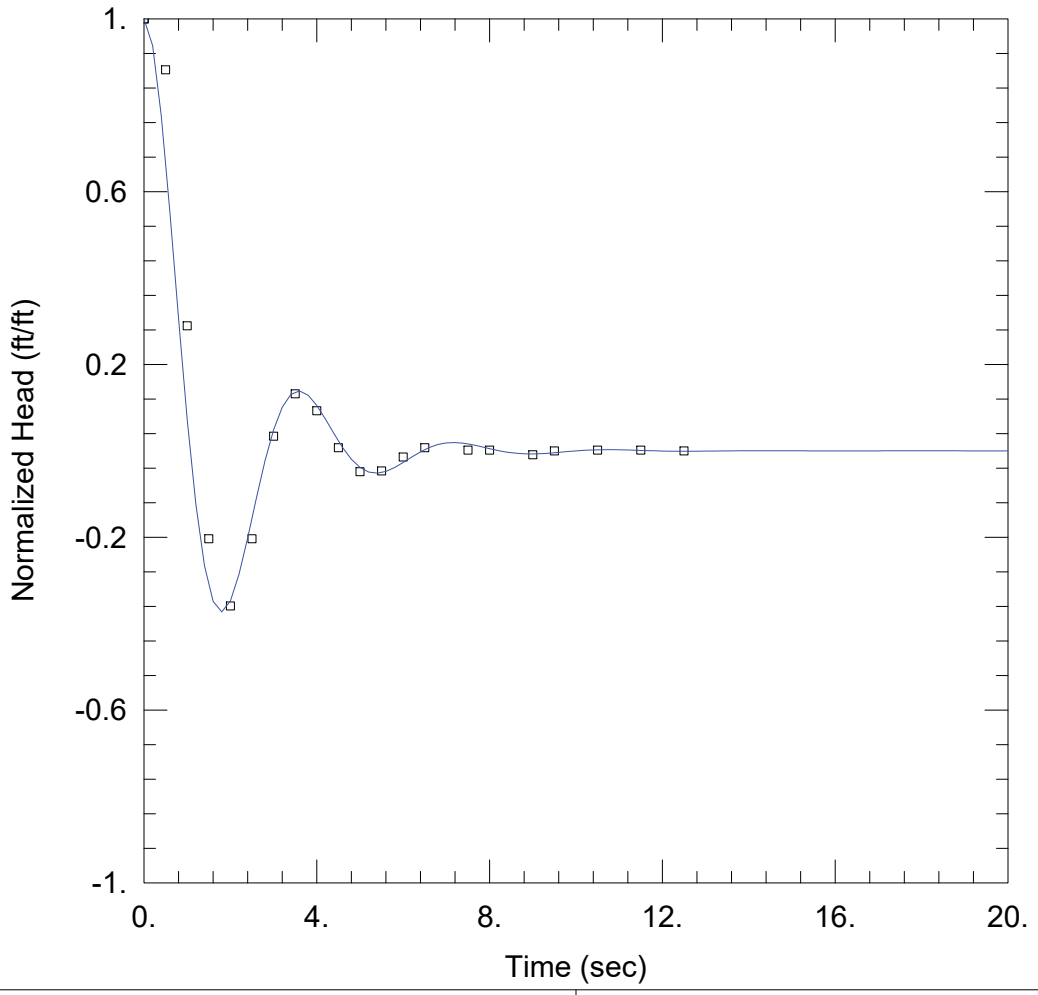
AEP

APPENDIX E

Slug Testing Results

MW-1601A Test 3

Prepared By:	Prepared For:
ARCADIS	AEP
Project:	**Location:**
OH015976.0009	Mountaineer, WV



SOLUTION

Aquifer Model: Unconfined
Solution Method: Springer-Gelhar

K = 0.075 cm/sec Le = 9.516 ft

AQUIFER DATA

Saturated Thickness: 16.5 ft

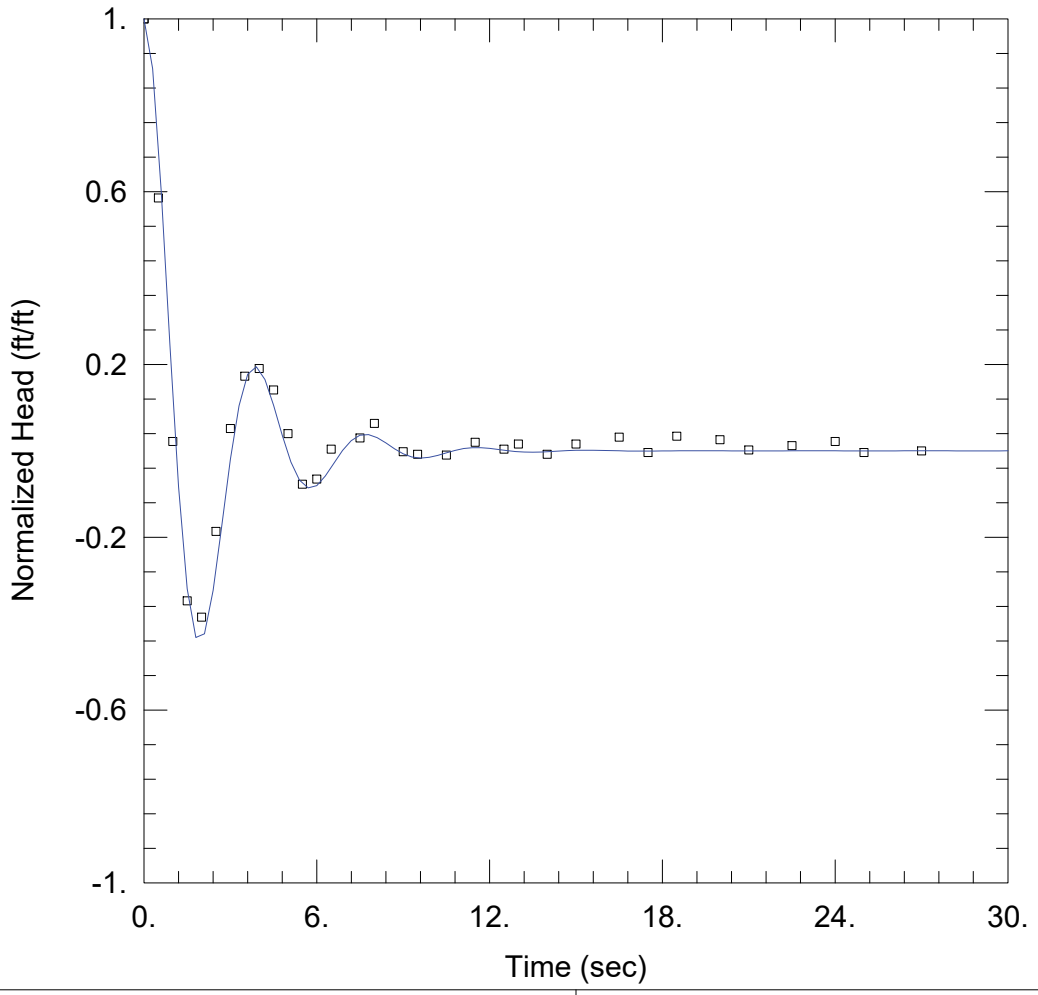
WELL DATA (MW-1601A Test 3)

Initial Displacement: 0.56 ft
Static Water Column Height: 11.5 ft
Total Well Penetration Depth: 11.5 ft
Screen Length: 10. ft
Casing Radius: 0.0833 ft
Well Radius: 0.3437 ft

ARCADIS

MW-1603 Test 1

Prepared By:	Prepared For:
ARCADIS	AEP
Project:	**Location:**
OH015976.0009	Mountaineer, WV



SOLUTION

Aquifer Model: Unconfined
Solution Method: Springer-Gelhar

K = 0.071 cm/sec Le = 11.3 ft

AQUIFER DATA

Saturated Thickness: 17.9 ft

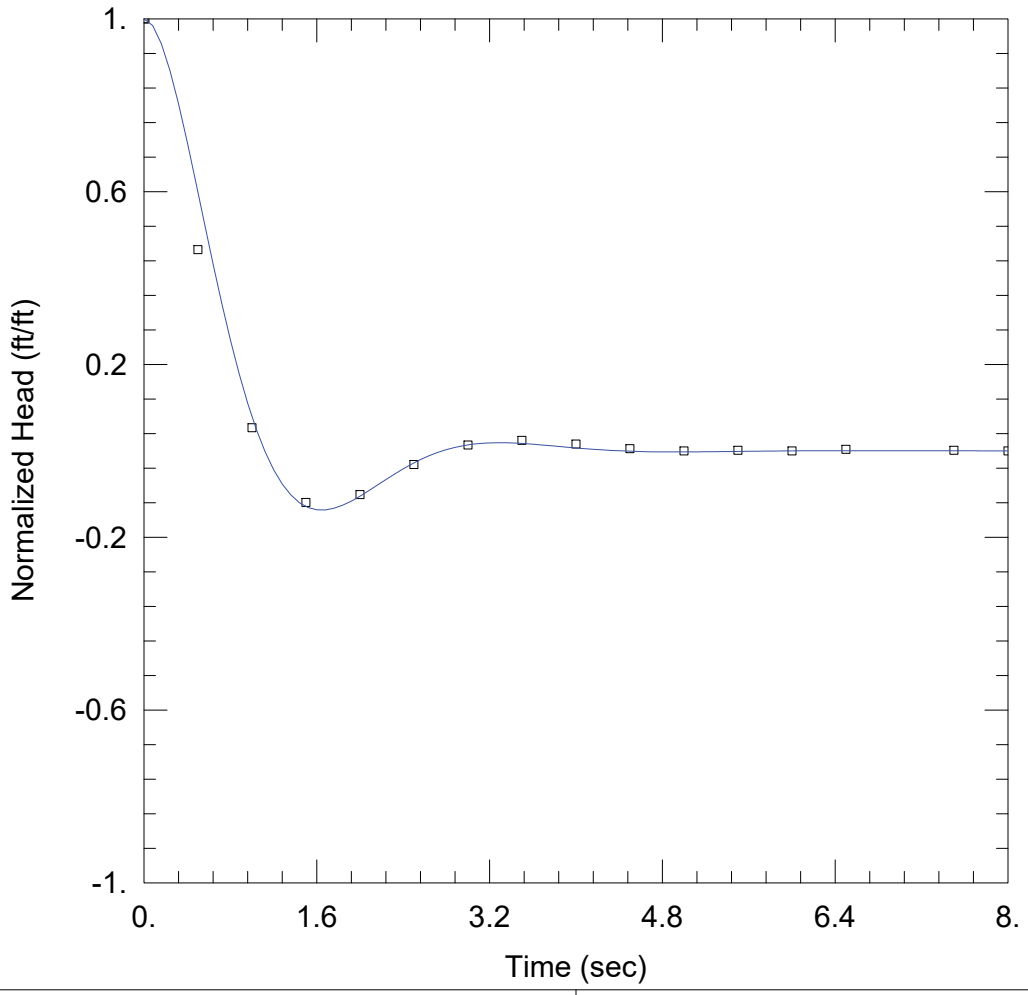
WELL DATA (MW-1603 Test 1)

Initial Displacement: 0.504 ft
Static Water Column Height: 17.9 ft
Total Well Penetration Depth: 17.9 ft
Screen Length: 15. ft
Casing Radius: 0.0833 ft
Well Radius: 0.3437 ft

ARCADIS

MW-1605S Test 3

Prepared By:	Prepared For:
ARCADIS	AEP
Project:	**Location:**
OH015976.0009	Mountaineer, WV



SOLUTION

Aquifer Model: Unconfined
Solution Method: Springer-Gelhar

K = 0.052 cm/sec Le = 6.301 ft

AQUIFER DATA

Saturated Thickness: 37. ft

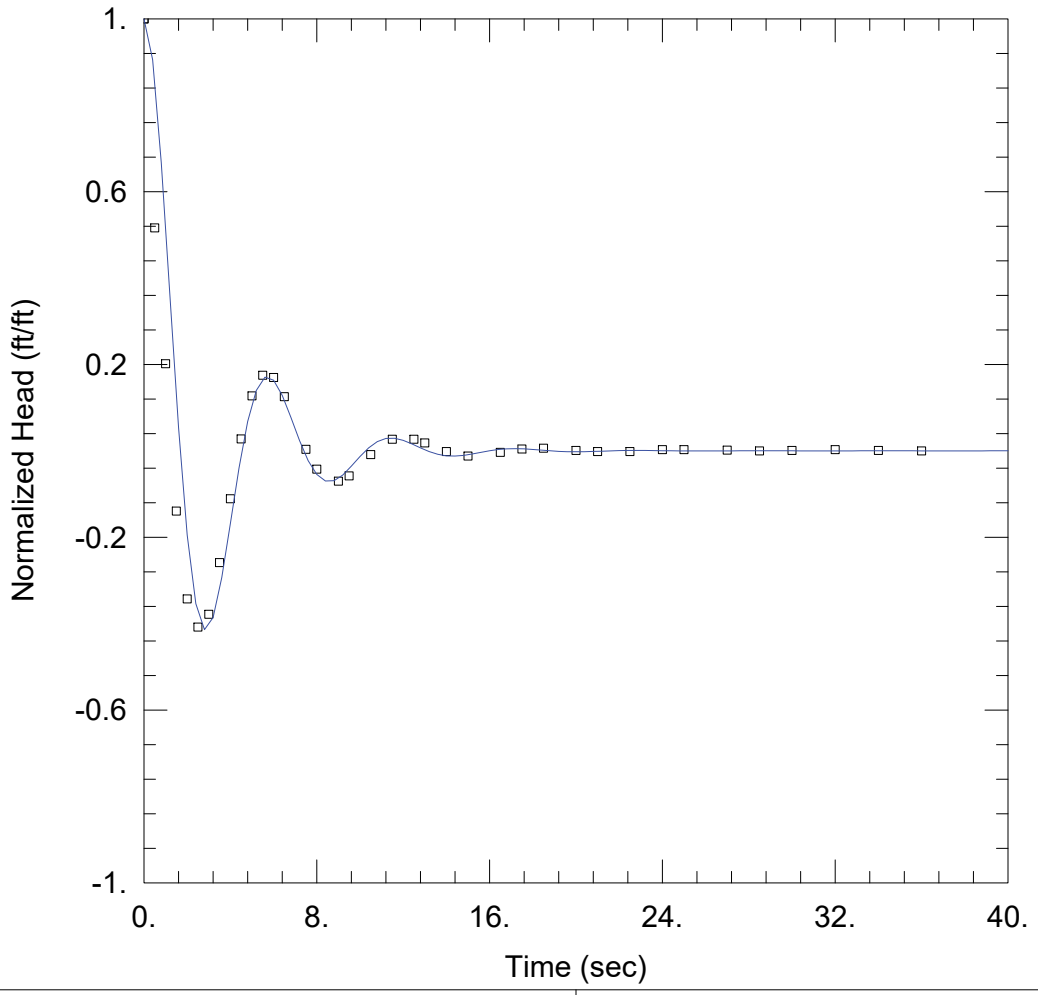
WELL DATA (MW-1605S Test 3)

Initial Displacement: 0.82 ft
Static Water Column Height: 14.9 ft
Total Well Penetration Depth: 14.9 ft
Screen Length: 10. ft
Casing Radius: 0.0833 ft
Well Radius: 0.3437 ft

ARCADIS

MW-1605D Test 3

Prepared By:	Prepared For:
ARCADIS	AEP
Project:	**Location:**
OH015976.0009	Mountaineer, WV



SOLUTION

Aquifer Model: Unconfined
Solution Method: Springer-Gelhar

K = 0.067 cm/sec Le = 24.68 ft

AQUIFER DATA

Saturated Thickness: 37. ft

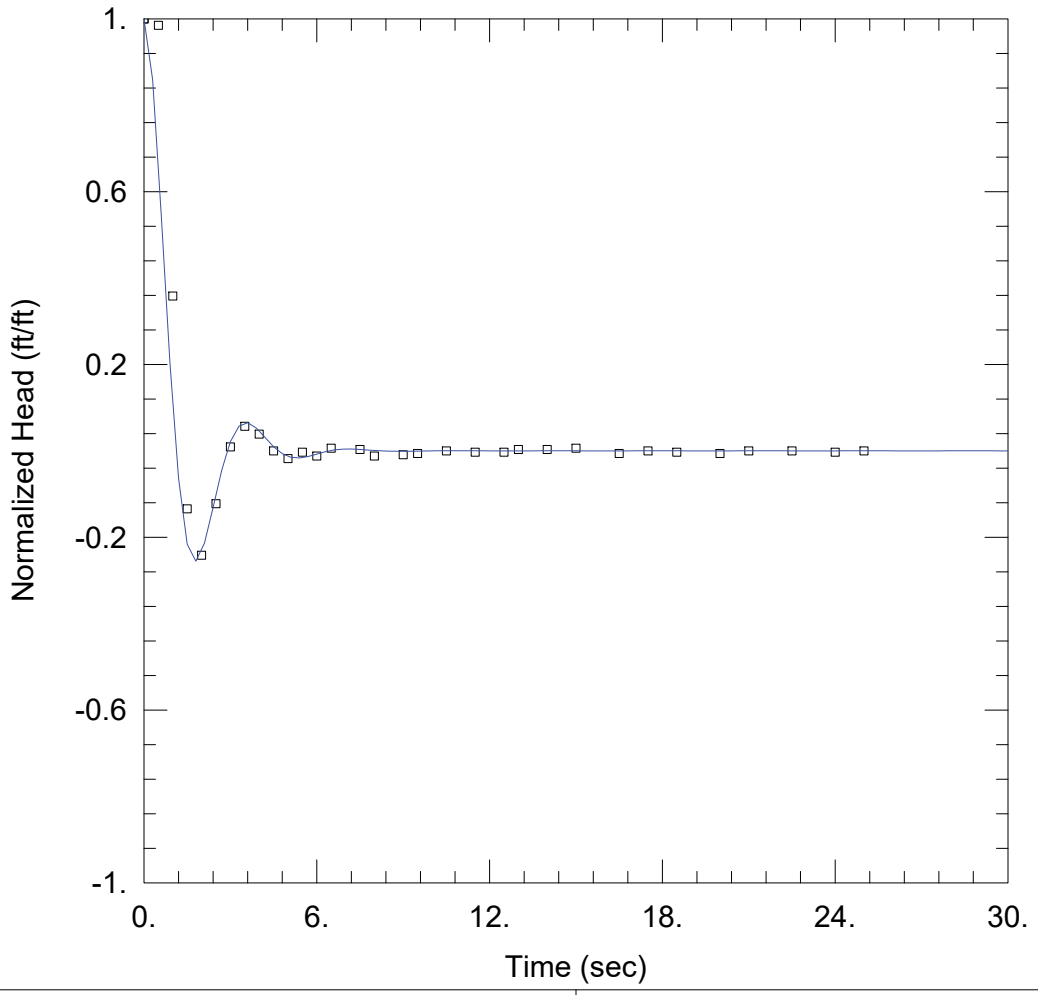
WELL DATA (MW-1605D Test 3)

Initial Displacement: 1.155 ft
Static Water Column Height: 35.32 ft
Total Well Penetration Depth: 35.32 ft
Screen Length: 10. ft
Casing Radius: 0.0833 ft
Well Radius: 0.3437 ft

ARCADIS

MW-1607S Test 1

Prepared By:	Prepared For:
ARCADIS	AEP
Project:	**Location:**
OH015976.0009	Mountaineer, WV



SOLUTION

Aquifer Model: Unconfined
Solution Method: Springer-Gelhar

K = 0.066 cm/sec Le = 8.612 ft

AQUIFER DATA

Saturated Thickness: 37. ft

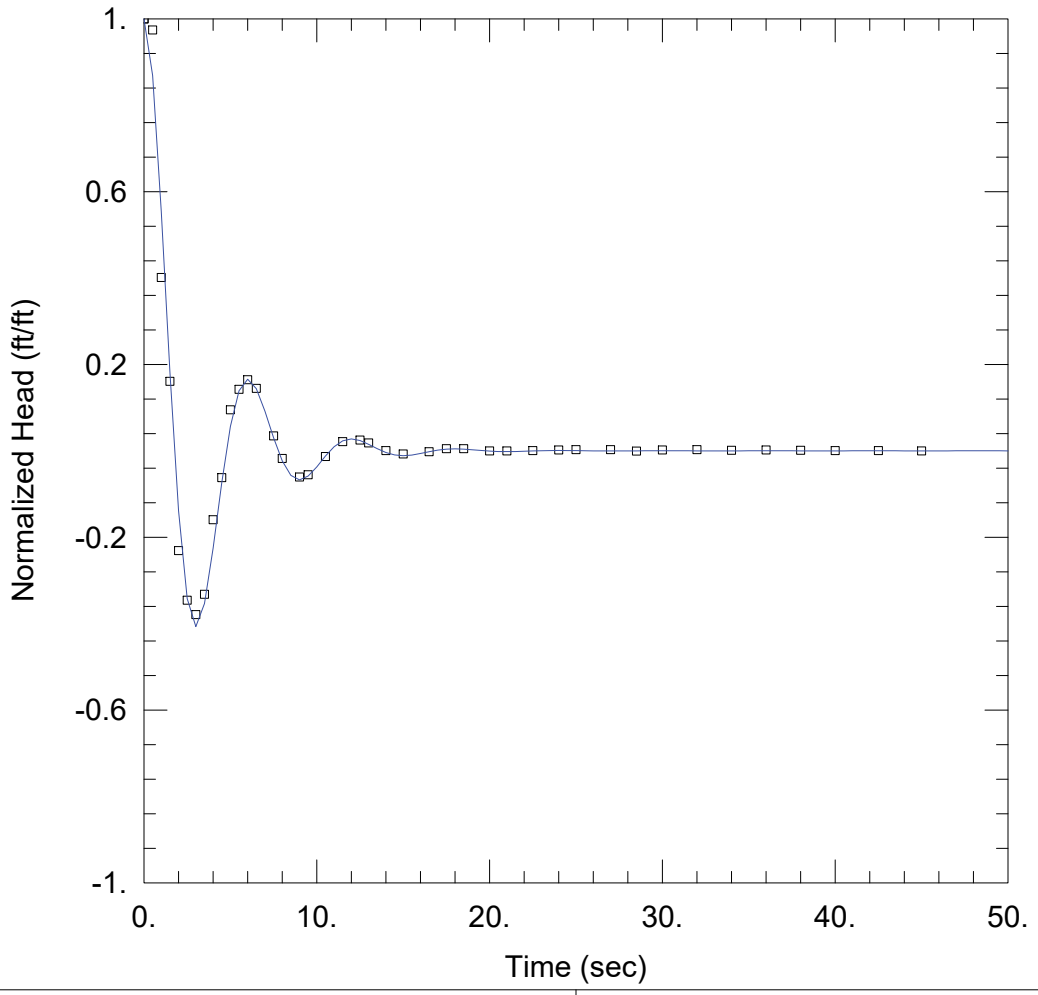
WELL DATA (MW-1607S Test 1)

Initial Displacement: 0.335 ft
Static Water Column Height: 23.2 ft
Total Well Penetration Depth: 23.2 ft
Screen Length: 10. ft
Casing Radius: 0.0833 ft
Well Radius: 0.3437 ft

ARCADIS

MW-1607D Test 3

Prepared By:	Prepared For:
ARCADIS	AEP
Project:	**Location:**
OH015976.0009	Mountaineer, WV



SOLUTION

Aquifer Model: Unconfined
Solution Method: Springer-Gelhar

K = 0.059 cm/sec Le = 27.11 ft

AQUIFER DATA

Saturated Thickness: 37. ft

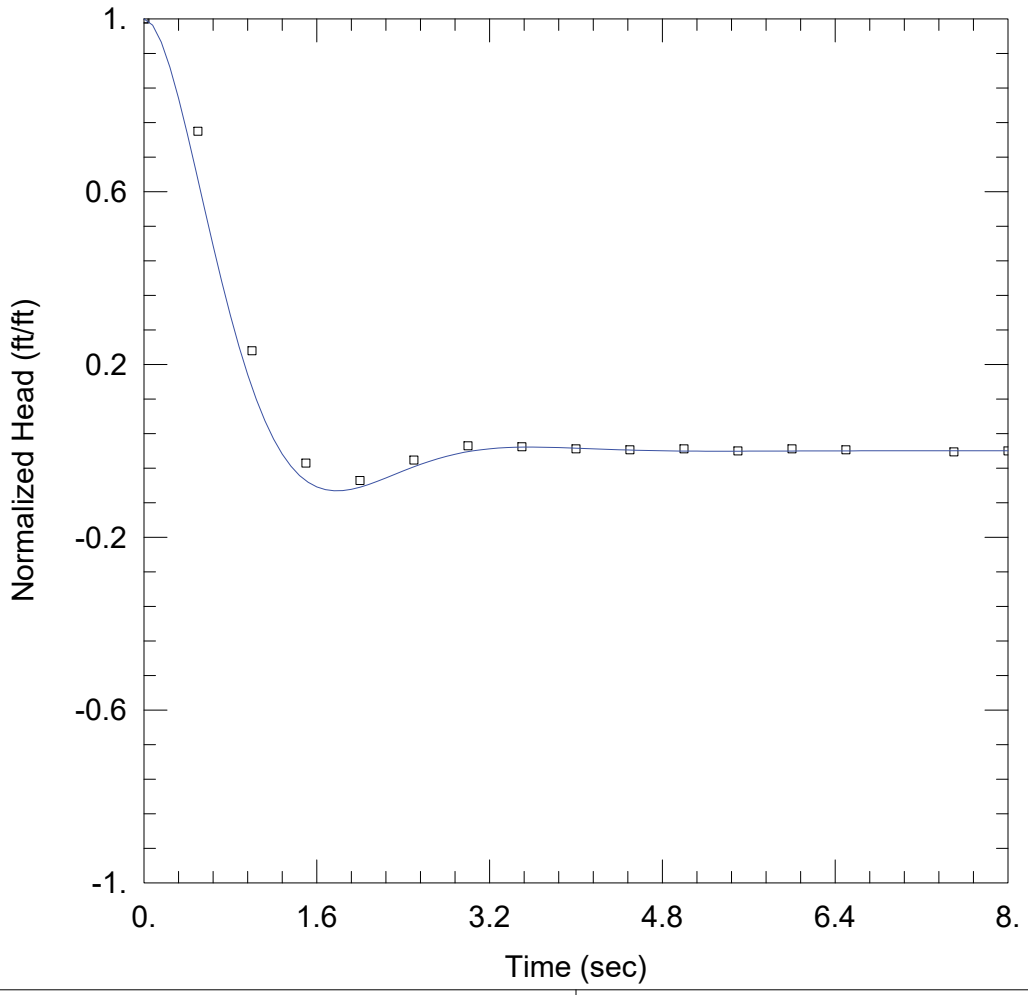
WELL DATA (MW-1607D Test 3)

Initial Displacement: 1.356 ft
Static Water Column Height: 32.81 ft
Total Well Penetration Depth: 32.03 ft
Screen Length: 10. ft
Casing Radius: 0.0833 ft
Well Radius: 0.3437 ft

ARCADIS

MW-1608 Test 2

Prepared By:	Prepared For:
ARCADIS	AEP
Project:	**Location:**
OH015976.0009	Mountaineer, WV



SOLUTION

Aquifer Model: Unconfined
Solution Method: Springer-Gelhar

K = 0.072 cm/sec Le = 6.607 ft

AQUIFER DATA

Saturated Thickness: 60. ft

WELL DATA (MW-1608 Test 2)

Initial Displacement: 0.423 ft
Static Water Column Height: 60. ft
Total Well Penetration Depth: 60. ft
Screen Length: 10. ft
Casing Radius: 0.0833 ft
Well Radius: 0.3437 ft

ARCADIS

APPENDIX F

Field Methodology

APPENDIX F – FIELD METHODOLOGY

Based on the recommended well network modifications, the following generalized tasks were completed:

- Installation of 13 unconsolidated borings
- Installation and development of 12 new monitoring wells
- The redevelopment of 6 existing monitoring wells

Arcadis provided oversight for drilling of 13 unconsolidated borings that resulted in installation of 12 monitoring wells by a licensed drilling company (DLZ). One unconsolidated borings was sealed due to not encountering groundwater before reaching refusal at the soil-rock interface (SB-1601). Implementation of the field activities began with utility clearance activities beginning April 18, 2016. Additional utility location was completed on May 16, 2016 and May 24, 2016. Drilling operations began on April 25, 2016 and ended on June 10, 2016.

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 8 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 pad was constructed for decontamination of the down-hole tools. Containerization was not required for decontamination water, if directed to the leachate system. Water for decontamination or drilling was potable and obtained from the AEP Mountaineer Plant.

Borehole Advancement and Stratigraphy/Lithology

Unconsolidated boreholes were drilled using standard hollow-stem auger methods with a minimum 4.25” inner diameter auger in accordance with ASTM D5784 until the soil-rock interface was encountered, or until the pre-determined termination depth was reached, whichever was shallowest. Continuous spit-spoon

sampling and standard penetration testing was performed in accordance with ASTM D1586 until the termination depth.

Arcadis logged all geologic samples collected during the drilling process. Field logging of the soil samples were performed in accordance with ASTM D5434-12, and were classified under the Unified Soil Classification System (USCS). Boring logs and well construction details for all installations completed during this scope of work are provided in **Appendix A**. Unconsolidated soil samples were collected continuously using 2-inch diameter by 2-foot long split spoon samplers. For each new monitoring well location, the selected split spoon samples from the screened interval were composited into a sample container. These containers were appropriately labeled according to the monitoring well identification number and were transported to the AEP Dolan Civil Engineering Laboratory in Groveport, Ohio for particle-size analysis.

Monitoring Well Installation and Construction

Monitoring well installation and construction was completed in accordance with the AEP- approved work plan prepared by Arcadis following an initial review of the Site monitoring well network. The work plan was prepared using West Virginia Department of Environmental Protection Title 47 Series 60 Monitoring Well Design Standards dated June 21, 2011 and American Society of Testing Material (ASTM) standards, where referenced, as guidance. Arcadis directed the drilling and installation of the identified up and down gradient monitoring wells. DLZ was the drilling company that installed the wells and was directly contracted through AEP. Drilling activities began on April 25, 2016. Prior to beginning work, daily health and safety meetings were held each morning, including a thorough discussion of the day's scope of work, identified hazards, hazard mitigation, and completion of the AEP Job Safety Analysis documentation in the presence of AEP staff. Health and safety documentation was retained by both Arcadis and AEP.

Based on the field conditions, Arcadis directed DLZ regarding the total drilling and well completion depths, well construction configuration, and well materials to be used. Screened intervals for unconsolidated monitoring wells targeted saturated alluvial sand and gravel. Final well depths and screened intervals are included in **Table 2**.

All monitoring wells were constructed in general accordance with West Virginia Department of Environmental Protection Title 47 Series 60 Monitoring Well Design Standards dated June 21, 2011.

Unconsolidated monitoring wells were constructed of 2-inch Schedule 40 PVC risers and screens. Well screens were constructed of 10 slot (0.010 ft screen openings) PVC. A primary filter pack of Global® #5 sand was placed across the screened interval, followed by approximately 2 feet of secondary (finer gradation) filter pack composed of Global® #6 sand.

Boring logs and well construction diagrams are provided in **Appendix A**. **Table 2** provides a summary of the well construction details of all wells in the current monitoring well network.

Monitoring Well Development

Well development was completed at all newly-installed wells, as well as 6 existing wells to be retained in the monitoring well network. At existing wells, the wells were 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 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 F**.

ARCADIS

Well Development Logs

WELL DEVELOPMENT LOG

Site/Well No. MW-001

Project AEP Mountaineer Plant | Project No. OHO15976.0009 | Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 | Date 6/28/2016

Weather Sunny, ~73 F | Development Time Begin 6/28/16 8:10 | End 6/28/16 8:48

Evacuation Data

Measuring Point	TOC	Pump Intake Setting (ft bmp)	~34
MP Elevation (ft)	571.32	Pumping Rate (gpm)	0.132
Land Surface Elevation (ft)	569.18	Evacuation Method	Submersible Pump
Sounded Well Depth (ft bmp)	39.17	Volumes Purged	2.97
Depth to Water (ft bmp)	29.60		
Water-Level Elevation (ft)	--	**Field Parameters**	
Water Column in Well (ft)	9.57	Color	Light brown to clear
Casing Diameter/Type	2" PVC	Odor	None
Gallons in Well	1.53	Appearance	slightly turbid

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
6/28/16 8:15	29.60	0.65	0.42	0.745	163.0	16.62	6.66	NM	7.33	0.132	---
6/28/16 8:20	29.89	1.30	0.85	0.758	92.4	16.88	6.51	NM	6.64	0.132	---
6/28/16 8:25	29.90	1.95	1.27	0.766	73.9	17.17	6.57	NM	6.40	0.132	---
6/28/16 8:30	29.90	2.60	1.70	0.773	19.3	17.49	6.64	NM	6.31	0.132	---
6/28/16 8:35	29.90	3.25	2.12	0.770	10.8	17.33	6.71	NM	6.26	0.132	---
6/28/16 8:40	29.90	3.90	2.55	0.769	9.3	17.27	6.74	NM	6.24	0.132	---
6/28/16 8:45	29.90	4.55	2.97	0.768	6.54	17.16	6.75	NM	6.21	0.132	---

Development Personnel: T. Darmon

Notes:

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-002

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 6/30/2016

Weather Sunny, ~70s F Development Time Begin 6/30/16 8:15 End 6/30/16 8:35

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): 582.81
Land Surface Elevation (ft): 580.82
Sounded Well Depth (ft bmp): 72.90
Depth to Water (ft bmp): 41.97
Water-Level Elevation (ft): --
Water Column in Well (ft): 30.93
Casing Diameter/Type: 2" PVC
Gallons in Well: 4.95

Pump Intake Setting (ft bmp): ~67.5
Pumping Rate (gpm): 0.132
Evacuation Method: Submersible Pump
Volumes Purged: 0.53

Field Parameters

Color: Light yellow
Odor: None
Appearance: slightly turbid

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
6/30/16 8:20	NM	0.65	0.13	0.444	53.8	14.55	8.09	NM	7.28	0.132	---
6/30/16 8:25	42.03	1.30	0.26	0.572	158	14.54	7.74	NM	5.30	0.132	---
6/30/16 8:30	NM	1.95	0.39	0.587	127	14.51	7.69	NM	4.97	0.132	---
6/30/16 8:35	42.06	2.60	0.53	0.591	117	14.61	7.67	NM	4.76	0.132	---

Development Personnel: T. Darmon

Notes:

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

WELL DEVELOPMENT LOG

Site/Well No. MW-004

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 6/30/2016

Weather Sunny, ~70s F Development Time Begin 6/30/16 9:40 End 6/30/16 10:00

Evacuation Data

Measuring Point	TOC	Pump Intake Setting (ft bmp)	~45.5
MP Elevation (ft)	583.13	Pumping Rate (gpm)	0.132
Land Surface Elevation (ft)	581.08	Evacuation Method	Submersible Pump
Sounded Well Depth (ft bmp)	50.20	Volumes Purged	2.15
Depth to Water (ft bmp)	42.11		
Water-Level Elevation (ft)	--	**Field Parameters**	
Water Column in Well (ft)	8.09	Color	clear
Casing Diameter/Type	2" PVC	Odor	None
Gallons in Well	1.21	Appearance	clear

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
6/30/16 9:45	42.10	0.65	0.54	0.245	33.4	14.92	6.72	NM	3.57	0.132	---
6/30/16 9:50	42.14	1.30	1.07	0.242	34.7	14.95	6.63	NM	3.20	0.132	---
6/30/16 9:55	42.14	1.95	1.61	0.237	29.8	15.01	5.62	NM	2.57	0.132	---
6/30/16 10:00	42.16	2.60	2.15	0.238	18.7	15.03	5.59	NM	2.10	0.132	---

Development Personnel: T. Darmon

Notes:

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-016

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 6/10/2016

Weather Cloudy, ~75 F Development Time Begin 6/10/16 10:52 End 6/10/16 11:42

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): 588.61
Land Surface Elevation (ft): 586.82
Sounded Well Depth (ft bmp): 81.80
Depth to Water (ft bmp): 46.11
Water-Level Elevation (ft): --
Water Column in Well (ft): 35.69
Casing Diameter/Type: 2" PVC
Gallons in Well: 5.7

Pump Intake Setting (ft bmp):
Pumping Rate (gpm): 0.132
Evacuation Method: Foot valve/proactive pump
Volumes Purged: 9.88

Field Parameters

Color: clear
Odor: None
Appearance: clear

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
6/10/16 10:52	46.13	0.25	0.04	2.295	61.9	16.53	6.85	-10.0	0.86	0.145	Clear, no odor
6/10/16 10:57	46.13	0.50	0.09	2.285	58.4	16.81	6.90	-13.4	0.28	0.145	Clear, no odor
6/10/16 11:02	46.13	1.00	0.18	2.255	50.5	17.25	7.01	-11.5	0.30	0.145	Clear, no odor
6/10/16 11:07	46.13	1.50	0.26	2.235	29.1	17.16	7.05	-9.1	0.27	0.145	Clear, no odor
6/10/16 11:12	46.13	2.00	0.35	2.211	29.2	17.28	7.08	-11.6	0.19	0.145	Clear, no odor
6/10/16 11:17	46.13	2.50	0.44	2.189	35.7	17.21	7.09	-13.4	0.21	0.145	Clear, no odor
6/10/16 11:22	46.13	3.00	0.53	2.182	38.6	17.31	7.11	-10.6	0.17	0.145	Clear, no odor
6/10/16 11:27	46.13	3.50	0.61	2.173	31.3	17.43	7.12	-11.4	0.17	0.132	Clear, no odor
6/10/16 11:32	46.13	4.00	0.70	2.164	27.7	17.22	7.13	-7.2	0.17	0.132	Clear, no odor
6/10/16 11:37	46.13	4.50	0.79	2.165	32.0	17.16	7.13	-9.6	0.19	0.132	Clear, no odor
6/10/16 11:42	46.13	5.00	0.88	2.159	25.3	17.03	7.14	-16.5	0.14	0.132	Clear, no odor

Development Personnel: Tim Eyerdom

Notes: ~2.5 well volumes removed with foot valve; ~6.5 well volumes removed with proactive pump prior to measuring water quality.
Well Location: In gravel parking lot. Condition of well: good, needs j-plug. Well locked at arrival? Yes. Well locked at departure? Yes.

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. JTMN-1

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 6/29/2016

Weather Sunny, 70s (F) Development Time Begin 6/29/16 9:50 End 6/29/16 11:15

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): 583.67
Land Surface Elevation (ft): 582.17
Sounded Well Depth (ft bmp): 76.39
Depth to Water (ft bmp): 43.40
Water-Level Elevation (ft): --
Water Column in Well (ft): 32.99
Casing Diameter/Type: 2" PVC
Gallons in Well: 5.28

Pump Intake Setting (ft bmp): ~66
Pumping Rate (gpm): 0.08-2.2
Evacuation Method: submersible & waterra
Volumes Purged: 10.04

Field Parameters

Color: Brown
Odor: None
Appearance: Turbid

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
6/29/16 9:55	43.42	0.65	0.12	0.581	225	15.99	7.21	NM	13.02	0.132	---
6/29/16 10:00	43.42	1.30	0.25	0.587	533	15.69	6.87	NM	1.58	0.132	---
6/29/16 10:05	43.44	1.95	0.37	0.590	707	15.76	6.91	NM	1.09	0.132	---
6/29/16 10:10	43.44	2.60	0.49	0.592	641	16.01	7.03	NM	0.98	0.132	---
6/29/16 10:15	43.44	3.25	0.62	0.595	598	16.21	7.15	NM	0.81	0.132	---
6/29/16 10:20	43.44	3.90	0.74	0.599	592	16.47	7.28	NM	0.72	0.132	---
6/29/16 10:25	43.44	4.55	0.86	0.608	421	16.69	7.31	NM	0.51	0.132	---
6/29/16 10:30	43.44	5.20	0.98	0.614	322	16.69	7.31	NM	0.43	0.132	---
6/29/16 10:40	Additional surging done on well										
6/29/16 11:00	NM	20.00	3.79	NM	NM	NM	NM	NM	NM	1.00	---
6/29/16 11:15	43.46	53.00	10.04	0.617	232	16.72	7.34	NM	0.57	2.20	---

Development Personnel: T. Darmon

Notes:

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. JTMN-1

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 6/16/2016

Weather Sunny, ~80 F Development Time Begin 6/16/16 11:05 End 6/16/16 11:28

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): 583.67
Land Surface Elevation (ft): 582.17
Sounded Well Depth (ft bmp): 77.80
Depth to Water (ft bmp): 43.63
Water-Level Elevation (ft): --
Water Column in Well (ft): 34.17
Casing Diameter/Type: 2" PVC
Gallons in Well: 5.57

Pump Intake Setting (ft bmp): ~77.5
Pumping Rate (gpm): 0.211
Evacuation Method: submersible impeller pump
Volumes Purged: 5.75

Field Parameters

Color: Brown changing to clear
Odor: None
Appearance:

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
6/16/16 11:08	43.65	26.00	4.67	0.577	26.4	15.53	7.43	NM	1.61	0.211	---
6/16/16 11:13	43.65	27.50	4.94	0.576	ERROR	15.52	7.43	NM	1.29	0.211	---
6/16/16 11:18	43.65	29.00	5.21	0.576	ERROR	15.57	7.42	NM	1.07	0.211	---
6/16/16 11:23	43.65	30.50	5.48	0.577	ERROR	15.59	7.44	NM	0.97	0.211	---
6/16/16 11:28	43.65	32.00	5.75	0.576	ERROR	15.58	7.42	NM	0.95	0.211	---

Development Personnel: T. Debnam

Notes:

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. JTMN-2

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 6/28/2016

Weather Sunny, ~80s F Development Time Begin 6/28/16 15:30 End 6/28/16 16:45

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): 584.06
Land Surface Elevation (ft): 582.16
Sounded Well Depth (ft bmp): 75.84
Depth to Water (ft bmp): 43.87
Water-Level Elevation (ft): --
Water Column in Well (ft): 31.97
Casing Diameter/Type: 2" PVC
Gallons in Well: 5.12

Pump Intake Setting (ft bmp): ~67
Pumping Rate (gpm): 0.080-0.132
Evacuation Method: submersible pump
Volumes Purged: 2.06

Field Parameters

Color: Light Brown changing to clear
Odor: None
Appearance: Slightly turbid

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
6/28/16 15:35	43.76	2.50	0.49	0.665	Overrange	16.11	6.95	NM	36.43	0.650	rate from 0.5-0.8 gpm
6/28/16 15:40	43.76	3.25	0.63	0.668	Overrange	16.02	6.61	NM	18.71	0.159	---
6/28/16 15:45	43.76	3.90	0.76	0.680	Overrange	15.51	6.37	NM	7.23	0.132	---
6/28/16 15:50	43.76	4.55	0.89	0.629	803	19.60	6.68	NM	2.26	0.132	---
6/28/16 15:55	43.76	5.20	1.02	0.641	184	18.23	6.69	NM	1.07	0.132	---
6/28/16 16:00	43.76	5.85	1.14	0.618	162	17.54	6.74	NM	0.91	0.132	---
6/28/16 16:05	43.76	6.50	1.27	0.600	126	17.22	6.78	NM	0.65	0.132	---
6/28/16 16:10	43.76	7.15	1.40	0.595	108	16.89	6.79	NM	0.33	0.132	---
6/28/16 16:15	43.76	7.80	1.52	0.596	86.7	16.72	6.80	NM	0.32	0.132	---
6/28/16 16:20	43.76	8.45	1.65	0.592	52.1	16.28	6.80	NM	0.29	0.132	---
6/28/16 16:25	43.76	9.10	1.78	0.589	47.8	16.06	6.83	NM	0.23	0.132	---
6/28/16 16:30	43.76	9.75	1.90	0.584	22.4	15.48	6.83	NM	0.19	0.132	---
6/28/16 16:35	43.76	10.10	1.97	0.584	12.10	15.48	6.82	NM	0.21	0.08	---
6/28/16 16:40	43.76	10.55	2.06	0.584	9.28	15.47	6.81	NM	0.15	0.08	---

Development Personnel: T. Darmon

Notes:

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-1601A

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 6/15/2016

Weather Cloudy, ~75 F Development Time Begin 6/15/16 11:22 End 6/15/16 12:43

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): 610.66
Land Surface Elevation (ft): 607.47
Sounded Well Depth (ft bmp): 80.84
Depth to Water (ft bmp): 65.81
Water-Level Elevation (ft): --
Water Column in Well (ft): 15.03
Casing Diameter/Type: 2" PVC
Gallons in Well: 2.45

Pump Intake Setting (ft bmp): ~80
Pumping Rate (gpm): 0.211
Evacuation Method: Submersible impeller pump
Volumes Purged: 12.24

Field Parameters

Color: Dark brown turning clear
Odor: None
Appearance:

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
6/15/16 11:33	65.84	5.00	2.04	0.599	126	15.87	7.20	NM	4.93	0.211	---
6/15/16 11:38	65.84	7.00	2.86	0.598	62.7	15.74	7.21	NM	4.77	0.211	---
6/15/16 11:43	65.84	8.50	3.47	0.598	40.9	15.72	7.20	NM	4.77	0.211	---
6/15/16 11:48	65.84	10.00	4.08	0.599	44.5	16.01	7.19	NM	4.71	0.211	---
6/15/16 11:53	65.84	12.50	5.10	0.599	45.4	16.08	7.14	NM	4.65	0.211	---
6/15/16 11:58	65.84	14.00	5.71	0.599	34.5	15.98	7.14	NM	4.71	0.211	---
6/15/16 12:03	65.84	16.50	6.73	0.599	31.0	16.07	7.20	NM	4.73	0.211	---
6/15/16 12:08	65.84	17.50	7.14	0.600	31.2	15.97	7.20	NM	4.79	0.211	---
6/15/16 12:13	65.84	19.00	7.76	0.600	24.8	15.84	7.19	NM	4.67	0.211	---
6/15/16 12:18	65.84	21.50	8.78	0.601	25.7	15.90	7.18	NM	4.65	0.211	---
6/15/16 12:23	65.84	23.00	9.39	0.601	25.0	15.92	7.20	NM	4.58	0.211	---
6/15/16 12:28	65.84	24.50	10.00	0.601	14.2	15.80	7.15	NM	4.49	0.211	---
6/15/16 12:33	65.84	27.00	11.02	0.602	13.7	15.86	7.13	NM	4.32	0.211	---
6/15/16 12:38	65.84	28.50	11.63	0.603	12.9	15.80	7.13	NM	4.43	0.211	---
6/15/16 12:43	65.84	30.00	12.24	0.603	10.2	15.85	7.14	NM	4.39	0.211	---

Development Personnel: T. Debnam

Notes:

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-1602

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 6/7/2016

Weather Sunny, ~75 F Development Time Begin _____ End _____

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): 605.12
Land Surface Elevation (ft): 602.37
Sounded Well Depth (ft bmp): 74.10
Depth to Water (ft bmp): 59.81
Water-Level Elevation (ft): --
Water Column in Well (ft): 14.29
Casing Diameter/Type: 2" PVC
Gallons in Well: 2.2864

Pump Intake Setting (ft bmp): _____
Pumping Rate (gpm): _____
Evacuation Method: Foot pump
Volumes Purged: 10.00

Field Parameters

Color: _____
Odor: None
Appearance: Very turbid

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks

Development Personnel: Tim Eyerdom

Notes: 10 well volumes removed with foot pump; water appeared very turbid. Proactive pump not used and water quality data not taken.

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

WELL DEVELOPMENT LOG

Site/Well No. MW-1602

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 6/15/2016

Weather Cloudy, ~75 F Development Time Begin 6/15/16 10:27 End 6/15/16 11:05

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): 605.12
Land Surface Elevation (ft): 602.37
Sounded Well Depth (ft bmp): 73.31
Depth to Water (ft bmp): 59.82
Water-Level Elevation (ft): --
Water Column in Well (ft): 13.49
Casing Diameter/Type: 2" PVC
Gallons in Well: 2.2

Pump Intake Setting (ft bmp): ~70
Pumping Rate (gpm): 0.211
Evacuation Method: Submersible impeller pump
Volumes Purged: 6.82

Field Parameters

Color: Dark brown turning clear
Odor: None
Appearance:

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
6/15/16 10:45	59.85	5.00	2.27	0.494	10.6	14.38	6.78	NM	0.61	0.211	---
6/15/16 10:50	59.84	7.00	3.18	0.489	22.4	14.13	6.77	NM	0.80	0.211	---
6/15/16 10:55	59.84	9.00	4.09	0.488	11.7	14.10	6.77	NM	0.86	0.211	---
6/15/16 11:00	59.84	12.00	5.45	0.487	6.89	14.07	6.77	NM	0.88	0.211	---
6/15/16 11:05	59.84	15.00	6.82	0.487	4.52	14.07	6.77	NM	0.90	0.211	---

Development Personnel: T. Debnam

Notes:

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-1603

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 6/10/2016

Weather Sunny, 70 F Development Time Begin _____ End _____

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): 606.30
Land Surface Elevation (ft): 602.92
Sounded Well Depth (ft bmp): 76.80
Depth to Water (ft bmp): 61.85
Water-Level Elevation (ft): --
Water Column in Well (ft): 14.95
Casing Diameter/Type: 2" PVC
Gallons in Well: 2.4

Pump Intake Setting (ft bmp): _____
Pumping Rate (gpm): _____
Evacuation Method: foot valve
Volumes Purged: 10.00

Field Parameters

Color: _____
Odor: _____
Appearance: _____

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks

Development Personnel: Tim Eyerdom

Notes: 10 well volumes removed with foot pump without any change in clarity. Proactive pump not deployed.

Well location: In gravel by conveyor. Well Condition: Good. Well locked at arrival? No. Well locked at departure? No.

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-1603

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 6/15/2016

Weather Cloudy, 75 F Development Time Begin 6/15/16 8:37 End 6/15/16 10:05

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): 606.30
Land Surface Elevation (ft): 602.92
Sounded Well Depth (ft bmp): 79.90
Depth to Water (ft bmp): 61.35
Water-Level Elevation (ft): --
Water Column in Well (ft): 18.55
Casing Diameter/Type: 2" PVC
Gallons in Well: 3.02

Pump Intake Setting (ft bmp): ~79
Pumping Rate (gpm): 0.177
Evacuation Method: submersible impeller pump
Volumes Purged: 7.78

Field Parameters

Color: dark brown
Odor: None
Appearance:

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
6/15/16 8:50	61.74	5.00	1.66	0.741	87.9	16.96	6.45	NM	3.68	0.177	---
6/15/16 8:55	61.74	5.75	1.90	0.758	74.9	16.71	6.47	NM	3.65	0.177	---
6/15/16 9:00	61.74	6.50	2.15	0.757	64.6	16.54	6.47	NM	3.56	0.177	---
6/15/16 9:05	61.74	7.50	2.48	0.753	46.0	16.56	6.48	NM	3.57	0.177	---
6/15/16 9:10	61.74	9.00	2.98	0.744	41.2	16.67	6.47	NM	3.59	0.177	---
6/15/16 9:15	61.74	10.00	3.31	0.750	30.0	16.60	6.47	NM	3.73	0.177	---
6/15/16 9:20	61.74	11.50	3.81	0.745	30.5	16.49	6.47	NM	3.71	0.177	---
6/15/16 9:25	61.74	12.50	4.14	0.743	24.7	16.49	6.47	NM	3.91	0.177	---
6/15/16 9:30	61.74	14.00	4.64	0.742	21.5	16.48	6.47	NM	3.87	0.177	---
6/15/16 9:35	61.74	15.00	4.97	0.737	17.5	16.38	6.46	NM	3.97	0.177	---
6/15/16 9:40	61.74	17.00	5.63	0.736	15.1	16.38	6.47	NM	3.97	0.177	---
6/15/16 9:45	61.74	18.00	5.96	0.736	15.0	16.42	6.46	NM	3.97	0.177	---
6/15/16 9:50	61.74	19.50	6.46	0.737	10.1	16.42	6.46	NM	3.98	0.177	---
6/15/16 9:55	61.74	21.00	6.95	0.732	10.2	16.37	6.46	NM	4.05	0.177	---
6/15/16 10:00	61.74	22.50	7.45	0.730	8.37	16.38	6.45	NM	4.04	0.177	---
6/15/16 10:05	61.74	23.50	7.78	0.730	8.52	16.39	6.45	NM	4.01	0.177	---

Development Personnel: T. Debnam

Notes:

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-1604S

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 6/9/2016

Weather Sunny, 75 F Development Time Begin _____ End _____

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): 598.07
Land Surface Elevation (ft): 595.48
Sounded Well Depth (ft bmp): 63.40
Depth to Water (ft bmp): 54.44
Water-Level Elevation (ft): --
Water Column in Well (ft): 8.96
Casing Diameter/Type: 2" PVC
Gallons in Well: 1.43

Pump Intake Setting (ft bmp): _____
Pumping Rate (gpm): _____
Evacuation Method: Foot valve
Volumes Purged: >10

Field Parameters

Color: _____
Odor: _____
Appearance: _____

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks

Development Personnel: T. Eyerdom

Notes: >10 well volumes removed from well with no visible change in clarity. Proactive pump not deployed.
Well location: Grass near gated area. Condition of Well: Good. Well locked at arrival? No. Well locked at departure? No.

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-1604S

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 6/16/2016

Weather Sunny, 70 F Development Time Begin 6/16/16 7:35 End 6/16/16 8:30

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): 598.07
Land Surface Elevation (ft): 595.48
Sounded Well Depth (ft bmp): 62.43
Depth to Water (ft bmp): 54.49
Water-Level Elevation (ft): --
Water Column in Well (ft): 7.94
Casing Diameter/Type: 2" PVC
Gallons in Well: 1.29

Pump Intake Setting (ft bmp): ~62
Pumping Rate (gpm): 0.211
Evacuation Method: Submersible Impeller pump
Volumes Purged: 12.79

Field Parameters

Color: Brown ---> Clear
Odor: None
Appearance:

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
6/16/16 7:40	54.51	1.50	1.16	1.444	173	16.57	7.34	NM	5.42	0.211	---
6/16/16 7:45	54.51	3.00	2.33	1.496	164	16.48	7.18	NM	3.23	0.211	---
6/16/16 7:50	54.51	4.50	3.49	1.537	124	16.85	7.13	NM	2.77	0.211	---
6/16/16 7:55	54.51	6.00	4.65	1.556	100	17.19	7.13	NM	2.33	0.211	---
6/16/16 8:00	54.51	7.50	5.81	1.569	88.7	17.31	7.12	NM	2.05	0.211	---
6/16/16 8:05	54.51	9.00	6.98	1.570	54.9	17.44	7.12	NM	1.95	0.211	---
6/16/16 8:10	54.51	10.50	8.14	1.571	34.7	17.47	7.12	NM	1.92	0.211	---
6/16/16 8:15	54.51	12.00	9.30	1.573	20.3	17.52	7.11	NM	1.95	0.211	---
6/16/16 8:20	54.51	13.50	10.47	1.574	14.3	17.58	7.11	NM	1.91	0.211	---
6/16/16 8:25	54.51	15.00	11.63	1.573	12.4	17.65	7.10	NM	1.87	0.211	---
6/16/16 8:30	54.51	16.50	12.79	1.577	9.34	17.64	7.10	NM	1.86	0.211	---

Development Personnel: T. Debnam

Notes:

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-1604D

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 6/9/2016

Weather Sunny, 75 F Development Time Begin 6/9/16 13:05 End 6/9/16 14:05

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): 598.22
Land Surface Elevation (ft): 595.59
Sounded Well Depth (ft bmp): 83.30
Depth to Water (ft bmp): 54.56
Water-Level Elevation (ft): --
Water Column in Well (ft): 28.74
Casing Diameter/Type: 2" PVC
Gallons in Well: 4.59

Pump Intake Setting (ft bmp):
Pumping Rate (gpm): 0.132
Evacuation Method: proactive and foot valve
Volumes Purged: 12.83

Field Parameters

Color:
Odor: None
Appearance: Cloudy

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
6/9/16 13:05	54.58	0.50	0.11	1.814	243	18.75	7.39	129.7	5.12	0.080	---
6/9/16 13:10	54.58	1.00	0.22	1.807	163	18.28	7.29	128.0	0.32	0.132	---
6/9/16 13:15	54.58	2.50	0.54	1.802	119	18.32	7.22	126.0	0.18	0.132	---
6/9/16 13:20	54.58	3.00	0.65	1.801	114	18.24	7.26	125.9	0.13	0.132	---
6/9/16 13:25	54.58	4.50	0.98	1.800	99	18.06	7.22	124.8	0.11	0.132	---
6/9/16 13:30	54.58	6.00	1.31	1.802	77.3	17.99	7.29	124.4	0.09	0.264	---
6/9/16 13:35	54.58	8.00	1.74	1.802	62.5	17.97	7.21	123.7	0.08	0.264	---
6/9/16 13:40	54.58	9.00	1.96	1.804	45.0	18.53	7.19	123.3	0.08	0.132	---
6/9/16 13:45	54.58	10.00	2.18	1.810	39.3	18.41	7.20	123.2	0.10	0.132	---
6/9/16 13:50	54.58	11.00	2.40	1.806	34.8	18.74	7.23	122.6	0.09	0.132	---
6/9/16 13:55	54.58	11.50	2.51	1.804	29.2	18.58	7.23	122.4	0.07	0.132	---
6/9/16 14:00	54.58	12.00	2.61	1.801	22.8	19.47	7.23	121.9	0.07	0.132	---
6/9/16 14:05	54.58	13.00	2.83	1.820	20.8	19.90	7.22	121.4	0.08	0.132	---

Development Personnel: T. Debnam

Notes: 3 well volumes removed with foot valve and 7 removed with proactive pump prior to taking water measurements.
Well location: Grass near gated area. Condition of well: good. Well locked at arrival? No. Well locked at departure? No.

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-1605S

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 6/8/2016

Weather Sunny, 75 F Development Time Begin _____ End _____

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): 590.86
Land Surface Elevation (ft): 588.51
Sounded Well Depth (ft bmp): 63.00
Depth to Water (ft bmp): 47.29
Water-Level Elevation (ft): --
Water Column in Well (ft): 15.71
Casing Diameter/Type: 2" PVC
Gallons in Well: 2.51

Pump Intake Setting (ft bmp): _____
Pumping Rate (gpm): _____
Evacuation Method: Foot valve
Volumes Purged: 10.00

Field Parameters

Color: _____
Odor: _____
Appearance: _____

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks

Development Personnel: T. Debnam

Notes: 10 well volumes purged using foot pump. Clarity of water did not improve and proactive pump was not deployed.
Well location: Grass along HWY 62. Condition of well: good; need J-plug. Well locked at arrival? No. Well locked at departure? No.

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-1605S

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 6/16/2016

Weather Sunny, 65 F Development Time Begin 6/16/16 6:40 End 6/16/16 7:07

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): 590.86
Land Surface Elevation (ft): 588.51
Sounded Well Depth (ft bmp): 61.96
Depth to Water (ft bmp): 47.36
Water-Level Elevation (ft): --
Water Column in Well (ft): 14.57
Casing Diameter/Type: 2" PVC
Gallons in Well: 2.37

Pump Intake Setting (ft bmp): ~61.5
Pumping Rate (gpm): 0.211
Evacuation Method:
Volumes Purged: 4.64

Field Parameters

Color: Brown--->Clear
Odor: None
Appearance:

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
6/16/16 6:47	47.40	5.00	2.11	1.656	29.3	16.24	7.26	NM	10.76	0.211	---
6/16/16 6:52	47.40	6.50	2.74	1.657	16.5	16.51	7.25	NM	7.62	0.211	---
6/16/16 6:57	47.40	8.00	3.38	1.657	13.2	16.55	7.25	NM	4.28	0.211	---
6/16/16 7:02	47.40	9.50	4.01	1.657	9.53	16.61	7.26	NM	3.92	0.211	---
6/16/16 7:07	47.40	11.00	4.64	1.658	5.73	16.67	7.25	NM	3.86	0.211	---

Development Personnel: T. Eyerdom

Notes:

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-1605D

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 6/8/2016

Weather Sunny, 70 F Development Time Begin 6/8/16 10:40 End 6/8/16 11:20

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): 591.01
Land Surface Elevation (ft): 588.51
Sounded Well Depth (ft bmp): 84.10
Depth to Water (ft bmp): 47.51
Water-Level Elevation (ft): --
Water Column in Well (ft): 36.59
Casing Diameter/Type: 2" PVC
Gallons in Well: 5.85

Pump Intake Setting (ft bmp):
Pumping Rate (gpm): 0.132
Evacuation Method: Foot pump / Proactive
Volumes Purged: 10.85

Field Parameters

Color: Clear
Odor: None
Appearance: Clear

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
6/8/16 10:40	47.50	1.00	0.17	2.517	77.3	16.92	7.15	128.7	4.16	0.132	clear, no odor
6/8/16 10:45	47.50	1.50	0.26	2.487	57.7	17.09	7.18	48.1	0.53	0.132	clear, no odor
6/8/16 10:50	47.50	2.00	0.34	2.442	12.5	16.81	7.23	89.9	0.26	0.132	clear, no odor
6/8/16 10:55	47.50	2.50	0.43	2.417	8.60	17.06	7.23	54.2	0.20	0.132	clear, no odor
6/8/16 11:00	47.50	3.00	0.51	2.416	9.77	17.18	7.24	21.7	0.18	0.132	clear, no odor
6/8/16 11:05	47.50	3.50	0.60	2.417	11.80	17.31	7.25	-1.2	0.19	0.132	clear, no odor
6/8/16 11:10	47.50	4.00	0.68	2.413	5.89	17.07	7.26	-15.9	0.25	0.132	clear, no odor
6/8/16 11:15	47.50	4.50	0.77	2.408	4.57	17.32	7.26	-23.9	0.29	0.132	clear, no odor
6/8/16 11:20	47.50	5.00	0.85	2.412	8.56	17.26	7.25	-28.5	0.20	0.132	clear, no odor

Development Personnel: T. Eyerdom

Notes: 40 gal removed with foot pump (~7 well volumes). 15 gal removed with proactive pump (~3 well volumes). 5 gal removed while taking water quality measurements (60 gal total). Well location: grass alongside Hwy 62. Condition of well: good, needs J-plug. Well locked at arrival: No. Well locked at departure: No.

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-1606S

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 6/8/2016

Weather Sunny, 75 F Development Time Begin _____ End _____

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): 590.15
Land Surface Elevation (ft): 587.28
Sounded Well Depth (ft bmp): 57.10
Depth to Water (ft bmp): 46.01
Water-Level Elevation (ft): --
Water Column in Well (ft): 11.09
Casing Diameter/Type: 2" PVC
Gallons in Well: 1.77

Pump Intake Setting (ft bmp): _____
Pumping Rate (gpm): _____
Evacuation Method: Foot pump
Volumes Purged: 11.30

Field Parameters

Color: _____
Odor: _____
Appearance: _____

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks

Development Personnel: T. Debnam

Notes: 11.3 well volumes were removed with foot pump/surge block. Clairty of water did not improve. Submersible proactive pump was not deployed. Well location: grass along Hwy 62. Condition of well: good, needs J-plug. Well locked at arrival: No. Well locked at departure: no

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

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WELL DEVELOPMENT LOG

Site/Well No. MW-1606S

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 6/15/2016

Weather Sunny, 85 F Development Time Begin 6/15/16 18:16 End 6/15/16 18:45

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): 590.15
Land Surface Elevation (ft): 587.28
Sounded Well Depth (ft bmp): 57.23
Depth to Water (ft bmp): 46.02
Water-Level Elevation (ft): --
Water Column in Well (ft): 11.21
Casing Diameter/Type: 2" PVC
Gallons in Well: 1.83

Pump Intake Setting (ft bmp): ~57
Pumping Rate (gpm): 0.224
Evacuation Method: submersible impeller pump
Volumes Purged: 5.19

Field Parameters

Color: brown--->Clear
Odor: None
Appearance:

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
6/15/16 18:25	46.06	2.50	1.37	1.587	76.4	16.41	7.29	NM	1.38	0.224	---
6/15/16 18:30	46.06	4.00	2.19	1.589	37.7	16.33	7.16	NM	1.25	0.224	---
6/15/16 18:35	46.06	6.50	3.55	1.589	29.6	16.38	7.12	NM	1.19	0.224	---
6/15/16 18:40	46.06	8.00	4.37	1.590	14.6	16.41	7.11	NM	1.14	0.224	---
6/15/16 18:45	46.06	9.50	5.19	1.590	10.1	16.43	7.10	NM	1.16	0.224	---

Development Personnel: T. Debnam

Notes:

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

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WELL DEVELOPMENT LOG

Site/Well No. MW-1606D

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 6/9/2016

Weather Sunny, 70 F Development Time Begin 6/9/16 9:34 End 6/9/16 10:34

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): 590.10
Land Surface Elevation (ft): 587.25
Sounded Well Depth (ft bmp): 77.60
Depth to Water (ft bmp): 46.01
Water-Level Elevation (ft): --
Water Column in Well (ft): 31.59
Casing Diameter/Type: 2" PVC
Gallons in Well: 5.05

Pump Intake Setting (ft bmp):
Pumping Rate (gpm): 0.106
Evacuation Method: proactive and foot valve
Volumes Purged: 11.09

Field Parameters

Color: Clear
Odor: None
Appearance:

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
6/9/16 9:34	46.09	0.00	0.00	2.017	202	16.84	7.26	-22.0	2.46	0.106	cloudy, no odor
6/9/16 9:39	46.11	0.50	0.10	2.017	156	17.07	7.31	-24.6	0.44	0.106	cloudy, no odor
6/9/16 9:44	46.11	1.00	0.20	2.009	148	17.82	7.32	-25.3	0.27	0.106	cloudy, no odor
6/9/16 9:49	46.11	1.50	0.30	2.014	225	16.21	7.37	-27.5	0.94	0.106	cloudy, no odor
6/9/16 9:54	46.11	2.00	0.40	2.001	337	16.81	7.33	-25.9	0.25	0.106	cloudy, no odor
6/9/16 9:59	46.11	2.50	0.50	1.988	438	16.81	7.39	-29.0	0.34	0.106	cloudy, no odor
6/9/16 10:04	Proactive used to surge well to lower turbidity										
6/9/16 10:09	46.11	3.00	0.59	2.033	403	16.35	7.46	-31.8	0.75	0.106	cloudy, no odor
6/9/16 10:14	46.11	3.50	0.69	2.022	378	17.26	7.36	-27.4	0.17	0.106	cloudy, no odor
6/9/16 10:19	46.11	4.00	0.79	2.034	339	17.46	7.35	149.7	0.12	0.106	cloudy, no odor
6/9/16 10:24	46.11	4.50	0.89	2.026	155	17.01	7.34	149.5	0.11	0.106	cloudy, no odor
6/9/16 10:29	46.11	5.00	0.99	2.015	152	18.18	7.33	147.4	0.17	0.106	cloudy, no odor
6/9/16 10:34	46.11	5.50	1.09	2.017	163	17.39	7.34	146.4	0.16	0.106	cloudy, no odor

Development Personnel: T. Eyerdom

Notes: 8 well volumes were removed with the foot valve. 2 well volumes were removed with proactive pump before taking water quality measurements.

Location of well: grass along hwy 62. Condition of well: good. Well locked at arrival: no. Well locked at departure: no.

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

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WELL DEVELOPMENT LOG

Site/Well No. MW-1606D

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 6/15/2016

Weather Sunny, 85 F Development Time Begin 6/15/16 17:36 End 6/15/16 18:00

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): 590.10
Land Surface Elevation (ft): 587.25
Sounded Well Depth (ft bmp): 77.78
Depth to Water (ft bmp): 46.03
Water-Level Elevation (ft): --
Water Column in Well (ft): 31.75
Casing Diameter/Type: 2" PVC
Gallons in Well: 5.18

Pump Intake Setting (ft bmp): ~77.5
Pumping Rate (gpm): 0.211
Evacuation Method: submersible impeller pump
Volumes Purged: 2.12

Field Parameters

Color: brown--->clear
Odor: None
Appearance:

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
6/15/16 17:40	46.06	5.0	0.97	1.747	23.6	16.25	7.33	NM	2.62	0.211	---
6/15/16 17:45	46.06	6.5	1.25	1.748	15.0	16.17	7.30	NM	0.40	0.211	---
6/15/16 17:50	46.06	8.0	1.54	1.748	11.2	16.13	7.30	NM	0.24	0.211	---
6/15/16 17:55	46.06	9.5	1.83	1.749	9.62	16.10	7.30	NM	0.23	0.211	---
6/15/16 18:00	46.02	11.0	2.12	1.749	7.82	16.12	7.29	NM	0.20	0.211	---

Development Personnel: T. Debnam

Notes:

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

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WELL DEVELOPMENT LOG

Site/Well No. MW-1607S

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 6/15/2016

Weather Sunny, 85 F Development Time Begin 6/15/16 16:30 End 6/15/16 16:55

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): 593.99
Land Surface Elevation (ft): 590.79
Sounded Well Depth (ft bmp): 60.28
Depth to Water (ft bmp): 46.56
Water-Level Elevation (ft): --
Water Column in Well (ft): 13.72
Casing Diameter/Type: 2" PVC
Gallons in Well: 2.24

Pump Intake Setting (ft bmp): ~60
Pumping Rate (gpm): 0.211
Evacuation Method: submersible impeller pump
Volumes Purged: 3.57

Field Parameters

Color: brown--->clear
Odor: None
Appearance:

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
6/15/16 16:35	46.59	2.0	0.89	0.836	63.3	15.91	7.51	NM	0.93	0.211	---
6/15/16 16:40	46.59	3.5	1.56	0.835	28.3	15.92	7.47	NM	0.98	0.211	---
6/15/16 16:45	46.59	5.0	2.23	0.836	18.3	15.92	7.47	NM	0.80	0.211	---
6/15/16 16:50	46.59	6.5	2.90	0.836	12.0	15.90	7.46	NM	0.81	0.211	---
6/15/16 16:55	46.59	8.0	3.57	0.835	9.73	15.90	7.44	NM	0.82	0.211	---

Development Personnel: T. Debnam

Notes:

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

WELL DEVELOPMENT LOG

Site/Well No. MW-1607D

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 6/15/2016

Weather Partly Cloudy, 80 F Development Time Begin 6/15/16 15:50 End 6/15/16 16:20

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): 593.93
Land Surface Elevation (ft): 590.75
Sounded Well Depth (ft bmp): 80.61
Depth to Water (ft bmp): 46.72
Water-Level Elevation (ft): --
Water Column in Well (ft): 33.89
Casing Diameter/Type: 2" PVC
Gallons in Well: 5.52

Pump Intake Setting (ft bmp): ~80
Pumping Rate (gpm): 0.224
Evacuation Method: submersible impeller pump
Volumes Purged: 1.54

Field Parameters

Color: light brown--->clear
Odor: None
Appearance:

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
6/15/16 16:00	46.76	2.5	0.45	0.759	57.1	16.32	7.72	NM	0.24	0.224	---
6/15/16 16:05	46.76	4.0	0.72	0.759	26.5	16.45	7.69	NM	0.20	0.224	---
6/15/16 16:10	46.76	5.5	1.00	0.759	15.4	16.56	7.66	NM	0.16	0.224	---
6/15/16 16:15	46.76	7.0	1.27	0.758	9.23	16.55	7.65	NM	0.15	0.224	---
6/15/16 16:20	46.76	8.5	1.54	0.757	5.94	16.58	7.67	NM	0.14	0.224	---

Development Personnel: T. Debnam

Notes:

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

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WELL DEVELOPMENT LOG

Site/Well No. MW-1608

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 6/17/2016

Weather Cloudy, ~75 F Development Time Begin 6/17/16 12:12 End 6/17/16 12:43

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): 590.65
Land Surface Elevation (ft): 587.26
Sounded Well Depth (ft bmp): 60.45
Depth to Water (ft bmp): 47.66
Water-Level Elevation (ft): --
Water Column in Well (ft): 12.79
Casing Diameter/Type: 2" PVC
Gallons in Well: 2.08

Pump Intake Setting (ft bmp): ~60
Pumping Rate (gpm): 0.211
Evacuation Method: submersible impeller pump
Volumes Purged: 15.87

Field Parameters

Color: dark brown--->clear
Odor: None
Appearance:

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
6/17/16 12:13	47.66	24.0	11.54	0.514	18.7	14.87	7.16	NM	17.59	0.211	---
6/17/16 12:18	47.66	25.5	12.26	0.513	21.9	14.85	7.02	NM	13.02	0.211	---
6/17/16 12:23	47.66	27.0	12.98	0.513	9.67	14.79	6.99	NM	10.14	0.211	---
6/17/16 12:28	47.66	28.5	13.70	0.511	4.88	14.78	7.04	NM	7.67	0.211	---
6/17/16 12:33	47.66	30.0	14.42	0.511	8.69	14.79	7.04	NM	6.30	0.211	---
6/17/16 12:38	47.66	31.50	15.14	0.510	5.85	14.81	7.03	NM	5.31	0.211	---
6/17/16 12:43	47.66	33.00	15.87	0.511	3.60	14.90	7.03	NM	5.06	0.211	---

Development Personnel: T. Debnam

Notes:

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

ARCADIS Design & Consultancy for natural and built assets

AEP AMERICAN® ELECTRIC POWER

LITTLE BROAD RUN LANDFILL-CCR GROUNDWATER MONITORING WELL NETWORK EVALUATION

Mountaineer Plant
Graham Station Road
Mason County
New Haven, West Virginia

October 18, 2016

LITTLE BROAD RUN LANDFILL-CCR GROUNDWATER MONITORING WELL NETWORK EVALUATION

Mountaineer Plant, Graham Station Road, Mason County, New Haven, WV

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Date:

October 18, 2016

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APPENDICES

A Boring/Well Construction Logs
B Banks Well Inventory Report
C Hydraulic Testing Results
D Field Methodology & Borehole Geophysics Report

ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power Service Corporation
amsl	above mean sea level
Arcadis	Arcadis U.S., Inc.
CCR	Coal Combustion Residual
CFR	Code of Federal Regulations
CSM	Conceptual Site Model
EPRI	Electric Power Research Institute
FGD	flue gas desulfurization
ft	feet
LBR	Little Broad Run
LCS	Leachate Collection System
WVDOH	West Virginia Department of Health

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 Little Broad Run (LBR) Landfill (CCR Unit) at the AEP Mountaineer Generating Plant (Plant) located on Graham Station Road in New Haven, 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 groundwater monitoring well network in the uppermost aquifer at the LBR landfill (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 bottom ash ponds and the LBR Landfill (**Figure 2**). The evaluation of the bottom ash ponds is not included in this report and will be completed under separate cover.

Initial evaluation of the monitoring well network was completed in February 2016 and included a review of AEP-provided data associated with previously completed subsurface investigation activities in the vicinity of the LBR Landfill, as well as publicly-available geologic and hydrogeologic data. Gaps in the monitoring well network were identified during this initial evaluation. Additional monitoring wells were installed from May through August 2016 to address these data gaps. Drilling activities were performed by a West Virginia-licensed drilling contractor (DLZ) with Arcadis personnel completing borehole logging and well installation oversight. During well installation, borehole geophysics were performed at select boreholes by THG Geophysics, Ltd. to assist with characterization of hydrologic units. 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 landfill in the uppermost aquifer; therefore, the report objective has been met.

2. BACKGROUND INFORMATION

The following section provides background information for the AEP Mountaineer Generating Plant LBR Landfill.

2.1 Facility Location Description

The LBR Landfill is located in Mason County approximately 2 miles southwest of the Plant and west of West Virginia Route 62 (**Figures 1** and **2**). The Site occupies approximately 660 total acres, of which 325 acres is permitted for ash disposal. The landfill is located in an isolated area, with undeveloped wooded areas to the south, east, and west.

2.2 Description of LBR Landfill CCR Unit

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

2.2.1 Landfill Configuration

The landfill is situated within the drainage basin of Little Broad Run and consists of 9 planned fill areas. As of 2015, Areas 1 through 7 were either temporarily closed pending final capping, or in construction. The surface of the landfill will be covered with 2 ft of low-permeability compacted soil and vegetated with grass cover as construction at each landfill area is completed. Clay material for this cover will be derived from onsite borrow areas. General construction of the landfill is further detailed in the Vertical Expansion Engineering Design Report for the Site (Hull, 2008).

2.2.2 Area/Volume

The total area of the Site is approximately 660 acres which includes both disposal and non-disposal use. The current permitted area for disposal is 297 acres, with a total landfill disposal volume of approximately 56.5 million cubic yards, which includes both bottom ash and fly ash from both the Mountaineer and Sporn Plants (Hull, 2008) (**Figure 3**).

2.2.3 Construction and Operational History

The landfill began operation under West Virginia Department of Health (WVDOH) Permit Number 7285, dated November 16, 1978. Subsequently, the West Virginia Department of Natural Resources assumed regulatory status for the Site and operation was conducted under Application Number I-1588-L dated November 1, 1984 (Appalachian Power Company, 1984). In 1989, the pending permit Application Number I-1588-L was amended with the submission of the *Class F Industrial Landfill Facility Application Addendum, Application Number WV0077038,* dated September 21, 1989 (Appalachian Power Company, 1989). The landfill currently operated under Application Number WV 0077038, with addendums and/or

renewals having been submitted in 1991, 1997, 1998, 2003, 2004, 2007, 2008, 2013 and most recently 2015.

Landfill construction is planned for 9 individual sequences (i.e. areas), with a total landfill disposal volume of approximately 56.5 million cubic yards, which includes both bottom ash and fly ash from both the Mountaineer and Sporn Plants (Hull, 2008). The Sporn Plant was de-activated on June 1, 2015 and currently does not contribute CCR material to the Site. As of 2015, Areas 1 through 7 were either temporarily closed pending final capping, or in construction.

During typical landfill construction, a liner is placed at the base of each area. Liner construction specifics have varied over time. Liners at landfill Areas 1 through 3 consist of a minimum 2-ft thick natural clay liner overlain by a single-underdrain system to collect leachate and groundwater seepage. The liner at Area 4 consists of a minimum 2-ft thick engineered clay liner overlain by a single-underdrain system, as well as a groundwater interceptor drain system beneath the clay liner to capture spring flow from perched groundwater (EPRI, 1999). Liner construction for Areas 5 through 7 is described in detail in *Solid Waste/NPDES Permit No. WV0077038 Permit Renewal Application* (AEP, 2003), consisting in general of the following layers:

- Groundwater interceptor drainage system
- Minimum 12-inches of compacted or in-place clayey subbase
- Minimum 24-inches of compacted clay liner
- Leachate Collection System (LCS)
- Protective cover zone

With the Sporn Plant closure in June 2015, only CCR byproducts from the Mountaineer Plant are currently placed in the landfill. These waste products include fly ash, bottom ash, flue gas desulfurization (FGD) (synthetic gypsum), and FGD purge stream treatment solids (limestone inerts and solids). The FGD and gypsum are transported to the landfill via above-ground conveyors, while fly ash and bottom ash are de-watered and removed from the Mountaineer bottom ash ponds or fly ash silo before being hauled to the landfill via private haul road. The landfill also occasionally receives CCR byproducts from the AEP Plants at Clinch River (VA), Glen Lyn (VA), and Kanawha River (WV) (AEP, 2003).

2.2.4 Surface Water Control

Surface water control at the Site is discussed in detail in Vertical Expansion Engineering Design Report (Hull, 2008). Structures are in place at the Site that control surface runoff and infiltration of surface runoff. Surface runoff is managed through a series of leachate ponds, sediment control basins, and diversion ditches that channel flow to temporary sediment collection ponds around the perimeter of the site (non-contact runoff) or the permanent leachate collection pond located to the northeast and downstream of the Little Broad Run valley. The two leachate ponds consist of an underdrain/groundwater interceptor system consisting of (from bottom to top) a 1.0-foot drainage layer that collects groundwater and a 4” perforated high density polyethylene (HDPE) pipe that coveys collected groundwater to a sump via gravity flow; an 8 ounce non-woven geotextile above the drainage layer; a minimum 1.5-foot compacted clayey soil liner;

HDPE geomembrane, a 16 ounce non-woven geotextile above the HDPE membrane; and a 12-inch minimum reinforced concrete base installed above the 16-ounce geotextile (Hull, 2010)

2.3 Previous Investigations

Prior to submission of the original WVDOH Permit Number 7285, AEP performed a site investigation to characterize the conditions at the proposed landfill facility. These investigations included drilling through soil and into rock, split barrel soil sampling and standard penetration testing, undisturbed soil sampling (Shelby tubes), and continuous rock coring, where appropriate (AEP Service Corp., 1978).

Soil samples were analyzed for geotechnical parameters to assist with general site characterization and stability analyses. These parameters include grain size distribution, moisture content, plasticity, and permeability (AEP Service Corp., 1978).

In 1986, AEP published the results of additional site investigations in *Ground-Water Monitoring of Little Broad Run Fly Ash Landfill, New Haven, W. Va.* This investigation included the installation of additional soil and rock borings, packer testing of select borings to determine hydraulic properties of the water-bearing zones, and the installation of four monitoring wells (MW-1 through MW-4) (AEP Service Corp., 1986). Approximately half of the current monitoring well network was installed in subsequent investigation activities from 1992 to 1997. These monitoring wells were routinely sampled and gauged, and the results of routine monitoring were published in landfill permit renewals in 1997, 1998, and 2003. From 2004 to 2010, the remainder of the wells and piezometers of the monitoring well network were installed and are currently sampled or gauged as part of routine Site monitoring (AEP, 2003).

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 Mountaineer 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. These studies are described in detail in the report *Groundwater Quality at the Philip Sporn and Mountaineer Power Plants, Mason County, West Virginia* (EPRI, 1999). For the landfill, groundwater quality was assessed in these studies from analytical results dated April, July, and October 1997 from 24 existing wells (MW-3 to MW-9, MW-12, MW-14 to MW-22, MW-27 to MW-33).

In addition to groundwater monitoring and site characterization investigations, an evaluation of stability related to underground mining at the Philip Sporn Mine was performed in 1992 (Gales, 1992). As part of this investigation, one test hole was drilled to intercept the Pittsburg Coal seam. Samples of the coal and surrounding rock strata were collected and analyzed for mechanical properties. Additionally, pillar load calculations were performed to assess pillar strength under post-landfill construction conditions. This investigation concluded that subsidence has not occurred at the LBR Landfill, that the pillars would not fail under increased loading, and that no sensible strain would be present at the ground surface as a result of previous mining (Gales, 1992).

2.4 Hydrogeologic Setting

The hydrogeologic setting is discussed in detail in *Solid Waste/NPDES Permit No. WV0077038 Permit Renewal Application* (AEP, 2003). The geologic setting surrounding the Site primarily consists of the Pennsylvanian age sandstones, shales, limestones, and coal of the Monongahela Group. At higher elevations, the hilltops are capped by the Permian age Dunkard Formation, which is lithologically similar to the Monongahela Group (EPRI, 1999). Groundwater occurrence in the bedrock generally coincides with the stress relief fracture system and is not necessarily related to lithology. Fracture orientation ranges from vertical (predominantly along valley slopes) to horizontal (along bedding planes). Groundwater flow occurs primarily in this fracture network, and the lateral flow generally follows topography towards the LBR valley center. The principal direction of groundwater flow in the valley is towards the LBR valley mouth to the northeast.

Unconsolidated deposits in the vicinity of the landfill consist primarily of weathered bedrock and residuum blanketing the underlying bedrock, with some colluvial deposits consisting of weathered rock, sand, silt, and clay. Soils are generally clay-type and vary in thickness from 1.8 ft to 20.3 ft (AEP, 2003). Further down valley towards the valley mouth, alluvial deposits derived from Little Broad Run, combined with residuum, are present in thickness up to 28 ft. These alluvial sediments overlie bedrock and are in hydraulic connection to the fracture network.

These features are further illustrated on two lines of cross section that were initially prepared by AEP with modifications through the LBR landfill made by Arcadis to incorporate data obtained in 2016. One cross section trends from southwest to northeast through the landfill (A to A') and the other cross section trends from the northwest to the southeast through the landfill (B to B'). The cross section location map is included as **Figure 4** and the cross sections are included as **Figure 5A** (A to A') and **Figure 5B** (B to B'). Boring logs and well construction diagrams are included in **Appendix A**.

2.4.1 Climate and Water Budget

The climate of Mason County, West Virginia is characterized as humid continental with an average rainfall of approximately 42 inches annually. The average maximum temperature is 68 ºF and the average minimum temperature is 44 ºF based on information from the Southeast Regional Climate Center (SERCC, 2015).

The results of a mass balance water budget analysis performed as part of the March 2003 *Solid Waste/NPDES Permit No. WV0077038 Permit Renewal Application* is described in detail in Section D of that application (AEP, 2003). The primary objective of this analysis was to estimate the average annual precipitation, evapotranspiration, and leachate production (AEP, 2003).

2.4.2 Regional and Local Geologic Setting

2.4.2.1 Unconsolidated

The Site is located in the Appalachian Plateau physiographic province, and unconsolidated soils are limited in extent. Depending on geologic setting, soils are residual, colluvial, and/or alluvial in origin.

Soils in lower topographic areas (i.e. valleys) consist of a combination of residuum derived from weathered sandstone/shale and colluvium. Adjacent to the Little Broad Run, alluvial deposits are present, consisting of silty to sandy clay. Further up the ridges, soils are composed mainly of residuum. Unconsolidated material is thickest in the valley floors. Based on historical and recent soil samples and well installation logs, the soil thickness ranges from 1.8 to 28 ft.

2.4.2.2 Bedrock

The primary regional bedrock units underlying the landfill are sedimentary rocks of the Permian age Dunkard Formation and the Pennsylvanian age Monongahela Formation. The depositional environment for these formations is characterized by a gradually subsiding shallow sea with alternating marine and freshwater strata. Sedimentary rocks associated with the Dunkard Formation, which immediately underlie unconsolidated sediments beneath the Site, consist of predominantly clay-shale with alternating beds of siltstone, sandstone, and occasionally thin limestone beds (AEP, 2003). The base of the Dunkard Formation is marked by a thick, massive conglomeritic sandstone that separates it from the deeper Monongahela Formation (EPRI, 1999). The Monongahela Formation is lithologically similar to the Dunkard Formation. Several coal horizons are present in the region and often serve as marker beds for unit identification. Locally, the Pittsburg No. 8A coal bed defines the base of the Monongahela Formation (EPRI, 1999). Bedrock occurrence is illustrated on both cross sections (**Figures 5A** and **5B**) and detailed in boring logs included in **Appendix A**.

No geologic structures have been mapped in the immediate vicinity of the Site. Regionally, a series of gently dipping anticlines and synclines strike to the north-northeast, and the Parkersburg Syncline is located approximately 11 miles to the east-southeast from the Site (AEP, 2003). The Parkersburg Syncline appears to dip to the north-northwest, and bedding planes generally dip toward the axis of the syncline. Locally, however, bedding planes are reversed due to mild up-warping, and are essentially flat lying (EPRI, 1999).

2.4.3 Surface Water and Surface Water/Groundwater Interactions

One intermittent stream, Little Broad Run, occurs in the vicinity of the Site and originates at the northeastern corner of the landfill. Little Broad Run flows to the north and ultimately discharges into the Ohio River. Groundwater flow follows topographic relief and is generally in the flow direction of Little Broad Run to the northeast. Two leachate collection ponds are constructed northeast of the landfill. This system collects surface water runoff, groundwater from the leachate and groundwater interceptor drain systems as well as the gypsum stack-out pad. The two leachate ponds consist of an underdrain/groundwater interceptor system consisting of (from bottom to top) a 1.0-foot drainage layer that collects groundwater and a 4” perforated high density polyethylene (HDPE) pipe that coveys collected groundwater to a sump via gravity flow; an 8 ounce non-woven geotextile above the drainage layer; a minimum 1.5-foot compacted clayey soil liner; HDPE geomembrane, a 16 ounce non-woven geotextile above the HDPE membrane; and a 12-inch minimum reinforced concrete base installed above the 16-ounce geotextile (Hull, 2010).

The leachate collection ponds discharge water to the leachate surge pond at Mountaineer Plant. The water is pumped to the bioreactor for treatment and then pumped to the clear water pond where this water will eventually flow to outlet 001, which discharges to the Ohio River.

2.4.4 Water Users

In 2014, a water well inventory for the Mountaineer Plant indicated no information regarding the use of wells located in the vicinity of the Site was available (Banks, 2014). However, the one well that was identified was registered with the United States Geological Survey, is located at the Phillip Sporn Power Plant, and appears to be used for groundwater monitoring. A copy of the well report is included in **Appendix B**.

3. MONITORING WELL NETWORK EVALUATION

An initial evaluation of the monitoring well network present at the Site was performed in February 2016 to determine if any of the wells were viable for continued use as part of the groundwater monitoring well network or also 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. Additional monitoring wells were installed in May through August 2016. Wells included in the monitoring network are designated as up or down gradient. Up gradient wells represent background groundwater quality and the down gradient wells were placed down gradient of the CCR unit boundary to monitor water quality.

3.1 Hydrostratigraphic Units

3.1.1 Horizontal and Vertical Position Relative to CCR Unit

Groundwater occurrence at the Site is generally in fractured sandstone units, and have been identified as Hydrologic Units 1 through 4 in order from shallowest to deepest beneath the landfill. Hydrologic Units 1 and 2 are limited in lateral extent in this area and are restricted to higher elevations along valley walls, and likely discharge to a seepage face or local drainages in close proximity to the landfill. Therefore, these units are not sources of groundwater for wells or developed springs and thus not considered as part of the uppermost aquifer. Therefore, the uppermost aquifer at the Site is defined as the laterally extensive Hydrologic Unit 3, and in the absence of Hydrologic Unit 3 the uppermost aquifer is defined as the deeper Hydrologic Unit 4. Hydrologic Unit 3 is present throughout most of the Site; however, the bedrock unit pinches out to the northeast (in the vicinity of MW-15 and MW-20) and the southeast (between SB-1602R and MW-24/MW-25) (**Figure 5B**). Hydrologic Unit 4 pinches out to the northeast between the MW-9/MW-19/MW-32 well cluster and SB-1609R/SB-1619R, but is otherwise present underlying the landfill (**Figure 5A**). In addition to primary porosity which provides groundwater storage, secondary porosity in the form of stress relief fractures (paleo-relief) occur in both the Dunkard and Monongahela Formations. Stress relief fractures are likely hydraulically connected with deeper open horizontal bedding planes. In similar stress relief fracture systems, the aquifers are generally unconfined; however, conditions can exhibit confined behavior in valley floors if low-transmissivity sediments (i.e. clay) are present (USGS, 1981). Vertical stress relief fracture frequency decreases with depth, and fractures are less common in interbedded shale units between sandstone units (EPRI, 1999). As a result, deeper Hydrologic Units 3 and 4 exhibit confined conditions. The uppermost aquifer, consisting of Hydrologic Units 3 and/or 4, is horizontally continuous across the entire Site.

Towards the northeast valley mouth and down gradient of the landfill, Hydrologic Unit 4 is blanketed by alluvium consisting of silty to sandy clay. The alluvium and shallow weather shale bedrock occurrence continues downvalley and is hydraulically connected to Hydrologic Unit 4; Therefore, these shallow units are included as part of the down gradient monitoring of the landfill. Alluvial thickness observed at MW-1611 and SB-1609R ranged from 26 to 28 ft, respectively (**Figure 5A**).

The upper limit of the uppermost aquifer is located beneath the original ground surface prior to landfill construction and is defined as the top of Hydrologic Unit 3, or the top of Hydrologic Unit 4 in the absence of Hydrologic Unit 3. The top of Hydrologic Unit 3 occurs at depths as shallow as 15 ft below ground surface (bgs) (near MW-15 and MW-20). The top of Hydrologic Unit 4 occurs at depths as shallow as 26 ft bgs (MW-1611).

3.1.2 Overall Flow Conditions

Groundwater flow is laterally continuous throughout most of the Site within Hydrologic Units 3 and 4. Where Hydrologic Unit 3 is no longer present, Hydrologic Unit 4 is present and continuous. Groundwater flow in these units follow historical topography towards the LBR valley bottom. Groundwater underlying the valley floor generally flows to the northeast towards the northeast valley mouth. Available groundwater elevations for Hydrologic Units 3 and 4 wells are summarized on **Table 1** from August 1993 to August 2016. Potentiometric contours from October 2001 is the most complete data set with the closed wells in the center portion of the landfill and were used to depict groundwater flow conditions (**Figure 6**). Recently installed monitoring wells MW-1611 and MW-1612 were not be used in potentiometric contouring presented on **Figure 6**; However, groundwater levels collected during from these two wells are consistent with general piezometric elevation understanding and groundwater flow directions. Well designations are presented in **Table 2**.

Towards the northeast valley mouth down gradient of the landfill, Hydrologic Unit 4 is likely hydraulically connected to the overlying and laterally adjacent alluvium and weathered bedrock. Groundwater flow in this northeastern portion of the Site is likely towards the valley center and down valley in the direction of Little Broad Run. Available groundwater elevations for alluvium monitoring wells are summarized on **Table 1**.

Water level gauging conducted at well nests at the Site are from historical information since many of the wells are now closed. The wells nests water levels indicate downward vertical hydraulic gradients between Hydrologic Units 1 and 3 ranging from 0.39 to 0.91 ft/ft, whereas deeper vertical hydraulic gradients tend to be upwards. An upward vertical hydraulic gradient of 0.09 ft/ft was measured at the MW-20/MW-15 well pair (EPRI, 1999).

3.1.3 Hydraulic Conductivity

The intent of injection packer testing is to estimate relative bedrock permeability for various borehole depth intervals. Packer testing was conducted during installation of select monitor wells in the 1980s and 1990s, as well as during more recent well installations in May through August 2016. The intent of injection packer testing is to estimate relative bedrock permeability for various borehole depth intervals. In the 1980s and 1990s, hydraulic conductivities calculated at two boreholes in Hydrologic Unit 1 ranged from 1.4×10^{-3} to 7.1×10^{-7} centimeters per second (cm/sec) at MW-1 and MW-7, respectively. The geometric mean hydraulic conductivity for Hydrologic Unit 3 was 3.5×10^{-5} cm/sec, and was 3.9×10^{-4} cm/sec for Hydrologic Unit 4. In general, borehole pressure testing indicated that horizontal hydraulic conductivity decreased with depth, and also decreased in the ridge areas (EPRI, 1999).

Packer testing was also performed at several of the recently installed boreholes to target Hydrologic Unit 3, Unit 4 and vertically adjacent shales or weathered bedrock. The purposed of the packer testing was to

determine whether the targeted intervals produce adequate flow for a monitoring well within the targeted zones. Packer testing at SB-1602R, SB-1609R and SB-1610 was completed on May 27, June 1 and June 16, 2016, respectively. MW-1611 and MW-1612 packer testing was completed on June 20 and July 15, 2016, respectively. Upon completion of each borehole, rock cuttings were flushed from the borehole with water in preparation for packer testing. Inflatable upper and lower rubber packers were then inserted to a specified 10-ft depth interval and inflated to create a seal. A riser pipe was attached to the top of the upper packer to provide a rigid, sealed standpipe with a pressure gauge at a known distance above the ground surface. Through this riser pipe, water was injected into the packer interval while measuring the gauge injection pressure, as well as injection volumes via a totalizing flowmeter.

The packer test commenced by injecting water into the packer interval at a constant pressure. During the test, the flow rates and pressure was monitored at regular intervals. Packer tests were completed in continuous, 10-ft intervals related to the targeted zones. Test data was analyzed using the method described in the U.S. Department of the Interior Ground Water Manual (1977). Hydraulic conductivity estimates derived from the borehole packer tests were 1.0 x 10^{-3} cm/sec to 1.5x10^{-3} cm/sec (MW-1611 Hydrologic Unit 4) and 2.9x10^{-4} cm/sec (MW-1612 Hydrologic Unit 3). Packer tests conducted at SB-1602R (Hydrologic Units 3 and 4), SB-1609R (weathered bedrock lateral equivalent to Hydrologic Unit 4), and SB-1610 (Hydrologic Units 3 and 4) had no flow. It was determined that the tested intervals at these locations did not have the available connected fracture network to retain and transmit groundwater. Packer test results are summarized on **Table 3** and packer testing logs are included in **Appendix C**.

3.1.4 Borehole Geophysics

In order to further characterize the hydrologic units at the Site in support of the monitoring well network evaluation, THG Geophysics, Ltd. performed downhole geophysical logging at SB-1610 and MW-1611 on June 21, 2016. The purpose in the further characterization was to obtain more detailed information on groundwater transmissive zones of the uppermost aquifer units (bedrock type, fractures, permeability and porosity) in relation to. The geophysical logging included the following suite: optical and acoustic televiewing, caliper borehole diameter, electrical resistivity, fluid resistivity, natural gamma radiation, spontaneous potential, single point resistance, and temperature.

In general, the geophysical logging results were consistent with shaley packages with occasional sandstone beds corresponding to Hydrologic Units 1 through 5 at SB-1610 and Hydrologic Unit 4 at MW-1611. At SB-1610, The geophysical logging indicated sandstone or shaley sandstone from approximately 30 to 41 ft bgs, 70 to 75 ft bgs, 145 to 157 ft bgs and 190 to 195 ft bgs. One partially open fracture and 10 planar features (e.g. bedding plane or filled fracture) were identified; however, all occurred greater than 127 ft bgs and none appeared to transmit water. At MW-1611, geophysical logging indicated sandstone from approximately 26 to 35 ft bgs. Up to 5 open fractures were identified at depths ranging from 31 to 39 ft bgs with fracture apertures ranging from 5.3 to 17.4 inches. The results of the borehole geophysics evaluation were used to confirm the understanding of conditions of flow. Subsequently, these results coupled with the packer testing led to sealing of SB-1610 and a monitoring well installed within the Hydrologic Unit 4 fracture network at MW-1611. Additional detail of the procedures and results of borehole geophysical logging are included in **Appendix D**.

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 that 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 definition of the uppermost aquifer under 40 CFR 257.53 is 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 Hydrologic Unit 3, or Hydrologic Unit 4 in the absence of Hydrologic Unit 3. This aquifer is not known to be used locally for groundwater supply or industrial water use.

3.3 Review of Monitoring Well Network

3.3.1 Overview

The Site was visited by Arcadis and AEP personnel on August 12, 2015 to review existing well network conditions and locations and the initial evaluation was completed in February 2016. The well network that existed at the time of that Site visit was deficient, lacking both the minimum quantity of monitoring wells (i.e. 3 down gradient, 1 up gradient) and 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. Following that Site visit, additional monitoring wells were installed to augment the monitoring well network. 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 have been abandoned are shaded on **Tables 1** and **2** and **Figure 3**. All closed wells at the landfill are assumed to have been closed in accordance to Title 47 Series 60 Monitoring Well Design Standards dated June 21, 2011.

The groundwater quality monitoring well network monitors Hydrologic Units 3 and 4, as well as the alluvial sediments and weathered bedrock laterally down gradient of Hydrologic Unit 4 of the landfill. It includes 5 wells installed between 1996 and 2005 and 2 wells installed from May to August 2016. In total, there are 2 up gradient monitoring wells (MW-30 and MW-1612) and 5 down gradient monitoring wells (MW-26, MW-27, MW-38, MW-39 and MW-1611) (**Table 2** and **Figure 7**). An additional 6 monitoring wells are utilized for the purpose of hydraulic monitoring (**Table 2**). Down gradient well pairs MW-26/MW-27 and MW-38/MW-39 measure vertical flow and transport properties across lithologic units. The current monitoring well network distribution is presented on **Figure 7**. Monitoring wells are located up gradient along the western and southwestern boundaries of the landfill are screened in Hydrologic Unit 3 (MW-30 and MW-1612). Monitoring wells located along the northeastern and eastern landfill boundaries are installed in Hydrologic Units 3 (MW-26) and 4 (MW-27 and MW-1611). Further to the northeast the network extends down gradient along the LBR valley within valley alluvium and shallow weather bedrock (MW-38 and MW-39). During field activities completed from May through August, 2016, boreholes SB-1602R, SB-1609R, SB-1610 and SB-1619R were installed with the purpose of placing additional up gradient and down gradient monitoring wells. As discussed above in Section 3.1.3, packer testing and field observations indicated that those boreholes did not encounter a suitable zone for monitoring and, therefore, were sealed. Additional details of the field methodology are included in **Appendix D**.

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 February 2016. Following monitoring well installation described in this report and detailed in **Appendix D**, there are no gaps in the monitoring network. The recommended monitoring well network is described in Section 4.

4. RECOMMENDED MONITORING 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 LBR Landfill (up gradient or down gradient), well depth, and well construction. The recommended monitoring 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 2 monitoring wells were installed to augment the existing network. The total groundwater quality monitoring network includes 2 up gradient wells (Hydrologic Unit 3) and 5 down gradient wells (Hydrologic Unit 3, Unit 4, alluvium and weathered bedrock) (**Table 2** and **Figure 7**). Specifics on field methodology and other documentation on installation of the additional wells in 2016 is provided in **Appendix D**. The monitoring well distribution adequately covers down gradient and up gradient areas as detailed in the following sections. In addition, 6 wells are used to refine the understanding of groundwater flow and hydraulic gradients in the vicinity and down gradient of the landfill (**Table 2** and **Figure 3**).

4.1.1 Down Gradient Locations

Five wells, located northeast of the landfill, are utilized for down gradient groundwater quality monitoring. Monitoring well MW-1611 is located immediately down gradient of the landfill boundary and monitors Hydrologic Unit 4. Monitoring wells MW-27 and MW-28 are located to the northeast of landfill and monitor Hydrologic Units 3 and 4, respectively. Further down gradient along the LBR valley, monitoring wells MW-38 and MW-39 monitor the alluvium and shallow weathered bedrock, respectively.

4.1.2 Up Gradient Locations

Two wells, located to the west and southwest of the LBR landfill, are utilized for up gradient groundwater quality monitoring. Monitoring well MW-1612 is located immediately up gradient of the landfill boundary and monitors Hydrologic Unit 3. Monitoring well MW-30 is located to the southwest of the landfill boundary and also monitors Hydrologic Unit 3.

4.2 Monitoring Well Construction Details

As discussed above in Section 3, gaps in the monitoring well network for the uppermost aquifer at the LBR Landfill were addressed by installation of 2 monitoring wells from May to August 2016. All monitoring wells were constructed in general accordance with West Virginia Department of Environmental Protection Title 47 Series 60 Monitoring Well Design Standards dated June 21, 2011 by a state licensed driller.

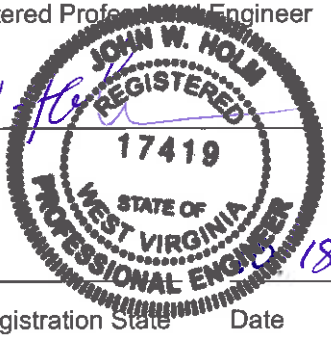
Installation details and field methods are provided in **Appendix D**. Well construction data for the monitoring well network are summarized on **Table 2**. Boring logs and the monitoring well completion diagrams are provided in **Appendix A**.

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 — 10/18/16

Registration No. — Registration State — Date

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TABLES

Table 1
Water Level Data
AEP Mountaineer Generating Plant - Little Broad Run Landfill
New Haven, West Virginia

Well ID	Aug-93 GW Elev. ft. amsl	Oct-93 GW Elev. ft. amsl	Feb-94 GW Elev. ft. amsl	Apr-94 GW Elev. ft. amsl	Jul-94 GW Elev. ft. amsl	Oct-94 GW Elev. ft. amsl	Dec-94 GW Elev. ft. amsl	Jan-95 GW Elev. ft. amsl	Apr-95 GW Elev. ft. amsl	Jul-95 GW Elev. ft. amsl	Oct-95 GW Elev. ft. amsl	Jan-96 GW Elev. ft. amsl	Apr-96 GW Elev. ft. amsl	Jul-96 GW Elev. ft. amsl	Oct-96 GW Elev. ft. amsl	Jan-97 GW Elev. ft. amsl	Apr-97 GW Elev. ft. amsl	Jul-97 GW Elev. ft. amsl	Oct-97 GW Elev. ft. amsl	Jan-98 GW Elev. ft. amsl	Apr-98 GW Elev. ft. amsl	Jul-98 GW Elev. ft. amsl	Oct-98 GW Elev. ft. amsl
Groundwater Quality Monitoring Wells																							
Alluvium																							
Downgradient																							
MW-38	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hydrologic Unit 3																							
Upgradient																							
MW-30	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		695.29	693.72	697.14	698.29	698.79	698.68	697.95
MW-1612	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Downgradient																							
MW-26	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hydrologic Unit 4																							
Downgradient																							
MW-27	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	646.94	646.54	645.95	645.91	646.81	647.14	NA
MW-39	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-1611	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hydraulic Monitoring Wells Only																							
Hydrologic Unit 3																							
MW-2	657.55	653.25	655.01	654.75	657.05	653.15	653.35	653.65	653.05	655.83	654.65	657.87	655.25	654.93	653.20	656.31	654.58	656.95	654.4	657.47	659.04	660.81	662.8
MW-12	714.61	713.33	716.30	717.61	718.04	717.58	716.92	712.85	718.50	718.21	717.95	719.38	718.75	718.93	693.67	719.30	719.72	719.51	718.77	719.65	720.42	719.72	719.12
MW-34	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hydrologic Unit 4																							
MW-23	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	583.91	586.07	587.66	589.61	581.83	593.74	595.8
MW-25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Other and Abandoned Wells																							
Alluvium																							
MW-16	618.88	618.22	620.95	621.11	620.39	619.13	620.48	621.03	620.92	619.36	619.08	621.14	620.88	620.53	620.86	621.18	620.78	619.46	618.66	620.82	621.06	621.08	617.58
MW-17	615.58	614.14	615.52	617.49	616.88	615.06	616.70	618.09	616.43	616.19	616.29	617.02	617.42	616.52	617.53	617.57	617.29	615.84	615.22	617.67	617.33	617.91	613.85
MW-18	614.86	614.97	615.81	617.61	616.86	615.78	617.44	617.23	616.97	615.35	615.78	617.20	617.60	617.39	617.58	617.74	617.48	616.02	615.43	617.04	617.64	617.97	614.13
MW-19	642.14	642.14	643.33	644.34	643.71	642.75	644.14	644.64	644.39	643.02	643.54	645.14	645.14	644.23	644.11	644.04	644.24	644.24	643.84	645.14	645.14	645.14	643.34
MW-43	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-44s	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-44i	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-44d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hydrologic Unit 1																							
MW-1	717.35	710.10	712.23	710.50	710.90	710.45	709.85	709.70	709.55	710.47	710.15	711.25	709.47	709.82	709.90	712.09	709.58	709.78	709.64	711.4	713.32	715.01	716.97
MW-3	752.75	752.64	753.22	753.41	752.93	752.62	752.84	752.61	753.36	752.92	752.76	753.42	753.60	752.90	752.81	753.43	753.58	753.39	752.93	753.34	753.61	753.26	752.9
MW-4	721.42	721.14	722.04	721.84	722.17	722.49	722.99	723.04	722.68	724.21	724.74	725.52	725.44	725.46	725.65	726.04	726.54	726.88	726.95	727.04	727.97	728.11	727.85
MW-5	760.24	760.00	760.13	761.95	760.25	759.45	759.45	759.30	760.19	760.30	760.15	756.95	760.77	760.78	760.25	760.41	761.18	761.06	760.45	759.51	760.73	760.78	760.17
MW-7	759.43	759.60	761.12	762.02	759.49	759.51	759.60	759.77	760.87	759.72	759.62	760.39	761.07	760.45	749.57	754.97	755.12	753.88	753.6	753.68	781.88	754.97	NA
MW-10	724.50	724.47	724.25	724.27	724.01	724.60	724.07	723.67	724.25	723.67	723.71	724.40	724.27	724.33	724.29	724.82	724.37	723.69	724.57	723.65	724.04	724.29	724.34
MW-24	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	790.06	795.11	797.31	798.26	792.45	792.17	NA
MW-29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	711.14	714.75	715.61	715.94	714.33	713.14	NA
MW-31	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	752.41	755.85	757.27	758.01	758.99	758.97	NA
MW-35	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-36	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-45	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-46	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-47	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 1
Water Level Data
AEP Mountaineer Generating Plant - Little Broad Run Landfill
New Haven, West Virginia

Well ID	Aug-93	Oct-93	Feb-94	Apr-94	Jul-94	Oct-94	Dec-94	Jan-95	Apr-95	Jul-95	Oct-95	Jan-96	Apr-96	Jul-96	Oct-96	Jan-97	Apr-97	Jul-97	Oct-97	Jan-98	Apr-98	Jul-98	Oct-98
	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl
Hydrologic Unit 3																							
MW-6	665.21	665.43	674.86	671.73	677.18	672.33	681.53	682.16	680.93	677.53	664.53	670.43	675.21	671.93	669.14	678.94	684.01	681.45	676.18	676.02	674.36	667.38	NA
MW-11	681.74	679.48	682.08	682.01	682.63	682.65	680.13	682.83	682.42	682.90	682.97	683.13	682.94	682.78	682.83	683.28	683.23	682.82	684.2	685.78	687.38	687.79	687.48
MW-13	674.90	669.74	674.73	671.55	673.25	671.20	667.28	664.55	671.30	672.30	671.15	666.77	672.03	672.16	673.21	673.65	673.55	676.15	674.25	673.88	674.8	672.95	674.58
MW-14	702.45	697.37	701.87	700.87	701.67	700.19	698.24	693.87	701.59	686.92	701.27	677.05	701.61	691.59	701.52	699.97	702.81	702.81	702	702.31	702.82	703.05	NA
MW-20	667.33	666.85	668.05	668.88	667.46	666.84	666.80	667.03	668.03	667.18	667.08	668.13	668.91	667.91	668.26	668.83	668.68	667.68	667.38	668.48	668.8	669.11	666.96
Hydrologic Unit 4																							
MW-8	671.43	671.43	673.28	674.09	672.33	670.61	671.19	671.97	673.03	670.98	671.03	673.65	674.54	671.86	672.38	674.34	671.81	671.23	670.55	672.73	672.39	672.99	670.53
MW-9	634.15	633.90	635.58	635.90	634.35	633.72	634.18	634.73	635.38	634.07	633.80	635.37	635.64	634.51	635.10	635.65	635.55	634.2	633.71	634.75	635.53	634.99	632.92
MW-15	671.28	671.52	673.22	674.00	672.20	670.75	671.57	672.20	673.25	671.00	670.95	673.56	674.62	671.84	672.39	673.85	671.84	671.46	670.57	671.5	672.42	673.49	670.45
MW-21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	655.03	653.1	653.04	654.5	655.45	655.26	652.75
MW-22	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	647.76	686.27	689.54	694.47	694.62	694.42	691.4
MW-33	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	672.17	671.15	670.71	671.79	672.83	673.42	670.75
Pittsburg Sandstone																							
MW-40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Redstone Coal																							
MW-41	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-42	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pittsburg Coal																							
MW-32	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	516.87	517.32	517.01	517.6	519.55	520.71	NA
Piezometers																							
CTL PZ-1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CTL PZ-4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-46S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-47S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HMW-1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HMW-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HMW-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HMW-4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HMW-5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 1
Water Level Data
AEP Mountaineer Generating Plant - Little Broad Run Landfill
New Haven, West Virginia

Well ID	Jan-99	Apr-99	Jul-99	Oct-99	Jan-00	Feb-00	Apr-00	Jul-00	Oct-00	Jan-01	Apr-01	May-01	Jul-01	Oct-01	Jan-02	Apr-02	Jul-02	Oct-02	Jan-03	Jul-05	Jul-16	Aug-16
	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl
Groundwater Quality Monitoring Wells																						
Alluvium																						
Downgradient																						
MW-38	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	623.49	NA	NA
Hydrologic Unit 3																						
Upgradient																						
MW-30	NA	697.45	NA	698.12	NA	NA	698.02	NA	698.07	NA	699.33	NA	NA	698.4	NA	698.7	NA	698.34	NA	700.85	NA	NA
MW-1612	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	737.34
Downgradient																						
MW-26	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	669.80	NA	NA
Hydrologic Unit 4																						
Downgradient																						
MW-27	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	647.39	NA	NA
MW-39	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	623.20	NA	NA
MW-1611	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	642.80	NA
Hydraulic Monitoring Wells Only																						
Hydrologic Unit 3																						
MW-2	674.46	664.94	667.47	668.14	669.88	NA	670.68	672.1	676.42	673.1	674.63	NA	675.2	676	681.59	676.47	677.18	NA	NA	689.75	NA	NA
MW-12	720.9	720.8	720.23	720.26	721.85	NA	722.76	722.12	721.86	719.5	719.17	NA	719.97	718.04	717.59	718.04	718.92	721.32	NA	723.83	NA	NA
MW-34	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	673.88	NA	NA
MW-37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	687.03	NA	NA
Hydrologic Unit 4																						
MW-23	NA	601.23	604.81	NA	NA	NA	618.34	621.03	NA	NA	627.58	NA	NA	629.91	NA	NA	631.75	NA	NA	NA	NA	NA
MW-25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Other and Abandoned Wells																						
Alluvium																						
MW-16	NA	620.94	NA	620.18	NA	NA	621.31	NA	619.42	NA	621.32	NA	NA	617.96	NA	620.93	NA	619.20	NA	618.78	NA	NA
MW-17	NA	617.29	NA	616.27	NA	NA	617.99	NA	616.65	NA	617.5	NA	NA	615.17	NA	617.86	NA	616.59	NA	616.11	NA	NA
MW-18	NA	617.19	NA	615.91	NA	NA	618.05	NA	616.35	NA	617.78	NA	NA	615.57	NA	617.83	NA	616.63	NA	615.62	NA	NA
MW-19	NA	645.14	NA	644.52	NA	NA	645.14	NA	644.17	NA	645.14	NA	NA	643.59	NA	645.14	NA	643.89	NA	NA	NA	NA
MW-43	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	630.15	NA	NA
MW-44s	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	617.43	NA	NA
MW-44i	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	616.79	NA	NA
MW-44d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	617.04	NA	NA
Hydrologic Unit 1																						
MW-1	718.48	719.35	720.82	721.95	723.19	NA	724.12	725.13	725.82	727.15	728.24	NA	729.03	730.03	730.76	731.51	732.2	NA	NA	746.95	NA	NA
MW-3	NA	753.55	NA	752.69	NA	NA	752.69	NA	752.64	NA	753.14	NA	NA	752.71	NA	752.36	NA	752.76	NA	753.06	NA	NA
MW-4	728.07	728.4	725.74	724.93	NA	724.93	724.18	723.99	723.99	723.9	723.79	NA	723.65	723.71	724.44	723.49	722.77	722.48	NA	NA	NA	NA
MW-5	760.07	760.11	760.32	759.86	760.1	NA	760.45	760.33	760.16	759.53	760.23	NA	760.06	759.75	759.23	759.47	759.68	759.41	760.01	758.90	NA	NA
MW-7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-10	NA	724.34	724.33	724.11	725.57	NA	724.65	723.89	NA	724.62	724.59	NA	724.45	724.57	724.07	724.3	723.49	723.77	NA	NA	NA	NA
MW-24	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	737.76	NA	NA
MW-28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	808.73	NA	NA
MW-29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	748.73	NA	NA
MW-31	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	762.56	NA	NA
MW-35	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	728.15	NA	NA
MW-36	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	731.05	NA	NA
MW-45	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	750.28	NA	NA
MW-46	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	775.68	NA	NA
MW-47	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	766.39	NA	NA

Table 1
Water Level Data
AEP Mountaineer Generating Plant - Little Broad Run Landfill
New Haven, West Virginia

Well ID	Jan-99	Apr-99	Jul-99	Oct-99	Jan-00	Feb-00	Apr-00	Jul-00	Oct-00	Jan-01	Apr-01	May-01	Jul-01	Oct-01	Jan-02	Apr-02	Jul-02	Oct-02	Jan-03	Jul-05	Jul-16	Aug-16
	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl	GW Elev. ft. amsl
Hydrologic Unit 3																						
MW-6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-11	NA	687.45	687.43	686	686.32	NA	686.45	686.31	NA	685.61	685.74	NA	685.63	685.62	685.55	685.8	686.05	684.51	NA	NA	NA	NA
MW-13	679.44	680.46	680.52	680.7	681.3	NA	681.43	680.82	680.73	681.05	681.3	NA	680.92	680.95	680.97	680.88	680.55	680.45	NA	NA	NA	NA
MW-14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-20	NA	668.37	NA	668.18	NA	NA	669.28	NA	667.35	NA	668.65	NA	NA	667.03	NA	668.1	NA	667.27	NA	NA	NA	NA
Hydrologic Unit 4																						
MW-8	NA	671.73	NA	671.58	NA	NA	671.66	NA	670.67	NA	670.9	NA	NA	669.66	NA	670.9	NA	670.28	NA	NA	NA	NA
MW-9	NA	635.12	NA	633.12	NA	NA	635.66	NA	633.98	NA	635.16	NA	NA	633.09	NA	634.95	NA	633.63	NA	NA	NA	NA
MW-15	671.96	671.78	671	670.39	NA	670.39	671.67	671.67	670.64	670.2	670.91	NA	670.56	669.73	670.22	671.42	670.85	670.54	NA	NA	NA	NA
MW-21	NA	654.66	NA	653.7	NA	NA	655.18	NA	653.62	NA	654.78	NA	NA	652.9	NA	654.36	NA	652.95	NA	NA	NA	NA
MW-22	NA	685.91	NA	695.89	NA	NA	695.75	NA	694.78	NA	694.65	NA	NA	693.75	NA	690.94	NA	692.91	NA	NA	NA	NA
MW-33	NA	NA	671.01	671.83	NA	NA	671.99	NA	670.5	NA	NA	670.39	NA	669.8	NA	671.02	NA	671.23	NA	NA	NA	NA
Pittsburg Sandstone																						
MW-40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	504.16	NA	NA
Redstone Coal																						
MW-41	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-42	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	622.57	NA	NA
Pittsburg Coal																						
MW-32	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Piezometers																						
CTL PZ-1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	774.05	NA	NA
CTL PZ-4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	791.14	NA	NA
MW-46S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	803.73	NA	NA
MW-47S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	789.55	NA	NA
HMW-1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	723.07	NA	NA
HMW-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	796.19	NA	NA
HMW-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	799.06	NA	NA
HMW-4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	785.35	NA	NA
HMW-5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	814.86	NA	NA

Notes:
Shaded - well not verified or abandoned
Elevation in feet above mean sea level
amsl - above mean sea level
Elev - elevation
ft - feet
GW - groundwater
NA - Not available

Table 2
Well Construction Details
AEP Mountaineer Generating Plant - Little Broad Run Landfill
New Haven, West Virginia

Well ID	Location Description to CCR Unit	Northing [a]	Easting [a]	Ground Surface Elevation	Top of Casing Elevation ft. amsl	Borehole depth ft. bls	Date Installed	Screen Material	Well diameter inches	Boring ID	Pump Type	Top of Screen		Bottom of Screen	
												Depth ft. bls	Elevation ft. amsl	Depth ft. bls	Elevation ft. amsl
Groundwater Quality Monitoring Wells															
Alluvium															
Downgradient															
MW-38	Northeast	713780.04	1701342.57	627.70	630.40	27.10	9/8/2005	Sch. 40 PVC	2.00	B-0502	Bladder	8.3	619.40	24.0	603.70
Hydrologic Unit 3															
Upgradient															
MW-30	Southwest	708701.00	1697043.00	879.83	881.54	227.81	12/11/1996	Sch. 40 PVC	2.00		Bladder	195.9	683.93	225.0	654.83
MW-1612 [b]	West	710022.47	1696530.10	780.70	783.27	118.43	7/19/2016	Sch. 40 PVC	2.00		Bladder	98.4	682.27	118.4	662.27
Downgradient															
MW-26	Northeast	712593.03	1699981.97	718.20	720.70	59.80	8/24/2005	Sch. 40 PVC	2.00	9627	Bladder	27.3	690.90	56.3	661.90
Hydrologic Unit 4															
Downgradient															
MW-27	Northeast	712597.94	1699973.80	718.06	719.49	132.53	10/9/1996	Sch. 40 PVC	2.00		Bladder	111.0	607.06	130.0	588.06
MW-39	Northeast	713778.64	1701334.27	627.70	630.00	57.80	9/7/2005	Sch. 40 PVC	2.00	B-0502	Bladder	35.8	591.90	54.8	572.90
MW-1611 [b]	Northeast	711992.87	1700414.67	654.01	656.90	41.11	6/23/2016	Sch. 40 PVC	2.00		Bladder	26.1	627.90	41.1	612.90
Hydraulic Monitoring Wells Only															
Hydrologic Unit 3															
MW-2	Southeast	709770.82	1700304.68	854.61	856.35	203.44	7/25/1986	Sch. 80 PVC	0.75	B-403	Geomon	202.3	652.31	206.3	648.31
MW-12	Southwest	709206.52	1697510.54	856.93	858.85	191.92	5/6/1992	Sch. 80 PVC	1.00		Geomon	192.6	664.33	195.4	661.53
MW-34	North	712564.83	1699347.76	815.60	818.10	171.50	8/4/2005	Sch. 40 PVC	2.00	B-402	Bladder	139.3	676.30	168.3	647.30
MW-37	Northeast	713421.05	1702216.58	797.60	800.40	152.20	7/12/2005	Sch. 40 PVC	2.00	B-0501	Bladder	129.5	668.10	148.5	649.10
Hydrologic Unit 4															
MW-23	South	708450.58	1699007.50	690.45	692.50	114.14	10/15/1996	Sch. 40 PVC	2.00		Bladder	91.9	598.55	111.0	579.45
MW-25	Southeast	709367.14	1700683.61	820.30	822.60	274.80	8/15/2005	Sch. 40 PVC	2.00	9624	Bladder	223.6	596.70	271.1	549.24
Other and Abandoned Wells															
Alluvium															
MW-16	Northeast	714590.99	1701806.27	626.03	628.78	24.75	5/21/1992	Sch. 40 PVC	2.00		Bladder	11.0	615.03	21.4	604.58
MW-17	Northeast	714877.50	1701807.74	621.47	623.29	30.82	5/20/1992	Sch. 40 PVC	2.00		Bladder	18.6	602.92	28.0	593.47
MW-18	Northeast	714966.05	1701804.93	621.95	623.78	27.03	5/19/1992	Sch. 40 PVC	2.00		Bladder	15.1	606.85	24.2	597.75
MW-19	Northeast	712307.73	1700772.04	643.18	645.14	23.56	8/13/1992	Sch. 40 PVC	2.00		Bladder	11.6	631.58	20.5	622.68
MW-43	Northeast	714653.85	1702105.28	636.58	640.08	33.60	7/12/2006	Sch. 40 PVC	2.00		Unknown	10.9	625.68	29.7	606.88
MW-44s	Northeast	714741.97	1701898.56	624.49	627.14	12.65	2/2/2010	Soinst Model 403 CMT	2.00			9.5	614.99	10.0	614.49
MW-44i	Northeast	714741.97	1701898.56	624.49	627.14	17.15	2/2/2010	Soinst Model 403 CMT	2.00			14.0	610.49	14.5	609.99
MW-44d	Northeast	714741.97	1701898.56	624.49	627.14	26.15	2/2/2010	Soinst Model 403 CMT	2.00			23.0	601.49	23.5	600.99
Hydrologic Unit 1															
MW-1	Southeast	709770.82	1700304.68	854.61	856.35	146.74	7/25/1986	Sch. 80 PVC	0.75	B-403	Geomon	145.6	709.01	149.6	705.01
MW-3	Southwest	709217.33	1697544.12	855.56	857.56	144.60	7/21/1986	Sch. 80 PVC	0.75		Geomon	143.2	712.36	147.2	708.36
MW-4	Within CCR	710401.03	1699700.07	802.08	803.44	95.76	7/31/1986	Sch. 80 PVC	0.75		Geomon	95.0	707.08	99.0	703.08
MW-5	Northwest	711506.72	1697144.87	788.93	791.45	48.72	6/23/1992	Sch. 80 PVC	1.00		Geomon	46.8	742.13	48.8	740.13
MW-7	Within CCR	712026.08	1698170.12	792.66	795.02	54.96	6/1/1992	Sch. 80 PVC	1.00		Geomon	53.2	739.46	55.2	737.46
MW-10	Within CCR	711012.66	1698778.89	810.83	813.07	88.74	7/9/1992	Sch. 80 PVC	1.00		Geomon	89.1	721.73	91.9	718.93
MW-24	Southeast	709390.74	1700721.78	820.30	822.20	121.00	8/17/2005	Sch. 40 PVC	2.00	9624	Bladder	89.2	731.10	118.2	702.10
MW-28	Southwest	708701.00	1697043.00	879.56	881.26	101.70	12/10/1996	Sch. 40 PVC	2.00		Bladder	69.8	809.76	98.9	780.66
MW-29	Southwest	708701.20	1697043.20	879.75	881.43	177.68	12/4/1996	Sch. 40 PVC	2.00		Bladder	152.8	726.95	171.9	707.85
MW-31	Northwest	711108.15	1696404.80	826.56	828.31	87.75	9/12/1996	Sch. 40 PVC	2.00		Bladder	55.8	770.76	84.9	741.66
MW-35	Northeast	713141.66	1702987.09	790.10	792.70	80.10	8/25/2005	Sch. 40 PVC	2.00	B-400	Bladder	47.5	742.60	76.5	713.60
MW-36	Northeast	713416.65	1702214.38	797.60	800.40	91.80	7/14/2005	Sch. 40 PVC	2.00	B-0501	Bladder	59.1	738.50	88.1	709.50
MW-45	Southwest	708997.71	1697555.36	852.23	854.83	135.70	1/7/2010	Sch. 40 PVC	2.00		Unknown	98.1	754.13	133.1	719.13
MW-46	Southwest	709236.01	1696752.55	808.77	811.81	83.44	1/19/2010	Sch. 40 PVC	2.00		Unknown	55.6	753.17	80.4	728.37
MW-47	West	710212.61	1696564.35	793.01	811.46	62.48	2/2/2010	Sch. 40 PVC	2.00		Unknown	59.6	733.41	79.4	713.61

Table 2
Well Construction Details
AEP Mountaineer Generating Plant - Little Broad Run Landfill
New Haven, West Virginia

Well ID	Location Description to CCR Unit	Northing [a]	Easting [a]	Ground Surface Elevation	Top of Casing Elevation ft. amsl	Borehole depth ft. bls	Date Installed	Screen Material	Well diameter inches	Boring ID	Pump Type	Top of Screen		Bottom of Screen	
												Depth ft. bls	Elevation ft. amsl	Depth ft. bls	Elevation ft. amsl
Hydrologic Unit 3															
MW-6	Within CCR	712047.90	1698223.21	794.61	796.43	137.52	6/16/1992	Sch. 40 PVC	2.00		Bladder	125.8	668.79	134.8	659.81
MW-11	Within CCR	711012.31	1698778.83	810.83	813.63	152.80	7/8/1992	Sch. 40 PVC	2.00		Bladder	139.9	670.93	148.9	661.93
MW-13	Within CCR	710381.40	1700701.18	802.01	805.05	153.84	5/14/1992	Sch. 80 PVC	1.00		Geomon	153.4	648.61	156.2	645.81
MW-14	Within CCR	710316.62	1697772.52	715.10	716.87	57.17	8/11/1992	Sch. 40 PVC	2.00		Bladder	45.4	669.70	54.9	660.20
MW-20	Within CCR	711000.12	1699440.88	679.99	682.03	21.04	8/18/1992	Sch. 40 PVC	2.00		Bladder	8.9	671.09	17.9	662.09
Hydrologic Unit 4															
MW-8	Within CCR	710824.89	1699403.52	675.49	677.23	55.74	7/29/1992	Sch. 40 PVC	2.00		Bladder	44.0	631.49	52.9	622.59
MW-9	Northeast	712312.49	1700764.50	643.00	644.90	55.90	8/6/1992	Sch. 40 PVC	2.00		Bladder	43.8	599.20	52.9	590.10
MW-15	Within CCR	710987.84	1699433.25	679.29	681.20	56.91	7/22/1992	Sch. 40 PVC	2.00		Bladder	44.9	634.39	53.9	625.39
MW-21	Within CCR	711473.35	1700163.80	658.00	659.90	38.00	9/18/1996	Sch. 40 PVC	2.00		Bladder	26.0	632.00	35.0	623.00
MW-22	Within CCR	712351.22	1699713.80	803.13	805.31	194.78	9/6/1996	Sch. 40 PVC	2.00		Bladder	162.5	640.63	191.5	611.63
MW-33	Within CCR	710919.61	1699640.40	669.81	671.75	43.04	1/23/1997	Sch. 40 PVC	2.00		Artesian	21.0	648.81	40.0	629.81
Pittsburg Sandstone															
MW-40	Northeast	713774.44	1701332.17	627.70	630.40	143.20	9/6/2005	Sch. 40 PVC	2.00	B-0502	Bladder	110.8	516.90	139.8	487.90
Redstone Coal															
MW-41	Northeast	713774.45	1702218.68	797.60	800.40	341.10	8/1/2005	Sch. 40 PVC	2.00	MW-41	Geomon	338.3	459.30	340.3	457.30
MW-42	Northeast	713774.44	1701330.67	627.70	630.00	154.20	9/8/2005	Sch. 40 PVC	2.00	MW-42	Geomon	151.9	475.80	153.9	473.80
Pittsburg Coal															
MW-32	Northeast	712296.27	1700787.80	643.91	645.52	179.61	9/20/1996	Sch. 40 PVC	2.00		Bladder	167.8	476.11	176.9	467.01
Piezometers															
CTL PZ-1	West	709998.16	1696524.13	782.23	782.05	15.82	9/22/2004	PVC	2.00		Unknown	6.0	776.23	16.0	766.23
CTL PZ-4	West	710059.37	1696647.85	805.58	808.49	24.76	1/4/2005	PVC	2.00		Unknown	1.9	803.73	21.9	783.73
MW-46S	Southwest	709239.51	1696756.35	808.77	811.46	12.99	1/27/2010	Sch. 40 PVC	2.00		Unknown	10.3	798.47	15.0	793.77
MW-47S	West	710207.91	1696564.95	793.01	796.03	15.92	2/2/2010	Sch. 40 PVC	2.00		Unknown	12.9	780.11	17.5	775.51
HMW-1	Within CCR	710233.78	1697658.66	855.76	858.07	128.00	12/13/2005	PVC	2.00		Unknown	117.9	737.87	127.9	727.87
HMW-2	Within CCR	710127.81	1696921.69	840.75	843.09	50.00	12/14/2005	PVC	2.00		Unknown	40.2	800.51	50.2	790.51
HMW-3	Within CCR	710173.79	1697226.51	843.59	846.06	44.00	12/19/2005	PVC	2.00		Unknown	32.9	810.74	42.9	800.74
HMW-4	Within CCR	709990.51	1697123.71	842.47	844.85	72.00	12/19/2005	PVC	2.00		Unknown	51.4	791.10	71.4	771.10
HMW-5	Within CCR	709598.07	1697062.93	842.37	844.86	28.50	12/20/2005	PVC	2.00		Unknown	17.7	824.65	27.7	814.65

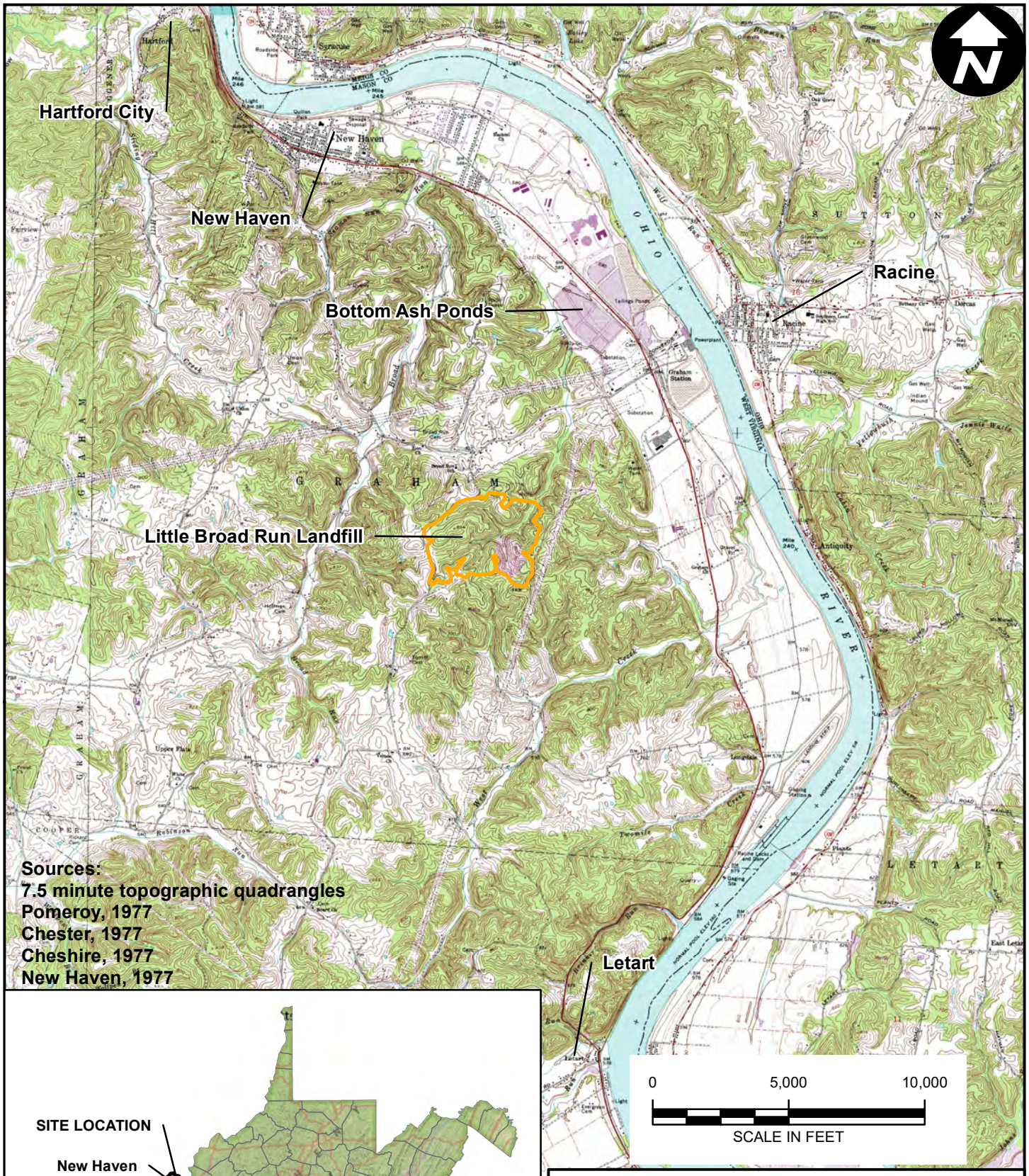
Notes:
Shaded - well not verified or abandoned
Elevation in feet above mean sea level
Source for all wells except MW-1611 and MW-1612: AEP DWG. NO. 1-30045-F. Monitoring Wells Construction Details Table
a. 1983 West Virginia State Planar Coordinates
b. Well coordinates were surveyed by AEP in September 2016
amsl - above mean sea level
bls - below land surface
ft - feet

Table 3
Packer Testing Results Summary
AEP Mountaineer Generating Plant -
Little Broad Run Landfill
New Haven, West Virginia

Well/Borehole ID	Packer Interval ft bgs	Packer Interval Lithology Description	Hydraulic Conductivity ft/day	Hydraulic Conductivity cm/sec
SB-1602R	200-210	SANDSTONE - SHALE	--	--
	236-246	SANDSTONE - SHALE	--	--
SB-1609R	52-62	SHALE	--	--
SB-1610	147-157	SANDSTONE	--	--
	184-194	SANDSTONE - SHALE	--	--
MW-1611	29-39	SANDSTONE - SHALE	2.83	1.0E-03
	33-43	SANDSTONE - SHALE	4.25	1.5E-03
MW-1612	86-96	SANDSTONE - SHALE	--	--
	96-106	MUDSTONE - SANDSTONE	--	--
	106-116	SANDSTONE	0.82	2.9E-04
	116-126	SANDSTONE - SHALE	--	--
	126-136	CLAYSTONE - MUDSTONE	--	--
	136-146	SANDSTONE - SHALE	--	--
	146-156	SANDSTONE - SHALE	--	--

Notes:
All packer tests analyses completed using USDOI Groundwater Manual (1977) analytical solution.
-- - Packer interval was tested with no flow
ft - feet
cm/sec - centimeters per second
bgs - below ground surface
USDOI - United States Department of Interior
Reference: U.S. Department of the Interior, Bureau of Reclamation, 1977. Ground Water Manual, A Water Resources Technical .
Publication, pp. 258-264

FIGURES



AEP MOUNTAINEER GENERATING PLANT - LBR LANDFILL
BROAD RUN ROAD
NEW HAVEN, WEST VIRGINIA

SITE LOCATION MAP

ARCADIS

FIGURE
1

Document Path: Z:\GISPROJECTS_ENV\AEP\MountaineerMXD\Landfill Report\Updated September 2016\F1_ Mtr Landfill Site Map.mxd

New Haven

Graham Station Road / WV-62

Bottom Ash Ponds

Broad Run Road

Little Broad Run

Little Broad Run Landfill

Ohio River

Racine

N

0 3,500 7,000

SCALE IN FEET

Legend

- Coal Combustion Residual (CCR) Unit
- Streamflow Direction
- Rivers and Streams

NOTES:
1. 2014 AERIAL IMAGERY OBTAINED FROM USDA IMAGE SERVICE.
2. CCR BOUNDARY INCLUSIVE OF LANDFILL AREAS 1 THROUGH 7.
3. WEST VIRGINIA 1983 STATE PLANAR COORDINATES

AEP MOUNTAINEER GENERATING PLANT - LBR LANDFILL
BROAD RUN ROAD
NEW HAVEN, 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)
Z:\GISPROJECTS_ENV\AEP\Mountaineer\MXD\Landfill Report\Updated September 2016\F2_ Mtr Landfill Well Network - Plant and CCR Unit Location Map.mxd 9/16/2016 10:12:21 AM

ALLUVIUM
MW-16, MW-17, MW-18, MW-19, MW-38, MW-43, MW-44S, MW-44I, MW-44D
HYDROLOGIC UNIT 1
MW-1, MW-3, MW-4, MW-5, MW-7, MW-10, MW-24, MW-28, MW-29, MW-31, MW-35, MW-36, MW-45, MW-46, MW-47
HYDROLOGIC UNIT 3
MW-2, MW-6, MW-11, MW-12, MW-13, MW-14, MW-20, MW-26, MW-30, MW-34, MW-37, MW-1612
HYDROLOGIC UNIT 4
MW-8, MW-9, MW-15, MW-21, MW-22, MW-23, MW-25, MW-27, MW-33, MW-39, MW-1611
PITTSBURG SANDSTONE
MW-40
REDSTONE COAL
MW-41, MW-42
PITTSBURG COAL
MW-32
PIEZOMETERS
CTL PZ-1, CTL PZ-4, MW-46S, MW-47S, HMW-1, HMW-2, HMW-3, HMW-4, HMW-5

Little Broad Run
Broad Run Road
Conveyor
Ohio River
Graham Station Road / WV-62
Stackout Pad
MW-44S
MW-44D
MW-44I
MW-18
MW-17
MW-16
MW-43
MW-38
MW-42
MW-39
MW-40
MW-41
MW-36
MW-37
MW-35
SB-1619R Alternate
MW-27
MW-26
MW-34
SB-1609R
SB-1619R
MW-32
MW-9
MW-19
MW-7
MW-6
MW-5
MW-21
MW-1611
SB-1610
MW-31
MW-10
MW-11
MW-20
MW-15
MW-33
MW-8
MW-22
MW-13
MW-4
HMW-3
MW-14
HMW-1
MW-47
MW-47S
MW-1612
HMW-4
HMW-2
CTL PZ-1
CTL PZ-4
HMW-5
SB-1602R
MW-1
MW-2
MW-25
MW-24
MW-46S
MW-46
MW-12
MW-3
MW-45
MW-30
MW-29
MW-28
MW-23

Legend

- CCR Unit Boundary

Monitoring Well Network (gray if abandoned)

- Alluvium
- Hydrologic Unit 1
- Hydrologic Unit 3
- Hydrologic Unit 4
- Piezometer
- Pittsburg Coal
- Pittsburg Sandstone
- Redstone Coal
- Streamflow Direction
- Rivers and Streams
- Pond Boundary
- Sporn Mine Footprint (Closed in 1975)

NOTES:
1. 2015 AERIAL IMAGERY OBTAINED FROM ESRI IMAGE SERVICE
2. WELL COORDINATE SOURCE: GROUNDWATER QUALITY AT THE PHILIP SPORN AND MOUNTAINEER POWER PLANTS, MASON COUNTY, WEST VIRGINIA. EPRI. JUNE 1999 (WEST VIRGINIA 1983 STATE PLANAR COORDINATES)
3. MONITORING WELL COORDINATES FOR MW-1611 AND MW-1612 WERE SURVEYED BY AEP IN SEPTEMBER 2016 (WEST VIRGINIA 1927 STATE PLANAR COORDINATES)
4. CCR BOUNDARY INCLUSIVE OF LANDFILL AREAS 1 THROUGH 7
5. SPORN MINE FOOTPRINT SOURCE: GALES ENGINEERING COMPANY, 1992, LITTLE BROAD RUN LANDFILL MINING SUBSIDENCE REPORT
6. SPORN MINE COAL SEAM (I.E. PITTSBURG NO. 8 COAL) BOTTOM ELEVATION IS 460 TO 480 FT AMSL (AT LEAST 170 FT BELOW LANDFILL). SEAM THICKNESS IS 60 TO 65 INCHES

0 1,000 2,000
SCALE IN FEET

AEP MOUNTAINEER GENERATING PLANT - LBR LANDFILL
BROAD RUN ROAD
NEW HAVEN, WEST VIRGINIA

LBR LANDFILL LAYOUT AND WELL LOCATION MAP

ARCADIS

FIGURE 3

City: CITRIX Div/Group: IM/DV Created By: K.Ives Last Saved By: webb
OH015976.0009.00001 (Mountaineer Ash Pond)
Z:\GISPROJECTS_ENV\AEP\Mountaineer\MXD\Landfill Report\Updated September 2016\F3_ Mtr Landfill Well Network.mxd 9/19/2016 9:23:44 AM

ALLUVIUM
MW-16, MW-17, MW-18, MW-19, MW-38, MW-43, MW-44S, MW-44I, MW-44D
HYDROLOGIC UNIT 1
MW-1, MW-3, MW-4, MW-5, MW-7, MW-10, MW-24, MW-28, MW-29, MW-31, MW-35, MW-36, MW-45, MW-46, MW-47
HYDROLOGIC UNIT 3
MW-2, MW-6, MW-11, MW-12, MW-13, MW-14, MW-20, MW-26, MW-30, MW-34, MW-37, MW-1612
HYDROLOGIC UNIT 4
MW-8, MW-9, MW-15, MW-21, MW-22, MW-23, MW-25, MW-27, MW-33, MW-39, MW-1611
PITTSBURG SANDSTONE
MW-40
REDSTONE COAL
MW-41, MW-42
PITTSBURG COAL
MW-32
PIEZOMETERS
CTL PZ-1, CTL PZ-4, MW-46S, MW-47S, HMW-1, HMW-2, HMW-3, HMW-4, HMW-5

Little Broad Run
Broad Run Road
Conveyor
Graham Station Road / WV-62
Stackout Pad
Ohio River
A
A'
B
B'
MW-18
MW-17
MW-16
MW-44S
MW-44D
MW-44I
MW-43
MW-38
MW-42
MW-39
MW-40
MW-41
MW-36
MW-37
MW-35
SB-1619R Alternate
SB-1609R
SB-1619R
MW-27
MW-26
MW-34
MW-9
MW-19
MW-32
MW-1611
MW-21
MW-7
MW-6
MW-5
SB-1610
MW-31
MW-10
MW-11
MW-20
MW-15
MW-33
MW-8
MW-22
MW-13
MW-4
MW-14
HMW-3
HMW-1
HMW-4
HMW-2
HMW-5
MW-47
MW-47S
MW-1612
CTL PZ-1
CTL PZ-4
MW-46S
MW-46
MW-12
MW-3
MW-45
MW-30
MW-29
MW-28
MW-23
SB-1602R
MW-2
MW-1
MW-25
MW-24

Legend

- CCR Unit Boundary

Monitoring Well Network (gray if abandoned)

- Alluvium
- Hydrologic Unit 1
- Hydrologic Unit 3
- Hydrologic Unit 4
- Piezometer
- Pittsburg Coal
- Pittsburg Sandstone
- Redstone Coal
- Cross Section Location
- Streamflow Direction
- Rivers and Streams
- Topographic Contour (Contour Interval - 10 feet)
- Pond Boundary

0 1,250 2,500
SCALE IN FEET

NOTES:
1. TOPOGRAPHY FROM AEP DRAWING MTLF_3_20_12_2729SF.DGN
2. WELL COORDINATE SOURCE: GROUNDWATER QUALITY AT THE PHILIP SPORN AND MOUNTAINEER POWER PLANTS, MASON COUNTY, WEST VIRGINIA. EPRI. JUNE 1999 (WEST VIRGINIA 1983 STATE PLANAR COORDINATES)
3. MONITORING WELL COORDINATES FOR MW-1611 AND MW-1612 WERE SURVEYED BY AEP IN SEPTEMBER 2016 (WEST VIRGINIA 1927 STATE PLANAR COORDINATES)
4. CCR BOUNDARY INCLUSIVE OF LANDFILL AREAS 1 THROUGH 7

AEP MOUNTAINEER GENERATING PLANT - LBR LANDFILL
BROAD RUN ROAD
NEW HAVEN, 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)
Z:\GISPROJECTS_ENV\AEP\Mountaineer\MXD\Landfill Report\Updated September 2016\F4_ Mtr Landfill Well Network - Cross Section Location Map_topo.mxd 9/19/2016 9:25:50 AM

A
SOUTHWEST

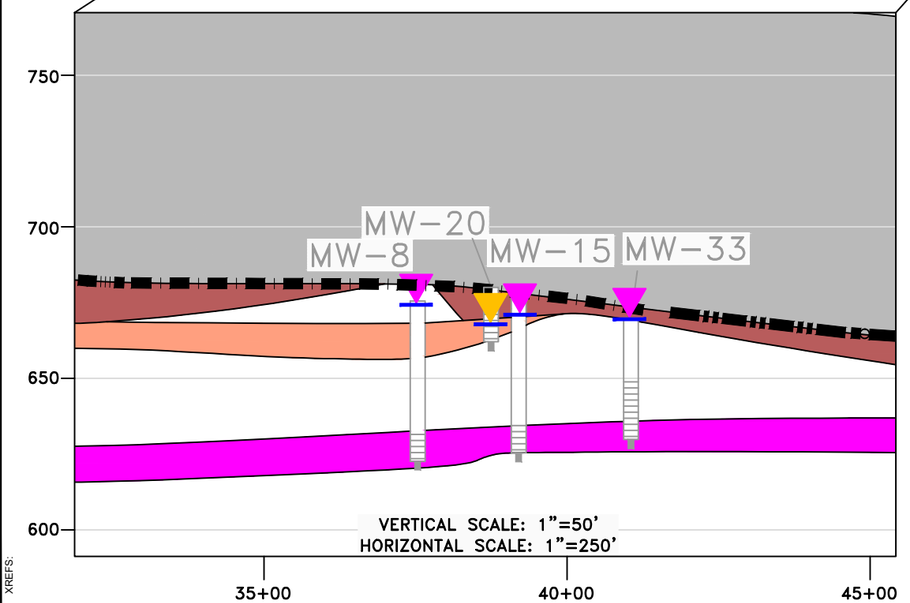
A'
NORTHEAST

ELEVATION (FEET ABOVE MEAN SEA LEVEL)

900
800
700
600
500
400

HMW-2
HMW-3
HMW-1
CURRENT GROUND SURFACE (LANDFILL)
CTL-PZ-4
MW-1612
CTL-PZ-1
MW-14
MW-20
MW-8
MW-15
MW-33
MW-21
MW-1611
POND
MW-32
MW-9
MW-19
SB-1609R
SB-1619R
POND
SB-1619R
ALTERNATE
MW-39
MW-38
PITTSBURG SANDSTONE
PITTSBURG No. 8 COAL

0+00 5+00 10+00 15+00 20+00 25+00 30+00 35+00 40+00 45+00 50+00 55+00 60+00 65+00 70+00



LEGEND

MW-8 — WELL IDENTIFICATION (GRAY IF ABANDONED)
WELL (GRAY IF ABANDONED)
WELL SCREEN
BORING
BOTTOM AND FLY ASH
ALLUVIUM AND SOILS
SHALE AND SILTSTONE
HYDROLOGIC UNIT 1 (SANDSTONE)
HYDROLOGIC UNIT 2 (SANDSTONE)
HYDROLOGIC UNIT 3 (SANDSTONE)
HYDROLOGIC UNIT 4 (SANDSTONE)
AREA 3 LINER
AREA 4 LINER
AREA 5 LINER
AREA 6 LINER
AREA 7 LINER

UPPERMOST AQUIFER

HYDROLOGIC UNIT 3 WATER LEVEL – MAXIMUM OBSERVED, AUG 1993–OCT 2002
HYDROLOGIC UNIT 4 WATER LEVEL – MAXIMUM OBSERVED, AUG 1993–OCT 2002

VERTICAL SCALE: 1"=100'
HORIZONTAL SCALE: 1"=500'

NOTES:

1. AREA 3 LINER: MINIMUM 2–FT THICK NATURAL CLAY LINER OVERLAIN BY A SINGLE UNDERDRAIN SYSTEM TO COLLECT LEACHATE AND GROUNDWATER SEEPAGE.
3. AREA 4 LINER: MINIMUM 2–FT THICK ENGINEERED CLAY LINER OVERLAIN BY A SINGLE UNDERDRAIN SYSTEM, AS WELL AS A GROUNDWATER INTERCEPTOR DRAIN SYSTEM BENEATH THE CLAY LINER TO CAPTURE SPRING FLOW FROM PERCHED GROUNDWATER.
4. AREA 5 LINER: GROUNDWATER INTERCEPTOR DRAINAGE SYSTEM, MINIMUM 1–FT COMPACTED OR IN–PLACE CLAYEY SUBBASE, MINIMUM 2–FT OF COMPACTED CLAY LINER, LEACHATE COLLECTION SYSTEM (LCS), AND 18–INCH PROTECTIVE COVER ZONE.
5. AREA 6 LINER: GROUNDWATER INTERCEPTOR DRAINAGE SYSTEM, 1–FT MINIMUM COMPACTED OR IN–PLACE CLAYEY SUBBASE, MINIMUM 2–FT OF COMPACTED CLAY LINER, LEACHATE COLLECTION SYSTEM (LCS), AND 18–INCH PROTECTIVE COVER ZONE.
6. AREA 7 LINER: GROUNDWATER INTERCEPTOR DRAINAGE SYSTEM, MINIMUM 1–FT COMPACTED OR IN–PLACE CLAYEY SUBBASE, MINIMUM 2–FT OF COMPACTED CLAY LINER, LEACHATE COLLECTION SYSTEM (LCS), AND 18–INCH PROTECTIVE COVER ZONE.

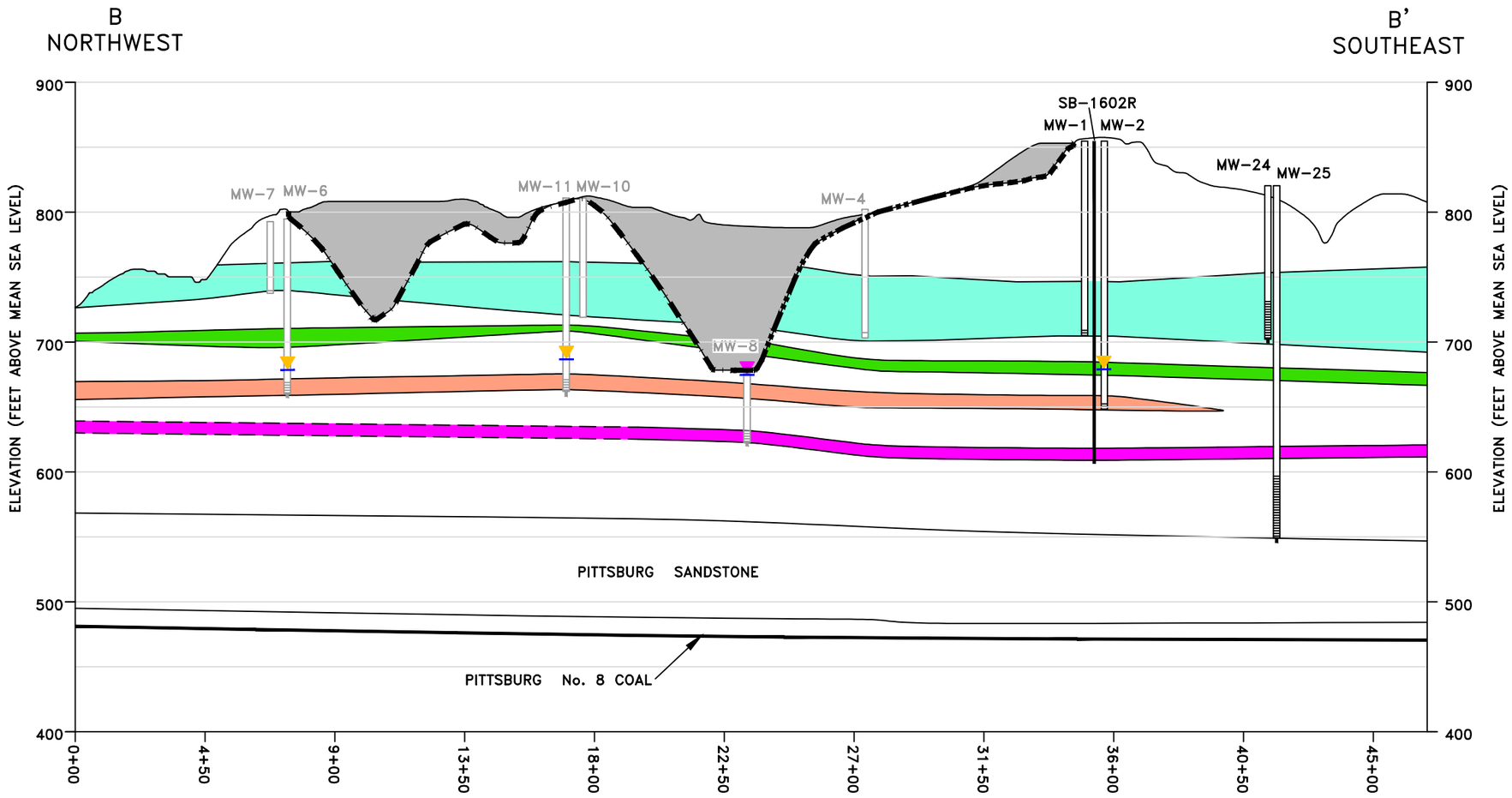
AEP MOUNTAINEER GENERATING PLANT - LBR LANDFILL
BROAD RUN ROAD
NEW HAVEN, WEST VIRGINIA

CROSS SECTION A-A'

ARCADIS Design & Consultancy for natural and built assets

FIGURE
5A

G:\ENVCAD\Columbus-OH\ACT\OH015976 - AEP MOUNTAINEER\00090003 - LANDFILL\OH015976-MTR-LBR LANDFILL-2016-CS.dwg LAYOUT: CS A-A SAVED: 9/22/2016 12:08 PM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ACAD.CTB PLOTTED: 9/22/2016 12:20 PM BY: SMITH, BOB
XREFS:



NOTES:

1. AREA 1 LINER: MINIMUM 2-FT THICK NATURAL CLAY LINER OVERLAIN BY A SINGLE UNDERDRAIN SYSTEM TO COLLECT LEACHATE AND GROUNDWATER SEEPAGE.
2. AREA 4 LINER: MINIMUM 2-FT THICK ENGINEERED CLAY LINER OVERLAIN BY A SINGLE UNDERDRAIN SYSTEM, AS WELL AS A GROUNDWATER INTERCEPTOR DRAIN SYSTEM BENEATH THE CLAY LINER TO CAPTURE SPRING FLOW FROM PERCHED GROUNDWATER.
3. AREA 6 LINER: GROUNDWATER INTERCEPTOR DRAINAGE SYSTEM, MINIMUM 1-FT COMPACTED OR IN-PLACE CLAYEY SUBBASE, MINIMUM 2-FT OF COMPACTED CLAY LINER, LEACHATE COLLECTION SYSTEM (LCS), AND 18-INCH PROTECTIVE COVER ZONE.

LEGEND

- BOTTOM AND FLY ASH
- SHALE AND SILTSTONE
- HYDROLOGIC UNIT 1 (SANDSTONE)
- HYDROLOGIC UNIT 2 (SANDSTONE)
- HYDROLOGIC UNIT 3 (SANDSTONE)
- HYDROLOGIC UNIT 4 (SANDSTONE)
- AREA 1 LINER
- AREA 4 LINER
- AREA 6 LINER

MW-8 — WELL IDENTIFICATION (GRAY IF ABANDONED)
- WELL (GRAY IF ABANDONED)
- WELL SCREEN
- BORING

UPPERMOST AQUIFER
- HYDROLOGIC UNIT 3 WATER LEVEL – MAXIMUM OBSERVED, AUG 1993–OCT 2002
- HYDROLOGIC UNIT 4 WATER LEVEL – MAXIMUM OBSERVED, AUG 1993–OCT 2002

VERTICAL SCALE: 1"=100'

HORIZONTAL SCALE: 1"=450'

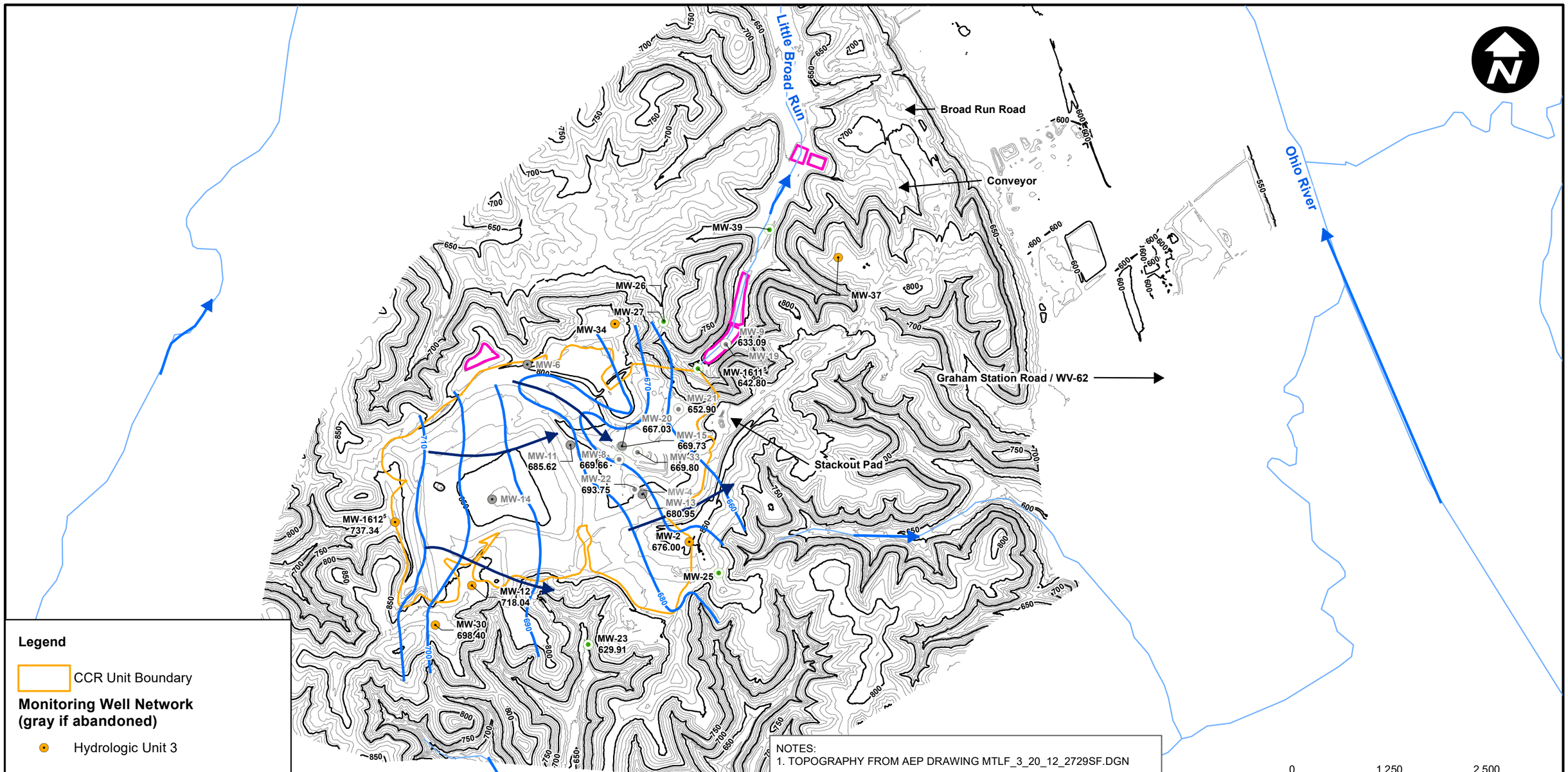
AEP MOUNTAINEER GENERATING PLANT - LBR LANDFILL
BROAD RUN ROAD
NEW HAVEN, WEST VIRGINIA

CROSS SECTION B-B'

ARCADIS Design & Consultancy for natural and built assets

FIGURE
5B

G:\ENVCAD\Columbus-OH\ACTIVE\OH015976 - AEP MOUNTAINEER\00090003 - LANDFILL\OH015976-MTR-LBR LANDFILL-2016-CS.dwg LAYOUT: CS B-B SAVED: 9/22/2016 12:08 PM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ACAD.CTB PLOTTED: 9/22/2016 12:20 PM BY: SMITH, BOB
XREFS:



Legend

- CCR Unit Boundary

Monitoring Well Network (gray if abandoned)

- Hydrologic Unit 3
- Hydrologic Unit 4
- Potentiometric Surface Contour Lines
- Estimated Groundwater Flow Path
- Streamflow Direction
- Rivers and Streams
- Topographic Contour (Contour Interval - 10 feet)
- Pond Boundary

NOTES:

1. TOPOGRAPHY FROM AEP DRAWING MTLF_3_20_12_2729SF.DGN
2. WELL COORDINATE SOURCE: GROUNDWATER QUALITY AT THE PHILIP SPORN AND MOUNTAINEER POWER PLANTS, MASON COUNTY, WEST VIRGINIA. EPRI. JUNE 1999 (WEST VIRGINIA 1983 STATE PLANAR COORDINATES)
3. MONITORING WELL COORDINATES FOR MW-1611 AND MW-1612 WERE SURVEYED BY AEP IN SEPTEMBER 2016 (WEST VIRGINIA 1927 STATE PLANAR COORDINATES)
4. CCR BOUNDARY INCLUSIVE OF LANDFILL AREAS 1 THROUGH 7
5. WATER LEVELS FOR MW-1611 AND MW-1612 WERE COLLECTED DURING WELL DEVELOPMENT IN JULY AND AUGUST 2016, RESPECTIVELY. THESE WELLS WERE NOT USED FOR CONTOURING, BUT ARE INCLUDED TO ILLUSTRATE THAT 2016 GROUNDWATER ELEVATIONS WERE CONSISTENT WITH HISTORICAL OBSERVATIONS BOTH UPGRADIENT AND DOWNGRADIENT OF THE CCR UNIT

AEP MOUNTAINEER GENERATING PLANT - LBR LANDFILL
BROAD RUN ROAD
NEW HAVEN, WEST VIRGINIA

POTENTIOMETRIC SURFACE MAP - UPPERMOST AQUIFER OCTOBER 2001

ARCADIS

FIGURE 6

City: CITRIX Div/Group: IM/DV Created By: K.Ives Last Saved By: webb
OH015976.0009.00001 (Mountaineer Ash Pond)
Z:\GISPROJECTS_ENV\AEP\Mountaineer\MXD\Landfill Report\Updated September 2016\F6_Mtr Landfill Well Network - POT Surface Map Uppermost-topo.mxd 9/19/2016 10:21:42 AM

Alluvium
MW-38
Hydrologic Unit 3 Upgradient
MW-30, MW-1612
Hydrologic Unit 3 Downgradient
MW-26
Hydrologic Unit 4 Downgradient
MW-27, MW-39, MW-1611

Little Broad Run

Broad Run Road

Conveyor

Ohio River

MW-39 MW-38

MW-27 MW-26

MW-1611

Graham Station Road / WV-62

Stackout Pad

MW-1612

MW-30

Legend

- CCR Unit Boundary

Monitoring Well Network

- Upgradient Monitoring Well
- Downgradient Monitoring Well
- Streamflow Direction
- Rivers and Streams
- Pond Boundary
- Sporn Mine Footprint (Closed in 1975)

NOTES:
1. 2015 NAIP AERIAL IMAGERY OBTAINED FROM ESRI IMAGE SERVICE.
2. WELL COORDINATE SOURCE: GROUNDWATER QUALITY AT THE PHILIP SPORN AND MOUNTAINEER POWER PLANTS, MASON COUNTY, WEST VIRGINIA. EPRI. JUNE 1999 (WEST VIRGINIA 1983 STATE PLANAR COORDINATES)
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4. CCR BOUNDARY INCLUSIVE OF LANDFILL AREAS 1 THROUGH 7
5. SPORN MINE FOOTPRINT SOURCE: GALES ENGINEERING COMPANY, 1992, LITTLE BROAD RUN LANDFILL MINING SUBSIDENCE REPORT
6. SPORN MINE COAL SEAM (I.E. PITTSBURG NO. 8 COAL) BOTTOM ELEVATION IS 460 TO 480 FT AMSL (AT LEAST 170 FT BELOW LANDFILL). SEAM THICKNESS IS 60 TO 65 INCHES

0 1,000 2,000
SCALE IN FEET

AEP MOUNTAINEER GENERATING PLANT - LBR LANDFILL
BROAD RUN ROAD
NEW HAVEN, 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\AEP\Mountaineer\MXD\Landfill Report\Updated September 2016\F7_ Mtr Landfill Proposed Well Network_v2.mxd 9/22/2016 10:12:44 AM

APPENDIX A

Boring/Well Construction Logs

ARCADIS

AEP 1986, 1992

Boring Logs

B-400 to B-405, BFA-1

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 713,091.5 E 1,734,431.1**

GROUND ELEVATION **792.2** SYSTEM _____

Water Level, ft	▽ **56.0**	▼	▼
TIME			
DATE	**5/2/1986**		

BORING NO. **B-400** DATE **7/23/15** SHEET **1** OF **9**

BORING START **3/12/86** BORING FINISH **3/18/86**

PIEZOMETER TYPE _____ WELL TYPE _____

HGT. RISER ABOVE GROUND _____ DIA _____

DEPTH TO TOP OF WELL SCREEN _____ BOTTOM _____

WELL DEVELOPMENT _____ BACKFILL _____

FIELD PARTY **ROUSH/LAMBERT** RIG **B-61**

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
		0.0	3.0							**BROWN CLAY**		
1	SS	3.0	4.5	2-3-6	1.2							
							5					
2	SS	8.0	8.2	50/.2	0.1					**GREENISH BROWN CLAY SHALE**		Started coring @ 8.2'
3	NQ2	8.2	15.0		6.6							
							10			**GREENISH BROWN SANDSTONE**		
										GRAY SANDSTONE		
										BROWN SANDY SHALE		
										GRAY SANDSTONE		
4	NQ2	15.0	25.0		8.6		15			**BROWN SANDSTONE**		
										BROWN SHALE		
										GRAY SANDY SHALE		
										GRAY CLAY SHALE		
										GRAY SANDY SHALE		

TYPE OF CASING USED

X	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"
	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 **JCM**

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-400** DATE **7/23/15** SHEET **2** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/12/86** BORING FINISH **3/18/86**

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
										GRAY CLAY SHALE		
										GRAY SANDY SHALE		
5	NQ2	25.0	35.0		9.3		25			**MULTI COLOR CLAY SHALE**		
										GRAY SANDSTONE		
										GRAY SANDY SHALE		
										GRAY SANDSTONE		
										GRAY CLAY SHALE		
							30			**MULTI COLOR CLAY SHALE**		
										RED CLAY SHALE		
6	NQ2	35.0	45.0		9.8		35					
										GRAY CLAY SHALE		
							40					
7	NQ2	45.0	55.0		10.0		45			**GRAY SANDSTONE**		

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-400** DATE **7/23/15** SHEET **3** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/12/86** BORING FINISH **3/18/86**

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
										GREENISH BROWN SANDY SHALE		
										GREENISH BROWN COARSE GRAIN SANDSTONE		
							50					
8	NQ2	55.0	65.0		10.0		55				▽	
							60					
9	NQ2	65.0	75.0		10.0		65			**GRAY COARSE GRAIN SANDSTONE**		
							70					

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-400** DATE **7/23/15** SHEET **4** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/12/86** BORING FINISH **3/18/86**

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
							75					
10	NQ2	75.0	80.0		4.9					**GREENISH COARSE GRAIN SANDSTONE**		
										GRAY CLAY SHALE		
11	NQ2	80.0	85.0		5.0		80			**MULTI COLOR CLAY SHALE**		
										GRAY CLAY SHALE		
12	NQ2	85.0	95.0		10.0		85					
							90			**RED CLAY SHALE**		
										GRAY CLAY SHALE		
										RED & GRAY CLAY SHALE		
13	NQ2	95.0	105.0		10.0		95			**GRAY CLAY SHALE**		

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-400** DATE **7/23/15** SHEET **5** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/12/86** BORING FINISH **3/18/86**

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
							100			**RED CLAY SHALE**		
										GRAY CLAY SHALE		
										GRAY SANDSTONE		
										GRAY CLAY SHALE		
14	NQ2	105.0	110.0		4.8		105					
										RED CLAY SHALE		
15	NQ2	110.0	115.0		5.0		110					
										GRAY CLAY SHALE		
16	NQ2	115.0	125.0		10.0		115					
										RED & GRAY CLAY SHALE		
										GRAY CLAY SHALE		
							120			**RED & GRAY CLAY SHALE**		
										GRAY CLAY SHALE		
										RED CLAY SHALE		
										GRAY CLAY SHALE		
										MULTI COLOR CLAY SHALE		

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-400** DATE **7/23/15** SHEET **6** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/12/86** BORING FINISH **3/18/86**

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
							125			**GRAY SANDY SHALE**		
17	NQ2	125.0	135.0		9.9					**GRAY SANDSTONE**		
										GRAY SANDY SHALE		
										GRAY SANDSTONE		
							130			**GRAY CLAY SHALE**		
										RED CLAY SHALE		
18	NQ2	135.0	139.8				135			**MULTI COLOR CLAY SHALE**		
19	NQ2	139.8	145.0		5.1		140			**RED CLAY SHALE**		
20	NQ2	145.0	155.0		9.9		145			**GRAY CLAY SHALE**		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-400** DATE **7/23/15** SHEET **7** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/12/86** BORING FINISH **3/18/86**

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
										GRAY SILTSTONE		
										RED CLAY SHALE		
										GRAY SILTSTONE		
21	NQ2	155.0	165.0		10.0		155			**GRAY SANDSTONE**		
										GRAY CLAY SHALE		
										RED & GRAY CLAY SHALE		
										RED CLAY SHALE		
							160					
							165					
22	NQ2	165.0	175.0		9.7					**GRAY CLAY SHALE**		
										GRAY SANDSTONE		
										GRAY CLAY SHALE		
							170			**RED CLAY SHALE**		
										GRAY SILTSTONE		
										RED SILTSTONE		
										GRAY SILTSTONE		
23	NQ2	175.0	185.0		9.9		175			**GRAY SANDSTONE**		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-400** DATE **7/23/15** SHEET **8** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/12/86** BORING FINISH **3/18/86**

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
										GRAY SILTSTONE		
							180			**GRAY SANDSTONE**		
										GRAY SILTSTONE		
										GRAY SANDSTONE		
24	NQ2	185.0	195.0		9.8		185			**GRAY FINE GRAIN SANDSTONE**		
							190					
25	NQ2	195.0	200.0		4.8		195			**GRAY SILTSTONE**		
										GRAY CLAY SHALE		
										RED CLAY SHALE		
										RED & GRAY CLAY SHALE		
26	NQ2	200.0	210.0		9.8		200			**GRAY CLAY SHALE**		
										MULTI COLOR CLAY SHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-400** DATE **7/23/15** SHEET **9** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/12/86** BORING FINISH **3/18/86**

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
										RED CLAY SHALE		
							205					
										GRAY CLAY SHALE		
							210					Stopped boring @ 210.0' on 3/18/1986

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 713,554.3 E 1,730,964.3**

GROUND ELEVATION **692.1** SYSTEM _____

Water Level, ft	▽ 27.7	▼	▼
TIME			
DATE	5/2/1986		

BORING NO. **B-401** DATE **7/23/15** SHEET **1** OF **5**

BORING START **4/3/86** BORING FINISH **4/7/86**

PIEZOMETER TYPE _____ WELL TYPE _____

HGT. RISER ABOVE GROUND _____ DIA _____

DEPTH TO TOP OF WELL SCREEN _____ BOTTOM _____

WELL DEVELOPMENT _____ BACKFILL _____

FIELD PARTY **ROUSH/LAMBERT** RIG **B-61**

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	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
		0.0	2.5							**REDDISH BROWN CLAY**		
1	SS	2.5	4.0	4-10-13	1.0		5					
2	SS	7.5	9.0	3-6-8	1.4					**REDDISH BROWN CLAYEY SAND**		
3	SS	12.5	13.9	10-14-50/.5	1.3		10			**BROWN SANDSTONE IN END OF SPOON**		
										BROWN SANDSTONE		
4	SS	17.5	17.6	50/.1	0		15					Auger refusal @ 18.1'. Moved over 3.0', drilled casing to 18.0' and started coring.
5	NQ2	18.0	25.3		7.3	100						

TYPE OF CASING USED

X	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"
	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 **JCM**

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-401** DATE **7/23/15** SHEET **2** OF **5**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **4/3/86** BORING FINISH **4/7/86**

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
										GRAY SANDSTONE		
										BROWN SANDSTONE		
										GRAY SANDSTONE		
6	NQ2	25.3	33.4		4.5	39	25			**BROWN SANDY SHALE**		
										GRAY SANDY SHALE		
										BADLY BROKEN GRAY CLAY SHALE		
										BADLY BROKEN RED CLAY SHALE	▽	
7	NQ2	33.4	35.3		1.6	52	30					
8	NQ2	35.3	45.3		10	77	35			**RED CLAY SHALE**		
										GRAY CLAY SHALE		
							40			**RED CLAY SHALE**		
										GRAY CLAY SHALE		
										GRAY SANDSTONE		
										GRAY CLAY SHALE		
										RED CLAY SHALE		
										GRAY CLAY SHALE		
9	NQ2	45.3	55.3		10	100	45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-401** DATE **7/23/15** SHEET **3** OF **5**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **4/3/86** BORING FINISH **4/7/86**

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
							50					
										GRAY SANDY SHALE		
10	NQ2	55.3	65.3		9.9	88	55					
							60					
										GRAY SANDSTONE		
11	NQ2	65.3	70.3		4.9	98	65			**RED & GRAY CLAY SHALE**		
12	NQ2	70.3	75.3		4.6	76	70			**GRAY CLAY SHALE**		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-401** DATE **7/23/15** SHEET **4** OF **5**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **4/3/86** BORING FINISH **4/7/86**

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
							75			**RED & GRAY CLAY SHALE**		
13	NQ2	75.3	84.3		3.9					**RED CLAY SHALE**		
							80			**GRAY CLAY SHALE**		
										GRAY SILTSTONE		
14	NQ2	84.3	94.3		9.9	100	85			**GRAY CLAY SHALE**		
							90					
15	NQ2	94.3	100.0		5.6	95	95			**RED CLAY SHALE**		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-401** DATE **7/23/15** SHEET **5** OF **5**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **4/3/86** BORING FINISH **4/7/86**

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
												Stopped boring @ 100.0' on 4/1/1986
							100					

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 712,518.0 E 1,730,842.0**

GROUND ELEVATION **813.1** SYSTEM _____

Water Level, ft	▽ **62.7**	▼	▼
TIME			
DATE	**5/2/1986**		

BORING NO. **B-402** DATE **7/23/15** SHEET **1** OF **10**

BORING START **3/19/86** BORING FINISH **3/24/86**

PIEZOMETER TYPE _____ WELL TYPE _____

HGT. RISER ABOVE GROUND _____ DIA _____

DEPTH TO TOP OF WELL SCREEN _____ BOTTOM _____

WELL DEVELOPMENT _____ BACKFILL _____

FIELD PARTY **ROUSH/LAMBERT** RIG **B-61**

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
		0.0	5.0									Drilled casing to 5.0' and started coring.
1	NQ2	5.0	14.4		9.4	82	5			**BROWN SHALE**		
							10					
										BROWN SANDY SHALE		
										BROWN SANDSTONE		
2	NQ2	14.4	24.4		9.5	80	15			**GREENISH BROWN SANDSTONE**		
										BROWN CLAY SHALE		
										GREENISH BROWN SANDSTONE		
										GREENISH BROWN CLAY SHALE		
										GRAY CLAY SHALE		

TYPE OF CASING USED

X	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 **JCM**

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-402** DATE **7/23/15** SHEET **2** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/19/86** BORING FINISH **3/24/86**

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
										GRAY SANDSTONE		
										GRAY CLAY SHALE		
3	NQ2	24.4	34.4		8.5	83	25			**RED & GRAY CLAY SHALE**		
4	NQ2	34.4	44.4		9.9	88	30			**RED CLAY SHALE**		
							35			**GRAY CLAY SHALE**		
5	NQ2	44.4	54.4		9.9	98	40			**GREENISH BROWN SANDSTONE**		
							45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-402** DATE **7/23/15** SHEET **3** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/19/86** BORING FINISH **3/24/86**

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
6	NQ2	54.4	64.4		10	100	50					
							55					
							60				▽	
7	NQ2	64.4	74.4		9.8	87	65			**WHITE SANDSTONE**		
										GREENISH WHITE SANDSTONE		
										GREENISH BROWN SHALE		
										GREENISH BROWN SANDSTONE		
										GRAY SANDSTONE		
							70					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-402** DATE **7/23/15** SHEET **4** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/19/86** BORING FINISH **3/24/86**

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
										GRAY CLAY SHALE		
										RED CLAY SHALE		
8	NQ2	74.4	84.4		10.2	100	75			**GRAY CLAY SHALE**		Picked up 0.2' of recovery from previous run.
							80			**RED & GRAY CLAY SHALE**		
										GRAY SANDSTONE		
9	NQ2	84.4	94.4		10	100	85			**GRAY CLAY SHALE**		
										RED & GRAY CLAY SHALE		
										GRAY SILTSTONE		
							90					
										GRAY CLAY SHALE		
10	NQ2	94.4	104.4		9.5	98	95					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-402** DATE **7/23/15** SHEET **5** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/19/86** BORING FINISH **3/24/86**

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
							100			**GRAY SANDSTONE**		
										GRAY CLAY SHALE		
11	NQ2	104.4	114.4		10	100	105			**RED CLAY SHALE**		
										GRAY SANDY CLAY SHALE		
12	NQ2	114.4	124.4		9.8	98	110					
							115			**GRAY SANDSTONE**		
										GRAY CLAY SHALE		
										RED CLAY SHALE		
										MULTI COLOR CLAY SHALE		
										GRAY CLAY SHALE		
							120			**GRAY SANDSTONE**		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-402** DATE **7/23/15** SHEET **6** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/19/86** BORING FINISH **3/24/86**

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
13	NQ2	124.4	134.4		9.5	89	125					
										GRAY CLAY SHALE		
										MULTI COLOR CLAY SHALE		
14	NQ2	134.4	144.4		9.9	90	130					
							135			**RED CLAY SHALE**		
										GRAY CLAY SHALE		
										GRAY SILTSTONE		
							140					
										GRAY SANDSTONE		
15	NQ2	144.4	154.4		9.5	94	145					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-402** DATE **7/23/15** SHEET **7** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/19/86** BORING FINISH **3/24/86**

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
										GRAY CLAY SHALE		
										RED CLAY SHALE		
16	NQ2	154.4	164.4		9.9	80	155					
							160					
										GRAY CLAY SHALE		
17	NQ2	164.4	174.4		10	100						
							165					
							170					
										GRAY SANDSTONE		
18	NQ2	174.4	184.4		10	100						
							175					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-402** DATE **7/23/15** SHEET **8** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/19/86** BORING FINISH **3/24/86**

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	NQ2	184.4	194.4		9.2	98	180					
							185					
							190			**GRAY SILTSTONE**		
										RED CLAY SHALE		
20	NQ2	194.4	204.4		10	79	195			**RED & GRAY CLAY SHALE**		
										GRAY CLAY SHALE		
							200			**RED & GRAY CLAY SHALE**		
										RED CLAY SHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-402** DATE **7/23/15** SHEET **9** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/19/86** BORING FINISH **3/24/86**

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	NQ2	204.4	214.4		9.9	98	205			**MULTI COLOR CLAY SHALE**		
										GRAY CLAY SHALE		
										GRAY SILTSTONE		
22	NQ2	214.4	224.4		10	100	210			**GRAY SANDSTONE**		
							215			**GRAY CLAY SHALE**		
							220					
23	NQ2	224.4	230.0		4.9	78				**MULTI COLOR CLAY SHALE**		
							225					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-402** DATE **7/23/15** SHEET **10** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/19/86** BORING FINISH **3/24/86**

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
							230					Stopped boring @ 230.0' on 3/24/1986

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 709,726.8 E 1,731,757.6**

GROUND ELEVATION **854.6** SYSTEM _____

Water Level, ft	▽ 14.0	▼	▼
TIME			
DATE	02-06-86		

BORING NO. **B-403** DATE **7/23/15** SHEET **1** OF **12**

BORING START **2/5/86** BORING FINISH _____

PIEZOMETER TYPE _____ WELL TYPE **GM**

HGT. RISER ABOVE GROUND **1.74-1.74** DIA **3"**

DEPTH TO TOP OF WELL SCREEN _____ BOTTOM _____

WELL DEVELOPMENT **SEE NOTES** BACKFILL **CEMENT/BENTONIT**

FIELD PARTY **ROUSH/LAMBERT** RIG **B-61**

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
										AUGERED		Wells MW-1 and MW-2 were installed in boring B-403.
1	NQ	7.2	14.7		7.5	92	5			BROWN CLAYSHALE		
2	NQ	14.7	24.7		10	90	10			BROWN SANDY SHALE		
							15			BROWN CLAYSHALE		
										BROWN SANDY SHALE		
										BROWN SANDSTONE		
										GRAY SANDSTONE		

TYPE OF CASING USED

X	NQ-2 ROCK CORE	
	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
X	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 **JCM**

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-403** DATE **7/23/15** SHEET **2** OF **12**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **2/5/86** BORING FINISH _____

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
										RED CLAYSHALE		
										GRAY CLAYSHALE		
3	NQ	24.7	34.7		10	100	25			RED CLAYSHALE		
										GRAY CLAYSHALE		
							30					30.0 Top of seal.
										RED CLAYSHALE		
4	NQ	34.7	44.7		9.2	92	35			RED CLAYSHALE		
							40					39.4 Top of gravel.
5	NQ	44.7	50.8		6.1	96	45			RED AND GRAY CLAYSHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-403** DATE **7/23/15** SHEET **3** OF **12**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **2/5/86** BORING FINISH _____

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
6	NQ	50.8	52.3		1.3	77	50			RED CLAYSHALE		
7	NQ	52.3	54.7		2.0	83						
8	NQ	54.7	64.7		10	100	55			GRAY CLAYSHALE GRAY SANDY SHALE		
							60			GRAY CLAYSHALE GRAY SANDY SHALE GRAY CLAYSHALE GRAY SANDY SHALE		
9	NQ	64.7	74.7		10	100	65					
							70			GRAY SANDSTONE GRAY CLAYSHALE GRAY SANDY SHALE GRAY CLAYSHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-403** DATE **7/23/15** SHEET **4** OF **12**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **2/5/86** BORING FINISH

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
10	NQ	74.7	84.7		9.6	96	75			GRAY SANDSTONE		
										GRAY SANDY SHALE		
										GRAY CLAYSHALE		
							80					
11	NQ	84.7	89.7		5.0	92	85			RED CLAYSHALE		
12	NQ	89.7	94.7		5.0	100	90			GRAY CLAYSHALE		
13	NQ	94.7	104.7		9.9	99	95					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-403** DATE **7/23/15** SHEET **5** OF **12**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **2/5/86** BORING FINISH _____

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
							100					
										RED CLAYSHALE		
14	NQ	104.7	107.6		2.6	94	105					
15	NQ	107.6	114.7		7.0	100				GRAY CLAYSHALE		
										GRAY SANDSTONE		
							110			GRAY SILTSTONE		
										GRAY SANDSTONE		
										GRAY SILTSTONE		
										GRAY SANDSTONE		
16	NQ	114.7	124.7		10	100	115					
										GRAY SILTSTONE		
							120					
										GRAY SANDSTONE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-403** DATE **7/23/15** SHEET **6** OF **12**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **2/5/86** BORING FINISH _____

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
17	NQ	124.7	134.7		9.8	98	125					
										GRAY CLAYSHALE		
							130			GRAY SILTSTONE		
18	NQ	134.7	144.7		9.9	99	135					
							140			GRAY SANDSTONE		
19	NQ	144.7	154.7		9.9	99	145			GRAY SILTSTONE		145.6 Top of screen.
										RED CLAYSHALE		149.6 Bottom of

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-403** DATE **7/23/15** SHEET **7** OF **12**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **2/5/86** BORING FINISH _____

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
												screen.
												151.0 Bottom of gravel pack.
20	NQ	154.7	161.5		6.3	77	155			GRAY SILTSTONE		
										RED CLAYSHALE		
21	NQ	161.5	164.7		3.2	92	160					
22	NQ	164.7	174.7		10	100	165			GRAY SILTSTONE		
												168.9 Top of gravel pack.
							170			GRAY SANDSTONE		
										GRAY SILTSTONE		
23	NQ	174.7	184.7		9.8	97	175			GRAY CLAYSHALE		
										RED CLAYSHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-403** DATE **7/23/15** SHEET **8** OF **12**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **2/5/86** BORING FINISH _____

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
										GRAY SILTSTONE		
							180					
24	NQ	184.7	191.3		6.4	56	185			MULTI-COLORED CLAYSHALE		
							190					
25	NQ	191.3	194.7		78	78				RED CLAYSHALE		
26	NQ	194.7	204.7		9.9	90	195					
										GRAY SANDSTONE		
							200					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-403** DATE **7/23/15** SHEET **9** OF **12**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **2/5/86** BORING FINISH _____

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
27	NQ	204.7	214.7		10		205			GRAY CLAYSHALE GRAY SANDSTONE GRAY CLAYSHALE RED CLAYSHALE RED AND GRAY CLAYSHALE RED CLAYSHALE GRAY CLAYSHALE RED CLAYSHALE		202.3 Top of screen. 206.3 Bottom of screen. 212.0 Bottom of gravel pack.
28	NQ	214.7	224.7		9.8	87	210 215			GRAY CLAYSHALE RED CLAYSHALE GRAY CLAYSHALE		
29	NQ	224.7	234.7		9.8	95	220 225			RED CLAYSHALE GRAY CLAYSHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-403** DATE **7/23/15** SHEET **10** OF **12**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **2/5/86** BORING FINISH _____

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
							230					
30	NQ	234.7	244.7		10	100	235					
										GRAY SANDSTONE		
							240					
31	NQ	244.7	254.7		9.8	83	245					
										RED AND GRAY CLAYSHALE		
							250					
										GRAY CLAYSHALE		
										RED CLAYSHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-403** DATE **7/23/15** SHEET **11** OF **12**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **2/5/86** BORING FINISH _____

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	NQ	254.7	264.7		10	92	255					
							260					
33	NQ	264.7	274.7		9.7	97	265			GRAY SANDSTONE		
										GRAY SILTSTONE		
							270					274.0 Bottom of boring.
										BOTTOM OF BORING 274.7'		

WELLS MW-1 AND MW-2 WERE NESTED IN A 3" DIAMETER HOLE.
WELL MW-1
N.709,726.78
E.1,731,757.61
GROUND ELEVATION 854.61
TOP OF PIPE ELEVATION 856.35
LATITUDE 38 56 43.00
LONGITUDE 81 56 33.09
1.25" DIAMETER POLETHYLENE SCREEN.

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-403** DATE **7/23/15** SHEET **12** OF **12**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **2/5/86** BORING FINISH _____

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
										0.75" DIAMETER SCH. 80 PVC CASING. Hole was flushed with drill water until return drill water was visually clear. A geomon type monitoring well was installed and purged until a visually clear sample was obtaied. WELL MW-2 N.709,726.78 E.1,731,757.61 GROUND ELEVATION 854.61 TOP OF PIPE ELEVATION 856.35 LATITUDE 38 56 43.00 LONGITUDE 81 56 33.09 1.25 DIAMETER POLETHYLENE SCREEN. 0.75" SCH. 80 PVC RIZER Hole was flushed with drill water until return drill water was visually clear. A geomen type monitoring well was installed and purged until a visually clear sample was obtained.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 709,984.6 E 1,728,253.0**

GROUND ELEVATION **756.7** SYSTEM _____

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **B-404** DATE **7/23/15** SHEET **1** OF **6**

BORING START **3/25/86** BORING FINISH **3/26/86**

PIEZOMETER TYPE _____ WELL TYPE _____

HGT. RISER ABOVE GROUND _____ DIA **6"**

DEPTH TO TOP OF WELL SCREEN _____ BOTTOM _____

WELL DEVELOPMENT _____ BACKFILL _____

FIELD PARTY **ROUSH/LAMBERT** RIG **B-61**

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	3.0	4.5	2-3-3	1.33		5			BROWN CLAY with rock fragments		
2	SS	8.0	8.4	50/0.1	0.1					BROWN SHALE sandy		
1	NQ	8.4	13.4		5.0	61						SEATED CASING - STARTED CORING
							10			GRAY CLAYSHALE		
2	NQ	13.4	20.5		6.4	84						
							15					

TYPE OF CASING USED

X	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"
	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 **JCM**

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-404** DATE **7/23/15** SHEET **2** OF **6**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/25/86** BORING FINISH **3/26/86**

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
3	NQ	20.5	25.5		4.7	57				gray siltstone lense 22.1 to 22.6 gray siltstone lense 22.7 to 23.8		
							25			gray siltstone lense 24.1 to 24.4 gray siltstone lense 24.9 to 25.5		
4	NQ	25.5	35.5		9.6	92				gray sandstone lense 25.5 to 26.1 gray sandstone lense 26.3 to 26.6		
							30					
										red clayshale 31.3 to 34.8		
							35					
5	NQ	35.5	45.5		9.4	80						
							40			GRAY SANDSTONE		
										GRAY CLAYSHALE		
							45					
6	NQ	45.5	54.6		8.3	78				RED CLAYSHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-404** DATE **7/23/15** SHEET **3** OF **6**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/25/86** BORING FINISH **3/26/86**

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
							50					
7	NQ	54.6	55.5		0.9	46				GRAY CLAYSHALE		
							55					
8	NQ	55.5	65.5		10.0	91				RED CLAYSHALE GRAY CLAYSHALE		
							60			RED CLAYSHALE		
9	NQ	65.5	75.5		9.9	96	65			GRAY CLAYSHALE		
							70			MULTI-COLORED CLAYSHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-404** DATE **7/23/15** SHEET **4** OF **6**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/25/86** BORING FINISH **3/26/86**

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
							75					
10	NQ	75.5	85.5		10	100				RED CLAYSHALE		
							80			GRAY CLAYSHALE		
										GRAY SANDSTONE		
11	NQ	85.5	94.9		9.4	100	85			GRAY SANDSTONE		
							90					
										GRAY CLAYSHALE		
12	NQ	95.5	104.6		8.8	57	95			RED CLAYSHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-404** DATE **7/23/15** SHEET **5** OF **6**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/25/86** BORING FINISH **3/26/86**

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
13	NQ	104.6	105.5		0.9	93	100					
14	NQ	105.5	115.5		9.8	89	105			GRAY CLAYSHALE		
							110			GRAY SILTSTONE		
15	NQ	115.5	125.5		10.0	100	115					
							120			GRAY SANDSTONE		
										GRAY CLAYSHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-404** DATE **7/23/15** SHEET **6** OF **6**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/25/86** BORING FINISH **3/26/86**

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
							125			GRAY SANDSTONE		
16	NQ	125.5	135.0		9.5	100						
							130			RED AND GRAY CLAYSHALE		
							135			BOTTOM OF BORING 135.0'		STOPPED BORING AT 135.0'

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 709,173.3 E 1,728,977.0**

GROUND ELEVATION **855.6** SYSTEM _____

Water Level, ft	▽ 67.0	▼	▼
TIME			
DATE	5-2-86		

BORING NO. **B-405** DATE **7/23/15** SHEET **1** OF **11**

BORING START **3/12/86** BORING FINISH **4/2/86**

PIEZOMETER TYPE _____ WELL TYPE **GM**

HGT. RISER ABOVE GROUND **2.0** DIA **3"**

DEPTH TO TOP OF WELL SCREEN **143.2** BOTTOM **147.2**

WELL DEVELOPMENT **SEE NOTES** BACKFILL **CONCRETE SAND**

FIELD PARTY **TLS-GB** RIG **CME-75**

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	3.2	4.7							LIGHT BROWN SANDSTONE weathered.		
2	SS	7.8	8.1	50/.3	.3	70	5			LIGHT BROWN SANDSTONE weathered.		
3	NQ	8.1	15.3		9.7					BROWN SANDSTONE fine grain,well cemented. Broken with clay on joints.		
							10					
4	NQ	15.3	25.3		10.0	81	15			15.0 to 15.3 vertical cracks with red and brown clay on joint. BROWN SANDSTONE well graded,well cemented,grading to blue gray at 24.2		
										17.9 to 21.7 vertical cracks filled with red clay		

TYPE OF CASING USED

X	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 _____

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-405** DATE **7/23/15** SHEET **2** OF **11**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/12/86** BORING FINISH **4/2/86**

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
							25					
5	NQ	25.3	35.3		9.6	93				GRAY/BLUE GREEN SANDSTONE V-fine grain,well cemented 27.5 TO 29.0 Fine grain		
							30					
6	NQ	35.3	40.3		3.8		35			RED AND GRAY CLAY SHALE V-soft RED CLAY SHALE Soft		34.7 Top of seal.
												39.3 Top of gravel pack.
7	NQ	40.3	45.3		4.1	70	40					
										BLUE GRAY SILTY SHALE		
8	NQ	45.3	55.3		10.0	96	45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-405** DATE **7/23/15** SHEET **3** OF **11**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/12/86** BORING FINISH **4/2/86**

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
										BLUE GRAY SANDSTONE Fine grain,well sorted.		
							50			BLUE GRAY CLAY SHALE Soft,broken		
										BLUE GRAY SHALEY SANDSTONE		
9	NQ	55.3	65.3		10.0	96	55					
							60			BROWN SANDSTONE Fine grain,well sorted vertical cracks at 59.5 to 60.0 GRAY SANDSTONE Fine grain,well sorted.		
										GRAY SILTY SHALE Soft.		
10	NQ	65.3	70.3		5.0	96	65					
										RED AND GRAY CLAY SHALE		
11	NQ	70.3	75.3		4.6		70			GRAY CLAY SHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-405** DATE **7/23/15** SHEET **4** OF **11**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/12/86** BORING FINISH **4/2/86**

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
										RED CLAY SHALE		
12	NQ	75.3	85.3		9.9		75					
							80					
13	NQ	85.3	95.3		9.8		85					
							90					
14	NQ	95.3	105.3		10.0		95			GRAY SHALEY SANDSTONE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-405** DATE **7/23/15** SHEET **5** OF **11**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/12/86** BORING FINISH **4/2/86**

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
							100			GRAY SANDSTONE		
15	NQ	105.3	115.3		96		105					
							110					
										GRAY CLAY SHALE		
16	NQ	115.3	125.3		10.0		115			GRAY SANDY SHALE With clayshale lens		
							120					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-405** DATE **7/23/15** SHEET **6** OF **11**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/12/86** BORING FINISH **4/2/86**

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
							125			GRAY SANDSTONE		
17	NQ	125.3	135.3		9.8							
							130			RED AND GRAY SHALE		
										GRAY SANDSTONE Course grain.		
18	NQ	135.3	145.1		9.8	100	135			GRAY SILTSTONE		
										GRAY CLAYSHALE		
							140					
										GRAY SANDSTONE		143.2 Top of screen.
19	NQ	145.1	150.1		4.6	91	145			GRAY CLAY SHALE RED CLAY SHALE		147.2 Bottom of screen.

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-405** DATE **7/23/15** SHEET **7** OF **11**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/12/86** BORING FINISH **4/2/86**

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
20	NQ	150.1	155.1		5.0	83						150.4 Bottom of gravel pack.
										GRAY CLAY SHALE		
21	NQ	155.1	165.1		10.0	100	155			RED AND GRAY CLAY SHALE Layers.		
							160					
22	NQ	165.1	175.1		10.0	100	165			GRAY SILTSTONE		
										GRAY AND RED CLAY SHALE Layers.		
							170			MULTI-COLORED CLAY SHALE		
23	NQ	175.1	185.1		10.0	100	175					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-405** DATE **7/23/15** SHEET **8** OF **11**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/12/86** BORING FINISH **4/2/86**

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
							180			GRAY CLAY SHALE		
										GRAY SANDSTONE		
24	NQ	185.1	195.1		9.8	98	185					
							190					
25	NQ	195.1	205.1		10.0	87	195					
										GRAY AND GRAY CLAY SHALE		
							200					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-405** DATE **7/23/15** SHEET **9** OF **11**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/12/86** BORING FINISH **4/2/86**

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
							205					
26	NQ	205.1	215.1		10.0	100				GRAY SANDY SHALE		
							210					
										GRAY SILTSTONE		
										GRAY SANDY SHALE		
27	NQ	215.1	225.1		10.0	100	215			GRAY CLAY SHALE		
							220			GRAY SANDSTONE		
28	NQ	225.1	235.1		9.7	93	225			GRAY SILTSTONE		
										GRAY SANDSTONE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-405** DATE **7/23/15** SHEET **10** OF **11**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/12/86** BORING FINISH **4/2/86**

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
							230			GRAY SILTSTONE		
										GRAY SANDSTONE		
										GRAY SILTSTONE		
										RED AND GRAY CLAY SHALE		
29	NQ	235.1	245.1		10.0	36	235					
							240					
30	NQ	245.1	255.1		10.0	100	245			GRAY SILTSTONE		
										GRAY SANDSTONE		
							250			GRAY SILTSTONE		
										GRAY SANDSTONE		
										GRAY SILTSTONE		
										GRAY CLAYSHALE		
										GRAY SANDSTONE		
										GRAY SILTSTONE		
										GRAY SANDSTONE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-405** DATE **7/23/15** SHEET **11** OF **11**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **3/12/86** BORING FINISH **4/2/86**

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
							255			GRAY SILTSTONE		
31	NQ	255.1	260.1		5.0	100				SANDSTONE		
										GRAY SILTSTONE		
										GRAY SANDSTONE		
							260			GRAY CLAY SHALE		260.1 Bottom of boring.

LATITUDE 38 56 37.25
LONGITUDE 81 57 09.95
WELL DEVELOPMENT
Boring was flushed with drill water until drill water return was visually clean and a geomon type well was installed and purged until a visually clean sample was obtained.
WELL MATERIAL
1.25" diameter polethylene screen.
0.75" diameter sch. 80 pvc casing

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 710,550.0 E 1,730,365.0**

GROUND ELEVATION **680.0** SYSTEM _____

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **BFA-1** DATE **7/23/15** SHEET **1** OF **9**

BORING START _____ BORING FINISH **8/25/92**

PIEZOMETER TYPE _____ WELL TYPE _____

HGT. RISER ABOVE GROUND _____ DIA **6"**

DEPTH TO TOP OF WELL SCREEN _____ BOTTOM _____

WELL DEVELOPMENT _____ BACKFILL _____

FIELD PARTY _____ RIG _____

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
							5			OVERBURDEN CLAY AND SANDSTONE		
							10					
1	NQ	14.0	25.1		11.1	65	15			SANDSTONE AND CLAY INTERBEDDED		
										GRAY SANDSTONE fine to medium grained, two 45 degree shears		

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 _____

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **BFA-1** DATE **7/23/15** SHEET **2** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START _____ BORING FINISH **8/25/92**

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
										MOTTLED GRAY AND MAROON CLAYSTONE badly broken in places, core loss 0.5'		
2	NQ	25.1	35.1		10	27	25			MAROON CLAYSTONE badly broken in places, includes core loss 1.30'		
							30					
3	NQ	35.1	45.1		10	81	35			MAROON CLAYSTONE badly broken in places, includes 1.0' of core loss		
										GREENISH GRAY CLAYSTONE sandy		
										MOTTLED GREEN AND MAROON CLAYSTONE		
							40			GREENISH GRAY CLAYSTONE sandy in places		
4	NQ	45.1	55.1		10	63	45			GREENISH GRAY SANDSTONE with shale laminations		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **BFA-1** DATE **7/23/15** SHEET **3** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START BORING FINISH **8/25/92**

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
										GREENISH GRAY CLAYSTONE few interbeds of sandstone, badly broken		
							50			GREENISH GRAY CLAYSTONE		
										GREENISH GRAY SANDSTONE medium grained, few shale laminations at top		
5	NQ	55.1	65.1		10	81	55			GREENISH GRAY SANDSTONE medium grained		
										CLAYEY SANDSTONE medium grained		
							60			GREENISH GRAY SANDSTONE medium grained		
										GREENISH GRAY CLAYSTONE soft		
										GREENISH GRAY SANDSTONE medium to fine grained		
										VARIGATED MAROON AND GREENISH GRAY CLAYSTONE		
6	NQ	65.1	75.1		10	33	65			MAROON VAREGATED WITH GREEN CLAYSTONE broken		
										BLACK CLAY hard, carbonaceous		
							70			DK. GRAY UNDERCLAY soft, coaly lenses, includes 1.70' of core loss		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **BFA-1** DATE **7/23/15** SHEET **4** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START BORING FINISH **8/25/92**

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
										MAROON CLAYSTONE soft, broken		
7	NQ	75.1	85.1		10	85	75			MAROON, MOTTLED GREEN CLAYSTONE broken at base		
							80			GREEN CLAYSTONE shaley, sandy in places, mottled cream-colored blebs		
										GREEN SANDSTONE medium grained		
										GREEN CLAYSTONE sandy		
8	NQ	85.1	95.1		10	85	85			GREEN CLAYSTONE shaley, cream-colored blebs		
							90			DK. GREENISH GRAY CLAYSTONE sandy		
										MAROON MOTTLED WITH GREEN CLAYSTONE sandy		
9	NQ	95.1	105.1		10	52	95			GREEN MOTTLED WITH MAROON CLAYSTONE sandy		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **BFA-1** DATE **7/23/15** SHEET **5** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START BORING FINISH **8/25/92**

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
										MAROON WITH SOME GREEN MOTTLING CLAYSTONE badly broken in lower half		
							100					
										GREEN CLAYSTONE soft		
10	NQ	105.1	110.1		5	43	105			MAROON WITH GREEN MOTTLING CLAYSTONE badly broken, includes 2.0' of core loss - core barrel blocked		
							110					
										GREEN CLAYSTONE broken		
11	NQ	115.1	125.1		10	96	115			GREEN SHALE sandy GREEN GRAY SANDSTONE fine grained, shaley		
										GREEN SANDSTONE fine grained		
							120					
										GREEN SANDSTONE medium grained		
										GREEN SANDSTONE medium to coarse grained		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **BFA-1** DATE **7/23/15** SHEET **6** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START BORING FINISH **8/25/92**

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
							125					
12	NQ	125.1	135.1		10	100				GREEN WITH BLACK MICACEOUS PARTINGS, SANDSTONE coarse grained		
							130					
							135					
13	NQ	135.1	145.1		10	97				GREEN SANDSTONE coarse to very coarse grained, micaceous		
							140					
										GREEN SANDSTONE coarse to very coarse grained, green, micaceous		
										DK. GRAY SANDSTONE fine grained		
										DK. GREENISH GRAY CLAYSTONE		
										DK. GRAY SHALE clayey		
14	NQ	145.1	155.1		10	98	145			GRAY CLAY soft		
										GRAY SHALE solid		
										GREENISH GRAY SANDSTONE coarse to very coarse, very competent, few granules of white quartz		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **BFA-1** DATE **7/23/15** SHEET **7** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START BORING FINISH **8/25/92**

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
							155					
15	NQ	155.1	165.1		10	100				GREENISH GRAY SANDSTONE very coarse grained, few granules of white quartz, very competent		
							160					
16	NQ	165.1	175.1		10	100	165			SANDSTONE very coarse grained, few granules of white quartz, very compenent		
							170					
17	NQ	175.1	185.1		10	100	175			GREENISH GRAY SANDSTONE very coarse grained, micaceous		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **BFA-1** DATE **7/23/15** SHEET **8** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START _____ BORING FINISH **8/25/92**

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
										DK. GRAY SANDSTONE medium grained		
										GREENISH GRAY SANDSTONE very coarse grained		
							180			DK. GREENISH GRAY SANDSTONE with black micaceous partings, medium to coarse grained		
18	NQ	185.1	195.1		10	100	185			GREENISH GRAY SANDSTONE medium to coarse grained, with black micaceous partings		
										GREENISH GRAY SANDSTONE very coarse grained		
							190					
19	NQ	195.1	205.2		10.10	60	195			GREENISH GRAY SANDSTONE coarse grained		
										CORE LOSS-TOOLS SANDED IN		
										SANDSTONE WITH INTERBEDDED SHALE		
										GREENISH GRAY SANDSTONE coarse grained, shale breccia at base		
										GRAY SHALE		
										DK. GRAY SHALE clayey and broken at top		
							200			DK. GRAY SHALE pyrite inclusions		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **BFA-1** DATE **7/23/15** SHEET **9** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START BORING FINISH **8/25/92**

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
										CORE LOSS-COAL		
										DK. GRAY SHALE		
							205					
20	NQ	205.2	212.0		6.8	0				DK. GRAY SHALE		
										CORE BED AS FOLLOWS bone coal, hard, somewhat bony bone coal, hard, somewhat bony coal, bright, hard coal, bright, thick pyrite lense near base coal, bright with sporadic pyrite, badly crushed coal, bright, thick, pyrite lense near base		
							210					
										GRAY SHALE clayey		
21	NQ	212.0	216.1		4.10	78				GRAY SHALE clayey		
										GRAY SHALE sandy with sandstone laminations		
							215					
										GRAY SHALE clayey, broken		
										BOTTOM OF BORING 216.1'		

ARCADIS

AEP 1992, 2006, 2008

Boring Logs

MW-05 to MW-10, MW-12 to MW-21, MW-43, MW-44

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 711,462.7 E 1,728,597.8**

GROUND ELEVATION **788.9** SYSTEM _____

Water Level, ft	▽ 33.9	▼	▼
TIME	0715		
DATE	6-17-92		

BORING NO. **MW-05** DATE **7/23/15** SHEET **1** OF **4**

BORING START **6/16/92** BORING FINISH **6/23/92**

PIEZOMETER TYPE _____ WELL TYPE **GM**

HGT. RISER ABOVE GROUND **2.52** DIA **1.0**

DEPTH TO TOP OF WELL SCREEN **46.8** BOTTOM **48.8**

WELL DEVELOPMENT **SEE NOTES** BACKFILL **VOLCLAY GROUT**

FIELD PARTY **TJH-RLY** RIG **CME-75**

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	2.3	3.8	4-5-6	.8					RED CLAY		
2	SS	7.3	7.8	50/.5	.5		5			BROWN SANDY ROCK FRAGMENT		
1	NQ-2	8.7	12.6		3.8	27				RED AND BROWN SHALE		
2	NQ-2	12.6	14.8		1.5	0	10			LIGHT BROWN SANDSTONE		
3	NQ-2	14.8	24.8		6.8	32	15			LIGHT BROWN SANDYSHALE		
										RED SHALE		

TYPE OF CASING USED

X	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"
	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 _____

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-05** DATE **7/23/15** SHEET **2** OF **4**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **6/16/92** BORING FINISH **6/23/92**

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
4	NQ-2	24.8	34.8		7.8	32	25					24.3 Top of bentonite seal.
							30			GRAY SHALE		29.2 Top of gravel pack.
5	NQ-2	34.8	44.8		10.0	67	35			GRAY SHALE with oxidation throughout		
							40					
										GRAY SANDSTONE		
6	NQ-2	44.8	49.4		3.6	74	45					

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-05** DATE **7/23/15** SHEET **3** OF **4**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **6/16/92** BORING FINISH **6/23/92**

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
7	NQ-2	49.4	54.8		5.4	90	50			GRAY SHALE RED SHALE RED SHALE		46.8 Top of screen. 48.8 Bottom of screen. 50.2 Bottom of gravel pack.
8	NQ-2	54.8	64.8		10.0	95	55			GRAY SHALE hard		
9	NQ-2	64.8	74.8		10.0	100	60					
							65					
							70					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-05** DATE **7/23/15** SHEET **4** OF **4**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **6/16/92** BORING FINISH **6/23/92**

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
10	NQ-2	74.8	83.5		8.7	45	75					
										RED SHALE soft		
							80					
11	NQ-2	83.5	84.8		.8	0						
12	NQ-2	84.8	89.8		5.0	100	85			GRAY SHALE		
		89.9										90.0 Bottom of boring.

Well development Hole was flushed with drill water until return water appered visually clear.Geomon type monitoring well installed and purged untill a visually clear sample was obtained.
WELL MATERIAL 1.25" Diameter 20 slot screen, 1" sch. 80 pvc casing.

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 712,003.9 E 1,729,676.1**

GROUND ELEVATION **799.2** SYSTEM _____

Water Level, ft	▽ 17.5	▼	▼
TIME	0720		
DATE	6-3-92		

BORING NO. **MW-06** DATE **7/23/15** SHEET **1** OF **6**

BORING START **7/2/92** BORING FINISH **7/16/92**

PIEZOMETER TYPE _____ WELL TYPE **OW**

HGT. RISER ABOVE GROUND **1.8** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **125.8** BOTTOM **134.8**

WELL DEVELOPMENT **SEE NOTES** BACKFILL **VOLCLAY GROUT**

FIELD PARTY **TJH-RLY** RIG **CME-75**

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
							5					Reamed hole to 6" and installed well.
							10					
							15					
1	NQ	18.7	24.7		3.4	20				BROWN CLAY	▽	
										RED CLAY SHALE soft		

TYPE OF CASING USED

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

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-06** DATE **7/23/15** SHEET **2** OF **6**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **7/2/92** BORING FINISH **7/16/92**

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
2	NQ	24.7	34.7		10.0	47	25			GRAY SHALE soft		
3	NQ	34.7	40.0		5.3	94	30					
4	NQ	40.0	45.0		5.0	100	35			GRAY SANDSTONE hard		
5	NQ	45.0	55.0		10.0	78	40					
							45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-06** DATE **7/23/15** SHEET **3** OF **6**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **7/2/92** BORING FINISH **7/16/92**

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
							50					
6	NQ	55.0	65.0		9.7	74	55					
										GRAY SHALE hard		
							60					
7	NQ	65.0	74.7		9.3	93	65					
										GRAY SANDSTONE		
							70					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-06** DATE **7/23/15** SHEET **4** OF **6**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **7/2/92** BORING FINISH **7/16/92**

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
										RED SHALE		
8	NQ	74.7	84.7		10.0	94	75			GRAY SHALE		
							80			GRAY SHALE hard with red lens		
9	NQ	84.7	90.0		5.0	65	85			GRAY SANDSTONE		
										RED SHALE with high angle fracture		
10	NQ	90.0	95.0		4.5	35	90			GRAY SHALE hard		
11	NQ	95.0	105.0		10.0	75	95			GRAY SHALEY SANDSTONE hard		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-06** DATE **7/23/15** SHEET **5** OF **6**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **7/2/92** BORING FINISH **7/16/92**

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
							100					
										RED SHALE		
										GRAY SHALEY SANDSTONE		
12	NQ	105.0	115.0		10.0	82	105			GRAY SHALE hard		
										RED SHALE		
										GRAY SHALE hard		
							110					
13	NQ	115.0	123.7		8.3	53	115					
										RED SHALE WITH HIGH ANGLE FRACTURE		
												119.2 Top of bentonite seal.
							120					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-06** DATE **7/23/15** SHEET **6** OF **6**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **7/2/92** BORING FINISH **7/16/92**

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
14	NQ	123.7	125.0		1.3	26						
15	NQ	125.0	134.3		9.3	97	125			GRAY SHALE GRAY SHALEY SANDSTONE		124.5 Top of gravel pack. 125.8 Top of screen.
										GRAY SANDSTONE hard		
							130					
16	NQ	134.3	135.0		.6	66						
17	NQ	135.0	140.0		5.0		135					134.8 Bottom of screen.
										RED/GRAY SHALE		137.0 Bottom of screen.
		140.0					140			WELL DEVELOPMENT Boring flushed with drill water until return drill water appeared visually clear. Boring bailed dry and a 2" diameter well installed. WELL MATERIAL 2" diameter 20 slot screen, 2" sch. 40 casing.		140.0 Bottom of boring.

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 711,982.1 E 1,729,623.0**

GROUND ELEVATION **800.5** SYSTEM _____

Water Level, ft	▽ 23.1	▼ 28.0	▼
TIME	0710	0720	
DATE	5-27-92	5-28-92	

BORING NO. **MW-07** DATE **7/23/15** SHEET **1** OF **4**

BORING START **5/21/92** BORING FINISH **6/19/92**

PIEZOMETER TYPE _____ WELL TYPE **GM**

HGT. RISER ABOVE GROUND **2.3** DIA **1.0**

DEPTH TO TOP OF WELL SCREEN **53.2** BOTTOM **55.2**

WELL DEVELOPMENT **SEE NOTES** BACKFILL **VOLCLAY GROUT**

FIELD PARTY **TJH/RLY** RIG **CME-75**

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	2.3	3.8	11-12-18	.5	0				BROWN CLAY		
2	SS	7.3	8.8	12-17-21	1.3		5					
3	SS	12.3	13.8	14-39-47	1.0		10			BROWN SHALEY CLAY		
1	NQ	13.8	15.3		.5	0				BROWN CLAY		
2	NQ	15.3	21.7		4.4	14	15			RED SHALE		

TYPE OF CASING USED

X	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"
	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 _____

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-07** DATE **7/23/15** SHEET **2** OF **4**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **5/21/92** BORING FINISH **6/19/92**

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
3	NQ	21.7	24.8		2.5	55				BROWN SANDSTONE weathered oxidized lens		Lost water return.
4	NQ	24.8	34.8		9.5	30	25					24.0 Top of bentonite seal.
										GRAY SHALE hard some oxidized		
							30					29.8 Top of gravel pack.
5	NQ	34.8	44.8		10.0	95	35					
										GRAY SANDSTONE hard		
							40					
6	NQ	44.8	54.8		10.0	84	45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-07** DATE **7/23/15** SHEET **3** OF **4**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **5/21/92** BORING FINISH **6/19/92**

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
							50					
7	NQ	54.8	64.8		10.0	67	55			GRAY SHALE soft with some red lens		53.2 Top of screen. 55.2 Bottom of screen. 57.0 Bottom of gravel pack.
							60			GRAY SHALE hard some what sandy to 64.8		
8	NQ	64.8	74.8		10.0	98	65			GRAY SHALE hard with red lens to 70.4		
							70					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-07** DATE **7/23/15** SHEET **4** OF **4**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **5/21/92** BORING FINISH **6/19/92**

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
										GRAY SANDSTONE hard		
9	NQ	74.8	84.8		10.0	92	75					
							80			GRAY SHALE hard with red lens		
10	NQ	84.8	91.0		6.2	74	85			GRAY SHALE hard		
										GRAY SHALE soft		
										RED SHALE medium hard		
							90					
		91.0										91.0 Bottom of boring.
										WELL DEVELOPMENT Boring flushed with drill water until return water visually clear.Geomon type monitoring well was installed and purged until visually clear sample was obtained. WELL MATERIAL 1.25" diameter 20 slot screen, 1" sch. 80 pvc casing.		

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 710,780.9 E 1,730,856.4**

GROUND ELEVATION **675.5** SYSTEM _____

Water Level, ft	▽ 6.1	▼	▼
TIME	0730		
DATE	7-23-92		

BORING NO. **MW-08** DATE **7/23/15** SHEET **1** OF **5**

BORING START **7/22/92** BORING FINISH **7/29/92**

PIEZOMETER TYPE _____ WELL TYPE **OW**

HGT. RISER ABOVE GROUND **1.73** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **44.0** BOTTOM **52.9**

WELL DEVELOPMENT **SEE NOTES** BACKFILL **VOLCLAY GROUT**

FIELD PARTY **TJH-GCF** RIG **CME-75**

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	3.5	5.0	5-8-9	1.2					BROWN/TAN CLAYEY SILT with rock fragments.		Hole reamed to 6" and installed well
2	SS	8.5	10.0	6-11-14	1.3		5			BROWN/TAN SANDY CLAY with clay shale soft to medium throughout	▽	
3	SS	13.5	15.0	6-10-12	1.5		10					
4	SS	18.5	18.7	50/.2	.2		15			RED CLAY SHALE soft to hard		

TYPE OF CASING USED

X	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"
	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 _____

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-08** DATE **7/23/15** SHEET **2** OF **5**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **7/22/92** BORING FINISH **7/29/92**

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
5	NQ-2	20.5	24.7		2.8	25				RED CLAY SHALE soft to hard		
6	NQ-2	24.7	31.6		5.3	68	25			GRAY CLAY SHALE medium to hard fine grain sandy shale 31.6 to 32.7		
7	NQ-2	31.6	34.7		2.8	45	30					
8	NQ-2	34.7	44.7		10.0		35			BLUE/GRAY SHALE AND CLAYEY SANDSTONE		36.6 Top of bentonite seal.
9	NQ-2	44.7	54.7		10.0	98	40					42.6 Top of gravel pack.
							45					44.0 Top of screen.

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-08** DATE **7/23/15** SHEET **3** OF **5**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **7/22/92** BORING FINISH **7/29/92**

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
										GRAY SANDSTONE hard		
							50			GRAY CLAY SHALE AND CLAYEY SANDSTONE		52.9 Bottom of screen.
10	NQ-2	54.7	61.8		6.9		55			RED AND GRAY CLAY SHALE medium to hard		55.0 Bottom of gravel pack.
							60			BLACK AND GRAY CLAY SHALE MEDIUM TO HARD WITH RUST STAIN. 61.5 TO 61.7 COAL		
11	NQ-2	61.8	64.7		2.7					GRAY AND GREEN LAYERED CLAY SHALE soft to medium with rust stain, 61.5 to 61.7		
12	NQ-2	64.7	69.7		4.1	41	65			RED CLAY SHALE		
13	NQ-2	69.7	74.7		5.0	100	70			BLUE AND GRAY CLAY SHALE hard with calcite throughout soft areas 72.7 TO 72.8 and 73.4 TO 73.5		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-08** DATE **7/23/15** SHEET **4** OF **5**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **7/22/92** BORING FINISH **7/29/92**

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
										GRAY/BLUE CLAY SHALE hard,soft lens 85.5 TO 85.7		
14	NQ-2	74.7	84.7		9.7	92	75					
15	NQ-2	84.7	94.7		9.7	97	80					
							85					
							90			RED CLAY SHALE hard gray/green seams , rust stains 92.1 TO 92.6		
16	NQ-2	94.7	102.2		6.2		95					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-08** DATE **7/23/15** SHEET **5** OF **5**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **7/22/92** BORING FINISH **7/29/92**

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
							100					
17	NQ-2	102.2	104.7		2.3					CLAY SHALE hard GRAY LIMESTONE ? hard WELL DEVELOPMENT Boring was flushed with drill water until return water was visually clear. 2" diameter well was installed amd pumped until a visually clear sample was obtained. WELL MATERIAL 2" diameter 20 slot screen, 2" diameter sch. 40 casing.		104.7 Bottom of boring.

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 712,268.5 E 1,732,217.4**

GROUND ELEVATION **643.0** SYSTEM _____

Water Level, ft	▽ 14.0	▼ 0.0	▽
TIME	0730	.730	
DATE	7-29-92	7-30-92	

BORING NO. **MW-09** DATE **7/23/15** SHEET **1** OF **3**

BORING START **8/12/92** BORING FINISH **8/13/92**

PIEZOMETER TYPE _____ WELL TYPE **OW**

HGT. RISER ABOVE GROUND **1.9** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **43.8** BOTTOM **52.9**

WELL DEVELOPMENT **SEE NOTES** BACKFILL **VOLCLAY GROUT**

FIELD PARTY **TJH-GCF** RIG **CME-75**

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
										BROWN CLAY SILT moist		Hole was reamed to 6" and well installed.
										BLUE/GRAY SANDY CLAY SILT wet		
1	SS	3.8	5.3	5-8-9	1.1							
							5					
2	SS	8.8	10.3	1-1-1	1.3							
							10					
3	SS	13.8	15.3	3-3-4	0							
							15					
4	SS	18.8	20.3	3-4-3	1.5					BLUE SANDY CLAY SHALE trace of sand,saturated		

TYPE OF CASING USED

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

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-09** DATE **7/23/15** SHEET **2** OF **3**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **8/12/92** BORING FINISH **8/13/92**

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
5	SS	23.8	24.0	50/.2	.2	0				GREEN SANDY CLAY SHALE		
6	NQ-2	24.0	25.3		.9		25			GREEN/GRAY SANDY SHALE soft to medium with vertical cracks 24.7 to 24.9		
7	NQ-2	25.3	35.3		9.3	31				GRAY SANDSTONE medium to hard		
										GRAY/RED CLAY SHALE soft		
							30					
							35					
8	NQ-2	35.3	40.3		2.6	0						36.8 Top of bentonite seal.
9	NQ-2	40.3	43.4		2.1		40					
10	NQ-2	43.4	45.3		1.7							42.9 Top of gravel pack. 43.8 Top of screen.
							45					
11	NQ-2	45.3	55.3		9.4					GRAY CLAY SHALE medium to hard		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-09** DATE **7/23/15** SHEET **3** OF **3**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **8/12/92** BORING FINISH **8/13/92**

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
										SHALEY SANDSTONE medium to hard		
							50					52.9 Bottom of screen.
										GRAY CLAY SHALE medium to hard		
							55			WELL DEVELOPMENT Hole was flushed with drill water until drill water was visually clear. A 2" monitoring well was installed and pumped until visually clean and a sample was obtained. WELL MATERIAL 2" diameter 20 slot screen pvc 2" diametet sch. 40 pvc casing.		55.3 Bottom of gravel pack and bottom of boring.

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 710,968.6 E 1,730,231.8**

GROUND ELEVATION **810.8** SYSTEM _____

Water Level, ft	▽ 14.7	▼ 31.6	▼ 58.4
TIME	0705	0710	0850
DATE	6-24-92	6-25-92	7-1.92

BORING NO. **MW-10** DATE **7/23/15** SHEET **1** OF **7**

BORING START **6/23/92** BORING FINISH **7/8/92**

PIEZOMETER TYPE _____ WELL TYPE **GM-OW**

HGT. RISER ABOVE GROUND **2.27-2.8** DIA **2\1**

DEPTH TO TOP OF WELL SCREEN **87.1-139.8** BOTTOM **89.1-148.9**

WELL DEVELOPMENT **SEE NOTES** BACKFILL **VOLCLAY GROUT**

FIELD PARTY **TJH\RLY** RIG **CME-75**

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	2.2	3.7	8-12-15	1.2					RED SANDY CLAY		Reamed hole to 6"and installed wells MW-10 and MW-11.
2	SS	7.2	7.4	50/.2	.2		5			BROWN SAND		
3	NQ	9.0	15.0		6.0	19	10			BROWN SANDSTONE		
										BROWN SANDY SHALE		
4	NQ	15.0	25.0		10.0	23	15			BROWN SHALE hard BROWN SANDSTONE		
										BROWN SHALE soft		

TYPE OF CASING USED

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

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-10** DATE **7/23/15** SHEET **2** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **6/23/92** BORING FINISH **7/8/92**

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
5	NQ	25.0	33.6		4.0	20	25			RED SHALE soft		
6	NQ	33.6	35.0		1.3	92	30			GRAY SHALE		
7	NQ	35.0	45.0		10.0	64	35					
							40			GRAY SANDSTONE with oxidized breaks 41.0-42.7		
8	NQ	45.0	55.0		9.4	50	45			GRAY SHALE hard and medium from 49.2 to49.8		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-10** DATE **7/23/15** SHEET **3** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **6/23/92** BORING FINISH **7/8/92**

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
							50			BROWN SANDSTONE		
										BROWN SHALE		
										GRAY SHALE medium hard oxidized breaks some high angle fracture and calcite		
9	NQ	55.0	65.0		10.0	50	55					
							60					
										BROWN SANDSTONE with oxidation throughout to 65.0 and course to68.2		63.5 Top of bentonite seal.
10	NQ	65.0	73.9		8.9	50	65					
										GRAY SANDSTONE		
							70			GRAY SHALE		71.3 Top of gravel

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-10** DATE **7/23/15** SHEET **4** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **6/23/92** BORING FINISH **7/8/92**

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
												pack.
11	NQ	73.9	75.0		1.1	100				BROWN SANDSTONE with oxidized fracture at 77.7 and changing to gray at78.0 to 85		
12	NQ	75.0	85.0		10.0	68	75					
							80					
13	NQ	85.0	95.0		10.0	79	85			GRAY SANDY SHALE hard		87.1 Top of screen.
							90					89.1 Bottom of screen. GEOMOND TIP
										BROWN SANDSTONE with oxidized fracture		
										GRAY SANDY SHALE		92.1 Bottom of gravel pack.
14	NQ	95.0	105.0		10.0	68	95			RED SHALE hard		
										GRAY SHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-10** DATE **7/23/15** SHEET **5** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **6/23/92** BORING FINISH **7/8/92**

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
							100			GRAY SANDY SHALE		
										RED SHALE soft from 105.0 to 107.0		
15	NQ	105.0	115.0		9.6	54	105					
							110			GRAY SHALE		
16	NQ	115.0	125.0		10.0	76	115					
										RED SHALE		
							120			GRAY SHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-10** DATE **7/23/15** SHEET **6** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **6/23/92** BORING FINISH **7/8/92**

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
							125					
17	NQ	125.0	130.0		4.5	50				RED SHALE soft from 130.0 to 135.0 and 135.0 to 137.1 high angle fracture		
18	NQ	130.0	135.0		4.0	36	130					
19	NQ	135.0	142.8		7.4	68	135			GRAY SHALE		137.0 Top of gravel pack.
										GRAY SANDSTONE		
20	NQ	142.8	145.0		2.2	100	140					139.9 Top of screen.
21	NQ	145.0	152.2		7.1	74	145			GRAY SHALE		148.9 Bottom of screen.

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-10** DATE **7/23/15** SHEET **7** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **6/23/92** BORING FINISH **7/8/92**

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
										RED SHALE		
												150.0 Bottom of gravel pack.
										MONITORING WELL MW-11 IS NESTED IN THE SAME BORING HOLE WITH MW-10. MONITORING WELL MW-11 COORDINATES N.710,968.29 E.1,730,231.77 ELEVATION 810.83 CASING ELEVATION 813.63 2" DIAMETER 20 SLOT SCREEN. 2" DIAMETER SCH. 40 PVC. WELL DEVELOPMENT Hole was flushed with drill water until return water appeared visually clear. Hole was bailed dry and a geomon type monitoring well installed and purged.		152.2 Bottom of boring

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 709,162.5 E 1,728,963.4**

GROUND ELEVATION **856.9** SYSTEM _____

Water Level, ft	▽ 20.7	▼ 23.9	▼ 88.7
TIME	1330	0710	0720
DATE	4-27-92	4-28-92	4-29-92

BORING NO. **MW-12** DATE **7/23/15** SHEET **1** OF **9**

BORING START **4/22/92** BORING FINISH **5/6/92**

PIEZOMETER TYPE _____ WELL TYPE **GM**

HGT. RISER ABOVE GROUND **1.95** DIA **1.0-2.0**

DEPTH TO TOP OF WELL SCREEN **190.6** BOTTOM **192.6**

WELL DEVELOPMENT **SEE NOTES** BACKFILL **VOLCLAY GROUT**

FIELD PARTY **HOWWELL/YATES** RIG **CME-75**

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	4.0	5.4	19-37-50/.4	1.4		5			BROWN SILTY SANDSTONE		
2	SS	9.0	9.3	50/.3	.3							
1	NQ	9.3	15.3		6.0	82	10			YELLOW/BROWN SANDSTONE with red vertical clay seams 14.5 to15.9		AUGER REFUSAL
2	NQ	15.3	25.3		9.8	58	15					

TYPE OF CASING USED

X	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"
	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 _____

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-12** DATE **7/23/15** SHEET **2** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **4/22/92** BORING FINISH **5/6/92**

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
							25					
3	NQ	25.3	35.3		10.0	72						
							30			GRAY SANDSTONE		
4	NQ	35.3	36.3		.4	33	35					
5	NQ	36.3	40.3		1.7	18				RED SHALE		
6	NQ	40.3	44.0		45	45	40					
7	NQ	44.0	45.3		1.1	60				GRAY SHALE		
8	NQ	45.3	55.3		10.0	74	45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-12** DATE **7/23/15** SHEET **3** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **4/22/92** BORING FINISH **5/6/92**

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
							50					0715 5-5-92 SWL 49.3 FT.
9	NQ	55.3	65.3		10.0	51	55			GRAY SANDY SHALE		
							60					
10	NQ	65.3	75.3		10.0	51	65			GRAY SHALE		
							70			RED SHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-12** DATE **7/23/15** SHEET **4** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **4/22/92** BORING FINISH **5/6/92**

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
							75					
11	NQ	75.3	85.3		9.4	66						
							80			RED AND GRAY SHALE		
12	NQ	85.3	95.3		10.0	68	85			GRAY SHALE		
										RED SHALE		
							90			GRAY SHALE		
13	NQ	95.3	105.3		10.0	85	95					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-12** DATE **7/23/15** SHEET **5** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **4/22/92** BORING FINISH **5/6/92**

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
							100			GRAY SANDSTONE		Momentary loss of water. 1450 5-4-92 SWL 96 HRS.100.0
14	NQ	105.3	115.3		10.0	100	105					
							110					
15	NQ	115.3	125.3		9.3	74	115			GRAY SHALE soft RED SHALE GRAY SHALE hard		
							120					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-12** DATE **7/23/15** SHEET **6** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **4/22/92** BORING FINISH **5/6/92**

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
							125					
16	NQ	125.3	135.3		10.0	82				GRAY SANDSTONE hard		
							130					
										RED SHALE		
										GRAY SHALE hard		
17	NQ	135.3	140.3		4.6	88	135					
18	NQ	140.3	150.3		10.0	67	140					
							145					
										RED SHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-12** DATE **7/23/15** SHEET **7** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **4/22/92** BORING FINISH **5/6/92**

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	NQ	150.3	155.3		4.9	68						HOLE CASED TO 153.7 FT.
20	NQ	155.3	165.3		10.0	82	155			GRAY SHALE hard		
							160					
21	NQ	165.3	170.3		4.6	89	165					166.0 Top of bentonite seal.
22	NQ	170.3	175.3		4.1	28	170			RED SHALE with limestone nodules		172.0 Top of gravel pack.
23	NQ	175.3	185.3		9.9	54	175					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-12** DATE **7/23/15** SHEET **8** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **4/22/92** BORING FINISH **5/6/92**

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
							180			GRAY SANDY SHALE		
										GRAY SHALEY SANDSTONE		
24	NQ	185.3	195.3		10.0	83	185			GRAY SANDSTONE		
							190					190.6 Top of screen.
												192.6 Bottom of screen.
										GRAY SHALE medium hard		194.0 Bottom of gravel pack.
25	NQ	195.3	200.3		4.6	45	195			GRAY SHALE hard		
										RED SHALE medium hard		
							200					200.3 Bottom of bore hole.

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-12** DATE **7/23/15** SHEET **9** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **4/22/92** BORING FINISH **5/6/92**

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
										WELL DEVELOPMENT Hole was flushed with drill water until drill water was visually clear. Hole was bailed dry and a geomon type monitoring well was installed and purged until a visually clear sample was abtained. WELL MATERIAL 1.25" diameter 20 slot screen pvc. 1" sch. 80 pvc casing.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 710,337.4 E 1,731,154.1**

GROUND ELEVATION **802.0** SYSTEM _____

Water Level, ft	▽ 18.4	▼ 23.9	▼ 44.0
TIME	1536	0750	0715
DATE	5-11-92	5-12-92	5-13-92

BORING NO. **MW-13** DATE **7/23/15** SHEET **1** OF **7**

BORING START **5/7/92** BORING FINISH **5/13/92**

PIEZOMETER TYPE _____ WELL TYPE **GM**

HGT. RISER ABOVE GROUND **3.04** DIA **1.0**

DEPTH TO TOP OF WELL SCREEN **151.4** BOTTOM **153.4**

WELL DEVELOPMENT **SEE NOTES** BACKFILL **VOLCLAY GROUT**

FIELD PARTY **HOWELL\YATES** RIG **CME75**

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	NQ-2	3.4	4.5		.6	0				BROWN SANDSTONE		
2	NQ-2	4.5	14.5		10.0	62	5					
3	NQ-2	14.5	24.5		8.0	27	10					
							15			GRAY SHALE, soft		

TYPE OF CASING USED

X	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"
	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 _____

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-13** DATE **7/23/15** SHEET **2** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **5/7/92** BORING FINISH **5/13/92**

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
4	NQ-2	24.5	33.4		2.9	14	25			RED SHALE, soft		
5	NQ-2	33.4	34.5		1.1	50	30			GRAY SHALE hard		
6	NQ-2	34.5	44.5		10.0	59	35			GRAY SHALE medium hard		
7	NQ-2	44.5	54.5		10.0	54	40					
							45			RED SHALE soft		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-13** DATE **7/23/15** SHEET **3** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **5/7/92** BORING FINISH **5/13/92**

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
										GRAY SANDY SHALE hard		
							50			GRAY/BROWN SANDSTONE		
										GRAY SHALE		
										BROWN SHALEY SANDSTONE		
8	NQ-2	54.5	64.5		10.0	23				YELLOW SHALE hard oxidation throughout		
							55			GRAY SHALE soft		
										BROWN SANDSTONE		
							60			GRAY SANDSTONE hard		
9	NQ-2	64.5	74.5		10.0	59				GRAY SHALEhard		
							65					
							70					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-13** DATE **7/23/15** SHEET **4** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **5/7/92** BORING FINISH **5/13/92**

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
10	NQ-2	74.5	84.5		10.0	83	75					
							80			GRAY SANDSTONE hard with oxidation and high angle fracture at 80.6		PARTIAL LOSS OF DRILL WATER
11	NQ-2	84.5	94.5		10.0	74	85			GRAY SHALE		
										RED SHALE		
							90			GRAY SHALE		
12	NQ-2	94.5	104.5		10.0	76	95			GRAY SANDY SHALE hard		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-13** DATE **7/23/15** SHEET **5** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **5/7/92** BORING FINISH **5/13/92**

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
							100					
										RED SHALE medium hard		
13	NQ-2	104.5	114.5		10.0	79	105					
										GRAY SHALE hard		
							110					
										GRAY SANDSTONE		
14	NQ-2	114.5	124.5		10.0	87	115					
										GRAY SHALE hard		
										RED SHALE hard		
							120			GRAY SANDSTONE hard		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-13** DATE **7/23/15** SHEET **6** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **5/7/92** BORING FINISH **5/13/92**

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	NQ-2	124.5	132.5		7.8	73	125			GRAY SHALE hard		
										RED SHALE hard		128.0 Top of bentonite seal.
16	NQ-2	132.5	140.0		7.0	65	130			RED SHALE hard, high angle fractures		133.5 Top of gravel pack.
17	NQ-2	140.0	150.0		9.9	95	135			GRAY SANDSTONE hard		
							140					
							145					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-13** DATE **7/23/15** SHEET **7** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **5/7/92** BORING FINISH **5/13/92**

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
18	NQ-2	150.0	155.0		5.0	88				GRAY SANDSTONE hard		
										RED SHALE		151.4 Top of screen.
												153.4 Bottom of screen.
							155					155.0 Bottom of gravel pack and boring.
										WELL DEVELOPMENT Hole was flushed with drill water until return water was visually clear. Hole was bailed and a geomon type monitoring well was installed and purged until a visually clear sample was obtained. WELL MATERIAL 1.25" diameter 20 slot screen pvc. 1" sch. 80 casing pvc.		
							160					

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 710,272.6 E 1,729,225.4**

GROUND ELEVATION **715.1** SYSTEM _____

Water Level, ft	▽ 9.1	▼	▼
TIME	0715		
DATE	8-11-92		

BORING NO. **MW-14** DATE **7/23/15** SHEET **1** OF **3**

BORING START **8/6/92** BORING FINISH **8/11/92**

PIEZOMETER TYPE _____ WELL TYPE **OW**

HGT. RISER ABOVE GROUND **1.77** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **45.4** BOTTOM **54.9**

WELL DEVELOPMENT **SEE NOTES** BACKFILL **VOLCLAY GROUT**

FIELD PARTY **TJH-TLS** RIG **CME-75**

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	3.5	5.0	4-6-8	1.4					BROWN AND GRAY SILTY CLAY		Hole was reamed to 6" and well installed.
2	SS	8.5	9.3	42-50/3			5			RED CLAY SHALE weathered		
3	NQ-2	9.3	15.0		2.4	0	10			RED CLAY SHALE		
4	NQ-2	15.0	23.5		6.3	30	15					

TYPE OF CASING USED

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

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-14** DATE **7/23/15** SHEET **2** OF **3**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **8/6/92** BORING FINISH **8/11/92**

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
5	NQ-2	23.5	25.0		.5	27						
6	NQ-2	25.0	35.0		9.9	85	25			GRAY SILTY CLAY SHALE well cemented		
							30			GRAY CLAY SHALE v-soft		
7	NQ-2	35.0	43.2		6.0	12	35			RED AND GRAY CLAY SHALE soft		
										RED CLAY SHALE soft		38.2 Top of bentonite seal,
							40					
8	NQ-2	43.2	45.0		1.5	46				GRAY CLAY SHALE soft		
										GRAY CLAY SHALE well cemented		44.0 Top of gravel pack.
9	NQ-2	45.0	55.0		10.0	97	45			GRAY SANDY CLAY SHALE		45.4 Top of screen.

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-14** DATE **7/23/15** SHEET **3** OF **3**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **8/6/92** BORING FINISH **8/11/92**

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
							50			GRAY SANDSTONE well cemented,fine grain		
10	NQ-2	55.0	59.0		3.7	45	55			GRAY SHALEY SANDSTONE GRAY SANDY SHALE RED AND GRAY CLAY SHALE		54.9 Bottom of screen. 56.4 Bottom of gravel pack and boring.

WELL DEVELOPMENT Hole was flushed with drill water until return water was visually clear. Hole was bailed dry and a 2" well installed and pumped until a visually clear and a sample obtained.
WELL MATERIAL 2" diameter 20 slot screen pvc. 2" diameter sch. 40 pvc casing.

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 710,943.8 E 1,730,886.1**

GROUND ELEVATION **679.3** SYSTEM _____

Water Level, ft	▽ 48.5	▼	▼
TIME	0730		
DATE	7-14-92		

BORING NO. **MW-15** DATE **7/23/15** SHEET **1** OF **3**

BORING START **7/13/92** BORING FINISH **7/22/92**

PIEZOMETER TYPE _____ WELL TYPE **OW**

HGT. RISER ABOVE GROUND **1.91** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **44.9** BOTTOM **53.9**

WELL DEVELOPMENT **SEE NOTES** BACKFILL **VOLCLAY GROUT**

FIELD PARTY **TJH-RLY** RIG **CME-75**

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	2.7	4.2	24-22-21	1.4					RED CLAY		Hole was reamed to 6" beforing installing well.
										BROWN SAND		
2	SS	7.7	9.2	6-7-8	1.2		5			BROWN SANDY SILT		
3	NQ-2	10.5	15.2		4.1	46	10			BROWN SANDY SHALE		
4	NQ-2	15.2	23.2		7.6	20	15			BROWN SANDSTONE		
										GRAY CLAY SHALE soft		
										RED CLAY SHALE soft		

TYPE OF CASING USED

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

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-15** DATE **7/23/15** SHEET **2** OF **3**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **7/13/92** BORING FINISH **7/22/92**

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
5	NQ-2	23.2	25.2		1.4	70						
6	NQ-2	25.2	29.6		3.2	34	25					
7	NQ-2	29.6	35.2		5.5	84	30			high angle fracture fracture at 29.2 GRAY CLAY SHALE		
8	NQ-2	35.2	45.2			74	35			GRAY CLAY SHALE hard		38.7 Top of bentonite seal.
							40			GRAY SANDSTONE GRAY CLAY SHALE		43.7 Top of gravel pack.
9	NQ-2	45.2	55.2		10.0	45	45			GRAY SANDSTONE hard		44.9 Top of screen.

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-15** DATE **7/23/15** SHEET **3** OF **3**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **7/13/92** BORING FINISH **7/22/92**

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
							50					
												53.9 Bottom of screen.
							55					
10	NQ-2	55.2	58.1		2.7					GRAY SANDY SHALE		56.0 Bottom of gravel pack.
												58.1 Bottom of boring.
										WELL DEVELOPMENT Hole was flushed with drill water until drill water was visually clear. Boring was bailed and a 2" monitoring well was installed and pumped until visaully clear sample obtained. WELL MATERIAL 2"diameter 20 slot screen pvc. 2" diameter sch 80 pvc.		

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 714,546.9 E 1,733,259.1**

GROUND ELEVATION **626.0** SYSTEM _____

Water Level, ft	▽ 16.0	▼	▼
TIME			
DATE	5-20-92		

BORING NO. **MW-16** DATE **7/23/15** SHEET **1** OF **2**

BORING START **5/20/92** BORING FINISH **5/21/92**

PIEZOMETER TYPE _____ WELL TYPE **OW**

HGT. RISER ABOVE GROUND **2.75** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **11.0** BOTTOM **21.45**

WELL DEVELOPMENT **SEE NOTES** BACKFILL **BENTONITE**

FIELD PARTY **HOWELL/YATES** RIG **CME-75**

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	2.0	3.5	2-4-5-	1.2					BROWN AND GRAY CLAY with rock fragment		Volclay grout seal replaced with bentonite seal.
2	SS	7.0	8.5	2-3-4-	1.3		5			BROWN SANDY SILT moist		
3	SS	12.0	13.5	3-5-6	1.1		10					10.0 Top of gravel pack. 11.0 Top of screen.
4	SS	17.0	18.5	4-5-6-	1.2		15			GRAY CLAY moist		

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"
	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 _____

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-16** DATE **7/23/15** SHEET **2** OF **2**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **5/20/92** BORING FINISH **5/21/92**

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
5	SS	22.0	23.5	3-7-8	1.1					GRAY SHALE moist cemented		21.4 Bottom of screen.
6	SS	27.0	28.5	4-7-12	1.3		25			RED SHALE		28.5 Bottom of gravel pack and bottom of boring.
										WELL DEVELOPMENT 6"casing was installed and flushed with drill water until visaully clear and a 2" monitoring well installed. Boring was pumped and a sample was obtained. Sample obtained was turbid. WELL MATERIAL 2" diameter 20 slot screen pvc. 2" diameter sch. 40 pvc screen.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 714,833.5 E 1,733,260.6**

GROUND ELEVATION **621.5** SYSTEM _____

Water Level, ft	▽ 8.1	▼	▼
TIME			
DATE	5-20-92		

BORING NO. **MW-17** DATE **7/23/15** SHEET **1** OF **2**

BORING START **5/20/92** BORING FINISH **5/20/92**

PIEZOMETER TYPE _____ WELL TYPE **OW**

HGT. RISER ABOVE GROUND **1.82** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **18.55** BOTTOM **28**

WELL DEVELOPMENT **SEE NOTES** BACKFILL **VOLCLAY GROUT**

FIELD PARTY **HOWELL/YATES** RIG **CME-75**

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	2.4	3.9	4-9-12	1.1					RED AND BROWN CLAY		
2	SS	7.4	8.9	3-7-8	1.3		5			BROWN CLAY		
3	SS	12.4	13.9	2-2-4	1.4		10			BROWN SANDY SILT BROWN CLAY		12.0 Top of bentonite seal. AUGER RETURN SATURATER BROWN SANDY SILT.
4	SS	17.4	18.9	2-3-5	1.2		15			BROWN SANDY CLAY wet GRAY CLAY		17.0 Top of gravel pack. 18.5 Top of screen.

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"
	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 _____

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-17** DATE **7/23/15** SHEET **2** OF **2**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **5/20/92** BORING FINISH **5/20/92**

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
5	SS	22.4	23.9	2-4-5	1.1					GRAY SILTY CLAY moist GRAY CLAY moist with rock fragment throughout		
							25					
6	SS	27.4	28.9	3-4-6	1.2					GRAY CLAY SHALE moist cemented		28.0 Bottom of screen.
							30					
7	SS	30.0	30.5	75/.5	.5					TOP .4 GRAY CLAY SHALE BOTTOM .1 GRAY SHALE hard		AUGER REFUSAL 30.5 Bottom of gravel pack and boring.

WELL DEVELOPMENT 6" diameter casing was installed and flushed with drill water was visually clear and a 2" diameter well installed. Well was pumped until a visually clear sample was obtained.

WELL MATERIAL 2" diameter 20 slot screen pvc. 2" diameter sch. 40 pvc casing.

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 714,922.0 E 1,733,257.8**

GROUND ELEVATION **622.0** SYSTEM _____

Water Level, ft	▽ 13.3	▼	▼
TIME			
DATE	5-19-92		

BORING NO. **MW-18** DATE **7/23/15** SHEET **1** OF **2**

BORING START **5/19/92** BORING FINISH **5/19/92**

PIEZOMETER TYPE _____ WELL TYPE **OW**

HGT. RISER ABOVE GROUND **1.83** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **15.1** BOTTOM **24.2**

WELL DEVELOPMENT **SEE NOTES** BACKFILL **VOLCLAY GROUT**

FIELD PARTY **TJW/RLY** RIG **CME-75**

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
1.1	SS	2.4	3.9	9-10-12	1					RED CLAY with rock fragment		
.8	SS	7.4	8.9	1-2-2	2		5			GRAY SILT moist		
1.0	SS	12.4	13.9	8-9-15	3		10			BROWN AND GRAY CLAY		9.0 Top of bentonite seal.
1.1	SS	17.4	18.9	4-6-12	4		15					13.8 Top of gravel pack. 15.1 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"
	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 _____

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-18** DATE **7/23/15** SHEET **2** OF **2**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **5/19/92** BORING FINISH **5/19/92**

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
1.2	SS	22.4	23.9	4-8-12	5					RED CLAY with rock fragment, bottom of sample changes from red to a green/brown shaley		
1.0	SS	25.9	26.9	39-54	6		25			TOP .9 S-1 GREEN/BROWN CLAY SHALE BOTTOM .1 S-2 GRAY SHALE hard TOP .9 S-1 GREENISH/BROWN CLAY SHALE with rock fragmentBOTTOM .1 S-2 HARD GRAY SHALE		24.2 Bottom of screen. 26.2 Bottom of gravel pack and boring.

WELL DEVELOPMENT 6" casing was installed and flushed with drill water until drill water return visually clear and a 2" monitoring well was installed. Well was pumped until visually clear sample was obtained.
WELL MATERIAL 2" diameter 20 slot screen pvc. 2" diameter sch. 40 pvc casing.

60

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 712,263.7 E 1,732,224.9**

GROUND ELEVATION **643.2** SYSTEM _____

Water Level, ft	▽ 2.7	▼	▼
TIME			
DATE	8-27-92		

BORING NO. **MW-19** DATE **7/23/15** SHEET **1** OF **2**

BORING START **8/12/92** BORING FINISH **8/13/92**

PIEZOMETER TYPE _____ WELL TYPE **OW**

HGT. RISER ABOVE GROUND **1.96** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **11.6** BOTTOM **20.5**

WELL DEVELOPMENT **SEE NOTES** BACKFILL **VOLCLAY GROUT**

FIELD PARTY **TJH-TLS** RIG **CME-75**

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
										0 TO 8.0 FT. AUGERED BEFORE PERFORMING FIRST SAMPLE		Volclay grout seal was replaced with bentonite pellets.
1	SS	8.0	9.5	4-1-1	1.2		5			GRAY SANDY CLAY with wood fragment		
2	SS	9.5	11.0	1-1-1	.9							
3	SS	11.0	12.5	4-12-7	1.4		10			BROWN SANDY CLAY		10.5 Top of gravel pack.
4	SS	12.5	14.0	4-5-7	0					GRAY SANDY CLAY		11.6 Top of screen.
5	SS	14.0	15.5	3-2-3	.2					BROWN SILTY CLAY		
6	SS	15.5	17.0	2-2-2	1.5		15					
7	SS	17.0	18.5	1-1-1								
8	SS	18.5	20.0	1-2-2						BROWN AND GRAY CLAYEY SAND		
										BROWN AND GRAY SANDY CLAY with .2'sand lens		

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"
X	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 _____

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-19** DATE **7/23/15** SHEET **2** OF **2**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **8/12/92** BORING FINISH **8/13/92**

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
9	SS	20.0	21.3	2-2-50/2						BROWN AND GRAY SANDY CLAY with sandstone fragment AUGER REFUSAL WELL DEVELOPMENT 6" casing was installed and flushed with drill water until drill water was visually clear and a 2" diameter well installed and pumped until a visually clear sample was obtained. WELL MATERIAL 2" diameter 20 slot screen pvc. 2" diameter sch. 40 pvc casing.		20.5 Bottom of screen. 22.8 Bottom of gravel pack and boring.

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 710,956.1 E 1,730,893.8**

GROUND ELEVATION **680.0** SYSTEM _____

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **MW-20** DATE **7/23/15** SHEET **1** OF **2**

BORING START **8/18/92** BORING FINISH **8/18/92**

PIEZOMETER TYPE _____ WELL TYPE **OW**

HGT. RISER ABOVE GROUND **2.03** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **8.9** BOTTOM **17.9**

WELL DEVELOPMENT **SEE NOTES** BACKFILL **BENTONITE**

FIELD PARTY **TJH-TLS** RIG **CME-75**

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
							5					Volclay grout seal was replaced with bentonite pellets.
							10					7.9 Top of gravel pack. 8.9 Top of screen.
	NQ-2	13.9	20.5		6.6	60	15			BROWN SANDY SHALE		
										GRAY SANDSTONE hard		
										GRAY SHALE hard		17.9 Bottom 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"
X	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 _____

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-20** DATE **7/23/15** SHEET **2** OF **2**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **8/18/92** BORING FINISH **8/18/92**

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
										WELL DEVELOPMENT 6" CASING WAS INSTALLED AND FLUSHED WITH DRILL WATER UNTIL DRILL WATER APPERED VISUALLY CLEAN. A 2" DIAMETER WELL WAS INSTALLED AND PUMPED UNTIL VISUALLY CLEAR AND A SAMPLE OBTAINED. WELL MATERIAL 2" diameter 20 slot screen pvc. 2" diameter sch 80 pvc casing.		20.5 Bottom of gravel pack and boring.

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 710,790.4 E 1,730,872.3**

GROUND ELEVATION **674.9** SYSTEM _____

Water Level, ft			
TIME			
DATE			

BORING NO. **MW-21** DATE **7/23/15** SHEET **1** OF **1**

BORING START **9/2/92** BORING FINISH **9/2/92**

PIEZOMETER TYPE _____ WELL TYPE _____

HGT. RISER ABOVE GROUND _____ DIA _____

DEPTH TO TOP OF WELL SCREEN _____ BOTTOM _____

WELL DEVELOPMENT _____ BACKFILL **VOLCLAY**

FIELD PARTY **TJH-TLS** RIG **CME-75**

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
										AUGERED TO 8.0 BEFORE FIRST SPT		
1	SS	8.0	9.5	5-8-9	1.5		5			BROWN SILTY CLAY with sandstone fragment		
2	SS	9.5	11.0	8-13-15	1.3		10			RED SILTY CLAY with sandstone fragment		
3	SS	11.0	12.5	7-8-11	.8							
4	SS	12.5	14.0	5-7-11	.7					RED CLAY		
										BROWN SANDSTONE weathered		
5	SS	14.0	15.5	3-4-7	1.1					RED CLAY		
6	SS	15.5	17.0	4-12-21	1.5		15			GREEN SANDSTONE weathered		
										RED CLAY SHALE weathered		
7	SS	17.0	17.9	22/50.4	.6							
										BROWN AND PURPLE CLAY SHALE weathered		

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"
	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 _____

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 714,609.8 E 1,733,558.2**

GROUND ELEVATION **636.6** SYSTEM **State Plane using NAD27/29**

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **MW-43** DATE **7/23/15** SHEET **1** OF **3**

BORING START **7/10/06** BORING FINISH **7/12/06**

PIEZOMETER TYPE **N/A** WELL TYPE **OW**

HGT. RISER ABOVE GROUND **3.5** DIA **2"**

DEPTH TO TOP OF WELL SCREEN **10.9** BOTTOM **29.7**

WELL DEVELOPMENT **Yes/Reclaimer** BACKFILL **Quick Grout**

FIELD PARTY **MCR / ZLR** RIG **D-120**

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
0	AUGER	0.0	3.5							**AUGER**		GROUNDING PROCEDURE NOT IN USE ON THIS BORING DIGGING PERMIT REQUIRED DECONNED ALL TOOLS USING MOUNTAINEER FIRE PROTECTION WATER AND LIQUI-NOX
1	SPT	3.5	5.0	10-4-3	.6		5			**LOOSE 5YR 3/4 MODERATE BROWN MEDIUM SAND** w/little clay & sandstone frag, dry		
2	SPT	8.5	10.0	3-4-5	1.5		10			**STIFF 5YR 4/4 MODERATE BROWN CLAY** 1.25 tsf, w/trace fine sand, dry		
3	SPT	13.5	15.0	7-9-13	1.2		15			**STIFF 5YR 4/4 MODERATE BROWN CLAY** 3.0 tsf, w/trace fine sand, dry		
4	SPT	18.5	20.0	17-11-50/.2	1.0					**HARD 5YR 6/4 LIGHT BROWN CLAY** 2.5 tsf, w/some medium sand, dry		

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 **MCR**

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-43** DATE **7/23/15** SHEET **2** OF **3**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **7/10/06** BORING FINISH **7/12/06**

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
5	SPT	23.5	23.9	50/.4	.3		25			**HARD 5GY 5/2 DUSKY YELLOW GREEN WEATHERED FINE GRAIN SANDY SHALE** dry		
6	SPT	28.5	29.2	30-50/.2	.7		30			**HARD 5YR 3/4 MODERATE BROWN CLAY SHALE** dry		
7	SPT	30.8	31.0	50/.2	.2	59				**HARD 5G 4/1 DARK GREENISH GRAY CLAY SHALE** dry		STOPPED CASING ADVANCER @ 30.8' STARTED CORING @ 31.0'
1	NQ	31.0	34.5		2.7					**MEDIUM HARD 5G 4/1 DARK GREENISH GRAY CLAY SHALE**		
2	NQ	34.5	44.5		6.5	22	35			**VERY SOFT 10R 5/4 PALE REDDISH BROWN CLAY SHALE**		
3	NQ	44.5	49.5		5.0	62	40					
							45			**HARD 5B 7/1 LIGHT BLUISH GRAY SILTY CLAY SHALE** .1 soft area @ 48.3'		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-43** DATE **7/23/15** SHEET **3** OF **3**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **7/10/06** BORING FINISH **7/12/06**

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
												STOPPED BORING @ 49.5' PLUGGED NQ ROCK HOLE W/BENTONITE PELLETS PULLED HW CASING & REDRILLED SAME BORE HOLE W/6.25" HSA'S TO SET 2" WELL

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 714,697.9 E 1,733,351.5**

GROUND ELEVATION **624.5** SYSTEM **State Plane using NAD27**

Water Level, ft			
TIME			
DATE			

BORING NO. **MW-44** DATE **7/23/15** SHEET **1** OF **2**

BORING START **6/10/08** BORING FINISH **6/10/08**

PIEZOMETER TYPE _____ WELL TYPE _____

HGT. RISER ABOVE GROUND **2.642** DIA _____

DEPTH TO TOP OF WELL SCREEN _____ BOTTOM _____

WELL DEVELOPMENT **N/A** BACKFILL **Quick Grout**

FIELD PARTY **MCR / ZLR / RMP** RIG **D-120**

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	SPT	0.0	1.5	3-4-7	1.5					**STIFF 10R 3/4 DARK REDDISH BROWN CLAY** tsf 4.5, w/trace of silts and trace of weathered coal, dry		NO GROUNDING PROCEDURE IN USE ON THIS BORING; DIGGING PERMIT IN HAND
2	SPT	1.5	3.0	4-7-10	1.5					**STIFF 10R 3/4 DARK REDDISH BROWN CLAY** tsf 4.0, w/trace of silts, dry		
3	SPT	3.0	4.5	3-4-7	1.5					**STIFF 10R 5/4 PALE REDDISH BROWN CLAY** tsf 3.75, w/trace of silts and trace of weathered coal, dry		
4	SPT	4.5	6.0	3-4-6	1.5		5			**STIFF 10R 5/4 PALE REDDISH BROWN CLAY** tsf 3.0, w/ little silt, dry		
5	SPT	6.0	7.5	4-7-12	1.5					**STIFF 10YR 6/6 DARK YELLOWISH ORANGE CLAY** tsf 2.5, w/some sand and weathered fine grain sandstone and coal, dry		
6	SPT	7.5	9.0	7-4-6	1.4					**STIFF 10YR 6/6 DARK YELLOWISH ORANGE CLAY** tsf 2.0, w/some sand and weather fine grain sandstone and coal, .2' medium grain sand at bottom of spoon, moist		
7	SPT	9.0	10.5	5-4-5	1.5		10			**STIFF 10YR 6/6 DARK YELLOWISH ORANGE CLAY AND SAND** tsf 1.75, coarse w/sandstone and coal fragments, wet - water on outside of spoon		
8	SPT	10.5	12.0	3-5-7	1.5					**STIFF 5 YR 6/4 LIGHT BROWN CLAY** tsf 2.25, dry		
9	SPT	12.0	13.5	4-5-9	1.5					**STIFF 10YR 6/6 DARK YELLOWISH ORANGE CLAY** tsf 3.25, w/ little fine sand, moist		
10	SPT	13.5	15.0	7-7-11	1.5					**STIFF 10R 6/6 DARK YELLOWISH ORANGE CLAY** tsf 3.75, w/some coarse sand w/sandstone fragments, moist		
11	SPT	15.0	16.5	6-7-11	1.5		15			**STIFF N5 MEDIUM GRAY CLAY** tsf 2.5, w/ 2" silt seam, dry		
12	SPT	16.5	18.0	3-5-7	1.5					**STIFF N6 MEDIUM LIGHT GRAY CLAY** tsf 1.5, w/some silts, dry		
13	SPT	18.0	19.5	3-4-6	1.4					**STIFF N6 MEDIUM LIGHT GRAY CLAYEY SILT** tsf 1.5, dry to moist		
14	SPT	19.5	21.0	3-5-7	1.3							

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 _____

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **MW-44** DATE **7/23/15** SHEET **2** OF **2**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **6/10/08** BORING FINISH **6/10/08**

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	SPT	21.0	22.5	4-6-12	1.5					**STIFF N6 MEDIUM LIGHT GRAY CLAYEY SILT** tsf 1.75, w/little medium sand w/sandstone fragments, moist		
16	SPT	22.5	24.0	4-12-16	1.4					**VERY STIFF N6 MEDIUM LIGHT GRAY SILTY CLAY** tsf 1.75, w/some medium sand and sandstone fragments, wet		
17	SPT	24.0	25.5	7-21-34	1.5					**VERY STIFF 10YR 4/6 MEDIUM REDDISH BROWN CLAY** tsf 1.75, w/little silts, dry to moist		
							25					
18	SPT	25.5	27.0	16-36-50/3	1.4					**VERY STIFF N6 MEDIUM LIGHT GRAY SILTY CLAY** tsf 1.25, w/trace of fine sand and rock fragments, wet		
19	SPT	27.0	28.5	20-38-50/2	1.1					**SOFT 5R 3/4 DUSKY RED SILT** tsf 1.25, dry		
										VERY STIFF 5R 6/2 PALE RED CLAY tsf 2.25, w/trace of fine sand, wet		STOPPED BORING @ 28.1', TREMIE GROUTED 28.1' TO GRADE USING 50 GALLONS OF QUICK GROUT; SWL 06/12/08 = 4.8', 16 hr READING
										SOFT 5R 3/4 DUSKY RED SILT tsf 2.25, dry		
										VERY STIFF 5R 4/2 GRAYISH RED WEATHERED CLAYSHALE tsf 4.5, dry		
										VERY STIFF 5R 4/2 GRAYISH RED WEATHERED CLAYSHALE tsf 3.25, dry		
										VERY STIFF N7 LIGHT GRAY WEATHERED CLAYSHALE tsf 3.25, dry		

ARCADIS

AEP 1996, 1997

Boring Logs

96-21 to 96-24, 96-27 to 96-33

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 711,473.4 E 1,700,163.8**

GROUND ELEVATION **658.0** SYSTEM

Water Level, ft			
TIME			
DATE			

BORING NO. **96-21** DATE **7/23/15** SHEET **1** OF **3**

BORING START **9/17/96** BORING FINISH **9/18/96**

PIEZOMETER TYPE WELL TYPE **OW**

HGT. RISER ABOVE GROUND **1.9** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **26.0** BOTTOM **35.0**

WELL DEVELOPMENT **YES** BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-LD** RIG **BK-81**

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	1-1-2	1.0				CL	BROWN SANDY CLAY Fine grain.		Flushed boring with approximately 500 gallons of water.
2	SS	1.5	3.0	4-4-4	1.2							Rig was decon 1-23-97 potable water and Alconax.
3	SS	3.0	5.0	5-5-7-8	1.5							Hole drilled with HSA.
4	SS	5.0	7.0	4-6-8-10	1.5		5		CL	REDDISH BROWN CLAY With small sandstone gravels.		
5	ST	7.0	9.0		1.3				CL	TAN SILTY CLAY PUSH 2.0 PSI 1000 TIME 8 SEC.		
6	SS	9.0	11.0	5-8-11-15					CL	REDDISH BROWN CLAY With sandstone gravels.		
7	SS	11.0	13.0	4-6-7-8	1.5		10		CL	REDDISH GRAY SANDY CLAY		
8	SS	13.0	15.0	3-3-5	1.5							
9	ST	15.0	16.5		1.3		15			REDDISH TAN CLAYSHALE PUSH 1.5 TIME 10 SEC. PSI 1200 UNTIL LIFTED RIG		
10	SS	17.0	17.7	40-50/.2	.6					GRAY SILTY CLAYSHALE MEDIUM GRAY N5 CLAYSHALE With some fractures FE stains, 19.8 vertical fracture to 20.0'.		18.3 Top of seal.
11	NQ	19.1	25.0		5.9	19						

TYPE OF CASING USED

X	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 **LD**

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-21** DATE **7/23/15** SHEET **2** OF **3**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/17/96** BORING FINISH **9/18/96**

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
										20.4 to 22.8' clay seams.		
												24.0 Top of sand.
12	NQ	25.0	35.0		9.9	56	25			MEDIUM GRAY N-5 SANDSTONE With cross bedding, 26.0 leisigang staining on rock 26.0 to 26.2.		26.0 Top of screen.
							30					
13	NQ	35.0	40.0		5.0	68	35					35.0 Bottom of screen.
										MEDIUM GRAY N-5 CLAYSHALE		36.1 Bottom of sand.
										GRAYISH RED 10R 4\2 CLAYSHALE		
							40			1-30-97 SWL 7.5. pH COND. TEMP. GALLONS SWL. 8.66 652 56 2.0 9.3. 8.17 633 56 6.0 12.8. 7.83 661 56 10.0 14.8. 8.42 653 56 12.0 16.0. 9.02 653 56 12.0 16.9. 8.98 644 56 12.0 17.5. 8.95 616 56 20.0 21.1. 8.88 666 56 20.0 24.1. 8.94 645 56 20.0 26.2. 9.07 642 56 60.0 29.7. 9.11 651 56 60.0 33.8.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-21** DATE **7/23/15** SHEET **3** OF **3**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/17/96** BORING FINISH **9/18/96**

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
										STOPPED PUMP 2:19 SWL AT 2:29 12.9'. SWL 2-6-97 6.16'.		

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 710,351.2 E 1,699,713.8**

GROUND ELEVATION **803.1** SYSTEM _____

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **96-22** DATE **7/23/15** SHEET **1** OF **10**

BORING START **9/4/96** BORING FINISH **9/6/96**

PIEZOMETER TYPE _____ WELL TYPE **OW**

HGT. RISER ABOVE GROUND **1.68** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **163.0** BOTTOM **292.0**

WELL DEVELOPMENT **YES** BACKFILL **QUICK GROUT**

FIELD PARTY **REB-RLY** RIG **JOY 22**

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
							5					Rig and tools decon 11-14-96 with potable water and Alconox. 11-19-96 Adavance boring to 160, blown dry, 11-20-96 14 hrs 18'. 11-20-96 Completed hole blown dry, water returning about 2-3 gpm
1	NQ	8.5	20.2		11.7	34	10			BROWN SANDY CLAYSHALE With red oxidation throughout.		
							15					

TYPE OF CASING USED

X	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 **RLY**

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-22** DATE **7/23/15** SHEET **2** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/4/96** BORING FINISH **9/6/96**

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
2	NQ	20.2	30.2		7.6	62				GRAY SANDY SHALE		
							25			BROWNISH GRAY CLAYSTONE		
3	NQ	30.2	40.2		8.8	73	30			RED CLAYSHALE		
							35			GRAY CLAYSHALE Hard with limestone nodules.		
4	NQ	40.2	50.2		10.0	79	40			Well cemented		
							45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-22** DATE **7/23/15** SHEET **3** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/4/96** BORING FINISH **9/6/96**

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
							50					
5	NQ	50.2	60.2		10.0	80				GRAY SANDY SHALE Well cemented.		
										GRAY CLAYSHALE		
							55					
							60					
6	NQ	60.2	70.2		10.0	90				OLIVE BROWN SANDY SHALE		
							65					
										GRAY CLAYSHALE		
							70					
7	NQ	70.2	80.2		10.0	64				GRAY CLAY 70.2-70.4		
										GRAY SANDY SHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-22** DATE **7/23/15** SHEET **4** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/4/96** BORING FINISH **9/6/96**

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
							75					
8	NQ	80.2	90.2		10.0	90	80			GRAY SANDSTONE Well cemented.		
							85			RED CLAYSHALE		
9	NQ	90.2	100.2		10.0	100	90			GRAY SANDY SHALE Well cemented, limestone nodules.		
							95					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-22** DATE **7/23/15** SHEET **5** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/4/96** BORING FINISH **9/6/96**

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
							100					
10	NQ	100.2	110.2		10.0	90				RED CLAYSHALE		
							105					
										GRAY SANDY SHALE		
11	NQ	110.2	120.2		10.0	98	110			DARK GREENISH GRAY 5G 4\1 SANDY CLAYSHALE Hard, well cemented, fine grain some cross bedding.		
							115					
										DARK REDDISH BROWN 10R 3\4 CLAYSHALE Soft.		
										MEDIUM GRAY N-5 SANDSTONE Hard, well cemented, silty, fine grain.		
12	NQ	120.2	130.2		9.0	90	120			GRAY SANDY SHALE Well cemented.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-22** DATE **7/23/15** SHEET **6** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/4/96** BORING FINISH **9/6/96**

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
							125			RED AND GRAY MOTTLED CLAYSHALE		
13	NQ	130.2	140.2		10.0	47	130			RED CLAYSHALE High angle fracture at 135.0,140.2.		
							135					
14	NQ	140.2	150.2		10.0	93	140			LIGHT GRAY CLAYSHALE Interbedded with sandstone.		
							145					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-22** DATE **7/23/15** SHEET **7** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/4/96** BORING FINISH **9/6/96**

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	NQ	150.2	160.2		10.0	59						
							155			RED CLAYSHALE		153.0 Top of seal.
16	NQ	160.2	170.2		10.0	60	160					160.0 Top of sand.
												163.0 Top of screen.
							165			GRAY CLAYSHALE Limestone nodules.		
17	NQ	170.2	180.2		10.0	100	170			Interbedded sandstone		
							175					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-22** DATE **7/23/15** SHEET **8** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/4/96** BORING FINISH **9/6/96**

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
							180					
18	NQ	180.2	190.2		10.0	100				GRAY SANDSTONE Massive.		
							185			GRAY CLAYSHALE Interbedded sandstone.		
							190			MEDIUM GRAY N-5 SANDSTONE With shale cross bedding.		
19	NQ	190.2	200.2		10.0	89				GRAYISH RED 10R 4\2 CLAYSHALE		192.0 Bottom of screen.
							195					194.0 Bottom of sand.
							200					
20	NQ	200.2	210.2		10.0	87						

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-22** DATE **7/23/15** SHEET **9** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/4/96** BORING FINISH **9/6/96**

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
							205			LIGHT GRAY N-7 SANDSTONE Shale cross bedding.		
										Fine grain, massive.		
							210			Shale cross bedding.		
21	NQ	210.2	220.2		10.0	90				LIGHT GRAY SANDSTONE Hard, massive.		
										MEDIUM GRAY N-5 CLAYSHALE		
							215			LIGHT GRAY SANDSTONE Massive, hard.		
										MEDIUM GRAY CLAYSHALE		
22	NQ	220.2	230.2		10.0	69	220			GRAYISH RED 10R 4\2 CLAYSHALE High angle fracture.		
							225					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-22** DATE **7/23/15** SHEET **10** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/4/96** BORING FINISH **9/6/96**

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
							230			SWL 1-7-97 109.55. 8L 10 MIN. SWL 136 Ph 8.39 COND. 2610. 9L 14.5 MIN. SWL151. 49L 30 MIN. SWL 167 pH 8.62 COND 2560 LIGHT RED. 76L 45 MIN. SWL 174. 92L 60 MIN. SWL 178.2 pH 8.51 COND 2570 REDDISH LIGHT RED. 108L 75 MIN. SWL 182.4. 135L 90 MIN. SWL 188.5 pH 8.48 COND 2520. 105 MIN. SWL 193.0. 1-8-97 22 HRS. SWL 191.48. pH 8.20 COND 2590. pH 8.43 COND. 2680. 2L DRY. 1-9-97 10:40 AM SWL 191.55. 2-6-97 SWL 183.03.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 708,450.6 E 1,698,953.5**

GROUND ELEVATION **690.5** SYSTEM _____

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **96-23** DATE **7/23/15** SHEET **1** OF **7**

BORING START **10/9/96** BORING FINISH **10/15/96**

PIEZOMETER TYPE _____ WELL TYPE **OW**

HGT. RISER ABOVE GROUND **2.05** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **91.9** BOTTOM **111.0**

WELL DEVELOPMENT **YES** BACKFILL **QUICK GROUT**

FIELD PARTY **REB -LD** RIG **JOY 22**

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
												SWL in NQ hole 7.6'
												Boring produceed a lot of water while advanceing air hammer.
							5					No drill water used to advance boring.
												Decon 1-13-96 potable water and Alconox.
1	NQ	8.9	21.2		10.0	55				MEDIUM LIGHT GRAY N-6 SANDSTONE Fine to medium grain.		
							10					
										MEDIUM LIGHT GRAY N-6 CLAYSHALE		
							15			GRAYISH RED 10R 4\2 CLAYSHALE		

TYPE OF CASING USED

X	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 **LD**

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-23** DATE **7/23/15** SHEET **2** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **10/9/96** BORING FINISH **10/15/96**

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
2	NQ	21.2	31.2		7.2	43				DARK REDDISH BROWN 10R 3\4 SILTY CLAYSHALE		
							25			MEDIUM LIGHT GRAY N-6 SANDSTONE Fine grain.		
										MEDIUM GRAY N-5 SANDSTONE Medium grain.		
3	NQ	31.2	41.2		9.8	60	30					
										MEDIUM LIGHT GRAY N-6 SANDSTONE Fine to medium grain.		
							35					
										MEDIUM LIGHT GRAY N-6 CLAYSHALE		
							40					
4	NQ	41.2	51.2		8.1	19				GRAYISH RED 10R\4\2 CLAYSHALE		
										DARK REDDISH BROWN 10R 4\2 CLAYSHALE		
							45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-23** DATE **7/23/15** SHEET **3** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **10/9/96** BORING FINISH **10/15/96**

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
							50					
5	NQ	51.2	61.2		9.4	60				MEDIUM LIGHT GRAY N-6 CLAYSHALE		
							55			MEDIUM GRAY N-5 SANDY SHALE Fine grain.		
6	NQ	61.2	71.2		10.0	72	60			Well cemented		
							65					
							70					
7	NQ	71.2	81.2		9.6	76				MEDIUM LIGHT GRAY N-6 SANDSTONE Fine to medium grain.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-23** DATE **7/23/15** SHEET **4** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **10/9/96** BORING FINISH **10/15/96**

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
							75					
										GRAYISH RED 10R 4\2 CLAYSHALE		
							80					
8	NQ	81.2	91.2		9.0	88				MULTI COLORED DARK REDDISH BROWN, GRAY, GRAY BLACK 10R 3\4 CLAYSHALE		82.2 Top of seal.
							85					87.9 Top of sand.
							90					
9	NQ	91.2	101.2		10.0							91.9 Top screen.
										MEDIUM N-5 SANDY SHALE Fine grain.		
							95					

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-23** DATE **7/23/15** SHEET **5** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **10/9/96** BORING FINISH **10/15/96**

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
							100					
10	NQ	101.2	111.2		10.0	85						
							105					
							110			GRAYISH RED 10R 4\2 CLAYSHALE		
11	NQ	111.2	121.2		96.	43				GRAYISH RED 10R 4\2 MULTI COLORED GRAY MOTTLED BROWN, RED CLAYSHALE		111.0 Bottom of screen. 112.1 Bottom of sand.
							115					
							120					
12	NQ	121.2	131.2		10.0	38						

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-23** DATE **7/23/15** SHEET **6** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **10/9/96** BORING FINISH **10/15/96**

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
							125					
							130					
13	NQ	131.2	141.2		10.0					GRAYISH RED 10R 4\2 CLAYSHALE MEDIUM LIGHT GRAY N-6 SANDY SHALE		
							135					
14	NQ	141.2	151.2		10.0		140			MEDIUM GRAY N\5 SANDY SHALE		
							145					149.0 Bottom of bottom seal.

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-23** DATE **7/23/15** SHEET **7** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **10/9/96** BORING FINISH **10/15/96**

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
										1-31-97 SWL 36.7'. pH COND. TEMP. GALLONS SWL. 10.07 1007 52 2.0 49.4. 10.00 976 53 2.0 64.1. 10.13 980 56 2.0 77.9. 10.07 962 56 2.0 92.6. 9.90 865 56 2.0 95.8. 9.80 1004 56 4.0 98.0. 10.20 994 56 4.0 103.0. 10.12 990 56 6.0 108.6. 10.07 995 56 5 DRY. 9:30 SWL 113.0 10:00 112.7. 12:00 112.0. 2-6-97 SWL 111.70.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 709,245.0 E 1,732,142.0**

GROUND ELEVATION **825.5** SYSTEM

Water Level, ft			
TIME			
DATE			

BORING NO. **96-24** DATE **7/23/15** SHEET **1** OF **10**

BORING START **9/17/96** BORING FINISH **9/23/96**

PIEZOMETER TYPE WELL TYPE **OW**

HGT. RISER ABOVE GROUND **N/A** DIA

DEPTH TO TOP OF WELL SCREEN **N/A** BOTTOM **N/A**

WELL DEVELOPMENT **N/A** BACKFILL **QUICK GROUT**

FIELD PARTY **REB-RLY** RIG **JOY 22**

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		.7				CL	BROWN SANDY CLAY		
2	SS	1.5	3.0		1.1							
3	SS	3.0	4.5		.9					BROWN SILTY CLAY SHALE		
4	SS	4.5	6.0		1.1		5			RED CLAY SHALE		
5	SS	6.0	7.5		.9							
6	SS	7.5	9.0		.8							
7	SS	9.0	10.5		1.1		10					
8	NQ	11.0	20.0		5.1	22				MODERATE REDDISH BROWN 10R 4\6 CLAYSHALE		
							15			GRAYISH ORANGE 10YR 7\4 CLAYSHALE		

TYPE OF CASING USED

X	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 **RLY**

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-24** DATE **7/23/15** SHEET **2** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/17/96** BORING FINISH **9/23/96**

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
9	NQ	20.0	30.0		4.4	0				5Y 5\2 LIGHT OLIVE GRAY CLAYSHALE Soft.		
							25			10R 5\4 PALE REDDISH BROWN CLAYSHALE Soft.		
10	NQ	30.0	40.0		8.0	50	30					
							35			5B 5\1 MEDIUM BLUISH GRAY SANDY SHALE		
11	NQ	40.0	50.0		10.0	100	40					
							45			.5 VERTICAL CRACK 44.5'		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-24** DATE **7/23/15** SHEET **3** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/17/96** BORING FINISH **9/23/96**

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
							50					
12	NQ	50.0	60.0		10.0	80				5YR 4\1 BROWNISH GRAY CLAYSHALE		
										5B 5\1 MEDIUM BLUISH GRAY SANDSTONE With shale partings.		
							55			5YR 4\1 BROWNISH GRAY CLAYSHALE		
13	NQ	60.0	70.0		10.0	30	60			10R 4\6 MODERATE REDDISH BROWN CLAYSHALE With high angle fractures at 66.4'		
							65					
										5B 5\1 MEDIUM BLUISH GRAY SHALE SANDSTONE Hard.		
14	NQ	70.0	80.0		10.0	100	70			MEDIUM GRAY SANDY SHALE Limestone nodules.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-24** DATE **7/23/15** SHEET **4** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/17/96** BORING FINISH **9/23/96**

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
							75					
							80			5B 7\1 MEDIUM GRAY SANDY SHALE Hard.		
							85					
										N-7 LIGHT GRAY SANDSTONE		
15	NQ	90.0	100.0		10.0	100	90			5B 7\1 LIGHT BLUISH GRAY SANDSTONE With shale partings, well cemented.		
							95					

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-24** DATE **7/23/15** SHEET **5** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/17/96** BORING FINISH **9/23/96**

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	NQ	100.0	110.0		10.0	56	100			N\4 MEDIUM DARK GRAY SHALEY SANDSTONE Limestone nodules.		
							105					
										N\5 GRAY SANDSTONE		
17	NQ	110.0	120.0		10.0	100	110			5B 5\1 MEDIUM BLUISH GRAY SANDSTONE		
							115					
18	NQ	120.0	130.0		10.0	67	120			5B 5\1 MEDIUM BLUISH GRAY CLAYSHALE 10R 5\4 PALE REDDISH BROWN CLAYSHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-24** DATE **7/23/15** SHEET **6** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/17/96** BORING FINISH **9/23/96**

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
							125			5B 5\1 MEDIUM BLUISH GRAY CLAYSHALE Limestone nodules.		
19	NQ	130.0	140.0		10.0	40	130			N7 LIGHT GRAY SANDSTONE		
										10 5\4 PALE REDDISH BROWN CLAYSHALE		
							135					
										5B 5\1 MEDIUM BLUISH GRAY SANDY SHALE		
20	NQ	140.0	150.0		10.0	86	140			5b 5\1 MEDIUM BLUISH GRAY CLAYSHALE Limestone nodules.		
										5B 7\1 LIGHT BLUISH GRAY SANDSTONE		
							145			RED CLAYSHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-24** DATE **7/23/15** SHEET **7** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/17/96** BORING FINISH **9/23/96**

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	NQ	150.0	160.0		9.5	87				5B 5\1 MEDIUM BLUISH GRAY SHALEY SANDSTONE		
										N-6 MEDIUM LIGHT GRAY SANDY SHALE		
							155					
										N-4 MEDIUM DARK GRAY WITH RED LAYERS CLAYSHALE		
22	NQ	160.0	170.0		9.4	52	160			RED, GRAY, BROWN MOTTLED CLAYSHALE		
							165			5R 3\4 DUSKY RED CLAYSHALE		
23	NQ	170.0	180.0		10.0	92	170			RED, GRAY, BROWN MOTTLED CLAYSHALE		
										N\5 MEDIUM GRAY SANDY SHALE Fine to medium grain.		
							175					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-24** DATE **7/23/15** SHEET **8** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/17/96** BORING FINISH **9/23/96**

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
24	NQ	180.0	190.0		9.4	32	180			N-6 MEDIUM LIGHT GRAY SANDY SHALE Fine grain.		
										RED, GRAY, BROWN MOTTLED CLAYSHALE		
										10R 2\2 VERY DUSKY RED CLAYSHALE		
							185					
25	NQ	190.0	200.0		9.4	67	190			10R 3\4 DARK REDDISH, BROWN, RED CLAYSHALE		
										N-5 MEDIUM GRAY SANDY SHALE		
							195					
										5R 4\2 GRAYISH RED CLAYSHALE Limestone nodules.		
										N\4 MEDIUM DARK GRAY SANDY SHALE		
26	NQ	200.0	210.0		10.0	100	200			N-6 MEDIUM DARK GRAY SANDY SHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-24** DATE **7/23/15** SHEET **9** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/17/96** BORING FINISH **9/23/96**

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
							205					
27	NQ	210.0	220.0		9.4	71	210			N-5 MEDIUM GRAY SANDSTONE With shale partings. Cross bedding		
							215					
28	NQ	220.0	230.0		9.6	54	220			N-4 MEDIUM DARK GRAY SANDY SHALE Fine grain N-5 MEDIUM GRAY SANDY SHALE Fine grain. RED, GRAY, BROWN MOTTLED CLAYSHALE		
							225			N-4 MEDIUM DARK GRAY, RED STREAKS CLAYSHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-24** DATE **7/23/15** SHEET **10** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/17/96** BORING FINISH **9/23/96**

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
										5R 3\4 DUSKY RED CLAYSHALE		
							230					
							235					
							240					

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 712,597.9 E 1,699,973.8**

GROUND ELEVATION **718.1** SYSTEM _____

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **96-27** DATE **7/23/15** SHEET **1** OF **8**

BORING START **9/25/96** BORING FINISH **10/9/96**

PIEZOMETER TYPE _____ WELL TYPE **OW**

HGT. RISER ABOVE GROUND **1.43** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **111.0** BOTTOM **130.0**

WELL DEVELOPMENT _____ BACKFILL **QUICK GROUT**

FIELD PARTY **REB-TLS-RLY** RIG **JOY 22**

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
							5					Decon 1-15-97 potable water and Alconox. SWL 1-16-97 NQ hole 70.65 SWL 66.35 8" hole to 100' 500 gallons of water use to flush hole. SWL after installation 99.8. From 181.2 to 132 tremie backfill w/ bentonite pellets
							10					
							15					
1	NQ	15.7	20.6		4.9	37				PALE REDDISH BROWN 10R 5\4 SANDY SHALE Brown sandstone nodules.		

TYPE OF CASING USED

X	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 **TLS-RLY**

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-27** DATE **7/23/15** SHEET **2** OF **8**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/25/96** BORING FINISH **10/9/96**

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
2	NQ	20.6	30.6		10.0							
										PALE YELLOWISH BROWN 10YR 6\2 SANDSTONE Fine to medium grain.		
										MEDIUM GRAY N-5 SILTY CLAYSHALE		
							25			PALE YELLOWISH BROWN 10YR 6\2 SANDY SHALE		
										MEDIUM LIGHT GRAY N\6 SANDSTONE		
										MEDIUM GRAY N-5 CLAYSHALE		
							30					
3	NQ	30.6	40.6		3.6	18				MEDIUM LIGHT GRAY N-6 SILTY CLAYSHALE		
							35					
							40					
4	NQ	40.6	44.6		1.1	0				DUSKY RED 5R 3\4 SILTY CLAYSHALE		
5	NQ	44.6	50.6		6.0	100	45			MEDIUM GRAY N-5 SANDSTONE Fine to medium grain.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-27** DATE **7/23/15** SHEET **3** OF **8**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/25/96** BORING FINISH **10/9/96**

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
							50					
6	NQ	50.6	55.6		4.4	33				MEDIUM GRAY 5-N CLAYSHALE		
7	NQ	55.6	61.2		5.6	41	55			MEDIUM GRAY N-5 CLAYSHALE DUSKY RED 5R CLAYSHALE		
8	NQ	61.2	71.2		9.5	64	60					
							65			MEDIUM GRAY N-5 CLAYSHALE		
9	NQ	71.2	81.2		9.5	68	70					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-27** DATE **7/23/15** SHEET **4** OF **8**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/25/96** BORING FINISH **10/9/96**

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
							75					
							80					
10	NQ	81.2	91.2		9.5	57				DARK GRAY N-3 SILTY CLAYSHALE With vertical crack.		
							85			MEDIUM GRAY N-5 SANDSTONE With cross bedding.		
							90					
11	NQ	91.2	101.2		6.2	29				Medium to fine grain.		
							95			DARK GRAY N-3 CLAYSHALE Trace of red.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-27** DATE **7/23/15** SHEET **5** OF **8**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/25/96** BORING FINISH **10/9/96**

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
							100					
12	NQ	101.2	111.2		9.1	16				MEDIUM DARK GRAY N-4 CLAYSHALE		102.6 Top of seal.
							105			DARK REDDISH BROWN 10R 3\4 RED, BROWN, GRAY MOTTLED CLAYSHALE		
							110					109.0 Top of sand.
13	NQ	111.2	121.2		9.9	75						111.0 Top of screen.
										MEDIUM GRAY N-5 SANDY SHALE		
							115			MEDIUM GRAY N-5 SANDSTONE Medium to fine grain, vertical fracture 119.2-120.0.		
							120					
14	NQ	121.2	131.2		9.1	49				MEDIUM GRAY N-5 CLAYSHALE MEDIUM DARK GRAY N-4 CLAYSHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-27** DATE **7/23/15** SHEET **6** OF **8**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/25/96** BORING FINISH **10/9/96**

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
							125			MEDIUM GRAY N-5 SANDY SHALE		
										GRAYISH RED 5R 4\2 MOTTLED RED, BROWN, GRAY CLAYSHALE		
							130					130.0 Bottom of screen.
15	NQ	131.2	141.2		9.2	42				DARK REDDISH BROWN 10R 3\4 MOTTLED REDDISH BROWN GRAY CLAYSHALE		132.0 Bottom of sand.
							135					
							140					
16	NQ	141.2	151.2		8.9	53						
							145			MEDIUM LIGHT GRAY N-6 SANDSTONE		
										DARK REDDISH BROWN 10R 3\4 MOTTLED CLAYSHALE		
										MEDIUM DARK GRAY N-4 SANDY SHALE		

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-27** DATE **7/23/15** SHEET **7** OF **8**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/25/96** BORING FINISH **10/9/96**

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
17	NQ	151.2	161.2		10.0	97						
							155			MEDIUM LIGHT GRAY N-6 SANDSTONE Fine to medium grain.		
							160					
18	NQ	161.2	171.2		10.0	100						
							165					
							170					
19	NQ	171.2	181.2		8.3	59						
							175			DARK REDDISH BROWN 10R 3\4 MOTTLED RED, BROWN, GRAY CLAYSHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-27** DATE **7/23/15** SHEET **8** OF **8**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/25/96** BORING FINISH **10/9/96**

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
							180					

pH COND TEMP. GALLONS SWL .
9.80 695 55 2.0 83.5.
9.81 699 56 2.0 84.8.
9.91 690 56 2.0 87.2.
9.94 685 57 2.0 88.8
9.88 682 58 2.0 90.6.
9.73 681 58 2.0 92.8.
9.75 680 58 2.0 95.5.
9.85 684 58 4.0 101.2.
9.82 694 58 4.0 106.7.
9.84 687 58 4.0 110.9.
9.86 698 58 4.0 114.6.
9.88 698 58 4.0 115.7.
9.85 702 58 4.0 117.1.
9.73 701 58 6.0 119.3.
9.73 701 58 6.0 122.3.
9.72 713 58 6.0 124.6.
9.85 704 58 +6.0 127.4.
9.83 719 58 6.0 131.6.
3:58 SWL DRY.
4:05 126.7.
4:15 123.3.
4:30 120.9
1-23-97 swl 8:38 AM
10.04 713 55 2.0 86.9.
9.91 703 56 4.0 92.3.
9.92 718 56 4.0 95.9.
9.86 705 56 4.0 101.4.
9.23 752 56 4.0 105.3.
9.07 56 6.0 111.5.
9.87 56 8.0 118.9.
9.78 56 8.0 122.0.
9.85 56 8.0 124.4.
9.88 56 8.0 129.1.
9.91 3.0 132.0.
DRY.
2-6-97 SWL 73.99.

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 708,701.0 E 1,697,043.0**

GROUND ELEVATION **879.6** SYSTEM _____

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **96-28** DATE **7/23/15** SHEET **1** OF **10**

BORING START _____ BORING FINISH **12/10/96**

PIEZOMETER TYPE _____ WELL TYPE **OW**

HGT. RISER ABOVE GROUND **1.7** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **69.8** BOTTOM **98.9**

WELL DEVELOPMENT **YES** BACKFILL **QUICK GROUT**

FIELD PARTY **TJH-RLY** RIG **CME-75**

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
									CL	LIGHT BROWN SILTY CLAY		
										REDDISH BROWN CLAY		Some water showing in cuttings.
										TAN TO BROWN CLAYSHALE		SWL 9:30 12-11-96 possible excess drill water.
							5					Boring flushed with 300 to 500 prior to well installation.
							10			MODERATE REDDISH BROWN 10R 4\6 CLAYSHALE		
							15			GREENISH GRAY SILTY CLAYSHALE Medium hard.		
										MEDIUM GRAY N-5 SILTY CLAYSHALE Sandstone lens, 21.5, 24.8 vertical fractures.		

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 _____

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-28** DATE **7/23/15** SHEET **2** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START _____ BORING FINISH **12/10/96**

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
							25			MEDIUM LIGHT GRAY N-6 SANDY CLAYSHALE Hard.		
							30					
							35					
										PALE OLIVE 10Y 6\2 SANDSTONE Hard, medium to large grain.		
							40					
							45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-28** DATE **7/23/15** SHEET **3** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START _____ BORING FINISH **12/10/96**

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
							50			MEDIUM LIGHT GRAY N-6 SANDSTONE Hard, medium to large grain.		
							55					
							60			MEDIUM GRAY N-5 CLAYSHALE 57.9 TO 58.5 vertical fracture. GRAYISH RED 10R 4\2 CLAYSHALE		58.9 Top of seal.
							65			GRAYISH RED 10R 4\2 CLAYSHALE MEDIUM GRAY N-5 CLAYSHALE		65.0 Top of sand.
							70					69.8 Top of screen.

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-28** DATE **7/23/15** SHEET **4** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START _____ BORING FINISH **12/10/96**

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
							75					
							80					
							85			MEDIUM GRAY N-5 SILTY SANDSTONE Medium to large grain.		
							90			MEDIUM GRAY N-5 CLAYSHALE		
							95			MEDIUM DARK GRAY N-4 SILTY CLAYSHLE Hard.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-28** DATE **7/23/15** SHEET **5** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START BORING FINISH **12/10/96**

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
										GRAYISH RED 5R 4\2 SANDY CLAYSHALE Medium hard.		98.9 Bottom of screen.
							100					100.0 Bottom of sand.
							105			DARK REDDISH BROWN 10R 3\4 CLAY SHALE Well cemented.		
										MEDIUM GRAY N-5 CLAYSHALE		
							110					
							115			DARK REDDISH BROWN 10R 3\4 SILTY CLAYSHALE MEDIUM DARK GRAY N-4 CLAYSHALE Well cemented.		
							120					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-28** DATE **7/23/15** SHEET **6** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START BORING FINISH **12/10/96**

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
							125			MEDIUM DARK GRAY N-4 SANDSTONE Fine to medium grain, cross bedding.		
							130					
							135					
							140			DARK GREENISH GRAY 5G 4\12 CLAYSHALE Well cemented, broken are 140,142.		
							145			MEDIUM DARK GRAY N-4 SANDSTONE Fine to medium grain.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-28** DATE **7/23/15** SHEET **7** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START BORING FINISH **12/10/96**

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
										MEDIUM GRAY N-5 SANDSTONE Fine to medium grain, well cemented.		
							155			MEDIUM DARK GRAY N-4 SANDSTONE Fine to medium grain.		
										MEDIUM GRAY N-5 CLAYSHALE GRAYISH RED 10R 4\2 CLAYSHALE		
							160			MEDIUM GRAY N-5 CLAYSHALE		
										MEDIUM DARK GRAY N-4 SANDSTONE Fine to medium grain.		
							165					
							170			GRAYISH RED 10R 4\2 CLAYSHEL		
							175					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-28** DATE **7/23/15** SHEET **8** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START _____ BORING FINISH **12/10/96**

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
										MEDIUM DARK GRAY N-4 CLAYEY SANDSTONE		
							180					
							185			GRAYISH RED 1-R 4\2 CLAYSHALE		
							190			MEDIUM GRAY N-5 CLAYSHALE		
							195			DARK GRAY N-3 CLAYSHALE		
							200			LIGHT OLIVE GRAY 5Y 5\2 SANDY CLAYSHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-28** DATE **7/23/15** SHEET **9** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START BORING FINISH **12/10/96**

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
							205			GRAYISH PURPLE SANDY CLAYSHLAE GRAYISH PURPLE 5P 4\2 CLAYSHALE Broken, medium hard.		
							210			LIGHT GRAY N-7 SANDSTONE Hard, well cemented, cross bedding, medium to large grain.		
							215					
							220			MEDIUM LIGHT GRAY N-6 TO DARK REDDISH 10R 2\2 SILTY CLAYSHALE Medium hard.		
							225			1-8-97 SWL 98.0. L pH COM.SWL. 1 8.70 770 98.0. 2 8.60 859. 3 8.82 884. 4 8.93 906 99.2.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-28** DATE **7/23/15** SHEET **10** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START _____ BORING FINISH **12/10/96**

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
										5 9.12 953. 6 9.13 912. 7 9.18 898. 8 9.17 877 100. 9 8.99 8.72. 10 9.13 8.59 . 11 8.91 8.58 100.8. 12 9.11 8.73 101.5. VERY REDDISH BROWN. 2-6-97 DRY BAILER IN WELL.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 708,701.2 E 1,697,043.2**

GROUND ELEVATION **879.8** SYSTEM _____

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **96-29** DATE **7/23/15** SHEET **1** OF **9**

BORING START _____ BORING FINISH **12/4/96**

PIEZOMETER TYPE _____ WELL TYPE **OW**

HGT. RISER ABOVE GROUND **1.68** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **152.8** BOTTOM **171.9**

WELL DEVELOPMENT **YES** BACKFILL **QUICK GROUT**

FIELD PARTY **TJH-RLY** RIG **CME-75**

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
									CL	LIGHT BROWN SILTY CLAY		
										REDDISH BROWN CLAY		Well installed in dry hole.
										TAN TO BROWN CLAYSHALE		
							5					
							10			MODERATE REDDISH BROWN 10R 4\6 CLAYSHALE		
							15			GREENISH GRAY SILTY CLAYSHALE Medium hard.		
										MEDIUM GRAY N-5 SILTY CLAYSHALE Sandstone lens, 21.5, 24.8 vertical fractures.		

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 _____

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-29** DATE **7/23/15** SHEET **2** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START _____ BORING FINISH **12/4/96**

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
							25			MEDIUM LIGHT GRAY N-6 SANDY CLAYSHALE Hard.		
							30					
							35					
										PALE OLIVE 10Y 6\2 SANDSTONE Hard, medium to large grain.		
							40					
							45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-29** DATE **7/23/15** SHEET **3** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START _____ BORING FINISH **12/4/96**

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
							50			MEDIUM LIGHT GRAY N-6 SANDSTONE Hard, medium to large grain.		
							55			MEDIUM GRAY N-5 CLAYSHALE 57.9 TO 58.5 vertical fracture. GRAYISH RED 10R 4\2 CLAYSHALE		
							60					
							65			GRAYISH RED 10R 4\2 CLAYSHALE		
										MEDIUM GRAY N-5 CLAYSHALE		
							70					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-29** DATE **7/23/15** SHEET **4** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START _____ BORING FINISH **12/4/96**

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
							75					
							80					
							85			MEDIUM GRAY N-5 SILTY SANDSTONE Medium to large grain.		
							90			MEDIUM GRAY N-5 CLAYSHALE		
							95			MEDIUM DARK GRAY N-4 SILTY CLAYSHLE Hard.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-29** DATE **7/23/15** SHEET **5** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START BORING FINISH **12/4/96**

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
							100			GRAYISH RED 5R 4\2 SANDY CLAYSHALE Medium hard.		
							105			DARK REDDISH BROWN 10R 3\4 CLAY SHALE Well cemented.		
							110			MEDIUM GRAY N-5 CLAYSHALE		
							115			DARK REDDISH BROWN 10R 3\4 SILTY CLAYSHALE MEDIUM DARK GRAY N-4 CLAYSHALE Well cemented.		
							120					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-29** DATE **7/23/15** SHEET **6** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START BORING FINISH **12/4/96**

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
							125			MEDIUM DARK GRAY N-4 SANDSTONE Fine to medium grain, cross bedding.		
							130					
							135					
							140			DARK GREENISH GRAY 5G 4\12 CLAYSHALE Well cemented, broken are 140,142.		144.1 Top seal.
							145			MEDIUM DARK GRAY N-4 SANDSTONE Fine to medium grain.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-29** DATE **7/23/15** SHEET **7** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START _____ BORING FINISH **12/4/96**

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
										MEDIUM GRAY N-5 SANDSTONE Fine to medium grain, well cemented.		150.0 Top of sand.
												152.8 Top of sreen.
							155			MEDIUM DARK GRAY N-4 SANDSTONE Fine to medium grain.		
										MEDIUM GRAY N-5 CLAYSHALE		
										GRAYISH RED 10R 4\2 CLAYSHALE		
							160			MEDIUM GRAY N-5 CLAYSHALE		
										MEDIUM DARK GRAY N-4 SANDSTONE Fine to medium grain.		
							165					
							170			GRAYISH RED 10R 4\2 CLAYSHEL		171.9 Bottom of screen
												174.0 Bottom of sand.
							175					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-29** DATE **7/23/15** SHEET **8** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START BORING FINISH **12/4/96**

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
										MEDIUM DARK GRAY N-4 CLAYEY SANDSTONE		
							180					
							185			GRAYISH RED 1-R 4\2 CLAYSHALE		
							190			MEDIUM GRAY N-5 CLAYSHALE		
							195			DARK GRAY N-3 CLAYSHALE		
							200			LIGHT OLIVE GRAY 5Y 5\2 SANDY CLAYSHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-29** DATE **7/23/15** SHEET **9** OF **9**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START BORING FINISH **12/4/96**

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
							205			GRAYISH PURPLE SANDY CLAYSHLAE GRAYISH PURPLE 5P 4\2 CLAYSHALE Broken, medium hard.		
										LIGHT GRAY N-7 SANDSTONE Hard, well cemented, cross bedding, medium to large grain.		
							210					
							215					
							220			MEDIUM LIGHT GRAY N-6 TO DARK REDDISH 10R 2\2 SILTY CLAYSHALE Medium hard.		
							225			1-8-97 SWL DRY. 2-6-97 SWL DRY.		

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 708,701.0 E 1,697,043.0**

GROUND ELEVATION **879.8** SYSTEM _____

Water Level, ft	▽ DRY	▼ 35.1	▼ 45.2
TIME			14 hrs.
DATE	9-9-96	9-10-96	9-11-96

BORING NO. **96-30** DATE **7/23/15** SHEET **1** OF **10**

BORING START **9/5/96** BORING FINISH **9/11/96**

PIEZOMETER TYPE _____ WELL TYPE **OW**

HGT. RISER ABOVE GROUND **1.71** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **195.9** BOTTOM **225.0**

WELL DEVELOPMENT **YES** BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-LD** RIG **BK-81**

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	4-4-3	1.3				CL	LIGHT BROWN SILTY CLAY		4.7=9.2 NO SAMPLES TAKEN DRILL WATER BROWN TO RED CLAYSHALE. No water in well immediatly after installation 12-4-96
2	SS	1.5	3.0	3-3-4	1.0					REDDISH BROWN CLAY		
3	SS	3.0	4.5	9-18-37	1.0					TAN TO BROWN CLAYSHALE		Decon rig and tools with potalbe water and alconox.
4	SS	4.5	4.7	50/.2	0		5					BORING FLUSHED WITH APPROXIMATELY 700 GALLONS OF WATER.
5	NQ	9.2	15.0		2.8	0	10			MODERATE REDDISH BROWN 10R 4\6 CLAYSHALE		
6	NQ	15.0	25.0		8.8	0	15			GREENISH GRAY SILTY CLAYSHALE Medium hard.		Boring grouted with approximately 100 gallons.
										MEDIUM GRAY N-5 SILTY CLAYSHALE Sandstone lens, 21.5, 24.8 vertical fractures.		

TYPE OF CASING USED

X	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 **LD**

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-30** DATE **7/23/15** SHEET **2** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/5/96** BORING FINISH **9/11/96**

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
7	NQ	25.0	35.0		10.0	39	25			MEDIUM LIGHT GRAY N-6 SANDY CLAYSHALE Hard.		
							30					
8	NQ	35.0	45.0		10.0	64	35			PALE OLIVE 10Y 6\2 SANDSTONE Hard, medium to large grain.		APPROXIMATELY 1000 GALLONS OF WATER USED.
							40					
9	NQ	45.0	55.0		10.0	96	45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-30** DATE **7/23/15** SHEET **3** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/5/96** BORING FINISH **9/11/96**

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
							50			MEDIUM LIGHT GRAY N-6 SANDSTONE Hard, medium to large grain.		
10	NQ	55.0	65.0		9.9	58	55					
										MEDIUM GRAY N-5 CLAYSHALE 57.9 TO 58.5 vertical fracture.		
										GRAYISH RED 10R 4\2 CLAYSHALE		
							60					
11	NQ	65.0	66.5		1.3	53	65			GRAYISH RED 10R 4\2 CLAYSHALE		
12	NQ	66.5	75.0		7.4	73				MEDIUM GRAY N-5 CLAYSHALE		
							70					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-30** DATE **7/23/15** SHEET **4** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/5/96** BORING FINISH **9/11/96**

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
							75					
13	NQ	75.0	85.0		9.9	95						
							80					
14	NQ	85.0	95.0		10.0	78	85			MEDIUM GRAY N-5 SILTY SANDSTONE Medium to large grain.		
							90					
										MEDIUM GRAY N-5 CLAYSHALE		
15	NQ	95.0	105.0		10.0	20	95			MEDIUM DARK GRAY N-4 SILTY CLAYSHLE Hard.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-30** DATE **7/23/15** SHEET **5** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/5/96** BORING FINISH **9/11/96**

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
										GRAYISH RED 5R 4\2 SANDY CLAYSHALE Medium hard.		
							100					
16	NQ	105.0	115.0		10.0	50	105			DARK REDDISH BROWN 10R 3\4 CLAY SHALE Well cemented.		
										MEDIUM GRAY N-5 CLAYSHALE		
							110					
17	NQ	115.0	125.0		7.2	72	115			DARK REDDISH BROWN 10R 3\4 SILTY CLAYSHALE MEDIUM DARK GRAY N-4 CLAYSHALE Well cemented.		
							120					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-30** DATE **7/23/15** SHEET **6** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/5/96** BORING FINISH **9/11/96**

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
							125					
18	NQ	125.0	135.0		9.7	83				MEDIUM DARK GRAY N-4 SANDSTONE Fine to medium grain, cross bedding.		
							130					
19	NQ	135.0	145.0		9.4	87	135					
										DARK GREENISH GRAY 5G 4\12 CLAYSHALE Well cemented, broken are 140,142.		
							140					
20	NQ	145.0	155.0		10.0	96	145			MEDIUM DARK GRAY N-4 SANDSTONE Fine to medium grain.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-30** DATE **7/23/15** SHEET **7** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/5/96** BORING FINISH **9/11/96**

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
										MEDIUM GRAY N-5 SANDSTONE Fine to medium grain, well cemented.		
21	NQ	155.0	165.0		10.0		155			MEDIUM DARK GRAY N-4 SANDSTONE Fine to medium grain.		
										MEDIUM GRAY N-5 CLAYSHALE GRAYISH RED 10R 4\2 CLAYSHALE		
							160			MEDIUM GRAY N-5 CLAYSHALE		
22	NQ	165.0	175.0		9.9	85	165			MEDIUM DARK GRAY N-4 SANDSTONE Fine to medium grain.		
							170			GRAYISH RED 10R 4\2 CLAYSHEL		
23	NQ	175.0	185.0		10.0	71	175					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-30** DATE **7/23/15** SHEET **8** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/5/96** BORING FINISH **9/11/96**

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
										MEDIUM DARK GRAY N-4 CLAYEY SANDSTONE		
							180					
												184.1 Top of seal.
24	NQ	185.0	195.0		9.6	76	185			GRAYISH RED 1-R 4\2 CLAYSHALE		APPROXIMATELY 42000 GALLONS OF WATER USED.
							190			MEDIUM GRAY N-5 CLAYSHALE		190.0 Top of sand.
25	NQ	195.0	205.0		9.9	33	195			DARK GRAY N-3 CLAYSHALE		195.9 Top of screen.
							200			LIGHT OLIVE GRAY 5Y 5\2 SANDY CLAYSHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-30** DATE **7/23/15** SHEET **9** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/5/96** BORING FINISH **9/11/96**

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
										GRAYISH PURPLE SANDY CLAYSHLAE		
26	NQ	205.0	215.0		9.9	88	205			GRAYISH PURPLE 5P 4\2 CLAYSHALE Broken, medium hard.		
										LIGHT GRAY N-7 SANDSTONE Hard, well cemented, cross bedding, medium to large grain.		
							210					
27	NQ	215.0	225.0		9.9	82	215					
							220			MEDIUM LIGHT GRAY N-6 TO DARK REDDISH 10R 2\2 SILTY CLAYSHALE Medium hard.		
							225			1-8-97 SWL 202.4 L pH COND SWL 5 8.26 2160 204.7 WATER LIGHT BROWN. 10 8.39 2140 205.75. 15 8.59 2002 207.0 20 8.80 2000 207.95 SLIGHTLY DARKER.		225.0 Bottom of screen. 227.0 Bottom of sand.

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-30** DATE **7/23/15** SHEET **10** OF **10**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/5/96** BORING FINISH **9/11/96**

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
										25 8.63 2008 209.15. 30 8.57 2007 210.55. 35 8.64 2009 212.1. 40 8.52 2120 213.65. 45 8.47 2140 215.2 DARK THAN ABOVE. 50 8.56 2120 216.55. 55 8.6 2140 218.3. 60 8.54 2140 219.45. 65 8.54 2190 221.4. 70 8.65 2200 222.4. 75 8.61 2230 224.0. 80 8.53 2120 225.1. 82 8.48 2170. 82L WELL DRY 4:40 PM. 1-9-97 10:50 AM SWL 221.85. pH COND. SWL 8.58 2220. 8.63 2230. 8.67 2180. 8.65 2160. 8.72 2190. 8.56 2150 224.8. 2-6-97 SWL 204.62.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 711,108.2 E 1,696,404.8**

GROUND ELEVATION **826.6** SYSTEM

Water Level, ft	▽ 55.6	▼ 16.9	▼
TIME			
DATE	9-5-96	9-17-96	

BORING NO. **96-31** DATE **7/23/15** SHEET **1** OF **7**

BORING START **9/11/96** BORING FINISH **9/12/96**

PIEZOMETER TYPE WELL TYPE **OW**

HGT. RISER ABOVE GROUND **1.75** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **55.8** BOTTOM **84.9**

WELL DEVELOPMENT **YES** BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-LD** RIG **BK-81**

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	4-6-5	.8				CL	RED CLAY		Decon at fly ash site 9-11-96 8:30 using potable water. Hole grouted using 100 gallons quick grout. Decon rig and tools 12-11-96 with potable water and Alconox. Bentonite seal hydroate 12-11-96 grouting 12-12-96.
2	SS	1.5	3.0	8-8-12	.8							
4	SS	3.0	4.5	10-12-16	.8					BROWN SHALEY CLAY		
5	SS	4.5	6.0	15-19-19	1.0		5			GRAYISH BROWN CLAYSHALE		
6	SS	6.0	6.8	25-50/.3	.6							
7	NQ	9.0	15.0		5.5	8	10			DARK YELLOWISH ORANGE 10YR 6\6 CLAYSHALE Soft.		
										Silty		
8	NQ	15.0	25.0		9.0	0	15			GRAYISH BLACK N-2 SILTY CLAYSHALE	▼	

TYPE OF CASING USED

X	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 **LD**

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-31** DATE **7/23/15** SHEET **2** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/11/96** BORING FINISH **9/12/96**

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
							25			GRAYISH ORANGE 10R 7\4 CLAYSHALE		
9	NQ	25.0	35.0		10.0	15				MODERATE YELLOWISH BROWN 10YR 5\4 SANDSTONE Medium grain.		
										MEDIUM DARK GRAY N-4 SANDSTONE Fine to medium grain.		
							30			LIGHT GRAY N-7 CLAYSHALE		
										MEDIUM LIGHT GRAY N-6 SANDSTONE		
										LIGHT GRAY N-7 CLAYSHALE		
										MEDIUM GRAY N5 SANDSTONE Fine to medium grain, vertical fracture.		
										LIGHT GRAY N\7 CLAYSHALE		
10	NQ	35.0	45.0		10.0	61	35			MEDIUM GRAY N-5 SANDSTONE Fine to medium grain. N-6		800 gallons water used.
												39.2 Top of seal.
							40			GRAYISH RED 5R 4\2 CLAYSHALE		
												44.2 Top of sand.
11	NQ	45.0	55.0		9.9	59	45			MEDIUM GRAY N-5 TRACE OF RED CLAYSHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-31** DATE **7/23/15** SHEET **3** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/11/96** BORING FINISH **9/12/96**

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
							50					
12	NQ	55.0	65.0		10.0	43	55			MEDIUM DARK GRAY N-4 CLAYSHALE		55.8 Top of screen.
										GRAYISH RED 4-2 CLAYSHALE		
							60					
										MEDIUM GRAY N-5 CLAYSHALE		
13	NQ	65.0	75.0		10.0	85	65			MEDIUM DARK GRAY N-4 SILTY CLAYSHALE		
							70					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-31** DATE **7/23/15** SHEET **4** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/11/96** BORING FINISH **9/12/96**

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
							75					
14	NQ	75.0	85.0		10.0	82				MEDIUM GRAY N-5 SILTY SANDSTONE Medium to fine grain.		
							80					
15	NQ	85.0	95.0		10.0	95	85			MEDIUM GRAY N-5 CLAYSHALE Stain 89.1.		84.9 Bottom of screen. 86.0 Bottom of sand.
										MEDIUM GRAY N-5 CLAYSHALE		
							90					
16	NQ	95.0	105.0		9.7	81	95			MEDIUM DARK GRAY N-4 CLAYSHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-31** DATE **7/23/15** SHEET **5** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/11/96** BORING FINISH **9/12/96**

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
										MEDIUM GRAY N-5 SANDSTONE Fine to medium grain.		
							100					
							105					
17	NQ	105.0	115.0		10.0	68				MEDIUM GRAY N-5 CLAYSHALE Well cemented.		
							110					
										MEDIUM DARK GRAY N-4 CLAYSHALE Trace of red.		
18	NQ	115.0	125.0		9.8	38	115			DARK REDDISH BROWN 10R 3\4 CLAYSHALE		
							120			MEDIUM GRAY N-5 SANDSTONE Fine grain.		
										DARK REDDISH BROWN 10R 3\4 CLAYSHALE MEDIUM DARK GRAY N-4 CLAYSHALE		
										MEDIUM GRAY N-5 SANDSTONE Fine grain.		

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-31** DATE **7/23/15** SHEET **6** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/11/96** BORING FINISH **9/12/96**

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
							125					
19	NQ	125.0	135.0		10.0	74				MEDIUM DARK GRAY N-4 SILTY SANDSTONE Fine grain.		
										MEDIUM DARK GRAY N-4 CLAYSHALE DARK REDDISH BROWN 10R 3\4 CLAYSHALE		
							130					
										MEDIUM DARK GRAY N-5 SANDSTONE Fine to medium grain.		
							135					
20	NQ	135.0	145.0		10.0	39				MEDIUM DARK GRAY N-4 SANDSTONE Fine to medium grain.		2400 gallons water used.
										MEDIUM DARK GRAY N-4 CLAYSHALE		
										GRAYISH RED 4-2 SILTY CLAYSHALE		
							140					
							145					
21	NQ	145.0	155.0		10.0	56				GRAYISH RED 5R 4\2 CLAYSHALE		
										MEDIUM LIGHT GRAY N-6 SANDSTONE Fine to medium grain.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-31** DATE **7/23/15** SHEET **7** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/11/96** BORING FINISH **9/12/96**

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
22	NQ	155.0	165.0		9.9	99	155					
							160					
										MEDIUM DARK GRAY N-4 CLAYSHALE		
							165			1-29-97 SWL 85.85 DRY. 2-6-97 SWL 84.92.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 712,296.3 E 1,700,787.8**

GROUND ELEVATION **643.9** SYSTEM _____

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **96-32** DATE **7/23/15** SHEET **1** OF **8**

BORING START **9/10/96** BORING FINISH **9/20/96**

PIEZOMETER TYPE _____ WELL TYPE **OW**

HGT. RISER ABOVE GROUND **1.61** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **167.8** BOTTOM **176.9**

WELL DEVELOPMENT **YES** BACKFILL **QUICK GROUT**

FIELD PARTY **REB-RLY** RIG **BK-81**

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
												7000 gallons of water to drill hole.
												Rig and tools decon with potable water and Alconox.
1	NQ	8.5	19.7		0		5					Cored hole from 8.5 to 19.7 soil sandy clay wash water.
							10					
							15					

TYPE OF CASING USED

X	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 **LD**

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-32** DATE **7/23/15** SHEET **2** OF **8**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/10/96** BORING FINISH **9/20/96**

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
2	NQ	19.7	20.5		.8	0				LIGHT OLIVE GRAY 5Y 5\2 SANDSTONE Well cemented		
3	NQ	20.5	30.5		9.8							
							25			MEDIUM BLUISH GRAY 5B 5\1 SANDSTONE Hard.		
										DUSKY YELLOWISH 5Y6\4 CLAYSHALE		
										MEDIUM BLUISH GRAY 5B 5\1 SANDSTONE Hard.		
							30					
4	NQ	30.5	40.5		10.0	30				PALE REDDISH BROWN 10R 5\4 CLAYSHALE		
							35					
5	NQ	40.5	50.5		10.0		40			MODERATE REDDISH BROWN 10R 4\6 CLAYSHALE		
							45			MEDIUM BLUISH GRAY CLAYSHALE		

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-32** DATE **7/23/15** SHEET **3** OF **8**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/10/96** BORING FINISH **9/20/96**

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
							50					
6	NQ	50.5	60.5		10.0	90				MEDIUM LIGHT GRAY N-6 SANDY SHALE		
							55			MEDIUM LIGHT GRAY N-6 CLAYSHALE		
7	NQ	60.5	70.5		10.0	70	60			GRAYISH RED 10R 4\2 CLAYSHALE		
							65					
8	NQ	70.5	80.5		7.8	0	70			MIXED 5B 5\1 GRAY, RED CLAYSHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-32** DATE **7/23/15** SHEET **4** OF **8**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/10/96** BORING FINISH **9/20/96**

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
							75					
9	NQ	80.5	90.5		10.0	100	80			MEDIUM BLUISH GRAY 5B 5\1 SANDY SHALE		
							85			GRAY N-6 SANDSTONE Shale lens, well cemented.		
10	NQ	90.5	100.5		10.0	100	90			Hard, massive		
							95					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-32** DATE **7/23/15** SHEET **5** OF **8**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/10/96** BORING FINISH **9/20/96**

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
							100					
11	NQ	100.5	110.5		10.0	100						
							105					
										Limestone nodules.		
12	NQ	110.5	120.5		8.6	20	110					
										MEDIUM BLUISH GRAY 5B 5\1 CLAYSHALE Badly broken, high angle fracture.		
							115					
13	NQ	120.5	130.5		10.0	97	120			MEDIUM GRAY N-5 CLAYSHALE		
										LIGHT GRAY N-6 SANDSTONE Shale lens, soft gray clay seam 123.8-124.2.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-32** DATE **7/23/15** SHEET **6** OF **8**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/10/96** BORING FINISH **9/20/96**

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
							125					
14	NQ	130.5	140.5		10.0	100	130			LIGHT GRAY N-7 SANDSTONE Hard, coarse.		
										MEDIUM LIGHT GRAY SANDSTONE Shale lens		
							135					
										LIGHT GRAY N-7 SANDSTONE Coarse grain, hard.		
15	NQ	140.5	150.5		10.0	100	140					
							145					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-32** DATE **7/23/15** SHEET **7** OF **8**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/10/96** BORING FINISH **9/20/96**

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	NQ	150.5	160.5		10.0	100	155					
										MEDIUM GRAY SANDY SHALE		
17	NQ	160.5	170.5		10.0	86	160					160.8 Top of seal.
							165			GRAY BLACK N-2 CLAYSHALE		166.0 Top of sand.
												167.8 Top of screen.
										BLACK COAL		
18	NQ	170.5	180.5		10.0	59	170					
							175			DARK GRAY N-3 CLAYSHALE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-32** DATE **7/23/15** SHEET **8** OF **8**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **9/10/96** BORING FINISH **9/20/96**

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
												176.9 Bottom of screen.
												178.0 Bottom of sand.
										MEDIUM GRAY N-5 SANDSTONE Shale lens.		
19	NQ	180.5	190.5		10.0		180					
										DARK GRAY CLAYSHALE		
							185					
							190					
										1-21-97 SWL 132.0 pH COND TEMP GALLONS SWL 7.96 1028 56 2.0 146.5. 8.75 960 27 2.0 154. 8.59 837 59 2.0 163.0. 8.78 829 60 2.0 164.5. 816 1283 58 2.0 170.0. 798 1421 57 2.0 -. WELL RECOVERED 2500 ML IN 20 MIN. 1-22-97 SWL 131.9. 8.12 2880 54 2.0 147.2. 8.00 2750 56 2.0 156.3. 7.85 3500 56 2.0 157.0. 1-23-97 SWL 132.1 PUMPED WELL TO 175' WITH ONE TEST pH 7.68 COND. 772 PUMP STOPPED RUNNING. 2-6-97 SWL 132.0'.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 710,919.6 E 1,699,640.4**

GROUND ELEVATION **669.8** SYSTEM _____

Water Level, ft	▽ GR	▼	▼
TIME	12:30		
DATE	1-22-97		

BORING NO. **96-33** DATE **7/23/15** SHEET **1** OF **2**

BORING START **1/21/97** BORING FINISH **1/23/97**

PIEZOMETER TYPE _____ WELL TYPE **OW**

HGT. RISER ABOVE GROUND **1.94** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **21.0** BOTTOM **40.0**

WELL DEVELOPMENT **YES** BACKFILL **QUICK GROUT**

FIELD PARTY **MCR-WEB** RIG **CME-75**

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
												Drill & tools decon 1-21-97 prior to drilling with potable water
1	SS	3.2	4.7	7-7-8	1.4				CL	REDDISH BROWN SANDY CLAY Dry.		
							5					
2	SS	8.2	9.7	7-11-18	1.4					GREENISH GRAY CLAY Dry.		
							10					
3	SS	13.2	14.7	3-3-8	1.3					LIGHT SILVER GRAY SANDY SHALE Moist to wet.		
							15					15.0 Top of seal.
4	SS	18.2	18.7	50	.5					RED CLAYSHALE Weathered, dry.		
5	NQ	18.8	20.2		1.2	0				RED CLAYSHALE Soft hard in area.		

TYPE OF CASING USED

X	NQ-2 ROCK CORE	
	6" x 3.25 HSA	
X	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 **WEB**

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **96-33** DATE **7/23/15** SHEET **2** OF **2**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **1/21/97** BORING FINISH **1/23/97**

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
6	NQ	20.2	25.2		4.8	82				BLUISH GRAY CLAYSHALE Hard.		20.0 Top of sand.
												21.0 Top of screen.
										BLUISH GRAY AND RED CLAYSHALE		
										BLUISH GRAY CLAYSHALE Hard, fractures at 28.5, 30.6, 31.4, 32.8 soft, 30.8, 31.4 shaley sandstone.		
							25					
7	NQ	25.2	35.2		10.0	92				BLUISH GRAY SANDY SHALE		
							30					
							35					
8	NQ	35.2	40.2		5.0	100				GRAY SANDY SHALE		
										GRAY AND SILVER SANDSTONE Shale lens.		
										GRAY SANDY SHALE		
										GRAY AND SILVER SANDSTONE Shale lens.		
							40					40.0 Bottom of screen.
										pH 8.68 COND. 635 TEMP. 56 HI. 2:40 4.04'. HI. 3:40 3.94. HI. 4:00 3.91. HI. 4:15 3.87. 1-30-97 1375 ML/MIN. ARTESIAN.		41.1 Bottom of sand.

ARCADIS

AEP 2005

Boring Logs

B0501 & B0502

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 713,381.3 E 1,733,671.6**

GROUND ELEVATION **797.6** SYSTEM **State Plane using NAD27**

Water Level, ft			
TIME			
DATE			

BORING NO. **B0501** DATE **7/23/15** SHEET **1** OF **14**

BORING START **6/23/05** BORING FINISH **6/29/05**

PIEZOMETER TYPE _____ WELL TYPE _____

HGT. RISER ABOVE GROUND _____ DIA _____

DEPTH TO TOP OF WELL SCREEN _____ BOTTOM _____

WELL DEVELOPMENT _____ BACKFILL **QUICK GROUT**

FIELD PARTY **MCR / CB** RIG **BK-81**

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
	AUGER	0.0	1.8									Digging permit required and in hand. Grounding procedures not in use on this boring. Using well / fire protection water from Mountaineer Plant to drill with. Deconned on 06/23/05 using Mountaineer water and liqui-nox.
1	SS	1.8	3.3	2-4-7	1.1					**STIFF 10YR 6/6 DARK YELLOWISH ORANGE SILTY CLAY** 3.0 tsf, Dry		
							5					
2	SS	6.8	7.1	50/.3	0.2					**HARD 10YR 7/4 GRAYISH ORANGE WEATHERED FINE GRAIN SANDY CLAY SHALE**		
3	NQ2	9.6	15.1		5.6	0	10			**10YR 7/4 GRAYISH ORANGE SILTY CLAY SHALE** Iron Staining @ 11.2'-11.4' Broken Area @ 17.2'-17.8'		Auger & spoon refusal @ 9.6'
4	NQ2	15.1	25.1		6.9	7	15					

TYPE OF CASING USED

X	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"
	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 **CB**

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B0501** DATE **7/23/15** SHEET **2** OF **14**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **6/23/05** BORING FINISH **6/29/05**

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
												SWL @ 22.4' on 6/24/05 w/ NQ hole to 60.1'
5	NQ2	25.1	30.1		2.3	48	25			**5B 7/1 LIGHT BLUISH GRAY CLAY SHALE** Broken Area @ 27.1'		
6	NQ2	30.1	40.1		5.8	9	30			**SOFT 5YR 8/4 MODERATE BROWN CLAY**		
							35			**5B 5/1 MEDIUM BLUISH GRAY CLAY SHALE**		
7	NQ2	40.1	50.1		9.7	96	40			**10YR 6/2 PALE YELLOWISH BROWN FINE to MEDIUM GRAIN SANDSTONE**		
							45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B0501** DATE **7/23/15** SHEET **3** OF **14**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **6/23/05** BORING FINISH **6/29/05**

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
							50					
8	NQ2	50.1	60.1		9.6	80				**SOFT 5B 5/1 MEDIUM BLUISH GRAY CLAY SHALE**		
										10YR 6/1 PALE YELLOWISH BROWN FINE to MEDIUM GRAIN SANDSTONE		
							55					
9	NQ2	60.1	70.1		9.5	100	60			**10YR 6/1 PALE YELLOWISH BROWN FINE to MEDIUM GRAIN SANDSTONE** w/ coal streaks throughout		1500 gallons of water used to this point - 60.1' SWL @ 62.2' on 6/27/05 w/ NQ hole to 120.1'
							65					SWL @ 68.2' on 6/28/05 w/ NQ hole to 180.1'; 12 hr reading
10	NQ2	70.1	80.1		9.6	74	70			**5Y 6/1 LIGHT OLIVE GRAY COARSE GRAIN SANDSTONE**		

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B0501** DATE **7/23/15** SHEET **4** OF **14**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **6/23/05** BORING FINISH **6/29/05**

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
										5B 5/1 MEDIUM BLUISH GRAY CLAY SHALE		
							75			High angle fracture @ 73.9' - 70 degrees from horizontal w/ iron staining Soft area @ 74.6'-75.8' w/ iron staining		
11	NQ2	80.1	90.1		9.0	61	80			High angle fracture @ 81.3' -80 degrees from horizontal		
							85			Broken area w/ iron staining @ 85.2'-86.9' High angle fracture @ 86.9' - 40 degrees from horizontal		
12	NQ2	90.1	100.1		9.8	91	90			High angle fracture @ 86.9' - 85 degrees from horizontal		
							95			Broken area w/ iron staining @ 94.8'		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B0501** DATE **7/23/15** SHEET **5** OF **14**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **6/23/05** BORING FINISH **6/29/05**

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
							100					
13	NQ2	100.1	110.1		9.2	88				**SOFT 5YR 4/4 MODERATE BROWN CLAY SHALE**		
							105			**5B 5/1 MEDIUM BLUISH GRAY CLAY SHALE**		
14	NQ2	110.1	120.1		9.3	84	110			High angle fracture @ 112.6' - 50 degrees from horizontal High angle fracture @ 113.5' - 50 degrees from horizontal		
							115			High angle fracture @ 115.2' - 85 degrees from horizontal		
										5YR 4/4 MODERATE BROWN CLAY SHALE		
										5B 5/1 MEDIUM BLUISH GRAY CLAY SHALE		
15	NQ2	120.1	130.1		9.6	88	120					SWL @ 119.8' on 6/29/05 w/ NQ hole to 310.1' 3500 gallons of water used to this point - 120.1'

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B0501** DATE **7/23/15** SHEET **6** OF **14**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **6/23/05** BORING FINISH **6/29/05**

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
							125					
										5YR 4/1 BROWNISH GRAY CLAY SHALE		
										High angle fracture @ 129.2' - 40 degrees from horizontal		
16	NQ2	130.1	140.1		9.4	70	130			High angle fracture @ 129.8' - 35 degrees from horizontal		
							135			High angle fracture @ 134.9' - 40 degrees from horizontal		
										High angle fracture @ 136.1' - 40 degrees from horizontal		
										Horizontal soft area @ 138.1'		
										5B 5/1 MEDIUM BLUISH GRAY CLAY SHALE		
							140			High angle fracture @ 139.4' - 35 degrees from horizontal		
17	NQ2	140.1	150.1		9.7	100				**5B 5/1 MEDIUM BLUISH GRAY SILTY CLAY SHALE**		
										High angle fracture @ 143.9' - 75 degrees from horizontal		
							145					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B0501** DATE **7/23/15** SHEET **7** OF **14**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **6/23/05** BORING FINISH **6/29/05**

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
18	NQ2	150.1	160.1		9.0							
							155			**SOFT 5B 5/1 BROWNISH GRAY CLAY SHALE**		
										Broken area @ 157.2'		
19	NQ2	160.1	170.1		9.6	79	160					
										5B 5/1 MEDIUM BLUISH GRAY SILTY CLAY SHALE		
							165					
20	NQ2	170.1	180.1		9.9	100	170					
							175					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B0501** DATE **7/23/15** SHEET **8** OF **14**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **6/23/05** BORING FINISH **6/29/05**

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	NQ2	180.1	190.1		9.6	96	180					5500 gallons of water used to this point - 180.1'
										High angle fracture @ 184.2' - 65 degrees from horizontal		
							185					
										High angle fracture @ 187.7' - 55 degrees from horizontal		
22	NQ2	190.1	195.1		3.7	54	190			**5R 4/2 GRAYISH RED CLAY SHALE** Soft area @ 190.2'		
										Soft area @ 192.6'		
23	NQ2	195.1	205.1		10	79	195					
										High angle fracture @ 198.7' - 40 degrees from horizontal		
							200			High angle fracture @ 199.1' - 40 degrees from horizontal		
										High angle fracture @ 200.1' - 40 degrees from horizontal		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B0501** DATE **7/23/15** SHEET **9** OF **14**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **6/23/05** BORING FINISH **6/29/05**

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
										5B 5/1 MEDIUM BLUISH GRAY SILTY CLAY SHALE High angle fracture @ 202.5' - 65 degrees from horizontal		
24	NQ2	205.1	215.1		8.2	100	205					
							210					
25	NQ2	215.1	223.1		9.2	64	215					Picked up 1.1' from previous run.
										5R 4/2 GRAYISH RED CLAY SHALE		
							220					
26	NQ2	223.1	230.1		6.2	47				Broken area @ 221.9'-222.4'		
							225			High angle fracture @ 224.6' - 25 degrees from horizontal High angle fracture @ 225.7' - 30 degrees from horizontal High angle fracture @ 226.7' - 40 degrees from horizontal High angle fracture @ 227.1' - 45 degrees from		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B0501** DATE **7/23/15** SHEET **10** OF **14**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **6/23/05** BORING FINISH **6/29/05**

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
										horizontal		
27	NQ2	230.1	240.1		8.9	64	230					7500 gallons of water used to this point - 230.1'
										5B 5/1 MEDIUM BLUISH GRAY SILTY CLAY SHALE		
							235			236.9'-239.7' - Clayey Limestone w/ secondary calcite fractures		
28	NQ2	240.1	250.1		9.9	100	240			**5B 5/1 MEDIUM BLUISH GRAY FINE GRAIN SILTY SANDSTONE** Fine laminar bedding, grading to current ripple bedding w/ increasing depth		
							245					
29	NQ2	250.1	260.1		10.0	83	250					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B0501** DATE **7/23/15** SHEET **11** OF **14**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **6/23/05** BORING FINISH **6/29/05**

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
										5R 4/2 GRAYISH RED CLAY SHALE		
							255			**5B 5/1 MEDIUM BLUISH GRAY FINE GRAIN SILTY SANDSTONE** laminar to current ripple cross bedding, micaceous nodular limestone w/ maroon mottles		
30	NQ2	260.1	270.1				260			**5B 5/1 MEDIUM BLUISH GRAY FINE GRAIN SANDSTONE** Broken area @ 263.5'-264.1'		
										5R 4/2 GRAYISH RED SILTY CLAY SHALE		
							265					
							270					
31	NQ2	270.1	280.1		9.7	80				**5B 5/1 MEDIUM BLUISH GRAY FINE GRAIN SANDSTONE** High angle fracture @ 272.9' - 45 degrees from horizontal Broken area @ 273.8'-274.9'		
							275					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B0501** DATE **7/23/15** SHEET **12** OF **14**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **6/23/05** BORING FINISH **6/29/05**

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	NQ2	280.1	290.1		9.7	100	285			**5B 7/1 LIGHT BLUISH GRAY FINE to MEDIUM GRAIN SANDSTONE** Coal streaks throughout		9500 gallons of water used to this point - 280.1'
33	NQ2	290.1	300.1		10.0	100	290					
34	NQ2	300.1	310.1		9.0	96	295					
							300					
							305			**5B 7/1 LIGHT BLUISH GRAY SILTY CLAY SHALE**		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B0501** DATE **7/23/15** SHEET **13** OF **14**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **6/23/05** BORING FINISH **6/29/05**

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
										Coal streaks throughout **5B 7/1 LIGHT BLUISH GRAY FINE to MEDIUM GRAIN SANDSTONE**		
35	NQ2	310.1	320.1		10.2	100	310					Picked up 0.2' from previous run.
							315					
36	NQ2	320.1	330.1		9.9	100	320			**5B 7/1 LIGHT BLUISH GRAY FINE to MEDIUM GRAIN SANDSTONE** Coal streaks throughout		
							325			0.05' Clay Shale lense @ 326.9'		
37	NQ2	330.1	340.1		10.0	67	330			**5B 7/1 LIGHT BLUISH GRAY FINE to MEDIUM GRAIN SANDSTONE**		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B0501** DATE **7/23/15** SHEET **14** OF **14**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **6/23/05** BORING FINISH **6/29/05**

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
							335			**HARD SILTY CLAY SHALE** **N1 BLACK COAL** 337.8'-338.1' - Fractures w/ calcite fill		
										HARD CLAY SHALE		
38	NQ2	340.1	350.1		9.8	100	340			**5B 5/1 MEDIUM BLUISH GRAY CLAY SHALE** Carbonaceous, fossil stems, pyrite		
							345					
							350					Stopped boring @ 350.1' on 6/29/05. Flushed boring with approx. 1000 gallons of water. Boring geo-physical logged on 6/29/05. Installation of 1" geomon well (MW-41) will be done at a later date.

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 713,726.5 E 1,732,783.6**

GROUND ELEVATION **627.7** SYSTEM **State Plane using NAD27**

Water Level, ft	▽ 3.8	▼ 3.8	▼ 4.1
TIME	8:00AM	12:30PM	8:30AM
DATE	1/5/05	1/11/05	1/13/05

BORING NO. **B0502** DATE **7/23/15** SHEET **1** OF **11**

BORING START **1/4/05** BORING FINISH **6/23/05**

PIEZOMETER TYPE WELL TYPE **GM**

HGT. RISER ABOVE GROUND DIA **1"**

DEPTH TO TOP OF WELL SCREEN BOTTOM

WELL DEVELOPMENT BACKFILL **BENSEAL**

FIELD PARTY **MCR / CB** RIG **BK-81**

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	2-3-3	0.8					**MEDIUM STIFF 5YR 5/6 LIGHT BROWN SILTY CLAY** 3.5 tsf, moist		Grounding procedures not in use on this boring. Using well / fire protection water from Mountaineer Plant to drill with. Deconned on 01/04/05 using Mountaineer water and liqui-nox with drill pump. SWL @ 3.8' on 1/5/05 with HSA's to 24.0' SWL @ 3.8' on 1/11/05 with HSA's on bedrock. SWL @ 4.1' on 1/13/05 with NQ hole to 183.2' SWL @ 7.1' on 6/23/05 with NQ hole to 230.2'
2	SS	1.5	3.0	2-2-3	0.6					**MEDIUM STIFF 5YR 5/6 LIGHT BROWN SILTY CLAY** 1.5 tsf, w/ trace of fine sand, moist		
3	SS	3.0	4.5	1-2-2	0.5							
4	SS	4.5	6.0	2-5-7	1.5		5			**STIFF 5YR 5/6 LIGHT BROWN CLAY** 1.75 tsf, moist		
5	SS	6.0	7.5	2-5-7	1.5							
6	SS	7.5	9.0	1-3-5	1.5					**STIFF 5YR 5/6 LIGHT BROWN CLAY** 1.25 tsf, moist		
7	SS	9.0	10.5	2-4-5	1.5					**STIFF 5YR 5/6 LIGHT BROWN CLAY** 2.0 tsf, moist		
8	SS	10.5	12.0	2-3-6	1.5		10			**STIFF 10YR 6/2 PALE YELLOWISH BROWN CLAY** 1.75 tsf, moist		
9	SS	12.0	13.5	2-4-6	1.4					**STIFF 10YR 6/2 PALE YELLOWISH BROWN CLAY** 1.5 tsf, moist		
10	SS	13.5	15.0	2-5-6	1.5					**STIFF 10YR 6/2 PALE YELLOWISH BROWN CLAY** 2.25 tsf, moist		
11	SS	15.0	16.5	3-3-5	1.4		15			**STIFF 5G 6/1 GREENISH GRAY CLAY** 1.75 tsf, w/ trace of fine sand, moist		
12	SS	16.5	18.0	3-5-7	1.0					**STIFF 10YR 6/6 DARK YELLOWISH ORANGE CLAY** 1.5 tsf, moist		
13	SS	18.0	19.5	2-3-6	1.2					**STIFF 5YR 4/4 MODERATE BROWN CLAY** 1.5 tsf, moist		
14	SS	19.5	21.0	4-5-6	0.9					**STIFF 5YR 4/4 MODERATE BROWN CLAY**		

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TYPE OF CASING USED

X	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"
	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 **MCR / CB**

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B0502** DATE **7/23/15** SHEET **2** OF **11**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **1/4/05** BORING FINISH **6/23/05**

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
										1.75 tsf, moist		
15	SS	21.0	22.5	4-5-7	1.2					**STIFF 5GY 4/1 DARK GREENISH GRAY CLAY** 1.5 tsf, moist		
16	SS	22.5	24.0	2-5-7	1.2					**STIFF 5GY 4/1 DARK GREENISH GRAY CLAY** 1.5 tsf, w/ trace of fine sand, moist		
17	SS	24.0	25.5	1-3-4	1.3		25			**MEDIUM STIFF 10YR 6/6 DARK YELLOWISH ORANGE CLAY** 2.25 tsf, w/ some shale fragments, moist		
18	SS	25.5	27.0	3-5-12	1.2					**VERY STIFF 10G 6/2 PALE GREEN SHALEY CLAY** 2.0 tsf, moist		
19	SS	27.0	27.3	50/.3	0.2					**HARD 10G 6/2 PALE GREEN SHALEY CLAY** Moist		
20	SS	28.5	28.9	50/.4	0.5							
21	NQ2	29.5	35.7		5.3	100	30			**5B 5/1 MEDIUM BLUISH GRAY CLAY SHALE** Soft broken area from 37.0' to 37.4'		Auger refusal @ 29.5'; started coring.
22	NQ2	35.7	45.7		9.3	90	35					
							40			**5R 4/2 GRAYISH RED CLAY SHALE**		
							45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B0502** DATE **7/23/15** SHEET **3** OF **11**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **1/4/05** BORING FINISH **6/23/05**

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
23	NQ2	45.7	55.7		4.4	30						Reason for poor recovery - Core lifter stuck in end of inner tube and washed core away
							50					
24	NQ2	55.7	65.7		9.8	87	55					
										5B 5/1 MEDIUM BLUISH GRAY CLAY SHALE		
							60					
25	NQ2	65.7	75.7		10.0	100	65					
							70					
										5B 7/1 LIGHT BLUISH GRAY FINE to MEDIUM GRAIN SANDSTONE		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B0502** DATE **7/23/15** SHEET **4** OF **11**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **1/4/05** BORING FINISH **6/23/05**

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
							75					
26	NQ2	75.7	85.7		10.0	100						
							80					
27	NQ2	85.7	95.7		10.0	100						
							90					
										5B 5/1 MEDIUM BLUISH GRAY CLAY SHALE Area w/ numerous calcite deposits @ 92-93.6'		
							95					
28	NQ2	95.7	105.7		10.0	91				**5B 7/1 LIGHT BLUISH GRAY FINE to MEDIUM GRAIN SANDSTONE**		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B0502** DATE **7/23/15** SHEET **5** OF **11**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **1/4/05** BORING FINISH **6/23/05**

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
							100					
							105			**5B 5/1 MEDIUM BLUISH GRAY CLAY SHALE**		
29	NQ2	105.7	115.7		10.0	100				**5B 7/1 LIGHT BLUISH GRAY FINE to MEDIUM GRAIN SANDSTONE**		
							110					
							115					
30	NQ2	115.7	125.7		10.0	100				**5B 7/1 LIGHT BLUISH GRAY COARSE GRAIN SANDSTONE** w/ cross bedding throughout		
							120					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B0502** DATE **7/23/15** SHEET **6** OF **11**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **1/4/05** BORING FINISH **6/23/05**

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
							125					
31	NQ2	125.7	135.7		10.0	85						
							130					
32	NQ2	135.7	145.7		10.0	97	135					
							140			**High angle fracture @ 142.2' w/ clay shale**		
33	NQ2	145.7	155.7		10.0	83	145					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B0502** DATE **7/23/15** SHEET **7** OF **11**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **1/4/05** BORING FINISH **6/23/05**

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
										COAL		
34	NQ2	155.7	165.7		10.0	100	155			**N4 MEDIUM DARK GRAY CLAY SHALE**		
							160					
							165					
35	NQ2	165.7	175.7		10.0	84				**5B 5/1 MEDIUM BLUISH GRAY CLAY SHALE**		
							170					
							175					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B0502** DATE **7/23/15** SHEET **8** OF **11**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **1/4/05** BORING FINISH **6/23/05**

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
36	NQ2	175.7	183.2		7.5	91	180			**5G 4/1 DARK GREENISH GRAY CLAY SHALE**		Flushed boring with approx. 1000 gallons of water when boring stopped @ 183.2' on 1/12/05. SWL @ 8.8' on 6/22/05 with NQ hole to 183.2' Hole open to 175' Deconned rig & tools on 6/21/05 with water and liqui-nox. Resumed drilling on 6/22/05
37	NQ2	183.2	185.2		2.2	64				**5B 5/1 MEDIUM BLUISH GRAY CLAY SHALE** **Fracture @ 184.2'**		
38	NQ2	185.2	191.2		3.9	85	185					
39	NQ2	191.2	200.2		9.2	78	190			**Fracture @ 189.7'**		Picked up 0.2' of core from previous run.
							195			**Soft area @ 196.1' to 196.9'**		
40	NQ2	200.2	210.2		9.8	76	200			**5B 5/1 MEDIUM BLUISH GRAY CLAY SHALE w/ 5R 4/2 GRAYISH RED LENSES**		

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B0502** DATE **7/23/15** SHEET **9** OF **11**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **1/4/05** BORING FINISH **6/23/05**

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
										Fracture @ 203.1'		
							205			**5B 5/1 MEDIUM BLUISH GRAY SILTY CLAY SHALE** Hard		
41	NQ2	210.2	220.2		10	96	210					
							215			**5B 5/1 MEDIUM BLUISH GRAY SILTY FINE GRAIN SANDSTONE**		
42	NQ2	220.2	230.2		9.7	93	220			**Soft area @ 224.3'**		
							225			**5B 5/1 MEDIUM BLUISH GRAY CLAY SHALE** Hard		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B0502** DATE **7/23/15** SHEET **10** OF **11**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **1/4/05** BORING FINISH **6/23/05**

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
							230					
43	NQ2	230.2	240.2		10.1	70				**5B 5/1 MEDIUM BLUISH GRAY SILTY CLAY SHALE** Hard **Soft area @ 232.0'**		Picked up 0.1' of core from previous run.
							235					
							240					
44	NQ2	240.2	250.2		9.9	96				**5B 5/1 MEDIUM BLUISH GRAY CLAY SHALE** Hard		
										5B 7/1 LIGHT BLUISH GRAY MEDIUM GRAIN SANDSTONE w/ COAL STREAKS THROUGHOUT		
							245					
										CLAY SHALE AREA @ 248.3 - 248.4' **5B 7/1 LIGHT BLUISH GRAY MEDIUM GRAIN SANDSTONE w/ COAL STREAKS THROUGHOUT**		
							250					Stopped boring @ 250.2' on 6/23/05. Flushed boring with approx. 700 gallons of water. Boring was geo-physical logged on 6/29/05. Installation of 1" geomon well

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B0502** DATE **7/23/15** SHEET **11** OF **11**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **1/4/05** BORING FINISH **6/23/05**

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
												(MW-42) will be done at a later date.

ARCADIS

AEP 2010, 2012

Boring Logs

B-0901 to B-0903, B-1201

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 708,953.7 E 1,729,008.3**

GROUND ELEVATION **852.2** SYSTEM **State Plane using NAD27/29**

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **B-0901** DATE **7/23/15** SHEET **1** OF **7**

BORING START **1/5/10** BORING FINISH **1/7/10**

PIEZOMETER TYPE **N/A** WELL TYPE **OW**

HGT. RISER ABOVE GROUND **2.60** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **98.1** BOTTOM **133.1**

WELL DEVELOPMENT **YES** BACKFILL **QUICK GROUT**

FIELD PARTY **ZLR / MWJ** RIG **D-120**

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
										GROUNDING PROCEDURE NOT IN USE / DOZED A PAD ~1' OF FILL / CORE RUNNING DOWN 4" CASING TO 8.9' / WATER FROM MT FIRE SYSTEM / DECONED 8:30 01/05/10		
1	NQ	8.9	14.6		1.6		5			**LIGHT BROWN 5YR 5/6 SANDSTONE**		
2	NQ	14.6	24.6		9.4	64	10					
							15			**LIGHT BROWN 5YR 5/6 HARD FINE SANDSTONE**		
										MODERATE YELLOWISH BROWN 10YR 5/4 HARD FINE GRAIN SANDSTONE		
										MEDIUM BLUISH GRAY 5B 5/1 HARD FINE GRAIN SANDSTONE W/CLAYSHALE		

TYPE OF CASING USED

X	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 _____

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-0901** DATE **7/23/15** SHEET **2** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **1/5/10** BORING FINISH **1/7/10**

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
3	NQ	24.6	34.6		8.8	17	25			**MEDIUM GRAY N5 HARD COARSE SANDSTONE** w/fractures		
										MEDIUM GRAY N5 COARSE SANDSTONE w/crossbeddings throughout		
							30			**BROWNISH GRAY 5YR 4/1 HARD COARSE SANDSTONE** w/fractures		
										MEDIUM GRAY N5 HARD COARSE SANDSTONE w/crossbeddings throughout		
4	NQ	34.6	44.6		3.9	100	35			**MEDIUM LIGHT GRAY N6 SOFT SILTY CLAYSHALE**		
										DUSKY RED 5R 3/4 SOFT CLAYSHALE		
										MEDIUM BLUISH GRAY 5B 5/1 HARD CLAYSHALE		
							40					
5	NQ	44.6	54.6		10.0	60	45			**MEDIUM BLUISH GRAY 5B 5/1 CLAYSHALE**		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-0901** DATE **7/23/15** SHEET **3** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **1/5/10** BORING FINISH **1/7/10**

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
							50			**MEDIUM BLUISH GRAY 5B 5/1 SOFT CLAYSHALE**		
										MEDIUM BLUISH GRAY 5B 5/1 HARD CLAYSHALE		
6	NQ	54.6	64.6		10.0		55			**MEDIUM GRAY N5 SANDSTONE**		
										MEDIUM GRAY N5 COARSE HARD SANDSTONE		
							60			**MEDIUM DARK GRAY N4 SILTY HARD SHALE**		
7	NQ	64.6	74.6		8.8		65			**MEDIUM DARK GRAY N4 SHALE**		
										GRAYISH RED 5R 4/2 HARD SHALE		
										MEDIUM GRAY N5 SOFT SHALE		
							70			**DARK REDISH BROWN 10R 2/2 SOFT SILTY CLAYSHALE**		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-0901** DATE **7/23/15** SHEET **4** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **1/5/10** BORING FINISH **1/7/10**

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
8	NQ	74.6	84.6		10.0	48	75			**VERY DARK RED 5R 2/6 SOFT SHALE**		
										MODERATE BLUISH GRAY 5B 5/1 HARD SHALE		
							80			**VERY DARK RED 5R 2/6 SOFT SHALE**		
										MODERATE BLUISH GRAY 5B 5/1 HARD SHALE		
9	NQ	84.6	94.6		9.7	47	85			**DARK GREENISH GRAY 5G 4/1 HARD SHALE**		
										DARK REDISH BROWN 10YR 3/4 SOFT SHALE		
							90			**DARK GREENISH GRAY 5G 4/1 HARD SHALE**		
10	NQ	94.6	104.6		10.0	63	95			**DARK GREENISH GRAY 5G 4/1 HARD SHALE**		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-0901** DATE **7/23/15** SHEET **5** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **1/5/10** BORING FINISH **1/7/10**

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
							100					
										MEDIUM GRAY N5 COARSE HARD SANDSTONE w/crossbeddings throughout		
11	NQ	104.6	114.6		10.0	70	105			**MEDIUM GRAY N5 COARSE HARD SANDSTONE** w/crossbedding throughout		
							110			**MEDIUM DARK GRAY N4 SOFT SHALE**		
										GRAYISH RED 10R 4/2 SOFT SILTY CLAYSHALE		
12	NQ	114.6	124.6		9.6	96	115			**DARK GREENISH GRAY 5G 4/1 HARD SHALE**		
										DARK GREENISH GRAY 5G 4/1 HARD SHALE w/fine sandstone		
										GRAYISH RED 5R 4/2 HARD SHALE		
							120			**DARK GREENISH GRAY 5G 4/1 HARD SHALE**		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-0901** DATE **7/23/15** SHEET **6** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **1/5/10** BORING FINISH **1/7/10**

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
13	NQ	124.6	134.6		10.0	96	125			**MEDIUM BLUISH GRAY 5B 5/1 HARD SHALE**		
							130			**BROWNISH GRAY 5YR 4/1 HARD SHALE**		
										BROWNISH GRAY 5YR 4/1 HARD SHALE w/fine grain sandstone		
14	NQ	134.6	144.6		10.0	76	135			**MEDIUM DARK GRAY N4 HARD SHALE**		
										GRAYISH RED 5R 4/2 HARD SHALE		
										MEDIUM GRAY N5 HARD LIMESTONE		
							140					
										GRAYISH RED 5R 4/2 SOFT SHALE		
15	NQ	144.6	154.6		10.0	56	145			**DARK REDDISH BROWN 10R 3/4 SOFT CLAYSHALE** 145.0' - 146.8 and 147.8' - 151.0' fractures throughout		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-0901** DATE **7/23/15** SHEET **7** OF **7**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **1/5/10** BORING FINISH **1/7/10**

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
										BROWNISH GRAY 5YR 4/1 HARD CLAYSHALE w/limestone nodules throughout		
16	NQ	154.6	159.6		4.9	73	155			**MEDIUM GRAY N4 HARD SHALE** w/limestone nodules		
										MEDIUM GRAY N4 SOFT SHALE w/limestone nodules		
										BROWNISH GRAY 5YR 4/1 HARD LIMESTONE w/some hard clayshale		
										STOPPED BORING @ 159.6' / PACKER TESTED BOREHOLE / BENTONITE PELLETS FROM 159.6' - 137.0' / PULLED 4" CASING / DECONNED 01/14/10 / DRLLED 6" CASING TO 9.5' / AIR HAMMER TO 136.0'		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 709,192.0 E 1,728,205.5**

GROUND ELEVATION **808.8** SYSTEM **State Plane using NAD27/29**

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **B-0902** DATE **7/23/15** SHEET **1** OF **2**

BORING START **1/19/10** BORING FINISH **1/19/10**

PIEZOMETER TYPE **N/A** WELL TYPE **OW**

HGT. RISER ABOVE GROUND **3.04** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **55.6** BOTTOM **80.4**

WELL DEVELOPMENT **YES** BACKFILL **QUICK GROUT**

FIELD PARTY **ZLR / MWJ** RIG **D-120**

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	SPT	0.0	2.0	3-4-10-19	1.6					**VERY STIFF MEDIUM DARK GRAY N4 FLYASH** moist		
2	SPT	2.0	4.0	3-6-14-22	2.0					**HARD MEDIUM GRAY N5 FLYASH** moist		
3	SPT	4.0	6.0	3-2-8-17	2.0		5			**VERY STIFF MEDIUM GRAY N5 FLYASH** moist		
4	SPT	6.0	8.0	4-2-9-15	2.0					**VERY STIFF N4 FLYASH** moist		
5	SPT	8.0	10.0	4-7-13-27	2.0					**HARD MEDIUM LIGHT GRAY N6 FLYASH** moist		
6	SPT	10.0	12.0	2-4-10-25	2.0		10			**HARD MEDIUM DARK GRAY N4 FLYASH** moist		
7	SPT	12.0	14.0	1-5-7-13	1.6					**VERY STIFF MEDIUM DARK GRAY N4 FLYASH** 1.0 tsf, moist, wet		
8	SPT	14.0	16.0	1-6-8-13	1.8					**VERY STIFF N4 MEDIUM DARK GRAY FLYASH** 1.5 tsf, moist, wet		
9	SPT	16.0	18.0	2-3-4-6	1.4		15			**MEDIUM STIFF N4 MEDIUM DARK GRAY FLYASH** 2.5 tsf, moist/wet, trace of clay in end of spoon		
10	SPT	18.0	20.0	2-2-6-12	1.5					**VERY STIFF LIGHT BROWN 5YR 5/6 STIFF CLAY** 2.25 tsf, w/some fine sand, moist		

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TYPE OF CASING USED

X	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"
	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 _____

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-0902** DATE **7/23/15** SHEET **2** OF **2**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **1/19/10** BORING FINISH **1/19/10**

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
11	SPT	20.0	22.0	2-10-19-30	1.8					**HARD LIGHT BROWN 5YR 5/6 HARD CLAY** w/trace of fine sand, dry		
12	SPT	22.0	24.0	7-11-15-27	2.0					**HARD LIGHT BROWN 5YR 5/6 SILTY CLAY** 3.5 tsf, w/trace of weathered sandstone fragments, dry		
13	SPT	24.0	26.0	4-11-19-30	2.0		25			**HARD LIGHT BROWN 5YR 5/6 SILTY CLAY** 3.0 tsf, w/trace of weathered sandstone fragments, dry		
14	SPT	26.0	28.0	6-8-10-22	1.8					**VERY STIFF LIGHT BROWN 5YR 5/6 SILTY CLAY** 3.5 tsf, w/trace of weathered sandstone fragments, moist		
15	SPT	28.0	30.0	3-8-12-31	1.2					**VERY STIFF DARK REDDISH BROWN 10R 3/4 CLAY** 2.5 tsf, moist		
16	SPT	30.0	30.6	35-50/1	.6		30			**HARD DRAK REDDISH BROWN 10R 3/4 CLAY** dry		
										HARD DRAK REDDISH BROWN 10R 3/4 WEATHERED CLAYSHALE 3.5 tsf, dry		
										HARD PALE YELLOWISH BROWN 10YR 6/2 CLAYSHALE dry		
										SPOON REFUSAL @ 30.6' / FINISHED SPLIT SPOONING 01/19/10 / NOTICED ALOT OF RUST/IRON IN DRILL & DECON WATER / DRILLED 6" ROLLER BIT W/WATER TO 30.0' / PLACED 3/8" HOLE PLUG FROM 30.0' TO 26.5' / PULLED 6.25" HSA'S AND INSERTED 6" SW CASING TO 30.' / CLEANED BENTONITE FROM INSIDE OF 6' SW CASING W/6" ROLLER BIT & WATER TO CORE / STARTED CORING @ 30.2'		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 710,168.6 E 1,728,017.3**

GROUND ELEVATION **793.0** SYSTEM **State Plane using NAD27/29**

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **B-0903** DATE **7/23/15** SHEET **1** OF **4**

BORING START **2/2/10** BORING FINISH **2/2/10**

PIEZOMETER TYPE **N/A** WELL TYPE **OW**

HGT. RISER ABOVE GROUND **2.88** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **59.6** BOTTOM **79.4**

WELL DEVELOPMENT **YES** BACKFILL **QUICK GROUT**

FIELD PARTY **ZLR / MWJ** RIG **D-120**

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	SPT	0.0	2.0	11-5-5-11	.7					**VERY STIFF GRAYISH RED 5R 4/2 CLAY** 4.5 tsf, dry		GROUNDING PROCEDURE NOT IN USE ON THIS BORING.
2	SPT	2.0	4.0	6-7-8-12	1.0					**VERY STIFF GRAYISH RED 5R 4/2 CLAY** 3.75 tsf, dry		
3	SPT	4.0	6.0	3-4-8-17	1.6					**VERY STIFF LIGHT BROWNISH GRAY 5YR 6/1 CLAY** dry		
							5			**VERY STIFF MEDIUM GRAY N5 FLYASH** 1.0 tsf, moist		
4	SPT	6.0	8.0	9-8-12-20	1.7					**HARD LIGHT GRAY N6 FLYASH** 1.75 tsf		
										MEDIUM DARK GRAY N4 FLYASH dry		
5	SPT	8.0	10.0	4-5-12-19	1.0					**MEDIUM LIGHT GRAY N6 FLYASH** 1.25 tsf		
										HARD LIGHT BROWN 5YR 5/6 SANDSTONE AND CLAY moist		
6	SPT	10.0	12.0	5-5-11-18	1.3		10			**MEDIUM LIGHT GRAY N6 FLYASH** 1.0 tsf, moist		
7	SPT	12.0	14.0	1-8-17-38	1.2					**DARK REDDISH BROWN 10R 3/4 HARD CLAY** w/little red gravels/sand, moist		
										MEDIUM GRAY N5 FLYASH 1.5 tsf, moist		
8	SPT	14.0	16.0	3-10-23-39	1.6					**HARD MEDIUM GRAY N5 FLYASH** 1.0 tsf, dry		
							15					
9	SPT	16.0	18.0	3-10-17-20	1.0					**HARD MEDIUM GRAY N5 FLYASH** 1.5 tsf, moist		
10	SPT	18.0	20.0	3-6-7-12	1.4					**VERY STIFF MEDIUM GRAY N5 FLYASH** .5 tsf, moist		

TYPE OF CASING USED

X	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"
	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 _____

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-0903** DATE **7/23/15** SHEET **2** OF **4**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **2/2/10** BORING FINISH **2/2/10**

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
11	SPT	20.0	22.0	3-3-6-7	1.6					**STIFF MODERATE YELLOWISH BROWN 10YR 5/4 CLAY** .75 tsf, moist		
12	SPT	22.0	24.0	4-4-12-20	1.7					**HARD DARK YELLOWISH ORANGE 10YR 6/6 CLAY** 3.0 tsf, moist		
13	SPT	24.0	26.0	5-7-10-17	1.9		25			**VERY STIFF HARD DARK YELLOWISH ORANGE 10YR 6/6 CLAY** 2.75 tsf, moist		
14	SPT	26.0	28.0	4-5-8-12	1.6					**VERY STIFF HARD DARK YELLOWISH ORANGE 10YR 6/6 CLAY** 3.0 tsf, moist		
15	SPT	28.0	30.0	3-3-4-7						**STIFF YELLOWISH ORANGE 10YR 6/6 CLAY** 1.0 tsf, moist		
16	SPT	30.0	32.0	4-6-9-13	1.4		30			**VERY STIFF MODERATE YELLOWISH BROWN 10YR 5/4 CLAY** .75 tsf, w/little sand, moist		
17	SPT	32.0	33.8	4-7-27-50/.3	1.6					**HARD DARK YELLOWISH BROWN 10YR 5/4 CLAY** 2.5 tsf, w/weathered sandstone, moist		
18	SPT	34.0	34.8	40-50/.3	.8							
1	NQ	35.0	39.0		2.5	0	35			**DARK YELLOWISH ORANGE 10YR 6/6 SOFT CLAYSHALE**		STOPPED SPLIT SPOONING @ 34.8' / PLACED 4.6' of SEAL IN BOTTOM OF BORING / PULLED AUGERS / DECONNED TOOLS ON 02/02/10 / SET 6" CASING TO 34.8' in 4.6' SEAL / WASHED PLUG OUT OF 6" CASING
2	NQ	39.0	49.0		10.0	18	40			**MEDIUM LIGHT GRAY SHALE**		
										MEDIUM LIGHT GRAY SHALE w/iron staining		
							45			**MEDIUM GRAY N5 SHALE** w/iron staining @ 45.6' and 47.1'		

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-0903** DATE **7/23/15** SHEET **3** OF **4**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **2/2/10** BORING FINISH **2/2/10**

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
3	NQ	49.0	59.0		10.0	70	50			**MEDIUM DARK GRAY N4 SOFT CLAYSHALE**		
										MEDIUM BLUISH GRAY 5B 5/1 HARD SANDY CLAYSHALE w/high angle fracture 58.3' to 59.0'		
4	NQ	59.0	69.0		10.0	56	55			**MEDIUM BLUISH GRAY 5B 5/1 CLAYSHALE**		
							60			**MEDIUM GRAY N5 WELL CEMENTED FINE GRAIN SANDSTONE**		
										MEDIUM GRAY N5 HARD SHALE		
							65			**BROWNISH GRAY 5YR 4/1 HARD SHALE**		
										BROWNISH GRAY 5YR 4/1 FINE GRAIN SANDSTONE		
5	NQ	69.0	79.0		10.0	64	70			**MEDIUM BLUISH GRAY 5B 5/1 HARD FINE GRAIN SANDSTONE**		
										BROWNISH GRAY 5YR 4/1 HARD SHALE		

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-0903** DATE **7/23/15** SHEET **4** OF **4**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **2/2/10** BORING FINISH **2/2/10**

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
							75			**MEDIUM GRAY N5 HARD FINE GRAIN SANDSTONE**		
6	NQ	79.0	85.8		5.4	33	80			**MEDIUM GRAY N5 HARD FINE GRAIN SANDSTONE**		
										MEDIUM LIGHT GRAY SOFT CLAYSHALE		
							85			**DARK REDDISH BROWN SOFT CLAYSHALE**		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **APPALACHIAN POWER COMPANY**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 714,832.4 E 1,733,268.2**

GROUND ELEVATION **621.6** SYSTEM **State Plane using NAD27/29**

Water Level, ft			
TIME			
DATE			

BORING NO. **B-1201** DATE **7/23/15** SHEET **1** OF **2**

BORING START **1/10/12** BORING FINISH **1/10/12**

PIEZOMETER TYPE WELL TYPE

HGT. RISER ABOVE GROUND **2.132** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **18.4** BOTTOM **28.0**

WELL DEVELOPMENT **Yes** BACKFILL

FIELD PARTY **ZLR** RIG **D-120**

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	SPT	0.0	1.5	4-2-4	.2					**GRAVEL ROAD BASE**		Grounding procedures in use. Drilling w/ 3.25" augers and split spoon sampling. Used high pressure and steam cleaning at plant.
2	SPT	1.5	3.0	4-2-4	.2					**MEDIUM STIFF MODERATE BROWN 5YR 4/4 CLAY**		
3	SPT	3.0	4.5	2-4-5	.53					**SOFT MODERATE BROWN 5YR 3/4 CLAY**		
4	SPT	4.5	6.0	2-1-1	1.3		5			**SOFT MODERATE BROWN 5YR 4/4 CLAY** .5 tsf		
5	SPT	6.0	7.5	4-3-3	1.1					**SOFT DUSKY BROWN 5YR 2/2 CLAY** .5 tsf **MEDIUM STIFF PALE BROWN 5YR 5/2 CLAY** 1.0 tsf		
6	SPT	7.5	9.0	4-5-6	.54					**STIFF GRAYISH BROWN 5YR 3/2 CLAY**		
7	SPT	9.0	10.5	3-4-9	1.5					**STIFF LIGHT BROWN 5YR 5/6 CLAY** 2.0 tsf		
8	SPT	10.5	12.0	3-4-4	1.5		10			**STIFF LIGHT BROWN 5YR 5/6 CLAY** .5 tsf		
9	SPT	12.0	13.5	2-3-2	1.5					**MEDIUM STIFF LIGHT BROWN 5YR 5/6 CLAY** .5 tsf		
10	SPT	13.5	15.0	5-7-15	1.5					**VERY STIFF MODERATE BROWN 5YR 4/4 CLAY** 3.0 tsf		
11	SPT	15.0	16.5	3-4-7	1.5		15			**STIFF PALE BROWN 5YR 5/2 CLAY** 2.5 tsf, wet		
12	SPT	16.5	18.0	3-3-4	1.5					**MEDIUM STIFF MEDIUM LIGHT GRAY N6 CLAY** 1.0 tsf, moist		
13	SPT	18.0	19.5	3-3-14	1.4					**VERY STIFF MEDIUM GRAY N5 CLAY** 1.0 tsf, wet		
14	SPT	19.5	21.0	3-3-4	1.2					**MEDIUM STIFF MEDIUM LIGHT GRAY N6**		

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"
	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

AEP MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER _____

COMPANY **APPALACHIAN POWER COMPANY** BORING NO. **B-1201** DATE **7/23/15** SHEET **2** OF **2**

PROJECT **MOUNTAINEER LBR LANDFILL** BORING START **1/10/12** BORING FINISH **1/10/12**

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
										CLAY 1.0 tsf, wet		
15	SPT	21.0	22.5	3-4-7	1.4					**STIFF MEDIUM GRAY N5 SANDY CLAY** 1.0 tsf, wet		
16	SPT	22.5	24.0	4-4-10	1.2					**STIFF MODERATE BROWN 5YR 4/4 CLAY** 1.5 tsf, wet		
17	SPT	24.0	25.5	5-15-24	1.5					**HARD GREENISH GRAY 5GY 6/1 CLAYSHALE** wet w/rock fragments throughout		
18	SPT	25.5	27.0	17-47-50/.3	1.3		25			**HARD GREENISH GRAY 5GY 6/1 CLAYSHALE** wet		
19	SPT	27.0	28.5	5-45-50/.3	1.3					**HARD DUSKY YELLOW GREEN 5GY 5/2 CLAYSHALE** wet		
20	SPT	28.5	30.0	8-27-50/.3	1.3					**HARD DUSKY YELLOW GREEN 5GY 5/2 CLAYSHALE** wet		
							30					

ARCADIS

Arcadis 2016

Boring Logs

MW-1611, MW-1612, SB-1602, SB-1609R, SB-1610, SB-1619R, SB-1619R ALT

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power**

PROJECT **Mountaineer Plant**

COORDINATES **N 711,948.8 E 1,731,867.6**

GROUND ELEVATION **654.0** SYSTEM

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **MW-1611** DATE **09/22/16** SHEET **1** OF **3**

BORING START **06/02/16** BORING FINISH **06/02/16**

PIEZOMETER TYPE **NA** WELL TYPE

HGT. RISER ABOVE GROUND **2.89** DIA

DEPTH TO TOP OF WELL SCREEN BOTTOM

WELL DEVELOPMENT BACKFILL

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

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
0	NR	0.0	10.0		0					Straight drilled to 10 feet, boring was pre-drilled for utility clearance; no samples were taken.		
							5					
1	SS	10.0	12.0	2-3-3-3	0.3		10			FILL, brown, very soft, slightly silty fill.		
2	SS	12.0	14.0	0-0-2-3	24				CL	Clay; some silt; moist; soft; medium plasticity; medium tough; (5Y 4/1).		

TYPE OF CASING USED

	NQ-2 ROCK CORE	
NA	6" x 3.25 HSA	
NA	9" x 6.25 HSA	
NA	HW CASING ADVANCER	4"
NA	NW CASING	3"
NA	SW CASING	6"
NA	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 **J. Wanner**

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1611** DATE **09/22/16** SHEET **2** OF **3**

PROJECT **Mountaineer Plant** BORING START **06/02/16** BORING FINISH **06/02/16**

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
3	SS	14.0	16.0	0-0-1-2	24		15					
4	SS	16.0	18.0	0-0-0-0	24				CL	Clay with silt; little to some sand, fine to medium; soft; low plasticity; low toughness; moist; color 5GY 6/1 (greenish gray); bottom 0.5 feet includes 10% gravel.		
5	SS	18.0	20.0	3-4-3-5	19							
6	SS	20.0	22.0	21-22-24-31	12		20			Note: From 20 to 22 feet moist; color grades to (5/56-1).		
7	SS	22.0	24.0		0.3					Weathered shale; dry; fine pastes; weak plates; very faint iron staining. Straight drilled using a tricone bit, weathered bedrock.		
8	SS	24.0	26.0		24							
9	RC	26.0	30.5		60	60	25			Sandstone; field strength strong; color 10YR 6/3 to 10YR 5/2; texture medium grained; structure thinly bedded; decomposition slight; disintegration slight; fracture density intensely slight to very intense.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1611** DATE **09/22/16** SHEET **3** OF **3**

PROJECT **Mountaineer Plant** BORING START **06/02/16** BORING FINISH **06/02/16**

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
10	RC	30.5	35.5		62.4	58						
										Sandstone; field strength strong; color N 3/ (very dark gray) to N 6/ (gray); texture medium grained; structure thinly bedded, cross-bedded; decomposition fresh; disintegration competent; fracture density none unfractured.		
11	RC	35.5	40.7		55.2	79	35			Shale; field strength very weak to moderate; color N5/ (gray) to 10Y 5/1 (greenish gray); texture medium grained; structure thinly bedded; decomposition slightly; disintegration slightly; fracture density moderate to intense.		
									CL	Claystone/Mudstone; field strength; moderate to strong; color 7.5R 3/3; texture fine grained; structure thinly bedded; decomposition slightly; disintegration slightly; fracture density moderate to intensely.		
										Muddy shale; field strength strong; color 10BG 4/1 (dark greenish gray) to 5BG 4/1 (dark greenish gray); texture fine grained; structure thinly bedded; decomposition slightly; disintegration slightly; fracture density moderately to intensely.		
12	RC	40.7	46.0		57.6	39	40		CL	Claystone/Mudstone; field strength strong; color N 2.5/ (black) to 5GY 4/1 (dark greenish gray); texture fine grained; structure massive; decomposition moderately; disintegration slightly to moderately; fracture density intensely.		
									CL	Claystone/Mudstone; field strength strong; color 5GY 4/1 (dark greenish gray); texture fine grained; structure massive; decomposition slightly; disintegration slightly; fracture density moderately.		
							45			End of boring at 46 feet.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power**

PROJECT **Mountaineer Plant**

COORDINATES **N 709,978.5 E 1,727,983.1**

GROUND ELEVATION **780.7** SYSTEM

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **MW-1612** DATE **09/22/16** SHEET **1** OF **9**

BORING START **07/12/16** BORING FINISH **07/14/16**

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

HGT. RISER ABOVE GROUND **2.57** DIA **2"**

DEPTH TO TOP OF WELL SCREEN **101** BOTTOM **121**

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

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

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
0	NR	0.0	8.0		0					Straight drilled to 8 feet, boring was pre-drilled for utility clearance; no samples were taken.		
1	SS	8.0	10.0	2-6-9-12	21		5		CL	Clay; trace silt; medium to high plasticity; no dilatancy; moist; stiff; yellowish red (5YR 4/6).		
2	SS	10.0	12.0	6-7-9-9	23		10		CL	Clay; little silt; trace very fine sand; medium plasticity; no dilatancy; moist; very stiff; yellowish brown (10YR 5/4) with trace stone brown and light gray (75YR 5/8).		
3	SS	12.0	14.0	3-6-9-9	26					Note: At 13 feet color changes to strong brown (7.5YR 4/6).		
4	SS	14.0	16.0	2-6-9-10	28					Note: At 13.1 feet lens of poorly sorted sand, fine to very coarse; and granules; angular, black. Note: From 14 to 16 feet strong brown; 10%		

TYPE OF CASING USED

	NQ-2 ROCK CORE
NA	6" x 3.25 HSA
NA	9" x 6.25 HSA
NA	HW CASING ADVANCER 4"
NA	NW CASING 3"
NA	SW CASING 6"
NA	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 **K. Eldridge**

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1612** DATE **09/22/16** SHEET **2** OF **9**

PROJECT **Mountaineer Plant** BORING START **07/12/16** BORING FINISH **07/14/16**

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
										light gray; 1% black; no sand.		
5	SS	16.0	18.0	3-5-7-8	26							
6	SS	18.0	20.0	3-6-7-8	25							
									CL	Clay; trace silt; some very fine sand; low plasticity; moist; very stiff; strong brown with approximately 3% light gray (7.5YR 5/6).		
							20					
7	SS	20.0	22.0	4-6-7-6	20				CL	Clay, little silt; trace fine sand; trace weathered fragments sandstone, olive (5Y 5/3); medium plasticity; very stiff; moist; strong brown (7.5YR 4/6) with 10% black (7.5YR 2 5/1).		
8	SS	22.0	24.0	2-6-17-18	19							
									CL	Clay; some silt; low to medium plasticity; no dilatancy; dry; yellowish brown (10YR 5/6) with 10% dark brown (10YR 3/3).		
9	SS	24.0	26.0	50/4-7	2					Weathered shale; dry; (10YR 5/6).		
							25			Sandstone; field strength weak; color 2.5 Y 5/4 light olive brown with orange oxidize lamination; texture fine grained; structure laminated; decomposition slight; disintegration slight; fracture density intense.		
10	RC	26.5	27.7		14.4							
11	RC	27.7	32.6		59					Sandstone; field strength strong; color 5Y 4/2, (olive gray) to 5B 5/1 (bluish gray) with orange oxidize lamination; texture fine grained; structure laminated; decomposition slight; disintegration slight; fracture density moderate.		
							30					
12	RC	32.6	36.2		43							

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1612** DATE **09/22/16** SHEET **3** OF **9**

PROJECT **Mountaineer Plant** BORING START **07/12/16** BORING FINISH **07/14/16**

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
							35					
13	RC	36.2	41.9		68				CL	Shale; field strength very strong; color 10Y 4/1 (dark greenish gray) to 5GY 5/1 (greenish gray) with trace oxidize lamination; texture fine grained; structure laminated; decomposition high; disintegration slight; fracture density intense.		
										Claystone/Mudstone; field strength very weak; color 5R 3/2 (dusky red) and 10BG 4/1 (dark greenish gray); texture fine grained; structure massive; decomposition high; disintegration slight; fracture density intense.		
							40					
14	RC	41.9	46.9		60					Shale; field strength very weak; color 10G 4/1 (dark greenish gray); texture fine grained; structure laminated; decomposition slight; disintegration slight; fracture density moderate.		
							45					
15	RC	46.9	51.5		55					Sandstone; field strength strong; color 10BG 5/1 (greenish gray); texture fine grained; structure massive; decomposition fresh; disintegration slight; fracture density moderate.		
										Shale trace calcite fossil; field strength moderate to strong; color 10G 4/1 (dark greenish gray) to 5B 4/1 (dark bluish gray); texture fine grained; structure laminated; decomposition slight; disintegration slight; fracture density moderate.		
							50					
16	RC	51.5	57.9		60.36					Shale; field strength strong; color 5B 4/1 (dark bluish gray); texture fine grained; structure laminated; decomposition slight; disintegration slight; fracture density moderate.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1612** DATE **09/22/16** SHEET **4** OF **9**

PROJECT **Mountaineer Plant** BORING START **07/12/16** BORING FINISH **07/14/16**

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
							55					
17	RC	57.9	60.8		34.8							
										Sandstone with some shale; field strength very strong; color 5B 4/1 (dark bluish gray); texture fine grained; structure massive; decomposition slight to fresh; disintegration competent; fracture density moderate.		
							60					
18	RC	60.8	126.3		54					Sandstone some shale; field strength strong to very strong; color 5B 4/1 (dark bluish gray); texture fine grained; structure medium to laminated; decomposition slight to fresh; disintegration competent; fracture density slight.		
							65					
19	RC	65.5	67.5		31.56					Sandstone; field strength very strong; color 5B 5/1 (bluish gray); texture fine grained; structure laminated with x-bedding; decomposition fresh; disintegration competent; fracture density none.		
20	RC	67.5	71.6		59.76				CL	Claystone/Mudstone; field strength very weak; color 5R 3/4 (dusky red) and 5BG 4/1 (dark greenish gray); texture fine grained; structure massive; decomposition slight; disintegration slight; fracture density moderate.		
							70					
21	RC	71.6	77.6		58.92				CL	Claystone/Mudstone; field strength very weak; color 10R 3/4; texture fine grained; structure massive; decomposition fresh to slight; disintegration slight; fracture density moderate.		

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AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1612** DATE **09/22/16** SHEET **5** OF **9**

PROJECT **Mountaineer Plant** BORING START **07/12/16** BORING FINISH **07/14/16**

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
							75					
22	RC	77.6	81.6		58.8				CL	Claystone/Mudstone with cal fossil; field strength very strong; color 5BG 3/1 (very dark greenish gray); texture fine grained; structure massive; decomposition fresh to slight; disintegration slight; fracture density moderate.		
										Shale; field strength very weak; color 5BG 4/1 (dark greenish gray); texture fine grained; structure laminated; decomposition fresh; disintegration competent; fracture density intense.		
							80			Sandstone with trace calc. fossil; field strength very strong; color 5BG 4/1 (dark greenish gray); texture fine grained; structure massive; decomposition fresh; disintegration competent; fracture density slight.		
23	RC	81.6	86.4		51							
									CL	Claystone/Mudstone; field strength moderate; color 2.5R 2.5/3 and trace 10G 4/1 (dark greenish gray); texture fine grained; structure massive; decomposition fresh; disintegration competent; fracture density moderate.		
							85					
24	RC	86.4	92.4		59.52							
										Shale and sandstone transition; field strength strong; color 5BG 6/1 (greenish gray); texture fine grained; structure laminated; decomposition fresh; disintegration competent; fracture density moderate.		
							90			Sandstone; field strength very strong; color 5B 5/1 (bluish gray); texture fine grained; structure laminated and x-bedding; decomposition fresh; disintegration competent; fracture density none.		
25	RC	92.4	95.4		48							

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LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1612** DATE **09/22/16** SHEET **6** OF **9**

PROJECT **Mountaineer Plant** BORING START **07/12/16** BORING FINISH **07/14/16**

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
							95		CL	Claystone/Mudstone; field strength moderate; color 10R 2.5/2 and 10BG 4/1 (dark greenish gray); texture fine grained; structure massive; decomposition high; disintegration competent to slight; fracture density moderate to intense.		
26	RC	95.4	100.5		34.8							
							100					
27	RC	100.5	103.7		34.56							
28	RC	103.7	106.5		32.04					Sandstone with calc. fossil; field strength very strong; color 10B 5/1 (bluish gray); texture fine grained; structure massive; decomposition fresh; disintegration competent; fracture density none to moderate.		
							105					
29	RC	106.5	111.5		57.6							
							110					
30	RC	111.5	115.8		54							

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LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1612** DATE **09/22/16** SHEET **7** OF **9**

PROJECT **Mountaineer Plant** BORING START **07/12/16** BORING FINISH **07/14/16**

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
							115					
31	RC	115.8	119.8		46.8					Shale; field strength moderate; color 5BG 4/1 (dark greenish gray) to 2.5 YR 2.5/4; texture fine grained; structure laminate; decomposition fresh; disintegration competent; fracture density slight.		
32	RC	119.8	124.2		46.8		120			Shale; field strength moderate; color 2.5 YR 2.5/4; texture fine grained; structure laminate; decomposition fresh; disintegration competent; fracture density intense to moderate.		
									CL	Claystone/Mudstone; field strength strong; color 10G 5/1 (greenish gray) and 10 R 3/4; texture fine grained; structure massive; decomposition fresh; disintegration competent; fracture density intense to moderate.		
33	RC	124.2	126.7		26.4		125		CL	Claystone/Mudstone; field strength strong; color 10 R 3/4 trace 10G 5/1 (greenish gray); texture fine grained; structure massive; decomposition fresh; disintegration competent; fracture density slight.		
34	RC	126.7	131.6		59.28				CL	Claystone/Mudstone; field strength strong; color 10 R 3/4 from 126.7 to 130.8 feet and 5BG 4/1 (dark greenish gray) from 130.8 to 131.6 feet; texture fine grained; structure massive; decomposition fresh; disintegration competent; fracture density moderate.		
							130					
35	RC	131.6	135.0		42.48					Sandstone and shale with some calc. fossil;		

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LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1612** DATE **09/22/16** SHEET **8** OF **9**

PROJECT **Mountaineer Plant** BORING START **07/12/16** BORING FINISH **07/14/16**

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
										field strength very strong; color 5BG 4/1 (dark greenish gray); texture fine grained; structure massive; decomposition fresh; disintegration competent; fracture density slight.		
									CL	Claystone/Mudstone; field strength very strong; color 10 R 3/4; texture fine grained; structure massive; decomposition fresh; disintegration competent; fracture density slight.		
36	RC	135.0	140.2		60.24		135			Sandstone with trace calc. fossil; field strength very strong; color 5B 4/1 (dark bluish gray); texture fine grained; structure laminated; decomposition fresh; disintegration competent; fracture density slight.		
										Sandstone with trace calc. fossil; field strength very strong; color 5B 4/1 (dark bluish gray); texture fine grained; structure laminated and x-bedding; decomposition fresh; disintegration competent; fracture density slight.		
37	RC	140.2	145.3		60.6		140			Sandstone with calc. fossil; field strength very strong; color 5B 5/1 (bluish gray); texture fine grained; structure laminated cross bedding; decomposition fresh; disintegration competent; fracture density slight.		
										Shale with calc. fossil; field strength very strong; color 5B 3/1 (very dark bluish gray); texture fine grained; structure laminate; decomposition fresh; disintegration competent; fracture density slight.		
38	RC	145.3	150.2		59.64		145			Shale with calc. fossil; field strength strong to very strong; color 5B 3/1 (very dark bluish gray); texture fine grained; structure laminated; decomposition fresh; disintegration competent; fracture density moderate.		
										Sandstone; field strength very strong; color 10B 5/1 (bluish gray); texture fine grained; structure laminate; decomposition fresh; disintegration competent; fracture density moderate.		
39	RC	150.2	154.7		52.8		150			Sandstone; fields strength very strong; color 10B 5/1 (bluish gray); texture fine grained; structure laminate; decomposition fresh; disintegration competent; fracture density		

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JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **MW-1612** DATE **09/22/16** SHEET **9** OF **9**

PROJECT **Mountaineer Plant** BORING START **07/12/16** BORING FINISH **07/14/16**

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
										slight.		
40	RC	154.7	159.5		55.2		155			Sandstone; field strength very strong; color 10B 5/1 (bluish gray); texture medium grained; structure massive; decomposition fresh; disintegration competent; fracture density none.		
									CL	Claystone/Mudstone; field strength very strong; color 2.5YR 2.5/3; texture medium grained; structure massive; decomposition fresh; disintegration slight; fracture density intense.		
										Shale; field strength very strong; color 5BG 4/1 (dark greenish gray); texture medium grained; structure laminated; decomposition fresh; disintegration slight; fracture density none.		
									CL	Claystone/Mudstone; field strength very strong; color 10B 5/1 (bluish gray); texture medium grained; structure massive; decomposition fresh; disintegration slight; fracture density intense.		
										End of boring at 159.5 feet.		

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AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power**

PROJECT **Mountaineer Plant**

COORDINATES

GROUND ELEVATION **NA** SYSTEM

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **SB-1602** DATE **09/22/16** SHEET **1** OF **10**

BORING START **05/20/16** BORING FINISH **05/26/16**

PIEZOMETER TYPE **NA** WELL TYPE

HGT. RISER ABOVE GROUND DIA

DEPTH TO TOP OF WELL SCREEN BOTTOM

WELL DEVELOPMENT BACKFILL

FIELD PARTY **NA** RIG **CME75**

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
0	SS	0.0	12.5		0	NA				Straight drilled to 12.5 feet, boring was pre-drilled for utility clearance; no samples wer taken.		
1	RC	12.5	15.7		37.2	25%	5 10 15			Sandstone; field strength strong; color 5Y 5/4 grades to 5Y 4/2; texture fine grained; structure thinly bedded to massive; decomposition slight; disintegration slight; fracture density intense.		
2	RC	15.7	24.5		99.6	49%				Sandstone; field strength strong; color 5Y 5/4; texture fine grained; structure massive; decomposition fresh; disintegration slight; fracture density very intense. Note: Color grades to 2.5Y 5/3 down to 20.3 feet.		

TYPE OF CASING USED

	NQ-2 ROCK CORE	
NA	6" x 3.25 HSA	
NA	9" x 6.25 HSA	
NA	HW CASING ADVANCER	4"
NA	NW CASING	3"
NA	SW CASING	6"
NA	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 **J. Wanner**

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LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1602** DATE **09/22/16** SHEET **2** OF **10**

PROJECT **Mountaineer Plant** BORING START **05/20/16** BORING FINISH **05/26/16**

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
										Sandstone inter layered with red bed; field strength moderate; color 7.5 R 4/2; texture fine grained; structure massive; decomposition fresh; disintegration slight; fracture density very intense.		
3	RC	24.5	25.2		8.4	100%	25			Shale; field strength strong; color 5GY 3/1 (very dark greenish gray) grades to 10GY 5/1 (greenish gray); texture fine grained; structure thinly bedded; decomposition fresh; disintegration slight; fracture density intense. Note: From 25 to 25.2 feet field strength is moderate.		
4	RC	25.2	31.0		67.8	96%				Claystone/Mudstone; field strength moderate; color 7.5 R 3/2; texture fine grained; structure massive; decomposition fresh; disintegration slight; fracture density moderate. Note: At 25. 2 feet contact, clear.		
5	RC	31.0	36.0		50.4	72%	30			Shale; field strength strong; color 10GY 6/1 (greenish gray); texture fine grained; structure massive to thinly bedded; decomposition fresh; disintegration slight; fracture density moderate. Note: At 27 to 34 feet clear boundary into shale (blue).		
										Shale; field strength strong; color 5GY 5/1 (greenish gray); texture fine grained; structure massive to thinly bedded; decomposition fresh; disintegration slight; fracture density intense to moderate.		
6	RC	36.0	39.9		50.4	21%	35			Claystone/Mudstone; field strength moderate; color 7.5 Y 5/2; texture fine grained; structure massive; decomposition fresh; disintegration slight; fracture density intense to moderate.		
										Claystone/Mudstone; field strength weak; color 7.5 Y 5/2 grades to 7.5 Y 4/2; texture fine grained; structure massive; decomposition fresh; disintegration slight; fracture density very intense.		
7	RC	39.9	41.0		0	0%	40			No recovery inner barrier split.		
8	RC	41.0	46.0		58.8	93%				Claystone/Mudstone; field strength moderate; color 7.5 YR 5/2 grades to 7.5 R 3/3 to 4/4; texture fine grained; structure thinly bedded; decomposition fresh; disintegration slight; fracture density intense to moderate.		
							45					

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JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1602** DATE **09/22/16** SHEET **3** OF **10**

PROJECT **Mountaineer Plant** BORING START **05/20/16** BORING FINISH **05/26/16**

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
9	RC	46.0	48.0		19.2	78%				Claystone/Mudstone; field strength moderate; color grades to 7.5 R 5/1 to 3/2; texture fine grained; structure thinly bedded; decomposition fresh; disintegration slight; fracture density very intense.		
10	RC	48.0	51.0		31.2	25%				Claystone/Mudstone; field strength weak; color grades to 2.5 Y 5/3; texture fine grained; structure 48 to 50 feet thinly bedded at 50 to 51 feet massive; decomposition fresh to slight; disintegration slight; fracture density intense to moderate.		
11	RC	51.0	56.0		31.2	32%	50			Claystone/Mudstone; field strength strong; color 7.5 R 3/2 with 20% coarse mottles 10B 6/1; texture fine grained; structure massive; decomposition fresh; disintegration slight; fracture density intense to moderate.		
12	RC	56.0	61.0		58.8	92%	55			Claystone/Mudstone; field strength strong; color 7.5 R 3/3; texture fine grained; structure massive; decomposition fresh; disintegration slight; fracture density slightly fractured.		
										Transition.		
13	RC	61.0	66.0		58.2	81%	60			Sandstone; field strength strong; color 5B 5/1 (bluish gray); texture fine grained; structure thinly bedded; decomposition fresh; disintegration slight; fracture density slightly fractured.		
										Sandstone; field strenth strong; color 5B 5/1 (bluish gray) grades to 5B 4/1 (dark bluish gray); texture fine grained; structure thinly bedded; decomposition slight to fresh; disintegration slight; fracture density moderate.		
14	RC	66.0	71.0		60	97%	65			Sandy Shale; field strenth strong; color 5B 5/1 (bluish gray) grades to 5B 4/1 (dark bluish gray); texture fine grained; structure thinly bedded; decomposition slight to fresh; disintegration slight; fracture density moderate.		
										Shaly sandstone; field strength strong; color 10B 4/1 (dark bluish gray); texture fine grained; structure thinly bedded; decomposition fresh; disintegration competent; fracture density from 66 to 68 feet moderate from 69 to 71 feet intense. Note: From 68 to 69 feet fracture density very intense.		
15	RC	71.0	76.0		60	93%	70			Sandstone with interbedded shale, clear boundaries; field strength very strong; color 5B		

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JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1602** DATE **09/22/16** SHEET **4** OF **10**

PROJECT **Mountaineer Plant** BORING START **05/20/16** BORING FINISH **05/26/16**

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
							75			5/1 (bluish gray) and 5B 4/1 (dark bluish gray); texture fine grained; structure thinly bedded; cross bedded throughout; decomposition fresh; disintegration competent; fracture density moderate. Note: At 72 to 73 feet fresh undecomposed plant roots up to 3mm observed paleosol.		
16	RC	76.0	81.0		61.2	98%				Sandstone with interbedded shale, gradual to diffuse boundaries; field strength very strong; color 5B 5/1 (bluish gray) and 5B 4/1 (dark bluish gray); texture fine grained; structure thinly bedded; decomposition fresh; disintegration competent; fracture density moderate.		
17	RC	81.0	86.0		55.8	58%	80			Shale weakling developed; field strength strong; color 81 to 82.5 feet 5B 4/1 (dark bluish gray) then at 82.5 to 84 feet 7.5 R 3/2; texture fine grained; structure thinly bedded; decomposition slight; disintegration slight; fracture density moderate grades to intense.		
										Claystone/Mudstone; field strength moderate; color 10Y 5/1 (greenish gray) to N 3/ (very dark gray); texture fine grained; structure massive; decomposition slight; disintegration slight; fracture density moderate grades to intense.		
18	RC	86.0	91.0		60	78%	85			Transition. Note: From 86 to 92.9 feet sandy fine paleosol. Claystone/Mudstone; field strength strong; color 7.5 R 3/4; texture fine grained; structure massive; decomposition fresh; disintegration slight; fracture density moderate to intense.		
19	RC	91.0	96.0		61.2	99%	90			Claystone/Mudstone; field strength strong; color 7.5 R 4/3; texture fine grained; structure massive; decomposition fresh; disintegration competent; fracture density moderate to slight.		
										Shale; field strength strong; color 10BG 4/1 (dark greenish gray) to 10BG 6/1 (greenish gray); texture fine grained; structure massive; decomposition fresh; disintegration competent; fracture density moderate to slight.		
20	RC	96.0	101.0		55.8	92%	95					

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COMPANY **American Electric Power** BORING NO. **SB-1602** DATE **09/22/16** SHEET **5** OF **10**

PROJECT **Mountaineer Plant** BORING START **05/20/16** BORING FINISH **05/26/16**

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
							100					
21	RC	101.0	106.0		60	64%				Shale; field strength strong; color 5B 6/1 (bluish gray) to 10B 2.5/1 (bluish black); texture fine grained; structure thinly bedded and massive; decomposition slight; disintegration slight; fracture density intense.		
										Transition; structure massive.		
22	RC	106.0	111.0		62.4	71%	105			Claystone/Mudstone; field strength strong; color 7.5 R 3/2 to 7.5 R 3/3; texture fine grained; structure massive; decomposition slight; disintegration slight; fracture density intense.		
										Claystone/Mudstone; field strength strong; color 7.5 R 3/2; texture fine grained; structure massive; decomposition fresh; disintegration slight to competent; fracture density intense to very intense.		
23	RC	111.0	116.0		56.4	83%	110			Shale; field strength strong; color 10BG 4/1 (dark greenish gray); texture fine grained; structure thinly bedded; decomposition fresh; disintegration slight to competent; fracture density intense to very intense.		
										Shale; field strength strong; color 10BG 6/1 (greenish gray to 5BG 3/1 (very dark greenish gray); texture fine grained; structure thinly bedded; decomposition fresh; disintegration competent; fracture density moderate to very intense.		
24	RC	116.0	121.0		56.4	92%	115			Sandstone; field strength strong; color 10BG 6/1 (greenish gray to 5BG 3/1 (very greenish gray); texture medium grained; structure massive; decomposition fresh; disintegration competent; fracture density moderate to very intense.		
										Shale; field strength strong; color 10BG 6/1 (greenish gray to 5BG 3/1 (very dark greenish gray); texture fine grained; structure thinly bedded; decomposition fresh; disintegration competent; fracture density moderate to very intense.		
25	RC	121.0	126.0		62.4	98%	120			Sandstone; field strength strong; color 10BG 4/1 (dark greenish gray) to 5G 5/1 (greenish gray); texture fine grained; structure thinly bedded; cross bedding evident at 16 to 120 feet; decomposition fresh; disintegration competent; fracture density moderate.		
										Shale grades to sandstone; field strength strong; color 10BG 4/1 (dark greenish gray) to 5G 5/1 (greenish gray); texture fine grained;		

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JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1602** DATE **09/22/16** SHEET **6** OF **10**

PROJECT **Mountaineer Plant** BORING START **05/20/16** BORING FINISH **05/26/16**

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
							125			structure thinly bedded; cross bedded at 122 to 126 feet; decomposition fresh; disintegration competent; fracture density very intense at 121 to 121.3 feet and unfractured at 121.3 to 126 feet.		
26	RC	126.0	131.0		54	74%				Shale; field strength strong; color 5B 4/1 (dark bluish gray) and 5B 7/1 (light bluish gray); texture fine grained; structure thinly bedded; decomposition fresh; disintegration competent; fracture density unfractured to slight.		
27	RC	131.0	136.0		57.6	92%	130			Sandstone; field strength strong; color 7.5YR 5/2 (brown) and 5B 4/1 (dark bluish gray); texture fine grained; structure thinly bedded; decomposition slight; disintegration slight; fracture density very intense; horizontal and up to 70 degrees.		
										Sandstone; bottom 2 feet shaly; field strength strong; color 10BG 4/1 (dark greenish gray); texture fine grained; structure massive to thinly bedded; decomposition fresh; disintegration competent; fracture density slight.		
28	RC	136.0	141.0		61.2	102%	135			Sandstone grades to shale; field strength strong; color 5B 4/1 (dark bluish gray) to 5B 5/1 (bluish gray); texture fine grained; structure massive grades to thinly bedded; decomposition fresh; disintegration competent; fracture density unfractured.		
29	RC	141.0	146.0		55.2	92%	140					
30	RC	146.0	151.0		58.8	68%	145			Note: From 149 to 150 feet fracture density intense; vertical and horizontal fractures.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1602** DATE **09/22/16** SHEET **7** OF **10**

PROJECT **Mountaineer Plant** BORING START **05/20/16** BORING FINISH **05/26/16**

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
31	RC	151.0	156.0		60	46%				Claystone/Mudstone; field strength strong; color 7.5 R 3/3; texture fine grained; structure massive; decomposition slight; disintegration slight; fracture density intense to very intense.		
32	RC	156.0	161.0		62.4	83%	155			Shale; field strength strong; color 5B 4/1 (dark bluish gray) to 10B 3/1 (very dark bluish gray); texture fine grained; structure thinly bedded, weakly developed; decomposition slight; disintegration slight; fracture density intense.		
33	RC	161.0	166.0		48	56%	160			Claystone/Mudstone; field strength strong; color 7.5R 3/3 (dusty red); texture fine grained; structure massive; decomposition fresh to slight; disintegration competent to slight; fracture density intense to very intense.		
34	RC	166.0	171.0		74.4	96%	165					
35	RC	171.0	176.0		62.4	104%	170			Shale; field strength strong; color 10G 6/1 (greenish gray) to 5B 3/1 (very dark bluish gray); texture fine grained; structure massive; decomposition slight; disintegration slight; fracture density intense to very intense. Note: From 170 to 171 driller ran cleanout as part of this run. Shaly sandstone inter layered with sandy shale; gradual boundary; field strength strong; color 10B 6/1 (bluish gray) to 10BG 4/1 (dark greenish gray); texture fine grained; structure massive; decomposition fresh; disintegration competent; fracture density unfractured.		
							175					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1602** DATE **09/22/16** SHEET **8** OF **10**

PROJECT **Mountaineer Plant** BORING START **05/20/16** BORING FINISH **05/26/16**

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
36	RC	176.0	181.0		60	87%				Claystone/Mudstone finger interbed of weakly developed; field strength strong; color 10BG 5/1 (greenish gray); texture fine grained; structure massive; decomposition fresh; disintegration competent; fracture density slight.		
							180			Sandy shale; field strength strong; color 10BG 5/1 (greenish gray); texture fine grained; structure massive; decomposition fresh; disintegration competent; fracture density slight.		
37	RC	181.0	186.0		55.8	85%				Sandy shale; field strength strong; color 10G 5/1; texture fine to medium grained; structure massive grades to thinly bedded; decomposition fresh; disintegration competent; fracture density slight.		
							185					
38	RC	186.0	191.0		55.2	33%			CL	Claystone/Mudstone; field strength strong; color 7.5R 4/2 (weak red) with 5Y 6/3 (pale olive); texture fine grained; structure massive; decomposition slight; disintegration slight; fracture density moderate.		
							190					
39	RC	191.0	196.0		62.4	71%			CL	Claystone/Mudstone; field strength strong; color 7.5 R 3/3; texture fine grained; structure massive; decomposition slight; disintegration slight; fracture density moderate to intense.		
							195					
40	RC	196.0	201.0		61.2	88%			CL	Claystone/Mudstone; field strength strong; color 7.5 R 3/3; texture fine grained; structure massive; decomposition slight; disintegration slight; fracture density moderate.		
							200			Shaly sandstone; field strength strong; color 10B 4/1 (dark bluish gray) to 5B 6/1 (bluish gray); texture fine grained; structure massive; decomposition slight; disintegration slight; fracture density moderate.		
41	RC	201.0	206.0		60	100%						

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AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1602** DATE **09/22/16** SHEET **9** OF **10**

PROJECT **Mountaineer Plant** BORING START **05/20/16** BORING FINISH **05/26/16**

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
							205					
42	RC	206.0	211.0		56.4	89%						
							210					
43	RC	211.0	213.5		33	96%				Claystone/Mudstone; field strength strong; color 7.5 R 3/3; texture fine grained; structure massive; decomposition slight; disintegration slight; fracture density moderate grades to very intense.		
44	RC	213.5	216.0		27.6	74%						
							215					
45	RC	216.0	221.0		30	48%						
							220			Shaly sandstone grades to sandy shale very fine; field strength strong; color 10G 4/1 (dark greenish gray); texture fine grained; structure massive grades to thinly bedded, weakly developed; decomposition fresh; disintegration slight; fracture density slight.		
46	RC	221.0	235.4		175.2	96%				Sandy shale; field strength strong; color 5BG 3/1 (very dark greenish gray); texture fine grained; structure thinly bedded; decomposition fresh; disintegration competent to slight; fracture density slight to moderate.		
							225			Claystone/Mudstone; field strength strong; color 7.5R 3/3 (dusky red); texture fine grained; structure massive; decomposition fresh; disintegration competent to slight; fracture density slight to moderate.		
										Shale; field strength strong; color 5BG 3/1 (very dark greenish gray); texture fine grained;		

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LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1602** DATE **09/22/16** SHEET **10** OF **10**

PROJECT **Mountaineer Plant** BORING START **05/20/16** BORING FINISH **05/26/16**

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
										structure thinly bedded grades with massive; decomposition fresh; disintegration competent to slight; fracture density slight to moderate.		
							230					
										Shaly sandstone; field strength strong; color 5BG 3/1 (very dark greenish gray); texture fine grained; structure thinly bedded, cross bedded from 232 to 234 feet; decomposition fresh; disintegration competent to slight; fracture density slight to moderate.		
							235					
47	RC	235.4	241.0		56.4	84%				Shale grades with sandy shale (sand fraction is fine to medium); field strength strong; color 5B 5/1 (bluish gray); texture fine grained; structure thinly bedded with some cross bedding; decomposition fresh; disintegration competent; fracture density unfractured.		
							240					
48	RC	241.0	246.0		61.8	102%				Sandy shale grades to sandstone; field strength strong; color 10G 4/1 (dark greenish gray) to 10B 5/1 (bluish gray); texture fine grained grades to medium grained; structure massive grades to thinly bedded; decomposition fresh; disintegration competent; fracture density 241 to 241.4 feet very intensely fractured and from 241.4 to 246 feet unfractured.		
							245					
49	RC	246.0	251.0		44.4	68%				Claystone/Mudstone; field strength strong; color 7.5 R 3/2 to 7.5 R 3/3; texture fine grained; structure massive with faint layered appearance; decomposition fresh; disintegration competent; fracture density intense		
							250					
										End of boring at 251 feet.		

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AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power**

PROJECT **Mountaineer Plant**

COORDINATES

GROUND ELEVATION **NA** SYSTEM

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **SB-1609R** DATE **09/22/16** SHEET **1** OF **3**

BORING START **05/11/16** BORING FINISH **05/11/16**

PIEZOMETER TYPE **NA** WELL TYPE

HGT. RISER ABOVE GROUND DIA

DEPTH TO TOP OF WELL SCREEN BOTTOM

WELL DEVELOPMENT BACKFILL

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

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
0	NR	0.0	6.0		0					Straight drilled to 6 feet, boring was pre-drilled for utility clearance; no samples were taken.		
1	SS	6.0	8.0	1-0-0-2	24		5			Backfill; silt and sand.		
2	SS	8.0	10.0	6-6-8-9	12				ML CL	Clayey silt; most; low plastic; low tough; yellowish brown (10YR 5/4).		
									ML CL	Clayey silt; trace to little sand; trace to little fine gravel; dry; low plastic; medium toughness; color grades to reddish brown (5YR 4/4); massive; firm. Note: From 8 to 13.5 feet includes some coal fragments.		
3	SS	10.0	12.0	4-4-5-4	20		10					
4	SS	12.0	14.0	3-4-5-5	13							
5	SS	14.0	16.0	7-7-8-6	18					Note: From 13.5 to 13.6 feet sand lens, fine to medium; loose; dry. Note: From 14 to 16 feet includes <20% mottles; <15 mm in size; distinct contrast; very dark bluish gray (10B 3/1), and dark reddish gray (5R 4/1).		
6	SS	16.0	18.0	3-3-6-6	21		15		SP ML CL	Sand with silt; dry; loose; sand is fine to medium; brown (10YR 5/3).		
7	SS	18.0	20.0	1-2-4-4	24					Silt with clay; little sand, fine to coarse; little grave, fine to coarse; dry; firm; reddish brown (5YR 4/4). Note: From 16 to 20 feet gradual increase in		

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TYPE OF CASING USED

	NQ-2 ROCK CORE	
NA	6" x 3.25 HSA	
NA	9" x 6.25 HSA	
NA	HW CASING ADVANCER	4"
NA	NW CASING	3"
NA	SW CASING	6"
NA	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 **J. Wanner**

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AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1609R** DATE **09/22/16** SHEET **2** OF **3**

PROJECT **Mountaineer Plant** BORING START **05/11/16** BORING FINISH **05/11/16**

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
										the abundance and size of mottles.		
8	SS	20.0	22.0	0-2-4-5	24		20					
9	SS	22.0	24.0	1-2-4-4	24				SM GM	Silt with sand; some gravel; some clay; moist; firm; massive; sand is fine to coarse; gravel is fine to coarse, angular dominant.; dark yellowish brown (10YR 4/4).		
10	SS	24.0	26.0	1-2-7-29	24				SM	Silt with very fine sand; some clay; dry; firm; massive; includes trace fine to medium, subangular gravel; very dark bluish gray (10B 3/1).		
11	SS	26.0	28.0	23-24-41-50/3	13		25		ML CL	Note: From 25.5 to 26 feet broken gravel or rock; dry.		
										Silt with clay; moist; soft; yellowish brown (10YR 5/4).		
12	RC	28.0	30.0		24					Weathered shale; weak plates to 5mm; light brownish gray (2.5Y 6/2) with very dark gray (5YR 3/1) on plate surface.		
										Shale; strong field strength; 10B 5/1 (bluish gray); aphanitic texture; laminated structure; fresh (undecomposed); cross-bedding is prominent 31.0 to 36.0 feet.		
13	RC	30.0	31.0		3	0	30					
14	RC	31.0	36.0		60	69				Interbedded "Red bed" and blue-gray shale; decreasing shale with depth; intensely fractured to very intensely fractured.		
15	RC	36.0	41.0		63.6	74	35					
16	RC	41.0	44.5		30.6	14	40			Red clay stone or mudstone; weak to very weak field strength, with some recovery having moderate strength; 7.5R 4/2 (weak red); massive to laminated structure; (regionally known as a so-called 'red bed'); intensely fractured to very intensely fractured.		
										Interbedded "red bed" and blue-gray shale; increasing shale with depth; intensely fractured		

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AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1609R** DATE **09/22/16** SHEET **3** OF **3**

PROJECT **Mountaineer Plant** BORING START **05/11/16** BORING FINISH **05/11/16**

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
										to very intensely fractured.		
17	RC	44.5	46.0		3.6	0	45					
18	RC	46.0	51.0		56.4	40						
							50					
19	RC	51.0	52.0		5.4	0						
20	RC	52.0	56.0		44.4	46				Shale, strong field strength; 10B 5/1 (bluish gray): aphanitic texture; laminated structure; fresh (undecomposed); cross-bedding is prominent.		
							55					
21	RC	56.0	65.0		102	81						
							60					
							65			End of boring at 65 feet.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power**

PROJECT **Mountaineer Plant**

COORDINATES

GROUND ELEVATION **NA** SYSTEM

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **SB-1610** DATE **09/22/16** SHEET **1** OF **14**

BORING START **06/14/16** BORING FINISH **06/16/16**

PIEZOMETER TYPE **NA** WELL TYPE

HGT. RISER ABOVE GROUND DIA

DEPTH TO TOP OF WELL SCREEN BOTTOM

WELL DEVELOPMENT BACKFILL

FIELD PARTY **NA** RIG **CME75**

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
0	NR	0.0	9.5		0					Straight drilled to 9.5 feet, boring was pre-drilled for utility clearance; no samples were taken.		
1	RC	9.5	11.2		12	29	5			Sandstone; field strength moderate to strong; color 10 YR 5/4; texture medium grained; structure massive; decomposition slight; disintegration slight; fracture density moderate to intense.		
2	RC	11.2	15.9		57.6	52	10			Sandstone; field strength strong except at 15.6 to 15.8 feet is weak; color 10 YR 5/4 with 10 YR 3/4; texture medium grained; structure		

TYPE OF CASING USED

	NQ-2 ROCK CORE	
NA	6" x 3.25 HSA	
NA	9" x 6.25 HSA	
NA	HW CASING ADVANCER	4"
NA	NW CASING	3"
NA	SW CASING	6"
NA	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 **J. Wanner**

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AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1610** DATE **09/22/16** SHEET **2** OF **14**

PROJECT **Mountaineer Plant** BORING START **06/14/16** BORING FINISH **06/16/16**

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
										thinly bedded; decomposition slight; disintegration slight; fracture density moderate to intense.		
3	RC	15.9	20.9		62.4	58	15			Sandstone; field strength strong; color 5PB 5/1 with 10 YR 3/4, and with 20% 5/5 PB; texture medium grained; structure thinly bedded, dipped non-horizontal; decomposition slight; disintegration slight; fracture density very intensely.		
4	RC	20.9	25.9		58.8	78	20			Sandstone; field strength strong; color 5B 4/1 (dark bluish gray) to 5PB 5/1 (bluish gray); texture medium grained; structure thinly bedded, dipped non-horizontal; decomposition slight; disintegration slight; fracture density very intensely.		
5	RC	25.9	30.9		57.6	41	25					

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AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1610** DATE **09/22/16** SHEET **3** OF **14**

PROJECT **Mountaineer Plant** BORING START **06/14/16** BORING FINISH **06/16/16**

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
										Sandy shale grades with shale; strong field strength; color 10BG 2.5/1 (greenish black) to 5PB 4/1 (dark bluish gray); fine grained texture; thinly bedded structure; slight decomposition; intensely fractured.		
6	RC	30.9	35.9		54	85	30			Sandstone; field strength strong; color 10B 6/1 (bluish gray) to 5B 4/1 (dark bluish gray); texture medium grained; structure thinly bedded; decomposition fresh; disintegration competent; fracture density slight.		
7	RC	35.9	40.9		61.2	88	35			Sandstone; field strength very stong; color 10B 6/1; texture medium grained; structure massive; decomposition fresh; disintegration competent; fracture density slight.		
8	RC	40.9	45.9		60	65	40		CL	Claystone/Mudstone; field strength weak to moderate; color 10B 6/1; texture fine; structure massive; decomposition moderate; disintegration slight; fracture density none. Sandstone; field strength strong; color 10B 6/1 (bluish gray to 5B 4/1 (dark bluish gray); texture fine grained; structure thinly bedded; decomposition fresh; disintegration competent; fracture density none.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1610** DATE **09/22/16** SHEET **4** OF **14**

PROJECT **Mountaineer Plant** BORING START **06/14/16** BORING FINISH **06/16/16**

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
										Shaly sandstone; field strength strong; color 5BG 4/1 (dark greenish gray) to 5B 5/1 (bluish gray); texture fine grained; structure massive; decomposition slight to moderate; disintegration slight; fracture density none.		
							45			Claystone/Mudstone; field strength strong; color 5BG 5/1 (greenish gray) to 7.5R 3/2 (dusky red); texture fine grained; structure massive; decomposition slight to moderate; disintegration slight; fracture density none.		
9	RC	45.9	50.9		63.6	44			CL	Shale; field strength strong; color 7.5 R 3/2 to 7.5 R 5/2; texture fine grained; structure massive; decomposition slight; disintegration slight; fracture density moderate.		
										Claystone/Mudstone; field strength strong; color 5BG 4/1 (dark greenish gray) to 5B 5/1 (bluish gray); texture fine grained; structure massive; decomposition slight; disintegration slight; fracture density intense to very intense.		
										Sandy shale grades to sandstone; field strength strong; color 7.5 R 3/2 to 7.5 R 5/2; texture fine grained; structure massive; decomposition slight; disintegration slight; fracture density moderate.		
							50					
10	RC	50.9	55.9		55.8	83				Claystone/Mudstone; field strength strong; color 5BG 4/1 (dark greenish gray) to 5B 5/1 (bluish gray) ; texture fine grained; structure massive; decomposition slight; disintegration slight; fracture density intense to very intense. Shale; field strength strong; color 5B 3/1 (very bluish gray) to 10BG 4/1 (dark greenish gray); texture fine grained; structure massive; decomposition fresh to slight; disintegration slight; fracture density moderate.		
										Claystone/Mudstone; field strength strong to moderate; color 7.5 R 3/2 to 7.5 R 5/2; texture fine grained; structure massive; decomposition fresh to slight; disintegration slight; fracture density very intense.		
							55					
11	RC	55.9	60.9		61.2	63				Shale; field strength strong; color 3.5 B to 4/10 BG; texture fine grained; structure massive; decomposition fresh to slight; disintegration slight; fracture density moderate. Claystone/Mudstone; field strength strong; color 7.5 R 3/2 to 7.5 R 5/2; texture fine grained; structure massive; decomposition fresh to slight; disintegration slight; fracture density moderate to very intense.		
										Sandstone grades with Shaly sandstone; field		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1610** DATE **09/22/16** SHEET **5** OF **14**

PROJECT **Mountaineer Plant** BORING START **06/14/16** BORING FINISH **06/16/16**

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
										strength strong; color 5BG 4/1 (dark greenish gray) to 5B 5/1 (bluish gray); texture fine grained; structure thinly bedded; decomposition fresh; disintegration competent; fracture density slight.		
12	RC	60.9	65.9		62.4	103	60			Grades to shaly sandstone; field strength strong; color 4/5 BG to 5/5 B; texture fine grained; structure massive; decomposition slight; disintegration slight; fracture density moderate grades to slight.		
										Shale and claystone/mudstone; field strength weak to moderate; color 2.5 Y 5/2; texture fine grained; structure massive; decomposition moderate; disintegration moderate; fracture density moderate to very intense.		
13	RC	65.9	70.9		58.8	83	65			Shale; field strength moderate to strong; color 5BG 4/1 (dark greenish gray) to 5B 5/1 (bluish gray); texture fine grained; structure massive; decomposition fresh; disintegration competent; fracture density slight.		
										Grades to sandstone; field strength strong; color 4/5 BG to 5/5 B; texture fine grained; structure thin bedded cross bedded; decomposition fresh; disintegration competent; fracture density slight.		
14	RC	70.9	75.9		60	100	70					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1610** DATE **09/22/16** SHEET **6** OF **14**

PROJECT **Mountaineer Plant** BORING START **06/14/16** BORING FINISH **06/16/16**

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
							75					
15	RC	75.9	80.9		58.8	65						
									CL	Claystone/Mudstone; field strength strong; color 5B 3/1 (very dark bluish gray); texture fine grained; structure thinly bedded; decomposition slight; disintegration slight; fracture density intense.		
							80					
16	RC	80.9	85.9		58.8	98				Shaly sandstone grades with sandy shale; field strength strong; color 5BG 4/1 (dark greenish gray) to 5B 5/1 (bluish gray); texture fine grained; structure massive; decomposition fresh; disintegration slight; fracture density slight.		
							85					
17	RC	85.9	90.9		60	97						

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AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1610** DATE **09/22/16** SHEET **7** OF **14**

PROJECT **Mountaineer Plant** BORING START **06/14/16** BORING FINISH **06/16/16**

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
18	RC	90.9	95.9		52.8	80				Sandy shale; strong field strength; color 10Y 4/1 (dark greenish gray) to 5GY 5/1 (greenish gray); texture fine grained; massive structure; slight decomposition; moderately fractured.		
19	RC	95.9	100.9		61.2	98	95			Muddy shale; field strength strong; color 10Y 4/1 (dark greenish gray) to 5GY 5/1 (greenish gray); texture fine grained; structure massive; decomposition slight; disintegration slight; fracture density slight.		
20	RC	100.9	105.9		57.6	72	100			Note: At 102 feet slickenside.		
							105			Shaly sandstone; field strength strong; color 10BG 3/1 (very dark greenish gray); texture fine grained; structure massive; decomposition fresh; disintegration competent; fracture density none to slight.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1610** DATE **09/22/16** SHEET **8** OF **14**

PROJECT **Mountaineer Plant** BORING START **06/14/16** BORING FINISH **06/16/16**

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	RC	105.9	110.4		58.8	59				Sandy shale; field strength strong; color 5BG 4/1 (dark greenish gray) to 5B 5/1 (bluish gray); texture fine grained; structure massive; decomposition slight; disintegration slight; fracture density very intense grades to slight.		
									CL	Claystone/mudstone; field strength strong; color 7.5 R 3/2 to 7.5 R 5/2; texture fine grained; structure massive; decomposition slight; disintegration slight; fracture density very intense.		
22	RC	110.4	115.4		62.4	55	110					
										Sandy shale; field strength strong; color 10B 4/1 (dark bluish gray); texture fine grained; structure massive; decomposition fresh; disintegration competent; fracture density slight.		
23	RC	115.4	121.0		62.4	98	115			Muddy shale grades to claystone/mudstone; field strength strong; color 10B 4/1)dark bluish gray) grades to 7.5 R 3/3; texture fine grained; structure massive; decomposition slight; disintegration slight; fracture density intense.		
							120			Sandstone; field strength strong; color 10B 4/1 (dark bluish gray); texture fine grained; structure thinly bedded; decomposition fresh; disintegration competent; fracture density moderate to intense.		

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AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1610** DATE **09/22/16** SHEET **9** OF **14**

PROJECT **Mountaineer Plant** BORING START **06/14/16** BORING FINISH **06/16/16**

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
24	RC	121.0	126.0		39.6	34						
										Shale; field strength strong; color 10B 4/1 (dark bluish gray); texture fine grained; structure massive; decomposition slight; disintegration slight; fracture density slight to intense.		
									CL	Claystone/mudstone; field strength strong; color 7.5 R 3/3; texture fine grained; structure massive; decomposition slight; disintegration slight; fracture density slight to intense.		
25	RC	126.0	131.3		81.6	101	125					
										Transition; field strength strong; color 7.5 R 3/3 and 4/10 BG; texture fine grained; structure massive; decomposition fresh; disintegration competent; fracture density slight.		
							130			Sandstone; field strength strong; color 10B 4/1 (dark bluish gray); fine grained; structure massive; decomposition fresh; disintegration competent; fracture density slight.		
26	RC	131.3	136.3		51.6	78				Sandstone grades to shale; field strength strong; color 10B 4/1 (dark bluish gray); texture fine grained; structure massive; decomposition fresh; disintegration competent; fracture density slight.		
										Muddy shale grades to claystone/mudstone; field strength strong; color 10B 4/1 (dark bluish gray) and 7.5 R 4.2; texture fine grained; structure massive; decomposition fresh; disintegration competent; fracture density moderate.		
							135					
27	RC	136.3	141.3		54	60			CL	Claystone/mudstone; field strength strong; color 7.5 R 3/2 and 5/N grades to 2/5 y 5/4		

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LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1610** DATE **09/22/16** SHEET **10** OF **14**

PROJECT **Mountaineer Plant** BORING START **06/14/16** BORING FINISH **06/16/16**

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
										grades to 7.5 R 3/3; texture fine grained; structure massive; decomposition fresh to slight; disintegration slight; fracture density intense to very intense.		
28	RC	141.3	146.3		62.4	90	140					
										Sandstone; field strength strong to very strong; color 10B 5/1 (bluish gray) to 10B 6/1 (bluish gray); texture medium grained; structure massive; decomposition fresh; disintegration competent; fracture density none.		
29	RC	146.3	151.3		61.8	103	145			Sandstone; field strength strong to very strong; color 5/10 B to 6/10 B; texture medium grained; structure massive; decomposition fresh; disintegration competent; fracture density none.		
30	RC	151.3	156.3		61.8	103	150					

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LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1610** DATE **09/22/16** SHEET **11** OF **14**

PROJECT **Mountaineer Plant** BORING START **06/14/16** BORING FINISH **06/16/16**

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
							155					
31	RC	156.3	160.7		51.6	85				Sandy shale grades to shale; field strength strong; color 5B 5/1 (bluish gray); texture fine grained; structure thinly bedded; decomposition fresh; disintegration competent to slight; fracture density slight.		
							160					
32	RC	160.7	165.7		61.2	44				Muddy shale; field strength strong; color 7.5 R 4/3; texture fine grained; structure thinly bedded; decomposition fresh; disintegration competent to slight; fracture density slight.		
									CL	Claystone/mudstone; field strength strong; color 7.5 R 3/3; texture fine grained; structure massive; decomposition slight; disintegration slight; fracture density very intense.		
										SHALE; field strength strong; color 5B 5/1 (bluish gray); texture fine grained; structure massive; decomposition slight; disintegration slight; fracture density none.		
										Claystone/mudstone; field strength strong; color 7.5 R 3/2 to 7.5 R 5/2; texture fine grained; structure massive; decomposition slight; disintegration slight; fracture density intense to very intense.		
							165					
33	RC	165.7	170.7		56.4	66						

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LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1610** DATE **09/22/16** SHEET **12** OF **14**

PROJECT **Mountaineer Plant** BORING START **06/14/16** BORING FINISH **06/16/16**

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
							170					
34	RC	170.7	175.7		58.8	95				Sandstone; field strength strong; color 7.5 R 3/3 and 5B 5/1 (bluish gray); texture fine grained; structure massive; decomposition slight; disintegration slight; fracture density moderate to intense.		
							175		CL	Claystone/mudstone; field strength strong; color 7.5 R 3/3; texture fine grained; structure massive; decomposition fresh; disintegration competent; fracture density slight.		
35	RC	175.7	180.7		60	92				Sandy shale; field strength strong; color 5B 4/1 (dark bluish gray); structure thinly bedded; decomposition fresh; disintegration competent; fracture density none.		
							180					
36	RC	180.7	185.7		58.8	98				Sandy shale grades to shaly sandstone; field strength strong; color 5B 4/1 (dark bluish gray); structure thinly bedded; decomposition fresh; disintegration competent; fracture density none.		

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AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1610** DATE **09/22/16** SHEET **13** OF **14**

PROJECT **Mountaineer Plant** BORING START **06/14/16** BORING FINISH **06/16/16**

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
							185					
37	RC	185.7	190.7		62.4	99				Shale; field strength strong; color 5B 4/1 (dark bluish gray); texture fine grained; structure thinly bedded; decomposition fresh; disintegration competent; fracture density slight.		
							190			Sandstone; field strength strong; color 5B 4/1 (dark bluish gray); texture fine grained; structure thinly bedded; decomposition fresh; disintegration competent; fracture density slight.		
38	RC	190.7	195.7		60	100						
							195			Muddy shale; field strength strong; color 10BG 3/1 (very dark greenish gray and 7.5 R 3/2; texture fine grained; structure massive; decomposition fresh; disintegration competent; fracture density none.		
39	RC	195.7	200.7		55.2	90						

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AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1610** DATE **09/22/16** SHEET **14** OF **14**

PROJECT **Mountaineer Plant** BORING START **06/14/16** BORING FINISH **06/16/16**

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
							200					
40	RC	200.7	205.1		51.6	67				Sandstone; field strength strong; color 5PB 4/1 (dark bluish gray) with 20% 7.5 R 4/3; texture fine grained; structure thinly bedded; decomposition slight; disintegration slight; fracture density moderate.		
							205			End of boring at 205.1 feet.		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power**

PROJECT **Mountaineer Plant**

COORDINATES

GROUND ELEVATION **NA** SYSTEM

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **SB-1619R (ALT)** DATE **09/22/16** SHEET **1** OF **2**

BORING START **05/12/16** BORING FINISH **05/12/16**

PIEZOMETER TYPE **NA** WELL TYPE

HGT. RISER ABOVE GROUND DIA

DEPTH TO TOP OF WELL SCREEN BOTTOM

WELL DEVELOPMENT BACKFILL

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

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
	NR	0.0	6.0		0					Straight drilled to 6 feet, boring was pre-drilled for utility clearance; no samples were taken.		
1	SS	6.0	8.0	2-3-3-3	16		5		CL ML	Silt with clay; some sand, fine to coarse; trace gravel, fine to medium, subrounded, dry; firm; yellowish brown (10YR 5/4). Note: From 6 to 8 feet material was non-plastic. Note: From 7 to 8 feet includes some coal fragments.		
2	SS	8.0	10.0	1-1-3-2	13				CL ML	Sand with gravel; some silt; wet; loose; sand is fine to coarse; grave is fine, subrounded.		
									CL ML	Silt with clay; trace fine to medium sand; dry; firm; non-plastic.		
3	SS	10.0	12.0	NM	24		10		CL ML	Silt; some clay; some fine sand; moist; soft; N 7/ (light gray).		
									CL ML	Clayey silt; moist; soft; medium plastic; low toughness; massive, N 5/ (gray). Note: At 10.5 feet trace coarse subangular gravel.		
4	SS	12.0	14.0	NM	24							
5	SS	14.0	16.0	NM	24					Note: At 14.5 feet trace subrounded gravel, 22		

TYPE OF CASING USED

	NQ-2 ROCK CORE
NA	6" x 3.25 HSA
NA	9" x 6.25 HSA
NA	HW CASING ADVANCER 4"
NA	NW CASING 3"
NA	SW CASING 6"
NA	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 **J. Wanner**

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1619R (ALT)** DATE **09/22/16** SHEET **2** OF **2**

PROJECT **Mountaineer Plant** BORING START **05/12/16** BORING FINISH **05/12/16**

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
										mm in size, white quarts.		
6	SS	16.0	18.0	0-0-0-3	24							
7	SS	18.0	20.0	1-1-2-3	13				SM GM	Grades to silt; some sand, fine to coarse; some gravel, fine to medium, angular; little clay; dry; firm massive; non-plastic; non-dilatancy; 10B 4/1 (dark bluish gray). Note: At 18 to 20 feet dry; driller comments spoon had water in it.		
8	SS	20.0	22.0	1-4-5-3	14		20					
9	SS	22.0	24.0	3-5-5-6	20					Note: At 23 feet increase in common i.e. 10% area; medium; mottles; brown (7.5 YR 4/3).		
10	SS	24.0	26.0	3-5-7-7	13							
11	SS	26.0	28.0	4-8-10-6	13		25					
12	SS	28.0	30.0	3-5-8-6	13							
13	SS	30.0	32.0	4-23-30-41	0.7		30		CH	Clay; some silt; dry; hard to very hard; high plasticity; high toughness: dark reddish brown (2.5YR 3/4).		
14	SS	32.0	46.0	13-50/2	0.3					Weathered shale, no distinct plates; very hard; dry ; 5G 3/1 (very dark greenish gray).		
										End of boring at 33.2 feet refusal bedrock.		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power**

PROJECT **Mountaineer Plant**

COORDINATES

GROUND ELEVATION **NA** SYSTEM

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **SB-1619R** DATE **09/22/16** SHEET **1** OF **2**

BORING START **05/11/16** BORING FINISH **05/11/16**

PIEZOMETER TYPE **NA** WELL TYPE

HGT. RISER ABOVE GROUND DIA

DEPTH TO TOP OF WELL SCREEN BOTTOM

WELL DEVELOPMENT BACKFILL

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

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
0	NR	0.0	6.0		0					Straight drilled to 6 feet, boring was pre-drilled for utility clearance; no samples were taken.		
1	SS	6.0	8.0	1-0-0-2	24		5			Backfill; silt and sand.		
2	SS	8.0	10.0	6-6-8-9	12				CL ML	Clayey silt; moist; low plasticity; low tough; yellowish brown (10YR 5/4).		
3	SS	10.0	12.0	4-4-5-4	20		10		CL ML	Clayey silt; trace to little sand; trace to little fine gravel; dry; low plasticity; medium toughness; massive; firm; color grades to reddish brown (5YR 4/4). Note: From 8 to 10 feet includes some coal fragments. Note: From 10 to 11 feet includes some coal fragments.		
4	SS	12.0	14.0	3-4-5-5	13							
5	SS	14.0	16.0	7-7-8-6	18					Note: From 13.5 to 13.6 feet sand lens; fine to coarse; loose; dry. Note: From 14 to 16 feet increase <20% mottles; <15 mm in size; distinct contrast; very		

TYPE OF CASING USED

	NQ-2 ROCK CORE	
NA	6" x 3.25 HSA	
NA	9" x 6.25 HSA	
NA	HW CASING ADVANCER	4"
NA	NW CASING	3"
NA	SW CASING	6"
NA	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 **J. Wanner**

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AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **OH015976.0009**

COMPANY **American Electric Power** BORING NO. **SB-1619R** DATE **09/22/16** SHEET **2** OF **2**

PROJECT **Mountaineer Plant** BORING START **05/11/16** BORING FINISH **05/11/16**

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
									SP	dark bluish gray (10B 3/1 (very dark bluish gray) and 5R 4/1 (dark bluish gray).		
6	SS	16.0	18.0	3-3-6-6	21				CL ML	Sand with silt; dry; loose; sand is fine to coarse; brown (10YR 5/3).		
										Silt with clay; little sand, fine to coarse; little gravel; dry; firm; reddish brown (5YR 4/4). Note: From 16 to 20 feet granules increase in abundance and size of mottles.		
7	SS	18.0	20.0	1-2-4-4	24							
8	SS	20.0	22.0	0-2-4-5	24		20					
9	SS	22.0	24.0	1-2-4-4	24				SP SM	Silt with sand; some gravel; some clay; moist; firm; massive; sand is fine to coarse; gravel is fine to coarse, ingush dominant; dark yellowish brown (10YR 4/4).		
10	SS	24.0	26.0	1-2-7-29	24				SM	Silt with very fine sand; some clay; dry; firm; massive; incluse trace fine to medium subangular gravel; 10B 3/1 (very dark bluish gray).		
							25			Broken gravel or rock; dry.		
11	SS	26.0	28.0	23-24-41-50/3	13				CL ML	Silt with clay; moist; soft; yellowish brown (10YR 5/4).		
										Weathered shale; up to 5 mm; light brownish gray (2.5Y 6/2) to very dark brown (5YR 3/1) at plate surfaces.		
										End of boring at 27.9 feet top of rock.		

AEP - AEP.GDT - 09/22/16 10:47 - C:\CHERYL\PROJECTS\AEP MOUNTAINEER 7-2016 REV\AEP MOUNTAINEER.GPJ

ARCADIS

AEP 1986, 1992

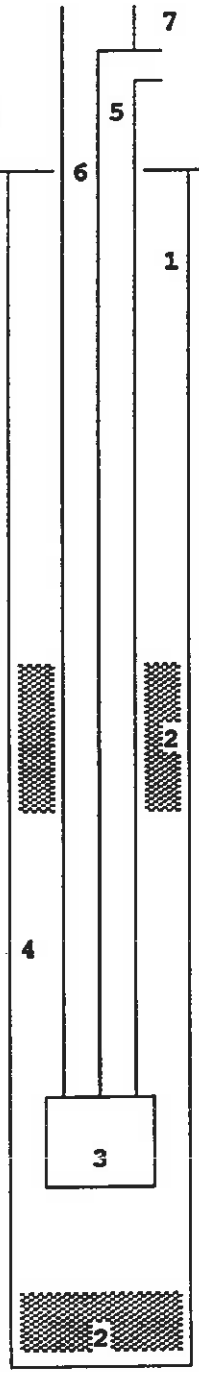
Monitoring Well Construction Diagrams

MW-1 to MW-20

COMPANY MOUNTAINNEER PLANT
PROJECT ASH LANDFILL
COORDINATES N.709,726.78 E.1,731,757.61
DATE INSTALLED 7-25-86
LATITUDE N. 38 56 43.00
LONGITUDE W. 81 56 33.09

NOTE: CASING PROTECTOR DETAILS NOT SHOWN

WELL CONSTRUCTION SUMMARY ELEVATION (ft. NGVD)
WELL NO. MW-1
REF. DATUM PT. 856.35
GRADE 854.61



1 GROUT SEAL CEMENT/BENTONITE
2 BENTONITE SEAL
3 GEOMON UNIT 1.25 POLETHYLENE
4 GRAVEL PACK CONCRETE SAND
5 CONTINUOUS UNKINKED NYLON TUBING EXTENDED TO TOP OF CHECK VALVE
6 CASING 3/4 DIA. SCH. 80 PVC
7 BRASS 'Y'FITTING
MW-1 & MW-2 NESTED IN THE SAME 3" DIAMETER BORE HOLE

CEMENTED BENTONITE SEAL FROM 824.61 TO BOTTOM OF CONCRETE PAD.

TOP OF BENTONITE SEAL 824.61

TOP OF GRAVEL PACK 815.21

CHECK VALVE 709.61
TOP OF SCREEN 709.01

BOTTOM OF SCREEN 705.01

BOTTOM OF GRAVEL PACK 703.61

BOTTOM OF BORE HOLE 642.61

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

AMERICAN ELECTRIC POWER SERVICE CORPORATION

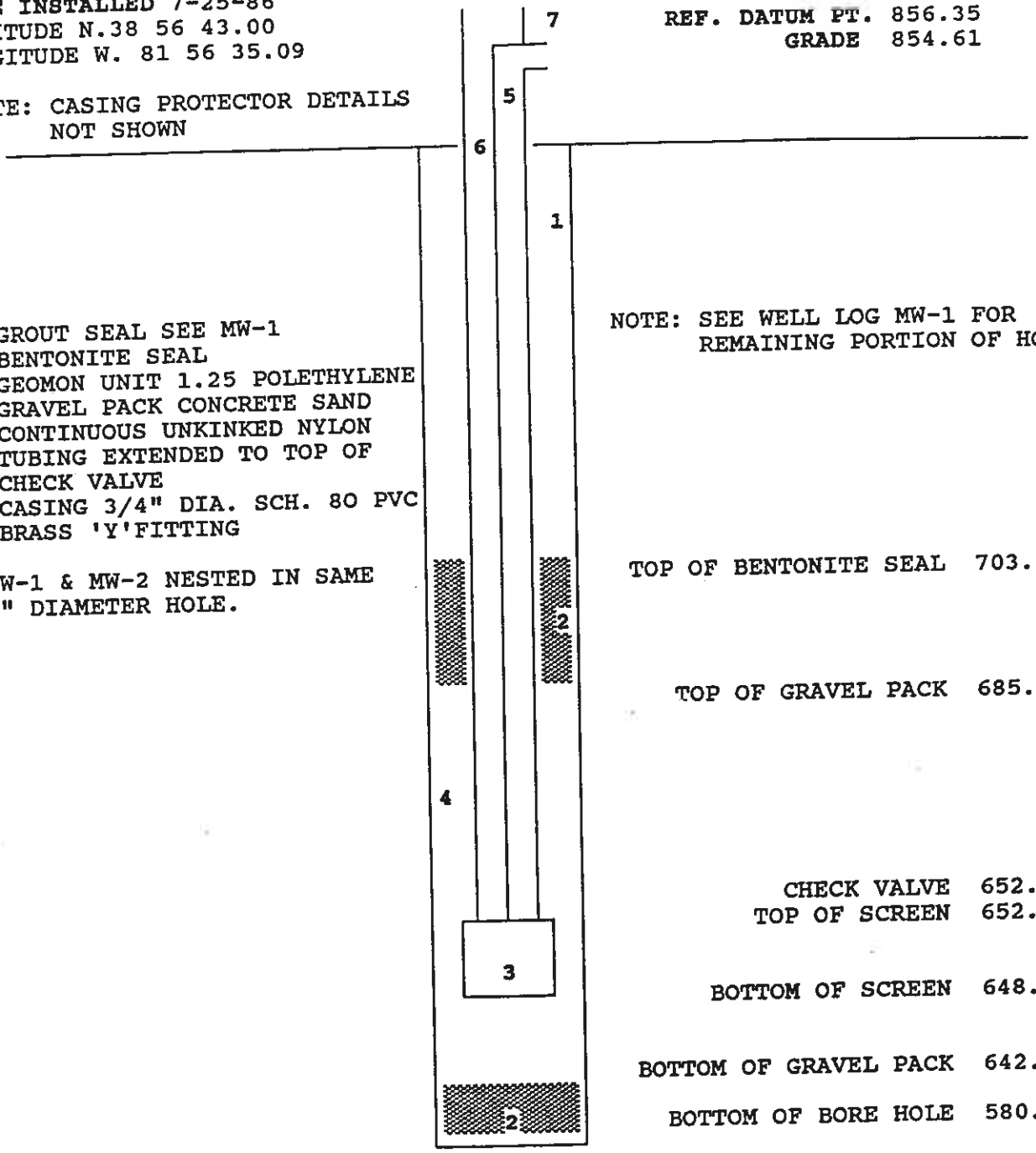
GEOMON WELL

CDS-04C

COMPANY MOUNTAINNEER PLANT
PROJECT ASH LANDFILL
COORDINATES N.709,726.78 E.1,731,757.61
DATE INSTALLED 7-25-86
LATITUDE N.38 56 43.00
LONGITUDE W. 81 56 35.09

NOTE: CASING PROTECTOR DETAILS NOT SHOWN

WELL CONSTRUCTION SUMMARY ELEVATION (ft. NGVD)
WELL NO. MW-2
REF. DATUM PT. 856.35
GRADE 854.61



1 GROUT SEAL SEE MW-1
2 BENTONITE SEAL
3 GEOMON UNIT 1.25 POLETHYLENE
4 GRAVEL PACK CONCRETE SAND
5 CONTINUOUS UNKINKED NYLON TUBING EXTENDED TO TOP OF CHECK VALVE
6 CASING 3/4" DIA. SCH. 80 PVC
7 BRASS 'Y'FITTING

MW-1 & MW-2 NESTED IN SAME 3" DIAMETER HOLE.

NOTE: SEE WELL LOG MW-1 FOR REMAINING PORTION OF HOLE.

TOP OF BENTONITE SEAL 703.61

TOP OF GRAVEL PACK 685.71

CHECK VALVE 652.91
TOP OF SCREEN 652.31

BOTTOM OF SCREEN 648.31

BOTTOM OF GRAVEL PACK 642.61

BOTTOM OF BORE HOLE 580.61

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

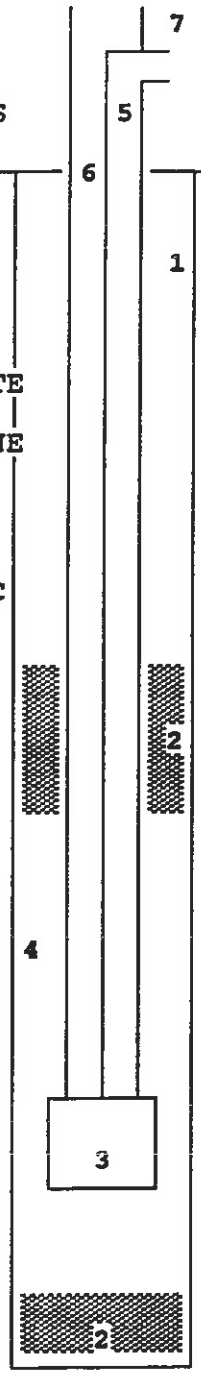
AMERICAN ELECTRIC POWER SERVICE CORPORATION

GEOMON WELL
CDS-04C

COMPANY MOUNTAINNEER PLANT
PROJECT ASH LANDFILL
COORDINATES N.709,173.32 E.1,728,977.06
DATE INSTALLED 7-21-86
LATITUDE N.38 56 37.25
LONGITUDE W.81 57 09.95

NOTE: CASING PROTECTOR DETAILS NOT SHOWN

WELL CONSTRUCTION SUMMARY ELEVATION (ft. NGVD)
WELL NO. MW-3
REF. DATUM PT. 857.56
GRADE 855.56



1 GROUT SEAL CEMENTED/BENTONITE
2 BENTONITE SEAL
3 GEOMON UNIT 1.25 POLYETHYLENE
4 GRAVEL PACK CONCRETE SAND
5 CONTINUOUS UNKINKED NYLON TUBING EXTENDED TO TOP OF CHECK VALVE
6 CASING 3/4" DIA. SCH. 80 PVC
7 BRASS 'Y'FITTING
BOREING DIAMETER 3"
BENTONITE SEAL 705.16 TO 595.56

CEMENT BENTONITE SEAL FROM 820.86 TO BOTTOM OF CONCRETE PAD.

TOP OF BENTONITE SEAL 820.86

TOP OF GRAVEL PACK 816.26

CHECK VALVE 712.96
TOP OF SCREEN 712.36

BOTTOM OF SCREEN 708.36

BOTTOM OF GRAVEL PACK 705.16

BOTTOM OF BORE HOLE 595.56

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

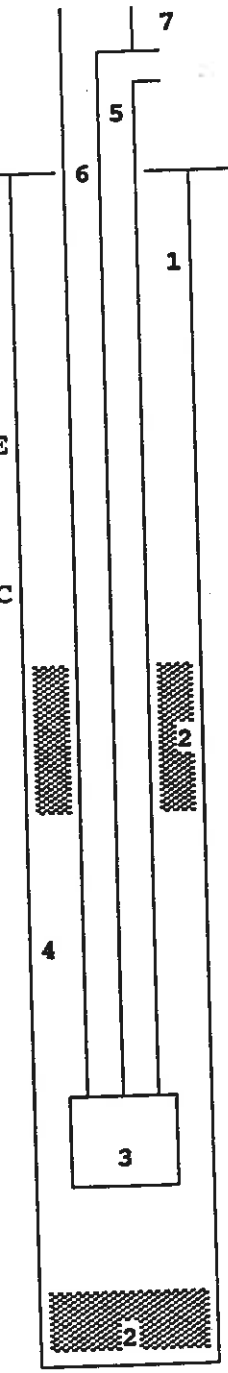
AMERICAN ELECTRIC POWER SERVICE CORPORATION

GEOMON WELL
CDS-04C

COMPANY MOUNTAINNEER PLANT
PROJECT ASH LANDFILL
COORDINATES N.710,357.00.E.1,731,153.00
DATE INSTALLED 7-21-86
LATITUDE N.38 56 49.17
LONGITUDE W.81 56 42.82

NOTE: CASING PROTECTOR DETAILS NOT SHOWN

WELL CONSTRUCTION SUMMARY ELEVATION (ft. NGVD)
WELL NO. MW-4
REF. DATUM PT. 803.44
GRADE 802.08



1 GROUT SEAL CEMENT BENTONITE
2 BENTONITE SEAL
3 GEOMON UNIT 1.25 POLYETHYENE
4 GRAVEL PACK CONCRETE SAND
5 CONTINUOUS UNKINKED NYLON TUBING EXTENDED TO TOP OF CHECK VALVE
6 CASING 3/4" DIA. SCH. 80 PVC
7 BRASS 'Y'FITTING
BORE HOLE 3" DIA.

CEMENT BENTONITE SEAL FROM 782.38 TO BOTTOM OF CONCRETE PAD.

TOP OF BENTONITE SEAL 782.38

TOP OF GRAVEL PACK 777.08

CHECK VALVE 707.68
TOP OF SCREEN 707.08

BOTTOM OF SCREEN 703.08

BOTTOM OF GRAVEL PACK 702.38

BOTTOM OF BORE HOLE 702.38

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

AMERICAN ELECTRIC POWER SERVICE CORPORATION

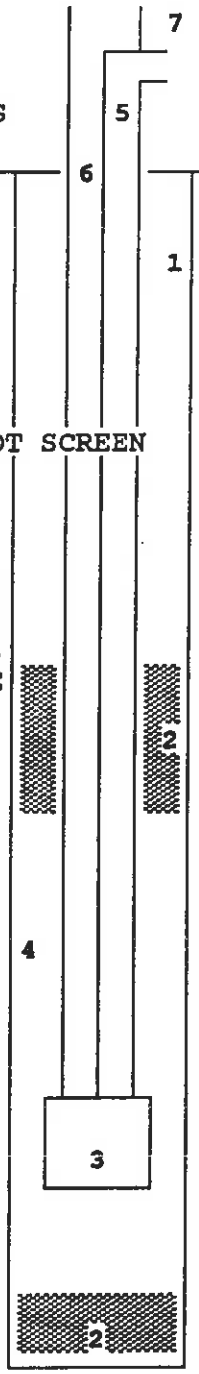
GEOMON WELL '

CDS-04C

COMPANY MOUNTAINEER PLANT
PROJECT ASH LANDFILL
COORDINATES N.711462.71 E.1728597.82
DATE INSTALLED 6-23-92
LATITUDE 38 56 59.84041
LONGITUDE 81 57 15.30527

NOTE: CASING PROTECTOR DETAILS NOT SHOWN

WELL CONSTRUCTION SUMMARY ELEVATION (ft. NGVD)
WELL NO. MW-5
REF. DATUM PT. 791.45
GRADE 788.93



1 GROUT SEAL VOLCLAY GROUT
2 BENTONITE SEAL
3 GEOMON UNIT 1.25 DIA. 20 SLOT SCREEN
4 GRAVEL PACK #4 OHIO QUARTZ
5 CONTINUOUS UNKINKED NYLON TUBING EXTENDED TO TOP OF CHECK VALVE
6 CASING 1" DIA. SCH. 80 PVC
7 BRASS 'Y'FITTING
BENTOITE PELLETS FROM 738.73 TO 698.93 EMPLACED BY TREMIE PIPE.
3" DIA. BORE HOLE.

VOLCLAY GROUT FROM 764.63 TO BOTTOM OF CONCRETE PAD.

TOP OF BENTONITE SEAL 764.63

TOP OF GRAVEL PACK 759.73

CHECK VALVE	742.73
TOP OF SCREEN	742.13
BOTTOM OF SCREEN	740.13
GEOMON TIP	739.73

BOTTOM OF GRAVEL PACK 738.73

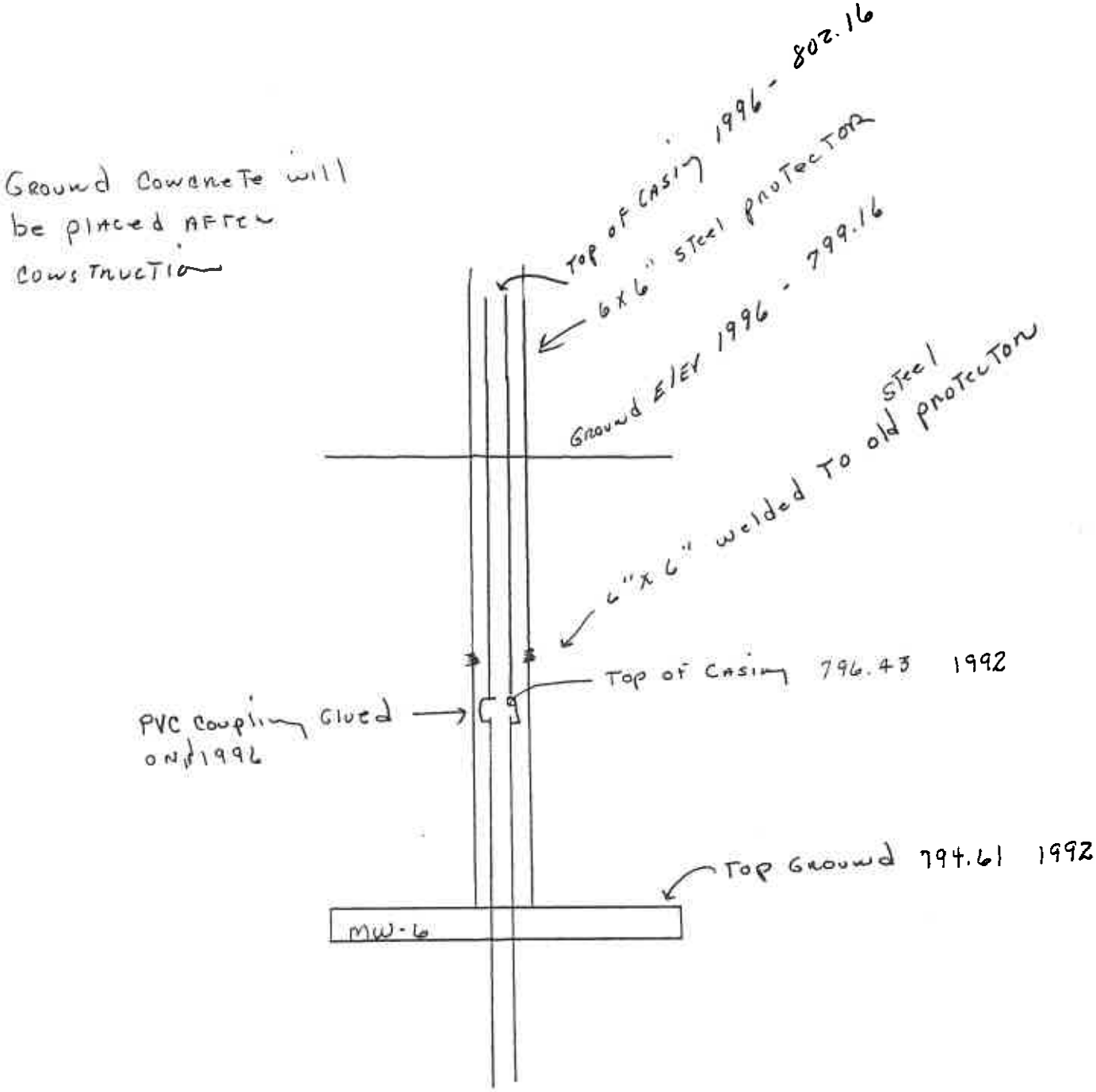
BOTTOM OF BORE HOLE 698.93

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

AMERICAN ELECTRIC POWER SERVICE CORPORATION

GEOMON WELL
CDS-04C

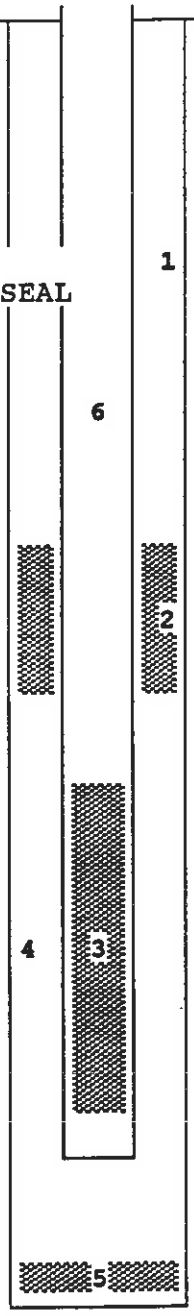
MW-6 2" well


Ground Concrete will be placed after construction
Top of Casing 1996 - 802.16
6 x 6" steel protector
Ground Elev 1996 - 799.16
6"x 6" welded To old steel protector
Top of Casing 796.43 1992
PVC coupling Glued on 1996
Top Ground 794.61 1992
MW-6

COMPANY APCO MOUNTAINEER PLANT
PROJECT ASH LANDFILL
COORDINATES N.712003.88 E.1729676.15
DATE INSTALLED 6-16-92
LATITUDE 38 57 05.29684
LONGITUDE 81 57 01.72920
NOTE: CASING PROTECTOR DETAILS
NOT SHOWN

WELL CONSTRUCTION
SUMMARY ELEVATION
(ft. NGVD)
WELL NO. MW-6
REF. DATUM PT. 796.43
GRADE 794.61

1 GROUT SEAL VALCLAY GROUT
2 BENTONITE SEAL PELLETS SEAL
3 SCREEN 20 SLOT SIZE 2" DIA.
4 GRAVEL PACK #4 OHIO QUARTZ
5 N.A.
6 RISER PIPE 2" DIA. SCH. 40
6-15-92 BAILED HOLE DRY.
6-16-92 SWL 663.71
6-16-92 AFTER INSTALLATION
BAILED WELL TO 664.61
BORE HOLE 6"DIAMETER



VOLCLAY GROUT FROM 675.41
TO BOTTOM OF CONCRETE PAD.

TOP OF BENTONITE SEAL 675.41

TOP OF GRAVEL PACK 670.11

TOP OF SCREEN 668.81

BOTTOM OF SCREEN 659.81

BOTTOM OF BLANK SECTION 658.91

BOTTOM OF GRAVEL PACK 657.61

BOTTOM OF BORE HOLE 654.61

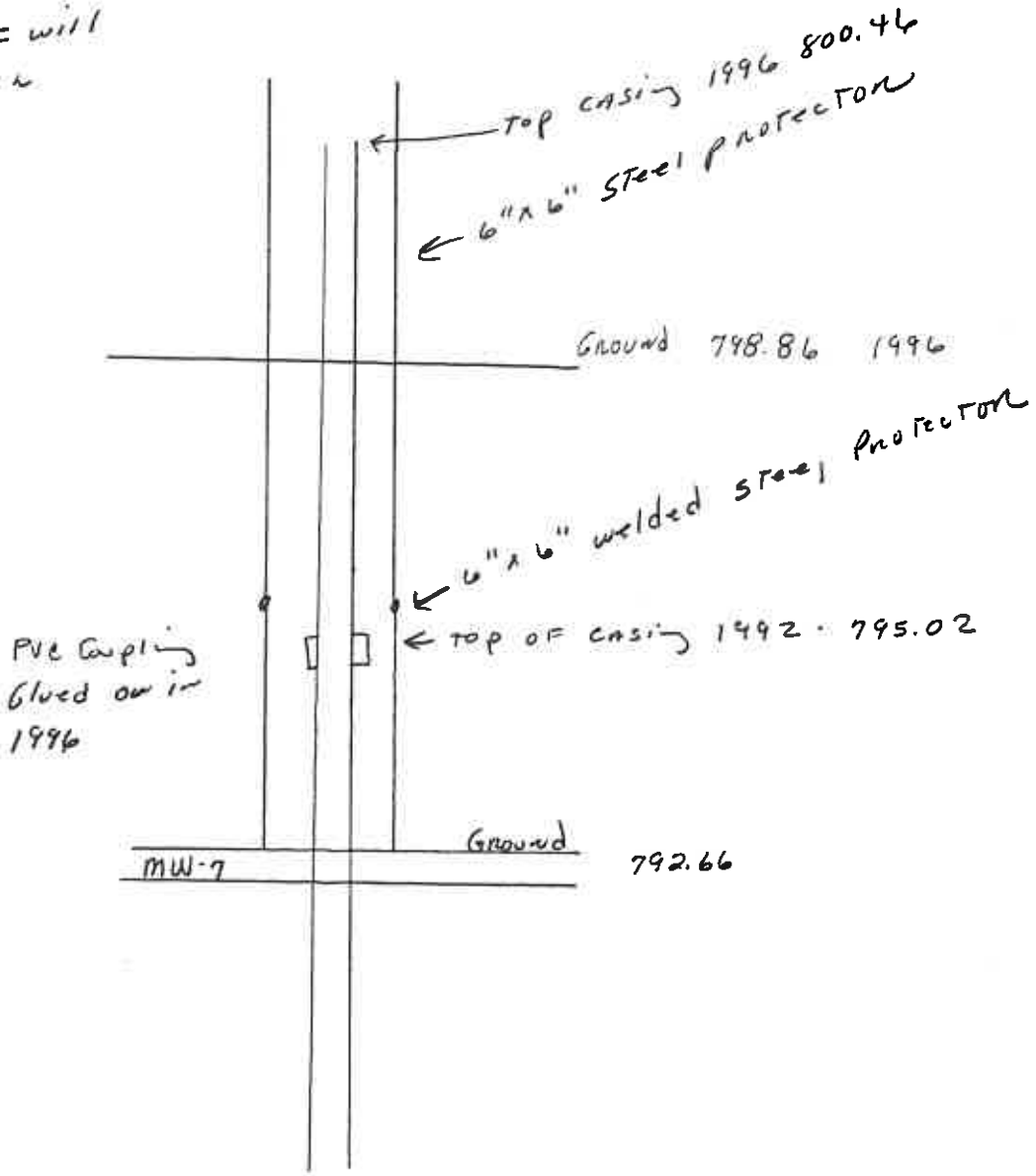
GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

AMERICAN ELECTRIC POWER SERVICE CORPORATION

OBSERVATION WELL
CDS-04

MW-07 1" well

Ground Concrete will be placed after construction

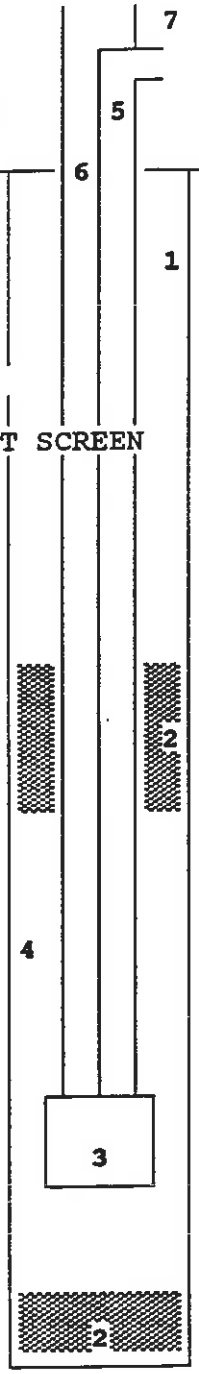


COMPANY MOUNTAINEER PLANT
PROJECT ASH LANDFILL
COORDINATES N.711982.06 E.1729623.07
DATE INSTALLED 6-1-92
LATITUDE 38 57 05.07624
LONGITUDE 81 57 02.39998

NOTE: CASING PROTECTOR DETAILS NOT SHOWN

WELL CONSTRUCTION SUMMARY ELEVATION (ft. NGVD)

WELL NO. MW-7
REF. DATUM PT. 795.02
GRADE 792.66



1 GROUT SEAL VOLCLAY GROUT
2 BENTONITE SEAL BENTONITE
3 GEOMON UNIT 1.25 DIA. 20 SLOT SCREEN
4 GRAVEL PACK #4 OHIO QUARTZ
5 CONTINUOUS UNKINKED NYLON TUBING EXTENDED TO TOP OF CHECK VALVE
6 CASING 1"DIA. SCH.80 PVC
7 BRASS 'Y'FITTING
SWL 762.46 PRIOR TO INSTALLATION.

BORE HOLE DIAMETER 3"

VOLCLAY GROUT FROM 768.66 TO BOTTOM OF CONCRETE PAD.

TOP OF BENTONITE SEAL 768.86

TOP OF GRAVEL PACK 762.86

CHECK VALVE 740.06
TOP OF SCREEN 739.46
BOTTOM OF SCREEN 737.46
GEOMON TIP 737.06

BOTTOM OF GRAVEL PACK 735.66

2OTTOM OF BORE HOLE 701.66

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

AMERICAN ELECTRIC POWER SERVICE CORPORATION

GEOMON WELL
CDS-04C

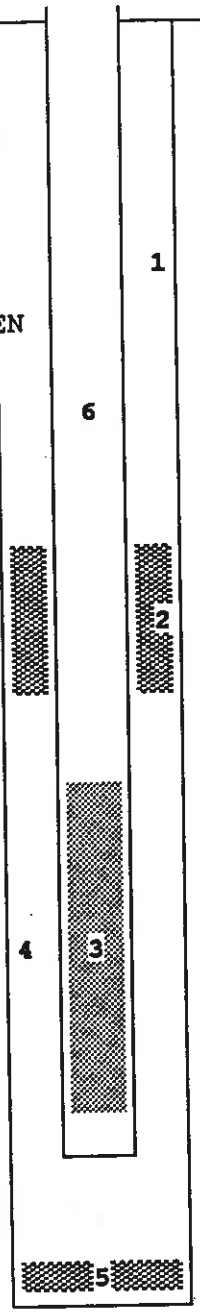
COMPANY APCO MOUNTAINEER PLANT
PROJECT ASH LANDFILL
COORDINATES N.710780.86 E.1730856.45
DATE INSTALLED 7-29-92
LATITUDE 38 56 53.33134
LONGITUDE 81 56 46.63136
NOTE: CASING PROTECTOR DETAILS NOT SHOWN

WELL CONSTRUCTION SUMMARY ELEVATION (ft. NGVD)
WELL NO. MW-8
REF. DATUM PT. 677.23
GRADE 675.49

1 GROUT SEAL VOLCLAY GROUT
2 BENTONITE SEAL BENTONITE
3 SCREEN 2" DIA. 20 SLOT SCREEN GRAVEL PACK #4 OHIO QUARTZ
5 N.A.
6 RISER PIPE 2"DIA SCH 40 PVC

BAILED WATER FROM COMPLETED WELL. WATER LEVEL WOULD NOT DROP BELOW 663.49 ELEVATION. RECOVERED TO 669.49 ELEVATION WITH IN MINUTES.

BORE HOLE 6"DIAMETER BENTONITE PELLETS EMPLACED THROUGH TREMIE PIPE FROM 620.49 TO 570.79.



VOLCLAY GROUT FROM 638.89 TO BOTTOM OF CONCRETE PAD.

TOP OF BENTONITE SEAL 638.89

TOP OF GRAVEL PACK 632.89

TOP OF SCREEN 631.49

BOTTOM OF SCREEN 622.59

BOTTOM OF BLANK SECTION 621.49

BOTTOM OF GRAVEL PACK 620.49

BOTTOM OF BORE HOLE 570.79

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

AMERICAN ELECTRIC POWER SERVICE CORPORATION

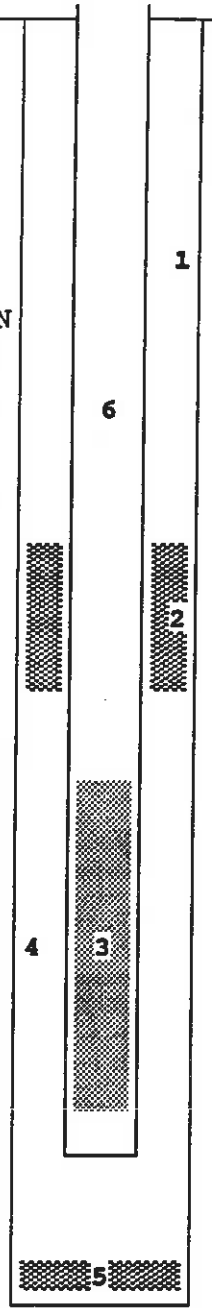
OBSERVATION WELL
CDS-04

COMPANY APCO MOUNTAINEER PLANT
PROJECT ASH LANDFILL
COORDINATES N.712268.45 E.1732217.43
DATE INSTALLED 8-6-92
LATITUDE 38 57 08.17104
LONGITUDE 81 56 29.59950
NOTE: CASING PROTECTOR DETAILS NOT SHOWN

WELL CONSTRUCTION SUMMARY ELEVATION (ft. NGVD)
WELL NO. MW-9
REF. DATUM PT. 644.9
GRADE 643.0

1 GROUT SEAL VOLCLAY GROUT
2 BENTONITE SEAL
3 SCREEN 2"DIA 20 SLOT SCREEN
4 GRAVEL PACK #4 OHIO QUARTZ
5 N.A.
6 RISER PIPE 2" DIA. SCH. 40

BAILED WELL AFTER INSTALLATION SWL RECOVERED TO APPROX. 6 FT. FROM GRADE.
BORE HOLE 6" DIAMETER



1 VOLCLAY GROUT FROM 607.0 TO BOTTOM OF CONCRETE PAD.

TOP OF BENTONITE SEAL 607.0

TOP OF GRAVEL PACK 600.1

TOP OF SCREEN 599.2

BOTTOM OF SCREEN 590.1

BOTTOM OF BLANK SECTION 589.0

BOTTOM OF GRAVEL PACK 587.7

BOTTOM OF BORE HOLE 587.7

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

AMERICAN ELECTRIC POWER SERVICE CORPORATION

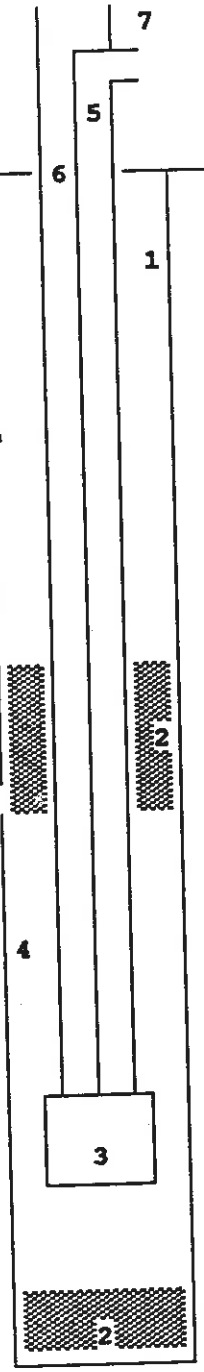
OBSERVATION WELL
CDS-04

COMPANY MOUNTAINEER PLANT
PROJECT ASH LANDFILL
COORDINATES 710968.64 E.1730231.83
DATE INSTALLED 7-9-92
LATITUDE 38 56 55.12112
LONGITUDE 81 57 54.56506

NOTE: CASING PROTECTOR DETAILS NOT SHOWN

WELL CONSTRUCTION SUMMARY ELEVATION (ft. NGVD)

WELL NO. MW-10
REF. DATUM PT. 813.07
GRADE 810.83



1 GROUT SEAL VOLCLAY GROUT
2 BENTONITE SEAL PELLETS
3 GEOMON UNIT 1.25 DIA. 20 SLOT
4 GRAVEL PACK #4 OHIO QUARTZ
5 CONTINUOUS UNKINKED NYLON TUBING EXTENDED TO TOP OF CHECK VALVE
6 CASING 1" SCH. 80 PVC
7 BRASS 'Y'FITTING

SWL 773.63 PRIOR TO INSTALLATION.

6" DIA BORE HOLE
WELLS MW-10 AND MW-11 NESTED IN THE SAME HOLE.

VOLCLAY GROUT FROM 747.33 TO BOTTOM OF CONCRETE PAD.

TOP OF BENTONITE SEAL 747.33

TOP OF GRAVEL PACK 739.53

CHECK VALVE	724.33
TOP OF SCREEN	723.73
BOTTOM OF SCREEN	721.73
GEOMON TIP	721.33

BOTTOM OF GRAVEL PACK 718.73

BOTTOM OF BORE HOLE 658.63

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

AMERICAN ELECTRIC POWER SERVICE CORPORATION

GEOMON WELL
CDS-04C

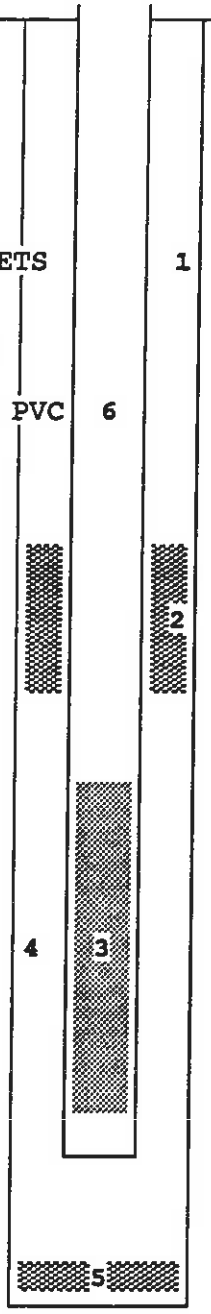
COMPANY APCO MOUNTAINEER PLANT
PROJECT ASH LANDFILL
COORDINATES N.710968.29 E.1730231.77
DATE INSTALLED 7-8-922
LATITUDE 38 56 55.12004
LONGITUDE 81 56 54.56455
NOTE: CASING PROTECTOR DETAILS NOT SHOWN

WELL CONSTRUCTION SUMMARY ELEVATION (ft. NGVD)
WELL NO. MW-11
REF. DATUM PT. 813.63
GRADE 810.83

1 GROUT SEAL BENTONITE PELLETS
2 BENTONITE SEAL
3 SCREEN 2"DIA. 20 SLOT PVC
4 GRAVEL PACK #4 OHIO QUARTZ
5 N.A.
6 RISER PIPE 2" DIA SCH. 40 PVC

SWL BAILED HOLE DRY PRIOR TO INSTALLATION.

MW-10 AND MW-11 NESTED IN THE SAME 6" DIA HOLE.



1 BENTONITE PELLETS FROM 673.83 TO 718.13.

TOP OF BENTONITE SEAL 718.73

TOP OF GRAVEL PACK 673.83

TOP OF SCREEN 670.93

BOTTOM OF SCREEN 661.93

BOTTOM OF BLANK SECTION 660.83

BOTTOM OF GRAVEL PACK 659.83

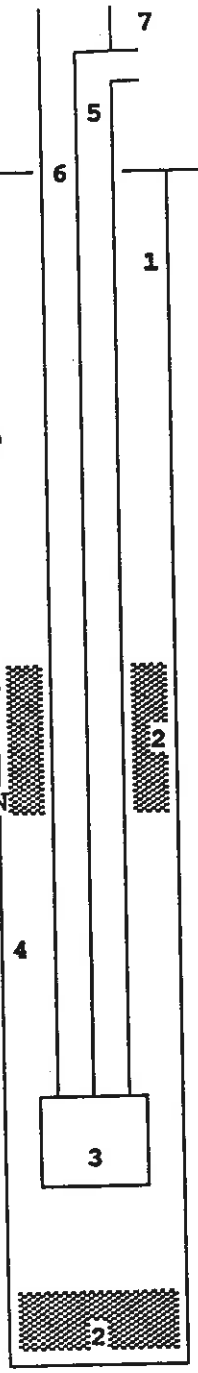
BOTTOM OF BORE HOLE 658.63

GEOTECHNICAL ENGINEERING SECTION CIVIL ENGINEERING DESIGN	OBSERVATION WELL
AMERICAN ELECTRIC POWER SERVICE CORPORATION	CDS-04

COMPANY APCO MOUNTAINTEES PLANT
PROJECT LANDFILL
COORDINATES N.709162.51 E.1728963.47
DATE INSTALLED 5-6-92
LATITUDE 38 56 37.14206
LONGITUDE 81 57 10.38134

NOTE: CASING PROTECTOR DETAILS NOT SHOWN

WELL CONSTRUCTION SUMMARY ELEVATION (ft. NGVD)
WELL NO. MW12
REF. DATUM PT. 858.85
GRADE 856.93



1 GROUT SEAL VOLCLAY GROUT
2 BENTONITE SEAL PELLETS
3 GEOMON UNIT 1.25 DIA. 20 SLOT
4 GRAVEL PACK #4 OHIO QUARTZ
5 CONTINUOUS UNKINKED NYLON TUBING EXTENDED TO TOP OF CHECK VALVE
6 CASING 1" DIA SCH. 80 PVC.
7 BRASS 'Y'FITTING

SWL PRIOR TO INSTALLATION 8FT. HOLE BAILED DRY PRIOR TO INSTALLATION.

UNIT PURGED AFTER INSTALLATION SWL NOT NOTED SINCE THIS WATER IS DISPLACED BY WELL.

BORING DIAMETER 3"

VOLCLAY GROUT FROM 690.93 TO BOTTOM OF CONCRETE PAD.

TOP OF BENTONITE SEAL 690.93

TOP OF GRAVEL PACK 684.93

CHECK VALVE 666.93
TOP OF SCREEN 666.33
BOTTOM OF SCREEN 664.33
GEOMON TIP 663.93

BOTTOM OF GRAVEL PACK 662.93

BOTTOM OF BORE HOLE 656.63

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

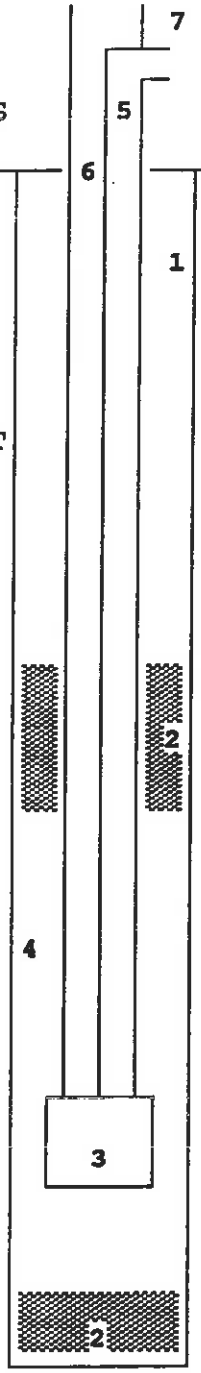
AMERICAN ELECTRIC POWER SERVICE CORPORATION

GEOMON WELL
CDS-04C

COMPANY APCO MOUNTAINTEER PLANT
PROJECT LANDFILL
COORDINATES N.710337.36 E.1731154.1
DATE INSTALLED 5-14-92
LATITUDE 38 56 48.97734
LONGITUDE 81 56 42.79826

NOTE: CASING PROTECTOR DETAILS NOT SHOWN

WELL CONSTRUCTION SUMMARY ELEVATION (ft. NGVD)
WELL NO. MW-13
REF. DATUM PT. 805.05
GRADE 802.01



1 GROUT SEAL VOLCLAY GROUT
2 BENTONITE SEAL PELLETS
3 GEOMON UNIT 1.25 DIA 20 SLOT
4 GRAVEL PACK #4 OHIO QUARTZ
5 CONTINUOUS UNKINKED NYLON TUBING EXTENDED TO TOP OF CHECK VALVE
6 CASING 1" DIA. SCH. 80 PVC
7 BRASS 'Y'FITTING

BORE HOLE DIAMETER 3".

VOLCLAY GROUT FROM 674.01 TO BOTTOM OF CONCRETE PAD.

TOP OF BENTONITE SEAL 674.01

TOP OF GRAVEL PACK 668.51

CHECK VALVE 651.21
TOP OF SCREEN 650.61
BOTTOM OF SCREEN 648.61
GEOMON TIP 648.21

BOTTOM OF GRAVEL PACK 647.01

BOTTOM OF BORE HOLE 647.01

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

AMERICAN ELECTRIC POWER SERVICE CORPORATION

GEOMON, WELL
CDS-04C

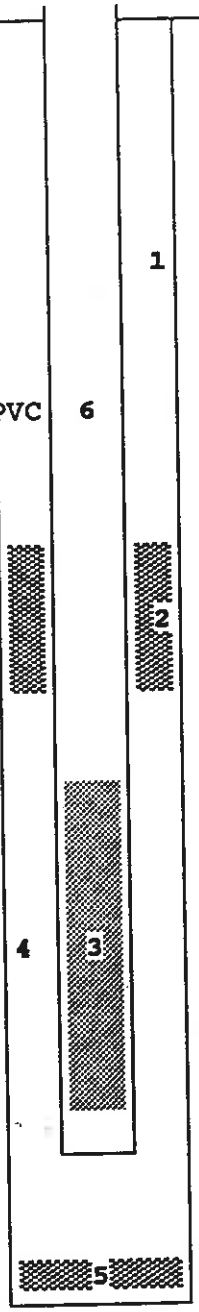
COMPANY APCO MOUNTAINEER PLANT
PROJECT ASH LANDFILL
COORDINATES N.710272.6 E.1729225.46
DATE INSTALLED 8-11-92
LATITUDE 38 56 48.14330
LONGITUDE 81 57 07.20934
NOTE: CASING PROTECTOR DETAILS NOT SHOWN

WELL CONSTRUCTION SUMMARY ELEVATION (ft. NGVD)
WELL NO. MW-14
REF. DATUM PT. 716.87
GRADE 715.1

1 GROUT SEAL VOLCLAY
2 BENTONITE SEAL PELLETS
3 SCREEN 2" DIA. 20 SLOT PVC
4 GRAVEL PACK #4 OHIO QUARTZ
5 N.A.
6 RISER PIPE 2" DIA. SCH 40 PVC

WELL BAILED DRY AFTER INSTALLATION.

BOREHOLE DIAMETER 6"



VOLCLAY GROUT FROM 676.9 TO BOTTOM OF CONCRETE PAD.

TOP OF BENTONITE SEAL 676.9

TOP OF GRAVEL PACK 671.1

TOP OF SCREEN 669.7

BOTTOM OF SCREEN 660.2

BOTTOM OF BLANK SECTION 659.7

BOTTOM OF GRAVEL PACK 658.7

BOTTOM OF BORE HOLE 658.7

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

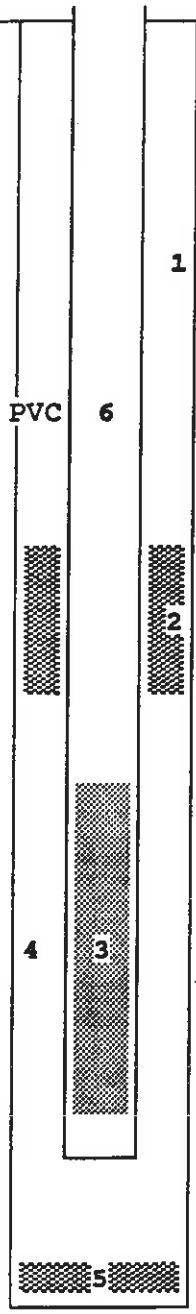
AMERICAN ELECTRIC POWER SERVICE CORPORATION

OBSERVATION WELL
CDS-04

COMPANY APCO MOUNTAINEER PLANT
PROJECT ASH LANDFILL
COORDINATES N.710943.81 E.1730886.18
DATE INSTALLED 7-22-92
LATITUDE 38 56 54.94387
LONGITUDE 81 56 46.27894
NOTE: CASING PROTECTOR DETAILS NOT SHOWN

WELL CONSTRUCTION SUMMARY ELEVATION (ft. NGVD)
WELL NO. MW-15
REF. DATUM PT. 681.2
GRADE 679.29

1 GROUT SEAL VOLCLAY GROUT
2 BENTONITE SEAL PELLETS
3 SCREEN 2" DIA. 20 SLOT PVC
4 GRAVEL PACK #4 OHIO QUARTZ
5 N.A.
6 RISER PIPE 2" DIA. SCH. 40 PVC
BORE HOLE 6"



VOLCLAY GROUT FROM 640.59 TO BOTTOM OF CONCRETE PAD.

TOP OF BENTONITE SEAL 640.59

TOP OF GRAVEL PACK 635.59

TOP OF SCREEN 634.39

BOTTOM OF SCREEN 625.39

BOTTOM OF BLANK SECTION 624.29

BOTTOM OF GRAVEL PACK 623.29

BOTTOM OF BORE HOLE 621.19

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

AMERICAN ELECTRIC POWER SERVICE CORPORATION

OBSERVATION WELL
CDS-04

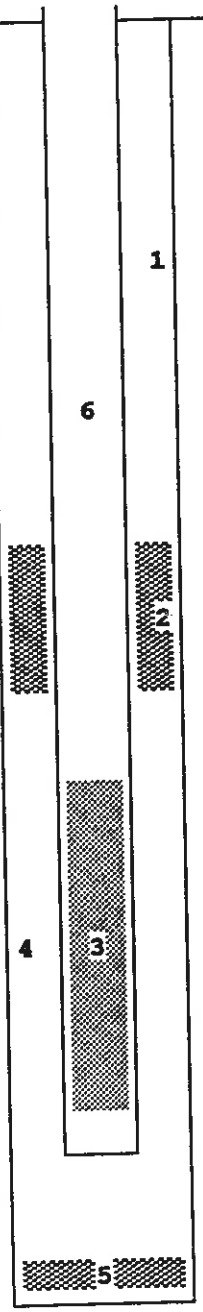
COMPANY APCO MOUNTAINEER PLANT
PROJECT ASH LANDFILL
COORDINATES N.714546.94 E.1733259.19
DATE INSTALLED 5-21-92
LATITUDE 38 57 30.79416
LONGITUDE 81 56 16.70491
NOTE: CASING PROTECTOR DETAILS NOT SHOWN

WELL CONSTRUCTION SUMMARY ELEVATION (ft. NGVD)

WELL NO.	MW-16
REF. DATUM PT.	628.78
GRADE	626.03

1 GROUT SEAL VOLCLAY GROUT
2 BENTONITE SEAL PELLETS
3 SCREEN 2" DIA. 20 SLOT PVC
4 GRAVEL PACK #4 OHIO QUARTZ
5 N.A.
6 RISER PIPE 2" DIA. SCH. 40

BORE HOLE 6"



BENTONITE PELLETS FROM 621.03 TO BOTTOM OF CONCRETE PAD. BENTONITE PELLETS WERE HYDRATED DURING INSTALLATION.

TOP OF BENTONITE SEAL 621.03

TOP OF GRAVEL PACK 616.03

TOP OF SCREEN 615.03

BOTTOM OF SCREEN 604.58

BOTTOM OF BLANK SECTION 604.03

BOTTOM OF GRAVEL PACK 597.53

BOTTOM OF BORE HOLE 597.53

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

AMERICAN ELECTRIC POWER SERVICE CORPORATION

OBSERVATION WELL

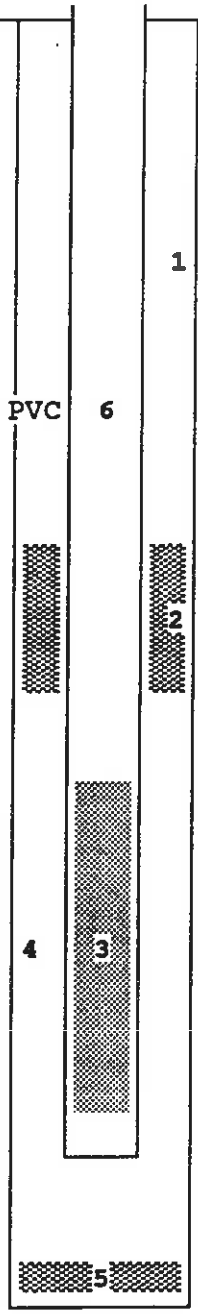
CDS-04

COMPANY APCO MOUNTAINEER PLANT
PROJECT ASH LANDFILL
COORDINATES N.714833.45 E.1733260.67
DATE INSTALLED 5-20-92
LATITUDE 38 57 33.62858
LONGITUDE 81 56 16.72503
NOTE: CASING PROTECTOR DETAILS NOT SHOWN

WELL CONSTRUCTION SUMMARY ELEVATION (ft. NGVD)
WELL NO. MW-17
REF. DATUM PT. 623.29
GRADE 621.47

1 GROUT SEAL VOLCLAY GROUT
2 BENTONITE SEAL PELLETS
3 SCREEN 2" DIA. 20 SLOT PVC
4 GRAVEL PACK #4 OHIO QUARTZ
5 N.A.
6 RISER PIPE 2" DIA. SCH. 40 PVC

BORE HOLE DIAMETER 6"



VOLCLAY GROUT TO BOTTOM OF CONCRETE PAD.

TOP OF BENTONITE SEAL 609.47

TOP OF GRAVEL PACK 604.47

TOP OF SCREEN 602.92

BOTTOM OF SCREEN 593.47

BOTTOM OF BLANK SECTION 592.47

BOTTOM OF GRAVEL PACK 590.97

BOTTOM OF BORE HOLE 590.97

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

AMERICAN ELECTRIC POWER SERVICE CORPORATION

OBSERVATION WELL

CDS-04

COMPANY APCO MOUNTAINEER PLANT
PROJECT ASH LANDFILL
COORDINATES N.714922.00 E.1733257.86
DATE INSTALLED 5-19-92
LATITUDE 38 57 34.50337
LONGITUDE 81 56 16.77161
NOTE: CASING PROTECTOR DETAILS NOT SHOWN

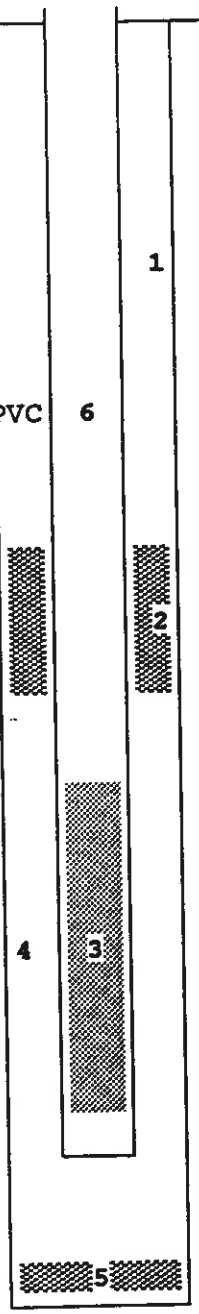
WELL CONSTRUCTION SUMMARY ELEVATION (ft. NGVD)

WELL NO.	MW-18
REF. DATUM PT.	623.78
GRADE	621.95

1 GROUT SEAL VOLCLAY GROUT
2 BENTONITE SEAL PELLETS
3 SCREEN 2" DIA. 20 SLOT PVC
4 GRAVEL PACK #4 OHIO QUARTZ
5 N.A.
6 RISER PIPE 2" DIA. SCH. 40 PVC

SWL PRIOR TO INSTALLATION 608.65
BAILED TO 20.0 DURING INSTALLATION.

BORE HOLE DIAMETER 6"



VOLCLAY GROUT FROM 612.95 TO BOTTOM OF CONCRETE PAD.

TOP OF BENTONITE SEAL 612.95

TOP OF GRAVEL PACK 608.15

TOP OF SCREEN 606.85

BOTTOM OF SCREEN 597.75

BOTTOM OF BLANK SECTION 596.75

BOTTOM OF GRAVEL PACK 595.75

BOTTOM OF BORE HOLE 595.75

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

AMERICAN ELECTRIC POWER SERVICE CORPORATION

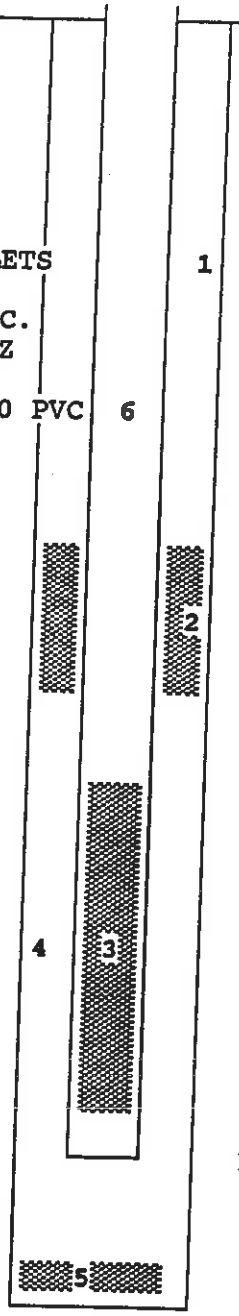
OBSERVATION WELL
CDS-04

COMPANY APCO MOUNTAINEER PLANT
PROJECT ASH LANDFILL
COORDINATES N.712263.69 E.1732224.97
DATE INSTALLED 8-13-92
LATITUDE 38 57 08.12124
LONGITUDE 81 56 29.50359
NOTE: CASING PROTECTOR DETAILS NOT SHOWN

WELL CONSTRUCTION SUMMARY ELEVATION (ft. NGVD)
WELL NO. MW-19
REF. DATUM PT. 645.14
GRADE 643.18

1 GROUT SEAL BENTONITE PELLETS
2 BENTONITE SEAL PELLETS
3 SCREEN 2" DIA. 20 SLOT PVC.
4 GRAVEL PACK #4 OHIO QUARTZ
5 N.A.
6 RISER PIPE 2" DIA. SCH. 40 PVC

BORE HOLE DIAMETER 6"
CLUSTERED WELL SITE WITH MW-9.



TOP OF BENTONITE SEAL BOTTOM OF CONCRETE PAD. PELLETS WERE HYDRATED DURING INSTALLATION.

TOP OF GRAVEL PACK 632.68

TOP OF SCREEN 631.58

BOTTOM OF SCREEN 622.68

BOTTOM OF BLANK SECTION 621.58

BOTTOM OF GRAVEL PACK 620.38

BOTTOM OF BORE HOLE 620.38

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

AMERICAN ELECTRIC POWER SERVICE CORPORATION

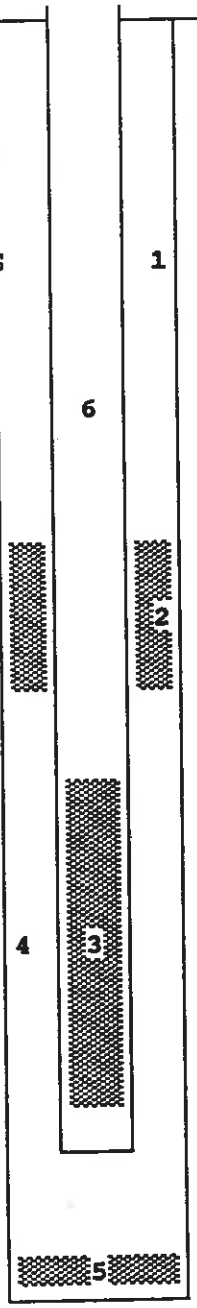
OBSERVATION WELL
CDS-04

COMPANY APCO MOUNTAINEER PLANT
PROJECT ASH LANDFILL
COORDINATES N.710956.09 E.1730893.81
DATE INSTALLED 8-18-92
LATITUDE 38 56 55.06653
LONGITUDE 81 56 46.18349
NOTE: CASING PROTECTOR DETAILS NOT SHOWN

WELL CONSTRUCTION SUMMARY ELEVATION (ft. NGVD)
WELL NO. MW-20
REF. DATUM PT. 682.03
GRADE 679.99

1 GROUT SEAL BENTONITE PELLETS
2 BENTONITE SEAL
3 SCREEN 2" DIA. 20 SLOT PVC
4 GRAVEL PACK #4 OHIO QUARTZ
5 N.A.
6 RISER PIPE 2" DIA. SCH. 40

BORE HOLE DIAMETER 6"
CLUSTERED WELL SITE WITH MW-15.



BENTONITE SEAL FROM 632.68 TO BOTTOM OF CONCRETE PAD.
BENTONITE PELLETE WERE HYDRATED DURING INSTALLATION.

TOP OF GRAVEL PACK 672.09

TOP OF SCREEN 671.09

BOTTOM OF SCREEN 662.09

BOTTOM OF BLANK SECTION 660.99

BOTTOM OF GRAVEL PACK 659.49

BOTTOM OF BORE HOLE 659.49

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

AMERICAN ELECTRIC POWER SERVICE CORPORATION

OBSERVATION WELL
CDS-04

ARCADIS

AEP 1992, 2005, 2006, 2008

Monitoring Well Construction Diagrams

MW-05 to MW-22, MW-24 to MW-26, MW-34 to MW-44, MW-44D, MW-44I, MW-44S

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

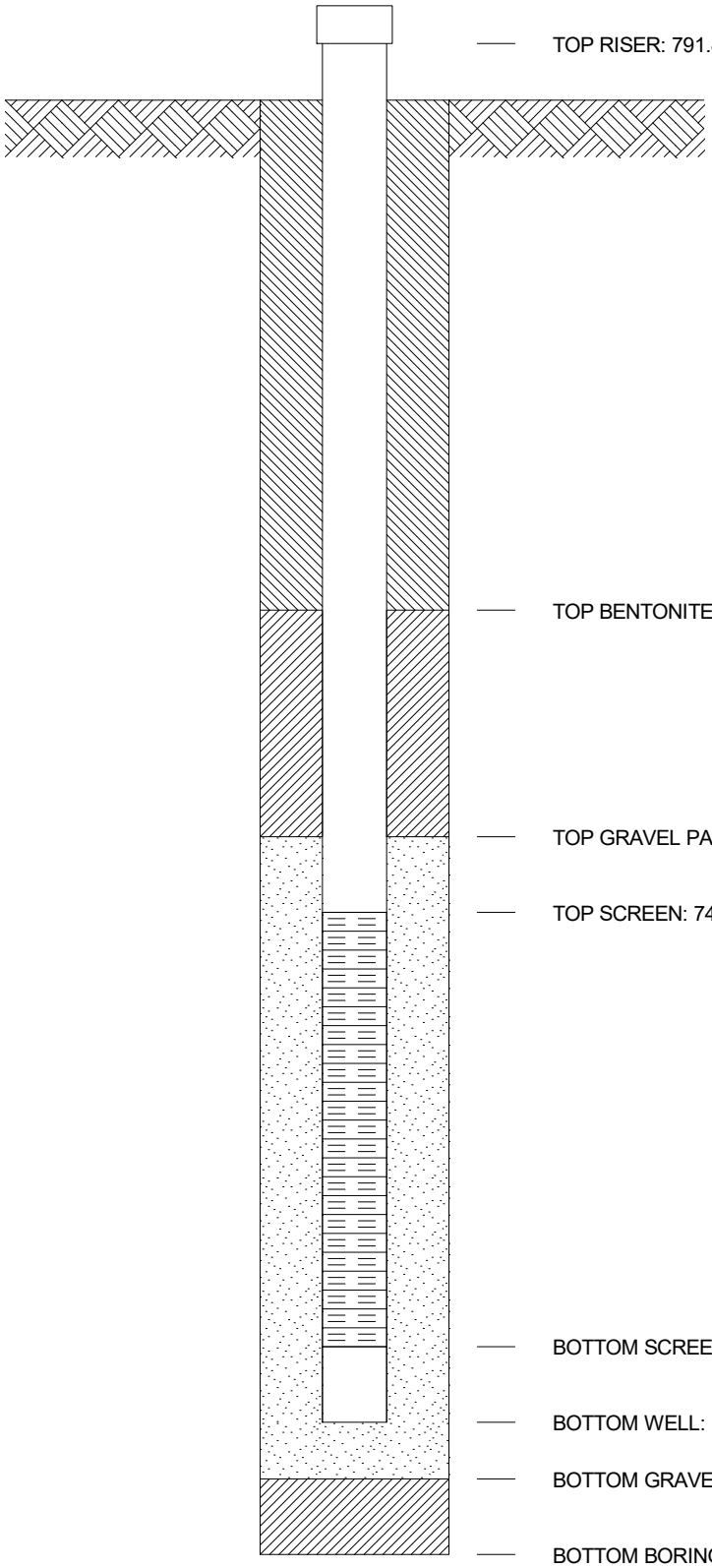
COMPANY **APPALACHIAN POWER COMPANY** WELL No. _____ BORING No. **MW-05** INSTALLED **6/23/92**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 711,462.7 E 1,728,597.8**

SYSTEM _____

GROUND ELEVATION 788.93 FT.



GROUT SEAL:

BENTONITE SEAL:

SCREEN: dia., ,

GRAVEL PACK:

RISER PIPE: , dia.,

SPACERS, DEPTH:

GEOMCNST MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

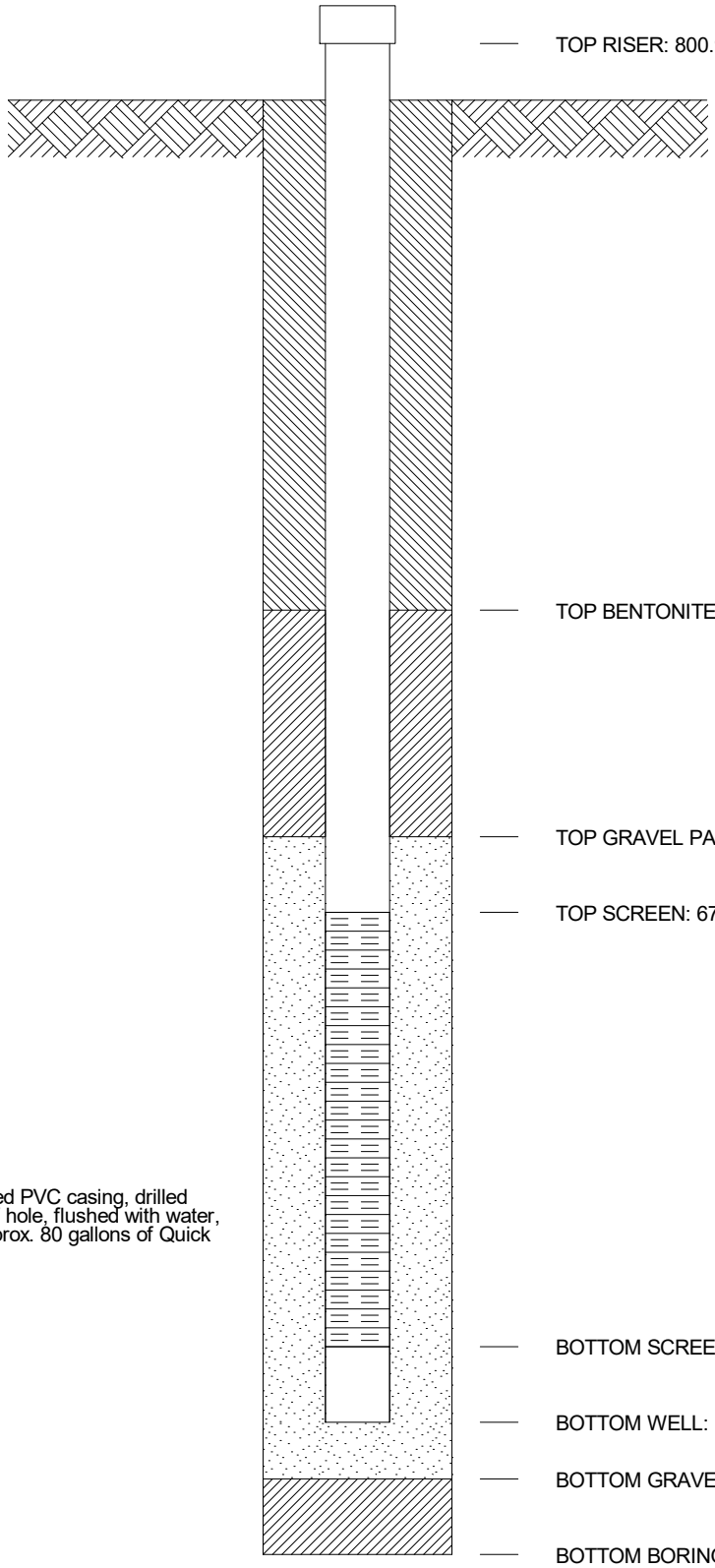
COMPANY **APPALACHIAN POWER COMPANY** WELL No. BORING No. **MW-06** INSTALLED **7/16/92**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 712,003.9 E 1,729,676.1**

SYSTEM

GROUND ELEVATION 799.16 FT.



GROUT SEAL:

BENTONITE SEAL:

SCREEN: dia., ,

GRAVEL PACK:

RISER PIPE: , dia.,

SPACERS, DEPTH:

WV00019

Well abandoned 8/18/99 - Pulled PVC casing, drilled 5.25"roller bit to bottom of hole, flushed with water, & triemie grouted with approx. 80 gallons of Quick grout

GEOMCNST MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

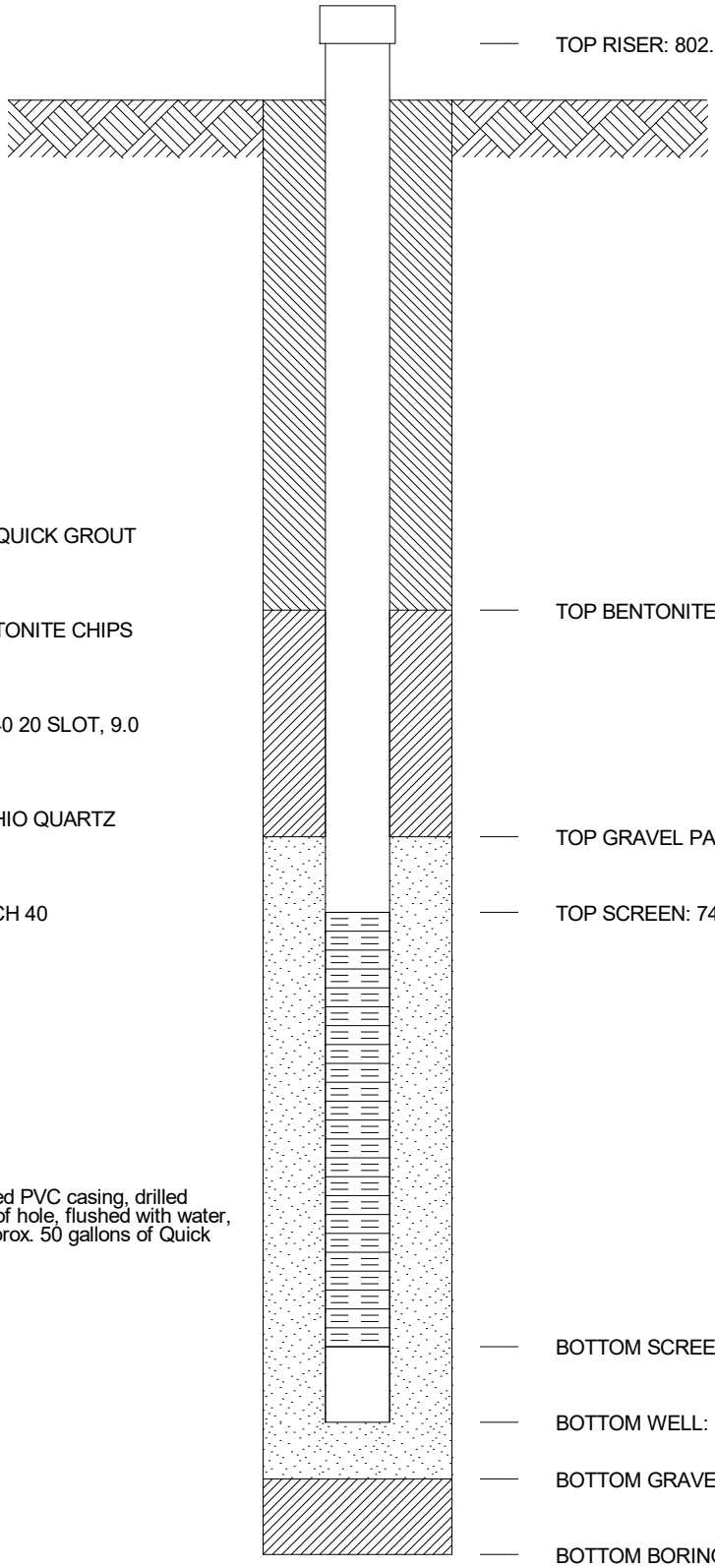
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **9621** BORING No. **MW-07** INSTALLED **6/19/92**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 711,982.1 E 1,729,623.0**

SYSTEM

GROUND ELEVATION 800.46 FT.



GROUT SEAL: 50 GALLONS QUICK GROUT

BENTONITE SEAL: 50 # BENTONITE CHIPS

SCREEN: 2.0 dia., PVC SCH 40 20 SLOT, 9.0

GRAVEL PACK: 175# No.4 OHIO QUARTZ

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH: 25', 26'

WV00019

Well abandoned 8/17/99 - Pulled PVC casing, drilled 2.875"roller bit to bottom of hole, flushed with water, & triemie grouted with approx. 50 gallons of Quick grout

GEOMCNST MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

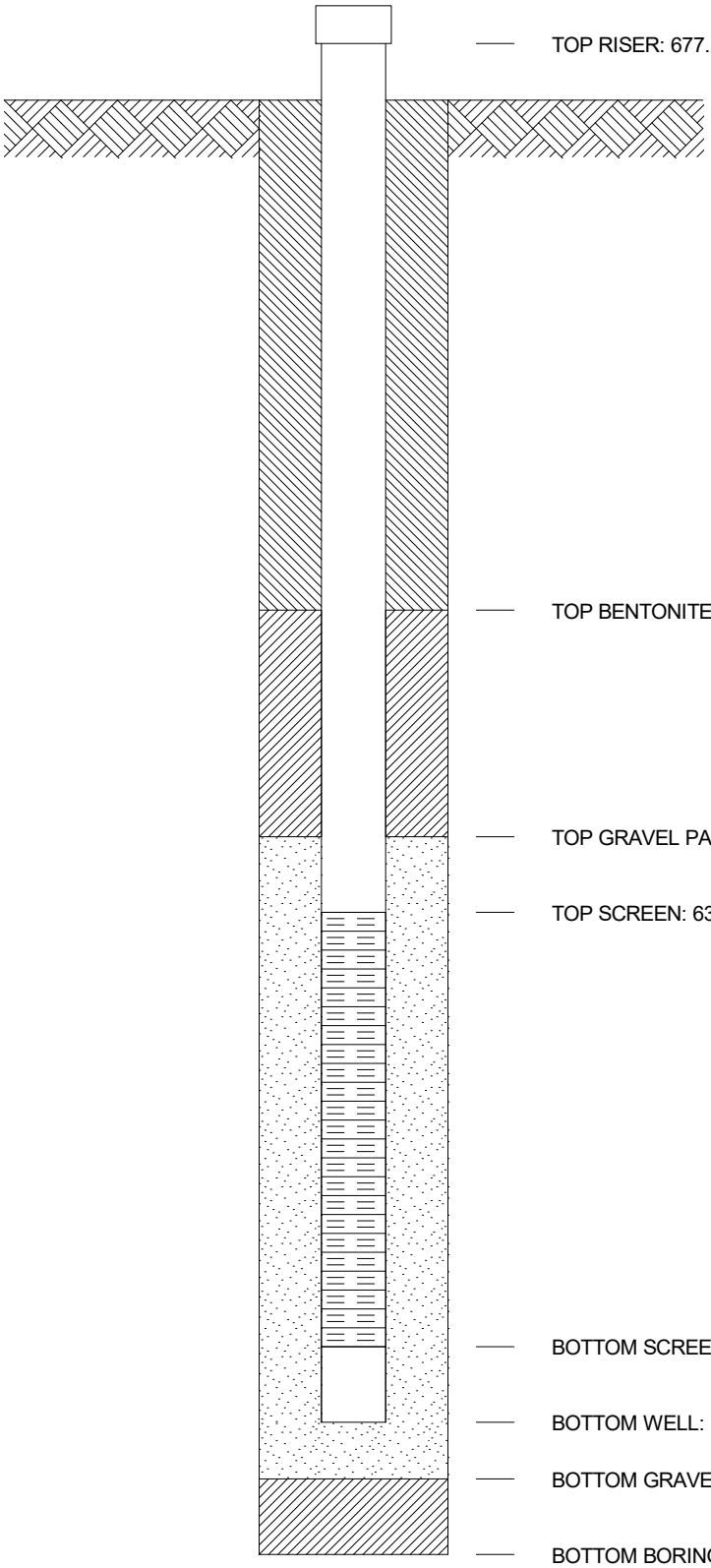
COMPANY **APPALACHIAN POWER COMPANY** WELL No. _____ BORING No. **MW-08** INSTALLED **7/29/92**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 710,780.9 E 1,730,856.4**

SYSTEM _____

GROUND ELEVATION 675.49 FT.



GROUT SEAL:

BENTONITE SEAL:

SCREEN: dia., ,

GRAVEL PACK:

RISER PIPE: , dia.,

SPACERS, DEPTH:

GEOMCNST MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

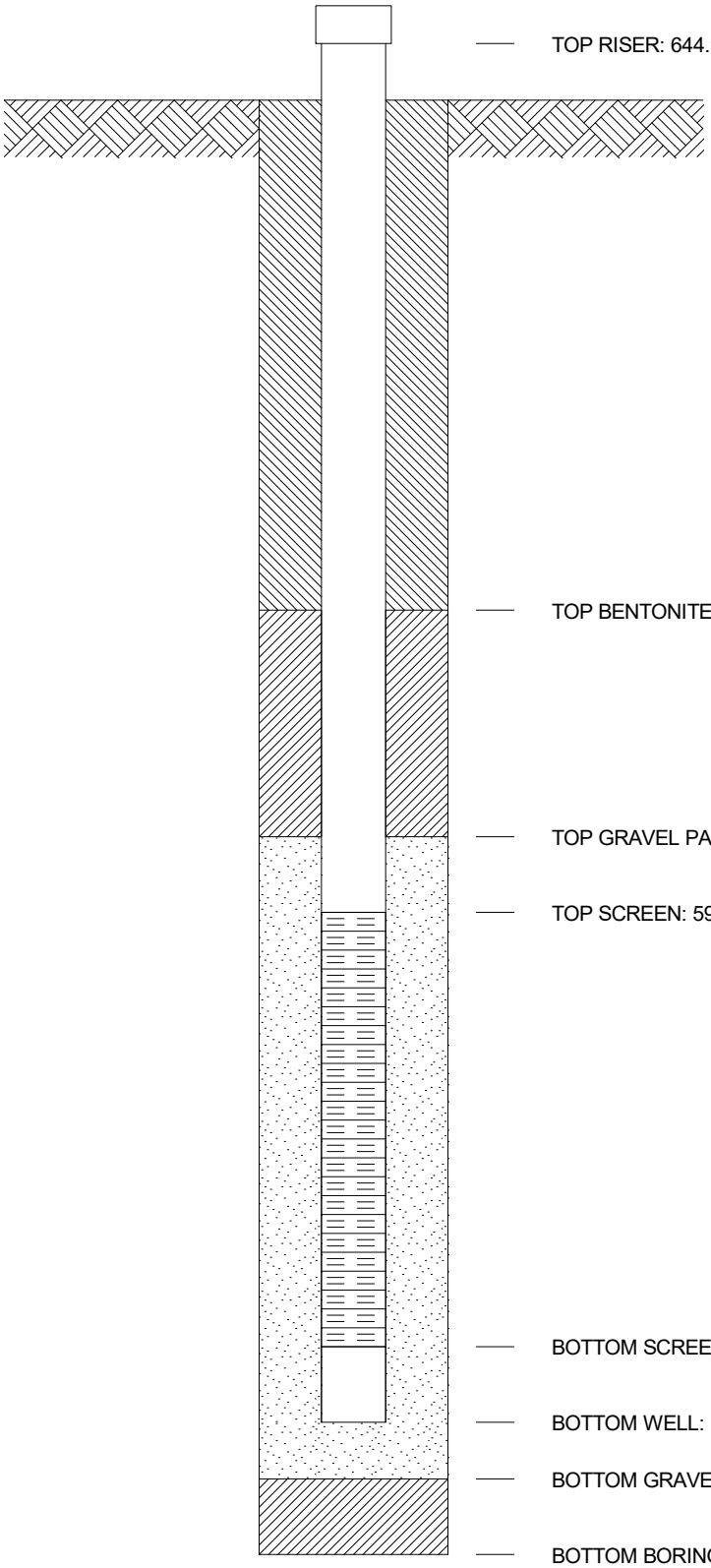
COMPANY **APPALACHIAN POWER COMPANY** WELL No. _____ BORING No. **MW-09** INSTALLED **8/13/92**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 712,268.5 E 1,732,217.4**

SYSTEM _____

GROUND ELEVATION 643.00 FT.



GROUT SEAL:

BENTONITE SEAL:

SCREEN: dia., ,

GRAVEL PACK:

RISER PIPE: , dia.,

SPACERS, DEPTH:

GEOMCNST MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

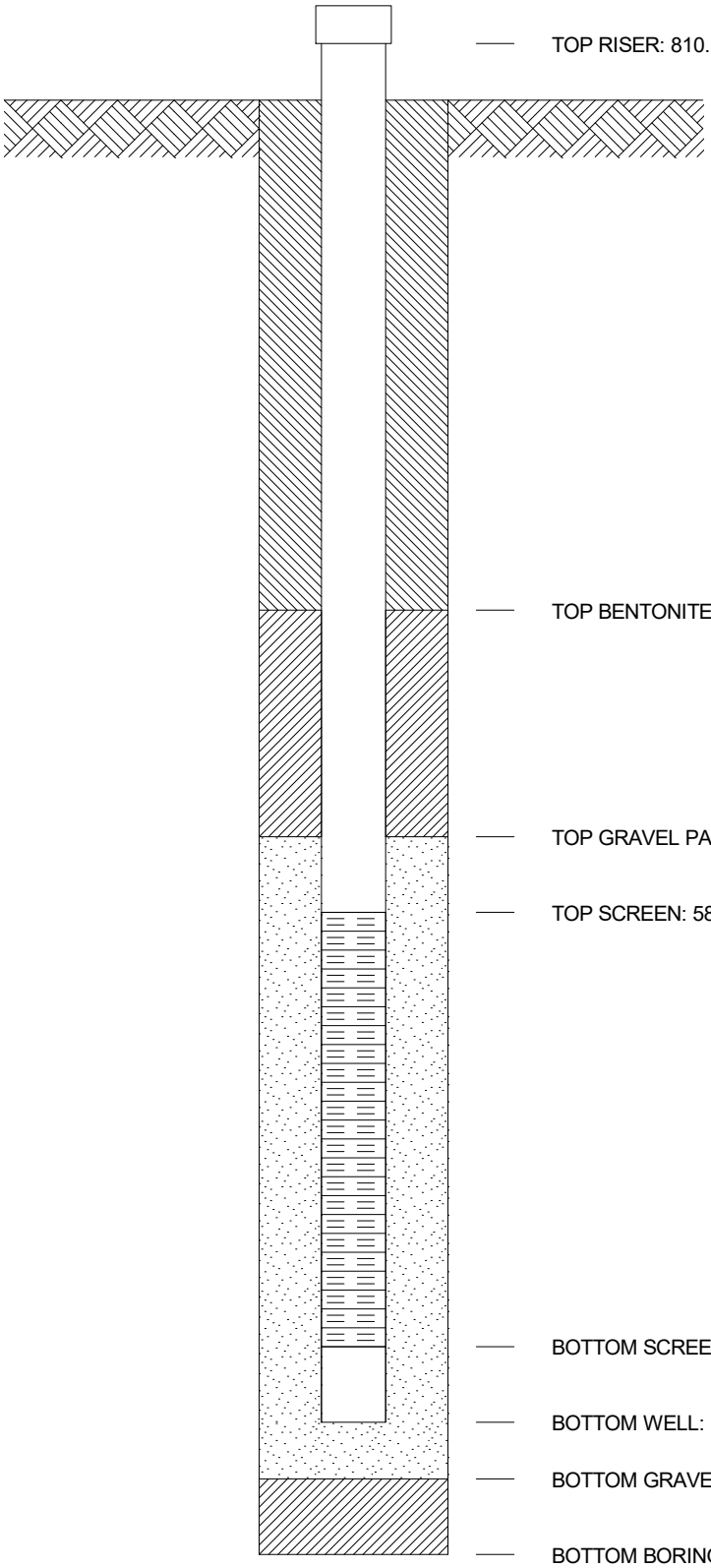
COMPANY **APPALACHIAN POWER COMPANY** WELL No. _____ BORING No. **MW-10** INSTALLED **7/8/92**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 710,968.6 E 1,730,231.8**

SYSTEM _____

GROUND ELEVATION 810.83 FT.



GROUT SEAL:

BENTONITE SEAL:

SCREEN: dia., ,

GRAVEL PACK:

RISER PIPE: , dia.,

SPACERS, DEPTH:

GEOMCNST MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

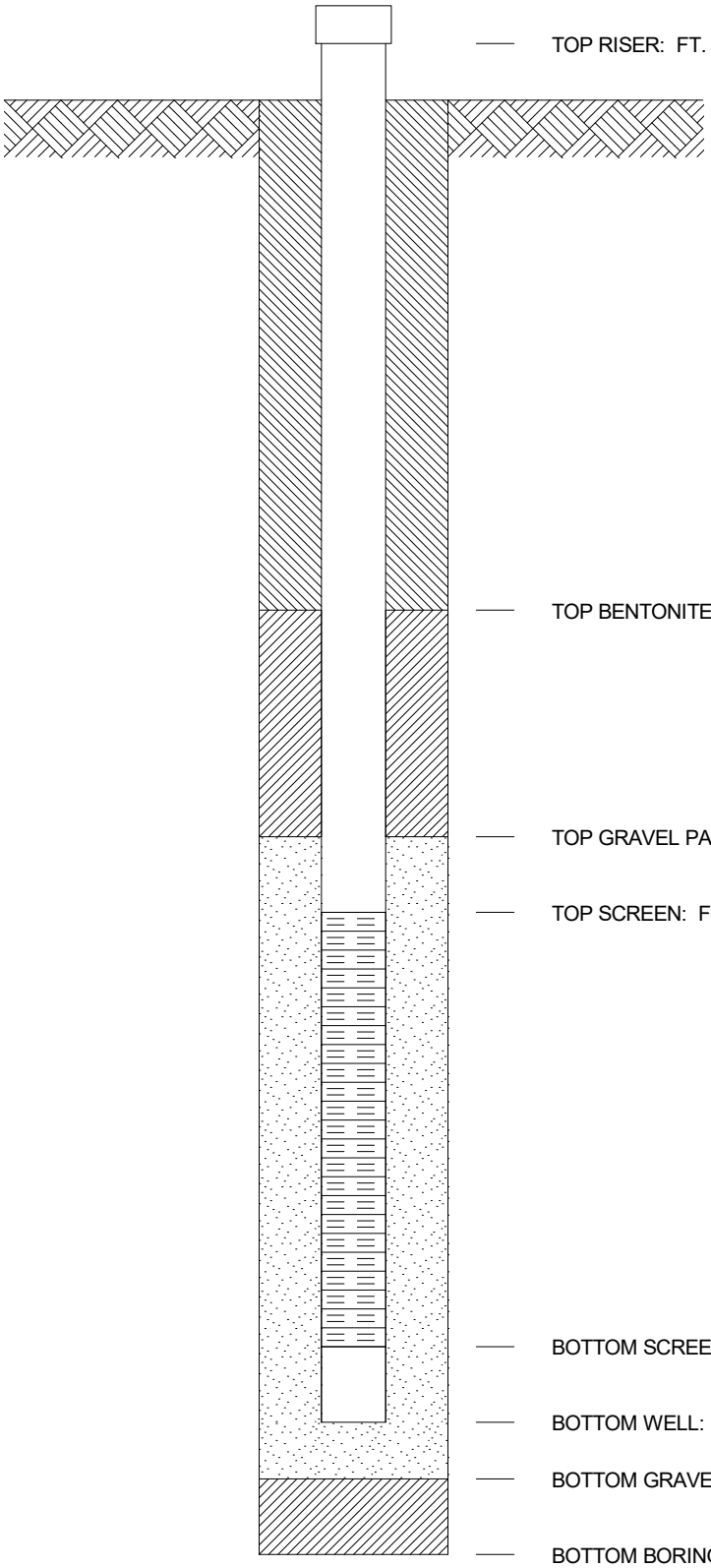
COMPANY **APPALACHIAN POWER COMPANY** WELL No. _____ BORING No. **MW-11** INSTALLED _____

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES _____

SYSTEM _____

GROUND ELEVATION FT.



TOP RISER: FT.

TOP BENTONITE SEAL: FT.

TOP GRAVEL PACK: FT.

TOP SCREEN: FT.

BOTTOM SCREEN: FT.

BOTTOM WELL: FT.

BOTTOM GRAVEL PACK: FT.

BOTTOM BORING: FT.

GROUT SEAL:

BENTONITE SEAL:

SCREEN: dia., ,

GRAVEL PACK:

RISER PIPE: , dia.,

SPACERS, DEPTH:

GEOMCNST MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

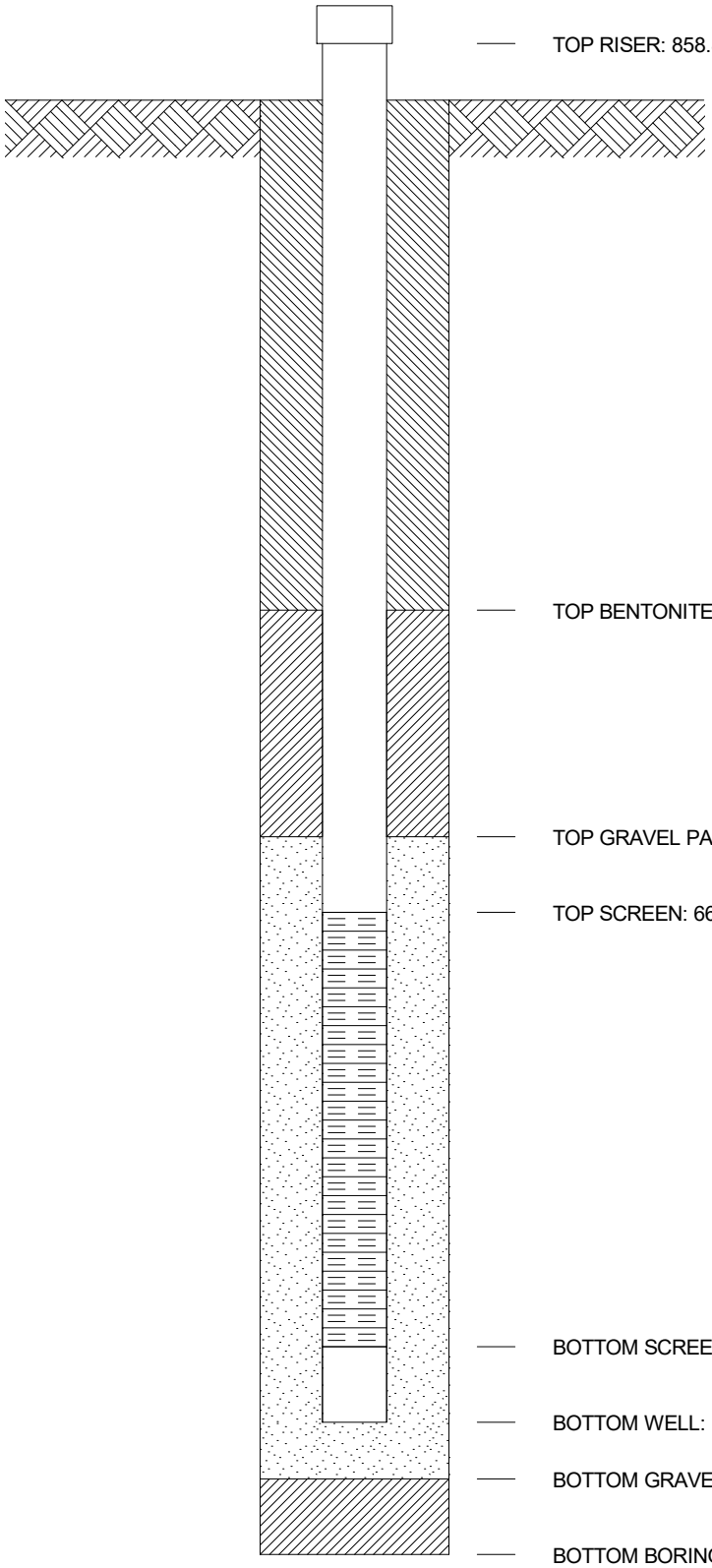
COMPANY **APPALACHIAN POWER COMPANY** WELL No. _____ BORING No. **MW-12** INSTALLED **5/6/92**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 709,162.5 E 1,728,963.4**

SYSTEM _____

GROUND ELEVATION 856.93 FT.



GROUT SEAL:

BENTONITE SEAL:

SCREEN: dia., ,

GRAVEL PACK:

RISER PIPE: , dia.,

SPACERS, DEPTH:

GEOMCNST MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

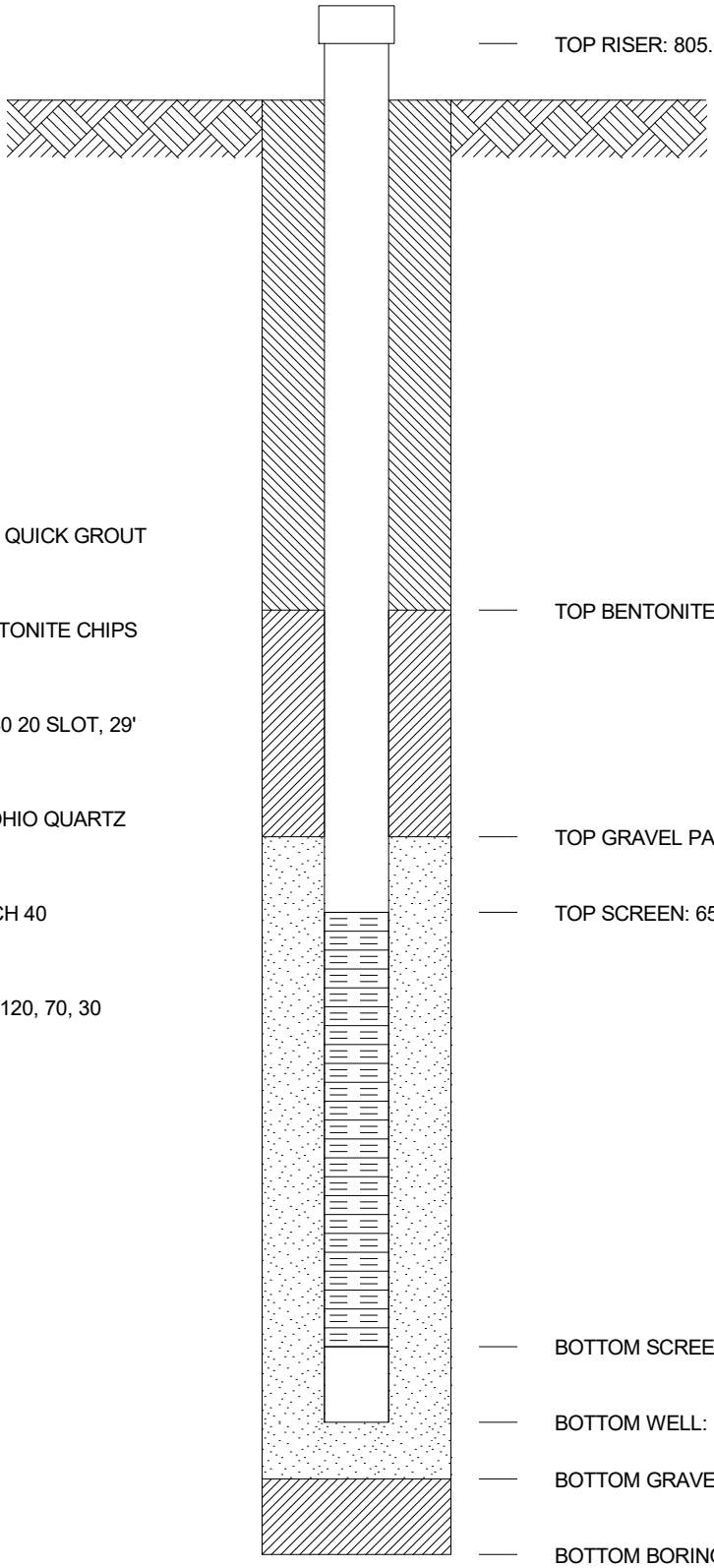
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **9622** BORING No. **MW-13** INSTALLED **5/13/92**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 710,337.4 E 1,731,154.1**

SYSTEM

GROUND ELEVATION 802.01 FT.



GROUT SEAL: 300 GALLONS QUICK GROUT

BENTONITE SEAL: 150# BENTONITE CHIPS

SCREEN: 2.0 dia., PVC SCH 40 20 SLOT, 29'

GRAVEL PACK: 1000# No.4 OHIO QUARTZ

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH: 180, 170, 120, 70, 30

????

GEOMCNST MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

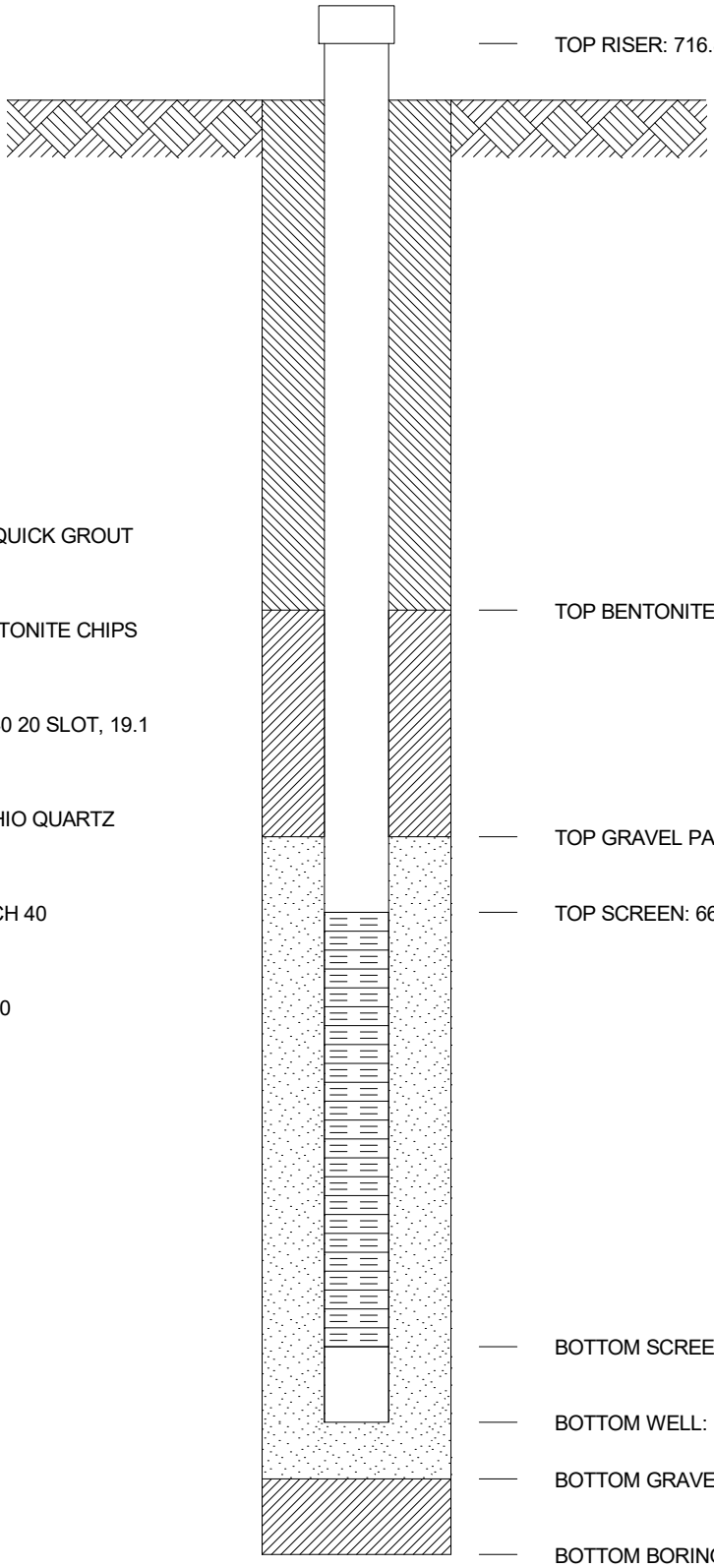
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **9623** BORING No. **MW-14** INSTALLED **8/11/92**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 710,272.6 E 1,729,225.4**

SYSTEM

GROUND ELEVATION 715.10 FT.



GROUT SEAL: 400 GALLON QUICK GROUT

BENTONITE SEAL: 120# BENTONITE CHIPS

SCREEN: 2.0 dia., PVC SCH 40 20 SLOT, 19.1

GRAVEL PACK: 700# No.4 OHIO QUARTZ

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH: 110, 90, 40

????

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

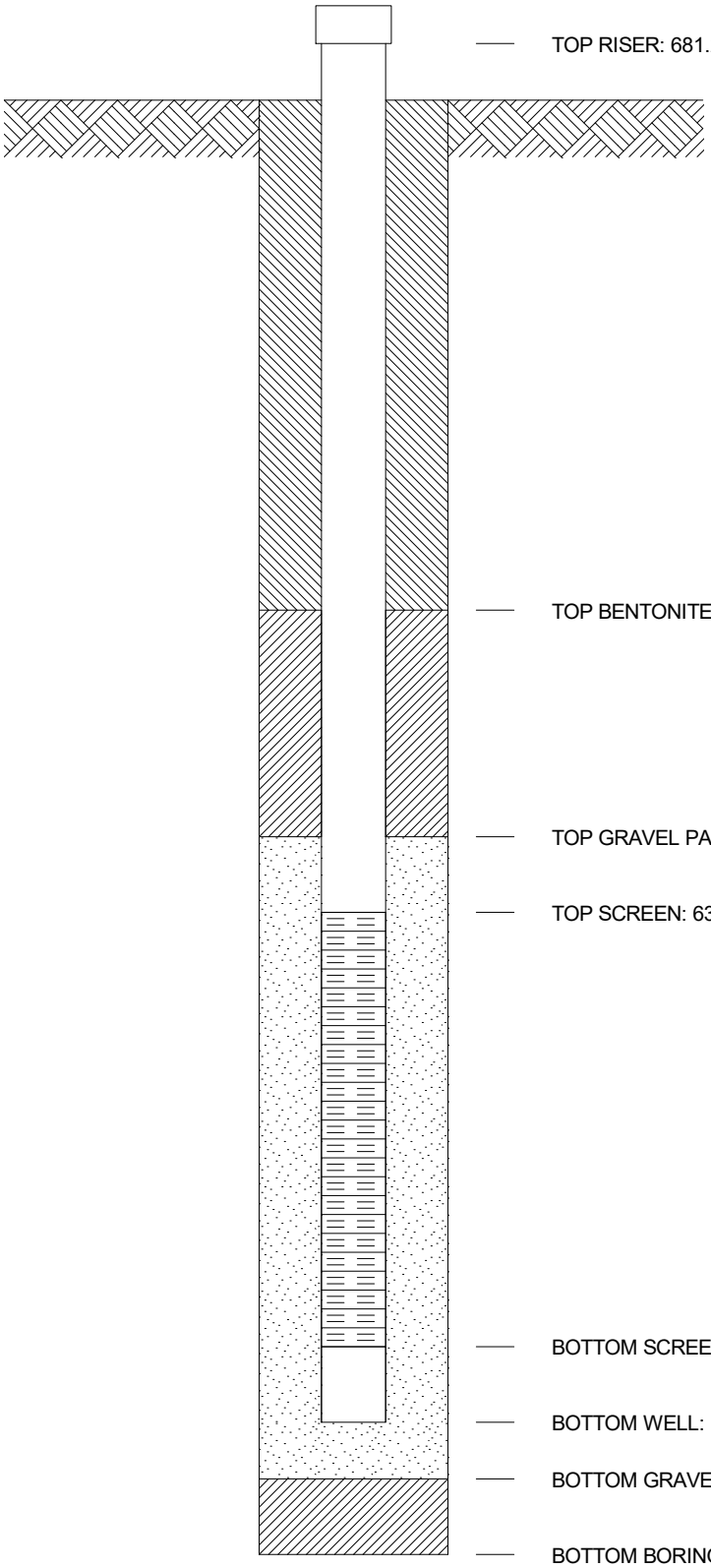
COMPANY **APPALACHIAN POWER COMPANY** WELL No. _____ BORING No. **MW-15** INSTALLED **7/22/92**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 710,943.8 E 1,730,886.1**

SYSTEM _____

GROUND ELEVATION 679.29 FT.



GROUT SEAL:

BENTONITE SEAL:

SCREEN: dia., ,

GRAVEL PACK:

RISER PIPE: , dia.,

SPACERS, DEPTH:

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

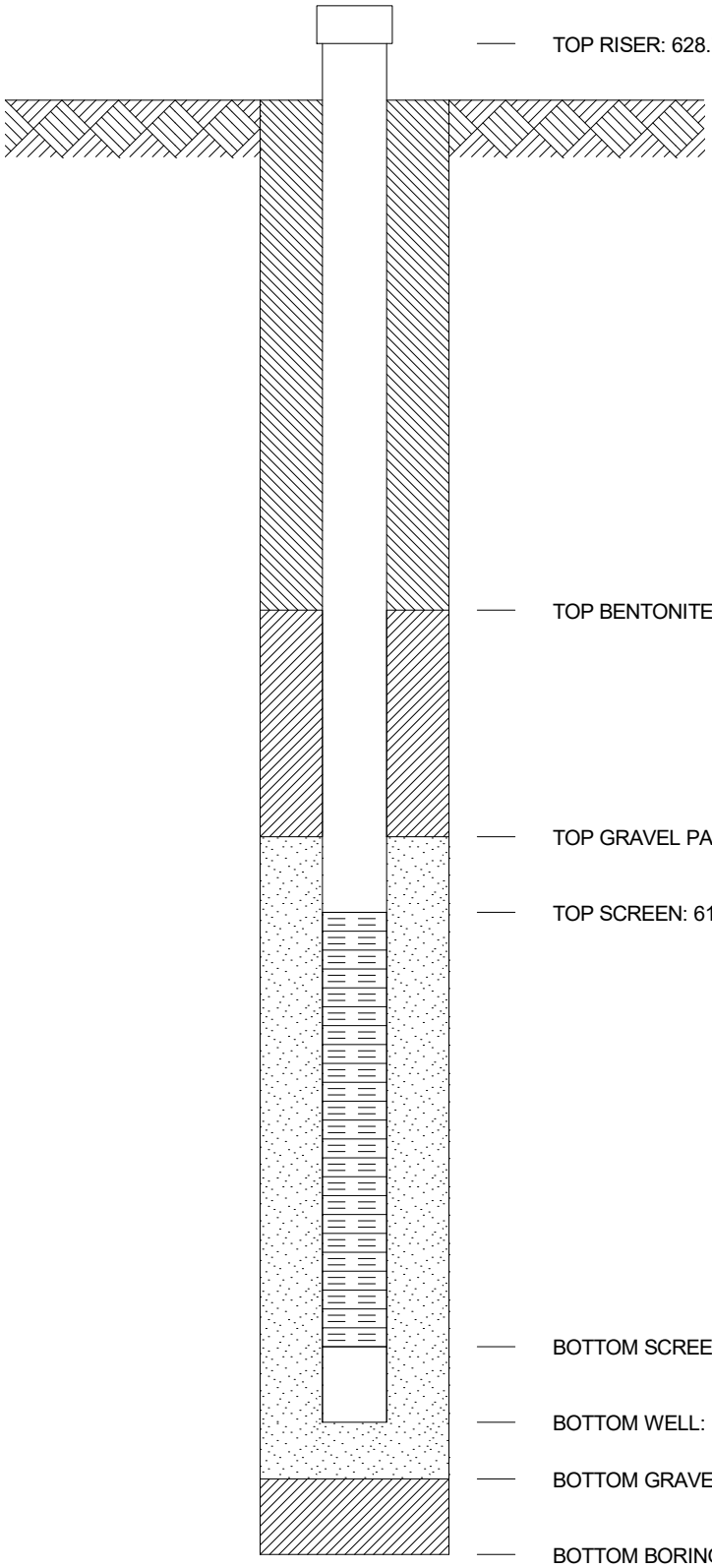
COMPANY **APPALACHIAN POWER COMPANY** WELL No. _____ BORING No. **MW-16** INSTALLED **5/21/92**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 714,546.9 E 1,733,259.1**

SYSTEM _____

GROUND ELEVATION 626.03 FT.



GROUT SEAL:

BENTONITE SEAL:

SCREEN: dia., ,

GRAVEL PACK:

RISER PIPE: , dia.,

SPACERS, DEPTH:

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

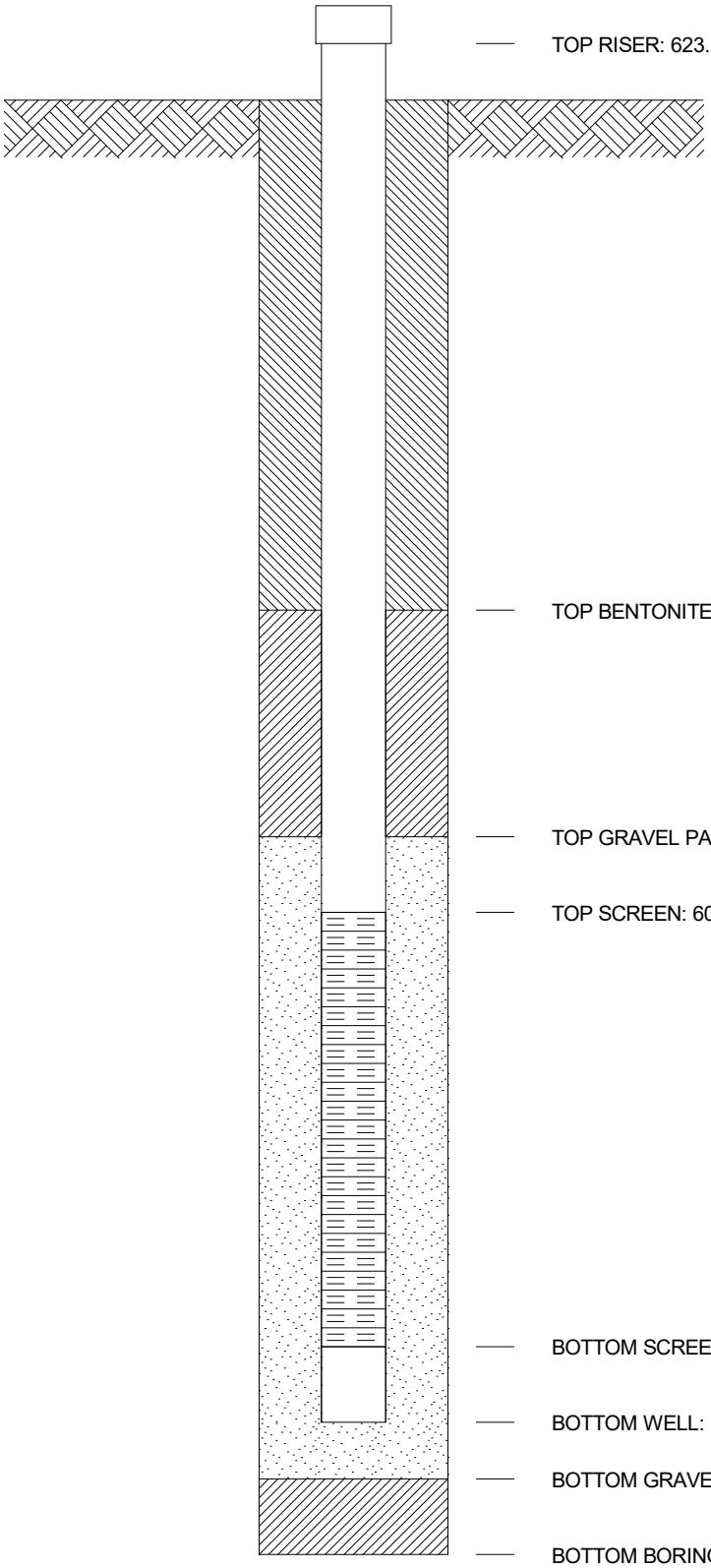
COMPANY **APPALACHIAN POWER COMPANY** WELL No. _____ BORING No. **MW-17** INSTALLED **5/20/92**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 714,833.5 E 1,733,260.6**

SYSTEM _____

GROUND ELEVATION 621.47 FT.



GROUT SEAL:

BENTONITE SEAL:

SCREEN: dia., ,

GRAVEL PACK:

RISER PIPE: , dia.,

SPACERS, DEPTH:

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

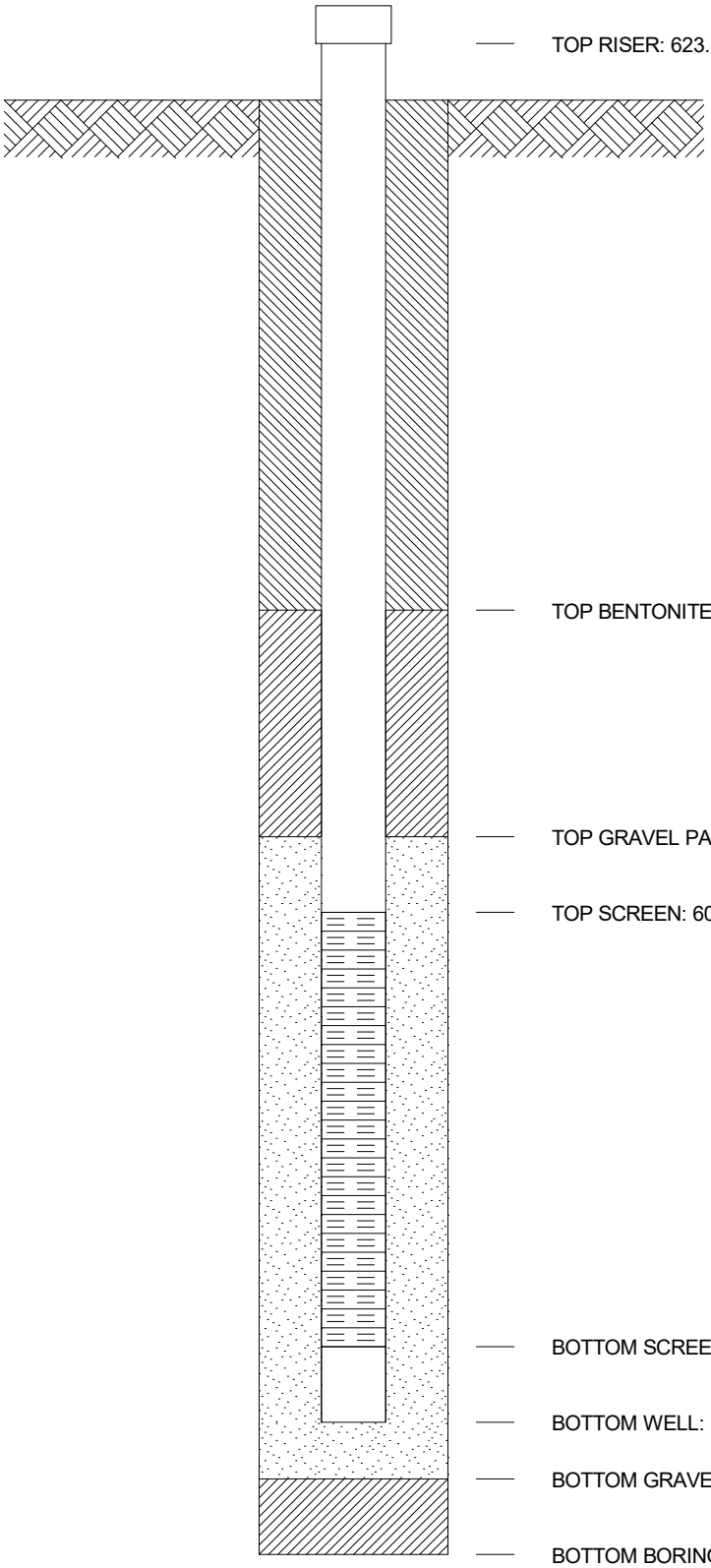
COMPANY **APPALACHIAN POWER COMPANY** WELL No. _____ BORING No. **MW-18** INSTALLED **5/19/92**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 714,922.0 E 1,733,257.8**

SYSTEM _____

GROUND ELEVATION 621.95 FT.



GROUT SEAL:

BENTONITE SEAL:

SCREEN: dia., ,

GRAVEL PACK:

RISER PIPE: , dia.,

SPACERS, DEPTH:

GEOMCNST MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

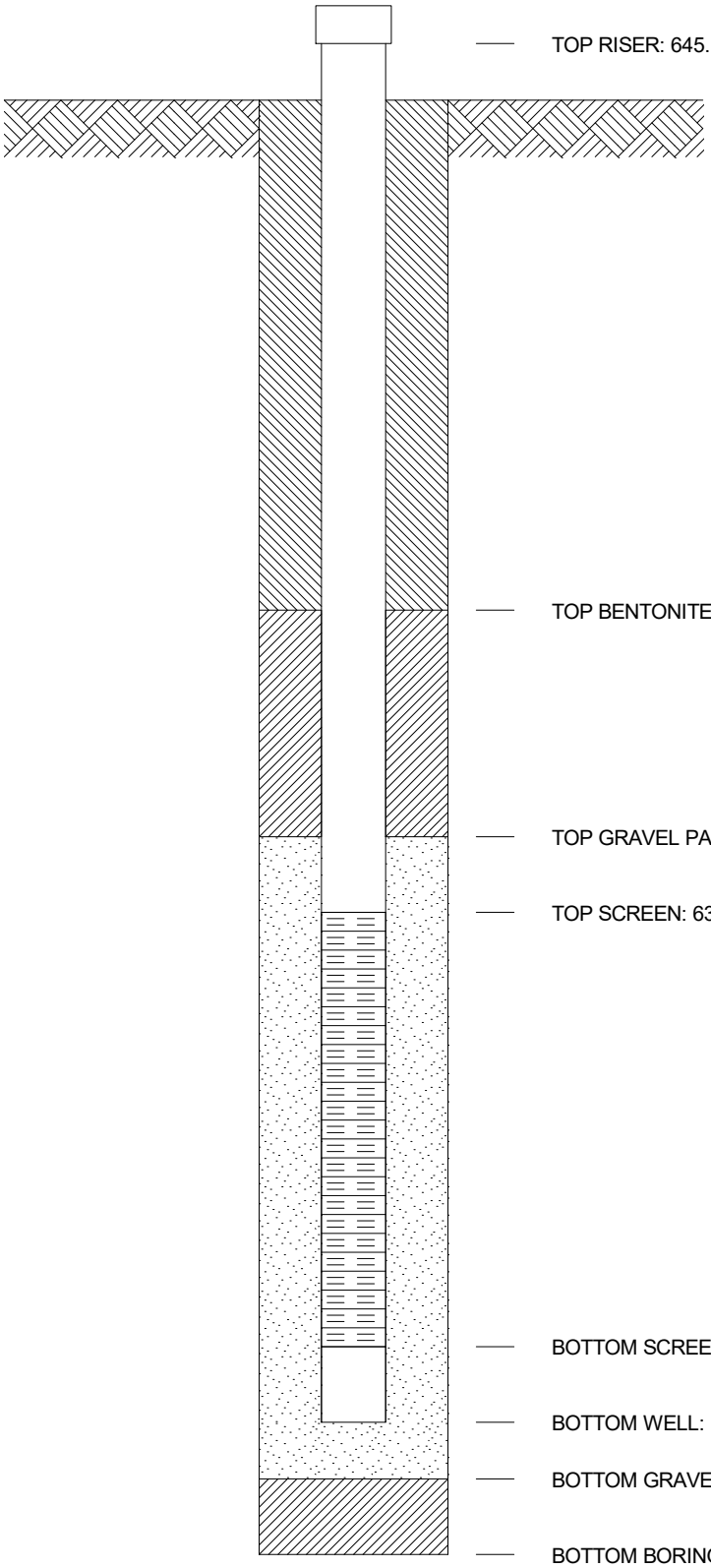
COMPANY **APPALACHIAN POWER COMPANY** WELL No. _____ BORING No. **MW-19** INSTALLED **8/13/92**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 712,263.7 E 1,732,224.9**

SYSTEM _____

GROUND ELEVATION 643.18 FT.



GROUT SEAL:

BENTONITE SEAL:

SCREEN: dia., ,

GRAVEL PACK:

RISER PIPE: , dia.,

SPACERS, DEPTH:

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

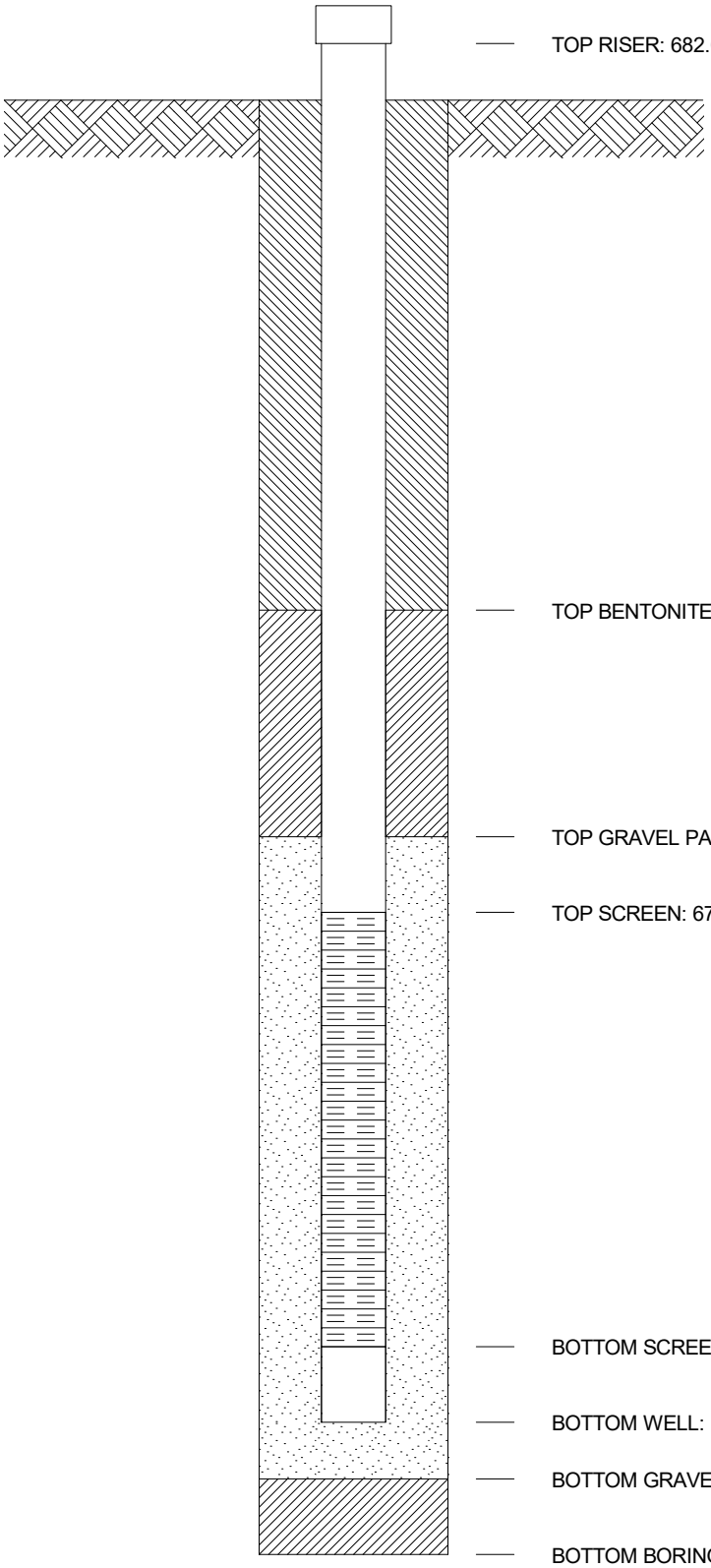
COMPANY **APPALACHIAN POWER COMPANY** WELL No. _____ BORING No. **MW-20** INSTALLED **8/18/92**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 710,956.1 E 1,730,893.8**

SYSTEM _____

GROUND ELEVATION 679.97 FT.



GROUT SEAL:

BENTONITE SEAL:

SCREEN: dia., ,

GRAVEL PACK:

RISER PIPE: , dia.,

SPACERS, DEPTH:

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

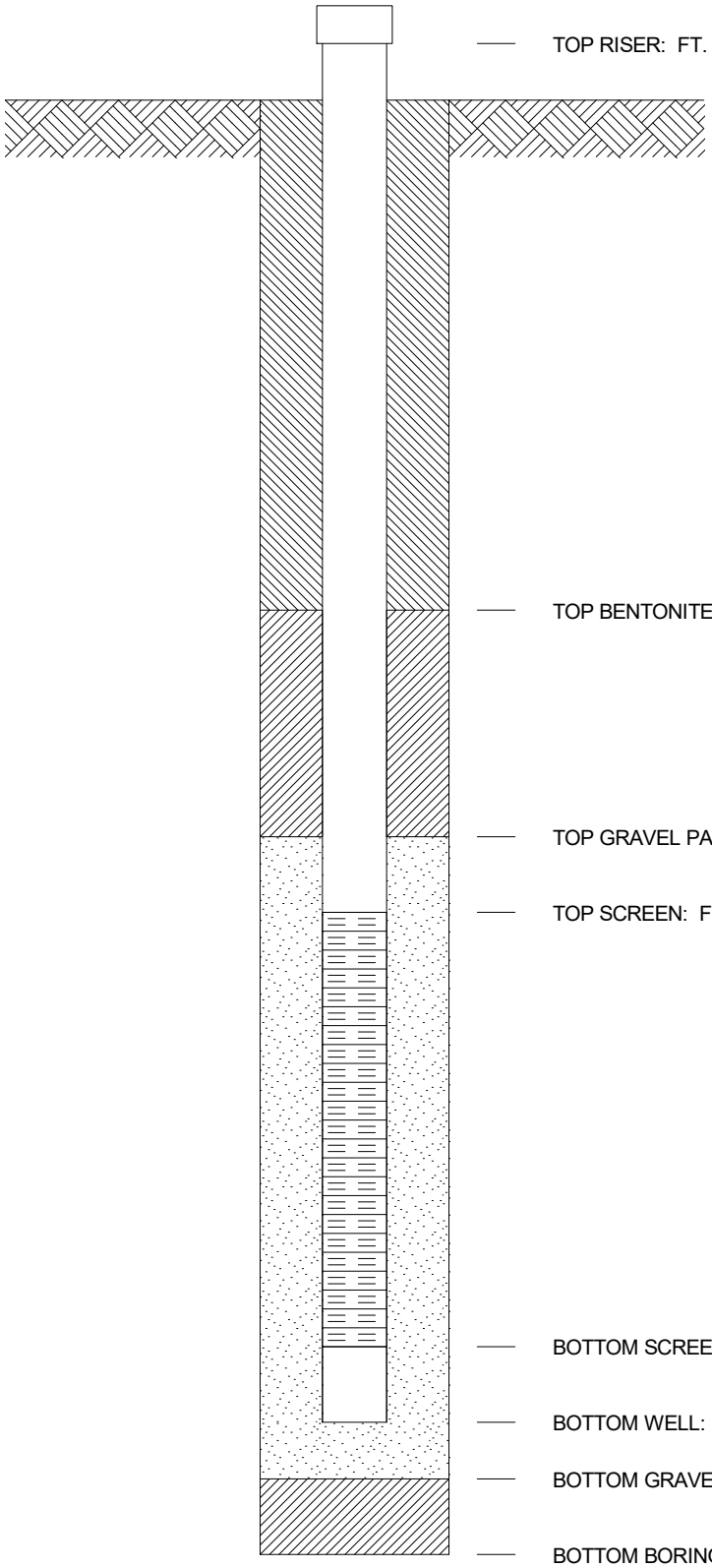
COMPANY **APPALACHIAN POWER COMPANY** WELL No. _____ BORING No. **MW-21** INSTALLED **9/2/92**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 710,790.4 E 1,730,872.3**

SYSTEM _____

GROUND ELEVATION 674.90 FT.



TOP RISER: FT.

TOP BENTONITE SEAL: FT.

TOP GRAVEL PACK: FT.

TOP SCREEN: FT.

BOTTOM SCREEN: FT.

BOTTOM WELL: FT.

BOTTOM GRAVEL PACK: FT.

BOTTOM BORING: 657.00 FT.

GROUT SEAL:

BENTONITE SEAL:

SCREEN: dia., ,

GRAVEL PACK:

RISER PIPE: , dia.,

SPACERS, DEPTH:

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

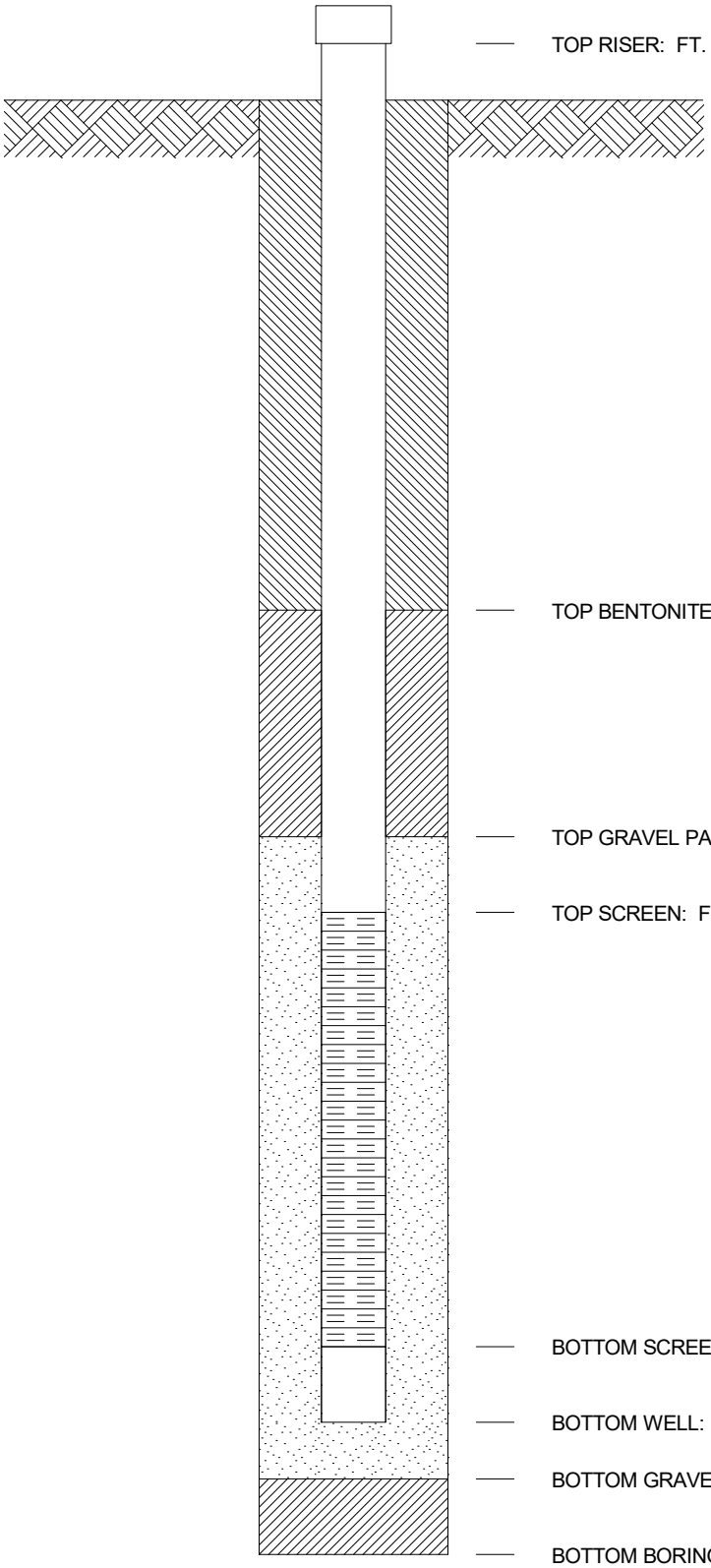
COMPANY **APPALACHIAN POWER COMPANY** WELL No. _____ BORING No. **MW-22** INSTALLED **7/1/92**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES _____

SYSTEM _____

GROUND ELEVATION FT.



GROUT SEAL:

BENTONITE SEAL:

SCREEN: dia., ,

GRAVEL PACK:

RISER PIPE: , dia.,

SPACERS, DEPTH:

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

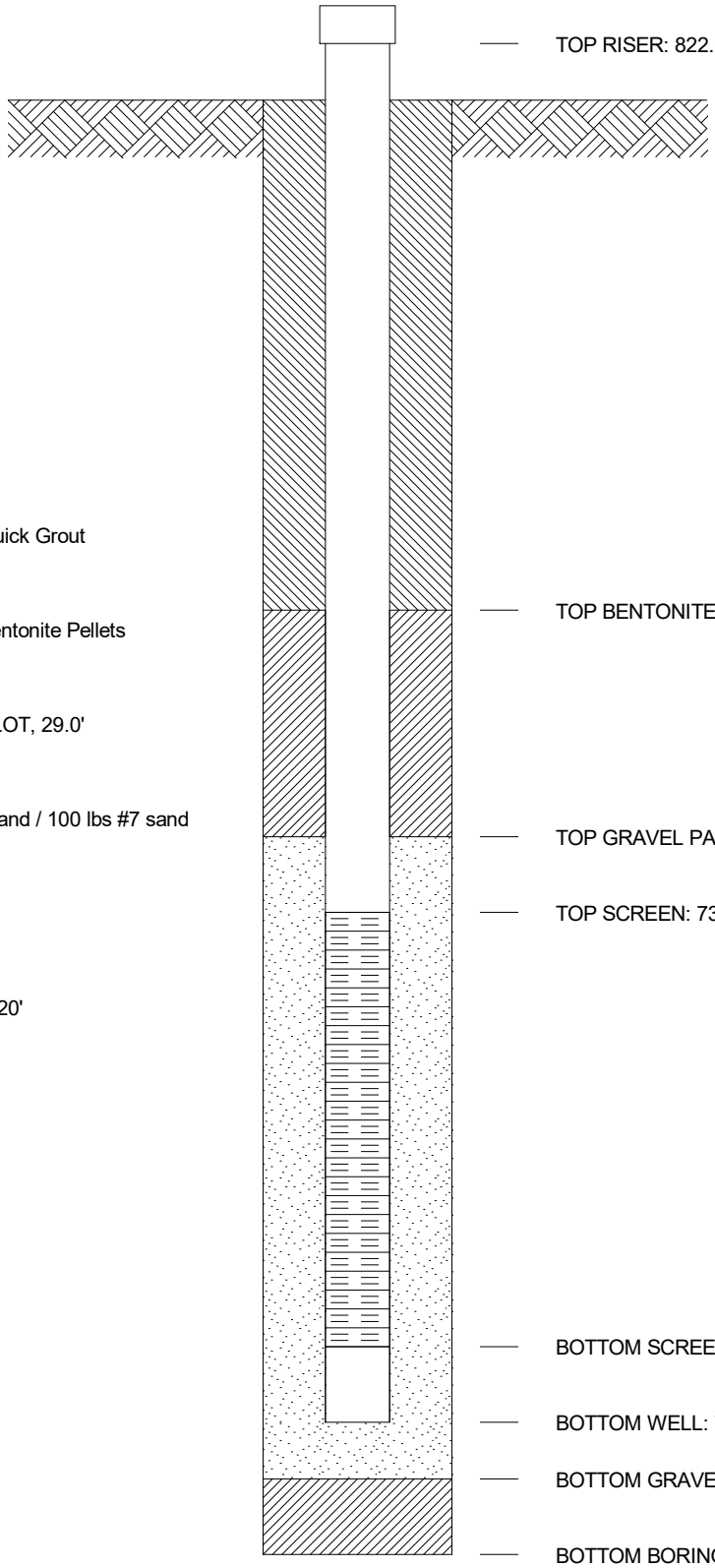
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **MW-24** BORING No. **MW-24** INSTALLED **8/17/05**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 709,346.7 E 1,732,174.7**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 820.30 FT.



GROUT SEAL: 250 Gallons Quick Grout

BENTONITE SEAL: 100 lbs Bentonite Pellets

SCREEN: 2.0" dia., PVC 20 SLOT, 29.0'

GRAVEL PACK: 1250 lbs #4 sand / 100 lbs #7 sand

RISER PIPE: 2.0, dia., PVC

SPACERS, DEPTH: 115', 65', 20'

NOTES:
- SWL = Dry @ installation
- Drilled with 8" air hammer
- Hydrated pellets
- Bladder pump set @ 117.0'

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

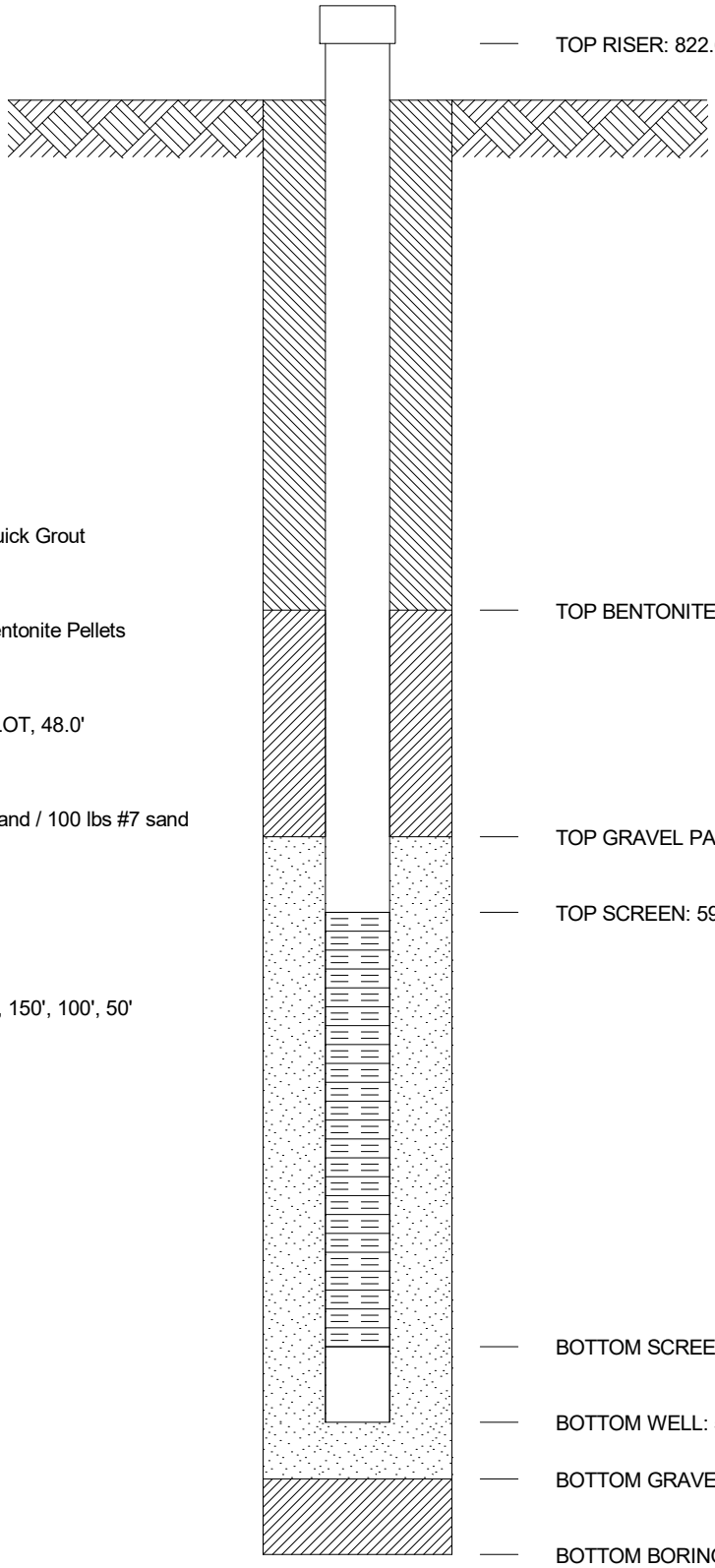
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **MW-25** BORING No. **MW-25** INSTALLED **8/15/05**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 709,352.0 E 1,732,176.8**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 820.30 FT.



GROUT SEAL: 500 Gallons Quick Grout

BENTONITE SEAL: 100 lbs Bentonite Pellets

SCREEN: 2.0" dia., PVC 20 SLOT, 48.0'

GRAVEL PACK: 1750 lbs #4 sand / 100 lbs #7 sand

RISER PIPE: 2.0, dia., PVC

SPACERS, DEPTH: 270', 210', 150', 100', 50'

NOTES:
- SWL = Dry @ installation
- Drilled with 8" air hammer
- Hydrated pellets
- No pump installed

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

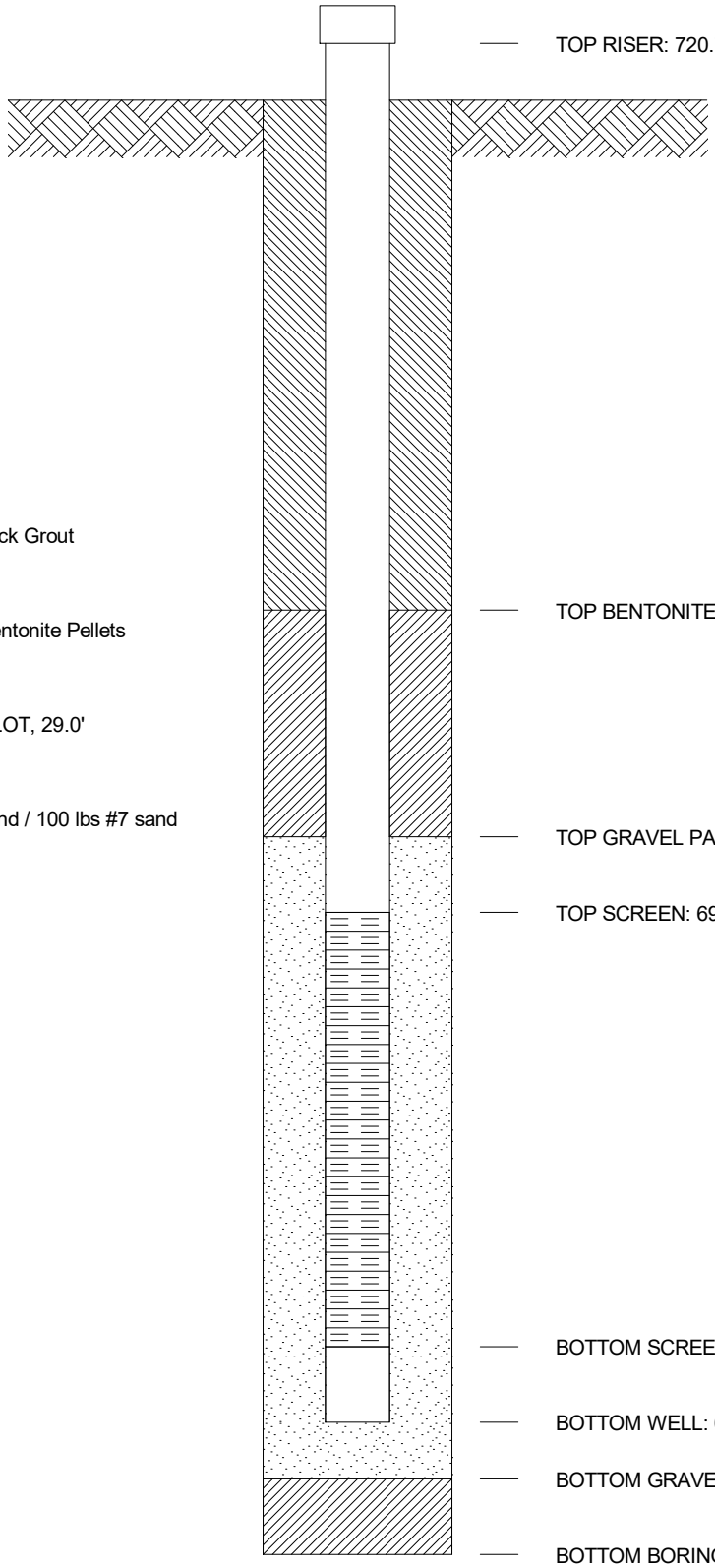
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **MW-26** BORING No. **MW-26** INSTALLED **8/24/05**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 712,549.0 E 1,731,434.9**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 718.20 FT.



GROUT SEAL: 50 Gallons Quick Grout

BENTONITE SEAL: 100 lbs Bentonite Pellets

SCREEN: 2.0" dia., PVC 20 SLOT, 29.0'

GRAVEL PACK: 900 lbs #4 sand / 100 lbs #7 sand

RISER PIPE: 2.0, dia., PVC

SPACERS, DEPTH: 55', 20'

NOTES:
- SWL = Dry @ installation
- Drilled with 8" air hammer
- Hydrated pellets
- Bladder pump set @ 55.3'

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

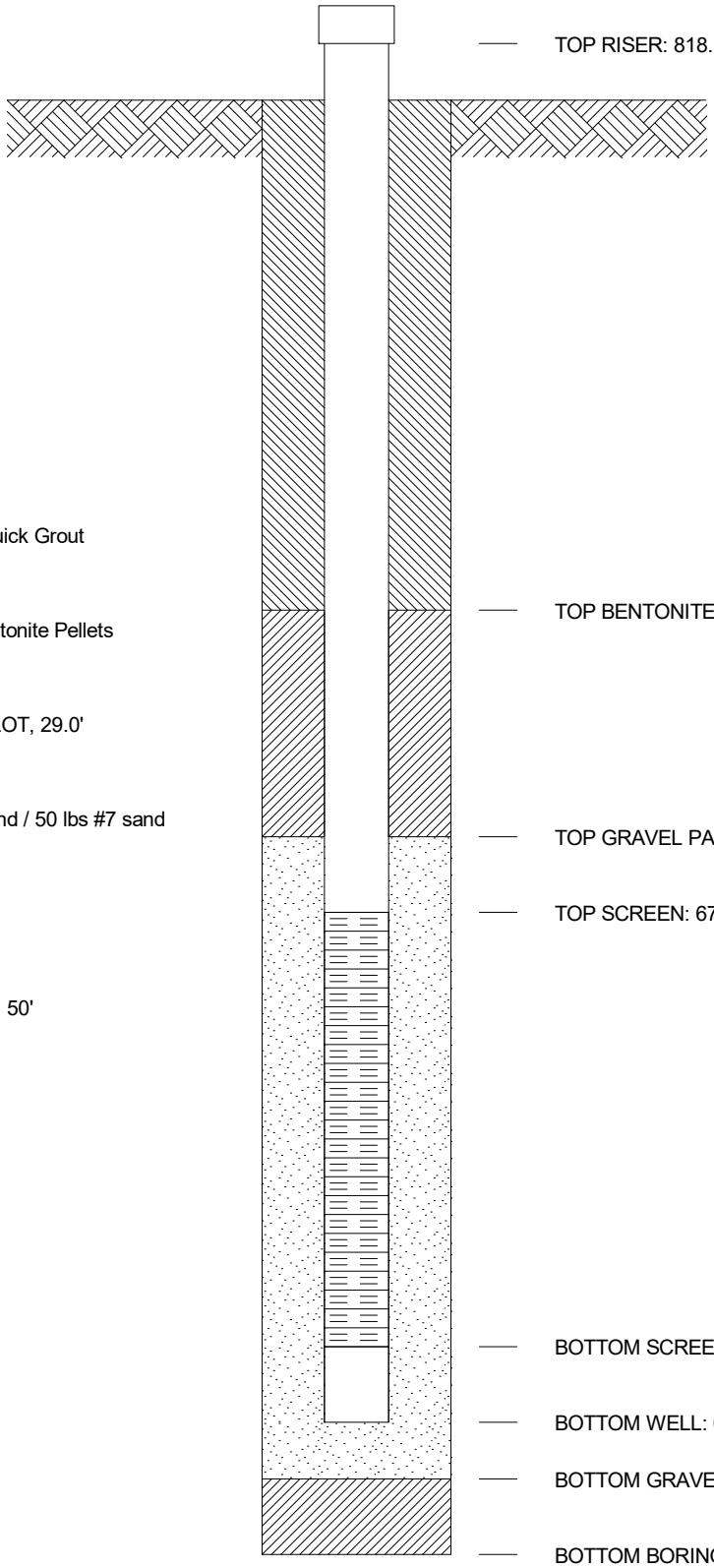
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **MW-34** BORING No. **MW-34** INSTALLED **8/4/05**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 712,520.8 E 1,730,800.7**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 815.60 FT.



GROUT SEAL: 300 Gallons Quick Grout

BENTONITE SEAL: 75 lbs Bentonite Pellets

SCREEN: 2.0" dia., PVC 20 SLOT, 29.0'

GRAVEL PACK: 900 lbs #4 sand / 50 lbs #7 sand

RISER PIPE: 2.0, dia., PVC

SPACERS, DEPTH: 165', 110', 50'

NOTES:
- SWL = 162.4' @ installation
- Drilled with 8" air hammer
- Hydrated pellets
- Bladder pump set @ 167.0'

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

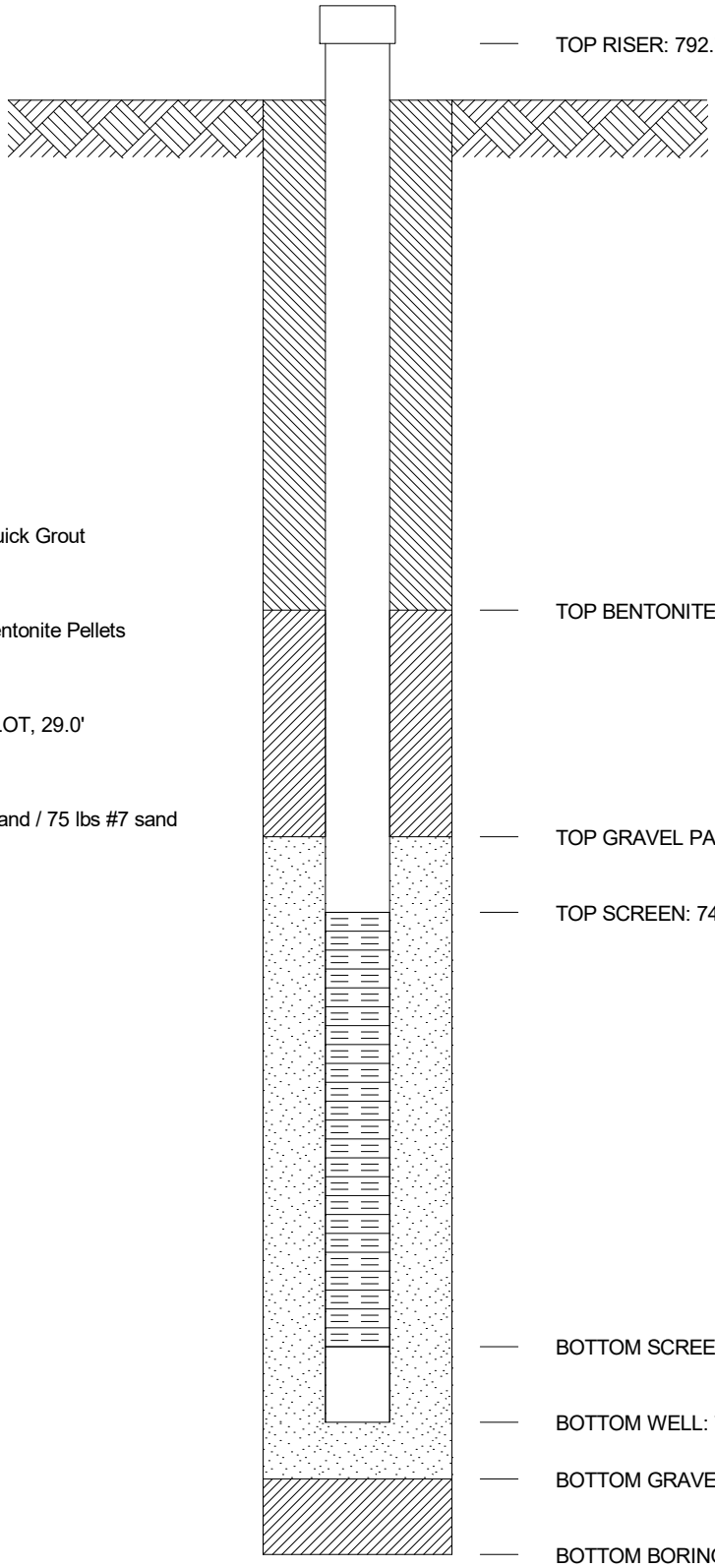
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **MW-35** BORING No. **MW-35** INSTALLED **8/25/05**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 713,097.6 E 1,734,440.0**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 790.10 FT.



GROUT SEAL: 100 Gallons Quick Grout

BENTONITE SEAL: 100 lbs Bentonite Pellets

SCREEN: 2.0" dia., PVC 20 SLOT, 29.0'

GRAVEL PACK: 1000 lbs #4 sand / 75 lbs #7 sand

RISER PIPE: 2.0, dia., PVC

SPACERS, DEPTH: 75', 25'

NOTES:
- SWL = Dry @ installation
- Drilled with 8" air hammer
- Hydrated pellets
- Bladder pump set @ 75.5'

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

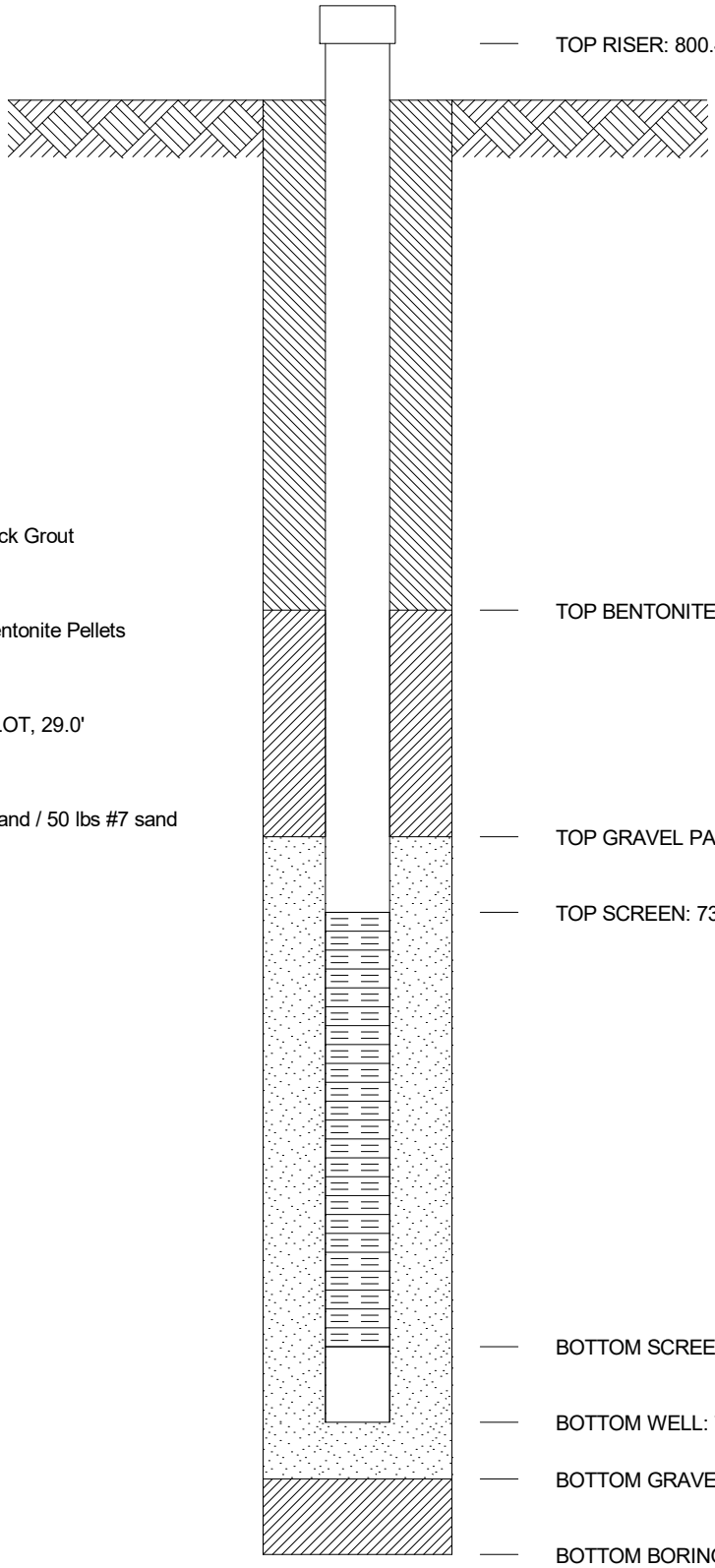
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **MW-36** BORING No. **MW-36** INSTALLED **7/14/05**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 713,372.6 E 1,733,667.3**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 797.60 FT.



GROUT SEAL: 75 Gallons Quick Grout

BENTONITE SEAL: 100 lbs Bentonite Pellets

SCREEN: 2.0" dia., PVC 20 SLOT, 29.0'

GRAVEL PACK: 1150 lbs #4 sand / 50 lbs #7 sand

RISER PIPE: 2.0, dia., PVC

SPACERS, DEPTH: 85', 40'

NOTES:
- SWL = 87.3' @ installation
- Drilled with 8" air hammer
- Hydrated pellets
- Bladder pump set @ 87.0'

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

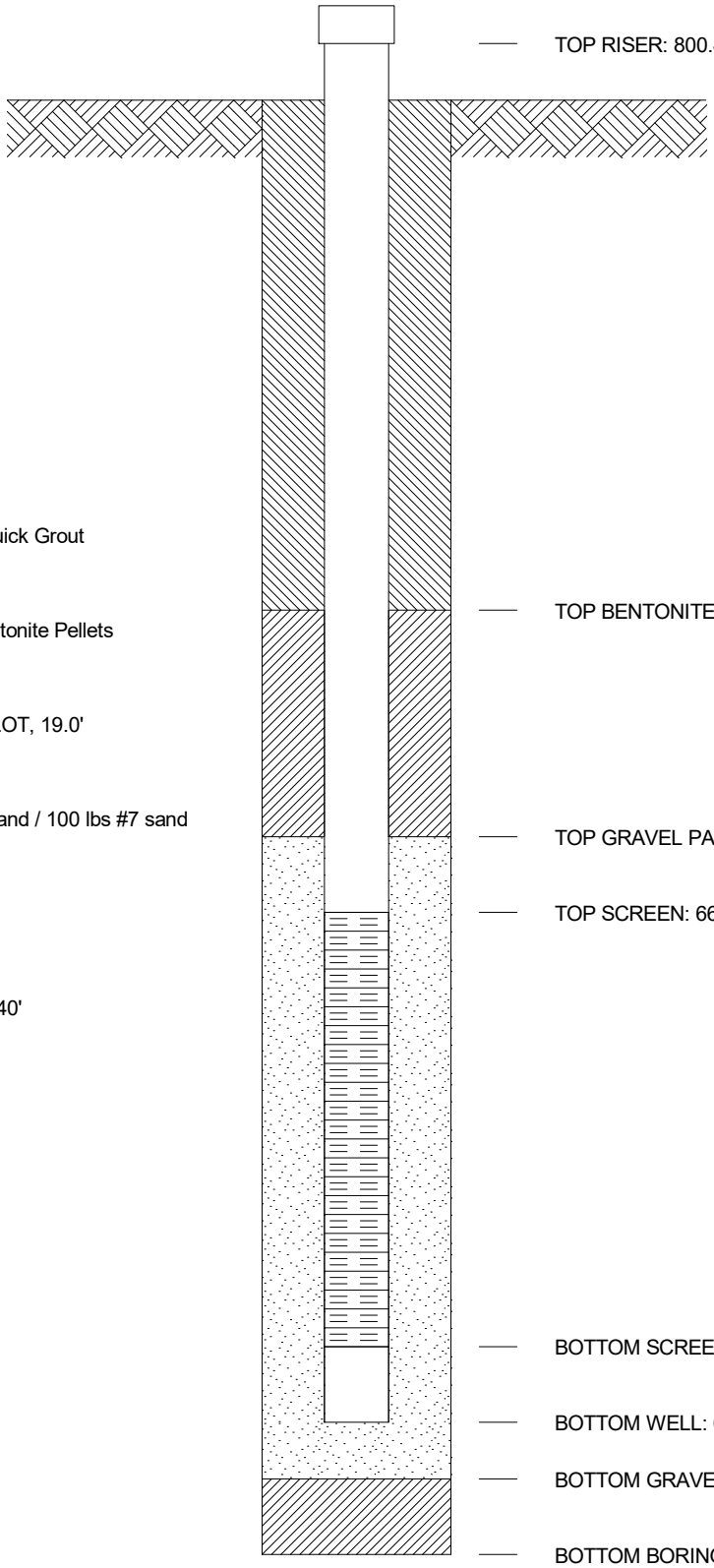
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **MW-37** BORING No. **MW-37** INSTALLED **7/12/05**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 713,377.0 E 1,733,669.5**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 797.60 FT.



GROUT SEAL: 200 Gallons Quick Grout

BENTONITE SEAL: 50 lbs Bentonite Pellets

SCREEN: 2.0" dia., PVC 20 SLOT, 19.0'

GRAVEL PACK: 1300 lbs #4 sand / 100 lbs #7 sand

RISER PIPE: 2.0, dia., PVC

SPACERS, DEPTH: 140', 90', 40'

NOTES:
- SWL = 144.4' @ installation
- Drilled with 8" air hammer
- Hydrated pellets
- Bladder pump set @ 147.4'

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

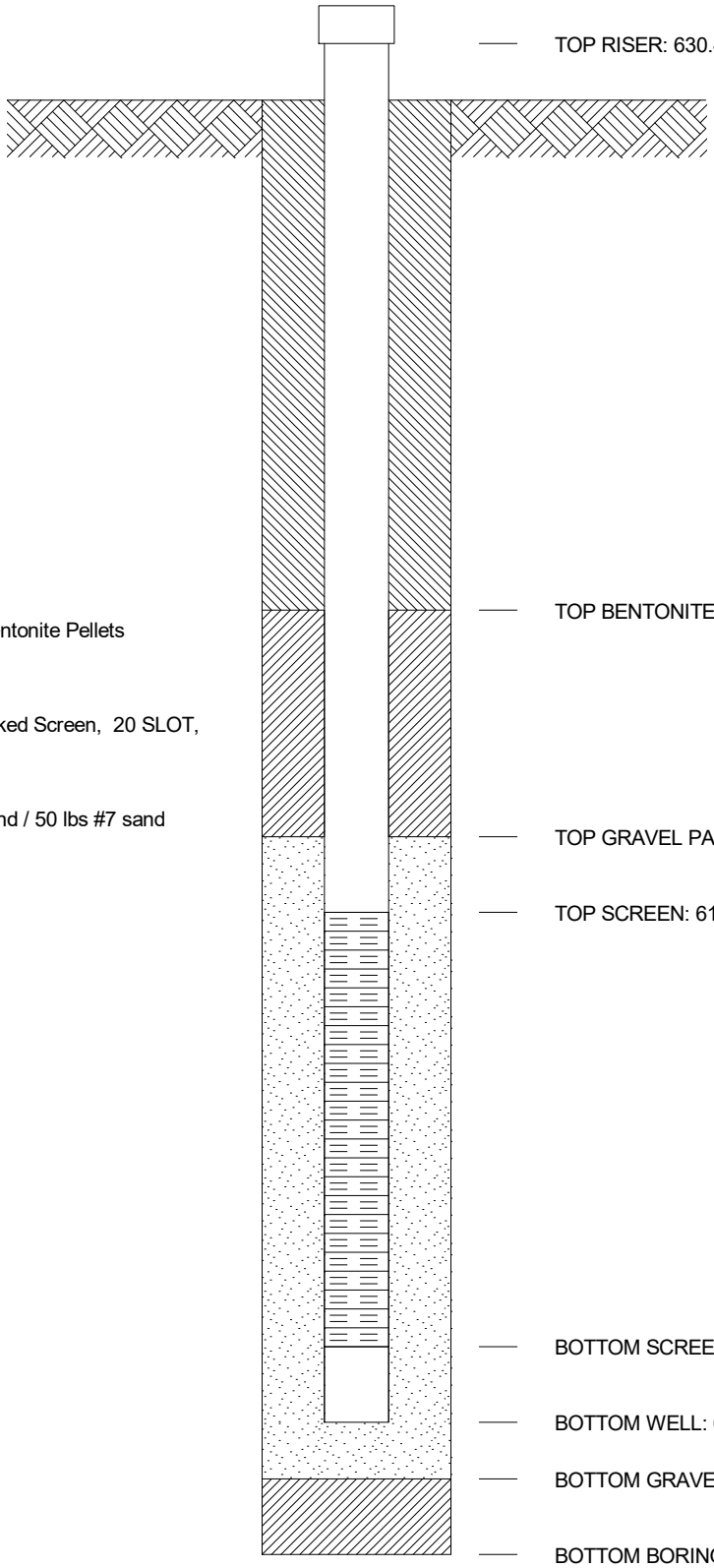
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **MW-38** BORING No. **MW-38** INSTALLED **9/8/05**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 713,736.0 E 1,732,795.5**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 627.70 FT.



GROUT SEAL: Hole Plug

BENTONITE SEAL: 125 lbs Bentonite Pellets

SCREEN: 2.0" dia., 15' Prepacked Screen, 20 SLOT, 15.0'

GRAVEL PACK: 750 lbs #4 sand / 50 lbs #7 sand

RISER PIPE: 2.0, dia., PVC

SPACERS, DEPTH: 23'

NOTES:
- SWL = Dry @ installation
- Drilled with 6.25" HSA's
- Hydrated pellets
- Bladder pump set @ 22.4'
- Hole plug from 3.8' to grade

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

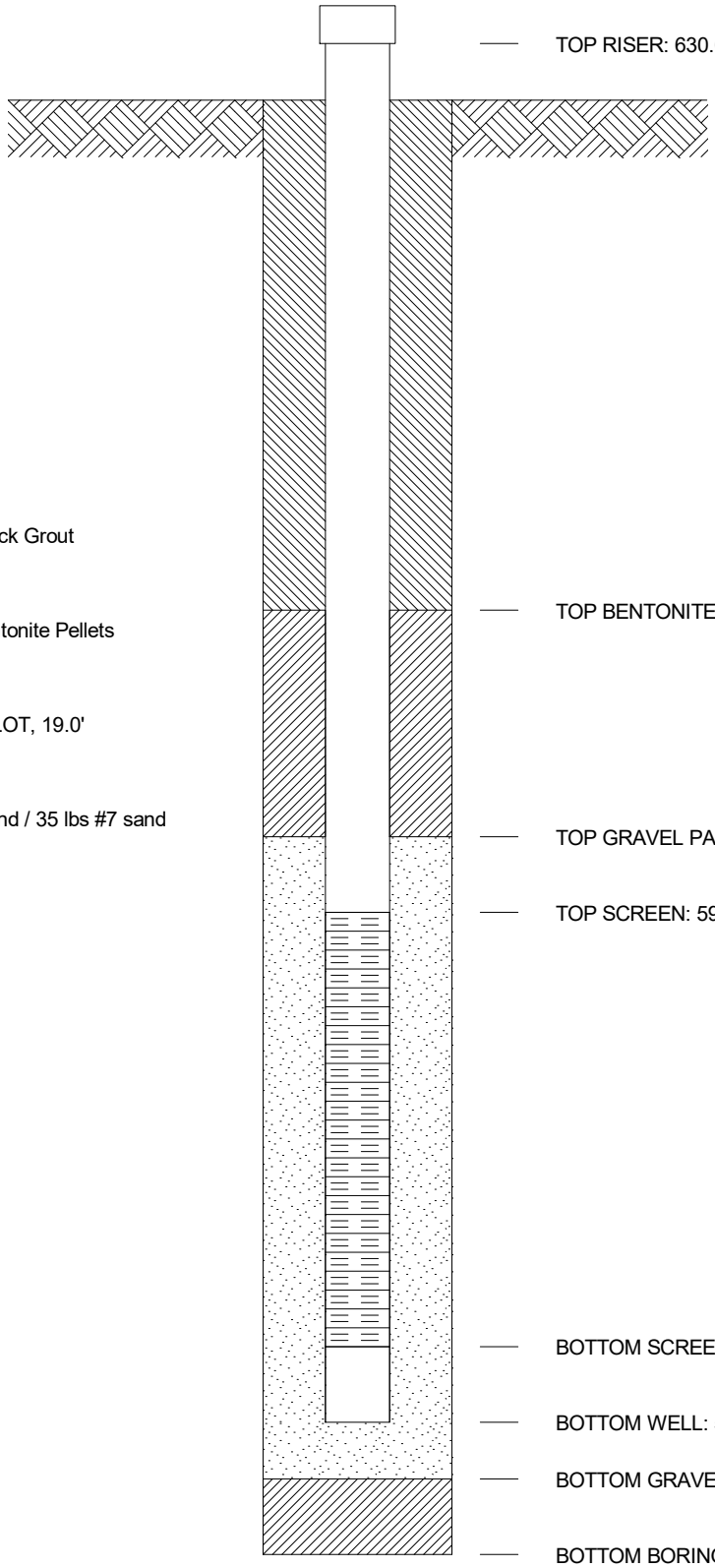
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **MW-39** BORING No. **MW-39** INSTALLED **9/7/05**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 713,734.6 E 1,732,787.2**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 627.70 FT.



GROUT SEAL: 50 Gallons Quick Grout

BENTONITE SEAL: 50 lbs Bentonite Pellets

SCREEN: 2.0" dia., PVC 20 SLOT, 19.0'

GRAVEL PACK: 300 lbs #4 sand / 35 lbs #7 sand

RISER PIPE: 2.0, dia., PVC

SPACERS, DEPTH: 50', 20'

NOTES:
- SWL = 12.4' @ installation
- Drilled with 6" rotary wash
- Bladder pump set @ 53.5'

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

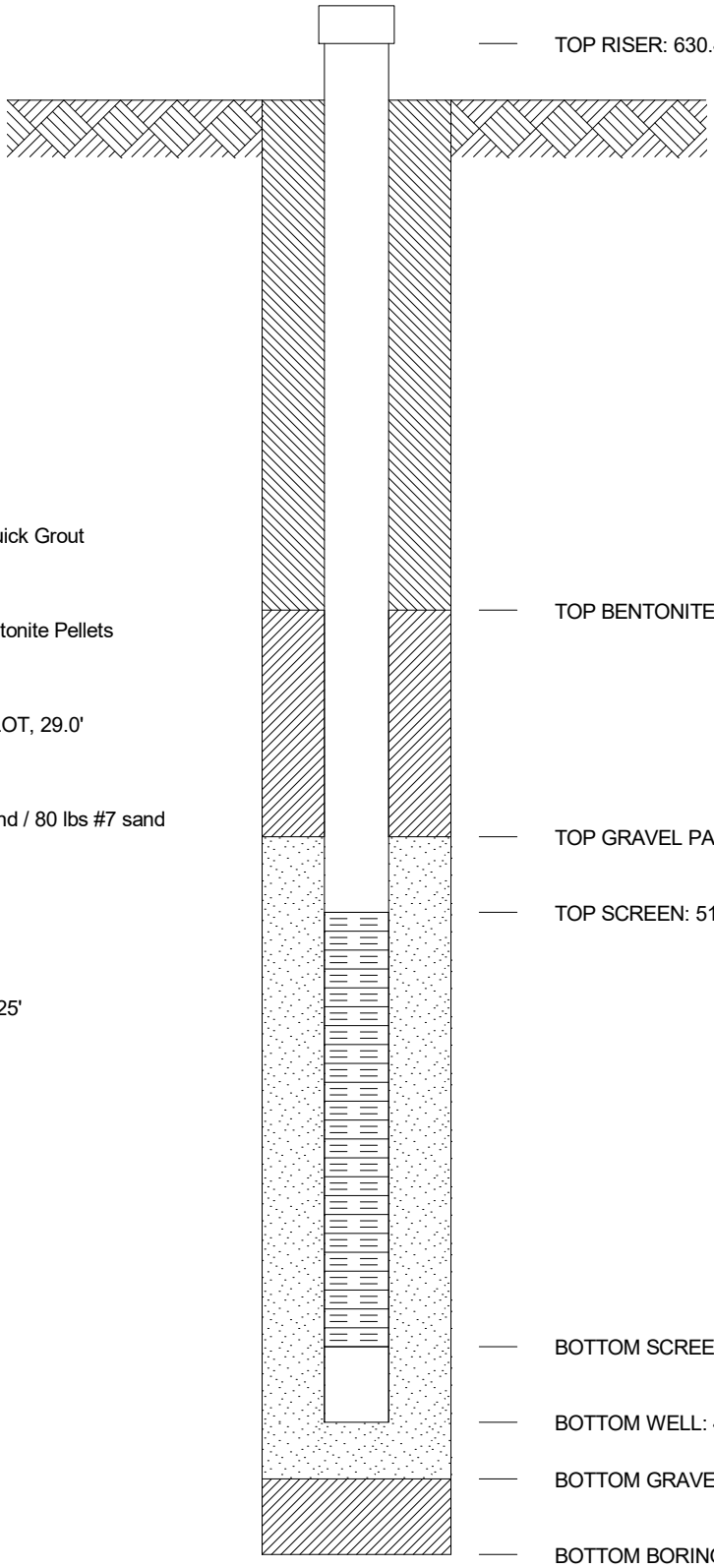
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **MW-40** BORING No. **MW-40** INSTALLED **9/6/05**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 713,730.4 E 1,732,785.1**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 627.70 FT.



GROUT SEAL: 150 Gallons Quick Grout

BENTONITE SEAL: 80 lbs Bentonite Pellets

SCREEN: 2.0" dia., PVC 20 SLOT, 29.0'

GRAVEL PACK: 550 lbs #4 sand / 80 lbs #7 sand

RISER PIPE: 2.0, dia., PVC

SPACERS, DEPTH: 135', 75', 25'

NOTES:
- SWL = 16.8' @ installation
- Drilled with 6" rotary wash
- Bladder pump set @ 138.5'

GEOMCNST MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

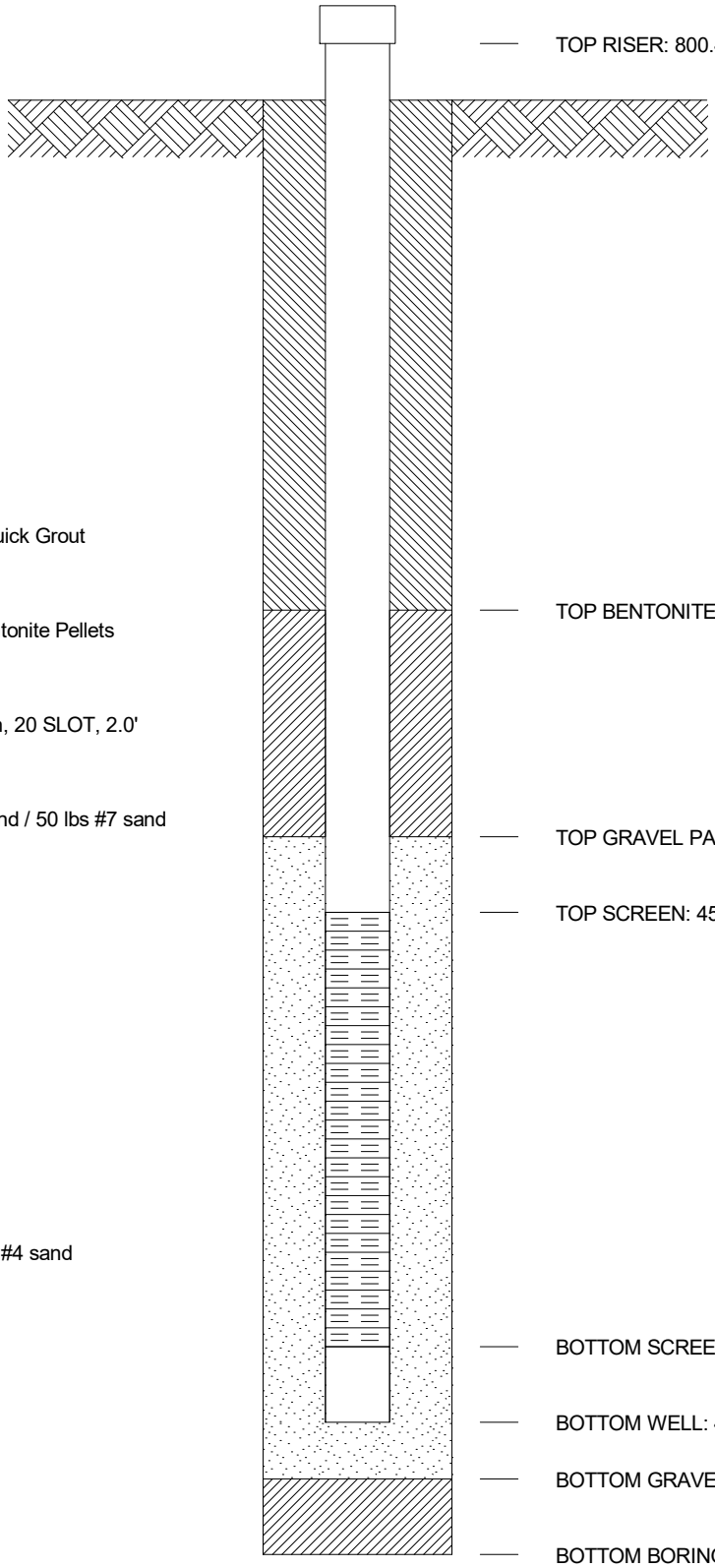
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **MW-41** BORING No. **MW-41** INSTALLED **8/1/05**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 713,381.3 E 1,733,671.6**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 797.60 FT.



GROUT SEAL: 200 Gallons Quick Grout

BENTONITE SEAL: 40 lbs Bentonite Pellets

SCREEN: 1.0" dia., 1" Geomon, 20 SLOT, 2.0'

GRAVEL PACK: 250 lbs #4 sand / 50 lbs #7 sand

RISER PIPE: , dia.,

SPACERS, DEPTH:

NOTES:
- SWL = NA @ installation
- Drilled with NQ Rock Core
- Bottom of hole backfilled with #4 sand

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

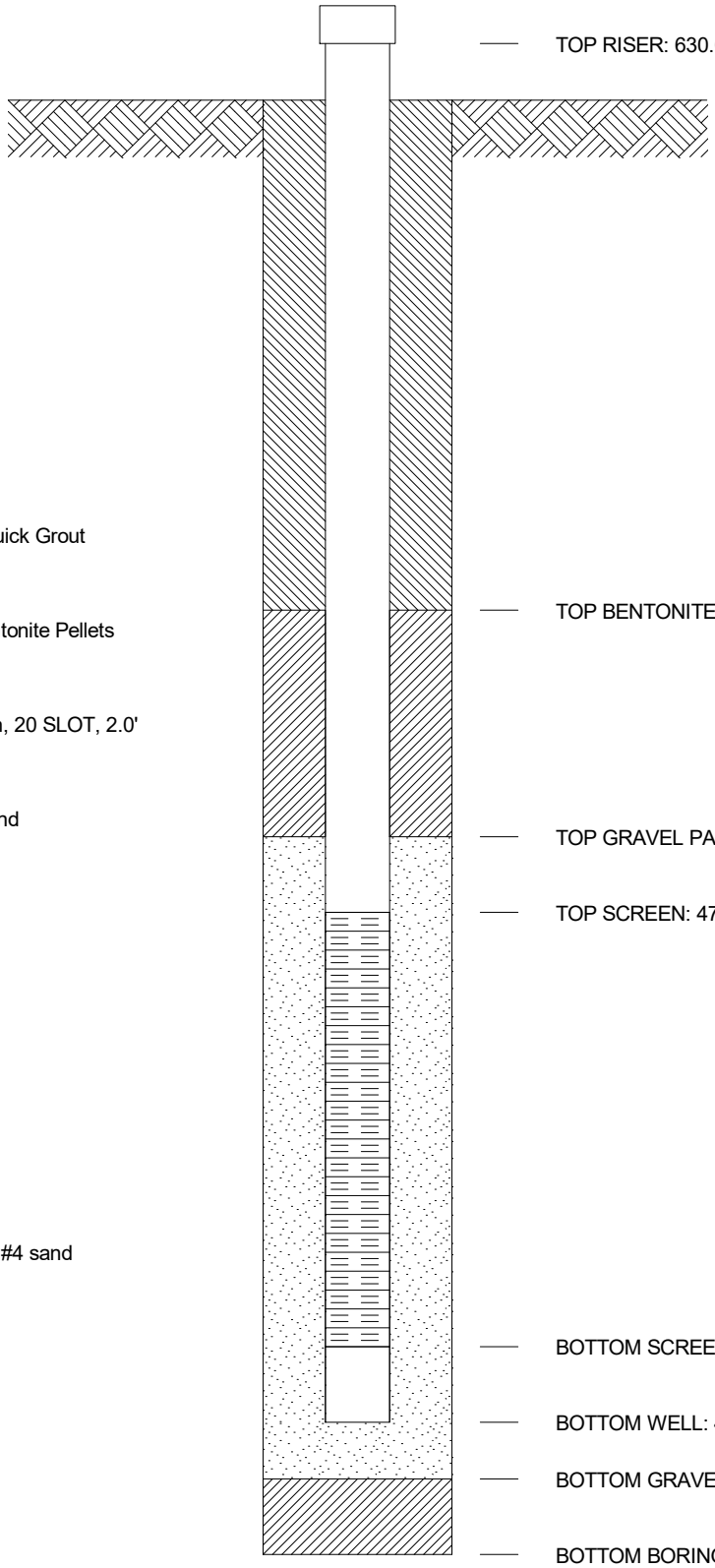
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **MW-42** BORING No. **MW-42** INSTALLED **9/8/05**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 713,726.5 E 1,732,783.6**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 627.70 FT.



GROUT SEAL: 100 Gallons Quick Grout

BENTONITE SEAL: 30 lbs Bentonite Pellets

SCREEN: 1.0" dia., 1" Geomon, 20 SLOT, 2.0'

GRAVEL PACK: 150 lbs #4 sand

RISER PIPE: , dia.,

SPACERS, DEPTH:

NOTES:
- SWL = 14.8 @ installation
- Drilled with NQ Rock Core
- Bottom of hole backfilled with #4 sand

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

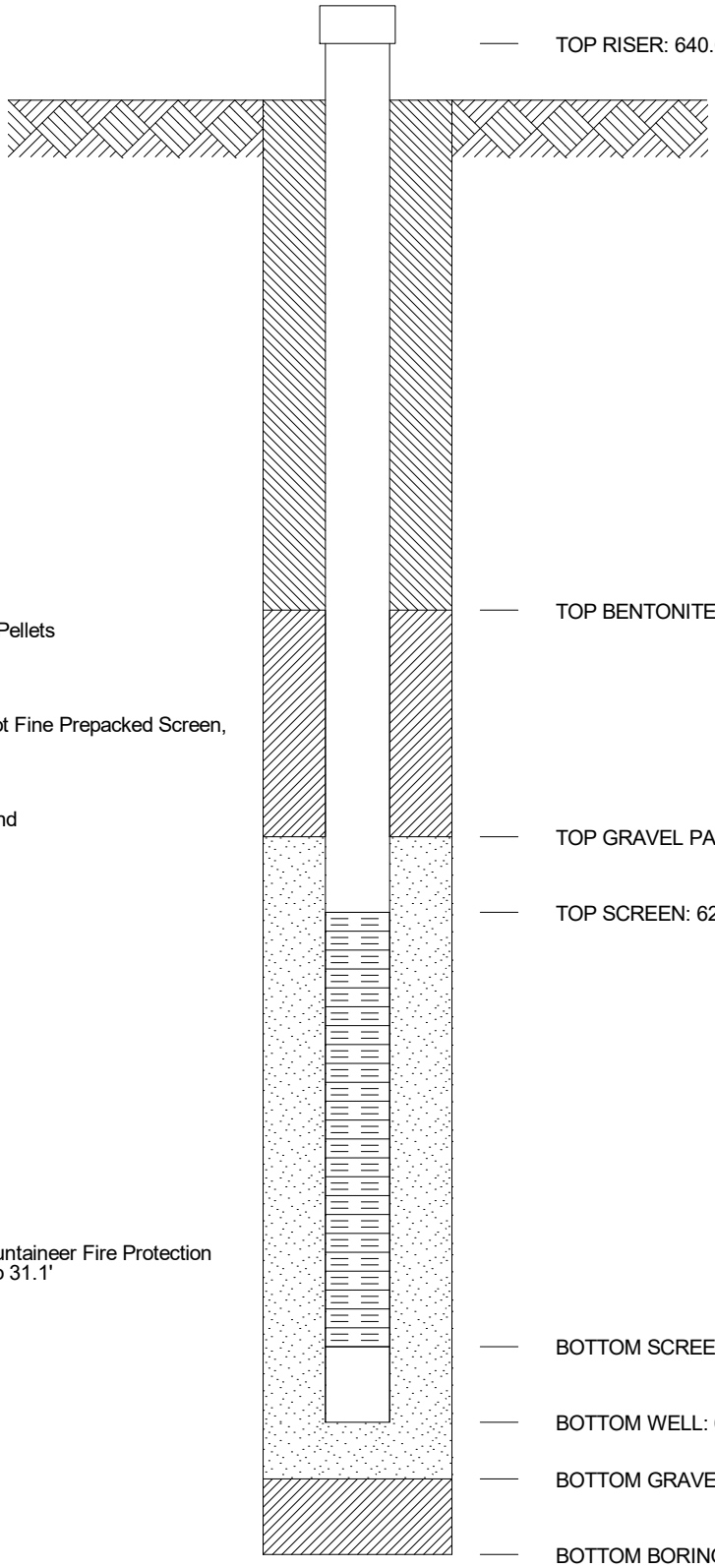
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **MW-43** BORING No. **MW-43** INSTALLED **7/12/06**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 714,609.8 E 1,733,558.2**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 636.58 FT.



GROUT SEAL:

BENTONITE SEAL: Bentonite Pellets

SCREEN: 2.0" dia., 20' #10 Slot Fine Prepacked Screen, 18.8'

GRAVEL PACK: #4 Quartz Sand

RISER PIPE: 2.0, dia., PVC

SPACERS, DEPTH:

NOTES:
- Installed w/6.25" HSA's
- SWL = 8.2' @ installation
- Drill & Decon Water from Mountaineer Fire Protection
- Bentonite Pellets from 49.5' to 31.1'
- Hydrated Upper Seal
- Well Development Performed

GEOMCNST MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

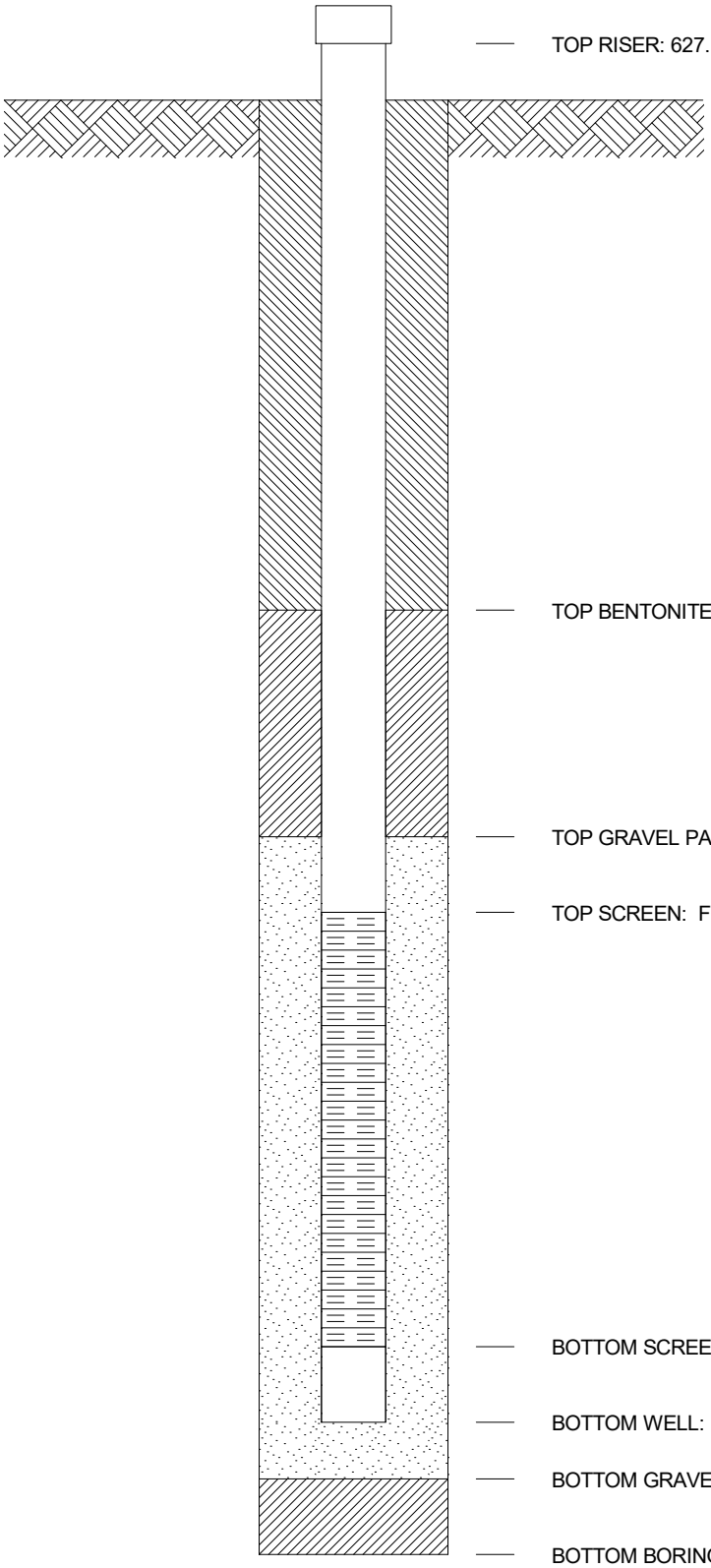
COMPANY **APPALACHIAN POWER COMPANY** WELL No. _____ BORING No. **MW-44** INSTALLED **6/10/08**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 714,697.9 E 1,733,351.5**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 624.49 FT.



GROUT SEAL:

BENTONITE SEAL:

SCREEN: dia., ,

GRAVEL PACK:

RISER PIPE: , dia.,

SPACERS, DEPTH:

GEOMCNST MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

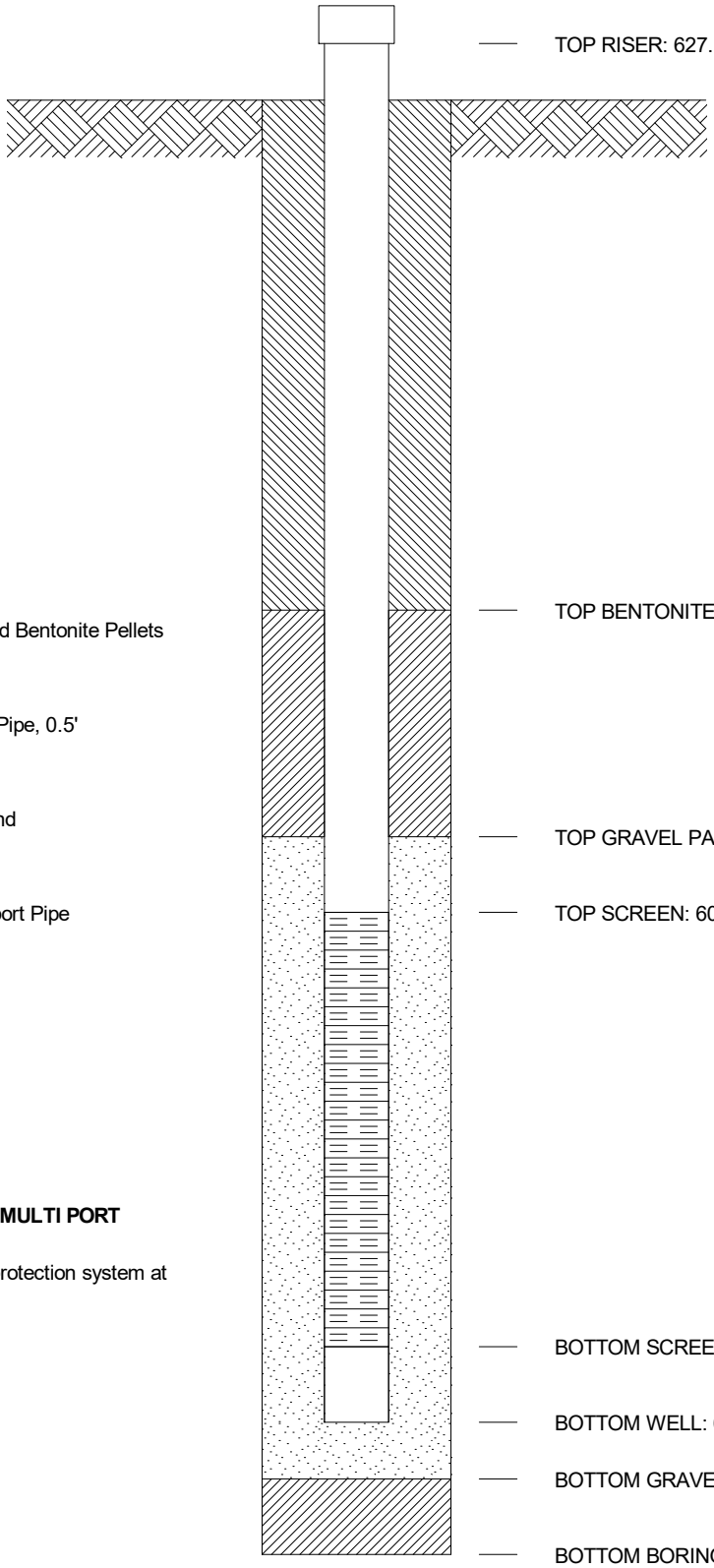
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **MW-44D** BORING No. **MW-44D** INSTALLED **6/18/08**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 714,697.9 E 1,733,351.5**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 624.49 FT.



GROUT SEAL: NA

BENTONITE SEAL: 3/8" Coated Bentonite Pellets

SCREEN: 1.77" dia., Multiport Pipe, 0.5'

GRAVEL PACK: #4 Quartz Sand

RISER PIPE: 1.77", dia., Multiport Pipe

SPACERS, DEPTH:

NOTES: Abandoned 11/22/10
THIS WELL IS PART OF THE MULTI PORT MONITORING WELL.
- Drilled with 4" HW Casing
- Decon & drill water from fire protection system at Mountaineer Plant
- Sampling Channel #7

GEOMCNST MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

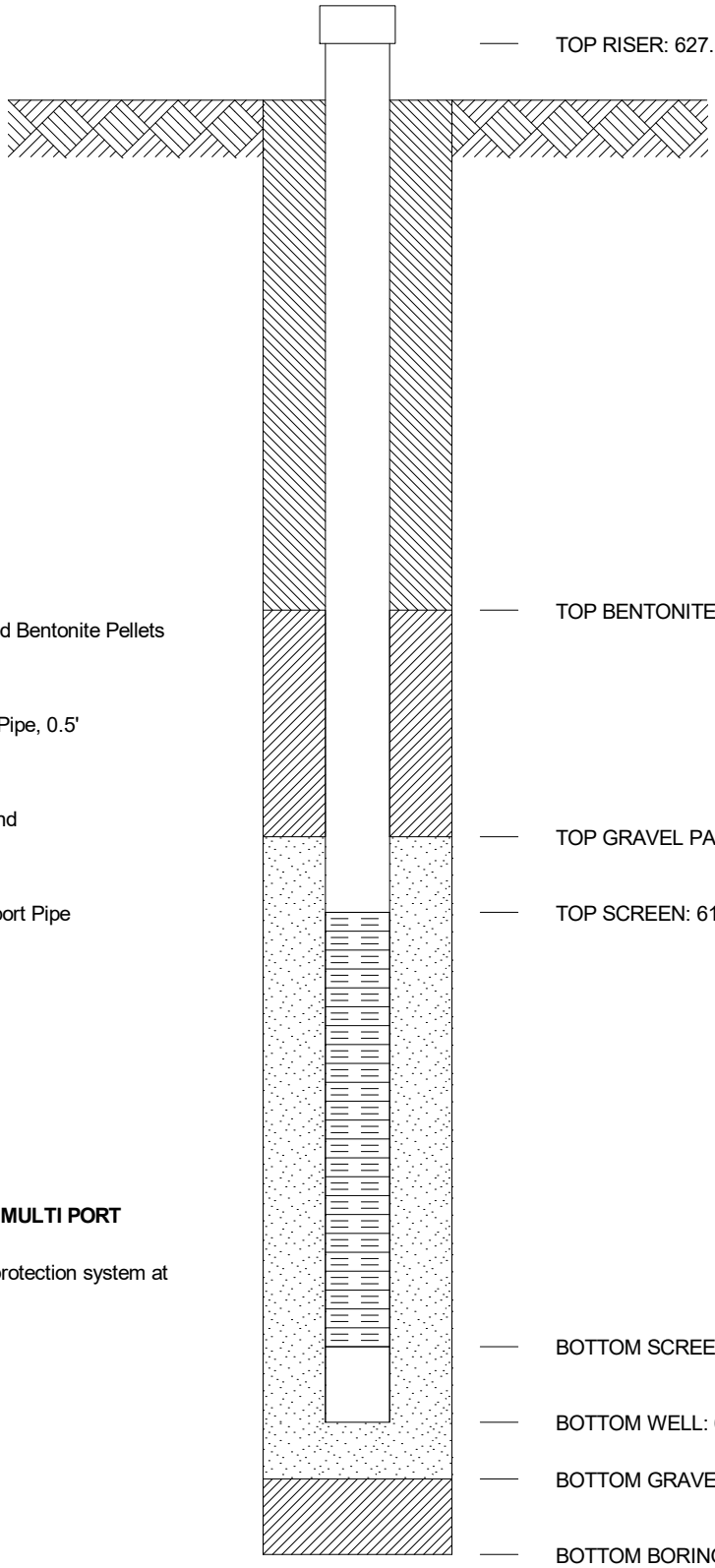
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **MW-44I** BORING No. **MW-44I** INSTALLED **6/18/08**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 714,697.9 E 1,733,351.5**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 624.49 FT.



GROUT SEAL: NA

BENTONITE SEAL: 3/8" Coated Bentonite Pellets

SCREEN: 1.77" dia., Multiport Pipe, 0.5'

GRAVEL PACK: #4 Quartz Sand

RISER PIPE: 1.77", dia., Multiport Pipe

SPACERS, DEPTH:

NOTES: Abandoned 11/22/10
THIS WELL IS PART OF THE MULTI PORT MONITORING WELL.
- Drilled with 4" HW Casing
- Decon & drill water from fire protection system at Mountaineer Plant
- Sampling Channel #3

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

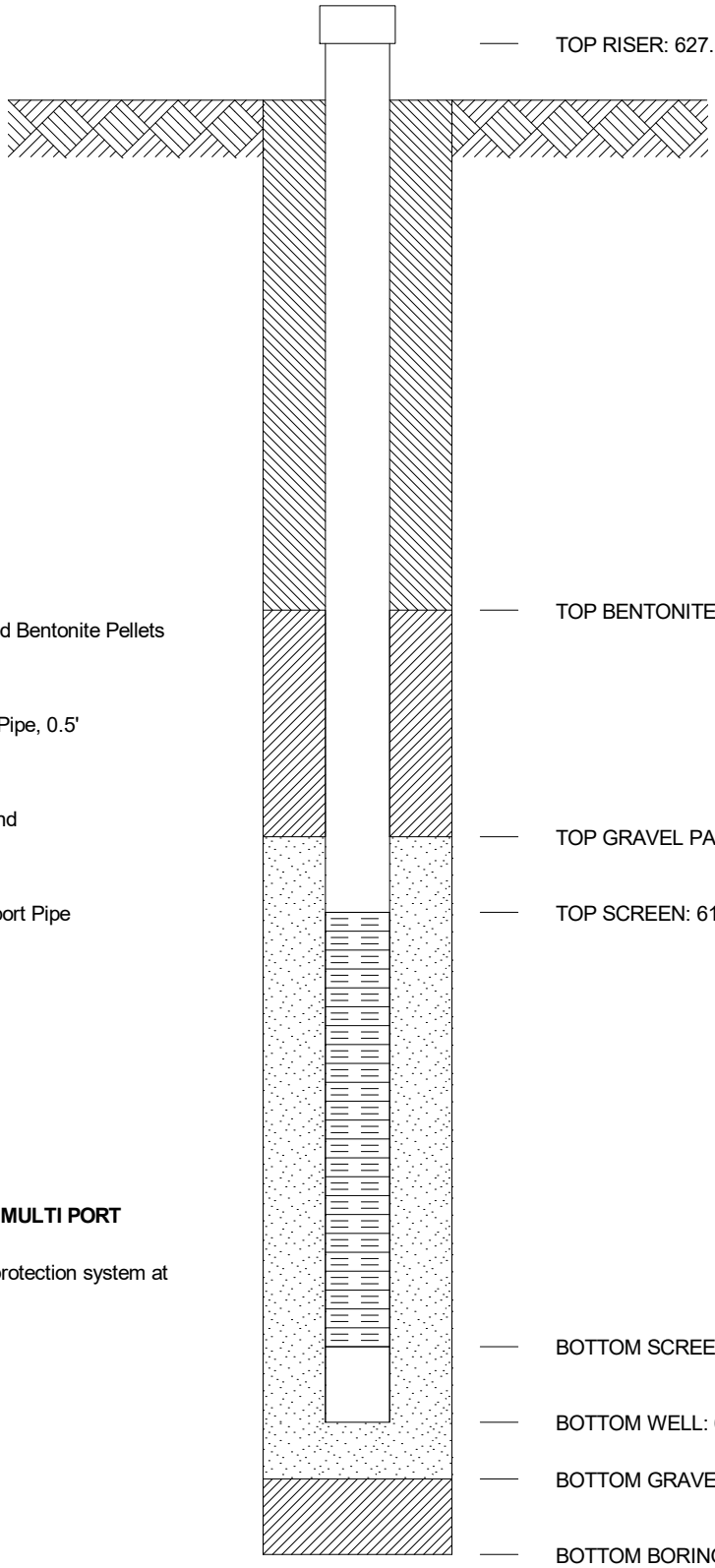
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **MW-44S** BORING No. **MW-44S** INSTALLED **6/18/08**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 714,697.9 E 1,733,351.5**

SYSTEM **State Plane using NAD27**

GROUND ELEVATION 624.49 FT.



GROUT SEAL: NA

BENTONITE SEAL: 3/8" Coated Bentonite Pellets

SCREEN: 1.77" dia., Multiport Pipe, 0.5'

GRAVEL PACK: #4 Quartz Sand

RISER PIPE: 1.77", dia., Multiport Pipe

SPACERS, DEPTH:

NOTES: Abandoned 11/22/10
THIS WELL IS PART OF THE MULTI PORT MONITORING WELL.
- Drilled with 4" HW Casing
- Decon & drill water from fire protection system at Mountaineer Plant
- Sampling Channel #1

GEOMCNST MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

ARCADIS

AEP 1996, 1997

Monitoring Well Construction Diagrams

9623, 9624, 9627 to 9633

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

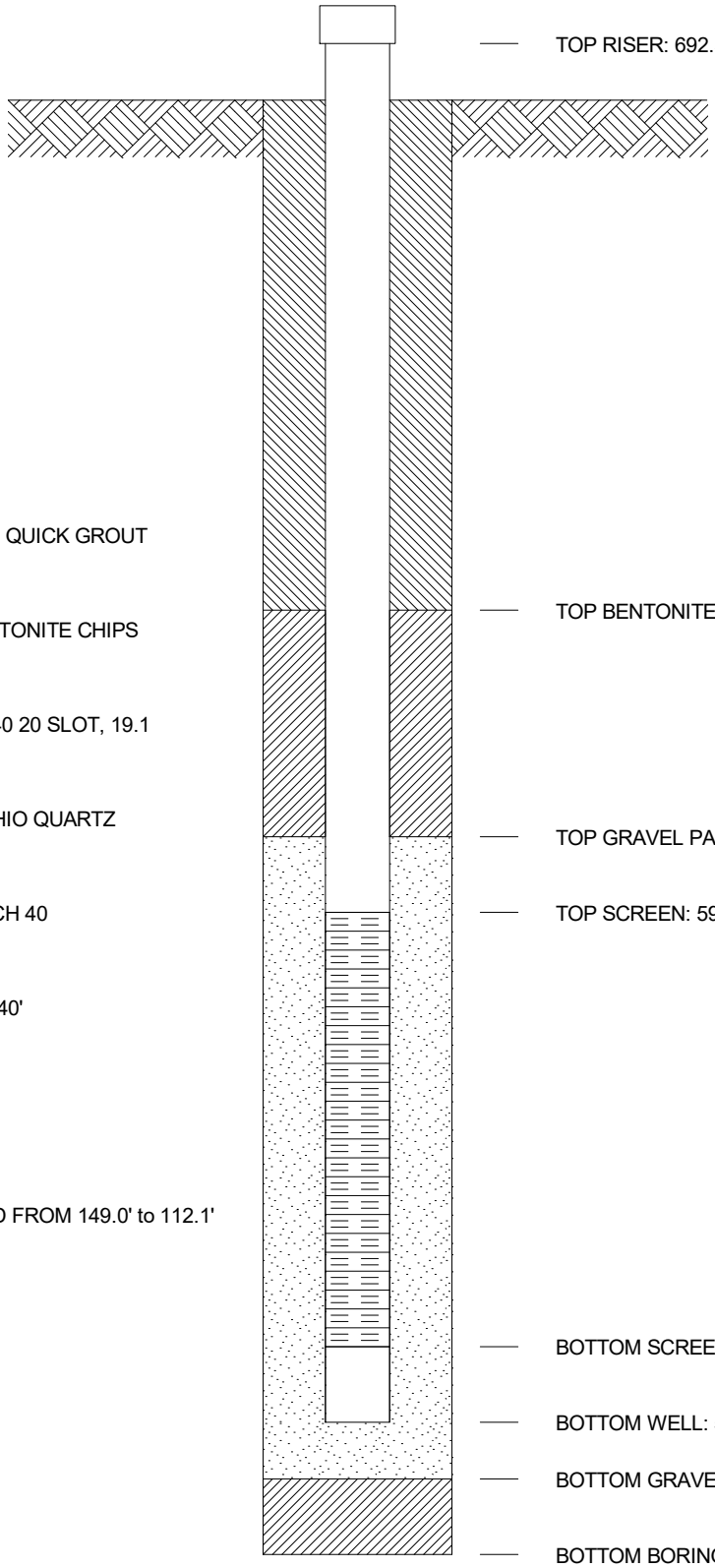
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **9623** BORING No. **96-23** INSTALLED **10/15/96**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 708,450.6 E 1,698,953.5**

SYSTEM

GROUND ELEVATION 690.45 FT.



GROUT SEAL: 400 GALLONS QUICK GROUT

BENTONITE SEAL: 120# BENTONITE CHIPS

SCREEN: 2.0 dia., PVC SCH 40 20 SLOT, 19.1

GRAVEL PACK: 700# No.4 OHIO QUARTZ

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH: 110', 90', 40'

SWL @ COMPLETION - 32.0'
90# BENTONITE CHIPS USED FROM 149.0' to 112.1'

GEOMCNST MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER _____

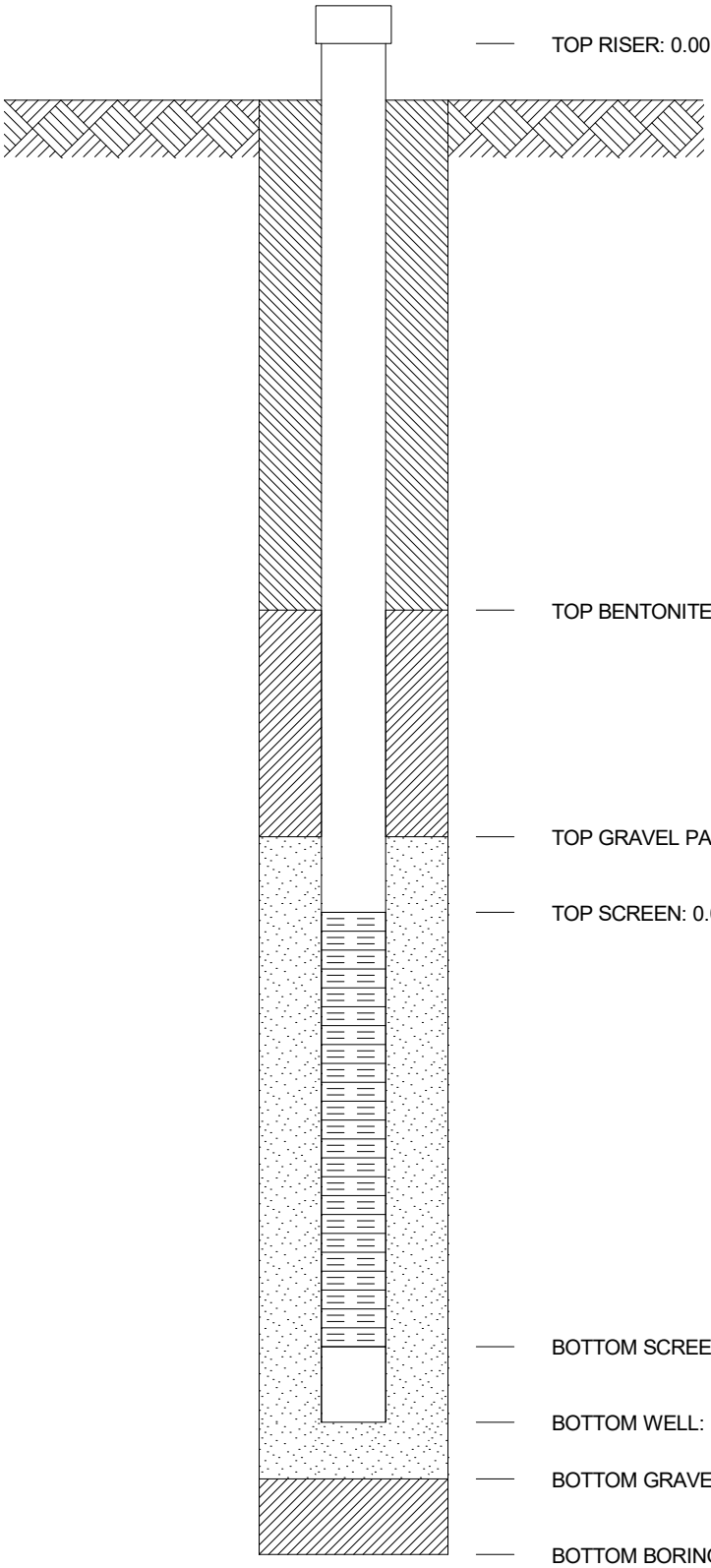
COMPANY **APPALACHIAN POWER COMPANY** WELL No. _____ BORING No. **96-24** INSTALLED **9/23/96**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 709,245.0 E 1,732,142.0**

SYSTEM _____

GROUND ELEVATION 825.49 FT.



GROUT SEAL:

BENTONITE SEAL:

SCREEN: dia., ,

GRAVEL PACK:

RISER PIPE: , dia.,

SPACERS, DEPTH:

GEOMCNST MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

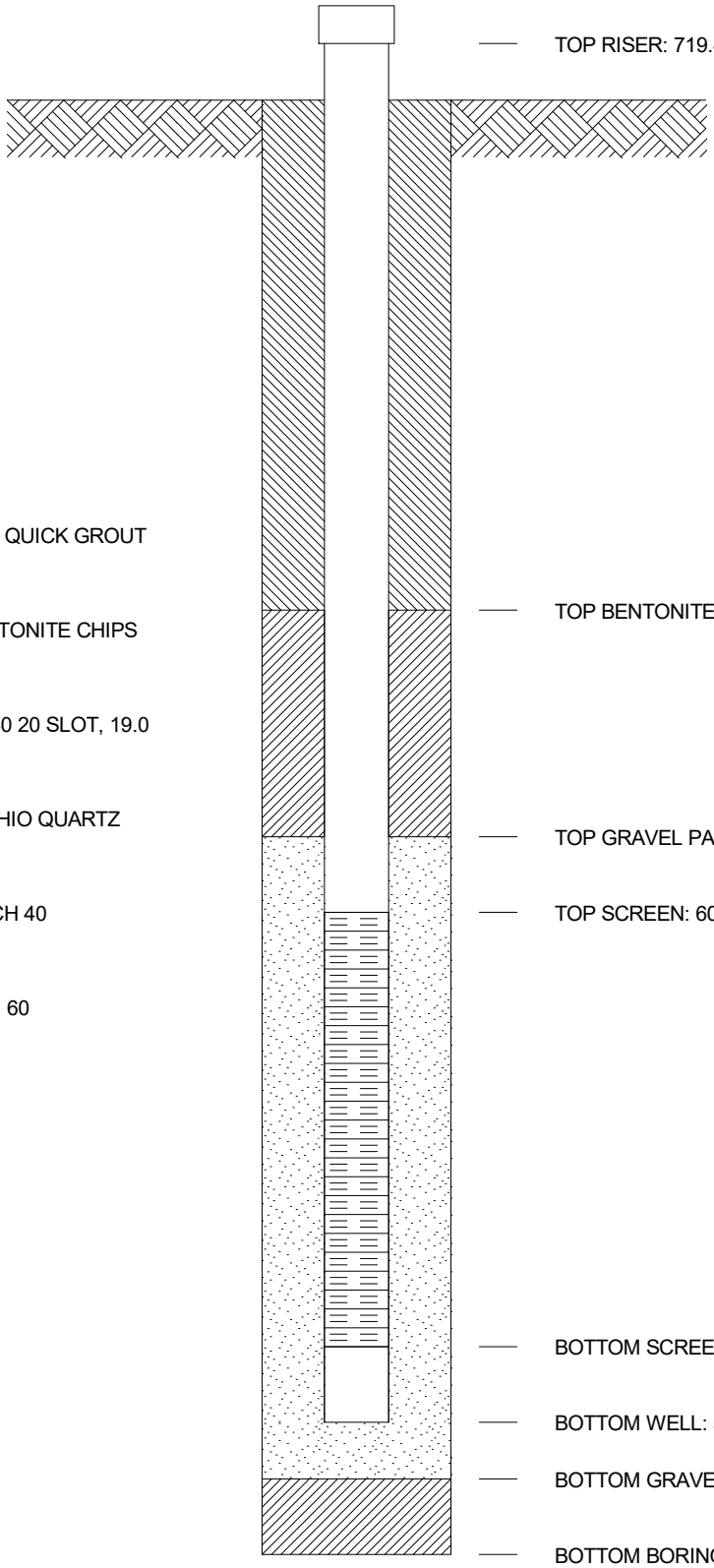
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **9627** BORING No. **96-27** INSTALLED **10/9/96**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 712,597.9 E 1,699,973.8**

SYSTEM

GROUND ELEVATION 718.06 FT.



TOP RISER: 719.49 FT.

TOP BENTONITE SEAL: 615.46 FT.

TOP GRAVEL PACK: 609.06 FT.

TOP SCREEN: 607.06 FT.

BOTTOM SCREEN: 588.06 FT.

BOTTOM WELL: 586.96 FT.

BOTTOM GRAVEL PACK: 586.06 FT.

BOTTOM BORING: 536.86 FT.

GROUT SEAL: 350 GALLONS QUICK GROUT

BENTONITE SEAL: 150# BENTONITE CHIPS

SCREEN: 2.0 dia., PVC SCH 40 20 SLOT, 19.0

GRAVEL PACK: 650# No. 4 OHIO QUARTZ

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH: 130', 110', 60

SWL @ COMPLETION - 99.8'

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

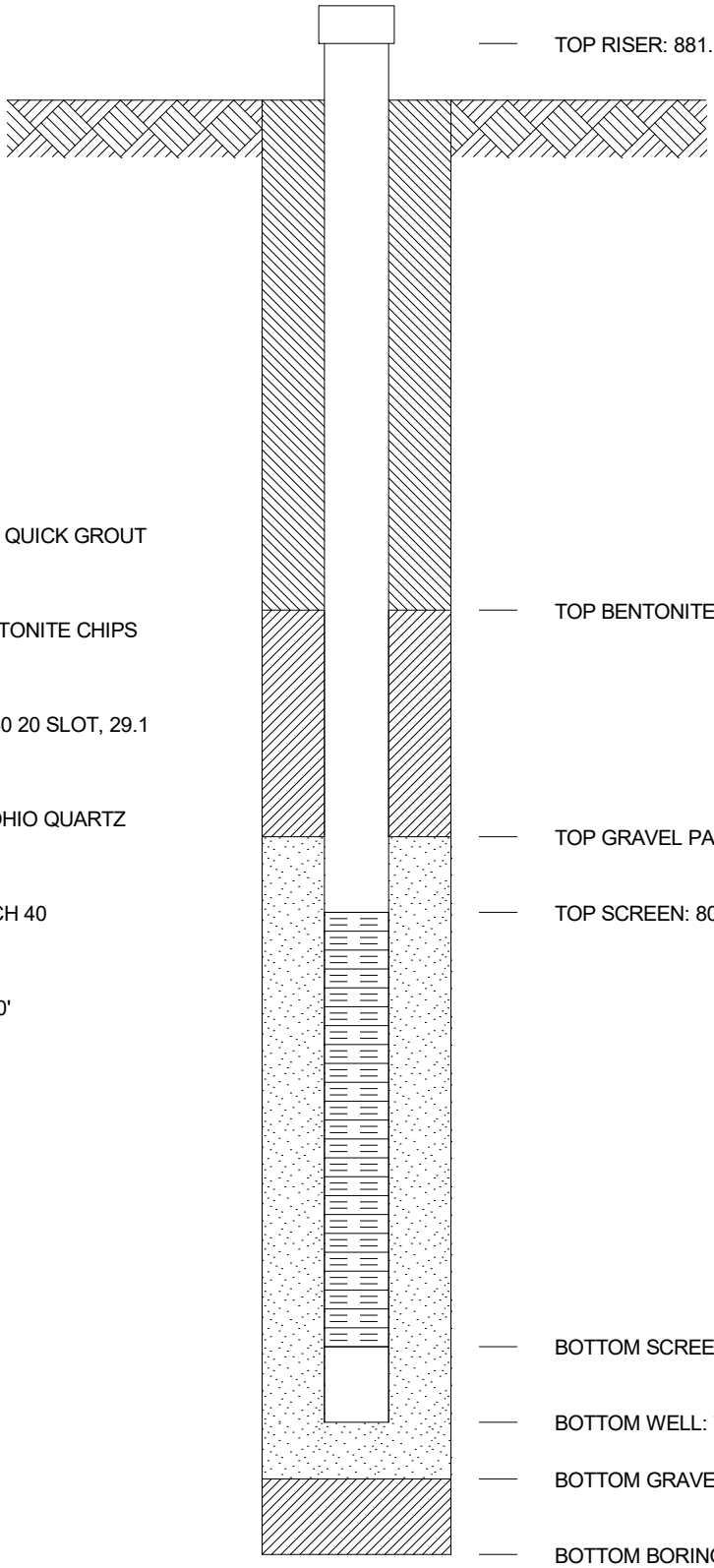
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **9628** BORING No. **96-28** INSTALLED **12/10/96**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 708,701.0 E 1,697,043.0**

SYSTEM

GROUND ELEVATION 879.56 FT.



GROUT SEAL: 150 GALLONS QUICK GROUT

BENTONITE SEAL: 150# BENTONITE CHIPS

SCREEN: 2.0 dia., PVC SCH 40 20 SLOT, 29.1

GRAVEL PACK: 1200# No.4 OHIO QUARTZ

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH: 99', 85', 40'

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

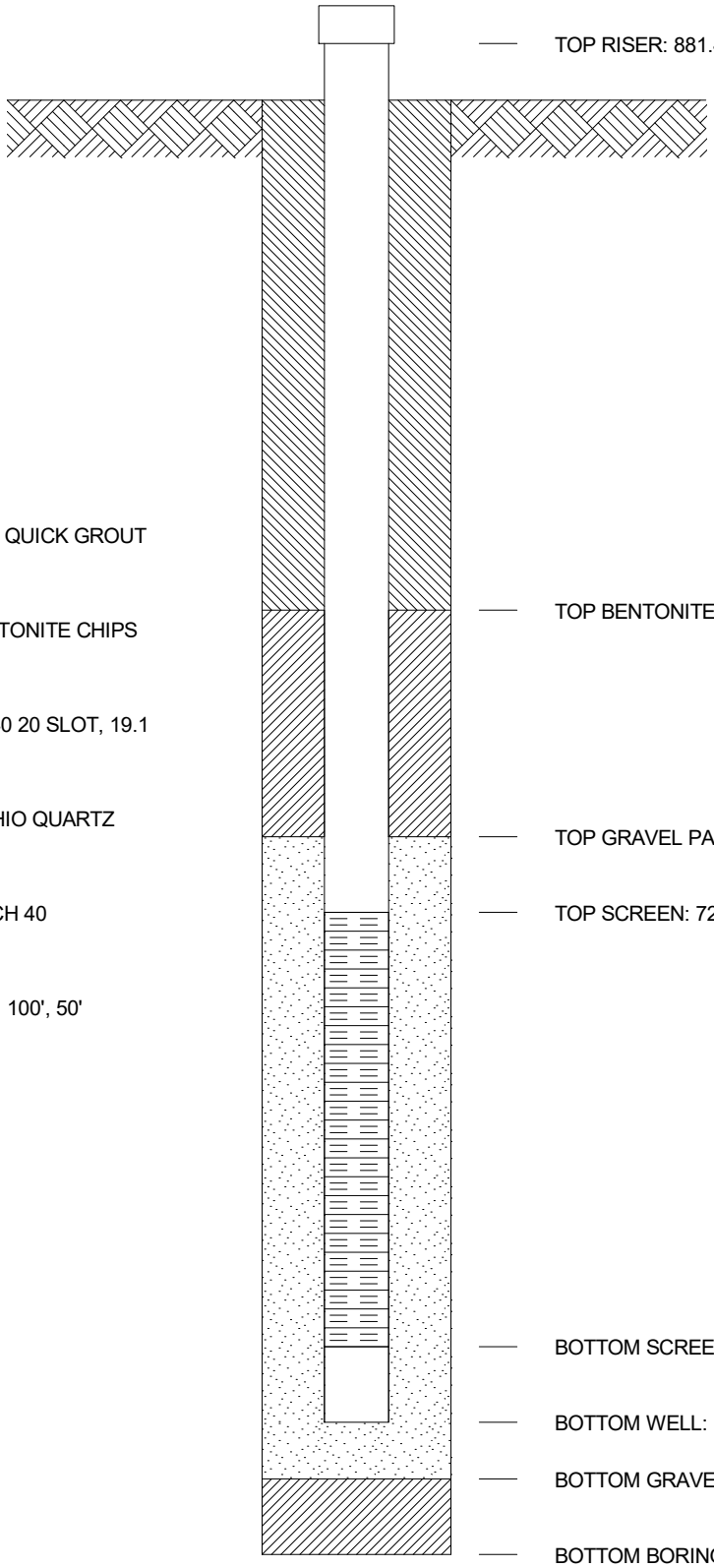
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **9629** BORING No. **96-29** INSTALLED **12/4/96**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 708,701.2 E 1,697,043.2**

SYSTEM

GROUND ELEVATION 879.75 FT.



TOP RISER: 881.43 FT.

TOP BENTONITE SEAL: FT.

TOP GRAVEL PACK: FT.

TOP SCREEN: 726.95 FT.

BOTTOM SCREEN: 707.85 FT.

BOTTOM WELL: FT.

BOTTOM GRAVEL PACK: FT.

BOTTOM BORING: 654.75 FT.

GROUT SEAL: 300 GALLONS QUICK GROUT

BENTONITE SEAL: 150# BENTONITE CHIPS

SCREEN: 2.0 dia., PVC SCH 40 20 SLOT, 19.1

GRAVEL PACK: 750# No.4 OHIO QUARTZ

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH: 171', 151', 100', 50'

????

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

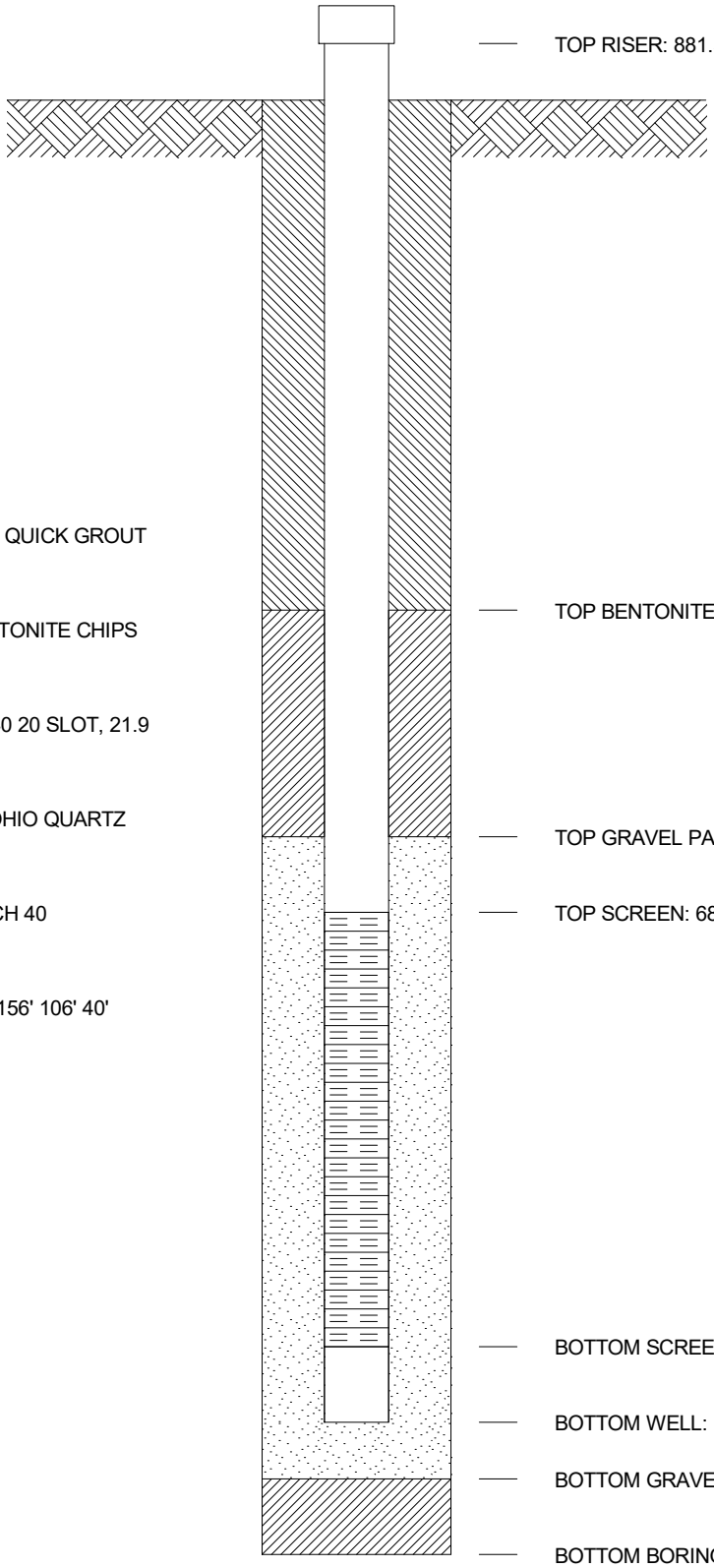
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **9630** BORING No. **96-30** INSTALLED **9/11/96**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 708,701.0 E 1,697,043.0**

SYSTEM

GROUND ELEVATION 879.83 FT.



GROUT SEAL: 500 GALLONS QUICK GROUT

BENTONITE SEAL: 150# BENTONITE CHIPS

SCREEN: 2.0 dia., PVC SCH 40 20 SLOT, 21.9

GRAVEL PACK: 1000# No.4 OHIO QUARTZ

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH: 225' 210' 156' 106' 40'

????

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

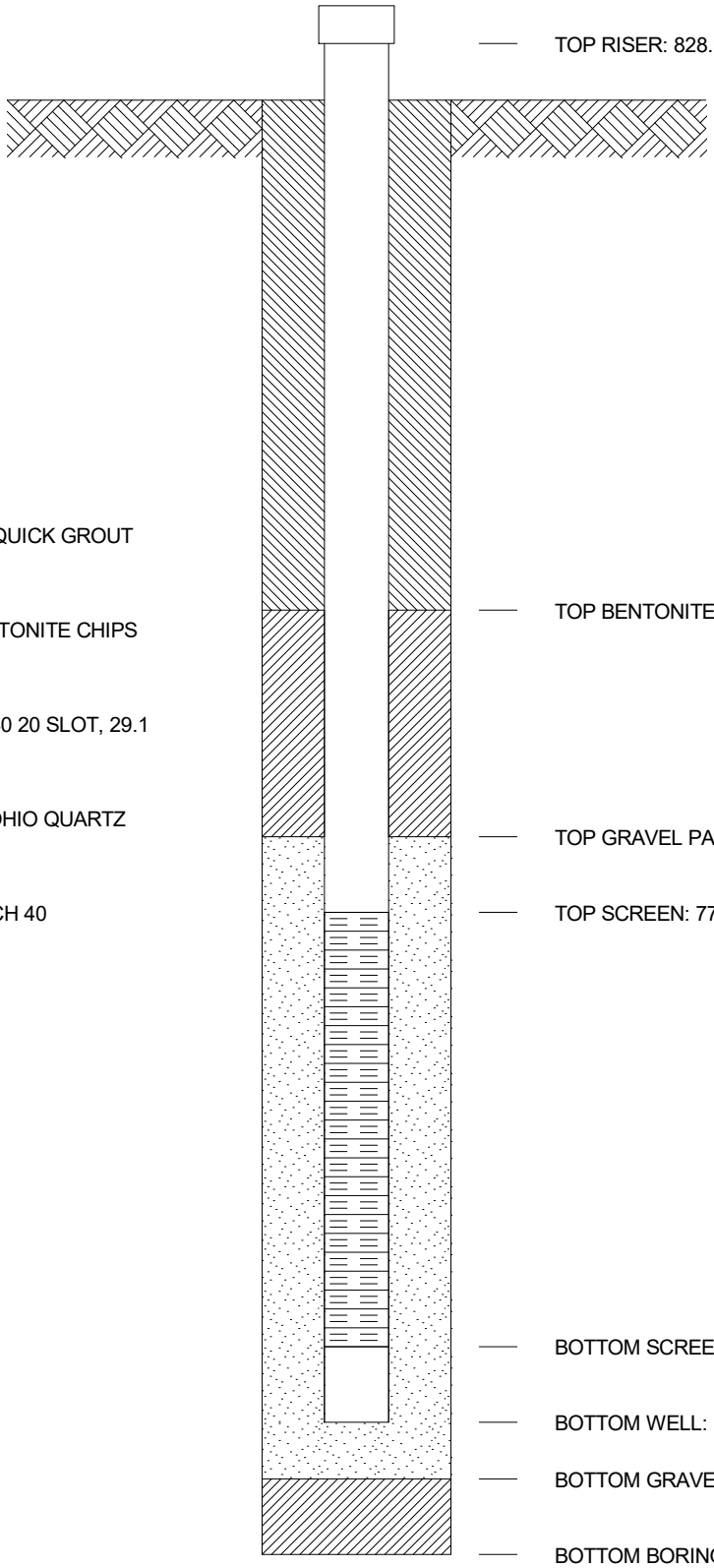
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **9631** BORING No. **96-31** INSTALLED **9/12/96**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 711,108.2 E 1,696,404.8**

SYSTEM

GROUND ELEVATION 826.56 FT.



GROUT SEAL: 150 GALLON QUICK GROUT

BENTONITE SEAL: 150# BENTONITE CHIPS

SCREEN: 2.0 dia., PVC SCH 40 20 SLOT, 29.1

GRAVEL PACK: 1000# No.4 OHIO QUARTZ

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH: 85' 70'

????

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

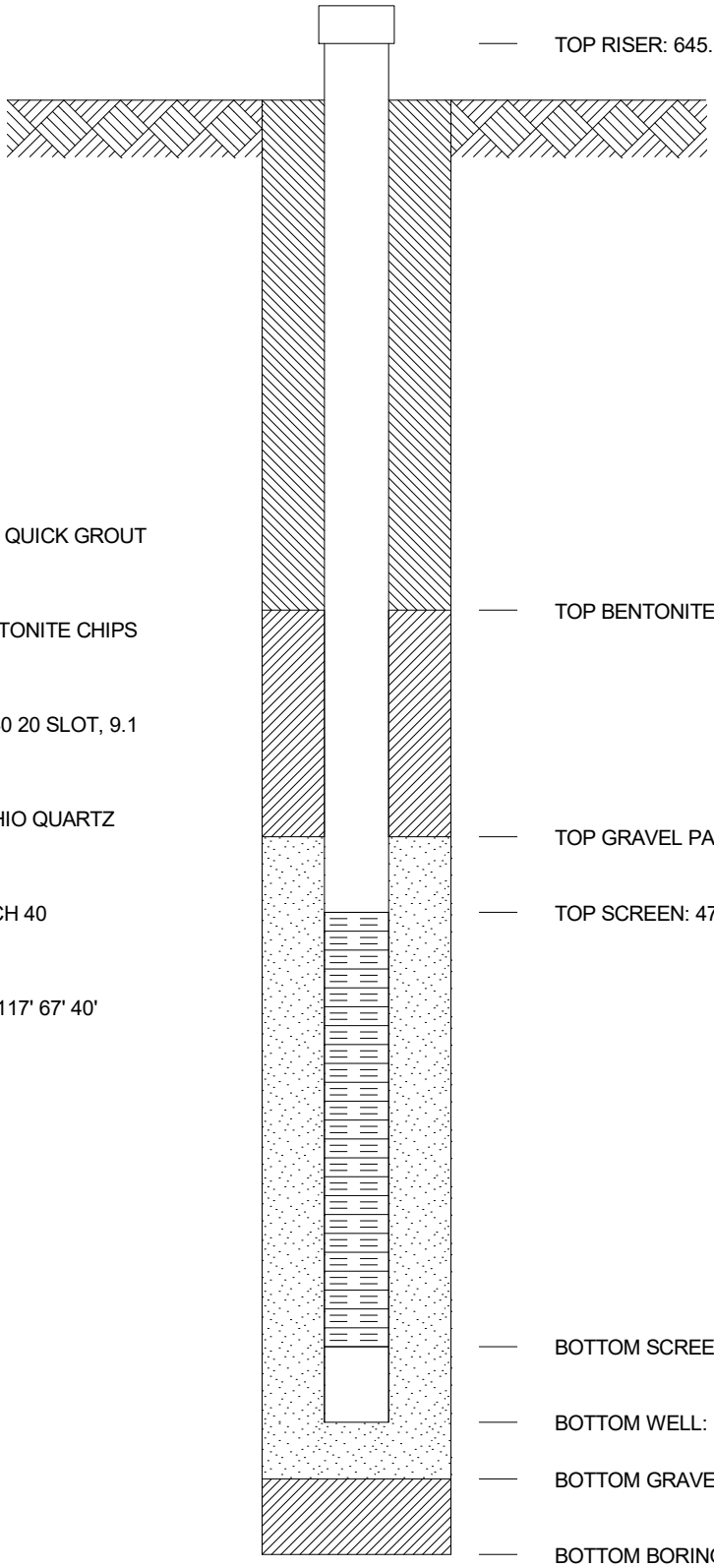
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **9632** BORING No. **96-32** INSTALLED **9/20/96**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 712,296.3 E 1,700,787.8**

SYSTEM

GROUND ELEVATION 643.91 FT.



TOP RISER: 645.52 FT.

TOP BENTONITE SEAL: FT.

TOP GRAVEL PACK: FT.

TOP SCREEN: 476.11 FT.

BOTTOM SCREEN: 467.01 FT.

BOTTOM WELL: FT.

BOTTOM GRAVEL PACK: FT.

BOTTOM BORING: 452.81 FT.

GROUT SEAL: 500 GALLONS QUICK GROUT

BENTONITE SEAL: 100# BENTONITE CHIPS

SCREEN: 2.0 dia., PVC SCH 40 20 SLOT, 9.1

GRAVEL PACK: 450# No.4 OHIO QUARTZ

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH: 177' 167' 117' 67' 40'

????

GEOMCNST MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

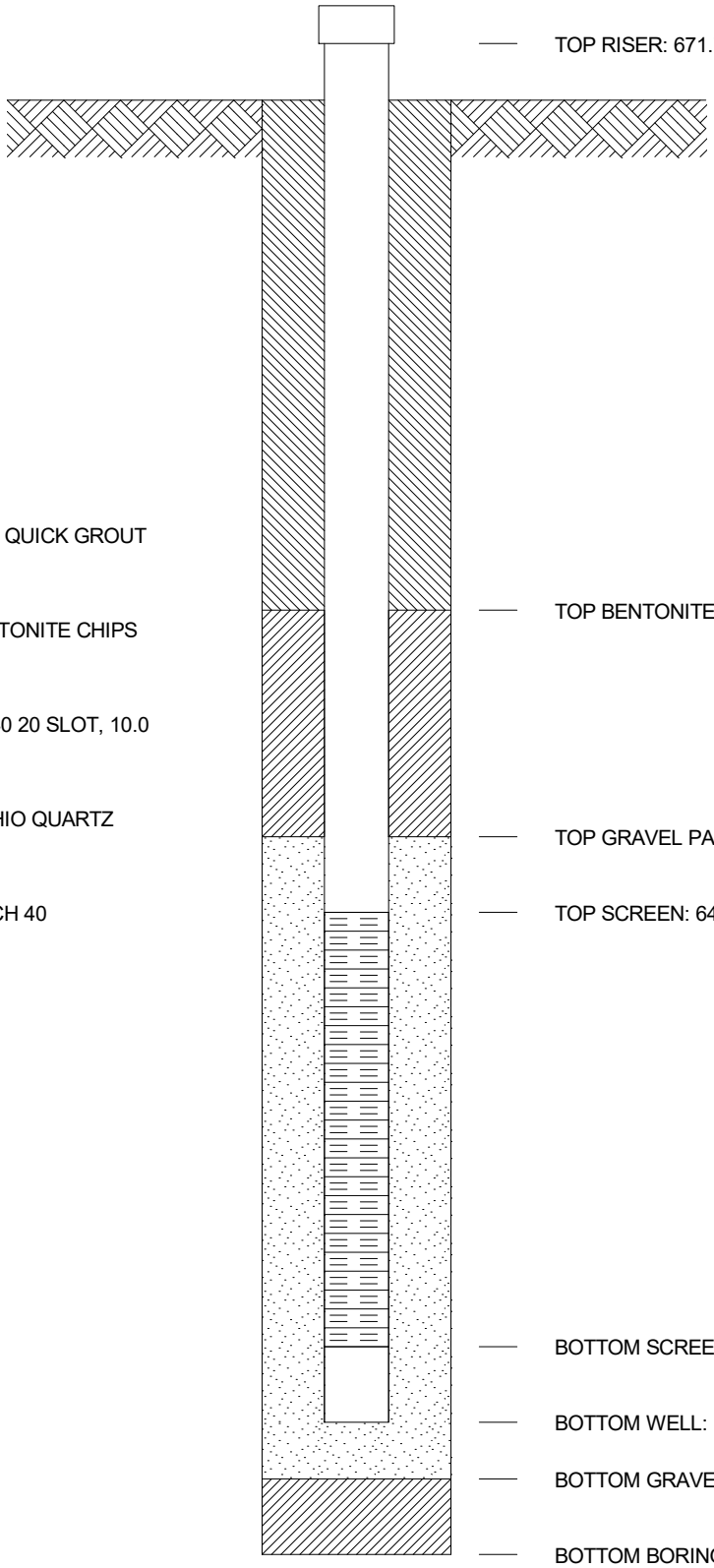
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **9633** BORING No. **96-33** INSTALLED **1/23/97**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 710,919.6 E 1,699,640.4**

SYSTEM

GROUND ELEVATION 669.81 FT.



TOP RISER: 671.75 FT.

TOP BENTONITE SEAL: FT.

TOP GRAVEL PACK: FT.

TOP SCREEN: 648.81 FT.

BOTTOM SCREEN: 629.81 FT.

BOTTOM WELL: FT.

BOTTOM GRAVEL PACK: FT.

BOTTOM BORING: 628.61 FT.

GROUT SEAL: 100 GALLONS QUICK GROUT

BENTONITE SEAL: 150# BENTONITE CHIPS

SCREEN: 2.0 dia., PVC SCH 40 20 SLOT, 10.0

GRAVEL PACK: 300# NO4 OHIO QUARTZ

RISER PIPE: 2.0, dia., PVC SCH 40

SPACERS, DEPTH: 40', 21'

????

GEOMCNST MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

ARCADIS

AEP 2010, 2012

Monitoring Well Construction Diagrams

MW-17A, MW-45, MW-46, MW-46s, MW-47, MW-47s

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

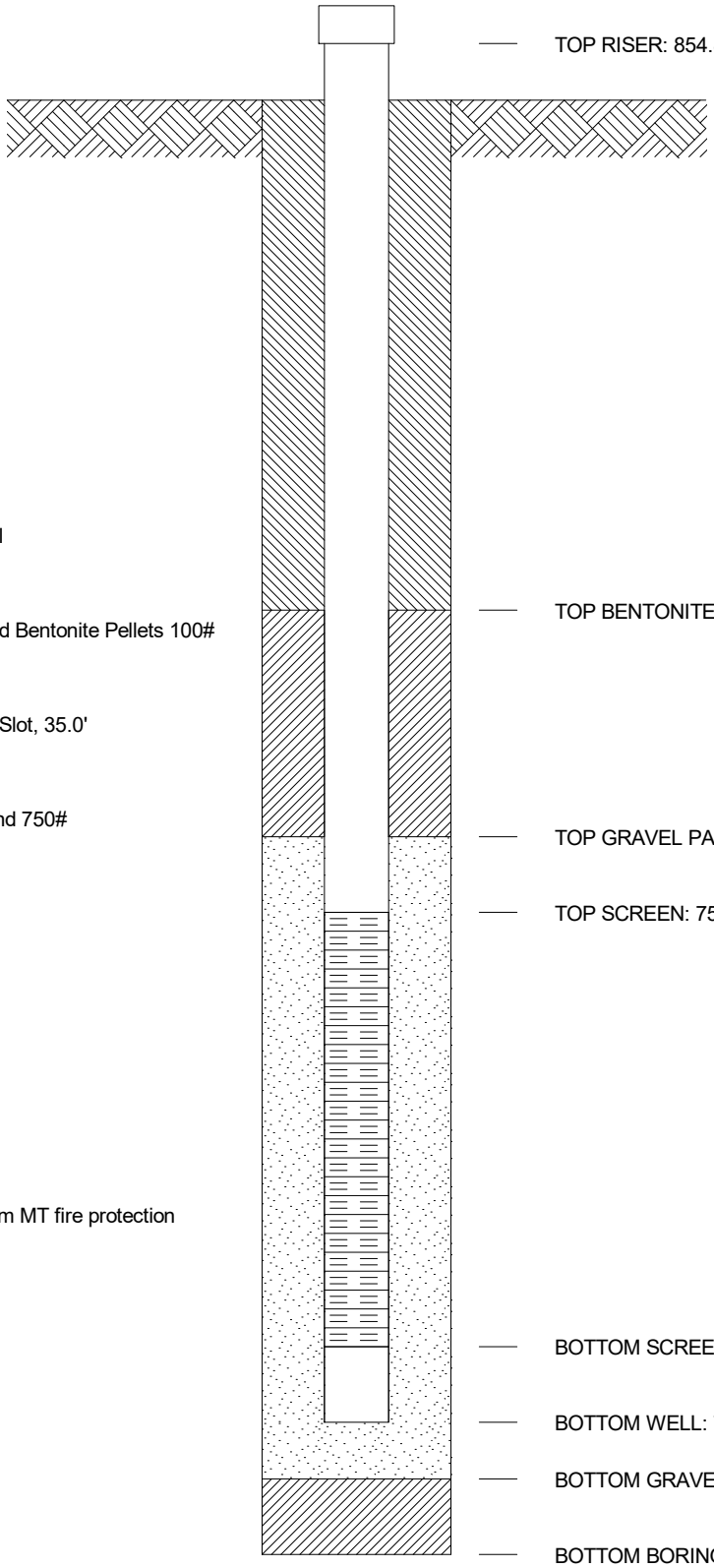
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **MW-45** BORING No. **B-0901** INSTALLED **1/7/10**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 708,953.7 E 1,729,008.3**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 852.23 FT.



GROUT SEAL: Volclay 200 Gal

BENTONITE SEAL: 3/8" Coated Bentonite Pellets 100#

SCREEN: 2.0" dia., Sch 40 20 Slot, 35.0'

GRAVEL PACK: #5 Quartz Sand 750#

RISER PIPE: 2.0", dia., Sch 40

SPACERS, DEPTH: 89',49',9'

NOTES:
-Drill & decon water coming from MT fire protection system
-Decon drill & tools 01/14/10
-SWL @ installation 16.1'
-136.0' - 134.2' cuttings
-Drilled w/6" air hammer

GEOMCNST MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

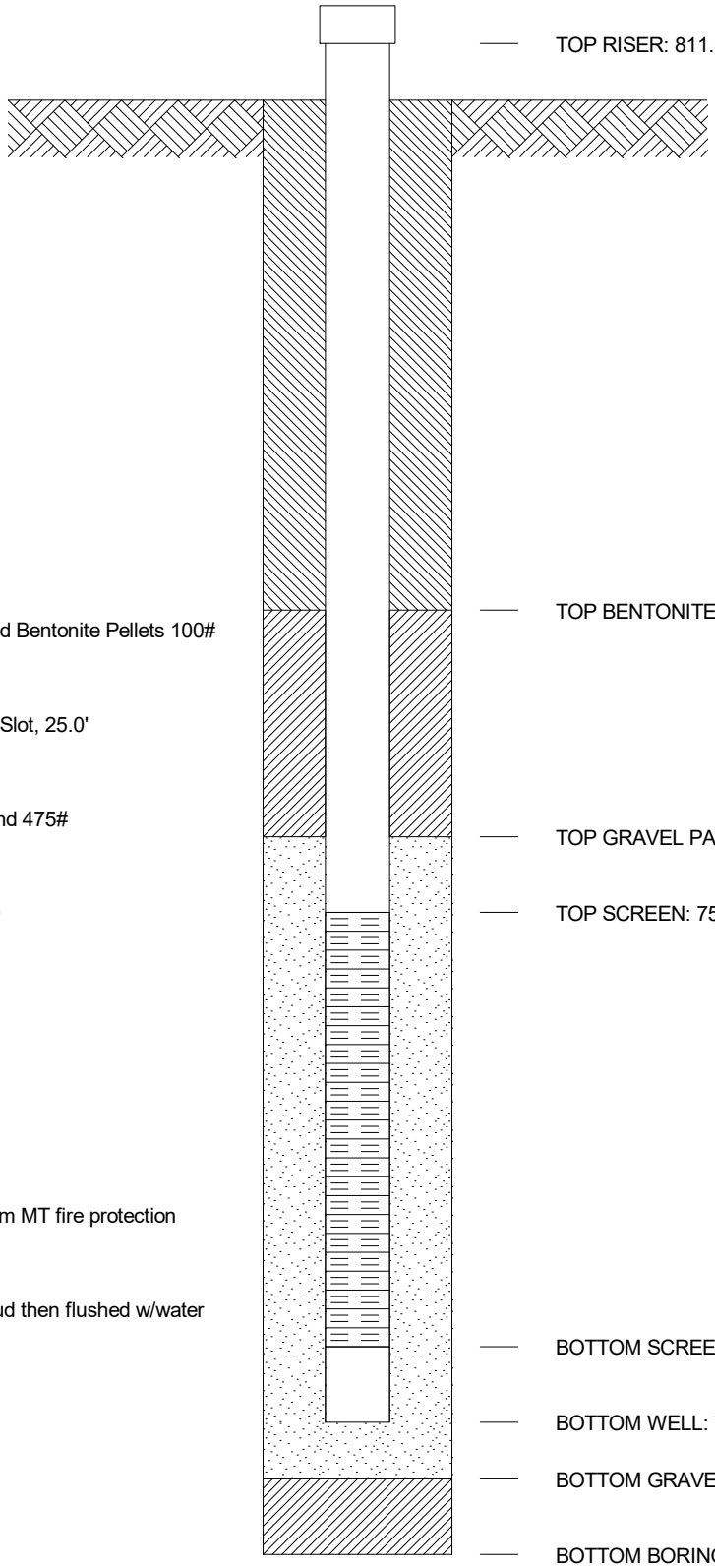
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **MW-46** BORING No. **B-0902** INSTALLED **1/19/10**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 709,192.0 E 1,728,205.5**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 808.77 FT.



GROUT SEAL: Volclay 75 Gal

BENTONITE SEAL: 3/8" Coated Bentonite Pellets 100#

SCREEN: 2.0" dia., Sch 40 20 Slot, 25.0'

GRAVEL PACK: #5 Quartz Sand 475#

RISER PIPE: 2.0", dia., Sch 40

SPACERS, DEPTH: 45', 20'

NOTES:
-Drill & decon water coming from MT fire protection system
-Decon drill & tools 01/28/10
-SWL @ installation 29.2'
-82.0' - 81.4' cuttings
-Washed cuttings out w/drill mud then flushed w/water

GEOMCNST MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

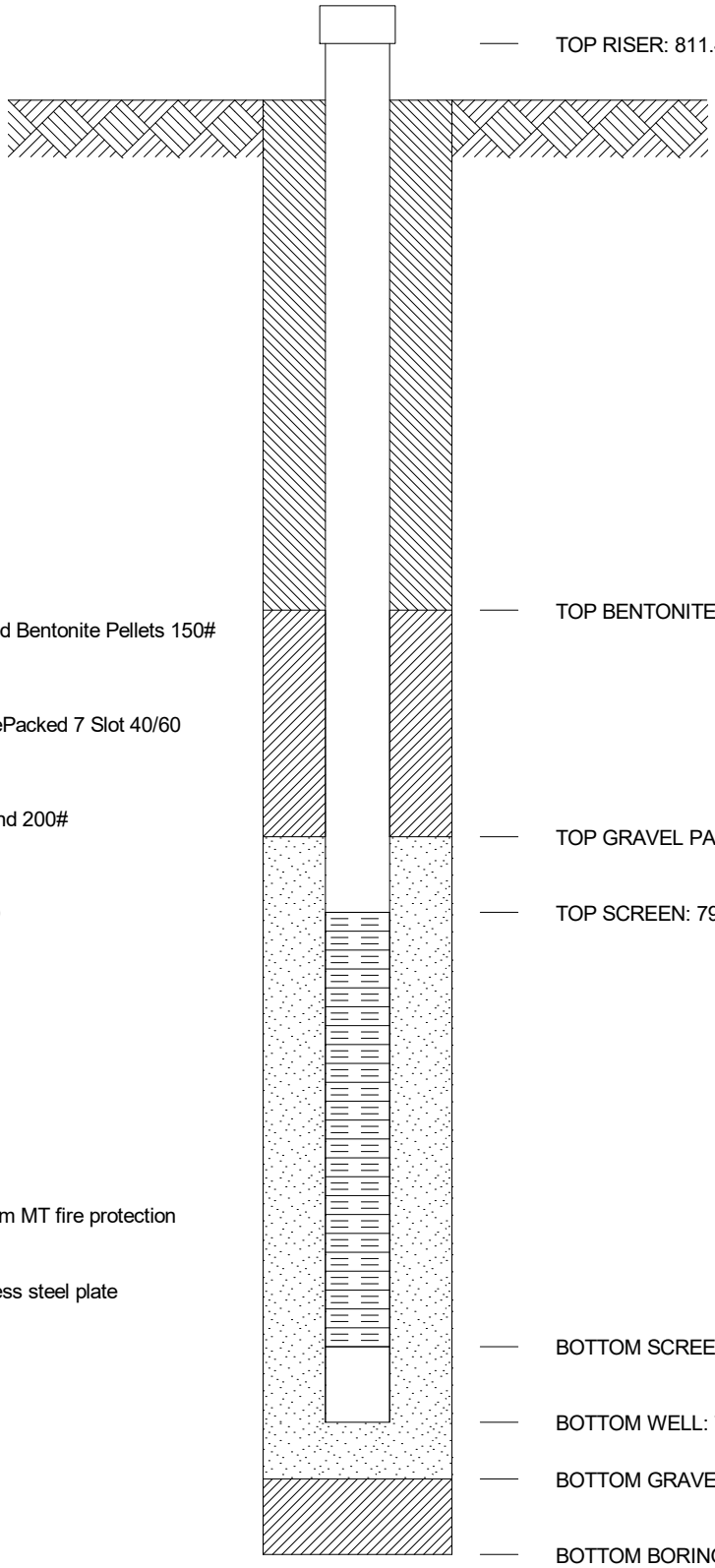
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **MW-46s** BORING No. **B-0902A** INSTALLED **1/27/10**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 709,195.5 E 1,728,209.3**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 808.77 FT.



GROUT SEAL: Hole Plug 3/8"

BENTONITE SEAL: 3/8" Coated Bentonite Pellets 150#

SCREEN: 2.0" dia., Sch 40 PrePacked 7 Slot 40/60 Sand, 5.0'

GRAVEL PACK: #5 Quartz Sand 200#

RISER PIPE: 2.0", dia., Sch 40

SPACERS, DEPTH: 4'

NOTES:
-Drill & decon water coming from MT fire protection system
-Decon drill & tools 01/29/10
-SWL @ installation 13.8'
-Drilled w/6.25" HSA's & stainless steel plate

GEOMCNST MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

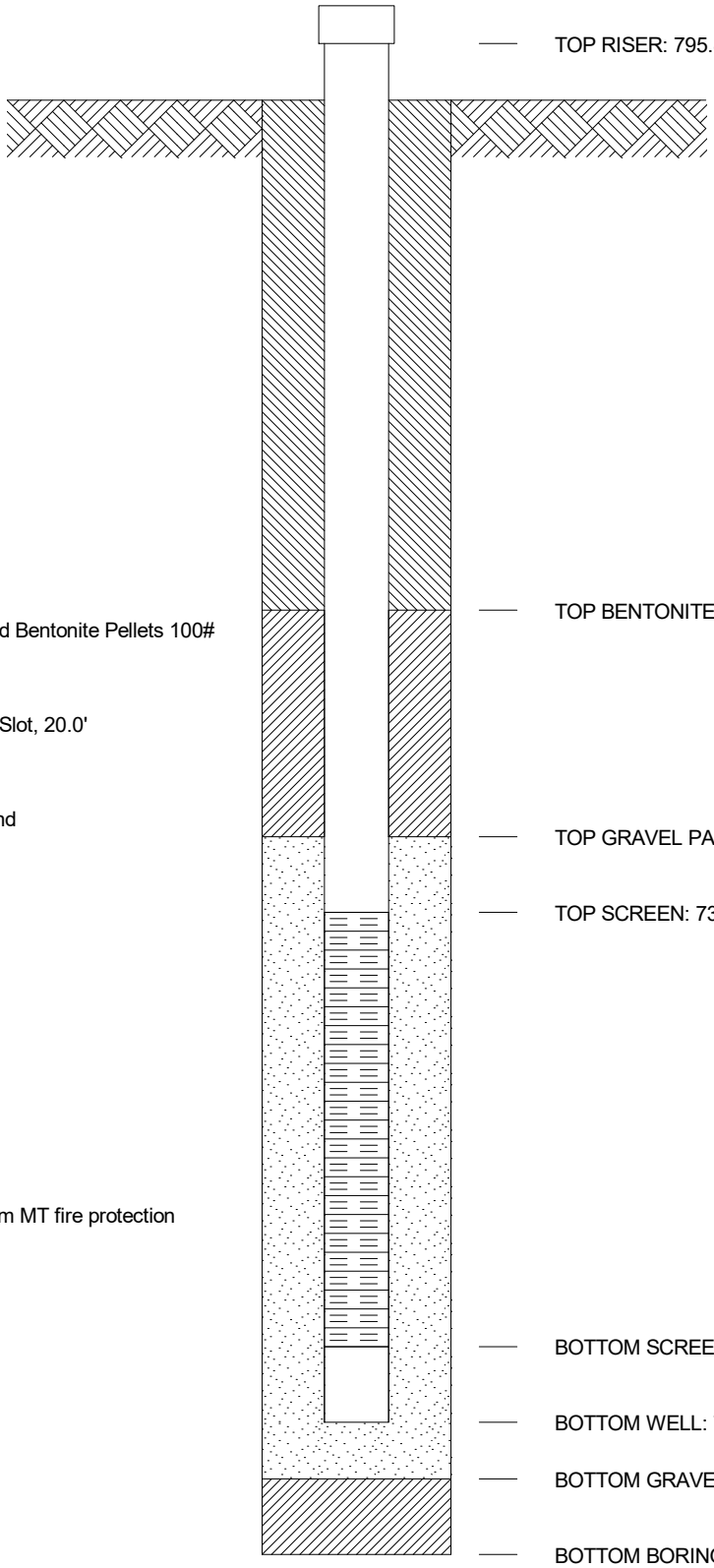
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **MW-47** BORING No. **B-0903** INSTALLED **2/2/10**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 710,168.6 E 1,728,017.3**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 793.01 FT.



GROUT SEAL: Volclay 75 Gal

BENTONITE SEAL: 3/8" Coated Bentonite Pellets 100#

SCREEN: 2.0" dia., Sch 40 20 Slot, 20.0'

GRAVEL PACK: #5 Quartz Sand

RISER PIPE: 2.0", dia., Sch 40

SPACERS, DEPTH: 49', 10'

NOTES:
-Drill & decon water coming from MT fire protection system
-Decon drill & tools 02/2/10
-SWL @ installation 30.8'
-Drilled w/6" air hammer

GEOMCNST MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

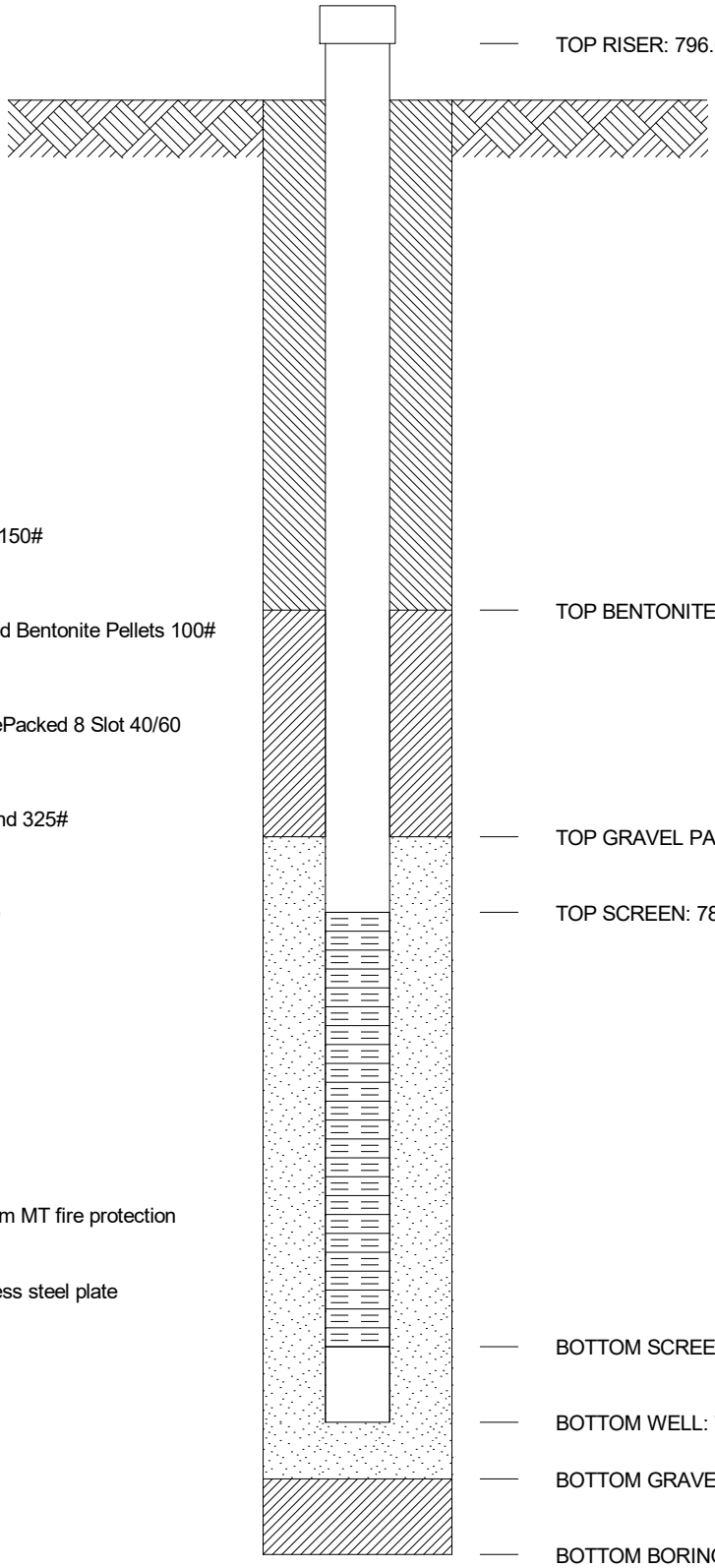
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **MW-47s** BORING No. **B-0903s** INSTALLED **2/2/10**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 710,163.9 E 1,728,017.9**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 793.01 FT.



GROUT SEAL: Hole Plug 3/8" 150#

BENTONITE SEAL: 3/8" Coated Bentonite Pellets 100#

SCREEN: 2.0" dia., Sch 40 PrePacked 8 Slot 40/60 Sand, 5.0'

GRAVEL PACK: #5 Quartz Sand 325#

RISER PIPE: 2.0", dia., Sch 40

SPACERS, DEPTH: 5'

NOTES:
-Drill & decon water coming from MT fire protection system
-Decon drill & tools 02/4/10
-SWL @ installation 18.1'
-Drilled w/6.25" HSA's & stainless steel plate

GEOMCNST MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

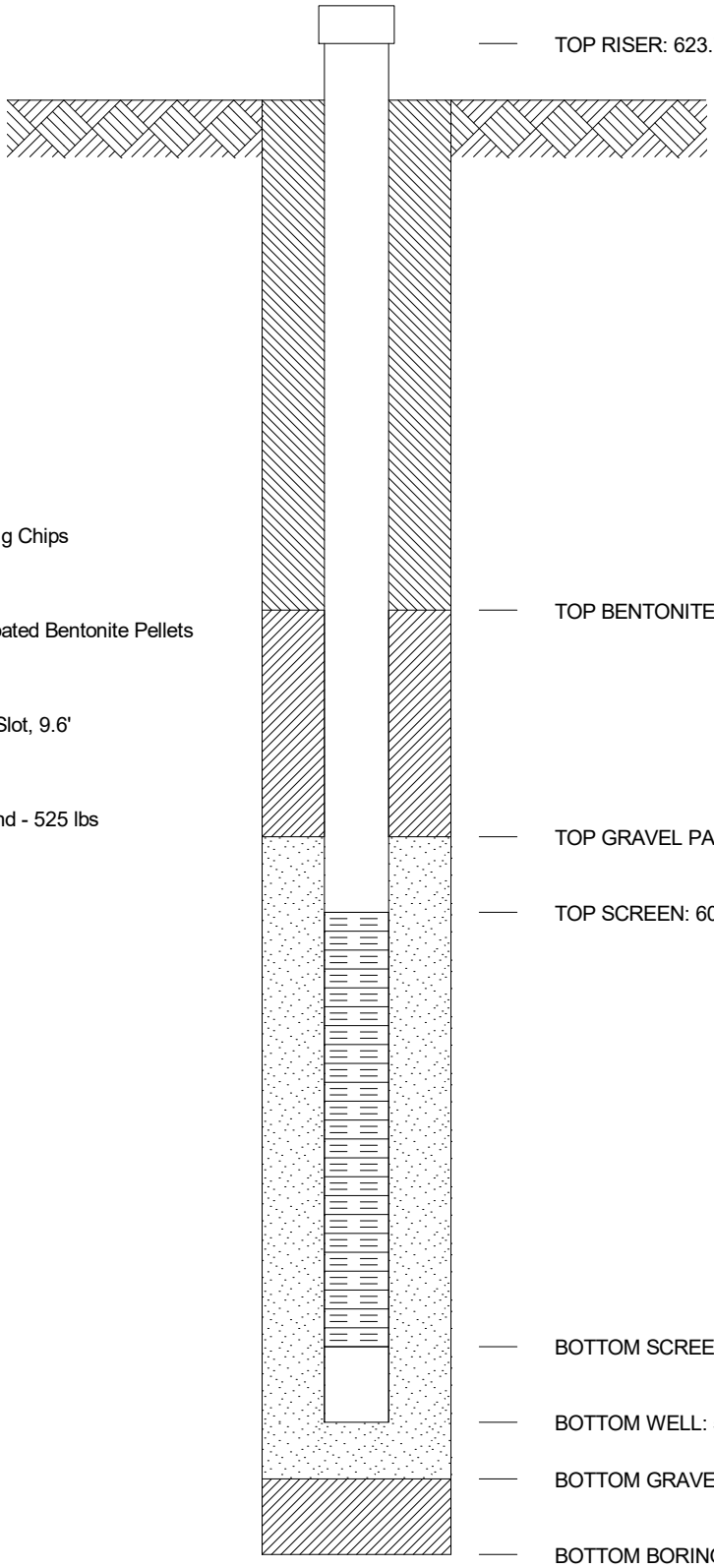
COMPANY **APPALACHIAN POWER COMPANY** WELL No. **MW-17A** BORING No. **B-1201** INSTALLED **1/10/12**

PROJECT **MOUNTAINEER LBR LANDFILL**

COORDINATES **N 714,832.4 E 1,733,268.2**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 621.63 FT.



GROUT SEAL: 150 lbs Holeplug Chips

BENTONITE SEAL: 150 lbs Coated Bentonite Pellets

SCREEN: 2.0" dia., PVC .010 Slot, 9.6'

GRAVEL PACK: #5 Quartz Sand - 525 lbs

RISER PIPE: 2.0", dia., PVC

SPACERS, DEPTH: N/A

GEOMCNST MT LBR LF FKA SI.GPJ AEP.GDT 7/23/15

ARCADIS

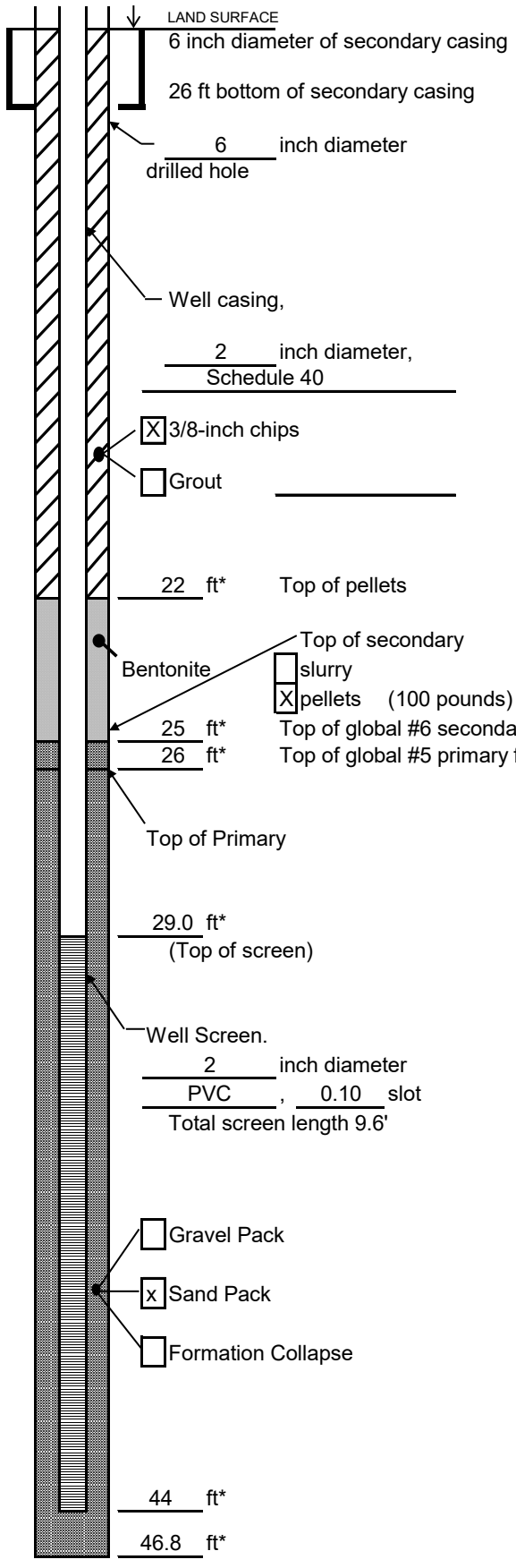
Arcadis 2016

Monitoring Well Construction Diagrams

MW-1611, MW-1612

WELL CONSTRUCTION LOG

(Unconsolidated)



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

Project AEP - Mountaineer Well MW-1611

Town/City New Haven

County Mason County State WV

Permit No. N/A

Land-Surface (LS) Elevation and Datum:

654.01 feet ☐ Surveyed ☐ Estimated

Installation Date(s) 6/23/2016

Drilling Method Hollow Stem Auger

Drilling Contractor DLZ Ohio, Inc.

Drilling Fluid None

Development Technique(s) and Date(s)
Waterra and Submersible Pump (7/7 thru 7/8/16)

Fluid Loss During Drilling N/A gallons

Water Removed During Development 70.7 gallons

Static Depth to Water 14.10 feet below M.P.

Pumping Depth to Water 42 feet below M.P.

Pumping Duration NM hours

Yield N/A gpm Date 7/7 thru 7/8/16

Specific Capacity N/A gpm/ft

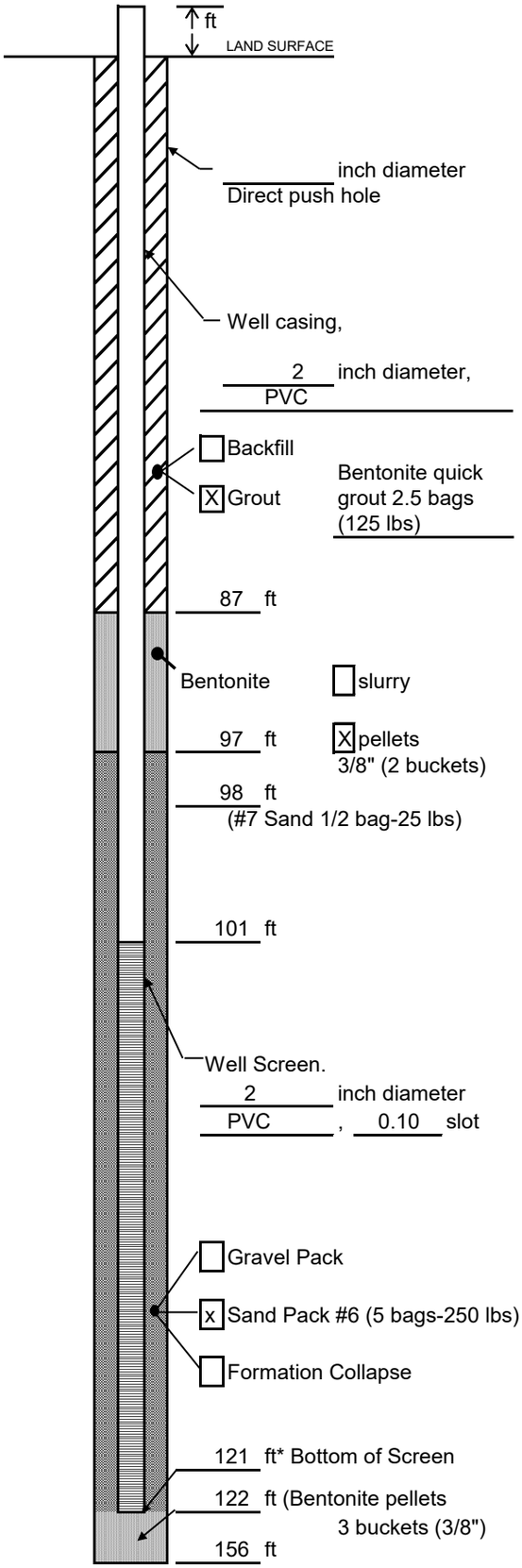
Well Purpose Monitoring well

Remarks

Prepared by Judd Wanner

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 - Mountaineer Well MW-1612

Town/City New Haven

County Mason State WV

Permit No.

Land-Surface (LS) Elevation and Datum:

780.70 feet [x] Surveyed [ ] Estimated

Installation Date(s) 7/19/2016

Drilling Method

Drilling Contractor DLZ

Drilling Fluid Potable water

Development Technique(s) and Date(s)
Surging and submersible pump

Fluid Loss During Drilling NM gallons

Water Removed During Development 67 gallons

Static Depth to Water 86.20 feet below M.P.

Pumping Depth to Water 118 feet below M.P.

Pumping Duration NM hours

Yield NA gpm Date 8/26/16

Specific Capacity gpm/ft

Well Purpose Monitoring well

Remarks

Prepared by Kari Eldridge

APPENDIX B

Banks Well Inventory Report

Prepared for:

ARCADIS U.S., INC.-Columbus
630 Plaza Drive, Suite 600
Highlands Ranch, CO 80129

BANKS ENVIRONMENTAL DATA
A DIVISION OF THE BANKS GROUP

Water Well Report

AEP Water Well Inventory

MOUNTAINEER PLANT

1347 GRAHAM STATION ROAD

NEW HAVEN, WV

MASON County

PO #: OH015976.0004

ES-112028

Monday, September 08, 2014

Banks Environmental Data, Inc. - 1601 Rio Grande, Ste. 500 - Austin, TX 78701 - 800.531.5255 P - 512.478.1433 F
www.banksenvdata.com

Table of Contents *AEP Water Well Inventory*

Geographic Summary	**3**
Maps	
Summary Map - 0.5 Mile Buffer	**4**
Topographic Overlay Map - 0.5 Mile Buffer	**5**
Current Imagery Overlay Map - 0.5 Mile Buffer	**6**
Water Well Details	**7**
Database Definitions and Sources	**8**
Disclaimer	**9**

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Geographic Summary *AEP Water Well Inventory*

Location
MASON County, WV
Target location is 0.131 square miles and has a 1.5 mile perimeter

Coordinates	
Longitude & Latitude in Degrees Minutes Seconds	NA
Longitude & Latitude in Decimal Degrees	NA
X and Y in UTM	NA

Elevation
NA

Zip Codes Searched	
Search Distance	**Zip Codes (historical zip codes included)**
Target Property	25253, 25247, 25264, 25265
0.5 miles	25253, 25247, 25264, 25265

Topos Searched	
Search Distance	**Topo Name**
Target Property	New Haven (1977)
0.5 miles	New Haven (1977)

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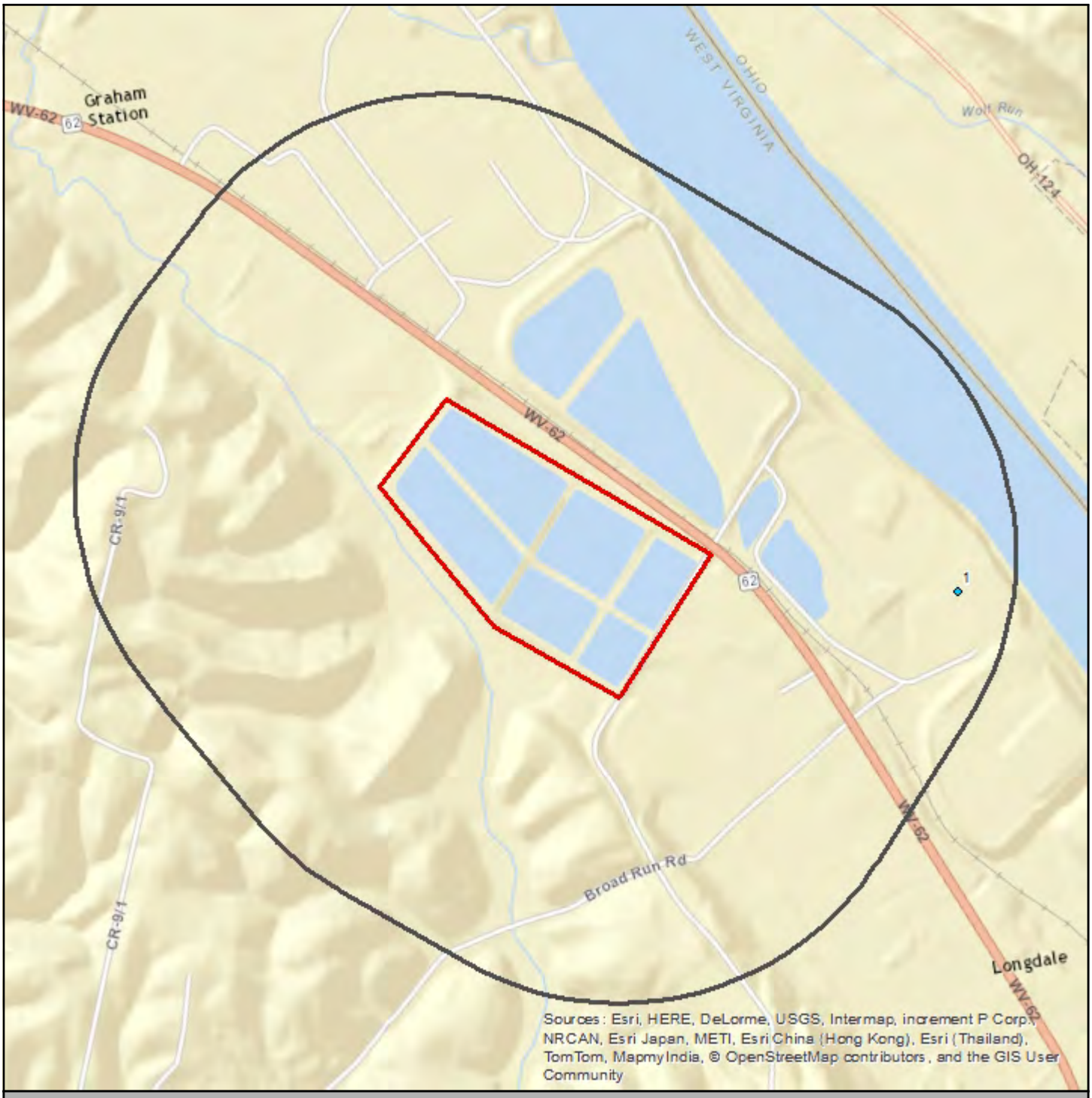
Summary Map - 0.5 Mile Buffer

BANKS ENVIRONMENTAL DATA
A DIVISION OF THE BANKS GROUP



AEP Water Well Inventory

- Well
- Well Cluster
- Target Property
- Search Buffer

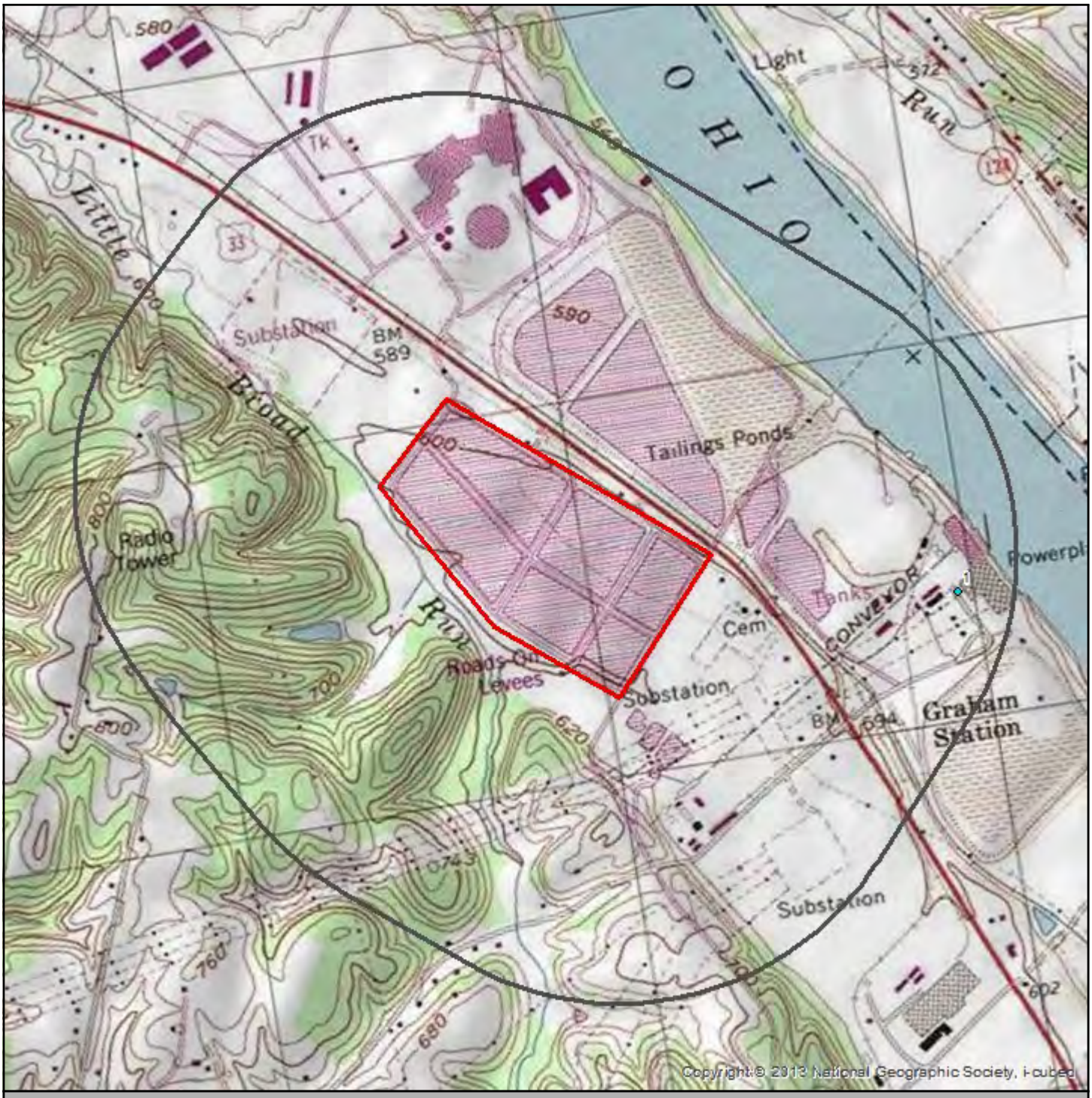
1 : 15,000
1 inch = 0.237 miles
1 inch = 1250 feet
1 centimeter = 0.150 kilometers
1 centimeter = 150 meters

N

Lambert Conformal Conic Projection
1983 North American Datum
First Standard Parallel: 33 0' 00" North
Second Standard Parallel: 45 0' 00" North
Central Meridian: 96 0' 00" West
Latitude of Origin: 39 0' 00" North

Topographic Overlay Map - 0.5 Mile Buffer

BANKS ENVIRONMENTAL DATA
A DIVISION OF THE BANKS GROUP



AEP Water Well Inventory

- Well
- Well Cluster
- Target Property
- Search Buffer

Target Property Quad Name(s)
New Haven (1977)

1 : 15,000
1 inch = 0.237 miles
1 inch = 1250 feet

Lambert Conformal Conic Projection
1983 North American Datum
First Standard Parallel: 33 0' 00" North
Second Standard Parallel: 45 0' 00" North
Central Meridian: 96 0' 00" West
Latitude of Origin: 39 0' 00" North

N

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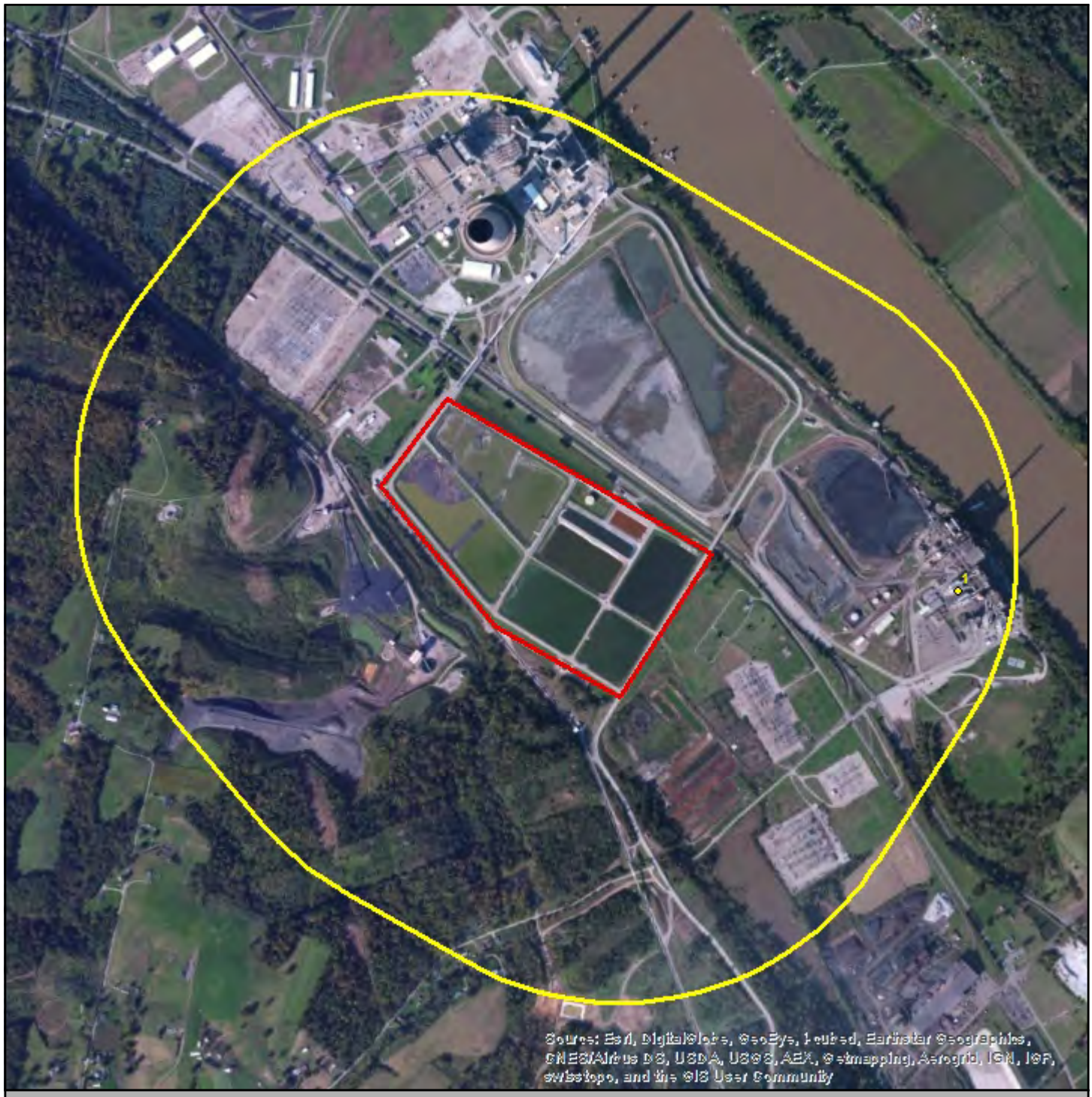
Current Imagery Overlay Map - 0.5 Mile Buffer

BANKS ENVIRONMENTAL DATA
A DIVISION OF THE BANKS GROUP



AEP Water Well Inventory

- Well
- Well Cluster
- Target Property
- Search Buffer

1 : 15,000
1 inch = 0.237 miles
1 inch = 1250 feet
1 centimeter = 0.150 kilometers
1 centimeter = 150 meters

N

Lambert Conformal Conic Projection
1983 North American Datum
First Standard Parallel: 33 0' 00" North
Second Standard Parallel: 45 0' 00" North
Central Meridian: 96 0' 00" West
Latitude of Origin: 39 0' 00" North

Water Well Details *AEP Water Well Inventory*

Map ID	Source ID	Dataset	Owner of Well	Type of Well	Depth Drilled	Completion Date	Longitude	Latitude	Elevation	Driller's Logs
1	USGS-385802081552602	WW USGS	USGS	Not Reported	80	01/01/1950	-81.923748	38.967302	585 ft	N/A

Well Summary

Water Well Dataset	# of Wells
WW USGS	1
Total Count	**1**

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Dataset Descriptions and Sources *AEP Water Well Inventory*

Dataset	Source	Dataset Description	Update Schedule	Data Requested	Data Obtained	Data Updated	Source Updated
WV WW - West Virginia Water Wells	West Virginia Department of Health and Human Resources	This dataset contains groundwater well information provided by West Virginia Department of Health and Human Resources.	As requested	N/A	N/A	N/A	N/A
OH WW - Ohio Water Wells	Ohio Department of Natural Resources	This dataset contains all historical water well records searched from Ohio Department of Natural Resources Division of Water	As requested	N/A	N/A	N/A	N/A
WW USGS - USGS Water Wells	U.S. Geological Survey	This dataset contains groundwater well records from the U.S. Geological Survey.	Quarterly	06/30/2014	06/30/2014	07/13/2014	06/30/2014

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Disclaimer *AEP Water Well Inventory*

The Banks Environmental Data Water Well Report was prepared from existing state water well databases and/or additional file data/records research conducted at the state agency and the U.S. Geological Survey. Banks Environmental Data has performed a thorough and diligent search of all groundwater well information provided and recorded. All mapped locations are based on information obtained from the source. Although Banks performs quality assurance and quality control on all research projects, we recognize that any inaccuracies of the records and mapped well locations could possibly be traced to the appropriate regulatory authority or the actual driller. It may be possible that some water well schedules and logs have never been submitted to the regulatory authority by the water driller and, thus, may explain the possible unaccountability of privately drilled wells. It is uncertain if the above listing provides 100% of the existing wells within the area of review. Therefore, Banks Environmental Data cannot fully guarantee the accuracy of the data or well location(s) of those maps and records maintained by the regulatory authorities.

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APPENDIX C

Hydraulic Testing Results

BEDROCK INJECTION PACKER TESTING LOG

Boring No.	MW-1611	Contractor	DLZ Ohio	Page	1	of	1
Project	AEP Mountaineer Plant	Project No.	OH015976.0009	Staff	J.Wanner		
Site Location	1347 Graham Station Road, New Haven, West Virginia 25253			Date	6/20/2016		

Base of Top Packer (ft bgs/ft amsl)	29.0	Surface Elevation (ft amsl)	654.0
Top of Bottom Packer (ft bgs/ft amsl)	39.0	Distance from Gauge to Ground Surface (ft)	6.0
Depth to Water Prior to Install (ft bgs/ft amsl)	11.8	Diameter of Boring (inches)	3.0
Depth to Water After Install (ft bgs/ft amsl)	11.8		

Pre-Test 1

Constant Pressure (psi) 1.9

Elapsed Time (mins)	Flow Totalizer Readings (gallons)	Flow Rate (gpm)	Borehole Water Level (ft)
0	0.0	0	NM
1	4.7	4.700	NM
2	9.3	4.650	NM
3	13.9	4.633	NM
4	18.3	4.575	NM
5	22.8	4.560	NM
10	44.3	4.430	NM
15	64.9	4.327	NM
20	84.7	4.235	NM
25	103.9	4.156	NM
30	122.4	4.080	NM

Test 2

Constant Pressure (psi)

Time (mins)	Flow Totalizer Readings (gallons)	Flow Rate (gpm)	Borehole Water Level (ft)

Pre-Test 1

Duration _____ (mins) Pressure _____ (psi)

Flow Totalizer Readings (gallons)	Flow Rate (gpm)	Borehole Water Level (ft)

Pre-Test 2

Duration _____ (mins) Pressure _____ (psi)

Flow Totalizer Readings (gallons)	Flow Rate (gpm)	Borehole Water Level (ft)

Ground Water Manual, 1977, Packer Test Solution

Q =	9.9E-03	ft^3/s
h1 =	17.80	ft
h2 =	4.38	ft
H =	22.18	ft
r =	0.13	ft
A =	10.00	ft
A/r =	80.00	unitless
Cs =~	105.00	unitless
K =	1.0E-03	cm/s

ZONE 3

METHOD 2

$$K = \frac{Q}{C_s r H}$$

BEDROCK INJECTION PACKER TESTING LOG

Boring No.	MW-1611	Contractor	DLZ Ohio	Page	1	of	1
Project	AEP Mountaineer Plant	Project No.	OH015976.0009	Staff	J.Wanner		
Site Location	1347 Graham Station Road, New Haven, West Virginia 25253			Date	6/20/2016		

Base of Top Packer (ft bgs/ft amsl)	33.0	Surface Elevation (ft amsl)	654.0
Top of Bottom Packer (ft bgs/ft amsl)	43.0	Distance from Gauge to Ground Surface (ft)	6.0
Depth to Water Prior to Install (ft bgs/ft amsl)	11.80	Diameter of Boring (inches)	3.0
Depth to Water After Install (ft bgs/ft amsl)	11.80		

Pre-Test 1

Constant Pressure (psi) 2.0 +/- 1.0
2

Elapsed Time (mins)	Flow Totalizer Readings (gallons)	Flow Rate (gpm)	Borehole Water Level (ft)
0	0.0	0	
1	6.6	6.600	
2	13.1	6.550	
3	19.7	6.567	
4	26.1	6.525	
5	32.6	6.520	
10	64.6	6.460	
15	96.0	6.400	
20	126.7	6.335	
25	156.9	6.276	
30	186.7	6.223	

Test 2

Constant Pressure (psi)

Time (mins)	Flow Totalizer Readings (gallons)	Flow Rate (gpm)	Borehole Water Level (ft)

Pre-Test 1

Duration _____ (mins) Pressure _____ (psi)

Flow Totalizer Readings (gallons)	Flow Rate (gpm)	Borehole Water Level (ft)

Pre-Test 2

Duration _____ (mins) Pressure _____ (psi)

Flow Totalizer Readings (gallons)	Flow Rate (gpm)	Borehole Water Level (ft)

Ground Water Manual, 1977, Packer Test Solution

Q =	1.4E-02	ft^3/s
h1 =	17.80	ft
h2 =	4.61	ft
H =	22.41	ft
r =	0.13	ft
A =	10.00	ft
A/r =	80.00	unitless
Cs =~	105.00	unitless
K =	1.5E-03	cm/s

ZONE 3

METHOD 2

$$K = \frac{Q}{C_s r H}$$

BEDROCK INJECTION PACKER TESTING LOG

Boring No.	MW-1612	Contractor	DLZ Ohio	Page	1 of 1
Project	AEP Mountaineer Plant	Project No.	OH015976.0009	Arcadis Staff	K. Eldridge
Site Location	1347 Graham Station Road, New Haven, West Virginia 25253			Date	7/15/2016

Base of Top Packer (ft bgs/ft amsl)	106.0	Surface Elevation (ft amsl)	780.70
Top of Bottom Packer (ft bgs/ft amsl)	116.0	Distance from Gauge to Ground Surface (ft)	6.0
Depth to Water Prior to Install (ft bgs/ft amsl)	NM	Diameter of Boring (inches)	3.0
Depth to Water After Install (ft bgs/ft amsl)	12.05 note: measured on 7/19/2016, 4 days after test		

Pre-Test 1

Constant Pressure (psi) 72

Elapsed Time (mins)	Flow Totalizer Readings (gallons)	Flow Rate (gpm)	Borehole Water Level (ft)
0	0.0	0	
1	10.9	10.900	
2	21.5	10.750	
3	31.9	10.633	
4	42.3	10.575	
5	52.4	10.480	
10	101.8	10.180	
15	148.4	9.893	
20	191.9	9.595	
25	236.5	9.460	
30	276.6	9.220	

Test 2

Constant Pressure (psi)

Time (mins)	Flow Totalizer Readings (gallons)	Flow Rate (gpm)	Borehole Water Level (ft)

Ground Water Manual, 1977, Packer Test Solution

Q =	2.3E-02	ft^3/s
h1 =	18.05	ft
h2 =	166.10	ft
H =	184.15	ft
r =	0.13	ft
A =	10.00	ft
A/r =	80.00	unitless
Cs =~	105.00	unitless
K =	2.9E-04	cm/s

ZONE 3

METHOD 2

$$K = \frac{Q}{C_s r H}$$

Pre-Test 1

Duration _____ (mins) Pressure _____ (psi)

Flow Totalizer Readings (gallons)	Flow Rate (gpm)	Borehole Water Level (ft)

Pre-Test 2

Duration _____ (mins) Pressure _____ (psi)

Flow Totalizer Readings (gallons)	Flow Rate (gpm)	Borehole Water Level (ft)

APPENDIX D

Field Methodology & Borehole Geophysics Report

APPENDIX D

FIELD METHODOLOGY AND BOREHOLE GEOPHYSICS REPORT

Based on the recommended well network modifications, the following generalized tasks were completed:

- Installation of 5 bedrock borings
- Installation and development of 2 new monitoring wells
- The redevelopment of 5 existing monitoring wells

Arcadis provided oversight for drilling of 5 bedrock borings that resulted in installation of 2 monitoring wells by a licensed drilling company (DLZ). Three bedrock borings were sealed due to inadequate yield for groundwater monitoring within the targeted units. Implementation of the field activities began with utility clearance activities beginning April 18, 2016. Additional utility location was completed on May 16, 2016, May 24, 2016, June 13, 2016, and July 6, 2016. Drilling operations began on May 20, 2016 and ended on July 19, 2016.

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 8 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 pad was constructed for decontamination of the down-hole tools. Containerization was not required for decontamination water, if directed to the leachate system. Water for decontamination or drilling was potable and obtained from the AEP Mountaineer Plant.

Borehole Advancement and Stratigraphy/Lithology

Bedrock boreholes began by using standard hollow-stem auger methods with a minimum 8.25” inner diameter auger in accordance with ASTM D5784 until the soil-rock interface was encountered. Continuous

spit-spoon sampling and standard penetration testing was performed in accordance with ASTM D1586 until bedrock was encountered. A minimum 6-inch diameter PVC surface casing was temporarily set 2 feet into the competent bedrock prior to beginning rock coring. Bentonite chips swere placed in the annulus between the borehole and the surface casing to ground surface, serving as a temporary seal around the surface casing during drilling operations. The chips were placed in a controlled manner so as not to contaminate the well. Chips were hydrated periodically during placement. The bentonite annulus seal was allowed to set for approximately 12 hours (overnight) before continuing with rock coring. The 6-inch PVC casing was removed upon installation of the permanent well casing.

Rock core samples were completed with PQ2 sized wireline system in accordance with ASTM D 2113-93. Upon completion of coring, the bore holes were enlarged to 6" diameter using rotary drilling methods in accordance with ASTM D 5783-95.

Arcadis logged all geologic samples collected during the drilling process for both the unconsolidated (split-spoon soil samples) and bedrock (rock core samples) monitoring wells. Field logging of the soil and rock samples were performed in accordance with ASTM D5434-12. Unconsolidated soils were classified under the Unified Soil Classification System (USCS), while rock core logging was classified in accordance with the *Midwest Geosciences Group; Field Guide for Rock Core Logging and Fracture Analysis*. Boring logs and well construction details for all installations completed during this scope of work are provided in **Appendix A**. Unconsolidated soil samples were collected continuously using 2-inch diameter by 2-foot long split spoon samplers. Rock coring was completed continuously using a PQ2 wireline system that retrieved a 2-inch diameter core.

Monitoring Well Installation and Construction

Monitoring well installation and construction was completed in accordance with the AEP- approved work plan prepared by Arcadis following an initial review of the Site monitoring well network. The work plan was prepared using West Virginia Department of Environmental Protection Title 47 Series 60 Monitoring Well Design Standards dated June 21, 2011 and American Society of Testing Material (ASTM) standards, where referenced, as guidance. Arcadis directed the drilling and installation of the identified up and down gradient monitoring wells. DLZ was the drilling company that installed the wells and was directly contracted through AEP. Drilling activities began on May 20, 2016. Prior to beginning work, daily health and safety meetings were held each morning, including a thorough discussion of the day's scope of work, identified hazards, hazard mitigation, and completion of the AEP Job Safety Analysis documentation in the presence of AEP staff. Health and safety documentation was retained by both Arcadis and AEP.

Based on the field conditions, Arcadis directed DLZ regarding the total drilling and well completion depths, well construction configuration, and well materials to be used. Screened intervals for bedrock monitoring wells targeted water-bearing zones of Hydrologic Units 3 and 4. Final well depths and screened intervals are included in **Table 2**.

All monitoring wells were constructed in general accordance with West Virginia Department of Environmental Protection Title 47 Series 60 Monitoring Well Design Standards dated June 21, 2011.

Bedrock monitoring wells were constructed of 2-inch Schedule 40 PVC risers and screens. The well was double-cased, with a 6-inch PVC surface casing installed into the upper two feet of bedrock. The surface casing was grouted in place using a bentonite grout. Well screens were constructed of 10 slot (0.010 ft screen openings) PVC. A primary filter pack of Global® #6 sand was placed across the screened interval, followed by approximately 2 feet of secondary (finer gradation) filter pack composed of Global® #7 sand.

Boring logs and well construction diagrams are provided in **Appendix A**. **Table 2** provides a summary of the well construction details of all wells in the current monitoring well network.

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 wells were 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**.

Additionally, Arcadis subcontracted with Parrat-Wolff, Inc to complete well development at select bedrock monitoring wells (MW-26, MW-27, MW-30 and MW-1612). Arcadis provided oversight during all development activities. Parrat-Wolff, Inc utilized a winch truck to surge the screen intervals. Following the surging, the wells were purged to remove dislodged materials. This process was repeated until water clarity improved or the well went dry. Arcadis collect water quality parameters following development as described above.

BOREHOLE GEOPHYSICS REPORT

During well installation activities, THG Geophysics, Ltd. was contracted by Arcadis to perform downhole geophysical logging. The purpose was to obtain more detailed information on groundwater transmissive zones of the uppermost aquifer units (bedrock type, fractures, permeability and porosity). The geophysical logging included the following suite: optical and acoustic televiewing, caliper borehole diameter, electrical resistivity, fluid resistivity, natural gamma radiation, spontaneous potential, single point resistance, and temperature.

The THG Geophysics, Ltd. report is included as an attachment to **Appendix D**.

ARCADIS

Well Development Logs

WELL DEVELOPMENT LOG

Site/Well No. MW-1611

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 7/7/2016

Weather 80F, Sunny Development Time Begin 7/7/16 13:35 End 7/7/16 18:08

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): N/A
Land Surface Elevation (ft):
Sounded Well Depth (ft bmp): 46.46
Depth to Water (ft bmp): 14.10
Water-Level Elevation (ft):
Water Column in Well (ft): 32.12
Casing Diameter/Type: 2" PVC
Gallons in Well: 5.14

Pump Intake Setting (ft bmp): 42.00
Pumping Rate (gpm): .08-.28
Evacuation Method: submersible pump
Volumes Purged: 1.38

Field Parameters

Color: brown
Odor: None
Appearance: Very turbid

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
7/7/16 17:03	14.34	0.00	10.00	0.477	390.0	21.50	8.28	181	2.29	---	orange/tan, no odor
7/7/16 17:08	14.48	1.40	10.27	0.493	189.0	19.14	8.03	158	0.45	0.28	orange/tan, no odor
7/7/16 17:13	14.49	2.00	10.39	0.497	110.0	19.62	7.99	147	0.26	0.12	clear, no odor
7/7/16 17:18	14.47	2.70	10.53	0.499	77.1	20.26	7.91	125	0.12	0.14	clear, no odor
7/7/16 17:23	14.47	3.20	10.62	0.495	139.0	20.39	7.88	103	0.10	0.10	clear, no odor
7/7/16 17:28	14.45	3.75	10.73	0.496	142.0	20.51	7.86	73	0.07	0.11	clear, no odor
7/7/16 17:33	14.46	4.20	10.82	0.494	125.0	20.36	7.85	54	0.18	0.09	clear, no odor
7/7/16 17:38	14.46	4.65	10.90	0.495	110.0	20.16	7.84	43	0.02	0.09	clear, no odor
7/7/16 17:43	14.45	5.20	11.01	0.495	93.5	20.30	7.83	35	0.00	0.11	clear, no odor
7/7/16 17:48	14.45	5.70	11.11	0.496	84.5	20.20	7.83	29	0.00	0.10	clear, no odor
7/7/16 17:53	14.44	6.20	11.21	0.495	81.3	20.29	7.83	25	0.00	0.10	clear, no odor
7/7/16 17:58	14.44	6.60	11.28	0.495	77.7	20.66	7.83	22	0.00	0.08	clear, no odor
7/7/16 18:03	14.44	7.10	11.38	0.497	78.4	21.08	7.83	20	0.00	0.10	clear, no odor

Development Personnel: Kari Eldridge

Notes: 10 gallons removed prior to purge with pump; total volumes purged =11.38.
Will resume pumping 7/8/16.

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

WELL DEVELOPMENT LOG

Site/Well No. MW-1612

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 8/25/2016

Weather Development Time Begin 8/25/16 9:30 End 8/25/16 15:01

Evacuation Data

Measuring Point TOC

MP Elevation (ft)

Land Surface Elevation (ft)

Sounded Well Depth (ft bmp) 125.25

Depth to Water (ft bmp) 45.93

Water-Level Elevation (ft)

Water Column in Well (ft) 79.32

Casing Diameter/Type 2" PVC

Gallons in Well 12.7

Pump Intake Setting (ft bmp) ~109

Pumping Rate (gpm) .053-.080

Evacuation Method bladder pump

Volumes Purged 0.33

Field Parameters

Color brown

Odor None

Appearance cloudy

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
8/25/16 13:42	86.20	0.25	0.02	1.21	Overrange	23.19	9.00	NM	5.85		
8/25/16 13:46	86.63	0.50	0.04	1.22	Overrange	22.12	8.90	NM	4.14		
8/25/16 13:52	87.55	0.75	0.06	1.21	Overrange	20.06	8.87	NM	4.20		
8/25/16 13:56	88.10	1.00	0.08	1.20	Overrange	19.06	8.87	NM	7.73		
8/25/16 14:01	88.94	1.25	0.10	1.21	Overrange	20.49	8.85	NM	5.50		
8/25/16 14:06	89.34	1.50	0.12	1.20	Overrange	22.24	8.83	NM	9.59		
8/25/16 14:11	89.55	1.75	0.14	1.19	Overrange	26.24	8.75	NM	6.37		
8/25/16 14:16	89.90	2.00	0.16	1.19	Overrange	27.06	8.73	NM	2.76		
8/25/16 14:21	90.40	2.25	0.18	1.18	Overrange	23.15	8.81	NM	2.98		
8/25/16 14:26	90.55	2.50	0.20	1.18	Overrange	23.61	8.83	NM	2.94		
8/25/16 14:31	90.55	2.75	0.22	1.19	Overrange	25.76	8.82	NM	2.93		
8/25/16 14:36	90.90	3.00	0.24	1.19	Overrange	26.57	8.83	NM	3.09		
8/25/16 14:41	90.95	3.25	0.26	1.19	Overrange	26.61	8.85	NM	3.10		
8/25/16 14:46	91.15	3.50	0.28	1.20	Overrange	17.14	8.85	NM	3.30		
8/25/16 14:51	91.58	3.75	0.30	1.20	Overrange	26.68	8.88	NM	3.56		
8/25/16 14:56	91.61	4.00	0.31	1.20	Overrange	28.30	8.88	NM	3.23		
8/25/16 15:01	91.50	4.25	0.33	1.22	Overrange	30.90	8.86	NM	3.00		

Development Personnel: T. Eyerdom

Notes: Well purged dry twice before parameters being taken

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

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WELL DEVELOPMENT LOG

Site/Well No. MW-26

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 8/23/2016

Weather 80F, Sunny Development Time Begin 8/22/16 13:30 End 8/24/16 10:30

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): N/A
Land Surface Elevation (ft):
Sounded Well Depth (ft bmp): 60.25
Depth to Water (ft bmp): 51.41
Water-Level Elevation (ft):
Water Column in Well (ft): 8.84
Casing Diameter/Type: 2" PVC
Gallons in Well: 1.41

Pump Intake Setting (ft bmp): 58
Pumping Rate (gpm): 0.053-.080
Evacuation Method: Bladder pump
Volumes Purged: 10.99

Field Parameters

Color: White
Odor: None
Appearance: Cloudy

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Remarks
8/23/16 9:45	56.22	11.75	8.32	0.510	97.3	14.96	7.61	NM	6.92	
8/23/16 9:50	56.43	12.50	8.86	0.483	98.7	13.32	7.90	NM	6.32	
8/23/16 10:00	56.77	13.00	9.21	0.484	77.1	16.28	7.93	NM	5.37	
8/23/16 10:05	56.97	13.25	9.40	0.484	67.4	14.48	7.94	NM	5.62	
8/23/16 10:10	BPI	13.50	9.60	0.482	55.7	13.70	7.98	NM	5.16	DRY
8/24/16 9:40	55.78	13.75	9.75	0.518	OVERRANGE	18.50	7.11	NM	6.75	
8/24/16 9:45	56.10	14.00	9.92	0.488	OVERRANGE	15.94	7.16	NM	4.52	
8/24/16 9:50	56.28	14.25	10.11	0.484	633	15.68	7.19	NM	4.15	
8/24/16 9:55	56.45	14.50	10.30	0.482	237	15.60	7.23	NM	4.79	
8/24/16 10:00	56.62	14.75	10.46	0.483	157	16.04	7.30	NM	4.90	
8/24/16 10:05	56.75	15.00	10.64	0.483	92.8	16.20	7.37	NM	4.83	
8/24/16 10:10	56.89	15.25	10.81	0.483	67.1	16.43	7.45	NM	4.66	
8/24/16 10:15	BPI	15.50	10.99	0.483	60.0	16.45	7.51	NM	4.48	
8/24/16 10:20	BPI	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY

Development Personnel: T. Eyerdom

Notes: Did not measure at 0955 on 8/23 due to need to recalibrate turbidimeter.

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

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WELL DEVELOPMENT LOG

Site/Well No. MW-26

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 7/6/2016

Weather 80F, Sunny Development Time Begin 7/6/16 14:01 End 7/6/16 15:33

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): N/A
Land Surface Elevation (ft):
Sounded Well Depth (ft bmp): 60.23
Depth to Water (ft bmp): 52.23
Water-Level Elevation (ft):
Water Column in Well (ft): 8.00
Casing Diameter/Type: 2" PVC
Gallons in Well: 1.28

Pump Intake Setting (ft bmp): 58.00
Pumping Rate (gpm): 0.11
Evacuation Method: submersible pump
Volumes Purged: 6.05

Field Parameters

Color: clear/tan
Odor: None
Appearance:

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
7/6/16 14:06	NM	0.35	0.27	0.503	413.0	18.52	7.68	8	2.36		clear/tan, no odor
7/6/16 14:11	NM	0.75	0.59	0.500	227.0	18.40	7.60	-41	1.63		clear/tan, no odor
7/6/16 14:16	NM	1.20	0.94	0.488	115.0	18.10	7.57	-55	1.09		clear/tan, no odor
7/6/16 14:21	NM	1.80	1.41	0.483	73.1	18.87	7.59	-60	0.78		clear, no odor
7/6/16 14:26	NM	2.25	1.76	0.480	59.2	19.96	7.76	-74	0.55		clear, no odor
7/6/16 14:31	52.75	2.80	2.19	0.476	43.2	19.71	7.77	-77	0.44		clear, no odor
7/6/16 14:45	NM	5.50	4.30	0.484	142.0	16.70	7.61	-77	0.00		clear, no odor
7/6/16 14:50	NM	6.00	4.69	0.484	147.0	19.35	7.68	-82	0.00		clear, no odor
7/6/16 14:55	NM	6.25	4.88	0.479	130.0	18.78	7.66	-81	0.00		clear, no odor
7/6/16 15:00	NM	6.50	5.08	0.481	160.0	19.18	7.62	-80	0.00		clear, no odor
7/6/16 15:05	NM	6.85	5.35	0.491	166.0	20.34	7.59	-79	0.03		clear, no odor
7/6/16 15:10	NM	7.25	5.66	0.478	290.0	23.40	7.69	-86	0.00		clear/tan, no odor
7/6/16 15:15	NM	7.50	5.86	0.488	338.0	24.21	7.55	-81	0.00		clear/tan, no odor
7/6/16 15:25	NM	7.60	5.94	0.488	365.0	27.38	7.75	-96	0.00		clear/tan, no odor
7/6/16 15:30	NM	7.75	6.05	0.470	193.0	21.26	7.79	-95	0.00		clear, no odor

Development Personnel: Kari Eldridge

Notes: At 1438- pump turned up to purge 2 well volumes quickly, then will turn back down and resume low-flow parameter collection.
At 1533- Well dry or pump quit & battery dead in Solinst. No backups, so quit for today; will resume tomorrow.
Well condition: Good. Well locked at arrival? Yes. Well locked at departure? Yes.

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-26

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 7/1/2016

Weather 70F, Sunny Development Time Begin 7/1/16 8:55 End 7/1/16 9:25

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): N/A
Land Surface Elevation (ft):
Sounded Well Depth (ft bmp): 61.20
Depth to Water (ft bmp): 55.10
Water-Level Elevation (ft):
Water Column in Well (ft): 6.1
Casing Diameter/Type: 2" PVC
Gallons in Well: 0.976

Pump Intake Setting (ft bmp):
Pumping Rate (gpm): 0.11
Evacuation Method: proactive pump
Volumes Purged: 3.07

Field Parameters

Color: Light brown
Odor: None
Appearance:

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Remarks
7/1/16 8:55	55.48	0.25	0.26	0.513	>1000	16.96	6.61	119	0.00	Light brown, no odor
7/1/16 9:00	56.69	0.75	0.77	0.511	>1000	17.85	6.87	72	0.00	Light brown, no odor
7/1/16 9:05	57.42	1.00	1.02	0.512	731.0	17.65	6.90	53	0.22	Light brown, no odor
7/1/16 9:10	58.09	1.50	1.54	0.512	469.0	17.55	7.01	37	0.06	Light brown, no odor
7/1/16 9:15	58.76	2.25	2.31	0.513	452.0	17.63	7.15	18	0.00	Light brown, no odor
7/1/16 9:20	59.47	3.00	3.07	0.529	1000*	18.90	7.26	---	0.00	Light brown, no odor
7/1/16 9:25	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY

Development Personnel: T. Eyerdom

Notes: *After pump was lowered into water after water level dropped below intake.

Well location- grass by trail. Condition: Good. Well locked at arrival? Yes. Well locked at departure? Yes. Key number to well: Masterlock.

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-27

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 8/24/2016

Weather 80F, Sunny Development Time Begin 8/23/16 9:30 End 8/24/16 12:16

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): N/A
Land Surface Elevation (ft):
Sounded Well Depth (ft bmp): 132.80
Depth to Water (ft bmp): 73.70
Water-Level Elevation (ft):
Water Column in Well (ft): 59.1
Casing Diameter/Type: 2" PVC
Gallons in Well: 9.5

Pump Intake Setting (ft bmp): 119
Pumping Rate (gpm): 0.053
Evacuation Method: Bladder pump
Volumes Purged: 5.05

Field Parameters

Color: Brown
Odor: None
Appearance: Cloudy

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Remarks
8/24/16 11:16	74.78	0.45	4.74	0.694	OVERRANGE	21.33	9.46	NM	.4.11	
8/24/16 11:21	74.68	0.25	4.78	0.705	OVERRANGE	18.90	9.48	NM	3.12	
8/24/16 11:26	74.85	0.50	4.80	0.701	OVERRANGE	18.67	9.48	NM	3.12	
8/24/16 11:31	75.05	0.75	4.80	0.697	OVERRANGE	18.45	9.48	NM	2.56	
8/24/16 11:36	74.65	1.00	4.84	0.698	OVERRANGE	18.97	9.48	NM	2.19	
8/24/16 11:41	75.20	1.25	4.87	0.701	OVERRANGE	18.66	9.48	NM	2.31	
8/24/16 11:46	75.35	1.50	4.89	0.697	OVERRANGE	18.51	9.48	NM	2.20	
8/24/16 11:51	75.35	1.75	4.92	0.697	952	18.82	9.49	NM	2.24	
8/24/16 11:56	76.00	2.00	4.95	0.700	940	18.66	9.50	NM	2.29	
8/24/16 12:01	76.15	2.25	4.97	0.697	934	18.65	9.51	NM	2.32	
8/24/16 12:06	76.20	2.50	5.00	0.696	849	18.68	9.49	NM	2.43	
8/24/16 12:11	76.30	2.75	5.02	0.696	705	18.75	9.49	NM	2.51	
8/24/16 12:16	76.50	3.00	5.05	0.694	711	18.77	9.50	NM	2.51	

Development Personnel: T. Eyerdom

Notes:

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds		

WELL DEVELOPMENT LOG

Site/Well No. MW-30

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 4/11/2016

Weather 80F, Hot Development Time Begin 4/11/16 13:20 End 4/11/16 14:25

Evacuation Data

Measuring Point: TOC
MP Elevation (ft):
Land Surface Elevation (ft):
Sounded Well Depth (ft bmp): 224.35
Depth to Water (ft bmp): 198.21
Water-Level Elevation (ft):
Water Column in Well (ft): 31.14
Casing Diameter/Type: 2" PVC
Gallons in Well: 4.95

Pump Intake Setting (ft bmp): 228
Pumping Rate (gpm):
Evacuation Method:
Volumes Purged: 15.00

Field Parameters

Color: clear
Odor: None
Appearance:

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks

Development Personnel:

Notes: Removed ~15 gallons prior to well going dry

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-38

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 7/11/2016

Weather 75F, Sunny Development Time Begin 7/11/16 10:08 End 7/11/16 11:08

Evacuation Data

Measuring Point: TOC
MP Elevation (ft):
Land Surface Elevation (ft):
Sounded Well Depth (ft bmp): 28.20
Depth to Water (ft bmp): 8.11
Water-Level Elevation (ft):
Water Column in Well (ft): 20.09
Casing Diameter/Type: 2" PVC
Gallons in Well: 3.21

Pump Intake Setting (ft bmp):
Pumping Rate (gpm):
Evacuation Method: proactive pump
Volumes Purged: 1.79

Field Parameters

Color: clear
Odor: None
Appearance:

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
7/11/16 10:08	10.30	0.25	0.08	0.517	305	17.11	7.14	152	10.52	0.11	light brown, no odor
7/11/16 10:13	11.11	0.75	0.23	0.518	182	18.69	6.92	174	6.23	0.11	light brown, no odor
7/11/16 10:18	11.32	1.25	0.39	0.517	164	19.29	6.85	185	5.27	0.11	light brown, no odor
7/11/16 10:23	11.44	2.00	0.62	0.519	161	20.05	6.82	192	4.26	0.11	light brown, no odor
7/11/16 10:28	11.41	2.50	0.78	0.520	135	20.75	6.82	194	3.58	0.11	light brown, no odor
7/11/16 10:33	11.38	2.75	0.86	0.520	107	21.05	6.82	196	3.15	0.08	light brown, no odor
7/11/16 10:38	11.22	3.00	0.93	0.519	81.7	21.15	6.84	196	2.64	0.08	light brown, no odor
7/11/16 10:43	10.98	3.25	1.01	0.521	59.9	21.35	6.86	195	2.52	0.08	light brown, no odor
7/11/16 10:48	11.65	3.75	1.17	0.518	39.9	19.75	6.88	195	2.28	0.11	light brown, no odor
7/11/16 10:53	11.90	4.25	1.32	0.514	27.0	19.57	6.93	191	1.90	0.11	light brown, no odor
7/11/16 10:58	12.70	4.50	1.40	0.513	25.1	18.79	6.80	196	1.78	0.11	light brown, no odor
7/11/16 11:03	13.42	5.00	1.56	0.511	10.7	18.70	6.93	189	1.41	0.11	light brown, no odor
7/11/16 11:08	13.50	5.75	1.79	0.511	9.85	19.35	6.90	189	1.28	0.11	light brown, no odor

Development Personnel: T. Eyerdom

Notes: Well purged dry twice before parameters being taken

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

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WELL DEVELOPMENT LOG

Site/Well No. MW-39

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 7/7/2016

Weather 70F, Overcast Development Time Begin 7/7/16 8:45 End 7/7/16 11:55

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): 630.00
Land Surface Elevation (ft):
Sounded Well Depth (ft bmp): 84.77
Depth to Water (ft bmp): 4.89
Water-Level Elevation (ft): 625.11
Water Column in Well (ft): 79.88
Casing Diameter/Type: 2" PVC
Gallons in Well: 12.78

Pump Intake Setting (ft bmp): 80.00
Pumping Rate (gpm):
Evacuation Method: submersible pump
Volumes Purged: 0.58

Field Parameters

Color: brown
Odor: None
Appearance: Very turbid

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
7/7/16 8:45	4.75	0.00	0.00	0.471	>800	16.24	8.59	150	2.14	0	
7/7/16 8:50	5.03	0.45	0.04	0.476	>800	17.09	8.44	125	0.76	0.09	
7/7/16 8:55	5.01	0.85	0.07	0.476	>800	17.06	8.36	64	0.33	0.08	
7/7/16 9:00	5.03	1.10	0.09	0.478	>800	17.03	8.32	16	0.10	0.05	
7/7/16 9:05	5.06	1.45	0.11	0.478	>800	16.65	8.28	-24	0.00	0.07	
7/7/16 9:10	5.11	1.85	0.14	0.478	>800	16.55	8.27	-49	0.00	0.08	
7/7/16 9:15	5.12	2.25	0.18	0.478	>800	16.67	8.26	-67	0.00	0.08	
7/7/16 9:20	5.19	2.70	0.21	0.478	>800	16.16	8.26	-75	0.00	0.09	
7/7/16 9:25	5.23	3.30	0.26	0.477	651.0	15.74	8.26	-81	0.00	0.12	
7/7/16 9:30	5.29	3.75	0.29	0.477	390.0	15.76	8.26	-88	0.00	0.09	
7/7/16 9:35	5.29	4.50	0.35	0.477	269.0	15.83	8.25	-92	0.00	0.15	
7/7/16 9:40	5.29	4.80	0.38	0.478	257.0	15.74	8.49	-105	0.00	0.06	
7/7/16 9:45	5.30	5.40	0.42	0.477	164.0	15.87	8.39	-104	0.00	0.06	
7/7/16 9:50	5.33	5.90	0.46	0.477	129.0	15.64	8.35	-105	0.00	0.10	
7/7/16 9:55	5.32	6.45	0.50	0.477	96.4	15.79	8.34	-106	0.00	0.11	
7/7/16 10:00	5.32	6.95	0.54	0.477	88.2	15.91	8.33	-108	0.00	0.10	
7/7/16 10:05	5.29	7.40	0.58	0.478	79.5	16.21	8.33	-109	0.00	0.09	

Development Personnel: Kari Eldridge

Notes:

Well Condition: Good. Well locked at arrival? Yes. Well locked at departure? Yes.

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-39

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 7/7/2016

Weather 70F, Overcast Development Time Begin 7/7/16 8:45 End 7/7/16 11:55

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): 630.00
Land Surface Elevation (ft):
Sounded Well Depth (ft bmp): 84.77
Depth to Water (ft bmp): 4.89
Water-Level Elevation (ft): 625.11
Water Column in Well (ft): 79.88
Casing Diameter/Type: 2" PVC
Gallons in Well: 12.78

Pump Intake Setting (ft bmp): 80.00
Pumping Rate (gpm):
Evacuation Method: submersible pump
Volumes Purged: 1.15

Field Parameters

Color: clear
Odor: None
Appearance:

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
7/7/16 10:10	5.29	7.75	0.61	0.478	74.5	16.24	8.33	-111	0.00	0.07	Clear, no odor
7/7/16 10:15	5.29	8.20	0.64	0.478	69.0	16.10	8.33	-112	0.00	0.09	Clear, no odor
7/7/16 10:20	5.27	8.55	0.67	0.478	61.8	16.20	8.33	-113	0.00	0.07	Clear, no odor
7/7/16 10:25	5.31	8.95	0.70	0.477	58.6	16.15	8.34	-115	0.00	0.08	Clear, no odor
7/7/16 10:30	5.31	9.50	0.74	0.476	50.7	16.12	8.37	-117	0.00	0.11	Clear, no odor
7/7/16 10:35	5.31	9.90	0.77	0.477	45.1	15.87	8.42	-121	0.00	0.08	Clear, no odor
7/7/16 10:40	5.36	10.25	0.80	0.477	42.6	15.76	8.46	-124	0.00	0.07	Clear, no odor
7/7/16 10:45	5.36	10.70	0.84	0.477	39.1	15.87	8.50	-126	0.00	0.09	Clear, no odor
7/7/16 10:50	5.36	11.10	0.87	0.477	36.7	15.99	8.50	-127	0.00	0.08	Clear, no odor
7/7/16 10:55	5.38	11.60	0.91	0.477	33.0	16.22	8.50	-128	0.00	0.10	Clear, no odor
7/7/16 11:00	5.38	12.05	0.94	0.477	30.5	16.28	8.49	-129	0.00	0.09	Clear, no odor
7/7/16 11:05	5.37	12.60	0.99	0.477	29.0	16.26	8.50	-130	0.00	0.11	Clear, no odor
7/7/16 11:10	5.39	13.05	1.02	0.477	27.9	16.42	8.50	-131	0.00	0.09	Clear, no odor
7/7/16 11:15	5.40	13.45	1.05	0.477	26.6	16.37	8.51	-132	0.00	0.08	Clear, no odor
7/7/16 11:20	5.39	13.85	1.08	0.477	23.3	16.55	8.53	-134	0.00	0.08	Clear, no odor
7/7/16 11:25	5.36	14.25	1.12	0.477	23.1	16.91	8.57	-137	0.00	0.08	Clear, no odor
7/7/16 11:30	5.34	14.75	1.15	0.477	23.6	16.94	8.62	-140	0.00	0.1	Clear, no odor

Development Personnel: Kari Eldridge

Notes:

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-39

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 7/7/2016

Weather 70F, Overcast Development Time Begin 7/7/16 8:45 End 7/7/16 11:55

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): 630.00
Land Surface Elevation (ft):
Sounded Well Depth (ft bmp): 84.77
Depth to Water (ft bmp): 4.89
Water-Level Elevation (ft): 625.11
Water Column in Well (ft): 79.88
Casing Diameter/Type: 2" PVC
Gallons in Well: 12.78

Pump Intake Setting (ft bmp): 80.00
Pumping Rate (gpm):
Evacuation Method: submersible pump
Volumes Purged: 1.27

Field Parameters

Color: clear
Odor: None
Appearance:

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
7/7/16 11:35	5.35	15.05	1.18	0.477	22.9	16.83	8.69	-143	0.00	0.06	Clear, no odor
7/7/16 11:40	5.35	15.30	1.20	0.477	22.3	17.32	8.72	-146	0.00	0.05	Clear, no odor
7/7/16 11:45	5.34	15.55	1.22	0.477	21.6	17.48	8.74	-147	0.00	0.05	Clear, no odor
7/7/16 11:50	5.32	15.95	1.25	0.476	21.7	17.64	8.75	-147	0.00	0.08	Clear, no odor
7/7/16 11:55	5.32	16.20	1.27	0.477	21.0	17.09	8.75	-147	0.00	0.05	Clear, no odor

Development Personnel: Kari Eldridge

Notes:

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

ARCADIS Design & Consultancy for natural and built assets

WELL DEVELOPMENT LOG

Site/Well No. MW-39

Project AEP Mountaineer Plant Project No. OHO15976.0009 Page 1 of 1

Site Location 1347 Graham Station Rd., New Haven, WV 25253 Date 7/1/2016

Weather 75F, Cloudy, Rain Development Time Begin 7/1/16 13:48 End 7/1/16 14:03

Evacuation Data

Measuring Point: TOC
MP Elevation (ft): N/A
Land Surface Elevation (ft):
Sounded Well Depth (ft bmp): 58.50
Depth to Water (ft bmp): 5.43
Water-Level Elevation (ft):
Water Column in Well (ft): 53.07
Casing Diameter/Type: 2" PVC
Gallons in Well: 8.5

Pump Intake Setting (ft bmp):
Pumping Rate (gpm): .11
Evacuation Method: foot valve/surge block, proactive
Volumes Purged: 10.53

Field Parameters

Color: brown
Odor: None
Appearance: Very turbid

Time	Depth to Water (ft btoc)	Volume Withdrawn (gal)	Well Volumes Removed	Conductivity (mS/cm or umhos/cm)	Turbidity (NTU)	Temperature (°C)	pH (s.u.)	ORP (mV)	Dissolved Oxygen (g/mL)	Rate (gpm)	Remarks
7/1/16 13:48	9.39	85.00	10.00	0.491	95.7	15.03	8.67	-141	0.35	0.11	white brown/no odor
7/1/16 13:53	9.34	86.50	10.18	0.491	108.0	15.66	8.48	-132	0.11	0.11	white brown/no odor
7/1/16 13:58	8.05	88.00	10.35	0.491	141.0	15.25	8.43	-130	0.00	0.11	white brown/no odor
7/1/16 14:03	7.69	89.50	10.53	0.490	156.0	15.10	8.35	-127	0.00	0.11	white brown/no odor

Development Personnel: Tim Eyerdom

Notes: ~10 well volumes removed 5 well volumes by foot valve/surge and 5 by proactive). Sampling stopped due to high turbidity values.

Well location- grass next to trail. Condition: Good. Well locked at arrival? Yes. Well locked at departure? Yes. Key number to well: Masterlock.

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 Potential
°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	mV	millivolts
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds	BPI	Below Pump Intake

ARCADIS

Borehole Geophysics Report

VIA EMAIL: trey.fortner@arcadis.com

June 23, 2016
Revised September 14, 2016

Robert Wolford, MS, EI
Environmental Specialist
Arcadis U.S., Inc,
100 E. Campus View Blvd, Suite 200
Columbus OH | 43235
(614) 985-9103

Re: Geophysical Logging
Mountaineer Generating Power Plant, New Haven, WV
THG Project No. 246-6306

Dear Mr. Wolford:

THG Geophysics, Ltd. (THG) completed geophysical logging of 2 borings at the coal combustion residuals landfill of the American Electric Power – Mountaineer Plant located in New Haven, West Virginia (Figure 1, Table 1). Logging took place June 21, 2016. A series of down-hole logs were collected including caliper, resistivity, natural gamma, temperature, SP, SPR, and fluid resistivity. Depending upon water turbidity, either an acoustic and/or an optical televiewer of each well was acquired. Due to the nature of each well, the surveys were tailored to maximize available data from each individual well.

GEOPHYSICAL WELL LOGGING SUITE

Optical Televiewer provides a graphic image of the borehole sidewall by generating a continuous oriented 360° image of the borehole wall using an optical imaging system; a downhole CCD camera records the image of the borehole wall in a prism. The tool contains a gyroscope for orientation and for accurate borehole deviation. Post processing can identify fracture location, aperture and orientation (Table 2).

Acoustic Televiewer provides a graphic image of the borehole sidewall and is used for fracture location and orientation. The azimuth direction of the fracture is the direction from true north (in a clockwise direction) of the maximum dip angle of the fracture from the horizontal position. Azimuth is 90° from the direction of the strike of the fracture (Table 2).

Caliper (inches) measures the changes in hole diameter and is used for fracture detection.

Electrical Resistivity (ER) is a measurement of the formation apparent resistivity and is used for lithologic correlation, fluid invasion and provides an indication of potential porosity.

Fluid Resistivity (Ohm-m) measures the fluid resistivity and is used to locate conductive contaminant plumes.

Natural Gamma (API Units or cycles per second) is a measurement of the naturally occurring gamma radiation (K^{40}, U^{238}, Th^{232}) that is used for lithologic correlation.

Spontaneous Potential (SP) is a measurement in milliVolts of the naturally occurring potential that develops between the borehole fluids, formation water, and rock and is used for lithologic correlation.

Single Point Resistance (SPR) is a measurement in Ohms of the potential difference with respect to a surface ground electrode and is used to detect the vertical migration of water.

Temperature (°C) is a measure of the fluid temperature and can be used to identify transmissive zones.

BORING LOGS

MW-1610

The geophysical log for 1610 shows that this boring was logged to 206.7 feet below grade (ftbg) and casing ends at 26 ftbg. The optical televiewer was used until image quality was reduced by turbid water encountered at 117 ftbg. An acoustic televiewer was used to image the remainder of the borehole from 117-206.7 ftbg. The optical/acoustic televiewer identified 1 partially open fracture and 10 planar features, none of which appeared to transmit water (Table 2).

MW-1611

The geophysical log for 1611 shows that this boring was logged to 46.3 ftbg and casing ends at 26.4 ftbg. Due to poor image quality caused by turbid water, the acoustic televiewer was used image the borehole. The acoustic televiewer identified 6 fractures (Table 2). The broken zone at the bottom of the boring appears to be very transmissive.

For 1610 and 1611, a pole plot exhibiting the great circle indicated that the mean lineation azimuth is 227° and the mean lineation plunge is 48°. The great circle azimuth is 72° and the great circle plunge is 69° (Figure 1). Combined for both borings, the rose diagram vector mean of the strike is 25° and the vector mean of the dip is 43° (Figure 2).

Should you have any questions or comments, please contact our office at (724) 325-3996 or via e-mail at pjh@thggeophysics.com.

Respectfully,
THG Geophysics, Ltd.

Peter J. Hutchinson, PhD, PG
Senior Geophysicist

Enclosure

Geophysical investigations are a non-invasive method of interpreting physical properties of the shallow earth using electrical, electromagnetic, or mechanical energy. This document contains geophysical interpretations of responses to induced or real-world phenomena. As such, the measured phenomenon may be impacted by variables not readily identified in the field that can result in a false-positive and/or false-negative interpretation. THG makes no representations or warranties as to the accuracy of the interpretations.

Table 1

Well Statistics

AEP- Mountaineer Power Plant
New Haven, West Virginia

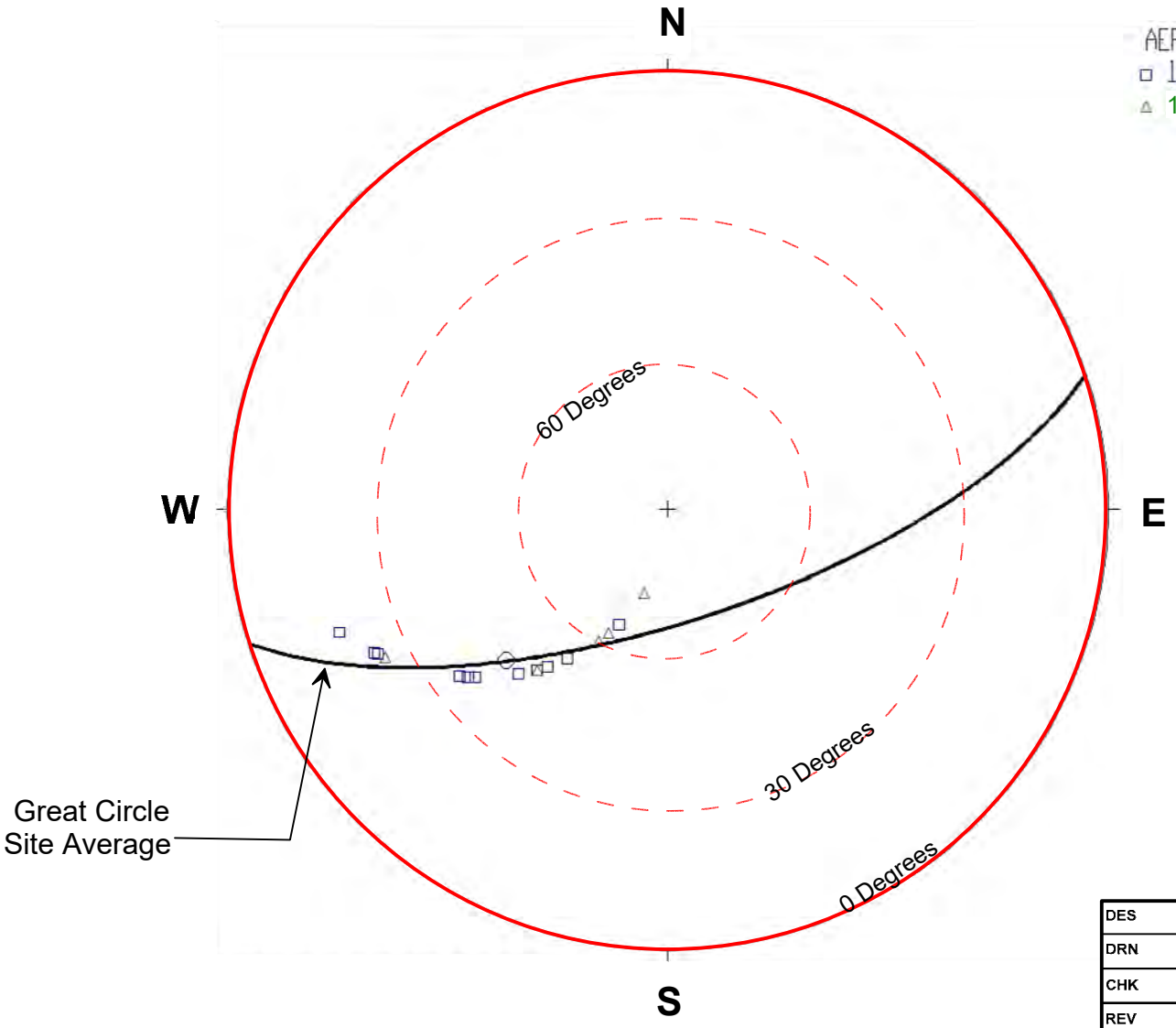
Boring Number	Casing Depth (ft)	Total Depth (ft)	Depth to Water (ft)
MW-1610	26.0	206.7	<26.0
MW-1611	26.4	46.3	~12.0

Table 2

Fracture Depths and Orientation

AEP- Mountaineer Power Plant
New Haven, West Virginia

BORING	Depth (ft)	Azimuth (deg)	Dip (deg)	Aperture (in)	Type
MW-1610	127.5	13.2	69.59	0.0	Partially Open Fracture
	136.7	39.7	42.36	0.0	Bedding
	137.5	45.4	33.9	0.0	Bedding
	138.7	18.0	37.52	0.0	Bedding
	139.5	55.8	49.04	0.0	Bedding
	140.7	42.1	23.36	0.0	Bedding
	143.2	30.2	39.21	0.0	Filled Fracture
	162.0	185.7	64.15	0.0	Filled Fracture
	171.7	3.3	63.62	0.0	Filled Fracture
	176.9	132.3	51.3	0.0	Filled Fracture
	198.7	204.6	50.19	0.0	Broken Zone
MW-1611	30.67	337.8	39.21	6.5	Major Open Fracture
	32.48	115.75	16.07	5.3	Partially Open Fracture
	35.94	11.34	27.83	17.4	Major Open Fracture
	37.02	89.76	25.64	13.9	Major Open Fracture
	38.76	130.87	39.21	7.8	Major Open Fracture
	43.43	81.26	62.49	74.3	Broken Zone



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(724) 325-3996 Fax: (724) 733-7901
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DES	LEM	6/23/16
DRN	LEM	6/23/16
CHK	PJH	6/23/16
REV	AB	9/14/16
PROJ MGR.	PJH	9/14/16

PROJECT:
Geophysical Borehole Logging
AEP - Mountaineer Plant
New Haven, West Virginia

SCALE: Not Applicable

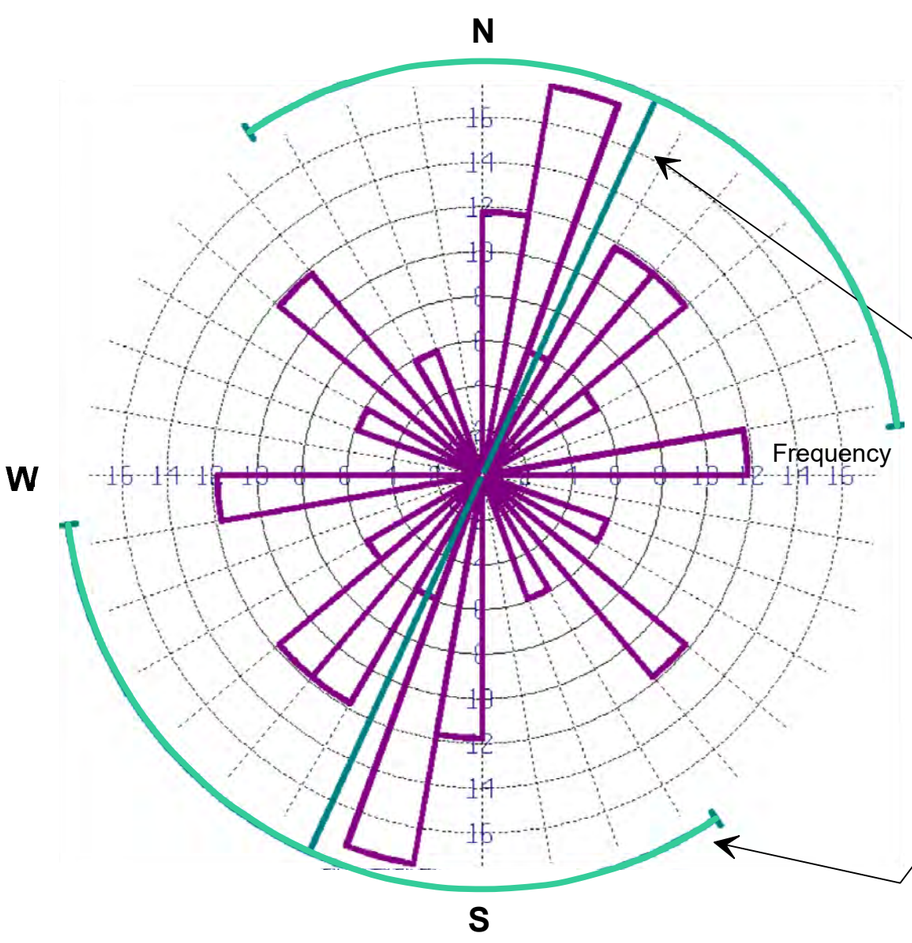
SOURCE: Not Applicable

SHEET TITLE:
Figure 1
Pole Plot
MW-1610 & MW-1611

PREPARED FOR:
ARCADIS Design & Consultancy for natural and built assets

PROJECT NO.: 246-6306

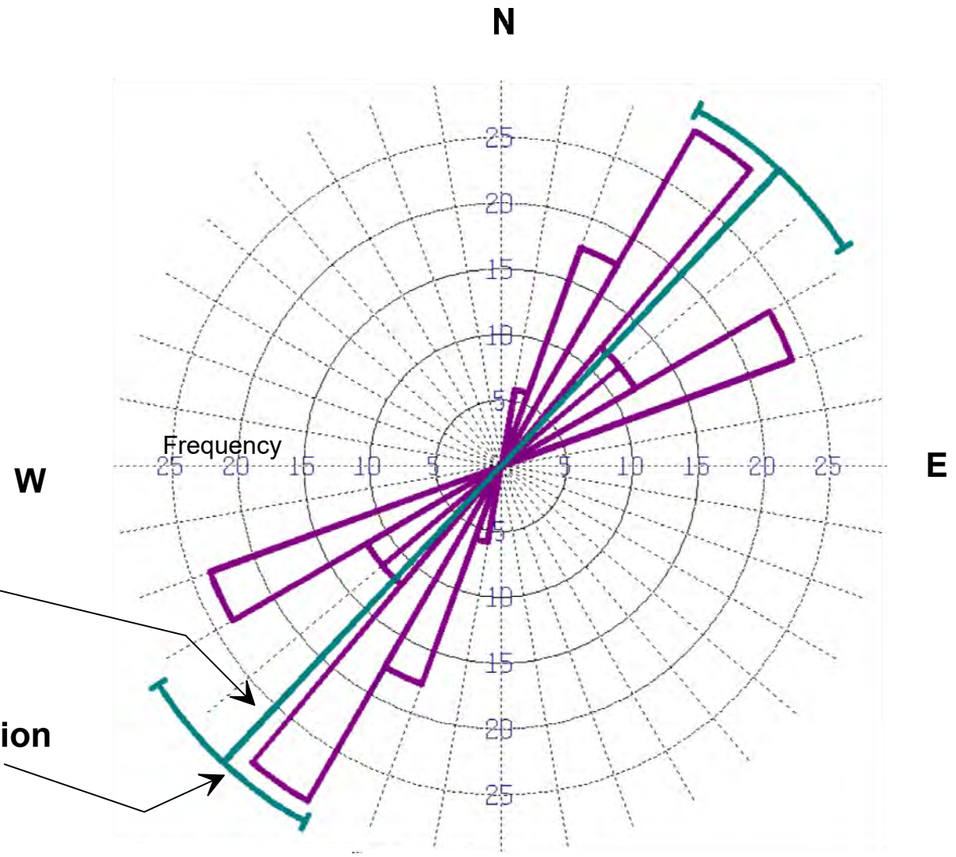
DRAWING NO.: DWG6306F1



Strike

Site Average

Standard Deviation



Dip Vectors

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DES	LEM	6/23/16
DRN	LEM	6/23/16
CHK	PJH	6/23/16
REV	AB	9/14/16
PROJ MGR.	PJH	9/14/16

PROJECT:
Geophysical Borehole Logging
AEP - Mountaineer Plant
New Haven, West Virginia

SCALE: Not Applicable

SOURCE: Not Applicable

SHEET TITLE:
Figure 2
Strike and Dip Vectors
Rose Diagrams - MW-1610 & MW1611

PREPARED FOR: ARCADIS Design & Consultancy for natural and built assets

PROJECT NO.: 246-6306

DRAWING NO.: DWG6306F2

Site Name:	American Electric Power - Mountaineer
Site Location:	New Haven, West Virginia
Well Number:	MW-1610
Type of Survey:	Lithologic Log
Date Logged:	6/21/2016
Bore Hole Diameter:	3 inches
Log Depth:	206.7 ft; casing 26 ft
Logged By:	P. Hutchinson, L. Mathews
Client:	ARCADIS

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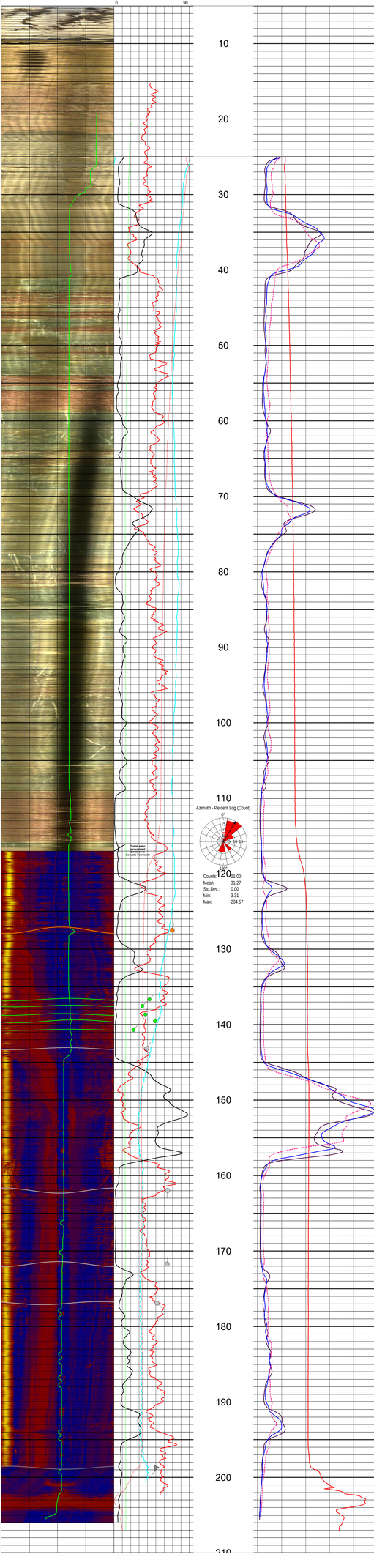
- Broken Zone / Undifferentiated
- Partially Open Joint / Fracture
- Filled Fracture / Joint
- Bedding / Banding / Foliation

Acoustic Televiewer Amplitude-NM 0° 90° 180° 270°
Optical Televiewer Image-NM 0° 90° 180° 270°
Caliper 2 in 4
Planar Features 0° 90° 180° 270°
Gamma 0° 30 cps 250
SP 0 650 mV 800
SPR 0° 440 uS/cm 1800
FCond 50 DegF 70
Temp 0 90
Tadpole
Depth 1in:5ft
Rose Diagram - Azimuth
Azimuth - Percent Log (Count) 0 650
Fres 0 Ohm-m 25
R8 0 Ohm-m 650
R16 0 Ohm-m 550
R32 0 Ohm-m 400



Site Name:	American Electric Power - Mountaineer
Site Location:	New Haven, West Virginia
Well Number:	MW-1611
Type of Survey:	Lithologic Log
Date Logged:	6/21/2016
Bore Hole Diameter:	3 inches
Log Depth:	46.3 ft; casing 26.4 ft
Logged By:	P. Hutchinson, L. Mathews
Client:	ARCADIS

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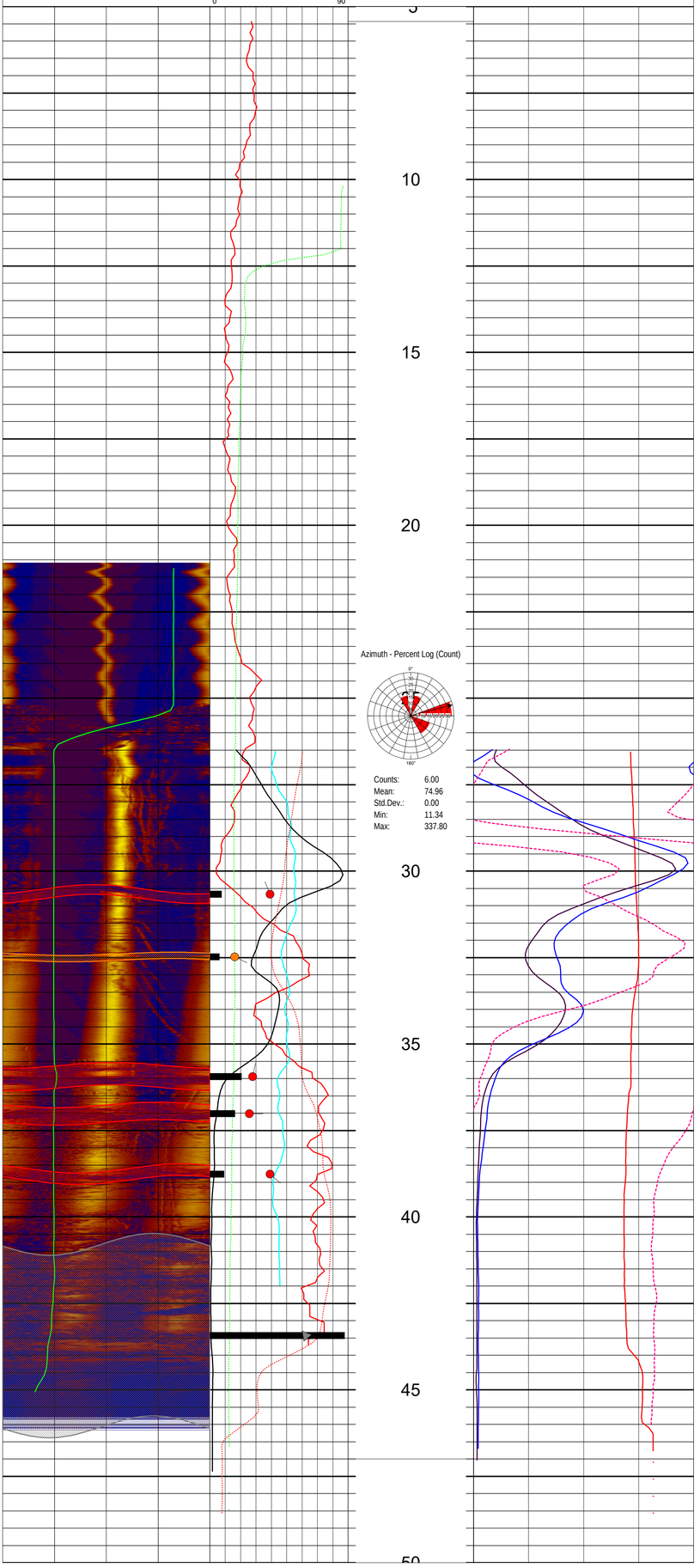
Broken Zone / Undifferentiated
Major Open Joint / Fracture
Partially Open Joint / Fracture

Acoustic Televiewer Amplitude-NM
0° 90° 180° 270° 0°
Caliper
2 in 7
Planar Features
0° 90° 180° 270° 0°

Gamma
50 cps 250
SP
650 mV 750
SPR
60 Ohm 750
FCond
600 uS/cm 750
Temp
50 DegF 80
Planar Features : Aperture
0 inch/10 300
Tadpole
0 90

Depth
1in:2ft
Rose Diagram - Azimuth - Percent Log (Count)

Fres
0 Ohm-m 20
R8
0 Ohm-m 700
R16
0 Ohm-m 410
R32
25 Ohm-m 125



Azimuth - Percent Log (Count)

Counts:	6.00
Mean:	74.96
Std.Dev.:	0.00
Min:	11.34
Max:	337.80

Appendix E

Annual Groundwater Monitoring and Corrective Action Reports

DRAFT

Annual Groundwater Monitoring Report

Appalachian Power Company

Mountaineer Plant

Bottom Ash Pond CCR Management Unit

Letart, WV

January 2020

Prepared by:
American Electric Power Service Corporation
1 Riverside Plaza
Columbus, Ohio 43215

APPALACHIAN POWER™

An AEP Company

BOUNDLESS ENERGY™

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III.	Monitoring Wells Installed or Decommissioned	4
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Appendix 1 – GW Quality Data, GW Flow Directions, GW Flow Rates

Appendix 2 – GW Quality Data Statistical Analyses

Appendix 3 – Alternative Source Demonstrations

Appendix 4 – Notices for Monitoring Program Transitions

Appendix 5 – Well Installation / Decommissioning Logs

I. Overview

This *Annual Groundwater Monitoring and Corrective Action Report* (Report) has been prepared to report the status of activities for the preceding year for the bottom ash pond CCR unit at Appalachian Power Company's, a wholly-owned subsidiary of American Electric Power Company (AEP), Mountaineer Power Plant. The USEPA's CCR rules require that the Annual Groundwater Monitoring and Corrective Action Report be posted to the operating record for the preceding year no later than January 31.

In general, the following activities were completed in 2019:

- Groundwater samples were collected and analyzed for Appendix III and Appendix IV constituents, as specified in 40 CFR 257.95 *et seq.* and AEP's *Groundwater Sampling and Analysis Plan*;
- Groundwater was sampled in April, June, and September 2019 as part of the Assessment Monitoring Program requirements;
- Groundwater data underwent various validation tests, including tests for completeness, valid values, transcription errors, and consistent units;
- Notification of a statistically significant level (SSL) of constituent above groundwater protection standard (GWPS) was completed;
- Assessment of Corrective Action was initiated, an Assessment of Corrective Measures report was completed, and a corrective action public meeting was held. Evaluation of selection of remedy is ongoing.
- Monitoring wells were installed and developed as part of the Nature and Extent Study and Assessment of Corrective Measures around the CCR unit in accordance with the requirements of 40 CFR 257.95;

The major components of this annual report, to the extent applicable at this time, are presented in sections that follow:

- A map, aerial photograph or a drawing showing the CCR management unit(s), all groundwater monitoring wells and monitoring well identification numbers.
- Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a statement as to why that happened.
- All of the monitoring data collected, including the rate and direction of groundwater flow, plus a summary showing the number of samples collected per monitoring well, the dates the samples were collected and whether the sample was collected as part of detection monitoring or assessment monitoring programs (Attached as **Appendix 1**).

- A summary of any transition between monitoring programs or an alternate monitoring frequency, for example the date and circumstances for transitioning from detection monitoring to assessment monitoring, in addition to identifying the constituents detected at a statistically significant increase over background concentrations (**Appendix 4**).
- Other information required to be included in the annual report such as alternate source demonstration or assessment of corrective measures, if applicable

In addition, this report summarizes key actions completed, and where applicable, describes any problems encountered and actions taken to resolve those problems. The report includes a projection of key activities for the upcoming year.

II. Groundwater Monitoring Well Locations and Identification Numbers

The figure that follows depicts the PE-certified groundwater monitoring network, the monitoring well locations and their corresponding identification numbers. The total groundwater monitoring network includes 4 up-gradient wells and 8 down-gradient wells. The monitoring well distribution adequately cover down-gradient and up-gradient areas as detailed in the *Ground Water Monitoring Well Network Evaluation* report that was placed in the American Electric Power CCR public internet site on March 9, 2017. Additional wells are shown in the figure that were installed as part of the Nature and Extent Characterization study.

Monitoring Well Network

- Compliance Sampling Location
- Background Sampling Location
- Nature and Extent Wells
- Bottom Ash Ponds

Notes

- Monitoring well coordinates provided by AEP.
- Site features based on information available in Ash Pond System-CCR Groundwater Monitoring Well Network Evaluation (Arcadis, 2016) provided by AEP.

Site Layout
CCR Bottom Ash Ponds
AEP Mountaineer Generating Plant
Letart, West Virginia

Geosyntec consultants

Columbus, Ohio | 2020/01/24

Figure 1

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mountaineer\AEP-Mountaineer_BAP_Site_Layout.mxd. ARevezzo. 1/24/2020. CHA8423/07/08.

III. Monitoring Wells Installed or Decommissioned

There was installation of 10 additional groundwater monitoring wells at the Mountaineer Bottom Ash Pond as part of the characterization of nature and extent of a release from the BAP. These are:

- MW-1921, MW-1922S, MW-1922D, MW-1923, MW-1924, MW-1925, MW-1926, MW-1927, MW-1928, MW-1929

An additional monitoring well was also installed in 2018 and included in the 2019 nature and extent study.

- MW-1805

Additionally, three monitoring wells that were installed as part of a subsurface investigation in 2006 have been included in the sampling and analysis as a part of the nature and extent characterization.

- MW-107, MW-112, MW-203

Boring logs and well construction forms for these 14 monitoring wells are included in **Appendix 5**.

IV. Groundwater Quality Data and Static Water Elevation Data and Flow Rate

Appendix 1 contains tables showing the groundwater quality data collected during the establishment of background quality, detection monitoring, and assessment monitoring. Static water elevation data from each monitoring event also are shown in **Appendix 1**, along with the groundwater velocity calculations, groundwater flow direction and potentiometric maps developed after each sampling event. It is important to note that MW-1928 although installed, was unable to be sampled due to very low groundwater yield the first attempt and the monitoring well being dry and not recovering on the following attempts.

V. Groundwater Quality Data Statistical Analysis

Statistical analysis of the first 257.95(d)(1) (assessment monitoring of all Appendix III and detected Appendix IV parameters) resulted in a SSL above the GWPS for lithium on January 8, 2019. A notice of this SSL was placed in the facility electronic operating record and on the publicly available internet site. The next 257.95(d)(1) sampling and analysis continued to result in a SSL above the lithium GWPS on July 12, 2019 and a notice was subsequently made and placed in the facility electronic operating record and on the publicly available internet site. The second 257.95(d)(1) groundwater sampling, laboratory analysis, and statistical analysis resulted

in a SSL above the lithium GWPS on December 23, 2019 and a notice was subsequently made and placed in the facility electronic operating record and will be placed on the publically available internet site within 30 days of the operating record notice. The notice of statistically significant levels above the groundwater protection standard can be found in **Appendix 4** and on the publicly available internet site at https://www.aep.com/environment/ccr. The statistical analysis reports completed in 2019 related to the September 2018 assessment monitoring, April 2019 assessment monitoring, and September 2019 sampling events can be found in **Appendix 2** of this report.

VI. Alternative Source Demonstrations

No alternative source demonstrations were completed related to the assessment monitoring sampling events and statistical analysis.

VII. Discussion About Transition Between Monitoring Requirements or Alternate Monitoring Frequency

The Mountaineer Bottom Ash Pond CCR Unit transitioned from the Assessment Monitoring program to the Assessment of Corrective Measures program on March 26, 2019 due to the SSL above a GWPS on January 8, 2019. An Assessment of Corrective Measures Report was completed on June 24, 2019. A public meeting was held to present the assessment of corrective measure options. At this time, the selection of remedy is on-going and a semi-annual report describing the progress in selecting and designing the remedy will be completed in early 2020. Semi-annual assessment monitoring sampling and analysis will continue during the assessment of corrective measures and selection of remedy. The notice for initiating an assessment of corrective measures can be found in **Appendix 4** of this report and on the publicly available internet site at https://www.aep.com/environment/ccr.

Regarding defining an alternate monitoring frequency, the groundwater velocity and monitoring well production is high enough at this facility that no modification to the monitoring frequency is needed.

VIII. Other Information Required

All required information has been included in this annual groundwater monitoring report.

IX. Description of Any Problems Encountered in 2019 and Actions Taken

No significant problems were encountered. The low flow sampling effort went smoothly and the schedule was met to support this annual groundwater report preparation.

X. A Projection of Key Activities for the Upcoming Year

Key activities for 2020 include:

- Assessment monitoring on a twice per year schedule;
- Continue evaluation of the selection of remedy;
- Prepare a selection of remedy semi-annual progress report;
- Responding to any new data received in light of what the CCR rule requires; and
- Preparation of the next annual groundwater report.

APPENDIX 1

Tables follow that show the groundwater monitoring data collected and rate and direction of groundwater flow. The dates that the samples were collected are also shown.

Table 1 - Groundwater Data Summary: MW-107
Mountaineer - BAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
4/10/2019	Assessment	0.614	270	71.4	0.21	6.8	1270	518
6/18/2019	Assessment	0.592	245	71.7	0.22	6.8	1250	545
9/10/2019	Assessment	0.696	316	79.7	0.19	7.1	1410	631

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-107
Mountaineer - BAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
4/10/2019	Assessment	<0.10 U	1.08	68.3	<0.1 U	0.05 J	0.4 J	1.03	1.854	0.21	0.4 J	0.02 J	<0.002 U	<2 U	0.7 J	<0.5 U
6/18/2019	Assessment	0.03 J	0.44	69.4	<0.02 U	0.05	0.08 J	1.45	0.2284	0.22	0.04 J	<0.009 U	<0.002 U	<0.4 U	0.6	<0.1 U
9/10/2019	Assessment	0.02 J	0.44	67.8	<0.02 U	0.04 J	0.07 J	1.08	3.5	0.19	<0.05 U	0.00358	<0.002 U	<0.4 U	0.8	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-112
Mountaineer - BAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
6/19/2019	Assessment	0.283	142	37.2	0.24	7.17	668	255

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-112
Mountaineer - BAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
6/19/2019	Assessment	<0.02 U	0.40	76.9	<0.02 U	<0.01 U	0.2 J	0.02 J	0.0507	0.24	0.02 J	<0.009 U	<0.002 U	11.2	1.5	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-203
Mountaineer - BAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
6/18/2019	Assessment	0.1 J	115	31.4	0.22	7.2	472	86.8
9/11/2019	Assessment	0.104	106	10.1	0.22	7.1	435	65.5

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-203
Mountaineer - BAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
6/18/2019	Assessment	<0.02 U	0.30	34.7	<0.02 U	<0.01 U	0.2 J	0.054	0.1139	0.22	0.113	<0.009 U	<0.002 U	2 J	1.4	<0.1 U
9/11/2019	Assessment	0.02 J	0.33	31.6	<0.02 U	<0.01 U	0.2 J	0.139	0.381	0.22	0.2 J	0.00230	<0.002 U	1 J	1.1	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1601A
Mountaineer - BAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/28/2016	Background	0.211	141	21.8	0.17	7.6	538	130
11/1/2016	Background	0.170	122	17.3	0.19	7.2	534	136
12/19/2016	Background	0.196	130	20.4	0.18	7.2	544	141
2/20/2017	Background	0.253	117	31.0	0.20	7.2	568	135
3/27/2017	Background	0.515	119	42.1	0.19	7.1	530	148
4/18/2017	Background	0.259	130	55.3	0.19	7.1	580	169
5/15/2017	Background	0.224	159	74.4	0.18	7.7	676	197
6/12/2017	Background	0.285	138	57.7	0.18	6.9	586	170
10/30/2017	Detection	0.224	137	49.4	0.19	7.1	564	169
5/10/2018	Assessment	- -	- -	- -	0.16	7.3	- -	- -
9/20/2018	Assessment	0.251	148	51.0	0.19	7.1	638	189
4/9/2019	Assessment	0.224	155	44.4	0.1 J	7.1	692	176
6/20/2019	Assessment	0.160	165	48.6	0.16	7.3	730	207
9/11/2019	Assessment	0.153	164	45.8	0.14	7.0	749	221

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1601A
Mountaineer - BAP
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
9/28/2016	Background	0.05	0.62	46.6	<0.005 U	0.01 J	0.3	0.116	0.43758	0.17	0.132	0.002	<0.002 U	2.61	1.3	0.053
11/1/2016	Background	0.05 J	0.61	45.2	<0.005 U	0.02 J	1.3	0.086	2.011	0.19	0.108	0.001	<0.002 U	2.36	1.1	0.058
12/19/2016	Background	0.05 J	0.65	47.0	<0.005 U	0.02 J	0.806	0.282	1.544	0.18	0.383	<0.0002 U	<0.002 U	0.93	1.1	0.04 J
2/20/2017	Background	0.03 J	0.55	41.4	<0.005 U	0.02 J	0.198	0.132	0.313	0.20	0.139	0.005	<0.002 U	1.42	1.4	0.070
3/27/2017	Background	0.03 J	0.49	40.2	<0.005 U	0.01 J	0.225	0.097	0.495	0.19	0.069	0.006	<0.002 U	2.85	1.0	0.03 J
4/18/2017	Background	0.03 J	0.59	47.5	<0.004 U	0.01 J	0.170	0.093	0.814	0.19	0.052	0.007	0.003 J	1.53	1.5	0.04 J
5/15/2017	Background	0.04 J	0.79	56.9	<0.004 U	0.02 J	0.166	0.154	1.279	0.18	0.141	<0.0002 U	<0.002 U	2.04	1.3	0.04 J
6/12/2017	Background	0.04 J	0.61	49.0	<0.004 U	0.02 J	0.152	0.098	0.599	0.18	0.063	0.004	<0.002 U	1.13	1.5	0.04 J
5/10/2018	Assessment	0.03 J	0.55	63.9	<0.004 U	0.02 J	0.153	0.083	0.767	0.16	0.034	0.004	<0.002 U	0.99	1.5	0.03 J
9/20/2018	Assessment	0.03 J	0.58	55.3	<0.004 U	0.02 J	0.131	0.059	0.696	0.19	0.005 J	0.004	<0.002 U	0.76	1.1	0.04 J
4/9/2019	Assessment	<0.10 U	0.61	52.0	<0.1 U	<0.05 U	0.2 J	0.2 J	1.168	0.1 J	<0.1 U	0.02 J	<0.002 U	<2 U	1.1	<0.5 U
6/20/2019	Assessment	0.03 J	0.63	63.1	<0.02 U	0.02 J	0.314	0.03 J	0.45	0.16	0.07 J	<0.009 U	<0.002 U	0.9 J	1.3	<0.1 U
9/11/2019	Assessment	0.03 J	0.62	65.3	<0.02 U	0.02 J	0.370	0.03 J	1.168	0.14	<0.05 U	0.00184	<0.002 U	0.9 J	1.1	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1602
Mountaineer - BAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/28/2016	Background	0.141	74.9	7.95	0.17	7.3	412	167
11/1/2016	Background	0.115	71.1	8.70	0.18	6.6	424	178
12/19/2016	Background	0.120	74.7	9.91	0.18	6.9	470	188
2/20/2017	Background	0.093	69.6	9.76	0.19	6.5	494	193
3/27/2017	Background	0.240	86.6	12.0	0.19	6.3	504	231
4/17/2017	Background	0.107	91.1	12.1	0.20	6.7	520	248
5/15/2017	Background	0.115	105	12.6	0.19	7.0	598	273
6/12/2017	Background	0.153	94.0	11.8	0.20	6.8	588	269
10/30/2017	Detection	0.093	78.1	8.41	0.23	6.7	468	184
5/10/2018	Assessment	- -	- -	- -	0.23	7.0	- -	- -
9/20/2018	Assessment	0.109	81.6	10.5	0.25	7.1	502	195
4/9/2019	Assessment	0.09 J	99.8	11.4	0.20	6.6	595	221
6/20/2019	Assessment	0.1 J	91.2	10.7	0.23	7.0	606	267
9/11/2019	Assessment	0.111	95.1	10.4	0.21	6.7	603	259

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1602
Mountaineer - BAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
9/28/2016	Background	0.02 J	0.40	27.1	<0.005 U	0.02 J	0.2	0.217	0.275	0.17	0.255	0.013	<0.002 U	0.90	0.08 J	0.092
11/1/2016	Background	0.02 J	0.35	28.7	<0.005 U	0.02 J	0.6	0.108	2.086	0.18	0.070	0.014	<0.002 U	1.48	0.1	0.116
12/19/2016	Background	0.02 J	0.43	28.9	<0.005 U	0.01 J	1.65	0.225	0.7053	0.18	0.272	0.008	<0.002 U	0.56	0.08 J	0.02 J
2/20/2017	Background	<0.01 U	0.35	26.9	<0.005 U	0.01 J	0.194	0.052	0.75	0.19	0.052	0.013	<0.002 U	0.63	0.1	0.02 J
3/27/2017	Background	0.01 J	0.34	29.9	<0.005 U	0.02 J	0.456	0.059	0.679	0.19	0.063	0.019	<0.002 U	1.49	0.2	0.01 J
4/17/2017	Background	0.02 J	0.36	32.1	<0.004 U	0.01 J	0.240	0.049	0.337	0.20	0.087	0.017	0.002 J	0.66	0.1	0.01 J
5/15/2017	Background	0.02 J	0.42	33.2	<0.004 U	0.02 J	0.136	0.072	1.9116	0.19	0.078	0.009	<0.002 U	1.28	0.1	0.04 J
6/12/2017	Background	0.03 J	0.36	33.1	<0.004 U	0.01 J	0.408	0.066	0.2898	0.20	0.061	0.018	<0.002 U	0.53	0.1	0.02 J
5/10/2018	Assessment	0.02 J	0.34	31.2	0.005 J	0.01 J	0.121	0.036	0.342	0.23	0.038	0.015	<0.002 U	0.71	0.1	0.03 J
9/20/2018	Assessment	0.01 J	0.32	26.7	<0.004 U	0.01 J	0.210	0.02 J	0.683	0.25	0.01 J	0.012	<0.002 U	0.84	0.07 J	0.02 J
4/9/2019	Assessment	<0.10 U	0.4 J	29.0	<0.1 U	<0.05 U	<0.2 U	<0.1 U	1.0509	0.20	<0.1 U	0.02 J	<0.002 U	3 J	0.2 J	<0.5 U
6/20/2019	Assessment	0.02 J	0.33	29.5	<0.02 U	0.01 J	0.2 J	0.03 J	0.1531	0.23	0.07 J	0.01 J	<0.002 U	0.9 J	0.1 J	<0.1 U
9/11/2019	Assessment	<0.02 U	0.31	27.3	<0.02 U	0.01 J	0.2 J	<0.02 U	0.451	0.21	<0.05 U	0.00979	<0.002 U	1 J	0.1 J	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1603
Mountaineer - BAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/28/2016	Background	0.327	124	15.7	0.07 J	7.3	618	388
11/2/2016	Background	0.334	146	22.8	0.08 J	6.6	814	483
12/19/2016	Background	0.495	164	30.1	0.1 J	7.4	908	504
2/20/2017	Background	0.543	169	27.4	0.1 J	6.8	962	485
3/28/2017	Background	0.781	181	25.2	0.1 J	6.6	918	476
4/17/2017	Background	0.519	170	22.9	0.1 J	6.9	910	474
5/15/2017	Background	0.546	187	24.7	0.1 J	7.4	910	470
6/12/2017	Background	0.535	176	20.5	0.1 J	7.0	878	482
10/30/2017	Detection	0.360	171	13.1	0.1 J	6.6	872	553
5/10/2018	Assessment	- -	- -	- -	0.09 J	6.6	- -	- -
9/20/2018	Assessment	0.324	167	14.0	0.09	6.6	920	524
4/9/2019	Assessment	0.408	182	15.8	0.11	6.8	918	429
6/20/2019	Assessment	0.299	162	10.9	0.09	7.0	878	434
9/11/2019	Assessment	0.308	156	10.0	0.09	6.7	853	421

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1603
Mountaineer - BAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
9/28/2016	Background	0.02 J	0.36	29.5	<0.005 U	0.02 J	0.3	0.317	0.0927	0.07 J	0.253	0.021	<0.002 U	1.21	0.1	0.02 J
11/2/2016	Background	0.02 J	0.36	34.1	<0.005 U	0.01 J	0.4	0.166	2.593	0.08 J	0.131	0.022	<0.002 U	2.47	0.4	0.04 J
12/19/2016	Background	0.03 J	0.40	33.1	<0.005 U	0.01 J	2.37	0.134	0.966	0.1 J	0.084	0.010	<0.002 U	0.36	0.3	0.063
2/20/2017	Background	0.01 J	0.37	31.7	<0.005 U	0.01 J	0.229	0.105	0.384	0.1 J	0.077	0.012	<0.002 U	0.37	0.4	0.02 J
3/28/2017	Background	0.02 J	0.36	32.9	<0.005 U	0.01 J	0.545	0.093	0.2071	0.1 J	0.080	0.020	<0.002 U	0.72	0.2	<0.01 U
4/17/2017	Background	0.03 J	0.52	33.7	0.005 J	0.01 J	0.304	0.377	0.6154	0.1 J	0.308	0.018	0.003 J	0.27	0.2	0.01 J
5/15/2017	Background	0.03 J	0.43	33.0	<0.004 U	0.01 J	0.415	0.101	1.6052	0.1 J	0.079	0.012	<0.002 U	0.71	0.1	0.02 J
6/12/2017	Background	0.03 J	0.35	32.0	<0.004 U	0.01 J	0.963	0.085	0.776	0.1 J	0.059	0.021	<0.002 U	0.29	0.1	0.01 J
5/10/2018	Assessment	0.02 J	0.31	41.3	0.007 J	0.01 J	0.099	0.054	0.363	0.09 J	0.042	0.021	<0.002 U	0.14	0.2	0.02 J
9/20/2018	Assessment	0.02 J	0.26	35.9	<0.004 U	0.01 J	0.102	0.032	0.881	0.09	0.02 J	0.022	<0.002 U	0.07 J	0.4	0.01 J
4/9/2019	Assessment	<0.10 U	0.56	32.4	<0.1 U	<0.05 U	0.4 J	0.622	2.389	0.11	0.5 J	0.030	<0.002 U	<2 U	0.4 J	<0.5 U
6/20/2019	Assessment	0.03 J	0.41	30.7	<0.02 U	0.01 J	0.249	0.204	0.2974	0.09	0.176	<0.009 U	<0.002 U	0.9 J	0.3	<0.1 U
9/11/2019	Assessment	0.03 J	0.35	30.9	<0.02 U	0.01 J	0.205	0.112	1.07	0.09	0.1 J	0.015	<0.002 U	0.5 J	0.2	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1604D
Mountaineer - BAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/26/2016	Background	3.54	306	111	0.18	7.3	1650	865
11/1/2016	Background	2.98	277	116	0.19	7.3	1580	866
12/20/2016	Background	3.07	289	118	0.17	7.4	1630	863
2/21/2017	Background	3.01	260	111	0.21	7.2	1640	823
3/28/2017	Background	4.18	293	112	0.19	7.2	1660	814
4/19/2017	Background	2.97	269	109	0.20	7.2	1570	797
5/16/2017	Background	2.95	300	112	0.18	7.9	1610	828
6/13/2017	Background	2.98	283	118	0.18	7.5	1620	856
10/30/2017	Detection	2.60	295	116	0.20	7.2	1570	833
1/22/2018	Detection	3.07	291	118	- -	7.2	1620	862
5/9/2018	Assessment	- -	- -	- -	0.21	7.1	- -	- -
9/19/2018	Assessment	1.33	144	41.3	0.19	7.2	838	313
4/9/2019	Assessment	2.82	236	100	0.15	6.9	1300	539
6/19/2019	Assessment	1.66	196	93.0	0.14	7.2	1110	461
9/9/2019	Assessment	2.18	217	82.2	0.17	7.0	1210	551

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1604D
Mountaineer - BAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
9/26/2016	Background	0.14	0.48	29.1	<0.005 U	0.14	0.4	1.76	1.38	0.18	0.106	0.059	<0.002 U	19.8	0.9	0.235
11/1/2016	Background	0.15	0.59	28.4	<0.005 U	0.17	0.5	1.78	1.056	0.19	0.039	0.057	0.036	20.0	1.0	0.261
12/20/2016	Background	0.14	0.57	30.3	<0.005 U	0.17	0.798	1.92	1.45	0.17	0.02 J	0.045	<0.002 U	20.8	1.0	0.283
2/21/2017	Background	0.11	0.45	26.2	<0.005 U	0.13	0.297	1.85	0.824	0.21	0.02 J	0.050	<0.002 U	17.4	0.7	0.264
3/28/2017	Background	0.13	0.41	28.9	<0.005 U	0.13	0.416	1.74	0.806	0.19	0.022	0.064	<0.002 U	18.2	0.7	0.336
4/19/2017	Background	0.12	0.49	27.9	<0.004 U	0.09	0.323	1.60	1.537	0.20	0.584	0.051	0.003 J	17.4	0.7	0.217
5/16/2017	Background	0.13	0.54	27.5	<0.004 U	0.10	0.079	1.60	3.489	0.18	0.027	0.052	<0.002 U	18.1	0.5	0.231
6/13/2017	Background	0.15	0.46	27.9	<0.008 U	0.15	0.180	1.95	1.058	0.18	0.03 J	0.058	<0.002 U	18.3	0.8	0.256
5/9/2018	Assessment	0.04 J	0.34	32.0	<0.004 U	0.04	0.195	0.314	0.687	0.21	0.035	0.024	<0.002 U	2.05	1.4	0.02 J
9/19/2018	Assessment	0.04 J	0.29	37.0	<0.004 U	0.03	0.169	0.203	0.316	0.19	0.303	0.016	<0.002 U	1.57	3.8	0.02 J
4/9/2019	Assessment	<0.10 U	0.4 J	42.5	<0.1 U	0.05 J	0.2 J	0.345	0.957	0.15	<0.1 U	0.038	<0.002 U	<2 U	2.0	<0.5 U
6/19/2019	Assessment	0.04 J	0.28	52.9	<0.02 U	0.04 J	0.212	0.242	0.1922	0.14	0.07 J	<0.009 U	<0.002 U	1 J	3.1	<0.1 U
9/9/2019	Assessment	0.03 J	0.30	55.6	<0.02 U	0.03 J	0.345	0.181	0.464	0.17	<0.05 U	0.0188	<0.002 U	2 J	3.4	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1604S
Mountaineer - BAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/26/2016	Background	2.12	178	83.9	0.20	7.0	1280	602
11/1/2016	Background	1.90	167	99.4	0.21	7.1	1310	626
12/20/2016	Background	2.35	165	99.9	0.19	7.2	1300	618
2/21/2017	Background	3.08	168	112	0.21	7.0	1430	634
3/28/2017	Background	4.04	180	116	0.20	6.9	1420	663
4/19/2017	Background	3.68	191	130	0.21	7.0	1500	716
5/16/2017	Background	3.63	202	122	0.19	7.7	1510	708
6/13/2017	Background	3.48	182	112	0.20	7.5	1400	685
10/30/2017	Detection	2.17	167	85.3	0.21	7.1	1150	544
1/22/2018	Detection	2.36	- -	105	- -	6.9	1312	602
5/9/2018	Assessment	- -	- -	- -	0.22	7.4	- -	- -
9/19/2018	Assessment	2.49	262	109	0.22	7.3	1500	742
4/9/2019	Assessment	3.50	301	132	0.19	7.1	1650	703
6/19/2019	Assessment	3.15	278	127	0.16	7.3	1580	741
9/9/2019	Assessment	3.23	267	128	0.20	7.3	1520	770

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1604S
Mountaineer - BAP
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
9/26/2016	Background	0.04 J	0.39	29.4	<0.005 U	0.03	0.2	0.358	0.136	0.20	0.114	0.034	<0.002 U	3.20	3.1	0.03 J
11/1/2016	Background	0.04 J	0.46	27.2	<0.005 U	0.04	0.3	0.307	0.769	0.21	0.065	0.035	<0.002 U	2.47	2.5	0.02 J
12/20/2016	Background	0.04 J	0.42	26.6	<0.005 U	0.04	1.97	0.390	0.5256	0.19	0.093	0.023	<0.002 U	2.71	2.7	0.03 J
2/21/2017	Background	0.03 J	0.42	26.7	<0.005 U	0.04	0.379	0.501	0.92	0.21	0.140	0.033	<0.002 U	2.52	2.2	0.03 J
3/28/2017	Background	0.03 J	0.37	31.6	<0.005 U	0.03	0.692	0.308	0.585	0.20	0.055	0.042	<0.002 U	2.53	2.2	0.119
4/19/2017	Background	0.03 J	0.44	28.9	<0.004 U	0.04	0.158	0.317	0.722	0.21	0.051	0.041	0.003 J	2.53	1.7	0.02 J
5/16/2017	Background	0.04 J	0.51	32.2	<0.004 U	0.04	0.098	0.317	2.577	0.19	0.100	0.033	<0.002 U	2.54	2.0	0.04 J
6/13/2017	Background	0.03 J	0.41	28.7	<0.004 U	0.04	0.149	0.308	0.598	0.20	0.033	0.038	<0.002 U	2.41	2.5	0.02 J
5/9/2018	Assessment	0.13	0.33	28.7	0.024	0.15	0.107	1.83	1.173	0.22	0.034	0.051	<0.002 U	16.2	1.0	0.22
9/19/2018	Assessment	0.13	0.32	26.6	<0.004 U	0.15	0.093	1.88	1.159	0.22	0.02 J	0.052	<0.002 U	15.6	0.8	0.251
4/9/2019	Assessment	0.20 J	0.54	29.1	<0.1 U	0.27	0.3 J	2.41	1.472	0.19	<0.1 U	0.061	<0.002 U	17.8	1.2	<0.5 U
6/19/2019	Assessment	0.15	0.33	29.0	<0.02 U	0.21	0.09 J	2.16	1.256	0.16	<0.02 U	0.032	<0.002 U	16.6	1.0	0.3 J
9/9/2019	Assessment	0.14	0.34	29.0	<0.02 U	0.21	0.1 J	2.14	1.15	0.20	<0.05 U	0.0476	<0.002 U	16.3	1.0	0.3 J

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1605D
Mountaineer - BAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/27/2016	Background	12.2	462	195	0.18	7.6	2650	1480
11/2/2016	Background	9.96	381	195	0.19	7.4	2510	1500
12/20/2016	Background	9.35	341	168	0.18	7.4	2300	1290
2/21/2017	Background	9.16	318	163	0.20	7.3	2290	1190
3/28/2017	Background	11.6	344	169	0.20	7.2	2350	1200
4/18/2017	Background	9.06	360	172	0.20	7.5	2280	1180
5/16/2017	Background	8.77	374	187	0.20	7.9	2240	1130
6/13/2017	Background	9.09	351	196	0.17	- -	2260	1190
10/31/2017	Detection	7.83	324	198	0.21	7.3	2170	1170
1/22/2018	Detection	9.33	321	197	- -	7.2	2060	1070
5/9/2018	Assessment	- -	- -	- -	0.23	7.5	- -	- -
9/19/2018	Assessment	9.11	278	188	0.22	7.6	1960	972
4/9/2019	Assessment	6.90	247	169	0.22	7.3	1710	791
6/19/2019	Assessment	6.57	265	165	0.19	7.5	1890	877
9/10/2019	Assessment	8.57	283	168	0.17	7.2	2050	974

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1605D
Mountaineer - BAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
9/27/2016	Background	0.03 J	2.29	31.5	<0.01 U	0.04	0.1	1.91	1.06	0.18	0.080	0.085	<0.002 U	54.6	0.2	0.06 J
11/2/2016	Background	0.03 J	2.48	30.6	<0.01 U	0.04	0.2	1.79	1.925	0.19	0.044	0.078	<0.002 U	52.4	0.2	0.05 J
12/20/2016	Background	0.03 J	2.26	28.2	<0.01 U	0.04 J	2.29	1.75	2.662	0.18	0.03 J	0.063	<0.002 U	54.7	0.3	0.05 J
2/21/2017	Background	0.04 J	2.23	25.9	<0.005 U	0.03	0.282	1.84	1.033	0.20	0.021	0.071	<0.002 U	46.8	0.2	0.138
3/28/2017	Background	0.04 J	2.01	27.9	<0.005 U	0.03	0.556	1.69	0.578	0.20	0.02 J	0.086	<0.002 U	44.6	0.2	0.090
4/18/2017	Background	0.03 J	2.25	25.8	<0.008 U	0.02 J	0.127	1.69	0.821	0.20	0.02 J	0.077	0.002 J	43.2	0.2 J	0.04 J
5/16/2017	Background	0.03 J	2.45	26.3	<0.004 U	0.02 J	0.099	1.63	3.433	0.20	0.01 J	0.075	<0.002 U	48.1	0.2	0.04 J
6/13/2017	Background	0.04 J	1.99	27.2	<0.008 U	0.04	0.120	1.86	0.668	0.17	0.02 J	0.081	<0.002 U	45.5	0.4	0.05 J
5/9/2018	Assessment	0.03 J	2.22	21.6	<0.004 U	0.01 J	0.067	1.51	0.523	0.23	0.02 J	0.062	<0.002 U	46.4	0.2	0.04 J
9/19/2018	Assessment	0.04 J	2.51	25.9	<0.004 U	0.02 J	0.229	1.80	0.759	0.22	0.01 J	0.060	<0.002 U	47.9	0.3	0.05 J
4/9/2019	Assessment	0.04 J	2.81	26.4	<0.02 U	0.01 J	0.06 J	1.56	0.543	0.22	0.03 J	0.075	<0.002 U	40.6	0.2	<0.1 U
6/19/2019	Assessment	<0.04 U	2.67	28.6	<0.04 U	0.02 J	0.2 J	1.65	0.831	0.19	<0.04 U	0.02 J	<0.002 U	40.0	0.2 J	<0.2 U
9/10/2019	Assessment	0.03 J	2.78	33.1	<0.02 U	0.03 J	0.04 J	1.69	1.641	0.17	<0.05 U	0.0561	<0.002 U	39.7	0.3	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1605S
Mountaineer - BAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/27/2016	Background	8.30	224	150	0.24	7.5	1910	965
11/1/2016	Background	6.55	220	159	0.25	7.3	1930	1010
12/20/2016	Background	7.30	279	173	0.22	7.4	2160	1180
2/21/2017	Background	9.04	249	179	0.25	7.2	2220	1110
3/28/2017	Background	10.8	261	212	0.25	7.1	2250	1110
4/18/2017	Background	8.69	244	180	0.23	7.4	2120	1100
5/16/2017	Background	8.75	251	217	0.26	7.7	2160	1060
6/13/2017	Background	8.80	218	191	0.24	7.8	1980	1000
10/31/2017	Detection	5.88	212	222	0.25	7.2	2000	1040
1/22/2018	Detection	10.1	231	220	- -	7.1	1970	976
5/9/2018	Assessment	- -	- -	- -	0.30	7.2	- -	- -
9/19/2018	Assessment	7.75	182	171	0.32	7.4	1650	793
4/9/2019	Assessment	9.39	164	140	0.33	7.2	1450	599
6/19/2019	Assessment	7.02	156	140	0.23	7.4	1510	649
9/10/2019	Assessment	8.05	174	149	0.26	7.2	1470	694

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1605S
Mountaineer - BAP
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
9/27/2016	Background	0.16	1.38	49.6	0.02 J	0.13	0.6	3.16	0.777	0.24	2.18	0.086	<0.002 U	25.8	1.1	0.174
11/1/2016	Background	0.07	0.93	38.2	0.009 J	0.08	0.7	1.26	2.692	0.25	0.793	0.084	<0.002 U	23.9	0.9	0.055
12/20/2016	Background	0.07 J	0.88	37.0	<0.01 U	0.08	2.85	0.861	0.337	0.22	0.410	0.076	<0.002 U	22.9	0.7	0.05 J
2/21/2017	Background	0.04 J	0.86	36.0	0.007 J	0.08	0.39	1.10	0.785	0.25	0.636	0.068	<0.002 U	17.5	1.1	0.055
3/28/2017	Background	0.03 J	0.63	32.5	<0.005 U	0.06	0.349	0.448	0.466	0.25	0.181	0.076	<0.002 U	15.4	1.0	0.102
4/18/2017	Background	0.06 J	0.74	31.9	<0.008 U	0.08	0.245	0.715	0.827	0.23	0.285	0.067	0.003 J	20.8	3.0	0.04 J
5/16/2017	Background	0.06 J	0.88	33.3	<0.008 U	0.08	0.585	0.647	2.733	0.26	0.382	0.076	<0.002 U	18.6	1.7	0.06 J
6/13/2017	Background	0.05 J	0.75	30.8	<0.008 U	0.08	0.387	0.708	0.611	0.24	0.541	0.071	<0.002 U	17.8	1.7	0.05 J
5/9/2018	Assessment	0.04 J	0.50	23.5	<0.004 U	0.06	0.083	0.518	0.3045	0.30	0.056	0.051	<0.002 U	15.6	2.0	0.04 J
9/19/2018	Assessment	0.04 J	0.49	23.1	<0.004 U	0.05	0.644	0.360	0.347	0.32	0.093	0.049	<0.002 U	15.1	1.0	0.04 J
4/9/2019	Assessment	0.05 J	0.64	25.2	<0.02 U	0.05	0.293	0.631	0.369	0.33	0.331	0.079	<0.002 U	15.9	0.7	<0.1 U
6/19/2019	Assessment	0.04 J	0.47	23.6	<0.02 U	0.05 J	0.1 J	0.279	0.424	0.23	0.08 J	0.040	<0.002 U	13.6	0.6	<0.1 U
9/10/2019	Assessment	0.04 J	0.59	29.6	<0.02 U	0.05 J	0.237	0.379	0.542	0.26	0.202	0.0524	<0.002 U	14.2	0.4	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1606D
Mountaineer - BAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/27/2016	Background	4.29	278	190	0.25	7.2	1710	813
11/2/2016	Background	3.97	252	201	0.28	7.4	1720	796
12/20/2016	Background	4.96	260	206	0.24	7.5	1690	796
2/21/2017	Background	5.48	242	190	0.26	7.3	1670	759
3/28/2017	Background	6.90	247	187	0.26	7.2	1700	739
4/18/2017	Background	5.46	274	104	0.26	7.4	1690	385
5/16/2017	Background	5.26	278	218	0.26	8.0	1730	764
6/13/2017	Background	5.90	262	219	0.24	7.5	1680	752
10/31/2017	Detection	7.03	287	213	0.24	7.3	1590	770
1/23/2018	Detection	9.59	322	237	- -	7.4	1730	760
5/9/2018	Assessment	- -	- -	- -	0.26	7.4	- -	- -
9/19/2018	Assessment	7.27	260	201	0.26	7.2	1610	722
4/8/2019	Assessment	7.32	265	214	0.26	7.2	1600	682
6/19/2019	Assessment	7.79	281	231	0.1 J	7.4	1690	693
9/10/2019	Assessment	6.38	281	244	0.49	7.4	1700	588

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1606D
Mountaineer - BAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
9/27/2016	Background	0.19	0.71	64.0	0.005 J	0.07	0.3	2.20	8.459	0.25	0.522	0.129	<0.002 U	81.4	1.8	0.123
11/2/2016	Background	0.19	0.84	62.6	<0.005 U	0.07	0.9	1.92	3.659	0.28	0.491	0.120	<0.002 U	81.2	4.7	0.092
12/20/2016	Background	0.16	0.63	58.4	<0.005 U	0.06	0.736	1.52	1.179	0.24	0.164	0.110	<0.002 U	83.2	3.6	0.094
2/21/2017	Background	0.16	0.51	52.6	<0.005 U	0.07	0.300	1.33	1.71	0.26	0.082	0.109	<0.002 U	76.6	4.1	0.119
3/28/2017	Background	0.15	0.44	53.6	<0.005 U	0.05	0.541	1.17	1.459	0.26	0.087	0.130	<0.002 U	73.3	3.6	0.113
4/18/2017	Background	0.25	1.38	64.2	0.01 J	0.08	0.853	4.26	1.212	0.26	2.04	0.119	0.004 J	71.5	4.1	0.097
5/16/2017	Background	0.19	0.63	56.7	0.031	0.07	0.163	1.39	3.18	0.26	0.162	0.124	<0.002 U	79.1	5.9	0.095
6/13/2017	Background	0.16	0.52	52.0	<0.008 U	0.08	0.153	1.46	1.026	0.24	0.084	0.132	<0.002 U	77.8	8.1	0.09 J
5/9/2018	Assessment	0.16	0.44	53.0	<0.004 U	0.07	0.198	1.40	0.972	0.26	0.115	0.112	<0.002 U	70.3	2.6	0.086
9/19/2018	Assessment	0.15	0.38	48.9	0.004 J	0.07	0.151	1.17	0.4378	0.26	0.01 J	0.107	<0.002 U	65.3	3.3	0.108
4/8/2019	Assessment	0.15	0.35	47.3	<0.02 U	0.07	0.1 J	1.25	0.94	0.26	0.03 J	0.124	<0.002 U	71.8	8.1	<0.1 U
6/19/2019	Assessment	0.14	0.37	49.4	<0.02 U	0.09	0.07 J	1.36	0.933	0.1 J	<0.02 U	0.058	<0.002 U	68.3	9.6	0.1 J
9/10/2019	Assessment	0.15	0.40	51.4	<0.02 U	0.08	0.1 J	1.09	2.2714	0.49	<0.05 U	0.0835	<0.002 U	68.5	1.0	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1606S
Mountaineer - BAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/27/2016	Background	5.25	219	182	0.50	6.0	1470	621
11/2/2016	Background	4.57	183	183	0.57	7.2	1470	638
12/20/2016	Background	5.35	200	170	0.46	7.3	1420	621
2/21/2017	Background	5.03	211	231	0.46	7.1	1500	578
3/28/2017	Background	6.67	217	226	0.45	7.0	1500	589
4/18/2017	Background	5.80	228	217	0.43	7.2	1540	615
5/16/2017	Background	5.72	228	227	0.45	7.7	3230	635
6/13/2017	Background	6.12	230	230	0.45	7.4	1540	643
10/31/2017	Detection	9.54	226	187	0.46	7.1	1410	644
1/23/2018	Detection	6.62	218	184	0.43	7.2	1450	660
5/9/2018	Assessment	- -	- -	- -	0.44	6.9	- -	- -
9/19/2018	Assessment	5.87	199	219	0.46	7.1	1370	571
4/8/2019	Assessment	7.68	229	223	0.54	6.8	1480	592
6/19/2019	Assessment	6.08	223	232	0.25	7.2	1490	581
9/10/2019	Assessment	6.19	229	221	0.28	7.3	1460	705

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1606S
Mountaineer - BAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
9/27/2016	Background	0.16	0.88	76.7	<0.005 U	0.08	0.2	0.466	0.592	0.50	0.234	0.116	<0.002 U	112	1.2	0.074
11/2/2016	Background	0.17	0.94	69.7	<0.005 U	0.07	0.4	0.432	1.55	0.57	0.207	0.103	<0.002 U	112	1.0	0.06
12/20/2016	Background	0.16	0.83	71.6	<0.005 U	0.07	1.26	0.280	1.656	0.46	0.084	0.102	<0.002 U	101	0.9	0.063
2/21/2017	Background	0.15	0.88	77.2	<0.005 U	0.08	0.384	0.372	0.993	0.46	0.158	0.108	<0.002 U	93.1	0.7	0.086
3/28/2017	Background	0.14	0.78	75.7	<0.005 U	0.06	0.742	0.258	0.945	0.45	0.096	0.126	<0.002 U	90.1	0.7	0.100
4/18/2017	Background	0.16	0.86	74.2	<0.004 U	0.07	0.134	0.234	1.303	0.43	0.070	0.117	0.002 J	92.4	0.8	0.062
5/16/2017	Background	0.16	0.90	74.1	<0.004 U	0.07	0.093	0.241	2.167	0.45	0.062	0.110	<0.002 U	90.2	0.9	0.069
6/13/2017	Background	0.16	0.81	77.1	<0.008 U	0.09	0.178	0.281	1.28	0.45	0.090	0.118	<0.002 U	95.7	0.9	0.07 J
5/9/2018	Assessment	0.14	0.72	73.2	<0.004 U	0.08	0.056	0.318	0.3443	0.44	0.040	0.107	<0.002 U	70.2	2.0	0.076
9/19/2018	Assessment	0.13	0.69	64.8	0.005 J	0.06	0.297	0.260	0.439	0.46	0.02 J	0.096	<0.002 U	70.6	2.8	0.112
4/8/2019	Assessment	0.15	0.70	63.1	<0.02 U	0.07	0.08 J	0.320	0.595	0.54	0.107	0.117	<0.002 U	67.7	1.4	<0.1 U
6/19/2019	Assessment	0.15	0.63	67.2	<0.02 U	0.08	0.08 J	0.171	1.0123	0.25	0.111	0.056	<0.002 U	58.9	1.3	0.1 J
9/10/2019	Assessment	0.13	0.67	70.4	<0.02 U	0.07	0.08 J	0.312	2.682	0.28	<0.05 U	0.0877	<0.002 U	54.9	2.7	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1607D
Mountaineer - BAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/27/2016	Background	1.64	141	88.3	0.54	6.9	744	285
11/2/2016	Background	1.42	155	103	0.61	7.8	856	376
12/20/2016	Background	1.46	187	118	0.50	7.7	1050	474
1/23/2017	Background	- -	- -	- -	- -	7.5	- -	- -
2/21/2017	Background	1.54	165	107	0.51	7.6	1010	415
3/29/2017	Background	1.89	162	106	0.52	7.6	938	393
4/18/2017	Background	1.58	168	104	0.52	7.6	904	383
5/16/2017	Background	1.54	156	102	0.52	8.4	876	347
6/14/2017	Background	1.50	159	104	0.49	7.6	872	365
10/31/2017	Detection	1.76	214	138	0.47	7.6	1290	626
1/23/2018	Detection	2.34	244	150	0.44	7.5	1380	668
5/10/2018	Assessment	- -	- -	- -	0.54	7.5	- -	- -
9/20/2018	Assessment	2.44	222	163	0.52	7.7	1450	662
4/8/2019	Assessment	3.10	232	162	0.52	7.4	1480	656
6/19/2019	Assessment	3.14	234	167	0.40	7.8	1600	710
9/10/2019	Assessment	3.65	233	174	0.56	7.7	1610	699

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1607D
Mountaineer - BAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
9/27/2016	Background	0.04 J	0.91	117	<0.005 U	0.02 J	0.3	0.439	0.86	0.54	0.179	0.068	<0.002 U	96.2	0.1	0.05 J
11/2/2016	Background	0.03 J	1.02	155	<0.005 U	0.02 J	0.7	0.396	3.997	0.61	0.058	0.069	<0.002 U	91.1	0.07 J	0.04 J
12/20/2016	Background	0.03 J	1.02	168	<0.005 U	0.005 J	2.07	0.526	1.689	0.50	0.038	0.075	<0.002 U	89.6	0.03 J	0.04 J
2/21/2017	Background	0.03 J	1.14	133	<0.005 U	<0.004 U	0.090	0.481	0.883	0.51	0.041	0.072	<0.002 U	87.7	0.03 J	0.04 J
3/29/2017	Background	0.05	1.24	140	0.008 J	0.03	0.602	0.805	1.872	0.52	0.628	0.087	0.002 J	85.9	0.5	0.062
4/18/2017	Background	0.03 J	1.00	126	<0.004 U	<0.005 U	0.133	0.414	1.535	0.52	0.070	0.079	0.002 J	81.8	0.05 J	0.02 J
5/16/2017	Background	0.03 J	1.11	129	<0.004 U	<0.005 U	0.078	0.399	1.265	0.52	0.041	0.087	<0.002 U	91.2	0.04 J	0.02 J
6/14/2017	Background	0.03 J	0.98	131	<0.004 U	<0.005 U	0.141	0.439	1.764	0.49	0.124	0.088	<0.002 U	90.8	0.03 J	0.04 J
5/10/2018	Assessment	0.03 J	1.15	73.5	<0.004 U	<0.005 U	0.051	0.521	1.254	0.54	0.043	0.089	<0.002 U	80.9	<0.03 U	0.02 J
9/20/2018	Assessment	0.03 J	1.34	92.3	<0.004 U	<0.005 U	0.158	0.769	0.926	0.52	0.044	0.104	<0.002 U	83.4	<0.03 U	0.04 J
4/8/2019	Assessment	0.03 J	1.31	75.7	<0.02 U	<0.01 U	0.07 J	0.778	1.3269	0.52	0.05 J	0.127	<0.002 U	79.8	0.05 J	<0.1 U
6/19/2019	Assessment	0.03 J	1.61	82.3	<0.02 U	<0.01 U	0.1 J	0.799	1.31	0.40	0.07 J	0.072	<0.002 U	81.8	0.06 J	<0.1 U
9/10/2019	Assessment	0.03 J	1.53	79.3	<0.02 U	0.01 J	0.05 J	0.848	1.855	0.56	<0.05 U	0.110	<0.002 U	82.1	0.09 J	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1607S
Mountaineer - BAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
10/31/2016	Background	1.38	126	90.8	0.31	7.6	670	213
11/2/2016	Background	1.35	126	90.6	0.32	7.6	698	214
12/21/2016	Background	1.02	129	92.7	0.33	7.7	716	246
2/21/2017	Background	1.27	131	91.9	0.29	7.5	746	244
3/28/2017	Background	1.70	131	93.1	0.28	7.4	706	233
4/18/2017	Background	1.65	135	92.6	0.30	7.6	678	225
5/16/2017	Background	1.64	133	97.5	0.29	8.2	746	221
6/14/2017	Background	1.74	136	96.3	0.27	7.5	708	229
10/31/2017	Detection	1.32	165	100	0.28	7.5	860	343
1/23/2018	Detection	1.49	- -	111	- -	7.4	- -	- -
5/10/2018	Assessment	- -	- -	- -	0.29	7.4	- -	- -
9/20/2018	Assessment	1.71	220	151	0.28	7.6	1160	478
4/8/2019	Assessment	2.35	226	153	0.26	7.2	1310	504
6/19/2019	Assessment	2.46	233	154	0.19	7.5	1370	524
9/10/2019	Assessment	3.21	198	167	0.27	7.7	1350	465

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1607S
Mountaineer - BAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
10/31/2016	Background	0.46	1.86	56.7	0.01 J	0.06	0.8	2.59	2.504	0.31	1.40	0.098	0.003 J	48.4	7.1	0.060
11/2/2016	Background	0.45	1.30	55.5	<0.005 U	0.04	0.4	0.752	1.338	0.32	0.264	0.092	<0.002 U	50.4	7.0	0.05 J
12/21/2016	Background	0.84	11.2	114	0.123	0.22	3.10	20.1	2.81	0.33	11.0	0.088	0.012	45.7	9.4	0.150
2/21/2017	Background	0.42	1.19	63.9	0.007 J	0.03	0.325	1.21	1.974	0.29	0.267	0.091	<0.002 U	41.3	9.0	0.069
3/28/2017	Background	0.43	1.17	66.8	<0.005 U	0.02	0.390	0.942	1.153	0.28	0.134	0.110	<0.002 U	39.2	9.2	0.052
4/18/2017	Background	0.55	1.62	67.6	0.01 J	0.06	0.514	2.60	1.632	0.30	1.25	0.102	0.003 J	45.1	8.9	0.058
5/16/2017	Background	0.50	1.17	63.7	<0.004 U	0.03	0.226	0.851	2.408	0.29	0.159	0.094	<0.002 U	48.1	9.1	0.05 J
6/14/2017	Background	0.48	1.10	62.9	<0.004 U	0.03	0.200	0.936	1.017	0.27	0.138	0.106	<0.002 U	46.1	9.4	0.05 J
5/10/2018	Assessment	0.44	0.93	71.1	<0.004 U	0.04	0.121	1.18	1.29	0.29	0.128	0.103	<0.002 U	43.2	11.4	0.064
9/20/2018	Assessment	0.42	0.90	80.6	<0.004 U	0.04	0.086	0.840	0.584	0.28	0.094	0.118	<0.002 U	41.5	8.8	0.089
4/8/2019	Assessment	0.40	0.94	72.7	<0.02 U	0.04 J	0.376	1.21	0.723	0.26	0.09 J	0.141	<0.002 U	37.9	7.0	<0.1 U
6/19/2019	Assessment	0.44	0.96	81.0	<0.02 U	0.04 J	0.428	0.990	1.121	0.19	0.108	0.075	<0.002 U	34.6	5.6	<0.1 U
9/10/2019	Assessment	0.41	0.87	67.7	<0.02 U	0.05 J	0.357	0.971	2.765	0.27	0.09 J	0.0990	<0.002 U	35.0	4.3	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1608
Mountaineer - BAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/27/2016	Background	0.150	93.8	6.55	0.27	7.4	368	70.6
11/1/2016	Background	0.113	86.2	6.43	0.30	7.3	352	64.3
12/19/2016	Background	0.118	83.0	4.25	0.26	7.3	338	58.3
2/22/2017	Background	0.156	83.3	4.37	0.25	7.1	398	94.4
3/27/2017	Background	0.238	80.3	5.27	0.24	6.8	350	112
4/17/2017	Background	0.233	101	7.08	0.23	7.0	424	168
5/15/2017	Background	0.200	102	8.62	0.23	7.8	475	208
6/12/2017	Background	0.169	110	8.23	0.21	6.7	486	204
10/31/2017	Detection	0.140	94.7	5.13	0.22	7.1	430	131
5/10/2018	Assessment	- -	- -	- -	0.18	6.8	- -	- -
9/20/2018	Assessment	0.169	128	6.59	0.21	7.2	572	256
4/9/2019	Assessment	0.156	102	6.82	0.20	6.9	451	179
6/18/2019	Assessment	0.116	86.5	5.06	0.16	6.2	416	144
9/10/2019	Assessment	0.124	92.0	4.01	0.20	7.1	369	109

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1608
Mountaineer - BAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
9/27/2016	Background	0.10	0.82	42.0	0.02 J	0.03	0.9	1.21	0.454	0.27	0.881	0.003	<0.002 U	2.35	1.2	0.03 J
11/1/2016	Background	0.04 J	0.53	33.4	<0.005 U	0.02 J	0.6	0.254	2.282	0.30	0.232	0.004	<0.002 U	2.16	1.3	0.081
12/19/2016	Background	0.04 J	0.68	32.2	0.009 J	0.02	2.78	0.588	0.379	0.26	0.405	<0.0002 U	<0.002 U	1.94	1.1	0.03 J
2/22/2017	Background	0.03 J	0.52	32.4	<0.005 U	0.01 J	0.364	0.240	1.235	0.25	0.205	0.003	<0.002 U	1.40	1.5	0.053
3/27/2017	Background	0.03 J	0.56	31.4	<0.005 U	0.01 J	0.335	0.330	0.417	0.24	0.274	0.006	<0.002 U	2.49	1.3	0.04 J
4/17/2017	Background	0.04 J	0.50	35.3	<0.004 U	0.01 J	0.223	0.196	0.1298	0.23	0.173	0.006	0.002 J	1.89	1.3	0.01 J
5/15/2017	Background	0.04 J	0.49	35.1	<0.004 U	0.008 J	0.151	0.098	0.857	0.23	0.073	0.006	<0.002 U	2.08	1.0	0.01 J
6/12/2017	Background	0.03 J	0.49	36.4	<0.004 U	0.006 J	0.277	0.040	0.146	0.21	0.024	0.016	<0.002 U	1.57	1.1	0.02 J
5/10/2018	Assessment	0.02 J	0.37	46.6	0.009 J	0.01 J	0.126	0.095	0.565	0.18	0.079	0.0003 J	<0.002 U	0.53	0.9	0.02 J
9/20/2018	Assessment	0.03 J	0.42	42.6	<0.004 U	0.008 J	0.264	0.052	0.55	0.21	0.037	0.004	<0.002 U	1.18	1.2	0.02 J
4/9/2019	Assessment	0.04 J	0.56	41.2	<0.02 U	0.02 J	0.372	0.597	0.2435	0.20	0.454	0.01 J	<0.002 U	1 J	1.2	<0.1 U
6/18/2019	Assessment	0.03 J	0.40	32	<0.02 U	0.01 J	0.306	0.05 J	0.104	0.16	0.06 J	<0.009 U	<0.002 U	0.8 J	0.8	<0.1 U
9/10/2019	Assessment	0.03 J	0.52	26.8	0.05 J	<0.01 U	0.327	0.056	1.348	0.20	0.06 J	0.00286	<0.002 U	1 J	1.0	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1805
Mountaineer - BAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
4/10/2019	Assessment	4.24	147	146	0.36	7.8	1500	639
6/19/2019	Assessment	6.38	280	156	0.1 J	7.5	1860	894
9/10/2019	Assessment	6.00	273	- -	- -	7.4	- -	- -
9/11/2019	Assessment	- -	- -	167	0.24	- -	1880	908

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1805
Mountaineer - BAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
4/10/2019	Assessment	2.14	20.3	54.3	<0.1 U	<0.05 U	1.00	3.31	3.12	0.36	1.21	0.043	<0.002 U	80.1	<0.3 U	<0.5 U
6/19/2019	Assessment	<0.04 U	66.3	42.4	<0.04 U	<0.02 U	0.2 J	4.91	1.412	0.1 J	<0.04 U	0.032	<0.002 U	96.2	0.1 J	<0.2 U
9/10/2019	Assessment	0.07 J	70.4	41.9	<0.02 U	<0.01 U	0.415	3.39	2.7353	0.24*	0.1 J	0.0426	<0.002 U	78.0	0.1 J	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter
* Sample collected on 9/11/2019

Table 1 - Groundwater Data Summary: MW-1921
Mountaineer - BAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
4/10/2019	Assessment	0.571	55.9	34.7	0.77	7.6	452	106
6/19/2019	Assessment	0.644	77.7	33.3	0.87	8.2	435	128
9/11/2019	Assessment	0.647	79.6	- -	- -	7.6	- -	- -
9/13/2019	Assessment	- -	- -	33.2	0.79	- -	438	131

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1921
Mountaineer - BAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
4/10/2019	Assessment	0.10 J	3.36	68.0	<0.1 U	<0.05 U	1.13	2.64	1.678	0.77	0.944	0.075	0.002 J	478	0.4 J	<0.5 U
6/19/2019	Assessment	0.10	1.19	51.2	<0.02 U	<0.01 U	0.07 J	0.860	0.276	0.87	0.06 J	0.074	<0.002 U	502	0.2 J	<0.1 U
9/11/2019	Assessment	0.10 J	1.25	50.8	<0.02 U	0.03 J	0.1 J	0.692	1.228	0.79*	0.08 J	0.0926	<0.002 U	500	0.1 J	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter
* Sample collected on 9/11/2019

Table 1 - Groundwater Data Summary: MW-1922D
Mountaineer - BAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
4/9/2019	Assessment	1.00	145	53.5	0.29	7.5	908	333
6/19/2019	Assessment	0.725	121	44.1	0.31	7.6	724	269
9/10/2019	Assessment	0.44	96.5	- -	- -	7.6	- -	- -
9/11/2019	Assessment	- -	- -	32.7	0.33	- -	566	167

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1922D
Mountaineer - BAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
4/9/2019	Assessment	0.88	323	69.3	<0.1 U	<0.05 U	0.4 J	1.02	2.64	0.29	0.1 J	0.02 J	<0.002 U	488	<0.2 U	<0.5 U
6/19/2019	Assessment	0.29	716	54.7	<0.02 U	<0.01 U	<0.04 U	0.530	3.332	0.31	<0.02 U	<0.009 U	<0.002 U	515	0.04 J	<0.1 U
9/10/2019	Assessment	1.04	839	51.0	<0.02 U	0.01 J	0.08 J	0.492	3.089	0.33*	<0.05 U	0.0126	<0.002 U	478	0.06 J	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter
* Sample collected on 9/11/2019

Table 1 - Groundwater Data Summary: MW-1922S
Mountaineer - BAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
4/9/2019	Assessment	7.66	359	171	0.16	7.2	2090	978
6/20/2019	Assessment	6.95	335	169	0.17	7.4	2090	1020
9/10/2019	Assessment	6.34	342	- -	- -	7.3	- -	- -
9/11/2019	Assessment	- -	- -	179	0.19	- -	2060	1070

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1922S
Mountaineer - BAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
4/9/2019	Assessment	<0.10 U	1.95	30.7	<0.1 U	<0.05 U	0.3 J	1.83	2.124	0.16	0.3 J	0.082	<0.002 U	43.5	<0.2 U	<0.5 U
6/20/2019	Assessment	<0.04 U	1.89	26.9	<0.04 U	<0.02 U	0.2 J	1.37	1.156	0.17	0.08 J	0.03 J	<0.002 U	36.4	0.07 J	<0.2 U
9/10/2019	Assessment	0.02 J	1.75	26.5	<0.02 U	<0.01 U	0.2 J	1.23	2.945	0.19*	0.1 J	0.0556	<0.002 U	33.9	0.08 J	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter
* Sample collected on 9/11/2019

Table 1 - Groundwater Data Summary: MW-1923
Mountaineer - BAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
4/10/2019	Assessment	1.09	113	38.0	0.16	7.6	584	181
6/18/2019	Assessment	0.804	91.4	35.9	0.16	7.3	526	147
9/11/2019	Assessment	0.756	105	38.3	0.13	6.8	545	159

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1923
Mountaineer - BAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
4/10/2019	Assessment	0.20 J	0.55	77.6	<0.1 U	<0.05 U	0.3 J	0.317	0.706	0.16	0.1 J	0.223	<0.002 U	160	23.8	<0.5 U
6/18/2019	Assessment	0.21	0.56	72.9	<0.02 U	0.01 J	0.353	0.657	0.836	0.16	0.255	0.135	<0.002 U	101	14.4	<0.1 U
9/11/2019	Assessment	0.24	0.75	86.6	<0.02 U	0.03 J	0.541	1.01	2.099	0.13	0.543	0.137	<0.002 U	84.2	14.0	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1924
Mountaineer - BAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
4/10/2019	Assessment	7.49	286	136	0.42	6.9	1700	766
6/18/2019	Assessment	6.22	243	122	0.38	7.3	1570	721
9/11/2019	Assessment	4.89	238	109	0.44	7.1	1500	662

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1924
Mountaineer - BAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
4/10/2019	Assessment	0.20 J	0.91	59.8	<0.1 U	0.2 J	0.3 J	2.29	0.921	0.42	0.3 J	0.133	<0.002 U	89.5	1.3	<0.5 U
6/18/2019	Assessment	0.06 J	0.55	69.5	<0.02 U	0.05	0.1 J	2.74	1.417	0.38	0.07 J	0.087	<0.002 U	69.0	3.6	<0.1 U
9/11/2019	Assessment	0.07 J	0.61	54.5	<0.02 U	0.06	0.2 J	4.10	1.719	0.44	0.218	0.102	<0.002 U	76.7	3.5	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1925
Mountaineer - BAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
4/10/2019	Assessment	4.17	172	128	0.33	7.2	1460	624
6/19/2019	Assessment	5.21	242	147	0.25	7.6	1520	686
9/10/2019	Assessment	5.86	249	147	0.26	7.2	1500	683

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1925
Mountaineer - BAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
4/10/2019	Assessment	0.20 J	0.88	46.6	<0.1 U	0.06 J	0.4 J	1.65	2.726	0.33	0.4 J	0.094	<0.002 U	76.0	6.2	<0.5 U
6/19/2019	Assessment	0.18	0.35	48.0	<0.02 U	0.04 J	0.1 J	1.28	1.245	0.25	0.04 J	0.095	<0.002 U	63.5	6.3	<0.1 U
9/10/2019	Assessment	0.20	0.41	45.0	<0.02 U	0.06	0.1 J	1.27	1.041	0.26	0.2 J	0.0947	<0.002 U	54.6	4.1	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1926
Mountaineer - BAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
4/10/2019	Assessment	0.263	95.4	57.8	0.25	7.2	506	67.4
6/20/2019	Assessment	0.165	82.1	23.2	0.28	7.3	416	47.8
9/11/2019	Assessment	0.145	87.6	- -	- -	7.3	- -	- -
9/13/2019	Assessment	- -	- -	8.57	0.24	- -	396	26.4

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1926
Mountaineer - BAP
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
4/10/2019	Assessment	0.10 J	0.95	28.8	<0.1 U	0.06 J	0.4 J	5.05	1.327	0.25	0.981	0.01 J	<0.002 U	9 J	0.3 J	<0.5 U
6/20/2019	Assessment	0.08 J	0.38	22.9	<0.02 U	0.05	0.06 J	1.81	0.524	0.28	0.05 J	<0.009 U	<0.002 U	7.05	0.3	<0.1 U
9/11/2019	Assessment	0.07 J	0.37	23.9	<0.02 U	0.06	0.09 J	1.17	0.4608	0.24*	0.07 J	0.00624	<0.002 U	5.38	0.4	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter
* Sample collected on 9/11/2019

Table 1 - Groundwater Data Summary: MW-1927
Mountaineer - BAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
4/10/2019	Assessment	0.654	151	20.3	0.18	7.3	898	327
6/20/2019	Assessment	0.513	159	15.6	0.13	7.8	849	335
9/11/2019	Assessment	0.498	143	- -	- -	7.0	- -	- -
9/13/2019	Assessment	- -	- -	15.2	0.14	- -	839	306

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1927
Mountaineer - BAP
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
4/10/2019	Assessment	0.30 J	0.4 J	63.4	<0.1 U	<0.05 U	<0.2 U	0.319	1.533	0.18	0.1 J	0.03 J	<0.002 U	7 J	0.8 J	<0.5 U
6/20/2019	Assessment	0.15	0.28	61.5	<0.02 U	0.05 J	0.1 J	0.251	0.866	0.13	0.03 J	<0.009 U	<0.002 U	2.82	0.3	<0.1 U
9/11/2019	Assessment	0.12	0.27	58.7	<0.02 U	0.05	0.08 J	0.225	1.415	0.14*	<0.05 U	0.00638	<0.002 U	2 J	0.4	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter
* Sample collected on 9/11/2019

Table 1 - Groundwater Data Summary: MW-1929
Mountaineer - BAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
4/10/2019	Assessment	0.243	115	11.7	0.19	7.5	574	214
6/18/2019	Assessment	0.219	97.8	13.6	0.20	7.5	541	237
9/10/2019	Assessment	0.236	113	15.1	0.19	7.6	528	234

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1929
Mountaineer - BAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

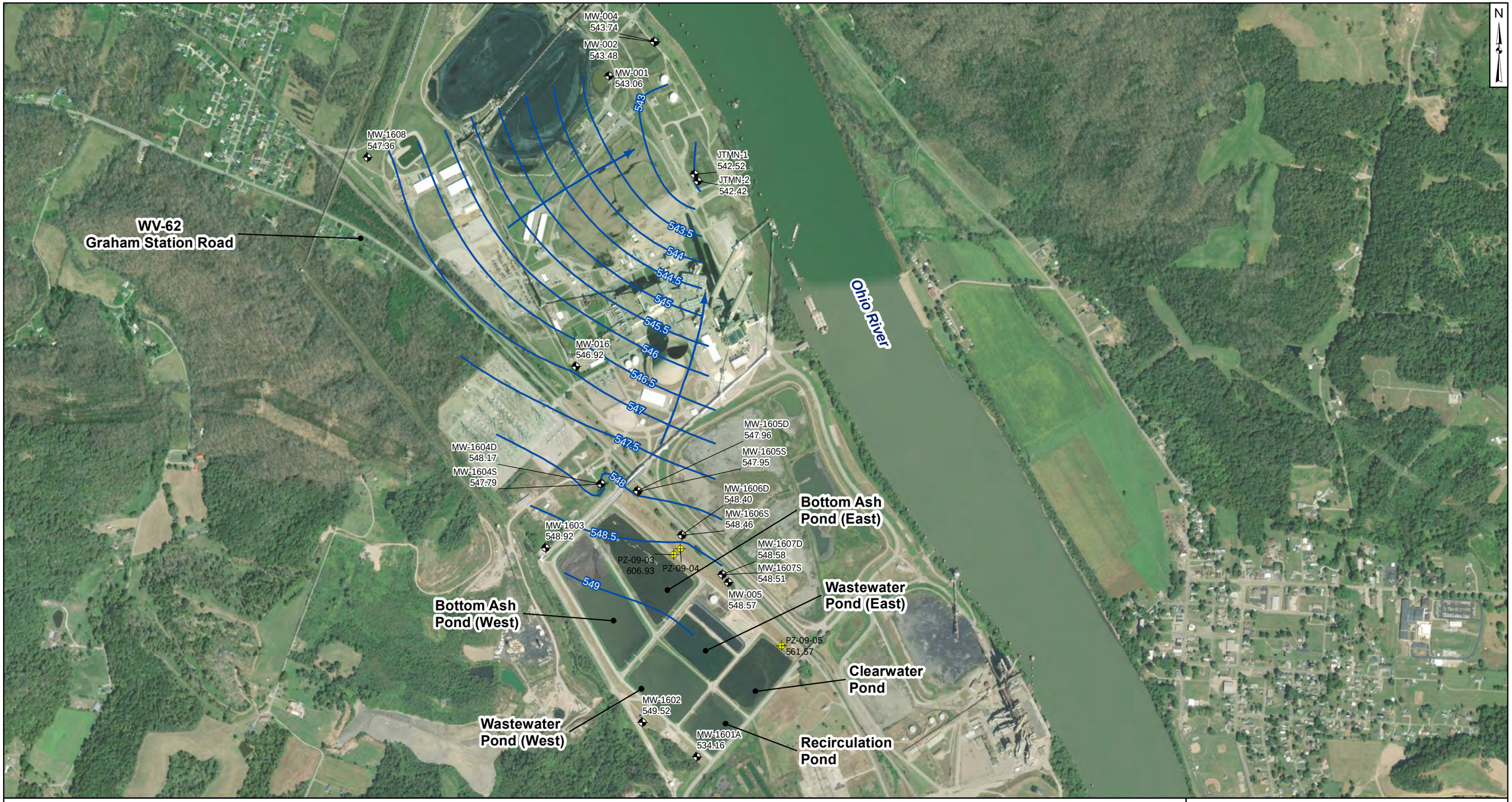
Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
4/10/2019	Assessment	<0.10 U	0.80	56.9	<0.1 U	<0.05 U	0.5 J	3.03	0.823	0.19	1.15	0.01 J	<0.002 U	<2 U	1.3	<0.5 U
6/18/2019	Assessment	0.02 J	0.37	47.6	<0.02 U	0.02 J	0.2 J	0.157	0.398	0.20	0.08 J	<0.009 U	<0.002 U	0.7 J	1.3	<0.1 U
9/10/2019	Assessment	0.03 J	0.47	52.1	<0.02 U	0.01 J	0.280	0.606	2.994	0.19	0.274	0.0048	<0.002 U	0.7 J	1.7	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 2: Residence Time Calculation Summary - Bottom Ash Pond Mountaineer Bottom Ash Pond

			2019-04		2019-06		2019-09	
CCR Management Unit	Monitoring Well	Well Diameter (inches)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)
Bottom Ash Pond	MW-1601A [1]	2.0	1,743	0.03	145	0.4	227	0.3
	MW-1602 [1]	2.0	120	0.5	177	0.3	208	0.3
	MW-1603 [1]	2.0	279	0.2	192	0.3	366	0.2
	MW-1604D [2]	2.0	148	0.4	6,426	0.01	231	0.3
	MW-1604S [2]	2.0	314	0.2	5,275	0.01	407	0.1
	MW-1605D [2]	2.0	252	0.2	234	0.3	355	0.2
	MW-1605S [2]	2.0	244	0.2	91.1	0.7	363	0.2
	MW-1606D [2]	2.0	293	0.2	1,048	0.1	224	0.3
	MW-1606S [2]	2.0	337	0.2	1,697	0.04	267	0.2
	MW-1607D [2]	2.0	139	0.4	1,337	0.05	98.5	0.6
	MW-1607S [2]	2.0	162	0.4	1,556	0.04	126	0.5
	MW-1608 [1]	2.0	343	0.2	294	0.2	238	0.3

Notes:
[1] - Background Well
[2] - Downgradient Well



Legend

- Monitoring Well
- Piezometer
- Approximate Groundwater Flow Direction
- Groundwater Elevation Contour

Notes

- Monitoring well coordinates and water level data (collected on April 8,2019) provided by AEP.
- Site features based on information available in Ash Pond System-CCR Groundwater Monitoring Well Network Evaluation (Arcadis, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level.
- Water levels from piezometers were inconsistent with other local data and not used to create groundwater contours.
- Normal lower pool elevation of the Ohio River at Racine Lock and Dam is 539.5 ft amsl (USACE).
- Intermittent usage of pumping wells for plant activities impact water levels in the vicinity. In general, shallow groundwater beneath the plant flows northeast towards the Ohio River.
- MW-1601A was not used in contouring due to anomalous/inconsistent reading.

0 250 500 1,000 1,500 Feet

Potentiometric Surface Map - Uppermost Aquifer April 2019

AEP Mountaineer Generating Plant - Bottom Ash Ponds
New Haven, West Virginia

Geosyntec consultants

Columbus, Ohio | 2019/12/30

Figure 1

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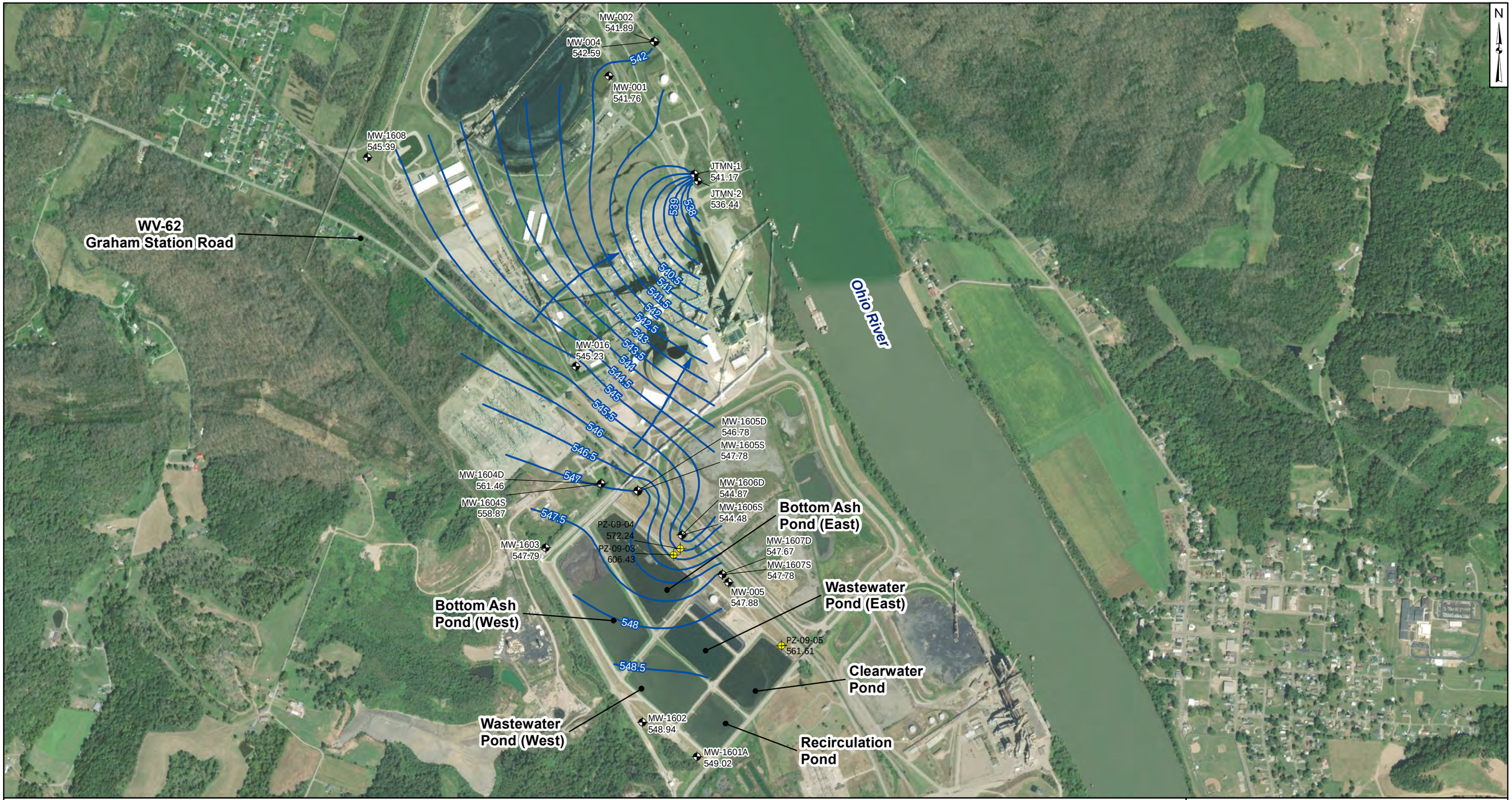

Legend

- Monitoring Well
- Piezometer
- Approximate Groundwater Flow Direction
- Groundwater Elevation Contour

Notes

- Monitoring well coordinates and water level data (collected on June 17,2019) provided by AEP.
- Site features based on information available in Ash Pond System-CCR Groundwater Monitoring Well Network Evaluation (Arcadis, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level.
- Water levels from piezometers were inconsistent with other local data and not used to create groundwater contours.
- Normal lower pool elevation of the Ohio River at Racine Lock and Dam is 539.5 ft amsl (USACE).
- Intermittent usage of pumping wells for plant activities impact water levels in the vicinity. In general, shallow groundwater beneathe the plant flows northeast towards the Ohio River.
- MW-1604S and MW-1604D were not used in contouring due to anomalous/inconsistent readings.

0 250 500 1,000 1,500 Feet

Potentiometric Surface Map - Uppermost Aquifer June 2019

AEP Mountaineer Generating Plant - Bottom Ash Ponds
New Haven, West Virginia

Geosyntec consultants

Columbus, Ohio | 2019/12/31

Figure 2

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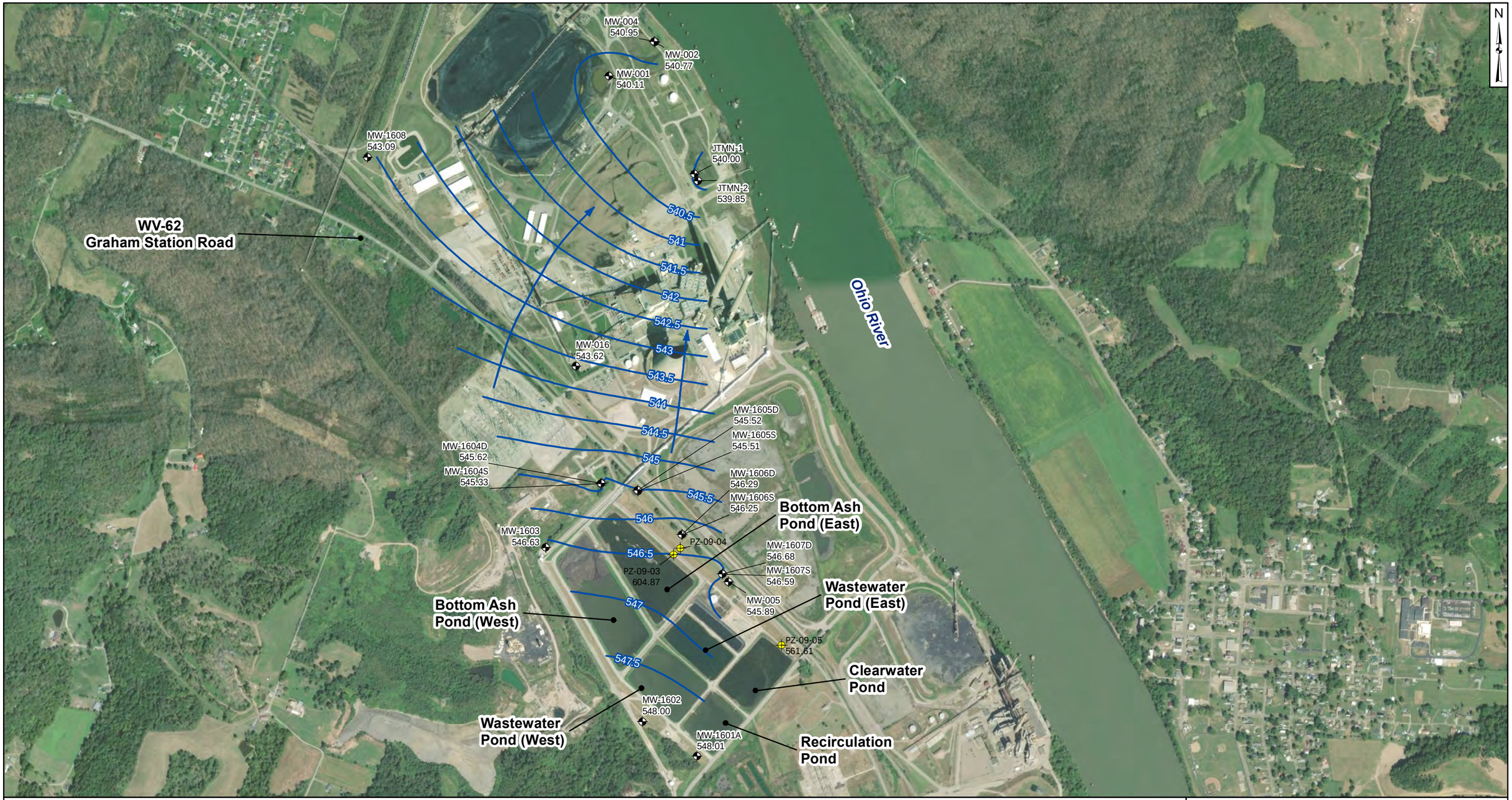

Legend

- Monitoring Well
- Piezometer
- Approximate Groundwater Flow Direction
- Groundwater Elevation Contour

Notes

- Monitoring well coordinates and water level data (collected on September 9, 2019) provided by AEP.
- Site features based on information available in Ash Pond System-CCR Groundwater Monitoring Well Network Evaluation (Arcadis, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level.
- Water levels from piezometers were inconsistent with other local data and not used to create groundwater contours.
- Normal lower pool elevation of the Ohio River at Racine Lock and Dam is 539.5 ft amsl (USACE).
- Intermittent usage of pumping wells for plant activities impact water levels in the vicinity. In general, shallow groundwater beneath the plant flows northeast toward the Ohio River.

0 250 500 1,000 1,500 Feet

Potentiometric Surface Map - Uppermost Aquifer September 2019

AEP Mountaineer Generating Plant - Bottom Ash Ponds
New Haven, West Virginia

Geosyntec consultants

Columbus, Ohio | 2019/12/31

Figure 3

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mountaineer\2019\AEP-Mountaineer_BAP_GW_2019-09.mxd. ARevezzo. 12/31/2019. CHA8423/07/08.

Appendix 2

The groundwater data statistical analyses completed in 2019 follow.

STATISTICAL ANALYSIS SUMMARY
BOTTOM ASH POND
Mountaineer Plant
New Haven, West Virginia

Submitted to

1 Riverside Plaza
Columbus, Ohio 43215-2372

Submitted by

Geosyntec consultants

engineers | scientists | innovators

941 Chatham Lane
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January 8, 2019

CHA8473

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LIST OF ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
ASD	Alternative Source Demonstration
BAP	Bottom Ash Pond
CCR	Coal Combustion Residuals
CCV	Continuing Calibration Verification
CFR	Code of Federal Regulations
GWPS	Groundwater Protection Standard
LCL	Lower Confidence Limit
LFB	Laboratory Fortified Blanks
LRB	Laboratory Reagent Blanks
MCL	Maximum Contaminant Level
NELAP	National Environmental Laboratory Accreditation Program
QA	Quality Assurance
QC	Quality Control
RSL	Regional Screening Level
SSI	Statistically Significant Increase
SSL	Statistically Significant Level
TDS	Total Dissolved Solids
UPL	Upper Prediction Limit
USEPA	United States Environmental Protection Agency
UTL	Upper Tolerance Limit

SECTION 1

EXECUTIVE SUMMARY

In accordance with the United States Environmental Protection Agency's (USEPA's) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR 257.90-257.98, "CCR rule"), groundwater monitoring has been conducted at the Bottom Ash Pond (BAP), an existing CCR unit at the Mountaineer Power Plant located in New Haven, West Virginia.

Based on detection monitoring conducted in 2017 and 2018, statistically significant increases (SSIs) over background were concluded for boron, calcium, chloride, total dissolved solids (TDS), and sulfate at the BAP. An alternate source was not identified at the time, so two assessment monitoring events were conducted at the BAP in 2018, in accordance with 40 CFR 257.95.

Groundwater data underwent several validation tests, including those for completeness, sample tracking accuracy, transcription errors, and consistent use of measurement units. No data quality issues were identified which would impact the usability of the data.

The monitoring data were submitted to Groundwater Stats Consulting, LLC for statistical analysis. Groundwater protection standards (GWPSs) were established for the Appendix IV parameters. Confidence intervals were calculated for Appendix IV parameters at the compliance wells to assess whether Appendix IV parameters were present at a statistically significant level (SSL) above the GWPS. SSLs were identified for lithium. Thus, either the unit will move to an assessment of corrective measures or an alternative source demonstration (ASD) will be conducted to evaluate if the unit can remain in assessment monitoring. Certification of the selected statistical methods by a qualified professional engineer is documented in Attachment A.

SECTION 2

BOTTOM ASH POND EVALUATION

2.1 Data Validation & QA/QC

During the assessment monitoring program, two sets of samples were collected for analysis from each upgradient and downgradient well to meet the requirements of 40 CFR 257.95(b) and 257.95(d)(1). Samples from both sampling events were analyzed for the Appendix IV parameters, while samples from the second sampling event were also analyzed for Appendix III parameters. A summary of data collected during assessment monitoring may be found in Table 1.

Chemical analysis was completed by an analytical laboratory certified by the National Environmental Laboratory Accreditation Program (NELAP). Quality assurance and quality control (QA/QC) samples completed by the analytical laboratory included the use of laboratory reagent blanks (LRBs), continuing calibration verification (CCV) samples, and laboratory fortified blanks (LFBs).

The analytical data were imported into a Microsoft Access database, where checks were completed to assess the accuracy of sample location identification and analyte identification. Where necessary, unit conversions were applied to standardize reported units across all sampling events. Exported data files were created for use with the Sanitas™ v.9.5 statistics software. The export file was checked against the analytical data for transcription errors and completeness. No QA/QC issues were noted which would impact data usability.

2.2 Statistical Analysis

Statistical analyses for the BAP were conducted in accordance with the January 2017 *Statistical Analysis Plan* (AEP, 2017), except where noted below. Time series plots and results for all completed statistical tests are provided in Attachment B.

The data obtained to meet the requirements of 40 CFR 257.95(b) and 257.95(d)(1) were screened for potential outliers. No outliers were identified. Outliers identified from the background and detection monitoring events conducted through January 2018 were summarized in a previous report (Geosyntec, 2018).

2.2.1 Establishment of GWPSs

A GWPS was established for each Appendix IV parameter in accordance with 40 CFR 257.95(h) and the *Statistical Analysis Plan* (AEP, 2017). The established GWPS was determined to be the greater value of the background concentration and the maximum contaminant level (MCL) or regional screening level (RSL) for each Appendix IV parameter. To determine background concentrations, an upper tolerance limit (UTL) was calculated using pooled data from the background wells collected during the background monitoring and assessment monitoring events.

Tolerance limits were generally calculated parametrically with 95% coverage and 95% confidence. Non-parametric tolerance limits were calculated for antimony, cadmium, and selenium due to apparent non-normal distributions and for beryllium and mercury due to a high non-detect frequency. Tolerance limits and the final GWPSs are summarized in Table 2.

2.2.2 Evaluation of Potential Appendix IV SSLs

A confidence interval was constructed for each Appendix IV parameter at each compliance well. Confidence limits were generally calculated parametrically ($\alpha = 0.01$); however, non-parametric confidence limits were calculated in some cases (e.g., when the data did not appear to be normally distributed or when the non-detect frequency was too high). An SSL was concluded if the lower confidence limit (LCL) exceeded the GWPS (i.e., if the entire confidence interval exceeded the GWPS). Calculated confidence limits are shown in Attachment B.

The following SSLs were identified at the Mountaineer BAP:

- LCLs for lithium exceeded the GWPS of 0.04 mg/L at MW-1605D (0.0653 mg/L), MW-1605S (0.0594 mg/L), MW-1606D (0.111 mg/L), MW-1606S (0.102 mg/L), MW-1607D (0.0718 mg/L), MW-1607S (0.0918 mg/L).

As a result, the Mountaineer BAP will either move to an assessment of corrective measures or an alternative source demonstration will be conducted to evaluate if the unit can remain in assessment monitoring.

2.3 Conclusions

Two assessment monitoring events were conducted in 2018 in accordance with the CCR Rule. The laboratory and field data were reviewed prior to statistical analysis, with no QA/QC issues identified that impacted data usability. A review of outliers identified no potential outliers in the 2018 data. GWPSs were established for the Appendix IV parameters. A confidence interval was constructed at each compliance well for each Appendix IV parameter; SSLs were concluded if the entire confidence interval exceeded the GWPS. SSLs were identified for lithium.

Based on this evaluation, the Mountaineer BAP CCR unit will either move to an assessment of corrective measures or an ASD will be conducted to evaluate if the unit can remain in assessment monitoring.

SECTION 3

REFERENCES

American Electric Power (AEP). 2017. Statistical Analysis Plan – Mountaineer Plant. January 2017.

Geosyntec Consultants (Geosyntec). 2018. Statistical Analysis Summary – Bottom Ash Pond, Mountaineer Plant, New Haven, West Virginia. January 15, 2018.

TABLES

Table 1 – Groundwater Data Summary
Mountaineer – Bottom Ash Pond

Parameter	Unit	MW-1601A		MW-1602		MW-1603		MW-1604D		MW-1604S		MW-1605D		MW-1605S	
		5/10/2018	9/20/2018	5/10/2018	9/20/2018	5/10/2018	9/20/2018	5/9/2018	9/19/2018	5/9/2018	9/19/2018	5/9/2018	9/19/2018	5/9/2018	9/19/2018
Antimony	µg/L	0.0300 J	0.0300 J	0.0200 J	0.0100 J	0.0200 J	0.0200 J	0.0400 J	0.0400 J	0.130	0.130	0.0300 J	0.0400 J	0.0400 J	0.0400 J
Arsenic	µg/L	0.550	0.580	0.340	0.320	0.310	0.260	0.340	0.290	0.330	0.320	2.22	2.51	0.500	0.490
Barium	µg/L	63.9	55.3	31.2	26.7	41.3	35.9	32.0	37.0	28.7	26.6	21.6	25.9	23.5	23.1
Beryllium	µg/L	0.02 U	0.02 U	0.00500 J	0.02 U	0.00700 J	0.02 U	0.02 U	0.02 U	0.0240	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Boron	mg/L	-	0.251	-	0.109	-	0.324	-	1.33	-	2.49	-	9.11	-	7.75
Cadmium	µg/L	0.0200 J	0.0200 J	0.0100 J	0.0100 J	0.0100 J	0.0100 J	0.0400	0.0300	0.150	0.150	0.0100 J	0.0200 J	0.0600	0.0500
Calcium	mg/L	-	148	-	81.6	-	167	-	144	-	262	-	278	-	182
Chloride	mg/L	-	51.0	-	10.5	-	14.0	-	41.3	-	109	-	188	-	171
Chromium	µg/L	0.153	0.131	0.121	0.210	0.0990	0.102	0.195	0.169	0.107	0.0930	0.0670	0.229	0.0830	0.644
Cobalt	µg/L	0.0830	0.0590	0.0360	0.0200 J	0.0540	0.0320	0.314	0.203	1.83	1.88	1.51	1.80	0.518	0.360
Combined Radium	pCi/L	0.767	0.696	0.342	0.683	0.363	0.881	0.687	0.316	1.17	1.16	0.523	0.759	0.305	0.347
Fluoride	mg/L	0.160	0.190	0.230	0.250	0.0900 J	0.0900	0.210	0.190	0.220	0.220	0.230	0.220	0.300	0.320
Lead	µg/L	0.0340	0.00500 J	0.0380	0.0100 J	0.0420	0.0200 J	0.0350	0.303	0.0340	0.0200 J	0.0200 J	0.0100 J	0.0560	0.0930
Lithium	mg/L	0.00400	0.00400	0.0150	0.0120	0.0210	0.0220	0.0240	0.0160	0.0510	0.0520	0.0620	0.0600	0.0510	0.0490
Mercury	µg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Molybdenum	µg/L	0.990	0.760	0.710	0.840	0.140	0.0700 J	2.05	1.57	16.2	15.6	46.4	47.9	15.6	15.1
Selenium	µg/L	1.50	1.10	0.100	0.0700 J	0.200	0.400	1.40	3.80	1.00	0.800	0.200	0.300	2.00	1.00
Total Dissolved Solids	mg/L	-	638	-	502	-	920	-	838	-	1500	-	1960	-	1650
Sulfate	mg/L	-	189	-	195	-	524	-	313	-	742	-	972	-	793
Thallium	µg/L	0.0300 J	0.0400 J	0.0300 J	0.0200 J	0.0200 J	0.0100 J	0.0200 J	0.0200 J	0.220	0.251	0.0400 J	0.0500 J	0.0400 J	0.0400 J
pH	SU	7.30	7.14	7.01	7.14	6.55	6.58	7.09	7.21	7.43	7.30	7.46	7.57	7.21	7.35

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
SU: standard unit
U: Parameter was not present in concentrations above method detection limit and is reported as the reporting limit
J: Estimated value. Parameter was detected in concentrations below the reporting limit
-: Not sampled

Table 1 – Groundwater Data Summary
Mountaineer – Bottom Ash Pond

Parameter	Unit	MW-1606D		MW-1606S		MW-1607D		MW-1607S		MW-1608	
		5/9/2018	9/19/2018	5/9/2018	9/19/2018	5/10/2018	9/20/2018	5/10/2018	9/20/2018	5/10/2018	9/20/2018
Antimony	µg/L	0.160	0.150	0.140	0.130	0.0300 J	0.0300 J	0.440	0.420	0.0200 J	0.0300 J
Arsenic	µg/L	0.440	0.380	0.720	0.690	1.15	1.34	0.930	0.900	0.370	0.420
Barium	µg/L	53.0	48.9	73.2	64.8	73.5	92.3	71.1	80.6	46.6	42.6
Beryllium	µg/L	0.02 U	0.00400 J	0.02 U	0.00500 J	0.02 U	0.02 U	0.02 U	0.02 U	0.00900 J	0.02 U
Boron	mg/L	-	7.27	-	5.87	-	2.44	-	1.71	-	0.169
Cadmium	µg/L	0.0700	0.0700	0.0800	0.0600	0.02 U	0.02 U	0.0400	0.0400	0.0100 J	0.00800 J
Calcium	mg/L	-	260	-	199	-	222	-	220	-	128
Chloride	mg/L	-	201	-	219	-	163	-	151	-	6.59
Chromium	µg/L	0.198	0.151	0.0560	0.297	0.0510	0.158	0.121	0.0860	0.126	0.264
Cobalt	µg/L	1.40	1.17	0.318	0.260	0.521	0.769	1.18	0.840	0.0950	0.0520
Combined Radium	pCi/L	0.972	0.438	0.344	0.439	1.25	0.926	1.29	0.584	0.565	0.550
Fluoride	mg/L	0.260	0.260	0.440	0.460	0.540	0.520	0.290	0.280	0.180	0.210
Lead	µg/L	0.115	0.0100 J	0.0400	0.0200 J	0.0430	0.0440	0.128	0.0940	0.0790	0.0370
Lithium	mg/L	0.112	0.107	0.107	0.0960	0.0890	0.104	0.103	0.118	0.000300 J	0.00400
Mercury	µg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Molybdenum	µg/L	70.3	65.3	70.2	70.6	80.9	83.4	43.2	41.5	0.530	1.18
Selenium	µg/L	2.60	3.30	2.00	2.80	0.10 U	0.10 U	11.4	8.80	0.900	1.20
Total Dissolved Solids	mg/L	-	1610	-	1370	-	1450	-	1160	-	572
Sulfate	mg/L	-	722	-	571	-	662	-	478	-	256
Thallium	µg/L	0.0860	0.108	0.0760	0.112	0.0200 J	0.0400 J	0.0640	0.0890	0.0200 J	0.0200 J
pH	SU	7.43	7.19	6.93	7.10	7.54	7.73	7.40	7.57	6.78	7.17

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
SU: standard unit
U: Parameter was not present in concentrations above method detection limit and is reported as the reporting limit
J: Estimated value. Parameter was detected in concentrations below the reporting limit
-: Not sampled

Table 2: Groundwater Protection Standards
Mountaineer Plant - Bottom Ash Pond

Constituent Name	MCL	CCR Rule-Specified	Background Limit
Antimony, Total (mg/L)	0.006		0.0001
Arsenic, Total (mg/L)	0.01		0.00075
Barium, Total (mg/L)	2		0.058
Beryllium, Total (mg/L)	0.004		0.00002
Cadmium, Total (mg/L)	0.005		0.00003
Chromium, Total (mg/L)	0.1		0.0019
Cobalt, Total (mg/L)	n/a	0.006	0.00066
Combined Radium, Total (pCi/L)	5		2.36
Fluoride, Total (mg/L)	4		0.3
Lead, Total (mg/L)	n/a	0.015	0.00052
Lithium, Total (mg/L)	n/a	0.04	0.031
Mercury, Total (mg/L)	0.002		0.000005
Molybdenum, Total (mg/L)	n/a	0.1	0.0029
Selenium, Total (mg/L)	0.05		0.0015
Thallium, Total (mg/L)	0.002		0.000093

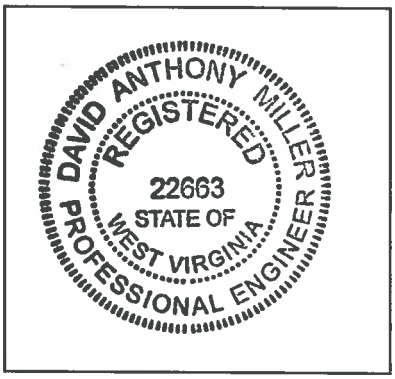
Notes:
Grey cell indicates calculated UTL is higher than MCL.
MCL = Maximum Contaminant Level
Calculated UTL (Upper Tolerance Limit) represents site-specific background values.
The higher of the calculated UTL or MCL/RSL is used as the GWPS.

ATTACHMENT A

Certification by Qualified Professional Engineer

Certification by Qualified Professional Engineer

I certify that the selected and above described statistical method is appropriate for evaluating the groundwater monitoring data for the Mountaineer Bottom Ash Pond CCR management area and that the requirements of 40 CFR 257.93(f) have been met.



DAVID ANTHONY MILLER
Printed Name of Licensed Professional Engineer

David Anthony Miller
Signature

22663	WEST VIRGINIA	01.08.19
License Number	Licensing State	Date

ATTACHMENT B
Statistical Analysis Output

GROUNDWATER STATS CONSULTING

December 3, 2018

Geosyntec Consultants
Attn: Ms. Allison Kreinberg
941 Chatham Lane, #103
Columbus, OH 43221

Re: Mountaineer BAP
Assessment Monitoring Event – September 2018

Groundwater Stats Consulting, formerly the statistical consulting division of Sanitas Technologies, is pleased to provide the statistical analysis of the September 2018 groundwater data for American Electric Power Inc.'s Mountaineer Bottom Ash Pond. The analysis complies with the federal rule for the Disposal of Coal Combustion Residuals from Electric Utilities (CCR Rule, 2015) as well as with the USEPA Unified Guidance (2009).

Sampling began at the site for the CCR program in 2016. The monitoring well network, as provided by Geosyntec Consultants, consists of the following:

- **Upgradient wells:** MW-1601A, MW-1602, MW-1603, MW-1608; and
- **Downgradient wells:** MW-1604D, MW-1604S, MW-1605D, MW-1605S, MW-1606D, MW-1606S, MW-1607D, MW-1607S.

Data were sent electronically, and the statistical analysis was conducted according to the Statistical Analysis Plan and screening evaluation prepared by GSC and approved by Dr. Kirk Cameron, PhD Statistician with MacStat Consulting, primary author of the USEPA Unified Guidance, and Senior Advisor to GSC.

The CCR program consists of the following constituents:

- **Appendix III** (Detection Monitoring) **-** boron, calcium, chloride, fluoride, pH, sulfate, and TDS;

- **Appendix IV** (Assessment Monitoring) **–** antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, combined radium 226 + 228, fluoride, lead, lithium, mercury, molybdenum, selenium, and thallium.

Time series plots for Appendix III and IV parameters are provided for all wells and constituents; and are used to evaluate concentrations over the entire record. Values previously flagged during the screening as outliers may be seen in a lighter font and disconnected symbol on the time series graphs.

Evaluation of Appendix III Parameters

Interwell prediction limits combined with a 1-of-2 verification strategy were constructed for boron, calcium, chloride, fluoride, sulfate and TDS; and intrawell prediction limits combined with a 1-of-2 verification strategy were constructed for pH. The statistical method selected for each parameter was determined based on the results of the screening analysis performed in December 2017.

In the event of an initial exceedance of compliance well data, the 1-of-2 resample plan allows for collection of one additional sample to determine whether the initial exceedance is confirmed. When the resample confirms the initial exceedance, a statistically significant increase (SSI) is identified and further research would be required to identify the cause of the exceedance (i.e. impact from the site, natural variation, or an off-site source). If the resample falls within the statistical limit, the initial exceedance is considered a false positive result and, therefore, no further action is necessary. SSIs were noted for several of the Appendix III parameters and the results of those findings may be found in the Prediction Limit Summary tables following this letter.

When a statistically significant increase is identified, the data are further evaluated using the Sen's Slope/Mann Kendall trend test to determine whether concentrations are statistically increasing, decreasing or stable. Upgradient wells are included in the trend analyses to identify whether similar patters exist upgradient of the site which is an indication of natural variability in groundwater unrelated to practices at the site.

Statistically significant increasing trends were found for several constituents in both upgradient and downgradient wells. A statistically significant increasing trend was noted for calcium in well MW-1607S; however, with the exception of the most recent sample, historical concentrations are similar and, in some cases, lower than those reported in upgradient wells. Further research beyond the scope of this analysis would be required to identify the cause for any changing groundwater concentrations in downgradient wells

(i.e. result of practices at the site, natural variation, or an off-site source). A Trend Test summary table follows this letter.

Evaluation of Appendix IV Parameters

Parametric tolerance limits were used to calculate background limits from pooled upgradient well data for Appendix IV parameters with a target of 95% confidence and 95% coverage to determine the Alternate Contaminant Level (ACL). The confidence and coverage levels for nonparametric tolerance limits are dependent upon the number of background samples. These limits were compared to the Maximum Contaminant Levels (MCLs) and Regional Screening Levels (RSLs) in the Groundwater Protection Standard (GWPS) table following this letter to determine the highest limit for use as the GWPS in the Confidence Interval comparisons.

Confidence intervals were then constructed on downgradient wells for each of the Appendix IV parameters using the highest limit of either the MCL, RSL, or ACL as discussed above. Only when the entire confidence interval is above a GWPS is the well/constituent pair considered to exceed its respective standard. No confidence interval exceedances were found except for lithium in wells MW-1605D, MW1605S, MW-1606D, MW-1606S, MW-1607D and MW-1607S. A summary of the confidence interval results follows this letter.

Thank you for the opportunity to assist you in the statistical analysis of groundwater quality for the Mountaineer BAP. If you have any questions or comments, please feel free to contact me.

For Groundwater Stats Consulting,

Kristina L. Rayner
Groundwater Statistician

Data were sent electronically to Groundwater Stats Consulting, and the statistical analysis was reviewed by Dr. Kirk Cameron, PhD Statistician with MacStat Consulting, primary author of the USEPA Unified Guidance, and Senior Advisor to Groundwater Stats Consulting.

The following constituents were evaluated: Appendix III parameters – boron, calcium, chloride, fluoride, pH, sulfate, and TDS; and Appendix IV parameters - antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, combined radium 226 & 228, fluoride, lead, lithium, mercury, molybdenum, selenium, and thallium.

Time series plots for Appendix III and IV parameters at all wells are provided for the purpose of screening data at these wells (Figure A). Additionally, box plots are included for all constituents at upgradient and downgradient wells (Figure B). The time series plots are used to initially screen for suspected outliers and trends, while the box plots provide visual representation of variation within individual wells and between all wells.

Data at all wells were evaluated for the following: 1) outliers; 2) trends; 3) most appropriate statistical method for Appendix III parameters based on site characteristics of groundwater data upgradient of the facility; and 4) eligibility of downgradient wells when intrawell statistical methods are recommended. Power curves are provided to demonstrate that the selected statistical methods for Appendix III parameters comply with the USEPA Unified Guidance recommendations as discussed below.

Summary of Statistical Method:

1) Intrawell prediction limits, combined with a 1-of-2 resample plan for pH; and
2) Interwell prediction limits combined with a 1-of-2 resample plan for boron, calcium, chloride, fluoride, sulfate, and TDS.

Parametric prediction limits are utilized when the screened historical data follow a normal or transformed-normal distribution. When data cannot be normalized or the majority of data are nondetects, a nonparametric test is utilized. The distribution of data is tested using the Shapiro-Wilk/Shapiro-Francia test for normality. After testing for normality and performing any adjustments as discussed below (US EPA, 2009), data are analyzed using either parametric or non-parametric prediction limits.

- No statistical analyses are required on wells and analytes containing 100% nondetects (USEPA Unified Guidance, 2009, Chapter 6).

- When data contain <15% nondetects in background, simple substitution of one-half the reporting limit is utilized in the statistical analysis. The reporting limit utilized for nondetects is the practical quantification limit (PQL) as reported by the laboratory.
- When data contain between 15-50% nondetects, the Kaplan-Meier nondetect adjustment is applied to the background data. This technique adjusts the mean and standard deviation of the historical concentrations to account for concentrations below the reporting limit.
- Nonparametric prediction limits are used on data containing greater than 50% nondetects.

Background Screening

Outlier Evaluation

Time series plots are used to identify suspected outliers, or extreme values that would result in limits that are not conservative from a regulatory perspective, in proposed background data. Suspected outliers at all wells for Appendix III and Appendix IV parameters were formally tested using Tukey's box plot method and, when identified, flagged in the computer database with "o" and deselected prior to construction of statistical limits (Figure C).

Tukey's outlier test noted a few outliers as may be seen on the Outlier Summary Table and accompanying graphs. Any values flagged as outliers are plotted in a lighter font on the time series graph. The test identified two outliers for chloride and one low outlier for pH in well MW-1607D; however, these values were not flagged due to all concentrations being consistent over time and similar to concentrations in neighboring wells. The high value identified as an outlier for pH at well MW-1607D was, however, flagged in the database. A substitution of the most recent reporting limit was applied when varying detection limits existed in data.

No true seasonal patterns were observed on the time series plots for any of the detected data; therefore, no deseasonalizing adjustments were made to the data. When seasonal patterns are observed, data may be deseasonalized so that the resulting limits will correctly account for the seasonality as a predictable pattern rather than random variation or a release.

While trends may be visual, a quantification of the trend and its significance is needed. The Sen's Slope/Mann Kendall trend test was used to evaluate all data at each well to identify statistically significant increasing or decreasing trends (Figure D). In the absence of suspected contamination, significant trending data are typically not included as part of the background data used for construction of prediction limits. This step serves to eliminate the trend and, thus, reduce variation in background. When statistically significant decreasing trends are present, earlier data are evaluated to determine whether earlier concentration levels are significantly different than current reported concentrations and will be deselected as necessary. When the historical records of data are truncated for the reasons above, a summary report will be provided to show the date ranges used in construction of the statistical limits.

The results of the trend analyses showed a handful of statistically significant trends as may be seen on the Trend Test Summary table that accompanies the trend tests. All trends were relatively low in magnitude when compared to average concentrations. One exception is chloride in upgradient well MW-1601A which shows a statistically significant increasing trend over time. However, concentrations in this well are similar to neighboring upgradient well concentrations and, therefore, required no adjustment at this time. This well will continue to be monitored and re-evaluated as more data are collected.

Appendix III – Determination of Spatial Variation

The Analysis of Variance (ANOVA) was used to statistically evaluate differences in average concentrations among upgradient wells, which assists in identifying the most appropriate statistical approach (Figure E). Interwell tests, which compare downgradient well data to statistical limits constructed from pooled upgradient well data, are appropriate when average concentrations are similar across upgradient wells. Intrawell tests, which compare compliance data from a single well to screened historical data within the same well, are appropriate when upgradient wells exhibit spatial variation; when statistical limits constructed from upgradient wells would not be conservative from a regulatory perspective; and when downgradient water quality is unimpacted compared to upgradient water quality for the same parameter.

The ANOVA identified variation for all Appendix III parameters; therefore, these data were further evaluated as described for the appropriateness of intrawell testing to accommodate the groundwater quality. A summary table of the ANOVA results is included with the reports.

Appendix III - Statistical Limits

Intrawell limits constructed from carefully screened background data from within each well serve to provide statistical limits that are conservative (i.e. lower) from a regulatory perspective, and that will rapidly identify a change in more recent compliance data from within a given well. This statistical method removes the element of variation from across wells and eliminates the chance of mistaking natural spatial variation for a release from the facility. Prior to performing intrawell prediction limits, several steps are required to reasonably demonstrate downgradient water quality does not have existing impacts from the practices of the facility.

Exploratory data analysis was used as a general comparison of concentrations in downgradient wells for all Appendix III parameters recommended for intrawell analyses to concentrations reported in upgradient wells. Upper tolerance limits are used in conjunction with confidence intervals to determine whether the estimated averages in downgradient wells are higher than observed levels upgradient of the facility. The upper tolerance limits were constructed to represent the extreme upper range of possible background levels at the site.

In cases where downgradient average concentrations are higher than observed concentrations upgradient for a given constituent, an independent study and hydrogeological investigation would be required to identify local geochemical conditions and expected groundwater quality for the region to justify an intrawell approach. Such an assessment is beyond the scope of services provided by Groundwater Stats Consulting. When there is not an obvious explanation for observed concentration differences in downgradient wells relative to reported concentrations in upgradient wells, interwell prediction limits will initially be selected for the statistical method until further evidence shows that concentrations are due to natural variation rather than a result of the facility.

Parametric tolerance limits were constructed with a target of 99% confidence and 95% coverage using pooled upgradient well data for each of the Appendix III parameters (Figure F). The confidence and coverage levels for nonparametric tolerance limits are dependent upon the number of background samples. As more data are collected, the background population is better represented and the confidence and coverage levels increase.

Confidence intervals were constructed on downgradient wells for each of the Appendix III parameters, using the tolerance limits discussed above, to determine intrawell eligibility (Figure G). When the entire confidence interval is above a background

standard for a given parameter, interwell methods are initially recommended as the statistical method. Therefore, only parameters with confidence intervals which did not exceed background standards are eligible for intrawell prediction limits.

Confidence intervals for the above parameters were found to be within their respective background limit for pH; while confidence intervals were above their respective background limits in at least one well for all other Appendix III parameters. Therefore, intrawell methods are recommended for pH, and interwell methods are initially recommended for boron, calcium, chloride, fluoride, sulfate and TDS. As mentioned earlier, if a demonstration supports natural variation in groundwater, intrawell methods will be considered for all parameters.

All available data through June 2017 at each well were used to establish intrawell background limits based on a 1-of-2 resample plan that will be used for future comparisons (Figure H). Interwell prediction limits, combined with a 1-of-2 resample plan, were constructed from upgradient wells (Figure I). Downgradient measurements will be compared to these background limits during each subsequent semi-annual sampling event.

Natural systems continuously evolve due to physical changes made to the environment. Examples include capping a landfill, paving areas near a well, or lining a drainage channel to prevent erosion. Periodic updating of background statistical limits will be necessary to accommodate these types of changes In the interwell case, newer data will be included in background when a minimum of 2 new samples are available. In the intrawell case, data for all wells and constituents are re-evaluated when a minimum of 4 new data points are available to determine whether earlier concentrations are representative of present-day groundwater quality. In some cases, the earlier portion of data are deselected prior to construction of limits in order to provide sensitive limits that will rapidly detect changes in groundwater quality. Even though the data are excluded from the calculation, the values will continue to be reported and shown in tables and graphs.

In the event of an initial exceedance of compliance well data, the 1-of-2 resample plan allows for collection of an additional sample to determine whether the initial exceedance is confirmed. When the resample confirms the initial exceedance, a statistically significant increase (SSI) is identified and further research would be required to identify the cause of the exceedance (i.e. impact from the site, natural variation, or an off-site source). If the resample falls within the statistical limit, the initial exceedance is

considered to be a false positive result and, therefore, no further action is necessary. A summary table of the background prediction limits follows this letter.

Appendix IV – Assessment Monitoring Program

During an Assessment Monitoring program confidence intervals are constructed at all wells for detected Appendix IV parameters. A minimum of 4 samples is required to construct confidence intervals; however, 8 samples are generally recommended for better representation of the true average population. Established Maximum Contaminant Levels (MCLs) are used as the GWPS comparisons, unless background limits are higher as discussed below. Parametric confidence intervals are constructed with 99% confidence when data follow a normal or transformed-normal distribution. For all other cases, nonparametric confidence intervals are constructed, with the confidence level based on the number of samples available. The GWPS is exceeded only when the entire confidence interval exceeds its respective GWPS.

Background limits are established for the Appendix IV parameters using upper tolerance limits constructed with 95% confidence/95% coverage using pooled upgradient well data, for comparison against established MCLs. When background limits, or Alternate Contaminant Levels (ACLs), are higher than established MCLs, the CCR Rule recommends using these ACLs as the GWPS for the confidence interval comparisons. Additionally, tolerance limits are also recommended to establish ACLs for Appendix IV parameters, cobalt, lithium, and molybdenum, which do not have established MCLs. Since the scope of this project included screening and development of background limits for Appendix III Detection Monitoring statistics, comparison of the Appendix IV parameters with confidence intervals was not included in this report.

Recommendations

In summary, as a result of the background screening described in this letter, intrawell prediction limits combined with a 1-of-2 resample plan are recommended for pH; and interwell prediction limits combined with a 1-of-2 resample plan are recommended for boron, calcium, chloride, fluoride, sulfate, and TDS. The statistical analyses will be constructed according to the USEPA Unified Guidance, based on seven Appendix III parameters and eight downgradient wells.

Thank you for the opportunity to assist you in the statistical analysis of groundwater quality for the Mountaineer Bottom Ash Pond. If you have any questions or comments, please feel free to contact me.

For Groundwater Stats Consulting,

Kristina L. Rayner
Groundwater Statistician

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

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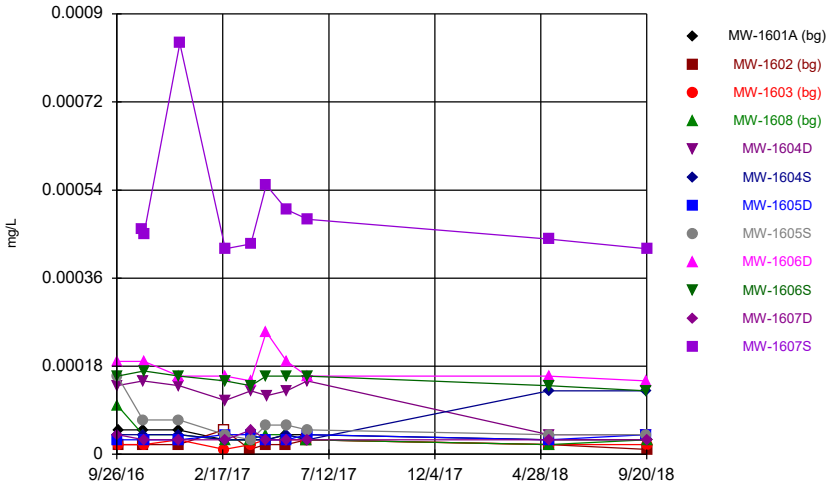

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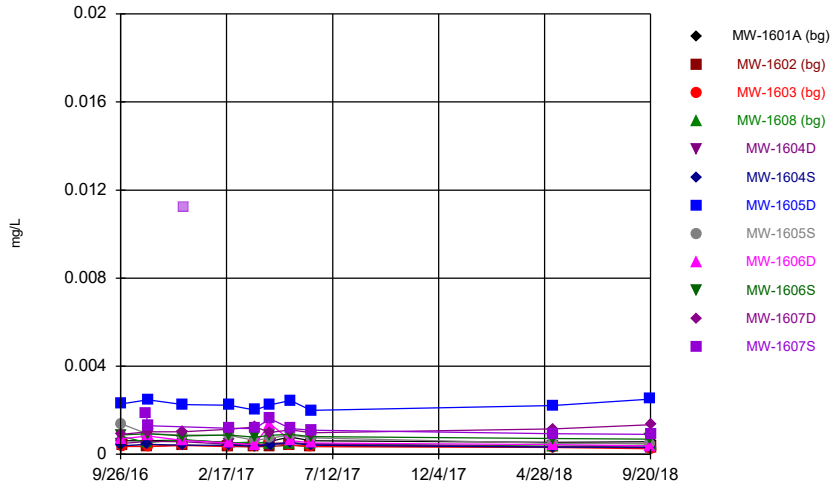
Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series



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Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

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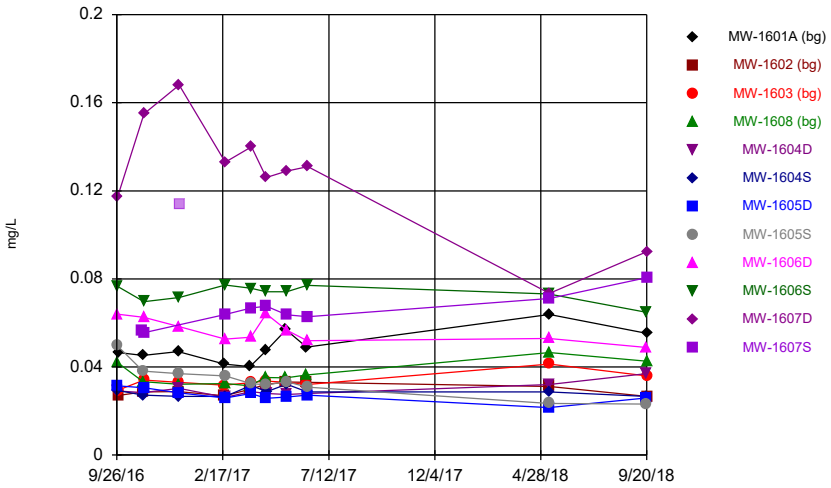

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Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG
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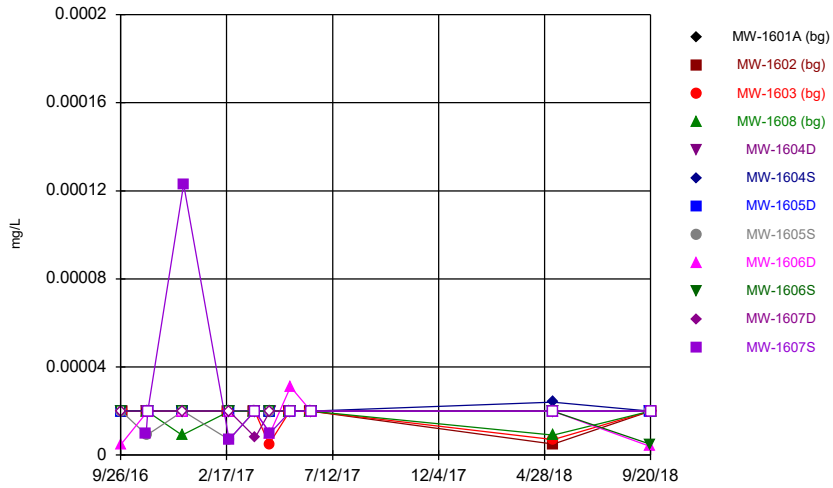

Constituent: Beryllium, total Analysis Run 12/3/2018 8:23 AM View: Descriptive
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Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

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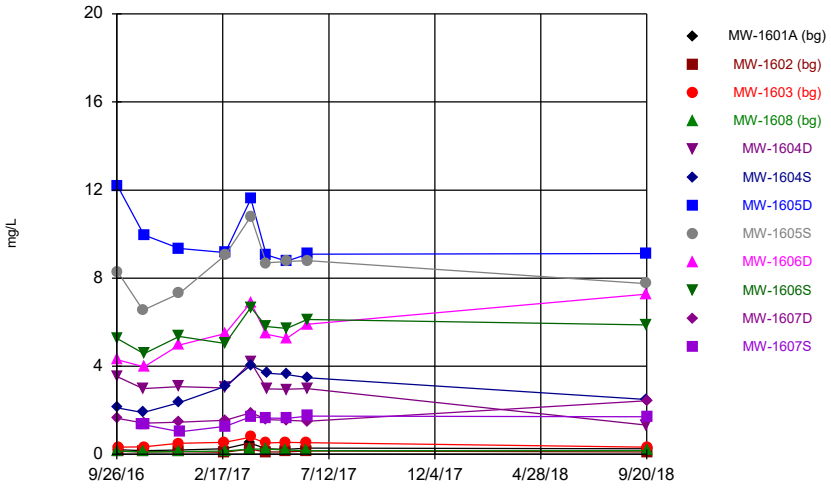

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Hollow symbols indicate censored values.

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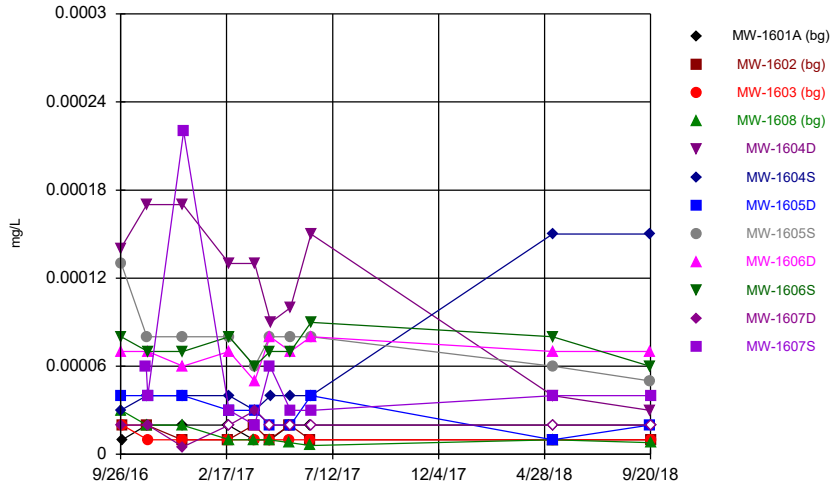

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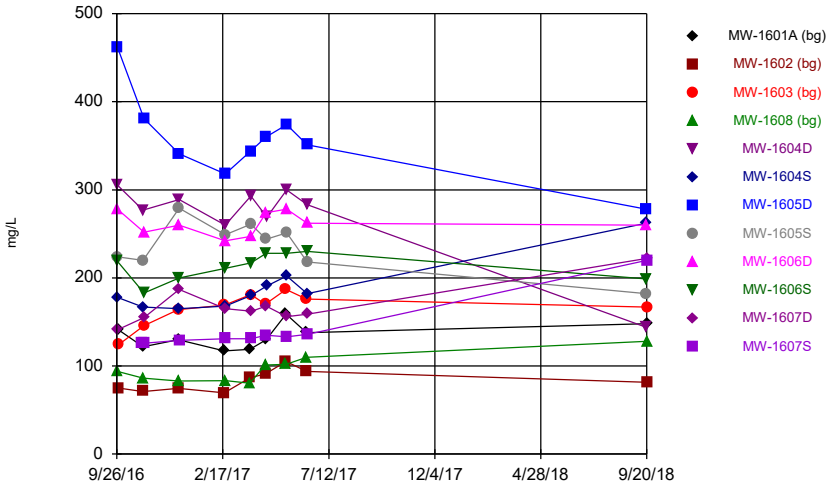

Constituent: Calcium, total Analysis Run 12/3/2018 8:23 AM View: Descriptive
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Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

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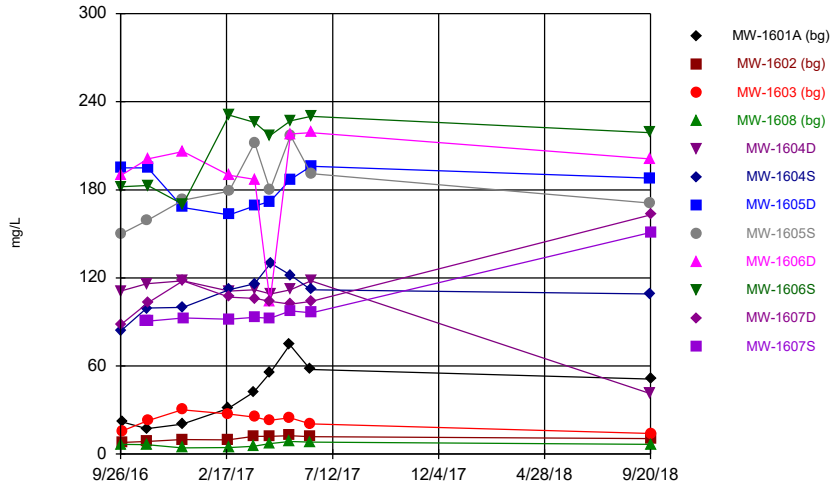

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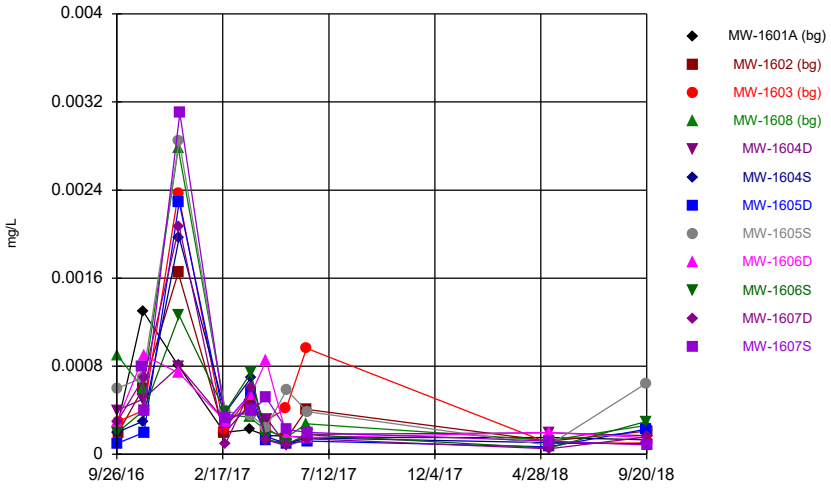

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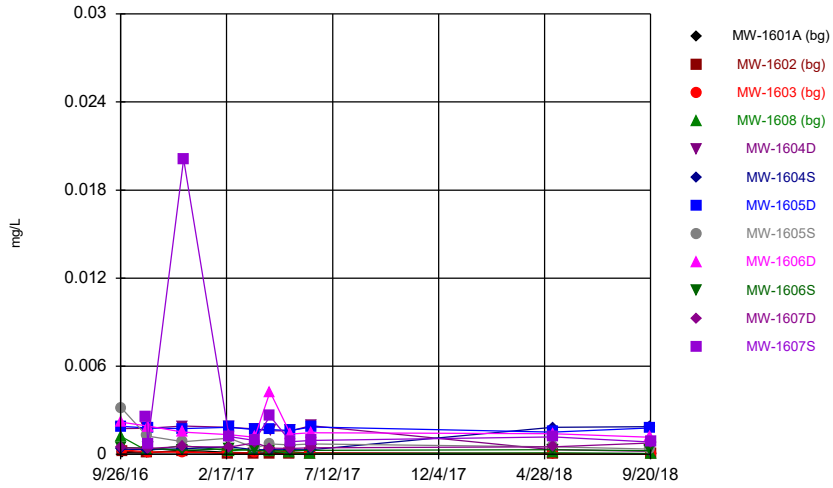

Constituent: Cobalt, total Analysis Run 12/3/2018 8:23 AM View: Descriptive
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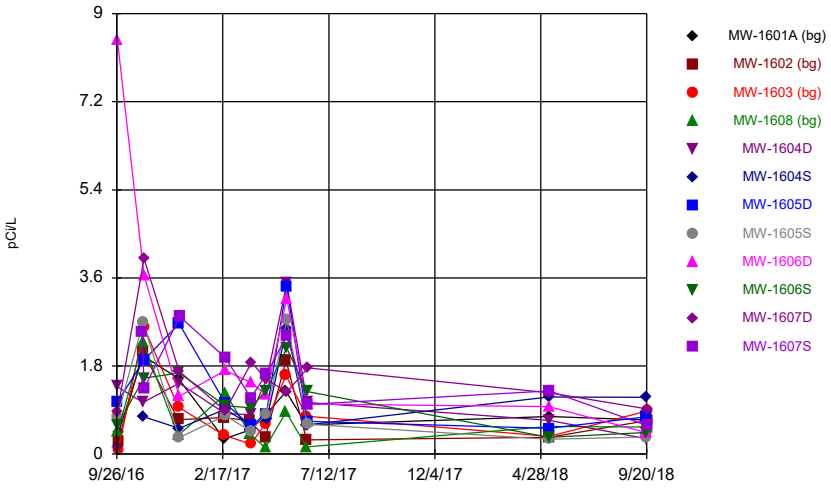

Constituent: Combined Radium 226 + 228 Analysis Run 12/3/2018 8:23 AM View: Descriptive
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Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

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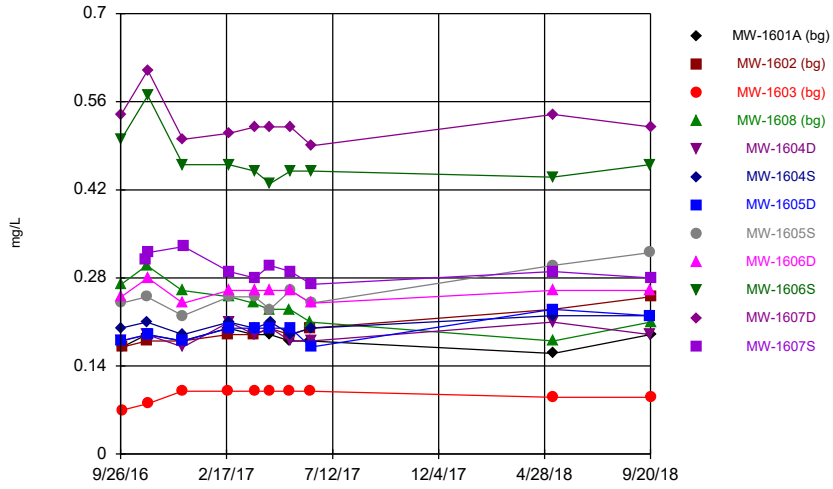

Constituent: Fluoride, total Analysis Run 12/3/2018 8:23 AM View: Descriptive
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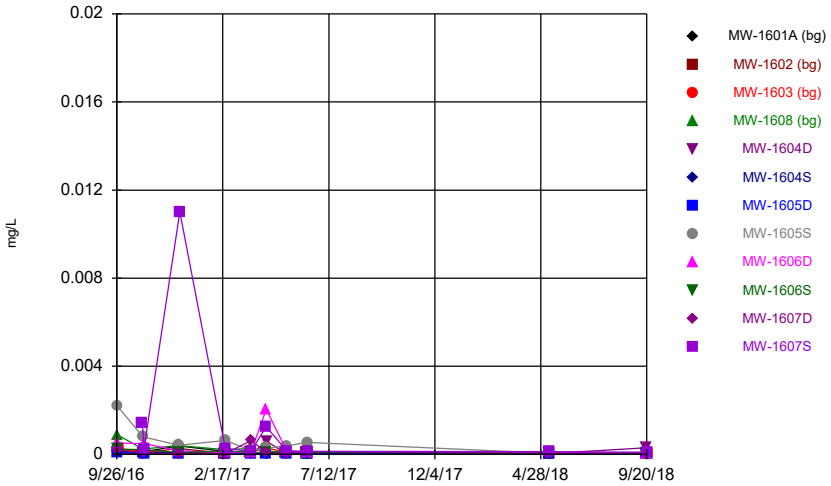

Constituent: Lead, total Analysis Run 12/3/2018 8:23 AM View: Descriptive
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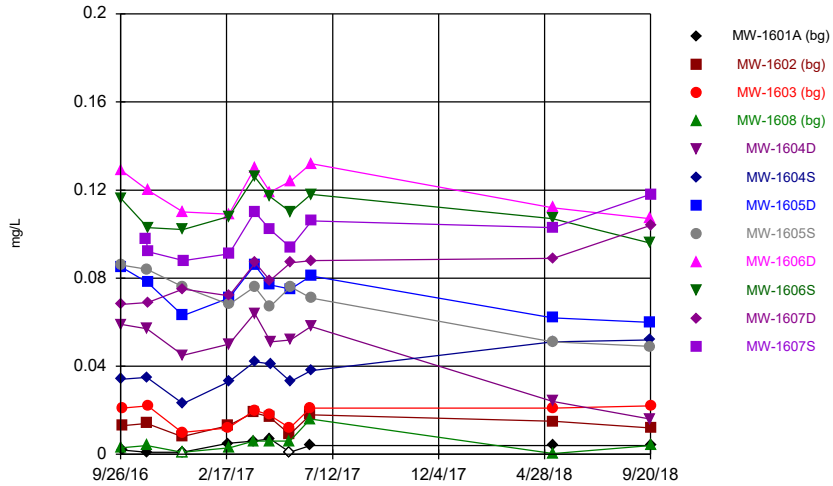

Constituent: Lithium, total Analysis Run 12/3/2018 8:23 AM View: Descriptive
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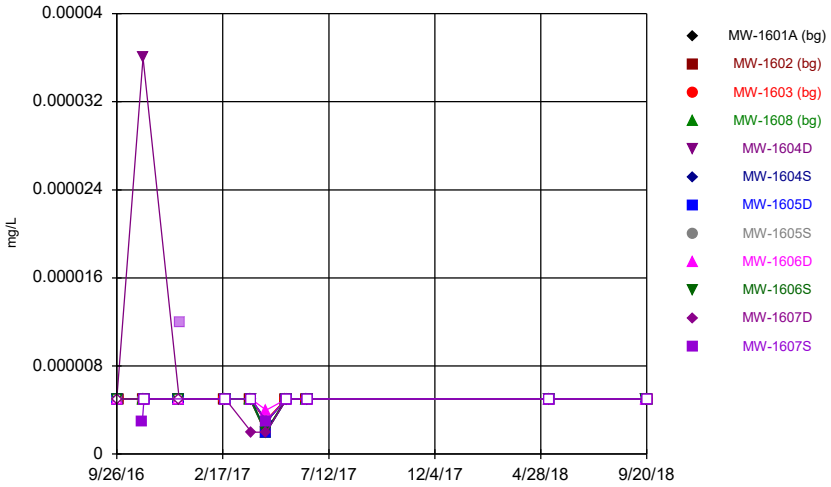

Constituent: Mercury, total Analysis Run 12/3/2018 8:23 AM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

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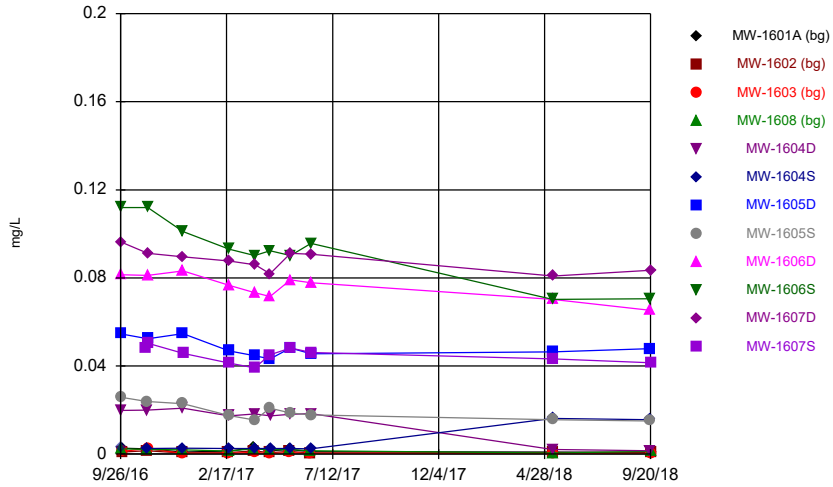

Constituent: Molybdenum, total Analysis Run 12/3/2018 8:23 AM View: Descriptive
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Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

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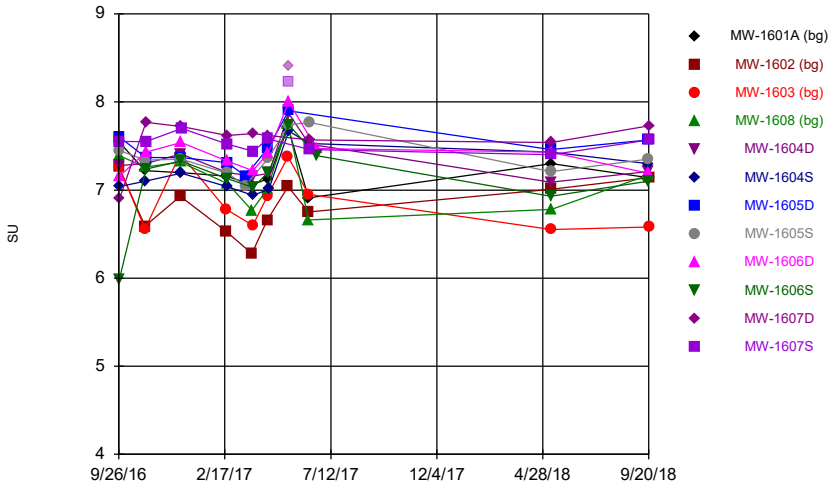

Constituent: pH, field Analysis Run 12/3/2018 8:23 AM View: Descriptive
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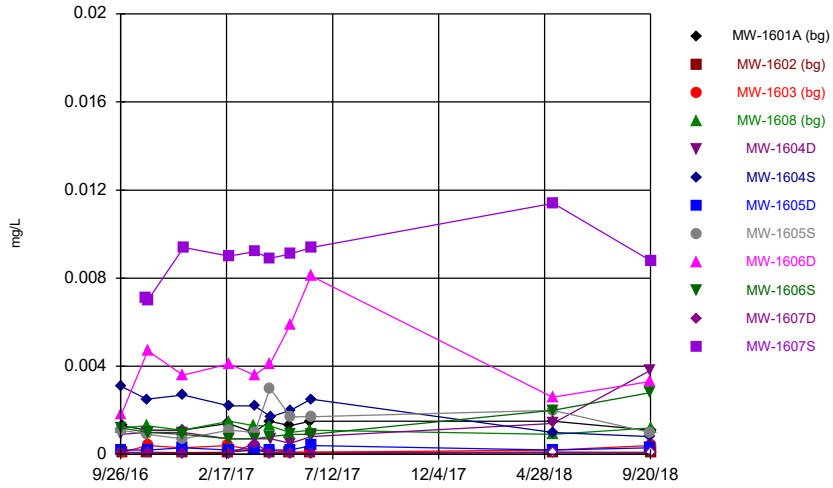

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Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

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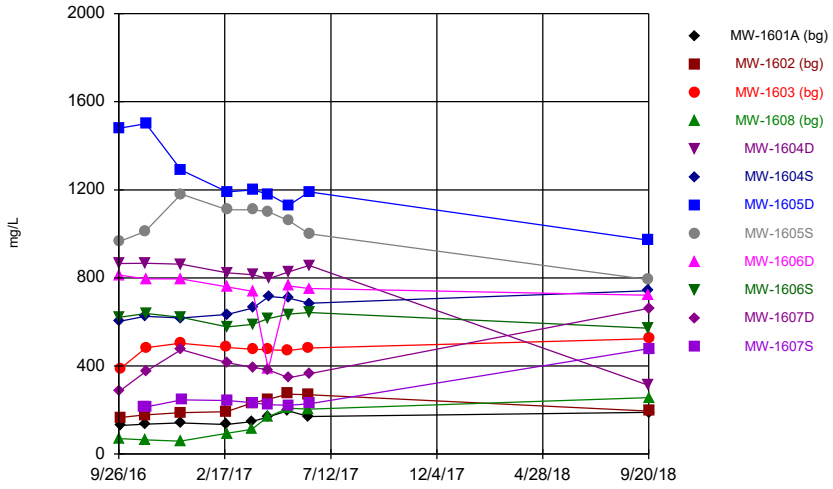

Constituent: Sulfate, total Analysis Run 12/3/2018 8:24 AM View: Descriptive
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Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG
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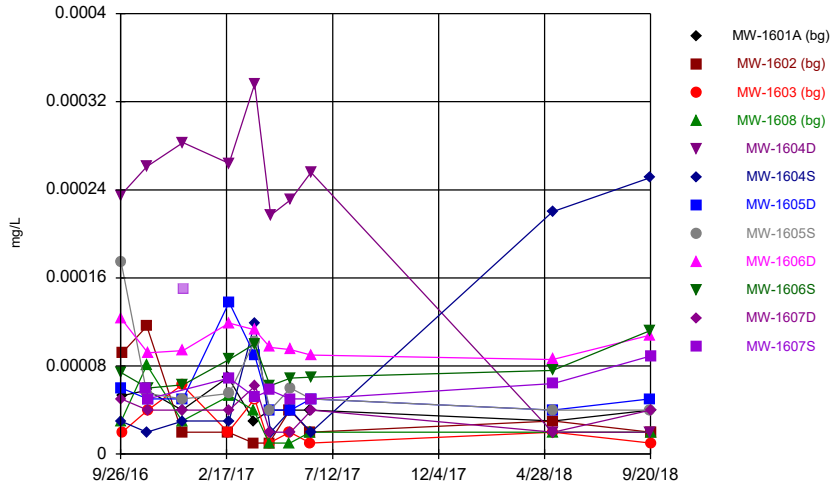
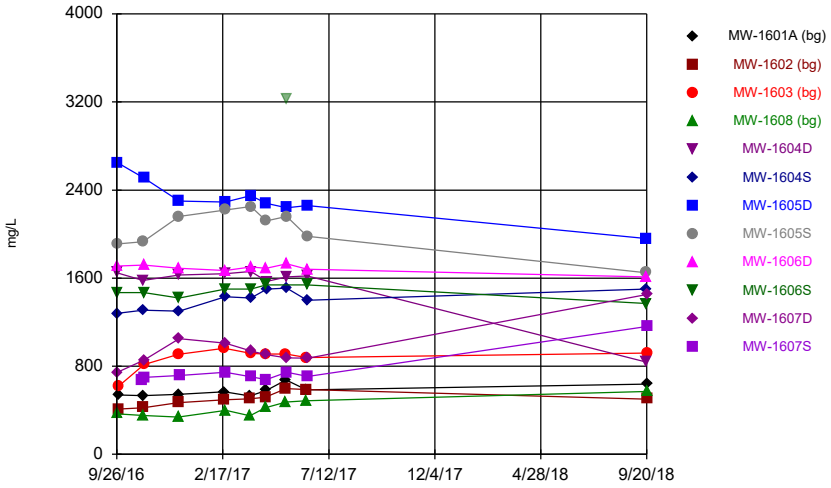


Constituent: Thallium, total Analysis Run 12/3/2018 8:24 AM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Time Series



Constituent: Total Dissolved Solids [TDS] Analysis Run 12/3/2018 8:24 AM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Interwell Prediction Limit Summary Table - Significant Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 12/3/2018, 6:38 AM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig. Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj	Transform	Alpha	Method
Boron, total (mg/L)	MW-1604D	0.6495	n/a	9/19/2018	1.33	Yes 36	0.6179	0.1221	0	None	x^(1/3)	0.0009403	Param 1 of 2
Boron, total (mg/L)	MW-1604S	0.6495	n/a	9/19/2018	2.49	Yes 36	0.6179	0.1221	0	None	x^(1/3)	0.0009403	Param 1 of 2
Boron, total (mg/L)	MW-1605D	0.6495	n/a	9/19/2018	9.11	Yes 36	0.6179	0.1221	0	None	x^(1/3)	0.0009403	Param 1 of 2
Boron, total (mg/L)	MW-1605S	0.6495	n/a	9/19/2018	7.75	Yes 36	0.6179	0.1221	0	None	x^(1/3)	0.0009403	Param 1 of 2
Boron, total (mg/L)	MW-1606D	0.6495	n/a	9/19/2018	7.27	Yes 36	0.6179	0.1221	0	None	x^(1/3)	0.0009403	Param 1 of 2
Boron, total (mg/L)	MW-1606S	0.6495	n/a	9/19/2018	5.87	Yes 36	0.6179	0.1221	0	None	x^(1/3)	0.0009403	Param 1 of 2
Boron, total (mg/L)	MW-1607D	0.6495	n/a	9/20/2018	2.44	Yes 36	0.6179	0.1221	0	None	x^(1/3)	0.0009403	Param 1 of 2
Boron, total (mg/L)	MW-1607S	0.6495	n/a	9/20/2018	1.71	Yes 36	0.6179	0.1221	0	None	x^(1/3)	0.0009403	Param 1 of 2
Calcium, total (mg/L)	MW-1604S	192.1	n/a	9/19/2018	262	Yes 36	119.6	35.73	0	None	No	0.0009403	Param 1 of 2
Calcium, total (mg/L)	MW-1605D	192.1	n/a	9/19/2018	278	Yes 36	119.6	35.73	0	None	No	0.0009403	Param 1 of 2
Calcium, total (mg/L)	MW-1606D	192.1	n/a	9/19/2018	260	Yes 36	119.6	35.73	0	None	No	0.0009403	Param 1 of 2
Calcium, total (mg/L)	MW-1606S	192.1	n/a	9/19/2018	199	Yes 36	119.6	35.73	0	None	No	0.0009403	Param 1 of 2
Calcium, total (mg/L)	MW-1607D	192.1	n/a	9/20/2018	222	Yes 36	119.6	35.73	0	None	No	0.0009403	Param 1 of 2
Calcium, total (mg/L)	MW-1607S	192.1	n/a	9/20/2018	220	Yes 36	119.6	35.73	0	None	No	0.0009403	Param 1 of 2
Chloride, total (mg/L)	MW-1604S	59.92	n/a	9/19/2018	109	Yes 36	2.553	0.6694	0	None	x^(1/3)	0.0009403	Param 1 of 2
Chloride, total (mg/L)	MW-1605D	59.92	n/a	9/19/2018	188	Yes 36	2.553	0.6694	0	None	x^(1/3)	0.0009403	Param 1 of 2
Chloride, total (mg/L)	MW-1605S	59.92	n/a	9/19/2018	171	Yes 36	2.553	0.6694	0	None	x^(1/3)	0.0009403	Param 1 of 2
Chloride, total (mg/L)	MW-1606D	59.92	n/a	9/19/2018	201	Yes 36	2.553	0.6694	0	None	x^(1/3)	0.0009403	Param 1 of 2
Chloride, total (mg/L)	MW-1606S	59.92	n/a	9/19/2018	219	Yes 36	2.553	0.6694	0	None	x^(1/3)	0.0009403	Param 1 of 2
Chloride, total (mg/L)	MW-1607D	59.92	n/a	9/20/2018	163	Yes 36	2.553	0.6694	0	None	x^(1/3)	0.0009403	Param 1 of 2
Chloride, total (mg/L)	MW-1607S	59.92	n/a	9/20/2018	151	Yes 36	2.553	0.6694	0	None	x^(1/3)	0.0009403	Param 1 of 2
Fluoride, total (mg/L)	MW-1605S	0.2944	n/a	9/19/2018	0.32	Yes 40	0.178	0.05788	0	None	No	0.0009403	Param 1 of 2
Fluoride, total (mg/L)	MW-1606S	0.2944	n/a	9/19/2018	0.46	Yes 40	0.178	0.05788	0	None	No	0.0009403	Param 1 of 2
Fluoride, total (mg/L)	MW-1607D	0.2944	n/a	9/20/2018	0.52	Yes 40	0.178	0.05788	0	None	No	0.0009403	Param 1 of 2
Sulfate, total (mg/L)	MW-1604S	610.7	n/a	9/19/2018	742	Yes 36	6.043	1.202	0	None	x^(1/3)	0.0009403	Param 1 of 2
Sulfate, total (mg/L)	MW-1605D	610.7	n/a	9/19/2018	972	Yes 36	6.043	1.202	0	None	x^(1/3)	0.0009403	Param 1 of 2
Sulfate, total (mg/L)	MW-1605S	610.7	n/a	9/19/2018	793	Yes 36	6.043	1.202	0	None	x^(1/3)	0.0009403	Param 1 of 2
Sulfate, total (mg/L)	MW-1606D	610.7	n/a	9/19/2018	722	Yes 36	6.043	1.202	0	None	x^(1/3)	0.0009403	Param 1 of 2
Sulfate, total (mg/L)	MW-1607D	610.7	n/a	9/20/2018	662	Yes 36	6.043	1.202	0	None	x^(1/3)	0.0009403	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1604S	1016	n/a	9/19/2018	1500	Yes 36	8.31	0.8575	0	None	x^(1/3)	0.0009403	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1605D	1016	n/a	9/19/2018	1960	Yes 36	8.31	0.8575	0	None	x^(1/3)	0.0009403	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1605S	1016	n/a	9/19/2018	1650	Yes 36	8.31	0.8575	0	None	x^(1/3)	0.0009403	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1606D	1016	n/a	9/19/2018	1610	Yes 36	8.31	0.8575	0	None	x^(1/3)	0.0009403	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1606S	1016	n/a	9/19/2018	1370	Yes 36	8.31	0.8575	0	None	x^(1/3)	0.0009403	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1607D	1016	n/a	9/20/2018	1450	Yes 36	8.31	0.8575	0	None	x^(1/3)	0.0009403	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1607S	1016	n/a	9/20/2018	1160	Yes 36	8.31	0.8575	0	None	x^(1/3)	0.0009403	Param 1 of 2

Interwell Prediction Limit Summary Table - All Results

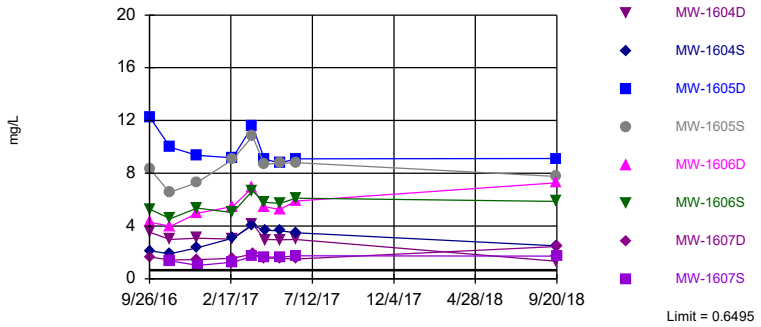
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 12/3/2018, 6:38 AM

Constituent	Well	Upper Lim.	Lower Lim	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj	Transform	Alpha	Method
Boron, total (mg/L)	**MW-1604D**	**0.6495**	**n/a**	**9/19/2018**	**1.33**	**Yes**	**36**	**0.6179**	**0.1221**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2
Boron, total (mg/L)	**MW-1604S**	**0.6495**	**n/a**	**9/19/2018**	**2.49**	**Yes**	**36**	**0.6179**	**0.1221**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2
Boron, total (mg/L)	**MW-1605D**	**0.6495**	**n/a**	**9/19/2018**	**9.11**	**Yes**	**36**	**0.6179**	**0.1221**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2
Boron, total (mg/L)	**MW-1605S**	**0.6495**	**n/a**	**9/19/2018**	**7.75**	**Yes**	**36**	**0.6179**	**0.1221**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2
Boron, total (mg/L)	**MW-1606D**	**0.6495**	**n/a**	**9/19/2018**	**7.27**	**Yes**	**36**	**0.6179**	**0.1221**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2
Boron, total (mg/L)	**MW-1606S**	**0.6495**	**n/a**	**9/19/2018**	**5.87**	**Yes**	**36**	**0.6179**	**0.1221**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2
Boron, total (mg/L)	**MW-1607D**	**0.6495**	**n/a**	**9/20/2018**	**2.44**	**Yes**	**36**	**0.6179**	**0.1221**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2
Boron, total (mg/L)	**MW-1607S**	**0.6495**	**n/a**	**9/20/2018**	**1.71**	**Yes**	**36**	**0.6179**	**0.1221**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2
Calcium, total (mg/L)	MW-1604D	192.1	n/a	9/19/2018	144	No	36	119.6	35.73	0	None	No	0.0009403	Param 1 of 2
Calcium, total (mg/L)	**MW-1604S**	**192.1**	**n/a**	**9/19/2018**	**262**	**Yes**	**36**	**119.6**	**35.73**	**0**	**None**	**No**	**0.0009403**	Param 1 of 2
Calcium, total (mg/L)	**MW-1605D**	**192.1**	**n/a**	**9/19/2018**	**278**	**Yes**	**36**	**119.6**	**35.73**	**0**	**None**	**No**	**0.0009403**	Param 1 of 2
Calcium, total (mg/L)	MW-1605S	192.1	n/a	9/19/2018	182	No	36	119.6	35.73	0	None	No	0.0009403	Param 1 of 2
Calcium, total (mg/L)	**MW-1606D**	**192.1**	**n/a**	**9/19/2018**	**260**	**Yes**	**36**	**119.6**	**35.73**	**0**	**None**	**No**	**0.0009403**	Param 1 of 2
Calcium, total (mg/L)	**MW-1606S**	**192.1**	**n/a**	**9/19/2018**	**199**	**Yes**	**36**	**119.6**	**35.73**	**0**	**None**	**No**	**0.0009403**	Param 1 of 2
Calcium, total (mg/L)	**MW-1607D**	**192.1**	**n/a**	**9/20/2018**	**222**	**Yes**	**36**	**119.6**	**35.73**	**0**	**None**	**No**	**0.0009403**	Param 1 of 2
Calcium, total (mg/L)	**MW-1607S**	**192.1**	**n/a**	**9/20/2018**	**220**	**Yes**	**36**	**119.6**	**35.73**	**0**	**None**	**No**	**0.0009403**	Param 1 of 2
Chloride, total (mg/L)	MW-1604D	59.92	n/a	9/19/2018	41.3	No	36	2.553	0.6694	0	None	x^(1/3)	0.0009403	Param 1 of 2
Chloride, total (mg/L)	**MW-1604S**	**59.92**	**n/a**	**9/19/2018**	**109**	**Yes**	**36**	**2.553**	**0.6694**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2
Chloride, total (mg/L)	**MW-1605D**	**59.92**	**n/a**	**9/19/2018**	**188**	**Yes**	**36**	**2.553**	**0.6694**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2
Chloride, total (mg/L)	**MW-1605S**	**59.92**	**n/a**	**9/19/2018**	**171**	**Yes**	**36**	**2.553**	**0.6694**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2
Chloride, total (mg/L)	**MW-1606D**	**59.92**	**n/a**	**9/19/2018**	**201**	**Yes**	**36**	**2.553**	**0.6694**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2
Chloride, total (mg/L)	**MW-1606S**	**59.92**	**n/a**	**9/19/2018**	**219**	**Yes**	**36**	**2.553**	**0.6694**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2
Chloride, total (mg/L)	**MW-1607D**	**59.92**	**n/a**	**9/20/2018**	**163**	**Yes**	**36**	**2.553**	**0.6694**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2
Chloride, total (mg/L)	**MW-1607S**	**59.92**	**n/a**	**9/20/2018**	**151**	**Yes**	**36**	**2.553**	**0.6694**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2
Fluoride, total (mg/L)	MW-1604D	0.2944	n/a	9/19/2018	0.19	No	40	0.178	0.05788	0	None	No	0.0009403	Param 1 of 2
Fluoride, total (mg/L)	MW-1604S	0.2944	n/a	9/19/2018	0.22	No	40	0.178	0.05788	0	None	No	0.0009403	Param 1 of 2
Fluoride, total (mg/L)	MW-1605D	0.2944	n/a	9/19/2018	0.22	No	40	0.178	0.05788	0	None	No	0.0009403	Param 1 of 2
Fluoride, total (mg/L)	**MW-1605S**	**0.2944**	**n/a**	**9/19/2018**	**0.32**	**Yes**	**40**	**0.178**	**0.05788**	**0**	**None**	**No**	**0.0009403**	Param 1 of 2
Fluoride, total (mg/L)	MW-1606D	0.2944	n/a	9/19/2018	0.26	No	40	0.178	0.05788	0	None	No	0.0009403	Param 1 of 2
Fluoride, total (mg/L)	**MW-1606S**	**0.2944**	**n/a**	**9/19/2018**	**0.46**	**Yes**	**40**	**0.178**	**0.05788**	**0**	**None**	**No**	**0.0009403**	Param 1 of 2
Fluoride, total (mg/L)	**MW-1607D**	**0.2944**	**n/a**	**9/20/2018**	**0.52**	**Yes**	**40**	**0.178**	**0.05788**	**0**	**None**	**No**	**0.0009403**	Param 1 of 2
Fluoride, total (mg/L)	MW-1607S	0.2944	n/a	9/20/2018	0.28	No	40	0.178	0.05788	0	None	No	0.0009403	Param 1 of 2
Sulfate, total (mg/L)	MW-1604D	610.7	n/a	9/19/2018	313	No	36	6.043	1.202	0	None	x^(1/3)	0.0009403	Param 1 of 2
Sulfate, total (mg/L)	**MW-1604S**	**610.7**	**n/a**	**9/19/2018**	**742**	**Yes**	**36**	**6.043**	**1.202**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2
Sulfate, total (mg/L)	**MW-1605D**	**610.7**	**n/a**	**9/19/2018**	**972**	**Yes**	**36**	**6.043**	**1.202**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2
Sulfate, total (mg/L)	**MW-1605S**	**610.7**	**n/a**	**9/19/2018**	**793**	**Yes**	**36**	**6.043**	**1.202**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2
Sulfate, total (mg/L)	**MW-1606D**	**610.7**	**n/a**	**9/19/2018**	**722**	**Yes**	**36**	**6.043**	**1.202**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2
Sulfate, total (mg/L)	MW-1606S	610.7	n/a	9/19/2018	571	No	36	6.043	1.202	0	None	x^(1/3)	0.0009403	Param 1 of 2
Sulfate, total (mg/L)	**MW-1607D**	**610.7**	**n/a**	**9/20/2018**	**662**	**Yes**	**36**	**6.043**	**1.202**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2
Sulfate, total (mg/L)	MW-1607S	610.7	n/a	9/20/2018	478	No	36	6.043	1.202	0	None	x^(1/3)	0.0009403	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1604D	1016	n/a	9/19/2018	838	No	36	8.31	0.8575	0	None	x^(1/3)	0.0009403	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	**MW-1604S**	**1016**	**n/a**	**9/19/2018**	**1500**	**Yes**	**36**	**8.31**	**0.8575**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	**MW-1605D**	**1016**	**n/a**	**9/19/2018**	**1960**	**Yes**	**36**	**8.31**	**0.8575**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	**MW-1605S**	**1016**	**n/a**	**9/19/2018**	**1650**	**Yes**	**36**	**8.31**	**0.8575**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	**MW-1606D**	**1016**	**n/a**	**9/19/2018**	**1610**	**Yes**	**36**	**8.31**	**0.8575**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	**MW-1606S**	**1016**	**n/a**	**9/19/2018**	**1370**	**Yes**	**36**	**8.31**	**0.8575**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	**MW-1607D**	**1016**	**n/a**	**9/20/2018**	**1450**	**Yes**	**36**	**8.31**	**0.8575**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	**MW-1607S**	**1016**	**n/a**	**9/20/2018**	**1160**	**Yes**	**36**	**8.31**	**0.8575**	**0**	**None**	**x^(1/3)**	**0.0009403**	Param 1 of 2

Exceeds Limit: MW-1604D, MW-1604S, MW-1605D, MW-1605S, MW-1606D, MW-1

Prediction Limit

Interwell Parametric



Background Data Summary (based on cube root transformation): Mean=0.6179, Std. Dev.=0.1221, n=36. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9135, critical = 0.912. Kappa = 2.031 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.0009403. Comparing 8 points to limit.

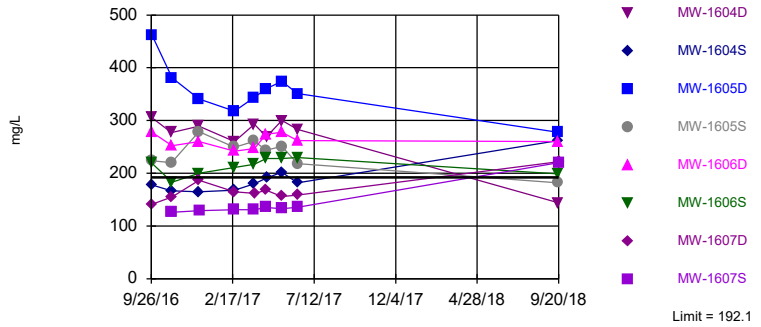
Constituent: Boron, total Analysis Run 12/3/2018 6:35 AM View: PL's - Interwell

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Exceeds Limit: MW-1604S, MW-1605D, MW-1606D, MW-1606S, MW-1607D, MW-1

Prediction Limit

Interwell Parametric



Background Data Summary: Mean=119.6, Std. Dev.=35.73, n=36. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9272, critical = 0.912. Kappa = 2.031 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.0009403. Comparing 8 points to limit.

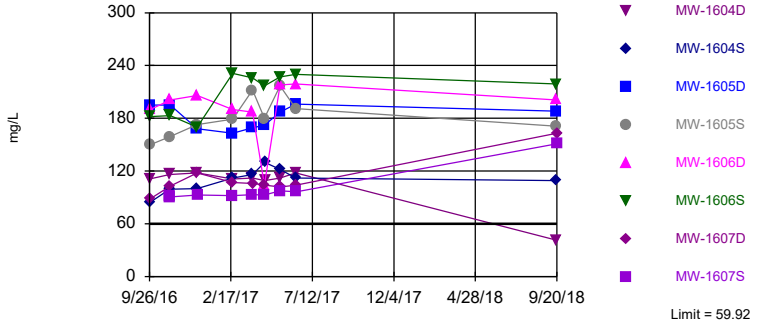
Constituent: Calcium, total Analysis Run 12/3/2018 6:35 AM View: PL's - Interwell

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Exceeds Limit: MW-1604S, MW-1605D, MW-1605S, MW-1606D, MW-1606S, MW-1

Prediction Limit

Interwell Parametric



Background Data Summary (based on cube root transformation): Mean=2.553, Std. Dev.=0.6694, n=36. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9317, critical = 0.912. Kappa = 2.031 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.0009403. Comparing 8 points to limit.

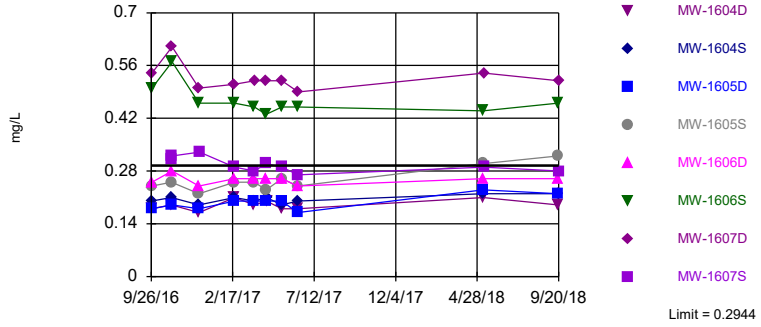
Constituent: Chloride, total Analysis Run 12/3/2018 6:35 AM View: PL's - Interwell

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Exceeds Limit: MW-1605S, MW-1606S, MW-1607D

Prediction Limit

Interwell Parametric



Background Data Summary: Mean=0.178, Std. Dev.=0.05788, n=40. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9253, critical = 0.919. Kappa = 2.012 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.0009403. Comparing 8 points to limit.

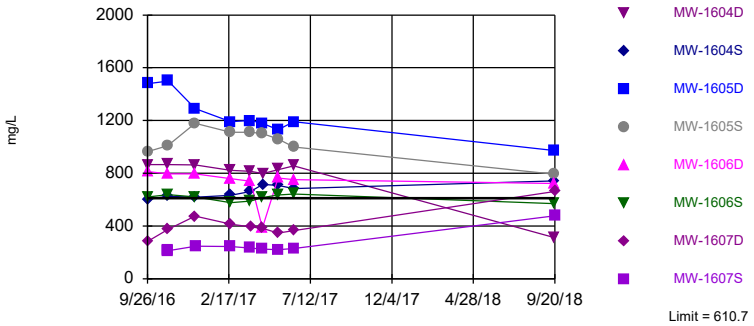
Constituent: Fluoride, total Analysis Run 12/3/2018 6:35 AM View: PL's - Interwell

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Exceeds Limit: MW-1604S, MW-1605D, MW-1605S, MW-1606D, MW-1607D

Prediction Limit

Interwell Parametric



Background Data Summary (based on cube root transformation): Mean=6.043, Std. Dev.=1.202, n=36. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9171, critical = 0.912. Kappa = 2.031 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.0009403. Comparing 8 points to limit.

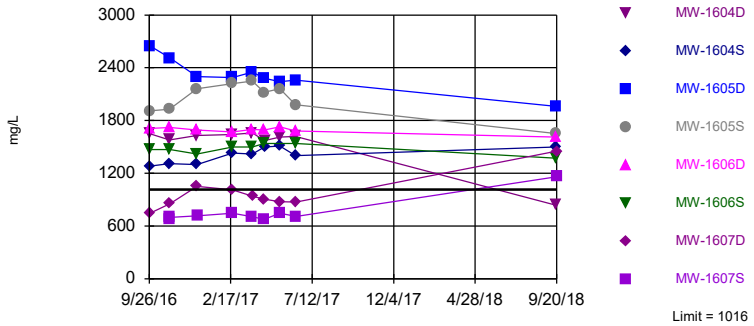
Constituent: Sulfate, total Analysis Run 12/3/2018 6:35 AM View: PL's - Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limit: MW-1604S, MW-1605D, MW-1605S, MW-1606D, MW-1606S, MW-1

Prediction Limit

Interwell Parametric



Background Data Summary (based on cube root transformation): Mean=8.31, Std. Dev.=0.8575, n=36. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9144, critical = 0.912. Kappa = 2.031 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.0009403. Comparing 8 points to limit.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/3/2018 6:35 AM View: PL's - Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Intrawell Prediction Limit Summary Table - All Results (No Significant Results)

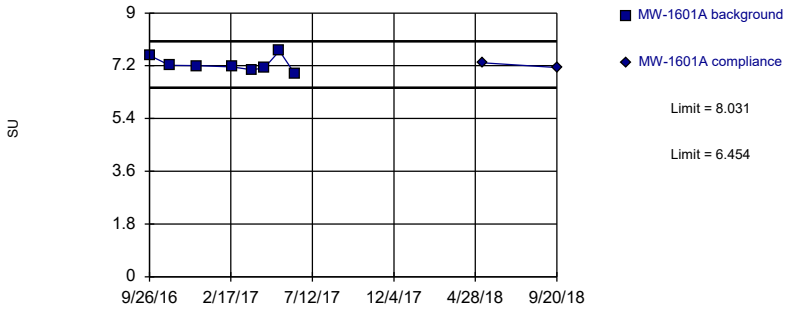
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 12/3/2018, 6:44 AM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj	Transform	Alpha	Method
pH, field (SU)	MW-1601A	8.031	6.454	9/20/2018	7.14	No	8	7.243	0.2615	0	None	No	0.0004701	Param 1 of 2
pH, field (SU)	MW-1602	7.694	5.816	9/20/2018	7.14	No	8	6.755	0.3115	0	None	No	0.0004701	Param 1 of 2
pH, field (SU)	MW-1603	7.999	5.971	9/20/2018	6.58	No	8	6.985	0.3366	0	None	No	0.0004701	Param 1 of 2
pH, field (SU)	MW-1608	8.216	6.092	9/19/2018	7.17	No	8	7.154	0.3523	0	None	No	0.0004701	Param 1 of 2
pH, field (SU)	MW-1604D	8.08	6.653	9/19/2018	7.21	No	8	7.366	0.2368	0	None	No	0.0004701	Param 1 of 2
pH, field (SU)	MW-1604S	7.991	6.389	9/19/2018	7.3	No	8	7.19	0.2657	0	None	No	0.0004701	Param 1 of 2
pH, field (SU)	MW-1605D	8.258	6.653	9/19/2018	7.57	No	7	7.456	0.2388	0	None	No	0.0004701	Param 1 of 2
pH, field (SU)	MW-1605S	8.152	6.66	9/19/2018	7.35	No	8	7.406	0.2476	0	None	No	0.0004701	Param 1 of 2
pH, field (SU)	MW-1606D	8.222	6.671	9/19/2018	7.19	No	8	7.446	0.2573	0	None	No	0.0004701	Param 1 of 2
pH, field (SU)	MW-1606S	8.662	5.6	9/19/2018	7.1	No	8	7.131	0.508	0	None	No	0.0004701	Param 1 of 2
pH, field (SU)	MW-1607D	7.77	6.9	9/20/2018	7.73	No	7	n/a	n/a	0	n/a	n/a	0.05531	NP (normality) 1 of 2
pH, field (SU)	MW-1607S	7.831	7.255	9/20/2018	7.57	No	7	7.543	0.08577	0	None	No	0.0004701	Param 1 of 2

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.243, Std. Dev.=0.2615, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.902, critical = 0.749. Kappa = 3.014 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403.

Constituent: pH, field Analysis Run 12/3/2018 6:40 AM View: PL's - Intrawell

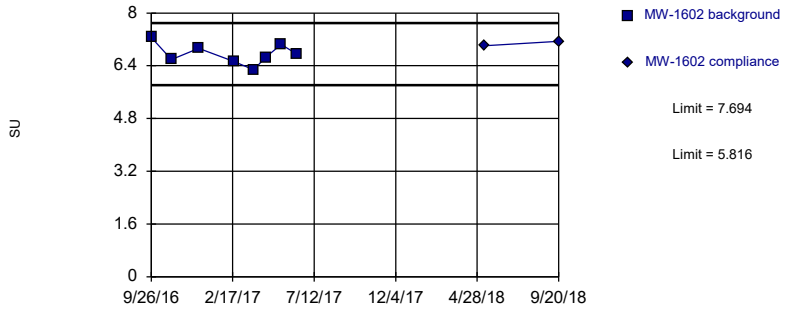
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=6.755, Std. Dev.=0.3115, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9867, critical = 0.749. Kappa = 3.014 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403.

Constituent: pH, field Analysis Run 12/3/2018 6:40 AM View: PL's - Intrawell

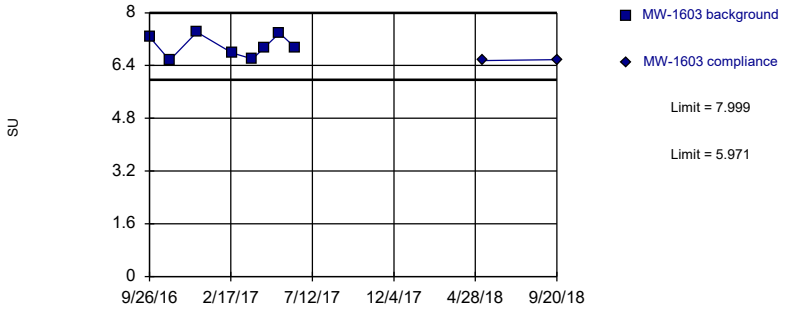
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=6.985, Std. Dev.=0.3366, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9063, critical = 0.749. Kappa = 3.014 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403.

Constituent: pH, field Analysis Run 12/3/2018 6:40 AM View: PL's - Intrawell

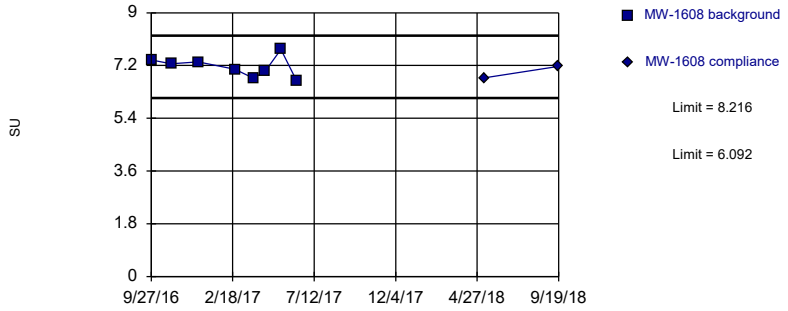
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.154, Std. Dev.=0.3523, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9751, critical = 0.749. Kappa = 3.014 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403.

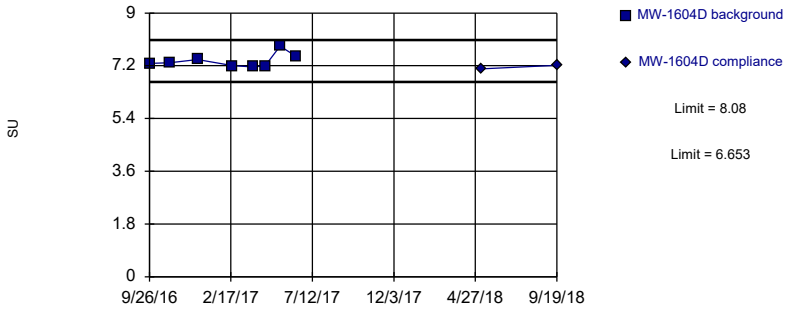
Constituent: pH, field Analysis Run 12/3/2018 6:40 AM View: PL's - Intrawell

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.366, Std. Dev.=0.2368, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8333, critical = 0.749. Kappa = 3.014 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403.

Constituent: pH, field Analysis Run 12/3/2018 6:40 AM View: PL's - Intrawell

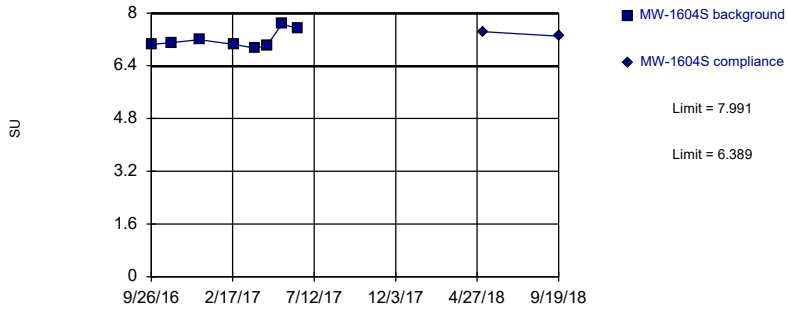
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.19, Std. Dev.=0.2657, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8184, critical = 0.749. Kappa = 3.014 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403.

Constituent: pH, field Analysis Run 12/3/2018 6:40 AM View: PL's - Intrawell

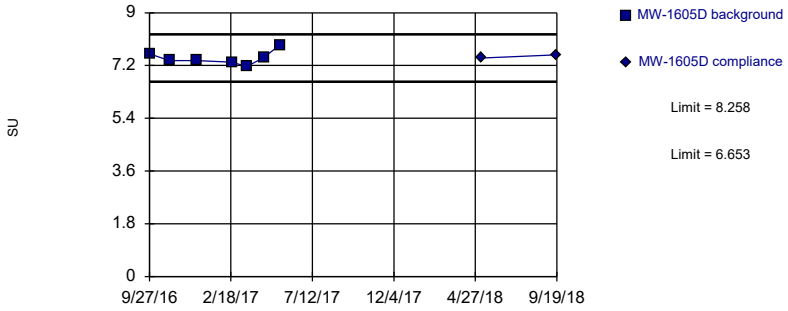
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.456, Std. Dev.=0.2388, n=7. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9315, critical = 0.73. Kappa = 3.361 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403.

Constituent: pH, field Analysis Run 12/3/2018 6:40 AM View: PL's - Intrawell

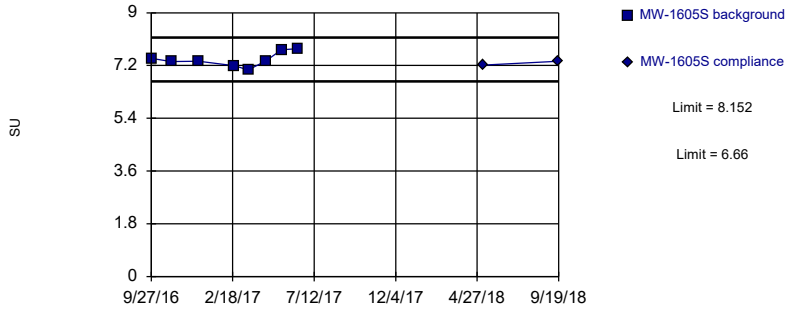
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.406, Std. Dev.=0.2476, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9237, critical = 0.749. Kappa = 3.014 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403.

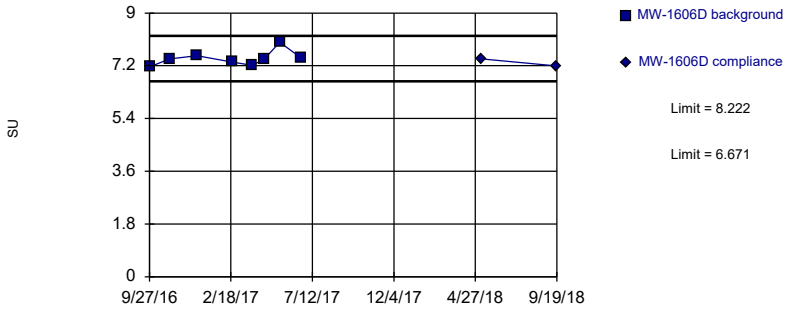
Constituent: pH, field Analysis Run 12/3/2018 6:40 AM View: PL's - Intrawell

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.446, Std. Dev.=0.2573, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8686, critical = 0.749. Kappa = 3.014 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403.

Constituent: pH, field Analysis Run 12/3/2018 6:40 AM View: PL's - Intrawell

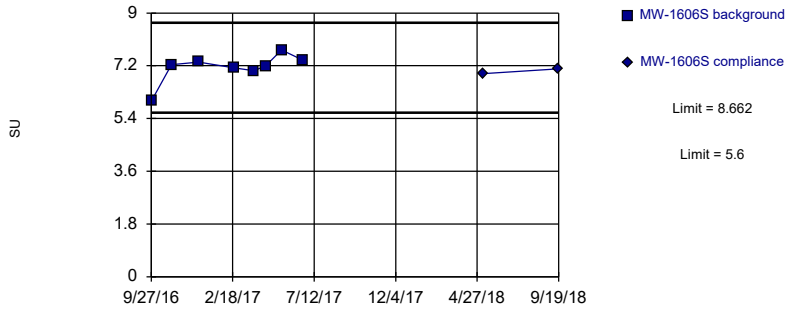
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.131, Std. Dev.=0.508, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8107, critical = 0.749. Kappa = 3.014 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403.

Constituent: pH, field Analysis Run 12/3/2018 6:40 AM View: PL's - Intrawell

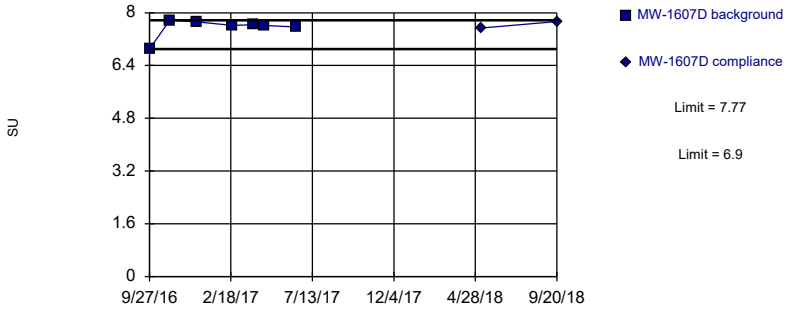
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limits are highest and lowest of 7 background values. Well-constituent pair annual alpha = 0.1091. Individual comparison alpha = 0.05531 (1 of 2).

Constituent: pH, field Analysis Run 12/3/2018 6:40 AM View: PL's - Intrawell

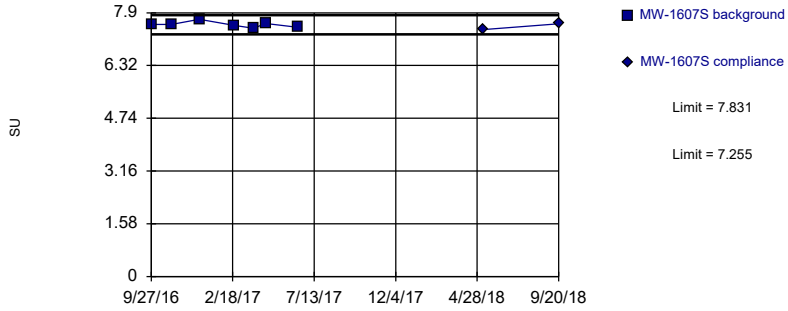
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.543, Std. Dev.=0.08577, n=7. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9302, critical = 0.73. Kappa = 3.361 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403.

Constituent: pH, field Analysis Run 12/3/2018 6:40 AM View: PL's - Intrawell

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Trend Test Summary Table - Significant Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 12/3/2018, 8:36 AM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Calcium, total (mg/L)	**MW-1607S**	**16.37**	**32**	**25**	**Yes**	**9**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	**MW-1607S**	**12.46**	**26**	**25**	**Yes**	**9**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Fluoride, total (mg/L)	**MW-1602 (bg)**	**0.03724**	**38**	**30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Fluoride, total (mg/L)	**MW-1608 (bg)**	**-0.06348**	**-39**	**-30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Sulfate, total (mg/L)	**MW-1601A (bg)**	**52.31**	**28**	**25**	**Yes**	**9**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Sulfate, total (mg/L)	**MW-1602 (bg)**	**140.9**	**26**	**25**	**Yes**	**9**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Sulfate, total (mg/L)	**MW-1608 (bg)**	**191.7**	**28**	**25**	**Yes**	**9**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Sulfate, total (mg/L)	**MW-1604S**	**100.2**	**28**	**25**	**Yes**	**9**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Sulfate, total (mg/L)	**MW-1605D**	**-336.3**	**-27**	**-25**	**Yes**	**9**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Total Dissolved Solids [TDS] (mg/L)	**MW-1602 (bg)**	**203.2**	**26**	**25**	**Yes**	**9**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Total Dissolved Solids [TDS] (mg/L)	**MW-1605D**	**-320.7**	**-30**	**-25**	**Yes**	**9**	**0**	**n/a**	**n/a**	**0.01**	**NP**

Trend Test Summary Table - All Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 12/3/2018, 8:36 AM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Boron, total (mg/L)	MW-1601A (bg)	0.07813	14	25	No	9	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1602 (bg)	-0.003813	-3	-25	No	9	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1603 (bg)	0.09386	8	25	No	9	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1608 (bg)	0.03387	13	25	No	9	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1604D	-0.3259	-19	-25	No	9	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1604S	2.133	12	25	No	9	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1605D	-1.432	-20	-25	No	9	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1605S	0.7029	8	25	No	9	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1606D	1.645	22	25	No	9	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1606S	0.9538	18	25	No	9	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1607D	0.2427	9	25	No	9	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1607S	0.5123	18	25	No	9	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1601A (bg)	15.24	11	25	No	9	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1602 (bg)	28.4	16	25	No	9	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1603 (bg)	47.47	20	25	No	9	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1608 (bg)	22.55	18	25	No	9	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1604S	45.11	24	25	No	9	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1605D	-51.95	-12	-25	No	9	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1606D	2.086	2	25	No	9	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1606S	43.85	13	25	No	9	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1607D	24.49	12	25	No	9	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	**MW-1607S**	**16.37**	**32**	**25**	**Yes**	**9**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	MW-1601A (bg)	60.97	24	25	No	9	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1602 (bg)	5.271	20	25	No	9	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1603 (bg)	-5.669	-10	-25	No	9	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1608 (bg)	1.415	14	25	No	9	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1604S	41.14	17	25	No	9	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1605D	2.681	7	25	No	9	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1605S	48.88	18	25	No	9	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1606D	8.223	6	25	No	9	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1606S	33.57	14	25	No	9	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1607D	10.3	7	25	No	9	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	**MW-1607S**	**12.46**	**26**	**25**	**Yes**	**9**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Fluoride, total (mg/L)	MW-1601A (bg)	0	-4	-30	No	10	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	**MW-1602 (bg)**	**0.03724**	**38**	**30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Fluoride, total (mg/L)	MW-1603 (bg)	0	5	30	No	10	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	**MW-1608 (bg)**	**-0.06348**	**-39**	**-30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Fluoride, total (mg/L)	MW-1605S	0.04044	21	30	No	10	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1606S	-0.02483	-21	-30	No	10	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1607D	0	-4	-30	No	10	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	**MW-1601A (bg)**	**52.31**	**28**	**25**	**Yes**	**9**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Sulfate, total (mg/L)	**MW-1602 (bg)**	**140.9**	**26**	**25**	**Yes**	**9**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Sulfate, total (mg/L)	MW-1603 (bg)	16.59	4	25	No	9	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	**MW-1608 (bg)**	**191.7**	**28**	**25**	**Yes**	**9**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Sulfate, total (mg/L)	**MW-1604S**	**100.2**	**28**	**25**	**Yes**	**9**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Sulfate, total (mg/L)	**MW-1605D**	**-336.3**	**-27**	**-25**	**Yes**	**9**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Sulfate, total (mg/L)	MW-1605S	-168.5	-11	-25	No	9	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1606D	-75.65	-23	-25	No	9	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1607D	70.09	4	25	No	9	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1601A (bg)	74.12	22	25	No	9	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	**MW-1602 (bg)**	**203.2**	**26**	**25**	**Yes**	**9**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Total Dissolved Solids [TDS] (mg/L)	MW-1603 (bg)	20.19	13	25	No	9	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1608 (bg)	149	24	25	No	9	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1604S	188.5	21	25	No	9	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	**MW-1605D**	**-320.7**	**-30**	**-25**	**Yes**	**9**	**0**	**n/a**	**n/a**	**0.01**	**NP**

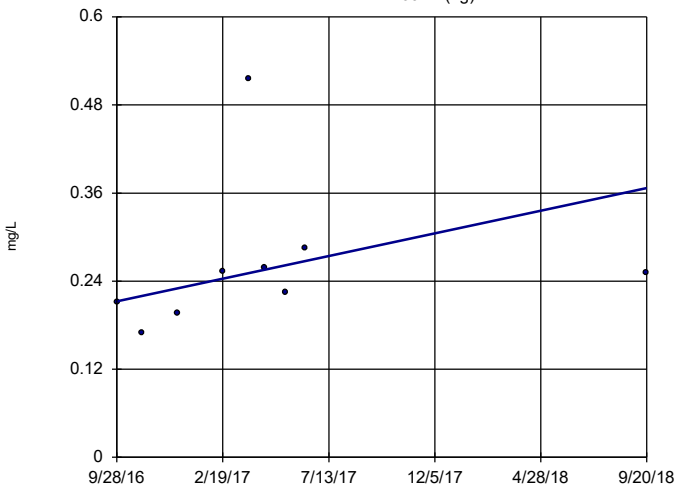
Trend Test Summary Table - All Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 12/3/2018, 8:36 AM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Total Dissolved Solids [TDS] (mg/L)	MW-1605S	-61.34	-1	-25	No	9	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1606D	-47.88	-13	-25	No	9	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1606S	74.74	7	21	No	8	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1607D	142.3	6	25	No	9	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1607S	112	17	25	No	9	0	n/a	n/a	0.01	NP

Sen's Slope Estimator

MW-1601A (bg)



n = 9

Slope = 0.07813 units per year.

Mann-Kendall statistic = 14 critical = 25

Trend not significant at 99% confidence level (α = 0.005 per tail).

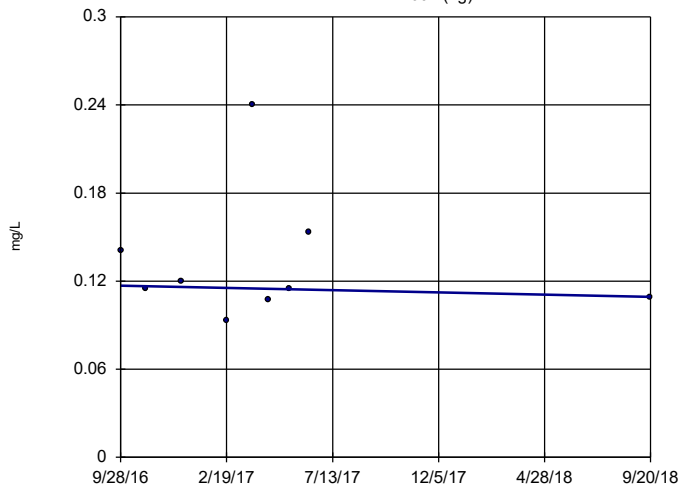
Constituent: Boron, total Analysis Run 12/3/2018 8:31 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1602 (bg)



n = 9

Slope = -0.003813 units per year.

Mann-Kendall statistic = -3 critical = -25

Trend not significant at 99% confidence level (α = 0.005 per tail).

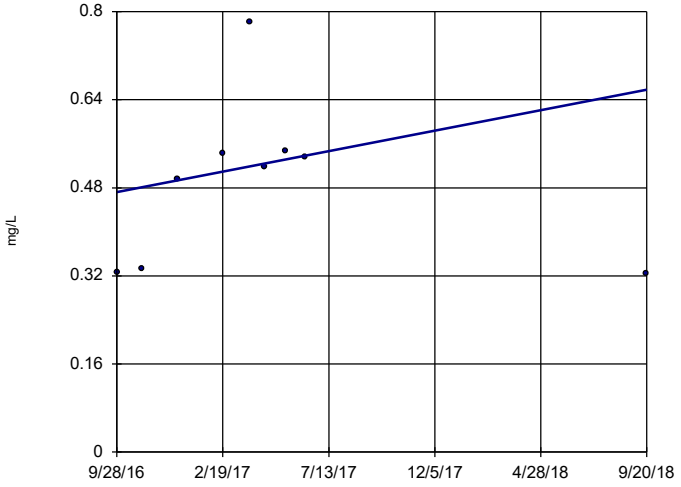
Constituent: Boron, total Analysis Run 12/3/2018 8:31 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1603 (bg)



n = 9

Slope = 0.09386 units per year.

Mann-Kendall statistic = 8 critical = 25

Trend not significant at 99% confidence level (α = 0.005 per tail).

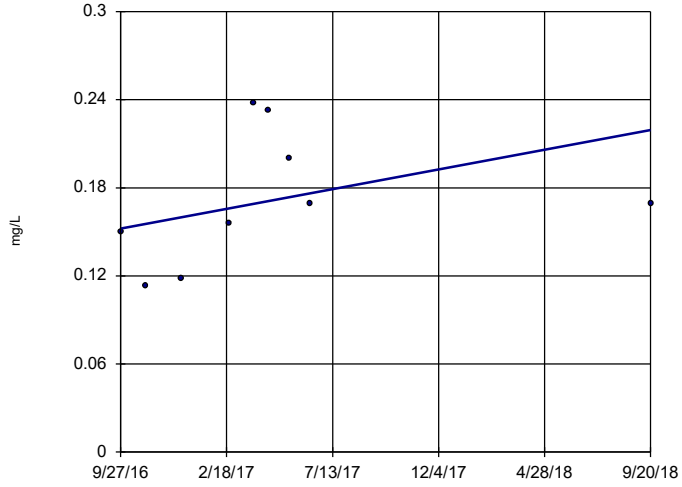
Constituent: Boron, total Analysis Run 12/3/2018 8:31 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1608 (bg)



n = 9

Slope = 0.03387 units per year.

Mann-Kendall statistic = 13 critical = 25

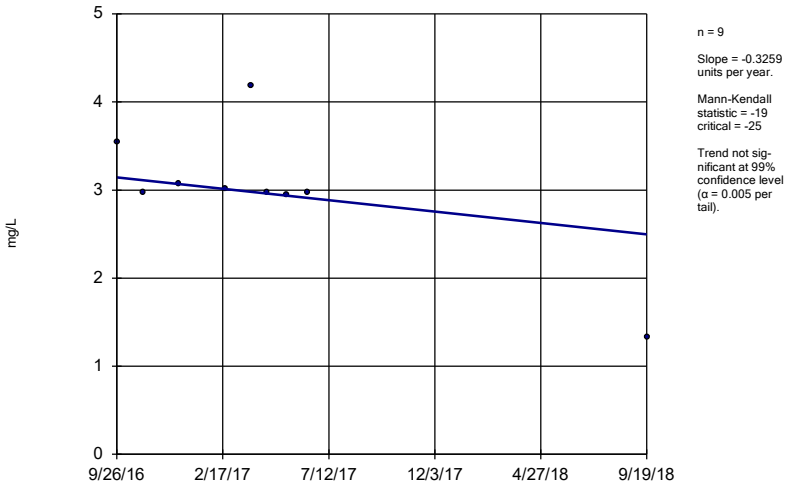
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 12/3/2018 8:31 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1604D

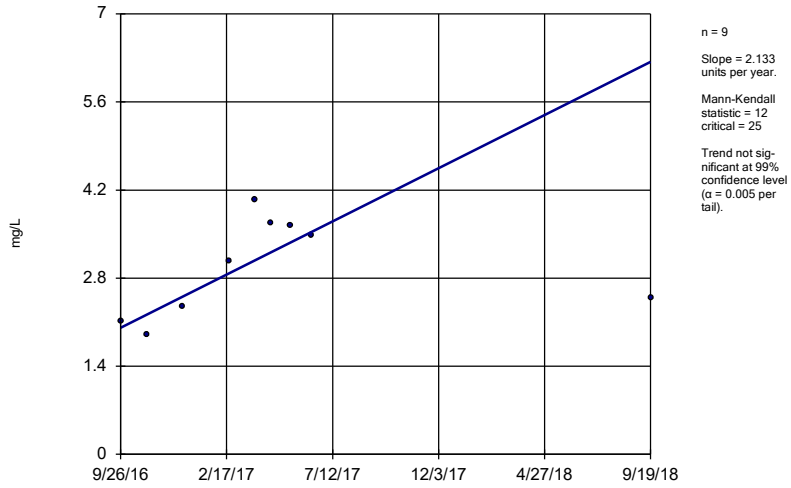


Constituent: Boron, total Analysis Run 12/3/2018 8:31 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1604S

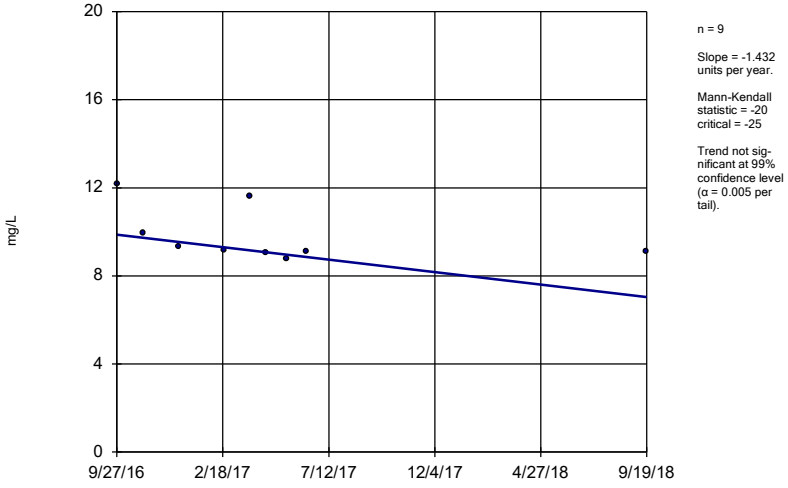


Constituent: Boron, total Analysis Run 12/3/2018 8:31 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1605D

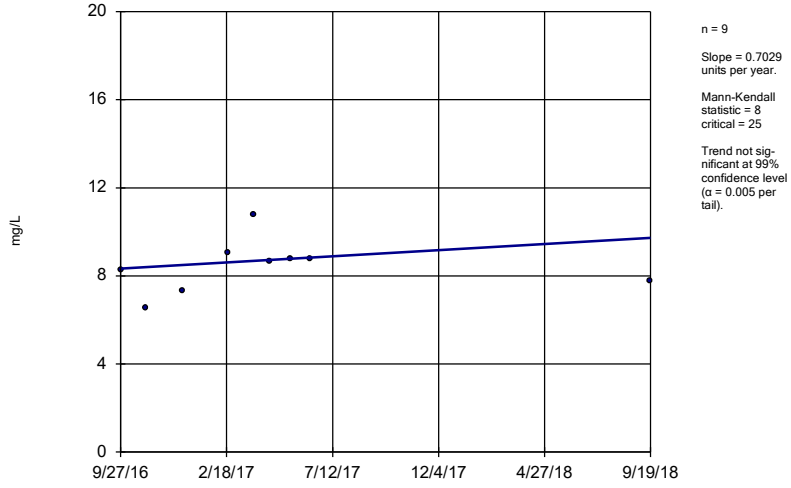


Constituent: Boron, total Analysis Run 12/3/2018 8:31 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

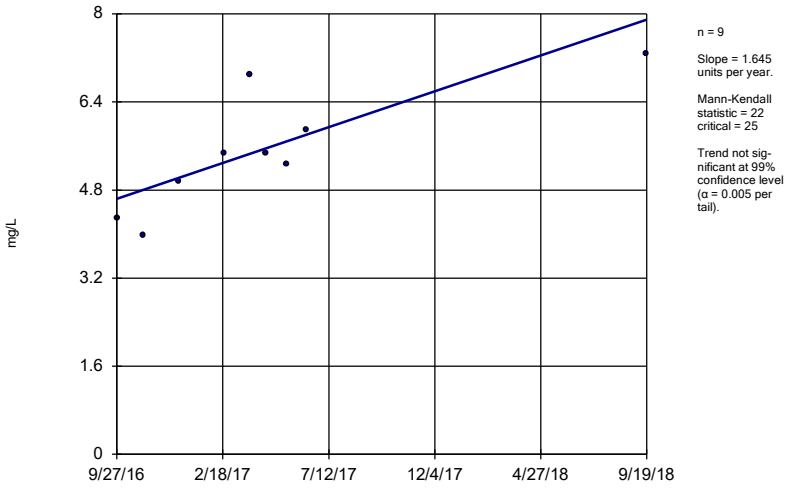
MW-1605S



Constituent: Boron, total Analysis Run 12/3/2018 8:31 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1606D



n = 9

Slope = 1.645 units per year.

Mann-Kendall statistic = 22 critical = 25

Trend not significant at 99% confidence level (α = 0.005 per tail).

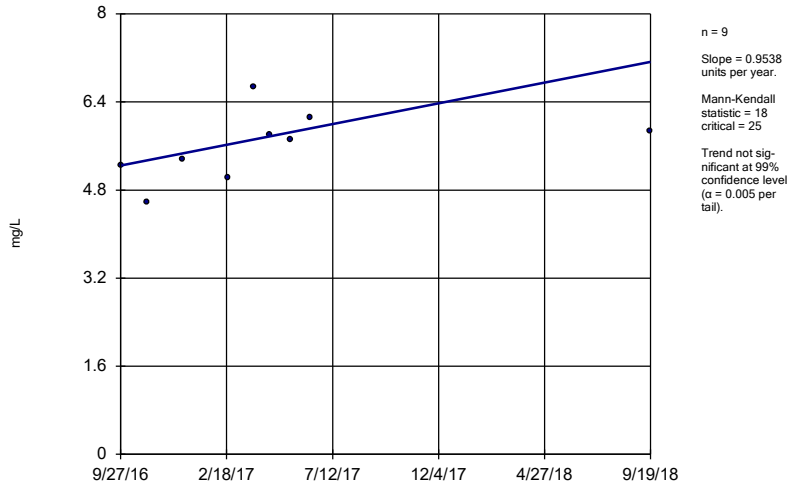
Constituent: Boron, total Analysis Run 12/3/2018 8:31 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1606S



n = 9

Slope = 0.9538 units per year.

Mann-Kendall statistic = 18 critical = 25

Trend not significant at 99% confidence level (α = 0.005 per tail).

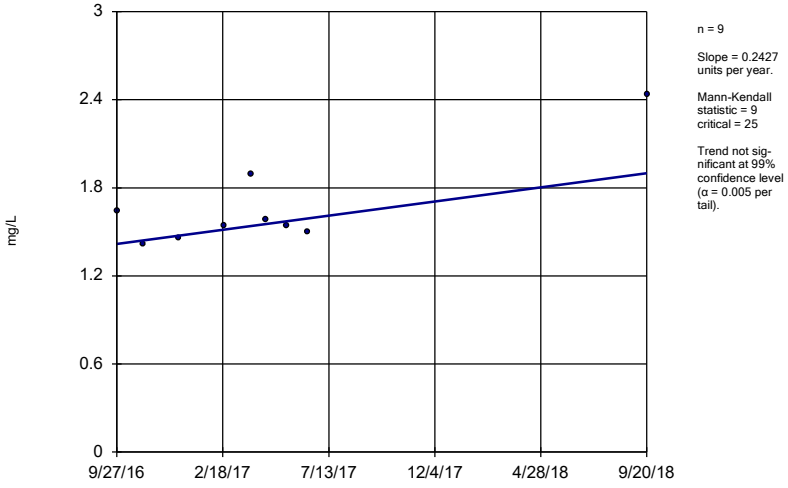
Constituent: Boron, total Analysis Run 12/3/2018 8:31 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1607D



n = 9

Slope = 0.2427 units per year.

Mann-Kendall statistic = 9 critical = 25

Trend not significant at 99% confidence level (α = 0.005 per tail).

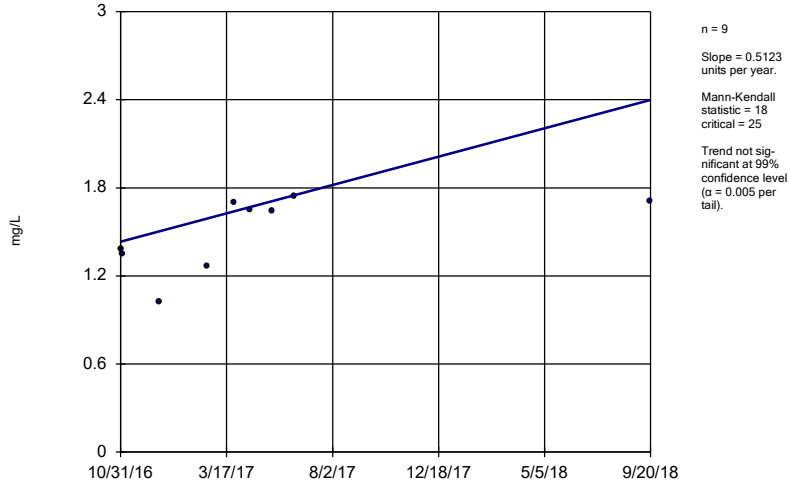
Constituent: Boron, total Analysis Run 12/3/2018 8:31 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1607S



n = 9

Slope = 0.5123 units per year.

Mann-Kendall statistic = 18 critical = 25

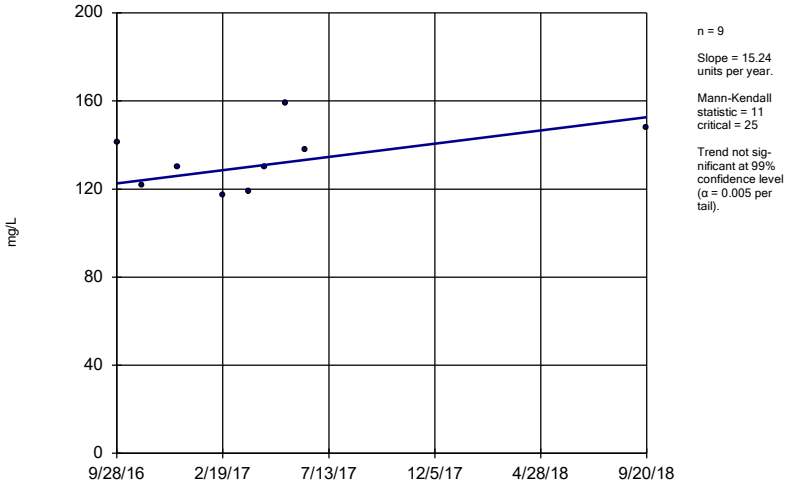
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 12/3/2018 8:31 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1601A (bg)



n = 9

Slope = 15.24 units per year.

Mann-Kendall statistic = 11 critical = 25

Trend not significant at 99% confidence level (α = 0.005 per tail).

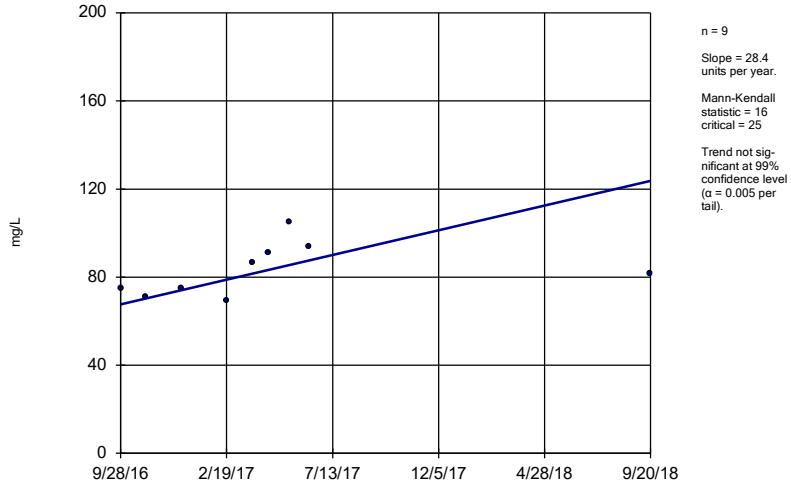
Constituent: Calcium, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1602 (bg)



n = 9

Slope = 28.4 units per year.

Mann-Kendall statistic = 16 critical = 25

Trend not significant at 99% confidence level (α = 0.005 per tail).

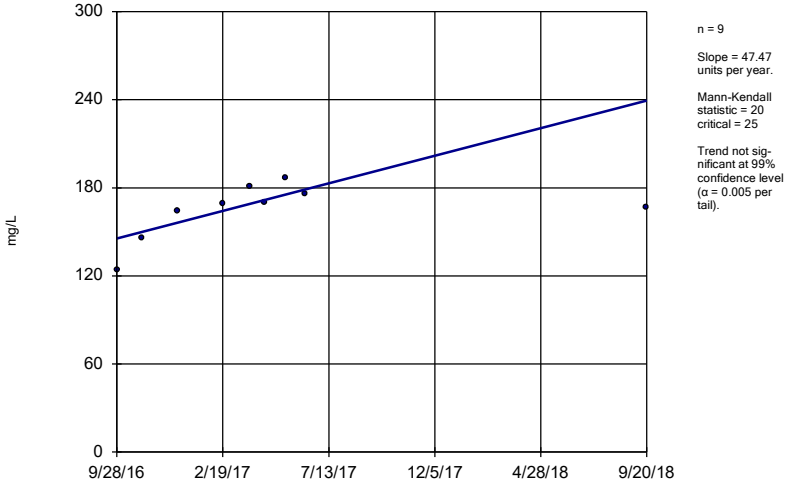
Constituent: Calcium, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1603 (bg)



n = 9

Slope = 47.47 units per year.

Mann-Kendall statistic = 20 critical = 25

Trend not significant at 99% confidence level (α = 0.005 per tail).

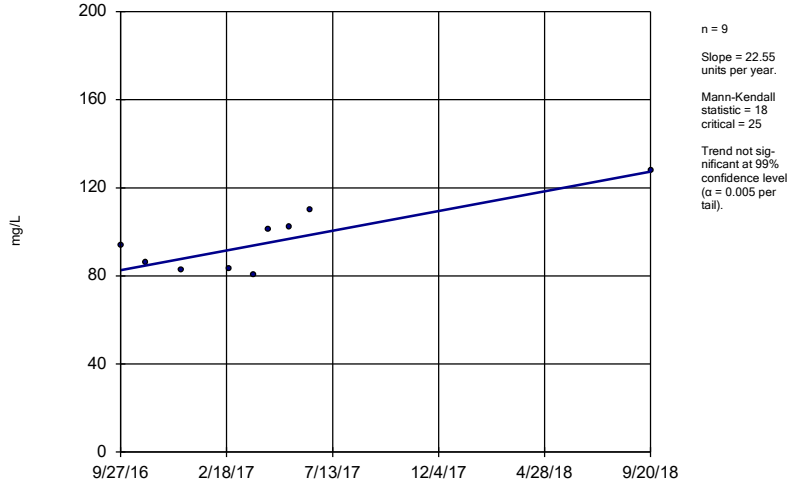
Constituent: Calcium, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1608 (bg)



n = 9

Slope = 22.55 units per year.

Mann-Kendall statistic = 18 critical = 25

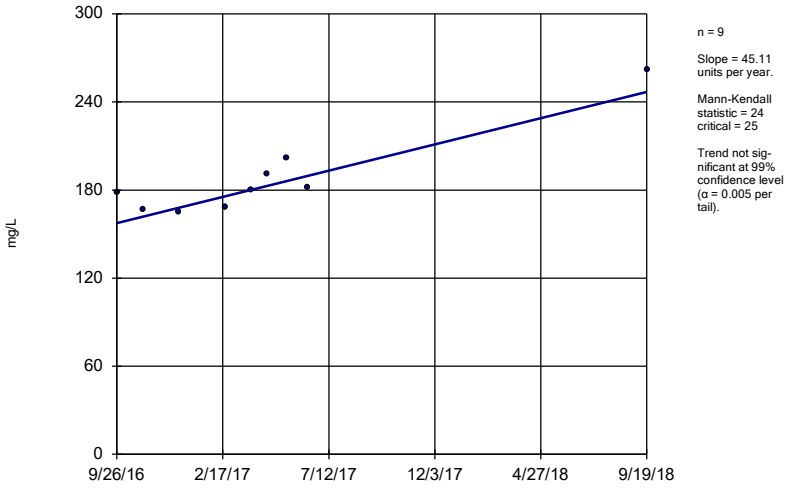
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1604S



n = 9

Slope = 45.11 units per year.

Mann-Kendall statistic = 24 critical = 25

Trend not significant at 99% confidence level (α = 0.005 per tail).

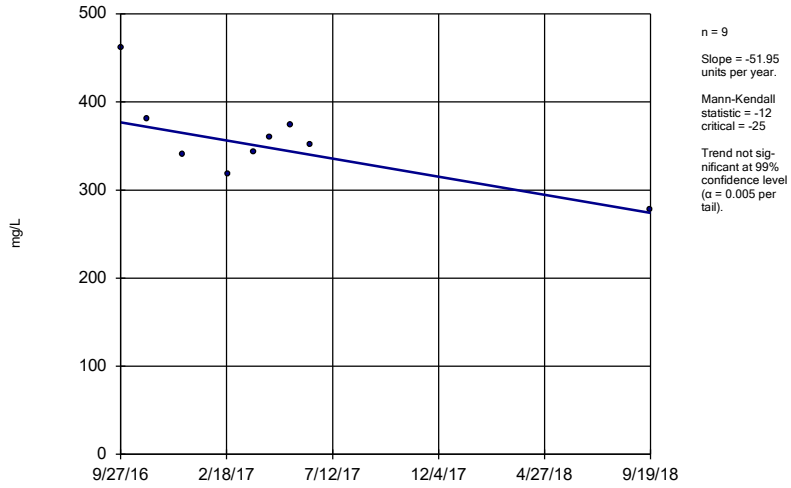
Constituent: Calcium, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1605D



n = 9

Slope = -51.95 units per year.

Mann-Kendall statistic = -12 critical = -25

Trend not significant at 99% confidence level (α = 0.005 per tail).

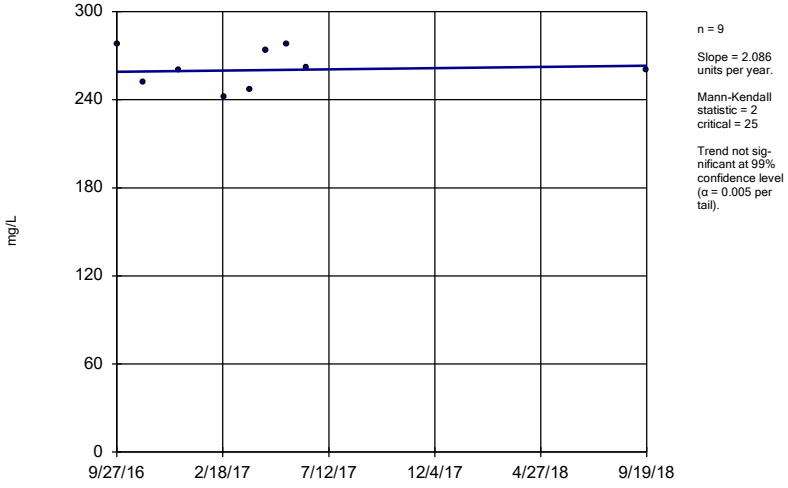
Constituent: Calcium, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1606D



n = 9

Slope = 2.086 units per year.

Mann-Kendall statistic = 2 critical = 25

Trend not significant at 99% confidence level (α = 0.005 per tail).

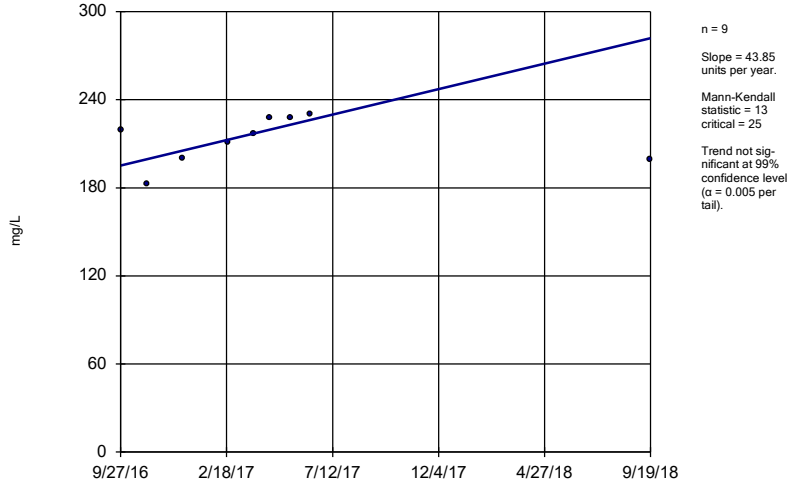
Constituent: Calcium, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1606S



n = 9

Slope = 43.85 units per year.

Mann-Kendall statistic = 13 critical = 25

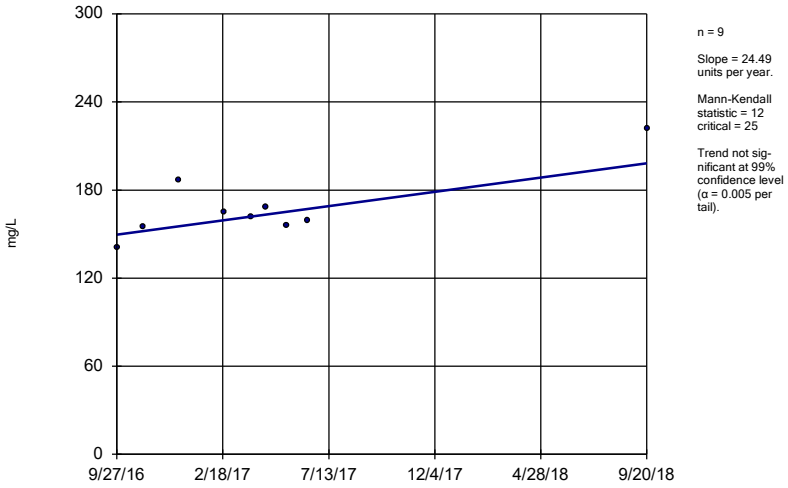
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1607D



n = 9

Slope = 24.49 units per year.

Mann-Kendall statistic = 12 critical = 25

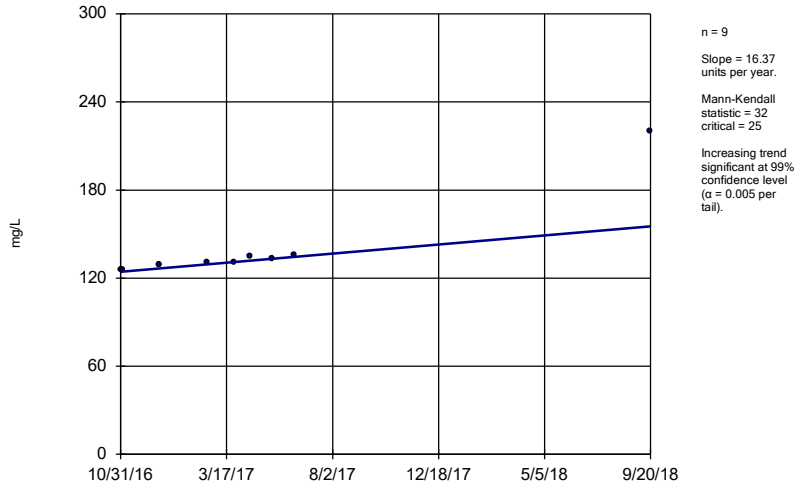
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1607S



n = 9

Slope = 16.37 units per year.

Mann-Kendall statistic = 32 critical = 25

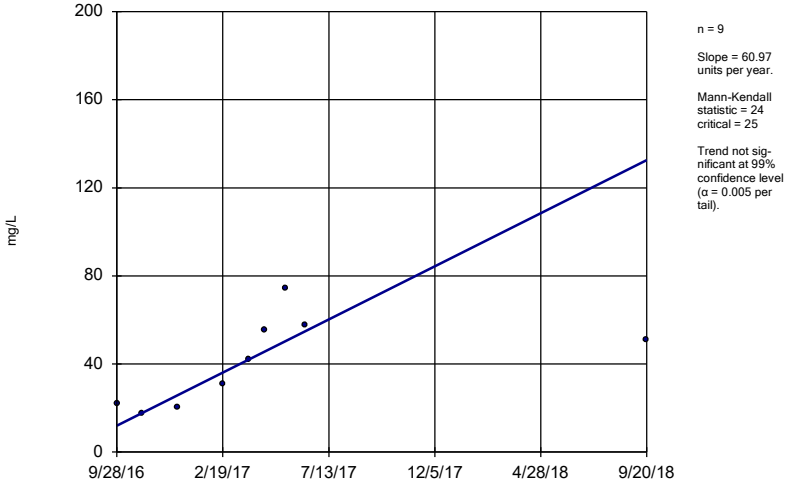
Increasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1601A (bg)



n = 9

Slope = 60.97 units per year.

Mann-Kendall statistic = 24 critical = 25

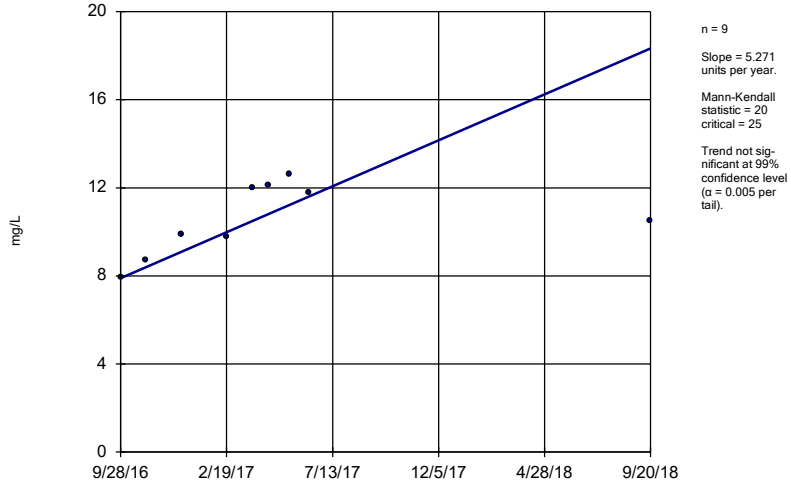
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1602 (bg)



n = 9

Slope = 5.271 units per year.

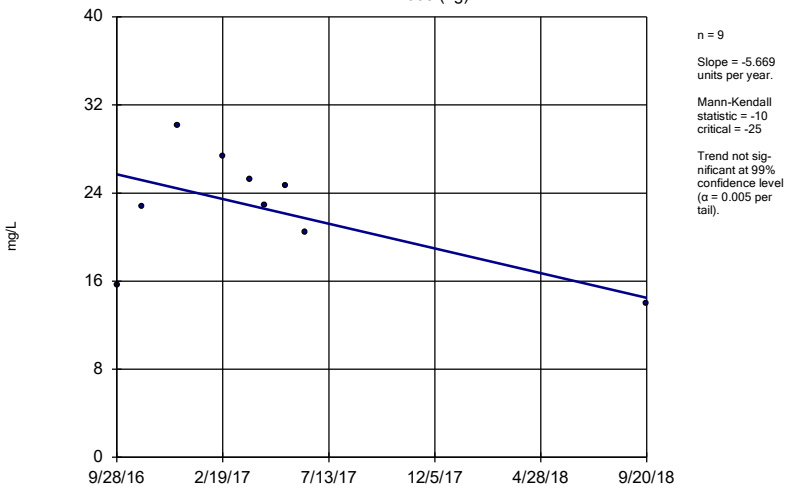
Mann-Kendall statistic = 20 critical = 25

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1603 (bg)



n = 9

Slope = -5.669 units per year.

Mann-Kendall statistic = -10 critical = -25

Trend not significant at 99% confidence level (α = 0.005 per tail).

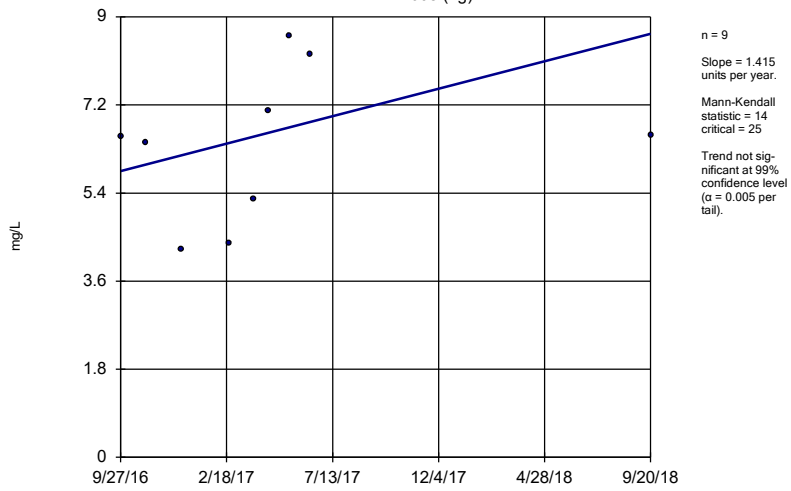
Constituent: Chloride, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1608 (bg)



n = 9

Slope = 1.415 units per year.

Mann-Kendall statistic = 14 critical = 25

Trend not significant at 99% confidence level (α = 0.005 per tail).

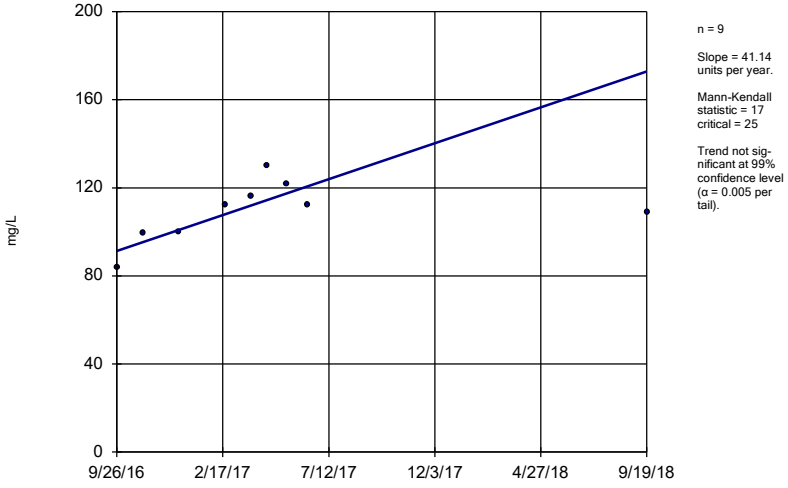
Constituent: Chloride, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1604S



n = 9

Slope = 41.14 units per year.

Mann-Kendall statistic = 17 critical = 25

Trend not significant at 99% confidence level (α = 0.005 per tail).

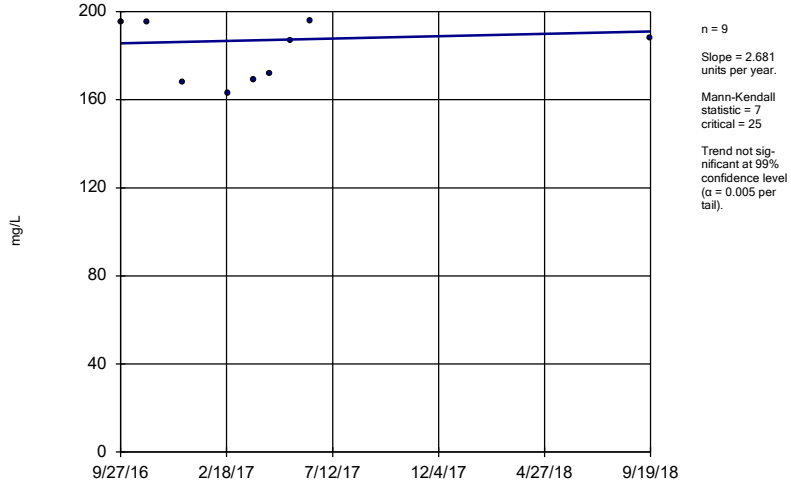
Constituent: Chloride, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1605D



n = 9

Slope = 2.681 units per year.

Mann-Kendall statistic = 7 critical = 25

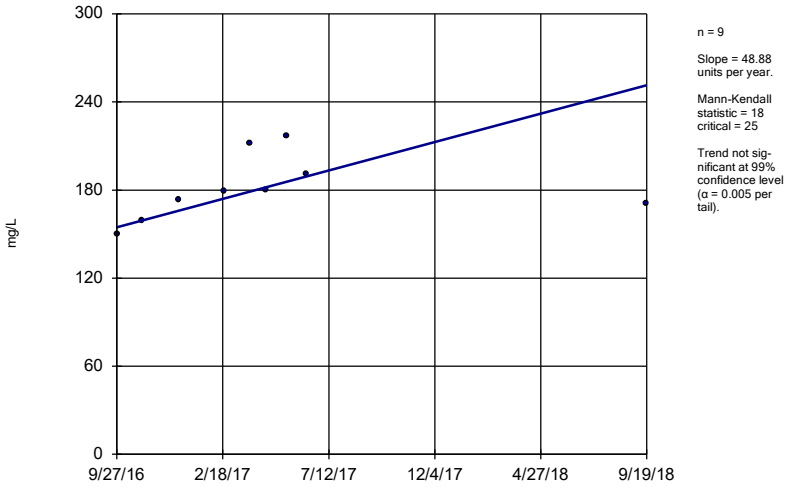
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1605S



n = 9

Slope = 48.88 units per year.

Mann-Kendall statistic = 18 critical = 25

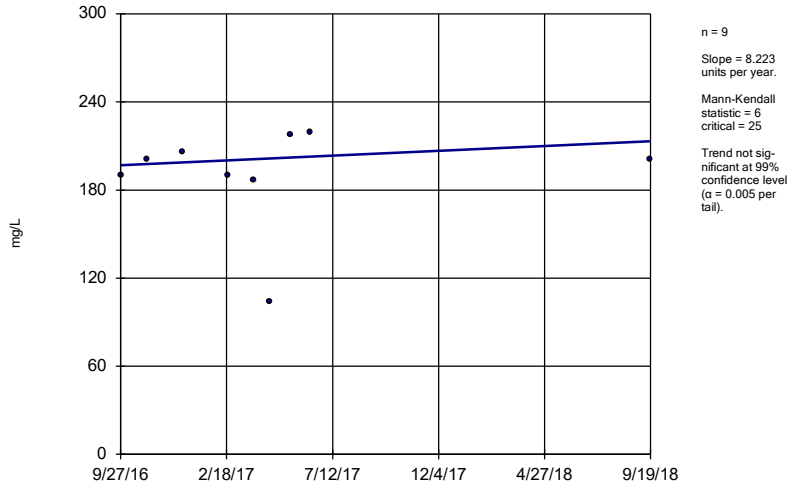
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1606D



n = 9

Slope = 8.223 units per year.

Mann-Kendall statistic = 6 critical = 25

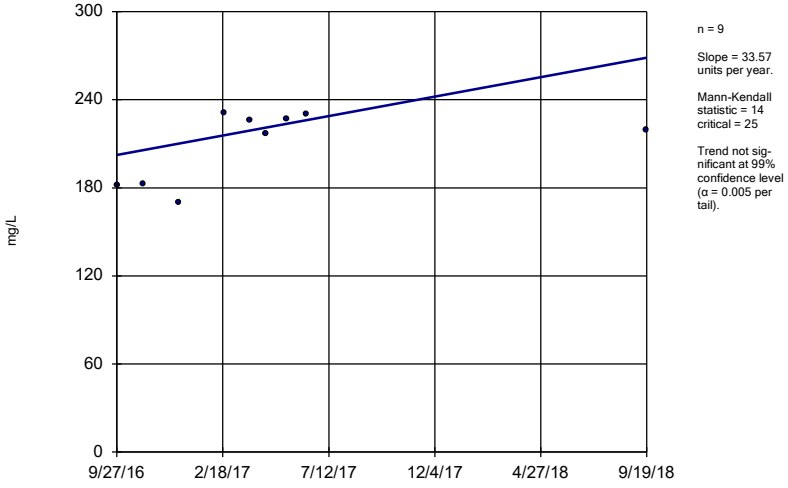
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1606S



n = 9

Slope = 33.57 units per year.

Mann-Kendall statistic = 14 critical = 25

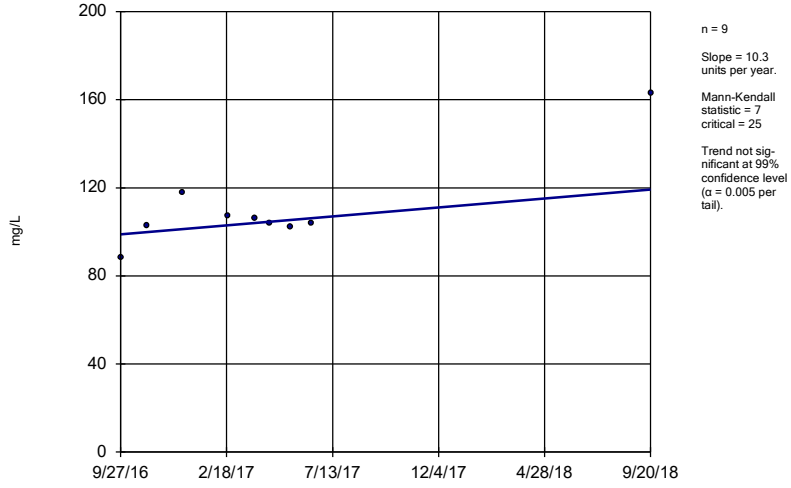
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1607D



n = 9

Slope = 10.3 units per year.

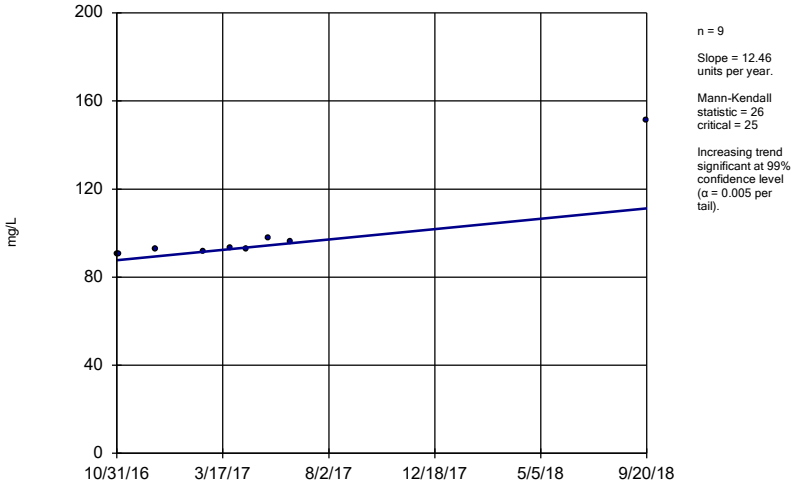
Mann-Kendall statistic = 7 critical = 25

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1607S



n = 9

Slope = 12.46 units per year.

Mann-Kendall statistic = 26 critical = 25

Increasing trend significant at 99% confidence level (α = 0.005 per tail).

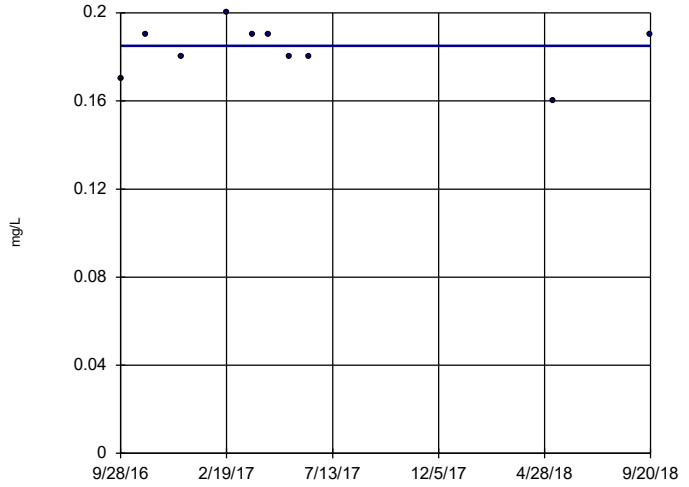
Constituent: Chloride, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1601A (bg)



n = 10

Slope = 0 units per year.

Mann-Kendall statistic = -4 critical = -30

Trend not significant at 99% confidence level (α = 0.005 per tail).

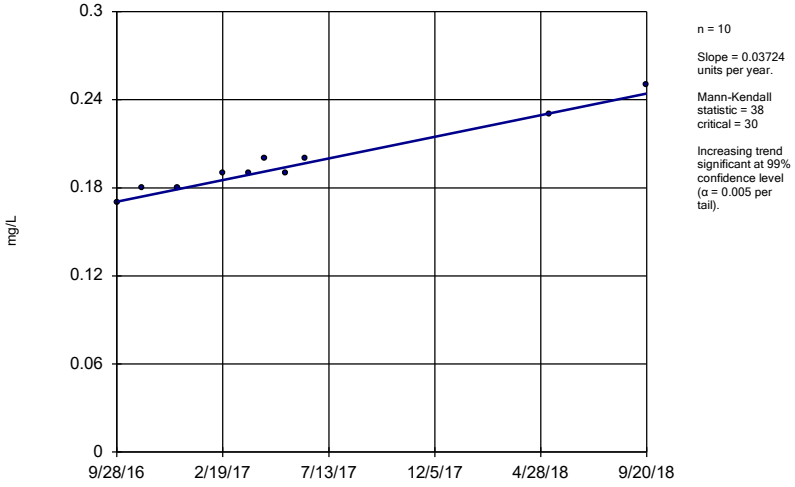
Constituent: Fluoride, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1602 (bg)



n = 10

Slope = 0.03724 units per year.

Mann-Kendall statistic = 38 critical = 30

Increasing trend significant at 99% confidence level (α = 0.005 per tail).

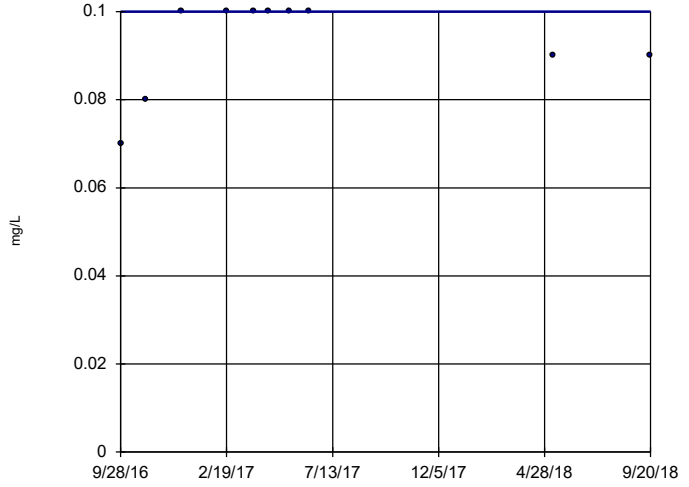
Constituent: Fluoride, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1603 (bg)



n = 10

Slope = 0 units per year.

Mann-Kendall statistic = 5 critical = 30

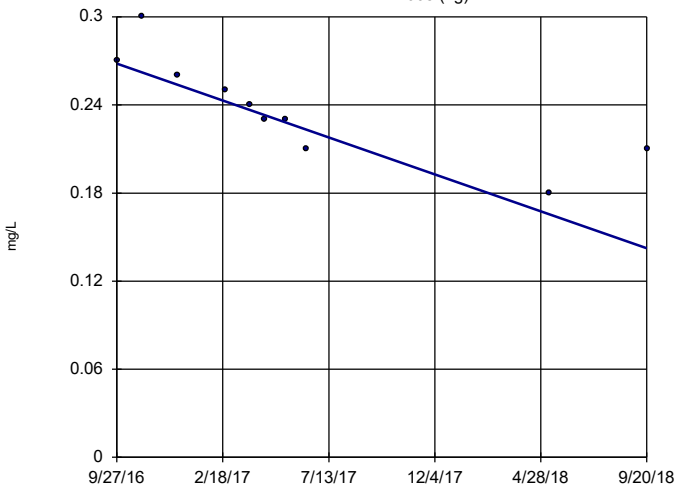
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Fluoride, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1608 (bg)



n = 10

Slope = -0.06348 units per year.

Mann-Kendall statistic = -39 critical = -30

Decreasing trend significant at 99% confidence level (α = 0.005 per tail).

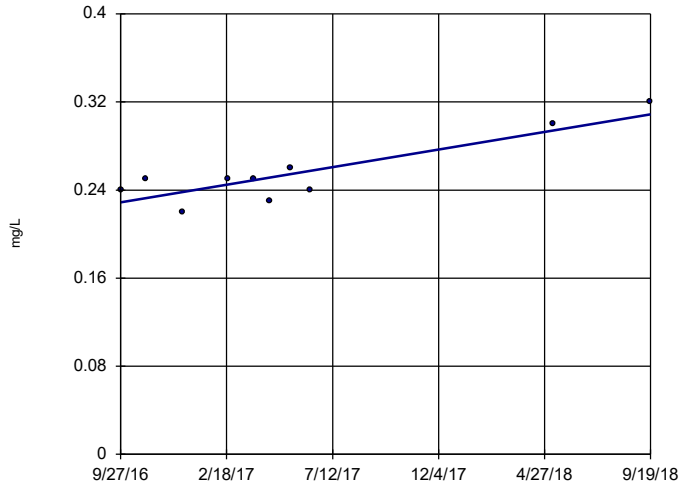
Constituent: Fluoride, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1605S



n = 10

Slope = 0.04044 units per year.

Mann-Kendall statistic = 21 critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

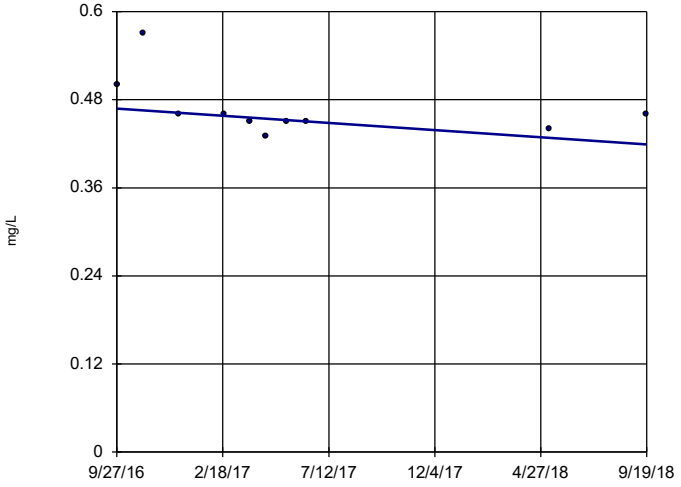
Constituent: Fluoride, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1606S



n = 10

Slope = -0.02483 units per year.

Mann-Kendall statistic = -21 critical = -30

Trend not significant at 99% confidence level (α = 0.005 per tail).

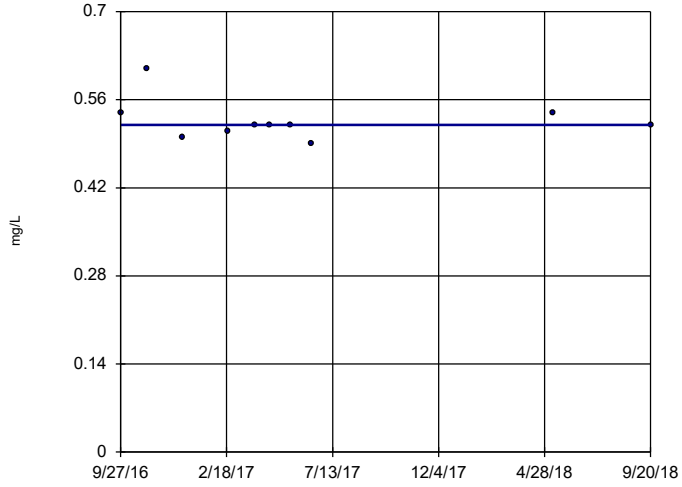
Constituent: Fluoride, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1607D



n = 10

Slope = 0 units per year.

Mann-Kendall statistic = -4 critical = -30

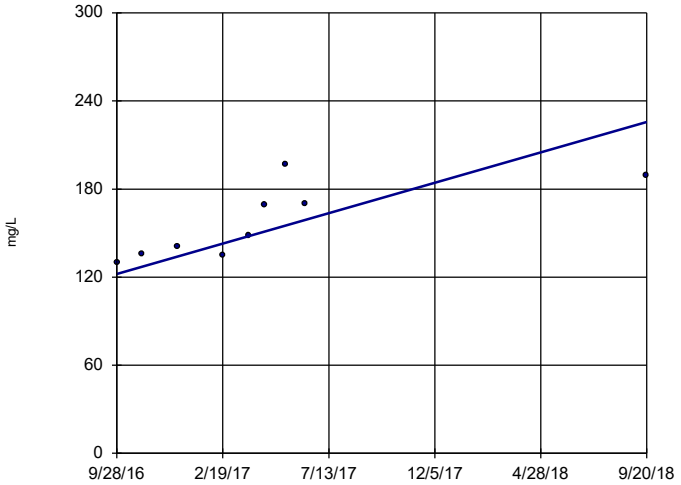
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Fluoride, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1601A (bg)



n = 9

Slope = 52.31 units per year.

Mann-Kendall statistic = 28 critical = 25

Increasing trend significant at 99% confidence level (α = 0.005 per tail).

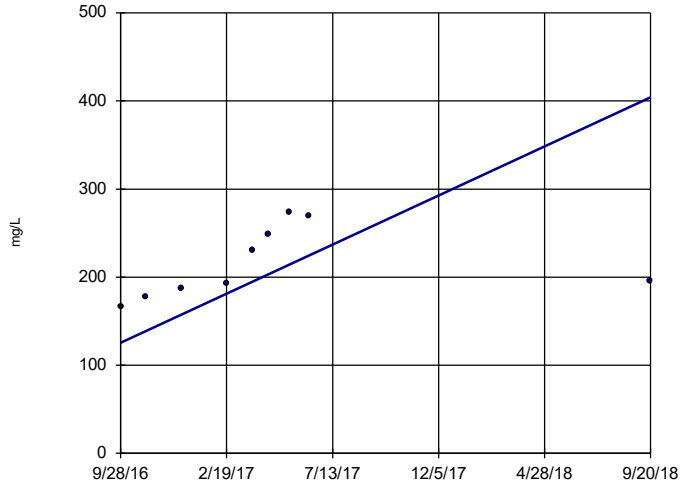
Constituent: Sulfate, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1602 (bg)



n = 9

Slope = 140.9 units per year.

Mann-Kendall statistic = 26 critical = 25

Increasing trend significant at 99% confidence level (α = 0.005 per tail).

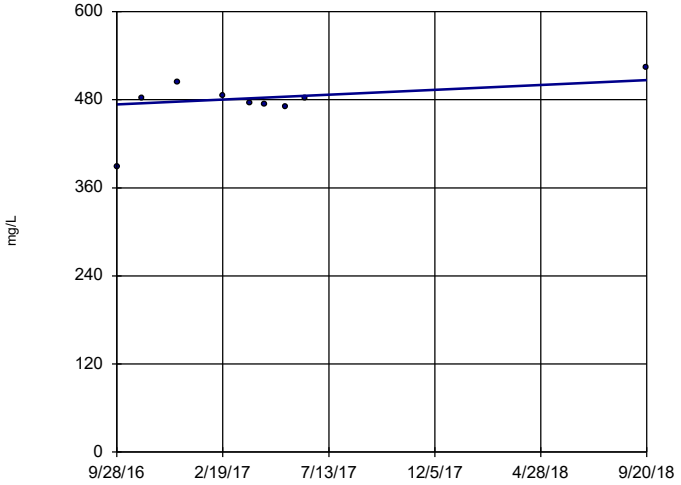
Constituent: Sulfate, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1603 (bg)



n = 9

Slope = 16.59 units per year.

Mann-Kendall statistic = 4 critical = 25

Trend not significant at 99% confidence level (α = 0.005 per tail).

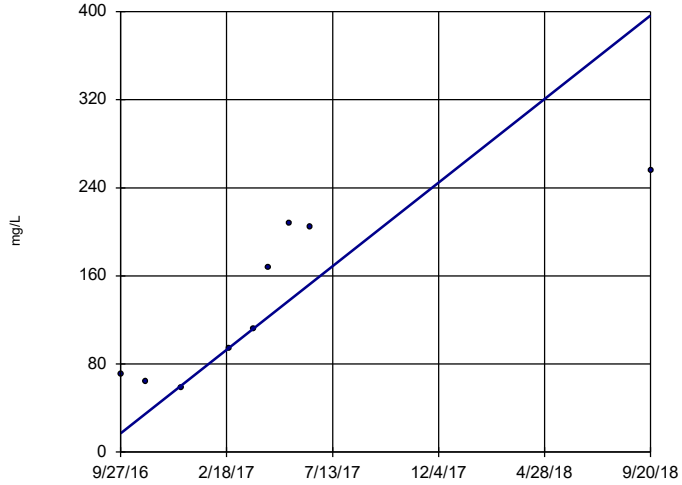
Constituent: Sulfate, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1608 (bg)



n = 9

Slope = 191.7 units per year.

Mann-Kendall statistic = 28 critical = 25

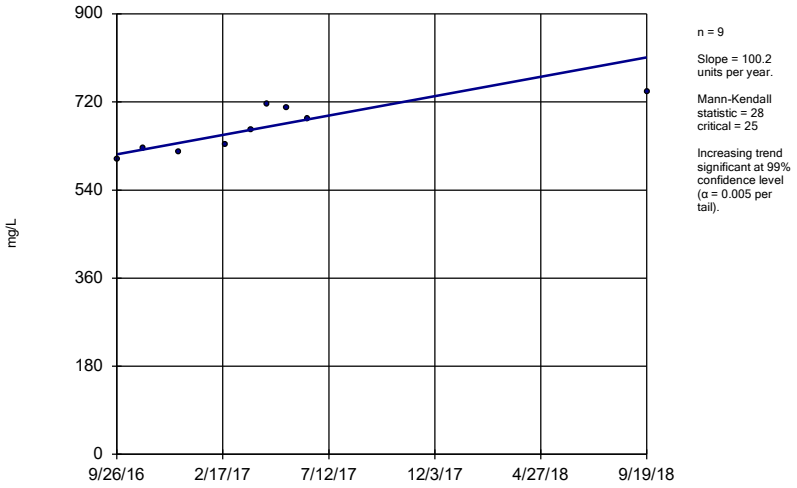
Increasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1604S



n = 9

Slope = 100.2 units per year.

Mann-Kendall statistic = 28
critical = 25

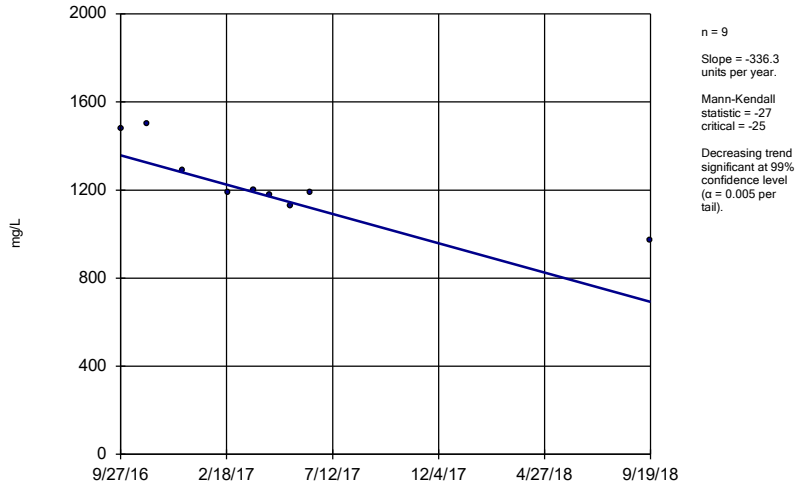
Increasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1605D



n = 9

Slope = -336.3 units per year.

Mann-Kendall statistic = -27
critical = -25

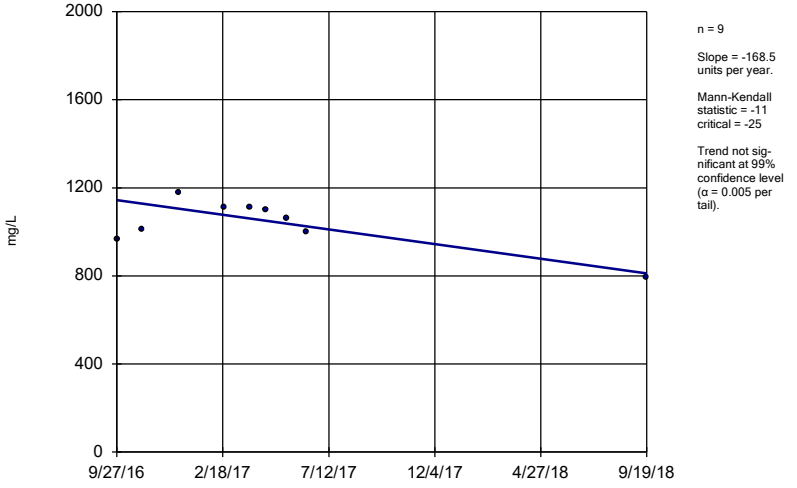
Decreasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1605S



n = 9

Slope = -168.5 units per year.

Mann-Kendall statistic = -11
critical = -25

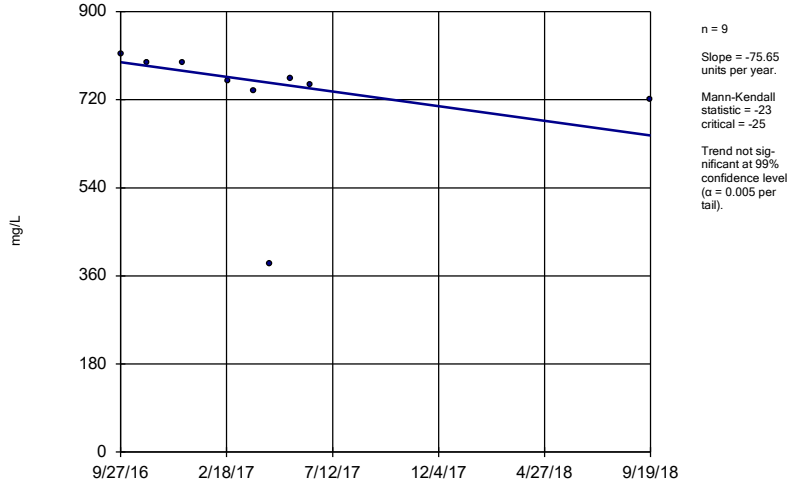
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1606D



n = 9

Slope = -75.65 units per year.

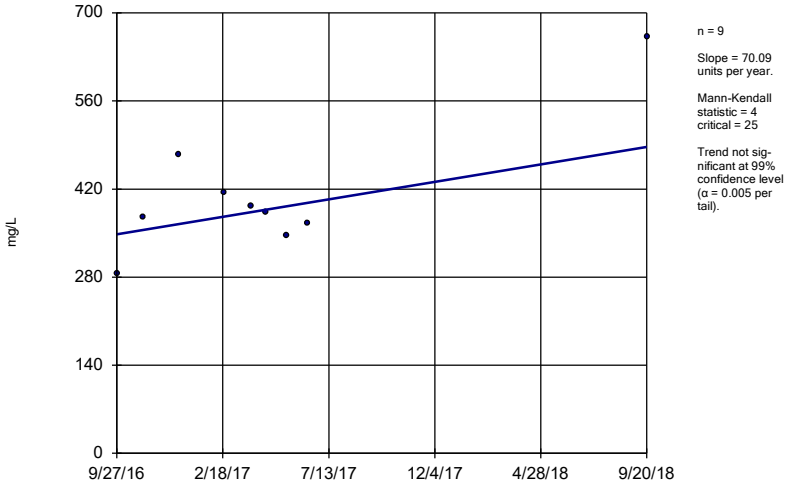
Mann-Kendall statistic = -23
critical = -25

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1607D



n = 9

Slope = 70.09 units per year.

Mann-Kendall statistic = 4 critical = 25

Trend not significant at 99% confidence level (α = 0.005 per tail).

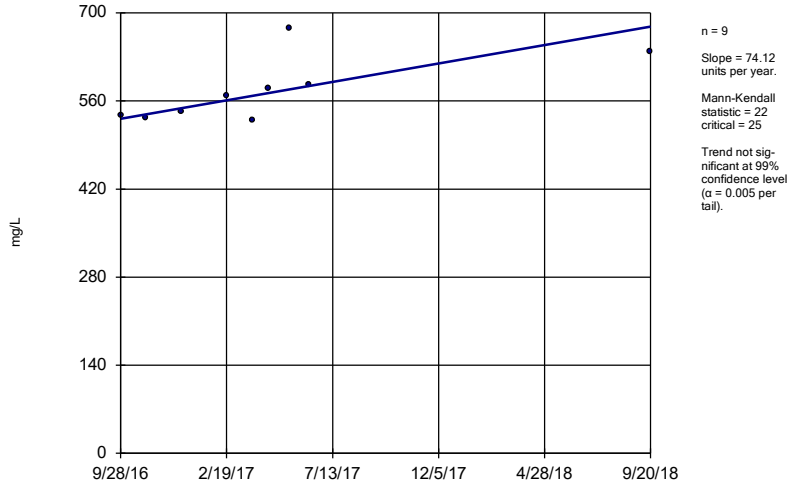
Constituent: Sulfate, total Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1601A (bg)



n = 9

Slope = 74.12 units per year.

Mann-Kendall statistic = 22 critical = 25

Trend not significant at 99% confidence level (α = 0.005 per tail).

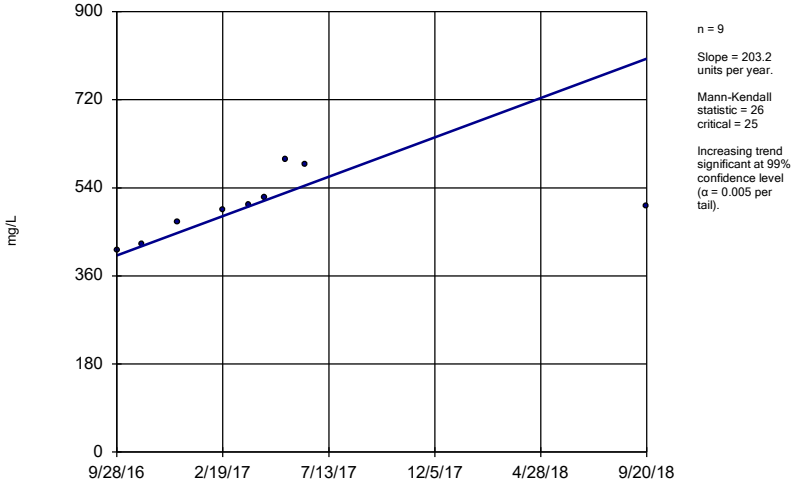
Constituent: Total Dissolved Solids [TDS] Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1602 (bg)



n = 9

Slope = 203.2 units per year.

Mann-Kendall statistic = 26 critical = 25

Increasing trend significant at 99% confidence level (α = 0.005 per tail).

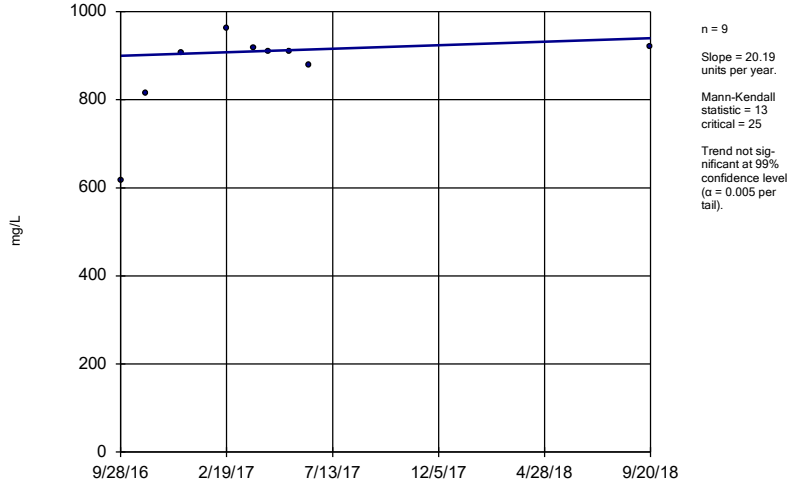
Constituent: Total Dissolved Solids [TDS] Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1603 (bg)



n = 9

Slope = 20.19 units per year.

Mann-Kendall statistic = 13 critical = 25

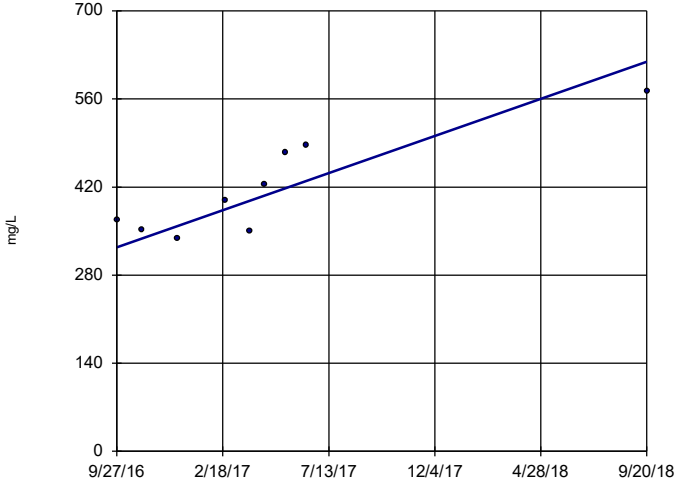
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1608 (bg)



n = 9

Slope = 149 units per year.

Mann-Kendall statistic = 24 critical = 25

Trend not significant at 99% confidence level (α = 0.005 per tail).

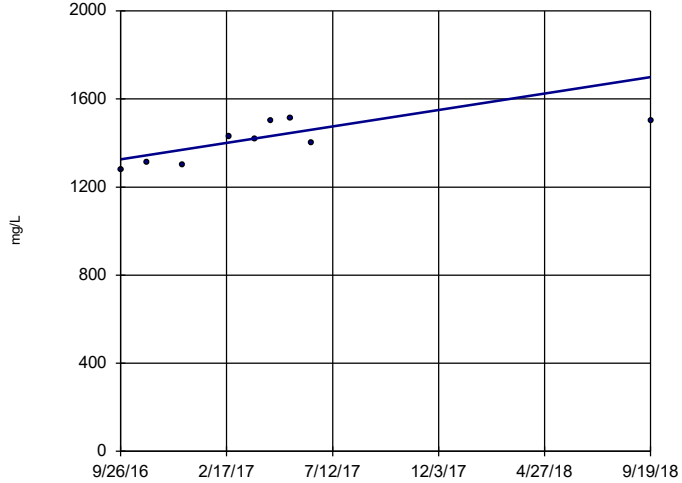
Constituent: Total Dissolved Solids [TDS] Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1604S



n = 9

Slope = 188.5 units per year.

Mann-Kendall statistic = 21 critical = 25

Trend not significant at 99% confidence level (α = 0.005 per tail).

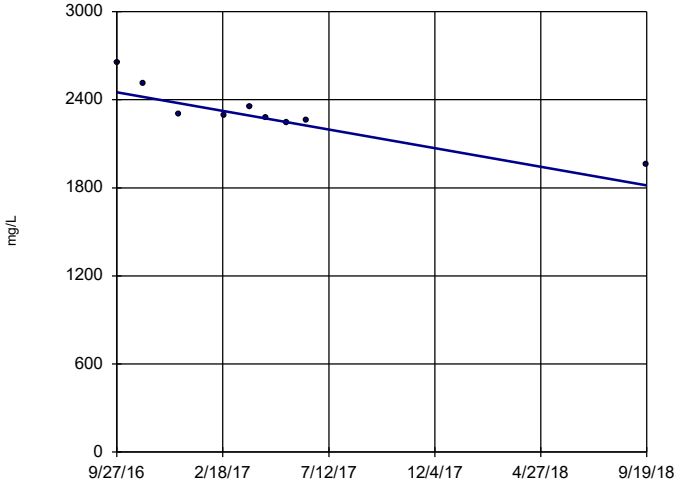
Constituent: Total Dissolved Solids [TDS] Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1605D



n = 9

Slope = -320.7 units per year.

Mann-Kendall statistic = -30 critical = -25

Decreasing trend significant at 99% confidence level (α = 0.005 per tail).

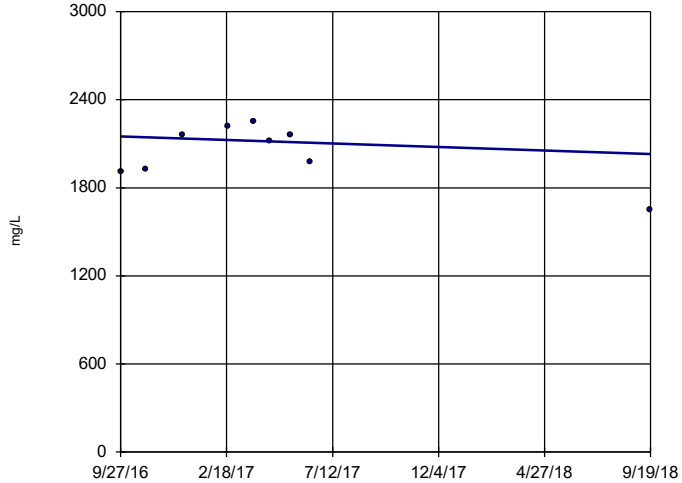
Constituent: Total Dissolved Solids [TDS] Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1605S



n = 9

Slope = -61.34 units per year.

Mann-Kendall statistic = -1 critical = -25

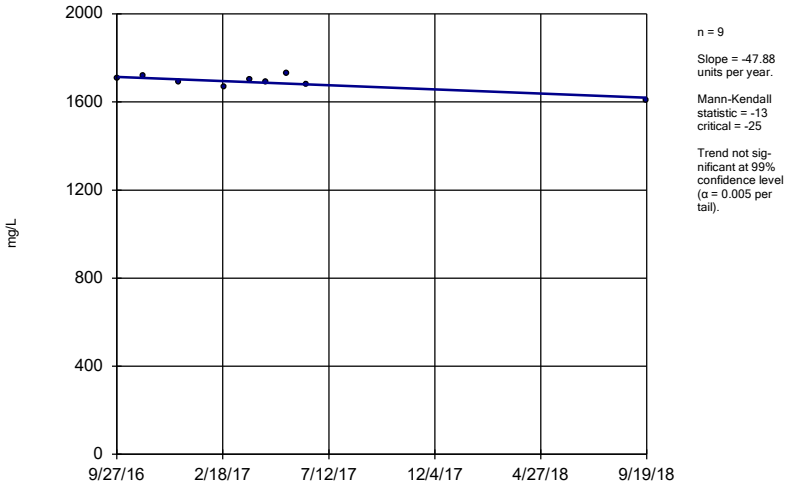
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/3/2018 8:32 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1606D



n = 9

Slope = -47.88 units per year.

Mann-Kendall statistic = -13 critical = -25

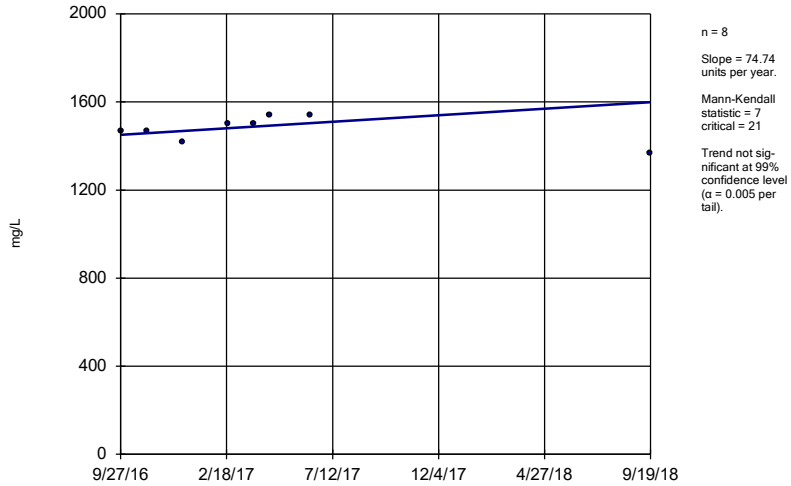
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/3/2018 8:32 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1606S



n = 8

Slope = 74.74 units per year.

Mann-Kendall statistic = 7 critical = 21

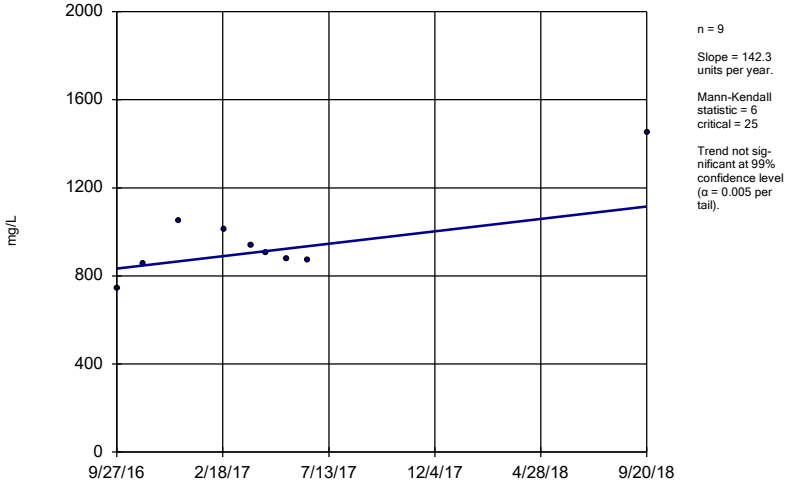
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/3/2018 8:32 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1607D



n = 9

Slope = 142.3 units per year.

Mann-Kendall statistic = 6 critical = 25

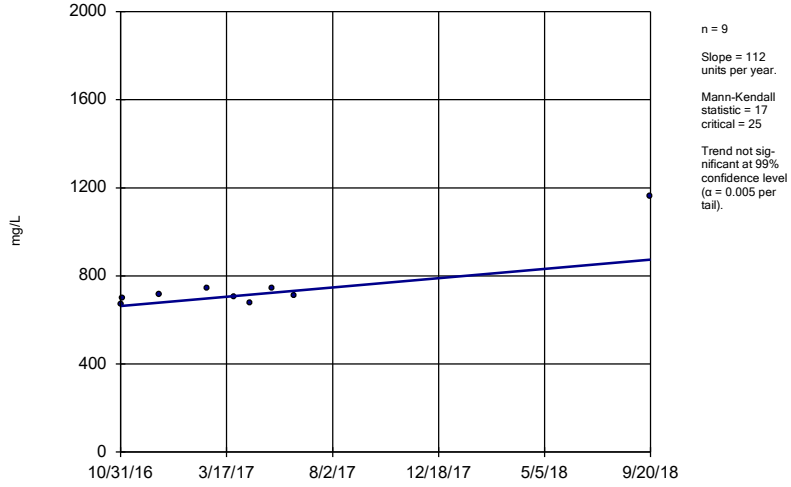
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/3/2018 8:32 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1607S



n = 9

Slope = 112 units per year.

Mann-Kendall statistic = 17 critical = 25

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/3/2018 8:32 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Upper Tolerance Limits

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 12/3/2018, 9:14 AM

Constituent	Upper Lim.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony, total (mg/L)	0.0001	40	n/a	n/a	2.5	n/a	n/a	0.1285	NP Inter(normality)
Arsenic, total (mg/L)	0.0007528	40	0.0004703	0.0001329	0	None	No	0.05	Inter
Barium, total (mg/L)	0.05785	40	-3.311	0.2167	0	None	ln(x)	0.05	Inter
Beryllium, total (mg/L)	0.00002	40	n/a	n/a	85	n/a	n/a	0.1285	NP Inter(NDs)
Cadmium, total (mg/L)	0.00003	40	n/a	n/a	0	n/a	n/a	0.1285	NP Inter(normality)
Chromium, total (mg/L)	0.00193	40	-8.045	0.8441	0	None	ln(x)	0.05	Inter
Cobalt, total (mg/L)	0.0006586	40	-9.087	0.8285	0	None	ln(x)	0.05	Inter
Combined Radium 226 + 228 (pCi/L)	2.36	40	0.8419	0.3265	0	None	sqrt(x)	0.05	Inter
Fluoride, total (mg/L)	0.301	40	0.178	0.05788	0	None	No	0.05	Inter
Lead, total (mg/L)	0.0005165	40	0.04708	0.01559	0	None	x^(1/3)	0.05	Inter
Lithium, total (mg/L)	0.03084	40	0.0924	0.03915	7.5	None	sqrt(x)	0.05	Inter
Mercury, total (mg/L)	0.000005	40	n/a	n/a	90	n/a	n/a	0.1285	NP Inter(NDs)
Molybdenum, total (mg/L)	0.002886	40	0.001248	0.0007705	0	None	No	0.05	Inter
Selenium, total (mg/L)	0.0015	40	n/a	n/a	0	n/a	n/a	0.1285	NP Inter(normality)
Thallium, total (mg/L)	0.00009255	40	0.005606	0.001888	2.5	None	sqrt(x)	0.05	Inter

Confidence Intervals - Significant Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 12/3/2018, 6:57 AM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	%NDs	Transform	Alpha	Method
Lithium, total (mg/L)	**MW-1605D**	**0.08226**	**0.06534**	**0.04**	**Yes**	**10**	**0**	**No**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1605S**	**0.08143**	**0.05937**	**0.04**	**Yes**	**10**	**0**	**No**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1606D**	**0.1276**	**0.1108**	**0.04**	**Yes**	**10**	**0**	**No**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1606S**	**0.1183**	**0.1023**	**0.04**	**Yes**	**10**	**0**	**No**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1607D**	**0.09185**	**0.07175**	**0.04**	**Yes**	**10**	**0**	**No**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1607S**	**0.1086**	**0.09178**	**0.04**	**Yes**	**10**	**0**	**No**	**0.01**	**Param.**

Confidence Intervals - All Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 12/3/2018, 6:57 AM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	%NDs	Transform	Alpha	Method
Antimony, total (mg/L)	MW-1604D	0.000147	0.00008903	0.006	No	10	0	x^2	0.01	Param.
Antimony, total (mg/L)	MW-1604S	0.00013	0.00003	0.006	No	10	0	No	0.011	NP (normality)
Antimony, total (mg/L)	MW-1605D	0.00004	0.00003	0.006	No	10	0	No	0.011	NP (normality)
Antimony, total (mg/L)	MW-1605S	0.0000839	0.00003655	0.006	No	10	0	ln(x)	0.01	Param.
Antimony, total (mg/L)	MW-1606D	0.00019	0.00015	0.006	No	10	0	No	0.011	NP (normality)
Antimony, total (mg/L)	MW-1606S	0.0001642	0.0001418	0.006	No	10	0	No	0.01	Param.
Antimony, total (mg/L)	MW-1607D	0.00004	0.00003	0.006	No	10	0	No	0.011	NP (normality)
Antimony, total (mg/L)	MW-1607S	0.00055	0.00042	0.006	No	10	0	No	0.011	NP (normality)
Arsenic, total (mg/L)	MW-1604D	0.0005475	0.0003765	0.01	No	10	0	No	0.01	Param.
Arsenic, total (mg/L)	MW-1604S	0.0004585	0.0003555	0.01	No	10	0	No	0.01	Param.
Arsenic, total (mg/L)	MW-1605D	0.002428	0.00211	0.01	No	10	0	No	0.01	Param.
Arsenic, total (mg/L)	MW-1605S	0.001033	0.0005754	0.01	No	10	0	No	0.01	Param.
Arsenic, total (mg/L)	MW-1606D	0.0008752	0.0004153	0.01	No	10	0	sqrt(x)	0.01	Param.
Arsenic, total (mg/L)	MW-1606S	0.0009003	0.0007577	0.01	No	10	0	No	0.01	Param.
Arsenic, total (mg/L)	MW-1607D	0.001208	0.0009743	0.01	No	10	0	No	0.01	Param.
Arsenic, total (mg/L)	MW-1607S	0.001549	0.0009483	0.01	No	9	0	No	0.01	Param.
Barium, total (mg/L)	MW-1604D	0.03213	0.02689	2	No	10	0	x^(1/3)	0.01	Param.
Barium, total (mg/L)	MW-1604S	0.03045	0.02687	2	No	10	0	No	0.01	Param.
Barium, total (mg/L)	MW-1605D	0.02956	0.02462	2	No	10	0	No	0.01	Param.
Barium, total (mg/L)	MW-1605S	0.04036	0.02682	2	No	10	0	No	0.01	Param.
Barium, total (mg/L)	MW-1606D	0.06149	0.05171	2	No	10	0	No	0.01	Param.
Barium, total (mg/L)	MW-1606S	0.0769	0.06996	2	No	10	0	No	0.01	Param.
Barium, total (mg/L)	MW-1607D	0.1511	0.1019	2	No	10	0	No	0.01	Param.
Barium, total (mg/L)	MW-1607S	0.07271	0.05814	2	No	9	0	No	0.01	Param.
Beryllium, total (mg/L)	MW-1604D	0.00002	0.00002	0.004	No	10	100	No	0.011	NP (NDs)
Beryllium, total (mg/L)	MW-1604S	0.00002	0.00002	0.004	No	10	90	No	0.011	NP (NDs)
Beryllium, total (mg/L)	MW-1605D	0.00002	0.00002	0.004	No	10	100	No	0.011	NP (NDs)
Beryllium, total (mg/L)	MW-1605S	0.00002	0.000007	0.004	No	10	70	No	0.011	NP (normality)
Beryllium, total (mg/L)	MW-1606D	0.00002	0.000004	0.004	No	10	60	No	0.011	NP (normality)
Beryllium, total (mg/L)	MW-1606S	0.00002	0.000005	0.004	No	10	90	No	0.011	NP (NDs)
Beryllium, total (mg/L)	MW-1607D	0.00002	0.000008	0.004	No	10	90	No	0.011	NP (NDs)
Beryllium, total (mg/L)	MW-1607S	0.00002	0.000007	0.004	No	10	60	No	0.011	NP (normality)
Cadmium, total (mg/L)	MW-1604D	0.0001592	0.00007084	0.005	No	10	0	No	0.01	Param.
Cadmium, total (mg/L)	MW-1604S	0.00015	0.00003	0.005	No	10	0	No	0.011	NP (normality)
Cadmium, total (mg/L)	MW-1605D	0.00003882	0.00001918	0.005	No	10	0	No	0.01	Param.
Cadmium, total (mg/L)	MW-1605S	0.00008	0.00005	0.005	No	10	0	No	0.011	NP (normality)
Cadmium, total (mg/L)	MW-1606D	0.00007638	0.00006205	0.005	No	10	0	x^3	0.01	Param.
Cadmium, total (mg/L)	MW-1606S	0.00008146	0.00006454	0.005	No	10	0	No	0.01	Param.
Cadmium, total (mg/L)	MW-1607D	0.00002	0.000005	0.005	No	10	60	No	0.011	NP (normality)
Cadmium, total (mg/L)	MW-1607S	0.00006	0.00002	0.005	No	10	0	No	0.011	NP (normality)
Chromium, total (mg/L)	MW-1604D	0.0005216	0.0001498	0.1	No	10	0	No	0.01	Param.
Chromium, total (mg/L)	MW-1604S	0.0005807	0.0001015	0.1	No	10	0	ln(x)	0.01	Param.
Chromium, total (mg/L)	MW-1605D	0.0005311	0.00008298	0.1	No	10	0	ln(x)	0.01	Param.
Chromium, total (mg/L)	MW-1605S	0.001104	0.0001965	0.1	No	10	0	x^(1/3)	0.01	Param.
Chromium, total (mg/L)	MW-1606D	0.0006749	0.0001734	0.1	No	10	0	sqrt(x)	0.01	Param.
Chromium, total (mg/L)	MW-1606S	0.0006344	0.00009926	0.1	No	10	0	sqrt(x)	0.01	Param.
Chromium, total (mg/L)	MW-1607D	0.0007252	0.00006417	0.1	No	10	0	x^(1/3)	0.01	Param.
Chromium, total (mg/L)	MW-1607S	0.0008722	0.0001432	0.1	No	10	0	ln(x)	0.01	Param.
Cobalt, total (mg/L)	MW-1604D	0.001902	0.001301	0.006	No	10	0	x^3	0.01	Param.
Cobalt, total (mg/L)	MW-1604S	0.00183	0.000307	0.006	No	10	0	No	0.011	NP (normality)
Cobalt, total (mg/L)	MW-1605D	0.001854	0.00164	0.006	No	10	0	No	0.01	Param.
Cobalt, total (mg/L)	MW-1605S	0.001475	0.0004285	0.006	No	10	0	x^(1/3)	0.01	Param.
Cobalt, total (mg/L)	MW-1606D	0.0022	0.00117	0.006	No	10	0	No	0.011	NP (normality)
Cobalt, total (mg/L)	MW-1606S	0.0003873	0.0002411	0.006	No	10	0	No	0.01	Param.
Cobalt, total (mg/L)	MW-1607D	0.000769	0.000396	0.006	No	10	0	No	0.011	NP (normality)

Confidence Intervals - All Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 12/3/2018, 6:57 AM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	%NDs	Transform	Alpha	Method
Cobalt, total (mg/L)	MW-1607S	0.0026	0.000752	0.006	No	10	0	No	0.011	NP (normality)
Combined Radium 226 + 228 (pCi/L)	MW-1604D	1.909	0.5872	5	No	10	0	sqrt(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1604S	1.424	0.5484	5	No	9	0	ln(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1605D	2.096	0.5645	5	No	10	0	sqrt(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1605S	1.458	0.3561	5	No	10	0	ln(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1606D	3.902	0.6694	5	No	10	0	sqrt(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1606S	1.644	0.6102	5	No	10	0	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1607D	2.246	0.9231	5	No	10	0	x^(1/3)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1607S	2.32	1.022	5	No	10	0	No	0.01	Param.
Fluoride, total (mg/L)	MW-1604D	0.2019	0.1781	4	No	10	0	No	0.01	Param.
Fluoride, total (mg/L)	MW-1604S	0.2146	0.1954	4	No	10	0	No	0.01	Param.
Fluoride, total (mg/L)	MW-1605D	0.2133	0.1807	4	No	10	0	No	0.01	Param.
Fluoride, total (mg/L)	MW-1605S	0.2836	0.2284	4	No	10	0	No	0.01	Param.
Fluoride, total (mg/L)	MW-1606D	0.26	0.24	4	No	10	0	No	0.011	NP (normality)
Fluoride, total (mg/L)	MW-1606S	0.5	0.43	4	No	10	0	No	0.011	NP (normality)
Fluoride, total (mg/L)	MW-1607D	0.54	0.49	4	No	10	0	No	0.011	NP (normality)
Fluoride, total (mg/L)	MW-1607S	0.3129	0.2791	4	No	10	0	No	0.01	Param.
Lead, total (mg/L)	MW-1604D	0.000303	0.00002	0.015	No	10	0	No	0.011	NP (normality)
Lead, total (mg/L)	MW-1604S	0.0001057	0.00003526	0.015	No	10	0	No	0.01	Param.
Lead, total (mg/L)	MW-1605D	0.00004138	0.00001242	0.015	No	10	0	x^(1/3)	0.01	Param.
Lead, total (mg/L)	MW-1605S	0.0009624	0.0001231	0.015	No	10	0	sqrt(x)	0.01	Param.
Lead, total (mg/L)	MW-1606D	0.0006317	0.00003806	0.015	No	10	0	x^(1/3)	0.01	Param.
Lead, total (mg/L)	MW-1606S	0.0001693	0.00004293	0.015	No	10	0	No	0.01	Param.
Lead, total (mg/L)	MW-1607D	0.000179	0.000038	0.015	No	10	0	No	0.011	NP (normality)
Lead, total (mg/L)	MW-1607S	0.0014	0.000094	0.015	No	10	0	No	0.011	NP (normality)
Lithium, total (mg/L)	MW-1604D	0.05993	0.03714	0.04	No	10	0	x^2	0.01	Param.
Lithium, total (mg/L)	MW-1604S	0.04601	0.03039	0.04	No	10	0	No	0.01	Param.
Lithium, total (mg/L)	**MW-1605D**	**0.08226**	**0.06534**	**0.04**	**Yes**	**10**	**0**	**No**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1605S**	**0.08143**	**0.05937**	**0.04**	**Yes**	**10**	**0**	**No**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1606D**	**0.1276**	**0.1108**	**0.04**	**Yes**	**10**	**0**	**No**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1606S**	**0.1183**	**0.1023**	**0.04**	**Yes**	**10**	**0**	**No**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1607D**	**0.09185**	**0.07175**	**0.04**	**Yes**	**10**	**0**	**No**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1607S**	**0.1086**	**0.09178**	**0.04**	**Yes**	**10**	**0**	**No**	**0.01**	**Param.**
Mercury, total (mg/L)	MW-1604D	0.000005	0.000003	0.002	No	10	80	No	0.011	NP (NDs)
Mercury, total (mg/L)	MW-1604S	0.000005	0.000003	0.002	No	10	90	No	0.011	NP (NDs)
Mercury, total (mg/L)	MW-1605D	0.000005	0.000002	0.002	No	10	90	No	0.011	NP (NDs)
Mercury, total (mg/L)	MW-1605S	0.000005	0.000003	0.002	No	10	90	No	0.011	NP (NDs)
Mercury, total (mg/L)	MW-1606D	0.000005	0.000004	0.002	No	10	90	No	0.011	NP (NDs)
Mercury, total (mg/L)	MW-1606S	0.000005	0.000002	0.002	No	10	90	No	0.011	NP (NDs)
Mercury, total (mg/L)	MW-1607D	0.000005	0.000002	0.002	No	10	80	No	0.011	NP (NDs)
Mercury, total (mg/L)	MW-1607S	0.000005	0.000003	0.002	No	9	77.78	No	0.002	NP (NDs)
Molybdenum, total (mg/L)	MW-1604D	0.01989	0.01465	0.1	No	10	0	x^4	0.01	Param.
Molybdenum, total (mg/L)	MW-1604S	0.0162	0.00241	0.1	No	9	0	No	0.002	NP (normality)
Molybdenum, total (mg/L)	MW-1605D	0.05207	0.04477	0.1	No	10	0	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1605S	0.02275	0.01593	0.1	No	10	0	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1606D	0.08108	0.07086	0.1	No	10	0	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1606S	0.1055	0.08	0.1	No	10	0	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1607D	0.09219	0.08353	0.1	No	10	0	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1607S	0.04809	0.04171	0.1	No	10	0	No	0.01	Param.
Selenium, total (mg/L)	MW-1604D	0.0014	0.0005	0.05	No	10	0	No	0.011	NP (normality)
Selenium, total (mg/L)	MW-1604S	0.002719	0.001421	0.05	No	10	0	No	0.01	Param.
Selenium, total (mg/L)	MW-1605D	0.0003	0.0002	0.05	No	10	0	No	0.011	NP (normality)
Selenium, total (mg/L)	MW-1605S	0.002039	0.0008007	0.05	No	10	0	No	0.01	Param.
Selenium, total (mg/L)	MW-1606D	0.00576	0.0026	0.05	No	10	0	No	0.01	Param.
Selenium, total (mg/L)	MW-1606S	0.002	0.0007	0.05	No	10	0	No	0.011	NP (normality)

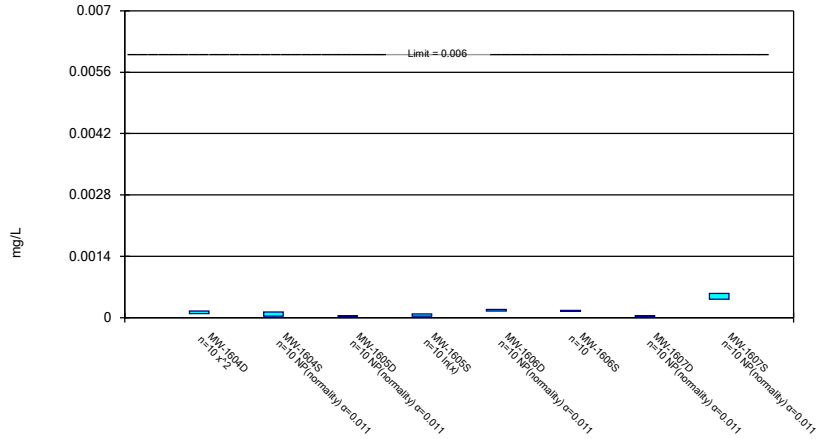
Confidence Intervals - All Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 12/3/2018, 6:57 AM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	%NDs	Transform	Alpha	Method
Selenium, total (mg/L)	MW-1607D	0.0001	0.00003	0.05	No	10	20	No	0.011	NP (normality)
Selenium, total (mg/L)	MW-1607S	0.01003	0.007828	0.05	No	10	0	No	0.01	Param.
Thallium, total (mg/L)	MW-1604D	0.0002929	0.0001575	0.002	No	10	0	x^2	0.01	Param.
Thallium, total (mg/L)	MW-1604S	0.00022	0.00002	0.002	No	10	0	No	0.011	NP (normality)
Thallium, total (mg/L)	MW-1605D	0.00009	0.00004	0.002	No	10	0	No	0.011	NP (normality)
Thallium, total (mg/L)	MW-1605S	0.000102	0.00004	0.002	No	10	0	No	0.011	NP (normality)
Thallium, total (mg/L)	MW-1606D	0.0001133	0.00009009	0.002	No	10	0	No	0.01	Param.
Thallium, total (mg/L)	MW-1606S	0.00009256	0.00006184	0.002	No	10	0	No	0.01	Param.
Thallium, total (mg/L)	MW-1607D	0.00004948	0.00002492	0.002	No	10	0	No	0.01	Param.
Thallium, total (mg/L)	MW-1607S	0.000089	0.00005	0.002	No	9	0	No	0.002	NP (normality)

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

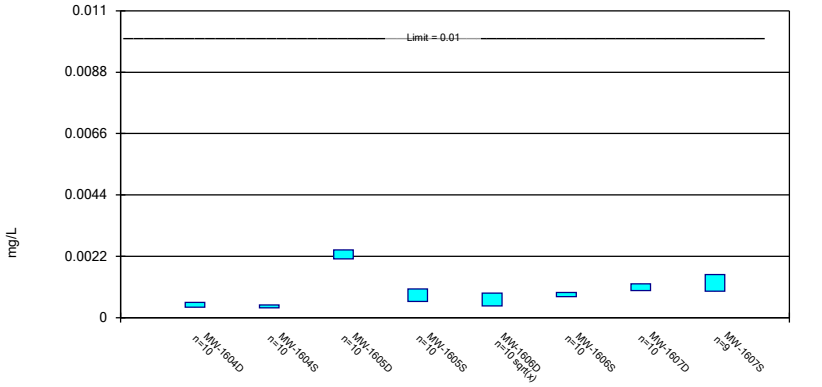


Constituent: Antimony, total Analysis Run 12/3/2018 6:55 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

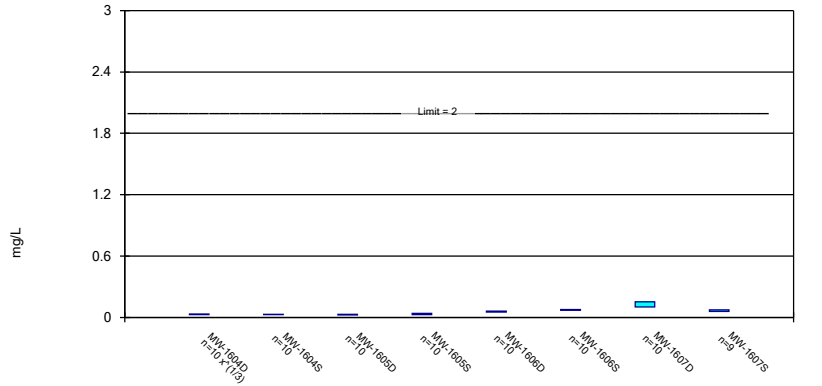


Constituent: Arsenic, total Analysis Run 12/3/2018 6:55 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

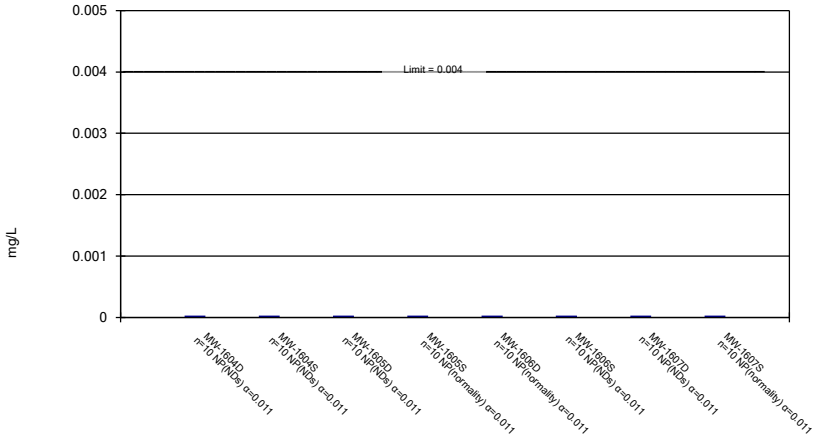


Constituent: Barium, total Analysis Run 12/3/2018 6:55 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

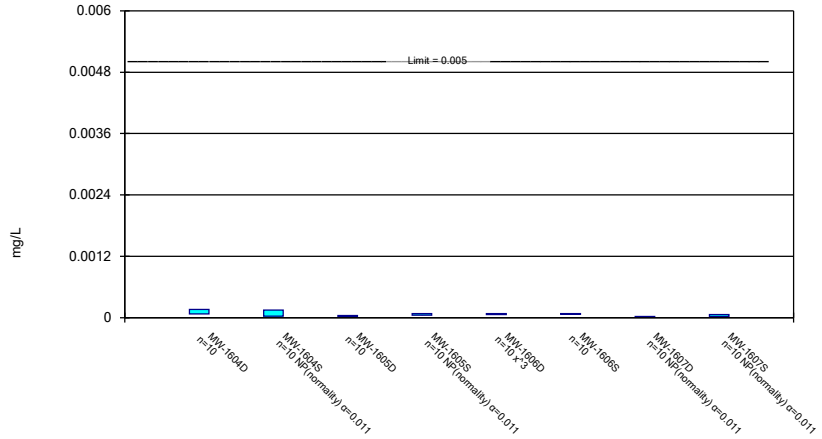
Compliance Limit is not exceeded.



Constituent: Beryllium, total Analysis Run 12/3/2018 6:56 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric and Non-Parametric (NP) Confidence Interval

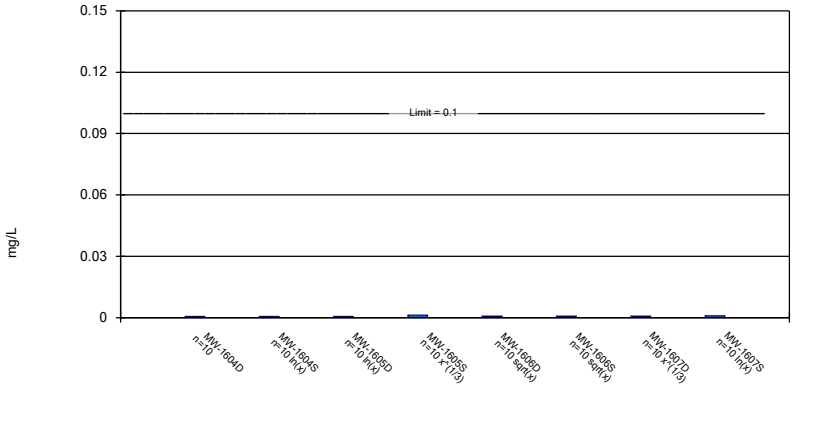
Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Cadmium, total Analysis Run 12/3/2018 6:56 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric Confidence Interval

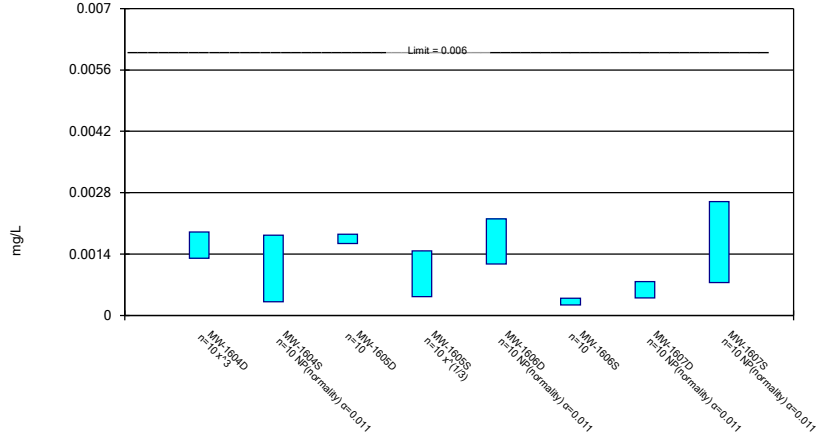
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Chromium, total Analysis Run 12/3/2018 6:56 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric and Non-Parametric (NP) Confidence Interval

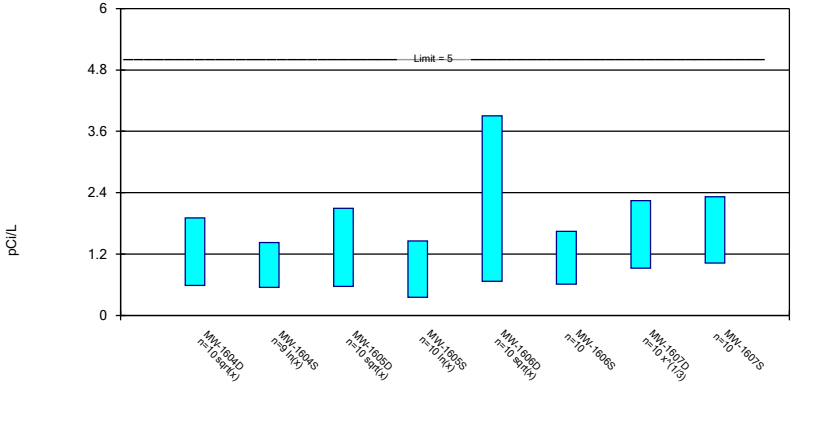
Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Cobalt, total Analysis Run 12/3/2018 6:56 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric Confidence Interval

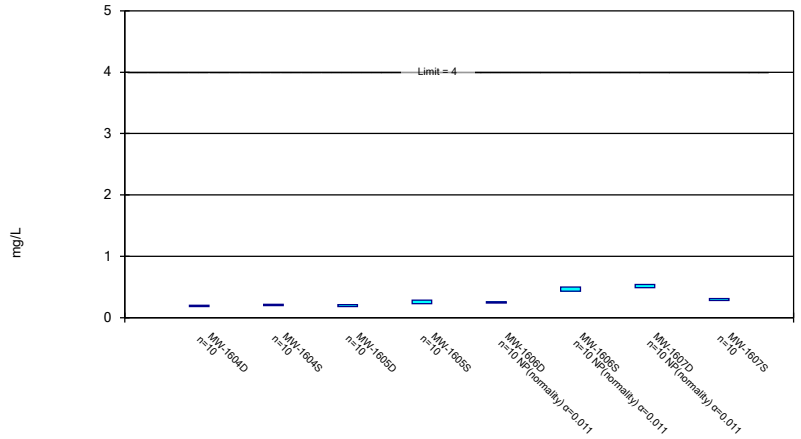
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Combined Radium 226 + 228 Analysis Run 12/3/2018 6:56 AM View: Confidence Intervals -
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

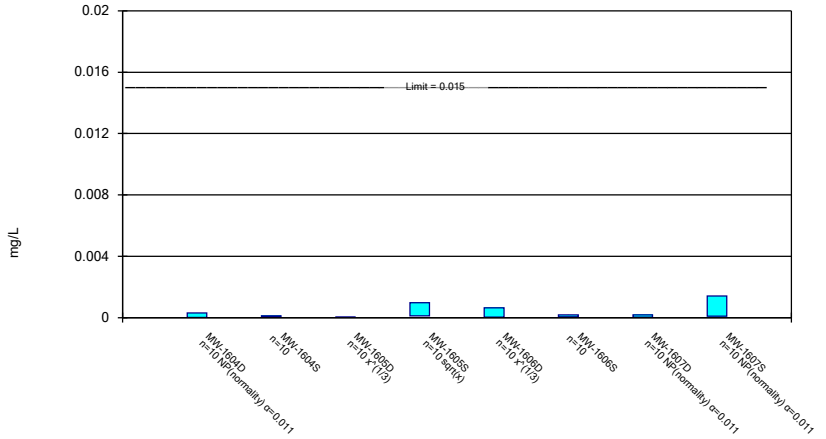


Constituent: Fluoride, total Analysis Run 12/3/2018 6:56 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

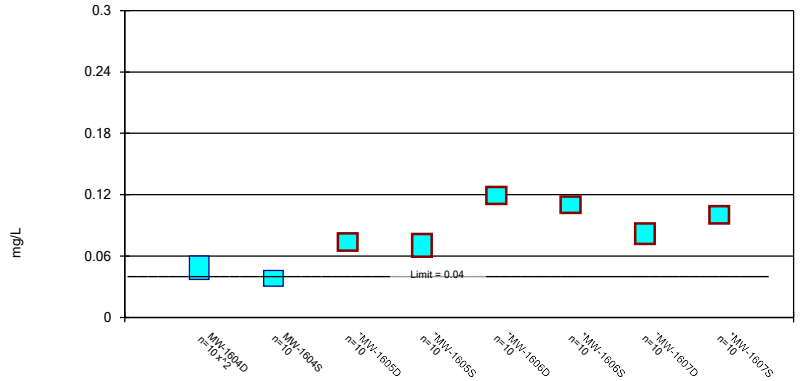


Constituent: Lead, total Analysis Run 12/3/2018 6:56 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance limit is exceeded.* Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

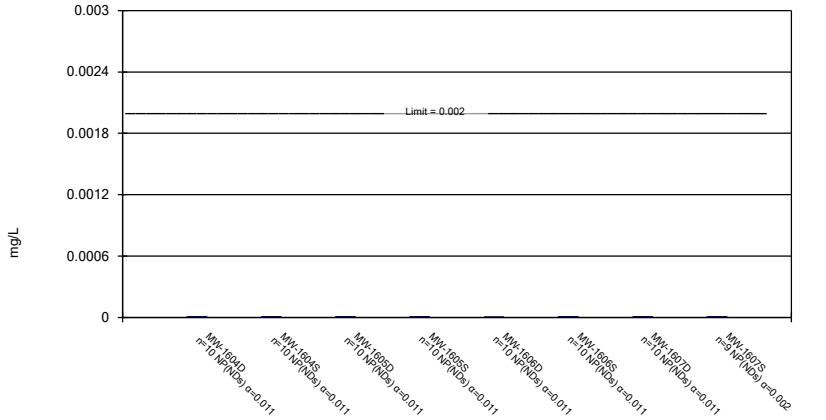


Constituent: Lithium, total Analysis Run 12/3/2018 6:56 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

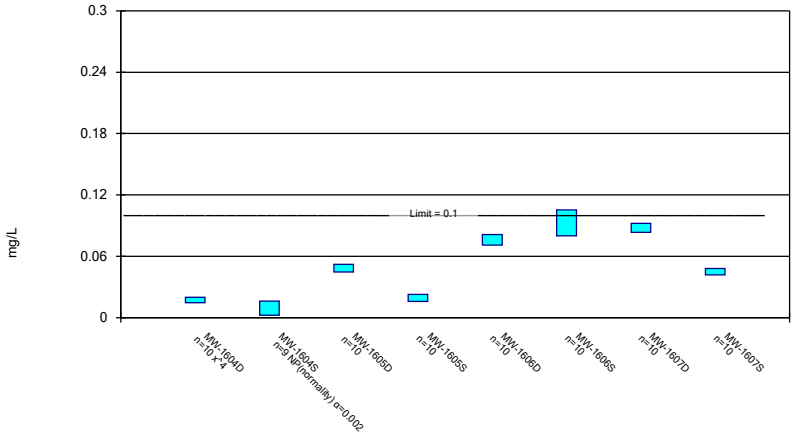
Compliance Limit is not exceeded.



Constituent: Mercury, total Analysis Run 12/3/2018 6:56 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric and Non-Parametric (NP) Confidence Interval

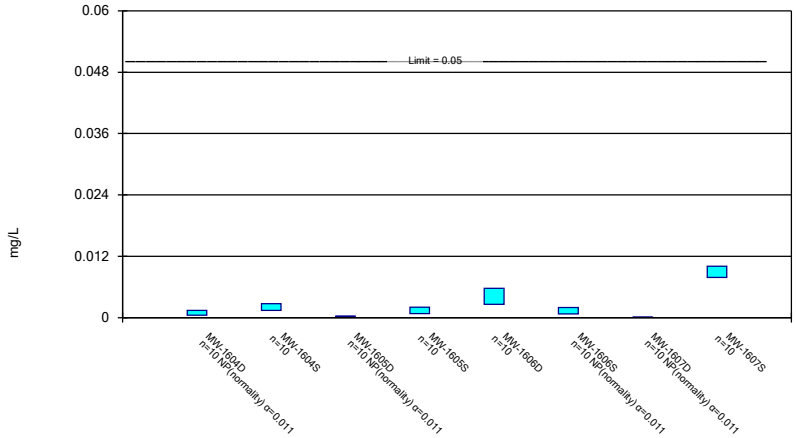
Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Molybdenum, total Analysis Run 12/3/2018 6:56 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric and Non-Parametric (NP) Confidence Interval

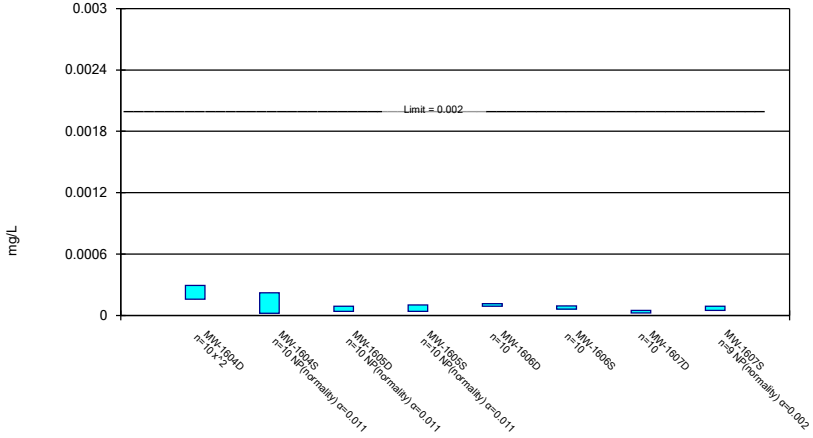
Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Selenium, total Analysis Run 12/3/2018 6:56 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Thallium, total Analysis Run 12/3/2018 6:56 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

STATISTICAL ANALYSIS SUMMARY
BOTTOM ASH POND
Mountaineer Plant
New Haven, West Virginia

Submitted to

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Submitted by

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Attachment A Certification by Qualified Professional Engineer
Attachment B Statistical Analysis Output

LIST OF ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
ASD	Alternative Source Demonstration
BAP	Bottom Ash Pond
CCR	Coal Combustion Residuals
CCV	Continuing Calibration Verification
CFR	Code of Federal Regulations
GWPS	Groundwater Protection Standard
LCL	Lower Confidence Limit
LFB	Laboratory Fortified Blanks
LPL	Lower Prediction Limit
LRB	Laboratory Reagent Blanks
MCL	Maximum Contaminant Level
NELAP	National Environmental Laboratory Accreditation Program
QA	Quality Assurance
QC	Quality Control
RSL	Regional Screening Level
SSI	Statistically Significant Increase
SSL	Statistically Significant Level
TDS	Total Dissolved Solids
USEPA	United States Environmental Protection Agency
UPL	Upper Prediction Limit
UTL	Upper Tolerance Limit

SECTION 1

EXECUTIVE SUMMARY

In accordance with the United States Environmental Protection Agency's (USEPA's) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR 257.90-257.98, "CCR rule"), groundwater monitoring has been conducted at the Bottom Ash Pond (BAP), an existing CCR unit at the Mountaineer Power Plant located in New Haven, West Virginia.

Based on detection monitoring conducted in 2017 and 2018, statistically significant increases (SSIs) over background were concluded for boron, calcium, chloride, total dissolved solids (TDS), and sulfate at the BAP. An alternative source was not identified at the time, so two assessment monitoring events were conducted at the BAP in 2018, in accordance with 40 CFR 257.95. SSLs for lithium were identified at wells MW-1605D, MW-1605S, MW-1606D, MW-1606S, MW-1607D, and MW-1607S and so the unit is completing an assessment of corrective measures in accordance with 40 CFR 257.96. A semi-annual assessment monitoring event was also completed in April 2019, with the results of the April 2019 event documented in this report.

Groundwater data underwent several validation tests, including those for completeness, sample tracking accuracy, transcription errors, and consistent use of measurement units. No data quality issues were identified which would impact the usability of the data.

The monitoring data were submitted to Groundwater Stats Consulting, LLC for statistical analysis. Groundwater protection standards (GWPSs) were re-established for the Appendix IV parameters. Confidence intervals were calculated for Appendix IV parameters at the compliance wells to assess whether Appendix IV parameters were present at a statistically significant level (SSL) above the GWPS, with SSLs identified for lithium. Certification of the selected statistical methods by a qualified professional engineer is documented in Attachment A.

SECTION 2

BOTTOM ASH POND EVALUATION

2.1 Data Validation & QA/QC

During the assessment monitoring program, one set of samples was collected for analysis from each upgradient and downgradient well to meet the requirements of 40 CFR 257.95(d)(1). Samples from the April 2019 semi-annual sampling event were analyzed for the Appendix III and Appendix IV parameters. A summary of data collected during this assessment monitoring event may be found in Table 1.

Chemical analysis was completed by an analytical laboratory certified by the National Environmental Laboratory Accreditation Program (NELAP). Quality assurance and quality control (QA/QC) samples completed by the analytical laboratory included the use of laboratory reagent blanks (LRBs), continuing calibration verification (CCV) samples, and laboratory fortified blanks (LFBs).

The analytical data were imported into a Microsoft Access database, where checks were completed to assess the accuracy of sample location identification and analyte identification. Where necessary, unit conversions were applied to standardize reported units across all sampling events. Exported data files were created for use with the Sanitas™ v.9.6.14 statistics software. The export file was checked against the analytical data for transcription errors and completeness. No QA/QC issues were noted which would impact data usability.

2.2 Statistical Analysis

Statistical analyses for the BAP were conducted in accordance with the January 2017 *Statistical Analysis Plan* (AEP, 2017), except where noted below. Time series plots and results for all completed statistical tests are provided in Attachment B.

The data obtained to meet the requirements of 40 CFR 257.95(d)(1) were screened for potential outliers. No outliers were identified.

2.2.1 Establishment of GWPSs

A GWPS was established for each Appendix IV parameter in accordance with 40 CFR 257.95(h) and the *Statistical Analysis Plan* (AEP, 2017). The established GWPS was determined to be the greater value of the background concentration and the maximum contaminant level (MCL) or risk-based level specified in 40 CFR 257.95(h)(2) for each Appendix IV parameter. To determine background concentrations, an upper tolerance limit (UTL) was calculated using pooled data from the background wells collected during the background monitoring and assessment monitoring events. Generally, tolerance limits were calculated parametrically with 95% coverage and 95% confidence. Non-parametric tolerance limits were calculated for antimony, cadmium, selenium,

and thallium due to apparent non-normal distributions and for beryllium and mercury due to a high non-detect frequency. Tolerance limits and the final GWPSs are summarized in Table 2.

2.2.2 Evaluation of Potential Appendix IV SSLs

A confidence interval was constructed for each Appendix IV parameter at each compliance well. Confidence limits were generally calculated parametrically ($\alpha = 0.01$); however, non-parametric confidence limits were calculated in some cases (e.g., when the data did not appear to be normally distributed or when the non-detect frequency was too high). An SSL was concluded if the lower confidence limit (LCL) exceeded the GWPS (i.e., if the entire confidence interval exceeded the GWPS). Calculated confidence limits are shown in Attachment B.

The following SSLs were identified at the Mountaineer BAP:

- LCLs for lithium exceeded the GWPS of 0.04 mg/L at MW-1605D (0.0664 mg/L), MW-1605S (0.0612), MW-1606D (0.112 mg/L), MW-1606S (0.104 mg/L), MW-1607D (0.0715 mg/L), and 1607S (0.0912 mg/L).

2.2.3 Evaluation of Potential Appendix III SSIs

While SSLs were identified, a review of the Appendix III results were also completed to assess whether concentrations of Appendix III parameters at the compliance wells exceeded background concentrations. Prediction limits were calculated for the Appendix III parameters to represent background values. As described in the January 2018 *Statistical Analysis Summary* report (Geosyntec, 2018), intrawell tests were used to evaluate potential SSIs for pH, whereas interwell tests were used to evaluate potential SSIs for boron, calcium, chloride, fluoride, sulfate, and TDS.

Prediction limits for the interwell tests were recalculated using data collected during the April 2019 assessment monitoring event. Eight data points (i.e., one sample from eight background wells) were added to the background dataset for each interwell test. New data were tested for outliers prior to being added to the background dataset. The updated prediction limits were calculated for a one-of-two retesting procedure, as during detection monitoring. The values of the updated prediction limits were similar to the values of the prediction limits calculated during detection monitoring. The revised interwell prediction limits were used to evaluate potential SSIs for boron, calcium, chloride, fluoride, sulfate, and TDS.

For the intrawell tests, limited data made it possible to add only one data point (i.e., one sample from each compliance well) to each background dataset. Because one sample result is insufficient to compare against the existing background dataset, the prediction limits were not updated for the intrawell tests at this time. The intrawell prediction limits calculated during detection monitoring were used to evaluate potential SSIs for pH.

Data collected during April 2019 assessment monitoring event from each compliance well were compared to the prediction limits to evaluate results above background values. The results from

this event and the prediction limits are summarized in Table 3. The following exceedances of the upper prediction limits (UPLs) were noted:

- Boron concentrations exceeded the interwell value of 0.632 mg/L at MW-1604D (2.82 mg/L), MW-1604S (3.50 mg/L), MW-1605D (6.90 mg/L), MW-1605S (9.39 mg/L), MW-1606D (7.32 mg/L), MW-1606S (7.68 mg/L), MW-1607D (3.10 mg/L), and MW-1607S (2.35 mg/L).

- Calcium concentrations exceeded the interwell value of 193 mg/L at MW-1604D (236 mg/L), MW-1604S (301 mg/L), MW-1605D (247 mg/L), MW-1606D (265 mg/L), MW-1606S (229 mg/L), MW-1607D (232 mg/L), and MW-1607S (226 mg/L).

- Chloride concentrations exceeded the interwell value of 58.8 mg/L at MW-1604D (100 mg/L), MW-1604S (132 mg/L), MW-1605D (169 mg/L), MW-1605S (140 mg/L), MW-1606D (214 mg/L), MW-1606S (223 mg/L), MW-1607D (162 mg/L), and MW-1607S (153 mg/L).

- Fluoride concentrations exceeded the interwell value of 0.27 mg/L at MW-1605S (0.33 mg/L), MW-1606S (0.54 mg/L), and MW-1607D (0.52 mg/L).

- pH levels were below the intrawell lower prediction limit (LPL) of 7.3 SU at MW-1607S (7.2 SU).

- Sulfate concentrations exceeded the interwell value of 681 mg/L at MW-1604S (703 mg/L), MW-1605D (791 mg/L), and MW-1606D (682 mg/L).

- TDS concentrations exceeded the interwell value of 1054 mg/L at MW-1604D (1300 mg/L), MW-1604S (1650 mg/L), MW-1605D (1710 mg/L), MW-1605S (1450 mg/L), MW-1606D (1600 mg/L), MW-1606S (1480 mg/L), MW-1607D (1480 mg/L), and MW-1607S (1310 mg/L).

While the prediction limits were calculated assuming a one-of-two testing procedure, it was conservatively assumed that an SSI was identified if the initial sample exceeded either the UPL based on previous results. Based on these results, concentrations of Appendix III parameters exceeded background levels at compliance wells at the Mountaineer BAP during assessment monitoring.

2.3 Conclusions

A semi-annual assessment monitoring event was conducted in accordance with the CCR Rule. The laboratory and field data were reviewed prior to statistical analysis, with no QA/QC issues identified that impacted data usability. A review of outliers identified no potential outliers in the April 2019 data. GWPSs were re-established for the Appendix IV parameters. A confidence interval was constructed at each compliance well for each Appendix IV parameter; SSLs were concluded if the entire confidence interval exceeded the GWPS. SSLs were identified for lithium.

Appendix III parameters were also evaluated, with exceedances identified for boron, calcium, chloride, fluoride, pH, sulfate, and TDS. The unit is currently completing an assessment of corrective measures and will continue semi-annual assessment monitoring.

SECTION 3

REFERENCES

American Electric Power (AEP). 2017. Statistical Analysis Plan – Mountaineer Plant. January 2017.

Geosyntec Consultants (Geosyntec). 2018. Statistical Analysis Summary – Bottom Ash Pond, Mountaineer Plant, New Haven, West Virginia. January 15, 2018.

TABLES

Table 1 - Groundwater Data Summary
Mountaineer - Bottom Ash Pond

Parameter	Unit	MW-1601A	MW-1602	MW-1603	MW-1604D	MW-1604S	MW-1605D	MW-1605S	MW-1606D	MW-1606S	MW-1607D	MW-1607S	MW-1608
		4/9/2019	4/9/2019	4/9/2019	4/9/2019	4/9/2019	4/9/2019	4/9/2019	4/8/2019	4/8/2019	4/8/2019	4/8/2019	4/9/2019
Antimony	µg/L	0.500 U	0.500 U	0.500 U	0.500 U	0.200 J	0.0400 J	0.0500 J	0.150	0.150	0.0300 J	0.400	0.0400 J
Arsenic	µg/L	0.610	0.400 J	0.560	0.400 J	0.540	2.81	0.640	0.350	0.700	1.31	0.940	0.560
Barium	µg/L	52.0	29.0	32.4	42.5	29.1	26.4	25.2	47.3	63.1	75.7	72.7	41.2
Beryllium	µg/L	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U
Boron	mg/L	0.224	0.0900 J	0.408	2.82	3.50	6.90	9.39	7.32	7.68	3.10	2.35	0.156
Cadmium	µg/L	0.200 U	0.200 U	0.200 U	0.0500 J	0.270	0.0100 J	0.0500	0.0700	0.0700	0.0500 U	0.0400 J	0.0200 J
Calcium	mg/L	155	99.8	182	236	301	247	164	265	229	232	226	102
Chloride	mg/L	44.4	11.4	15.8	100	132	169	140	214	223	162	153	6.82
Chromium	µg/L	0.200 J	1.00 U	0.400 J	0.200 J	0.300 J	0.0600 J	0.293	0.100 J	0.0800 J	0.0700 J	0.376	0.372
Cobalt	µg/L	0.200 J	0.200 U	0.622	0.345	2.41	1.56	0.631	1.25	0.320	0.778	1.21	0.597
Combined Radium	pCi/L	1.17	1.05	2.39	0.957	1.47	0.543	0.369	0.940	0.595	1.33	0.723	0.244
Fluoride	mg/L	0.100 J	0.200	0.110	0.150	0.190	0.220	0.330	0.260	0.540	0.520	0.260	0.200
Lead	µg/L	0.500 U	0.500 U	0.500 J	0.500 U	0.500 U	0.0300 J	0.331	0.0300 J	0.107	0.0500 J	0.0900 J	0.454
Lithium	mg/L	0.0200 J	0.0200 J	0.0300	0.0380	0.0610	0.0750	0.0790	0.124	0.117	0.127	0.141	0.0100 J
Mercury	µg/L	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U
Molybdenum	µg/L	10.0 U	3.00 J	10.0 U	10.0 U	17.8	40.6	15.9	71.8	67.7	79.8	37.9	1.00 J
Selenium	µg/L	1.10	0.200 J	0.400 J	2.00	1.20	0.200	0.700	8.10	1.40	0.0500 J	7.00	1.20
Total Dissolved Solids	mg/L	692	595	918	1300	1650	1710	1450	1600	1480	1480	1310	451
Sulfate	mg/L	176	221	429	539	703	791	599	682	592	656	504	179
Thallium	µg/L	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U
pH	SU	7.14	6.62	6.80	6.92	7.14	7.31	7.19	7.19	6.81	7.39	7.23	6.86

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
SU: standard unit
U: Non-detect value. For statistical analysis, parameters which were not detected were replaced with the reporting limit.
J: Estimated value. Parameter was detected in concentrations below the reporting limit.

Table 2: Groundwater Protection Standards
Mountaineer Plant - Bottom Ash Pond

Constituent Name	MCL	CCR Rule-Specified	Background Limit
Antimony, Total (mg/L)	0.006		0.00025
Arsenic, Total (mg/L)	0.01		0.00075
Barium, Total (mg/L)	2		0.058
Beryllium, Total (mg/L)	0.004		0.00001
Cadmium, Total (mg/L)	0.005		0.00001
Chromium, Total (mg/L)	0.1		0.0018
Cobalt, Total (mg/L)	n/a	0.006	0.00076
Combined Radium, Total (pCi/L)	5		2.45
Fluoride, Total (mg/L)	4		0.28
Lead, Total (mg/L)	n/a	0.015	0.00055
Lithium, Total (mg/L)	n/a	0.04	0.027
Mercury, Total (mg/L)	0.002		0.000005
Molybdenum, Total (mg/L)	n/a	0.1	0.0042
Selenium, Total (mg/L)	0.05		0.0015
Thallium, Total (mg/L)	0.002		0.00025

Notes:
Grey cell indicates calculated UTL is higher than MCL.
MCL = Maximum Contaminant Level
Calculated UTL (Upper Tolerance Limit) represents site-specific background values.
The higher of the calculated UTL or MCL/Rule-Specified Level is used as the GWPS.

Table 3: Appendix III Data Summary
Mountaineer Plant - Bottom Ash Pond

Geosyntec Consultants, Inc.

Parameter	Units	Description	MW-1604D	MW-1604S	MW-1605D	MW-1605S	MW-1606D	MW-1606S	MW-1607D	MW-1607S
			4/9/2019	4/9/2019	4/9/2019	4/9/2019	4/8/2019	4/8/2019	4/8/2019	4/8/2019
Boron	mg/L	Interwell Background Value (UPL)	0.632							
		Detection Monitoring Result	**2.82**	**3.50**	**6.90**	**9.39**	**7.32**	**7.68**	**3.10**	**2.35**
Calcium	mg/L	Interwell Background Value (UPL)	193							
		Detection Monitoring Result	**236**	**301**	**247**	164	**265**	**229**	**232**	**226**
Chloride	mg/L	Interwell Background Value (UPL)	58.8							
		Detection Monitoring Result	**100**	**132**	**169**	**140**	**214**	**223**	**162**	**153**
Fluoride	mg/L	Interwell Background Value (UPL)	0.27							
		Detection Monitoring Result	0.15	0.19	0.22	**0.33**	0.26	**0.54**	**0.52**	0.26
pH	SU	Intrawell Background Value (UPL)	8.1	8.0	8.3	8.2	8.2	8.7	7.8	7.8
		Intrawell Background Value (LPL)	6.7	6.4	6.7	6.7	6.7	5.6	6.9	7.3
		Detection Monitoring Result	6.9	7.1	7.3	7.2	7.2	6.8	7.4	**7.2**
Sulfate	mg/L	Interwell Background Value (UPL)	681							
		Detection Monitoring Result	539	**703**	**791**	599	**682**	592	656	504
Total Dissolved Solids	mg/L	Interwell Background Value (UPL)	1054							
		Detection Monitoring Result	**1300**	**1650**	**1710**	**1450**	**1600**	**1480**	**1480**	**1310**

Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit
*: Designates results for a duplicate sample
-: Not Sampled
Bold values exceed the background value.
Background values are shaded gray.

ATTACHMENT A

Certification by Qualified Professional Engineer

Certification by Qualified Professional Engineer

I certify that the selected and above described statistical method is appropriate for evaluating the groundwater monitoring data for the Mountaineer Bottom Ash Pond CCR management area and that the requirements of 40 CFR 257.93(f) have been met.

DAVID ANTHONY MILLER

Printed Name of Licensed Professional Engineer

David Anthony Miller

Signature

22663	WEST VIRGINIA	07.12.19
License Number	Licensing State	Date

ATTACHMENT B
Statistical Analysis Output

GROUNDWATER STATS CONSULTING

July 10, 2019

Geosyntec Consultants
Attn: Ms. Allison Kreinberg
941 Chatham Lane, #103
Columbus, OH 43221

Re: Mountaineer BAP
Assessment Monitoring Event – April 2019

Groundwater Stats Consulting, formerly the statistical consulting division of Sanitas Technologies, is pleased to provide the statistical analysis of the April 2019 groundwater data for American Electric Power Inc.'s Mountaineer Bottom Ash Pond. The analysis complies with the federal rule for the Disposal of Coal Combustion Residuals from Electric Utilities (CCR Rule, 2015) as well as with the USEPA Unified Guidance (2009).

Sampling began at the site for the CCR program in 2016. The monitoring well network, as provided by Geosyntec Consultants, consists of the following:

- **Upgradient wells:** MW-1601A, MW-1602, MW-1603, MW-1608; and
- **Downgradient wells:** MW-1604D, MW-1604S, MW-1605D, MW-1605S, MW-1606D, MW-1606S, MW-1607D, MW-1607S.

Data were sent electronically, and the statistical analysis was conducted according to the Statistical Analysis Plan and screening evaluation prepared by GSC and approved by Dr. Kirk Cameron, PhD Statistician with MacStat Consulting, primary author of the USEPA Unified Guidance, and Senior Advisor to GSC.

The CCR program consists of the following constituents:

- **Appendix III** (Detection Monitoring) **-** boron, calcium, chloride, fluoride, pH, sulfate, and TDS;

- **Appendix IV** (Assessment Monitoring) **–** antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, combined radium 226 + 228, fluoride, lead, lithium, mercury, molybdenum, selenium, and thallium.

Time series plots for Appendix III and IV parameters are provided for all wells and constituents; and are used to evaluate concentrations over the entire record (Figure A). Values previously flagged during the screening as outliers may be seen in a lighter font and disconnected symbol on the time series graphs. A summary of outliers follows this letter (Figure B).

Evaluation of Appendix III Parameters

Interwell prediction limits combined with a 1-of-2 verification strategy were constructed for boron, calcium, chloride, fluoride, sulfate and TDS; and intrawell prediction limits combined with a 1-of-2 verification strategy were constructed for pH (Figures C and D, respectively). The statistical method selected for each parameter was determined based on the results of the evaluation performed in December 2017; and all proposed background data were screened for outliers and trends at that time. The findings of those reports were submitted with that analysis.

Interwell prediction limits utilize all upgradient well data for construction of statistical limits. During each sample event, upgradient well data are screened for any newly suspected outliers or obvious trending patterns using time series plots. All values flagged as outliers may be seen on the Outlier Summary report following this letter. No obvious trending patterns were observed in the upgradient wells.

Intrawell prediction limits utilize the background data set that was originally screened in 2017. As recommended in the EPA Unified Guidance (2009), the background data set will be tested for the purpose of updating statistical limits using the Mann-Whitney two-sample test when an additional four to eight measurements are available.

In the event of an initial exceedance of compliance well data, the 1-of-2 resample plan allows for collection of one additional sample to determine whether the initial exceedance is confirmed. When the resample confirms the initial exceedance, a statistically significant increase (SSI) is identified and further research would be required to identify the cause of the exceedance (i.e. impact from the site, natural variation, or an off-site source). If the resample falls within the statistical limit, the initial exceedance is considered a false positive result and, therefore, no further action is necessary. Prediction limit exceedances were noted for several of the downgradient wells for

boron, calcium, chloride, fluoride, pH, sulfate and TDS. Prediction Limit Summary tables follow this letter.

When a statistically significant increase is identified, the data are further evaluated using the Sen's Slope/Mann Kendall trend test to determine whether concentrations are statistically increasing, decreasing or stable (Figure E). Upgradient wells are included in the trend analyses to identify whether similar patterns exist upgradient of the site which is an indication of natural variability in groundwater unrelated to practices at the site.

Statistically significant increasing trends were found for several constituents in both upgradient and downgradient wells. For the statistically significant increasing trend noted for calcium in well MW-1607S, with the exception of the most recent sample, historical concentrations are similar and, in some cases, lower than those reported in upgradient wells. Further research beyond the scope of this analysis would be required to identify the cause for any changing groundwater concentrations in downgradient wells (i.e. result of practices at the site, natural variation, or an off-site source). A Trend Test summary table follows this letter.

Evaluation of Appendix IV Parameters

Interwell Tolerance limits were used to calculate background limits from all available pooled upgradient well data for Appendix IV parameters to determine the Alternate Contaminant Level (ACL) for each constituent (Figure F). Background data are screened for outliers and extreme trending patterns that would lead to artificially elevated statistical limits. Any flagged values may be seen on the Outlier Summary following this letter.

Parametric limits use a target of 95% confidence and 95% coverage. The confidence and coverage levels for nonparametric tolerance limits are dependent upon the number of background samples. These limits were compared to the Maximum Contaminant Levels (MCLs) and CCR-Rule specified levels in the Groundwater Protection Standard (GWPS) table following this letter to determine the highest limit for use as the GWPS in the Confidence Interval comparisons (Figure G).

Confidence intervals were then constructed on downgradient wells for each of the Appendix IV parameters using the highest limit of either the MCL, CCR-rule specified, or ACL as discussed above (Figure H). Only when the entire confidence interval is above a GWPS is the well/constituent pair considered to exceed its respective standard. No confidence interval exceedances were found except for lithium in wells MW-1605D,

MW1605S, MW-1606D, MW-1606S, MW-1607D and MW-1607S. A summary of the confidence interval results follows this letter.

Thank you for the opportunity to assist you in the statistical analysis of groundwater quality for the Mountaineer BAP. If you have any questions or comments, please feel free to contact me.

For Groundwater Stats Consulting,

Kristina L. Rayner
Groundwater Statistician

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

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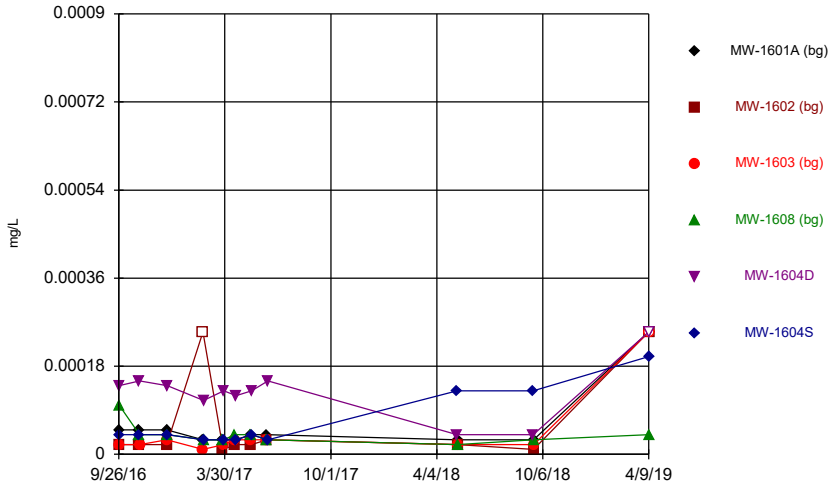

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Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

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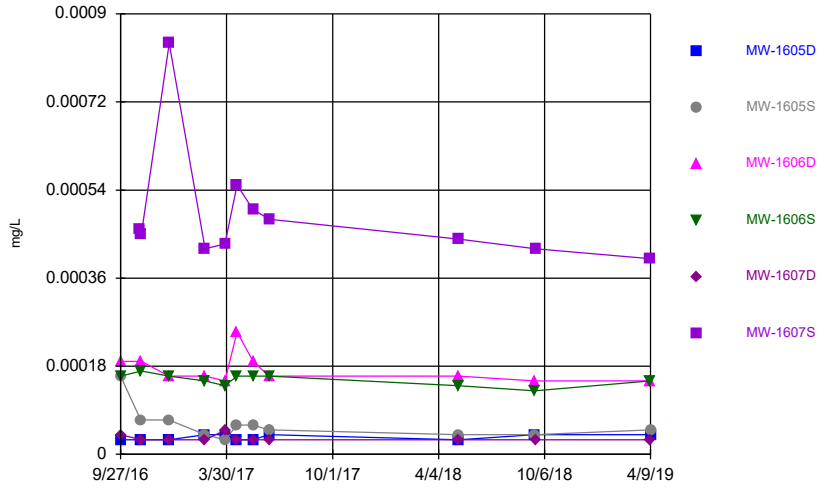

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Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

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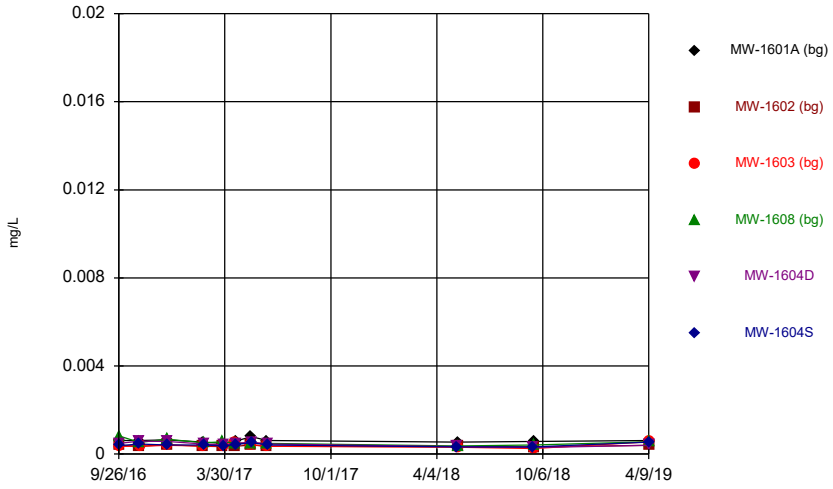

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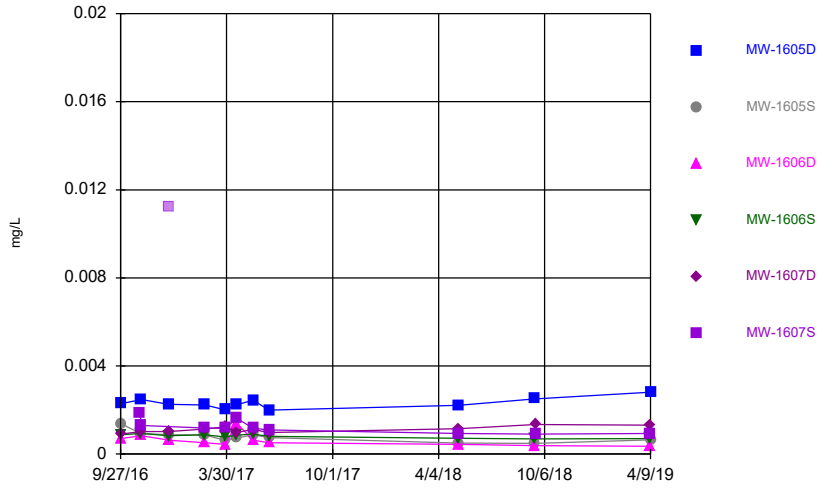

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Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

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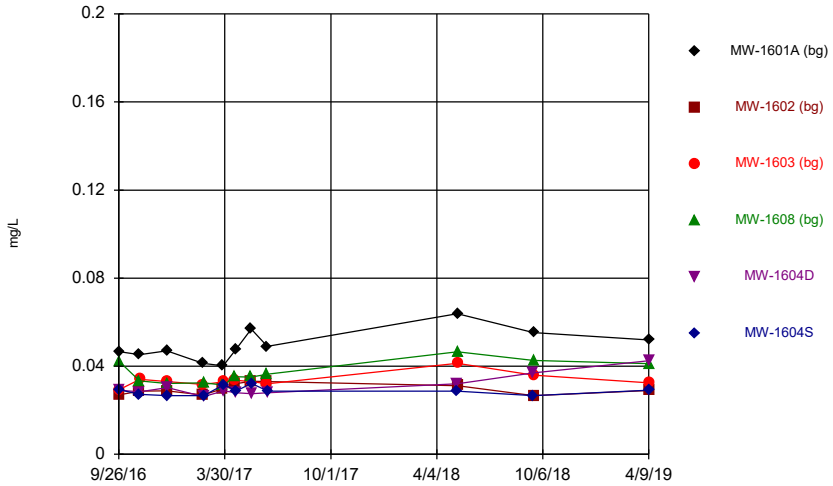

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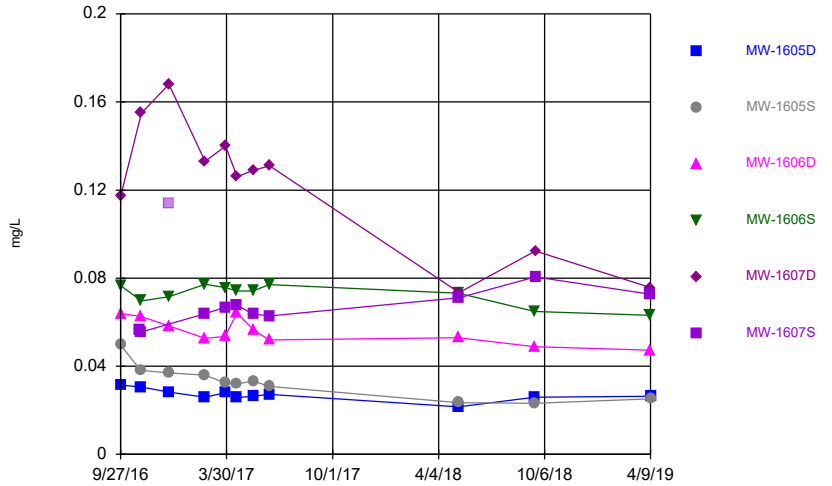

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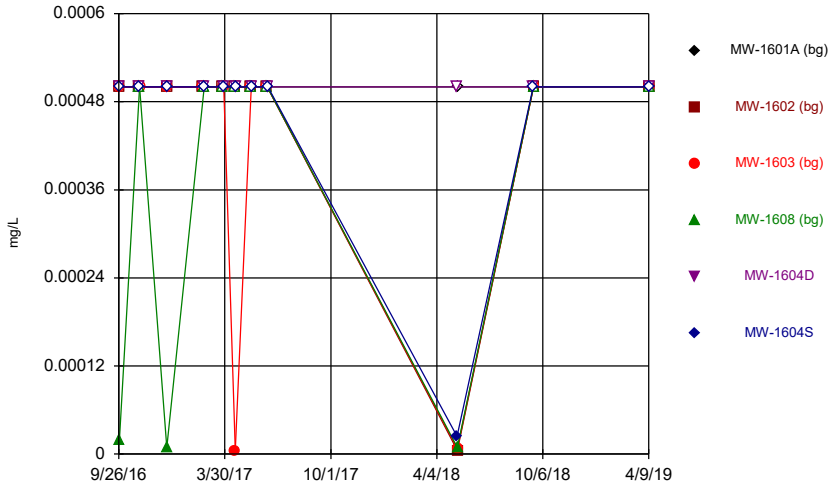

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Hollow symbols indicate censored values.

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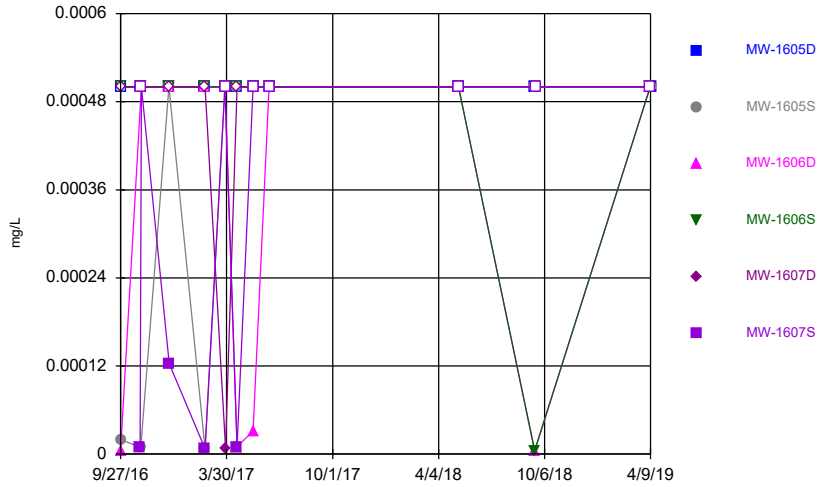

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Hollow symbols indicate censored values.

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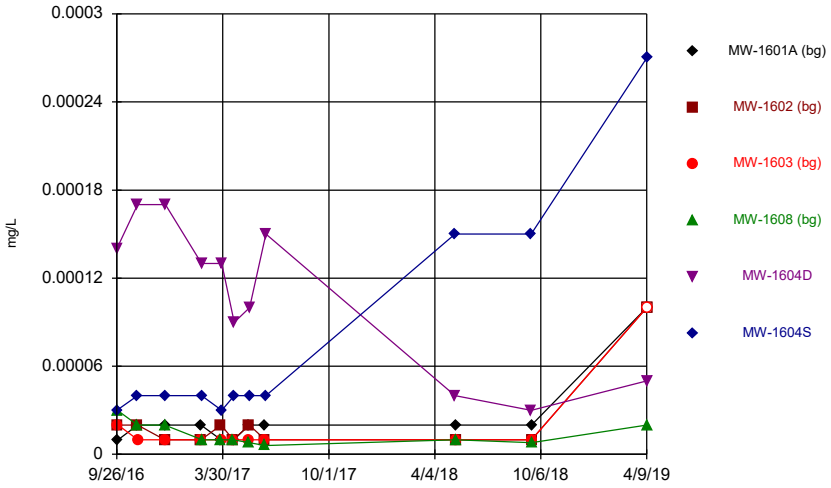

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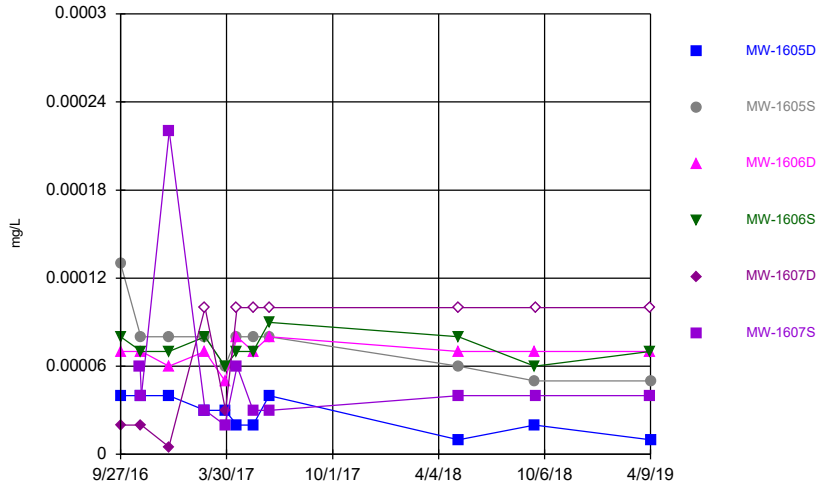

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Hollow symbols indicate censored values.

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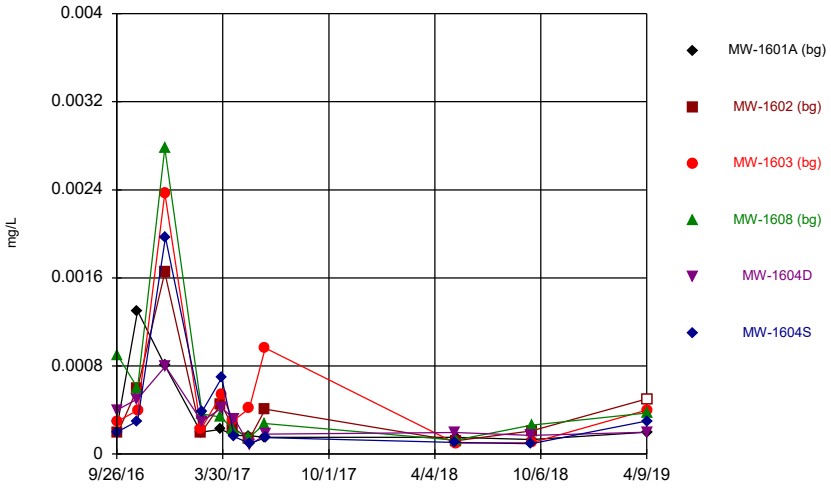

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Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

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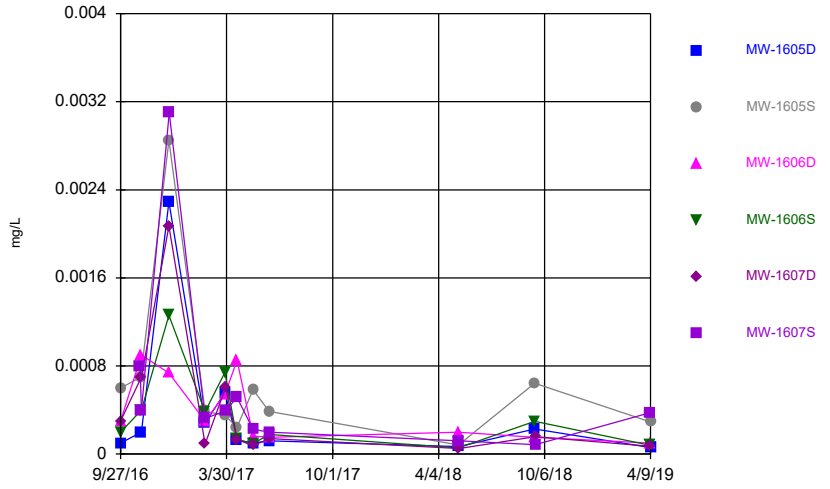

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Hollow symbols indicate censored values.

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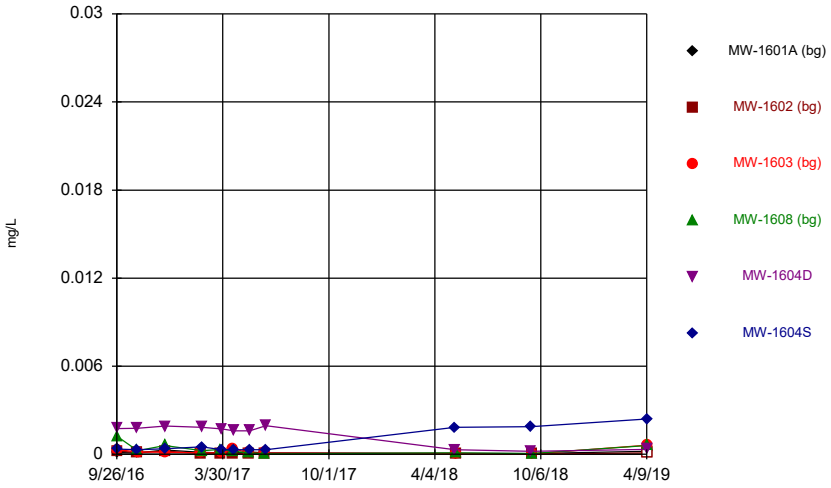

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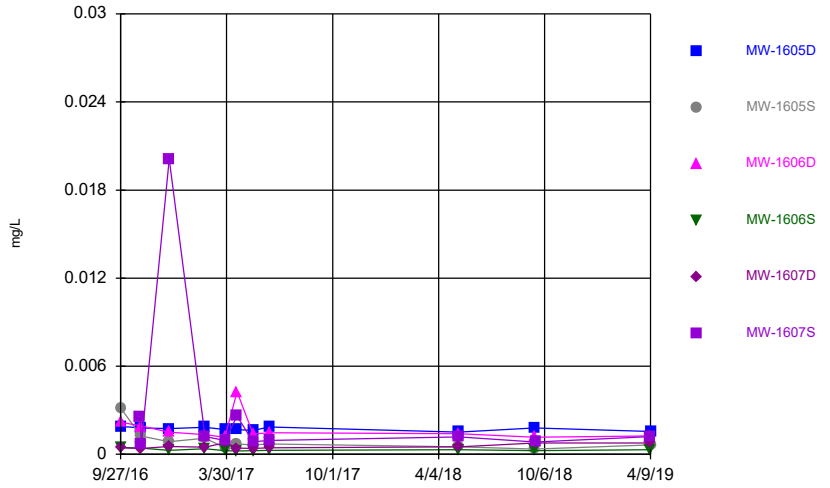
Time Series



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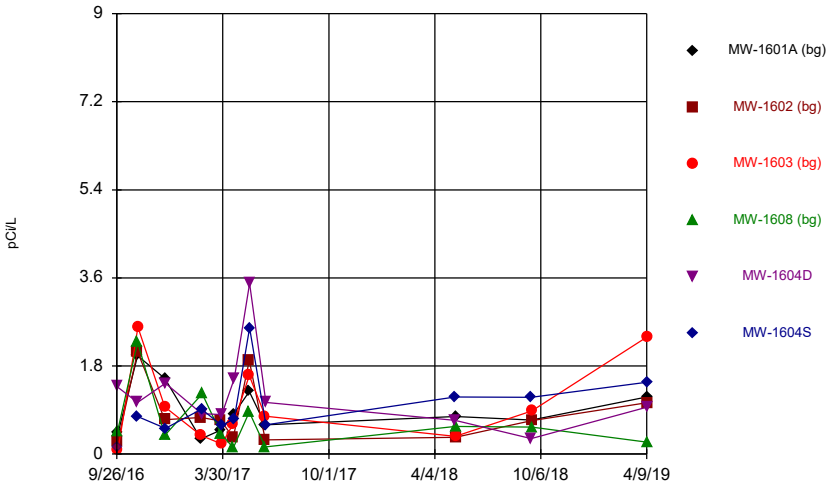
Time Series



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Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

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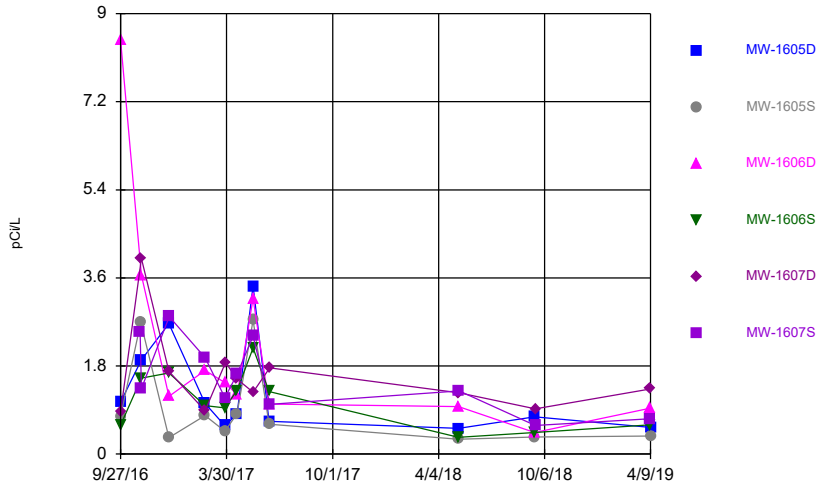

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Hollow symbols indicate censored values.

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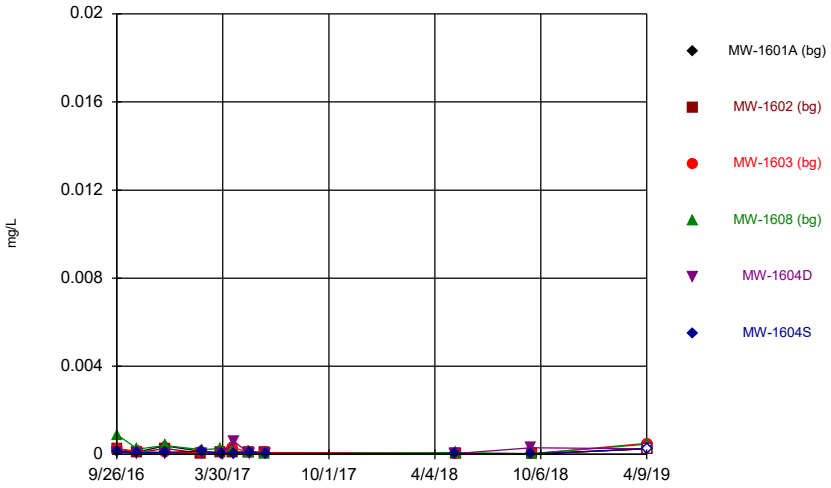

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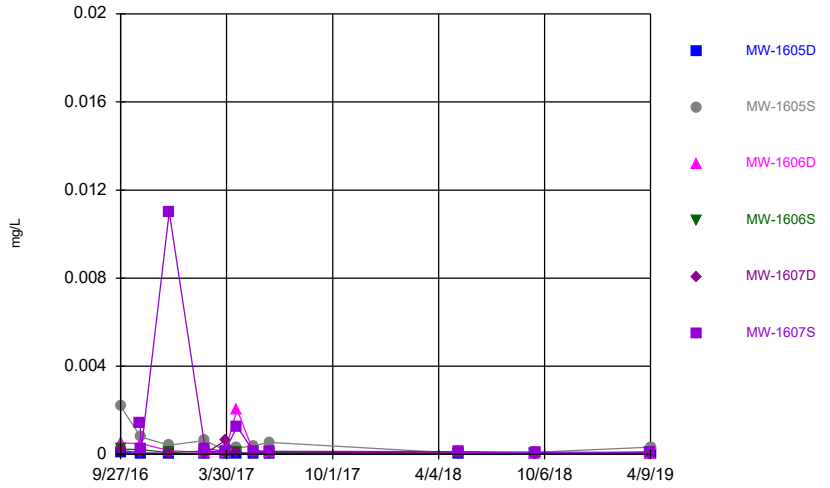

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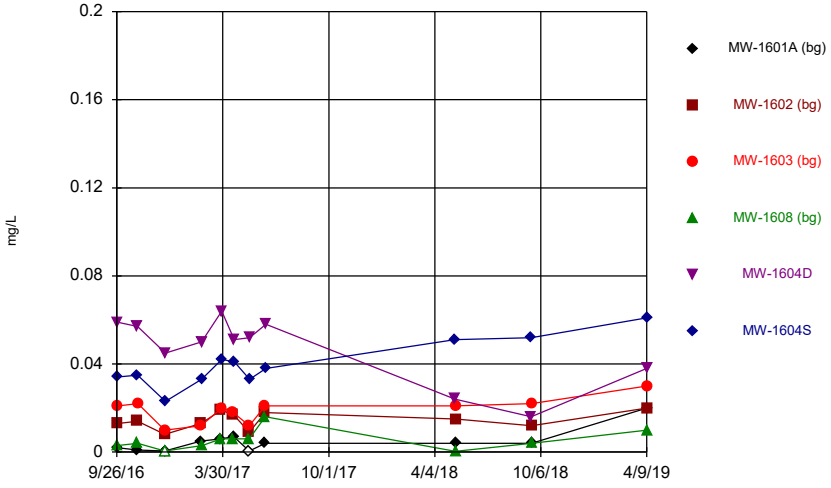

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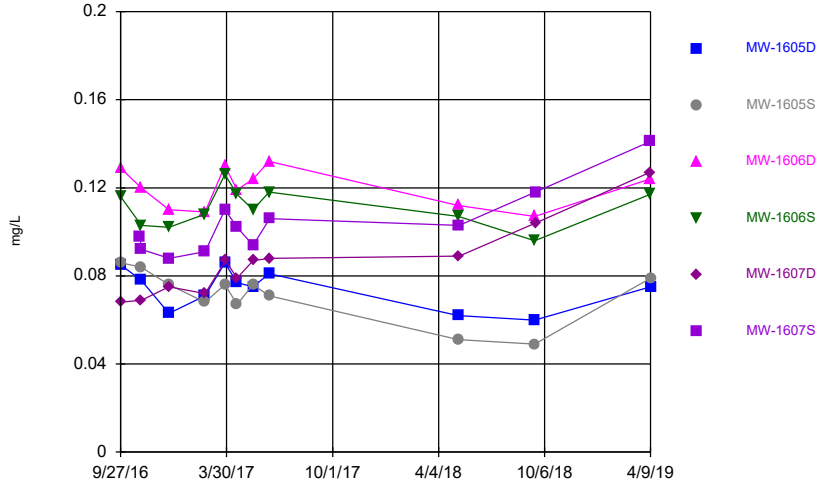
Time Series



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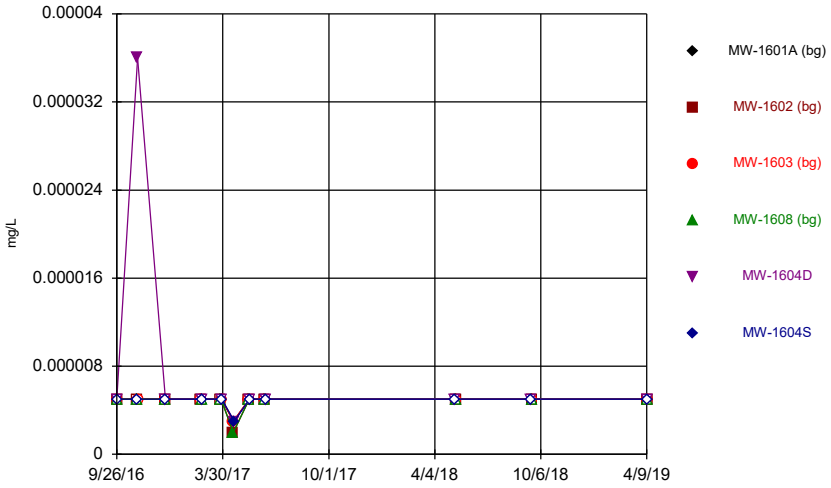
Hollow symbols indicate censored values.

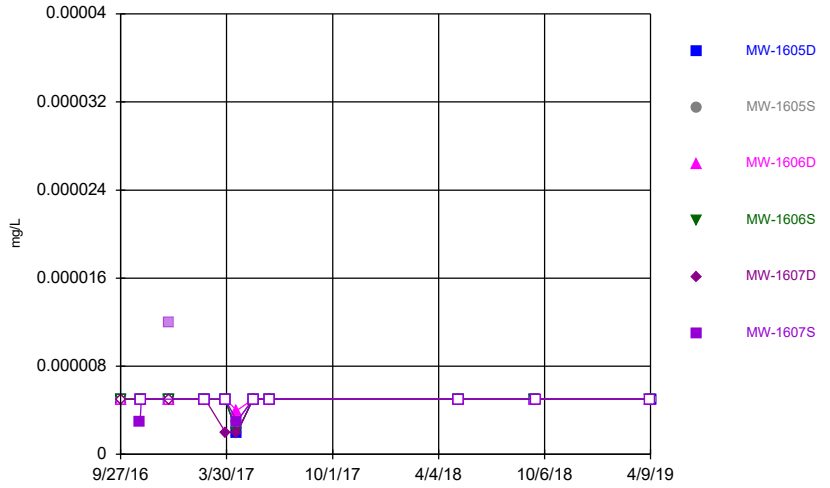
Time Series



Constituent: Mercury, total Analysis Run 6/23/2019 12:52 PM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



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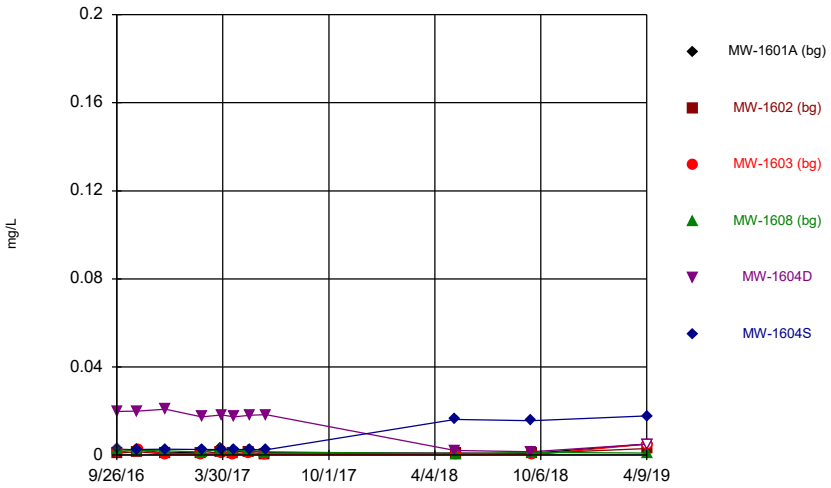
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

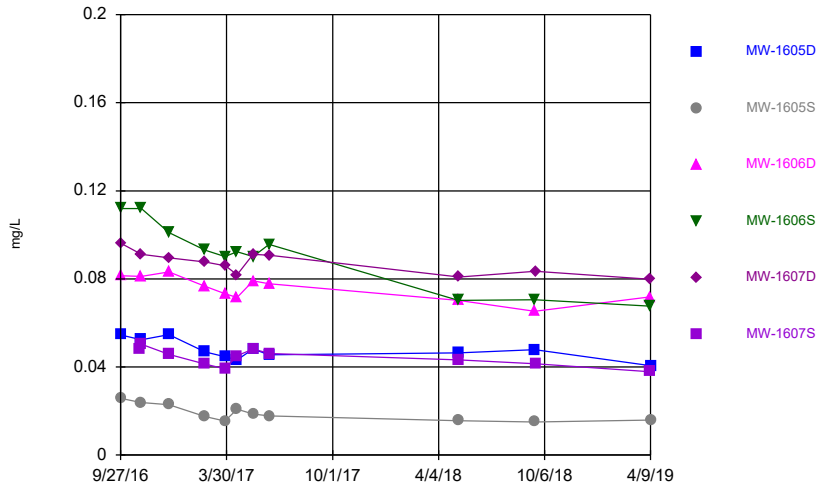
Time Series



Constituent: Molybdenum, total Analysis Run 6/23/2019 12:52 PM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series



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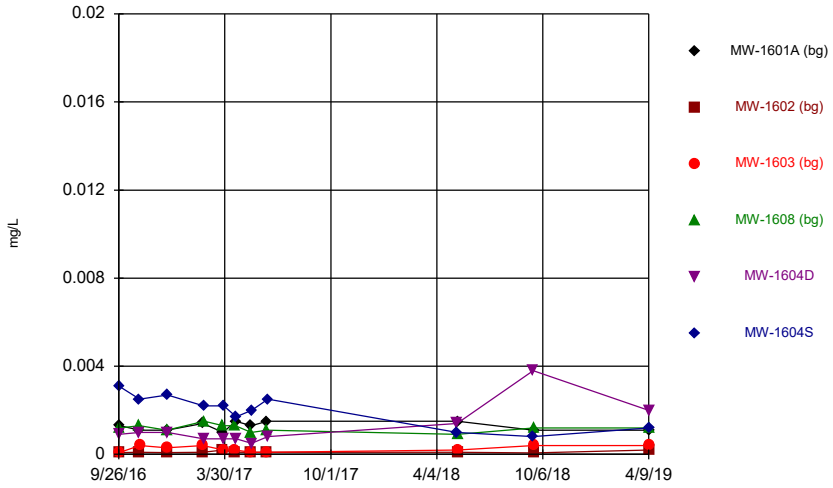
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series



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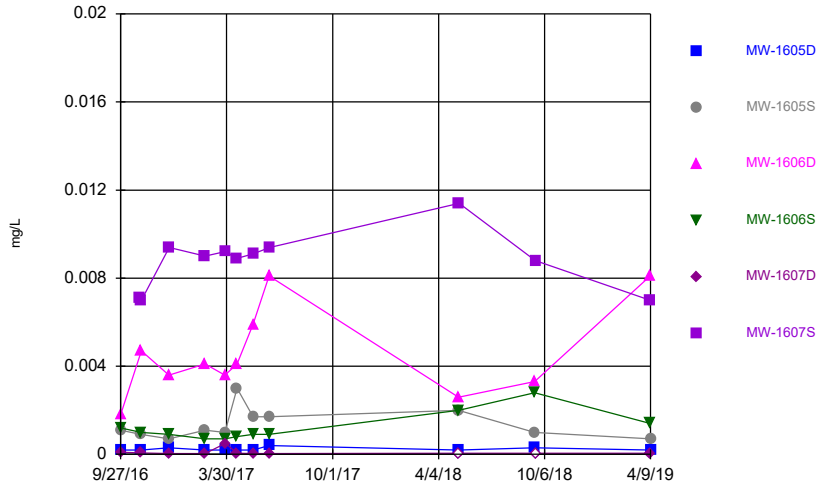
Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



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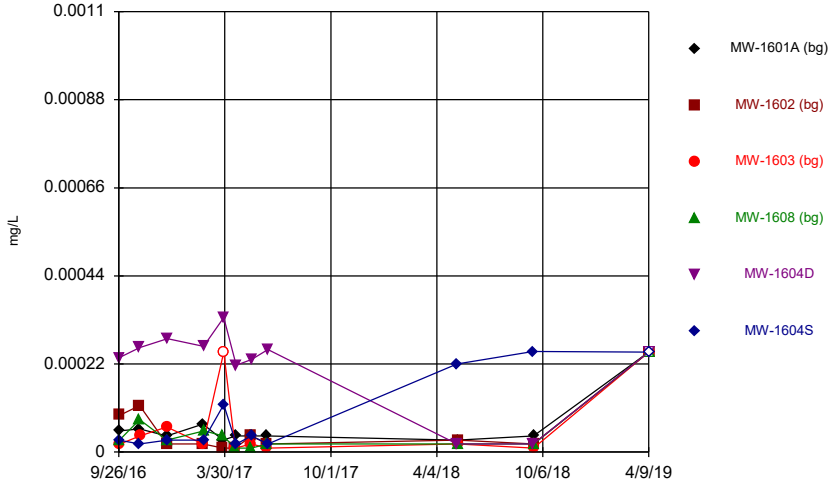
Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



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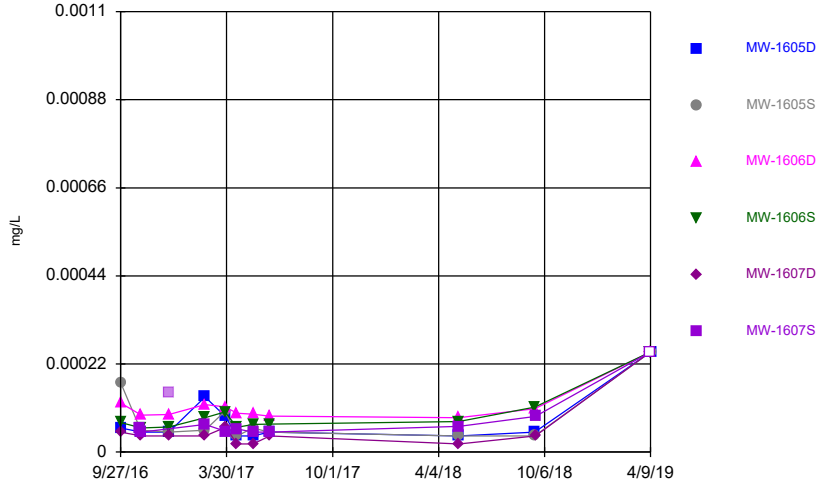
Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



Constituent: Thallium, total Analysis Run 6/23/2019 12:52 PM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Outlier Summary Table

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 7/3/2019, 10:01 a.m.

	MW-1607S Arsenic, total (mg/L)	MW-1607S Barium, total (mg/L)	MW-1604S Combined Radium 226 + 228 (pCi/L)	MW-1607S Mercury, total (mg/L)	MW-1604S Molybdenum, total (mg/L)	MW-1607D pH, field (SU)	MW-1607S pH, field (SU)	MW-1607S Thallium, total (mg/L)	MW-1606S Total Dissolved Solids [TDS] (mg/L)
9/26/2016			0.136 (o)		0.0032 (o)				
12/21/2016	0.0112 (o)	0.114 (o)		1.2E-05 (o)				0.00015 (o)	
5/16/2017						8.41 (o)	8.23 (o)		3230 (o)

Interwell Prediction Limit Summary - Significant Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 6/30/2019, 6:31 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron, total (mg/L)	MW-1604D	0.6322	n/a	4/9/2019	2.82	Yes	40	0.6145	0.1211	0	None	x^(1/3)	0.0009403	Param Inter 1 of 2
Boron, total (mg/L)	MW-1604S	0.6322	n/a	4/9/2019	3.5	Yes	40	0.6145	0.1211	0	None	x^(1/3)	0.0009403	Param Inter 1 of 2
Boron, total (mg/L)	MW-1605D	0.6322	n/a	4/9/2019	6.9	Yes	40	0.6145	0.1211	0	None	x^(1/3)	0.0009403	Param Inter 1 of 2
Boron, total (mg/L)	MW-1605S	0.6322	n/a	4/9/2019	9.39	Yes	40	0.6145	0.1211	0	None	x^(1/3)	0.0009403	Param Inter 1 of 2
Boron, total (mg/L)	MW-1606D	0.6322	n/a	4/8/2019	7.32	Yes	40	0.6145	0.1211	0	None	x^(1/3)	0.0009403	Param Inter 1 of 2
Boron, total (mg/L)	MW-1606S	0.6322	n/a	4/8/2019	7.68	Yes	40	0.6145	0.1211	0	None	x^(1/3)	0.0009403	Param Inter 1 of 2
Boron, total (mg/L)	MW-1607D	0.6322	n/a	4/8/2019	3.1	Yes	40	0.6145	0.1211	0	None	x^(1/3)	0.0009403	Param Inter 1 of 2
Boron, total (mg/L)	MW-1607S	0.6322	n/a	4/8/2019	2.35	Yes	40	0.6145	0.1211	0	None	x^(1/3)	0.0009403	Param Inter 1 of 2
Calcium, total (mg/L)	MW-1604D	193.4	n/a	4/9/2019	236	Yes	40	121.1	35.96	0	None	No	0.0009403	Param Inter 1 of 2
Calcium, total (mg/L)	MW-1604S	193.4	n/a	4/9/2019	301	Yes	40	121.1	35.96	0	None	No	0.0009403	Param Inter 1 of 2
Calcium, total (mg/L)	MW-1605D	193.4	n/a	4/9/2019	247	Yes	40	121.1	35.96	0	None	No	0.0009403	Param Inter 1 of 2
Calcium, total (mg/L)	MW-1606D	193.4	n/a	4/8/2019	265	Yes	40	121.1	35.96	0	None	No	0.0009403	Param Inter 1 of 2
Calcium, total (mg/L)	MW-1606S	193.4	n/a	4/8/2019	229	Yes	40	121.1	35.96	0	None	No	0.0009403	Param Inter 1 of 2
Calcium, total (mg/L)	MW-1607D	193.4	n/a	4/8/2019	232	Yes	40	121.1	35.96	0	None	No	0.0009403	Param Inter 1 of 2
Calcium, total (mg/L)	MW-1607S	193.4	n/a	4/8/2019	226	Yes	40	121.1	35.96	0	None	No	0.0009403	Param Inter 1 of 2
Chloride, total (mg/L)	MW-1604D	58.8	n/a	4/9/2019	100	Yes	40	2.553	0.6638	0	None	x^(1/3)	0.0009403	Param Inter 1 of 2
Chloride, total (mg/L)	MW-1604S	58.8	n/a	4/9/2019	132	Yes	40	2.553	0.6638	0	None	x^(1/3)	0.0009403	Param Inter 1 of 2
Chloride, total (mg/L)	MW-1605D	58.8	n/a	4/9/2019	169	Yes	40	2.553	0.6638	0	None	x^(1/3)	0.0009403	Param Inter 1 of 2
Chloride, total (mg/L)	MW-1605S	58.8	n/a	4/9/2019	140	Yes	40	2.553	0.6638	0	None	x^(1/3)	0.0009403	Param Inter 1 of 2
Chloride, total (mg/L)	MW-1606D	58.8	n/a	4/8/2019	214	Yes	40	2.553	0.6638	0	None	x^(1/3)	0.0009403	Param Inter 1 of 2
Chloride, total (mg/L)	MW-1606S	58.8	n/a	4/8/2019	223	Yes	40	2.553	0.6638	0	None	x^(1/3)	0.0009403	Param Inter 1 of 2
Chloride, total (mg/L)	MW-1607D	58.8	n/a	4/8/2019	162	Yes	40	2.553	0.6638	0	None	x^(1/3)	0.0009403	Param Inter 1 of 2
Chloride, total (mg/L)	MW-1607S	58.8	n/a	4/8/2019	153	Yes	40	2.553	0.6638	0	None	x^(1/3)	0.0009403	Param Inter 1 of 2
Fluoride, total (mg/L)	MW-1605S	0.2718	n/a	4/9/2019	0.33	Yes	44	0.03409	0.01991	0	None	x^2	0.0009403	Param Inter 1 of 2
Fluoride, total (mg/L)	MW-1606S	0.2718	n/a	4/8/2019	0.54	Yes	44	0.03409	0.01991	0	None	x^2	0.0009403	Param Inter 1 of 2
Fluoride, total (mg/L)	MW-1607D	0.2718	n/a	4/8/2019	0.52	Yes	44	0.03409	0.01991	0	None	x^2	0.0009403	Param Inter 1 of 2
Sulfate, total (mg/L)	MW-1604S	680.5	n/a	4/9/2019	703	Yes	40	5.35	0.5827	0	None	ln(x)	0.0009403	Param Inter 1 of 2
Sulfate, total (mg/L)	MW-1605D	680.5	n/a	4/9/2019	791	Yes	40	5.35	0.5827	0	None	ln(x)	0.0009403	Param Inter 1 of 2
Sulfate, total (mg/L)	MW-1606D	680.5	n/a	4/8/2019	682	Yes	40	5.35	0.5827	0	None	ln(x)	0.0009403	Param Inter 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1604D	1054	n/a	4/9/2019	1300	Yes	40	6.35	0.3033	0	None	ln(x)	0.0009403	Param Inter 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1604S	1054	n/a	4/9/2019	1650	Yes	40	6.35	0.3033	0	None	ln(x)	0.0009403	Param Inter 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1605D	1054	n/a	4/9/2019	1710	Yes	40	6.35	0.3033	0	None	ln(x)	0.0009403	Param Inter 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1605S	1054	n/a	4/9/2019	1450	Yes	40	6.35	0.3033	0	None	ln(x)	0.0009403	Param Inter 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1606D	1054	n/a	4/8/2019	1600	Yes	40	6.35	0.3033	0	None	ln(x)	0.0009403	Param Inter 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1606S	1054	n/a	4/8/2019	1480	Yes	40	6.35	0.3033	0	None	ln(x)	0.0009403	Param Inter 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1607D	1054	n/a	4/8/2019	1480	Yes	40	6.35	0.3033	0	None	ln(x)	0.0009403	Param Inter 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1607S	1054	n/a	4/8/2019	1310	Yes	40	6.35	0.3033	0	None	ln(x)	0.0009403	Param Inter 1 of 2

Interwell Prediction Limit Summary - All Results

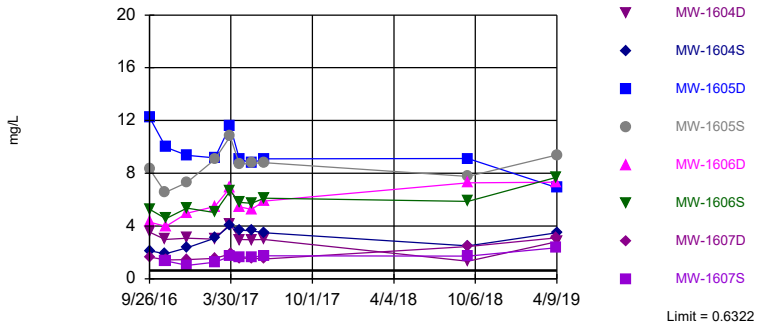
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 6/30/2019, 6:31 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron, total (mg/L)	**MW-1604D**	**0.6322**	**n/a**	**4/9/2019**	**2.82**	**Yes**	**40**	**0.6145**	**0.1211**	**0**	**None**	**x^(1/3)**	**0.0009403**	**Param Inter 1 of 2**
Boron, total (mg/L)	**MW-1604S**	**0.6322**	**n/a**	**4/9/2019**	**3.5**	**Yes**	**40**	**0.6145**	**0.1211**	**0**	**None**	**x^(1/3)**	**0.0009403**	**Param Inter 1 of 2**
Boron, total (mg/L)	**MW-1605D**	**0.6322**	**n/a**	**4/9/2019**	**6.9**	**Yes**	**40**	**0.6145**	**0.1211**	**0**	**None**	**x^(1/3)**	**0.0009403**	**Param Inter 1 of 2**
Boron, total (mg/L)	**MW-1605S**	**0.6322**	**n/a**	**4/9/2019**	**9.39**	**Yes**	**40**	**0.6145**	**0.1211**	**0**	**None**	**x^(1/3)**	**0.0009403**	**Param Inter 1 of 2**
Boron, total (mg/L)	**MW-1606D**	**0.6322**	**n/a**	**4/8/2019**	**7.32**	**Yes**	**40**	**0.6145**	**0.1211**	**0**	**None**	**x^(1/3)**	**0.0009403**	**Param Inter 1 of 2**
Boron, total (mg/L)	**MW-1606S**	**0.6322**	**n/a**	**4/8/2019**	**7.68**	**Yes**	**40**	**0.6145**	**0.1211**	**0**	**None**	**x^(1/3)**	**0.0009403**	**Param Inter 1 of 2**
Boron, total (mg/L)	**MW-1607D**	**0.6322**	**n/a**	**4/8/2019**	**3.1**	**Yes**	**40**	**0.6145**	**0.1211**	**0**	**None**	**x^(1/3)**	**0.0009403**	**Param Inter 1 of 2**
Boron, total (mg/L)	**MW-1607S**	**0.6322**	**n/a**	**4/8/2019**	**2.35**	**Yes**	**40**	**0.6145**	**0.1211**	**0**	**None**	**x^(1/3)**	**0.0009403**	**Param Inter 1 of 2**
Calcium, total (mg/L)	**MW-1604D**	**193.4**	**n/a**	**4/9/2019**	**236**	**Yes**	**40**	**121.1**	**35.96**	**0**	**None**	**No**	**0.0009403**	**Param Inter 1 of 2**
Calcium, total (mg/L)	**MW-1604S**	**193.4**	**n/a**	**4/9/2019**	**301**	**Yes**	**40**	**121.1**	**35.96**	**0**	**None**	**No**	**0.0009403**	**Param Inter 1 of 2**
Calcium, total (mg/L)	**MW-1605D**	**193.4**	**n/a**	**4/9/2019**	**247**	**Yes**	**40**	**121.1**	**35.96**	**0**	**None**	**No**	**0.0009403**	**Param Inter 1 of 2**
Calcium, total (mg/L)	MW-1605S	193.4	n/a	4/9/2019	164	No	40	121.1	35.96	0	None	No	0.0009403	Param Inter 1 of 2
Calcium, total (mg/L)	**MW-1606D**	**193.4**	**n/a**	**4/8/2019**	**265**	**Yes**	**40**	**121.1**	**35.96**	**0**	**None**	**No**	**0.0009403**	**Param Inter 1 of 2**
Calcium, total (mg/L)	**MW-1606S**	**193.4**	**n/a**	**4/8/2019**	**229**	**Yes**	**40**	**121.1**	**35.96**	**0**	**None**	**No**	**0.0009403**	**Param Inter 1 of 2**
Calcium, total (mg/L)	**MW-1607D**	**193.4**	**n/a**	**4/8/2019**	**232**	**Yes**	**40**	**121.1**	**35.96**	**0**	**None**	**No**	**0.0009403**	**Param Inter 1 of 2**
Calcium, total (mg/L)	**MW-1607S**	**193.4**	**n/a**	**4/8/2019**	**226**	**Yes**	**40**	**121.1**	**35.96**	**0**	**None**	**No**	**0.0009403**	**Param Inter 1 of 2**
Chloride, total (mg/L)	**MW-1604D**	**58.8**	**n/a**	**4/9/2019**	**100**	**Yes**	**40**	**2.553**	**0.6638**	**0**	**None**	**x^(1/3)**	**0.0009403**	**Param Inter 1 of 2**
Chloride, total (mg/L)	**MW-1604S**	**58.8**	**n/a**	**4/9/2019**	**132**	**Yes**	**40**	**2.553**	**0.6638**	**0**	**None**	**x^(1/3)**	**0.0009403**	**Param Inter 1 of 2**
Chloride, total (mg/L)	**MW-1605D**	**58.8**	**n/a**	**4/9/2019**	**169**	**Yes**	**40**	**2.553**	**0.6638**	**0**	**None**	**x^(1/3)**	**0.0009403**	**Param Inter 1 of 2**
Chloride, total (mg/L)	**MW-1605S**	**58.8**	**n/a**	**4/9/2019**	**140**	**Yes**	**40**	**2.553**	**0.6638**	**0**	**None**	**x^(1/3)**	**0.0009403**	**Param Inter 1 of 2**
Chloride, total (mg/L)	**MW-1606D**	**58.8**	**n/a**	**4/8/2019**	**214**	**Yes**	**40**	**2.553**	**0.6638**	**0**	**None**	**x^(1/3)**	**0.0009403**	**Param Inter 1 of 2**
Chloride, total (mg/L)	**MW-1606S**	**58.8**	**n/a**	**4/8/2019**	**223**	**Yes**	**40**	**2.553**	**0.6638**	**0**	**None**	**x^(1/3)**	**0.0009403**	**Param Inter 1 of 2**
Chloride, total (mg/L)	**MW-1607D**	**58.8**	**n/a**	**4/8/2019**	**162**	**Yes**	**40**	**2.553**	**0.6638**	**0**	**None**	**x^(1/3)**	**0.0009403**	**Param Inter 1 of 2**
Chloride, total (mg/L)	**MW-1607S**	**58.8**	**n/a**	**4/8/2019**	**153**	**Yes**	**40**	**2.553**	**0.6638**	**0**	**None**	**x^(1/3)**	**0.0009403**	**Param Inter 1 of 2**
Fluoride, total (mg/L)	MW-1604D	0.2718	n/a	4/9/2019	0.15	No	44	0.03409	0.01991	0	None	x^2	0.0009403	Param Inter 1 of 2
Fluoride, total (mg/L)	MW-1604S	0.2718	n/a	4/9/2019	0.19	No	44	0.03409	0.01991	0	None	x^2	0.0009403	Param Inter 1 of 2
Fluoride, total (mg/L)	MW-1605D	0.2718	n/a	4/9/2019	0.22	No	44	0.03409	0.01991	0	None	x^2	0.0009403	Param Inter 1 of 2
Fluoride, total (mg/L)	**MW-1605S**	**0.2718**	**n/a**	**4/9/2019**	**0.33**	**Yes**	**44**	**0.03409**	**0.01991**	**0**	**None**	**x^2**	**0.0009403**	**Param Inter 1 of 2**
Fluoride, total (mg/L)	MW-1606D	0.2718	n/a	4/8/2019	0.26	No	44	0.03409	0.01991	0	None	x^2	0.0009403	Param Inter 1 of 2
Fluoride, total (mg/L)	**MW-1606S**	**0.2718**	**n/a**	**4/8/2019**	**0.54**	**Yes**	**44**	**0.03409**	**0.01991**	**0**	**None**	**x^2**	**0.0009403**	**Param Inter 1 of 2**
Fluoride, total (mg/L)	**MW-1607D**	**0.2718**	**n/a**	**4/8/2019**	**0.52**	**Yes**	**44**	**0.03409**	**0.01991**	**0**	**None**	**x^2**	**0.0009403**	**Param Inter 1 of 2**
Fluoride, total (mg/L)	MW-1607S	0.2718	n/a	4/8/2019	0.26	No	44	0.03409	0.01991	0	None	x^2	0.0009403	Param Inter 1 of 2
Sulfate, total (mg/L)	MW-1604D	680.5	n/a	4/9/2019	539	No	40	5.35	0.5827	0	None	ln(x)	0.0009403	Param Inter 1 of 2
Sulfate, total (mg/L)	**MW-1604S**	**680.5**	**n/a**	**4/9/2019**	**703**	**Yes**	**40**	**5.35**	**0.5827**	**0**	**None**	**ln(x)**	**0.0009403**	**Param Inter 1 of 2**
Sulfate, total (mg/L)	**MW-1605D**	**680.5**	**n/a**	**4/9/2019**	**791**	**Yes**	**40**	**5.35**	**0.5827**	**0**	**None**	**ln(x)**	**0.0009403**	**Param Inter 1 of 2**
Sulfate, total (mg/L)	MW-1605S	680.5	n/a	4/9/2019	599	No	40	5.35	0.5827	0	None	ln(x)	0.0009403	Param Inter 1 of 2
Sulfate, total (mg/L)	**MW-1606D**	**680.5**	**n/a**	**4/8/2019**	**682**	**Yes**	**40**	**5.35**	**0.5827**	**0**	**None**	**ln(x)**	**0.0009403**	**Param Inter 1 of 2**
Sulfate, total (mg/L)	MW-1606S	680.5	n/a	4/8/2019	592	No	40	5.35	0.5827	0	None	ln(x)	0.0009403	Param Inter 1 of 2
Sulfate, total (mg/L)	MW-1607D	680.5	n/a	4/8/2019	656	No	40	5.35	0.5827	0	None	ln(x)	0.0009403	Param Inter 1 of 2
Sulfate, total (mg/L)	MW-1607S	680.5	n/a	4/8/2019	504	No	40	5.35	0.5827	0	None	ln(x)	0.0009403	Param Inter 1 of 2
Total Dissolved Solids [TDS] (mg/L)	**MW-1604D**	**1054**	**n/a**	**4/9/2019**	**1300**	**Yes**	**40**	**6.35**	**0.3033**	**0**	**None**	**ln(x)**	**0.0009403**	**Param Inter 1 of 2**
Total Dissolved Solids [TDS] (mg/L)	**MW-1604S**	**1054**	**n/a**	**4/9/2019**	**1650**	**Yes**	**40**	**6.35**	**0.3033**	**0**	**None**	**ln(x)**	**0.0009403**	**Param Inter 1 of 2**
Total Dissolved Solids [TDS] (mg/L)	**MW-1605D**	**1054**	**n/a**	**4/9/2019**	**1710**	**Yes**	**40**	**6.35**	**0.3033**	**0**	**None**	**ln(x)**	**0.0009403**	**Param Inter 1 of 2**
Total Dissolved Solids [TDS] (mg/L)	**MW-1605S**	**1054**	**n/a**	**4/9/2019**	**1450**	**Yes**	**40**	**6.35**	**0.3033**	**0**	**None**	**ln(x)**	**0.0009403**	**Param Inter 1 of 2**
Total Dissolved Solids [TDS] (mg/L)	**MW-1606D**	**1054**	**n/a**	**4/8/2019**	**1600**	**Yes**	**40**	**6.35**	**0.3033**	**0**	**None**	**ln(x)**	**0.0009403**	**Param Inter 1 of 2**
Total Dissolved Solids [TDS] (mg/L)	**MW-1606S**	**1054**	**n/a**	**4/8/2019**	**1480**	**Yes**	**40**	**6.35**	**0.3033**	**0**	**None**	**ln(x)**	**0.0009403**	**Param Inter 1 of 2**
Total Dissolved Solids [TDS] (mg/L)	**MW-1607D**	**1054**	**n/a**	**4/8/2019**	**1480**	**Yes**	**40**	**6.35**	**0.3033**	**0**	**None**	**ln(x)**	**0.0009403**	**Param Inter 1 of 2**
Total Dissolved Solids [TDS] (mg/L)	**MW-1607S**	**1054**	**n/a**	**4/8/2019**	**1310**	**Yes**	**40**	**6.35**	**0.3033**	**0**	**None**	**ln(x)**	**0.0009403**	**Param Inter 1 of 2**

Exceeds Limit: MW-1604D, MW-1604S, MW-1605D, MW-1605S, MW-1606D, MW-1

Prediction Limit

Interwell Parametric



Background Data Summary (based on cube root transformation): Mean=0.6145, Std. Dev.=0.1211, n=40. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9221, critical = 0.919. Kappa = 2.012 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.0009403. Comparing 8 points to limit.

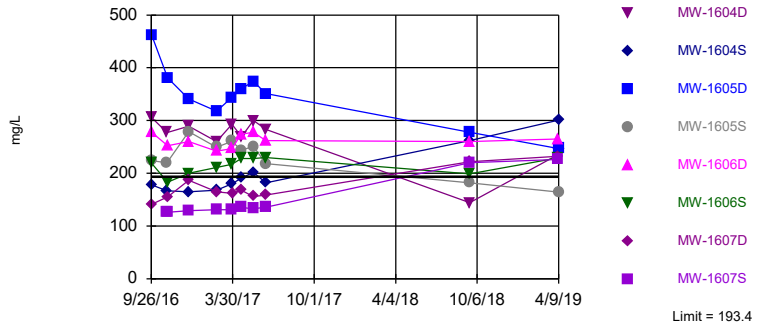
Constituent: Boron, total Analysis Run 6/30/2019 6:27 PM View: PL's - Interwell

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Exceeds Limit: MW-1604D, MW-1604S, MW-1605D, MW-1606D, MW-1606S, MW-1

Prediction Limit

Interwell Parametric



Background Data Summary: Mean=121.1, Std. Dev.=35.96, n=40. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9249, critical = 0.919. Kappa = 2.012 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.0009403. Comparing 8 points to limit.

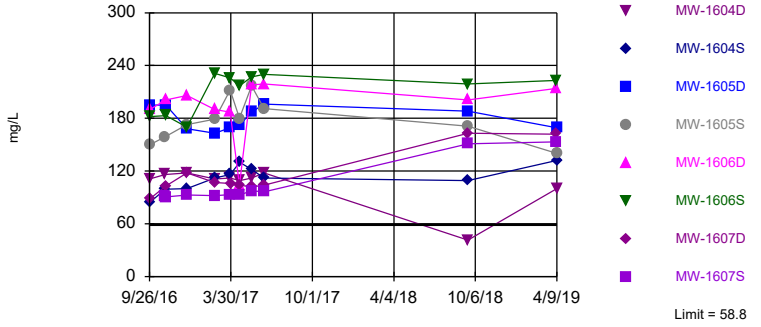
Constituent: Calcium, total Analysis Run 6/30/2019 6:27 PM View: PL's - Interwell

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Exceeds Limit: MW-1604D, MW-1604S, MW-1605D, MW-1605S, MW-1606D, MW-1

Prediction Limit

Interwell Parametric



Background Data Summary (based on cube root transformation): Mean=2.553, Std. Dev.=0.6638, n=40. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9301, critical = 0.919. Kappa = 2.012 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.0009403. Comparing 8 points to limit.

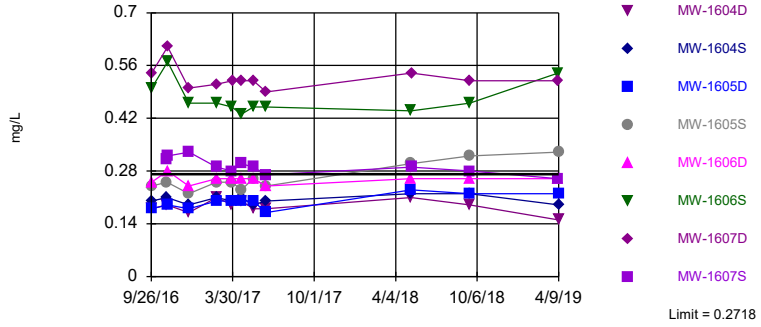
Constituent: Chloride, total Analysis Run 6/30/2019 6:28 PM View: PL's - Interwell

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Exceeds Limit: MW-1605S, MW-1606S, MW-1607D

Prediction Limit

Interwell Parametric



Background Data Summary (based on square transformation): Mean=0.03409, Std. Dev.=0.01991, n=44. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9267, critical = 0.924. Kappa = 1.999 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.0009403. Comparing 8 points to limit.

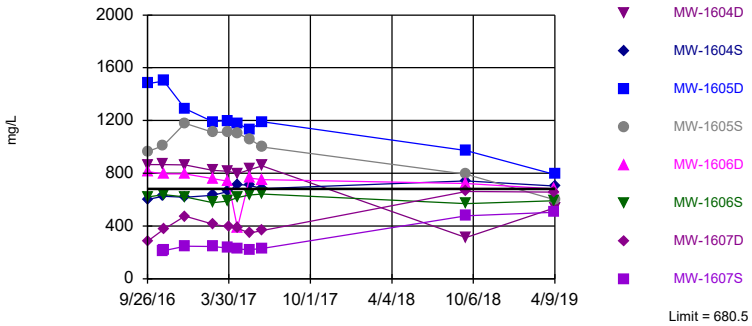
Constituent: Fluoride, total Analysis Run 6/30/2019 6:28 PM View: PL's - Interwell

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Exceeds Limit: MW-1604S, MW-1605D, MW-1606D

Prediction Limit

Interwell Parametric



Background Data Summary (based on natural log transformation): Mean=5.35, Std. Dev.=0.5827, n=40. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9307, critical = 0.919. Kappa = 2.012 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.0009403. Comparing 8 points to limit.

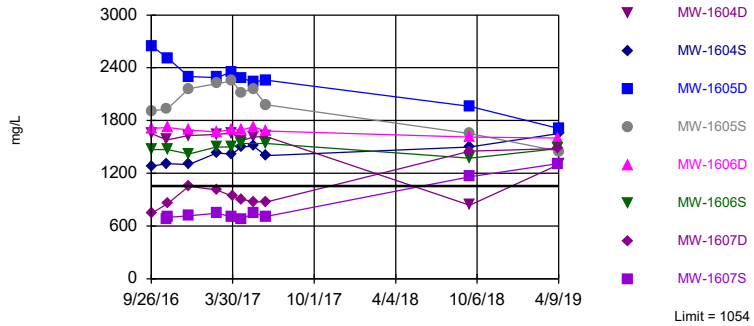
Constituent: Sulfate, total Analysis Run 6/30/2019 6:28 PM View: PL's - Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limit: MW-1604D, MW-1604S, MW-1605D, MW-1605S, MW-1606D, MW-1

Prediction Limit

Interwell Parametric



Background Data Summary (based on natural log transformation): Mean=6.35, Std. Dev.=0.3033, n=40. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.931, critical = 0.919. Kappa = 2.012 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.0009403. Comparing 8 points to limit.

Constituent: Total Dissolved Solids [TDS] Analysis Run 6/30/2019 6:28 PM View: PL's - Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Intrawell Prediction Limit Summary - Significant Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 6/30/2019, 6:34 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
pH, field (SU)	**MW-1607S**	**7.831**	**7.255**	**4/8/2019**	**7.23**	**Yes**	**7**	**7.543**	**0.08577**	**0**	**None**	**No**	**0.0004701**	Param 1 of 2

Intrawell Prediction Limit Summary - All Results

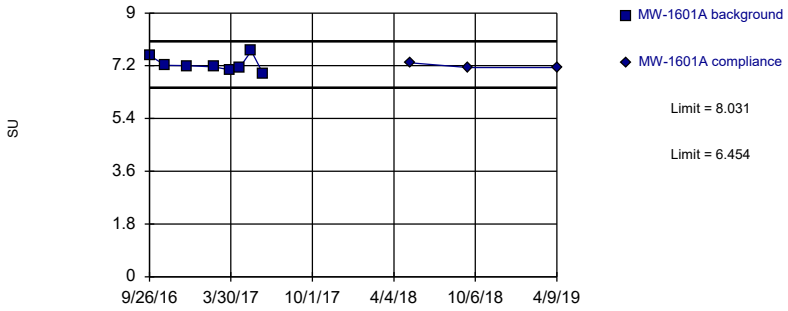
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 6/30/2019, 6:34 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
pH, field (SU)	MW-1601A	8.031	6.454	4/9/2019	7.14	No	8	7.243	0.2615	0	None	No	0.0004701	Param 1 of 2
pH, field (SU)	MW-1602	7.694	5.816	4/9/2019	6.62	No	8	6.755	0.3115	0	None	No	0.0004701	Param 1 of 2
pH, field (SU)	MW-1603	7.999	5.971	4/9/2019	6.8	No	8	6.985	0.3366	0	None	No	0.0004701	Param 1 of 2
pH, field (SU)	MW-1608	8.216	6.092	4/9/2019	6.86	No	8	7.154	0.3523	0	None	No	0.0004701	Param 1 of 2
pH, field (SU)	MW-1604D	8.08	6.653	4/9/2019	6.92	No	8	7.366	0.2368	0	None	No	0.0004701	Param 1 of 2
pH, field (SU)	MW-1604S	7.991	6.389	4/9/2019	7.14	No	8	7.19	0.2657	0	None	No	0.0004701	Param 1 of 2
pH, field (SU)	MW-1605D	8.258	6.653	4/9/2019	7.31	No	7	7.456	0.2388	0	None	No	0.0004701	Param 1 of 2
pH, field (SU)	MW-1605S	8.152	6.66	4/9/2019	7.19	No	8	7.406	0.2476	0	None	No	0.0004701	Param 1 of 2
pH, field (SU)	MW-1606D	8.222	6.671	4/8/2019	7.19	No	8	7.446	0.2573	0	None	No	0.0004701	Param 1 of 2
pH, field (SU)	MW-1606S	8.662	5.6	4/8/2019	6.81	No	8	7.131	0.508	0	None	No	0.0004701	Param 1 of 2
pH, field (SU)	MW-1607D	7.77	6.9	4/8/2019	7.39	No	7	n/a	n/a	0	n/a	n/a	0.05531	NP (normality) 1 of 2
pH, field (SU)	**MW-1607S**	**7.831**	**7.255**	**4/8/2019**	**7.23**	**Yes**	**7**	**7.543**	**0.08577**	**0**	**None**	**No**	**0.0004701**	Param 1 of 2

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.243, Std. Dev.=0.2615, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.902, critical = 0.749. Kappa = 3.014 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403.

Constituent: pH, field Analysis Run 6/30/2019 6:31 PM View: PL's - Intrawell

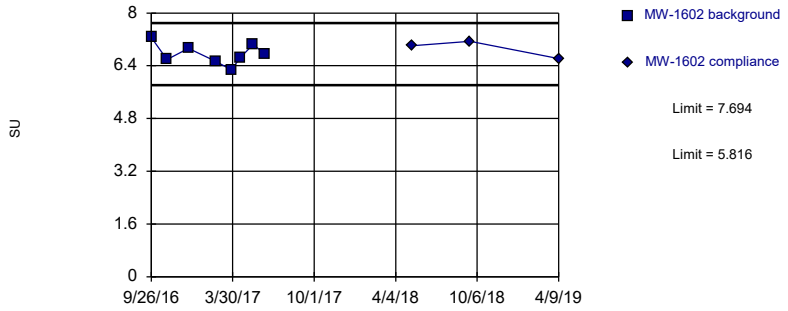
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=6.755, Std. Dev.=0.3115, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9867, critical = 0.749. Kappa = 3.014 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403.

Constituent: pH, field Analysis Run 6/30/2019 6:31 PM View: PL's - Intrawell

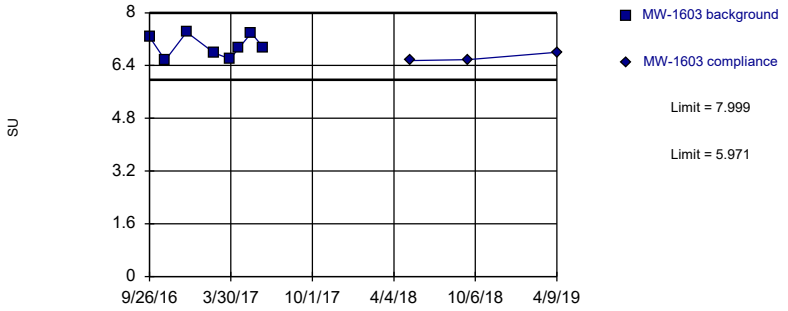
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=6.985, Std. Dev.=0.3366, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9063, critical = 0.749. Kappa = 3.014 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403.

Constituent: pH, field Analysis Run 6/30/2019 6:32 PM View: PL's - Intrawell

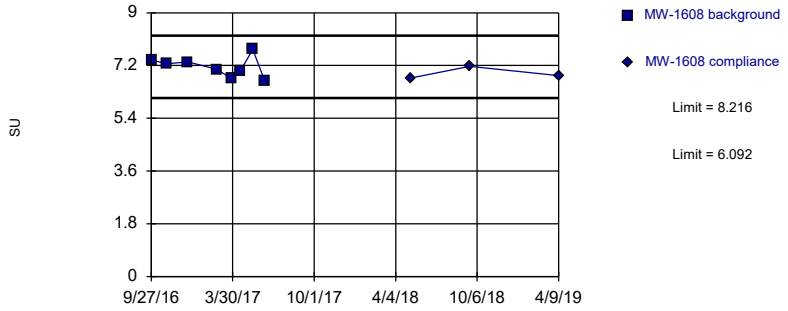
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.154, Std. Dev.=0.3523, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9751, critical = 0.749. Kappa = 3.014 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403.

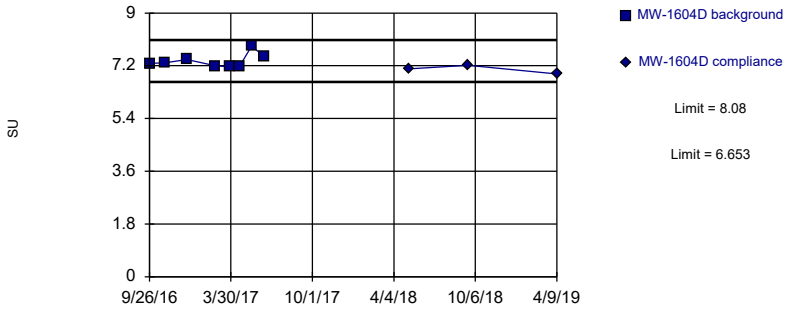
Constituent: pH, field Analysis Run 6/30/2019 6:32 PM View: PL's - Intrawell

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.366, Std. Dev.=0.2368, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8333, critical = 0.749. Kappa = 3.014 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403.

Constituent: pH, field Analysis Run 6/30/2019 6:32 PM View: PL's - Intrawell

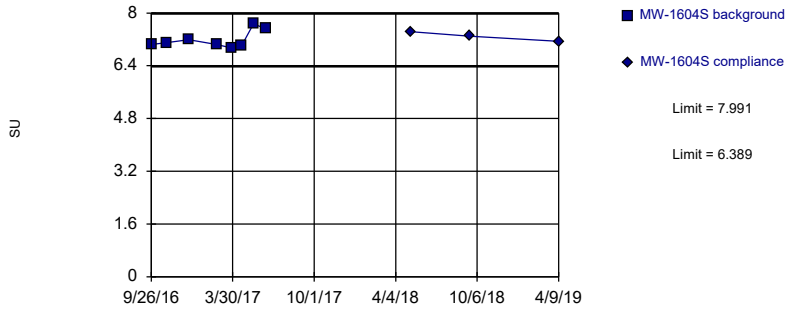
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.19, Std. Dev.=0.2657, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8184, critical = 0.749. Kappa = 3.014 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403.

Constituent: pH, field Analysis Run 6/30/2019 6:32 PM View: PL's - Intrawell

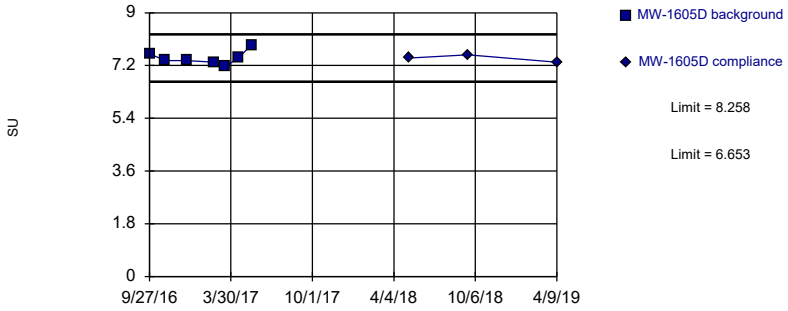
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.456, Std. Dev.=0.2388, n=7. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9315, critical = 0.73. Kappa = 3.361 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403.

Constituent: pH, field Analysis Run 6/30/2019 6:32 PM View: PL's - Intrawell

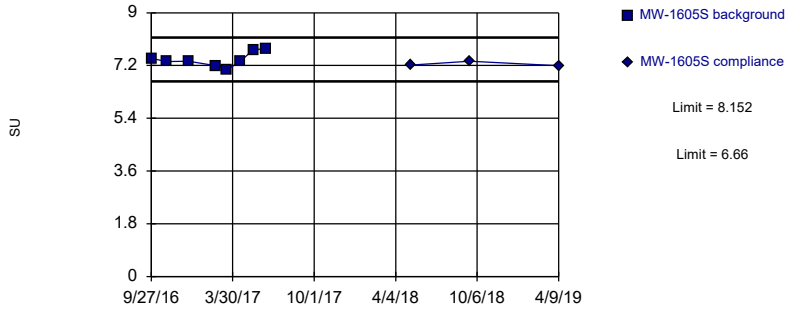
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.406, Std. Dev.=0.2476, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9237, critical = 0.749. Kappa = 3.014 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403.

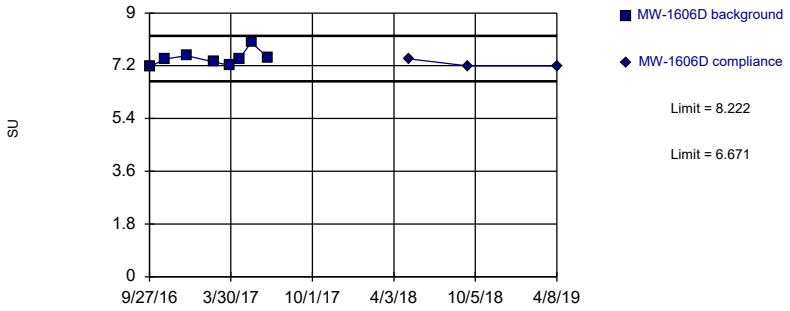
Constituent: pH, field Analysis Run 6/30/2019 6:32 PM View: PL's - Intrawell

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.446, Std. Dev.=0.2573, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8686, critical = 0.749. Kappa = 3.014 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403.

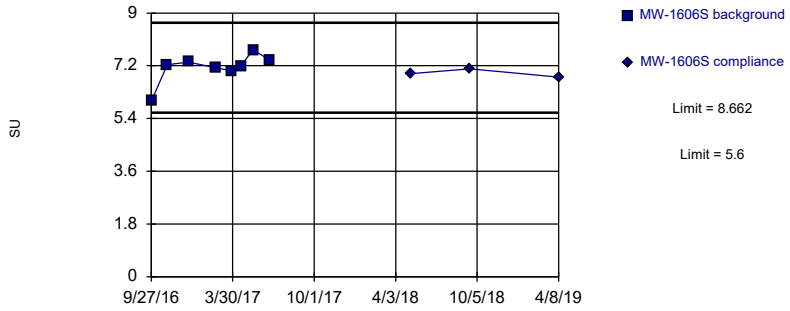
Constituent: pH, field Analysis Run 6/30/2019 6:32 PM View: PL's - Intrawell

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.131, Std. Dev.=0.508, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8107, critical = 0.749. Kappa = 3.014 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403.

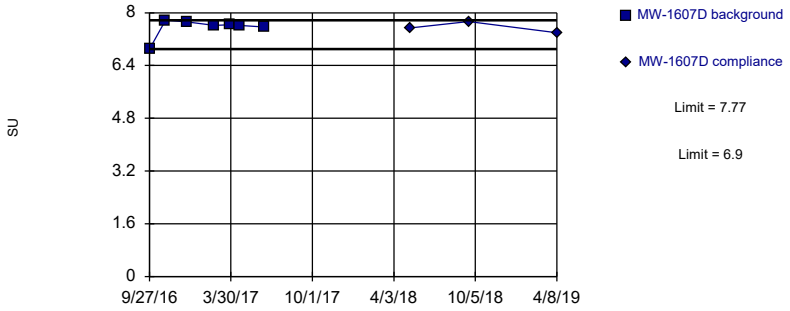
Constituent: pH, field Analysis Run 6/30/2019 6:32 PM View: PL's - Intrawell

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Within Limits

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limits are highest and lowest of 7 background values. Well-constituent pair annual alpha = 0.1091. Individual comparison alpha = 0.05531 (1 of 2).

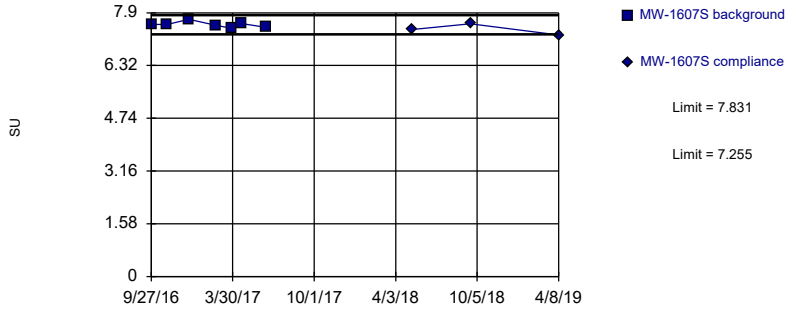
Constituent: pH, field Analysis Run 6/30/2019 6:32 PM View: PL's - Intrawell

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Exceeds Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.543, Std. Dev.=0.08577, n=7. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9302, critical = 0.73. Kappa = 3.361 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403.

Constituent: pH, field Analysis Run 6/30/2019 6:32 PM View: PL's - Intrawell

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Trend Test Summary Table - Significant Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 7/3/2019, 10:06 AM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Boron, total (mg/L)	**MW-1606D**	**1.379**	**31**	**30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Calcium, total (mg/L)	**MW-1604S**	**51.83**	**33**	**30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Calcium, total (mg/L)	**MW-1607S**	**19.67**	**41**	**30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	**MW-1607S**	**14.21**	**35**	**30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Fluoride, total (mg/L)	**MW-1602 (bg)**	**0.03503**	**42**	**34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Fluoride, total (mg/L)	**MW-1608 (bg)**	**-0.05568**	**-47**	**-34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Sulfate, total (mg/L)	**MW-1601A (bg)**	**30**	**33**	**30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Sulfate, total (mg/L)	**MW-1608 (bg)**	**102.6**	**31**	**30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Sulfate, total (mg/L)	**MW-1604S**	**70.94**	**31**	**30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Sulfate, total (mg/L)	**MW-1605D**	**-272.2**	**-36**	**-30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Total Dissolved Solids [TDS] (mg/L)	**MW-1601A (bg)**	**64.87**	**31**	**30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Total Dissolved Solids [TDS] (mg/L)	**MW-1602 (bg)**	**168.9**	**33**	**30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Total Dissolved Solids [TDS] (mg/L)	**MW-1605D**	**-301.9**	**-39**	**-30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**

Trend Test Summary Table - All Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 7/3/2019, 10:06 AM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Boron, total (mg/L)	MW-1601A (bg)	0.02217	12	30	No	10	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1602 (bg)	-0.01026	-12	-30	No	10	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1603 (bg)	0.03203	5	30	No	10	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1608 (bg)	0.01649	11	30	No	10	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1604D	-0.2704	-26	-30	No	10	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1604S	0.6569	15	30	No	10	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1605D	-1.258	-29	-30	No	10	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1605S	0.6518	15	30	No	10	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	**MW-1606D**	**1.379**	**31**	**30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Boron, total (mg/L)	MW-1606S	0.9889	27	30	No	10	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1607D	0.3718	18	30	No	10	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1607S	0.4115	27	30	No	10	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1601A (bg)	12.71	18	30	No	10	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1602 (bg)	18.9	23	30	No	10	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1603 (bg)	25.03	27	30	No	10	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1608 (bg)	14.13	22	30	No	10	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1604D	-25.93	-17	-30	No	10	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	**MW-1604S**	**51.83**	**33**	**30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Calcium, total (mg/L)	MW-1605D	-55.08	-21	-30	No	10	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1606D	2.175	5	30	No	10	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1606S	15.5	20	30	No	10	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1607D	31.51	21	30	No	10	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	**MW-1607S**	**19.67**	**41**	**30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	MW-1601A (bg)	23.57	25	30	No	10	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1602 (bg)	3.486	21	30	No	10	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1603 (bg)	-4.675	-15	-30	No	10	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1608 (bg)	0.9577	17	30	No	10	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1604D	-5.903	-12	-30	No	10	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1604S	20.53	26	30	No	10	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1605D	0.4345	3	30	No	10	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1605S	34.76	9	30	No	10	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1606D	9.463	11	30	No	10	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1606S	18.7	15	30	No	10	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1607D	22.04	14	30	No	10	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	**MW-1607S**	**14.21**	**35**	**30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Fluoride, total (mg/L)	MW-1601A (bg)	-0.0144	-14	-34	No	11	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	**MW-1602 (bg)**	**0.03503**	**42**	**34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Fluoride, total (mg/L)	MW-1603 (bg)	0	15	34	No	11	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	**MW-1608 (bg)**	**-0.05568**	**-47**	**-34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Fluoride, total (mg/L)	MW-1605S	0.03758	31	34	No	11	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1606S	-0.01234	-13	-34	No	11	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1607D	0	-4	-34	No	11	0	n/a	n/a	0.01	NP
pH, field (SU)	MW-1601A (bg)	-0.1544	-16	-34	No	11	0	n/a	n/a	0.01	NP
pH, field (SU)	MW-1602 (bg)	0.05759	5	34	No	11	0	n/a	n/a	0.01	NP
pH, field (SU)	MW-1603 (bg)	-0.07449	-9	-34	No	11	0	n/a	n/a	0.01	NP
pH, field (SU)	MW-1608 (bg)	-0.2395	-19	-34	No	11	0	n/a	n/a	0.01	NP
pH, field (SU)	MW-1607S	-0.09887	-18	-30	No	10	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	**MW-1601A (bg)**	**30**	**33**	**30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Sulfate, total (mg/L)	MW-1602 (bg)	93.48	27	30	No	10	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1603 (bg)	-9.777	-3	-30	No	10	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	**MW-1608 (bg)**	**102.6**	**31**	**30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Sulfate, total (mg/L)	**MW-1604S**	**70.94**	**31**	**30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Sulfate, total (mg/L)	**MW-1605D**	**-272.2**	**-36**	**-30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Sulfate, total (mg/L)	MW-1606D	-51.8	-30	-30	No	10	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	**MW-1601A (bg)**	**64.87**	**31**	**30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**

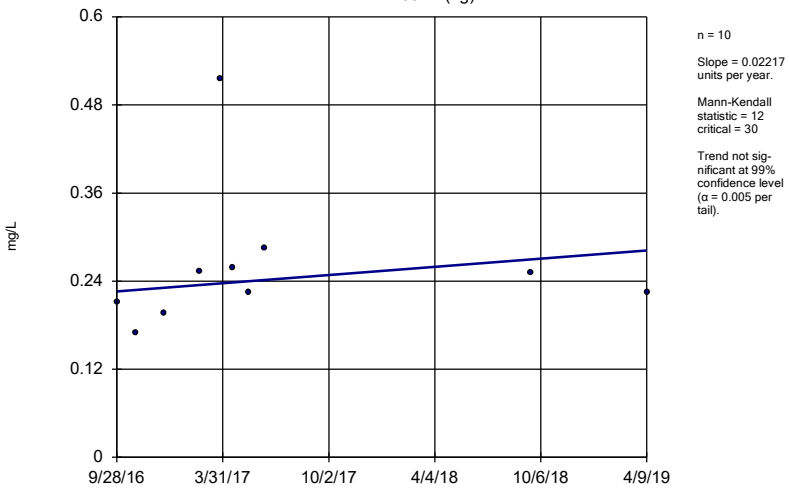
Trend Test Summary Table - All Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 7/3/2019, 10:06 AM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Total Dissolved Solids [TDS] (mg/L)	**MW-1602 (bg)**	**168.9**	**33**	**30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Total Dissolved Solids [TDS] (mg/L)	MW-1603 (bg)	7.006	17	30	No	10	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1608 (bg)	110.5	27	30	No	10	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1604D	-130.4	-19	-30	No	10	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1604S	146	30	30	No	10	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	**MW-1605D**	**-301.9**	**-39**	**-30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Total Dissolved Solids [TDS] (mg/L)	MW-1605S	-197.1	-10	-30	No	10	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1606D	-45.63	-22	-30	No	10	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1606S	15.11	7	25	No	9	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1607D	208.6	15	30	No	10	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1607S	192.1	26	30	No	10	0	n/a	n/a	0.01	NP

Sen's Slope Estimator

MW-1601A (bg)



n = 10

Slope = 0.02217 units per year.

Mann-Kendall statistic = 12 critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

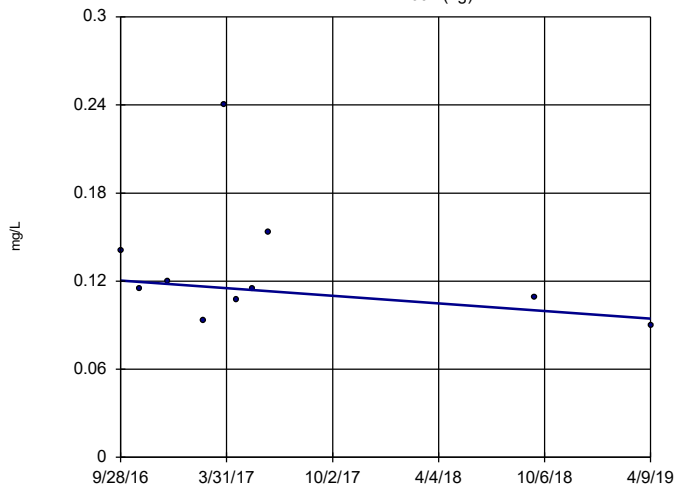
Constituent: Boron, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1602 (bg)



n = 10

Slope = -0.01026 units per year.

Mann-Kendall statistic = -12 critical = -30

Trend not significant at 99% confidence level (α = 0.005 per tail).

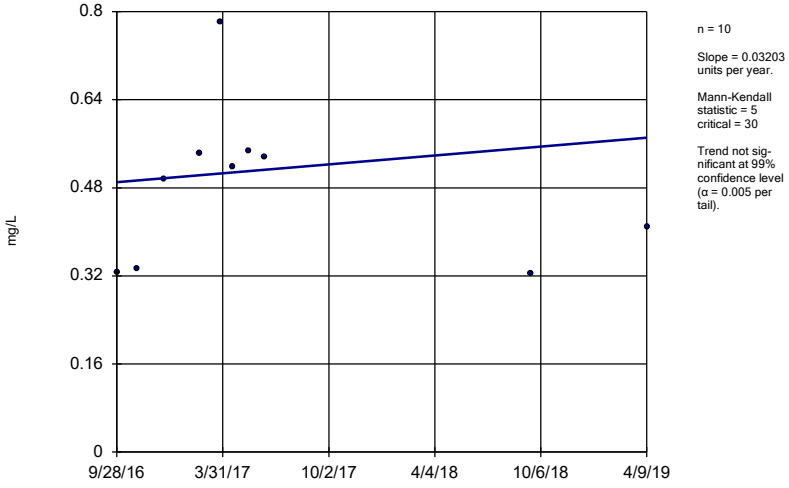
Constituent: Boron, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1603 (bg)



n = 10

Slope = 0.03203 units per year.

Mann-Kendall statistic = 5 critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

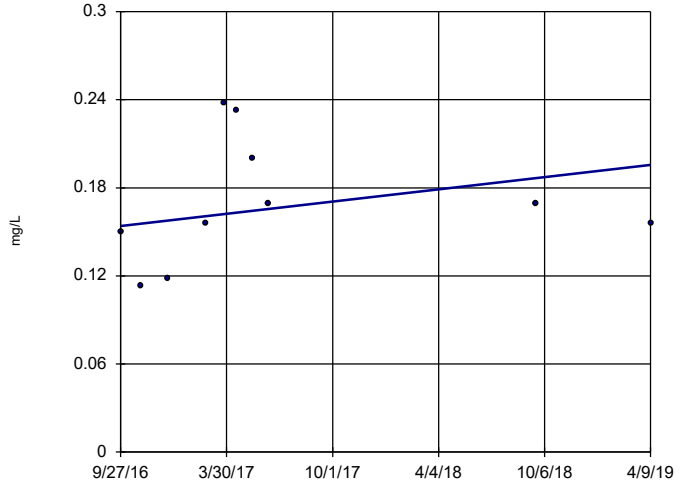
Constituent: Boron, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1608 (bg)



n = 10

Slope = 0.01649 units per year.

Mann-Kendall statistic = 11 critical = 30

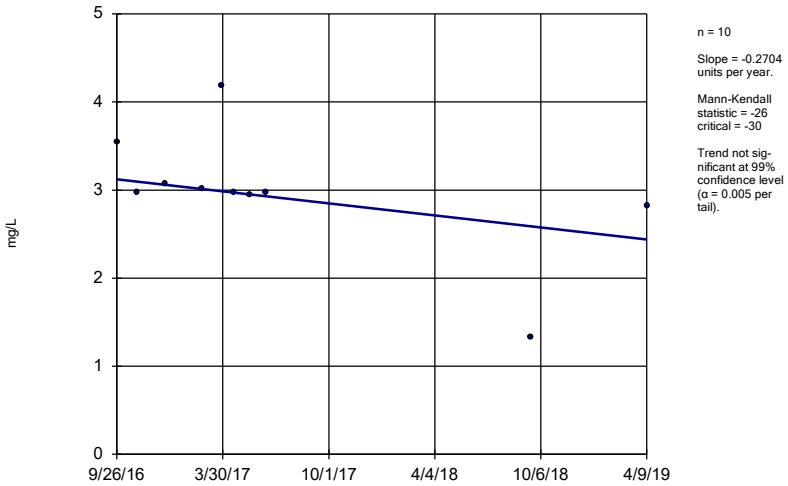
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1604D



n = 10

Slope = -0.2704 units per year.

Mann-Kendall statistic = -26 critical = -30

Trend not significant at 99% confidence level (α = 0.005 per tail).

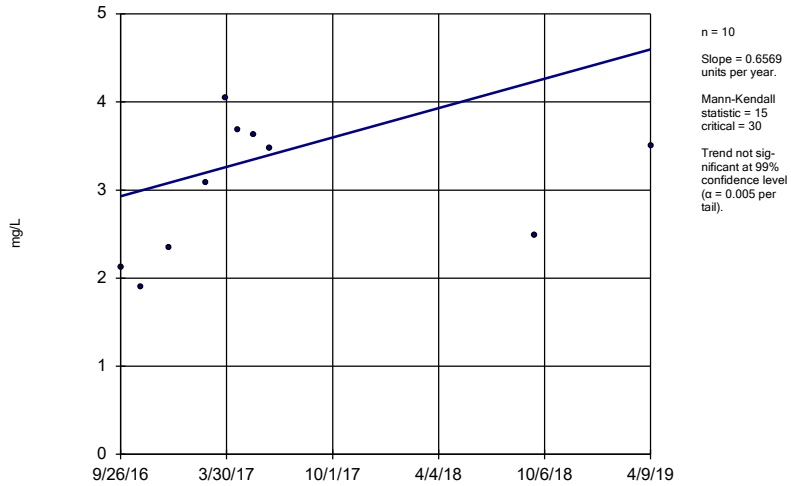
Constituent: Boron, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1604S



n = 10

Slope = 0.6569 units per year.

Mann-Kendall statistic = 15 critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

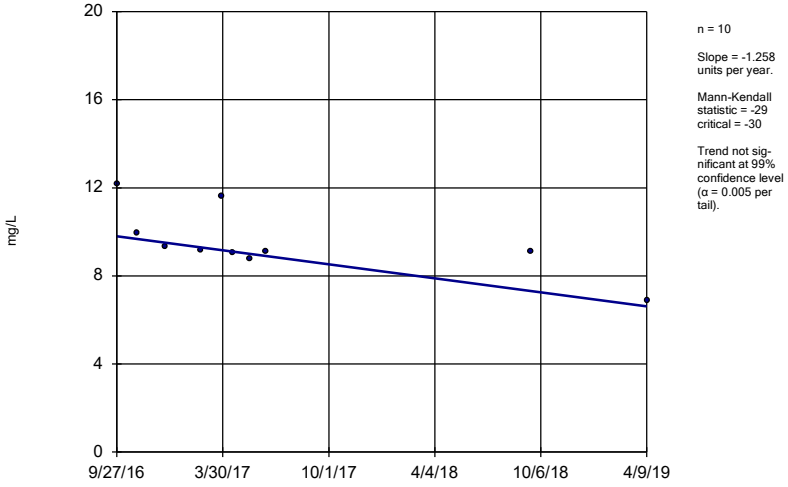
Constituent: Boron, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1605D



n = 10

Slope = -1.258 units per year.

Mann-Kendall statistic = -29 critical = -30

Trend not significant at 99% confidence level (α = 0.005 per tail).

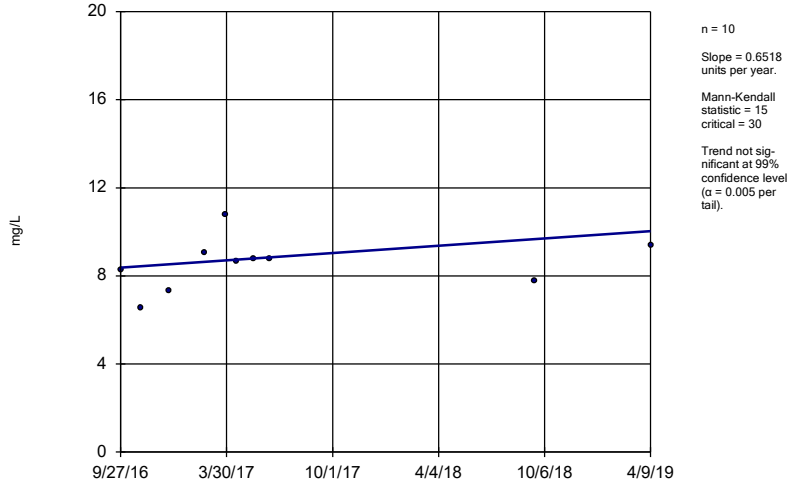
Constituent: Boron, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1605S



n = 10

Slope = 0.6518 units per year.

Mann-Kendall statistic = 15 critical = 30

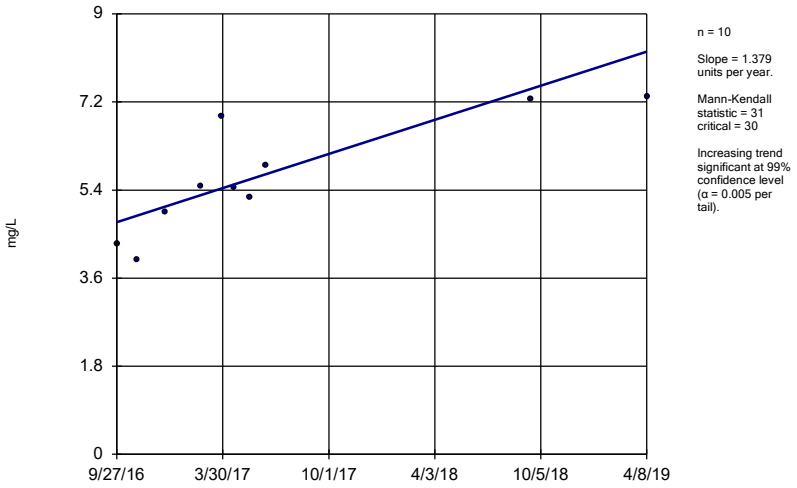
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1606D



n = 10

Slope = 1.379 units per year.

Mann-Kendall statistic = 31
critical = 30

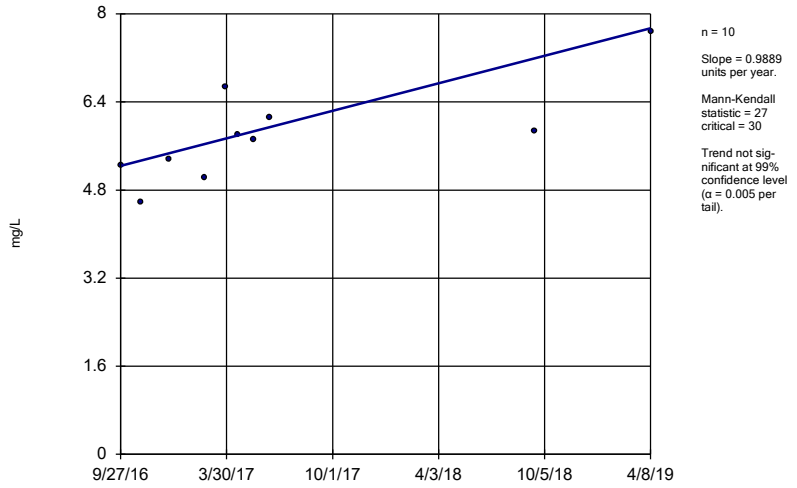
Increasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1606S



n = 10

Slope = 0.9889 units per year.

Mann-Kendall statistic = 27
critical = 30

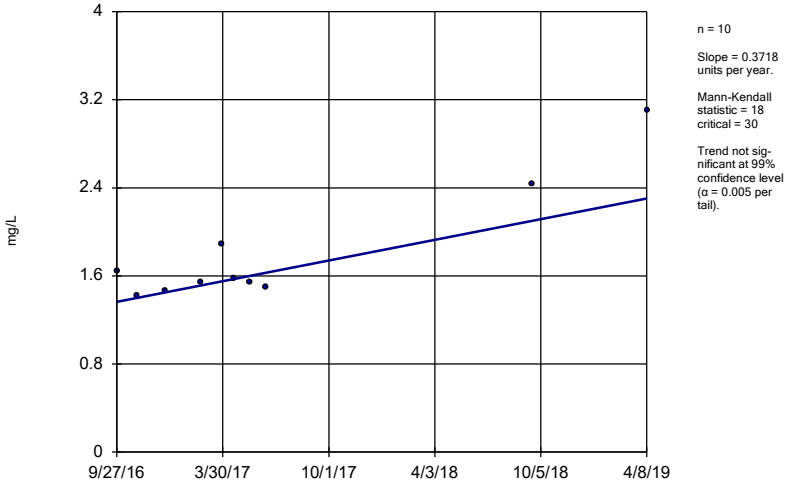
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1607D



n = 10

Slope = 0.3718 units per year.

Mann-Kendall statistic = 18
critical = 30

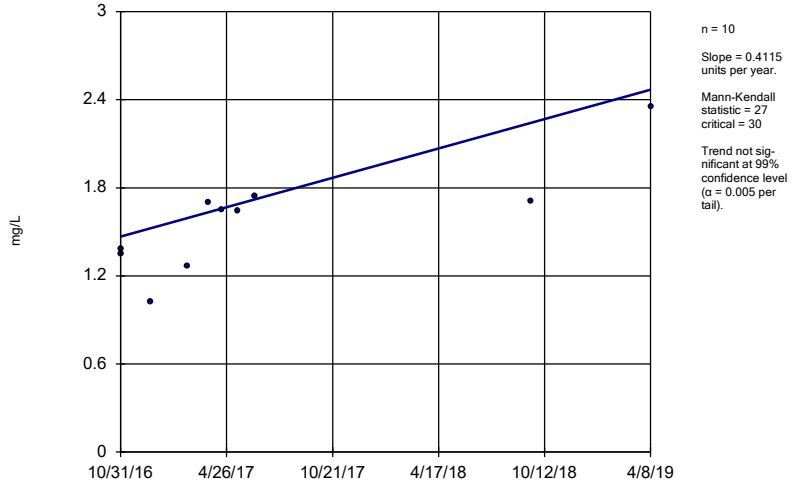
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1607S



n = 10

Slope = 0.4115 units per year.

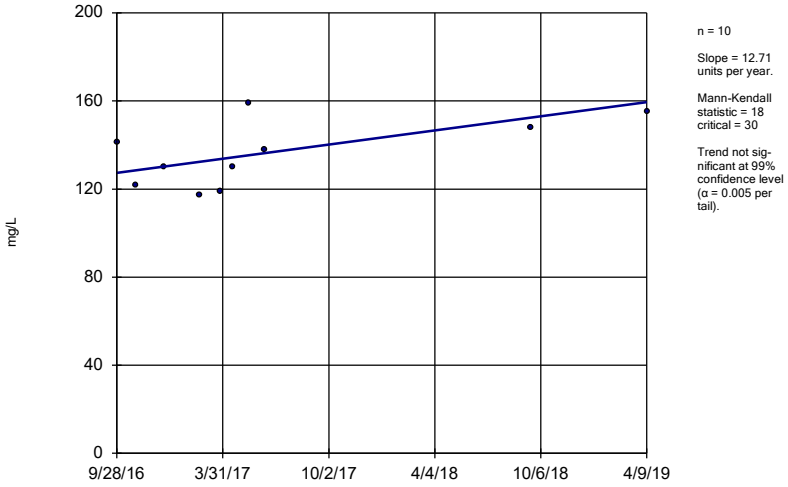
Mann-Kendall statistic = 27
critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1601A (bg)



n = 10

Slope = 12.71 units per year.

Mann-Kendall statistic = 18 critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

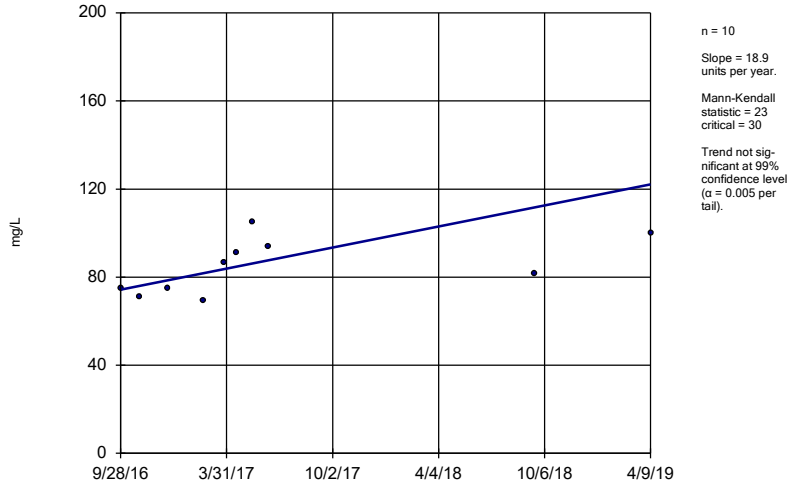
Constituent: Calcium, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1602 (bg)



n = 10

Slope = 18.9 units per year.

Mann-Kendall statistic = 23 critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

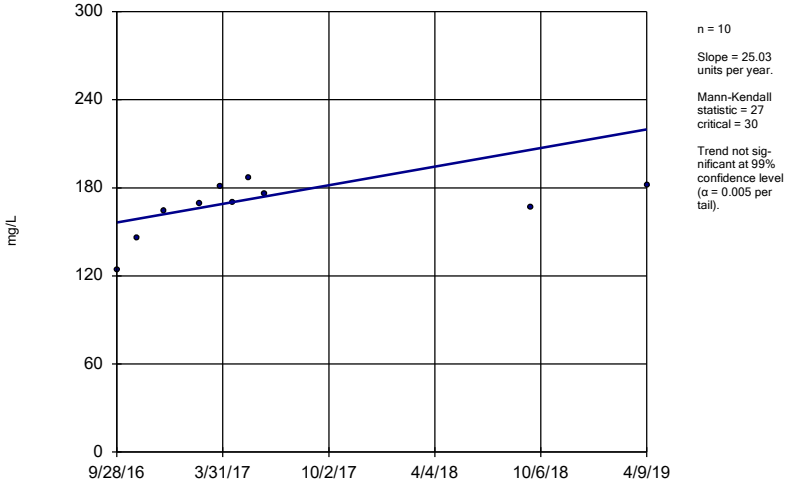
Constituent: Calcium, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1603 (bg)



n = 10

Slope = 25.03 units per year.

Mann-Kendall statistic = 27 critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

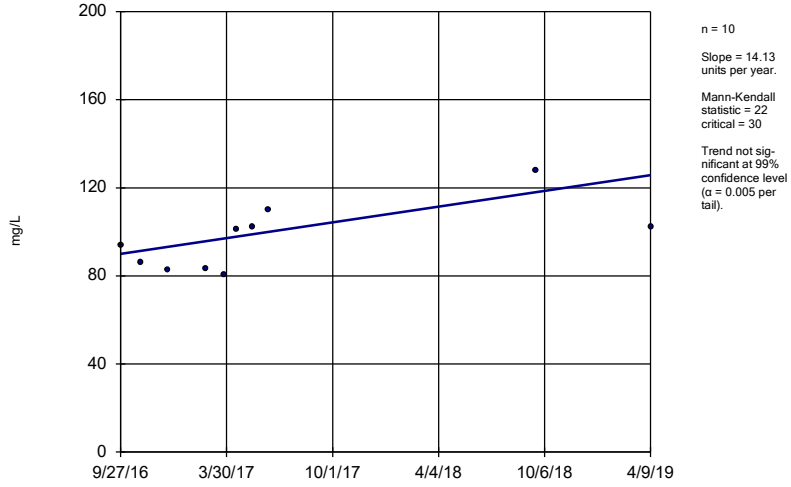
Constituent: Calcium, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1608 (bg)



n = 10

Slope = 14.13 units per year.

Mann-Kendall statistic = 22 critical = 30

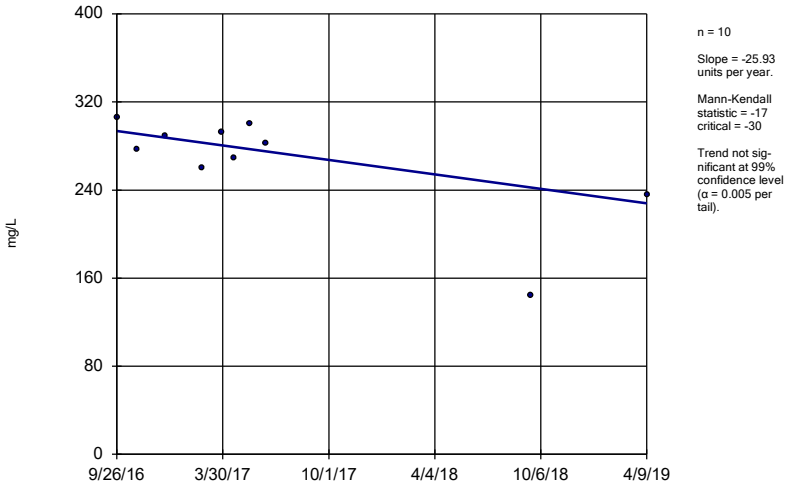
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1604D



n = 10

Slope = -25.93 units per year.

Mann-Kendall statistic = -17 critical = -30

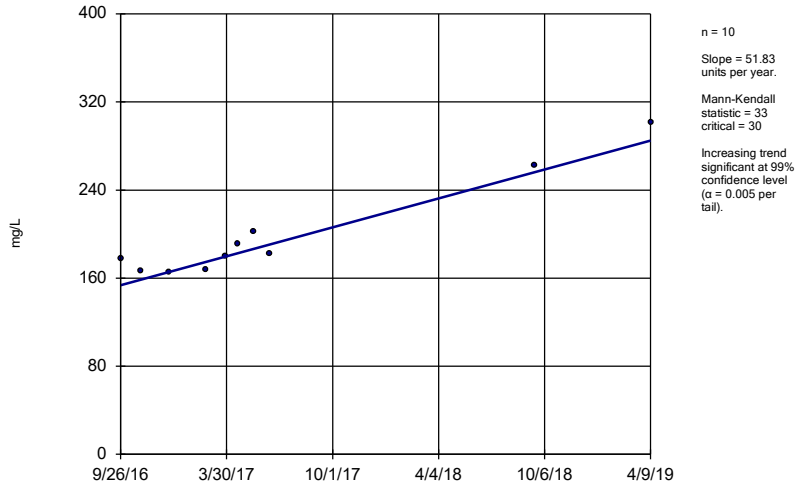
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1604S



n = 10

Slope = 51.83 units per year.

Mann-Kendall statistic = 33 critical = 30

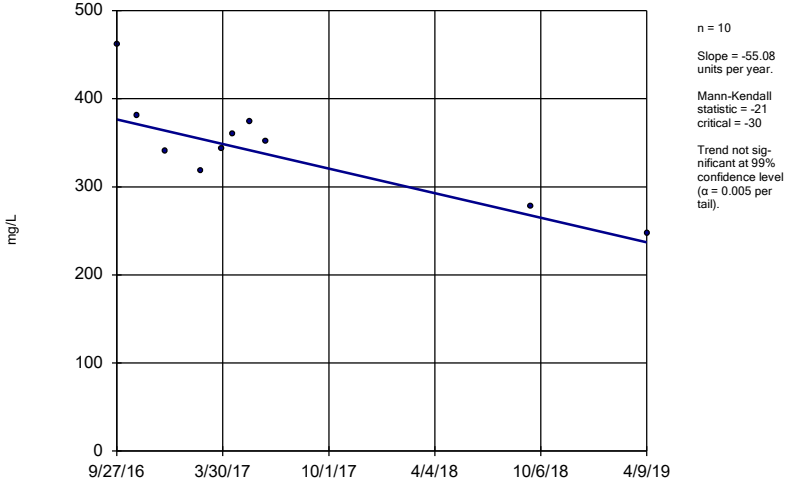
Increasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1605D



n = 10

Slope = -55.08 units per year.

Mann-Kendall statistic = -21 critical = -30

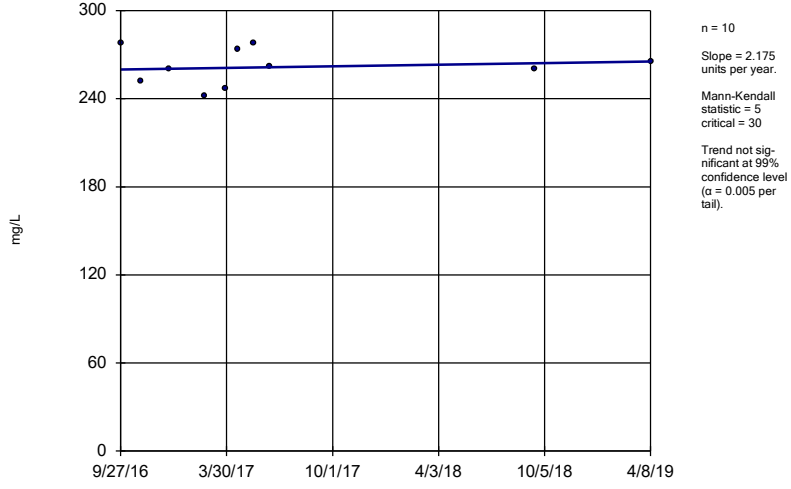
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1606D



n = 10

Slope = 2.175 units per year.

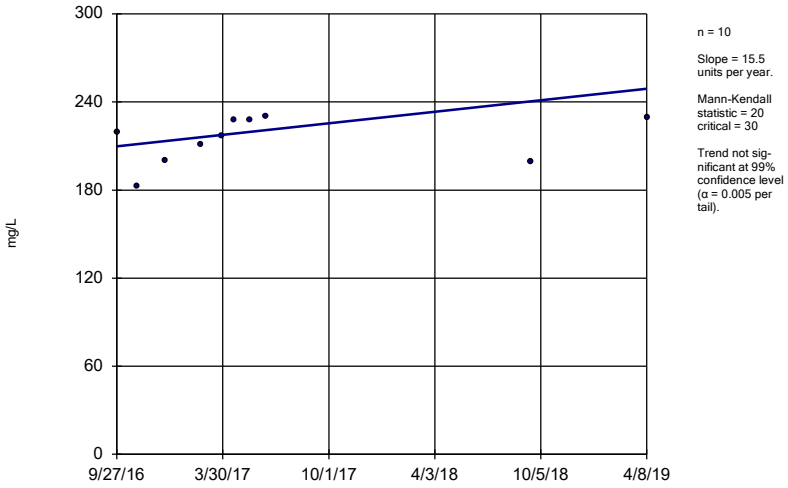
Mann-Kendall statistic = 5 critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1606S



n = 10

Slope = 15.5 units per year.

Mann-Kendall statistic = 20 critical = 30

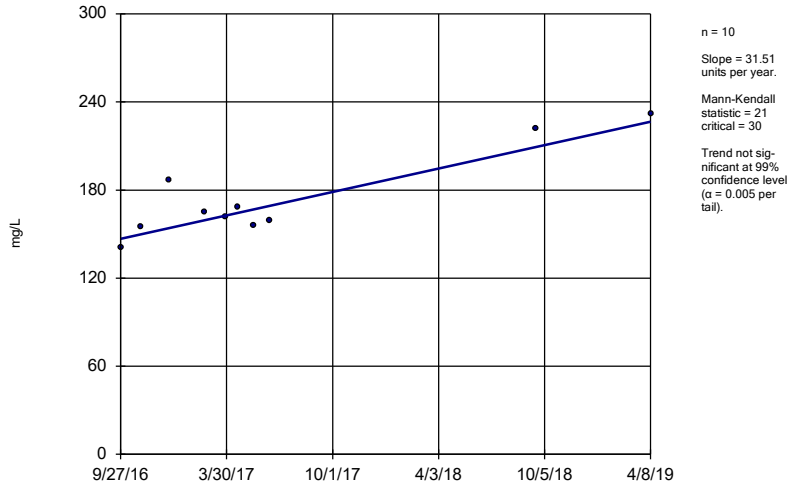
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1607D



n = 10

Slope = 31.51 units per year.

Mann-Kendall statistic = 21 critical = 30

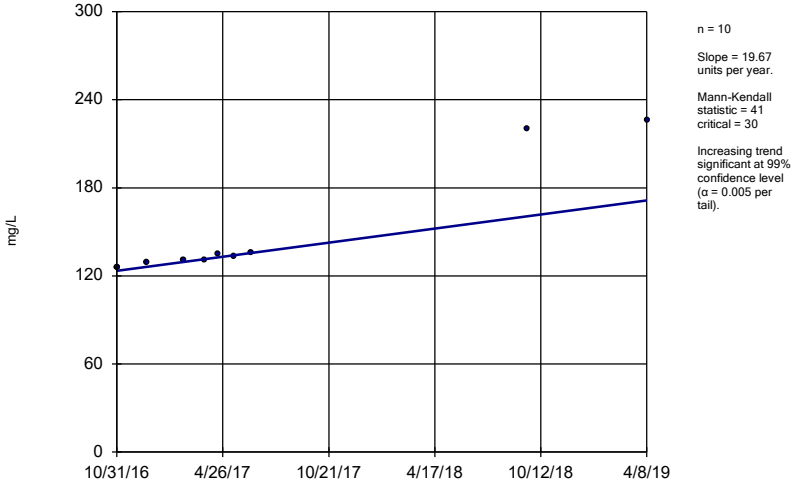
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1607S



n = 10

Slope = 19.67 units per year.

Mann-Kendall statistic = 41 critical = 30

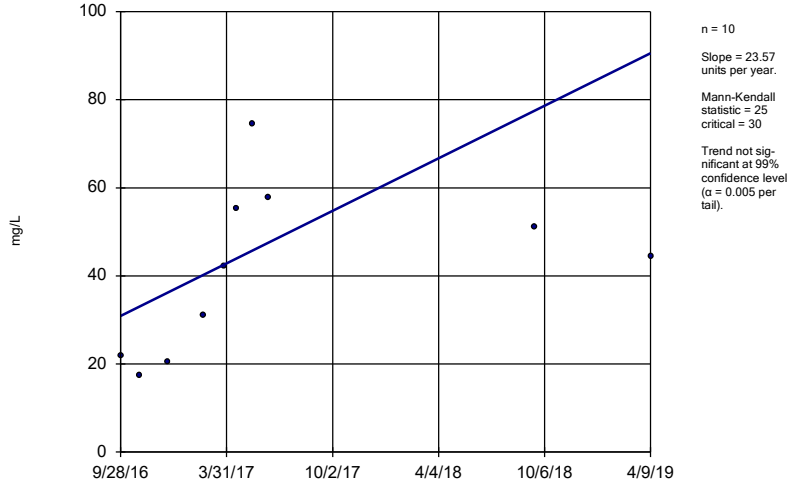
Increasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1601A (bg)



n = 10

Slope = 23.57 units per year.

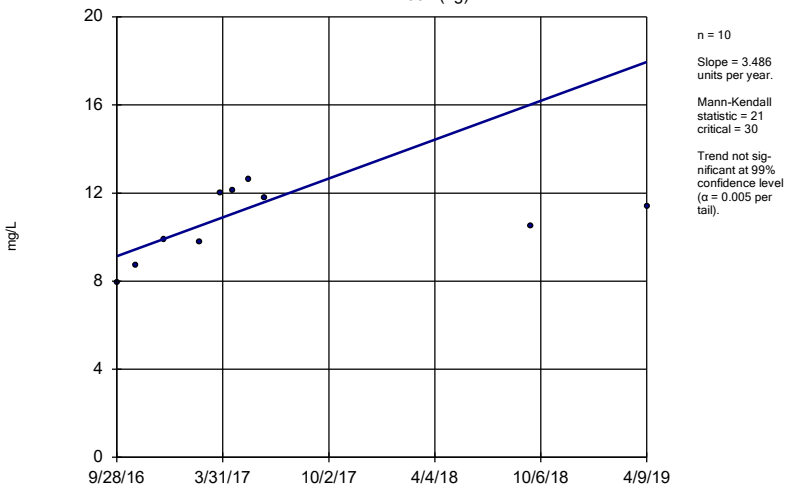
Mann-Kendall statistic = 25 critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1602 (bg)



n = 10

Slope = 3.486 units per year.

Mann-Kendall statistic = 21 critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

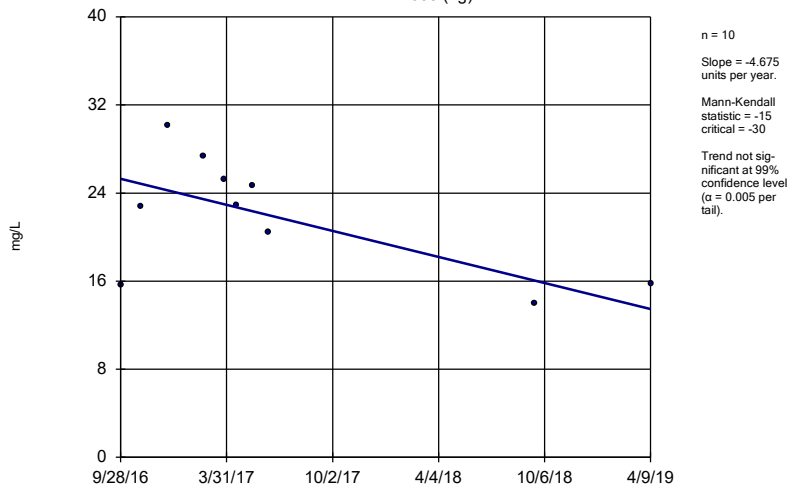
Constituent: Chloride, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1603 (bg)



n = 10

Slope = -4.675 units per year.

Mann-Kendall statistic = -15 critical = -30

Trend not significant at 99% confidence level (α = 0.005 per tail).

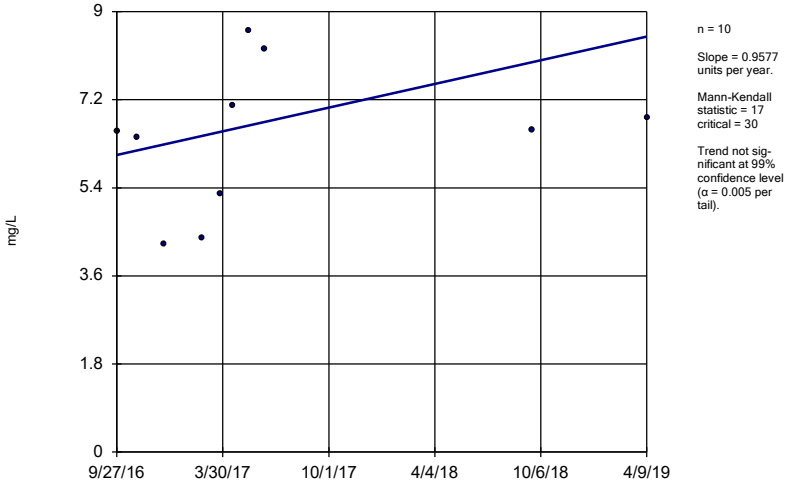
Constituent: Chloride, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1608 (bg)



n = 10

Slope = 0.9577 units per year.

Mann-Kendall statistic = 17 critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

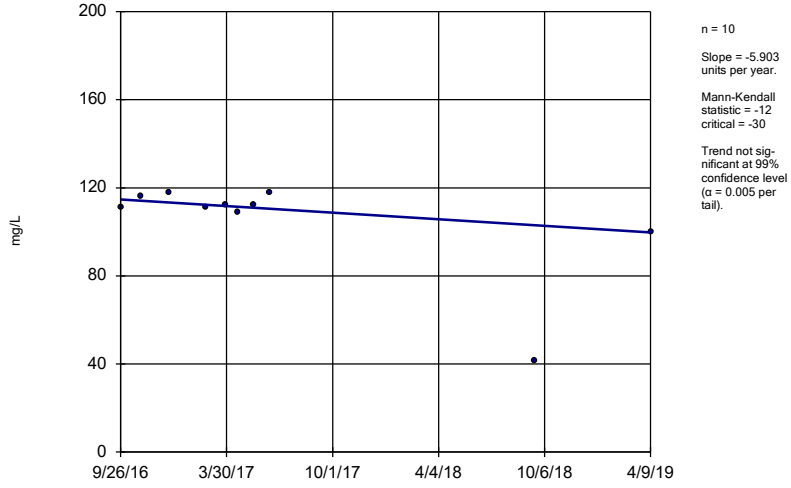
Constituent: Chloride, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1604D



n = 10

Slope = -5.903 units per year.

Mann-Kendall statistic = -12 critical = -30

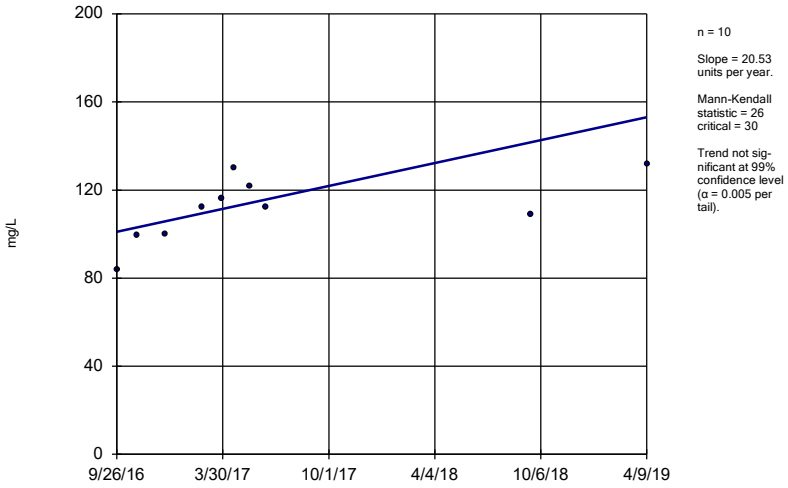
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1604S



n = 10

Slope = 20.53 units per year.

Mann-Kendall statistic = 26 critical = 30

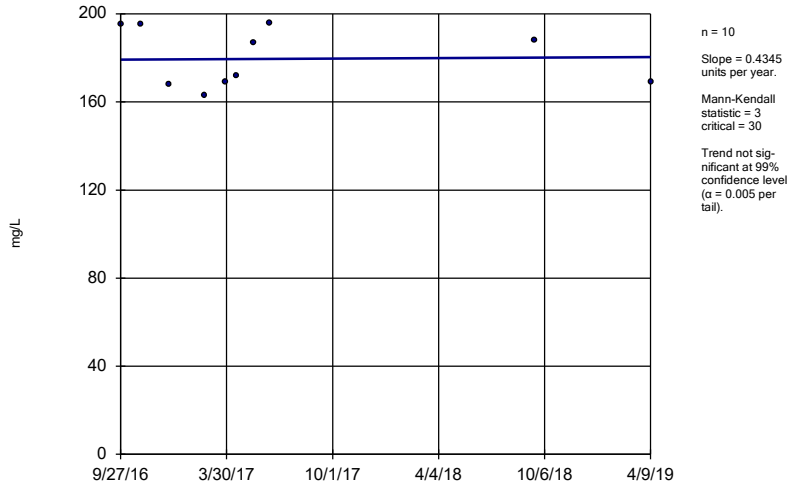
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1605D



n = 10

Slope = 0.4345 units per year.

Mann-Kendall statistic = 3 critical = 30

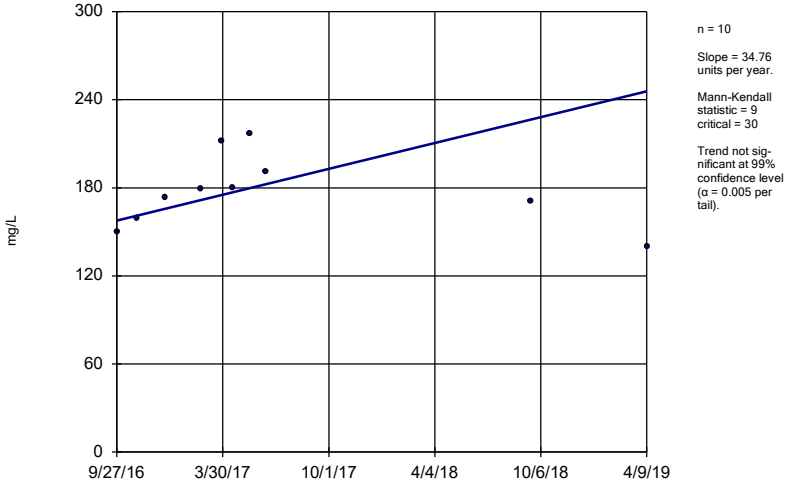
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1605S



n = 10

Slope = 34.76 units per year.

Mann-Kendall statistic = 9 critical = 30

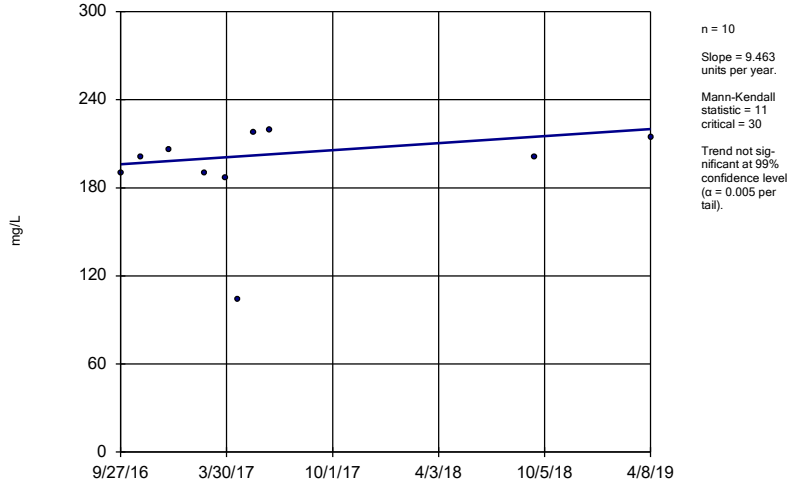
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1606D



n = 10

Slope = 9.463 units per year.

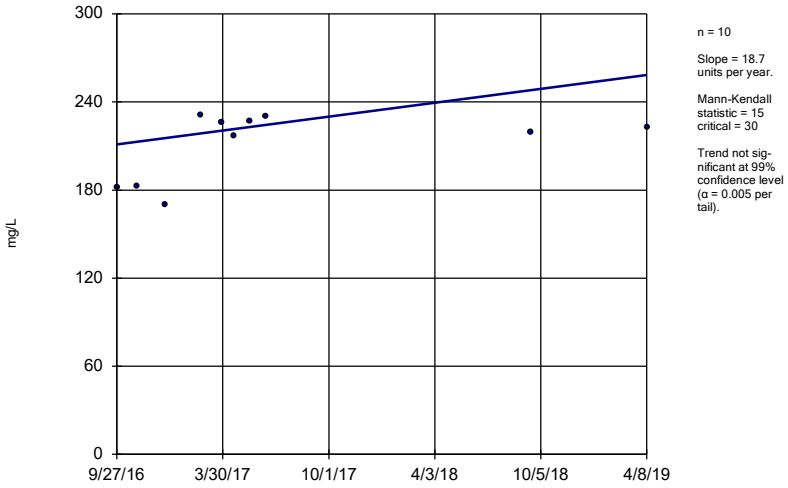
Mann-Kendall statistic = 11 critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1606S



n = 10

Slope = 18.7 units per year.

Mann-Kendall statistic = 15 critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

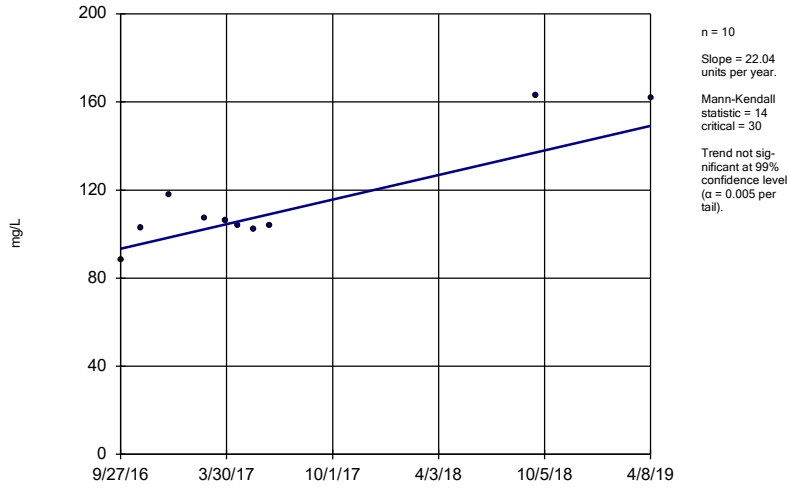
Constituent: Chloride, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1607D



n = 10

Slope = 22.04 units per year.

Mann-Kendall statistic = 14 critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

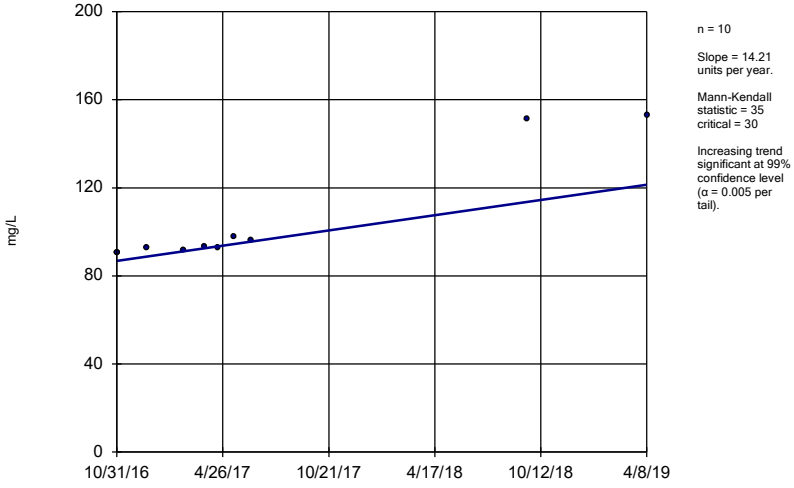
Constituent: Chloride, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1607S



n = 10

Slope = 14.21 units per year.

Mann-Kendall statistic = 35 critical = 30

Increasing trend significant at 99% confidence level (α = 0.005 per tail).

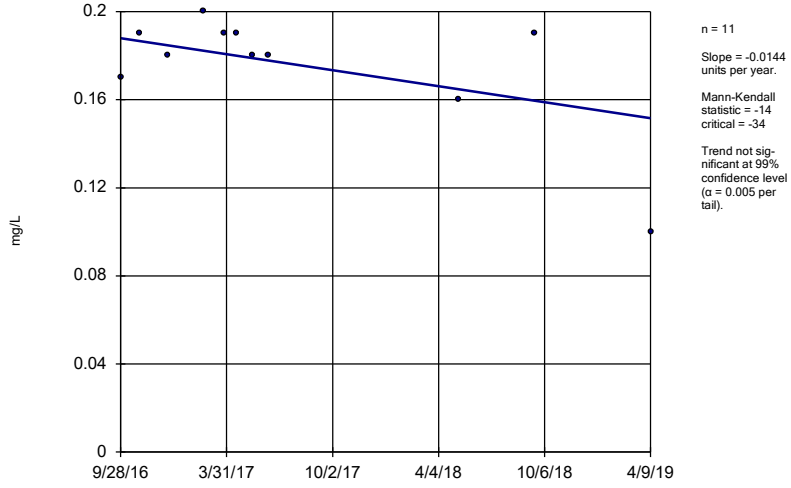
Constituent: Chloride, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1601A (bg)



n = 11

Slope = -0.0144 units per year.

Mann-Kendall statistic = -14 critical = -34

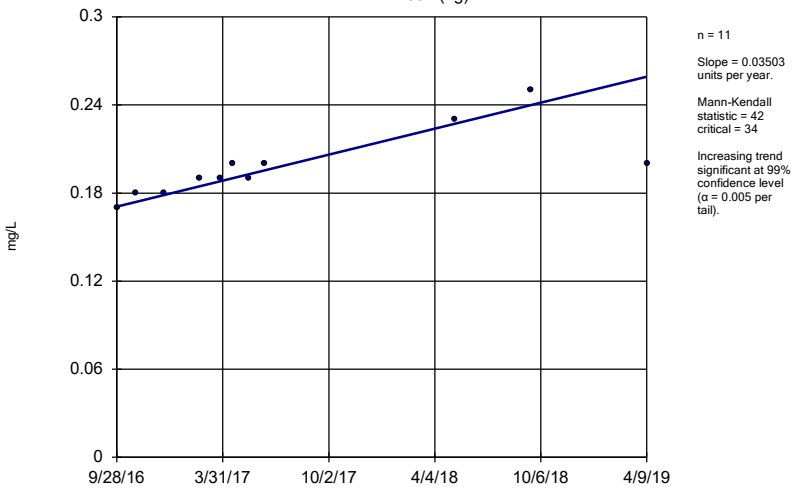
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Fluoride, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1602 (bg)



n = 11

Slope = 0.03503 units per year.

Mann-Kendall statistic = 42
critical = 34

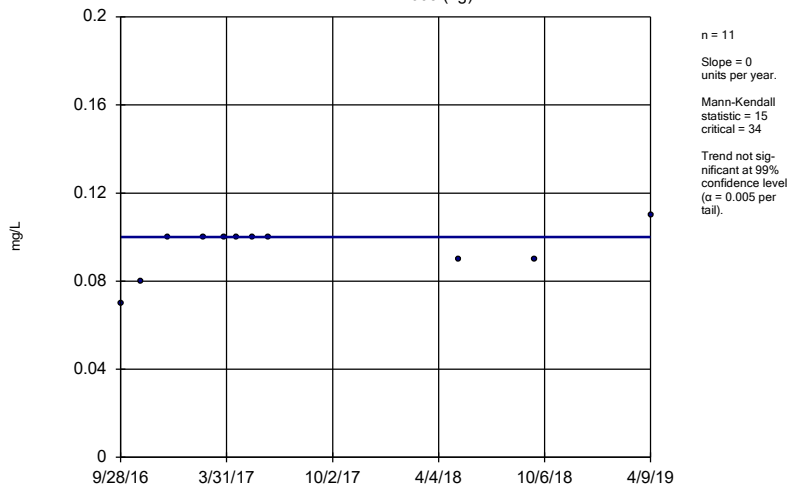
Increasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Fluoride, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1603 (bg)



n = 11

Slope = 0 units per year.

Mann-Kendall statistic = 15
critical = 34

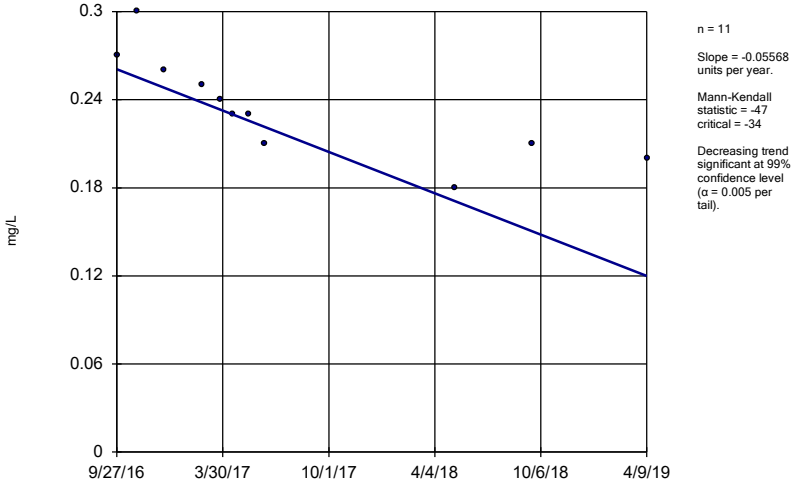
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Fluoride, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1608 (bg)



n = 11

Slope = -0.05568 units per year.

Mann-Kendall statistic = -47
critical = -34

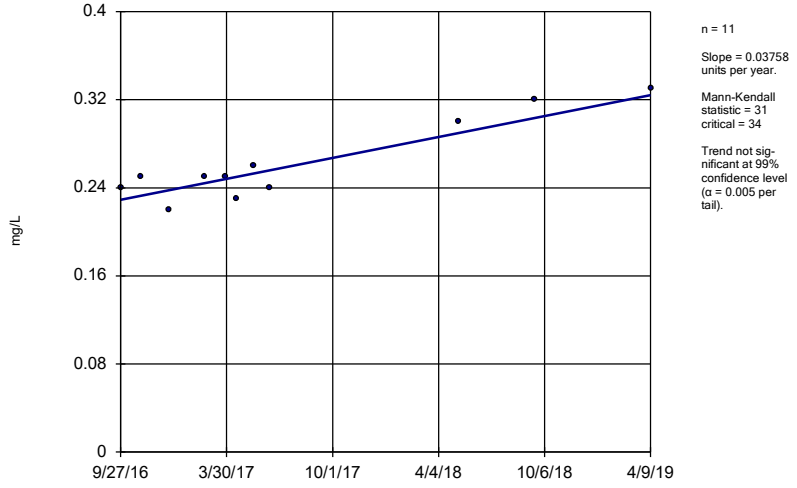
Decreasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Fluoride, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1605S



n = 11

Slope = 0.03758 units per year.

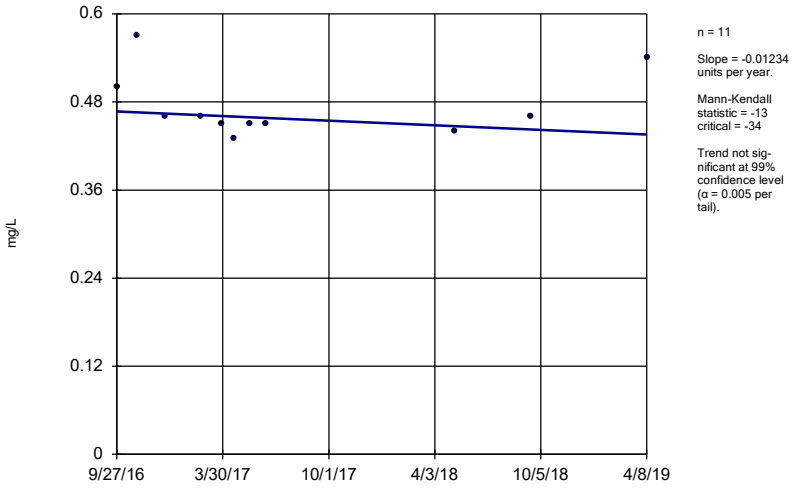
Mann-Kendall statistic = 31
critical = 34

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Fluoride, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1606S



n = 11

Slope = -0.01234 units per year.

Mann-Kendall statistic = -13
critical = -34

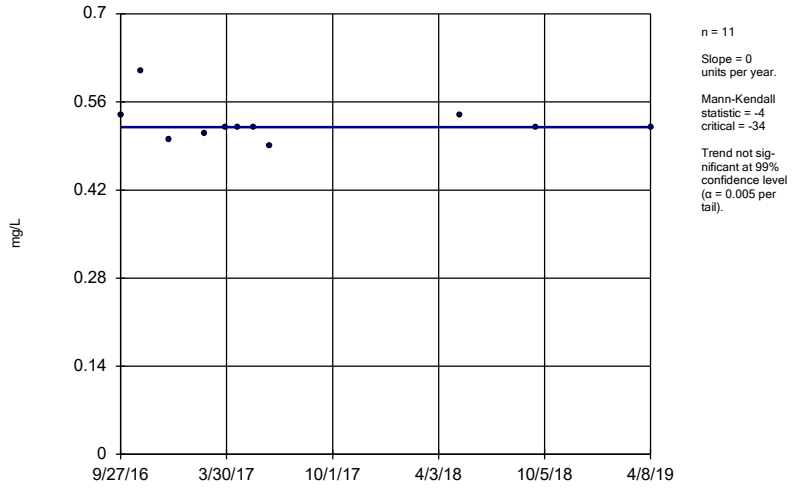
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Fluoride, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1607D



n = 11

Slope = 0 units per year.

Mann-Kendall statistic = -4
critical = -34

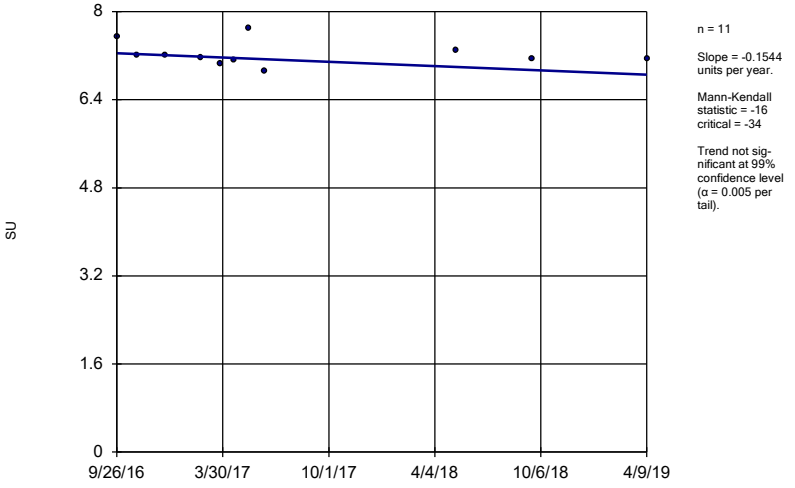
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Fluoride, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1601A (bg)



n = 11

Slope = -0.1544 units per year.

Mann-Kendall statistic = -16
critical = -34

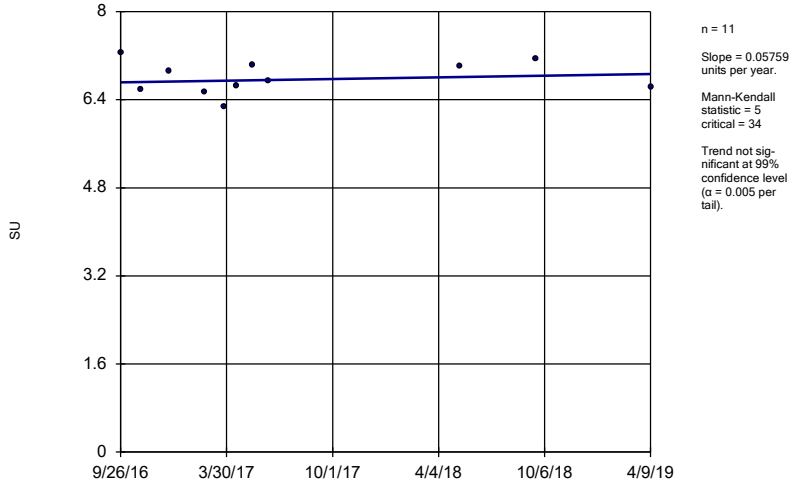
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: pH, field Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1602 (bg)



n = 11

Slope = 0.05759 units per year.

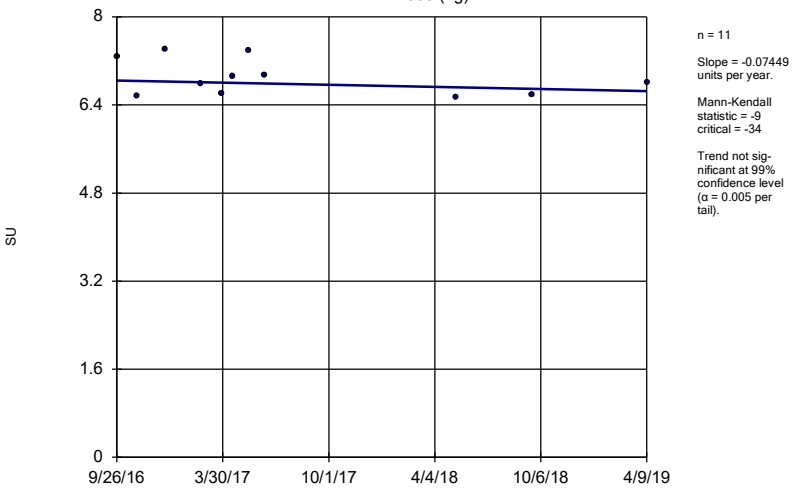
Mann-Kendall statistic = 5
critical = 34

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: pH, field Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1603 (bg)



n = 11

Slope = -0.07449 units per year.

Mann-Kendall statistic = -9
critical = -34

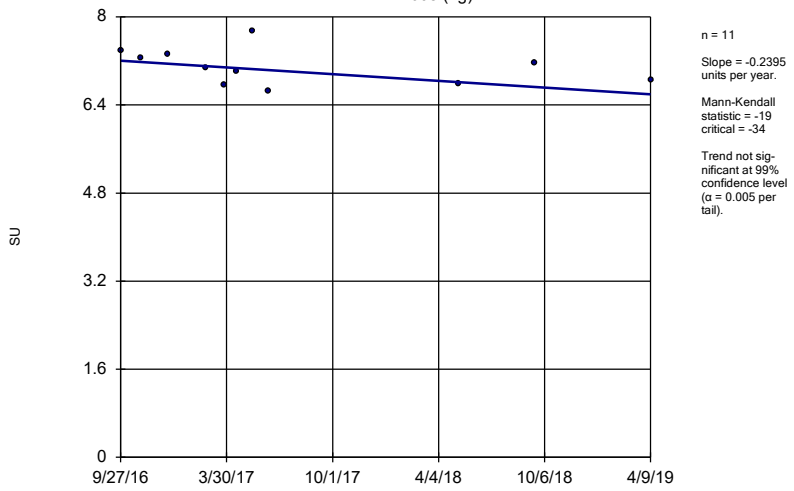
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: pH, field Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1608 (bg)



n = 11

Slope = -0.2395 units per year.

Mann-Kendall statistic = -19
critical = -34

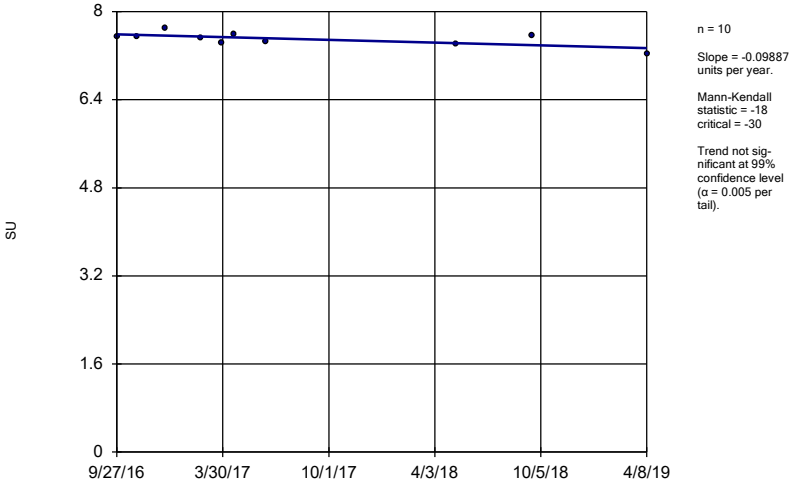
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: pH, field Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1607S



n = 10

Slope = -0.09887 units per year.

Mann-Kendall statistic = -18
critical = -30

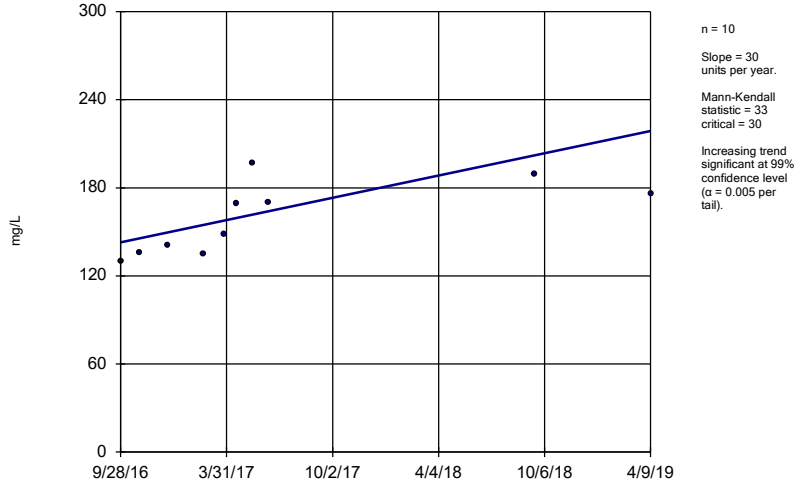
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: pH, field Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1601A (bg)



n = 10

Slope = 30 units per year.

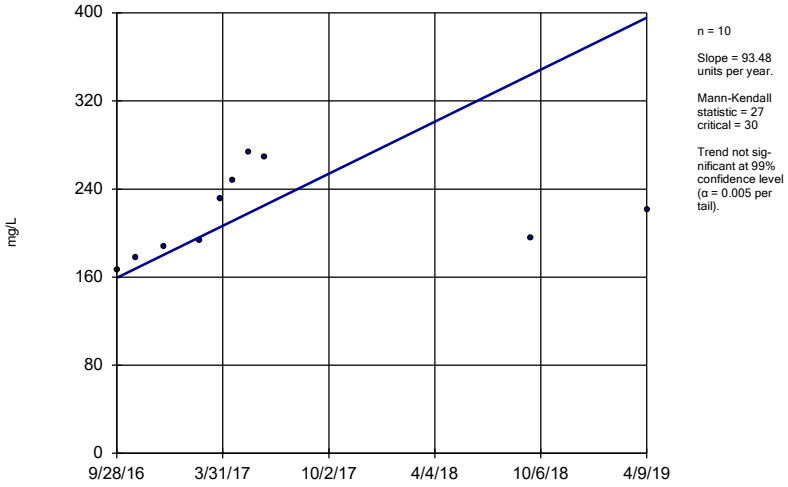
Mann-Kendall statistic = 33
critical = 30

Increasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1602 (bg)



n = 10

Slope = 93.48 units per year.

Mann-Kendall statistic = 27
critical = 30

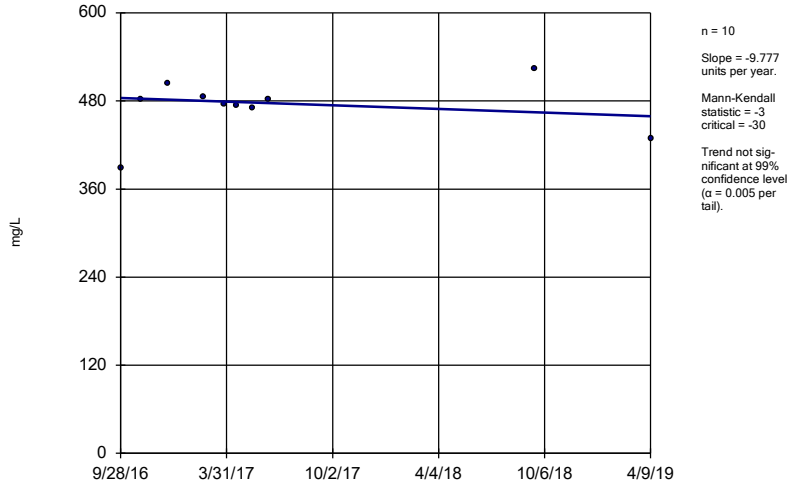
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1603 (bg)



n = 10

Slope = -9.777 units per year.

Mann-Kendall statistic = -3
critical = -30

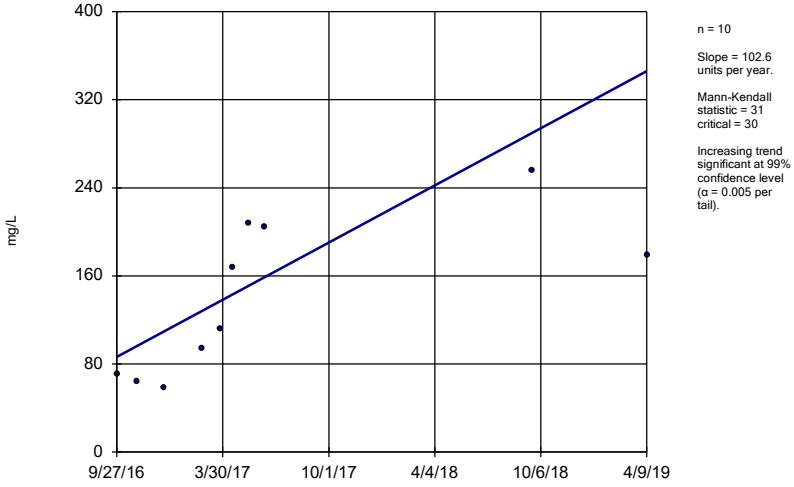
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 7/3/2019 10:04 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1608 (bg)



n = 10

Slope = 102.6 units per year.

Mann-Kendall statistic = 31
critical = 30

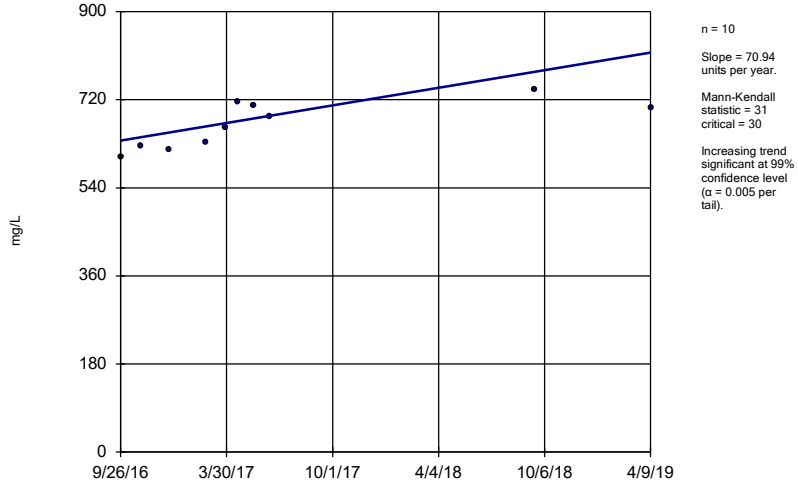
Increasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 7/3/2019 10:05 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1604S



n = 10

Slope = 70.94 units per year.

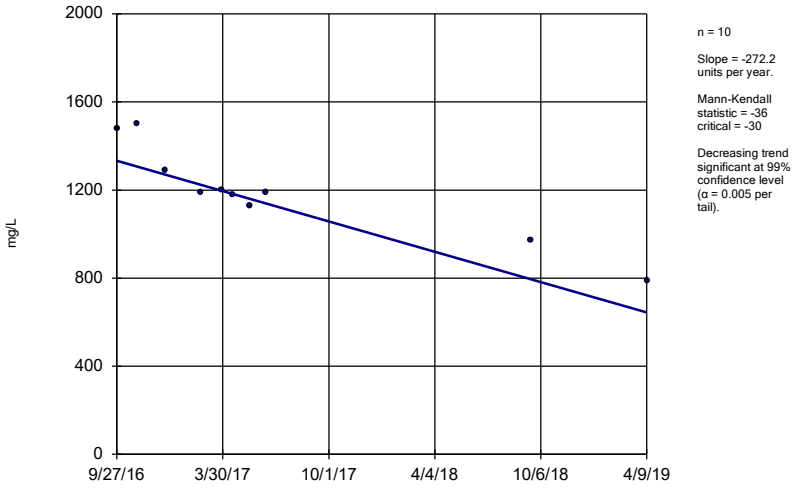
Mann-Kendall statistic = 31
critical = 30

Increasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 7/3/2019 10:05 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1605D



n = 10

Slope = -272.2 units per year.

Mann-Kendall statistic = -36
critical = -30

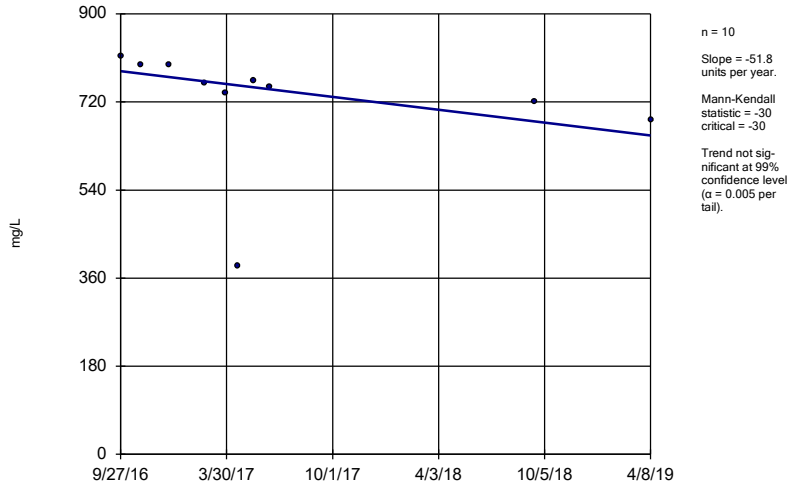
Decreasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 7/3/2019 10:05 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1606D



n = 10

Slope = -51.8 units per year.

Mann-Kendall statistic = -30
critical = -30

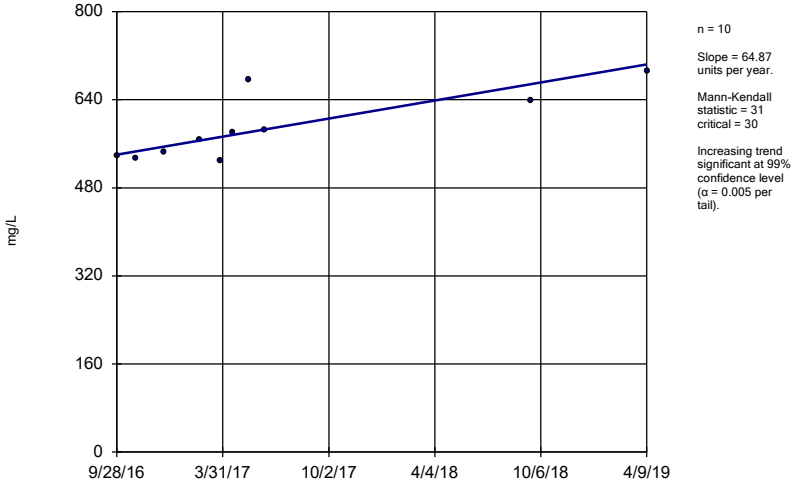
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 7/3/2019 10:05 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1601A (bg)



n = 10

Slope = 64.87 units per year.

Mann-Kendall statistic = 31
critical = 30

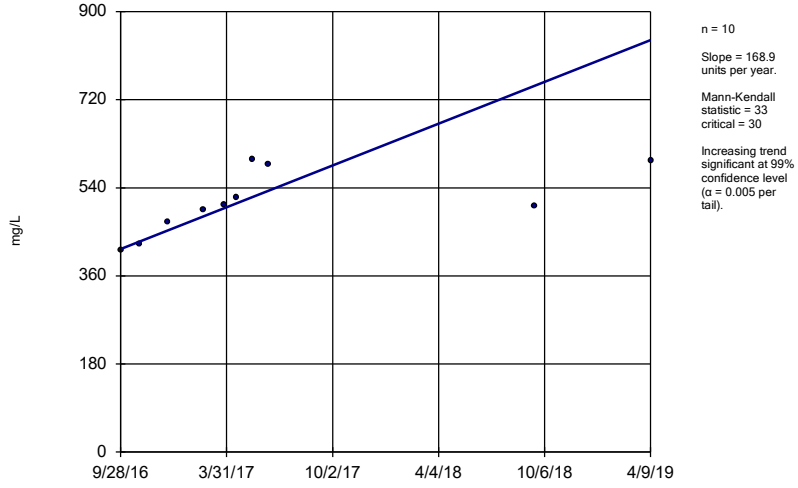
Increasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 7/3/2019 10:05 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1602 (bg)



n = 10

Slope = 168.9 units per year.

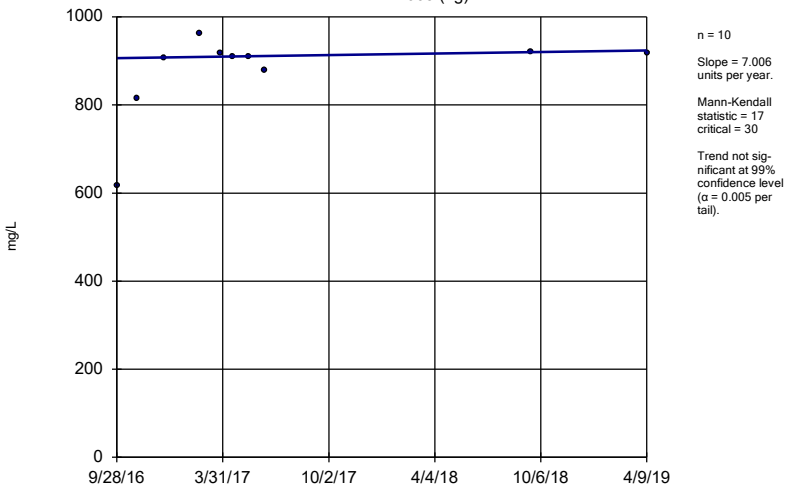
Mann-Kendall statistic = 33
critical = 30

Increasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 7/3/2019 10:05 AM View: Trend Tests
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1603 (bg)



n = 10

Slope = 7.006 units per year.

Mann-Kendall statistic = 17 critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

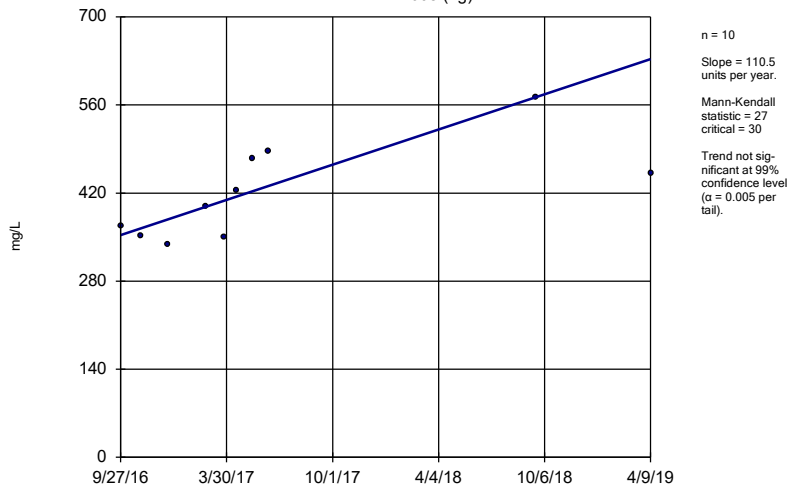
Constituent: Total Dissolved Solids [TDS] Analysis Run 7/3/2019 10:05 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1608 (bg)



n = 10

Slope = 110.5 units per year.

Mann-Kendall statistic = 27 critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

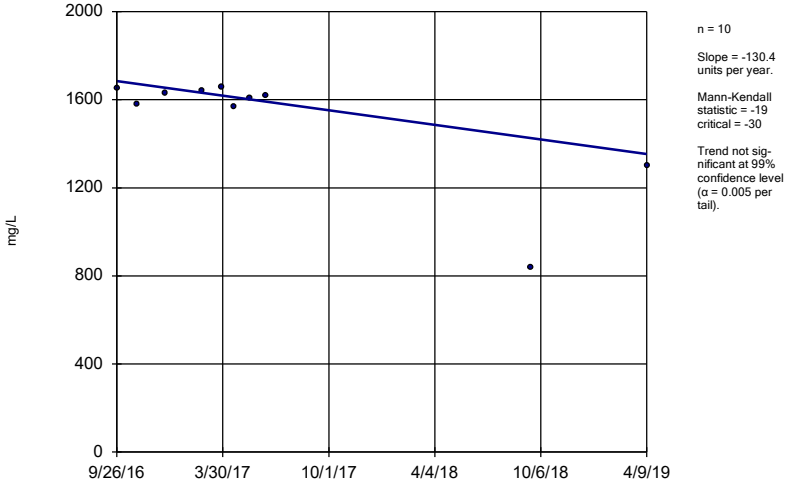
Constituent: Total Dissolved Solids [TDS] Analysis Run 7/3/2019 10:05 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1604D



n = 10

Slope = -130.4 units per year.

Mann-Kendall statistic = -19 critical = -30

Trend not significant at 99% confidence level (α = 0.005 per tail).

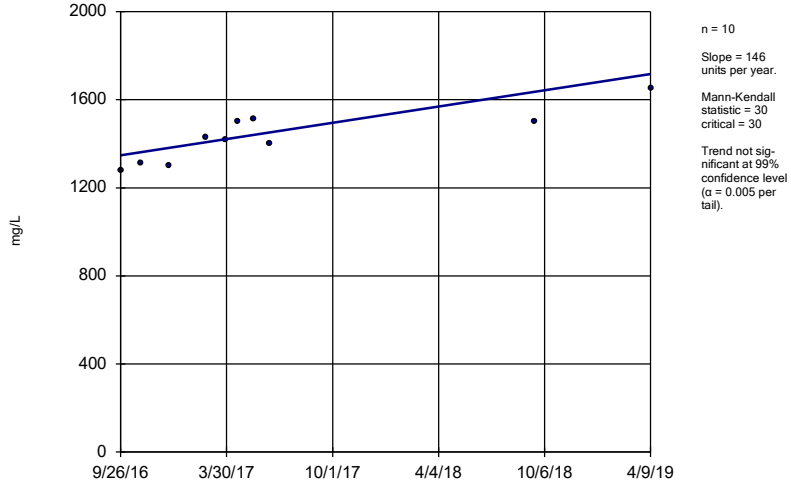
Constituent: Total Dissolved Solids [TDS] Analysis Run 7/3/2019 10:05 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1604S



n = 10

Slope = 146 units per year.

Mann-Kendall statistic = 30 critical = 30

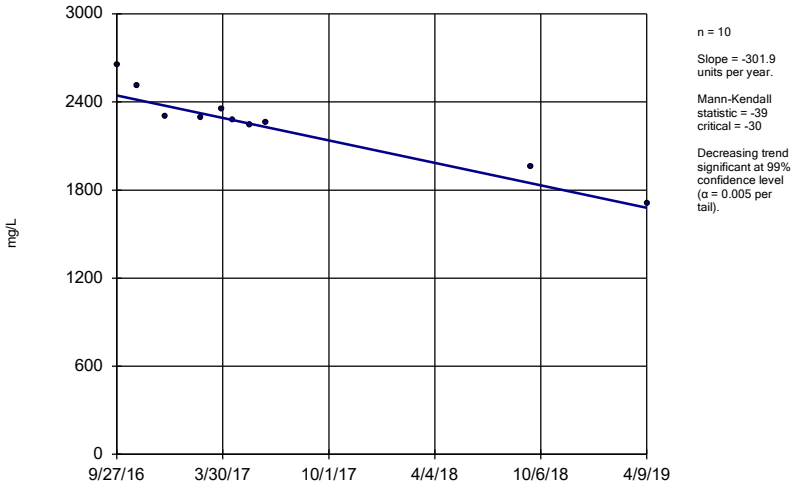
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 7/3/2019 10:05 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1605D



n = 10

Slope = -301.9 units per year.

Mann-Kendall statistic = -39 critical = -30

Decreasing trend significant at 99% confidence level (α = 0.005 per tail).

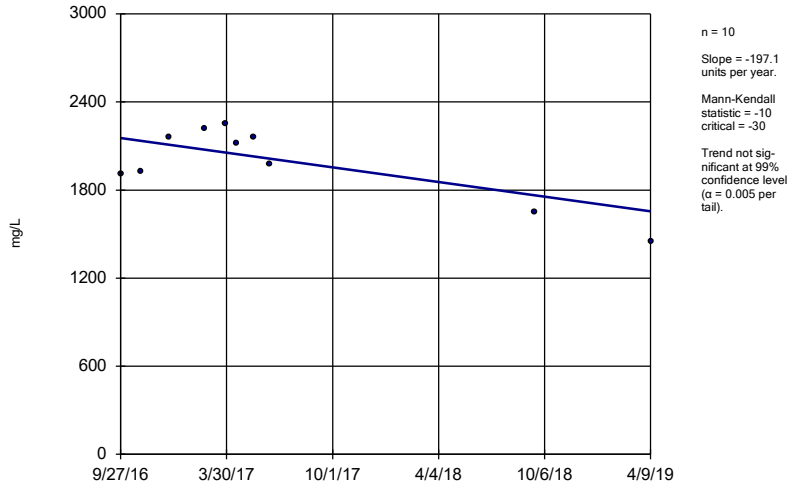
Constituent: Total Dissolved Solids [TDS] Analysis Run 7/3/2019 10:05 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1605S



n = 10

Slope = -197.1 units per year.

Mann-Kendall statistic = -10 critical = -30

Trend not significant at 99% confidence level (α = 0.005 per tail).

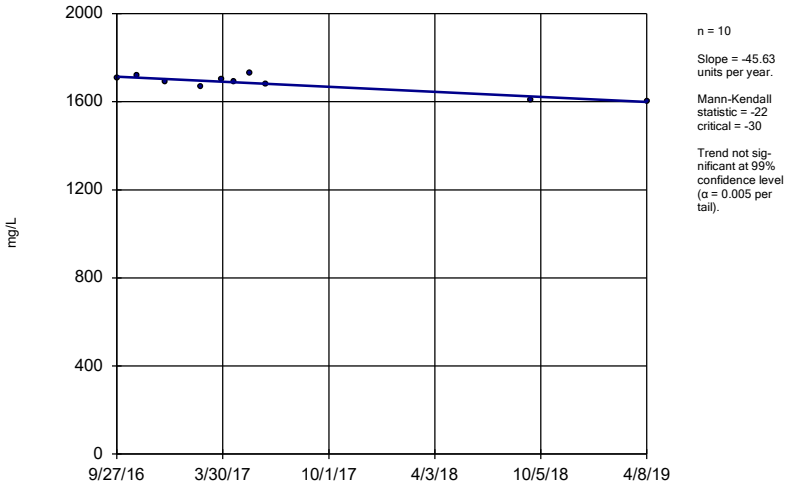
Constituent: Total Dissolved Solids [TDS] Analysis Run 7/3/2019 10:05 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1606D



n = 10

Slope = -45.63 units per year.

Mann-Kendall statistic = -22 critical = -30

Trend not significant at 99% confidence level (α = 0.005 per tail).

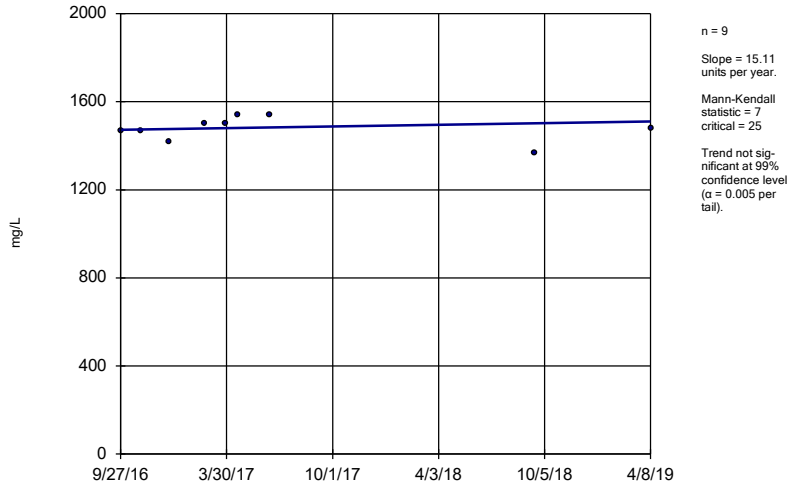
Constituent: Total Dissolved Solids [TDS] Analysis Run 7/3/2019 10:05 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1606S



n = 9

Slope = 15.11 units per year.

Mann-Kendall statistic = 7 critical = 25

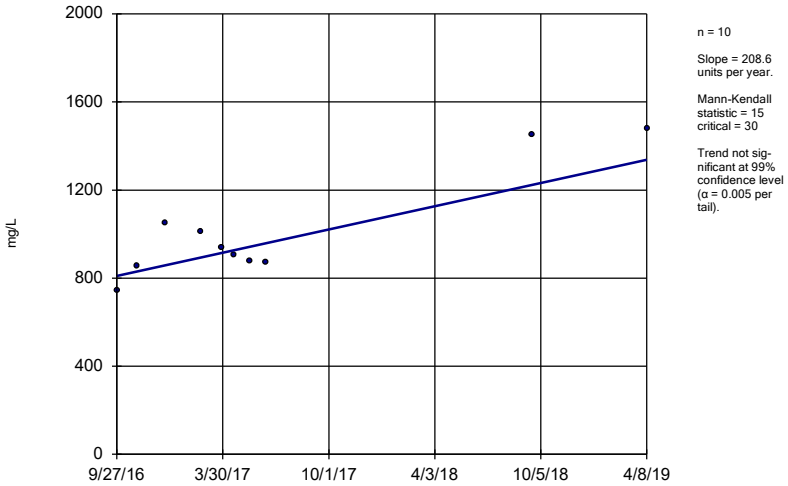
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 7/3/2019 10:05 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1607D



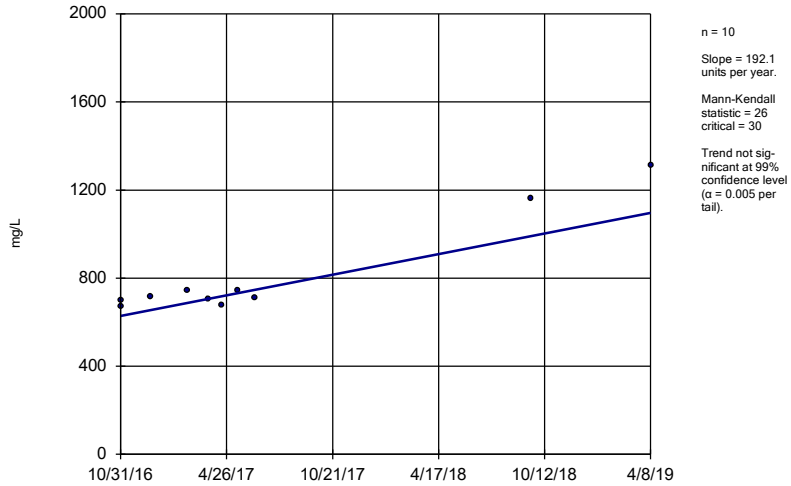
Constituent: Total Dissolved Solids [TDS] Analysis Run 7/3/2019 10:05 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1607S



Constituent: Total Dissolved Solids [TDS] Analysis Run 7/3/2019 10:05 AM View: Trend Tests

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Upper Tolerance Limits

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 6/17/2019, 1:38 PM

Constituent	Upper Lim.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony, total (mg/L)	0.00025	44	n/a	n/a	9.091	n/a	n/a	0.1047	NP Inter(normality)
Arsenic, total (mg/L)	0.000749	44	0.0004759	0.0001301	0	None	No	0.05	Inter
Barium, total (mg/L)	0.0578	44	-3.308	0.2177	0	None	ln(x)	0.05	Inter
Beryllium, total (mg/L)	0.0001	44	n/a	n/a	86.36	n/a	n/a	0.1047	NP Inter(NDs)
Cadmium, total (mg/L)	0.0001	44	n/a	n/a	6.818	n/a	n/a	0.1047	NP Inter(normality)
Chromium, total (mg/L)	0.001773	44	-8.037	0.8109	2.273	None	ln(x)	0.05	Inter
Cobalt, total (mg/L)	0.0007641	44	-9	0.8687	2.273	None	ln(x)	0.05	Inter
Combined Radium 226 + 228 (pCi/L)	2.448	44	0.8596	0.3359	0	None	sqrt(x)	0.05	Inter
Fluoride, total (mg/L)	0.2755	44	0.03409	0.01991	0	None	x^2	0.05	Inter
Lead, total (mg/L)	0.0005448	44	0.01136	0.005707	4.545	None	sqrt(x)	0.05	Inter
Lithium, total (mg/L)	0.02713	44	0.0109	0.007732	6.818	None	No	0.05	Inter
Mercury, total (mg/L)	0.000005	44	n/a	n/a	90.91	n/a	n/a	0.1047	NP Inter(NDs)
Molybdenum, total (mg/L)	0.004186	44	0.03555	0.01389	4.545	None	sqrt(x)	0.05	Inter
Selenium, total (mg/L)	0.0015	44	n/a	n/a	0	n/a	n/a	0.1047	NP Inter(normality)
Thallium, total (mg/L)	0.00025	44	n/a	n/a	11.36	n/a	n/a	0.1047	NP Inter(normality)

Confidence Intervals - Significant Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 6/17/2019, 1:47 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	%NDs	Transform	Alpha	Method
Lithium, total (mg/L)	**MW-1605D**	**0.08141**	**0.06641**	**0.04**	**Yes**	**11**	**0**	**No**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1605S**	**0.08119**	**0.06118**	**0.04**	**Yes**	**11**	**0**	**No**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1606D**	**0.1271**	**0.1121**	**0.04**	**Yes**	**11**	**0**	**No**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1606S**	**0.1182**	**0.1036**	**0.04**	**Yes**	**11**	**0**	**No**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1607D**	**0.1003**	**0.07148**	**0.04**	**Yes**	**11**	**0**	**No**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1607S**	**0.1166**	**0.09123**	**0.04**	**Yes**	**11**	**0**	**No**	**0.01**	**Param.**

Confidence Intervals - All Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 6/17/2019, 1:47 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	%NDs	Transform	Alpha	Method
Antimony, total (mg/L)	MW-1604D	0.0001744	0.00008012	0.006	No	11	9.091	No	0.01	Param.
Antimony, total (mg/L)	MW-1604S	0.00013	0.00003	0.006	No	11	0	No	0.006	NP (normality)
Antimony, total (mg/L)	MW-1605D	0.00004	0.00003	0.006	No	11	0	No	0.006	NP (normality)
Antimony, total (mg/L)	MW-1605S	0.00007935	0.00003793	0.006	No	11	0	ln(x)	0.01	Param.
Antimony, total (mg/L)	MW-1606D	0.00019	0.00015	0.006	No	11	0	No	0.006	NP (normality)
Antimony, total (mg/L)	MW-1606S	0.0001627	0.0001428	0.006	No	11	0	No	0.01	Param.
Antimony, total (mg/L)	MW-1607D	0.00004	0.00003	0.006	No	11	0	No	0.006	NP (normality)
Antimony, total (mg/L)	MW-1607S	0.00055	0.00042	0.006	No	11	0	No	0.006	NP (normality)
Arsenic, total (mg/L)	MW-1604D	0.0005337	0.0003791	0.01	No	11	0	No	0.01	Param.
Arsenic, total (mg/L)	MW-1604S	0.0004757	0.0003625	0.01	No	11	0	No	0.01	Param.
Arsenic, total (mg/L)	MW-1605D	0.002514	0.002123	0.01	No	11	0	No	0.01	Param.
Arsenic, total (mg/L)	MW-1605S	0.0009958	0.0005824	0.01	No	11	0	No	0.01	Param.
Arsenic, total (mg/L)	MW-1606D	0.0008285	0.0004015	0.01	No	11	0	sqrt(x)	0.01	Param.
Arsenic, total (mg/L)	MW-1606S	0.0008883	0.0007463	0.01	No	11	0	No	0.01	Param.
Arsenic, total (mg/L)	MW-1607D	0.001228	0.0009938	0.01	No	11	0	No	0.01	Param.
Arsenic, total (mg/L)	MW-1607S	0.001494	0.000942	0.01	No	10	0	No	0.01	Param.
Barium, total (mg/L)	MW-1604D	0.037	0.0275	2	No	11	0	No	0.006	NP (normality)
Barium, total (mg/L)	MW-1604S	0.03029	0.02711	2	No	11	0	No	0.01	Param.
Barium, total (mg/L)	MW-1605D	0.02922	0.02483	2	No	11	0	No	0.01	Param.
Barium, total (mg/L)	MW-1605S	0.03919	0.02647	2	No	11	0	No	0.01	Param.
Barium, total (mg/L)	MW-1606D	0.06068	0.05083	2	No	11	0	No	0.01	Param.
Barium, total (mg/L)	MW-1606S	0.07652	0.06847	2	No	11	0	No	0.01	Param.
Barium, total (mg/L)	MW-1607D	0.1471	0.09659	2	No	11	0	No	0.01	Param.
Barium, total (mg/L)	MW-1607S	0.07282	0.05948	2	No	10	0	No	0.01	Param.
Beryllium, total (mg/L)	MW-1604D	0.0001	0.0001	0.004	No	11	100	No	0.006	NP (NDs)
Beryllium, total (mg/L)	MW-1604S	0.0001	0.0001	0.004	No	11	90.91	No	0.006	NP (NDs)
Beryllium, total (mg/L)	MW-1605D	0.0001	0.0001	0.004	No	11	100	No	0.006	NP (NDs)
Beryllium, total (mg/L)	MW-1605S	0.0001	0.000009	0.004	No	11	72.73	No	0.006	NP (normality)
Beryllium, total (mg/L)	MW-1606D	0.0001	0.000005	0.004	No	11	63.64	No	0.006	NP (normality)
Beryllium, total (mg/L)	MW-1606S	0.0001	0.0001	0.004	No	11	90.91	No	0.006	NP (NDs)
Beryllium, total (mg/L)	MW-1607D	0.0001	0.0001	0.004	No	11	90.91	No	0.006	NP (NDs)
Beryllium, total (mg/L)	MW-1607S	0.0001	0.00001	0.004	No	11	63.64	No	0.006	NP (normality)
Cadmium, total (mg/L)	MW-1604D	0.0001515	0.00006669	0.005	No	11	0	No	0.01	Param.
Cadmium, total (mg/L)	MW-1604S	0.00015	0.00003	0.005	No	11	0	No	0.006	NP (normality)
Cadmium, total (mg/L)	MW-1605D	0.0000372	0.00001735	0.005	No	11	0	No	0.01	Param.
Cadmium, total (mg/L)	MW-1605S	0.00009148	0.00005802	0.005	No	11	0	ln(x)	0.01	Param.
Cadmium, total (mg/L)	MW-1606D	0.00008	0.00006	0.005	No	11	0	No	0.006	NP (normality)
Cadmium, total (mg/L)	MW-1606S	0.00008026	0.00006519	0.005	No	11	0	No	0.01	Param.
Cadmium, total (mg/L)	MW-1607D	0.000025	0.00002	0.005	No	11	63.64	No	0.006	NP (normality)
Cadmium, total (mg/L)	MW-1607S	0.00006	0.00003	0.005	No	11	0	No	0.006	NP (normality)
Chromium, total (mg/L)	MW-1604D	0.0004916	0.0001552	0.1	No	11	0	No	0.01	Param.
Chromium, total (mg/L)	MW-1604S	0.000537	0.0001141	0.1	No	11	0	ln(x)	0.01	Param.
Chromium, total (mg/L)	MW-1605D	0.0004519	0.00007766	0.1	No	11	0	ln(x)	0.01	Param.
Chromium, total (mg/L)	MW-1605S	0.000915	0.0002181	0.1	No	11	0	ln(x)	0.01	Param.
Chromium, total (mg/L)	MW-1606D	0.0006184	0.0001572	0.1	No	11	0	sqrt(x)	0.01	Param.
Chromium, total (mg/L)	MW-1606S	0.00057	0.0000942	0.1	No	11	0	sqrt(x)	0.01	Param.
Chromium, total (mg/L)	MW-1607D	0.0005194	0.00007628	0.1	No	11	0	ln(x)	0.01	Param.
Chromium, total (mg/L)	MW-1607S	0.0007914	0.0001596	0.1	No	11	0	ln(x)	0.01	Param.
Cobalt, total (mg/L)	MW-1604D	0.001857	0.001312	0.006	No	11	0	x^4	0.01	Param.
Cobalt, total (mg/L)	MW-1604S	0.00188	0.000308	0.006	No	11	0	No	0.006	NP (normality)
Cobalt, total (mg/L)	MW-1605D	0.001836	0.001624	0.006	No	11	0	No	0.01	Param.
Cobalt, total (mg/L)	MW-1605S	0.001276	0.000477	0.006	No	11	0	ln(x)	0.01	Param.
Cobalt, total (mg/L)	MW-1606D	0.0022	0.00117	0.006	No	11	0	No	0.006	NP (normality)
Cobalt, total (mg/L)	MW-1606S	0.0003795	0.0002499	0.006	No	11	0	No	0.01	Param.
Cobalt, total (mg/L)	MW-1607D	0.000778	0.000399	0.006	No	11	0	No	0.006	NP (normality)

Confidence Intervals - All Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 6/17/2019, 1:47 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	%NDs	Transform	Alpha	Method
Cobalt, total (mg/L)	MW-1607S	0.0026	0.00084	0.006	No	11	0	No	0.006	NP (normality)
Combined Radium 226 + 228 (pCi/L)	MW-1604D	1.793	0.6266	5	No	11	0	sqrt(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1604S	1.516	0.568	5	No	10	0	sqrt(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1605D	1.768	0.5945	5	No	11	0	ln(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1605S	2.692	0.337	5	No	11	0	No	0.006	NP (normality)
Combined Radium 226 + 228 (pCi/L)	MW-1606D	3.369	0.7491	5	No	11	0	x^(1/3)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1606S	1.555	0.6016	5	No	11	0	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1607D	2.059	0.9912	5	No	11	0	ln(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1607S	2.207	0.9624	5	No	11	0	No	0.01	Param.
Fluoride, total (mg/L)	MW-1604D	0.2009	0.1718	4	No	11	0	No	0.01	Param.
Fluoride, total (mg/L)	MW-1604S	0.213	0.1943	4	No	11	0	No	0.01	Param.
Fluoride, total (mg/L)	MW-1605D	0.2147	0.1835	4	No	11	0	No	0.01	Param.
Fluoride, total (mg/L)	MW-1605S	0.2935	0.232	4	No	11	0	No	0.01	Param.
Fluoride, total (mg/L)	MW-1606D	0.26	0.24	4	No	11	0	No	0.006	NP (normality)
Fluoride, total (mg/L)	MW-1606S	0.54	0.44	4	No	11	0	No	0.006	NP (normality)
Fluoride, total (mg/L)	MW-1607D	0.54	0.5	4	No	11	0	No	0.006	NP (normality)
Fluoride, total (mg/L)	MW-1607S	0.3102	0.2752	4	No	11	0	No	0.01	Param.
Lead, total (mg/L)	MW-1604D	0.000303	0.00002	0.015	No	11	9.091	No	0.006	NP (normality)
Lead, total (mg/L)	MW-1604S	0.0001417	0.00003197	0.015	No	11	9.091	No	0.01	Param.
Lead, total (mg/L)	MW-1605D	0.00004085	0.00001345	0.015	No	11	0	sqrt(x)	0.01	Param.
Lead, total (mg/L)	MW-1605S	0.0008795	0.0001426	0.015	No	11	0	sqrt(x)	0.01	Param.
Lead, total (mg/L)	MW-1606D	0.0005378	0.00003565	0.015	No	11	0	x^(1/3)	0.01	Param.
Lead, total (mg/L)	MW-1606S	0.0001622	0.00005021	0.015	No	11	0	No	0.01	Param.
Lead, total (mg/L)	MW-1607D	0.000179	0.000041	0.015	No	11	0	No	0.006	NP (normality)
Lead, total (mg/L)	MW-1607S	0.0014	0.000094	0.015	No	11	0	No	0.006	NP (normality)
Lithium, total (mg/L)	MW-1604D	0.0593	0.03415	0.04	No	11	0	No	0.01	Param.
Lithium, total (mg/L)	MW-1604S	0.04926	0.03129	0.04	No	11	0	No	0.01	Param.
Lithium, total (mg/L)	**MW-1605D**	**0.08141**	**0.06641**	**0.04**	**Yes**	**11**	**0**	**No**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1605S**	**0.08119**	**0.06118**	**0.04**	**Yes**	**11**	**0**	**No**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1606D**	**0.1271**	**0.1121**	**0.04**	**Yes**	**11**	**0**	**No**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1606S**	**0.1182**	**0.1036**	**0.04**	**Yes**	**11**	**0**	**No**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1607D**	**0.1003**	**0.07148**	**0.04**	**Yes**	**11**	**0**	**No**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1607S**	**0.1166**	**0.09123**	**0.04**	**Yes**	**11**	**0**	**No**	**0.01**	**Param.**
Mercury, total (mg/L)	MW-1604D	0.000005	0.000005	0.002	No	11	81.82	No	0.006	NP (NDs)
Mercury, total (mg/L)	MW-1604S	0.000005	0.000005	0.002	No	11	90.91	No	0.006	NP (NDs)
Mercury, total (mg/L)	MW-1605D	0.000005	0.000005	0.002	No	11	90.91	No	0.006	NP (NDs)
Mercury, total (mg/L)	MW-1605S	0.000005	0.000005	0.002	No	11	90.91	No	0.006	NP (NDs)
Mercury, total (mg/L)	MW-1606D	0.000005	0.000005	0.002	No	11	90.91	No	0.006	NP (NDs)
Mercury, total (mg/L)	MW-1606S	0.000005	0.000005	0.002	No	11	90.91	No	0.006	NP (NDs)
Mercury, total (mg/L)	MW-1607D	0.000005	0.000002	0.002	No	11	81.82	No	0.006	NP (NDs)
Mercury, total (mg/L)	MW-1607S	0.000005	0.000003	0.002	No	10	80	No	0.011	NP (NDs)
Molybdenum, total (mg/L)	MW-1604D	0.01959	0.01388	0.1	No	11	9.091	x^4	0.01	Param.
Molybdenum, total (mg/L)	MW-1604S	0.0162	0.00247	0.1	No	10	0	No	0.011	NP (normality)
Molybdenum, total (mg/L)	MW-1605D	0.0515	0.04392	0.1	No	11	0	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1605S	0.02217	0.01589	0.1	No	11	0	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1606D	0.08024	0.07094	0.1	No	11	0	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1606S	0.1034	0.07754	0.1	No	11	0	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1607D	0.09146	0.08279	0.1	No	11	0	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1607S	0.04759	0.04094	0.1	No	11	0	No	0.01	Param.
Selenium, total (mg/L)	MW-1604D	0.001654	0.0006355	0.05	No	11	0	ln(x)	0.01	Param.
Selenium, total (mg/L)	MW-1604S	0.002606	0.001376	0.05	No	11	0	No	0.01	Param.
Selenium, total (mg/L)	MW-1605D	0.0003	0.0002	0.05	No	11	0	No	0.006	NP (normality)
Selenium, total (mg/L)	MW-1605S	0.001858	0.0008189	0.05	No	11	0	sqrt(x)	0.01	Param.
Selenium, total (mg/L)	MW-1606D	0.006248	0.002825	0.05	No	11	0	No	0.01	Param.
Selenium, total (mg/L)	MW-1606S	0.001579	0.0007583	0.05	No	11	0	ln(x)	0.01	Param.

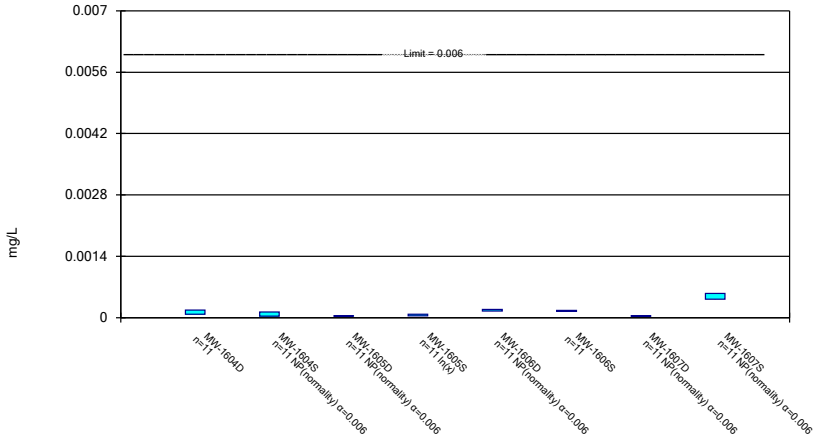
Confidence Intervals - All Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 6/17/2019, 1:47 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	%NDs	Transform	Alpha	Method
Selenium, total (mg/L)	MW-1607D	0.0001	0.00003	0.05	No	11	18.18	No	0.006	NP (normality)
Selenium, total (mg/L)	MW-1607S	0.009845	0.007664	0.05	No	11	0	No	0.01	Param.
Thallium, total (mg/L)	MW-1604D	0.0002881	0.0001699	0.002	No	11	9.091	x^2	0.01	Param.
Thallium, total (mg/L)	MW-1604S	0.00025	0.00002	0.002	No	11	9.091	No	0.006	NP (normality)
Thallium, total (mg/L)	MW-1605D	0.000138	0.00004	0.002	No	11	9.091	No	0.006	NP (normality)
Thallium, total (mg/L)	MW-1605S	0.000174	0.00004	0.002	No	11	9.091	No	0.006	NP (normality)
Thallium, total (mg/L)	MW-1606D	0.000123	0.00009	0.002	No	11	9.091	No	0.006	NP (normality)
Thallium, total (mg/L)	MW-1606S	0.000112	0.000062	0.002	No	11	9.091	No	0.006	NP (normality)
Thallium, total (mg/L)	MW-1607D	0.000062	0.00002	0.002	No	11	9.091	No	0.006	NP (normality)
Thallium, total (mg/L)	MW-1607S	0.000089	0.00005	0.002	No	10	10	No	0.011	NP (normality)

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

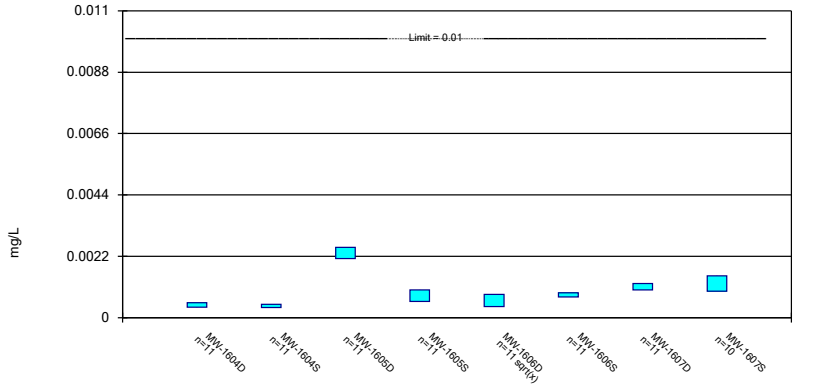


Constituent: Antimony, total Analysis Run 6/17/2019 1:44 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

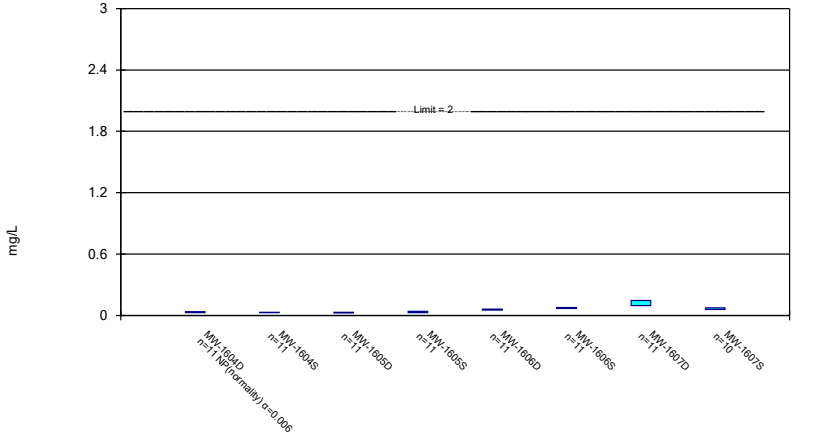


Constituent: Arsenic, total Analysis Run 6/17/2019 1:44 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

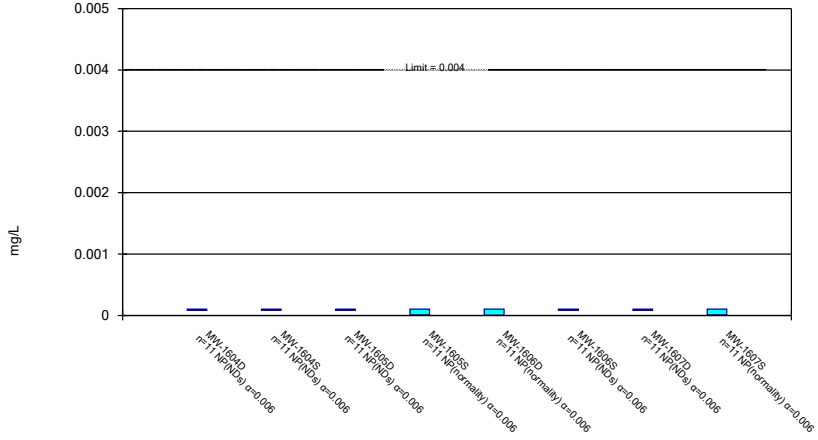


Constituent: Barium, total Analysis Run 6/17/2019 1:44 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.

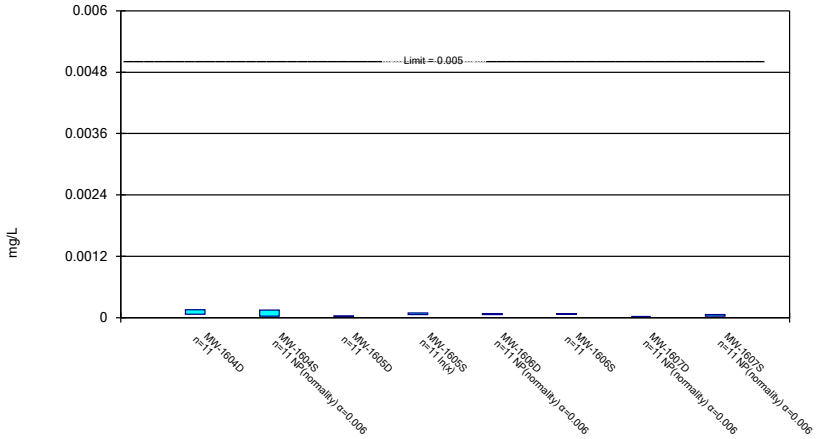


Constituent: Beryllium, total Analysis Run 6/17/2019 1:44 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

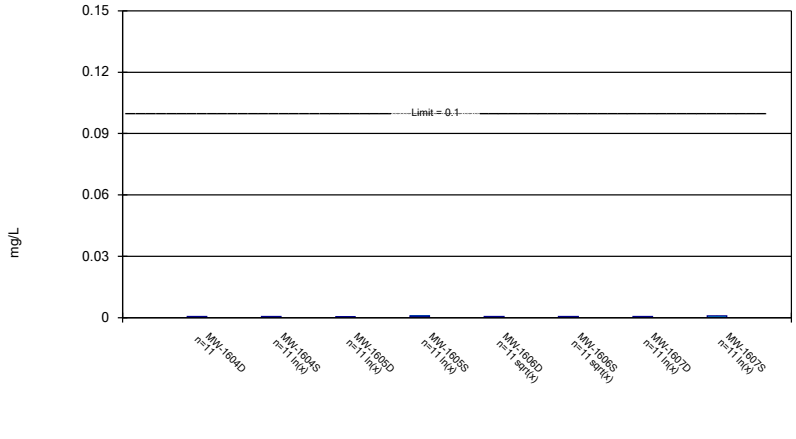


Constituent: Cadmium, total Analysis Run 6/17/2019 1:44 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

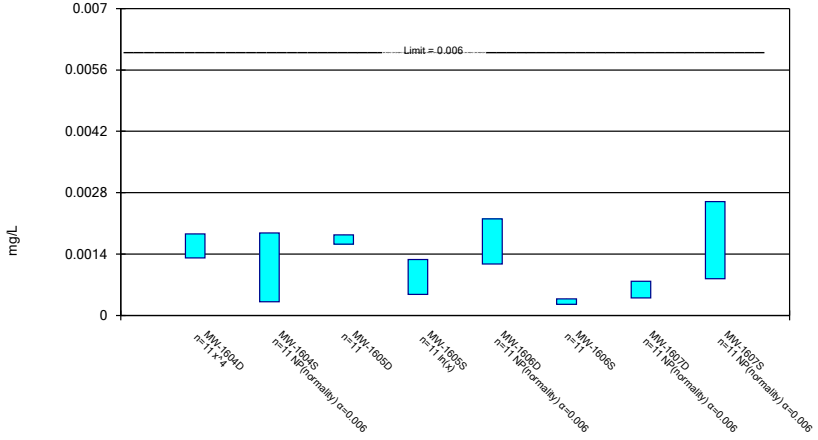


Constituent: Chromium, total Analysis Run 6/17/2019 1:44 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

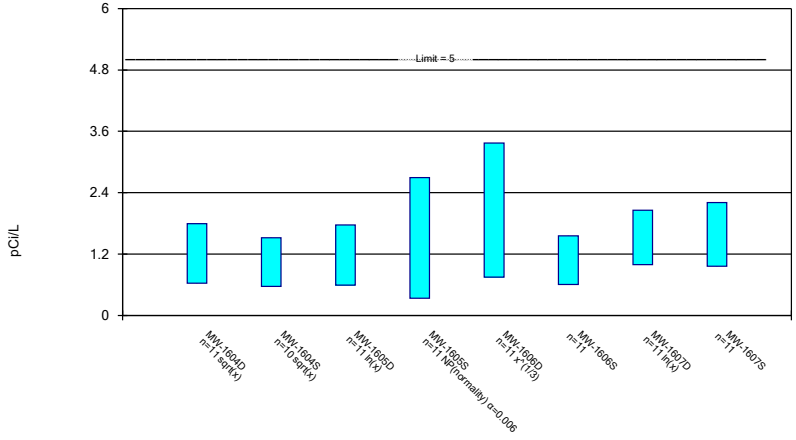


Constituent: Cobalt, total Analysis Run 6/17/2019 1:44 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

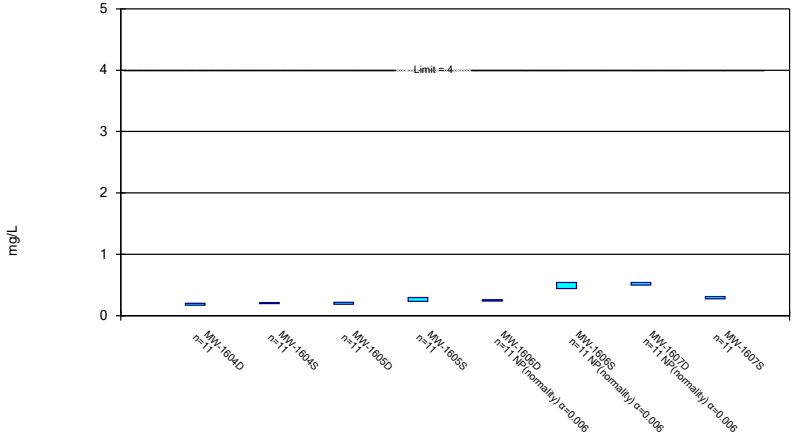


Constituent: Combined Radium 226 + 228 Analysis Run 6/17/2019 1:44 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

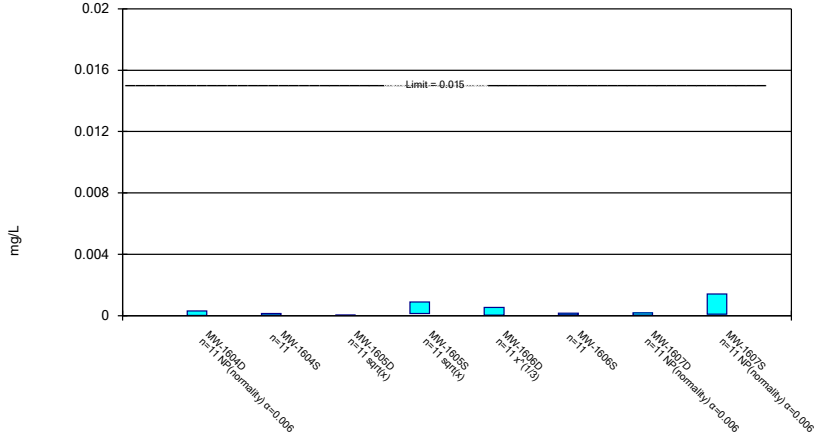


Constituent: Fluoride, total Analysis Run 6/17/2019 1:44 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

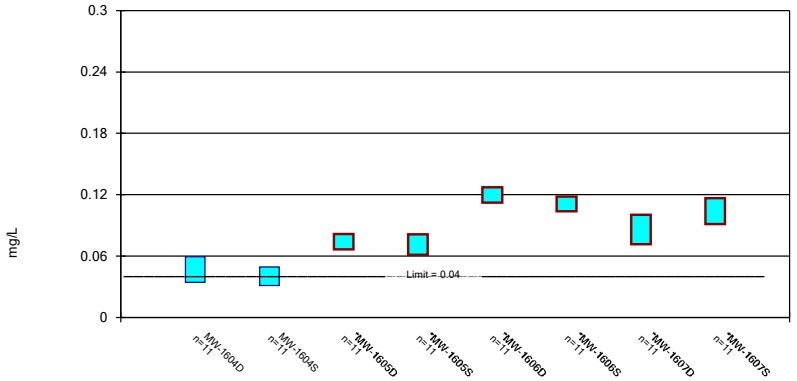


Constituent: Lead, total Analysis Run 6/17/2019 1:44 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric Confidence Interval

Compliance limit is exceeded.* Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

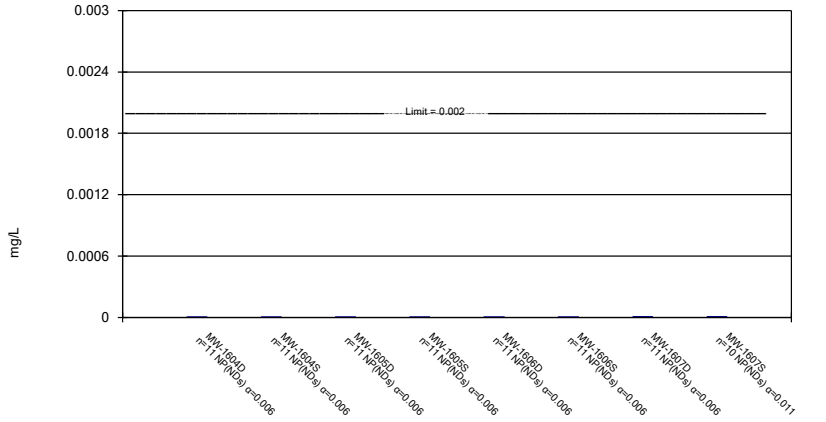


Constituent: Lithium, total Analysis Run 6/17/2019 1:44 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.

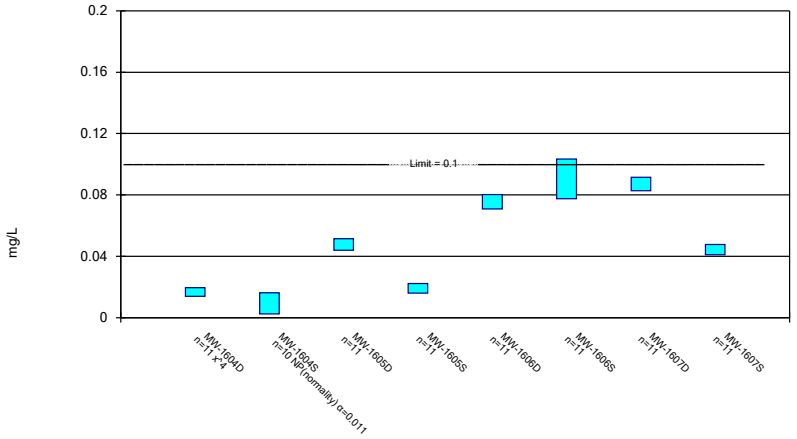


Constituent: Mercury, total Analysis Run 6/17/2019 1:44 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

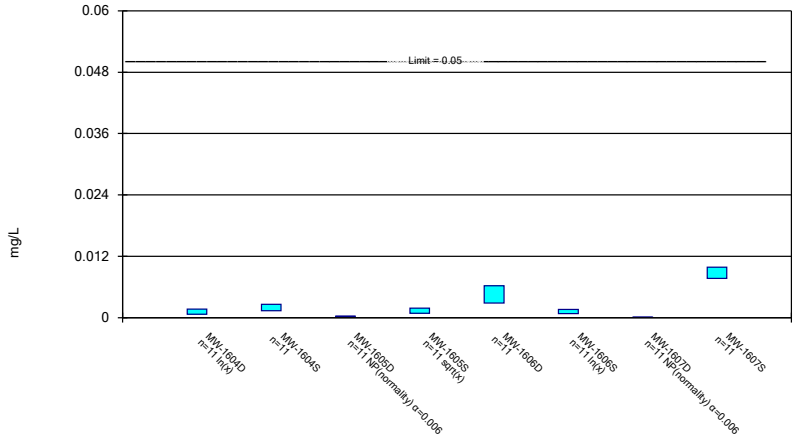


Constituent: Molybdenum, total Analysis Run 6/17/2019 1:44 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

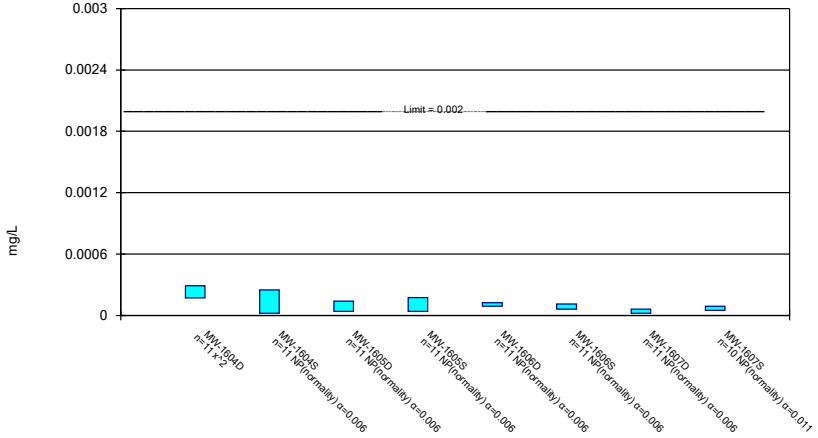


Constituent: Selenium, total Analysis Run 6/17/2019 1:44 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Thallium, total Analysis Run 6/17/2019 1:44 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

STATISTICAL ANALYSIS SUMMARY
BOTTOM ASH POND
Mountaineer Plant
New Haven, West Virginia

Submitted to

1 Riverside Plaza
Columbus, Ohio 43215-2372

Submitted by

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December 23, 2019

CHA8473

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LIST OF ATTACHMENTS

Attachment A Certification by Qualified Professional Engineer
Attachment B Statistical Analysis Output

LIST OF ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
ASD	Alternative Source Demonstration
BAP	Bottom Ash Pond
CCR	Coal Combustion Residuals
CCV	Continuing Calibration Verification
CFR	Code of Federal Regulations
GWPS	Groundwater Protection Standard
LCL	Lower Confidence Limit
LFB	Laboratory Fortified Blanks
LRB	Laboratory Reagent Blanks
MCL	Maximum Contaminant Level
NELAP	National Environmental Laboratory Accreditation Program
QA	Quality Assurance
QC	Quality Control
SSI	Statistically Significant Increase
SSL	Statistically Significant Level
SU	Standard Units
TDS	Total Dissolved Solids
UPL	Upper Prediction Limit
USEPA	United States Environmental Protection Agency
UTL	Upper Tolerance Limit

SECTION 1

EXECUTIVE SUMMARY

In accordance with the United States Environmental Protection Agency's (USEPA's) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR 257.90-257.98, "CCR rule"), groundwater monitoring has been conducted at the Bottom Ash Pond (BAP), an existing CCR unit at the Mountaineer Power Plant located in New Haven, West Virginia.

Based on detection monitoring conducted in 2017 and 2018, statistically significant increases (SSIs) over background were concluded for boron, calcium, chloride, total dissolved solids (TDS), and sulfate at the BAP. An alternative source was not identified at the time, so the BAP initiated assessment monitoring in April 2018. Upon receipt of assessment monitoring data from September 2018, statistical analysis was performed within 90 days. The statistical analysis of this assessment monitoring event determined SSLs for lithium at wells MW-1605D, MW-1605S, MW-1606D, MW-1606S, MW-1607D, and MW-1607S (Geosyntec, 2019a). An ASD was not successful and within 90 days of exceeding the GWPS for lithium, the BAP initiated assessment of corrective measures.

During the first assessment monitoring event of 2019, completed in April 2019, SSLs were identified for lithium at wells MW-1605D, MW-1605S, MW-1606D, MW-1606S, MW-1607D, and MW-1607S, and the unit continued to work on the assessment of corrective measures in accordance with 40 CFR 257.96. Following the April 2019 event, two assessment monitoring events were conducted at the BAP in June and September 2019, in accordance with 40 CFR 257.95. The statistical summary report for the April 2019 assessment monitoring event was completed within 90 days of receiving the laboratory results and is documented under a separate cover (Geosyntec, 2019b). Only the results of the June and September 2019 events are documented in this report.

Groundwater data underwent several validation tests, including those for completeness, sample tracking accuracy, transcription errors, and consistent use of measurement units. No data quality issues were identified which would impact the usability of the data.

The monitoring data were submitted to Groundwater Stats Consulting, LLC for statistical analysis. Groundwater protection standards (GWPSs) were re-established for the Appendix IV parameters. Confidence intervals were calculated for Appendix IV parameters at the compliance wells to assess whether Appendix IV parameters were present at a statistically significant level (SSL) above the GWPS. SSLs were identified for lithium. Thus, the unit will continue to complete an assessment of corrective measures and continue to monitor the groundwater monitoring network in accordance with the assessment monitoring program per 40 CFR 257.95. Certification of the selected statistical methods by a qualified professional engineer is documented in Attachment A.

SECTION 2

BOTTOM ASH POND EVALUATION

2.1 Data Validation & QA/QC

During the assessment monitoring program, two sets of samples were collected for analysis from each upgradient and downgradient well to meet the requirements of 40 CFR 257.95(b) (June 2019) and 257.95(d)(1) (September 2019). Samples from both sampling events were analyzed for the Appendix III and Appendix IV parameters. A summary of data collected during these assessment monitoring events may be found in Table 1.

Chemical analysis was completed by an analytical laboratory certified by the National Environmental Laboratory Accreditation Program (NELAP). Quality assurance and quality control (QA/QC) samples completed by the analytical laboratory included the use of laboratory reagent blanks (LRBs), continuing calibration verification (CCV) samples, and laboratory fortified blanks (LFBs).

The analytical data were imported into a Microsoft Access database, where checks were completed to assess the accuracy of sample location identification and analyte identification. Where necessary, unit conversions were applied to standardize reported units across all sampling events. Exported data files were created for use with the Sanitas™ v.9.6.23 statistics software. The export file was checked against the analytical data for transcription errors and completeness. No QA/QC issues were noted which would impact data usability.

2.2 Statistical Analysis

Statistical analyses for the BAP were conducted in accordance with the January 2017 *Statistical Analysis Plan* (AEP, 2017), except where noted below. Time series plots and results for all completed statistical tests are provided in Attachment B.

The data obtained in June and September 2019 were screened for potential outliers. Outliers were identified for antimony at MW-1605D in the June 2019 data; fluoride at MW-1606D and MW-1606S in the June and September 2019 data; and thallium at MW-1606D and MW-1606S in the September 2019 data. However, these values were not removed from the dataset as they either were non-detects or were similar to values reported in neighboring wells. Several chromium values from the December 2016 background monitoring event were removed from the dataset even though they were not identified as outliers by Tukey's Test, as they were not representative of chromium results during later events. Additional information regarding outliers is provided in Attachment B.

2.2.1 Establishment of GWPSs

A GWPS was established for each Appendix IV parameter in accordance with 40 CFR 257.95(h) and the *Statistical Analysis Plan* (AEP, 2017). The established GWPS was determined to be the greater value of the background concentration and the maximum contaminant level (MCL) or the CCR Rule level specified in 40 CFR 257.95(h)(2) for each Appendix IV parameter. To determine background concentrations, an upper tolerance limit (UTL) was calculated using pooled data from the background wells collected during the background monitoring and assessment monitoring events. Generally, tolerance limits were calculated parametrically with 95% coverage and 95% confidence. Non-parametric tolerance limits were calculated for antimony, barium, cadmium, selenium, and thallium due to apparent non-normal distributions and for beryllium and mercury due to a high non-detect frequency. Tolerance limits and the final GWPSs are summarized in Table 2.

2.2.2 Evaluation of Potential Appendix IV SSLs

A confidence interval was constructed for each Appendix IV parameter at each compliance well. Confidence limits were generally calculated parametrically ($\alpha = 0.01$); however, non-parametric confidence limits were calculated in some cases (e.g., when the data did not appear to be normally distributed or when the non-detect frequency was too high). An SSL was concluded if the lower confidence limit (LCL) exceeded the GWPS (i.e., if the entire confidence interval exceeded the GWPS). Calculated confidence limits are shown in Attachment B.

The following SSLs were identified at the Mountaineer BAP:

- LCLs for lithium exceeded the GWPS of 0.0400 mg/L at MW-1605D (0.0593 mg/L), MW-1605S (0.0565 mg/L), MW-1606D (0.0998 mg/L), MW-1606S (0.0941 mg/L), MW-1607D (0.0735 mg/L), MW-1607S (0.0894 mg/L).

As a result, the Mountaineer BAP will continue the assessment of corrective measures and continue to monitor the groundwater monitoring network in accordance with the assessment monitoring program per 40 CFR 257.95.

2.2.3 Establishment of Appendix III Prediction Limits

Upper prediction limits (UPL) were previously established for all Appendix III parameters following the background monitoring period (Geosyntec, 2018). Intrawell tests were used to evaluate potential SSIs for pH, whereas interwell tests were used to evaluate potential SSIs for boron, calcium, chloride, fluoride, sulfate, and TDS. While interwell prediction limits have been updated periodically during the assessment monitoring period as sufficient data became available, this represents the first update to the background dataset for parameters evaluated using intrawell tests.

Mann-Whitney (Wilcoxon rank-sum) tests were performed to determine whether the newer data are affected by a release from the BAP. Because the interwell Appendix III limits and the

Appendix IV GWPSs are based on data from upgradient wells which we would not expect to have been impacted by a release, these tests were used for intrawell Appendix III tests only. Mann-Whitney tests were used to compare the medians of historical data (September 2016 - June 2017) to the new compliance samples (October 2017 – April 2019) for pH. Results were evaluated to determine if the medians of the two groups were similar at the 99% confidence level. Where no significant difference was found, the new compliance data were added to the background dataset. Where a statistically significant difference was found between the medians of the two groups, the data were reviewed to evaluate the cause of the difference and to determine if adding newer data to the background dataset, replacing the background dataset with the newer data, or continuing to use the existing background dataset was most appropriate. If the differences appeared to have been caused by a release, then the previous background dataset would have continued to be used. However, no significant differences were found between the two groups. The complete Mann-Whitney test results and a summary of the significant findings can be found in Attachment B.

After the revised background set was established, a parametric or non-parametric analysis was selected based on the distribution of the data and the frequency of non-detect data. Estimated results less than the practical quantitation limit (PQL) – i.e., "J-flagged" data – were considered detections and the estimated results were used in the statistical analyses. Non-parametric analyses were selected for datasets with at least 50% non-detect data or datasets that could not be normalized. Parametric analyses were selected for datasets (either transformed or untransformed) that passed the Shapiro-Wilk / Shapiro-Francía test for normality. The Kaplan-Meier non-detect adjustment was applied to datasets with between 15% and 50% non-detect data. For datasets with fewer than 15% non-detect data, non-detect data were replaced with one half of the PQL. The selected analysis (i.e., parametric or non-parametric) and transformation (where applicable) for each background dataset are shown in Attachment B.

UPLs were updated using all the historical data through April 2019 to represent background values. LPLs were also updated for pH. The updated prediction limits are summarized in Table 3. Intrawell tests continued to be used to evaluate potential SSIs for pH, whereas interwell tests continued to be used to evaluate potential SSIs for boron, calcium, chloride, fluoride, sulfate, and TDS. The intrawell UPLs were calculated for a one-of-two retesting procedure; i.e., if at least one sample in a series of two does not exceed the UPL, then it can be concluded that an SSI has not occurred. In practice, where the initial result did not exceed the UPL, a second sample was not collected. The retesting procedures allowed achieving an acceptably high statistical power to detect changes at downgradient wells for constituents evaluated using intrawell prediction limits.

2.2.4 Evaluation of Potential Appendix III SSIs

While SSLs were identified, a review of the Appendix III results were also completed to assess whether concentrations of Appendix III parameters at the compliance wells exceeded background concentrations.

Data collected during the June and September 2019 assessment monitoring events from each compliance well were compared to the prediction limits to evaluate results above background

values. The results from this event and the prediction limits are summarized in Table 4. The following exceedances of the upper prediction limits (UPLs) were noted:

- Boron concentrations exceeded the interwell UPL of 0.614 mg/L at MW-1604D (1.66 mg/L and 2.18 mg/L), MW-1604S (3.15 mg/L and 3.23 mg/L), MW-1605D (6.57 mg/L and 8.57 mg/L), MW-1605S (7.02 mg/L and 8.05 mg/L), MW-1606D (7.79 mg/L and 6.38 mg/L), MW-1606S (6.08 mg/L and 6.19 mg/L), MW-1607D (3.14 mg/L and 3.65 mg/L), and MW-1607S (2.46 mg/L and 3.21 mg/L).

- Calcium concentrations exceeded the interwell UPL of 200 mg/L at MW-1604D (217 mg/L), MW-1604S (278 mg/L and 267 mg/L), MW-1605D (265 mg/L and 283 mg/L), MW-1606D (281 mg/L for both events), MW-1606S (223 mg/L and 229 mg/L), MW-1607D (234 mg/L and 233 mg/L), and MW-1607S (233 mg/L and 198 mg/L).

- Chloride concentrations exceeded the interwell UPL of 68.5 mg/L at MW-1604D (93.0 mg/L and 82.2 mg/L), MW-1604S (127 mg/L and 128 mg/L), MW-1605D (165 mg/L and 168 mg/L), MW-1605S (140 mg/L and 149 mg/L), MW-1606D (231 mg/L and 244 mg/L), MW-1606S (232 mg/L and 221 mg/L), MW-1607D (167 mg/L and 174 mg/L), and MW-1607S (154 mg/L and 167 mg/L).

- Fluoride concentrations exceeded the interwell UPL of 0.271 mg/L at MW-1606D (0.490 mg/L), MW-1606S (0.280 mg/L), and MW-1607D (0.400 mg/L and 0.560 mg/L).

- Sulfate concentrations exceeded the interwell UPL of 674 mg/L at MW-1604S (741 mg/L and 770 mg/L), MW-1605D (877 mg/L and 974 mg/L), MW-1605S (694 mg/L), MW-1606D (693 mg/L), MW-1606S (705 mg/L), MW-1607D (710 mg/L and 699 mg/L).

- TDS concentrations exceeded the interwell UPL of 1040 mg/L at MW-1604D (1110 mg/L and 1210 mg/L), MW-1604S (1580 mg/L and 1520 mg/L), MW-1605D (1890 mg/L and 2050 mg/L), MW-1605S (1510 mg/L and 1470 mg/L), MW-1606D (1690 mg/L and 1700 mg/L), MW-1606S (1490 mg/L and 1460 mg/L), MW-1607D (1600 mg/L and 1610 mg/L),

Based on these results, concentrations of Appendix III parameters exceeded background levels at compliance wells at the Mountaineer BAP during assessment monitoring.

2.3 Conclusions

A semi-annual assessment monitoring event was conducted in accordance with the CCR Rule. The laboratory and field data were reviewed prior to statistical analysis, with no QA/QC issues identified that impacted data usability. A review of outliers resulted in the removal of several chromium values from the December 2016 background monitoring event, as the reported results were not representative of later sampling events. GWPSs were re-established for the Appendix IV parameters. A confidence interval was constructed at each compliance well for each Appendix IV parameter; SSLs were concluded if the entire confidence interval exceeded the GWPS. SSLs

were identified for lithium. Appendix III parameters were compared to recalculated prediction limits, with exceedances identified for boron, calcium, chloride, fluoride, sulfate, and TDS.

Based on this evaluation, the Mountaineer BAP CCR unit will continue with the assessment of corrective measures and continue to monitor the groundwater monitoring network in accordance with the assessment monitoring program per 40 CFR 257.95

SECTION 3

REFERENCES

American Electric Power (AEP). 2017. Statistical Analysis Plan – Mountaineer Plant. January 2017.

Geosyntec Consultants (Geosyntec). 2018. Statistical Analysis Summary – Bottom Ash Pond, Mountaineer Plant, New Haven, West Virginia. January 15, 2018.

Geosyntec. 2019a. Statistical Analysis Summary – Bottom Ash Pond. Mountaineer Plant, New Haven, West Virginia. January 8, 2019.

Geosyntec. 2019b. Statistical Analysis Summary – Bottom Ash Pond. Mountaineer Plant, New Haven, West Virginia. July 12, 2019.

TABLES

Table 1 - Groundwater Data Summary
Mountaineer - Bottom Ash Pond

Geosyntec Consultants, Inc.

Component	Unit	MW-1601A		MW-1602		MW-1603		MW-1604D		MW-1604S		MW-1605D	
		6/20/2019	9/11/2019	6/20/2019	9/11/2019	6/20/2019	9/11/2019	6/19/2019	9/9/2019	6/19/2019	9/9/2019	6/19/2019	9/10/2019
Antimony	µg/L	0.0300 J	0.0300 J	0.0200 J	0.100 U	0.0300 J	0.0300 J	0.0400 J	0.0300 J	0.150	0.140	0.200 U	0.0300 J
Arsenic	µg/L	0.630	0.620	0.330	0.310	0.410	0.350	0.280	0.300	0.330	0.340	2.67	2.78
Barium	µg/L	63.1	65.3	29.5	27.3	30.7	30.9	52.9	55.6	29.0	29.0	28.6	33.1
Beryllium	µg/L	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.200 U	0.100 U
Boron	mg/L	0.160	0.153	0.100 J	0.111	0.299	0.308	1.66	2.18	3.15	3.23	6.57	8.57
Cadmium	µg/L	0.0200 J	0.0200 J	0.0100 J	0.0100 J	0.0100 J	0.0100 J	0.0400 J	0.0300 J	0.210	0.210	0.0200 J	0.0300 J
Calcium	mg/L	165	164	91.2	95.1	162	156	196	217	278	267	265	283
Chloride	mg/L	48.6	45.8	10.7	10.4	10.9	10.0	93.0	82.2	127	128	165	168
Chromium	µg/L	0.314	0.370	0.200 J	0.200 J	0.249	0.205	0.212	0.345	0.0900 J	0.100 J	0.200 J	0.0400 J
Cobalt	µg/L	0.0300 J	0.0300 J	0.0300 J	0.0500 U	0.204	0.112	0.242	0.181	2.16	2.14	1.65	1.69
Combined Radium	pCi/L	0.450	1.17	0.153	0.451	0.297	1.07	0.192	0.464	1.26	1.15	0.831	1.64
Fluoride	mg/L	0.160	0.140	0.230	0.210	0.0900	0.0900	0.140	0.170	0.160	0.200	0.190	0.170
Lead	µg/L	0.0700 J	0.200 U	0.0700 J	0.200 U	0.176	0.100 J	0.0700 J	0.200 U	0.100 U	0.200 U	0.200 U	0.200 U
Lithium	mg/L	0.0300 U	0.00184	0.0100 J	0.00979	0.0300 U	0.0150	0.0300 U	0.0188	0.0320	0.0476	0.0200 J	0.0561
Mercury	µg/L	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U
Molybdenum	µg/L	0.900 J	0.900 J	0.900 J	1.00 J	0.900 J	0.500 J	1.00 J	2.00 J	16.6	16.3	40.0	39.7
Selenium	µg/L	1.30	1.10	0.100 J	0.100 J	0.300	0.200	3.10	3.40	1.00	1.00	0.200 J	0.300
Total Dissolved Solids	mg/L	730	749	606	603	878	853	1110	1210	1580	1520	1890	2050
Sulfate	mg/L	207	221	267	259	434	421	461	551	741	770	877	974
Thallium	µg/L	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.300 J	0.300 J	1.00 U	0.500 U
pH	SU	7.26	6.96	6.98	6.71	6.97	6.65	7.18	7.04	7.27	7.33	7.48	7.23

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
SU: standard unit
U: Parameter was not present in concentrations above the method detection limit and is reported as the reporting limit
J: Estimated value. Parameter was detected in concentrations below the reporting limit
-: Not analyzed

Table 1 - Groundwater Data Summary
Mountaineer - Bottom Ash Pond

Geosyntec Consultants, Inc.

Component	Unit	MW-1605S		MW-1606D		MW-1606S		MW-1607D		MW-1607S		MW-1608	
		6/19/2019	9/10/2019	6/19/2019	9/10/2019	6/19/2019	9/10/2019	6/19/2019	9/10/2019	6/19/2019	9/10/2019	6/18/2019	9/10/2019
Antimony	µg/L	0.0400 J	0.0400 J	0.140	0.150	0.150	0.130	0.0300 J	0.0300 J	0.440	0.410	0.0300 J	0.0300 J
Arsenic	µg/L	0.470	0.590	0.370	0.400	0.630	0.670	1.61	1.53	0.960	0.870	0.400	0.520
Barium	µg/L	23.6	29.6	49.4	51.4	67.2	70.4	82.3	79.3	81.0	67.7	32.0	26.8
Beryllium	µg/L	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.0500 J
Boron	mg/L	7.02	8.05	7.79	6.38	6.08	6.19	3.14	3.65	2.46	3.21	0.116	0.124
Cadmium	µg/L	0.0500 J	0.0500 J	0.0900	0.0800	0.0800	0.0700	0.0500 U	0.0100 J	0.0400 J	0.0500 J	0.0100 J	0.0500 U
Calcium	mg/L	156	174	281	281	223	229	234	233	233	198	86.5	92.0
Chloride	mg/L	140	149	231	244	232	221	167	174	154	167	5.06	4.01
Chromium	µg/L	0.100 J	0.237	0.0700 J	0.100 J	0.0800 J	0.0800 J	0.100 J	0.0500 J	0.428	0.357	0.306	0.327
Cobalt	µg/L	0.279	0.379	1.36	1.09	0.171	0.312	0.799	0.848	0.990	0.971	0.0500 J	0.0560
Combined Radium	pCi/L	0.424	0.542	0.933	2.27	1.01	2.68	1.31	1.86	1.12	2.77	0.104	1.35
Fluoride	mg/L	0.230	0.260	0.100 J	0.490	0.250	0.280	0.400	0.560	0.190	0.270	0.160	0.200
Lead	µg/L	0.0800 J	0.202	0.100 U	0.200 U	0.111	0.200 U	0.0700 J	0.200 U	0.108	0.0900 J	0.0600 J	0.0600 J
Lithium	mg/L	0.0400	0.0524	0.0580	0.0835	0.0560	0.0877	0.0720	0.110	0.0750	0.0990	0.0300 U	0.00286
Mercury	µg/L	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U
Molybdenum	µg/L	13.6	14.2	68.3	68.5	58.9	54.9	81.8	82.1	34.6	35.0	0.800 J	1.00 J
Selenium	µg/L	0.600	0.400	9.60	1.00	1.30	2.70	0.0600 J	0.0900 J	5.60	4.30	0.800	1.00
Total Dissolved Solids	mg/L	1510	1470	1690	1700	1490	1460	1600	1610	1370	1350	416	369
Sulfate	mg/L	649	694	693	588	581	705	710	699	524	465	144	109
Thallium	µg/L	0.500 U	0.500 U	0.100 J	0.500 U	0.100 J	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U
pH	SU	7.35	7.16	7.40	7.40	7.19	7.32	7.79	7.71	7.49	7.66	6.24	7.13

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
SU: standard unit
U: Parameter was not present in concentrations above the method detection limit and is reported as the reporting limit
J: Estimated value. Parameter was detected in concentrations below the reporting limit
-: Not analyzed

Table 2: Groundwater Protection Standards
Mountaineer Plant - Bottom Ash Pond

Constituent Name	MCL	CCR Rule-Specified	Background Limit
Antimony, Total (mg/L)	0.006		0.0001
Arsenic, Total (mg/L)	0.01		0.00074
Barium, Total (mg/L)	2		0.065
Beryllium, Total (mg/L)	0.004		0.0001
Cadmium, Total (mg/L)	0.005		0.00003
Chromium, Total (mg/L)	0.1		0.0009
Cobalt, Total (mg/L)	n/a	0.006	0.0007
Combined Radium, Total (pCi/L)	5		2.33
Fluoride, Total (mg/L)	4		0.27
Lead, Total (mg/L)	n/a	0.015	0.00067
Lithium, Total (mg/L)	n/a	0.04	0.026
Mercury, Total (mg/L)	0.002		0.000005
Molybdenum, Total (mg/L)	n/a	0.1	0.0038
Selenium, Total (mg/L)	0.05		0.0015
Thallium, Total (mg/L)	0.002		0.0005

Notes:
Grey cell indicates calculated UTL is higher than MCL.
MCL = Maximum Contaminant Level
Calculated UTL (Upper Tolerance Limit) represents site-specific background values.
The higher of the calculated UTL or MCL/Rule-Specified Level is used as the GWPS.

Table 3: Revised Prediction Limits
Mountaineer Plant - Bottom Ash Pond

Parameter	Unit	Description	MW-1604D	MW-1604S	MW-1605D	MW-1605S	MW-1606D	MW-1606S	MW-1607D	MW-1607S
Boron	mg/L	Interwell Background Value (UPL)	0.614							
Calcium	mg/L	Interwell Background Value (UPL)	200							
Chloride	mg/L	Interwell Background Value (UPL)	68.5							
Fluoride	mg/L	Interwell Background Value (UPL)	0.271							
pH	SU	Intrawell Background Value (UPL)	7.8	7.8	7.9	7.9	7.9	8.1	8.0	7.8
		Intrawell Background Value (LPL)	6.7	6.6	6.9	6.8	6.9	6.1	7.0	7.2
Sulfate	mg/L	Interwell Background Value (UPL)	674							
Total Dissolved Solids	mg/L	Interwell Background Value (UPL)	1040							

Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit

Table 4: Appendix III Data Summary
Mountaineer Plant - Bottom Ash Pond

Geosyntec Consultants, Inc.

Parameter	Unit	Description	MW-1604D		MW-1604S		MW-1605D		MW-1605S		MW-1606D		MW-1606S		MW-1607D		MW-1607S	
			6/19/2019	9/9/2019	6/19/2019	9/9/2019	6/19/2019	9/10/2019	6/19/2019	9/10/2019	6/19/2019	9/10/2019	6/19/2019	9/10/2019	6/19/2019	9/10/2019	6/19/2019	9/10/2019
Boron	mg/L	Interwell Background Value (UPL)	0.614															
		Detection Monitoring Result	**1.66**	**2.18**	**3.15**	**3.23**	**6.57**	**8.57**	**7.02**	**8.05**	**7.79**	**6.38**	**6.08**	**6.19**	**3.14**	**3.65**	**2.46**	**3.21**
Calcium	mg/L	Interwell Background Value (UPL)	200															
		Detection Monitoring Result	196	**217**	**278**	**267**	**265**	**283**	156	174	**281**	**281**	**223**	**229**	**234**	**233**	**233**	**198**
Chloride	mg/L	Interwell Background Value (UPL)	68.5															
		Detection Monitoring Result	**93.0**	**82.2**	**127**	**128**	**165**	**168**	**140**	**149**	**231**	**244**	**232**	**221**	**167**	**174**	**154**	**167**
Fluoride	mg/L	Interwell Background Value (UPL)	0.271															
		Detection Monitoring Result	0.140	0.170	0.160	0.200	0.190	0.170	0.230	0.260	0.100	**0.490**	0.250	**0.280**	**0.400**	**0.560**	0.190	0.270
pH	SU	Intrawell Background Value (UPL)	7.8		7.8		7.9		7.9		7.9		8.1		8.0		7.8	
		Intrawell Background Value (LPL)	6.7		6.6		6.9		6.8		6.9		6.1		7.0		7.2	
		Detection Monitoring Result	7.2	7.0	7.3	7.3	7.5	7.2	7.4	7.2	7.4	7.4	7.2	7.3	7.8	7.7	7.5	7.7
Sulfate	mg/L	Interwell Background Value (UPL)	674															
		Detection Monitoring Result	461	551	**741**	**770**	**877**	**974**	649	**694**	**693**	588	581	**705**	**710**	**699**	524	465
Total Dissolved Solids	mg/L	Interwell Background Value (UPL)	1040															
		Detection Monitoring Result	**1110**	**1210**	**1580**	**1520**	**1890**	**2050**	**1510**	**1470**	**1690**	**1700**	**1490**	**1460**	**1600**	**1610**	**1370**	**1350**

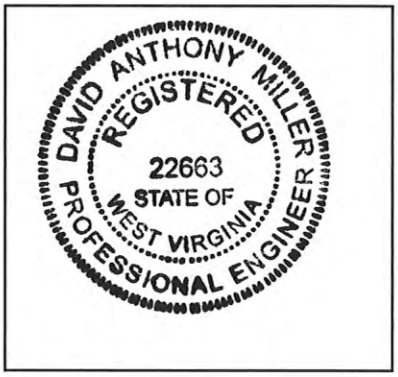
Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit
Bold values exceed the background value.
Background values are shaded gray.

ATTACHMENT A

Certification by Qualified Professional Engineer

Certification by Qualified Professional Engineer

I certify that the selected and above described statistical method is appropriate for evaluating the groundwater monitoring data for the Mountaineer Bottom Ash Pond CCR management area and that the requirements of 40 CFR 257.93(f) have been met.



DAVID ANTHONY MILLER

Printed Name of Licensed Professional Engineer

David Anthony Miller

Signature

22663	WEST VIRGINIA	12.23.19
License Number	Licensing State	Date

ATTACHMENT B
Statistical Analysis Output

GROUNDWATER STATS
CONSULTING

December 9, 2019

Geosyntec Consultants
Attn: Ms. Allison Kreinberg
941 Chatham Lane, #103
Columbus, OH 43221

Re: Mountaineer BAP – Assessment Monitoring Report & Background Update - 2019

Groundwater Stats Consulting, formerly the statistical consulting division of Sanitas Technologies, is pleased to provide the statistical analysis and background update of 2019 groundwater data for American Electric Power Inc.'s Mountaineer Bottom Ash Pond. The analysis complies with the federal rule for the Disposal of Coal Combustion Residuals from Electric Utilities (CCR Rule, 2015) as well as with the USEPA Unified Guidance (2009).

Sampling began at the site for the CCR program in 2016. The monitoring well network, as provided by Geosyntec Consultants, consists of the following:

- **Upgradient wells:** MW-1601A, MW-1602, MW-1603, MW-1608; and
- **Downgradient wells:** MW-1604D, MW-1604S, MW-1605D, MW-1605S, MW-1606D, MW-1606S, MW-1607D, MW-1607S.

Data were sent electronically, and the statistical analysis was conducted according to the Statistical Analysis Plan and screening evaluation prepared by GSC and approved by Dr. Kirk Cameron, PhD Statistician with MacStat Consulting, primary author of the USEPA Unified Guidance, and Senior Advisor to GSC.

The CCR program consists of the following constituents:

- **Appendix III** (Detection Monitoring) **-** boron, calcium, chloride, fluoride, pH, sulfate, and TDS;

- **Appendix IV** (Assessment Monitoring) **–** antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, combined radium 226 + 228, fluoride, lead, lithium, mercury, molybdenum, selenium, and thallium.

Time series plots for Appendix III and IV parameters are provided for all wells and are used to evaluate concentrations over time as well as for the purpose of updating statistical limits (Figure A). Additionally, box plots are included for all constituents at upgradient and downgradient wells (Figure B). Values in background which have been flagged as outliers may be seen in a lighter font and as a disconnected symbol on the graph. A summary of these values follows this letter (Figure C). The time series plots are used to initially screen for suspected outliers and trends, while the box plots provide visual representation of variation within individual wells and between all wells.

During the background screening conducted in December 2017 data at all wells were evaluated for the following: 1) outliers; 2) trends; 3) most appropriate statistical method for Appendix III parameters based on site characteristics of groundwater data upgradient of the facility; and 4) eligibility of downgradient wells when intrawell statistical methods are recommended. Power curves were provided to demonstrate that the selected statistical methods for Appendix III parameters comply with the USEPA Unified Guidance recommendations as discussed below.

Summary of Statistical Method:

1) Intrawell prediction limits, combined with a 1-of-2 resample plan for pH;
2) Interwell prediction limits, combined with a 1-of-2 resample plan for boron, calcium, chloride, fluoride, sulfate, and TDS.

Parametric prediction limits are utilized when the screened historical data follow a normal or transformed-normal distribution. When data cannot be normalized or the majority of data are nondetects, a nonparametric test is utilized. While the false positive rate associated with the parametric limits is based on an annual 10% as recommended by the EPA Unified Guidance (2009), the false positive rate associated with the nonparametric limits is dependent upon the available background sample size, number of future comparisons, and verification resample plan. The distribution of data is tested using the Shapiro-Wilk/Shapiro-Francia test for normality. After testing for normality and performing any adjustments as discussed below (US EPA, 2009), data are analyzed using either parametric or non-parametric prediction limits.

- No statistical analyses are required on wells and analytes containing 100% nondetects (USEPA Unified Guidance, 2009, Chapter 6).

- When data contain <15% nondetects in background, simple substitution of one-half the reporting limit is utilized in the statistical analysis. The reporting limit utilized for nondetects is the practical quantification limit (PQL) as reported by the laboratory.
- When data contain between 15-50% nondetects, the Kaplan-Meier nondetect adjustment is applied to the background data. This technique adjusts the mean and standard deviation of the historical concentrations to account for concentrations below the reporting limit.
- Nonparametric prediction limits are used on data containing greater than 50% nondetects.

Historical Summary December 2017 - Evaluation of Appendix III Parameters

Outlier Evaluation

During the previous background screening, visual screening was used to detect potential outliers in all wells for all parameters, while Tukey's outlier test was used for all wells to formally test data in wells for intrawell parameters and for combined upgradient wells for interwell parameters. High values were noted in downgradient wells for pH in wells MW-1607D and MW-1607S; and TDS in MW-1606S. No outliers were noted for upgradient wells. The current assumption is that changes in concentrations are reflective of natural variation upgradient of the facility; however, a separate study and hydrogeological investigation would be required to fully understand the geochemical conditions and expected groundwater quality for the region. That study and assessment is beyond the scope of services provided by Groundwater Stats Consulting.

Statistical Limits

Interwell prediction limits combined with a 1-of-2 verification strategy were constructed for boron, calcium, chloride, fluoride, sulfate and TDS; and intrawell prediction limits combined with a 1-of-2 verification strategy were constructed for pH. The statistical method selected for each parameter was determined based on the results of the evaluation performed in December 2017; and all proposed background data were screened for outliers and trends at that time. The findings of those reports were submitted with that analysis.

Interwell prediction limits utilize all upgradient well data for construction of statistical limits. During each sample event, upgradient well data were screened for any newly suspected outliers or obvious trending patterns using time series plots. Intrawell

prediction limits utilized the background data set that was originally screened in 2017. As recommended in the EPA Unified Guidance (2009), the set background data will be tested for the purpose of updating statistical limits using the Mann-Whitney two-sample test when an additional four to eight measurements are available.

In the event of an initial exceedance of compliance well data, the 1-of-2 resample plan allows for collection of one additional sample to determine whether the initial exceedance is confirmed. When the resample confirms the initial exceedance, a statistically significant increase (SSI) is identified and further research would be required to identify the cause of the exceedance (i.e. impact from the site, natural variation, or an off-site source). If the resample falls within the statistical limit, the initial exceedance is considered a false positive result and, therefore, no further action is necessary. Prediction limit exceedances were noted for several of the downgradient wells for boron, calcium, chloride, fluoride, pH, sulfate and TDS. These results can be found in the previous screening in the Prediction Limit Summary tables.

When a statistically significant increase is identified, the data are further evaluated using the Sen's Slope/Mann Kendall trend test to determine whether concentrations are statistically increasing, decreasing or stable. Upgradient wells are included in the trend analyses to identify whether similar patterns exist upgradient of the site which is an indication of natural variability in groundwater unrelated to practices at the site.

Statistically significant increasing trends were found for several constituents in both upgradient and downgradient wells. For the statistically significant increasing trend noted for calcium in well MW-1607S, with the exception of the most recent sample, historical concentrations are similar and, in some cases, lower than those reported in upgradient wells. Further research beyond the scope of this analysis would be required to identify the cause for any changing groundwater concentrations in downgradient wells (i.e. result of practices at the site, natural variation, or an off-site source). The Trend Test summary table was included in the previous screening.

Appendix III Background Update – November 2019

Prior to updating background data, samples are re-evaluated for all wells for parameters tested with intrawell analyses (pH), and for combined upgradient well data for parameters tested with interwell analyses (boron, calcium, chloride, fluoride, sulfate and TDS) using Tukey's outlier test and visual screening for all historical data through April 2019 samples. When Tukey's outlier test detects an outlier for the most recent sample, it will not be flagged in the event that the data precede a trend that is more

representative of current concentrations. In some cases, Tukey's noted outliers in a given well that were similar to those reported in neighboring wells for the same event and, therefore, those values were not flagged. The fluoride values identified by Tukey's at well MW-1606D was the most recent sample and was not flagged in the database. If future values are significantly lower than the reported value, this will be flagged in the database in the future. None of the fluoride values were flagged as outliers in well MW-1606S since all values were similar to remaining measurements within this well, with the most recent measurements lower than historical measurements. If this decrease in concentrations continues, earlier higher measurements may be deselected in the future.

Tukey's identified outliers for thallium at wells MW-1606D and MW-1606S; however, these were nondetect values and were not flagged in the database. In other cases, Tukey's test did not identify outliers and those values were flagged because they were not representative of the population at that well. For instance, several high values were noted several parameters for the same event early in the record for well MW-1607S. These values were flagged as outliers in the database. As mentioned above, flagged data are displayed in a lighter font and as a disconnected symbol on the time series reports, as well as in a lighter font on the accompanying data pages. An updated summary of Tukey's test results and flagged outliers follows this letter.

For constituents requiring intrawell prediction limits, the Mann-Whitney (Wilcoxon Rank Sum) test was used to compare the medians of historical data through June 2017 to the new compliance samples at each well through April 2019 to evaluate whether the groups are statistically different at the 99% confidence level, in which case background data may be updated with compliance data (Figure D). No statistically significant differences were found between the two groups for any of the well/constituent pairs. Typically, when the test concludes that the medians of the two groups are significantly different, particularly in the downgradient wells, the background are not updated to include the newer data but will be reconsidered in the future. A summary of these results follows this letter and the test results are included with the Mann Whitney test section at the end of this report.

Intrawell prediction limits using all historical data through April 2019, combined with a 1-of-2 resample plan, were constructed for pH (Figure E).

For parameters tested using interwell analyses, the Sen's Slope/Mann-Kendall trend test was used on upgradient wells to determine whether concentrations are statistically increasing, decreasing or stable (Figure F). A few statistically significant increasing and decreasing trends were noted; however, the magnitudes of the trends are low relative to

average concentrations within each well. With limited background samples collected to date, all data from upgradient wells were used to construct interwell prediction limits for all Appendix III parameters except pH which is tested using intrawell prediction limits. As more data are collected, all upgradient well data will be re-evaluated for possible deselection of earlier measurements if they no longer represent present-day groundwater quality conditions. A summary of those results is included with the trend tests.

Interwell prediction limits, combined with a 1-of-2 resample plan, were updated using all available data from upgradient wells through April 2019 for boron, calcium, chloride, fluoride, sulfate, and TDS (Figure G). Interwell prediction limits pool upgradient well data to establish a background limit for an individual constituent. A summary table of the updated limits may be found following this letter in the Prediction Limit Summary Tables.

Evaluation of Appendix IV Parameters – November 2019

Interwell Tolerance limits were used to calculate background limits from all available pooled upgradient well data for Appendix IV parameters to determine the Alternate Contaminant Level (ACL) for each constituent (Figure H). Background data are screened for outliers and extreme trending patterns that would lead to artificially elevated statistical limits. In some cases, due to the natural log transformation, Tukey's test did not identify outliers for values which were significantly higher than remaining observations in a given well. For instance, during the December 2016 sample event, high values were reported for chromium in several wells (both upgradient and downgradient). These values were flagged in the database as outliers as they did not appear to represent the population at these wells. Any flagged values may be seen on the Outlier Summary following this letter.

Parametric limits use a target of 95% confidence and 95% coverage. The confidence and coverage levels for nonparametric tolerance limits are dependent upon the number of background samples. These limits were compared to the Maximum Contaminant Levels (MCLs) and CCR-Rule specified levels in the Groundwater Protection Standard (GWPS) table following this letter to determine the highest limit for use as the GWPS in the Confidence Interval comparisons (Figure I).

Confidence intervals were then constructed on downgradient wells for each of the Appendix IV parameters using the highest limit of the MCL, CCR-rule specified, or ACL as discussed above (Figure J). Only when the entire confidence interval is above a GWPS

is the well/constituent pair considered to exceed its respective standard. No confidence interval exceedances were found except for lithium in wells MW-1605D, MW1605S, MW-1606D, MW-1606S, MW-1607D and MW-1607S. A summary of the confidence interval results follows this letter.

Thank you for the opportunity to assist you in the statistical analysis of groundwater quality for the Mountaineer BAP. If you have any questions or comments, please feel free to contact us.

For Groundwater Stats Consulting,

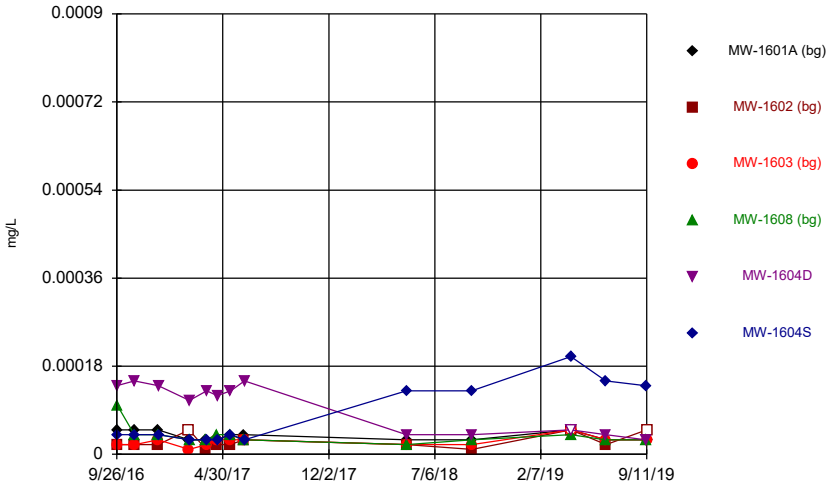
Andrew T. Collins
Groundwater Analyst

Kristina L. Rayner
Groundwater Statistician

FIGURE A: TIME SERIES

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



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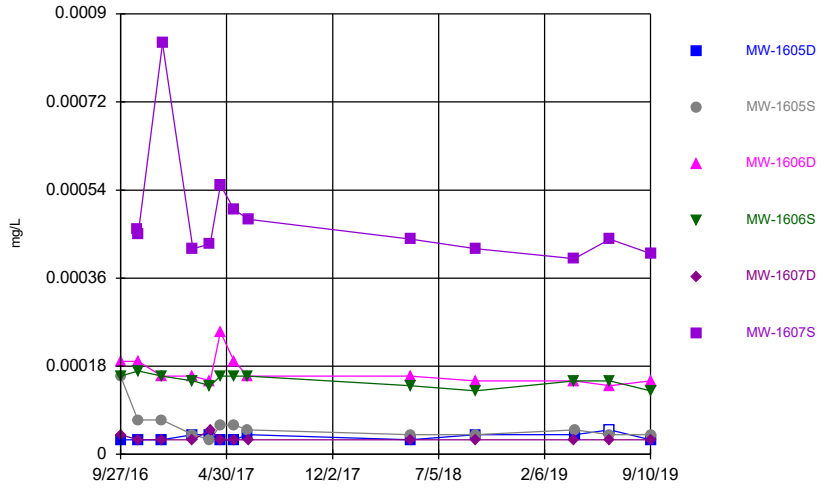

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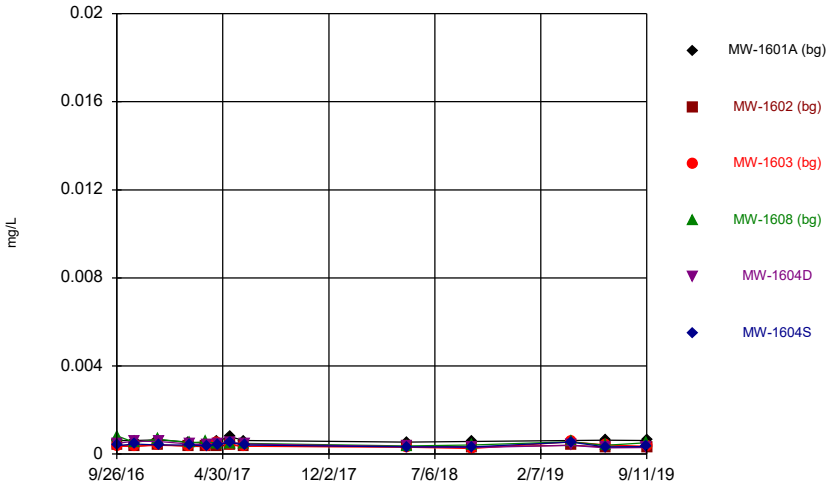

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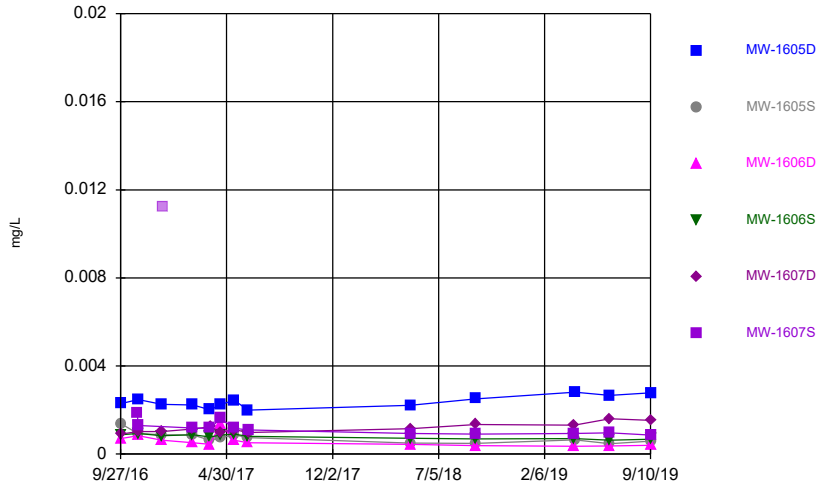

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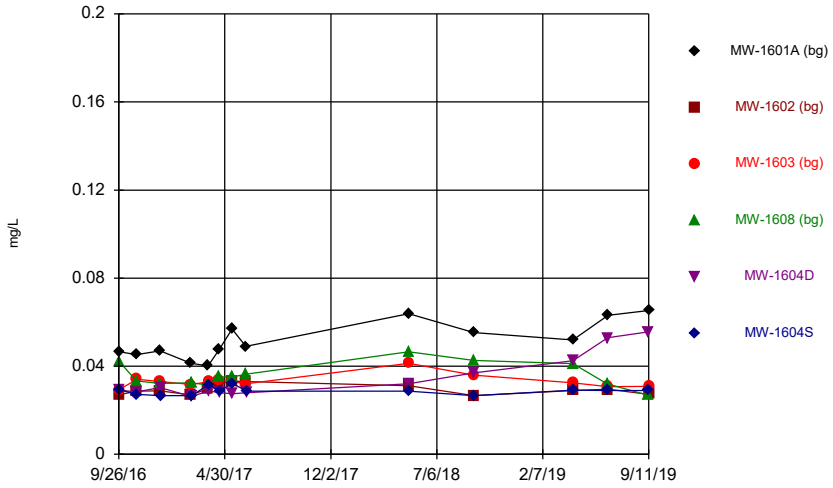

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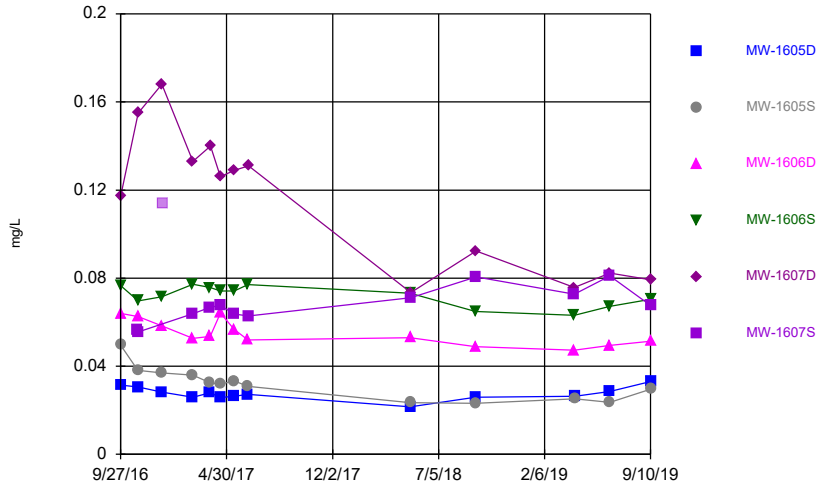

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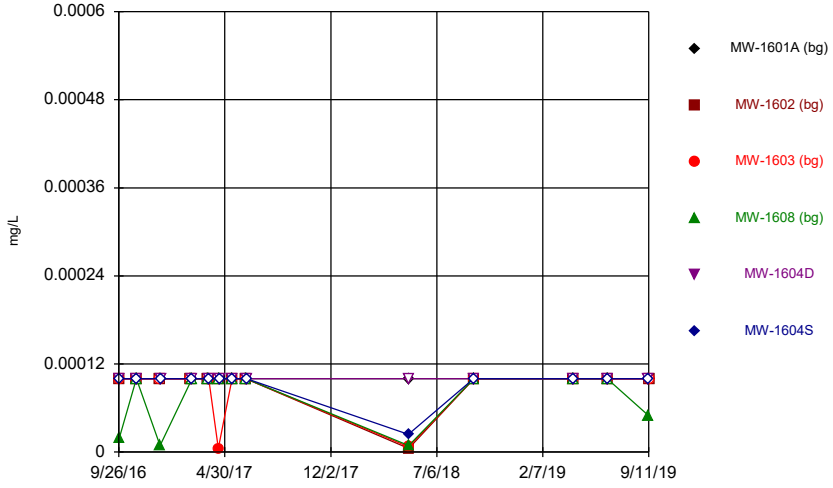

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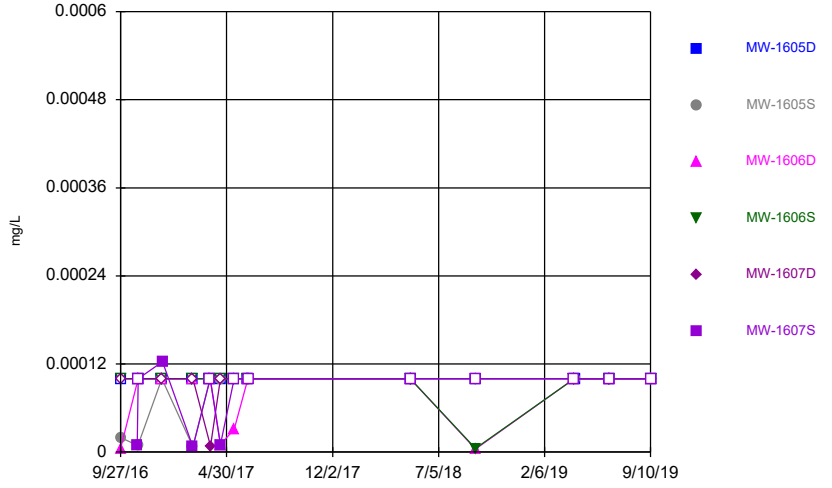

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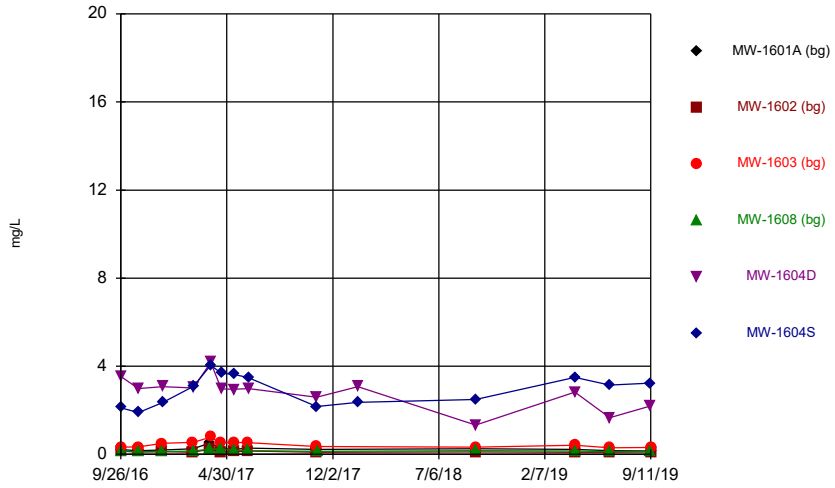

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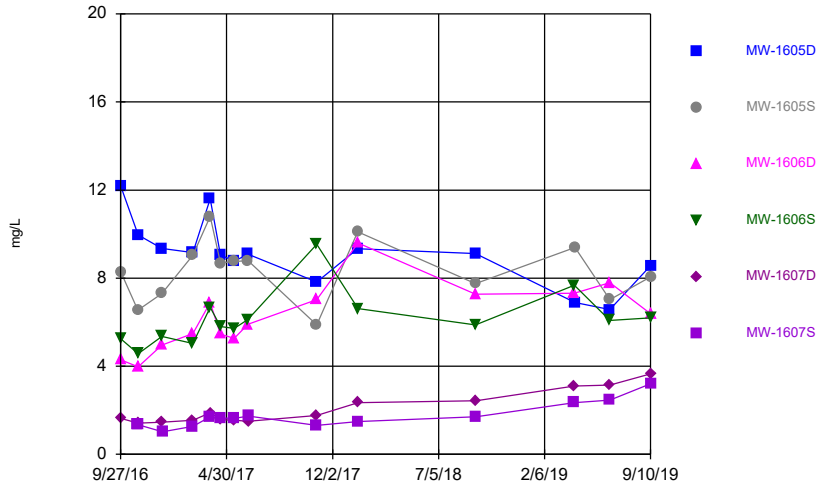

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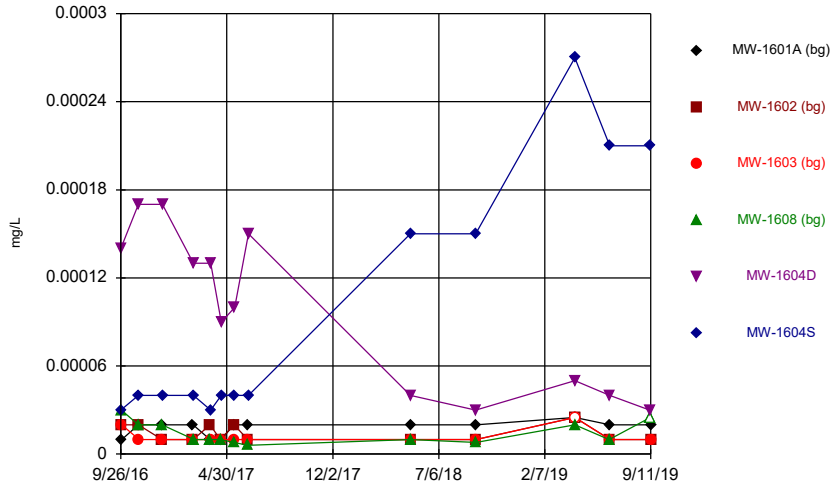

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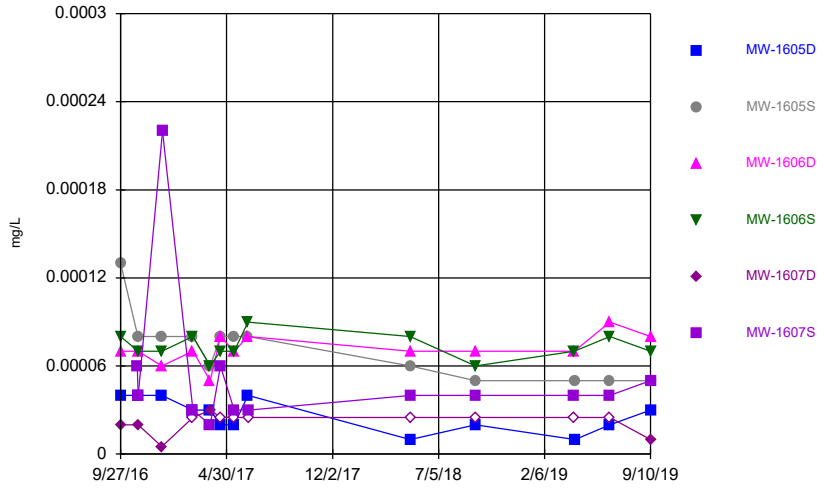

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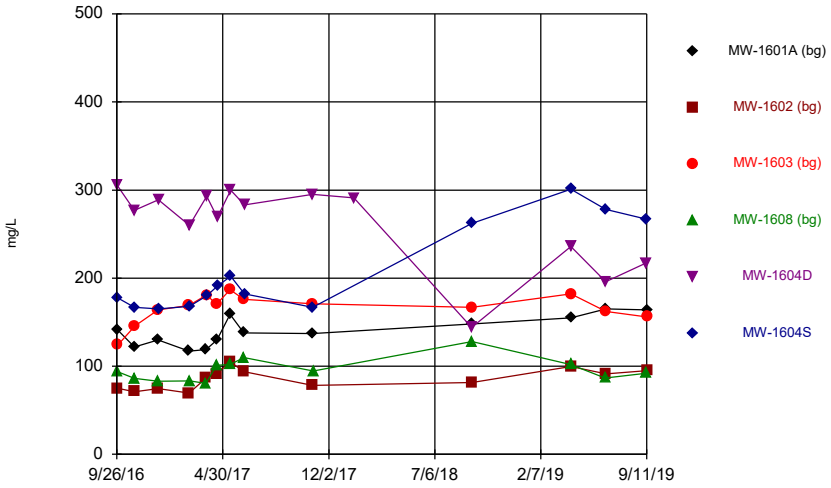

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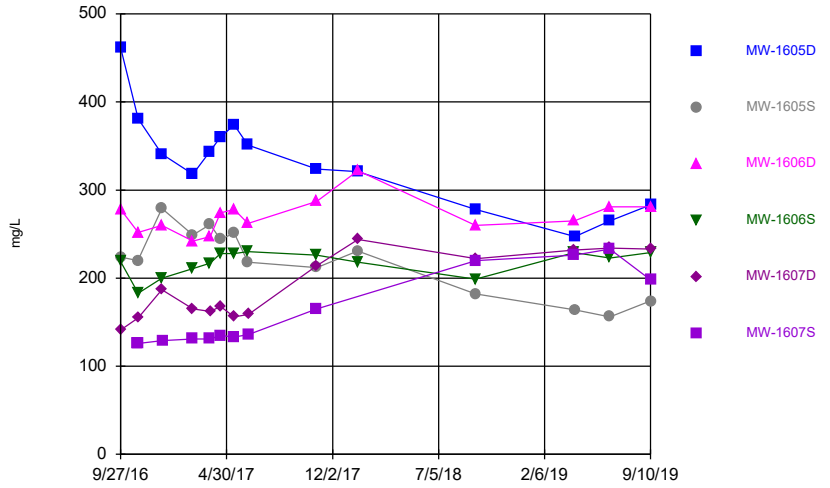

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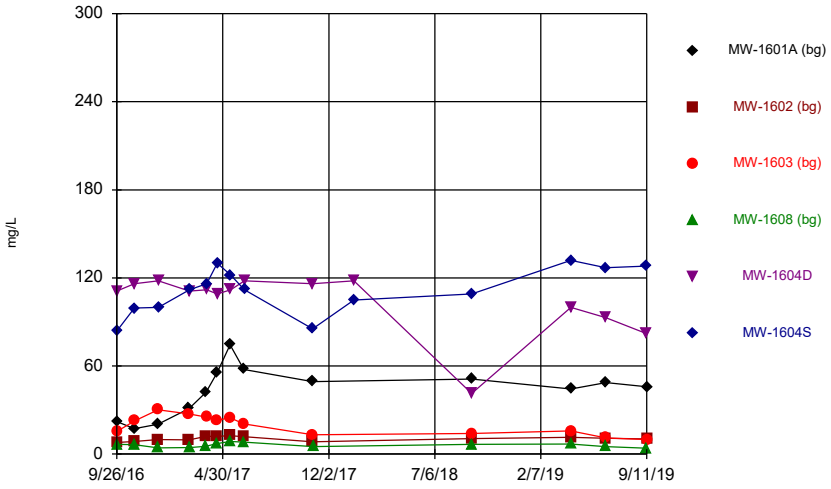
Time Series



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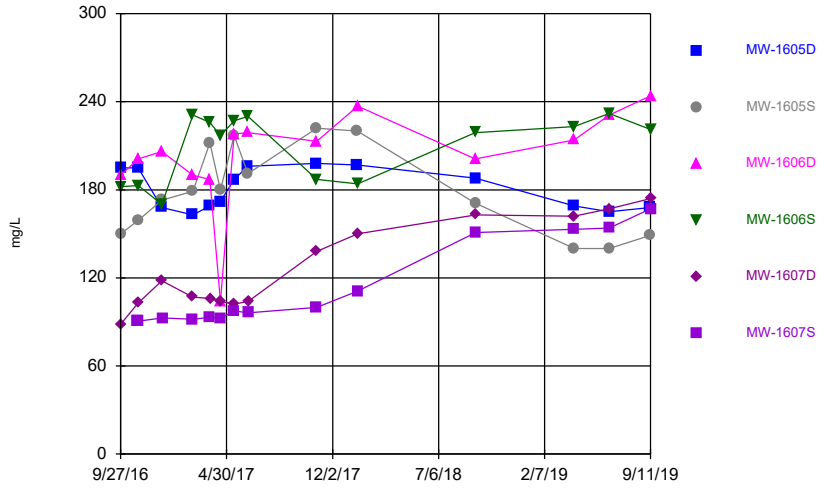
Time Series



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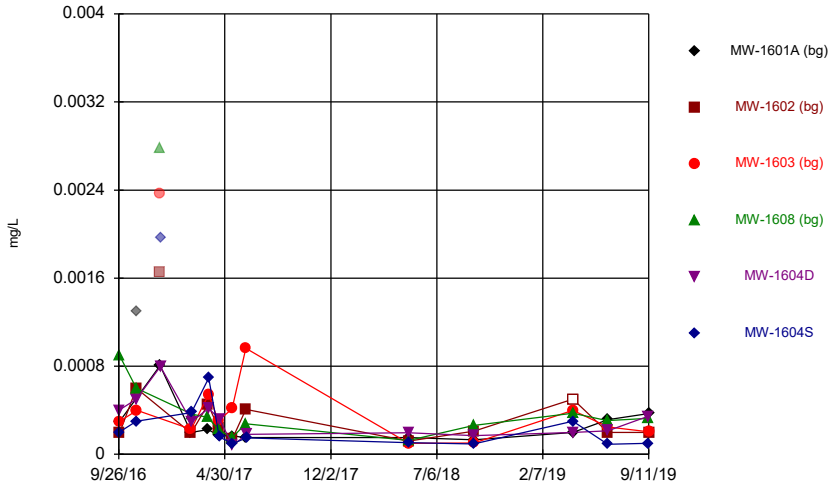
Hollow symbols indicate censored values.

Time Series



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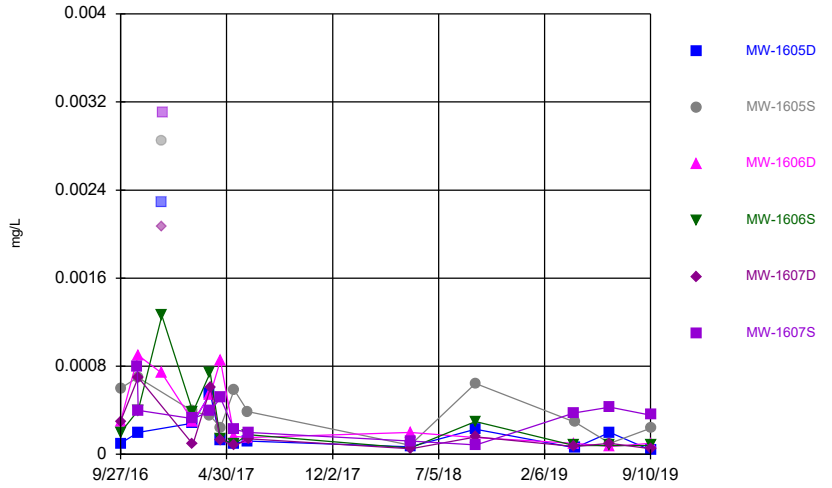
Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series



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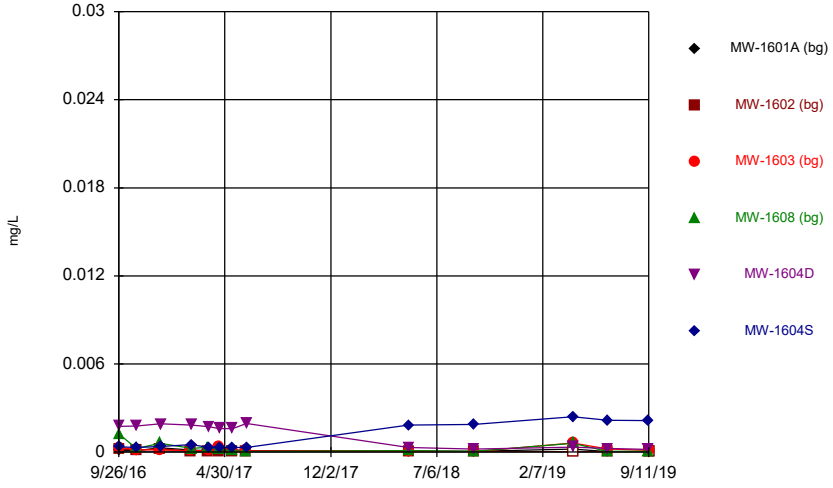
Time Series



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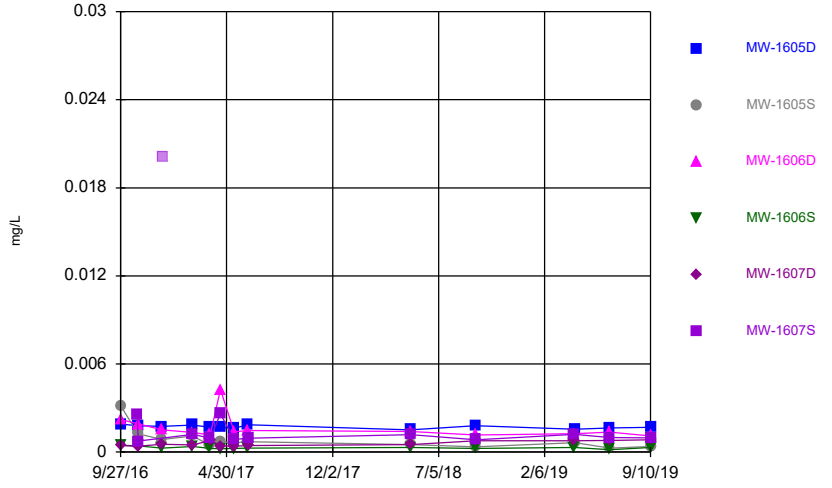
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

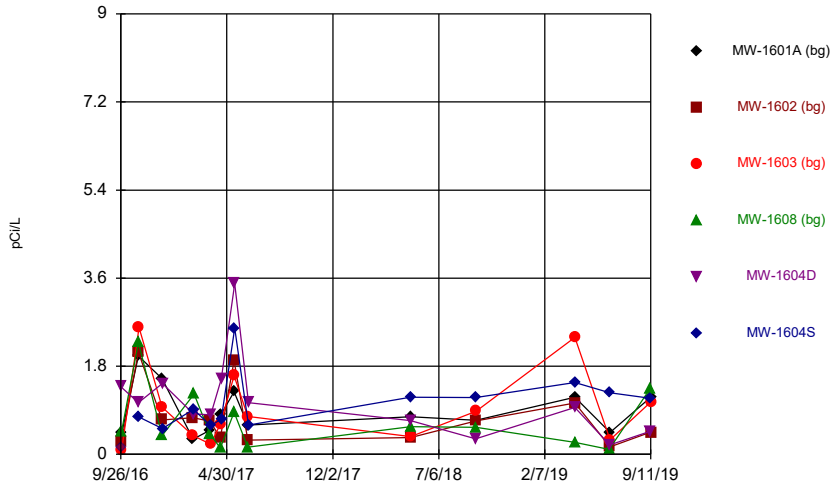
Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series



Constituent: Cobalt, total Analysis Run 12/1/2019 10:02 AM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

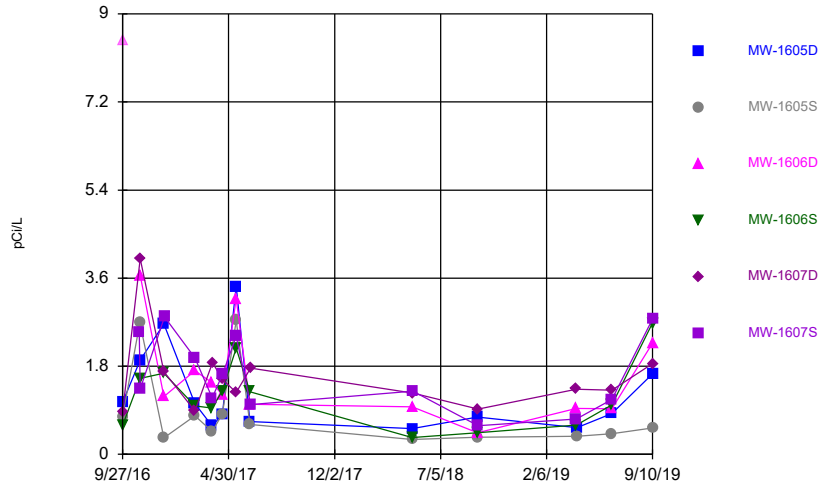
Time Series



Constituent: Combined Radium 226 + 228 Analysis Run 12/1/2019 10:02 AM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

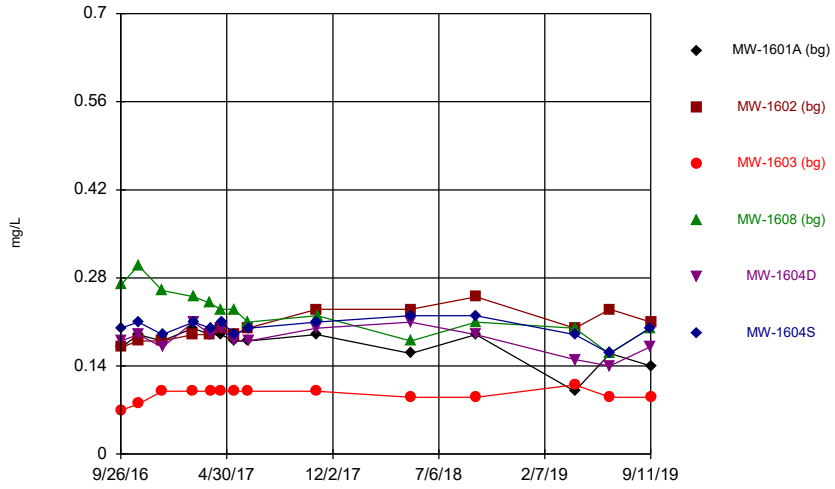
Time Series



Constituent: Combined Radium 226 + 228 Analysis Run 12/1/2019 10:02 AM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

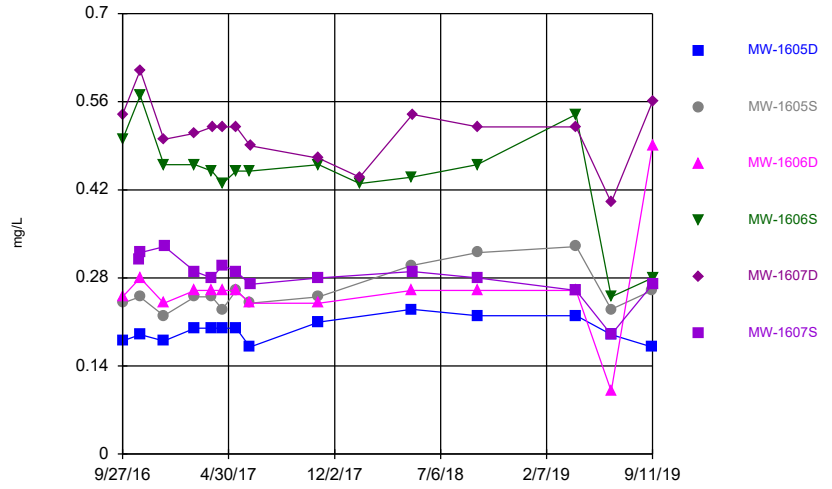
Time Series



Constituent: Fluoride, total Analysis Run 12/1/2019 10:02 AM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

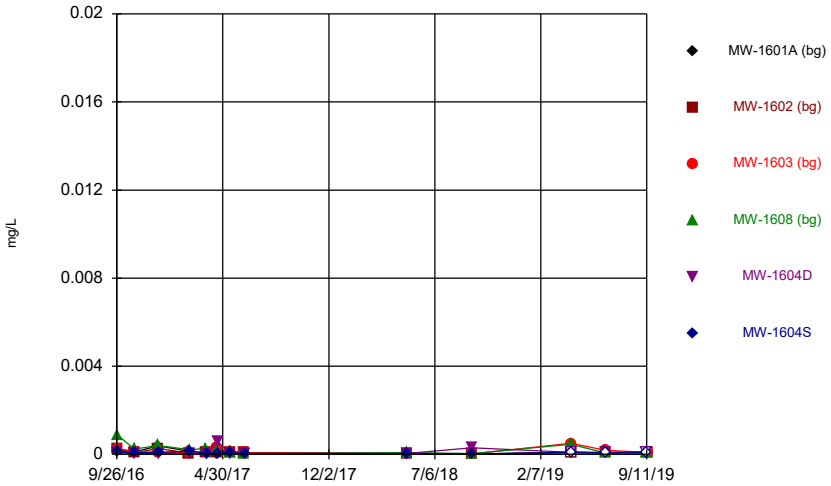
Time Series



Constituent: Fluoride, total Analysis Run 12/1/2019 10:02 AM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

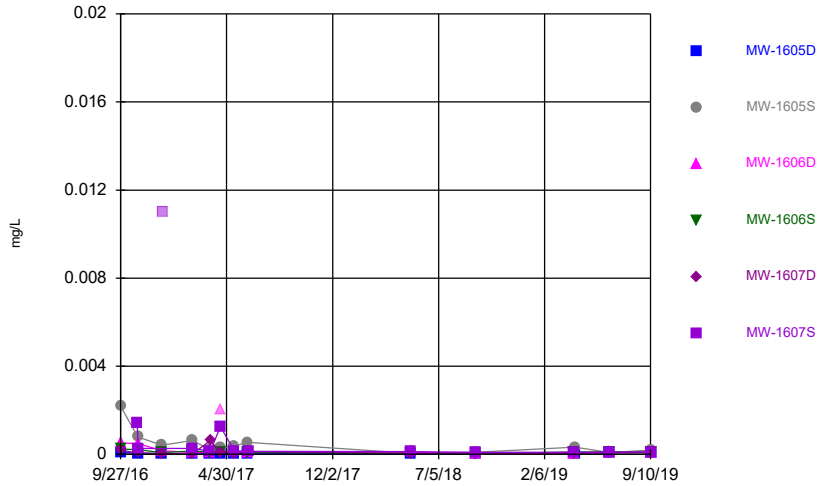
Time Series



Constituent: Lead, total Analysis Run 12/1/2019 10:02 AM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

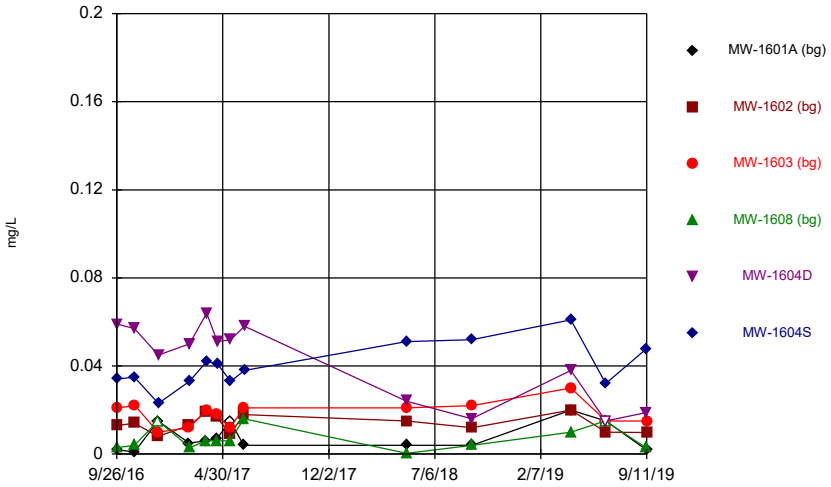
Time Series



Constituent: Lead, total Analysis Run 12/1/2019 10:02 AM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

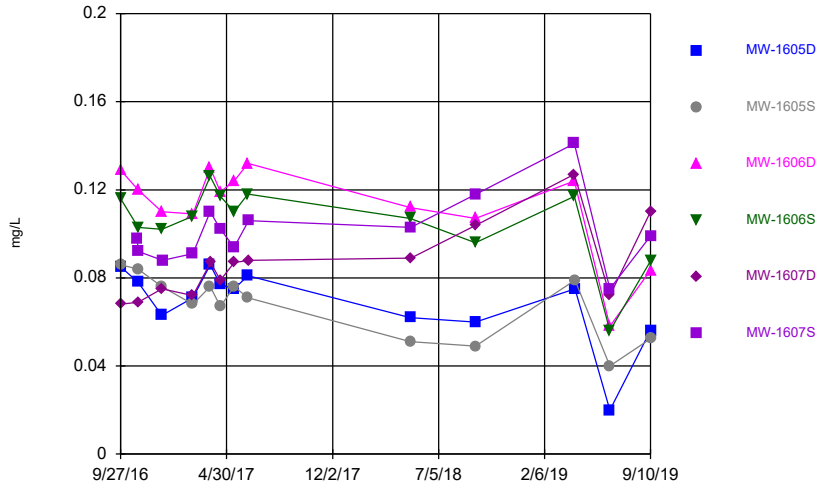
Time Series



Constituent: Lithium, total Analysis Run 12/1/2019 10:02 AM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

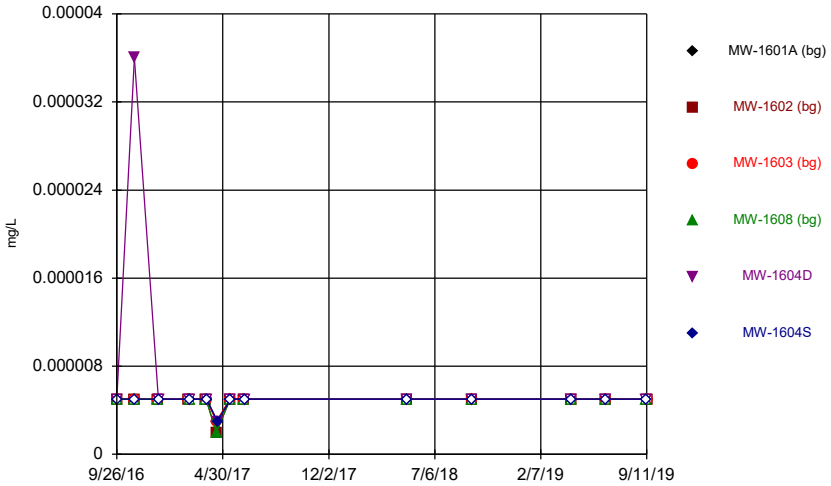
Time Series



Constituent: Lithium, total Analysis Run 12/1/2019 10:02 AM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

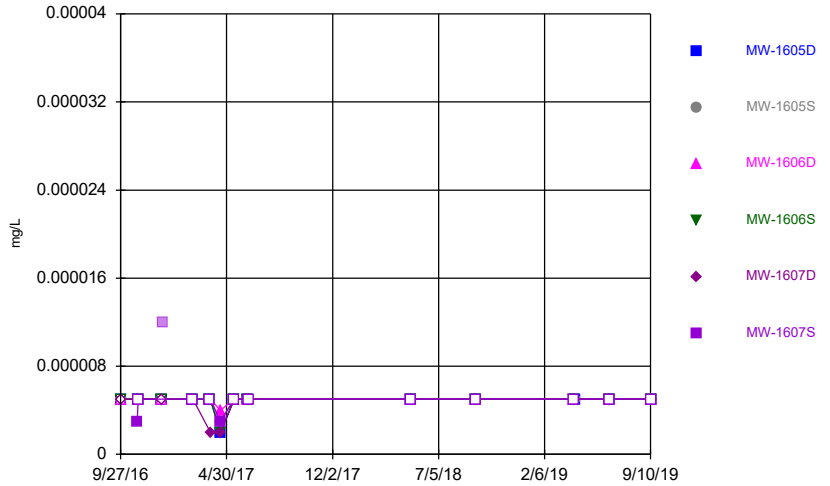
Time Series



Constituent: Mercury, total Analysis Run 12/1/2019 10:02 AM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

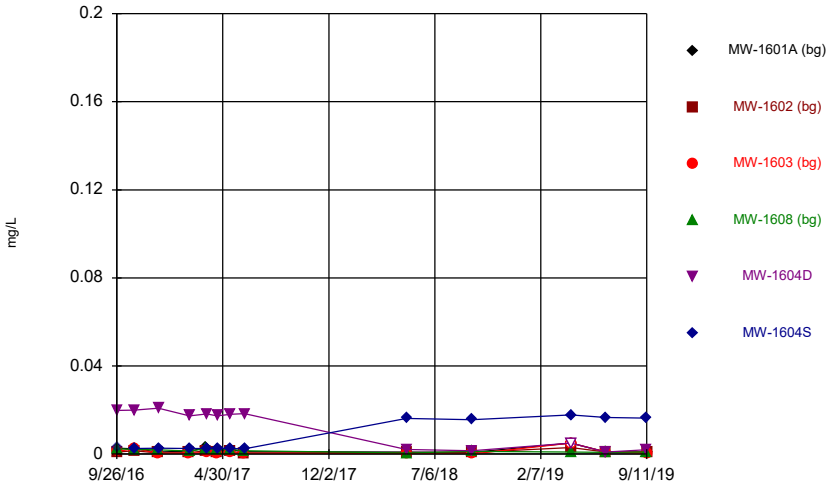
Time Series



Constituent: Mercury, total Analysis Run 12/1/2019 10:02 AM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

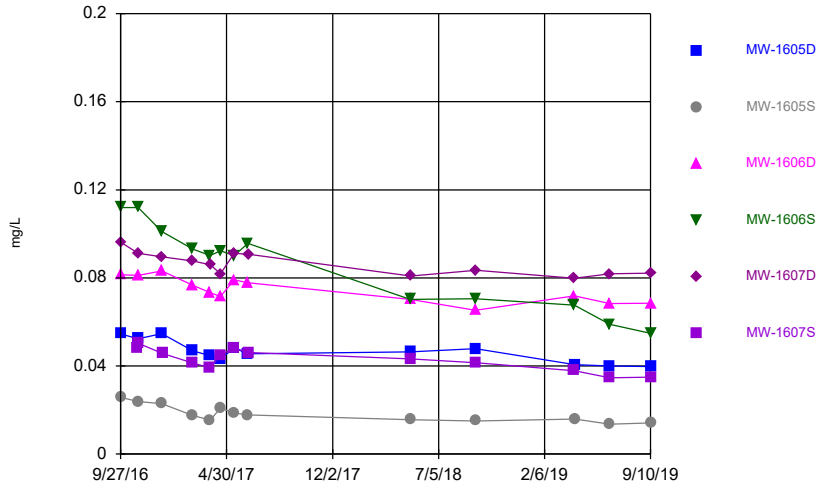
Time Series



Constituent: Molybdenum, total Analysis Run 12/1/2019 10:02 AM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

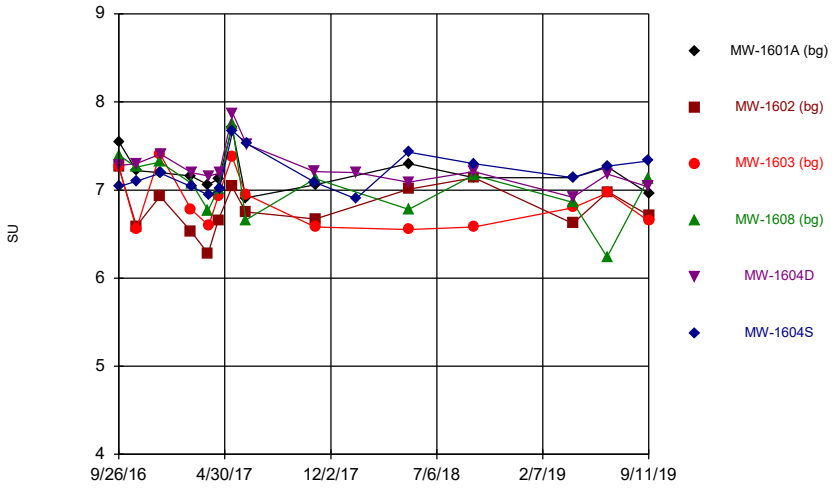
Time Series



Constituent: Molybdenum, total Analysis Run 12/1/2019 10:02 AM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

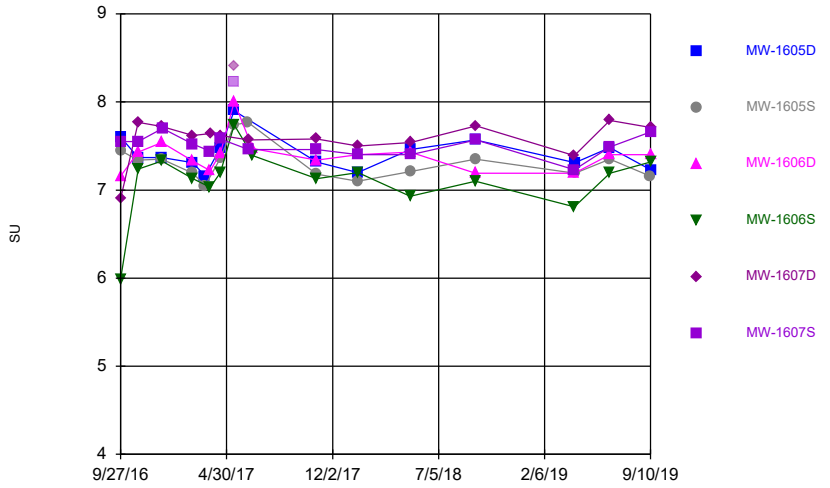
Time Series



Constituent: pH, field Analysis Run 12/1/2019 10:02 AM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

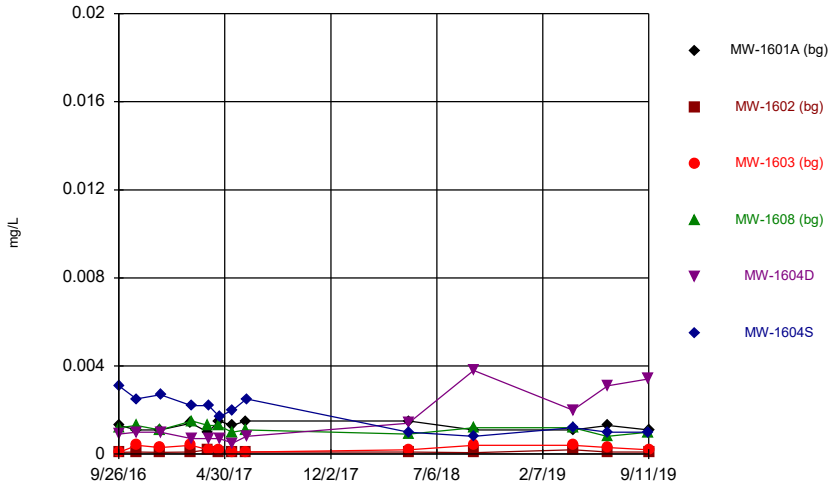
Time Series



Constituent: pH, field Analysis Run 12/1/2019 10:02 AM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

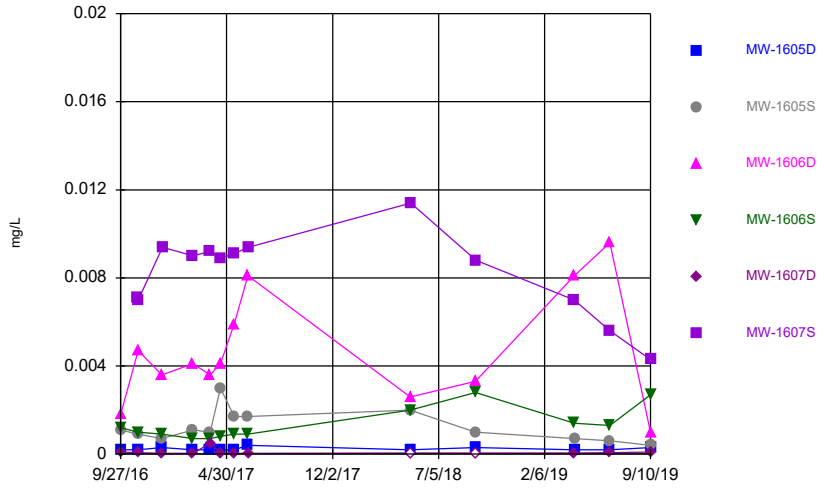
Time Series



Constituent: Selenium, total Analysis Run 12/1/2019 10:02 AM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

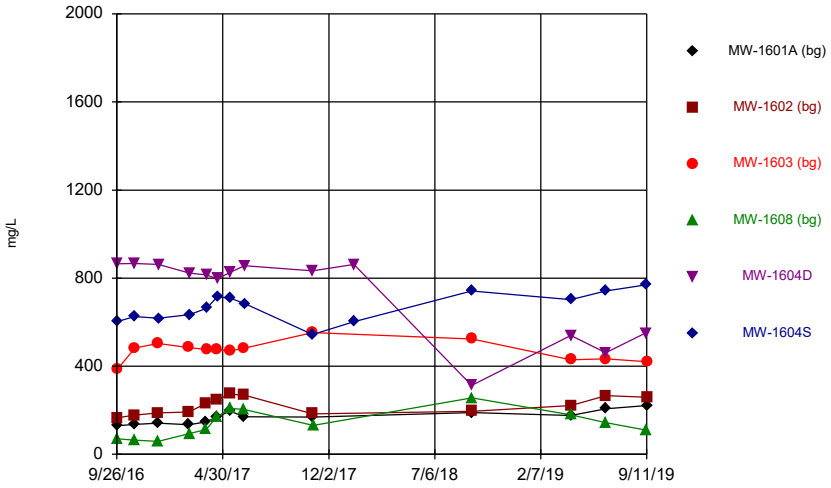
Time Series



Constituent: Selenium, total Analysis Run 12/1/2019 10:02 AM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

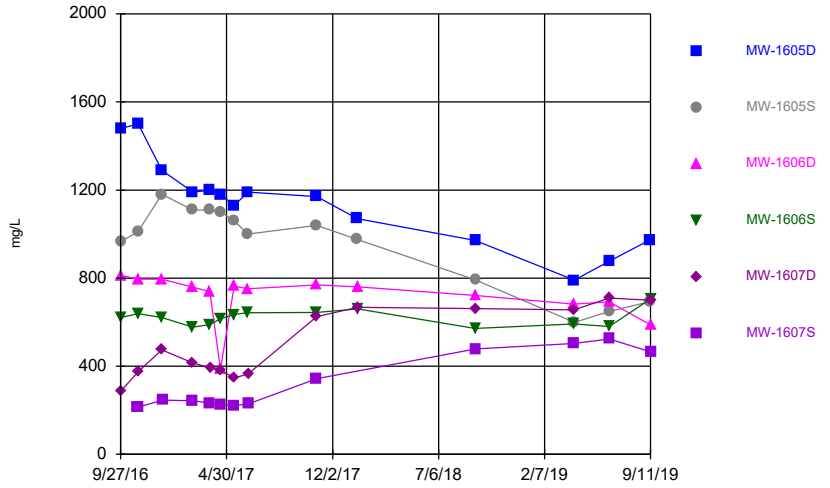
Time Series



Constituent: Sulfate, total Analysis Run 12/1/2019 10:02 AM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

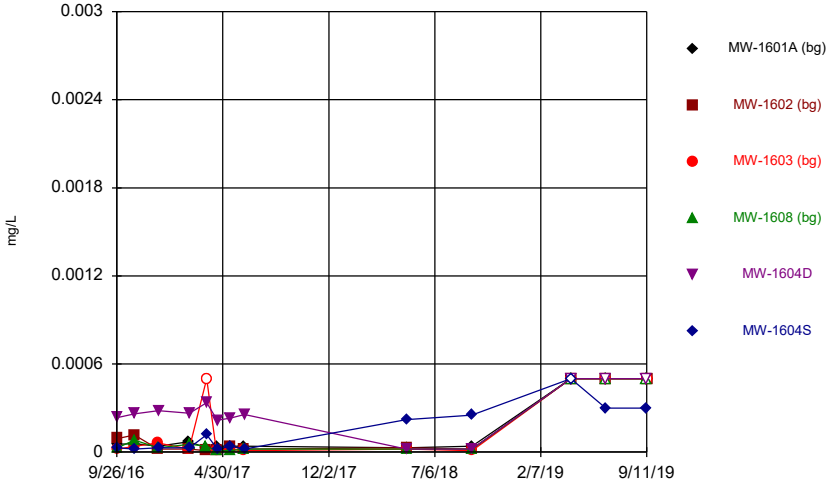
Time Series



Constituent: Sulfate, total Analysis Run 12/1/2019 10:02 AM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

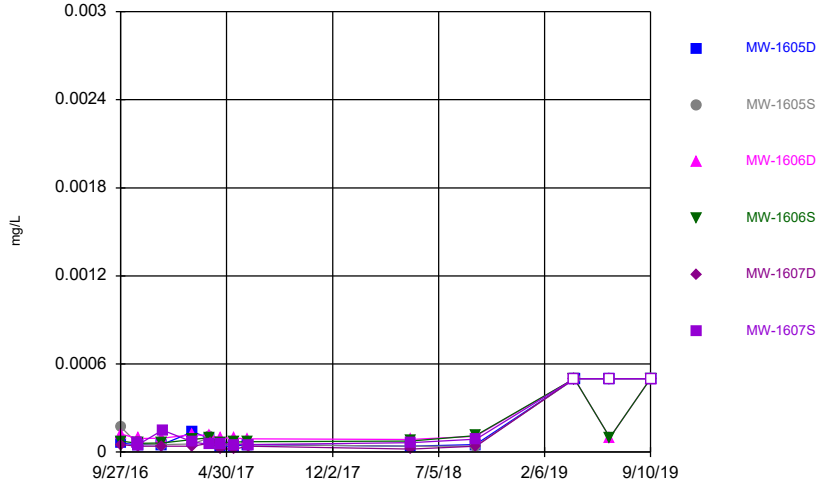
Time Series



Constituent: Thallium, total Analysis Run 12/1/2019 10:02 AM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

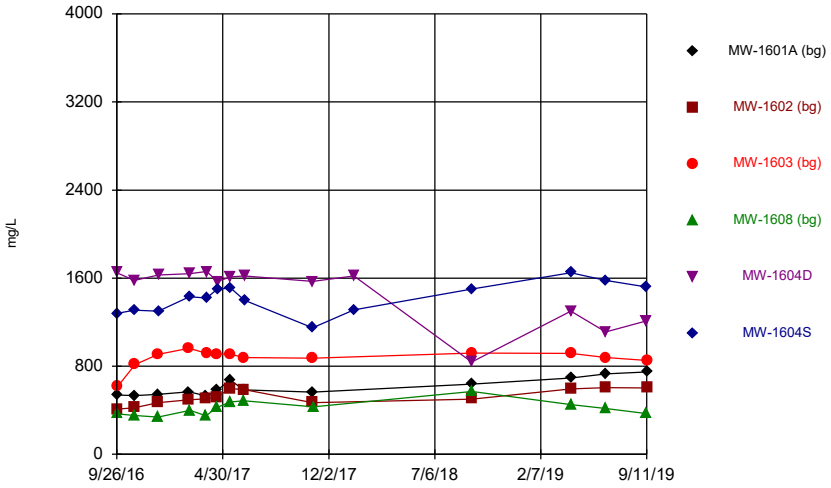
Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



Constituent: Thallium, total Analysis Run 12/1/2019 10:02 AM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

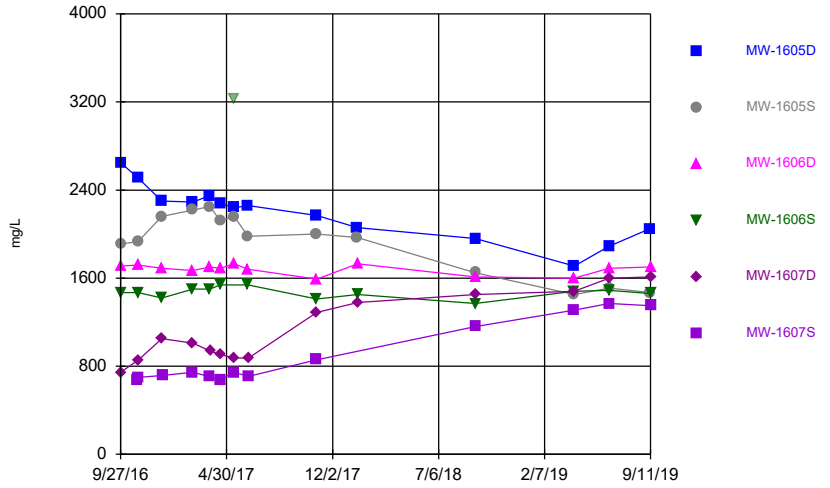
Time Series



Constituent: Total Dissolved Solids [TDS] Analysis Run 12/1/2019 10:02 AM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series

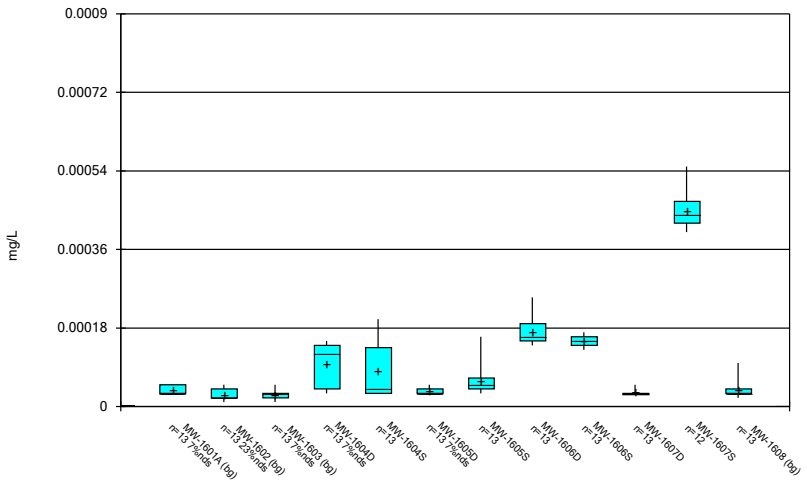


Constituent: Total Dissolved Solids [TDS] Analysis Run 12/1/2019 10:02 AM View: Descriptive
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

FIGURE B: BOX PLOTS

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Box & Whiskers Plot

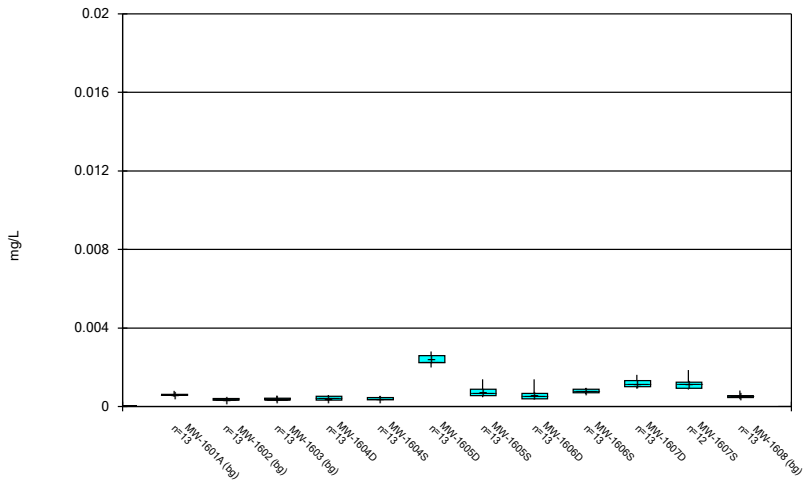


Constituent: Antimony, total Analysis Run 11/25/2019 1:15 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Box & Whiskers Plot

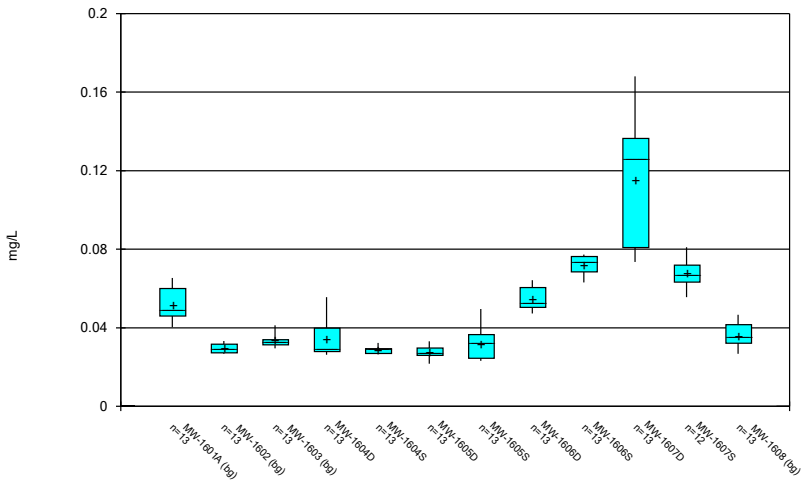


Constituent: Arsenic, total Analysis Run 11/25/2019 1:15 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Box & Whiskers Plot

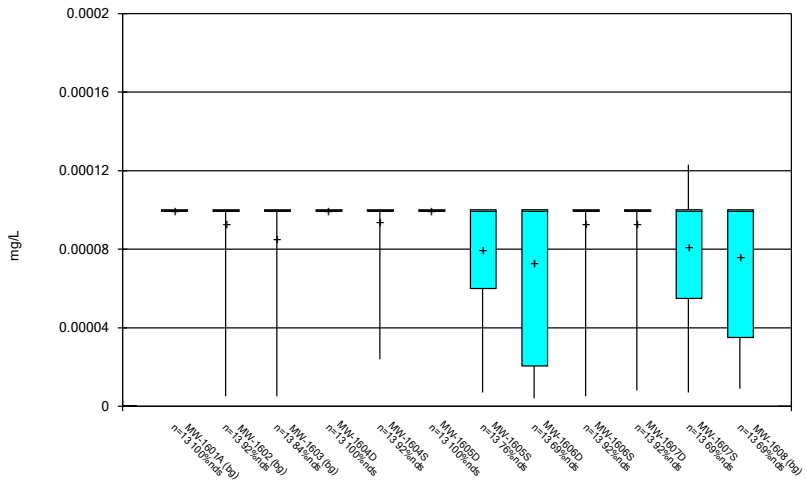


Constituent: Barium, total Analysis Run 11/25/2019 1:15 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

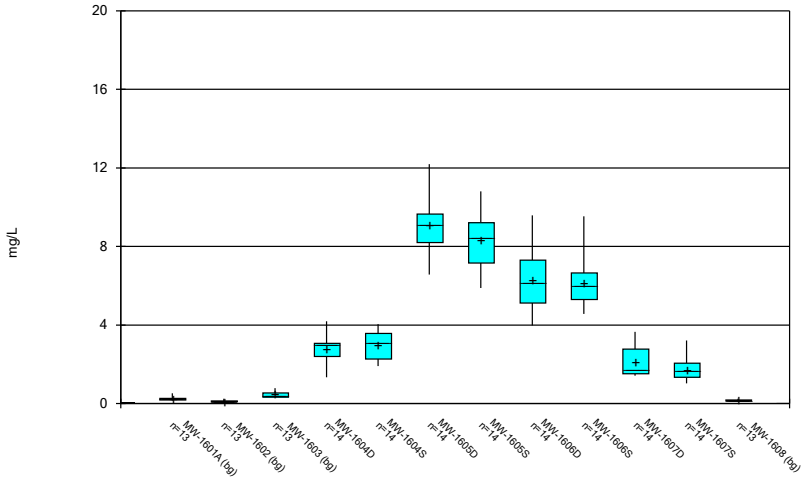
Box & Whiskers Plot



Constituent: Beryllium, total Analysis Run 11/25/2019 1:15 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Box & Whiskers Plot

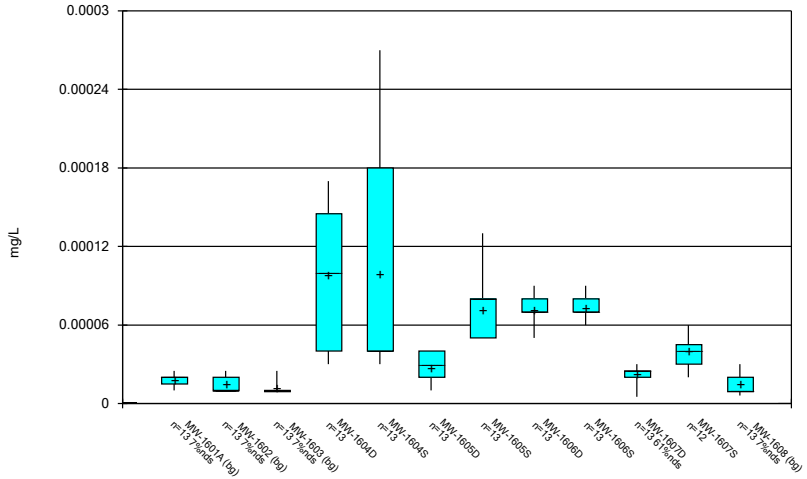


Constituent: Boron, total Analysis Run 11/25/2019 1:15 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Box & Whiskers Plot

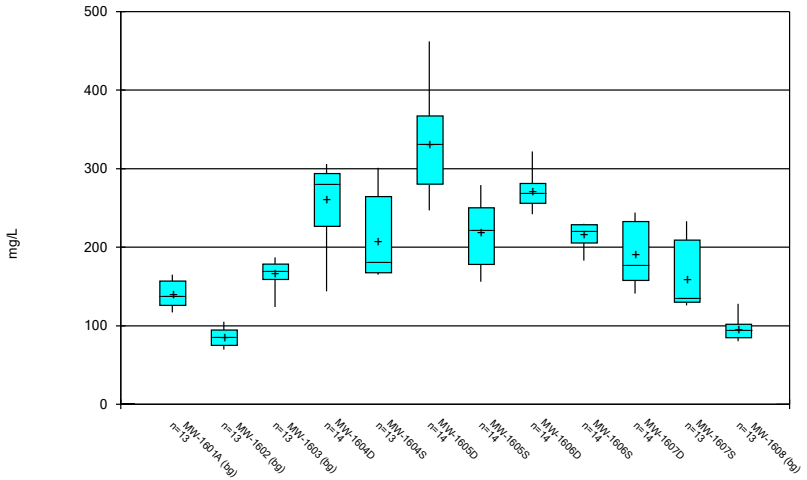


Constituent: Cadmium, total Analysis Run 11/25/2019 1:15 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Box & Whiskers Plot

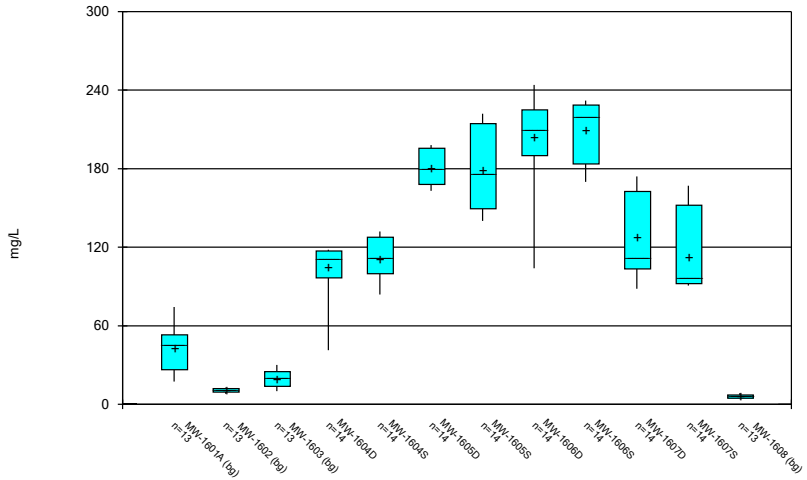


Constituent: Calcium, total Analysis Run 11/25/2019 1:15 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

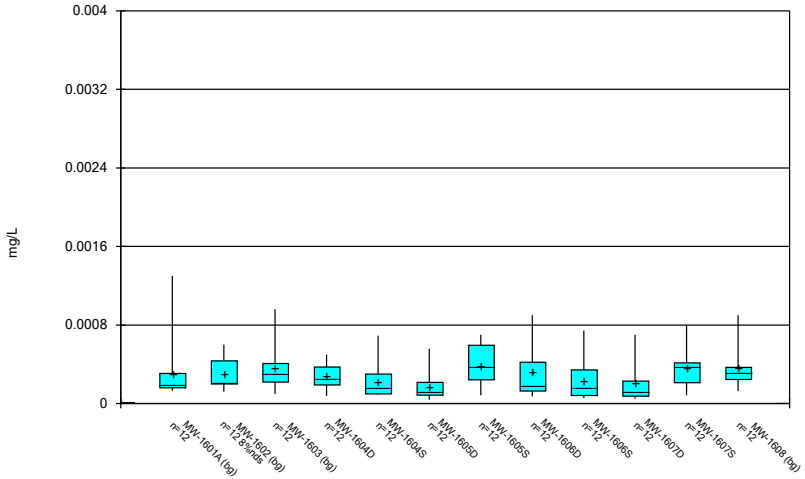
Box & Whiskers Plot



Constituent: Chloride, total Analysis Run 11/25/2019 1:15 PM

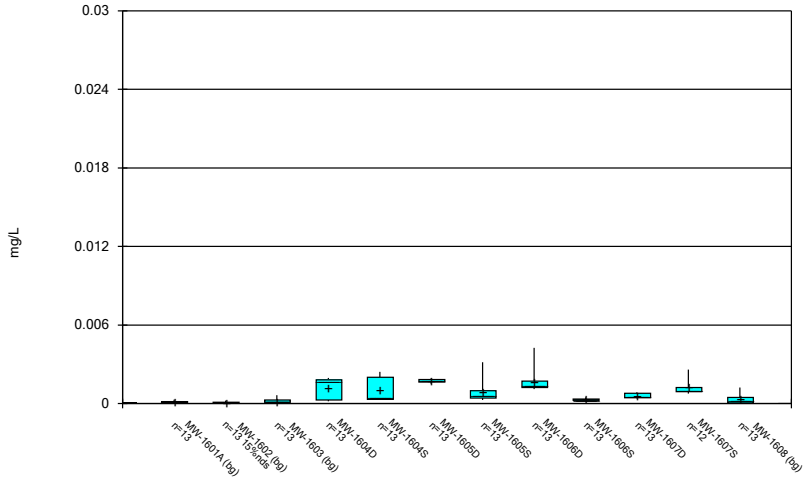
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Box & Whiskers Plot



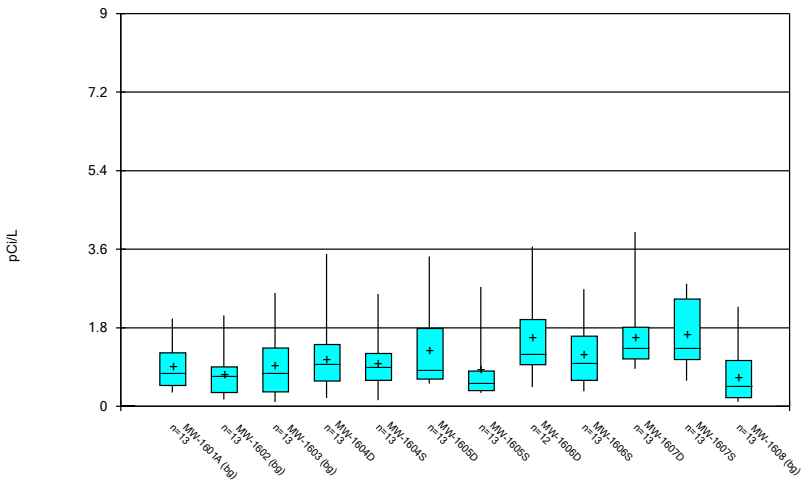
Constituent: Chromium, total Analysis Run 11/25/2019 1:15 PM
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Box & Whiskers Plot



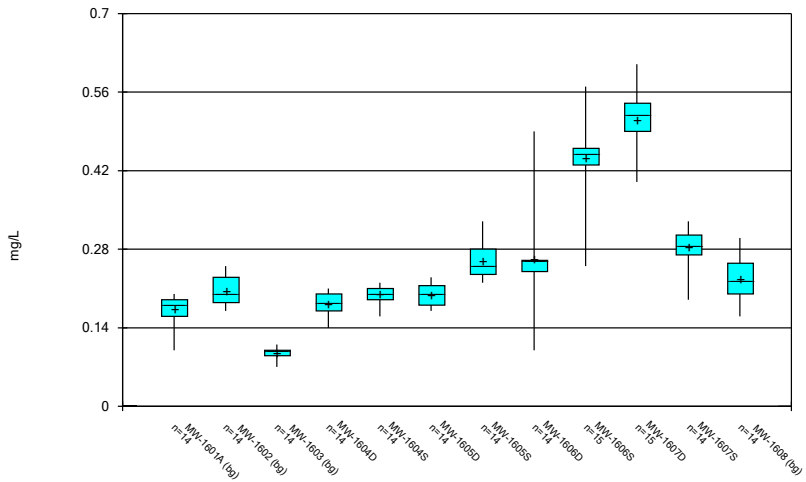
Constituent: Cobalt, total Analysis Run 11/25/2019 1:15 PM
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Box & Whiskers Plot



Constituent: Combined Radium 226 + 228 Analysis Run 11/25/2019 1:15 PM
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

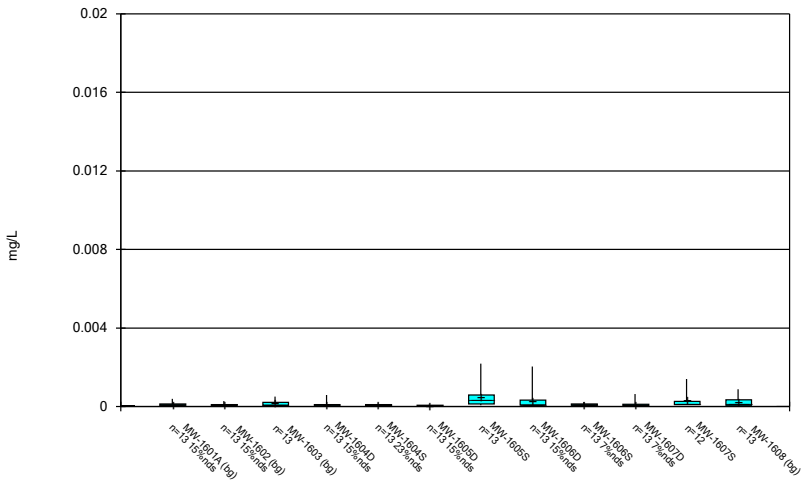
Box & Whiskers Plot



Constituent: Fluoride, total Analysis Run 11/25/2019 1:15 PM
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Box & Whiskers Plot

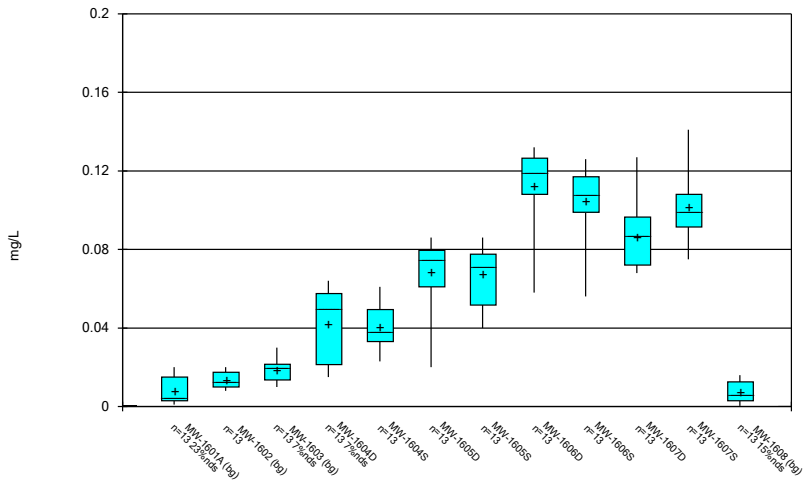


Constituent: Lead, total Analysis Run 11/25/2019 1:15 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Box & Whiskers Plot

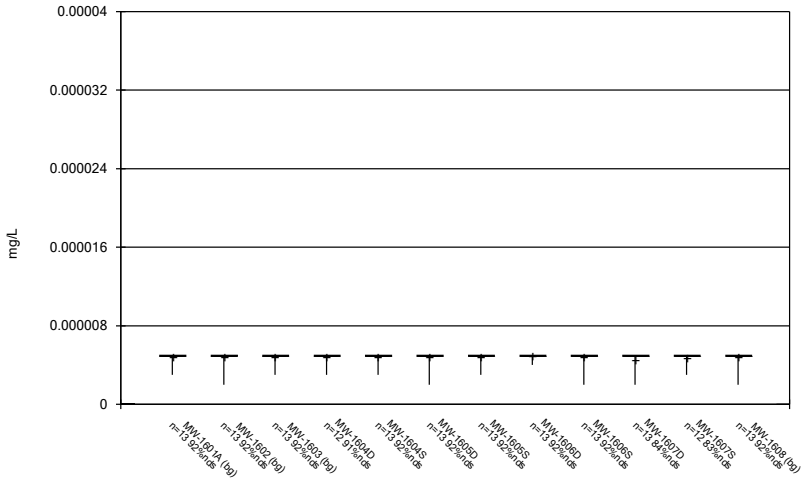


Constituent: Lithium, total Analysis Run 11/25/2019 1:15 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Box & Whiskers Plot

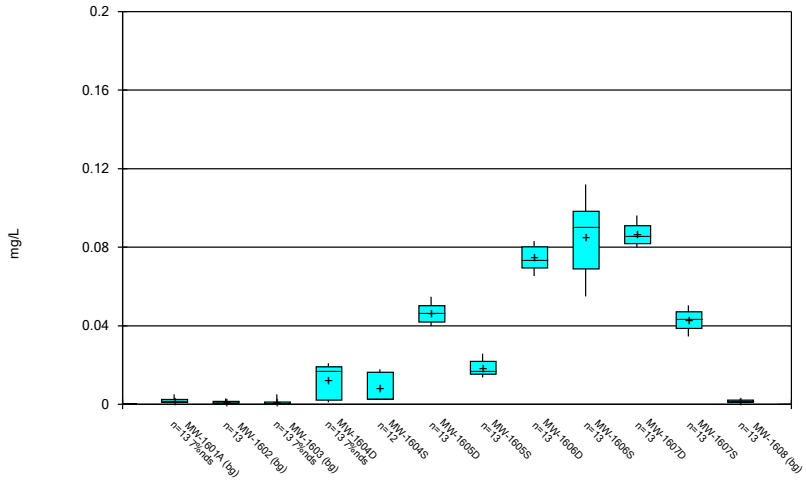


Constituent: Mercury, total Analysis Run 11/25/2019 1:15 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

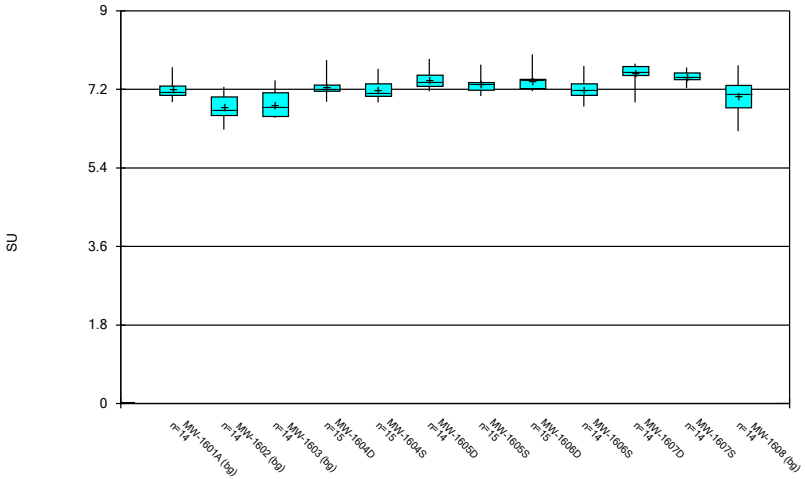
Box & Whiskers Plot



Constituent: Molybdenum, total Analysis Run 11/25/2019 1:15 PM

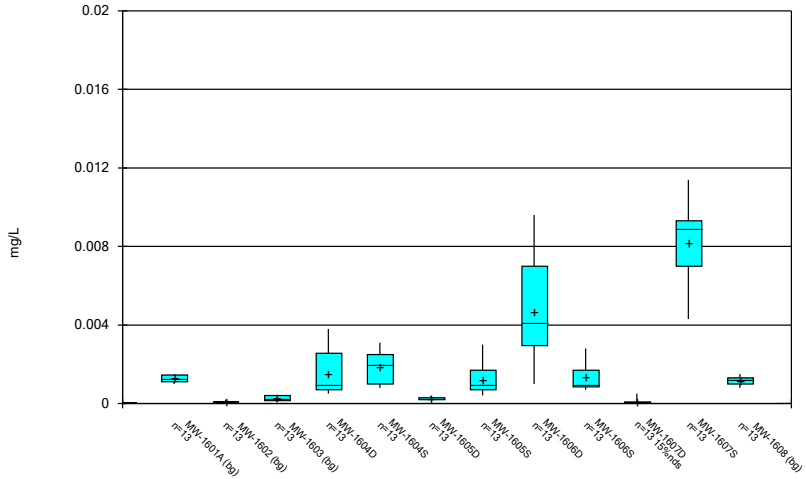
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Box & Whiskers Plot



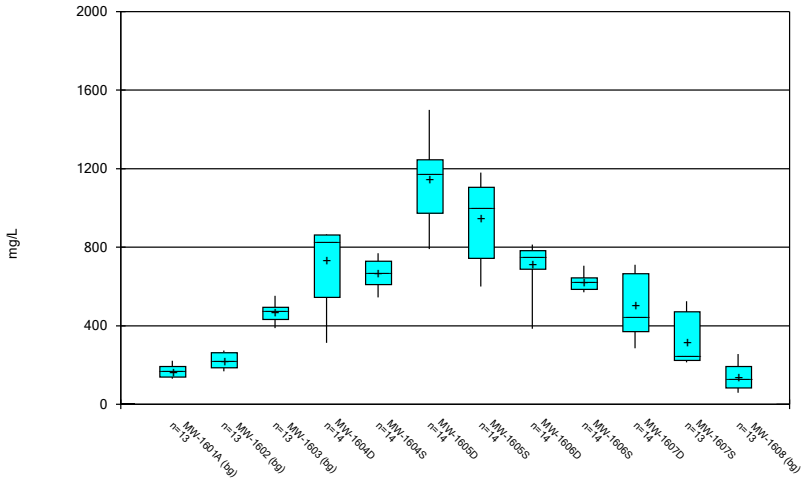
Constituent: pH, field Analysis Run 11/25/2019 1:15 PM
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Box & Whiskers Plot



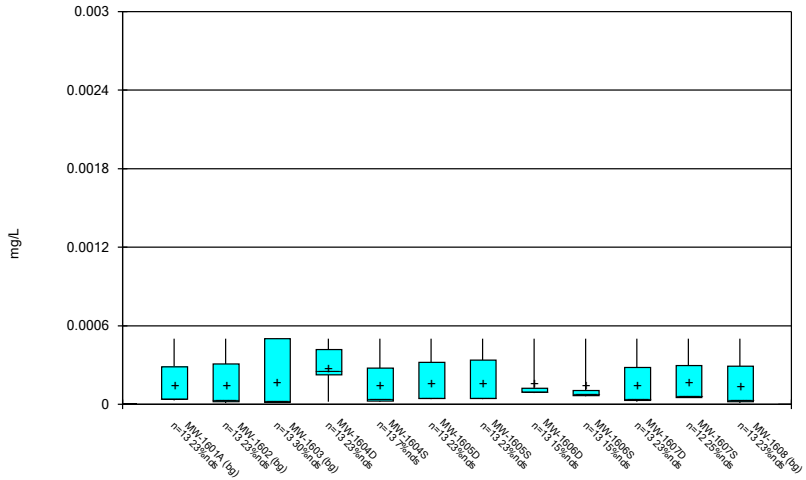
Constituent: Selenium, total Analysis Run 11/25/2019 1:15 PM
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Box & Whiskers Plot



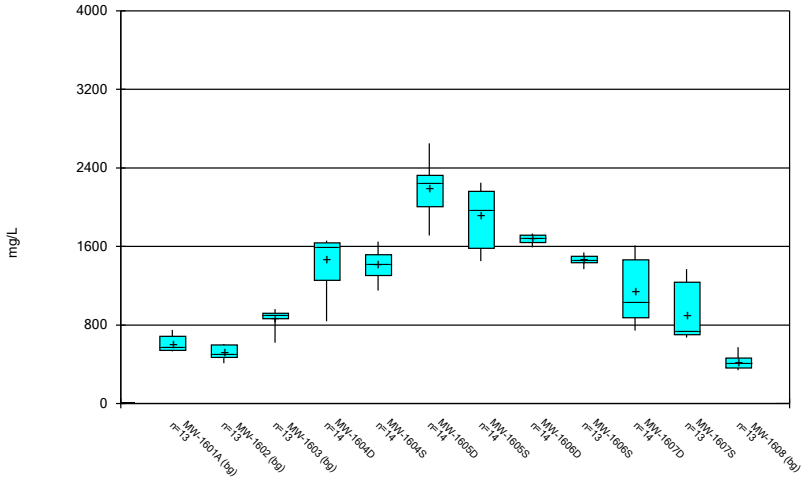
Constituent: Sulfate, total Analysis Run 11/25/2019 1:15 PM
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Box & Whiskers Plot



Constituent: Thallium, total Analysis Run 11/25/2019 1:15 PM
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Box & Whiskers Plot



Constituent: Total Dissolved Solids [TDS] Analysis Run 11/25/2019 1:15 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

FIGURE C: OUTLIER SUMMARY

Outlier Summary

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 12/1/2019, 9:58 AM

	MW-1607S Arsenic, total (mg/L)	MW-1607S Barium, total (mg/L)	MW-1601A Chromium, total (mg/L)	MW-1602 Chromium, total (mg/L)	MW-1603 Chromium, total (mg/L)	MW-1608 Chromium, total (mg/L)	MW-1604S Chromium, total (mg/L)	MW-1605D Chromium, total (mg/L)	MW-1605S Chromium, total (mg/L)	MW-1607D Chromium, total (mg/L)
9/26/2016										
9/27/2016										
11/1/2016			0.0013 (o)							
12/19/2016				0.00165 (o)	0.00237 (o)	0.00278 (o)				
12/20/2016							0.00197 (o)	0.00229 (o)	0.00285 (o)	0.00207 (o)
12/21/2016	0.0112 (o)	0.114 (o)								
4/18/2017										
5/16/2017										

	MW-1607S Chromium, total (mg/L)	MW-1607S Cobalt, total (mg/L)	MW-1604S Combined Radium 226 + 228 (pCi/L)	MW-1606D Combined Radium 226 + 228 (pCi/L)	MW-1606D Lead, total (mg/L)	MW-1607S Lead, total (mg/L)	MW-1607S Mercury, total (mg/L)	MW-1604S Molybdenum, total (mg/L)	MW-1607D pH, field (SU)	MW-1607S pH, field (SU)
9/26/2016			0.136 (o)					0.0032 (o)		
9/27/2016				8.459 (o)						
11/1/2016										
12/19/2016										
12/20/2016										
12/21/2016	0.0031 (o)	0.0201 (o)				0.011 (o)	1.2E-05 (o)			
4/18/2017					0.00204 (o)					
5/16/2017									8.41 (o)	8.23 (o)

	MW-1606S Total Dissolved Solids [TDS] (mg/L)
9/26/2016	
9/27/2016	
11/1/2016	
12/19/2016	
12/20/2016	
12/21/2016	
4/18/2017	
5/16/2017	3230 (o)

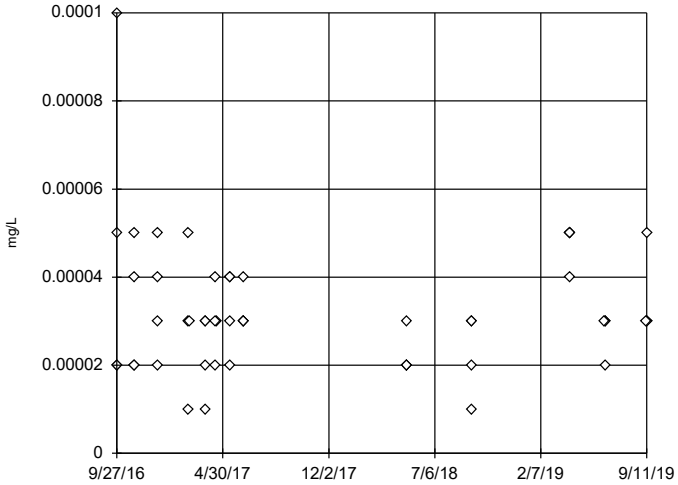
Upgradient Outlier Analysis - All Results (No Significant Results)

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 11/25/2019, 3:35 PM

Constituent	Well	Outlier	Value(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Antimony, total (mg/L)	MW-1601A,MW-1602,...	No	n/a	NP	NaN	52	0.00003212	0.00001473	ln(x)	ShapiroFrancia
Arsenic, total (mg/L)	MW-1601A,MW-1602,...	No	n/a	NP	NaN	52	0.0004713	0.000129	ln(x)	ShapiroFrancia
Barium, total (mg/L)	MW-1601A,MW-1602,...	No	n/a	NP	NaN	52	0.03761	0.01006	ln(x)	ShapiroFrancia
Beryllium, total (mg/L)	MW-1601A,MW-1602,...	n/a	n/a	NP	NaN	52	0.00008856	0.00002982	unknown	ShapiroFrancia
Boron, total (mg/L)	MW-1601A,MW-1602,...	No	n/a	NP	NaN	52	0.2418	0.1525	ln(x)	ShapiroFrancia
Cadmium, total (mg/L)	MW-1601A,MW-1602,...	No	n/a	NP	NaN	52	0.00001465	0.0000061	ln(x)	ShapiroFrancia
Calcium, total (mg/L)	MW-1601A,MW-1602,...	No	n/a	NP	NaN	52	121.8	35.97	ln(x)	ShapiroFrancia
Chloride, total (mg/L)	MW-1601A,MW-1602,...	No	n/a	NP	NaN	52	19.75	16.83	ln(x)	ShapiroFrancia
Chromium, total (mg/L)	MW-1601A,MW-1602,...	No	n/a	NP	NaN	52	0.0004463	0.0005233	ln(x)	ShapiroFrancia
Cobalt, total (mg/L)	MW-1601A,MW-1602,...	No	n/a	NP	NaN	52	0.0001664	0.0002052	ln(x)	ShapiroFrancia
Combined Radium 226 + 228 (pCi/L)	MW-1601A,MW-1602,...	No	n/a	NP	NaN	52	0.8155	0.6349	ln(x)	ShapiroFrancia
Fluoride, total (mg/L)	MW-1601A,MW-1602,...	No	n/a	NP	NaN	56	0.1741	0.05624	x^2	ShapiroFrancia
Lead, total (mg/L)	MW-1601A,MW-1602,...	No	n/a	NP	NaN	52	0.0001446	0.0001551	ln(x)	ShapiroFrancia
Lithium, total (mg/L)	MW-1601A,MW-1602,...	No	n/a	NP	NaN	52	0.01169	0.006974	sqrt(x)	ShapiroFrancia
Mercury, total (mg/L)	MW-1601A,MW-1602,...	n/a	n/a	NP	NaN	52	0.000004808	6.9e-7	unknown	ShapiroFrancia
Molybdenum, total (mg/L)	MW-1601A,MW-1602,...	No	n/a	NP	NaN	52	0.001362	0.00104	x^(1/3)	ShapiroFrancia
Selenium, total (mg/L)	MW-1601A,MW-1602,...	No	n/a	NP	NaN	52	0.000691	0.0005369	sqrt(x)	ShapiroFrancia
Sulfate, total (mg/L)	MW-1601A,MW-1602,...	No	n/a	NP	NaN	52	249.7	139.5	ln(x)	ShapiroFrancia
Thallium, total (mg/L)	MW-1601A,MW-1602,...	No	n/a	NP	NaN	52	0.0001509	0.0002046	ln(x)	ShapiroFrancia
Total Dissolved Solids [TDS] (mg/L)	MW-1601A,MW-1602,...	No	n/a	NP	NaN	52	605.8	185.6	ln(x)	ShapiroFrancia

Tukey's Outlier Screening, Pooled Background

MW-1601A,MW-1602,MW-1603,MW-1608



n = 52

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

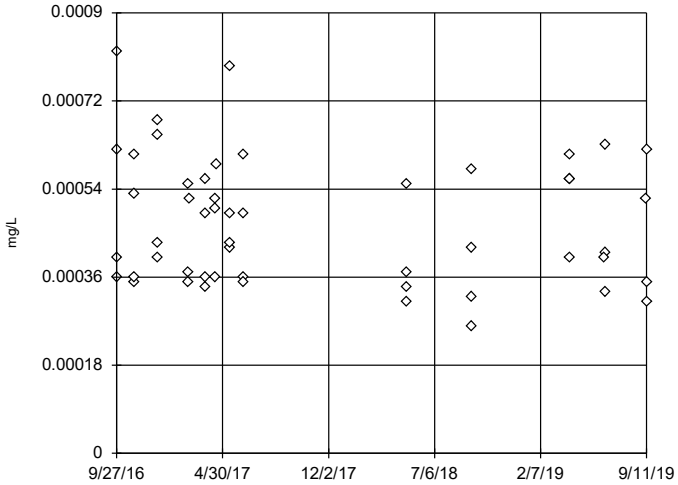
High cutoff = 0.00032, low cutoff = 0.0000025, based on IQR multiplier of 3.

Constituent: Antimony, total Analysis Run 11/25/2019 3:33 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening, Pooled Background

MW-1601A,MW-1602,MW-1603,MW-1608



n = 52

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

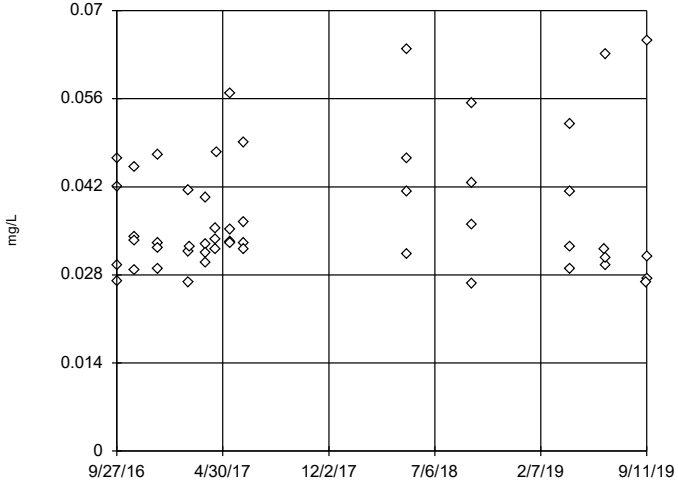
High cutoff = 0.002108, low cutoff = 0.00009564, based on IQR multiplier of 3.

Constituent: Arsenic, total Analysis Run 11/25/2019 3:33 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening, Pooled Background

MW-1601A,MW-1602,MW-1603,MW-1608



n = 52

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

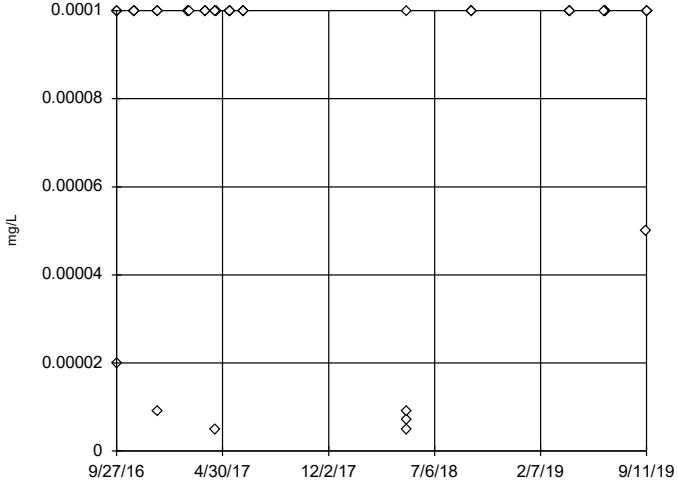
High cutoff = 0.1069, low cutoff = 0.01228, based on IQR multiplier of 3.

Constituent: Barium, total Analysis Run 11/25/2019 3:33 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening, Pooled Background

MW-1601A,MW-1602,MW-1603,MW-1608



n = 52

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

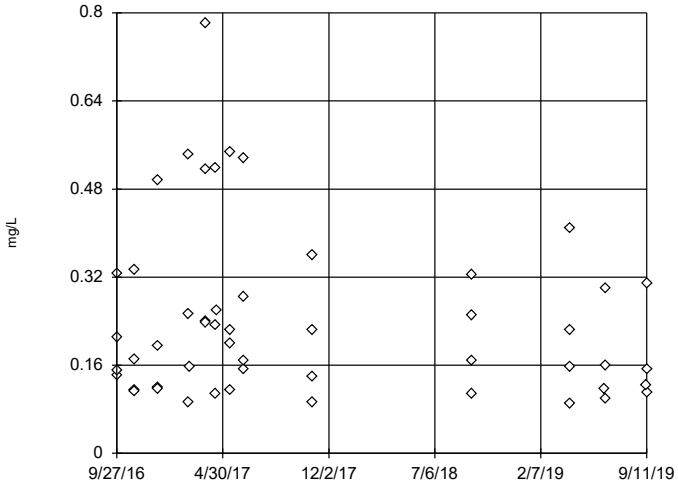
The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Beryllium, total Analysis Run 11/25/2019 3:33 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening, Pooled Background

MW-1601A,MW-1602,MW-1603,MW-1608



n = 52

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 4.672, low cutoff = 0.007923, based on IQR multiplier of 3.

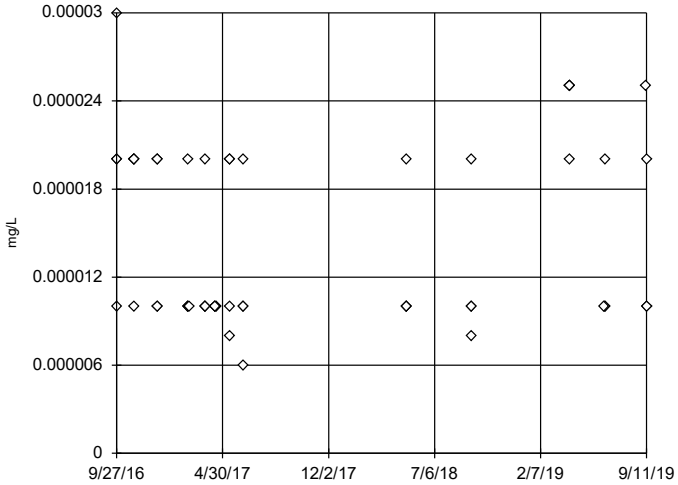
Constituent: Boron, total Analysis Run 11/25/2019 3:33 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1601A,MW-1602,MW-1603,MW-1608



n = 52

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.00016, low cutoff = 0.00000125, based on IQR multiplier of 3.

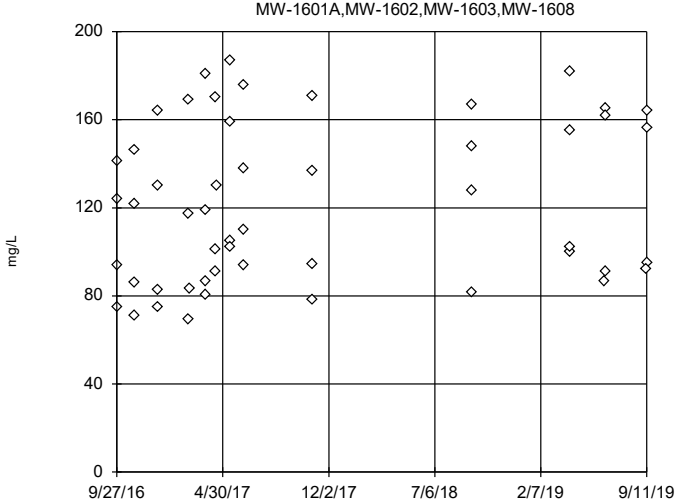
Constituent: Cadmium, total Analysis Run 11/25/2019 3:33 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1601A,MW-1602,MW-1603,MW-1608



n = 52

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 812.4, low cutoff = 17.67, based on IQR multiplier of 3.

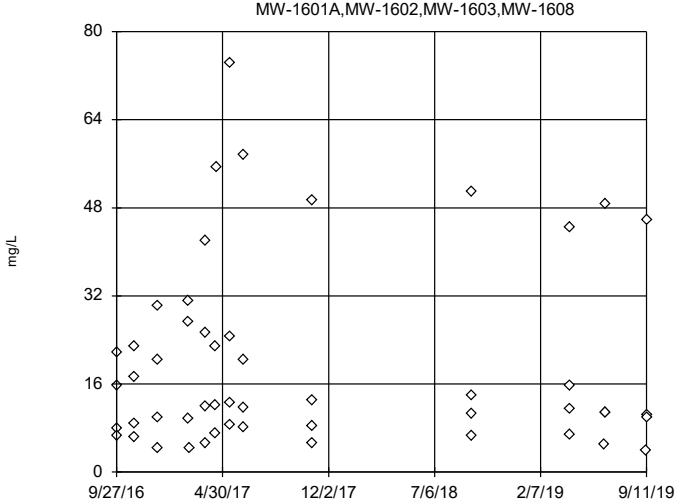
Constituent: Calcium, total Analysis Run 11/25/2019 3:33 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1601A,MW-1602,MW-1603,MW-1608



n = 52

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

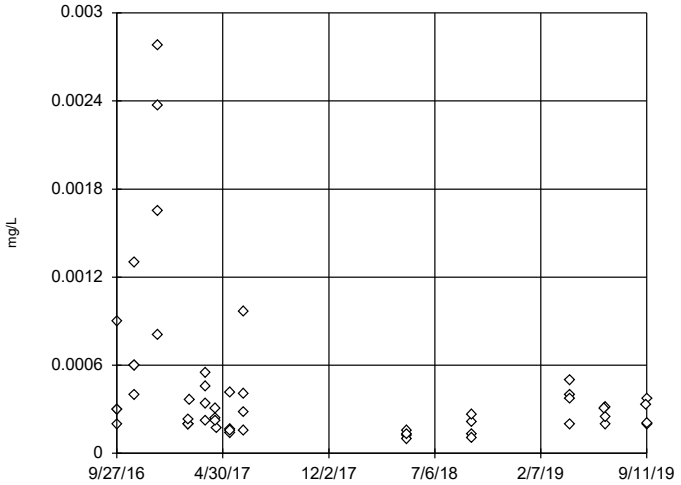
High cutoff = 672.8, low cutoff = 0.3085, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 11/25/2019 3:33 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening, Pooled Background

MW-1601A,MW-1602,MW-1603,MW-1608



n = 52

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.003638, low cutoff = 0.00002251, based on IQR multiplier of 3.

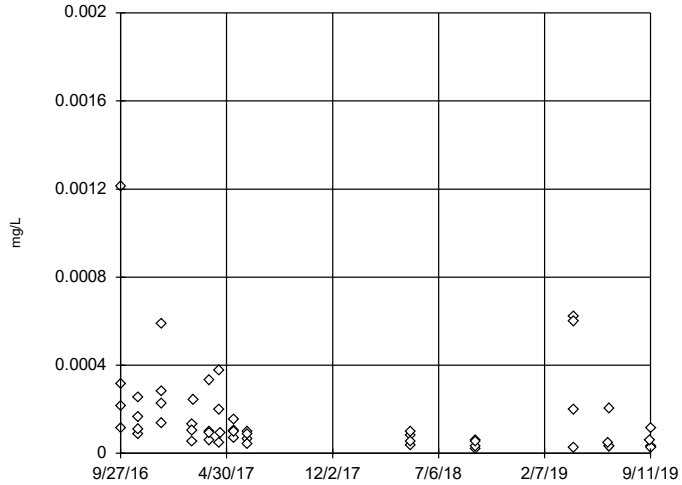
Constituent: Chromium, total Analysis Run 11/25/2019 3:33 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1601A,MW-1602,MW-1603,MW-1608



n = 52

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.01119, low cutoff = 9.6e-7, based on IQR multiplier of 3.

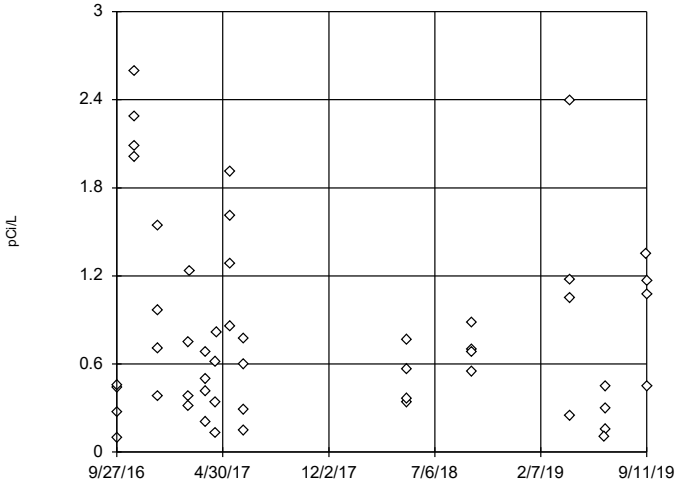
Constituent: Cobalt, total Analysis Run 11/25/2019 3:33 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1601A,MW-1602,MW-1603,MW-1608



n = 52

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 35.71, low cutoff = 0.01103, based on IQR multiplier of 3.

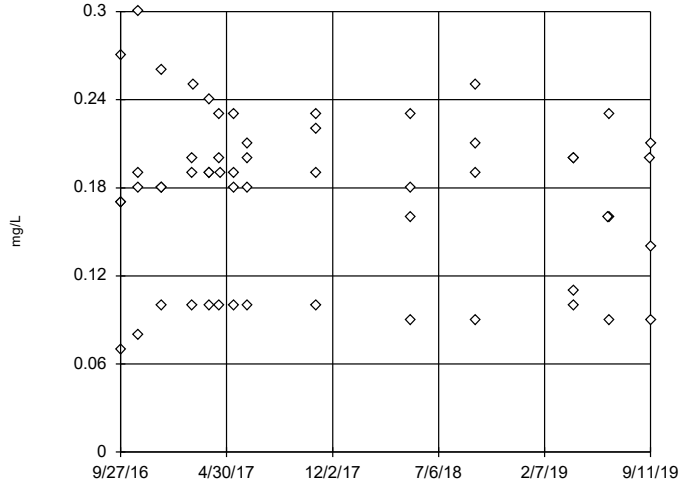
Constituent: Combined Radium 226 + 228 Analysis Run 11/25/2019 3:33 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1601A,MW-1602,MW-1603,MW-1608



n = 56

No outliers found. Tukey's method selected by user.

Data were square transformed to achieve best W statistic (graph shown in original units).

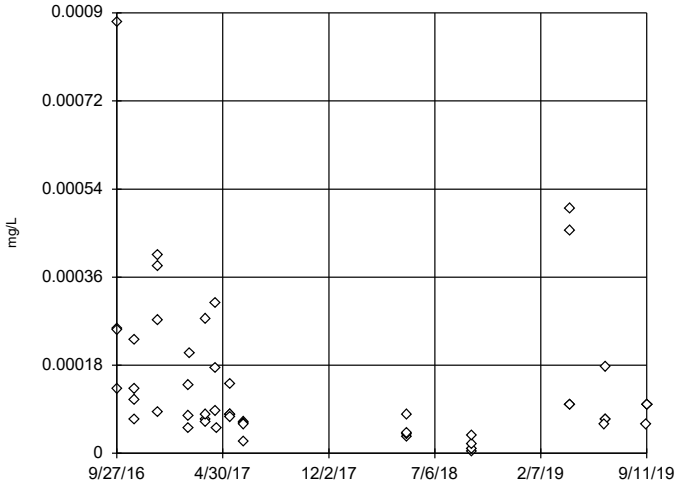
High cutoff = 0.3785, low cutoff = -0.2968, based on IQR multiplier of 3.

Constituent: Fluoride, total Analysis Run 11/25/2019 3:33 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening, Pooled Background

MW-1601A,MW-1602,MW-1603,MW-1608



n = 52

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.004187, low cutoff = 0.000002521, based on IQR multiplier of 3.

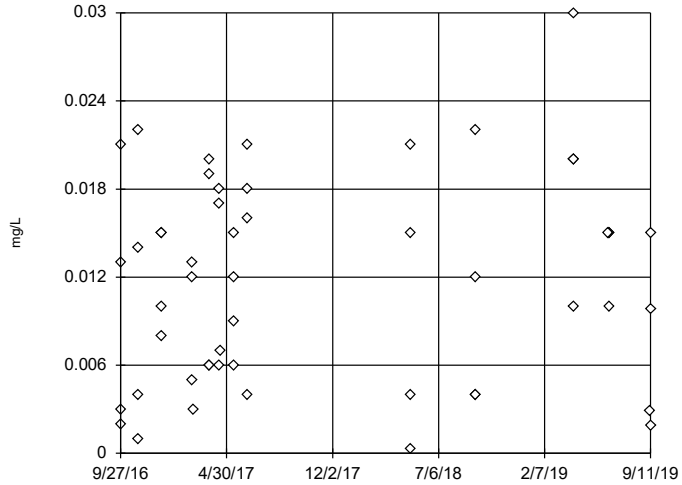
Constituent: Lead, total Analysis Run 11/25/2019 3:33 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1601A,MW-1602,MW-1603,MW-1608



n = 52

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.08497, low cutoff = -0.007916, based on IQR multiplier of 3.

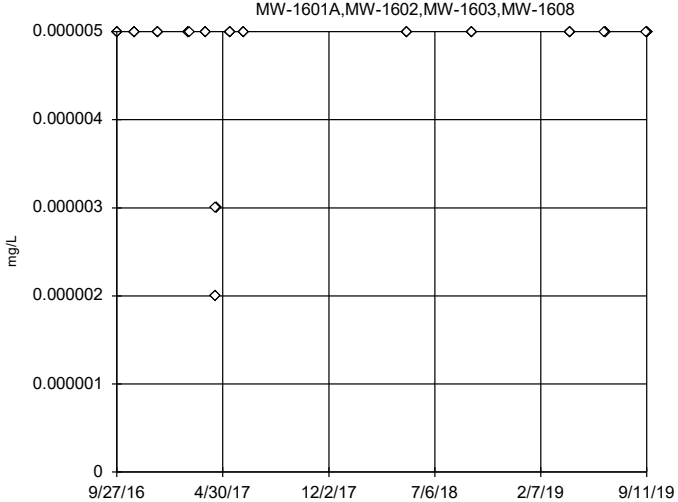
Constituent: Lithium, total Analysis Run 11/25/2019 3:33 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1601A,MW-1602,MW-1603,MW-1608



n = 52

No outliers found. Tukey's method selected by user.

Data were square transformed to achieve best W statistic (graph shown in original units).

The results were invalidated, because the lower and upper quartiles are equal.

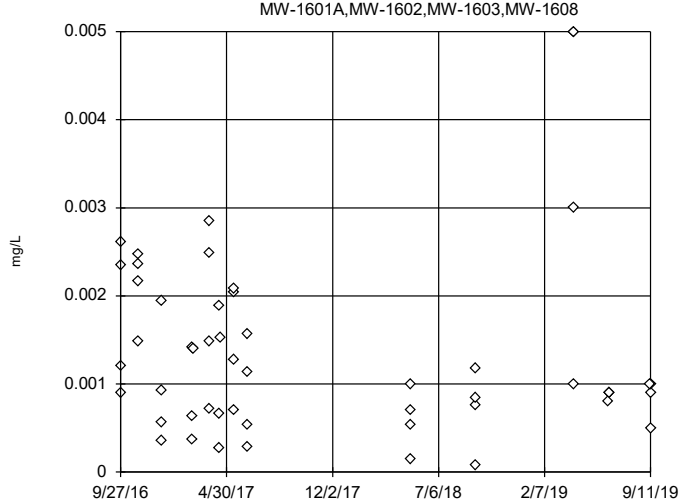
Constituent: Mercury, total Analysis Run 11/25/2019 3:33 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1601A,MW-1602,MW-1603,MW-1608



n = 52

No outliers found. Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

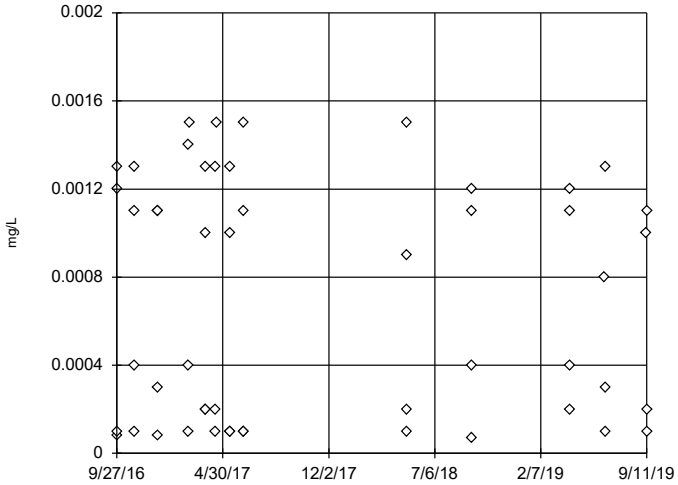
High cutoff = 0.01202, low cutoff = -0.000003864, based on IQR multiplier of 3.

Constituent: Molybdenum, total Analysis Run 11/25/2019 3:33 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening, Pooled Background

MW-1601A,MW-1602,MW-1603,MW-1608



n = 52

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.01179, low cutoff = -0.004086, based on IQR multiplier of 3.

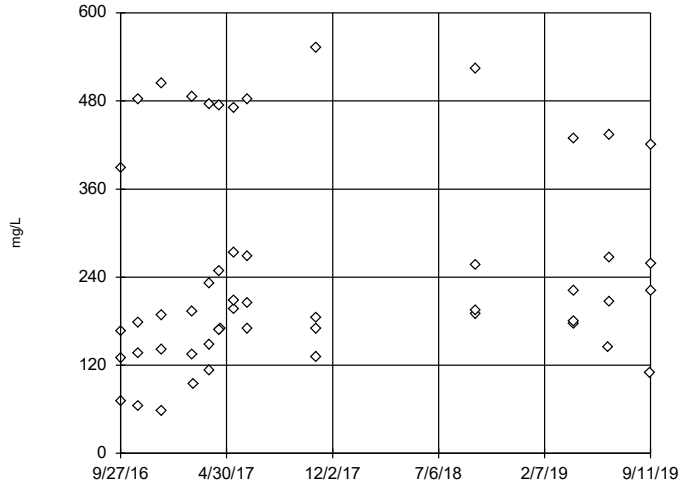
Constituent: Selenium, total Analysis Run 11/25/2019 3:33 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1601A,MW-1602,MW-1603,MW-1608



n = 52

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 2887, low cutoff = 17.72, based on IQR multiplier of 3.

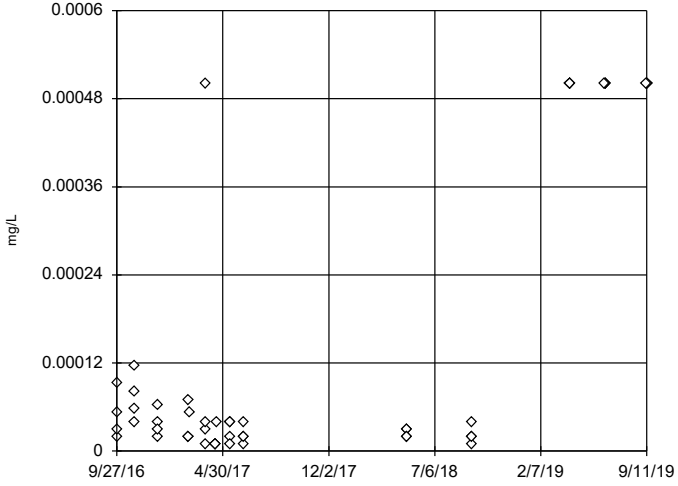
Constituent: Sulfate, total Analysis Run 11/25/2019 3:33 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1601A,MW-1602,MW-1603,MW-1608



n = 52

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.4205, low cutoff = 1.1e-8, based on IQR multiplier of 3.

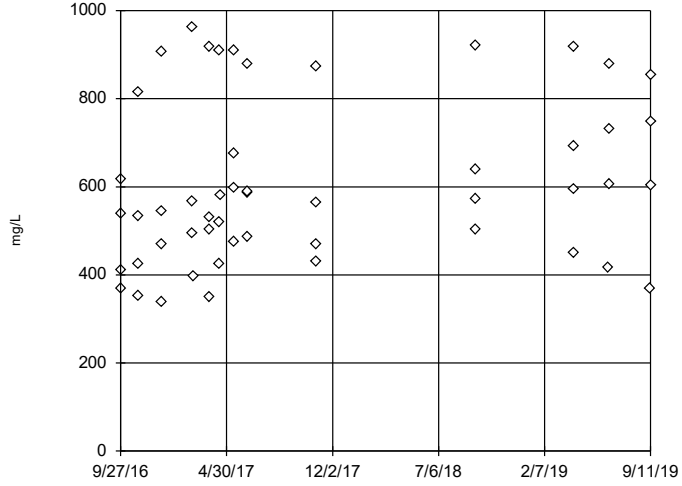
Constituent: Thallium, total Analysis Run 11/25/2019 3:33 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1601A,MW-1602,MW-1603,MW-1608



n = 52

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 2898, low cutoff = 119.7, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS] Analysis Run 11/25/2019 3:33 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Outlier Analysis - Significant Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 11/25/2019, 3:32 PM

Constituent	Well	Outlier	Value(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Antimony, total (mg/L)	**MW-1605D**	**Yes**	**0.0001**	**NP**	**NaN**	**13**	**0.00003923**	**0.00001891**	**ln(x)**	**ShapiroWilk**
Antimony, total (mg/L)	**MW-1607S**	**Yes**	**0.00084**	**NP**	**NaN**	**13**	**0.00048**	**0.0001156**	**ln(x)**	**ShapiroWilk**
Arsenic, total (mg/L)	**MW-1607S**	**Yes**	**0.0112**	**NP**	**NaN**	**13**	**0.001939**	**0.002798**	**ln(x)**	**ShapiroWilk**
Cobalt, total (mg/L)	**MW-1607S**	**Yes**	**0.0201**	**NP**	**NaN**	**13**	**0.002706**	**0.005262**	**ln(x)**	**ShapiroWilk**
Fluoride, total (mg/L)	**MW-1606D**	**Yes**	**0.1,0.49**	**NP**	**NaN**	**14**	**0.2614**	**0.07853**	**sqrt(x)**	**ShapiroWilk**
Fluoride, total (mg/L)	**MW-1606S**	**Yes**	**0.57,0.54,0.25,0.28**	**NP**	**NaN**	**15**	**0.442**	**0.08205**	**x^3**	**ShapiroWilk**
pH, field (SU)	**MW-1604D**	**Yes**	**7.87**	**NP**	**NaN**	**15**	**7.252**	**0.2219**	**ln(x)**	**ShapiroWilk**
pH, field (SU)	**MW-1607D**	**Yes**	**6.9,8.41**	**NP**	**NaN**	**15**	**7.633**	**0.3047**	**x^(1/3)**	**ShapiroWilk**
pH, field (SU)	**MW-1607S**	**Yes**	**8.23**	**NP**	**NaN**	**15**	**7.549**	**0.2201**	**ln(x)**	**ShapiroWilk**
Thallium, total (mg/L)	**MW-1606D**	**Yes**	**0.0005,0.0005**	**NP**	**NaN**	**13**	**0.0001628**	**0.0001501**	**ln(x)**	**ShapiroWilk**
Thallium, total (mg/L)	**MW-1606S**	**Yes**	**0.0005,0.0005**	**NP**	**NaN**	**13**	**0.000144**	**0.0001588**	**ln(x)**	**ShapiroWilk**

Outlier Analysis - All Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 11/25/2019, 3:32 PM

Constituent	Well	Outlier	Value(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Antimony, total (mg/L)	MW-1604D	No	n/a	NP	NaN	13	0.0001131	0.00006223	normal	ShapiroWilk
Antimony, total (mg/L)	MW-1604S	No	n/a	NP	NaN	13	0.00007923	0.00006075	ln(x)	ShapiroWilk
Antimony, total (mg/L)	**MW-1605D**	**Yes**	**0.0001**	**NP**	**NaN**	**13**	**0.00003923**	**0.00001891**	**ln(x)**	**ShapiroWilk**
Antimony, total (mg/L)	MW-1605S	No	n/a	NP	NaN	13	0.00005769	0.0000332	ln(x)	ShapiroWilk
Antimony, total (mg/L)	MW-1606D	No	n/a	NP	NaN	13	0.0001692	0.00002957	ln(x)	ShapiroWilk
Antimony, total (mg/L)	MW-1606S	No	n/a	NP	NaN	13	0.0001508	0.00001256	x^4	ShapiroWilk
Antimony, total (mg/L)	MW-1607D	n/a	n/a	NP	NaN	13	0.00003231	0.000005991	unknown	ShapiroWilk
Antimony, total (mg/L)	**MW-1607S**	**Yes**	**0.00084**	**NP**	**NaN**	**13**	**0.00048**	**0.0001156**	**ln(x)**	**ShapiroWilk**
Arsenic, total (mg/L)	MW-1604D	No	n/a	NP	NaN	13	0.0004308	0.0001053	normal	ShapiroWilk
Arsenic, total (mg/L)	MW-1604S	No	n/a	NP	NaN	13	0.0004062	0.00006959	ln(x)	ShapiroWilk
Arsenic, total (mg/L)	MW-1605D	No	n/a	NP	NaN	13	0.002381	0.0002641	ln(x)	ShapiroWilk
Arsenic, total (mg/L)	MW-1605S	No	n/a	NP	NaN	13	0.0007492	0.0002476	ln(x)	ShapiroWilk
Arsenic, total (mg/L)	MW-1606D	No	n/a	NP	NaN	13	0.0005846	0.0002808	ln(x)	ShapiroWilk
Arsenic, total (mg/L)	MW-1606S	No	n/a	NP	NaN	13	0.0007915	0.0001003	x^2	ShapiroWilk
Arsenic, total (mg/L)	MW-1607D	No	n/a	NP	NaN	13	0.001182	0.0002155	ln(x)	ShapiroWilk
Arsenic, total (mg/L)	**MW-1607S**	**Yes**	**0.0112**	**NP**	**NaN**	**13**	**0.001939**	**0.002798**	**ln(x)**	**ShapiroWilk**
Barium, total (mg/L)	MW-1604D	No	n/a	NP	NaN	13	0.03432	0.009917	ln(x)	ShapiroWilk
Barium, total (mg/L)	MW-1604S	No	n/a	NP	NaN	13	0.02875	0.001746	ln(x)	ShapiroWilk
Barium, total (mg/L)	MW-1605D	No	n/a	NP	NaN	13	0.02762	0.002947	normal	ShapiroWilk
Barium, total (mg/L)	MW-1605S	No	n/a	NP	NaN	13	0.03187	0.007452	ln(x)	ShapiroWilk
Barium, total (mg/L)	MW-1606D	No	n/a	NP	NaN	13	0.05493	0.005769	ln(x)	ShapiroWilk
Barium, total (mg/L)	MW-1606S	No	n/a	NP	NaN	13	0.07192	0.004669	x^6	ShapiroWilk
Barium, total (mg/L)	MW-1607D	No	n/a	NP	NaN	13	0.1155	0.0317	x^2	ShapiroWilk
Barium, total (mg/L)	MW-1607S	No	n/a	NP	NaN	13	0.07109	0.01499	ln(x)	ShapiroWilk
Beryllium, total (mg/L)	MW-1604D	n/a	n/a	NP	NaN	13	0.0001	0	unknown	ShapiroWilk
Beryllium, total (mg/L)	MW-1604S	n/a	n/a	NP	NaN	13	0.00009415	0.00002108	unknown	ShapiroWilk
Beryllium, total (mg/L)	MW-1605D	n/a	n/a	NP	NaN	13	0.0001	0	unknown	ShapiroWilk
Beryllium, total (mg/L)	MW-1605S	No	n/a	NP	NaN	13	0.00007969	0.0000387	ln(x)	ShapiroWilk
Beryllium, total (mg/L)	MW-1606D	No	n/a	NP	NaN	13	0.00007308	0.0000425	ln(x)	ShapiroWilk
Beryllium, total (mg/L)	MW-1606S	n/a	n/a	NP	NaN	13	0.00009269	0.00002635	unknown	ShapiroWilk
Beryllium, total (mg/L)	MW-1607D	n/a	n/a	NP	NaN	13	0.00009292	0.00002552	unknown	ShapiroWilk
Beryllium, total (mg/L)	MW-1607S	n/a	n/a	NP	NaN	13	0.00008077	0.0000414	unknown	ShapiroWilk
Cadmium, total (mg/L)	MW-1604D	No	n/a	NP	NaN	13	0.00009769	0.00005418	normal	ShapiroWilk
Cadmium, total (mg/L)	MW-1604S	No	n/a	NP	NaN	13	0.00009923	0.00008636	ln(x)	ShapiroWilk
Cadmium, total (mg/L)	MW-1605D	No	n/a	NP	NaN	13	0.00002692	0.00001109	normal	ShapiroWilk
Cadmium, total (mg/L)	MW-1605S	No	n/a	NP	NaN	13	0.00007154	0.0000223	ln(x)	ShapiroWilk
Cadmium, total (mg/L)	MW-1606D	No	n/a	NP	NaN	13	0.00007154	0.000009871	x^2	ShapiroWilk
Cadmium, total (mg/L)	MW-1606S	No	n/a	NP	NaN	13	0.00007308	0.000008549	sqrt(x)	ShapiroWilk
Cadmium, total (mg/L)	MW-1607D	n/a	n/a	NP	NaN	13	0.00002192	0.000006934	unknown	ShapiroWilk
Cadmium, total (mg/L)	MW-1607S	No	n/a	NP	NaN	13	0.00005385	0.00005124	ln(x)	ShapiroWilk
Chromium, total (mg/L)	MW-1604D	No	n/a	NP	NaN	13	0.0003165	0.000187	ln(x)	ShapiroWilk
Chromium, total (mg/L)	MW-1604S	No	n/a	NP	NaN	13	0.0003566	0.0005136	ln(x)	ShapiroWilk
Chromium, total (mg/L)	MW-1605D	No	n/a	NP	NaN	13	0.0003362	0.0006025	ln(x)	ShapiroWilk
Chromium, total (mg/L)	MW-1605S	No	n/a	NP	NaN	13	0.0005741	0.0007123	ln(x)	ShapiroWilk
Chromium, total (mg/L)	MW-1606D	No	n/a	NP	NaN	13	0.0003512	0.0003008	ln(x)	ShapiroWilk
Chromium, total (mg/L)	MW-1606S	No	n/a	NP	NaN	13	0.0003065	0.0003456	ln(x)	ShapiroWilk
Chromium, total (mg/L)	MW-1607D	No	n/a	NP	NaN	13	0.0003495	0.000558	ln(x)	ShapiroWilk
Chromium, total (mg/L)	MW-1607S	No	n/a	NP	NaN	13	0.0005633	0.0007838	ln(x)	ShapiroWilk
Cobalt, total (mg/L)	MW-1604D	No	n/a	NP	NaN	13	0.001191	0.0007762	x^6	ShapiroWilk
Cobalt, total (mg/L)	MW-1604S	No	n/a	NP	NaN	13	0.001017	0.0008896	ln(x)	ShapiroWilk
Cobalt, total (mg/L)	MW-1605D	No	n/a	NP	NaN	13	0.001721	0.0001182	x^2	ShapiroWilk
Cobalt, total (mg/L)	MW-1605S	No	n/a	NP	NaN	13	0.0008512	0.0007502	ln(x)	ShapiroWilk
Cobalt, total (mg/L)	MW-1606D	No	n/a	NP	NaN	13	0.001655	0.0008412	ln(x)	ShapiroWilk
Cobalt, total (mg/L)	MW-1606S	No	n/a	NP	NaN	13	0.0003035	0.00008138	ln(x)	ShapiroWilk
Cobalt, total (mg/L)	MW-1607D	No	n/a	NP	NaN	13	0.0005857	0.0001814	ln(x)	ShapiroWilk

Outlier Analysis - All Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 11/25/2019, 3:32 PM

Constituent	Well	Outlier	Value(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Cobalt, total (mg/L)	**MW-1607S**	**Yes**	**0.0201**	**NP**	**NaN**	**13**	**0.002706**	**0.005262**	**ln(x)**	**ShapiroWilk**
Combined Radium 226 + 228 (pCi/L)	MW-1604D	No	n/a	NP	NaN	13	1.094	0.8316	ln(x)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-1604S	No	n/a	NP	NaN	13	1.003	0.5981	sqrt(x)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-1605D	No	n/a	NP	NaN	13	1.267	0.9067	ln(x)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-1605S	No	n/a	NP	NaN	13	0.8627	0.8402	ln(x)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-1606D	No	n/a	NP	NaN	13	2.111	2.124	ln(x)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-1606S	No	n/a	NP	NaN	13	1.197	0.6873	x^(1/3)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-1607D	No	n/a	NP	NaN	13	1.58	0.8076	ln(x)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-1607S	No	n/a	NP	NaN	13	1.64	0.7717	ln(x)	ShapiroWilk
Fluoride, total (mg/L)	MW-1604D	No	n/a	NP	NaN	14	0.1829	0.02054	x^4	ShapiroWilk
Fluoride, total (mg/L)	MW-1604S	No	n/a	NP	NaN	14	0.2007	0.01542	x^6	ShapiroWilk
Fluoride, total (mg/L)	MW-1605D	No	n/a	NP	NaN	14	0.1971	0.01858	sqrt(x)	ShapiroWilk
Fluoride, total (mg/L)	MW-1605S	No	n/a	NP	NaN	14	0.2593	0.03362	ln(x)	ShapiroWilk
Fluoride, total (mg/L)	**MW-1606D**	**Yes**	**0.1,0.49**	**NP**	**NaN**	**14**	**0.2614**	**0.07853**	**sqrt(x)**	**ShapiroWilk**
Fluoride, total (mg/L)	**MW-1606S**	**Yes**	**0.57,0.54,0.25,0.28**	**NP**	**NaN**	**15**	**0.442**	**0.08205**	**x^3**	**ShapiroWilk**
Fluoride, total (mg/L)	MW-1607D	No	n/a	NP	NaN	15	0.5107	0.0492	x^2	ShapiroWilk
Fluoride, total (mg/L)	MW-1607S	No	n/a	NP	NaN	14	0.2829	0.03315	x^4	ShapiroWilk
Lead, total (mg/L)	MW-1604D	No	n/a	NP	NaN	13	0.000112	0.0001611	ln(x)	ShapiroWilk
Lead, total (mg/L)	MW-1604S	No	n/a	NP	NaN	13	0.00007731	0.00003657	normal	ShapiroWilk
Lead, total (mg/L)	MW-1605D	No	n/a	NP	NaN	13	0.00003885	0.00003261	ln(x)	ShapiroWilk
Lead, total (mg/L)	MW-1605S	No	n/a	NP	NaN	13	0.0004746	0.0005588	ln(x)	ShapiroWilk
Lead, total (mg/L)	MW-1606D	No	n/a	NP	NaN	13	0.0003067	0.0005448	ln(x)	ShapiroWilk
Lead, total (mg/L)	MW-1606S	No	n/a	NP	NaN	13	0.0001061	0.00006136	x^(1/3)	ShapiroWilk
Lead, total (mg/L)	MW-1607D	No	n/a	NP	NaN	13	0.0001143	0.0001597	ln(x)	ShapiroWilk
Lead, total (mg/L)	MW-1607S	No	n/a	NP	NaN	13	0.001163	0.002989	ln(x)	ShapiroWilk
Lithium, total (mg/L)	MW-1604D	No	n/a	NP	NaN	13	0.04214	0.01777	x^3	ShapiroWilk
Lithium, total (mg/L)	MW-1604S	No	n/a	NP	NaN	13	0.0402	0.01035	x^(1/3)	ShapiroWilk
Lithium, total (mg/L)	MW-1605D	No	n/a	NP	NaN	13	0.06839	0.01741	x^4	ShapiroWilk
Lithium, total (mg/L)	MW-1605S	No	n/a	NP	NaN	13	0.06734	0.01465	x^3	ShapiroWilk
Lithium, total (mg/L)	MW-1606D	No	n/a	NP	NaN	13	0.1121	0.02078	x^6	ShapiroWilk
Lithium, total (mg/L)	MW-1606S	No	n/a	NP	NaN	13	0.1049	0.01791	x^5	ShapiroWilk
Lithium, total (mg/L)	MW-1607D	No	n/a	NP	NaN	13	0.08669	0.01771	ln(x)	ShapiroWilk
Lithium, total (mg/L)	MW-1607S	No	n/a	NP	NaN	13	0.1013	0.01604	ln(x)	ShapiroWilk
Mercury, total (mg/L)	MW-1604D	n/a	n/a	NP	NaN	13	0.000007231	0.000008662	unknown	ShapiroWilk
Mercury, total (mg/L)	MW-1604S	n/a	n/a	NP	NaN	13	0.000004846	5.5e-7	unknown	ShapiroWilk
Mercury, total (mg/L)	MW-1605D	n/a	n/a	NP	NaN	13	0.000004769	8.3e-7	unknown	ShapiroWilk
Mercury, total (mg/L)	MW-1605S	n/a	n/a	NP	NaN	13	0.000004846	5.5e-7	unknown	ShapiroWilk
Mercury, total (mg/L)	MW-1606D	n/a	n/a	NP	NaN	13	0.000004923	2.8e-7	unknown	ShapiroWilk
Mercury, total (mg/L)	MW-1606S	n/a	n/a	NP	NaN	13	0.000004769	8.3e-7	unknown	ShapiroWilk
Mercury, total (mg/L)	MW-1607D	n/a	n/a	NP	NaN	13	0.000004538	0.000001127	unknown	ShapiroWilk
Mercury, total (mg/L)	MW-1607S	n/a	n/a	NP	NaN	13	0.000005231	0.000002166	unknown	ShapiroWilk
Molybdenum, total (mg/L)	MW-1604D	No	n/a	NP	NaN	13	0.01243	0.008423	x^6	ShapiroWilk
Molybdenum, total (mg/L)	MW-1604S	No	n/a	NP	NaN	13	0.007955	0.00705	x^6	ShapiroWilk
Molybdenum, total (mg/L)	MW-1605D	No	n/a	NP	NaN	13	0.0465	0.005091	ln(x)	ShapiroWilk
Molybdenum, total (mg/L)	MW-1605S	No	n/a	NP	NaN	13	0.01824	0.003943	ln(x)	ShapiroWilk
Molybdenum, total (mg/L)	MW-1606D	No	n/a	NP	NaN	13	0.07448	0.005767	ln(x)	ShapiroWilk
Molybdenum, total (mg/L)	MW-1606S	No	n/a	NP	NaN	13	0.08529	0.01896	x^2	ShapiroWilk
Molybdenum, total (mg/L)	MW-1607D	No	n/a	NP	NaN	13	0.08633	0.005134	ln(x)	ShapiroWilk
Molybdenum, total (mg/L)	MW-1607S	No	n/a	NP	NaN	13	0.04281	0.00509	x^3	ShapiroWilk
pH, field (SU)	MW-1601A (bg)	No	n/a	NP	NaN	14	7.2	0.2133	ln(x)	ShapiroWilk
pH, field (SU)	MW-1602 (bg)	No	n/a	NP	NaN	14	6.798	0.2696	normal	ShapiroWilk
pH, field (SU)	MW-1603 (bg)	No	n/a	NP	NaN	14	6.858	0.3077	ln(x)	ShapiroWilk
pH, field (SU)	**MW-1604D**	**Yes**	**7.87**	**NP**	**NaN**	**15**	**7.252**	**0.2219**	**ln(x)**	**ShapiroWilk**
pH, field (SU)	MW-1604S	No	n/a	NP	NaN	15	7.199	0.2212	ln(x)	ShapiroWilk
pH, field (SU)	MW-1605D	No	n/a	NP	NaN	14	7.411	0.193	ln(x)	ShapiroWilk

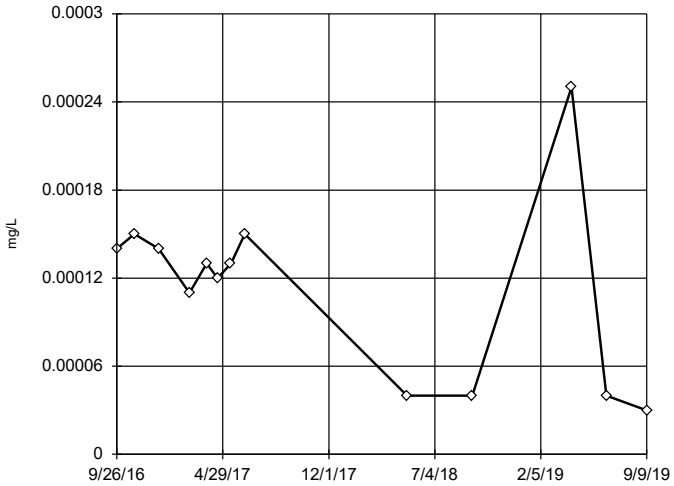
Outlier Analysis - All Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 11/25/2019, 3:32 PM

Constituent	Well	Outlier	Value(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
pH, field (SU)	MW-1605S	No	n/a	NP	NaN	15	7.319	0.2092	ln(x)	ShapiroWilk
pH, field (SU)	MW-1606D	No	n/a	NP	NaN	15	7.395	0.2023	ln(x)	ShapiroWilk
pH, field (SU)	MW-1606S	No	n/a	NP	NaN	15	7.115	0.3771	x^6	ShapiroWilk
pH, field (SU)	**MW-1607D**	**Yes**	**6.9,8.41**	**NP**	**NaN**	**15**	**7.633**	**0.3047**	**x^(1/3)**	**ShapiroWilk**
pH, field (SU)	**MW-1607S**	**Yes**	**8.23**	**NP**	**NaN**	**15**	**7.549**	**0.2201**	**ln(x)**	**ShapiroWilk**
pH, field (SU)	MW-1608 (bg)	No	n/a	NP	NaN	14	7.039	0.3664	x^3	ShapiroWilk
Selenium, total (mg/L)	MW-1604D	No	n/a	NP	NaN	13	0.001538	0.001154	ln(x)	ShapiroWilk
Selenium, total (mg/L)	MW-1604S	No	n/a	NP	NaN	13	0.001838	0.0007698	normal	ShapiroWilk
Selenium, total (mg/L)	MW-1605D	No	n/a	NP	NaN	13	0.0002385	0.00006504	ln(x)	ShapiroWilk
Selenium, total (mg/L)	MW-1605S	No	n/a	NP	NaN	13	0.001223	0.0007108	ln(x)	ShapiroWilk
Selenium, total (mg/L)	MW-1606D	No	n/a	NP	NaN	13	0.004654	0.002584	x^(1/3)	ShapiroWilk
Selenium, total (mg/L)	MW-1606S	No	n/a	NP	NaN	13	0.001331	0.0007216	ln(x)	ShapiroWilk
Selenium, total (mg/L)	MW-1607D	No	n/a	NP	NaN	13	0.00008846	0.0001256	ln(x)	ShapiroWilk
Selenium, total (mg/L)	MW-1607S	No	n/a	NP	NaN	13	0.008169	0.001881	x^2	ShapiroWilk
Thallium, total (mg/L)	MW-1604D	No	n/a	NP	NaN	13	0.0002787	0.0001563	normal	ShapiroWilk
Thallium, total (mg/L)	MW-1604S	No	n/a	NP	NaN	13	0.00026	0.0005348	ln(x)	ShapiroWilk
Thallium, total (mg/L)	MW-1605D	No	n/a	NP	NaN	13	0.0001622	0.0001944	ln(x)	ShapiroWilk
Thallium, total (mg/L)	MW-1605S	No	n/a	NP	NaN	13	0.0001666	0.0001935	ln(x)	ShapiroWilk
Thallium, total (mg/L)	**MW-1606D**	**Yes**	**0.0005,0.0005**	**NP**	**NaN**	**13**	**0.0001628**	**0.0001501**	**ln(x)**	**ShapiroWilk**
Thallium, total (mg/L)	**MW-1606S**	**Yes**	**0.0005,0.0005**	**NP**	**NaN**	**13**	**0.000144**	**0.0001588**	**ln(x)**	**ShapiroWilk**
Thallium, total (mg/L)	MW-1607D	No	n/a	NP	NaN	13	0.000144	0.0002033	ln(x)	ShapiroWilk
Thallium, total (mg/L)	MW-1607S	No	n/a	NP	NaN	13	0.0001686	0.0001908	ln(x)	ShapiroWilk

Tukey's Outlier Screening

MW-1604D



n = 13

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

High cutoff = 0.00046, low cutoff = -0.000275, based on IQR multiplier of 3.

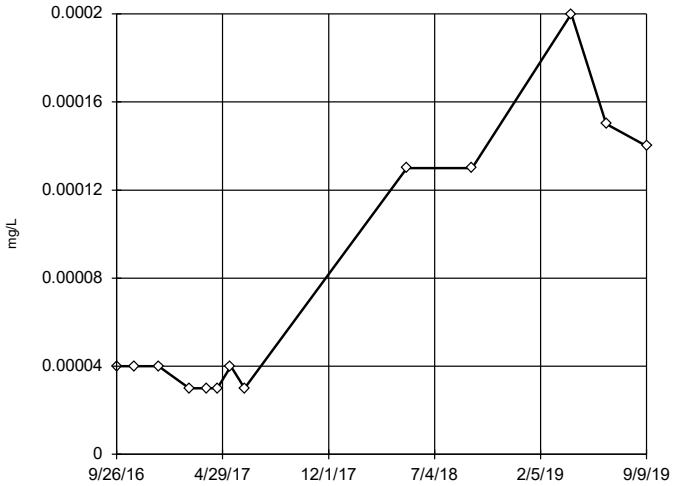
Constituent: Antimony, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.01227, low cutoff = 3.3e-7, based on IQR multiplier of 3.

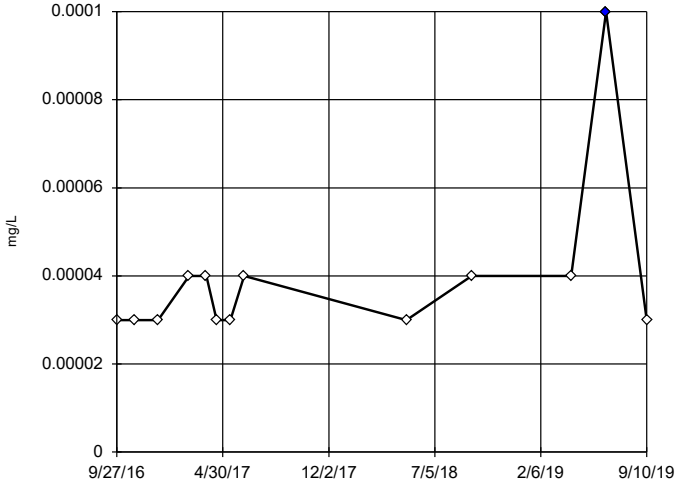
Constituent: Antimony, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605D



n = 13

Outlier is drawn as solid. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.00009481, low cutoff = 0.00001266, based on IQR multiplier of 3.

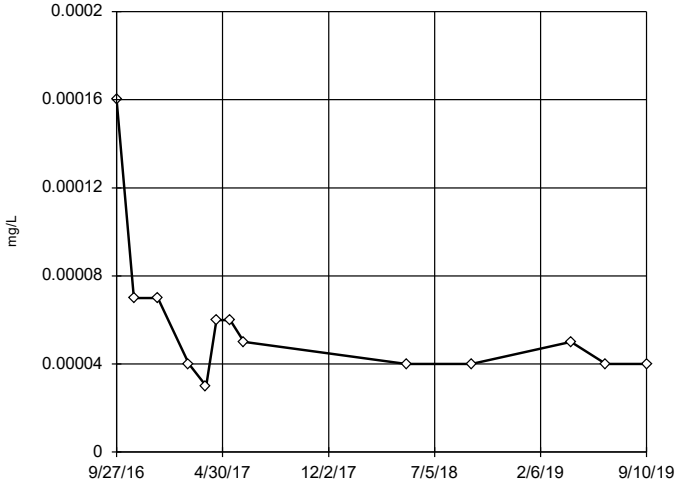
Constituent: Antimony, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

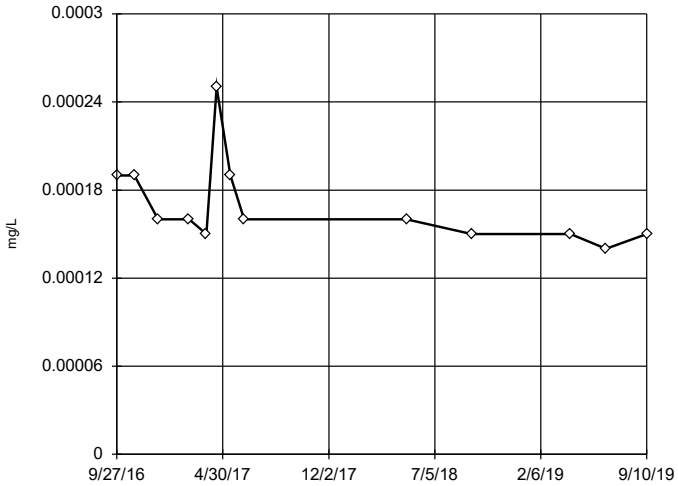
High cutoff = 0.0002756, low cutoff = 0.000009405, based on IQR multiplier of 3.

Constituent: Antimony, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1606D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.0003861, low cutoff = 0.00007381, based on IQR multiplier of 3.

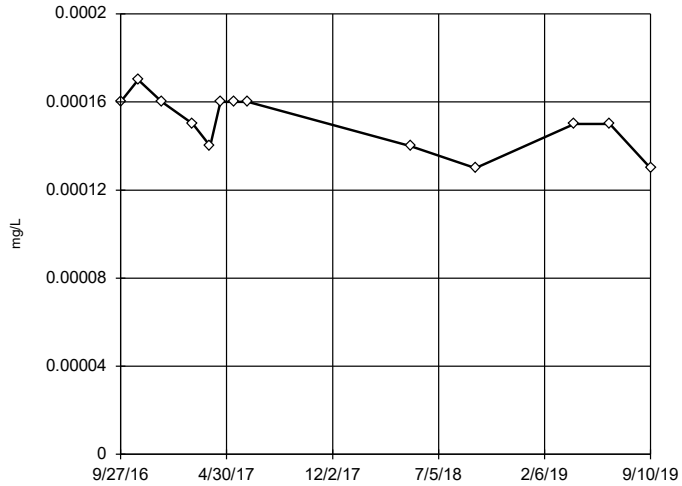
Constituent: Antimony, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606S



n = 13

No outliers found. Tukey's method selected by user.

Data were x^4 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.0001958, low cutoff = -0.000144, based on IQR multiplier of 3.

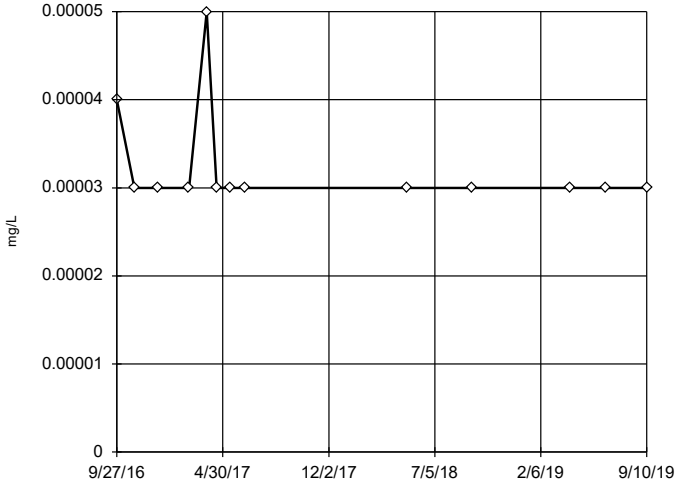
Constituent: Antimony, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

The results were invalidated, because the lower and upper quartiles are equal.

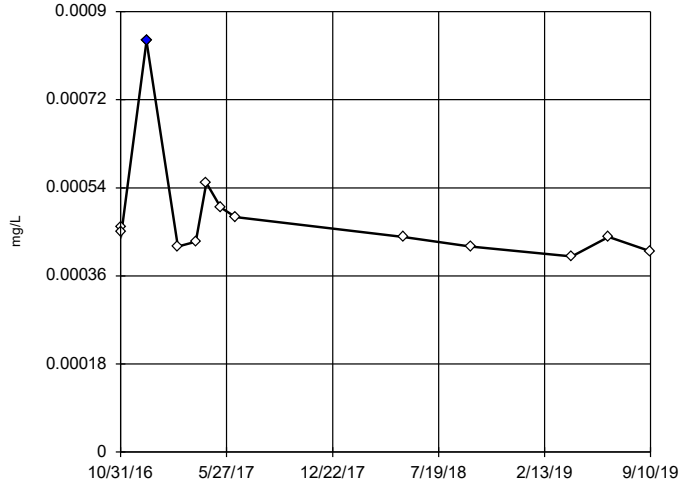
Constituent: Antimony, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607S



n = 13

Outlier is drawn as solid. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

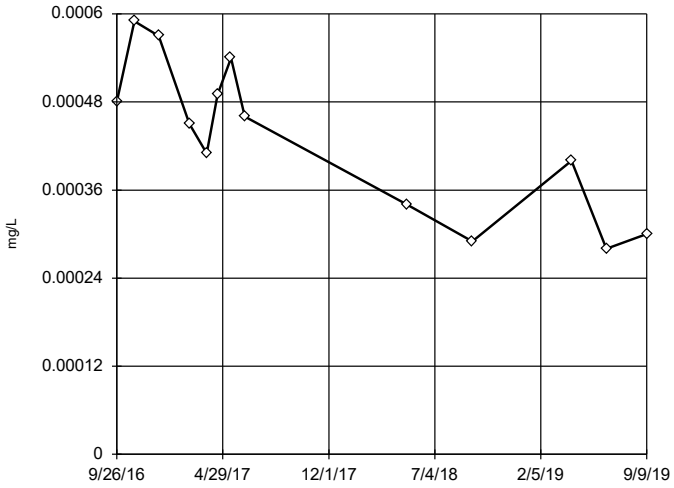
High cutoff = 0.0007775, low cutoff = 0.0002647, based on IQR multiplier of 3.

Constituent: Antimony, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1604D



n = 13

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

High cutoff = 0.0011, low cutoff = -0.000265, based on IQR multiplier of 3.

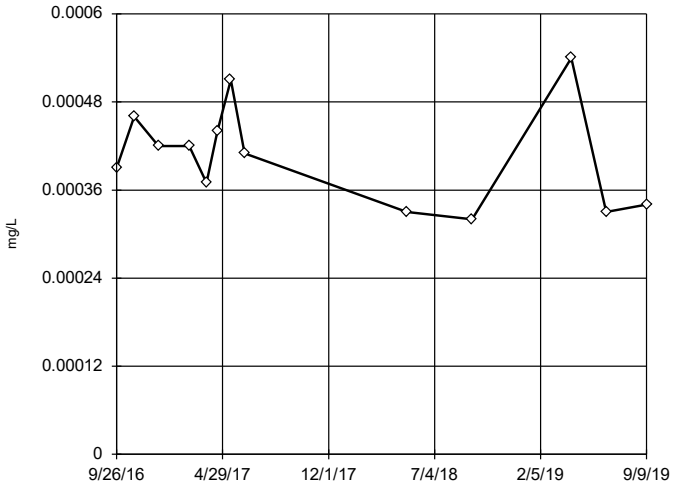
Constituent: Arsenic, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.00109, low cutoff = 0.0001383, based on IQR multiplier of 3.

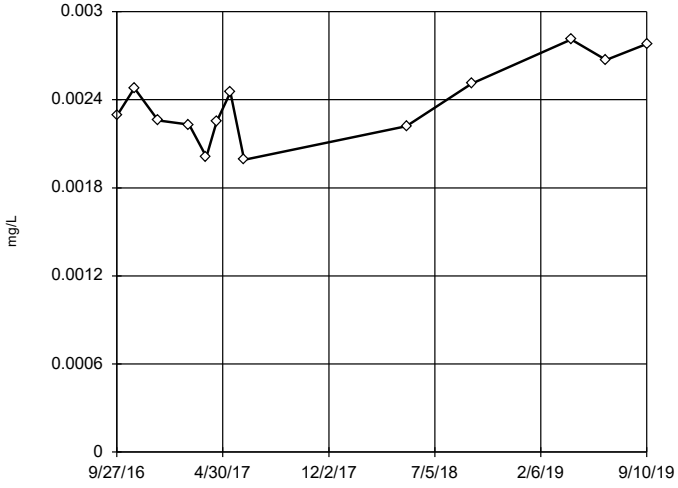
Constituent: Arsenic, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.004077, low cutoff = 0.001413, based on IQR multiplier of 3.

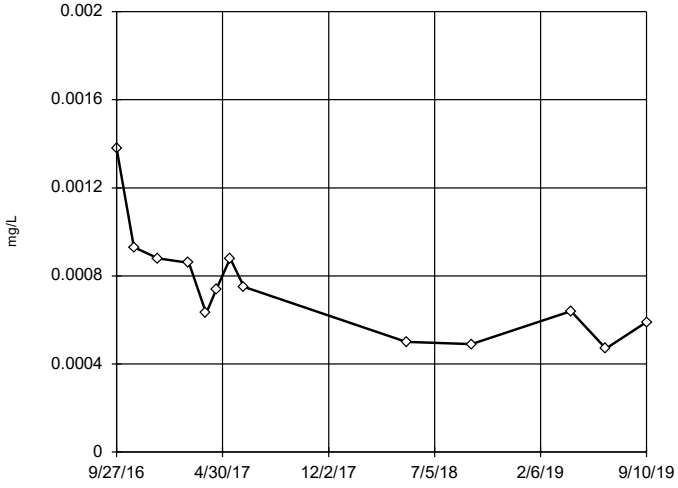
Constituent: Arsenic, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

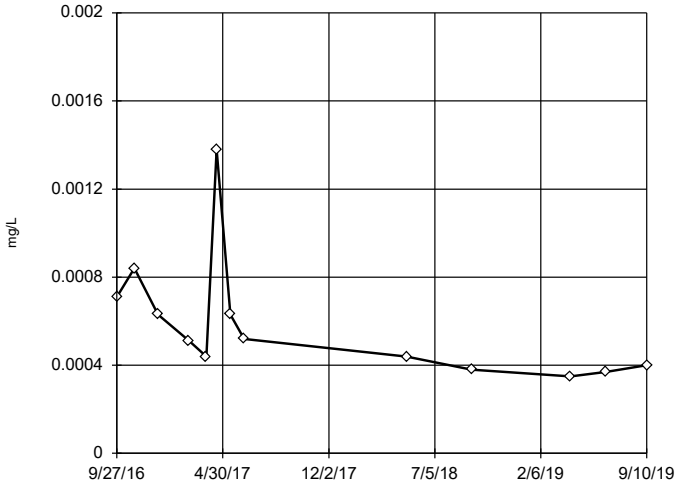
High cutoff = 0.003743, low cutoff = 0.0001277, based on IQR multiplier of 3.

Constituent: Arsenic, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1606D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.003376, low cutoff = 0.00007723, based on IQR multiplier of 3.

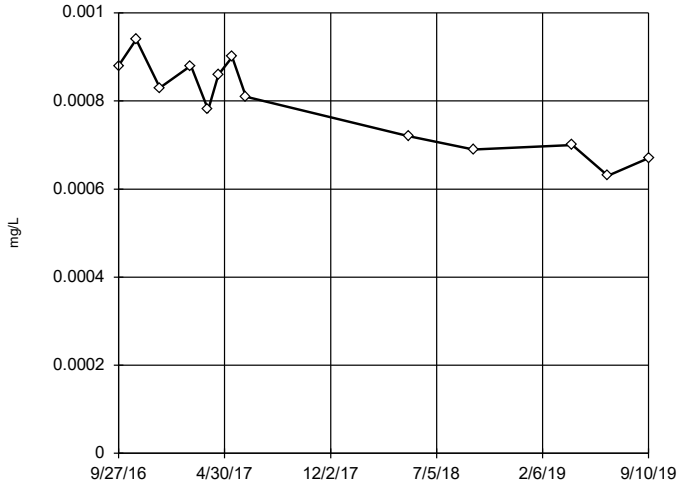
Constituent: Arsenic, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606S



n = 13

No outliers found. Tukey's method selected by user.

Data were square transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.001284, low cutoff = -0.0006253, based on IQR multiplier of 3.

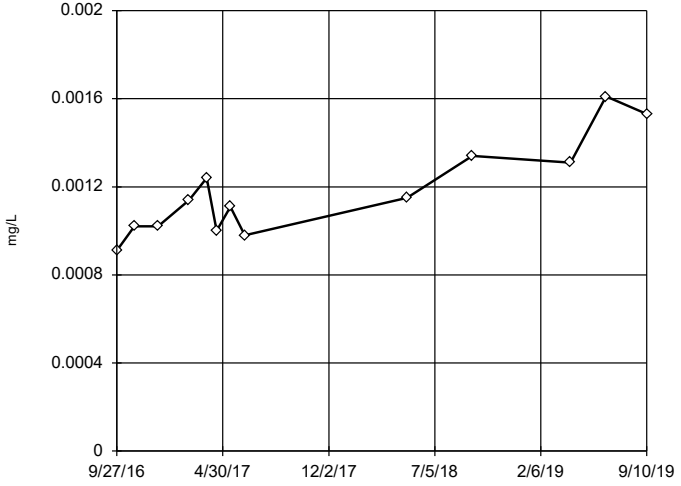
Constituent: Arsenic, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.002991, low cutoff = 0.0004473, based on IQR multiplier of 3.

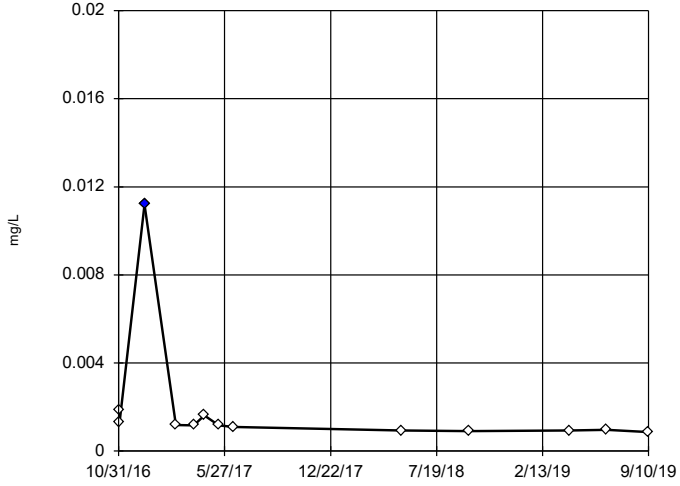
Constituent: Arsenic, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607S



n = 13

Outlier is drawn as solid. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

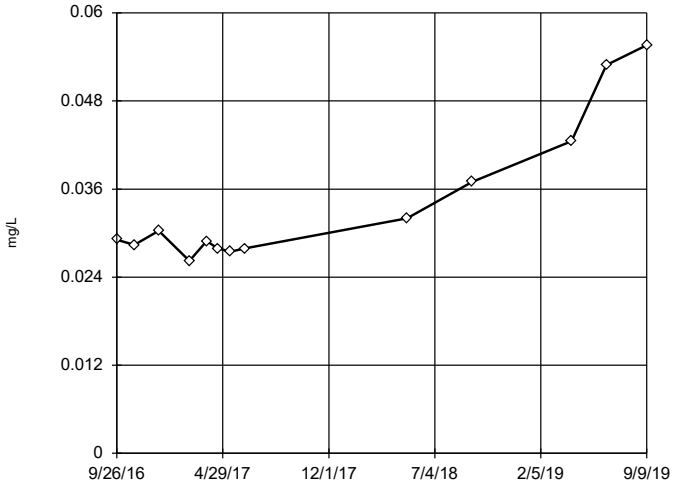
High cutoff = 0.005426, low cutoff = 0.0002501, based on IQR multiplier of 3.

Constituent: Arsenic, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1604D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.1139, low cutoff = 0.009717, based on IQR multiplier of 3.

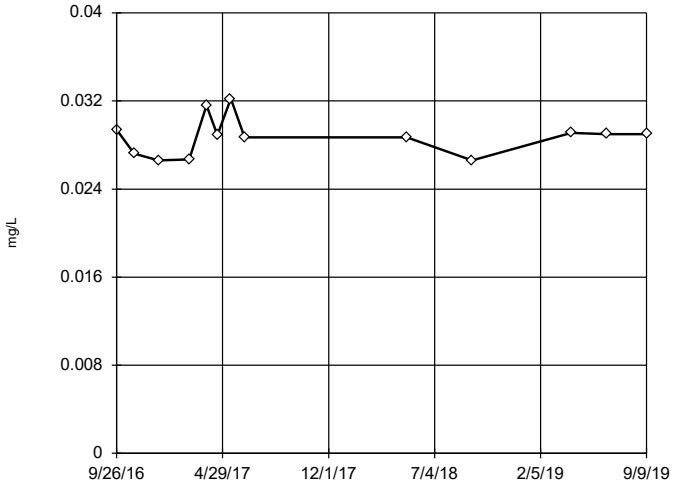
Constituent: Barium, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.0374, low cutoff = 0.02108, based on IQR multiplier of 3.

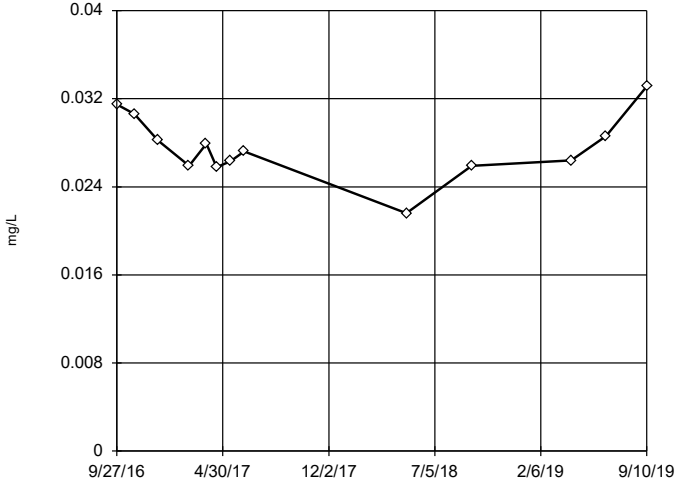
Constituent: Barium, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605D



n = 13

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

High cutoff = 0.0407, low cutoff = 0.0148, based on IQR multiplier of 3.

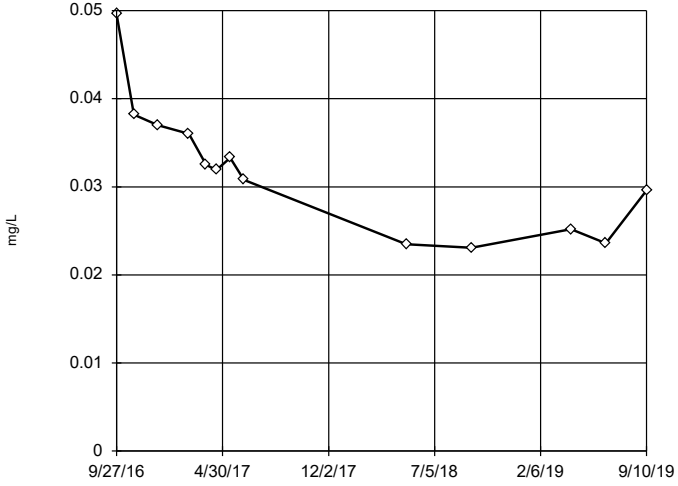
Constituent: Barium, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

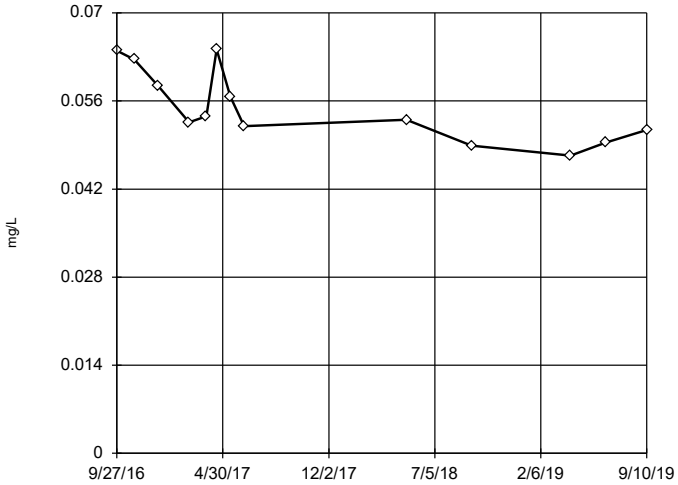
High cutoff = 0.1223, low cutoff = 0.007276, based on IQR multiplier of 3.

Constituent: Barium, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1606D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.1045, low cutoff = 0.02917, based on IQR multiplier of 3.

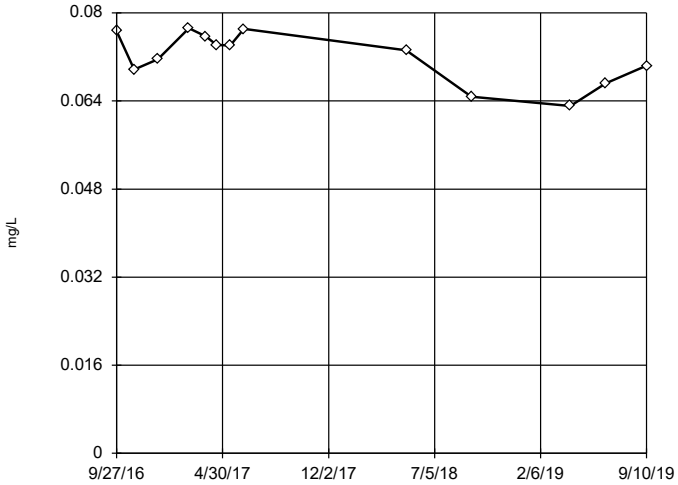
Constituent: Barium, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606S



n = 13

No outliers found. Tukey's method selected by user.

Data were x^6 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.08828, low cutoff = -0.07473, based on IQR multiplier of 3.

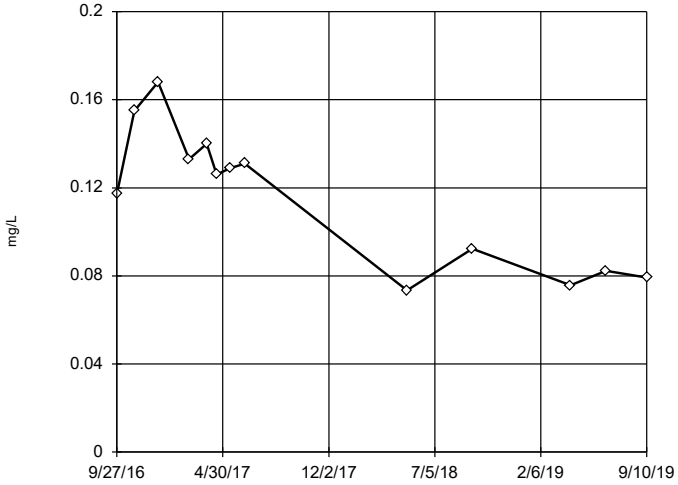
Constituent: Barium, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607D



n = 13

No outliers found. Tukey's method selected by user.

Data were square transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.2345, low cutoff = -0.1727, based on IQR multiplier of 3.

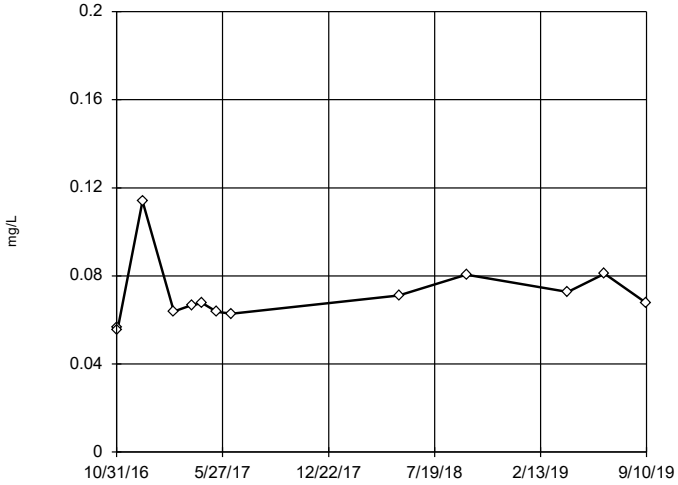
Constituent: Barium, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

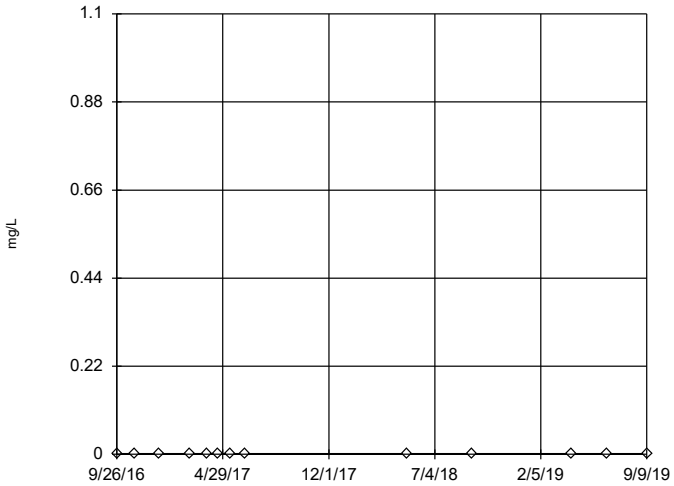
High cutoff = 0.1354, low cutoff = 0.03579, based on IQR multiplier of 3.

Constituent: Barium, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1604D



n = 13

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

The results were invalidated, because the lower and upper quartiles are equal.

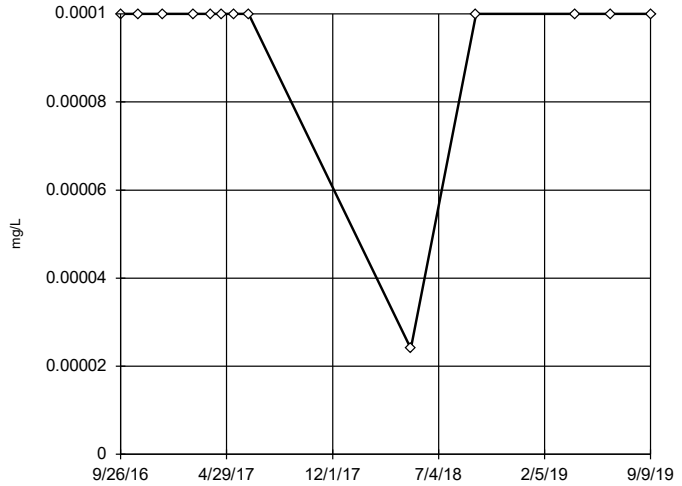
Constituent: Beryllium, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604S



n = 13

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

The results were invalidated, because the lower and upper quartiles are equal.

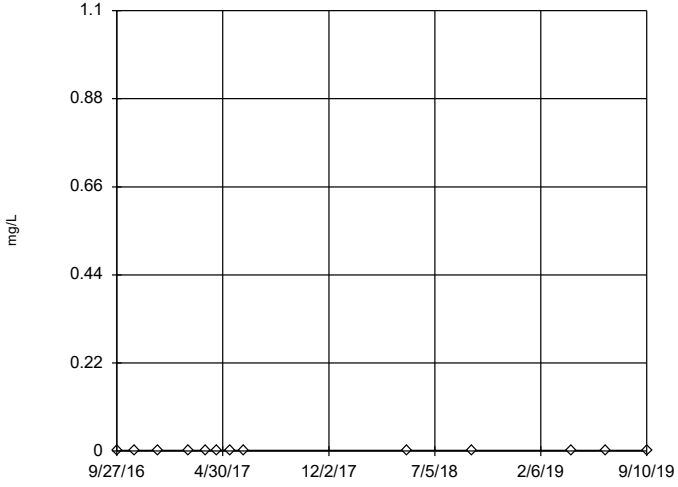
Constituent: Beryllium, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605D



n = 13

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

The results were invalidated, because the lower and upper quartiles are equal.

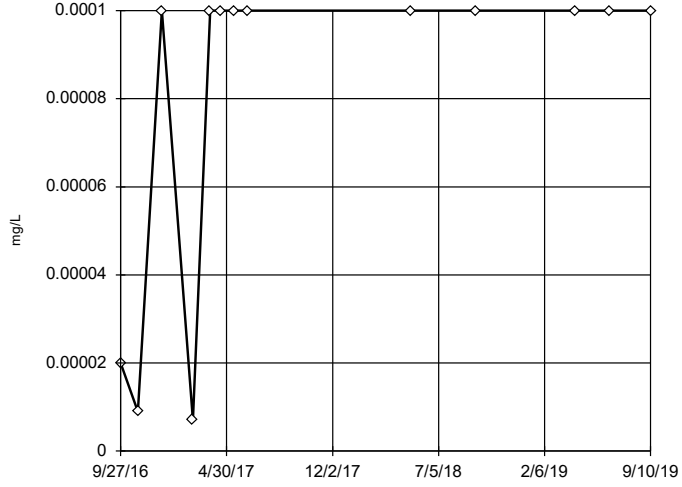
Constituent: Beryllium, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

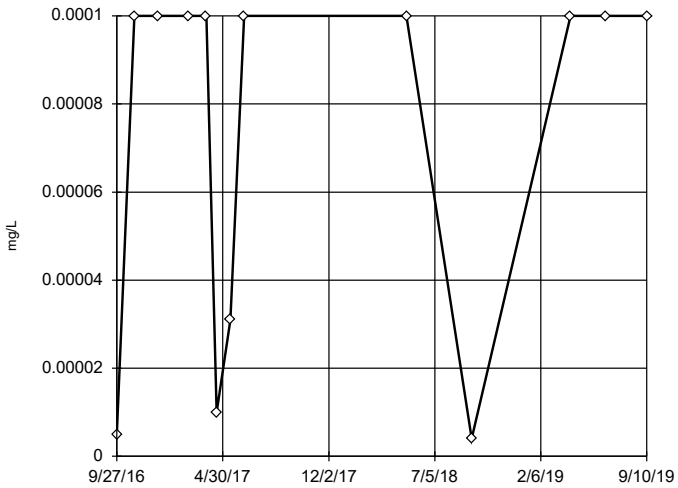
High cutoff = 0.001118, low cutoff = 0.000004, based on IQR multiplier of 3.

Constituent: Beryllium, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1606D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.01832, low cutoff = 9.6e-8, based on IQR multiplier of 3.

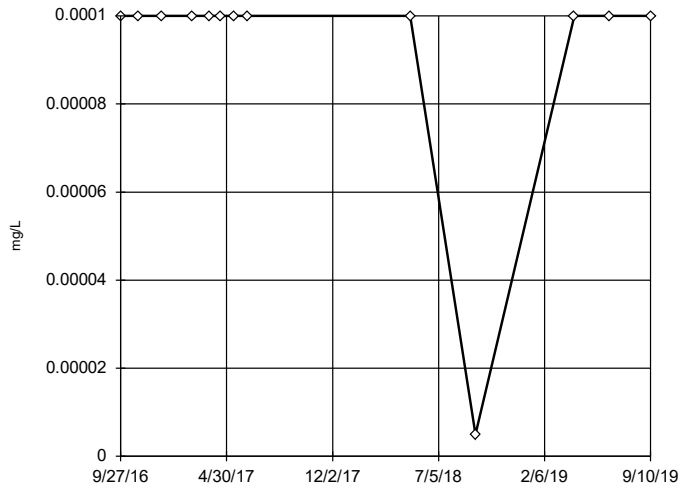
Constituent: Beryllium, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606S



n = 13

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

The results were invalidated, because the lower and upper quartiles are equal.

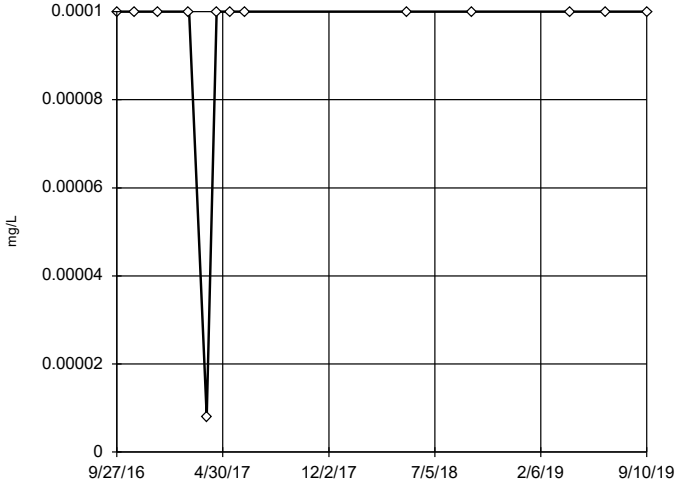
Constituent: Beryllium, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607D



n = 13

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

The results were invalidated, because the lower and upper quartiles are equal.

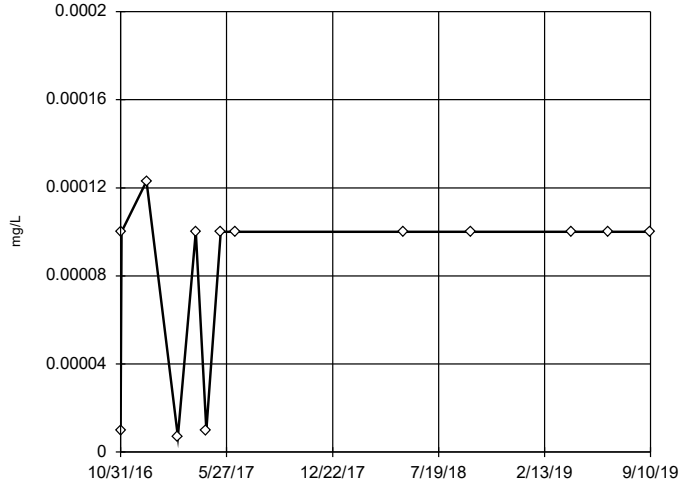
Constituent: Beryllium, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607S



n = 13

No outliers found. Tukey's method selected by user.

Data were x^4 transformed to achieve best W statistic (graph shown in original units).

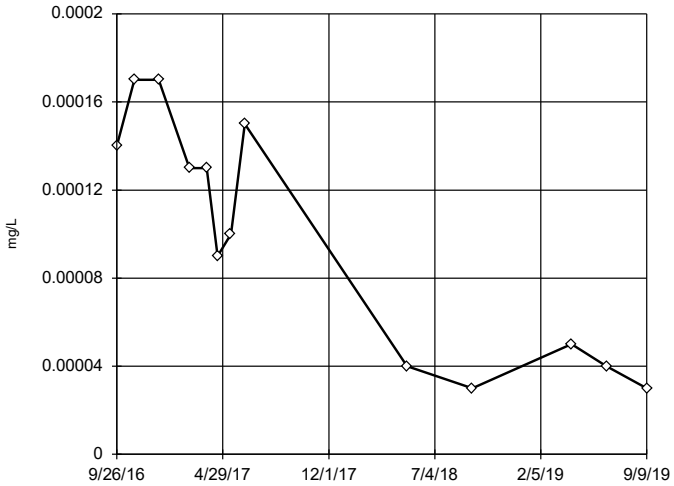
The results were invalidated, because both the lower and upper quartiles represent reporting limits.

Constituent: Beryllium, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1604D



n = 13

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

High cutoff = 0.00046, low cutoff = -0.000275, based on IQR multiplier of 3.

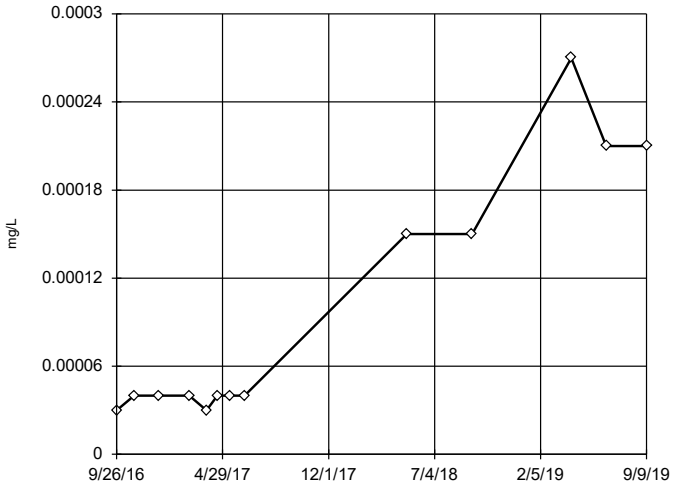
Constituent: Cadmium, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.0155, low cutoff = 4.6e-7, based on IQR multiplier of 3.

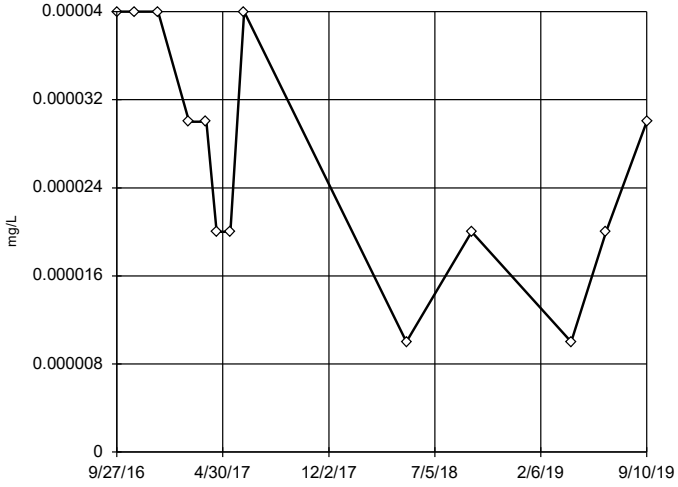
Constituent: Cadmium, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605D



n = 13

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

High cutoff = 0.0001, low cutoff = -0.00004, based on IQR multiplier of 3.

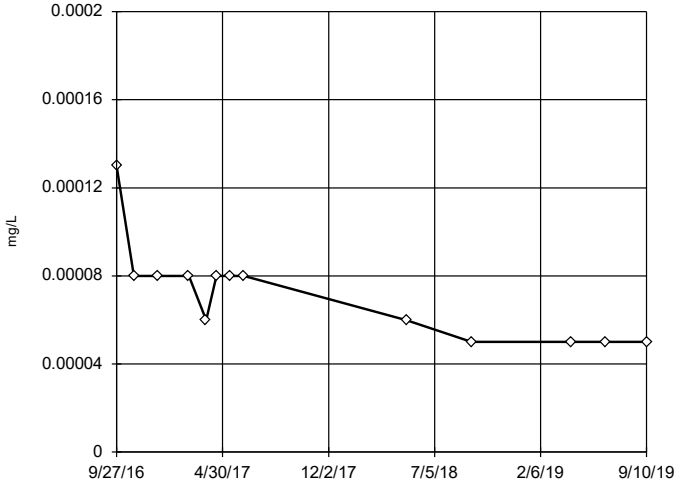
Constituent: Cadmium, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

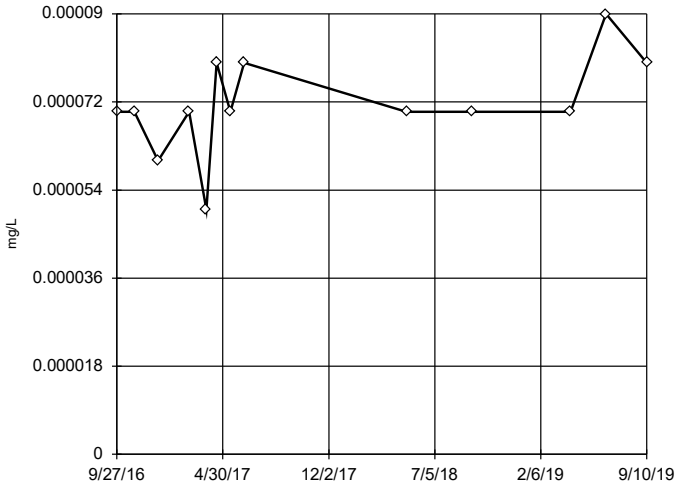
High cutoff = 0.0003277, low cutoff = 0.00001221, based on IQR multiplier of 3.

Constituent: Cadmium, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1606D



n = 13

No outliers found. Tukey's method selected by user.

Data were square transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.0001044, low cutoff = 0.00002, based on IQR multiplier of 3.

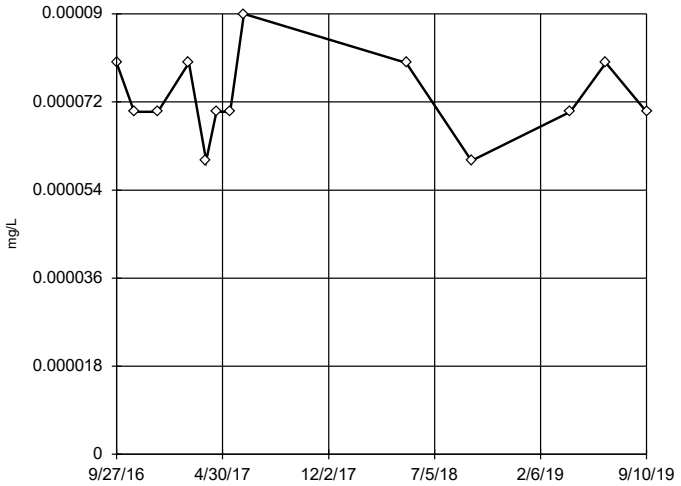
Constituent: Cadmium, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606S



n = 13

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.000114, low cutoff = 0.000044, based on IQR multiplier of 3.

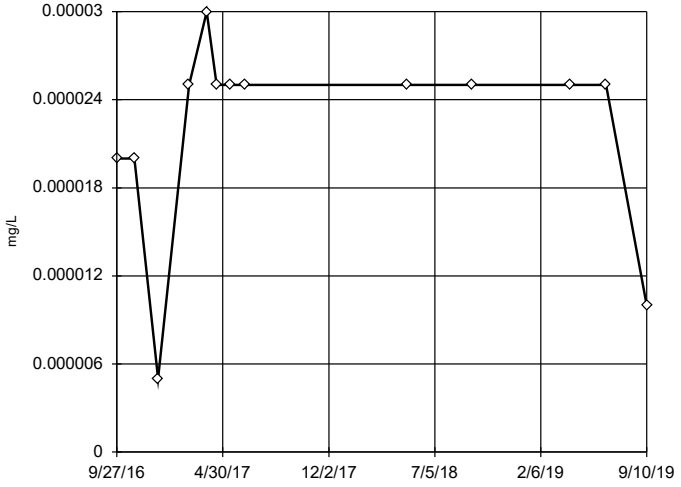
Constituent: Cadmium, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607D



n = 13

No outliers found. Tukey's method selected by user.

Data were cube transformed to achieve best W statistic (graph shown in original units).

The results were invalidated, because both the lower and upper quartiles represent reporting limits.

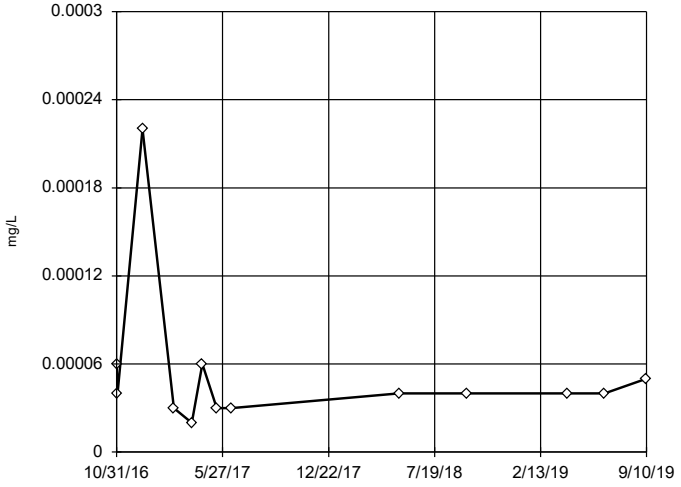
Constituent: Cadmium, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

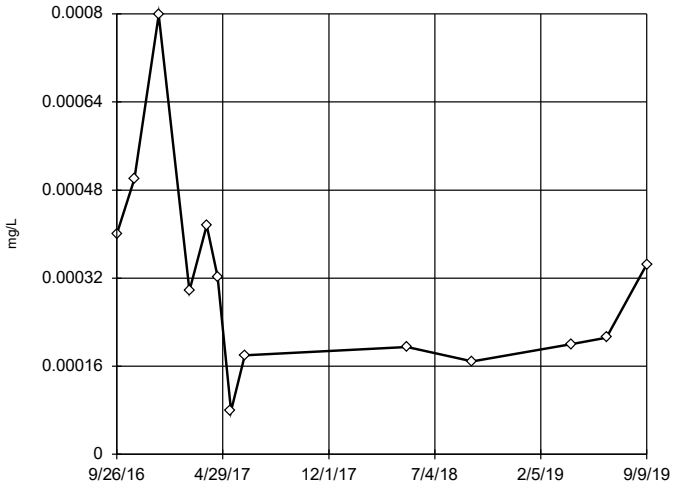
High cutoff = 0.0003333, low cutoff = 0.00000493, based on IQR multiplier of 3.

Constituent: Cadmium, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1604D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.004211, low cutoff = 0.00001815, based on IQR multiplier of 3.

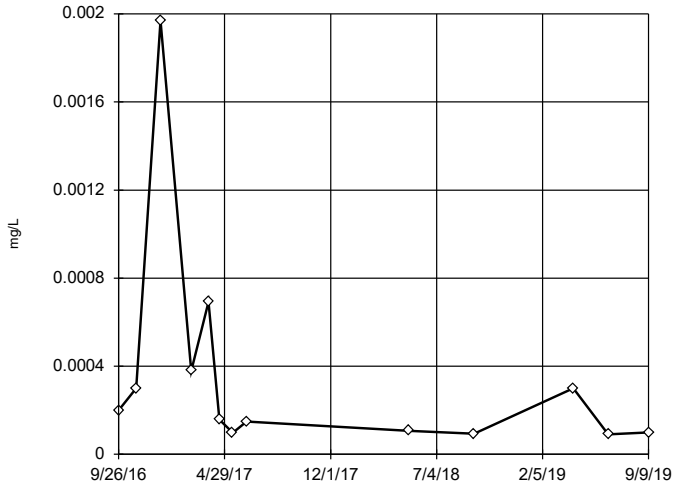
Constituent: Chromium, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.01333, low cutoff = 0.000002505, based on IQR multiplier of 3.

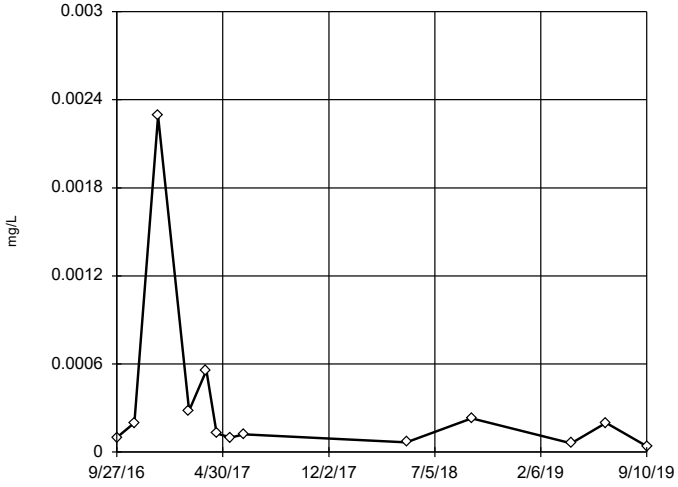
Constituent: Chromium, total Analysis Run 11/25/2019 3:29 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.00772, low cutoff = 0.000002681, based on IQR multiplier of 3.

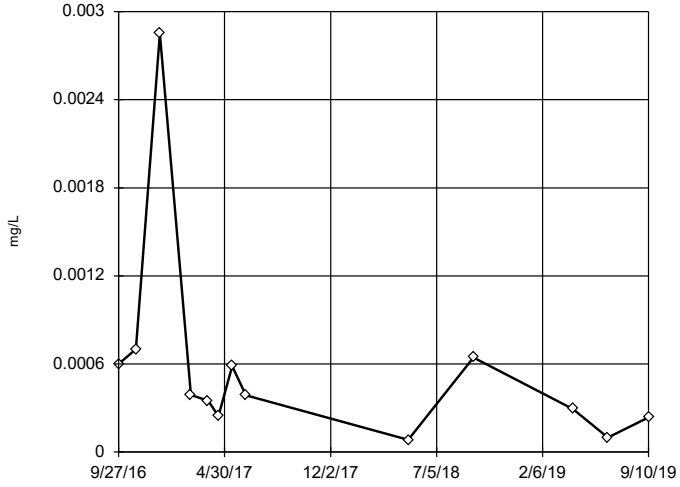
Constituent: Chromium, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

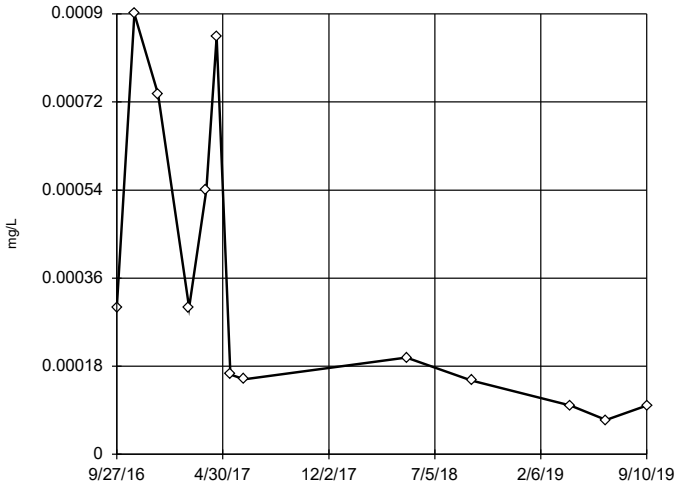
High cutoff = 0.01067, low cutoff = 0.00001404, based on IQR multiplier of 3.

Constituent: Chromium, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1606D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.08544, low cutoff = 9.1e-7, based on IQR multiplier of 3.

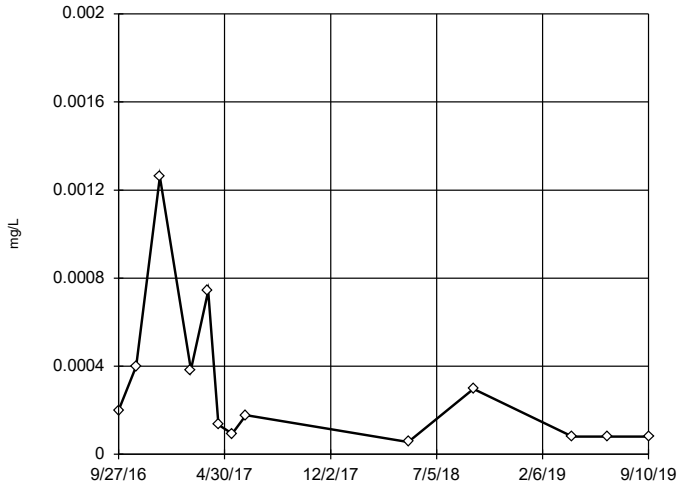
Constituent: Chromium, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.04608, low cutoff = 6.8e-7, based on IQR multiplier of 3.

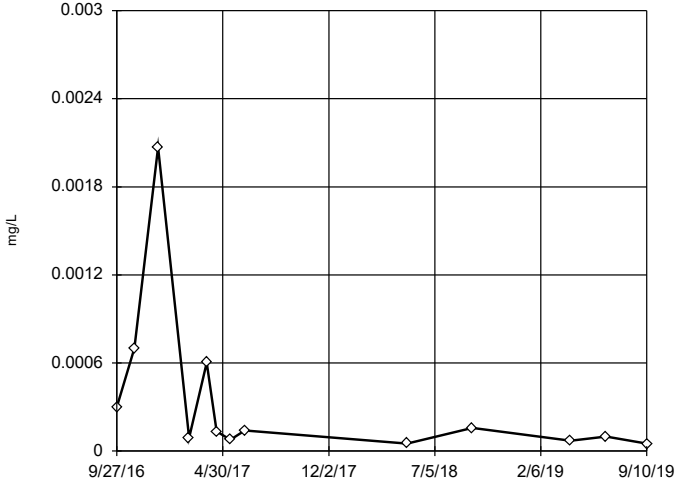
Constituent: Chromium, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.08084, low cutoff = 3.9e-7, based on IQR multiplier of 3.

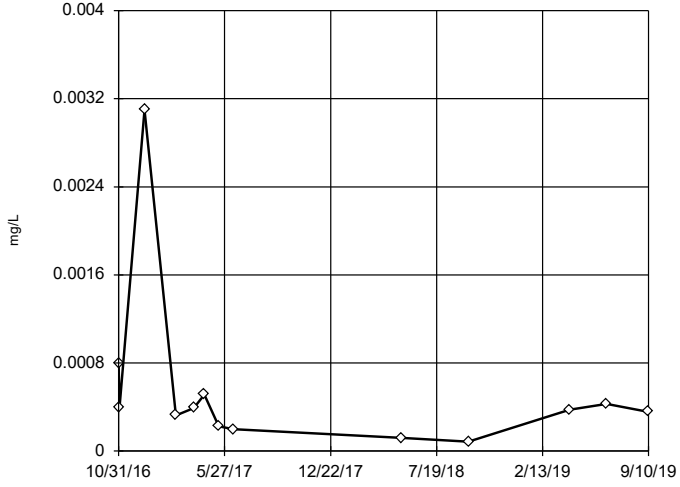
Constituent: Chromium, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

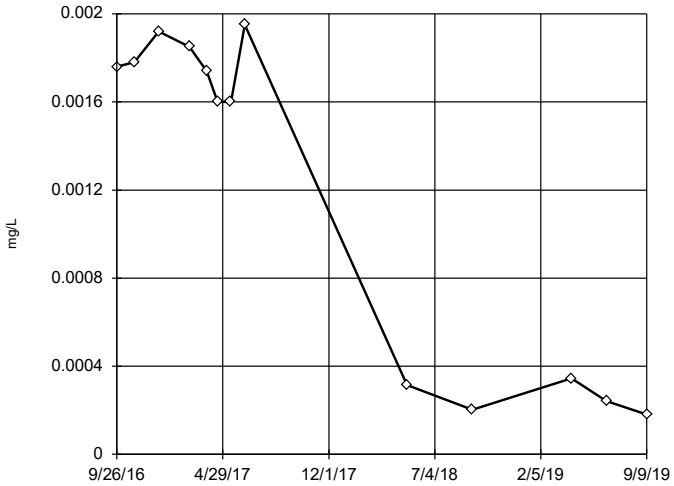
High cutoff = 0.005036, low cutoff = 0.0000198, based on IQR multiplier of 3.

Constituent: Chromium, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1604D



n = 13

No outliers found. Tukey's method selected by user.

Data were x^6 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.002289, low cutoff = -0.002182, based on IQR multiplier of 3.

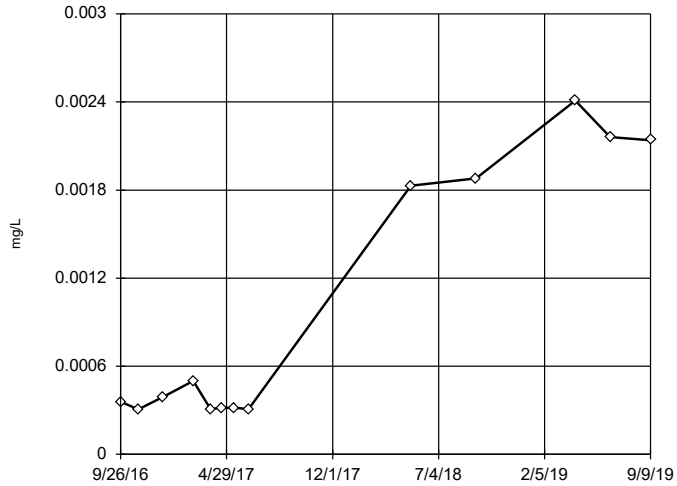
Constituent: Cobalt, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.5306, low cutoff = 0.000001181, based on IQR multiplier of 3.

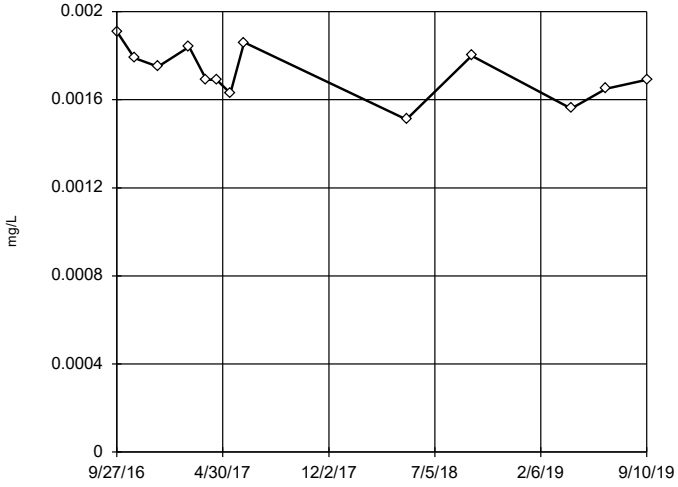
Constituent: Cobalt, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605D



n = 13

No outliers found. Tukey's method selected by user.

Data were square transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.002276, low cutoff = 0.0009058, based on IQR multiplier of 3.

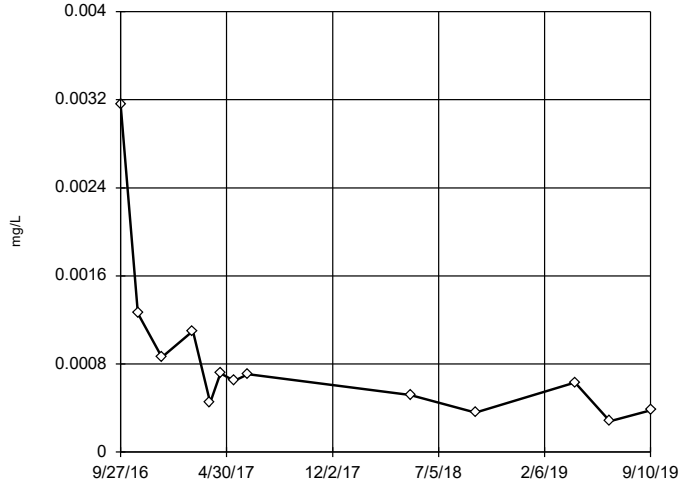
Constituent: Cobalt, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

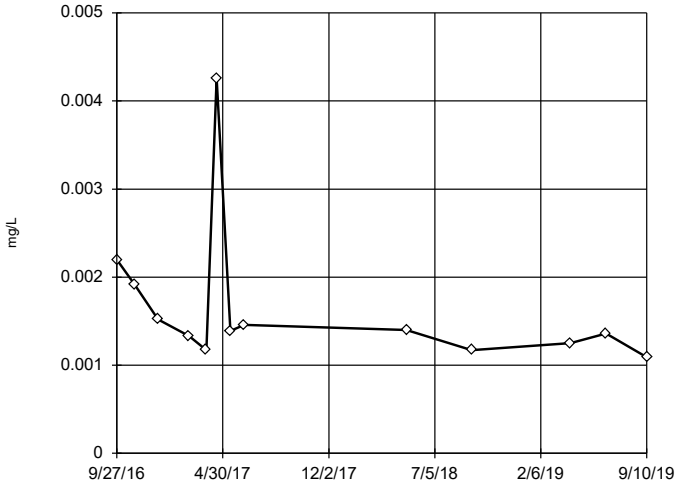
High cutoff = 0.01282, low cutoff = 0.00003128, based on IQR multiplier of 3.

Constituent: Cobalt, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1606D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.004816, low cutoff = 0.000429, based on IQR multiplier of 3.

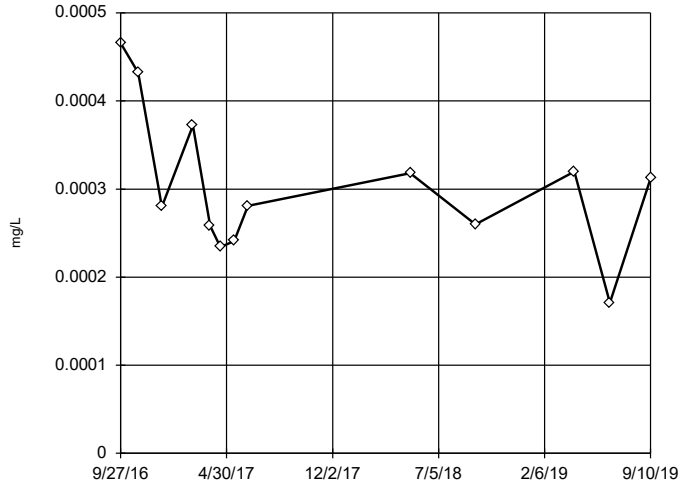
Constituent: Cobalt, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.000914, low cutoff = 0.00009413, based on IQR multiplier of 3.

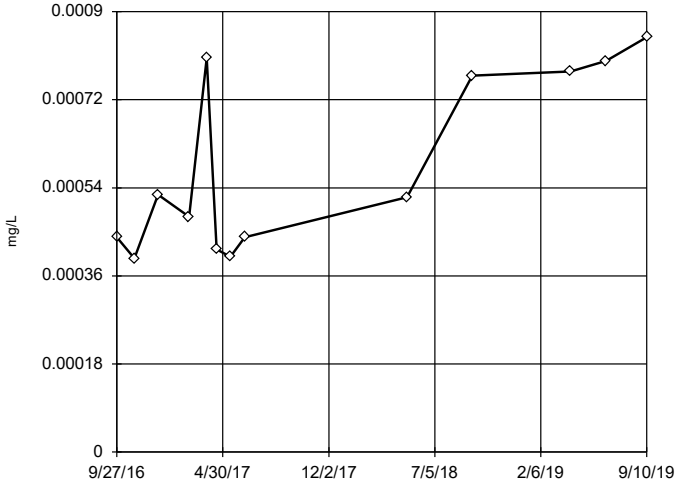
Constituent: Cobalt, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.004987, low cutoff = 0.0000674, based on IQR multiplier of 3.

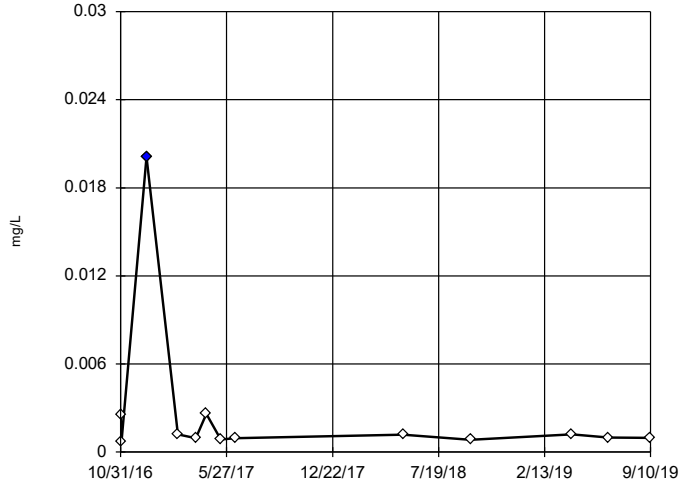
Constituent: Cobalt, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607S



n = 13

Outlier is drawn as solid. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

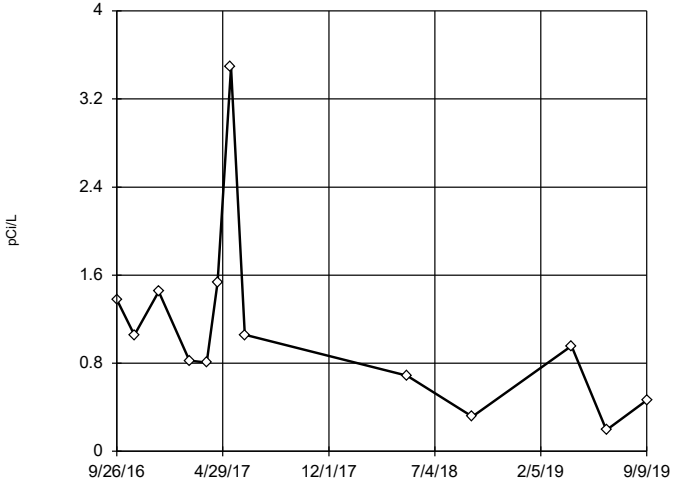
High cutoff = 0.01382, low cutoff = 0.0001144, based on IQR multiplier of 3.

Constituent: Cobalt, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1604D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 22.25, low cutoff = 0.0359, based on IQR multiplier of 3.

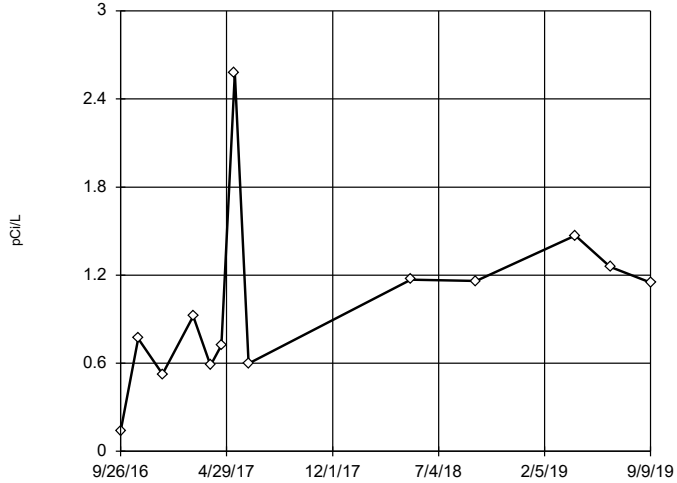
Constituent: Combined Radium 226 + 228 Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604S



n = 13

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 4.4, low cutoff = -0.05164, based on IQR multiplier of 3.

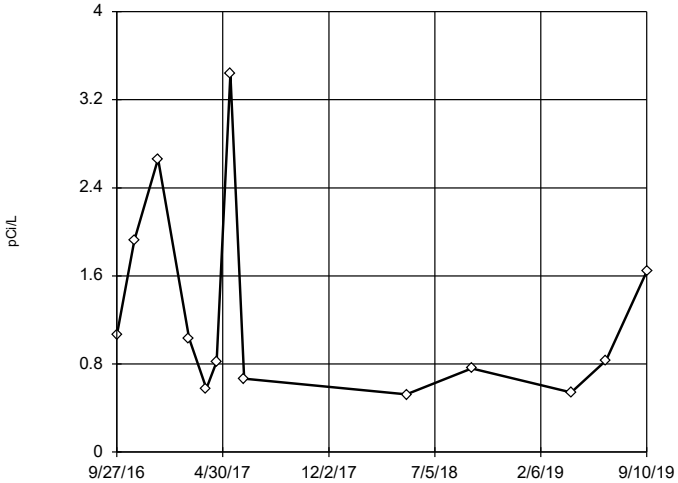
Constituent: Combined Radium 226 + 228 Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 41.59, low cutoff = 0.02655, based on IQR multiplier of 3.

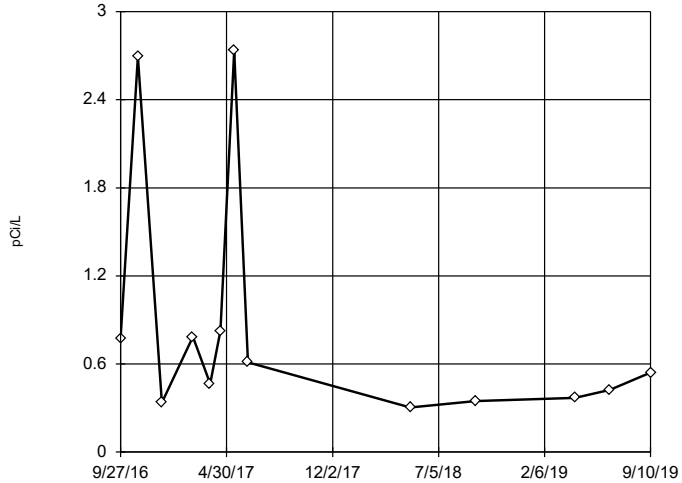
Constituent: Combined Radium 226 + 228 Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

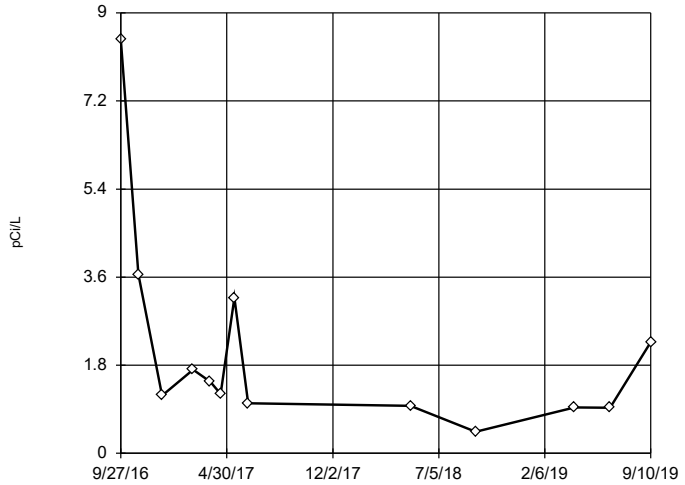
High cutoff = 9.198, low cutoff = 0.03134, based on IQR multiplier of 3.

Constituent: Combined Radium 226 + 228 Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1606D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 59.74, low cutoff = 0.043, based on IQR multiplier of 3.

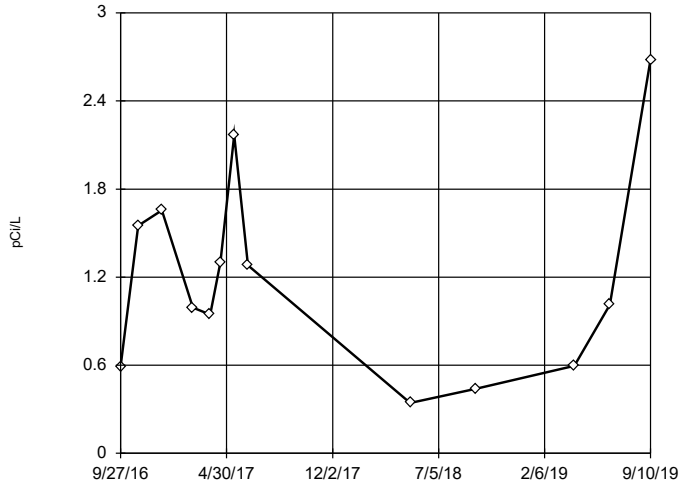
Constituent: Combined Radium 226 + 228 Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606S



n = 13

No outliers found. Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 10.07, low cutoff = -0.003314, based on IQR multiplier of 3.

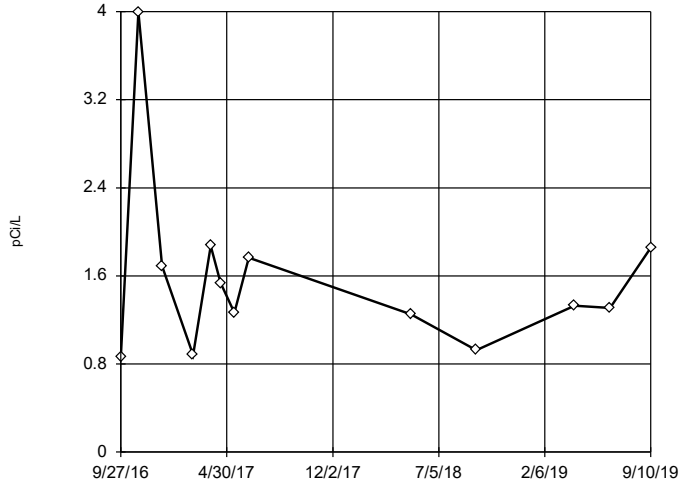
Constituent: Combined Radium 226 + 228 Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 8.598, low cutoff = 0.2263, based on IQR multiplier of 3.

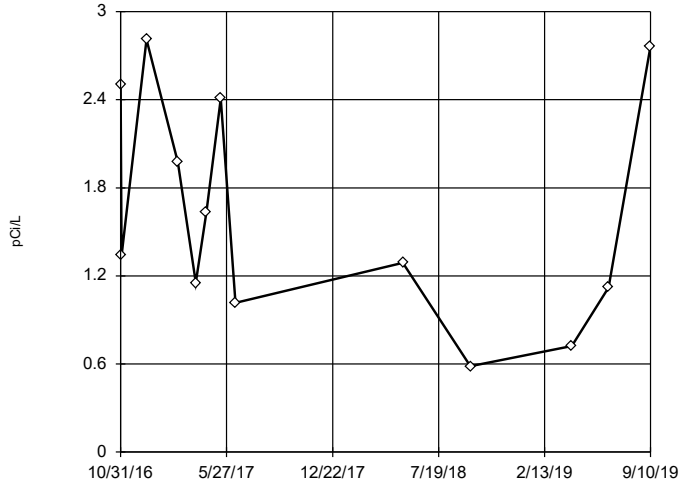
Constituent: Combined Radium 226 + 228 Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

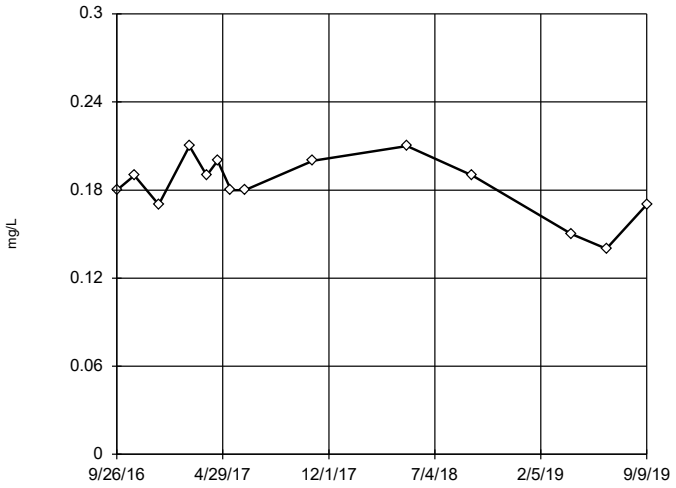
High cutoff = 29.87, low cutoff = 0.08778, based on IQR multiplier of 3.

Constituent: Combined Radium 226 + 228 Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1604D



n = 14

No outliers found. Tukey's method selected by user.

Data were x^4 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.2498, low cutoff = -0.1954, based on IQR multiplier of 3.

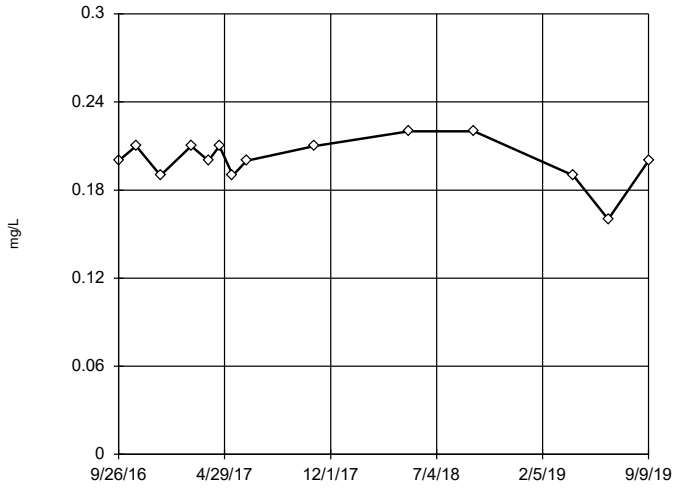
Constituent: Fluoride, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604S



n = 14

No outliers found. Tukey's method selected by user.

Data were x^6 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.2422, low cutoff = -0.2026, based on IQR multiplier of 3.

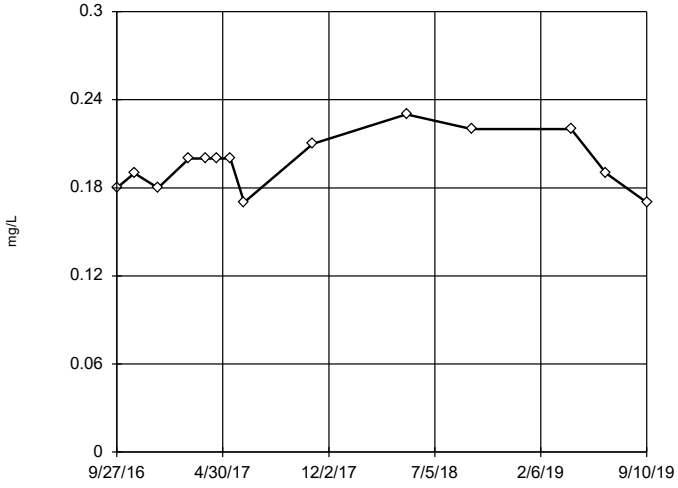
Constituent: Fluoride, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605D



n = 14

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.3385, low cutoff = 0.0937, based on IQR multiplier of 3.

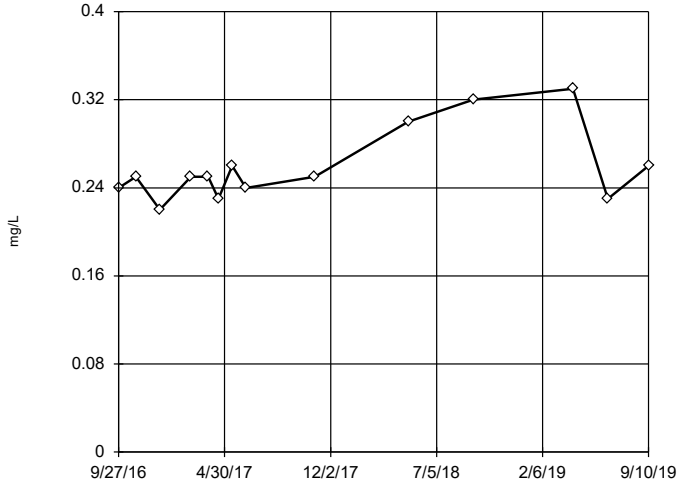
Constituent: Fluoride, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605S



n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

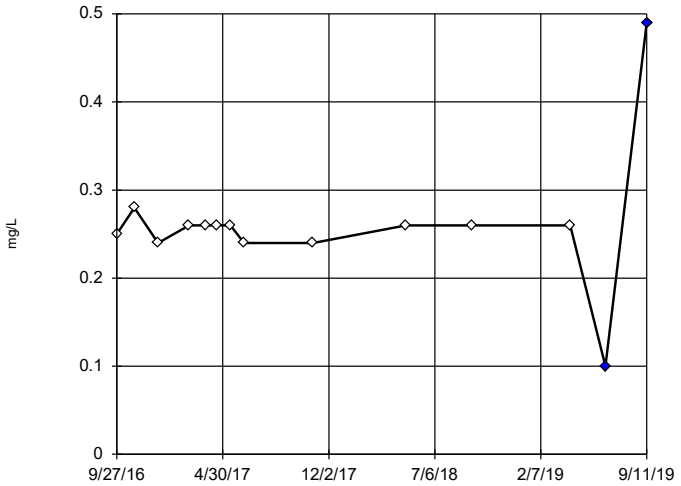
High cutoff = 0.4691, low cutoff = 0.1399, based on IQR multiplier of 3.

Constituent: Fluoride, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1606D



n = 14

Outliers are drawn as solid.
Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

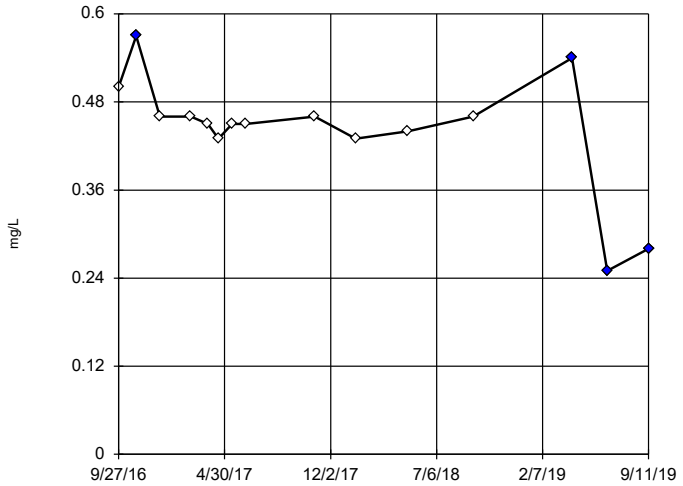
High cutoff = 0.3248, low cutoff = 0.1848, based on IQR multiplier of 3.

Constituent: Fluoride, total Analysis Run 11/25/2019 3:30 PM
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606S



n = 15

Outliers are drawn as solid.
Tukey's method selected by user.

Data were cube transformed to achieve best W statistic (graph shown in original units).

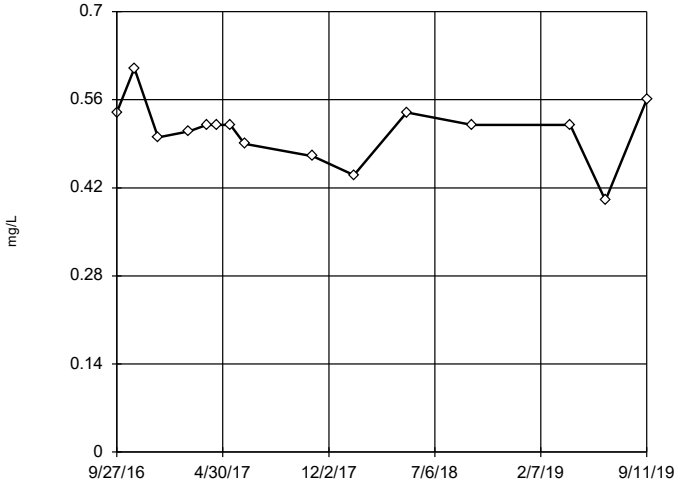
High cutoff = 0.5323, low cutoff = 0.2963, based on IQR multiplier of 3.

Constituent: Fluoride, total Analysis Run 11/25/2019 3:30 PM
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607D



n = 15

No outliers found.
Tukey's method selected by user.

Data were square transformed to achieve best W statistic (graph shown in original units).

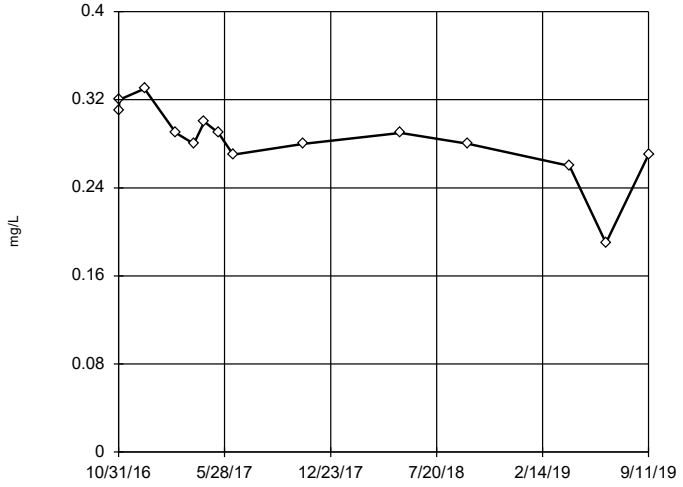
High cutoff = 0.6679, low cutoff = 0.2926, based on IQR multiplier of 3.

Constituent: Fluoride, total Analysis Run 11/25/2019 3:30 PM
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607S



n = 14

No outliers found.
Tukey's method selected by user.

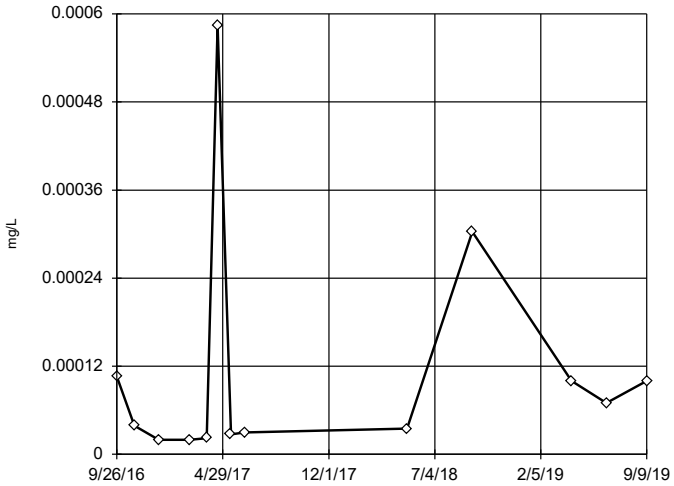
Data were x^4 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.3699, low cutoff = -0.2625, based on IQR multiplier of 3.

Constituent: Fluoride, total Analysis Run 11/25/2019 3:30 PM
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1604D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.007761, low cutoff = 3.2e-7, based on IQR multiplier of 3.

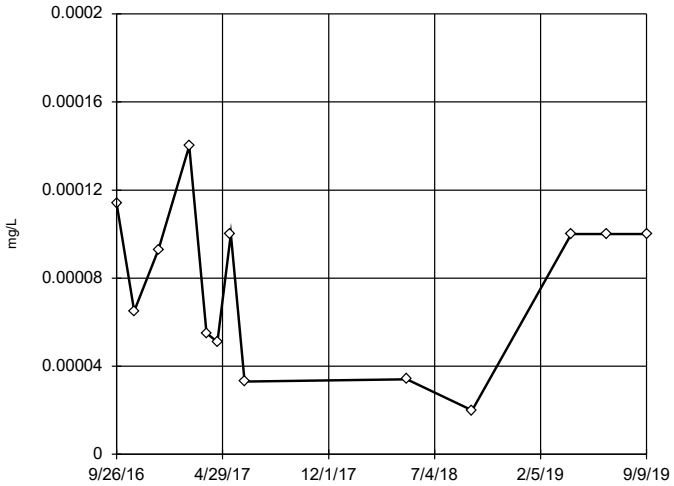
Constituent: Lead, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604S



n = 13

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

High cutoff = 0.0002725, low cutoff = -0.00013, based on IQR multiplier of 3.

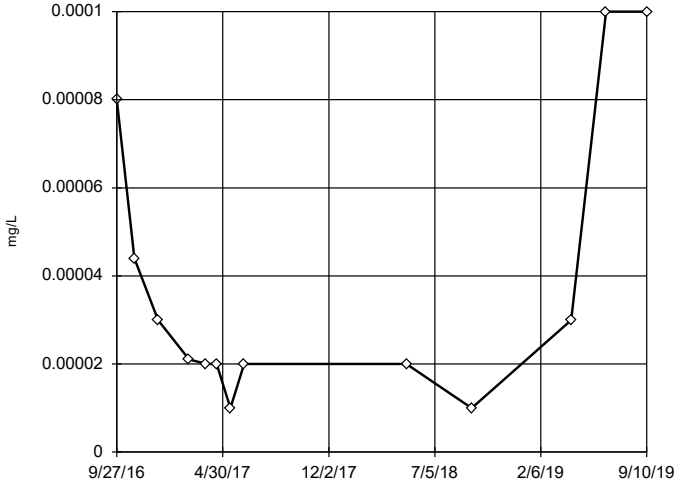
Constituent: Lead, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.001549, low cutoff = 7.7e-7, based on IQR multiplier of 3.

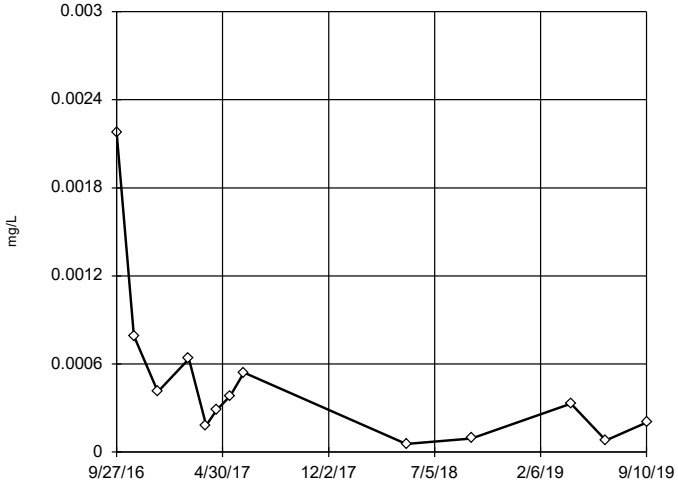
Constituent: Lead, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

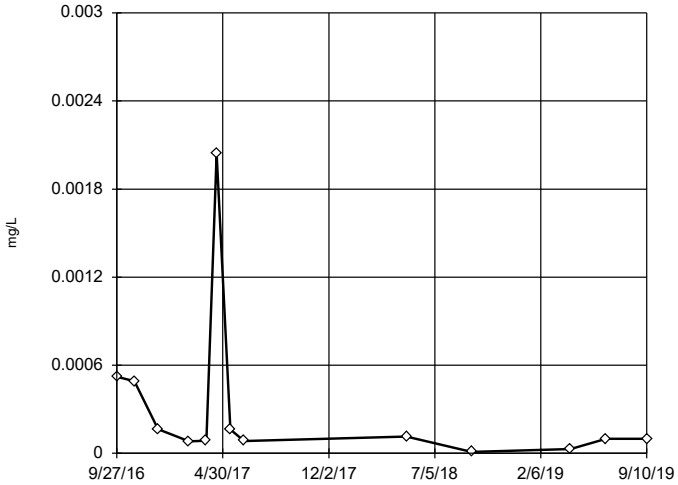
High cutoff = 0.05421, low cutoff = 0.000001404, based on IQR multiplier of 3.

Constituent: Lead, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1606D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.01134, low cutoff = 0.000002076, based on IQR multiplier of 3.

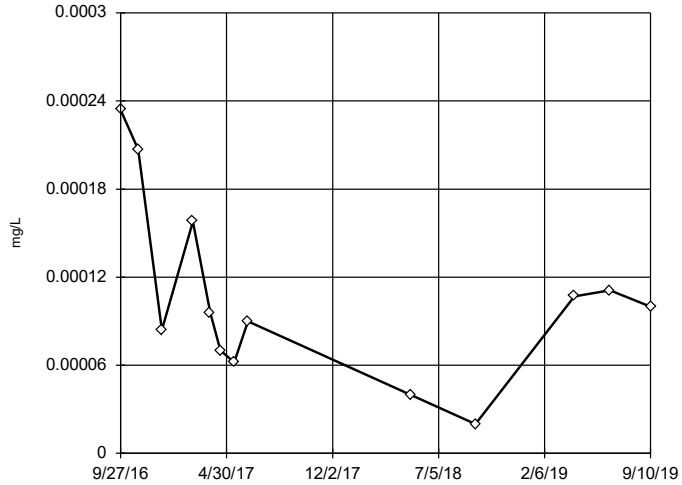
Constituent: Lead, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606S



n = 13

No outliers found. Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.0005729, low cutoff = 5.9e-7, based on IQR multiplier of 3.

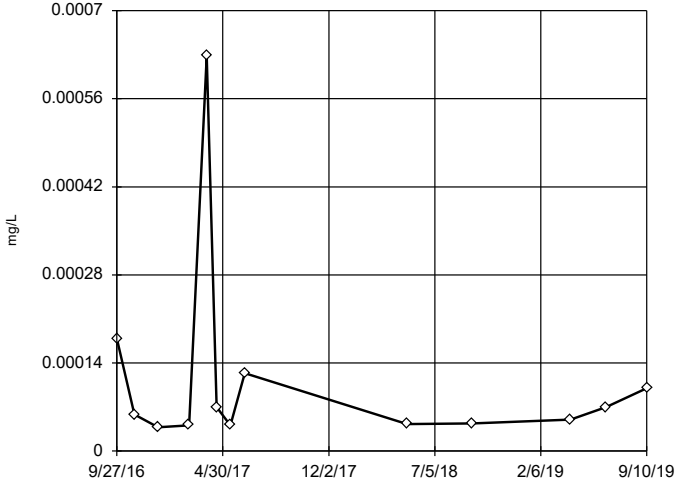
Constituent: Lead, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.002077, low cutoff = 0.000002251, based on IQR multiplier of 3.

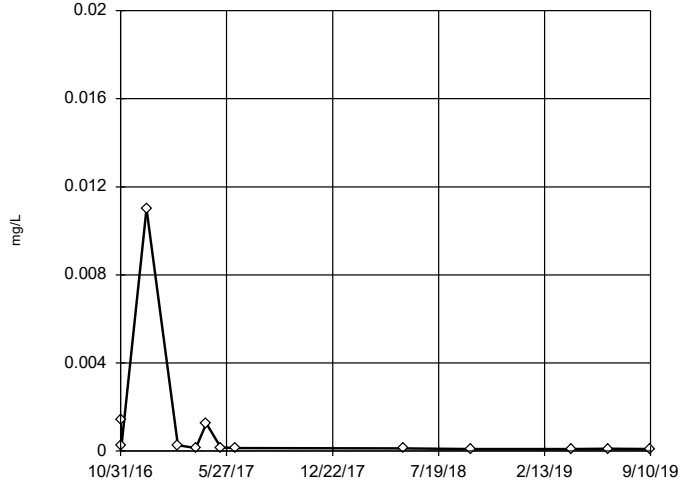
Constituent: Lead, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

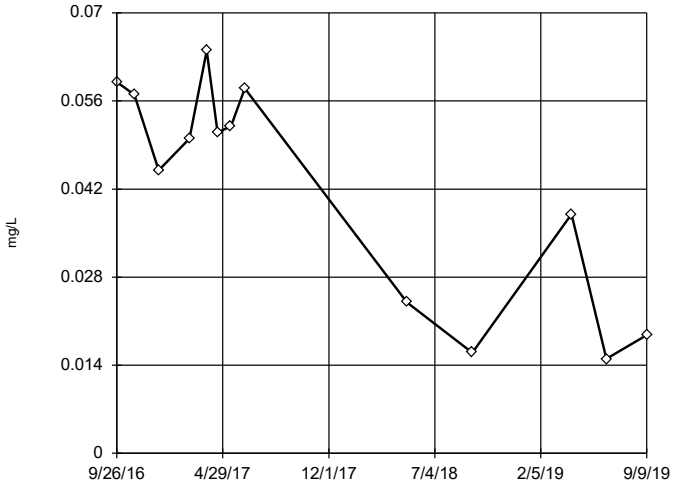
High cutoff = 0.1089, low cutoff = 5.3e-7, based on IQR multiplier of 3.

Constituent: Lead, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1604D



n = 13

No outliers found. Tukey's method selected by user.

Data were cube transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.09004, low cutoff = -0.0809, based on IQR multiplier of 3.

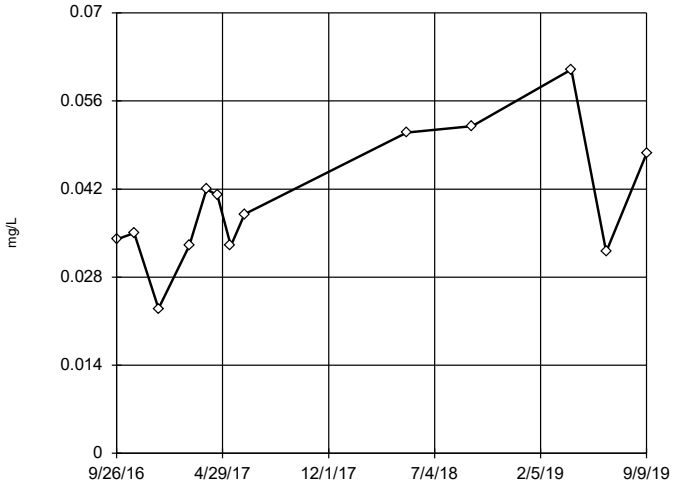
Constituent: Lithium, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604S



n = 13

No outliers found. Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.1282, low cutoff = 0.006142, based on IQR multiplier of 3.

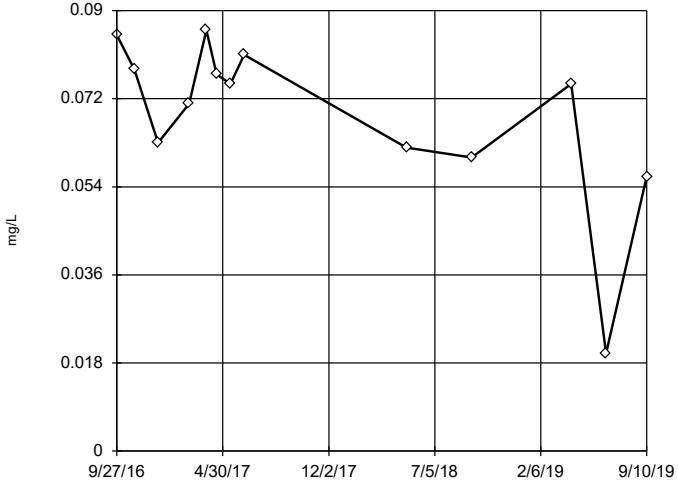
Constituent: Lithium, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605D



n = 13

No outliers found. Tukey's method selected by user.

Data were x^4 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.1043, low cutoff = -0.08966, based on IQR multiplier of 3.

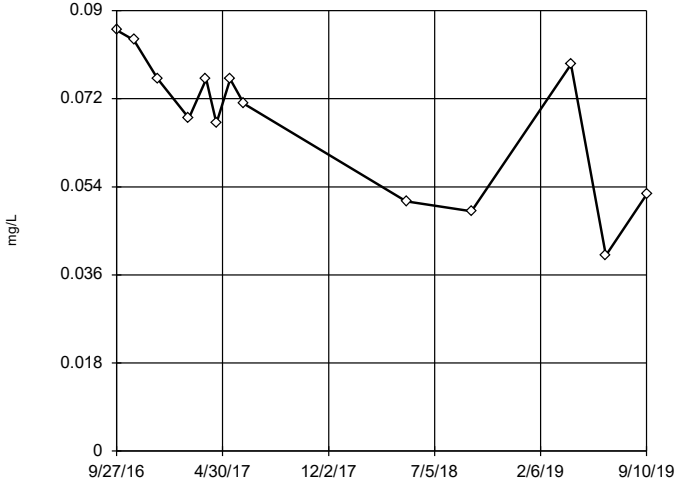
Constituent: Lithium, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605S



n = 13

No outliers found. Tukey's method selected by user.

Data were cube transformed to achieve best W statistic (graph shown in original units).

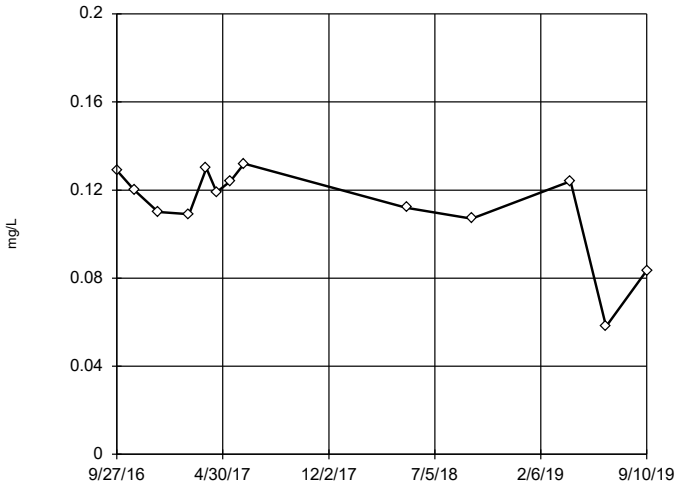
High cutoff = 0.1132, low cutoff = -0.09454, based on IQR multiplier of 3.

Constituent: Lithium, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1606D



n = 13

No outliers found. Tukey's method selected by user.

Data were x^6 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.1507, low cutoff = -0.1348, based on IQR multiplier of 3.

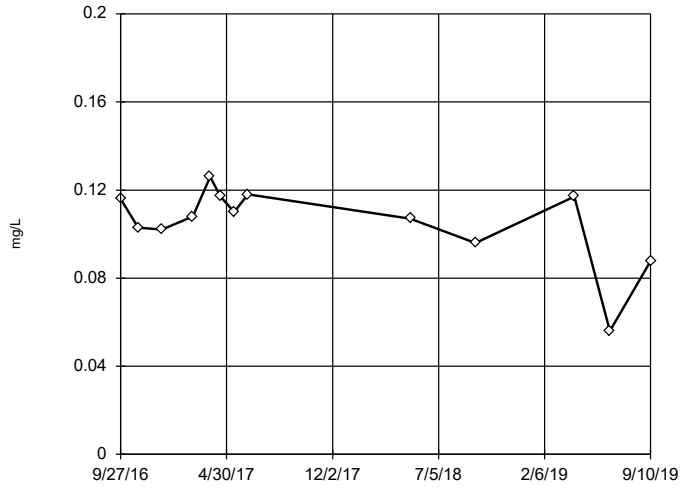
Constituent: Lithium, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606S



n = 13

No outliers found. Tukey's method selected by user.

Data were x^5 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.1426, low cutoff = -0.1223, based on IQR multiplier of 3.

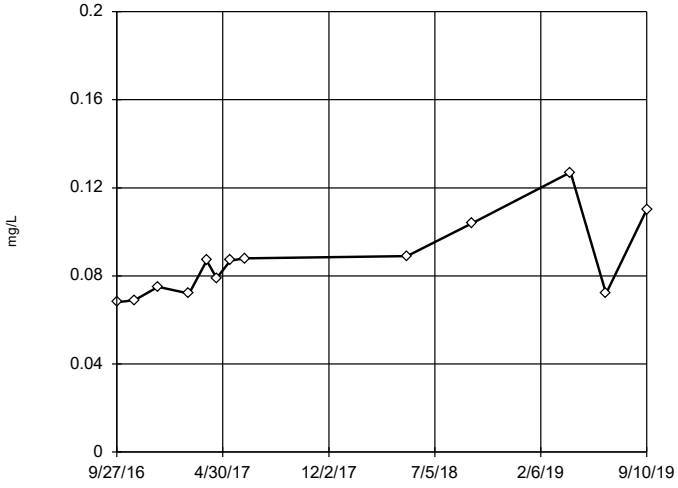
Constituent: Lithium, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.2295, low cutoff = 0.03018, based on IQR multiplier of 3.

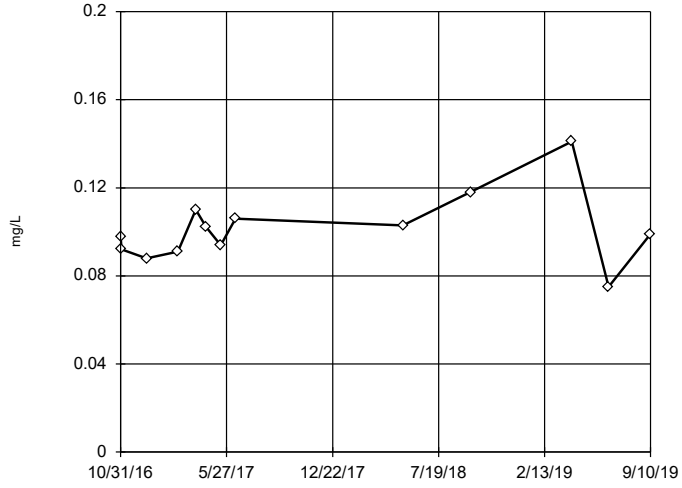
Constituent: Lithium, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

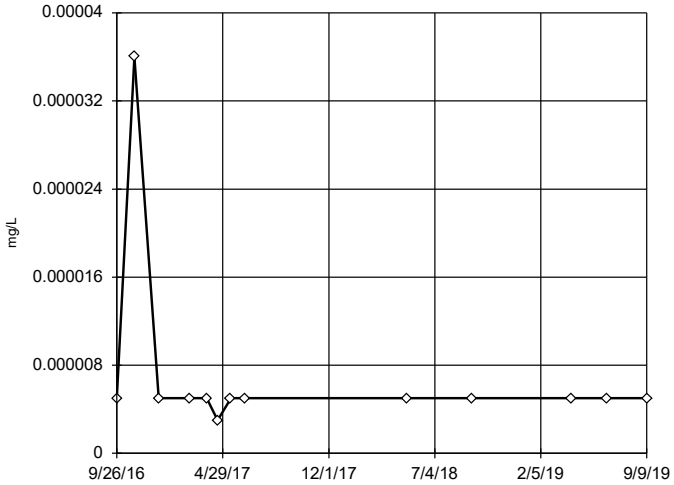
High cutoff = 0.1775, low cutoff = 0.05567, based on IQR multiplier of 3.

Constituent: Lithium, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1604D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

The results were invalidated, because the lower and upper quartiles are equal.

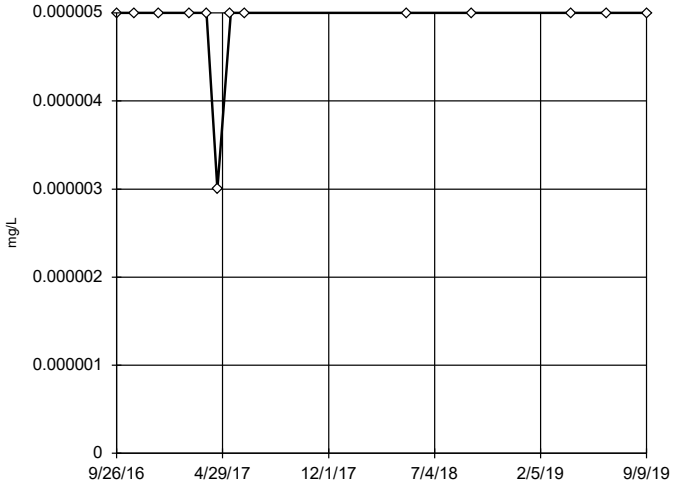
Constituent: Mercury, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604S



n = 13

No outliers found. Tukey's method selected by user.

Data were cube transformed to achieve best W statistic (graph shown in original units).

The results were invalidated, because the lower and upper quartiles are equal.

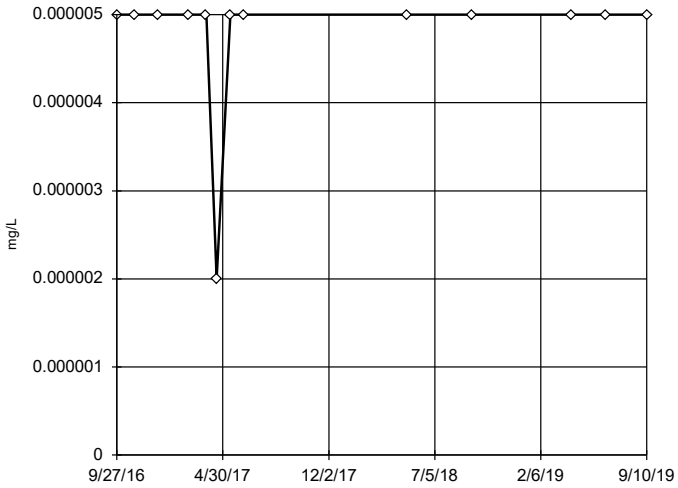
Constituent: Mercury, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605D



n = 13

No outliers found. Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

The results were invalidated, because the lower and upper quartiles are equal.

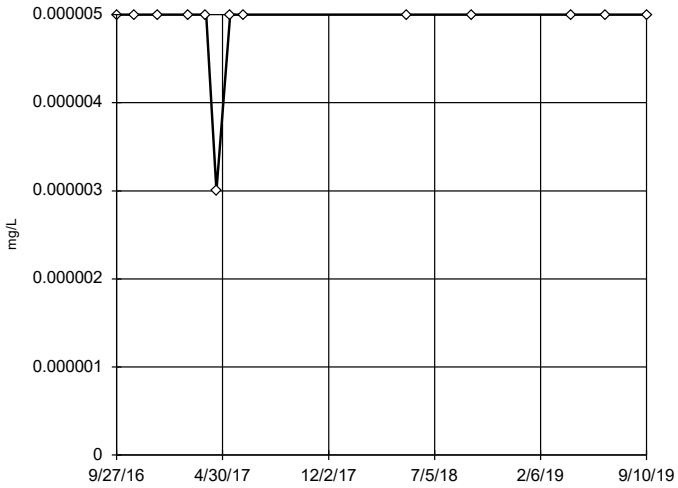
Constituent: Mercury, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605S



n = 13

No outliers found. Tukey's method selected by user.

Data were cube transformed to achieve best W statistic (graph shown in original units).

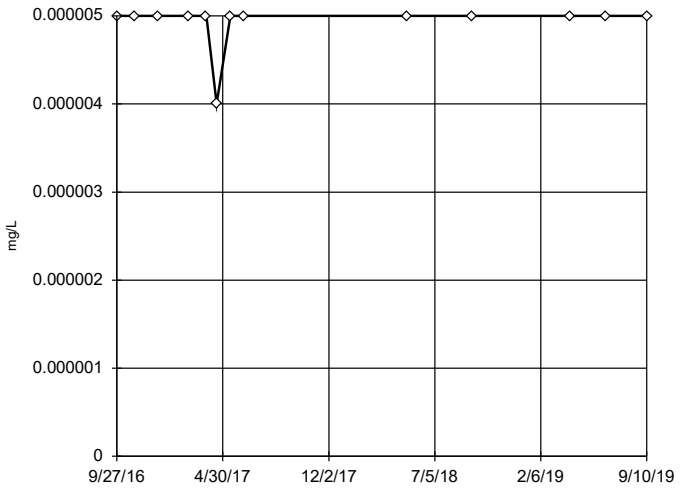
The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Mercury, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1606D



n = 13

No outliers found. Tukey's method selected by user.

Data were square transformed to achieve best W statistic (graph shown in original units).

The results were invalidated, because the lower and upper quartiles are equal.

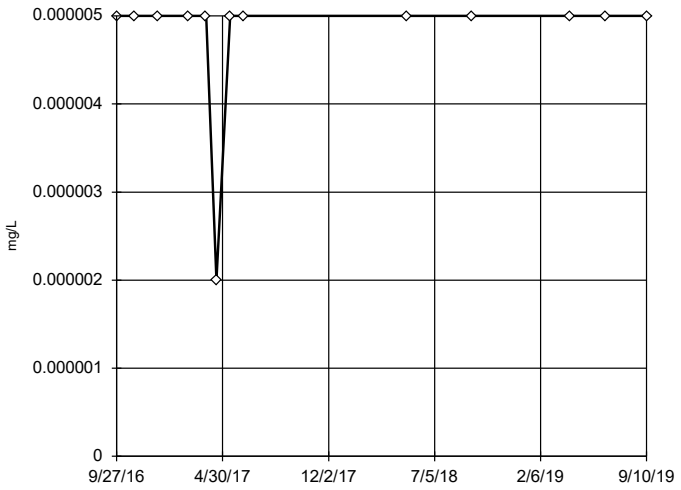
Constituent: Mercury, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606S



n = 13

No outliers found. Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

The results were invalidated, because the lower and upper quartiles are equal.

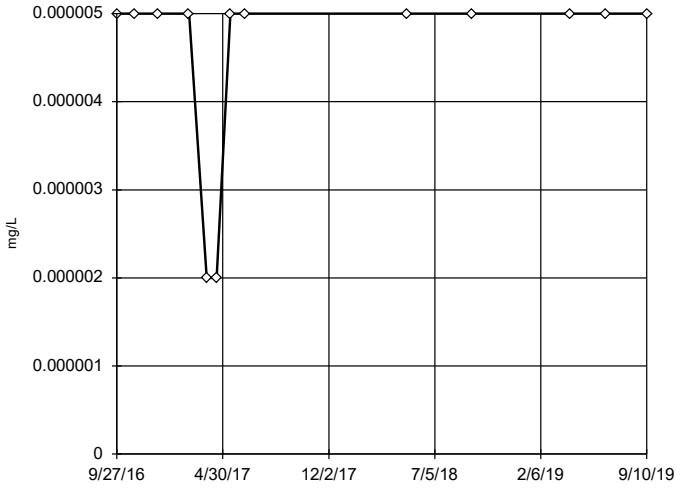
Constituent: Mercury, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607D



n = 13

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

The results were invalidated, because the lower and upper quartiles are equal.

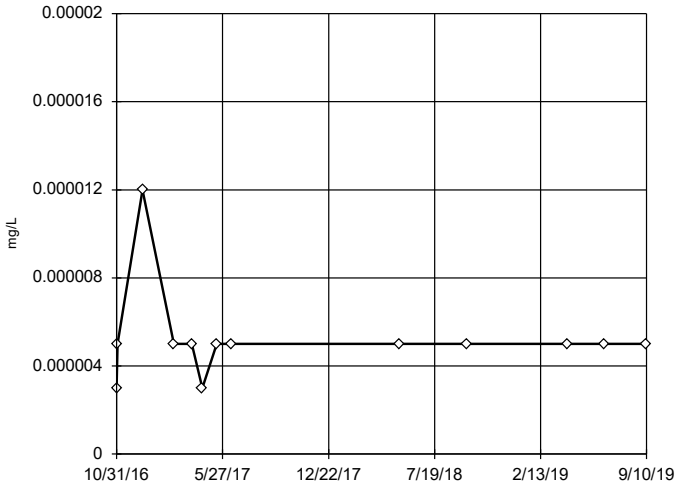
Constituent: Mercury, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

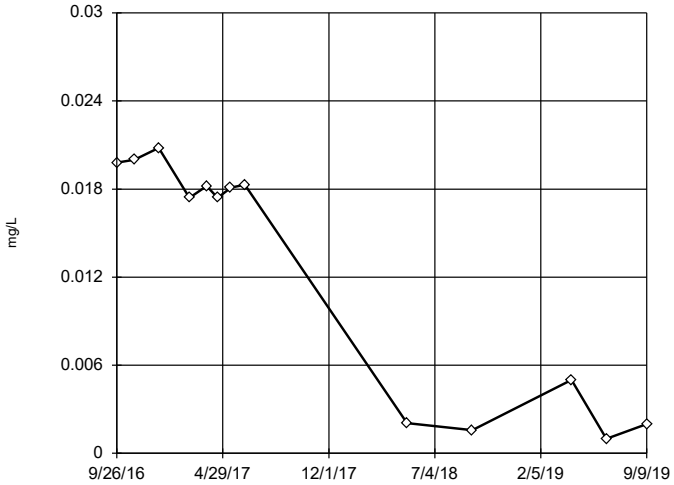
The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Mercury, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1604D



n = 13

No outliers found. Tukey's method selected by user.

Data were x^6 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.02409, low cutoff = -0.02297, based on IQR multiplier of 3.

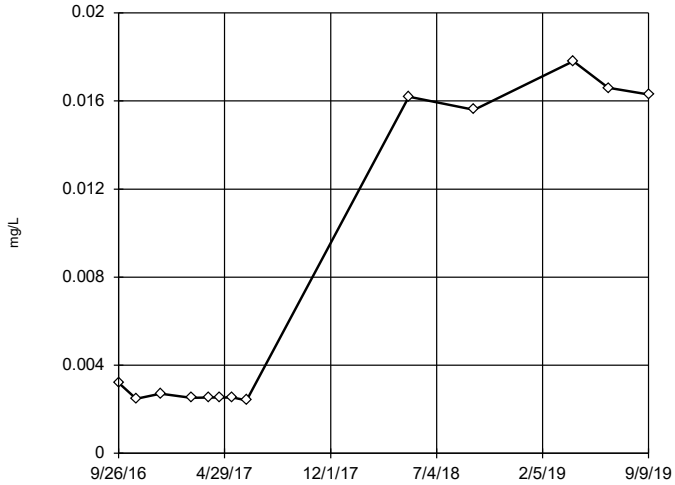
Constituent: Molybdenum, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604S



n = 13

No outliers found. Tukey's method selected by user.

Data were x^6 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.02047, low cutoff = -0.01952, based on IQR multiplier of 3.

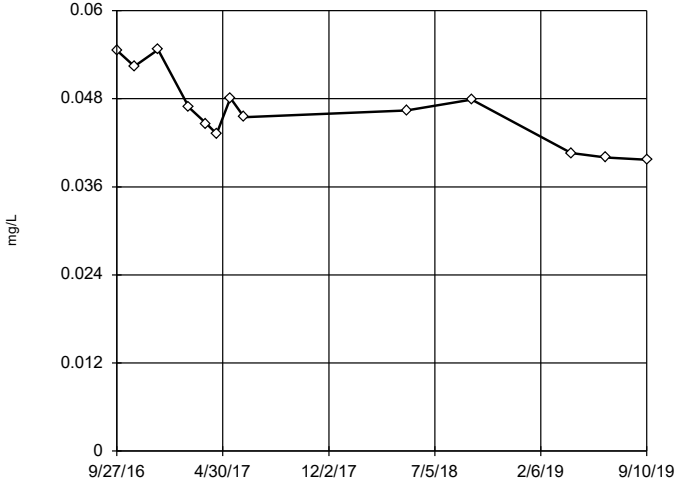
Constituent: Molybdenum, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.08648, low cutoff = 0.02431, based on IQR multiplier of 3.

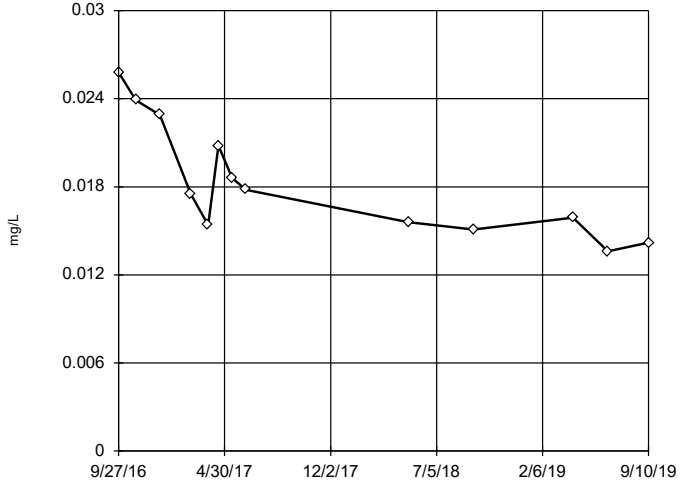
Constituent: Molybdenum, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

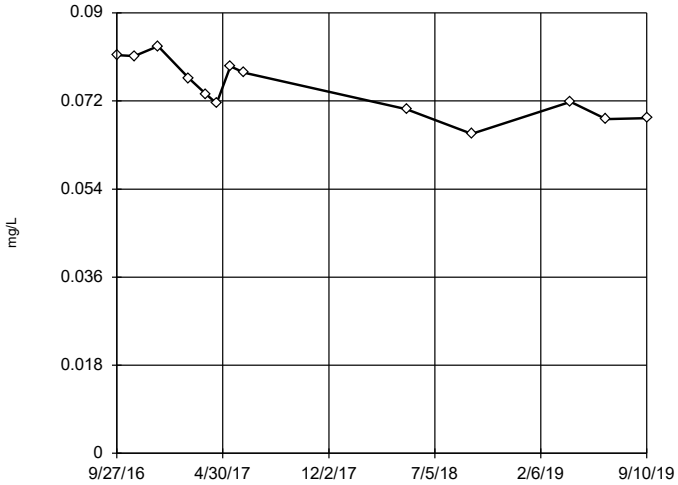
High cutoff = 0.06398, low cutoff = 0.005202, based on IQR multiplier of 3.

Constituent: Molybdenum, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1606D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.1235, low cutoff = 0.04505, based on IQR multiplier of 3.

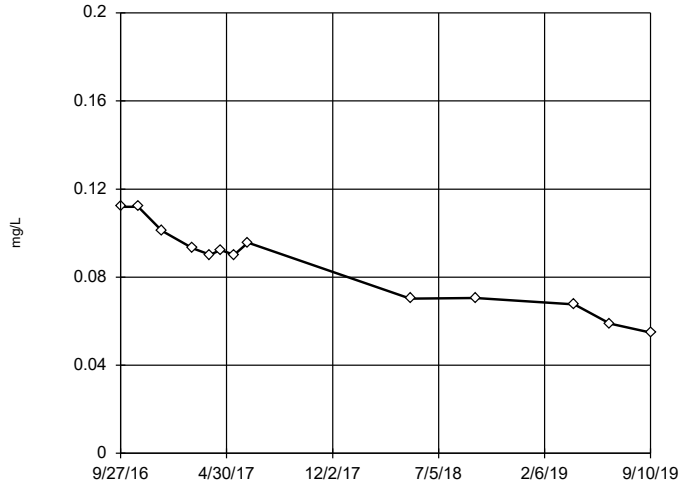
Constituent: Molybdenum, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606S



n = 13

No outliers found. Tukey's method selected by user.

Data were square transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.1564, low cutoff = -0.1001, based on IQR multiplier of 3.

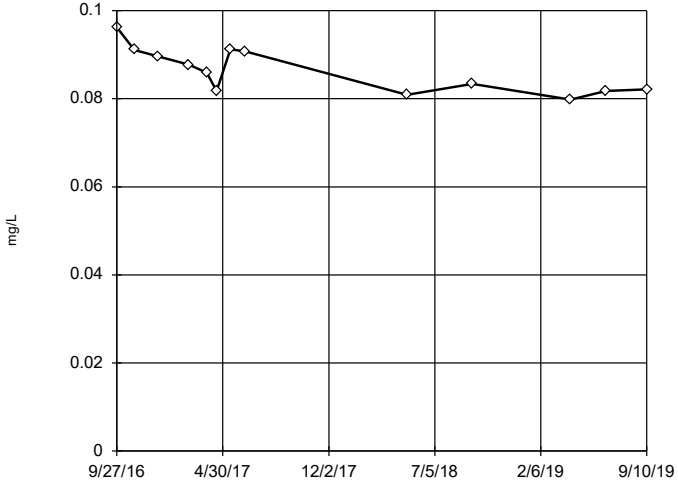
Constituent: Molybdenum, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.125, low cutoff = 0.05951, based on IQR multiplier of 3.

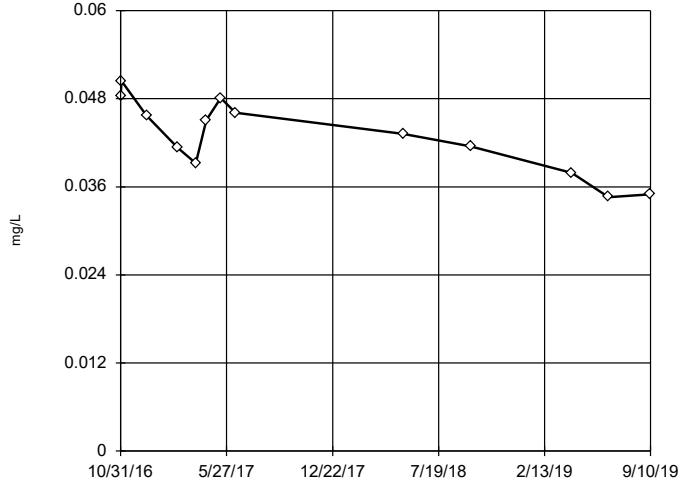
Constituent: Molybdenum, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607S



n = 13

No outliers found. Tukey's method selected by user.

Data were cube transformed to achieve best W statistic (graph shown in original units).

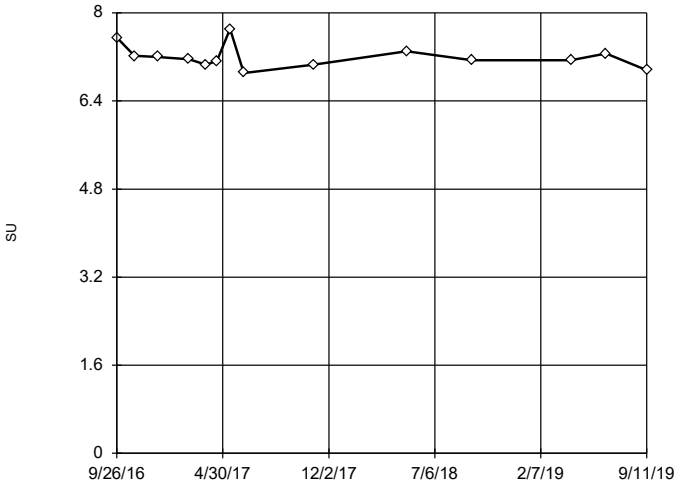
High cutoff = 0.0627, low cutoff = -0.04389, based on IQR multiplier of 3.

Constituent: Molybdenum, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1601A (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 7.982, low cutoff = 6.439, based on IQR multiplier of 3.

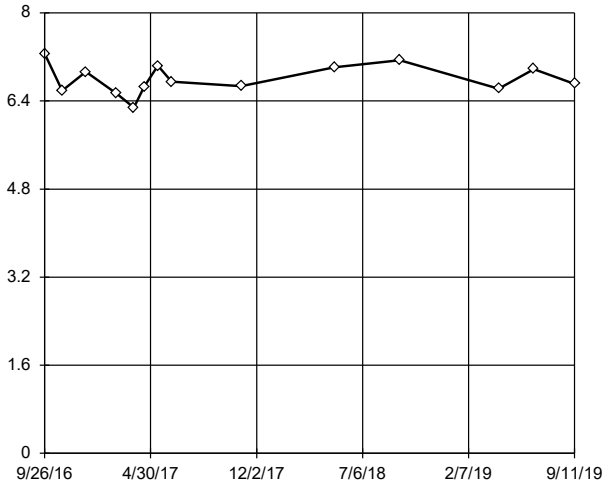
Constituent: pH, field Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602 (bg)



n = 14

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

High cutoff = 8.285, low cutoff = 5.345, based on IQR multiplier of 3.

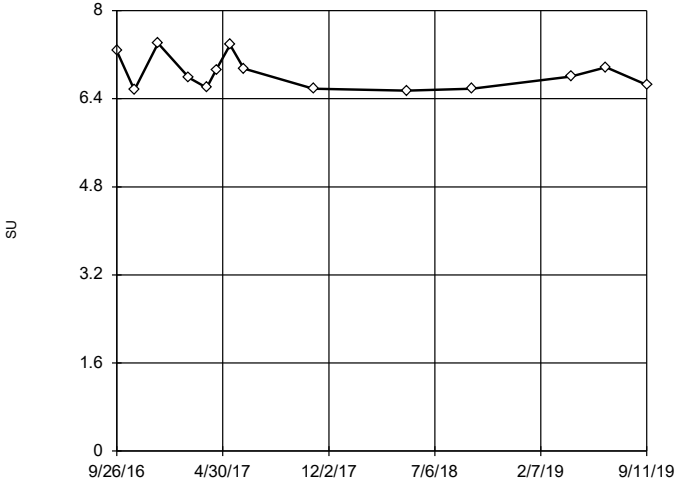
Constituent: pH, field Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603 (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 9.013, low cutoff = 5.197, based on IQR multiplier of 3.

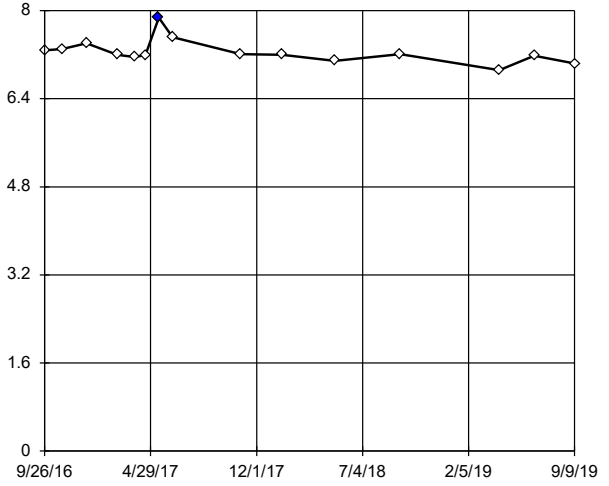
Constituent: pH, field Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604D



n = 15

Outlier is drawn as solid. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

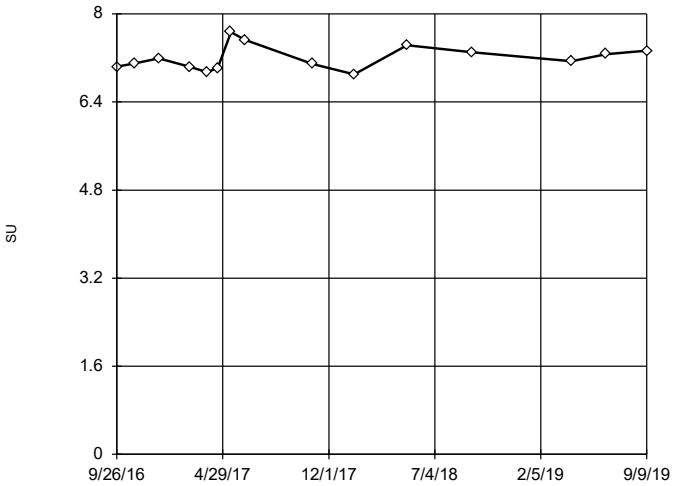
High cutoff = 7.737, low cutoff = 6.756, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1604S



n = 15

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 8.274, low cutoff = 6.237, based on IQR multiplier of 3.

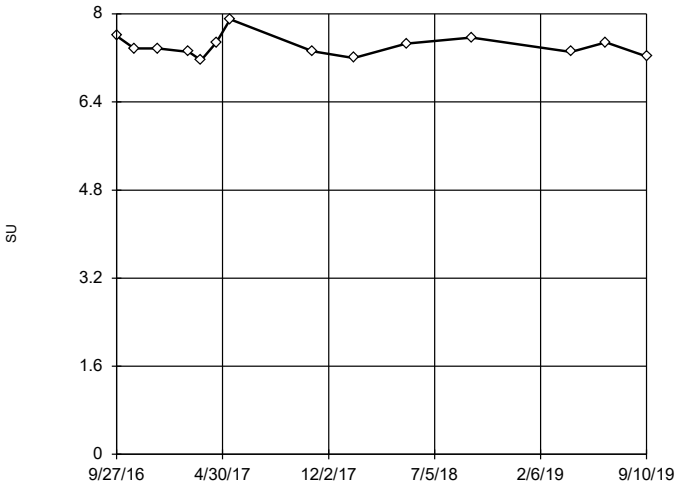
Constituent: pH, field Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605D



n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 8.345, low cutoff = 6.556, based on IQR multiplier of 3.

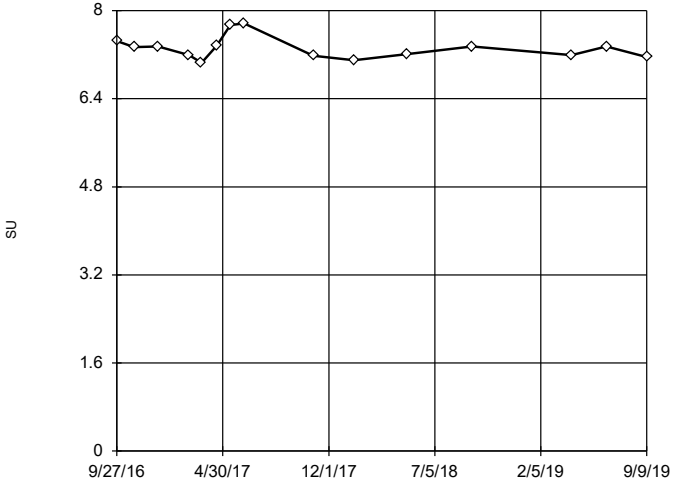
Constituent: pH, field Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605S



n = 15

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 7.928, low cutoff = 6.666, based on IQR multiplier of 3.

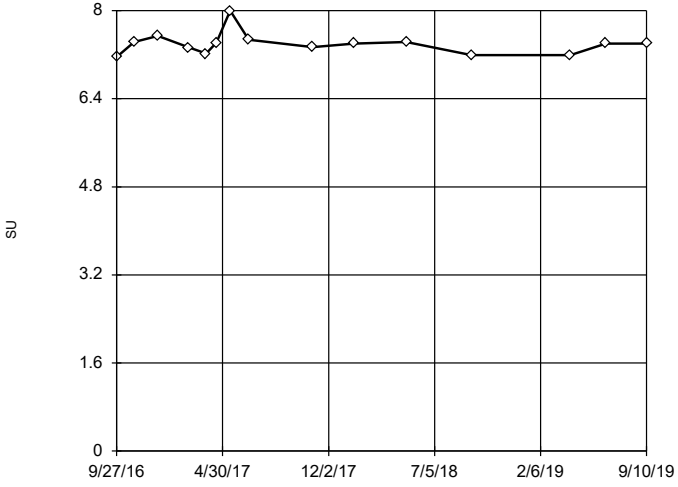
Constituent: pH, field Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606D



n = 15

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

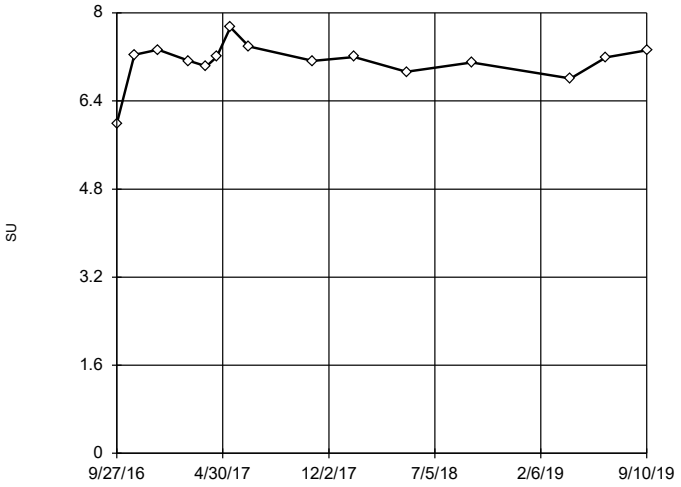
High cutoff = 8.097, low cutoff = 6.625, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1606S



n = 15

No outliers found.
Tukey's method selected by user.

Data were x^6 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 7.954, low cutoff = 5.265, based on IQR multiplier of 3.

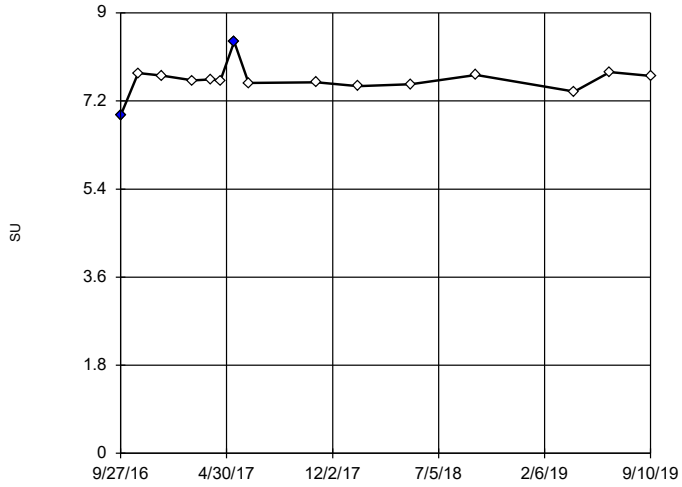
Constituent: pH, field Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607D



n = 15

Outliers are drawn as solid.
Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 8.319, low cutoff = 6.989, based on IQR multiplier of 3.

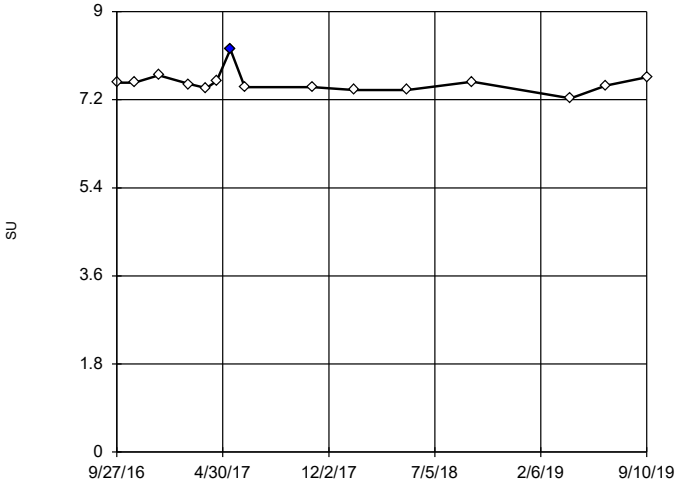
Constituent: pH, field Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607S



n = 15

Outlier is drawn as solid.
Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 8.016, low cutoff = 7.035, based on IQR multiplier of 3.

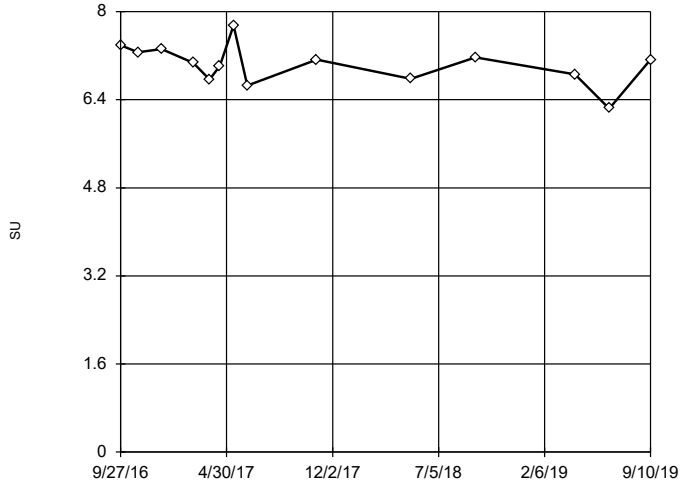
Constituent: pH, field Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1608 (bg)



n = 14

No outliers found.
Tukey's method selected by user.

Data were cube transformed to achieve best W statistic (graph shown in original units).

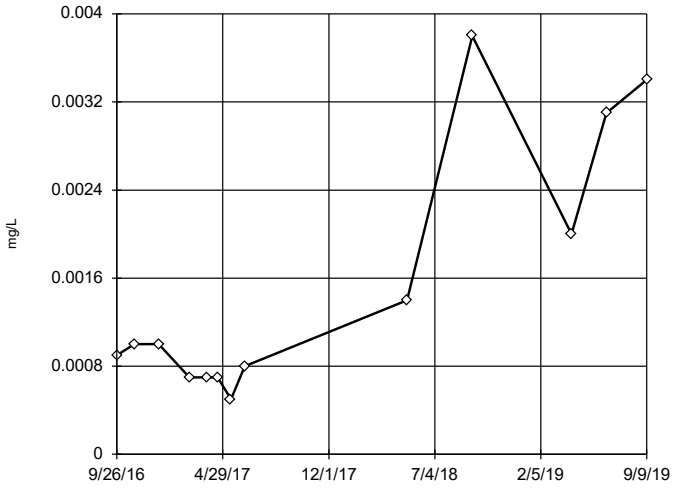
High cutoff = 8.512, low cutoff = 4.337, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1604D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.1121, low cutoff = 0.00001555, based on IQR multiplier of 3.

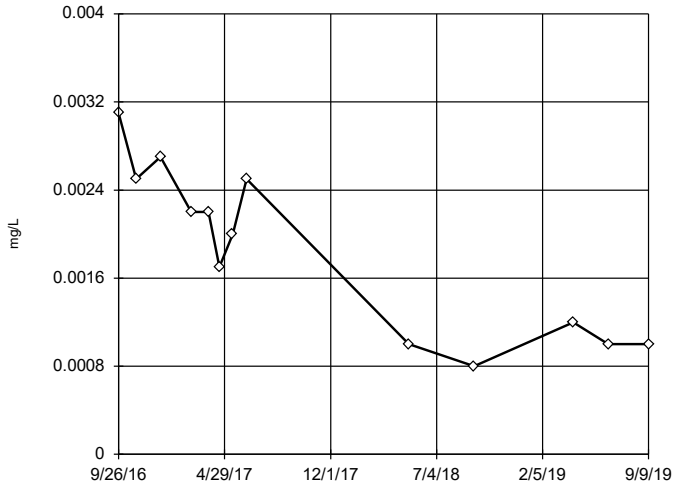
Constituent: Selenium, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604S



n = 13

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

High cutoff = 0.007, low cutoff = -0.0035, based on IQR multiplier of 3.

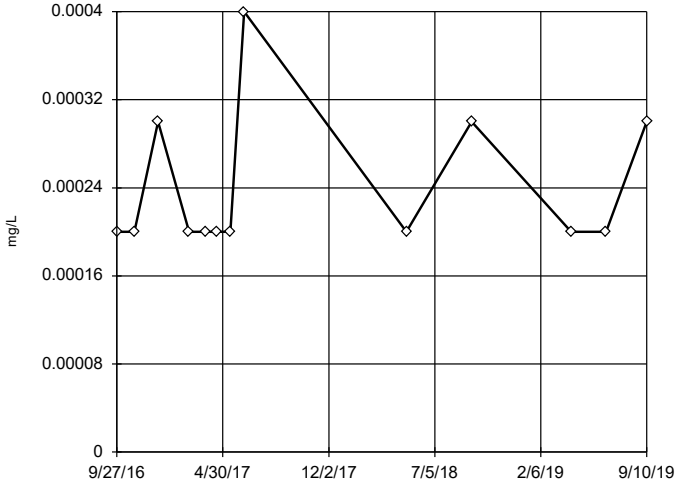
Constituent: Selenium, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.001013, low cutoff = 0.00005926, based on IQR multiplier of 3.

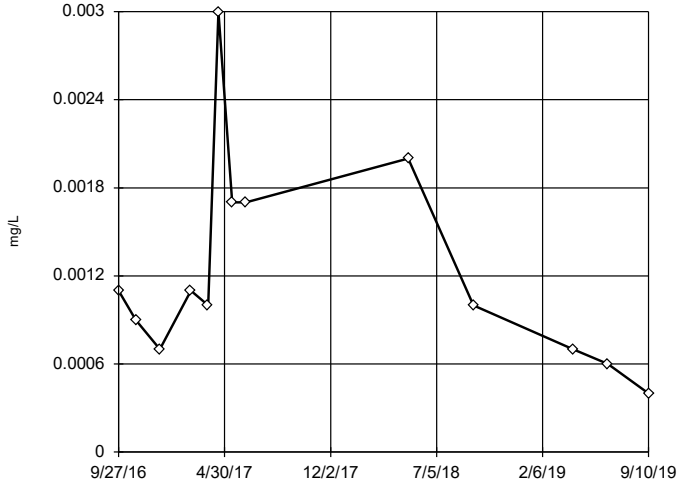
Constituent: Selenium, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

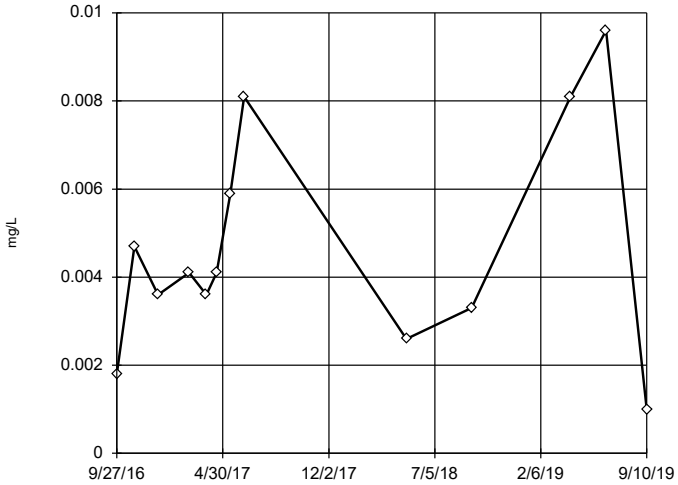
High cutoff = 0.02435, low cutoff = 0.00004887, based on IQR multiplier of 3.

Constituent: Selenium, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1606D



n = 13

No outliers found. Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.03708, low cutoff = 1.1e-10, based on IQR multiplier of 3.

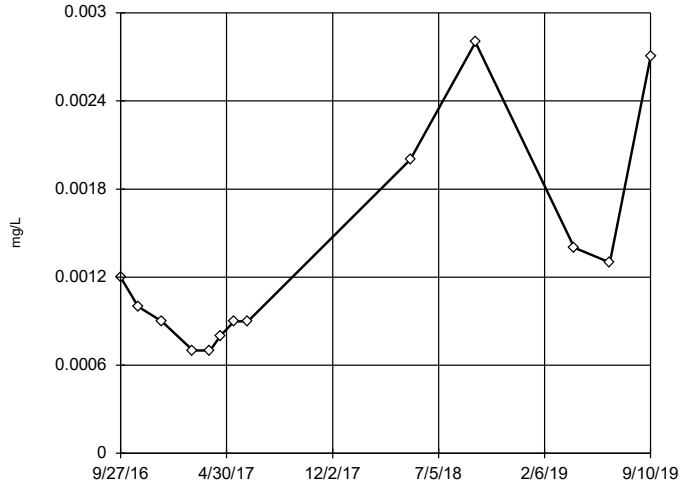
Constituent: Selenium, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.01283, low cutoff = 0.0001106, based on IQR multiplier of 3.

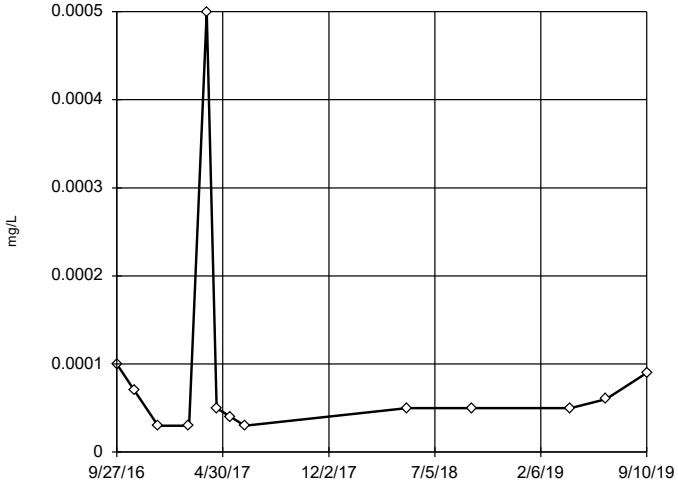
Constituent: Selenium, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.0009548, low cutoff = 0.00000288, based on IQR multiplier of 3.

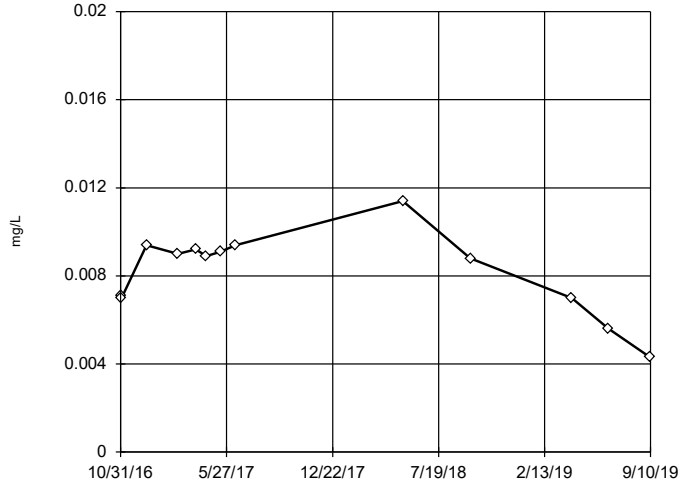
Constituent: Selenium, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607S



n = 13

No outliers found. Tukey's method selected by user.

Data were square transformed to achieve best W statistic (graph shown in original units).

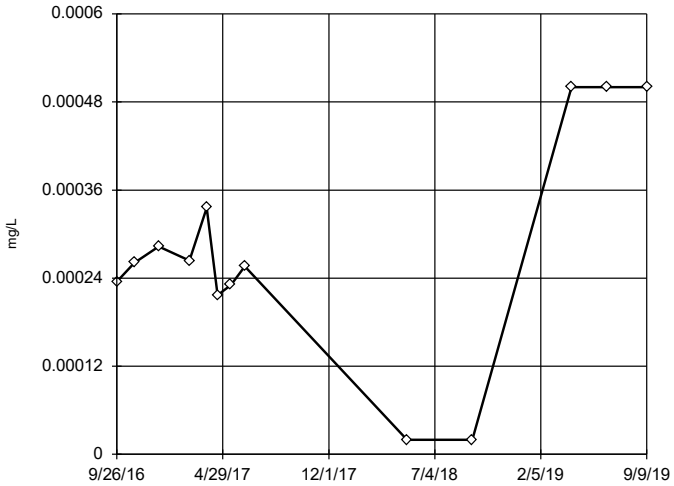
High cutoff = 0.01411, low cutoff = -0.007969, based on IQR multiplier of 3.

Constituent: Selenium, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1604D



n = 13

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

High cutoff = 0.001, low cutoff = -0.000358, based on IQR multiplier of 3.

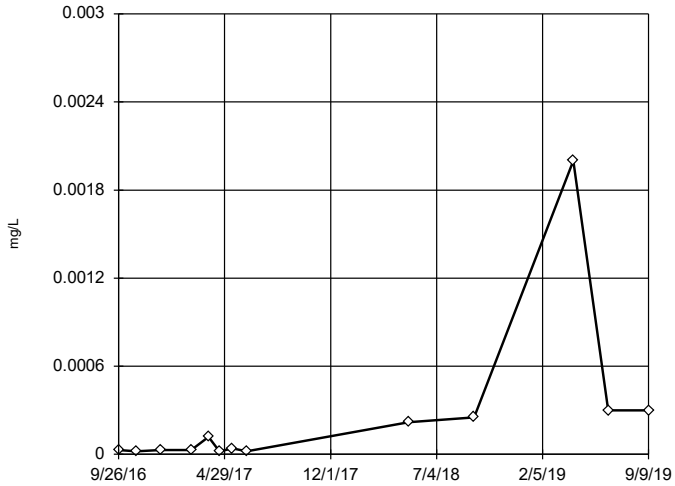
Constituent: Thallium, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.3858, low cutoff = 1.7e-8, based on IQR multiplier of 3.

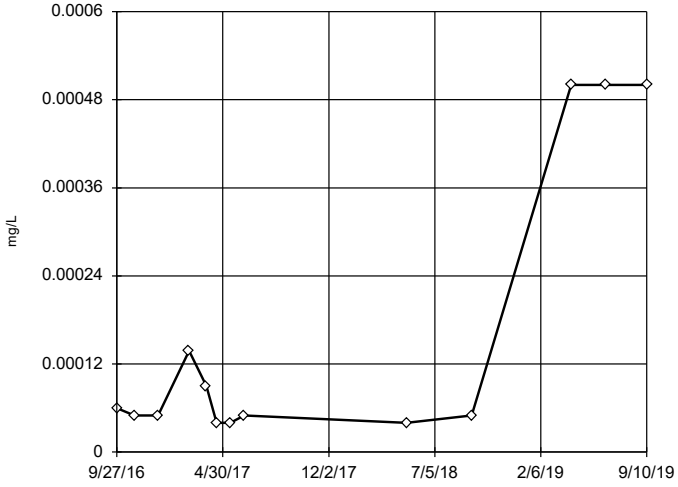
Constituent: Thallium, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605D



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.05323, low cutoff = 2.2e-7, based on IQR multiplier of 3.

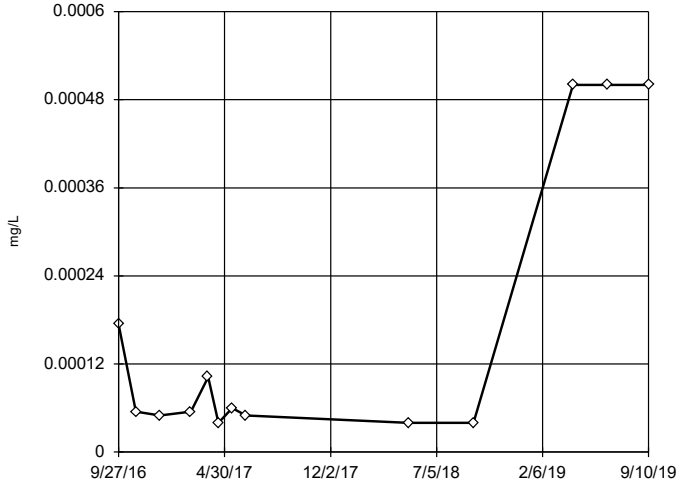
Constituent: Thallium, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605S



n = 13

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

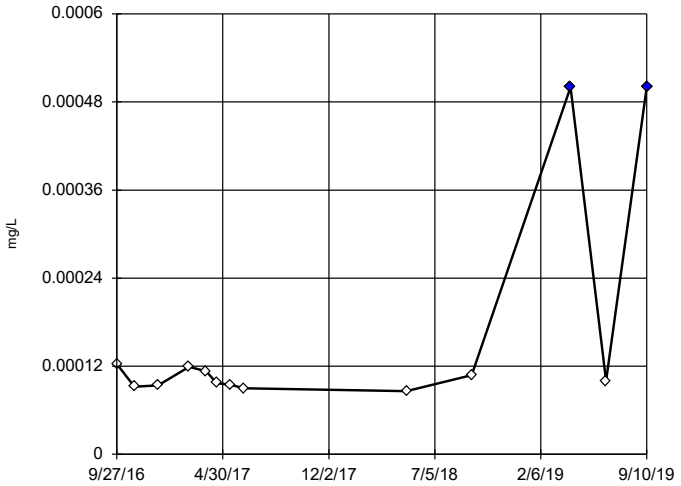
High cutoff = 0.08462, low cutoff = 1.6e-7, based on IQR multiplier of 3.

Constituent: Thallium, total Analysis Run 11/25/2019 3:30 PM

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Tukey's Outlier Screening

MW-1606D



n = 13

Outliers are drawn as solid.
Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

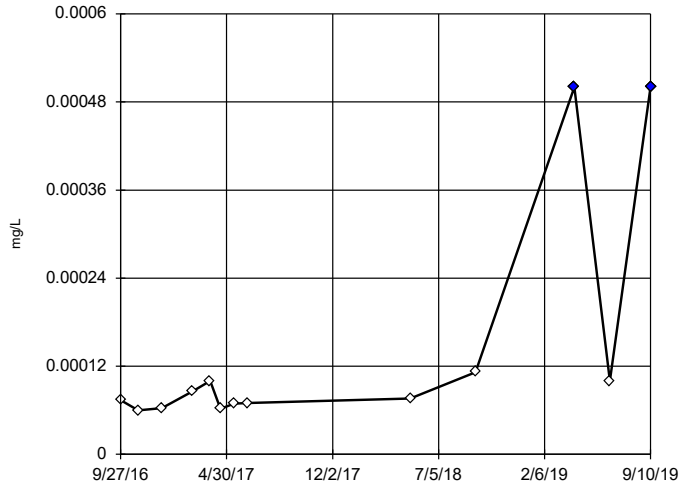
High cutoff = 0.0002664, low cutoff = 0.00004223, based on IQR multiplier of 3.

Constituent: Thallium, total Analysis Run 11/25/2019 3:31 PM
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606S



n = 13

Outliers are drawn as solid.
Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

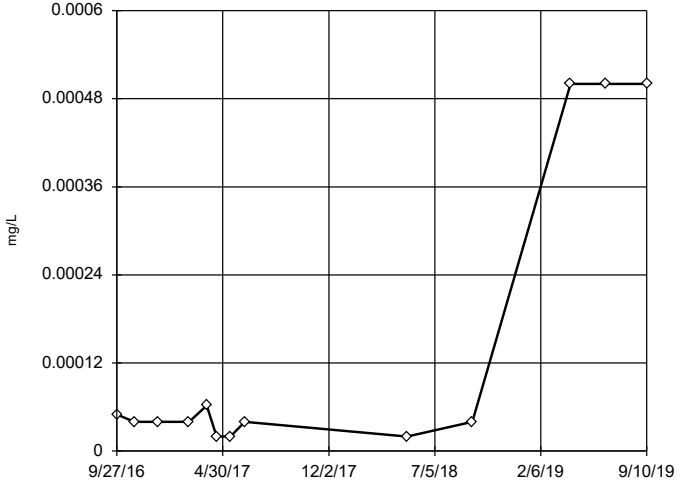
High cutoff = 0.0004377, low cutoff = 0.00001594, based on IQR multiplier of 3.

Constituent: Thallium, total Analysis Run 11/25/2019 3:31 PM
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607D



n = 13

No outliers found.
Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

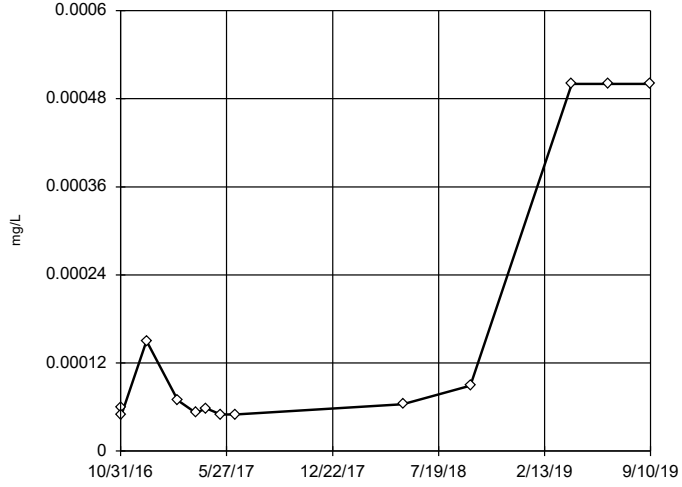
High cutoff = 0.04247, low cutoff = 1.2e-7, based on IQR multiplier of 3.

Constituent: Thallium, total Analysis Run 11/25/2019 3:31 PM
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1607S



n = 13

No outliers found.
Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.04243, low cutoff = 3.3e-7, based on IQR multiplier of 3.

Constituent: Thallium, total Analysis Run 11/25/2019 3:31 PM
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

FIGURE D: MANN-WHITNEY ANALYSIS

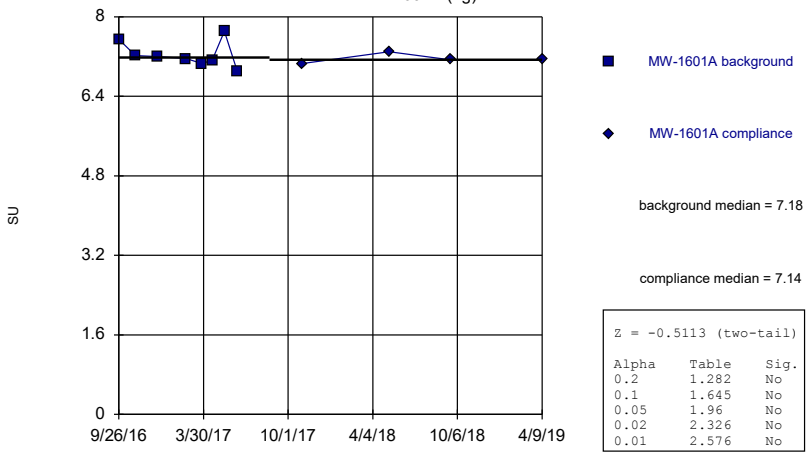
Welch's t-test/Mann-Whitney - All Results (No Significant Results)

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 12/9/2019, 8:34 AM

Constituent	Well	Calc.	0.01	Method
pH, field (SU)	MW-1601A (bg)	-0.5113	No	Mann-W
pH, field (SU)	MW-1602 (bg)	0.5944	No	Mann-W
pH, field (SU)	MW-1603 (bg)	-1.957	No	Mann-W
pH, field (SU)	MW-1604D	-1.761	No	Mann-W
pH, field (SU)	MW-1604S	0.07329	No	Mann-W
pH, field (SU)	MW-1605D	-0.7334	No	Mann-W
pH, field (SU)	MW-1605S	-1.688	No	Mann-W
pH, field (SU)	MW-1606D	-1.174	No	Mann-W
pH, field (SU)	MW-1606S	-1.541	No	Mann-W
pH, field (SU)	MW-1607D	-1.139	No	Mann-W
pH, field (SU)	MW-1607S	-1.877	No	Mann-W
pH, field (SU)	MW-1608 (bg)	-0.7643	No	Mann-W

Mann-Whitney (Wilcoxon Rank Sum)

MW-1601A (bg)



Z = -0.5113 (two-tail)

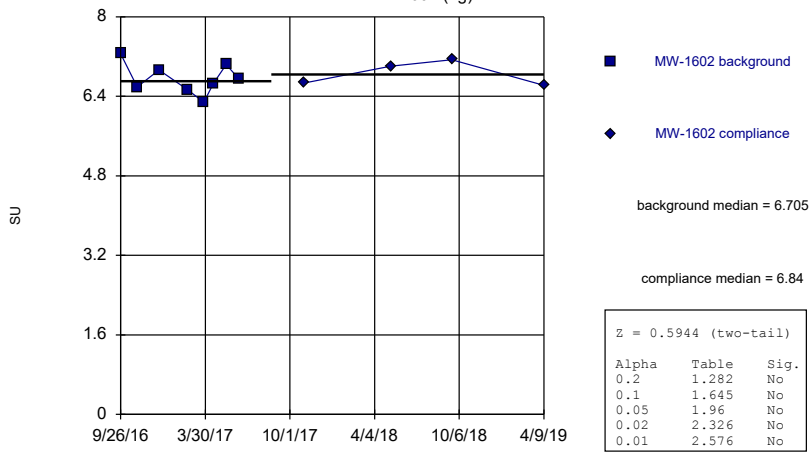
Alpha	Table	Sig.
0.2	1.282	No
0.1	1.645	No
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

Constituent: pH, field Analysis Run 12/9/2019 8:33 AM View: Intrawell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW-1602 (bg)



Z = 0.5944 (two-tail)

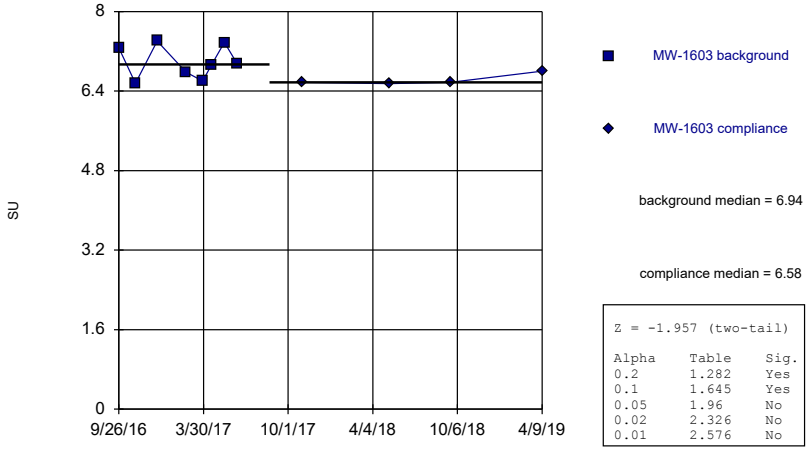
Alpha	Table	Sig.
0.2	1.282	No
0.1	1.645	No
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

Constituent: pH, field Analysis Run 12/9/2019 8:33 AM View: Intrawell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW-1603 (bg)



Z = -1.957 (two-tail)

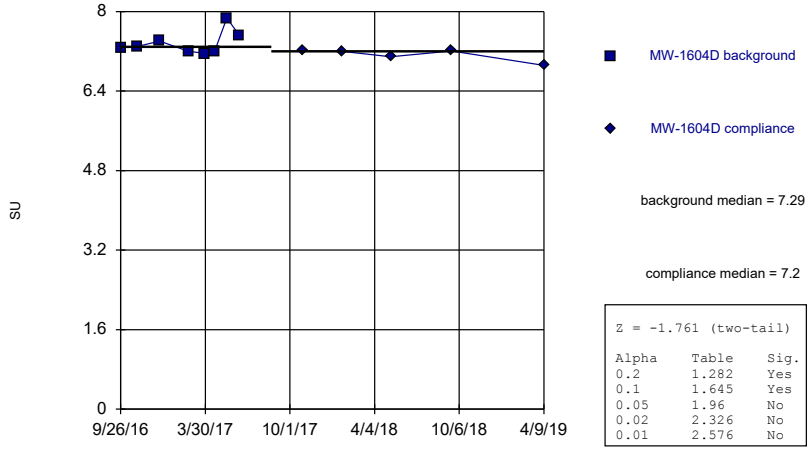
Alpha	Table	Sig.
0.2	1.282	Yes
0.1	1.645	Yes
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

Constituent: pH, field Analysis Run 12/9/2019 8:33 AM View: Intrawell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW-1604D



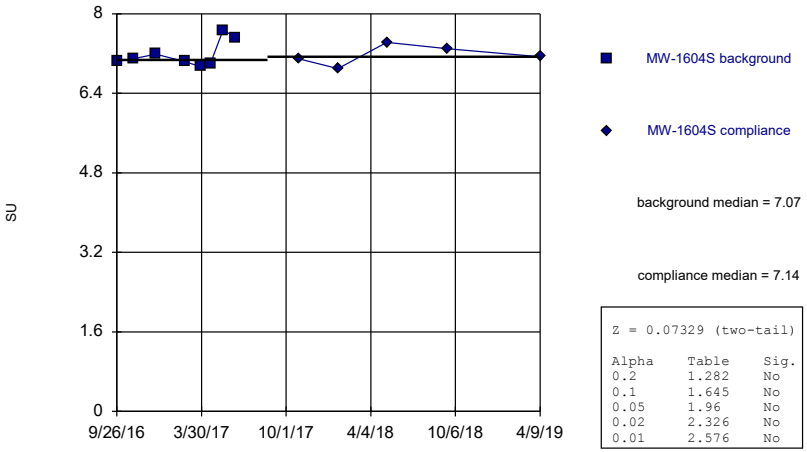
Z = -1.761 (two-tail)

Alpha	Table	Sig.
0.2	1.282	Yes
0.1	1.645	Yes
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

Constituent: pH, field Analysis Run 12/9/2019 8:33 AM View: Intrawell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Mann-Whitney (Wilcoxon Rank Sum)

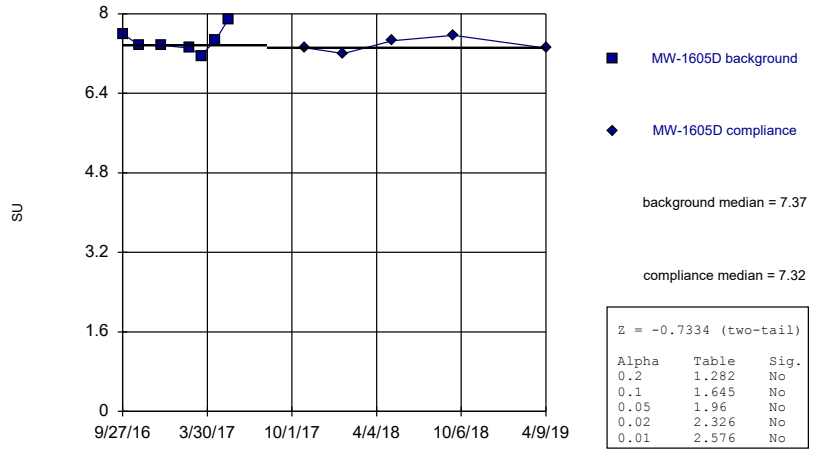
MW-1604S



Constituent: pH, field Analysis Run 12/9/2019 8:33 AM View: Intrawell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Mann-Whitney (Wilcoxon Rank Sum)

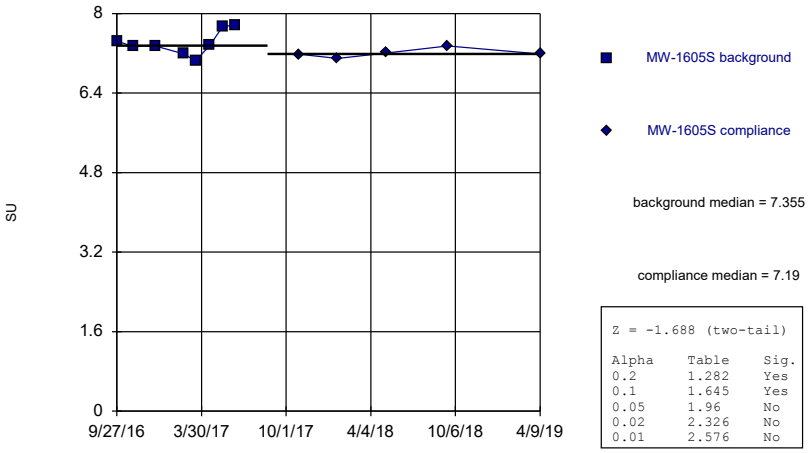
MW-1605D



Constituent: pH, field Analysis Run 12/9/2019 8:33 AM View: Intrawell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Mann-Whitney (Wilcoxon Rank Sum)

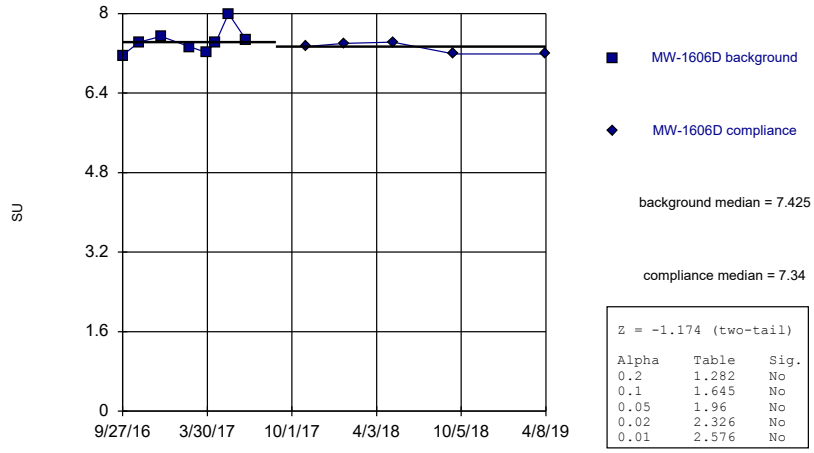
MW-1605S



Constituent: pH, field Analysis Run 12/9/2019 8:33 AM View: Intrawell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Mann-Whitney (Wilcoxon Rank Sum)

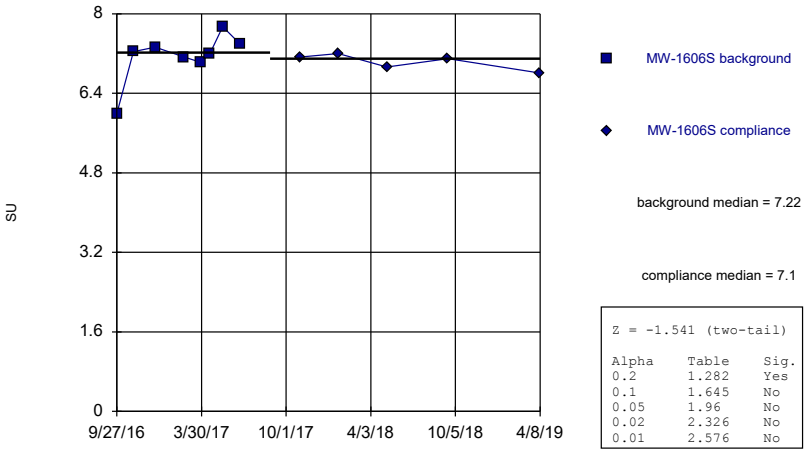
MW-1606D



Constituent: pH, field Analysis Run 12/9/2019 8:33 AM View: Intrawell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Mann-Whitney (Wilcoxon Rank Sum)

MW-1606S

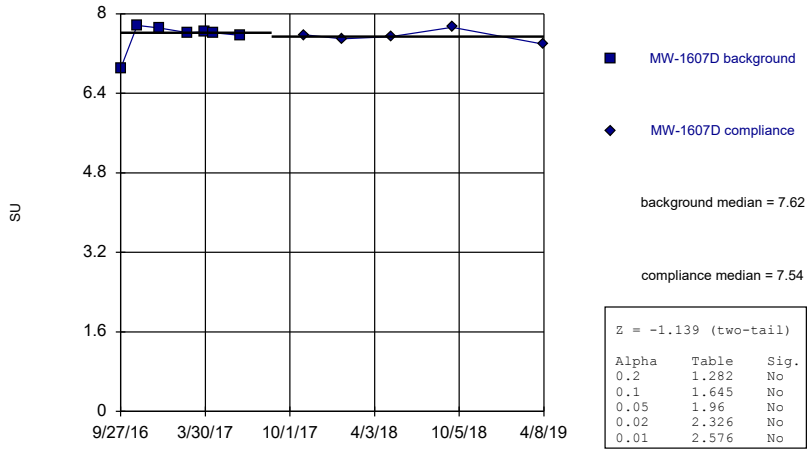


Constituent: pH, field Analysis Run 12/9/2019 8:33 AM View: Intrawell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW-1607D

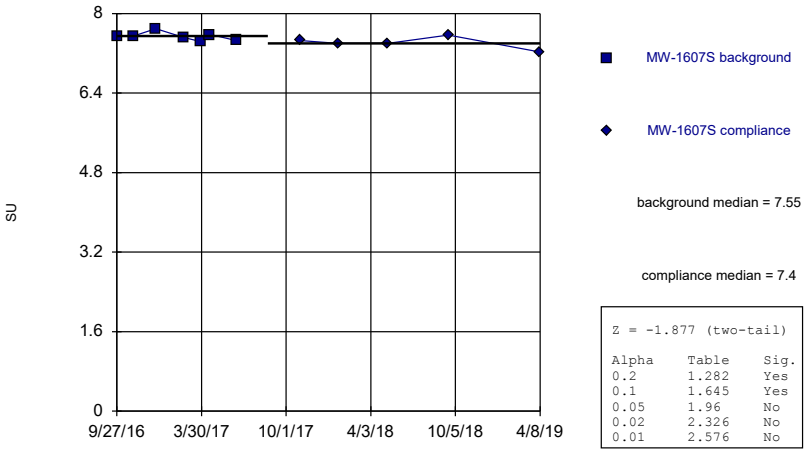


Constituent: pH, field Analysis Run 12/9/2019 8:33 AM View: Intrawell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW-1607S

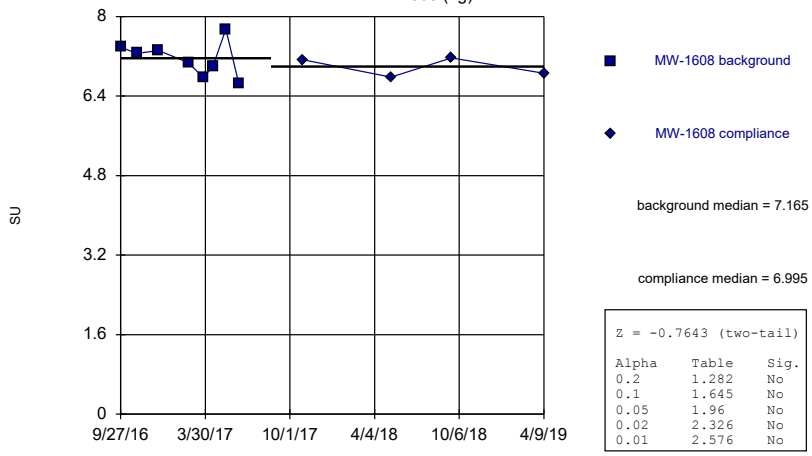


Constituent: pH, field Analysis Run 12/9/2019 8:33 AM View: Intrawell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

MW-1608 (bg)



Constituent: pH, field Analysis Run 12/9/2019 8:33 AM View: Intrawell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

FIGURE E: INTRAWELL PREDICTION LIMITS

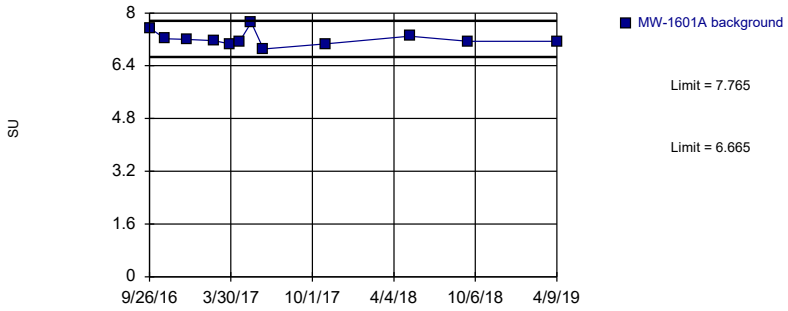
Intrawell Prediction Limit Summary Table - All Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 12/9/2019, 8:35 AM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
pH, field (SU)	MW-1601A	7.765	6.665	n/a	1 future	n/a	12	7.215	0.2189	0	None	No	0.0004701	Param Intra 1 of 2
pH, field (SU)	MW-1602	7.51	6.07	n/a	1 future	n/a	12	6.79	0.2866	0	None	No	0.0004701	Param Intra 1 of 2
pH, field (SU)	MW-1603	7.687	6.045	n/a	1 future	n/a	12	6.866	0.3267	0	None	No	0.0004701	Param Intra 1 of 2
pH, field (SU)	MW-1604D	7.84	6.708	n/a	1 future	n/a	13	7.274	0.2297	0	None	No	0.0004701	Param Intra 1 of 2
pH, field (SU)	MW-1604S	7.761	6.606	n/a	1 future	n/a	13	7.183	0.2345	0	None	No	0.0004701	Param Intra 1 of 2
pH, field (SU)	MW-1605D	7.926	6.915	n/a	1 future	n/a	12	7.421	0.2013	0	None	No	0.0004701	Param Intra 1 of 2
pH, field (SU)	MW-1605S	7.873	6.785	n/a	1 future	n/a	13	7.329	0.2208	0	None	No	0.0004701	Param Intra 1 of 2
pH, field (SU)	MW-1606D	7.932	6.856	n/a	1 future	n/a	13	7.394	0.2185	0	None	No	0.0004701	Param Intra 1 of 2
pH, field (SU)	MW-1606S	8.084	6.104	n/a	1 future	n/a	13	7.094	0.4018	0	None	No	0.0004701	Param Intra 1 of 2
pH, field (SU)	MW-1607D	8.016	6.957	n/a	1 future	n/a	12	24701	3344	0	None	x^5	0.0004701	Param Intra 1 of 2
pH, field (SU)	MW-1607S	7.786	7.19	n/a	1 future	n/a	12	7.488	0.1186	0	None	No	0.0004701	Param Intra 1 of 2
pH, field (SU)	MW-1608	7.876	6.319	n/a	1 future	n/a	12	7.098	0.3101	0	None	No	0.0004701	Param Intra 1 of 2

Prediction Limit

Intrawell Parametric, MW-1601A (bg)



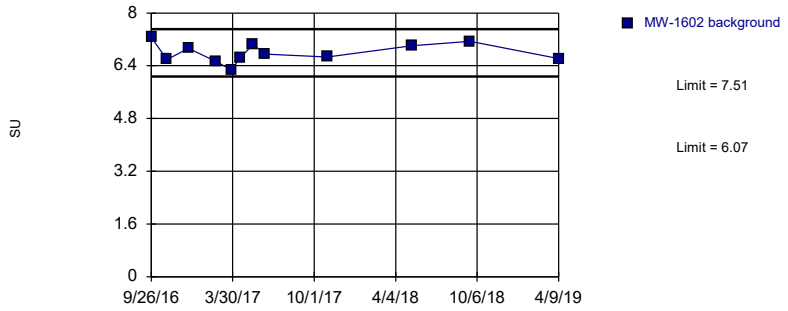
Background Data Summary: Mean=7.215, Std. Dev.=0.2189, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8709, critical = 0.805. Kappa = 2.512 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/9/2019 8:34 AM View: Intrawell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1602 (bg)



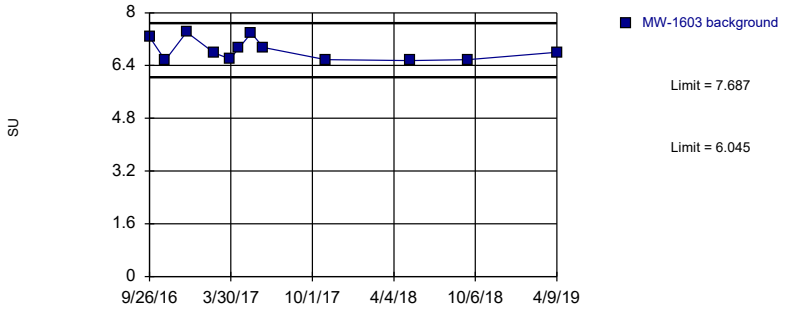
Background Data Summary: Mean=6.79, Std. Dev.=0.2866, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.966, critical = 0.805. Kappa = 2.512 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/9/2019 8:34 AM View: Intrawell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1603 (bg)



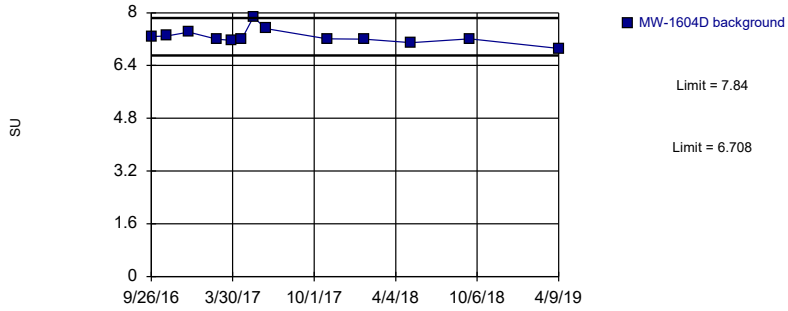
Background Data Summary: Mean=6.866, Std. Dev.=0.3267, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8435, critical = 0.805. Kappa = 2.512 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/9/2019 8:34 AM View: Intrawell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1604D

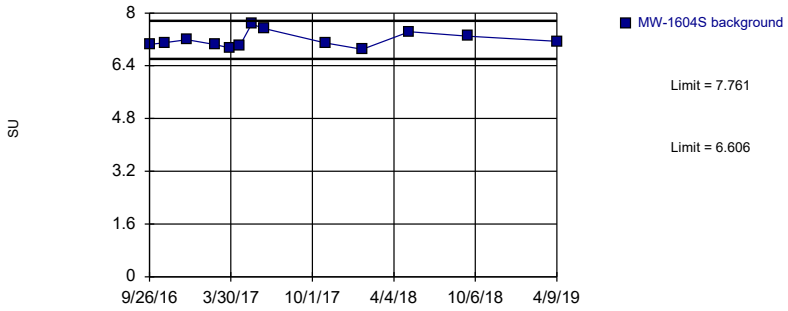


Background Data Summary: Mean=7.274, Std. Dev.=0.2297, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8658, critical = 0.814. Kappa = 2.463 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/9/2019 8:34 AM View: Intrawell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Prediction Limit

Intrawell Parametric, MW-1604S



Background Data Summary: Mean=7.183, Std. Dev.=0.2345, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9074, critical = 0.814. Kappa = 2.463 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/9/2019 8:34 AM View: Intrawell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

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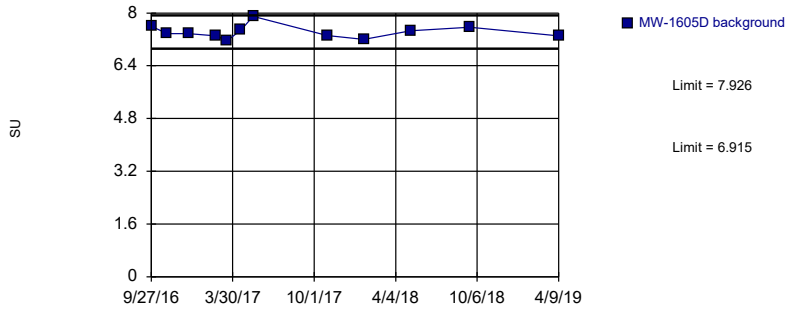
Prediction Limit

Intrawell Parametric, MW-1605D



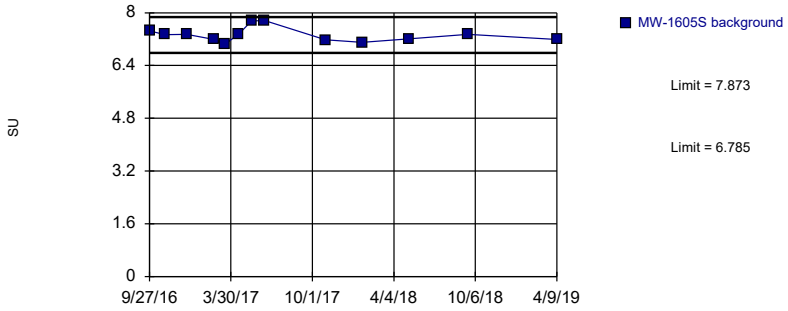
Background Data Summary: Mean=7.421, Std. Dev.=0.2013, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9163, critical = 0.805. Kappa = 2.512 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/9/2019 8:34 AM View: Intrawell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1605S



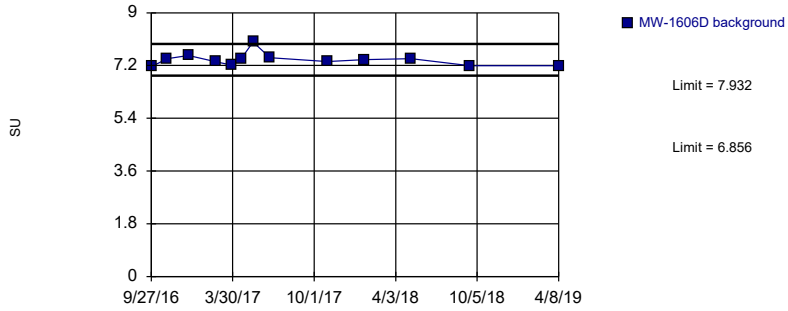
Background Data Summary: Mean=7.329, Std. Dev.=0.2208, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8806, critical = 0.814. Kappa = 2.463 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/9/2019 8:34 AM View: Intrawell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1606D

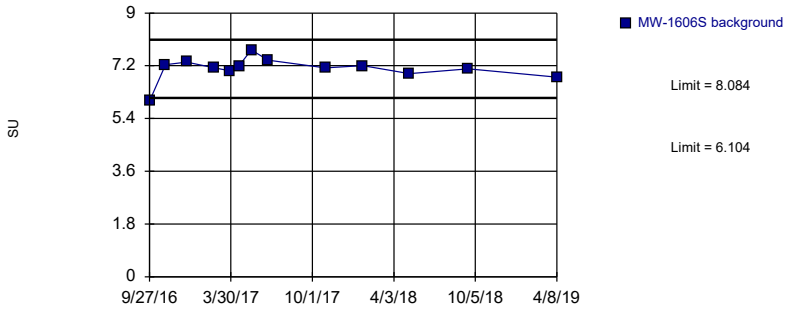


Background Data Summary: Mean=7.394, Std. Dev.=0.2185, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8195, critical = 0.814. Kappa = 2.463 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/9/2019 8:34 AM View: Intrawell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Prediction Limit

Intrawell Parametric, MW-1606S



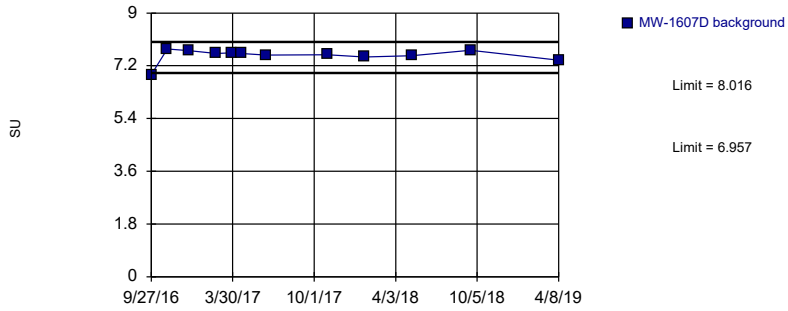
Background Data Summary: Mean=7.094, Std. Dev.=0.4018, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8427, critical = 0.814. Kappa = 2.463 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/9/2019 8:34 AM View: Intrawell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1607D



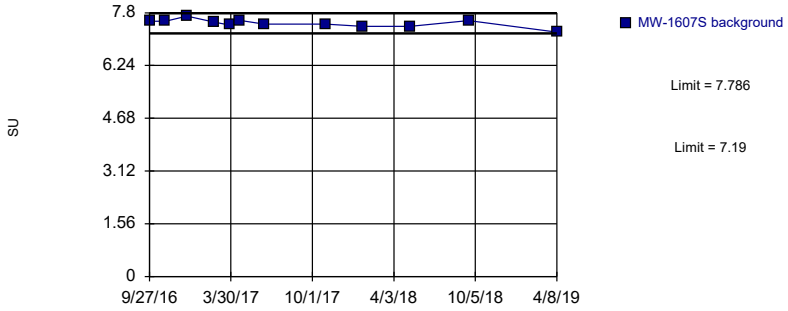
Background Data Summary (based on x^5 transformation): Mean=24701, Std. Dev.=3344, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8159, critical = 0.805. Kappa = 2.512 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/9/2019 8:34 AM View: Intrawell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1607S



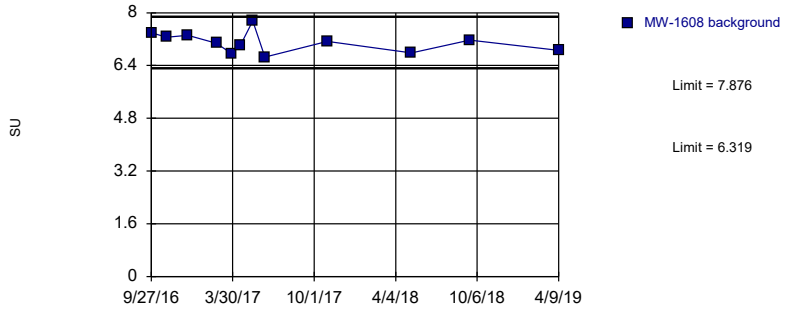
Background Data Summary: Mean=7.488, Std. Dev.=0.1186, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9559, critical = 0.805. Kappa = 2.512 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/9/2019 8:34 AM View: Intrawell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1608 (bg)



Background Data Summary: Mean=7.098, Std. Dev.=0.3101, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9637, critical = 0.805. Kappa = 2.512 (c=7, w=8, 1 of 2, event alpha = 0.05132). Report alpha = 0.0009403. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/9/2019 8:34 AM View: Intrawell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

FIGURE F: TREND TESTS

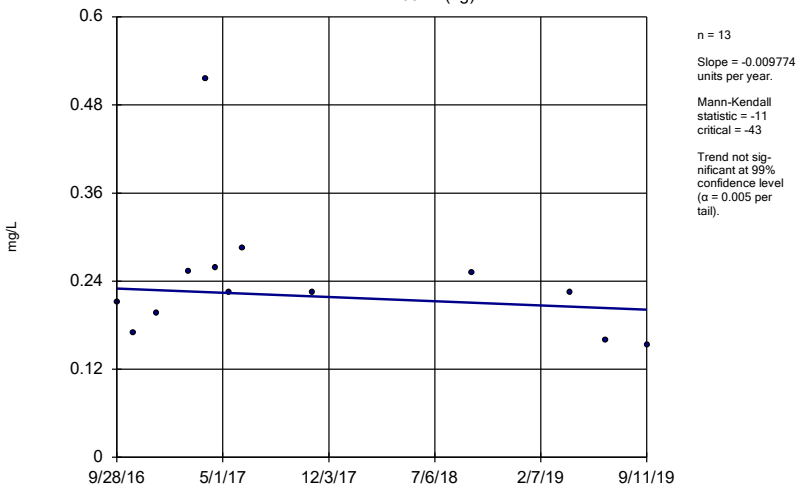
Trend Tests Summary Table - Upgradient Wells

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 11/25/2019, 3:20 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Boron, total (mg/L)	MW-1601A (bg)	-0.009774	-11	-43	No	13	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1602 (bg)	-0.007572	-24	-43	No	13	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1603 (bg)	-0.03533	-20	-43	No	13	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1608 (bg)	-0.007863	-6	-43	No	13	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1601A (bg)	13.67	43	43	No	13	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1602 (bg)	7.533	38	43	No	13	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1603 (bg)	6.075	14	43	No	13	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1608 (bg)	3.358	21	43	No	13	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1601A (bg)	10.19	28	43	No	13	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1602 (bg)	0.5312	16	43	No	13	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	**MW-1603 (bg)**	**-5.236**	**-44**	**-43**	**Yes**	**13**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	MW-1608 (bg)	-0.09116	-4	-43	No	13	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1601A (bg)	-0.01381	-33	-48	No	14	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	**MW-1602 (bg)**	**0.025**	**63**	**48**	**Yes**	**14**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Fluoride, total (mg/L)	MW-1603 (bg)	0	4	48	No	14	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	**MW-1608 (bg)**	**-0.03883**	**-76**	**-48**	**Yes**	**14**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Sulfate, total (mg/L)	**MW-1601A (bg)**	**28.78**	**61**	**43**	**Yes**	**13**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Sulfate, total (mg/L)	MW-1602 (bg)	28.64	38	43	No	13	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1603 (bg)	-18.84	-14	-43	No	13	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1608 (bg)	40.3	32	43	No	13	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	**MW-1601A (bg)**	**71.01**	**56**	**43**	**Yes**	**13**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Total Dissolved Solids [TDS] (mg/L)	**MW-1602 (bg)**	**59.17**	**52**	**43**	**Yes**	**13**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Total Dissolved Solids [TDS] (mg/L)	MW-1603 (bg)	0.6747	3	43	No	13	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1608 (bg)	36.72	28	43	No	13	0	n/a	n/a	0.01	NP

Sen's Slope Estimator

MW-1601A (bg)



n = 13

Slope = -0.009774 units per year.

Mann-Kendall statistic = -11
critical = -43

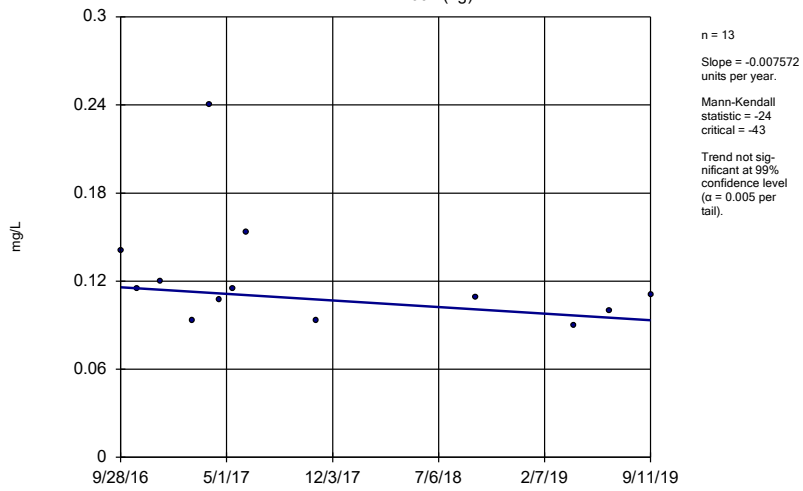
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 11/25/2019 3:19 PM View: Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1602 (bg)



n = 13

Slope = -0.007572 units per year.

Mann-Kendall statistic = -24
critical = -43

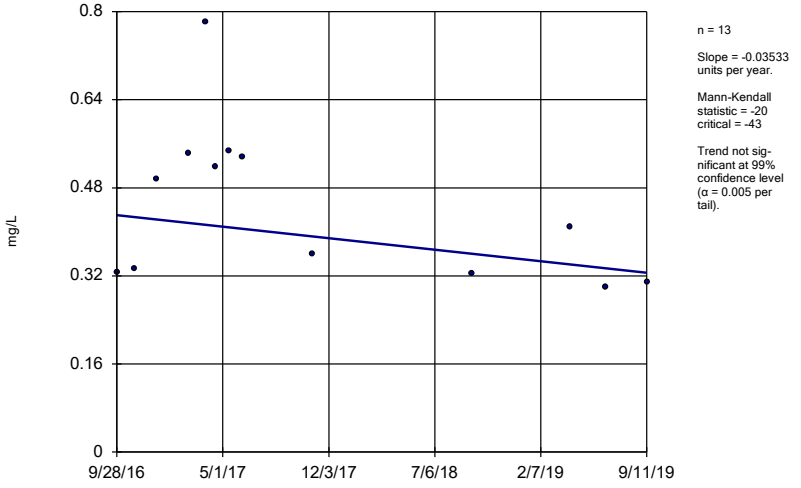
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 11/25/2019 3:19 PM View: Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1603 (bg)



n = 13

Slope = -0.03533 units per year.

Mann-Kendall statistic = -20
critical = -43

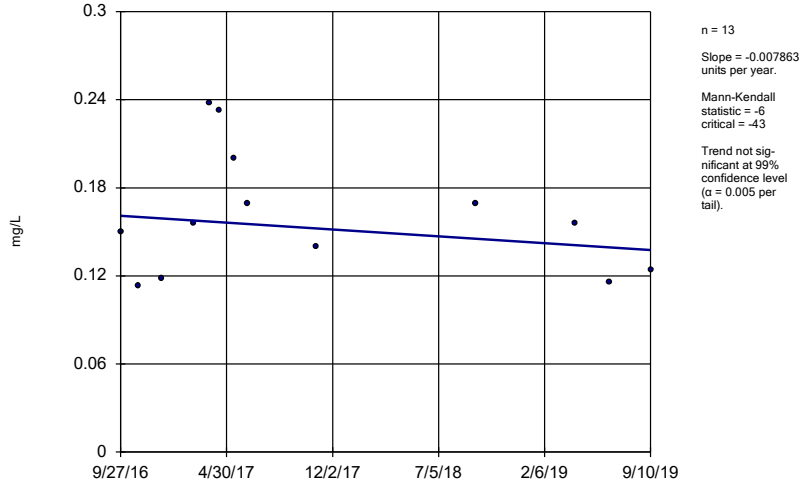
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 11/25/2019 3:19 PM View: Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1608 (bg)



n = 13

Slope = -0.007863 units per year.

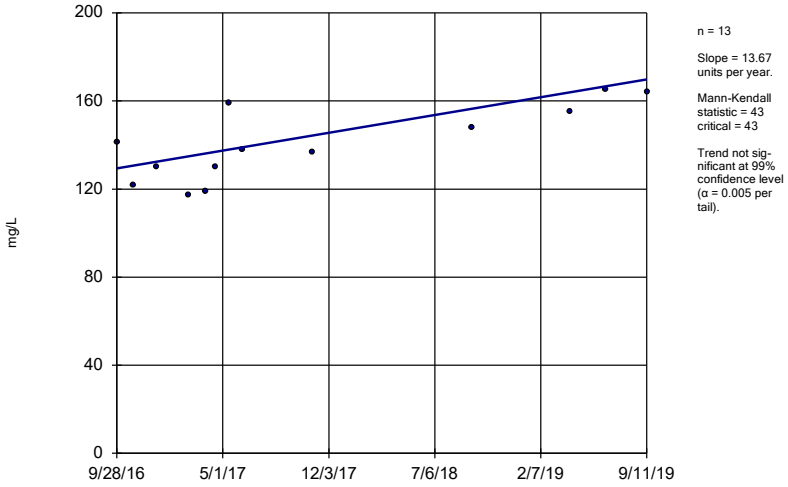
Mann-Kendall statistic = -6
critical = -43

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 11/25/2019 3:19 PM View: Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1601A (bg)



n = 13

Slope = 13.67 units per year.

Mann-Kendall statistic = 43
critical = 43

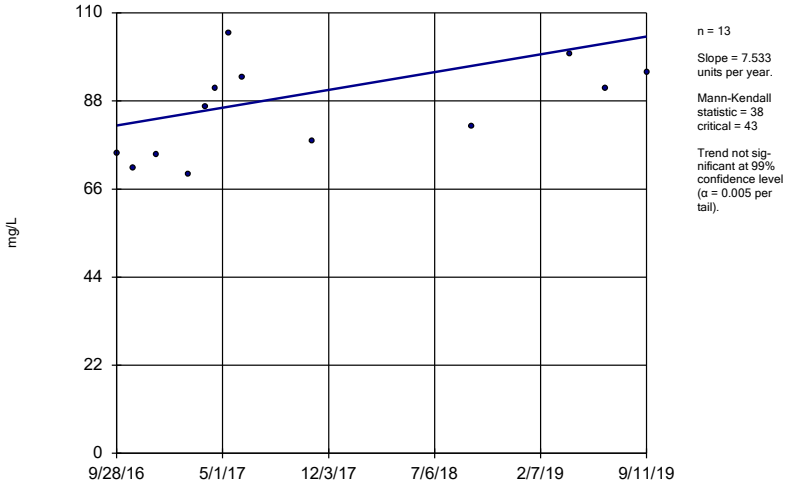
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total Analysis Run 11/25/2019 3:19 PM View: Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1602 (bg)



n = 13

Slope = 7.533 units per year.

Mann-Kendall statistic = 38
critical = 43

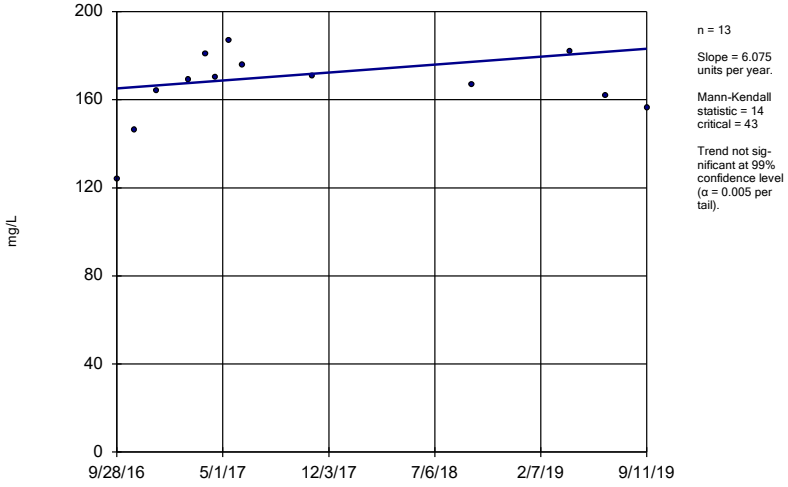
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total Analysis Run 11/25/2019 3:19 PM View: Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1603 (bg)



n = 13

Slope = 6.075 units per year.

Mann-Kendall statistic = 14
critical = 43

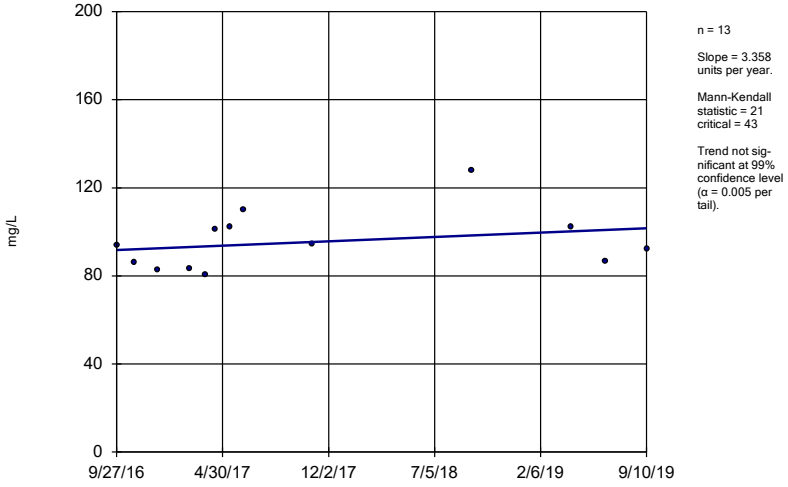
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total Analysis Run 11/25/2019 3:19 PM View: Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1608 (bg)



n = 13

Slope = 3.358 units per year.

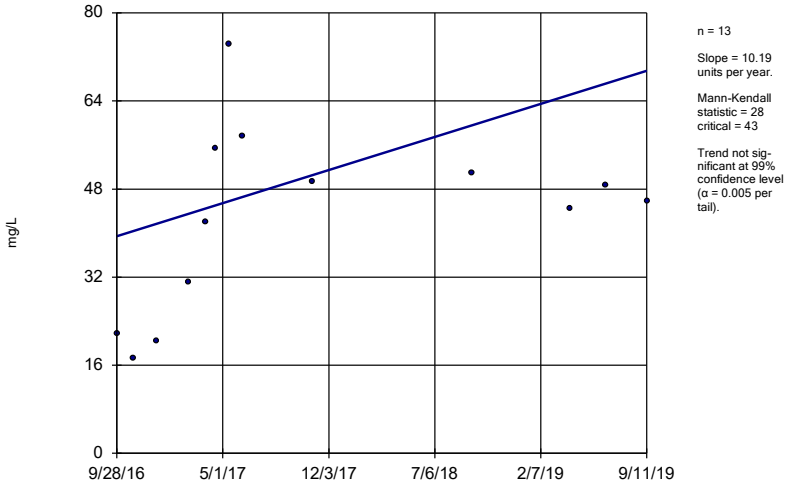
Mann-Kendall statistic = 21
critical = 43

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total Analysis Run 11/25/2019 3:19 PM View: Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1601A (bg)



n = 13

Slope = 10.19 units per year.

Mann-Kendall statistic = 28
critical = 43

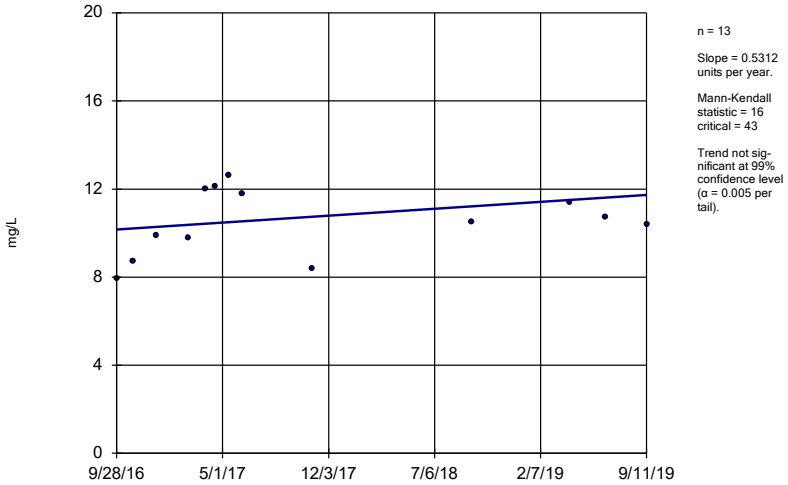
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 11/25/2019 3:19 PM View: Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1602 (bg)



n = 13

Slope = 0.5312 units per year.

Mann-Kendall statistic = 16
critical = 43

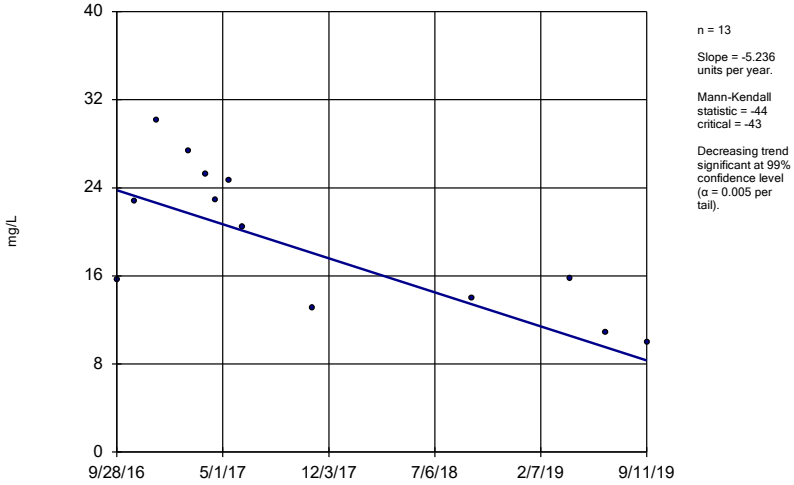
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 11/25/2019 3:19 PM View: Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1603 (bg)



n = 13

Slope = -5.236 units per year.

Mann-Kendall statistic = -44
critical = -43

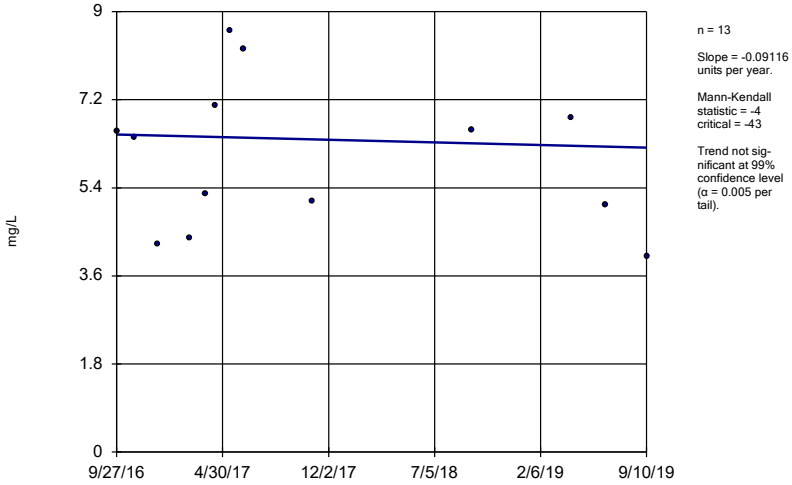
Decreasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 11/25/2019 3:19 PM View: Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1608 (bg)



n = 13

Slope = -0.09116 units per year.

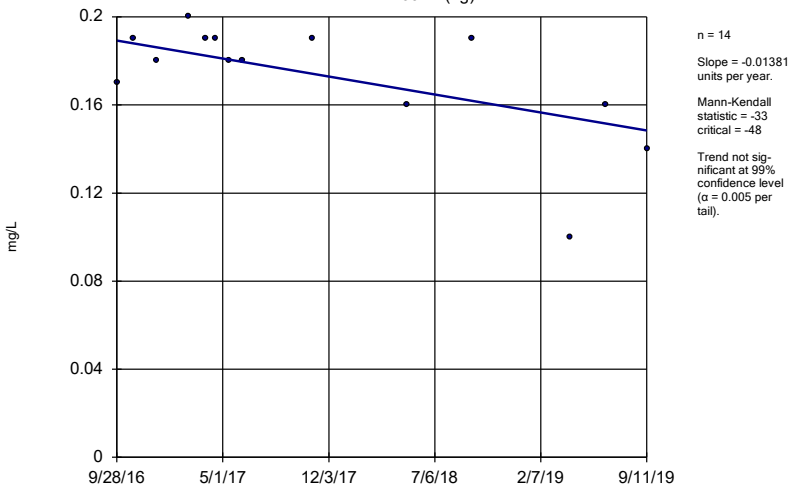
Mann-Kendall statistic = -4
critical = -43

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 11/25/2019 3:19 PM View: Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1601A (bg)



n = 14

Slope = -0.01381 units per year.

Mann-Kendall statistic = -33
critical = -48

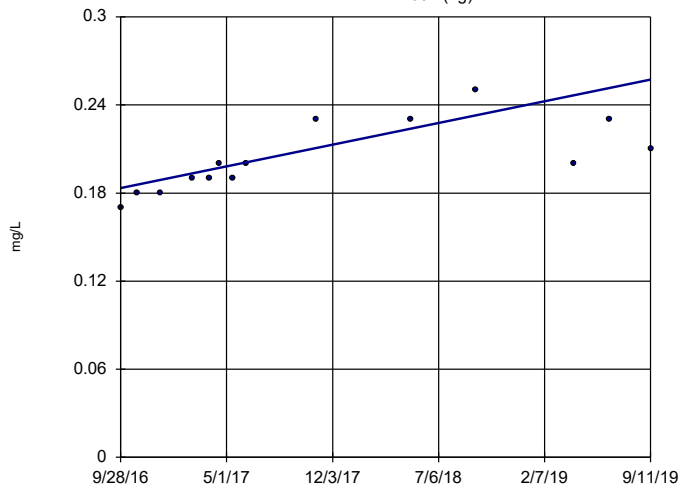
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Fluoride, total Analysis Run 11/25/2019 3:19 PM View: Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1602 (bg)



n = 14

Slope = 0.025 units per year.

Mann-Kendall statistic = 63
critical = 48

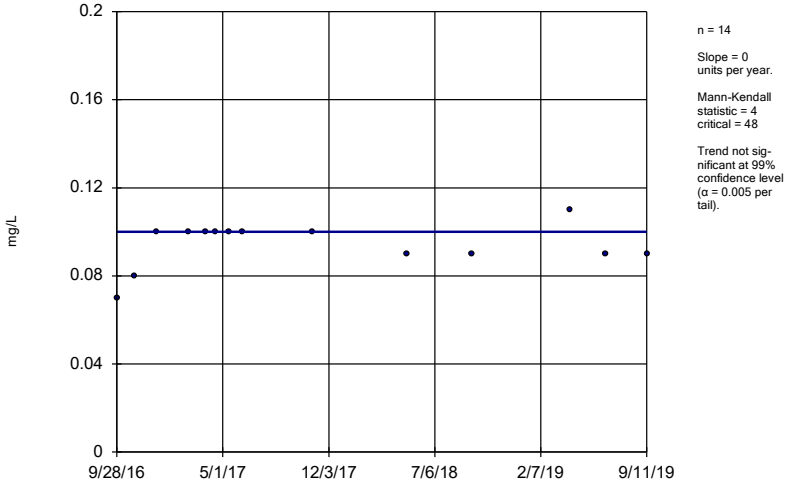
Increasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Fluoride, total Analysis Run 11/25/2019 3:19 PM View: Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1603 (bg)



n = 14

Slope = 0 units per year.

Mann-Kendall statistic = 4
critical = 48

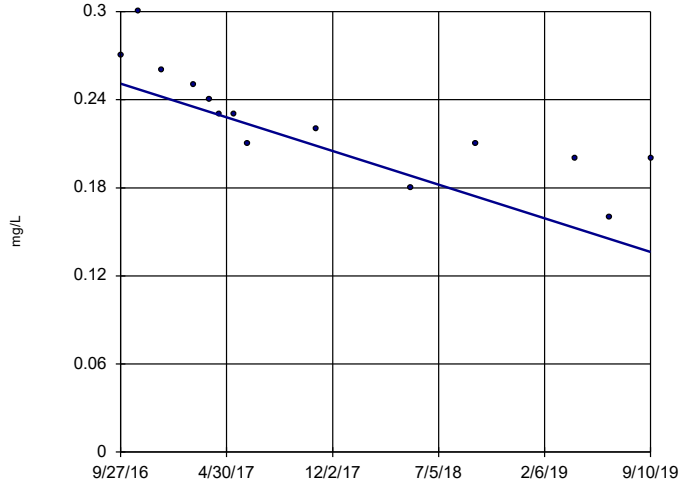
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Fluoride, total Analysis Run 11/25/2019 3:19 PM View: Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1608 (bg)



n = 14

Slope = -0.03883 units per year.

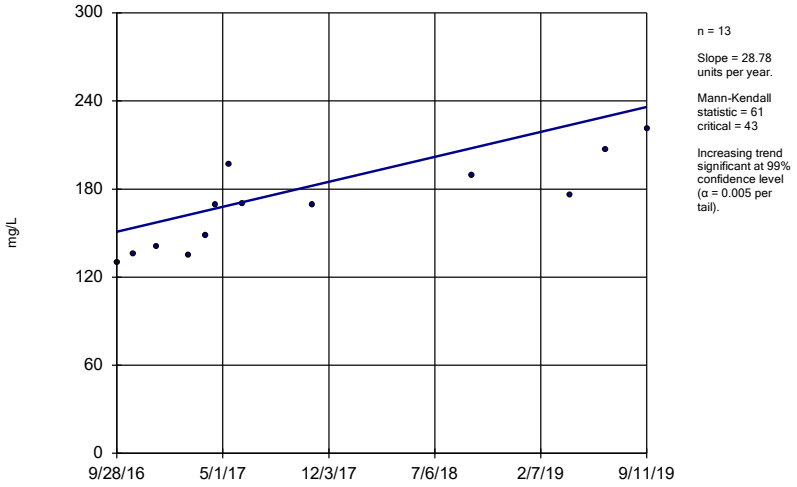
Mann-Kendall statistic = -76
critical = -48

Decreasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Fluoride, total Analysis Run 11/25/2019 3:19 PM View: Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1601A (bg)



n = 13

Slope = 28.78 units per year.

Mann-Kendall statistic = 61 critical = 43

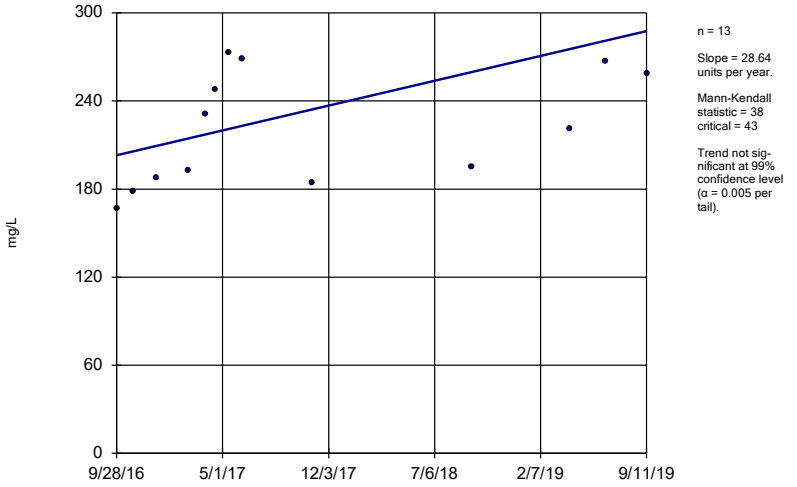
Increasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 11/25/2019 3:19 PM View: Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1602 (bg)



n = 13

Slope = 28.64 units per year.

Mann-Kendall statistic = 38 critical = 43

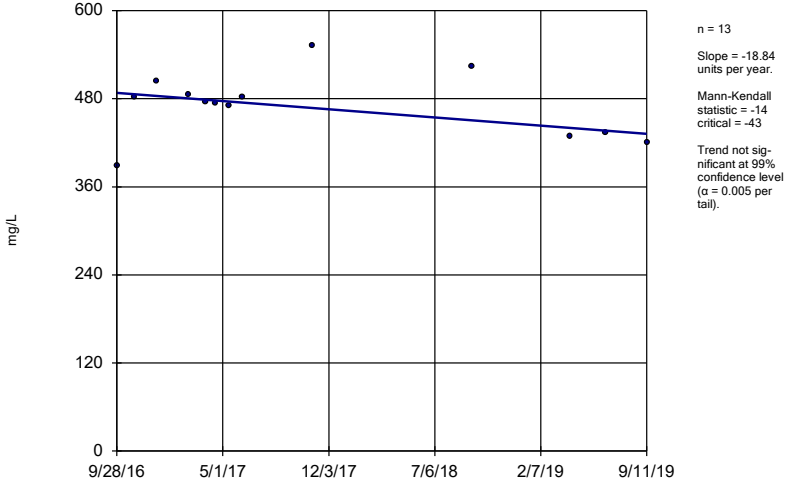
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 11/25/2019 3:19 PM View: Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1603 (bg)



n = 13

Slope = -18.84 units per year.

Mann-Kendall statistic = -14 critical = -43

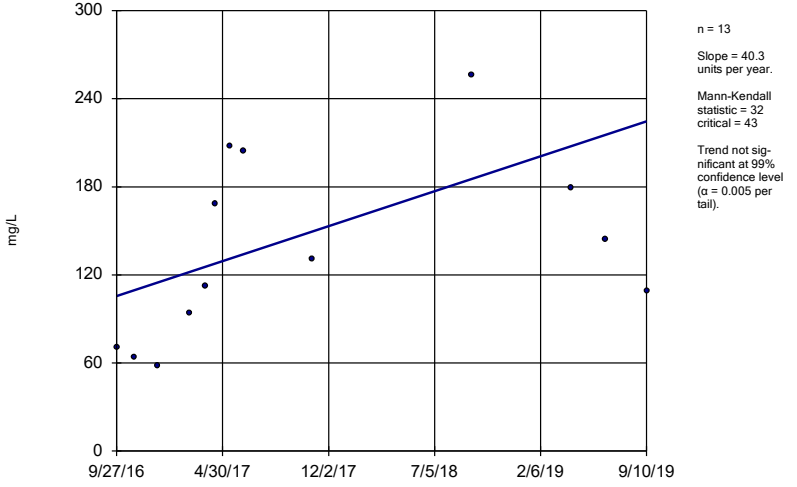
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 11/25/2019 3:19 PM View: Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1608 (bg)



n = 13

Slope = 40.3 units per year.

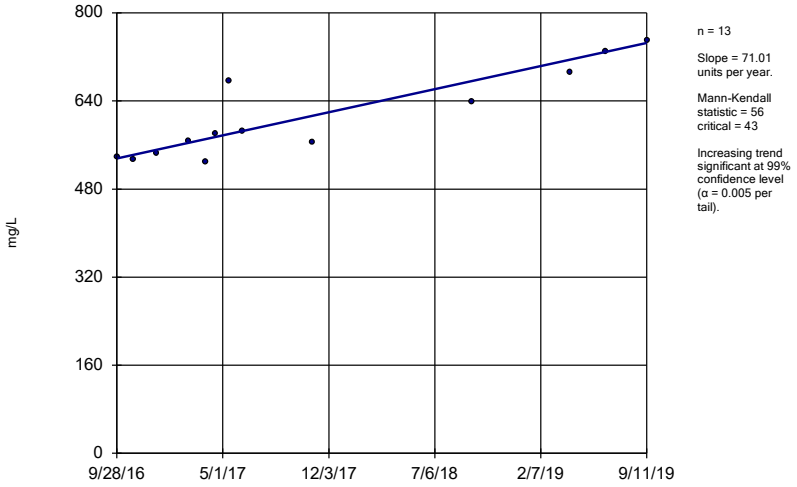
Mann-Kendall statistic = 32 critical = 43

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 11/25/2019 3:19 PM View: Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sen's Slope Estimator

MW-1601A (bg)



n = 13

Slope = 71.01 units per year.

Mann-Kendall statistic = 56
critical = 43

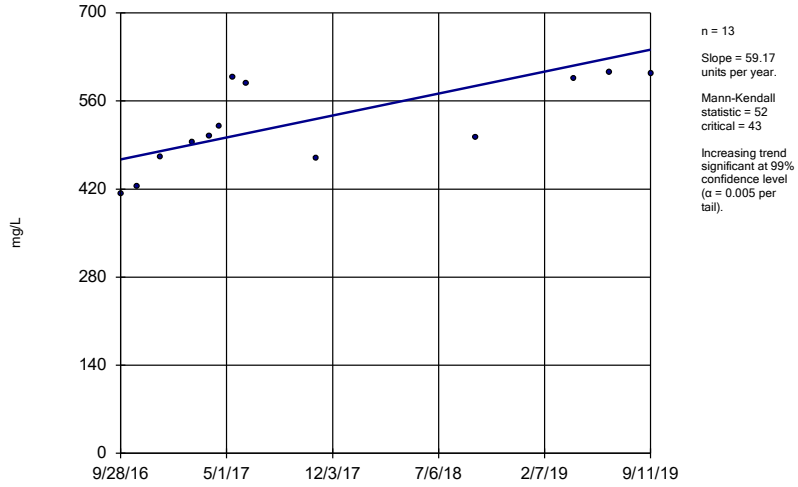
Increasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 11/25/2019 3:19 PM View: Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1602 (bg)



n = 13

Slope = 59.17 units per year.

Mann-Kendall statistic = 52
critical = 43

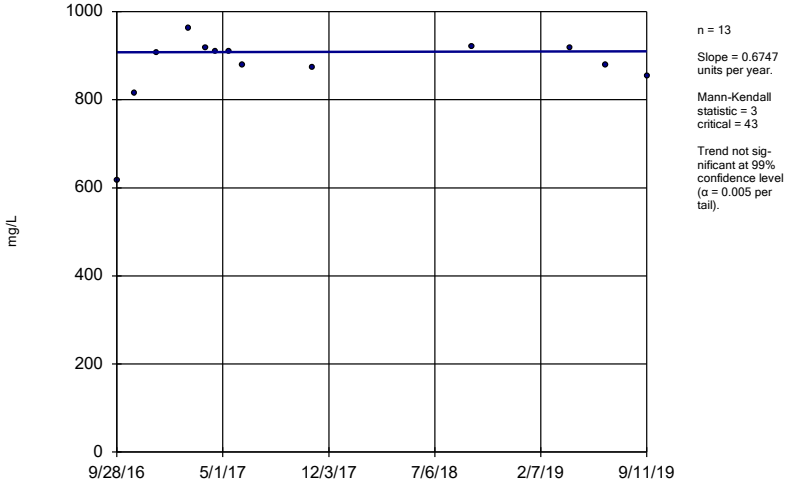
Increasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 11/25/2019 3:19 PM View: Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1603 (bg)



n = 13

Slope = 0.6747 units per year.

Mann-Kendall statistic = 3
critical = 43

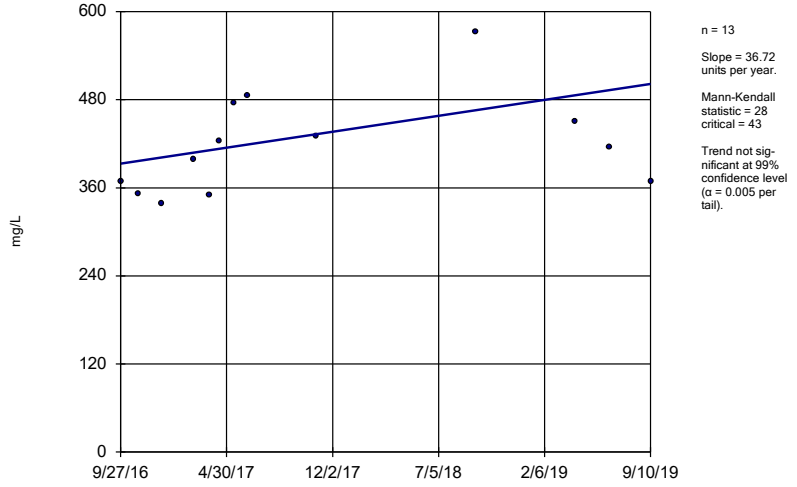
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 11/25/2019 3:19 PM View: Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1608 (bg)



n = 13

Slope = 36.72 units per year.

Mann-Kendall statistic = 28
critical = 43

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 11/25/2019 3:19 PM View: Interwell
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

FIGURE G: INTERWELL PREDICTION LIMITS

Interwell Prediction Limit Summary Table - All Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 12/9/2019, 8:37 AM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron, total (mg/L)	n/a	0.6142	n/a	n/a	8 future	n/a	44	0.6107	0.1197	0	None	x^(1/3)	0.0009403	Param Inter 1 of 2
Calcium, total (mg/L)	n/a	200.1	n/a	n/a	8 future	n/a	44	10.88	1.633	0	None	sqrt(x)	0.0009403	Param Inter 1 of 2
Chloride, total (mg/L)	n/a	68.45	n/a	n/a	8 future	n/a	44	2.704	0.7615	0	None	ln(x)	0.0009403	Param Inter 1 of 2
Fluoride, total (mg/L)	n/a	0.271	n/a	n/a	8 future	n/a	48	0.03432	0.01967	0	None	x^2	0.0009403	Param Inter 1 of 2
Sulfate, total (mg/L)	n/a	673.9	n/a	n/a	8 future	n/a	44	5.353	0.58	0	None	ln(x)	0.0009403	Param Inter 1 of 2
Total Dissolved Solids [TDS] (mg/L)	n/a	1042	n/a	n/a	8 future	n/a	44	6.348	0.3006	0	None	ln(x)	0.0009403	Param Inter 1 of 2

FIGURE H: TOLERANCE LIMITS

Upper Tolerance Limits - App IV

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 11/26/2019, 1:34 PM

Constituent	Upper Lim.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony, total (mg/L)	0.0001	52	n/a	n/a	9.615	n/a	n/a	0.06944	NP Inter(normality)
Arsenic, total (mg/L)	0.0007362	52	0.0004713	0.000129	0	None	No	0.05	Inter
Barium, total (mg/L)	0.0653	52	n/a	n/a	0	n/a	n/a	0.06944	NP Inter(normality)
Beryllium, total (mg/L)	0.0001	52	n/a	n/a	86.54	n/a	n/a	0.06944	NP Inter(NDs)
Cadmium, total (mg/L)	0.00003	52	n/a	n/a	7.692	n/a	n/a	0.06944	NP Inter(normality)
Chromium, total (mg/L)	0.0008959	48	-8.21	0.5744	2.083	None	ln(x)	0.05	Inter
Cobalt, total (mg/L)	0.0007027	52	-9.164	0.9269	3.846	None	ln(x)	0.05	Inter
Combined Radium 226 + 228 (pCi/L)	2.328	52	0.8404	0.3337	0	None	sqrt(x)	0.05	Inter
Fluoride, total (mg/L)	0.2693	56	0.03342	0.01924	0	None	x^2	0.05	Inter
Lead, total (mg/L)	0.0006734	52	-9.264	0.9549	7.692	None	ln(x)	0.05	Inter
Lithium, total (mg/L)	0.02601	52	0.01169	0.006974	11.54	None	No	0.05	Inter
Mercury, total (mg/L)	0.000005	52	n/a	n/a	92.31	n/a	n/a	0.06944	NP Inter(NDs)
Molybdenum, total (mg/L)	0.003756	52	0.03458	0.01301	3.846	None	sqrt(x)	0.05	Inter
Selenium, total (mg/L)	0.0015	52	n/a	n/a	0	n/a	n/a	0.06944	NP Inter(normality)
Thallium, total (mg/L)	0.0005	52	n/a	n/a	25	n/a	n/a	0.06944	NP Inter(normality)

FIGURE I: GROUNDWATER PROTECTION STANDARDS

MOUNTAINEER BAP GWPS				
Constituent Name	**MCL**	**CCR Rule-Specified**	**Background Limit**	**GWPS**
Antimony, Total (mg/L)	0.006		0.0001	0.006
Arsenic, Total (mg/L)	0.01		0.00074	0.01
Barium, Total (mg/L)	2		0.065	2
Beryllium, Total (mg/L)	0.004		0.0001	0.004
Cadmium, Total (mg/L)	0.005		0.00003	0.005
Chromium, Total (mg/L)	0.1		0.0009	0.1
Cobalt, Total (mg/L)	n/a	0.006	0.0007	0.006
Combined Radium, Total (pCi/L)	5		2.33	5
Fluoride, Total (mg/L)	4		0.27	4
Lead, Total (mg/L)	0.015		0.00067	0.015
Lithium, Total (mg/L)	n/a	0.04	0.026	0.04
Mercury, Total (mg/L)	0.002		0.000005	0.002
Molybdenum, Total (mg/L)	n/a	0.1	0.0038	0.1
Selenium, Total (mg/L)	0.05		0.0015	0.05
Thallium, Total (mg/L)	0.002		0.0005	0.002

**Grey cell indicates ACL is higher than MCL.*

**MCL = Maximum Contaminant Level*

**RSL = Regional Screening Level*

FIGURE J: CONFIDENCE INTERVALS

Confidence Interval Summary Table - Significant Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 12/1/2019, 11:08 AM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Lithium, total (mg/L)	**MW-1605D**	**0.07997**	**0.05932**	**0.04**	**Yes**	**13**	**0.06839**	**0.01741**	**0**	**None**	**x^2**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1605S**	**0.07823**	**0.05645**	**0.04**	**Yes**	**13**	**0.06734**	**0.01465**	**0**	**None**	**No**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1606D**	**0.1264**	**0.0998**	**0.04**	**Yes**	**13**	**0.1121**	**0.02078**	**0**	**None**	**x^2**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1606S**	**0.1172**	**0.09409**	**0.04**	**Yes**	**13**	**0.1049**	**0.01791**	**0**	**None**	**x^2**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1607D**	**0.09986**	**0.07352**	**0.04**	**Yes**	**13**	**0.08669**	**0.01771**	**0**	**None**	**No**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1607S**	**0.1132**	**0.08938**	**0.04**	**Yes**	**13**	**0.1013**	**0.01604**	**0**	**None**	**No**	**0.01**	**Param.**

Confidence Interval Summary Table - All Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 12/1/2019, 11:08 AM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony, total (mg/L)	MW-1604D	0.0001368	0.00008695	0.006	No	13	0.0001015	0.0000467	7.692	None	x^3	0.01	Param.
Antimony, total (mg/L)	MW-1604S	0.00015	0.00003	0.006	No	13	0.00007923	0.00006075	0	None	No	0.01	NP (normality)
Antimony, total (mg/L)	MW-1605D	0.0001	0.00003	0.006	No	13	0.00003923	0.00001891	7.692	None	No	0.01	NP (normality)
Antimony, total (mg/L)	MW-1605S	0.00007	0.00003	0.006	No	13	0.00005769	0.0000332	0	None	No	0.01	NP (normality)
Antimony, total (mg/L)	MW-1606D	0.00019	0.00015	0.006	No	13	0.0001692	0.00002957	0	None	No	0.01	NP (normality)
Antimony, total (mg/L)	MW-1606S	0.0001601	0.0001414	0.006	No	13	0.0001508	0.00001256	0	None	No	0.01	Param.
Antimony, total (mg/L)	MW-1607D	0.00004	0.00003	0.006	No	13	0.00003231	0.000005991	0	None	No	0.01	NP (normality)
Antimony, total (mg/L)	MW-1607S	0.00055	0.00041	0.006	No	13	0.00048	0.0001156	0	None	No	0.01	NP (normality)
Arsenic, total (mg/L)	MW-1604D	0.0005091	0.0003525	0.01	No	13	0.0004308	0.0001053	0	None	No	0.01	Param.
Arsenic, total (mg/L)	MW-1604S	0.0004579	0.0003544	0.01	No	13	0.0004062	0.00006959	0	None	No	0.01	Param.
Arsenic, total (mg/L)	MW-1605D	0.002577	0.002184	0.01	No	13	0.002381	0.0002641	0	None	No	0.01	Param.
Arsenic, total (mg/L)	MW-1605S	0.0009334	0.0005651	0.01	No	13	0.0007492	0.0002476	0	None	No	0.01	Param.
Arsenic, total (mg/L)	MW-1606D	0.0007217	0.0004037	0.01	No	13	0.0005846	0.0002808	0	None	ln(x)	0.01	Param.
Arsenic, total (mg/L)	MW-1606S	0.0008661	0.0007169	0.01	No	13	0.0007915	0.0001003	0	None	No	0.01	Param.
Arsenic, total (mg/L)	MW-1607D	0.001342	0.001021	0.01	No	13	0.001182	0.0002155	0	None	No	0.01	Param.
Arsenic, total (mg/L)	MW-1607S	0.001387	0.0009372	0.01	No	12	0.001168	0.0003042	0	None	sqrt(x)	0.01	Param.
Barium, total (mg/L)	MW-1604D	0.0529	0.0275	2	No	13	0.03432	0.009917	0	None	No	0.01	NP (normality)
Barium, total (mg/L)	MW-1604S	0.03004	0.02745	2	No	13	0.02875	0.001746	0	None	No	0.01	Param.
Barium, total (mg/L)	MW-1605D	0.02981	0.02542	2	No	13	0.02762	0.002947	0	None	No	0.01	Param.
Barium, total (mg/L)	MW-1605S	0.03741	0.02633	2	No	13	0.03187	0.007452	0	None	No	0.01	Param.
Barium, total (mg/L)	MW-1606D	0.05922	0.05064	2	No	13	0.05493	0.005769	0	None	No	0.01	Param.
Barium, total (mg/L)	MW-1606S	0.07539	0.06845	2	No	13	0.07192	0.004669	0	None	No	0.01	Param.
Barium, total (mg/L)	MW-1607D	0.1391	0.09198	2	No	13	0.1155	0.0317	0	None	No	0.01	Param.
Barium, total (mg/L)	MW-1607S	0.07379	0.06124	2	No	12	0.06752	0.007998	0	None	No	0.01	Param.
Beryllium, total (mg/L)	MW-1604D	0.0001	0.0001	0.004	No	13	0.0001	0	100	None	No	0.01	NP (NDs)
Beryllium, total (mg/L)	MW-1604S	0.0001	0.000024	0.004	No	13	0.00009415	0.00002108	92.31	None	No	0.01	NP (NDs)
Beryllium, total (mg/L)	MW-1605D	0.0001	0.0001	0.004	No	13	0.0001	0	100	None	No	0.01	NP (NDs)
Beryllium, total (mg/L)	MW-1605S	0.0001	0.000009	0.004	No	13	0.00007969	0.0000387	76.92	None	No	0.01	NP (NDs)
Beryllium, total (mg/L)	MW-1606D	0.0001	0.000005	0.004	No	13	0.00007308	0.0000425	69.23	None	No	0.01	NP (normality)
Beryllium, total (mg/L)	MW-1606S	0.0001	0.000005	0.004	No	13	0.00009269	0.00002635	92.31	None	No	0.01	NP (NDs)
Beryllium, total (mg/L)	MW-1607D	0.0001	0.000008	0.004	No	13	0.00009292	0.00002552	92.31	None	No	0.01	NP (NDs)
Beryllium, total (mg/L)	MW-1607S	0.000123	0.00001	0.004	No	13	0.00008077	0.0000414	69.23	None	No	0.01	NP (normality)
Cadmium, total (mg/L)	MW-1604D	0.000138	0.0000574	0.005	No	13	0.00009769	0.00005418	0	None	No	0.01	Param.
Cadmium, total (mg/L)	MW-1604S	0.00021	0.00003	0.005	No	13	0.00009923	0.00008636	0	None	No	0.01	NP (normality)
Cadmium, total (mg/L)	MW-1605D	0.000035170	0.000018670	0.005	No	13	0.00002692	0.00001109	0	None	No	0.01	Param.
Cadmium, total (mg/L)	MW-1605S	0.00013	0.00005	0.005	No	13	0.00007154	0.0000223	0	None	No	0.01	NP (normality)
Cadmium, total (mg/L)	MW-1606D	0.000078880	0.0000642	0.005	No	13	0.00007154	0.000009871	0	None	No	0.01	Param.
Cadmium, total (mg/L)	MW-1606S	0.000079430	0.000066720	0.005	No	13	0.00007308	0.000008549	0	None	No	0.01	Param.
Cadmium, total (mg/L)	MW-1607D	0.00003	0.00001	0.005	No	13	0.00002192	0.000006934	61.54	None	No	0.01	NP (normality)
Cadmium, total (mg/L)	MW-1607S	0.00006	0.00003	0.005	No	13	0.00005385	0.00005124	0	None	No	0.01	NP (normality)
Chromium, total (mg/L)	MW-1604D	0.0004555	0.0001774	0.1	No	13	0.0003165	0.000187	0	None	No	0.01	Param.
Chromium, total (mg/L)	MW-1604S	0.0003179	0.0001026	0.1	No	12	0.0002222	0.0001771	0	None	x^(1/3)	0.01	Param.
Chromium, total (mg/L)	MW-1605D	0.0002588	0.000074240	0.1	No	12	0.0001733	0.0001416	0	None	sqrt(x)	0.01	Param.
Chromium, total (mg/L)	MW-1605S	0.0005477	0.0002212	0.1	No	12	0.0003844	0.0002081	0	None	No	0.01	Param.
Chromium, total (mg/L)	MW-1606D	0.0005256	0.0001334	0.1	No	13	0.0003512	0.0003008	0	None	sqrt(x)	0.01	Param.
Chromium, total (mg/L)	MW-1606S	0.0004454	0.0000925	0.1	No	13	0.0003065	0.0003456	0	None	x^(1/3)	0.01	Param.
Chromium, total (mg/L)	MW-1607D	0.000275	0.000069080	0.1	No	12	0.0002061	0.0002194	0	None	ln(x)	0.01	Param.
Chromium, total (mg/L)	MW-1607S	0.0005017	0.0002021	0.1	No	12	0.0003519	0.0001909	0	None	No	0.01	Param.
Cobalt, total (mg/L)	MW-1604D	0.001806	0.001283	0.006	No	13	0.001191	0.0007762	0	None	x^5	0.01	Param.
Cobalt, total (mg/L)	MW-1604S	0.00216	0.000308	0.006	No	13	0.001017	0.0008896	0	None	No	0.01	NP (normality)
Cobalt, total (mg/L)	MW-1605D	0.001809	0.001633	0.006	No	13	0.001721	0.0001182	0	None	No	0.01	Param.
Cobalt, total (mg/L)	MW-1605S	0.001093	0.0004255	0.006	No	13	0.0008512	0.0007502	0	None	ln(x)	0.01	Param.
Cobalt, total (mg/L)	MW-1606D	0.0022	0.00117	0.006	No	13	0.001655	0.0008412	0	None	No	0.01	NP (normality)
Cobalt, total (mg/L)	MW-1606S	0.000364	0.0002429	0.006	No	13	0.0003035	0.00008138	0	None	No	0.01	Param.
Cobalt, total (mg/L)	MW-1607D	0.000805	0.000399	0.006	No	13	0.0005857	0.0001814	0	None	No	0.01	NP (normality)

Confidence Interval Summary Table - All Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 12/1/2019, 11:08 AM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Cobalt, total (mg/L)	MW-1607S	0.00259	0.00084	0.006	No	12	0.001256	0.0006424	0	None	No	0.01	NP (normality)
Combined Radium 226 + 228 (pCi/L)	MW-1604D	1.572	0.52	5	No	13	1.094	0.8316	0	None	sqrt(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1604S	1.447	0.6675	5	No	12	1.075	0.5623	0	None	sqrt(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1605D	1.745	0.6532	5	No	13	1.267	0.9067	0	None	x^(1/3)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1605S	2.692	0.337	5	No	13	0.8627	0.8402	0	None	No	0.01	NP (normality)
Combined Radium 226 + 228 (pCi/L)	MW-1606D	2.231	0.8522	5	No	12	1.582	0.9769	0	None	sqrt(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1606S	1.708	0.6857	5	No	13	1.197	0.6873	0	None	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1607D	1.961	1.069	5	No	13	1.58	0.8076	0	None	ln(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1607S	2.214	1.066	5	No	13	1.64	0.7717	0	None	No	0.01	Param.
Fluoride, total (mg/L)	MW-1604D	0.1974	0.1683	4	No	14	0.1829	0.02054	0	None	No	0.01	Param.
Fluoride, total (mg/L)	MW-1604S	0.2114	0.1905	4	No	14	0.2007	0.01542	0	None	x^2	0.01	Param.
Fluoride, total (mg/L)	MW-1605D	0.2103	0.184	4	No	14	0.1971	0.01858	0	None	No	0.01	Param.
Fluoride, total (mg/L)	MW-1605S	0.3	0.23	4	No	14	0.2593	0.03362	0	None	No	0.01	NP (normality)
Fluoride, total (mg/L)	MW-1606D	0.28	0.24	4	No	14	0.2614	0.07853	0	None	No	0.01	NP (normality)
Fluoride, total (mg/L)	MW-1606S	0.4972	0.4029	4	No	15	0.442	0.08205	0	None	x^3	0.01	Param.
Fluoride, total (mg/L)	MW-1607D	0.544	0.4773	4	No	15	0.5107	0.0492	0	None	No	0.01	Param.
Fluoride, total (mg/L)	MW-1607S	0.3055	0.2622	4	No	14	0.2829	0.03315	0	None	x^2	0.01	Param.
Lead, total (mg/L)	MW-1604D	0.000303	0.000022	0.015	No	13	0.000112	0.0001611	15.38	None	No	0.01	NP (Cohens/xfrm)
Lead, total (mg/L)	MW-1604S	0.0001707	0.00004925	0.015	No	13	0.00007731	0.00003657	23.08	Cohen`s	No	0.01	Param.
Lead, total (mg/L)	MW-1605D	0.00008	0.00001	0.015	No	13	0.00003885	0.00003261	15.38	None	No	0.01	NP (Cohens/xfrm)
Lead, total (mg/L)	MW-1605S	0.0007334	0.0001364	0.015	No	13	0.0004746	0.0005588	0	None	sqrt(x)	0.01	Param.
Lead, total (mg/L)	MW-1606D	0.000491	0.00003	0.015	No	12	0.0001622	0.0001669	16.67	None	No	0.01	NP (Cohens/xfrm)
Lead, total (mg/L)	MW-1606S	0.0001517	0.00006045	0.015	No	13	0.0001061	0.00006136	7.692	None	No	0.01	Param.
Lead, total (mg/L)	MW-1607D	0.000179	0.000041	0.015	No	13	0.0001143	0.0001597	7.692	None	No	0.01	NP (normality)
Lead, total (mg/L)	MW-1607S	0.00125	0.00009	0.015	No	12	0.0003435	0.0004635	0	None	No	0.01	NP (normality)
Lithium, total (mg/L)	MW-1604D	0.05535	0.02892	0.04	No	13	0.04214	0.01777	7.692	None	No	0.01	Param.
Lithium, total (mg/L)	MW-1604S	0.04789	0.03251	0.04	No	13	0.0402	0.01035	0	None	No	0.01	Param.
Lithium, total (mg/L)	**MW-1605D**	**0.07997**	**0.05932**	**0.04**	**Yes**	**13**	**0.06839**	**0.01741**	**0**	**None**	**x^2**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1605S**	**0.07823**	**0.05645**	**0.04**	**Yes**	**13**	**0.06734**	**0.01465**	**0**	**None**	**No**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1606D**	**0.1264**	**0.0998**	**0.04**	**Yes**	**13**	**0.1121**	**0.02078**	**0**	**None**	**x^2**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1606S**	**0.1172**	**0.09409**	**0.04**	**Yes**	**13**	**0.1049**	**0.01791**	**0**	**None**	**x^2**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1607D**	**0.09986**	**0.07352**	**0.04**	**Yes**	**13**	**0.08669**	**0.01771**	**0**	**None**	**No**	**0.01**	**Param.**
Lithium, total (mg/L)	**MW-1607S**	**0.1132**	**0.08938**	**0.04**	**Yes**	**13**	**0.1013**	**0.01604**	**0**	**None**	**No**	**0.01**	**Param.**
Mercury, total (mg/L)	MW-1604D	0.000036	0.000003	0.002	No	13	0.000007231	0.000008662	84.62	None	No	0.01	NP (NDs)
Mercury, total (mg/L)	MW-1604S	0.000005	0.000003	0.002	No	13	0.000004846	5.5e-7	92.31	None	No	0.01	NP (NDs)
Mercury, total (mg/L)	MW-1605D	0.000005	0.000002	0.002	No	13	0.000004769	8.3e-7	92.31	None	No	0.01	NP (NDs)
Mercury, total (mg/L)	MW-1605S	0.000005	0.000003	0.002	No	13	0.000004846	5.5e-7	92.31	None	No	0.01	NP (NDs)
Mercury, total (mg/L)	MW-1606D	0.000005	0.000004	0.002	No	13	0.000004923	2.8e-7	92.31	None	No	0.01	NP (NDs)
Mercury, total (mg/L)	MW-1606S	0.000005	0.000002	0.002	No	13	0.000004769	8.3e-7	92.31	None	No	0.01	NP (NDs)
Mercury, total (mg/L)	MW-1607D	0.000005	0.000002	0.002	No	13	0.000004538	0.000001127	84.62	None	No	0.01	NP (NDs)
Mercury, total (mg/L)	MW-1607S	0.000005	0.000003	0.002	No	12	0.000004667	7.8e-7	83.33	None	No	0.01	NP (NDs)
Molybdenum, total (mg/L)	MW-1604D	0.01906	0.01355	0.1	No	13	0.01243	0.008423	7.692	None	x^5	0.01	Param.
Molybdenum, total (mg/L)	MW-1604S	0.0166	0.00247	0.1	No	12	0.008351	0.007211	0	None	No	0.01	NP (normality)
Molybdenum, total (mg/L)	MW-1605D	0.05029	0.04271	0.1	No	13	0.0465	0.005091	0	None	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1605S	0.02117	0.01531	0.1	No	13	0.01824	0.003943	0	None	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1606D	0.07877	0.0702	0.1	No	13	0.07448	0.005767	0	None	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1606S	0.09939	0.07119	0.1	No	13	0.08529	0.01896	0	None	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1607D	0.09015	0.08251	0.1	No	13	0.08633	0.005134	0	None	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1607S	0.04659	0.03902	0.1	No	13	0.04281	0.00509	0	None	No	0.01	Param.
Selenium, total (mg/L)	MW-1604D	0.002029	0.0007384	0.05	No	13	0.001538	0.001154	0	None	ln(x)	0.01	Param.
Selenium, total (mg/L)	MW-1604S	0.002411	0.001266	0.05	No	13	0.001838	0.0007698	0	None	No	0.01	Param.
Selenium, total (mg/L)	MW-1605D	0.0003	0.0002	0.05	No	13	0.0002385	0.00006504	0	None	No	0.01	NP (normality)
Selenium, total (mg/L)	MW-1605S	0.001752	0.0006945	0.05	No	13	0.001223	0.0007108	0	None	No	0.01	Param.
Selenium, total (mg/L)	MW-1606D	0.006576	0.002732	0.05	No	13	0.004654	0.002584	0	None	No	0.01	Param.
Selenium, total (mg/L)	MW-1606S	0.00169	0.0008356	0.05	No	13	0.001331	0.0007216	0	None	ln(x)	0.01	Param.

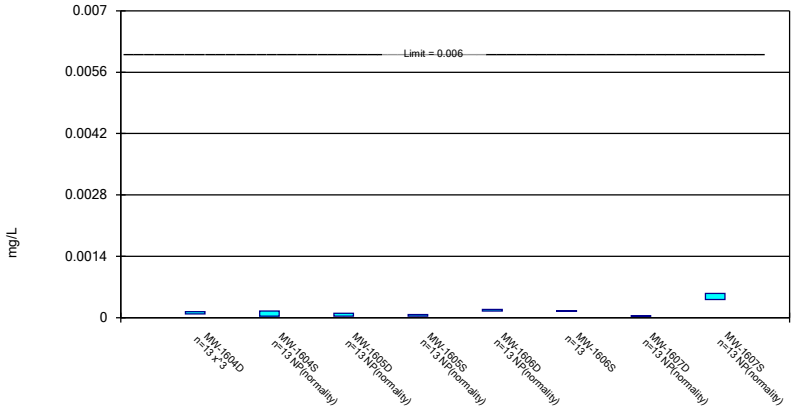
Confidence Interval Summary Table - All Results

Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP Printed 12/1/2019, 11:08 AM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Selenium, total (mg/L)	MW-1607D	0.0001	0.00003	0.05	No	13	0.00008846	0.0001256	15.38	None	No	0.01	NP (normality)
Selenium, total (mg/L)	MW-1607S	0.009568	0.00677	0.05	No	13	0.008169	0.001881	0	None	No	0.01	Param.
Thallium, total (mg/L)	MW-1604D	0.0004453	0.0001587	0.002	No	13	0.0002787	0.0001563	23.08	Cohen`s	No	0.01	Param.
Thallium, total (mg/L)	MW-1604S	0.0003	0.00002	0.002	No	13	0.0001446	0.0001552	7.692	None	No	0.01	NP (normality)
Thallium, total (mg/L)	MW-1605D	0.0005	0.00004	0.002	No	13	0.0001622	0.0001944	23.08	None	No	0.01	NP (normality)
Thallium, total (mg/L)	MW-1605S	0.0005	0.00004	0.002	No	13	0.0001666	0.0001935	23.08	None	No	0.01	NP (normality)
Thallium, total (mg/L)	MW-1606D	0.000123	0.00009	0.002	No	13	0.0001628	0.0001501	15.38	None	No	0.01	NP (normality)
Thallium, total (mg/L)	MW-1606S	0.000112	0.000062	0.002	No	13	0.000144	0.0001588	15.38	None	No	0.01	NP (normality)
Thallium, total (mg/L)	MW-1607D	0.0005	0.00002	0.002	No	13	0.000144	0.0002033	23.08	None	No	0.01	NP (normality)
Thallium, total (mg/L)	MW-1607S	0.0005	0.00005	0.002	No	13	0.0001686	0.0001908	23.08	None	No	0.01	NP (normality)

Parametric and Non-Parametric (NP) Confidence Interval

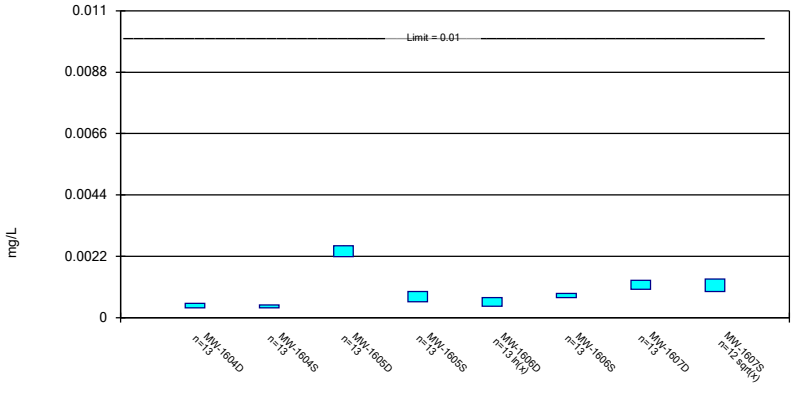
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Antimony, total Analysis Run 12/1/2019 11:05 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric Confidence Interval

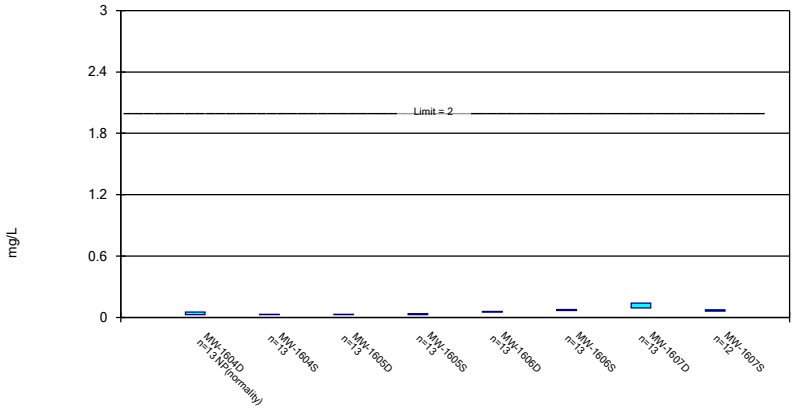
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Arsenic, total Analysis Run 12/1/2019 11:05 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric and Non-Parametric (NP) Confidence Interval

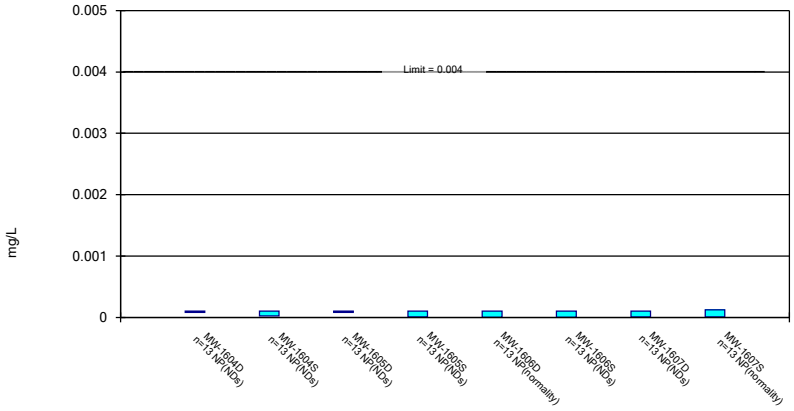
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Barium, total Analysis Run 12/1/2019 11:05 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Non-Parametric Confidence Interval

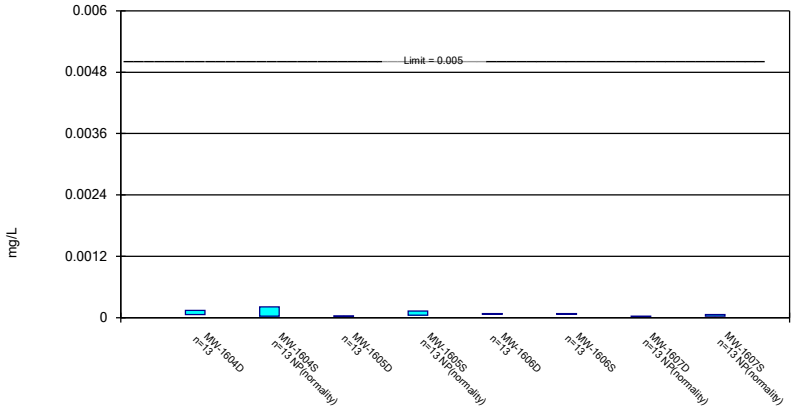
Compliance Limit is not exceeded. Per-well alpha = 0.01.



Constituent: Beryllium, total Analysis Run 12/1/2019 11:05 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

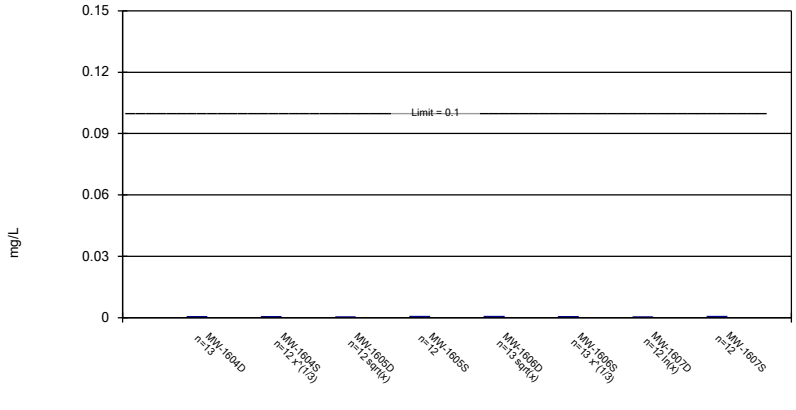


Constituent: Cadmium, total Analysis Run 12/1/2019 11:05 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

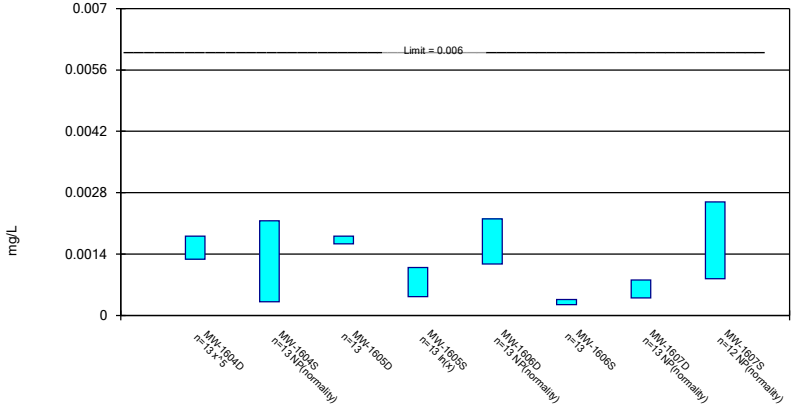


Constituent: Chromium, total Analysis Run 12/1/2019 11:05 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

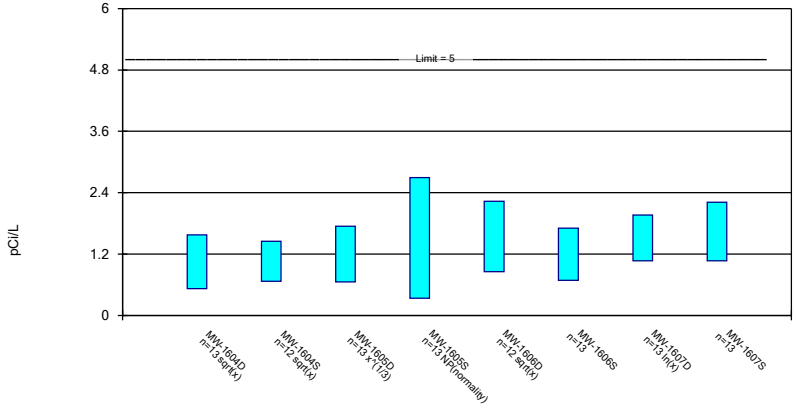


Constituent: Cobalt, total Analysis Run 12/1/2019 11:05 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

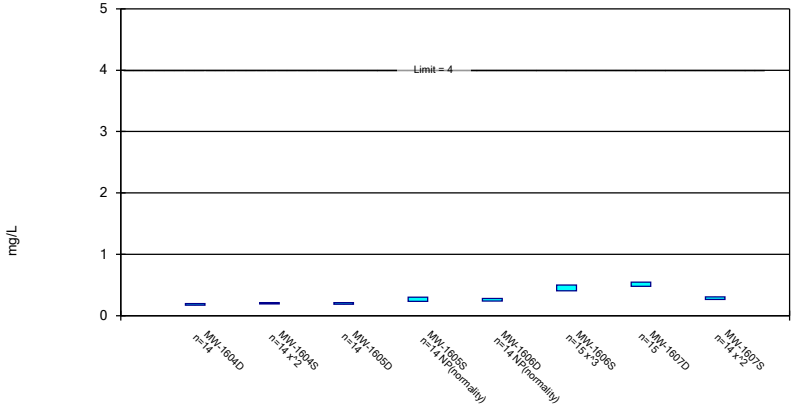
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Combined Radium 226 + 228 Analysis Run 12/1/2019 11:05 AM View: Confidence Intervals -
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric and Non-Parametric (NP) Confidence Interval

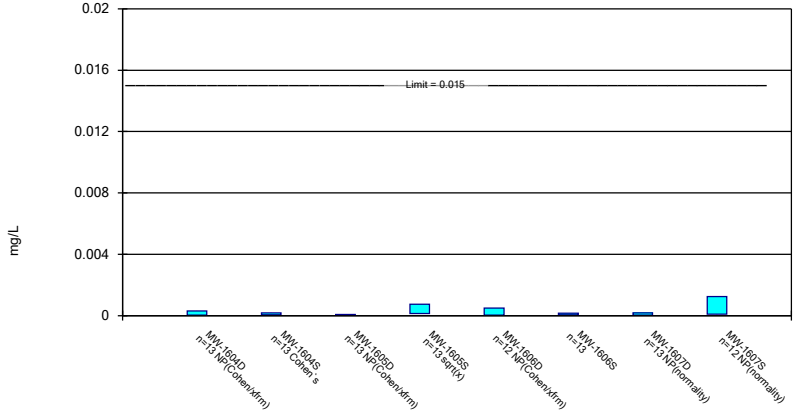
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Fluoride, total Analysis Run 12/1/2019 11:05 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric and Non-Parametric (NP) Confidence Interval

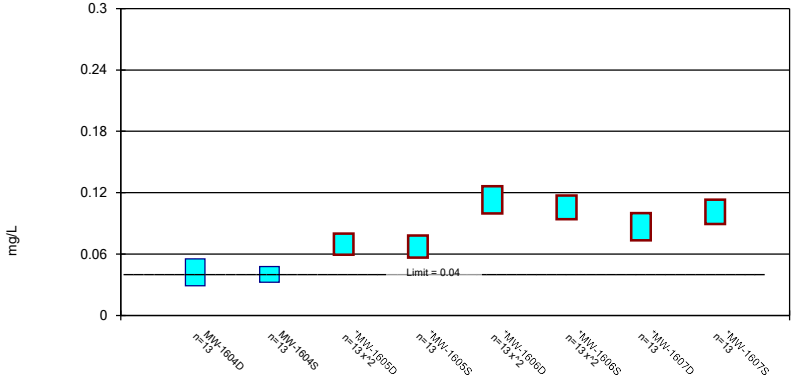
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Lead, total Analysis Run 12/1/2019 11:05 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric Confidence Interval

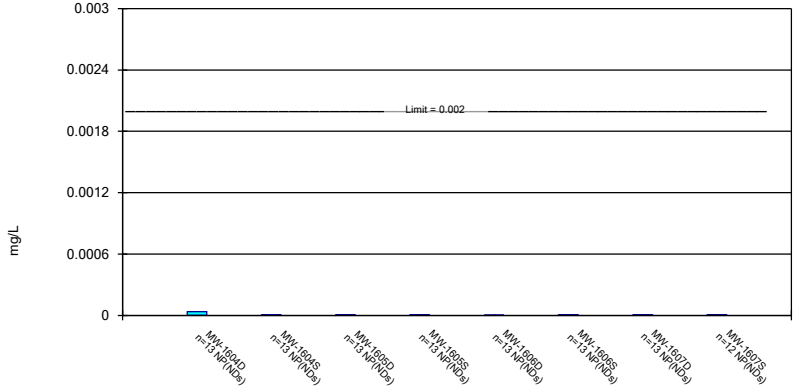
Compliance limit is exceeded.* Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Lithium, total Analysis Run 12/1/2019 11:05 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Non-Parametric Confidence Interval

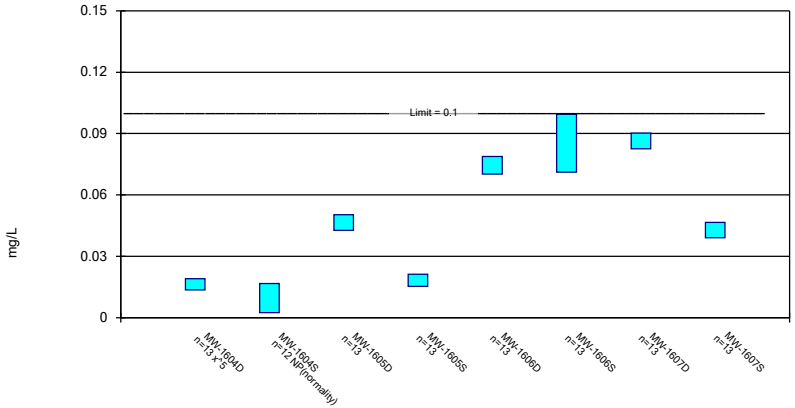
Compliance Limit is not exceeded. Per-well alpha = 0.01.



Constituent: Mercury, total Analysis Run 12/1/2019 11:05 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

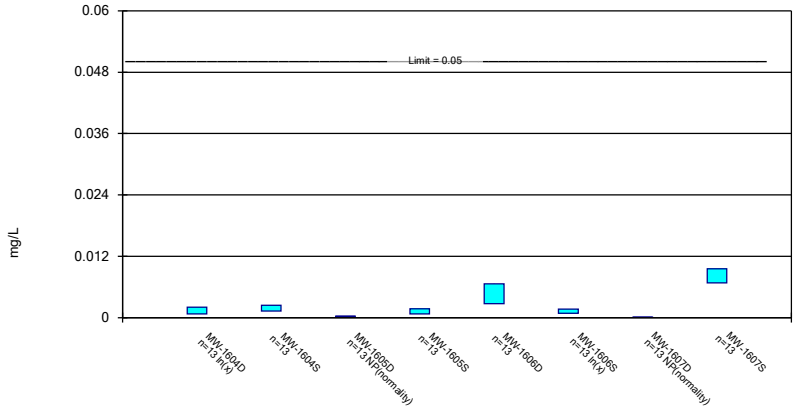


Constituent: Molybdenum, total Analysis Run 12/1/2019 11:06 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

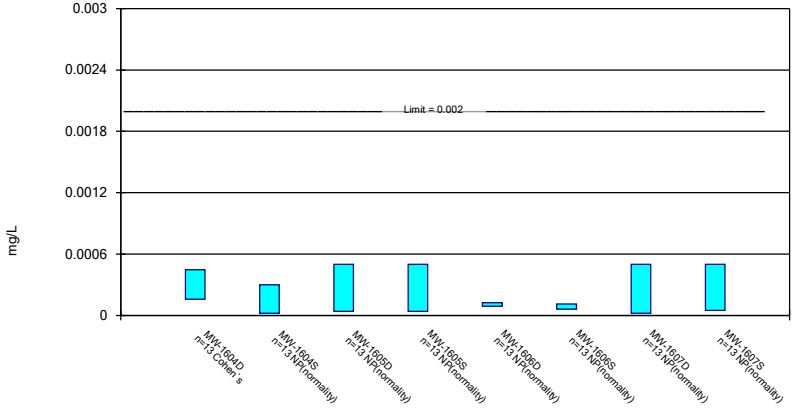


Constituent: Selenium, total Analysis Run 12/1/2019 11:06 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Thallium, total Analysis Run 12/1/2019 11:06 AM View: Confidence Intervals - App IV
Mountaineer BAP Client: Geosyntec Data: Mountaineer BAP

Appendix 3

No alternative source demonstrations were completed in 2019.

Appendix 4

The notifications of an SSL above a GWPS, as determined by statistical analysis following each assessment monitoring event in 2019, and the notice of initiation of Assessment of Corrective Measures follow.

Mountaineer Plant

Notice of Statistically Significant Levels (SSLs) above the Groundwater Protection Standard (GWPS)

CCR Unit – Bottom Ash Pond

As required by 40 CFR 257.95(g), this is a notification that on January 8, 2019 lithium was detected at SSLs above the GWPSs. This notification is being placed in the operating record, as required by 40 CRF 257.105(h)(8).

Mountaineer Plant

Notice for Initiating an Assessment of Corrective Measures

CCR Unit – Bottom Ash Pond

This notice is being provided, as required by 40 CFR 257.95(g)(5), that an Assessment of Corrective Measures was initiated on March 26, 2019 for Mountaineer Plant's Bottom Ash Pond due to the statistically significant concentrations detected above the established groundwater protection standard for lithium.

Mountaineer Plant

Notice of Statistically Significant Levels (SSLs) above the Groundwater Protection Standard (GWPS)

CCR Unit – Bottom Ash Pond

As required by 40 CFR 257.95(g), this is a notification that on July 12, 2019 lithium was detected at SSLs above the GWPSs. This notification is being placed in the operating record, as required by 40 CRF 257.105(h)(8).

Mountaineer Plant

Notice of Statistically Significant Levels (SSLs) above the Groundwater Protection Standard (GWPS)

CCR Unit – Bottom Ash Pond

As required by 40 CFR 257.95(g), this is a notification that on December 23, 2019 lithium was detected at SSLs above the GWPSs. This notification is being placed in the operating record, as required by 40 CRF 257.105(h)(8).

AEP Internal - Low Risk - Archived - ESH0000053637 - 02/07/2019 - mtp cmp rpt esh0000053637.pdf

Appendix 5

Monitoring well installation boring logs and well construction reports follow.

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PROJECT AEP IGCC Mountaineer Plant - Bechtel Borings — BORING NO. S-107

ELEVATION 585.8' GWL 0 HRS — PROJECT NO C050299.33

HRS

DATE Aug. 23-25, 2006 — CLASSIFIED BY Richard M. Ruffolo — PAGE 1 of 4

DEPTH (FT.)	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%) OR TORVANE	DESCRIPTION: PROFILE	SOIL DENSITY - CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS
1	2	3	4	5	6	7	8	9	10
	7 10	○ S-1 1.4		0.5		Brn	Topsoil	ml	
1.5	10				V. Stiff	D. Brn	Sandy lean clay, some rock fragments and		*3.0, dry
2.5	12						gravel -- 2.0" ⌀ , Fill	cl	
4.0	13 13	○ S-2 1.5			Hard				*>4.0, dry
5.0									
	5 7	○ S-3 1.4			V. Stiff			CL	*3.0, dry
6.5	11								
7.5				7.5					
	7				Stiff	D. Gray	Fly ash and silt mix, some rock and coal frags,	ml	*2.0, moist
9.0	9 12	○ S-4 1.3					Fill		
10.0									
	2 2	○ S-5 0.7			M. Stiff	Brn	Lean clay w/sand, trace rock frags and gravel,	CL	*1.0, moist
11.5	3						Fill		
12.5	2								
14.0	3 3	○ S-6 1.5	△ ST-1						Shelby tube 12.0-14.0'
15.0									*1.0, moist
	3 2	○ S-7 1.0							*1.0, moist
16.5	2								
17.5	2								
19.0	4 5	○ S-8 1.5							*1.0, moist
20.0									
	2 3	○ S-9 0.8	△ ST-2						*1.0, moist
21.5	3							CL-ML	Shelby tube 20.0-22.0'
22.5	2								
24.0	2 2	○ S-10 1.0			Stiff				*1.5, moist
25.0				25.0					
	3 5	○ S-11 1.2			Stiff	Brn	Silty clay, laminated, trace root frags, alluvial	cl	*1.5, moist
26.5	7								
				30.0					

REMARKS ** 4-1/4" I.D. Hollow Stem Augers 0.0-6.5', 6.5-81.2' Mud rotary drilling with 3-7/8"⌀ Tri-Cone Roller Bit w/SPT; 5-1/4"⌀ PVC casing 0.0-7.0'; NQ conventional rock core, CME 85 truck mount drill rig, Tim Caudill - Driller - FMSM

* POCKET PENETROMETER READINGS (TSF)

** METHOD OF ADVANCING AND CLEANING BORING

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PROJECT AEP IGCC Mountaineer Plant - Bechtel Borings BORING NO. S-107

ELEVATION 585.8' GWL 0 HRS PROJECT NO C050299.33

HRS

DATE Aug. 23-25, 2006 CLASSIFIED BY Richard M. Ruffolo PAGE 2 of 4

DEPTH (FT.)	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%) OR TORVANE	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY - CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS
1	2	3	4	5	6	7	8	9	10
	3 4	S-12 0.8			M. Stiff	Brn	Gravelly clay, <1.0" ⌀ gravel, alluvial	cl	*1.0, wet
31.5	4								
35.0				35.0					
	4 5	S-13 1.5			M. Stiff	D. Gray	Lean clay w/sand, homogeneous, organic	cl	*0.5, wet
36.5	5						decomposing odor, trace leaf and root		
							fragments, alluvial		
40.0									
	3 3	S-14 1.5				D. Gray/ Blk			*1.0, wet-moist
41.5	5								
45.0				45.0					
	9 22	S-15 1.1			Dense	Brn	Silty gravel (<2.0"⌀) with sand (med-coarse gr)	gm	Wet
46.5	13						alluvial		
50.0				50.0					
	4 4	S-16 1.1			Loose	Brn	Sand, alluvial	SP	Wet
51.5	3								
55.0									
	2 5	S-17 1.5			M. Dense				
56.5	6								

REMARKS ** 4-1/4" I.D. Hollow Stem Augers 0.0-6.5', 6.5-81.2' Mud rotary drilling with 3-7/8"⌀ Tri-Cone Roller Bit

w/SPT; 5-1/4"⌀ PVC casing 0.0-7.0'; NQ conventional rock core, CME 85 truck mount drill rig, Tim Caudill - Driller - FMSM

* POCKET PENETROMETER READINGS (TSF)

** METHOD OF ADVANCING AND CLEANING BORING

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PROJECT AEP IGCC Mountaineer Plant - Bechtel Borings BORING NO. S-107

ELEVATION 585.8' GWL 0 HRS PROJECT NO C050299.33

HRS

DATE Aug. 23-25, 2006 CLASSIFIED BY Richard M. Ruffolo PAGE 3 of 4

DEPTH (FT.)	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%) OR TORVANE	DESCRIPTION: PROFILE	SOIL DENSITY - CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS
1	2	3	4	5	6	7	8	9	10
	11 9	S-18 0.8			M. Dense	D. Brn	Sand w/gravel, alluvial	SP	Wet
61.5	8								
65.0									
	8 9	S-19 0.6							
66.5	11								
70.0				70.0					
	14 14	S-20 1.4			Dense	L. Brn	Silty sand (fine-med. gr.), alluvial	sm	Wet
71.5	18								
75.0				75.0					
	6 11	S-21 1.5			M. Dense	Brn	Sand, well graded w/fine gravel	sw	Wet
76.5	9								
80.0									
	11 15	S-22 1.2		81.0					
81.2	50/0.2			81.2	V. Dense	Tan	Decomposed sandstone	gp	T.O.R. @ 504.6"
82.2	1.35				M. Soft	Gray	Sandstone (med. gr)	V. BR	
83.7	1.5	R-1 90	57		M. Hard			BL	
							-85.0-85.2' clay seam		
	10.0 10.0	R-2 100	83				-87.2-.3'clay seam		
							89.5 becomes coarse grained 89.4-89.8 very broken zone		
								V.BR	89.9 Lose Water

REMARKS ** 4-1/4" I.D. Hollow Stem Augers 0.0-6.5', 6.5-81.2' Mud rotary drilling with 3-7/8" ⛧ Tri-Cone Roller Bit w/SPT; 5-1/4"⛧ PVC casing 0.0-7.0'; NQ conventional rock core, CME 85 truck mount drill rig, Tim Caudill - Driller - FMSM

* POCKET PENETROMETER READINGS (TSF)

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PROJECT AEP IGCC Mountaineer Plant - Bechtel Borings BORING NO. S-107

ELEVATION 585.8' GWL 0 HRS PROJECT NO C050299.33

HRS

DATE Aug. 23-25, 2006 CLASSIFIED BY Richard M. Ruffolo PAGE 4 of 4

DEPTH (FT.)	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%) OR TORVANE	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY - CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS
1	2	3	4	5	6	7	8	9	10
								BL	~91.0 approx. half of water return
93.7				93.7					
							End of boring		

REMARKS ** 4-1/4" I.D. Hollow Stem Augers 0.0-6.5', 6.5-81.2' Mud rotary drilling with 3-7/8"ø Tri-Cone Roller Bit w/SPT; 5-1/4"ø PVC casing 0.0-7.0'; NQ conventional rock core, CME 85 truck mount drill rig, Tim Caudill - Driller - FMSM

* POCKET PENETROMETER READINGS (TSF)

** METHOD OF ADVANCING AND CLEANING BORING

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PROJECT AEP IGCC Mountaineer Plant - Bechtel Borings — BORING NO. S-112

ELEVATION 583.4' GWL 0 HRS — PROJECT NO C050299.33

HRS

DATE Aug. 28-29, 2006 — CLASSIFIED BY Richard M. Ruffolo — PAGE 1 of 3

DEPTH (FT.)	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%) OR TORVANE	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY - CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS
1	2	3	4	5	6	7	8	9	10
	12 32	○ S-1 1.5			V. Dense	Brn	Sand w/silt and gravel rock fragments, Fill	sp-sm	Dry
1.5	31								
2.5				2.5					
	11								
4.0	19 20	○ S-2 1.3			Dense	Brn	Sand w/silt and gravel, Fill	sp-sm	Moist
5.0				5.0					
	2 3	○ S-3 0.5			Stiff	L. Brn	Lean clay, homogeneous, alluvial	CL	*2.0, moist
6.5	3		6.5 △ ST-5 Rec. 1.8						*2.0 bottom of Shelby tube
7.5									
	4								
9.0	3 4	○ S-4 1.3	8.5				- with fine sand		*2.0, moist
10.0				10.0					
	3 6	○ S-5 1.0			V. Stiff	Brn	Lean clay, mottled, alluvial	CL	*3.0, moist
11.5	6						- trace root fragments		
12.5									
	3								
14.0	6 8	○ S-6 1.1							*2.5, moist
15.0									
	4 6	○ S-7 1.3							*2.5, moist
16.5	8								
17.5			17.5 △ ST-6 Rec. 2.0 19.5						
	3								
19.0	6 6	○ S-8 1.3							*2.5, moist
20.0				20.0					*2.0 bottom of Shelby tube
	1 3	○ S-9 1.5			M. Stiff	Brn	Sandy lean clay, homogeneous,	cl	*1.0, wet
21.5	4						alluvial		
22.5				22.5					
	5								
24.0	5 5	○ S-10 1.2			Loose	Brn	Silty sand (fine gr), alluvial	sm	Moist
25.0									
	4 5	○ S-11 1.0							Moist
26.5	4								
				30.0					

REMARKS ** 4-1/4" I.D. Hollow Stem Augers 0.0-9.0 w/SPT, 0.9-79.1' Mud Rotary drilling w/Tricone roller bit w/Revert mud, NQ conventional rock core; Tim Caudill, Driller - FMSM; CME 85 Truck Mount Rig; 3-1/4" I.D. PVC casing 0.0-7.0'

* POCKET PENETROMETER READINGS (TSF)

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PROJECT AEP IGCC Mountaineer Plant - Bechtel Borings BORING NO. S-112

ELEVATION 583.4' GWL 0 HRS PROJECT NO C050299.33

HRS

DATE Aug. 28-29, 2006 CLASSIFIED BY Richard M. Ruffolo PAGE 2 of 3

DEPTH (FT.)	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%) OR TORVANE	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY - CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS
1	2	3	4	5	6	7	8	9	10
	5 4	S-12 1.1			M. Dense	Brn	Sitly sand w/gravel, alluvial	sm	Moist
31.5	12								
35.0	15 19	S-13 1.2			Dense				Wet
36.5	15								
40.0	11 19	S-14 1.0							Wet
41.5	26								
45.0	11 14	S-15 1.1			M. Dense		- coarse gravel and interbedded fines		Wet
46.5	7								
50.0	5 19	S-16 1.2			Dense	Brn	Sand w/silt and gravel	sp-sm	Wet
51.5	27								
55.0	14 8	S-17 1.0		55.0	M. Dense	Brn	Sand (med-coarse gr.),w/fine gravel, trace	sp	Wet
56.5	8						silt, alluvial		

REMARKS ** 4-1/4" I.D. Hollow Stem Augers 0.0-9.0 w/SPT, 0.9-79.1' Mud Rotary drilling w/Tricone roller bit w/Revert mud, NQ conventional rock core; Tim Caudill, Driller - FMSM; CME 85 Truck Mount Rig; 3-1/4" I.D. PVC casing 0.0-7.0'

* POCKET PENETROMETER READINGS (TSF)

** METHOD OF ADVANCING AND CLEANING BORING

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PROJECT AEP IGCC Mountaineer Plant - Bechtel Borings — BORING NO. S-112

ELEVATION 583.4' GWL 0 HRS — PROJECT NO C050299.33

HRS

DATE Aug. 28-29, 2006 — CLASSIFIED BY Richard M. Ruffolo — PAGE 3 of 3

DEPTH (FT.)	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%) OR TORVANE	DESCRIPTION: PROFILE	SOIL DENSITY - CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS
1	2	3	4	5	6	7	8	9	10
	4 4	S-18 1.3							Wet
61.5	5								
65.0				65.0					
	5 4	S-19 1.0			Loose	Brn	Silty sand, fine gr., homogeneous, alluvial	sm	Wet
66.5	6								
70.0									
	10 12	S-20 1.0			M. Dense	Brn	Sand w/silt, alluvial	sw-sm	Wet
71.5	14								
75.0									
	9 8	S-21 0.8							Wet
76.5	12								
									78.3-79.0 difficult drilling
79.0				79.0	V. Dense	Gray	Decomposed sandstone	gp	Wet, 79.0 roller bit refusal
79.1	50/0.1	S-22 0.1		79.1					T.O.R. Elev 504.3'
					M. Hard	Gray	Sandstone, med. gr., few ~20° x-beds	br	
								bl	
	10.0 / 10.0	R-1 100	95						
								m	
89.1				89.1			End of boring		

REMARKS ** 4-1/4" I.D. Hollow Stem Augers 0.0-9.0 w/SPT, 0.9-79.1' Mud Rotary drilling w/Tricone roller bit w/Revert mud, NQ conventional rock core; Tim Caudill, Driller - FMSM; CME 85 Truck Mount Rig; 3-1/4" I.D. PVC casing 0.0-7.0'

* POCKET PENETROMETER READINGS (TSF)

** METHOD OF ADVANCING AND CLEANING BORING

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PROJECT AEP IGCC Mountaineer Plant - Bechtel Borings BORING NO. S-203

ELEVATION 587.1' GWL 0 HRS PROJECT NO C050299.33

HRS

DATE Sept. 6-8, 2006 CLASSIFIED BY Richard M. Ruffolo PAGE 1 of 3

DEPTH (FT.)	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%) OR TORVANE	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY - CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS
1	2	3	4	5	6	7	8	9	10
	2 5	S-1 1.5		0.3	Hard	Brn	Lean clay, fill	CL	0.3' of topsoil
1.5	6								*>4.0, dry
2.5	3								
4.0	3 5	S-2 1.5			Stiff				*2.0, Moist
5.0									
	1 2	S-3 1.5							*2.0, Moist
6.5	4			6.5					
7.5	3		7.5		Stiff	Brn	Silt w/fine sand, laminated, alluvial	ML	
9.0	1 3	S-4 1.5	ST-15 Rec. 2.0						*1.0, Moist
10.0			9.5						*2.0 bottom of Shelby tube
	3 3	S-5 1.5	ST-16 Rec. 2.0						*1.0, Moist
11.5	5		11.5						*1.0 bottom of Shelby tube
12.5	2								
14.0	1 2	S-6 1.5					- interbedded fine sand		*1.0, Moist
15.0									
	1 1	S-7 1.5							*1.0, Moist
16.5	2								
17.5	7			17.5					
19.0	13 12	S-8 0.9			M. Dense	Brn	Sand w/silt and gravel, alluvial	sp-sm	Moist
20.0									
	6 10	S-9 0.9							Moist
21.5	17								
22.5	22								
24.0	20 30	S-10 1.5			Dense				Moist
25.0									
	22 16	S-11 1.0							Moist
26.5	30								End 9/6

REMARKS ** 4-1/4" I.D. Hollow Stem Augers 0.0-6.5' and Mud Rotary Drilling w 4-1/4" Tri-Cone Roller bit in conjunction w/SPT

Install 5-1/4" PVC pipe; 0.0-7.0'; NQ conventional rock core; CME 55 Truck Mount Drill Rig, Mark Martin, driller - FMSM

* POCKET PENETROMETER READINGS (TSF)

** METHOD OF ADVANCING AND CLEANING BORING

gai consultants
transforming ideas into reality

PROJECT AEP IGCC Mountaineer Plant - Bechtel Borings — BORING NO. S-203

ELEVATION 587.1' GWL 0 HRS — PROJECT NO C050299.33

HRS

DATE Sept. 6-8, 2006 — CLASSIFIED BY Richard M. Ruffolo — PAGE 2 of 3

DEPTH (FT.)	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%) OR TORVANE	DESCRIPTION: PROFILE	SOIL DENSITY - CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS
1	2	3	4	5	6	7	8	9	10
	18 12	○ S-12 0.4							Moist
31.5	29								
35.0									
	15 12	○ S-13 1.0			M. Dense				Wet
36.5	18								
40.0									
	10 8	○ S-14 1.0							Wet
41.5	8								
45.0				45.0					
	4 3	○ S-15 0.6			Loose	Brn	Sand (med. Gr) trace silt and gravel, alluvial	sp	Wet
46.5	5								
50.0									
	7 7	○ S-16 1.5			M. Dense				Wet
51.5	11								
55.0				55.0					
	13 11	○ S-17 1.0			M. Dense	Brn	Sand (fine-coarse gr), trace fine gravel, alluvial	sw	Wet
56.5	18								

REMARKS ** 4-1/4" I.D. Hollow Stem Augers 0.0-6.5' and Mud Rotary Drilling w 4-1/4"ø Tri-Cone Roller bit in conjunction w/SPT

Install 5-1/4"ø PVC pipe; 0.0-7.0'; NQ conventional rock core; CME 55 Truck Mount Drill Rig, Mark Martin, driller - FMSM

* POCKET PENETROMETER READINGS (TSF)

** METHOD OF ADVANCING AND CLEANING BORING

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PROJECT AEP IGCC Mountaineer Plant - Bechtel Borings — BORING NO. S-203

ELEVATION 587.1' GWL 0 HRS — PROJECT NO C050299.33

HRS

DATE Sept. 6-8, 2006 — CLASSIFIED BY Richard M. Ruffolo — PAGE 3 of 3

DEPTH (FT.)	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%) OR TORVANE	DESCRIPTION: PROFILE	SOIL DENSITY - CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS
1	2	3	4	5	6	7	8	9	10
	17 17	S-18 1.5			Dense	Brn	Sand w/silt and gravel, alluvial	sp-sm	Wet
61.5	15								
65.0									
	14 16	S-19 1.0			M. Dense				Wet
66.5	12								
70.0				70.0					
	19 17	S-20 1.5			Dense	Brn	Sand w/silt, alluvial	sw-sm	Wet
71.5	14								
75.0									
	17 18	S-21 0.8							Wet
76.5	26								
80.0				80.0					
	11 11	S-22 0.9			M. Dense	Brn	Gravel w/sand, 80% coarse gravel, 20% sand	gp	Wet, end 9/7
81.5	14								
81.8				81.8			alluvial		81.7' Roller bit refusal
					M. Hard	Gray	Sandstone, med-coarse gr., few ~20°	V. Br.	81.8' seat casing
							x-beds	BR	T.O.R. elev 505.3'
							83.0-83.2' ~45° fractures	M	
	7.8 8.0	R-1 98	81				83.4-83.6' horizontal Fe stain fracture		
							88.2-88.3' horizontal Fe stain fracture	Br	88.5' Lose water
89.8				89.8			End of boring		

REMARKS ** 4-1/4" I.D. Hollow Stem Augers 0.0-6.5' and Mud Rotary Drilling w 4-1/4" Tri-Cone Roller bit in conjunction w/SPT

Install 5-1/4" PVC pipe; 0.0-7.0'; NQ conventional rock core; CME 55 Truck Mount Drill Rig, Mark Martin, driller - FMSM

* POCKET PENETROMETER READINGS (TSF)

** METHOD OF ADVANCING AND CLEANING BORING

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: AEP Mountaineer
Location: New Haven, WV
Project No.: 4345.00

Log of Boring SB-1805

Ground Elevation: Not Available

Drilling Method: HWT Casing with advancer, 3 1/4" ID HSA, PWL Coring

Sampling Method: 2" O.D and 3" O.D. Split Spoon with automatic hammer; 2" OD Shelby tube; NQ2 5-ft long core barrel

Drilling Company: Terracon Consultants, Inc.

Foreman: N. Francis/K. Fowler

Date Started: 06/18/18 **Date Finished: 06/21/18**

Logged By: L. Corenthal **Checked By: A. Ashton**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
06/22/18	07:00	38.7'	Ground Surface	0'	133.8'	~ 14 hours

Depth (ft)	Drill Rate (min/ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
0								-----0'-----		
2										
4										
		S-01	5 - 6.5	2 2 3	18/18	PID: NM		SILT & CLAY	S-01 (5 to 6.5'): Medium stiff, reddish brown, SILT & CLAY, seam of fine Sand. Moist.	
6										
8										
10		S-02	10 - 11.5	2 2 4	18/18	PID: NM		-----10'----- CLAYEY SILT -----11'-----	S-02A (10 to 11'): Medium stiff, reddish brown, Clayey SILT. Moist. S-02B (11 to 11.5'): Loose, reddish brown, fine to coarse SAND, some Silt. Moist.	
12										
14										
		S-03	15 - 16.5	2 2 2	18/14	PID: NM			S-03 (15 to 16.5'): Very loose, brown, fine SAND, little Silt. Moist. Stratified at approximately 16 feet.	
16										
18								FINE TO COARSE SAND		
20		S-04	20 - 21.5	8 12 12	18/12	PID: NM			S-04 (20 to 21.5'): Medium dense, brown, fine to coarse SAND, trace Gravel, trace Silt. Moist.	
22										
24										

BORING LOG P:\4300S\4345.00\WORK\LOGS\4345.00 LOGS.GPJ 2017 SANBORN HEAD V1.GLB 2017 SANBORN HEAD V1.GDT 12/7/18

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: AEP Mountaineer
Location: New Haven, WV
Project No.: 4345.00

Log of Boring SB-1805

Ground Elevation: Not Available

Drilling Method: HWT Casing with advancer, 3 1/4" ID HSA, PWL Coring

Sampling Method: 2" O.D and 3" O.D. Split Spoon with automatic hammer; 2" OD Shelby tube; NQ2 5-ft long core barrel

Drilling Company: Terracon Consultants, Inc.

Foreman: N. Francis/K. Fowler

Date Started: 06/18/18 **Date Finished: 06/21/18**

Logged By: L. Corenthal **Checked By: A. Ashton**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
06/22/18	07:00	38.7'	Ground Surface	0'	133.8'	~ 14 hours

Depth (ft)	Drill Rate (min/ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
26		S-05	25 - 26.5	4 7 8	18/10	PID: NM			S-05 (25 to 26.5'): Medium dense, brown, fine to coarse SAND, little Gravel, trace Silt. Moist.	
30		S-06	30 - 31.5	4 15 10	18/11	PID: NM			S-06 (30 to 31.5'): Medium dense, brown, fine to coarse SAND, trace Gravel, trace Silt. Moist.	
36		S-07	35 - 36.5	4 4 7	18/9	PID: NM			S-07 (35 to 36.5'): Medium dense, brown, fine to coarse SAND, trace Gravel, trace Silt. Moist.	
		S-08	36.5 - 38.5	4 6 8 8	24/11	PID: NM		FINE TO COARSE SAND	S-08 (36.5 to 38.5'): Medium dense, brown/black, fine to coarse SAND, trace Silt. Moist.	
40		S-09	38.5 - 40.5	3 5 5 7	24/12	PID: NM			S-09 (38.5 to 40.5'): Loose, brown/black, fine to coarse SAND, trace Gravel, trace Silt. Moist.	
42		S-10	40.5 - 42.5	3 6 5 7	24/13	PID: NM			S-10 (40.5 to 42.5'): Medium dense, brown/black, fine to coarse SAND, trace Gravel, trace Silt. Moist.	
44		S-11	42.5 - 44.5	3 4 8 7	24/0	PID: NM			S-11 (42.5 to 44.5'): No recovery.	
46		S-12	44.5 - 46.5	7 6 3 8	24/4	PID: NM			S-12 (44.5 to 46.5'): Loose, brown, fine to medium SAND, trace Silt. Wet.	
48		S-13	46.5 - 48.5	2 3 6 8	24/11	PID: NM			S-13 (46.5 to 48.5'): Loose, brown, fine to coarse SAND, trace Silt. Wet.	
50		S-14	48.5 - 50.5	1 3 5 7	24/11	PID: NM			S-14 (48.5 to 50.5'): Loose, brown, fine to medium SAND, trace Silt. Wet.	

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SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: AEP Mountaineer
Location: New Haven, WV
Project No.: 4345.00

Log of Boring SB-1805

Ground Elevation: Not Available

Drilling Method: HWT Casing with advancer, 3 1/4" ID HSA, PWL Coring

Sampling Method: 2" O.D and 3" O.D. Split Spoon with automatic hammer; 2" OD Shelby tube; NQ2 5-ft long core barrel

Drilling Company: Terracon Consultants, Inc.

Foreman: N. Francis/K. Fowler

Date Started: 06/18/18 **Date Finished: 06/21/18**

Logged By: L. Corenthal **Checked By: A. Ashton**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
06/22/18	07:00	38.7'	Ground Surface	0'	133.8'	~ 14 hours

Depth (ft)	Drill Rate (min/ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
50		S-15	50.5 - 52	3 5 7	18/9	PID: NM			S-15 (50.5 to 52'): Medium dense, brown, fine to coarse SAND, little Silt. Wet.	At S-15 switch to 3 inch split spoon (18 inches long) from 2 inch split spoon (24 inches long) to increase sample volume.
52		S-16	52 - 53.5	1 3 5	18/0	PID: NM			S-16 (52 to 53.5'): No recovery.	
54		S-17	53.5 - 55	1 6 10	18/6	PID: NM			S-17 (53.5 to 55'): Medium dense, brown, fine to coarse SAND, trace Silt. Wet.	
56		S-18	55 - 56.5	2 4 7	18/7	PID: NM			S-18 (55 to 56.5'): Medium dense, grayish brown, fine to coarse SAND, trace Silt. Wet.	
		S-19	56.5 - 58	1 3 7	18/0	PID: NM			S-19 (56.5 to 58'): No recovery.	
58		S-20	58 - 59	NM	12/18	PID: NM			S-20 (58 to 59'): Brown, fine to coarse SAND, little Silt, trace Gravel. Wet.	S-20 sampled by Shelby tube, no recovery and refusal after 1 foot. Then collected with 2 inch split spoon and switch to 2 inch split spoon after S-20.
		S-21	59 - 60.5	3 8 6	18/14	PID: NM			S-21 (59 to 60.5'): Medium dense, brown, fine to coarse SAND, little Silt, trace Gravel. Wet. Seam black fine to medium SAND at 60 feet.	
60		S-22	60.5 - 62	6 7 11	18/22	PID: NM			S-22 (60.5 to 62'): Medium dense, brown, fine to coarse SAND, little Silt, trace Gravel. Wet.	
62		S-23	62 - 63.5	2 6 9	18/13	PID: NM		FINE TO COARSE SAND	S-23 (62 to 63.5'): Medium dense, brown, fine to coarse SAND, trace Silt, trace Gravel. Wet.	
64		S-24	63.5 - 65	3 5 7	18/12	PID: NM			S-24 (63.5 to 65'): Medium dense, brown, fine to coarse SAND, some Silt. Wet.	
		S-25	65 - 66.5	3 6 7	18/18	PID: NM			S-25 (65 to 66.5'): Medium dense, brown, fine to medium SAND, little Silt. Wet.	Start introducing Bentonite/water mix due to heaving sands.
66		S-26	66.5 - 68	8 11 9	18/18	PID: NM			S-26 (66.5 to 68'): Medium dense, gray/brown, fine to coarse SAND, little Silt, trace Gravel. Wet.	
68		S-27	68 - 69.5	3 6 9	18/14	PID: NM			S-27 (68 to 69.5'): Medium dense, gray, fine to coarse SAND, little Silt, trace Gravel. Wet.	
70		S-28	69.5 - 71	10 11 15	18/15	PID: NM			S-28 (69.5 to 71'): Medium dense, gray, fine to coarse SAND, little Gravel, trace Silt. Wet.	
		S-29	71 - 72.5	10 13 19	18/11	PID: NM			S-29 (71 to 72.5'): Medium dense, gray, fine to coarse SAND, little Gravel, trace Silt. Wet.	
72		S-30	72.5 - 74	8 12 10	18/11	PID: NM			S-30 (72.5 to 74'): Medium dense, gray, fine to coarse SAND, trace Gravel, trace Silt. Wet.	
74		S-31	74 - 75.5	11 13 14	18/10	PID: NM			S-31 (74 to 75.5'): Medium dense, gray, fine to coarse SAND, little Gravel, trace Silt. Wet.	

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SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: AEP Mountaineer
Location: New Haven, WV
Project No.: 4345.00

Log of Boring SB-1805

Ground Elevation: Not Available

Drilling Method: HWT Casing with advancer, 3 1/4" ID HSA, PWL Coring

Sampling Method: 2" O.D and 3" O.D. Split Spoon with automatic hammer; 2" OD Shelby tube; NQ2 5-ft long core barrel

Drilling Company: Terracon Consultants, Inc.

Foreman: N. Francis/K. Fowler

Date Started: 06/18/18 **Date Finished: 06/21/18**

Logged By: L. Corenthal **Checked By: A. Ashton**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
06/22/18	07:00	38.7'	Ground Surface	0'	133.8'	~ 14 hours

Depth (ft)	Drill Rate (min/ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
76		S-32	75.5 - 77	8 12 15	18/13	PID: NM			S-32 (75.5 to 77'): Medium dense, gray/brown, fine to coarse SAND, trace Gravel, trace Silt. Wet.	
78		S-33	77 - 78.5	7 10 14	18/11	PID: NM			S-33 (77 to 78.5'): Medium dense, gray/brown, fine to coarse SAND, trace Gravel, trace Silt. Wet.	
		S-34	78.5 - 80	7 9 10	18/0	PID: NM			S-34 (78.5 to 80'): No recovery.	
80		S-35	80 - 81.5	4 5 12	18/0	PID: NM		FINE TO COARSE SAND	S-35 (80 to 81.5'): No recovery.	
82		S-36	81.5 - 83	19 18 17	18/10	PID: NM			S-36 (81.5 to 83'): Dense, brown, fine to coarse SAND, some Gravel, trace Silt. Wet.	
		S-37	83 - 83.9	17 50/5"	11/10	PID: NM			S-37 (83 to 83.9'): Very dense, brown, fine to coarse SAND, some Gravel, little Silt. Wet. Sandstone in tip.	
84	NM	S-38 C-01	84.5 - 84.7 84.7 - 89.3	50/2"	2/7 55/39	PID: NM		-----84.7'-----	S-38 (84.5 to 84.7'): Very dense, gray, fine to medium SAND. Wet.	Auger refusal at 84.7 ft. Begin PWL coring.
86									C-01 (84.7 to 89.3'): Medium hard, medium gray, fine to medium-grained, slightly micaceous Sandstone, with very thin to thin horizontal partings spaced 2 to 3 inches apart. Thin horizontal black lenses fine to medium grained carbonaceous Sandstone between 86 and 86.4 feet. Brown fine grained sandstone cobble in upper 0.2 feet.. Moderately fractured. REC=71%. RQD=0%.	
88										
90	8	C-02	89.3 - 94.3		60/27				C-02 (89.3 to 94.3'): Medium hard to very soft, medium gray, fine to medium-grained, slightly micaceous Sandstone, with very thin to thin horizontal partings spaced 2 to 3 inches apart. Very soft, medium spaced Sandstone layers are 2 to 4 inches. Soft, medium spaced horizontal Silty Clay inclusions. Extremely fractured to sound. REC=45%. RQD=45%.	
92								SANDSTONE		
94	7	C-03	94.3 - 99.3		60/60				C-03 (94.3 to 99.3'): Medium hard to very soft, medium gray, fine to medium-grained, slightly micaceous Sandstone, with thin to medium partings spaced 1 inch to 13 inches apart. Thin horizontal layers of very soft fine to medium grained Sandstone from 94.3 to 96.9 feet. Moderately fractured. REC=100%. RQD=62%.	
96										
98										
100	6	C-04	99.3 - 104.3		60/60				C-04 (99.3 to 104.3'): Medium hard to very soft, gray, fine to medium-grained,	

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SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: AEP Mountaineer
Location: New Haven, WV
Project No.: 4345.00

Log of Boring SB-1805

Ground Elevation: Not Available

Drilling Method: HWT Casing with advancer, 3 1/4" ID HSA, PWL Coring

Sampling Method: 2" O.D and 3" O.D. Split Spoon with automatic hammer; 2" OD Shelby tube; NQ2 5-ft long core barrel

Drilling Company: Terracon Consultants, Inc.

Foreman: N. Francis/K. Fowler

Date Started: 06/18/18 **Date Finished: 06/21/18**

Logged By: L. Corenthal **Checked By: A. Ashton**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
06/22/18	07:00	38.7'	Ground Surface	0'	133.8'	~ 14 hours

Depth (ft)	Drill Rate (min/ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
100									SANDSTONE, with very thin to thin partings spaced 1 inch to 11 inches apart. Thin horizontal layers of very soft fine to medium grained Sandstone between 100.5 and 101.5 feet.. Extremely fractured to sound. REC=100%. RQD=38%.	
102										
104	3	C-05	104.3 - 109.3		60/60				C-05 (104.3 to 109.3'): Medium hard to hard, gray, very fine to fine-grained, SANDSTONE, Medium spaced moderately dipping to low angle to low angle black fine grained Sandstone lenses from 104.3 to 108.3 feet. Very soft gray fine to medium-grained very thin to thin horizontal partings spaced 2 to 4 inches apart from 108.3 to 109.3 feet. Broken platy dark gray zone at 108.3 feet. Moderately fractured to sound. REC=100%. RQD=80%.	
106										
108	NM	C-06	109.3 - 114.3		60/60			SANDSTONE	C-06 (109.3 to 114.3'): Medium hard to soft, gray, very fine to medium-grained, SANDSTONE, very thin to thin horizontal low angle partings spaced less then 1inch to 3 inches apart. Black fine to medium-grained very thinly spaced Sandstone lenses from 109.3 to 109.9.. Extremely fractured. REC=100%. RQD=0%.	
110										
112										
114	5	C-07	114.3 - 119.3		60/60				C-07 (114.3 to 119.3'): Medium hard to soft, light medium gray, very fine to medium-grained, SANDSTONE, very thin to medium horizontal partings spaced 1 to 6 inches apart. Black fine to medium-grained very thin to medium spaced sandstone lenses from 114.3 to 117 feet. Extremely fractured to sound. REC=100%. RQD=52%.	
116										
118										
120	4	C-08	119.3 - 124.3		60/60			119.6' SHALE 122.3'	C-08 (119.3 to 124.3'): Medium hard to soft, light gray, very fine to medium-grained, SANDSTONE, with thin horizontal partings spaced 2 to 5 inches apart and very thinly spaced clack horizontal lenses. Bed of very soft to soft, dark gray, very fine grained Silty clay Shale with very thin to thinly partings spaced less than 1 inch to 5 inches apart. Shale from 119.6 to 122.3 feet.. Extremely fractured to slightly fractured. REC=100%. RQD=38%.	
122										
124	8	C-09	124.3 - 129.3		60/53			SANDSTONE	C-09A (124.3 to 125.3'): Medium hard, light gray, very fine to medium-grained,	

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SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: AEP Mountaineer
Location: New Haven, WV
Project No.: 4345.00

Log of Boring SB-1805

Ground Elevation: Not Available

Drilling Method: HWT Casing with advancer, 3 1/4" ID HSA, PWL Coring

Sampling Method: 2" O.D and 3" O.D. Split Spoon with automatic hammer; 2" OD Shelby tube; NQ2 5-ft long core barrel

Drilling Company: Terracon Consultants, Inc.

Foreman: N. Francis/K. Fowler

Date Started: 06/18/18 **Date Finished: 06/21/18**

Logged By: L. Corenthal **Checked By: A. Ashton**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
06/22/18	07:00	38.7'	Ground Surface	0'	133.8'	~ 14 hours

Depth (ft)	Drill Rate (min/ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
126								SANDSTONE	SANDSTONE, with very thin to thin black lenses. Sound. REC=88%. RQD=65%.	
								125.3'		
128								COAL	C-09B (125.3 to 129.3'): Very soft to soft, black, very fine grained, COAL, with thinly spaced horizontal partings, very soft gray very fine grained horizontal Clay-rich zone from 125.5 to 125.8 feet, very thin to thin Clay lenses with Pyrite throughout. Vertical crack with calcite minderalization from 127.6 to 129.8 feet. Extremely to moderately fractured.	
130	NM	C-10	129.3 - 131.8		30/30				C-10A (129.3 to 130.4'): Very soft to soft, black, very fine grained, COAL, with thin to very thin horizontal partings. Vertical cracks with calcite mineralization from 129.2 to 129.8 feet and 130.0 to 130.3 feet. Extremely to moderately fractured. REC=100%. RQD=37%.	
								130.4'		
132	NM	C-11	131.8 - 133.8		24/20			SHALE	C-10B (130.4 to 131.8'): Very soft to medium hard, dark gray, very fine grained, SILTY CLAY SHALE, with very thin to thin horizontal partings. Clay rich zone from 130.4 to 130.8 feet. Slight Organic sheen. Extremely fractured.	
								133.8'		
134									C-11 (131.8 to 133.8'): Very soft to medium hard, dark gray, very fine grained, SILTY CLAY SHALE, with very thin horizontal, bedding. slight Organic sheen. Extremely to moderately fractured. REC=83%. RQD=0%.	
136									Boring terminated at 133.8 feet. No refusal encountered.	
138									NOTES:	
140									1. Approximately 5200 gallons of potable water was introduced during drilling upon completion of coring (approximately 3,200 gallons was used to advance to top of bedrock from a combination of potable wells and the plant fire suppression system; approximately 2,000 gallons of water from the plant fire suppression system was used during bedrock coring).	
142									2. Continuous sampling started approximately 5 ft above the water table based on a water level measurement collected by Sanborn Head on 6/18/2018 at 15:20 at MW-1605S of 44.84 ft below Top of PVC Riser and at 15:34 at MW-1604S of 51.99 ft below Top of PVC Riser.	
144									3. Advanced HWT casing to 29 ft bgs. Due to damage to casing advancer at 29 ft, advanced 3 1/4" ID hollow stem augers to 30 ft bgs to auger refusal at 84.7 ft bgs. Advanced HWT casing with roller bit advancer to 84.7 ft and began PWL coring at 84.7 ft.	
146									4. Approximately 1 week following completion of sample collection, the borehole was completed as a monitoring well by Terracon Consultants, Inc. Monitoring well installation was not observed by Sanborn Head personnel.	
148										
150										

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Geosyntec consultants
engineers | scientists | innovators

Client: American Electric Power
Project: CHW8293
Address: New Haven, WV

WELL LOG
Well No. MW-1921
Page: 1 of 5

Drilling Start Date:	1/22/2019	Boring Depth (ft):	91.3	Well Depth (ft):	87.5
Drilling End Date:	1/24/2019	Boring Diameter (in):	8.25	Well Diameter (in):	2
Drilling Company:	AEP	Sampling Method(s):	SPT	Screen Slot (in):	0.010
Drilling Method:	Hollow Stem Auger	DTW After Drilling (ft):		Riser Material:	Sch 40 PVC
Drilling Equipment:	Truck-mounted rotary	Ground Surface Elev. (ft):	595.639	Screen Material:	Sch 40 PVC Slotted
Driller:	ZR/BH	Top of Casing Elev. (ft):	598.659	Seal Material(s):	Grout, Bentonite
Logged By:	C. Christenson	Location (X,Y):	1,703,415.81, 721,382.16	Filter Pack:	#5 Sand

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	Date & Time	Blow Counts	Recovery (ft)	N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
0				SS01		2 4 6	1.0		(0') Medium dense, light brown to red, CLAYEY SILT (ML); dry, low to medium plasticity, cohesive, trace fine gravel and coal fragments, fill.		0.0
				SS02		2 8 7	1.4				
				SS03		3 5 8	1.3				
5				SS04		4 6 6	1.4				5.0
				SS05		2 4 5	1.5				
				SS06		2 5 7	1.5				
				SS07		3 5 6	1.5				
10				SS08		4 6 13	1.5				10.0
				SS09		2 4 8	1.0		(12') Brown SAND (SP); saturated, fine to medium, rounded gravel inclusions >30%.	Soil becomes wet at ~12'	
				SS10		3 7 12	1.2				
15				SS11		1 1 3	0.9		(15') GRAVEL with sand (GP); rounded to sub rounded coarse to fine gravel, fine to medium sand.		15.0
				SS12		5 3 3	1.2				
				SS13		10 8 7	1.4				
20				SS14		2	1.2				20.0

NOTES: Boring sampled with 2 in OD split spoon.
Well was constructed with approximately 3ft of casing stick up and well cover.

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Client: American Electric Power
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WELL LOG
Well No. MW-1921
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Drilling Start Date:	1/22/2019	Boring Depth (ft):	91.3	Well Depth (ft):	87.5
Drilling End Date:	1/24/2019	Boring Diameter (in):	8.25	Well Diameter (in):	2
Drilling Company:	AEP	Sampling Method(s):	SPT	Screen Slot (in):	0.010
Drilling Method:	Hollow Stem Auger	DTW After Drilling (ft):		Riser Material:	Sch 40 PVC
Drilling Equipment:	Truck-mounted rotary	Ground Surface Elev. (ft):	595.639	Screen Material:	Sch 40 PVC Slotted
Driller:	ZR/BH	Top of Casing Elev. (ft):	598.659	Seal Material(s):	Grout, Bentonite
Logged By:	C. Christenson	Location (X,Y):	1,703,415.81, 721,382.16	Filter Pack:	#5 Sand

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	Date & Time	Blow Counts	Recovery (ft)	N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
20				SS14		4 13	1.2		(20.5') Gray, SILTY CLAY (CL); moist, medium plasticity, cohesive.		20.0
				SS15		9 15	1.2		(21.2') SAND (SP); saturated, some rounded gravel inclusions.		
				SS16		11 8	1.3		(21.8') Gray/tan, CLAYEY SILT (ML); dry, low plasticity, noncohesive.		
				SS17		3 5 4	1.5		(22.5') SAND (SP); saturated, fine-grained, grades to medium gravel.		
25				SS18		4 6 3	1.5		(23.2') Tan to brown gray, SILTY CLAY (CL); damp, medium to high plasticity, cohesive, some rounded gravel inclusions.		25.0
				SS19		5 6 3	1.9		(25.5') Gray, CLAY (CL); damp, medium plasticity, cohesive, with brown/orange mottles 1/2 inch to 1 inch.		
				SS20		6 8 4	1.5		(27.5') Gray, CLAY (CL); dry, medium plasticity, cohesive, with brown large mottles and silt.		
30				SS21		6 7 3	1.8		(28.3') Red, SILTY CLAY (CL); damp, medium to high plasticity, cohesive.		30.0
				SS22		4 6 3	1.8		(30.8') Red, CLAYEY SILT (ML); dry to damp, medium to low plasticity.		
				SS23		4 7 3	2.0				
35				SS24		4 5 3	2.0		(35') Red, SANDY SILT (ML); wet, nonplastic, noncohesive, fine-grained.		35.0
				SS25		5 6 3	1.7				
				SS26		15 24 15	1.0		(37') Red-brown SAND (SP); saturated, medium- to fine-grained with some medium to coarse gravel inclusions, nonuniform.		
40				SS27		17 14 10	0.8				40.0

NOTES: Boring sampled with 2 in OD split spoon.
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WELL LOG
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Drilling Start Date:	1/22/2019	Boring Depth (ft):	91.3	Well Depth (ft):	87.5
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Drilling Company:	AEP	Sampling Method(s):	SPT	Screen Slot (in):	0.010
Drilling Method:	Hollow Stem Auger	DTW After Drilling (ft):		Riser Material:	Sch 40 PVC
Drilling Equipment:	Truck-mounted rotary	Ground Surface Elev. (ft):	595.639	Screen Material:	Sch 40 PVC Slotted
Driller:	ZR/BH	Top of Casing Elev. (ft):	598.659	Seal Material(s):	Grout, Bentonite
Logged By:	C. Christenson	Location (X,Y):	1,703,415.81, 721,382.16	Filter Pack:	#5 Sand

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	Date & Time	Blow Counts	Recovery (ft)	N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
40				SS27		21	0.8				40.0
						19					
				SS28		5	1.0				
						6					
				SS29		12	0.9				
						16					
						23					
				SS30		2	0.9				
						17					
45				SS31		19	1.3		(45') Medium dense, brown GRAVEL with sand (GP); saturated, fine-grained gravel and medium- to coarse-grained sand, trace coarse gravel and fine sand, nonuniform.		45.0
						15					
						32					
				SS32		31	1.1				
						27					
						25					
				SS33		24	1.0				
						15					
						15					
				SS34		15	0.9				
						13					
50						21					50.0
				SS35		20	0.8				
						11					
						13					
				SS36		17	0.8				
						16					
						12					
				SS37		8	0.7				
						8					
						10					
55				SS38		11	1.0				55.0
						17					
						9					
				SS39		11	0.5				
						7					
						9					
				SS40		11	1.3				
						7					
60						8			(59') 2 inch crumbly organic seem at 59.0 feet.		60.0
						8					

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Drilling Start Date:	1/22/2019	Boring Depth (ft):	91.3	Well Depth (ft):	87.5
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Drilling Company:	AEP	Sampling Method(s):	SPT	Screen Slot (in):	0.010
Drilling Method:	Hollow Stem Auger	DTW After Drilling (ft):		Riser Material:	Sch 40 PVC
Drilling Equipment:	Truck-mounted rotary	Ground Surface Elev. (ft):	595.639	Screen Material:	Sch 40 PVC Slotted
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Logged By:	C. Christenson	Location (X,Y):	1,703,415.81, 721,382.16	Filter Pack:	#5 Sand

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	Date & Time	Blow Counts	Recovery (ft)	N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
60				SS41		6 5 12	0.8		(59.2') Loose, brown SAND (SP); saturated, fine- to medium-grained, few coarse sand and fine gravel, trace silt.		60.0
				SS42		10 10 11	1.1				
				SS43		9 9 10	1.3				
65				SS44		13 8 9	1.3				65.0
				SS45		8 9 11	1.5				
				SS46		8 18 13	1.5				
				SS47		8 9 10	1.5		(69') Band of crumbly black organic material.		
70				SS48		7 11 14	1.0		(70') Loose, brown SAND (SP); saturated, medium- to fine-grained, trace coarse sand. (70.5') Becomes coarse-grained.		70.0
				SS49		7 9 11	1.0				
				SS50		9 18 25	1.4				
75				SS51		14 19 23	1.1				75.0
				SS52		14 14 23	1.0		(76.5') Loose, black ORGANIC SOIL with sand (OL); medium- to coarse-grained sand and some gravel, nonuniform and crumbly.		
				SS53		14 14 19	1.3				
80				SS54		16	1.1		(79') Medium dense, brown SAND (SP); saturated, fine-grained with trace silt, uniform.		80.0

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Drilling Company:	AEP	Sampling Method(s):	SPT	Screen Slot (in):	0.010
Drilling Method:	Hollow Stem Auger	DTW After Drilling (ft):		Riser Material:	Sch 40 PVC
Drilling Equipment:	Truck-mounted rotary	Ground Surface Elev. (ft):	595.639	Screen Material:	Sch 40 PVC Slotted
Driller:	ZR/BH	Top of Casing Elev. (ft):	598.659	Seal Material(s):	Grout, Bentonite
Logged By:	C. Christenson	Location (X,Y):	1,703,415.81, 721,382.16	Filter Pack:	#5 Sand

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	Date & Time	Blow Counts	Recovery (ft)	N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
80				SS54		20 29	1.1				80.0
				SS55		17 20 17	1.1		(81') Medium dense, brown SAND with gravel (SP); saturated, coarse-grained sand and fine-grained gravel with few coarse gravel and medium sand, nonuniform.		
				SS56		14 19 17	1.1				
85				SS57		21 23 22	1.2				85.0
				SS58		17 19 27	1.3				
				SS59		16 19 25	1.4		(87') Lens of fine loose sand at 87.0-87.5 feet.		
				SS60		35 50/2	0.6				
90				SS61		50/3					90.0
									(91.3') Boring terminated.		
95											95.0

NOTES: Boring sampled with 2 in OD split spoon.
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Client: American Electric Power
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Address: New Haven, WV

WELL LOG
Well No. MW-1922D
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Drilling Start Date:	1/28/2019	Boring Depth (ft):	114.2	Well Depth (ft):	83.5
Drilling End Date:	1/29/2019	Boring Diameter (in):	8.25	Well Diameter (in):	2
Drilling Company:	AEP	Sampling Method(s):	SPT; Core Barrel	Screen Slot (in):	0.010
Drilling Method:	Hollow Stem Auger	DTW After Drilling (ft):		Riser Material:	Sch 40 PVC
Drilling Equipment:	Truck-mounted rotary	Ground Surface Elev. (ft):	591.006	Screen Material:	Sch 40 PVC Slotted
Driller:	ZR/BH	Top of Casing Elev. (ft):	594.016	Seal Material(s):	Grout, Bentonite
Logged By:	C. Christenson	Location (X,Y):	1,701,767.67, 720,390.93	Filter Pack:	#5 Sand

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	Date & Time	Blow Counts	Recovery (ft)	N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
0									(0') Large stones.	Advanced hollow stem auger	0.0
				SS01		4 7 8	1.3		(1') Medium stiff to stiff, gray, CLAYEY SILT (ML); dry, low plasticity, few fine gravel, nonuniform. (2.5') Changes to dense and red-brown.		
5				SS02		2 3 4	1.3		(6.5') Changes to damp, cohesive, trace fine sand.		5.0
10				SS03		2 4 4	0.8		(11.5') Loose, red-brown, SANDY SILT (ML); damp, nonplastic, noncohesive, trace clay, uniform.		10.0
15				SS04		2 2 2	1.2		(16.5') Loose to medium dense, red-brown, SANDY SILT (ML); damp, low plasticity, cohesive, with some clay, uniform.		15.0
20											20.0

NOTES: Boring sampled with 2 in OD split spoon to 85 ft and wireline NQ to 115 ft.
Well was constructed with approximately 3ft of casing stick up and well cover.

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WELL LOG
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Drilling Start Date:	1/28/2019	Boring Depth (ft):	114.2	Well Depth (ft):	83.5
Drilling End Date:	1/29/2019	Boring Diameter (in):	8.25	Well Diameter (in):	2
Drilling Company:	AEP	Sampling Method(s):	SPT; Core Barrel	Screen Slot (in):	0.010
Drilling Method:	Hollow Stem Auger	DTW After Drilling (ft):		Riser Material:	Sch 40 PVC
Drilling Equipment:	Truck-mounted rotary	Ground Surface Elev. (ft):	591.006	Screen Material:	Sch 40 PVC Slotted
Driller:	ZR/BH	Top of Casing Elev. (ft):	594.016	Seal Material(s):	Grout, Bentonite
Logged By:	C. Christenson	Location (X,Y):	1,701,767.67, 720,390.93	Filter Pack:	#5 Sand

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	Date & Time	Blow Counts	Recovery (ft)	N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
20											20.0
				SS05		3 10 13	0.9		(21.5') Loose, brown SAND (SP); medium- to fine-grained, with trace coarse sand & gravel.		
25											25.0
				SS06		7 9 12	1.3		(26.5') Medium dense, gray-brown, CLAYEY SILT (ML); lens. (27') Loose, brown SAND (SP); damp, noncohesive, medium-grained sand, with few coarse sand and trace fine gravel.		
30											30.0
				SS07		5 6 7	0.3		(31.5') Loose, dark brown, SILTY and CLAYEY SAND (SM); damp, noncohesive, medium-grained sand with some fine rounded gravel, nonuniform.		
35											35.0
				SS08		4 5 8	1.3		(36.5') Loose, brown, SILTY CLAY (CL); damp, low plasticity, cohesive, lens. (37') Loose, brown SAND (SP); damp, noncohesive, medium-grained sand with few fine sand and gravel.		
40											40.0

NOTES: Boring sampled with 2 in OD split spoon to 85 ft and wireline NQ to 115 ft.
Well was constructed with approximately 3ft of casing stick up and well cover.

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Drilling Start Date:	1/28/2019	Boring Depth (ft):	114.2	Well Depth (ft):	83.5
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Drilling Company:	AEP	Sampling Method(s):	SPT; Core Barrel	Screen Slot (in):	0.010
Drilling Method:	Hollow Stem Auger	DTW After Drilling (ft):		Riser Material:	Sch 40 PVC
Drilling Equipment:	Truck-mounted rotary	Ground Surface Elev. (ft):	591.006	Screen Material:	Sch 40 PVC Slotted
Driller:	ZR/BH	Top of Casing Elev. (ft):	594.016	Seal Material(s):	Grout, Bentonite
Logged By:	C. Christenson	Location (X,Y):	1,701,767.67, 720,390.93	Filter Pack:	#5 Sand

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	Date & Time	Blow Counts	Recovery (ft)	N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
40											40.0
				SS09		4 5 8	1.3		(41.5') Loose, brown, SILTY CLAY (CL); damp, low plasticity, cohesive, trace sand.		
									(42') Loose, brown SAND (SP); damp, nonplastic, noncohesive, fine- to medium-grained sand, uniform.		
45											45.0
				SS10		4 6 7	1.5		(46.5') Changes to wet with few coarse sand and trace fine gravel.		
				SS11		9 6 8	1.3		(48.5') 2 inch dark gray clay lens at 48.5 feet.		
50				SS12		9 9 10	1.5		(49.5') Medium dense, brown SAND (SP); wet, nonplastic, noncohesive, medium- to fine-grained, uniform, with black partings throughout.		50.0
				SS13		4 6 9	1.3				
				SS14		4 7 8	1.2		(52.5') With few fine to coarse gravel.		
55				SS15		3 5 10	1.1				55.0
				SS16		6 8 9	0.9				
				SS17		4 7 8	1.0				
				SS18		4 5 4	1.0				
60											60.0

NOTES: Boring sampled with 2 in OD split spoon to 85 ft and wireline NQ to 115 ft.
Well was constructed with approximately 3ft of casing stick up and well cover.

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WELL LOG
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Drilling Company:	AEP	Sampling Method(s):	SPT; Core Barrel	Screen Slot (in):	0.010
Drilling Method:	Hollow Stem Auger	DTW After Drilling (ft):		Riser Material:	Sch 40 PVC
Drilling Equipment:	Truck-mounted rotary	Ground Surface Elev. (ft):	591.006	Screen Material:	Sch 40 PVC Slotted
Driller:	ZR/BH	Top of Casing Elev. (ft):	594.016	Seal Material(s):	Grout, Bentonite
Logged By:	C. Christenson	Location (X,Y):	1,701,767.67, 720,390.93	Filter Pack:	#5 Sand

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	Date & Time	Blow Counts	Recovery (ft)	N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
60				SS19		8, 13, 16	0.9		(60') Loose to medium dense, brown SAND (SP); wet, some coarse sand, uniform.		60.0
				SS20		8, 12, 13	1.1		(61.5') Loose, gray-brown SAND (SP); wet, medium- to coarse-grained with few fine rounded gravel, nonuniform.		
				SS21		8, 12, 14	1.3		(63') Medium dense, gray-brown, SANDY SILT (ML); wet.		
65				SS22		8, 13, 18	0.8		(63.3') Medium dense, tan gray SAND (SP); wet, fine- to medium-grained, with some coarse sand, several black partings.		65.0
				SS23		6, 7, 10	1.2				
				SS24		8, 11, 16	1.1		(67.5') Trace fine gravel.		
				SS25		12, 13, 15	1.0				
70				SS26		7, 16, 22	1.1				70.0
				SS27		13, 14, 14	0.9				
				SS28		11, 13, 20	1.1				
75				SS29		20, 24, 25	1.2		(75') Some medium sand.		75.0
				SS30		12, 11, 13	1.2		(77') Medium dense, gray SAND (SP); wet, nonplastic, noncohesive, uniform.		
				SS31		10, 13, 15	1.1				
80				SS32		20	1.3			Silty sand at 79.5'	80.0

NOTES: Boring sampled with 2 in OD split spoon to 85 ft and wireline NQ to 115 ft.
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Drilling Equipment:	Truck-mounted rotary	Ground Surface Elev. (ft):	591.006	Screen Material:	Sch 40 PVC Slotted
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	Date & Time	Blow Counts	Recovery (ft)	N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
80				SS32		18 14	1.3		(80') Medium dense, gray SAND with gravel (SP); wet, noncohesive, coarse-grained sand and fine-grained gravel with some coarse gravel and medium sand, nonuniform.		80.0
						12					
				SS33		11	1.0				
						19					
				SS34		24 38	1.1		(82.5') Dense, gray GRAVEL with sand (GP); wet, noncohesive, some coarse gravel and coarse sand and few medium sand, nonuniform.	Advanced using water rotary drilling	
						25					
						20			(84') Medium dense, brown gray GRAVEL with sand (GP); wet, fine-grained gravel and coarse-grained sand with some coarse gravel and clay lens at 84.0 feet.		
85				SS35		50/5	1.0		(85.5') Auger refusal at 85.0 feet.		85.0
									(86') Moderately hard, fine- to medium-grained, light gray SANDSTONE with thin dark gray partings less that 1 inch apart, moderately fractured and fine-grained between 86.0-88.0 feet.		
									(88') Sound and medium-grained below 88.0 feet.		
90				CB 1			8.2	91			90.0
95									(94.2') Moderately hard to moderately soft, light to medium gray, fine- to medium-grained SANDSTONE (very thin); dark gray, horizontal partings approximately 12 to 14 inches apart, lightly fractured to sound.		95.0
				CB 2			9.6	98			
100											100.0

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Drilling Company:	AEP	Sampling Method(s):	SPT; Core Barrel	Screen Slot (in):	0.010
Drilling Method:	Hollow Stem Auger	DTW After Drilling (ft):		Riser Material:	Sch 40 PVC
Drilling Equipment:	Truck-mounted rotary	Ground Surface Elev. (ft):	591.006	Screen Material:	Sch 40 PVC Slotted
Driller:	ZR/BH	Top of Casing Elev. (ft):	594.016	Seal Material(s):	Grout, Bentonite
Logged By:	C. Christenson	Location (X,Y):	1,701,767.67, 720,390.93	Filter Pack:	#5 Sand

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
100				CB 2			9.6	98	(104.2') Moderately hard to moderately soft, medium gray, medium- to fine-grained SANDSTONE (thin to horizontal); dark gray partings every 4 to 6 inches, lightly fractured, sound.		100.0
105				CB 3			9.8	100			105.0
110											110.0
115									(114.2') Boring terminated.		115.0

NOTES: Boring sampled with 2 in OD split spoon to 85 ft and wireline NQ to 115 ft.
Well was constructed with approximately 3ft of casing stick up and well cover.

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Client: American Electric Power
Project: CHW8293
Address: New Haven, WV

WELL LOG
Well No. MW-1923
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Drilling Start Date:	2/8/2019	Boring Depth (ft):	70	Well Depth (ft):	65.5
Drilling End Date:	2/8/2019	Boring Diameter (in):	8.25	Well Diameter (in):	2
Drilling Company:	AEP	Sampling Method(s):	SPT	Screen Slot (in):	0.010
Drilling Method:	Hollow Stem Auger	DTW After Drilling (ft):		Riser Material:	Sch 40 PVC
Drilling Equipment:	Truck-mounted rotary	Ground Surface Elev. (ft):	591.012	Screen Material:	Sch 40 PVC Slotted
Driller:	ZR/BH	Top of Casing Elev. (ft):	593.972	Seal Material(s):	Grout, Bentonite
Logged By:	C. Christenson	Location (X,Y):	1,703,107.28, 722,110.27	Filter Pack:	#5 Sand

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
0									(0') Concrete. (0.5') Hydroexcavate from 0.5-11.5 ft.	No samples collected. No subsurface utilities encountered.	0.0
5											5.0
10											10.0
11.5				SS01		7 8 11	1.5		(11.5') Soft to medium stiff, red-brown, CLAYEY SILT (ML); damp, low plasticity, cohesive, with few fine sand, uniform.		
15											15.0
17				SS02		5 5 12	0.9				
20											20.0

NOTES: Boring sampled with 2 in OD split spoon.
Well was constructed with approximately 3ft of casing stick up and well cover.

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Client:	**American Electric Power**
Project:	**CHW8293**
Address:	**New Haven, WV**

WELL LOG

Well No. **MW-1923**
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Drilling Start Date:	**2/8/2019**	Boring Depth (ft):	**70**	Well Depth (ft):	**65.5**
Drilling End Date:	**2/8/2019**	Boring Diameter (in):	**8.25**	Well Diameter (in):	**2**
Drilling Company:	**AEP**	Sampling Method(s):	**SPT**	Screen Slot (in):	**0.010**
Drilling Method:	**Hollow Stem Auger**	DTW After Drilling (ft):		Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**Truck-mounted rotary**	Ground Surface Elev. (ft):	**591.012**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**ZR/BH**	Top of Casing Elev. (ft):	**593.972**	Seal Material(s):	**Grout, Bentonite**
Logged By:	**C. Christenson**	Location (X,Y):	**1,703,107.28, 722,110.27**	Filter Pack:	**#5 Sand**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
20											20.0
				SS03		4 5 8	1.5				
25											25.0
				SS04		2 4 6	1.3				
30											30.0
				SS05		12 17 20	1.5		(32') Loose, red-brown SAND with gravel (SP); dry, noncohesive, fine- to medium-grained sand with some coarse gravel, nonuniform.		
35											35.0
				SS06		9 13 15	1.5		(36.5') Loose to medium dense, red-brown, CLAYEY SILT (ML); wet, medium plasticity, cohesive, with fine sand. (37') Loose to medium dense, brown SAND (SP); damp, nonplastic, noncohesive, fine- to medium-grained sand with some fine to coarse gravel, nonuniform.		
40											40.0

NOTES: Boring sampled with 2 in OD split spoon.
Well was constructed with approximately 3ft of casing stick up and well cover.

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Client: American Electric Power
Project: CHW8293
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WELL LOG
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Drilling Start Date:	2/8/2019	Boring Depth (ft):	70	Well Depth (ft):	65.5
Drilling End Date:	2/8/2019	Boring Diameter (in):	8.25	Well Diameter (in):	2
Drilling Company:	AEP	Sampling Method(s):	SPT	Screen Slot (in):	0.010
Drilling Method:	Hollow Stem Auger	DTW After Drilling (ft):		Riser Material:	Sch 40 PVC
Drilling Equipment:	Truck-mounted rotary	Ground Surface Elev. (ft):	591.012	Screen Material:	Sch 40 PVC Slotted
Driller:	ZR/BH	Top of Casing Elev. (ft):	593.972	Seal Material(s):	Grout, Bentonite
Logged By:	C. Christenson	Location (X,Y):	1,703,107.28, 722,110.27	Filter Pack:	#5 Sand

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	Date & Time	Blow Counts	Recovery (ft)	N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
40											40.0
				SS07		10 15 21	1.3				
45											45.0
				SS08		5 10 10	1.1				
50											50.0
				SS09		4 9 14	2.0				
55											55.0
				SS10		11 12 19	1.1		(56.5') Changes to wet, cohesive clay layers at approximately 6-inch intervals from 56.5-58 ft.		
				SS11		8 10 14	1.5				
60				SS12		8	1.3				60.0

NOTES: Boring sampled with 2 in OD split spoon.
Well was constructed with approximately 3ft of casing stick up and well cover.

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Client: American Electric Power
Project: CHW8293
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WELL LOG
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Drilling Start Date:	2/8/2019	Boring Depth (ft):	70	Well Depth (ft):	65.5
Drilling End Date:	2/8/2019	Boring Diameter (in):	8.25	Well Diameter (in):	2
Drilling Company:	AEP	Sampling Method(s):	SPT	Screen Slot (in):	0.010
Drilling Method:	Hollow Stem Auger	DTW After Drilling (ft):		Riser Material:	Sch 40 PVC
Drilling Equipment:	Truck-mounted rotary	Ground Surface Elev. (ft):	591.012	Screen Material:	Sch 40 PVC Slotted
Driller:	ZR/BH	Top of Casing Elev. (ft):	593.972	Seal Material(s):	Grout, Bentonite
Logged By:	C. Christenson	Location (X,Y):	1,703,107.28, 722,110.27	Filter Pack:	#5 Sand

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	Date & Time	Blow Counts	Recovery (ft)	N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
60				SS12		11 13	1.3				60.0
				SS13		8 13	1.2		(61') Changes to medium- to coarse-grained sand.		
				SS14		12 7 8	1.0				
				SS15		10 14 18	1.2		(64') Changes to dense.		
65				SS16		19 10 12	1.1				65.0
				SS17		21 10 21	0.5				
				SS18		22 18 20	1.1		(68.5') Changes to coarse-grained sand.		
70						21			(70') Boring terminated.		70.0
75											75.0

NOTES: Boring sampled with 2 in OD split spoon.
Well was constructed with approximately 3ft of casing stick up and well cover.

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Client:	**American Electric Power**
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Address:	**New Haven, WV**

WELL LOG

Well No. **MW-1924**
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Drilling Start Date:	**2/7/2019**	Boring Depth (ft):	**71**	Well Depth (ft):	**70.7**
Drilling End Date:	**2/12/2019**	Boring Diameter (in):	**8.25**	Well Diameter (in):	**2**
Drilling Company:	**AEP**	Sampling Method(s):	**SPT (2 in ID)**	Screen Slot (in):	**0.010**
Drilling Method:	**Hollow Stem Auger**	DTW After Drilling (ft):		Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**Hollow Stem Auger**	Ground Surface Elev. (ft):	**586.072**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**ZR/RB**	Top of Casing Elev. (ft):	**585.922**	Seal Material(s):	**Grout, Bentonite**
Logged By:	**K. Villars**	Location (X,Y):	**1,702,779.26, 721,897.95**	Filter Pack:	**#5 Sand**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
0									(0') CONCRETE. (0.5') Hydroexcavate 0.5 feet to approximately 12 feet bgs on 2/8/2019.		0.0
12				SS01		3 3 3	0.6		(12') Loose, gray SAND (SP); moist, noncohesive, fine-grained with few medium and trace coarse grained sand.		
16.5				SS02		4 5 8	1.4		(16.5') Very loose, red brown, WELL-GRADED SAND with silt (SW-SM); moist, low plasticity, fine-grained.		
21.5				SS03		10 9 14	1.2		(21.5') Medium dense to dense, brown, SAND (SP); noncohesive, little to some gravel.		
25											25.0

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WELL LOG

Well No. **MW-1924**
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Drilling Start Date:	**2/7/2019**	Boring Depth (ft):	**71**	Well Depth (ft):	**70.7**
Drilling End Date:	**2/12/2019**	Boring Diameter (in):	**8.25**	Well Diameter (in):	**2**
Drilling Company:	**AEP**	Sampling Method(s):	**SPT (2 in ID)**	Screen Slot (in):	**0.010**
Drilling Method:	**Hollow Stem Auger**	DTW After Drilling (ft):		Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**Hollow Stem Auger**	Ground Surface Elev. (ft):	**586.072**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**ZR/RB**	Top of Casing Elev. (ft):	**585.922**	Seal Material(s):	**Grout, Bentonite**
Logged By:	**K. Villars**	Location (X,Y):	**1,702,779.26, 721,897.95**	Filter Pack:	**#5 Sand**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
25				SS04		10 12 17	1.2				25.0
30				SS05		10 14 16	1.2				30.0
35				SS06		11 12 15	1.4			Stop advancing on 2/11/2019 - resume advancing on 2/12/2019	35.0
40				SS07		13 13 11	1.3		(41.5') Grading change to sand with gravel.		40.0
45				SS08		4 7 13	1.6		(46.5') Medium, dark gray, WELL-GRADED SAND (SP); very moist, unconsolidated, trace coarse sand and silt with some medium sand, some black staining in top 0.5 feet.	Begin using Quick Gel to hold boring open and prevent heaving	45.0
50											50.0

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WELL LOG
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Drilling Start Date:	2/7/2019	Boring Depth (ft):	71	Well Depth (ft):	70.7
Drilling End Date:	2/12/2019	Boring Diameter (in):	8.25	Well Diameter (in):	2
Drilling Company:	AEP	Sampling Method(s):	SPT (2 in ID)	Screen Slot (in):	0.010
Drilling Method:	Hollow Stem Auger	DTW After Drilling (ft):		Riser Material:	Sch 40 PVC
Drilling Equipment:	Hollow Stem Auger	Ground Surface Elev. (ft):	586.072	Screen Material:	Sch 40 PVC Slotted
Driller:	ZR/RB	Top of Casing Elev. (ft):	585.922	Seal Material(s):	Grout, Bentonite
Logged By:	K. Villars	Location (X,Y):	1,702,779.26, 721,897.95	Filter Pack:	#5 Sand

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	Date & Time	Blow Counts	Recovery (ft)	N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
50											50.0
				SS09		5 7 16	1.2		(51.5') Loose to medium dense, tan SAND (SP); wet, noncohesive, trace fine gravel.	Below water table	
				SS10		6 15 20	1.5		(54') Black staining/coal.		
55				SS11		7 10 15	1.5		(54.5') Medium dense, black to dark brown silty clay lens.		55.0
				SS12		7 15 16	1.2		(56.9') Fractured rock lens.		
				SS13		7 11 16	1.2				
60				SS14		5 9 13	1.1				60.0
				SS15		10 13 17	1.1		(60.5') Medium to dense, light brown to gray brown, SAND (SP); wet, noncohesive, some fine sand and fine gravel, top 2 inches with black staining.		
				SS16		10 15 19	1.1				
				SS17		15 20 25	1.2				
65				SS18		12 17 18	1				65.0
				SS19		14 12 11	1.2				
				SS20		8 14 21	1.1				
70				SS21		10 12 18	1.1		(71') Boring terminated.		70.0
75											75.0

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Project:	**CHW8293**
Address:	**New Haven, WV**

WELL LOG

Well No. **MW-1925**
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Drilling Start Date:	**2/13/2019**	Boring Depth (ft):	**59.5**	Well Depth (ft):	**58.5**
Drilling End Date:	**2/15/2019**	Boring Diameter (in):	**8.25**	Well Diameter (in):	**2**
Drilling Company:	**AEP**	Sampling Method(s):	**SPT (2 in ID)**	Screen Slot (in):	**0.010**
Drilling Method:	**Hollow Stem Auger**	DTW After Drilling (ft):		Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**Hollow Stem Auger**	Ground Surface Elev. (ft):	**586.101**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**ZR/RB**	Top of Casing Elev. (ft):	**588.991**	Seal Material(s):	**Grout, Bentonite**
Logged By:	**K. Villars**	Location (X,Y):	**1,702,277.23, 720,908.19**	Filter Pack:	**#5 Sand**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
0									(0') TOPSOIL; with limestone cobble.		0.0
				SS01		7 12 14	1.3		(0.3') Stiff, light brown, LEAN CLAY (CL); moist, medium plasticity.		
5				SS02		4 4 5	0				5.0
10				SS03		5 11 15	1.2		(12') Loose to medium dense, light brown, SAND (SP); moist, noncohesive, fine-grained with some gravel.	SS-03-1 SS-03-2	10.0
15				SS04		6 11 23	1.3				15.0
20				SS05		11 21 30	0.9		(22.8') Narrow lens of black coal less than 0.1-inch thick.		20.0
25											25.0

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WELL LOG
Well No. MW-1925
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Drilling Start Date:	2/13/2019	Boring Depth (ft):	59.5	Well Depth (ft):	58.5
Drilling End Date:	2/15/2019	Boring Diameter (in):	8.25	Well Diameter (in):	2
Drilling Company:	AEP	Sampling Method(s):	SPT (2 in ID)	Screen Slot (in):	0.010
Drilling Method:	Hollow Stem Auger	DTW After Drilling (ft):		Riser Material:	Sch 40 PVC
Drilling Equipment:	Hollow Stem Auger	Ground Surface Elev. (ft):	586.101	Screen Material:	Sch 40 PVC Slotted
Driller:	ZR/RB	Top of Casing Elev. (ft):	588.991	Seal Material(s):	Grout, Bentonite
Logged By:	K. Villars	Location (X,Y):	1,702,277.23, 720,908.19	Filter Pack:	#5 Sand

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	Date & Time	Blow Counts	Recovery (ft)	N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
25				SS06		6 13 21	0.9				25.0
30				SS07		17 27 29	1.3				30.0
35				SS08		5 10 10	0.8		(37') Grading to less gravel and wet. (37.6') Thin black coal lens.		35.0
40				SS09		3 5 7	1.4		(41.5') Loose, light brown SAND (SP); wet, noncohesive, fine-grained trace coarse sand.	Fully saturated, below water table	40.0
				SS10		4 4 4	1.2				
45				SS11		4 6 8	1				45.0
				SS12		4 7 7	1.2		(47') Trace silt.		
				SS13		3 6 6	1.2				
50				SS14		4 6	1.3				50.0

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WELL LOG
Well No. MW-1925
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Drilling Start Date:	**2/13/2019**	Boring Depth (ft):	**59.5**	Well Depth (ft):	**58.5**
Drilling End Date:	**2/15/2019**	Boring Diameter (in):	**8.25**	Well Diameter (in):	**2**
Drilling Company:	**AEP**	Sampling Method(s):	**SPT (2 in ID)**	Screen Slot (in):	**0.010**
Drilling Method:	**Hollow Stem Auger**	DTW After Drilling (ft):		Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**Hollow Stem Auger**	Ground Surface Elev. (ft):	**586.101**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**ZR/RB**	Top of Casing Elev. (ft):	**588.991**	Seal Material(s):	**Grout, Bentonite**
Logged By:	**K. Villars**	Location (X,Y):	**1,702,277.23, 720,908.19**	Filter Pack:	**#5 Sand**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
50				SS14		6 5	1.3				50.0
				SS15		8 9	1.3				
				SS16		5 8 9	1.3		(52') Loose, gray brown, WELL-GRADED SAND (SW); wet, noncohesive, fine- to medium-grained.		
				SS17		7 9 13	1.4				
55				SS18		7 13 18	1.7		(55') Medium dense, light brown, WELL-GRADED SAND (SW); wet, noncohesive, fine-grained with few medium-grained sand and silt.		55.0
				SS19		13 18 22	1.2		(56') 2-inch coal seam.	56.5-57.2 collected	
				SS20		7 11 11	1.1		(56.5') Medium dense, black, WELL-GRADED SAND (SW); wet, noncohesive, few coarse sand.		
60									(57.2') Medium dense, light brown, WELL-GRADED SAND (SW); wet, noncohesive, medium-grained with few coarse sand and trace fine gravel.		60.0
									(58') Loose, gray brown, WELL-GRADED SAND (SW); wet, noncohesive, medium-grained with some fine sand and trace fine gravel, black to dark green in top half of interval.		
									(59.5') Boring terminated.		

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Address:	**New Haven, WV**

WELL LOG

Well No. **MW-1926**
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Drilling Start Date:	**2/15/2019**	Boring Depth (ft):	**65**	Well Depth (ft):	**63.5**
Drilling End Date:	**2/18/2019**	Boring Diameter (in):	**8.25**	Well Diameter (in):	**2**
Drilling Company:	**AEP**	Sampling Method(s):	**SPT (2 in ID)**	Screen Slot (in):	**0.010**
Drilling Method:	**Hollow Stem Auger**	DTW After Drilling (ft):		Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**Hollow Stem Auger**	Ground Surface Elev. (ft):	**597.783**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**ZR/RB**	Top of Casing Elev. (ft):	**600.723**	Seal Material(s):	**Grout, Bentonite**
Logged By:	**K. Villars**	Location (X,Y):	**1,703,841.94, 718,333.14**	Filter Pack:	**#5 Sand**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
0									(0') Hydroexcavated on 2/15/2019.		0.0
				SS01		13 18 9	1		(2.8') Loose, red brown, SILTY SAND (SM); moist, cohesive, trace gravel.		
5				SS02		2 2 5	1.3		(6.5') Loose, dark gray brown, WELL-GRADED SAND with gravel (SW); moist, noncohesive, fine-grained sand.		5.0
									(7.2') Medium, light yellow brown, CLAY (CL); dry to moist, medium plasticity, few sand and trace fine gravel.		
10				SS03		2 4 6	1.3		(12') Very loose to loose, light brown, WELL-GRADED SAND (SW); moist, noncohesive, some gravel.		10.0
15				SS04		2 4 6	1.3		(16.5') Changes to trace gravel.		15.0
20				SS05		3 4 4	1.3				20.0
25											25.0

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Project: CHW8293
Address: New Haven, WV

WELL LOG
Well No. MW-1926
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Drilling Start Date:	2/15/2019	Boring Depth (ft):	65	Well Depth (ft):	63.5
Drilling End Date:	2/18/2019	Boring Diameter (in):	8.25	Well Diameter (in):	2
Drilling Company:	AEP	Sampling Method(s):	SPT (2 in ID)	Screen Slot (in):	0.010
Drilling Method:	Hollow Stem Auger	DTW After Drilling (ft):		Riser Material:	Sch 40 PVC
Drilling Equipment:	Hollow Stem Auger	Ground Surface Elev. (ft):	597.783	Screen Material:	Sch 40 PVC Slotted
Driller:	ZR/RB	Top of Casing Elev. (ft):	600.723	Seal Material(s):	Grout, Bentonite
Logged By:	K. Villars	Location (X,Y):	1,703,841.94, 718,333.14	Filter Pack:	#5 Sand

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	Date & Time	Blow Counts	Recovery (ft)	N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
25				SS06		5 8 8	1.3				25.0
30				SS07		8 9 10	1.2		(31.5') Changes to poorly graded. (32') With black material.		30.0
35				SS08		3 7 7	1.2		(36.5') Changes to without gravel.		35.0
40				SS09		11 12 14	1.5		(41.5') Changes to medium dense and well-graded. (42.5') <0.1-inch black layer.	Resume on 2/18/2019	40.0
45				SS10		6 12 12	1.3				45.0
50											50.0

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Address: New Haven, WV

WELL LOG
Well No. MW-1926
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Drilling Start Date:	2/15/2019	Boring Depth (ft):	65	Well Depth (ft):	63.5
Drilling End Date:	2/18/2019	Boring Diameter (in):	8.25	Well Diameter (in):	2
Drilling Company:	AEP	Sampling Method(s):	SPT (2 in ID)	Screen Slot (in):	0.010
Drilling Method:	Hollow Stem Auger	DTW After Drilling (ft):		Riser Material:	Sch 40 PVC
Drilling Equipment:	Hollow Stem Auger	Ground Surface Elev. (ft):	597.783	Screen Material:	Sch 40 PVC Slotted
Driller:	ZR/RB	Top of Casing Elev. (ft):	600.723	Seal Material(s):	Grout, Bentonite
Logged By:	K. Villars	Location (X,Y):	1,703,841.94, 718,333.14	Filter Pack:	#5 Sand

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	Date & Time	Blow Counts	Recovery (ft)	N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
50											50.0
				SS11		5 6 9	1.5		(51.5') Loose, light brown SAND (SW); wet, noncohesive, fine-grained.	Encountered water table between SS10 and SS11	
				SS12		14 9 11	1.2		(52.5') Trace black layer.	Introduce Quick Gel drilling mud	
55				SS13		3 8 10	1.5		(54.5') Changes to trace to little gravel.		55.0
				SS14		4 6 8	1.2		(56') Changes to medium sand and gray brown.		
				SS15		6 6 8	1.5				
60				SS16		4 6 8	1.3				60.0
				SS17		10 13 18					
				SS18		10 14 14	1.4		(62.8') Black stain and wet.		
				SS19		5 8 15	1.3		(64.7') Black lens.		
65									(65') Boring terminated.		65.0
70											70.0

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Project: CHW8293
Address: New Haven, WV

WELL LOG
Well No. MW-1927
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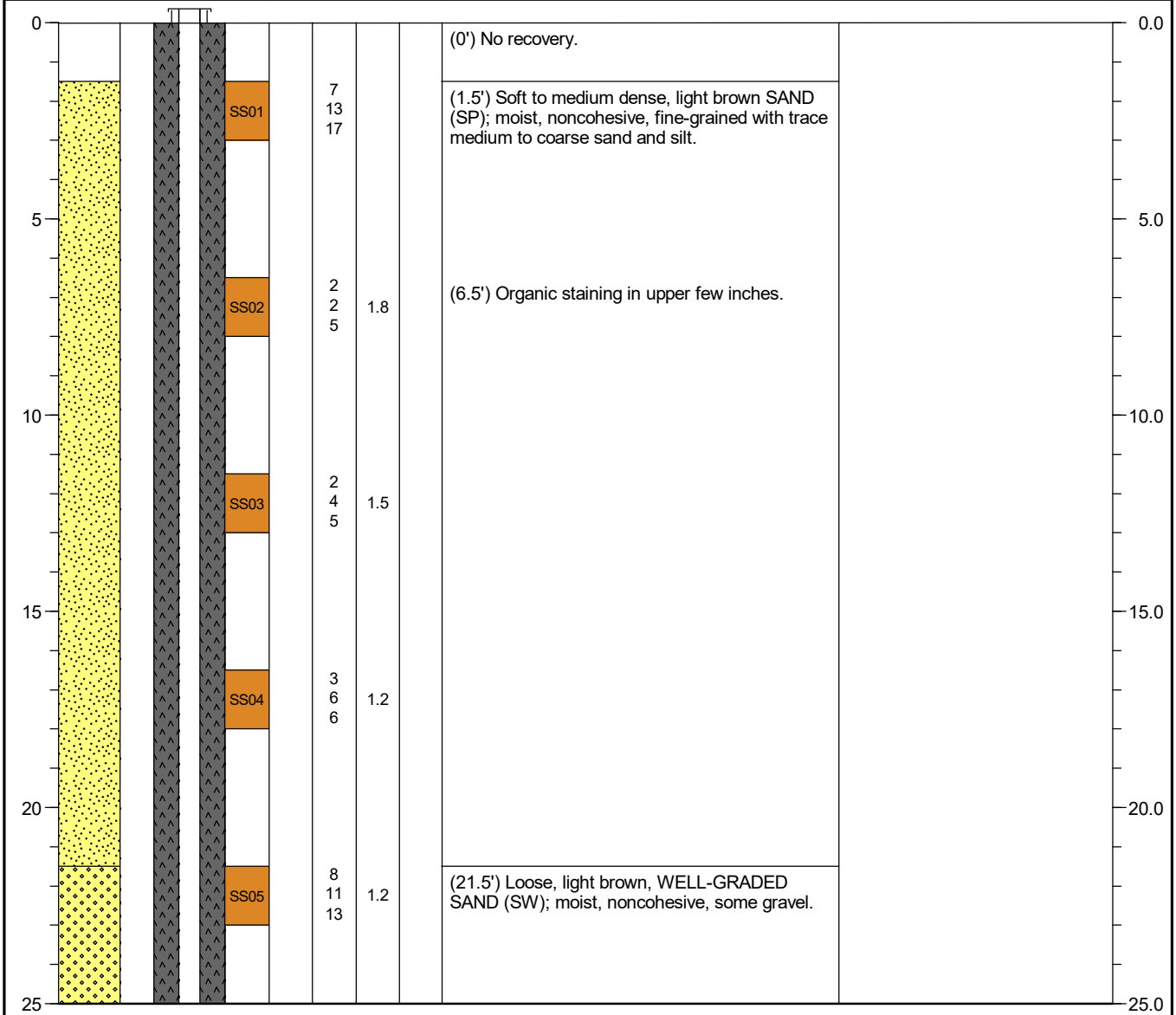
Drilling Start Date:	2/19/2019	Boring Depth (ft):	71	Well Depth (ft):	50.0
Drilling End Date:	2/20/2019	Boring Diameter (in):	8.25	Well Diameter (in):	2
Drilling Company:	AEP	Sampling Method(s):	SPT (2 in ID)	Screen Slot (in):	0.010
Drilling Method:	Hollow Stem Auger	DTW After Drilling (ft):		Riser Material:	Sch 40 PVC
Drilling Equipment:	Hollow Stem Auger	Ground Surface Elev. (ft):	593.737	Screen Material:	Sch 40 PVC Slotted
Driller:	ZR/RB	Top of Casing Elev. (ft):	596.737	Seal Material(s):	Grout, Bentonite
Logged By:	K. Villars	Location (X,Y):	1,700,372.74, 721,535.11	Filter Pack:	#5 Sand



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Address: New Haven, WV

WELL LOG
Well No. MW-1927
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Drilling Start Date:	2/19/2019	Boring Depth (ft):	71	Well Depth (ft):	50.0
Drilling End Date:	2/20/2019	Boring Diameter (in):	8.25	Well Diameter (in):	2
Drilling Company:	AEP	Sampling Method(s):	SPT (2 in ID)	Screen Slot (in):	0.010
Drilling Method:	Hollow Stem Auger	DTW After Drilling (ft):		Riser Material:	Sch 40 PVC
Drilling Equipment:	Hollow Stem Auger	Ground Surface Elev. (ft):	593.737	Screen Material:	Sch 40 PVC Slotted
Driller:	ZR/RB	Top of Casing Elev. (ft):	596.737	Seal Material(s):	Grout, Bentonite
Logged By:	K. Villars	Location (X,Y):	1,700,372.74, 721,535.11	Filter Pack:	#5 Sand

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	Date & Time	Blow Counts	Recovery (ft)	N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
25				SS06		9 11 13	1.1				25.0
30				SS07		9 10 13	1.2		(32') Coal-like black large gravel-sized particle.		30.0
35				SS08		5 6 6	1.2		(37') Layered coal from 37.0-37.2 feet.		35.0
40				SS09		9 12 18	1.5		(41.5') Loose to medium dense, brown, SAND (SP); dry, fine-grained.		40.0
45				SS10		7 7 7	1.3		(46.5') Black staining from 46.5-46.6 feet. (47') Changes to well-graded and wet.	Stop advancing at 1630 on 2/19/2019	45.0
50											50.0

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WELL LOG
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Drilling Start Date:	2/19/2019	Boring Depth (ft):	71	Well Depth (ft):	50.0
Drilling End Date:	2/20/2019	Boring Diameter (in):	8.25	Well Diameter (in):	2
Drilling Company:	AEP	Sampling Method(s):	SPT (2 in ID)	Screen Slot (in):	0.010
Drilling Method:	Hollow Stem Auger	DTW After Drilling (ft):		Riser Material:	Sch 40 PVC
Drilling Equipment:	Hollow Stem Auger	Ground Surface Elev. (ft):	593.737	Screen Material:	Sch 40 PVC Slotted
Driller:	ZR/RB	Top of Casing Elev. (ft):	596.737	Seal Material(s):	Grout, Bentonite
Logged By:	K. Villars	Location (X,Y):	1,700,372.74, 721,535.11	Filter Pack:	#5 Sand

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	Date & Time	Blow Counts	Recovery (ft)	N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
50				SS11		4 6 8	1.2			Begin advancing at 1230 on 2/20/2019 Static water level at 50.18 at 1230 on 2/20/2019	50.0
				SS12		4 4 4	1.1		(52.3') Black staining. (52.8') Black fragments.	Introduce Quick Gel	
55				SS13		3 3 6	1.1				55.0
				SS14		5 6 11	1.2		(56') Changes to poorly graded.		
				SS15		6 10 17	1.3				
60				SS16		9 11 16	1.3				60.0
				SS17		8 11 16	1.3				
				SS18		7 13 22	1.2		(63') Faint black.		
65				SS19		11 11 12	1.1		(63.5') Medium dense, light brown, WELL-GRADED SAND (SW); wet, noncohesive, fine- to medium-grained with few gravel.		65.0
				SS20		11 12 17	1				
				SS21		12 15 16	1.2				
70				SS22		14 11 14	1.2				70.0
				SS23		12 18 26	1.2		(71') Boring terminated.		
75											75.0

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WELL LOG

Well No. **MW-1928**
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Drilling Start Date:	**2/21/2019**	Boring Depth (ft):	**100.2**	Well Depth (ft):	**99.5**
Drilling End Date:	**2/25/2019**	Boring Diameter (in):	**8.25**	Well Diameter (in):	**2**
Drilling Company:	**AEP**	Sampling Method(s):	**SPT (2 in ID)**	Screen Slot (in):	**0.010**
Drilling Method:	**Hollow Stem Auger**	DTW After Drilling (ft):		Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**Hollow Stem Auger**	Ground Surface Elev. (ft):	**646.848**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**ZR/RB**	Top of Casing Elev. (ft):	**649.668**	Seal Material(s):	**Grout, Bentonite**
Logged By:	**K. Villars**	Location (X,Y):	**1,701,131.62, 718,577.76**	Filter Pack:	**#5 Sand**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
0									(0') No recovery.		0.0
				SS01		5 11 12	1.1		(1.5') Medium dense, yellow, red, brown, and gray FILL (FILL); little coarse angular gravel, with clay shale and lean clay (MINE SPOIL).		
5				SS02		6 9 14	1				5.0
10				SS03		16 9 9	1.1				10.0
15				SS04		6 9 9	1.2				15.0
20				SS05		6 8 8	1.2		(22') Soft to medium dense, red brown CLAY (CL); moist, medium plasticity, some coarse sand, few fractured sandstone.		20.0
25											25.0

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Drilling Start Date:	**2/21/2019**	Boring Depth (ft):	**100.2**	Well Depth (ft):	**99.5**
Drilling End Date:	**2/25/2019**	Boring Diameter (in):	**8.25**	Well Diameter (in):	**2**
Drilling Company:	**AEP**	Sampling Method(s):	**SPT (2 in ID)**	Screen Slot (in):	**0.010**
Drilling Method:	**Hollow Stem Auger**	DTW After Drilling (ft):		Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**Hollow Stem Auger**	Ground Surface Elev. (ft):	**646.848**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**ZR/RB**	Top of Casing Elev. (ft):	**649.668**	Seal Material(s):	**Grout, Bentonite**
Logged By:	**K. Villars**	Location (X,Y):	**1,701,131.62, 718,577.76**	Filter Pack:	**#5 Sand**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
25				SS06		15 3 4	0.9				25.0
30				SS07		10 5 7	0.6			Little recovery due to limestone rock in cutting shoe	30.0
35				SS08		17 12 18	0.5		(37') LIMESTONE and SANDSTONE; dry, noncohesive, fractured.	Red Clay (as in SS07) over fractured rock	35.0
40				SS09		7 14 16	1.7		(39') Medium dense, yellow, SILT with gray shale (ML); dry, noncohesive.	Augers bring up wood fragments	40.0
45				SS10		7 9 10	1.2		(46.5') Changes to moist.		45.0
50											50.0

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WELL LOG

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Drilling Start Date:	**2/21/2019**	Boring Depth (ft):	**100.2**	Well Depth (ft):	**99.5**
Drilling End Date:	**2/25/2019**	Boring Diameter (in):	**8.25**	Well Diameter (in):	**2**
Drilling Company:	**AEP**	Sampling Method(s):	**SPT (2 in ID)**	Screen Slot (in):	**0.010**
Drilling Method:	**Hollow Stem Auger**	DTW After Drilling (ft):		Riser Material:	**Sch 40 PVC**
Drilling Equipment:	**Hollow Stem Auger**	Ground Surface Elev. (ft):	**646.848**	Screen Material:	**Sch 40 PVC Slotted**
Driller:	**ZR/RB**	Top of Casing Elev. (ft):	**649.668**	Seal Material(s):	**Grout, Bentonite**
Logged By:	**K. Villars**	Location (X,Y):	**1,701,131.62, 718,577.76**	Filter Pack:	**#5 Sand**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS
50										
				SS11		6 7 11	1.8		(51.5') Medium dense, red, yellow, and black SILT (ML); moist, non-plastic, cohesive, with some fine gravel and sand.	
55				SS12		3 6 8	2.1		(56.5') Soft, light and red brown, highly plastic clay, moist.	Top 0.5 feet may be plug
60				SS13		8 10 12	1.3		(61.5') Medium dense, light brown, POORLY GRADED SAND (SP); moist, noncohesive, fine-grained with few coarse sand.	
65				SS14		4 7 11	1.4		(66.5') Loose, gray brown, POORLY GRADED SAND (SP); moist to wet, noncohesive, medium- to fine-grained with trace fine gravel. (67.4') Black lenses at 67.4 and 67.6 feet.	
70				SS15		3 1 3	1.8		(71.5') Very loose, gray brown, POORLY GRADED SAND (SP); wet, noncohesive, fine-grained with few silt and layer of medium black sand.	
				SS16		1 2 25			(72.5') Layer of medium black sand.	Attempt static water level reading, not yet at water table
75				SS17		11	1.5			

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Drilling Start Date:	2/21/2019	Boring Depth (ft):	100.2	Well Depth (ft):	99.5
Drilling End Date:	2/25/2019	Boring Diameter (in):	8.25	Well Diameter (in):	2
Drilling Company:	AEP	Sampling Method(s):	SPT (2 in ID)	Screen Slot (in):	0.010
Drilling Method:	Hollow Stem Auger	DTW After Drilling (ft):		Riser Material:	Sch 40 PVC
Drilling Equipment:	Hollow Stem Auger	Ground Surface Elev. (ft):	646.848	Screen Material:	Sch 40 PVC Slotted
Driller:	ZR/RB	Top of Casing Elev. (ft):	649.668	Seal Material(s):	Grout, Bentonite
Logged By:	K. Villars	Location (X,Y):	1,701,131.62, 718,577.76	Filter Pack:	#5 Sand

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	Date & Time	Blow Counts	Recovery (ft)	N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
75				SS17		12 10	1.5		(73.7') Black seam.	Transition zone	75.0
				SS18		8 11	1.2		(74') Medium dense, red brown, CLAYEY SAND with gravel (SC); wet, noncohesive.		
						17			(74.5') Medium to loose, gray brown, SILTY SAND (SM); wet, noncohesive.	Dry	
				SS19		17 16	1		(75.2') Medium dense, red brown, WELL-GRADED GRAVEL with clay and sand (GW-GC); wet, noncohesive.		
80				SS20		16 14	1		(76') Medium dense, brown to light brown, SILTY SAND (SM); dry, well-graded, noncohesive, trace gravel.		80.0
				SS21		15 12 12	1.2		(80.2') Changes to moist.	Dry	
				SS22		17 13 16	1		(81') Changes to wet.		
				SS23		15 9 12	1.1		(83.2') Black seam.	Dry	
85				SS24		16 10 17	1			Dry	85.0
				SS25		24 15 17	1.3				
				SS26		19 12 17	1.2				
				SS27		24 16 15	1.1				
90				SS28		16 10 17	1.2			Dry	90.0
				SS29		23 11 21	1.7				
				SS30		28 9 16	1.1			Thin woody debris	
95				SS31		22 18 20	1.2				95.0
				SS32		28 12 19	1.1			Drillers replace mud due to sand binding ??? SS 32 on 2/25/2019 at 1235???	
				SS33		18 23 31 50/3	1.1		(98.5') Dense, light brown, WELL-GRADED GRAVEL with silt and sand (GW-GM); wet,		
100											100.0

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Drilling Start Date:	2/21/2019	Boring Depth (ft):	100.2	Well Depth (ft):	99.5
Drilling End Date:	2/25/2019	Boring Diameter (in):	8.25	Well Diameter (in):	2
Drilling Company:	AEP	Sampling Method(s):	SPT (2 in ID)	Screen Slot (in):	0.010
Drilling Method:	Hollow Stem Auger	DTW After Drilling (ft):		Riser Material:	Sch 40 PVC
Drilling Equipment:	Hollow Stem Auger	Ground Surface Elev. (ft):	646.848	Screen Material:	Sch 40 PVC Slotted
Driller:	ZR/RB	Top of Casing Elev. (ft):	649.668	Seal Material(s):	Grout, Bentonite
Logged By:	K. Villars	Location (X,Y):	1,701,131.62, 718,577.76	Filter Pack:	#5 Sand

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
100				SS34		50/2	0.2		noncohesive, medium- to coarse-grained gravel with coarse sand.		100.0
									(99.5') Dense, light brown, WELL-GRADED GRAVEL with silt (GW-GM); dry, coarse-grained.		
									(100') SANDSTONE; dry, micaceous, weathered.		
105									(100.2') Boring terminated.		105.0

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WELL LOG
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Drilling Start Date:	3/19/2019	Boring Depth (ft):	78.3	Well Depth (ft):	
Drilling End Date:	3/19/2019	Boring Diameter (in):	8.25	Well Diameter (in):	
Drilling Company:	AEP	Sampling Method(s):	SPT (2 in ID)	Screen Slot (in):	
Drilling Method:	Hollow Stem Auger	DTW After Drilling (ft):		Riser Material:	
Drilling Equipment:	Hollow Stem Auger	Ground Surface Elev. (ft):	581.655	Screen Material:	
Driller:	ZR	Top of Casing Elev. (ft):	584.635	Seal Material(s):	
Logged By:	J. Bannantine	Location (X,Y):	1,699,808.45, 725,147.52	Filter Pack:	

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS
0				SS01		3 3 5	17/18		(0') Medium stiff, orange brown SILT with sand (ML); damp.	Split spoon samples every 5 feet until water table
5				SS02		2 2 4	17/18		(6.5') Some thin sand.	
10				SS03		2 2 3	17/18		(11.5') Medium-grained sand from 12.8-13.0 feet.	
15				SS04		8 12 14	16/18		(16.5') Very stiff, orange brown SAND (SP); damp, medium-grained with few coarse sand and trace gravel.	
20				SS05		8 12 15	16/18			
25										

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WELL LOG
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Drilling Start Date:	3/19/2019	Boring Depth (ft):	78.3	Well Depth (ft):	
Drilling End Date:	3/19/2019	Boring Diameter (in):	8.25	Well Diameter (in):	
Drilling Company:	AEP	Sampling Method(s):	SPT (2 in ID)	Screen Slot (in):	
Drilling Method:	Hollow Stem Auger	DTW After Drilling (ft):		Riser Material:	
Drilling Equipment:	Hollow Stem Auger	Ground Surface Elev. (ft):	581.655	Screen Material:	
Driller:	ZR	Top of Casing Elev. (ft):	584.635	Seal Material(s):	
Logged By:	J. Bannantine	Location (X,Y):	1,699,808.45, 725,147.52	Filter Pack:	

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	Date & Time	Blow Counts	Recovery (ft)	N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
25				SS06		12 17 17	15/18		(26.5') Hard, increasing gravels.		25
30				SS07		12 16 18	14/18		(31.5') Brown SAND (SP); medium- to coarse-grained with trace gravel, subrounded to subangular.		30
35				SS08		5 6 8	16/18		(36.5') Stiff, brown SAND with gravel (SP); wet, medium- to coarse-grained, gravel is subangular to angular.	SS-8 is wet; switch to continuous sampling	35
				SS09		5 6 9	16/18			After SS-9 mud added to borehole	
40				SS10		10 10 7	13/18		(39.5') Very stiff, without gravel.		40
				SS11		4 4 8	16/18		(41') Stiff SAND (SP); medium-grained with trace coarse sand, grades from overlying layer.		
				SS12		4 4 6	10/18		(42.5') Trace gravel.		
45				SS13		5 5 4	11/18				45
				SS14		5 4 5	7/18				
				SS15		3 3 5	14/18				
				SS16		6 6 7	14/18				
50											50

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Drilling Start Date:	3/19/2019	Boring Depth (ft):	78.3	Well Depth (ft):	
Drilling End Date:	3/19/2019	Boring Diameter (in):	8.25	Well Diameter (in):	
Drilling Company:	AEP	Sampling Method(s):	SPT (2 in ID)	Screen Slot (in):	
Drilling Method:	Hollow Stem Auger	DTW After Drilling (ft):		Riser Material:	
Drilling Equipment:	Hollow Stem Auger	Ground Surface Elev. (ft):	581.655	Screen Material:	
Driller:	ZR	Top of Casing Elev. (ft):	584.635	Seal Material(s):	
Logged By:	J. Bannantine	Location (X,Y):	1,699,808.45, 725,147.52	Filter Pack:	

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	Date & Time	Blow Counts	Recovery (ft)	N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
50				SS17		4 8 17	16/18		(50') Very stiff SAND (SP); medium-grained with trace coarse sand.		50
				SS18		7 12 13	18/18				
				SS19		7 10 13	13/18				
55				SS20		7 8 17	15/18				55
				SS21		7 17 17	11/18		(56') Hard.		
				SS22		7 11 9	13/18		(57.5') Very stiff.		
60				SS23		6 9 11	11/18				60
				SS24		6 9 16	15/18		(60.5') Trace gravel.		
				SS25		5 10 14	16/18		(62') SAND (SP); medium- to coarse-grained with trace gravel.		
				SS26		8 18 27	15/18				
65				SS27		12 15 15	16/18				65
				SS28		6 15 18	16/18				
				SS29		9 11 15	17/18				
70				SS30		9 11 15	16/18				70
				SS31		5 12 14	15/18				
				SS32		5 6 12	16/18		(72.5') Very stiff, light brown SAND (SP); medium-grained.		
75				SS33		7 10	15/18		(74') Very stiff, brown SAND (SP); medium- to		75

NOTES:

Geosyntec consultants
engineers | scientists | innovators

Client: American Electric Power
Project: CHW8293
Address: New Haven, WV

WELL LOG
Well No. MW-1929
Page: 4 of 4

Drilling Start Date:	3/19/2019	Boring Depth (ft):	78.3	Well Depth (ft):	
Drilling End Date:	3/19/2019	Boring Diameter (in):	8.25	Well Diameter (in):	
Drilling Company:	AEP	Sampling Method(s):	SPT (2 in ID)	Screen Slot (in):	
Drilling Method:	Hollow Stem Auger	DTW After Drilling (ft):		Riser Material:	
Drilling Equipment:	Hollow Stem Auger	Ground Surface Elev. (ft):	581.655	Screen Material:	
Driller:	ZR	Top of Casing Elev. (ft):	584.635	Seal Material(s):	
Logged By:	J. Bannantine	Location (X,Y):	1,699,808.45, 725,147.52	Filter Pack:	

DEPTH (ft)	LITHOLOGY	WATER LEVEL	WELL COMPLETION	COLLECT: Sample Type	COLLECT: Date & Time	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD (%)	SOIL/ROCK VISUAL DESCRIPTION	REMARKS	DEPTH (ft)
75				SS33		11 9	15/18		coarse-grained with trace gravel.		75
				SS34		11 14	16/18				
				SS35		11 20 50/4"	15/16		(78.3') Boring terminated. Refusal on bedrock.	Borehole abandoned with bentonite grout. MW-1929 installed.	
80											80

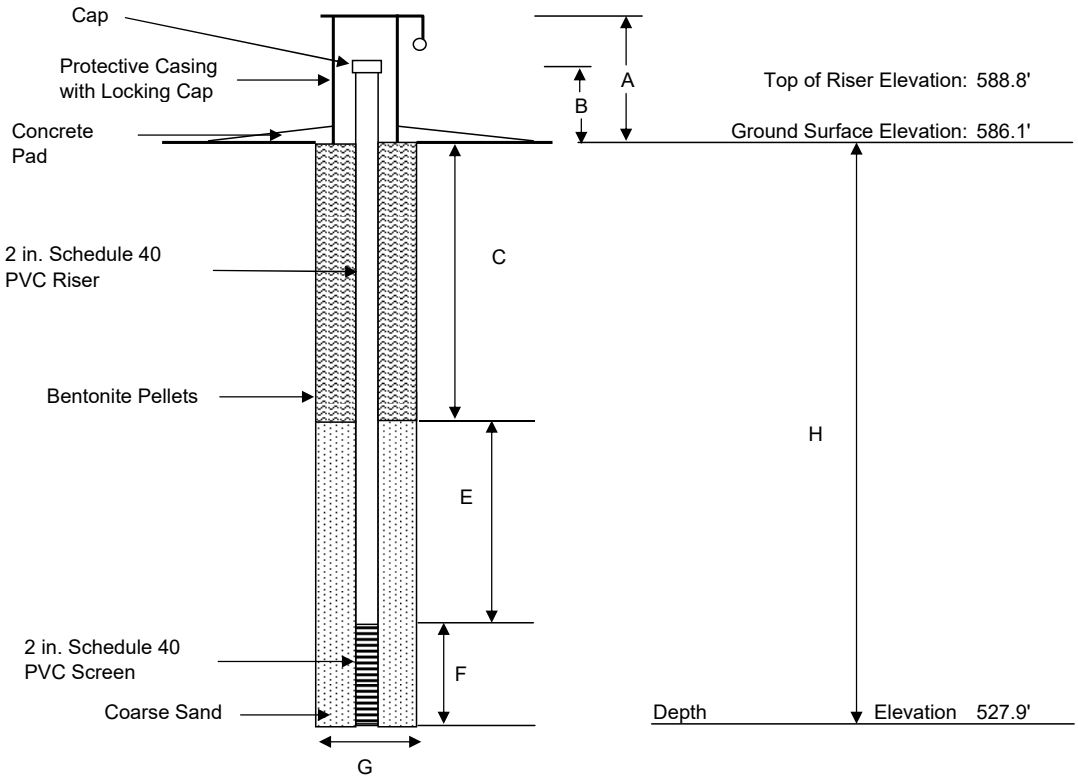
NOTES:

MONITORING WELL CONSTRUCTION DIAGRAM
MW - 107
(Not to Scale)

Project: AEP IGCC Mountaineer Plant - Bechtel Borings | Project No. : C050299.33

Date : Aug. 28, 2006 | Engineer/Geologist: RMR | Well No. : MW-107

Drilling Company: FMSM | Driller: Tim Caudill



STANDPIPE PIEZOMETER INSTALLATION SKETCH

DIMENSIONS (Feet)					
A	B	C	D	E	F
~3.0	2.7	25.0		3.2	30.0
G	H	I	J	K	L
0.7	58.2				

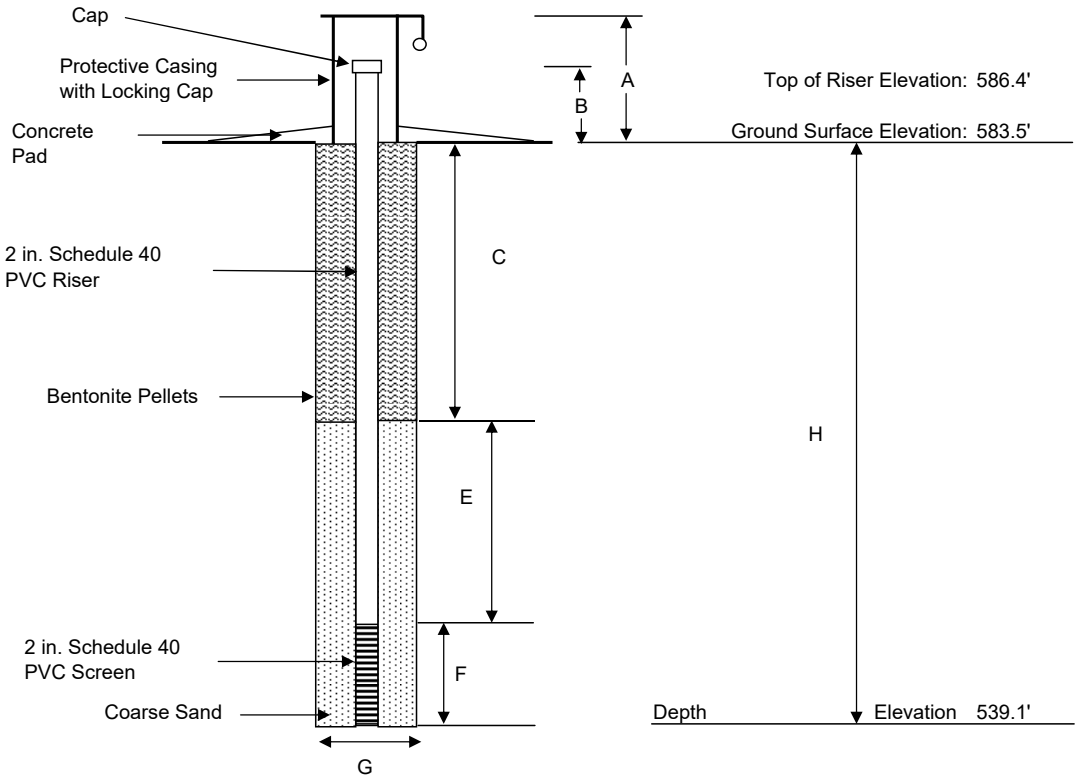
Remarks: Developed well Sept. 7, 2006

MONITORING WELL CONSTRUCTION DIAGRAM
MW - 112
(Not to Scale)

Project: AEP IGCC Mountaineer Plant - Bechtel Borings | Project No. : C050299.33

Date : Aug. 31, 2006 | Engineer/Geologist: RMR | Well No. : MW-112

Drilling Company: FMSM | Driller: Tim Caudill



STANDPIPE PIEZOMETER INSTALLATION SKETCH

DIMENSIONS (Feet)					
A	B	C	D	E	F
~3.5	2.9	30.0		4.4	10.0
G	H	I	J	K	L
0.7	44.4				

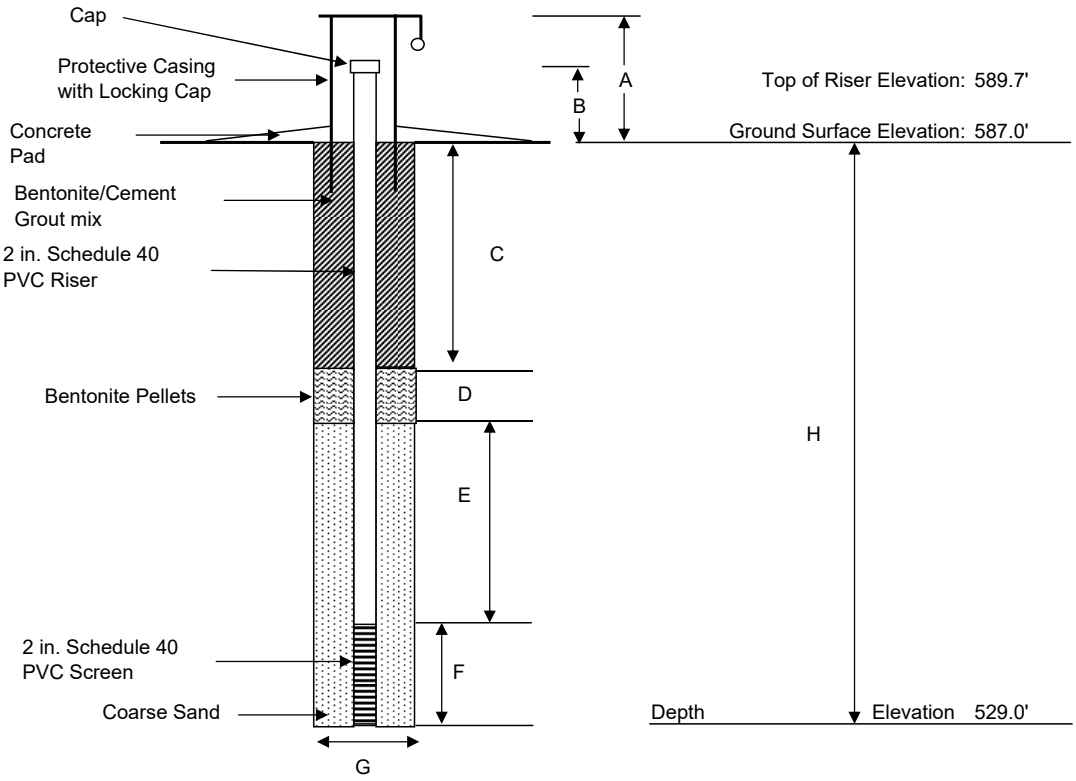
Remarks: Developed well Sept. 7, 2006

MONITORING WELL CONSTRUCTION DIAGRAM
MW - 203
(Not to Scale)

Project: AEP IGCC Mountaineer Plant - Bechtel Borings | Project No. : C050299.33

Date : Sept. 27, 2006 | Engineer/Geologist: RMR | Well No. : MW-203

Drilling Company: FMSM | Driller: Mike Muncy



STANDPIPE PIEZOMETER INSTALLATION SKETCH

DIMENSIONS (Feet)					
A	B	C	D	E	F
~3.0	2.7	14.0	6.0	28.0	10.0
G	H	I	J	K	L
0.8	58.0				

Remarks Developed well Sept. 28, 2006

State of West Virginia
Department of Environmental Protection

Monitoring Well Construction
Well Number: WV00540-1805-18
Approved

Site Name/Physical Address:
Site: AEP Mountaineer Plant
Line 1: 1347 Graham Station Road
Line 2:
City: Letart
State: WV
Zip: 25253-
County: Mason

Well Registration No. WV00540-1805-18
Grid Location:
a. Latitude: 38 58 29 .0
b. Longitude: 81 56 18 .0
c. Method Used:Computer Mapped/Generated Coordinates

Company/Project Well No.:
MW-1805

Purpose of Monitoring Well:
to monitor the hydrologic conditions of a coal seam.

Well Owner (Name, Firm, Address):
Owner: Randall Brown
Line 1: American Electric Power - Mountaineer Plant
Line 2: 1347 Graham Station Road
City: Letart
State: WV
Zip: 25253-
Phone: 304-882-4024

Installed By (Name, Firm, Address):
Installer: Kenn Fowler
Line 1: Terracon Consultants, Inc.
Line 2: 912 Morris Street
City: Charleston
State: WV
Zip: 25301-
Phone: 304-344-0821

Date Well Installed:
07/06/2018

Driller's WV Cert No.
WV00540

Section B: (all number fields must be in decimal format)

1.Gap and Lock: YES

2.Protective Cover: Protective Cover Pipe

3.Monitoring Well Reference Point: 591 ft.

4.Borehole Diameter: 5 inches.

5.Ground Surface Seal:
a.Material: concrete
b.Installation Procedure: ASTM D5092

6.Surface Seal Bottom/Annular Space Top: 3 ft.

7.Well Riser: a.OD Well Riser: 2.38 inches. b.ID Well Riser: 2.05 inches
c.Material: PVC
d.Installation Procedure: ASTM D5092

8.Annular Space Seal:
a.Material: high solids grout -
b.Installation Procedure: tremie pipe-pumped

9.Well Development Procedure: overpump -

10.Drilling Method Used: mud rotary -

11.Annular Space Seal Bottom/Filter Seal Top: 117.5 ft.

12.Drilling Fluid Used: Yes Source: Mud

13.Filter Pack Seal:
a.Material: bentonite pellet
b.Installation Procedure: Gravity Fed
c.Volume Added: 0.34 cubic feet

14.Bottom of Bentonite Seal/Filter Pack Top: 120.5 ft.

15.Depth to Top of Screen: 123.5 ft.

16.Screen:
a.Material: PVC
b.Installation Procedure: ASTM D5092
c.Slot Size: 0.01 inches. d.Screen Length: 10 ft.

17.Filter Pack:
a.Material: medium sand
b.Installation Procedure: gravity fed

18.Well Depth: 133.5 ft.

19.Bottom of Filter Pack: 134 ft.

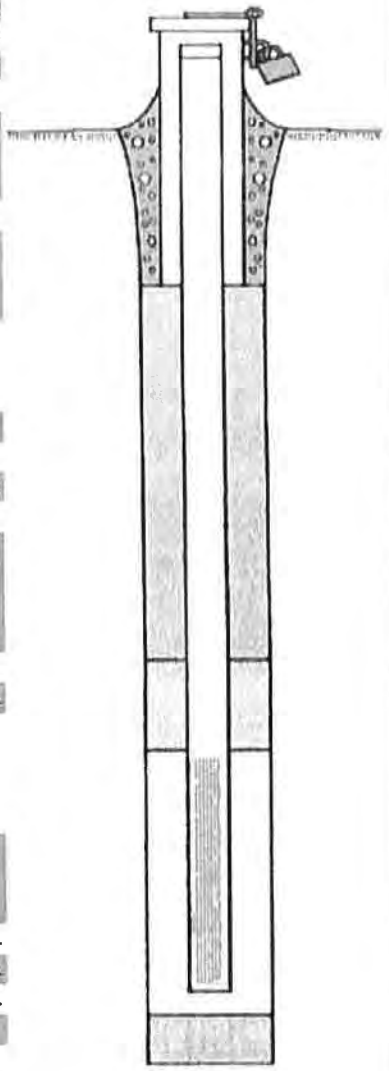
20.Bottom of Borehole: 134 ft.

21.Backfill Material (below filter pack): medium sand

22.Decontamination Procedures: water

23.Special Circumstances and Exceptions: No Variance Number:

24.WV Contractor License No.



State of West Virginia
Department of Environmental Protection

Monitoring Well Construction
Well Number: WV00528-0002-19
Approved

Site Name/Physical Address:
Site: AEP/Mountaineer Plant
Line 1: 1347 Graham Station Road
Line 2:
City: New Haven
State: WV
Zip: 25265-
County: Mason

Well Registration No. WV00528-0002-19
Grid Location:
a. Latitude: 38 58 38 .0
b. Longitude: 81 55 57 .0
c. Method Used: GPS

Company/Project Well No.:
MW-1921

Purpose of Monitoring Well:
Assessment

Well Owner (Name, Firm, Address):
Owner: AEP/Mountaineer Plant
Line 1: 1347 Graham Station Road
Line 2:
City: New Haven
State: WV
Zip: 25265-
Phone: 304-882-4000

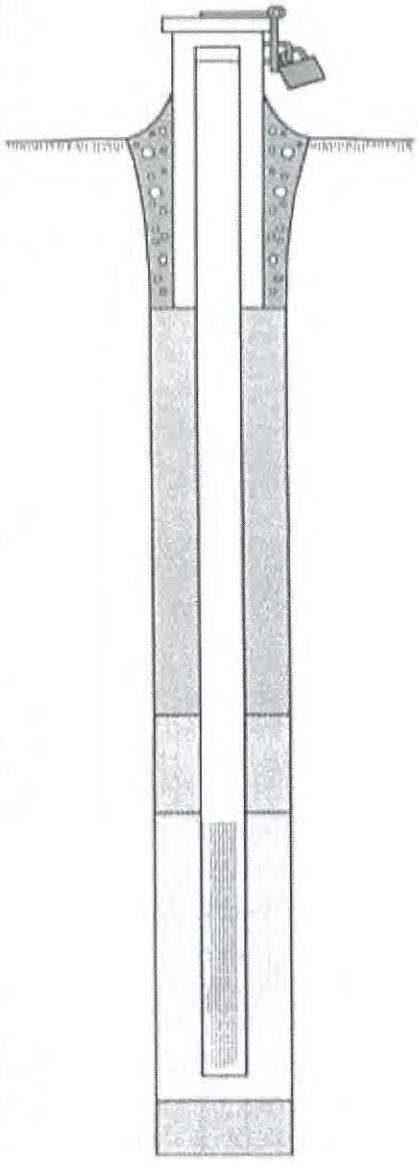
Installed By (Name, Firm, Address):
Installer: AEP/Dolan Lab
Line 1: 4001 Bixby Road
Line 2:
City: Groveport
State: OH
Zip: 43125-
Phone: 614-836-4200

Date Well Installed:
04/01/2019

Driller's WV Cert No.
WV00528

Section B: (all number fields must be in decimal format)

1.Cap and Lock: YES
2.Protective Cover: Protective Cover Pipe
3.Monitoring Well Reference Point: 0 ft.
4.Borehole Diameter: 8 inches.
5.Ground Surface Seal:
a.Material: bentonite-cement grout
b.Installation Procedure: tremie pipe
6.Surface Seal Bottom/Annular Space Top: 3 ft.
7.Well Riser: a.OD Well Riser: 2 inches. b.ID Well Riser: 1.98 inches.
c.Material: PVC
d.Installation Procedure: hand set
8.Annular Space Seal:
a.Material: high solids grout -
b.Installation Procedure: tremie pipe-pumped
9.Well Development Procedure: airlift -
10.Drilling Method Used: hollow stem auger -
11.Annular Space Seal Bottom/Filter Seal Top: 68 ft.
12.Drilling Fluid Used: No Source:
13.Filter Pack Seal:
a.Material: bentonite pellet
b.Installation Procedure: Gravity Fed
c.Volume Added: 150 pounds
14.Bottom of Bentonite Seal/Filter Pack Top: 74 ft.
15.Depth to Top of Screen: 77.4 ft.
16.Screen:
a.Material: PVC
b.Installation Procedure: hand set
c.Slot Size: 0.01 inches. d.Screen Length: 9.6 ft.
17.Filter Pack:
a.Material: fine sand
b.Installation Procedure: gravity
18.Well Depth: 87.5 ft.
19.Bottom of Filter Pack: 88.5 ft.
20.Bottom of Borehole: 91.3 ft.
21.Backfill Material (below filter pack): none
22.Decontamination Procedures: high pressure wash
23.Special Circumstances and Exceptions: No Variance Number:
24.WV Contractor License No.



State of West Virginia
Department of Environmental Protection

Monitoring Well Construction
Well Number: WV00528-0003-19
Approved

Site Name/Physical Address:
Site: AEP/Mountaineer Plant
Line 1: 1347 Graham Station Road
Line 2:
City: New Haven
State: WV
Zip: 25265-
County: Mason

Well Registration No. WV00528-0003-19
Grid Location:
a. Latitude: 38 58 28 .0
b. Longitude: 81 56 17 .0
c. Method Used: GPS

Company/Project Well No.:
MW-1922D

Purpose of Monitoring Well:
Assessment

Well Owner (Name, Firm, Address):
Owner: AEP/Mountaineer Plant
Line 1: 1347 Graham Station Road
Line 2:
City: New Haven
State: WV
Zip: 25265-
Phone: 304-882-4000

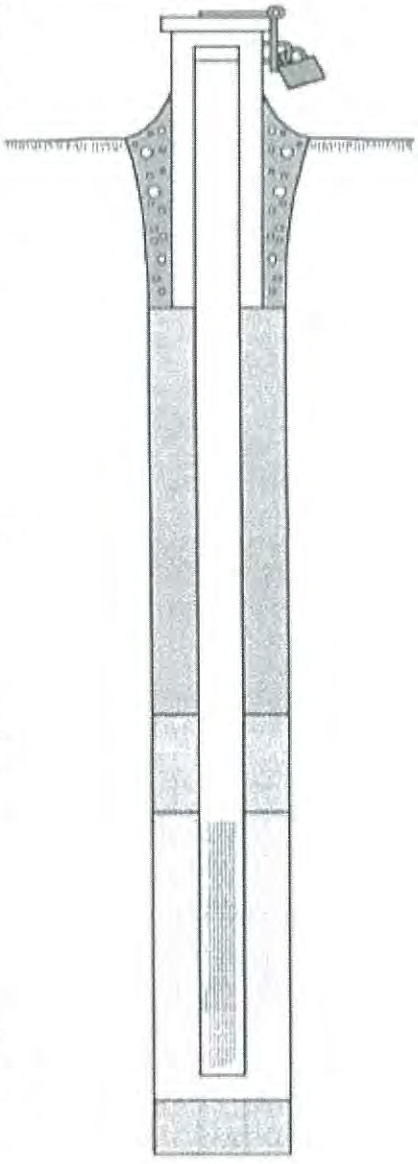
Installed By (Name, Firm, Address):
Installer: AEP/Dolan Lab
Line 1: 4001 Bixby Road
Line 2:
City: Groveport
State: OH
Zip: 43125-
Phone: 614-836-4200

Date Well Installed:
04/01/2019

Driller's WV Cert No.
WV00528

Section B: (all number fields must be in decimal format)

1.Cap and Lock: YES
2.Protective Cover: Protective Cover Pipe
3.Monitoring Well Reference Point: 0 ft.
4.Borehole Diameter: 4 inches.
5.Ground Surface Seal:
a.Material: bentonite-cement grout
b.Installation Procedure: tremie pipe
6.Surface Seal Bottom/Annular Space Top: 3 ft.
7.Well Riser: a.OD Well Riser: 2 inches. b.ID Well Riser: 1.98 inches.
c.Material: PVC
d.Installation Procedure: hand set
8.Annular Space Seal:
a.Material: high solids grout -
b.Installation Procedure: tremie pipe-pumped
9.Well Development Procedure: airlift -
10.Drilling Method Used: hollow stem auger -
11.Annular Space Seal Bottom/Filter Seal Top: 93.4 ft.
12.Drilling Fluid Used: No Source:
13.Filter Pack Seal:
a.Material: bentonite pellet
b.Installation Procedure: Gravity Fed
c.Volume Added: 100 pounds
14.Bottom of Bentonite Seal/Filter Pack Top: 101 ft.
15.Depth to Top of Screen: 103.4 ft.
16.Screen:
a.Material: PVC
b.Installation Procedure: hand set
c.Slot Size: 0.01 inches. d.Screen Length: 9.6 ft.
17.Filter Pack:
a.Material: fine sand
b.Installation Procedure: gravity
18.Well Depth: 113.5 ft.
19.Bottom of Filter Pack: 114.8 ft.
20.Bottom of Borehole: 114.8 ft.
21.Backfill Material (below filter pack): none
22.Decontamination Procedures: high pressure wash
23.Special Circumstances and Exceptions: No Variance Number:
24.WV Contractor License No.



State of West Virginia
Department of Environmental Protection

Monitoring Well Construction
Well Number: WV00528-0004-19
Approved

Site Name/Physical Address:
Site: AEP/Mountaineer Plant
Line 1: 1347 Graham Stat
Line 2:
City: New Haven
State: WV
Zip: 25265-
County: Mason

Well Registration No. WV00528-0004-19
Grid Location:
a. Latitude: 38 58 28 .0
b. Longitude: 81 56 17 .0
c. Method Used: GPS

Company/Project Well No.:
MW-1922S

Purpose of Monitoring Well:
Assessment

Well Owner (Name, Firm, Address):
Owner: AEP/Mountaineer Plant
Line 1: 1347 Graham Station Road
Line 2:
City: New Haven
State: WV
Zip: 25265-
Phone: 304-882-4000

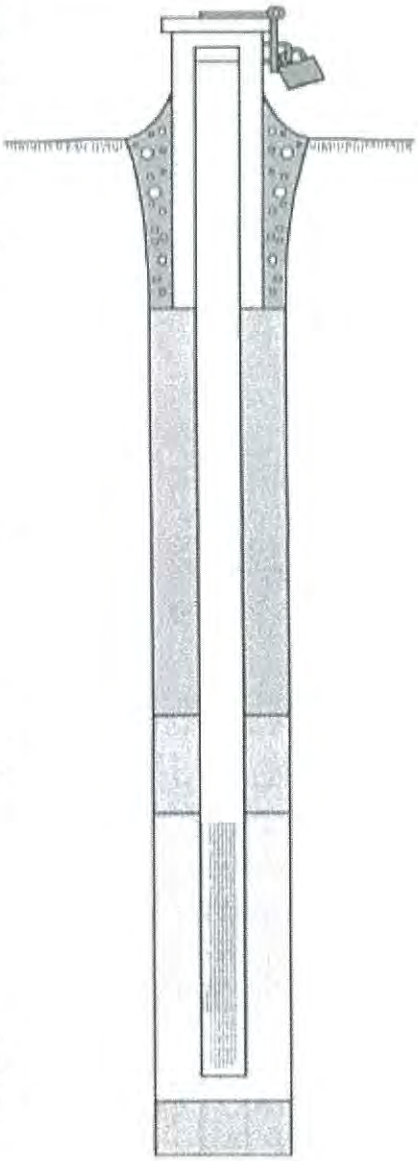
Installed By (Name, Firm, Address):
Installer: AEP/Dolan Lab
Line 1: 4001 Bixby Road
Line 2:
City: Groveport
State: OH
Zip: 43125-
Phone: 614-836-4200

Date Well Installed:
04/01/2019

Driller's WV Cert No.
WV00528

Section B: (all number fields must be in decimal format)

1.Cap and Lock: YES
2.Protective Cover: Protective Cover Pipe
3.Monitoring Well Reference Point: 0 ft.
4.Borehole Diameter: 8 inches.
5.Ground Surface Seal:
a.Material: bentonite-cement grout
b.Installation Procedure: tremie pipe
6.Surface Seal Bottom/Annular Space Top: 3 ft.
7.Well Riser: a.OD Well Riser: 2 inches. b.ID Well Riser: 1.98 inches.
c.Material: PVC
d.Installation Procedure: hand set
8.Annular Space Seal:
a.Material: high solids grout -
b.Installation Procedure: tremie pipe-pumped
9.Well Development Procedure: airlift -
10.Drilling Method Used: hollow stem auger -
11.Annular Space Seal Bottom/Filter Seal Top: 62.3 ft.
12.Drilling Fluid Used: No Source:
13.Filter Pack Seal:
a.Material: bentonite pellet
b.Installation Procedure: Gravity Fed
c.Volume Added: 150 pounds
14.Bottom of Bentonite Seal/Filter Pack Top: 70.7 ft.
15.Depth to Top of Screen: 73.4 ft.
16.Screen:
a.Material: PVC
b.Installation Procedure: hand set
c.Slot Size: 0.01 inches. d.Screen Length: 9.6 ft.
17.Filter Pack:
a.Material: fine sand
b.Installation Procedure: gravity
18.Well Depth: 83.5 ft.
19.Bottom of Filter Pack: 84.2 ft.
20.Bottom of Borehole: 84.2 ft.
21.Backfill Material (below filter pack): none
22.Decontamination Procedures: high pressure wash
23.Special Circumstances and Exceptions: No Variance Number:
24.WV Contractor License No.



State of West Virginia
Department of Environmental Protection

Monitoring Well Construction
Well Number: WV00528-0005-19
Approved

Site Name/Physical Address:
Site: AEP/Mountaineer Plant
Line 1: 1347 Graham Station Road
Line 2:
City: New Haven
State: WV
Zip: 25265-
County: Mason

Well Registration No. WV00528-0005-19
Grid Location:
a. Latitude: 38 58 45 .0
b. Longitude: 81 56 1 .0
c. Method Used: GPS

Company/Project Well No.:
MW-1923

Purpose of Monitoring Well:
Assessment

Well Owner (Name, Firm, Address):
Owner: AEP/Mountaineer Plant
Line 1: 1347 Graham Station Road
Line 2:
City: New Haven
State: WV
Zip: 25265-
Phone: 304-882-4000

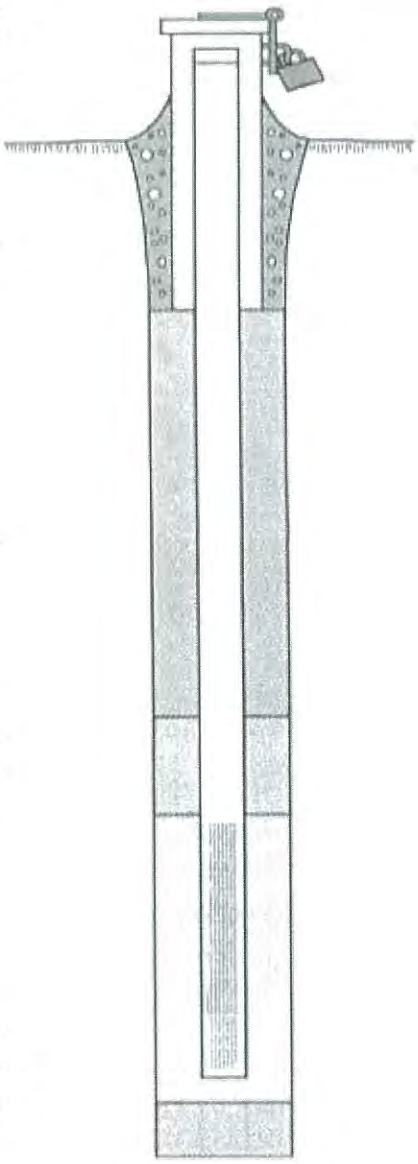
Installed By (Name, Firm, Address):
Installer: AEP/Dolan Lab
Line 1: 4001 Bixby Road
Line 2:
City: Groveport
State: OH
Zip: 43125-
Phone: 614-836-4200

Date Well Installed:
04/01/2019

Driller's WV Cert No.
WV00528

Section B: (all number fields must be in decimal format)

1.Cap and Lock: YES
2.Protective Cover: Flush Mount
3.Monitoring Well Reference Point: 0.6 ft.
4.Borehole Diameter: 8 inches.
5.Ground Surface Seal:
a.Material: bentonite-cement grout
b.Installation Procedure: tremie pipe
6.Surface Seal Bottom/Annular Space Top: 3 ft.
7.Well Riser: a.OD Well Riser: 2 inches. b.ID Well Riser: 1.98 inches.
c.Material: PVC
d.Installation Procedure: hand set
8.Annular Space Seal:
a.Material: high solids grout -
b.Installation Procedure: tremie pipe-pumped
9.Well Development Procedure: airlift -
10.Drilling Method Used: hollow stem auger -
11.Annular Space Seal Bottom/Filter Seal Top: 46 ft.
12.Drilling Fluid Used: No Source:
13.Filter Pack Seal:
a.Material: bentonite pellet
b.Installation Procedure: Gravity Fed
c.Volume Added: 150 pounds
14.Bottom of Bentonite Seal/Filter Pack Top: 74 ft.
15.Depth to Top of Screen: 55.4 ft.
16.Screen:
a.Material: PVC
b.Installation Procedure: hand set
c.Slot Size: 0.01 inches. d.Screen Length: 9.6 ft.
17.Filter Pack:
a.Material: fine sand
b.Installation Procedure: gravity
18.Well Depth: 65.5 ft.
19.Bottom of Filter Pack: 70 ft.
20.Bottom of Borehole: 70 ft.
21.Backfill Material (below filter pack): none
22.Decontamination Procedures: high pressure wash
23.Special Circumstances and Exceptions: No Variance Number:
24.WV Contractor License No.



State of West Virginia
Department of Environmental Protection

Monitoring Well Construction
Well Number: WV00528-0006-19
Approved

Site Name/Physical Address:
Site: AEP/Mountaineer Plant
Line 1: 1347 Graham Station Road
Line 2:
City: New Haven
State: WV
Zip: 25265-
County: Mason

Well Registration No. WV00528-0006-19
Grid Location:
a. Latitude: 38 58 43 .0
b. Longitude: 81 56 5 .0
c. Method Used: GPS

Company/Project Well No.:
MW-1924

Purpose of Monitoring Well:
Assessment

Well Owner (Name, Firm, Address):
Owner: AEP/Mountaineer Plant
Line 1: 1347 Graham Station Road
Line 2:
City: New Haven
State: WV
Zip: 25265-
Phone: 304-882-4000

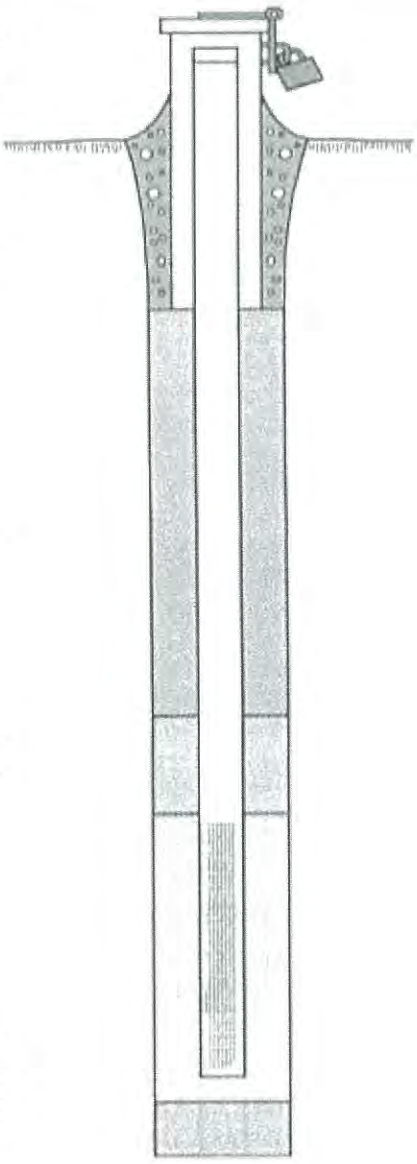
Installed By (Name, Firm, Address):
Installer: AEP/Dolan Lab
Line 1: 4001 Bixby Road
Line 2:
City: Groveport
State: OH
Zip: 43125-
Phone: 614-836-4200

Date Well Installed:
04/01/2019

Driller's WV Cert No.
WV00528

Section B: (all number fields must be in decimal format)

1.Cap and Lock: YES
2.Protective Cover: Flush Mount
3.Monitoring Well Reference Point: 0.6 ft.
4.Borehole Diameter: 8 inches.
5.Ground Surface Seal:
a.Material: bentonite-cement grout
b.Installation Procedure: tremie pipe
6.Surface Seal Bottom/Annular Space Top: 3 ft.
7.Well Riser: a.OD Well Riser: 2 inches. b.ID Well Riser: 1.98 inches.
c.Material: PVC
d.Installation Procedure: hand set
8.Annular Space Seal:
a.Material: high solids grout -
b.Installation Procedure: tremie pipe-pumped
9.Well Development Procedure: airlift -
10.Drilling Method Used: hollow stem auger -
11.Annular Space Seal Bottom/Filter Seal Top: 51.4 ft.
12.Drilling Fluid Used: No Source:
13.Filter Pack Seal:
a.Material: bentonite pellet
b.Installation Procedure: Gravity Fed
c.Volume Added: 150 pounds
14.Bottom of Bentonite Seal/Filter Pack Top: 57.8 ft.
15.Depth to Top of Screen: 60.6 ft.
16.Screen:
a.Material: PVC
b.Installation Procedure: hand set
c.Slot Size: 0.01 inches. d.Screen Length: 9.6 ft.
17.Filter Pack:
a.Material: fine sand
b.Installation Procedure: gravity
18.Well Depth: 70.7 ft.
19.Bottom of Filter Pack: 71.2 ft.
20.Bottom of Borehole: 71.2 ft.
21.Backfill Material (below filter pack): none
22.Decontamination Procedures: high pressure wash
23.Special Circumstances and Exceptions: No Variance Number:
24.WV Contractor License No.



State of West Virginia
Department of Environmental Protection

Monitoring Well Construction
Well Number: WV00528-0007-19
Approved

Site Name/Physical Address:
Site: AEP/Mountaineer Plant
Line 1: 1347 Graham Station Road
Line 2:
City: New Haven
State: WV
Zip: 25265-
County: Mason

Well Registration No. WV00528-0007-19
Grid Location:
a. Latitude: 38 58 33 .0
b. Longitude: 81 56 11 .0
c. Method Used: GPS

Company/Project Well No.:
MW-1925

Purpose of Monitoring Well:
Assessment

Well Owner (Name, Firm, Address):
Owner: AEP/Mountaineer Plant
Line 1: 1347 Graham Station Road
Line 2:
City: New Haven
State: WV
Zip: 25265-
Phone: 304-882-4000

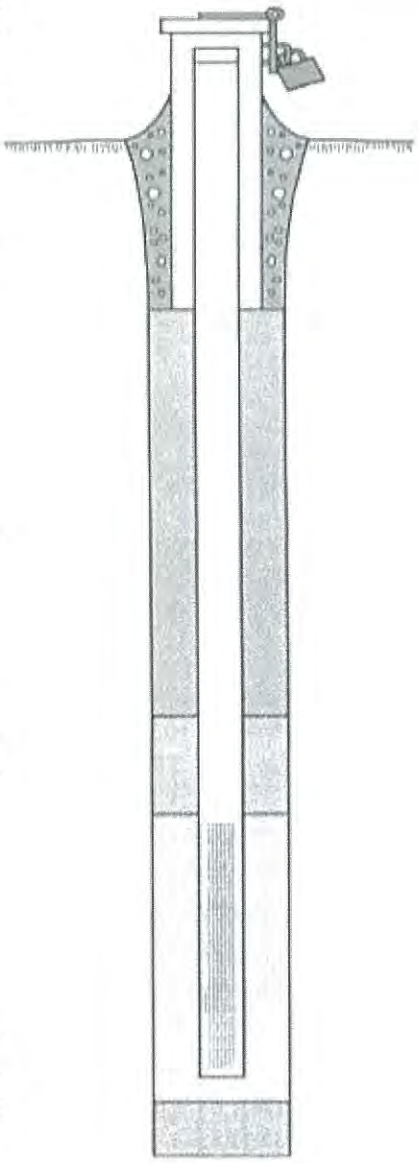
Installed By (Name, Firm, Address):
Installer: AEP/Dolan Lab
Line 1: 4001 Bixby Road
Line 2:
City: Groveport
State: OH
Zip: 43125-
Phone: 614-836-4200

Date Well Installed:
04/01/2019

Driller's WV Cert No.
WV00528

Section B: (all number fields must be in decimal format)

1.Cap and Lock: YES
2.Protective Cover: Protective Cover Pipe
3.Monitoring Well Reference Point: 0 ft.
4.Borehole Diameter: 8 inches.
5.Ground Surface Seal:
a.Material: bentonite-cement grout
b.Installation Procedure: tremie pipe
6.Surface Seal Bottom/Annular Space Top: 3 ft.
7.Well Riser: a.OD Well Riser: 2 inches. b.ID Well Riser: 1.98 inches.
c.Material: PVC
d.Installation Procedure: hand set
8.Annular Space Seal:
a.Material: high solids grout -
b.Installation Procedure: tremie pipe-pumped
9.Well Development Procedure: airlift -
10.Drilling Method Used: hollow stem auger -
11.Annular Space Seal Bottom/Filter Seal Top: 38.5 ft.
12.Drilling Fluid Used: No Source:
13.Filter Pack Seal:
a.Material: bentonite pellet
b.Installation Procedure: Gravity Fed
c.Volume Added: 150 pounds
14.Bottom of Bentonite Seal/Filter Pack Top: 45.7 ft.
15.Depth to Top of Screen: 48.4 ft.
16.Screen:
a.Material: PVC
b.Installation Procedure: hand set
c.Slot Size: 0.01 inches. d.Screen Length: 9.6 ft.
17.Filter Pack:
a.Material: fine sand
b.Installation Procedure: gravity
18.Well Depth: 58.5 ft.
19.Bottom of Filter Pack: 59.5 ft.
20.Bottom of Borehole: 59.5 ft.
21.Backfill Material (below filter pack): none
22.Decontamination Procedures: high pressure wash
23.Special Circumstances and Exceptions: No Variance Number:
24.WV Contractor License No.



State of West Virginia
Department of Environmental Protection

Monitoring Well Construction
Well Number: WV00528-0008-19
Approved

Site Name/Physical Address:
Site: AEP/Mountaineer Plant
Line 1: 1347 Graham Station Road
Line 2:
City: New Haven
State: WV
Zip: 25265-
County: Mason

Well Registration No. WV00528-0008-19
Grid Location:
a. Latitude: 38 58 8 .0
b. Longitude: 81 55 51 .0
c. Method Used: GPS

Company/Project Well No.:
MW-1926

Purpose of Monitoring Well:
Assessment

Well Owner (Name, Firm, Address):
Owner: AEP/Mountaineer Plant
Line 1: 1347 Graham Station Road
Line 2:
City: New Haven
State: WV
Zip: 25265-
Phone: 304-882-4000

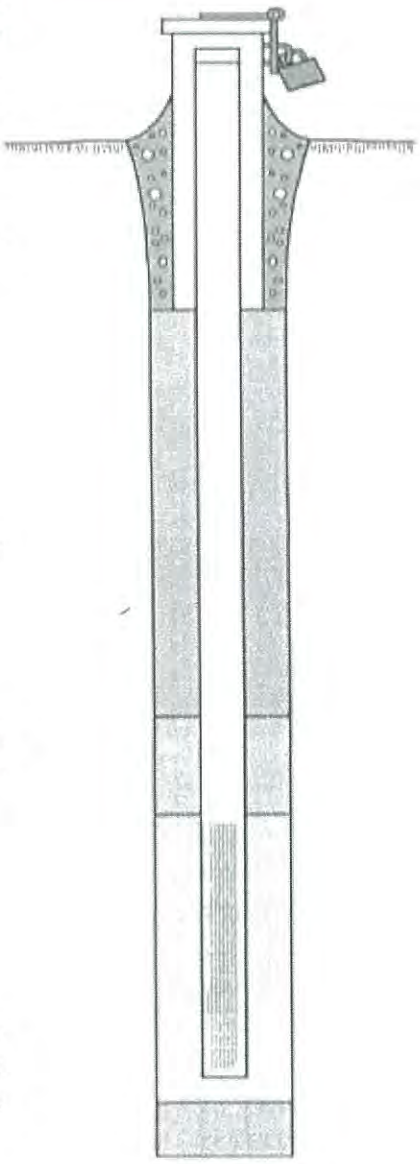
Installed By (Name, Firm, Address):
Installer: AEP/Dolan Lab
Line 1: 4001 Bixby Road
Line 2:
City: Groveport
State: OH
Zip: 43125-
Phone: 614-836-4200

Date Well Installed:
04/01/2019

Driller's WV Cert No.
WV00528

Section B: (all number fields must be in decimal format)

1.Cap and Lock: YES
2.Protective Cover: Protective Cover Pipe
3.Monitoring Well Reference Point: 0 ft.
4.Borehole Diameter: 8 inches.
5.Ground Surface Seal:
a.Material: bentonite-cement grout
b.Installation Procedure: tremie pipe
6.Surface Seal Bottom/Annular Space Top: 3 ft.
7.Well Riser: a.OD Well Riser: 2 inches. b.ID Well Riser: 1.98 inches.
c.Material: PVC
d.Installation Procedure: hand set
8.Annular Space Seal:
a.Material: high solids grout -
b.Installation Procedure: tremie pipe-pumped
9.Well Development Procedure: airlift -
10.Drilling Method Used: hollow stem auger -
11.Annular Space Seal Bottom/Filter Seal Top: 44.5 ft.
12.Drilling Fluid Used: No Source:
13.Filter Pack Seal:
a.Material: bentonite pellet
b.Installation Procedure: Gravity Fed
c.Volume Added: 150 pounds
14.Bottom of Bentonite Seal/Filter Pack Top: 50.7 ft.
15.Depth to Top of Screen: 53.4 ft.
16.Screen:
a.Material: PVC
b.Installation Procedure: hand set
c.Slot Size: 0.01 inches. d.Screen Length: 9.6 ft.
17.Filter Pack:
a.Material: fine sand
b.Installation Procedure: gravity
18.Well Depth: 63.5 ft.
19.Bottom of Filter Pack: 65 ft.
20.Bottom of Borehole: 65 ft.
21.Backfill Material (below filter pack): none
22.Decontamination Procedures: high pressure wash
23.Special Circumstances and Exceptions: No Variance Number:
24.WV Contractor License No.



State of West Virginia
Department of Environmental Protection

Monitoring Well Construction
Well Number: WV00528-0009-19
Approved

Site Name/Physical Address:
Site: AEP/Mountaineer Plant
Line 1: 1347 Graham Station Road
Line 2:
City: New Haven
State: WV
Zip: 25265-
County: Mason

Well Owner (Name, Firm, Address):
Owner: AEP/Mountaineer Plant
Line 1: 1347 Graham Station Road
Line 2:
City: New Haven
State: WV
Zip: 25265-
Phone: 304-882-4000

Well Registration No. WV00528-0009-19
Grid Location:
a. Latitude: 38 58 39 .0
b. Longitude: 81 56 35 .0
c. Method Used: GPS

Company/Project Well No.:
MW-1927

Installed By (Name, Firm, Address):
Installer: AEP/Dolan Lab
Line 1: 4001 Bixby Road
Line 2:
City: Groveport
State: OH
Zip: 43125-
Phone: 614-836-4200

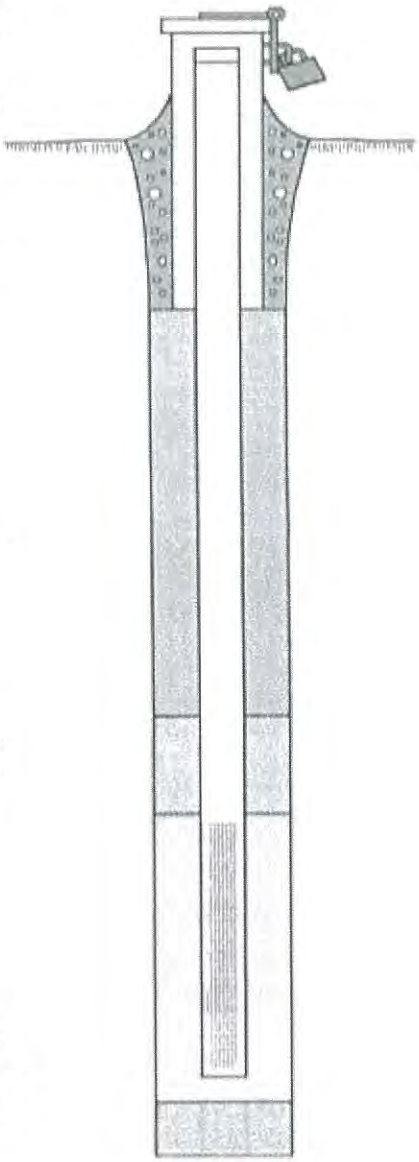
Purpose of Monitoring Well:
Assessment

Date Well Installed:
04/01/2019

Driller's WV Cert No.
WV00528

Section B: (all number fields must be in decimal format)

1.Cap and Lock: YES
2.Protective Cover: Protective Cover Pipe
3.Monitoring Well Reference Point: 0 ft.
4.Borehole Diameter: 8 inches.
5.Ground Surface Seal:
a.Material: bentonite-cement grout
b.Installation Procedure: tremie pipe
6.Surface Seal Bottom/Annular Space Top: 3 ft.
7.Well Riser: a.OD Well Riser: 2 inches. b.ID Well Riser: 1.98 inches.
c.Material: PVC
d.Installation Procedure: hand set
8.Annular Space Seal:
a.Material: high solids grout -
b.Installation Procedure: tremie pipe-pumped
9.Well Development Procedure: airlift -
10.Drilling Method Used: hollow stem auger -
11.Annular Space Seal Bottom/Filter Seal Top: 50 ft.
12.Drilling Fluid Used: No Source:
13.Filter Pack Seal:
a.Material: bentonite pellet
b.Installation Procedure: Gravity Fed
c.Volume Added: 150 pounds
14.Bottom of Bentonite Seal/Filter Pack Top: 56 ft.
15.Depth to Top of Screen: 58.4 ft.
16.Screen:
a.Material: PVC
b.Installation Procedure: hand set
c.Slot Size: 0.01 inches. d.Screen Length: 9.6 ft.
17.Filter Pack:
a.Material: fine sand
b.Installation Procedure: gravity
18.Well Depth: 68.5 ft.
19.Bottom of Filter Pack: 71 ft.
20.Bottom of Borehole: 71 ft.
21.Backfill Material (below filter pack): none
22.Decontamination Procedures: high pressure wash
23.Special Circumstances and Exceptions: No Variance Number:
24.WV Contractor License No.



State of West Virginia
Department of Environmental Protection

Monitoring Well Construction
Well Number: WV00528-0010-19
Approved

Site Name/Physical Address:
Site: AEP/Mountaineer Plant
Line 1: 1347 Graham Station Road
Line 2:
City: New Haven
State: WV
Zip: 25265-
County: Mason

Well Registration No. WV00528-0010-19
Grid Location:
a. Latitude: 38 58 10 .0
b. Longitude: 81 56 25 .0
c. Method Used: GPS

Company/Project Well No.:
MW-1928

Purpose of Monitoring Well:
Assessment

Well Owner (Name, Firm, Address):
Owner: AEP/Mountaineer Plant
Line 1: 1347 Graham Station Road
Line 2:
City: New Haven
State: WV
Zip: 25265-
Phone: 304-882-4000

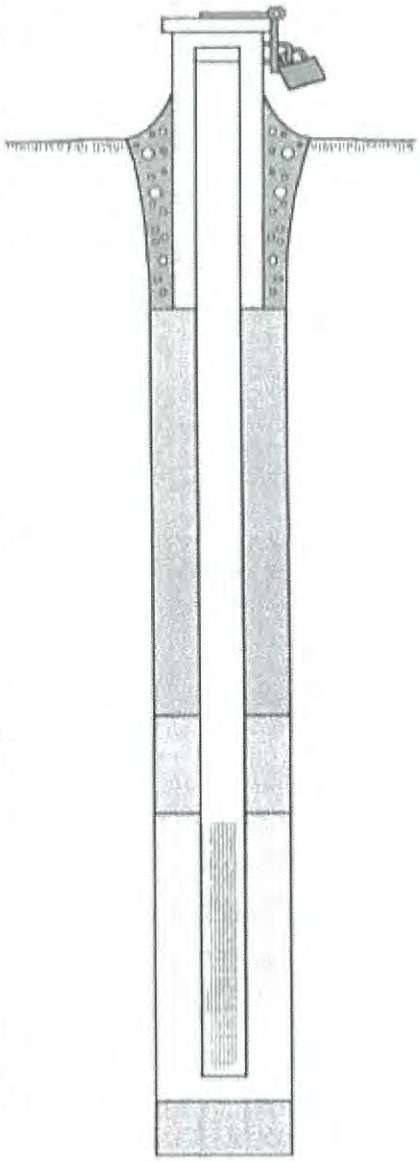
Installed By (Name, Firm, Address):
Installer: AEP/Dolan Lab
Line 1: 4001 Bixby Road
Line 2:
City: Groveport
State: OH
Zip: 43125-
Phone: 614-836-4200

Date Well Installed:
04/01/2019

Driller's WV Cert No.
WV00528

Section B: (all number fields must be in decimal format)

1.Cap and Lock: YES
2.Protective Cover: Protective Cover Pipe
3.Monitoring Well Reference Point: 0 ft.
4.Borehole Diameter: 8 inches.
5.Ground Surface Seal:
a.Material: bentonite-cement grout
b.Installation Procedure: tremie pipe
6.Surface Seal Bottom/Annular Space Top: 3 ft.
7.Well Riser: a.OD Well Riser: 2 inches. b.ID Well Riser: 1.98 inches.
c.Material: PVC
d.Installation Procedure: hand set
8.Annular Space Seal:
a.Material: high solids grout -
b.Installation Procedure: tremie pipe-pumped
9.Well Development Procedure: airlift -
10.Drilling Method Used: hollow stem auger -
11.Annular Space Seal Bottom/Filter Seal Top: 79.3 ft.
12.Drilling Fluid Used: No Source:
13.Filter Pack Seal:
a.Material: bentonite pellet
b.Installation Procedure: Gravity Fed
c.Volume Added: 150 pounds
14.Bottom of Bentonite Seal/Filter Pack Top: 86.6 ft.
15.Depth to Top of Screen: 89.4 ft.
16.Screen:
a.Material: PVC
b.Installation Procedure: hand set
c.Slot Size: 0.01 inches. d.Screen Length: 9.6 ft.
17.Filter Pack:
a.Material: fine sand
b.Installation Procedure: gravity
18.Well Depth: 99.5 ft.
19.Bottom of Filter Pack: 100.2 ft.
20.Bottom of Borehole: 100.2 ft.
21.Backfill Material (below filter pack): none
22.Decontamination Procedures: high pressure wash
23.Special Circumstances and Exceptions: No Variance Number:
24.WV Contractor License No.



State of West Virginia
Department of Environmental Protection

Monitoring Well Construction
Well Number: WV00528-0011-19
Approved

Site Name/Physical Address:
Site: AEP/Mountaineer Plant
Line 1: 1347 Graham Station Road
Line 2:
City: New Haven
State: WV
Zip: 25265-
County: Mason

Well Owner (Name, Firm, Address):
Owner: AEP/Mountaineer Plant
Line 1: 1347 Graham Station Road
Line 2:
City: New Haven
State: WV
Zip: 25265-
Phone: 304-882-4000

Well Registration No. WV00528-0011-19
Grid Location:
a. Latitude: 38 59 15 .0
b. Longitude: 81 56 43 .0
c. Method Used: GPS

Company/Project Well No.:
MW-1929

Installed By (Name, Firm, Address):
Installer: AEP/Dolan Lab
Line 1: 4001 Bixby Road
Line 2:
City: Groveport
State: OH
Zip: 43125-
Phone: 614-836-4200

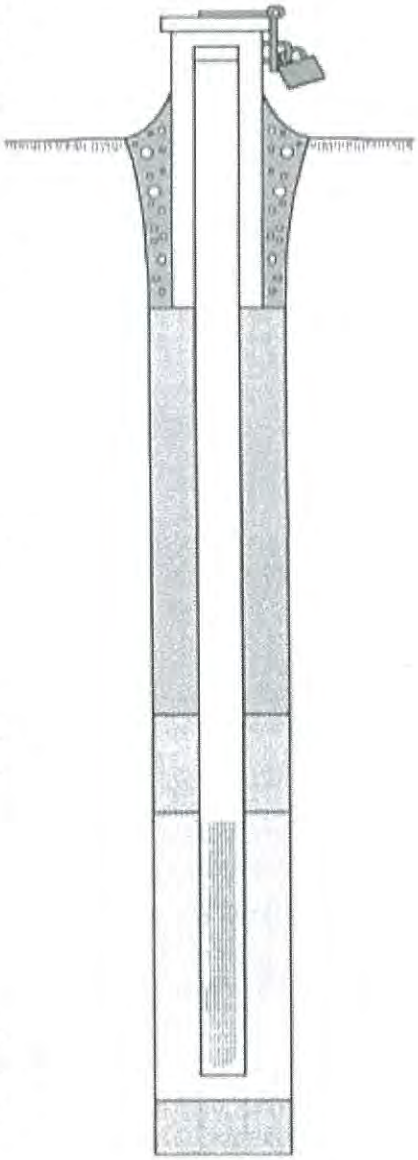
Purpose of Monitoring Well:
Assessment

Date Well Installed:
04/08/2019

Driller's WV Cert No.
WV00528

Section B: (all number fields must be in decimal format)

1.Cap and Lock: YES
2.Protective Cover: Protective Cover Pipe
3.Monitoring Well Reference Point: 0 ft.
4.Borehole Diameter: 8 inches.
5.Ground Surface Seal:
a.Material: bentonite-cement grout
b.Installation Procedure: tremie pipe
6.Surface Seal Bottom/Annular Space Top: 3 ft.
7.Well Riser: a.OD Well Riser: 2 inches. b.ID Well Riser: 1.98 inches.
c.Material: PVC
d.Installation Procedure: hand set
8.Annular Space Seal:
a.Material: high solids grout -
b.Installation Procedure: tremie pipe-pumped
9.Well Development Procedure: airlift -
10.Drilling Method Used: hollow stem auger -
11.Annular Space Seal Bottom/Filter Seal Top: 30.9 ft.
12.Drilling Fluid Used: No Source:
13.Filter Pack Seal:
a.Material: bentonite pellet
b.Installation Procedure: Gravity Fed
c.Volume Added: 150 pounds
14.Bottom of Bentonite Seal/Filter Pack Top: 42.7 ft.
15.Depth to Top of Screen: 45.4 ft.
16.Screen:
a.Material: PVC
b.Installation Procedure: hand set
c.Slot Size: 0.01 inches. d.Screen Length: 9.6 ft.
17.Filter Pack:
a.Material: fine sand
b.Installation Procedure: gravity
18.Well Depth: 55.5 ft.
19.Bottom of Filter Pack: 56.8 ft.
20.Bottom of Borehole: 56.8 ft.
21.Backfill Material (below filter pack): none
22.Decontamination Procedures: high pressure wash
23.Special Circumstances and Exceptions: No Variance Number:
24.WV Contractor License No.



Annual Groundwater Monitoring Report

Appalachian Power Company

Mountaineer Plant

Landfill CCR Management Unit

Letart, WV

January 2020

Prepared by:
American Electric Power Service Corporation
1 Riverside Plaza
Columbus, Ohio 43215

APPALACHIAN POWER℠

An AEP Company

BOUNDLESS ENERGY℠

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I. Overview

This *Annual Groundwater Monitoring and Corrective Action Report* (Report) has been prepared to report the status of activities for the preceding year for the landfill CCR unit at Appalachian Power Company's, a wholly-owned subsidiary of American Electric Power Company (AEP), Mountaineer Power Plant. The USEPA's CCR rules require that the Annual Groundwater Monitoring and Corrective Action Report be posted to the operating record for the preceding year no later than January 31st.

In general, the following activities were completed in 2019:

- Groundwater samples were collected and analyzed for Appendix III constituents, as specified in 40 CFR 257.94 *et seq.* and AEP's *Groundwater Sampling and Analysis Plan (2016)*;
- Groundwater data underwent various validation tests, including tests for completeness, valid values, transcription errors, and consistent units;
- Appendix III constituents were compared to prediction intervals established from background data established previously;
- Statistically significant increases (SSIs) over background concentrations were observed from the September 2018 sampling event and April 2019 sampling event, however, an alternative source demonstration (ASD) was successful for each event in showing that the observed increases were due to natural variation. The statistics reports and alternative source demonstration reports were completed in 2019.

The major components of this annual report, to the extent applicable at this time, are presented in sections that follow:

- A map, aerial photograph or a drawing showing the CCR management unit(s), all groundwater monitoring wells and monitoring well identification numbers;
- All of the monitoring data collected, including the rate and direction of groundwater flow, plus a summary showing the number of samples collected per monitoring well, the dates the samples were collected and whether the sample was collected as part of detection monitoring or assessment monitoring programs (Attached as **Appendix 1**);
- Statistical comparison of monitoring data to determine if there have been significant increase over background concentrations (Attached as **Appendix 2**, where applicable);
- A discussion of whether any alternate source demonstration were performed, and the conclusions (Attached as **Appendix 3**, where applicable);
- A summary of any transition between monitoring program, for example the date and circumstances for transitioning from detection monitoring to assessment monitoring (Notices attached as **Appendix 4**, where applicable);

- Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a statement as to why that happened (Attached as **Appendix 5**, where applicable); and
- Other information required to be included in the annual report such as an alternate monitoring frequency, or assessment of corrective measures, if applicable.

In addition, this report summarizes key actions completed, and where applicable, describes any problems encountered and actions taken to resolve those problems. The report includes a projection of key activities for the upcoming year.

II. Groundwater Monitoring Well Locations and Identification Numbers

The figure that follows depicts the PE-certified groundwater monitoring network, the monitoring well locations and their corresponding identification.

Monitoring Well Network

- Downgradient Sampling Location
- Background Sampling Location
- Landfill

Notes

- Monitoring well coordinates provided by AEP.
- Site features based on information available in Little Broad Run Landfill-CCR Groundwater Monitoring Well Network Evaluation (Arcadis, 2016) provided by AEP.

750 375 0 750 Feet

Site Layout
CCR Landfill

AEP Mountaineer Generating Plant
Letart, West Virginia

Geosyntec consultants

Columbus, Ohio | 2018/01/26

Figure 1

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mountaineer\AEP-Mountaineer_LF_Site_Layout.mxd. ARevezzo. 1/26/2018. CHA8423/07/08.

III. Monitoring Wells Installed or Decommissioned

There were no monitoring wells installed or decommissioned in 2019. The network design, as summarized in the *Groundwater Monitoring Network Design Report* (2016) and as posted at the CCR web site for Mountaineer Plant, did not change. That design report, viewable on the AEP CCR web site, discusses the facility location, the hydrogeological setting, the hydrostratigraphic units, the uppermost aquifer, downgradient monitoring well locations and the upgradient monitoring well locations.

IV. Groundwater Quality Data and Static Water Elevation Data, With Flow Rate and Direction and Discussion

Appendix 1 contains tables showing the groundwater quality data collected since background through data received in 2019. Static water elevation data from each monitoring event also are shown in **Appendix 1**, along with the groundwater velocity calculations, groundwater flow direction and potentiometric maps developed after each sampling event.

V. Groundwater Quality Data Statistical Analysis

Statistical analysis completed in 2019 of the detection monitoring samples collected and analyzed in September 2018, November 2018, and April 2019 are included in **Appendix 2** of this report. Samples collected in September 2019 were analyzed and results received in late 2019. The statistical analysis of these results is underway and will be completed within the 90-day timeframe allowed.

The statistically significant increases (SSIs) observed from the September 2018 sampling event in the Appendix III parameters were boron, calcium, pH, and total dissolved solids; however, an alternative source demonstration was successful and detection monitoring continued on a semi-annual basis in the final sample of 2018 and all of 2019.

The statistically significant increases (SSIs) observed from the April 2019 sampling event in the Appendix III parameters were chloride and total dissolved solids; however an alternative source demonstration was successful and the detection monitoring continued in the second half of 2019.

VI. Alternative Source Demonstrations

SSIs over background for the September 2018 and April 2019 detection monitoring events were determined to be due to an alternative source per the ASD's mentioned above. The demonstrations were certified by a qualified professional engineer and are included in **Appendix 3**.

VII. Discussion About Transition Between Monitoring Requirements or Alternate Monitoring Frequency

There has been no transition between detection monitoring and assessment monitoring at Mountaineer Plant's Landfill. Detection monitoring will continue in 2020. The sampling frequency of twice per year will be maintained for the Appendix III parameters (boron, calcium, chloride, fluoride, pH, sulfate and total dissolved solids).

Regarding defining an alternate monitoring frequency, the groundwater velocity and monitoring well production is high enough at this facility that no modification of the twice-per-year detection monitoring effort is needed.

VIII. Description of Any Problems Encountered in 2019 and Actions Taken

No significant problems were encountered. The low flow sampling effort went smoothly and the schedule was met to support this first annual groundwater report preparation.

IX. A Projection of Key Activities for the Upcoming Year

Key activities for 2020 include:

- Detection monitoring on a twice per year schedule.
- Evaluation of the detection monitoring results from a statistical analysis viewpoint, looking for any statistically significant increases, or decreases when pH is considered.
- Responding to any new data received in light of what the CCR rule requires.
- Preparation of the annual groundwater report due in January 2021.

APPENDIX 1 - Groundwater Data Tables and Figures

Tables follow, showing the groundwater monitoring data collected and the rate and direction of groundwater flow. The dates that the samples were collected also is shown.

Table 1 - Groundwater Data Summary: MW-26
Mountaineer - LF
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/27/2016	Background	0.097	61.5	5.57	0.12	7.5	322	9.6
11/1/2016	Background	0.117	50.5	5.17	0.13	7.4	270	10.6
12/21/2016	Background	0.074	48.6	5.21	0.13	7.6	316	10.2
2/22/2017	Background	0.145	56.2	5.35	0.13	7.4	325	6.5
3/28/2017	Background	0.222	52.9	6.25	0.13	7.4	334	7.3
4/17/2017	Background	0.169	57.1	5.73	0.13	7.3	320	6.7
5/17/2017	Background	0.161	58.6	5.87	0.13	8.1	343	6.5
6/13/2017	Background	0.121	53.7	5.00	0.12	7.4	324	5.3
10/31/2017	Detection	0.165	54.7	5.48	0.13	7.5	346	5.8
1/22/2018	Detection	- -	55.7	- -	- -	7.3	- -	- -
9/20/2018	Detection	0.214	49.4	6.04	0.16	8.0	344	6.3
11/26/2018	Detection	0.182	53.6	5.97	0.14	7.4	364	7.2
4/9/2019	Detection	0.128	62.8	6.71	0.13	7.3	370	7.6
6/18/2019	Detection	- -	- -	7.22	- -	7.2	387	- -
9/9/2019	Detection	0.099	60.2	5.80	0.14	7.4	353	5.7

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-26
Mountaineer - LF
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
9/27/2016	Background	0.13	3.57	917	<0.005 U	0.01 J	0.4	0.214	3.25	0.12	0.165	0.010	<0.002 U	1.88	0.1	0.03 J
11/1/2016	Background	0.11	4.06	871	<0.005 U	0.005 J	0.3	0.2200	3.57	0.13	0.043	0.006	<0.002 U	3.07	0.1	0.02 J
12/21/2016	Background	0.12	4.51	872	0.01 J	0.006 J	1.27	0.329	3.15	0.13	0.167	0.004	<0.002 U	3.52	0.2	0.062
2/22/2017	Background	0.09	4.11	717	0.01 J	0.01 J	0.731	0.345	3.6	0.13	0.244	0.012	<0.002 U	2.53	0.1	0.04 J
3/28/2017	Background	0.50	3.95	886	0.028	0.01 J	1.43	0.532	2.88	0.13	0.517	0.014	<0.002 U	1.18	0.2	0.03 J
4/17/2017	Background	0.09	3.60	802	0.007 J	0.007 J	0.328	0.299	1.967	0.13	0.164	0.009	<0.002 U	1.08	0.1 J	0.01 J
5/17/2017	Background	0.06	4.01	869	<0.004 U	0.007 J	0.238	0.251	3.22	0.13	0.090	0.007	<0.002 U	3.99	0.1	0.01 J
6/13/2017	Background	0.10	3.45	905	0.008 J	0.008 J	0.405	0.325	3.28	0.12	0.252	0.018	<0.002 U	1.23	0.1	0.01 J

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-27
Mountaineer - LF
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/27/2016	Background	0.276	18.9	1.82	2.23	9.2	618	4.9
11/1/2016	Background	0.288	1.57	1.86	2.38	9.1	558	7.2
12/21/2016	Background	0.219	1.39	1.69	2.44	9.2	528	7.3
2/22/2017	Background	0.282	1.42	1.48	2.27	9.1	531	4.3
3/28/2017	Background	0.387	1.26	1.59	2.32	9.3	508	4.7
4/17/2017	Background	0.312	1.65	1.56	2.30	9.0	536	5.0
5/17/2017	Background	0.290	1.48	1.59	2.38	11.1	539	4.8
6/13/2017	Background	0.293	1.77	1.64	2.33	9.4	526	4.5
10/31/2017	Detection	0.275	1.33	1.63	2.38	9.2	544	4.2
9/20/2018	Detection	0.357	1.14	1.69	2.41	9.1	550	4.4
11/26/2018	Detection	0.292	1.20	1.52	2.37	9.0	522	3.6
4/9/2019	Detection	0.303	1.19	1.54	2.32	9.0	542	2.9
9/10/2019	Detection	0.285	1.13	1.67	2.71	9.1	530	3.0

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-27
Mountaineer - LF
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
9/27/2016	Background	0.39	8.05	326	0.654	0.11	11.6	4.95	2.565	2.23	17.3	0.016	0.004 J	24.2	2.2	0.1 J
11/1/2016	Background	0.26	5.42	151	0.158	0.02	5.00	0.817	2.003	2.38	4.00	0.007	<0.002 U	35.6	0.4	0.03 J
12/21/2016	Background	0.23	4.26	113	0.093	0.01 J	2.94	0.502	1.489	2.44	8.87	0.001	<0.002 U	34.6	0.3	0.04 J
2/22/2017	Background	0.06	3.76	94.8	0.054	0.009 J	1.95	0.320	1.419	2.27	1.28	0.012	0.002 J	32.1	0.1	0.03 J
3/28/2017	Background	0.08	4.45	105	0.062	0.008 J	1.69	0.319	0.888	2.32	1.06	0.016	<0.002 U	31.5	0.2	0.02 J
4/17/2017	Background	0.15	4.54	108	0.085	0.01 J	2.36	0.511	0.486	2.30	1.45	0.005	0.002 J	32.0	0.2	0.02 J
5/17/2017	Background	0.11	4.54	94.6	0.052	0.005 J	1.33	0.335	0.20279	2.38	0.971	0.015	<0.002 U	31.6	0.2	0.01 J
6/13/2017	Background	0.18	4.55	102	0.082	0.01 J	2.25	0.600	0.797	2.33	1.39	0.015	<0.002 U	30.6	0.2	0.02 J

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-30
Mountaineer - LF
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
10/26/2016	Background	0.239	16.6	250	3.42	8.7	- -	31.5
11/2/2016	Background	0.240	10.9	257	3.41	8.6	1350	19.6
12/28/2016	Background	0.250	9.91	250	3.43	8.0	1280	19.1
2/22/2017	Background	0.257	2.76	246	3.18	8.6	1220	11.5
3/29/2017	Background	0.344	2.54	242	3.31	8.7	1270	0.1 J
4/19/2017	Background	0.296	2.91	247	3.28	8.5	1210	11.2
5/17/2017	Background	0.269	2.97	247	1.34	10.1	1290	4.4
6/13/2017	Background	0.283	4.06	255	3.28	8.9	1170	10.8
10/30/2017	Detection	0.315	3.27	257	3.30	8.5	1210	11.4
9/20/2018	Detection	0.315	4.69	253	3.36	8.6	1230	13.0
11/27/2018	Detection	0.344	3.16	247	3.40	8.4	1240	11.7
4/9/2019	Detection	0.290	2.88	245	3.32	8.4	1260	10.6
9/10/2019	Detection	0.259	3.39	249	3.76	8.3	1260	9.6

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-30
Mountaineer - LF
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
10/26/2016	Background	0.36	7.38	567	0.692	0.10	13.1	33.8	2.588	3.42	33.2	0.034	0.054	68.7	3.8	0.724
11/2/2016	Background	0.26	7.54	576	0.630	0.09	11.7	33.3	1.404	3.41	30.9	0.026	0.016	73.7	2.7	0.654
12/28/2016	Background	0.91	6.87	360	0.502	0.08	18.1	15.9	2.725	3.43	13.8	0.024	0.026	107	2.6	0.35
2/22/2017	Background	0.52	4.65	223	0.082	0.008 J	3.24	2.40	2.418	3.18	1.68	0.022	0.004 J	125	0.5	0.258
3/29/2017	Background	0.66	5.45	243	0.149	0.007 J	6.13	4.24	1.204	3.31	3.62	0.027	0.003 J	120	0.7	0.381
4/19/2017	Background	1.55	5.80	246	0.140	0.01 J	5.76	3.91	3.83	3.28	3.49	0.019	0.061	123	0.7	0.365
5/17/2017	Background	0.75	6.90	241	0.120	<0.005 U	3.99	3.63	2.395	1.34	3.41	0.027	0.004 J	128	0.9	0.287
6/13/2017	Background	2.74	6.86	251	0.197	0.02 J	6.83	5.35	3.45	3.28	4.80	0.027	0.005 J	118	0.8	0.366

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-38
Mountaineer - LF
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/27/2016	Background	0.024	55.7	7.12	0.32	7.1	410	28.1
11/2/2016	Background	0.040	46.3	7.27	0.32	7.0	358	36.6
12/21/2016	Background	0.019	48.2	7.43	0.35	7.4	404	35.8
2/22/2017	Background	0.028	47.2	7.21	0.29	7.0	409	31.7
3/28/2017	Background	0.070	50.0	7.08	0.32	7.0	390	30.1
4/18/2017	Background	0.038	52.5	7.22	0.33	7.0	422	30.6
5/16/2017	Background	0.027	54.5	7.41	0.33	7.6	421	32.5
6/13/2017	Background	0.093	51.4	7.01	0.28	7.0	406	31.0
10/31/2017	Detection	0.045	56.1	7.59	0.38	7.0	460	28.7
1/22/2018	Detection	- -	53.8	- -	- -	6.7	419	- -
9/20/2018	Detection	0.068	51.2	7.31	0.36	7.4	441	31.5
11/26/2018	Detection	0.08 J	48.2	7.06	0.34	7.0	415	35.2
4/9/2019	Detection	0.04 J	52.0	7.46	0.32	6.9	427	27.8
6/18/2019	Detection	- -	- -	- -	- -	7.6	- -	- -
9/9/2019	Detection	0.03 J	49.9	7.45	0.35	7.7	406	28.2
10/22/2019	Detection	- -	- -	- -	- -	6.9	- -	- -

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-38
Mountaineer - LF
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
9/27/2016	Background	0.09	9.82	221	0.023	0.03	1.0	2.72	2.229	0.32	0.442	0.002	<0.002 U	2.76	0.2	0.103
11/2/2016	Background	0.07	8.15	179	<0.005 U	0.02 J	0.4	0.855	1.744	0.32	0.113	0.0009 J	<0.002 U	2.10	0.04 J	0.04 J
12/21/2016	Background	0.05	6.62	162	<0.005 U	0.02	1.67	0.655	2.06	0.35	0.082	<0.0002 U	<0.002 U	2.50	0.06 J	0.082
2/22/2017	Background	0.03 J	5.74	141	<0.005 U	0.02	0.526	0.949	1.000	0.29	0.039	0.004	<0.002 U	3.37	0.03 J	0.04 J
3/28/2017	Background	0.05 J	11.5	184	<0.005 U	0.03	0.197	0.916	0.548	0.32	0.073	0.006	<0.002 U	2.47	0.06 J	0.05 J
4/18/2017	Background	0.04 J	6.34	179	<0.004 U	0.03	0.111	2.87	0.494	0.33	0.02 J	0.003	<0.002 U	2.30	<0.03 U	0.068
5/16/2017	Background	0.06	5.09	186	<0.004 U	0.03	0.093	3.66	0.536	0.33	0.01 J	0.004	<0.002 U	3.76	<0.03 U	0.062
6/13/2017	Background	0.06	8.09	187	<0.004 U	0.03	0.130	2.53	1.268	0.28	0.056	0.013	<0.002 U	2.67	0.04 J	0.056

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-39
Mountaineer - LF
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/26/2016	Background	0.143	12.4	3.00	0.77	8.4	350	<0.04 U
11/2/2016	Background	0.134	7.88	3.05	0.83	8.4	344	<0.04 U
12/21/2016	Background	0.122	10.5	3.07	0.86	8.8	450	<0.04 U
2/22/2017	Background	0.134	7.65	2.98	0.80	8.4	374	<0.04 U
3/28/2017	Background	0.202	5.95	2.95	0.78	8.4	310	0.1 J
4/18/2017	Background	0.156	6.48	2.91	0.78	8.3	344	<0.04 U
5/16/2017	Background	0.139	6.74	2.98	0.79	9.5	367	1.5
6/14/2017	Background	0.179	6.15	2.92	0.78	8.5	340	0.1
10/31/2017	Detection	0.171	7.25	3.05	0.78	8.3	385	0.2
9/20/2018	Detection	0.182	6.43	2.99	0.8	8.5	369	0.1 J
11/26/2018	Detection	0.167	6.33	2.93	0.8	8.3	380	0.07 J
4/9/2019	Detection	0.158	6.65	2.94	0.77	8.3	376	<0.06 U
9/9/2019	Detection	0.144	6.78	3.07	0.84	8.1	369	<0.06 U

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-39
Mountaineer - LF
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
9/26/2016	Background	0.06	4.80	264	0.095	0.01 J	2.2	1.43	1.142	0.77	2.21	0.016	<0.002 U	8.51	0.3	0.04 J
11/2/2016	Background	0.04 J	3.89	276	0.068	<0.004 U	3.2	0.615	1.941	0.83	0.532	0.011	<0.002 U	9.54	0.09 J	0.03 J
12/21/2016	Background	0.08	3.95	296	0.202	0.006 J	6.32	2.34	1.311	0.86	1.79	0.008	<0.002 U	8.03	0.6	0.070
2/22/2017	Background	0.03 J	3.91	243	0.041	0.01 J	1.41	0.539	1.162	0.80	0.467	0.012	0.002 J	9.23	0.1	0.03 J
3/28/2017	Background	0.02 J	3.58	241	0.01 J	<0.004 U	0.560	0.206	0.793	0.78	0.176	0.015	<0.002 U	8.50	0.06 J	0.02 J
4/18/2017	Background	0.01 J	3.70	244	0.007 J	<0.005 U	0.243	0.188	0.1602	0.78	0.113	0.009	<0.002 U	8.65	0.04 J	<0.01 U
5/16/2017	Background	0.01 J	3.88	244	0.004 J	0.02	0.221	0.174	0.611	0.79	0.073	0.017	<0.002 U	9.39	0.04 J	<0.01 U
6/14/2017	Background	0.02 J	3.76	247	0.008 J	<0.005 U	0.203	0.209	0.47	0.78	0.092	0.028	<0.002 U	9.06	0.06 J	<0.01 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1611
Mountaineer - LF
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/26/2016	Background	0.136	25.0	8.72	0.56	7.8	382	17.3
11/2/2016	Background	0.140	22.8	9.36	0.61	7.8	388	22.7
12/20/2016	Background	0.124	22.2	9.39	0.64	7.7	380	21.8
2/22/2017	Background	0.175	22.5	9.10	0.57	7.7	381	18.0
3/28/2017	Background	0.210	22.3	8.04	0.50	7.8	326	15.7
4/18/2017	Background	0.155	22.8	8.59	0.56	7.7	388	17.7
5/16/2017	Background	0.190	23.1	9.14	0.60	8.3	392	18.7
6/12/2017	Background	0.158	22.4	9.29	0.57	7.2	384	19.4
10/31/2017	Detection	0.152	24.0	9.80	0.61	7.8	402	18.9
1/22/2018	Detection	- -	22.6	- -	- -	7.5	376	- -
9/20/2018	Detection	0.258	23.2	9.48	0.61	7.8	416	19.0
11/26/2018	Detection	0.147	21.9	9.57	0.62	7.7	387	18.5
4/9/2019	Detection	0.139	26.2	7.96	0.46	7.6	431	20.7
6/18/2019	Detection	- -	22.8	9.58	- -	7.9	- -	- -
7/10/2019	Detection	- -	- -	- -	- -	7.6	402	- -
9/9/2019	Detection	0.136	26.1	10.1	0.62	7.7	402	17.3

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1611
Mountaineer - LF
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
9/26/2016	Background	0.03 J	1.01	165	0.046	0.02	1.4	0.370	1.258	0.56	0.482	0.004	<0.002 U	6.97	0.07 J	0.088
11/2/2016	Background	0.03 J	0.97	156	0.03	0.01 J	0.9	0.245	2.888	0.61	0.310	0.004	<0.002 U	5.83	0.06 J	0.03 J
12/20/2016	Background	<0.01 U	0.74	140	<0.005 U	<0.004 U	2.10	0.092	0.772	0.64	0.023	0.002	<0.002 U	5.46	<0.03 U	<0.01 U
2/22/2017	Background	<0.01 U	0.75	135	0.007 J	0.006 J	0.209	0.096	0.5828	0.57	0.055	0.007	0.002 J	5.36	0.04 J	0.208
3/28/2017	Background	0.01 J	0.60	166	0.01 J	0.005 J	0.426	0.108	0.645	0.5	0.195	0.011	<0.002 U	7.26	0.07 J	0.02 J
4/18/2017	Background	0.01 J	0.69	155	0.01 J	0.006 J	0.337	0.104	0.487	0.56	0.133	0.003	<0.002 U	6.01	<0.03 U	<0.01 U
5/16/2017	Background	0.03 J	0.75	145	0.008 J	<0.005 U	0.661	0.101	2.534	0.6	0.119	0.006	<0.002 U	5.49	0.04 J	0.02 J
6/12/2017	Background	0.03 J	0.76	148	0.007 J	<0.005 U	0.138	0.092	0.508	0.57	0.058	0.018	<0.002 U	5.39	0.03 J	<0.01 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1612
Mountaineer - LF
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
10/26/2016	Background	0.637	9.47	38.1	3.02	8.3	- -	272
11/2/2016	Background	0.629	8.48	33.4	3.23	8.3	850	238
12/21/2016	Background	0.501	8.96	36.1	3.33	8.1	966	271
2/22/2017	Background	0.473	7.90	35.6	2.95	8.4	1090	288
3/29/2017	Background	0.673	7.10	23.7	3.50	8.7	1240	190
4/19/2017	Background	0.589	8.61	22.4	3.26	8.4	1040	226
5/16/2017	Background	0.565	12.5	27.8	2.88	8.8	1150	346
6/13/2017	Background	0.532	8.09	27.4	2.98	8.2	1130	334
10/30/2017	Detection	0.457	7.22	20.2	3.53	8.2	914	147
9/20/2018	Detection	0.543	4.50	14.6	3.78	8.4	835	63.9
11/26/2018	Detection	0.413	4.25	11.5	3.91	8.0	764	49.2
4/9/2019	Detection	0.449	3.21	10.2	4.02	8.3	725	54.8
9/10/2019	Detection	0.438	4.77	11.1	4.34	8.3	786	31.3

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1612
Mountaineer - LF
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
10/26/2016	Background	0.31	12.4	66.2	0.033	0.007 J	1.63	0.367	2.765	3.02	0.391	0.018	<0.002 U	62.1	0.2	0.03 J
11/2/2016	Background	0.35	16.8	80.4	0.009 J	<0.004 U	0.6	0.197	0.973	3.23	0.168	0.014	0.002 J	67.6	0.08 J	0.087
12/21/2016	Background	0.13	14.9	62.1	0.007 J	<0.004 U	0.913	0.111	0.947	3.33	0.121	0.011	0.002 J	52.2	0.1	<0.01 U
2/22/2017	Background	0.31	14.4	72.4	0.058	<0.004 U	2.13	0.700	1.084	2.95	0.640	0.018	0.003 J	38.5	0.1	0.04 J
3/29/2017	Background	0.77	12.4	141	0.290	0.01 J	3.19	2.60	0.86	3.50	1.37	0.020	0.014	45.9	0.5	0.03 J
4/19/2017	Background	0.82	10.7	233	0.551	<0.05 U	15.5	3.94	0.425	3.26	4.10	0.019	0.004 J	58.0	1.2	0.2 J
5/16/2017	Background	0.15	10.4	77.1	0.02 J	<0.005 U	0.445	0.231	2.744	2.88	0.210	0.022	<0.002 U	43.1	0.1	0.02 J
6/13/2017	Background	0.15	10.7	59.6	0.006 J	<0.005 U	0.227	0.101	0.824	2.98	0.023	0.028	<0.002 U	34.3	0.06 J	<0.01 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 2: Residence Time Calculation Summary - Landfill Mountaineer Landfill

Geosyntec Consultants, Inc.

CCR Management Unit	Monitoring Well	Well Diameter (inches)	2019-04		2019-09	
			Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)
Landfill	MW-26 [2]	2.0	1.8	34.0	2.2	27.4
	MW-27 [2]	2.0	19.6	3.1	19.5	3.1
	MW-30 [1]	2.0	5.3	11.5	5.3	11.6
	MW-38 [2]	2.0	NC	NC	NC	NC
	MW-39 [2]	2.0	17.6	3.5	17.4	3.5
	MW-1611 [2]	2.0	12.6	4.8	11.4	5.3
	MW-1612 [1]	2.0	15.4	4.0	15.4	3.9

Notes:
[1] - Background Well
[2] - Downgradient Well
NC - Not Calculated. Groundwater residence time for MW-38 could not be calculated, as it is the only monitoring well for its lithologic unit (valley alluvium) within the monitoring network.

Legend

Monitoring Wells
- Alluvium
- Hydrologic Unit 3
- Hydrologic Unit 4

Groundwater Elevation Contours
- Approximate Groundwater Flow Direction (Unit 3)
- Hydrologic Unit 3
- Hydrologic Unit 3 (Inferred)
- Approximate Groundwater Flow Direction (Unit 4)
- Hydrologic Unit 4

Notes
- Monitoring well coordinates and water level data (collected on April 8, 2019) provided by AEP.
- Site features based on information available in Little Broad Run Landfill-CCR Groundwater Monitoring Well Network Evaluation (Arcadis, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level.
- Water level measurements from MW-25 (screened in shale below Unit 4), MW-37 (hydraulically disconnected from the rest of Unit 3), and MW-38 (screened in alluvium) were not used in groundwater contouring.
- Groundwater elevation units are feet above mean sea level.

750 375 0 750 Feet

Potentiometric Surface Map - Uppermost Aquifer April 2019

AEP Mountaineer Generating Plant - CCR Landfill
New Haven, West Virginia

Geosyntec consultants

Columbus, Ohio | 2019/12/11

Figure 1

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Legend

Monitoring Wells
- Alluvium
- Hydrologic Unit 3
- Hydrologic Unit 4

Groundwater Elevation Contours
- Approximate Groundwater Flow Direction (Unit 3)
- Hydrologic Unit 3
- Approximate Groundwater Flow Direction (Unit 4)
- Hydrologic Unit 4

Notes

- Monitoring well coordinates and water level data (collected on June 17, 2019) provided by AEP.
- MW-12 was not gauged during June sampling event.
- Site features based on information available in Little Broad Run Landfill-CCR Groundwater Monitoring Well Network Evaluation (Arcadis, 2016) provided by AEP.
- Water level measurements from MW-25 (screened in shale below Unit 4), MW-37 (hydraulically disconnected from the rest of Unit 3), and MW-38 (screened in alluvium) were not used in ground water contouring.
- Groundwater elevation units are feet above mean sea level.

750 375 0 750 Feet

Potentiometric Surface Map - Uppermost Aquifer
June 2019

AEP Mountaineer Generating Plant - CCR Landfill
New Haven, West Virginia

Geosyntec consultants

Columbus, Ohio | 2019/12/11

Figure **2**

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Legend

Monitoring Wells
- Alluvium
- Hydrologic Unit 3
- Hydrologic Unit 4

Groundwater Elevation Contours
- Approximate Groundwater Flow Direction (Unit 3)
- Hydrologic Unit 3
- Approximate Groundwater Flow Direction (Unit 4)
- Hydrologic Unit 4

Notes

- Monitoring well coordinates and water level data (collected on September 9, 2019) provided by AEP.
- Site features based on information available in Little Broad Run Landfill-CCR Groundwater Monitoring Well Network Evaluation (Arcadis, 2016) provided by AEP.
- Water level measurements from MW-25 (screened in shale below Unit 4), MW-37 (hydraulically disconnected from the rest of Unit 3), and MW-38 (screened in alluvium) were not used in ground water contouring.
- Groundwater elevation units are feet above mean sea level.

750 375 0 750 Feet

Potentiometric Surface Map - Uppermost Aquifer September 2019

AEP Mountaineer Generating Plant - CCR Landfill
New Haven, West Virginia

Geosyntec consultants

Columbus, Ohio | 2019/12/31

Figure 3

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APPENDIX 2 - Statistical Analyses

Memoranda follow summarizing the statistical analyses of Appendix III parameters.

Geosyntec consultants

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Memorandum

Date:	February 27, 2019
To:	David Miller (AEP)
Copies to:	Justin Jent (AEP)
From:	Allison Kreinberg and Bruce Sass, Ph.D. (Geosyntec)
Subject:	Evaluation of Detection Monitoring Data at Mountaineer Plant's Landfill

In accordance with the United States Environmental Protection Agency's (USEPA's) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR 257.90-257.98, "CCR rule"), a detection monitoring event was completed on September 20, 2018 at the Landfill (LF), an existing CCR unit at the Mountaineer Power Plant located in New Haven, West Virginia.

Eight background monitoring events were conducted at the Mountaineer LF prior to these detection monitoring events, and upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. Lower prediction limits (LPLs) were also calculated for pH. Details on the calculation of these background values are described in Geosyntec's *Statistical Analysis Summary* report, dated January 15, 2018.

To achieve an acceptably high statistical power while maintaining a site-wide false-positive rate (SWFPR) of 10% per year or less, prediction limits were calculated based on a one-of-two retesting procedure for all Appendix III parameters. With this procedure, a statistically significant increase (SSI) is only concluded if all samples in a series of two exceeds the UPL or are below the LPL. However, only one sampling event was completed and so it was conservatively assumed that an SSI was identified if the initial sample exceeded the UPL or was below the LPL.

Detection monitoring results and the relevant background values are compared in Table 1 and noted exceedances are described in the list below.

- The boron concentration of 0.256 mg/L at MW-1611 exceeded the intrawell UPL of 0.241 mg/L. Therefore, an SSI over background is concluded for boron at MW-1611.

- Calcium concentrations exceeded the interwell UPL of 16.2 mg/L in the samples collected at MW-1611 (23.2 mg/L), MW-26 (49.4 mg/L), and MW-38 (51.2 mg/L). Therefore, SSIs over background are concluded for calcium at MW-1611, MW-26, and MW-38.

- pH values were below the interwell LPL of 8.0 SU in the samples collected at MW-1611 (7.8 SU) and MW-38 (7.4 SU). Therefore, SSIs below background are concluded for pH at MW-1611 and MW-38.

- The total dissolved solids (TDS) concentration of 416 mg/L at MW-1611 exceeded the intrawell UPL of 392 mg/L. Therefore, an SSI over background is concluded for TDS at MW-1611.

No other exceedances of UPLs were observed during this detection monitoring event.

The statistical analysis was conducted within 90 days of completion of sampling and analysis in accordance with 40 CFR 257.93(h)(2). Within 90 days of identification of the above-listed SSIs, a written demonstration that a source other than the Mountaineer Landfill caused the increases will be completed in accordance with 40 CFR 257.94(e)(2). If the demonstration is successful, the Mountaineer Landfill will remain in detection monitoring.

A certification of these statistics by a qualified professional engineer is provided in Attachment A.

Table 1: Detection Monitoring Data Evaluation
Mountaineer Plant - Landfill

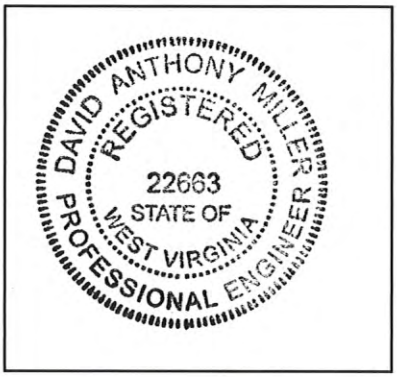
Geosyntec Consultants, Inc.

Parameter	Units	Description	MW-1611	MW-26	MW-27	MW-38	MW-39
			9/20/2018	9/20/2018	9/20/2018	9/20/2018	9/20/2018
Boron	mg/L	Intrawell Background Value (UPL)	0.241	0.266	0.421	0.113	0.225
		Detection Monitoring Data	**0.258**	0.214	0.357	0.068	0.182
Calcium	mg/L	Interwell Background Value (UPL)	16.2				
		Detection Monitoring Data	**23.2**	**49.4**	1.14	**51.2**	6.43
Chloride	mg/L	Intrawell Background Value (UPL)	10.24	6.66	2.01	7.63	3.14
		Detection Monitoring Data	9.48	6.04	1.69	7.31	2.99
Fluoride	mg/L	Interwell Background Value (UPL)	3.67				
		Detection Monitoring Data	0.61	0.16	2.41	0.36	0.8
pH	SU	Interwell Background Value (UPL)	10.1				
		Interwell Background Value (LPL)	8.0				
		Detection Monitoring Data	**7.8**	8.0	9.1	**7.4**	8.5
Sulfate	mg/L	Intrawell Background Value (UPL)	25.3	13.3	8.9	39.9	1.5
		Detection Monitoring Data	19	6.3	4.4	31.5	0.1
TDS	mg/L	Intrawell Background Value (UPL)	392	379	635	459	473
		Detection Monitoring Data	**416**	344	550	441	369

Notes
UPL: Upper prediction limit
LPL: Lower prediction limit
TDS: Total dissolved solids
Bold values exceed the background value.
Background values are shaded gray.

CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected statistical method, described above and in the January 15, 2018 *Statistical Analysis Summary* report, is appropriate for evaluating the groundwater monitoring data for the Mountaineer LF CCR management area and that the requirements of 40 CFR 257.93(f) have been met.



DAVID ANTHONY MILLER
Printed Name of Licensed Professional Engineer

David Anthony Miller
Signature

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Geosyntec consultants

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Memorandum

Date:	March 4, 2019
To:	David Miller (AEP)
Copies to:	Justin Jent (AEP)
From:	Allison Kreinberg and Bruce Sass, Ph.D. (Geosyntec)
Subject:	Evaluation of Detection Monitoring Data at Mountaineer Plant's Landfill

In accordance with the United States Environmental Protection Agency's (USEPA's) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR Subpart D, "CCR rule"), a detection monitoring event was completed on November 26, 2018 at the Landfill (LF), an existing CCR unit at the Mountaineer Power Plant located in New Haven, West Virginia.

Eight background monitoring events were conducted at the Mountaineer LF prior to these detection monitoring events, and upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. Lower prediction limits (LPLs) were also calculated for pH. Details on the calculation of these background values are described in Geosyntec's *Statistical Analysis Summary* report, dated January 15, 2018. An alternative source demonstration (ASD) was certified on March 1, 2019 which resulted in a revision to the calculated prediction limits for calcium and pH.

To achieve an acceptably high statistical power while maintaining a site-wide false-positive rate (SWFPR) of 10% per year or less, prediction limits were calculated based on a one-of-two retesting procedure for all Appendix III parameters. With this procedure, a statistically significant increase (SSI) is only concluded if all samples in a series of two exceeds the UPL or are below the LPL. However, only one sampling event was completed and so it was conservatively assumed that an SSI was identified if the initial sample exceeded the UPL or was below the LPL.

Detection monitoring results and the relevant background values are summarized in Table 1. No SSIs were observed at the Mountaineer LF, and as a result the Landfill will remain in detection monitoring.

The statistical analysis was conducted within 90 days of completion of sampling and analysis in accordance with 40 CFR 257.93(h)(2). A certification of these statistics by a qualified professional engineer is provided in Attachment A.

Table 1: Detection Monitoring Data Evaluation
Mountaineer Plant - Landfill

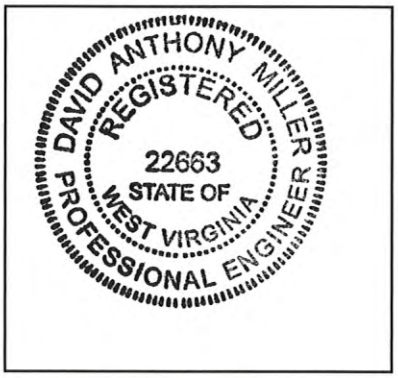
Geosyntec Consultants, Inc.

Parameter	Units	Description	MW-1611	MW-26	MW-27	MW-38	MW-39
			11/26/2018	11/26/2018	11/26/2018	11/26/2018	11/26/2018
Boron	mg/L	Intrawell Background Value (UPL)	0.241	0.266	0.421	0.113	0.225
		Detection Monitoring Result	0.147	0.182	0.292	0.08	0.167
Calcium	mg/L	Intrawell Background Value (UPL)	25.0	66.6	2.02	60.1	14.3
		Detection Monitoring Result	21.9	53.6	1.20	48.2	6.33
Chloride	mg/L	Intrawell Background Value (UPL)	10.2	6.66	2.01	7.63	3.14
		Detection Monitoring Result	9.57	5.97	1.52	7.06	2.93
Fluoride	mg/L	Interwell Background Value (UPL)	3.67				
		Detection Monitoring Result	0.62	0.14	2.37	0.34	0.80
pH	SU	Intrawell Background Value (UPL)	7.8	7.7	9.6	7.6	9.5
		Intrawell Background Value (LPL)	7.2	7.1	8.8	7.0	8.3
		Detection Monitoring Result	7.7	7.4	9.0	7.0	8.3
Sulfate	mg/L	Intrawell Background Value (UPL)	25.3	13.3	8.9	39.9	1.5
		Detection Monitoring Result	18.5	7.2	3.6	35.2	0.07
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	392	379	635	459	473
		Detection Monitoring Result	387	364	522	415	380

Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit
Bold values exceed the background value.
Background values are shaded gray.

CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected statistical method, described above and in the January 15, 2018 *Statistical Analysis Summary* report, is appropriate for evaluating the groundwater monitoring data for the Mountaineer LF CCR management area and that the requirements of 40 CFR 257.93(f) have been met.



DAVID ANTHONY MILLER

Printed Name of Licensed Professional Engineer

David Anthony Miller

Signature

22663	WEST VIRGINIA	03.04.19
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Memorandum

Date:	September 25, 2019
To:	David Miller (AEP)
Copies to:	Justin Jent (AEP)
From:	Allison Kreinberg and Bruce Sass, Ph.D. (Geosyntec)
Subject:	Evaluation of Detection Monitoring Data at Mountaineer Plant's Landfill

In accordance with the United States Environmental Protection Agency's (USEPA's) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR Subpart D, "CCR rule"), detection monitoring sampling events were completed on April 9, 2019, June 18, 2019, and July 10, 2019 at the Landfill (LF), an existing CCR unit at the Mountaineer Power Plant located in New Haven, West Virginia.

Eight background monitoring events were conducted at the Mountaineer LF prior to these detection monitoring events, and upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. Lower prediction limits (LPLs) were also calculated for pH. Details on the calculation of these background values are described in Geosyntec's *Statistical Analysis Summary* report, dated January 15, 2018. An alternative source demonstration (ASD) was certified on March 1, 2019 which resulted in a revision to the calculated prediction limits for calcium and pH.

To achieve an acceptably high statistical power while maintaining a site-wide false-positive rate (SWFPR) of 10% per year or less, prediction limits were calculated based on a one-of-two retesting procedure for all Appendix III parameters. With this procedure, a statistically significant increase (SSI) is only concluded if all samples in a series of two exceeds the UPL or are below the LPL.

Detection monitoring results and the relevant background values are summarized in Table 1 and noted exceedances are described in the list below.

- Chloride concentrations exceeded the intrawell UPL of 6.66 mg/L in both the initial (6.71 mg/L) and second (7.22 mg/L) samples collected at MW-26. Therefore, an SSI over background is concluded for chloride at MW-26.

- Total dissolved solids (TDS) concentrations exceeded the intrawell UPL of 392 mg/L in both the initial (431 mg/L) and second (402 mg/L) samples collected at MW-1611. Therefore, an SSI over background is concluded for TDS at MW-1611.

The statistical analysis was conducted within 90 days of completion of sampling and analysis in accordance with 40 CFR 257.93(h)(2). Within 90 days of identification of the above-listed SSIs, a written demonstration that a source other than the Mountaineer LF caused the increases will be completed in accordance with 40 CFR 257.94(e)(2). If the ASD is successful, the Mountaineer LF will remain in detection monitoring.

A certification of these statistics by a qualified professional engineer is provided in Attachment A.

Table 1: Detection Monitoring Data Evaluation
Mountaineer Plant - Landfill

Geosyntec Consultants, Inc.

Parameter	Units	Description	MW-1611		MW-26		MW-27	MW-38		MW-39
			4/9/2019	6/18/2019	4/9/2019	6/18/2019	4/9/2019	4/9/2019	6/18/2019	4/9/2019
Boron	mg/L	Intrawell Background Value (UPL)	0.241		0.266		0.421	0.113		0.225
		Detection Monitoring Data	0.139	--	0.128	--	0.303	0.040	--	0.158
Calcium	mg/L	Intrawell Background Value (UPL)	25.0		66.6		2.02	60.1		14.3
		Detection Monitoring Data	**26.2**	22.8	62.8	--	1.19	52.0	--	6.65
Chloride	mg/L	Intrawell Background Value (UPL)	10.2		6.66		2.01	7.63		3.14
		Detection Monitoring Data	7.96	--	**6.71**	**7.22**	1.54	7.46	--	2.94
Fluoride	mg/L	Intrawell Background Value (UPL)	3.67		3.67		3.67	3.67		3.67
		Detection Monitoring Data	0.46	--	0.13	--	2.32	0.32	--	0.77
pH	SU	Intrawell Background Value (UPL)	7.8		7.7		9.6	7.6		9.5
		Intrawell Background Value (LPL)	7.2		7.1		8.8	7.0		8.3
		Detection Monitoring Data	7.6	**--**	7.3	**--**	9.0	**6.9**	7.6	8.3
Sulfate	mg/L	Intrawell Background Value (UPL)	25.3		13.3		8.88	39.9		1.50
		Detection Monitoring Data	20.7	--	7.60	--	2.90	27.8	--	0.06
TDS	mg/L	Intrawell Background Value (UPL)	392		379		635	459		473
		Detection Monitoring Data	**431**	**402***	370	--	542	427	--	376

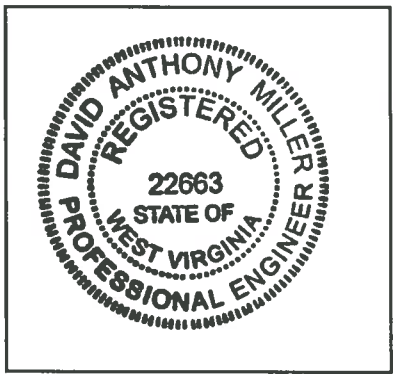
Notes
UPL: Upper prediction limit
LPL: Lower prediction limit
TDS: Total dissolved solids
Bold values exceed the background value.
Background values are shaded gray.
*TDS sample was collected on 7/10/2019.

ATTACHMENT A

Certification by Qualified Professional Engineer

CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected statistical method, described above and in the January 15, 2018 *Statistical Analysis Summary* report, is appropriate for evaluating the groundwater monitoring data for the Mountaineer LF CCR management area and that the requirements of 40 CFR 257.93(f) have been met.



DAVID ANTHONY MILLER

Printed Name of Licensed Professional Engineer

David Anthony Miller

Signature

22663	WEST VIRGINIA	09.25.19
License Number	Licensing State	Date

APPENDIX 3 – Alternative Source Demonstrations

The certified alternative source demonstration for Appendix III parameters from the September 2018 and April 2019 detection monitoring events follow.

ALTERNATIVE SOURCE DEMONSTRATION REPORT FEDERAL CCR RULE

Mountaineer Plant Landfill
New Haven, West Virginia

Submitted to

AMERICAN ELECTRIC POWER

1 Riverside Plaza
Columbus, Ohio 43215-2372

Submitted by

Geosyntec consultants

engineers | scientists | innovators

941 Chatham Lane, Suite 103
Columbus, Ohio 43221

March 1, 2019

CHA8462

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Attachment D Certification by a Qualified Professional Engineer

LIST OF ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
ASD	Alternative Source Demonstration
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
EPA	Environmental Protection Agency
LPL	Lower Prediction Limit
QC	Quality Control
SSI	Statistically Significant Increase
TDS	Total Dissolved Solids
UPL	Upper Prediction Limit
USEPA	United States Environmental Protection Agency

SECTION 1

INTRODUCTION AND SUMMARY

Eight background monitoring events were conducted at the Mountaineer Landfill, and upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. A lower prediction limit (LPL) was also calculated for pH. The first semi-annual detection monitoring event for 2018 occurred in September. While the prediction limits were calculated assuming a 1-of-2 testing procedure, it was conservatively assumed that an SSI was identified if the initial sample exceeded either the LPL or UPL. Following the first semi-annual detection monitoring event at the Landfill, SSIs were identified for the following constituents listed in 40 CFR Part 257 Appendix III:

- Boron at MW-1611 by intrawell analysis;
- Calcium at MW-26, MW-38, and MW-1611 by interwell analysis;
- pH at MW-26, MW-38, and MW-1611 by interwell analysis; and,
- TDS at MW-1611 by intrawell analysis.

A summary of the detection monitoring analytical results and the calculated prediction limits to which they were compared is provided in Table 1.

1.1 CCR Rule Requirements

In accordance with the United States Environmental Protection Agency (USEPA) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments, Rule 40 CFR 257.94(e)(2) states the following:

> *The owner or operator may demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. The owner or operator must complete the written demonstration within 90 days of detecting a statistically significant increase over background levels to include obtaining a certification from a qualified professional engineer verifying the accuracy of the information in the report.*

The first semi-annual detection monitoring event for 2018 was completed on September 20 at the Mountaineer Landfill. Pursuant to 40 CFR 257.94(e)(2), Geosyntec Consultants, Inc. (Geosyntec) has prepared this Alternative Source Demonstration (ASD) report, which documents that the SSIs cited above should not be attributed to the Landfill.

1.2 Demonstration of Alternative Sources

An evaluation was completed to assess possible alternative sources to which identified SSIs could be attributed. Alternative sources were identified amongst five types, based on methodology provided by EPRI (2017):

- ASD Type I: Sampling Causes;
- ASD Type II: Laboratory Causes;
- ASD Type III: Statistical Evaluation Causes;
- ASD Type IV: Natural Variation; and
- ASD Type V: Alternative Sources.

A demonstration was conducted to show that the increases in constituent concentrations were based on both Type I and Type IV causes and not by a release from the Landfill.

SECTION 2

ALTERNATIVE SOURCE DEMONSTRATION

The CCR Rule allows the owner or operator 90 days from the determination of an SSI to demonstrate that a source other than the CCR unit caused the SSI. Identified SSIs, evaluation methodology, and the proposed alternative source are described below.

2.1 Proposed Alternative Source

Initial review of sampling and laboratory data indicated that the observed boron exceedance is due to a Type I (sampling) error. A review of the laboratory and statistical analyses did not identify any Type II or III issues. An initial review of site geochemistry revealed natural variation (Type IV) as a source of the observed calcium, pH, and TDS SSIs.

2.1.1 Calcium and pH SSIs

A previous ASD generated for the Landfill attributed the observed SSIs for calcium and pH to cation exchange occurring along the groundwater flow path, which results in higher calcium concentrations and lower pH values at downgradient locations (Geosyntec, 2018). A one-dimensional (1D) reactive transport model (Model) was developed using PHREEQC to simulate the hypothesized chemical changes in groundwater as it migrates beneath the landfill. The results of the model supported the hypothesized behavior of sodium-calcium cation exchange followed by precipitation of calcite.

The results of the recent detection monitoring event are comparable to previous results, suggesting that the cation exchange process is ongoing (Figure 1). The results of this detection monitoring event were compared to the output of the Model. The Model was not revised to incorporate the most recent data. Figure 2 shows the trend lines generated from the Model overlaid onto the observed calcium and sodium concentrations and pH values. The Model results are overall in qualitative agreement with the observed changes in calcium and pH. The modeled concentration of calcium in solution increases while the concentration of sodium decreases as the modeled groundwater migrates beneath the Landfill. Additionally, a decrease in pH is observed, which is consistent with field measurements (Figure 2).

The previously generated Model supported the hypothesized behavior of sodium-calcium cation exchange followed by precipitation of calcite. The results of the September 2018 sampling event are consistent with previous results and the output of the Model. These results provide evidence that the observed SSIs for calcium and pH can be attributed to natural processes as groundwater moves downgradient beneath the Landfill.

2.1.1.1 Statistical Revision

Initial statistics developed interwell parameters for calcium, fluoride, and pH, as summarized in Table 1. However, because groundwater composition changes as it travels downgradient due to the hypothesized cation-exchange and precipitation processes, intrawell tests are considered to be the more appropriate means to evaluate calcium and pH potential SSIs. Intrawell prediction limits were not developed for fluoride, as it would tend to be unaffected by cation exchange.

The revised intrawell prediction limits and detection monitoring results are summarized in Table 2, and the results of the revised statistical evaluation are included in Attachment A. Comparing the detection monitoring results to the revised intrawell prediction limits, the original SSIs were no longer identified. However, the reported pH value of 8.0 SU at MW-26 was above the revised UPL of 7.7. The reported pH value for the next sampling event at MW-26 was 7.4, which is within the UPL and LPL. This result suggests that there is not an increasing pH trend at MW-26 and the observed SSI at MW-26 can instead be attributed to natural variation.

2.1.2 Boron at MW-1611

A review of the field quality control (QC) sample results for the September 2018 sampling event identified detected concentrations of boron in the equipment and field blanks which likely impacted the associated sample result as a high bias for boron. The field sampling technician collected an equipment blank and field blank during completion of the sampling event to evaluate both the equipment decontamination procedure and the environmental conditions surrounding the sample collection activities. Boron was detected in the equipment blank and field blank at a concentration of 0.039 milligrams per liter (mg/L) and 0.046 mg/L, respectively. QC sample concentrations greater than 10% of the concentration reported for a sample are typically considered present at a level which would affect the data quality of the sample. These values are within 10% of the reported boron concentration at MW-1611 of 0.258 mg/L, indicating that the concentration should be considered estimated with a high bias. These results are provided in the September 2018 analytical report (Attachment B).

In order to verify the occurrence of the high bias as evidenced by impacted field QC, the results of the next sampling event at MW-1611 were reviewed. The second semi-annual detection monitoring event occurred in November 2018. A field blank and equipment blank were also collected during this event. The reported boron concentration at MW-1611 was 0.147 mg/L, which is below the intrawell UPL of 0.241 mg/L. Boron was not detected in the field blank or equipment blank during this sampling event. These results are provided in the November 2018 analytical report (Attachment C). These observations suggest that the elevated reported boron concentration for the September 2018 sampling event was likely due to high bias from sampling error. Additionally, the boron concentration at MW-1611 declined below the intrawell UPL during the second semi-annual detection monitoring event and so a positive trend is not observed for boron at this well (Figure 4). These observations resulted in the conclusion that a Type I ASD was responsible for the boron SSI at MW-1611.

2.1.3 TDS at MW-1611

An SSI was also reported for TDS at MW-1611 during the September 2018 detection monitoring event, with a reported concentration of 416 mg/L. While TDS was detected in the equipment blank and field blank at 10 and 5 mg/L, respectively, these concentrations are less than 10% of the sample concentration. This suggests that the TDS value is not significantly impacted, and no bias would be applied to the results.

While the reported concentration of 416 mg/L is above the intrawell UPL of 392 mg/L, it is lower than the TDS concentrations at upgradient wells MW-30 and MW-1612 (Figure 5). As discussed in Section 2.1.1, this is due to the removal of dissolved species during the cation-exchange and precipitation processes as groundwater is transported downgradient. Additionally, the reported TDS concentration for the second semi-annual event was 387 mg/L, which is below the UPL for MW-1611. This result suggests that a positive trend is not observed for TDS at this well. Thus, the observed TDS concentration at MW-1611 is likely due to natural variation and is not considered indicative of a release from the Landfill.

2.2 Sampling Requirements

As the ASD described above supports the position that the identified SSIs are not due to a release from the Mountaineer Landfill, the unit will remain in the detection monitoring program. Groundwater at the unit will be sampled for Appendix III parameters on a semi-annual basis.

SECTION 3

CONCLUSIONS AND RECOMMENDATIONS

The preceding information serves as the ASD prepared in accordance with 40 CFR 257.94(e)(2) and supports the position that the SSIs in Appendix III detection monitoring constituents are not due to a release from the Mountaineer Landfill during the September 2018 sampling events. The observed calcium and pH SSIs were attributed to naturally occurring cation exchange and precipitation processes as groundwater moves downgradient. Based on the observed changes in groundwater composition, intrawell statistics were developed for pH and calcium. Using the revised statistics, no SSIs were observed for pH or calcium. The observed boron SSI at MW-1611 was attributed to sampling error. The observed TDS SSI at MW-1611 was attributed to natural variation. Both boron and TDS at MW-1611 declined below their respective UPLs at the next sampling event, suggesting that positive trends for these constituents are not present. Therefore, no further action is warranted, and the Mountaineer Landfill will remain in the detection monitoring program. Certification of this ASD by a qualified professional engineer is provided in Attachment D.

SECTION 4

REFERENCES

EPRI, 2017. Guidelines for Development of Alternative Source Demonstrations at Coal Combustion Residual Site. 3002010920. October.

Geosyntec Consultants, Inc. 2018. Alternative Source Demonstration Report – Federal CCR Rule. Mountaineer Plant Landfill. April.

U.S. EPA, 2015. Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities (Final Rule). Fed. Reg. 80 FR 21301, pp. 21301-21501, 40 CFR Parts 257 and 261, April.

TABLES

Table 1: Detection Monitoring Data Evaluation
Mountaineer Plant - Landfill

Geosyntec Consultants, Inc.

Parameter	Units	Description	MW-1611	MW-26	MW-27	MW-38	MW-39
			9/20/2018	9/20/2018	9/20/2018	9/20/2018	9/20/2018
Boron	mg/L	Intrawell Background Value (UPL)	0.241	0.266	0.421	0.113	0.225
		Detection Monitoring Data	**0.258**	0.214	0.357	0.068	0.182
Calcium	mg/L	Interwell Background Value (UPL)	16.2				
		Detection Monitoring Data	**23.2**	**49.4**	1.14	**51.2**	6.43
Chloride	mg/L	Intrawell Background Value (UPL)	10.24	6.66	2.01	7.63	3.14
		Detection Monitoring Data	9.48	6.04	1.69	7.31	2.99
Fluoride	mg/L	Interwell Background Value (UPL)	3.67				
		Detection Monitoring Data	0.61	0.16	2.41	0.36	0.8
pH	SU	Interwell Background Value (UPL)	10.1				
		Interwell Background Value (LPL)	8.0				
		Detection Monitoring Data	**7.8**	8.0	9.1	**7.4**	8.5
Sulfate	mg/L	Intrawell Background Value (UPL)	25.3	13.3	8.9	39.9	1.5
		Detection Monitoring Data	19	6.3	4.4	31.5	0.1
TDS	mg/L	Intrawell Background Value (UPL)	392	379	635	459	473
		Detection Monitoring Data	**416**	344	550	441	369

Notes
UPL: Upper prediction limit
LPL: Lower prediction limit
TDS: Total dissolved solids
Bold values exceed the background value.
Background values are shaded gray.

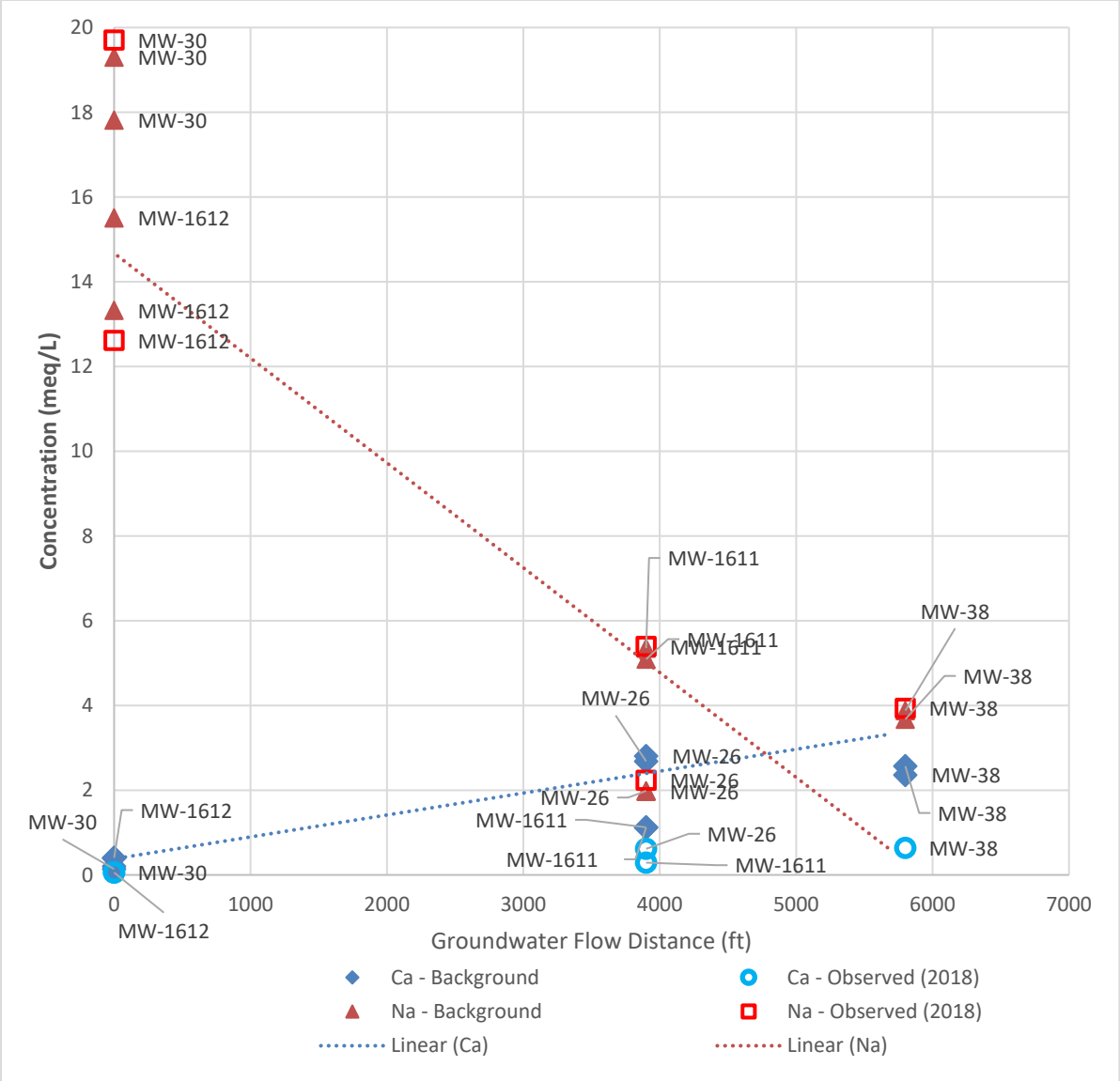
Table 2: Detection Monitoring Data Evaluation - Revised Statistics
Mountaineer Plant - Landfill

Geosyntec Consultants, Inc.

Parameter	Units	Description	MW-1611	MW-26	MW-27	MW-38	MW-39
			9/20/2018	9/20/2018	9/20/2018	9/20/2018	9/20/2018
Boron	mg/L	Intrawell Background Value (UPL)	0.241	0.266	0.421	0.113	0.225
		Detection Monitoring Data	**0.258**	0.214	0.357	0.068	0.182
Calcium	mg/L	Intrawell Background Value (UPL)	25.0	66.6	2.02	60.1	14.3
		Detection Monitoring Data	23.2	49.4	1.14	51.2	6.43
Chloride	mg/L	Intrawell Background Value (UPL)	10.24	6.66	2.01	7.63	3.14
		Detection Monitoring Data	9.48	6.04	1.69	7.31	2.99
Fluoride	mg/L	Interwell Background Value (UPL)	3.67				
		Detection Monitoring Data	0.61	0.16	2.41	0.36	0.8
pH	SU	Intrawell Background Value (UPL)	7.8	7.7	9.6	7.6	9.5
		Intrawell Background Value (LPL)	7.2	7.1	8.8	7.0	8.3
		Detection Monitoring Data	7.8	**8.0**	9.1	7.4	8.5
Sulfate	mg/L	Intrawell Background Value (UPL)	25.3	13.3	8.9	39.9	1.5
		Detection Monitoring Data	19	6.3	4.4	31.5	0.1
TDS	mg/L	Intrawell Background Value (UPL)	392	379	635	459	473
		Detection Monitoring Data	**416**	344	550	441	369

Notes
UPL: Upper prediction limit
LPL: Lower prediction limit
TDS: Total dissolved solids
Bold values exceed the background value.
Background values are shaded gray.

FIGURES



Notes: Calcium and sodium background values are from February and June 2017 sampling events and were used to generate the Model. Groundwater flow distance was estimated using approximate distance between upgradient and downgradient wells along a flow path that is consistent with observed potentiometric surfaces.

Sodium and Calcium Concentrations v. Distance

Mountaineer Landfill

Geosyntec consultants

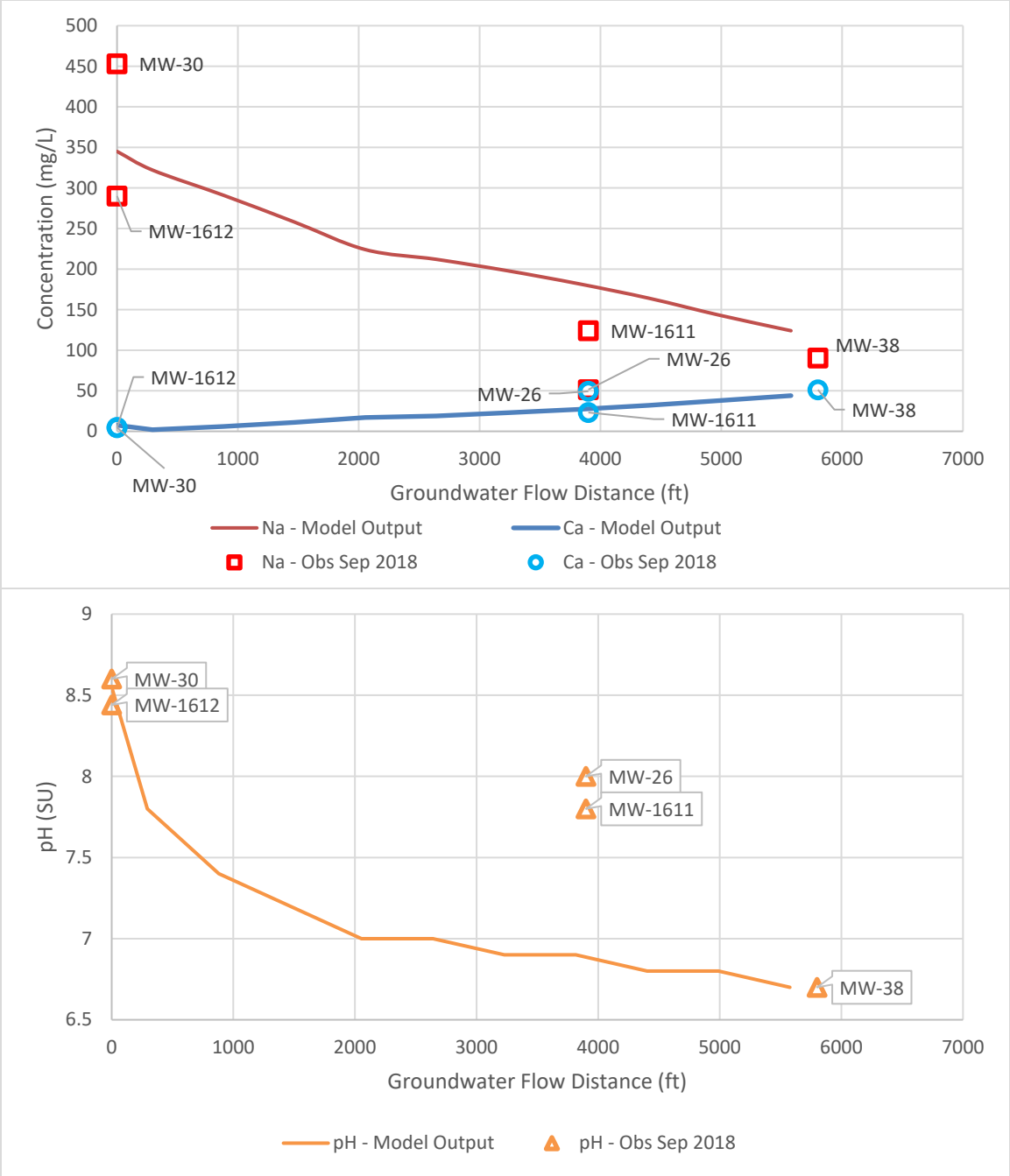
AMERICAN ELECTRIC POWER

Figure 1

Columbus, Ohio

21-Feb-2019

internal info: path, date revised, author



Notes: The one-dimensional reactive transport model was generated using PHREEQC. The model was generated using reported February and June 2017 concentrations. Observed concentrations are shown for the September 2018 first semi-annual detection monitoring event.

Observed Concentration vs. Model Output
Mountaineer Landfill

Geosyntec consultants

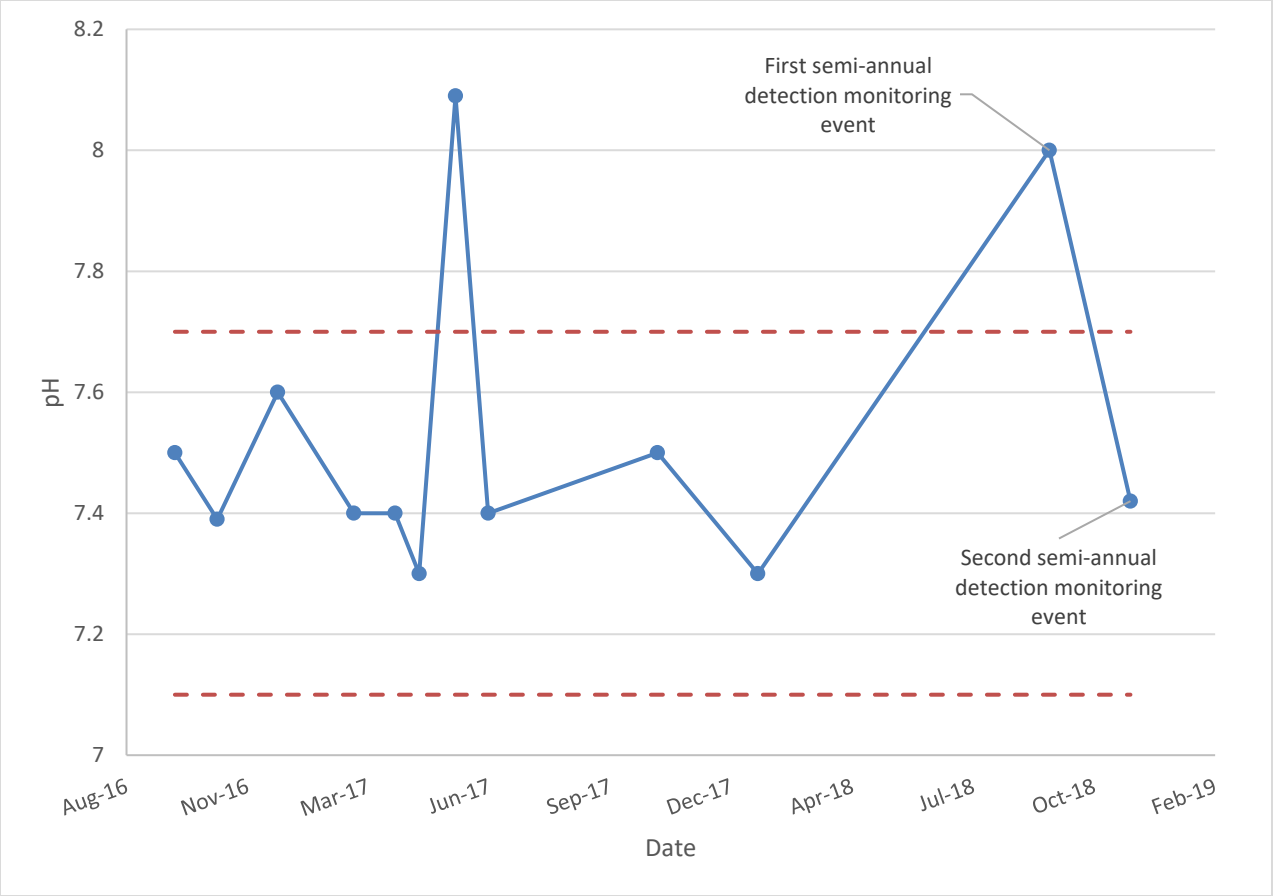
AMERICAN ELECTRIC POWER

Figure **2**

Columbus, Ohio

21-Feb-2019

internal info: path, date revised, author



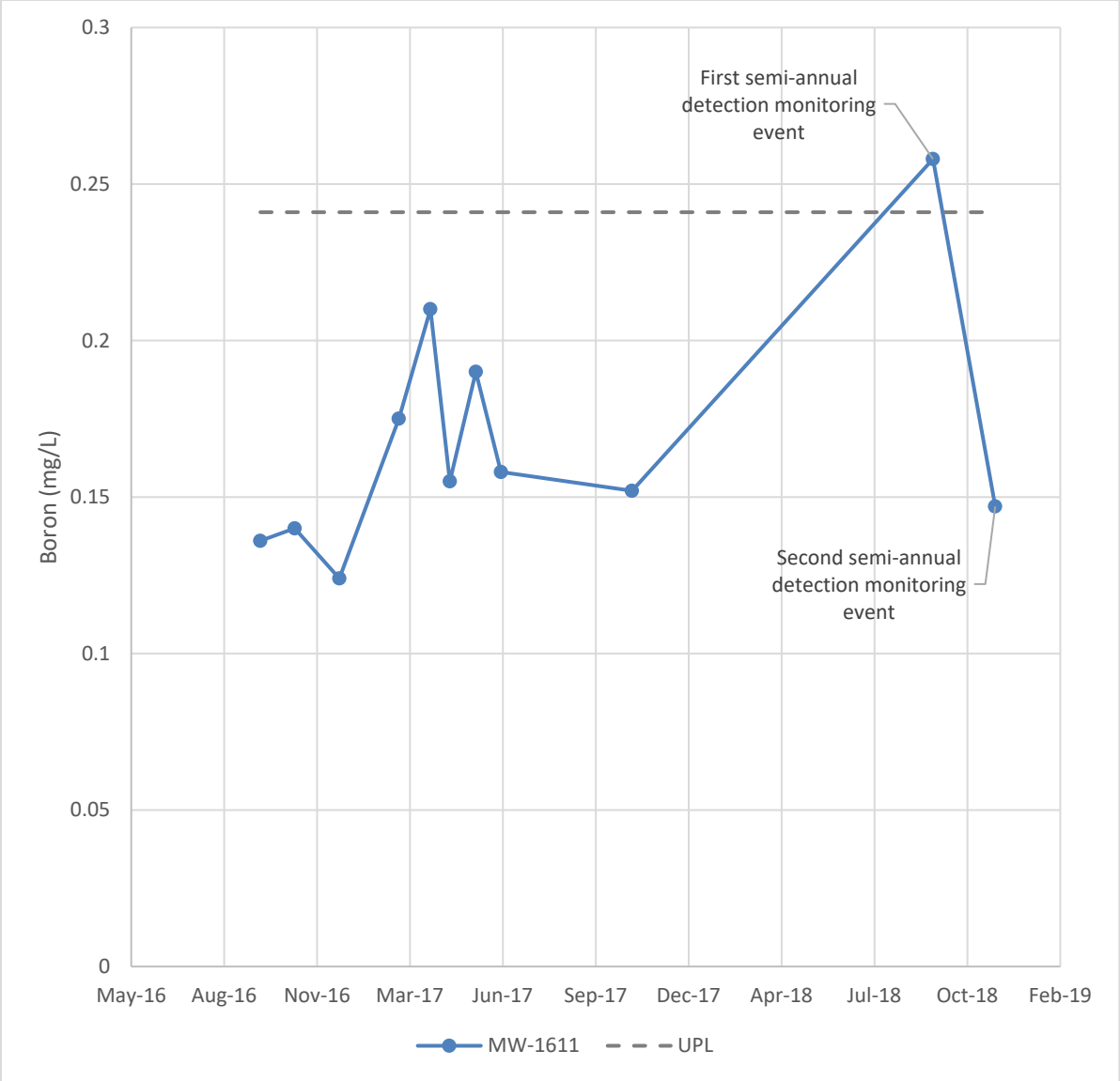
Notes: pH time series for downgradient well MW-26. The dashed lines represent the calculated intrawell upper prediction limit (UPL, 7.70 SU) and lower prediction limit (LPL, 7.10 SU) for MW-26.

pH Time Series Graph
Mountaineer Landfill

Geosyntec consultants | AMERICAN ELECTRIC POWER | Figure 3

Columbus, Ohio | 21-Feb-2019

internal info: path, date revised, author



Notes: The dashed line represents the calculated intrawell upper prediction limit (UPL) for MW-1611.

Boron Time Series Graph
Mountaineer Landfill

Geosyntec consultants

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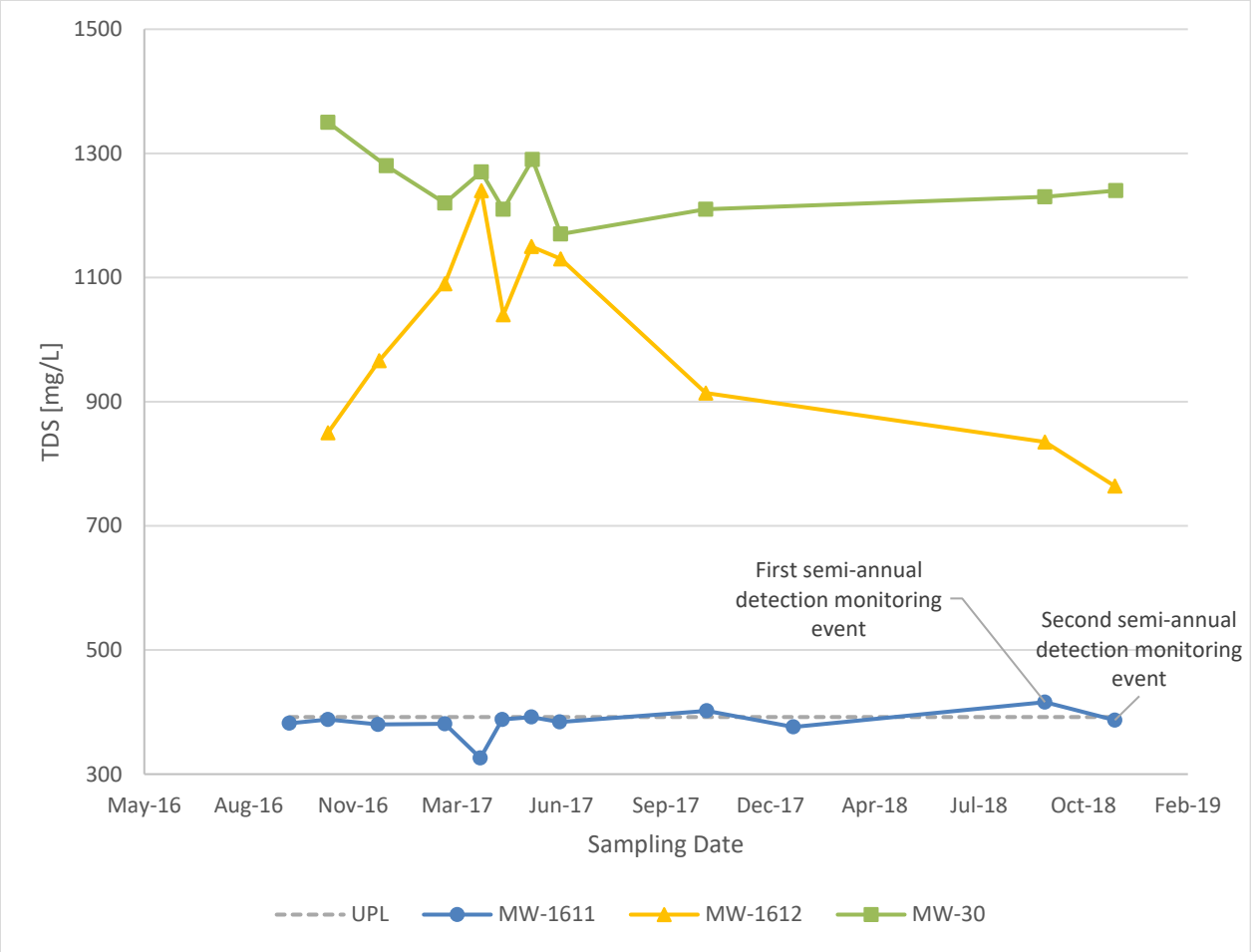
Figure **4**

Columbus, Ohio

21-Feb-2019

internal info: path, date revised, author



Notes: Total dissolved solids (TDS) time series for downgradient well MW-1611 and upgradient wells MW-1612 and MW-30. The dashed line represents the calculated intrawell upper prediction limit (UPL) for MW-1611.

Total Dissolved Solids Time Series Graph
Mountaineer Landfill

Geosyntec consultants | AMERICAN ELECTRIC POWER | Figure 5

Columbus, Ohio | 21-Feb-2019

internal info: path, date revised, author

ATTACHMENT A

REVISED STATISTICAL OUTPUT

GROUNDWATER STATS CONSULTING

January 18, 2019

Geosyntec Consultants
Attn: Mr. Bruce Sass
150 E. Wilson Bridge Rd., #232
Worthington, OH 43085

Dear Mr. Sass,

Groundwater Stats Consulting, formerly the statistical consulting division of Sanitas Technologies, is pleased to provide the screening and statistical analysis of background groundwater data for American Electric Power's Mountaineer Landfill. The analysis complies with the federal rule for the Disposal of Coal Combustion Residuals from Electric Utilities (CCR Rule, 2015) as well as with the USEPA Unified Guidance (2009).

Sampling began at Mountaineer Landfill for the CCR program in 2016, and 8 background samples were initially collected at each of the groundwater monitoring wells. The monitoring well network, as provided by Geosyntec Consultants, consists of the following: upgradient wells MW-1612 and MW-30; and downgradient wells MW-1611, MW-26, MW-27, MW-38, and MW-39.

Data were sent electronically to Groundwater Stats Consulting, and the statistical analysis was reviewed by Dr. Kirk Cameron, PhD Statistician with MacStat Consulting, primary author of the USEPA Unified Guidance, and Senior Advisor to Groundwater Stats Consulting.

The following constituents were evaluated: Appendix III parameters – boron, calcium, chloride, fluoride, pH, sulfate, and TDS; and Appendix IV parameters - antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, combined radium 226 & 228, fluoride, lead, lithium, mercury, molybdenum, selenium, and thallium.

Time series plots for Appendix III and IV parameters at all wells are provided for the purpose of screening data at these wells (Figure A). Additionally, box plots are included for all constituents at upgradient and downgradient wells (Figure B). The time series plots are used to initially screen for suspected outliers and trends, while the box plots provide visual representation of variation within individual wells and between all wells.

Data at all wells were evaluated for the following: 1) outliers; 2) trends; 3) most appropriate statistical method for Appendix III parameters based on site characteristics of groundwater data upgradient of the facility; and 4) eligibility of downgradient wells when intrawell statistical methods are recommended. Power curves are provided to demonstrate that the selected statistical methods for Appendix III parameters comply with the USEPA Unified Guidance recommendations as discussed below.

Summary of Statistical Method:

1) Intrawell prediction limits, combined with a 1-of-2 resample plan for boron, calcium, chloride, pH, sulfate, and TDS; and
2) Interwell prediction limits combined with a 1-of-2 resample plan for fluoride.

Parametric prediction limits are utilized when the screened historical data follow a normal or transformed-normal distribution. When data cannot be normalized or the majority of data are nondetects, a nonparametric test is utilized. The distribution of data is tested using the Shapiro-Wilk/Shapiro-Francia test for normality. After testing for normality and performing any adjustments as discussed below (US EPA, 2009), data are analyzed using either parametric or non-parametric prediction limits.

- No statistical analyses are required on wells and analytes containing 100% nondetects (USEPA Unified Guidance, 2009, Chapter 6).
- When data contain <15% nondetects in background, simple substitution of one-half the reporting limit is utilized in the statistical analysis. The reporting limit utilized for nondetects is the practical quantification limit (PQL) as reported by the laboratory.
- When data contain between 15-50% nondetects, the Kaplan-Meier nondetect adjustment is applied to the background data. This technique adjusts the mean and standard deviation of the historical concentrations to account for concentrations below the reporting limit.
- Nonparametric prediction limits are used on data containing greater than 50% nondetects.

Background Screening

Outlier Evaluation

Time series plots are used to identify suspected outliers, or extreme values that would result in limits that are not conservative from a regulatory perspective, in proposed background data. Suspected outliers at all wells for Appendix III and Appendix IV parameters were formally tested using Tukey's box plot method and, when identified, flagged in the computer database with "o" and deselected prior to construction of statistical limits (Figure C).

Tukey's outlier test noted a few outliers as may be seen on the Outlier Summary Table and accompanying graphs. Any values flagged as outliers are plotted in a lighter font on the time series graph. The pH values reported during the May 2017 sample event were, reportedly, due to instrumentation error. The test identified two outliers for boron in well MW-27; an outlier for calcium in well MW-1611; a low outlier for pH in well MW-1611; and an outlier for TDS in well MW-1611. However, these values were not flagged due to all concentrations being consistent over time and similar to concentrations in neighboring wells. A substitution of the most recent reporting limit was applied when varying detection limits existed in data.

No true seasonal patterns were observed on the time series plots for any of the detected data; therefore, no deseasonalizing adjustments were made to the data. When seasonal patterns are observed, data may be deseasonalized so that the resulting limits will correctly account for the seasonality as a predictable pattern rather than random variation or a release.

While trends may be visual, a quantification of the trend and its significance is needed. The Sen's Slope/Mann Kendall trend test was used to evaluate all data at each well to identify statistically significant increasing or decreasing trends (Figure D). In the absence of suspected contamination, significant trending data are typically not included as part of the background data used for construction of prediction limits. This step serves to eliminate the trend and, thus, reduce variation in background. When statistically significant decreasing trends are present, earlier data are evaluated to determine whether earlier concentration levels are significantly different than current reported concentrations and will be deselected as necessary. When the historical records of data are truncated for the reasons above, a summary report will be provided to show the date ranges used in construction of the statistical limits.

The results of the trend analyses showed all data are consistent over time with no statistically significant increasing trends. A few statistically significant decreasing trends were noted; however, the magnitudes of the trends were low relative to the average concentrations, as may be seen on the Trend Test Summary table (Figure D). It was noted that boron, sulfate, and TDS concentrations are found to have the highest concentrations in the upgradient wells. No adjustments to any data sets were required at this time.

Appendix III – Determination of Spatial Variation

The Analysis of Variance (ANOVA) was used to statistically evaluate differences in average concentrations among upgradient wells, which assists in identifying the most appropriate statistical approach (Figure E). Interwell tests, which compare downgradient well data to statistical limits constructed from pooled upgradient well data, are appropriate when average concentrations are similar across upgradient wells. Intrawell tests, which compare compliance data from a single well to screened historical data within the same well, are appropriate when upgradient wells exhibit spatial variation; when statistical limits constructed from upgradient wells would not be conservative from a regulatory perspective; and when downgradient water quality is unimpacted compared to upgradient water quality for the same parameter.

The ANOVA identified no variation for calcium, fluoride, or pH making these parameters eligible for interwell prediction limits. Variation was identified for boron, chloride, sulfate, and TDS suggesting an intrawell approach for these parameters. Data were further evaluated as described for the appropriateness of intrawell testing to accommodate the groundwater quality. A summary table of the ANOVA results is included with the reports.

Appendix III - Statistical Limits

Intrawell limits constructed from carefully screened background data from within each well serve to provide statistical limits that are conservative (i.e. lower) from a regulatory perspective, and that will rapidly identify a change in more recent compliance data from within a given well. This statistical method removes the element of variation from across wells and eliminates the chance of mistaking natural spatial variation for a release from the facility. Prior to performing intrawell prediction limits, several steps are required to reasonably demonstrate downgradient water quality does not have existing impacts from the practices of the facility.

Exploratory data analysis was used as a general comparison of concentrations in downgradient wells for all Appendix III parameters recommended for intrawell analyses to concentrations reported in upgradient wells. Upper tolerance limits are used in conjunction with confidence intervals to determine whether the estimated averages in downgradient wells are higher than observed levels upgradient of the facility. The upper tolerance limits were constructed to represent the extreme upper range of possible background levels at the site.

In cases where downgradient average concentrations are higher than observed concentrations upgradient for a given constituent, an independent study and hydrogeological investigation would be required to identify local geochemical conditions and expected groundwater quality for the region to justify an intrawell approach. Such an assessment is beyond the scope of services provided by Groundwater Stats Consulting. When there is not an obvious explanation for observed concentration differences in downgradient wells relative to reported concentrations in upgradient wells, interwell prediction limits will initially be selected for the statistical method until further evidence shows that concentrations are due to natural variation rather than a result of the facility.

Parametric tolerance limits were constructed with a target of 99% confidence and 95% coverage using pooled upgradient well data for each of the Appendix III parameters (Figure F). The confidence and coverage levels for nonparametric tolerance limits are dependent upon the number of background samples. As more data are collected, the background population is better represented and the confidence and coverage levels increase.

Confidence intervals were constructed on downgradient wells for each of the Appendix III parameters, using the tolerance limits discussed above, to determine intrawell eligibility (Figure G). When the entire confidence interval is above a background standard for a given parameter, interwell methods are initially recommended as the statistical method. Therefore, only parameters with confidence intervals which did not exceed background standards are eligible for intrawell prediction limits.

Confidence intervals for boron, chloride, sulfate and TDS were found were found to be within their respective background limits and are, therefore, eligible for intrawell prediction limits. Interwell prediction limits were initially recommended for calcium, fluoride and pH. However, additional studies provided by Geosyntec Consultants support natural variation in groundwater for calcium and pH; therefore, interwell methods will be used for fluoride only.

All available data through June 2017, for parameters mentioned above, at each well were used to establish intrawell background limits based on a 1-of-2 resample plan that will be used for future comparisons (Figure H). Interwell prediction limits for fluoride as described above, combined with a 1-of-2 resample plan, were constructed from upgradient wells (Figure I). Downgradient measurements will be compared to these background limits during each subsequent semi-annual sampling event.

Natural systems continuously evolve due to physical changes made to the environment. Examples include capping a landfill, paving areas near a well, or lining a drainage channel to prevent erosion. Periodic updating of background statistical limits will be necessary to accommodate these types of changes In the interwell case, newer data will be included in background when a minimum of 2 new samples are available. In the intrawell case, data for all wells and constituents are re-evaluated when a minimum of 4 new data points are available to determine whether earlier concentrations are representative of present-day groundwater quality. In some cases, the earlier portion of data are deselected prior to construction of limits in order to provide sensitive limits that will rapidly detect changes in groundwater quality. Even though the data are excluded from the calculation, the values will continue to be reported and shown in tables and graphs.

In the event of an initial exceedance of compliance well data, the 1-of-2 resample plan allows for collection of an additional sample to determine whether the initial exceedance is confirmed. When the resample confirms the initial exceedance, a statistically significant increase (SSI) is identified and further research would be required to identify the cause of the exceedance (i.e. impact from the site, natural variation, or an off-site source). If the resample falls within the statistical limit, the initial exceedance is considered to be a false positive result and, therefore, no further action is necessary. A summary table of the background prediction limits follows this letter.

Appendix IV – Assessment Monitoring Program

During an Assessment Monitoring program confidence intervals are constructed at all wells for detected Appendix IV parameters. A minimum of 4 samples is required to construct confidence intervals; however, 8 samples are generally recommended for better representation of the true average population. Established Maximum Contaminant Levels (MCLs) are used as the GWPS comparisons, unless background limits are higher as discussed below. Parametric confidence intervals are constructed with 99% confidence when data follow a normal or transformed-normal distribution.

For all other cases, nonparametric confidence intervals are constructed, with the confidence level based on the number of samples available. The GWPS is exceeded only when the entire confidence interval exceeds its respective GWPS.

Background limits are established for the Appendix IV parameters using upper tolerance limits constructed with 95% confidence/95% coverage using pooled upgradient well data, for comparison against established MCLs. When background limits, or Alternate Contaminant Levels (ACLs), are higher than established MCLs, the CCR Rule recommends using these ACLs as the GWPS for the confidence interval comparisons. Additionally, tolerance limits are also recommended to establish ACLs for Appendix IV parameters, cobalt, lithium, and molybdenum, which do not have established MCLs. Since the scope of this project included screening and development of background limits for Appendix III Detection Monitoring statistics, comparison of the Appendix IV parameters with confidence intervals was not included in this report.

Recommendations

In summary, as a result of the background screening described in this letter, interwell prediction limits combined with a 1-of-2 resample plan are recommended for fluoride; and intrawell prediction limits combined with a 1-of-2 resample plan are recommended for boron, calcium, chloride, pH, sulfate and TDS. The statistical analyses will be constructed according to the USEPA Unified Guidance, based on seven Appendix III parameters and five downgradient wells.

Thank you for the opportunity to assist you in the statistical analysis of groundwater quality for the Mountaineer Landfill. If you have any questions or comments, please feel free to contact me.

For Groundwater Stats Consulting,

Kristina L. Rayner
Groundwater Statistician

Intrawell Prediction Limit Summary

Mountaineer LF Client: Geosyntec Data: Mountaineer Landfill Printed 1/17/2019, 6:06 PM

Constituent	Well	Upper Lim.	Lower Lim.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron, total (mg/L)	MW-1612	0.7669	n/a	8	0.5749	0.07009	0	None	No	0.001504	Param Intra 1 of 2
Boron, total (mg/L)	MW-30	0.3689	n/a	8	0.2723	0.03528	0	None	No	0.001504	Param Intra 1 of 2
Boron, total (mg/L)	MW-1611	0.2407	n/a	8	0.161	0.02908	0	None	No	0.001504	Param Intra 1 of 2
Boron, total (mg/L)	MW-26	0.2655	n/a	8	0.1383	0.04645	0	None	No	0.001504	Param Intra 1 of 2
Boron, total (mg/L)	MW-27	0.4207	n/a	8	0.2934	0.04647	0	None	No	0.001504	Param Intra 1 of 2
Boron, total (mg/L)	MW-38	0.1132	n/a	8	0.04238	0.02585	0	None	No	0.001504	Param Intra 1 of 2
Boron, total (mg/L)	MW-39	0.2246	n/a	8	0.1511	0.02682	0	None	No	0.001504	Param Intra 1 of 2
Calcium, total (mg/L)	MW-1612	13.34	n/a	8	8.889	1.623	0	None	No	0.001504	Param Intra 1 of 2
Calcium, total (mg/L)	MW-30	21	n/a	8	6.581	5.263	0	None	No	0.001504	Param Intra 1 of 2
Calcium, total (mg/L)	MW-1611	25	n/a	8	n/a	n/a	0	n/a	n/a	0.02144	NP Intra (normality) ...
Calcium, total (mg/L)	MW-26	66.62	n/a	8	54.89	4.281	0	None	No	0.001504	Param Intra 1 of 2
Calcium, total (mg/L)	MW-27	2.024	n/a	7	1.506	0.1715	0	None	No	0.001504	Param Intra 1 of 2
Calcium, total (mg/L)	MW-38	60.08	n/a	8	50.73	3.412	0	None	No	0.001504	Param Intra 1 of 2
Calcium, total (mg/L)	MW-39	14.29	n/a	8	7.969	2.307	0	None	No	0.001504	Param Intra 1 of 2
Chloride, total (mg/L)	MW-1612	47.01	n/a	8	30.56	6.003	0	None	No	0.001504	Param Intra 1 of 2
Chloride, total (mg/L)	MW-30	262.7	n/a	8	249.3	4.892	0	None	No	0.001504	Param Intra 1 of 2
Chloride, total (mg/L)	MW-1611	10.24	n/a	8	8.954	0.47	0	None	No	0.001504	Param Intra 1 of 2
Chloride, total (mg/L)	MW-26	6.663	n/a	8	5.519	0.4175	0	None	No	0.001504	Param Intra 1 of 2
Chloride, total (mg/L)	MW-27	2.011	n/a	8	1.654	0.1303	0	None	No	0.001504	Param Intra 1 of 2
Chloride, total (mg/L)	MW-38	7.628	n/a	8	7.219	0.1495	0	None	No	0.001504	Param Intra 1 of 2
Chloride, total (mg/L)	MW-39	3.139	n/a	8	2.983	0.05701	0	None	No	0.001504	Param Intra 1 of 2
pH, field (SU)	MW-1612	9.056	7.744	8	8.4	0.2396	0	None	No	0.000752	Param Intra 1 of 2
pH, field (SU)	MW-30	10.41	7.113	8	8.761	0.6017	0	None	No	0.000752	Param Intra 1 of 2
pH, field (SU)	MW-1611	7.8	7.2	7	n/a	n/a	0	n/a	n/a	0.05531	NP Intra (normality) ...
pH, field (SU)	MW-26	7.717	7.138	7	7.427	0.09569	0	None	No	0.000752	Param Intra 1 of 2
pH, field (SU)	MW-27	9.602	8.758	7	9.18	0.1395	0	None	No	0.000752	Param Intra 1 of 2
pH, field (SU)	MW-38	7.6	7	8	n/a	n/a	0	n/a	n/a	0.04288	NP Intra (normality) ...
pH, field (SU)	MW-39	9.5	8.3	8	n/a	n/a	0	n/a	n/a	0.04288	NP Intra (normality) ...
Sulfate, total (mg/L)	MW-1612	415.5	n/a	8	270.6	52.86	0	None	No	0.001504	Param Intra 1 of 2
Sulfate, total (mg/L)	MW-30	40.36	n/a	8	13.53	9.794	0	None	No	0.001504	Param Intra 1 of 2
Sulfate, total (mg/L)	MW-1611	25.31	n/a	8	18.91	2.336	0	None	No	0.001504	Param Intra 1 of 2
Sulfate, total (mg/L)	MW-26	13.31	n/a	8	7.838	1.997	0	None	No	0.001504	Param Intra 1 of 2
Sulfate, total (mg/L)	MW-27	8.878	n/a	8	2.299	0.2485	0	None	sqrt(x)	0.001504	Param Intra 1 of 2
Sulfate, total (mg/L)	MW-38	39.92	n/a	8	32.05	2.871	0	None	No	0.001504	Param Intra 1 of 2
Sulfate, total (mg/L)	MW-39	1.5	n/a	8	n/a	n/a	62.5	n/a	n/a	0.02144	NP Intra (NDs) 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1612	1456	n/a	7	1067	128.7	0	None	No	0.001504	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-30	1437	n/a	7	1256	59.96	0	None	No	0.001504	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1611	392	n/a	8	n/a	n/a	0	n/a	n/a	0.02144	NP Intra (normality) ...
Total Dissolved Solids [TDS] (mg/L)	MW-26	378.6	n/a	8	319.3	21.65	0	None	No	0.001504	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-27	634.5	n/a	8	543	33.38	0	None	No	0.001504	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-38	459	n/a	8	402.5	20.61	0	None	No	0.001504	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-39	472.6	n/a	8	359.9	41.16	0	None	No	0.001504	Param Intra 1 of 2

Interwell Prediction Limit Summary

Mountaineer LF Client: Geosyntec Data: Mountaineer Landfill Printed 1/17/2019, 6:07 PM

Constituent	Well	Upper Lim.	Lower Lim.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Fluoride, total (mg/L)	n/a	3.671	n/a	16	104.3	36.16	0	None	x^4	0.001504	Param Inter 1 of 2

ATTACHMENT B

SEPTEMBER 2018 FIELD QUALITY CONTROL ANALYTICAL DATA

Dup-2 Dissolved

Sample Number: 183293-008A **Date Collected: 09/20/2018 14:00** **Date Received: 9/21/2018**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Iron, Fe	2.43	mg/L		0.005	0.002	DAM	10/03/2018 12:14	EPA 200.7-1994, Rev. 4.4
Manganese, Mn	0.741	mg/L		0.001	0.0002	DAM	10/03/2018 12:14	EPA 200.7-1994, Rev. 4.4

FB-2

Sample Number: 183293-009 **Date Collected: 09/20/2018 09:15** **Date Received: 9/21/2018**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Boron, B	0.046	mg/L		0.005	0.002	DAM	10/03/2018 11:24	EPA 200.7-1994, Rev. 4.4
Calcium, Ca	0.034	mg/L		0.02	0.005	DAM	10/03/2018 11:24	EPA 200.7-1994, Rev. 4.4
Magnesium, Mg	0.005	mg/L	J	0.01	0.002	DAM	10/03/2018 11:24	EPA 200.7-1994, Rev. 4.4
Potassium, K	0.34	mg/L		0.2	0.06	DAM	10/03/2018 11:24	EPA 200.7-1994, Rev. 4.4
Sodium, Na	0.41	mg/L		0.05	0.01	DAM	10/03/2018 11:24	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	< 0.0001	mg/L	U	0.0005	0.0001	DAM	10/03/2018 11:24	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	< 1	mg/L	U	5	1	GES	09/24/2018	SM 2320B-1997
Bromide, Br	< 0.02	mg/L	U	0.06	0.02	CRJ	10/01/2018 19:18	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	< 0.02	mg/L	U	0.06	0.02	CRJ	10/01/2018 19:18	EPA 300.1-1997, Rev. 1.0
Fluoride, F	< 0.02	mg/L	U	0.06	0.02	CRJ	10/01/2018 19:18	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	10	mg/L	J	20	5	SDW	09/24/2018	SM 2540C-1997
Sulfate, SO4	< 0.04	mg/L	U	0.1	0.04	CRJ	10/01/2018 19:18	EPA 300.1-1997, Rev. 1.0

EB-2

Sample Number: 183293-010 **Date Collected: 09/20/2018 09:15** **Date Received: 9/21/2018**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Boron, B	0.039	mg/L		0.005	0.002	DAM	10/03/2018 11:27	EPA 200.7-1994, Rev. 4.4
Calcium, Ca	0.031	mg/L		0.02	0.005	DAM	10/03/2018 11:27	EPA 200.7-1994, Rev. 4.4
Magnesium, Mg	0.002	mg/L	J	0.01	0.002	DAM	10/03/2018 11:27	EPA 200.7-1994, Rev. 4.4
Potassium, K	0.2	mg/L	J	0.2	0.06	DAM	10/03/2018 11:27	EPA 200.7-1994, Rev. 4.4
Sodium, Na	0.43	mg/L		0.05	0.01	DAM	10/03/2018 11:27	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	0.0019	mg/L		0.0005	0.0001	DAM	10/03/2018 11:27	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	< 1	mg/L	U	5	1	GES	09/24/2018	SM 2320B-1997
Bromide, Br	< 0.02	mg/L	U	0.06	0.02	CRJ	10/01/2018 18:55	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	< 0.02	mg/L	U	0.06	0.02	CRJ	10/01/2018 18:55	EPA 300.1-1997, Rev. 1.0
Fluoride, F	< 0.02	mg/L	U	0.06	0.02	CRJ	10/01/2018 18:55	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	5	mg/L	J	20	5	SDW	09/24/2018	SM 2540C-1997
Sulfate, SO4	< 0.04	mg/L	U	0.1	0.04	CRJ	10/01/2018 18:55	EPA 300.1-1997, Rev. 1.0

ATTACHMENT C

NOVEMBER 2018 FIELD QUALITY CONTROL ANALYTICAL DATA

Dup-1 Dissolved

Sample Number: 183990-008A **Date Collected:** 11/26/2018 **Date Received:** 11/27/2018

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Iron, Fe	0.058	mg/L		0.02	0.003	DAM	12/05/2018 14:59	EPA 200.7-1994, Rev. 4.4
Manganese, Mn	0.0143	mg/L		0.001	0.0002	DAM	12/05/2018 14:59	EPA 200.7-1994, Rev. 4.4

FB-1

Sample Number: 183990-009 **Date Collected:** 11/27/2018 09:25 **Date Received:** 11/27/2018

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Boron, B	< 0.02	mg/L	U	0.1	0.02	DAM	12/05/2018 14:12	EPA 200.7-1994, Rev. 4.4
Calcium, Ca	0.1	mg/L	J	0.3	0.04	DAM	12/05/2018 14:12	EPA 200.7-1994, Rev. 4.4
Magnesium, Mg	< 0.01	mg/L	U	0.05	0.01	DAM	12/05/2018 14:12	EPA 200.7-1994, Rev. 4.4
Potassium, K	0.2	mg/L	J	0.5	0.2	DAM	12/05/2018 14:12	EPA 200.7-1994, Rev. 4.4
Sodium, Na	0.43	mg/L		0.2	0.06	DAM	12/05/2018 14:12	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	< 0.0008	mg/L	U	0.005	0.0008	DAM	12/05/2018 14:12	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	< 3	mg/L	U	10	3	MGK	11/30/2018	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	11/30/2018 21:54	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	< 0.01	mg/L	U	0.04	0.01	CRJ	11/30/2018 21:54	EPA 300.1-1997, Rev. 1.0
Fluoride, F	< 0.01	mg/L	U	0.06	0.01	CRJ	11/30/2018 21:54	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	< 5	mg/L	U	20	5	KAL	11/29/2018	SM 2540C-2011
Sulfate, SO4	< 0.06	mg/L	U	0.4	0.06	CRJ	11/30/2018 21:54	EPA 300.1-1997, Rev. 1.0

EB-1

Sample Number: 183990-010 **Date Collected:** 11/27/2018 09:25 **Date Received:** 11/27/2018

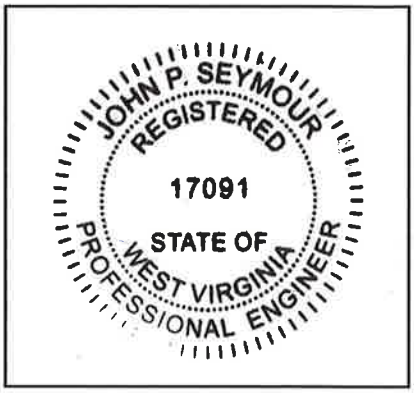
Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Boron, B	< 0.02	mg/L	U	0.1	0.02	DAM	12/05/2018 14:16	EPA 200.7-1994, Rev. 4.4
Calcium, Ca	< 0.04	mg/L	U	0.3	0.04	DAM	12/05/2018 14:16	EPA 200.7-1994, Rev. 4.4
Magnesium, Mg	< 0.01	mg/L	U	0.05	0.01	DAM	12/05/2018 14:16	EPA 200.7-1994, Rev. 4.4
Potassium, K	< 0.2	mg/L	U	0.5	0.2	DAM	12/05/2018 14:16	EPA 200.7-1994, Rev. 4.4
Sodium, Na	0.24	mg/L		0.2	0.06	DAM	12/05/2018 14:16	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	< 0.0008	mg/L	U	0.005	0.0008	DAM	12/05/2018 14:16	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	< 3	mg/L	U	10	3	MGK	11/30/2018	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	11/30/2018 22:17	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	0.02	mg/L	J	0.04	0.01	CRJ	11/30/2018 22:17	EPA 300.1-1997, Rev. 1.0
Fluoride, F	< 0.01	mg/L	U	0.06	0.01	CRJ	11/30/2018 22:17	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	< 5	mg/L	U	20	5	KAL	11/29/2018	SM 2540C-2011
Sulfate, SO4	< 0.06	mg/L	U	0.4	0.06	CRJ	11/30/2018 22:17	EPA 300.1-1997, Rev. 1.0

ATTACHMENT D

CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER

CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected and above described alternative source demonstration is appropriate for evaluating the groundwater monitoring data for the Mountaineer Landfill CCR management area and that the requirements of 40 CFR 257.94(e)(2) have been met.



John Seymour
Printed Name of Licensed Professional Engineer

Signature

17091	West Virginia	3/1/2019
License Number	Licensing State	Date

ALTERNATIVE SOURCE DEMONSTRATION REPORT FEDERAL CCR RULE

Mountaineer Plant Landfill
New Haven, West Virginia

Submitted to

AMERICAN ELECTRIC POWER

1 Riverside Plaza
Columbus, Ohio 43215-2372

Submitted by

Geosyntec consultants

engineers | scientists | innovators

941 Chatham Lane, Suite 103
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November 12, 2019

CHA8462

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LIST OF ATTACHMENTS

Attachment A Certification by a Qualified Professional Engineer

LIST OF ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
ASD	Alternative Source Demonstration
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
EPA	Environmental Protection Agency
LPL	Lower Prediction Limit
QC	Quality Control
SSI	Statistically Significant Increase
TDS	Total Dissolved Solids
UPL	Upper Prediction Limit
USEPA	United States Environmental Protection Agency

SECTION 1

INTRODUCTION AND SUMMARY

Following completion of eight background monitoring events at the Mountaineer Landfill, upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. A lower prediction limit (LPL) was also calculated for pH. Prediction limits were calculated based on a one-of-two retesting procedure. With this procedure, a statistically significant increase (SSI) is concluded only if both samples in a series of two exceeds the UPL, or in the case of pH is above the LPL. In practice, if the initial result did not result in an exceedance, a second sample was not collected or analyzed.

The first semi-annual detection monitoring event of 2019 at the Landfill was performed in April 2019 (initial sampling event) and June 2019 (verification sampling event) and the results were compared to the calculated prediction limits. Following the first semi-annual detection monitoring event, SSIs were identified for the following constituents listed in 40 CFR Part 257 Appendix III:

- Chloride at MW-26 by intrawell analysis; and,
- TDS at MW-1611 by intrawell analysis.

A summary of the detection monitoring analytical results and the calculated prediction limits to which they were compared is provided in Table 1.

1.1 CCR Rule Requirements

In accordance with the United States Environmental Protection Agency (USEPA) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments, Rule 40 CFR 257.94(e)(2) states the following:

> *The owner or operator may demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. The owner or operator must complete the written demonstration within 90 days of detecting a statistically significant increase over background levels to include obtaining a certification from a qualified professional engineer verifying the accuracy of the information in the report.*

The first semi-annual detection monitoring event for 2019 was completed in April and June 2019 at the Mountaineer Landfill. Pursuant to 40 CFR 257.94(e)(2), Geosyntec Consultants, Inc. (Geosyntec) has prepared this Alternative Source Demonstration (ASD) report, which documents that the SSIs cited above should not be attributed to the Landfill.

1.2 Demonstration of Alternative Sources

An evaluation was completed to assess possible alternative sources to which identified SSIs could be attributed. Alternative sources were identified amongst five types:

- ASD Type I: Sampling Causes;
- ASD Type II: Laboratory Causes;
- ASD Type III: Statistical Evaluation Causes;
- ASD Type IV: Natural Variation; and
- ASD Type V: Alternative Sources.

A demonstration was conducted to show that the increases in constituent concentrations were based on Type IV causes and not by a release from the Landfill.

SECTION 2

ALTERNATIVE SOURCE DEMONSTRATION

The CCR Rule allows the owner or operator 90 days from the determination of an SSI to demonstrate that a source other than the CCR unit caused the SSI. Identified SSIs, evaluation methodology, and the proposed alternative source are described below.

2.1 Proposed Alternative Source

An initial review of sampling and laboratory data did not identify any Type I (sampling) errors. A review of the laboratory and statistical analyses did not identify any Type II or III issues. An initial review of site geochemistry revealed natural variation (Type IV) as the source of the observed chloride and TDS SSIs.

2.1.1 Chloride SSI at MW-26

An SSI was identified for chloride at MW-26, which had an initial result of 6.71 mg/L, which is slightly above the calculated UPL of 6.66 mg/L. The exceedance by only 0.05 mg/L is believed to be a result of variability across the site, including the background well locations. For instance, chloride concentrations are consistently near 250 mg/L at background well MW-30 and have been as high as 38 mg/L at background well MW-1612 (Figure 1). In contrast, chloride concentrations at MW-26 are consistently below those of the background wells. Thus, changes in chloride concentrations at MW-26 likely represent natural variation in the dilution of chloride-rich groundwater as it moves through the aquifer.

Overall, concentrations of chloride at MW-26 from 2016 to present are stable. A sample was collected in September 2019 to serve as the initial sample for the second semiannual detection monitoring event of 2019 at the Mountaineer LF. The reported chloride concentration for this sample is 5.8 mg/L, which is below the calculated UPL of 6.66 mg/L (Figure 2).

2.1.2 TDS SSI at MW-1611

An SSI was also reported for TDS at MW-1611 during the first semiannual detection monitoring event of 2019. While the reported concentrations of 431 and 402 mg/L for the initial and verification sampling event, respectively, are above the intrawell UPL of 392 mg/L, they are both lower than the TDS concentrations at background wells MW-30 and MW-1612 (Figure 3). The relatively low TDS of groundwater at MW-1611 is due to the removal of dissolved species during cation-exchange and precipitation processes as groundwater is transported downgradient, as previously described (Geosyntec, 2018; Geosyntec, 2019). The net effect leads to higher concentrations of calcium and lower concentrations of sodium at downgradient locations. The increase in TDS at downgradient well MW-1611 is likely also related to natural variation in the dilution of TDS-rich groundwater.

2.2 Sampling Requirements

As the ASD described above supports the position that the identified SSIs are not due to a release from the Mountaineer Landfill, the unit will remain in the detection monitoring program. Groundwater at the unit will be sampled for Appendix III parameters on a semi-annual basis.

SECTION 3

CONCLUSIONS AND RECOMMENDATIONS

The preceding information serves as the ASD prepared in accordance with 40 CFR 257.94(e)(2) and supports the position that the SSIs for chloride and TDS during the first semiannual sampling event of 2019 are not due to a release from the Mountaineer Landfill. The observed chloride and TDS SSIs were attributed to natural variation. Therefore, no further action is warranted, and the Mountaineer Landfill will remain in the detection monitoring program. Certification of this ASD by a qualified professional engineer is provided in Attachment A.

SECTION 4

REFERENCES

Geosyntec Consultants, Inc. 2018. Alternative Source Demonstration Report – Federal CCR Rule. Mountaineer Plant Landfill. April.

Geosyntec Consultants, Inc. 2019. Alternative Source Demonstration Report – Federal CCR Rule. Mountaineer Plant Landfill. March.

U.S. EPA, 2015. Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities (Final Rule). Fed. Reg. 80 FR 21301, pp. 21301-21501, 40 CFR Parts 257 and 261, April.

TABLES

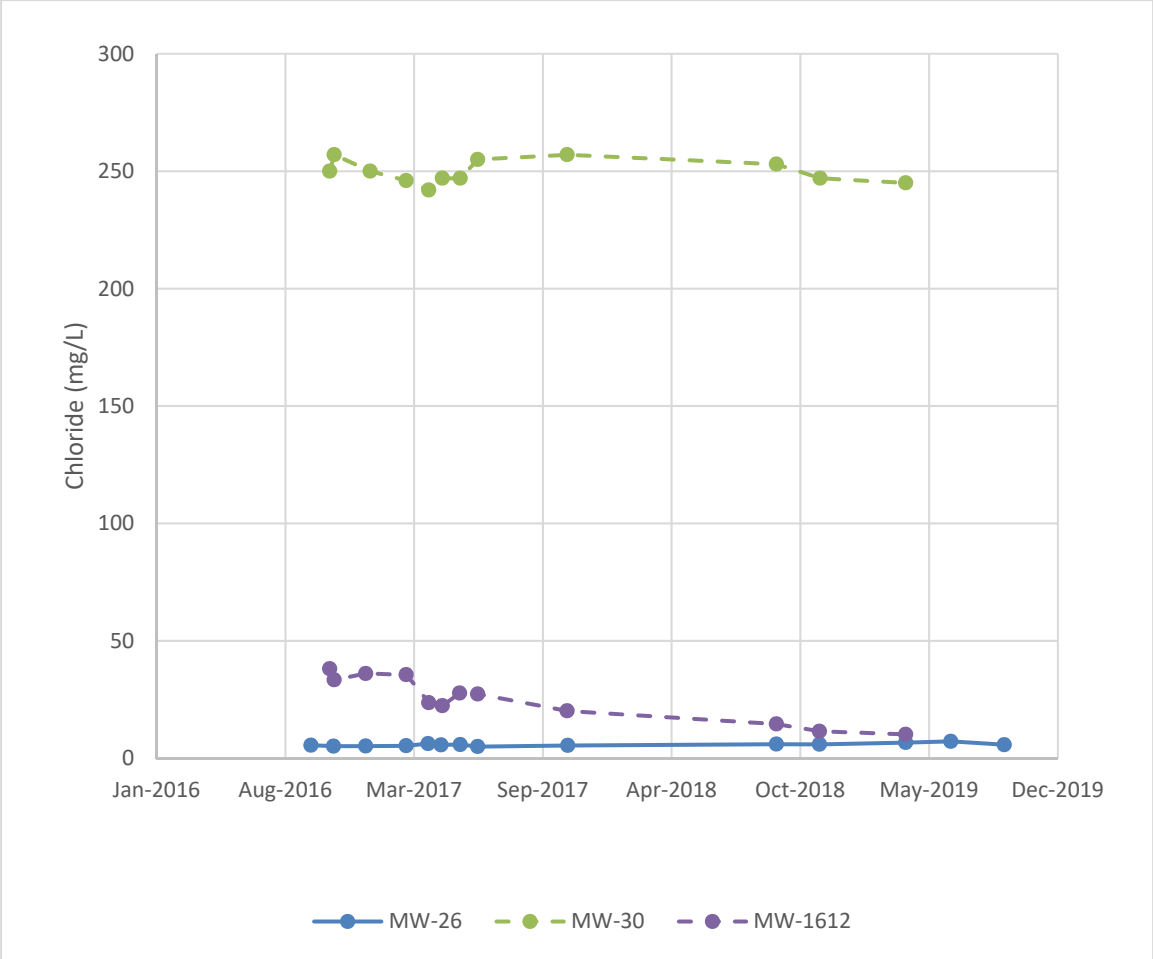
Table 1: Detection Monitoring Data Evaluation
Mountaineer Plant - Landfill

Geosyntec Consultants, Inc.

Parameter	Units	Description	MW-1611		MW-26		MW-27	MW-38		MW-39
			4/9/2019	6/18/2019	4/9/2019	6/18/2019	4/9/2019	4/9/2019	6/18/2019	4/9/2019
Boron	mg/L	Intrawell Background Value (UPL)	0.241		0.266		0.421	0.113		0.225
		Detection Monitoring Data	0.139	--	0.128	--	0.303	0.040	--	0.158
Calcium	mg/L	Intrawell Background Value (UPL)	25.0		66.6		2.02	60.1		14.3
		Detection Monitoring Data	**26.2**	22.8	62.8	--	1.19	52.0	--	6.65
Chloride	mg/L	Intrawell Background Value (UPL)	10.2		6.66		2.01	7.63		3.14
		Detection Monitoring Data	7.96	--	**6.71**	**7.22**	1.54	7.46	--	2.94
Fluoride	mg/L	Intrawell Background Value (UPL)	3.67		3.67		3.67	3.67		3.67
		Detection Monitoring Data	0.46	--	0.13	--	2.32	0.32	--	0.77
pH	SU	Intrawell Background Value (UPL)	7.8		7.7		9.6	7.6		9.5
		Intrawell Background Value (LPL)	7.2		7.1		8.8	7.0		8.3
		Detection Monitoring Data	7.6	**--**	7.3	**--**	9.0	**6.9**	7.6	8.3
Sulfate	mg/L	Intrawell Background Value (UPL)	25.3		13.3		8.88	39.9		1.50
		Detection Monitoring Data	20.7	--	7.60	--	2.90	27.8	--	0.06
TDS	mg/L	Intrawell Background Value (UPL)	392		379		635	459		473
		Detection Monitoring Data	**431**	**402***	370	--	542	427	--	376

Notes
UPL: Upper prediction limit
LPL: Lower prediction limit
TDS: Total dissolved solids
Bold values exceed the background value.
Background values are shaded gray.
*TDS sample was collected on 7/10/2019.

FIGURES



Notes: Chloride time series for downgradient well MW-26 and background wells MW-1612 and MW-30.

Chloride Time Series Graph
Mountaineer Landfill

Geosyntec consultants

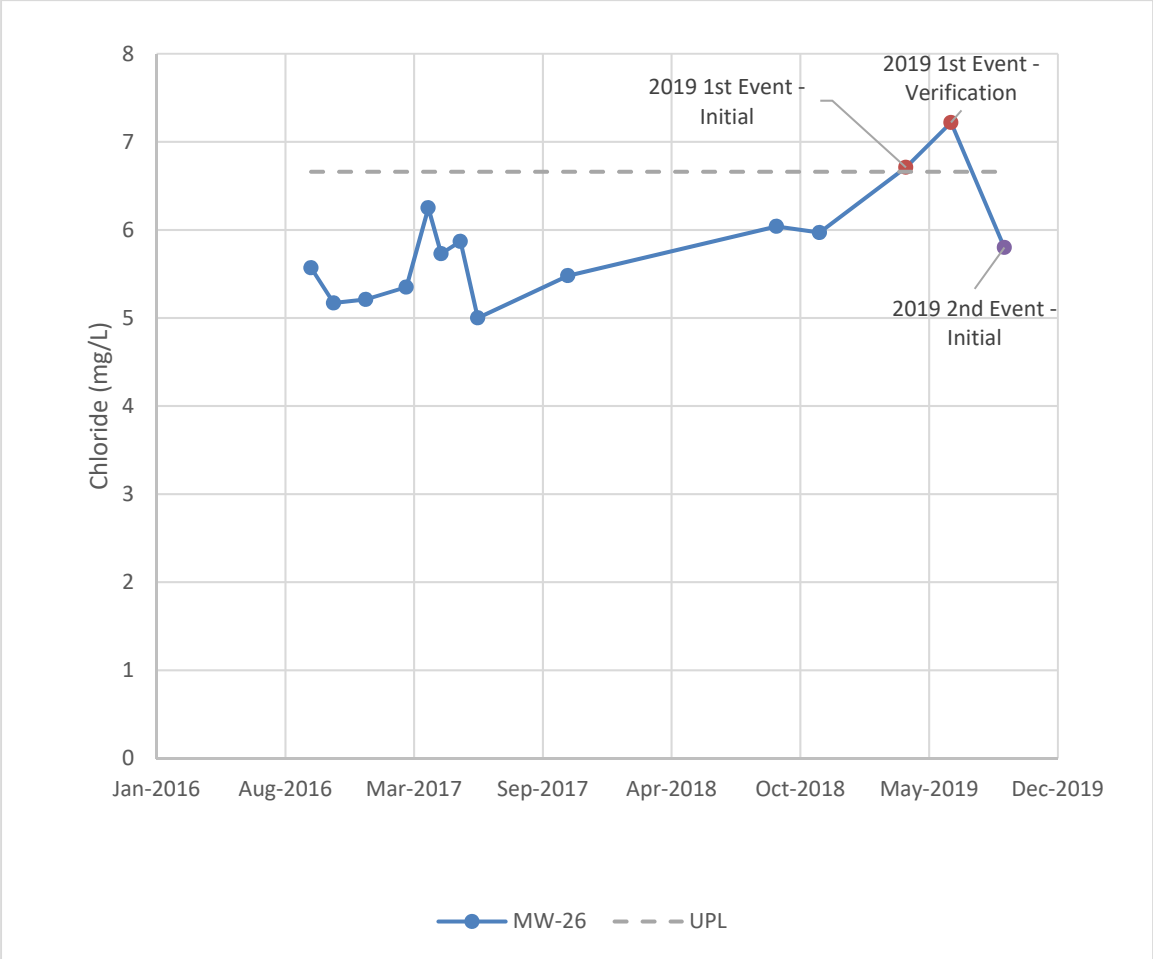
AMERICAN ELECTRIC POWER

Figure **1**

Columbus, Ohio

07-Nov-2019

internal info: path, date revised, author



Notes: Data collected from MW-26 during the background and detection monitoring period under the Federal CCR Rule are shown. Red circles represent data for the current detection monitoring event. The purple circle represents data collected for the second semiannual detection monitoring event of 2019.

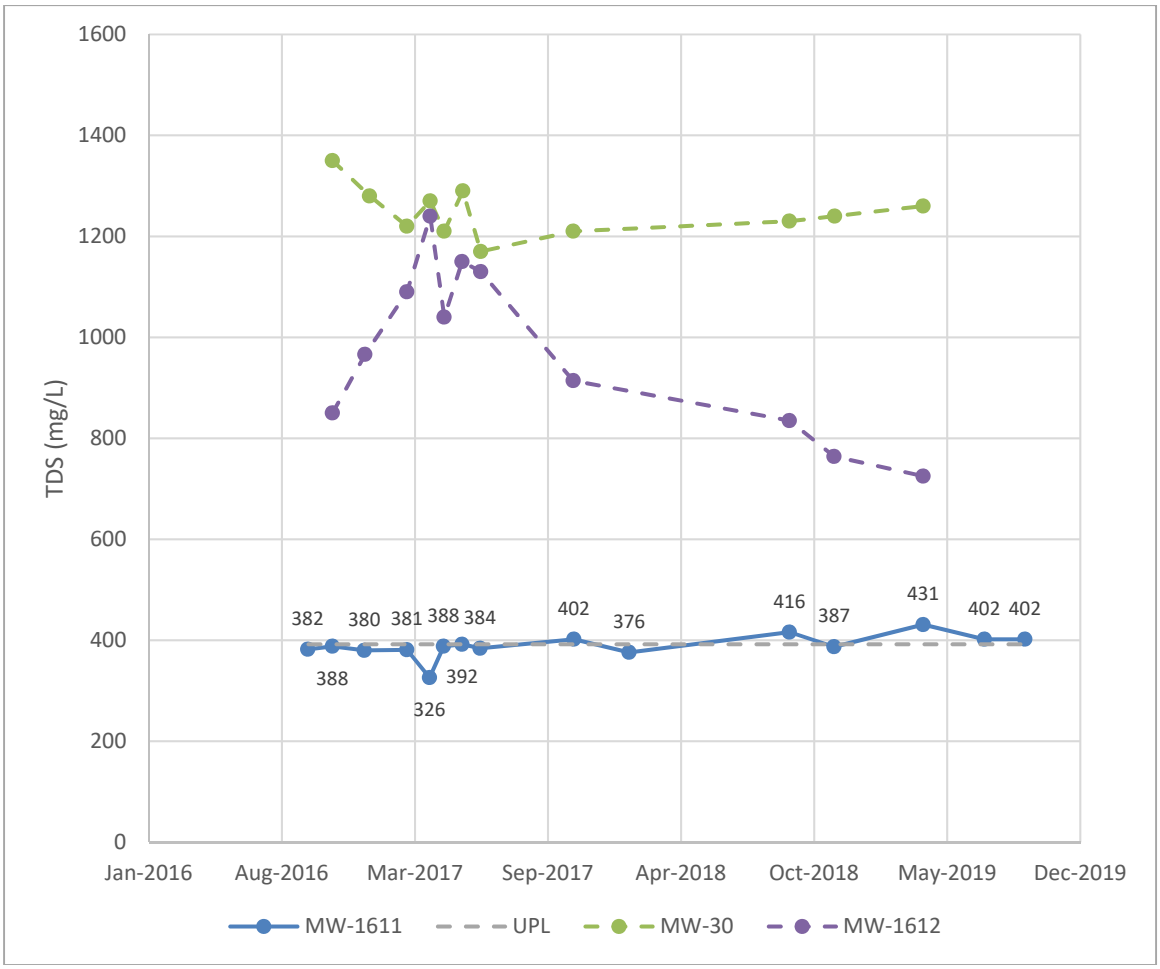
MW-26 Chloride Time Series Graph
Mountaineer Landfill

Geosyntec consultants | AMERICAN ELECTRIC POWER

Columbus, Ohio | 07-Nov-2019

Figure **2**

internal info: path, date revised, author



Notes: Total dissolved solids (TDS) time series for downgradient well MW-1611 and background wells MW-1612 and MW-30. The dashed line represents the calculated intrawell upper prediction limit (UPL) for MW-1611 of 392 mg/L. Data labels represent TDS concentrations at MW-1611.

Total Dissolved Solids Time Series Graph
Mountaineer Landfill

Geosyntec consultants | AMERICAN ELECTRIC POWER

Columbus, Ohio | 07-Nov-2019

Figure **3**

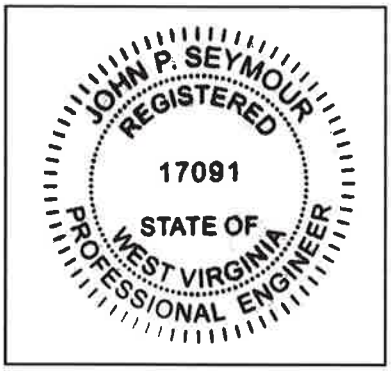
internal info: path, date revised, author

ATTACHMENT A

CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER

CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected and above described alternative source demonstration is appropriate for evaluating the groundwater monitoring data for the Mountaineer Landfill CCR management area and that the requirements of 40 CFR 257.94(e)(2) have been met.



John Seymour
Printed Name of Licensed Professional Engineer

Signature

017091 — License Number

West Virginia — Licensing State

11/14/2019 — Date

APPENDIX 4 - Notices for Monitoring Program Transitions

Not applicable at this time.

APPENDIX 5 - Well Installation/Decommissioning Logs

Not applicable at this time.

Appendix F

Assessment of Corrective Measures Report required at § 257.96

DRAFT

SANBORN HEAD

Building Trust. Engineering Success.

REVISED ASSESSMENT OF CORRECTIVE MEASURES

AEP MOUNTAINEER PLANT
BOTTOM ASH PONDS

New Haven, West Virginia

Prepared for American Electric Power
File No. 4345.01
Submitted: June 24, 2019
Revised: November 30, 2020

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1.0 INTRODUCTION

This document is the Assessment of Corrective Measures (ACM) Report for groundwater impacts associated with the Bottom Ash Pond (BAP) complex, a coal combustion residuals[1] unit at the American Electric Power (AEP) Mountaineer Power Plant in Letart, West Virginia (the Site) near the Town of New Haven. On behalf of AEP, Sanborn, Head & Associates, Inc. (Sanborn Head) has prepared this report according to the requirements set forth by the U.S. Environmental Protection Agency (USEPA) in the Coal Combustion Residuals (CCR[2]) Rule under Subtitle D of the Resource Conservation and Recovery Act (RCRA) which regulates the disposal of CCR from electric utilities and independent power producers. The CCR Rule establishes minimum criteria for CCR landfills, CCR surface impoundments, and all lateral expansions of CCR units including location restrictions, liner design criteria, structural integrity requirements, operating criteria, groundwater monitoring and corrective action requirements, closure and post-closure care requirements, and recordkeeping, notification, and internet posting requirements. [3]

Groundwater concentrations of lithium (a listed constituent in Appendix IV of the CCR Rule) at the Mountaineer Power Plant have been detected at statistically significant levels (SSLs) exceeding the groundwater protection standard (GWPS), as discussed in the 2019 report, *Statistical Analysis Summary, Bottom Ash Pond*.[4] In accordance with the CCR Rule, corrective measures must be assessed.

1.1 Document Purpose

The purpose of this Assessment of Corrective Measures Report is to identify, develop, and evaluate potential corrective measures that could be implemented at the Mountaineer Power Plant to prevent further releases and to remediate CCR impacts. A complete evaluation and justification for the selection of a remedy will be provided in the Selection of Remedy Report.

1.2 Review of Data Sources

Sanborn Head utilized a compilation of data sources to facilitate the analysis of Site conditions. These sources are discussed in the following sections.

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1 The EPA CCR Rule defines coal combustion residuals as material that is generated from the combustion of coal, including solid fuels classified as anthracite, bituminous, subbituminous, and lignite, for the purpose of generating steam for the purpose of powering a generator to produce electricity or electricity and other thermal energy by electric utilities and independent power producers. CCR includes fly ash, bottom ash, boiler slag, and flue gas desulfurization materials.

2 Title 40 of the Code of Federal Regulations (CFR) Parts 257 and 261 (40 CFR 257 and 261) dated April 17, 2015.

3 Ibid.

4 *Statistical Analysis Summary, Bottom Ash Pond, Mountaineer Plant, New Haven, West Virginia* prepared by Geosyntec dated January 8, 2019.

***Ash Pond System-CCR Groundwater Monitoring Well Network Evaluation, Mountaineer Plant*, prepared by Arcadis U.S., Inc., on behalf of AEP, dated October 27, 2016**

Sanborn Head reviewed the Ash Pond System-CCR Groundwater Monitoring Well Network Evaluation completed by Arcadis in January 2016. As part of this evaluation, Arcadis conducted a groundwater flow modeling study to improve the understanding of the effect of the Site production wells on flow patterns in the vicinity of the BAPs. The predicted flow patterns were considered in the selection of new monitoring well locations.

***Little Broad Run Landfill – CCR Groundwater Monitoring Well Network Evaluation, Mountaineer Plant*, prepared by Arcadis, on behalf of AEP, dated October 18, 2016**

Sanborn Head reviewed the Little Broad Run Landfill report prepared by Arcadis in October 2016. The report provides comprehensive background information pertaining to the configuration, construction, and operational history of the landfill.

***Annual Groundwater Monitoring Report, APC Power Company, Mountaineer Plant, Bottom Ash Pond CCR Management Unit*, prepared by AEP Service Corporation dated January 2019**

Sanborn Head reviewed the 2019 Annual Groundwater Monitoring Report completed by AEP Service Corporation in January 2019. Information on the Site and groundwater conditions provided in this report includes a location plan for existing groundwater monitoring wells, static water elevation data, evaluation of groundwater velocities and flow directions, and potentiometric maps. The report also provides the following information:

- Assessment of 2016 and 2017 groundwater data to establish background values for Appendix III and Appendix IV parameters;
- Statistical evaluation of groundwater quality data based on the background sampling events and the October 2017 detection monitoring event;
- Groundwater quality data from the assessment monitoring events in May and September 2018.

***Statistical Analysis Summary, Bottom Ash Pond, Mountaineer Plant*, prepared by Geosyntec, on behalf of AEP, dated January 8, 2019**

Sanborn Head reviewed the Statistical Analysis Summary completed by Geosyntec in January 2019. Geosyntec performed a statistical evaluation of data from the assessment monitoring events in May and September 2018 and utilized these results to establish Groundwater Protection Standards (GWPSs) for Appendix IV parameters. In this analysis, SSLs were identified for lithium.

2.0 SITE BACKGROUND

The Mountaineer Power Plant is an electric power generating facility identified with the address of 1347 Graham Station Road, Letart, West Virginia, 25253. The Site is located on approximately 1,925 acres along the western bank of the Ohio River approximately two (2) miles east of the City of New Haven in Mason County, West Virginia (latitude 38°58'47.38"N, longitude 81°55'50.60"W). The location of the Site property is depicted in Figure 1.

2.1 Site Description and History

The Site is owned and operated by Appalachian Power Company, a wholly-owned subsidiary of AEP. The Mountaineer Power Plant burns approximately 9,000 tons of coal and provides approximately 1,300 megawatts of power for consumption on a daily basis.

The Ohio River is located east of the Site. The area on the southeastern border of the Site is occupied by the retired AEP Phillip Sporn Plant which ceased operations in 2015. West Virginia Route 62 (Graham Station Road) runs through the Site, and Little Broad Run is near the western border. The Town of New Haven lies to the northwest of the Site.

Two currently inactive underground coal mines lie on the western side of the Site.[5] Broad Run Mine (RDT-500476A) and the Phillip Sporn Mine (RDT-324045A) formerly extracted coal from the Redstone Seam of the Monongahela Formation.

As shown on Figure 2, the Site includes the following significant features:
- The Mountaineer Power Plant;
- The Bottom Ash Pond (BAP) Complex (West Virginia ID No. 05307).
- Five (5) groundwater pumping wells to provide water for plant operations; and
- A coal storage area.

In addition, the Little Broad Run Landfill (Application No. WV 0077038) is located approximately 1.5 miles west of the Site, and accepts CCR from the Mountaineer power plant.

Significant aspects of several of these features are discussed in the following sections.

2.1.1 Bottom Ash Pond Complex

The BAP Complex is comprised of the following components: East BAP, West BAP, East Wastewater Pond, West Wastewater Pond, Reclaim Pond, and Clearwater Pond. Of the BAP complex features mentioned herein, only the West and East BAPs are considered part of the regulated CCR impoundment.

The BAP Complex is located in the southern portion of the AEP Mountaineer Plant, approximately 0.5 mile southwest of the Ohio River. The retired AEP Phillip Sporn Plant separates the BAP Complex from the Ohio River. The BAPs are bordered by West Virginia Route 62 (Graham Station Road) to the northeast, a fly ash conveyor to the northwest and

[5] "Underground and Surface Coal Mines." West Virginia Geological and Economic Survey. April 19, 2019. http://www.wvgs.wvnet.edu/GIS/CBMP/all_mining.html

western sides of the BAP, Little Broad Run to the southwest, and wastewater ponds to the southeast. Refer to Figure 2 for a site plan.

The West and East BAPs, with a combined normal pool surface area of 28 acres, are constructed of earthen embankments approximately 35 ft tall, and lined with 3 feet of clay derived from offsite borrow areas[6]. The BAPs receive influent through above- and below-ground piping from coal pile run-off, fly ash silo and turbine room sumps, pyrite and bottom ash transport, stormwater, as well as direct precipitation[7]. Impounded water generally flows from northwest to southeast through the BAPs, and then from the BAP (West/East) to the Wastewater Ponds (West/East), next to either the Reclaim Pond or Clearwater Pond, and eventually to the Ohio River[8]. In addition to BAP effluent, the wastewater ponds receive influent from the water treatment sump and cooling tower blowdown.

As described in the Groundwater Monitoring Well Network Evaluation (GMWNE) [9], the BAP groundwater monitoring network consists of four upgradient (MW-1601A, MW-1602, MW-1603, and MW-1608) and eight downgradient (MW-1604S/D, MW-1605S/D, MW-1606S/D, and MW-1607S/D) monitoring wells sampled for water quality. An additional eleven monitoring wells/wells/piezometers are used for hydraulic monitoring only. Refer to Figure 2 for monitoring well locations.

2.1.2 Groundwater Pumping Wells

Five (5) groundwater pumping wells are currently active at the Site. Two wells (West 1 and East 1) provide cooling and process water for the Site. West 1 and East 1 have pumping capacities of approximately 930-950 gallons per minute (gpm) and 550-575 gpm, respectively. Well 4 supplies water for the wastewater system, and Wells 5 and 6 supply water for the emergency fire suppression system. Wells 4, 5 and 6 are pumped at lower flow rates than West 1 and East 1, and are operated on an intermittent, "as needed" basis. There are no groundwater wells supplying water for human consumption at the Site. The plant receives potable water from the Town of New Haven's water supply system.

2.1.3 Little Broad Run Landfill[10]

The Little Broad Run (LBR) Landfill, located approximately 1.5 miles west of the Site, is bordered by undeveloped, wooded land in an isolated area. The landfill occupies approximately 660 total acres, of which 325 acres are permitted for ash disposal. The LBR Landfill began operation in 1978 and accepted both bottom ash and fly ash from the Mountaineer and Sporn power plants. Since the Sporn Plant closure on June 1, 2015, the Mountaineer Plant is the primary contributor of CCR byproducts, but the landfill occasionally

---

6 *Ash Pond System-CCR Groundwater Monitoring Well Network Evaluation, Mountaineer Plant*, prepared by Arcadis U.S., Inc., on behalf of AEP, dated October 27, 2016.

7 History of Construction CFR 257.73(c)(1) Bottom Ash Complex Mountaineer Plant, prepared by American Electric Power Service Corporation on behalf of Appalachian Power Company, dated October 2016.

8 Ibid.

9 Ash Pond System-CCR Groundwater Monitoring Well Network Evaluation, Mountaineer Plant, prepared by Arcadis U.S., Inc., on behalf of AEP, dated October 27, 2016.

10 *Little Broad Run Landfill – CCR Groundwater Monitoring Well Network Evaluation*, Mountaineer Plant prepared by Arcadis dated October 18, 2016.

receives materials from other AEP locations including Clinch River, VA; Glyn Lyn, VA; and Kanawha River, WV.

The LBR has 9 permitted valley-fill Areas and 5 vertical expansion Phases that are permitted for construction over the valley-fill landfill area. As of 2015, Areas 1 through 7 were filled and temporarily closed with two feet of soil cover to their permitted final grades or were transitioned into vertical expansion filling operations; Areas 8 and 9 have not been constructed. The first phase of the vertical expansion was subdivided into three sub-phases (1A, 1B, and 1C). Current filling operations are primarily in Phase 1B.

2.2 CCR Regulatory Status

Two Mountaineer Plant ash storage sites are included in the CCR monitoring program, including the bottom ash ponds and the LBR landfill, and both storage sites are in active use. Mountaineer Plant has switched to dry fly ash handling, and fly ash is now stored in the lined LBR landfill operated by AEP. Bottom ash from the plant is stored in the bottom ash ponds. The CCR Rule requires groundwater monitoring and establishes criteria for existing and new CCR landfills and surface impoundments. In accordance with the CCR Rule, detection monitoring for the Mountaineer Site was conducted in 2017 and 2018. At this time, Mountaineer's LBR Landfill is in a detection monitoring status and does not require an assessment of corrective measures to be performed.[11] Any further reference to the LBR Landfill in this document in the following sections relates only to the potential for the landfill to act as a potential disposal location for CCR that is in the BAPs.

The following is a summary of the steps that have resulted in the need for this assessment of corrective measures to be performed for the Mountaineer Plant BAPs.

Statistical analysis of the groundwater quality data showed statistically significant increases (SSIs) in the following Appendix III parameters: boron, calcium, chloride, fluoride, sulfate, and TDS. In April 2018, an alternative source demonstration was undertaken, and it concluded that an alternative source for the Appendix III parameter SSIs could not be identified at the time. An assessment monitoring program for Appendix IV parameters was initiated in April 2018, and sampling for Appendix III and IV parameters was conducted in May and September 2018. A Groundwater Protection Standard (GWPS) was established for each Appendix IV parameter in accordance with 40 CFR 257.95(h). Statistical analysis of the monitoring data yielded confidence intervals for each Appendix IV parameter at each compliance well. An SSL was indicated if the Lower Confidence Limit (LCL) of a parameter exceeded the GWPS. Through this analysis, SSLs were identified for lithium as LCLs for lithium exceeded the GWPS of 0.040 mg/L at MW-1605D (0.0653 mg/L), MW-1605S (0.0594 mg/L), MW-1606D (0.111 mg/L), MW-1606S (0.102 mg/L), MW-1607D (0.0718 mg/L), and MW-1607S (0.0918 mg/L).

[11] *Annual Groundwater Monitoring Report, Appalachian Power Company Mountaineer Plant, Landfill CCR Management Unit*, prepared by American Electric Power Service Corporation, dated January, 2019

2.3 Conceptual Site Model (CSM)

The CSM presented in this ACM Report was developed by Sanborn Head to document the current understanding of the relationship of the BAP to the regional and Site geology and hydrogeology, and to provide guidance for future investigation, data collection and evaluation, and the assessment of corrective measures.

2.3.1 Physiographic Setting

The Site lies within the Ohio River alluvial floodplain and the Upper Ohio-Shade watershed. The elevation of the Ohio River to the east of the Site is regulated by the upstream Racine Lock (Letart, WV) and the downstream Robert C. Byrd Lock (Gallipolis Ferry, WV). The normal pool stage under non-flood conditions is an elevation of approximately 542 ft amsl near to the Site. The Site topography is relatively flat with a typical elevation of around 590 ft amsl, with steeper inclines to the west due to the slope of the valley and to the east where the river bank slopes down to the river.

2.3.2 Site Geology

Previous investigations as summarized in *Ash Pond System-CCR Groundwater Monitoring Well Network Evaluation* (Arcadis, 2016) have provided information to characterize the geology of the Site. The general stratigraphic units were identified as unconsolidated valley-fill alluvial deposits (silt, clay, sand and gravel), and bedrock. In addition, fill material, comprised reworked soils (i.e., silt, clay and sand) and mine spoil, is found in areas of the Site that have been excavated and reworked during construction activities, and covers a relatively limited area. A generalized cross-section depicting the Site geology is shown in Figure 3.

The unconsolidated valley-fill alluvial deposits consist of the following two units:

- Alternating horizons of clay and clayey silt, with thickness ranging from about 0 to 30 feet below ground surface (ft bgs); and
- Sand, generally medium to coarse grained, with some gravel horizons, that generally coarsens with depth. The sand unit varies in thickness across the Site and is typically has thickness in the range of 40 to 60 ft.

Bedrock beneath the Site is described as a fine to medium grained, moderately hard, competent sandstone. Depth to bedrock typically ranges from approximately 60 to 90 ft bgs across the Site.

2.3.3 Site Hydrogeology

The Ohio River flows north-northwest along the northeastern Site boundary, but regionally flows south and west. The alluvial sand and gravel associated with the Ohio River valley was the only aquifer encountered at the Site, with a saturated thickness of about 20 to 45 ft. The aquifer is primarily recharged by local precipitation and inflow from the Ohio River during high river stages. Depth to groundwater at the Site ranges is around 40 to 50 ft bgs.

Groundwater flow is influenced by Site pumping wells and by the stage of the Ohio River. During regular operating conditions, wells East 1 and West 1 are actively pumping and have capacities of approximately 550 and 950 gallons per minute (gpm), respectively although the wells are typically operated at lower flow rates. Groundwater elevations measured on February 4, 2019 (shown on Figure 5), under these pumping conditions resulted in a cone of depression that extends at least 800 feet from the wells and in which the overall groundwater flow direction is toward the wells. Outside of this area, groundwater flow is generally east towards the Ohio River.

A groundwater flow modeling study was conducted by Arcadis in 2016[12] to improve the understanding of the effect of facility well pumping on the flow patterns in the vicinity of the BAP complex. This study included the following factors:

- Pumping rates of 400 gpm each for East 1 and West 1;
- Pumping rates of 19 gpm each for Well 5 and Well 6;
- Normal operating levels for the Mountaineer pond elevations (BAPs, wastewater ponds, reclaim pond, and clearwater pond);
- Inactive and dry Sporn ponds due to plant closure;
- Ohio River water level for December (groundwater flow toward river)

The results of the model show good agreement with measured groundwater elevations and inferred flow directions observed at the Site under typical pumping conditions. Both suggest a pattern of groundwater flow diverging away from the BAP complex ponds, with flow being directed toward the Ohio River and the cone of depression surrounding the East 1 and West 1 wells.

Vertical groundwater flow at the Site is expected to be downward in the vicinity of the BAP complex, which is a source of groundwater recharge under current conditions, as well as near to the plant supply wells which are screened in the deeper part of the granular overburden. Groundwater that is not captured by the plant supply wells is expected to flow generally eastward toward the Ohio River, where the vertical gradient is anticipated to be upward as the groundwater discharges to surface water.

Although the plant supply wells are generally operated continuously, an opportunity to observe groundwater flow under non-pumping conditions was provided in March 2019 when pumps at the facility were shut down for maintenance. Two sets of groundwater elevation measurements were collected during this time. The first set of measurements was recorded on March 1 after the pumps had been shut down since sometime prior to February 27. The resulting contours indicate that shallow horizontal groundwater flow is generally west to southwest. During this time, the Ohio River elevation ranged from approximately 560 ft amsl on February 25 to 547 ft amsl on March 1, although typical elevation near the Site is approximately 542 feet amsl. While non-pumping conditions will provide an understanding of groundwater flow under static conditions, the elevated stage of the Ohio River during this timeframe was observed to potentially cause temporary reversal of "normal" groundwater flow direction adjacent to the river, resulting in flow out of the Ohio

[12] *Ash Pond System-CCR Groundwater Monitoring Well Network Evaluation, Mountaineer Plant*, prepared by Arcadis U.S., Inc., on behalf of AEP, dated October 27, 2016.

River and into the groundwater of the sand and gravel for a short duration. This effect is defined as riverbank storage: when the river level rises during a flood, water will flow from the river into the riverbank; the flood water that is stored in the riverbank (as groundwater) will then flow back into the river over a period following recession of the high river levels. The volume of water entering the river bank from the river and the duration of this effect is dependent on the permeability of the riverbank soils. A second set of water level measurements was collected on March 7, 2019 once flooding in the Ohio River had subsided to a more typical Ohio River stage of 541.48 amsl. The resulting groundwater contours indicate that groundwater flow in the sand and gravel is generally northeast toward the Ohio River under static, non-pumping conditions (noting that there may be some residual transient influence of pumping in the area located between the pumping wells and the Ohio River).

Sanborn Head further assessed the onsite groundwater flow including flow direction and groundwater travel time under both non-pumping and pumping conditions for groundwater originating from the edge of the BAPs. This assessment was performed using a particle tracking method that is implemented in the ArcGIS software package. The particle tracking tool requires groundwater contours, saturated thickness, and hydraulic conductivity values in order to calculate the direction and travel time of groundwater from a specified starting point. Groundwater contours used for the calculation are described in Figure 4 and 5. Saturated thickness of the sand and gravel was calculated using the groundwater elevation contours and an estimated depth to bedrock. The depth to bedrock and the hydraulic conductivity data was applied using information presented in the groundwater flow modeling study conducted by Arcadis in 2016[13].

Groundwater conditions while pumps were not in operation (i.e. for measurements recorded on March 7, 2019), are illustrated in Figure 4. As depicted in the figure, groundwater generally flows northeast from the BAPs toward the Main Plant Area and onward toward the Ohio River. The ArcGIS particle tracking method indicates particle travel from the north and northeast sides of the BAPs is initially north at travel times ranging from <5 to 5-20 years with groundwater flow turning toward the northeast beginning in the southwest portion of the Main Plant Area with travel times ranging from <5 to 20-40 years, slowing as the path progresses. Inferred groundwater travel from the southeast side of the BAPs is northeast at a rate of 5-20 years with more downgradient flow near the Main Plant Area turning more toward the north with travel times ranging from 5-20 to 40-60 years, slowing as the path progresses.

Groundwater flow conditions under the more typical pumping conditions (i.e., measurements recorded on February 4, 2019) are illustrated in Figure 5. As depicted in the figure, groundwater generally flows north from the BAPs toward the vicinity of Well 5 in the southwest portion of the Main Plant Area. A cone of depression is present beneath the main plant area resulting from pumping of the plant supply wells (East 1 and West 1). The ArcGIS particle tracking method indicates particle travel from the north and northeast sides of the BAPs is generally toward Well 5 with a travel time of <5 years, and groundwater flow from

[13] *Ash Pond System-CCR Groundwater Monitoring Well Network Evaluation, Mountaineer Plant*, prepared by Arcadis U.S., Inc., on behalf of AEP, dated October 27, 2016.

the southeast side of the BAPs is toward the area slightly east of Well 5 at travel times ranging from <5 to >15 years, slowing as the path progresses.

2.3.4 Population and Land Use

The CSM enables a qualitative assessment of the risk to human and ecological receptors from CCR impacts in groundwater at the Mountaineer Power Plant. Lithium was the only Appendix IV parameter for which an SSL was determined. The BAPs appear to be one potential source of lithium in groundwater, and this point of origin was considered in the evaluation of migration pathways to receptors.

Land use downgradient of the BAPs includes the AEP energy production facility to the northeast, the former Sporn Plant bottom ash ponds to the east and northeast, and the former Sporn Plant to the southeast. Downgradient flow ends at the plant supply wells (under pumping conditions) or the Ohio River (under static, non-pumping conditions). Discharge to the river is not expected to cause appreciable increase in the lithium concentration of the river or impacts to ecological or human receptors due to the substantial dilution from the high volumetric flow of the river, of approximately 50,000 CFS under long term average flow conditions.

Five non-potable production wells exist onsite that are used for process water, fire water supply, and the plant's wastewater system.[14] Under current conditions, the extracted water is used for Site operations and then discharged in accordance with the Site's National Pollutant Discharge Elimination System (NPDES) permit. Prior to discharge, the extracted water is delivered to the Site's wastewater treatment plant for removal of solids and then to a bioreactor for treatment of metals. From the bioreactor, the water moves to the clearwater pond in the BAP complex for settling and then from clearwater pond to the Ohio River outfall where it is monitored for NPDES compliance.

A well inventory performed by Arcadis (2016) identified one USGS well within a 0.5-mile buffer of the BAP complex with the apparent purpose of groundwater monitoring.[15] Two public water supply wells for the town of New Haven (New Haven 3 and New Haven 4) are located over 6,000 feet to the northwest of the BAPs as shown on Figure 2. Figures 4 and 5 illustrate that under both non-pumping and pumping conditions, these wells are upgradient from the BAPs and contamination from the BAPs would not travel towards or reach them. Further, the BAPs are outside of the local Source Water Protection Area (reference SWPA report). Therefore, groundwater transport of lithium emanating from the BAPs is not likely to affect water extracted for drinking water purposes in the area.

2.3.5 Nature and Extent of Lithium in Site Groundwater

Detection monitoring events that identified SSIs occurred on October 30, 2017 and January 22, 2018. Statistical analysis to determine SSIs was conducted using groundwater data collected from eight wells along the downgradient perimeter of the BAPs (MW-1604D, MW-

[14] Ibid.

[15] *Little Broad Run Landfill-CCR Groundwater Monitoring Well Network Evaluation*, prepared by Arcadis U.S., Inc., on behalf of AEP, dated October 18, 2016.

1604S, MW-1605D, MW-1605S, MW-1606D, MW-1606S, MW-1607D, and MW-1607S). This process identified SSIs for boron, calcium, chloride, fluoride, sulfate, and TDS, and all locations showed an SSI for at least one parameter.

Assessment monitoring was conducted on May 9, 2018 and September 9, 2018. Lithium concentrations at the wells where multi-parameter SSIs were identified ranged from 16 118 µg/L. Exceedances of the established GWPS for lithium (40 µg/L) occurred at seven of the eight wells (concentrations at MW-1604D were below the GWPS).

Background, detection, and assessment monitoring provided data for lithium concentrations in groundwater between 2016 and 2018. This information was used to infer the distribution of lithium in overburden groundwater across the Site. MW-1608 can be considered an indicator of background levels as it lies side-gradient to and approximately 0.8 miles northwest of the BAPs. Lithium concentrations at MW-1608 ranged from non-detect (reporting limit of 0.0002 mg/L) to 16 µg/L. MW-1601A, MW-1602, and MW-1603 are upgradient to and on the southern and western side of the BAPs. Lithium concentrations at these locations ranged from non-detect (reporting limit of 0.0002 mg/L) to 22 µg/L. MW-1604D, MW-1604S, MW-1605D, MW-1605S, MW-1606D, MW-1606S, MW-1607D, and MW-1607S are immediately downgradient from the BAPs. Lithium concentrations at these locations ranged from 16 µg/L to 132 µg/L. As supported by these data, and as previously described in work by others[e.g. 16,17], concentrations of lithium in groundwater are elevated in downgradient monitoring wells compared to upgradient monitoring wells.

As part of the characterization of nature and extent of a release from the BAP, installation of ten (10) additional groundwater monitoring wells was performed in January and February 2019 at the Mountaineer Bottom Ash Pond. These additional groundwater monitoring wells include: MW-1921, MW-1922S, MW-1922D, MW-1923, MW-1924, MW-1925, MW-1926, MW-1927, MW-1928, MW-1929. Monitoring well MW-1805 was installed in 2018 and was also included in the 2019 nature and extent study. Additionally, three monitoring wells (MW-016, MW-107, MW-112, and MW-203) that were installed as part of a subsurface investigation in 2006 have been included in the sampling and analysis as a part of the nature and extent characterization. The location of these additional groundwater monitoring wells is shown on Figure 2, Figure 4, and Figure 5. Boring logs and well construction forms for these monitoring wells are included in the Annual Groundwater Monitoring Report[18]. A summary of lithium concentrations from Assessment groundwater monitoring conducted in 2019 is provided in Exhibit 1

[16] Ash Pond System-CCR Groundwater Monitoring Well Network Evaluation, Mountaineer Plant, prepared by Arcadis U.S., Inc., on behalf of AEP, dated October 27, 2016.

[17] Statistical Analysis Summary Bottom Ash Pond, Mountaineer Plant, prepared by Geosyntec Consultants on behalf of AEP, dated January 15, 2018.

[18] *Annual Groundwater Monitoring and Corrective Action Report*, Bottom Ash Pond, Mountaineer Plant, prepared by AEP, dated January 2020

Exhibit 1 – Summary of Lithium Concentrations in Site Groundwater

Monitoring Well	Monitoring Program	Monitoring Well Location	Lithium (µg/L)		
			April 2019	June 2019	September 2019
BAP-MW-1601A	Detection monitoring	Upgradient	20 J	<9	1.84
BAP-MW-1602	Detection monitoring	Upgradient	20 J	10 J	9.79
BAP-MW-1603	Detection monitoring	Upgradient	30	<9	15
BAP-MW-1608	Detection monitoring	Sidegradient	10 J	<9	2.86
BAP-MW-1926	Nature and Extent	Sidegradient	10 J	<9	6.24
BAP-MW-1927	Nature and Extent	Sidegradient	30 J	<9	6.38
BAP-MW-107	Other	Sidegradient	20 J	<9	3.58
BAP-MW-112	Other	Sidegradient	NS	<9	NS
BAP-MW-203	Other	Sidegradient	NS	<9	2.3
BAP-MW-1604S	Detection monitoring	Downgradient	61	32	47.6
BAP-MW-1604D	Detection monitoring	Downgradient	38	<9	18.8
BAP-MW-1605S	Detection monitoring	Downgradient	79	40	52.4
BAP-MW-1605D	Detection monitoring	Downgradient	75	20 J	56.1
BAP-MW-1606S	Detection monitoring	Downgradient	117	56	87.7
BAP-MW-1606D	Detection monitoring	Downgradient	124	58	83.5
BAP-MW-1607S	Detection monitoring	Downgradient	141	75	99
BAP-MW-1607D	Detection monitoring	Downgradient	127	72	110
BAP-MW-1921	Nature and Extent	Downgradient	75	74	92.6
BAP-MW-1922S	Nature and Extent	Downgradient	82	30 J	55.6
BAP-MW-1922D	Nature and Extent	Downgradient	20 J	<9	12.6
BAP-MW-1923	Nature and Extent	Downgradient	223	135	137
BAP-MW-1924	Nature and Extent	Downgradient	133	87	102
BAP-MW-1925	Nature and Extent	Downgradient	94	95	94.7
BAP-MW-1929	Nature and Extent	Downgradient	10 J	<9	4.8
BAP-MW-1805	Other	Downgradient	43	32	42.6

A summary of the 2019 lithium groundwater concentration data as it relates to nature and extent is provided below:

- Upgradient monitoring wells (MW-1601A, MW-1602, and MW-1603) had lithium concentrations ranging from 1.84 µg/L to 30 µg/L. Background monitoring well MW-1608, which is located approximately 4,500 feet northwest of the BAP, had lithium concentrations between 2.86 µg/L and 10 µg/L. Newly installed nature and extent well MW-1926 is located on the eastern corner of the clearwater pond that is part of the Mountaineer Bottom Ash Complex and had concentrations in 2019 that are also representative of background (2 µg/L to 10 µg/L).

- Detection monitoring wells immediately downgradient of the BAP show variation from northwest to southeast: MW-1604S and MW-1605S had lithium concentrations between 32 µg/L and 79 µg/L, while MW-1606S and MW-1607S had concentrations from 56 µg/L to 141 µg/L. Deep detection monitoring wells along the downgradient edge of the BAP (MW-1604D, MW-1605D, MW-1606D and MW-1607D) generally exhibit similar or slightly lower concentrations than their shallow counterpart.

- Downgradient monitoring wells installed to assess nature and extent of lithium include MW-1921, MW-1922S, MW-1922D, MW-1923, MW-1924, and MW-1925. Monitoring well MW-1922S is immediately downgradient of the northwest corner of the BAP and shows similar concentrations (30 µg/L to 82 µg/L) to MW-1604S and MW-1605S (32 µg/L to 79 µg/L). The deep companion well (MW-1922D) installed next to MW-1922S had concentrations (<9 µg/L to 20 µg/L) that are representative of background. However, concentrations measured in the four wells (MW-1921, MW-1923, MW-1924, and MW-1925) further downgradient of the BAP were between 74 µg/L and 223 µg/L, with the highest concentration measured at MW-1923 (223 µg/L in April 2019).

- Four monitoring wells bound the lithium plume to the northwest including nature and extent well MW-1927 and existing site wells MW-107, MW-112, and MW-203, and have lithium concentrations representative of background. In June 2019, lithium was not detected (at a reporting limit of 9 µg/L) in any of the four wells while in September 2019 concentrations were between 2.30 µg/L and 6.38 µg/L. In addition, we note that MW-1929 is installed near the northwest property boundary and is the nearest monitoring well to the two public water supply wells for the Town of New Haven (New Haven 3 and New Haven 4). Lithium concentrations in this well are also representative of background and ranged from 4.8 µg/L to 10 µg/L.

Complete characterization of the nature and extent of lithium coming from the BAP is currently complicated by other potential contributors of lithium in groundwater, which have not been determined during the Alternate Source Demonstration. Several monitoring wells (MW-1607S/D, MW-1921, MW-1923, MW-1924, and MW-1925) have higher lithium concentrations than those wells located immediately downgradient of the BAP (MW-1604S/D, MW-1605S/D, MW-1606S/D, and MW-1922S/D). The highest lithium concentrations measured at the site occur in the monitoring well furthest downgradient from the BAP which is inconsistent with the BAP being the source of the lithium in those wells. If the BAP was the source of lithium in downgradient wells, it would be expected that the highest concentrations would be observed nearest the BAP, and would decline in a downgradient direction due to dilution, dispersion and sorption. Observed groundwater flow directions at the site (Figure 4 and 5) indicate that operation of supply wells West 1 and East 1 results in radial flow of groundwater, including from the direction of the former Sporn Plant toward wells West 1 and East 1.

Time series data collected over a three-year time period from September 2016 to September 2019 is presented in the BAP Groundwater Statistical Analysis Summary Report (December 2019)[19] for individual wells sampled as part of the detection and assessment monitoring. Review of the time series data show that lithium appears to be stable or decreasing in monitoring wells immediately downgradient of the BAP (MW-1604S/D, MW-1605S/D, MW-1606S/D). This implies the potential for a stable or shrinking lithium plume in groundwater which is an important component of MNA.

[19] Statistical Analysis Summary – Bottom Ash Pond. Mountaineer Plant, New Haven, West Virginia. Geosyntec. December 23, 2019.

2.3.6 Environmental Fate and Transport of Lithium in Groundwater

US EPA MNA guidance[20] discusses and recommends a tiered evaluation and analysis approach for site characterization and development of multiple lines of evidence for evaluation of MNA. The US EPA MNA Guidance recommends that information and data collection and evaluation within the tiered analysis approach typically should be developed in the following four phases:

- Phase I: Demonstration that the groundwater plume is not expanding.
- Phase II: Determination that the mechanism and rate of the attenuation process are sufficient.
- Phase III: Determination that the capacity of the aquifer is sufficient to attenuate the mass of contaminant within the plume and the stability of the immobilized contaminant is sufficient to resist re-mobilization.
- Phase IV: Design of a performance monitoring program based on an understanding of the mechanism of the attenuation process, and establishment of contingency remedies tailored to site-specific characteristics.

To evaluate the potential for MNA at the site, Sanborn Head performed a subsurface geochemical assessment of the BAP complex at the Mountaineer Plant on behalf of AEP to assist with remediation design for the BAP CCR Unit. The assessment included a review of the site environmental system to allow an understanding of the fate and transport of lithium in groundwater; and geochemical analysis of site samples to assess fate and mobility of lithium. Soil samples were collected and submitted for geochemical analyses relevant to the occurrence, fate and transport of COCs. Testing included bulk analysis of Appendix III/IV parameters; sequential extraction procedure analysis; partition coefficient analysis; pH dependent batch leaching tests; column leaching test of source material; clay mineral analysis; and Heavy Mineral Separation and Mineralogic and Chemical Analysis using a combination of XRD, XRF, and ICP-MS techniques to provide a qualitative and quantitative assessment of mineralogy and major and trace elements. Results of geochemical analysis related to the fate and mobility of COCs in groundwater were used to form a conceptual understanding of the soil geochemistry and hydrogeology, and integrated to inform the assessment of remedial alternatives.

The geochemistry and environmental fate and transport of lithium is summarized in *Chemical Constituents in Coal Combustion Products: Lithium.* (EPRI, Palo Alto, CA: 2018. 3002012311), and pertinent information from this guidance document relative to the ACM is provided below. In addition, a literature review was performed to collect published soil/water partition coefficient (K_d) values for lithium. The K_d is a factor that is applied to the groundwater seepage velocity rate, to account for the retardation (i.e., slowing down) of a dissolved contaminant due to partitioning (i.e., by adsorption to solid particles) of the contaminant between solid and dissolved phases. K_d is defined as the ratio of: the

[20] *Use of Monitored Natural Attenuation for Inorganic Contaminants in Groundwater at Superfund Sites* (OSWER Directive 9283.1-36, August 2015) (EPA 2015c).

contaminant concentration sorbed per unit mass of solid, to the dissolved concentration of the contaminant remaining in solution at equilibrium, or

K_d = Contaminant Concentration in Soil / Contaminant Concentration Dissolved in Groundwater.

The literature-derived K_d values are used to calculate retardation factors for lithium as part of the ACM. K_d values vary based on factors such as: method of analysis; soil composition (e.g. grain size, mineralogy, organic matter content, initial COC concentration); water composition (e.g. initial COC concentration, pH); and solid/liquid ratio. Therefore, the literature search was limited to references that provide overview of multiple studies to gain an understanding of the degree of variability, as well as studies based on conditions generally similar to those encountered at the site (e.g. granular soils and near neutral groundwater pH). A summary of the literature review is provided in Exhibit 2.

Exhibit 2 – Summary of Literature Review - Partition Coefficient Values

Analyte	Soil/Water Partition Coefficient (mL/g)	Reference	Notes
Lithium	0.0	(a) USDOE 1989	pH 5 to 9, sandy soils
	0.2		pH 5 to 9, loamy soils
	0.8		pH 5 to 9, clayey soils

Notes:
1. References:
(a) Chemical Data Bases for the Multimedia Environmental Pollutant Assessment System (MEPAS): Version 1, prepared by Strenge, D.L. and Peterson, S.R. (Pacific Northwest National Laboratory operated by Battelle) on behalf of the U.S. Department of Energy, dated December 1989.

2. Soil/water partition coefficients (K_d) are presented in units of milliliters per gram (mL/g).

Lithium is generally weakly or not taken up by soils (low K_d), and its leaching is expected to decrease as pH increases. These relatively low K_d values are consistent with the generally relatively weak cation exchange strength of lithium relative to the other monovalent cations (e.g., Na^+, K^+, Rb^+) and divalent cations (e.g., Mg^{2+}, Ca^{2+}, Co^{2+})[21] (Rose et al, 1979). Lithium is thought to substitute for major elements such as sodium or potassium in silicate minerals such as clays and feldspars. Lithium may therefore be weakly attenuated in the shallow silty clay soils beneath the BAPs but would be expected to be relatively mobile in the groundwater present in the deeper sand and gravel under existing Site conditions. This information, along with the observation of generally elevated lithium concentrations (relative to the GWPS of 40 µg/l) in groundwater in the downgradient wells, suggest that lithium is relatively mobile under site conditions.

[21] Rose, A.W., Hawkes, H.E. and Webb, J.S. (1979) Geochemistry in Mineral Exploration. 2nd Edition, Academic Press, London, 658.

3.0 IDENTIFICATION AND DEVELOPMENT OF CORRECTIVE MEASURE ALTERNATIVES

This section of the report identifies remedial technologies that are applicable to the groundwater conditions at the Site and evaluates the merits of using each technology for development of corrective measure alternatives to achieve the corrective action objectives discussed in this section. Selection of remedial technologies and development of corrective measure alternatives for the Site was performed with the understanding that AEP will include source control in conjunction with groundwater remedial technologies.

3.1 Establishment of Corrective Action Objectives

Based on the CSM described above, and in accordance with the CCR Rule, the following remedial objectives were developed for the Site:

- Be protective of human health and the environment;
- Prevent potential human or environmental exposure to groundwater impacted by lithium, including potential downgradient receptors, at concentrations exceeding USEPA Maximum Contaminant Levels (MCLs) and GWPSs;
- Restore groundwater quality within the aquifer consistent with the GWPS;
- Control the CCR source material to limit the potential for release of lithium into groundwater;
- Remove from the environment as much of the contaminated material as is feasible without inappropriate disturbance of sensitive ecosystems; and
- Comply with waste management standards.

3.2 Screening and Evaluation of Remedial Technologies

Sanborn Head performed an initial screening and evaluation of multiple remedial technologies, which is included in Table 1. The evaluation for the Site included a range of general response actions, including: no further action, institutional controls, monitored natural attenuation, in-situ treatment, ex-situ treatment and discharge, containment, and source control. The remedial technologies were evaluated based on their risk reduction and protectiveness, potential effectiveness in the treatment of lithium contamination in groundwater based on available literature, and ease of implementation with respect to site conditions. A brief summary of the Table 1 general response actions (GRAs), not including No Further Action, evaluated is presented below.

- Institutional Controls – Institutional controls were retained for development of corrective measures. Although they are not considered a treatment remedy, they can be important tools for the protection of receptors while remediation is ongoing.
- Passive In-Situ Treatment – These remedial technologies include passive measures to reduce contaminant concentrations below the GWPS developed for the Site. For the ACM,

we evaluated the Attenuation technology, specifically monitored natural attenuation, which was retained for development of corrective measures.

- Active In-Situ Treatment – This category includes active remedial technologies implemented at the existing location of the contamination. For the ACM, we evaluated two forms of sorption/precipitation technologies, including permeable reactive barriers and in-situ stabilization. Permeable reactive barriers were retained for development of corrective measures based on ongoing research and testing, carried out by a team including AEP, to identify reactive media effective at adsorbing lithium from water. In-situ stabilization was not retained based on concerns that common stabilization materials, such as Portland cement, could affect in-situ geochemistry and mobilize other potential contaminants.

- Ex-Situ Treatment – Several ex-situ treatment technologies were evaluated for alternatives including extraction of contaminated groundwater, which would require removal of lithium and other potential contaminants prior to disposal of treated groundwater. Reverse osmosis, chemical precipitation, and ion exchange were all eliminated from consideration because of unproven effectiveness to reliably remove lithium from water. Adsorption was retained for development of corrective measures based on ongoing research of adsorbent media being conducted by a team including AEP.

- Containment – Containment technologies are intended to isolate contamination in source zones from spreading into downgradient areas. Isolation of contaminated areas can be accomplished by the construction of an impermeable barriers preventing leaching of contamination from solid source materials (such as the stabilization/solidification, lined landfill, or barrier cap options) and/or barriers intended to prevent migration of contaminated groundwater (e.g., impermeable barrier walls or hydraulic containment). Of the technologies identified and evaluated in Table 1, only hydraulic containment was retained for development of corrective measures because a system of groundwater extraction wells that could be operated as a hydraulic containment system already exists at the Site.

- Removal and Disposal – Excavation and removal of source materials, i.e. the CCR present in the BAP complex, was retained for development of corrective measures on the basis of effectiveness and the CCR regulations requirements for closure of CCR impoundments and the reduction of source materials.

As summarized in Table 1, the following technologies were retained for development of corrective measures alternatives:

- Institutional Controls;

- Passive In-Situ Treatment by Monitored Natural Attenuation;

- Active In-situ Treatment by Permeable Reactive Barrier;

- Active Ex-situ Treatment by Mixed Metals Oxides Adsorption Media;

- Groundwater Plume Containment by Hydraulic Containment System; and
- Source Control (bottom ash will either be removed by excavation or the bottom ash ponds will be capped in-place).

3.3 Development of Corrective Measures Alternatives

The primary corrective measure for each alternative includes source control. In addition to implementation of the source control measures, each alternative includes a different groundwater remediation approach that has the potential to meet the corrective action objectives of preventing potential human exposure to groundwater impacted by lithium and restoring groundwater quality within the aquifer consistent with MCLs/GWPS. The three remedial alternatives developed for detailed evaluation include:

- Alternative #1: Source Removal and Disposal with Monitored Natural Attenuation
- Alternative #2: Source Removal and Disposal with Groundwater Plume Containment by Hydraulic Containment System
- Alternative #3: Source Removal and Disposal and In-Situ Groundwater Treatment by Permeable Reactive Barrier

In addition to source removal, each alternative includes institutional controls to restrict use of the groundwater as drinking water until the corrective action objectives are met. Each alternative is discussed and evaluated in detail in the following section.

4.0 DETAILED EVALUATION OF CORRECTIVE MEASURE ALTERNATIVES

As discussed in Section 3.0, three remedial alternatives have been developed that have the potential to be implemented at the Site to prevent further releases of lithium and to remediate existing lithium impacts to groundwater. Each of these alternatives includes removal of the CCR source material thereby significantly reducing or eliminating additional contaminant mass flux to groundwater. Sanborn Head performed an evaluation of each alternative based on the criteria in 40 CFR 257.96 and 257.97 including:

- Overall Protection of Human Health and the Environment[22]
- Ability to Comply with Groundwater Protection Standard
- Source Control and Reduction of Contaminated Material
- Long-Term Effectiveness/Reliability
- Short-Term Effectiveness
- Ease of Implementation
- Long-Term Management Requirements
- Community Acceptance
- State Acceptance
- Time Required to Meet Remedial Objectives

[22] Potential impacts of the potential remedy, including safety, cross-media, and exposure impacts, will be discussed under this criterion.

The following three subsections include an evaluation of the above criteria for each of the three alternatives.

4.1 Alternative 1 – Source Removal and Disposal with Monitored Natural Attenuation

This alternative includes monitored natural attenuation (MNA) of the dissolved phase plume following removal and disposal of CCR source material from the BAPs. MNA would be facilitated by the removal of CCR source material that would reduce or eliminate the contaminant mass flux into the groundwater from the BAPs. The conceptual approach for this alternative is presented on Figure 6. The alternative involves routine periodic monitoring of the existing groundwater monitoring network for a list of analytes similar to the current CCR monitoring program[23]. MNA relies on naturally occurring subsurface processes that act to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in groundwater. These processes include oxidation/reduction, precipitation, sorption, dispersion and dilution. As discussed in Section 2.3.6, US EPA recommends a tiered approach for assessment of MNA in groundwater at sites with inorganic contaminants. Assessment of suitability of MNA at the site has been initiated as part of the ACM and will continue during assessment for selection of the remedy. Completed and on-going assessment includes understanding of site groundwater hydraulics to control the extent of the plume, evaluation of plume stability and attenuation, and geochemical assessment of site soils to determine capacity for attenuation and/or immobilization of the contaminant.

4.1.1 Overall Protection of Human Health and the Environment

The combination of CCR source material removal and MNA would significantly reduce or eliminate CCR contaminant leaching to groundwater and allow for dissolved concentrations in groundwater to attenuate over time. During the attenuation process, institutional controls would protect local residents and other potentially affected people by limiting exposure to impacted groundwater. In addition, this Alternative is protective of the New Haven public water supply wells located along the northwest property boundary, based on a groundwater modeling simulation showing no migration of contaminant to the wells.

This alternative is anticipated to maintain current groundwater chemistry conditions (e.g., pH), therefore, selecting this remedial alternative would not likely result in unintended changes to concentrations of other metals that may be present.

Excavation and removal of the CCR material could create the potential for worker exposure to contaminated material and potential off-site fugitive dust emissions; however, the impact is anticipated to be short-term and could be managed with engineering controls.

[23] Ash Pond System-CCR Groundwater Monitoring Well Network Evaluation, Mountaineer Plant, prepared by Arcadis U.S., Inc., on behalf of AEP, dated October 27, 2016.

4.1.2 Ability to Comply with Groundwater Protection Standard

This alternative provides the Site the ability to comply with the GWPS over time through source removal and natural attenuation.

4.1.3 Source Control and Reduction of Contaminated Material

Ceasing discharge of bottom ash and sluice water into the BAPs and excavating and removing existing CCR material in the BAP with disposal in the Site's lined landfill would adequately control the source. The concentration of dissolved lithium in groundwater and in unsaturated overburden materials beneath the current BAPs would reduce naturally over time through advective transport, dispersion, dilution, and sorption. Initial evaluation suggests that lithium is stable or decreasing in monitoring wells downgradient of the BAP. Review of groundwater hydraulics at the site indicates that the plume is being controlled by extraction of groundwater that is required for plant operation. The current nature and extent of the plume is understood, and existing conditions are protective of human health and the environment. Initial geochemical evaluation of site soils suggests that there is some potential for attenuation and immobilization of lithium on site soils.

4.1.4 Long-Term Effectiveness

The effectiveness of this remedy relies on completion of source removal in the BAP complex and ceasing discharge of additional CCR material to the BAPs, which will effectively eliminate future input of lithium to groundwater. Once the contamination source is removed, it is expected that natural attenuation will reduce lithium concentrations over time. Monitored natural attenuation has been effectively used as a passive remedy for groundwater remediation at numerous sites throughout the U.S. and is a proven and widely accepted approach; reliability and permanence are considered probable.

This alternative relies on a strong understanding and characterization of subsurface conditions. With the removal and disposal of the CCR source material, the mass of lithium available for leaching will be limited, and hence lithium leaching is expected to decrease with time assuming current groundwater pH and redox conditions are maintained. Our review of historical data sources, and additional Site characterization and data analysis conducted including plume stability analysis and groundwater modeling confirm our understanding that the subsurface conditions at the Site are sufficiently stable to employ this approach.

4.1.5 Short-Term Effectiveness

Removing and disposing of the source material from the BAPs will have a positive effect in the short term by significantly decreasing, and potentially eliminating mass flux of additional contaminant to groundwater. Groundwater monitoring will provide verification of effectiveness and is expected to indicate decreasing concentrations of lithium in groundwater within several years of completion of source removal activities. However, the short-term effectiveness of achieving the GWPSs at locations hydrogeologically downgradient from the BAPs (e.g., near the Mountaineer Plant) may be influenced by contaminant contribution to groundwater from other potential sources near the BAP complex (e.g., the Sporn Plant former ash ponds).

4.1.6 Ease of Implementation

Removal of CCR material from the BAPs is implementable using standard earthwork construction equipment with disposal of the excavated material in the Little Broad Run Landfill. MNA could be readily implemented using the existing groundwater monitoring network for a list of analytes similar to the current CCR monitoring program. MNA does not require direct energy inputs and would not remove water from the aquifer.

Prior to implementation of the excavation and removal phase, an engineered design plan should be developed that considers the geotechnical requirements for BAP stability, dewatering requirements, wastewater management/treatment processes, and construction sequencing.

4.1.7 Long-Term Management Requirements

Groundwater monitoring to evaluate the progress of attenuation, distinguish contaminant contribution to groundwater from other potential sources near the BAP complex (e.g., the Sporn Plant former ash ponds), and ensure that GWPSs are met are the only long-term management requirements for this option. Groundwater monitoring is anticipated to occur on a semi-annual basis until the GWPSs are met.

4.1.8 Community Acceptance

Currently, no concerns relating to local permitting or approval processes have been identified. Community acceptance will be assessed during public meetings.

4.1.9 State Acceptance

State acceptance of this alternative requires a Solid Waste Landfill Permit and a Construction Stormwater General Permit. As the area disturbed during source removal would exceed three (3) acres, as part of the construction stormwater general permitting process a Construction Site Registration Application must be submitted at least forty-five (45) days prior to site disturbance. Also, the proximity of Little Broadrun Stream would necessitate the establishment of a fifty (50) foot natural vegetative buffer in addition to other erosion control BMPs. AEP already possesses Solid Waste Landfill Permit WV077038 which may need to be modified under this alternative.

4.1.10 Time Required to Meet Remedial Objectives

Because lithium will not degrade in the subsurface, MNA will reduce lithium concentrations in groundwater over time through natural attenuation processes such as advective transport, dilution, dispersion, and sorption. Based on attenuation modeling and predicted conditions at the Site following source removal, the time for this Alternative to reach GWPSs for the contaminant of concern is estimated to be approximately 10 years or longer depending on actual conditions. The actual timeframe to reach GWPSs may be influenced by contaminant contribution to groundwater from other potential sources near the BAP complex (e.g., the Sporn Plant former ash ponds).

4.2 Alternative 2 – Source Removal and Disposal with Groundwater Plume Containment by Hydraulic Containment System

This alternative proposes operating up to five of the groundwater pumping wells that are currently active at the Site to provide hydraulic control of the groundwater plume following removal of the CCR source material in the BAP and disposal of that material in the Site's lined landfill. As groundwater is pumped from the extraction well network, a hydraulic gradient is created that draws the contaminated groundwater towards the extraction wells and limits or prevents the contaminated water from migrating off site. The conceptual approach for this alternative is presented on Figure 7.

The two primary wells proposed for the hydraulic containment system (HCS) include West 1 and East 1, which provide cooling and process water for the Site. West 1 and East 1 have pumping capacities of approximately 930-950 gallons per minute (gpm) and 550-575 gpm, respectively. Wells 4, 5 and 6 would be pumped at lower flow rates than West 1 and East 1 and would be operated on an intermittent basis to supplement the HCS as needed to maintain hydraulic capture of contaminated groundwater at the Site. The HCS would include automated groundwater elevation measurement at the Site to track hydraulic control and to guide adjustment of relative pumping rates of the five groundwater extraction wells.

Like current site operations, the extracted water would be used for Site operations and then delivered to the Site's wastewater treatment plant (WWTP) prior to discharge at the Ohio River outfall where it would be monitored in accordance with the Site's National Pollutant Discharge Elimination System (NPDES) permit.

Within the source area, natural attenuation processes such as advective transport, sorption, dispersion, and dilution would act on the existing groundwater and unsaturated overburden materials to gradually reduce the residual contaminant mass in the area until compliance with GWPSs was achieved.

4.2.1 Overall Protection of Human Health and the Environment

The combination of CCR removal and hydraulic containment would remove contaminant mass from the ground and minimize further leaching to groundwater. This method would also significantly reduce and potentially eliminate off-site migration of lithium and allow for concentrations of contaminant to attenuate. Reduction or elimination of off-site migration would reduce unmonitored release of lithium to the surface waters of the Ohio River and reduce the potential for exposure of environmental receptors to lithium from groundwater.

During the attenuation process, institutional controls would protect local residents and other potentially affected people by limiting exposure to impacted groundwater. In addition, this alternative is protective of the New Haven public water supply wells located along the northwest property boundary, based on a groundwater modeling simulation showing no migration of contaminant to the wells.

This alternative is anticipated to maintain current groundwater chemistry conditions (e.g., pH) and would not likely result in unintended changes to concentrations of other metals that may be present.

Excavation and removal of the CCR material could create the potential for worker exposure to contaminated material and potential off-site fugitive dust emissions as well as safety hazards common to earthmoving and construction activities; however, the impact is anticipated to be short-term and could be managed with engineering controls.

The utilization of extracted water for Site operations could create the potential for worker exposure, although the likelihood of contact is minimal due to the essentially non-volatile nature of lithium and enclosed process equipment. Final discharge to the Ohio River would not present a concern to human health and the environment as the discharge would meet regulatory standards.

4.2.2 Ability to Comply with Groundwater Protection Standard

This alternative provides the Site the ability to comply with the GWPS over time through source removal, containment and extraction of contaminated groundwater, and natural attenuation.

4.2.3 Source Control and Reduction of Contaminated Material

Ceasing discharge of bottom ash and sluice water into the BAPs and excavating and removing existing CCR material in the BAP with disposal at the Site's lined landfill would adequately control the source of contamination. Reduction of contaminated groundwater would be achieved through contaminant mass removal via the HCS and through natural attenuation involving, dispersion, dilution, and sorption over time.

Reduction of lithium mass in the extracted groundwater during treatment at the WWTP will need to be evaluated during remedy selection. The existing WWTP which includes settling and chemical precipitation/clarification unit operations intended to remove solid particles and metals, which may provide some lithium removal. Additional lithium removal may be achievable with mixed metal oxide adsorbent materials or other similar amendments used in water treatment facilities for the removal of arsenic. AEP, in conjunction with others, is currently studying the effectiveness of these materials for treatment of lithium-contaminated groundwater, both in-situ and ex-situ, and initial results are encouraging.

4.2.4 Long-Term Effectiveness/Reliability

The effectiveness of this remedy relies on two integrated measures. First, the completion of source removal in the BAP complex will effectively eliminate future mass flux of lithium from the BAPs to groundwater. Second, the containment and extraction of contaminated groundwater will significantly reduce and potentially eliminate off-site migration of lithium and remove contaminant mass from groundwater. While mass removal rates of groundwater extraction are typically low, the reliability and permanence of this approach is considered probable.

This alternative relies on a strong understanding and characterization of subsurface conditions. With the removal and disposal of the CCR source material, the mass of lithium available for leaching will be limited, and hence lithium leaching is expected to decrease with

time assuming current groundwater pH and redox conditions are maintained. Our review of historical data sources, and additional Site characterization and data analysis conducted including plume stability analysis and groundwater modeling confirm our understanding that the subsurface conditions at the Site are sufficiently stable to employ this approach.

The alternative relies on the on-site treatment of extracted groundwater and discharge of the treated groundwater to the Ohio River in accordance with the Site's existing NPDES permit. The existing WWTP is currently treating extracted groundwater sufficiently to meet the discharge criteria of the Site's NPDES permit. As noted above, the ability of the existing wastewater treatment to remove lithium from the extracted groundwater is not currently known, although AEP, with others, is investigating potential treatment technologies for their effectiveness to remove lithium.

4.2.5 Short-Term Effectiveness

Removing and disposing of the source material from the BAPs will have a positive effect in the short term by significantly decreasing, and potentially eliminating mass flux of additional contaminant to groundwater. Operating the HCS will also have a positive effect in the short term by significantly decreasing, and potentially eliminating off-site migration of lithium. Groundwater monitoring will provide verification of effectiveness and is expected to indicate decreasing concentrations of lithium in groundwater within the BAP complex within several years, and the containment of contaminated groundwater while the HCS is operated. Also, monitoring of extracted and treated groundwater will provide a method to assess contaminant mass removal to evaluate the effectiveness of the approach.

The short-term effectiveness of achieving the GWPSs at locations hydrogeologically downgradient from the BAPs (e.g., near the Mountaineer Plant) may be influenced by contaminant contribution to groundwater from other potential sources near the BAP complex (e.g., the Sporn Plant former ash ponds); however, HCS is anticipated to effectively contain contaminated groundwater at and downgradient from the BAP complex in the short term.

4.2.6 Ease of Implementation

Removal of CCR material from the BAPs is implementable using standard earthwork construction equipment with disposal of the excavated material in the Little Broad Run Landfill. Prior to implementation of the excavation and removal phase, an engineered design plan should be developed that considers the geotechnical requirements for BAP stability, dewatering requirements, wastewater management/treatment processes, and construction sequencing.

Hydraulic containment is readily implementable using existing facility groundwater extraction wells and treatment processes. Monitoring can be performed prior to discharge for a list of analytes similar to the current CCR monitoring program and discharge monitoring under the Site's NPDES permit.

In the case that the Mountaineer Power Plant ceases operations before the corrective action objectives are met, a groundwater extraction and treatment system may need to be

implemented. In addition, if the existing facility treatment processes do not meet the contaminant removal requirements, additional ex-situ treatment may need to be applied as described above.

4.2.7 Long-Term Management Requirements

Long-term management requirements for this alternative include operation and maintenance of the HCS and the Site's wastewater treatment systems. Monitoring of groundwater elevation and flow direction, as well as groundwater and WWTP effluent water quality would be required to evaluate the effectiveness of the HCS and the progress of attenuation to ensure that GWPSs are met. In addition, groundwater monitoring to distinguish contaminant contribution to groundwater from other potential sources near the BAP complex (e.g., the Sporn Plant former ash ponds) is included to evaluate the effectiveness of this alternative at meeting the GWPSs.

4.2.8 Community Acceptance

Currently, no concerns relating to local permitting or approval processes have been identified based on the Alternative's similarity to current operations. Community acceptance will be assessed during public meetings.

4.2.9 State Acceptance

Similar to Alternative 1, state acceptance of this alternative requires a Solid Waste Landfill Permit and a Construction Stormwater General Permit. As the area disturbed during source removal would exceed three (3) acres, as part of the construction stormwater general permitting process a Construction Site Registration Application must be submitted at least forty-five (45) days prior to site disturbance. Also, the proximity of Little Broad Run Stream would necessitate the establishment of a fifty (50) foot natural vegetative buffer in addition to other erosion control BMPs. AEP already possesses Solid Waste Landfill Permit WV077038, which may need to be modified under this alternative.

Alternative 2 additionally requires an Individual Industrial Facilities NPDES Permit to discharge extracted water to the Ohio River. AEP already possesses Individual Industrial Facilities NPDES Permit WV0048500 for discharge of treated wastewater to the Ohio River. The current NPDES permit expired in 2013, and although AEP has submitted a permit renewal application and provided supplemental information in 2018, a renewed permit has not been issued to AEP yet. Under current conditions, the Site's wastewater treatment plant is able to comply with discharge permit limits, and although the relative groundwater pumping rates of the five, existing groundwater extraction wells may shift over time to better maintain the effectiveness of the HCS, it is unlikely that adjustment of relative pumping rates will significantly affect the operation of the wastewater treatment plant or prevent the plant from achieving discharge limits.

Based on communications with the West Virginia Department of Environmental Protection (WVDEP), in the case that a new or modified groundwater extraction and treatment system needs to be implemented (e.g., if the Mountaineer Power Plant ceases operations before the corrective action objectives are met) the NDPES permit may need to be modified. In addition,

if the existing facility treatment processes do not meet the contaminant removal requirements and additional ex-situ treatment is required, a modification to the NDPES permit may be required.

4.2.10 Time Required to Meet Remedial Objectives

Because lithium has not been demonstrated to readily degrade in the subsurface, natural attenuation will reduce lithium concentrations over time through natural attenuation processes such as dilution, dispersion, and sorption. The operation of the HCS has the potential to accelerate the attenuation process through additional flushing of groundwater through areas with residual contamination. Based on attenuation modeling and predicted conditions at the Site following source removal and operation of the HCS, the time to reach GWPSs for lithium within the existing BAP complex is estimated to be approximately 5 years.

Achievement of GWPSs in the areas downgradient of the existing BAP complex would be accelerated relative to Alternative 1 by operation of the HCS. The time to reach GWPSs for lithium downgradient of the existing BAP complex is estimated to be approximately 5 years or longer depending on actual conditions. The actual timeframe to reach GWPSs may be influenced by contaminant contribution to groundwater from other potential sources near the BAP complex (e.g., the Sporn Plant former ash ponds).

4.3 Alternative 3 – Source Removal and Disposal and In-Situ Treatment by Permeable Reactive Barrier

This alternative includes installation of an on-site permeable reactive barrier (PRB) located hydrogeologically downgradient from the BAPs along the northwestern and northeastern edges, as shown on Figure 8. The proposed PRB would include an engineered reactive amendment/media that is intended to remove lithium from groundwater by precipitation and/or sorption to the media to reduce the concentration of lithium in groundwater downgradient of the PRB. The PRB would transect the aquifer and be keyed into the underlying low-permeability layer (sandstone bedrock) to provide contact with the plume across the vertical extent of the permeable saturated zone, as shown on Figure 9. This alternative would decrease concentrations downgradient from the PRB as contaminant mass would be removed from the groundwater as it passes through the media.

4.3.1 Overall Protection of Human Health and the Environment

The combination of CCR removal and in-situ treatment is a two-stage approach. First, source removal would remove contaminant mass from the ground and minimize further leaching to groundwater. Eliminating the contaminant source would allow for concentrations of contaminant to attenuate through sorption, dispersion, and dilution. Second, installation of a PRB would potentially eliminate off-site migration of lithium and allow for downgradient attenuation. Reduction or elimination of off-site migration would reduce unmonitored release of lithium to the surface waters of the Ohio River and reduce the potential for exposure of environmental receptors to lithium from groundwater.

During the attenuation process, institutional controls would protect local residents and other potentially affected people by limiting exposure to impacted groundwater. In addition,

this alternative is protective of the New Haven public water supply wells located along the northwest property boundary, based on a groundwater modeling simulation showing no migration of contaminant to the wells.

Based on ongoing research conducted by a team of power-generation industry organizations, including AEP, this alternative is anticipated to maintain current groundwater chemistry conditions (e.g., pH) and would not likely result in unintended changes to concentrations of other metals that may be present.

Excavation and removal of the CCR material could create the potential for worker exposure to contaminated material and potential off-site fugitive dust emissions as well as safety hazards common to earthmoving and construction activities; however, the impact is anticipated to be short-term and could be managed with engineering controls.

Installation of a PRB could involve the disruption of surface and deep soils which could create the potential for worker exposure to contaminated material and off-site fugitive dust emissions as well as safety hazards common to drilling, earthmoving and construction activities. AEP and others are conducting pilot testing on the feasibility of injectable reactive media as an alternative to excavation and placement of reactive material in slurry trenches. After installation, PRB treatment is not expected to pose further environmental or human health risks as operation is in the subsurface region; however, if media replacement is required, disruption of surface and deep soils could create the potential for worker exposure and off-site fugitive dust emissions during the replacement work.

While PRB treatment is expected to capture lithium and therefore limit off-site and downgradient migration, permanent immobilization is uncertain. Mobilization of previously captured contaminant could create future exposure concerns. AEP is part of a team that are currently planning pilot studies for implementation of PRBs at CCR sites which include evaluations of potential remobilization of adsorbed contaminants. If remobilization of adsorbed contaminants is confirmed, removal and disposal of spent PRB materials, and/or placement/injection of additional PRB materials might increase the long-term protectiveness of this alternative.

4.3.2 Ability to Comply with Groundwater Protection Standard

This alternative provides the Site the ability to comply with the GWPS over time through source removal, immobilization of lithium, and natural attenuation.

4.3.3 Source Control and Reduction of Contaminated Material

Ceasing discharge of bottom ash and sluice water into the BAPs and excavating and removing existing CCR material with disposal at the Site's lined landfill would adequately control the source of contamination. Reduction of contamination in groundwater would be achieved by immobilizing lithium using a PRB and through natural attenuation involving advective transport, dispersion, dilution, and sorption over time. Removal and disposal of spent PRB materials would remove additional contaminant mass from the subsurface, particularly if ongoing monitoring suggests that remobilization of lithium from the PRB is occurring.

4.3.4 Long-Term Effectiveness/Reliability

The effectiveness of this remedy relies on two integrated measures. First, the completion of source removal in the BAP complex will significantly reduce or eliminate future mass flux of contaminant to groundwater. Once the contamination source is removed, it is expected that natural attenuation will reduce lithium groundwater concentrations in areas upgradient of the PRB over time.

Second, the immobilization of lithium in groundwater passing through the PRB will likely eliminate off-site migration of lithium and facilitate attenuation in downgradient groundwater. AEP is part of a team currently conducting research into the feasibility and performance of materials capable of in-situ adsorption of lithium, including planned PRB pilot-testing at the Mountaineer facility. This research is intended to provide information on the adsorptive capacity of potential PRB materials in field conditions, the likelihood of remobilization of lithium over time, and further assess the potential for the PRB to cause changes to groundwater conditions which may affect groundwater quality.

This alternative relies on a strong understanding and characterization of subsurface conditions. With the removal and disposal of the CCR source material, the mass of lithium available for leaching will be limited, and hence lithium leaching is expected to decrease with time assuming current groundwater pH and redox conditions are maintained. Our review of historical data sources, and additional Site characterization and data analysis conducted including plume stability analysis and groundwater modeling confirm our understanding that the subsurface conditions at the Site are sufficiently stable to employ this approach.

4.3.5 Short-Term Effectiveness

Removing and disposing of the source material from the BAPs will have a positive effect in the short term by significantly decreasing, and potentially eliminating mass flux of additional contaminant to groundwater. Installation of a PRB will also have a positive effect in the short term by significantly decreasing, and potentially eliminating off-site migration of lithium.

Groundwater monitoring will provide verification of effectiveness and is expected to indicate decreasing concentrations of lithium in groundwater within the BAP complex within several years, and the immediate containment of contaminated groundwater emanating from the BAPs. Monitoring will also help gauge the ongoing effectiveness and required management of the PRB, as return of contamination in downgradient groundwater could indicate that the PRB media is spent and requires renewal (e.g., installation of additional reactive media).

The short-term effectiveness of achieving the GWPSs at locations hydrogeologically downgradient from the BAPs (e.g., near the Mountaineer Plant) may be influenced by contaminant contribution to groundwater from other potential sources near the BAP complex (e.g., the Sporn Plant former ash ponds); however, installation of a PRB as described in Alternative 3 is anticipated to effectively contain contaminated groundwater emanating from the BAPs in the short term.

4.3.6 Ease of Implementation

Removal of CCR material from the BAPs is implementable using standard earthwork construction equipment with disposal of the excavated material in the Little Broad Run Landfill. Prior to implementation of the excavation and removal phase, an engineered design plan should be developed that considers the geotechnical requirements for BAP stability, dewatering requirements, wastewater management/treatment processes, and construction sequencing/coordination with installation of the PRB.

Three approaches to implementation of the PRB are possible. The first option involves installation of the PRB as a bio-polymer slurry trench filled with reactive media that is keyed into the lower permeability sandstone and shale materials at depths up to approximately 80-90 feet below grade. This installation could be accomplished using a modified backhoe with an extended boom or a clamshell-type excavator along with use of a biodegradable polymer liquid that could be pumped into the trench during excavation to provide stability to the excavated trench walls. However, installation to depths of up to 90 feet below grade and 50 feet below the water table could result in a high risk of construction difficulties. The presence of flowing or running sands, as observed during previous drilling operations at the Site, in the subsurface could eliminate this method of construction or necessitate use of a non-continuous permeable trench (e.g., alternating reactive "panels" and low permeability elements to improve trench stability during excavation) as it would be very difficult to keep the trench from collapsing during construction. This method would also require a working platform wide enough to accommodate removal of spoils from excavation, and the area between the downgradient edge of the existing BAPs and the Site property boundary is limited.

The second option would be to mix an amendment material directly to the soil, typically using soil augers in overlapping boreholes to turn over soil as the amendment suspended in water is fed into the borehole. Soil mixing becomes more difficult as the remediation depth increases, and a total depth of 90 feet is likely beyond the limit of the technology. Similar to the slurry trench method described above, soil mixing equipment would require a working platform wide enough to accommodate the mixing equipment, and the area between the downgradient edge of the existing BAPs and the Site property boundary is limited.

The third installation option for the PRB would depend on the properties of the selected amendment/media (e.g., particle size). The PRB could potentially be installed as a network of injection borings. Success of an injectable PRB depends on:

- The particle size of the amendment/media is large relative to the available pore size of subsurface soils in the PRB alignment.
- Uniform radial distribution of reactive material from each injection point.

AEP is part of a team currently planning a pilot test of an injectable PRB material to develop information on injection radius of influence and injection rates for several possible amendments at the Mountaineer site.

4.3.7 Long-Term Management Requirements

Long-term management requirements for this alternative include groundwater monitoring to evaluate the effectiveness of the PRB, distinguish contaminant contribution to groundwater from other potential sources near the BAP complex (e.g., the Sporn Plant former ash ponds), and the progress of attenuation to ensure that GWPSs are met. Monitoring will help gauge the ongoing effectiveness and required management of the PRB, as return of contamination in downgradient groundwater could indicate that the PRB media is spent and requires renewal (e.g., installation of additional reactive media). Other than monitoring, the routine operational requirements of the PRB wall are limited, unless supplemental renewal of PRB media is required. If renewal is required, an effort similar to the initial installation of the PRB would be required although only expended portions of the wall would require renewal.

4.3.8 Community Acceptance

Currently, no concerns relating to local permitting or approval processes have been identified. Community acceptance will be assessed during public meetings.

4.3.9 State Acceptance

Similar to Alternatives 1 and 2, state acceptance of this alternative requires a Solid Waste Landfill Permit and a Construction Stormwater General Permit. As the area disturbed during source removal would exceed three (3) acres, as part of the construction stormwater general permitting process a Construction Site Registration Application must be submitted at least forty-five (45) days prior to site disturbance. Also, the proximity of Little Broad Run Stream would necessitate the establishment of a fifty (50) foot natural vegetative buffer in addition to other erosion control BMPs. AEP already possesses Solid Waste Landfill Permit WV077038, which may need to be modified under this alternative.

Alternative 3 would additionally require a Rule Authorization Letter (RAL) approving installation of the PRB, as the construction methods (either slurry trench or injection well) would require the injection of a fluid into the subsurface. Based on correspondence with the WVDEP, obtaining an RAL would allow the installation of the PRBs described in Alternative 3 without obtaining an Underground Injection Control (UIC) permit.

4.3.10 Time Required to Meet Remedial Objectives

Because the contaminant of concern has not been demonstrated to readily degrade in the subsurface, natural attenuation will reduce lithium concentrations over time through natural attenuation processes such as dilution, dispersion, and sorption. Based on attenuation modeling and predicted conditions at the Site following source removal, the time to reach GWPSs for lithium within the existing BAP complex is estimated to be approximately 8 years.

Achievement of GWPSs in the areas downgradient of the PRB would be accelerated relative to Alternative 1 by the significant reduction or elimination of off-site migration of contaminant. The time to reach GWPSs for lithium downgradient of the PRB is estimated to be approximately 8 years or longer depending on actual conditions. The actual timeframe to

reach GWPSs may be influenced by contaminant contribution to groundwater from other potential sources near the BAP complex (e.g., the Sporn Plant former ash ponds).

5.0 SUMMARY

A comparative summary of remedial alternatives for the BAPs is presented in the Risk-Based Technical Options (RBTO) Matrix included in Table 2. The RBTO Matrix lists the three options (i.e., alternatives) evaluated for the BAPs, the risks associated with each option, the benefits of each option, and the key assumptions.

In accordance with the CCR Rule, at least 30 days prior to selecting a corrective measure alternative, AEP will organize a public meeting to solicit input from interested and affected parties. Based on the results of this ACM report, and in consideration of any public comments received, AEP will select a corrective measure alternative that will achieve the corrective action objectives described in this report.

6.0 REFERENCES

- *History of Construction CFR 257.73(c)(1) Bottom Ash Complex Mountaineer Plant*, prepared by American Electric Power Service Corporation on behalf of Appalachian Power Company, dated October 2016.
- *Annual Groundwater Monitoring Report, Appalachian Power Company Mountaineer Plant, Landfill CCR Management Unit*, prepared by American Electric Power Service Corporation, dated January 2019
- *Little Broad Run Landfill – CCR Groundwater Monitoring Well Network Evaluation*, Mountaineer Plant prepared by Arcadis, on behalf of AEP, dated October 18, 2016.
- *Ash Pond System-CCR Groundwater Monitoring Well Network Evaluation*, Mountaineer Plant, prepared by Arcadis, on behalf of AEP, dated October 27, 2016.
- *Statistical Analysis Summary Bottom Ash Pond*, Mountaineer Plant, prepared by Geosyntec Consultants, on behalf of AEP, dated January 15, 2018.
- *Statistical Analysis Summary, Bottom Ash Pond, Mountaineer Plant, New Haven, West Virginia* prepared by Geosyntec Consultants, on behalf of AEP, dated January 8, 2019.
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- *Geochemistry in Mineral Exploration*. 2nd Edition. Rose, A.W., Hawkes, H.E. and Webb, J.S., 1979. Academic Press, London, pp658.

TABLES

TABLE 1
Screening and Evaluation of Remedial Technologies
Bottom Ash Pond ACM
American Electric Power Mountaineer Power Plant
New Haven, West Virginia

General Response Action	Remedial Technology	Process Option	Description	Risk Reduction/Protectiveness	Effectiveness	Implementability	Initial Screening
No Further Action	Not considered a treatment remedy	N/A	No additional monitoring.	Provides no additional risk reduction or protectiveness.	Natural attenuation of contaminants (dissolved metals) in groundwater by adsorption, dilution and dispersion is assumed to occur but not verified.	Easily implemented.	Eliminated. Monitoring of Natural Attenuation (MNA) considered more protective.
Institutional Controls	Not considered a treatment remedy	N/A	This option involves implementation of institutional controls such as activity and use restrictions to limit the potential for unintended access to the waste materials or contaminated groundwater.	May reduce potential exposure of receptors by restricting access and future land use. Provides some level of protection over No Further Action.	Does not reduce certain contaminant migration pathways offsite such as leaching to groundwater, fugitive dust, surface runoff, etc. Does not permanently address contamination problem, therefore long-term effectiveness is uncertain.	Easily implemented. Typically used in conjunction with engineering controls when the remedy results in long-term waste management on site.	**Retained for development of remedial alternatives.**
Passive In-Situ Treatment	Attenuation	Monitored Natural Attenuation (MNA)	This option involves routine periodic monitoring of the existing groundwater monitoring network. MNA relies on naturally occurring subsurface processes that act to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in groundwater. These processes include oxidation/reduction, precipitation, sorption, dispersion, and dilution. MNA typically requires long-term monitoring to verify performance.	Unlike some contaminants, metals are incapable of breaking down to simpler, less toxic compounds. Attenuation would rely primarily on changes of mobility or dilution through isolation from source areas. Maintaining current conditions is also unlikely to change the concentrations of other metals present i.e., unlike other options that may change the groundwater chemistry there are not likely to be any unintended changes because of selecting this remedial technology.	Performance data is limited with respect to sites with metals contamination. Effectiveness is site-specific and exact processes that are occurring may be uncertain. Metals are generally considered recalcitrant to degradation in natural systems. If the contamination source is removed, the mass of lithium available for leaching is limited and lithium leaching is expected to decrease with time assuming current groundwater pH and redox conditions are maintained.	Monitoring is readily implemented using the existing groundwater monitoring network.	**Retained for development of remedial alternatives.**
Active In-Situ Treatment	Physical/Chemical Sorption/ Precipitation	Permeable Reactive Barrier	This technology involves installation of an engineered subsurface treatment zone across the flow path of the dissolved contaminant plume. As groundwater passes through the zone, it is treated in-situ by reactive media that is intended to remove contaminants by destruction, precipitation, or sorption to the media and reduce their concentrations in groundwater. The barrier can be used in conjunction with impermeable wall sections (funnels) to force groundwater to flow through the permeable sections (gates).	Removes contaminants from groundwater but not likely to destroy metals. Would potentially eliminate migration off-site and allow for downgradient groundwater to attenuate thereby reducing concentrations; however, because the metals are not destroyed but only immobilized, there is concern that over time they will again become mobile.	Potentially effective method for in-situ adsorption and/or precipitation. Long-term effectiveness is questionable due to uncertain in-situ adsorption rates and behavior. Reagents and media for treatment of lithium have not been tested in a CCP setting. A groundwataer treatability study performed by Anchor QEA, LLC indicated that the amendment Carus MMO II (a granular powder composed of iron, manganese, aluminum, oxides, and calcium carbonate) is effective at removing lithium from groundwater in a laboratory setting. Installation of adsorptive media is unlikely to cause desorption of metals, but may not attenuate all metals or may attenuate metals to varying degrees. Furthermore, because the metals are not destroyed but only immobilized, there is concern that over time they will again become mobile.	Implementable as a vertical barrier keyed into the lower permeability sandstone and shale materials at depths up to approximately 80-90 feet below grade. The PRB could be installed with a modified backhoe with extended boom; however, installation to depths of up to 90 feet below grade and 50 feet below the water table could result in high risk of construction difficulties. Installation would also require a working platform wide enough to accommodate removal of spoils from excavation. Depending on the properities of the seletected media (e.g., particle size), the PRB could also potentially be installed as a network of injection borings similar to the In-Situ Injection option. The injection radius of influence should be evaluated in a pilot test prior to implementation.	**Retained for development of remedial alternatives.**

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General Response Action	Remedial Technology	Process Option	Description	Risk Reduction/Protectiveness	Effectiveness	Implementability	Initial Screening
Active In-Situ Treatment	Physical/Chemical Sorption/ Precipitation	In-Situ Stabilization	This technology involves injection of a chemical into the dissolved contaminant plume. The chemical is intended to raise or lower pH, modify redox conditions, and/or provide adsorptive capacity, and thereby enhance the adsorption and/or precipitation of metals and reduce their concentrations in groundwater. The treatment zone can be used in conjunction with impermeable wall sections (funnels) to force groundwater to flow through the permeable sections (gates).	Removes contaminants from groundwater but not likely to destroy metals. Would potentially eliminate migration off-site and allow for downgradient groundwater to attenuate thereby reducing concentrations; however, the variable, and sometimes opposite, leaching behavior of metals in response to an increase or decrease in pH, suggests that the injected reagent option may cause concentrations of some other metals to increase unintentionally. If groundwater composition changes, the tendency of metals to leach or attenuate may change in response. Furthermore, because the metals are not destroyed but only immobilized, there is concern that over time they will again become mobile.	Changing redox conditions may influence concentrations of other metals apart from the lithium. The variable, and sometimes opposite, leaching behavior of metals in response to an increase or decrease in pH, suggests that the injected reagent option may cause concentrations of some other metals to increase unintentionally. If groundwater composition changes, the tendency of metals to leach or attenuate may change in response. Changing redox conditions is anticipated to have similarly variable effects on different site metals based on differences in metals behavior. Furthermore, because the metals are not destroyed but only immobilized, there is concern that over time they will again become mobile.	Implementable as a network of injection borings installed in a single line of injection wells, multiple treatment lines, or a grid pattern. Can be designed to have a continuous treatment zone by overlapping multiple rows of injection points based on the anticipated ROI; however, uniform radial distribution of reactive material from each injection point is not likely to be achieved, which could reduce the performance of the treatment zone or require higher injection volumes. Pilot testing should be completed prior to design of the full-scale system to evaluate hydraulic fracturing and particulate distribution throughout the targeted treatment ROI.	Eliminated. Implementation could result in mobilzation of other potential contaminants.
Ex-Situ Treatment	Reverse Osmosis	Porous Membrane	Removal of dissolved lithium from extracted groundwater by using pressure to force an aqueous solution through a porous membrane.	Removal of metals from extracted groundwater would eliminate off-site migration of metals, remove metal mass from dissolved phase for off-site disposal (sludge), and would allow for off-site groundwater to attenuate.	Effective in removing most cationic and anionic solutes, but lithium-specific treatment data are limited. Supported liquid membrane (SLM) is considered an efficient technology for selective separation and concentration of different chemical species; however, lithium-specific membrane technologies are still in the experimental phase of development.	Not readily implemented. Still in the experimental phase of development.	Eliminated. Technology not proven for lithium.
	Precipitation and Co-precipitation	Chemical Precipitation and Coagulation/ Flocculation	Adjustment of extracted groundwater to an optimal pH range by addition of acids or bases, and depending on the solution, addition of precipitating agents. Compounds may precipitate out of solution depending on pH, temperature, and/or other physicochemical parameters or they may co-precipitate by adhereing to less soluble compounds.	Removal of metals from extracted groundwater would eliminate off-site migration of metals, remove metal mass from dissolved phase for off-site disposal (sludge), and would allow for off-site groundwater to attenuate.	Precipitation and co-precipitation have been utilized as part of lithium recovery from high concentration brines, seawater, and geothermal waters, but data on lithium-specific precipitation and coprecipitation treatment performance for groundwater remediation are limited. The kinetics are dependent on concentrations of dissolved solids (including lithium), pH, temperature, and the choice of precipitation agents, therefore, site-specific bench- and pilot-scale testing is performed to assess potential effectiveness.	Utilized for removal of dissolved metals from solutions in a variety of applications, including environmental remediation, industrial waste treatment, and mining. Water conditioning is often needed to help remove precipitates from process water. The handling of solids generated will need to be considered based on site-specific water quality.	Eliminated. Technology not proven for lithium remediation. Technology is proven to recover lithium for beneficial use (mining operations).
	Adsorption	Mixed Metal Oxides Media	Adsorption is the removal of lithium from extracted groundwater by the adhesion of a thin layer of molecules to the surface of media with an affinity for the adsorbed substance.	Removal of metals from extracted groundwater would eliminate off-site migration of metals, remove metal mass from dissolved phase for off-site disposal (spent media), and would allow for off-site groundwater to attenuate.	Potentially effective method for ex-situ adsorption. Reagents and media for treatment of lithium have not been field tested in a CCR setting. A groundwataer treatability study performed by Anchor QEA, LLC indicated that the amendment Carus MMO II (a granular powder composed of iron, manganese, aluminum, oxides, and calcium carbonate) is effective at removing lithium from groundwater in a laboratory setting.	Readily implementable, however the field performance of available materials has not been conclusively proven for lithium. Pilot-scale testing should be completed prior to design of the full-scale system.	**Retained for development of remedial alternatives.**

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General Response Action	Remedial Technology	Process Option	Description	Risk Reduction/Protectiveness	Effectiveness	Implementability	Initial Screening
Ex-Situ Treatment	Ion Exchange	Resins	Ion exchange is the reversible exchange of ions between a solid-phase (resin) and a liquid-phase (extracted groundwater). The ions are electrostatically bound to the solid-phase resin and removed from the extracted groundwater. Resins may require regeneration with an acid or alkaline solution depending on the application.	Removal of metals from extracted groundwater would eliminate off-site migration of metals, remove metal mass from dissolved phase for off-site disposal (sludge), and would allow for off-site groundwater to attenuate.	High removal efficiency and high treatment capacity may be possible with ion exchange, however, multiple resin beds may be required to treat the various constituents. Other anions and cations may need to be removed so that the resin can effectively target the specified constituent. Previous efforts have demonstrated that some ion exchange resins have an affinity for lithium.	Readily implementable, however there are currently no lithium-selective resins currently on the market. Bench-scale testing should be completed prior to design of the full-scale system. Need to consider resin regeneration requirements and management of associated wastewater stream.	Eliminated. Technology not proven for lithium.
Containment	Stabilization / Solidification	Chemical reagent	A chemical reagent is physically mixed into the Bottom Ash Pond (BAP) to solidify the waste material and lower its hydraulic conductivity to limit the volume of water that can move through it and chemically binds constituents to the solid matrix.	Would significantly reduce leaching to groundwater. Creating a low permeability barrier may change pH, redox conditions and temperature near the BAP, which could affect groundwater metal concentrations.	Potentially effective method of source control. Does not directly address existing plume; however, it may be effective at reducing contaminant concentrations in combination with MNA.	Requires a stable work platform to support construction equipment and may require removal and management of water contained in the BAP. Can be safety risks involved with working on the wet bottom ash material until it has solidified.	Eliminated. Removal and Disposal option considered more effective and implementable.
	Lined Landfill	Geomembrane liner with leachate collection system	Bottom ash material is excavated from the BAP, stockpiled on site, and then placed in a new on-site landfill with a liner and leachate collection system built in the footprint of the former BAP.	Provides a barrier between the waste material and the underlying soil and groundwater. Adding an impermeable liner may change pH, redox conditions and temperature under the BAP, which could affect groundwater metal concentrations.	Effective method of source control. Does not directly address existing plume; however it may be effective at reducing contaminant concentrations in combination with MNA.	Can be significant safety or monetary/scope risks involved working on wet bottom ash during dewatering and excavation required for liner installation. Requires area for storing waste material during liner installation and double handling of waste.	Eliminated. Removal and Disposal option considered more implementable.
	Barrier Cap System	Geomembrane or compacted soil	A barrier cap system designed to minimize vertical infiltration of rainwater into the BAP. The barrier can consist of compacted soil, geomembrane, or both.	Adding an impermeable cap may change pH, redox conditions and temperature under the BAP, which could affect groundwater metal concentrations, or changing stormwater management may locally influence groundwater flow conditions, and could result in negative impacts to mobility.	Potentially effective method of source control at unlined facilities when groundwater does not intersect the BAP. Even if there is intersecting groundwater, a cap can reduce the mass flux of constituents released to groundwater. Does not directly address existing plume; however it may be effective at reducing contaminant concentrations in combination with MNA.	Implementable as a geomembrane or compacted soil barrier. Need to consider geotechnical requirements for BAP stability, dewatering requirements and treatment processes, and construction sequencing if being implemented with additional technologies (e.g., PRB).	Eliminated. Removal and Disposal option considered more effective and implementable.
	Barrier Wall	Sheet Pile Wall	A subsurface vertical wall constructed by driving vertical sheets of steel into the ground and joining the sheets together using sealants such as grout or cement. The wall is used to contain or divert the lateral flow of groundwater. Vertical barriers are used in combination with groundwater extraction for hydraulic control.	Installation of a vertical barrier coupled with hydraulic control using groundwater extraction would limit off-site migration of contaminants and remove dissolved phase contaminants from impacted groundwater for off-site disposal. Off-site groundwater concentrations would then naturally attenuate once migration from the source has been eliminated.	Potentially effective method for hydraulically facilitating containment/removal with groundwater extraction or a PRB. Not effective by itself in limiting migration of contaminants. Concern for seal between metal sheets and concern for achieving total depth due to refusal at shallower depths might result in partially penetrating barrier allowing for continued migration unless groundwater extraction is significantly modified to address.	Implementable as a vertical barrier to depths of 50 to 80 ft bgs. However, challenges with sealing sheets and driving to these depths could result in the barrier being only partially penetrating and allowing for continued migration at depth or requiring additional pumping to achieve hydraulic control. Does not require removal of spoils.	Eliminated. Hydraulic containment system considered more effective and implementable.

TABLE 1
Screening and Evaluation of Remedial Technologies
Bottom Ash Pond ACM
American Electric Power Mountaineer Power Plant
New Haven, West Virginia

General Response Action	Remedial Technology	Process Option	Description	Risk Reduction/Protectiveness	Effectiveness	Implementability	Initial Screening
Containment	Barrier Wall	Slurry Wall	A subsurface vertical wall constructed by filling a vertically excavated trench with a slurry to prevent collapse of the trench walls. The wall, which is often keyed into a low permeability natural base such as clay or competent bedrock, is backfilled with a low permeability material (e.g., soil-bentonite) to form a subsurface vertical barrier which is used to contain or divert lateral groundwater flow. Vertical barriers are used in combination with groundwater extraction for hydraulic control.	Same as sheet pile wall above.	Potentially effective method for hydraulically facilitating containment/removal with groundwater extraction or a PRB. Not effective by itself in limiting migration of contaminants and long-term effectiveness questionable.	Implementable as a vertical barrier keyed into the lower permeability sandstone material at depths up to approximately 50 to 80 feet. Potentially applicable with installation by a modified excavator with extended boom to depths of up to approximately 80 to 90 feet, or deeper with crane-mounted clamshell excavator. Requires a working platform wide enough to accommodate removal spoils from excavation. Removal of material could affect stability of BAP embankment.	Eliminated. Hydraulic containment system considered more effective and implementable.
	Barrier Wall	Grout Curtain Wall	A subsurface vertical wall constructed by injecting a grout mixture into soil pores under pressure to form a cementious mass. The wall is used to contain or divert the lateral flow of groundwater. Vertical barriers are used in combination with groundwater extraction for hydraulic control.	Same as sheet pile wall above.	Potentially effective method for hydraulically facilitating containment/removal via groundwater extraction or a PRB. Not effective by itself in limiting migration of contaminants. Concern of ability to uniformly distribute grout material in subsurface due to potential heterogeneities in the formation. Uneven distribution could result in flow paths where contaminants could bypass the barrier.	Potentially applicable to depths of up to approximately 80 to 90 feet. Concern for evenly distributed grout in subsurface could result in a barrier with flow paths still able to migrate downgradient of barrier.	Eliminated. Hydraulic containment system considered more effective and implementable.
	Hydraulic Containment System	Groundwater Extraction	Groundwater is pumped from one or more extraction wells located near the source area creating a hydraulic gradient that prevents contaminated groundwater from migrating off site. Extracted water is treated ex-situ to remove contaminants as needed to support discharge.	Groundwater extraction would eliminate off-site migration of metals, remove contaminant mass from the ground, and would allow for off-site groundwater to attenuate.	Effective at controlling migration of groundwater; however, the mass removal rates are typically very slow and limited by pore-water exchange and the relative amount of sorbed mass.	Readily implementable using existing facility groundwater extraction wells.	**Retained for development of remedial alternatives.**
Removal and Disposal	Excavate and Remove	Disposal in Lined Landfill	Bottom ash material is excavated from the BAP and transported to a lined landfill for disposal.	Would eliminate leaching from source materials to groundwater and allow for dissolved concentrations in groundwater to attenuate over time.	Effective method for source removal. Mass of contaminants (dissolved metals) in the groundwater is reduced naturally over time by, dispersion, dilution, and sorption.	Readily implementable using the facility's existing lined landfill for disposal of excavated material. Need to consider geotechnical requirements for BAP stability, dewatering requirements and treatment processes, and construction sequencing if being implemented with additional technologies (e.g., PRB).	**Retained for development of remedial alternatives.**

References:

1. Chemical Constituents in Coal Combustion Products: Lithium, prepared by Electric Power Research Institute, dated April 2018.
2. Corrective Action Technology Profile, Groundwater Extraction and Treatment at Coal Combustion Residual Facilities, prepared by Electric Power Research Institute, dated September 2017.
3. Cost and Application Considerations for Remediation Technologies at Coal Combustion Residual Landfills and Impoundments, prepared by Electric Power Research Institute, dated March 2018.

FIGURES

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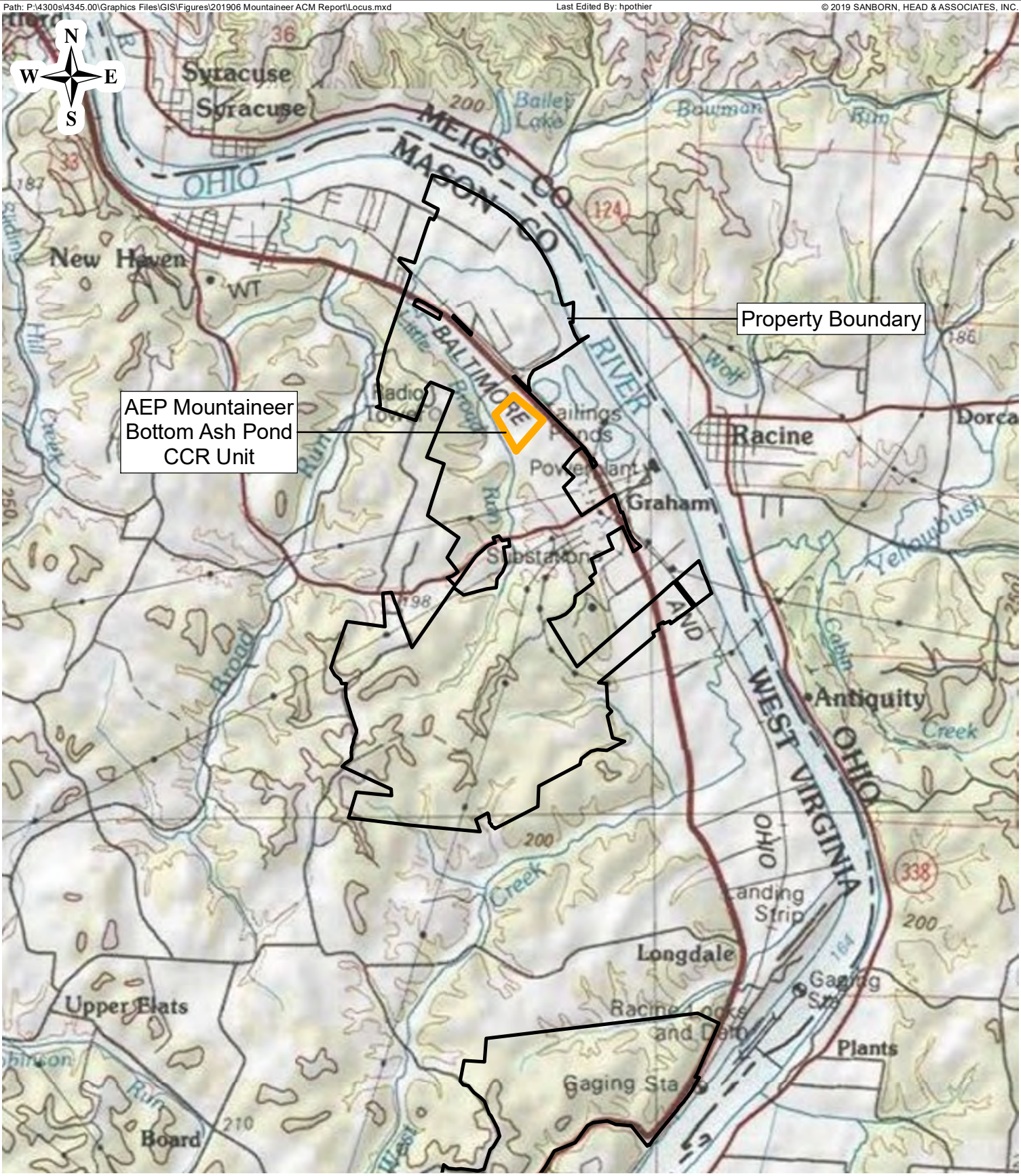

Drawn By: H. Pothier
Designed By: A. Ashton
Reviewed By: C. Crocetti
Project No: 4345.01
Date: June 2019

0.5 0.25 0 0.5 1 Miles

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Figure 1

Locus Plan

Mountaineer Bottom Ash Pond - Assessment of Corrective Measures

American Electric Power
AEP Mountaineer Generating Plant
New Haven, West Virginia

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Last Edited By: hpothier

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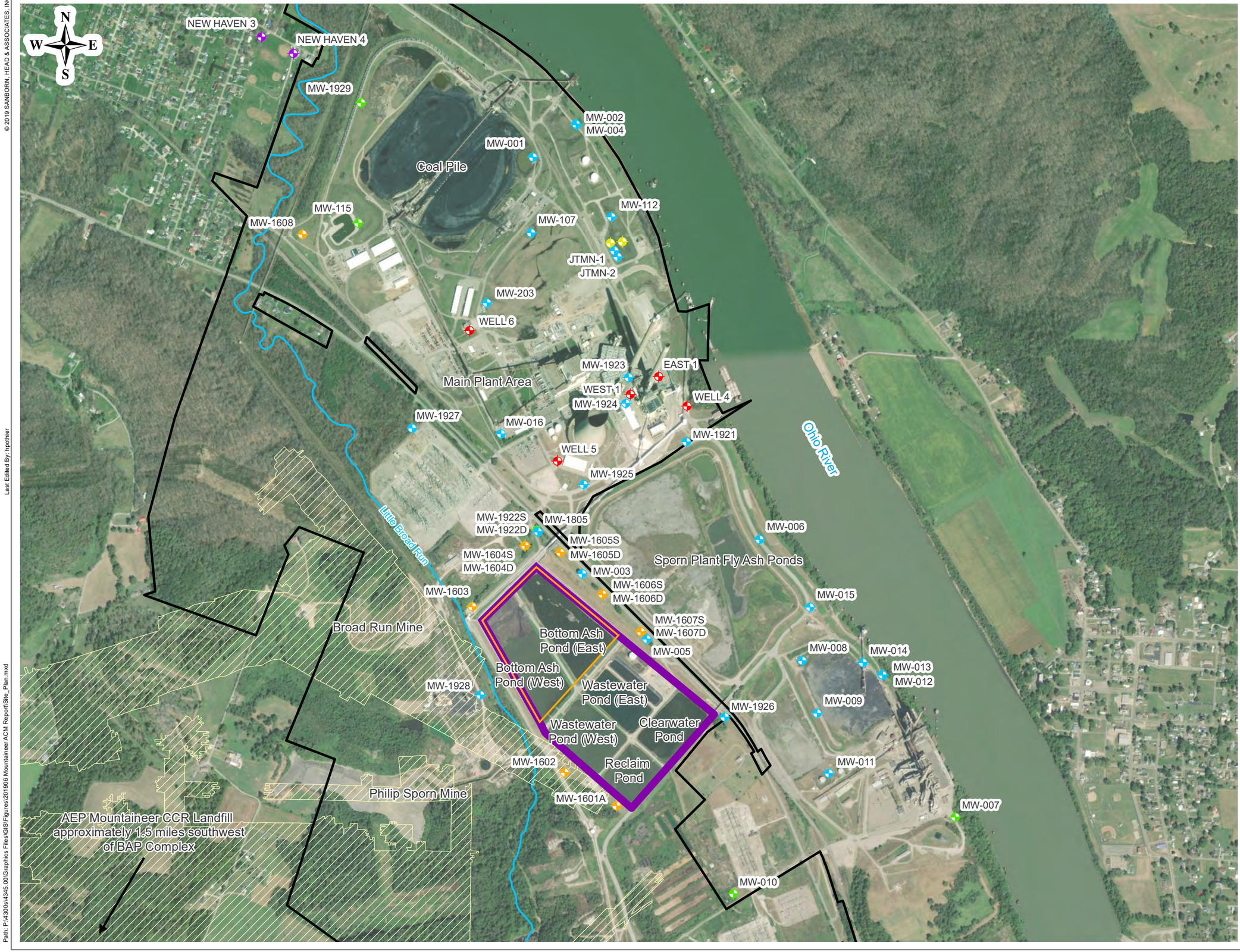

Figure 2

Site Plan and Monitoring Well Locations

Mountaineer Bottom Ash Pond - Assessment of Corrective Measures

American Electric Power
AEP Mountaineer Generating Plant
New Haven, West Virginia

Drawn By:	H. Pothier
Designed By:	A. Ashton
Reviewed By:	C. Crocetti
Project No:	4345.01
Date:	June 2019

Figure Narrative

This site plan depicts the general area in and around American Electric Power's (AEP) Mountaineer Generating Plant in Letart near the Town of New Haven, West Virginia. The location of key site features pertinent to this report including the power plant, bottom ash pond complex, and site pumping (water supply) wells are shown. Shallow groundwater monitoring wells i.e., screened in the overburden sand and gravel are shown for reference.

Notes

1. Locations of the monitoring wells and other site features were provided by Geosyntec Consultants.

2. Aerial Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- AEP Supply Well (non-potable)
- Former AEP Supply Well (potable)
- Public Supply Well
- CCR Monitoring Well Network
- Other Monitoring Well (used for water level measurements)
- Other Monitoring Well (not used for water level measurements)
- Approximate area of underground mine
- CCR Unit
- Mountaineer Bottom Ash Complex (BAC)
- Property Boundary

500 250 0 500 1,000 Feet

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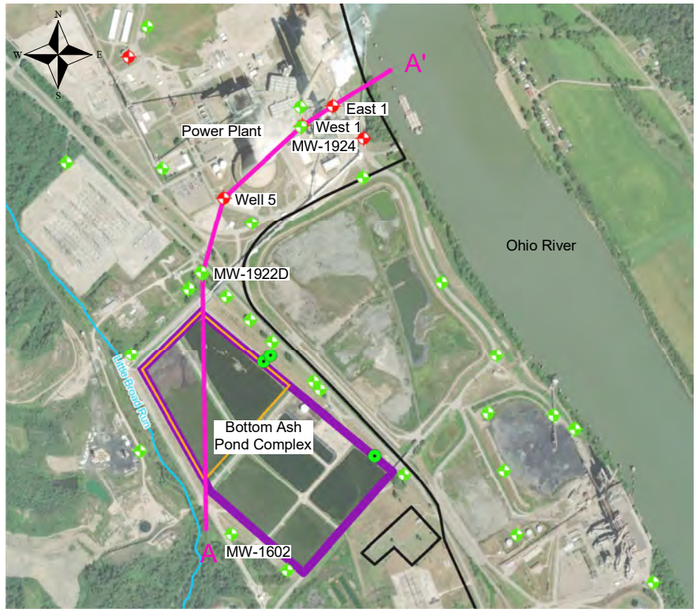


Plan View

Not to scale

Notes

1. Stratigraphic information is conceptual and was interpreted from site boring/monitoring well logs provided by AEP.

2. Bottom Ash Pond Complex construction information was compiled from the History of Construction Bottom Ash Pond Complex Report available on AEP's CCR website.

3. Ground elevations were interpreted from digital elevation measurement data obtained from the West Virginia GIS website (http://mapwv.gov/gis.html). Bottom ash pond elevations are based on information in the History of Construction Report.

4. Groundwater elevations are conceptual and based on measurements obtained during site water supply well pumping conditions. Groundwater elevations will vary from those shown due to changing conditions including precipitation, and groundwater pumping.

Legend

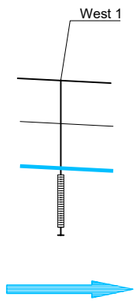


Figure 3

Cross Section A-A'

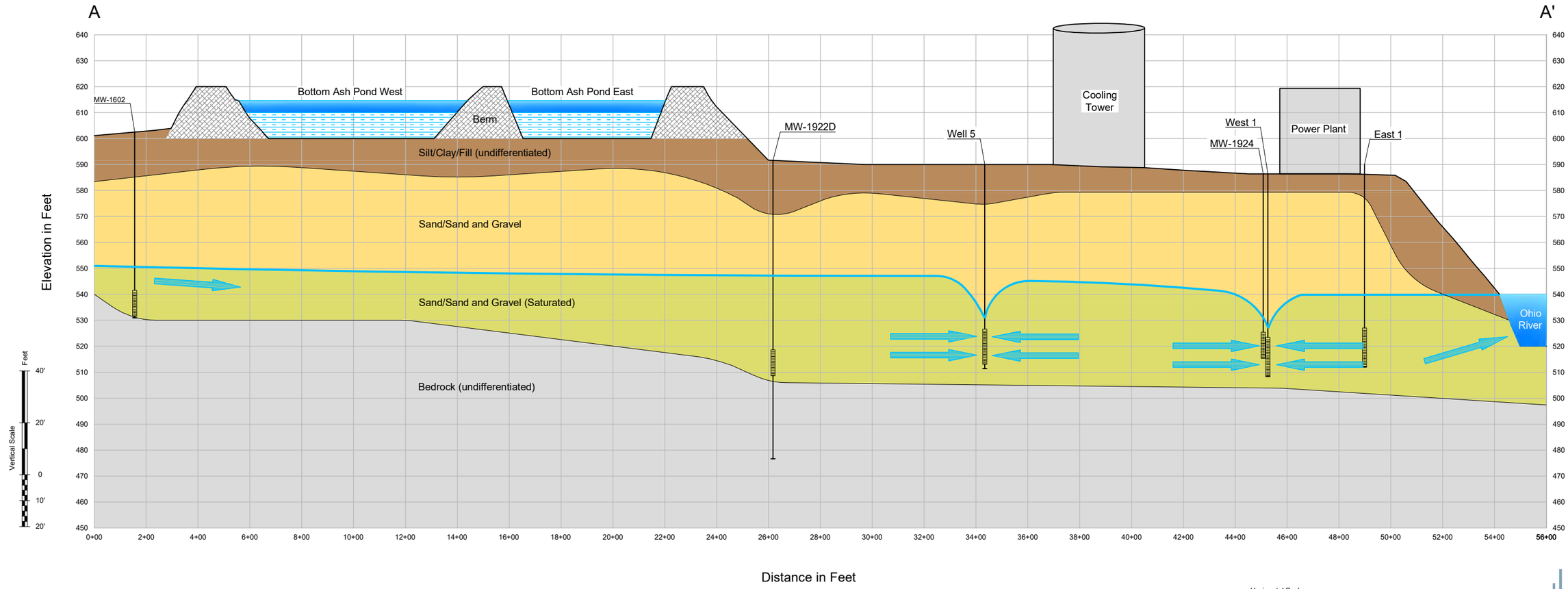
Mountaineer Bottom Ash Pond - Assessment of Corrective Measures

American Electric Power
AEP Mountaineer Generating Plant
New Haven, West Virginia

Drawn By: E. Wright
Designed By: A. Ashton
Reviewed By: C. Crocetti
Project No: 4345.01
Date: June 2019

Figure Narrative

This figure depicts conceptual hydrostratigraphy and the relative position of key site features in the vicinity of the Bottom Ash Pond Complex at the American Electric Power (AEP) Mountaineer Generating Plant. Refer to the inset plan on this figure (or Figure 2) for the locations of the explorations and features shown on this cross-section. The information presented herein is generalized and based on widely spaced explorations, actual conditions should be expected to vary from those shown.



Horizontal Scale
200' 100' 0 200' 400' Feet

SANBORN HEAD

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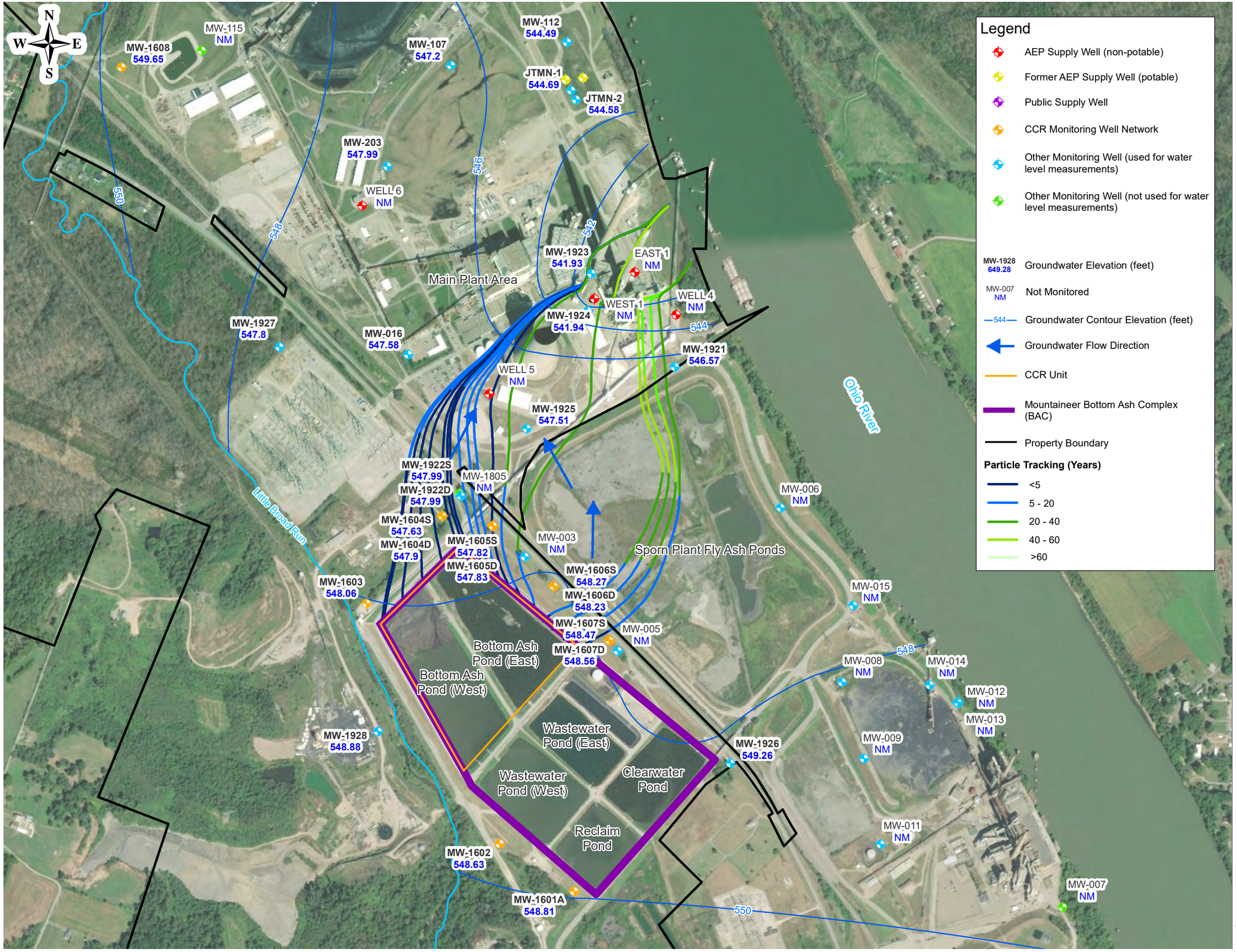

Legend

- AEP Supply Well (non-potable)
- Former AEP Supply Well (potable)
- Public Supply Well
- CCR Monitoring Well Network
- Other Monitoring Well (used for water level measurements)
- Other Monitoring Well (not used for water level measurements)
- MW-1928 649.28 — Groundwater Elevation (feet)
- MW-007 NM — Not Monitored
- 544 — Groundwater Contour Elevation (feet)
- Groundwater Flow Direction
- CCR Unit
- Mountaineer Bottom Ash Complex (BAC)
- Property Boundary

Particle Tracking (Years)

- <5
- 5 - 20
- 20 - 40
- 40 - 60
- >60

Figure 4

Groundwater Flow under Non-Pumping Conditions

Mountaineer Bottom Ash Pond - Assessment of Corrective Measures

American Electric Power
AEP Mountaineer Generating Plant
New Haven, West Virginia

Drawn By:	H. Pothier
Designed By:	A. Ashton
Reviewed By:	C. Crocetti
Project No:	4345.01
Date:	June 2019

Figure Narrative

This figure shows the site groundwater elevation contour map for overburden sand and gravel deposits based on static (non-pumping) conditions. The groundwater elevation contours were drawn by Geosyntec and provided as an electronic GIS shapefile to Sanborn Head via email on May 8, 2019. The groundwater elevation contours are based on the groundwater levels measured in the site monitoring wells by Geosyntec on March 7, 2019, and provided to Sanborn Head as an electronic GIS file via email on May 8, 2019. Note that groundwater elevations may vary due to seasonal or other changes in precipitation, recharge, temperature, and other factors. The groundwater elevation contours are based on interpolation between widely-spaced data points, and developed by Geosyntec to illustrate general trends in groundwater elevations and flow. Note that other interpretations are possible, and actual conditions may vary from those depicted in the figure. Sanborn Head has relied upon the groundwater elevation data provided by Geosyntec, and has not conducted an independent evaluation of the reliability of these data. The contours and groundwater elevations have been used by Sanborn Head without modification and applied for planning level assessment of corrective measures; they are not considered suitable for remedial design purposes. The figure also depicts the approximate forward rate and direction of groundwater flow from the bottom ash ponds based on an ArcGIS particle tracking method that was performed by Sanborn Head. The color symbology of the particle tracks indicates travel time along the flow path.

Notes

1. Refer to Figure 2 for additional notes and legend.

350 175 0 350 700 Feet

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Last Edited By: hpothier

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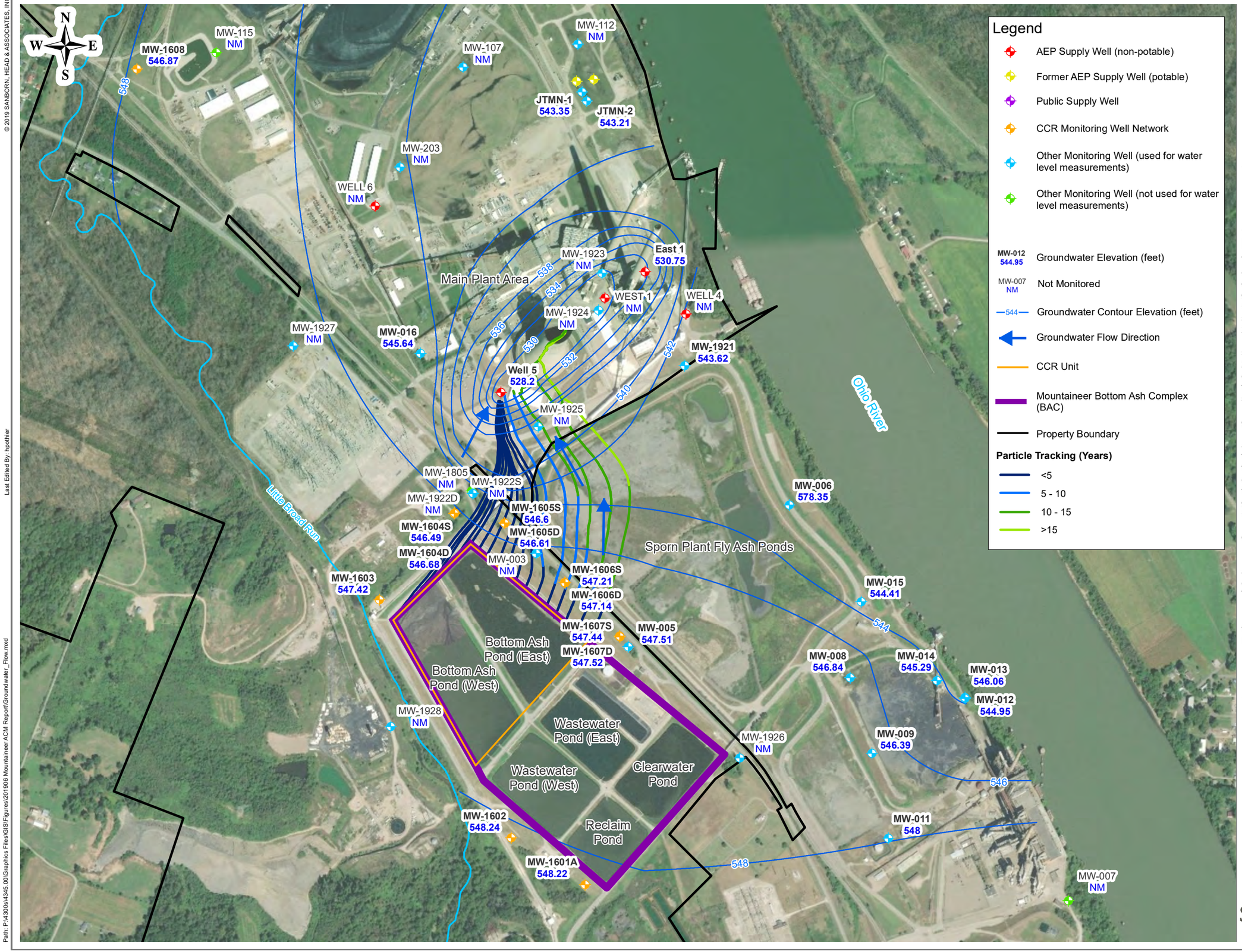

Legend

- AEP Supply Well (non-potable)
- Former AEP Supply Well (potable)
- Public Supply Well
- CCR Monitoring Well Network
- Other Monitoring Well (used for water level measurements)
- Other Monitoring Well (not used for water level measurements)
- MW-012 544.95 — Groundwater Elevation (feet)
- MW-007 NM — Not Monitored
- 544 — Groundwater Contour Elevation (feet)
- Groundwater Flow Direction
- CCR Unit
- Mountaineer Bottom Ash Complex (BAC)
- Property Boundary

Particle Tracking (Years)

- <5
- 5 - 10
- 10 - 15
- >15

Figure 5

Groundwater Flow under Pumping Conditions

Mountaineer Bottom Ash Pond - Assessment of Corrective Measures

American Electric Power
AEP Mountaineer Generating Plant
New Haven, West Virginia

Drawn By:	H. Pothier
Designed By:	A. Ashton
Reviewed By:	C. Crocetti
Project No:	4345.01
Date:	June 2019

Figure Narrative

This figure shows the site groundwater elevation contour map for overburden sand and gravel deposits based on pumping conditions. The groundwater elevation contours were drawn by Geosyntec and provided as an electronic GIS shapefile to Sanborn Head via email on May 8, 2019. The groundwater elevation contours are based on the groundwater levels measured in the site monitoring wells by Geosyntec on February 4, 2019, and provided to Sanborn Head as an electronic GIS file via email on May 8, 2019. Note that groundwater elevations may vary due to seasonal or other changes in precipitation, recharge, temperature, and other factors. The groundwater elevation contours are based on interpolation between widely-spaced data points, and developed by Geosyntec to illustrate general trends in groundwater elevations and flow. Note that other interpretations are possible, and actual conditions may vary from those depicted in the figure. Sanborn Head has relied upon the groundwater elevation data provided by Geosyntec, and has not conducted an independent evaluation of the reliability of these data. The contours and groundwater elevations have been used by Sanborn Head without modification and applied for planning level assessment of corrective measures; they are not considered suitable for remedial design purposes. The figure also depicts the approximate forward rate and direction of groundwater flow from the bottom ash ponds based on an ArcGIS particle tracking method that was performed by Sanborn Head. The color symbology of the particle tracks indicates travel time along the flow path.

Notes

1. Refer to Figure 2 for additional notes and legend.

350 175 0 350 700 Feet

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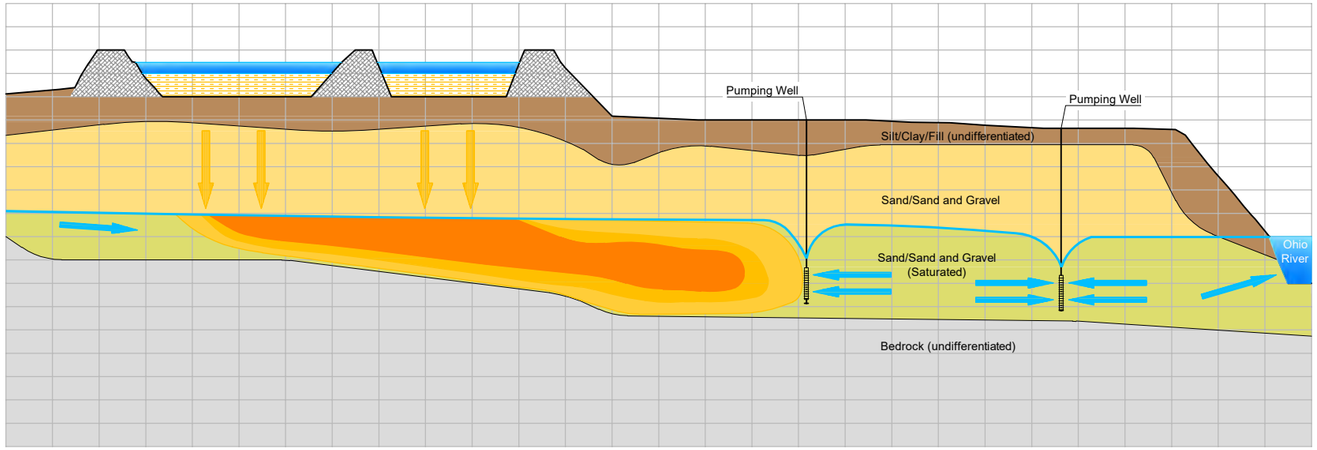
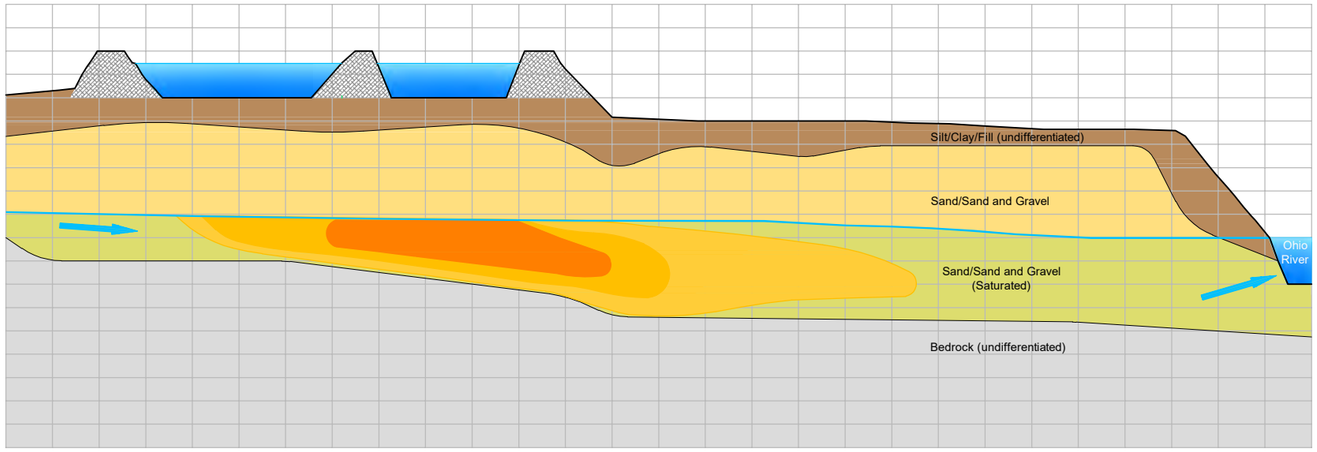
Current Condition



Post-Remediation (Short Term)



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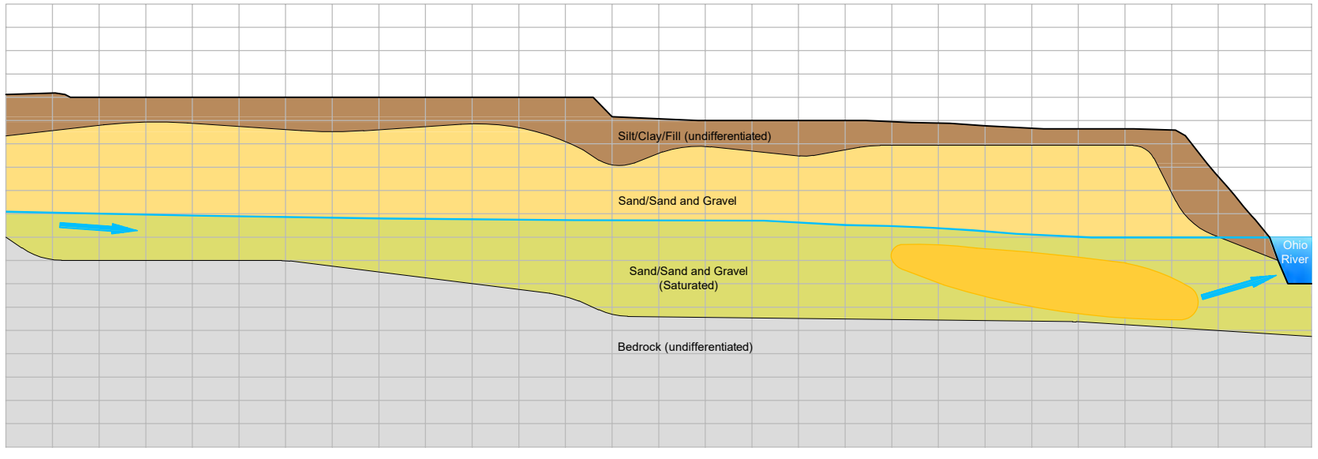

Figure 6

Conceptual Approach for Remedial Alternative 1 (Source Control and Monitored Natural Attenuation)

Mountaineer Bottom Ash Pond - Assessment of Corrective Measures

American Electric Power
AEP Mountaineer Generating Plant
New Haven, West Virginia

Drawn By: E. Wright
Designed By: A. Ashton
Reviewed By: C. Crocetti
Project No: 4345.01
Date: June 2019

Figure Narrative

This figure shows a hydro-stratigraphical cross-section depicting the conceptual operation of a source control and monitored natural attenuation approach being considered as part of the Assessment of Corrective Measures Alternative 1 (see report text for additional information). The sequence of images portrays potential conditions during current and after initiation of remediation i.e., post-remediation (short-term), and post-remediation (long-term) time frames - see report text for additional information about the remedial alternatives and associated time frames. The conditions shown in this series of figures are conceptual and not intended to represent actual site conditions.

Legend

- Plume concentration high
- Plume concentration medium
- Plume concentration low

Horizontal Scale

325' 162.5' 0 325' 650' Feet

SANBORN HEAD

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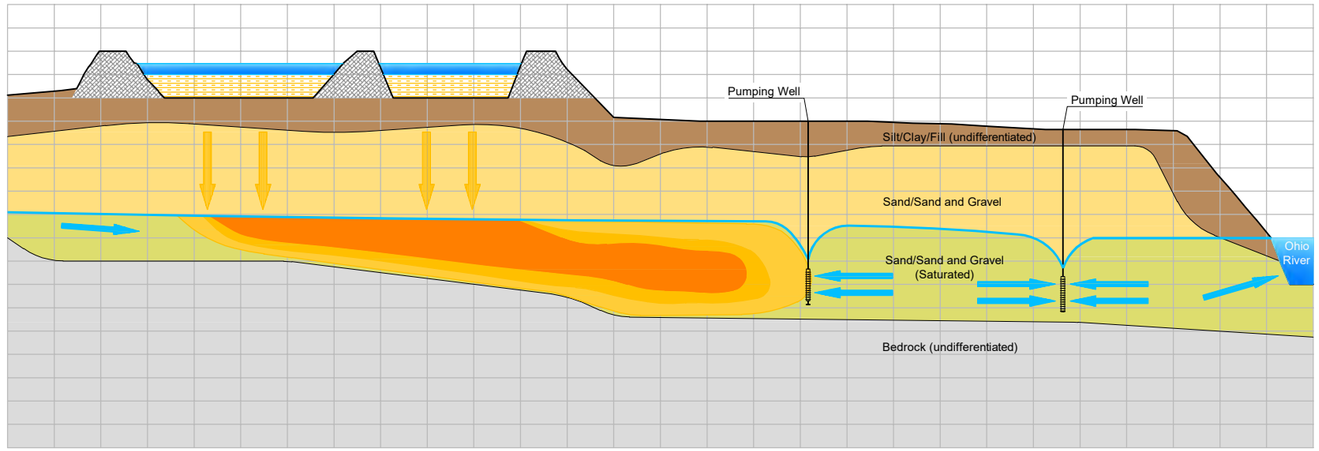
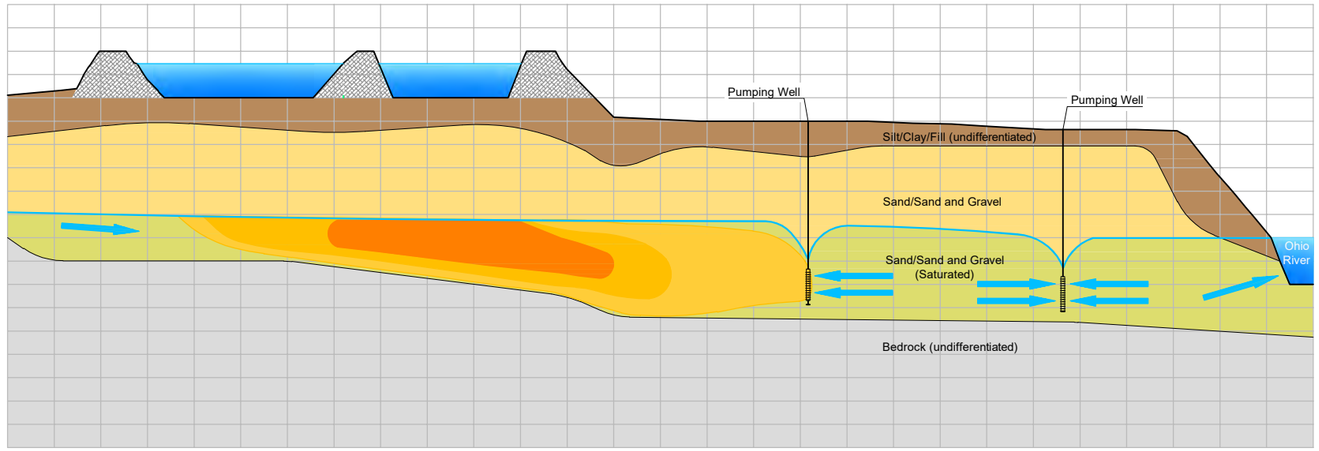
Current Condition



Post-Remediation (Short Term)



Post-Remediation (Long Term)

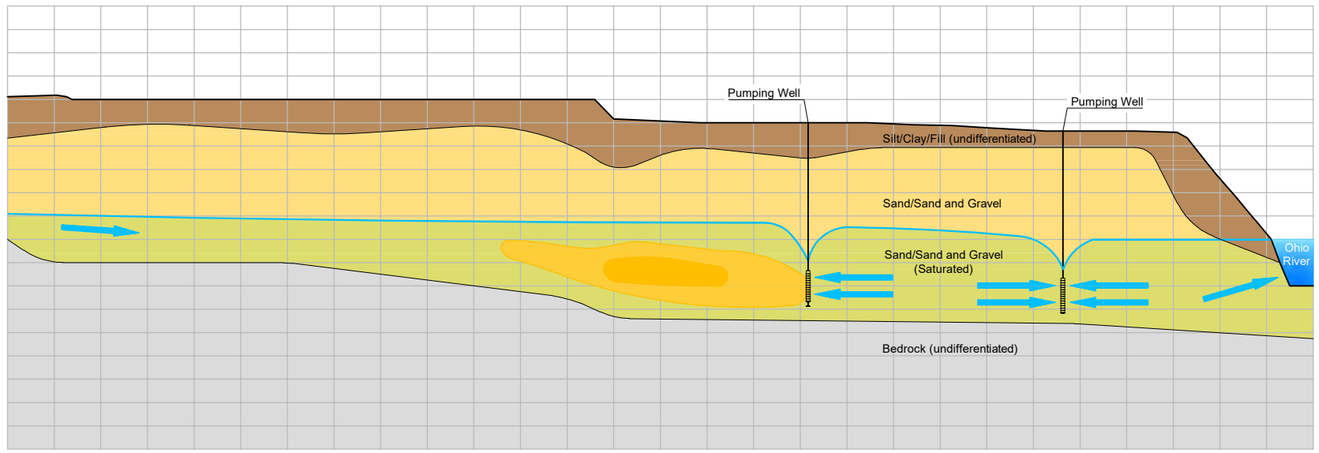


Figure 7

Conceptual Approach for Remedial Alternative 2 (Source Control with Groundwater Extraction and Treatment)

Mountaineer Bottom Ash Pond - Assessment of Corrective Measures

American Electric Power
AEP Mountaineer Generating Plant
New Haven, West Virginia

Drawn By: E. Wright
Designed By: A. Ashton
Reviewed By: C. Crocetti
Project No: 4345.01
Date: June 2019

Figure Narrative

This figure shows a hydro-stratigraphical cross-section depicting the conceptual operation of a source control and groundwater extraction and treatment approach being considered as part of the Assessment of Corrective Measures Alternative 2 (see report text for additional information). The sequence of images portrays potential conditions during current and after initiation of remediation i.e., post-remediation (short-term), and post-remediation (long-term) time frames - see report text for additional information about the remedial alternatives and associated time frames. The conditions shown in this series of figures are conceptual and not intended to represent actual site conditions.

Legend

- Plume concentration high
- Plume concentration medium
- Plume concentration low

Horizontal Scale

325' 162.5' 0 325' 650' Feet

SANBORN HEAD

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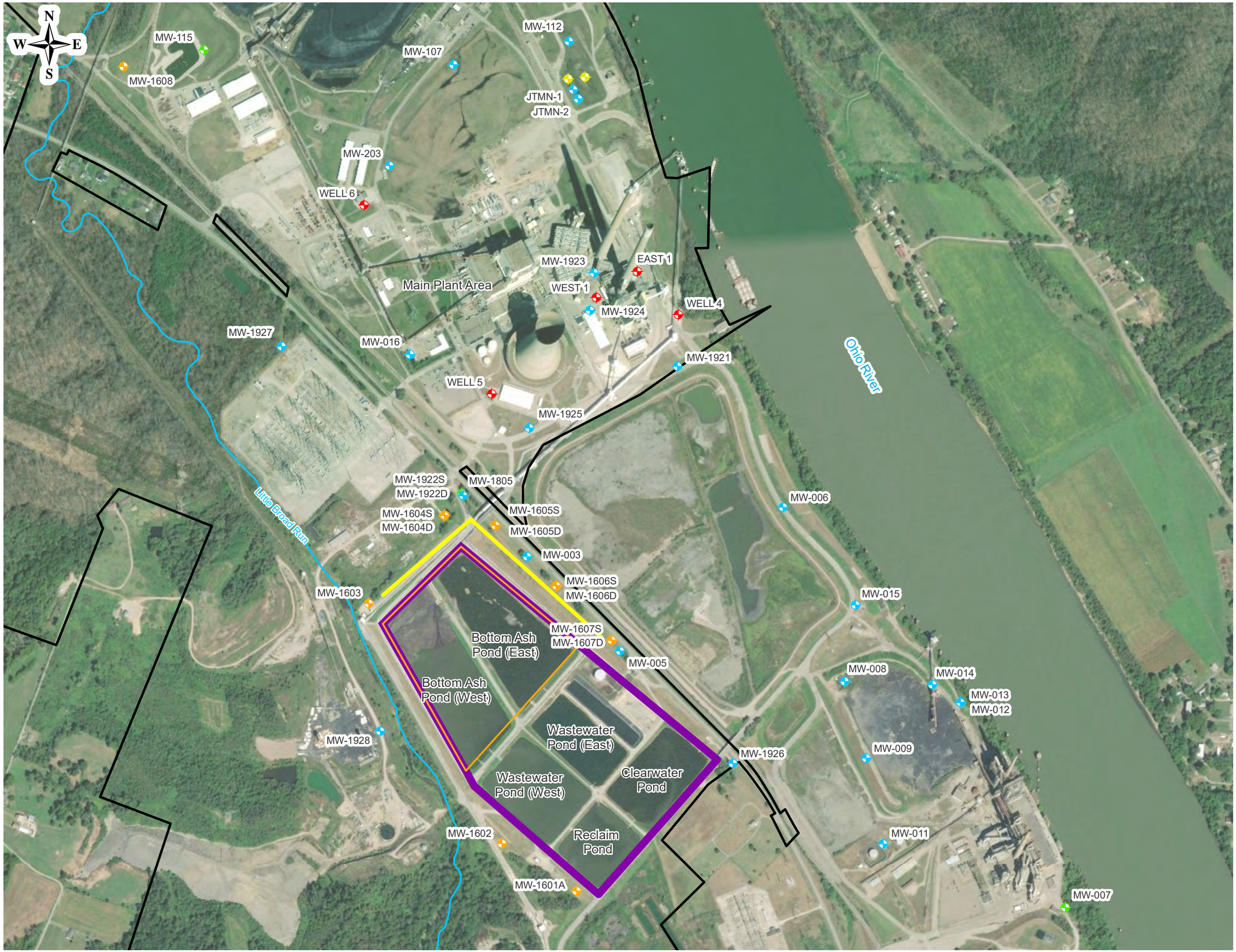

Figure 8

Potential Location of Permeable Reactive Barrier (PRB)

AEP Mountaineer Generating Plant
Bottom Ash Ponds

New Haven, West Virginia

Drawn By:	H. Pothier
Designed By:	A. Ashton
Reviewed By:	C. Crocetti
Project No:	4345.01
Date:	June 2019

Figure Narrative

This figure shows site features, monitoring well locations and potential extent of permeable reactive barrier. The location and dimensions of the permeable reactive barrier are shown for planning purposes only and may change during the design process if this alternative is selected.

Notes

1. Locations of the monitoring wells and other site features were provided by Geosyntec Consultants.

2. Aerial Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- AEP Supply Well (non-potable)
- Former AEP Supply Well (potable)
- Public Supply Well
- CCR Monitoring Well Network
- Other Monitoring Well (used for water level measurements)
- Other Monitoring Well (not used for water level measurements)
- Potential PRB Location
- CCR Unit
- Mountaineer Bottom Ash Complex (BAC)
- Property Boundary

350 175 0 350 700 Feet

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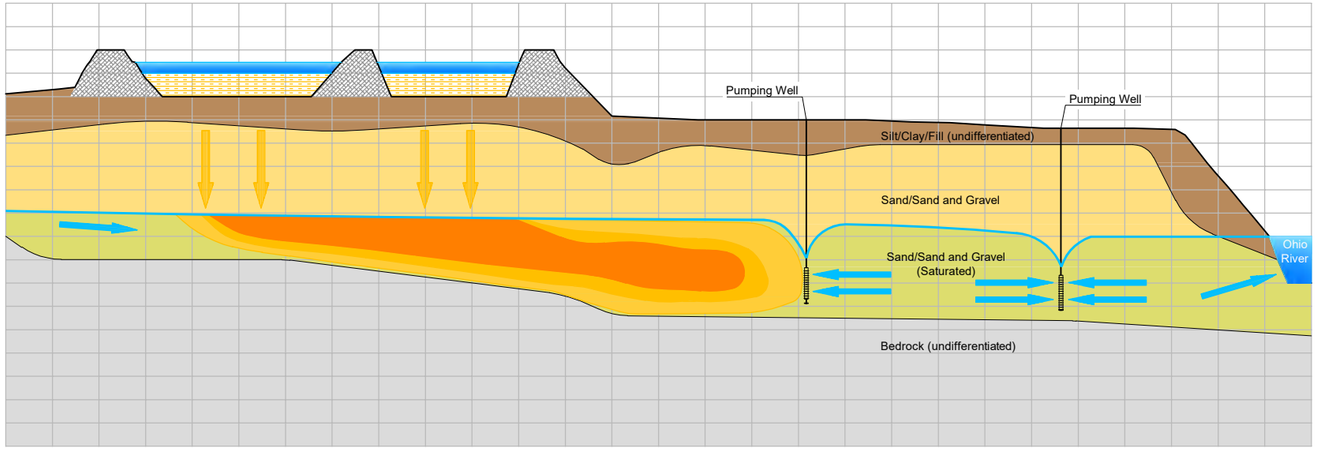
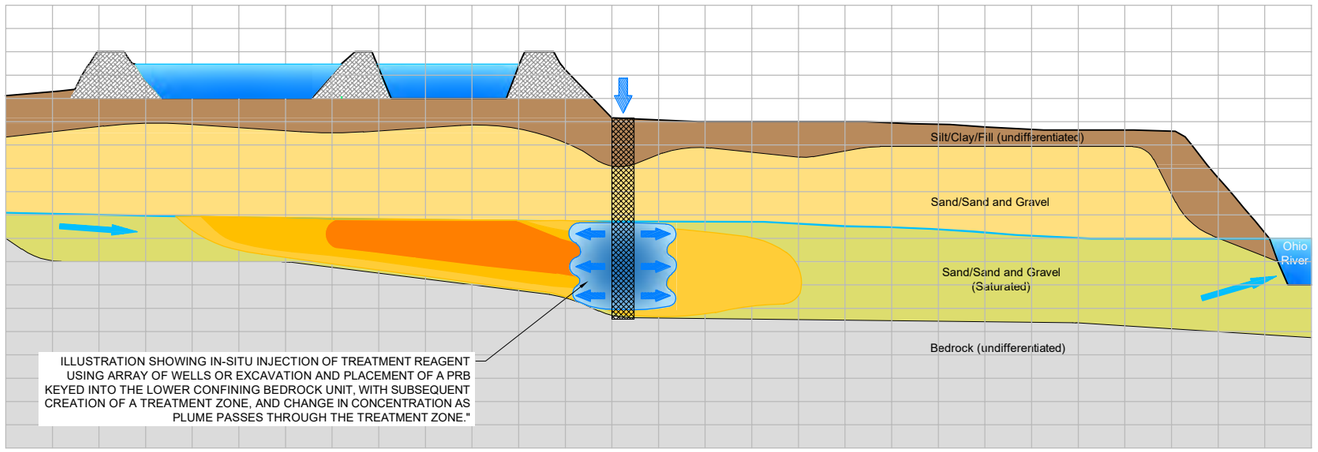
Current Condition



Post-Remediation (Short Term)



Post-Remediation (Long Term)

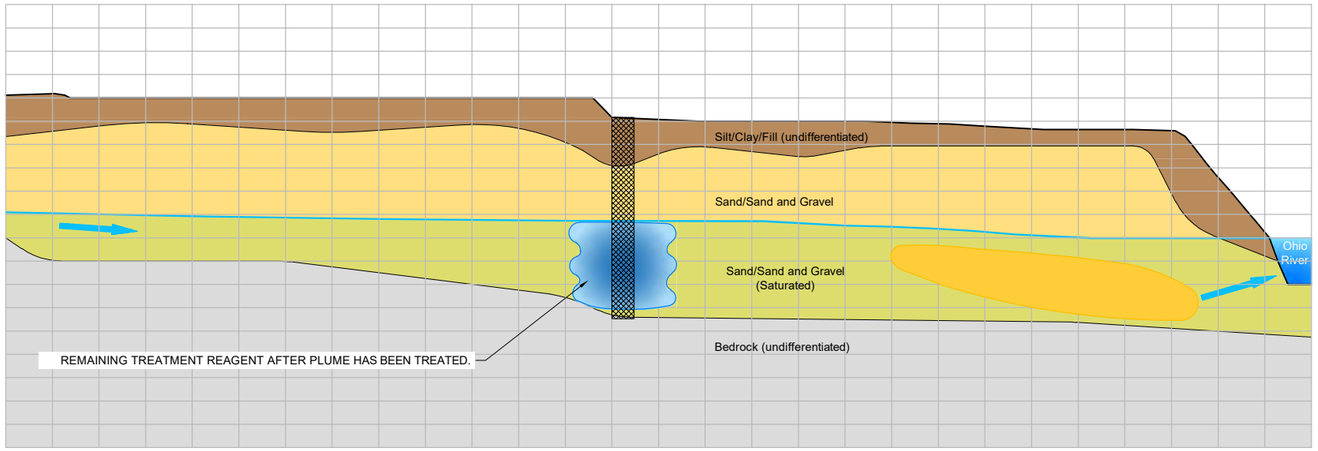


Figure 9

Conceptual Approach for Remedial Alternative 3 (Source Control with Groundwater Treatment by Permeable Reactive Barrier)

Mountaineer Bottom Ash Pond - Assessment of Corrective Measures

American Electric Power
AEP Mountaineer Generating Plant
New Haven, West Virginia

Drawn By: E. Wright
Designed By: A. Ashton
Reviewed By: C. Crocetti
Project No: 4345.01
Date: June 2019

Figure Narrative

This figure shows a hydro-stratigraphical cross-section depicting the conceptual operation of a source control and potential permeable reactive barrier being considered as part of the Assessment of Corrective Measures Alternative 3 (see report text for additional information). The sequence of images portrays potential conditions during current and after initiation of remediation i.e., post-remediation (short-term), and post-remediation (long-term) time frames - see report text for additional information about the remedial alternatives and associated time frames. The conditions shown in this series of figures are conceptual and not intended to represent actual site conditions.

Legend

- Plume concentration high
- Plume concentration medium
- Plume concentration low

Horizontal Scale

325' 162.5' 0 325' 650' Feet

SANBORN HEAD

File: P:\4300s\4345.00\Graphics Files\CAD\Cross Section\CrossSection_Sketches.dwg User: ohernandezpsz Plot Date: 6-24-19 1:26 PM

APPENDIX A

LIMITATIONS

APPENDIX A
LIMITATIONS

1. The conclusions and recommendations described in this report are based in part on the data obtained from a limited number of soil samples from widely spaced subsurface explorations. The nature and extent of variations between these explorations may not become evident until further investigation or remediation is initiated. If variations or other latent conditions then appear evident, it will be necessary to re-evaluate the recommendations of this report.

2. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretations of widely spaced explorations and samples; actual soil transitions are probably more gradual. For specific information, refer to the exploration logs.

3. Water level measurements have been made in observation wells at times and under conditions stated within the text of the report. Note that fluctuations in the level of the groundwater may occur due to variations in rainfall and other factors not evident at the time measurements were made.

4. Quantitative laboratory analyses were performed by previous investigators as noted within the report. The analyses were performed for specific parameters that were not selected by Sanborn Head. It must be noted that additional compounds not searched for may be present in soil and groundwater at the site. Sanborn Head has relied upon the data provided by the analytical laboratory, and has not conducted an independent evaluation of the reliability of these data. Moreover, it should be noted that variations in the types and concentrations of contaminants and variations in their distribution within the groundwater and soil may occur due to the passage of time, seasonal water table fluctuations, recharge events, and other factors.

5. The conclusions and recommendations contained in this report are based in part upon various types of chemical data as well as historical and hydrogeologic information developed by previous investigators. While Sanborn Head has reviewed that data and information as stated in this report, any of Sanborn Head's interpretations, conclusions, and recommendations that have relied on that information will be contingent on its validity. Should additional chemical data, historical information, or hydrogeologic information become available in the future, such information should be reviewed by Sanborn Head and the interpretations, conclusions and recommendations presented herein should be modified accordingly.

6. This report has been prepared for the exclusive use of American Electric Power (AEP) for specific application for the Assessment of Corrective Measures at AEP's Mountaineer Plant, Letart, West Virginia, in accordance with generally accepted hydrogeologic practices. No other warranty, express or implied, is made.

7. The analyses and recommendations contained in this report are based on the data obtained from the referenced subsurface explorations. The explorations indicate subsurface conditions only at the specific locations and times, and only to the depths penetrated. They do not necessarily reflect strata variations that may exist between such locations. The validity of the recommendations is based in part on assumptions Sanborn Head has made about conditions at the site. Such assumptions may be confirmed only during remediation. If subsurface conditions different from those described become evident, the recommendations in this report must be re-evaluated. It is advised that Sanborn Head be retained to monitor the remediation in order to help confirm that our assumptions and recommendations are valid or to modify them accordingly.

8. In the event that any changes in the nature, design, or location of the facilities are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing by Sanborn Head. Sanborn Head is not responsible for any claims, damages, or liability associated with interpretation of subsurface data or re-use of the subsurface data or engineering analyses without the express written authorization of Sanborn Head.

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APPENDIX B

SUMMARY OF REVISIONS NOVEMBER 2020

Main document changes and comments

Page 1: Inserted **Author**

A complete evaluation and justification for the selection of a remedy will be provided in the Selection of Remedy Report.

Page 4: Inserted **Author**

The plant receives potable water from the Town of New Haven's water supply system.

Page 10: Inserted **Author**

As part of the characterization of nature and extent of a release from the BAP, installation of ten (10) additional groundwater monitoring wells was performed in January and February 2019 at the Mountaineer Bottom Ash Pond. These additional groundwater monitoring wells include: MW-1921, MW-1922S, MW-1922D, MW-1923, MW-1924, MW-1925, MW-1926, MW-1927, MW-1928, MW-1929. Monitoring well MW-1805 was installed in 2018 and was also included in the 2019 nature and extent study. Additionally, three monitoring wells (MW-016, MW-107, MW-112, and MW-203) that were installed as part of a subsurface investigation in 2006 have been included in the sampling and analysis as a part of the nature and extent characterization. The location of these additional groundwater monitoring wells is shown on Figure 2, Figure 4, and Figure 5. Boring logs and well construction forms for these monitoring wells are included in the Annual Groundwater Monitoring Report[1]. A summary of lithium concentrations from Assessment groundwater monitoring conducted in 2019 is provided in Exhibit 1.

Exhibit 1 – Summary of Lithium Concentrations in Site Groundwater

Monitoring Well	Monitoring Program	Monitoring Well Location	Lithium (µg/L)		
			April 2019	June 2019	September 2019
BAP-MW-1601A	Detection monitoring	Upgradient	20 J	<9	1.84
BAP-MW-1602	Detection monitoring	Upgradient	20 J	10 J	9.79
BAP-MW-1603	Detection monitoring	Upgradient	30	<9	15
BAP-MW-1608	Detection monitoring	Sidegradient	10 J	<9	2.86
BAP-MW-1926	Nature and Extent	Sidegradient	10 J	<9	6.24
BAP-MW-1927	Nature and Extent	Sidegradient	30 J	<9	6.38
BAP-MW-107	Other	Sidegradient	20 J	<9	3.58
BAP-MW-112	Other	Sidegradient	NS	<9	NS
BAP-MW-203	Other	Sidegradient	NS	<9	2.3
BAP-MW-1604S	Detection monitoring	Downgradient	61	32	47.6
BAP-MW-1604D	Detection monitoring	Downgradient	38	<9	18.8
BAP-MW-1605S	Detection monitoring	Downgradient	79	40	52.4
BAP-MW-1605D	Detection monitoring	Downgradient	75	20 J	56.1
BAP-MW-1606S	Detection monitoring	Downgradient	117	56	87.7
BAP-MW-1606D	Detection monitoring	Downgradient	124	58	83.5

[1] *Annual Groundwater Monitoring and Corrective Action Report*, Bottom Ash Pond, Mountaineer Plant, prepared by AEP, dated January 2020

BAP-MW-1607S	Detection monitoring	Downgradient	141	75	99
BAP-MW-1607D	Detection monitoring	Downgradient	127	72	110
BAP-MW-1921	Nature and Extent	Downgradient	75	74	92.6
BAP-MW-1922S	Nature and Extent	Downgradient	82	30 J	55.6
BAP-MW-1922D	Nature and Extent	Downgradient	20 J	<9	12.6
BAP-MW-1923	Nature and Extent	Downgradient	223	135	137
BAP-MW-1924	Nature and Extent	Downgradient	133	87	102
BAP-MW-1925	Nature and Extent	Downgradient	94	95	94.7
BAP-MW-1929	Nature and Extent	Downgradient	10 J	<9	4.8
BAP-MW-1805	Other	Downgradient	43	32	42.6

A summary of the 2019 lithium groundwater concentration data as it relates to nature and extent is provided below:

- Upgradient monitoring wells (MW-1601A, MW-1602, and MW-1603) had lithium concentrations ranging from 1.84 µg/L to 30 µg/L. Background monitoring well MW-1608, which is located approximately 4,500 feet northwest of the BAP, had lithium concentrations between 2.86 µg/L and 10 µg/L. Newly installed nature and extent well MW-1926 is located on the eastern corner of the clearwater pond that is part of the Mountaineer Bottom Ash Complex and had concentrations in 2019 that are also representative of background (2 µg/L to 10 µg/L).

- Detection monitoring wells immediately downgradient of the BAP show variation from northwest to southeast: MW-1604S and MW-1605S had lithium concentrations between 32 µg/L and 79 µg/L, while MW-1606S and MW-1607S had concentrations from 56 µg/L to 141 µg/L. Deep detection monitoring wells along the downgradient edge of the BAP (MW-1604D, MW-1605D, MW-1606D and MW-1607D) generally exhibit similar or slightly lower concentrations than their shallow counterpart.

- Downgradient monitoring wells installed to assess nature and extent of lithium include MW-1921, MW-1922S, MW-1922D, MW-1923, MW-1924, and MW-1925. Monitoring well MW-1922S is immediately downgradient of the northwest corner of the BAP and shows similar concentrations (30 µg/L to 82 µg/L) to MW-1604S and MW-1605S (32 µg/L to 79 µg/L). The deep companion well (MW-1922D) installed next to MW-1922S had concentrations (<9 µg/L to 20 µg/L) that are representative of background. However, concentrations measured in the four wells (MW-1921, MW-1923, MW-1924, and MW-1925) further downgradient of the BAP were between 74 µg/L and 223 µg/L, with the highest concentration measured at MW-1923 (223 µg/L in April 2019).

- Four monitoring wells bound the lithium plume to the northwest including nature and extent well MW-1927 and existing site wells MW-107, MW-112, and MW-203, and have lithium concentrations representative of background. In June 2019, lithium was not detected (at a reporting limit of 9 µg/L) in any of the four wells while in September 2019 concentrations were between 2.30 µg/L and 6.38 µg/L. In addition, we note that MW-1929 is installed near the northwest property boundary and is the nearest monitoring well to the two public water supply wells for the Town of New Haven (New Haven 3 and

New Haven 4). Lithium concentrations in this well are also representative of background and ranged from 4.8 µg/L to 10 µg/L.

Complete characterization of the nature and extent of lithium coming from the BAP is currently complicated by other potential contributors of lithium in groundwater, which have not been determined during the Alternate Source Demonstration. Several monitoring wells (MW-1607S/D, MW-1921, MW-1923, MW-1924, and MW-1925) have higher lithium concentrations than those wells located immediately downgradient of the BAP (MW-1604S/D, MW-1605S/D, MW-1606S/D, and MW-1922S/D). The highest lithium concentrations measured at the site occur in the monitoring well furthest downgradient from the BAP which is inconsistent with the BAP being the source of the lithium in those wells. If the BAP was the source of lithium in downgradient wells, it would be expected that the highest concentrations would be observed nearest the BAP, and would decline in a downgradient direction due to dilution, dispersion and sorption. Observed groundwater flow directions at the site (Figure 4 and 5) indicate that operation of supply wells West 1 and East 1 results in radial flow of groundwater, including from the direction of the former Sporn Plant toward wells West 1 and East 1.

Page 12: Inserted **Author**

Time series data collected over a three-year time period from September 2016 to September 2019 is presented in the BAP Groundwater Statistical Analysis Summary Report (December 2019)[1] for individual wells sampled as part of the detection and assessment monitoring. Review of the time series data show that lithium appears to be stable or decreasing in monitoring wells immediately downgradient of the BAP (MW-1604S/D, MW-1605S/D, MW-1606S/D). This implies the potential for a stable or shrinking lithium plume in groundwater which is an important component of MNA.

2.3.6 Environmental Fate and Transport of Lithium in Groundwater

US EPA MNA guidance[1] discusses and recommends a tiered evaluation and analysis approach for site characterization and development of multiple lines of evidence for evaluation of MNA. The US EPA MNA Guidance recommends that information and data collection and evaluation within the tiered analysis approach typically should be developed in the following four phases:

- Phase I: Demonstration that the groundwater plume is not expanding.
- Phase II: Determination that the mechanism and rate of the attenuation process are sufficient.

[1] Statistical Analysis Summary – Bottom Ash Pond. Mountaineer Plant, New Haven, West Virginia. Geosyntec. December 23, 2019.

[1] *Use of Monitored Natural Attenuation for Inorganic Contaminants in Groundwater at Superfund Sites* (OSWER Directive 9283.1-36, August 2015) (EPA 2015c).

- Phase III: Determination that the capacity of the aquifer is sufficient to attenuate the mass of contaminant within the plume and the stability of the immobilized contaminant is sufficient to resist re-mobilization.

- Phase IV: Design of a performance monitoring program based on an understanding of the mechanism of the attenuation process, and establishment of contingency remedies tailored to site-specific characteristics.

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To evaluate the potential for MNA at the site, Sanborn Head performed a subsurface geochemical assessment of the BAP complex at the Mountaineer Plant on behalf of AEP to assist with remediation design for the BAP CCR Unit. The assessment included a review of the site environmental system to allow an understanding of the fate and transport of lithium in groundwater; and geochemical analysis of site samples to assess fate and mobility of lithium. Soil samples were collected and submitted for geochemical analyses relevant to the occurrence, fate and transport of COCs. Testing included bulk analysis of Appendix III/IV parameters; sequential extraction procedure analysis; partition coefficient analysis; pH dependent batch leaching tests; column leaching test of source material; clay mineral analysis; and Heavy Mineral Separation and Mineralogic and Chemical Analysis using a combination of XRD, XRF, and ICP-MS techniques to provide a qualitative and quantitative assessment of mineralogy and major and trace elements. Results of geochemical analysis related to the fate and mobility of COCs in groundwater were used to form a conceptual understanding of the soil geochemistry and hydrogeology, and integrated to inform the assessment of remedial alternatives.

Page 15: Inserted	Author

- Be protective of human health and the environment;

- Prevent potential human or environmental exposure to groundwater impacted by lithium, including potential downgradient receptors, at concentrations exceeding USEPA Maximum Contaminant Levels (MCLs) and GWPSs;

- Restore groundwater quality within the aquifer consistent with the GWPS;

Page 15: Inserted	Author

- Remove from the environment as much of the contaminated material as is feasible without inappropriate disturbance of sensitive ecosystems; and

Comply with waste management standards.
-

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Prevent potential human exposure to groundwater impacted by lithium, including potential downgradient receptors at concentrations exceeding USEPA Maximum Contaminant Levels (MCLs) and GWPSs; and
-

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Restore groundwater quality within the aquifer consistent with MCLs/GWPS
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A brief summary of the Table 1 general response actions (GRAs), not including No Further Action, evaluated is presented below.

- Institutional Controls – Institutional controls were retained for development of corrective measures. Although they are not considered a treatment remedy, they can be important tools for the protection of receptors while remediation is ongoing.

- Passive In-Situ Treatment – These remedial technologies include passive measures to reduce contaminant concentrations below the GWPS developed for the Site. For the ACM, we evaluated the Attenuation technology, specifically monitored natural attenuation, which was retained for development of corrective measures.

- Active In-Situ Treatment – This category includes active remedial technologies implemented at the existing location of the contamination. For the ACM, we evaluated two forms of sorption/precipitation technologies, including permeable reactive barriers and in-situ stabilization. Permeable reactive barriers were retained for development of corrective measures based on ongoing research and testing, carried out by a team including AEP, to identify reactive media effective at adsorbing lithium from water. In-situ stabilization was not retained based on concerns that common stabilization materials, such as Portland cement, could affect in-situ geochemistry and mobilize other potential contaminants.

- Ex-Situ Treatment – Several ex-situ treatment technologies were evaluated for alternatives including extraction of contaminated groundwater, which would require removal of lithium and other potential contaminants prior to disposal of treated groundwater. Reverse osmosis, chemical precipitation, and ion exchange were all eliminated from consideration because of unproven effectiveness to reliably remove lithium from water. Adsorption was retained for development of corrective measures based on ongoing research of adsorbent media being conducted by a team including AEP.

- Containment – Containment technologies are intended to isolate contamination in source zones from spreading into downgradient areas. Isolation of contaminated areas can be accomplished by the construction of an impermeable barriers preventing leaching of contamination from solid source materials (such as the stabilization/solidification, lined landfill, or barrier cap options) and/or barriers intended to prevent migration of contaminated groundwater (e.g., impermeable barrier walls, or hydraulic containment). Of the technologies identified and evaluated in Table 1, only hydraulic containment was retained for development of corrective measures because a system of groundwater extraction wells that could be operated as a hydraulic containment system already exists at the Site.

- Removal and Disposal – Excavation and removal of source materials, i.e. the CCR present in the BAP complex, was retained for development of corrective measures on the basis of

effectiveness and the CCR regulations requirements for closure of CCR impoundments and the reduction of source materials.

Page 16: Inserted	Author

Active Ex-situ Treatment by Mixed Metals Oxides Adsorption Media;
■

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As discussed in Section 2.3.6, US EPA recommends a tiered approach for assessment of MNA in groundwater at sites with inorganic contaminants. Assessment of suitability of MNA at the site has been initiated as part of the ACM and will continue during assessment for selection of the remedy. Completed and on-going assessment includes understanding of site groundwater hydraulics to control the extent of the plume, evaluation of plume stability and attenuation, and geochemical assessment of site soils to determine capacity for attenuation and/or immobilization of the contaminant.

Page 19: Inserted	Author

Initial evaluation suggests that lithium is stable or decreasing in monitoring wells downgradient of the BAP. Review of groundwater hydraulics at the site indicates that the plume is being controlled by extraction of groundwater that is required for plant operation. The current nature and extent of the plume is understood, and existing conditions are protective of human health and the environment. Initial geochemical evaluation of site soils suggests that there is some potential for attenuation and immobilization of lithium on site soils.

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The HCS would include automated groundwater elevation measurement at the Site to track hydraulic control and to guide adjustment of relative pumping rates of the five groundwater extraction wells.

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Reduction or elimination of off-site migration would reduce unmonitored release of lithium to the surface waters of the Ohio River and reduce the potential for exposure of environmental receptors to lithium from groundwater.

Page 21: Inserted	Author

as wells as safety hazards common to earthmoving and construction activities

Page 22: Inserted	Author

Reduction of lithium mass in the extracted groundwater during treatment at the WWTP will need to be evaluated during remedy selection. The existing WWTP which includes settling and chemical precipitation/clarification unit operations intended to remove solid particles and metals, which may provide some lithium removal. Additional lithium removal may be achievable with mixed metal oxide adsorbent materials or other similar amendments used in water treatment facilities for the removal of arsenic. AEP, in conjunction with others, is

currently studying the effectiveness of these materials for treatment of lithium-contaminated groundwater, both in-situ and ex-situ, and initial results are encouraging.

Page 22: Inserted **Author**

The alternative relies on the on-site treatment of extracted groundwater and discharge of the treated groundwater to the Ohio River in accordance with the Site's existing NPDES permit. The existing WWTP is currently treating extracted groundwater sufficiently to meet the discharge criteria of the Site's NPDES permit. As noted above, the ability of the existing wastewater treatment to remove lithium from the extracted groundwater is not currently known, although AEP, with others, is investigating potential treatment technologies for their effectiveness to remove lithium.

Page 24: Inserted **Author**

treated wastewater

Page 24: Inserted **Author**

Under current conditions, the Site's wastewater treatment plant is able to comply with discharge permit limits, and although the relative groundwater pumping rates of the five, existing groundwater extraction wells may shift over time to better maintain the effectiveness of the HCS, it is unlikely that adjustment of relative pumping rates will significantly affect the operation of the wastewater treatment plant or prevent the plant from achieving discharge limits.

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Reduction or elimination of off-site migration would reduce unmonitored release of lithium to the surface waters of the Ohio River and reduce the potential for exposure of environmental receptors to lithium from groundwater.

Page 25: Inserted **Author**

Based on ongoing research conducted by a team of power-generation industry organizations, including AEP, this alternative is anticipated to maintain current groundwater chemistry conditions (e.g., pH) and would not likely result in unintended changes to concentrations of other metals that may be present.

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as well as safety hazards common to earthmoving and construction activities

Page 26: Inserted **Author**

as well as safety hazards common to drilling, earthmoving and construction activities

Page 26: Inserted **Author**

AEP and others are conducting pilot testing on the feasibility of injectable reactive media as an alternative to excavation and placement of reactive material in slurry trenches.

Page 26: Inserted **Author**

AEP is part of a team that are currently planning pilot studies for implementation of PRBs at CCR sites which include evaluations of potential remobilization of adsorbed contaminants.

If remobilization of adsorbed contaminants is confirmed, removal and disposal of spent PRB materials, and/or placement/injection of additional PRB materials might increase the long-term protectiveness of this alternative.

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Removal and disposal of spent PRB materials would remove additional contaminant mass from the subsurface, particularly if ongoing monitoring suggests that remobilization of lithium from the PRB is occurring.

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However, the long-term effectiveness of the PRB approach is uncertain due to long-term in-situ sorption rates and behavior. Further, because lithium is simply immobilized, but not destroyed or removed from the subsurface region, there is the potential that changes in subsurface geochemical conditions could cause sorbed lithium to return to solution and mobilize in the future. Additionally, the media could run out of reactive capacity and no longer be effective at immobilizing additional mass of lithium; in this case replacing the media, or installing additional media may be needed to achieve the corrective action objectives.

Page 27: Inserted	Author

AEP is part of a team currently conducting research into the feasibility and performance of materials capable of in-situ adsorption of lithium, including planned PRB pilot-testing at the Mountaineer facility. This research is intended to provide information on the adsorptive capacity of potential PRB materials in field conditions, the likelihood of remobilization of lithium over time, and further assess the potential for the PRB to cause changes to groundwater conditions which may affect groundwater quality.

Page 28: Inserted	Author

The second option would be to mix an amendment material directly to the soil, typically using soil augers in overlapping boreholes to turn over soil as the amendment suspended in water is fed into the borehole. Soil mixing becomes more difficult as the remediation depth increases, and a total depth of 90 feet is likely beyond the limit of the technology. Similar to the slurry trench method described above, soil mixing equipment would require a working platform wide enough to accommodate the mixing equipment, and the area between the downgradient edge of the existing BAPs and the Site property boundary is limited.

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Success of an injectable PRB depends on:

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, it may not effectively distribute in the subsurface and may not allow sufficient mass into the subsurface to contain the plume for a significant time period before the media is expended

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is difficult to achieve, which could require substantial over-injection of reagent to prevent gaps in the barrier, as gaps would reduce the performance of the PRB by allowing contaminated groundwater to pass through untreated

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AEP is part of a team currently planning a pilot test of an injectable PRB material to develop information on

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several possible

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/media would need to be evaluated in a pilot test prior to implementation

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at the Mountaineer site

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(e.g., if the reactive media is installed in panels, renewal could be achieved by replacing individual expended panel sections only)

Header and footer changes

Text Box changes

Header and footer text box changes

Footnote changes

Page 10: Inserted **Author**

[1] *Annual Groundwater Monitoring and Corrective Action Report*, Bottom Ash Pond, Mountaineer Plant, prepared by AEP, dated January 2020

Page 17: Inserted **Author**

[1] Potential impacts of the potential remedy, including safety, cross-media, and exposure impacts, will be discussed under this criterion.

Endnote changes

Appendix G

Semi-Annual Progress Reports for Selection of Remedy at § 257.97(a)

DRAFT

Semi-Annual Progress Report-01
Selection and Design of Corrective Remedy
Mountaineer Bottom Ash Pond

Mountaineer Plant

Appalachian Power Company.

New Haven, WV

March 2020

Prepared for: Appalachian Power Company

Prepared by: American Electric Power Service Corporation

1 Riverside Plaza

Columbus, OH 43215

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1.0 BACKGROUND

The Bottom Ash Pond (BAP) at the Mountaineer Plant is regulated by the Federal CCR Rule, 40 CFR Part 257. Sampling and analyses of groundwater from the monitoring network installed pursuant to 40 CFR §257.95 identified the following Appendix IV constituent at statistically significant levels above the respective groundwater protection standards (GWPS): lithium.

AEP determined that there are three technically feasible alternatives for remediating the groundwater at the BAP. Each alternative includes some form of source control. The current plan for source control would be to close the bottom ash pond by removing the ash.

Alternative #1: Source Control with Monitored Natural Attenuation

Alternative #2: Source Control with Groundwater Plume Containment by Hydraulic Containment System

Alternative #3: Source Control and In-Situ Treatment by Permeable Reactive Barrier

The Assessment of Corrective Measures report was prepared and posted to the Operating Record on June 24, 2019. A public meeting was conducted on August 22, 2019 in the town of New Haven, West Virginia to discuss the remediation technologies that are technically feasible for the specific site conditions at the bottom ash pond. A 30-day public comment period started on August 22 and ended on September 21, 2019. No public comments were received during the 30-day period.

2.0 PURPOSE

This semiannual report is required by 40 CCR §257.97 and describes AEP's progress in selecting and designing the corrective measure(s) discussed in the ACM Report.

This report covers the period from: September 21, 2019 – March 20, 2020.

3.0 PROGRESS

During the period covered by Report-01, AEP made progress in evaluating each of the three corrective measure alternatives.

With respect to source control, which applies to all three alternatives, AEP hired an engineering firm to develop a preliminary design of the closure by removal project and other ancillary modifications to the BAP. The engineering work started in December 2019.

In regards to Alternatives 2 and 3, AEP continued laboratory testing of potential media to remove the constituents of concern. This initially involved bench scale treatability testing by mixing potential media with quartz sand as a base soil matrix. Site-specific groundwater was added to the base soil matrix. The test solutions were analyzed to evaluate metals removal rates and efficiency. The bench scale test results were then used to design a series of laboratory testing called column tests. The column tests mixed media with site-specific aquifer soils to create the soil matrix. Site- specific groundwater was pumped through the soil column and allowed to infiltrate through the soil matrix.

AEP conducted the semi-annual groundwater sampling and testing during this report period. The results are summarized in the report, "Annual Groundwater Monitoring and Corrective Action Report."

4.0 PLANNED WORK

In terms of planned work, AEP will continue to evaluate each of the three corrective measure alternatives.

AEP will continue to work on the design and plan of a closure by removal project as means of source control for each alternative.

AEP will continue the next phase of media testing and evaluation. This work is being conducted under a contract with the Electric Power Research Institute (EPRI).

AEP will sample and test all of the monitoring wells as part of the semi-annual requirement.

AEP also plans to retain the services of a consultant to further evaluate the technologies identified in the ACM as per the criteria set forth in 40 CCR §257.97

AEP will submit another progress report by September 20, 2020.

Semi-Annual Progress Report-02
Selection and Design of Corrective Remedy
Mountaineer Bottom Ash Pond

Mountaineer Plant

Appalachian Power Company.

New Haven, WV

September 2020

Prepared for: Appalachian Power Company

Prepared by: American Electric Power Service Corporation

1 Riverside Plaza

Columbus, OH 43215

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1.0 BACKGROUND

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2.0 PURPOSE

This semiannual report is required by 40 CCR §257.97 and describes AEP's progress in selecting and designing the corrective measure(s) discussed in the ACM Report.

This report covers the period from: March 21, 2020 – September 20, 2020.

3.0 PROGRESS

During the period covered by Report-02, AEP has made progress in evaluating each of the three corrective measure alternatives.

AEP has been working with an engineering firm. The preliminary engineering is complete and detailed engineering is started for design work for closure by removal and other ancillary modifications to the BAPs. This work includes alternate CCR disposal methods and water treatment methods to align the facility with finalized CCR and proposed ELG rules.

In regards to Alternatives 2 and 3, AEP has continued laboratory testing of potential media to remove the constituents of concern. The column tests were performed with mixed media and site-specific aquifer soils to create the soil matrix. Additional samples of site-specific groundwater was pumped through the soil column to infiltrate the soil matrix.

AEP conducted the semi-annual groundwater sampling and testing during this report period. The results are summarized in the report, "Annual Groundwater Monitoring and Corrective Action Report."

4.0 PLANNED WORK

In terms of planned work, AEP will continue to evaluate each of the three corrective measure alternatives.

AEP will continue to work on the design and plan for closure by removal project as means of source control for each alternative.

AEP will finalize media testing and evaluation. This work is being conducted under a contract with the Electric Power Research Institute (EPRI).

AEP will sample and test all of the monitoring wells as part of the semi-annual requirement.

AEP also plans to retain the services of a consultant to further evaluate the technologies identified in the ACM as per the criteria set forth in 40 CCR §257.97.

AEP will submit another progress report by March 20, 2021.

Appendix H

Structural Stability Assessment Required at § 257.73(d)

DRAFT

STRUCTURAL STABILITY ASSESSMENT

CFR 257.73(d)

Bottom Ash Complex

Mountaineer Plant
New Haven, West Virginia

October, 2016

Prepared for: Appalachian Power Company

New Haven, West Virginia

Prepared by: American Electric Power Service Corporation

1 Riverside Plaza

Columbus, OH 43215

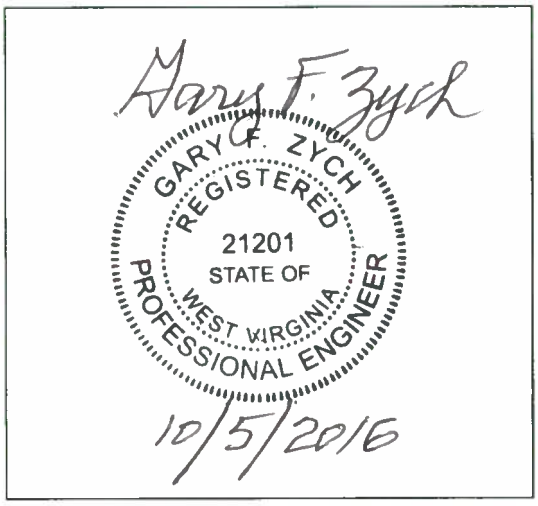
GERS-16-128

STRUCTURAL STABILITY ASSESSMENT
CFR 257.73(D)
MOUNTAINEER POWER PLANT
BOTTOM ASH POND COMPLEX

PREPARED BY M. Leilah Saadi DATE 10/3/16
M. Leilah Saadi, E.I.T.

REVIEWED BY Brian G. Palmer DATE 10-3-16
Brian G. Palmer, P.E.

APPROVED BY Gary F. Zych DATE 10/5/2016
Gary F. Zych, P.E.
Manager – AEP Geotechnical Engineering



I certify to the best of my knowledge, information and belief that the information contained in this structural stability assessment meets the requirements of 40 CFR 257.73(d)

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1.0 OBJECTIVE 257.73(d)

This report was prepared by AEP- Geotechnical Engineering Services (GES) section to fulfill requirements of CFR 257.73(d) – document whether the design, construction, operations, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices.

2.0 NAME AND DESCRIPTION OF CCR SURFACE IMPOUNDMENT

The Mountaineer Power Plant is located near the City of New Haven, Mason County, West Virginia. It is owned and operated by Appalachian Power Company (APCo). The facility operates one surface impoundment for storing CCR called the Bottom Ash Complex.

The Bottom Ash Complex is comprised of diked embankments on the north, east, and west sides. The south side of the Bottom Ash Complex is incised. There are six main ponds within the Bottom Ash Complex as listed below. The Bottom Ash Ponds and Wastewater Ponds were designed in tandem; one Bottom Ash Pond and one Wastewater Pond are in service at a given time.

List of Main Ponds within the Bottom Ash Complex
East Bottom Ash Pond
West Bottom Ash Pond
East Wastewater Pond
West Wastewater Pond
Reclaim Pond
Clearwater Pond

3.0 STABLE FOUNDATION AND ABUTMENTS 257.73(d)(1)(i)

[Was the facility designed for and constructed on stable foundations and abutments? Describe any foundation improvements required as part of construction.]

Based on the design drawings, the foundation was stripped and the subgrade was prepared prior to construction of the embankment. The dikes were constructed using soils excavated from within the pond area. Soil borings taken prior to construction indicate that most of the soils used for the dikes range from silty and clayey fine sand to fine medium sand. Based on recent subsurface investigations, the foundation materials of the Bottom Ash Pond Complex consist of Silty Sand / Sandy Silt – Very Loose to Loose (SM) materials overlaying Poorly Graded Sand/Gravel – Dense to Very Dense (SP or GP). The findings of the subsurface investigations the foundations materials are suitable for this CCR unit.

In 2006, the north and west embankments were modified to accommodate a gypsum conveyor system. There is no documentation of any foundation improvements due to this construction. Stability analysis of the perimeter dikes along the gypsum conveyors demonstrates the stability of the downstream slope of the dike has met West Virginia dam safety criteria prior to installation.

Operation of the impoundment is performed so as to not adversely affect the foundation and abutments. As required by the CCR rules the Bottom Ash Pond Complex is inspected at least every 7 days by a qualified person. Also as a requirement of the CCR rules, the impoundment is also inspected annually by a professional engineer. Maintenance items are addressed as they are discovered as a part of those inspections.

4.0 SLOPE PROTECTION 257.73(d)(1)(ii)

[Adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown.]

The Bottom Ash Pond Complex was designed and constructed with compacted sand fill that was assembled at a 2.5H to 1V slope. For protection of the clay lining against damage, mine waste was placed on the inside slopes. The outside slopes were covered with mine waste and then covered with topsoil and seeded, except for the bottom 2 ft to permit free drainage at the downstream toe. The current condition of the grassed slopes is adequate. Grassed slopes are mowed regularly. Any erosion or slips that may occur are repaired within a timely period.

5.0 EMBANKMENT CONSTRUCTION 257.73 (d)(1)(iii)

[Describe the specifications for compaction and/or recent boring to give a relative comparison of density.]

The construction specifications indicate that the embankment was constructed with sand fill placed in lifts not exceeding 6-inches. The clay liner was compacted in thin lifts at water contents within +/- 2% of standard optimum. Recent borings through the embankment indicate that the material is dense to very dense and representative of a compacted material.

6.0 VEGETATION CONTROL 257.73 (d)(1)(iv)

[Describe the maintenance plan for vegetative cover.]

The vegetative areas are mowed to facilitate inspections and promote the growth of the vegetative layer; and prevent the growth of woody vegetation.

7.0 SPILLWAY SYSTEM 257.73(d)(1)(v)

[Describe the spillway system and its capacity to pass the Inflow Design Flood as per its Hazard Classification.]

The Bottom Ash Pond Complex has been determined to be a Significant Hazard potential CCR impoundment. Based on this hazard classification, the design flood was determined by section 257.82(a)(3) to be the 1000-year storm which corresponds to 7 inches in 24hours for this site. An analysis was performed for the 1000-year storm event. Results of this analysis show that the Bottom Ash Pond Complex has adequate hydrologic and hydraulic capacity to collect and control peak discharge resulting from the 1000-year inflow design.

The outlet works for the Bottom Ash Pond cells consists of a reinforced concrete drop inlet structure with weir openings on three sides which include slide stop logs approximately 3-feet wide. A wooded surface skimming structure is constructed around the weir box. The outlet works of the Wastewater Pond cells consist of a 250-feet long concrete weir. The weir discharges into a concrete chute which transitions into a box structure leading to a junction chamber. The chamber controls flows from the Wastewater Ponds into the Reclaim Pond and/or Clearwater Pond. The outlet works for the Clearwater pond consists of a 185-feet long concrete weir. The weir discharges into a concrete structure and into a discharge pipe to the Ohio River. Drainage is diverted around the Bottom Ash Pond Complex by natural drainage channels and grass lined ditches.

Maintenance of the spillways is performed as needed based on periodic 7-day and annual inspections.

8.0 BURIED HYDRAULIC STRUCTURES 257.73 (d)(1)(vi)

[Describe the condition of the sections of any hydraulic structure that in buried beneath and/or in the embankment.]

The discharge pipes do not show signs of excess corrosion or deterioration based on an exterior visual inspection.

9.0 SUDDEN DRAWDOWN 257.73 (d)(1)(vii)

[If the downstream slope is susceptible to inundation, discuss the stability due to a sudden drawdown.]

The downstream slope of the Bottom Ash Pond Complex is not expected to be inundated from any adjacent water bodies.

Appendix I

Safety Factor Assessment Required at § 257.73(e)

DRAFT

Geotechnical Engineering Report

AEP Mountaineer Plant Bottom Ash Complex
Professional Engineering Certification
New Haven, West Virginia

December 22, 2015

Terracon Project No. N4155129

Prepared for:

American Electric Power
Columbus, Ohio

Prepared by:

Terracon Consultants, Inc.
Columbus, Ohio

terracon.com

Terracon

Environmental ■ Facilities ■ Geotechnical ■ Materials

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LIST OF EXHIBITS

Location Map ..... Exhibit A
Previous 2009 Stability Analyses ..... Exhibits B through D
Supplemental Stability Analyses ..... Exhibits E through G
Previous 2009 Liquefaction Analysis ..... Exhibit H
Site Reconnaissance Photographs ..... Exhibit I

1.0 INTRODUCTION

This report presents our conclusions and slope stability analysis results to satisfy the criteria set forth by the most recently mandated USEPA CCR rules for the AEP Mountaineer Bottom Ash Complex in New Haven, West Virginia.

2.0 PROJECT INFORMATION

In our Geotechnical Engineering Report dated March 12, 2009 H.C. Nutting (HCN), now Terracon, conducted geotechnical engineering analyses of the Mountaineer impoundment and determined the minimum upstream and downstream dike factors of safety against slope failure considering both existing and earthquake loading conditions in accordance with West Virginia Dam Safety Rule provisions (47CSR34-7.4.B.1.D.1). A hydrologic and hydraulic (H&H) analysis was not included as part of the scope for the previous project (HCN/Terracon Project No. N2095019). As part of the current project, Terracon was requested to perform the following tasks in order to certify that the existing impoundment meets the minimum requirement of the recently mandated USEPA CCR rules:

- Perform Site Visit
- Review Previous Analysis
- Perform Hydrologic and Hydraulic Analysis
- Establishment of Piezometer Action Values

The results of these tasks are summarized in the following sections. Please note that the results of the hydrologic and hydraulic analysis are being submitted in a separate report.

3.0 SITE VISIT

On July 21, 2015 the undersigned representatives of Terracon met with AEP personnel and performed a site reconnaissance of the Mountaineer Plant Bottom Ash Pond Complex. Exhibit A shows the impoundment and the three (3) slope stability cross-sections evaluated in our 2009 geotechnical report. During the site reconnaissance, the current conditions of the impoundment perimeter embankment were observed to be consistent with the conditions modeled in our previous slope stability analyses. We understand that no significant modifications have been made to the geometry of the existing impoundment perimeter embankment slopes since the time of our original investigation. A review of prior photographs at the site, taken in 2007, 2009 and 2014 during inspection visits by AEP also indicate that the geometry of the existing critical impoundment slopes have not been modified since the time of our previous 2009 subsurface investigation. Previous modifications to the perimeter embankment of the existing complex are

understood to have occurred in 2006 prior to our 2009 investigation at the site. These previous modifications included extending the slopes of the north and west dikes for construction of the gypsum conveyor system as analyzed by Shaw, Stone & Webster in their 2006 Engineering Report. Pertinent photographs from the July 21, 2015 site reconnaissance have been included in the Appendix of this report as Exhibit I.

Standing water was observed along the downstream toe of the eastern dike of the East Bottom Ash Pond, which was also noted in our 2009 report. It was previously speculated that this water was the result of seepage through the dike; however, long-term groundwater readings obtained from monitoring wells located at the toe of the embankment indicate groundwater levels at a depth of about 25 feet below the existing ground surface. After further consideration, it is likely that the standing water observed in this area is the result of poor drainage and surficial grading, and that the water can likely be attributed to surficial runoff. Terracon recommends that the area in question be re-graded to improve drainage and that continued monitoring take place following the grading operations to ensure that the problem has been adequately resolved.

4.0 REVIEW OF PREVIOUS SLOPE STABILITY ANALYSES

Terracon has completed a review of the slope stability analyses performed as part of our previously submitted Geotechnical Engineering Report for the subject site. During the previous investigation, it was determined that Cross-Section A-A', located along the northeast side of the existing East Bottom Ash Pond, was the critical section with respect to slope stability. Please refer to Exhibit A in the Appendix of this report for a drawing illustrating the location of Cross-Section A-A'.

Previous analyses were performed for the following cases:

- Long Term, Steady-State at Maximum Storage Pool Elevation 617 feet – This case represents the expected maximum normal operating elevation.

- Seismic – For this case, seismic loading was applied to the "Long Term, Steady-State at Maximum Storage Pool Elevation 617 feet" case and performed using a horizontal seismic coefficient of 0.05. The 2008 (updated in October 2009) Peak Ground Acceleration (PGA) with 2% Probability of Exceedance in 50 Years for the site is 0.058 g.

The stability analyses were performed using the Modified Bishop's Method and Spencer's Method in the software package STEDWIN, which is a Windows version of the computer program STABL7 as developed by Purdue University through the support of the Indiana State Highway Commission.

Strength parameters were developed based on the results of the field and laboratory testing and engineering correlations. Soil profiles were developed based on subsurface conditions interpreted from the borings. The soil parameters used for the slope stability analyses are summarized in the following table and included on their respective slope stability summary exhibits.

Material	Unit Weight (pcf)		Effective Strength Parameters	
	Total	Saturated	φ (deg)	C (psf)
Clay Liner (CL)	118	125	33	0
Mine Waste (MW)	135	140	36	0
Sand Fill – Dense to Very Dense (SF)	110	115	33	0
Silty Sand/Sandy Silt – Very Loose to Loose (SM)	110	115	28	0
Poorly Graded Sand/Gravel – Dense to Very Dense (SP or GP)	120	120	34	0
Lean and Silty Clay – Stiff (CL/CL-ML)	110	115	30	0
Silty Clay – Medium Stiff (CL-ML)	105	110	28	0

The calculated factors of safety meeting the CCR rules requirements and the minimum required factors of safety for each case are presented in the following table:

Summary of Previous Stability Analysis Results – Section A-A'

Slope Stability Case	Minimum Factor of Safety from Slope Stability Analyses		Required Minimum Factor of Safety	Exhibits [2]
	Upstream	Downstream		
Long-Term, Steady-State at Maximum Storage Pool Elevation 617 Feet [1]	1.91	N/P [3]	1.5	B
Long-term with Seismic Loading [1]	1.48	1.24	1.0	C, D

1. *Analysis performed as part of our previous 2009 Geotechnical Engineering Report.*
2. *Refers to exhibit designation of slope stability output included in the Appendix of this submittal.*
3. *Not Presented – this analysis did not meet the minimum required factor of safety.*

Based on the results of the previous analyses, the minimum required factor of safety for the CCR rules was met for all of the cases except for the downstream slope under the maximum storage pool case. The results of the previous analysis for this case are not presented in this report. An updated analysis for this case is discussed in section **5.0 Supplemental Analyses**. The CCR rules also require slope stability analyses for the maximum surcharge pool, with the

water level located at the top of the embankment (elevation 621.5 feet). This analysis was not performed as part of the prior geotechnical Engineering Report.

In addition, the CCR rules require that for dikes constructed of soils with a susceptibility to liquefaction, the calculated factor of safety against liquefaction must equal or exceed a values of 1.20. As part of our previous investigation, a preliminary liquefaction analysis was performed based on the estimated groundwater levels, earthquake magnitude and peak ground acceleration values. The results of this analysis are included as Exhibit H and indicated that factor of safety values ranged from a minimum of 1.2 to over 6.0.

5.0 SUPPLEMENTAL ANALYSES

In order to certify that the impoundment meets the minimum requirements, supplementary slope stability analyses were performed to further investigate the maximum surcharge pool loading condition. Additional information was also reviewed relative to the analyses for the maximum storage pool downstream slope (water elevation 621.5 feet).

At the time of our 2009 Geotechnical Engineering Report, standing water had been observed at the downstream toe of the embankment. Our previous analyses were performed under the consideration that the standing water was attributable to seepage through the dike. Supplemental piezometer readings obtained in Piezometer PZ-09-04 since the time of our 2009 analyses indicate groundwater at the downstream toe of the embankment is located approximately 25 feet below the existing ground surface. The phreatic surface utilized in our previous analyses provides a conservative estimate of the conditions now anticipated to be occurring at the site based on the supplemental piezometric readings.

Slope/W® 2012 software developed by Geo-Slope International was utilized for the supplemental analyses employing Spencer's Method. Material properties and the subsurface profile utilized in the current analyses were the same as those utilized in our previous investigation. The phreatic surface utilized in the current analyses was updated based on the latest information available from the piezometers installed at the site during the 2009 HCN subsurface investigation, with a groundwater elevation at the toe of the embankment of 573 feet. A minimum failure depth of 5.0 feet was specified to eliminate reporting of local, surficial failure surfaces.

A summary of the resulting factors of safety against failure, along with the corresponding required minimum values for each of the supplemental analyses is presented in the following table.

Summary of Supplemental Stability Analysis Results – Section A-A'

Slope Stability Case	Minimum Factor of Safety from Slope Stability Analysis		Required Minimum Factor of Safety	Exhibits [1]
	Upstream	Downstream		
Long-Term, Maximum Storage Pool Loading	N/A [2]	2.00	1.5	E
Maximum Surcharge Pool Loading	2.04	2.00	1.4	F, G

1. *Refers to exhibit designation of slope stability output included in the Appendix of this submittal.*
2. *The previous upstream analysis met the required factor of safety. A supplemental analysis was not performed for this case.*

Based on the analyses performed to date, it is the conclusion of Terracon that the subject impoundment satisfies all of the minimum slope stability factor of safety values required by the CCR rules.

6.0 HYDROLOGIC AND HYDRAULIC ANALYSIS

As stated previously, the required hydrologic and hydraulic analysis for the Mountaineer Plant Bottom Ash Pond Complex are being submitted in a separate report.

7.0 GENERAL COMMENTS

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. In the event that changes in the configuration of the impoundment as outlined in this report are

planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

8.0 REFERENCES

Documents reviewed for our evaluation include:

- Engineering Report for Appalachian Power Company, Mountaineer Bottom Ash Pond Complex – North and West Dike Modification. Prepared in support of the application for a certificate of approval from the State of West Virginia Department of Environmental Protection, Division of Water and Waste Management, Dam Safety Section. Prepared by Shaw, Stone & Webster, Centennial, Colorado 80112. Project number 1024690305. March 21, 2006.

- 2007 Dam and Dike Inspection Report for State of West Virginia Department of Environmental Protection, Division of Water and Waste Management, Dam Safety Section, Mountaineer Bottom Ash Complex (ID# 05307). Prepared for compliance with Dam Safety Rules Section 47-34-15.4c. Prepared by American Electric Power Service Corporation, Engineering Department, Geotechnical Engineering Section, Columbus, Ohio 43215. June 15, 2007.

- 2009 Dam and Dike Inspection Report for American Electric Power Service Corporation, Engineering Department, Geotechnical Engineering Section, Mountaineer Bottom Ash Complex (ID# 05307). Prepared for compliance with Dam Safety Rules Section 47-34-15.4c. Prepared by H.C. Nutting (Terracon), Columbus, Ohio 43230. Project number N2095020. February 25, 2009.

- Geotechnical Engineering Report for American Electric Power Service Corporation, Engineering Department, Geotechnical Engineering Section, AEP Mountaineer Bottom Ash Pond Complex. Prepared in support of the maintenance of the AEP Mountaineer Bottom Ash Pond Complex. Prepared by H.C. Nutting (Terracon), Columbus, Ohio 43230. Project number N2095019. March 12, 2009.

- Sketch of the Mountaineer Bottom Ash Pond Complex East Dike. Prepared to illustrate groundwater conditions in relation to wet area at toe of the dike. Prepared by American Electric Power Service Corporation, Engineering Department, Geotechnical Engineering Section, Columbus, Ohio 43215. 2009.

- 2009 Dam and Dike Inspection Report for State of West Virginia Department of Environmental Protection, Division of Water and Waste Management, Dam Safety Section, Mountaineer Bottom Ash Complex (ID# 05307). Prepared for compliance with

Dam Safety Rules Section 47-34-15.4c. Prepared by American Electric Power Service Corporation, Engineering Department, Geotechnical Engineering Section, Columbus, Ohio 43215. July 10, 2009.

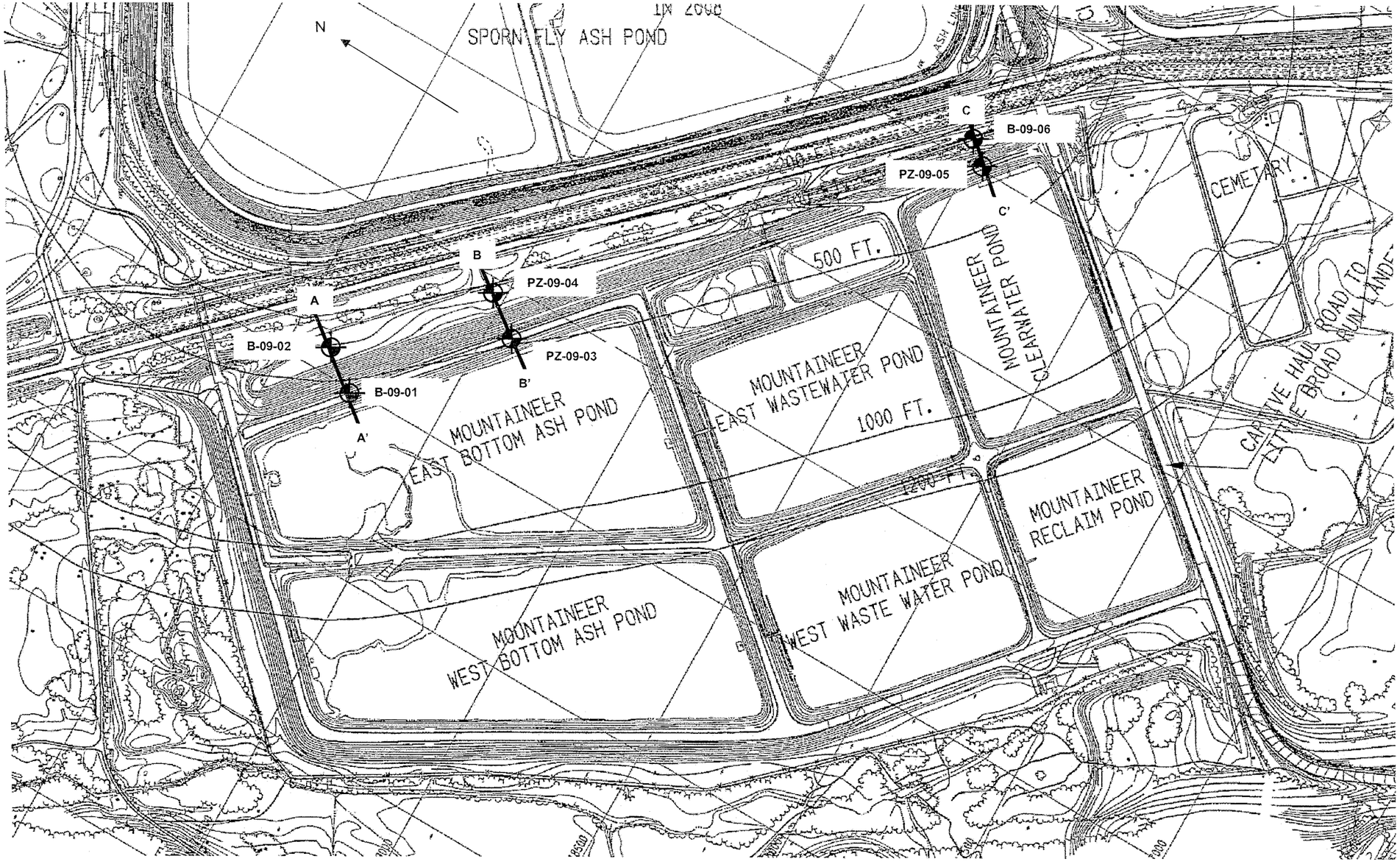
- 2014 Dam and Dike Inspection Report for State of West Virginia Department of Environmental Protection, Division of Water and Waste Management, Dam Safety Section, Mountaineer Bottom Ash Complex (ID# 05307). Prepared for compliance with Dam Safety Rules Section 47-34-15.4c. Prepared by American Electric Power Service Corporation, Engineering Department, Geotechnical Engineering Section, Columbus, Ohio 43215. November 17, 2014.

9.0 P.E. CERTIFICATION

Based on the site reconnaissance visit, review of previous analyses, field and laboratory testing, and the slope stability analysis performed by Terracon personnel, I hereby certify that the factors of safety for slope stability for the Mountaineer Plant Bottom Ash Pond Complex meet or exceed the minimum required factors of safety, in accordance with requirements of Section 257.73 of the USEPA CCR Rules.

Kevin M. Ernst, P.E.
Certifying Engineer
15825

EXHIBITS



Approximate Boring Location

Slope Stability Cross Section Lines

Project Mngr:	YSR
Drawn By:	YSR
Checked By:	YSR
Approved By:	

Project No.	N2095019
Scale:	NTS
File No.	N2095019
Date:	2/23/2009

Terracon
Consulting Engineers and Scientists
Charleston, West Virginia

Boring Location Diagram

Mountaineer Bottom Ash Pond Complex

New Haven, West Virginia

American Electric Power

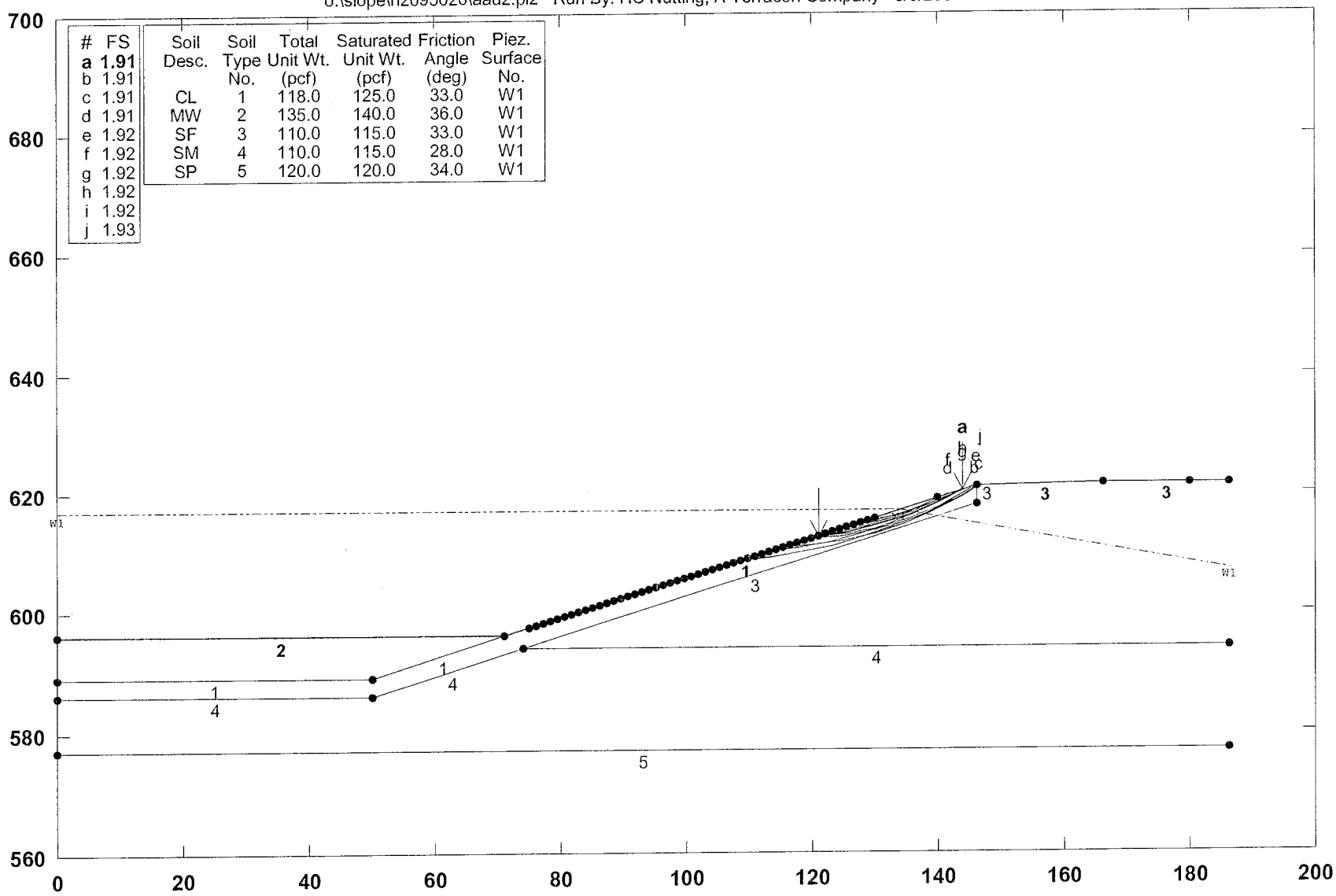
Exhibit

A

AEPMTP-000145

AEP / Mountaineer BAP Complex, C/S A-A',Upstream Slope, Long term Local

o:\slope\n2095020\aau2.pl2 Run By: HC Nutting, A Terracon Company 3/5/2009 10:14AM



#	FS
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b	1.91
c	1.91
d	1.91
e	1.92
f	1.92
g	1.92
h	1.92
i	1.92
j	1.93

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Friction Angle (deg)	Piez. Surface No.
CL	1	118.0	125.0	33.0	W1
MW	2	135.0	140.0	36.0	W1
SF	3	110.0	115.0	33.0	W1
SM	4	110.0	115.0	28.0	W1
SP	5	120.0	120.0	34.0	W1

PCSTABL7 FSmin=1.91

Safety Factors Are Calculated By The Modified Bishop Method

H. C. NUTTING

A Terracon COMPANY

Exhibit B

AEPMTP-000161

AEP / Mountaineer BAP Complex, C/S A-A',Upstream Slope, Long term Earthquake

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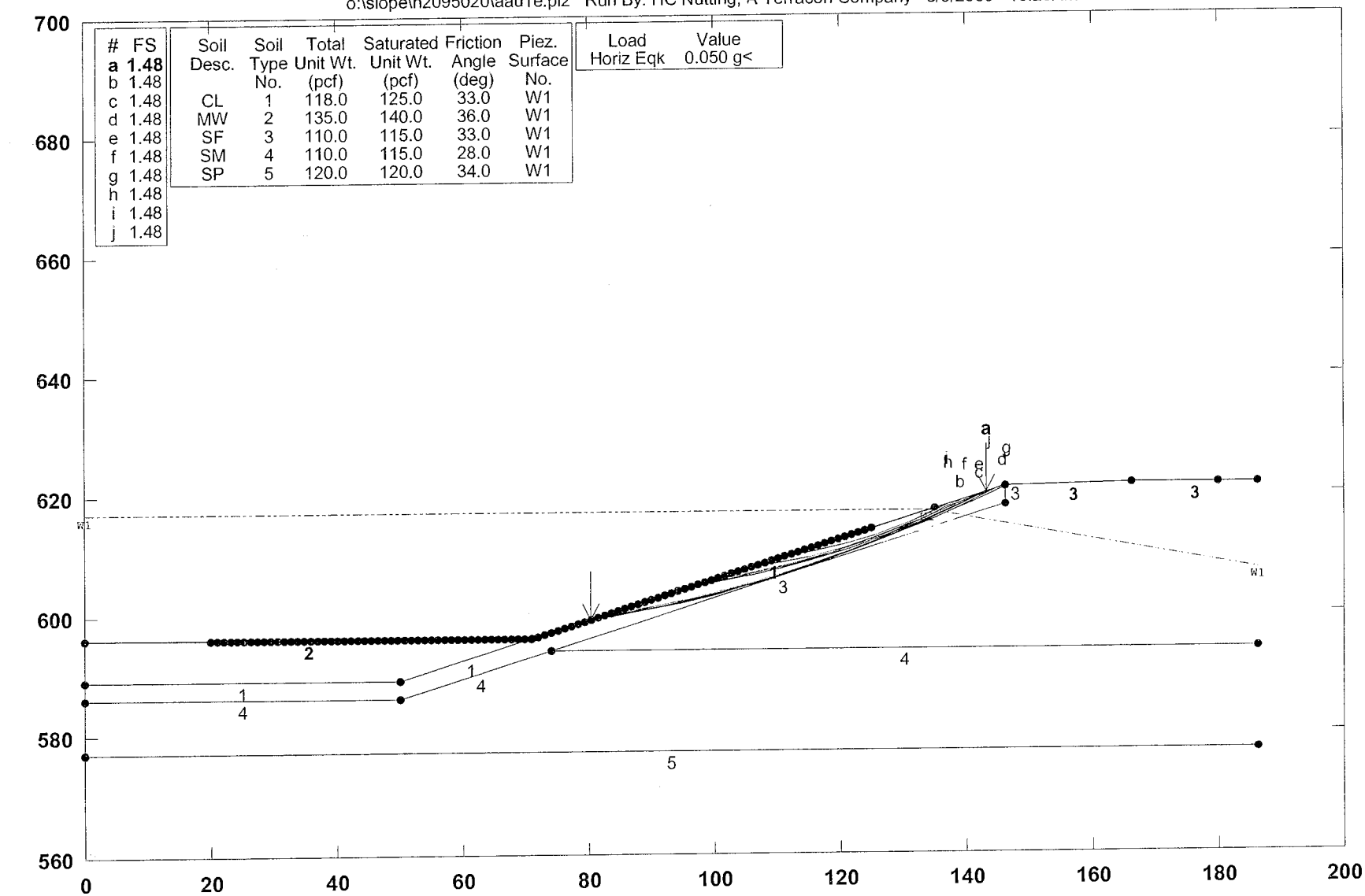

#	FS
a	**1.48**
b	1.48
c	1.48
d	1.48
e	1.48
f	1.48
g	1.48
h	1.48
i	1.48
j	1.48

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Friction Angle (deg)	Piez. Surface No.
CL	1	118.0	125.0	33.0	W1
MW	2	135.0	140.0	36.0	W1
SF	3	110.0	115.0	33.0	W1
SM	4	110.0	115.0	28.0	W1
SP	5	120.0	120.0	34.0	W1

Load	Value
Horiz Eqk	0.050 g<

PCSTABL7 FSmin=1.48

Safety Factors Are Calculated By Spencer`s Method

H. C. NUTTING

A Terracon COMPANY

Exhibit C

AEPMTP-000163

AEP / Mountaineer BAP Complex, C/S A-A',Downstream Slope, Long term, Earthquake

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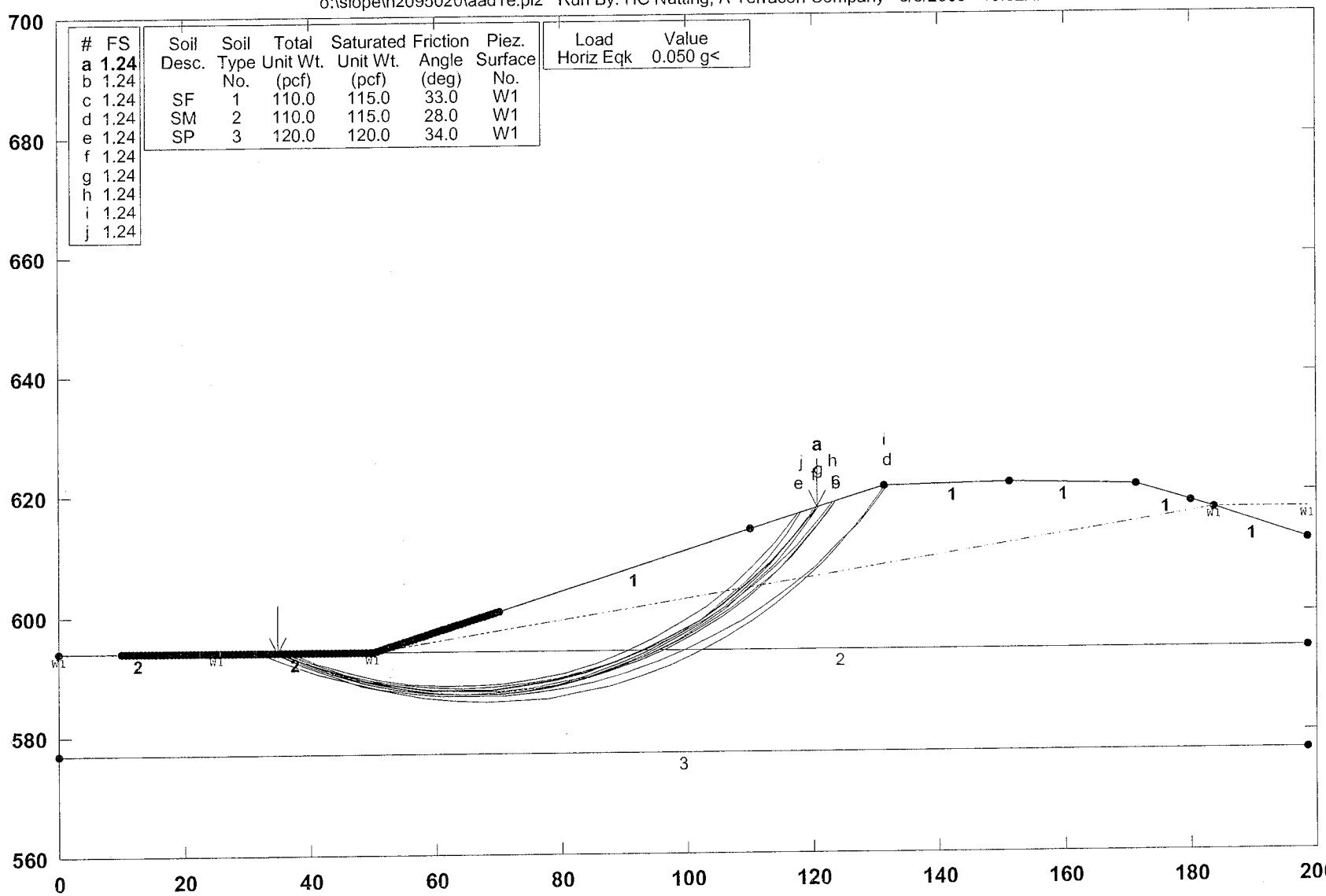

#	FS
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b	1.24
c	1.24
d	1.24
e	1.24
f	1.24
g	1.24
h	1.24
i	1.24
j	1.24

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Friction Angle (deg)	Piez. Surface No.
SF	1	110.0	115.0	33.0	W1
SM	2	110.0	115.0	28.0	W1
SP	3	120.0	120.0	34.0	W1

Load	Value
Horiz Eqk	0.050 g<

PCSTABL7 FSmin=1.24

Safety Factors Are Calculated By Spencer`s Method

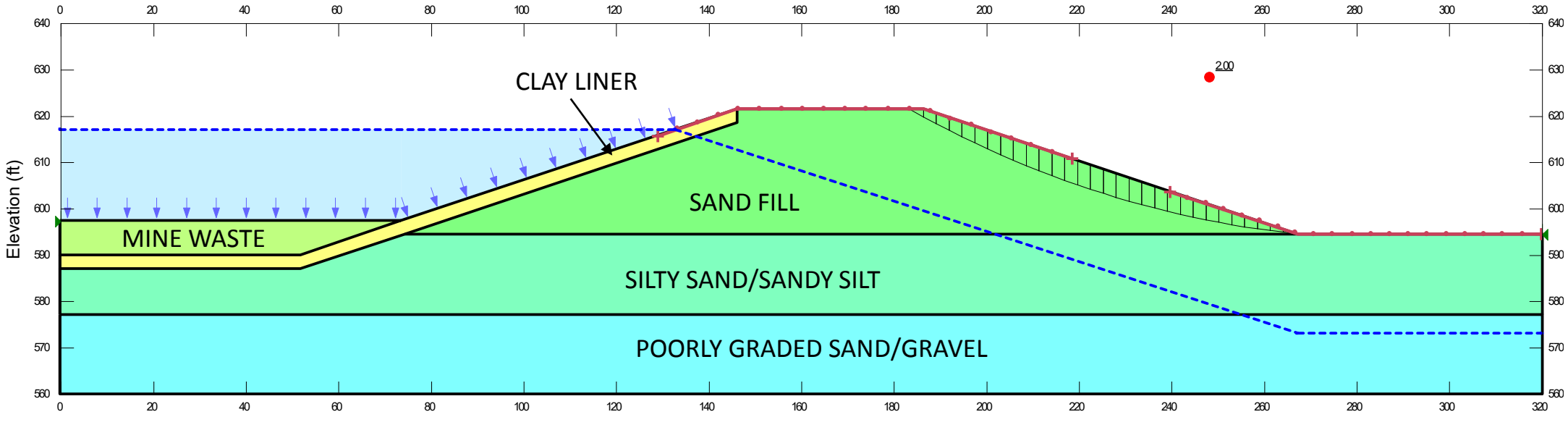
H. C. NUTTING

A Terracon COMPANY

Exhibit D

AEPMTP-000165

STORAGE POOL: DOWNSTREAM



Factor of Safety: 2.00

Material	Unit Weight (pcf)	Cohesion (psf)	Friction Angle (°)
Clay Liner	125	0	33
Mine Waste	140	0	36
Sand Fill	115	0	33
Silty Sand/Sandy Silt	115	0	28
Poorly Graded Sand/Gravel	120	0	34

Method: Spencer

Project Manager:	KME
Drawn by:	AKB
Checked by:	KME
Approved by:	KME

Project No.	N4155129
Scale:	N.T.S.
File Name:	N4155129
Date:	Dec 2015

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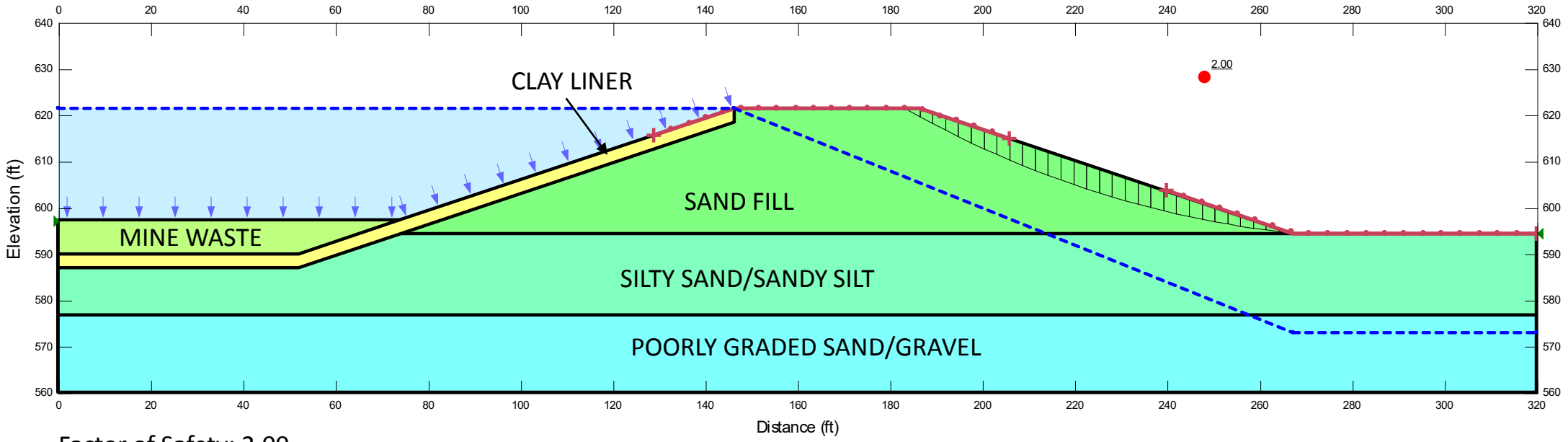
SLOPE/W MODEL SECTION A-A'

AMERICAN ELECTRIC POWER
MOUNTAINEER BOTTOM ASH POND COMPLEX
NEW HAVEN, WEST VIRGINIA

Exhibit

E

SURCHARGE POOL: DOWNSTREAM



Factor of Safety: 2.00

Material	Unit Weight (pcf)	Cohesion (psf)	Friction Angle (°)
Clay Liner	125	0	33
Mine Waste	140	0	36
Sand Fill	115	0	33
Silty Sand/Sandy Silt	115	0	28
Poorly Graded Sand/Gravel	120	0	34

Method: Spencer

Project Manager:	KME
Drawn by:	AKB
Checked by:	KME
Approved by:	KME

Project No.	N4155129
Scale:	N.T.S.
File Name:	N4155129
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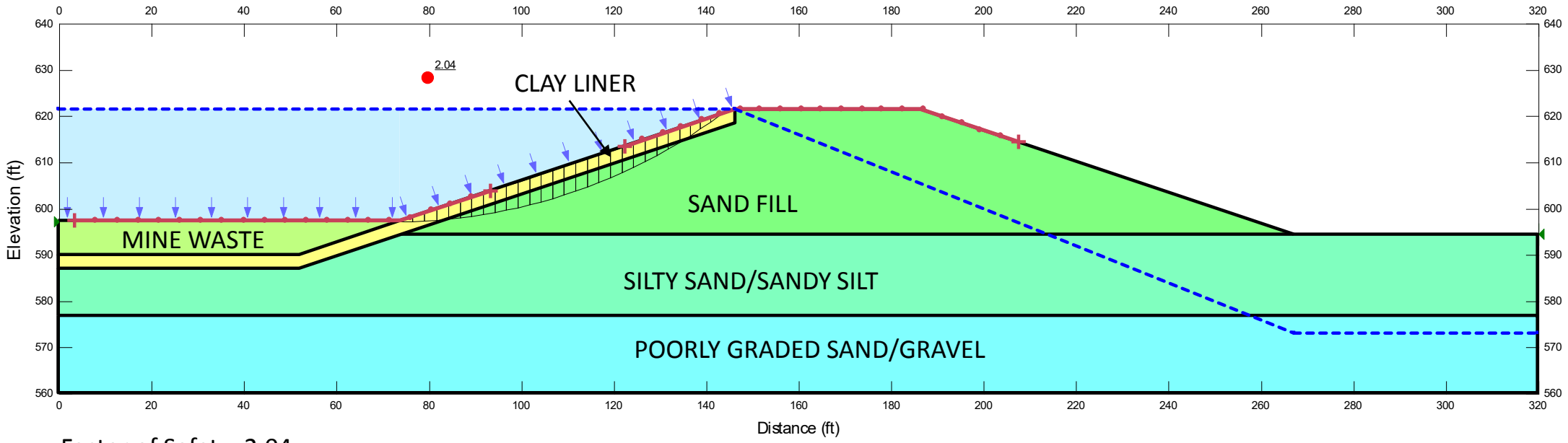
SLOPE/W MODEL SECTION A-A'

AMERICAN ELECTRIC POWER
MOUNTAINEER BOTTOM ASH POND COMPLEX
NEW HAVEN, WEST VIRGINIA

Exhibit

F

SURCHARGE POOL: UPSTREAM



Factor of Safety: 2.04

Material	Unit Weight (pcf)	Cohesion (psf)	Friction Angle (°)
Clay Liner	125	0	33
Mine Waste	140	0	36
Sand Fill	115	0	33
Silty Sand/Sandy Silt	115	0	28
Poorly Graded Sand/Gravel	120	0	34

Method: Spencer

Project Manager:	KME
Drawn by:	AKB
Checked by:	KME
Approved by:	KME

Project No.	N4155129
Scale:	N.T.S.
File Name:	N4155129
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SLOPE/W MODEL SECTION A-A'

AMERICAN ELECTRIC POWER
MOUNTAINEER BOTTOM ASH POND COMPLEX
NEW HAVEN, WEST VIRGINIA

Exhibit

G

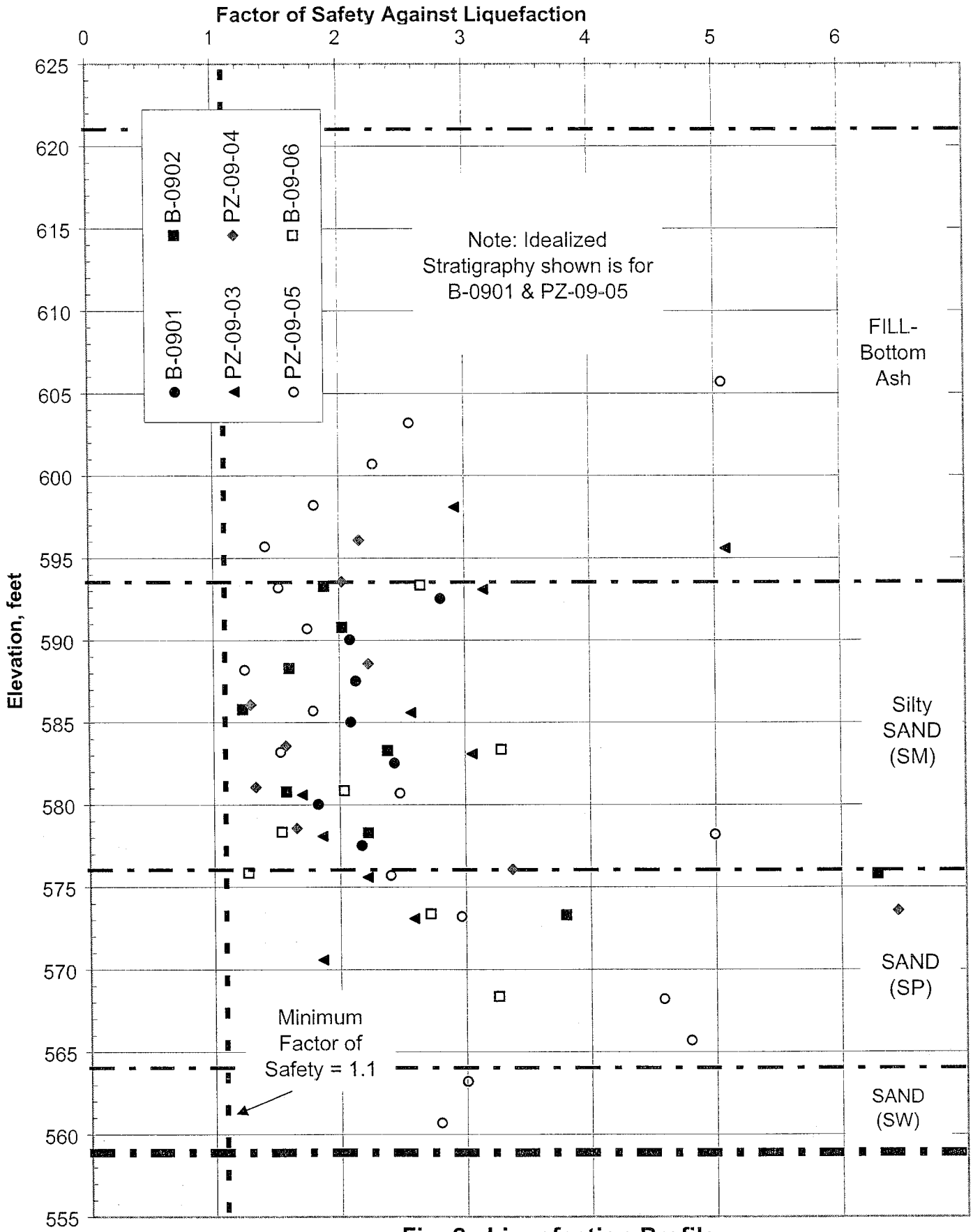

Fig. 2. Liquefaction Profile
AEP - Mountaineer Bottom Ash Pond
New Haven, WV

Exhibit H

Photo 1: West Bottom Ash Pond, north dike.

Photo 2: West Bottom Ash Pond, north dike.

Photo 3: Bottom Ash Ponds, splitter dike: bottom ash inlet pipes.

Photo 4: East Bottom Ash Pond, north/east dikes.

Photo 5: East Bottom Ash Pond, north/east dikes.

Photo 6: West Bottom Ash Pond: inlet structure.

Photo 7: West Bottom Ash Pond: inlet structure sluice gate.

Photo 8: Bottom Ash Ponds: bottom ash inlet pipes and inlet structure.

Photo 9: Bottom Ash Ponds: evidence of movement along bottom ash inlet pipes due to thermal expansion.

Photo 10: East Bottom Ash Pond: inlet structure.

Photo 11: Bottom Ash Ponds, splitter dike: bottom ash inlet pipes.

Photo 12: Bottom Ash Ponds, north dike: gypsum conveyor.

Photo 13: Bottom Ash Ponds, north dike: gypsum conveyor.

Photo 14: Bottom Ash Ponds, north dike: exterior slope.

Photo 15: Bottom Ash Ponds, north dike: exterior slope.

Photo 16: Bottom Ash Ponds, north dike: water near the exterior toe.

Photo 17: Bottom Ash Ponds, north dike: water near the exterior toe.

Photo 18: Bottom Ash Ponds, north dike: water near the exterior toe.

Photo 19: Bottom Ash Ponds, north dike: exterior slope.

Photo 20: Bottom Ash Ponds, north dike: exterior slope.

Photo 21: Bottom Ash Ponds, north dike: exterior slope.

Photo 22: West Bottom Ash Pond, west dike: exterior slope.

Photo 23: West Bottom Ash Pond, west dike: water near the exterior toe.

Photo 24: West Bottom Ash Pond, west dike: water near the exterior toe.

Photo 25: West Bottom Ash Pond, west dike.

Photo 26: West Waste Water Pond, north dike.

Photo 27: West Waste Water Pond, east dike.

Photo 28: West Waste Water Pond, west dike.

Photo 29: West Waste Water Pond, west dike.

Photo 30: Reclaim Water Pond, south dike.

Photo 31: Reclaim Water Pond, east dike.

Photo 32: Reclaim Water Pond, east dike.

Photo 33: Clearwater Pond, west dike.

Photo 34: Clearwater Pond, outlet weir.

Photo 35: Clearwater Pond, outlet weir.

Photo 36: Clearwater Pond, west dike.

Photo 37: Clearwater Pond, north dike.

Photo 38: Clearwater Pond, east dike.

Photo 39: Clearwater Pond, east dike.

Photo 40: Clearwater Pond, east dike: exterior slope.

Photo 41: Clearwater Pond, east dike.

Photo 42: Leachate Surge Pond.

Photo 43: East Wastewater Pond, east dike: piping along exterior slope.

Photo 44: East Wastewater Pond, east dike.

Photo 45: East Wastewater Pond, east dike: piping along exterior slope.

Photo 46: East Wastewater Pond, east dike: water along exterior toe.

Photo 47: East Wastewater Pond, east dike: water along exterior toe.

Photo 48: East Bottom Ash Pond, east dike: exterior slope.

Photo 49: East Bottom Ash Pond, east dike: water along exterior toe.

Photo 50: East Bottom Ash Pond, east dike: exterior slope.

Photo 51: East Bottom Ash Pond, north dike: bottom ash inlet pipes.

Photo 52: East Bottom Ash Pond, north dike.

Photo 53: East Bottom Ash Pond.

Photo 54: East Bottom Ash Pond, south dike: outlet structure.

Photo 55: East Bottom Ash Pond, south dike: outlet structure.

Photo 56: East Waste Water Pond: outlet structure.

Photo 57: Leachate Surge Pond.

Photo 58: Waste Water Ponds: valve outlet structure.

Photo 59: Waste Water Ponds: valve outlet structure.

Photo 60: Clearwater Pond: outlet structure.

Photo 61: Ohio River outlet structure.