Rockport 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 Rockport Power Plant (Rockport 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 Rockport Plant's operating record and posted to the CCR Rule Compliance Data and Information website.

AMERICAN
ELECTRIC
POWER
BOUNDLESS ENERGY

American Electric Power
1 Riverside Plaza
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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: Indiana Michigan Power Company
Rockport Power Plant Alternative Closure Demonstration

Dear Administrator Wheeler,

Indiana Michigan Power Company (I&M) Rockport Power Plant (Rockport 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 (BAP) located at the Rockport Plant near Rockport, Indiana. Rockport Plant is requesting an extension pursuant to 40 C.F.R. § 257.103(f)(1) to allow the BAP 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. 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

Indiana Michigan Power Company

Rockport Plant

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

Prepared by:

American Electric Power Service Corporation
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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 Indiana, 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
No. 11700730

David Anthony Miller

Signature

11700730

Registration No.

INDIANA

Registration State

11.30.2020

Date

EXECUTIVE SUMMARY

The Rockport Plant, which consists of two 1300 megawatt generating units, must continue to manage CCR and non-CCR wastestreams in its West Bottom Ash Pond (WBAP) past the April 11, 2021, deadline set forth in 40 CFR 257.101(a)(1) while alternative disposal capacity is developed. Currently, an average of 1.1 million gallons per day of CCR (wet sluiced bottom ash) and 3.7 million gallons per day of non-CCR wastestreams are managed in the East Bottom Ash Pond (EBAP) and WBAP at the Rockport Plant. The CCR and non-CCR wastestreams will cease being placed in the EBAP by April 11, 2021, and all CCR material will be removed from the EBAP prior to retrofitting the pond with a CCR compliant liner. Concurrently with the pond retrofit, a tank-based chemical treatment system will be installed. Upon completion of the CCR compliant pond and chemical treatment system by May 11, 2023, all CCR and non-CCR wastestreams will be re-routed from the WBAP to the CCR compliant pond and the WBAP will be permanently closed by removal.

INTRODUCTION

American Electric Power Service Corporation (AEP) as agent for Indiana Michigan Power Company (I&M), an owner of Unit 1 and the operator of the Rockport Plant, seeks EPA approval under 40 CFR 257.103(f) (1) - *"Development of Alternate Capacity Infeasible"* for a site-specific schedule to develop alternative disposal capacity for a CCR surface impoundment located at the Rockport Plant (Spencer County – 2791 North U.S. Highway 231, Rockport, Indiana). I&M seeks to establish a site-specific compliance deadline to continue to receive CCR and non-CCR wastestreams in the WBAP until May 11, 2023. The East Bottom Ash Pond (EBAP) will cease receiving CCR and non-CCR wastestreams by April 11, 2021, all CCR materials will be removed, and the pond will be converted to a CCR compliant pond. CCR and non-CCR wastestreams will continue to be routed to the unlined WBAP until construction of the CCR compliant pond is completed, no later than May 11, 2023. This document will demonstrate that the CCR and/or non-CCR wastestreams must continue to be managed in the WBAP until May 11, 2023 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 ROCKPORT PLANT AND AFFECTED CCR UNITS

The Rockport Plant is a coal-fired generating facility operated by Indiana Michigan Power Company, a subsidiary of AEP. The plant is located in Spencer County at the intersection of the Ohio River and State Rt. 231 near Rockport, Indiana. The Rockport Plant consists of two 1300 megawatt (MW) generating units which have a combined nameplate capacity of 2600 MW. Unit 1 is owned by AEP affiliates, and Unit 2 is leased from a trust under a lease arrangement whose initial term expires December 7, 2022. I&M will continue to operate Unit 2 after lease expiration unless replaced by the owners.

Throughout the life of the generating plant, various CCR materials have been generated. To manage the wet bottom ash and other wastewaters generated at the plant, the Rockport Plant operates a system consisting of two active CCR surface impoundments in the Bottom Ash Pond Complex (BAP Complex), the EBAP and the WBAP. The Rockport Plant also has a CCR landfill that receives flyash and other solid wastes. **Figure 1** provides a depiction of the overall layout of the plant site and CCR units.

The BAP Complex is located at the north end of the wastewater pond complex for the plant. It consists of two contiguous ponds, referred to as the EBAP and WBAP, which receive CCR and non-CCR wastestreams. Due to the proximity and integrated operation of the ponds, they have been treated as a single CCR unit for purposes of groundwater monitoring and other aspects of the rule, such as safety factor assessments, structural stability, and fugitive dust management in the operating record and on the public website.

The Rockport Plant currently routes CCR and non-CCR wastestreams in alternating fashion to the EBAP and WBAP, with one basin generally receiving wastestreams while the other basin is being cleaned out. Bottom ash in the inactive pond is drained and dewatered, and then moved by bulldozer to stockpiles on the north end of the pond. Dry ash in the stockpiles is loaded into trucks and transported to other locations for beneficial use or disposed of in the Rockport Landfill (LF). It takes approximately six months for the active pond to fill, at which time the second pond (which has been emptied of bottom ash) becomes the active pond, and the first pond is drained. Treated water flows from the EBAP or WBAP to the associated East or West Wastewater pond, and then to the

Reclaim pond and the Clear Water pond. Approximately 4.1 million gallons per day of the water in the Reclaim pond is pumped back to the plant for use as service water. Water that is not pumped back for re-use continues to the Clear Water pond for eventual discharge to the Ohio River through Outfall 001 as authorized by Indiana National Pollutant Discharge Elimination System (NPDES) Permit No. IN0051845.

The EBAP and WBAP are each approximately 30 acres in size, for a total of approximately 60 acres in the BAP Complex. The BAP Complex was formed by excavation into the existing ground with an earthen diked embankment along the WBAP. The dike along the WBAP is approximately 2000 feet long, 13 feet high, and 30 feet in width. The WBAP provides a CCR storage capacity of 211 acre-feet. The EBAP is an incised pond and provides 337 acre-feet of storage capacity.

The EBAP and WBAP do not meet the liner requirements of the CCR rule, and portions of the EBAP do not meet the required separation distance from the seasonally high uppermost aquifer. The ponds are currently in assessment monitoring for exceeding background limits for boron, chloride, fluoride, pH, TDS and sulfate; however, concentrations of all Appendix IV constituents remain well below the groundwater protection standards established for the site.

Groundwater at the BAP Complex is monitored in accordance with an assessment monitoring program, following the requirements of 40 CFR 257.95 in the CCR rule. Statistically significant concentrations over background were observed for boron, chloride, fluoride, pH, TDS and sulfate during the initial detection monitoring event at the BAP Complex. An alternative source for the exceedances could not be identified, and, following the requirements of 40 CFR 257.95, an assessment monitoring program and groundwater protection standards were established. There have been no statistically significant levels over groundwater protection standards detected for any constituent at any monitoring well in the unit's groundwater monitoring network. Following the requirements of 40 CFR 257.95, 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. Analysis 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 AEP plans to continue to manage in the WBAP, and discusses the options considered for obtaining alternative disposal capacity. As discussed in more detail below, AEP plans to close the EBAP by removal and establish a CCR compliant pond within the existing footprint to manage CCR and non-CCR wastestreams by no later than May 11, 2023. The workplan provides a detailed schedule for the pond closure, installation of chemical treatment systems, and pond retrofit projects, 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 decisions and an analysis of the adverse impact to plant operations if the Rockport Plant were no longer able to use the WBAP.

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;*

<u>Existing On and Off-site Disposal Capacity Evaluation</u>

The Rockport Plant does not currently have an existing alternate pond that meets all of the requirements of EPA's CCR regulation, and considerable modifications to plant equipment, facilities, and processes will be necessary before the Rockport Plant can cease placing CCR and non-CCR wastestreams into the WBAP. 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.

CCR Wastestreams:

AEP evaluated each CCR wastestream placed in the EBAP and WBAP at the Rockport Plant. Prior to submittal of this demonstration, as part of its normal plant operations, I&M ceased sluicing CCR and non-CCR materials to the EBAP and began removal of the CCR materials from the EBAP basin. Based on the requirements of the Final Part A rule and the evaluations performed for this demonstration, I&M intends to stop sluicing CCR and non-CCR wastestreams to the EBAP by no later than April 11, 2021, provide notification of intent to close this portion of the BAP Complex by removal, and submit the necessary permit applications to the Indiana Department of Environmental Management (IDEM) for approval of the closure plan. However, the WBAP will continue to receive CCR and non-CCR wastestreams until a CCR compliant pond can be established in the footprint of the former EBAP.

During normal operations, the active portion of the BAP Complex receives approximately 1.1 million gallons a day (MGD) of sluiced water containing bottom ash from Rockport Units 1 and 2.

In terms of on-site alternative disposal capacity; there are no other CCR surface impoundments that are available to directly receive wet bottom ash transport water. The EBAP will be undergoing closure and retrofitting during the extension period. The existing Wastewater ponds at the

Rockport Plant receive approximately 10.5 million gallons of excess service water, cooling tower blowdown, and other waters from existing sumps around the Rockport Plant, in addition to treated flows from the BAPs. See **Appendix B.** Further treatment of these wastestreams and the treated flows from the EBAP and WBAP is performed in the Wastewater ponds so that the water is of sufficient quality to be routed to the Reclaim pond. Approximately 4.1 million gallons is taken from the Reclaim pond and returned to the plant as service water on a daily basis, with the remaining 11 million gallons per day flowing to the Clear Water pond. This carefully balanced treatment system would be upset by re-routing bottom ash transport water or other untreated flows from the WBAP directly to the other wastewater ponds. It is necessary to develop alternative treatment capacity for these wastestreams.

In order to develop this alternative capacity refer to **Table 3** for the activities and the timing required to do so. The planned approach is the fastest feasible alternative, which is to establish an enhanced chemical treatment system, and a CCR compliant pond in the footprint of the EBAP following removal of the CCR material and certification of closure.

Relative to off-site disposal capacity, the sheer volume which will need to be handled on a daily basis makes off-site disposal of wet ash infeasible. 1.1 million gallons of bottom ash transport water equates to approximately 4,565 tons per day of CCR material and would require 229 trucks per day 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 implement a permanent solution that complies with the CCR rule. 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 facilities would likely be required to manage this flow, even if one were available.

For the reasons discussed above, and in **Table 1** below, the following CCR wastestreams must continue to be placed in the WBAP due to lack of alternative capacity both on and off-site.

Table 1: Rockport Plant CCR Wastestreams

CCR Wastestream	Average Flow (gpd)	Current Configuration	AEP Notes
Bottom Ash	1,100,000	Bottom ash is currently sluiced to the EBAP or WBAP, where it is temporarily stored until removed, dewatered and beneficially reused or disposed of in the Rockport landfill.	Bottom ash wastestream cannot be removed from the WBAP without significant changes to the Rockport Plant and development of alternative capacity. The EBAP will cease receiving CCR and non-CCR wastestreams no later than April 11, 2021, be closed by removal, and a CCR compliant pond will be established within the former EBAP footprint by no later than May 11, 2023. To estimate the number of trucks required to haul and dispose of this CCR material, the following calculations were performed: 1,100,000 gallons per day * 8.3 pounds per gallon = 9,130,000 pounds / 2000 pounds per ton = 4,565 tons per day / 20 tons per truck = 228.25 → 229 trucks per day

Non-CCR Wastestreams:

Approximately 3.7 MGD of various non-CCR wastestreams are sent to the WBAP. These wastewater streams include: coal pile runoff, pyrites sluice water, fly ash silo sump water, and storm water runoff.

The existing Wastewater ponds at the Rockport Plant already directly receive approximately 10.5 million gallons of excess service water, cooling tower blowdown, and other waters from existing sumps around the Rockport Plant. Further treatment of these wastestreams and the treated flows from the WBAP is performed in the Wastewater ponds so that the water is of sufficient quality to be routed to the Reclaim pond, where approximately 4.1 million gallons is returned as plant service water on a daily basis.

The coal pile runoff and stormwater flows will be redirected to the Wastewater ponds after completion of the chemical treatment system no later than February 28, 2023. The feasibility of rerouting the pyrites sluice and fly ash silo sump waste streams was evaluated. An additional 3,000-linear feet of piping would be required to deliver these wastestreams to the Wastewater ponds. The reroute requires several 45 to 90 degree turns. The dense particles in the sluice water would likely not remain in suspension given the added distance and route direction, resulting in potential operational issues such as pump failure and frequent maintenance to change out fittings and replace sections of piping which poses additional risk of releases. These items would need to be addressed during engineering and design. Furthermore, the solids loading from the higher flow pyrites sluice and fly ash silo sump wastestreams is recommended and currently planned to be routed to the retrofitted CCR compliant lined impoundment for settling before being discharged to the downstream Wastewater ponds to assure NPDES permit compliance. Allowing the existing delivery systems to be maintained expedites the compliance schedule and represents the best technical alternative for these wastestreams. Therefore, I&M has selected a compliance option that allows the existing non-CCR wastestreams to be discharged to the WBAP during closure and retrofitting of the EBAP and receive treatment in the current existing treatment path to ensure and maintain compliance with current NPDES permit limits. The selected alternative will allow the WBAP to cease receipt of all CCR and non-CCR wastestreams by May 11, 2023.

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 off-site disposal of non-CCR wastestreams infeasible. 3.7 million gallons of non-CCR wastewater equates to approximately 15,441 tons per day of liquid wastes and would require 773 trucks per day 24 hours per day 7 days per week to haul off and dispose. 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 implement a permanent solution that complies with the CCR rule. 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 facilities would likely be required to manage this flow, even if one were available.

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

Table 2: Rockport Plant non-CCR Wastestreams

Non-CCR Wastestream	Average Flow (gpd)	Current Configuration	AEP Notes
Pyrites Sluice Water	700,000	Flows to the existing WBAP	The WBAP provides treatment for these non-CCR wastestreams (primarily solids settling) that is essential to maintaining the water balance at the Rockport Plant. The EBAP will be closed and retrofitted to provide alternative treatment by May 11, 2023. The
Fly Ash Silo Sumps	3,000,000		
Storm water and Coal Pile Runoff	20,000 + 800 Intermittent		

Non-CCR Wastestream	Average Flow (gpd)	Current Configuration	AEP Notes
			Wastewater ponds already receive approximately 10.5 million gallons of other plant wastewaters, in addition to the treated water from the WBAP. This sequential treatment is essential to allow the plant to re-use approximately 4.1 million gallons per day of treated water that is diverted from the Reclaim pond. To estimate the number of trucks required to haul and dispose of these non-CCR wastestreams, the following calculations were performed: Pyrites Sluice Water 700,000 gallons per day * 8.3 pounds per gallon = 5,810,000 pounds / 2000 pounds per ton = 2905 tons per day / 20 tons per truck = 145.25 → 146 trucks per day Fly Ash Silo Sumps 3,000,000 gallons per day * 8.3 pounds per gallon = 24,900,000 pounds / 2000 pounds per ton = 12,450 tons per day / 20 tons per truck = 622.5 → 623 trucks per day Storm Water & Coal Pile Runoff

Non-CCR Wastestream	Average Flow (gpd)	Current Configuration	AEP Notes
			20,800 gallons per day * 8.3 pounds per gallon = 172,640 pounds / 2000 pounds per ton = 86.32 tons per day / 20 tons per truck = 4.316 → 4 trucks per day The Storm Water and Coal Pile Runoff flows will be rerouted to the new chemical mix tank system no later than February 28, 2023.

i) Alternatives for Disposal Capacity

In order to comply with the CCR rule, AEP performed an evaluation of alternative disposal capacity options at the Rockport Plant for both CCR and non-CCR wastestreams that are managed in the WBAP. 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.

The options considered for alternative disposal capacity of the CCR and non-CCR wastestreams currently routed to the WBAP are summarized in **Table 3** below.

Table 3: Alternatives for CCR and non-CCR Disposal Capacity

Alternative Capacity Technology	Estimated Implementation Time (Months)	Feasible at the Rockport Plant?	Selected?	AEP Notes
Conversion to dry handling	30	Yes	Under Evaluation	Adequate space is available at the site to install equipment necessary for a dry bottom ash conversion. This alternative has a similar compliance schedule to the other alternatives considered.
New CCR surface impoundment	38-72	No	No	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.

Alternative Capacity Technology	Estimated Implementation Time (Months)	Feasible at the Rockport Plant?	Selected?	AEP Notes
Retrofit a portion of CCR surface impoundment with a CCR compliant liner system	30	Yes	Yes	A CCR compliant pond can be established in the footprint of the EBAP by closing the pond by removal and establishing a CCR compliant pond within the existing basin. Additional treatment is required to maintain plant water balance and ability to re-use water from the Reclaim pond.
Multiple technology system	30	Yes	Yes	This alternative was selected for the Rockport Plant since the existing EBAP has the capacity to retrofit a CCR compliant pond, and can be coordinated with installation of a tank-based chemical treatment system during the same time frame.
Off-site disposal	N/A	No	No	The ELGs prohibit the disposal of CCR wastestreams in a public treatment works after October 13, 2023. 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 provide offsite treatment of the large volume of non-CCR wastestreams currently routed to the WBAP without considerable modifications and new equipment necessary to transport CCR and non-CCR wastestreams to an off-site disposal facility, if one were available. (See calculations in Table 1 and Table 2, above.)

Alternative Capacity Technology	**Estimated Implementation Time (Months)**	**Feasible at the Rockport Plant?**	**Selected?**	**AEP Notes**
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 WBAP during closure and retrofit of the EBAP. Temporary treatment systems to manage the CCR and non-CCR wastestreams for Rockport 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 WBAP would require at least two 100-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 evaluation of alternative disposal options, AEP selected the following options for compliance at the Rockport Plant:

- Closure of the EBAP by removal and establishing a CCR compliant pond and tank-based chemical treatment system by May 11, 2023 to manage CCR and non-CCR wastestreams.

- Permanent closure of the WBAP by removal.

This alternative and strategy can be implemented in a lesser or equal amount of time as the other alternatives and accommodates the unique site features, quantity and quality of wastestreams, plant water balance and water usage, and the infeasibility of using off-site disposal facilities.

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

- EBAP CCR Unit Closure and Retrofit CCR Compliant Pond
    - All CCR material within the existing EBAP will be removed via dewatering and mechanical excavation. All CCR material will either be hauled to the Rockport landfill for disposal or beneficially reused.
    - A third-party engineer will certify the removal of CCR upon completion. Certification will be performed in phases across the EBAP.

  - After certification of removal of all CCR within a given area of the existing EBAP, construction of the new 30-acre CCR-compliant pond will proceed. This pond will receive CCR and non-CCR wastestreams and will discharge to either the East or West Wastewater pond.

- Wastewater Pond Enhancement
  - A tank-based chemical treatment system will be designed and installed to treat the influent to the Wastewater ponds as needed to ensure compliance with plant discharge requirements.

- WBAP Closure by Removal
  - All CCR material within the existing WBAP will be removed via dewatering and mechanical excavation. All CCR material will either be hauled to the Rockport landfill for disposal or beneficially reused.
  - A third-party engineer will certify the removal of CCR upon completion.

Appendix A includes a site plan showing the existing and future configurations after removal of CCR from the EBAP and installation of the CCR compliant impoundment and tank-based chemical treatment system. The existing and future water balance diagram is included in **Appendix B**.

ii) Impact to Plant Operations if Alternative Capacity Not Obtained

Flows to the EBAP will cease by no later than April 11, 2021, as required by 40 CFR §257.101(a)(1), and the unit will commence closure upon receipt of necessary permits and approvals. If Rockport Plant were required to immediately cease the placement of CCR and non-CCR wastestreams into the WBAP, which is necessary for handling as much as 4.8 million gallons per day of CCR and non-CCR wastestreams, and initiate closure, AEP would have to temporarily or permanently cease power production at the plant.

The immediate forced cessation of power production at Rockport Plant would remove 2,600 MW of power production capacity from I&M's total resource mix of approximately 5,000 MW. The summer peak demand across I&M's service area is approximately 4,800 MWh, so removing Rockport Plant from the generation mix would leave a serious deficit in generation capacity. The company has issued a request for proposals for approximately 450 MW of wind and solar resources to be operational in 2023, but has no other currently planned capacity additions. Interruption of power production from these units could also 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, for 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).

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. AEP has already undertaken significant planning and implementation steps towards ceasing the receipt of CCR and non-CCR wastestreams within the EBAP. AEP believes the schedule represents the fastest technically feasible timeframe for compliance at the Rockport Plant.
A unique site-specific factor impacting the construction schedule at this facility is the presence of an endangered bird species within the BAP Complex at the Rockport Plant. Certain special scheduling accommodations will be needed due to the use of the BAP Complex embankments as nesting and breeding areas for the endangered interior least tern.

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 the plan to provide 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: East Pond Closure/Retrofit/Chemical Treatment and West Pond Closure.

East Bottom Ash Pond Closure/Retrofit/Tank Based Chemical Treatment

<u>Engineering and Design (November 2020 – October 2021)</u>
Detailed design of the EBAP closure/retrofit/chemical treatment system has started and is planned to be completed by October 2021. The design of the pond closure/retrofit includes a topographic survey and a bathymetric survey to verify CCR depths at certain locations, detailed civil designs and liner specifications, and detailed mechanical and balance of plant designs to allow for routing and management of the chemical treatment systems in conjunction with the CCR compliant pond.

<u>Permitting (November 2020 – April 2022)</u>
Permitting efforts necessary to close the ponds and retrofit a new pond have started and are planned to continue through April 2022. In addition to modifying the NPDES permit for the Rockport Plant, the state permitting authority requires a solid waste permit application to be submitted for the closure of an ash impoundment. Processing times for these permit applications have varied widely, and will impact the construction schedule if approvals are not issued in a timely fashion. Based upon similar closure plans recently submitted to IDEM, the schedule is built on 1 year for the review and approval. If approval is not received the certification of closure will be impacted which in turn impacts downstream activities associated with the retrofit work in the EBAP.

<u>Least Tern Avoidance (May 2021 - August 2021; May 2022 - August 2022; May 2023 - August 2023)</u>
As noted above, an endangered bird species, the interior least tern, has been observed nesting at the Rockport Plant since as early as 2003. This species was added to the list of endangered species by the U.S. Fish and Wildlife Service in 1985 and is also a state-listed endangered species. 50 *Fed. Reg.* 21784 (June 27, 1985). The tern is the smallest of the North American tern species, and habitually nests in pairs or colonies in sandy or rocky areas with sparse vegetation near open water. Terns have been observed at sand and gravel pits and power plant sites, as well as along rivers and other natural waterways. The breeding season for the tern begins in early May and lasts through late August.

The Rockport Plant has cooperated with the U.S. Fish and Wildlife Service and the Indiana Department of Natural Resources to protect nesting terns when present at the Rockport Plant. A management plan was developed in 2009 to enhance protection of the species during normal plant operations. See **Appendix D.** Plant employees are trained in identification of the least tern, and nesting areas are fenced to prevent human intrusion during the nesting season.

Contractor Selection (April 2021 – August 2021)
The main civil construction (labor contract) bid package for the ponds is planned to be issued for bid by April 2021 with an award date by August 2021.

Construction (August 2021 – May 2023)
The EBAP will be closed by removal of CCR primarily by means of dewatering and mechanical excavation, and is estimated to commence in August 2021. Once the contractor mobilizes to begin closing the EBAP, 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. Dewatering is estimated to occur over an approximate month-long period after which cleaning and stockpiling of rip rap and material removal will take place. The removal of ash will be verified visually and by comparing the excavated contours to the original contours when the plant was constructed. When the excavation has reached the pre-construction contours (or the visual bottom of the pond), the contractor will remove an additional one foot of material to confirm removal of all CCR. Material removal is scheduled to be complete by May of 2022, so that land disturbing activities can be suspended during the nesting season for the least terns in May through August. A third-party engineer will perform quality assurance/quality control (QAQC) services to independently verify that all CCR materials are removed and the results will be submitted to IDEM.

Closure by removal will be verified with a minimum of two groundwater sampling events. If the groundwater monitoring concentrations taken during those events do not exceed the groundwater protections standards the EBAP will be considered closed.

Subgrade preparations for the retrofit of the CCR pond will begin after receipt of IDEM's approval of closure and the end of the least tern avoidance period in August of 2022. Subgrading and filling of the EBAP to establish the minimum isolation distance and a suitable base for the geosynthetic liner will be completed in phases as the liner is installed during September 2022 through March 2023. Protective covering for the liner will be installed in parallel as lined areas are certified by third party contractors. The QA/QC report of the liner's installation will be completed in May 2023.

Re-routing the non-CCR wastestream piping and installation of the tank-based chemical treatment system is scheduled to occur concurrently with the pond retrofit commencing in August 2022. Construction of the new tank-based chemical treatment system is scheduled to be completed by February 28, 2023. Construction activities on the pond retrofit will be completed by May 11, 2023. Following the completion of QA/QC and commissioning activities, all CCR and non-CCR wastestreams are scheduled to be running through the new CCR impoundment by May 11, 2023.

West Bottom Ash Pond Closure (August 2023 - May 2024)

Dewatering of the WBAP will begin in August 2023, immediately after the conclusion of the 2023 Least Terns avoidance period, so that adults and fledglings can continue to nest and feed in their current habitat. Closure of the WBAP will continue through May 2024, and be completed prior to the 2024 Least Tern avoidance period. Removal of CCR materials is estimated to take approximately 6.4 months. A third-party engineer will perform quality assurance/quality control (QAQC) services to independently verify that all CCR materials are removed and the results will be submitted to IDEM.

Closure by removal will be verified with a minimum of two groundwater sampling events. If the groundwater monitoring concentrations taken during those events do not exceed the groundwater protections standards the WBAP will be considered closed.

At the completion of the CCR pond retrofit and WBAP closure, 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 Develop 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.*

AEP has made considerable progress at the time of this request towards creating alternative disposal capacity for the CCR and non-CCR wastestreams at Rockport that are currently discharged to the WBAP. 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 are complete and detailed design has started.
- Contractors have been engaged to discuss different aspects of the work and 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 2021.

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

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

(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 Rockport 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 Rockport Plant 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: http://www.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 Rockport Plant CCR units is accomplished using PE-certified groundwater monitoring networks. The EBAP and WBAP network is comprised 12 up-gradient monitoring wells and 15 down-gradient monitoring wells. The LF network is comprised of 5 up-gradient monitoring wells and 16 down-gradient monitoring wells. The complete Groundwater Monitoring Network (GWMN) Evaluation Reports are provided in **Appendix E**, and include the following:

- A map showing the location of the monitoring wells relative to the CCR units is provided in *Figure E-1*.
- Boring logs and well construction diagrams are provided in *Appendices E and F*.
- Typical groundwater flow direction maps are provided in *Figures C-4 of Appendix C*.

Additional flow direction maps for each sampling event are included in the latest Groundwater Monitoring and Corrective Action Reports (see **Appendix F)**.

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 F**).

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

Groundwater flow in the vicinity of Rockport Plant is from the north, northwest and west, and continues flowing under the site generally to the southeast. Drainage in the area is provided by the Ohio River, which is adjacent to the plant property on the southeast, and flows to the southwest toward Owensboro, Kentucky. The Ohio River is over 2,000 feet wide in the vicinity of the plant. The plant property slopes gently across a terraced surface from elevations greater than 410 feet on its northern edge, where it is bordered by low hills and an upper terrace, to about 390 feet along the top of the bank of the Ohio River. Much of the property is drained by Honey Creek, which flows south-southeast to the Ohio River and is incised down to an elevation of about 380 feet. The plant is located on a watershed divide between Honey Creek and an unnamed tributary offsite to the southwest. At times the groundwater flow direction and velocity can be impacted by the stage in the Ohio River and Honey Creek, which cause temporary and short duration flow reversals during high river stage events. While these events generate a water level response in the background wells for the BAP Complex, they are not likely to have a water quality impact on those wells.

Consistent with the definition in the CCR Rule, the hydrostratigraphic unit identified as the uppermost aquifer in this case is the saturated granular outwash deposit that underlies the Rockport Plant property including the BAP Complex. The top of this unit would be the typical seasonal high water level of 372 feet, 27 feet below the crest elevation of the pond embankments (399 feet). The bottom of the unit would be the top of bedrock. The shale bedrock underlying the granular outwash deposits does not represent a significant groundwater flow zone. The bedrock surface in the vicinity of the BAP Complex is irregular, generally sloping to the southeast, and occurs at elevations of 274 to 300 feet (111 to 126 feet immediately below the BAP Complex embankment crest level). The saturated thickness of this unit, therefore, is expected to range from 70 to 100 feet, thickening to the southeast.

A description of site hydrogeology for the BAP Complex and LF are included in each CCR unit's GWMN Reports included in **Appendix E**. Stratigraphic cross-sections for the BAP Complex are provided as *Figures 4 – 7* of the Monitoring Well Installation Report which is located in *Appendix D* of the BAP GWMN Report. Stratigraphic cross-sections for the LF are provided in *Appendix B* of the LF GWMN Report.

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

The BAP Complex is expected to remain in assessment monitoring until closure by removal is complete. The LF is in detection monitoring. The CCR units will transition to an assessment of corrective measures and selection of a 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 Rockport CCR units have not entered Assessment of Corrective Measures, therefore no progress reports on remedy selection and design and no reports of final remedy selection have been required or prepared.

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) for the BAP Complex is included in **Appendix G**. 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) for the BAP Complex is included in **Appendix H**. 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 – Alternative Closure Requirements and specifically 40 CFR 257.103(f)(1) – *Development of Alternative Capacity is Technically Infeasible*, the Rockport Plant qualifies for a site-specific alternate time frame for continuing to receive CCR and non-CCR wastestreams and initiate closure of the WBAP. Based upon the information submitted, I&M seeks to establish a site-specific compliance schedule to continue to receive CCR and non-CCR wastestreams in the WBAP until May 11, 2023. The EBAP will cease receiving CCR and non-CCR wastestreams by April 11, 2021. A CCR compliant pond will be established in the former EBAP footprint and CCR and non-CCR wastestreams be redirected to the CCR compliant pond no later than May 11, 2023. After all CCR and non-CCR wastestreams have been redirected, the WBAP will be closed by removal.

Figures

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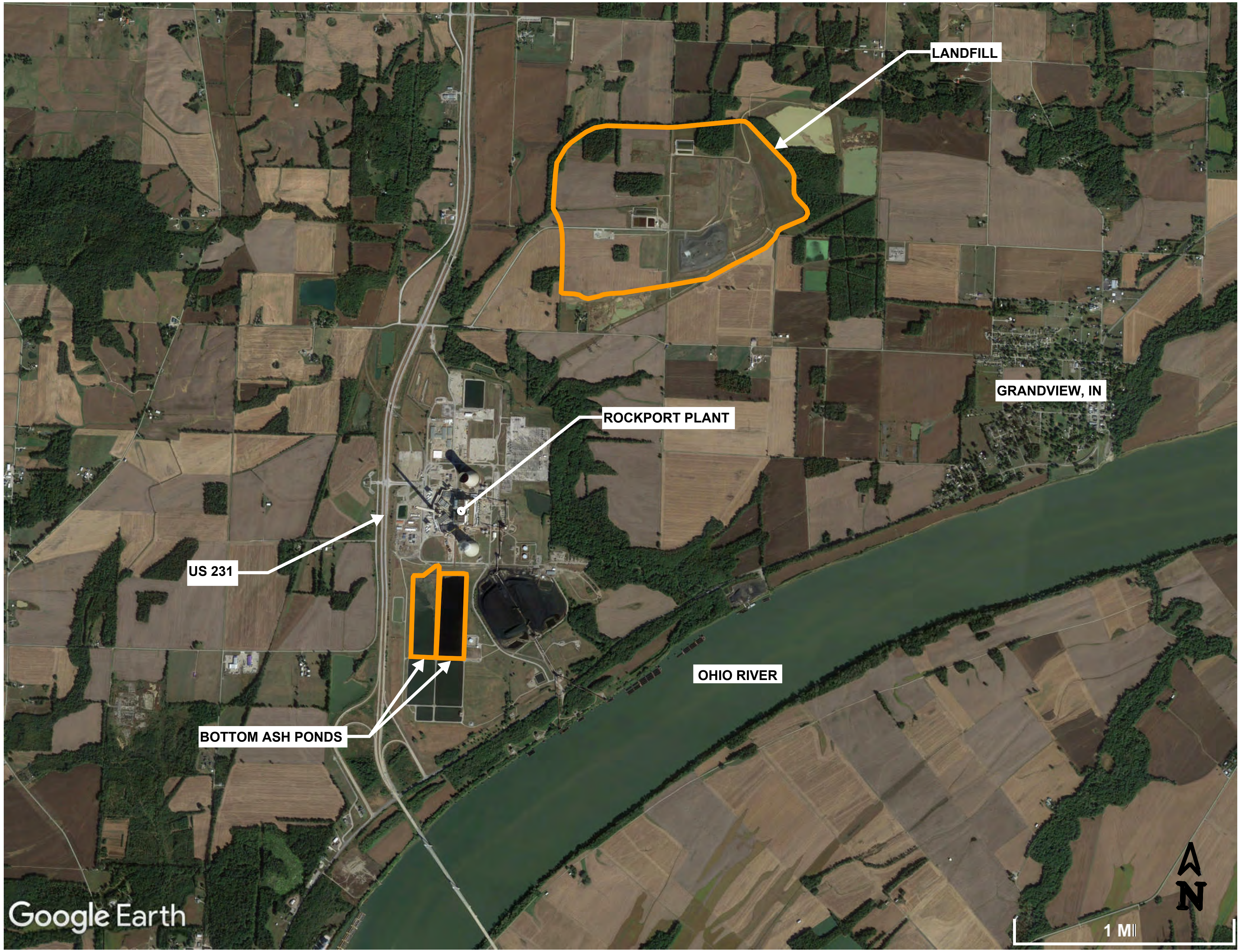

LEGEND:

🟧 CCR UNIT BOUNDARY

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INDIANA MICHIGAN POWER COMPANY

ROCKPORT PLANT

ROCKPORT INDIANA

CCR/ELG PROJECT

FIGURE 1

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SCALE:
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MECHANICAL ENGINEERING

APPROVED BY

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COLUMBUS, OH 43215

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Worley energy | chemicals | resources

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Appendix A

Existing and Future Pond Configurations

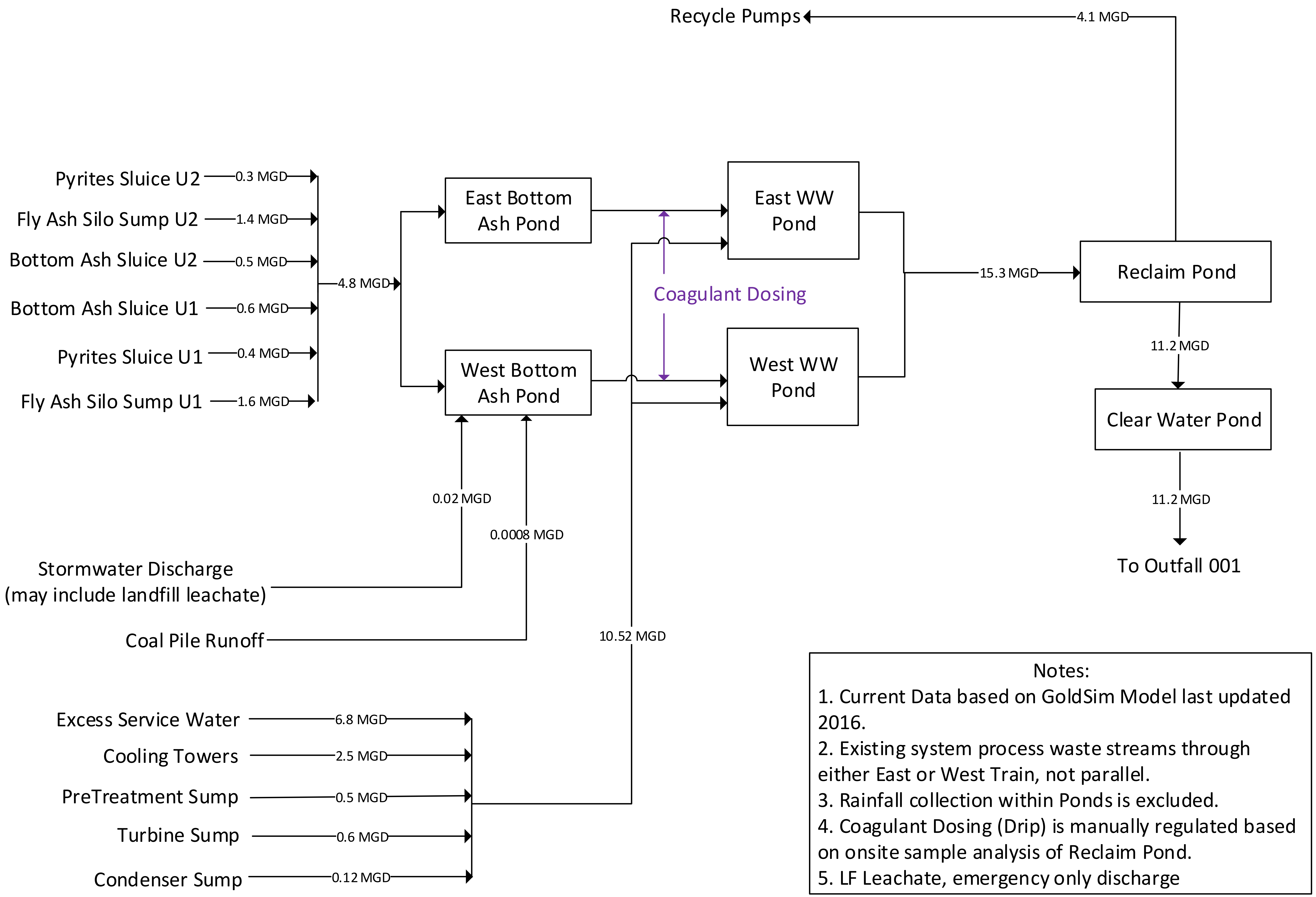
EXISTING WEST BOTTOM ASH POND (permanently close by removal of waste, restore riprap around pond perimiter)

CCR POND
- CCR-Compliant Liner
- No revetment
- 29 Acres / 500 Ac-Ft (top emb)
- Storage >10' Depth ~ 130 Ac-Ft

CCR FOREBAY
- CCR-Compliant Liner
- Lined with revetment
- 3.0 Acres / 55 Acre-Ft

Appendix B

Existing and Future Water Balances



Notes:

1. Current Data based on GoldSim Model last updated 2016.
2. Existing system process waste streams through either East or West Train, not parallel.
3. Rainfall collection within Ponds is excluded.
4. Coagulant Dosing (Drip) is manually regulated based on onsite sample analysis of Reclaim Pond.
5. LF Leachate, emergency only discharge

REV	DATE	DESCRIPTION	DRAWN	CHECKED	REVIEWED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER	PROJ ENGR MANAGER
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ROCKPORT PLANT

ROCKPORT INDIANA

CCR/ELG PROJECT

CURRENT WATER BALANCE
BLOW FLOW DIAGRAM

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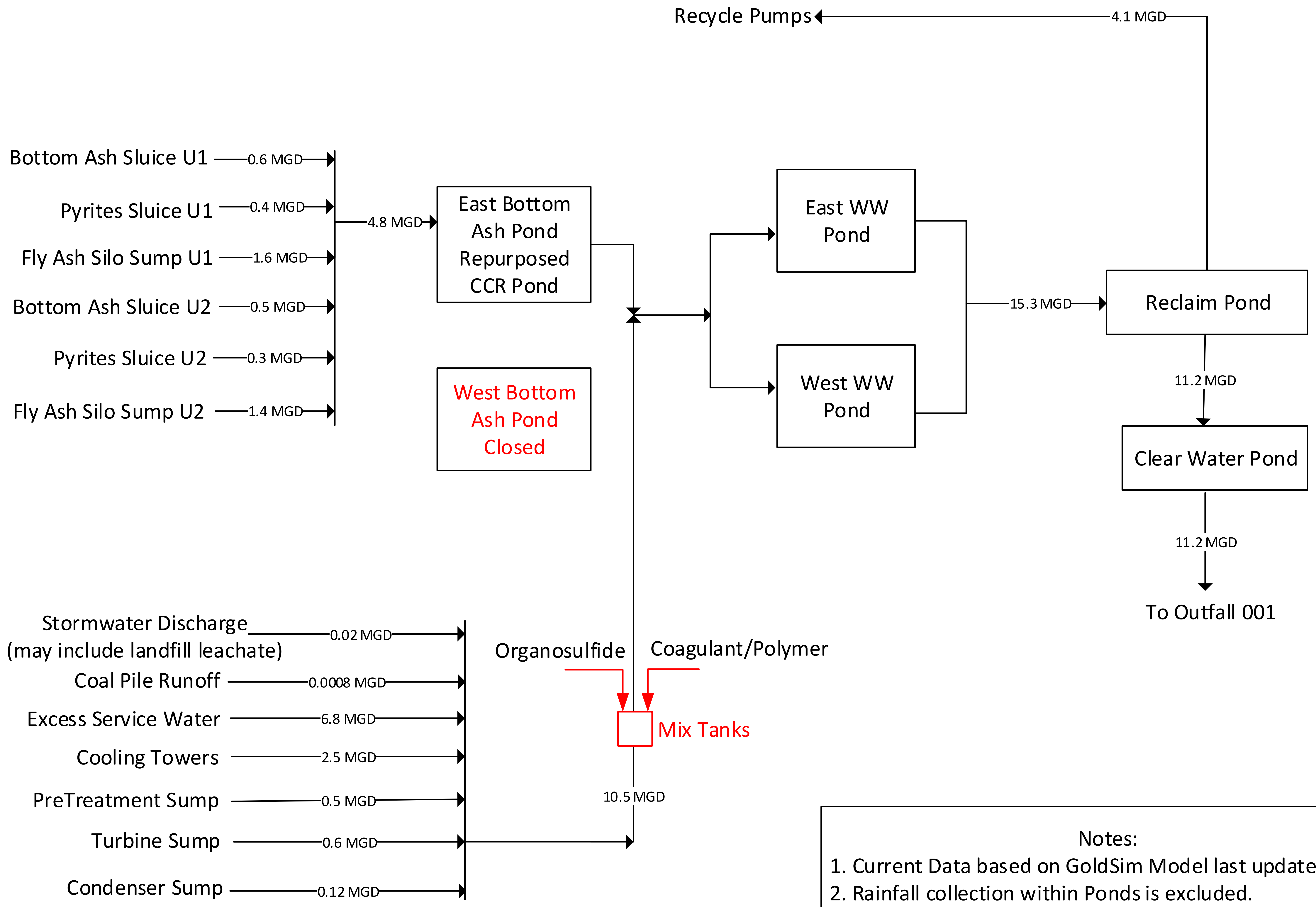

Notes:
1. Current Data based on GoldSim Model last updated 2016.
2. Rainfall collection within Ponds is excluded.
3. LF Leachate, emergency only discharge

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ROCKPORT PLANT

ROCKPORT INDIANA

CCR ONLY PROJECT

FUTURE WATER BALANCE
BLOW FLOW DIAGRAM

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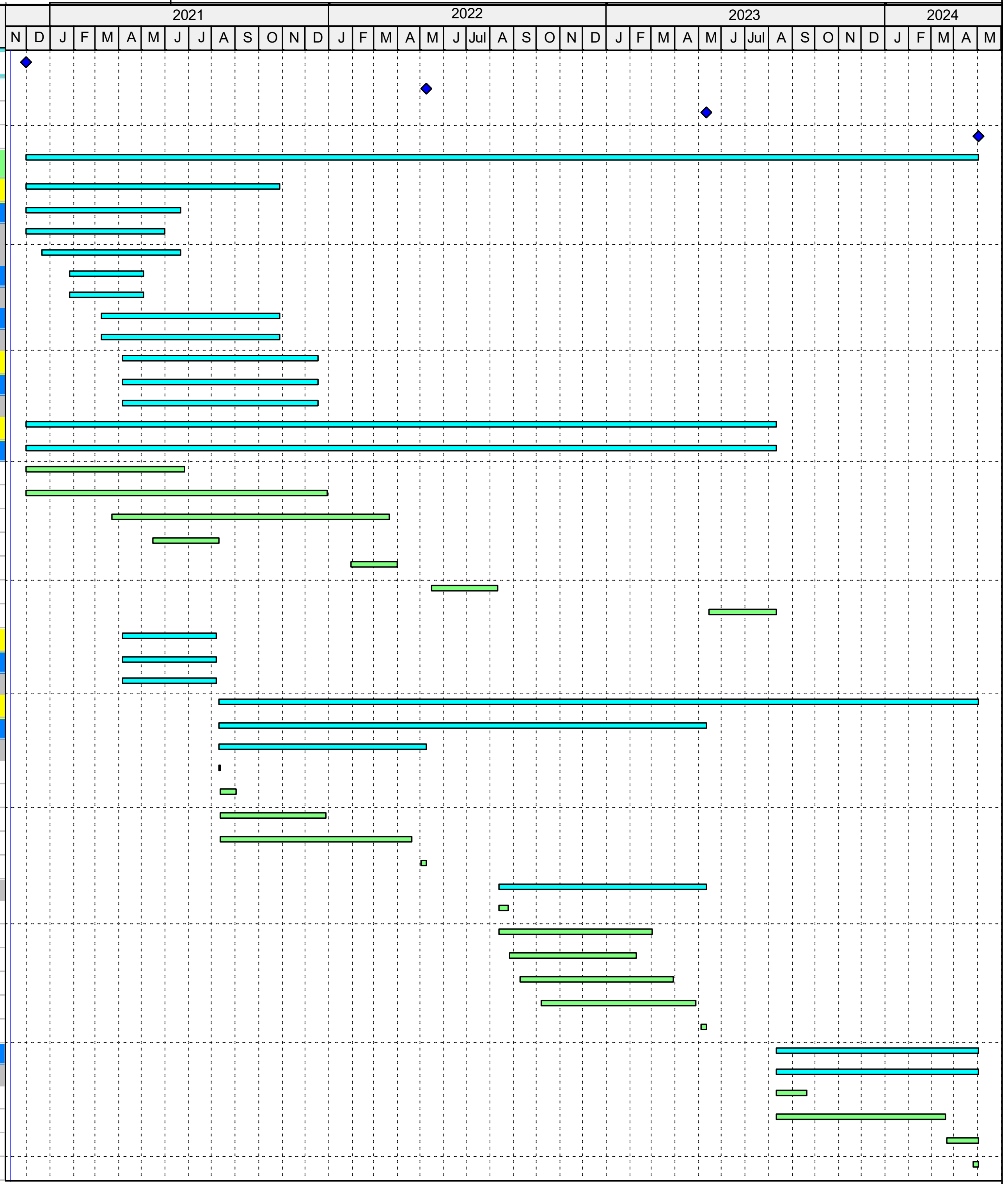
Appendix C

Site-Specific Schedule to Obtain Alternative Capacity

Rockport - CCR EPA Updated Timeline

AEP CCR RKP USEPA Agency Version

Activity ID	Activity Name	Duration (Months)	Start	Finish
R-00-M-020-SR-G-RPS-A80	AEP Release Engineer and OEM to Complete Detailed Design for CCR Compliance	0.0		30-Nov-20
R-PR-M-020-SR-G-RPS-A60	3rd Party QA/QC Certification of CCR Materials Removed for East Ash Pond Closure by Removal	0.0		09-May-22
R-PR-M-020-SR-G-RPS-A130	Initial Operation of CCR Compliant Pond (CCR Compliance)	0.0		11-May-23
R-PR-M-020-SR-G-RPS-A100	3rd Party QA/QC Certification of CCR Materials Removed for West Ash Pond Closure by Removal	0.0		02-May-24
Rockport Plant		35.8	Nov-20	May-24
Engineering & Design		9.6	Nov-20	Oct-21
Common		5.8	Nov-20	Jun-21
Civil / Site Infrastructure		5.2	Nov-20	May-21
Mechanical BOP Systems		5.2	Dec-20	Jun-21
Pond Closure		2.8	Jan-21	May-21
Civil / Site Infrastructure		2.8	Jan-21	May-21
Pond Enhancements		6.8	Mar-21	Oct-21
Mechanical BOP Systems		6.8	Mar-21	Oct-21
Procurement		7.4	Apr-21	Dec-21
Pond Enhancements		7.4	Apr-21	Dec-21
Mechanical BOP Systems		7.4	Apr-21	Dec-21
Permitting		28.2	Nov-20	Aug-23
Environmental Permits		28.2	Nov-20	Aug-23
R-00-L-915-SP-MP-PMT-A30	NPDES (Rockport)	6.0	Nov-20	Jun-21
R-00-L-915-SP-MP-PMT-A50	Air Permit (Rockport)	11.3	Dec-20	Dec-21
R-00-L-915-SP-MP-PMT-A60	IDEM Approval of Rockport Bottom Ash Pond Closure Plan / New CCR & Wastewater Pond	10.4	Mar-21	Mar-22
R-00-L-915-SP-MP-PMT-A70	Interior Least Terns 2021 (Rockport)	4.2	May-21	Aug-21
R-00-L-915-SP-MP-PMT-A20	SWPPP (Rockport)	1.8	Jan-22	Apr-22
R-00-L-915-SP-MP-PMT-A100	Interior Least Terns 2022 (Rockport)	4.3	May-22	Aug-22
R-00-L-915-SP-MP-PMT-A110	Interior Least Terns 2023 (Rockport)	4.3	May-23	Aug-23
Labor Contracts		3.6	Apr-21	Aug-21
Pond Closure & Enhancements Labor Contracts		3.6	Apr-21	Aug-21
Civil		3.6	Apr-21	Aug-21
Construction		28.5	Aug-21	May-24
East Bottom Ash Pond Closure and CCR Pond Construction		18.3	Aug-21	May-23
East Bottom Ash Pond Closure		7.8	Aug-21	May-22
R-PC-C-100-C-CON-S1-10	Divert pond inflows to West Bottom Ash Pond	0.0	Aug-21	Aug-21
R-PC-C-100-C-CON-S1-30	Dewater East Bottom Ash Pond	0.6	Aug-21	Sep-21
R-PC-C-100-C-CON-S1-45	Cleaning & Stockpiling of Riprap	4.0	Aug-21	Dec-21
R-PC-C-100-C-CON-S1-40	CCR Material Removal from East Bottom Ash Pond	7.2	Aug-21	Apr-22
R-PC-C-100-C-CON-S1-50	QA/QC of CCR Removal from East Bottom Ash Pond	0.2	May-22	May-22
East Pond Repurposing into CCR Compliant Pond		7.8	Aug-22	May-23
R-PR-C-100-C-CON-S1-10	Subgrade prep for pond enhancement equipment area (Includes Area Fill)	0.4	Aug-22	Aug-22
R-PC-C-100-C-CON-S1-70	Subgrade Fill	5.8	Aug-22	Mar-23
R-PR-C-100-C-CON-S1-110	Tank Based Chemical Treatment System Installation	4.8	Aug-22	Feb-23
R-PC-C-100-C-CON-S1-80	Liner Installation	5.8	Sep-22	Mar-23
R-PC-C-100-C-CON-S1-90	Liner Protection	5.8	Oct-22	Apr-23
R-PC-C-100-C-CON-S1-110	QA/QC Repurposed Pond	0.2	May-23	May-23
West Bottom Ash Pond Closure		7.6	Aug-23	May-24
West Bottom Ash Pond Closure		7.6	Aug-23	May-24
R-PC-C-100-C-CON-S2-10	Dewater West Bottom Ash Pond	1.2	Aug-23	Sep-23
R-PC-C-100-C-CON-S2-25	CCR Material Removal from West Bottom Ash Pond	6.4	Aug-23	Mar-24
R-PC-C-100-C-CON-S2-27	Cleaning & Re-Installation of Riprap	1.2	Mar-24	May-24
R-PC-C-100-C-CON-S2-30	QA/QC of CCR Removal	0.2	Apr-24	May-24



🟩 Current Bar Labels 🟦 Summary

◆ Milestone

Date: 18-Nov-20

Appendix D

Interior Least Tern
Management Plan

INDIANA MICHIGAN POWER COMPANY
Rockport Plant
Spencer County, Indiana

Interior Least Tern Management Plan

Prepared By:

American Electric Power Service Corporation
Environmental Services
1 Riverside Plaza
Columbus, Ohio 43215

On Behalf of:

Indiana Michigan Power Company
Rockport Plant
2791 North U.S. Hwy 231
Rockport, Indiana 47635

May 2009
Revision 0

TABLE OF CONTENTS

<u>Figures</u>

<u>Appendices</u>

1.0 INTRODUCTION

The interior least tern (*Sterna antillarum*) is listed as federally and state endangered by the U.S. Fish and Wildlife Service (USFWS) and Indiana Department of Natural Resources (IDNR), respectively. These designations, and the regulations which govern them, provide legal protection for *S. antillarum*. *S. antillarum* was first observed nesting at Rockport Plant in 2003. With the exception of 2004 and 2005, a nesting colony has continued to successfully nest at Rockport Plant. As such, this Interior Least Tern Management Plan (Plan) for Rockport Plant has been prepared by American Electric Power Service Corporation (AEPSC), Environmental Services for Indiana Michigan Power Company's Rockport Plant to ensure protection of *S. antillarum* that may nest on Plant grounds. A federal recovery plan for *S. antillarum* has been prepared by the USFWS and is included in Appendix A.

2.0 DESCRIPTION

S. antillarum are the smallest North American terns. Adult *S. antillarum* measure approximately 8 to 10 inches in length, and have an approximate 20 inch wingspan. Males and females are similar in appearance, characterized by black-capped crown, white forehead, grayish back and white undersurfaces, yellow bill with a black or brown tip, and yellow to orange legs. *S. antillarum's* narrow, pointed wings make them streamlined flyers that typically feed on small fish and aquatic crustaceans (USFWS 1990). *S. antillarum* call can be described as a high pitched "kit", "zeep" or "zreep".

3.0 LIFE HISTORY

S. antillarum are colonial nesters (nest in congregations) and spend upwards of 5 months at a nesting site. At Rockport Plant, they typically begin to appear mid-May and exit in late August. *S. antillarum* are ritual gulls, with courtship behaviors occurring at the nesting site or in the near vicinity. These courtship behaviors include fish flight—aerial pursue and maneuvering ending in fish transfer on the ground between two paring birds—nest scraping, posturing and calling.

S. antillarum nests are often 30 feet or more apart, but can be as close at 10 feet. The nest is a shallow depression in an open, sandy area, gravelly patch, or exposed flat. Small twigs, pieces of wood, small stones or other debris usually occur near the nest. *S. antillarum* prefer to be surrounded by water with open views for protective precautions from predators.

Egg-laying begins in late May, with the female laying 2 to 3 eggs over a period of 3 to 5 days. The eggs are pale to olive buff and speckled or streaked with dark purplish-brown, chocolate, or blue-gray markings. Both parents incubate the eggs, with incubation lasting about 20 to 22 days. The chicks hatch within one day of each other and remain in the nest for about a week. Hatchlings are approximately the size of golf balls and are yellow and buff with brown mottling. As they mature, they begin to wander from the nest, seeking shade and shelter in clumped vegetation and debris. Chicks are capable of flight within 3 weeks, but the parents continue to feed them until fall migration. *S. antillarum* will re-nest until late July if the first nesting is unsuccessful.

Fledglings (young birds that have left the nest) are grayish-brown, with white heads, dark bills and eye stripes, and stubby tails. Young *S. antillarum* acquire adult plumage after their first molt at about 1 year, but do not breed until they are 2 to 3 years old. *S. antillarum* often return to the same nesting sites year-after-year (USFWS 1990).

4.0 HABITAT

4.1 Natural Nesting Habitat

Nesting habitat of *S. antillarum* includes bare or sparsely vegetated sand, shell, and gravel beaches, sandbars, islands, and flats associated with rivers and reservoirs. The birds prefer open habitat, and tend to avoid thick vegetation and narrow beaches. Sand and gravel bars within a wide unobstructed river channel, or open flats along shorelines of lakes and reservoirs, provide favorable nesting habitat. Nesting locations are often at the higher elevations away from the water's edge, since nesting usually starts when river levels are high and relatively small amounts of sand are exposed. For feeding, *S. antillarum* need shallow water with an abundance of small fish. Shallow water areas of lakes, ponds, and rivers located close to nesting areas are preferred (USFWS 1990).

4.2 Rockport Plant Nesting Habitat

As natural nesting sites have become increasing scarce, *S. antillarum* have used sand and gravel pits, ash disposal areas of power plants, reservoir shorelines, and other manmade sites. At Rockport Plant, *S. antillarum* are drawn to the ash pond complex (Figure 1) potentially due to the permanent or temporary (flooding of sites during nesting periods) loss of habitat on the Ohio River. The ash pond complex dikes provide the nesting habitat requirements such as gravel substrate surrounded by water and unobstructed views.

5.0 ROCKPORT MANAGEMENT STRATEGIES

5.1 Rockport Plant Personnel Awareness

In order to protect *S. antillarum* that may nest at the Plant, the appropriate Rockport Plant personnel will be made aware of the presence, location and restrictions through meeting notices, posting around the Plant and/or email.

5.2 Identification of *S. antillarum* Presence

Rockport Plant’s Plant Environmental Coordinator or designee will work with the USFWS, IDNR or representatives from these resource agencies to identify the presence of *S. antillarum* and nesting locations on Plant grounds, and provide protective guidance to the necessary Plant staff to prevent nest sites from being disturbed.

5.3 Signage and Barriers

The center ash pond dike has been provided with entrance barriers and posted with signage to keep out. If *S. antillarum* begin nesting on or around the ash pond complex dikes not already protected from traffic, protective barriers shall be installed and signage indicating no entrance posted at the access locations.

5.4 Deterring and Attracting Devices

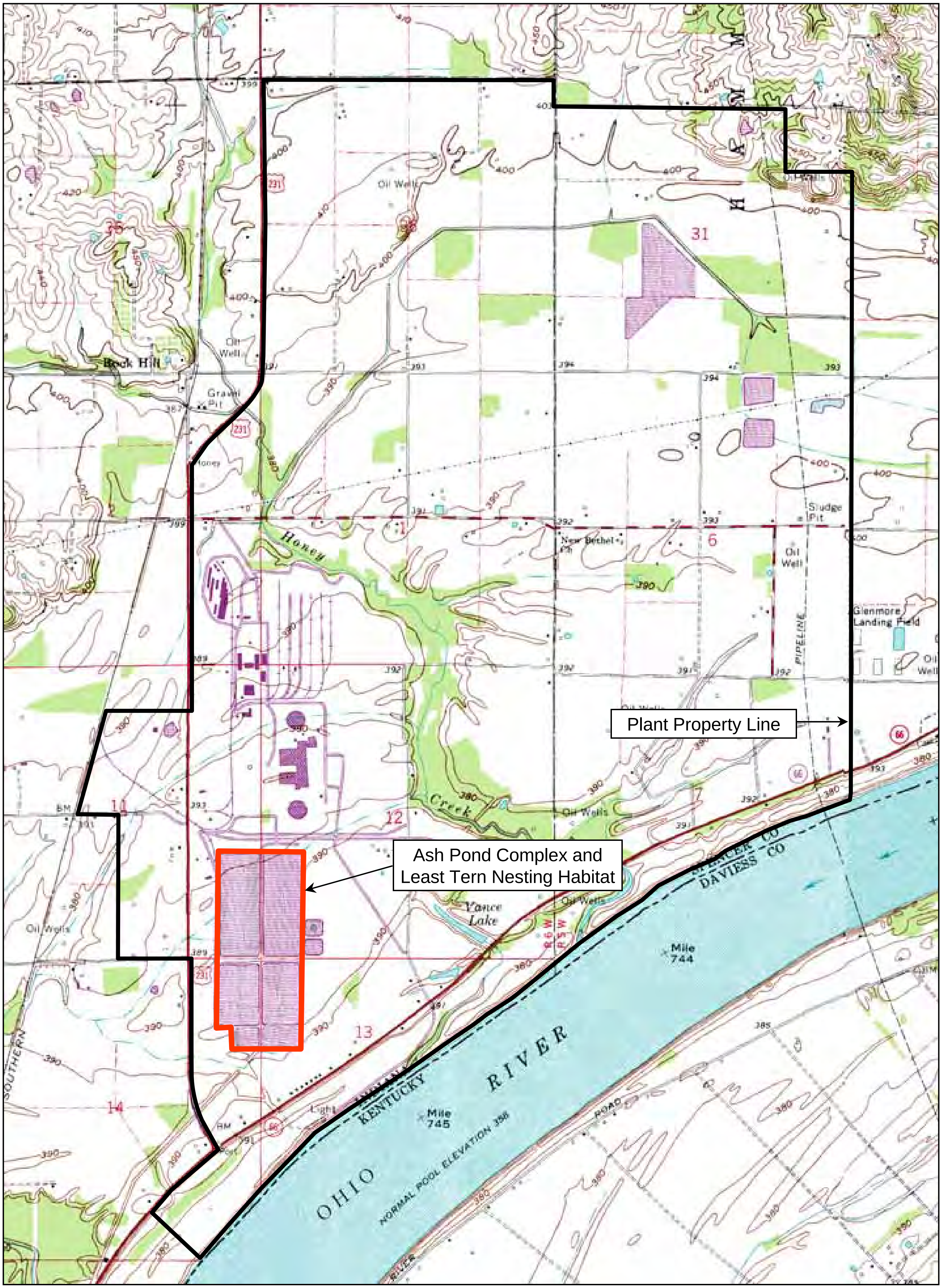
In the event deterring or attracting devices are recommended by the USFWS or IDNR, such recommended devices will be used. Deterring devices, in general, can deter *S. antillarum* from utilizing an area while the attracting devices can attract *S. antillarum.* No such devices shall be used unless recommended by USFWS or IDNR.

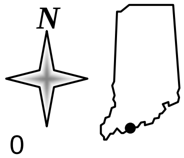
6.0 REFERENCES

U.S. Fish and Wildlife Service (USFWS). 1990. *Recovery plan for the interior population of the Least tern* (Sterna antillarum). U.S. Fish and Wildlife Service, Twin Cities, Minnesota. 90 pp.

Figures

Rockport Interior Least Tern Nesting Habitat Map





Rockport / Lewisport, IND-KY
Quadrangles
USGS Topographic Map

Indiana Michigan Power Company Rockport Plant

Figure 1 – Rockport Least Tern Nesting Habitat Map

Water & Ecological Resource Services

Appendix A

INTERIOR POPULATION OF THE LEAST TERN (*STERNA ANTILLARUM*) RECOVERY PLAN

SEPTEMBER 1990

Interior Population of the Least Tern

Sterna Antillarum

Recovery Plan

DEPARTMENT OF THE INTERIOR • U.S. FISH AND WILDLIFE SERVICE

RECOVERY PLAN FOR THE INTERIOR POPULATION OF THE LEAST TERN (*Sterna antillarum*)

September 1990

Prepared by

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Regional Director Date

EXECUTIVE SUMMARY OF THE RECOVERY PLAN FOR THE LEAST TERN

CURRENT STATUS: The interior population of the least tern (*Sterna antillarum*), a breeding migratory bird in mid-America, was listed as endangered on June 27, 1985 (50 *Federal Register* 21,784-21,792). Census data currently indicate about 5,000 interior least terns.

Habitat Requirements and Limiting Factors: Interior least terns breed in the Mississippi and Rio Grande River Basins from Montana to Texas and from eastern New Mexico and Colorado to Indiana and Louisiana. From late April to August they occur primarily on barren to sparsely vegetated riverine sandbars, dike field sandbar islands, sand and gravel pits, and lake and reservoir shorelines. Threats to the survival of the species include the actual and functional loss of riverine sandbar habitat. Channelization and impoundment of rivers have directly eliminated nesting habitat. This recovery plan outlines recovery strategies to increase the interior population of the least tern to approximately 7,000 birds throughout its range.

Recovery Objective: Delisting

Recovery Criteria: Assure the protection of essential habitat by removal of current threats and habitat enhancement, establish agreed upon management plans, and attain a population of 7,000 birds at the levels listed below.

1. Adult birds in the Missouri River system will increase to 2,100 and remain stable for 10 years.
2. Current numbers of adult birds (2,200-2,500) on the Lower Mississippi River will remain stable for 10 years.
3. Adult birds in the Arkansas River system will increase to 1,600 and remain stable for 10 years.
4. Adult birds in the Red River system will increase to 300 and remain stable for 10 years.
5. Current number of adult birds in the Rio Grande River system (500) will remain stable for 10 years.

Actions Needed:

1. Determine population trends and habitat requirements.
2. Protect, enhance and increase populations during breeding.
3. Manage reservoir and river water levels to the benefit of the species.
4. Develop public awareness and implement educational programs about the interior least tern.
5. Implement law enforcement actions at nesting areas in conflict with high public use.

Cost of Recovery: Estimated to be $1,720,000 - $2,000,000, to reach recovery criteria set out above, and complete subsequent monitoring for 10 years.

Date of Recovery: Delisting should be initiated in 2005, if recovery criteria have been met.

DISCLAIMER

Recovery plans delineate reasonable actions which are believed to be required to recover and/or protect listed species. Plans are published by the U.S. Fish and Wildlife Service, sometimes prepared with the assistance of recovery teams, contractors, State agencies, and others. Objectives will be attained and any necessary funds made available subject to budgetary constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not necessarily represent the views nor the official positions or approval of any individuals or agencies involved in the plan formulation, other than the U.S. Fish and Wildlife Service. They represent the official position of the U. S. Fish and Wildlife Service only after they have been signed by the Regional Director as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

Literature Citation should read as follows:

U. S. Fish and Wildlife Service. 1990. Recovery plan for the interior population of the least tern (*Sterna antillarum*). U. S. Fish and Wildlife Service, Twin Cities, Minnesota. 90 pp.

Additional copies may be purchased from:

U. S. Fish and Wildlife Service Reference Service
5430 Grosvenor Lane, Suite 110
Bethesda, Maryland 20814
301/492-6403 or 1-800-582-3421

The fee for the plan varies depending on the number of pages of the plan.

ACKNOWLEDGMENTS

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I. INTRODUCTION

The interior population of the least tern (Sterna antillarum) (hereafter referred to as the interior least tern) has been a species of concern for many years because of its perceived low numbers and the vast transformation of its riverine habitat. Barren sandbars, the interior least tern's most common nesting habitat, were once a common feature of the Mississippi, Missouri, Arkansas, Ohio, Red, Rio Grande, Platte, and other river systems in the central United States. Sandbars are still common at normal river stages on the Lower Mississippi River and on portions of other river systems. Sandbars generally are not stable features of the natural river landscape, but are formed or enlarged, disappear or migrate depending on the dynamic forces of the river. However, stabilization of major rivers to achieve objectives for navigation, hydropower, irrigation, and flood control has destroyed the dynamic nature of these processes (Smith and Stucky 1988). Many of the remaining sandbars are unsuitable for nesting because of vegetation encroachment or are too low and subject to frequent inundation. The number and distribution of interior least terns probably have declined accordingly.

The interior least tern was listed as an endangered species on June 27, 1985 (50 Federal Register 21,784-21,792) in the following States: Arkansas, Colorado, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana (Mississippi River and it's tributaries north of Baton Rouge), Mississippi (Mississippi River), Missouri, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Tennessee, and Texas (except within 80 km of Gulf Coast). The States of Arkansas, Illinois, Indiana, Iowa, Missouri, Nebraska, Tennessee, Texas, Kansas, Kentucky, New Mexico, Oklahoma, and South Dakota list the interior least tern as endangered under State laws. Although not legislatively designated as endangered in North Dakota, the interior least tern is regarded as endangered by the North Dakota Game and Fish Department and conservation organizations within the State.

Section 4 of the Endangered Species Act directs the Secretary of the Interior to develop and implement recovery plans for the conservation and survival of endangered and threatened species listed pursuant to Section 4 unless he finds that such a plan will not promote the conservation of the species. The Secretary, in developing and implementing recovery plans (1) shall, to the maximum extent practicable, give priority to those endangered species or threatened species most likely to benefit from such plans, particularly those species that are, or may be, in conflict with construction or other developmental projects or other forms of economic activity. The interior least tern occurs along rivers which are heavily regulated by numerous dam and irrigation projects.

The goal of this recovery plan is to describe actions for the conservation and survival of the interior least tern and to return the species to non-endangered status throughout its range. This plan summarizes available biological data, details various actions to stabilize and/or restore the interior least tern, and establishes criteria to remove it from the federal list of endangered species.

Description

Least terns (all currently recognized subspecies and populations) are the smallest members of the subfamily Sterninae and family Laridae of the order Charadriiformes, measuring about 21-24 cm long with a 51 cm wingspread. Sexes are alike, characterized by a black-capped crown, white forehead, grayish back and dorsal wing surfaces, snowy white undersurfaces, legs of various orange and yellow colors depending on the sex, and a black-tipped bill whose color also varies depending on sex (Watson 1966, Davis 1968, Boyd and Thompson 1985). Boyd and Thompson (1985) developed the following criteria to distinguish the sexes in the field based upon their work in Kansas:

1) Females usually have a wing chord less than 171 mm long while males usually have a wing chord greater than 174 mm.
2) A male's feet are brighter than its mate's feet; the male's are bright orange, while the female's feet are bright to pale yellow, or rarely grey.
3) A male's bill is larger than the female's; the female's bill depth at its widest point is 4.5 mm to 5.5 mm, while the male's is 6.0 mm or greater.
4) A male's bill is orange to bright yellow, whereas the female's bill is light or dull yellow, or straw-colored.

Immature birds have darker plumage than adults, a dark bill, and dark eye stripes on their white foreheads. Jackson (1976) described the developmental stages of least tern chicks. Further details on plumage development and variation were presented by Massey and Atwood (1978) and Thompson and Slack (1983).

Taxonomy

The least tern (*Sterna antillarum*) in North America was described by Lesson in 1847 (Ridgway 1895, American Ornithologists' Union 1957, 1983). The least tern in interior North America was described later as a race (*Sterna albifrons athalassos*) of the Old World little tern (*Sterna albifrons*) (Burleigh and Lowery 1942). Two other described New World races were the eastern or coastal least tern (*Sterna albifrons antillarum*), and the California least tern (*Sterna albifrons browni*). The coastal least tern breeds along the Atlantic and Gulf coasts and the California least tern breeds along the California coast.

As a result of studies on vocalizations and behavior of this group of terns in the Old and New Worlds, the American Ornithologists' Union (1983) now treats the New World least terns as a distinct species, *Sterna antillarum*. Subspecies of New World least terns recognized by the American Ornithologists' Union (1957, 1983) are the interior least tern (now *Sterna antillarum athalassos*), the eastern or coastal least tern (now *Sterna antillarum antillarum*), and the California least tern (now *Sterna antillarum browni*).

However, the validity of least tern subspecies has been questioned by several authors in recent years. Massey (1976) reported no consistent morphological, behavioral, or vocal differences between S. a. antillarum and S. a. browni. In Texas, where both S. a. antillarum and S. a. athalassos occur, electrophoretic analyses indicate little genetic differentiation between least terns produced on the Texas coast and Texas Panhandle rivers (McCament and Thompson 1987, McCament-Locknane 1988). Coastal least terns have populated interior breeding sites. Boyd and Thompson (1985) reported an incubating least tern at Quivira National Wildlife Refuge, Kansas, that originally had been banded as a chick on the Texas coast. The most recent morphometric and biochemical assessment of North American least terns could not distinguish subspecies (Thompson et al. In prep)

Originally, S. a. athalassos was proposed for endangered status. Because of the taxonomic uncertainty of least tern subspecies in North America, the U. S. Fish and Wildlife Service did not list the subspecies and instead designated as endangered those least terns occurring in interior North America. The California least tern has been listed as endangered since 1970 (U. S. Fish and Wildlife Service 1980).

Distribution

The interior least tern is migratory and historically bred along the Mississippi, Red and Rio Grande River systems and rivers of central Texas. The breeding range extended from Texas to Montana and from eastern Colorado and New Mexico to southern Indiana. It included the Red, Missouri, Arkansas, Mississippi, Ohio and Rio Grande River systems (American Ornithologists' Union 1957, Anderson 1971, Coues 1874, Burroughs 1961, Hardy 1957, Youngworth 1930, 1931, Ducey 1981). Incidental occurrences of least terns in Michigan, Minnesota, Wisconsin, Ohio and Arizona have been reported (Campbell 1935, Janssen 1986, Jung 1935, Mayfield 1943, Monson and Phillips 1981, Phillips et al. 1964).

Current Distribution

The interior least tern continues to breed in most of the aforementioned river systems, although its distribution generally is restricted to less altered river segments (Figure 1) (Tables 1-5).

Missouri River System: The explorers, Lewis and Clark, observed the least terns along the Missouri River frequently and believed them to be "a native of this country and probably a constant resident" (Burroughs 1961). In the Dakotas, most interior least terns occur on those segments of the Missouri River and its tributaries that are not affected by impoundments or channelization. In South Dakota, the interior least tern nests primarily on flowing segments of the Missouri River and Cheyenne River (Nebraska Game and Parks Commission, Schwalbach 1988, Schwalbach et al. 1986, 1988). Breeding areas in North Dakota constitute about 192 km of the Missouri River from Garrison Dam to the mouth of the Cannonball River south of Bismarck (Dryer and Dryer 1985, Mayer and Dryer 1988), and about 29 km of the Yellowstone River in North Dakota from the Montana border to the river's confluence with the Missouri River (Kreil and Dryer 1987). A few interior least terns nest on islands, shorelines and sandbars along the reservoir, Lake Oahe, an impoundment on the Missouri River in North and South Dakota (Schwalbach 1988, Mayer and Dryer 1988). In Montana, breeding interior least terns recently have been recorded on the Yellowstone River, and on the Missouri River between Fort Peck Reservoir and North Dakota. A few interior least terns have been recorded on islands and shoreline within the Fort Peck Reservoir (Charles M. Russell National Wildlife Refuge). These locations are the western most nesting sites of the interior least tern.

Interior least terns breed along the lower section of the Niobrara River, Nebraska, from Keya Paha and Rock Counties to the Missouri River (Nebraska Game and Parks Commission 1985a). Current distribution probably is similar to the historic distribution because the Niobrara River has been little changed by man (Ducey 1985). On the Platte River, Nebraska, interior least terns nest on sandbars and at sand and gravel pits from the Missouri River to North Platte (Nebraska Game and Parks Commission 1987) and along the South Platte River as far west as Ogallala. On the Loup River, a tributary of the Platte River, interior least terns breed as far west as Arcadia but are most common between Saint Paul, Nebraska and the Loup's confluence with the Platte River at Columbus, Nebraska. A few interior least terns also occur along the Elkhorn River, another tributary of the Platte River.

The interior least tern no longer nests in the Missouri reaches of the Missouri River (Smith 1985, Sidle et al. 1988, Smith and Renken 1990). The hydrology of the River in Missouri has been drastically altered by channelization, and studies show that river levels are typically too high during the breeding season to expose suitable nesting habitat (Smith and Renken 1990).

Arkansas River System: Breeding interior least terns occur along the Arkansas River system in Colorado, Kansas, Oklahoma, Arkansas and Texas (Table 2). In Colorado, interior least terns nest at Adobe Creek reservoir (Blue Lake) and have been observed at Nee Noshe reservoir (Carter 1989). Both reservoirs are located on small tributaries of the Arkansas River.

In Kansas, interior least terns nest on the Cimarron River in Meade, Comanche and Clark Counties, and Quivira National Wildlife Refuge, and in the recent past at Cheyenne Bottoms Wildlife Management Area (Boyd 1983, 1986, 1987; Schulenberg and Ptacek 1984).

The interior least tern occurs on several tributaries of the Arkansas River in Oklahoma. It breeds along the Salt Fork of the Arkansas River at the Salt Plains National Wildlife Refuge (Hill 1985, Grover and Knopf 1982); Optima Reservoir at the fork of the Coldwater Creek and Beaver River in the Oklahoma Panhandle; and on the Cimarron River in Beaver, Harper, Woods, Woodward, Major, Blaine, Kingfisher, Logan, and Payne Counties (Boyd 1987, L. Hill personal communication).

Along the Arkansas River in Oklahoma, the interior least tern breeds in Kay, Osage, Pawnee, Creek, Tulsa, Wagoner, Muskogee, and Sequoyah Counties (Hoffman 1986, L. Hill personal communication). In Arkansas, the breeding range on the Arkansas River is above Little Rock (Smith and Shepherd 1985, Smith et al. 1987, K. Smith 1986).

Along the Canadian River, interior least terns breed in Ellis, Roger Mills, Dewey, Cleveland, McClain, Haskell, and Sequoyah Counties, Oklahoma and in Hemphill, Roberts and Hutchinson Counties, Texas (McCament and Thompson 1985, 1987; U. S. Fish and Wildlife Service, unpublished data).

Mississippi and Ohio Rivers: On the Mississippi River, interior least terns occur almost entirely in the lower valley south of Cairo, Illinois to Vicksburg, Mississippi (Sidle et al. 1988) (Table 3). Surveys by the U. S. Army Corps of Engineers (Rumancik 1985, 1986, 1987, and 1988; M. Smith 1986) and Missouri Department of Conservation (J. Smith 1985, 1986, 1987, and 1988, Smith and Renken 1990) indicate that about one-half of all interior least terns occur along 1100 km of the Lower Mississippi River.

On the Ohio River system, the interior least tern occurs just above the confluence of the Tennessee and Ohio Rivers and at one artificial site on the Wabash River in Indiana.

Red River System: Interior least terns are known to occur on the Prairie Dog Town Fork of the Red River in the eastern Texas Panhandle and along the Texas/Oklahoma boundary as far east as Burkburnett, Texas (McCament and Thompson 1985, 1987) (Table 4).

Rio Grande River System: Interior least terns occur at three reservoirs along the Rio Grande River and along the Pecos River at the Bitter Lake National Wildlife Refuge, New Mexico (McCament and Thompson 1985, 1987; Neck and Riskind 1981, Seibert 1951, Marlatt 1984, 1987) (Table 5).

Wintering Areas: The wintering area of interior least terns is unknown. However, least terns of unknown populations or subspecies are found during the winter along the Central American coast and the northern coast of South America from Venezuela to northeastern Brazil. Roger Boyd (personal communication 1986) reports that about 35 least terns have been recaptured in South America, mostly in Guyana. One interior least tern banded by Boyd, was captured in El Salvador two years later. Also, a banded California least tern was recaptured in Guatemala.

Table 1. Known breeding areas for interior least terns along the Missouri River system in 1985-1988.

State	County	Locations
Montana	Valley	Fort Peck Reservoir, Charles M. Russell National Wildlife Refuge
	Garfield	Fort Peck Reservoir, Charles M. Russell National Wildlife Refuge
	Prairie	Yellowstone River sandbars
	McCone	Missouri River sandbars
	Richland	Missouri River sandbars
North Dakota	McLean	Missouri River sandbars
	Burleigh	Missouri River sandbars
	Oliver	Missouri River sandbars
	Morton	Missouri River sandbars
	Emmons	Lake Oahe
	Mercer	Missouri River sandbars
	Sioux	Missouri River sandbars
	McKenzie	Yellowstone River sandbars
South Dakota	Charles Mi	Missouri River sandbars
	Bon Homme	Missouri River sandbars
	Yankton	Missouri River sandbars
	Clay	Missouri River sandbars
	Union	Missouri River sandbars
	Sully	Lake Oahe
	Hughes	Lake Oahe
	Stanley	Lake Oahe
	Walworth	Lake Oahe
	Campbell	Lake Oahe
	Corson	Lake Oahe
	Potter	Lake Oahe
	Dewey	Lake Oahe
	Ziebach	Cheyenne River sandbars
	Haakon	Cheyenne River sandbars
Nebraska	Dixon	Missouri River sandbars
	Cedar	Missouri River sandbars
	Knox	Missouri River sandbars
	Howard	Loup River sandbars and sand/gravel pits
	Nance	Loup River sandbars and sand/gravel pits
	Sherman	Loup River sandbars and sand/gravel pits
	Platte	Loup River sandbars and sand/gravel pits
	Valley	Loup River sandbars and sand/gravel pits
	Douglas	Elkhorn River sandbars and sand/gravel pits
	Cumming	Elkhorn River sandbars and sand/gravel pits
	Stanton	Elkhorn River sandbars and sand/gravel pits
	Boyd	Niobrara River sandbars

	Holt	Niobrara River sandbars
	Keya Paha	Niobrara River sandbars
	Brown	Niobrara River sandbars
	Knox	Niobrara River sandbars
	Rock	Niobrara River sandbars
	Cass	Platte River sandbars and sand/gravel pits
	Sarpy	Platte River sandbars and sand/gravel pits
	Saunders	Platte River sandbars and sand/gravel pits
	Douglas	Platte River sandbars and sand/gravel pits
	Dodge	Platte River sandbars and sand/gravel pits
	Colfax	Platte River sandbars and sand/gravel pits
	Butler	Platte River sandbars and sand/gravel pits
	Platte	River sandbars and sand/gravel pits
	Polk	Platte River sandbars and sand/gravel pits
	Hall	Platte River sandbars and sand/gravel pits
	Buffalo	Platte River sandbars and sand/gravel pits
	Kearney	Platte River sandbars and sand/gravel pits
	Phelps	Platte River sandbars and sand/gravel pits
	Dawson	Platte River sandbars and sand/gravel pits
	Hamilton	Platte River sandbars and sand/gravel pits
	Merrick	Platte River sandbars and sand/gravel pits
	Lincoln	Platte River sandbars and sand/gravel pits
	Lincoln	So. Platte River sandbars/sand/gravel pits
	Keith	So. Platte River sandbars/sand/gravel pits
Iowa	Woodbury	Iowa Public Service ash ponds
	Pottawattamie	Iowa Power and Light ash ponds

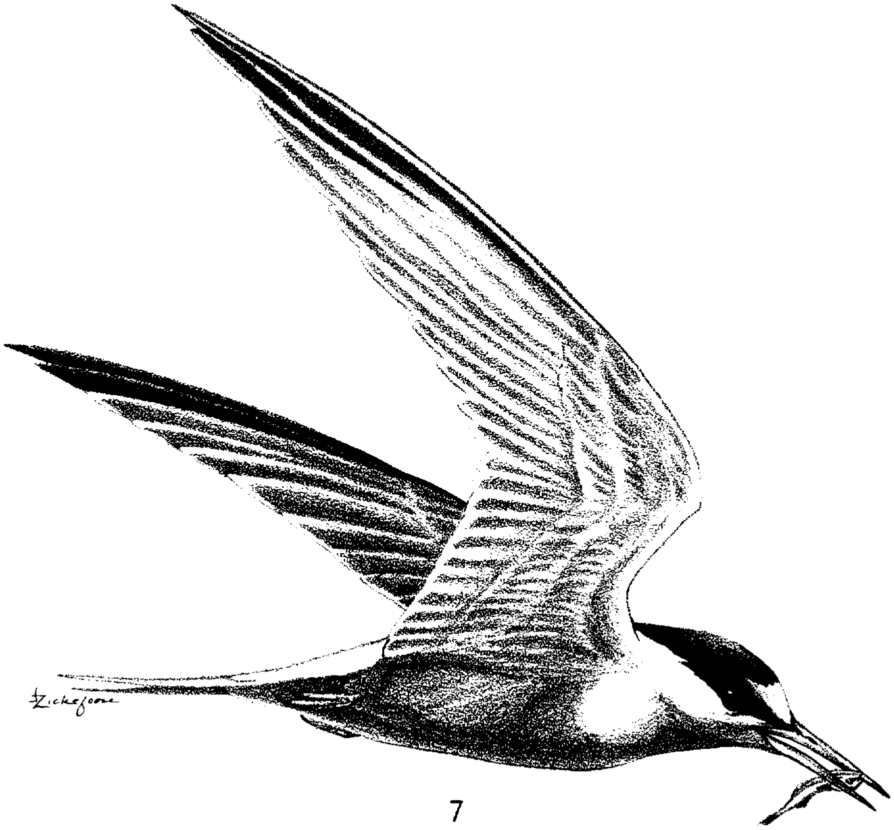

Table 2. Known breeding areas for interior least terns along the Mississippi and Ohio Rivers, 1985-1988.

State	County or Parish	Location
Missouri	Pemiscott	Mississippi River sandbars and dike fields
	New Madrid	Mississippi River sandbars and dike fields
	Mississippi	Mississippi River sandbars and dike fields
	Scott	Mississippi River sandbars and dike fields
Kentucky	Fulton	Mississippi River sandbars and dike fields
	Hickman	Mississippi River sandbars and dike fields
	Carlisle	Mississippi River sandbars and dike fields
Tennessee	Dyer	Mississippi River sandbars and dike fields
	Lake	Mississippi River sandbars and dike fields
	Lauderdale	Mississippi River sandbars and dike fields
	Tipton	Mississippi River sandbars and dike fields
	Shelby	Mississippi River sandbars and dike fields
Arkansas	Mississippi	Mississippi River sandbars and dike fields
	Crittenden	Mississippi River sandbars and dike fields
	Lee	Mississippi River sandbars and dike fields
	Phillips	Mississippi River sandbars and dike fields
	Deska	Mississippi River sandbars and dike fields
	Chicot	Mississippi River sandbars and dike fields
Mississippi	Desoto	Mississippi River sandbars and dike fields
	Tunica	Mississippi River sandbars and dike fields
	Coahoma	Mississippi River sandbars and dike fields
	Bolivar	Mississippi River sandbars and dike fields
	Washington	Mississippi River sandbars and dike fields
	Issaguena	Mississippi River sandbars and dike fields
	Warren	Mississippi River sandbars and dike fields
Louisiana	East Carroll	Mississippi River sandbars and dike fields
	Madison	Mississippi River sandbars and dike fields
Illinois	Alexander	Mississippi River sandbars and dike fields
	Pulaski	Ohio River sandbars and dike fields
Indiana	Gibson	Public Power plant along Wabash River at East Mt. Carmel

Table 3. Known breeding areas for interior least terns along the Arkansas River system, 1985-1988.

State	County	Location
Arkansas	Pulaski	Arkansas River sandbars and dike fields
	Faulkner	Arkansas River sandbars and dike fields
	Conway	Arkansas River sandbars and dike fields
	Perry	Arkansas River sandbars and dike fields
	Pope	Arkansas River sandbars and dike fields
	Logan	Arkansas River sandbars and dike fields
	Johnson	Arkansas River sandbars and dike fields
	Sabastian	Arkansas River sandbars and dike fields
	Crawford	Arkansas River sandbars and dike fields
Oklahoma	Osage	Arkansas River sandbars
	Kay	Arkansas River sandbars
	Pawnee	Arkansas River sandbars
	Creek	Arkansas River sandbars
	Tulsa	Arkansas River sandbars
	Wagoner	Arkansas River sandbars
	Muskogee	Arkansas River sandbars
	Beaver	Cimarron River sandbars
	Harper	Cimarron River sandbars
	Woods	Cimarron River sandbars
	Woodward	Cimarron River sandbars
	Major	Cimarron River sandbars
	Blaine	Cimarron River sandbars
	Kingfisher	Cimarron River sandbars
	Logan	Cimarron River sandbars
	Payne	Cimarron River sandbars
	Alfalfa	Salt Plains National Wildlife Refuge
	Texas	Optima Reservoir
	Ellis	Canadian River sandbars
	Roger Mills	Canadian River sandbars
	Dewey	Canadian River sandbars
	Haskell	Sequoyah National Wildlife Refuge
	Sequoyah	Sequoyah National Wildlife Refuge
	Cleveland	Canadian River sandbars
	McClain	Canadian River sandbars
Texas	Hemphill	Canadian River sandbars
	Roberts	Canadian River sandbars
	Hutchinson	Canadian River sandbars

Kansas	Barton	Cheyenne Bottoms
	Comanche	Cimarron River sandbars
	Clark	Cimarron River sandbars
	Meade	Cimarron River sandbars
	Stafford	Quivira National Wildlife Refuge
Colorado	Kiowa	Adobe Creek Reservoir
		Nee Noshe Reservoir
	Bent	Adobe Creek Reservoir

Table 4. Known breeding areas for interior least terns along the Red River system, 1985-1988.

State	County	Location
Texas	Childress	Prairie Dog Town Fork sandbars
	Hall	Prairie Dog Town Fork sandbars
	Briscoe	Prairie Dog Town Fork sandbars

Table 5. Known breeding areas for interior least terns along the Rio Grande system, 1985-1988.

State	County	Location
Texas	Zapata	Falcon Reservoir
	Webb	Lake Casa Blanca
	Val Verde	Amistad Reservoir
New Mexico	Chaves	Bitter Lake National Wildlife Refuge

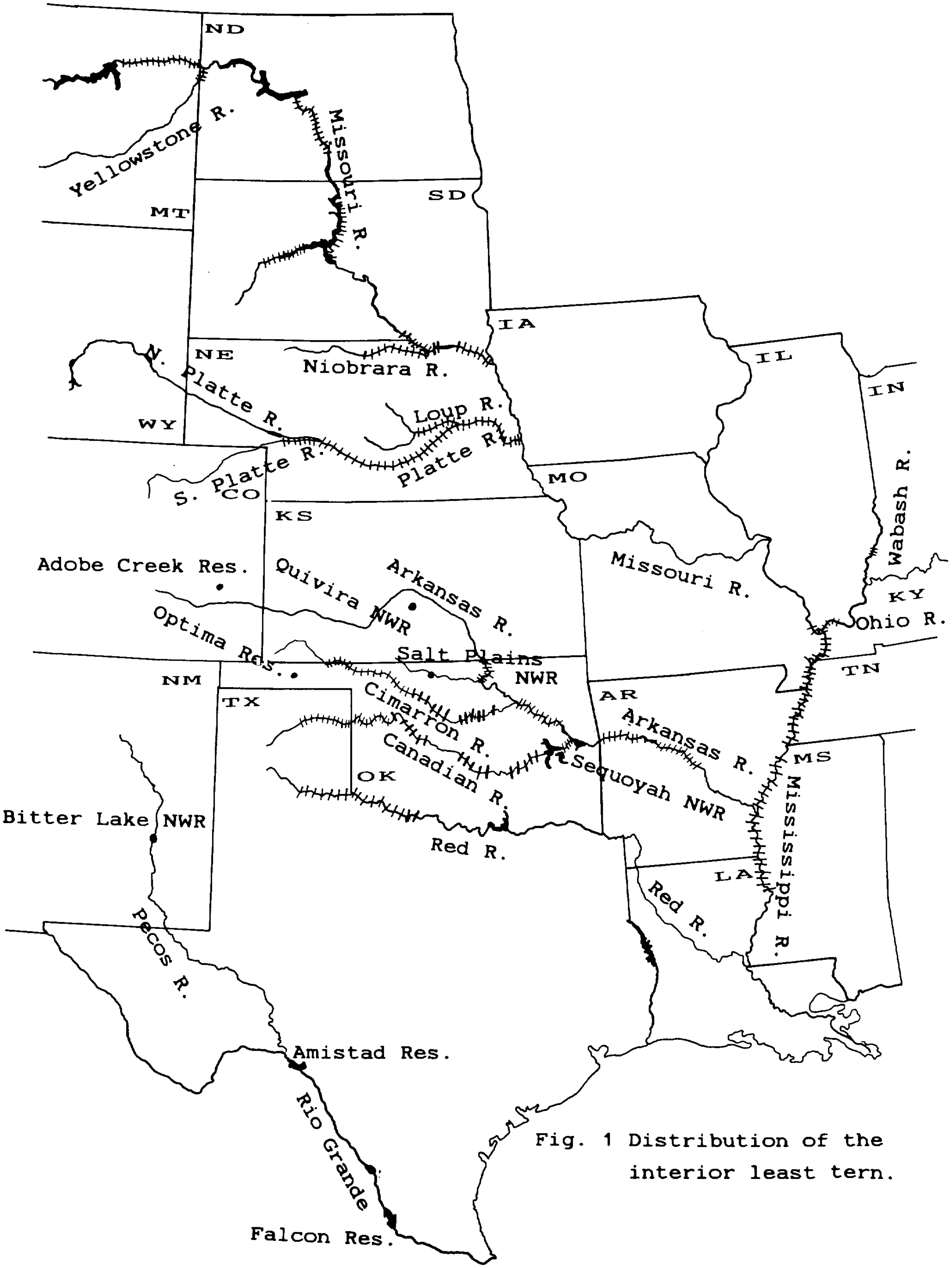

Fig. 1 Distribution of the interior least tern.

Life History

Breeding Behavior: Interior least terns spend about 4-5 months at their breeding sites. They arrive at breeding areas from late April to early June (Faanes 1983, Hardy 1957, U. S. Fish and Wildlife Service 1987a, Wilson 1984, Wycoff 1960, Youngworth 1930). Courtship behavior of least terns is similar throughout North America. Courtship occurs at the nesting site or at some distance from the nest site (Tomkins 1959). It includes the fish flight, an aerial display involving pursuit and maneuvers culminating in a fish transfer on the ground between two displaying birds. Other courtship behaviors include nest scraping, copulation and a variety of postures, and vocalizations (Ducey 1981, Hardy 1957, Wolk 1974).

The nest is a shallow and inconspicuous depression in an open, sandy area, gravelly patch, or exposed flat. Small stones, twigs, pieces of wood and debris usually lie near the nest. Least terns nest in colonies or terneries, and nests can be as close as just a few meters apart or widely scattered up to hundreds of meters (Ducey 1988, Anderson 1983, Hardy 1957, Kirsch 1990, Smith and Renken 1990, Stiles 1939). The benefit of semi-colonial nesting in least terns may be related to anti-predator behavior and social facilitation (Burger 1988).

Interior least tern eggs are pale to olive buff and speckled or streaked with dark purplish-brown, chocolate, or blue-grey markings (Hardy 1957, Whitman 1988). Occasionally, eggs are pink instead of pale to olive buff (P. Mayer and M. Schwalbach, personal communication), The birds usually lay two or three eggs (Anderson 1983, Faanes 1983, Hardy 1957, Kirsch 1987-89, Sweet 1985, Smith 1985). The average clutch size for interior least terns nesting on the Mississippi River during 1986-1989 was 2.4 eggs (Smith and Renken 1990). Egg-laying begins by late May. Both sexes share incubation which generally lasts 20-25 days but has ranged from 17 to 28 days (Faanes 1983, Hardy 1957, Moser 1940, Schwalbach 1988, G.R. Lingle, personal communication).

The precocial behavior of interior least tern chicks is similar to that of other least terns. They hatch within one day of each other, are brooded for about one week, and usually remain within the nesting territory but as they mature, wander further. Fledging occurs after three weeks, although parental attention continues until migration (Hardy 1957, Massey 1972, 1974; Tomkins 1959). Departure from colonies by both adults and fledglings varies but is usually complete by early September (Bent 1921, Hardy 1957, Stiles 1939). Thompson (1982) presented the following longevity data for coastal least terns revealed by band recoveries:

	Percentage of Recoveries
Age (years)	Known and Assumed Dead (N)
0-5	74 percent (58)
5-10	9 percent (7)
10-15	10 percent (8)
15-20	4 percent (3)
>20	3 percent

Population Biology: The interior least tern's annual reproductive success varies greatly along a given river or shoreline (Table 6). Because tern's use ephemeral habitats, they are susceptible to frequent nest and chick loss. Consequently there are great local differences in productivity. In 1987, total number of interior least terns reached 4,800 (Table 7). This is considerably higher than the 1,200 interior least terns estimated by a partial survey in 1975 by Downing (1980). There are no comprehensive historic numbers to compare with these figures, although early qualitative descriptions indicate that the interior least tern was rather common (Burroughs 1961, Hardy 1957). Increased censusing efforts during the past few years probably account for the differences among recent census figures and earlier surveys.

Table 6. Some examples of the productivity of interior least terns.

Locations	Year	Nest Success	Fledgings per Pair	Frequency of Visits	% Population Monitored	Source
Missouri River North Dakota	1988 1989	0.62 0.56	0.42 0.21	7-10 days "	100% "	Mayer and Dryer 1989
Missouri River South Dakota	1986 1987		0.20 0.64	7-10 days "	100% "	Schwalbach 1988
Missouri River South Dakota	1988 1989	0.36 0.51	0.44 0.55	7-10 days "	100% "	Dirks 1990
Lower Platte River River Nebraska	1987 1988 1989	0.57 0.67 0.43	0.29 0.71 0.47	2-3 days " "	39% 44% 42%	Kirsch 1987-89
Cimarron River Kansas	1982-83	0.18	1.09-0.56	--	--	Schulenberg and Ptacek 1984
Salt Plains NWR, Oklahoma	1987	0.44- 0.33	0.44- 0.15	1-3 days		Hill 1987

Dispersal Patterns: Breeding site fidelity of coastal and California least terns is very high (Atwood et al. 1984, Burger 1984). This may also be true for the interior least tern in its riverine environment. An interior least tern banded in 1988 as a breeding adult on the Missouri River in North Dakota returned in 1989 to breed on a Missouri River sandbar in North Dakota (Mayer and Dryer 1990). In the Mississippi River valley, a bird banded as a breeding adult in 1987 was observed nesting at the same site in 1989, and three others banded as breeding adults in 1988 returned to nest within the same stretch of the Mississippi River in 1989 (Smith and Renken 1990). Two of those birds had returned to within 4.8 km of their former nesting site. Along the Platte River in Nebraska, interior least terns demonstrate a strong return pattern to previous nesting sites on the river and at sand and gravel pits regardless of reproductive success (E.Kirsch, G. Lingle, personal communication). One interior least tern captured in 1987 as a breeding adult at a Mississippi River ternery in Missouri had been banded as a chick in 1980 by Marsha Waldron; this bird was nesting at a site 131 km upriver from its natal Tennessee colony (Smith 1987, Smith and Renken 1990). Chick dispersal may be as far as that reported by Boyd and Thompson (1985) for a breeding Kansas bird that had been banded as a chick on the Texas coast.

Home Range and Territoriality: The interior least tern's home range during the breeding season usually is limited to a reach of river near the sandbar nesting site. At Salt Plains National Wildlife Refuge, home ranges were highly variable, ranging from 11 to 1,015 ha (Talent and Hill 1985). Variation likely was due to food limitations and chick loss. The home range may change if renesting birds select a different breeding site. At sand and gravel pits along the central Platte River in Nebraska, nesting interior least terns utilize the pit area as well as an adjacent stretch of river. Nesting territories are defended and birds defend any nest in the colony. In defending the territory, the incubating bird will fly up and give an obvious alarm call followed by repeated dives at the intruder (Hardy 1957). The strong defense of territories facilitates locating terneries during census surveys.

Table 7. Census data on the interior population of the least tern, 1985-1988[1].

Location	Number of adult least terns				Approximate length of river stretch (km) where nesting least terns intermittently occur	Source
	1985	1986	1987	1988		
			Mississippi River Basin			
1. Ft. Peck Reservoir, Missouri River, Montana	-*	--**	4	2	-	(Alfonso, unpublished data, Montana Piping Plover) Recovery Committee 1988)
2. Below Ft. Peck Reservoir, Missouri River, Montana	-	--	--	18	22	(D. Christopherson, unpublished data)
3. Yellowstone River, Montana	-	--	--	12	-	(Gorges, unpublished data)
4. Below Garrison Dam, Missouri River, North Dakota	114	169	175	142	192	(Dryer and Dryer 1985, Mayer and Dryer 1988)
5. Lake Sakakawea, Missouri River, North Dakota	-	-	-	7	-	(Mayer and Dryer 1988)
6. Lake Oahe, Missouri River	-	-	-	7	-	(Mayer and Dryer 1988)
7. Yellowstone River, North Dakota	-	22	20	24	30	(Kreil and Dryer 1987, Mayer and Dryer 1988)
8. Cheyenne River, South Dakota	-	31	54	27	26	(Schwalbach et al. 1986, 1988; Schwalbach 1988)

Table 7 (continued)

Location	Number of adult least terns 1985	1986	1987	1988	Approximate length of river stretch (km) where nesting least terns intermittently occur	Source
9. Lake Oahe, Missouri River, South Dakota	-	16	21	61	-	(Schwalbach et al. 1986, 1988; Schwalbach 1988)
10. Below Fort Randall and Gavins Point Dam, MO River, South Dakota to Ponca, NE	202	206	292	297	140	(Schwalbach et al. 1986, 1988; Schwalbach 1988)
11. Power plant ash lagoons near Council Bluffs, Iowa	18	28	22	22		(Dinsmore and Dinsmore 1989, Wilson 1984)
12. Niobrara R., Nebraska	174	-	143	200	190	(Nebraska Game and Parks Commission 1985a)
13. Platte River, Nebraska	256	438	606	635	502	(Nebraska Game and Parks Commission 1988; G. R. Lingle, personal communication)
14. Loup River, Nebraska	-	-	100	155	70	(S. Gauthreaux and Nebraska Game and Parks Commission, unpublished data)
15. Elkhorn River, Nebraska	2	8	4	-	-	(J. Dinan, Nebraska Game and Parks Commission, personal communication)
16. Mississippi R., Cape Girardeau, Missouri to Vicksburg, Mississippi	1264	2244	2488	2356	1100	(Rumancik 1985, 1986; J.W. Smith 1985, 1986, 1987, 1988; M. Smith 1986; W. King personal communication; Smith and Renken 1990)
17. Power plant, Wabash River, E. Mt. Carmel, IN	2	4	4	-	-	(Johnson 1987, Mills 1987)

Table 7 (continued)

Location	Number of adult least terns				Approximate length of river stretch (km) where nesting least terns intermittently occur	Source
	1985	1986	1987	1988		
18. Arkansas River, Arkansas (above Little Rock)	50	80	130	119	256	(Smith and Shepherd 1985, K. Smith 1986, Smith et al. 1987)
19. Arkansas River, Oklahoma	-	78	200	200	119	(Hoffman 1986, L. Hill personal communication)
20. Quivira National Wildlife Refuge, Kansas (Rattlesnake Creek of Arkansas River)	48	48	54		-	(Boyd 1986, 1987)
21. Adobe Creek Reservoir Colorado	-	-	6	10	-	(Barbara Campbell, personal communication)
22. Salt Plains National Wildlife Refuge, Oklahoma (Salt Fork of the Arkansas River)	-	140	210	-	-	(Boyd 1986, 1987)
23. Cimarron River, Kansas and Oklahoma	82	150	132	-	121	(Boyd 1986, 1987)
24. Optima Reservoir, Oklahoma (Beaver River)	46	52	60	38	-	(Boyd 1986, 1987; L. Hill)
25. Canadian River, western Oklahoma and Texas	127	182	20	16	253	(McCament and Thompson 1985, 1987; U. S. Fish and Wildlife Service, unpublished data)

Table 7 (continued)

Location	Number of adult least terns				Approximate length of river stretch (km) where nesting least terns intermittently occur	Source
	1985	1986	1987	1988		
26. Canadian River, Eufaula Dam to Arkansas River, including Sequoyah National Wildlife Refuge	-	-	105	34	43	(L. Hill personal communication)
27. Canadian River at Norman, Oklahoma	-	-	-	12	3	(L. Hill, personal communication)
28. Prairie Dog Town Fork of Red River, Texas	44	50	12	16	241	(McCament and Thompson 1985, 1987; B. Thompson, pers. commun.)
Rio Grande River Basin						
29. Falcon Reservoir, Rio Grande River	500	150	50	222	-	(McCament and Thompson 1985, 1987; B. Thompson, pers. commun.)
30. Lake Casa Blanca	5	-	14	50	-	(McCament and Thompson 1985, 1987; B. Thompson, pers. commun.)
31. Amistad Reservoir, Rio Grande River	20	9	-	14	-	(McCament and Thompson 1985, 1987; B. Thompson, pers. commun.)

Table 7 (continued)

Location	Number of adult least terns				Approximate length of river stretch (km) where nesting least terns intermittently occur	Source
	1985	1986	1987	1988		
32. Bitter Lake National Wildlife Refuge, New Mexico (Pecos River)	-	8	6	6	-	(Shomo, 1988 and S. Williams, New Mexico Game and Fish Department, unpublished report)
Total	2952	4113	4932	4702	3308	

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[1] The census results should be viewed in light of the extent and frequency of census efforts. Increases or decreases from year to year may not be related to reproductive performance.

* no census conducted in that year.

** area surveyed but no birds found

Diet: The interior least tern is piscivorous, feeding in shallow waters of rivers, streams and lakes. Other least terns also feed on crustaceans, insects, mollusks and annelids (Whitman 1988). The terns usually feed close to their nesting sites. Fish prey is small sized and important genera include *Fundulus*, *Notropis*, *Campostoma*, *Pimephales*, *Gambusia*, *Blonesox*, *Morone*, *Dorosoma*, *Lepomis* and *Carpiodes* (Grover 1979, Hardy 1957, Rumancik 1988, 1989; Schulenberg et al. 1980, Smith and Renken 1990, Wilson et al. 1989). Moseley (1976) believed least terns to be opportunistic feeders, exploiting any fish within a certain size range. Fishing occurs close to the riverine colony. Terns nesting at sand and gravel pits and other artificial habitats may fly up to 3.2 km to fish. Radio-tagged terns at Salt Plains National Wildlife Refuge often traveled 3.2-6.4 km to fish (Talent and Hill 1985). Fishing behavior involves hovering and diving over standing or flowing water.

Interspecific Interactions: Interior least terns are breeding associates of the piping plover (*Charadrius melodus*) in the Missouri River system (Dryer and Dryer 1985, Faanes 1983, Nebraska Game and Parks Commission 1987, Schwalbach 1988) and the snowy plover (*Charadrius alexandrius*) and American avocet (*Recurvirostra americana*) in the Arkansas River system (Grover and Knopf 1982, Hill 1985). Nesting piping plovers usually can be found within or near nesting interior least terns at sand and gravel pits and on riverine sandbars.

Habitat Requirements

Least terns throughout North America nest in areas with similar habitat attributes.

Coastal Areas: Coastal and California least terns usually nest on elevated portions of level, unvegetated substrates near foraging areas (Carreker 1985). Beaches, sand pits, sandbars, islands and peninsulas are the principal breeding habitats (Moseley 1976). Nesting can be close to water but is usually between the dune environment and the high tide line (Akers 1975, Blodget 1978). Unconsolidated substrate such as small stones, gravel, sand, debris and shells comprise the nesting substrate. A mixture of coarse sand, shells and other fragments may be preferred over fine-grained substrates because of better cryptic qualities, stability in wind, and water permeability (Burroughs 1966, Craig 1971, Gochfeld 1983, Jernigan et al. 1978, Soots and Parnell 1975, Swickard 1972, Thompson and Slack 1982).

Vegetation at California and coastal least tern nesting sites is sparse, scattered and short. Vegetation cover is usually less than 20% at the time of nesting (Craig 1971, Thompson and Slack 1982, Gochfeld 1983). Least tern colonies in denser vegetation may be a response to habitat loss or a function of strong site tenacity.

Rivers: The riverine nesting areas of interior least terns are sparsely vegetated sand and gravel bars within a wide unobstructed river channel, or salt flats along lake shorelines. Nesting locations usually are at the higher elevations and away from the water's edge because nesting starts when the river flows are high and small amounts of sand are exposed. The size of nesting areas depends on water levels and the extent of associated sandbars. An examination of the interior least tern's nesting ecology on the Missouri River (Schwalbach et al. 1988) illustrates the changes caused by varying river flows. Along one stretch of the Missouri River in South Dakota the average size of nesting sandbars was 12 and 31 ha in 1986 and 1987, respectively; nest elevation and nest to water distance differed by a factor of three in both years.

The Lower Mississippi River is very wide and carries a tremendous volume of water and sand. Sandbars form annually, are washed away, and shift position. Many sandbars are over 3.2 km long and 1.2 km wide. Nest sites are often several hundred meters from the water (Rumancik 1987, 1988). Thus, nesting areas usually are several hundred hectares in size. Mississippi River levels at the onset of nesting also influences the number of nests at a colony. Smith and Renken (1990) observed Mississippi River colonies that averaged 100 nests/colony when habitat was restricted by high water early in the nesting period, but which averaged only 19.3 nests/colony during a year of more moderate river levels.

Artificial Nesting Habitat: Least terns nest on artificial habitats such as sand and gravel pits and dredge islands (Dryer and Dryer 1985, Haddon and Knight 1983, Kirsch 1987-89, Larkins 1984, Morris 1980). In North America the coastal and California least terns commonly nest on a variety of artificial nesting habitats, even roof-tops (Altman and Gano 1984, Atwood et al. 1979, Fisk 1975, 1978; Jernigan 1977, Massey and Atwood 1980, 1983; Swickard 1974).

The interior least tern nests on dike fields along the Mississippi River (Smith and Stucky 1988; Smith and Renken 1990), at sand and gravel pits (Kirsch 1987-89), ash disposal areas of power plants (Dinsmore and Dinsmore 1988, Johnson 1987, Wilson 1984), along the shores of reservoirs (Boyd 1987, Chase and Loeffler 1978, Neck and Riskind 1981, Schwalbach 1988) and at other manmade sites (Shomo 1988). The percentage of interior least terns nesting on pits adjacent to the lower reach (Columbus to Plattsmouth) of the Platte River varies depending on the flow and amount of exposed sandbar habitat (Kirsch 1987-89). Suitable nesting habitat in the upper Platte River channel has been severely reduced (Sidle et al. 1989) and in many stretches of the river, sand and gravel pits annually provide the only nesting habitat (Lingle 1989). It is unknown to what extent sand and gravel pits, dike fields, reservoir shorelines and other artificial habitats have replaced natural habitat. In the lower Mississippi River alone, 7,518 ha of bar and island habitat were lost in diked reaches between 1962 and 1976 (Nunnally and Beverly 1986, Smith and Stucky 1988).

Reasons For Current Status

Habitat alteration and destruction: Channelization, irrigation, and the construction of reservoirs and pools have contributed to the elimination of much of the tern's sandbar nesting habitat in the Missouri, Arkansas, and Red River systems (Funk and Robinson 1974, Hallber et al 1979, Sandheinrich and Atchison 1986). Ducey (1985), for example, describes the changes in the channel characteristics of the Missouri River since the early 1900s under the Missouri River Bank Stabilization and Navigation Project. The wide and braided character of the Missouri River was engineered into a single narrow navigation channel. Most sandbars virtually disappeared between Sioux City, Iowa and Saint Louis, Missouri (Sandheinrich and Atchison 1986, Smith and Stucky 1988).

Where sandbars still occur along the Nebraska-South Dakota boundary (Missouri River), approximately 3,156 ha of sandbar habitat have been lost between 1956 and 1975 (Schmulbach et al. 1981). Sandbars along the Nebraska-Iowa Missouri River boundary have been virtually eliminated with the exception of 890 ha inventoried along the 80-km Missouri National Recreation Area (Schmulbach et al. 1981).

Current regulation of Missouri River dam discharges pose additional problems for interior least terns nesting in remaining habitats (Nebraska Game and Parks Commission 1985c, Schwalbach et al. 1988). Before regulation of river flows, summer flow patterns were more predictable. Peak flows occurred in March from local runoff and then again in May and June when mountain snowmelt occurs. Flows then declined during the rest of the summer allowing interior least terns to nest as water levels dropped and sandbars became available (Stiles 1939, Hardy 1957). Currently, the main stem system is supposed to be regulated for hydropower, navigation, water quality and supply, flood evacuation, irrigation, fish and wildlife conservation, and public recreation. However, system releases are designed to provide equitable service to power and navigation demands, except when they conflict with flood control functions of the system.

The demands are unpredictable and flows can fluctuate greatly. Flow regimes differ greatly from historic regimes. High flow periods may now extend into the normal nesting period, thereby reducing the quality of existing nest sites and forcing interior least terns to initiate nests in poor quality locations. Extreme fluctuations can flood existing nests, inundate potential nesting areas, or dewater feeding areas. Interior least terns along the Arkansas River in Oklahoma and Arkansas contend with dam discharge problems similar to those on the Missouri River.

Along the Lower Mississippi River, and elsewhere, natural river discharge may exert considerable influence on reproductive success. A wet spring may delay river fall and habitat may not be available until later. Rises in the river during the spring and summer may inundate nests and wash away chicks (Rumancik 1986, 1989, Smith and Renken 1990). Renesting, however, does occur and may be an adaptation to river fluctuations. Dike construction has created many sandbars between the dikes and many nesting colonies are located on these sandbars (Landin et al. 1985, Rumancik 1986, 1987, 1988, 1989; J. Smith 1985, 1986, 1987). The extent to which these sandbars are attaching to the riverbank and reducing tern habitat is not known but according to Smith and Stucky (1988) the processes of dike field terrestrialization are well underway at several least tern colony sites in the lower Mississippi River.

Reservoir storage of flows responsible for scouring sandbars has resulted in the encroachment of vegetation along many rivers such as the Platte River, Nebraska and greatly reduced channel width (Currier et al. 1985, O'Brien and Currier 1987, Eschner et al. 1981, Lyons and Randle 1988, Sidle et al. 1989, Stinnett et al. 1987). In addition, river main stem reservoirs now trap much of the sediment load resulting in less aggradation and more degradation of the river bed and subsequently less formation of suitable sandbar nesting habitat. Riverine habitat along the central Platte River may require extensive vegetation clearing and other intensive management. In contrast, the lower Platte River (Columbus, Nebraska to the Missouri River confluence) has not undergone as extensive habitat changes as the central Platte. During 1987-1989, riverine sandbar habitat hosted 72% of the nests on the lower Platte and only 12% of the nests on the central Platte (Kirsch 1989, Lingle 1989).

Human disturbance: Many rivers have become the focus of recreational activities. Human presence reduces reproductive success (Mayer and Dryer 1988, Smith and Renken 1990). In mid-America, sandbars are fast becoming the recreational counterpart of coastal beaches. Even sand and gravel pits and other artificial nesting sites receive a high level of human disturbance.

Conservation Efforts

During the past few years there has been a great increase in the number of interior least tern surveys, research projects and public relations endeavors to protect the birds on the part of both public and private conservation organizations. Proposed federal listing of the interior least tern prompted much of the interest in the northern Great Plains and elsewhere. Today, many state, federal and private organizations are collaborating to census the birds, curtail human disturbance and conduct research.

Under authority of Section 7 of the Endangered Species Act, the U. S. Fish and Wildlife Service is consulting with the U. S. Army Corps of Engineers on whether dam operations on the Missouri and Arkansas Rivers jeopardize the continued existence of the interior least tern (U.S Fish and Wildlife Service 1989, 1990). The outcome of these formal consultations is crucial to the recovery of the interior least tern. Areas of habitat along the Missouri River, for example, continue to degrade due to physical controls on the river and present water management schemes. Changes in the water release regime and physical manipulation of habitat will be necessary.

Aside from the Section 7 consultation on the Missouri River, the Corps Master Manual for river operations is under review. If upper Missouri River Basin states have their way for holding water in the reservoirs for recreation and fisheries, navigation in the Missouri River could be reduced and maintenance of the commercial navigation project above Omaha could become infeasible. The reach between Sioux City, Iowa and the mouth of the Platte River could once more be available to interior least terns.

Montana: Current efforts include surveys to determine the number and distribution of interior least terns along the Missouri and Yellowstone Rivers and along the shores of the Fort Peck Reservoir.

North Dakota: Censusing has been conducted along the Missouri River since 1982 and along the Yellowstone River since 1986. Habitat requirements are being estimated and recommendations are being made for the management of Missouri River habitat. Research continues on reproductive success and on methods to increase productivity. Resource agencies are involved with a variety of public relations efforts to curtail human disturbance on Missouri River sandbars and islands.

South Dakota: Detailed studies of interior least tern nesting ecology continue at Missouri and Cheyenne River sandbars and along the reservoir shoreline of Lake Oahe. Resource agencies are involved with public relations efforts to curtail human disturbance on the Missouri River. Management activities include the posting of nesting sites and informational signs at boat ramps and elsewhere. This has been complemented with enforcement actions being taken by state and federal officials. Recent amendments to South Dakota law prohibit the harassment of least tern nesting and rearing sites on the Missouri River.

Nebraska: Nebraska supports one of the largest breeding populations of interior least terns. Annual surveys have been carried out since 1979. Efforts are underway to quantify available nesting habitat on the Platte River at various river flows. Research on reproductive success, habitat selection, foraging ecology, predation and the value of sand and gravel pits continues along the Platte River (Kirsch 1987-89, Lingle 1989, Wilson et al. 1989).

A flow management plan has been prepared for the Missouri River (Nebraska Game and Parks Commission 1985c) and certain instream flows have been determined on the Platte River for the interior least tern, its habitat and forage fish, and for other wildlife and resources (Table 8). In 1990 the Federal Energy Regulatory Commission (FERC) ordered the Nebraska Public Power District to maintain the instream flows in Table 8 for interior least terns (50 FERC Report (CCH) 61,180) (Sidle et al. 1990). The District seeks a new license to operate diversion dams and other facilities associated with the Lake McConaughy reservoir on the North Platte River. Lake McConaughy was constructed in the late 1930s and licensed for 50 years. The dam, diversion structures, and other facilities have had a major impact on the downstream habitat of the interior least tern. When granting a new power license the Federal Power Act requires FERC to give equal consideration to the protection, mitigation of damage to, and enhancement of, fish and wildlife.

Posting, extensive news media efforts, posters, brochures, information signs at river entry points, and law enforcement patrols are some of the additional activities being carried out in Nebraska. The Platte River Whooping Crane Habitat Trust is trying to rehabilitate sandbars in the central Platte River (Lexington to Grand Island) by removing vegetation over extensive areas of the river channel. FERC also ordered the Nebraska Public Power District to construct eight permanent five- to ten-acre sites for interior least tern nesting in the central Platte River where nesting habitat has been severely degraded, in part by the upstream Lake McConaughy and associated water diversion canals and offstream reservoirs.

Finally, Nebraska law requires state agencies to consult with the Nebraska Game and Parks Commission on any action authorized, funded, or carried out by the state agencies. This insures that such actions do not jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of habitat. The Commission reviews state sponsored or authorized projects that may impact endangered or threatened species and issues biological opinions to the state agencies.

Colorado: The interior least tern is known to breed at Adobe Creek reservoir and has been observed at Nee Noshe reservoir. Public relation efforts and other endeavors are underway to address fluctuating water levels, human disturbance, vegetation encroachment, and predation.

Iowa: Largely devoid of natural interior least tern habitat, Iowa's conservation efforts have focused on monitoring and protecting the few nest sites located on fly-ash disposal sites of two power generating stations along the Missouri River at Council Bluffs and Sioux City. Both sites are monitored to record the number of nesting pairs and reproductive success. The Council Bluffs nesting habitat also is protected by a management plan. The plan specifies that both people and heavy equipment will be kept out of the nesting area during the breeding season.

Interior least tern decoys have been set out at the DeSoto National Wildlife Refuge to attract terns which formerly nested there in the 1970s. Woody vegetation has been cleared and the areas are disked to maintain open habitat.

Table 8. Recommended annual flow regime for Central Platte River, Nebraska[1]

Time Period	Flow(cfs[2])	Species/Resources of Concern	Existing Median Flow(cfs) (1958-1985)
Jan 1-Mar 22	1,100	Bald Eagle, wet meadow sandhill crane, waterfowl, least tern forage fish, sport fish	1,710
Mar 23-May 10	2,000	Whooping crane, sandhill crane, waterfowl, least tern forage fish, sport fish	1,823
May 11-May 14	800	Least tern forage fish, sport fish	1,433
May 15-Sep 15	800	Least tern, piping plover, tern forage fish, sport fish	781
Sep 16-Nov 15	2,000	Whooping crane, sandhill crane, waterfowl, least tern forage fish, sport fish	893
Nov 16-Dec 9	1,000	Waterfowl, least tern forage fish, sport fish	1,186
Dec 10- Dec 31	1,100	Bald eagle, waterfowl, least tern forage fish, sport fish	1,253

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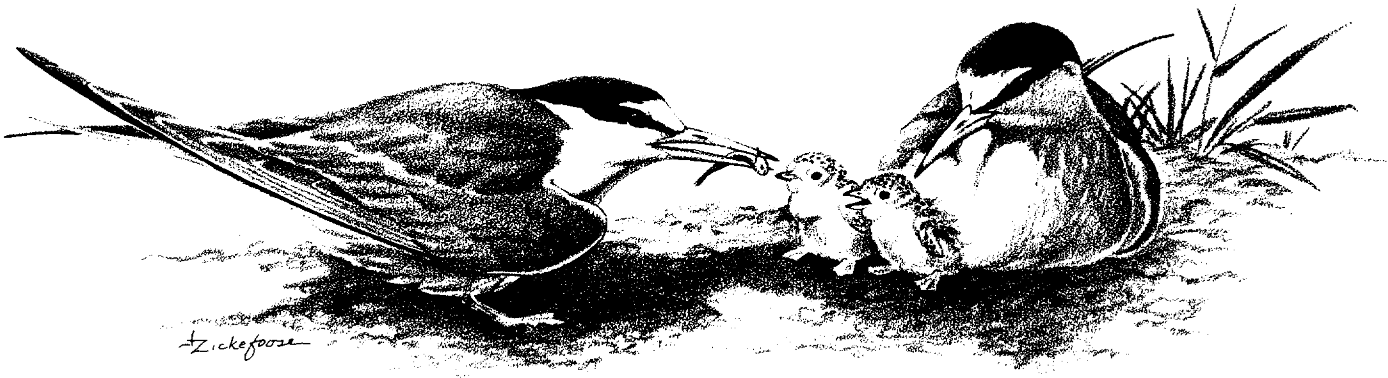
[1] As measured at the U. S. Geological Survey gage at Grand Island.
[2] Cubic feet per second



Missouri: The Missouri Department of Conservation maintains an active conservation, management and research program for interior least terns. The Missouri River has been thoroughly surveyed for potential habitat; Mississippi River colonies are closely monitored and under detailed study; and management plans have been developed. Regulations provide special protective status for least tern nesting areas on Department owned islands and sandbars. Public information programs about the interior least tern are widespread.

Kansas: The Kansas Department of Wildlife and Parks has funded research on distribution, reproductive success, banding and inter-colonial movements, foraging ecology, and predation since 1980. Annual surveys along the Cimarron River and at the Quivira National Wildlife Refuge have been conducted since 1980. Successful habitat alteration and management has been on-going since 1985. Studies also have focused on the issue of inadequate instream flows in both the Cimarron and Arkansas rivers in Kansas.

Oklahoma: The largest concentration of least terns in Oklahoma is at Salt Plains National Wildlife Refuge. This area has been studied intermittently since 1977. Research at river nesting sites has been on-going since 1982. The Cimarron and Arkansas rivers have received more survey and distribution effort than the Red and Canadian rivers. Various studies of reproductive success, inter-colonial movements and foraging ecology have been conducted at Salt Plains, Optima Reservoir and the western reaches of the Cimarron River. Posting, fencing and extensive news media efforts have been successful at Optima Reservoir and the western reaches of the Cimarron River. Nesting sites on the Cimarron River continue to be threatened by several river diversion and impoundment proposals. A memorandum of understanding has been developed between The Nature Conservancy, U. S. Army Corps of Engineers, Oklahoma Department of Wildlife Conservation, U. S. Fish and Wildlife Service, Tulsa Audubon Society, River Parks Authority and riverbed landowners for protection and management of essential habitat on the Arkansas River in Tulsa County.

Mississippi River States: The U. S. Army Corps of Engineers has undertaken extensive census work along the Mississippi River between Illinois and Vicksburg, Mississippi, and along the Arkansas River to the Oklahoma border. Their surveys have provided the only information on the tern on the Mississippi River below the State of Missouri. The locations of colonies are monitored and the information is used by regulatory personnel to evaluate permit applications and in planning operations and maintenance activities on the lower Mississippi River.

Texas and New Mexico: The Texas Parks and Wildlife Department has examined the numbers and distribution of interior least terns along the Rio Grande River and rivers in the Texas Panhandle, and investigated genetic characteristics of coastal and interior least terns. The New Mexico Department of Game and Fish has conducted several years of surveys and studies and developed management recommendations for interior least terns at and near the Bitter Lake National Wildlife Refuge along Pecos River (Jungemann 1988).

II. RECOVERY

Recovery objective

The purpose of this plan is to describe actions necessary to achieve recovery of interior least terns. The first step in this approach is to set a quantifiable goal (i. e., recovery objective) that, when reached, will assure populations remain stable. The remainder of this plan outlines steps necessary to achieve the recovery objective. Recovery goals, objectives and tasks may change as we learn more about the interior least terns.

Recognizing that the interior least tern has a broad distribution, the recovery objective was set by taking into account: 1) current data on distribution and abundance of interior least terns in each river system; 2) knowledge of how thoroughly each river system has been surveyed; 3) historic population data, when available; 4) loss of viable habitat; 5) an assessment of the potential to increase breeding pairs at currently occupied sites; 6) assessment of the potential to establish breeding pairs at unoccupied sites. Technical experts and state and federal resource agencies were consulted to determine the status of current populations and habitats, as well as the potential for population increase.

Therefore, in order to be considered for removal from the endangered species list, interior least tern essential habitat will be properly protected and managed and populations will have increased to 7,000 birds:

I. Missouri River System
   A. Number of birds in the Missouri River system will increase to 2,100 adults.
   B. Essential breeding habitat (Appendix 4) will be protected, enhanced and restored.
   C. The breeding pairs will be maintained in the following distribution for 10 years (assuming at least four major censuses will have been conducted during this time):
      Montana - 50 adults
      North Dakota - 250 adults
      South Dakota - 680 adults (includes 400 shared with Nebraska on the Missouri River).
      Missouri River below Gavin's Pt. Dam - 400 adults
      Lake Oahe - 100 adults
      Missouri River below Ft. Randall - 80 adults
      Other Missouri River sites - 20 adults
      Cheyenne River - 80 adults
      Nebraska - 1520 adults (includes 400 adults shared with South Dakota on the Missouri River).
      Missouri River - 400 adults
      Niobrara River - 200 adults
      Loup River - 170 adults
      Platte River - 750 adults
      Missouri and Iowa - Opportunities for habitat restoration and reestablishment of breeding pairs will be determined.

II. Mississippi and Ohio Rivers
  A. Current number of adult birds (2,200-2,500) on the Lower Mississippi River will remain stable for the next ten years.
  B. Essential breeding habitat (Appendix 4) will be protected, enhanced, and restored.

III. Arkansas River System
  A. Numbers of birds on the Arkansas River system will increase to 1,600 adults.
  B. Essential breeding habitat (Appendix 4) will be protected, enhanced and restored.
  C. The 1,600 breeding adults will be maintained in the following distribution for 10 years:
    Arkansas River, Arkansas - 150 adults
    Arkansas River, Oklahoma - 250 adults
    Quivira National Wildlife Refuge - 100 adults
    Salt Plains National Wildlife Refuge - 300 adults
    Cimarron River Basin - 400 adults
    Canadian River - 300 adults
    Beaver/ North Canadian River - 100 adults

IV. Red River System
  A. Number of birds in the Red River system will increase to 300 breeding adults.
  B. Essential Breeding habitat (Appendix 4) will be protected, enhanced and restored.
  C. The 300 adults will be distributed along the Prairie Dog Town Fork where interior least terns currently occur and at other essential habitat sites yet to be determined.

V. Rio Grande River System
  A. Current number of adult birds (500) in the Rio Grande River system will remain stable for 10 years.
  B. Essential breeding habitat will be protected, enhanced and restored.
  C. The birds will be distributed along the Rio Grande and Pecos Rivers.

Step-Down Outline

The step-down outline lists tasks necessary to meet the recovery objective. Steps (or tasks) are not presented in order of importance. Some steps are underway, while others may take years before they are begun. An explanation of these steps is presented in the Narrative section of this plan. Following the Narrative, the Implementation Schedule lists and sets priorities to be taken in the next three years. The step-down outline is very similar to the step-down outline in the Great Lakes/Northern Great Plains Piping Plover recovery plan (U. S. Fish and Wildlife Service 1988a) because both species breed in the same habitat areas in the Missouri River system and require similar recovery tasks.

1. Determine current distribution and population trends of the interior least tern.
  11. Assess status and distribution of breeding populations.
    111. Survey sandbars, reservoir shorelines, sand and gravel pits and other suitable habitats to determine breeding

distribution.

    112. Develop a method for standardization of census techniques and timing of censuses.
    113. Census known and potential breeding sites.
    114. Monitor reproductive success.
    115. Assess dispersal patterns and genetic diversity.
    116. Assess mortality.
    117. Further identify life history parameters and develop population models.
  12. Assess status and distribution for the migration period.
  13. Assess status and distribution during the winter.
    131. Survey beaches and other suitable habitat to determine winter distribution.
    132. Census known wintering areas.
    133. Monitor movement of birds between wintering sites and assess mixing of populations.
    134. Assess mortality on wintering areas.

2. Determine current habitat requirements and status.
  21. Determine breeding habitat requirements and status.
    211. Assess the characteristics, including prey resources, of breeding habitat.
    212. Quantify and evaluate available breeding habitat.
    213. Examine historic aerial photography and hydrographic surveys of river systems to determine the previous extent of potential habitat and vegetational changes.
  22. Determine current migration habitat requirements and status.
    221. Assess the characteristics, including prey resources, of migration habitat.
    222. Quantify and evaluate available migration habitat.
  23. Determine current habitat requirements and status on wintering areas.
    231. Assess the characteristics, including prey resources, of winter habitat.
    232. Quantify and evaluate winter habitat.
3. Protect, enhance, and increase interior least tern populations.
  31. Protect, enhance, and increase populations during the breeding season.
    311. Increase reproduction and survival at occupied breeding sites.
      3111. Evaluate predator impacts on eggs and chicks and identify species responsible for the predation.
      3112. Evaluate techniques for predator management and implement where appropriate.
      3113. Restrict public use within nesting areas and investigate enforcement options.
      3114. Manage water levels and river flows to reduce nest and chick loss.
      3115. Modify or eliminate construction activities that adversely impact reproductive success.

      3116. Investigate the effects of environmental contaminants at breeding areas.
  32. Protect and enhance populations during migration and winter.
    321. Manage areas to maximize survival of birds during migration.
    322. Manage winter areas to maximize survival of birds during winter.
      3221. Investigate the effects of human activities on winter survival.
      3222. Investigate the effects of environmental contaminants.
4. Preserve and enhance habitat.
  41. Provide protection and management of breeding habitat.
    411. Identify areas of essential breeding habitat.
    412. Continue to evaluate areas for consideration as essential breeding habitat.
    413. Establish liaison with agencies and organizations with land and water management responsibilities.
    414. Revise, establish, or utilize land and water laws and regulations to provide protection along rivers and lakes.
    415. Develop criteria and priorities for breeding habitat protection.
    416. Develop management plans for breeding habitat.
      4161. Determine direct, indirect and cumulative effects of manipulation of river hydraulics, flow regimes, and sediment discharge on breeding and foraging habitat.
      4162. Identify river flow regimes that will protect and enhance breeding and foraging habitat.
      4163. Determine the relationship of existing artificial breeding sites to river sites.
      4164. Identify need and techniques of improving habitat by management of substrate and by vegetation control through physical and/or non-toxic chemical means.
      4165. Study feasibility and determine need for creating new habitat and implement trials to determine success rates of creating new habitat.
      4166. Develop lake and reservoir control policies where existing and potential interior least tern habitat is threatened.
      4167. Identify needs and techniques for managing water levels.
    417. Evaluate success of protection and management techniques.
  42. Provide protection and management of migration habitat.
  43. Provide protection and management of winter habitat.
    431. Identify areas of essential winter habitat.
    432. Develop criteria and priorities for winter habitat protection.
    433. Develop management techniques.
    434. Modify construction activities that may reduce or negatively alter winter habitat.
    435. Evaluate success of protection and management techniques.
5. Develop and implement an education program that publicizes information on the interior least tern, including its life history, reasons for

current status, and options for recovery.

- 51. Inform and educate the public on the bird's plight and recovery efforts.
  - 511. Identify target audiences among the general public.
  - 512. Develop and distribute educational materials appropriate to various audiences.
  - 513. Develop materials for newspapers, radio, and television that highlight specific interior least tern projects.
  - 514. Provide controlled viewing opportunities if and when appropriate.
- 52. Inform and educate public resource management agencies.
  - 521. Identify critical resource agency constituents.
  - 522. Develop educational materials appropriate to respective agencies and their management authority.
  - 523. Provide public resource agencies with periodic updates on the interior least tern's status and progress of recovery efforts.

6. Coordinate recovery efforts.
   - 61. Designate a recovery plan coordinator.
     - 611. Coordinate research and management activities with federal,state, local and private organizations.
     - 612. Coordinate international research and management activities.
     - 613. Coordinate development of a public information program at the national and international level.

Narrative

The Narrative gives further details and justification for each task in the Step-Down Outline. The steps critical for recovery in the next three years are outlined and given priority in the Implementation Schedule.

1. Determine current distribution and population trends of the interior least tern.

The effectiveness of current conservation efforts will not be well-understood until comprehensive distribution and census data have been collected. Future plans for recovery also will be curtailed until a more accurate picture of the species status is defined.

11. Assess status and distribution of breeding populations.

Most interior least tern censusing has been carried out during the breeding season. Results indicate interior least terns are widely distributed, as scattered pairs or in concentrations at breeding areas. The terns probably disperse great distances as suggested by Boyd and Thompson (1985). Continued search for new breeding areas and evaluation of known areas are necessary to complete our knowledge of the birds' status.

111. Survey sandbars, reservoir shorelines, sand and gravel pits and other suitable habitats to determine breeding distribution.
Currently, the distribution of the interior least tern on most of the Missouri River system is well-known and monitored, although reservoir shorelines in the Dakotas and Montana should be further surveyed for accurate population estimates especially during drought years when reservoir levels are low. Additional survey work is needed on the Loup River in Nebraska and elsewhere in the Platte River system. The Arkansas River system needs further survey work in Arkansas, Kansas, Oklahoma and Texas. The length of the Red River requires a thorough survey as does the Rio Grande River system and rivers in central Texas. Additional survey work is needed on the Lower Mississippi River to determine distribution when the river rises and floods nesting colonies. The Missouri Department of Conservation has a study in progress to address this need. The status of potential sites should be monitored and updated at least once every five years.

112. Develop a method for standardization of census techniques and timing.
The exposure of sandbars in the spring follows the reduction of river flows. The breeding cycle may commence at different times throughout the interior least tern's range. Differences in breeding chronology from south to north must be determined. Because of the length of time involved in surveying long stretches of rivers, surveys should be correlated with reported river levels and the exposure of sandbars. Surveys should account for renesting birds and later nesting by younger adults (Massey and Atwood 1981, Smith and Renken 1990).

113. Census known and potential breeding sites.
Once sites are identified as containing breeding pairs, annual censuses of breeding and non-breeding adults should be carried out at essential breeding habitat (Appendix 4) for several years. If the birds are established for several years, censusing should continue at least once every year.

114. Monitor reproductive success.
Census data provide an indication of an area's population size, but estimates of reproductive success are also necessary. More adults may be present in nesting areas than actually breed. Frequent nest destruction further lowers productivity of a site, rendering simple counts of breeding pairs less meaningful than censuses of adults and fledged chicks. Reproductive success or recruitment (measured in terms of number of chicks fledged per pair) should be monitored annually at essential sites and at least every three years, on a rotating basis, at other sites. Causes of reproductive failure should be identified whenever possible. Because of possible early fledgling departure from colonies, multiple counts of fledglings should be made for

determination of the fledging rate (Thompson 1982, Thompson and Slack 1983).

115. Assess dispersal patterns and genetic diversity.

Little is known about the interaction between coastal least terns and the interior least tern. Boyd and Thompson (1985) found a nesting least tern in Kansas which had been banded as a chick on the Texas coast. It would be useful to know if coastal least terns serve as a reservoir to replenish the interior least tern population; and if the status of the coastal least tern population determines the numbers and distribution of interior least terns. Monitoring movements of marked birds in major breeding areas will fill the gap in our understanding of dispersal. Knowledge of how new nest sites are colonized, and where new birds originated will be useful in developing population management plans and models.

116. Assess mortality.

Factors such as human disturbance, predation, and water level regulation have reduced success of interior least tern eggs and chicks (Mayer and Dryer 1990). Factors affecting adult mortality, however, have never been fully addressed for any part of the annual cycle. Predation is a problem for some California and coastal least terns (Burger 1984, Minsky 1980, Massey 1981) and the closely allied little tern in Europe (Haddon and Knight 1983). During the breeding season, predation on interior least terns by coyote (*Canis latrans*), crow (*Corvus brachyrhynchos*), and raptors has been reported (G. R. Lingle, personal communication, Hill 1985, Kirsch 1990, Mayer and Dryer 1990) and predation on nesting adults by barred owls (*Strix varia*) has been recorded (Smith and Renken 1990). Predation is significant on the Missouri National Recreational River (U. S. Fish and Wildlife Service, unpublished data). It is important to determine the extent and cause of adult and juvenile mortality during the breeding season.

117. Further identify life history parameters and develop population models.

Field studies of interior least terns should be carried out without reducing reproductive success or site tenacity. Future breeding studies only should be undertaken after researchers have identified specific critical factors that require resolution in order to rehabilitate the species. It would be useful to compile all available life history data and develop a model to estimate potential population trends.

12. Assess status and distribution for the migration period.

Less is known about the migratory ecology for the interior least tern than for any other phase of the annual cycle. Migratory routes have not been adequately described for spring or fall. It is not known if interior least terns follow major river systems during migration or if they migrate directly north and south. Further, it is unknown if interior least terns join coastal least terns prior to coastal least tern migration to Latin America or if interior least terns have their own migration route. Before intensive individual field studies are undertaken, it may be beneficial to coordinate surveys of potential sites with natural resource employees or local birders to determine if interior least terns are stopping en route to wintering sites.

13. Assess status and distribution during the winter.
Interior least terns spend 6-7 months at wintering sites. Most field research, however, has been carried out on breeding birds. Factors limiting non-breeding birds may be as severe or worse than threats encountered during other times of the year. Field studies should begin to at least locate wintering sites.

    131. Survey beaches and other suitable habitat to determine winter distribution.
    Biologists familiar with the avifauna of Atlantic and Caribbean coastal Latin America should be contacted to assist in determining the winter distribution of least terns. A survey of the north coast of South America should be carried out to identify those habitat types used by least terns. However, the surveys may be difficult. Accessibility of coastal areas along central America and the northern coast of South America may be problematic for geographical and political reasons. Color-banded individuals would provide the means to distinguish interior least terns from other races or populations.

    132. Census known wintering areas.
    Once winter sites are known, censuses of important areas will provide an indication of their continuing importance and status as post-breeding sites.

    133. Monitor movement of birds between wintering sites and assess mixing of populations.
    It is not known if post-breeding interior least terns mix with coastal least terns at wintering sites. Once the habitat types of interior least terns are known, habitat protection can begin. Monitoring movements of birds between different sites will provide this information, as well as indicate the degree to which individuals from various breeding populations mix during the winter.

    134. Assess mortality on wintering areas.
    The extent and cause of mortality to post-breeding interior least terns has not been addressed. It is not clear if adults and juveniles suffer differential mortality, or if post-breeding birds face greater threats than do breeding birds. Any information leading to further delineation of threats to the species during this time will be important.

2. Determine current habitat requirements and status.

Habitat alteration has been identified as one of the principal causes of the current status of the interior least tern (U. S. Fish and Wildlife Service 1985, Whitman 1988). Recovery of the species will be affected substantially by the ability to identify and protect essential breeding habitat and to intensively manage that habitat to maximize productivity and survival. Setting priorities for protection of remaining sites and determining habitat management actions will require detailed knowledge of interior least tern habitat requirements and the availability and quality of existing sites.

21. Determine breeding habitat requirements and status.

Our knowledge of interior least tern breeding habitat requirements has increased greatly during the past five years. Data on seemingly adequate but unoccupied habitat is needed. Comparison of habitat conditions among used sites along with data on reproductive success will provide the information necessary to set priorities for protection, and determine site-specific management actions to enhance breeding habitat.

211. Assess the characteristics, including prey resources, of breeding habitat.

The characteristics of breeding habitat must be investigated across the entire range of the interior least tern. At riverine sites, habitat variables to be measured should include: nesting area and height above water level, vegetative cover and distribution, substrate type, and river level fluctuations. Other variables may be of particular interest at local breeding areas. Measurements taken and methods employed at various breeding sites should be standardized to allow comparisons among areas. Few data are available on food resources at interior least tern breeding areas. Information on prey species occurrence and abundance are needed, as are estimates of the likelihood of food being a limiting habitat factor. The goals of these investigations should be identification of the range of habitat conditions tolerated by interior least terns, determination of habitat factors that affect nest densities, and elucidation of habitat conditions that may be related to maximum reproductive success rates.

212. Quantify and evaluate available breeding habitat.

As habitat assessment is undertaken, efforts to quantify existing interior least tern habitat should be initiated. The first task should be quantification of known and potential breeding habitat. As habitat quality data become available, existing sites should be evaluated with respect to habitat adequacy and deficiencies. Based on this information, recommendations for site protection or management actions should be given priorities. Remote sensing techniques such as aerial videography (Sidle and Ziewitz 1990) can be useful to quantify and, if possible, rate interior least tern breeding habitat. Sandbars are easily visible on satellite imagery of the Mississippi and Missouri Rivers. A catalog or compendium of interior least tern nesting areas should be developed.

213. Examine historic aerial photography and hydrographic surveys of river systems to determine the previous extent of potential habitat and vegetational changes.

For many rivers periodic aerial photographs and hydrographic surveys are available. It would be useful for predictive purposes to measure the change, if any, in the quantity and quality of sandbar habitat since photo and hydrographic coverage began (Hamel et al. in press, Rodekohr and Engelbrecht 1988, Sidle et al. 1989). Such an endeavor would allow an accurate forecast of habitat trends.

22. Determine current migration habitat requirements and status.

Because migration patterns of interior least terns are not understood, no information on habitat requirements or status is available. Once stop-over sites, if they exist, are determined, evaluation of habitat requirements should be undertaken.

221. Assess the characteristics, including prey resources, of migration habitat.

If stop-over sites are identified, the habitats used should be described and variables characterizing those habitats quantified. Quantification (time activity budgets) of how interior least terns use the available habitats and their length of stay at stop-over sites also should be determined.

222. Quantify and evaluate available migration habitat.

Once migratory habitats are identified and characterized, the availability of such habitats should be determined. Initially, habitat availability in the vicinity of known stop-over sites should be quantified and its quality assessed. If migratory habitat in the vicinity of current stop-over sites is limited, a large scale survey of available habitat along suspected migratory corridors should be made.

23. Determine current habitat requirements and status on wintering areas.

No data are available on interior least tern winter habitat requirements. This task should be undertaken followed by a determination of the extent to which wintering habitats are traditionally used. Information on the role of winter habitat abundance, distribution, and quality in interior least tern population dynamics is totally lacking. Data relating winter habitat conditions to population status are needed.

231. Assess the characteristics, including prey resources, of winter habitat.

As primary wintering areas are identified, characteristics of the habitats used by interior least terns must be quantified and variables affecting quality of those habitats elucidated. Winter habitats should be assessed with regard to interior least tern prey abundance and distribution, roost site needs, and location of feeding and roosting habitat. Habitat characteristics near occupied sites, but not currently used by interior least terns, also should be assessed. Quantitative data on interior least tern use of winter habitats also are needed. Information on movements among wintering areas, movements among habitats, time-activity budgets, the use of pre-migration staging areas, etc., may provide important information on habitat quality. The goal of these studies should be identification of habitat features that affect winter survival of interior least terns, assure adequate pre-breeding condition, and favor mixing among individuals from local breeding populations.

232. Quantify and evaluate winter habitat.
After baseline information on habitat characteristics and quality is available, the amount and distribution of winter habitat should be determined. Additionally, the quality of existing habitat should be rated and deficiencies identified. This effort may involve development of remote sensing techniques to identify and monitor winter habitat. Based on data generated under steps 231 and 232 the likelihood of winter habitat quantity limiting the growth of the interior least tern population should be evaluated. If winter habitat is found to be limited, further recommendations should be developed on the need for habitat protection or management of specific sites.

233. Eliminate current or potential threats to winter habitat.
As winter habitat is identified, current and potential threats to each site should be determined. Priority should be given to sites currently used by interior least terns. It is important to not only identify threats that could destroy winter habitats, but also those that could result in lowering the quality of remaining sites. Habitat ownership will have to be taken into consideration when assessing threats to the species.

3. Protect, enhance, and increase interior least tern populations.
Legal protection is often not enough to ensure perpetuation of breeding populations. Active management actions, including predator management, restricted access, and water level management are critical components of a comprehensive protection plan.

31. Protect, enhance, and increase populations during the breeding season.
To date, breeding activity of interior least terns has been more thoroughly investigated than activities at other times of the year. Current surveys have now identified most of the nesting areas in the U. S. Extensive survey work and research investigations of several major breeding areas have helped delineate many factors contributing to the species' current status, thus enabling the development of specific recommendations that may enhance the species' survival during the reproductive season.

311. Increase reproduction and survival at occupied breeding sites.
Activities that reduce interior least tern reproductive success and survival on its breeding grounds are probably among the principal factors responsible for the species' current status. Actions directed at eliminating or

minimizing such impacts are essential to the interior least tern's recovery.

3111. Evaluate predator impacts on eggs and chicks and identify species responsible for the predation.

Predation can be high in California and coastal least tern colonies (Atwood et al. 1979, Burger 1984, Massey 1981). Surveys on the Lower Mississippi River revealed that nest predation, especially by coyotes, has substantially reduced reproductive success at certain colonies. The vulnerability of terneries to such predation increases when island habitat accretes to the shoreline during periods of low water (Smith and Renken 1990). Studies conducted in the Missouri River system have documented a high percentage of interior least tern egg and chick loss to predation (Nebraska Game and Parks Commission, unpublished data, Mayer and Dryer 1990). During 1987-1989, predation accounted for most of the nest losses on the Platte River except riverine nests on the central Platte where flooding caused the mortality (Kirsch 1990, Lingle 1989). Both avian and mammalian species are among the suspected predators. Further studies that document such losses should continue. Investigations that focus specifically on identifying predators, and the cues they use in locating nests and/or chicks, determining the time of predation, etc., are necessary if egg and chick mortality are to be curtailed.

3112. Evaluate techniques for predator management and implement where appropriate.

Lethal and non-lethal methods for managing mammalian predators have been extensively developed for other wildlife management purposes. They include: eliminating or relocating the animal, erecting electric fences, and developing taste aversions. Electric fences have been used to protect nesting California and coastal least terns (Massey and Atwood 1980, 1982; Minsky 1980). The applicability of these and other techniques (e. g. predator exclusion cages) to the interior least tern should be investigated. Few management efforts have focused on managing avian predators, such as common ravens (*Corvus corax*), American crows, great horned owls (*Bubo virginianus*), great blue herons (*Ardea herodias*), California gulls (*Larus californicus*), and ring-billed gulls (*L. delawarensis*). Appropriate management measures should be implemented at interior least tern sites that are now experiencing significant and repeated loss due to predation.

3113. Restrict public use within nesting areas and investigate enforcement options.

Disturbance of California and coastal least tern colonies caused by foot traffic and recreational vehicles has been well-documented (Massey and Atwood 1979, Goodrich 1982, Burger 1984) and is also true for interior least terns (Schwalbach 1988, Kirsch 1987-90, Lingle 1989, Smith and Renken 1990). Losses incurred by these activities can be direct, by destroying eggs and chicks, as well as indirect, by inhibiting territory establishment, feeding behavior, incubation and other reproductive behavior. A variety of techniques that restrict access to nesting areas have been successful in a few states and should be implemented on a wider scale. These include posting, restricted access, and fencing (Morris 1979, 1980; Larkins 1984, Massey and Atwood 1979). Because many interior least tern nesting areas are located in remote areas, strict enforcement of regulations is often impractical. Although the site may receive substantial recreational use, budget restrictions rarely allow full-time monitoring by professional staff. It is essential, therefore, that actions to restrict recreational activities always be accompanied by an aggressive public relations effort that will effectively reach all potential visitors to an area and adequately explain the purpose of the regulations. "Tern wardens" who patrol nesting areas to explain the restrictions, should be considered for particularly important breeding areas (McCulloch 1982). The U. S. Army Corps of Engineers, U. S. Fish and Wildlife Service, and state wildlife agencies could become involved in public relations efforts and patrols to protect interior least tern nesting areas on the river systems. Agents of the Missouri Department of Conservation maintain an active enforcement program at Mississippi River terneries. Similar state and federal enforcement endeavors have begun on the Missouri River in North and South Dakota, and Nebraska, and on the Platte River in Nebraska. Field research on interior least terns should be carefully examined for its effects on the reproductive success of the birds (Brubeck et al. 1981). Research proposals should be scrutinized for their benefit to interior least tern recovery.

3114. Manage water levels and river flows to reduce nest and chick loss.

A significant proportion of the interior least tern population resides along rivers where much habitat has been destroyed by reservoir construction, channelization, water depletion, vegetative encroachment, and modification of flow regimes (Currier et al. 1985, Nebraska Game and Parks Commission 1985b, Schwalbach et al. 1986, 1988, Eschner et al. 1981, Smith and Stucky 1988, Sidle et al. 1989). This riverine habitat is subject to a number of additional threats, including untimely water releases from dams that flood sandbar nesting habitat (Dryer and Dryer 1985, Schwalbach et al. 1986, 1988; Schwalbach 1988, G. R. Lingle, personal communication). Managing water levels early in the spring along some rivers could help to resolve this problem. Nesting habitat, expected to be flooded late in the season, could be submerged when interior least terns begin establishing territories in early May, forcing them to seek higher grounds that would be safe throughout the nesting season. It is essential, however, that sufficient nesting habitat is available above the fluctuation zone. High waters in spring also helps keep sandbars devoid of vegetation by reducing sprouting of young herbaceous growth and by increasing deposition of coarse sediments (Currier et al. 1985, O'Brien and Currier 1987).

Annual flow regimes need to be developed for many river segments where interior least terns occur. For example, along the central Platte River the Service has developed flow recommendations to support a variety of wildlife including least tern nesting habitat and the bird's forage fish (Table 8). These recommendations have been accepted by the Federal Energy Regulatory Commission as part of the annual relicensing of upstream water projects in Nebraska (Sidle et al. 1990). The water releases will occur on the North Platte River, far upstream of interior least tern nesting habitat. The Ohio River has a major effect on the availability of interior least tern habitat in the lower Mississippi River. Management of this river and other rivers throughout the bird's range need to be examined for their effect on the interior least tern and its habitat.

3115. <u>Modify or eliminate construction activities that adversely impact reproductive success of interior least terns.</u>

Recreational and residential development along river fronts should be discouraged in nesting areas. Proposals for maintenance or development activities that do not directly disturb breeding habitat but that occur in the vicinity of nest sites should be closely scrutinized for their potential impact.

3116. <u>Investigate the effects of environmental contaminants during the breeding season.</u>

Contaminant effects on interior least terns are unknown. It would be useful to at least collect addled eggs during surveys and field studies for later contaminant analysis.

32. Protect and enhance populations during migration and winter.

Each year, 30 percent or less of the interior least tern's time is spent on the breeding grounds. A comprehensive protection plan also should focus on the species survival during migration and winter. However, migration and winter are the most poorly understood stages of the bird's life cycle and little can be recommended until migratory patterns are determined. The delineation of key areas where interior least terns spend non-breeding months is a critical step to enable the protection measures necessary for the birds' survival year-round.

321. Manage areas to maximize survival during migration.

Nothing is currently known about either the extent or causes of mortality that interior least terns might encounter during migration. Work that focuses on delineating migration routes (Step 12) should be expanded to focus on causes of mortality as well. When appropriate, measures should then be taken to lessen the impact upon the species.

322. Manage winter areas to maximize survival during winter.

During winter, interior least terns probably use open habitats. Sand, gravel, and/or cobbled marine beaches may be selected, as well as intertidal beach bars and flats.

3221. Investigate effects of human activities on winter survival.

Recreational, residential, and industrial developments each pose a potential threat to interior least terns by increasing the level of human activity. Moreover, hunting of terns in Latin America may be a factor. To date, research studies have focused primarily on describing the impacts of human activities on nesting grounds. Future efforts also should be directed at collecting similar data from wintering areas, once such areas are discovered.

3222. Investigate the effects of environmental contaminants in wintering areas.

During surveys for interior least tern wintering areas, attention should be paid to coastal pollution. Chemical use and its impacts on foreign wintering areas should be evaluated.

4. Preserve and enhance habitat.

Because of major habitat losses and increasing demands on available habitat, protecting and enhancing existing and potential interior least tern habitat is a major concern. Important breeding areas have been identified but enhancement and protection of essential habitat has been limited. Little is known about those areas along the migration route or on the wintering grounds.

41. Provide protection and management of breeding habitat.

Essential breeding habitat (Appendix 4) will need delineation, protection, and enhancement to provide for recovery of the species. Efforts should include increased management activities to provide better use and protection of existing and potential areas. Compatibility of other uses (e.g., recreation) for breeding areas should be defined. All essential habitat needs permanent protection, where possible, through appropriate fee title acquisition, permanent easement, cooperative agreements, and memorandums of agreement or understanding among federal agencies and private organizations (Appendix 2).

411. Identify areas of essential breeding habitat.

Essential Habitat is listed in Appendix 4 to highlight known areas to be protected.

412. Continue to evaluate areas for consideration as essential breeding habitat.

Recognizing the fragile nature of much of the interior least tern's breeding habitat, continued evaluation and designation of essential habitat in primary breeding areas will protect areas from detrimental development.

413. Establish liaison with agencies and organizations with land and water management responsibilities.

Due to increasing pressure for development and use of land and water resources to meet human needs, efforts should be made to communicate with agencies, organizations, and individuals whose decisions affect the future of interior least tern habitat. The purpose would be to resolve conflicts between known development actions and future conflicts through planning of land and water development.

414. Revise, establish, or utilize land and water laws and regulations to provide protection along rivers and lakes.

Increasing demands for agricultural land and urban development, wetland drainage, power generation, water for irrigation, recreational space, and operation of river reservoirs have threatened or destroyed interior least tern habitat. Enforcement of laws and regulations, particularly those involving instream flow protection, 404 permits, and endangered or threatened species habitat protection, is needed to restrict or modify such developments on the remaining essential interior least tern habitat. All land- and water-use legislation should be scrutinized for potential impact to interior least tern habitat. Undesirable legislation should be modified and laws enacted that will expand the consideration given wildlife during water and land development planning.

415. Develop criteria and priorities for breeding habitat protection.

To provide adequate protection, some habitat will have to be purchased in fee title, or placed under a protective easement or cooperative landowner agreement. Although permanent protection of essential areas usually will be preferred, in some instances, temporary protection of ephemeral nesting areas may be achieved through agreements with private parties and public authorities. Protection of areas listed as essential habitat (Appendix 4) is based upon tradition of occupancy, number of birds present, site productivity, proximity to other protected sites, imminence of habitat destruction, and ephemeral nature of the site.

416. Develop management plans for riverine breeding habitat. Techniques may vary from site to site depending on need and opportunity, but plans should be developed for management of essential riverine habitat (see Step 2).

4161. Determine direct, indirect, and cumulative effects of manipulation of river hydraulics, flow regimes, and sediment discharge on breeding and foraging habitat. Manipulation of river flow regimes and river hydraulics through water diversion, storage of flows by dams, discharge from dams for power generation, navigation and irrigation demands, bank stabilization, and channelization has significantly altered the natural dynamic processes responsible for loss and creation of sandbars used for nesting (Nunnally and Beverly 1986, Sandheinrich and Atchison 1986, Smith and Stucky 1988). As a result, breeding habitat could be lost at a higher rate than what is being created. Modifications of river flow regimes through operation of reservoirs and lock and dams also has caused concern for long-term effects of riverbed degradation on interior least tern habitat. Although many direct effects of human manipulations have been identified, suspected indirect and cumulative impacts of ongoing and future river developments need to be determined. Under Section 7 of the Endangered Species Act the U. S. Fish and Wildlife Service and the U. S. Army Corps of Engineers have consulted on the effects of proposed dams in the Platte River system, and are consulting on the effects of main stem dam operations on interior least terns along the Arkansas and Missouri Rivers (U. S. Fish and Wildlife Service 1987b, 1987c, 1989, 1990). Section 7 consultation provides an opportunity to protect much of the interior least tern's breeding habitat.

4162. Identify river flow regimes that will protect and enhance breeding and foraging habitat. Control of river flows is desirable to prevent inundation of nests and young (Nebraska Game and Parks Commission 1985c), discourage growth of woody vegetation, and to maintain a river with a nutrient base necessary for production of fish used as food by interior least terns. Proper instream flow is a major goal of ongoing Section 7 consultations regarding the interior least tern.

4163. Determine the relationship of existing artificial breeding sites to river sites.

California and coastal least terns readily use man-made habitats. Islands, spoil piles, and beaches formed by dredged sand and gravel, and located immediately adjacent to the Platte River in Nebraska and elsewhere are used by interior least terns. A large percentage of the Platte River breeding population of interior least terns nests at sand and gravel pits. Dike fields are commonly used along the Mississippi River (Hamel et al. in press, Landin et al. 1985, Rumancik 1987, Smith and Renken 1990). Terns may use barges filled with sand on river segments now devoid of sandbar habitat. The importance of artificial habitat to recovery of the species, and to what extent such habitat can replace lost natural sandbars, should be determined.

4164. Identify need and techniques of improving habitat by management of substrate and by vegetation control through physical and/or non-toxic chemical means.
Existing woody vegetation may have to be removed from sandbars to provide suitable nesting habitat through physical or chemical means. Annual control may be necessary. Dredging and spreading sand or gravel of particular particle size could improve substrates for nesting and increase the height of sandbars to prevent continuous inundation. Currently, the U. S. Army Corps of Engineers and the Platte River Whooping Crane Habitat Maintenance Trust have been clearing islands on the Missouri and Platte Rivers, respectively.

4165. Study feasibility and determine need for creating new habitat and implement trials to determine success rates of creating new habitat.
A variety of techniques have been used to create artificial nesting sites for the California and coastal least terns and to attract terns to the sites (Massey 1981, Fancher 1984, Kotliar and Burger 1984). Creation of artificial habitat may be necessary in areas where manageable habitat is non-existent. This may be particularly important in areas where natural habitat has been lost to channelization and water diversion. For example, most of the lower Missouri River (Iowa, Kansas, Missouri, and Nebraska) is now a channel and artificially created sites (e.g., ash disposal sites at power stations in Iowa) (Wilson 1984, 1986; Dinsmore and Dinsmore 1989) are the only habitat available. As part of the annual relicensing effort for upstream water projects along the Platte River in Nebraska, restored least tern nesting habitat has been ordered by the Federal Energy Regulatory Commission for each bridge segment in the central Platte (Sidle et al. 1990). Additional restoration

will be needed elsewhere along the Platte River. Habitat on the Cimarron River appears to be progressively deteriorating from upstream to downstream as the channel narrows and woody vegetation encroaches. Vegetation control likely will be necessary to maintain essential habitat. Likewise, habitat restoration will be necessary if least terns are to recover in the Iowa and Missouri reaches of the Missouri River. In the Mississippi River, the Missouri Department of Conservation and the U. S. Army Corps of Engineers have developed a cooperative proposal to construct two artificial islands between St. Louis and Cape Girardeau, Missouri. Smith and Stucky (1988) discussed other recommendations, including modification of dike structures.

4166. Develop lake and reservoir control policies where existing and potential habitat is threatened.
Water levels affect interior least tern reproductive success by increasing or decreasing the amount of habitat available on the shoreline of reservoirs (e. g., Lakes Oahe and Sakakawea in the Dakotas, and Salt Plains National Wildlife Refuge, Oklahoma) and in dike fields. Changes in these levels during critical periods may delay initiation of nesting, flood nest sites or feeding areas, or increase the distance from nest sites to the water's edge. Lakes and reservoirs with interior least tern habitat must be identified and any policies controlling water levels need to be scrutinized to determine the effect on interior least tern reproductive success.

4167. Identify needs and techniques for managing water levels.
Lakes and reservoirs currently supporting nesting interior least terns or that provide suitable nesting habitat should be evaluated to determine if water level management is feasible. Where feasible, techniques should be developed to manage water levels to improve reproductive success.

418. Evaluate success of protection and management techniques.
Monitoring must be sufficient to detect and measure the positive effects of protection and management and to avoid potentially detrimental impacts on interior least tern habitat. Daily and seasonal activity patterns of interior least terns, along with locations of specific nesting areas, will provide key measures of the birds' response to various management practices. Monitoring vegetation to determine where changing habitat conditions exist and monitoring potential predator levels in the area should be considered. All techniques used to improve interior least tern habitat should be evaluated to determine their cost-efficiency.

42. Provide protection and management of migration habitat.

If migration sites are identified, their protection and enhancement will be essential. At that point, assessment of further needs of migrating interior least terns will be carried out. As stop-over habitats are identified, current and potential threats to those sites should be delineated. On publicly-owned sites, current land-use patterns or management actions that could conflict with interior least tern use of existing habitats should be identified. Feasibility of protecting major privately-owned stop-over sites should be assessed.

43. Provide protection and management of winter habitat.

Survival and continued existence of the species may depend on availability of suitable winter habitat. Furthermore, reproductive success of adults may partially be a function of their physical condition as they begin spring migration. Consequently, the quality and quantity of winter habitat may limit recovery of the species.

431. Identify areas of essential winter habitat.

Essential winter habitat first needs to be identified by surveys in Latin America.

432. Develop criteria and priorities for winter habitat protection.

Once further research is carried out in wintering areas, factors will be identified as being essential for winter habitat. At that point, a land protection strategy should be developed. Areas that support the greatest number of interior least terns, especially those supporting individuals from important sub-populations should be given priorities in a habitat management/protection plan.

433. Develop management techniques.

Once actual and/or potential interior least tern wintering habitat is identified, methods of managing those habitats should be developed and improved so that wintering habitat is of sufficient quantity and quality to accommodate and promote expansion of interior least tern populations to more stable levels.

5. Develop and implement an education program that publicizes information about the interior least tern, including its life history, reasons for current status and options for recovery.

Conservation of coastal least terns has benefitted greatly from public information endeavors (Jackson and Jackson 1985, Toups 1976). The interior least tern's successful recovery will depend on curtailing and/or redirecting human recreation and development activities. Therefore, resource managers and the general public should be provided with sufficient information to explain and justify changes in previous actions. Current efforts to develop a public information program have made an impressive start in this direction but must be intensified. These efforts also could benefit from better coordination at the national level to target specific audiences.

51. Inform and educate the public on the bird's plight and recovery efforts.

The first priority in developing a public information program should be to educate the general public about the significance and value of the interior least tern. The public's support and cooperation ultimately will be essential to the species full recovery.

511. Identify target audiences among the general public.

Materials prepared to increase public awareness and appreciation of the interior least tern can be more effective if they are developed to meet specific interests and concerns of a particular audience. Time should be spent delineating which public groups are affected, either directly or indirectly, by interior least tern conservation efforts and how each audience can best be reached.

512. Develop and distribute educational materials appropriate for various audiences.

Current efforts should be expanded to make greater use of the various media, including newspapers, radio, and television. The primary focus of this task should be to provide background information describing the interior least tern's life history and habitat requirements and to describe how human activity/disturbance can threaten the survival of interior least terns. The public should also be made aware of the necessity to enact local regulations to protect the interior least tern. However, information materials should not increase the potential for observer disturbance to nesting birds. The Service's Tulsa office has produced an information brochure useful throughout the range of the interior least tern.

513. Develop materials for newspapers, radio, and television, that highlight specific interior least tern projects.

In several states, cooperative projects between state and federal agencies, as well as private organizations and individuals are underway to protect interior least terns. Such efforts which generate public support should be applauded and widely publicized, particularly at the local level.

514. Provide controlled viewing opportunities if and when appropriate.

Guided opportunities for observing interior least terns may be one of the best vehicles for generating public support and concern. Led by a qualified biologist under conditions that minimize or prevent disturbance to the birds, such trips can educate visitors first-hand about the need for strong protection and curtailment of some recreational activities.

52. Inform and educate public resource management agencies.

Some interior least terns occur on lands that are protected and/or managed by state and federal resource agencies. Recreation permitted on these areas (e.g., hiking, vehicle use, camping) can reduce the bird's reproductive success. In some areas an agency's own activities may also pose a threat (e.g., control of water levels in lakes and along rivers). Contact with these agencies will facilitate better management of the areas for interior least terns.

521. Identify critical resource agency constituents.
Each resource agency (including state, federal, and private organizations) whose activities can impact the interior least tern should be identified.

522. Develop educational materials appropriate to respective agencies and their management authority.
Resource managers need to be provided with basic life history information about the interior least tern as well as specific management information and recommendations directly pertinent to their area of responsibility.

523. Provide public resource agencies with periodic updates on the interior least tern's status and progress of recovery efforts.
It is important that each public agency responsible for ensuring the interior least tern's survival, either directly or indirectly, be kept abreast of the success of their efforts at both the local and national level. Periodic updates not only inform them of progress being made, but also remind them of their responsibilities to the conservation of interior least terns.

6. Coordinate recovery efforts.
Development of a recovery plan for interior least terns involves coordination of biologists, agencies, and governments so that the most comprehensive, up-to-date information is collected and disseminated in an efficient way. Proper coordination would also help ensure rapid implementation of those actions necessary for full recovery.

61. Designate a recovery plan coordinator.
Designation of a coordinator is recommended. Duties of the coordinator would include: a) coordination of the implementation of the recovery plan; b) naming an individual in each state to coordinate and implement recovery tasks; c) monitoring execution of the plan's implementation schedule; d) maintaining collaboration with state, federal, and international agencies; disseminating critical annual data; and coordinating range-wide research activities for interior least terns. A least tern contact person should also be designated for each state.

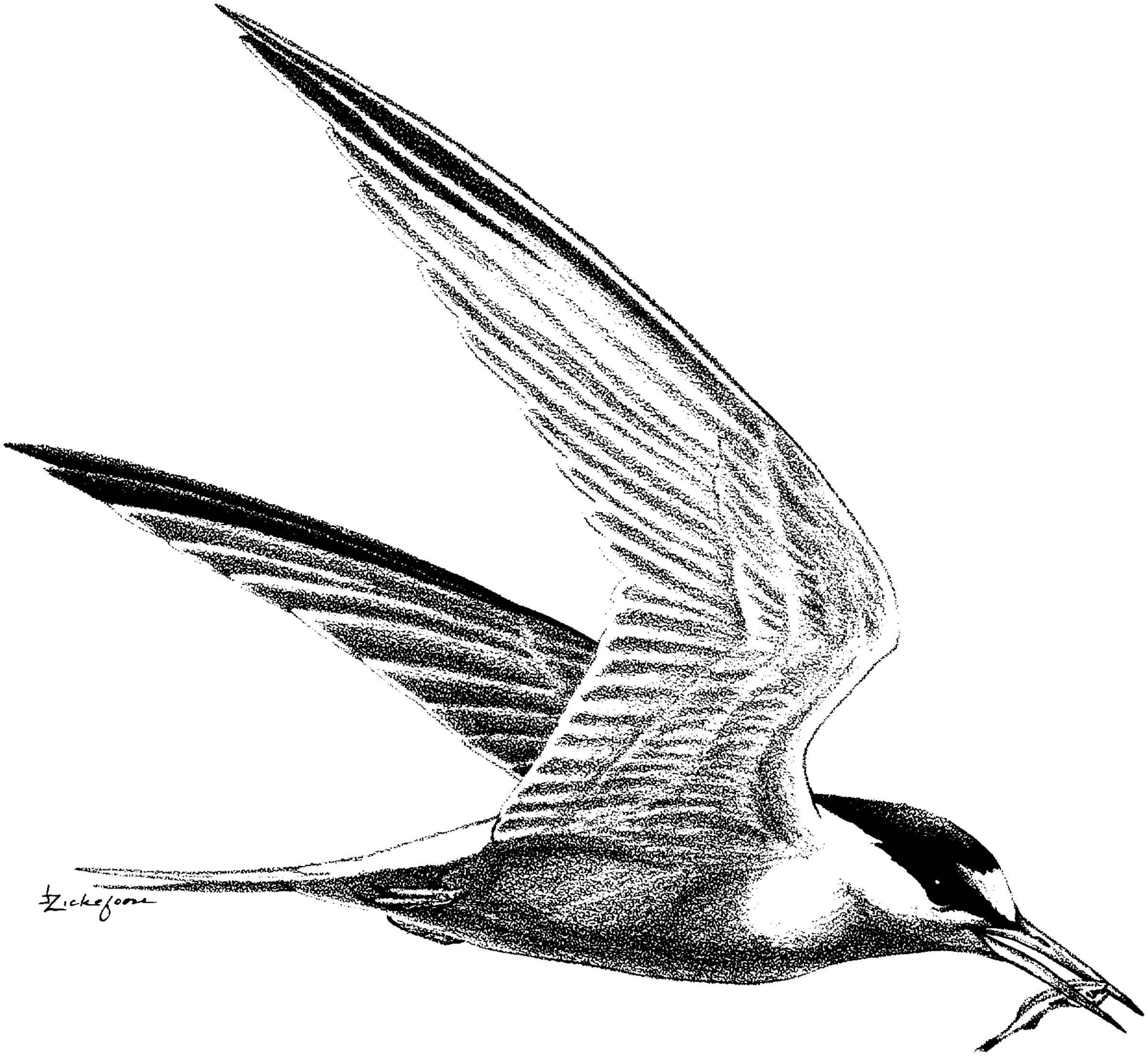
611. Coordinate research and management activities with federal, state, local, and private organizations.
Efficient achievement of recovery goals will be enhanced through coordination of research and management with private and governmental agencies. For example, it would be useful to establish and coordinate an international banding scheme whereby birds can be easily identified throughout the annual cycle. The recovery plan outlines many facets of interior least tern conservation that require urgent investigation. Repetition of efforts due to lack of coordination will slow the recovery process and may cause undue disturbance to the birds.

612. Coordinate international research and management activities.
Development of population management plans on an

international scale may be necessary. Interior least terns probably winter in Latin America and coordination with various nations and international conservation organizations may be necessary.

613. Coordinate development of a public information program at the national and international level.

Information and educational materials developed in one river system could be of equal benefit in other river systems. Some materials also may be helpful to states that support wintering populations. Coordination at the federal level will reduce duplication of effort and encourage more efficient use of time and money at the state level. A coordinated approach to raising an awareness of the interior least tern's plight at the international level would ensure protection throughout its range.



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III. IMPLEMENTATION

The Implementation Schedule outlines and gives priorities to tasks deemed necessary to be undertaken in the next three years to maximize recovery of the interior least tern. This process will be reviewed every three years until the recovery objective is met. Therefore, priorities and tasks may change in the future.

KEY TO IMPLEMENTATION SCHEDULE
General Category (Column 1):

Information and Research (I,R)

1. Population status
2. Habitat status
3. Habitat requirements
4. Management techniques
5. Taxonomy
6. Demographic studies
7. Propagation
8. Migration
9. Wintering
10. Predation
11. Competition
12. Disease
13. Environmental contaminant
14. Reintroduction
15. Other information

Acquisition - A

1. Lease
2. Easement
3. Management agreement
4. Exchange
5. Withdrawal
6. Fee title
7. Other

Management - M

1. Propagation
2. Reintroduction
3. Habitat maintenance and manipulation
4. Predator and competitor control
5. Depredation control
6. Desease control
7. Pollution control
8. Public information
9. Other information

Priority (column 4) :

1. Those actions absolutely necessary to prevent extinction of the species in the foreseeable future.

2. Those actions necessary to maintain the species' current population status.

3. All other actions necessary to provide for full recovery of the species.

Agency Responsibility (column 6):

USFWS Regional Office 2 - Albuquerque
3 - Twin Cities
4 - Atlanta
6 - Denver
USFWS Research = 8
USFWS Office of Migratory Bird Management = OMBM
USFWS Office of International Affairs = IA
SA = State Wildlife Agency
BR = Bureau of Reclamation
COE = U. S. Army Corps of Engineers
NPS = National Park Service
WCHT = Platte River Whooping Crane Habitat Maintenance Trust
CW = Colonial Waterbirds

MO = Missouri River System
MS = Mississippi River System
AR = Arkansas River System
RE = Red River System
RG = Rio Grande River System

IMPLEMENTATION SCHEDULE

Complete Implementation Schedule for First Three Years of Recovery Effort

General Category	Task	Task #	Priority #	Task Duration	Responsibility		Fiscal Year Costs		
					Region (USFWS)	Other Agencies	1	2	3
I1	Survey, census and monitor breeding populations	111-114	2 (MO)	Annual	Regions 3,6	SA, COE	$15K	$15K	$15K
			2 (MS)	Annual	Regions 3,4	SA, COE	$15K	$15K	$15K
			2 (AR)	Annual	Regions 2,4	SA, COE	$20K	$20K	$20K
			2 (RE)	Annual	Regions 2,4	SA, COE	$ 5K	$ 5K	$ 5K
			2 (RG)	Annual	Region 2	SA	$10K	$10K	$10K
I6, R6	Assess mortality and identify life history parameters (including population modeling)	116-117	3 (MO)	Annual	Regions 3,6	SA, WCHT	$10K	$10K	$10K
			3 (MS)	Annual	Regions 3,4	SA, COE	$10K	$10K	$10K
			3 (AR)	Annual	Regions 2,4,6	SA, COE	$10K	$10K	$10K
			3 (RE)	Annual	Region 2,4	SA, COE	$10K	$10K	$10K
			3 (RG)	Annual	Region 2	SA	$10K	$10K	$10K
R9, R1 R6	Survey and census winter populations	131-132	2	Annual	8,OMBM,IA	CW	$35K	$35K	$15K
I2, R3	Quantify and evaluate breeding habitat and threats	211-213	2 (MO)	2 years	Regions 3,6	SA, BR, WCHT	$15K	$10K	$10K
			2 (MS)	2 years	Regions 3,4	SA, COE	$15K	$15K	$15K
			2 (AR)	2 years	Regions 2,4,6	SA, COE	$15K	$15K	$15K
			2 (RE)	2 years	Regions 2,4	SA, COE	$ 5K	$ 5K	$ 5K
			2 (RG)	2 years	Region 2	SA	$10K	$10K	$10K
M4, R10	Evaluate predator impacts; evaluate predator management techniques and implement	3111-3112	2 (MO)	Annual	Regions 3,6	SA, WCHT	$15K	$15K	$10K
			2 (MS)	Annual	Regions 3,4	SA, COE	$10K	$10K	$10K
			2 (AR)	Annual	Regions 2,4,6	SA, COE	$15K	$15K	$15K
			2 (RE)	Annual	Regions 2,4	SA	$ 5K	$ 5K	$ 5K
			2 (RG)	Annual	Region 2	SA	$ 5K	$ 5K	$ 5K

IMPLEMENTATION SCHEDULE

Complete Implementation Schedule for First Three Years of Recovery Effort

General Category	Task	Task #	Priority #	Task Duration	Responsibility		Fiscal Year Costs		
					Region (USFWS)	Other Agencies	1	2	3
M8, M9	Restrict human and vehicular access to nesting areas	3113	2 (MO)	Annual	Regions 3,6	SA, COE	$15K	$15K	$15K
			2 (MS)	Annual	Regions 3,4	SA	$10K	$10K	$10K
			2 (AR)	Annual	Regions 2,4,6	SA, COE	$15K	$15K	$15K
			2 (RE)	Annual	Regions 2,4	SA	$ 5K	$ 5K	$ 5K
			2 (RG)	Annual	Region 2	SA	$ 5K	$ 5K	$ 5K
M3, M9	Manage water levels to reduce nest and chick loss	3114	1 (MO)	Annual	Regions 3,6	COE	$20K	$20K	$20K
			1 (MS)	Annual	Regions 3,4	COE	$15K	$15K	$15K
			1 (AR)	Annual	Regions 2,4,6	COE, BR	$10K	$10K	$10K
			1 (RE)	Annual	Regions 2,4	COE	$ 5K	$ 5K	$ 5K
			1 (RG)	Annual	Region 2	COE	$ 5K	$ 5K	$ 5K
I2	Identify essential breeding habitat	411-412	2 (MO)	Ongoing	Regions 3,6	SA			
			2 (MS)	Ongoing	Regions 3,4	SA			
			2 (AR)	Ongoing	Regions 2,4,6	SA			
			2 (RE)	Annual	Regions 2,4	SA			
			2 (RG)	Annual	Region 2	SA			
M3	Establish liaison to protect breeding habitat	413	3 (MO)	Annual	Regions 3,6	SA, COE, BR			
			3 (MS)	Annual	Regions 3,4	SA, COE			
			3 (AR)	Annual	Regions 2,4,6	SA, COE, BR			
			3 (RE)	Annual	Regions 2,4	SA, COE			
			3 (RG)	Annual	Region 2	SA			
M9	Revise or establish laws to protect breeding habitat	414	3 (MO)	Annual	Regions 3,6	SA			
			3 (MS)	Annual	Regions 3,4	SA			
			3 (AR)	Annual	Regions 2,4,6	SA			
			3 (RE)	Annual	Regions 2,4	SA			
			3 (RG)	Annual	Region 2	SA			

IMPLEMENTATION SCHEDULE

Complete Implementation Schedule for First Three Years of Recovery Effort

General Category	Task	Task #	Priority #	Task Duration	Responsibility		Fiscal Year Costs		
					Region (USFWS)	Other Agencies	1	2	3
R2, R3	Develop criteria and priorities for habitat protection	415	3 (MO)	1 year	Regions 3,6	SA			
			3 (MS)	1 year	Regions 3,4	SA			
			3 (AR)	1 year	Regions 2,4,6	SA			
			3 (RE)	1 year	Regions 2,4	SA			
			3 (RG)	1 year	Region 2	SA			
R3, M3	Develop river management plans	416	1 (MO)	Annual	Region 6	SA, COE, WCHT	$15K	$15K	$15K
			1 (MS)	Annual	Region 4	SA, COE	$10K	$10K	$10K
			1 (AR)	Annual	Regions 2,4,6	SA, COE, BR	$10K	$10K	$10K
			1 (RE)	Annual	Regions 2,4	SA, COE	$ 5K	$ 5K	$ 5K
			1 (RG)	Annual	Region 2	SA, COE, BR	$ 5K	$ 5K	$ 5K
R1, R2	Determine effects of river hydraulics and sediment discharge on breeding habitat; identify flow regimes to protect habitat	4161-4162	1 (MO)	Annual	Region 6	SA, COE, BR WCHT	$25K	$25K	$25K
			1 (MS)	Annual	Region 4	SA, COE	$20K	$20K	$20K
			1 (AR)	Annual	Region 2,6	SA, COE, BR	$20K	$20K	$20K
			1 (RE)	Annual	Region 2	SA, COE	$10K	$10K	$10K
			1 (RG)	Annual	Region 2	SA, COE	$10K	$10K	$10K
R3	Determine relationship of existing artificial breeding sites to riverine sites	4163	2 (MO)	2 years	Region 6	SA	$10K	$10K	$10K
			2 (MS)	3 years	Region 4	SA, COE	$10K	$10K	$10K
			2 (AR)	2 years	Regions 2,6	SA	$10K	$10K	$10K
			2 (RE)	2 years	Region 2	SA	$ 5K	$ 5K	$ 5K
			2 (RG)	2 years	Region 2	SA	$ 5K	$ 5K	$ 5K
M3	Modify and/or eliminate construction activities that impact breeding habitat	418	2 (MO)	Annual	Regions 3,6	SA, COE	$ 5K	$ 5K	$ 5K
			2 (MS)	Annual	Regions 3,4	SA, COE	$ 5K	$ 5K	$ 5K
			2 (AR)	Annual	Regions 2,4,6	SA, COE	$ 5K	$ 5K	$ 5K
			2 (RE)	Annual	Regions 2,4	SA, COE	$ 5K	$ 5K	$ 5K
			2 (RG)	Annual	Region 2	SA, COE	$ 5K	$ 5K	$ 5K

IMPLEMENTATION SCHEDULE

Complete Implementation Schedule for First Three Years of Recovery Effort

General Category	Task	Task #	Priority #	Task Duration	Responsibility		Fiscal Year Costs		
					Region (USFWS)	Other Agencies	1	2	3
M8	Inform and educate the public	511-513	2 (MO)	Annual	Regions 3,6	SA, COE	$ 5K	$ 5K	$ 5K
			2 (MS)	Annual	Regions 3,4	SA, COE	$ 5K	$ 5K	$ 5K
			2 (AR)	Annual	Regions 2,4,6	SA, COE, BR	$ 5K	$ 5K	$ 5K
			2 (RE)	Annual	Regions 2,4	SA, COE	$ 5K	$ 5K	$ 5K
			2 (RG)	Annual	Region 2	SA, COE	$ 5K	$ 5K	$ 5K
M8, M9	Inform and educate public resource management agencies	52	3 (MO)	Annual	Regions 3,6	SA, COE			
			3 (MS)	Annual	Regions 3,4	SA, COE			
			3 (AR)	Annual	Regions 2,4,6	SA, COE			
			3 (RE)	Annual	Region 2	SA, COE			
			3 (RG)	Annual	Region 2	SA, COE			
M9	Coordinate recovery efforts	61	2	Annual	Regions 2,4,6	SA, COE			

APPENDIX 1

Contact People

The following individuals have offered to provide interested parties with information pertaining to interior least terns in their area.

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APPENDIX 2

Agreements Necessary For Protection Of Essential Habitat

1. Memorandum of Understanding should be developed between the U. S. Army Corps of Engineers, National Park Service, U. S. Fish and Wildlife Service, and the State wildlife agency, for permanent protection and management (vegetation clearing, law enforcement, public relations, etc.) of all essential habitat on the Missouri River in North Dakota, South Dakota, and Nebraska.

2. U. S. Fish and Wildlife Service, National Park Service, and U. S. Army Corps of Engineers should acquire easements and/or fee title of essential interior least tern habitat on the Missouri River in North Dakota, South Dakota, and Nebraska.

3. Memorandum of Understanding should be developed between the U. S. Army Corps of Engineers, U. S. Bureau of Reclamation, U. S. Fish and Wildlife Service, Platte River Whooping Crane Habitat Maintenance Trust, and the state wildlife agency, for the permanent protection and management of all essential habitat on the Platte River system in Nebraska.

4. The U. S. Fish and Wildlife Service should provide land protection of essential interior least tern habitat on the Platte River system.

5. Memorandum of Understanding should be developed between the U. S. Army Corps of Engineers, State natural resource agency, and the U. S. Fish and Wildlife Service for the permanent protection and management of essential habitat on the Mississippi and Ohio Rivers.

6. Memorandum of Understanding should be developed between the U. S. Fish and Wildlife Service, State wildlife agency, and the U. S. Army Corps of Engineers governing the deposition of dredge spoils on the Mississippi and Ohio Rivers for purposes of enhancing or creating interior least tern habitat.

7. Memorandum of Understanding should be developed between the U.S. Army Corps of Engineers, U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, U. S. Section of the International Boundary and Water Commission, State wildlife agencies, and appropriate agencies in Mexico for permanent protection and management of all essential habitat in the Arkansas, Red, and Rio Grande Rivers basins in Kansas, Oklahoma, Arkansas, and Texas.

8. U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, U.S. Bureau of Reclamation, and The Nature Conservancy should acquire easements and/or fee title of essential interior least tern habitat in the Arkansas, Red, and Rio Grande river basins in Kansas, Oklahoma, Arkansas, and Texas.

9. Memorandum of Understanding should be developed between the U.S. Fish and Wildlife Service, State wildlife agencies, and the U.S. Army Corps of Engineers governing removal and deposition of dredge spoil from the McClellan-Kerr Arkansas River Navigation System, in Oklahoma and Arkansas, for purposes of enhancing or creating least tern habitat.

Appendix 3. Example of a memorandum of understanding

MEMORANDUM OF UNDERSTANDING

The Nature Conservancy
U.S. Army Corps of Engineers
Oklahoma Department of Wildlife Conservation
U.S. Fish and Wildlife Service
Tulsa Audubon Society
River Parks Authority

WHEREAS ____________________, an Oklahoma corporation, ("Owner") has acquired certain lands and riverbeds on the Arkansas River floodplain in Tulsa County, Oklahoma, as more particularly shown on the plat attached hereto as Exhibit A (the "Property"); and

WHEREAS said Property has special value for wildlife including nesting populations of the endangered Interior Least Tern, Stern antillarum athalassos; and

WHEREAS The Nature Conservancy ("Conservancy"), a private, nonprofit organization committed to the conservation and management of rare and endangered species, communities, and ecosystems, has expressed an interest to coordinate the efforts of local, state, and federal agencies in protecting the Least Tern; and

WHEREAS The United States Army Corps of Engineers ("Corps") has certain water management responsibilities on the Arkansas River that might affect the habitat of the Least Tern; and

WHEREAS the U.S. Fish and Wildlife Service ("USFWS") has federal management responsibilities over federally-listed endangered species such as the Least Tern, and the Oklahoma Department of Wildlife Conservation ("ODWC") has state management responsibilities over state-listed endangered species such as the Least Tern; and

WHEREAS the Tulsa Audubon Society ("TAS"), a private, nonprofit organization, has expertise in the preservation of birds such as the Least Tern; and

WHEREAS the River Parks Authority ("RPA") is a public trust charged with the responsibility of protecting and enhancing interalia, natural communities and species along the Arkansas River and its environment in Tulsa County, Oklahoma.

WHEREAS the Owner, ODWC, USFWS, Conservancy, TAS, the Corps and RPA all have an interest in protecting nesting populations of the rare and endangered Interior Least Tern on the Arkansas River; and

WHEREAS The Owner is agreeable to manage jointly these lands to protect the Least Tern.

NOW THEREFORE, the Owner hereby grants to The River Parks Authority, an exclusive license and permit, consisting of the following rights for the purposes described, in and to the lands described in Exhibit A attached hereto and made a part hereof, to-wit:

RIGHTS GRANTED TO THE RIVER PARKS AUTHORITY

1. The River Parks Authority shall have the right to enter upon and use said lands for the purpose of protecting all Least Tern nesting, fledging, feeding, resting and cover sites, located on said property. Said purposes shall include but not be limited to inspection, monitoring, research and, if deemed necessary, manipulation of the sites to enhance the Least Tern population. The River Parks Authority, upon consultation with the USFWS, may authorize personnel from the Corps, USFWS, ODWC, TAS, the Conservancy and others to enter said lands for the purposes described herein. Such consultation is necessary to alleviate potential for violations of the Endangered Species Act.

2. The River Parks Authority shall have the right to control and limit access to Least Tern nesting sites in breeding season, as necessary, and to erect and place any signs, posters, or other devices to identify the land as a protected area.

SAID RIGHTS ARE SUBJECT TO THE FOLLOWING LIMITATION, HOWEVER:

1. No one will construct facilities on said premises nor modify the land surface or habitat thereon until a proposal thereof has been reviewed and approved by USFWS and Owner.

2. All existing RPA regulations (e.g., no vehicle, dogs on leash, curfew clauses) will apply.

OBLIGATIONS OF RIVER PARKS AUTHORITY

AS PARTIAL CONSIDERATION for the rights hereby granted by the Owner, RPA agrees to:

Solicit expert advice regarding the protection, management and enhancement of the Least Tern population on the lands from the agencies and organizations that are party to this agreement and from other sources available to it, and shall exercise its best efforts to implement said recommendations consistent with the terms of this agreement.

OBLIGATIONS OF THE OWNER

THE OWNER agrees that:

1. In its planning and use of said lands, it shall, whenever practicable, take into consideration protection of said preserve area for endangered bird species.

2. It shall exercise its best efforts to implement recommendations of the River Parks Authority.

GENERAL PROVISIONS

1. Neither Owner nor any other party to this agreement is required to

obligate or spend funds under this agreement, it being the intent of the parties that staff time and expertise be the primary contribution of each party to the effective implementation of this Agreement.

2. This permit may be terminated, in whole or in part, by the Owner or by the River Parks Authority upon 90 days written notice to the other party.

3. All notices required under this agreement shall be effective when mailed to the following persons:

To Owner:	To River Parks Authority:
________________	Jackie Bubenik, Executive Director River Parks Authority 707 South Houston, Suite 202 Tulsa, Oklahoma 74127

4. By their signatures hereto, the Corps, USFWS, ODWC, TAS, and the Conservancy agree to assist the Owner and The River Parks Authority by providing expertise and assistance toward the common goal of protecting, managing, and enhancing the Least Tern population on the lands described.

IN WITNESS WHEREOF, the parties hereto have subscribed their names as of the dates indicated:

____

By: ____________________________ Dated: ________________

______Its:______________________

THE NATURE CONSERVANCY Dated: ____________________

Attest:

By: ____________________________ By: ________________

______Its Vice President Its Assistant Secretary

U.S. ARMY CORPS OF ENGINEERS Dated: ________________

______

By: ____________________________

Its: ____________________________

OKLAHOMA DEPARTMENT OF WILDLIFE CONSERVATION

By: ____________________________ Dated: ________________

______Its: ______________________

U.S. FISH AND WILDLIFE SERVICE

By: ____________________________ Dated: ________________

______Its: ______________________

TULSA AUDUBON SOCIETY Dated: ________________

______

Attest:

By: ______________________________ By: ____________________
_____Its: ______________________________ Its: ____________________

RIVER PARKS AUTHORITY Dated: ____________________

Attest:

By: ______________________________ Dated: ____________________
_____Its: ______________________________

APPENDIX 4

Essential Breeding Habitat for Interior Least Terns

Riverine sandbars, river channel environment including open channel area, channel width, and appropriate instream flows, and lake shorelines and other habitats provide essential habitat for the interior least tern. The interior least tern is completely dependent on these habitats for food and nesting sites. Therefore, destruction or adverse modification of remaining habitats will cause continued reduction of the species range and eventually a reduction in population numbers. The areas described and mapped herein as essential habitat will provide the space necessary for continued existence and growth of interior least tern populations required to meet the recovery objective. The following maps depict essential habitat for the interior least tern. Hatch marks along river segments and certain national wildlife refuges indicate the areas where essential habitat intermittently occurs depending on water conditions. For example, sandbars and interior least terns do not occur along every kilometer of the indicated segments of rivers. Locations of nesting birds may change from year to year within the indicated segment.

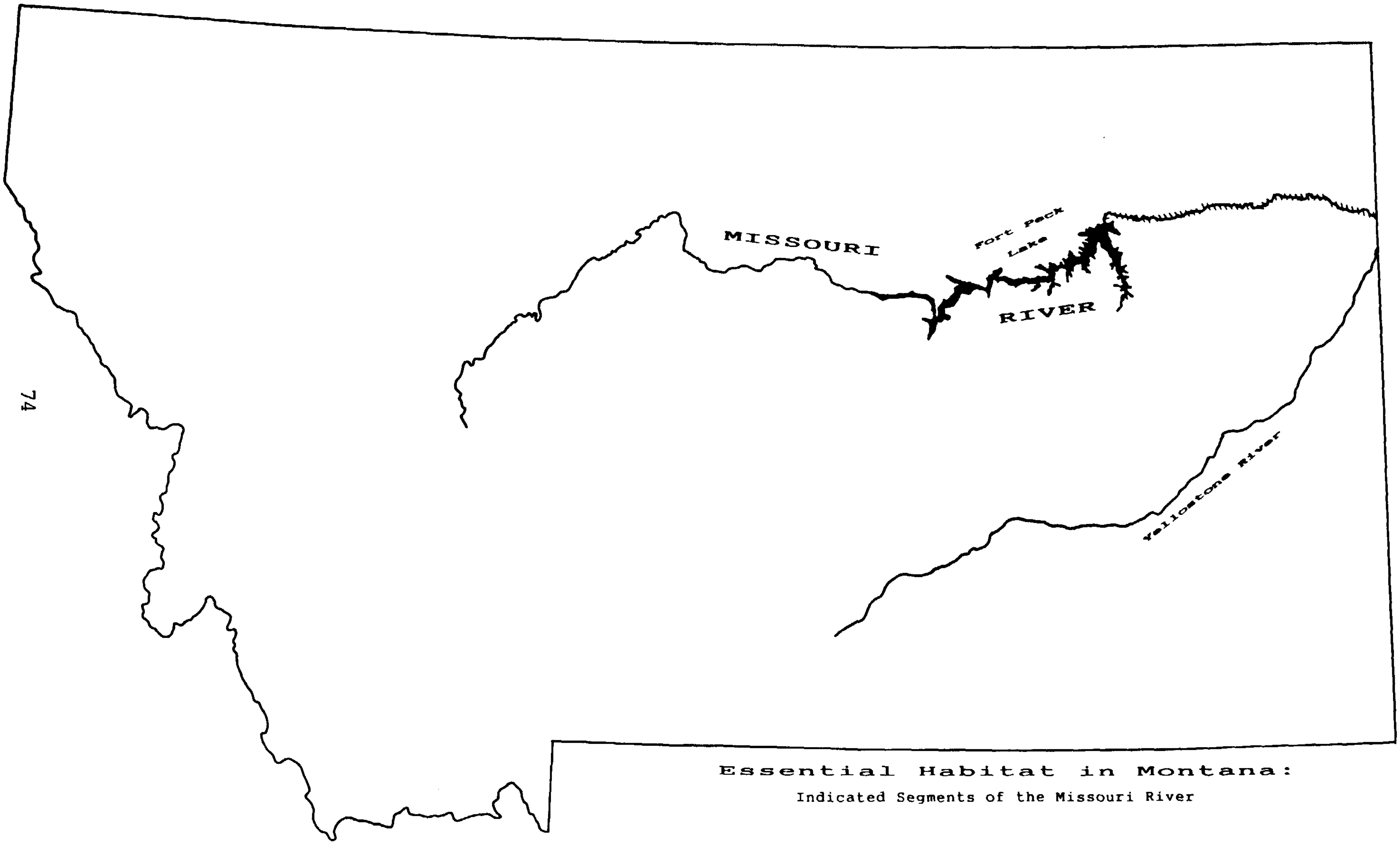
I. Missouri River System
  - Montana - Missouri River between Fort Peck Dam and North Dakota
  - North Dakota - Yellowstone River and Missouri River between Garrison Dam and the Cannonball River.
  - South Dakota - Cheyenne River from the Belle Fourche River to Lake Oahe; Missouri River from Ft. Randall Dam to mouth of the Niobrara River and from Gavin's Pt. Dam to Ponca, Nebraska.
  - Nebraska - Missouri River from South Dakota to mouth of the Niobrara River and from Gavin's Pt. Dam to Ponca; Niobrara River from Highway 183 bridge to Missouri River; Loup River from St. Paul to Platte River; Platte River from Lexington to Chapman and from Columbus (Highway 81 bridge to Missouri River.

II. Mississippi River - From Highway 146 bridge, Missouri and Illinois to Vicksburg, Mississippi

III. Arkansas River system
  - Kansas - Quivira National Wildlife Refuge and Cimarron River
  - Oklahoma - Salt Plains National Wildlife Refuge; from below Kaw Dam to Arkansas River and Arkansas River from Tulsa to Muskogee; Cimarron River in Beaver, Harper, Woods, Woodward, Major, Kingfisher, Logan, and Payne counties; Canadian River in Ellis, Roger Mills, Dewey, Cleveland, McClain, Haskell, Pittsburgh, Hughes, Muskogee, and Sequoyah counties; Sequoyah National Wildlife Refuge;

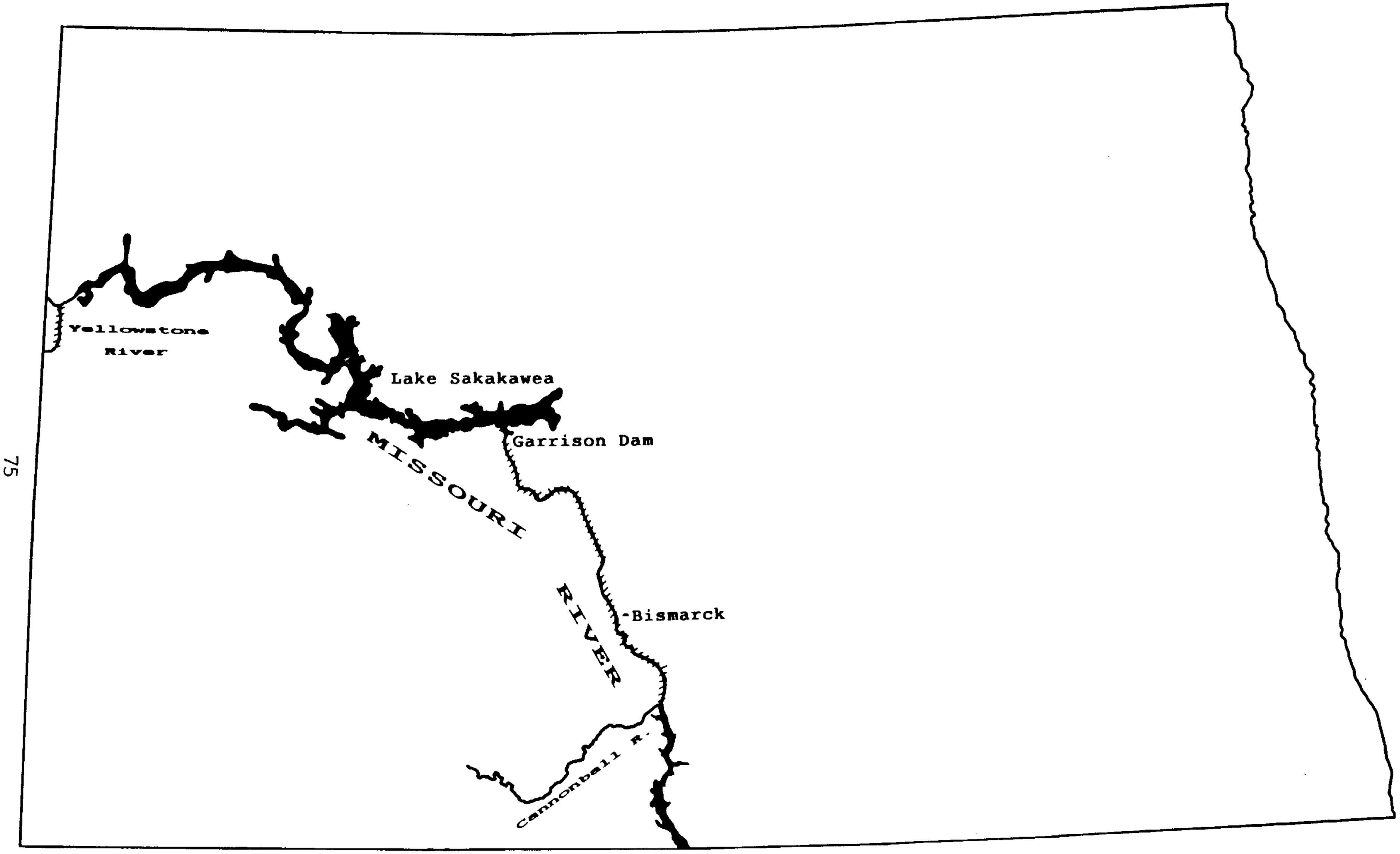
Red River from Harmon county to Highway 277/281 bridge.
Texas - Canadian River from Sanford Dam to Oklahoma; Prairie Dog Town Fork/Red River from Briscoe/Armstrong county boundary to Burkburnett, Texas.

IV. Pecos River - Bitter Lake National Wildlife Refuge, New Mexico.

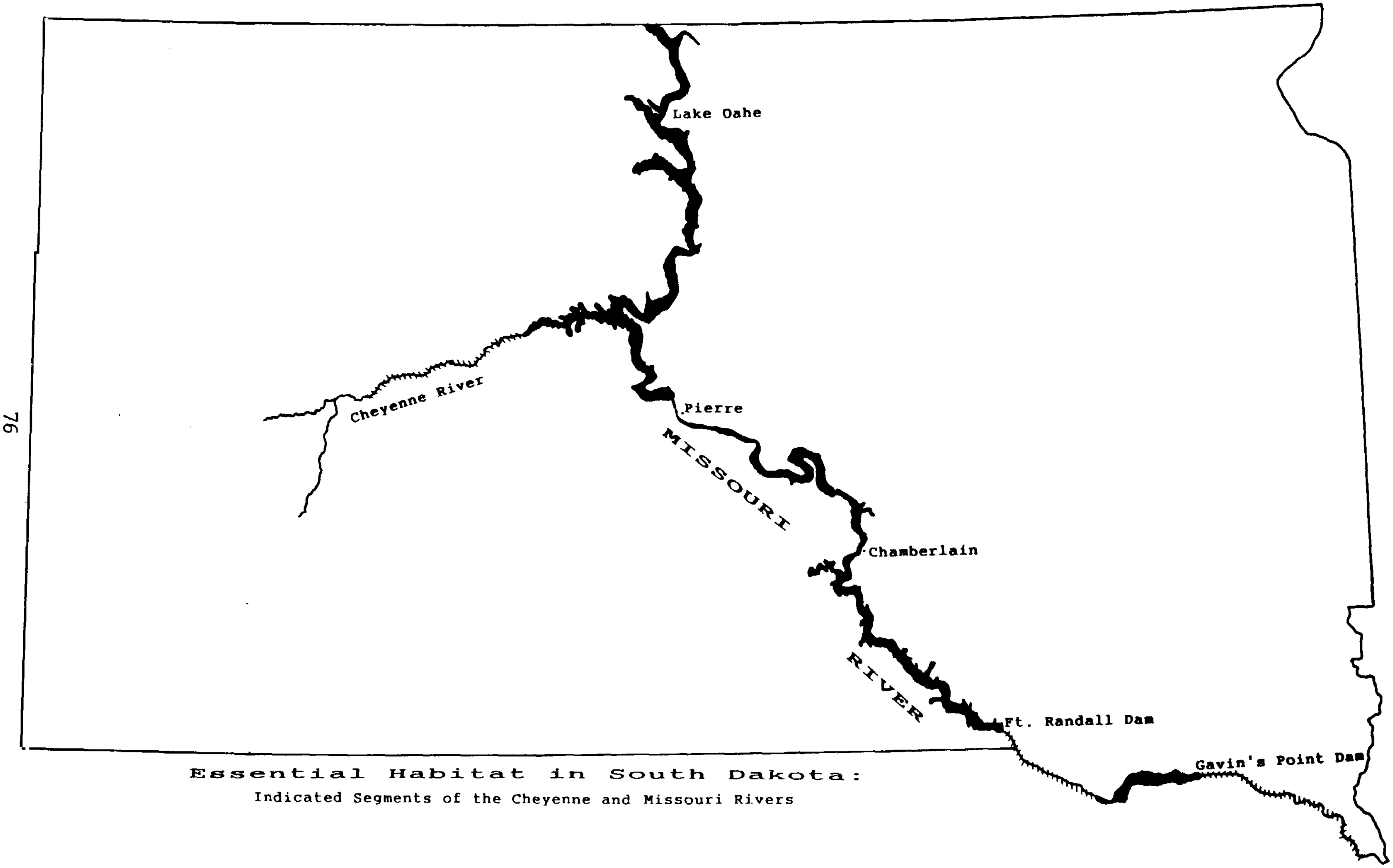


Essential Habitat in Montana:

Indicated Segments of the Missouri River



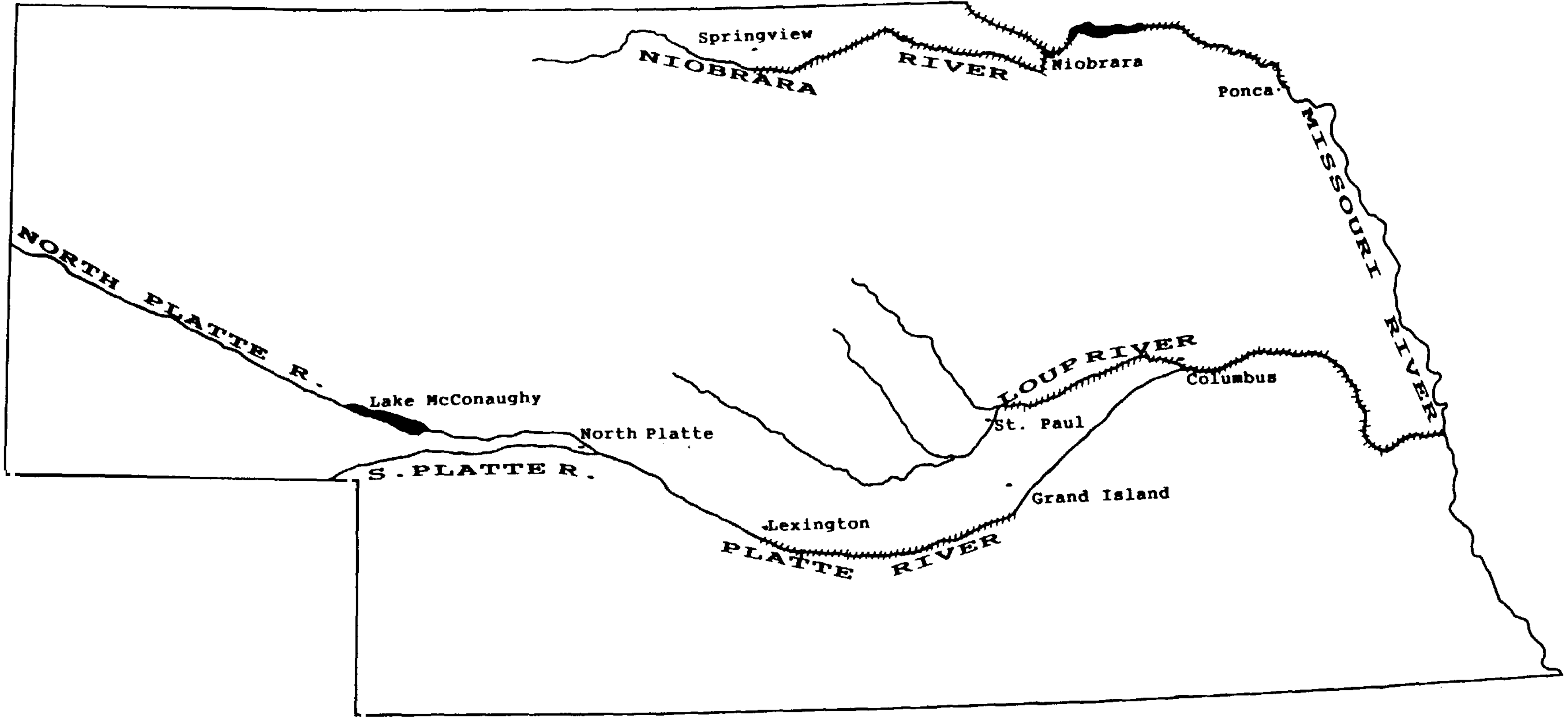
Essential Habitat in North Dakota:
Indicated Segments of the Missouri and Yellowstone Rivers



Essential Habitat in South Dakota:

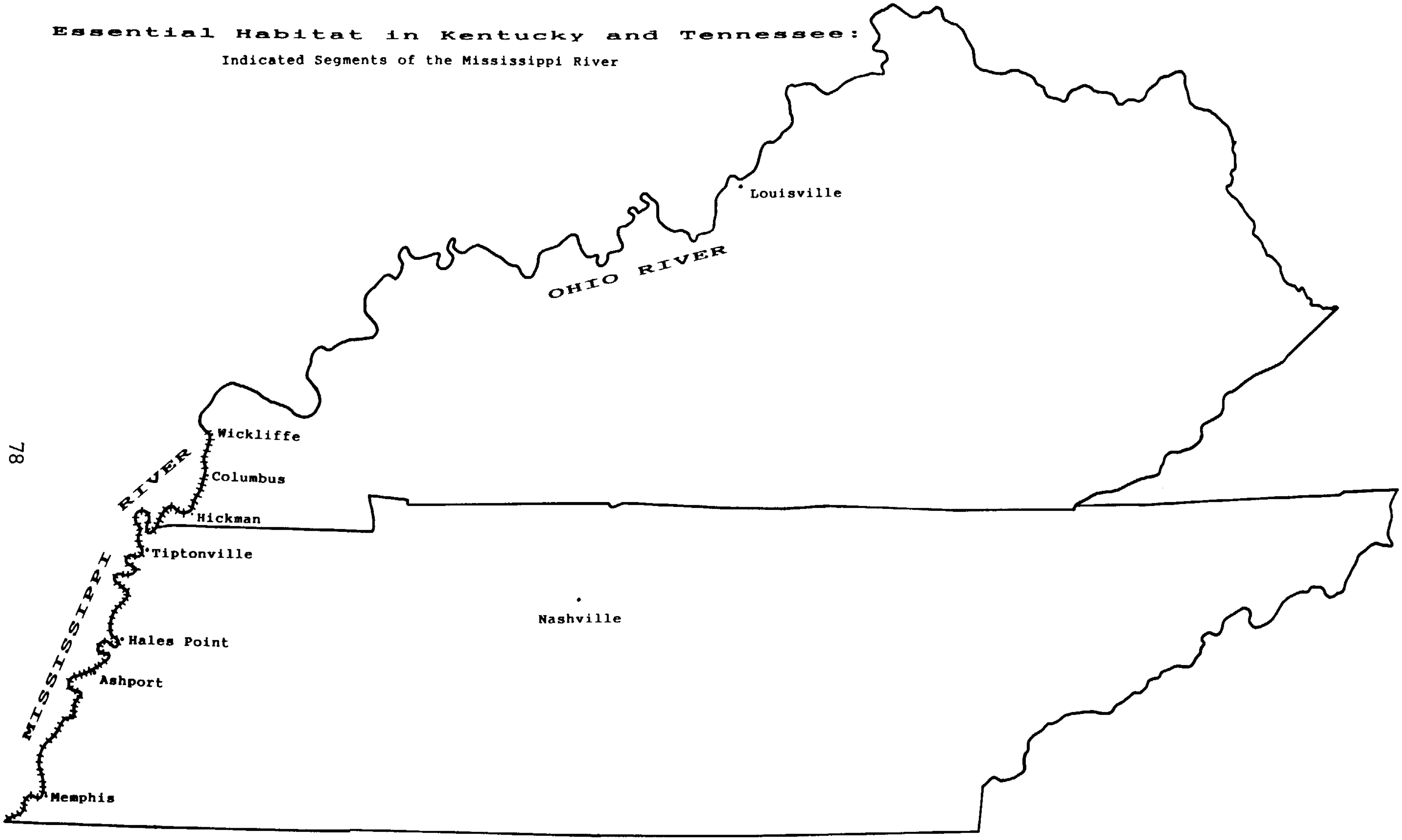
Indicated Segments of the Cheyenne and Missouri Rivers

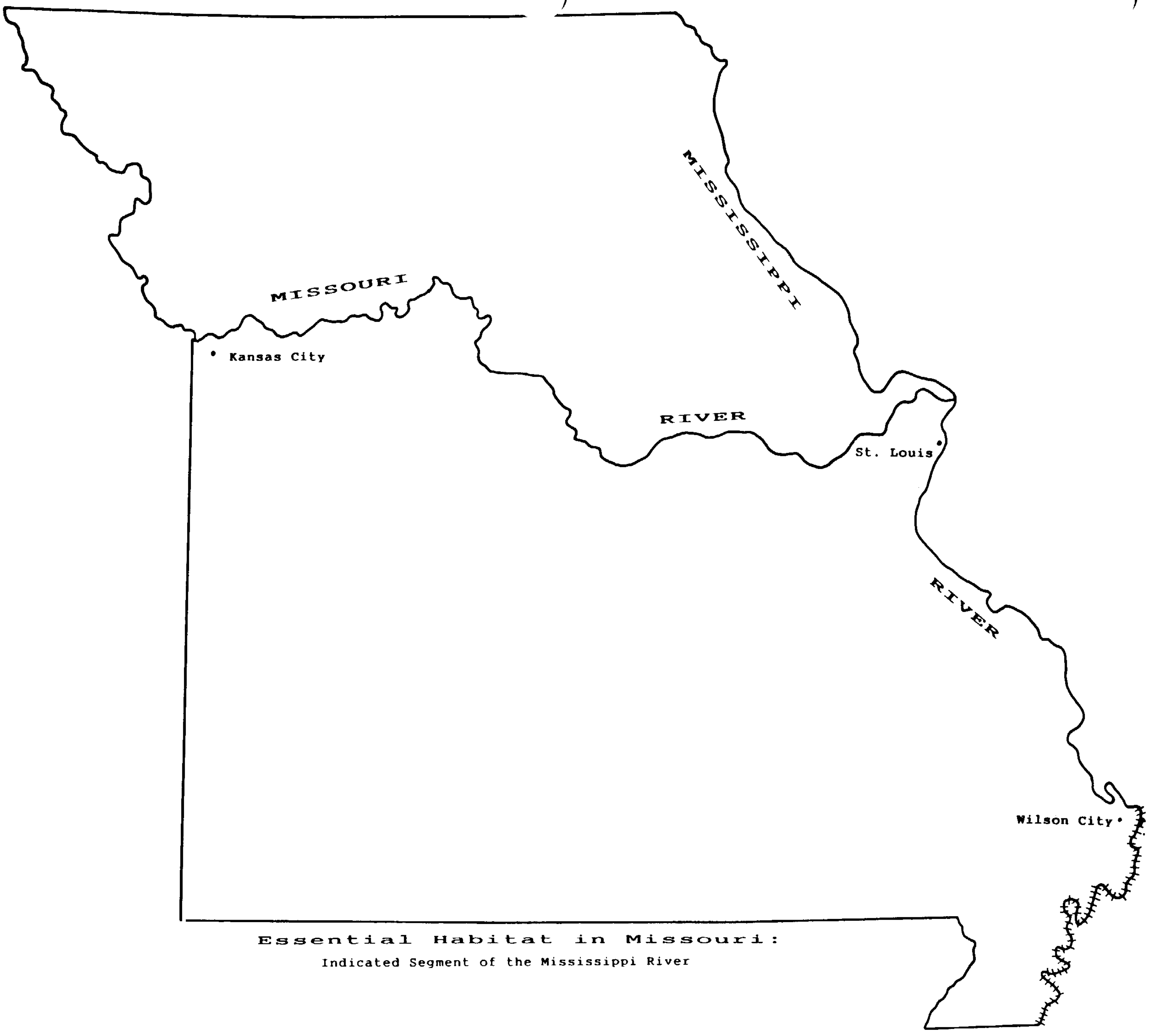
Essential Habitat in Nebraska: Indicated Segments of the Loup, Missouri, Niobrara and Platte Rivers



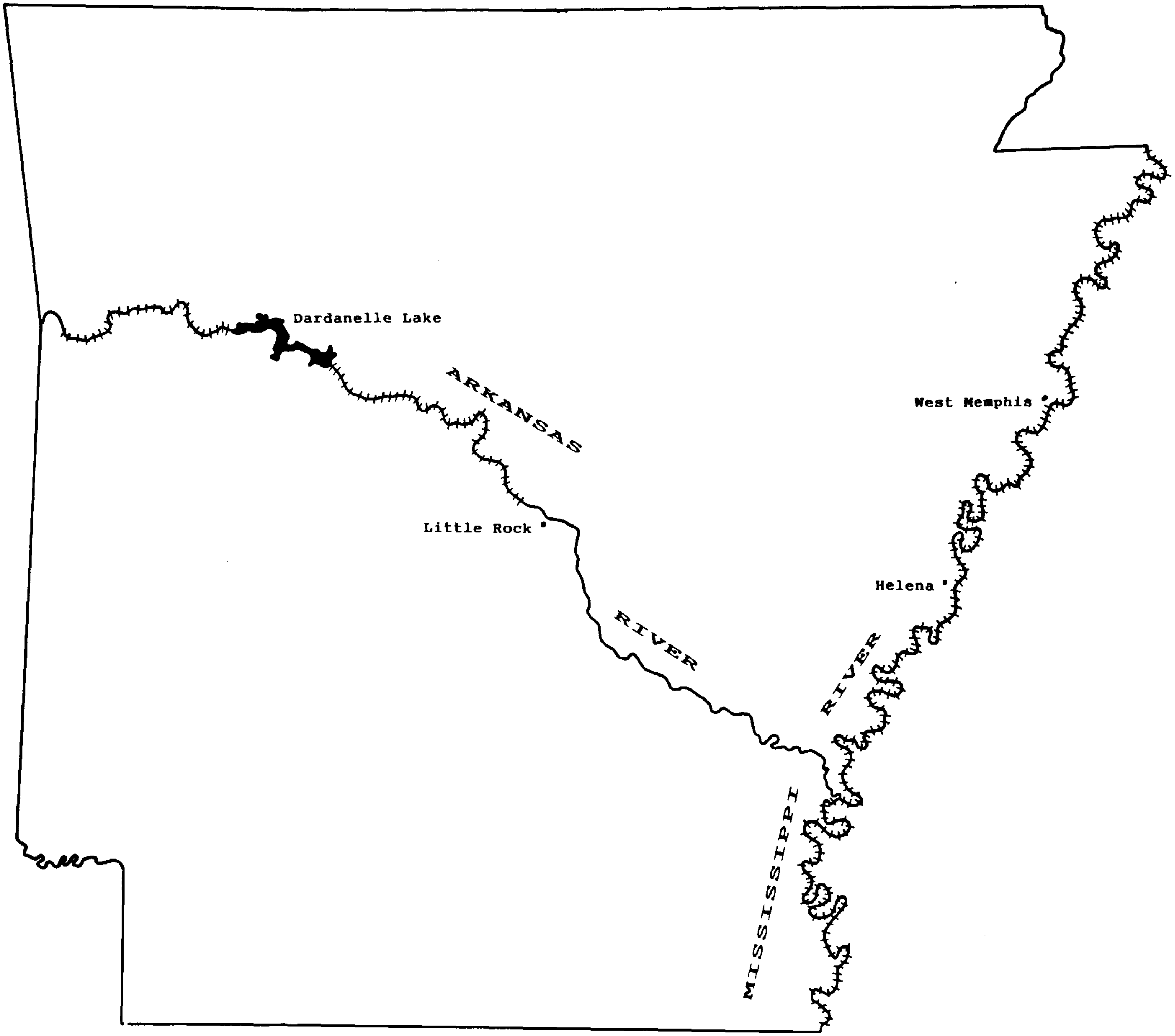
Essential Habitat in Kentucky and Tennessee:

Indicated Segments of the Mississippi River





Essential Habitat in Missouri:
Indicated Segment of the Mississippi River

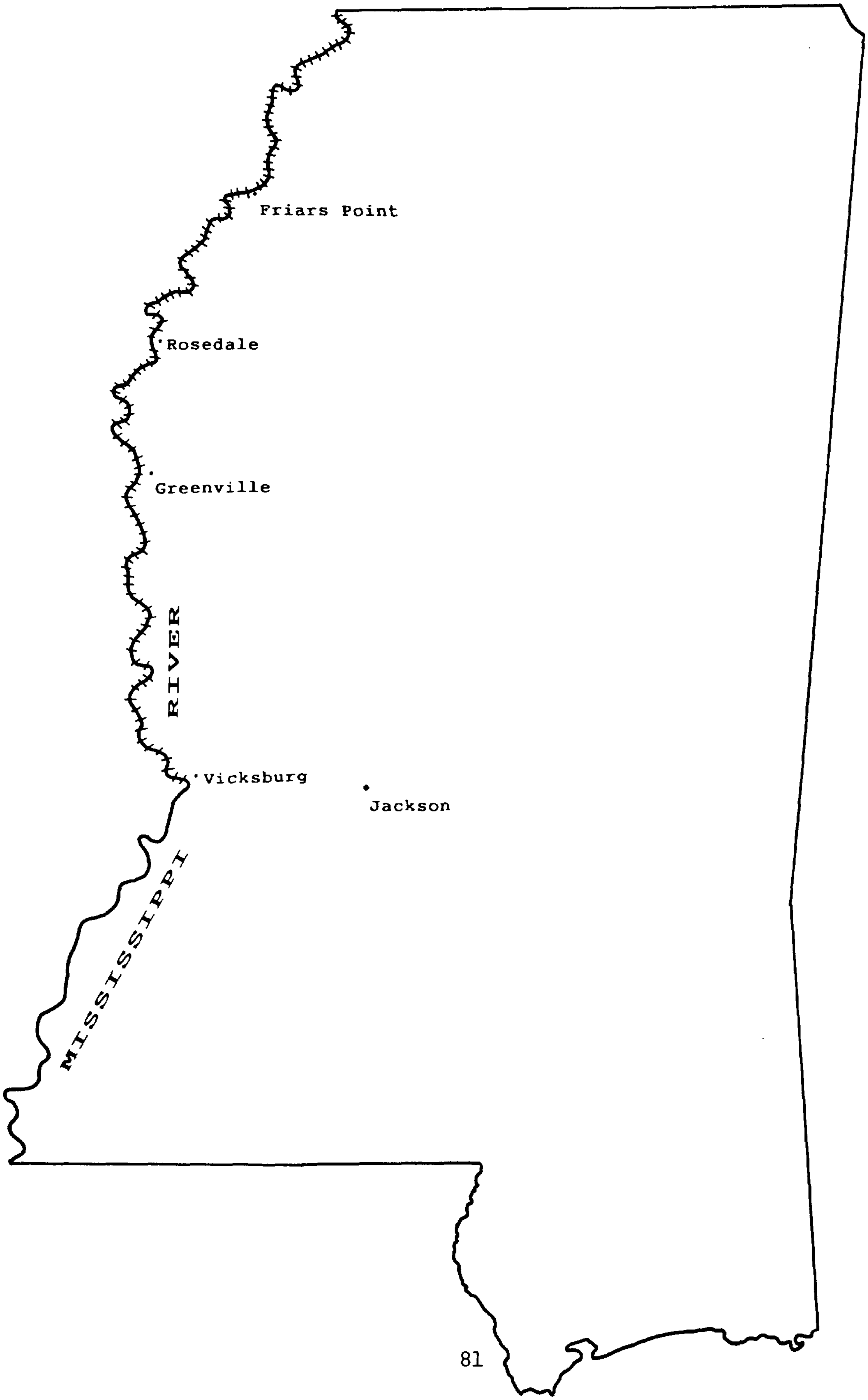


Essential Habitat in Arkansas:

Indicated Segments of the Arkansas and ssissippi Rivers

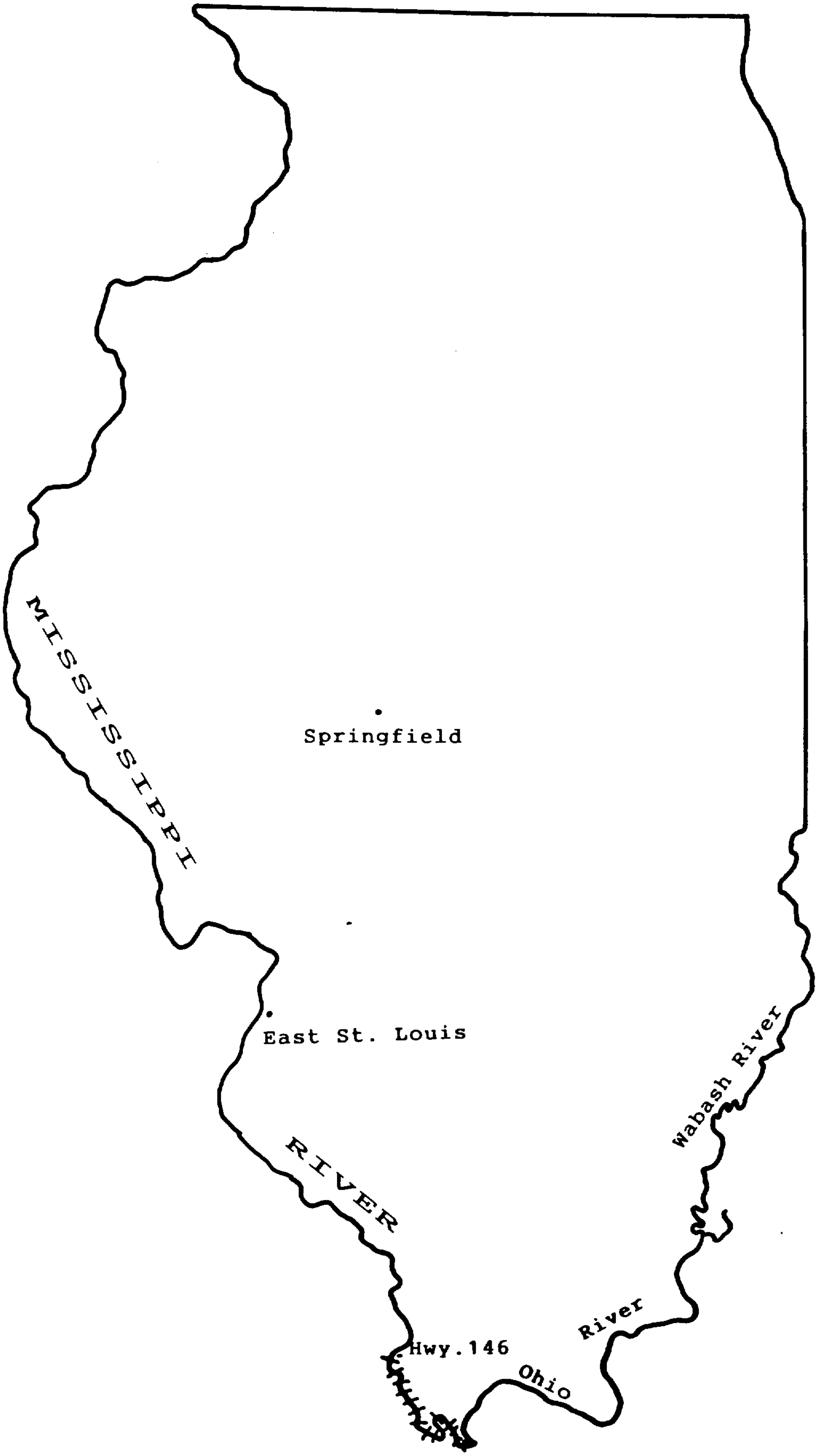
Essential Habitat in Mississippi

Indicated Segment of the Mississippi River



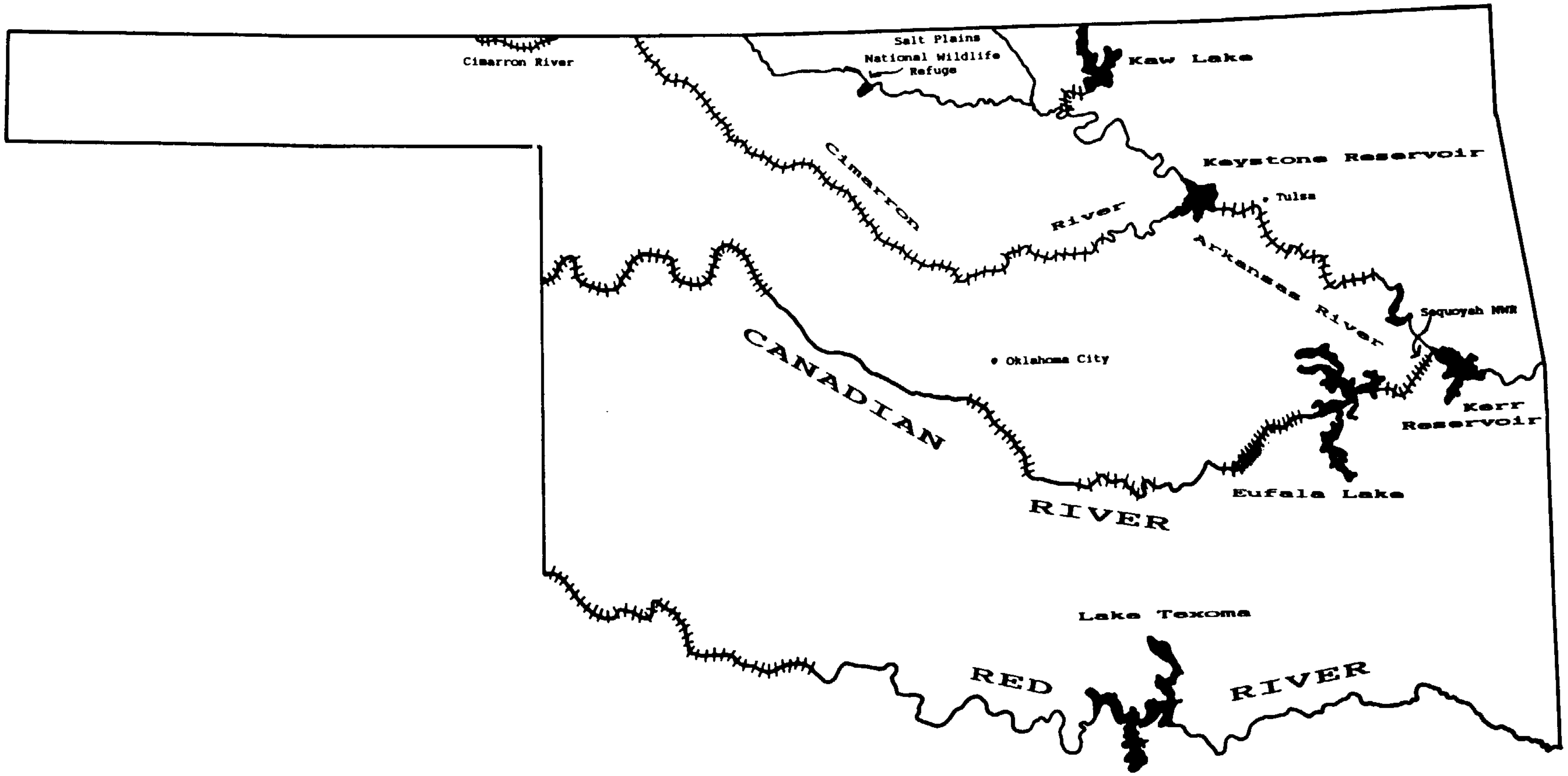
Essential Habitat in Louisiana:

Indicated Segment of the Mississippi River

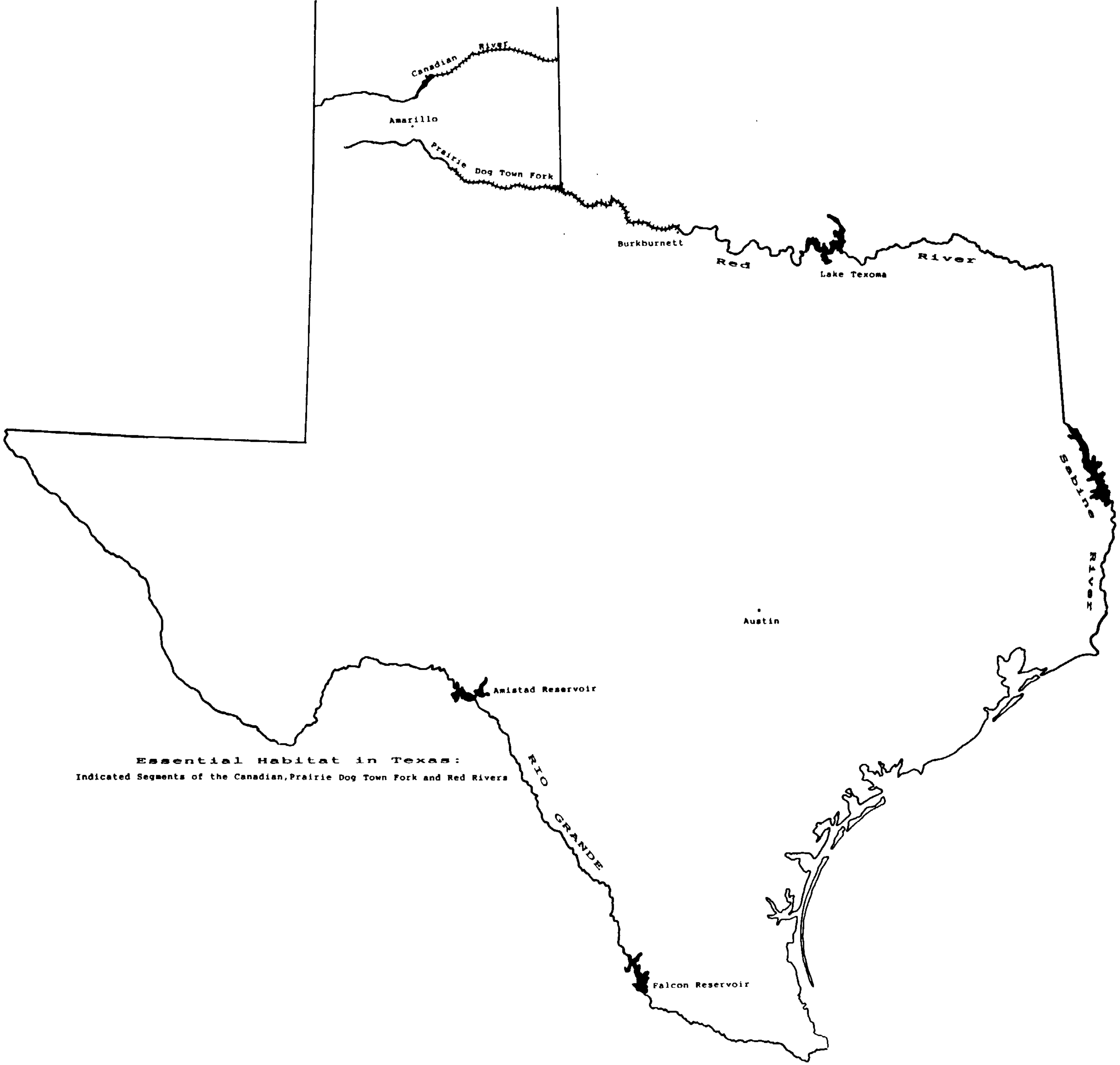


Essential Habitat in ILLinois:

Indicated Segment of the Mississippi River

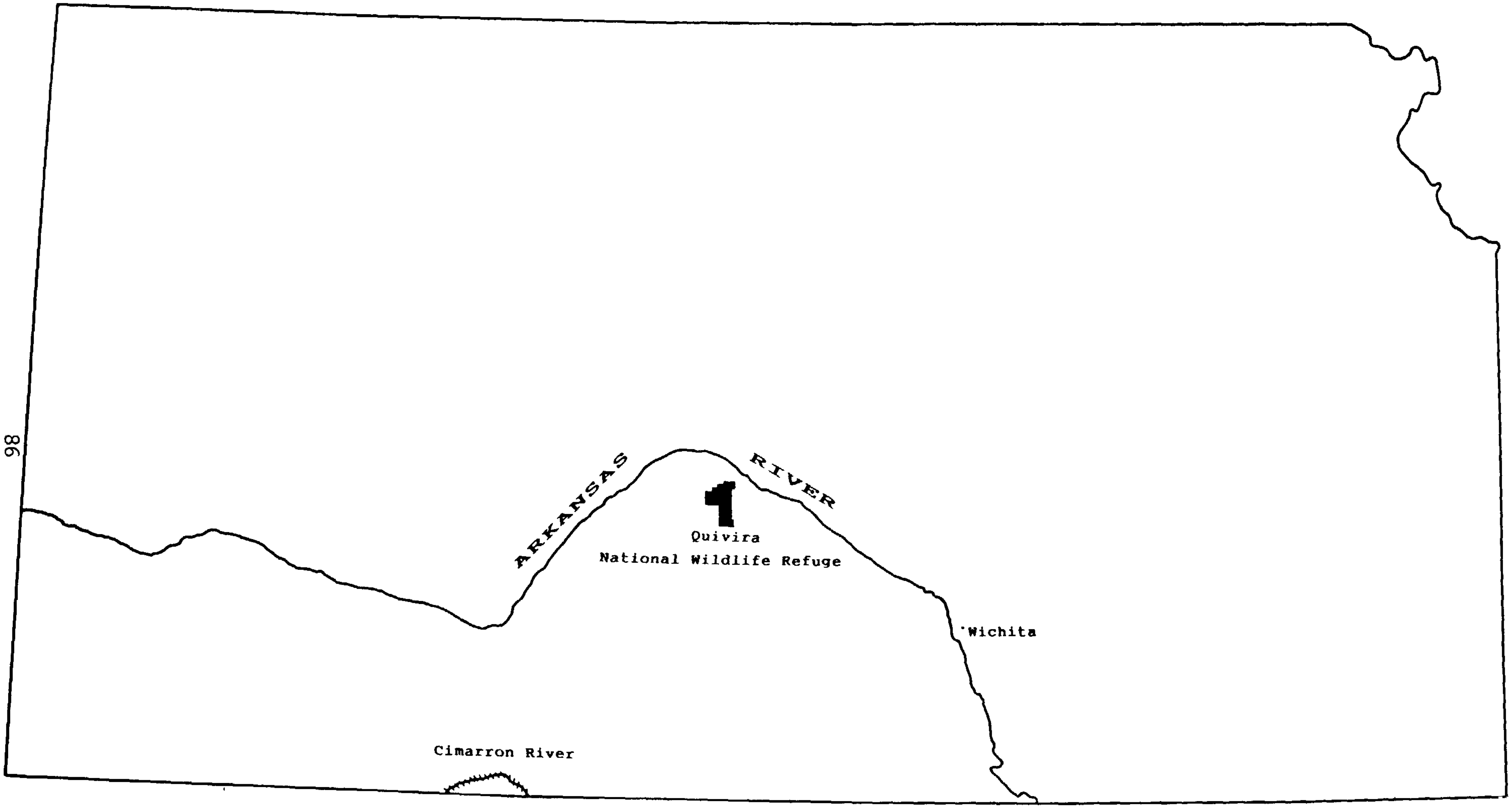


Essential Habitat in Oklahoma:
Sequoyah & Salt Plains National Wildlife Refuge
Indicated Segments of the Arkansas, Canadian, Cimarron and Red Rivers



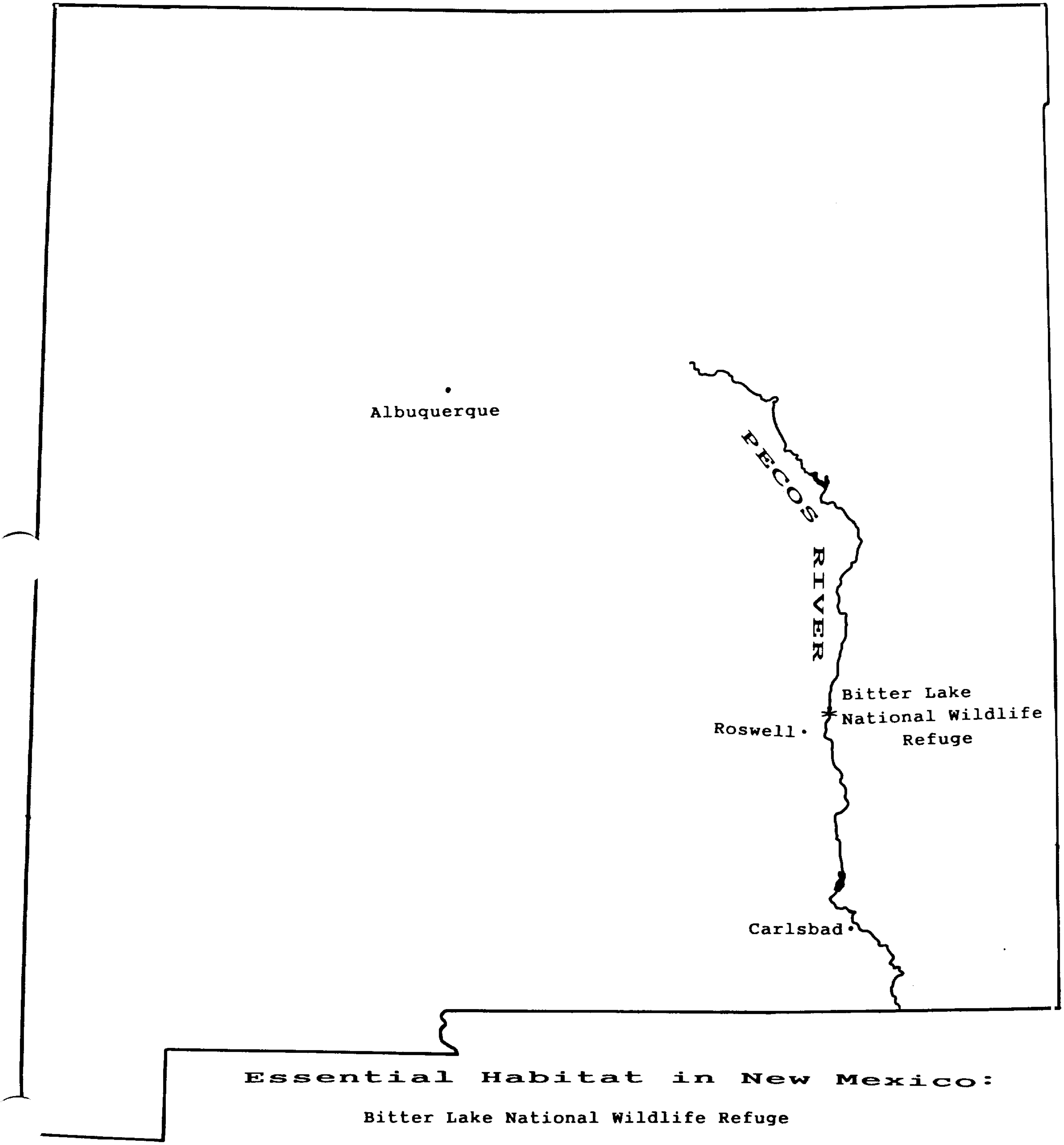
Essential Habitat in Texas:

Indicated Segments of the Canadian, Prairie Dog Town Fork and Red Rivers



Essential Habitat in Kansas:

Quivira National Wildlife Refuge and Cimarron River



Essential Habitat in New Mexico:

Bitter Lake National Wildlife Refuge

Appendix 5

LIST OF REVIEWERS

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Mr. Michael Bean
Enviromental Defense Fund
1616 P Street NW
Washington, DC 20036

Appendix E

Groundwater Monitoring Network Evaluation Reports

for

Rockport Plant's

Bottom Ash Pond Complex

and

Landfill

GROUNDWATER MONITORING NETWORK EVALUATION REPORT, BOTTOM ASH PONDS

American Electric Power Service Corporation
Rockport Generating Station, Rockport, Spencer County, Indiana
Wood Project No. 7362182624

Prepared for:

American Electric Power Service Corporation
1 Riverside Plaza, Columbus, Ohio 43215

14 September 2017
Rev 1 - 14 February 2019

14 February 2019

Wood Environment & Infrastructure Solutions, Inc.
2456 Fortune Drive
Suite 100
Lexington, KY 40509
USA
T: 859-255-3308
www.woodplc.com

Mr. David Miller
Director, Land Environment & Remediation Services
American Electric Power Service Corporation
1 Riverside Plaza
Columbus, OH 43215
Email: damiller@aep.com

Subject: Updated Groundwater Monitoring Network Evaluation Report
AEP Rockport Plant, Bottom Ash Ponds
Wood Project No. 7362182624

Dear Mr. Miller:

Wood Environment & Infrastructure Solutions, Inc. (Wood) has prepared this update to the *Groundwater Monitoring Network Evaluation Report, Bottom Ash Ponds* dated 14 September 2017. The report has been updated to incorporate additional background monitoring wells installed in 2017. The structure and content of the original report has remained unchanged except where discussion of the new wells have been added. We are available to discuss the details of this report at your convenience should you require additional information.

Sincerely,
Wood Environment & Infrastructure Solutions, Inc.

Thomas Reed
Thomas M. Reed, PG
Senior Hydrogeologist

Kathleen D. Regan
Kathleen D. Regan, PE
Associate Engineer

Enclosures

AMERICAN ELECTRIC POWER SERVICE CORPORATION
ROCKPORT GENERATING STATION
ROCKPORT, INDIANA

GROUNDWATER MONITORING NETWORK EVALUATION REPORT, BOTTOM ASH PONDS

RECORD OF CHANGES

REVISION 1:

This report, originally dated September 14, 2017, was revised on February 14, 2019 to incorporate installation details and sampling results for six additional background groundwater monitoring wells at the bottom ash ponds. The six wells are designated as MW 1701 shallow, intermediate, and deep (S,I,D) and MW 1702 S,I,D. The report includes the well locations, boring logs, and monitoring well installation details.

There were no changes to the information contained in the original report. This revision simply added six additional background groundwater well drilling and installation details.

GROUNDWATER MONITORING NETWORK EVALUATION REPORT, BOTTOM ASH PONDS

American Electric Power Service Corporation
Rockport Generating Station, Rockport, Spencer County, Indiana
Wood Project No. 7362182624

Prepared for:

American Electric Power Service Corporation
1 Riverside Plaza, Columbus, Ohio 43215

Prepared by:

Wood Environment & Infrastructure Solutions, Inc.
2456 Fortune Drive
Suite 100
Lexington, KY 40509
USA
T: 859-255-3308

14 February 2019

Copyright and non-disclosure notice

Third-party disclaimer

Executive Summary

The Groundwater Monitoring Network Evaluation was conducted to evaluate the adequacy of the existing monitoring well network and, if applicable, to make recommendations for additional well installations. Specifically, the existing monitoring well network at the BA Ponds was evaluated for compliance with the coal combustion residuals (CCR) Final Rule issued by the U.S. Environmental Protection Agency (USEPA) on 17 April 2015. Regulations pertaining to Groundwater Monitoring and Corrective Action are contained in the Code of Federal Regulations (CFR) 40 CFR Sections (§) 257.90 through 98. The focus of this evaluation was on §257.91 (Groundwater Monitoring Systems). The major elements of the evaluation are summarized below.

Description of the CCR Unit

The CCR unit referred to as the BA Ponds is located at the north end of the wastewater pond complex for the plant (**Figure 3**). It consists of two contiguous ponds, referred to as the East and West BA Ponds, which receive CCR. Other ponds in the complex include the east and west wastewater ponds, the reclaim pond, and the clearwater pond. The wastewater pond complex has a total surface area of 137 acres and a design storage capacity of 1,640 acre-feet (O&G 2011).

Water from the BA ponds drains to the two wastewater ponds, and stormwater from several stormwater collection ponds located at the perimeter of the generating station is also routed to the wastewater ponds. From the wastewater ponds, wastewater flows to the reclaim pond. If needed, water can be recirculated into the sluice water system from the reclaim pond. Excess water flows from the reclaim pond to the clearwater pond, and discharges from there to the Ohio River via a fixed weir outlet and a 66-inch CMP pipe. The discharge is permitted under National Pollution Discharge Elimination System (NPDES) permit number IN 0051845.

Hydrogeology

Groundwater flows into the project area from the north, northwest and west, and continues flowing under the site generally to the southeast. Drainage in the area is provided by the Ohio River, which is adjacent to the plant property on the southeast, is over 2,000 feet wide in the vicinity of the plant, and flows to the southwest toward Owensboro, Kentucky. The plant property slopes gently across a terraced surface from elevations greater than 410 feet on its northern edge, where it is bordered by low hills and an upper terrace, to about 390 feet along the top of the bank of the Ohio River. Much of the property is drained by Honey Creek, which flows south-southeast to the Ohio River and is incised down to an elevation of about 380 feet. The power generation plant is located on a watershed divide between Honey Creek and an unnamed tributary offsite to the southwest. At times the groundwater flow direction and velocity can be impacted by the stage in the Ohio River and Honey Creek, which cause temporary and short duration flow reversals during high river stage events. While these events generate a water level response in the background wells for the BA Ponds, they are not likely to have a water quality impact on those wells.

Hydrostratigraphic Unit

Consistent with the definition in the CCR Rule, the hydrostratigraphic unit identified as the uppermost aquifer in this case is the saturated granular outwash deposit that underlies the Rockport Plant property including the BA Ponds. The top of this unit would be the typical seasonal high water level of 372 feet, 27 feet below the crest elevation of the pond embankments (399 feet). The bottom of the unit would be the top of bedrock. The shale bedrock underlying the granular outwash deposits does not represent a significant groundwater flow zone. The bedrock surface in the vicinity of the pond is irregular, generally sloping to the southeast, and occurs at elevations of 274 to 300 feet (111 to 126 feet immediately below the BA Pond embankment crest level). The saturated thickness of this unit, therefore, is expected to range from 70 to 100 feet, thickening to the southeast.

General CCR Requirements

In summary, the performance standard for groundwater monitoring systems in the CCR Rule (§257.91) states that the system should consist of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that:

- Accurately represent the quality of background groundwater, and
- Accurately represent the quality of the groundwater passing the waste boundary of the CCR unit in the uppermost aquifer, and
- Monitor all potential contaminant pathways.

Monitoring Network Evaluation

Four shallow monitoring wells (MW-1001 through MW-1004) were installed in 2010 at the perimeter of the wastewater pond complex. Three of the wells are located adjacent or close to the BA Ponds; MW-1004 is located farther downgradient, at the southeast corner of the wastewater pond complex. A review of the available groundwater monitoring network for the BA Ponds was made in late 2015. As a result of the review, it was recommended that MW-1002 be included in the downgradient monitoring network, and that the other three wells (MW-1001, MW-1003, and MW-1004) be retained for use as piezometers, to monitor groundwater levels and aide in the interpretation of flow directions.

Twenty new wells were installed in January-March 2016, in seven three-well clusters that include MW-1002. The clusters are designated MW-1600 through MW-1606. Three wells are included in each cluster, finished at shallow (S), intermediate (I) and deep (D) levels. The background well clusters, designated MW-1600S/I/D and MW-1601S/I/D, are located approximately 1,000 feet and 850 feet, respectively, from the edge of the BA Ponds. Downgradient monitoring wells are designated by cluster as MW-1602 through MW-1606, with MW-1002 included as the shallow well in the MW-1602 cluster. The downgradient monitoring well clusters were installed on the perimeter segments of the ponds in the dominant downgradient directions (east and south). The downgradient wells were located as close as practical to the edge of the BA Ponds, just outside the road at the crest of the embankment, in order to be as close as possible to the *waste boundary* (defined in the CCR Rule as "the vertical surface located at the downgradient limit of the CCR unit, that extends down into the uppermost aquifer").

Six new monitoring wells were installed in September through October 2017, in two three-well clusters. The clusters are designated MW-1701 and MW-1702. Three wells are included in each cluster, finished at shallow (S), intermediate (I), and deep (D) levels. Water level data collected since November 2017 demonstrate that well clusters MW-1701 and MW-1702 are hydraulically upgradient of waste boundary wells at the BA Ponds. Well clusters MW-1701 and MW-1702 are located approximately 925 feet and 2,700 feet, respectively, from the BA Ponds.

Based on the information reviewed and presented in this report (including appendices), the groundwater monitoring network currently installed at the BA Ponds at the AEP Rockport plant can be considered appropriate under the requirements of the CCR Rule as a multiunit system for detection monitoring in the uppermost aquifer at the waste boundary.

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	C-2	Wastewater Pond Complex Monitoring Well Piezometric Data
	C-3	Wastewater Pond Complex Monitoring Well Hydrographs
	C-4	Wastewater Pond Complex Monitoring Well Piezometric Maps
Appendix D	2016 Monitoring Well Installation Report	
Appendix E	2017 Monitoring Well Installation Data	
	E-1	Monitoring Well Location Map
	E-2	Well Construction Summary
	E-3	Water Level Data Summary
	E-4	Boring and Well Construction Logs

1.0 Objective

This Groundwater Monitoring Network Evaluation Report has been prepared by Wood Environment & Infrastructure, Inc. (Wood), on behalf of American Electric Power Service Corporation (AEP), to document the results of the monitoring well network evaluation conducted for the Bottom Ash (BA) Ponds, at the Rockport Plant in Rockport, Indiana. The Groundwater Monitoring Network Evaluation was conducted to evaluate the adequacy of the existing monitoring well network and, if applicable, to make recommendations for additional well installations.

Specifically, the existing monitoring well network at the BA Ponds was evaluated for compliance with the coal combustion residuals (CCR) Final Rule issued by the U.S. Environmental Protection Agency (USEPA) on 17 April 2015. Regulations pertaining to Groundwater Monitoring and Corrective Action are contained in the Code of Federal Regulations (CFR) 40 CFR Sections (§) 257.90 through 98. The focus of this evaluation was on §257.91 (Groundwater Monitoring Systems).

2.0 Background Information

2.1 Facility Location and Description

The Rockport Power Plant is located in southwest Indiana (**Figure 1**) in Spencer County, on property extending into three Townships: Ohio, Hammond and Grass. The plant is situated on the north bank of the Ohio River, just northeast of the intersection of State Route (SR) 66, and United States (US) Highway 231. SR 66 runs along the river between the Town of Grandview (about 1.5 miles to the east) and the City of Rockport (about 1 mile to the southwest), and US 231 runs south from Interstate 64 (about 20 miles north of the plant), crossing the Ohio River into Kentucky via the William H. Natcher Bridge just southwest of the Power Plant.

The site is owned and operated by Indiana-Michigan Power Company, a regional unit of AEP. The property was developed in the late 1970s and early 1980s. The facility consists of two coal-fired 1,300-megawatt (MW) power generating units. The first unit went into operation in December 1984, and the second in December 1989. The facility has two existing CCR storage/disposal units, consisting of a landfill located north-northeast of the generating plant, and two adjacent bottom ash (BA) ponds located near the generating plant at the north end of a wastewater pond complex. The general layout of the property and the locations of the CCR units are shown on **Figure 2**.

The following description of CCR generation and handling processes at the Rockport Plant is summarized from a letter sent by AEP to the Indiana Department of Environmental Management (IDEM) on 6 May 2009:

> The plant burns about 9-10 million tons of coal per year. The coal, delivered by barge, is off-loaded to the coal storage yard then transported by conveyor into one of the two generating units, where it is pulverized to a powder then injected and burned. The heat produced in burning coal converts water to steam used to drive the turbine generators which produce electricity. The burning of coal produces two types of ash - fly ash and bottom ash. The Rockport Plant produces about 400,000 tons of fly ash and 140,000 tons of bottom ash per year.
>
> Fly ash is the fine particulate matter entrained in the hot flue gases. To remove the fly ash prior to the gases exiting through the plant stack, the flue gas is routed through an electrostatic precipitator (ESP), where the ash particles adhere to electrically charged plates. Mechanical

rappers knock the fly ash off the plates down into a series of collection hoppers. From the hoppers, the fly ash is pneumatically conveyed to a storage silo. From the silo, the ash is either loaded dry into closed trucks and shipped offsite for various uses, or conditioned with a small quantity of water and hauled by truck to the onsite landfill for disposal.

Bottom ash (BA) includes the heavier coal ash particles that fall to the bottom of the steam generator and are collected into refractory-lined hoppers. The hoppers are kept full of water to protect the lining and break the fall of large pieces of hot slag which shatter upon contact with the relatively cool water. From the hoppers, the BA-water mixture is routed to a crusher station where the ash is crushed to a size suitable for pumping. The BA is then pumped to one of the BA ponds located in the wastewater pond complex, where it precipitates out and can be reclaimed after the pond is drained.

2.2 Description of the CCR Unit

2.2.1 General

The CCR unit referred to as the BA Ponds is located at the north end of the wastewater pond complex for the plant (**Figure 3**). It consists of two contiguous ponds, referred to as the East and West BA Ponds, which receive CCR. Other ponds in the complex include the east and west wastewater ponds, the reclaim pond, and the clearwater pond. The wastewater pond complex has a total surface area of 137 acres and a design storage capacity of 1,640 acre-feet (O&G 2011).

Water from the BA ponds drains to the two wastewater ponds, and stormwater from several stormwater collection ponds located at the perimeter of the generating station is also routed to the wastewater ponds. From the wastewater ponds, wastewater flows to the reclaim pond. If needed, water can be recirculated into the sluice water system from the reclaim pond. Excess water flows from the reclaim pond to the clearwater pond, and discharges from there to the Ohio River via a fixed weir outlet and a 66-inch CMP pipe. The discharge is permitted under National Pollution Discharge Elimination System (NPDES) permit number IN 0051845.

Two small metal cleaning waste ponds were formerly located east of the East BA Pond. The northernmost of these two ponds was backfilled prior to 1998 and was replaced with a single aboveground tank located in a containment area above the former pond location. The south pond was backfilled in 2014-2015. A stormwater pond (the West Stormwater Pond) was constructed west of the west dike (between the BA Ponds and US 231) in 2006 or early 2007 (based on historical aerial photography available through GoogleEarth).

2.2.2 Embankment Configuration

The wastewater pond complex is a combination incised and diked earthen embankment impoundment. It is incised below grade along most of its perimeter, and is diked only on the west side of the West BA Pond, where the topography decreases in elevation toward a remnant drainage channel.

The embankments, including the west dike, have a crest elevation of 399 feet, and are approximately 30 feet wide. The west dike has a maximum height (from crest to outboard toe) of 13 feet. The inboard slope was constructed at a slope of 2 horizontal to 1 vertical (2H:1V), and the outboard slope at 2.5H:1V. The outer west dike, and the internal splitter dikes (constructed between the BA Ponds, and between each of the BA Ponds and the wastewater ponds to the south) were constructed of natural clayey soils excavated from the interior of the ponds. The inboard slopes were armored with rock riprap. Reportedly, no engineered liner systems are present in the BA Ponds or the other ponds in the wastewater pond complex.

2.2.3 Area/Volume

The East and West BA Ponds each have rough dimensions (at the crest) of 2,000 feet x 650 feet, corresponding to a surface area of approximately 30 acres each (60 acres total). The East BA Pond is deeper than the West BA Pond. The design bottom elevations in the ponds are: 386 feet, or 13 feet below crest elevation in the West BA Pond; and 377 feet, or 22 feet below crest elevation in the East BA Pond.

Assuming two feet of freeboard, the West BA Pond has a design capacity of approximately 310 acre-feet (500,000 cubic yards, or CY), compared to 540 acre-feet (870,000 CY) in the East BA Pond.

2.2.4 Construction and Operational History

The wastewater pond complex was constructed in the late 1970s, commissioned in 1981, and has not been significantly modified since original construction (O&G 2011).

The East and West BA Ponds are used alternately. Bottom ash generated at the plant is hydraulically sluiced to one of the ponds (the active pond) until it is close to full. Bottom ash in the inactive pond is drained and dewatered, and then moved by bulldozer to stockpiles on the north end of the pond. Dry ash in the stockpiles is loaded into trucks and transported to other locations for beneficial reuse. It typically takes approximately six months for the active pond to fill, at which time the second pond (which has been emptied of bottom ash) becomes the active pond, and the first pond is drained.

2.2.5 Surface Water Control

Both BA ponds have two outlet structures: a surface water adjustable weir outlet structure for use during sluicing, as the pond is filling, and a low-level outlet structure used after flow into the pond has stopped, to dewater the accumulated bottom ash. Water from both of these outlets gravity drains to the wastewater ponds.

2.3 Previous Investigations

Site investigations were performed on the Plant property in the late 1970s and early 1980s to support design, construction and permitting in advance of plant start-up, which occurred in December 1984. The following documents were provided by AEP for this review:

- Portions of a report titled *Foundation Investigations for Rockport Site*, by Casagrande Consultants, dated 25 April 1977. The portions provided included a boring location map and boring logs for nine soil borings (BH-361 to BH-369) performed in March 1977 along the proposed alignment for the perimeter and splitter dikes in the wastewater pond complex. The boring location map and boring logs are provided in **Appendix A**.
- AEP design drawing 12-30013-15 titled *Unit No. 1 & 2 Wastewater & Bottom Ash Pond Area - Grading & Drainage*, originally dated 18 July 1977, with revisions through 16 January 1990.
- AEP design drawing 12-30018-1 titled *Unit No. 1 & 2 Wastewater & Bottom Ash Pond Area – Sections and Details*, originally dated 18 July 1977, with revisions through 10 January 1979.
- An AEP Internal Memo titled *Stability Analysis of Bottom Ash Pond West Dike*, dated 21 June 2010, which included the three items listed above.

- Well construction and lithologic logs for four monitoring wells installed by AEP on the perimeter of the wastewater pond complex in June-July 2010. Copies of these logs are provided in **Appendix B**.
- A drawing titled *Boring Location Overall Plan*, by WorleyParsons, dated 7 November 2011.
- A report titled *Dam Safety Assessment of CCW Impoundments, Rockport Power Plant*. Report prepared for USEPA by O'Brien & Gere Engineers, Inc., 24 March 2011 (O&G 2011).

In addition, AEP provided a Landfill Application Package (AEP 1984) containing the methods and findings from a Site Investigation performed in 1983 by AEP Civil Engineering personnel of the northern portion of the plant property, to support permitting of two CCR stockpiles and landfilling areas.

2.4 Hydrogeologic Setting

The following sections provide information on the hydrogeologic setting of the AEP Rockport Plant, including climate, physiography and drainage, geology, hydraulic properties of the principal groundwater flow zone, surface water and interactions between surface water and groundwater, and water users.

2.4.1 Climate and Water Budget

The area of Rockport has a continental climate regime. As described by Ray (1965), summers are long, hot and humid, and winters are damp and relatively mild, with brief periods of intense cold. Mean monthly temperatures vary from 35 degrees Fahrenheit (ºF) in January to 79ºF in July.
The closest meteorological station with long-term data is Owensboro, Kentucky. Based on National Climatic Data Center (NCDC) data for the period from 1971 through 2000, as reported by the Midwest Regional Climate Center (MRCC, http://mrcc.isws.illinois.edu/), the normal annual precipitation in Owensboro is 45.07 inches. Precipitation is well distributed throughout the year, on average, but can be highly variable from month-to-month. Monthly normal precipitation varies from 2.67 inches in October to 4.66 inches in May. However, monthly extremes during the period from 1928 through 1990 ranged from 0.06 inches in October 1987 to 16.15 inches in March 1964.

Mean annual potential evapotranspiration in Owensboro is between 31 and 33 inches, according to mapped data available from the Kentucky Climate Center (http://www.kyclimate.org/ index.html). The adjusted annual potential evaporation estimated in the Landfill Application Package (AEP 1984, Table 10), based on climatic data from Tell City, was 32.22 inches per year. The mean monthly water balance developed for the landfill resulted in the following breakdown (AEP 1984, Table 11) for an estimated annual precipitation of 44.27 Inches:

- Surface Runoff – 13.23 inches (30%);
- Actual Evapotranspiration – 25.69 inches (58%);
- Percolation (groundwater recharge) – 5.44 inches (12%).

2.4.2 Regional and Local Geologic Setting

2.4.2.1 Physiography and Drainage

The area of Rockport lies in the western Interior Low Plateau physiographic province of the United States, in a subarea referred to as the Wabash Lowland. It is an area of broad alluviated valleys and dissected uplands of rolling to hilly terrain with gentle slopes and moderate relief (Ray 1965). The topography in the vicinity of the Rockport Plant is shown on the U.S. Geological Survey (USGS) topographic map reproduced in **Figure 4**. Elevations on the map are shown relative to Mean Seal Level (MSL, also known as the National Geodetic Vertical Datum of 1929, or NGVD29).

Drainage in the area is provided by the Ohio River, which is adjacent to the plant property on the southeast, is over 2,000 feet wide in the vicinity of the plant, and flows to the southwest toward Owensboro, Kentucky. The plant property slopes gently across a terraced surface from elevations greater than 410 feet on its northern edge, where it is bordered by low hills and an upper terrace, to about 390 feet along the top of the bank of the Ohio River. Much of the property is drained by Honey Creek, which flows south-southeast to the Ohio River and is incised down to an elevation of about 380 feet. The power generation plant was developed on the portion of the property between US 231 on the west and Honey Creek on the east. It is located on a watershed divide between Honey Creek and an unnamed tributary offsite to the southwest.

The natural topography over most of the property (outside the channel of Honey Creek) prior to development of the power plant consisted of a relatively flat terrace surface marked by east-west oriented crests and swales. Multiple low-gradient drainage ditches crossed the area, connecting the two watersheds (Honey Creek and the watershed to the west). Regrading for development of the power plant and associated facilities (including construction of the wastewater pond complex) disrupted some of the existing natural drainage as well as the man-made drainage that existed on the surface of the terrace and is still depicted on the USGS topographic map in **Figure 4**.

2.4.2.2 Geology

The area of the site lies in the southern portion of a broad shallow downwarp structure referred to as the Illinois Basin (also known as the Eastern Interior Basin), and is underlain by sedimentary bedrock of Pennsylvanian age. The bedrock underlying the site and most of Spencer County is the Pennsylvanian age Raccoon Group, consisting of sandstone and shale with minor amounts of mudstone, coal and limestone (Grove 2006). The rock reported from onsite borings that extended through the unconsolidated overburden into bedrock has been described primarily as shale. The boring for bedrock wells finished at the MW-5 location (at the landfill) encountered interbedded sandy claystone, sandy shale, limestone, coal and claystone.

The bedrock surface beneath the overburden is uneven, and includes rounded hills, ridges and valleys (draining southeast) representing the erosional surface that existed prior to filling of the valley with glaciofluvial sediments.

The geology of the near-surface unconsolidated Quaternary sediments associated with the Ohio River valley is depicted on the geology map in **Figure 5** (which excludes the far east portion of the Plant property), and is described in detail by Ray (1965). These sediments range in thickness from about 20 feet on northern sections of the property, to as much as 130 feet along the Ohio River west of the mouth of Honey Creek. They include windblown sediments (loess) up to 30 feet thick that mantle bedrock on the northeast perimeter of the property, possibly merging with lacustrine deposits in the tributary valley at the northwest corner of the property, and two series of Wisconsin age valley-train deposits (Tazewell and Cary) under most of the property. The valley-train sediments that fill the broad river valley were deposited by meltwater from retreating continental glaciers to the north and northeast, and were subsequently reworked by modern drainage systems, including the Ohio River and the Honey Creek drainage on the plant property.

Generally, the valley train deposits thicken and coarsen to the southeast, from the loess-mantled bedrock hills along the valley wall, toward and beyond the course of the modern Ohio River. In the subsurface, the valley train sediments typically coarsen downward, and can be classified generally into finer-grained sediments near the surface (including silt, sandy silt, silty clay and clay), and coarser-grained sediments (fine to coarse sand and some gravel) at depth.

Interpretive cross-sections of the subsurface were generated by AEP from data collected in the 1983 Site Investigation of the landfill area. In the report of the Site Investigation included in the Landfill Application Package (AEP 1984), the unconsolidated sediments encountered above bedrock were grouped into four units, described below in descending order:

- Unit No. 1 – surficial silt and clay. This unit was found to be 2 to more than 15 feet thick. The upper section is predominantly silty, sandy clay that is stiff, and of low to medium plasticity. Very fine-grained sand and silt are stratified with the clay toward the bottom of the unit, suggesting a lacustrine depositional environment where these finer-grained deposits are thickest.
- Unit No.2 – well sorted sand. This unit, where present, was found to extend from the bottom of the fine-grained surficial unit to elevations of 373-376 feet. It was found to consist of fine to medium-grained, well-sorted subangular to subrounded quartz sand.
- Unit No. 3 – poorly sorted sand. This lower sand unit, consisting of poorly sorted, very fine to very coarse-grained sand, is the dominant unit between elevations of 373-376 feet and the underlying bedrock, which is typically found at elevations of 290 to 300 feet under most of the property, and at shallower depths in the north and northwest portions.
- Unit No. 4 – sand and gravel. Unit No. 4, consisting of poorly sorted sand, gravel and gravelly sand, was found to be gradational with Unit No. 3, and to occur as lenses within Unit No. 3. Gravel in this unit is subangular to rounded, ranges in size from 3/8 to 1 inch in diameter, and commonly contains coal particles.

In 2010, AEP installed four monitoring wells at the perimeter of the wastewater pond complex. The lithologic borings for those wells were extended 39 to 46 feet below ground surface (BGS), at elevations of 351 to 359 feet, and did not encounter bedrock. The surficial silt and clay in these borings was found to be 16 to 24 feet thick, extending down to elevations of 373 to 381 feet. The underlying sand was described as primarily fine, grading downward to medium in one boring, and with gravel occurring in the sandy matrix below depths of 28 to 40 feet BGS in three borings.

Monitoring wells installed in 2016 and 2017 around the BA Ponds extended to bedrock and confirmed the lithology described above. Details of the 2016 well installations, along with interpretive cross-sections, are provided in the report in **Appendix D**. Boring logs and monitoring well construction logs for the 2017 well installations are provided in **Appendix E**. Based on the data available from the 2016 and 2017 subsurface explorations the fine-grained sediments corresponding to Unit No. 1 extend down to elevations of 369 to 385 feet in the vicinity of the ponds. The well-sorted sand unit corresponding to Unit No. 2 occurs below the fine-grained surficial sediments, extending down to elevations of 356 to 369 feet. Units No. 3 and 4 (interlayered) were found to extend down to shale bedrock at elevations of 274 to 299 feet.

2.4.2.3 Hydraulic Properties of Principal Groundwater Flow Zone

The saturated section of the unconsolidated sand and sand and gravel body comprising subsurface Unit Nos. 2, 3 and 4 (as described in the preceding section) makes up the principal groundwater flow zone underlying the site. This zone is hydraulically connected to the Ohio River but the connection is buffered by lower-permeability sediments that line the river bottom. Because of its relatively high permeability and its connection to the Ohio River, this zone represents an aquifer capable of supplying large yields to pumping wells. The depth to water in this zone typically ranges from 20 to 35 feet BGS, and the saturated thickness (which generally increases toward the river) ranges from less than 15 feet to more than 80 feet.

Groundwater occurs in this zone under unconfined conditions, or semi-confined conditions where the surficial silt and clay directly overlies the saturated zone.

AEP provided information concerning pumping tests of varying lengths performed in this zone using onsite supply wells, including a pumping test performed in 1977 that was documented in the Landfill Application Package (AEP 1984), a pumping test performed in 2004 at a new supply well installed at the landfill for flow augmentation, and yield tests performed in 2011 and 2012 at two new replacement wells used for fire water supply. Based on the information reviewed, the principal groundwater flow zone underlying the site has a transmissivity ranging from 126,000 to 250,000 gallons per day per foot (gpd/ft), corresponding to 17,000 to 34,000 square feet per day (ft2/day). The hydraulic conductivity of the formation ranges from 420 to 560 feet per day (ft/day), and the storage capacity (specific yield) ranges from 0.07 to 0.22. Pumping well yields range up to 1,000 gallons per minute (gpm), and specific capacities range from 48 to 121 gpm per foot of drawdown (gpm/ft).

2.4.3 Surface Water and Surface Water-Groundwater Interactions

The Ohio River at Owensboro drains a watershed of 97,000 square miles and the average flow is 121,200 cubic feet per second (cfs), according to Ray (1965). The stage in this section of the river is maintained by a downstream dam in Newburgh, Indiana above a minimum pool elevation of about 357.4 feet MSL (358 feet relative to the Ohio River Datum). The AEP Rockport Plant, located at River Mile (RM) 744-745, is halfway between the Newburgh Dam (RM 776) and the upstream Dam at Cannelton (RM 721). The river level at the Rockport Plant can be estimated by averaging the gauge data reported by the US Army Corps of Engineers (USACE) at Newburgh and Cannelton. A hydrograph (graph of water level over time) of the estimated daily stage in the Ohio River at the Rockport Plant from 2010 through 2015 is provided in **Appendix C-1**.

The water level in the Ohio River typically remains close to pool elevation in the summer and fall, and fluctuates at a relatively high frequency (for a few days to weeks), up to 20 feet above pool elevation, in the winter and spring months. The river stage typically reaches an elevation of 377 feet at least once in most years. The elevation of the 10-year flood is 387.7 feet, the 100-year flood level is 392 feet, and the level of the highest flood of record in the area (the flood of 1937) is 397 feet.

Groundwater levels and gradients in the glaciofluvial (valley train) sediments that fill the valley are strongly influenced by the Ohio River. Under low-water (pool) conditions, groundwater in the sediments flows under a low gradient toward the Ohio River. As the river level fluctuates in winter and spring, groundwater levels fluctuate along with it, although the effects are increasingly dampened with distance from the river. During rapid rises in river level, the groundwater gradient can be temporarily reversed to some distance from the river bank, resulting in excess groundwater being stored in the sediment (bank storage), and then draining slowly back toward the river again as the river stage falls.

2.4.4 Water Users

The Indiana Department of Natural Resources (IDNR) Division of Water maintains an online database of Significant Water Withdrawal Facilities (http://www.in.gov/dnr/water/4841.htm). A Significant Water Withdrawal Facility (SWWF) is defined as a facility that has the capacity to withdraw more than 100,000 gallons per day (gpd) in aggregate from surface water and/or groundwater, through one or more registered “sources” (individual pumping wells or stations). There are 10 SWWFs registered in Spencer County, of which the AEP Rockport Plant has the highest capacity.

2.4.4.1 Onsite Water Use

The main source of water used at the plant is the Ohio River. The plant's registered capacity for surface water is 80,000 gpm. According to the IDNR database, in 2011 the plant's actual average usage of river water was 22.3 million gallons per day (mgd), corresponding to an average surface water withdrawal of 15,500 gpm.

The plant also has seven registered water withdrawal wells. The locations of these supply wells are shown on **Figure 2**. The combined average withdrawal from these wells in 2011 was 0.59 mgd (410 gpm). Information available for the onsite water supply wells is summarized below (withdrawal rates are based on 2011 data available in the IDNR database):

- Wells PW-1 and PW-2 are used for plant potable supply. The combined average withdrawal rate for these two wells is approximately 120 gpm.
- Wells PW-3 and PW-4 are used for fire water supply as well as industrial supply. The combined average withdrawal rate for these two wells is approximately 120 gpm.
- Well PW-5 was installed on the west side of US 231 and was intended to be used for landscape watering around an energy education center constructed by AEP at that location. The well is inactive (no withdrawals since it was installed).
- PW-6 is a well installed immediately east of the landfill to fill water trucks used for dust control. The average water withdrawal rate for this well is 17 gpm.
- PW-7 is a well installed southeast of the landfill to provide water for treating landfill leachate through flow augmentation prior to discharge, as required under the plant's NPDES permit. The average water withdrawal rate for this well is 39 gpm.

2.4.4.2 Offsite Water Users

The other nine SWWFs in Spencer County include the following:

- The City of Rockport public supply (five wells with a combined capacity of 1,163 gpm).
- The Town of Grandview public supply (two wells with a combined capacity of 970 gpm).
- Reo Water, Inc., public supply for the City of Richland, west of Rockport (five wells with a combined capacity of 1,130 gpm).
- The City of Boonville public supply, northwest of Rockport (four wells with a combined capacity of 2,050 gpm).
- Corn Island Shipyard, a marine barge manufacturer on the Ohio River in Grandview (one well with a capacity of 450 gpm).
- Three agricultural irrigation users (Christmas Lake GC, Loehr Farms and Allen Gray LP II), all located remotely from the AEP Rockport Plant.
- One coal washing operation (Buckhorn Processing) using surface water, located in Lamar, Indiana north-northwest of the AEP Plant.

The Ohio River navigation charts (USACE 2014) show surface water intakes and other major structures along the river. The charts for sections of the river adjacent to and immediately downstream of the AEP Rockport Plant show the industrial intakes for the AEP plant and Rockport Terminals (a coal barging facility), and shoreline facilities in Rockport for one commercial marina, two crushed stone operations, and two loading facilities (ADM and Coal Inland).

3.0 Monitoring Network Evaluation

3.1 Hydrostratigraphic Units

Based on the available information, two generalized hydrostratigraphic units can be distinguished within the unconsolidated subsurface materials of the AEP Rockport Plant.

The upper unit (corresponding to the unit identified as Unit No. 1 in previous work by AEP, discussed above in Section 2.4.2.2), consists of surficial silt and clay (locally containing sand). It is typically 8 to 25 feet thick, and is generally not saturated. However, it can serve as a perching layer above which water can accumulate in surface depressions or in more permeable surface fill. Soil sampling and permeability testing performed as part of the 1983 landfill Site Investigation indicates the bulk vertical permeability of the material in this unit is on the order of 10-7 to 10-6 centimeters per second (cm/sec), or 0.003 to 0.0003 ft/day.

The lower unit (corresponding to combined Unit Nos. 2, 3 and 4, as discussed above in Section 2.4.2.2) extends from the bottom of the surficial silt and clay to the top of bedrock, and consists of granular outwash deposits. These deposits consist primarily of sand, ranging from well-sorted fine sand to poorly-sorted fine to coarse sand, with lenses of gravelly sand and sandy gravel. This unit has an uneven bottom surface, but generally thickens to the southeast, toward the Ohio River. The lower section of this unit is saturated and represents the principal groundwater flow zone beneath the property. The saturated thickness in this unit ranges from less than 15 to more than 80 feet, and the bulk horizontal permeability (hydraulic conductivity) of this unit is on the order of 500 ft/day.

Bedrock underlying the unconsolidated deposits consists predominantly of shale, and is expected to have low permeability. Bedrock in the area of the Rockport Plant does not represent a significant medium for flow or storage of recently recharged (meteoric) groundwater, and is not a reliable source of fresh water supply, relative to the much more available source in the sandy overburden.

3.1.1 Horizontal and Vertical Position Relative to the CCR Unit

The BA Ponds have design bottom elevations of 386 feet (West BA Pond) and 377 feet (East BA Pond). This is the reported elevation of the interface between CCR and the underlying material. The underlying material consists of native sediments, locally supplemented with addition of clay soil excavated from the interior of the ponds and used to line the sides and possibly the bottom of the ponds (if needed).

Stratigraphic information for the subsurface in the area of the wastewater pond complex is provided in the logs available for several soil borings advanced in 1977 (**Appendix A**), 2010 (**Appendix B**), early 2016 (**Appendix D**), and 2017 (**Appendix E**). Subsurface stratigraphy is also illustrated in the cross-sections developed from the boring logs for the new monitoring wells installed in 2016 (**Figures 5-7** in **Appendix D**).

The interface between the two uppermost native hydrostratigraphic units (surficial silt and clay, and underlying sand) is transitional, usually encompassing several feet of interlayered sandy and silty beds. However, it is apparent that the interface slopes to the south, from approximate elevations of 380-386 feet on the north and east (MW-1600, MW-1601, MW-1602 and MW-1002, MW-1603, MW-1001, BH-363, BH-366) to elevations of 369-377 feet on the south and southwest (MW-1606, MW-1605, MW-1606, MW-1003, MW-1004, BH-364, BH-365). A comparison of the reported pond bottom elevations to these data indicates there is at least 9 feet of native fine-grained sediments underlying the south end of the West BA Pond, and 4 feet under the north end of the West BA Pond. However, native fine-grained sediments may be thin or absent below the south end of the East BA Pond, which has a design bottom elevation of 377 feet.

3.1.2 Piezometric Conditions

Groundwater level data are available from piezometric measurements made from 2010 to 2016 in four monitoring wells (MW-1001 through MW-1004) installed in 2010 at the perimeter of the wastewater pond complex. Well construction details are summarized in **Table 1**, and well construction logs are provided in **Appendix B**. The wells are finished at depths of 38.0 to 45.5 feet BGS, with 10 feet of screen set close to the top of the lower sandy unit (approximately 10 feet below the bottom of the silt and clay deposits). The well piezometric data are provided in **Appendix C**, along with hydrographs (graphs of water levels over time) for the wells and the Ohio River, and piezometric maps for selected events. The available data include eight monitoring events conducted semi-annually in May and November, from May 2011 to May 2015 (except for May 2012, for which piezometric data are missing). In **Appendix D** (**Table 2** and **Attachment 3**), the piezometric data set has been updated with water level readings collected by Wood in early 2016 (in January in the 2010 wells, and on March 17 in the 2010 and 2016 wells). In **Appendix E**, the piezometric data set has been updated with water level readings collected by Wood following installation of additional wells in 2017.

The piezometric data for the four initial monitoring wells installed in 2010 show that water levels vary seasonally, typically fluctuating between 1 and 2.5 feet in an individual well, with higher water levels in May and lower water levels in November. This is consistent with river levels, which are low in summer and fall, and spike to higher levels for short periods in winter and spring. In the three wells closest to the BA Ponds (MW-1001 through MW-1003), groundwater levels occur most commonly between elevations of 367 and 370 feet, in sand or sand and gravel below the surficial silts and clays (see **Figures 5-7** in **Appendix D**). This is more than 7 feet below the design bottom of the East BA Pond (the deeper pond), and more than 9 feet above the river low pool elevation of 357.4 feet. In six of the eight monitoring events between collected from 2011 to 2015, the hydraulic gradient was toward the river, to the east-southeast, with water elevations occurring in descending order in the wells as follows: MW-1001, MW-1003, MW-1002, and MW-1004. In the last event (7 May 2015), the water level elevations in all four wells were within 0.60 feet of each other, and the highest water levels were observed in the middle wells (MW-1003 and MW-1002), reflecting a shallow divide most likely related to a spike in river level that was subsiding at the time of the monitoring (river gauge data not available for that period). The first event (17 May 2011) was conducted during a period of very high river levels: the Ohio River had spiked at 387.7 feet (the 10-year flood level) on April 28, and had dropped to 366.6 feet on 17 May. The water levels in the wells were lagging slightly behind the river, ranging from 376.13 feet in MW-1004 (closest to the river) to 371.61 feet in MW-1001 (farthest from the river), with the middle wells MW-1002 and MW-1003 (closer to the BA Ponds than MW-1004) having water levels of 373.20 and 373.72 feet respectively.

In early 2016, 20 new monitoring wells were installed in seven clusters of three wells each (including well MW-1002 installed in 2010). Water level elevations measured between January and March 2016 ranged between approximately 368 and 370 feet. A round of water level measurements was made after well construction was completed, on 17 March 2016 (**Table 2** and **Figure 3** in **Appendix D**). Piezometric levels measured on that date ranged between 369.09 and 370.20 feet, corresponding to a slight gradient to the east. Differences in water level elevations between wells in a single cluster were small, ranging from 0.01 to 0.33 feet, and averaging 0.08 feet.

Based on the available data and the analysis described above, a water level elevation of 374 feet can be considered a high groundwater level, and a level of 372 feet can be considered a typical seasonal high water level, in the sandy outwash deposits beneath the BA Ponds.

3.1.3 Overall Flow Conditions

The principal groundwater flow zone underlying the ponds is the lower overburden unit consisting of granular outwash deposits (poorly sorted sand with interlayered sand and gravel). Recharge into this unit occurs laterally from hills and buried tributary valleys to the north-northwest. Recharge also occurs from the Ohio River to the southeast during relatively brief periods (spikes) of high water level in the river. Areal recharge also occurs vertically from the surface. The rate of areal recharge varies locally according to the thickness and bulk permeability of the overlying silt and clay unit. Artificial recharge can also occur from units containing standing surface water, such as the wastewater pond complex including the BA Ponds (when they contain water), depending on the hydraulic separation provided by natural materials and engineered soil lining the bottoms of these units.

Groundwater flow in this zone is predominantly to the east-southeast, toward the Ohio River. Flow reversals occur during brief periods of high river level, but are temporary, without long-term effects on flow or migration of constituents in groundwater. Supply wells are present to the north and northeast of the BA Ponds, but these wells pump intermittently, at rates that are insufficient to affect flow directions at significant distances from the pumping centers.

Based on available data, the estimated hydraulic gradient (i) under typical flow conditions is 0.0015 feet/foot, and the hydraulic conductivity (K) is on the order of 500 ft/day. Assuming an effective porosity (n) of 0.20, the average flow velocity (v) can be estimated from the Darcy flow equation [$v = (Ki)/n$] as 3.75 ft/day, or 1,370 ft/year. Given the occurrence of temporary flow reversals in most years, the actual rate of groundwater flow toward the river would be expected to be somewhat less.

3.2 Uppermost Aquifer

3.2.1 CCR Rule Definition

As defined in the federal CCR Rule (§257.53 Definitions):

- *Aquifer* means a geologic formation, group of formations, or portion of a formation capable of yielding usable quantities of groundwater to wells or springs.
- *Groundwater* means water below the land surface in a zone of saturation.
- *Uppermost aquifer* means 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 ground surface to which the aquifer rises during the wet season.

3.2.2 Identified Onsite Hydrostratigraphic Unit

Consistent with the definition in the CCR Rule, the hydrostratigraphic unit identified as the uppermost aquifer in this case is the saturated granular outwash deposit that underlies the Rockport Plant property including the BA Ponds. The top of this unit would be the typical seasonal high water level of 372 feet, 27 feet below the crest elevation of the pond embankments (399 feet).

The bottom of the unit would be the top of bedrock. The shale bedrock underlying the granular outwash deposits does not represent a significant groundwater flow zone. The bedrock surface in the vicinity of the pond is irregular, generally sloping to the southeast, and occurs at elevations of 274 to 300 feet (111 to 126 feet immediately below the BA Pond embankment crest level). The saturated thickness of this unit, therefore, is expected to range from 70 to 100 feet, thickening to the southeast.

3.3 Review of Existing Monitoring Network

3.3.1 General CCR Rule Requirements

In summary, the performance standard for groundwater monitoring systems in the CCR Rule (§257.91) states that the system should consist of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that:

- Accurately represent the quality of background groundwater, and
- Accurately represent the quality of the groundwater passing the waste boundary of the CCR unit in the uppermost aquifer, and
- Monitor all potential contaminant pathways.

The following sections review the existing groundwater monitoring network at the BA Ponds in terms of these requirements.

3.3.2 Monitoring Wells Installed in 2010

Four shallow monitoring wells (MW-1001 through MW-1004) were installed in 2010 at the perimeter of the wastewater pond complex. Three of the wells are located adjacent or close to the BA Ponds; MW-1004 is located farther downgradient, at the southeast corner of the wastewater pond complex.
Well construction details are summarized in **Table 1**, and well construction logs are provided in **Appendix B**. Well piezometric data are provided in **Appendix C**. The 2010 monitoring wells are finished at depths of 38.0 to 45.5 feet BGS, with 10 feet of screen set approximately 10 feet below the bottom of the silt and clay deposits, and close to the top of the uppermost aquifer. Well bottom elevations range from 360 feet in MW-1001 to 353 and 352 in MW-1002 and MW-1003 respectively.
A review of the available groundwater monitoring network for the BA Ponds was made in late 2015, and identified the following gaps:

- MW-1001, although located in an upgradient position relative to the BA Ponds, is not a suitable background monitoring well because it is installed through CCR (bottom ash in a thin layer at 9-10 ft BGS), and is located too close to the ponds given the occasional temporary reversals in groundwater flow direction.
- MW-1004 is located remotely from the BA Ponds, and MW-1003 is also offset from the waste boundary. Therefore, only one well (MW-1002) was located at a downgradient boundary, and a minimum of three downgradient wells are required by the CCR rule.
- There were no wells intercepting deeper flow zones within the uppermost aquifer (between elevations of 350 and 280 feet).

As a result of the review, it was recommended that MW-1002 be included in the downgradient monitoring network, and that the other three wells (MW-1001, MW-1003, and MW-1004) be retained for use as piezometers, to monitor groundwater levels and aide in the interpretation of flow directions.

3.3.3 Monitoring Wells Installed in 2016

Twenty new wells were installed in January-March 2016, in seven three-well clusters that include MW-1002. The clusters are designated MW-1600 through MW-1606, and locations are shown on the monitoring network layout map (**Figure 1** in **Appendix D**). Three wells are included in each cluster, finished at shallow (S), intermediate (I) and deep (D) levels. Well construction details for the monitoring wells installed in 2016 are provided in **Table 1** and **Attachment 1** of **Appendix D**.

3.3.3.1 Background Monitoring Well Locations

A significant challenge in monitoring this site is the occurrence of temporary flow reversals in the uppermost aquifer that underlies the BA Ponds. Data available for the existing wells indicate that the dominant flow direction in the uppermost aquifer is to the southeast, toward the Ohio River. However, during short-term spikes in river level, the direction of groundwater flow can be temporarily reversed so that, for a short period, groundwater under the BA Ponds will flow northwest, followed by a flattening of the gradient, and then a return to the dominant flow direction. In eight monitoring events over five years, the groundwater hydraulic gradient was to the southeast in six events, transitional (with a divide under the ponds) in one event (May 2015), and fully reversed under the full length of the wastewater pond complex in one event (May 2011).

Another short-term influence on groundwater flow direction is pumping from the plant's supply wells, which are located north and northeast of the BA Ponds. However, based on distance, intermittent pumping schedule, and relatively low rates of pumping from these wells (see Section 2.4.1.1 above), they are not expected to exert a significant influence on groundwater flow directions under the BA Ponds in the way that the river does. Based on review of river stage data, and experience at similar sites elsewhere along the Ohio River, flow reversals related to river stage would not be expected to last longer than two to three weeks. Based on the groundwater velocity estimated above in Section 3.1.3 (3.75 ft/day), contaminants would be unlikely to travel more than approximately 75 feet from the pond during a three-week flow reversal, even using liberal estimates of migration (not subject to adsorption in the formation matrix). However, to be conservative and account for dispersion, it was recommended that background monitoring wells be located at least 200 feet north-northwest of the BA Ponds. Final locations for the two sets of upgradient monitoring wells are shown on **Figure 1** in **Appendix D**. The background well clusters, designated MW-1600S/I/D and MW-1601S/I/D, are located approximately 1,000 feet and 850 feet, respectively, from the edge of the BA Ponds.

3.3.3.2 Downgradient Monitoring Well Locations

The East and West BA Ponds each have rough dimensions of 2,000 feet x 650 feet, corresponding to a surface area of approximately 30 acres each (60 acres total). The two BA Ponds are currently monitored as a single (multiunit) system. Downgradient monitoring wells are designated by cluster as MW-1602 through MW-1606, with MW-1002 included as the shallow well in the MW-1602 cluster. The downgradient monitoring well clusters were installed on the perimeter segments of the ponds in the dominant downgradient directions (east and south), as shown on **Figure 1** in **Appendix D**.

The downgradient wells were located as close as practical to the edge of the BA Ponds, just outside the road at the crest of the embankment, in order to be as close as possible to the *waste boundary* (defined in the CCR Rule as "the vertical surface located at the downgradient limit of the CCR unit, that extends down into the uppermost aquifer").

3.3.4 Monitoring Wells Installed in 2017

Six new monitoring wells were installed in September through October 2017, in two three-well clusters. The clusters are designated MW-1701 and MW-1702, and locations are shown on the monitoring network layout map (**Figure 1** in **Appendix E**). Three wells are included in each cluster, finished at shallow (S), intermediate (I), and deep (D) levels. Well construction details for the monitoring wells are provided in **Table 1** of **Appendix E**.

Water level data collected since November 2017 (**Table 2** in **Appendix E**) demonstrate that well clusters MW-1701 and MW-1702 are hydraulically upgradient of waste boundary wells at the BA Ponds, as discussed in Section 2.1.1, and confirm the previously documented dominant flow direction to the southeast, toward the Ohio River. As discussed in previous reports, a challenge in monitoring this site is the occurrence of temporary flow reversals during short-term spikes in river level with a flow velocity of approximately 3.75 ft/day in the north and westerly direction. Flow reversal duration is usually on the order of 2 to 3 weeks. Assuming a flow velocity of 3.75 ft/day, contamination would travel approximately 75 feet from the BA Ponds during a typical flow reversal. Background well clusters MW-1600 and MW-1601 are located approximately 1,000 feet and 850 feet, respectively, from the edge of the BA Ponds. Well clusters MW-1701 and MW-1702 are located approximately 925 feet and 2,700 feet, respectively, from the BA Ponds.

3.3.5 Vertical Screening Levels

The saturated thickness of the upper aquifer in the vicinity of the BA Ponds is 70 to 100 feet. The 2010 monitoring wells are screened across 10 feet in the top 20 feet of the saturated zone.

In order to monitor all potential contaminant pathways in the upper aquifer, the groundwater monitoring system includes monitoring wells at three depths (shallow, intermediate and deep) at each of the seven cluster locations (including the two upgradient locations and the five downgradient locations), for a total of 21 wells that can serve as piezometric and/or water quality monitoring points. This protocol was continued for the MW-1701 and MW-1702 well clusters bringing the total number of wells in the monitoring network to 27. The 27 clustered monitoring wells are supplemented by three shallow wells installed in 2010 (MW1001, MW-1003 and MW-1004), which can serve as additional piezometric monitoring points, to improve interpretation of groundwater flow directions.

Screen lengths in all of the wells are 10 feet (the maximum allowable screen length for clustered wells in the Indiana waste regulations), installed approximately at the following elevations: just above the bedrock surface (D level, between elevations of 275 and 309 feet), at a level approximately midway up in the saturated zone (I level, between elevations of 321 to 333 feet, and at a shallow level near the top of the saturated zone (S level, between elevations of 353 and 364 feet). The screen elevation at MW-1701D and MW-1702D are shallower than the deep interval screens in the rest of the well network due to bedrock elevations increasing to the north and west of the BA Ponds. This variation necessitated raising the intermediate screen level for MW-1701 and MW-1702 by approximately 10 feet in comparison to the rest of the monitoring network. The shallow screen intervals are generally consistent with the rest of the monitoring network.

3.3.6 Monitoring Well Construction and Maintenance

The monitoring wells are constructed of 2-inch flush-threaded Schedule 40 PVC riser and 10-slot screen. Monitoring well construction has been documented in detail in the report in **Appendix D**.

Monitoring wells should be maintained consistent with minimum Indiana requirements as well as the requirements of §257.91(e) of the CCR Rule, including:

- Monitoring wells and piezometers should be maintained to insure continued performance through the life of the monitoring program.
- Design, installation and development of any new wells, and repair of existing wells, should be documented, and documentation maintained in the operating record for the unit.
- All new wells, and existing wells having modifications made to the wellhead at the surface, should be surveyed to determine ground surface elevation and a reference point elevation for piezometric monitoring

- Abandonment or decommissioning of any wells or piezometers should be documented, and documentation maintained in the operating record for the unit.

3.3.7 Summary

Based on the information reviewed and presented in this report (including appendices), the groundwater monitoring network currently installed at the BA Ponds at the AEP Rockport plant can be considered appropriate under the requirements of the CCR Rule as a multiunit system for detection monitoring in the uppermost aquifer at the waste boundary.

4.0 P.E. Certification

By means of this certification, I certify that I have reviewed the available documents (discussed in this report) for the groundwater monitoring system at the existing BA Ponds at the AEP Rockport Plant located in Spencer County, Indiana, and have found that it meets the requirements in 40 CFR §257.91.

KATHLEEN D. REGAN
No. PE11400182

Kathleen D. Regan
Printed Name of Registered Professional Engineer

Kathleen D. Regan
Signature

11400182	Indiana	13 February 2019
Registration No.	Registration State	Date

5.0 References

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Table

Table 1
Monitoring Well Construction Details
Wastewater Pond Complex
AEP Rockport Plant, Rockport, Indiana

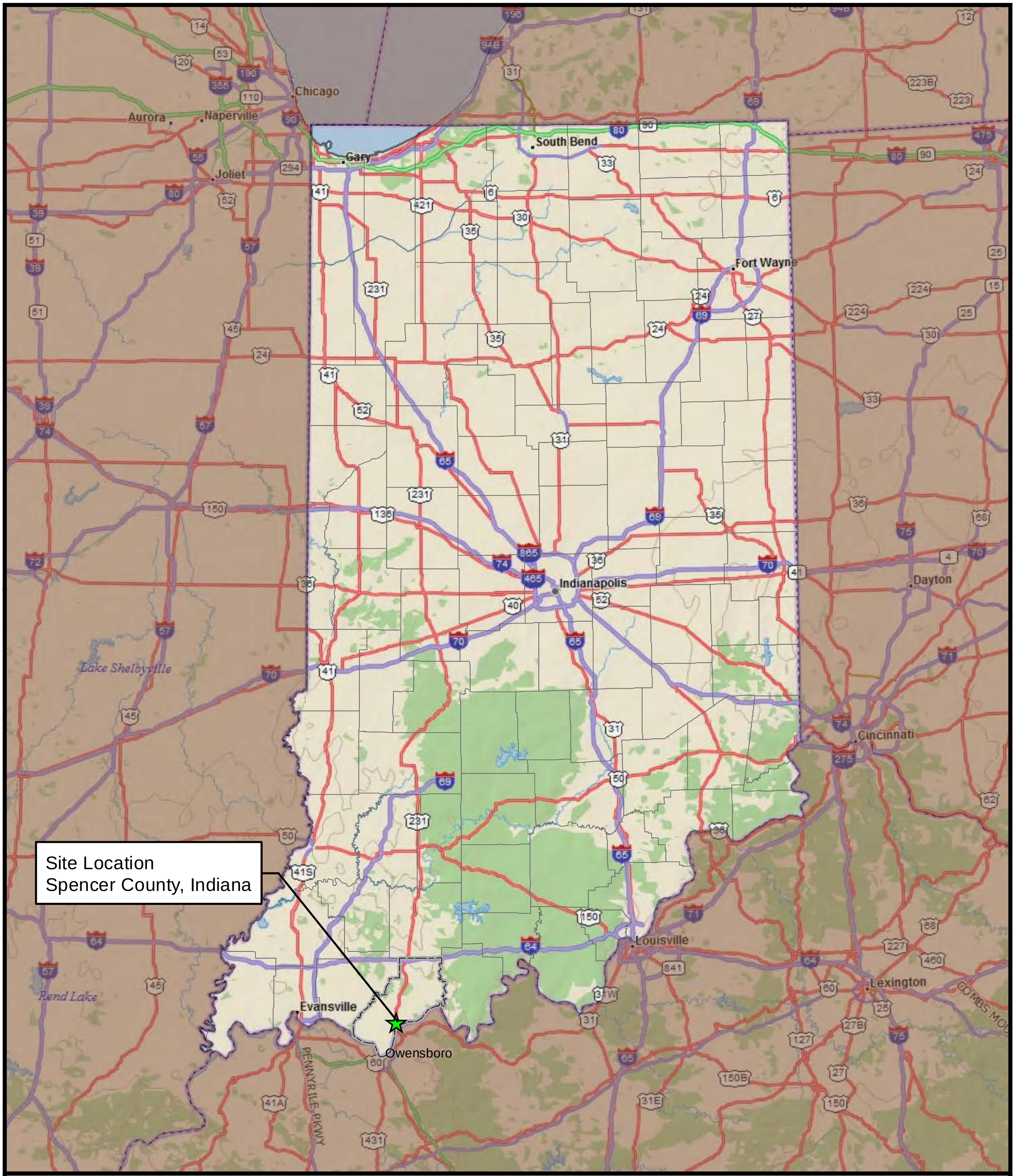
Well ID	Date Installed	Northing SPCS NAD27 (ft)	Easting SPCS NAD27 (ft)	Length of Screen (ft)	Casing Type	Casing Diameter (in)	Borehole Diameter (in)	Total Depth to Bottom of Well (ft BMP)	Total Depth to Bottom of Well (ft BGS)	Total Depth of Bore Hole (ft BGS)	Depth to Bedrock (ft BGS)
MW-1001	6/2/2010	153488.0	513047.6	9.7	PVC	2	6.25	42.3	40.0	41	no refusal
MW-1002	6/2/2010	152307.4	514231.0	9.7	PVC	2	6.25	47.8	45.5	46.5	no refusal
MW-1003	6/2/2010	151208.1	512820.7	9.7	PVC	2	6.25	40.4	38.0	39	no refusal
MW-1004	6/3/2010	150013.4	514264.7	9.7	PVC	2	6.25	44.8	42.5	43.5	no refusal

Well ID	Ground Surface Elevation (ft APD)	Top of Casing Elevation (ft APD)	Casing Stickup (ft AGS)	Top of Seal Elevation (ft APD)	Top of Sand Elevation (ft APD)	Top of Screen Elevation (ft APD)	Bottom of Screen Elevation (ft APD)	Bottom of Well Elevation (ft APD)	Bottom of Sand Elevation (ft APD)	Bottom of Borehole Elevation (ft APD)	Bedrock Elevation (ft APD)
MW-1001	400.03	402.35	2.3	374.33	372.33	370.33	360.63	360.03	359.03	359.03	no refusal
MW-1002	399.09	401.42	2.3	368.19	366.09	363.89	354.19	353.59	352.59	352.59	no refusal
MW-1003	390.84	393.23	2.4	368.04	365.14	363.14	353.44	352.84	351.84	351.84	no refusal
MW-1004	394.25	396.55	2.3	366.55	364.55	362.05	352.35	351.75	350.75	350.75	no refusal

Notes:

ft = feet
in = inches
BMP = below measuring point (top of casing)
BGS = below ground surface
APD = above plant datum
AGS = above ground surface

Figures



Site Location
Spencer County, Indiana

AMERICAN ELECTRIC POWER

Legend

★ Site Location

Service Layer Credits: Copyright:© 2015 DeLorme

0 40
Miles

NORTH

wood.

2456 Fortune Drive, Suite 100
Lexington, Kentucky 40509
Phone: (859) 255-3308

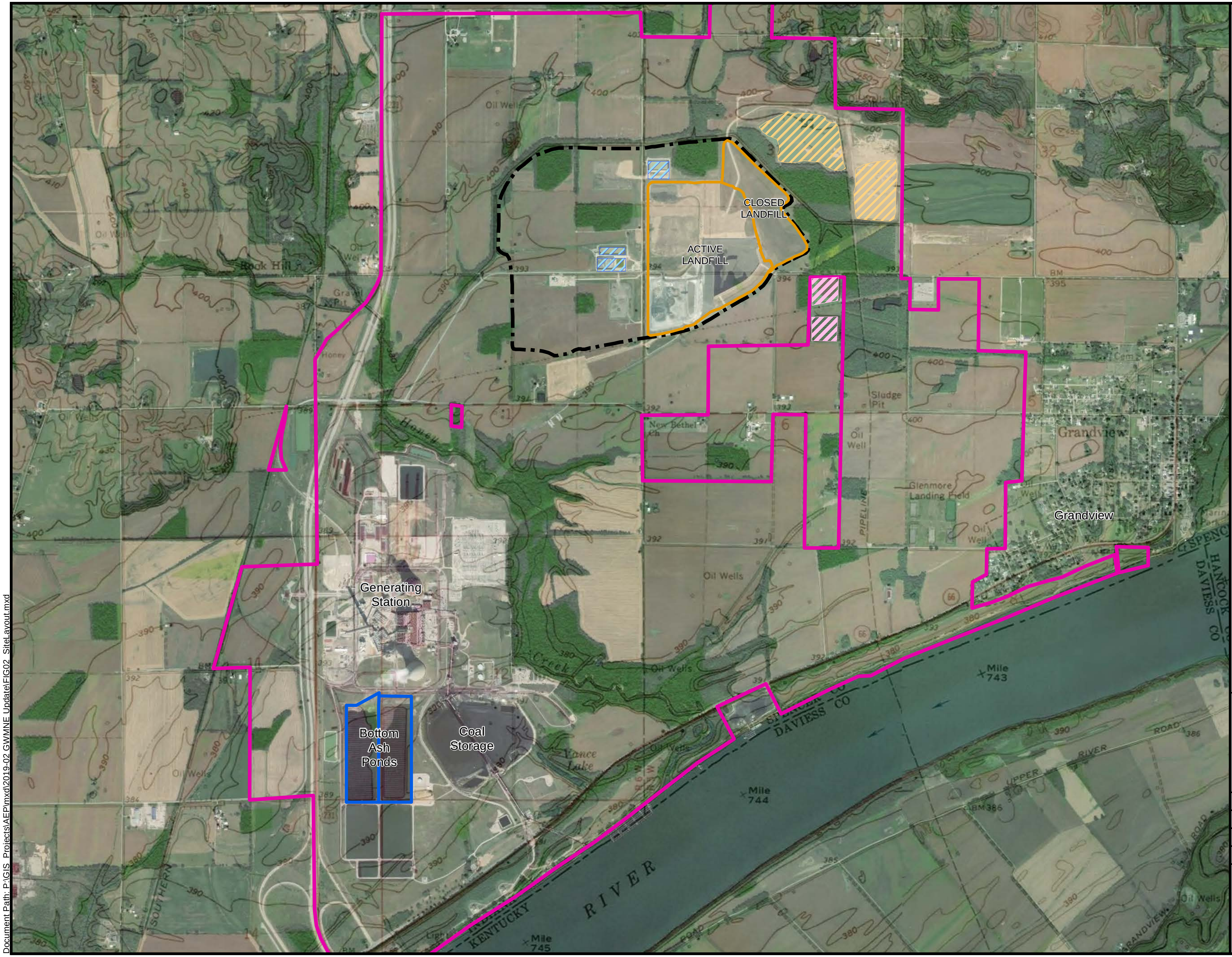
SITE LOCATION MAP

AEP - Rockport, IN

PROJECT NUMBER: 7362182624

SCALE 1" = 40 miles
DATE 2/11/2019
DRAWN BY TMR
APPROVED BY KDR

FIG.
1



Legend

- ▨ Stormwater Ponds
- ▨ Landfill Leachate Ponds
- ▨ Grandview Wastewater Ponds
- ☐ Property Boundary
- ☐ Bottom Ash Ponds (BAP)
- ☐ Landfill Area 1A (Active and Closed)
- ☐ 1984 Landfill Permit Boundary (Area 1)

Data Sources

Date of Photography: 2016
Source of Photography: U.S. Department of Agriculture, National Agriculture Imagery Program (NAIP)

USGS Rockport and Lewisport (IN/KY) Topographic Quadrangle Maps

0 900 1,800
SCALE IN FEET

SITE LAYOUT

AEP - ROCKPORT, IN

PROJECT NUMBER: 7362182624

SCALE	1" = 1,800'
DATE	9/4/2018
DRAWN BY	TMR
APPROVED BY	KDR

FIG. 2

wood.

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Lexington, Kentucky 40509
Phone: (859) 255-3308

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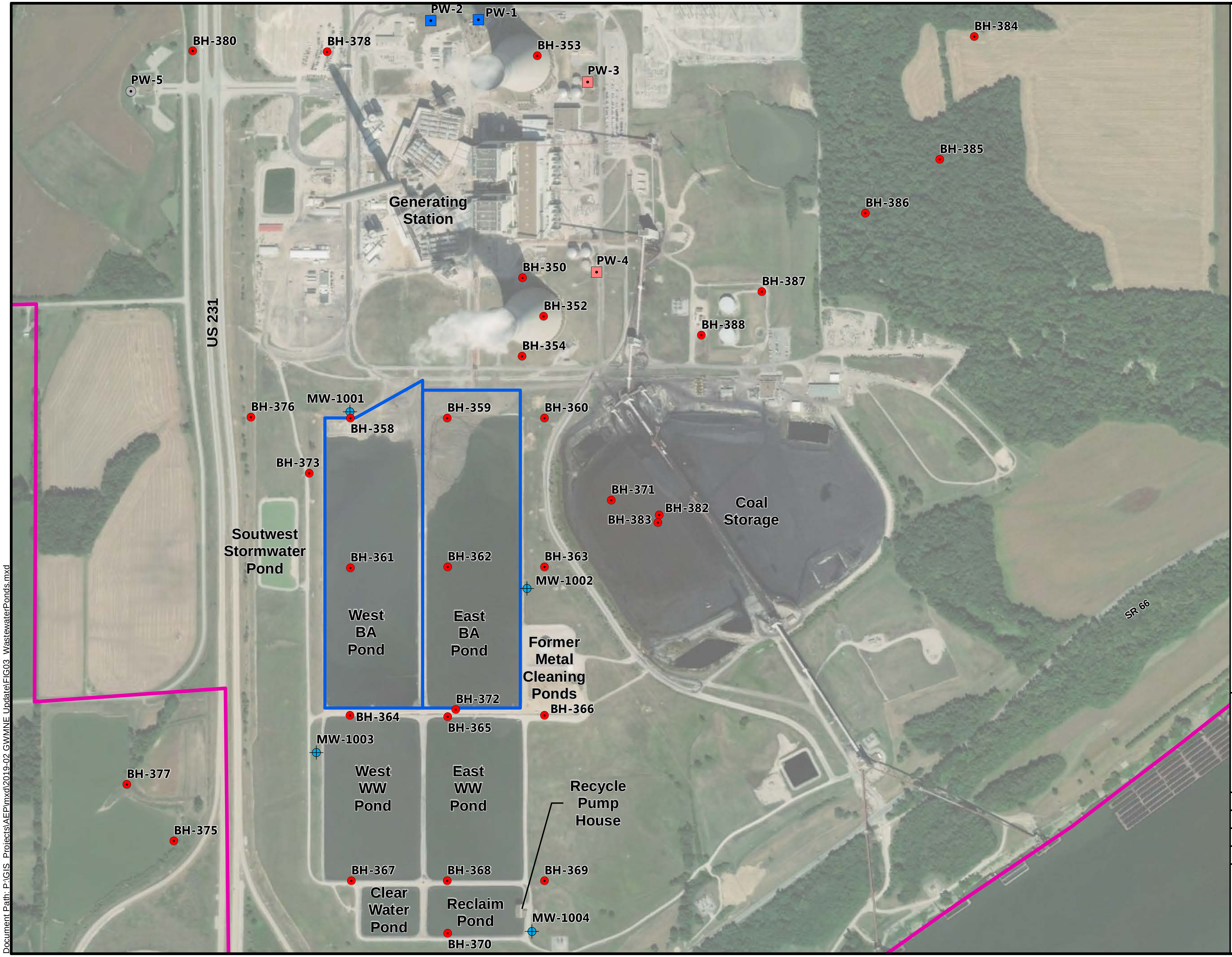

Legend

●	Geo_Borings
⌖	BAP - USWAG Monitoring Well
■	Plant - Potable Water Supply Well
■	Plant - Fire Water Supply Well
⊙	Inactive Water Supply Well
☐	Property Boundary
☐	Bottom Ash Ponds (BAP)

Data Sources

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Date of Photography: May-June 2016
Source of Photography: U.S. Department of Agriculture, National Agriculture Imagery Program (NAIP)

0 300 600
SCALE IN FEET

WASTEWATER POND COMPLEX

AEP - ROCKPORT, IN

PROJECT NUMBER: 7362182624

SCALE	1" = 600'	FIG. 3
DATE	2/11/2019	
DRAWN BY	TMR	
APPROVED BY	KDR	

wood.

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Lexington, Kentucky 40509
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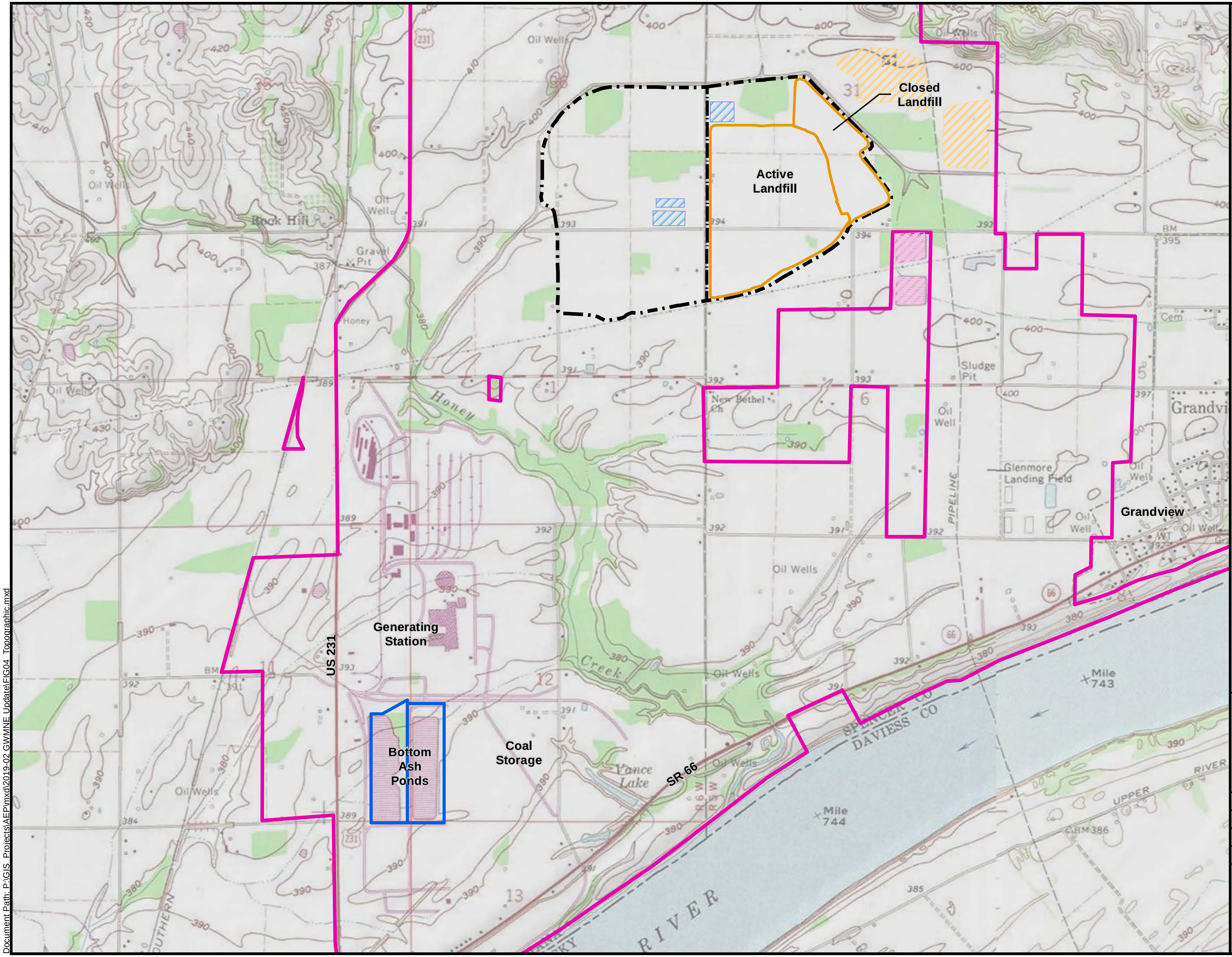

Legend

- ▨ Stormwater Ponds
- ▨ Landfill Leachate Ponds
- ▨ Grandview Wastewater Ponds
- ☐ Property Boundary
- ☐ Bottom Ash Ponds (BAP)
- ☐ Landfill Area 1A (Active and Closed)
- ☐ 1984 Landfill Permit Boundary (Area 1)

Data Sources

Service Layer Credits: Copyright:© 2013 National Geographic Society, i-cubed

Source: USGS Rockport and Lewisport (IN/KY) Topographic Quadrangle Maps, 1964, photorevised 1982

0 800 1,600
SCALE IN FEET

TOPOGRAPHIC MAP

AEP - ROCKPORT, IN

PROJECT NUMBER: 7362182624

SCALE	1" = 1,600'
DATE	2/11/2019
DRAWN BY	TMR
APPROVED BY	KDR

FIG. 4

wood.

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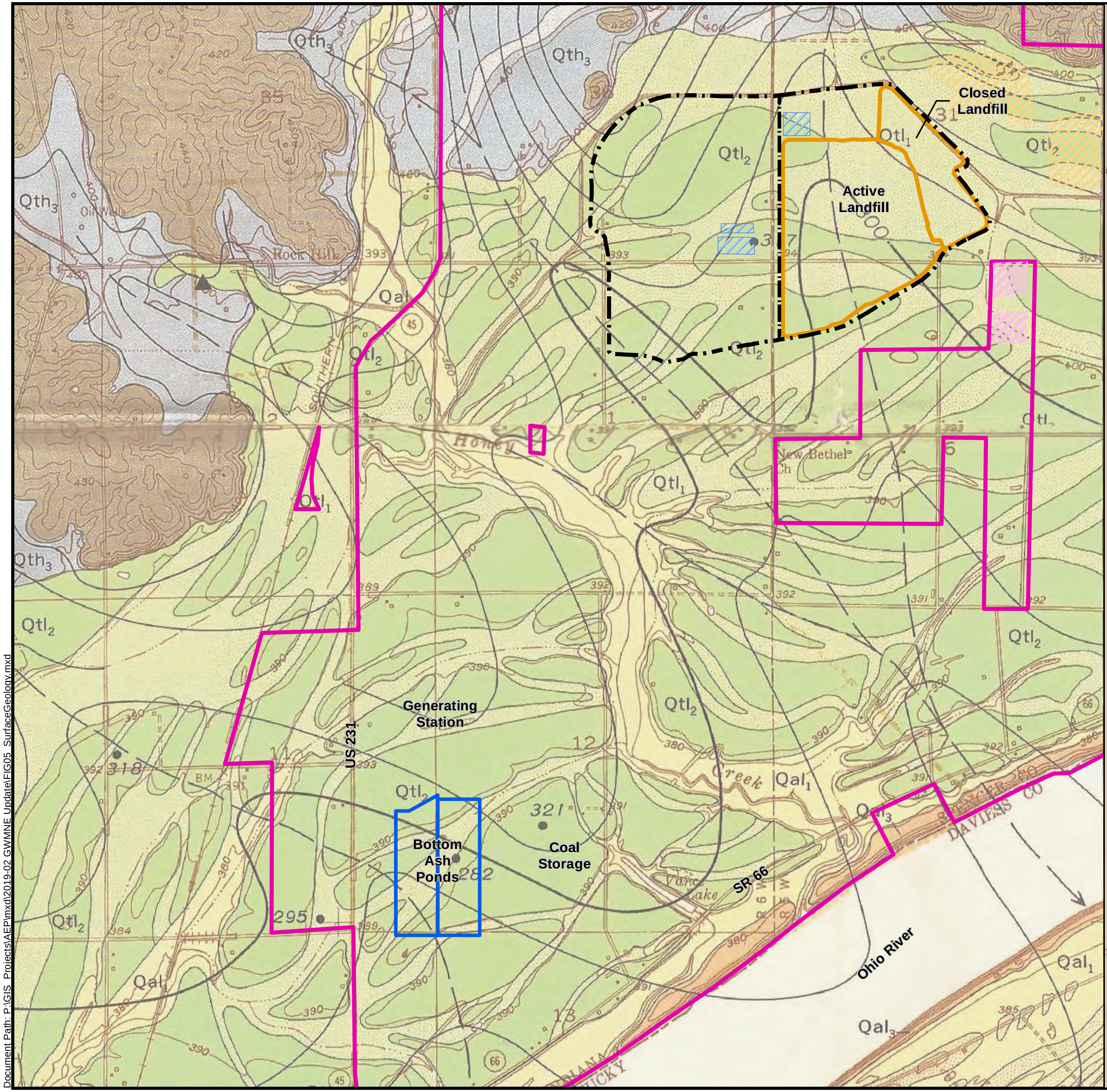

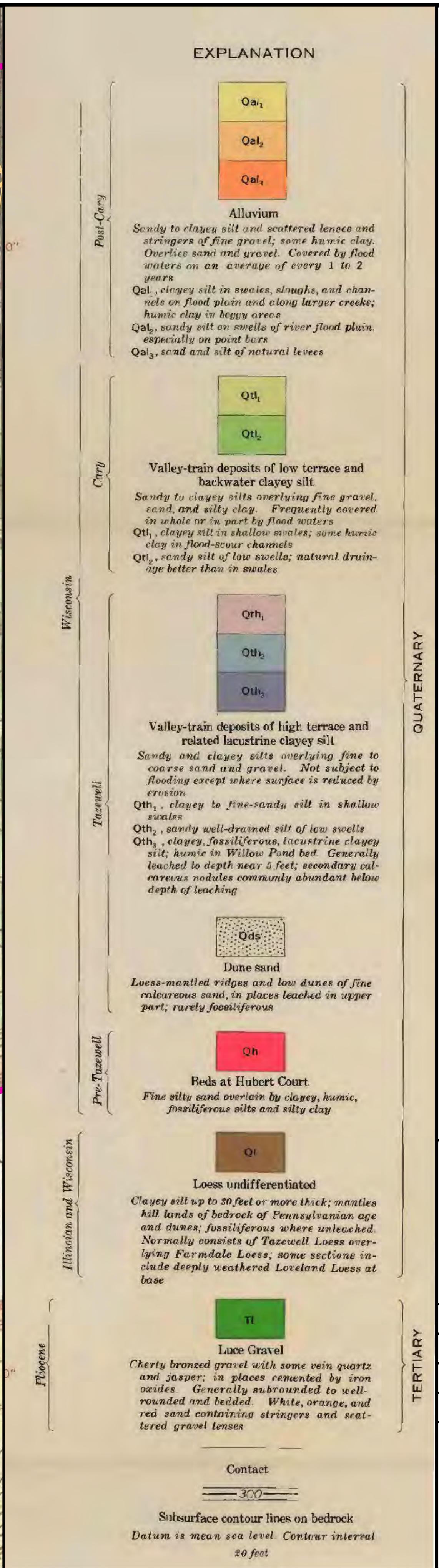

EXPLANATION

Qal1 / Qal2 / Qal3

Alluvium

Sandy to clayey silt and scattered lenses and stringers of fine gravel; some humic clay. Overlies sand and gravel. Covered by flood waters on an average of every 1 to 2 years

Qal1, *clayey silt in swales, sloughs, and channels on flood plain and along larger creeks; humic clay in boggy areas*

Qal2, *sandy silt on swells of river flood plain, especially on point bars*

Qal3, *sand and silt of natural levees*

Qtl1 / Qtl2

Valley-train deposits of low terrace and backwater clayey silt

Sandy to clayey silts overlying fine gravel, sand, and silty clay. Frequently covered in whole or in part by flood waters

Qtl1, *clayey silt in shallow swales; some humic clay in flood-scour channels*

Qtl2, *sandy silt of low swells; natural drainage better than in swales*

Qth1 / Qth2 / Qth3

Valley-train deposits of high terrace and related lacustrine clayey silt

Sandy and clayey silts overlying fine to coarse sand and gravel. Not subject to flooding except where surface is reduced by erosion

Qth1, *clayey to fine-sandy silt in shallow swales*

Qth2, *sandy well-drained silt of low swells*

Qth3, *clayey, fossiliferous, lacustrine clayey silt; humic in Willow Pond bed. Generally leached to depth near 5 feet; secondary calcareous nodules commonly abundant below depth of leaching*

Qds

Dune sand

Loess-mantled ridges and low dunes of fine calcareous sand, in places leached in upper part; rarely fossiliferous

Qh

Beds at Hubert Court

Fine silty sand overlain by clayey, humic, fossiliferous silts and silty clay

Ql

Loess undifferentiated

Clayey silt up to 30 feet or more thick; mantles hill lands of bedrock of Pennsylvanian age and dunes; fossiliferous where unleached. Normally consists of Tazewell Loess overlying Farmdale Loess; some sections include deeply weathered Loveland Loess at base

Tl

Luce Gravel

Cherty bronzed gravel with some vein quartz and jasper; in places cemented by iron oxides. Generally subrounded to well-rounded and bedded. White, orange, and red sand containing stringers and scattered gravel lenses

Contact

300

Subsurface contour lines on bedrock

Datum is mean sea level. Contour interval 20 feet

Legend

- ▨ Stormwater Ponds
- ▨ Leachate Ponds
- ▨ Grandview Wastewater Ponds
- ▭ Property Boundary
- ▭ 1984 Landfill Permit Boundary (Area 1)
- ▭ Landfill Area 1A (Active and Closed)
- ▭ Bottom Ash Ponds (BAP)

Data Sources

Source: Geologic Map of the Owensboro Quadrangle, Indiana and Kentucky, USGS Professional Paper 488, 1965

0 800 1,600

SCALE IN FEET

SURFACE GEOLOGY MAP

AEP - ROCKPORT, IN

PROJECT NUMBER: 7362182624

SCALE	1" = 1,600'	FIG. 5
DATE	2/11/2019	
DRAWN BY	TMR	
APPROVED BY	KDR	

wood.

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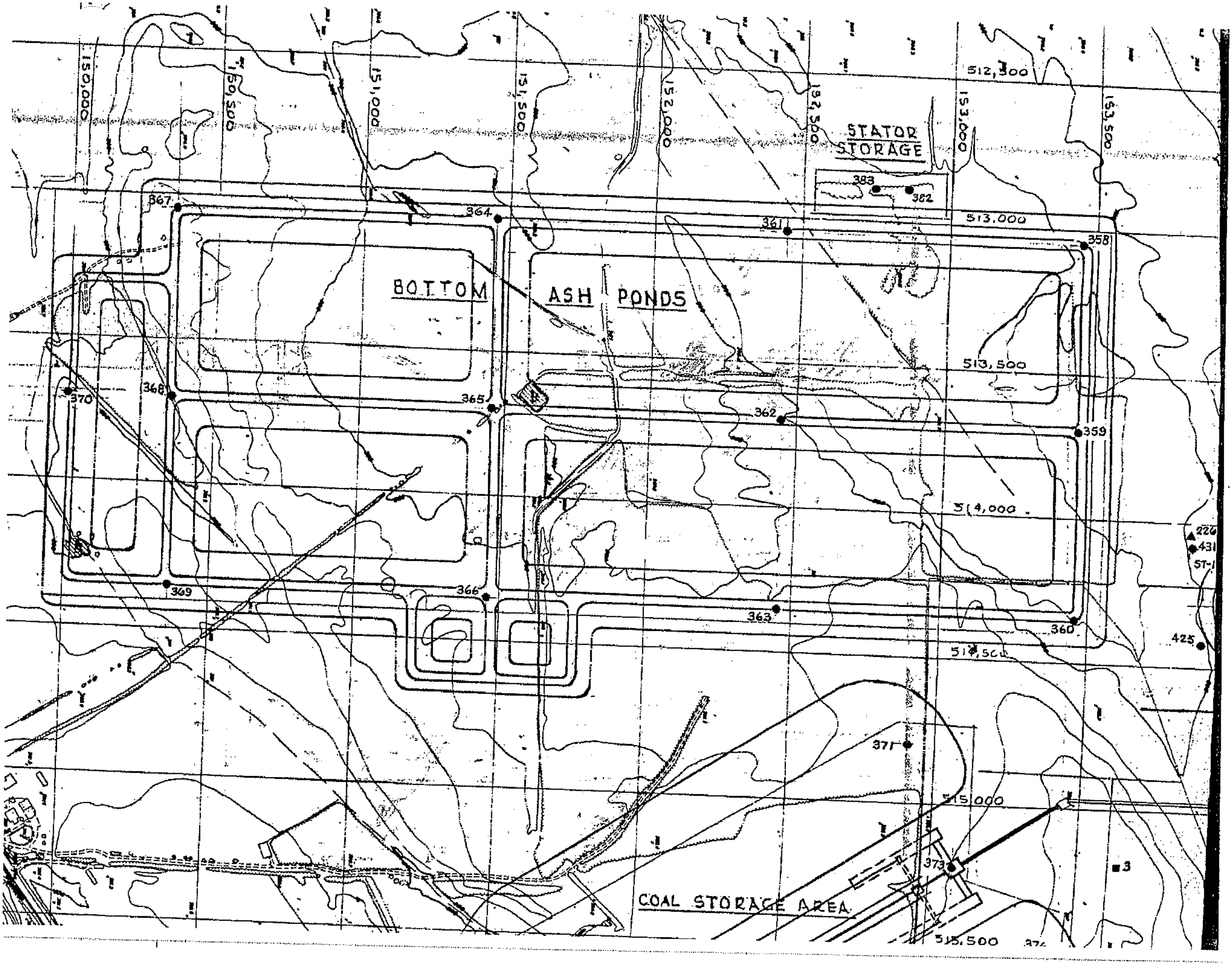
Appendix A

Map and Boring Logs, 1977 Soil Borings at Wastewater Pond Complex


150,000
150,500
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153,000
153,500
512,500
STATOR STORAGE
383
382
513,000
367
364
361
358
BOTTOM ASH PONDS
513,500
370
368
365
362
359
514,000
226
431
ST-1
369
366
363
360
425
514,500
371
515,000
373
3
COAL STORAGE AREA
515,500
374

PROJECT: Rockport Site PROJECT NO W6-1482 BORING: BH-361

DATE: 3/17/77 DRILLER: G. Powers CREW: J. Hardman/J. Selbe SURFACE ELEV.

DEPTH		SOIL STRATA				DEPTH					
FROM	TO	SOIL DESCRIPTION AND REMARKS	TIME	TYPE	NO.	FROM	TO	FIRST 6"	2ND 6"	3RD 6"	REC
		Topsoil									
	1.0										
1.0		Very stiff brown and gray silty clay		SS	1	5.0	6.5	5	8	11	10
		Very stiff brown and gray silty clay		SS	2	10.0	11.5	8	13	14	9
	13.0										
13.0		Firm brown silty fine sand		SS	3	15.0	16.5	5	5	6	8
	19.0										
19.0		Very loose brown silty fine sand		SS	4	20.0	21.5	1	2	2	1
		Very loose brown silty fine sand		SS	5	25.0	26.5	1	2	2	16
	30.0										
30.0		Very dense dark brown silty fine sand		SS	6	30.0	31.5	66	43	30	16
	34.0										
34.0		Firm brown medium to coarse silty sand		SS	7	35.0	36.5	9	10	13	8
	41.0										
41.0		Firm brown silty fine sand		SS	8	40.0	41.5	9	11	13	16
	44.0										
44.0		Firm brown medium and coarse sand		SS	9	45.0	46.5	8	11	19	16
	48.0										
48.0	51.5	Dense grayish brown silty fine to medium sand		SS	10	50.0	51.5	21	21	24	14
		Boring Terminated @ 51.5 3/17/77									

ETHOD OF DRILLING (Check One)

a. UGER XXXXX Rod SIZE A

b. WASH XX WATER MUD XX

ORING SIZE BIT USED 2-7/8" Side Discharge

G: SIZE N/W LENGTH 5.0

FURBED SAMPLES: NO. SIZE

SAMPLES: NO.

TER LOSSES % DEPTH

ECIAL TESTS (Hrs. & Explain)

WEATHER Overcast 45 degrees

NON-DRILLING TIME (Hrs.)

BORING LAYOUT MOVING

HAULING WATER STANDBY

WATER LEVEL: @ DATE TIME

@ DATE TIME

CAVE-IN DEPTH: @ DATE TIME

REMARKS: (All remarks should be explained on the back of white copy)

THIS IS A DRILLER S LOG AND
THE CLASSIFICATIONS HAVE NOT
BEEN REVIEWED BY AN ENGINEER

PROJECT: Lockport Site PROJECT NO. W6-1482 BORING: BE-362

DATE: 3/18/77 DRILLER: G. Powers CREW: J. Hardman/J. Selbe SURFACE ELEV. 392.7

DEPTH		SOIL STRATA				DEPTH		FIRST 6"	2ND 6"	3RD 6"	REC
FROM	TO	SOIL DESCRIPTION AND REMARKS	TIME	TYPE	NO.	FROM	TO				
0		Topsoil									
	1.2										
1.2		Very stiff brown and gray fine sandy silty		SS	1	5.0	6.5	7	10	12	15
	7.5	clay									
7.5		Stiff brown fine sandy silt		SS	2	10.0	11.5	4	4	6	16
	13.0										
13.0		Firm brown silty fine sand		SS	3	15.0	16.5	4	5	6	12
		Firm brown silty fine sand		SS	4	20.0	21.5	4	5	7	4
	23.5										
23.5		Loose brown silty fine to medium sand		SS	5	25.0	26.5	4	3	4	5
	29.0										
29.0		Firm brown silty fine to medium sand		SS	6	30.0	31.5	4	5	8	10
		Firm brown silty fine to medium sand		SS	7	35.0	36.5	7	6	10	9
	37.0										
37.0		Dense brown medium to coarse sand		SS	8	40.0	41.5	12	14	22	10
	44.0										
44.0		Firm brownish gray fine to medium silty		SS	9	45.0	46.5	12	12	11	10
		sand									
51.5		Firm brownish gray fine to medium silty		SS	10	50.0	51.5	8	8	12	9
		Boring Terminated @ 51.5 3/18/77									

METHOD OF DRILLING (Check One)

a. AXXXX Rod SIZE A

b. WASH XX WATER MUD XX

BORING SIZE BIT USED

CASING: SIZE N/W LENGTH 5'

UNDISTURBED SAMPLES: NO. SIZE

BAG SAMPLES: NO.

WATER LOSSES @ DEPTH

SPECIAL TESTS (Hrs & Explain)

WEATHER 45 degrees Overcast & windy

NON-DRILLING TIME (Hrs.)

BORING LAYOUT MOVING

HAULING WATER STANDBY

WATER LEVEL: @ DATE TIME

@ DATE TIME

CAVE IN DEPTH: @ DATE TIME

REMARKS: (All remarks should be explained on the back of white copy) THIS IS A DRILLER'S LOG AN
THE CLASSIFICATIONS HAVE NO
BEEN REVIEWED BY AN ENGINEE

BORING FIELD RECOR

PROJECT: Rockport Site PROJECT NO. W6-1482 BORING: BH-363

DATE: 3/18/77 DRILLER: G. Powers CREW: J. Hardman/J. Selbe SURFACE ELEV. 392

DEPTH		SOIL STRATA				DEPTH		FIRST	2ND	3RD	
FROM	TO	SOIL DESCRIPTION AND REMARKS	TIME	TYPE	NO.	FROM	TO	6"	6"	6"	RE
0		Topsoil									
	0.8										
0.8		Very stiff brown fine sandy silty clay		SS	1	5.0	6.5	6	9	12	1
	8.0										
8.0		Loose brown silty fine sand		SS	2	10.0	11.5	4	4	5	1
		Loose brown silty fine sand		SS	3	15.0	16.5	4	5	5	1
	20.5										
20.5		Firm brown silty fine sand		SS	4	20.0	21.5	2	5	8	10
	23.5										
23.5		Firm brown fine to medium sand		SS	5	25.0	26.5	5	6	6	8
		Firm brown fine to medium sand		SS	6	30.0	31.5	6	7	9	10
		Firm brown fine to medium sand		SS	7	35.0	26.5	8	8	14	7
	38.0										
38.0		Firm brown medium to coarse sand		SS	8	40.0	41.5	9	10	16	12
		Firm brown medium to coarse sand		SS	9	45.0	46.5	8	14	13	8
	47.0										
47.0	51.5	Firm grayish brown silty fine to medium sand		SS	10	50.0	51.5	7	10	10	12
		Boring Terminated @ 51.5 3/18/77									

METHOD OF DRILLING (Check One)

a. AUXXXR Rod SIZE A

b. WASH XX WATER MUD XX

ORING SIZE BIT USED 2-7/8" Side Discharge

CA G: SIZE N/W LENGTH 5.0

NDISTURBED SAMPLES: NO. SIZE

AG SAMPLES: NO.

WATER LOSSES % DEPTH

PECIAL TESTS (Hrs & Explain) ·

WEATHER 45 degrees Overcast Windy

NON-DRILLING TIME (Hrs.)

BORING LAYOUT MOVING

HAULING WATER STANDBY

WATER LEVEL: @ DATE TIME

@ DATE TIME

CAVE-IN DEPTH: @ DATE TIME

REMARKS: (All remarks should be explained on the back of white copy) THIS IS A DRILLER'S LOG A THE CLASSIFICATIONS HAVE

AW ENGINEERING TESTING COMPANY

TEST BORING FIELD RECORD

ROJECT: Rockport Site PROJECT NO. W6-1482 BORING: BH=364

DATE: 3/15/77 DRILLER: G. Powers CREW: J. Hardman/J. Selbe SURFACE ELEV. 389.5

DEPTH		SOIL STRATA				DEPTH					
FROM	TO	SOIL DESCRIPTION AND REMARKS	TIME	TYPE	NO.	FROM	TO	FIRST 6"	2ND 6"	3RD 6"	REC.
0		Topsoil									
	1.4										
1.4		Stiff brown and gray silty clay traces		SS	1	5.0	6.5	4	6	7	16
		fine sand									
		Stiff brown and gray silty clay traces		SS	2	10.0	11.5	3	4	6	12
	13.0	fine sand									
13.0		Loose brown silty fine sand		SS	3	15.0	16.5	3	4	3	17
		Loose brown silty fine sand		SS	4	20.0	21.5	3	3	3	8
	24.0										
24.0		Firm brown fine to medium sand		SS	5	25.0	26.5	6	8	8	7
		Firm brown fine to medium sand		SS	6	30.0	31.5	6	8	9	8
	34.5										
34.5		Firm brown medium to coarse sand		SS	7	35.0	36.5	5	8	10	8
		Firm brown medium to coarse sand		SS	8	40.0	41.5	5	6	8	7
	43.0										
43.0		Loose brown medium to coarse sand & gravel		SS	9	45.0	46.5	4	3	3	8
	47.0										
47.0	51.5	Firm brown medium to coarse sand		SS	10	50.0	51.5	8	9	13	8
		traces gravel									
		Boring Terminated @ 51.5 3/15/77									

METHOD OF DRILLING (Check One)

a. AUGER XXXXX Rod SIZE A

b. WASH XX WATER MUD XX

BORING SIZE BIT USED 2-7/8" Side Discharge

CASING: SIZE NW LENGTH 5'

UNDISTURBED SAMPLES: NO. SIZE

BAG SAMPLES: NO

WATER LOSSES @ DEPTH

SPECIAL TESTS (Hrs & Explain)

WEATHER 70 degrees clear

NON-DRILLING TIME (Hrs.)

BORING LAYOUT MOVING

HAULING WATER STANDBY

WATER LEVEL: @ DATE TIME

@ DATE TIME

CAVE-IN DEPTH: @ DATE TIME

REMARKS (All remarks should be explained on the back of white copy) THIS IS A DRILLER'S LOG THE CLASSIFICATIONS HAVE

W ENGINEERING TESTING COMPANY

OJECT: Rockport Site PROJECT NO. W6-1482 BORING: BH=365

ATE: 3/15/77 DRILLER: G. Powers CREW: J. Hardman/J. Selbe SURFACE ELEV.

DEPTH		SOIL STRATA	TIME	TYPE	NO.	DEPTH		FIRST 6"	2ND 6"	3RD 6"	REC.
	TO	SOIL DESCRIPTION AND REMARKS				FROM	TO				
0	1.3	Topsoil									
1.3	11.0	Stiff brown and gray silty clay traces		SS	1	5.0	6.5	3	5	9	18
11.0	13.5	Stiff brown fine sandy silty tan clay		SS	2	10.0	11.5	4	4	8	18
13.5	19.0	Loose brown silty fine sand		SS	3	15.0	16.5	2	3	4	12
19.0	25.5	Firm brown fine sand silt traces clay		SS	4	20.0	21.5	3	2	3	14
25.5	28.0	Firm brown and gray silty fine sand		SS	5	25.0	26.5	2	5	8	12
28.0	35.5	Firm brown silty fine sand		SS	6	30.0	31.5	8	10	10	6
35.5	38.0	Firm brown silty medium to coarse sand		SS	7	35.0	36.5	6	11	10	9
.0	42.0	Dense brown silty medium tocoarse sand traces gravel		SS	8	40.0	41.5	13	25	25	10
42.0	47.5	Firm brown silty medium to coarse sand traces gravel		SS	9	45.0	46.5	10	12	12	8
47.5	51.5	Firm gray fine to medium silty sand traces gravel		SS	10	50.0	51.5	8	7	9	8
		Boring Terminated @ 51.5 3/15/77									

METHOD OF DRILLING (Check One)

a. AUXXXR Rod SIZE A

b. WASH XX WATER MUD XX

BORING SIZE BIT USED 2-7/8" Side Discharge

CASING: SIZE NW LENGTH 5.0'

UNDISTURBED SAMPLES: NO. SIZE

BAG SAMPLES: NO.

WATER LOSSES % DEPTH

SPECIAL TESTS (Hrs. & Explain)

WEATHER 65 degrees clear

NON-DRILLING TIME (Hrs.)

BORING LAYOUT MOVING

HAULING WATER STANDBY

WATER LEVEL: @ DATE TIME

@ DATE TIME

CAVE-IN DEPTH: @ DATE TIME

REMARKS: (All remarks should be explained on the back of white copy) THIS IS A DRILLER'S LOG A
THE CLASSIFICATIONS HAVE N
BEEN REVIEWED BY AN ENGINE

PROJECT: Rockport Site PROJECT NO. W6-1482 BORING: BH-366

DATE: 3/15/77 DRILLER: G. Powers CREW: J. Hardman/J. Selbe SURFACE ELEV.

DEPTH FROM	DEPTH TO	SOIL STRATA SOIL DESCRIPTION AND REMARKS	TIME	TYPE	NO.	DEPTH FROM	DEPTH TO	FIRST 6"	2ND 6"	3RD 6"	REC
		Topsoil									
	1.5										
1.5		Very stiff brown and gray silty clay		SS	1	5.0	6.5	3	7	14	18
	9.0	traces fine sand									
9.0		Firm brown silty fine sand traces clay		SS	2	10.0	11.5	4	5	8	16
	15.0										
15.0		Loose brown silty fine sand traces clay		SS	3	15.0	16.5	2	4	6	16
	17.0										
17.0		Loose brown silty fine sand		SS	4	20.0	21.5	4	4	6	8
	24.0										
24.0		Firm brown fine to medium fine sand		SS	5	25.0	26.5	4	7	12	7
		Firm brown fine to medium fine sand		SS	6	30.0	31.5	5	8	9	7
	33.5										
33.5		Firm brown fine to medium sand traces		SS	7	35.0	36.5	5	8	9	6
	37.0										
37.0		Firm brown medium to coarse silty sand		SS	8	40.0	41.5	8	11	12	7
		Firm brown medium to coarse silty sand		SS	9	45.0	46.5	7	12	16	11
	47.5										
47.5	51.5	Firm brown medium to coarse sand some gravel		SS	10	50.0	51.5	7	7	9	8
		Boring Terminated @ 51.5 3/15/77									

OF DRILLING (Check One)

XX Rod SIZE A

XX WATER MUD XX

BORING SIZE BIT USED 2-7/8" Side Discharge

CASING: NW LENGTH 5.0

SAMPLES: NO SIZE

BAG SAMPLES NO.

WATER DEPTH

(Hrs. & Explain)

WEATHER 50 degrees overcast

NON-DRILLING TIME (Hrs.)

BORING LAYOUT MOVING

HAULING WATER STANDBY

WATER LEVEL: @ DATE TIME

@ DATE TIME

CAVE IN DEPTH @ DATE TIME

REMARKS (All remarks should be explained on the back of white copy) THIS IS A DRILLER'S LOG AND THE CLASSIFICATIONS HAVE NOT BEEN REVIEWED BY AN ENGINEER

PROJECT: Rockport Site PROJECT NO. W6-1482 BORING: Bh-367

DATE: 3/16/77 DRILLER: G. Powers CREW: J. Hardman/J. Selbe SURFACE ELEV.

DEPTH FROM	DEPTH TO	SOIL STRATA SOIL DESCRIPTION AND REMARKS	TIME	TYPE	NO.	DEPTH FROM	DEPTH TO	FIRST 6"	2ND 6"	3RD 6"	REC
0		Topsoil									
	1.2										
1.2		Firm brown silty fine sand traces clay		SS	1	5.0	6.5	3	4	7	14
	8.0										
8.0		Loose brown silty fine sand		SS	2	10.0	11.5	3	3	5	12
		Loose brown silty fine sand		SS	3	15.0	16.5	3	3	4	10
		Loose brown silty fine sand		SS	4	20.0	21.5	3	5	5	8
	23.0										
23.0		Firm brown silty fine to medium sand		SS	5	25.0	26.5	7	10	14	7
		Firm brown silty fine to medium sand		SS	6	30.0	31.5	7	8	9	6
		Firm brown silty fine to medium sand		SS	7	35.0	36.5	5	7	10	6
		Firm brown silty fine to medium sand		SS	8	40.0	41.5	8	11	14	6
	44.0										
44.0		Firm brown silty medium to coarse sand		SS	9	45.0	46.5	10	15	13	8
	51.5	Firm brown silty medium to coarse sand		SS	10	50.0	51.5	7	12	11	10
		Boring Terminated @ 51.5									

ETHOD OF DRILLING (Check One)

a. XXXX ~~AUGER~~ Rod SIZE A

b. WASH XX WATER MUD XX

ORING SIZE BIT USED 2-7/8" Side Discharge

AS'NG: SIZE NW LENGTH 5.0'

INL URBED SAMPLES: NO. SIZE

AG SAMPLES: NO.

ATER LOSSES % DEPTH

ECIAL TESTS (Hrs & Explain)

WEATHER Clear 60 degrees

NON-DRILLING TIME (Hrs.)

BORING LAYOUT MOVING

HAULING WATER STANDBY

WATER LEVEL: @ DATE TIME

@ DATE TIME

CAVE-IN DEPTH: @ DATE TIME

REMARKS: (All remarks should be explained on the back of white copy) THIS IS A DRILLER'S LOG AND THE CLASSIFICATIONS HAVE NOT BEEN REVIEWED BY AN ENGINEER

ROJECT: Rockport Site PROJECT NO. W6-1482 BORING: BH-368

ATE: 3/16/77 DRILLER: G. Powers CREW: J. Hardman/J. Selbe SURFACE ELEV. 392.3

DEPTH		SOIL STRATA				DEPTH		FIRST 6"	2ND 6"	3RD 6"	REC
FROM	TO	SOIL DESCRIPTION AND REMARKS	TIME	TYPE	NO.	FROM	TO				
0		Topsoil									
	0.7										
0.7		Very stiff brown silty clay		SS	1	5.0	6.5	3	12	15	18
	9.0										
9.0		Firm brown silty fine sand		SS	2	10.0	11.5	7	7	8	14
		Firm brown silty fine sand		SS	3	15.0	16.5	5	5	6	9
		Firm brown silty fine sand		SS	4	20.0	21.5	5	6	8	8
	24.0										
24.0		Firm brown silty fine to medium sand		SS	5	25.0	26.5	8	10	13	6
		Firm brown silty fine to medium sand		SS	6	30.0	31.5	5	7	7	7
	33.0										
33.0		Firm brown medium to coarse sand		SS	7	35.0	36.5	6	6	8	5
	37.5										
37.5		Firm brown fine to medium silty sand		SS	8	40.0	41.5	5	7	8	6
	44.0										
44.0		Firm brown medium to coarse sand		SS	9	45.0	46.5	5	10	13	9
	51.5										
51.5		Firm brown medium to coarse sand		SS	10	50.0	51.5	10	12	12	12
		Boring Terminated @ 51.5'									

ETHOD OF DRILLING (Check One)

a. ~~XXXXX~~ Rod SIZE A

b. WASH XX WATER MUD XX

ORING SIZE BIT USED 2-7/8" Side Discharge

CA G: SIZE NW LENGTH 5.0'

NDISTURBED SAMPLES: NO. SIZE

AG SAMPLES: NO.

ATER LOSSES, % DEPTH

PECIAL TESTS (Hrs. & Explain)

WEATHER Clear 45 degrees

NON-DRILLING TIME (Hrs.)

BORING LAYOUT MOVING

HAULING WATER STANDBY

WATER LEVEL: @ DATE TIME

@ DATE TIME

CAVE-IN DEPTH: @ DATE TIME

REMARKS: (All remarks should be explained on the back of white copy) THIS IS A DRILLER'S LOG AN
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BEEN REVIEWED BY AN ENGINEER

PROJECT: Rockport Site PROJECT NO. W6-1482 BORING: BH-369

DATE: 3/18/77 DRILLER: R. Stevens CREW: B. Blackford/D. Wooden SURFACE ELEV. 394.3

DEPTH		SOIL STRATA				DEPTH					
FROM	TO	SOIL DESCRIPTION AND REMARKS	TIME	TYPE	NO.	FROM	TO	FIRST 6"	2ND 6"	3RD 6"	REC.
0	12"	Topsoil									
		Very stiff brown and tan clay		SS	1	5	6.5	8	12	15	18
	9.0										
9.0		Loose brown very silty fine sand		SS	2	10	11.5	3	3	4	12
	12.7										
12.7		Firm brown medium sand		SS	3	15	16.5	5	6	7	5
	18.0										
18.0		Loose gray and brown silty fine to medium		SS	4	20	21.5	3	4	5	6
	22.1	sand									
22.1		Firm brown medium sand		SS	5	25.	26.5	9	10	10	6
	28.5										
28.5		Loose brown medium sand w/traces fine		SS	6	30	31.5	3	4	4	5
		gravel									
	32.0										
32.0		Firm brown medium to coarse sand		SS	7	35	36.5	7	10	16	8
		Firm brown medium to coarse sand		SS	8	40	41.5	10	11	13	7
	44.0										
44.0		Dense brown medium to coarse sand		SS	9	45	46.5	11	15	18	10
	47.5										
47.5		Dense brown medium to coarse sand w/fine		SS	10	50	51.5	11	19	26	10
		gravel									
		Boring Terminated @ 51.5'									

ETHOD OF DRILLING (Check One)

a ~~AUGER~~ Rod SIZE A

b WASH XX WATER MUD XX

ORING SIZE 2-7/8" BIT USED 2-7/8" Side Discharge

CASING: SIZE NW 5' LENGTH

NDISTURBED SAMPLES: NO. SIZE

AG SAMPLES: NO.

VATER LOSSES % DEPTH

PECIAL TESTS (Hrs. & Explain)

WEATHER Cloudy 50 degrees

NON-DRILLING TIME (Hrs.)

BORING LAYOUT MOVING

HAULING WATER STANDBY

WATER LEVEL: @ DATE TIME

@ DATE TIME

CAVE-IN DEPTH: @ DATE TIME

REMARKS: (All remarks should be explained on the back of white copy) THIS IS A DRILLER'S LOG AND THE CLASSIFICATIONS HAVE NOT BEEN REVIEWED BY AN ENGINEER

Appendix B

Well Construction and Lithologic Logs, 2010 Wastewater Pond Complex Monitoring Wells

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER **41510694-01**

COMPANY **AMERICAN ELECTRIC POWER**

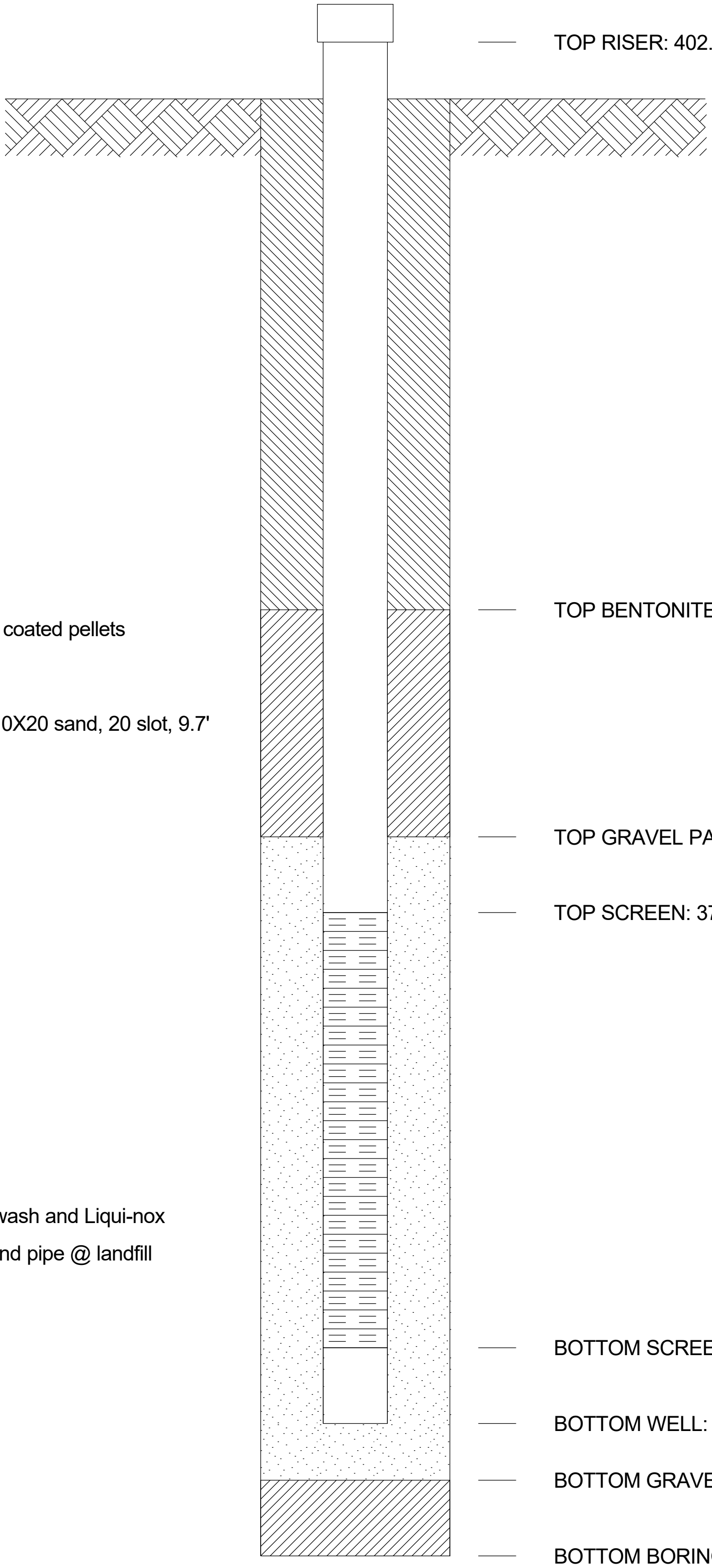
WELL No. **MW-1001** BORING No. **MW-1001** INSTALLED **6/2/10**

PROJECT **Rockport Bottom Ash Pond USWAG**

COORDINATES **N 153,488.0 E 513,047.6**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 400.03 FT.



TOP RISER: 402.35 FT.

TOP BENTONITE SEAL: 374.33 FT.

TOP GRAVEL PACK: 372.33 FT.

TOP SCREEN: 370.33 FT.

BOTTOM SCREEN: 360.63 FT.

BOTTOM WELL: 360.03 FT.

BOTTOM GRAVEL PACK: 359.03 FT.

BOTTOM BORING: 359.03 FT.

▧ GROUT SEAL: 200 gal Volclay

▨ BENTONITE SEAL: 75 lbs 3/8" coated pellets

☰ SCREEN: 2" dia., Prepacked, 10X20 sand, 20 slot, 9.7'

░ GRAVEL PACK: #5 sand

□ RISER PIPE: 2", dia., PVC

∿ SPACERS, DEPTH: 20'

Notes:
-Deconned with high pressure wash and Liqui-nox
-Drilled w/ 6.25" augers
- Drill and decon water from stand pipe @ landfill
- Well installed 6/2/10
-SWL @ install = 25.5'

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER **41510694-01**

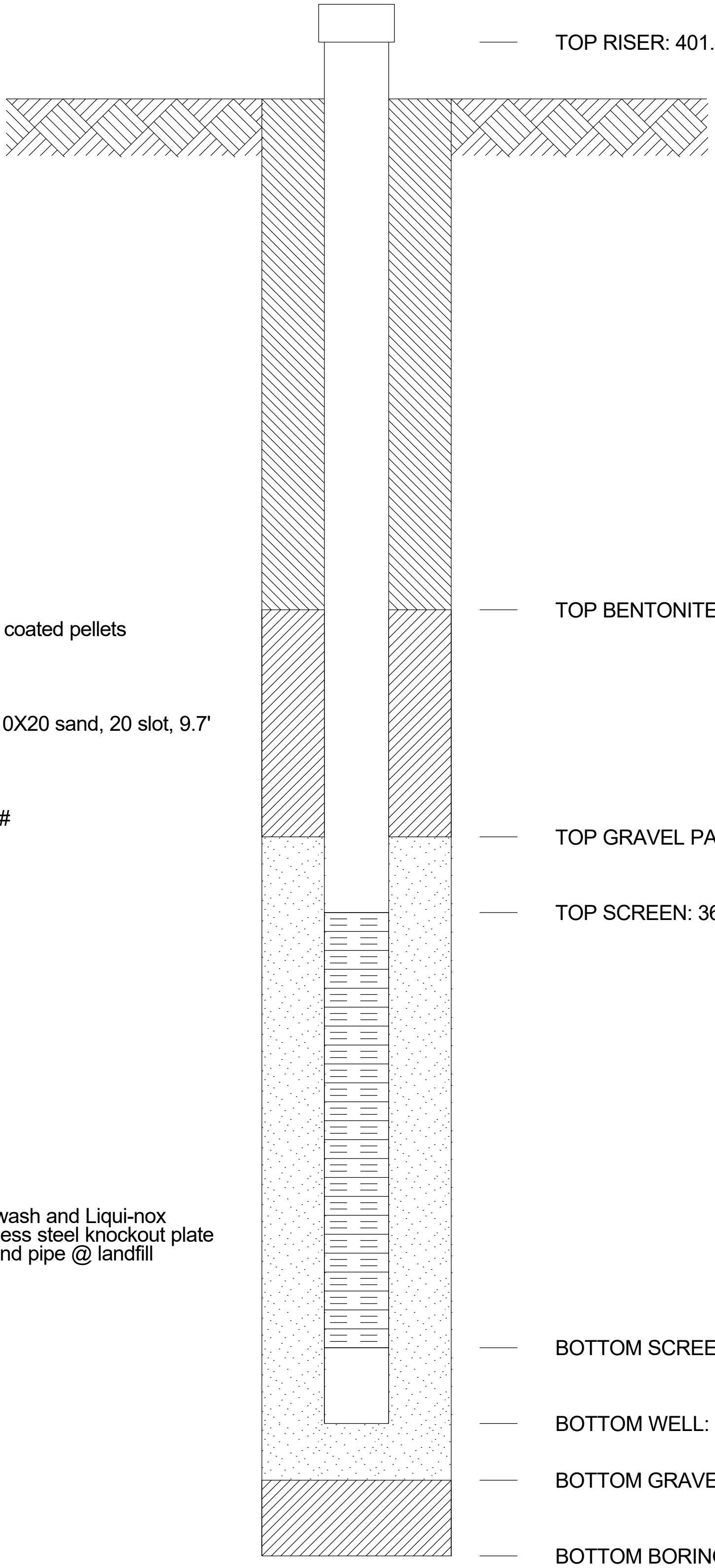
COMPANY **AMERICAN ELECTRIC POWER** WELL No. **MW-1002** BORING No. **MW-1002** INSTALLED **6/2/10**

PROJECT **Rockport Bottom Ash Pond USWAG**

COORDINATES **N 152,307.4 E 514,231.0**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 399.09 FT.



TOP RISER: 401.42 FT.

TOP BENTONITE SEAL: 368.19 FT.

TOP GRAVEL PACK: 366.09 FT.

TOP SCREEN: 363.89 FT.

BOTTOM SCREEN: 354.19 FT.

BOTTOM WELL: 353.59 FT.

BOTTOM GRAVEL PACK: 352.59 FT.

BOTTOM BORING: 352.59 FT.

▧ GROUT SEAL: 150 gal Volclay

▨ BENTONITE SEAL: 50 lbs 3/8" coated pellets

☰ SCREEN: 2" dia., Prepacked, 10X20 sand, 20 slot, 9.7'

░ GRAVEL PACK: #5 sand - 375#

☐ RISER PIPE: 2", dia., PVC

∿ SPACERS, DEPTH: 25'

Notes:
-Deconned with high pressure wash and Liqui-nox
-Drilled w/ 6.25" augers & stainless steel knockout plate
- Drill and decon water from stand pipe @ landfill
- Well installed 6/2/10
-SWL @ install = 29.8'

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

AEP

JOB NUMBER **41510694-01**

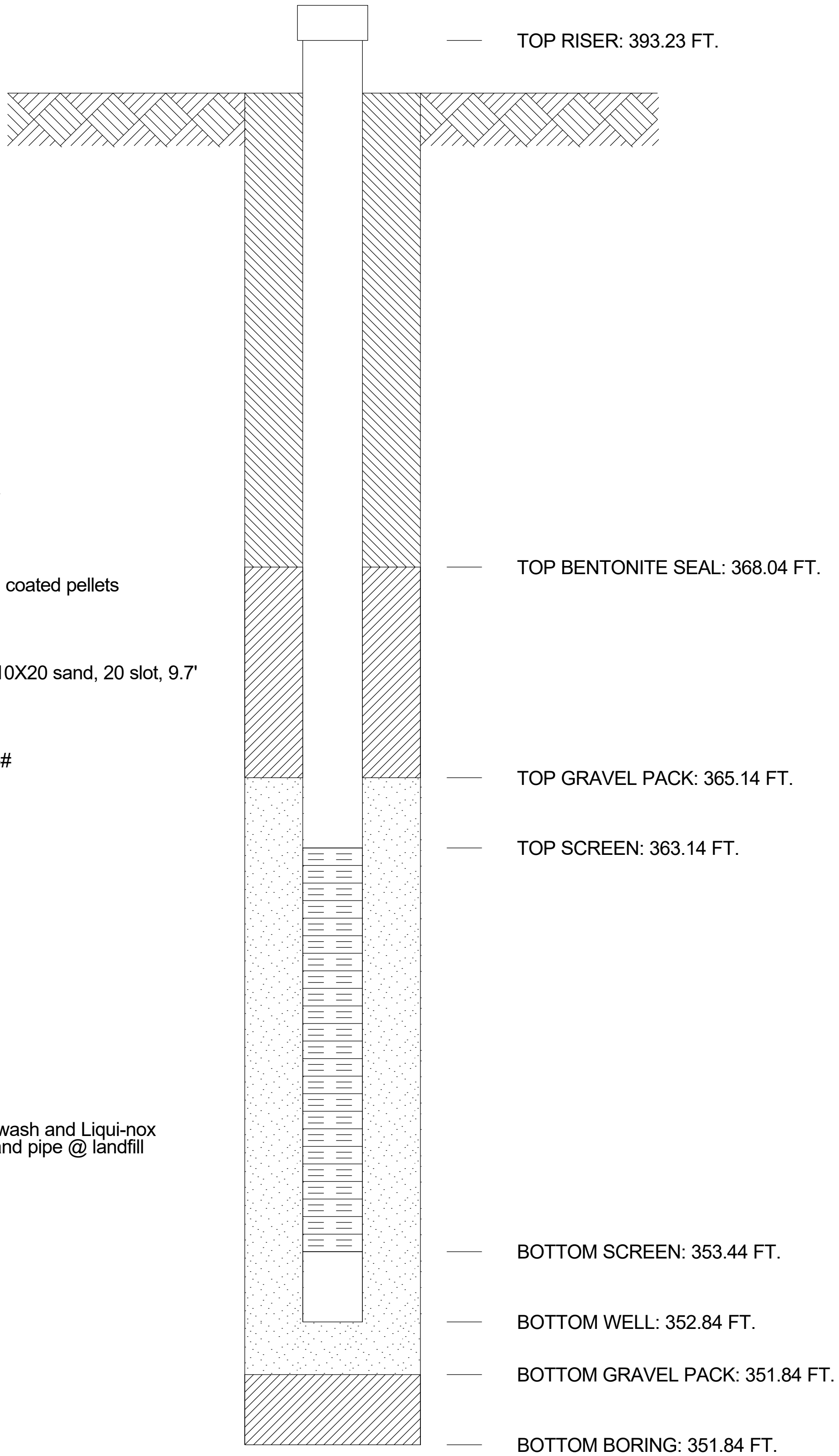
COMPANY **AMERICAN ELECTRIC POWER** WELL No. **MW-1003** BORING No. **MW-1003** INSTALLED **6/2/10**

PROJECT **Rockport Bottom Ash Pond USWAG**

COORDINATES **N 151,208.1 E 512,820.7**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 390.84 FT.



▧	GROUT SEAL: 100 gal Volclay
▨	BENTONITE SEAL: 75 lbs 3/8" coated pellets
☰	SCREEN: 2" dia., Prepacked, 10X20 sand, 20 slot, 9.7'
⠿	GRAVEL PACK: #5 sand - 375#
□	RISER PIPE: 2", dia., PVC
∿	SPACERS, DEPTH: 18'

Notes:
-Deconned with high pressure wash and Liqui-nox
- Drill and decon water from stand pipe @ landfill
- Well installed 6/2/10
-SWL @ install = 23.5'

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
MONITORING WELL CONSTRUCTION

JOB NUMBER **41510694-01**

COMPANY **AMERICAN ELECTRIC POWER**

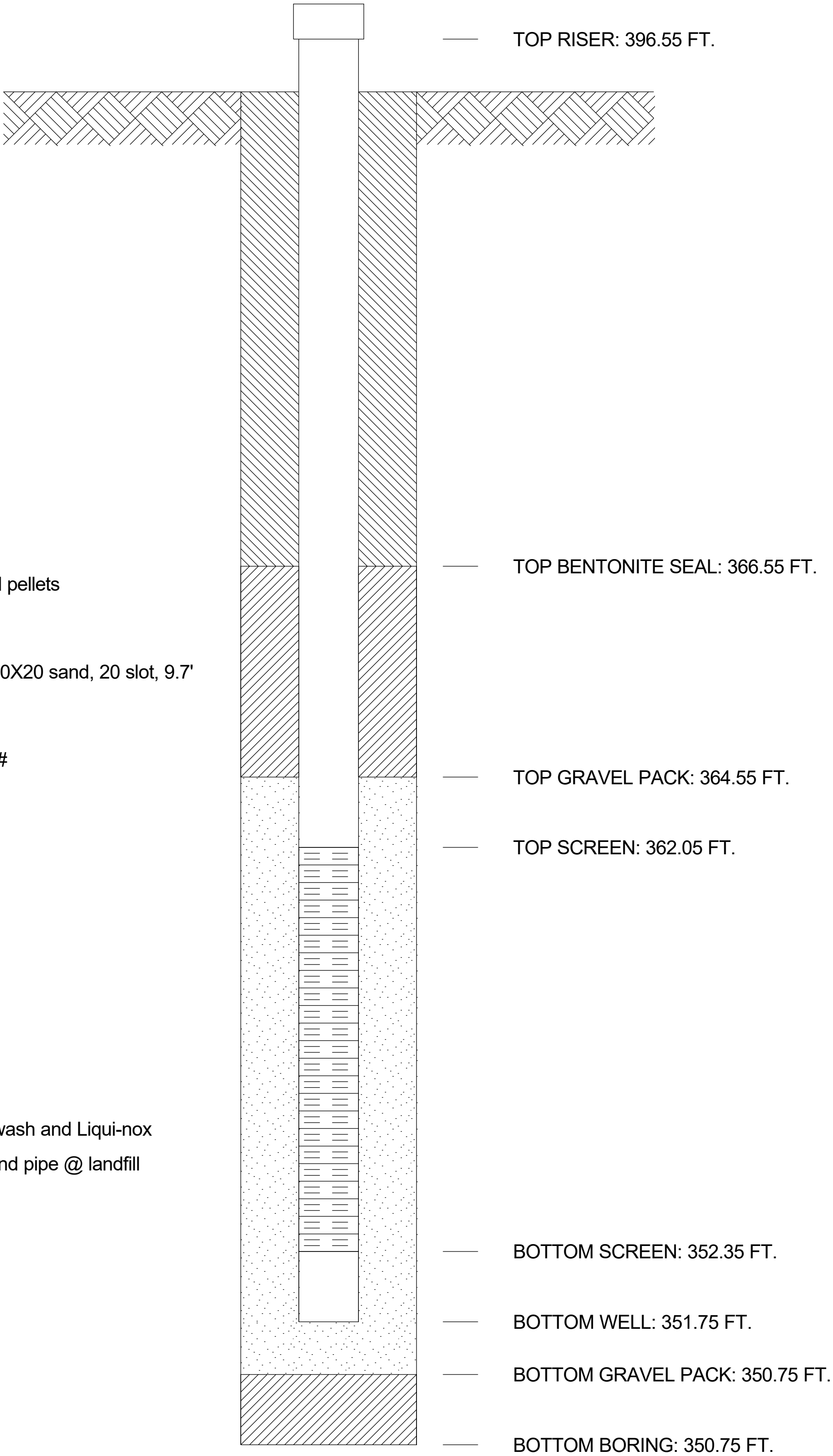
WELL No. **MW-1004** BORING No. **MW-1004** INSTALLED **6/3/10**

PROJECT **Rockport Bottom Ash Pond USWAG**

COORDINATES **N 150,013.4 E 514,264.7**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 394.25 FT.



▧ GROUT SEAL: 125 gal Volclay

▨ BENTONITE SEAL: 3/8" coated pellets

☰ SCREEN: 2" dia., Prepacked, 10X20 sand, 20 slot, 9.7'

░ GRAVEL PACK: #5 sand - 350#

☐ RISER PIPE: 2", dia., PVC

∿ SPACERS, DEPTH: 22'

Notes:
-Deconned with high pressure wash and Liqui-nox
-Drilled w/ 6.25" augers
- Drill and decon water from stand pipe @ landfill
- Well installed 6/3/10
-SWL @ install = 27.0'

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **41510694-01**

COMPANY	**AMERICAN ELECTRIC POWER**	BORING NO. **MW-1001**	DATE **7/16/10** SHEET **1** OF **2**
PROJECT	**Rockport Bottom Ash Pond USWAG**	BORING START **5/25/10**	BORING FINISH **6/2/10**
COORDINATES	**N 153,488.0 E 513,047.6**	PIEZOMETER TYPE **NA**	WELL TYPE **OW**
GROUND ELEVATION	**400.0** SYSTEM **State Plane using NAD27/29**	HGT. RISER ABOVE GROUND **2.32**	DIA **2"**
		DEPTH TO TOP OF WELL SCREEN **29.7**	BOTTOM **39.4**
		WELL DEVELOPMENT	BACKFILL **VOLCLAY**
		FIELD PARTY **ZLR / REB**	RIG **D-120**

Water Level, ft	▽ **31.5**	▼	▼
TIME			
DATE			

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
1	SPT	0.0	1.5	4-8-13	1.4					**MODERATE YELLOWISH BROWN 10YR 5/4 FINE SAND** w/some clay		GROUNDING PROCEDURE NOT IN USE / WATER FROM STANDPIPE @ LANDFILL / DECONED 05/25/10 / DRILLED w/ 4.25 HSA
2	SPT	1.5	3.0	6-9-10	1.5							
3	SPT	3.0	4.5	3-4-7	1.3					**MODERATE YELLOWISH BROWN 10YR 5/4 FINE SAND** w/medium stiff clay mixed		
4	SPT	4.5	6.0	3-6-9	1.3		5					
5	SPT	6.0	7.5	2-4-6	1.2					**SOFT MODERATE YELLOWISH BROWN 10YR 5/4 CLAY** tsf 0.5		
6	SPT	7.5	9.0	3-6-8	1.5					**SOFT MODERATE YELLOWISH BROWN 10YR 5/4 CLAY** w/some fine sands mixed		
7	SPT	9.0	10.5	3-4-6	1.5		10			**GREENISH GRAY 5G 6/1 BOTTOM ASH**		
8	SPT	10.5	12.0	1-1-3	1.4					**SOFT MODERATE YELLOWISH BROWN 10YR 5/4 CLAY**		
9	SPT	12.0	13.5	2-2-4	1.4					**SOFT MODERATE YELLOWISH BROWN 10YR 5/4 CLAY** tsf 0.5 **SOFT GRAYISH ORANGE 10YR 7/4 CLAY** tsf 0.5, wet		
10	SPT	13.5	15.0	4-4-6	1.4					**MEDIUM STIFF MODERATE YELLOWISH BROWN 10YR 5/4 CLAY** tsf 1.5		
11	SPT	15.0	16.5	4-4-7	1.5		15			**MEDIUM STIFF MODERATE YELLOWISH BROWN 10YR 5/4 CLAY** tsf 1.0		
12	SPT	16.5	18.0	4-4-8	1.4					**MEDIUM STIFF MODERATE YELLOWISH BROWN 10YR 5/4 CLAY** tsf 2.0		
13	SPT	18.0	19.5	4-4-4	1.4					**MODERATE YELLOWISH BROWN 10YR 5/4 FINE SAND**		
14	SPT	19.5	21.0	2-3-4	1.5					**SOFT MODERATE YELLOWISH BROWN**		

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 **REB**

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **41510694-01**

COMPANY **AMERICAN ELECTRIC POWER** BORING NO. **MW-1001** DATE **7/16/10** SHEET **2** OF **2**

PROJECT **Rockport Bottom Ash Pond USWAG** BORING START **5/25/10** BORING FINISH **6/2/10**

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
										CLAYEY SAND tsf 1.0		
15	SPT	21.0	22.5	2-4-7	1.4					**MODERATE YELLOWISH BROWN 10YR 5/4 FINE SAND**		
16	SPT	22.5	24.0	4-5-5	1.5					**DARK YELLOWISH ORANGE 10YR 6/6 MEDIUM SAND**		
17	SPT	24.0	25.5	3-6-7	1.5							
18	SPT	25.5	27.0	3-5-5	1.4		25					
19	SPT	27.0	28.5	4-4-5	1.5							
20	SPT	28.5	30.0	5-7-7	1.4							
21	SPT	30.0	31.5	5-7-7	1.5		30			**DARK YELLOWISH ORANGE 10YR 6/6 MEDIUM SAND** moist		
22	SPT	31.5	33.0	5-6-8	1.5					**DARK YELLOWISH ORANGE 10YR 6/6 MEDIUM SAND** wet	▽	
23	SPT	33.0	34.5	4-6-6	1.5					**DARK YELLOWISH ORANGE 10YR 6/6 MEDIUM SAND**		
24	SPT	34.5	36.0	4-6-6	1.5							
25	SPT	36.0	37.5	5-5-6	1.4		35					
26	SPT	37.5	39.0	6-6-6	1.4							
27	SPT	39.0	40.5	4-4-5	1.5							
							40					

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **41510694-01**

COMPANY **AMERICAN ELECTRIC POWER**

PROJECT **Rockport Bottom Ash Pond USWAG**

COORDINATES **N 152,307.4 E 514,231.0**

GROUND ELEVATION **399.1** SYSTEM **State Plane using NAD27/29**

BORING NO. **MW-1002** DATE **7/16/10** SHEET **1** OF **3**

BORING START **5/27/10** BORING FINISH **6/2/10**

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

HGT. RISER ABOVE GROUND **2.33** DIA **2"**

DEPTH TO TOP OF WELL SCREEN **35.2** BOTTOM **44.9**

WELL DEVELOPMENT ______ BACKFILL **VOLCLAY**

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

Water Level, ft	▽ **30.0**	▼	▼
TIME			
DATE			

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
1	SPT	0.0	1.5	4-4-6	1.4					**YELLOWISH ORANGE 10YR 6/6 SAND CLAY** dry		NO GROUNDING PROCEDURE IN USE / WATER FROM STAND PIPE @ LANDFILL / DECON 05/27/10
2	SPT	1.5	3.0	8-10-13	1.3					**STIFF MODERATE YELLOWISH BROWN 10YR 5/4 SANDY CLAY** dry		
3	SPT	3.0	4.5	4-7-7	1.5					**MEDIUM STIFF MODERATE YELLOWISH BROWN 10YR 5/4 SANDY CLAY** dry		
4	SPT	4.5	6.0	4-4-7	1.3		5			**MEDIUM STIFF MEDIUM LIGHT GRAY N6 CLAY** tsf 1.5		
5	SPT	6.0	7.5	4-4-5	1.4					**MEDIUM STIFF MODERATE YELLOWISH BROWN 10YR 5/4 SANDY CLAY** tsf 1.5, dry		
6	SPT	7.5	9.0	4-4-4	1.3					**MEDIUM STIFF MEDIUM LIGHT GRAY N6 CLAY** tsf 1.5		
7	SPT	9.0	10.5				10			**MEDIUM STIFF MIXTURE OF BROWN & GRAY CLAY** tsf 2.0		
8	SPT	10.5	12.0	4-6-6	1.4							
9	SPT	12.0	13.5	5-6-10	1.3					**MEDIUM STIFF MODERATE YELLOWISH BROWN 10YR 5/4 SANDY CLAY**		
10	SPT	13.5	15.0	5-7-9	1.5					**MEDIUM STIFF MODERATE YELLOWISH BROWN 10YR 5/4 W/MIXTURE OF MEDIUM LIGHT GRAY N6 SANDY CLAY**		
11	SPT	15.0	16.5	5-6-7	1.4		15			**MEDIUM STIFF MODERATE YELLOWISH BROWN 10YR 5/4 SANDY CLAY** tsf 1.5		
12	SPT	16.5	18.0	3-3-5	1.5					**SOFT MODERATE YELLOWISH BROWN 10YR 5/4 SANDY CLAY** tsf 1.0		
13	SPT	18.0	19.5	2-3-4	1.5					**SOFT MODERATE YELLOWISH BROWN 10YR 5/4 SANDY CLAY** tsf .5		
14	SPT	19.5	21.0	2-2-4	1.3					**YELLOWISH ORANGE 10YR 6/6 SAND FINE**		

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 **REB**

JOB NUMBER **41510694-01**

COMPANY **AMERICAN ELECTRIC POWER** BORING NO. **MW-1002** DATE **7/16/10** SHEET **2** OF **3**

PROJECT **Rockport Bottom Ash Pond USWAG** BORING START **5/27/10** BORING FINISH **6/2/10**

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
15	SPT	21.0	22.5	2-2-2	1.4					**SOFT YELLOWISH ORANGE 10YR 6/6 SANDY CLAY** tsf .5, moist		
16	SPT	22.5	24.0	2-2-2	1.3							
17	SPT	24.0	25.5	5-6-7	1.2		25			**YELLOWISH ORANGE 10YR 6/6 SAND FINE**		
18	SPT	25.5	27.0	3-4-7	1.5					**YELLOWISH ORANGE 10YR 6/6 SAND FINE** moist		
19	SPT	27.0	28.5	2-2-4	1.4							
20	SPT	28.5	30.0	2-2-2	1.4		30			**YELLOWISH ORANGE 10YR 6/6 SAND FINE** wet	▽	
21	SPT	30.0	31.5	3-3-3	1.2					**YELLOWISH ORANGE 10YR 6/6 SAND FINE**		
22	SPT	31.5	33.0	2-2-4	1.4							
23	SPT	33.0	34.5	4-4-4	1.3							
24	SPT	34.5	36.0	5-6-6	1.4		35					
25	SPT	36.0	37.5	5-5-6	1.4							
26	SPT	37.5	39.0	4-4-8	1.3					**YELLOWISH ORANGE 10YR 6/6 SAND FINE** w/some pebbles		
27	SPT	39.0	40.5	4-6-9	1.5		40			**YELLOWISH ORANGE 10YR 6/6 SAND FINE**		
28	SPT	40.5	42.0	6-8-10	1.3					**YELLOWISH ORANGE 10YR 6/6 SAND FINE** w/some pebbles		
29	SPT	42.0	43.5	7-6-10	1.4							
30	SPT	43.5	45.0	6-8-11	1.4		45					
31	SPT	45.0	46.5	7-9-11	1.4							

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **41510694-01**

COMPANY **AMERICAN ELECTRIC POWER** BORING NO. **MW-1002** DATE **7/16/10** SHEET **3** OF **3**

PROJECT **Rockport Bottom Ash Pond USWAG** BORING START **5/27/10** BORING FINISH **6/2/10**

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

AEP ROCKPORT BA POND USWAG.GPJ AEP.GDT 7/16/10

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **41510694-01**

COMPANY	**AMERICAN ELECTRIC POWER**	BORING NO. **MW-1003**	DATE **7/16/10** SHEET **1** OF **2**
PROJECT	**Rockport Bottom Ash Pond USWAG**	BORING START **5/26/10**	BORING FINISH **6/2/10**
COORDINATES	**N 151,208.1 E 512,820.7**	PIEZOMETER TYPE **NA**	WELL TYPE **OW**
GROUND ELEVATION	**390.8** SYSTEM **State Plane using NAD27/29**	HGT. RISER ABOVE GROUND **2.39**	DIA **2"**
		DEPTH TO TOP OF WELL SCREEN **27.7**	BOTTOM **37.4**
		WELL DEVELOPMENT	BACKFILL **VOLCLAY**
		FIELD PARTY **ZLR / REB**	RIG **D-120**

Water Level, ft	∇ **23.1**	▼	∇
TIME			
DATE			

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
1	SPT	0.0	1.5	5-12-13	1.5					**DARK YELLOWISH ORANGE 10RY 6/6 CLAYSHALE** dry		NO GROUNDING IN USE / WATER FROM STAND PIPE @ LANDFILL / DECON 05/26/10
2	SPT	1.5	3.0	4-7-11	1.5					**DARK YELLOWISH ORANGE 10RY 6/6 CLAYSHALE**		
3	SPT	3.0	4.5	3-4-5	1.4					**MEDIUM STIFF DARK YELLOWISH ORANGE 10YR 6/6 SANDY CLAY** tsf 2.0		
4	SPT	4.5	6.0	3-4-6	1.4		5			**MEDIUM STIFF DARK YELLOWISH ORANGE 10YR 6/6 SANDY CLAY** tsf 2.5		
5	SPT	6.0	7.5	2-3-5	1.4					**MEDIUM STIFF DARK YELLOWISH ORANGE 10YR 6/6 SANDY CLAY** tsf 1.5		
6	SPT	7.5	9.0	3-3-5	1.5							
7	SPT	9.0	10.5	4-4-4	1.5		10			**SOFT DARK YELLOWISH ORANGE 10YR 6/6 SANDY CLAY** tsf 1.0		
8	SPT	10.5	12.0	2-2-4	1.4					**SOFT DARK YELLOWISH ORANGE 10YR 6/6 SANDY CLAY** tsf 1.5		
9	SPT	12.0	13.5	2-3-4	1.5					**SOFT DARK YELLOWISH ORANGE 10YR 6/6 SANDY CLAY** tsf .5		
10	SPT	13.5	15.0	2-2-4	1.5							
11	SPT	15.0	16.5	2-2-2	1.5		15					
12	SPT	16.5	18.0	2-4-6	1.3					**YELLOWISH ORANGE 10YR 6/6 SAND FINE**		
13	SPT	18.0	19.5	4-4-4	1.4							
14	SPT	19.5	21.0	4-4-6	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 **REB**

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **41510694-01**

COMPANY **AMERICAN ELECTRIC POWER** BORING NO. **MW-1003** DATE **7/16/10** SHEET **2** OF **2**

PROJECT **Rockport Bottom Ash Pond USWAG** BORING START **5/26/10** BORING FINISH **6/2/10**

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
15	SPT	21.0	22.5	3-8-10	1.5					**MODERATE YELLOWISH BROWN 10YR 5/4** **SAND FINE** moist		
16	SPT	22.5	24.0	4-4-6	1.4					**MODERATE YELLOWISH BROWN 10YR 5/4** **SAND FINE** wet	∇	
17	SPT	24.0	25.5	4-6-6	1.5							
18	SPT	25.5	27.0	3-5-7	1.4		25					
19	SPT	27.0	28.5	4-5-7	1.4							
20	SPT	28.5	30.0	6-6-8	1.4							
21	SPT	30.0	31.5	4-5-9	1.3		30					
22	SPT	31.5	33.0	2-2-3	1.4							
23	SPT	33.0	34.5	5-6-8	1.3							
24	SPT	34.5	36.0	5-6-7	1.4		35					
25	SPT	36.0	37.5	5-5-5	1.3					**MODERATE YELLOWISH BROWN 10YR 5/4** **SAND FINE** w/pebbles, wet		
26	SPT	37.5	39.0	6-6-6	1.4							

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **41510694-01**

COMPANY	**AMERICAN ELECTRIC POWER**	BORING NO. **MW-1004**	DATE **7/16/10** SHEET **1** OF **2**
PROJECT	**Rockport Bottom Ash Pond USWAG**	BORING START **6/3/10**	BORING FINISH **6/3/10**
COORDINATES	**N 150,013.4 E 514,264.7**	PIEZOMETER TYPE **NA**	WELL TYPE **OW**
GROUND ELEVATION	**394.3** SYSTEM **State Plane using NAD27/29**	HGT. RISER ABOVE GROUND **2.30**	DIA **2"**
		DEPTH TO TOP OF WELL SCREEN **32.2**	BOTTOM **41.9**
		WELL DEVELOPMENT	BACKFILL **VOLCLAY**
		FIELD PARTY **ZLR / REB**	RIG **D-120**

Water Level, ft	▽ **28.8**	▼	▼
TIME			
DATE			

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
1	SPT	0.0	1.5	10-11-10	1.3					**MODERATE YELLOWISH BROWN 10YR 5/6 CLAYSHALE** dry		NO GROUNDING IN USE / WATER FROM STAND PIPE @ LANDFILL / DECON 06/03/10
2	SPT	1.5	3.0	5-6-7	1.4					**MODERATE YELLOWISH BROWN 10YR 5/6 SANDY CLAY** tsf 1.5, dry		
3	SPT	3.0	4.5	4-6-8						**MODERATE YELLOWISH BROWN 10YR 5/6 SANDY CLAY** tsf 1.5, w/limestone mixed, dry		
4	SPT	4.5	6.0	4-4-6	1.4		5			**GRAY N6 CLAY** tsf 1.5, dry		
5	SPT	6.0	7.5	3-4-4	1.3					**GRAY N6 SANDY CLAY** tsf 1.5, dry		
6	SPT	7.5	9.0	4-4-8	1.4					**MEDIUM STIFF MODERATE YELLOWISH BROWN 10YR 5/6 SANDY CLAY** tsf 2.0		
7	SPT	9.0	10.5	3-6-9	1.4		10			**MEDIUM STIFF MODERATE YELLOWISH BROWN 10YR 5/6 SANDY CLAY** tsf 3.0		
8	SPT	10.5	12.0	3-6-9	1.4							
9	SPT	12.0	13.5	3-5-8	1.4							
10	SPT	13.5	15.0	4-6-6	1.3							
11	SPT	15.0	16.5	3-5-9	1.5		15					
12	SPT	16.5	18.0	4-4-8	1.3					**MEDIUM STIFF MODERATE YELLOWISH BROWN 10YR 5/6 SANDY CLAY** tsf 3.0, w/more sand		
13	SPT	18.0	19.5	4-4-6	1.5					**MEDIUM STIFF MODERATE YELLOWISH BROWN 10YR 5/6 SANDY CLAY** tsf 2.5, moist		
14	SPT	19.5	21.0	2-3-5	1.4					**STIFF MODERATE YELLOWISH BROWN**		

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 **REB**

LOG OF BORING

JOB NUMBER **41510694-01**

COMPANY **AMERICAN ELECTRIC POWER**

PROJECT **Rockport Bottom Ash Pond USWAG**

BORING NO. **MW-1004** DATE **7/16/10** SHEET **2** OF **2**

BORING START **6/3/10** BORING FINISH **6/3/10**

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
										10YR 5/6 SANDY CLAY tsf 2.0		
15	SPT	21.0	22.5	2-4-7	1.4					**YELLOWISH ORANGE 10YR 6/6 SAND FINE**		
16	SPT	22.5	24.0	2-4-7	1.4							
17	SPT	24.0	25.5	2-4-6	1.5		25					
18	SPT	25.5	27.0	3-4-7	1.4					**YELLOWISH ORANGE 10YR 6/6 SAND FINE** w/some pebbles, wet		
19	SPT	27.0	28.5	4-4-8	1.5					**YELLOWISH ORANGE 10YR 6/6 SAND FINE**		
20	SPT	28.5	30.0	2-3-5	1.2					**YELLOWISH ORANGE 10YR 6/6 SAND FINE** w/pebbles, wet	▽	
21	SPT	30.0	31.5	5-7-7	1.3		30			**YELLOWISH ORANGE 10YR 6/6 SAND FINE** w/pebbles		
22	SPT	31.5	33.0	3-4-6	1.4					**YELLOWISH ORANGE 10YR 6/6 SAND FINE** w/gravels		
23	SPT	33.0	34.5	6-7-9	1.2					**YELLOWISH ORANGE 10YR 6/6 SAND FINE** w/gravels, wet		
24	SPT	34.5	36.0	4-5-5	1.3		35			**YELLOWISH ORANGE 10YR 6/6 SAND FINE**		
25	SPT	36.0	37.5	3-4-6	1.4					**YELLOWISH ORANGE 10YR 6/6 SAND FINE** w/pebbles, wet		
26	SPT	37.5	39.0	3-4-5	1.2							
27	SPT	39.0	40.5	3-4-4	1.3		40			**YELLOWISH ORANGE 10YR 6/6 SAND FINE** wet		
28	SPT	40.5	42.0	3-4-5	1.1							
29	SPT	42.0	43.5	5-6-9								

Appendix C

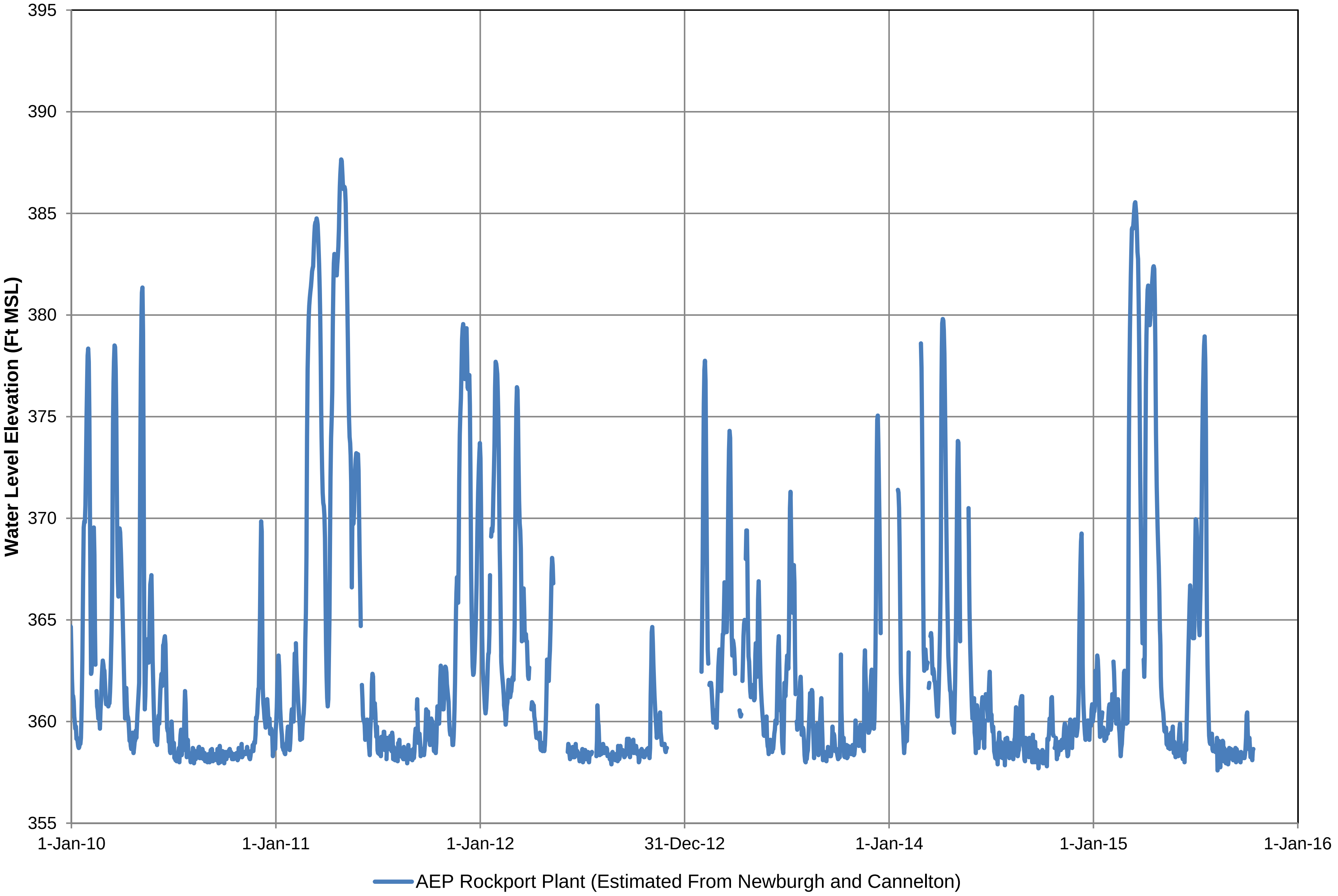
Piezometric Data

Appendix C-1

Ohio River Hydrograph, 2010-2015

AEP Rockport Plant

Ohio River Hydrograph, 2010-2015



Appendix C-2

Wastewater Pond Complex Monitoring Well Piezometric Data

Appendix C-2
Monitoring Well Piezometric Data
Wastewater Pond Complex
AEP Rockport Plant, Rockport, Indiana

Well:	**MW 1001**	**MW 1002**	**MW 1003**	**MW 1004**
Maximum:	371.61	373.20	373.72	376.13
Minimum:	368.38	366.99	367.49	365.57
Date:				
5/17/2011	371.61	373.20	373.72	376.13
11/17/2011	370.77	369.17	369.64	367.35
11/15/2012	368.91	367.48	367.83	365.93
5/20/2013	369.11	367.95	368.61	367.38
11/13/2013	368.38	366.99	367.49	366.43
5/12/2014	370.06	369.55	369.93	368.84
11/12/2014	368.57	367.03	367.64	365.57
5/7/2015	370.75	371.16	371.35	370.93

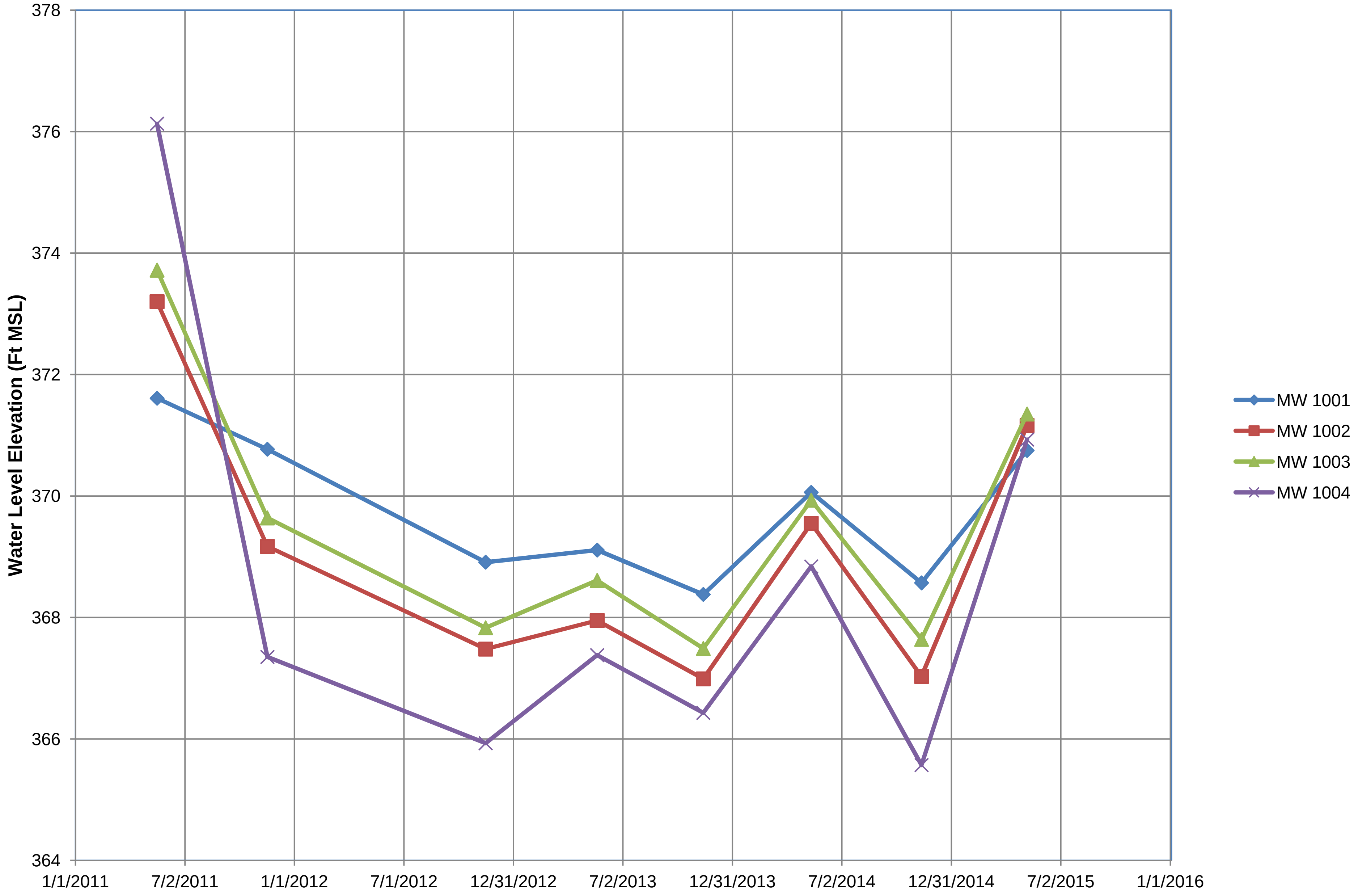
Note: Elevations reported by AEP in feet above Plant datum

Appendix C-3

Wastewater Pond Complex Monitoring Well Hydrographs

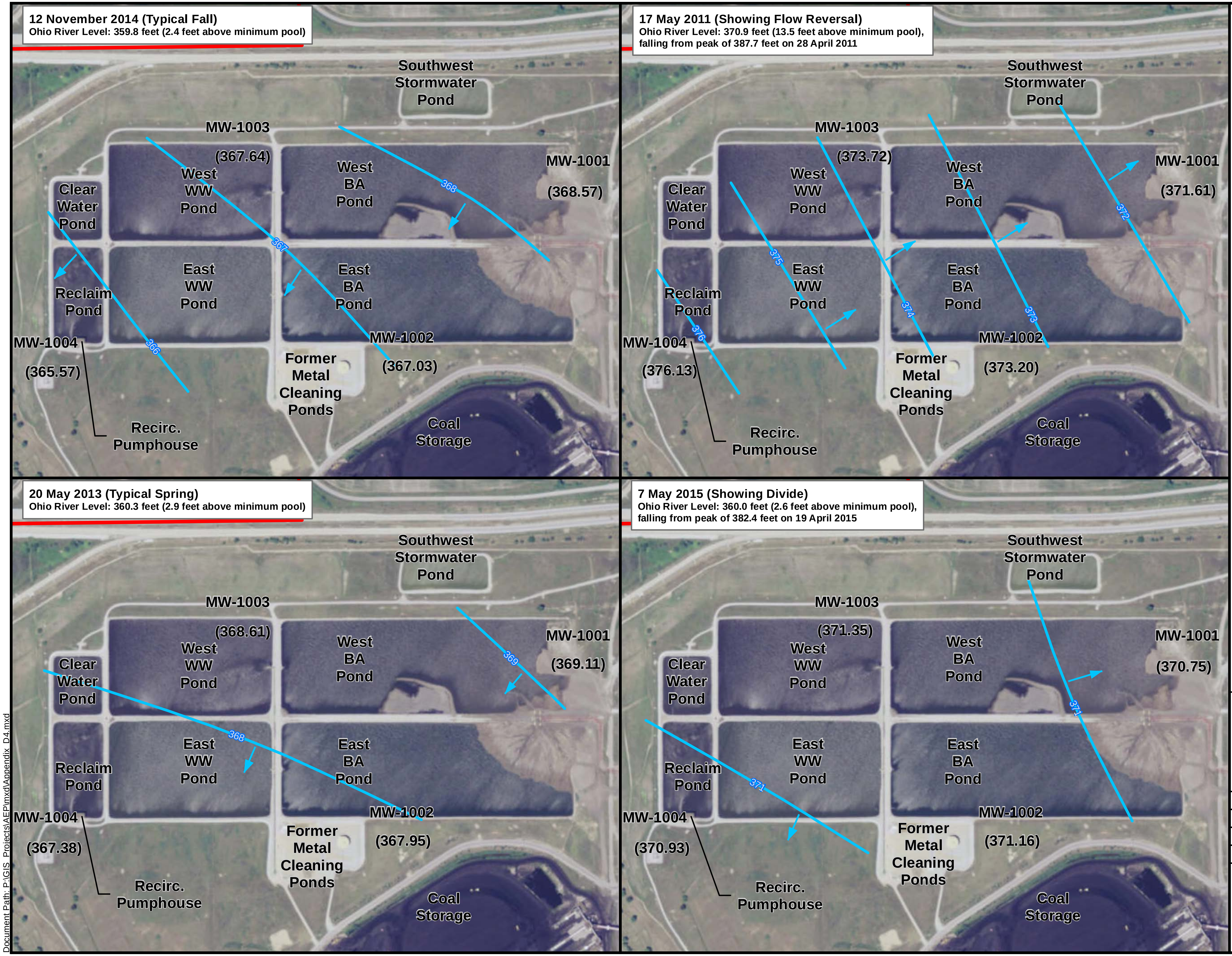
AEP Rockport Plant

Wastewater Pond Complex - Monitoring Well Hydrographs



Appendix C-4

Wastewater Pond Complex Monitoring Well Piezometric Maps



Legend

🟥 Property Boundary

━ Piezometric Surface Contour

MW-1001 - Well ID
(368.57) - Piezo Elevation

Note:
Elevations in feet NGVD29 (MSL)
Ohio River minimum pool: 357.4 feet MSL

Data Sources

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Date of Photography: July 2014
Source of Photography: U.S. Department of Agriculture, National Agriculature Imagery Program (NAIP)

0 300 600
SCALE IN FEET

PIEZOMETRIC SURFACE

AEP - ROCKPORT, IN

PROJECT NUMBER: 7382153161

SCALE	1" = 600'	**FIG. C-4**
DATE	6/3/2016	
DRAWN BY	TMR	
APPROVED BY	ALD	

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Document Path: P:\GIS_Projects\AEP\mxd\Appendix_D4.mxd

Appendix D

2016 Monitoring Well Installation Report

2016 MONITORING WELL INSTALLATION REPORT
Bottom Ash Ponds
Rockport Plant
Indiana-Michigan Power Company
Rockport, Indiana

Prepared for:
American Electric Power Service Corporation
and Indiana-Michigan Power Company
1 Riverside Plaza
Columbus, Ohio 43215

Prepared by:
Amec Foster Wheeler Environment & Infrastructure, Inc.
11003 Bluegrass Parkway, Suite 690
Louisville, Kentucky 40299

14 September 2017

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ATTACHMENTS

1.0 INTRODUCTION

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) was retained by American Electric Power Service Corporation (AEP) to observe and document drilling and monitoring well installation activities in the vicinity of the Bottom Ash (BA) Ponds at the AEP Rockport Plant.

The BA Ponds are located at the north end of the wastewater pond complex for the plant. The two contiguous ponds, referred to as the East and West BA Ponds, receive CCR on an alternating schedule. The ponds each have rough dimensions (at the crest of the embankments) of 2,000 feet x 650 feet, corresponding to a surface area of approximately 30 acres each (60 acres total).

Four shallow monitoring wells (MW-1001 through MW-1004) were installed in 2010 at the perimeter of the wastewater pond complex. Based on data collected from those wells, the dominant direction of groundwater flow beneath the ponds is to the east-southeast.

For the purpose of groundwater monitoring under the federal CCR Rule (40 CFR Part 257), AEP has elected to monitor groundwater at the BA Ponds using a multiunit groundwater monitoring system. The long-term groundwater monitoring network (GWMN) for the BA Ponds (including potentiometric and water quality monitoring) will consist of seven clusters of three wells each, installed at shallow, intermediate and deep levels in the unconsolidated overburden above bedrock. Five locations are along the downgradient sections of the pond perimeter, and two are at upgradient locations north of the BA Ponds. One of the existing shallow wells (MW-1002) has been incorporated into the GWMN. The other three existing wells (MW-1001, MW-1003, and MW-1004) have also been retained for water level monitoring (also known as potentiometric or piezometric monitoring) only. Twenty new monitoring wells were installed in early 2016 to complete the GWMN.

Monitoring well locations are shown on the map in **Figure 1**. Drilling, well construction and well development activities related to the new monitoring wells installed in 2016 are documented in this report.

2.0 FIELD ACTIVITIES

2.1 Schedule

Amec Foster Wheeler along with an AEP drilling crew mobilized to the site to kickoff drilling, well installation, and well development activities on 12 January 2016. A summary of key dates related to specific activities is provided below.

1) Amec Foster Wheeler and drill crew personnel attended safety orientation on 12 January 2016.
2) All drilling locations were identified and staked on 12 January 2016.
3) Locations and ground surface elevations were surveyed on 21 January 2016.

4) Drilling and monitoring well installation began on 13 January 2016 and was completed on 3 March 2016.
5) Locations, ground surface elevations, and top of casing elevations were surveyed on 3-4 March 2016.
6) Well Development began on 8 March 2016 and was completed by AEP on 29 March 2016. Amec Foster Wheeler observed well development activities 17 March 2016.

2.2 Staking, Surveying and Utility Clearances

1) All boring and monitoring well locations were staked prior to drilling.
2) All boring and monitoring well locations were surveyed both horizontally (northing and easting) and vertically (elevation) before and after installation, by AEP surveyors.
3) Coordinates were provided in the North American Datum of 1927 (NAD27), State Plane Coordinate System (SPCS) Indiana West Zone and elevations were provided in the North Geodetic Vertical Datum of 1929 (NGVD29), also known as Mean Sea Level (MSL).
4) Ground surface elevations were provided for all boring and monitoring well locations before and after well installation. Top of PVC casing elevations were provided for all monitoring well locations after well installation.
5) Prior to drilling activities, AEP located underground utilities near the new boring and monitoring well locations. Amec Foster Wheeler coordinated with onsite AEP personnel and drillers to make sure drilling locations were sufficiently removed from the located utilities to avoid damage.

2.3 Drilling and Soil Sampling

1) At each multi-level well location, three monitoring wells (shallow, intermediate, and deep) were installed. Because one shallow monitoring well already existed at the location for MW-1602 (MW-1002), only intermediate and deep wells were installed.
2) Drilling and monitoring well installation was performed by a drill rig equipped with hollow-stem augers with an inside diameter of 4¼ inches. Mud-rotary drilling was used below the water table due to running sands infiltrating the auger.
3) Continuous standard penetration testing (SPT) was performed from ground surface to refusal at all deep monitoring wells. Blow counts were recorded and used to develop N values for each sampled interval. For SPTs, AEP provided the hammer calibration record for review by Amec Foster Wheeler.
4) Recovered samples were described by Amec Foster Wheeler personnel and retained by AEP for laboratory analysis.

5) At each location, the deep monitoring well was installed first. Descriptions of subsurface materials recorded during the installation of the deep monitoring well were used to determine the depths of the screened intervals in the shallow and intermediate wells.
6) Boring logs including lithologic descriptions, blow counts, N values, and field observations are included as **Attachment 1.**

2.4 Geotechnical Sample Testing

1) AEP retained and transported samples collected during drilling to the AEP's Civil Engineering laboratory in Groveport, Ohio for geotechnical testing.
2) AEP tested selected samples from the screened intervals for gradation (ASTM D6913) and percent passing #200 sieve (ASTM D1140).
3) Gradation curves are provided as **Attachment 2**.

2.5 Monitoring Well Construction

1) Final well construction dimensions are provided in **Table 1**.
2) Monitoring wells were constructed of 2-inch schedule 40 PVC casing and 2-inch schedule 40 PVC 0.010-inch factory slotted screen.
3) A filter pack was placed in the annular space extending from a minimum of 6 inches below the bottom of the well to a minimum of 1 foot above the top of the screen.
4) A bentonite pellet seal was placed in the annular space above the filter pack and extended to a minimum of 2 feet above the filter pack. The bentonite pellets were hydrated as they were installed.
5) High solids bentonite grout was placed in the annular space from the bentonite seal to within 2 feet of ground surface using a tremie pipe.
6) A lockable steel protective casing, extending 2.5 to 3 ft above ground surface) was set in a concrete pad measuring 2 feet by 2 feet in area and 6 inches in thickness. The pad was constructed to slope away from the protective casing.

2.6 Well Development

1) Well development began on 8 March 2016 and was completed on 29 March 2016.
2) Well development was conducted by pumping using two Geotech Reclaimer pumps powered by a compressor. During pumping, each well was gently surged by moving the pump up and down the screened interval to mobilize fine-grained sediment and facilitate its removal.
3) Water quality parameters (discussed in **Section 2.8**) were monitored using a multi-parameter sonde, water quality meter, and flow-through cell (Geotech YSI ProDSS) in the final period of development.
4) During development, depth to water and flow rate measurements were also collected.

5) Pumping rates during well development ranged from 0.3 to 0.7 gallons per minute (gpm).

2.7 Water Level Gauging

1) Water level readings were collected periodically during drilling activities and during well development, using an electronic water level indicator, by measuring depth to water from the top of the inside casing.
2) Following well installation, while development of selected wells was still being conducted, a full round of water levels was collected on 17 March 2016.
3) All water level readings were converted to elevations relative to MSL using the surveyed top of casing elevations.
4) A summary of measured depths to water and water level elevations is provided in **Table 2**. The data in **Table 2** include historical water level elevations in the existing wells provided by AEP, two rounds of readings collected in existing wells by Amec Foster Wheeler on 14 January and 17 March 2016, and one round of water levels collected from the new wells on 17 March 2016. Updated hydrographs for the existing wells are provided in **Attachment 3**.

2.8 Water Quality Parameters

1) Water quality field parameters were collected during well development in a flow-through cell using a Geotech multiparameter digital sampling system (YSI ProDSS).
2) Water quality parameters monitored included temperature, pH, specific conductance (SC), dissolved oxygen (DO), oxidation-reduction potential (ORP), and turbidity.
3) Water quality parameters were monitored in the final period of well development at a reduced flow rate.
4) A summary of stabilized water quality parameters is provided in **Table 3**.

3.0 SUMMARY AND FINDINGS

Figure 1 is a map showing the locations of the monitoring wells as installed. Full boring and well construction logs are provided in **Attachment 1**. **Table 1** is a summary of well construction details. **Table 2** summarizes water level measurements collected over multiple events in the four monitoring wells installed in 2010, as well as measurements collected on 17 March 2016. **Table 2** also includes water level measurements collected on 17 March 2016, from the 20 new monitoring wells installed in 2016.

Geologic and hydraulic interpretations are provided in **Figures 2 through 7**. **Figure 2** is a contour map of the bedrock surface in the vicinity of the BA Ponds, and **Figure 3** is a contour map of the potentiometric surface on 17 March 2016, based on the water level measurements collected on that date from the wells installed in the shallow zone. **Figure 4** shows the lines of three geologic cross-sections through the area of the BA Ponds, provided in **Figures 5, 6 and 7**.

The information obtained during drilling and installation of the new monitoring wells has been compared to background information (published data for the area, as well as site documents provided for review by AEP) summarized in the report titled *Groundwater Monitoring Network Evaluation, Bottom Ash Ponds, Rockport Plant, Indiana-Michigan Power Company, Rockport, Indiana* (GWMN Report) prepared for AEP by Amec Foster Wheeler. Full citations are provided in that report for sources referenced in this discussion.

The bedrock elevations encountered in the deep soil borings near the BA Ponds, which ranged in elevation from 274.1 to 298.8 ft MSL, along with the east-southeasterly slope of the bedrock surface (in the direction of the Ohio River), are generally consistent with the site information and published documents reviewed in the GWMN Report.

Core samples from bedrock were not obtained, but fragments recovered in split spoons and cuttings indicate that bedrock beneath the area of the BA Ponds consists of gray shale. This is consistent with the information from other site borings, and with published geologic mapping (Grove 2006), which indicates that the bedrock underlying the site and most of Spencer County is the Pennsylvanian Age Raccoon Group, consisting of sandstone and shale with minor amounts of mudstone, coal and limestone.

The unconsolidated overburden materials above bedrock generally agreed with historical information available for the site and discussed in Section 2.4.2.2 of the Groundwater Monitoring Network Evaluation Report, which grouped unconsolidated material into four units. This terminology has been maintained for the discussion of unconsolidated materials encountered during monitoring well installation and has been carried over to the cross sections presented in **Figures 5 through 7**.

- Fill – silt and clay (presumed to be reworked native soils) associated with the pond dikes. Because all but two locations (MW-1600 S,I,D and MW-1601 S,I,D) were positioned on top of the dikes, a substantial amount of fill material was encountered from ground surface to depths up to 15 BGS. Fill material generally consisted of silty clay, clay, and small amounts of sand.
- Unit No. 1 – surficial silt and clay. This unit was encountered beneath the fill material extending to a depth of between 15 and 29 feet BGS. The unit is a stiff silty to sandy clay with small amounts of interbedded sand layers.
- Unit No. 2 – well sorted sand. Below the surficial silts and clays was a poorly graded (well sorted) fine to medium grained sand to a maximum depth of approximately 32 to 43 feet BGS.
- Unit No. 3 – poorly sorted sand. This unit was encountered below Unit No. 2 and extended (along with Unit No. 4) to bedrock. Unit No. 3 consists of fine to coarse grained sand grading to sand and gravel of Unit No. 4.

- Unit No. 4 – sand and gravel. This unit was encountered interbedded within Unit No. 3 and consisted of fine to coarse, poorly to well sorted sand with variable amounts of gravel and coal particles.

At each well location a shallow, intermediate, and deep monitoring well was installed. Because one shallow monitoring well already existed at the location for MW-1602, only two new wells (an intermediate and a deep well) were installed. Screening intervals for each well were selected based on lithology described from the deep boring and are provided in **Table 1**. Elevations of screened intervals for shallow and intermediate were generally consistent across all locations. Top of screen elevations ranged from 362.9 to 363.2 ft MSL for shallow wells and 330.7 to 332.3 ft MSL for intermediate wells. Screened intervals for deep wells varied more than the other wells due to differences in the depth to bedrock. Top of screen elevations ranged from 284.3 to 308.8 ft MSL.

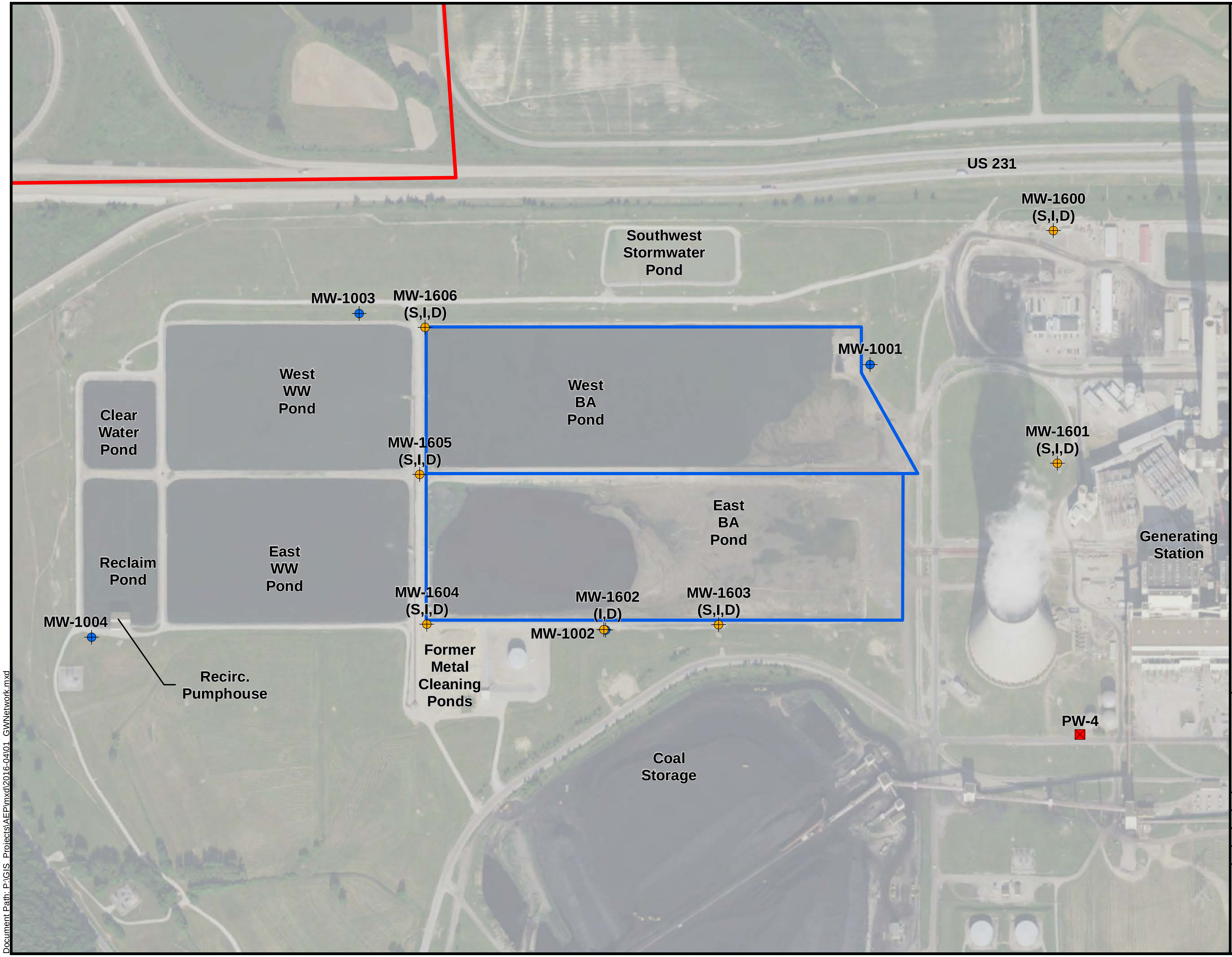
Following installation and during development, water levels were collected from all wells. Previous data from the four monitoring wells installed in 2010 indicate that the horizontal hydraulic gradient and groundwater flow direction beneath the ponds is typically to the east-southeast, toward the Ohio River. However, the historical data also indicate that temporary gradient reversals can occur in response to rapidly rising river stage conditions. The elevation of the water table can be expected to range between 366 and 372 ft MSL, with occasional (less than annual frequency) rises up to 376 ft MSL. The horizontal hydraulic gradient measured on 17 March 2016, as depicted in **Figure 3** based on the water levels in the shallow wells, was low (on the order of 0.0003 ft/ft) with a slope to the east.

Water level measurements collected in the three-well clusters installed in 2016 indicate there is very little difference in water levels between the three levels (shallow, intermediate and deep) at any location, and the direction of the vertical gradient is variable. Water level elevation differences on 17 March 2016, between wells in any cluster ranged from 0.01 to 0.33 ft, averaging 0.08 feet.

Field water quality data collected during well development is summarized in **Table 3**. Groundwater temperature ranged from 13.7° C in MW-1606I to 20.3° C in MW-1602D. The pH was neutral, ranging from 6.74 standard units (S.U.) in MW-1600S to 7.37 S.U. in MW-1604I. Specific Conductance (SC) ranged from 553 µS/cm in MW-1604D to 1,365 µS/cm in MW-1605D. Dissolved oxygen (DO) and oxidation-reduction potential (ORP) indicate a reducing to slightly oxidizing environment. DO ranged from 0.18 mg/L at MW-1606I to 6.61 at MW-1601I, while ORP ranged from -126 mV at MW-1606D to 219 mV at MW-1606S. Turbidity, stabilized at or below 5 NTU at all but one well and ranged from 0.7 NTU at MW-1604D to 5.8 NTU MW-1606S.

During well development, pumping rate and drawdown were recorded in the field notes. These data were used to calculate the specific capacity of each well to determine if additional hydraulic testing would be necessary. The specific capacity is the discharge in gallons per minute (gpm) per foot of drawdown. Specific capacity ranged from 0.2 gpm/ft at MW-1601D and MW-1603D to a maximum of 11 gpm/ft at MW-1600D. In 11 out of 20 wells there was no drawdown so specific capacity, which was essentially too high to measure from available pumping rates, could not be calculated.

FIGURES



Legend

⌖	Monitoring Well Cluster (2016)
⌖	USWAG Monitoring Well (2010)
☒	Water Supply Well
🟥	Property Boundary
🟦	Bottom Ash

Data Sources

Date of Photography: May-June 2016
Source of Photography: U.S. Department of Agriculture, National Agriculture Imagery Program (NAIP)

0 200 400
SCALE IN FEET

GROUNDWATER MONITORING NETWORK BOTTOM ASH PONDS

AEP - ROCKPORT, IN

PROJECT NUMBER: 7382153161

SCALE	1" = 400'
DATE	9/14/2017
DRAWN BY	TMR
APPROVED BY	ALD

FIG. 1

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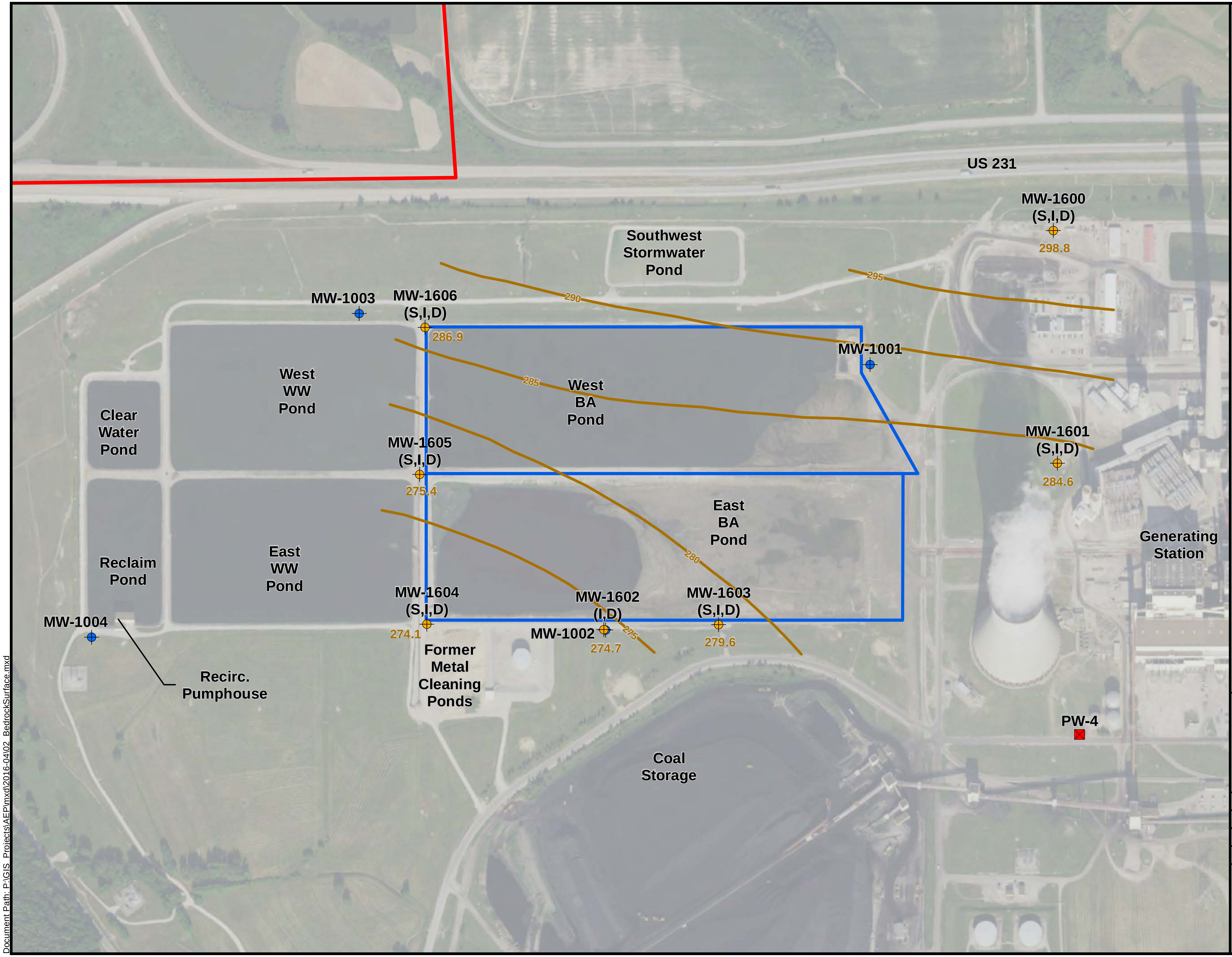

Legend

⊕	Monitoring Well Cluster
⊕	USWAG Monitoring Well
🟥	Water Supply Well
—	Bedrock Elevation Contour (FT
🟥	Property Boundary
🟦	Bottom Ash

Bedrock Elevation (FT MSL)

298.8 Bedrock elevation in the deep monitoring well boring

Data Sources

Date of Photography: May-June 2016
Source of Photography: U.S. Department of Agriculture, National Agriculture Imagery Program (NAIP)

0 200 400
SCALE IN FEET

BEDROCK SURFACE CONTOUR MAP BOTTOM ASH PONDS

AEP - ROCKPORT, IN

PROJECT NUMBER: 7382153161

SCALE	1" = 400'
DATE	9/14/2017
DRAWN BY	TMR
APPROVED BY	ALD

FIG. 2

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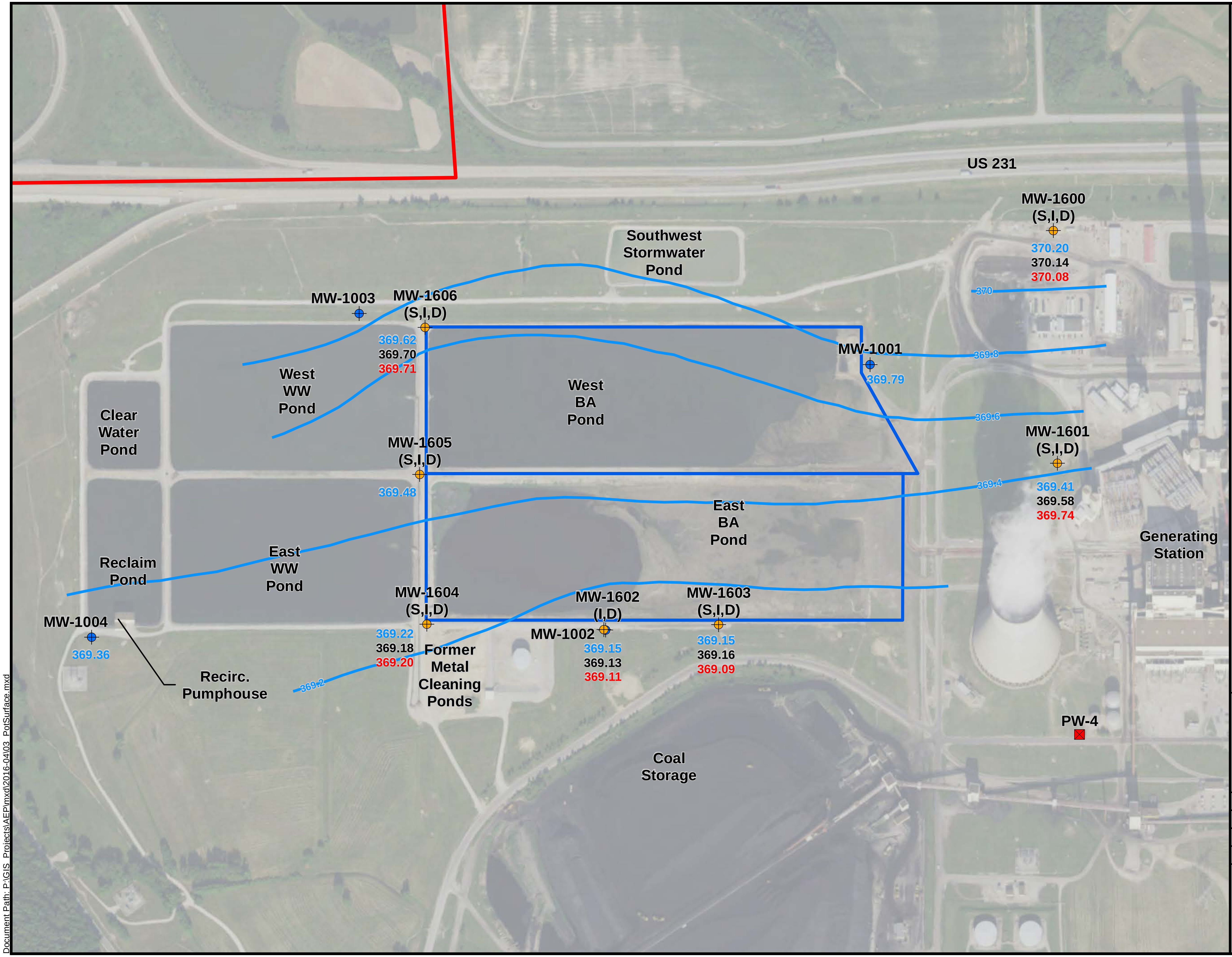
Document Path: P:\GIS_Projects\AEP\mxd\2016-04102_BedrockSurface.mxd



Legend

⊕	Monitoring Well Cluster
⊕	USWAG Monitoring Well
☒	Water Supply Well
—	Potentiometric Elevation Contour (FT MSL) Contour Interval: 0.2 FT
▭	Property Boundary
▭	Bottom Ash

Groundwater Potentiometric Elevation (FT MSL)

369.22	Shallow Well
369.18	Intermediate Well
369.20	Deep Well

Data Sources

Date of Photography: May-June 2016
Source of Photography: U.S. Department of Agriculture, National Agriculture Imagery Program (NAIP)

0 200 400
SCALE IN FEET

POTENTIOMETRIC SURFACE CONTOUR MAP
17 MARCH 2016
AEP - ROCKPORT, IN

PROJECT NUMBER: 7382153161

SCALE	1" = 400'	FIG. 3
DATE	9/14/2017	
DRAWN BY	TMR	
APPROVED BY	ALD	

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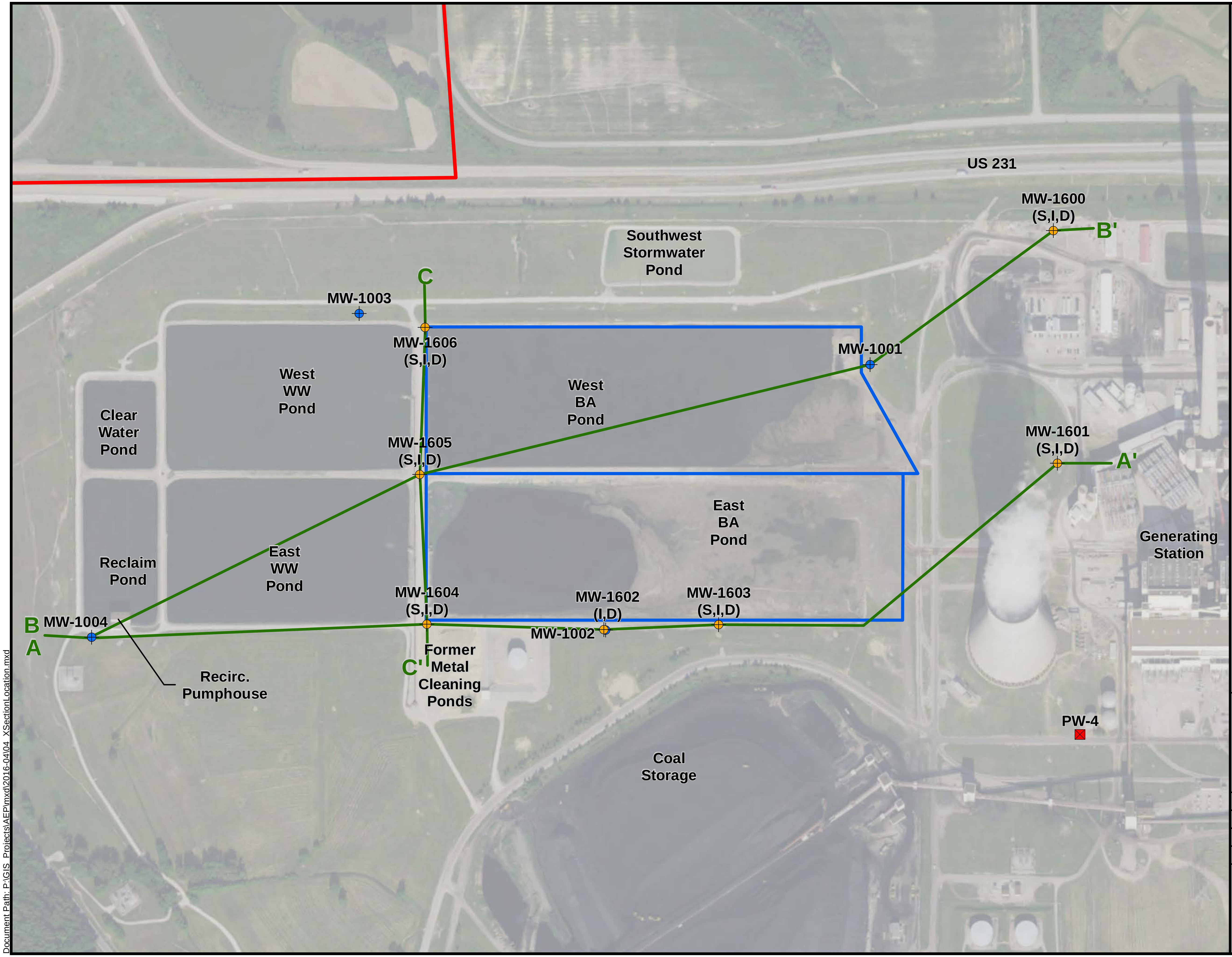
Document Path: P:\GIS Projects\AEP\mxd\2016-04\03 PotSurface.mxd



Legend

- Monitoring Well Cluster
- USWAG Monitoring Well
- Water Supply Well
- Cross Section Lines
- Property Boundary
- Bottom Ash

Data Sources

Date of Photography: May-June 2016
Source of Photography: U.S. Department of Agriculture, National Agriculature Imagery Program (NAIP)

0 200 400
SCALE IN FEET

CROSS SECTION LOCATION MAP BOTTOM ASH PONDS

AEP - ROCKPORT, IN

PROJECT NUMBER: 7382153161

SCALE	1" = 400'
DATE	9/14/2017
DRAWN BY	TMR
APPROVED BY	ALD

FIG.
4

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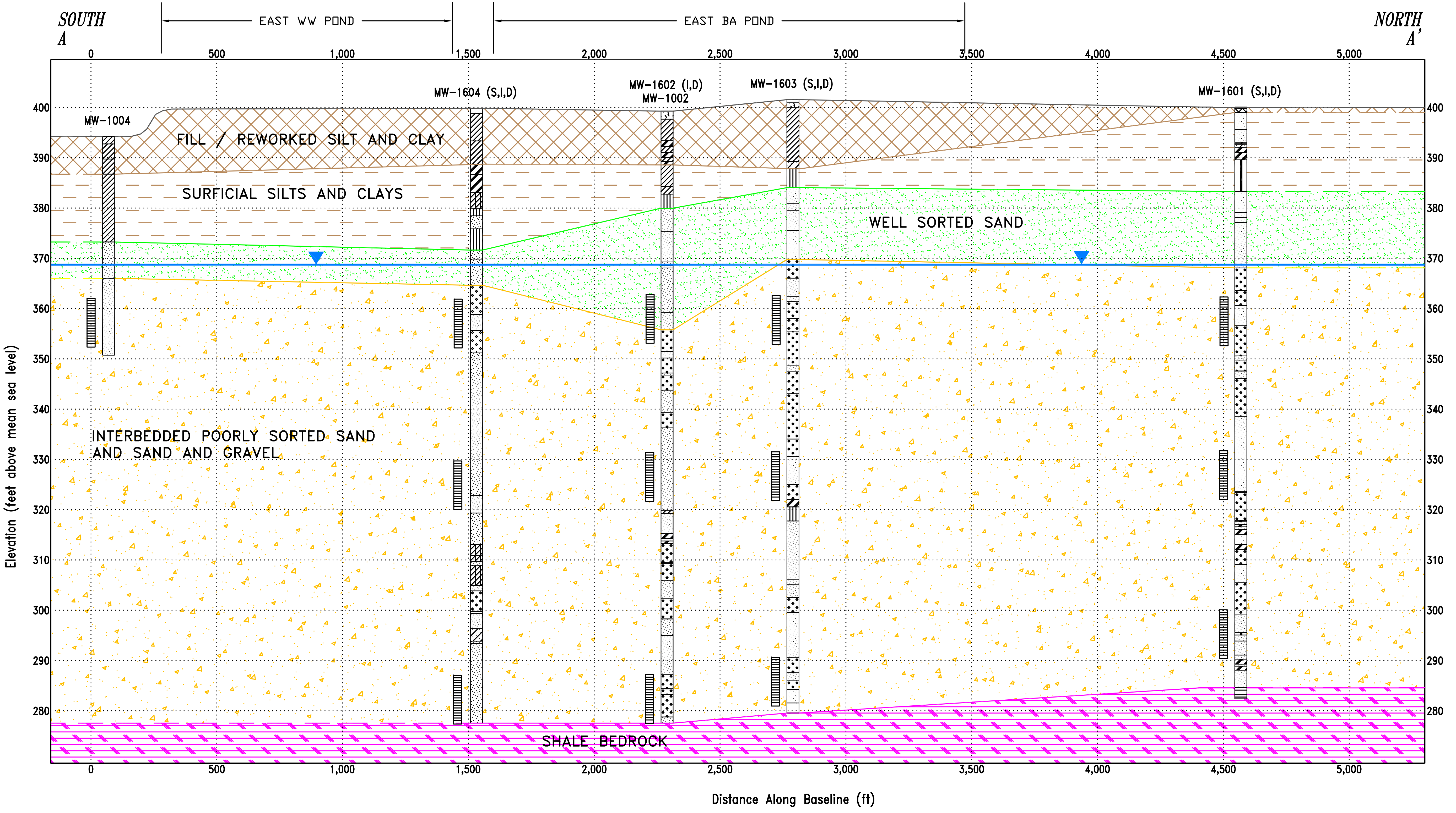

0' 400'

SCALE: 1"=400'
VERTICAL EXAGGERATION: 20X

N

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BOTTOM ASH PONDS
AEP - ROCKPORT, INDIANA

CROSS SECTION A - A'

PROJECT NUMBER: 7382-15-3161

SCALE	1" = 400'
DATE	05/20/2016
DRAWN BY	VM / TMR
APPROVED BY	ALD

FIG.
5

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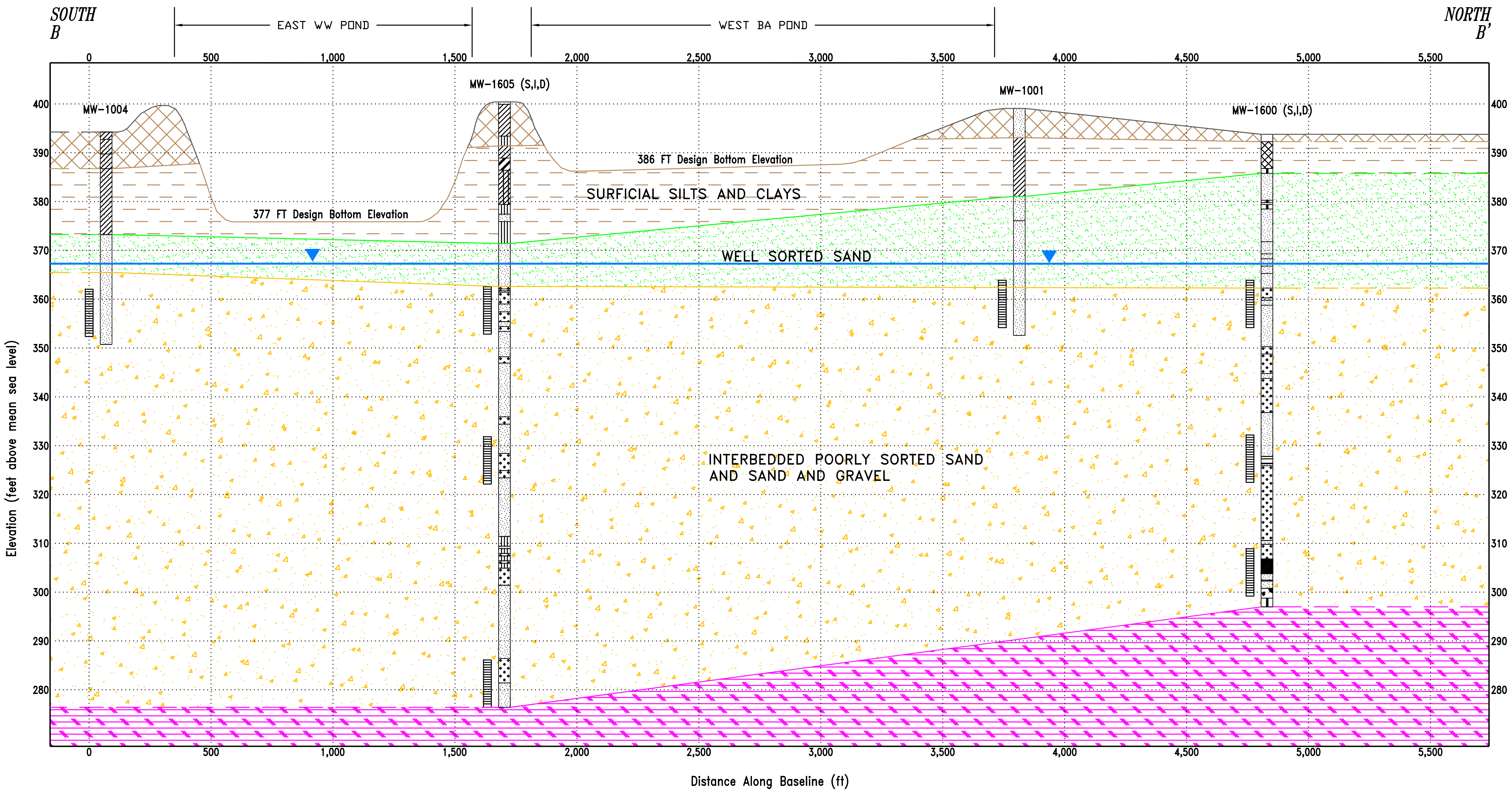

0' 400'
SCALE: 1"=400'
VERTICAL EXAGGERATION: 20X

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BOTTOM ASH PONDS
AEP - ROCKPORT, INDIANA

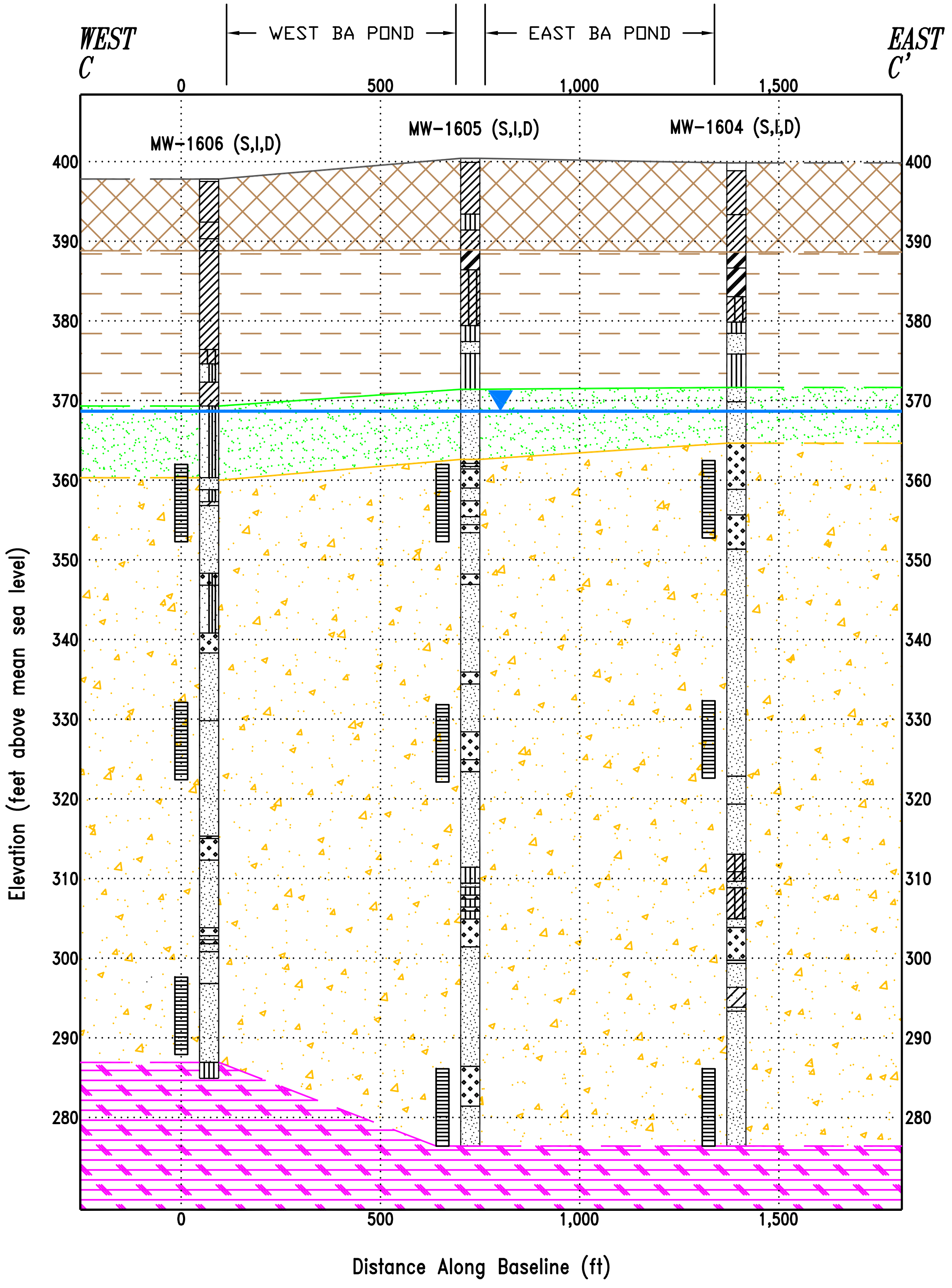
CROSS SECTION B - B'

PROJECT NUMBER: 7362-15-3161

SCALE	1" = 400'
DATE	05/20/2016
DRAWN BY	VM / TMR
APPROVED BY	ALD

FIG. 6

P:\Projects\15 projects\7382153161 AEP CCR Rockport IN\Drawings\AEP_ROCKPORT_SECTION_B.dwg May. 20, 2016 tom.reed



LEGEND:

- ▨ USCS Low Plasticity Clay
- ▨ USCS High Plasticity Clay
- ▥ USCS Low Plasticity Silty Clay
- ▥ USCS Silt
- ░ USCS Poorly-graded Sand
- ▦ USCS Well-graded Sand
- ▤ Shale
- ▨ USCS Clayey Sand
- ▥ USCS Poorly-graded Sand with Silt
- ▦ USCS Well-graded Sand with Silt
- ● USCS Well-graded Gravel
- ☒ Fill or Reworked Soil
- ☐ Surficial Silt and Clay
- 🟩 Well Sorted Sand
- ☐ Interbedded Poorly Sorted Sand and Sand and Gravel
- ▤ Shale Bedrock
- ▥ Screened Interval
- ▼ Water level elevation measured in shallow wells on 17 March 2016

0' 400'

SCALE: 1"=400'
VERTICAL EXAGGERATION: 20X

N

amec foster wheeler

Environment & Infrastructure, Inc.
2456 Fortune Drive, Suite 100
Lexington, Kentucky 40509
Phone: (859) 255-3308

BOTTOM ASH PONDS
AEP - ROCKPORT, INDIANA

CROSS SECTION C - C'

PROJECT NUMBER: 7382-15-3161

SCALE	1" = 400'
DATE	05/20/2016
DRAWN BY	VM / TMR
APPROVED BY	ALD

FIG. 7

P:\Projects\15 projects\7382153161 AEP CCR Rockport IN\Drawings\AEP_ROCKPORT_SECTION_C.dwg May. 20, 2016 tom.reed

TABLES

Table 1
Monitoring Well Construction Details
Bottom Ash Pond Complex
AEP Rockport Plant, Rockport, Indiana

Well ID	Date Installed	Northing SPCS NAD27	Easting SPCS NAD27	Top of Casing (TOC) Elevation*	Ground Surface Elevation	Casing Stick-Up	Length of Screen	Type of Screen	Total Depth of Boring	Depth to Top of Bedrock	Sounded Depth of Well	Depth to Top of Screen	Bottom of Boring Elevation	Top of Bedrock Elevation	Bottom of Well Elevation	Bottom of Screen Elevation	Top of Screen Elevation
		(ft)	(ft)	(ft MSL)	(ft MSL)	(ft AGS)	(ft)	(PVC)	(ft BGS)	(ft BGS)	(ft BMP)	(ft BGS)	(ft MSL)	(ft MSL)	(ft MSL)	(ft MSL)	(ft MSL)
MW-1001	6/2/2010	153488.0	513047.6	402.35	400.03	2.3	9.7	2" x 0.010"	41.0	---	---	29.7	359.0	---	360.0	360.6	370.3
MW-1002	6/2/2010	152307.4	514231.0	401.42	399.09	2.3	9.7	2" x 0.010"	46.5	---	---	35.2	352.6	---	353.6	354.2	363.9
MW-1003	6/2/2010	151208.1	512820.7	393.23	390.84	2.4	9.7	2" x 0.010"	39.0	---	---	27.7	351.8	---	352.8	353.4	363.1
MW-1004	6/3/2010	150013.4	514264.7	396.55	394.25	2.3	9.7	2" x 0.010"	43.5	---	---	32.2	350.8	---	351.8	352.4	362.1
MW-1600-S	2/29/2016	154305.946	512458.043	396.73	393.69	3.0	9.6	2" x 0.010"	41.6	---	43.59	30.6	352.1	---	353.1	353.5	363.1
MW-1600-I	2/29/2016	154306.008	512454.030	396.65	393.72	2.9	9.6	2" x 0.010"	73.0	---	74.59	61.7	320.7	---	322.1	322.5	332.1
MW-1600-D	2/17/2016	154306.313	512448.952	396.31	393.79	2.5	9.6	2" x 0.010"	96.8	95.0	97.52	85.0	297.0	298.8	298.8	299.2	308.8
MW-1601-S	2/27/2016	154327.617	513479.660	402.65	399.77	2.9	9.6	2" x 0.010"	48.0	---	49.74	36.9	351.8	---	352.9	353.3	362.9
MW-1601-I	2/26/2016	154325.290	513483.510	402.83	399.96	2.9	9.6	2" x 0.010"	79.8	---	80.95	68.1	320.2	---	321.9	322.3	331.9
MW-1601-D	2/26/2016	154323.168	513487.454	402.84	400.09	2.8	9.6	2" x 0.010"	117.7	115.5	112.77	100.0	282.4	284.6	290.1	290.5	300.1
MW-1602-I	2/9/2016	152295.035	514229.173	402.03	399.38	2.6	9.6	2" x 0.010"	78.7	---	80.45	67.8	320.7	---	321.6	322.0	331.6
MW-1602-D	1/26/2016	152300.217	514229.384	401.91	399.28	2.6	9.6	2" x 0.010"	125.0	124.6	126.96	114.3	274.3	274.7	275.0	275.4	285.0
MW-1603-S	2/3/2016	152802.696	514206.885	403.85	401.46	2.4	9.6	2" x 0.010"	49.3	---	50.63	38.2	352.2	---	353.2	353.6	363.2
MW-1603-I	2/1/2016	152807.294	519207.223	404.15	401.41	2.7	9.6	2" x 0.010"	79.6	---	81.67	68.9	321.8	---	322.5	322.9	332.5
MW-1603-D	1/29/2016	152811.949	514207.457	403.85	401.56	2.3	9.6	2" x 0.010"	122.0	122.0	123.14	110.9	279.6	279.6	280.7	281.1	290.7
MW-1604-S	1/29/2016	151503.132	514197.320	402.46	399.76	2.7	9.6	2" x 0.010"	48.0	---	49.35	36.7	351.8	---	353.1	353.5	363.1
MW-1604-I	1/28/2016	151506.473	514201.037	402.19	399.74	2.4	9.6	2" x 0.010"	79.0	---	81.46	69.0	320.7	---	320.7	321.1	330.7
MW-1604-D	1/15/2016	151510.165	514204.869	402.44	399.85	2.6	9.6	2" x 0.010"	126.6	125.8	128.15	115.6	273.3	274.1	274.3	274.7	284.3
MW-1605-S	3/1/2016	151478.765	513528.386	403.38	400.33	3.1	9.6	2" x 0.010"	49.0	---	50.60	37.6	351.3	---	352.8	353.2	362.8
MW-1605-I	3/2/2016	151478.914	513532.565	403.22	400.60	2.6	9.6	2" x 0.010"	80.0	---	81.50	68.9	320.6	---	321.7	322.1	331.7
MW-1605-D	2/3/2016	151478.903	513537.066	403.78	400.42	3.4	9.6	2" x 0.010"	127.5	125.0	128.00	114.6	272.9	275.4	275.8	276.2	285.8
MW-1606-S	3/2/2016	151498.907	512889.413	400.65	397.62	3.0	9.6	2" x 0.010"	46.0	---	47.62	34.6	351.6	---	353.0	353.4	363.0
MW-1606-I	3/1/2016	151500.402	512885.504	400.75	397.75	3.0	9.6	2" x 0.010"	77.0	---	78.41	65.4	320.8	---	322.3	322.7	332.3
MW-1606-D	2/12/2016	151502.092	512881.487	400.73	397.82	2.9	9.6	2" x 0.010"	112.9	110.9	113.15	100.2	284.9	286.9	287.6	288.0	297.6

Prepared By: TMR 4/19/16
Checked By: SGW 4/21/2016

Notes:

* Top of casing on new wells surveyed 3-4 March 2016.

--- = Data not available or not applicable
ft = feet
in = inches
BMP = below measuring point (top of casing)
BGS = below ground surface
MSL = above Mean Sea Level, equivalent to the National Geodetic Vertical Datum of 1929 (NGVD29)
AGS = above ground surface
TOC = top of casing (PVC pipe)
SPCS = State Plane Coordinate System
NAD27 = North American Datum of 1927

Table 2
Groundwater Elevation Summary
Bottom Ash Pond Complex
AEP Rockport Plant, Rockport, Indiana

Well No.	**MW 1001**	**MW 1002**	**MW 1003**	**MW 1004**	**MW-1600-S**	**MW-1600-I**	**MW-1600-D**	**MW-1601-S**
Date Installed	6/2/2010	6/2/2010	6/2/2010	6/2/2010	2/29/2016	2/29/2016	2/17/2016	2/27/2016
MP Elevation (ft MSL)*	402.35	401.42	393.23	396.55	396.73	396.65	396.31	402.65
Depth to Well Bottom (ft BMP)	42.32	47.83	40.39	44.80	43.59	74.59	97.52	49.74
Well Bottom Elevation (ft MSL)	360.0	353.6	352.8	351.8	353.1	322.1	298.8	352.9
Depth to Water (ft BMP)								
5/17/2011	---	---	---	---	---	---	---	---
11/17/2011	---	---	---	---	---	---	---	---
11/15/2012	---	---	---	---	---	---	---	---
5/20/2013	---	---	---	---	---	---	---	---
11/13/2013	---	---	---	---	---	---	---	---
5/12/2014	---	---	---	---	---	---	---	---
11/12/2014	---	---	---	---	---	---	---	---
5/7/2015	---	---	---	---	---	---	---	---
1/14/2016	33.01	32.87	24.20	28.58	---	---	---	---
3/17/2016	32.56	32.27	23.40	27.19	26.53	26.51	26.23	33.24
Water Level Elevation (ft MSL)								
5/17/2011	371.61	373.20	373.72	376.13	---	---	---	---
11/17/2011	370.77	369.17	369.64	367.35	---	---	---	---
11/15/2012	368.91	367.48	367.83	365.93	---	---	---	---
5/20/2013	369.11	367.95	368.61	367.38	---	---	---	---
11/13/2013	368.38	366.99	367.49	366.43	---	---	---	---
5/12/2014	370.06	369.55	369.93	368.84	---	---	---	---
11/12/2014	368.57	367.03	367.64	365.57	---	---	---	---
5/7/2015	370.75	371.16	371.35	370.93	---	---	---	---
1/14/2016	369.34	368.55	369.03	367.97	---	---	---	---
3/17/2016	369.79	369.15	369.83	369.36	370.20	370.14	370.08	369.41

Table 2
Groundwater Elevation Summary
Bottom Ash Pond Complex
AEP Rockport Plant, Rockport, Indiana

Well No.	**MW-1601-I**	**MW-1601-D**	**MW-1602-I**	**MW-1602-D**	**MW-1603-S**	**MW-1603-I**	**MW-1603-D**	**MW-1604-S**
Date Installed	2/26/2016	2/26/2016	2/9/2016	1/26/2016	2/3/2016	2/1/2016	1/29/2016	1/29/2016
MP Elevation (ft MSL)*	402.83	402.84	402.03	401.91	403.85	404.15	403.85	402.46
Depth to Well Bottom (ft BMP)	80.95	112.77	80.45	126.96	50.63	81.67	123.14	49.35
Well Bottom Elevation (ft MSL)	321.9	290.1	321.6	275.0	353.2	322.5	280.7	353.1
Depth to Water (ft BMP)								
5/17/2011	---	---	---	---	---	---	---	---
11/17/2011	---	---	---	---	---	---	---	---
11/15/2012	---	---	---	---	---	---	---	---
5/20/2013	---	---	---	---	---	---	---	---
11/13/2013	---	---	---	---	---	---	---	---
5/12/2014	---	---	---	---	---	---	---	---
11/12/2014	---	---	---	---	---	---	---	---
5/7/2015	---	---	---	---	---	---	---	---
1/14/2016	---	---	---	---	---	---	---	---
3/17/2016	33.25	33.10	32.90	32.80	34.70	34.99	34.76	33.24
Water Level Elevation (ft MSL)								
5/17/2011	---	---	---	---	---	---	---	---
11/17/2011	---	---	---	---	---	---	---	---
11/15/2012	---	---	---	---	---	---	---	---
5/20/2013	---	---	---	---	---	---	---	---
11/13/2013	---	---	---	---	---	---	---	---
5/12/2014	---	---	---	---	---	---	---	---
11/12/2014	---	---	---	---	---	---	---	---
5/7/2015	---	---	---	---	---	---	---	---
1/14/2016	---	---	---	---	---	---	---	---
3/17/2016	369.58	369.74	369.13	369.11	369.15	369.16	369.09	369.22

Table 2
Groundwater Elevation Summary
Bottom Ash Pond Complex
AEP Rockport Plant, Rockport, Indiana

Well No.	**MW-1604-I**	**MW-1604-D**	**MW-1605-S**	**MW-1605-I**	**MW-1605-D**	**MW-1606-S**	**MW-1606-I**	**MW-1606-D**
Date Installed	1/28/2016	1/15/2016	3/1/2016	3/2/2016	2/3/2016	3/2/2016	3/1/2016	2/12/2016
MP Elevation (ft MSL)*	402.19	402.44	403.38	403.22	403.78	400.65	400.75	400.73
Depth to Well Bottom (ft BMP)	81.46	128.15	50.60	81.50	128.00	47.62	78.41	113.15
Well Bottom Elevation (ft MSL)	320.7	274.3	352.8	321.7	275.8	353.0	322.3	287.6
Depth to Water (ft BMP)								
5/17/2011	---	---	---	---	---	---	---	---
11/17/2011	---	---	---	---	---	---	---	---
11/15/2012	---	---	---	---	---	---	---	---
5/20/2013	---	---	---	---	---	---	---	---
11/13/2013	---	---	---	---	---	---	---	---
5/12/2014	---	---	---	---	---	---	---	---
11/12/2014	---	---	---	---	---	---	---	---
5/7/2015	---	---	---	---	---	---	---	---
1/14/2016	---	---	---	---	---	---	---	---
3/17/2016	33.01	33.24	33.90	34.0	35.0	31.03	31.05	31.02
Water Level Elevation (ft MSL)								
5/17/2011	---	---	---	---	---	---	---	---
11/17/2011	---	---	---	---	---	---	---	---
11/15/2012	---	---	---	---	---	---	---	---
5/20/2013	---	---	---	---	---	---	---	---
11/13/2013	---	---	---	---	---	---	---	---
5/12/2014	---	---	---	---	---	---	---	---
11/12/2014	---	---	---	---	---	---	---	---
5/7/2015	---	---	---	---	---	---	---	---
1/14/2016	---	---	---	---	---	---	---	---
3/17/2016	369.18	369.20	369.48	369.22	368.78	369.62	369.70	369.71

Prepared by: TMR 4/19/16
Checked by: SGW 4/21/16

Notes:
* Top of casing on new wells surveyed 3-4 March 2016.
--- = Data not available or not applicable
ft = feet
BMP = below measuring point (top of casing)
MSL = above Mean Sea Level, equivalent to the National Geodetic Vertical Datum of 1929 (NGVD29)

Table 3
Field Water Quality Data
Bottom Ash Pond Complex
AEP Rockport Plant, Rockport, Indiana

Well ID	Date	Time	Static DTW (ft BMP)	pH (S.U.)	Temp (°C)	SC (µS/cm)	DO (mg/L)	ORP (mV)	Turb (NTU)
MW-1600-S	3/22/2016	10:15	26.53	6.74	15.5	735	0.8	103	1.6
MW-1600-I	3/22/2016	12:00	26.51	6.97	15.5	703	4.22	-64.3	5.0*
MW-1600-D	3/22/2016	9:40	26.23	6.88	14.3	715	0.52	-104	1.8
MW-1601-S	3/10/2016	15:05	33.36	7.17	16.0	725	0.89	---	1.6
MW-1601-I	3/10/2016	13:45	33.35	6.78	15.9	788	6.61	-59.0	3.9
MW-1601-D	3/30/2016	9:05	33.1	6.97	15.6	759	1.91	-102.6	4.0
MW-1602-I	3/15/2016	16:40	33.21	7.18	18.8	738	0.6	---	4.8
MW-1602-D	3/15/2016	15:45	32.51	7.18	20.3	919	0.58	---	5.0
MW-1603-S	3/20/2016	15:40	34.70	7.15	17.0	792	0.42	-90.2	1.8
MW-1603-I	3/20/2016	16:25	34.99	7.04	14.4	835	2.48	-71.6	5.0
MW-1603-D	3/20/2016	15:00	34.76	6.95	14.4	739	0.75	-98.3	2.1
MW-1604-S	3/14/2016	14:25	33.21	7.33	18.9	876	0.39	---	2.3
MW-1604-I	3/12/2016	12:50	33.40	7.37	16.9	782	1.58	---	1.9
MW-1604-D	3/12/2016	11:30	33.59	7.23	16.2	553	0.57	---	0.69
MW-1605-S	3/17/2016	14:05	33.62	7.11	18.3	978	0.25	157	2.1
MW-1605-I	3/17/2016	13:15	33.51	7.16	16.3	790	0.39	-90.7	4.9
MW-1605-D	3/17/2016	10:45	33.73	7.12	17.1	1,365	0.45	-95.2	3.3
MW-1606-S	3/19/2016	13:10	31.03	7.00	14.0	788	2.75	219	5.8
MW-1606-I	3/19/2016	9:55	31.50	7.21	13.7	631	0.18	-93.2	1.5
MW-1606-D	3/19/2016	10:35	31.20	7.11	13.8	568	0.71	-126	3.1

Prepared By: TMR 4/25/16

Checked By: ALD 4/26/2016

Notes:

* = Final turbidity measurement collected at 14:00 after an additional 2 hours of pumping.
--- = Data not available or not applicable
ft = feet
S.U. = Standard Units
°C = degrees Celcius
µS/cm = microSiemens per centimeter
mg/L = milligrams per liter
mV = milliVolts
NTU = Nephelometric Turbidity Units
DTW = Depth to Water
BMP = Below Measuring Point (top of casing)
Temp = Temperature
SC = Specific Conductance
DO = Dissolved Oxygen
ORP = Oxidation-Reduction Potential
Turb = Turbidity

ATTACHMENTS

ATTACHMENT 1

WELL CONSTRUCTION AND LITHOLOGIC LOGS
2016 BA POND MONITORING WELLS

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 154,306.3 E 512,449.0**

GROUND ELEVATION **393.8** SYSTEM **State Plane using NAD27/29**

BORING NO. **MW-1600D** DATE **4/27/16** SHEET **1** OF **4**

BORING START **2/17/16** BORING FINISH **2/17/16**

PIEZOMETER TYPE WELL TYPE **OW**

HGT. RISER ABOVE GROUND **2.52** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **84.99** BOTTOM **94.59**

WELL DEVELOPMENT **YES** BACKFILL

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

Water Level, ft	▽	▼	▼
TIME			
DATE			

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
1	SS	0.0	1.5	33-14-10	1.5					Gravel = 18 inches		
2	SS	1.5	3.0	3-5-6	1.5					Silty clay, l. brown 5YR 6/4 and l. grey N7 mottled, dry, stiff, FILL @ 3' sl. stiff @ 4.2' w/dusky brown 5YR 2/2 silt @ 4.5' stiff, some iron oxide particles, moist		
3	SS	3.0	4.5	2-3-4	1.5							
4	SS	4.5	6.0	4-4-6	1.5		5					
5	SS	6.0	7.5	3-6-9	1.5							
6	SS	7.5	9.0	2-5-6	1.5				MH SP	Clayey silt, moderate brown 5YR 4/4 and l. grey N7 fat clay mottled, moist, med. dense, trace oxide particles, likely fill Poorly graded sand, fine grained, l. brown 5YR 5/6, dry to moist, med. dense @ 9' v. fine grained, loose		
7	SS	9.0	10.5	3-4-4	1.4		10					
8	SS	10.5	12.0	3-4-4	1.4							
9	SS	12.0	13.5	2-3-5	1.5							
10	SS	13.5	15.0	2-4-5	1.5		15		MH SP MH	Clayey silt, moderate brown 5YR 4/4, moist, loose Poorly graded sand, fine grained pale yellowish brown 10YR 6/2, moist, loose Clayey silt, moderate brown 5YR 4/4, moist, loose		
11	SS	15.0	16.5	3-8-10	1.5				SP	Poorly graded sand, fine grained, pale yellowish brown 10YR 6/2, moist, med. dense @ 16' 3" layer - clayey silt (prev. material) @ 19' 4" layer - poorly graded sand (l. brown, v. fine grained) prev. material @ 21' loose @ 21.3' w/black silt		
12	SS	16.5	18.0	4-6-8	1.5							
13	SS	18.0	19.5	5-6-5	1.5							
14	SS	19.5	21.0	3-5-4	1.5							

Continued Next Page

TYPE OF CASING USED

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

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

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

RECORDER **AMEC FOSTER WHEELER**

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1600D** DATE **4/27/16** SHEET **2** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **2/17/16** BORING FINISH **2/17/16**

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	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
15	SS	21.0	22.5	3-3-5	1.5						
16	SS	22.5	24.0	2-3-3	1.5			SP	Poorly graded sand, v. fine grained, l. brown 5YR 5/6, moist, loose @ 22.8' 3" layer - PG sand, fine, pale yellowish br. prev. material @ 23.2' w/black silt @ 23.5' no black silt @ 24' moderate red 5R 4/6		
17	SS	24.0	25.5	4-6-6	1.5		25	SP			
18	SS	25.5	27.0	2-2-4	1.0			SP	Poorly graded sand, med. grained, d. yellowish brown 10YR 4/2, moist, med. dense, some black silt		
19	SS	27.0	28.5	2-2-2	1.2			SP	Poorly graded sand, v. fine grained, pale yellowish brown 10YR 6/2, wet, loose, trace clay (l. brown 5YR 6/4), trace coarse gravel, water in spoon		
20	SS	28.5	30.0	4-8-11	1.5			SP	Poorly graded sand, fine grained, pale yellowish brown 10YR 6/2, wet, v. loose, w/lean clay (mod. brown 5YR 4/4)		
21	SS	30.0	31.5	6-6-8	1.0		30		Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, wet, med. dense, w/fine gravel @ 30.5' w/black silt @ 30.7' no black silt		
22	SS	31.5	33.0	4-6-9	1.5			SW	Well graded sand, coarse grained, dark reddish brown 10R 3/4, wet, med. dense, w/fine gravel @ 32' 5" layer pg sand, fine, mod. yellowish brown, prev. material		
23	SS	33.0	34.5	8-9-12	1.5			SP	Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, wet, med. dense, w/fine gravel, trace black silt		
24	SS	34.5	36.0	13-16-12	1.5		35	SP SP	Poorly graded sand, fine to med. grained, dusky red 5R 3/4, wet, med. dense, w/fine gravel, trace coarse gravel		
25	SS	36.0	37.5	6-7-7	1.5				Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, wet, med. dense, w/fine gravel @ 36' trace coarse gavel @ 37.5' well graded SW @ 40' poorly graded SP @ 41' trace fine gravel, no coarse gravel @ 42' dense @ 43.1' 1" seam black silt and fine gravel - possible coal		
26	SS	37.5	39.0	5-8-12	1.5						
27	SS	39.0	40.5	6-12-17	1.5		40				
28	SS	40.5	42.0	6-11-19	1.5						
29	SS	42.0	43.5	7-15-24	1.5						
30	SS	43.5	45.0	3-10-16	1.4			SW	Well graded sand, fine to med. grained, pale yellowish brown 10YR 6/2 wet, med. dense, w/fine gravel		
31	SS	45.0	46.5	10-13-16	1.5		45	SW	@ 44' trace lean clay mod. brown 5YR 4/4 @ 44.4' no clay		

Continued Next Page

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1600D** DATE **4/27/16** SHEET **3** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **2/17/16** BORING FINISH **2/17/16**

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
32	SS	46.5	48.0	6-9-14	1.4					Well graded sand, coarse grained, mod. yellowish brown 10YR 5/4, wet, med. dense, w/fine gravel, trace coarse gravel @ 46.5' med. to coarse grained		
33	SS	48.0	49.5	9-16-20	1.5							
34	SS	49.5	51.0	12-11-15	1.4		50		SP	Poorly graded sand, fine grained, pale brown 5YR 5/4, wet, dense, trace coarse gravel		
35	SS	51.0	52.5	7-12-12	1.5				SW	Well graded sand, fine to med. grained, d. yellowish brown 10YR 4/2, wet, med. dense, some fine gravel, some black silt @ 51' trace coarse gravel @ 52.5' fine grained, no coarse gravel @ 54' no fine gravel @ 55.5' brownish grey 5YR 4/1 w/fine gravel		
36	SS	52.5	54.0	4-9-12	1.5							
37	SS	54.0	55.5	9-10-14	1.4		55					
38	SS	55.5	57.0	6-12-16	1.5							
39	SS	57.0	58.5	7-9-11	1.4				SP	Poorly graded sand, fine grained, brownish grey 5YR 4/1, wet, med. dense, w/black silt @ 60' dense @ 60.6' 1.5" shale fragment @ 62.1' w/fine gravel @ 63' v. dense @ 64.2' 3" layer shale, l. grey N7 @ 64.5' some coarse gravel @ 65' 2" layer shale, l. grey N7		
40	SS	58.5	60.0	7-10-16	1.2							
41	SS	60.0	61.5	13-16-16	1.5		60					
42	SS	61.5	63.0	6-14-25	1.4							
43	SS	63.0	64.5	11-20-38	1.5							
44	SS	64.5	66.0	22-24-29	1.4		65					
45	SS	66.0	67.5	50/3						Shale, l. grey, dry, hard		
46	SS	67.5	69.0	13-13-14	1.5				SP SW	Indeterminate layer transition due to 3" recovery (spoon refusal) in prev. sample Poorly graded sand, v. fine grained, brownish grey 5YR 4/1, wet, med. dense, w/fine gravel		
47	SS	69.0	70.5	12-16-16	1.4		70			Well graded sand, med. grained, d. yellowish brown 10YR 4/2, wet, med. dense, w/fine gravel, some coarse gravel @ 69' dense, fine to med. grained @ 70.5' med. grained @ 71' 3" layer fat clay, l. grey N7 (w/shale),		
48	SS	70.5	72.0	6-13-21	1.3							

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

AEP

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1600D** DATE **4/27/16** SHEET **4** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **2/17/16** BORING FINISH **2/17/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	SAMPLE DEPTH IN FEET TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %
49	SS	72.0	73.5	8-13-24	1.1	
50	SS	73.5	75.0	10-9-17	0	
51	SS	75.0	76.5	5-13-14	1.4	
52	SS	76.5	78.0	9-12-18	1.1	
53	SS	78.0	79.5	6-6-15	1.4	
54	SS	79.5	81.0	6-7-13	1.2	
55	SS	81.0	82.5	6-6-8	1.1	
56	SS	82.5	84.0	7-8-9	1.3	
57	SS	84.0	85.5	10-12-21	1.5	
58	SS	85.5	87.0	14-11-10	1.5	
59	SS	87.0	88.5	6-7-8	1.4	
60	SS	88.5	90.0	15-19-24	.08	
61	SS	90.0	91.5	11-25-21	1.5	
62	SS	91.5	93.0	16-13-12	1.5	
63	SS	93.0	94.5	10-11-12	1.0	
64	SS	94.5	96.0	9-26-50/5	1.4	
65	SS	96.0	97.5	35-50/4		

DEPTH IN FEET: 75, 80, 85, 90, 95

U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
	w/coarse gravel @ 72' no coarse gravel @ 73.5' mod. dense, sample washed out @76' 2.5" layer coal fragments @ 79' 1" seam fat clay, l. grey N7 @ 79.5' trace black silt		
SP	Poorly graded sand, v. fine grained, pale yellowish brown 10YR 6/2, wet, med. dense, trace black silt		
SW	Well graded sand, med. grained, d. yellowish brown 10YR 4/2, wet, dense, w/fine gravel, trace coarse gravel, trace black silt @ 84.6' 2.5" layer coal w/~30% above material SW @ 85.5' med. dense, no coarse gravel, no black silt		
GW	Well graded gravel, brownish grey 5YR 4/1, wet, med. dense, fine rounded, w/med. grained sand (l. yellowish brown 10YR 4.2, prev. material) @ 88.5' dense, sample washed out/blocket, cobble fragment in spoon tip		
SP	Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, wet, dense, some fine gravel, trace coarse gravel		
GW	Well graded gravel, brownish grey 5YR 4/1, wet, dense, fine to coarse, rounded, w/fine grained sand (mod. yellowish brown 10YR 5/4)		
SP	Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, wet, med. dense, w/fine gravel, some coarse gravel		
GW	Well graded gravel, brownish grey 5YR 4/1, wet, med. dense, fine to coarse, rounded, w/fine grained sand @ 94.5' hard		
MH	Clayey silt, l. grey moist, hard non-durable shale		
	Spoon refusal @ 96.8' Auger refusal @ 96.8' BT @ 96.8'		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 154,306.0 E 512,454.0**

GROUND ELEVATION **393.7** SYSTEM **State Plane using NAD27/29**

BORING NO. **MW-1600I** DATE **4/27/16** SHEET **1** OF **4**

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

PIEZOMETER TYPE WELL TYPE **OW**

HGT. RISER ABOVE GROUND **2.93** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **61.7** BOTTOM **71.22**

WELL DEVELOPMENT **YES** BACKFILL

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

Water Level, ft	▽	▼	▼
TIME			
DATE			

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	1.5	33-14-10	1.5					Gravel = 18 inches		
2	SS	1.5	3.0	3-5-6	1.5					Silty clay, l. brown 5YR 6/4 and l. grey N7 mottled, dry, stiff, FILL @ 3' sl. stiff @ 4.2' w/dusky brown 5YR 2/2 silt @ 4.5' stiff, some iron oxide particles, moist		
3	SS	3.0	4.5	2-3-4	1.5							
4	SS	4.5	6.0	4-4-6	1.5		5					
5	SS	6.0	7.5	3-6-9	1.5							
6	SS	7.5	9.0	2-5-6	1.5				MH SP	Clayey silt, moderate brown 5YR 4/4 and l. grey N7 fat clay mottled, moist, med. dense, trace oxide particles, likely fill Poorly graded sand, fine grained, l. brown 5YR 5/6, dry to moist, med. dense @ 9' v. fine grained, loose		
7	SS	9.0	10.5	3-4-4	1.4		10					
8	SS	10.5	12.0	3-4-4	1.4							
9	SS	12.0	13.5	2-3-5	1.5							
10	SS	13.5	15.0	2-4-5	1.5				MH SP MH	Clayey silt, moderate brown 5YR 4/4, moist, loose Poorly graded sand, fine grained pale yellowish brown 10YR 6/2, moist, loose Clayey silt, moderate brown 5YR 4/4, moist, loose		
11	SS	15.0	16.5	3-8-10	1.5		15		SP	Poorly graded sand, fine grained, pale yellowish brown 10YR 6/2, moist, med. dense @ 16' 3" layer - clayey silt (prev. material) @ 19' 4" layer - poorly graded sand (l. brown, v. fine grained) prev. material @ 21' loose @ 21.3' w/black silt		
12	SS	16.5	18.0	4-6-8	1.5							
13	SS	18.0	19.5	5-6-5	1.5							
14	SS	19.5	21.0	3-5-4	1.5							

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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 **AMEC FOSTER WHEELER**

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1600I** DATE **4/27/16** SHEET **2** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **2/29/16** BORING FINISH **2/29/16**

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
15	SS	21.0	22.5	3-3-5	1.5							
16	SS	22.5	24.0	2-3-3	1.5				SP	Poorly graded sand, v. fine grained, l. brown 5YR 5/6, moist, loose @ 22.8' 3" layer - PG sand, fine, pale yellowish br. prev. material		
17	SS	24.0	25.5	4-6-6	1.5		25		SP	@ 23.2' w/black silt @ 23.5' no black silt @ 24' moderate red 5R 4/6		
18	SS	25.5	27.0	2-2-4	1.0				SP	Poorly graded sand, med. grained, d. yellowish brown 10YR 4/2, moist, med. dense, some black silt		Water @ 25.5'
19	SS	27.0	28.5	2-2-2	1.2				SP	Poorly graded sand, v. fine grained, pale yellowish brown 10YR 6/2, wet, loose, trace clay (l. brown 5YR 6/4), trace coarse gravel, water in spoon		
20	SS	28.5	30.0	4-8-11	1.5				SP	Poorly graded sand, fine grained, pale yellowish brown 10YR 6/2, wet, v. loose, w/lean clay (mod. brown 5YR 4/4)		Began Mud Rotary @ 28.5'
21	SS	30.0	31.5	6-6-8	1.0		30			Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, wet, med. dense, w/fine gravel @ 30.5' w/black silt @ 30.7' no black silt		
22	SS	31.5	33.0	4-6-9	1.5				SW	Well graded sand, coarse grained, dark reddish brown 10R 3/4, wet, med. dense, w/fine gravel @ 32' 5" layer pg sand, fine, mod. yellowish brown, prev. material		
23	SS	33.0	34.5	8-9-12	1.5				SP SP	Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, wet, med. dense, w/fine gravel, trace black silt		
24	SS	34.5	36.0	13-16-12	1.5		35		SP	Poorly graded sand, fine to med. grained, dusky red 5R 3/4, wet, med. dense, w/fine gravel, trace coarse gravel		
25	SS	36.0	37.5	6-7-7	1.5					Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, wet, med. dense, w/fine gravel @ 36' trace coarse gavel		
26	SS	37.5	39.0	5-8-12	1.5					@ 37.5' well graded SW @ 40' poorly graded SP		
27	SS	39.0	40.5	6-12-17	1.5		40			@ 41' trace fine gravel, no coarse gravel @ 42' dense @ 43.1' 1" seam black silt and fine gravel - possible coal		
28	SS	40.5	42.0	6-11-19	1.5							
29	SS	42.0	43.5	7-15-24	1.5							
30	SS	43.5	45.0	3-10-16	1.4				SW	Well graded sand, fine to med. grained, pale yellowish brown 10YR 6/2 wet, med. dense, w/fine gravel @ 44' trace lean clay mod. brown 5YR 4/4		
31	SS	45.0	46.5	10-13-16	1.5		45		SW	@ 44.4' no clay		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1600I** DATE **4/27/16** SHEET **3** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **2/29/16** BORING FINISH **2/29/16**

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	WELL	DRILLER'S NOTES
32	SS	46.5	48.0	6-9-14	1.4				
33	SS	48.0	49.5	9-16-20	1.5				
34	SS	49.5	51.0	12-11-15	1.4		50		
35	SS	51.0	52.5	7-12-12	1.5				
36	SS	52.5	54.0	4-9-12	1.5				
37	SS	54.0	55.5	9-10-14	1.4		55		
38	SS	55.5	57.0	6-12-16	1.5				
39	SS	57.0	58.5	7-9-11	1.4				
40	SS	58.5	60.0	7-10-16	1.2				
41	SS	60.0	61.5	13-16-16	1.5		60		
42	SS	61.5	63.0	6-14-25	1.4				
43	SS	63.0	64.5	11-20-38	1.5				
44	SS	64.5	66.0	22-24-29	1.4		65		
45	SS	66.0	67.5	50/3					
46	SS	67.5	69.0	13-13-14	1.5				
47	SS	69.0	70.5	12-16-16	1.4		70		
48	SS	70.5	72.0	6-13-21	1.3				

USCS	SOIL / ROCK IDENTIFICATION
	Well graded sand, coarse grained, mod. yellowish brown 10YR 5/4, wet, med. dense, w/fine gravel, trace coarse gravel @ 46.5' med. to coarse grained
SP	Poorly graded sand, fine grained, pale brown 5YR 5/4, wet, dense, trace coarse gravel
SW	Well graded sand, fine to med. grained, d. yellowish brown 10YR 4/2, wet, med. dense, some fine gravel, some black silt @ 51' trace coarse gravel @ 52.5' fine grained, no coarse gravel @ 54' no fine gravel @ 55.5' brownish grey 5YR 4/1 w/fine gravel
SP	Poorly graded sand, fine grained, brownish grey 5YR 4/1, wet, med. dense, w/black silt @ 60' dense @ 60.6' 1.5" shale fragment @ 62.1' w/fine gravel @ 63' v. dense @ 64.2' 3" layer shale, l. grey N7 @ 64.5' some coarse gravel @ 65' 2" layer shale, l. grey N7
	Shale, l. grey, dry, hard
SP	Indeterminate layer transition due to 3" recovery (spoon refusal) in prev. sample Poorly graded sand, v. fine grained, brownish grey 5YR 4/1, wet, med. dense, w/fine gravel
SW	Well graded sand, med. grained, d. yellowish brown 10YR 4/2, wet, med. dense, w/fine gravel, some coarse gravel @ 69' dense, fine to med. grained @ 70.5' med. grained @ 71' 3" layer fat clay, l. grey N7 (w/shale),

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1600I** DATE **4/27/16** SHEET **4** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **2/29/16** BORING FINISH **2/29/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
49	SS	72.0	73.5	8-13-24	1.1					w/coarse gravel @ 72' no coarse gravel @ 73.5' mod. dense, sample washed out @76' 2.5" layer coal fragments @ 79' 1" seam fat clay, l. grey N7 @ 79.5' trace black silt		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 154,305.9 E 512,458.0**

GROUND ELEVATION **393.7** SYSTEM **State Plane using NAD27/29**

BORING NO. **MW-1600S** DATE **4/27/16** SHEET **1** OF **2**

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

PIEZOMETER TYPE ____ WELL TYPE **OW**

HGT. RISER ABOVE GROUND **3.04** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **30.6** BOTTOM **40.19**

WELL DEVELOPMENT **YES** BACKFILL ____

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

Water Level, ft	▽	▼	▼
TIME			
DATE			

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
1	SS	0.0	1.5	33-14-10	1.5					Gravel = 18 inches		
2	SS	1.5	3.0	3-5-6	1.5					Silty clay, l. brown 5YR 6/4 and l. grey N7 mottled, dry, stiff, FILL @ 3' sl. stiff @ 4.2' w/dusky brown 5YR 2/2 silt @ 4.5' stiff, some iron oxide particles, moist		
3	SS	3.0	4.5	2-3-4	1.5							
4	SS	4.5	6.0	4-4-6	1.5		5					
5	SS	6.0	7.5	3-6-9	1.5							
6	SS	7.5	9.0	2-5-6	1.5				MH SP	Clayey silt, moderate brown 5YR 4/4 and l. grey N7 fat clay mottled, moist, med. dense, trace oxide particles, likely fill Poorly graded sand, fine grained, l. brown 5YR 5/6, dry to moist, med. dense @ 9' v. fine grained, loose		
7	SS	9.0	10.5	3-4-4	1.4		10					
8	SS	10.5	12.0	3-4-4	1.4							
9	SS	12.0	13.5	2-3-5	1.5							
10	SS	13.5	15.0	2-4-5	1.5		15		MH SP MH	Clayey silt, moderate brown 5YR 4/4, moist, loose Poorly graded sand, fine grained pale yellowish brown 10YR 6/2, moist, loose Clayey silt, moderate brown 5YR 4/4, moist, loose		
11	SS	15.0	16.5	3-8-10	1.5				SP	Poorly graded sand, fine grained, pale yellowish brown 10YR 6/2, moist, med. dense @ 16' 3" layer - clayey silt (prev. material) @ 19' 4" layer - poorly graded sand (l. brown, v. fine grained) prev. material @ 21' loose @ 21.3' w/black silt		
12	SS	16.5	18.0	4-6-8	1.5							
13	SS	18.0	19.5	5-6-5	1.5							
14	SS	19.5	21.0	3-5-4	1.5							

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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 **AMEC FOSTER WHEELER**

JOB NUMBER **42393125-01**
COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1600S** DATE **4/27/16** SHEET **2** OF **2**
PROJECT **ROCKPORT PLANT** BORING START **2/29/16** BORING FINISH **2/29/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	SAMPLE DEPTH IN FEET TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DRILLER'S NOTES
15	SS	21.0	22.5	3-3-5	1.5		
16	SS	22.5	24.0	2-3-3	1.5		
17	SS	24.0	25.5	4-6-6	1.5		
18	SS	25.5	27.0	2-2-4	1.0		Water @ 25.5'
19	SS	27.0	28.5	2-2-2	1.2		
20	SS	28.5	30.0	4-8-11	1.5		Began Mud Rotary @ 28.5'
21	SS	30.0	31.5	6-6-8	1.0		
22	SS	31.5	33.0	4-6-9	1.5		
23	SS	33.0	34.5	8-9-12	1.5		
24	SS	34.5	36.0	13-16-12	1.5		
25	SS	36.0	37.5	6-7-7	1.5		
26	SS	37.5	39.0	5-8-12	1.5		
27	SS	39.0	40.5	6-12-17	1.5		
28	SS	40.5	42.0	6-11-19	1.5		

U S C S	SOIL / ROCK IDENTIFICATION
SP	Poorly graded sand, v. fine grained, l. brown 5YR 5/6, moist, loose @ 22.8' 3" layer - PG sand, fine, pale yellowish br. prev. material @ 23.2' w/black silt @ 23.5' no black silt @ 24' moderate red 5R 4/6
SP	Poorly graded sand, med. grained, d. yellowish brown 10YR 4/2, moist, med. dense, some black silt
SP	Poorly graded sand, v. fine grained, pale yellowish brown 10YR 6/2, wet, loose, trace clay (l. brown 5YR 6/4), trace coarse gravel, water in spoon
SP	Poorly graded sand, fine grained, pale yellowish brown 10YR 6/2, wet, v. loose, w/lean clay (mod. brown 5YR 4/4)
SP	Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, wet, med. dense, w/fine gravel @ 30.5' w/black silt @ 30.7' no black silt
SW	Well graded sand, coarse grained, dark reddish brown 10R 3/4, wet, med. dense, w/fine gravel @ 32' 5" layer pg sand, fine, mod. yellowish brown, prev. material
SP	Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, wet, med. dense, w/fine gravel, trace black silt
SP	Poorly graded sand, fine to med. grained, dusky red 5R 3/4, wet, med. dense, w/fine gravel, trace coarse gravel
SP	Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, wet, med. dense, w/fine gravel @ 36' trace coarse gavel @ 37.5' well graded SW @ 40' poorly graded SP @ 41' trace fine gravel, no coarse gravel @ 42' dense @ 43.1' 1" seam black silt and fine gravel - possible coal

DEPTH IN FEET: 25, 30, 35, 40

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER **42393125-01**

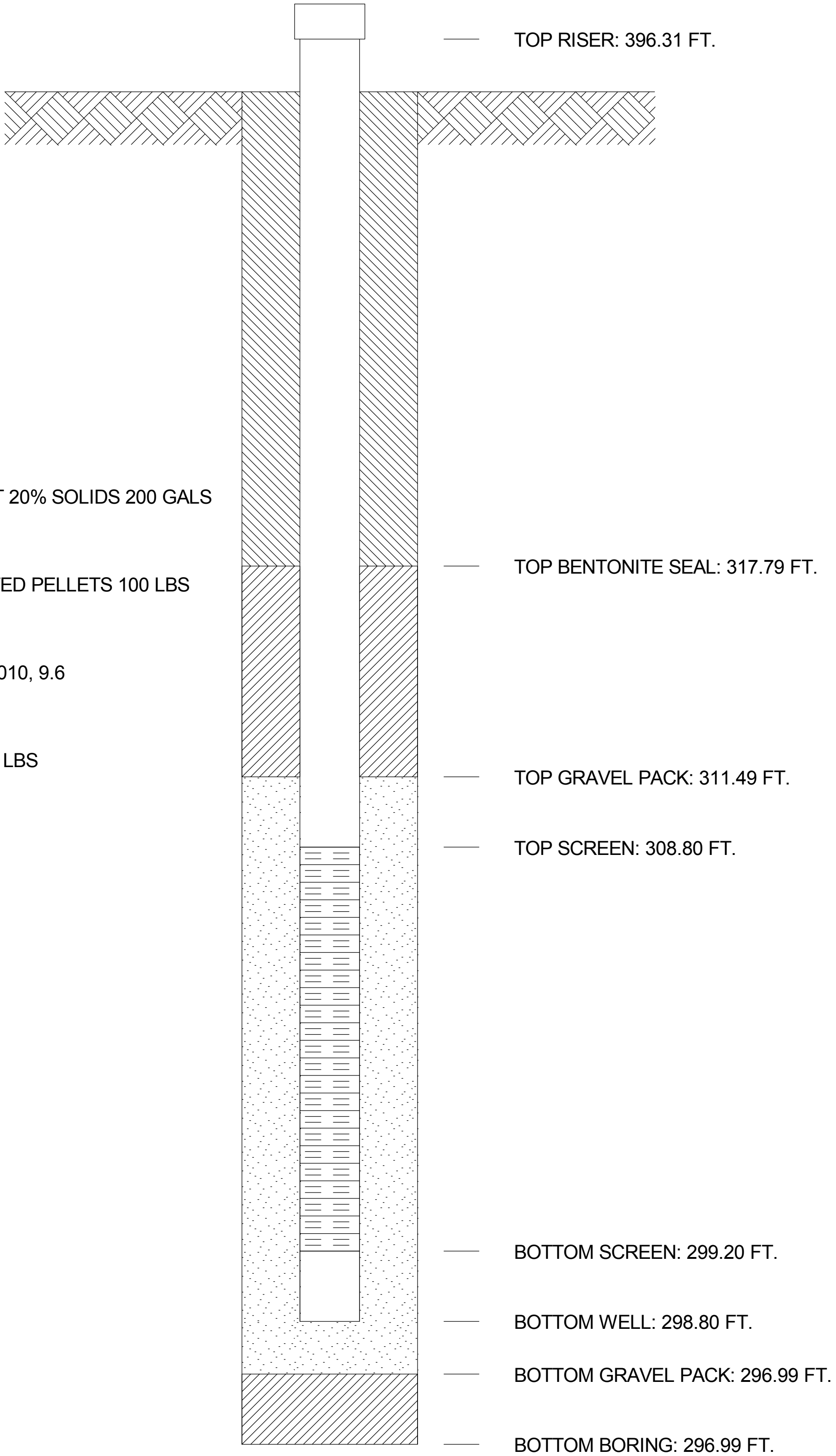
COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No. **MW-1600D** BORING No. **MW-1600D** INSTALLED **2/17/16**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 154,306.3 E 512,449.0**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 393.79 FT.



▧ GROUT SEAL: QUICK GROUT 20% SOLIDS 200 GALS

▨ BENTONITE SEAL: 3/8" COATED PELLETS 100 LBS

☰ SCREEN: 2.0 dia., SLOTTED .010, 9.6

░ GRAVEL PACK: #5 SAND 300 LBS

☐ RISER PIPE: 2.0, dia., PVC

∿ SPACERS, DEPTH:

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

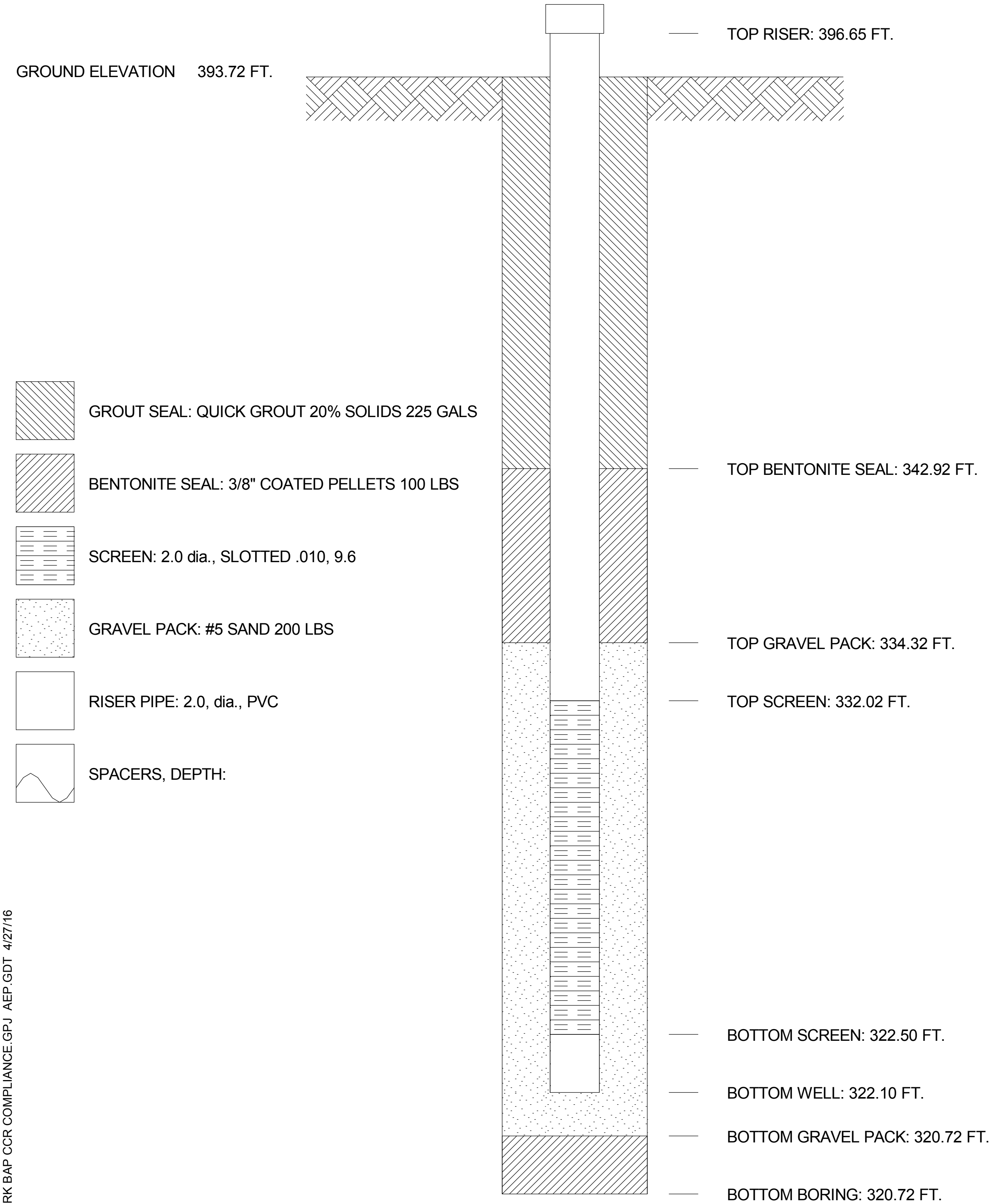
JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No. **MW-1600I** BORING No. **MW-1600I** INSTALLED **2/29/16**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 154,306.0 E 512,454.0**

SYSTEM **State Plane using NAD27/29**



AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
MONITORING WELL CONSTRUCTION

JOB NUMBER **42393125-01**

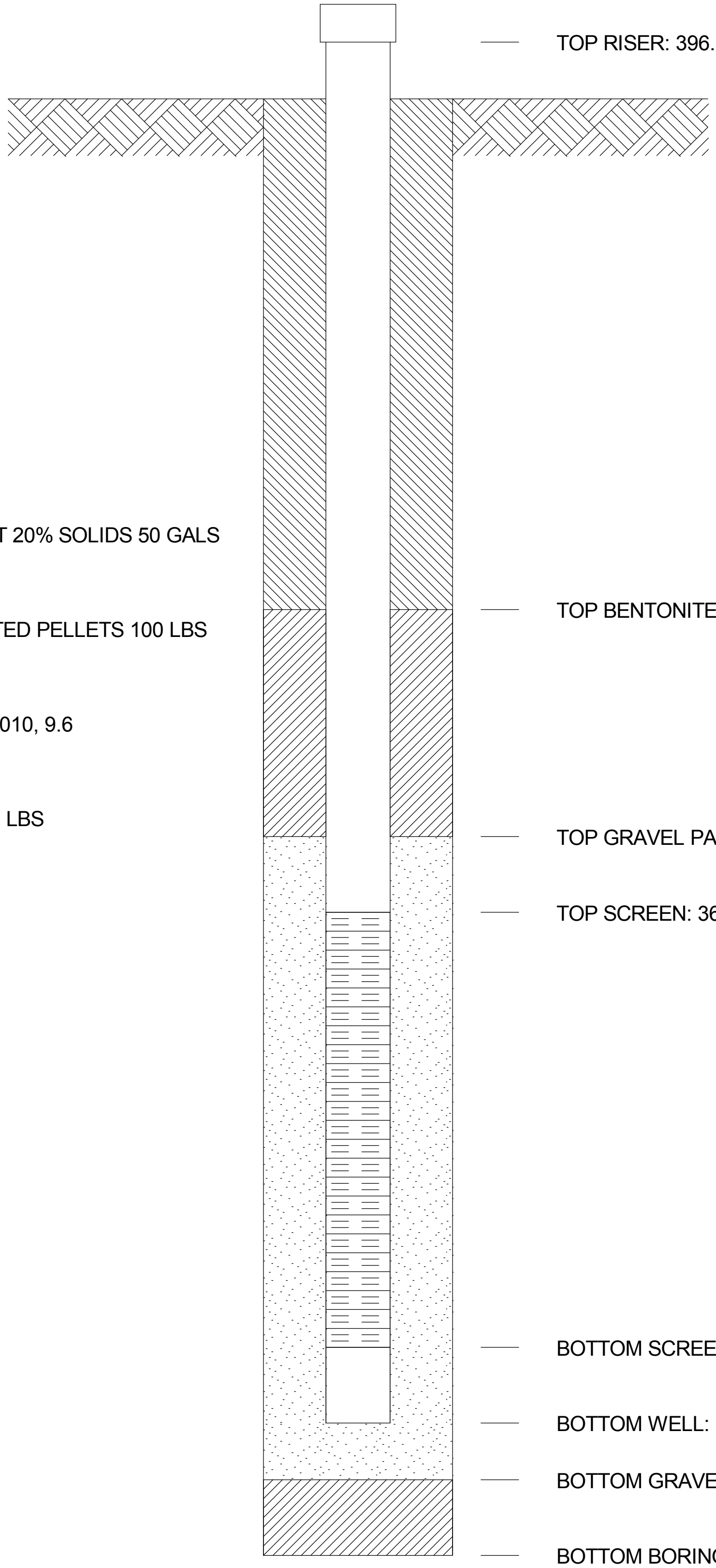
COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No. **MW-1600S** BORING No. **MW-1600S** INSTALLED **2/29/16**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 154,305.9 E 512,458.0**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 393.69 FT.



TOP RISER: 396.73 FT.

TOP BENTONITE SEAL: 372.29 FT.

TOP GRAVEL PACK: 365.39 FT.

TOP SCREEN: 363.09 FT.

BOTTOM SCREEN: 353.50 FT.

BOTTOM WELL: 353.10 FT.

BOTTOM GRAVEL PACK: 352.09 FT.

BOTTOM BORING: 352.09 FT.

▨ GROUT SEAL: QUICK GROUT 20% SOLIDS 50 GALS

▨ BENTONITE SEAL: 3/8" COATED PELLETS 100 LBS

☰ SCREEN: 2.0 dia., SLOTTED .010, 9.6

⁘ GRAVEL PACK: #5 SAND 225 LBS

☐ RISER PIPE: 2.0, dia., PVC

∿ SPACERS, DEPTH:

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 154,323.2 E 513,487.5**

GROUND ELEVATION **400.1** SYSTEM **State Plane using NAD27/29**

BORING NO. **MW-1601D** DATE **4/27/16** SHEET **1** OF **5**

BORING START **2/26/16** BORING FINISH **2/26/16**

PIEZOMETER TYPE WELL TYPE **OW**

HGT. RISER ABOVE GROUND **2.75** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **100.0** BOTTOM **109.59**

WELL DEVELOPMENT **YES** BACKFILL

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

Water Level, ft	▽	▼	▼
TIME			
DATE			

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
1	SS	0.0	1.5	4-5-8	1.5					Topsoil = 3 inches Silty clay, l. brown 5YR 6/4 and l. grey N7 mottled, dry, stiff *FILL		
2	SS	1.5	3.0	3-8-15	1.5				SP	Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, dry, med. dense @ 2' 2" layer - silty clay (prev. material) @ 4' some black silt		
3	SS	3.0	4.5	3-13-16	1.4							
4	SS	4.5	6.0	4-8-8	1.5		5		SP	Poorly graded sand, fine grained, d. yellowish brown 10YR 4/2, moist, med. dense, trace fine gravel @ 6' water in spoon, loose		
5	SS	6.0	7.5	2-3-4	1.5							
6	SS	7.5	9.0	2-3-5	1.5				SC SP SC CH	Clayey sand, fine grained, med. bluish gray 5B 5/1, moist, loose Poorly graded sand, fine grained, d. yellowish brown 10YR 4/2, moist, loose Clayey sand, fine grained, med. bluish grey SB 5/1, moist, loose Fat clay, l. grey N7, moist, firm		
7	SS	9.0	10.5	4-7-10	1.5		10		CH	Fat clay, l. grey N7 and poorly graded sand, fine grained d. yellowish brown 10YR 4/2, moist, med. dense, 50/50 mix		
8	SS	10.5	12.0	4-6-5	1.5				MH	Clayey silt, pale yellowish brown 10YR 6/2 and l. grey N7, moist, med. dense, mottled @ 12' loose @ 18.5' pale yellowish brown 10YR 6/2		
9	SS	12.0	13.5	3-5-5	1.5							
10	SS	13.5	15.0	3-4-6	1.5							
11	SS	15.0	16.5	3-4-4	1.5		15					
12	SS	16.5	18.0	3-5-5	1.5				SP	Poorly graded sand, v. fine grained greyish orange 10YR 7/4, moist, loose @ 20.7' trace black silt		
13	SS	18.0	19.5	4-4-5	1.5							
14	SS	19.5	21.0	3-4-4	1.5							

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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 **AMEC FOSTER WHEELER**

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1601D** DATE **4/27/16** SHEET **2** OF **5**

PROJECT **ROCKPORT PLANT** BORING START **2/26/16** BORING FINISH **2/26/16**

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
15	SS	21.0	22.5	3-6-6	1.5				SP	Poorly graded sand, fine grained, pale yellowish brown 10YR 6/2 moist, med. dense		
16	SS	22.5	24.0	4-5-8	1.5				SP	Poorly graded sand, v. fine grained, greyish orange 10YR 7/4, moist, med. dense		
17	SS	24.0	25.5	3-7-10	1.5		25		SP	Poorly graded sand, fine grained, pale yellowish brown 10YR 6/2 moist to wet, med. dense @ 23.8' fine to med. grained, trace black silt @ 24' fine grained, no black, silt, trace fine gravel @ 26' coal fragment (2") (bl. silt) @ 29.1' 1" layer - lean clay, d. yellowish brown 10YR 4/2 @ 31' trace black silt		
18	SS	25.5	27.0	4-6-7	1.5							
19	SS	27.0	28.5	3-5-10	1.5							
20	SS	28.5	30.0	3-6-8	1.5							
21	SS	30.0	31.5	4-4-9	1.5		30					
22	SS	31.5	33.0	4-5-6	1.5							
23	SS	33.0	34.5	3-3-4	1.3				SW	Well graded sand, fine to med. grained, d. yellowish brown 10YR 4/2, wet, med. dense, trace fine gravel @ 33' loose @ 34.5' med. dense, w/fine gravel		
24	SS	34.5	36.0	6-6-7	1.3		35					
25	SS	36.0	37.5	4-4-5	1.2							
26	SS	37.5	39.0	5-6-12	1.4				SW	Well graded sand, coarse grained, dusky brown 5YR 2/2, wet, loose, w/fine gravel @ 37.5' med. dense @ 39' trace coarse gravel		
27	SS	39.0	40.5	11-10-12	1.5		40					
28	SS	40.5	42.0	6-11-15	1.5				SP	Poorly graded sand, fine gained, l. brown 5YR 5/6, wet, med. dense, trace fine gravel @ 40.5' w/fine gravel, trace coarse gravel @ 42' some fine gravel, no coarse gravel		
29	SS	42.0	43.5	6-10-10	1.3							
30	SS	43.5	45.0	6-11-12	1.5				SW	Well graded sand, coarse grained, dusky brown 5YR 2/2, wet, med. dense, w/fine gravel, trace coarse gravel (rounded) @ 46.5' coarse gravel, plug in spoon @ 48' some coarse gravel, dense		
31	SS	45.0	46.5	9-8-8	1.4		45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1601D** DATE **4/27/16** SHEET **3** OF **5**

PROJECT **ROCKPORT PLANT** BORING START **2/26/16** BORING FINISH **2/26/16**

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
32	SS	46.5	48.0	10-9-16	.2							
33	SS	48.0	49.5	11-15-21	1.4							
34	SS	49.5	51.0	11-15-15	1.4		50		SP	Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, wet, med. dense, w/fine gravel @ 50' 1" layer - coal (angular fragments)		
35	SS	51.0	52.5	9-15-19	1.5				SW	Well graded sand, med. to coarse grained, d. yellowish brown 10YR 4/2, wet, med. dense, w/fine gravel, trace coarse gravel @ 51' dense @ 51.5' 1" layer - coal (angular fragments)		
36	SS	52.5	54.0	8-13-16	1.4				SP	Poorly graded sand, fine grained, olive grey 5Y 4/1, wet, med. dense, w/fine gravel @ 53.3' 1.5" layer - coal (angular fragments)		
37	SS	54.0	55.5	8-9-11	1.3		55		SW	Well graded sand, med. to coarse grained, d. yellowish brown 10YR 4/2, wet, med. dense, w/fine gravel @ 55.5' trace coarse gravel @ 57' no coarse gravel @ 59.7' w/coal fragments, angular @ 60.3' no coal fragments, some fine gravel		
38	SS	55.5	57.0	9-14-16	1.4							
39	SS	57.0	58.5	7-10-10	1.3							
40	SS	58.5	60.0	6-7-13	1.5							
41	SS	60.0	61.5	9-13-14	1.5		60					
42	SS	61.5	63.0	6-8-11	1.5				SP	Poorly graded sand, med. grained, pale yellowish brown 10YR 6/2, wet, med. dense, trace fine gravel @ 64.5' fine to med. grained @ 67.5' dense @ 69' med. dense @ 70.5' dense @ 71' some coarse gravel @ 72' w/coarse gravel		
43	SS	63.0	64.5	5-9-12	1.4							
44	SS	64.5	66.0	8-9-12	1.4		65					
45	SS	66.0	67.5	5-9-17	1.5							
46	SS	67.5	69.0	7-15-23	1.4							
47	SS	69.0	70.5	6-9-14	1.3		70					
48	SS	70.5	72.0	8-19-21	1.4							

Continued Next Page

LOG OF BORING

JOB NUMBER **42393125-01**
COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1601D** DATE **4/27/16** SHEET **4** OF **5**
PROJECT **ROCKPORT PLANT** BORING START **2/26/16** BORING FINISH **2/26/16**

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	WELL	DRILLER'S NOTES
49	SS	72.0	73.5	14-22-19	1.4				
50	SS	73.5	75.0	10-13-19	1.5		75		
51	SS	75.0	76.5	9-15-36	1.5				
52	SS	76.5	78.0	17-13-14	1.4				
53	SS	78.0	79.5	9-18-18	1.2				
54	SS	79.5	81.0	13-11-12	1.4		80		
55	SS	81.0	82.5	6-8-14	1.5				
56	SS	82.5	84.0	7-6-16	1.5				
57	SS	84.0	85.5	9-12-14	1.5		85		
58	SS	85.5	87.0	4-9-9	1.5				
59	SS	87.0	88.5	7-14-18	1.5				
60	SS	88.5	90.0	10-11-17	1.5		90		
61	SS	90.0	91.5	7-10-13	1.5				
62	SS	91.5	93.0	9-13-16	1.4				
63	SS	93.0	94.5	8-8-9	1.4				
64	SS	94.5	96.0	10-15-17	1.4		95		
65	SS	96.0	97.5	10-11-12	1.2				
66	SS	97.5	99.0	9-13-14	1.5				

U S C S	SOIL / ROCK IDENTIFICATION
SP	Poorly graded sand, fine grained, yellowish brown 10YR 5/4, wet, med. dense, some fine gravel, trace coarse gravel @ 75' v. dense, trace fine gravel, no coarse gravel
SW	Well graded sand, coarse grained, d. yellowish brown 10YR 4/2, wet, med. dense, w/fine gravel, some coarse gravel @ 78' dense @ 80' 4" layer - coarse gravel @ 81' 3" layer - poorly graded sand, fine grained, mod. yellowish brown (prev. material) @ 81.9' w/coal fragments
CH	Fat clay, l. grey N7, wet, v. stiff (shale)
SP	Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, wet, med. dense
CH	Fat clay, l. grey N7, wet, v. stiff
SP	Poorly graded sand, fine grained, l. grey N7, wet, med. dense
CH	Fat clay, l. grey N7, wet, v. stiff (shale)
SP	Poorly graded sand, fine grained, olive grey 5Y 4/1, wet, med. dense, some fat clay (l. grey, prev. material) @ 85.5' l. grey N7
CH	Fat clay, l. grey N7, wet, v. stiff
SW	Well graded sand, med. grained, med. l. grey N6, wet, dense, trace fine gravel @ 88.5' 3.5" layer - fat clay N7, prev. material @ 89' some fat clay N7, prev. material @ 90' 3.5" layer - fat clay N7, prev. material
SP	Poorly graded sand, fine to med. gained, med. d. grey N4, wet, med. dense @ 91.5' 1.5" layer - fat clay N7, prev. material @ 92' some fine gravel, trace black silt, trace fat clay (N7, prev. material) @ 93' w/fine gravel, trace coarse gravel, med. grained
SW	Well graded sand, med. grained, med. d. grey N4, wet, dense, w/fine gravel @ 96' med. to coarse gained, mod. dense @ 99' dense, trace coarse gravel @ 100.5' med. dense

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

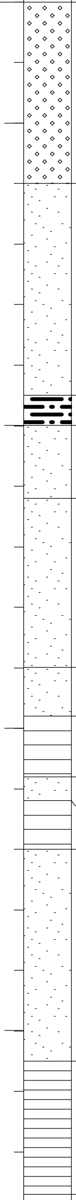
COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1601D** DATE **4/27/16** SHEET **5** OF **5**

PROJECT **ROCKPORT PLANT** BORING START **2/26/16** BORING FINISH **2/26/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	SAMPLE DEPTH IN FEET TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %
67	SS	99.0	100.5	10-15-19	1.5	
68	SS	100.5	102.0	10-12-10	1.4	
69	SS	102.0	103.5	7-2-6	1.5	
70	SS	103.5	105.0	5-5-9	1.5	
71	SS	105.0	106.5	5-6-13	1.5	
72	SS	106.5	108.0	10-11-14	1.4	
73	SS	108.0	109.5	7-8-9	1.5	
74	SS	109.5	111.0	4-4-10	1.5	
75	SS	111.0	112.5	7-9-20	1.5	
76	SS	112.5	114.0	50/3	0	
77	SS	114.0	115.5	12-13-20	1.1	
78	SS	115.5	117.0	50/5	.3	
79	SS	117.0	118.5	46-50/3	.5	

DEPTH IN FEET: 100, 105, 110, 115

GRAPHIC LOG



U S C S	SOIL / ROCK IDENTIFICATION
SP	Poorly graded sand, v. fine grained, brownish grey 5YR 4/1, wet, med. dense, some fine gravel @ 102' loose, no fine gravel, water in spoon @ 103.5 med. dense
MH	Clayey silt MH, l. grey N7, moist to wet, med. dense
SP	Poorly graded sand v. fine grained, med. l. grey N6, wet, med. dense
SP	Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, wet, med. dense, trace fine gravel
SP	Poorly graded sand, v. fine grained, med. l. grey N6, wet, med. dense, trace fat clay (CH - l. grey, prev. material)
CH	Fat clay, l. grey N7, wet, stiff
SP	Poorly graded sand, v. fine grained, med. l. grey N6, wet, mod. dense
CH	Fat clay, l. grey N7, wet, v. stiff
SP	Poorly graded sand, v. fine grained, med. l. grey N6, wet, med. dense, w/fat clay (l. grey, prev. material) @ 112.5' no recovery - possible cobble or rock fragment @ 114' dense @ 114.5' 2" layer - fat clay (N7), prev. material @ 115' w/coarse gravel, shale fragments @ 115.2' 1" layer - coal fragments
	Shale, l. grey N7, dry, hard, some siltstone (olive grey - 5Y 4/1) @117' no siltstone
	Spoon refusal @ 117.7' Auger refusal @ 117.7 BT @ 117.7'

WELL

DRILLER'S NOTES

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 154,325.3 E 513,483.5**

GROUND ELEVATION **400.0** SYSTEM **State Plane using NAD27/29**

BORING NO. **MW-1601I** DATE **4/27/16** SHEET **1** OF **4**

BORING START **2/26/16** BORING FINISH **2/26/16**

PIEZOMETER TYPE WELL TYPE **OW**

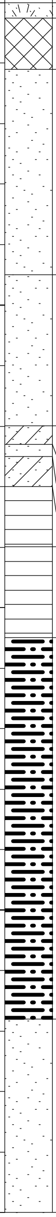
HGT. RISER ABOVE GROUND **2.87** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **68.1** BOTTOM **77.6**

WELL DEVELOPMENT **YES** BACKFILL

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

Water Level, ft	▽	▼	▼
TIME			
DATE			



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
1	SS	0.0	1.5	4-5-8	1.5					Topsoil = 3 inches Silty clay, l. brown 5YR 6/4 and l. grey N7 mottled, dry, stiff *FILL		
2	SS	1.5	3.0	3-8-15	1.5				SP	Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, dry, med. dense @ 2' 2" layer - silty clay (prev. material) @ 4' some black silt		
3	SS	3.0	4.5	3-13-16	1.4							
4	SS	4.5	6.0	4-8-8	1.5		5		SP	Poorly graded sand, fine grained, d. yellowish brown 10YR 4/2, moist, med. dense, trace fine gravel @ 6' water in spoon, loose		
5	SS	6.0	7.5	2-3-4	1.5							
6	SS	7.5	9.0	2-3-5	1.5				SC SP SC CH	Clayey sand, fine grained, med. bluish gray 5B 5/1, moist, loose Poorly graded sand, fine grained, d. yellowish brown 10YR 4/2, moist, loose		
7	SS	9.0	10.5	4-7-10	1.5		10		CH	Clayey sand, fine grained, med. bluish grey SB 5/1, moist, loose Fat clay, l. grey N7, moist, firm		
8	SS	10.5	12.0	4-6-5	1.5				MH	Fat clay, l. grey N7 and poorly graded sand, fine grained d. yellowish brown 10YR 4/2, moist, med. dense, 50/50 mix Clayey silt, pale yellowish brown 10YR 6/2 and l. grey N7, moist, med. dense, mottled @ 12' loose @ 18.5' pale yellowish brown 10YR 6/2		
9	SS	12.0	13.5	3-5-5	1.5							
10	SS	13.5	15.0	3-4-6	1.5							
11	SS	15.0	16.5	3-4-4	1.5		15					
12	SS	16.5	18.0	3-5-5	1.5				SP	Poorly graded sand, v. fine grained greyish orange 10YR 7/4, moist, loose @ 20.7' trace black silt		
13	SS	18.0	19.5	4-4-5	1.5							
14	SS	19.5	21.0	3-4-4	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 **AMEC FOSTER WHEELER**

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1601I** DATE **4/27/16** SHEET **2** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **2/26/16** BORING FINISH **2/26/16**

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
15	SS	21.0	22.5	3-6-6	1.5				SP	Poorly graded sand, fine grained, pale yellowish brown 10YR 6/2 moist, med. dense		
16	SS	22.5	24.0	4-5-8	1.5				SP	Poorly graded sand, v. fine grained, greyish orange 10YR 7/4, moist, med. dense		
17	SS	24.0	25.5	3-7-10	1.5				SP	Poorly graded sand, fine grained, pale yellowish brown 10YR 6/2 moist to wet, med. dense @ 23.8' fine to med. grained, trace black silt @ 24' fine grained, no black, silt, trace fine gravel @ 26' coal fragment (2") (bl. silt) @ 29.1' 1" layer - lean clay, d. yellowish brown 10YR 4/2 @ 31' trace black silt		
18	SS	25.5	27.0	4-6-7	1.5		25					
19	SS	27.0	28.5	3-5-10	1.5							
20	SS	28.5	30.0	3-6-8	1.5							
21	SS	30.0	31.5	4-4-9	1.5		30					
22	SS	31.5	33.0	4-5-6	1.5				SW	Well graded sand, fine to med. grained, d. yellowish brown 10YR 4/2, wet, med. dense, trace fine gravel @ 33' loose @ 34.5' med. dense, w/fine gravel		
23	SS	33.0	34.5	3-3-4	1.3							
24	SS	34.5	36.0	6-6-7	1.3		35					
25	SS	36.0	37.5	4-4-5	1.2				SW	Well graded sand, coarse grained, dusky brown 5YR 2/2, wet, loose, w/fine gravel @ 37.5' med. dense @ 39' trace coarse gravel		
26	SS	37.5	39.0	5-6-12	1.4							
27	SS	39.0	40.5	11-10-12	1.5				SP	Poorly graded sand, fine gained, l. brown 5YR 5/6, wet, med. dense, trace fine gravel @ 40.5' w/fine gravel, trace coarse gravel @ 42' some fine gravel, no coarse gravel		
28	SS	40.5	42.0	6-11-15	1.5		40					
29	SS	42.0	43.5	6-10-10	1.3							
30	SS	43.5	45.0	6-11-12	1.5				SW	Well graded sand, coarse grained, dusky brown 5YR 2/2, wet, med. dense, w/fine gravel, trace coarse gravel (rounded) @ 46.5' coarse gravel, plug in spoon @ 48' some coarse gravel, dense		
31	SS	45.0	46.5	9-8-8	1.4		45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1601I** DATE **4/27/16** SHEET **3** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **2/26/16** BORING FINISH **2/26/16**

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
32	SS	46.5	48.0	10-9-16	.2							
33	SS	48.0	49.5	11-15-21	1.4							
34	SS	49.5	51.0	11-15-15	1.4		50		SP	Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, wet, med. dense, w/fine gravel @ 50' 1" layer - coal (angular fragments)		
35	SS	51.0	52.5	9-15-19	1.5				SW	Well graded sand, med. to coarse grained, d. yellowish brown 10YR 4/2, wet, med. dense, w/fine gravel, trace coarse gravel @ 51' dense @ 51.5' 1" layer - coal (angular fragments)		
36	SS	52.5	54.0	8-13-16	1.4				SP	Poorly graded sand, fine grained, olive grey 5Y 4/1, wet, med. dense, w/fine gravel @ 53.3' 1.5" layer - coal (angular fragments)		
37	SS	54.0	55.5	8-9-11	1.3		55		SW	Well graded sand, med. to coarse grained, d. yellowish brown 10YR 4/2, wet, med. dense, w/fine gravel @ 55.5' trace coarse gravel @ 57' no coarse gravel @ 59.7' w/coal fragments, angular @ 60.3' no coal fragments, some fine gravel		
38	SS	55.5	57.0	9-14-16	1.4							
39	SS	57.0	58.5	7-10-10	1.3							
40	SS	58.5	60.0	6-7-13	1.5							
41	SS	60.0	61.5	9-13-14	1.5		60					
42	SS	61.5	63.0	6-8-11	1.5				SP	Poorly graded sand, med. grained, pale yellowish brown 10YR 6/2, wet, med. dense, trace fine gravel @ 64.5' fine to med. grained @ 67.5' dense @ 69' med. dense @ 70.5' dense @ 71' some coarse gravel @ 72' w/coarse gravel		
43	SS	63.0	64.5	5-9-12	1.4							
44	SS	64.5	66.0	8-9-12	1.4		65					
45	SS	66.0	67.5	5-9-17	1.5							
46	SS	67.5	69.0	7-15-23	1.4							
47	SS	69.0	70.5	6-9-14	1.3		70					
48	SS	70.5	72.0	8-19-21	1.4							

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1601I** DATE **4/27/16** SHEET **4** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **2/26/16** BORING FINISH **2/26/16**

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
49	SS	72.0	73.5	14-22-19	1.4							
50	SS	73.5	75.0	10-13-19	1.5							
51	SS	75.0	76.5	9-15-36	1.5		75					
52	SS	76.5	78.0	17-13-14	1.4				SP SW	Poorly graded sand, fine grained, yellowish brown 10YR 5/4, wet, med. dense, some fine gravel, trace coarse gravel @ 75' v. dense, trace fine gravel, no coarse gravel Well graded sand, coarse grained, d. yellowish brown 10YR 4/2, wet, med. dense, w/fine gravel, some coarse gravel @ 78' dense @ 80' 4" layer - coarse gravel @ 81' 3" layer - poorly graded sand, fine grained, mod. yellowish brown (prev. material) @ 81.9' w/coal fragments		
53	SS	78.0	79.5	9-18-18	1.2							
54	SS	79.5	81.0	13-11-12	1.4							

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 154,327.6 E 513,479.7**

GROUND ELEVATION **399.8** SYSTEM **State Plane using NAD27/29**

BORING NO. **MW-1601S** DATE **4/27/16** SHEET **1** OF **3**

BORING START **2/27/16** BORING FINISH **2/27/16**

PIEZOMETER TYPE ____ WELL TYPE **OW**

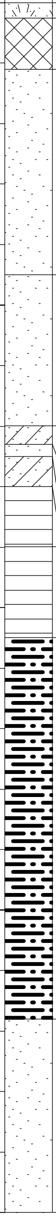
HGT. RISER ABOVE GROUND **2.88** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **36.9** BOTTOM **46.47**

WELL DEVELOPMENT **YES** BACKFILL ____

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

Water Level, ft	▽	▼	▼
TIME			
DATE			



SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	SAMPLE DEPTH IN FEET TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	WELL	DRILLER'S NOTES
1	SS	0.0	1.5	4-5-8	1.5			
2	SS	1.5	3.0	3-8-15	1.5			
3	SS	3.0	4.5	3-13-16	1.4			
4	SS	4.5	6.0	4-8-8	1.5			
5	SS	6.0	7.5	2-3-4	1.5			
6	SS	7.5	9.0	2-3-5	1.5			
7	SS	9.0	10.5	4-7-10	1.5			
8	SS	10.5	12.0	4-6-5	1.5			
9	SS	12.0	13.5	3-5-5	1.5			
10	SS	13.5	15.0	3-4-6	1.5			
11	SS	15.0	16.5	3-4-4	1.5			
12	SS	16.5	18.0	3-5-5	1.5			
13	SS	18.0	19.5	4-4-5	1.5			
14	SS	19.5	21.0	3-4-4	1.5			

U S C S	SOIL / ROCK IDENTIFICATION
	Topsoil = 3 inches
	Silty clay, l. brown 5YR 6/4 and l. grey N7 mottled, dry, stiff *FILL
SP	Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, dry, med. dense @ 2' 2" layer - silty clay (prev. material) @ 4' some black silt
SP	Poorly graded sand, fine grained, d. yellowish brown 10YR 4/2, moist, med. dense, trace fine gravel @ 6' water in spoon, loose
SC	Clayey sand, fine grained, med. bluish gray 5B 5/1, moist, loose
SP	Poorly graded sand, fine grained, d. yellowish brown 10YR 4/2, moist, loose
SC	Clayey sand, fine grained, med. bluish grey SB 5/1, moist, loose
CH	Fat clay, l. grey N7, moist, firm
CH	Fat clay, l. grey N7 and poorly graded sand, fine grained d. yellowish brown 10YR 4/2, moist, med. dense, 50/50 mix
MH	Clayey silt, pale yellowish brown 10YR 6/2 and l. grey N7, moist, med. dense, mottled @ 12' loose @ 18.5' pale yellowish brown 10YR 6/2
SP	Poorly graded sand, v. fine grained greyish orange 10YR 7/4, moist, loose @ 20.7' trace black silt

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 **AMEC FOSTER WHEELER**

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1601S** DATE **4/27/16** SHEET **2** OF **3**

PROJECT **ROCKPORT PLANT** BORING START **2/27/16** BORING FINISH **2/27/16**

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
15	SS	21.0	22.5	3-6-6	1.5				SP	Poorly graded sand, fine grained, pale yellowish brown 10YR 6/2 moist, med. dense		
16	SS	22.5	24.0	4-5-8	1.5				SP	Poorly graded sand, v. fine grained, greyish orange 10YR 7/4, moist, med. dense		
17	SS	24.0	25.5	3-7-10	1.5				SP	Poorly graded sand, fine grained, pale yellowish brown 10YR 6/2 moist to wet, med. dense @ 23.8' fine to med. grained, trace black silt @ 24' fine grained, no black, silt, trace fine gravel @ 26' coal fragment (2") (bl. silt) @ 29.1' 1" layer - lean clay, d. yellowish brown 10YR 4/2 @ 31' trace black silt		
18	SS	25.5	27.0	4-6-7	1.5		25					
19	SS	27.0	28.5	3-5-10	1.5							
20	SS	28.5	30.0	3-6-8	1.5							
21	SS	30.0	31.5	4-4-9	1.5		30					
22	SS	31.5	33.0	4-5-6	1.5							
23	SS	33.0	34.5	3-3-4	1.3				SW	Well graded sand, fine to med. grained, d. yellowish brown 10YR 4/2, wet, med. dense, trace fine gravel @ 33' loose @ 34.5' med. dense, w/fine gravel		
24	SS	34.5	36.0	6-6-7	1.3		35					
25	SS	36.0	37.5	4-4-5	1.2							
26	SS	37.5	39.0	5-6-12	1.4				SW	Well graded sand, coarse grained, dusky brown 5YR 2/2, wet, loose, w/fine gravel @ 37.5' med. dense @ 39' trace coarse gravel		
27	SS	39.0	40.5	11-10-12	1.5							
28	SS	40.5	42.0	6-11-15	1.5		40		SP	Poorly graded sand, fine gained, l. brown 5YR 5/6, wet, med. dense, trace fine gravel @ 40.5' w/fine gravel, trace coarse gravel @ 42' some fine gravel, no coarse gravel		
29	SS	42.0	43.5	6-10-10	1.3							
30	SS	43.5	45.0	6-11-12	1.5				SW	Well graded sand, coarse grained, dusky brown 5YR 2/2, wet, med. dense, w/fine gravel, trace coarse gravel (rounded) @ 46.5' coarse gravel, plug in spoon @ 48' some coarse gravel, dense		
31	SS	45.0	46.5	9-8-8	1.4		45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1601S** DATE **4/27/16** SHEET **3** OF **3**

PROJECT **ROCKPORT PLANT** BORING START **2/27/16** BORING FINISH **2/27/16**

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
32	SS	46.5	48.0	10-9-16	.2			░				

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER **42393125-01**

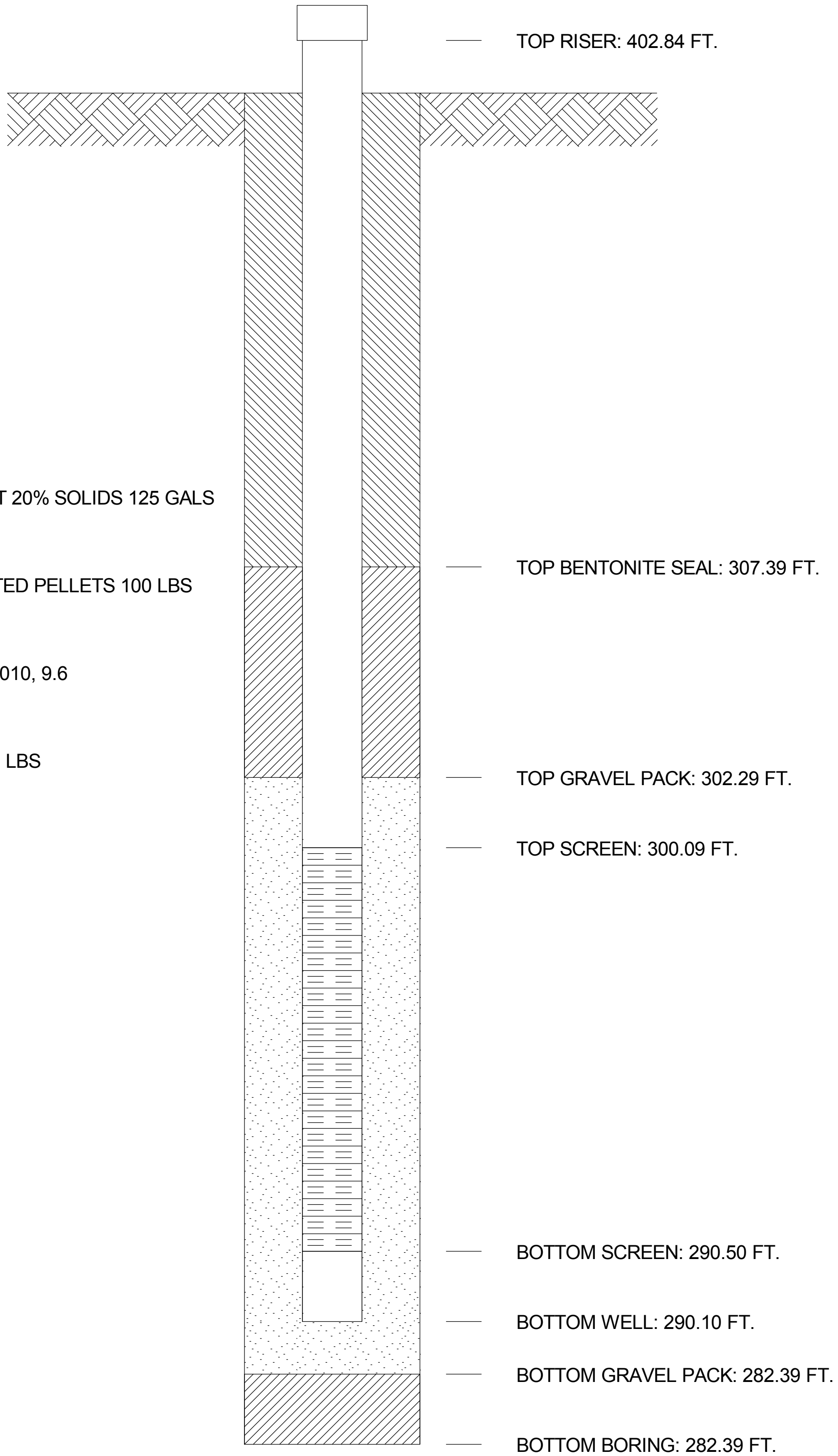
COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No. **MW-1601D** BORING No. **MW-1601D** INSTALLED **2/26/16**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 154,323.2 E 513,487.5**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 400.09 FT.



▧ GROUT SEAL: QUICK GROUT 20% SOLIDS 125 GALS

▨ BENTONITE SEAL: 3/8" COATED PELLETS 100 LBS

☰ SCREEN: 2.0 dia., SLOTTED .010, 9.6

░ GRAVEL PACK: #5 SAND 475 LBS

☐ RISER PIPE: 2.0, dia., PVC

∿ SPACERS, DEPTH:

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
MONITORING WELL CONSTRUCTION

JOB NUMBER **42393125-01**

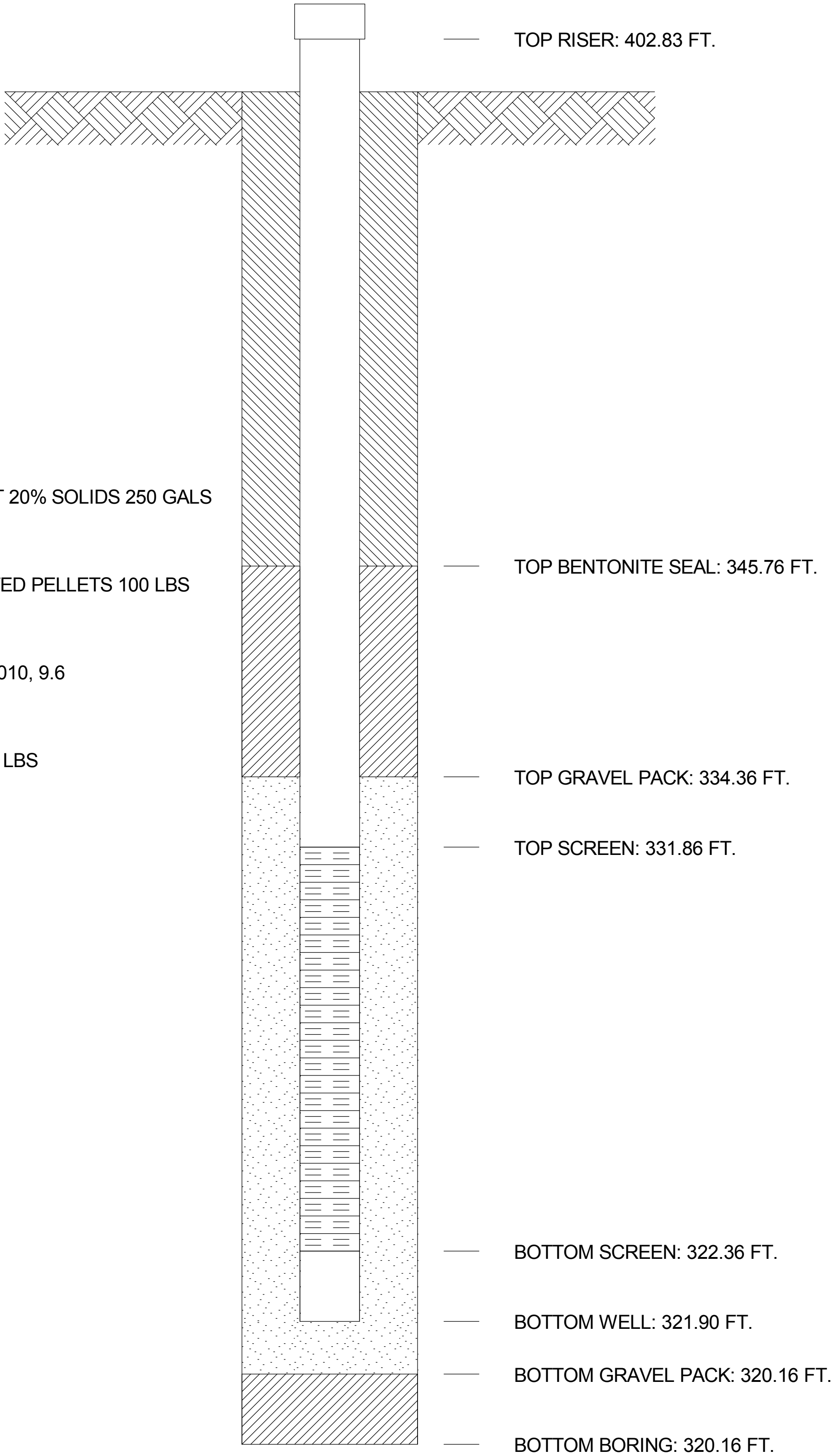
COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No. **MW-1601I** BORING No. **MW-1601I** INSTALLED **2/26/16**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 154,325.3 E 513,483.5**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 399.96 FT.



▧ GROUT SEAL: QUICK GROUT 20% SOLIDS 250 GALS

▨ BENTONITE SEAL: 3/8" COATED PELLETS 100 LBS

☰ SCREEN: 2.0 dia., SLOTTED .010, 9.6

░ GRAVEL PACK: #5 SAND 175 LBS

☐ RISER PIPE: 2.0, dia., PVC

∿ SPACERS, DEPTH:

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER **42393125-01**

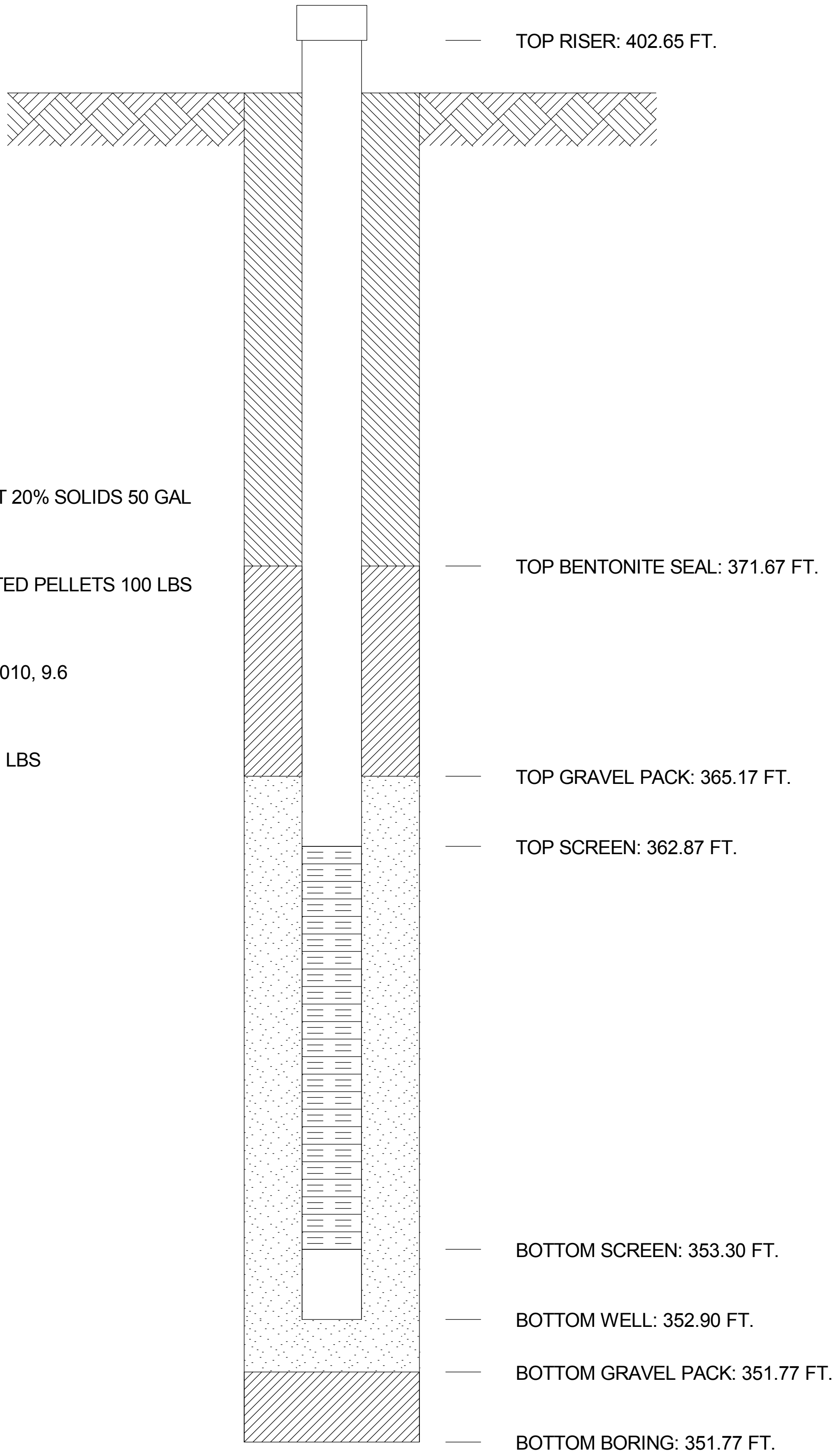
COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No. **MW-1601S** BORING No. **MW-1601S** INSTALLED **2/27/16**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 154,327.6 E 513,479.7**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 399.77 FT.



▨ GROUT SEAL: QUICK GROUT 20% SOLIDS 50 GAL

▨ BENTONITE SEAL: 3/8" COATED PELLETS 100 LBS

☰ SCREEN: 2.0 dia., SLOTTED .010, 9.6

░ GRAVEL PACK: #5 SAND 200 LBS

☐ RISER PIPE: 2.0, dia., PVC

∿ SPACERS, DEPTH:

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 152,300.2 E 514,229.4**

GROUND ELEVATION **399.3** SYSTEM **State Plane using NAD27/29**

BORING NO. **MW-1602D** DATE **4/27/16** SHEET **1** OF **6**

BORING START **1/26/16** BORING FINISH **1/26/16**

PIEZOMETER TYPE WELL TYPE **OW**

HGT. RISER ABOVE GROUND **2.63** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **114.3** BOTTOM **123.88**

WELL DEVELOPMENT **YES** BACKFILL

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

Water Level, ft	▽	▼	▼
TIME			
DATE			

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	1.5	3-2-5	1.5					Topsoil = 20 inches		
2	SS	1.5	3.0	6-9-9	1.25				CL	Silty lean clay, light brown 5YR 5/6 moderate brown 5YR 4/4 & medium light gray N5 fat clay seam, mottled, moist, v. stiff, trace organic *possible mud/grout/fill from nearby (~10') MW =>*FILL* @ 3' stiff no organic, some moderate yellowish brown 10YR 5/4 silt		
3	SS	3.0	4.5	4-6-7	1.25							
4	SS	4.5	6.0	3-3-4	1.16		5					
5	SS	6.0	7.5	3-3-4	1.5				CH	Fat clay, medium light gray N6, moist to moist, firm *FILL* @ 6' w/lean clay, dark yellowish brown 10YR 4/2 mottled		
6	SS	7.5	9.0	2-2-3	1.5				CL CH	Silty lean clay, dark yellowish brown 10YR 4/2, moist, firm, some water in spoon *FILL* Fat clay, olive gray 5Y 4/1, dry to moist, firm *FILL*		
7	SS	9.0	10.5	4-5-6	1.5				CL	Silty lean clay, dark yellowish brown 10YR 4/2 with olive gray 5Y 4/1 fat clay mottled, moist, stiff, some moderate yellowish brown 10YR 5/4 silt, trace organic (wood, roots) *FILL*		
8	SS	10.5	12.0	5-6-9	1.5		10		CH CL	Fat clay, olive gray 5Y 4/1, dry to moist, stiff, trace organic *FILL* Silty lean clay, dark yellowish brown 10YR 4/2 with olive gray 5Y 4/1 fat clay heavily mottled, moist, stiff, some moderate yellowish brown 10YR 5/4 and dark reddish brown 10R 3/4 silty *FILL* @ 12' trace sandstone to 1/4" @ 13.5' no sandstone, trace black oxide		
9	SS	12.0	13.5	2-5-8	1.41							
10	SS	13.5	15.0	2-5-8	1.33							
11	SS	15.0	16.5	4-5-7	1.5		15		CL	Lean silty clay, dark yellowish brown 10YR 4/2, moist, stiff, trace moderate yellowish brown 10YR 5/4 silt, trace medium light gray N6 fat clay		
12	SS	16.5	18.0	3-3-5	1.5				ML	Clayey silt, dark yellowish brown 10YR 4/2, moist, loose @ 18.5' .5" sand seam		
13	SS	18.0	19.5	4-3-5	1.5							
14	SS	19.5	21.0	3-3-4	1.5				SP	Very fine grained sand, moderate yellowish brown		

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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 **AMEC FOSTER WHEELER**

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1602D** DATE **4/27/16** SHEET **2** OF **6**

PROJECT **ROCKPORT PLANT** BORING START **1/26/16** BORING FINISH **1/26/16**

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
15	SS	21.0	22.5	2-2-3	1.5					10YR 5/4 to dark yellowish brown 10YR 4/2, moist, loose, poorly graded @ 19.8' clay, silt seam (prev. material) 4.5" @ 21.2' clayey silt seam (prev. material) 3" @ 22' fat clay seam, medium light gray N6 and dark yellowish orange 10YR 6/6 mottled, 2" @ 22.8' clay silt seam (prev. material) 8"		
16	SS	22.5	24.0	2-3-3	1.41							
17	SS	24.0	25.5	4-6-11	.91				SP	Med. grained sand, dark yellowish brown 10YR 4/2 to moderate yellowish brown 10YR 5/4, moist, med. dense @ 25.1' 25.3' fine grained sand seam (prev. material) .5" @ 27' loose @ 28.9' clayey silt seam (prev. material) 2.5" @ 29.7' coarse sand seam dark reddish brown 10R 3/4 w/black oxide, 2"		
18	SS	25.5	27.0	5-5-8	.83		25					
19	SS	27.0	28.5	3-5-5	1.0							
20	SS	28.5	30.0	2-4-5	1.25							
21	SS	30.0	31.5	4-5-7	1.08		30		SP	Coarse sand, dark reddish brown 10R 3/4, moist, med. dense		
22	SS	31.5	33.0	2-2-3	1.33				SP SP	Med. grain to coarse sand, dark yellowish brown 10YR 4/2, moist, med. dense, w/gravel to 1/4" Fine to med. grained sand, grayish brown 5YR 3/2, moist, med. dense, poorly graded @ 31.5' loose @ 33' moist to wet, water in spoon @ 34.5' v. loose @ 35.5' 6" silty clay seam ~50% medium light gray N6 @ 36' loose @ 37.5' trace gravel to 1/4"		
23	SS	33.0	34.5	1-2-3	1.33							
24	SS	34.5	36.0	3-1-3	.83		35					
25	SS	36.0	37.5	2-4-5	.91							
26	SS	37.5	39.0	7-4-4	.41							
27	SS	39.0	40.5	3-5-11	.83							
28	SS	40.5	42.0	6-7-9	.91		40		SP	Very fine grain to fine grained sand, dark yellowish brown 10YR 4/2, moist to wet, med. dense, poorly graded, trace gravel to 1/4", some black, @ 42' fine to med. grained		
29	SS	42.0	43.5	3-6-9	.75							
30	SS	43.5	45.0	3-6-8	.66				SW	Coarse sand, dark yellowish brown 10YR 4/2, moist to wet, med. dense, well graded, with gravel to 1/4", trace black silt @ 4' moderate brown 5YR 3/4 to grayish brown 5YR 3/2		
31	SS	45.0	46.5	11-9-13	1.08		45					

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JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1602D** DATE **4/27/16** SHEET **3** OF **6**

PROJECT **ROCKPORT PLANT** BORING START **1/26/16** BORING FINISH **1/26/16**

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	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
32	SS	46.5	48.0	5-11-13	1.0				@ 47.6' coal fragments (2")		
33	SS	48.0	49.5	11-12-13	1.0			SP	Fine to med. grain sand, grayish brown 5YR 3/2, moist to wet, med. dense, some gravel to 1/4"		
34	SS	49.5	51.0	5-5-8	1.16		50	SW	Coarse sand, grayish brown 5YR 3/2, moist to wet, med. dense, well graded with gravel to 1/4" @ 51.3' 2" coal seam @ 51.8' 3" med. grain sand seam, moderate brown 5YR 4/4, w/gravel to 1/4"		
35	SS	51.0	52.5	5-5-7	1.16						
36	SS	52.5	54.0	5-7-11	.75			SP SW	Fine to med. grain sand, grayish brown 5YR 3/2, moist to wet, med. dense, poorly graded, trace gravel to 1/4" Coarse sand, grayish brown 5YR 3/2, moist to wet, well graded, with gravel med. dense to 1/4" @ 54.5' 2" sandstone plug		
37	SS	54.0	55.5	9-8-11	.50		55				
38	SS	55.5	57.0	5-12-16	1.41			SP	Fine grained sand, grayish brown 5YR 3/2, moist to wet, med. dense, poorly graded @ 56' 1.5" coal seam @ 57' med. grained, with gravel (riverstone) to 1/4", well graded		
39	SS	57.0	58.5	10-14-14	1.08						
40	SS	58.5	60.0	6-10-17	1.25		60				
41	SS	60.0	61.5	10-13-16	1.16			SW	Coarse sand, grayish brown 5YR 3/2, wet, med. dense, well graded w/well rounded, fine to coarse gravel to 1"		
42	SS	61.5	63.0	7-11-20	1.25						
43	SS	63.0	64.5	7-13-15	1.25			SP	Med. grained sand, grayish brown 5YR 3/2, moist to wet, med. dense, poorly graded, trace gravel to 1/4" @ 64.5' fine grained @ 67.1' 1/5" coal fragments @ 67.5' dense, w/well rounded fine gravel @ 69' med. dense, well rounded fine gravel @ 70.5' dense @ 72' med. dense @ 73.5' dense @ 74.5' w/well rounded fine gravel @ 75' w/well rounded fine gravel @ 76.5 w/well rounded fine to coarse gravel @ 79.3' 2" shale fragment		
44	SS	64.5	66.0	6-10-14	1.33		65				
45	SS	66.0	67.5	8-10-13	1.16						
46	SS	67.5	69.0	10-19-22	1.25						
47	SS	69.0	70.5	9-10-12	1.08		70				
48	SS	70.5	72.0	10-15-18	1.16						

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JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1602D** DATE **4/27/16** SHEET **4** OF **6**

PROJECT **ROCKPORT PLANT** BORING START **1/26/16** BORING FINISH **1/26/16**

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
49	SS	72.0	73.5	8-10-12	1.16							
50	SS	73.5	75.0	7-15-19	1.1							
51	SS	75.0	76.5	12-18-21	1.33		75					
52	SS	76.5	78.0	8-16-29	1.41							
53	SS	78.0	79.5	27-18-15	1..5							
54	SS	79.5	81.0	11-16-26	1.5				CL	Silty clay, olive gray 5Y 3/2, wet, stiff (N values from shale)		
55	SS	81.0	82.5	9-18-23	1.41		80		SP	Fine grained sand, olive gray 5Y 3/2, wet, dense, poorly graded @ 81' silty clay seam (prev. material)		
56	SS	82.5	84.0	8-14-14	1.16							
57	SS	84.0	85.5	10-13-18	1.5				CH	Silty fat clay, brownish gray 5YR 4/1, wet, stiff		
58	SS	85.5	87.0	15-14-20	1.5		85		SP CH SW	Med. grained sand, moderate yellowish brown 10YR 5/4, wet, dense, trace well rounded fine gravel @ 85.2' 1" coal fragments Silty fat clay, moderate yellowish brown 10YR 5/4, wet, v. stiff Coarse sand, moderate yellowish brown 10YR 5/4, moist, dense, well graded, w/well rounded fine to coarse gravel to 1" @ 87' med. dense @ 88.5' clay plug (prev. material), 3"		
59	SS	87.0	88.5	10-12-12	1.08							
60	SS	88.5	90.0	15-13-24	1.33							
61	SS	90.0	91.5	15-17-21	1.75		90		SP SW	Med. grained sand, moderate yellowish brown 10YR 5/4, moist, dense, well rounded fine gravel Coarse sand, moderate yellowish brown 10YR 5/4, moist to wet, dense, well graded, w/gravel to 1.25'		
62	SS	91.5	93.0	11-17-20	1.08							
63	SS	93.0	94.5	8-11-16	1.33				SP	Med. grained sand, moderate yellowish brown 10YR 5/4, moist to wet, med. dense, trace fine gravel @ 95.5' mostly brown @ 96.3' .5" coal seam		
64	SS	94.5	96.0	1-11-17	1.41							
65	SS	96.0	97.5	7-10-18	1.41		95					
66	SS	97.5	99.0	6-11-13	1.16				SW	Coarse sand, moderate yellowish brown 10YR 5/4 to moderate brown 5YR 4/4, moist, med. dense,		

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JOB NUMBER **42393125-01**
COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1602D** DATE **4/27/16** SHEET **5** OF **6**
PROJECT **ROCKPORT PLANT** BORING START **1/26/16** BORING FINISH **1/26/16**

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
67	SS	99.0	100.5	8-13-21	1.25		100			well graded, w/fine to coarse gravel @ 100.3' shale fragment 2"		
68	SS	100.5	102.0	6-6-13	1.5							
69	SS	102.0	103.5	6-8-17	1.5				SP	V. fine to fine sand, grayish brown 5YR 3/2, moist to wet, med. dense, poorly graded @ 102.2' 3" coarse sand seam (prev. material)		
70	SS	103.5	105.0	10-12-15	1.25				SP	Fine to med. grained sand, grayish brown 5YR 3/2, moist to wet, med. dense, trace fine gravel @ 105' no gravel @ 106.5' dense @ 107.7' 1" shale fragment @ 109' 3" shale fragment @110.8' trace shale @ 111' no shale		
71	SS	105.0	106.5	8-11-19	1.41		105					
72	SS	106.5	108.0	8-12-20	1.33							
73	SS	108.0	109.5	13-21-17	1.33							
74	SS	109.5	111.0	8-16-31	1.5		110					
75	SS	111.0	112.5	12-20-31	1.41				SW	Coarse sand, grayish brown 5YR 3/2, moist to wet, v. dense, w/fine to coarse gravel (~50%), well graded @ 114.1' 1.5" clay seam (prev. material, gray fat)		
76	SS	112.5	114.0	17-27-28	1.41							
77	SS	114.0	115.5	12-26-22	1.5		115		SW	Fine grained sand, grayish brown 5YR 3/2, wet, dense, well graded, w/gravel to 1.75"		
78	SS	115.5	117.0	8-7-7	1.41				SW	Coarse sand, grayish brown 5YR 3/2, moist, med. dense, well graded w/fine gravel (~50%), some black silt		
79	SS	117.0	118.5	13-12-15	1.25							
80	SS	118.5	120.0	8-9-14	1.25							
81	SS	120.0	121.5	11-11-21	1.33		120		SP	Med. grained sand, grayish brown 5YR 3/2, moist to wet, dense, some gravel to 1/4" @ 122.8' gravel plug, 1.5" v. dense @ 123' w/gravel to 1.75" (~50%)		
82	SS	121.5	123.0	12-21-43	1.25							
83	SS	123.0	124.5	32-50/5	.91							

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1602D** DATE **4/27/16** SHEET **6** OF **6**

PROJECT **ROCKPORT PLANT** BORING START **1/26/16** BORING FINISH **1/26/16**

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
84	SS	124.5	126.0	50/5	.41		125			Shale, olive gray 5Y 4/1, moist, hard Spoon refusal @ 125' Auger refusal @ 125' TOR 124.6' Boring terminated @ 125'		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 152,295.0 E 514,229.2**

GROUND ELEVATION **399.4** SYSTEM **State Plane using NAD27/29**

BORING NO. **MW-1602I** DATE **4/27/16** SHEET **1** OF **4**

BORING START **2/9/16** BORING FINISH **2/9/16**

PIEZOMETER TYPE WELL TYPE **OW**

HGT. RISER ABOVE GROUND **2.65** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **67.8** BOTTOM **77.38**

WELL DEVELOPMENT **YES** BACKFILL

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

Water Level, ft	▽	▼	▼
TIME			
DATE			

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	SAMPLE DEPTH IN FEET TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %
1	SS	0.0	1.5	3-2-5	1.5	
2	SS	1.5	3.0	6-9-9	1.25	
3	SS	3.0	4.5	4-6-7	1.25	
4	SS	4.5	6.0	3-3-4	1.16	
5	SS	6.0	7.5	3-3-4	1.5	
6	SS	7.5	9.0	2-2-3	1.5	
7	SS	9.0	10.5	4-5-6	1.5	
8	SS	10.5	12.0	5-6-9	1.5	
9	SS	12.0	13.5	2-5-8	1.41	
10	SS	13.5	15.0	2-5-8	1.33	
11	SS	15.0	16.5	4-5-7	1.5	
12	SS	16.5	18.0	3-3-5	1.5	
13	SS	18.0	19.5	4-3-5	1.5	
14	SS	19.5	21.0	3-3-4	1.5	

DEPTH IN FEET: 5, 10, 15

U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
	Topsoil = 20 inches		
CL	Silty lean clay, light brown 5YR 5/6 moderate brown 5YR 4/4 & medium light gray N5 fat clay seam, mottled, moist, v. stiff, trace organic *possible mud/grout/fill from nearby (~10') MW =>*FILL* @ 3' stiff no organic, some moderate yellowish brown 10YR 5/4 silt		
CH	Fat clay, medium light gray N6, moist to moist, firm *FILL* @ 6' w/lean clay, dark yellowish brown 10YR 4/2 mottled		
CL	Silty lean clay, dark yellowish brown 10YR 4/2, moist, firm, some water in spoon *FILL*		
CH	Fat clay, olive gray 5Y 4/1, dry to moist, firm *FILL*		
CL	Silty lean clay, dark yellowish brown 10YR 4/2 with olive gray 5Y 4/1 fat clay mottled, moist, stiff, some moderate yellowish brown 10YR 5/4 silt, trace organic (wood, roots) *FILL*		
CH	Fat clay, olive gray 5Y 4/1, dry to moist, stiff, trace organic *FILL*		
CL	Silty lean clay, dark yellowish brown 10YR 4/2 with olive gray 5Y 4/1 fat clay heavily mottled, moist, stiff, some moderate yellowish brown 10YR 5/4 and dark reddish brown 10R 3/4 silty *FILL* @ 12' trace sandstone to 1/4" @ 13.5' no sandstone, trace black oxide		
CL	Lean silty clay, dark yellowish brown 10YR 4/2, moist, stiff, trace moderate yellowish brown 10YR 5/4 silt, trace medium light gray N6 fat clay		
ML	Clayey silt, dark yellowish brown 10YR 4/2, moist, loose @ 18.5' .5" sand seam		
SP	Very fine grained sand, moderate yellowish brown		

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 **AMEC FOSTER WHEELER**

JOB NUMBER **42393125-01**
COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1602I** DATE **4/27/16** SHEET **2** OF **4**
PROJECT **ROCKPORT PLANT** BORING START **2/9/16** BORING FINISH **2/9/16**

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
15	SS	21.0	22.5	2-2-3	1.5					10YR 5/4 to dark yellowish brown 10YR 4/2, moist, loose, poorly graded @ 19.8' clay, silt seam (prev. material) 4.5" @ 21.2' clayey silt seam (prev. material) 3" @ 22' fat clay seam, medium light gray N6 and dark yellowish orange 10YR 6/6 mottled, 2" @ 22.8' clay silt seam (prev. material) 8"		
16	SS	22.5	24.0	2-3-3	1.41							
17	SS	24.0	25.5	4-6-11	.91				SP	Med. grained sand, dark yellowish brown 10YR 4/2 to moderate yellowish brown 10YR 5/4, moist, med. dense @ 25.1' 25.3' fine grained sand seam (prev. material) .5" @ 27' loose @ 28.9' clayey silt seam (prev. material) 2.5" @ 29.7' coarse sand seam dark reddish brown 10R 3/4 w/black oxide, 2"		
18	SS	25.5	27.0	5-5-8	.83		25					
19	SS	27.0	28.5	3-5-5	1.0							
20	SS	28.5	30.0	2-4-5	1.25							
21	SS	30.0	31.5	4-5-7	1.08		30		SP SP	Coarse sand, dark reddish brown 10R 3/4, moist, med. dense Med. grain to coarse sand, dark yellowish brown 10YR 4/2, moist, med. dense, w/gravel to 1/4"		
22	SS	31.5	33.0	2-2-3	1.33				SP	Fine to med. grained sand, grayish brown 5YR 3/2, moist, med. dense, poorly graded @ 31.5' loose @ 33' moist to wet, water in spoon @ 34.5' v. loose @ 35.5' 6" silty clay seam ~50% medium light gray N6 @ 36' loose @ 37.5' trace gravel to 1/4"		
23	SS	33.0	34.5	1-2-3	1.33							
24	SS	34.5	36.0	3-1-3	.83		35					
25	SS	36.0	37.5	2-4-5	.91							
26	SS	37.5	39.0	7-4-4	.41							Began Mud Rotary @ 37.5'
27	SS	39.0	40.5	3-5-11	.83							
28	SS	40.5	42.0	6-7-9	.91		40		SP	Very fine grain to fine grained sand, dark yellowish brown 10YR 4/2, moist to wet, med. dense, poorly graded, trace gravel to 1/4", some black, @ 42' fine to med. grained		
29	SS	42.0	43.5	3-6-9	.75							
30	SS	43.5	45.0	3-6-8	.66				SW	Coarse sand, dark yellowish brown 10YR 4/2, moist to wet, med. dense, well graded, with gravel to 1/4", trace black silt @ 4' moderate brown 5YR 3/4 to grayish brown 5YR 3/2		
31	SS	45.0	46.5	11-9-13	1.08		45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1602I** DATE **4/27/16** SHEET **3** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **2/9/16** BORING FINISH **2/9/16**

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
32	SS	46.5	48.0	5-11-13	1.0					@ 47.6' coal fragments (2")		
33	SS	48.0	49.5	11-12-13	1.0				SP	Fine to med. grain sand, grayish brown 5YR 3/2, moist to wet, med. dense, some gravel to 1/4"		
34	SS	49.5	51.0	5-5-8	1.16		50		SW	Coarse sand, grayish brown 5YR 3/2, moist to wet, med. dense, well graded with gravel to 1/4" @ 51.3' 2" coal seam @ 51.8' 3" med. grain sand seam, moderate brown 5YR 4/4, w/gravel to 1/4"		
35	SS	51.0	52.5	5-5-7	1.16							
36	SS	52.5	54.0	5-7-11	.75				SP SW	Fine to med. grain sand, grayish brown 5YR 3/2, moist to wet, med. dense, poorly graded, trace gravel to 1/4"		
37	SS	54.0	55.5	9-8-11	.50		55			Coarse sand, grayish brown 5YR 3/2, moist to wet, well graded, with gravel med. dense to 1/4" @ 54.5' 2" sandstone plug		
38	SS	55.5	57.0	5-12-16	1.41				SP	Fine grained sand, grayish brown 5YR 3/2, moist to wet, med. dense, poorly graded @ 56' 1.5" coal seam @ 57' med. grained, with gravel (riverstone) to 1/4", well graded		
39	SS	57.0	58.5	10-14-14	1.08							
40	SS	58.5	60.0	6-10-17	1.25							
41	SS	60.0	61.5	10-13-16	1.16		60		SW	Coarse sand, grayish brown 5YR 3/2, wet, med. dense, well graded w/well rounded, fine to coarse gravel to 1"		
42	SS	61.5	63.0	7-11-20	1.25							
43	SS	63.0	64.5	7-13-15	1.25				SP	Med. grained sand, grayish brown 5YR 3/2, moist to wet, med. dense, poorly graded, trace gravel to 1/4" @ 64.5' fine grained @ 67.1' 1/5" coal fragments @ 67.5' dense, w/well rounded fine gravel @ 69' med. dense, well rounded fine gravel @ 70.5' dense @ 72' med. dense @ 73.5' dense @ 74.5' w/well rounded fine gravel @ 75' w/well rounded fine gravel @ 76.5 w/well rounded fine to coarse gravel @ 79.3' 2" shale fragment		
44	SS	64.5	66.0	6-10-14	1.33		65					
45	SS	66.0	67.5	8-10-13	1.16							
46	SS	67.5	69.0	10-19-22	1.25							
47	SS	69.0	70.5	9-10-12	1.08		70					
48	SS	70.5	72.0	10-15-18	1.16							

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1602I** DATE **4/27/16** SHEET **4** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **2/9/16** BORING FINISH **2/9/16**

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
49	SS	72.0	73.5	8-10-12	1.16							
50	SS	73.5	75.0	7-15-19	1.1							
51	SS	75.0	76.5	12-18-21	1.33		75					
52	SS	76.5	78.0	8-16-29	1.41							
53	SS	78.0	79.5	27-18-15	1..5							

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER **42393125-01**

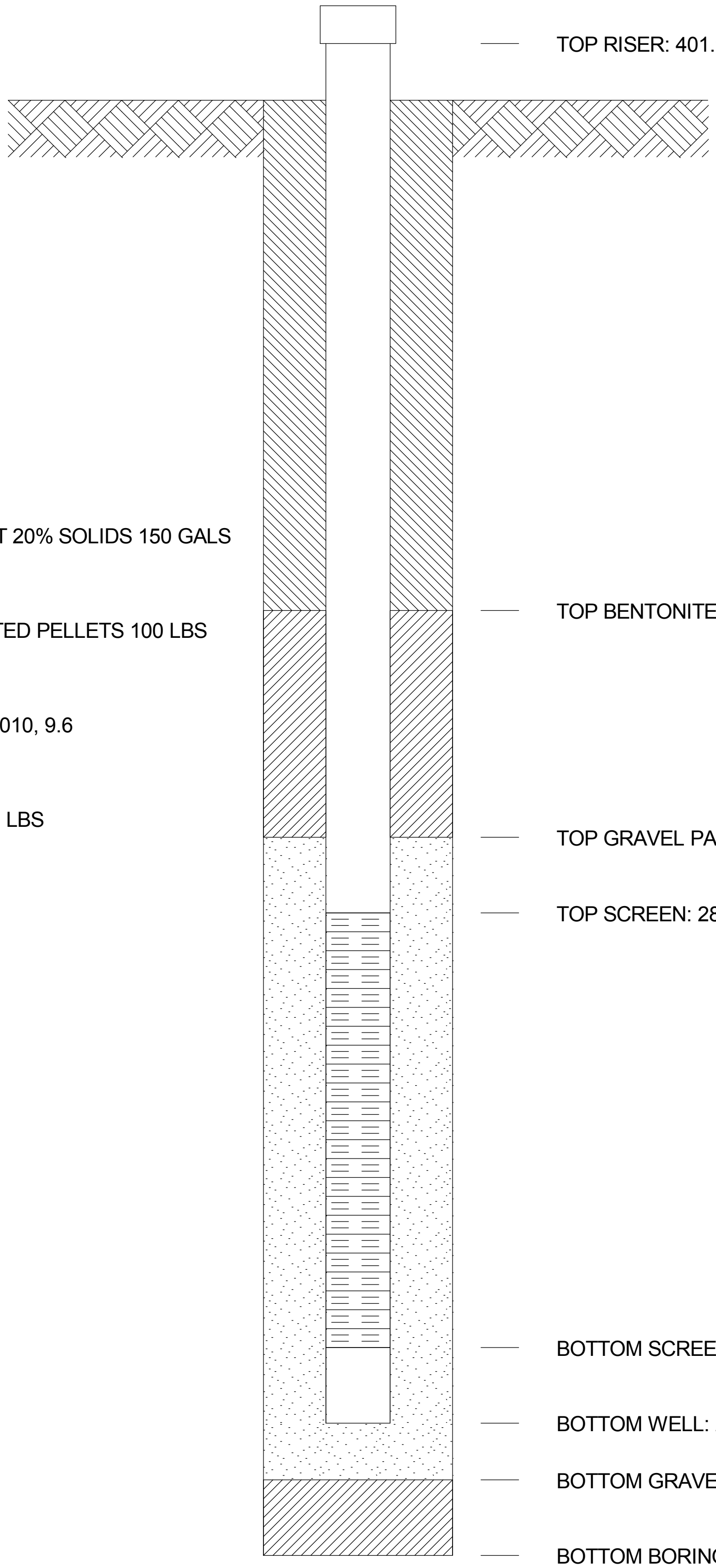
COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No. **MW-1602D** BORING No. **MW-1602D** INSTALLED **1/26/16**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 152,300.2 E 514,229.4**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 399.28 FT.



TOP RISER: 401.91 FT.

TOP BENTONITE SEAL: 293.28 FT.

TOP GRAVEL PACK: 287.28 FT.

TOP SCREEN: 284.98 FT.

BOTTOM SCREEN: 275.40 FT.

BOTTOM WELL: 275.00 FT.

BOTTOM GRAVEL PACK: 274.28 FT.

BOTTOM BORING: 274.28 FT.

▧ GROUT SEAL: QUICK GROUT 20% SOLIDS 150 GALS

▨ BENTONITE SEAL: 3/8" COATED PELLETS 100 LBS

☰ SCREEN: 2.0 dia., SLOTTED .010, 9.6

░ GRAVEL PACK: #5 SAND 200 LBS

☐ RISER PIPE: 2.0, dia., PVC

∿ SPACERS, DEPTH:

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER **42393125-01**

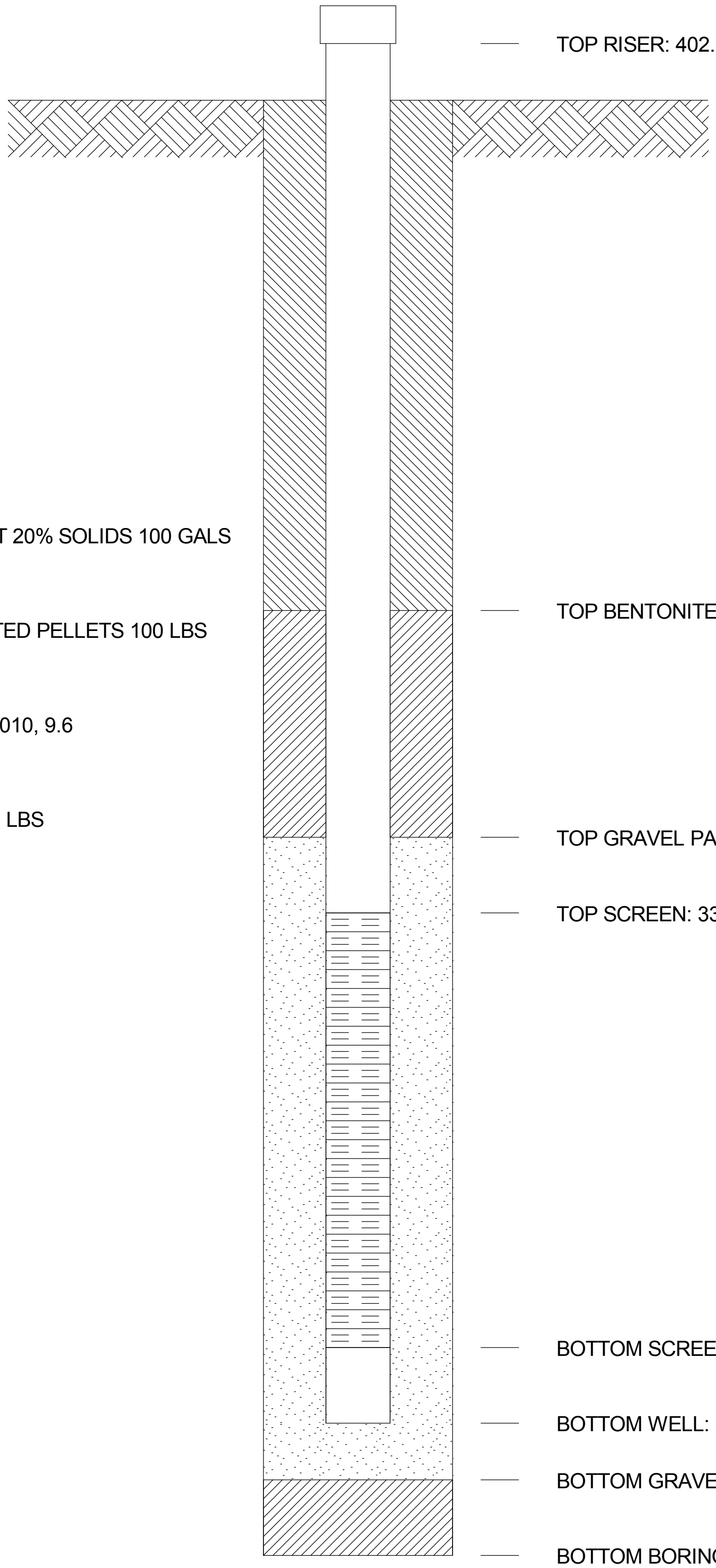
COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No. **MW-1602I** BORING No. **MW-1602I** INSTALLED **2/9/16**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 152,295.0 E 514,229.2**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 399.38 FT.



TOP RISER: 402.03 FT.

TOP BENTONITE SEAL: 344.38 FT.

TOP GRAVEL PACK: 333.88 FT.

TOP SCREEN: 331.58 FT.

BOTTOM SCREEN: 322.00 FT.

BOTTOM WELL: 321.60 FT.

BOTTOM GRAVEL PACK: 320.68 FT.

BOTTOM BORING: 320.68 FT.

▧ GROUT SEAL: QUICK GROUT 20% SOLIDS 100 GALS

▨ BENTONITE SEAL: 3/8" COATED PELLETS 100 LBS

☰ SCREEN: 2.0 dia., SLOTTED .010, 9.6

░ GRAVEL PACK: #5 SAND 150 LBS

☐ RISER PIPE: 2.0, dia., PVC

∿ SPACERS, DEPTH:

GEOMCNST RK BAP CCR COMPLIANCE.GPJ AEP.GDT 4/27/16

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 152,811.9 E 514,207.5**

GROUND ELEVATION **401.6** SYSTEM **State Plane using NAD27/29**

BORING NO. **MW-1603D** DATE **4/27/16** SHEET **1** OF **5**

BORING START **1/29/16** BORING FINISH **1/29/16**

PIEZOMETER TYPE ____ WELL TYPE **OW**

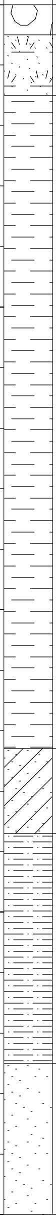
HGT. RISER ABOVE GROUND **2.29** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **110.9** BOTTOM **120.46**

WELL DEVELOPMENT **YES** BACKFILL ____

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

Water Level, ft	▽	▼	▼
TIME			
DATE			



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
1	SS	0.0	1.5	3-3-6	.5					Gravel = 6 inches		
										Topsoil = 12 inches		
2	SS	1.5	3.0	4-11-14	.75				CL	Silty clay, l. brown 5YR 6/4 and l. grey N7 mottled, dry to moist, v. stiff @ 3' trace moderate red 5R 4/6 silt @ 6' stiff, geofabric in spoon @ 7.5' v. stiff, wood debris @ 9' w/pale yellowish brown 10YR 6/2 fat clay, stiff		
3	SS	3.0	4.5	5-9-12	1.0							
4	SS	4.5	6.0	7-10-13	.92							
5	SS	6.0	7.5	4-6-9	1.08		5					
6	SS	7.5	9.0	4-8-12	1.5							
7	SS	9.0	10.5	2-3-7	1.33							
8	SS	10.5	12.0	2-4-9	1.5		10					
9	SS	12.0	13.5	4-5-7	1.33				SC	Clayey sand, moderate brown 5YR 4/4, moist, med. dense, w/l. grey N7 clay, fine grained, trace black N1 silt		
10	SS	13.5	15.0	3-5-9	1.5				ML	Clayey silt, moderate yellowish brown 10YR 5/4, moist, med. dense, some l. grey N7 fat clay @ 15' trace l. grey N7 fat clay		
11	SS	15.0	16.5	3-4-7	1.5		15					
12	SS	16.5	18.0	3-4-6	1.16							
13	SS	18.0	19.5	3-4-4	1.5				SP	Poorly graded sand, moderate yellowish brown 10YR 5/4, fine grained, moist, loose @ 18' v. fine to fine grained		
14	SS	19.5	21.0	4-6-8	1.5							

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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 **AMEC FOSTER WHEELER**

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1603D** DATE **4/27/16** SHEET **2** OF **5**

PROJECT **ROCKPORT PLANT** BORING START **1/29/16** BORING FINISH **1/29/16**

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
15	SS	21.0	22.5	2-2-3	1.42				SP	Poorly graded sand, grayish orange 10YR 7/4, moist, med. dense, fine grained, trace blacK N1 silt @ 21.5' 2" clay seam, moderate brown 5YR 4/4		
16	SS	22.5	24.0	1-3-4	1.5				SP	Poorly graded sand, moderate yellowish brown 10YR 5/4, moist, v. fine grained, loose @ 22.8' 2.5" clayey silt seam (prev. material) @ 23.6' 2" grayish orange 10YR 7/4 sand seam (prev. material) @ 24' 3" shale fragment, med. l. grey N6 @ 25.5' 2" shale fragments		
17	SS	24.0	25.5	4-7-8	.33							
18	SS	25.5	27.0	3-6-9	1.5		25		SP	Poorly graded sand, grayish orange 10YR 7/4, moist, med. dense, fine grained, trace black N1 silt @ 26.6' 1" coarse sand seam, dark yellowish brown 10YR 4/2, w/rounded fine gravel, well graded @ 27.9' 2" coarse sand seam (prev. material) @ 28.7' clay seam, 1.5" (prev. material @ 29.5' .5" coarse sand seam, moderate red 5R4/6, w/black N1 silt, poorly graded @ 31.1' 1/4" coal fragments and black N1 silt @ 31.3' 1/4" coal fragment and black, N1 silt		
19	SS	27.0	28.5	5-6-9	1.5							
20	SS	28.5	30.0	4-7-12	1.5							
21	SS	30.0	31.5	5-6-8	1.5		30					
22	SS	31.5	33.0	5-6-10	1.5				SW	Well graded sand, coarse grained, pale yellowish brown 10YR 6/2, moist, med. dense, trace black N1 silt @ 32.5' .5" coarse sand seam, moderate red (prev. material) @ 33' med. grained @ 35 1/4" coal fragments		
23	SS	33.0	34.5	3-5-8	1.25							
24	SS	34.5	36.0	5-7-9	1.41		35					
25	SS	36.0	37.5	6-5-7	1.25				SP	Poorly graded sand, moderate yellowish brown 10YR 5/4, moist to wet, med. dense, fine grained, some fine gravel, water in spoon @ 36' fine to med. grained @ 38.6' 2" coarse sand seam dark yellowish brown 10YR 4/2 w/black N1 silt (50%)		
26	SS	37.5	39.0	2-3-7	1.33							
27	SS	39.0	40.5	6-8-8	1.41				SP	Poorly graded sand, pale reddish brown 10R 5/4, fine grained, moist to wet, med, dense @ 40' 1/4" coal fragments		
28	SS	40.5	42.0	3-6-9	1.16		40		SW	Well graded sand, moderate, yellowish brown 10YR 5/4, fine grained, moist to wet, med. dense, some fine gravel @ 41' coarse sand seam, 3", d. yellowish brown 10YR 4/2, prev. material @ 42.5' coarse sand seam, 3.5", d. yellowish brown 10YR 4/2, w/black N1 silt and fine gravel		
29	SS	42.0	43.5	5-8-8	1.25							
30	SS	43.5	45.0	5-4-7	.83				SW	Well graded sand, d. yelllowish brown 10YR 4/2, coarse grained, moist to wet, med. dense, with fine gravel @ 43.8' trace coal fragments, angular @ 44' no coal fragments		
31	SS	45.0	46.5	6-8-14	1.16		45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1603D** DATE **4/27/16** SHEET **3** OF **5**

PROJECT **ROCKPORT PLANT** BORING START **1/29/16** BORING FINISH **1/29/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET
32	SS	46.5	48.0	13-10-18	1.33		
33	SS	48.0	49.5	9-14-19	1.41		
34	SS	49.5	51.0	11-15-18	1.33		50
35	SS	51.0	52.5	6-9-16	1.41		
36	SS	52.5	54.0	7-14-21	1.41		
37	SS	54.0	55.5	10-12-12	1.5		55
38	SS	55.5	57.0	9-12-31	1.41		
39	SS	57.0	58.5	10-10-15	1.16		
40	SS	58.5	60.0	8-10-15	1.5		
41	SS	60.0	61.5	7-10-11	1.25		60
42	SS	61.5	63.0	8-13-13	1.25		
43	SS	63.0	64.5	7-9-17	1.16		
44	SS	64.5	66.0	6-9-10	1.33		65
45	SS	66.0	67.5	10-11-15	1.16		
46	SS	67.5	69.0	10-11-15	1.33		
47	SS	69.0	70.5	9-13-15	1.5		70
48	SS	70.5	72.0	9-12-18	1.33		

U S C S	SOIL / ROCK IDENTIFICATION
SW	@ 45.5' some coarse gravel, rounded @ 45.7' .5" coal fragments @ 46' 1.5" coal fragments
	Well graded sand, moderate yellowish brown 10YR 5/4, fine grained, moist to wet, med. dense, some fine gravel @ 46.9' 1.5" shale seam @ 47.6' 1" coal fragment and black N1 silt, angular @ 47.8' 1.5" rounded fine gravel, clean, poorly graded @ 48' 1" shale fragment @ 48.1' dense, poorly graded, trace fine gravel @ 49.5' w/fine gravel @ 51' well graded, med. dense @ 52.5' trace shale fragments to 1.5"
SP	Poorly graded sand, med. grained, pale yellowish brown 10YR 6/2, moist to wet, dense, trace fine gravel
SW	Well graded sand, pale yellowish brown 10YR 6/2, fine grained, moist to wet, med. dense, some fine gravel, trace coarse gravel @ 55.5' dense, no coarse gravel @57' med. dense @ 58' 2.5" shale seam, med. l. grey N6
SW	Well graded sand, l. olive grey 5Y 6/1, fine to med. grained, moist to wet, med. dense, with fine gravel (rounded) @ 61.5' fine grained @ 63' trace fine gravel @ 64.5' d. yellowish brown 10YR 4/2 @ 66' fine to med. grained, some fine gravel (rounded)
SW	Well graded sand, d. yellowish brown 10YR 4/2, coarse grained, moist to wet, med. dense, with fine gravel
SP	Poorly graded sand, pale yellowish brown 10YR 6/2, fine grained, moist to wet, dense

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JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1603D** DATE **4/27/16** SHEET **4** OF **5**

PROJECT **ROCKPORT PLANT** BORING START **1/29/16** BORING FINISH **1/29/16**

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
49	SS	72.0	73.5	5-8-16	1.41					@ 72' med. dense @ 73' v. fine grained, moist @ 75.5' silty clay seam (~50%), moderate brown 5YR 3/4, moist, stiff to v. stiff @ 76.2' shale fragment, 3"		
50	SS	73.5	75.0	8-8-12	1.33							
51	SS	75.0	76.5	9-11-13	1.5		75					
52	SS	76.5	78.0	8-12-18	1.0				SW	Well graded sand, d. yellowish brown 10YR 4/2, coarse grained, moist to wet, dense, w/fine gavel, trace coarse gravel (rounded) @ 78' 3.5" shale fragment @ 78.4' coarse gravel seam 3" @ 78.6' 3" shale fragment		
53	SS	78.0	79.5	21-21-15	.75							
54	SS	79.5	81.0	3-6-6	1.41		80		CH	Fat clay, l. grey N7, wet, stiff		
55	SS	81.0	82.5	5-4-6	1.5				ML	Clayey silt, l. grey N7, moist to wet, loose @ 83' 2.5" fine grained sand seam, med. d. grey N4		
56	SS	82.5	84.0	5-6-11	1.5							
57	SS	84.0	85.5	5-6-15	1.5		85		SP	Poorly graded sand, med. d. grey N4, fine grained, moist to wet, med. dense @ 85' 4" clayey silt seam, prev. material @ 85.5' dense @ 86' 3.5" clayey silt seam, prev. material @ 88.5' v. dense @ 91.5' med. dense @ 92' some fine gravel @ 92.2' 1" coal fragments seam @ 93' d. yellowish brown 10YR 4/2, 4" clayey silt seam (prev. material) (50%) @ 94.4' 2" coal fragments seam @ 95' 6" coal fragments (75%) and above material (25%)		
58	SS	85.5	87.0	11-15-19	1.5							
59	SS	87.0	88.5	9-13-29	.41							
60	SS	88.5	90.0	15-21-34	1.5							
61	SS	90.0	91.5	12-22-30	1.5		90					
62	SS	91.5	93.0	7-12-17	1.33							
63	SS	93.0	94.5	8-11-12	1.5							
65	SS	94.0	95.5	12-22-17	1.5							
64	SS	94.5	96.0	7-14-19	1.5		95					
									SP	Poorly graded sand, coarse grained, moderate reddish brown 10R 4/6, moist to wet, dense, trace coal fragments @ 96' with coal fragements (~50%)		
66	SS	97.5	99.0	9-9-12	1.5				SP	Poorly graded sand, fine to med. grained, dusky		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1603D** DATE **4/27/16** SHEET **5** OF **5**

PROJECT **ROCKPORT PLANT** BORING START **1/29/16** BORING FINISH **1/29/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %
67	SS	99.0	100.5	8-9-15	1.5	
68	SS	100.5	102.0	16-20-12	.50	
69	SS	102.0	103.5	6-5-8	1.16	
70	SS	103.5	105.0	9-8-10	1.41	
71	SS	105.0	106.5	7-10-12	1.41	
72	SS	106.5	108.0	6-9-12	1.33	
73	SS	108.0	109.5	6-8-13	1.25	
74	SS	109.5	111.0	7-9-15	1.5	
75	SS	111.0	112.5	17-16-20	1.41	
76	SS	112.5	114.0	8-10-17	1.33	
77	SS	114.0	115.5	14-22-26	1.41	
78	SS	115.5	117.0	12-20-31	1.33	
79	SS	117.0	118.5	15-13-16	1.25	
80	SS	118.5	120.0	13-15-16	1.25	
81	SS	120.0	121.5	10-16-20	1.25	
82	SS	121.5	123.0	25-50/4	1.33	

DEPTH IN FEET	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
		yellow 5Y 6/4, moist to wet, dense, some coarse gravel @ 97.5' med. dense @ 97.7' 1" clayey silt plug (prev. material)		
100	SW	Well graded sand, coarse grained, dusky yellowish brown 10YR 2/2, moist to wet, med. dense, with fine gravel, trace coarse gravel @ 100.5' dense @ 101.8' 2.5" shale fragment		
105, 110	SP	Poorly graded sand, very fine grained, dark yellowish orange 10YR 6/6, wet, med. dense, trace fine gravel @ 105' grey 5Y 4/1 @ 108.5' moderate reddish brown 10R 4/6 @ 109' grey 5Y 4/1 @ 109.5' moist to wet		
	SW	Well graded sand, coarse grained, olive grey 5Y 3/2, moist to wet, dense, w/fine gravel, trace coarse gravel @ 112.5' med. dense		
115	SP	Poorly graded sand, fine grained, medium grey N5, moist to wet, dense, some fine gravel		
	SW	Well graded sand, coarse grained, light olive grey 5Y 6/1, moist to wet, v. dense, with fine gravel, some coarse gravel		
	SP	Poorly graded sand, fine grained, light olive grey 5Y 6/1, moist to wet, med. dense, some fine gravel @ 118.5' dense, with fine gravel, some coarse gravel		
120				
		Shale, med. l. grey N6, dry to moist, hard Spoon refusal @ 122' Auger refusal @ 122' Boring terminated @ 122'		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 152,807.3 E 519,207.2**

GROUND ELEVATION **401.4** SYSTEM **State Plane using NAD27/29**

BORING NO. **MW-1603I** DATE **4/27/16** SHEET **1** OF **4**

BORING START **2/1/16** BORING FINISH **2/1/16**

PIEZOMETER TYPE WELL TYPE **OW**

HGT. RISER ABOVE GROUND **2.74** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **68.9** BOTTOM **78.51**

WELL DEVELOPMENT **YES** BACKFILL

FIELD PARTY **MWJ / TAS** RIG **D-50**

Water Level, ft	▽	▼	▼
TIME			
DATE			

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
1	SS	0.0	1.5	3-3-6	.5					Gravel = 6 inches Topsoil = 12 inches		
2	SS	1.5	3.0	4-11-14	.75				CL	Silty clay, l. brown 5YR 6/4 and l. grey N7 mottled, dry to moist, v. stiff @ 3' trace moderate red 5R 4/6 silt @ 6' stiff, geofabric in spoon @ 7.5' v. stiff, wood debris @ 9' w/pale yellowish brown 10YR 6/2 fat clay, stiff		
3	SS	3.0	4.5	5-9-12	1.0							
4	SS	4.5	6.0	7-10-13	.92		5					
5	SS	6.0	7.5	4-6-9	1.08							
6	SS	7.5	9.0	4-8-12	1.5							
7	SS	9.0	10.5	2-3-7	1.33		10					
8	SS	10.5	12.0	2-4-9	1.5							
9	SS	12.0	13.5	4-5-7	1.33				SC	Clayey sand, moderate brown 5YR 4/4, moist, med. dense, w/l. grey N7 clay, fine grained, trace black N1 silt		
10	SS	13.5	15.0	3-5-9	1.5		15		ML	Clayey silt, moderate yellowish brown 10YR 5/4, moist, med. dense, some l. grey N7 fat clay @ 15' trace l. grey N7 fat clay		
11	SS	15.0	16.5	3-4-7	1.5							
12	SS	16.5	18.0	3-4-6	1.16							
13	SS	18.0	19.5	3-4-4	1.5				SP	Poorly graded sand, moderate yellowish brown 10YR 5/4, fine grained, moist, loose @ 18' v. fine to fine grained		
14	SS	19.5	21.0	4-6-8	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 **AMEC FOSTER WHEELER**

JOB NUMBER **42393125-01**
COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1603I** DATE **4/27/16** SHEET **2** OF **4**
PROJECT **ROCKPORT PLANT** BORING START **2/1/16** BORING FINISH **2/1/16**

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
15	SS	21.0	22.5	2-2-3	1.42				SP	Poorly graded sand, grayish orange 10YR 7/4, moist, med. dense, fine grained, trace blacK N1 silt @ 21.5' 2" clay seam, moderate brown 5YR 4/4		
16	SS	22.5	24.0	1-3-4	1.5				SP	Poorly graded sand, moderate yellowish brown 10YR 5/4, moist, v. fine grained, loose @ 22.8' 2.5" clayey silt seam (prev. material) @ 23.6' 2" grayish orange 10YR 7/4 sand seam (prev. material) @ 24' 3" shale fragment, med. l. grey N6 @ 25.5' 2" shale fragments		
17	SS	24.0	25.5	4-7-8	.33							
18	SS	25.5	27.0	3-6-9	1.5		25		SP	Poorly graded sand, grayish orange 10YR 7/4, moist, med. dense, fine grained, trace black N1 silt @ 26.6' 1" coarse sand seam, dark yellowish brown 10YR 4/2, w/rounded fine gravel, well graded @ 27.9' 2" coarse sand seam (prev. material) @ 28.7' clay seam, 1.5" (prev. material @ 29.5' .5" coarse sand seam, moderate red 5R4/6, w/black N1 silt, poorly graded @ 31.1' 1/4" coal fragments and black N1 silt @ 31.3' 1/4" coal fragment and black, N1 silt		
19	SS	27.0	28.5	5-6-9	1.5							
20	SS	28.5	30.0	4-7-12	1.5							
21	SS	30.0	31.5	5-6-8	1.5		30					
22	SS	31.5	33.0	5-6-10	1.5				SW	Well graded sand, coarse grained, pale yellowish brown 10YR 6/2, moist, med. dense, trace black N1 silt @ 32.5' .5" coarse sand seam, moderate red (prev. material) @ 33' med. grained @ 35 1/4" coal fragments		
23	SS	33.0	34.5	3-5-8	1.25							
24	SS	34.5	36.0	5-7-9	1.41							
25	SS	36.0	37.5	6-5-7	1.25		35		SP	Poorly graded sand, moderate yellowish brown 10YR 5/4, moist to wet, med. dense, fine grained, some fine gravel, water in spoon @ 36' fine to med. grained @ 38.6' 2" coarse sand seam dark yellowish brown 10YR 4/2 w/black N1 silt (50%)		
26	SS	37.5	39.0	2-3-7	1.33							
27	SS	39.0	40.5	6-8-8	1.41				SP	Poorly graded sand, pale reddish brown 10R 5/4, fine grained, moist to wet, med, dense @ 40' 1/4" coal fragments		
28	SS	40.5	42.0	3-6-9	1.16		40		SW	Well graded sand, moderate, yellowish brown 10YR 5/4, fine grained, moist to wet, med. dense, some fine gravel @ 41' coarse sand seam, 3", d. yellowish brown 10YR 4/2, prev. material @ 42.5' coarse sand seam, 3.5", d. yellowish brown 10YR 4/2, w/black N1 silt and fine gravel		
29	SS	42.0	43.5	5-8-8	1.25							
30	SS	43.5	45.0	5-4-7	.83				SW	Well graded sand, d. yelllowish brown 10YR 4/2, coarse grained, moist to wet, med. dense, with fine gravel @ 43.8' trace coal fragments, angular @ 44' no coal fragments		
31	SS	45.0	46.5	6-8-14	1.16		45					

Continued Next Page

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1603I** DATE **4/27/16** SHEET **3** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **2/1/16** BORING FINISH **2/1/16**

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
32	SS	46.5	48.0	13-10-18	1.33				SW	@ 45.5' some coarse gravel, rounded @ 45.7' .5" coal fragments @ 46' 1.5" coal fragments Well graded sand, moderate yellowish brown 10YR 5/4, fine grained, moist to wet, med. dense, some fine gravel @ 46.9' 1.5" shale seam @ 47.6' 1" coal fragment and black N1 silt, angular @ 47.8' 1.5" rounded fine gravel, clean, poorly graded @ 48' 1" shale fragment @ 48.1' dense, poorly graded, trace fine gravel @ 49.5' w/fine gravel @ 51' well graded, med. dense @ 52.5' trace shale fragments to 1.5"		
33	SS	48.0	49.5	9-14-19	1.41							
34	SS	49.5	51.0	11-15-18	1.33		50					
35	SS	51.0	52.5	6-9-16	1.41							
36	SS	52.5	54.0	7-14-21	1.41				SP	Poorly graded sand, med. grained, pale yellowish brown 10YR 6/2, moist to wet, dense, trace fine gravel		
37	SS	54.0	55.5	10-12-12	1.5				SW	Well graded sand, pale yellowish brown 10YR 6/2, fine grained, moist to wet, med. dense, some fine gravel, trace coarse gravel @ 55.5' dense, no coarse gravel @57' med. dense @ 58' 2.5" shale seam, med. l. grey N6		
38	SS	55.5	57.0	9-12-31	1.41		55					
39	SS	57.0	58.5	10-10-15	1.16							
40	SS	58.5	60.0	8-10-15	1.5				SW	Well graded sand, l. olive grey 5Y 6/1, fine to med. grained, moist to wet, med. dense, with fine gravel (rounded) @ 61.5' fine grained @ 63' trace fine gravel @ 64.5' d. yellowish brown 10YR 4/2 @ 66' fine to med. grained, some fine gravel (rounded)		
41	SS	60.0	61.5	7-10-11	1.25		60					
42	SS	61.5	63.0	8-13-13	1.25							
43	SS	63.0	64.5	7-9-17	1.16							
44	SS	64.5	66.0	6-9-10	1.33		65					
45	SS	66.0	67.5	10-11-15	1.16							
46	SS	67.5	69.0	10-11-15	1.33				SW	Well graded sand, d. yellowish brown 10YR 4/2, coarse grained, moist to wet, med. dense, with fine gravel		
47	SS	69.0	70.5	9-13-15	1.5							
48	SS	70.5	72.0	9-12-18	1.33		70					
									SP	Poorly graded sand, pale yellowish brown 10YR 6/2, fine grained, moist to wet, dense		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1603I** DATE **4/27/16** SHEET **4** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **2/1/16** BORING FINISH **2/1/16**

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
49	SS	72.0	73.5	5-8-16	1.41					@ 72' med. dense @ 73' v. fine grained, moist @ 75.5' silty clay seam (~50%), moderate brown 5YR 3/4, moist, stiff to v. stiff @ 76.2' shale fragment, 3"		
50	SS	73.5	75.0	8-8-12	1.33							
51	SS	75.0	76.5	9-11-13	1.5		75					
52	SS	76.5	78.0	8-12-18	1.0				SW	Well graded sand, d. yellowish brown 10YR 4/2, coarse grained, moist to wet, dense, w/fine gavel, trace coarse gravel (rounded) @ 78' 3.5" shale fragment @ 78.4' coarse gravel seam 3" @ 78.6' 3" shale fragment		
53	SS	78.0	79.5	21-21-15	.75							
54	SS	79.5	81.0	3-6-6	1.41				CH	Fat clay, l. grey N7, wet, stiff		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 152,802.7 E 514,206.9**

GROUND ELEVATION **401.5** SYSTEM **State Plane using NAD27/29**

BORING NO. **MW-1603S** DATE **4/27/16** SHEET **1** OF **3**

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

PIEZOMETER TYPE WELL TYPE **OW**

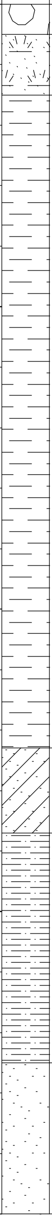
HGT. RISER ABOVE GROUND **2.39** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **38.2** BOTTOM **47.86**

WELL DEVELOPMENT **YES** BACKFILL

FIELD PARTY **MJW / TAS** RIG **D-50**

Water Level, ft	▽	▼	▼
TIME			
DATE			



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
1	SS	0.0	1.5	3-3-6	.5					Gravel = 6 inches Topsoil = 12 inches		
2	SS	1.5	3.0	4-11-14	.75				CL	Silty clay, l. brown 5YR 6/4 and l. grey N7 mottled, dry to moist, v. stiff @ 3' trace moderate red 5R 4/6 silt @ 6' stiff, geofabric in spoon @ 7.5' v. stiff, wood debris @ 9' w/pale yellowish brown 10YR 6/2 fat clay, stiff		
3	SS	3.0	4.5	5-9-12	1.0							
4	SS	4.5	6.0	7-10-13	.92		5					
5	SS	6.0	7.5	4-6-9	1.08							
6	SS	7.5	9.0	4-8-12	1.5							
7	SS	9.0	10.5	2-3-7	1.33		10					
8	SS	10.5	12.0	2-4-9	1.5							
9	SS	12.0	13.5	4-5-7	1.33				SC	Clayey sand, moderate brown 5YR 4/4, moist, med. dense, w/l. grey N7 clay, fine grained, trace black N1 silt		
10	SS	13.5	15.0	3-5-9	1.5				ML	Clayey silt, moderate yellowish brown 10YR 5/4, moist, med. dense, some l. grey N7 fat clay @ 15' trace l. grey N7 fat clay		
11	SS	15.0	16.5	3-4-7	1.5		15					
12	SS	16.5	18.0	3-4-6	1.16				SP	Poorly graded sand, moderate yellowish brown 10YR 5/4, fine grained, moist, loose @ 18' v. fine to fine grained		
13	SS	18.0	19.5	3-4-4	1.5							
14	SS	19.5	21.0	4-6-8	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 **AMEC FOSTER WHEELER**

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1603S** DATE **4/27/16** SHEET **2** OF **3**

PROJECT **ROCKPORT PLANT** BORING START **2/3/16** BORING FINISH **2/3/16**

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
15	SS	21.0	22.5	2-2-3	1.42		
16	SS	22.5	24.0	1-3-4	1.5		
17	SS	24.0	25.5	4-7-8	.33		
18	SS	25.5	27.0	3-6-9	1.5		25
19	SS	27.0	28.5	5-6-9	1.5		
20	SS	28.5	30.0	4-7-12	1.5		
21	SS	30.0	31.5	5-6-8	1.5		30
22	SS	31.5	33.0	5-6-10	1.5		
23	SS	33.0	34.5	3-5-8	1.25		
24	SS	34.5	36.0	5-7-9	1.41		
25	SS	36.0	37.5	6-5-7	1.25		35
26	SS	37.5	39.0	2-3-7	1.33		
27	SS	39.0	40.5	6-8-8	1.41		
28	SS	40.5	42.0	3-6-9	1.16		40
29	SS	42.0	43.5	5-8-8	1.25		
30	SS	43.5	45.0	5-4-7	.83		
31	SS	45.0	46.5	6-8-14	1.16		45

U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
SP	Poorly graded sand, grayish orange 10YR 7/4, moist, med. dense, fine grained, trace blacK N1 silt @ 21.5' 2" clay seam, moderate brown 5YR 4/4		
SP	Poorly graded sand, moderate yellowish brown 10YR 5/4, moist, v. fine grained, loose @ 22.8' 2.5" clayey silt seam (prev. material) @ 23.6' 2" grayish orange 10YR 7/4 sand seam (prev. material) @ 24' 3" shale fragment, med. l. grey N6 @ 25.5' 2" shale fragments		
SP	Poorly graded sand, grayish orange 10YR 7/4, moist, med. dense, fine grained, trace black N1 silt @ 26.6' 1" coarse sand seam, dark yellowish brown 10YR 4/2, w/rounded fine gravel, well graded @ 27.9' 2" coarse sand seam (prev. material) @ 28.7' clay seam, 1.5" (prev. material @ 29.5' .5" coarse sand seam, moderate red 5R4/6, w/black N1 silt, poorly graded @ 31.1' 1/4" coal fragments and black N1 silt @ 31.3' 1/4" coal fragment and black, N1 silt		
SW	Well graded sand, coarse grained, pale yellowish brown 10YR 6/2, moist, med. dense, trace black N1 silt @ 32.5' .5" coarse sand seam, moderate red (prev. material) @ 33' med. grained @ 35 1/4" coal fragments		
SP	Poorly graded sand, moderate yellowish brown 10YR 5/4, moist to wet, med. dense, fine grained, some fine gravel, water in spoon @ 36' fine to med. grained @ 38.6' 2" coarse sand seam dark yellowish brown 10YR 4/2 w/black N1 silt (50%)		
SP	Poorly graded sand, pale reddish brown 10R 5/4, fine grained, moist to wet, med, dense @ 40' 1/4" coal fragments		
SW	Well graded sand, moderate, yellowish brown 10YR 5/4, fine grained, moist to wet, med. dense, some fine gravel @ 41' coarse sand seam, 3", d. yellowish brown 10YR 4/2, prev. material @ 42.5' coarse sand seam, 3.5", d. yellowish brown 10YR 4/2, w/black N1 silt and fine gravel		
SW	Well graded sand, d. yelllowish brown 10YR 4/2, coarse grained, moist to wet, med. dense, with fine gravel @ 43.8' trace coal fragments, angular @ 44' no coal fragments		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1603S** DATE **4/27/16** SHEET **3** OF **3**

PROJECT **ROCKPORT PLANT** BORING START **2/3/16** BORING FINISH **2/3/16**

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
32	SS	46.5	48.0	13-10-18	1.33				SW	@ 45.5' some coarse gravel, rounded @ 45.7' .5" coal fragments @ 46' 1.5" coal fragments		
33	SS	48.0	49.5	9-14-19	1.41					Well graded sand, moderate yellowish brown 10YR 5/4, fine grained, moist to wet, med. dense, some fine gravel @ 46.9' 1.5" shale seam @ 47.6' 1" coal fragment and black N1 silt, angular @ 47.8' 1.5" rounded fine gravel, clean, poorly graded @ 48' 1" shale fragment @ 48.1' dense, poorly graded, trace fine gravel @ 49.5' w/fine gravel @ 51' well graded, med. dense @ 52.5' trace shale fragments to 1.5"		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER **42393125-01**

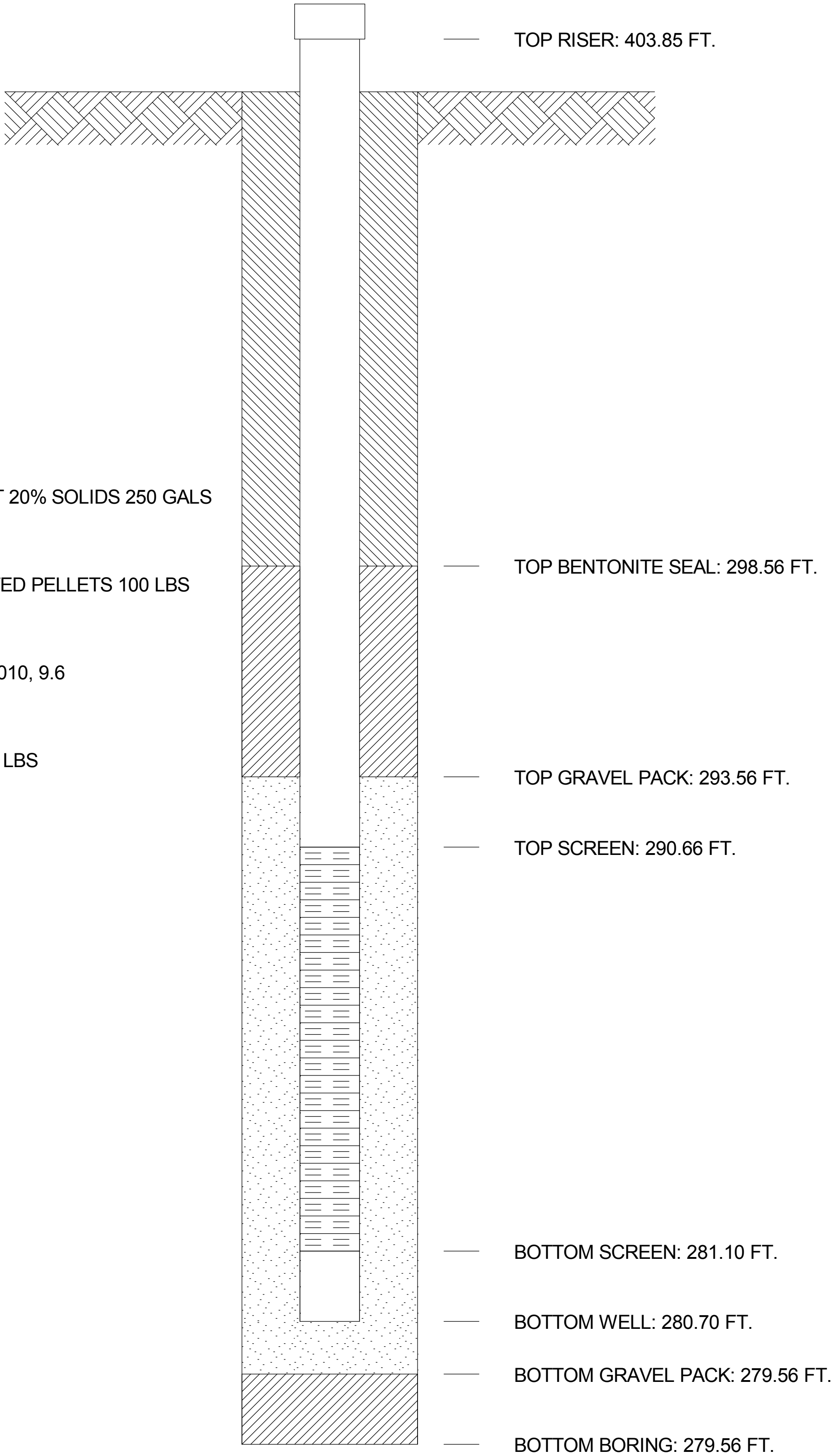
COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No. **MW-1603D** BORING No. **MW-1603D** INSTALLED **1/29/16**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 152,811.9 E 514,207.5**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 401.56 FT.



▧ GROUT SEAL: QUICK GROUT 20% SOLIDS 250 GALS

▨ BENTONITE SEAL: 3/8" COATED PELLETS 100 LBS

▤ SCREEN: 2.0 dia., SLOTTED .010, 9.6

░ GRAVEL PACK: #5 SAND 325 LBS

☐ RISER PIPE: 2.0, dia., PVC

∿ SPACERS, DEPTH:

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER **42393125-01**

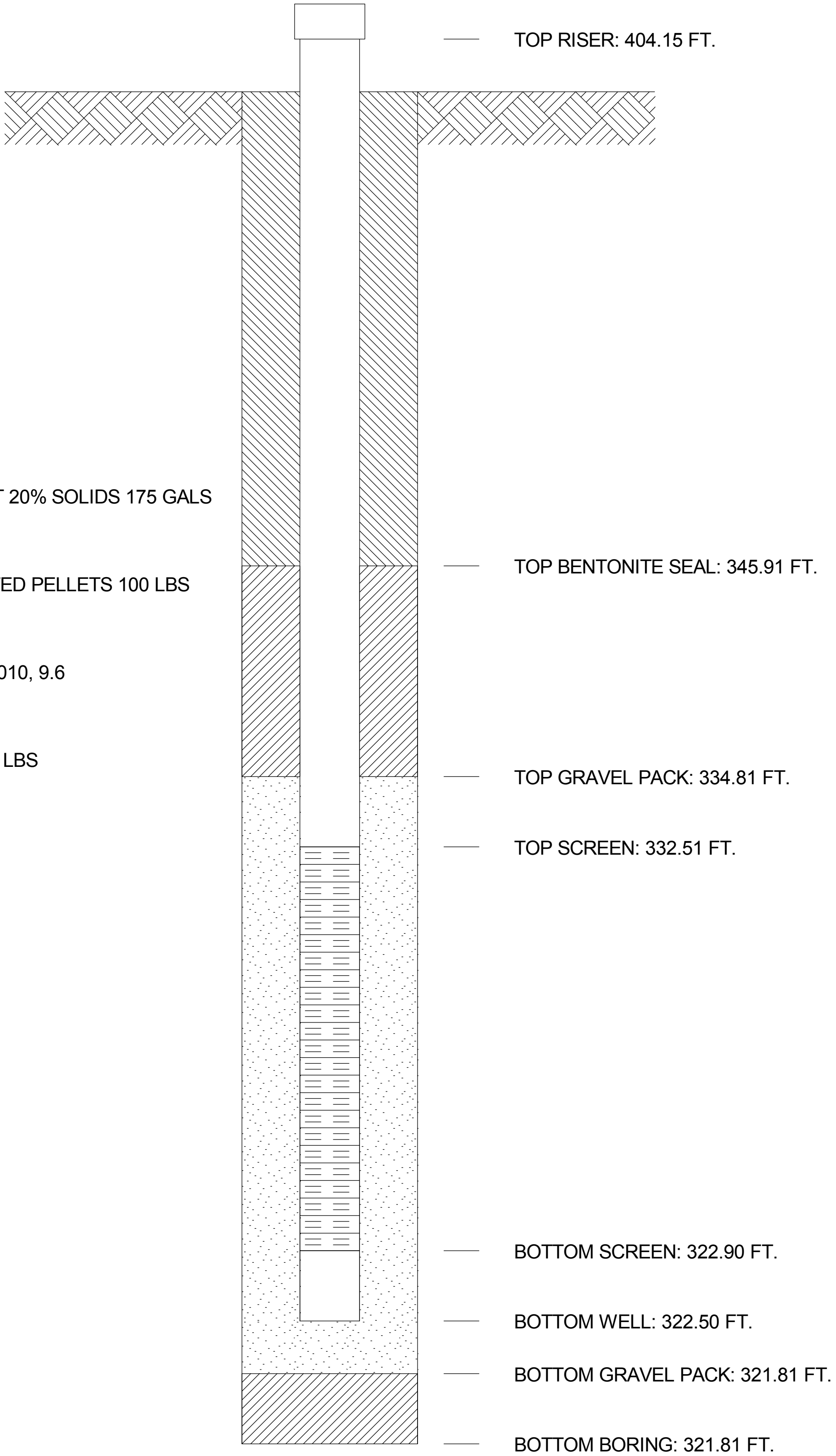
COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No. **MW-1603I** BORING No. **MW-1603I** INSTALLED **2/1/16**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 152,807.3 E 519,207.2**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 401.41 FT.



▧ GROUT SEAL: QUICK GROUT 20% SOLIDS 175 GALS

▨ BENTONITE SEAL: 3/8" COATED PELLETS 100 LBS

☰ SCREEN: 2.0 dia., SLOTTED .010, 9.6

░ GRAVEL PACK: #5 SAND 175 LBS

☐ RISER PIPE: 2.0, dia., PVC

∿ SPACERS, DEPTH:

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
MONITORING WELL CONSTRUCTION

JOB NUMBER **42393125-01**

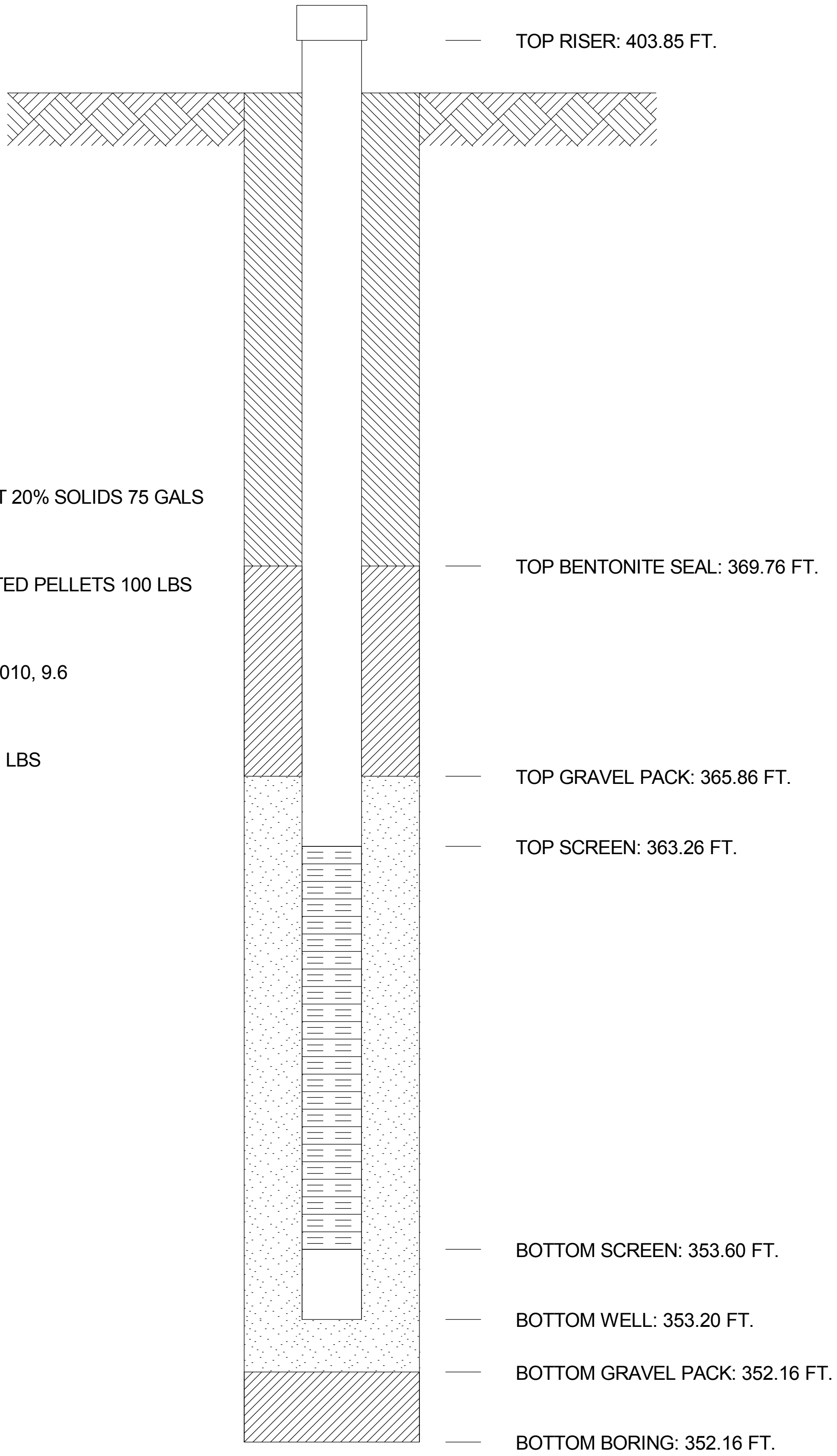
COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No. **MW-1603S** BORING No. **MW-1603S** INSTALLED **2/3/16**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 152,802.7 E 514,206.9**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 401.46 FT.



▧ GROUT SEAL: QUICK GROUT 20% SOLIDS 75 GALS

▨ BENTONITE SEAL: 3/8" COATED PELLETS 100 LBS

☰ SCREEN: 2.0 dia., SLOTTED .010, 9.6

░ GRAVEL PACK: #5 SAND 250 LBS

☐ RISER PIPE: 2.0, dia., PVC

∿ SPACERS, DEPTH:

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 151,510.2 E 514,204.9**

GROUND ELEVATION **399.9** SYSTEM **State Plane using NAD27/29**

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **MW-1604D** DATE **4/27/16** SHEET **1** OF **6**

BORING START **1/15/16** BORING FINISH **1/15/16**

PIEZOMETER TYPE WELL TYPE **OW**

HGT. RISER ABOVE GROUND **2.59** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **115.6** BOTTOM **125.15**

WELL DEVELOPMENT **YES** BACKFILL

FIELD PARTY **ZLR / REB** 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
1	SS	0.0	1.5	17-29-28	.6					Surface gravel		
2	SS	1.5	3.0	8-10-10	1.0				CL	Lean silty clay, dark yellowish brown 10YR 4/2, dry to moist, v. stiff @ 3' trace black oxide nodules, some l. brown silt seams, hard		
3	SS	3.0	4.5	10-19-30	1.0							
4	SS	4.5	6.0	5-15-15	1.2							
5	SS	5.0	6.5	5-5-9	1.1		5					
6	SS	7.5	9.0	7-6-9	1.2				CL	Lean silty clay, dark yellowish brown 10YR 4/2, moist, stiff, some medium dark gray N4 silt seams @ 9' wood (~1")		
7	SS	9.0	10.5	6-5-9	1.2							
8	SS	10.0	11.5	4-2-3	1.3		10					
9	SS	12.0	13.5	5-5-7	1.5				CH	Fat clay, olive gray 5Y 4/1, moist, firm, trace black oxide nodules @ 12' stiff @ 13' some moderate yellowish brown 10YR 5/4 silty clay mottled		
10	SS	13.5	15.0	4-5-9	1.5				CH	Fat clay, medium dark gray N4, and silty lean clay, dark yellowish brown 10YR 4/2, mottled, moist, stiff @ 15' tools sunk / 1" spoon driven / material same, pp same, N value inferred @ 15.5' trace black oxide		
11	SS	15.0	16.5	5-6-5	1.0		15					
12	SS	16.5	18.0	2-3-5	1.5				CL ML	Lean silty clay, moderate yellowish brown 10YR 5/4, moist, firm to stiff, w/medium dark gray N4 fat clay seams (~15%)		
13	SS	18.0	19.5	3-4-7	1.5							
14	SS	19.5	21.0	2-3-4	1.4							

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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 **AMEC FOSTER WHEELER**

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1604D** DATE **4/27/16** SHEET **2** OF **6**

PROJECT **ROCKPORT PLANT** BORING START **1/15/16** BORING FINISH **1/15/16**

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
15	SS	21.0	22.5	4-4-4	1.5				ML	Clayey silt, moderate yellowish brown 10YR 5/4, moist, loose		
16	SS	22.5	24.0	2-3-3	1.5				SP	Fine grained sand, moderate yellowish brown 10YR 5/4, moist, loose, poorly graded @ 22.2' ~3" seam clayey silt, moderate yellowish brown 10YR 5/4, moist, loose @ 23.8' ~ 2" silt seam		
17	SS	24.0	25.5	1-1-2	1.0		25		ML	Sandy silt to silty sand, light brown 5YR 5/6, moist, v. loose		
18	SS	25.5	27.0	1-1-2	1.0							
19	SS	27.0	28.5	1-1-5	.83							
20	SS	28.5	30.0	1-5-7	.6				SP	Fine sand, dark yellowish orange 10YR 6/6, moist, loose, poorly graded @ 29' transitioning to moderate yellowish brown 10YR 5/4, moist, sample SS20 spilled		
21	SS	30.0	31.5	5-11-12	.8		30		SP	Fine sand, moderate yellowish brown 10YR 5/4, moist, med. dense, poorly graded @ 31.5' moist, dark yellowish brown 10YR 4/2, loose @ 33' v. loose, water in spoon, wet		
22	SS	31.5	33.0	2-4-3	1.1							
23	SS	33.0	34.5	4-1-3	.8							
24	SS	34.5	36.0	4-3-5	.7		35					
25	SS	36.0	37.5	10-6-9	1.5				SW	Coarse grained sand, dark yellowish brown 10YR 4/2, wet loose, well rounded fine gravel, well graded @ 36.5' v. stiff lean clay moderate yellowish brown 10YR 5/4 seam, higher N value likely due to clay, ~30% clay over last 12" longitudinally @ 38' clay seam @ 40' sand sample mostly washed out clay seam (lean clay, moderate yellowish brown 10YR 5/4, wet, v. stiff) ~50%		
26	SS	37.5	39.0	12-10-12	1.5							
27	SS	39.0	40.5	14-14-16	.6		40					
28	SS	40.5	42.0	5-12-19	1.5							
29	SS	42.0	43.5	8-10-10	1.5				SP	Medium grained sand, moderate yellowish brown 10YR 5/4, wet, dense, poorly graded, well rounded fine gravel @ 42' med dense, well rounded fine gravel		
30	SS	43.5	45.0	14-16-11	1.5							
31	SS	45.0	46.5	3-9-12	1.5		45		SW	Coarse grained sand, moderate yellowish brown 10YR 5/4, wet med. dense, w/well rounded fine gravel (to 1/2"), well graded		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1604D** DATE **4/27/16** SHEET **3** OF **6**

PROJECT **ROCKPORT PLANT** BORING START **1/15/16** BORING FINISH **1/15/16**

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
32	SS	46.5	48.0	17-8-9	1.1							
33	SS	48.0	49.5	5-10-11	1.5							
34	SS	49.5	51.0	10-11-12	1.5		50		SP	Fine to med. grained sand, moderate yellowish brown 10YR 5/4, wet, med. dense, poorly graded, w/well rounded fine gravel @ 49.5' trace well rounded fine gravel @ 51' dense, moist @ 55.5' med. dense, transitioning to med. grain @ 57' w/well rounded fine to coarse gravel and rounded sandstone to ~1" @ 60' fully med. grained @ 61.5' w/well rounded fine to coarse gravel and rounded sandstone to 2" @ 63' fine to med. grain, well rounded fine gravel @ 67.5' trace black silt @ 70.5' mostly fine grained, no stone, wet @ 74.8' 1" seam, potential coal or slate, black N1, wet, coarse black N1 silt @ 75' back to fine to med. grain, trace small gravel (~1/4")		
35	SS	51.0	52.5	8-17-18	1.2							
36	SS	52.5	54.0	15-16-16	1.3							
37	SS	54.0	55.5	5-11-19	1.5		55					
38	SS	55.5	57.0	8-10-12	1.0							
39	SS	57.0	58.5	8-12-13	1.1							
40	SS	58.5	60.0	13-9-9	1.1							
41	SS	60.0	61.5	12-9-14	.8		60					
42	SS	61.5	63.0	10-10-11	.8							
43	SS	63.0	64.5	6-10-11	.8							
44	SS	64.5	66.0	7-9-13	1.0		65					
45	SS	66.0	67.5	7-10-16	.7							
46	SS	67.5	69.0	9-10-13	.8							
47	SS	69.0	70.5	8-12-14	.8		70					
48	SS	70.5	72.0	9-9-12	1.0							

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1604D** DATE **4/27/16** SHEET **4** OF **6**

PROJECT **ROCKPORT PLANT** BORING START **1/15/16** BORING FINISH **1/15/16**

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
49	SS	72.0	73.5	7-10-13	1.0							
50	SS	73.5	75.0	6-10-20	1.3							
51	SS	75.0	76.5	11-13-17	1.2		75					
52	SS	76.5	78.0	8-29-47	.8							
53	SS	78.0	79.5	16-23-19	1.0				SP	Coarse sand with gravel (~50%) to 15", moderate yellowish brown 10YR 5/4, moist, v. dense, well graded @ 78' fine gravel, dense		
54	SS	79.5	81.0	10-13-19	1.5		80					
55	SS	81.0	82.5	7-13-18	1.0				SP	Fine grained sand, moderate yellowish brown 10YR 5/4 to dark yellowish brown 10YR 4/2, moist, dense, trace fine gravel, poorly graded @ 81' moist to wet, no gravel @ 82.5' med. dense, trace gravel @ 84' dense, no gravel @ 85.5' med. dense		
56	SS	82.5	84.0	6-12-17	.9							
57	SS	84.0	85.5	10-16-20	.8		85					
58	SS	85.5	87.0	11-11-17	1.2							
59	SS	87.0	88.5	12-15-13	1.3				CL ML	Lean silty clay, dark yellowish brown 10YR 4/2 to medium dark gray N4, moist to wet, v. stiff, w/sand @ 87.2' fine grained sand, moist med. dense, poorly graded		
60	SS	88.5	90.0	11-8-10	1.3		90		CL ML	Lean silty clay, dark yellowish brown 10YR 4/2 to medium dark gray N4, moist to wet, v. stiff, w/sand		
61	SS	90.0	91.5	7-6-14	1.2				SP	Fine grained sand, dark yellowish brown 10YR 4/2, wet, med. dense, poorly graded		
62	SS	91.5	93.0	6-12-9	1.5				CL ML	Lean silty clay, dark yellowish brown 10YR 4/2, moist to wet, v. stiff, w/sand @ 92.3' 5" sand seam (prev material) @ 93.5' 4" sand seam (prev material)		
63	SS	93.0	94.5	7-6-16	1.3							
64	SS	94.5	96.0	9-11-12	1.5		95		SP	Fine grained sand, dark yellowish brown 10YR 4/2, wet, med. dense, poorly graded, trace pea gravel		
65	SS	96.0	97.5	9-8-9	.8				SW	Coarse sand and gravel, dark yellowish brown 10YR 4/2, moist to wet, med. dense, well graded, gravel to 1.5"		
66	SS	97.5	99.0	13-13-14	.8							

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LOG OF BORING

JOB NUMBER **42393125-01**
COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1604D** DATE **4/27/16** SHEET **5** OF **6**
PROJECT **ROCKPORT PLANT** BORING START **1/15/16** BORING FINISH **1/15/16**

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
67	SS	99.0	100.5	13-21-15	1.0		100					
68	SS	100.5	102.0	5-8-12	1.3				SP	Shale, medium dark gray N4, moist, v. stiff to hard, dark yellowish brown 10YR 4/2 w/sand Fine grained sand, dark yellowish brown 10YR 4/2, v. moist med. dense		
69	SS	102.0	103.5	9-13-13	1.1							
70	SS	103.5	105.0	5-3-8	1.4				SC	Clayey sand, fine grained, dark yellowish brown 10YR 4/2, wet, loose		
71	SS	105.0	106.5	7-11-17	1.4		105					
72	SS	106.5	108.0	10-15-15	1.3				SP SP	Very fine grain sand, moderate yellowish brown 10YR 5/4, moist to wet, med. dense, poorly graded Fine to med. grained sand, moderate yellowish brown 10YR 5/4 to medium dark gray N4, moist to wet, med. dense, poorly graded @ 100' dense @ 111' trace rock to 1.5" @ 112.5' no stone @ 114' med. dense @ 115.5' loose, moist to wet @ 117' med. dense @ 118.5' d. grey, w/black silt @ 120' trace gravel to 1/4", dense @ 121.5' med. dense @ 123' wet, dense		
73	SS	108.0	109.5	6-11-18	1.3							
74	SS	109.5	111.0	9-17-18	1.2		110					
75	SS	111.0	112.5	8-17-24	1.2							
76	SS	112.5	114.0	14-23-23	1.3							
77	SS	114.0	115.5	6-7-10	1.3		115					
78	SS	115.5	117.0	5-5-5	1.3							
79	SS	117.0	118.5	5-5-6	1.4							
80	SS	118.5	120.0	6-9-15	1.3							
81	SS	120.0	121.5	8-15-20	1.5		120					
82	SS	121.5	123.0	8-10-17	1.5							
83	SS	123.0	124.5	7-12-38	1.5							

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1604D** DATE **4/27/16** SHEET **6** OF **6**

PROJECT **ROCKPORT PLANT** BORING START **1/15/16** BORING FINISH **1/15/16**

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
84	SS	124.5	126.0	10-13-35	1.4		125		SW	Coarse sand, medium dark gray N4, moist to wet, dense, with gravel moist to wet graded @ 125.3' 2" coal seam (black, dry, coarse)		
85	SS	126.0	127.5	37-50/2	.5					Shale, medium dark gray N4, dry, hard TOR @ 125.8' Spoon refusal @ 126.6' BT @ 126.6'		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 151,506.5 E 514,201.0**

GROUND ELEVATION **399.7** SYSTEM **State Plane using NAD27/29**

Water Level, ft	▽	▼	▼
TIME			
DATE			

BORING NO. **MW-1604I** DATE **4/27/16** SHEET **1** OF **4**

BORING START **1/28/16** BORING FINISH **1/28/16**

PIEZOMETER TYPE ____ WELL TYPE **OW**

HGT. RISER ABOVE GROUND **2.45** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **69** BOTTOM **78.64**

WELL DEVELOPMENT **YES** BACKFILL ____

FIELD PARTY **MWJ / TAS** RIG **D-50**

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
1	SS	0.0	1.5	17-29-28	.6					Surface gravel		
2	SS	1.5	3.0	8-10-10	1.0				CL	Lean silty clay, dark yellowish brown 10YR 4/2, dry to moist, v. stiff @ 3' trace black oxide nodules, some l. brown silt seams, hard		
3	SS	3.0	4.5	10-19-30	1.0							
4	SS	4.5	6.0	5-15-15	1.2							
5	SS	5.0	6.5	5-5-9	1.1		5					
6	SS	7.5	9.0	7-6-9	1.2				CL	Lean silty clay, dark yellowish brown 10YR 4/2, moist, stiff, some medium dark gray N4 silt seams @ 9' wood (~1")		
7	SS	9.0	10.5	6-5-9	1.2							
8	SS	10.0	11.5	4-2-3	1.3		10					
9	SS	12.0	13.5	5-5-7	1.5				CH	Fat clay, olive gray 5Y 4/1, moist, firm, trace black oxide nodules @ 12' stiff @ 13' some moderate yellowish brown 10YR 5/4 silty clay mottled		
10	SS	13.5	15.0	4-5-9	1.5				CH	Fat clay, medium dark gray N4, and silty lean clay, dark yellowish brown 10YR 4/2, mottled, moist, stiff @ 15' tools sunk / 1" spoon driven / material same, pp same, N value inferred @ 15.5' trace black oxide		
11	SS	15.0	16.5	5-6-5	1.0		15					
12	SS	16.5	18.0	2-3-5	1.5				CL ML	Lean silty clay, moderate yellowish brown 10YR 5/4, moist, firm to stiff, w/medium dark gray N4 fat clay seams (~15%)		
13	SS	18.0	19.5	3-4-7	1.5							
14	SS	19.5	21.0	2-3-4	1.4							

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 **AMEC FOSTER WHEELER**

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1604I** DATE **4/27/16** SHEET **2** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **1/28/16** BORING FINISH **1/28/16**

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
15	SS	21.0	22.5	4-4-4	1.5				ML	Clayey silt, moderate yellowish brown 10YR 5/4, moist, loose		
16	SS	22.5	24.0	2-3-3	1.5				SP	Fine grained sand, moderate yellowish brown 10YR 5/4, moist, loose, poorly graded @ 22.2' ~3" seam clayey silt, moderate yellowish brown 10YR 5/4, moist, loose @ 23.8' ~ 2" silt seam		
17	SS	24.0	25.5	1-1-2	1.0				ML	Sandy silt to silty sand, light brown 5YR 5/6, moist, v. loose		
18	SS	25.5	27.0	1-1-2	1.0		25					
19	SS	27.0	28.5	1-1-5	.83							
20	SS	28.5	30.0	1-5-7	.6				SP	Fine sand, dark yellowish orange 10YR 6/6, moist, loose, poorly graded @ 29' transitioning to moderate yellowish brown 10YR 5/4, moist, sample SS20 spilled		
21	SS	30.0	31.5	5-11-12	.8		30		SP	Fine sand, moderate yellowish brown 10YR 5/4, moist, med. dense, poorly graded @ 31.5' moist, dark yellowish brown 10YR 4/2, loose @ 33' v. loose, water in spoon, wet		
22	SS	31.5	33.0	2-4-3	1.1							
23	SS	33.0	34.5	4-1-3	.8							
24	SS	34.5	36.0	4-3-5	.7		35					
25	SS	36.0	37.5	10-6-9	1.5				SW	Coarse grained sand, dark yellowish brown 10YR 4/2, wet loose, well rounded fine gravel, well graded @ 36.5' v. stiff lean clay moderate yellowish brown 10YR 5/4 seam, higher N value likely due to clay, ~30% clay over last 12" longitudinally @ 38' clay seam @ 40' sand sample mostly washed out clay seam (lean clay, moderate yellowish brown 10YR 5/4, wet, v. stiff) ~50%		
26	SS	37.5	39.0	12-10-12	1.5							
27	SS	39.0	40.5	14-14-16	.6							
28	SS	40.5	42.0	5-12-19	1.5		40		SP	Medium grained sand, moderate yellowish brown 10YR 5/4, wet, dense, poorly graded, well rounded fine gravel @ 42' med dense, well rounded fine gravel		
29	SS	42.0	43.5	8-10-10	1.5							
30	SS	43.5	45.0	14-16-11	1.5							
31	SS	45.0	46.5	3-9-12	1.5		45		SW	Coarse grained sand, moderate yellowish brown 10YR 5/4, wet med. dense, w/well rounded fine gravel (to 1/2"), well graded		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER	**42393125-01**
COMPANY	**INDIANA MICHIGAN POWER COMPANY**
BORING NO.	**MW-1604I**
DATE	**4/27/16**
SHEET	**3** OF **4**
PROJECT	**ROCKPORT PLANT**
BORING START	**1/28/16**
BORING FINISH	**1/28/16**

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
32	SS	46.5	48.0	17-8-9	1.1							
33	SS	48.0	49.5	5-10-11	1.5							
34	SS	49.5	51.0	10-11-12	1.5		50		SP	Fine to med. grained sand, moderate yellowish brown 10YR 5/4, wet, med. dense, poorly graded, w/well rounded fine gravel @ 49.5' trace well rounded fine gravel @ 51' dense, moist @ 55.5' med. dense, transitioning to med. grain @ 57' w/well rounded fine to coarse gravel and rounded sandstone to ~1" @ 60' fully med. grained @ 61.5' w/well rounded fine to coarse gravel and rounded sandstone to 2" @ 63' fine to med. grain, well rounded fine gravel @ 67.5' trace black silt @ 70.5' mostly fine grained, no stone, wet @ 74.8' 1" seam, potential coal or slate, black N1, wet, coarse black N1 silt @ 75' back to fine to med. grain, trace small gravel (~1/4")		
35	SS	51.0	52.5	8-17-18	1.2							
36	SS	52.5	54.0	15-16-16	1.3							
37	SS	54.0	55.5	5-11-19	1.5		55					
38	SS	55.5	57.0	8-10-12	1.0							
39	SS	57.0	58.5	8-12-13	1.1							
40	SS	58.5	60.0	13-9-9	1.1		60					
41	SS	60.0	61.5	12-9-14	.8							
42	SS	61.5	63.0	10-10-11	.8							
43	SS	63.0	64.5	6-10-11	.8							
44	SS	64.5	66.0	7-9-13	1.0		65					
45	SS	66.0	67.5	7-10-16	.7							
46	SS	67.5	69.0	9-10-13	.8							
47	SS	69.0	70.5	8-12-14	.8		70					
48	SS	70.5	72.0	9-9-12	1.0							

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1604I** DATE **4/27/16** SHEET **4** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **1/28/16** BORING FINISH **1/28/16**

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
49	SS	72.0	73.5	7-10-13	1.0							
50	SS	73.5	75.0	6-10-20	1.3							
51	SS	75.0	76.5	11-13-17	1.2		75					
52	SS	76.5	78.0	8-29-47	.8							
53	SS	78.0	79.5	16-23-19	1.0				SP	Coarse sand with gravel (~50%) to 15", moderate yellowish brown 10YR 5/4, moist, v. dense, well graded @ 78' fine gravel, dense		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 151,503.1 E 514,197.3**

GROUND ELEVATION **399.8** SYSTEM **State Plane using NAD27/29**

Water Level, ft	▽	▼	▼̲
TIME			
DATE			

BORING NO. **MW-1604S** DATE **4/27/16** SHEET **1** OF **3**

BORING START **1/29/16** BORING FINISH **1/29/16**

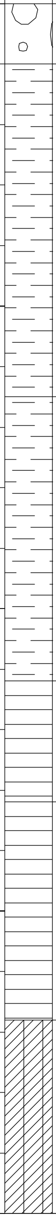
PIEZOMETER TYPE WELL TYPE **OW**

HGT. RISER ABOVE GROUND **2.70** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **36.7** BOTTOM **46.26**

WELL DEVELOPMENT **YES** BACKFILL

FIELD PARTY **MWJ / TAS** RIG **D-50**



SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	1.5	17-29-28	.6					Surface gravel		
2	SS	1.5	3.0	8-10-10	1.0				CL	Lean silty clay, dark yellowish brown 10YR 4/2, dry to moist, v. stiff @ 3' trace black oxide nodules, some l. brown silt seams, hard		
3	SS	3.0	4.5	10-19-30	1.0							
4	SS	4.5	6.0	5-15-15	1.2							
5	SS	5.0	6.5	5-5-9	1.1		5					
6	SS	7.5	9.0	7-6-9	1.2				CL	Lean silty clay, dark yellowish brown 10YR 4/2, moist, stiff, some medium dark gray N4 silt seams @ 9' wood (~1")		
7	SS	9.0	10.5	6-5-9	1.2							
8	SS	10.0	11.5	4-2-3	1.3		10					
9	SS	12.0	13.5	5-5-7	1.5				CH	Fat clay, olive gray 5Y 4/1, moist, firm, trace black oxide nodules @ 12' stiff @ 13' some moderate yellowish brown 10YR 5/4 silty clay mottled		
10	SS	13.5	15.0	4-5-9	1.5				CH	Fat clay, medium dark gray N4, and silty lean clay, dark yellowish brown 10YR 4/2, mottled, moist, stiff @ 15' tools sunk / 1" spoon driven / material same, pp same, N value inferred @ 15.5' trace black oxide		
11	SS	15.0	16.5	5-6-5	1.0		15					
12	SS	16.5	18.0	2-3-5	1.5				CL ML	Lean silty clay, moderate yellowish brown 10YR 5/4, moist, firm to stiff, w/medium dark gray N4 fat clay seams (~15%)		
13	SS	18.0	19.5	3-4-7	1.5							
14	SS	19.5	21.0	2-3-4	1.4							

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 **AMEC FOSTER WHEELER**

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER	**42393125-01**						
COMPANY	**INDIANA MICHIGAN POWER COMPANY**	BORING NO.	**MW-1604S**	DATE	**4/27/16**	SHEET **2**	OF **3**
PROJECT	**ROCKPORT PLANT**	BORING START	**1/29/16**	BORING FINISH	**1/29/16**		

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
15	SS	21.0	22.5	4-4-4	1.5				ML	Clayey silt, moderate yellowish brown 10YR 5/4, moist, loose		
16	SS	22.5	24.0	2-3-3	1.5				SP	Fine grained sand, moderate yellowish brown 10YR 5/4, moist, loose, poorly graded @ 22.2' ~3" seam clayey silt, moderate yellowish brown 10YR 5/4, moist, loose @ 23.8' ~ 2" silt seam		
17	SS	24.0	25.5	1-1-2	1.0		25		ML	Sandy silt to silty sand, light brown 5YR 5/6, moist, v. loose		
18	SS	25.5	27.0	1-1-2	1.0							
19	SS	27.0	28.5	1-1-5	.83							
20	SS	28.5	30.0	1-5-7	.6		30		SP	Fine sand, dark yellowish orange 10YR 6/6, moist, loose, poorly graded @ 29' transitioning to moderate yellowish brown 10YR 5/4, moist, sample SS20 spilled		
21	SS	30.0	31.5	5-11-12	.8				SP	Fine sand, moderate yellowish brown 10YR 5/4, moist, med. dense, poorly graded @ 31.5' moist, dark yellowish brown 10YR 4/2, loose @ 33' v. loose, water in spoon, wet		
22	SS	31.5	33.0	2-4-3	1.1							
23	SS	33.0	34.5	4-1-3	.8							
24	SS	34.5	36.0	4-3-5	.7		35					
25	SS	36.0	37.5	10-6-9	1.5				SW	Coarse grained sand, dark yellowish brown 10YR 4/2, wet loose, well rounded fine gravel, well graded @ 36.5' v. stiff lean clay moderate yellowish brown 10YR 5/4 seam, higher N value likely due to clay, ~30% clay over last 12" longitudinally @ 38' clay seam @ 40' sand sample mostly washed out clay seam (lean clay, moderate yellowish brown 10YR 5/4, wet, v. stiff) ~50%		
26	SS	37.5	39.0	12-10-12	1.5							
27	SS	39.0	40.5	14-14-16	.6		40					
28	SS	40.5	42.0	5-12-19	1.5				SP	Medium grained sand, moderate yellowish brown 10YR 5/4, wet, dense, poorly graded, well rounded fine gravel @ 42' med dense, well rounded fine gravel		
29	SS	42.0	43.5	8-10-10	1.5							
30	SS	43.5	45.0	14-16-11	1.5		45		SW	Coarse grained sand, moderate yellowish brown 10YR 5/4, wet med. dense, w/well rounded fine gravel (to 1/2"), well graded		
31	SS	45.0	46.5	3-9-12	1.5							

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1604S** DATE **4/27/16** SHEET **3** OF **3**

PROJECT **ROCKPORT PLANT** BORING START **1/29/16** BORING FINISH **1/29/16**

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
32	SS	46.5	48.0	17-8-9	1.1							

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER **42393125-01**

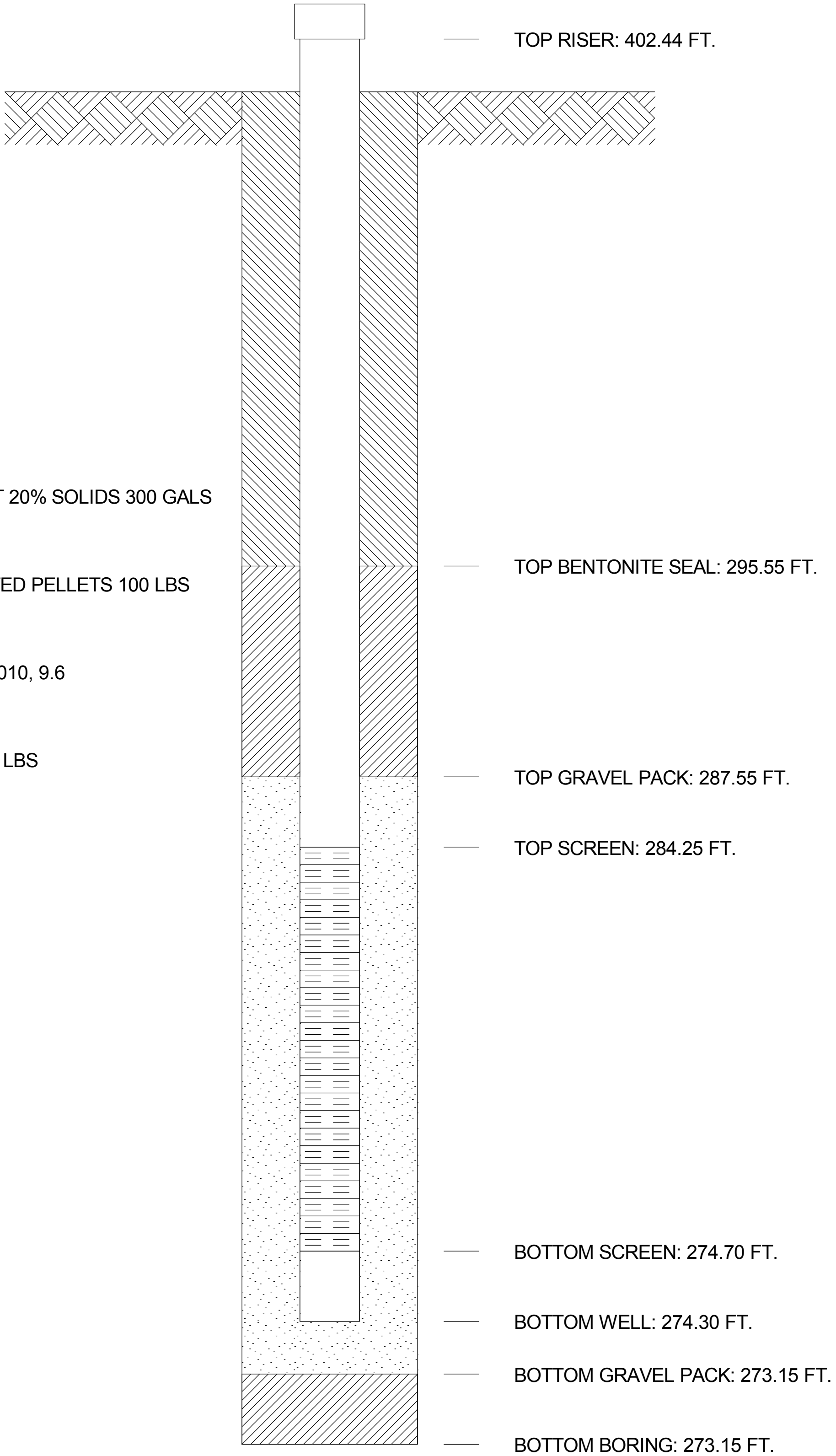
COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No. **MW-1604D** BORING No. **MW-1604D** INSTALLED **1/15/16**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 151,510.2 E 514,204.9**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 399.85 FT.



▧ GROUT SEAL: QUICK GROUT 20% SOLIDS 300 GALS

▨ BENTONITE SEAL: 3/8" COATED PELLETS 100 LBS

☰ SCREEN: 2.0 dia., SLOTTED .010, 9.6

░ GRAVEL PACK: #5 SAND 200 LBS

☐ RISER PIPE: 2.0, dia., PVC

∿ SPACERS, DEPTH:

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER **42393125-01**

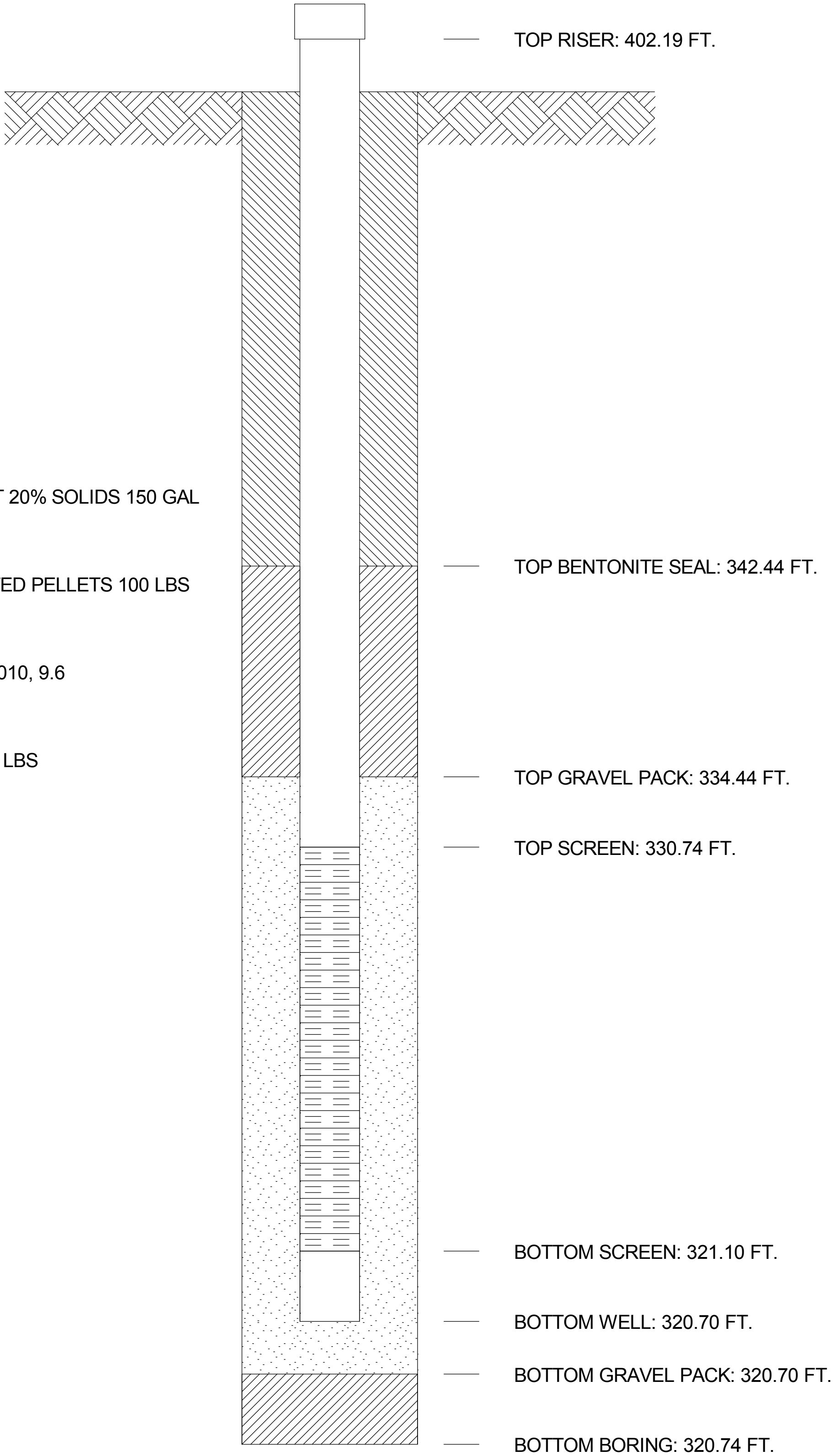
COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No. **MW-1604I** BORING No. **MW-1604I** INSTALLED **1/28/16**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 151,506.5 E 514,201.0**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 399.74 FT.



▧ GROUT SEAL: QUICK GROUT 20% SOLIDS 150 GAL

▨ BENTONITE SEAL: 3/8" COATED PELLETS 100 LBS

☰ SCREEN: 2.0 dia., SLOTTED .010, 9.6

░ GRAVEL PACK: #5 SAND 100 LBS

☐ RISER PIPE: 2.0, dia., PVC

∿ SPACERS, DEPTH:

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER **42393125-01**

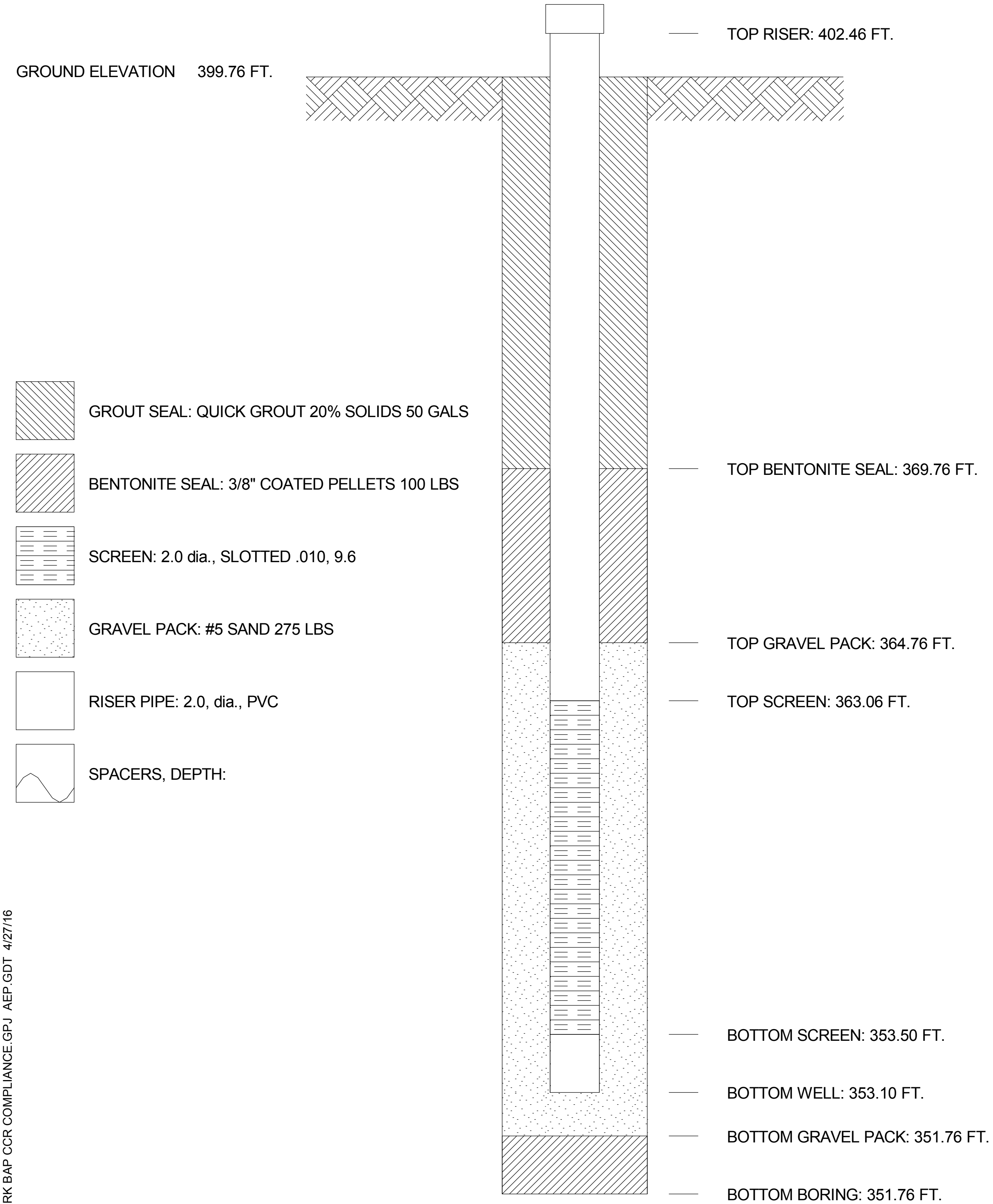
COMPANY **INDIANA MICHIGAN POWER COMPANY**

WELL No. **MW-1604S** BORING No. **MW-1604S** INSTALLED **1/29/16**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 151,503.1 E 514,197.3**

SYSTEM **State Plane using NAD27/29**



AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY**

BORING NO. **MW-1605D** DATE **4/27/16** SHEET **1** OF **6**

PROJECT **ROCKPORT PLANT**

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

COORDINATES **N 151,478.9 E 513,537.1**

PIEZOMETER TYPE

WELL TYPE **OW**

GROUND ELEVATION **400.4** SYSTEM **State Plane using NAD27/29**

HGT. RISER ABOVE GROUND **3.36** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **114.6** BOTTOM **124.22**

WELL DEVELOPMENT **YES** BACKFILL

FIELD PARTY **ZLR / REB** RIG **D-50**

Water Level, ft	▽	▼	▼
TIME			
DATE			

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
1	SS	0.0	1.5	20-13-10	1.25				 CL	Gravel = 6 inches Silty clay, moderate yellowish brown 10R 5/4 and med l. grey N6 mottled, moist, v. stiff		
2	SS	1.5	3.0	5-15-18	1.25					@ 1.5' hard @ 3' v. stiff		
3	SS	3.0	4.5	7-9-15	1.41							
4	SS	4.5	6.0	11-12-14	1.5		5					
5	SS	6.0	7.5	4-8-11	1.41							
6	SS	7.5	9.0	3-6-11	1.33				ML	Clayey silt, medium grey N5, moist, med. dense, w/mod. yellowish brown 10R 5/4 silty clay mottled		
7	SS	9.0	10.5	3-4-7	1.41		10		CL	Silty clay, mod. yellowish brown 10R 5/4, moist, stiff, w/med. grey N5 clayey silt mottled		
8	SS	10.5	12.0	3-4-6	1.5							
9	SS	12.0	13.5	2-2-4	1.5				CH	Fat to lean clay, med. l. grey N6, moist, firm		
10	SS	13.5	15.0	2-2-5	1.41				CL ML	Silty clay, mod. reddish brown 10R 4/6 w/med. l. grey N6 fat clay heavily mottled, moist, firm @ 15' stiff @ 15.5' l" shale fragment, angular @ 18' very silty @ 20' trace to some pale yellowish brown 10YR 6/2 silt		
11	SS	15.0	16.5	2-4-5	1.5		15					
12	SS	16.5	18.0	3-5-9	1.5							
13	SS	18.0	19.5	3-6-8	1.41							
14	SS	19.5	21.0	3-5-7	1.41							

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 **AMEC FOSTER WHEELER**

JOB NUMBER **42393125-01**
COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1605D** DATE **4/27/16** SHEET **2** OF **6**
PROJECT **ROCKPORT PLANT** BORING START **2/3/16** BORING FINISH **2/3/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %
15	SS	21.0	22.5	3-4-7	1.5	
16	SS	22.5	24.0	4-4-5	1.5	
17	SS	24.0	25.5	1-1-3	1.5	
18	SS	25.5	27.0	1-1-1	1.5	
19	SS	27.0	28.5	2-1-4	1.5	
20	SS	28.5	30.0	5-6-7	1.33	
21	SS	30.0	31.5	3-5-7	1.25	
22	SS	31.5	33.0	5-7-8	1.5	
23	SS	33.0	34.5	3-3-6	1.41	
24	SS	34.5	36.0	2-4-5	1.5	
25	SS	36.0	37.5	2-4-6	1.33	
26	SS	37.5	39.0	4-3-8	1.5	
27	SS	39.0	40.5	3-3-5	1.5	
28	SS	40.5	42.0	11-8-10	1.25	
29	SS	42.0	43.5	4-5-11	1.5	
30	SS	43.5	45.0	8-9-9	1.16	
31	SS	45.0	46.5	6-9-14	1.5	

DEPTH IN FEET	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
	ML	Clayey silt, pale yellowish brown 10YR 6/2, moist, med. dense, w/silty clay (prev. material), trace sand		
	SP	Poorly graded sand, v. fine to fine grained, l. brown 5YR 5/6, moist, loose @ 23.2' 2" clayey silt seam (prev. material)		
25	ML	Clayey silt, pale yellowish brown 10YR 6/2, moist to wet, v. loose @ 25' 2" l. brown sand seam (prev. material) @ 26' 2" l. brown sand seam @ 26.4' 15" l. brown sand seam @ 26.8' l" l. brown sand seam @ 27' loose @ 28' 2" l. brown sand seam		
30	SP	Poorly graded sand, fine grained, l. brown 5YR 5/6, moist, med. dense @ 30' d. yellowish orange 10YR 6/6 @ 31' 3" clayey silt seam (prev. material) @ 32.3' trace fine gravel and black silt @ 32.5' no fine gravel or silt @ 33' moist, loose @ 34.1' 2" clayey silt seam (prev. material) @ 34.5' moist to wet, water in spoon @ 34.9' 2.5' clayey silt seam (prev. material)		
35				
	SW	Well graded sand, fine grained, l. brown 5YR 5/6, moist to wet, med. dense, w/fine gravel		
	SW	Well graded sand, coarse grained, grayish black N2, moist to wet, med. dense, trace fine gravel		
	SP	Poorly graded sand, v. fine grained, l. brown 5YR 5/6, moist to wet, med. dense		
40	SW	Well graded sand, fine to med. grained, moderate yellowish brown 10YR 5/4, moist to wet, loose @ 40.5' med. dense @ 41' 1.5" shale seam w/clay		
	SP	Poorly graded sand, v. fine to fine grained, mod. yellowish brown 10YR 5/4, moist to wet, med. dense		
	SW	Well graded sand, med. grained, mod. reddish brown 10R 4/6, moist to wet, med. dense @ 44' med. to coarse grained		
45	SP	Poorly graded sand, fine grained, mod. yellowish		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1605D** DATE **4/27/16** SHEET **3** OF **6**

PROJECT **ROCKPORT PLANT** BORING START **2/3/16** BORING FINISH **2/3/16**

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
32	SS	46.5	48.0	6-8-11	1.5				SW	brown 10YR 5/4, moist to wet, mod. dense, some fine gravel		
33	SS	48.0	49.5	6-10-14	1.5				SP	Well graded sand, med. to coarse grained, mod. reddish brown 10R 4/6, moist to wet, med. dense, trace fine gravel		
34	SS	49.5	51.0	8-12-18	1.33		50			Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, moist to wet, med. dense, trace fine gravel @ 48' w/fine gravel, trace coarse gravel @ 49.5' no coarse gravel		
35	SS	51.0	52.5	8-11-18	1.41							
36	SS	52.5	54.0	8-9-13	.91				SW	Well graded sand, med. to coarse grained, mod. reddish brown 10R 4/6, moist to wet, mod. dense, trace fine gravel		
37	SS	54.0	55.5	11-20-26	1.25		55		SP	Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, moist to wet, mod. dense, trace fine gravel @ 54' no fine gravel, dense @ 57' wet, mod. dense @ 60' dense @ 63' mod. dense		
38	SS	55.5	57.0	10-15-16	1.5							
39	SS	57.0	58.5	6-12-16	1.33							
40	SS	58.5	60.0	7-10-18	1.33							
41	SS	60.0	61.5	8-9-12	1.33		60					
42	SS	61.5	63.0	10-13-19	1.25							
43	SS	63.0	64.5	9-11-18	1.33							
44	SS	64.5	66.0	9-11-15	1.08		65		SW	Well graded sand, med. to coarse grained, mod. yellowish brown 10YR 5/4, moist to wet, mod. dense, trace black silt		
45	SS	66.0	67.5	7-8-13	1.41				SP	Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, moist to wet, mod. dense @ 68.5' trace fine gravel, trace coal fragments @ 70' no fine gravel, no coal fragments @ 70.9' trace fine gravel @ 71.6' no fine gravel, wet		
46	SS	67.5	69.0	5-5-8	1.5							
47	SS	69.0	70.5	6-8-12	1.5		70					
48	SS	70.5	72.0	0-12-16	1.5							

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1605D** DATE **4/27/16** SHEET **4** OF **6**

PROJECT **ROCKPORT PLANT** BORING START **2/3/16** BORING FINISH **2/3/16**

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
49	SS	72.0	73.5	8-8-10	1.25				SW	Well graded sand, fine grained d. yellowish brown 10YR 4/2, moist to wet, mod. dense, trace fine gravel @ 73.5' w/fine gravel, trace coarse gravel		
50	SS	73.5	75.0	9-12-17	1.41							
51	SS	75.0	76.5	8-7-9	1.5		75					
									SW	Well graded sand, coarse grained, brownish grey 5YR 4/1, moist to wet, mod. dense, w/fine gravel, trace coarse gravel		
52	SS	76.5	78.0	10-15-25	1.5							
									SP	Poorly graded sand, fine grained, pale yellowish brown 10YR 6/2, wet, dense, trace fine gravel @ 78' mod. dense @ 81' v. fine to fine grained @ 82.5' no fine gravel @ 84' dense @ 85' 2" shale fragment @ 85.2' v. fine grained @ 85.5' 3.5" shale fragment @ 87' fine grained, d. yellowish brown 10YR 4/2 @ 88.5' v. fine grained, mod. dense		
53	SS	78.0	79.5	7-13-12	1.33							
54	SS	79.5	81.0	5-7-12	1.5		80					
55	SS	81.0	82.5	6-12-13	1.5							
56	SS	82.5	84.0	8-10-16	1.41							
57	SS	84.0	85.5	10-21-22	1.41							
							85					
58	SS	85.5	87.0	14-21-14	.5							
59	SS	87.0	88.5	6-13-25	1.41							
60	SS	88.5	90.0	8-9-9	1.16							
									ML	Clayey silt, med. l. grey N6, moist to wet, mod. dense		
61	SS	90.0	91.5	15-24-7	1.41		90					
									SP	Poorly graded sand, fine grained, d. yellowish brown 10YR 4/2, moist, dense		
62	SS	91.5	93.0	7-21-28	1.5				ML	Clayey silt, med. l. grey N6, moist to wet, dense		
									SW	Well graded sand, coarse grained, med. grey N5, w/fine gravel, some coarse gravel		
63	SS	93.0	94.5	14-18-21	1.5				ML	Clayey silt, med. l. grey N6, moist to wet, dense		
									SW	Well graded sand, fine grained, med. grey N5, moist to wet, dense, w/fine gravel		
64	SS	94.5	96.0	12-17-25	1.5		95		ML	Clayey silt, med. l. grey N6, moist to wet, dense		
									SW	Well graded sand, coarse grained, med. grey N5, moist to wet, dense, w/fine gravel @ 98.7' coal fragments		
65	SS	96.0	97.5	20-21-19	1.33							
66	SS	97.5	99.0	13-11-18	1.41							

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1605D** DATE **4/27/16** SHEET **5** OF **6**

PROJECT **ROCKPORT PLANT** BORING START **2/3/16** BORING FINISH **2/3/16**

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
67	SS	99.0	100.5	15-22-28	1.5		100		SP	Poorly graded sand, v. fine to fine grained, pale yellowish brown 10YR 6/2, moist to wet, dense, w/fine gravel @ 100.5' no fine gravel, mod. dense @ 102' v. fine, dense @ 105' mod. dense @ 106' trace coal fragments @ 106.3' no coal fragments @ 109.5' moist @ 111' v. moist to wet @ 112.5' moist to wet, dense @ 113' trace fine gravel, trace coarse gravel @ 113.5' no fine gravel, no coarse gravel		
68	SS	100.5	102.0	8-8-9	1.5							
69	SS	102.0	103.5	10-16-18	1.5							
70	SS	103.5	105.0	9-13-18	1.41							
71	SS	105.0	106.5	8-12-16	1.5		105					
72	SS	106.5	108.0	6-9-13	1.5							
73	SS	108.0	109.5	7-8-12	1.25							
74	SS	109.5	111.0	6-8-10	1.41		110					
75	SS	111.0	112.5	5-10-12	1.25							
76	SS	112.5	114.0	6-11-27	1.33							
77	SS	114.0	115.5	13-21-13	1.25		115		SW	Well graded sand, med. to coarse grained, med. grey N5, moist to wet, dense, w/fine gravel, some coarse gavel @ 115.5' coarse grained, mod. dense, trace coarse gravel @ 118.5' v. dense		
78	SS	115.5	117.0	7-7-9	1.33							
79	SS	117.0	118.5	9-9-8	1.16							
80	SS	118.5	120.0	12-36-22	1.5				SP	Poorly graded sand, v. fine grained, med. l. grey N6, moist to wet, v. dense @ 120' med. dense, sl. moist @ 122' fine grained, w/fine gravel, dense @ 124.5' trace coarse gravel		
81	SS	120.0	121.5	10-11-19	1.41		120					
82	SS	121.5	123.0	12-20-29	1.5							
83	SS	123.0	124.5	14-16-19	1.5							

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1605D** DATE **4/27/16** SHEET **6** OF **6**

PROJECT **ROCKPORT PLANT** BORING START **2/3/16** BORING FINISH **2/3/16**

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
84	SS	124.5	126.0	18-12-25	1.5		125					
85	SS	126.0	127.5	17-28-50/5	1.5				ML	Clayey silt, l. grey N7, moist, hard, non-durable shale @ 126' flaky, dry to moist Spoon refusal @ 127.4' Auger refusal @127.5' (shale)		
86	SS	127.5	129.0	27-50/2	.66							

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

AEP

JOB NUMBER	**42393125-01**		
COMPANY	**INDIANA MICHIGAN POWER COMPANY**	BORING NO. **MW-1605I**	DATE **4/27/16** SHEET **1** OF **4**
PROJECT	**ROCKPORT PLANT**	BORING START **3/2/16**	BORING FINISH **3/2/16**
COORDINATES	**N 151,478.9 E 513,532.6**	PIEZOMETER TYPE	WELL TYPE **OW**
GROUND ELEVATION	**400.6** SYSTEM **State Plane using NAD27/29**	HGT. RISER ABOVE GROUND **2.62**	DIA **2.0**
		DEPTH TO TOP OF WELL SCREEN **68.9**	BOTTOM **78.5**
		WELL DEVELOPMENT **YES**	BACKFILL
		FIELD PARTY **ZLR / REB**	RIG **D-120**

Water Level, ft	▽	▼	▼
TIME			
DATE			

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	1.5	20-13-10	1.25				 CL	Gravel = 6 inches Silty clay, moderate yellowish brown 10R 5/4 and med l. grey N6 mottled, moist, v. stiff @ 1.5' hard @ 3' v. stiff		
2	SS	1.5	3.0	5-15-18	1.25							
3	SS	3.0	4.5	7-9-15	1.41							
4	SS	4.5	6.0	11-12-14	1.5		5					
5	SS	6.0	7.5	4-8-11	1.41				ML	Clayey silt, medium grey N5, moist, med. dense, w/mod. yellowish brown 10R 5/4 silty clay mottled		
6	SS	7.5	9.0	3-6-11	1.33							
7	SS	9.0	10.5	3-4-7	1.41		10		CL	Silty clay, mod. yellowish brown 10R 5/4, moist, stiff, w/med. grey N5 clayey silt mottled		
8	SS	10.5	12.0	3-4-6	1.5				CH	Fat to lean clay, med. l. grey N6, moist, firm		
9	SS	12.0	13.5	2-2-4	1.5							
10	SS	13.5	15.0	2-2-5	1.41				CL ML	Silty clay, mod. reddish brown 10R 4/6 w/med. l. grey N6 fat clay heavily mottled, moist, firm @ 15' stiff @ 15.5' l" shale fragment, angular @ 18' very silty @ 20' trace to some pale yellowish brown 10YR 6/2 silt		
11	SS	15.0	16.5	2-4-5	1.5		15					
12	SS	16.5	18.0	3-5-9	1.5							
13	SS	18.0	19.5	3-6-8	1.41							
14	SS	19.5	21.0	3-5-7	1.41							

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 **AMEC FOSTER WHEELER**

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1605I** DATE **4/27/16** SHEET **2** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **3/2/16** BORING FINISH **3/2/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	WELL	DRILLER'S NOTES
15	SS	21.0	22.5	3-4-7	1.5				
16	SS	22.5	24.0	4-4-5	1.5				
17	SS	24.0	25.5	1-1-3	1.5				
18	SS	25.5	27.0	1-1-1	1.5		25		
19	SS	27.0	28.5	2-1-4	1.5				
20	SS	28.5	30.0	5-6-7	1.33				
21	SS	30.0	31.5	3-5-7	1.25		30		
22	SS	31.5	33.0	5-7-8	1.5				
23	SS	33.0	34.5	3-3-6	1.41				
24	SS	34.5	36.0	2-4-5	1.5				
25	SS	36.0	37.5	2-4-6	1.33		35		
26	SS	37.5	39.0	4-3-8	1.5				
27	SS	39.0	40.5	3-3-5	1.5				
28	SS	40.5	42.0	11-8-10	1.25		40		Begin Mud Rotary @ 40.5'
29	SS	42.0	43.5	4-5-11	1.5				
30	SS	43.5	45.0	8-9-9	1.16				
31	SS	45.0	46.5	6-9-14	1.5		45		

U S C S	SOIL / ROCK IDENTIFICATION
ML	Clayey silt, pale yellowish brown 10YR 6/2, moist, med. dense, w/silty clay (prev. material), trace sand
SP	Poorly graded sand, v. fine to fine grained, l. brown 5YR 5/6, moist, loose @ 23.2' 2" clayey silt seam (prev. material)
ML	Clayey silt, pale yellowish brown 10YR 6/2, moist to wet, v. loose @ 25' 2" l. brown sand seam (prev. material) @ 26' 2" l. brown sand seam @ 26.4' 15" l. brown sand seam @ 26.8' l" l. brown sand seam @ 27' loose @ 28' 2" l. brown sand seam
SP	Poorly graded sand, fine grained, l. brown 5YR 5/6, moist, med. dense @ 30' d. yellowish orange 10YR 6/6 @ 31' 3" clayey silt seam (prev. material) @ 32.3' trace fine gravel and black silt @ 32.5' no fine gravel or silt @ 33' moist, loose @ 34.1' 2" clayey silt seam (prev. material) @ 34.5' moist to wet, water in spoon @ 34.9' 2.5' clayey silt seam (prev. material)
SW	Well graded sand, fine grained, l. brown 5YR 5/6, moist to wet, med. dense, w/fine gravel
SW	Well graded sand, coarse grained, grayish black N2, moist to wet, med. dense, trace fine gravel
SP	Poorly graded sand, v. fine grained, l. brown 5YR 5/6, moist to wet, med. dense
SW	Well graded sand, fine to med. grained, moderate yellowish brown 10YR 5/4, moist to wet, loose @ 40.5' med. dense @ 41' 1.5" shale seam w/clay
SP	Poorly graded sand, v. fine to fine grained, mod. yellowish brown 10YR 5/4, moist to wet, med. dense
SW	Well graded sand, med. grained, mod. reddish brown 10R 4/6, moist to wet, med. dense @ 44' med. to coarse grained
SP	Poorly graded sand, fine grained, mod. yellowish

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AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1605I** DATE **4/27/16** SHEET **3** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **3/2/16** BORING FINISH **3/2/16**

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	WELL	DRILLER'S NOTES
32	SS	46.5	48.0	6-8-11	1.5				
33	SS	48.0	49.5	6-10-14	1.5				
34	SS	49.5	51.0	8-12-18	1.33		50		
35	SS	51.0	52.5	8-11-18	1.41				
36	SS	52.5	54.0	8-9-13	.91				
37	SS	54.0	55.5	11-20-26	1.25		55		
38	SS	55.5	57.0	10-15-16	1.5				
39	SS	57.0	58.5	6-12-16	1.33				
40	SS	58.5	60.0	7-10-18	1.33				
41	SS	60.0	61.5	8-9-12	1.33		60		
42	SS	61.5	63.0	10-13-19	1.25				
43	SS	63.0	64.5	9-11-18	1.33				
44	SS	64.5	66.0	9-11-15	1.08		65		
45	SS	66.0	67.5	7-8-13	1.41				
46	SS	67.5	69.0	5-5-8	1.5				
47	SS	69.0	70.5	6-8-12	1.5		70		
48	SS	70.5	72.0	0-12-16	1.5				

U S C S	SOIL / ROCK IDENTIFICATION
SW	brown 10YR 5/4, moist to wet, mod. dense, some fine gravel
SP	Well graded sand, med. to coarse grained, mod. reddish brown 10R 4/6, moist to wet, med. dense, trace fine gravel Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, moist to wet, med. dense, trace fine gravel @ 48' w/fine gravel, trace coarse gravel @ 49.5' no coarse gravel
SW	Well graded sand, med. to coarse grained, mod. reddish brown 10R 4/6, moist to wet, mod. dense, trace fine gravel
SP	Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, moist to wet, mod. dense, trace fine gravel @ 54' no fine gravel, dense @ 57' wet, mod. dense @ 60' dense @ 63' mod. dense
SW	Well graded sand, med. to coarse grained, mod. yellowish brown 10YR 5/4, moist to wet, mod. dense, trace black silt
SP	Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, moist to wet, mod. dense @ 68.5' trace fine gravel, trace coal fragments @ 70' no fine gravel, no coal fragments @ 70.9' trace fine gravel @ 71.6' no fine gravel, wet

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1605I** DATE **4/27/16** SHEET **4** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **3/2/16** BORING FINISH **3/2/16**

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
49	SS	72.0	73.5	8-8-10	1.25				SW	Well graded sand, fine grained d. yellowish brown 10YR 4/2, moist to wet, mod. dense, trace fine gravel @ 73.5' w/fine gravel, trace coarse gravel		
50	SS	73.5	75.0	9-12-17	1.41							
51	SS	75.0	76.5	8-7-9	1.5		75					
									SW	Well graded sand, coarse grained, brownish grey 5YR 4/1, moist to wet, mod. dense, w/fine gravel, trace coarse gravel		
52	SS	76.5	78.0	10-15-25	1.5							
									SP	Poorly graded sand, fine grained, pale yellowish brown 10YR 6/2, wet, dense, trace fine gravel @ 78' mod. dense @ 81' v. fine to fine grained @ 82.5' no fine gravel @ 84' dense @ 85' 2" shale fragment @ 85.2' v. fine grained @ 85.5' 3.5" shale fragment @ 87' fine grained, d. yellowish brown 10YR 4/2 @ 88.5' v. fine grained, mod. dense		
53	SS	78.0	79.5	7-13-12	1.33							
54	SS	79.5	81.0	5-7-12	1.5		80					

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 151,478.8 E 513,528.4**

GROUND ELEVATION **400.3** SYSTEM **State Plane using NAD27/29**

BORING NO. **MW-1605S** DATE **4/27/16** SHEET **1** OF **3**

BORING START **3/1/16** BORING FINISH **3/1/16**

PIEZOMETER TYPE WELL TYPE **OW**

HGT. RISER ABOVE GROUND **3.05** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **37.6** BOTTOM **47.13**

WELL DEVELOPMENT **YES** BACKFILL

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

Water Level, ft	▽	▼	▼
TIME			
DATE			

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
1	SS	0.0	1.5	20-13-10	1.25				 CL	Gravel = 6 inches Silty clay, moderate yellowish brown 10R 5/4 and med l. grey N6 mottled, moist, v. stiff @ 1.5' hard @ 3' v. stiff		
2	SS	1.5	3.0	5-15-18	1.25							
3	SS	3.0	4.5	7-9-15	1.41							
4	SS	4.5	6.0	11-12-14	1.5		5					
5	SS	6.0	7.5	4-8-11	1.41							
6	SS	7.5	9.0	3-6-11	1.33				ML	Clayey silt, medium grey N5, moist, med. dense, w/mod. yellowish brown 10R 5/4 silty clay mottled		
7	SS	9.0	10.5	3-4-7	1.41		10		CL	Silty clay, mod. yellowish brown 10R 5/4, moist, stiff, w/med. grey N5 clayey silt mottled		
8	SS	10.5	12.0	3-4-6	1.5							
9	SS	12.0	13.5	2-2-4	1.5				CH	Fat to lean clay, med. l. grey N6, moist, firm		
10	SS	13.5	15.0	2-2-5	1.41				CL ML	Silty clay, mod. reddish brown 10R 4/6 w/med. l. grey N6 fat clay heavily mottled, moist, firm @ 15' stiff @ 15.5' l" shale fragment, angular @ 18' very silty @ 20' trace to some pale yellowish brown 10YR 6/2 silt		
11	SS	15.0	16.5	2-4-5	1.5		15					
12	SS	16.5	18.0	3-5-9	1.5							
13	SS	18.0	19.5	3-6-8	1.41							
14	SS	19.5	21.0	3-5-7	1.41							

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 **AMEC FOSTER WHEELER**

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1605S** DATE **4/27/16** SHEET **2** OF **3**

PROJECT **ROCKPORT PLANT** BORING START **3/1/16** BORING FINISH **3/1/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	DRILLER'S NOTES
15	SS	21.0	22.5	3-4-7	1.5			
16	SS	22.5	24.0	4-4-5	1.5			
17	SS	24.0	25.5	1-1-3	1.5		25	
18	SS	25.5	27.0	1-1-1	1.5			
19	SS	27.0	28.5	2-1-4	1.5			
20	SS	28.5	30.0	5-6-7	1.33		30	
21	SS	30.0	31.5	3-5-7	1.25			
22	SS	31.5	33.0	5-7-8	1.5			
23	SS	33.0	34.5	3-3-6	1.41			
24	SS	34.5	36.0	2-4-5	1.5		35	
25	SS	36.0	37.5	2-4-6	1.33			
26	SS	37.5	39.0	4-3-8	1.5			
27	SS	39.0	40.5	3-3-5	1.5		40	
28	SS	40.5	42.0	11-8-10	1.25			Begin Mud Rotary @ 40.5'
29	SS	42.0	43.5	4-5-11	1.5			
30	SS	43.5	45.0	8-9-9	1.16		45	
31	SS	45.0	46.5	6-9-14	1.5			

U S C S	SOIL / ROCK IDENTIFICATION
ML	Clayey silt, pale yellowish brown 10YR 6/2, moist, med. dense, w/silty clay (prev. material), trace sand
SP	Poorly graded sand, v. fine to fine grained, l. brown 5YR 5/6, moist, loose @ 23.2' 2" clayey silt seam (prev. material)
ML	Clayey silt, pale yellowish brown 10YR 6/2, moist to wet, v. loose @ 25' 2" l. brown sand seam (prev. material) @ 26' 2" l. brown sand seam @ 26.4' 15" l. brown sand seam @ 26.8' l" l. brown sand seam @ 27' loose @ 28' 2" l. brown sand seam
SP	Poorly graded sand, fine grained, l. brown 5YR 5/6, moist, med. dense @ 30' d. yellowish orange 10YR 6/6 @ 31' 3" clayey silt seam (prev. material) @ 32.3' trace fine gravel and black silt @ 32.5' no fine gravel or silt @ 33' moist, loose @ 34.1' 2" clayey silt seam (prev. material) @ 34.5' moist to wet, water in spoon @ 34.9' 2.5' clayey silt seam (prev. material)
SW	Well graded sand, fine grained, l. brown 5YR 5/6, moist to wet, med. dense, w/fine gravel
SW	Well graded sand, coarse grained, grayish black N2, moist to wet, med. dense, trace fine gravel
SP	Poorly graded sand, v. fine grained, l. brown 5YR 5/6, moist to wet, med. dense
SW	Well graded sand, fine to med. grained, moderate yellowish brown 10YR 5/4, moist to wet, loose @ 40.5' med. dense @ 41' 1.5" shale seam w/clay
SP	Poorly graded sand, v. fine to fine grained, mod. yellowish brown 10YR 5/4, moist to wet, med. dense
SW	Well graded sand, med. grained, mod. reddish brown 10R 4/6, moist to wet, med. dense @ 44' med. to coarse grained
SP	Poorly graded sand, fine grained, mod. yellowish

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER 42393125-01

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1605S** DATE **4/27/16** SHEET **3** OF **3**

PROJECT **ROCKPORT PLANT** BORING START **3/1/16** BORING FINISH **3/1/16**

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
32	SS	46.5	48.0	6-8-11	1.5				SW	brown 10YR 5/4, moist to wet, mod. dense, some fine gravel		
33	SS	48.0	49.5	6-10-14	1.5				SP	Well graded sand, med. to coarse grained, mod. reddish brown 10R 4/6, moist to wet, med. dense, trace fine gravel Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, moist to wet, med. dense, trace fine gravel @ 48' w/fine gravel, trace coarse gravel @ 49.5' no coarse gravel		

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
MONITORING WELL CONSTRUCTION

JOB NUMBER **42393125-01**

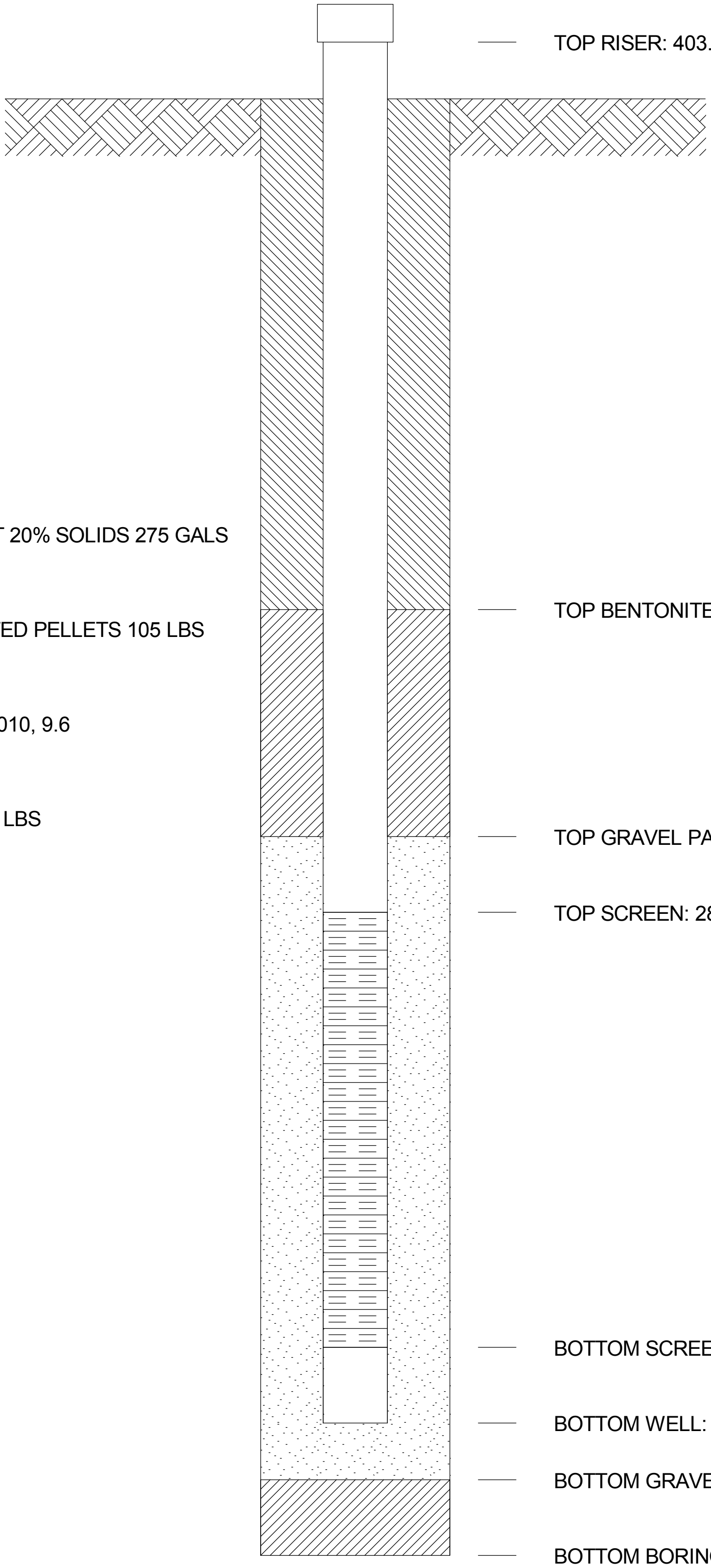
COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No. **MW-1605D** BORING No. **MW-1605D** INSTALLED **2/3/16**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 151,478.9 E 513,537.1**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 400.42 FT.



TOP RISER: 403.78 FT.

TOP BENTONITE SEAL: 292.42 FT.

TOP GRAVEL PACK: 287.42 FT.

TOP SCREEN: 285.82 FT.

BOTTOM SCREEN: 276.20 FT.

BOTTOM WELL: 275.80 FT.

BOTTOM GRAVEL PACK: 272.92 FT.

BOTTOM BORING: 272.92 FT.

▧ GROUT SEAL: QUICK GROUT 20% SOLIDS 275 GALS

▨ BENTONITE SEAL: 3/8" COATED PELLETS 105 LBS

☰ SCREEN: 2.0 dia., SLOTTED .010, 9.6

░ GRAVEL PACK: #5 SAND 375 LBS

☐ RISER PIPE: 2.0, dia., PVC

∿ SPACERS, DEPTH:

GEOMCNST RK BAP CCR COMPLIANCE.GPJ AEP.GDT 4/27/16

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
MONITORING WELL CONSTRUCTION

JOB NUMBER **42393125-01**

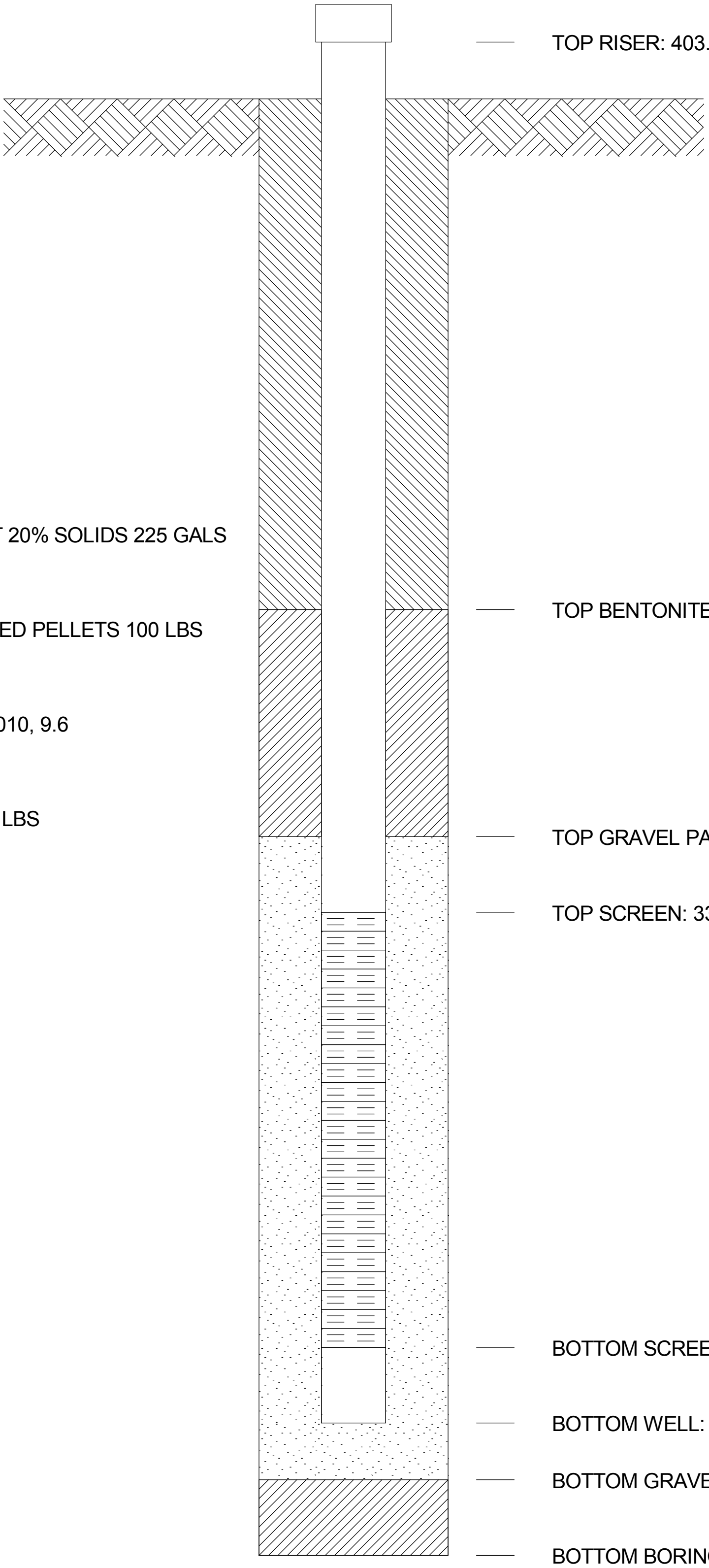
COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No. **MW-1605I** BORING No. **MW-1605I** INSTALLED **3/2/16**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 151,478.9 E 513,532.6**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 400.60 FT.



TOP RISER: 403.22 FT.

TOP BENTONITE SEAL: 343.10 FT.

TOP GRAVEL PACK: 334.20 FT.

TOP SCREEN: 331.70 FT.

BOTTOM SCREEN: 322.10 FT.

BOTTOM WELL: 321.70 FT.

BOTTOM GRAVEL PACK: 320.60 FT.

BOTTOM BORING: 320.60 FT.

▧ GROUT SEAL: QUICK GROUT 20% SOLIDS 225 GALS

▨ BENTONITE SEAL: 3/8" COATED PELLETS 100 LBS

☰ SCREEN: 2.0 dia., SLOTTED .010, 9.6

░ GRAVEL PACK: #5 SAND 200 LBS

☐ RISER PIPE: 2.0, dia., PVC

∿ SPACERS, DEPTH:

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER **42393125-01**

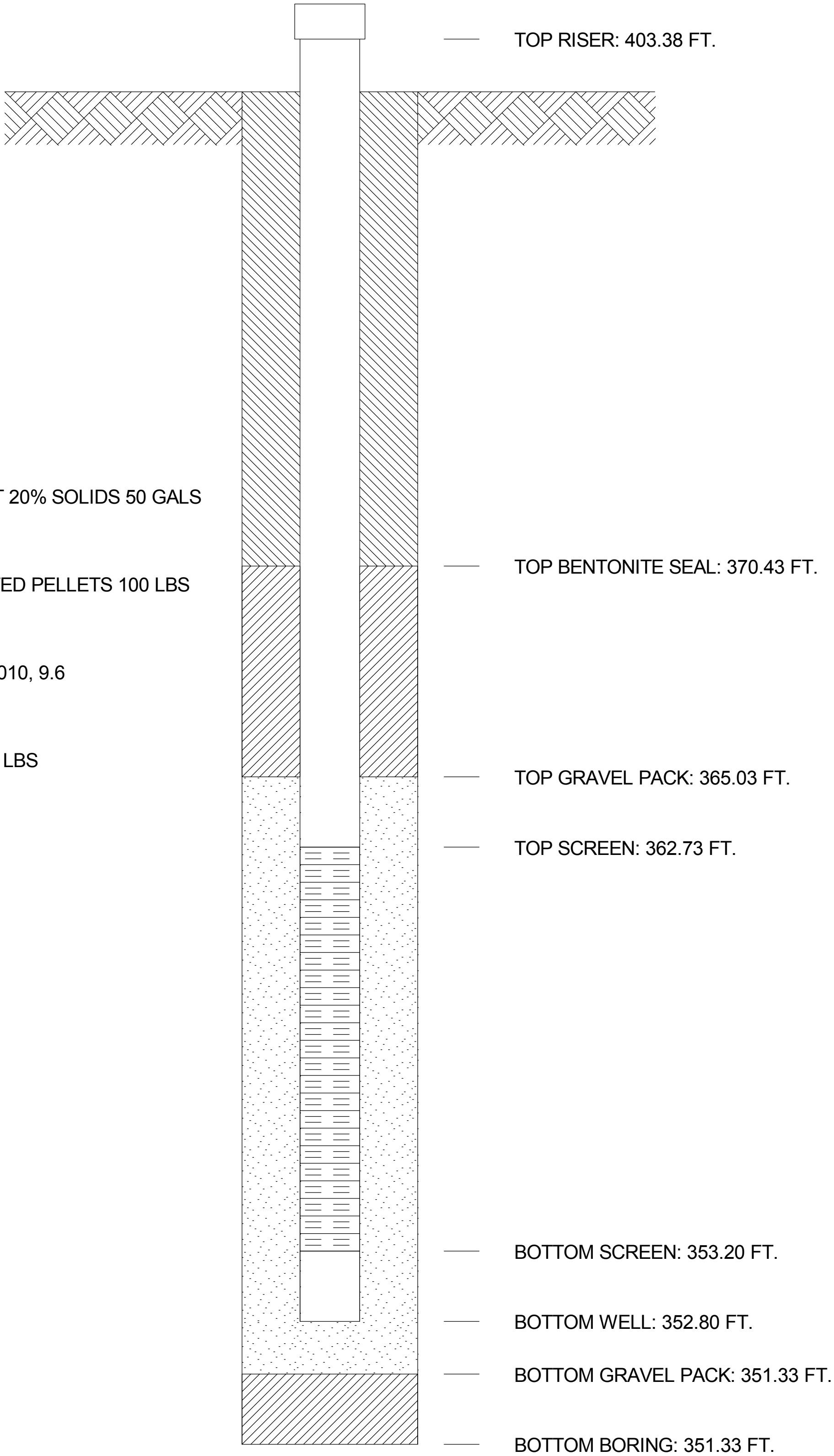
COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No. **MW-1605S** BORING No. **MW-1605S** INSTALLED **3/1/16**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 151,478.8 E 513,528.4**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 400.33 FT.



▨ GROUT SEAL: QUICK GROUT 20% SOLIDS 50 GALS

▧ BENTONITE SEAL: 3/8" COATED PELLETS 100 LBS

☰ SCREEN: 2.0 dia., SLOTTED .010, 9.6

░ GRAVEL PACK: #5 SAND 245 LBS

□ RISER PIPE: 2.0, dia., PVC

∿ SPACERS, DEPTH:

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 151,502.1 E 512,881.5**

GROUND ELEVATION **397.8** SYSTEM **State Plane using NAD27/29**

BORING NO. **MW-1606D** DATE **4/27/16** SHEET **1** OF **5**

BORING START **2/12/16** BORING FINISH **2/12/16**

PIEZOMETER TYPE WELL TYPE **OW**

HGT. RISER ABOVE GROUND **2.91** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **100.2** BOTTOM **109.82**

WELL DEVELOPMENT **YES** BACKFILL

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

Water Level, ft	▽	▼	▼
TIME			
DATE			

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
1	SS	0.0	1.5	3-5-9	1.5				 CL	Crushed stone gravel (limestone) Lean clay, moderate yellowish brown 10YR 5/4, moist, trace fine grained sand, stiff		
2	SS	1.5	3.0	4-7-9	1.5					@ 1.5' as above, trace coarse grain sand and black decomposed organic staining @ 3' trace fine gravel		
3	SS	3.0	4.5	3-4-6	1.3							
4	SS	4.5	6.0	1-2-8	1.3		5					
5	SS	6.0	7.5	5-9-10	1.5				CL	Lean clay, pale yellow brown 10YR 6/2, moist, some light brown oxide staining @ 6.0' yellow brown and brown 10YR 5/4 @ 7.5' pale yellow brown 10YR 6/2, trace fine roots, trace fine grained sand		
6	SS	7.5	9.0	3-6-9	1.5				CL	Lean clay w/sand, dark yellow brown 10YR 4/2, moist, little fine grained sand		
7	SS	9.0	10.5	2-4-5	1.5		10		CL	Lean clay, light bluish gray 5B 7/1, moist, some brown oxide staining, trace coarse grained sand @ 12.5' as above, becomes moderate brown in color 5YR 4/4 @ 13.5' moderate yellow brown 10YR 5/4 and pale yellow brown 10YR 6/2) mottled @ 13.5' - 15' trace fine grained sand, trace fine gravel @ 19.5' mostly 10YR 6/2 in color		
8	SS	10.5	12.0	3-4-6	1.5							
9	SS	12.0	13.5	3-5-9	1.5							
10	SS	13.5	15.0	4-5-7	1.5							
11	SS	15.0	16.5	3-5-6	1.5		15					
12	SS	16.5	18.0	3-4-6	1.5							
13	SS	18.0	19.5	2-5-7	1.5							
14	SS	19.5	21.0	3-3-6	1.5							

Continued Next Page

TYPE OF CASING USED

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

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

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

RECORDER **AMEC FOSTER WHEELER**

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1606D** DATE **4/27/16** SHEET **2** OF **5**

PROJECT **ROCKPORT PLANT** BORING START **2/12/16** BORING FINISH **2/12/16**

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
15	SS	21.0	22.5	3-4-5	1.5				CL ML	Silty clay, pale yellow brown 10YR 6/2, moist, trace to little fine grained sand		
16	SS	22.5	24.0	2-4-6	1.5				SP SM	Poorly graded sand w/silt, pale yellow brown 10YR 6/2, moist, fine to medium grained sand @ 24.9' 3" silt layer		
17	SS	24.0	25.5	1-2-5	1.2		25					
18	SS	25.5	27.0	2-4-6	1.5				CL	Lean clay, moderate yellowish brown 10YR 5/4, moist, few sandy layers <1" thick @ 28.3' SP-SM layer (~3" thick)		
19	SS	27.0	28.5	1-5-9	1.3							
20	SS	28.5	30.0	4-4-5	1.3		30		SP SM	Poorly graded sand w/silt, dark yellowish orange 10YR 6/6, wet, fine to medium grained sand, little coarse grained sand @ 31.5' trace fine gravel @ 34.5' trace fine gravel		
21	SS	30.0	31.5	5-7-8	1.5							
22	SS	31.5	33.0	3-3-4	1.1							
23	SS	33.0	34.5	1-2-5	0							
24	SS	34.5	36.0	3-4-8	.8		35					
25	SS	36.0	37.5	3-5-7	1.0							
26	SS	37.5	39.0	5-6-7	.9				SP	Poorly graded sand, dark yellowish orange 10YR 6/6, wet, fine to medium grained sand, trace to little coarse grained sand @ 37.5' trace gravel		
27	SS	39.0	40.5	4-7-20	1.2		40		SP SM	Poorly graded sand w/silt, dark yellowish orange 10YR 6/6, wet, fine to medium grained sand, trace coarse grained sand		
28	SS	40.5	42.0	7-7-8	1.1				SC SP	Clayey sand, moderate brown 5YR 3/4, wet, fine to medium grained sand Poorly graded sand, dark yellowish orange 10YR 6/6, wet, fine to medium grained sand, trace coarse grained sand & fine gravel @ 42.0' - 43.5' increase in coarse grained sand @ 45.2' - 45.5' color change to moderate brown 5YR 4/4 @ 46.5' increase in coarse grained sand, trace wood fragments (tree bark) @ 48' color change to pale yellowish brown 10YR		
29	SS	42.0	43.5	4-6-10	1.0							
30	SS	43.5	45.0	4-5-7	1.0		45					
31	SS	45.0	46.5	4-6-10	1.2							

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1606D** DATE **4/27/16** SHEET **3** OF **5**

PROJECT **ROCKPORT PLANT** BORING START **2/12/16** BORING FINISH **2/12/16**

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
32	SS	46.5	48.0	8-9-11	1.1					6/2, few black decomposed organic layers		
33	SS	48.0	49.5	6-10-13	1.1							
34	SS	49.5	51.0	18-13-13	.9		50		SW SM	Well graded sand w/silt & gravel, wet, pale yellowish brown 10YR 6/2, fine to coarse grained sand, little to some fine gravel, trace coarse gravel		
35	SS	51.0	52.5	7-14-16	1.1				SP SM	Poorly graded sand w/silt, moderate yellowish brown 10YR 5/4, wet, fine to medium grained sand, trace coarse grained sand, few layers of decomposed organics (from 51' - 52.5') @ 54' trace coarse gravel, fines between 5 - 10% @ 55.5' trace fine gravel		
36	SS	52.5	54.0	7-9-15	1.0							
37	SS	54.0	55.5	10-10-14	1.2		55					
38	SS	55.5	57.0	8-10-13	1.2							
39	SS	57.0	58.5	7-9-9	1.3				SW	Well graded sand, med. to coarse grained, dark yellowish brown 10YR 4/2), wet, med. dense, trace fine gravel @ 59' trace coarse gravel		
40	SS	58.5	60.0	4-5-9	1.2							
41	SS	60.0	61.5	6-6-9	1.5		60		SP	Poorly graded sand, fine grained, dusky yellowish brown 10YR 2/2, wet, med. dense, w/fine gravel @ 60.5' 2" shale fragment @ 61.5' dark yellowish brown 10YR 4/2, dense @ 61.8' 2" shale fragment @ 62' some lean clay, pale yellowish brown (prev. material) @ 62.5' no clay, trace fine gravel @ 63' no fine gravel @ 64.5' med. dense @ 65.8' 15" coarse sand seam (prev. material) @ 66' dense @ 67.2' 3" shale seam, med. l. grey N6 @ 67.7' med. grained		
42	SS	61.5	63.0	6-13-21	1.5							
43	SS	63.0	64.5	10-17-31	1.3							
44	SS	64.5	66.0	13-13-17	1.4		65					
45	SS	66.0	67.5	6-14-18	1.5							
46	SS	67.5	69.0	9-14-17	1.5							
47	SS	69.0	70.5	10-20-20	1.1		70		SP	Poorly graded sand, fine gravel, pale yellowish brown 10YR 6.2, wet, dense @ 69' moist to v. moist @ 72' med. dense, fine grained @ 75' dense, d. yellowish brown 10YR 4.2 @ 76.5' med. dense, trace black silt @ 80.6 3" shale plug (responsible for increase in N value (same material)) @ 81.3' 1.5" shale plug, dense		
48	SS	70.5	72.0	10-19-26	1.4							

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1606D** DATE **4/27/16** SHEET **4** OF **5**

PROJECT **ROCKPORT PLANT** BORING START **2/12/16** BORING FINISH **2/12/16**

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
49	SS	72.0	73.5	7-10-17	1.3					@ 81.5' no recovery, potential cobble blocking during sampling		
50	SS	73.5	75.0	8-9-13	1.2							
51	SS	75.0	76.5	10-16-25	1.4		75					
52	SS	76.5	78.0	9-10-14	1.4							
53	SS	78.0	79.5	6-9-18	1.5							
54	SS	79.5	81.0	10-17-34	1.5		80					
55	SS	81.0	82.5	31-19-14	1.3							
56	SS	82.5	84.0	10-16-21	1.5				CH SW	Fat clay, med. l. grey N6, moist, firm Well graded sand, med. grained, dark yellowish brown 10YR 4/2, wet, dense, w/fine gravel @ 83' coal fragment (2" diam., 1" thick) @ 83.6' coal fragment (2" diam, 1" thick)		
57	SS	84.0	85.5	9-19-21	1.5		85					
58	SS	85.5	87.0	7-15-24	1.3				SP	Poorly graded sand, fine grained, pale yellowish brown 10YR 6/2, wet, dense @ 88.5' trace fine gravel @ 91.5' with fine gravel		
59	SS	87.0	88.5	10-13-20	1.2							
60	SS	88.5	90.0	8-14-23	1.4							
61	SS	90.0	91.5	8-13-27	1.3		90					
62	SS	91.5	93.0	8-7-16	1.5							
63	SS	93.0	94.5	7-9-15	1.5							
64	SS	94.5	96.0	12-12-14	1.5		95		SW SP	Well graded sand, med. to coarse grained, dark yellowish brown 10YR 4/2, wet, med. dense, w/fine gravel		
65	SS	96.0	97.5	3-5-5	1.5				SW SP	Poorly graded sand, coarse grained, greyish red 5R 4/2, wet, med. dense, trace fine gravel Well graded sand, med. to coarse grained, dark yellowish brown 10YR 4/2, wet, med. dense, w/fine gravel		
66	SS	97.5	99.0	5-5-6	1.4				SP			

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1606D** DATE **4/27/16** SHEET **5** OF **5**

PROJECT **ROCKPORT PLANT** BORING START **2/12/16** BORING FINISH **2/12/16**

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
										Poorly graded sand, coarse grained, greyish red 5R 4/2, wet, med. dense to loose, trace fine gravel		
67	SS	99.0	100.5	4-5-7	1.5		100			Poorly graded sand, fine grained, pale yellowish brown 10YR 6/2, wet, loose @ 97.5' med. dense, fine grained		
68	SS	100.5	102.0	7-7-10	1.4				SP	Poorly graded sand, fine to fine grained, dusky red 5R 3/4, wet, med. dense @ 102' loose, fine grained, moist @ 103.5' med. dense @ 105' fine grained @ 106.5' dense @ 108' med. dense, trace fine gravel @ 109' no fine gravel @110.6' siltstone fragments to 2.5", moderate brown 5YR 4/4, shiny, angular		
69	SS	102.0	103.5	4-4-6	1.5							
70	SS	103.5	105.0	5-6-10	1.3							
71	SS	105.0	106.5	4-6-9	1.5		105					
72	SS	106.5	108.0	7-11-20	1.4							
73	SS	108.0	109.5	8-13-15	1.5							
74	SS	109.5	111.0	10-18-11	1.3		110					
75	SS	111.0	112.5	14-50/3					ML	Silt, l. grey N7, moist, med. dense, non-durable shale @ 111' clayey silt, hard Spoon refusal @ 111.7' Auger refusal @ 112.9 BT @ 112.9'		
76	SS	112.5	114.0	50/4								

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 151,500.4 E 512,885.5**

GROUND ELEVATION **397.8** SYSTEM **State Plane using NAD27/29**

BORING NO. **MW-1606I** DATE **4/27/16** SHEET **1** OF **4**

BORING START **3/1/16** BORING FINISH **3/1/16**

PIEZOMETER TYPE ______ WELL TYPE **OW**

HGT. RISER ABOVE GROUND **3.00** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **65.4** BOTTOM **75.05**

WELL DEVELOPMENT **YES** BACKFILL ______

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

Water Level, ft	▽	▼	▼
TIME			
DATE			

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	1.5	3-5-9	1.5				CL	Crushed stone gravel (limestone) Lean clay, moderate yellowish brown 10YR 5/4, moist, trace fine grained sand, stiff @ 1.5' as above, trace coarse grain sand and black decomposed organic staining @ 3' trace fine gravel		
2	SS	1.5	3.0	4-7-9	1.5							
3	SS	3.0	4.5	3-4-6	1.3							
4	SS	4.5	6.0	1-2-8	1.3		5					
5	SS	6.0	7.5	5-9-10	1.5				CL	Lean clay, pale yellow brown 10YR 6/2, moist, some light brown oxide staining @ 6.0' yellow brown and brown 10YR 5/4 @ 7.5' pale yellow brown 10YR 6/2, trace fine roots, trace fine grained sand		
6	SS	7.5	9.0	3-6-9	1.5				CL	Lean clay w/sand, dark yellow brown 10YR 4/2, moist, little fine grained sand		
7	SS	9.0	10.5	2-4-5	1.5		10		CL	Lean clay, light bluish gray 5B 7/1, moist, some brown oxide staining, trace coarse grained sand @ 12.5' as above, becomes moderate brown in color 5YR 4/4 @ 13.5' moderate yellow brown 10YR 5/4 and pale yellow brown 10YR 6/2) mottled @ 13.5' - 15' trace fine grained sand, trace fine gravel @ 19.5' mostly 10YR 6/2 in color		
8	SS	10.5	12.0	3-4-6	1.5							
9	SS	12.0	13.5	3-5-9	1.5							
10	SS	13.5	15.0	4-5-7	1.5		15					
11	SS	15.0	16.5	3-5-6	1.5							
12	SS	16.5	18.0	3-4-6	1.5							
13	SS	18.0	19.5	2-5-7	1.5							
14	SS	19.5	21.0	3-3-6	1.5							

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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 **AMEC FOSTER WHEELER**

LOG OF BORING

JOB NUMBER **42393125-01**
COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1606I** DATE **4/27/16** SHEET **2** OF **4**
PROJECT **ROCKPORT PLANT** BORING START **3/1/16** BORING FINISH **3/1/16**

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	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
15	SS	21.0	22.5	3-4-5	1.5			CL ML	Silty clay, pale yellow brown 10YR 6/2, moist, trace to little fine grained sand		
16	SS	22.5	24.0	2-4-6	1.5			SP SM	Poorly graded sand w/silt, pale yellow brown 10YR 6/2, moist, fine to medium grained sand @ 24.9' 3" silt layer		
17	SS	24.0	25.5	1-2-5	1.2		25				
18	SS	25.5	27.0	2-4-6	1.5			CL	Lean clay, moderate yellowish brown 10YR 5/4, moist, few sandy layers <1" thick @ 28.3' SP-SM layer (~3" thick)		
19	SS	27.0	28.5	1-5-9	1.3						
20	SS	28.5	30.0	4-4-5	1.3			SP SM	Poorly graded sand w/silt, dark yellowish orange 10YR 6/6, wet, fine to medium grained sand, little coarse grained sand @ 31.5' trace fine gravel @ 34.5' trace fine gravel		
21	SS	30.0	31.5	5-7-8	1.5		30				
22	SS	31.5	33.0	3-3-4	1.1						
23	SS	33.0	34.5	1-2-5	0						
24	SS	34.5	36.0	3-4-8	.8		35				
25	SS	36.0	37.5	3-5-7	1.0						
26	SS	37.5	39.0	5-6-7	.9			SP	Poorly graded sand, dark yellowish orange 10YR 6/6, wet, fine to medium grained sand, trace to little coarse grained sand @ 37.5' trace gravel		
27	SS	39.0	40.5	4-7-20	1.2		40	SP SM	Poorly graded sand w/silt, dark yellowish orange 10YR 6/6, wet, fine to medium grained sand, trace coarse grained sand		
28	SS	40.5	42.0	7-7-8	1.1			SC SP	Clayey sand, moderate brown 5YR 3/4, wet, fine to medium grained sand Poorly graded sand, dark yellowish orange 10YR 6/6, wet, fine to medium grained sand, trace coarse grained sand & fine gravel @ 42.0' - 43.5' increase in coarse grained sand @ 45.2' - 45.5' color change to moderate brown 5YR 4/4 @ 46.5' increase in coarse grained sand, trace wood fragments (tree bark) @ 48' color change to pale yellowish brown 10YR		
29	SS	42.0	43.5	4-6-10	1.0						
30	SS	43.5	45.0	4-5-7	1.0						
31	SS	45.0	46.5	4-6-10	1.2		45				

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1606I** DATE **4/27/16** SHEET **3** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **3/1/16** BORING FINISH **3/1/16**

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
32	SS	46.5	48.0	8-9-11	1.1					6/2, few black decomposed organic layers		
33	SS	48.0	49.5	6-10-13	1.1							
34	SS	49.5	51.0	18-13-13	.9		50		SW SM	Well graded sand w/silt & gravel, wet, pale yellowish brown 10YR 6/2, fine to coarse grained sand, little to some fine gravel, trace coarse gravel		
35	SS	51.0	52.5	7-14-16	1.1				SP SM	Poorly graded sand w/silt, moderate yellowish brown 10YR 5/4, wet, fine to medium grained sand, trace coarse grained sand, few layers of decomposed organics (from 51' - 52.5') @ 54' trace coarse gravel, fines between 5 - 10% @ 55.5' trace fine gravel		
36	SS	52.5	54.0	7-9-15	1.0							
37	SS	54.0	55.5	10-10-14	1.2		55					
38	SS	55.5	57.0	8-10-13	1.2							
39	SS	57.0	58.5	7-9-9	1.3				SW	Well graded sand, med. to coarse grained, dark yellowish brown 10YR 4/2), wet, med. dense, trace fine gravel @ 59' trace coarse gravel		
40	SS	58.5	60.0	4-5-9	1.2							
41	SS	60.0	61.5	6-6-9	1.5		60		SP	Poorly graded sand, fine grained, dusky yellowish brown 10YR 2/2, wet, med. dense, w/fine gravel @ 60.5' 2" shale fragment @ 61.5' dark yellowish brown 10YR 4/2, dense @ 61.8' 2" shale fragment @ 62' some lean clay, pale yellowish brown (prev. material) @ 62.5' no clay, trace fine gravel @ 63' no fine gravel @ 64.5' med. dense @ 65.8' 15" coarse sand seam (prev. material) @ 66' dense @ 67.2' 3" shale seam, med. l. grey N6 @ 67.7' med. grained		
42	SS	61.5	63.0	6-13-21	1.5							
43	SS	63.0	64.5	10-17-31	1.3							
44	SS	64.5	66.0	13-13-17	1.4		65					
45	SS	66.0	67.5	6-14-18	1.5							
46	SS	67.5	69.0	9-14-17	1.5							
47	SS	69.0	70.5	10-20-20	1.1		70		SP	Poorly graded sand, fine gravel, pale yellowish brown 10YR 6.2, wet, dense @ 69' moist to v. moist @ 72' med. dense, fine grained @ 75' dense, d. yellowish brown 10YR 4.2 @ 76.5' med. dense, trace black silt @ 80.6 3" shale plug (responsible for increase in N value (same material)) @ 81.3' 1.5" shale plug, dense		
48	SS	70.5	72.0	10-19-26	1.4							

Continued Next Page

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1606I** DATE **4/27/16** SHEET **4** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **3/1/16** BORING FINISH **3/1/16**

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
49	SS	72.0	73.5	7-10-17	1.3					@ 81.5' no recovery, potential cobble blocking during sampling		
50	SS	73.5	75.0	8-9-13	1.2							
51	SS	75.0	76.5	10-16-25	1.4		75					
52	SS	76.5	78.0	9-10-14	1.4							

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 151,498.9 E 512,889.4**

GROUND ELEVATION **397.6** SYSTEM **State Plane using NAD27/29**

BORING NO. **MW-1606S** DATE **4/27/16** SHEET **1** OF **3**

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

PIEZOMETER TYPE ______ WELL TYPE **OW**

HGT. RISER ABOVE GROUND **3.03** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **34.6** BOTTOM **44.22**

WELL DEVELOPMENT **YES** BACKFILL ______

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

Water Level, ft	▽	▼	▼
TIME			
DATE			

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
1	SS	0.0	1.5	3-5-9	1.5				CL	Crushed stone gravel (limestone) Lean clay, moderate yellowish brown 10YR 5/4, moist, trace fine grained sand, stiff @ 1.5' as above, trace coarse grain sand and black decomposed organic staining @ 3' trace fine gravel		
2	SS	1.5	3.0	4-7-9	1.5							
3	SS	3.0	4.5	3-4-6	1.3							
4	SS	4.5	6.0	1-2-8	1.3		5					
5	SS	6.0	7.5	5-9-10	1.5				CL	Lean clay, pale yellow brown 10YR 6/2, moist, some light brown oxide staining @ 6.0' yellow brown and brown 10YR 5/4 @ 7.5' pale yellow brown 10YR 6/2, trace fine roots, trace fine grained sand		
6	SS	7.5	9.0	3-6-9	1.5				CL	Lean clay w/sand, dark yellow brown 10YR 4/2, moist, little fine grained sand		
7	SS	9.0	10.5	2-4-5	1.5				CL	Lean clay, light bluish gray 5B 7/1, moist, some brown oxide staining, trace coarse grained sand @ 12.5' as above, becomes moderate brown in color 5YR 4/4 @ 13.5' moderate yellow brown 10YR 5/4 and pale yellow brown 10YR 6/2) mottled @ 13.5' - 15' trace fine grained sand, trace fine gravel @ 19.5' mostly 10YR 6/2 in color		
							10					
8	SS	10.5	12.0	3-4-6	1.5							
9	SS	12.0	13.5	3-5-9	1.5							
10	SS	13.5	15.0	4-5-7	1.5							
							15					
11	SS	15.0	16.5	3-5-6	1.5							
12	SS	16.5	18.0	3-4-6	1.5							
13	SS	18.0	19.5	2-5-7	1.5							
14	SS	19.5	21.0	3-3-6	1.5							

Continued Next Page

TYPE OF CASING USED

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

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

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

RECORDER **AMEC FOSTER WHEELER**

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1606S** DATE **4/27/16** SHEET **2** OF **3**

PROJECT **ROCKPORT PLANT** BORING START **3/2/16** BORING FINISH **3/2/16**

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
15	SS	21.0	22.5	3-4-5	1.5				CL ML	Silty clay, pale yellow brown 10YR 6/2, moist, trace to little fine grained sand		
16	SS	22.5	24.0	2-4-6	1.5				SP SM	Poorly graded sand w/silt, pale yellow brown 10YR 6/2, moist, fine to medium grained sand @ 24.9' 3" silt layer		
17	SS	24.0	25.5	1-2-5	1.2		25					
18	SS	25.5	27.0	2-4-6	1.5				CL	Lean clay, moderate yellowish brown 10YR 5/4, moist, few sandy layers <1" thick @ 28.3' SP-SM layer (~3" thick)		
19	SS	27.0	28.5	1-5-9	1.3							
20	SS	28.5	30.0	4-4-5	1.3				SP SM	Poorly graded sand w/silt, dark yellowish orange 10YR 6/6, wet, fine to medium grained sand, little coarse grained sand @ 31.5' trace fine gravel @ 34.5' trace fine gravel		
21	SS	30.0	31.5	5-7-8	1.5		30					
22	SS	31.5	33.0	3-3-4	1.1							
23	SS	33.0	34.5	1-2-5	0							
24	SS	34.5	36.0	3-4-8	.8		35					
25	SS	36.0	37.5	3-5-7	1.0							
26	SS	37.5	39.0	5-6-7	.9				SP	Poorly graded sand, dark yellowish orange 10YR 6/6, wet, fine to medium grained sand, trace to little coarse grained sand @ 37.5' trace gravel		
27	SS	39.0	40.5	4-7-20	1.2				SP SM	Poorly graded sand w/silt, dark yellowish orange 10YR 6/6, wet, fine to medium grained sand, trace coarse grained sand		
28	SS	40.5	42.0	7-7-8	1.1		40		SC SP	Clayey sand, moderate brown 5YR 3/4, wet, fine to medium grained sand Poorly graded sand, dark yellowish orange 10YR 6/6, wet, fine to medium grained sand, trace coarse grained sand & fine gravel @ 42.0' - 43.5' increase in coarse grained sand @ 45.2' - 45.5' color change to moderate brown 5YR 4/4 @ 46.5' increase in coarse grained sand, trace wood fragments (tree bark) @ 48' color change to pale yellowish brown 10YR		
29	SS	42.0	43.5	4-6-10	1.0							
30	SS	43.5	45.0	4-5-7	1.0							
31	SS	45.0	46.5	4-6-10	1.2		45					

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1606S** DATE **4/27/16** SHEET **3** OF **3**

PROJECT **ROCKPORT PLANT** BORING START **3/2/16** BORING FINISH **3/2/16**

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
								░		6/2, few black decomposed organic layers		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER **42393125-01**

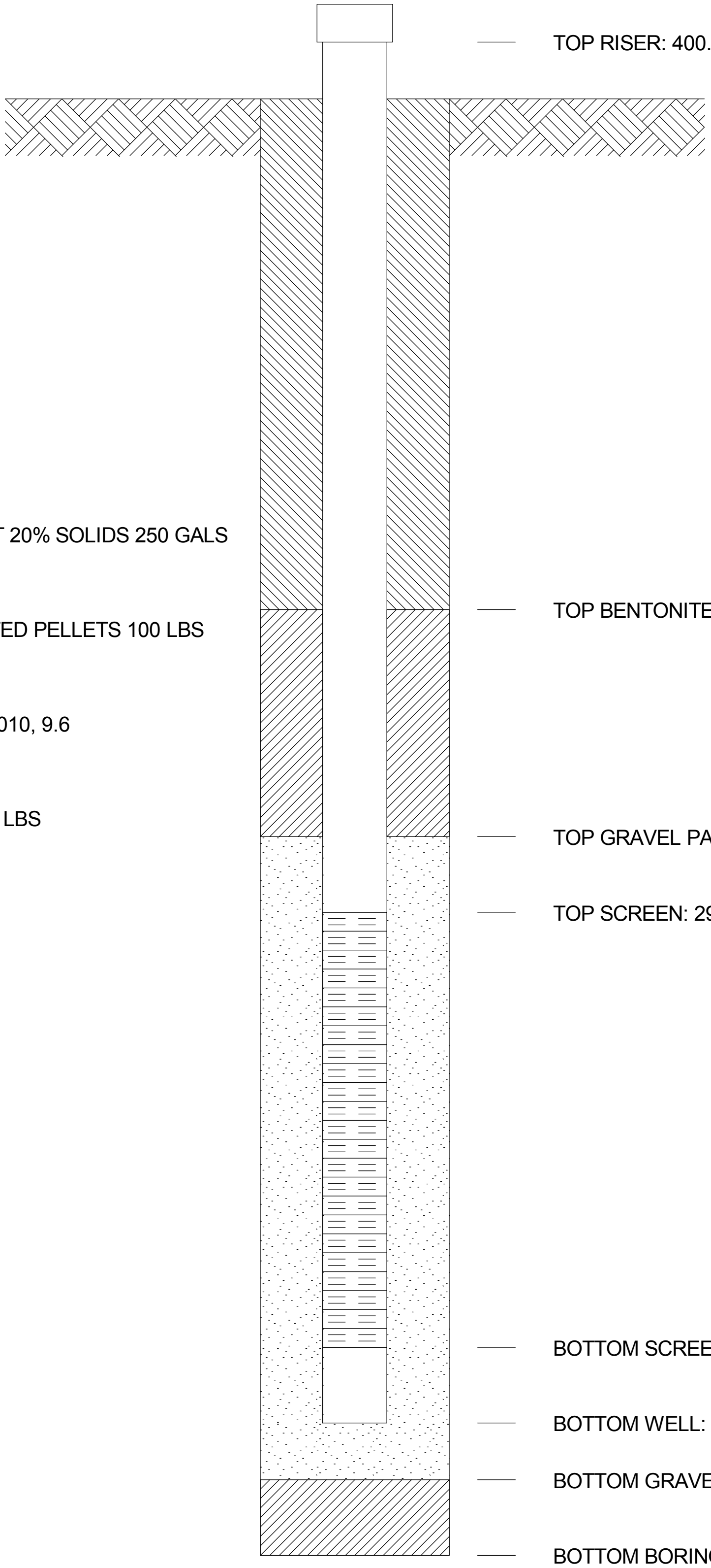
COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No. **MW-1606D** BORING No. **MW-1606D** INSTALLED **2/12/16**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 151,502.1 E 512,881.5**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 397.82 FT.



TOP RISER: 400.73 FT.

TOP BENTONITE SEAL: 306.32 FT.

TOP GRAVEL PACK: 300.12 FT.

TOP SCREEN: 297.62 FT.

BOTTOM SCREEN: 288.00 FT.

BOTTOM WELL: 287.60 FT.

BOTTOM GRAVEL PACK: 284.92 FT.

BOTTOM BORING: 284.92 FT.

▧ GROUT SEAL: QUICK GROUT 20% SOLIDS 250 GALS

▨ BENTONITE SEAL: 3/8" COATED PELLETS 100 LBS

▤ SCREEN: 2.0 dia., SLOTTED .010, 9.6

░ GRAVEL PACK: #5 SAND 350 LBS

☐ RISER PIPE: 2.0, dia., PVC

∿ SPACERS, DEPTH:

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER **42393125-01**

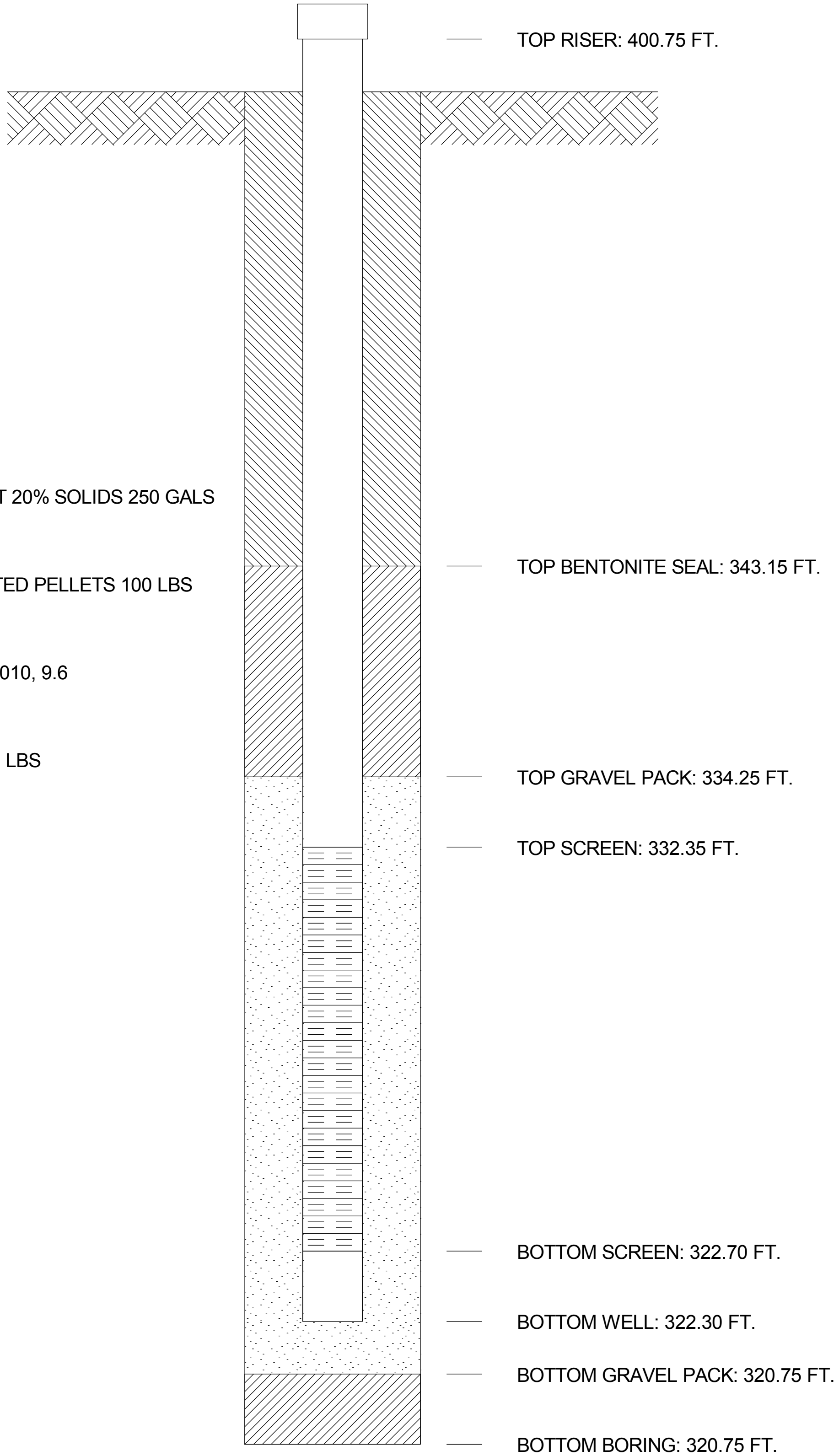
COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No. **MW-1606I** BORING No. **MW-1606I** INSTALLED **3/1/16**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 151,500.4 E 512,885.5**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 397.75 FT.



▧ GROUT SEAL: QUICK GROUT 20% SOLIDS 250 GALS

▨ BENTONITE SEAL: 3/8" COATED PELLETS 100 LBS

☰ SCREEN: 2.0 dia., SLOTTED .010, 9.6

⁘ GRAVEL PACK: #5 SAND 200 LBS

☐ RISER PIPE: 2.0, dia., PVC

∿ SPACERS, DEPTH:

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
MONITORING WELL CONSTRUCTION

JOB NUMBER **42393125-01**

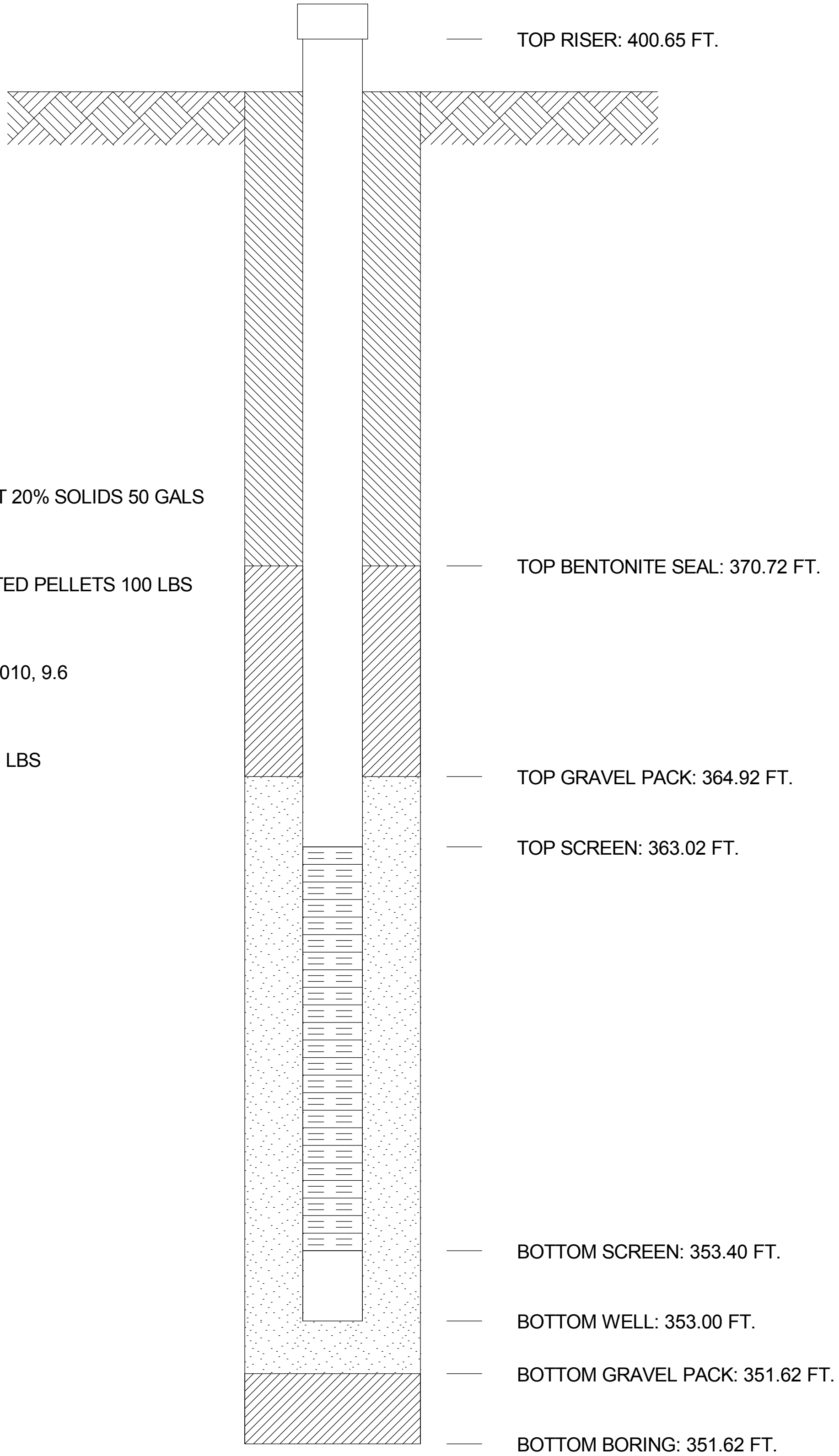
COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No. **MW-1606S** BORING No. **MW-1606S** INSTALLED **3/2/16**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 151,498.9 E 512,889.4**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 397.62 FT.



▧ GROUT SEAL: QUICK GROUT 20% SOLIDS 50 GALS

▨ BENTONITE SEAL: 3/8" COATED PELLETS 100 LBS

☰ SCREEN: 2.0 dia., SLOTTED .010, 9.6

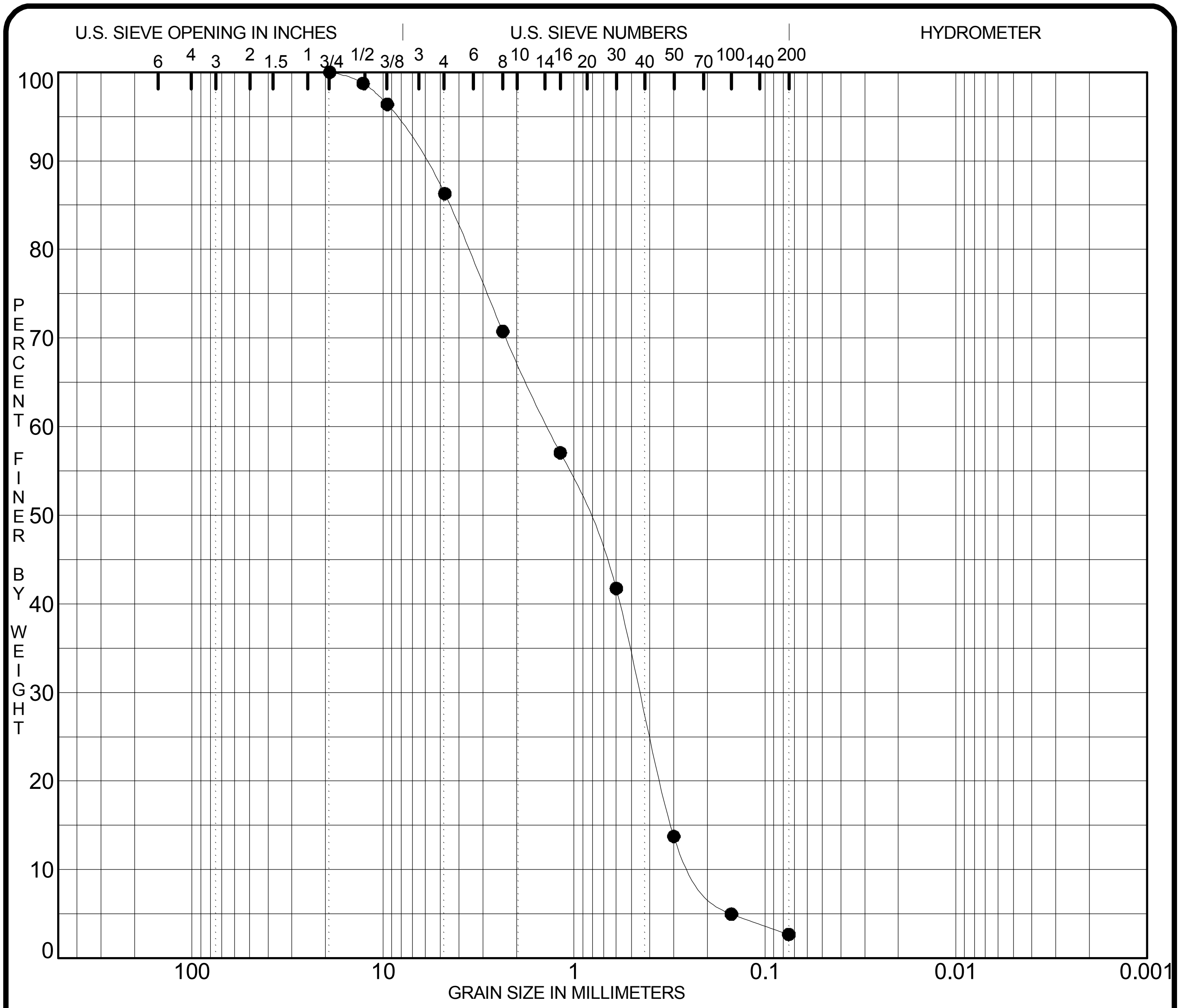
░ GRAVEL PACK: #5 SAND 225 LBS

☐ RISER PIPE: 2.0, dia., PVC

∿ SPACERS, DEPTH:

ATTACHMENT 2

GRADATION CURVES FOR SCREENED INTERVALS
2016 BA POND MONITORING WELLS



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
● **MW-1600D 84.5-94.1ft**		**13.5**					
	POORLY GRADED SAND SP						
	SS-57,58,59,60,61 (Composite)						
	N 154,306.3 E 512,449.0						
	ELEVATION 393.8						

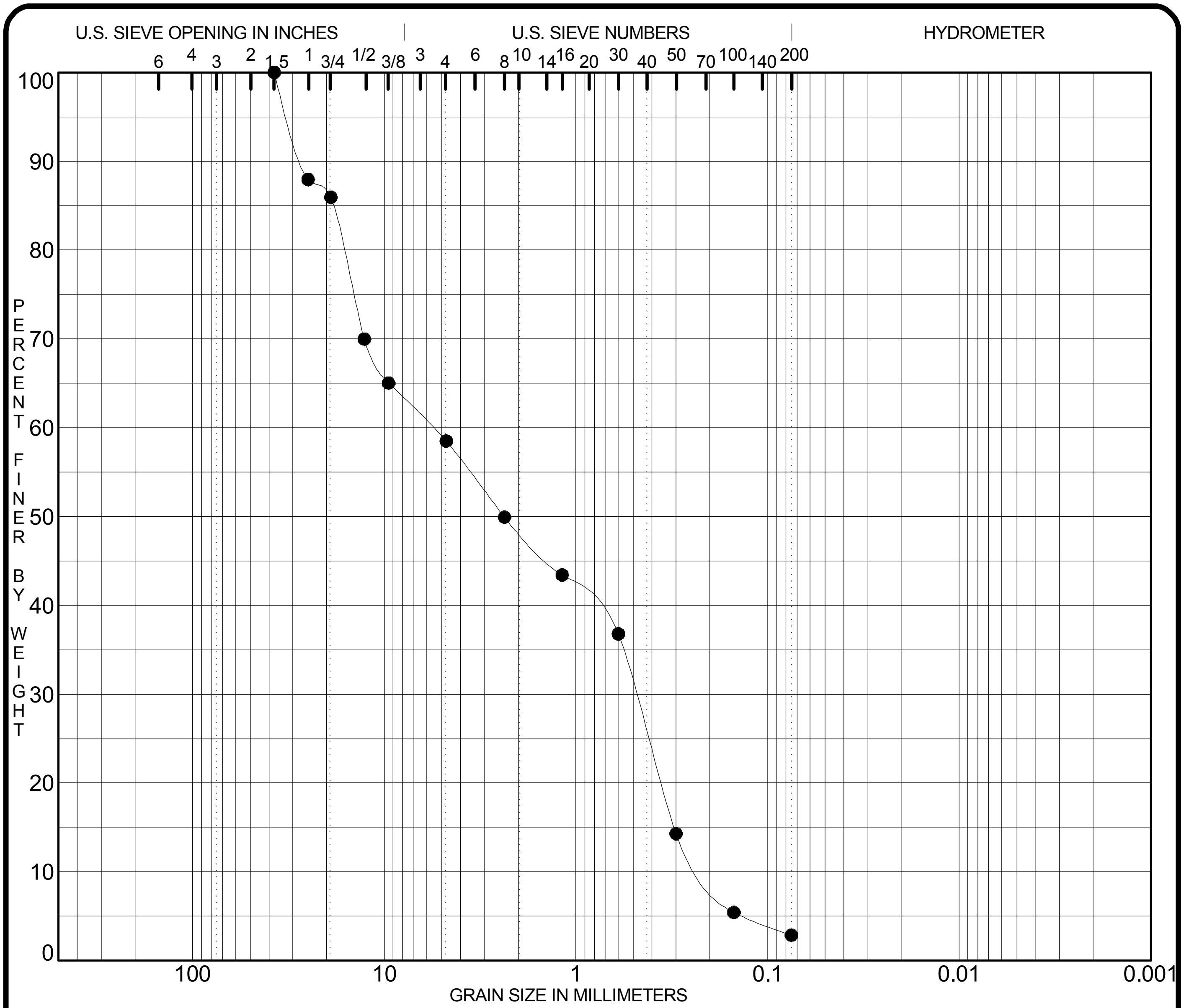
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● **MW-1600D 84.5-94.1ft**	**19.000**	**1.370**	**0.449**	**0.223**	**13.7**	**83.6**	**2.7**	

PROJECT **ROCKPORT PLANT -**

JOB NO. **42393125-01**
DATE **3/22/16**

GRADATION CURVES

American Electric Power Service Corp.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
● **MW-1600I 61.6-71.2ft**		**12.6**					
	POORLY GRADED SAND with GRAVEL SP						
	SS-42,43,44,45,46,47,48 (Composite)						
	N 154,306.0 E 512,454.0						
	ELEVATION 393.7						

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● **MW-1600I 61.6-71.2ft**	**37.500**	**5.568**	**0.487**	**0.214**	**41.5**	**55.6**	**2.9**	

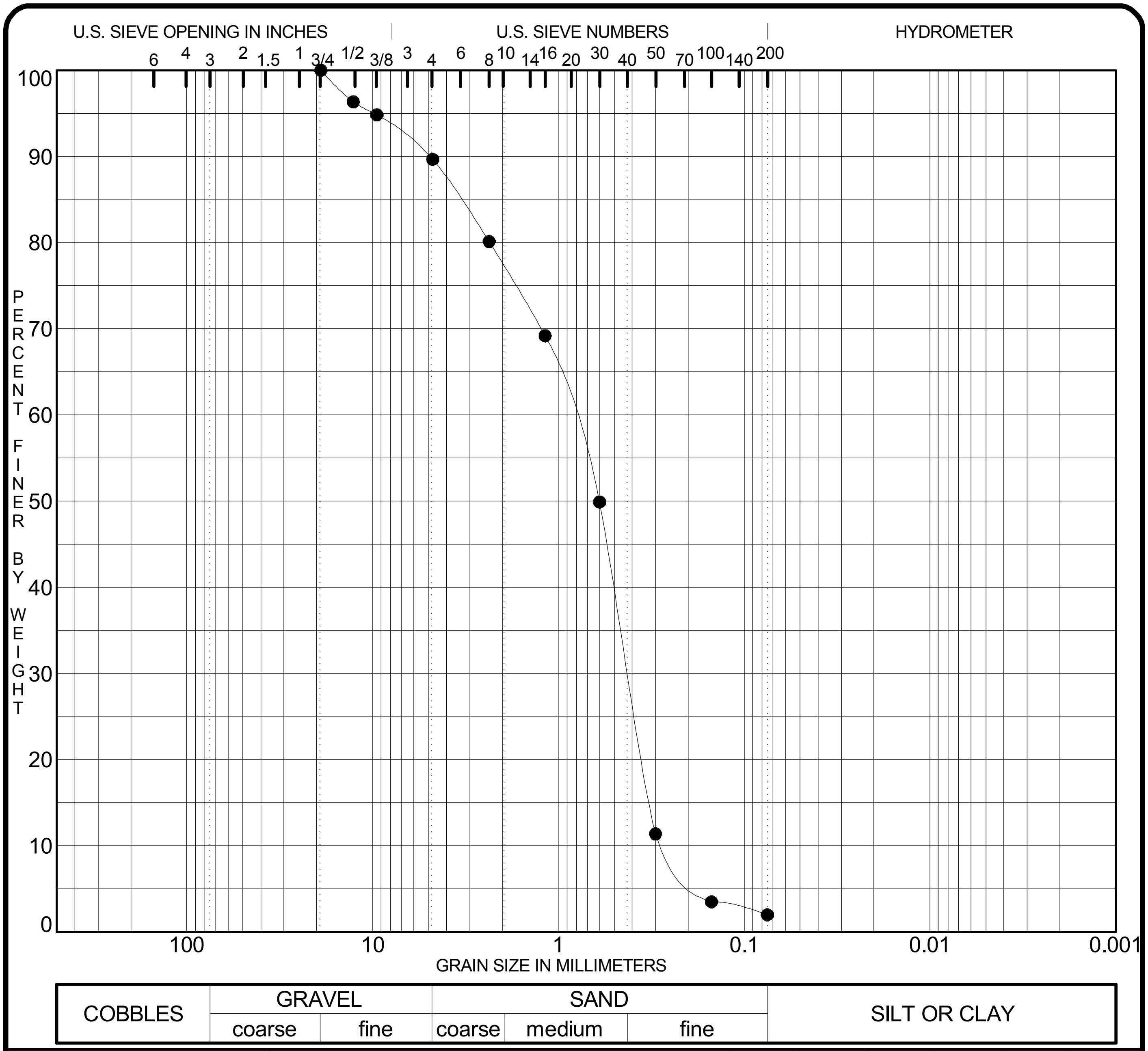
PROJECT **ROCKPORT PLANT -**

JOB NO. **42393125-01**
DATE **3/22/16**

GRADATION CURVES

American Electric Power Service Corp.

AEP



	Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
●	**MW-1600S 30.6-40.2ft**		**15.4**					
		POORLY GRADED SAND SP						
		SS-21,22,23,24,25,26,27,28 (Composite)						
		N 154,305.9 E 512,458.0						
		ELEVATION 393.7						

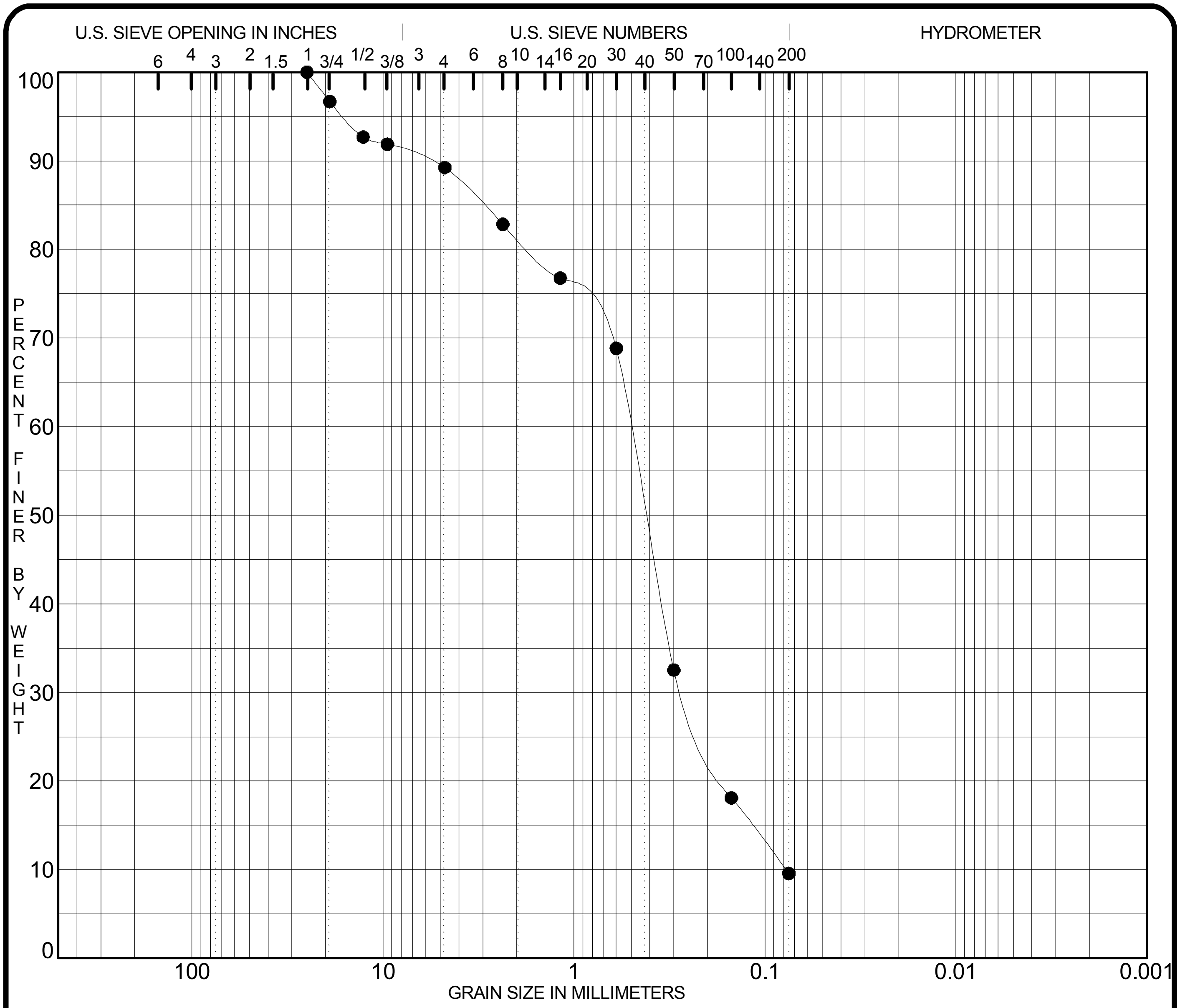
	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
●	**MW-1600S 30.6-40.2ft**	**19.000**	**0.855**	**0.419**	**0.266**	**10.3**	**87.7**	**2.0**	

PROJECT **ROCKPORT PLANT -**

JOB NO. **42393125-01**
DATE **3/22/16**

GRADATION CURVES

American Electric Power Service Corp.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
● **MW-1601D 99.8-109.4ft**		**23.9**					
	SS-68,69,70,71,72,73 (Composite)						
	N 154,323.2 E 513,487.5						
	ELEVATION 400.1						

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● **MW-1601D 99.8-109.4ft**	**25.000**	**0.507**	**0.266**	**0.078**	**10.8**	**79.7**	**9.6**	

PROJECT **ROCKPORT PLANT -**

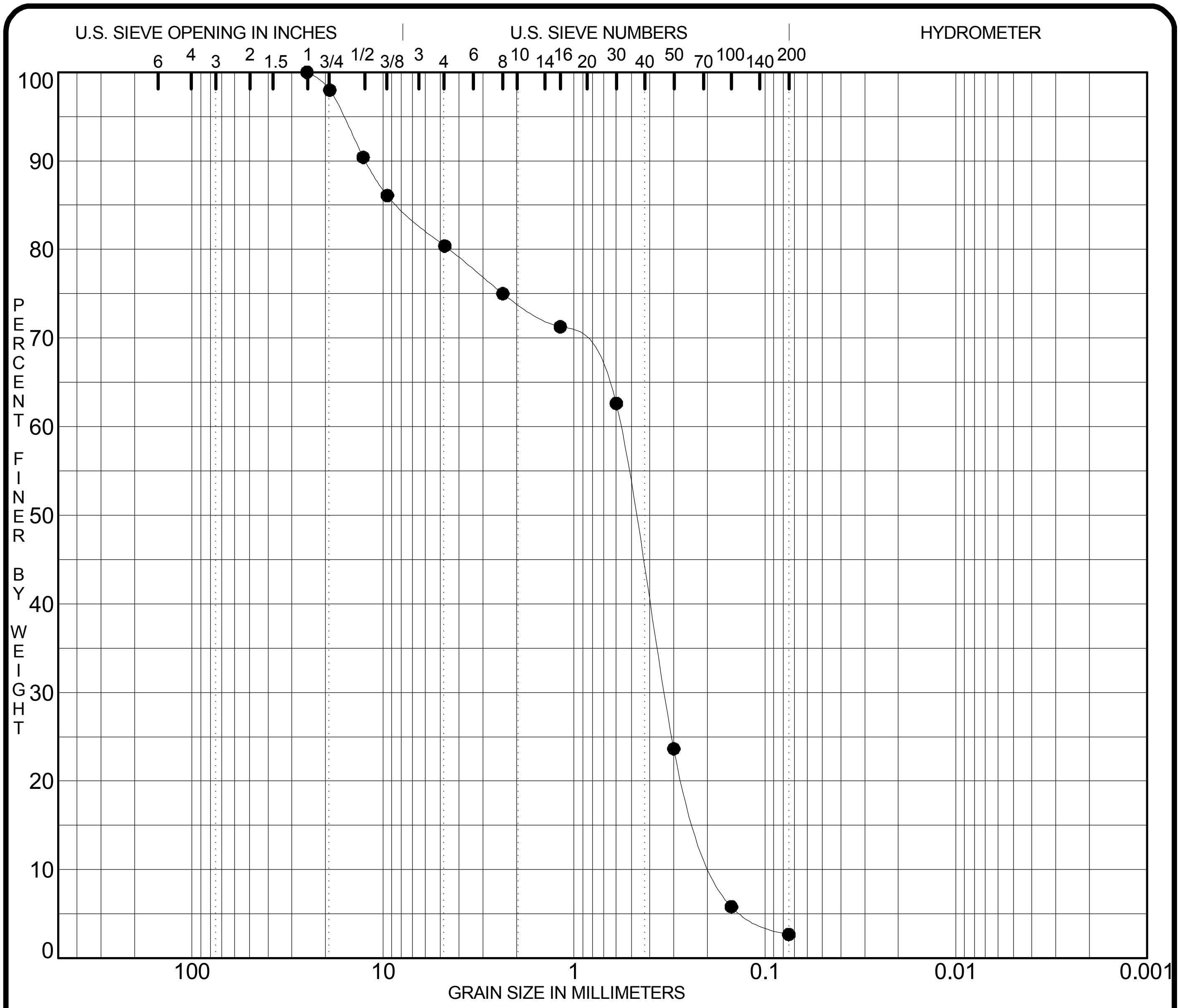
JOB NO. **42393125-01**

DATE **3/22/16**

GRADATION CURVES

American Electric Power Service Corp.

AEP



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
● **MW-1601I 67.8-77.4ft**		**15.7**					
	POORLY GRADED SAND with GRAVEL SP						
	SS-48,48,49,50,51 (Composite)						
	N 154,325.3 E 513,483.5						
	ELEVATION 400.0						

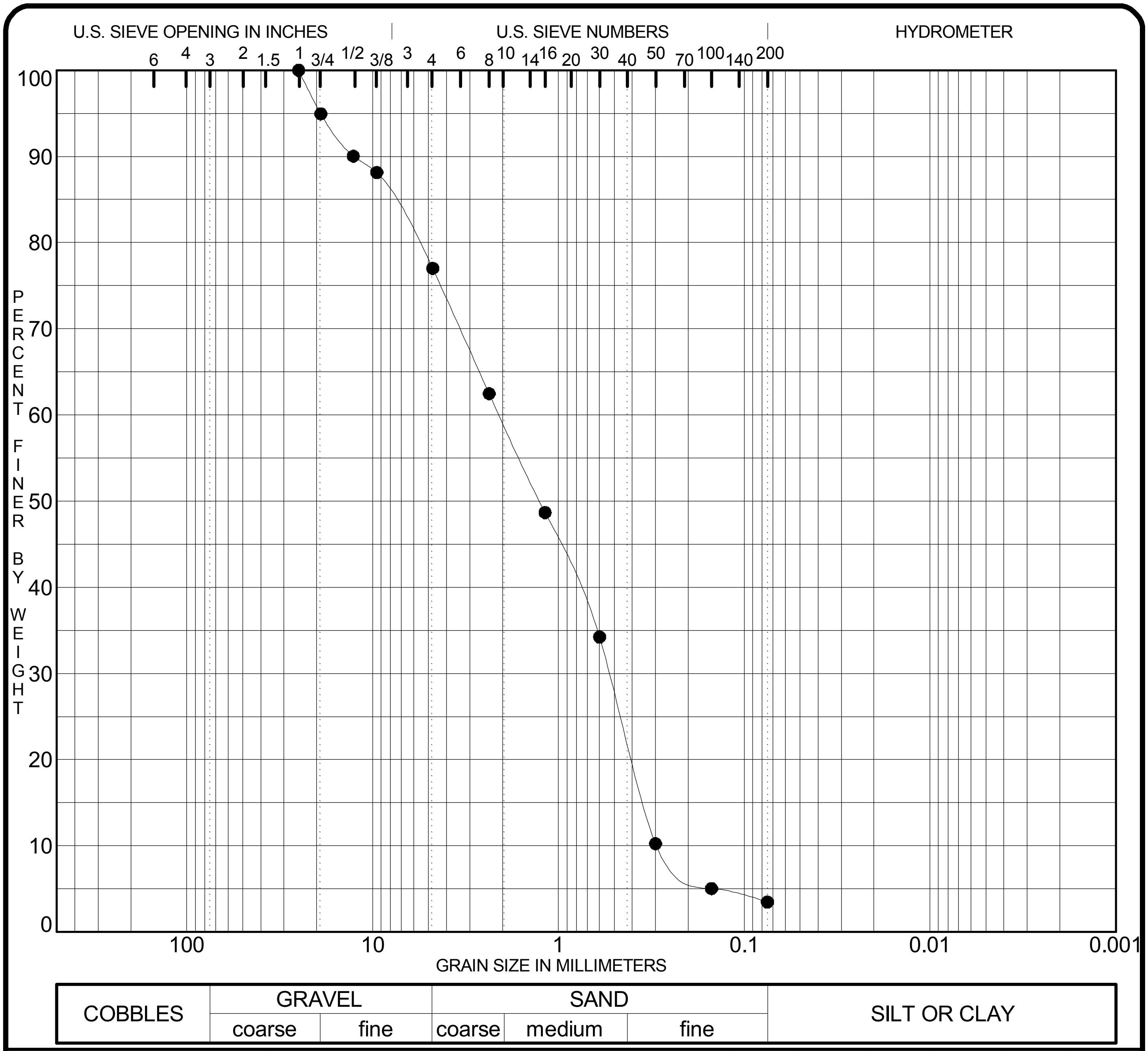
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● **MW-1601I 67.8-77.4ft**	**25.000**	**0.573**	**0.336**	**0.177**	**19.6**	**77.7**	**2.7**	

PROJECT **ROCKPORT PLANT -**

JOB NO. **42393125-01**
DATE **3/22/16**

GRADATION CURVES

American Electric Power Service Corp.



Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
● **MW-1601S 36.8-46.4ft**		**25.2**					
	POORLY GRADED SAND with GRAVEL SP						
	SS-26,27,28,29,30,31 (Composite)						
	N 154,327.6 E 513,479.7						
	ELEVATION 399.8						

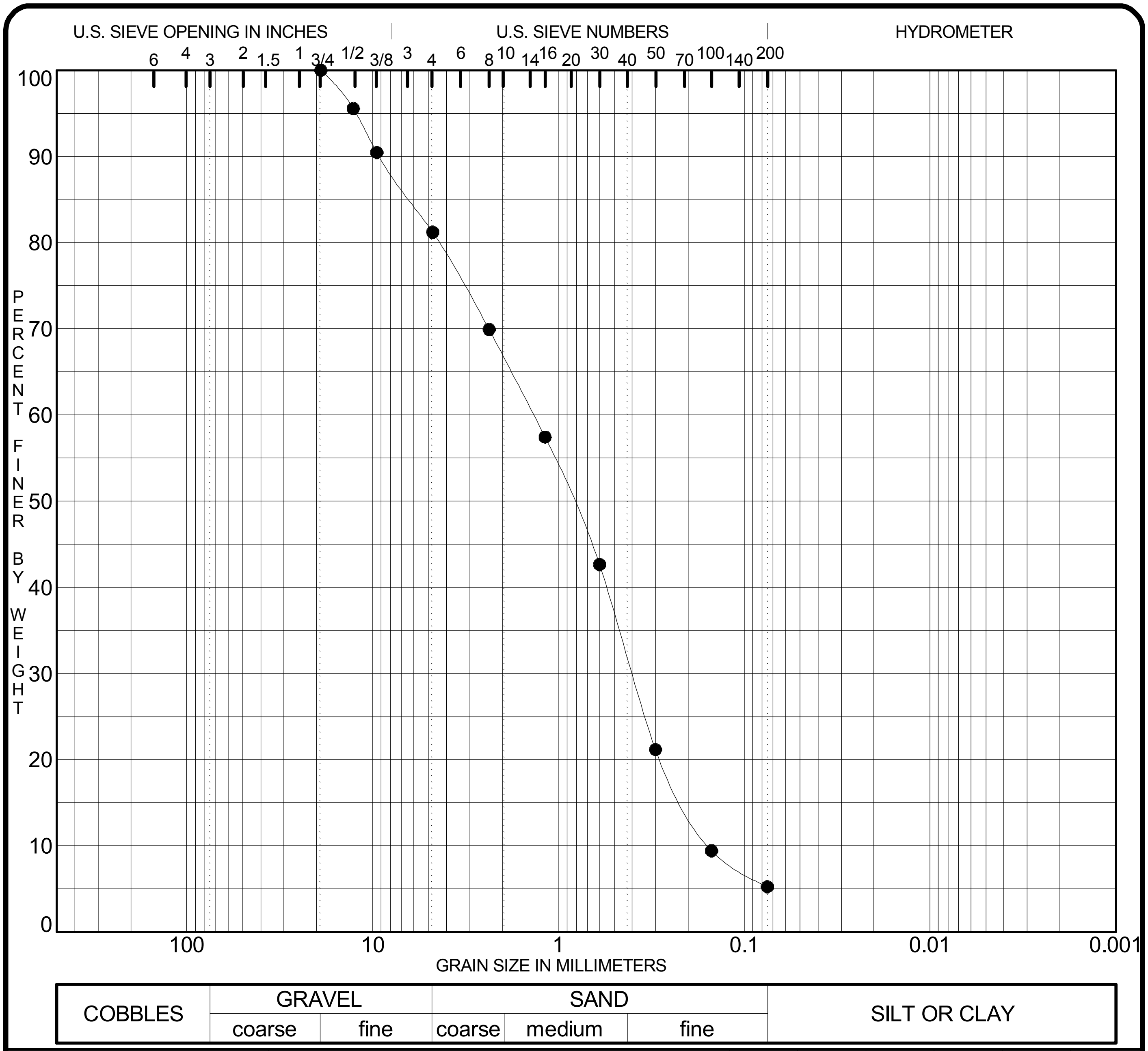
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● **MW-1601S 36.8-46.4ft**	**25.000**	**2.084**	**0.531**	**0.290**	**23.0**	**73.5**	**3.5**	

PROJECT **ROCKPORT PLANT -**

JOB NO. **42393125-01**
DATE **3/22/16**

GRADATION CURVES

American Electric Power Service Corp.



Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
● **MW-1602D 114.0-123.6ft**		**14.1**					
	N 152,300.2 E 514,229.4						
	ELEVATION 399.3						

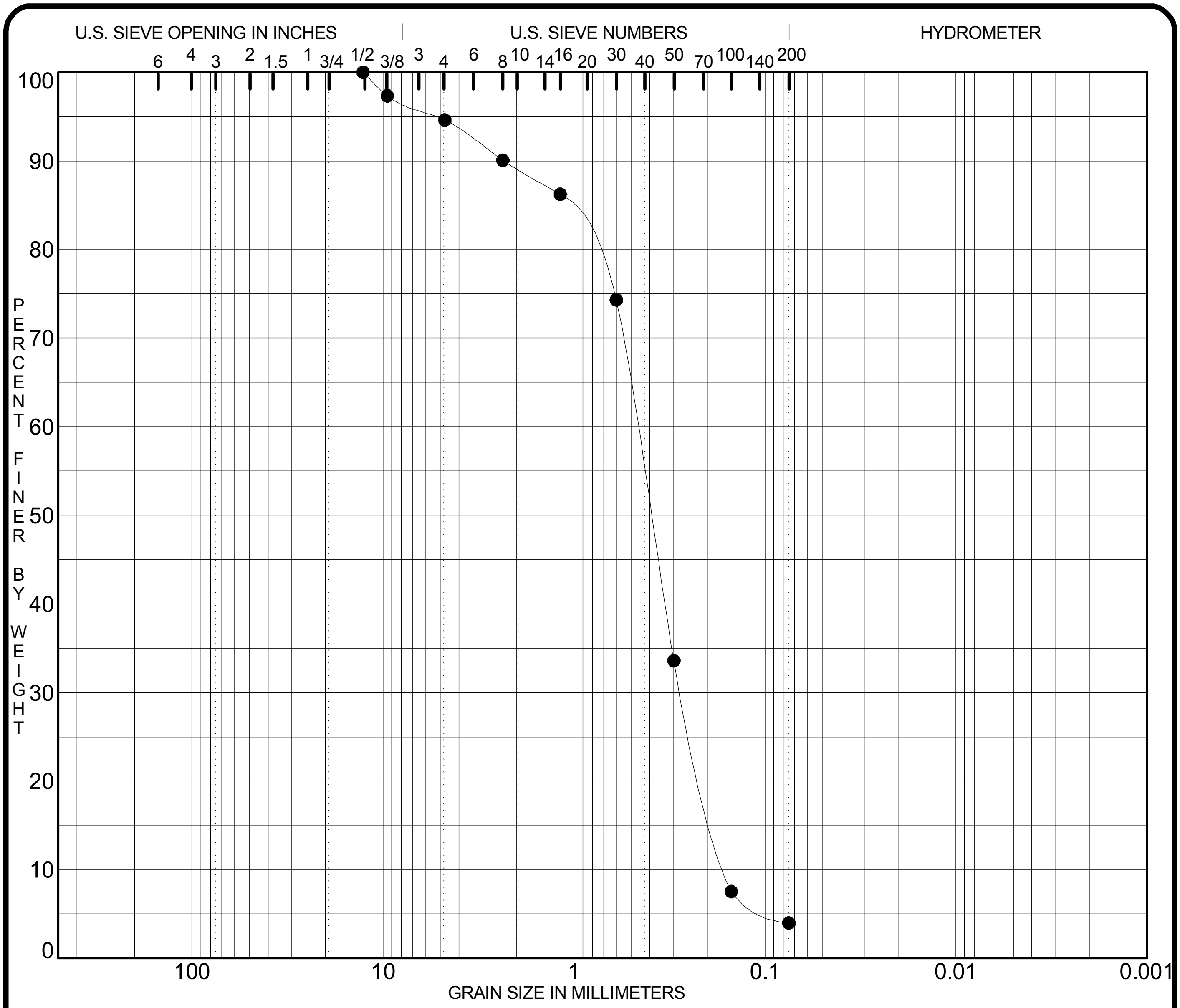
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● **MW-1602D 114.0-123.6ft**	**19.000**	**1.361**	**0.399**	**0.155**	**18.8**	**76.0**	**5.3**	

PROJECT **ROCKPORT PLANT -**

JOB NO. **42393125-01**
DATE **3/22/16**

GRADATION CURVES

American Electric Power Service Corp.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
● **MW-1602I 67.5-77.1ft**		**17.9**					
	POORLY GRADED SAND SP						
	N 152,295.0 E 514,229.2						
	ELEVATION 399.4						

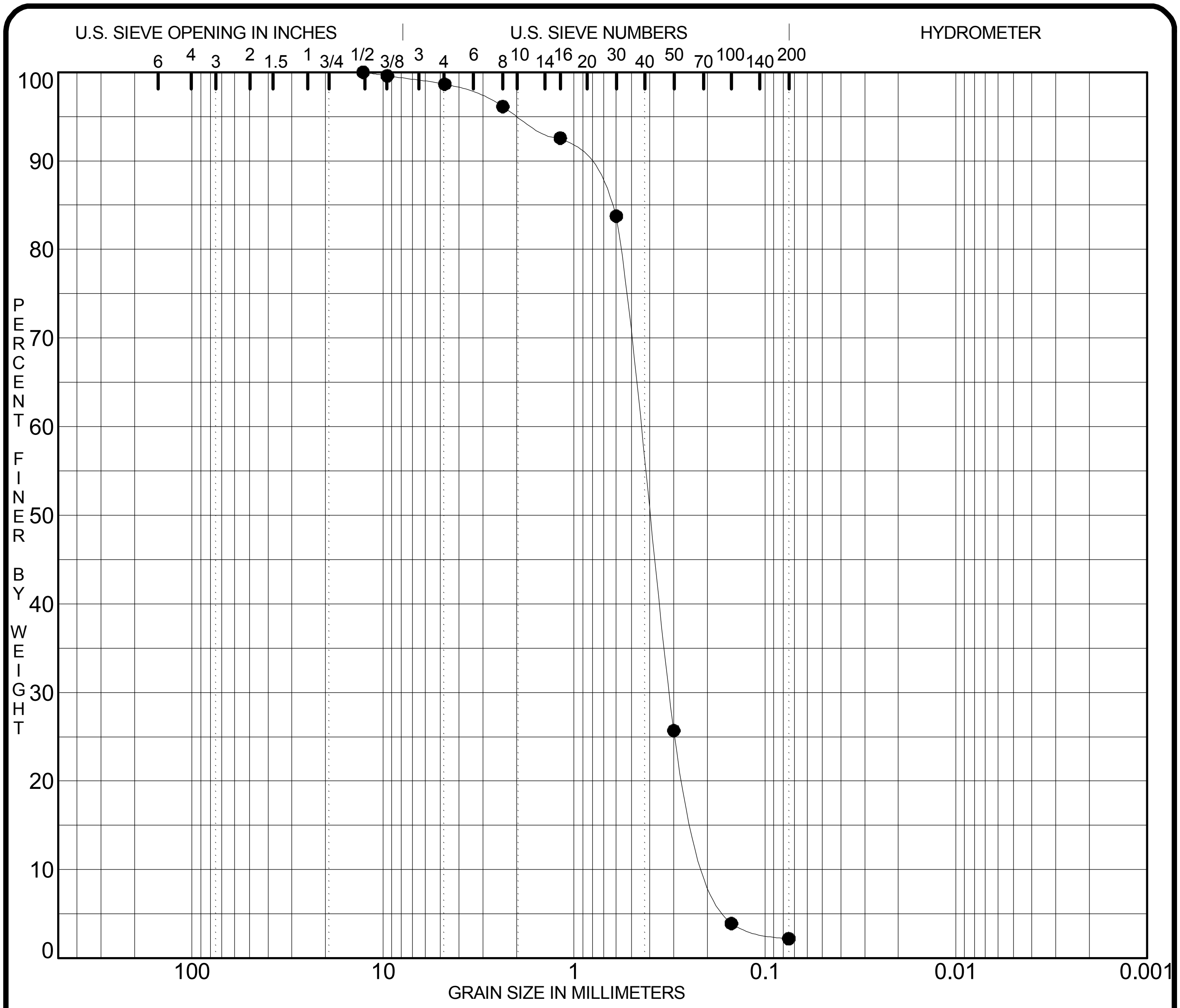
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● **MW-1602I 67.5-77.1ft**	**12.700**	**0.470**	**0.273**	**0.160**	**5.4**	**90.6**	**4.0**	

PROJECT **ROCKPORT PLANT -**

JOB NO. **42393125-01**
DATE **3/22/16**

GRADATION CURVES

American Electric Power Service Corp.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
●	**MW-1602S 35.5-45.5ft**		**21.8**					
		POORLY GRADED SAND SP						
		SS-24,25,26,27,28 (Composite Sample)						
		ELEVATION						

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
●	**MW-1602S 35.5-45.5ft**	**12.700**	**0.452**	**0.316**	**0.182**	**1.3**	**96.4**	**2.2**	

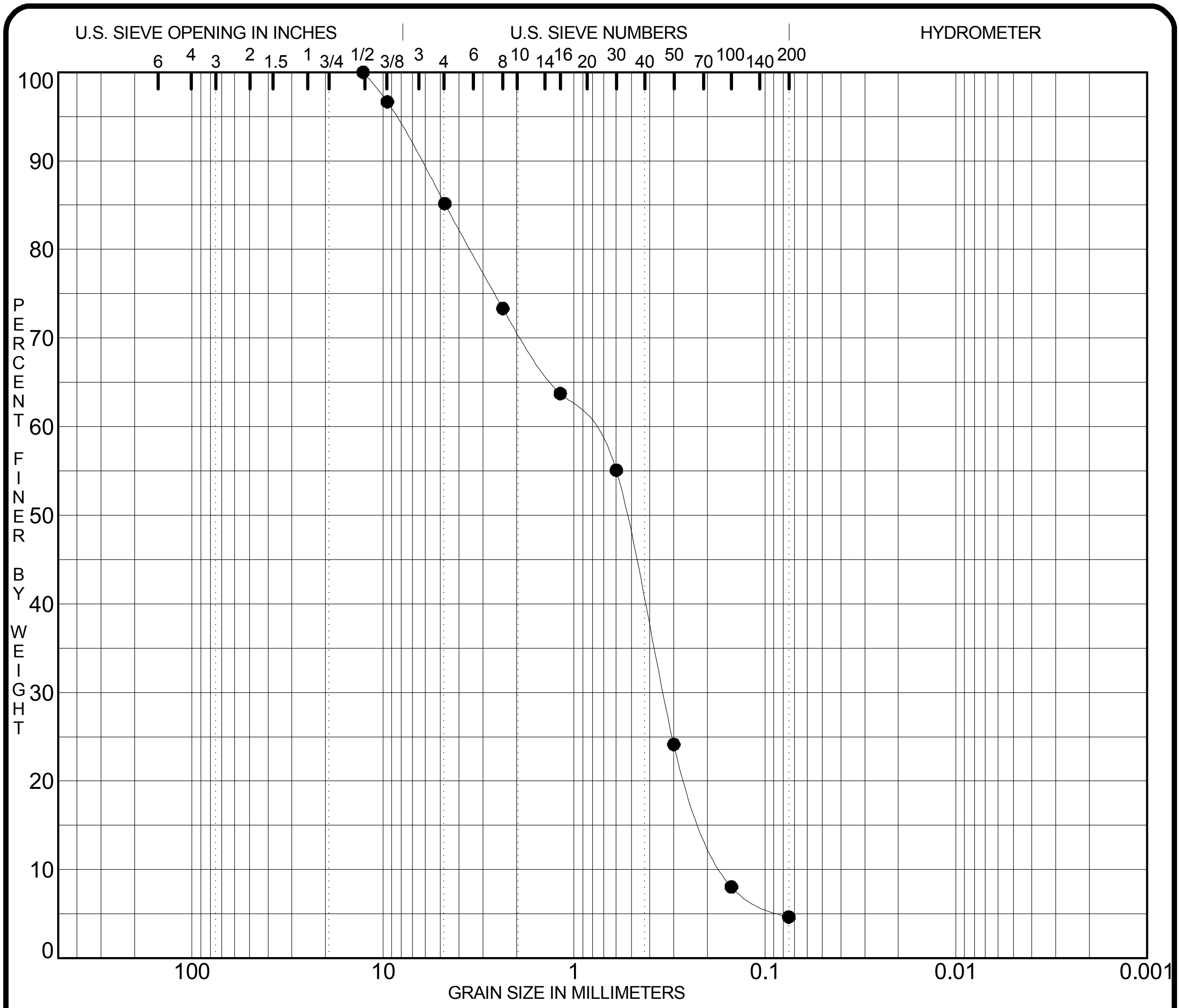
PROJECT **ROCKPORT PLANT -**

JOB NO. **42393125-01**

DATE **3/22/16**

GRADATION CURVES

American Electric Power Service Corp.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
● **MW-1603D 110.0-119.6ft**		**10.7**					
	POORLY GRADED SAND SP						
	SS-75,76,77,78,79 (Composite Sample)						
	N 152,811.9 E 514,207.5						
	ELEVATION 401.6						

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● **MW-1603D 110.0-119.6ft**	**12.700**	**0.881**	**0.342**	**0.163**	**14.8**	**80.5**	**4.7**	

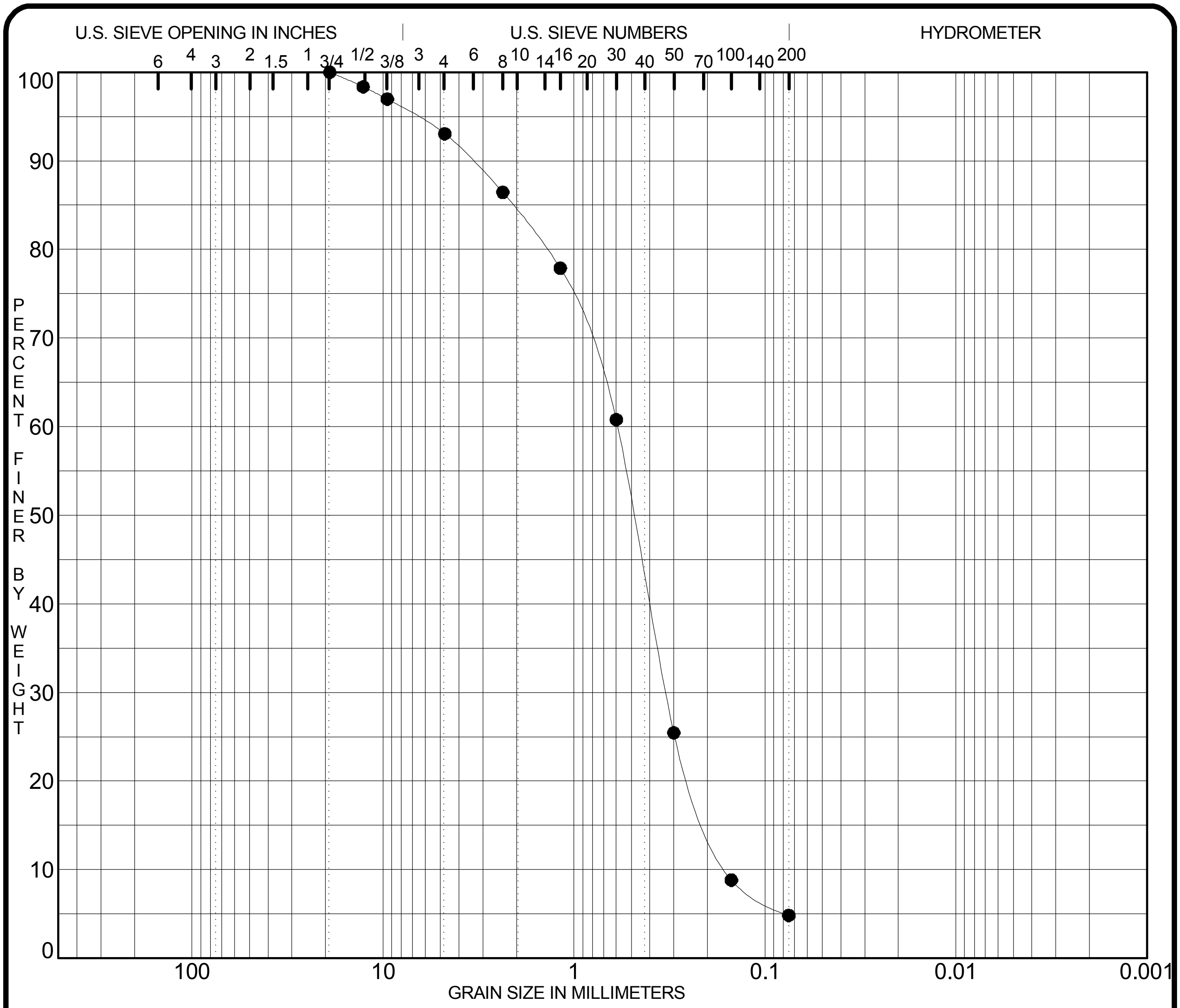
PROJECT **ROCKPORT PLANT -**

JOB NO. **42393125-01**

DATE **3/22/16**

GRADATION CURVES

American Electric Power Service Corp.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
● **MW-1603I 68.6-78.2ft**		**15.4**					
	POORLY GRADED SAND SP						
	SS-47,48,49,50,51,52 (Composite						
	N 152,807.8 E 519,207.2 Sample)						
	ELEVATION 401.4						

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● **MW-1603I 68.6-78.2ft**	**19.000**	**0.591**	**0.328**	**0.158**	**6.9**	**88.2**	**4.8**	

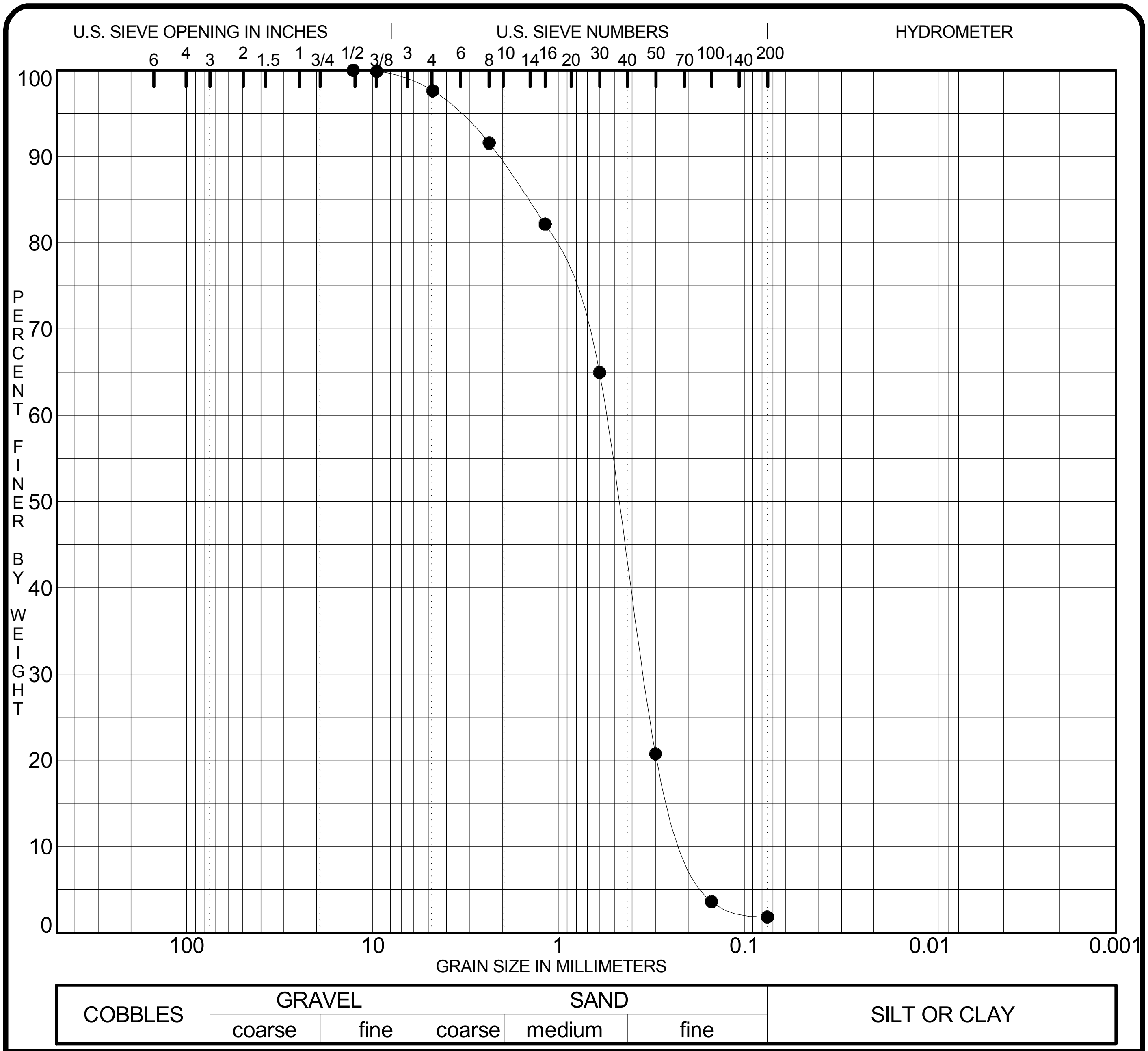
PROJECT **ROCKPORT PLANT -**

JOB NO. **42393125-01**
DATE **3/22/16**

GRADATION CURVES

American Electric Power Service Corp.

AEP



Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
● **MW-1603S 37.6-47.2ft**		**16.3**					
	POORLY GRADED SAND SP						
	SS-27,28,29,30 (Composite Sample)						
	N 152,802.7 E 514,206.9						
	ELEVATION 401.5						

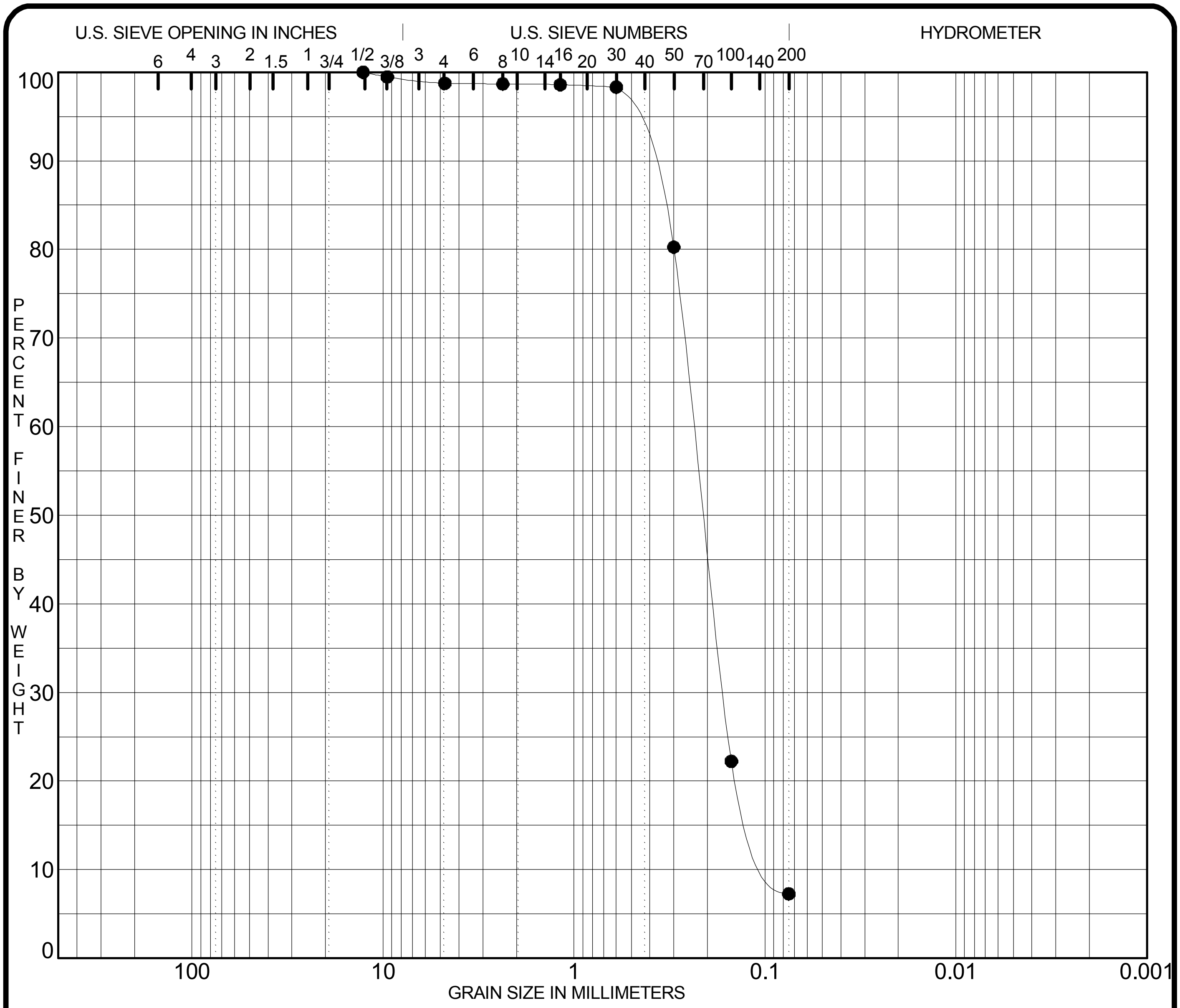
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● **MW-1603S 37.6-47.2ft**	**12.700**	**0.555**	**0.347**	**0.194**	**2.4**	**95.8**	**1.8**	

PROJECT **ROCKPORT PLANT -**

JOB NO. **42393125-01**
DATE **3/22/16**

GRADATION CURVES

American Electric Power Service Corp.



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<tr><td rowspan="2">COBBLES</td><td colspan="2">GRAVEL</td><td colspan="3">SAND</td><td rowspan="2">SILT OR CLAY</td></tr>
<tr><td>coarse</td><td>fine</td><td>coarse</td><td>medium</td><td>fine</td></tr>
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Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
● **MW-1604D 115.0-124.6ft**		**24.9**					
	SS-78,79,80,81,82,83 (Composite Sample)						
	N 151,518.2 E 514,204.9						
	ELEVATION 399.9						

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● **MW-1604D 115.0-124.6ft**	**12.700**	**0.236**	**0.165**	**0.085**	**1.3**	**91.5**	**7.3**	

PROJECT **ROCKPORT PLANT -**

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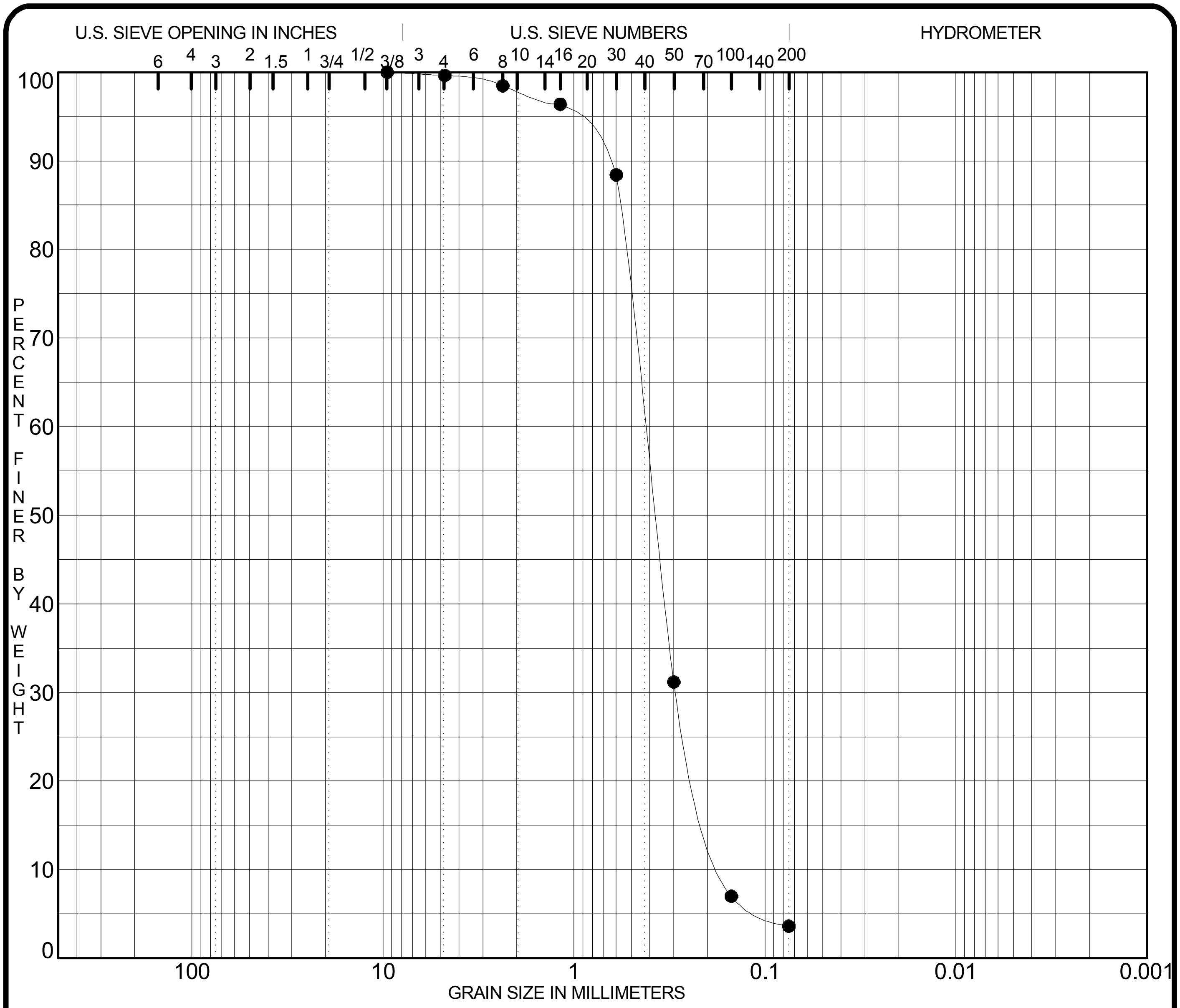
GRADATION CURVES

American Electric Power Service Corp.

AEP



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
● **MW-1604I 68.0-77.6ft**		**19.4**					
	POORLY GRADED SAND SP						
	SS-47,48,49,50,51 (Composite Sample)						
	N 151,506.5 E 514,201.0						
	ELEVATION 399.7						

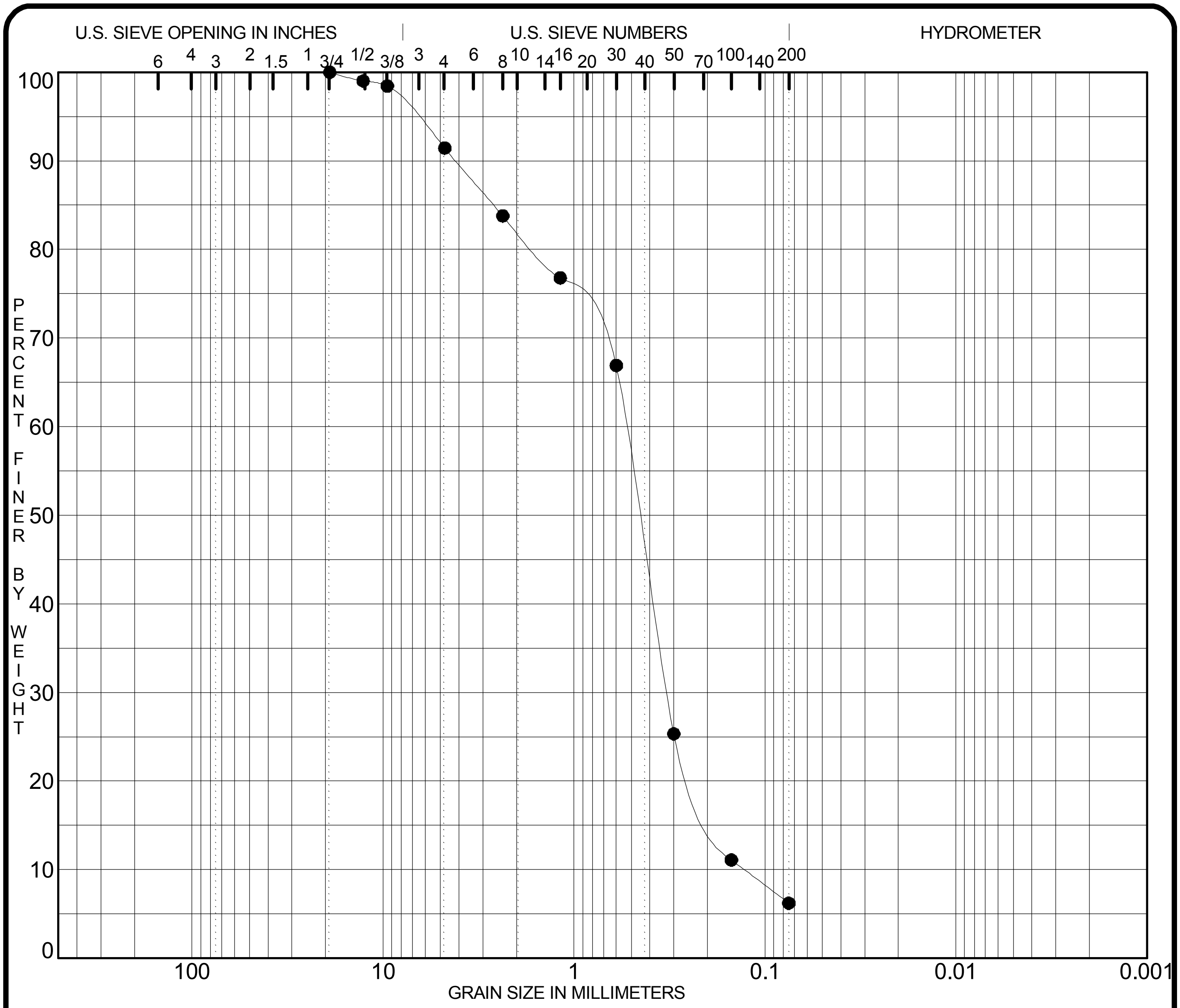
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● **MW-1604I 68.0-77.6ft**	**9.500**	**0.425**	**0.290**	**0.163**	**0.4**	**96.0**	**3.6**	

PROJECT **ROCKPORT PLANT -**

JOB NO. **42393125-01**
DATE **3/22/16**

GRADATION CURVES

American Electric Power Service Corp.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
● **MW-1604S 37.0-46.6ft**		**15.5**					
	SS-26,27,28,29,30,31 (Composite Sample)						
	N 151,503.4 E 514,197.3						
	ELEVATION 399.8						

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● **MW-1604S 37.0-46.6ft**	**19.000**	**0.535**	**0.324**	**0.128**	**8.6**	**85.2**	**6.2**	

PROJECT **ROCKPORT PLANT -**

JOB NO. **42393125-01**
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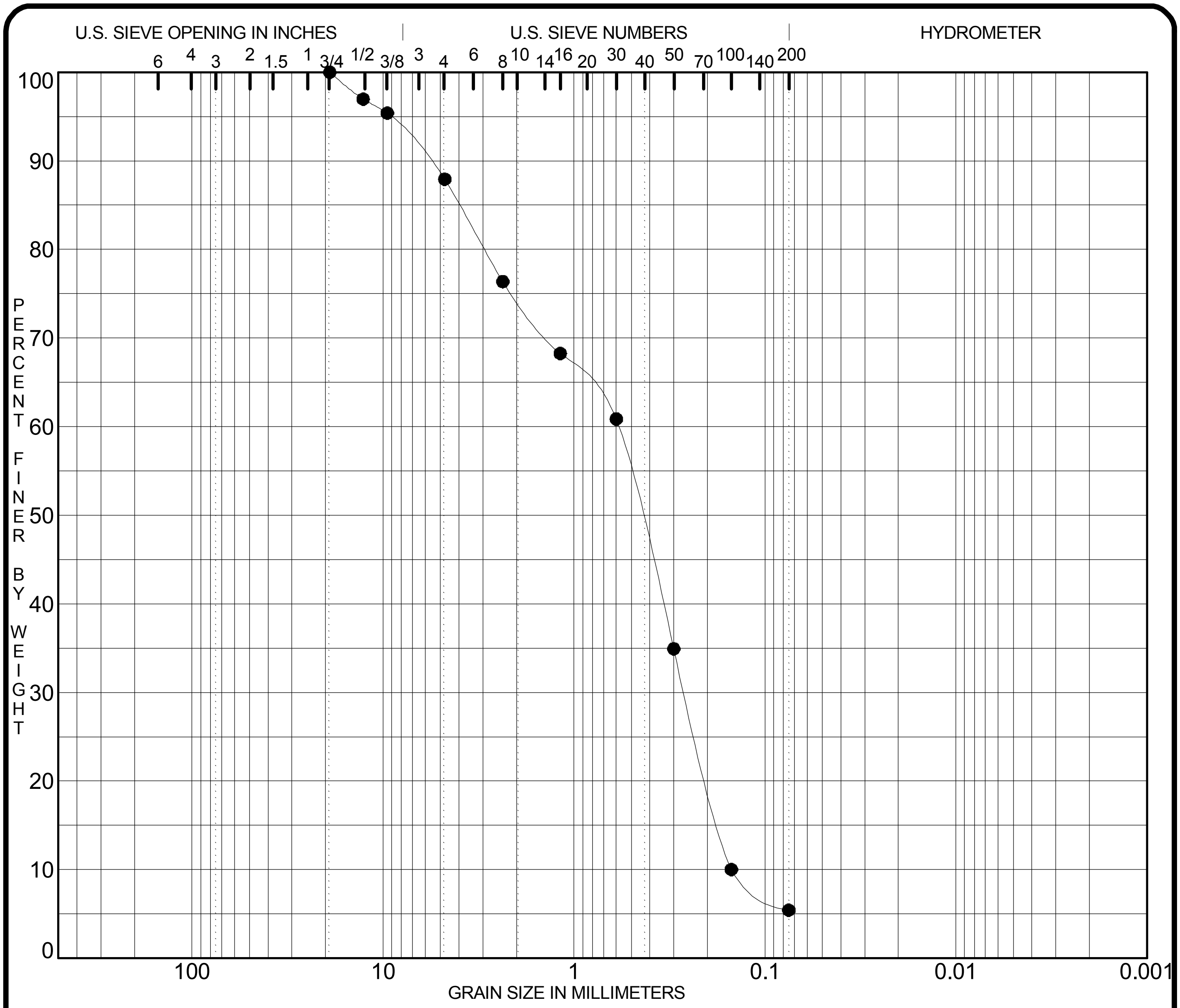
GRADATION CURVES

American Electric Power Service Corp.

AEP



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
● **MW-1605D115.0-124.6ft**		**14.5**					
	SS-78,79,80,81,82,83 (Composite						
	Sample) **N 151,478.9 E 513,537.1**						
	ELEVATION 400.4						

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● **MW-1605D115.0-124.6ft**	**19.000**	**0.586**	**0.262**	**0.150**	**12.1**	**82.5**	**5.4**	

PROJECT **ROCKPORT PLANT -**

JOB NO. **42393125-01**
DATE **3/22/16**

GRADATION CURVES

American Electric Power Service Corp.

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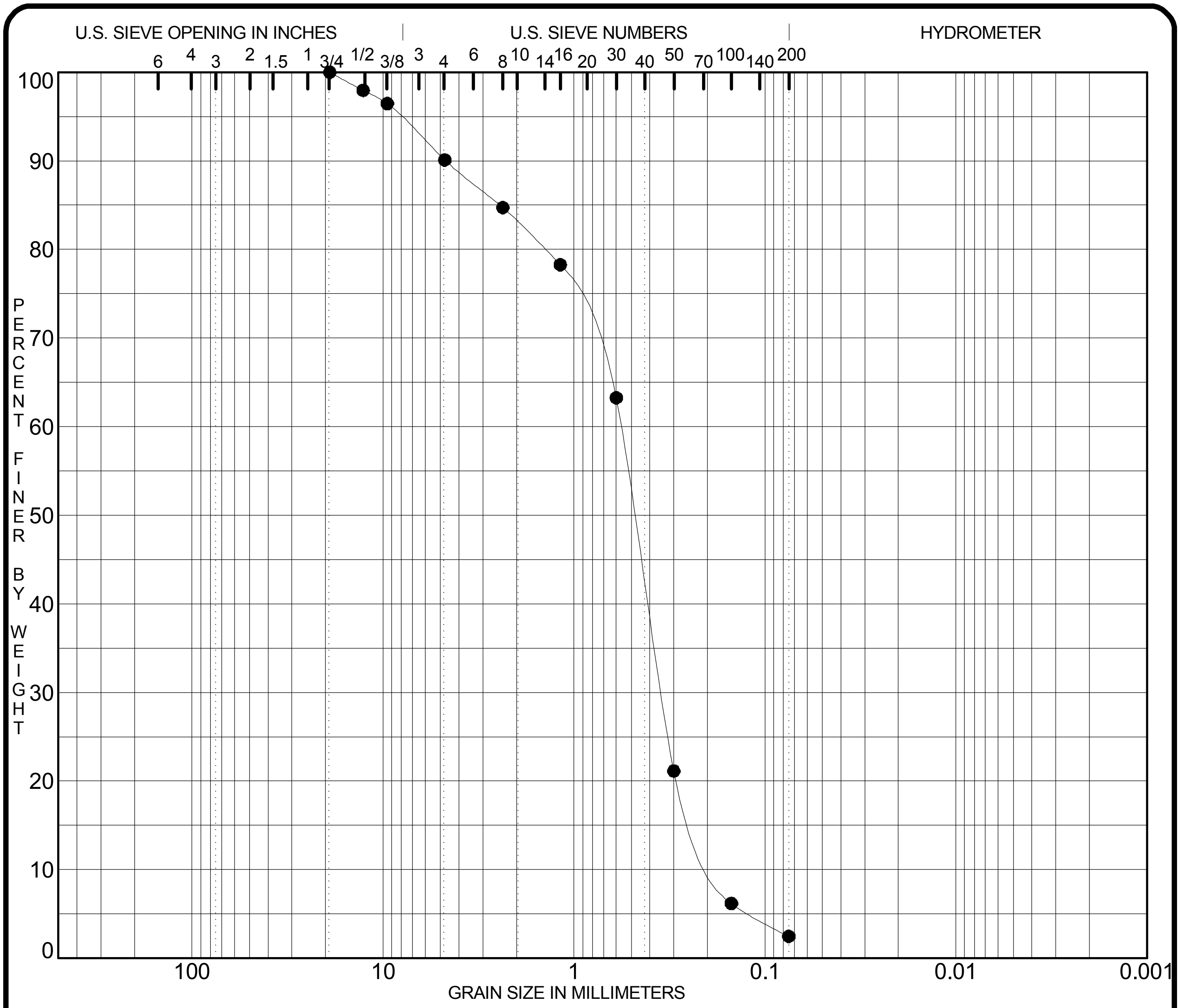


COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
● **MW-1605I 68.6-78.2ft**		**19.7**					
	POORLY GRADED SAND SP						
	SS-48,49,50,51,52 (Composite Sample)						
	N 151,478.9 E 513,532.6						
	ELEVATION 400.6						

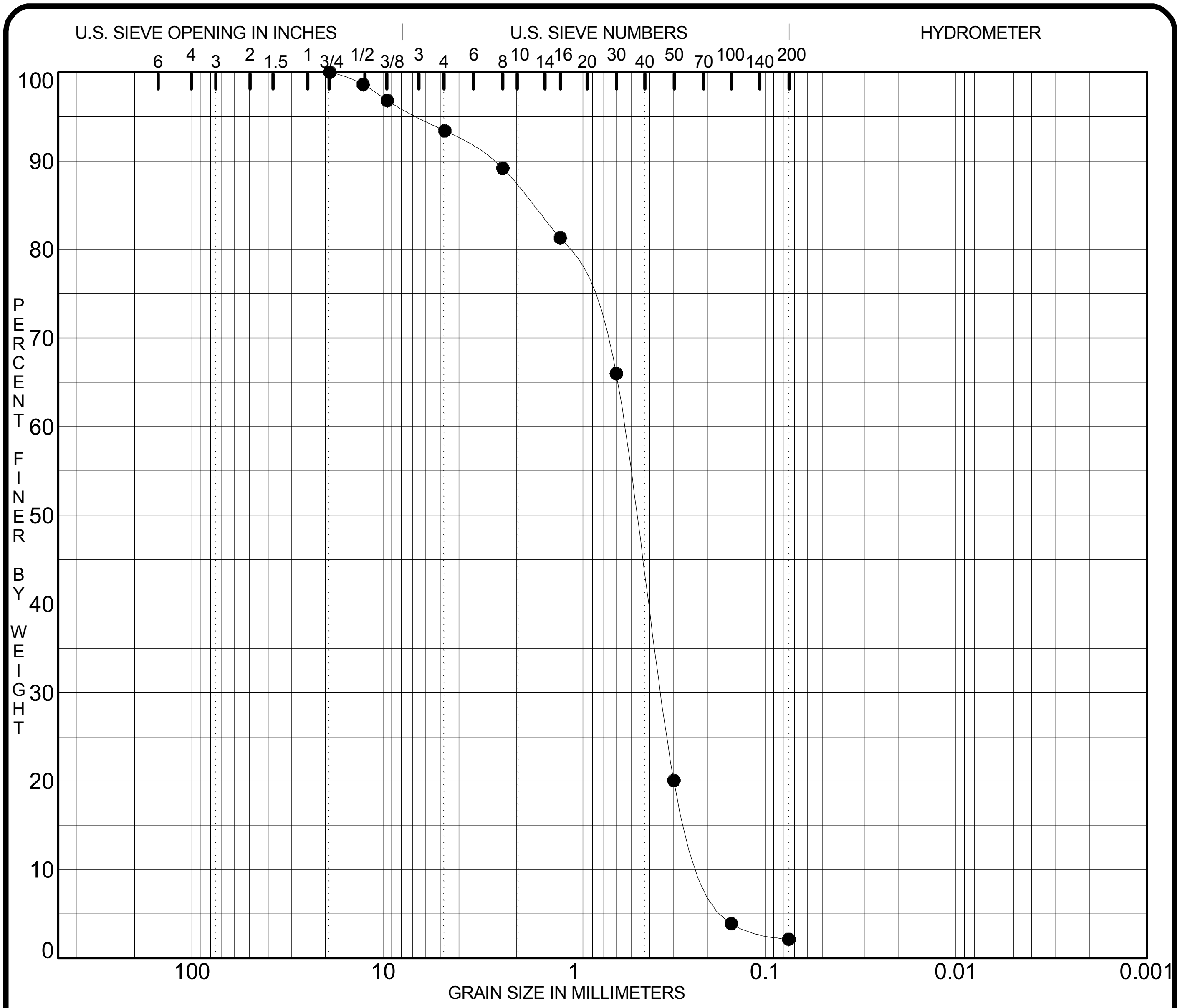
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● **MW-1605I 68.6-78.2ft**	**19.000**	**0.569**	**0.347**	**0.179**	**9.9**	**87.6**	**2.5**	

PROJECT **ROCKPORT PLANT -**

JOB NO. **42393125-01**
DATE **3/22/16**

GRADATION CURVES

American Electric Power Service Corp.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
● **MW-1605S 37.6-47.2ft**		**16.0**					
	POORLY GRADED SAND SP						
	SS-27,28,29,30,31 (Composite Sample)						
	N 151,478.8 E 513,528.4						
	ELEVATION 400.3						

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● **MW-1605S 37.6-47.2ft**	**19.000**	**0.548**	**0.349**	**0.195**	**6.6**	**91.3**	**2.1**	

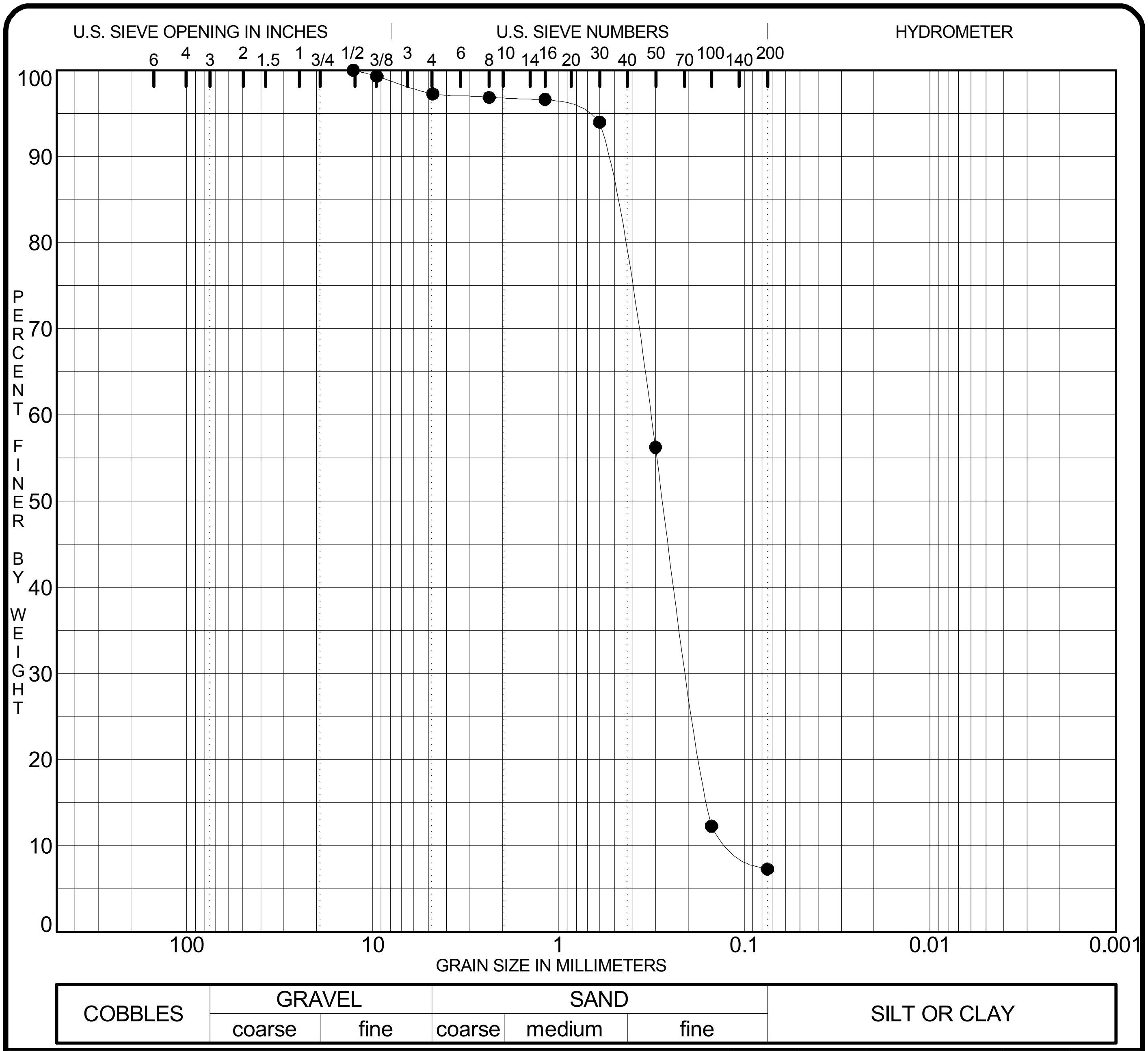
PROJECT **ROCKPORT PLANT -**

JOB NO. **42393125-01**
DATE **3/22/16**

GRADATION CURVES

American Electric Power Service Corp.

AEP



Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
● **MW-1606D100.0-109.6ft**		**28.6**					
	SS-68,69,70,71,72,73 (Composite Sample)						
	N 151,502.1 E 512,881.5						
	ELEVATION 397.8						

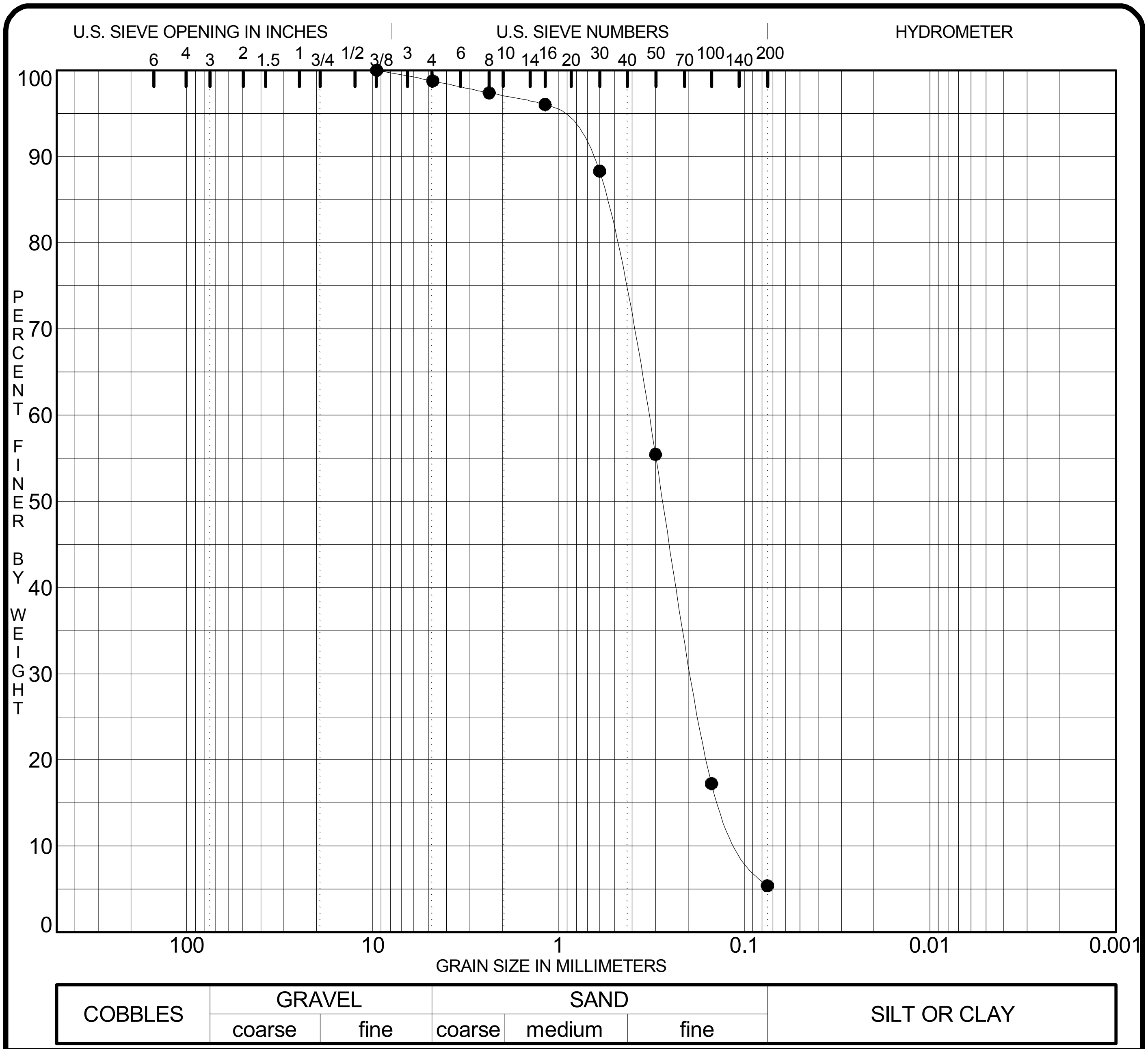
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● **MW-1606D100.0-109.6ft**	**12.700**	**0.321**	**0.198**	**0.109**	**2.7**	**90.0**	**7.3**	

PROJECT **ROCKPORT PLANT -**

JOB NO. **42393125-01**
DATE **3/22/16**

GRADATION CURVES

American Electric Power Service Corp.



Specimen Identification		Classification	MC%	LL	PL	PI	Sp.Gr.	
● **MW-1606I**	**65.7-75.3ft**		**18.9**					
		SS-45,46,47,48,49,50 (Composite						
		N 151,508.4 Sample) E 512,885.5						
		ELEVATION 397.8						

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● **MW-1606I**	**65.7-75.3ft**	**9.500**	**0.330**	**0.189**	**0.098**	**1.2**	**93.4**	**5.4**	

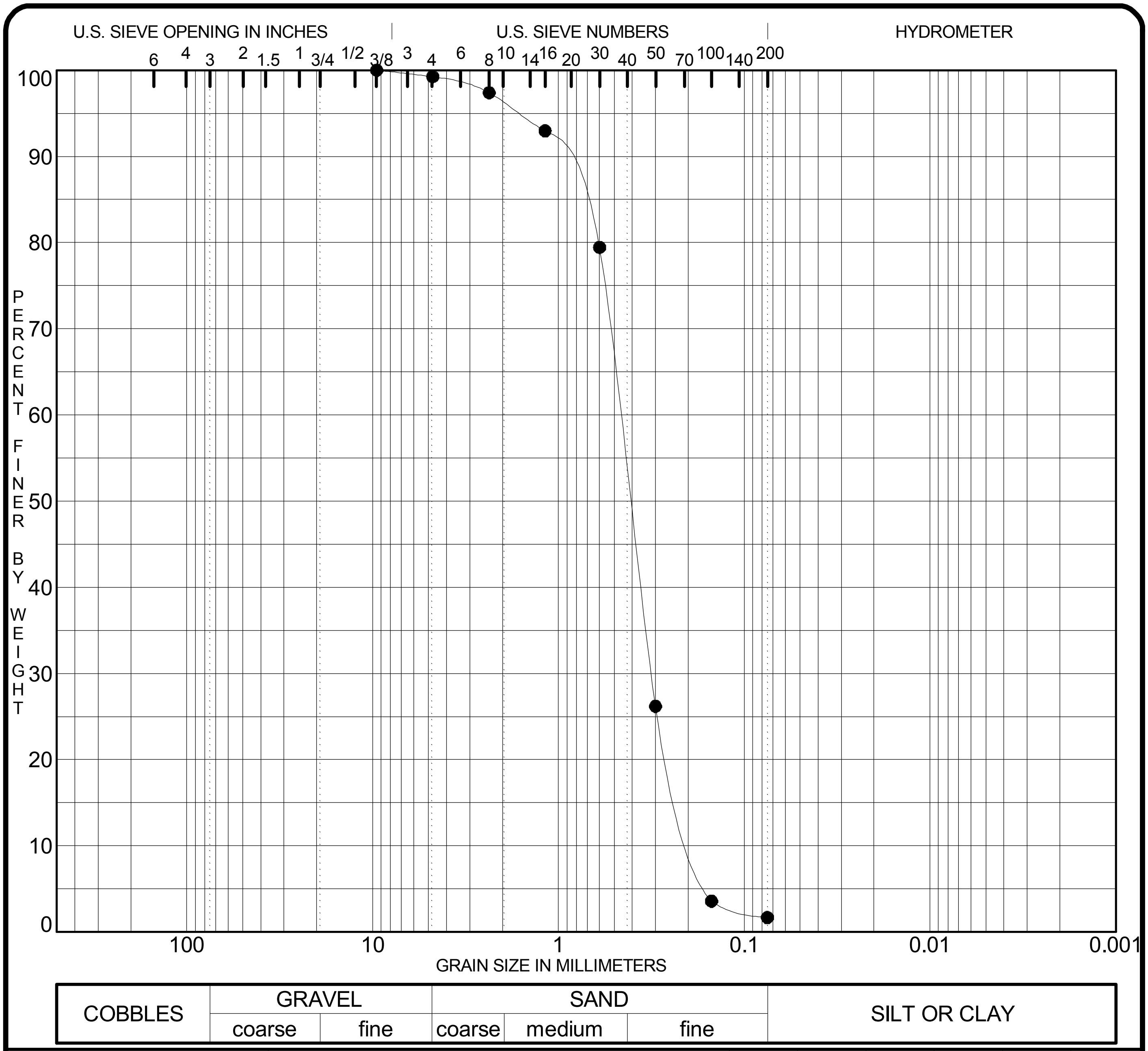
PROJECT **ROCKPORT PLANT -**

JOB NO. **42393125-01**
DATE **3/22/16**

GRADATION CURVES

American Electric Power Service Corp.

AEP



Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
● **MW-1606S 34.7-44.3ft**		**20.9**					
	POORLY GRADED SAND SP						
	SS-25,26,27,28,29 (Composite Sample)						
	N 151,498.9 E 512,889.4						
	ELEVATION 397.6						

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● **MW-1606S 34.7-44.3ft**	**9.500**	**0.466**	**0.315**	**0.183**	**0.8**	**97.6**	**1.7**	

PROJECT **ROCKPORT PLANT -**

JOB NO. **42393125-01**
DATE **3/22/16**

GRADATION CURVES

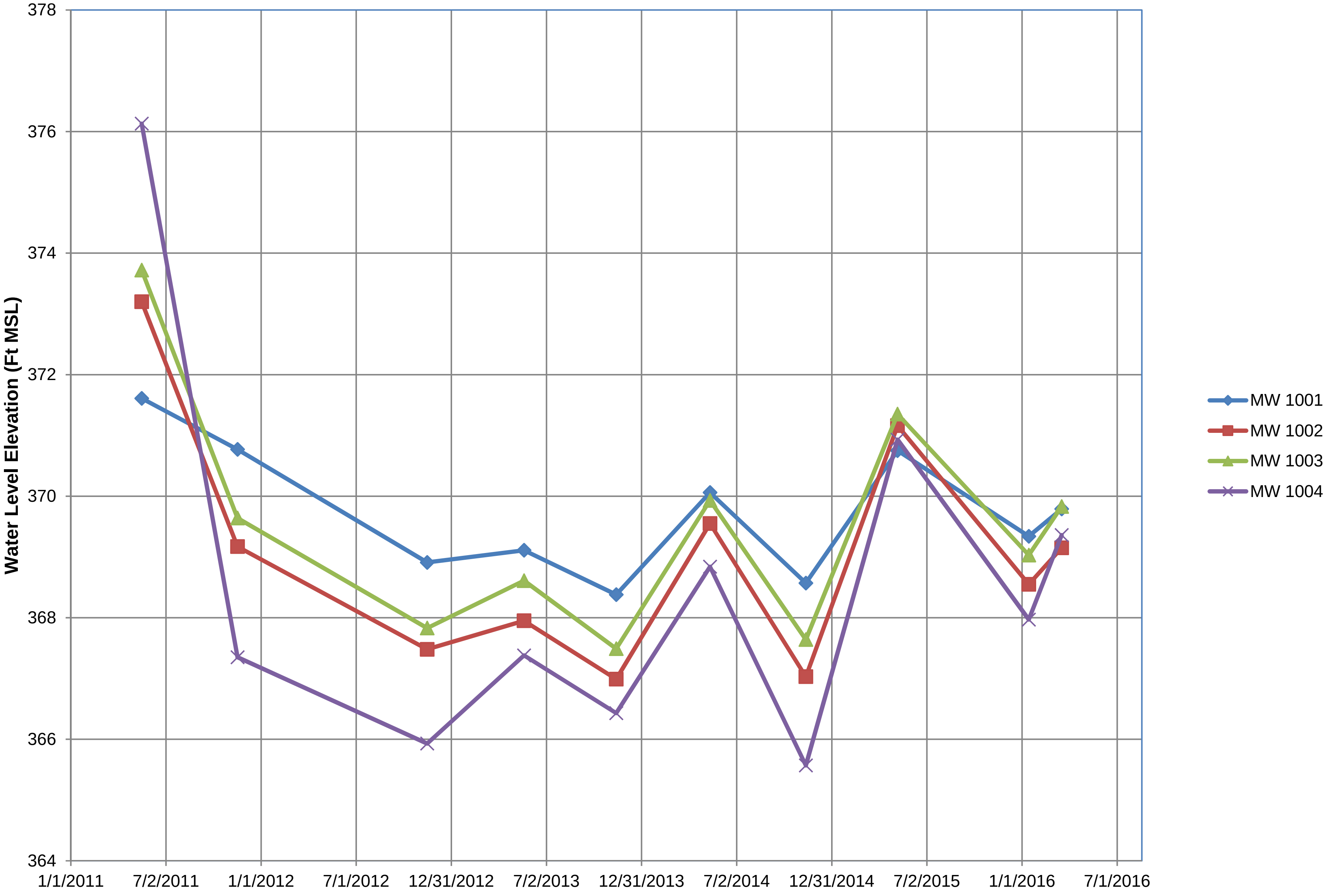
American Electric Power Service Corp.

ATTACHMENT 3

MONITORING WELL HYDROGRAPHS
2010 BA POND MONITORING WELLS

AEP Rockport Plant

Wastewater Pond Complex - Monitoring Well Hydrographs



Print Date: 4/22/2016

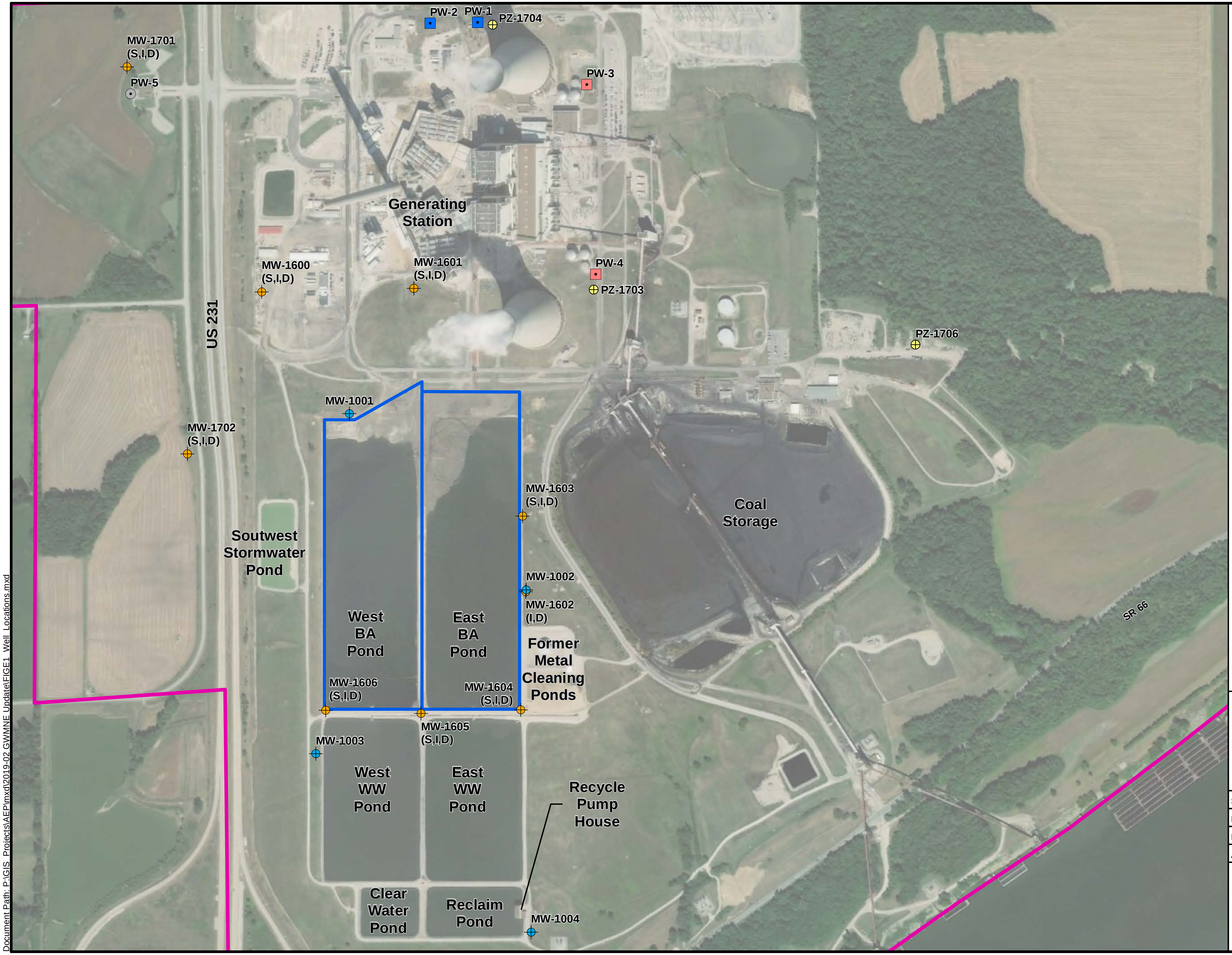
Amec Foster Wheeler

Appendix E

2017 Monitoring Well Installation Data

Appendix E-1

2017 Monitoring Well Location Map



Legend

- ⊕ Piezometer
- ⊕ BAP - USWAG Monitoring Well
- ⊕ BAP - CCR Monitoring Well
- ■ Plant - Potable Water Supply Well
- ■ Plant - Fire Water Supply Well
- ⊙ Inactive Water Supply Well
- ☐ Property Boundary
- ☐ Bottom Ash Ponds (BAP)

Data Sources

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Date of Photography: May-June 2016
Source of Photography: U.S. Department of Agriculture, National Agriculture Imagery Program (NAIP)

0 300 600
SCALE IN FEET

WASTEWATER POND COMPLEX

AEP - ROCKPORT, IN

PROJECT NUMBER: 7362182624

SCALE	1" = 600'	FIG. E-1
DATE	2/13/2019	
DRAWN BY	TMR	
APPROVED BY	KDR	

wood.

2456 Fortune Drive, Suite 100
Lexington, Kentucky 40509
Phone: (859) 255-3308

Document Path: P:\GIS Projects\AEP\mxd\2019-02 GWMNE Update\FIGE1 Well Locations.mxd

Appendix E-2

2017 Well Construction Summary

Table E-2
Monitoring Well Construction Details
Bottom Ash Pond Complex
AEP Rockport Plant, Rockport, Indiana

Well ID	Date Installed	Northing SPCS NAD27 (ft)	Easting SPCS NAD27 (ft)	Top of Casing (TOC) Elevation (ft MSL)	Ground Surface Elevation Before Drilling (ft MSL)	Ground Surface Elevation (ft MSL)	Casing Stick-Up (ft AGS)	Length of Screen (ft)	Type of Screen (PVC)	Total Depth of Boring (ft BGS)	Depth to Top of Bedrock (ft BGS)	Sounded Depth of Well (ft BMP)	Estimated Depth to Bottom of Well from TOC (ft BMP)	Estimated Depth to Top of Screen (ft BGS)	Depth to Top of Screen (ft BGS)	Depth to Top of Sand Pack (ft BGS)	Depth to Top of Bentonite Seal (ft BGS)	Bottom of Boring Elevation (ft MSL)	Top of Bedrock Elevation (ft MSL)	Bottom of Well Elevation (ft MSL)	Bottom of Screen Elevation (ft MSL)	Top of Screen Elevation (ft MSL)
MW-1001	6/2/2010	153488.0	513047.6	402.35	---	400.0	2.3	9.7	2" x 0.010"	41.0	---	---	---	---	29.7	27.70	25.70	359.0	---	360.0	360.6	370.3
MW-1002	6/2/2010	152307.4	514231.0	401.42	---	399.1	2.3	9.7	2" x 0.010"	46.5	---	---	---	---	35.2	33.00	30.90	352.6	---	353.6	354.2	363.9
MW-1003	6/2/2010	151208.1	512820.7	393.23	---	390.8	2.4	9.7	2" x 0.010"	39.0	---	---	---	---	27.7	25.70	22.80	351.8	---	352.8	353.4	363.1
MW-1004	6/3/2010	150013.4	514264.7	396.55	---	394.3	2.3	9.7	2" x 0.010"	43.5	---	---	---	---	32.2	29.70	27.70	350.8	---	351.8	352.4	362.1
MW-1600-S	2/29/2016	154305.946	512458.043	396.73	393.6	393.7	3.0	9.6	2" x 0.010"	41.6	---	43.59	43.59	30.6	30.6	28.3	21.4	352.1	---	353.1	353.5	363.1
MW-1600-I	2/29/2016	154306.008	512454.030	396.65	393.6	393.7	2.9	9.6	2" x 0.010"	73.0	---	74.59	74.59	61.6	61.7	59.4	50.8	320.7	---	322.1	322.5	332.1
MW-1600-D	2/17/2016	154306.313	512448.952	396.31	393.6	393.8	2.5	9.6	2" x 0.010"	96.8	95.0	97.52	97.52	84.5	85.0	82.3	76.0	297.0	298.8	298.8	299.2	308.8
MW-1601-S	2/27/2016	154327.617	513479.660	402.65	399.8	399.8	2.9	9.6	2" x 0.010"	48.0	---	49.74	49.74	36.8	36.9	34.6	28.1	351.8	---	352.9	353.3	362.9
MW-1601-I	2/26/2016	154325.290	513483.510	402.83	399.8	400.0	2.9	9.6	2" x 0.010"	79.8	---	80.95	80.96	67.8	68.1	65.6	54.2	320.2	---	321.9	322.3	331.9
MW-1601-D	2/26/2016	154323.168	513487.454	402.84	399.8	400.1	2.8	9.6	2" x 0.010"	117.7	115.5	112.77	112.77	99.8	100.0	97.8	92.7	282.4	284.6	290.1	290.5	300.1
MW-1602-I	2/9/2016	152295.035	514229.173	402.03	399.1	399.4	2.6	9.6	2" x 0.010"	78.7	---	80.45	80.45	67.5	67.8	65.5	55.0	320.7	---	321.6	322.0	331.6
MW-1602-D	1/26/2016	152300.217	514229.384	401.91	399.1	399.3	2.6	9.6	2" x 0.010"	125.0	124.6	126.96	126.9	114.0	114.3	112.0	106.0	274.3	274.7	275.0	275.4	285.0
MW-1603-S	2/3/2016	152802.696	514206.885	403.85	400.6	401.5	2.4	9.6	2" x 0.010"	49.3	---	50.63	50.63	37.6	38.2	35.6	31.7	352.2	---	353.2	353.6	363.2
MW-1603-I	2/1/2016	152807.294	519207.223	404.15	400.6	401.4	2.7	9.6	2" x 0.010"	79.6	---	81.67	81.67	68.6	68.9	66.6	55.5	321.8	---	322.5	322.9	332.5
MW-1603-D	1/29/2016	152811.949	514207.457	403.85	400.6	401.6	2.3	9.6	2" x 0.010"	122.0	122.0	123.14	123.4	110.0	110.9	108.0	103.0	279.6	279.6	280.7	281.1	290.7
MW-1604-S	1/29/2016	151503.132	514197.320	402.46	399.8	399.8	2.7	9.6	2" x 0.010"	48.0	---	49.35	N/A	37.0	36.7	35.0	30.0	351.8	---	353.1	353.5	363.1
MW-1604-I	1/28/2016	151506.473	514201.037	402.19	399.8	399.7	2.4	9.6	2" x 0.010"	79.0	---	81.46	81.5	68.0	69.0	65.3	57.3	320.7	---	320.7	321.1	330.7
MW-1604-D	1/15/2016	151510.165	514204.869	402.44	399.8	399.9	2.6	9.6	2" x 0.010"	126.6	125.8	128.15	128.0	115.0	115.6	112.3	104.3	273.3	274.1	274.3	274.7	284.3
MW-1605-S	3/1/2016	151478.765	513528.386	403.38	400.6	400.3	3.1	9.6	2" x 0.010"	49.0	---	50.60	50.6	37.6	37.6	35.3	29.9	351.3	---	352.8	353.2	362.8
MW-1605-I	3/2/2016	151478.914	513532.565	403.22	400.6	400.6	2.6	9.6	2" x 0.010"	80.0	---	81.50	81.5	68.6	68.9	66.4	57.5	320.6	---	321.7	322.1	331.7
MW-1605-D	2/3/2016	151478.903	513537.066	403.78	400.6	400.4	3.4	9.6	2" x 0.010"	127.5	125.0	128.00	127.95	115.0	114.6	113.0	108.0	272.9	275.4	275.8	276.2	285.8
MW-1606-S	3/2/2016	151498.907	512889.413	400.65	397.7	397.6	3.0	9.6	2" x 0.010"	46.0	---	47.62	47.62	34.7	34.6	32.7	26.9	351.6	---	353.0	353.4	363.0
MW-1606-I	3/1/2016	151500.402	512885.504	400.75	397.7	397.8	3.0	9.6	2" x 0.010"	77.0	---	78.41	78.41	65.7	65.4	63.5	54.6	320.8	---	322.3	322.7	332.3
MW-1606-D	2/12/2016	151502.092	512881.487	400.73	397.7	397.8	2.9	9.6	2" x 0.010"	112.9	110.9	113.15	113.15	100.0	100.2	97.7	91.5	284.9	286.9	287.6	288.0	297.6
MW-1701-S	10/16/2017	155697.39	511567.94	398.30	---	395.6	2.7	9.7	2" x 0.010"	42.0	---	43.06	43.4	30.0	30.1	28.0	25.5	353.6	---	355.2	355.8	365.5
MW-1701-I	10/13/2017	155703.04	511568.64	398.29	---	395.6	2.7	9.7	2" x 0.010"	63.0	---	63.78	64.1	51.0	50.8	47.5	43.0	332.6	---	334.5	335.1	344.8
MW-1701-D	10/13/2017	155710.21	511569.45	398.65	---	395.9	2.7	9.7	2" x 0.010"	83.5	82.0	85.00	85.2	72.0	72.1	69.2	66.0	312.4	313.9	313.7	314.3	323.9
MW-1702-S	10/5/2017	153650.79	511921.68	396.16	---	393.2	3.0	9.7	2" x 0.010"	41.0	---	44.45	43.7	30.1	31.2	28.1	25.0	352.2	---	351.7	352.4	362.0
MW-1702-I	10/4/2017	153655.81	511921.85	396.26	---	393.3	3.0	9.7	2" x 0.010"	64.0	---	66.05	65.2	53.3	53.0	51.0	48.0	329.3	---	330.2	330.7	340.3
MW-1702-D	10/3/2017	153661.11	511922.14	396.30	---	393.3	3.0	9.7	2" x 0.010"	87.6	86.5	89.00	89.0	75.7	76.0	73.8	69.8	305.7	306.8	307.3	307.8	317.4
PZ-1703	10/16/2017	154454.33	514680.15	402.30	---	399.2	3.1	9.7	2" x 0.010"	52.0	---	53.04	53.1	39.9	39.7	37.0	33.0	347.2	---	349.3	349.9	359.5
PZ-1704	10/9/2017	156117.98	513931.11	402.48	---	398.9	3.5	9.7	2" x 0.010"	52.0	---	53.73	53.8	40.5	39.9	38.2	34.5	346.9	---	348.8	349.4	359.0
PZ-1705	10/5/2017	158401.58	514999.97	393.17	---	389.8	3.4	9.7	2" x 0.010"	51.0	---	53.11	53.5	40.1	39.4	38.0	35.0	338.8	---	340.1	340.8	350.4
PZ-1706	10/10/2017	153981.56	517033.49	398.37	---	395.1	3.2	9.7	2" x 0.010"	52.0	---	53.30	53.5	40.2	39.8	38.3	35.5	343.1	---	345.1	345.7	355.4

Notes:

--- = Data not available or not applicable
ft = feet
BMP = below measuring point (top of casing)
BGS = below ground surface
MSL = above Mean Sea Level, equivalent to the National Geodetic Vertical Datum of 1929 (NGVD29)
AGS = above ground surface
TOC = top of casing (PVC pipe)
SPCS = State Plane Coordinate System
NAD27 = North American Datum of 1927

Prepared By: TMR 7/11/18
Checked By: JCF 7/12/18

Appendix E-3

2017 Water Level Data Summary

Table E-3

Monitoring Well Piezometric Data

AEP Rockport Plant, Rockport, Indiana

Well ID	MW 1001	MW 1002	MW 1003	MW 1004	MW-1600-S	MW-1600-I	MW-1600-D	MW-1601-S	MW-1601-I	MW-1601-D	MW-1602-I	MW-1602-D
Date Installed	6/2/2010	6/2/2010	6/2/2010	6/2/2010	2/29/2016	2/29/2016	2/17/2016	2/27/2016	2/26/2016	2/26/2016	2/9/2016	1/26/2016
Date												
5/17/2011	371.61	373.20	373.72	376.13								
11/10/2011												
11/17/2011	370.77	369.17	369.64	367.35								
5/8/2012												
11/7/2012												
11/15/2012	368.91	367.48	367.83	365.93								
5/16/2013												
5/20/2013	369.11	367.95	368.61	367.38								
8/21/2013												
11/4/2013												
11/13/2013	368.38	366.99	367.49	366.43								
1/20/2014												
5/7/2014												
5/12/2014	370.06	369.55	369.93	368.84								
11/11/2014												
11/12/2014	368.57	367.03	367.64	365.57								
5/5/2015												
5/7/2015	370.75	371.16	371.35	370.93								
1/14/2016	369.34	368.55	369.03	367.97								
3/17/2016	369.79	369.15	369.83	369.36	370.20	370.14	370.08	369.41	369.58	369.74	369.13	369.11
6/7/2016		369.50									369.3	369.23
6/8/2016	370.60		370.09	368.21	370.92		370.71	370.06	370.27	370.38		
7/18/2016	370.29	368.87	369.44	367.37							368.71	368.60
7/19/2016					370.67	370.62	370.49	369.81	370.01	370.14		
7/20/2016												
9/19/2016	369.79		368.80	366.47	370.16	370.13	370.05		369.47	369.63		
9/20/2016		368.34						369.32			368.15	367.98
10/10/2016												
11/15/2016	369.31	367.99		366.04							367.82	367.60
11/16/2016					369.63	369.57	369.46	368.76	368.97	369.07		
1/9/2017	368.92	368.01	368.13	366.74							367.88	367.83
1/10/2017					369.18	369.12	369.03	368.46	368.66	368.76		
3/6/2017	369.30		369.11	368.31								
3/7/2017		368.73			369.39	369.35	369.24	368.69	368.91	368.90	368.39	368.40
3/8/2017												
3/9/2017												
5/8/2017					369.62	369.51	369.46	368.86				
5/9/2017									369.07	369.22		
5/10/2017												
5/18/2017		368.68									368.52	368.46
5/19/2017												

Notes:

ft = feet

BMP = below measuring point (top of casing)

MSL = above Mean Sea Level, equivalent to the National Geodetic Vertical Datum of 1929 (NGVD29)

Table E-3
Monitoring Well Piezometric Data
AEP Rockport Plant, Rockport, Indiana

Well ID	MW 1001	MW 1002	MW 1003	MW 1004	MW-1600-S	MW-1600-I	MW-1600-D	MW-1601-S	MW-1601-I	MW-1601-D	MW-1602-I	MW-1602-D
Date Installed	6/2/2010	6/2/2010	6/2/2010	6/2/2010	2/29/2016	2/29/2016	2/17/2016	2/27/2016	2/26/2016	2/26/2016	2/9/2016	1/26/2016
Date												
7/17/2017		368.29			369.58	369.52	369.42	368.76	368.96	368.99	368.14	368.03
7/18/2017												
7/19/2017												
10/3/2017		367.10			368.97	368.91	368.79				367.02	366.80
10/4/2017								368.10	368.24	368.40		
11/13/2017	368.16	365.61	367.43	366.05	368.71	368.63	368.57	367.83	368.01	368.11	366.74	366.65
12/12/2017		366.94			367.46	368.41	368.26	367.65	367.87	367.96	366.74	366.59
1/3/2018		366.83									366.63	366.54
2/8/2018												
6/4/2018					372.42	372.37	372.31					
6/5/2018		371.54						371.84	372.02	372.17	371.21	371.31
6/6/2018												
7/10/2018												
8/11/2018												
8/13/2018												
8/14/2018						371.79	371.69					
8/15/2018		370.02			371.84			371.04	371.26	371.37	369.84	369.71
8/18/2018												
9/24/2018												
9/25/2018												
9/26/2018												

Notes:

ft = feet

BMP = below measuring point (top of casing)

MSL = above Mean Sea Level, equivalent to the National Geodetic Vertical Datum of 1929 (NGVD29)

Table E-3
Monitoring Well Piezometric Data
AEP Rockport Plant, Rockport, Indiana

Well ID	MW-1603-S	MW-1603-I	MW-1603-D	MW-1604-S	MW-1604-I	MW-1604-D	MW-1605-S	MW-1605-I	MW-1605-D	MW-1606-S	MW-1606-I	MW-1606-D
Date Installed	2/3/2016	2/1/2016	1/29/2016	1/29/2016	1/28/2016	1/15/2016	3/1/2016	3/2/2016	2/3/2016	3/2/2016	3/1/2016	2/12/2016
Date												
5/17/2011												
11/10/2011												
11/17/2011												
5/8/2012												
11/7/2012												
11/15/2012												
5/16/2013												
5/20/2013												
8/21/2013												
11/4/2013												
11/13/2013												
1/20/2014												
5/7/2014												
5/12/2014												
11/11/2014												
11/12/2014												
5/5/2015												
5/7/2015												
1/14/2016												
3/17/2016	369.15	369.16	369.09	369.22	369.18	369.20	369.48	369.22	368.78	369.62	369.70	369.71
6/7/2016				369.03	369.04	368.99	369.45	369.41	369.68	369.86	369.9	369.89
6/8/2016	369.51	369.52	369.34									
7/18/2016	369.06	369.05	368.78		368.34	368.27			369.02			
7/19/2016							368.85	368.77		369.26	369.32	369.32
7/20/2016				368.34								
9/19/2016				367.78	367.66	367.69	368.27	368.16	368.40	368.63	368.70	368.69
9/20/2016	368.50	368.51										
10/10/2016			368.16									
11/15/2016	368.15	368.12	367.79	367.28	367.27	367.20						
11/16/2016							367.78	367.71	367.94	368.17	368.22	368.21
1/9/2017	368.05	368.16	367.74	367.39	367.40	367.35						
1/10/2017							367.79	367.72	367.98	367.98	368.05	368.04
3/6/2017											368.85	368.86
3/7/2017	368.47	368.55		368.36	368.58	368.29	368.56	368.60		368.74		
3/8/2017									368.90			
3/9/2017												
5/8/2017	368.60					368.47						
5/9/2017					368.49							
5/10/2017												
5/18/2017		368.62	368.51	368.52			368.76	368.68	369.00	368.97	369.03	369.01
5/19/2017												

Notes:
ft = feet
BMP = below measuring point (top of casing)
MSL = above Mean Sea Level, equivalent to the National Geodetic Vertical Datum of 1929 (NGVD29)

Table E-3
Monitoring Well Piezometric Data
AEP Rockport Plant, Rockport, Indiana

Well ID	MW-1603-S	MW-1603-I	MW-1603-D	MW-1604-S	MW-1604-I	MW-1604-D	MW-1605-S	MW-1605-I	MW-1605-D	MW-1606-S	MW-1606-I	MW-1606-D
Date Installed	2/3/2016	2/1/2016	1/29/2016	1/29/2016	1/28/2016	1/15/2016	3/1/2016	3/2/2016	2/3/2016	3/2/2016	3/1/2016	2/12/2016
Date												
7/17/2017	368.30	368.32	368.17	367.87			368.28					
7/18/2017					367.88	367.83		368.21	368.49	368.64	368.71	368.69
7/19/2017												
10/3/2017	367.33	367.34	367.09	366.56	366.56	366.52	367.16	367.00	367.26	367.53	367.59	367.59
10/4/2017												
11/13/2017	366.98	366.98	366.81	366.48	366.49	366.46	366.96	366.92	367.17	367.37	367.43	367.43
12/12/2017	366.96	366.94	366.73	366.41	366.41	366.35	366.89	366.77	367.03	367.25	367.33	
1/3/2018	366.93	366.89		366.32	366.32		366.58	366.71		367.09		
2/8/2018												
6/4/2018												
6/5/2018	371.54	371.54	371.37				371.44					
6/6/2018				371.16	371.18	371.12		371.37	371.66	371.73	371.81	371.75
7/10/2018												
8/11/2018				369.36								
8/13/2018	370.08	370.15	369.91									
8/14/2018					369.37	369.30						
8/15/2018							369.88	369.80	370.04		370.50	370.43
8/18/2018										370.38		
9/24/2018												
9/25/2018												
9/26/2018												

Notes:
ft = feet
BMP = below measuring point (top of casing)
MSL = above Mean Sea Level, equivalent to the National Geodetic Vertical Datum of 1929 (NGVD29)

Table E-3
Monitoring Well Piezometric Data
AEP Rockport Plant, Rockport, Indiana

Well ID	**MW-1701-S**	**MW-1701-I**	**MW-1701-D**	**MW-1702-S**	**MW-1702-I**	**MW-1702-D**	**PZ-1703**	**PZ-1704**	**PZ-1705**	**PZ-1706**
Date Installed	10/16/2017	10/13/2017	10/13/2017	10/5/2017	10/4/2017	10/3/2017	10/16/2017	10/9/2017	10/5/2017	10/10/2017
Date										
5/17/2011										
11/10/2011										
11/17/2011										
5/8/2012										
11/7/2012										
11/15/2012										
5/16/2013										
5/20/2013										
8/21/2013										
11/4/2013										
11/13/2013										
1/20/2014										
5/7/2014										
5/12/2014										
11/11/2014										
11/12/2014										
5/5/2015										
5/7/2015										
1/14/2016										
3/17/2016										
6/7/2016										
6/8/2016										
7/18/2016										
7/19/2016										
7/20/2016										
9/19/2016										
9/20/2016										
10/10/2016										
11/15/2016										
11/16/2016										
1/9/2017										
1/10/2017										
3/6/2017										
3/7/2017										
3/8/2017										
3/9/2017										
5/8/2017										
5/9/2017										
5/10/2017										
5/18/2017										
5/19/2017										

Notes:
ft = feet
BMP = below measuring point (top of casing)
MSL = above Mean Sea Level, equivalent to the National Geodetic Vertical Datum of 1929 (NGVD29)

Table E-3
Monitoring Well Piezometric Data
AEP Rockport Plant, Rockport, Indiana

Well ID	**MW-1701-S**	**MW-1701-I**	**MW-1701-D**	**MW-1702-S**	**MW-1702-I**	**MW-1702-D**	**PZ-1703**	**PZ-1704**	**PZ-1705**	**PZ-1706**
Date Installed	10/16/2017	10/13/2017	10/13/2017	10/5/2017	10/4/2017	10/3/2017	10/16/2017	10/9/2017	10/5/2017	10/10/2017
Date										
7/17/2017										
7/18/2017										
7/19/2017										
10/3/2017										
10/4/2017										
11/13/2017	369.52	369.54	369.56	368.88	368.90	368.83	366.34	368.30	368.41	365.74
12/12/2017										
1/3/2018										
2/8/2018	368.87	368.75	368.87	368.31	368.23	368.17				
6/4/2018	373.06			372.65	372.67	372.61				
6/5/2018		373.10	373.01							
6/6/2018										
7/10/2018										
8/11/2018										
8/13/2018				372.09	372.12					
8/14/2018	372.63	372.71	372.63			372.01				
8/15/2018										
8/18/2018										
9/24/2018		372.36	372.36							
9/25/2018	372.37			371.67	371.67					
9/26/2018						371.52				

Notes:
ft = feet
BMP = below measuring point (top of casing)
MSL = above Mean Sea Level, equivalent to the National Geodetic Vertical Datum of 1929 (NGVD29)

Appendix E-4

2017 Boring and Well Construction Logs

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 155,708.2 E 511,570.0**

GROUND ELEVATION **395.3** SYSTEM **State Plane using NAD27/29**

BORING NO. **MW-1701D** DATE **7/11/18** SHEET **1** OF **4**

BORING START **10/11/17** BORING FINISH **10/11/17**

PIEZOMETER TYPE WELL TYPE

HGT. RISER ABOVE GROUND **3.1** DIA **4.25**

DEPTH TO TOP OF WELL SCREEN **72** BOTTOM **79.62**

WELL DEVELOPMENT **YES** BACKFILL

FIELD PARTY **TERRACON/AMEC** RIG

Water Level, ft	▽	▼	▼
TIME			
DATE			

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
1	SS	0.0	2.0	2-2-3-4	1.75		
2	SS	2.0	4.0	2-4-4-6	.83		
3	SS	4.0	6.0	3-5-5-6	2.0		5
4	SS	6.0	8.0	5-7-10-12	1.83		
5	SS	8.0	10.0	5-8-12-12	1.92		10
6	SS	10.0	12.0	4-6-8-11	2.0		
7	SS	12.0	14.0	4-4-7-8	2.0		
8	SS	14.0	16.0	4-8-10-11	1.75		15
9	SS	16.0	18.0	6-10-11-10	1.92		
10	SS	18.0	20.0	3-7-8-10	1.58		

U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
	TOPSOIL = 6 INCHES		
CL ML	MEDIUM STIFF LIGHT GRAYISH BROWN 2.5YR 6/2 SILTY CLAY (CL-ML)b w/some mottling, trace roots, moist		
ML	MEDIUM STIFF LIGHT GRAYISH BROWN 2.5YR 6/2 CLAYEY SILT (ML) trace roots, moist		
CL	MEDIUM STIFF LIGHT BROWN 5YR 7/4 LEAN CLAY (CL) trace black nodules, moist		
CL ML	STIFF GRAYISH BROWN 5YR 5/2 SILTY CLAY (CL-ML) little black nodules, moist		
CL	STIFF LIGHT BROWN 5YR 7/4 LEAN CLAY (CL) moist		
CL	VERY STIFF LIGHT BROWN 5YR 7/4 LEAN CLAY (CL) some red mottling, trace black nodules, trace silt, moist		
CL	STIFF LIGHT BROWN 5YR 7/4 AND GRAY (MOTTLED) LEAN CLAY (CL) w/black partings, moist		
CL	STIFF LIGHT BROWN 5YR 7/4 LEAN CLAY (CL) moist		
CL	STIFF LIGHT BROWN 5YR 7/4 LEAN CLAY (CL) trace soft zones, trace black silt, moist		
ML	VERY STIFF BROWN 5YR 5/4 SANDY SILT (ML) moist		
SP	MEDIUM DENSE LIGHT BROWN 5YR 8/4 FINE GRAINED PG SAND (SP) moist		
SP	MEDIUM DENSE LIGHT BROWN 5YR 8/4 FINE GRAINED PG SAND (SP) trace sandy silt, moist		
SP	MEDIUM DENSE LIGHT REDDISH BROWN 5YR 7/8 FINE GRAINED PG SAND (SP) moist		

Continued Next Page

TYPE OF CASING USED

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

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

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

RECORDER

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1701D** DATE **7/11/18** SHEET **2** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **10/11/17** BORING FINISH **10/11/17**

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
11	SS	20.0	22.0	5-7-9-9	1.75				SP	MEDIUM DENSE LIGHT BROWN 5YR 7/4 FINE GRAINED PG SAND (SP) moist		
12	SS	22.0	24.0	3-5-5-8	1.83				SP	LOOSE LIGHT BROWN 5YR 8/4 W/RED FINE TO MEDIUM GRAINED PG SAND (SP) silty sand seams, trace coal, moist		
13	SS	24.0	26.0	6-8-10-11	1.67		25		SP	MEDIUM DENSE LIGHT BROWN 5YR 8/4 W/RED FINE TO MEDIUM GRAINED PG SAND (SP) silty sand seam @ 24.5' - 24.9', trace coal, moist, wet @ 25.5'		
14	SS	26.0	28.0	3-6-6-7	1.5				SP	LOOSE LIGHT GRAYISH BROWN 5YR 6/3 W/RED FINE TO MEDIUM GRAINED PG SAND (SP) silty sand seams, trace coal, trace coarse grained, wet		
15	SS	28.0	30.0	1-3-6-8	1.67				SP	LOOSE LIGHT BROWN 5YR 6/6 W/RED MEDIUM GRAINED PG SAND (SP) trace coarse grained, little silty sand, wet		
16	SS	30.0	32.0	3-5-7-8	1.83		30		SP	LOOSE LIGHT BROWN 5YR 6/6 W/RED MEDIUM GRAINED PG SAND (SP) trace coarse grained, coarse grained seam @ 30.5' - 30.9', coal seams, little silty sand, wet		
17	SS	32.0	34.0	13-18-20-24	2.0				SP	DENSE BROWN 7YR 5/6 MEDIUM TO COARSE GRAINED PG SAND (SP) trace black silt, trace coarse grained, wet		
18	SS	34.0	36.0	3-6-12-14	.83		35		SP	MEDIUM DENSE BROWN 7YR 5/6 MEDIUM TO COARSE GRAINED PG SAND (SP) trace black silt, trace coarse grained, little fine to coarse gravel, wet		
19	SS	36.0	38.0	2-5-12-14	1.92							
20	SS	38.0	40.0	4-9-8-7	1.67				SP	DENSE BROWN 7YR 5/6 MEDIUM TO COARSE GRAINED PG SAND (SP) trace black silt, some coarse grained, wet		
21	SS	40.0	42.0	6-7-11-13	1.67		40					
									SW	MEDIUM DENSE GRAYISH BROWN 7.5YR 5/2 WG SAND AND FINE GRAVEL (SW) wet		
22	SS	42.0	44.0	5-6-8-9	1.5							
									SM	MEDIUM DENSE BROWN 5RY 5/6 SILTY SAND (SM) wet		
23	SS	44.0	46.0	3-5-2-19	2.0		45		SP	MEDIUM DENSE BROWN 5YR 5/6 FINE GRAINED PG SAND (SP) trace fine gravel, wet		

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1701D** DATE **7/11/18** SHEET **3** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **10/11/17** BORING FINISH **10/11/17**

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	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
24	SS	46.0	48.0	13-14-	2.0			SP	MEDIUM DENSE BROWN 5YR 5/6 FINE GRAINED PG SAND (SP) trace fine gravel, coal seam @ 47.1' - 47.5', wet		
								SW	MEDIUM DENSE GRAYISH BROWN 7.5YR 5/2 WG SAND (SW) AND FINE GRAVEL wet		
25	SS	48.0	50.0	5-6-11-12	1.83			SW	MEDIUM DENSE GRAYISH BROWN 7.5YR 5/2 WG SAND (SW) AND FINE GRAVEL silty sand seams, wet		
26	SS	50.0	52.0	5-6-11-11	1.42		50	SW	MEDIUM DENSE GRAYISH BROWN 7.5YR 5/2 WG SAND (SW) AND FINE GRAVEL fine to coarse gravel, wet		
27	SS	52.0	54.0	1-2-3-5	.67			SP	LOOSE BROWNISH GRAY 5YR 6/1 MEDIUM GRAINED PG SAND (SP) AND FINE GRAVEL wet		
28	SS	54.0	56.0	4-7-11-18	1.67						
							55	SM	MEDIUM DENSE BROWN 5YR 6/3 SILTY SAND (SM) some black staining, wet		
29	SS	56.0	58.0	13-16-18-21	1.42			SM	DENSE BROWN 5YR 6/3 SILTY SAND (SM) wet		
30	SS	58.0	60.0	4-8-13-16	1.75			SP	MEDIUM DENSE GRAYISH BROWN 7.5YR 5/2 MEDIUM GRAINED PG SAND (SP) some fine gravel, wet		
31	SS	60.0	62.0	6-10-11-11	1.75		60				
32	SS	62.0	64.0	3-6-14-15	1.67						
33	SS	64.0	66.0	9-9-12-15	1.67						
							65	SM	MEDIUM DENSE BROWNISH GRAY 2.5YR 7/1 SILTY SAND (SM) some fine gravel, wet		
34	SS	66.0	68.0	6-7-13-20	1.58			SP	MEDIUM DENSE BROWNISH GRAY 2.5YR 7/1 MEDIUM GRAINED PG SAND (SP) little coarse gravel, wet		
35	SS	68.0	70.0	5-8-8-9	.75			SM	MEDIUM DENSE BROWNISH GRAY 2.5YR 7/1 SILTY SAND (SM) AND FINE GRAVEL wet		
36	SS	70.0	72.0	3-5-7-7	.17		70	SM	MEDIUM DENSE BROWNISH GRAY 2.5YR 7/1 SILTY SAND (SM) AND FINE GRAVEL @ 70' low recovery (possible fall-in), wet		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1701D** DATE **7/11/18** SHEET **4** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **10/11/17** BORING FINISH **10/11/17**

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
37	SS	72.0	74.0	7-13-18-25	1.67				SW	DENSE GRAYISH BROWN 2.5 YR 6/2 WG SAND (SW) AND FINE TO COARSE GRAVEL wet		
38	SS	74.0	76.0	10-9-10-10	.92		75		SW	MEDIUM DENSE GRAYISH BROWN 2.5 YR 6/2 WG SAND (SW) AND FINE TO COARSE GRAVEL pockets of PG Sand (MG), wet		
39	SS	76.0	78.0	6-7-13-17	.42				SP	MEDIUM DENSE GRAYISH BROWN 2.5YR 6/2 MEDIUM GRAINED PG SAND (SP) AND FINE GRAVEL some coarse grained, wet		
40	SS	78.0	80.0	3-10-20-20	1.25				SP	MEDIUM DENSE GRAYISH BROWN 2.5YR 6/2 FINE TO MEDIUM GRAINED PG SAND (SP) trace fine gravel, wet		
41	SS	80.0	82.0	9-18-46-20	2.0		80		ML	HARD GRAYISH BROWN 5YR 7/2 SANDY SILT (ML) trace fine gravel, wet @ 81' cobble fragments, trace coarse gravel, little silty sand		
42	SS	82.0	84.0	19-48-50/5	1.42					VERY DENSE LIGHT GRAY GLEY 2/6 - 5BG SHALE wet		
43	SS	84.0	86.0				85			SR @ 83.5' / BT @ 83.5' Begin well installation @ 83.5'		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 153,659.2 E 511,922.9**

GROUND ELEVATION **392.4** SYSTEM **State Plane using NAD27/29**

BORING NO. **MW-1702D** DATE **7/11/18** SHEET **1** OF **4**

BORING START **9/26/17** BORING FINISH **10/2/17**

PIEZOMETER TYPE WELL TYPE

HGT. RISER ABOVE GROUND **3.95** DIA **4.25**

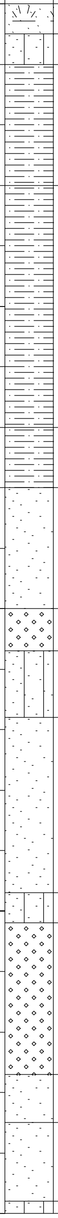
DEPTH TO TOP OF WELL SCREEN **75.7** BOTTOM **85.28**

WELL DEVELOPMENT **YES** BACKFILL

FIELD PARTY **TERRACON/AMEC** RIG

Water Level, ft	▽	▼	▼
TIME			
DATE			

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	SAMPLE DEPTH IN FEET TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %
1	SPT	0.0	2.0	2-3-4-5		
2	SPT	2.0	4.0	4-4-5-6		
3	SPT	4.0	6.0	4-4-6-7		
4	SPT	6.0	8.0	3-4-5-6		
5	SPT	8.0	10.0	3-2-3-2		
6	SPT	10.0	12.0	2-2-3-4		
7	SPT	12.0	14.0	2-2-4-5		
8	SPT	14.0	16.0	3-5-8-8		
9	SPT	16.0	18.0	3-3-6-7		
10	SPT	18.0	20.0	4-5-5-6		



DEPTH IN FEET	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
		LOOSE ORGANIC TOPSOIL		
	SM	LOOSE COARSE STRONG BROWN 7.5YR 4/6 SILTY SAND noncohesive, dry		
	ML	MEDIUM STRONG BROWN 7.5YR 4/6 SANDY SILT nonplastic, noncohesive, dry		
5	ML	MEDIUM LIGHT REDDISH BROWN 5YR 6/4 SILT nonplastic, noncohesive, mottled, dry		
	ML	MEDIUM LIGHT RED BROWN 5YR 6/4 SILT w/sand, noncohesive, dry		
	SP	VERY LOOSE BROWN 7.5YR 5/3 FINE GRAINED SAND poorly graded, trace silt		
10	SW	VERY LOOSE BROWNISH YELLOW 10YR 6/6 MEDIUM GRAINED SAND few gravel, rounded, moist		
	SM	VERY LOOSE STRONG BROWN 7.5YR 5/6 FINE SILTY SAND noncohesive, moist		
	SP	VERY LOOSE LIGHT YELLOWISH ORANGE 10YR 6/4 FINE GRAINED SAND poorly graded, rounded, moist		
15	SM	LOOSE DARK YELLOWISH BROWN 10YR 4/4 FINE SILTY SAND noncohesive, wet		
	SW	LOOSE BROWNISH YELLOW 10YR 6/6 MEDIUM TO COARSE GRAINED SAND noncohesive, subrounded, well graded, moist		
	SP	LOOSE YELLOWISH BROWN 10YR 5/6 FINE GRAINED SAND rounded, poorly graded, trace silt, moist		
	SP	LOOSE BROWNISH YELLOW 10YR 6/6 FINE TO MEDIUM GRAINED SAND		

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

LOG OF BORING

JOB NUMBER **42393125-01**
COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1702D** DATE **7/11/18** SHEET **2** OF **4**
PROJECT **ROCKPORT PLANT** BORING START **9/26/17** BORING FINISH **10/2/17**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	SAMPLE DEPTH IN FEET TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %
11	SPT	20.0	22.0	3-4-6-9		
12	SPT	22.0	24.0	3-5-6-5		
13	SPT	24.0	26.0	3-5-5-4		
14	SPT	26.0	28.0	3-4-6-5		
15	SPT	28.0	30.0	4-7-7-9		
16	SPT	30.0	32.0	5-9-9-10		
17	SPT	32.0	34.0	8-11-13-20		
18	SPT	34.0	36.0	6-6-5-6		
19	SPT	36.0	38.0	3-5-5-6		
20	SPT	38.0	40.0	5-6-11-15		
21	SPT	40.0	42.0	4-6-9-13		
22	SPT	42.0	44.0	7-9-11-15		
23	SPT	44.0	46.0	6-12-13-11		

DEPTH IN FEET: 25, 30, 35, 40, 45

U S C S: SM, SP, SW, SP, SW, SW, SP, SW, SW, SW, SP, SW, SP, SP, SW, SW, SP, SW

SOIL / ROCK IDENTIFICATION

rounded, poorly graded, noncohesive

LOOSE DARK YELLOWISH BROWN 10YR 4/4 FINE SILTY SAND
w/few gravel, noncohesive, wet

LOOSE BROWNISH YELLOW 10YR 6/6 FINE TO MEDIUM GRAINED SAND
rounded, poorly graded, noncohesive

LOOSE YELLOWISH BROWN 10YR 5/6 MEDIUM TO COARSE GRAINED SAND
well graded, angular, moist

LOOSE BROWNISH YELLOW 10YR 6/6 FINE TO MEDIUM GRAINED SAND
rounded, poorly graded, noncohesive, wet @ 23.6'

LOOSE BROWNISH YELLOW 10YR 6/6 COARSE GRAINED SAND
well graded, angular, wet

LOOSE BLACK 7.5YR 2.5/1 MEDIUM TO COARSE GRAINED SAND
well graded, noncohesive, wet

LOOSE BROWNISH YELLOW 10YR 6/6 FINE TO MEDIUM GRAINED SAND
rounded, poorly graded, noncohesive, wet

LOOSE BROWNISH YELLOW 10YR 6/6 COARSE GRAINED SAND
well graded, angular, wet

LOOSE BLACK 7.5YR 2.5/1 COARSE GRAINED SAND
well graded, noncohesive, angular, wet

LOOSE BROWNISH YELLOW 10YR 6/6 COARSE GRAINED SAND
well graded, wet

LOOSE YELLOWISH BROWN 10YR 5/4 MEDIUM GRAINED SAND
subrounded, poorly graded, wet

LOOSE DARK YELLOWISH BROWN 10YR 4/4 COARSE GRAINED SAND
angular, well graded, some gravel, wet

LOOSE YELLOWISH BROWN 10YR 5/4 MEDIUM GRAINED SAND
subrounded, poorly graded, trace gravel, wet

LOOSE YELLOWISH BROWN 10YR 5/4 FINE TO MEDIUM GRAINED SAND
rounded, poorly graded, wet

LOOSE YELLOWISH RED 5YR 5/6 MEDIUM GRAINED SAND
subrounded, few gravel, interbedded gravel seams, well graded, wet

LOOSE YELLOWISH BROWN 10YR 5/4 COARSE GRAINED SAND
well graded, few gravel, wet

LOOSE BROWNISH YELLOW 10YR 6/6 FINE SAND
rounded, poorly graded, wet

LOOSE YELLOWISH BROWN 10YR 5/4

WELL

DRILLER'S NOTES

Continued Next Page

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1702D** DATE **7/11/18** SHEET **3** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **9/26/17** BORING FINISH **10/2/17**

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
24	SPT	46.0	48.0	6-11-12-13						COARSE GRAINED SAND well graded, few gravel, wet		
									SP	MEDIUM DENSE YELLOWISH BROWN 10YR 5/4 FINE GRAINED SAND poorly graded, few silt, few gravel, wet		
25	SPT	48.0	50.0	8-9-11-20					SW	LOOSE YELLOWISH BROWN 10YR 5/4 MEDIUM TO COARSE GRAINED SAND noncohesive, well graded, subrounded, few gravel, wet		
26	SPT	50.0	52.0	6-8-12-14			50		SW	LOOSE OLIVE BROWN 2.5Y 4/3 MEDIUM TO COARSE GRAINED SAND noncohesive, subrounded, well graded, few gravel, wet		
27	SPT	52.0	54.0	3-5-7-9								
									SP	LOOSE OLIVE BROWN 2.5Y 4/3 FINE GRAINED SAND rounded, noncohesive, poorly graded, trace silt, wet		
28	SPT	54.0	56.0	5-5-10-11			55					
29	SPT	56.0	58.0	2-3-7-9								
30	SPT	58.0	60.0	4-4-6-11					SP	LOOSE OLIVE BROWN 2.5Y 4/3 FINE GRAINED SAND rounded, noncohesive, poorly graded, trace silt, wet		
31	SPT	60.0	62.0	8-17-18-11			60					
									SW	MEDIUM DENSE VERY DARK GRAYISH BROWN 10YR 3/2 MEDIUM GRAINED SAND subrounded, noncohesive, well graded, few gravel, wet		
32	SPT	62.0	64.0	8-9-12-13								
33	SPT	64.0	66.0	7-13-21-22			65					
									SW	MEDIUM DENSE DARK YELLOWISH BROWN 10YR 4/4 FINE GRAINED SAND w/gravel, well graded, wet		
34	SPT	66.0	68.0	14-18-24-19								
35	SPT	68.0	70.0	6-7-10-8								
									SW	LOOSE DARK YELLOWISH BROWN 10YR 4/4 MEDIUM TO COARSE GRAINED SAND noncohesive, well graded, few gravel, wet		
36	SPT	70.0	72.0	5-4-8-8			70					
									SW	OLIVE BROWN 2.5Y 4/3 SAND well graded, small gravel, wet		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1702D** DATE **7/11/18** SHEET **4** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **9/26/17** BORING FINISH **10/2/17**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	SAMPLE DEPTH IN FEET TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %
37	SPT	72.0	74.0	8-9-10-10		
38	SPT	74.0	76.0	4-9-13-17		
39	SPT	76.0	78.0	8-10-14-22		
40	SPT	78.0	80.0	6-12-12-12		
41	SPT	80.0	82.0	6-6-5-5		
42	SPT	82.0	84.0	6-12-12-8		
43	SPT	84.0	86.0	5-5-8-26		
44	SPT	86.0	88.0	26-50/2-49-50/3		

DEPTH IN FEET: 75, 80, 85

U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
CH	VERY STIFF VERY DARK GRAY 2.5Y 3/1 CLAY high plastic, cohesive, wet		
SW	MEDIUM DENSE OLIVE BROWN 2.5Y 4/4 MEDIUM GRAINED SAND w/interbedded coarse seams, subrounded, few gravel, wet		
SW	LOOSE OLIVE BROWN 2.5Y 4/4 COARSE GRAINED SAND well graded, few gravel, wet		
SP	LOOSE OLIVE BROWN 2.5Y 4/4 FINE TO MEDIUM GRAINED SAND poorly graded, subrounded		
CH	VERY STIFF VERY DARK GRAY 2.5Y 3/1 CLAY high plastic, cohesive, wet		
SW	LOOSE OLIVE BROWN 2.5Y 4/4 MEDIUM TO COARSE GRAINED SAND well graded, some gravel, wet		
CH	MEDIUM VERY DARK GRAY 2.5Y 3/1 CLAY high plastic, cohesive, rapid dilatancy, wet		
SP	LOOSE OLIVE BROWN 2.5Y 4/4 FINE GRAINED SAND noncohesive, rounded, poorly graded, wet		
CH	MEDIUM VERY DARK GRAY 2.5Y 3/1 CLAY high plastic, cohesive, wet		
SW	MEDIUM DENSE OLIVE BROWN 2.5Y 4/4 MEDIUM TO COARSE GRAINED SAND well graded, subrounded, some gravel, wet		
	HARD SANDSTONE		

REFUSAL @ 87.6'

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 154,452.3 E 514,681.1**

GROUND ELEVATION **399.2** SYSTEM **State Plane using NAD27/29**

BORING NO. **PZ-1703** DATE **7/11/18** SHEET **1** OF **3**

BORING START **10/16/17** BORING FINISH **10/16/17**

PIEZOMETER TYPE WELL TYPE

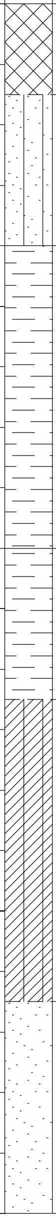
HGT. RISER ABOVE GROUND **3.24** DIA **4.25**

DEPTH TO TOP OF WELL SCREEN **39.85** BOTTOM **49.52**

WELL DEVELOPMENT **YES** BACKFILL

FIELD PARTY **TERRACON/AMEC** RIG

Water Level, ft	▽	▼	▼̲
TIME			
DATE			



SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
										SILT AND GRAVEL (FILL)		
									SM	LOOSE BROWN 7.5YR 5/3 SILTY SAND (SM) (FILL) trace fine gravel, moist		
1	SS	3.0	5.0	5-5-5-5	2.0							
									CL	STIFF BROWN 7.5YR 5/4 SANDY CLAY (CL) (~FILL) moist @8' silt seams		
							5					
2	SS	8.0	10.0	3-4-7-7	2.0							
									CL	STIFF LIGHT GRAY GLEY 1-8-N AND LIGHT BROWN MOTTLED LEAN CLAY (CL) (~FILL) w/black, moist		
							10					
									CL ML	STIFF BROWN 2.5YR 4/4 SILTY CLAY (cl-ml) w/some light gray mottling, moist		
3	SS	13.0	15.0	4-6-7-7	2.0							
							15					
									SP	LOOSE LIGHT BROWN 5YR 7/4 FINE GRAINED PG SAND (SP) silty sand pockets, moist		
4	SS	18.0	20.0	3-3-4-3	2.0							

Continued Next Page

TYPE OF CASING USED

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

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

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

RECORDER

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **PZ-1703** DATE **7/11/18** SHEET **2** OF **3**

PROJECT **ROCKPORT PLANT** BORING START **10/16/17** BORING FINISH **10/16/17**

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	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
5	SS	23.0	25.0	5-8-10-10	1.92		25	SM SP	MEDIUM DENSE BROWN 5YR 4/4 SILTY SAND (SM) moist MEDIUM DENSE LIGHT BROWN 5YR 7/4 FINE TO MEDIUM GRAINED PG SAND (SP) moist @ 28' trace coal fragments, little to some fine gravel @ 33' some black staining, little silt, no coal fragments, , wet, water in spoon		
6	SS	28.0	30.0	6-9-11-7	1.83		30				
7	SS	33.0	35.0	2-4-3-5	1.92		35	SP	LOOSE BROWN 5YR 4/4 MEDIUM TO COARSE GRAINED PG SAND (SP) trace fine gravel, wet		
8	SS	38.0	40.0	3-4-4-6	1.5		40	SW	LOOSE GRAYISH BROWN 2.5YR 4/1 WS SAND (SW) w/fine to coarse gravel, wet		
9	SS	43.0	45.0	8-7-10-7	1.0		45	SP	MEDIUM DENSE BROWN 7.5YR 4/4 FINE TO MEDIUM GRAINED PG SAND AND FINE GRAVEL (SP set		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **PZ-1703** DATE **7/11/18** SHEET **3** OF **3**

PROJECT **ROCKPORT PLANT** BORING START **10/16/17** BORING FINISH **10/16/17**

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
10	SS	48.0	50.0	6-11-17-14			50		SP	MEDIUM DENSE GRAYISH BROWN 2.5YR 5/2 MEDIUM TO COARSE GRAINED PG SAND AND FINE GRAVEL (SP) wet		
										BT @ 52'		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 156,115.9 E 513,931.8**

GROUND ELEVATION **398.9** SYSTEM **State Plane using NAD27/29**

BORING NO. **PZ-1704** DATE **7/11/18** SHEET **1** OF **2**

BORING START **10/6/17** BORING FINISH **10/6/17**

PIEZOMETER TYPE WELL TYPE

HGT. RISER ABOVE GROUND **3.70** DIA **4.25**

DEPTH TO TOP OF WELL SCREEN **40.53** BOTTOM **50.20**

WELL DEVELOPMENT **YES** BACKFILL

FIELD PARTY **TERRACON/AMEC** RIG

Water Level, ft	▽	▼	▼
TIME			
DATE			

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
1	SPT	3.0	5.0	4-5-4-3					CH	SOFT REDDISH BROWN 5YR 5/3 CLAY high plastic, cohesive, dry		
									SM	LOOSE STRONG BROWN 7.5YR 4/6 SILTY SAND rounded, medium gravel, poorly graded, dry		
							5		CL	SOFT REDDISH BROWN 5YR 4/3 SANDY LEAN CLAY medium plastic, cohesive, dry		
2	SPT	8.0	10.0	1-3-4-5					CH	SOFT GRAY GLEY1 6/6 CLAY high plastic, cohesive, dry		
							10					
3	SPT	13.0	15.0	4-7-7-6					CH	MEDIUM GRAY GLEY1 6/6 CLAY high plastic, mottled darker gray seams, dry		
							15		CH	MEDIUM STIFF REDDISH BROWN 5YR 5/3 CLAY high plastic, cohesive, mottled light gray, dry		
4	SPT	18.0	20.0	2-5-4-3					CH	MEDIUM STIFF REDDISH BROWN 5YR 5/3 FAT CLAY w/sand, high plastic, cohesive, 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"

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

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **PZ-1704** DATE **7/11/18** SHEET **2** OF **2**

PROJECT **ROCKPORT PLANT** BORING START **10/6/17** BORING FINISH **10/6/17**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
5	SPT	23.0	25.0	3-4-5-5			25	CH	MEDIUM STIFF REDDISH BROWN 5YR 5/3 FAT CLAY high plastic, cohesive, fine sand seams ~1" thick @ 24.5' & 25.2'		
6	SPT	28.0	30.0	4-8-12-11				CH	MEDIUM STIFF BROWN 7.5YR 4/2 FAT CLAY high plastic, cohesive, moist		
								SM	MEDIUM DENSE REDDISH BROWN 2.5YR 4/4 FINE GRAINED SILTY SAND rounded, poorly graded, wet		
							30	SW	MEDIUM DENSE YELLOWISH BROWN 10YR 5/4 COARSE SAND well graded, few gravel, wet		
7	SPT	33.0	35.0	1-3-4-5				ML	VERY SOFT YELLOWISH BROWN 10YR 5/4 SANDY SILT non plastic, rapid dilatancy, wet		
								SM	VERY LOOSE STRONG BROWN 7.5YR 5/6 MEDIUM GRAINED SILTY SAND subrounded, few gravel, wet		
									COAL SEAM		
							35	SW SM	LOOSE YELLOWISH BROWN 10YR 5/6 COARSE GRAINED SAND w/gravel, well graded, angular, wet		
8	SPT	38.0	40.0	3-4-7-8			40	SP	LOOSE YELLOWISH BROWN 10YR 5/6 MEDIUM GRAINED SAND subrounded, few gravel, wet		
							45				

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY	**INDIANA MICHIGAN POWER COMPANY**	BORING NO. **PZ-1705**	DATE **7/11/18** SHEET **1** OF **3**
PROJECT	**ROCKPORT PLANT**	BORING START **10/5/17**	BORING FINISH **10/5/17**
COORDINATES	**N 158,399.6 E 515,000.5**	PIEZOMETER TYPE	WELL TYPE
GROUND ELEVATION	**389.6** SYSTEM **State Plane using NAD27/29**	HGT. RISER ABOVE GROUND **3.60**	DIA **4.25**
		DEPTH TO TOP OF WELL SCREEN **40.07**	BOTTOM **49.13**
		WELL DEVELOPMENT **YES**	BACKFILL
		FIELD PARTY **TERRACON/AMEC**	RIG

Water Level, ft	▽	▼	▼
TIME			
DATE			

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
1	SPT	3.0	5.0	9-14-21-24					CH	VERY STIFF REDDISH BROWN 5YR 5/3 CLAY high plastic, cohesive, mottled, dry		
							5		ML	VERY STIFF YELLOW 10YR 7/6 CLAY low plastic, some sand, dry		
2	SPT	8.0	10.0	6-10-11-10					CH	STIFF YELLOWISH BROWN 10YR 5/6 CLAY high plastic, cohesive, mottled, dry		
									SM	LOOSE YELLOWISH BROWN 10YR 5/6 FINE GRAINED SILTY SAND rounded, poorly graded, dry		
							10		CH	STIFF YELLOWISH BROWN 10YR 5/6 CLAY high plastic, cohesive, mottled, dry		
3	SPT	13.0	15.0	5-7-8-10					CH	STIFF LIGHT GRAY 10YR 7/2 CLAY high plastic, cohesive, moist		
							15		SW	LOOSE YELLOWISH BROWN 10YR 5/4 MEDIUM TO COARSE GRAINED SAND subrounded, well graded, few gravel		
4	SPT	18.0	20.0	3-6-7-7					SW	LOOSE YELLOWISH BROWN 10YR 5/6 COARSE GRAINED SAND subrounded, well graded, some gravel, moist		

Continued Next Page

TYPE OF CASING USED

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

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

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

RECORDER

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **PZ-1705** DATE **7/11/18** SHEET **2** OF **3**

PROJECT **ROCKPORT PLANT** BORING START **10/5/17** BORING FINISH **10/5/17**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD 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	23.0	25.0	2-2-4-6			25		SP	VERY LOOSE YELLOWISH BROWN 10YR 5/6 MEDIUM GRAINED SAND subrounded, poorly graded, few gravel, wet		
6	SPT	28.0	30.0	3-3-2-3			30		SW SP	VERY LOOSE YELLOWISH BROWN 10YR 5/6 MEDIUM GRAINED SAND subrounded, well graded, few gravel, wet VERY DARK GRAYISH BROWN 10YR 3/2 SAND w/gravel, subrounded, well graded, rapid dilatancy, wet		
7	SPT	33.0	35.0	2-4-4-6			35		SP SW SP	VERY LOOSE DARK YELLOWISH ORANGE 10YR 6/6 FINE GRAINED SAND rounded, poorly graded, trace silt, wet VERY LOOSE DARK YELLOWISH BROWN 10YR 3/4 COARSE GRAINED SAND well graded, some gravel, trace clay, wet COAL SEAM LOOSE YELLOWISH BROWN 10YR 5/6 FINE GRAINED SAND rounded, poorlly graded, few gravel, wet		
8	SPT	38.0	40.0	2-2-3-5			40		SW SW	VERY LOOSE BROWN 10YR 5/3 COARSE GRAINED SAND w/gravel, well graded, subrounded, trace clay, wet LOOSE GRAYISH BROWN 10YR 5/2 MEDIUM GRAINED SAND subrounded, well graded		
9	SPT	43.0	45.0	9-14-16-16			45		SW SP	LOOSE YELLOW BROWN 10YR 5/6 COARSE GRAINED SAND w/gravel, well graded, subrounded to angular, wet MEDIUM DENSE DARK YELLOWISH BROWN 10YR 4/4 FINE GRAINED SAND subrounded, poorlly graded, few gravel, trace silt,		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **PZ-1705** DATE **7/11/18** SHEET **3** OF **3**

PROJECT **ROCKPORT PLANT** BORING START **10/5/17** BORING FINISH **10/5/17**

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
										wet		
10	SPT	48.0	50.0	9-11-12-14				░	SW	MEDIUM DENSE DARK YELLOWISH BROWN 10YR 4/6 COARSE GRAINED SAND well graded, subrounded, some gravel, wet		
							50					
										TBHD = 51'		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY	**INDIANA MICHIGAN POWER COMPANY**	BORING NO. **PZ-1706**	DATE **7/11/18** SHEET **1** OF **3**
PROJECT	**ROCKPORT PLANT**	BORING START **10/9/17**	BORING FINISH **10/9/17**
COORDINATES	**N 153,979.3 E 517,034.2**	PIEZOMETER TYPE	WELL TYPE
GROUND ELEVATION **395.1**	SYSTEM **State Plane using NAD27/29**	HGT. RISER ABOVE GROUND **3.36**	DIA **4.25**
		DEPTH TO TOP OF WELL SCREEN **40.16**	BOTTOM **49.85**
		WELL DEVELOPMENT **YES**	BACKFILL
		FIELD PARTY **TERRACON/AMEC**	RIG

Water Level, ft	▽	▼	▼
TIME			
DATE			

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
									TOPSOIL = 2" SILT AND GRAVEL FILL TO ~ 2.0'		
1	SS	3.0	5.0	4-6-8-7	1.42		5	CL ML	STIFF DARK GRAY (5YR 5/1) SILTY CLAY (CL-ML) AND GRAVEL (FINE TO COARSE) moist		
2	SS	8.0	10.0	2-2-3-3	1.58		10	CL	MEDIUM STIFF DARK GRAY (5YR 5/1) SANDY CLAY (CL) AND GRAVEL (FINE TO COARSE) moist		
3	SS	13.0	15.0	1-2-3-4	1.83		15	SP	LOOSE LIGHT BROWN (7.5YR 7/8) POORLY GRADED SAND (SP) FINE GRAINED sandy silt seams, moist @ 18' no sandy silt, trace fine gravel, trace coarse grained		
4	SS	18.0	20.0	4-4-5-4	1.75						

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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

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **PZ-1706** DATE **7/11/18** SHEET **2** OF **3**

PROJECT **ROCKPORT PLANT** BORING START **10/9/17** BORING FINISH **10/9/17**

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
5	SS	23.0	25.0	2-4-4-4	1.92				SP	LOOSE LIGHT BROWN (7.5YR 6/3) POORLY GRADED SAND (SP) AND FINE GRAVEL MEDIUM TO COARSE GRAINED moist		
							25		SP	LOOSE RED BROWN (2.5YR 5/8) POORLY GRADED SAND (SP) AND FINE GRAVEL COARSE GRAINED moist		
6	SS	28.0	30.0	4-4-2-3	1.92				SM	LOOSE LIGHT BROWN (7.5YR 6/6) SILTY SAND (SM) trace fine to coarse gravel, wet		
							30		SW	LOOSE GRAYISH BROWN (7.5YR 5/3) WELL GRADED SAND (SW) AND FINE GRAVEL wet		
7	SS	33.0	35.0	WH-WH-WH-2	1.83		35		SM	VERY LOOSE LIGHT BROWN (7.5YR 6/8) SILTY SAND (SM) wet		
8	SS	38.0	40.0	3-4-5-5	2.0				SP	LOOSE LIGHT BROWN (5YR 7/6) POORLY GRADED SAND (SP) FINE GRAINED wet		
							40		SM	LOOSE GRAYISH BROWN (2.5YR 6/2) SILTY SAND (SM) AND FINE GRAVEL wet		
9	SS	43.0	45.0	4-4-4-5	1.58		45		SW	LOOSE GRAYISH BROWN (5YR 6/2) WELL GRADED SAND (SW) AND FINE GRAVEL wet		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **PZ-1706** DATE **7/11/18** SHEET **3** OF **3**

PROJECT **ROCKPORT PLANT** BORING START **10/9/17** BORING FINISH **10/9/17**

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
10	SS	48.0	50.0	1-7-9-7	1.67		50		SP	MEDIUM DENSE BROWNISH GRAY (5YR 5/1) POORLY GRADED SAND (SP) FINE GRAINED some fine gravel, wet		
										BT @ 52' / WELL INSTALLATION @ 52'		

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER **42393125-01**

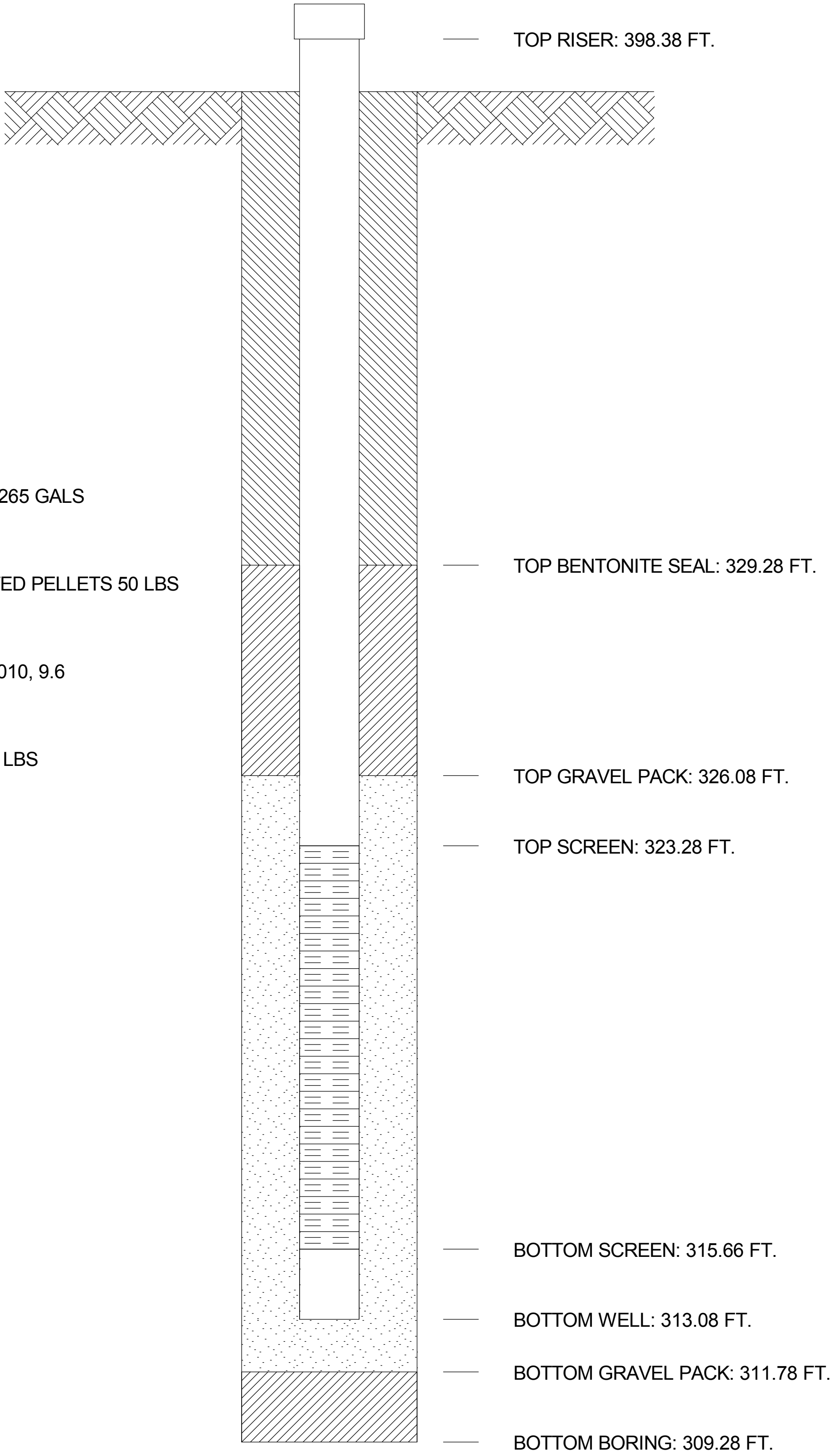
COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No. **MW-1701D** BORING No. ____ INSTALLED **10/11/17**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 155,708.2 E 511,570.0**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 395.28 FT.



▧ GROUT SEAL: HIGH SOLIDS 265 GALS

▨ BENTONITE SEAL: 3/8" COATED PELLETS 50 LBS

☰ SCREEN: 2.0 dia., SLOTTED .010, 9.6

░ GRAVEL PACK: #5 SAND 200 LBS

☐ RISER PIPE: 2.0, dia., PVC

∿ SPACERS, DEPTH:

MONITORING WELL CONSTRUCTION

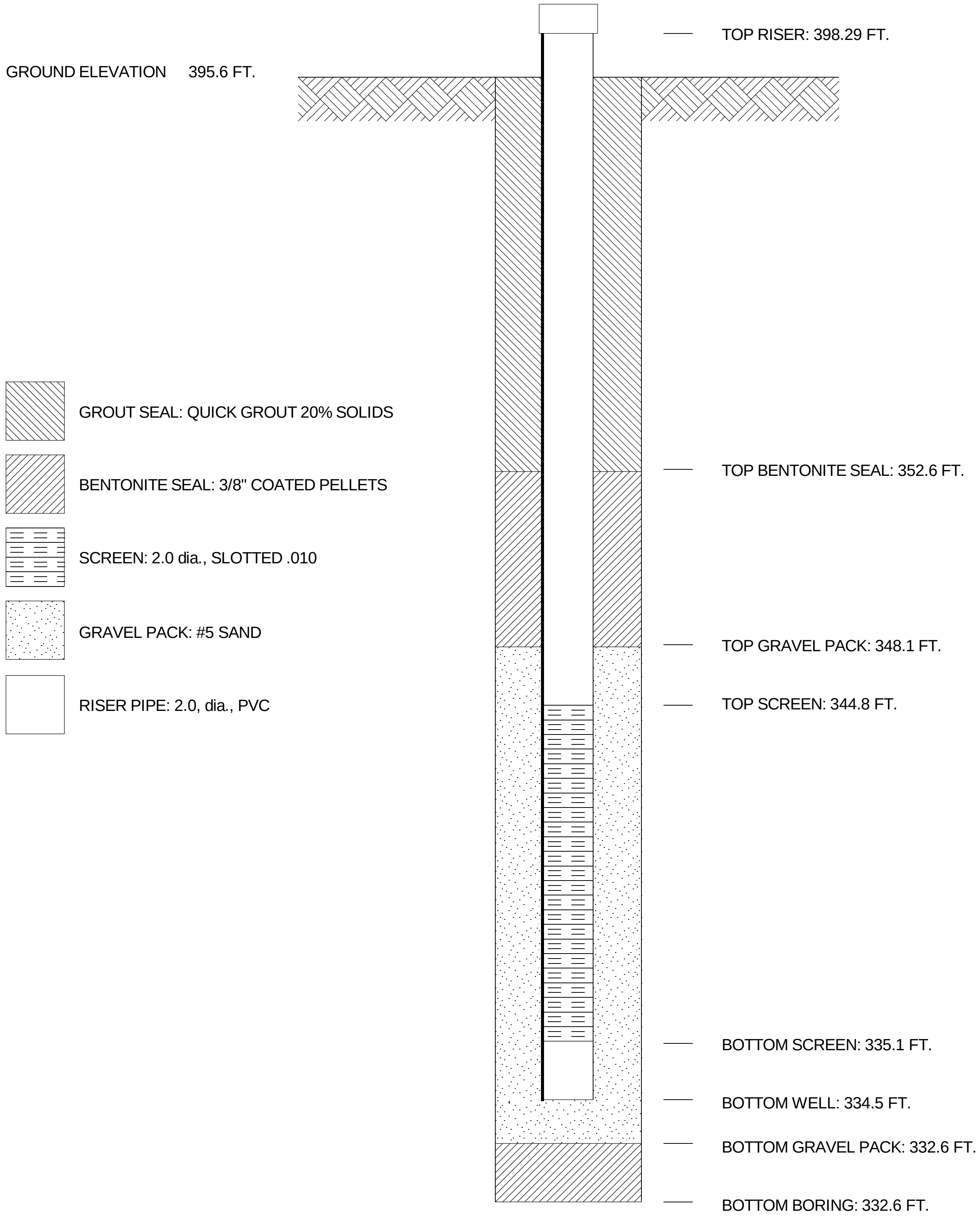
PROJECT NO. 7362172421

WELL ID MW-1701I

CLIENT AEP

DATE INSTALLED 10/13/2017

COORDINATES N 155703.04, E 511568.64 SPCS NAD27



MONITORING WELL CONSTRUCTION

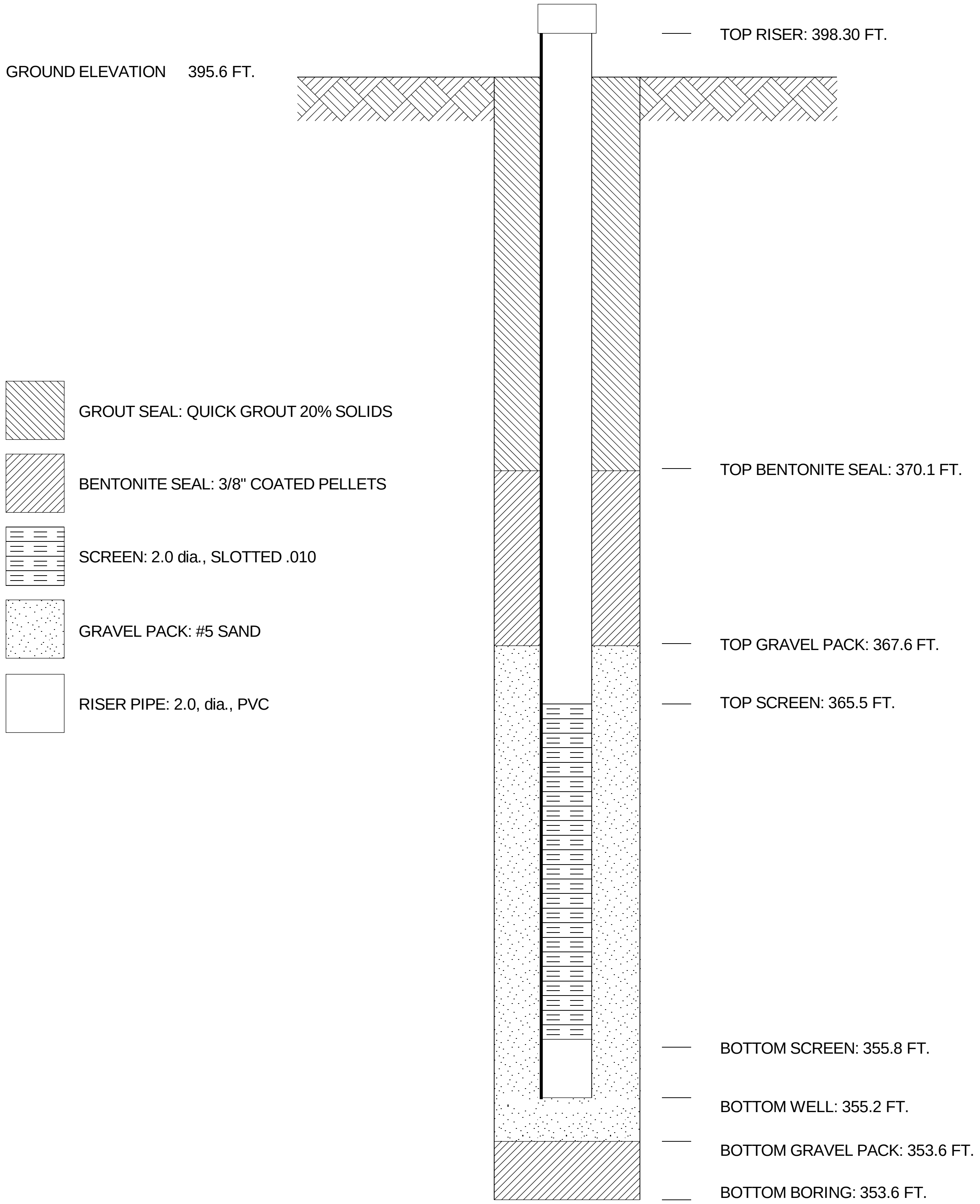
PROJECT NO. 7362172421

WELL ID MW-1701S

CLIENT AEP

DATE INSTALLED 10/16/2017

COORDINATES N 155697.39, E 511567.94 SPCS NAD27



AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER **42393125-01**

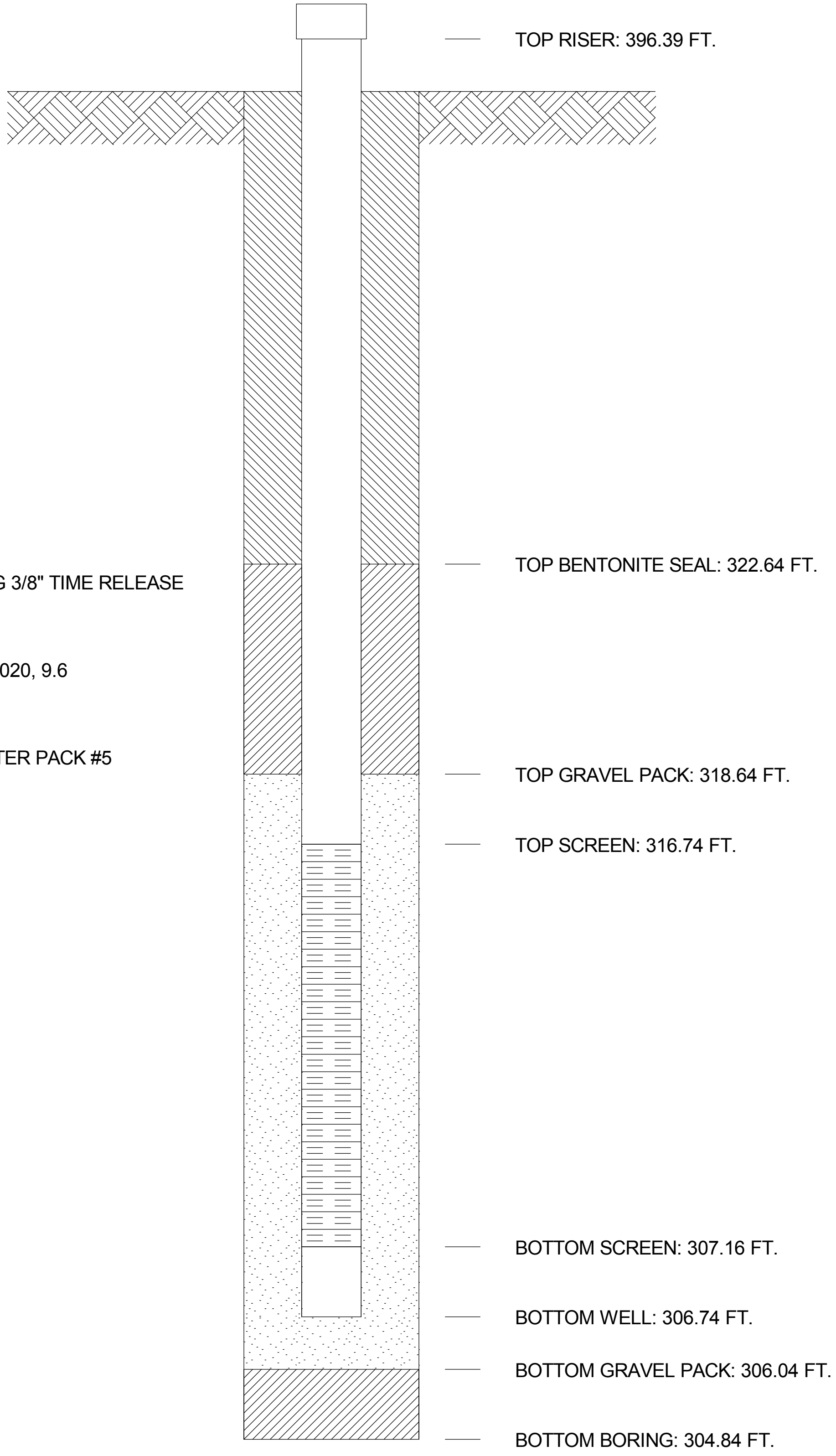
COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No. **MW-1702D** BORING No. INSTALLED **10/2/17**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 153,659.2 E 511,922.9**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 392.44 FT.



▧ GROUT SEAL:

▨ BENTONITE SEAL: PEL-PLUG 3/8" TIME RELEASE PELLETS

☰ SCREEN: 2.0 dia., SLOTTED .020, 9.6

░ GRAVEL PACK: GLOBAL FILTER PACK #5

☐ RISER PIPE: 2.0, dia., PVC

∿ SPACERS, DEPTH:

MONITORING WELL CONSTRUCTION

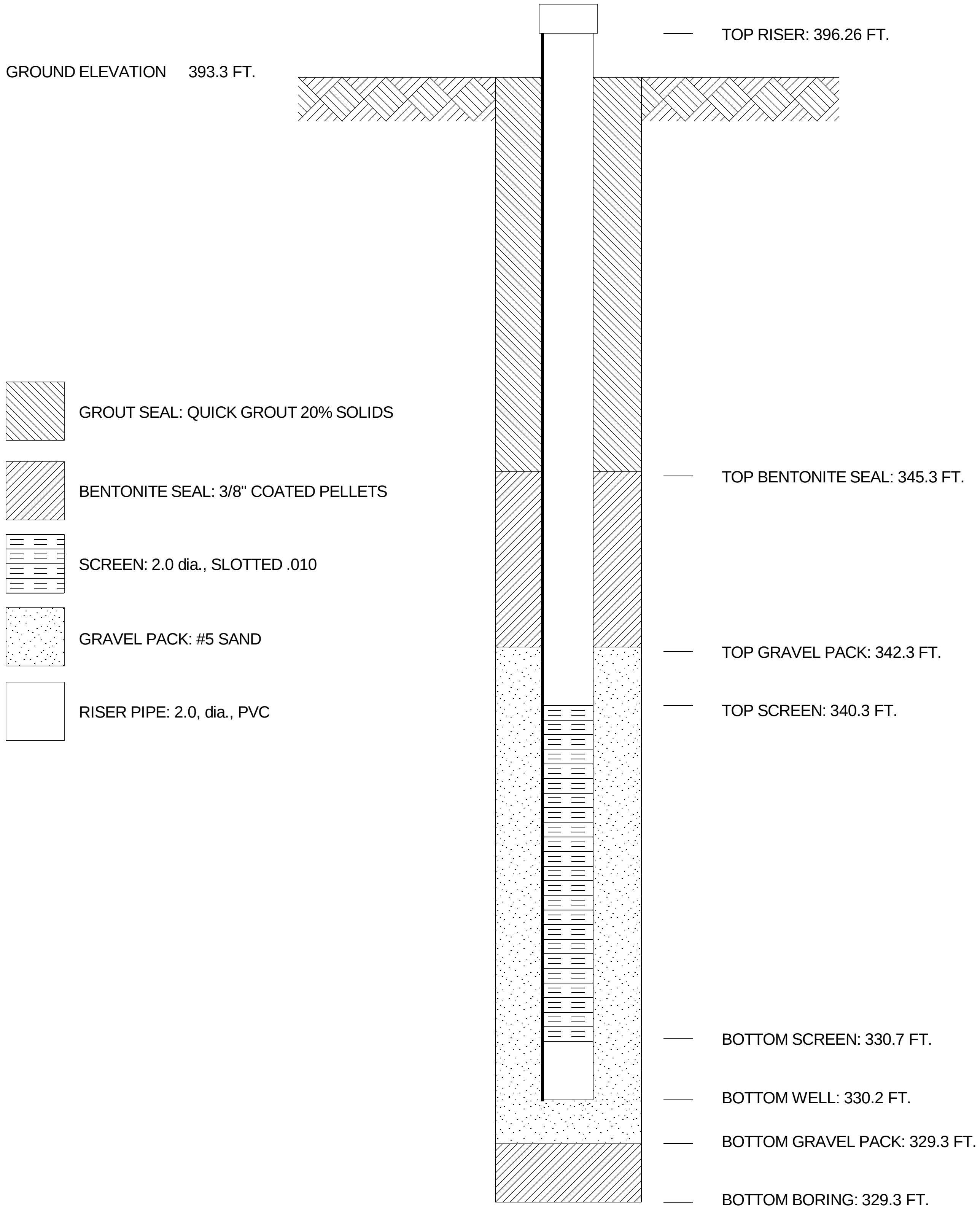
PROJECT NO. 7362172421

CLIENT AEP

COORDINATES N 153655.81, E 511921.85 SPCS NAD27

WELL ID MW-1702I

DATE INSTALLED 10/4/2017



MONITORING WELL CONSTRUCTION

PROJECT NO. 7362172421

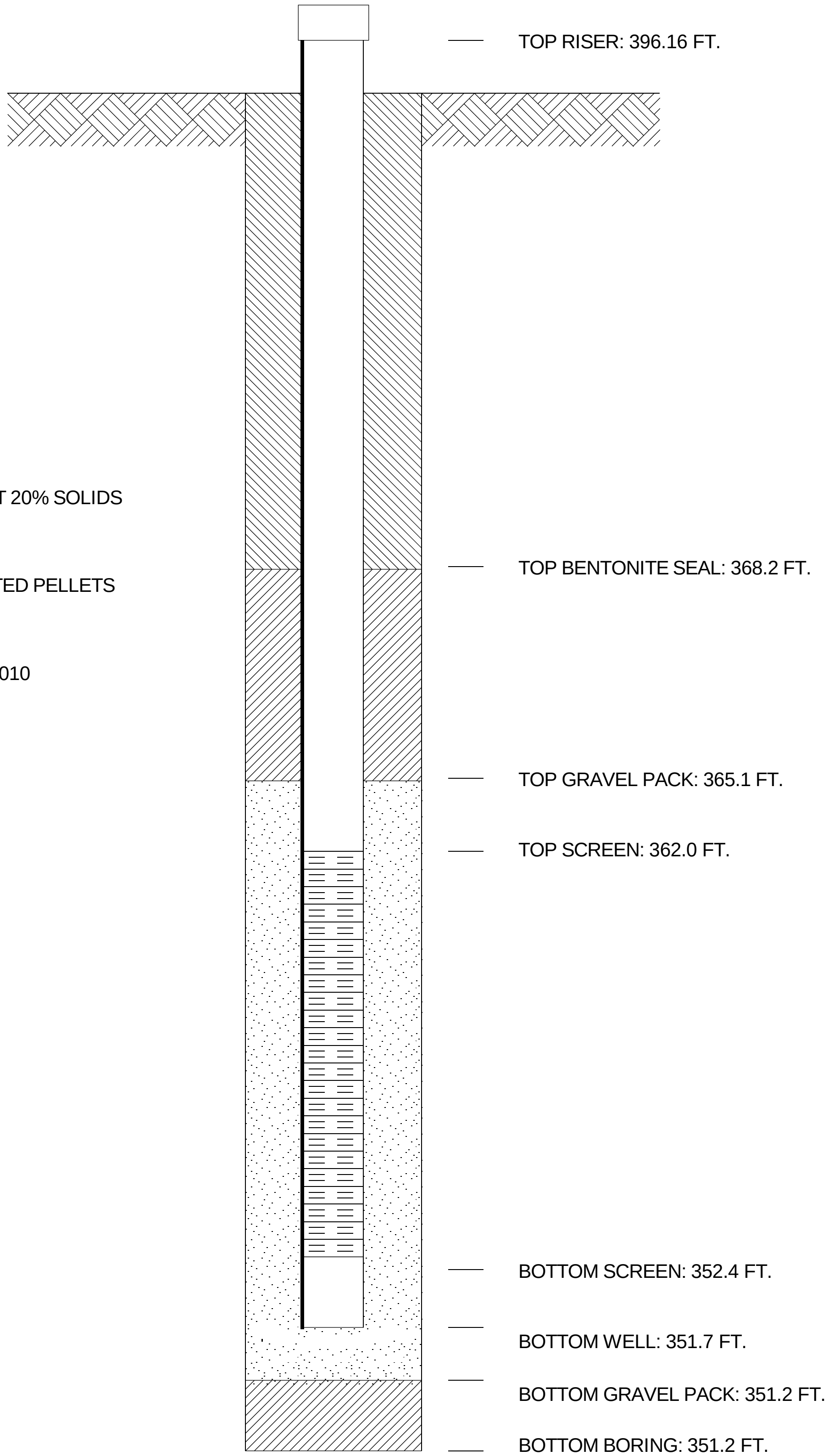
CLIENT AEP

COORDINATES N 153650.79, E 511921.68 SPCS NAD27

WELL ID MW-1702S

DATE INSTALLED 10/5/2017

GROUND ELEVATION 393.2 FT.



▧ GROUT SEAL: QUICK GROUT 20% SOLIDS

▨ BENTONITE SEAL: 3/8" COATED PELLETS

☰ SCREEN: 2.0 dia., SLOTTED .010

░ GRAVEL PACK: #5 SAND

□ RISER PIPE: 2.0, dia., PVC

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER **42393125-01**

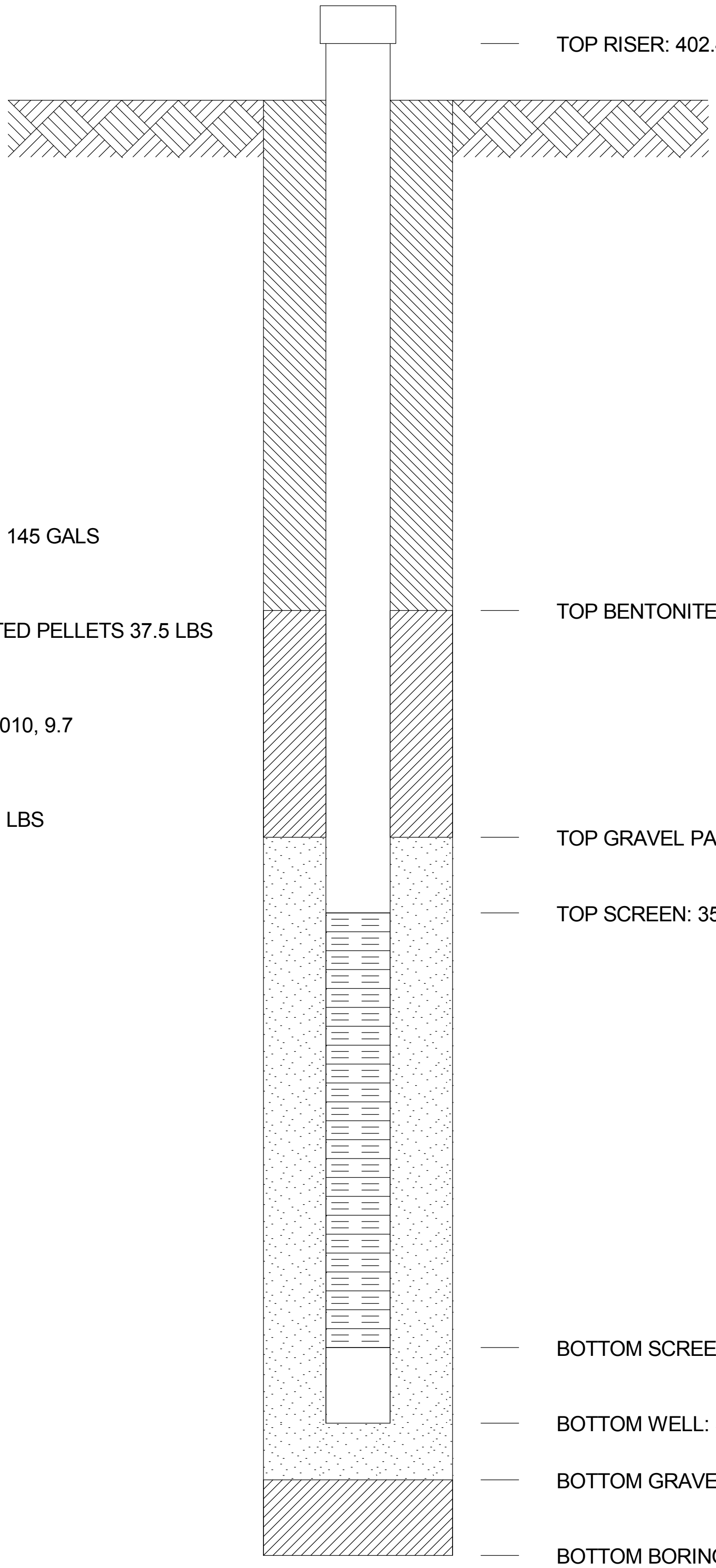
COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No. **PZ-1703** BORING No. ____ INSTALLED **10/16/17**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 154,452.3 E 514,681.1**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 399.18 FT.



TOP RISER: 402.42 FT.

TOP BENTONITE SEAL: 366.18 FT.

TOP GRAVEL PACK: 362.18 FT.

TOP SCREEN: 359.33 FT.

BOTTOM SCREEN: 349.66 FT.

BOTTOM WELL: 349.06 FT.

BOTTOM GRAVEL PACK: 347.18 FT.

BOTTOM BORING: 347.18 FT.

▧ GROUT SEAL: HIGH SOLIDS 145 GALS

▨ BENTONITE SEAL: 3/8" COATED PELLETS 37.5 LBS

☰ SCREEN: 2.0 dia., SLOTTED .010, 9.7

░ GRAVEL PACK: #5 SAND 200 LBS

☐ RISER PIPE: 2.0, dia., PVC

∿ SPACERS, DEPTH:

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

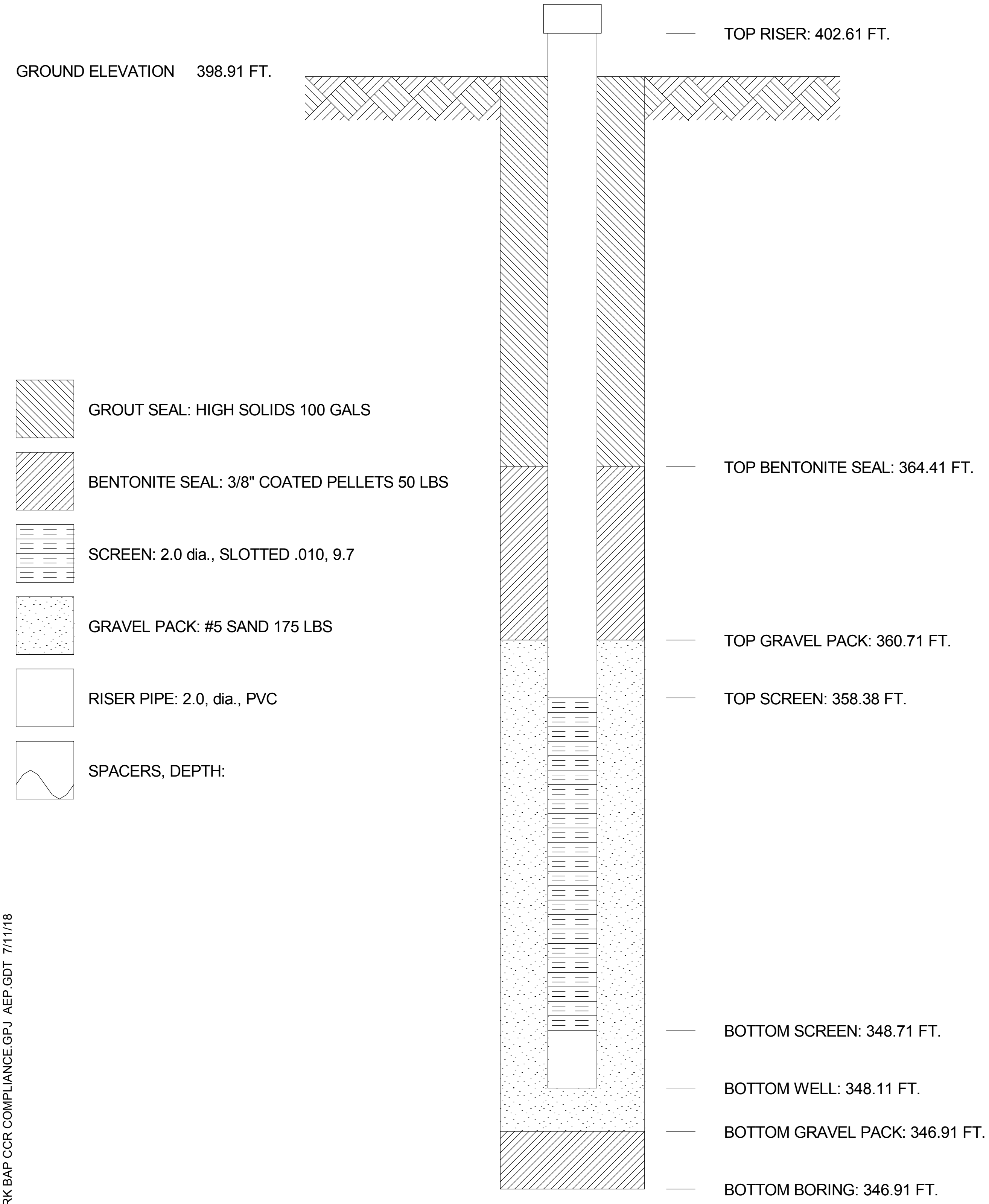
JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No. **PZ-1704** BORING No. INSTALLED **10/6/17**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 156,115.9 E 513,931.8**

SYSTEM **State Plane using NAD27/29**



AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER **42393125-01**

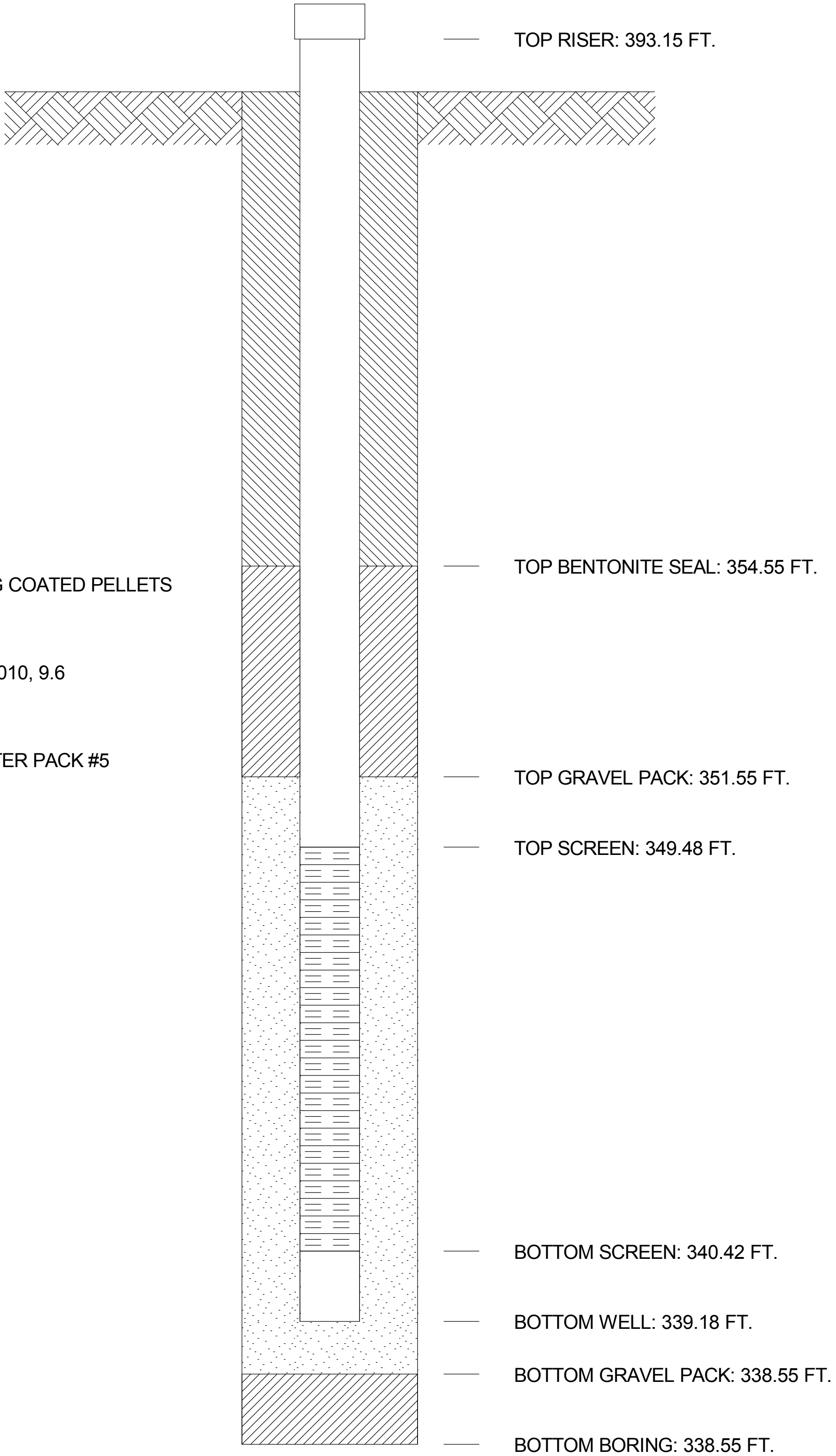
COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No. **PZ-1705** BORING No. INSTALLED **10/5/17**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 158,399.6 E 515,000.5**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 389.55 FT.



▨ GROUT SEAL: BENTONITE

▨ BENTONITE SEAL: PEL-PLUG COATED PELLETS

☰ SCREEN: 2.0 dia., SLOTTED .010, 9.6

░ GRAVEL PACK: GLOBAL FILTER PACK #5

☐ RISER PIPE: 2.0, dia., PVC

∿ SPACERS, DEPTH:

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER **42393125-01**

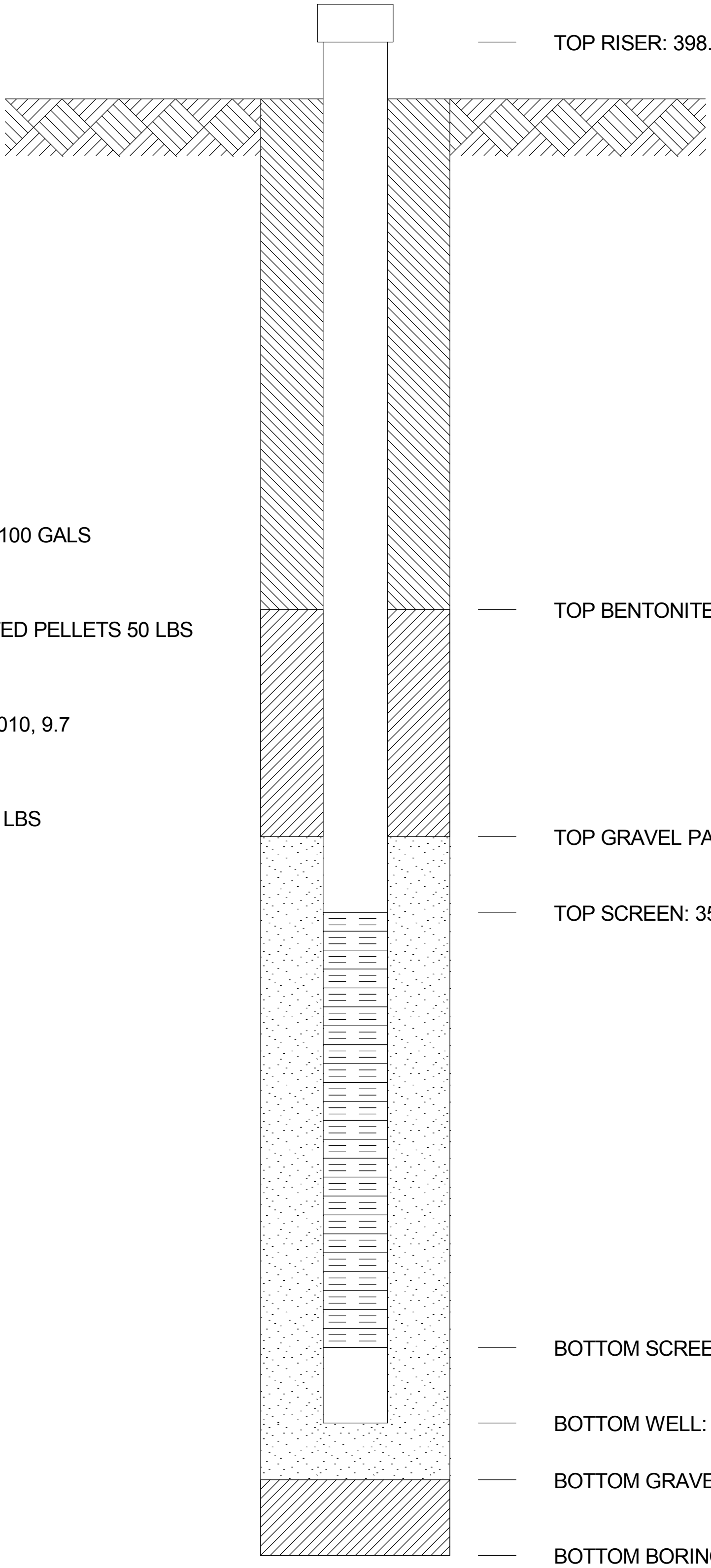
COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No. **PZ-1706** BORING No. INSTALLED **10/9/17**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 153,979.3 E 517,034.2**

SYSTEM **State Plane using NAD27/29**

GROUND ELEVATION 395.10 FT.



▧ GROUT SEAL: HIGH SOLIDS 100 GALS

▨ BENTONITE SEAL: 3/8" COATED PELLETS 50 LBS

☰ SCREEN: 2.0 dia., SLOTTED .010, 9.7

░ GRAVEL PACK: #5 SAND 200 LBS

□ RISER PIPE: 2.0, dia., PVC

∿ SPACERS, DEPTH:

GROUNDWATER MONITORING NETWORK EVALUATION
Existing CCR Landfill
Rockport Plant
Indiana-Michigan Power Company
Rockport, Indiana

Prepared for:
American Electric Power Service Corporation
and Indiana-Michigan Power Company
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14 September 2017

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APPENDICES

1.0 OBJECTIVE

This Groundwater Monitoring Network Evaluation Report has been prepared by Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler), on behalf of American Electric Power (AEP), to document the results of the monitoring well network evaluation conducted for the Ash Landfill at the Rockport Plant in Rockport, Indiana. The Groundwater Monitoring Network Evaluation was conducted to evaluate the adequacy of the existing monitoring well network and, if applicable, to make recommendations for additional well installations.

Specifically, the existing monitoring well network at the Ash Landfill was evaluated for compliance with the coal combustion residuals (CCR) Final Rule issued by the U.S. Environmental Protection Agency (USEPA) on 17 April 2015. Regulations pertaining to Groundwater Monitoring and Corrective Action are contained in the Code of Federal Regulations (CFR) 40 CFR 257.90 through 98. The focus of this evaluation was on §257.91 (Groundwater Monitoring Systems).

2.0 BACKGROUND INFORMATION

2.1 Facility Location and Description

The Rockport Power Plant is located in southwest Indiana (**Figure 1**) in Spencer County, on property extending into three Townships: Ohio, Hammond and Grass. The plant is situated on the north bank of the Ohio River, just northeast of the intersection of State Route (SR) 66, and United States (US) Highway 231. SR 66 runs along the river between the Town of Grandview (about 1.5 miles to the east) and the City of Rockport (about 1 mile to the southwest), and US 231 runs south from Interstate 64 (about 20 miles north of the plant), crossing the Ohio River into Kentucky via the William H. Natcher Bridge just southwest of the Power Plant.

The site is owned and operated by Indiana-Michigan Power Company, a regional unit of AEP. The property was developed in the late 1970s and early 1980s. The facility consists of two coal-fired 1,300-megawatt (MW) power generating units. The first unit went into operation in December 1984, and the second in December 1989. The facility has two existing CCR storage/disposal units consisting of the ash landfill located north-northeast of the generating plant, and two adjacent bottom ash (BA) ponds located just south of the generating plant at the north end of a wastewater pond complex. The general layout of the property and the locations of the CCR units are shown on **Figure 2**.

The following description of CCR generation and handling processes at the Rockport Plant is summarized from a letter sent by AEP to the Indiana Department of Environmental Management (IDEM) on 6 May 2009:

> The plant burns about 9-10 million tons of coal per year. The coal, delivered by barge, is off-loaded to the coal storage yard then transported by conveyor into one of the two generating units, where it is pulverized to a powder then injected and burned. The heat produced in burning coal converts water to steam used to drive the turbine generators which produce electricity. The burning of coal produces two types of ash - fly ash and bottom ash. The Rockport Plant produces about 400,000 tons of fly ash and 140,000 tons of bottom ash per year.

Fly ash is the fine particulate matter entrained in the hot flue gases. To remove the fly ash prior to the gases exiting through the plant stack, the flue gas is routed through an electrostatic precipitator (ESP), where the ash particles adhere to electrically charged plates. Mechanical rappers knock the fly ash off the plates down into a series of collection hoppers. From the hoppers, the fly ash is pneumatically conveyed to a storage silo. From the silo, the ash is either loaded dry into closed trucks and shipped offsite for various uses, or conditioned with a small quantity of water and hauled by truck to the onsite landfill for disposal.

Bottom ash (BA) includes the heavier coal ash particles that fall to the bottom of the steam generator and are collected into refractory-lined hoppers. The hoppers are kept full of water to protect the lining and break the fall of large pieces of hot slag which shatter upon contact with the relatively cool water. From the hoppers, the BA-water mixture is routed to a crusher station where the ash is crushed to a size suitable for pumping. The BA is then pumped to one of the BA ponds located in the wastewater pond complex, where it precipitates out and can be reclaimed after the pond is drained.

2.2 Description of CCR Unit

2.2.1 General

The CCR unit referred to as the Ash Landfill, or Landfill, is located about 8,000 feet (1.5 miles) northeast of the generating plant. **Figure 3** shows the general layout of the landfill and the monitoring well locations, using the U.S. Geological Survey (USGS) topographic quadrangle map of 1964 (photorevised 1982) as a base. **Figure 4** is a topographic map for the whole plant area.

In March 1984, AEP submitted an application to develop 606 acres in the northern portion of the property for CCR disposal, including 460 acres for fly ash disposal (Storage Area 1) and 146 acres for bottom ash disposal (Storage Area 2). The Indiana Environmental Management Board (precursor agency to IDEM) issued a permit to construct in August 1985, and an operating permit (Facility Permit FP 74-2) in July 1987.

Because the bottom ash produced by the plant has been sold or used onsite for beneficial reuse purposes since the plant started operation, the portion of the property reserved for bottom ash storage and/or landfilling (Area 2) has never been used. The 1984 Permitted Boundary shown on the figures in this report includes only Area 1, the 460-acre area reserved for fly ash disposal. That area is transected by a north-south power line right-of-way (ROW). The area east of the ROW (Storage Area 1A) includes both closed and currently active portions of the fly ash landfill. The area to the west of the ROW has not been used for landfilling, but includes support facilities for the active landfill, including an office trailer, stockpile areas, leachate storage and ponds and a NPDES discharge structure.

The fly ash landfill is currently permitted by IDEM Office of Land Quality, Solid Waste Permits Section, as a Restricted Waste Site (RWS) under Indiana Administrative Code (IAC) 329 Title 10 (Solid Waste Landfill Disposal Facilities) Rule 9-4. A Restricted Waste Site may accept only one type, or related types, of waste. The waste is classified according to the results of certain leaching tests for specific parameters specified in the regulation. Classifications range from Type I (highest leachate concentrations) to Type IV (lowest leachate concentrations), and the landfill requirements (including liner system and leachate handling requirements) are determined according to the waste class. The active landfill is permitted as a Restricted Waste Site Type I. The permit was most recently renewed on 10 February 2015, and expires on 11 February 2020. A copy of the permit is provided in **Appendix A**.

2.2.2 Surface Water and Leachate Control

As shown on the topographic maps in **Figures 3 and 4**, the original topography of the fly ash storage area was relatively flat, with grade elevations between 390 and 395 feet above Mean Sea Level (MSL, equivalent to the National Geodetic Vertical Datum of 1929, or NGVD29). Beyond the permitted boundary, the original topographic relief rose gently to the north-northwest, and more steeply toward hills to the northeast and northwest.

Stormwater from the landfill area is directed to perimeter drainage systems. The northeast, north and northwest perimeter of the landfill site is drained by Shafer Drain, part of a former agricultural drainage system that flows to Honey Creek southwest of the landfill. A perimeter ditch on the southeast landfill boundary also drains southwest to Honey Creek. Honey Creek flows southeast across the plant property to the Ohio River.

Leachate from the landfill cells is collected in lined ponds located north and west of the active landfill area. Prior to discharge, the leachate is transferred to the Leachate Treatment Pond (north of the West Leachate Pond), where it is diluted with well water from supply well PW-7. The effluent from the Leachate Treatment Pond is discharged and monitored under National Pollution Discharge Elimination System (NPDES) Permit No. IN0051845 at Station 002.

2.2.3 Construction and Operational History

Construction on the original fly ash landfill, located in the northeast portion of the permitted area (Area 1), was conducted between 1985 and 1987. In the early years of operation, much of the fly ash generated at the plant was beneficially reused (primarily for Ready-Mix concrete production), and filling of the landfill proceeded more slowly than anticipated at the time of permitting.

The original landfill cells were constructed on the east end of the permitted area, from north to south, with final cover being placed over the cells in this area (showed as Closed Landfill on the figures in this report) between 2000 and 2007. After 2007, expansion of the landfill continued into the southeast section of the area shown as the Active Landfill on the figures.

The ash that was landfilled originally (in the late 1980s and early 1990s) was generated from combustion of fuel high in western coal (relative to eastern coal), and was classified as Type II. This waste had very low permeability, and (consistent with the permit) was placed in cells lined with 5 feet of clay soil (either native in-situ soil or from borrow areas) having an average bulk permeability of 10^{-6} centimeters per second (cm/sec) or less. No leachate collection system exists between the CCR and the liner in the original landfill cells. Runoff from the cells was collected in a central pond west of the original landfill and within the currently active landfill area, and transferred from there to the leachate treatment pond for discharge via NPDES Station 002. In

2014, the original leachate collection pond in the active landfill area was removed and replaced with the perimeter leachate collection ponds (north and west).

Over a period of years after the mid-1990s, the chemistry of the fly ash changed due to changes in the sources of coal used for combustion at the plant, as well as the introduction of new materials used for emissions controls after 2007 (including sodium bicarbonate used for sulfur dioxide removal in a dry sorbent system, and granular activated carbon used for mercury removal). The landfill was reclassified as a Type I landfill through a permit modification approved by IDEM in August 2012. Under the modified permit, new cells are lined with a composite liner consisting (from the bottom up) of: 2 feet of clay with a bulk permeability of 10^{-7} cm/sec or less, a 30-mil PVC synthetic liner, and 2 feet of bottom ash containing a piping network for leachate collection. In some cells, bottom ash (which is still classified as a Type II waste) is also being placed below the composite liner to raise the subgrade level, to allow gravity drainage of the leachate collection system to the collection ponds. Current landfill construction is proceeding according to the design in the modified permit, *Fly Ash Landfill Redesign Construction Drawings, Storage Area 1A, RKP Permit #FP-74-2* prepared by Terracon and dated February 2012 (Terracon 2012).

2.2.4 Area/Volume

The total area inside the 1984 permit boundary for Area 1 is approximately 460 acres. The latest permit renewal, issued on 15 February 2015, indicates the total permitted landfill area is 554 acres, including 408 acres in Area 1 and 146 acres in Area 2 (the area designated for bottom ash storage). The permitted portions of Area 1 include Area 1A east of the power line ROW (approximately 175 acres), and Area 1B west of the ROW (approximately 233 acres). Area 1A includes the closed landfill area (approximately 41 acres) and the active landfill area (approximately 134 acres). Within the active landfill area, 110 acres have been approved for conversion from a Type II to a Type I RWS.

Based on information provided by AEP, the total permitted volume of landfill space for Type I waste is 10,840,300 cubic yards (CY). The total estimated volume of fly ash disposed in the Type I RWS through December 31 2015 was 324,523 CY, leaving 10,514,777 CY of capacity in Area 1A. Area 1B is expected to be developed for landfilling as Area 1A approaches capacity.

2.3 Previous Investigations

Site investigations were performed on the Plant property in the late 1970s and early 1980s to support design, construction and permitting in advance of plant start-up, which occurred in December 1984.

Specifically for the landfill area, AEP prepared a Landfill Application Package (AEP 1984) containing the methods and findings from a Site Investigation performed in 1983 by AEP Civil Engineering personnel of the northern portion of the plant property, to support permitting of the two CCR stockpile and landfilling areas. A location map and cross-sections as well as a bedrock topography map and a map showing the locations of existing oil and gas wells from that document are provided in **Appendix B**.

In addition, numerous subsequent submittals related to the landfill have been made by AEP to IDEM. These public records, including IDEM responses and notifications, are available for download from IDEM's online Virtual File Cabinet (VFC). They include additional borrow area investigation reports, landfill design submittals, permit modifications, and semi-annual groundwater monitoring reports (GWMRs). While an in-depth review of the totality of these records was beyond the scope of the current study, Amec Foster Wheeler has consulted selected documents available through the VFC for information on the landfill history and current permit status.

Information related to the monitoring wells installed at the landfill was provided to Amec Foster Wheeler by AEP, and construction details for those wells are summarized in **Table 1**. Monitoring well logs are reproduced in **Appendix C**.

2.4 Hydrogeologic Setting

The following sections provide information on the hydrogeologic setting of the AEP Rockport Plant, including climate, physiography and drainage, geology, hydraulic properties of the principal groundwater flow zone, surface water and interactions between surface water and groundwater, and water users.

2.4.1 Climate and Water Budget

The area of Rockport has a continental climate regime. As described by Ray (1965), summers are long hot and humid, and winters are damp and relatively mild, with brief periods of intense cold. Mean monthly temperatures vary from 35 degrees Fahrenheit (ºF) in January to 79ºF in July.

The closest meteorological station with long-term data is Owensboro, Kentucky. Based on National Climatic Data Center (NCDC) data for the period from 1971 through 2000, as reported by the Midwest Regional Climate Center (MRCC, http://mrcc.isws.illinois.edu/), the normal annual precipitation in Owensboro is 45.07 inches. Precipitation is well distributed throughout the year, on average, but can be highly variable from month-to-month. Monthly normal precipitation varies from 2.67 inches in October to 4.66 inches in May. However, monthly extremes during the period from 1928 through 1990 ranged from 0.06 inches in October 1987 to 16.15 inches in March 1964.

Mean annual potential evapotranspiration in Owensboro is between 31 and 33 inches, according to mapped data available from the Kentucky Climate Center (http://www.kyclimate.org/index.html). The adjusted annual potential evaporation estimated in the Landfill Application Package (AEP 1984, Table 10), based on climatic data from Tell City, was 32.22 inches per year. The mean monthly water balance developed for the landfill resulted in the following breakdown (Table 11) for an estimated annual precipitation of 44.27 Inches:

- Surface Runoff – 13.23 inches (30%);
- Actual Evapotranspiration – 25.69 inches (58%);
- Percolation (groundwater recharge) – 5.44 inches (12%).

2.4.2 Regional and Local Geologic Setting

2.4.2.1 Physiography and Drainage

The area of Rockport lies in the western Interior Low Plateau physiographic province of the United States, in a subarea referred to as the Wabash Lowland. It is an area of broad alluviated valleys and dissected uplands of rolling to hilly terrain with gentle slopes and moderate relief (Ray 1965). The topography in the vicinity of the Rockport Plant is shown on the U.S. Geological Survey (USGS) topographic map reproduced in **Figure 4**.

Drainage in the area is provided by the Ohio River, which is adjacent to the plant property on the southeast, is over 2,000 feet wide in the vicinity of the plant, and flows to the southwest toward Owensboro, Kentucky. The plant property slopes gently across a terraced surface from elevations greater than 410 feet on its northern edge, where it is bordered by low hills and an upper terrace, to as low as 390 feet along the top of the bank of the Ohio River. Much of the property is drained by Honey Creek, which flows south-southeast to the Ohio River and is incised down to an elevation of approximately 380 feet. The power generation plant was developed on the portion of the property between US 231 on the west and Honey Creek on the east. It is located on a watershed divide between Honey Creek and an unnamed tributary offsite to the southwest.

The natural topography over most of the property (outside the channel of Honey Creek) prior to development of the power plant consisted of a relatively flat terrace surface marked by east-west oriented crests and swales. Multiple low-gradient drainage ditches crossed the area, connecting the two watersheds (Honey Creek and the watershed to the west). Regrading for development of the power plant and associated facilities (including construction of the wastewater pond complex) disrupted some of the existing natural drainage as well as the man-made drainage that existed on the surface of the terrace and is still depicted on the USGS topographic map in **Figure 4**.

2.4.2.2 Geology

The area of the site lies in the southern portion of a broad shallow downwarp structure referred to as the Illinois Basin (also known as the Eastern Interior Basin), and is underlain by sedimentary bedrock of Pennsylvanian age. The bedrock underlying the site and most of Spencer County is the Pennsylvanian age Raccoon Group, consisting of sandstone and shale with minor amounts of mudstone, coal and limestone (Grove 2006). The rock reported from onsite borings that extended through the unconsolidated overburden into bedrock has been described primarily as shale. The boring for bedrock wells finished at the MW-5 location (at the northeast landfill perimeter) encountered interbedded sandy claystone, sandy shale, limestone, coal and claystone.

The bedrock surface beneath the overburden is uneven, and includes rounded hills, ridges and valleys (draining southeast) representing the erosional surface that existed prior to filling of the valley with glaciofluvial sediments.

The geology of the near-surface unconsolidated Quaternary sediments associated with the Ohio River valley is depicted on the geology map in **Figure 5** (which excludes the far east portion of the Plant property), and described in detail by Ray (1965). These sediments range in thickness from about 20 feet on northern sections of the property, to as much as 130 feet along the Ohio River west of the mouth of Honey Creek. They include windblown sediments (loess) up to 30 feet thick that mantle bedrock on the northeast perimeter of the property, possibly merging with lacustrine deposits in the tributary valley at the northwest corner of the property, and two series of Wisconsin age valley-train deposits (Tazewell and Cary) under most of the property. The valley-train sediments that fill the broad river valley were deposited by meltwater from retreating continental glaciers to the north and northeast, and were subsequently reworked by modern drainage systems, including the Ohio River and the Honey Creek drainage on the plant property.

Generally, the valley train deposits thicken and coarsen to the southeast, from the loess-mantled bedrock hills along the valley wall, toward and beyond the course of the modern Ohio River. In the subsurface, the valley train sediments typically coarsen downward, and can be classified generally into finer-grained sediments near the surface (including silt, sandy silt, silty clay and clay), and coarser-grained sediments (fine to coarse sand and some gravel) at depth.

Interpretive cross-sections of the subsurface were generated by AEP from data collected in the 1983 Site Investigation of the landfill area, and have been included in **Appendix B**. In the report of the Site Investigation included in the Landfill Application Package (AEP 1984), the unconsolidated sediments encountered above bedrock were grouped into four units, described below in descending order:

- Unit No. 1 – surficial silt and clay. This unit was found to be 2 to more than 15 feet thick. The upper section is predominantly silty, sandy clay that is stiff, and of low to medium plasticity. Very fine-grained sand and silt are stratified with the clay toward the bottom of the unit, suggesting a lacustrine depositional environment where these finer-grained deposits are thickest.
- Unit No.2 – well sorted sand. This unit, where present, was found to extend from the bottom of the fine-grained surficial unit to elevations of 373-376 feet. It was found to consist of fine to medium-grained, well-sorted subangular to subrounded quartz sand.
- Unit No. 3 – poorly sorted sand. This lower sand unit, consisting of poorly sorted, very fine to very coarse-grained sand, is the dominant unit between elevations of 373-376 feet and the underlying bedrock, which is typically found at elevations of 290 to 300 feet under most of the property, and at shallower depths in the north and northwest portions.
- Unit No. 4 – sand and gravel. Unit No. 4, consisting of poorly sorted sand, gravel and gravelly sand, was found to be gradational with Unit No. 3, and to occur as lenses within Unit No. 3. Gravel in this unit is subangular to rounded, ranges in size from 3/8 to 1 inch in diameter, and commonly contains coal particles.

2.4.2.3 Hydraulic Properties of Principal Groundwater Flow Zone

The saturated section of the unconsolidated sand and sand and gravel body comprising subsurface Unit Nos. 2, 3 and 4 (as described in the preceding section) makes up the principal groundwater flow zone underlying the site. This zone is hydraulically connected to the Ohio River but the connection is buffered by lower-permeability sediments that line the river bottom. Because of its relatively high permeability and its connection to the Ohio River, this zone represents an aquifer capable of supplying large yields to pumping wells. The depth to water in this zone typically ranges from 20 to 35 feet BGS, and the saturated thickness (which generally increases toward the river) ranges from less than 15 feet to more than 80 feet. Groundwater occurs in this zone under unconfined conditions, or semi-confined conditions where the surficial silt and clay directly overlie the saturated zone.

AEP provided information concerning pumping tests of varying lengths performed in this zone using onsite supply wells, including a pumping test performed in 1977 that was documented in the Landfill Application Package (AEP 1984), a pumping test performed in 2004 at a new supply well installed at the landfill for leachate dilution, and yield tests performed in 2011 and 2012 at two new replacement wells used for fire water supply. Based on the information reviewed, the principal groundwater flow zone underlying the site has a transmissivity ranging from 126,000 to 250,000 gallons per day per foot (gpd/ft), corresponding to 17,000 to 34,000 square feet per day (ft^2/day). The hydraulic conductivity of the formation ranges from 420 to 560 feet per day (ft/day), and the storage capacity (specific yield) ranges from 0.07 to 0.22. Pumping well yields range up to 1,000 gallons per minute (gpm), and specific capacities range from 48 to 121 gpm per foot of drawdown (gpm/ft).

2.4.3 Surface Water and Surface Water-Groundwater Interactions

The Ohio River at Owensboro drains a watershed of 97,000 square miles and the average flow is 121,200 cubic feet per second (cfs), according to Ray (1965). The stage in this section of the river is maintained by a downstream dam in Newburgh, Indiana above a minimum pool elevation of about 357.4 feet MSL (358 feet relative to the Ohio River Datum). The AEP Rockport Plant, located at River Mile (RM) 744-745, is halfway between the Newburgh Dam (RM 776) and the upstream Dam at Cannelton (RM 721). The river level at the Rockport Plant can be estimated by averaging the gauge data reported by the US Army Corps of Engineers (USACE) at Newburgh and Cannelton. A hydrograph (graph of water level over time) of the estimated daily stage in the Ohio River at the Rockport Plant from 2010 through 2015 is provided in **Appendix D-1**.

The water level in the Ohio River typically remains close to pool elevation in the summer and fall, and fluctuates at a relatively high frequency (for a few days to weeks), up to 20 feet above pool elevation, in the winter and spring months. The river stage typically reaches an elevation of 377 feet at least once in most years. The elevation of the 10-year flood is 387.7 feet, the 100-year flood level is 392 feet, and the level of the highest flood of record in the area (the flood of 1937) is 397 feet.

Groundwater levels and gradients in the glaciofluvial (valley train) sediments that fill the valley are strongly influenced by the Ohio River. Under low-water (pool) conditions, groundwater in the sediments flows under a low gradient toward the Ohio River. As the river level fluctuates in winter and spring, groundwater levels fluctuate along with it, although the effects are increasingly dampened with distance from the river. During rapid rises in river level, the groundwater gradient can be temporarily reversed to some distance from the river bank, resulting in excess groundwater being stored in the sediment (bank storage), and then draining slowly back toward the river again as the river stage falls.

2.4.4 Water Users

The Indiana Department of Natural Resources (IDNR) Division of Water maintains an online database of Significant Water Withdrawal Facilities (http://www.in.gov/dnr/water/4841.htm). A Significant Water Withdrawal Facility (SWWF) is defined as a facility that has the capacity to withdraw more than 100,000 gallons per day (gpd) in aggregate from surface water and/or groundwater, through one or more registered "sources" (individual pumping wells or stations). There are 10 SWWFs registered in Spencer County, of which the AEP Rockport Plant has the highest capacity.

2.4.4.1 Onsite Water Use

The main source of water used at the plant is the Ohio River. The plant's registered capacity for surface water is 80,000 gpm. According to the IDNR database, in 2011 the plant's actual average usage of river water was 22.3 million gallons per day (mgd), corresponding to an average surface water withdrawal of 15,500 gpm.

The plant also has seven registered water withdrawal wells. The locations of these supply wells are shown on **Figure 2**. The combined average withdrawal from these wells in 2011 was 0.59 mgd (410 gpm). Information available for the onsite water supply wells is summarized below (withdrawal rates are based on 2011 data available in the IDNR database):

- Wells PW-1 and PW-2 are used for plant potable supply. The combined average withdrawal rate for these two wells is approximately 120 gpm.
- Wells PW-3 and PW-4 are used for fire water supply as well as industrial supply. The combined average withdrawal rate for these two wells is approximately 120 gpm.
- Well PW-5 was installed on the west side of US 231 and was intended to be used for landscape watering around an energy education center constructed by AEP at that location. The well is inactive (no withdrawals since it was installed).
- PW-6 is a well installed immediately west of the active landfill to fill water trucks used for dust control. The average water withdrawal rate for this well is 17 gpm.
- PW-7 is a well installed southwest of the active landfill to provide water for treating landfill leachate prior to discharge, as required under the plant's NPDES permit. The average water withdrawal rate for this well is 39 gpm.

2.4.4.2 Offsite Water Users

The other nine SWWFs in Spencer County include the following:

- The City of Rockport public supply (five wells with a combined capacity of 1,163 gpm).
- The Town of Grandview public supply (two wells with a combined capacity of 970 gpm).
- Reo Water, Inc., public supply for the City of Richland, west of Rockport (five wells with a combined capacity of 1,130 gpm).
- The City of Boonville public supply, northwest of Rockport (four wells with a combined capacity of 2,050 gpm).
- Corn Island Shipyard, a marine barge manufacturer on the Ohio River in Grandview (one well with a capacity of 450 gpm).
- Three agricultural irrigation users (Christmas Lake GC, Loehr Farms and Allen Gray LP II), all located remotely from the AEP Rockport Plant.
- One coal washing operation (Buckhorn Processing) using surface water, located in Lamar, Indiana north-northwest of the AEP Plant.

The Ohio River navigation charts (USACE 2014) show surface water intakes and other major structures along the river. The charts for sections of the river adjacent to and immediately downstream of the AEP Rockport Plant show the industrial intakes for the AEP plant and Rockport Terminals (a coal barging facility), and shoreline facilities in Rockport for one commercial marina, two crushed stone operations, and two loading facilities (ADM and Coal Inland).

3.0 MONITORING NETWORK EVALUATION

3.1 Hydrostratigraphic Units

Based on the available information, two generalized hydrostratigraphic units can be distinguished within the unconsolidated subsurface materials below the AEP Rockport Plant.

The upper unit, consisting of surficial silt and clay (locally containing sand), is typically 8 to 25 feet thick, and is generally not saturated. However, it can serve as a perching layer above which water can accumulate in surface depressions or in more permeable surface fill. Soil sampling and permeability testing performed as part of the 1983 landfill Site Investigation indicates the bulk vertical permeability of the material in this unit is on the order of 10^{-7} to 10^{-6} centimeters per second (cm/sec), or 0.003 to 0.0003 ft/day.

The lower unit extends from the bottom of the surficial silt and clay to the top of bedrock, and consists of granular outwash deposits. These deposits consist primarily of sand, ranging from well-sorted fine sand to poorly-sorted fine to coarse sand, with lenses of gravelly sand and sandy gravel. This unit has an uneven bottom surface, but generally thickens to the southeast, toward the Ohio River. The lower section of this unit is saturated and represents the principal groundwater flow zone beneath the property. The saturated thickness in this unit ranges from less than 15 to more than 80 feet, and the bulk horizontal permeability (hydraulic conductivity) of this unit is on the order of 500 ft/day.

Bedrock underlying the unconsolidated deposits consists predominantly of shale, and is expected to have low permeability. Bedrock in the area of the Rockport Plant does not represent a significant medium for flow or storage of recently recharged (meteoric) groundwater, and is not a reliable source of fresh water supply, relative to the much more available source in the sandy overburden.

3.1.1 Horizontal and Vertical Position Relative to CCR Unit

Stratigraphic information for the area of the landfill is available from the lithologic logs for the monitoring wells (**Appendix C**) as well as the 1983 Site Investigation results illustrated in the maps and cross-sections in **Appendix B**, and several studies of nearby borrow areas.

The interface between the surficial silt and clay and the underlying granular outwash deposits occurs at an elevations of approximately 380 to 382 feet MSL below most of the landfill area (based on the logs for monitoring well locations MW-1, MW-2, MW-3, MW-8, and MW-18), or about 10 to 15 feet below original grade. On the northeast landfill perimeter (at locations MW-15, MW-16 and MW-17), the elevation of the interface is somewhat lower, closer to 370 feet. In a few locations (MW-4, MW-21), the surficial deposits are thin (less than 10 feet) and contain sandy interlayers. Bedrock elevations (at the base of the outwash deposits) rise from 286 to 290 feet at the southeast landfill perimeter to as high as 358 feet (at location MW-14) on the northern perimeter. Essentially, the outwash deposits thin and then pinch out moving northward from the landfill, as bedrock becomes shallower and the unconsolidated deposits overlying bedrock transition from outwash to less permeable terrace, lacustrine and loess deposits. Location MW-5 is located on top of a buried bedrock high, where bedrock is only 21 feet deep, and the overburden consists primarily of silty clay.

From the available documents, it appears that CCR in the closed sections of the landfill was placed close to or slightly below original grade, after removal of the top 1.5 feet of soil (including topsoil), and confirmation that at least 5 feet of in-situ silty clay soil was present. In the active landfill, bottom ash (a Type II waste) is still being placed at grade in some areas to raise the subgrade level for the Type I waste cell liner. A conservative estimate of the lowest elevation of CCR (including both bottom ash and flyash) in the landfill would be 390 feet MSL. The minimum separation between the bottom of the CCR and the underlying outwash deposits is 5 feet, by landfill design. In most locations, at least 10 feet of surficial silt and clay deposits would be expected to underlie the CCR. The outwash deposits underlying the surficial deposits thicken from about 15 feet or less near the northern landfill perimeter to as much as 90 feet at the southern perimeter.

3.1.2 Piezometric Conditions

Groundwater level data are available from piezometric measurements made in the landfill monitoring wells since 1985, and reported to IDEM in semi-annual groundwater monitoring reports (GWMRs). Each GWMR contains a plan sheet with a table summarizing water level and field parameter measurements, and a piezometric contour map (also known as a potentiometric map). Seven piezometric maps from May 2010 through May 2013 are reproduced in **Appendix D-2** (more recent maps were not available in the IDEM VFC). **Appendix D-3** contains a summary of the piezometric data provided by AEP for the period from November 1992 through May 2015. Hydrographs (graphs of water level elevations over time, by well), for the period from November 1998 through May 2015, are provided in **Appendix D-4**.

A review of the data indicates that water levels in the wells north of the landfill, including MW-9S, MW-10S and MW-5S and 5I (both finished in bedrock at the north perimeter of the landfill) are significantly higher (by 20 to 25 feet) than in the rest of the landfill wells. These three locations are located at the fringes, or outside of, the principal groundwater flow zone (i.e., the sandy outwash deposits).

All of the other wells monitor the principal flow zone that extends under the landfill and thickens to the southeast toward the Ohio River. These wells exhibit relatively low seasonal fluctuations, on the order of 1 to 2 feet, in most years. The long–term amplitude of groundwater level fluctuations under the landfill area is on the order of 6 feet, between elevations of approximately 366 and 372 feet. At its highest level, groundwater below the landfill is approximately 18 feet below the lowest CCR elevation of 390 feet.

The dominant groundwater flow direction under the landfill is to the southeast. Due to the high permeability of this zone, hydraulic gradients are relatively low. The differences in water levels between clustered (shallow/intermediate and deep) wells at a single location is on the order of 0.1 feet or less, indicating almost no vertical gradient. The difference in water level elevations on any one date between upgradient locations at the northern perimeter (MW-14) and in the west (MW-8), and at the downgradient (southern) perimeter (such as MW-1 and MW-21) is on the order of 1 foot (ranging from 0.2 to 1.8 feet). The water level in well MW-12S, approximately 3,000 feet to the southeast of the southern landfill perimeter, is generally lower than in the landfill perimeter wells, ranging from about 0.3 to 2.0 feet lower than in MW-1S. In one event (May 2011), the water level elevation in MW-12S was higher than in the southern perimeter wells. This condition was related to a temporary flow reversal associated with a period of very high river levels, in which the Ohio River had spiked at 387.7 feet (the 10-year flood level) on April 28; this flow reversal was also observed in the wells monitoring the wastewater pond complex farther to the south. As illustrated on the piezometric map for May 2011 (**Appendix D-2**), however, this flow reversal only reached the southern landfill perimeter, and apparently did not propagate under the landfill, where the gradient continued to be southeasterly.

Based on the available data and the analysis described above, a water level elevation of 372 feet can be considered a high groundwater level in the sandy outwash deposits that underlie the active landfill.

3.1.3 Overall Flow Conditions

The principal groundwater flow zone underlying the landfill is the lower overburden unit consisting of granular outwash deposits (sand with some gravel). Recharge into this unit occurs laterally from hills and buried tributary valleys to the north-northwest. Recharge also occurs from the Ohio River to the southeast during relatively brief periods (spikes) of high water level in the river. Areal recharge also occurs vertically from the surface. The rate of areal recharge varies locally according to the thickness and bulk permeability of the overlying silt and clay unit.

Groundwater flow in this zone is predominantly to the east-southeast, toward the Ohio River. Flow reversals occur during brief periods of high river level, but are temporary and do not extend under the landfill, therefore having no long-term effects on flow or migration of constituents in groundwater.

Supply wells are present to the southwest and west of the active landfill, including nearby wells PW-6 and PW-7. During a pumping test of PW-7 in 2004, in which that well was pumped at a rate of 1001 gpm for a period of 24 hours, significant drawdowns (ranging from 1.3 to 3.4 feet) were produced in nearby monitoring wells MW-18, MW-19 and MW-20. However, in actual operation, this well (like the other onsite supply wells) operates intermittently, and had an average pumping rate of 39 gpm in 2011. The intermittent operation and relatively low flow rates of the onsite pumping wells appear to be insufficient to affect flow directions at significant distances from the pumping centers on a long-term basis. However, during groundwater monitoring in May 2014, it was noted that groundwater flow was being pulled temporarily toward PW-7 due to an unusually high demand and longer-than-normal pump operation in this well. Therefore, temporary flow direction changes could be associated with onsite well operations.

Based on available data, the estimated horizontal average hydraulic gradient (i) beneath the landfill under typical flow conditions is 0.0003 feet/foot, and the hydraulic conductivity (K) is on the order of 500 ft/day. Assuming an effective porosity (n) of 0.20, the average flow velocity (v) through the principal flow zone can be estimated from the Darcy flow equation [$v = (Ki)/n$] as 0.75 ft/day, or 275 ft/year.

3.2 Uppermost Aquifer

3.2.1 CCR Rule Definition

As defined in the federal CCR Rule (§257.53 Definitions):

- *Aquifer* means a geologic formation, group of formations, or portion of a formation capable of yielding usable quantities of groundwater to wells or springs.
- *Groundwater* means water below the land surface in a zone of saturation.
- *Uppermost aquifer* means 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 ground surface to which the aquifer rises during the wet season.

3.2.2 Identified Onsite Hydrostratigraphic Unit

Consistent with the definition in the CCR Rule, the hydrostratigraphic unit identified as the uppermost aquifer in this case is the saturated granular outwash deposit that underlies the Rockport Plant property including the ash landfill. The top of this unit would be the typical seasonal high water level of 372 feet, approximately 18 feet below the lowest CCR elevation of 390 feet.

The bottom of the unit would be the top of bedrock. The shale bedrock underlying the granular outwash deposits does not represent a significant groundwater flow zone. The bedrock surface is expected to be irregular, generally sloping to the southeast, and to occur at elevations between 286 feet (at the southern landfill perimeter) and 371 feet (at a localized bedrock high in the vicinity of MW-5). The saturated thickness of this unit, therefore, is expected to range from 1 to 86 feet, thickening to the southeast.

3.3 Review of Existing Monitoring Network

3.3.1 Overview

Monitoring wells have been installed at 19 locations in or close to the landfill over a period of 30 years since the landfill began operations. Of those, two (located in the currently active area) have been abandoned to accommodate landfill expansion. At most locations, more than one well has been installed, most often as separate wells in a vertical cluster to monitor shallow (S), intermediate (I) and deep (D) conditions in the uppermost aquifer. At some locations to the north, northwest and northeast of the landfill, the overburden is thinner, and the saturated thickness is insufficient to accommodate more than one or two vertical levels of groundwater monitoring in the uppermost aquifer.

Well locations are shown on the map in **Figure 3**. The following paragraphs provide a listing of the wells by date of installation, and a summary of current status:

- MW-1S/I/D, MW-2S/I/D, MW-3S/I, MW-4S/I, MW-5S/I, MW-6S, MW-7S/I, MW-8S/I, MW-9S, and MW-10S (a total of 19 wells in 10 locations) were the original wells installed to monitor the landfill in 1984. No logging of subsurface materials was performed at the time of installation. Therefore, at the request of IDEM, stratigraphic borings were drilled near each well cluster in 1999 in order to establish the stratigraphy at each of the original monitoring locations. Of the original 10 well clusters, MW-3S/I and MW-4S/I have been abandoned and replaced with wells to the south. MW-8 is in an upgradient position relative to the other wells. The intermediate level well in the cluster (MW-8I) was added in 1992. The original well (MW-8S) experienced excessive siltation, and was abandoned and replaced with well MW-8SR in 2013. A total of 15 wells in 8 locations remain from this original group.
- MW-11S, MW-12S, MW-13S, MW-14S, MW-15S/I, MW-16S/I/D, and MW-17S/I/D (a total of 11 wells in 7 locations) were installed in 1992, to expand the monitoring network, in the sidegradient (MW-11S, MW-15S/I, MW-16S/I/D, and MW-17S/I/D), upgradient (MW-14S), and remote downgradient (MW-12S, MW-13S) directions.
- MW-18, MW-19, and MW-20 were installed in 2004, primarily for subsurface exploration and to serve as observation wells for the new supply well (PW-7) that was installed at that time. MW-18 is screened near the bottom of the aquifer (deep level), and MW-19 and

MW-20 are screened at the shallow level. They are relatively close together and are treated as a single monitoring location.

- The well cluster MW-21S/I/D was installed in 2009, as a replacement downgradient well location for the MW-3 and MW-4 locations that had to be abandoned due to landfill expansion.

All of these wells are constructed of 2-inch Schedule 40 PVC with factory slotted screens of nominal 10-foot length. Well construction details are summarized in **Table 1**, and well construction logs are provided in **Appendix C**. Well piezometric data are provided in **Appendix D**.

3.3.2 Gaps in Monitoring Network

No gaps have been identified in the existing downgradient monitoring network for the landfill. The following 16 wells at six locations have been designated as downgradient water quality monitoring wells for the landfill going forward: MW-1S/I/D, MW-2S/I/D, MW-15S/I, MW-16S/I/D, MW-17S/I, and MW-21S/I/D. These wells are located closest to the landfill perimeter in sidegradient/downgradient directions, and are spaced 800 to 1,500 feet apart, as approved by IDEM. Based on location and past performance, these wells appear to provide sufficient density of coverage both horizontally and vertically to adequately monitor groundwater passing the waste boundary in the uppermost unit in all potential downgradient flow directions. The other more remote sidegradient and downgradient monitoring wells will continue to be used for piezometric monitoring and preparation of piezometric maps with flow direction arrows.

Currently, AEP uses an intrawell statistical method (approved by IDEM), to establish intrawell prediction limits (IWPLs) for each monitored parameter in each well, and to identify statistically significant increases (SSIs) in concentrations that may occur in individual wells. Using this method, concentration data from upgradient or background wells are not required as part of the analysis. AEP also monitors selected wells (specifically MW-8S, MW-8I and MW-5I) as indicators of water quality in groundwater that is upgradient of, and not impacted by, CCR in the landfill. However, a review of the available monitoring wells in the uppermost aquifer (excluding MW-5S and I, which are screened in bedrock), suggests that the number of upgradient wells available to characterize background groundwater quality could be insufficient for statistical purposes.

4.0 RECOMMENDED MONITORING NETWORK IMPROVEMENTS

4.1 General

In summary, the performance standard for groundwater monitoring systems in the CCR Rule (§257.91) states that the system should consist of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that:

- Accurately represent the quality of background groundwater, and
- Accurately represent the quality of the groundwater passing the waste boundary of the CCR unit in the uppermost aquifer, and
- Monitor all potential contaminant pathways.

The following subsections provide recommendations for improvements to the existing monitoring network, to meet the performance standard summarized above.

4.2 Downgradient Monitoring Wells

The existing monitoring wells are located and constructed in a manner appropriate for monitoring groundwater quality at the landfill. As noted above (Section 3.3.2), 16 wells at six locations have been designated as downgradient water quality monitoring wells for the landfill going forward: MW-1S/I/D, MW-2S/I/D, MW-15S/I, MW-16S/I/D, MW-17S/I, and MW-21S/I/D. No new wells are recommended for downgradient monitoring.

4.3 Background Monitoring Wells

The following wells, located in an upgradient direction from the landfill (to the north-northwest) are appropriate wells for monitoring background groundwater quality: MW-8SR, MW-8I and MW-14S. It is recommended that the upgradient monitoring network be augmented with additional wells located to the northeast, MW-6S and MW-11S. Although not directly upgradient, these wells are remote from the CCR in the landfill, and piezometric data indicate they are installed in the principal flow zone. Therefore, the addition of these two wells to the background groundwater monitoring network is appropriate for determining the full range of background concentrations for the parameters required to be monitored under the CCR Rule. Three wells (MW-6S, MW-11S, and MW-14S) were re-developed by AEP in 2016, between March 30 and April 1.

It is recommended that the background monitoring network be expanded to include the four locations (five wells) listed above. No new wells are recommended for upgradient monitoring.

4.4 Vertical Screening Levels

The saturated thickness of the principal flow zone is relatively thin in the upgradient direction from the landfill, which serves to limit the number of wells needed to monitor the vertical dimension of the uppermost flow zone.

The depth to bedrock at the MW-8 location is just under 70 feet (at elevation 323 feet), and the saturated thickness is on the order of 50 feet. Two wells, each with 10 feet of screen, are currently installed at the MW-8 location: MW-8SR (screened approximately between elevations of 351 and 361 feet) and MW-8I (screened approximately between elevations of 327 and 337 feet).

The depth to bedrock at the MW-14 location is even shallower (just under 35 feet BGS, at elevation 358 feet), and the saturated thickness is 8 to 15 feet. One well screen (MW-14S, screened between 361 and 371 feet) is sufficient to monitor the relatively thin flow zone at this location.

The depth to bedrock at the MW-11 location is 49 feet (at elevation 348 feet), and the saturated thickness is 18 to 24 feet. One well, MW-11S (screened approximately between elevations of 359 and 368 feet) monitors this location.

The bedrock elevation at the MW-6S location is estimated to be 310 feet based on Drawing 12-30095 in Appendix B (no lithologic log available). One well is present at this location, screened at the shallow level (between 353 and 363 feet).

4.5 Updated Well Survey

In a review performed in 2015 of the monitoring well construction logs and the data being used by AEP as reference point elevations (the level from which depth-to-water readings are measured) for piezometric monitoring, some discrepancies were noted. AEP surveyors performed a new survey of the ground surface and the reference point elevation at each well on 31 May 2016. **Table 1** is a well construction summary table that has been updated using the 2016 survey data. The well construction logs in **Appendix C** have also been annotated with the 2016 suvey data for the reference points.

5.0 P.E. CERTIFICATION

By means of this certification, I certify that I have reviewed the available documents (discussed in this report) for the groundwater monitoring system at the existing CCR landfill at the AEP Rockport Plant located in Spencer County, Indiana, and have found that it meets the requirements in 40 CFR §257.91.

NICHOLAS G. SCHMITT
Nº 191576
9/14/17

Nicholas G. Schmitt
Printed Name of Registered Professional Engineer

Signature

191576	Indiana	14 September 2017
Registration No.	Registration State	Date

6.0 REFERENCES

American Electric Power Company (AEP), April 1984. *Application Package for Construction/Operating Permit for Solid Waste Management Facilities for Indiana and Michigan Electric Company's Ash Disposal Landfill for the Rockport Plant*. Submitted to Indiana Environmental Management Board. (AEP 1984).

Grove, Glenn E., May 2006. *Bedrock Aquifer Systems of Spencer County, Indiana.* Indiana Department of Natural Resources (IDNR) map. (Grove, 2006).

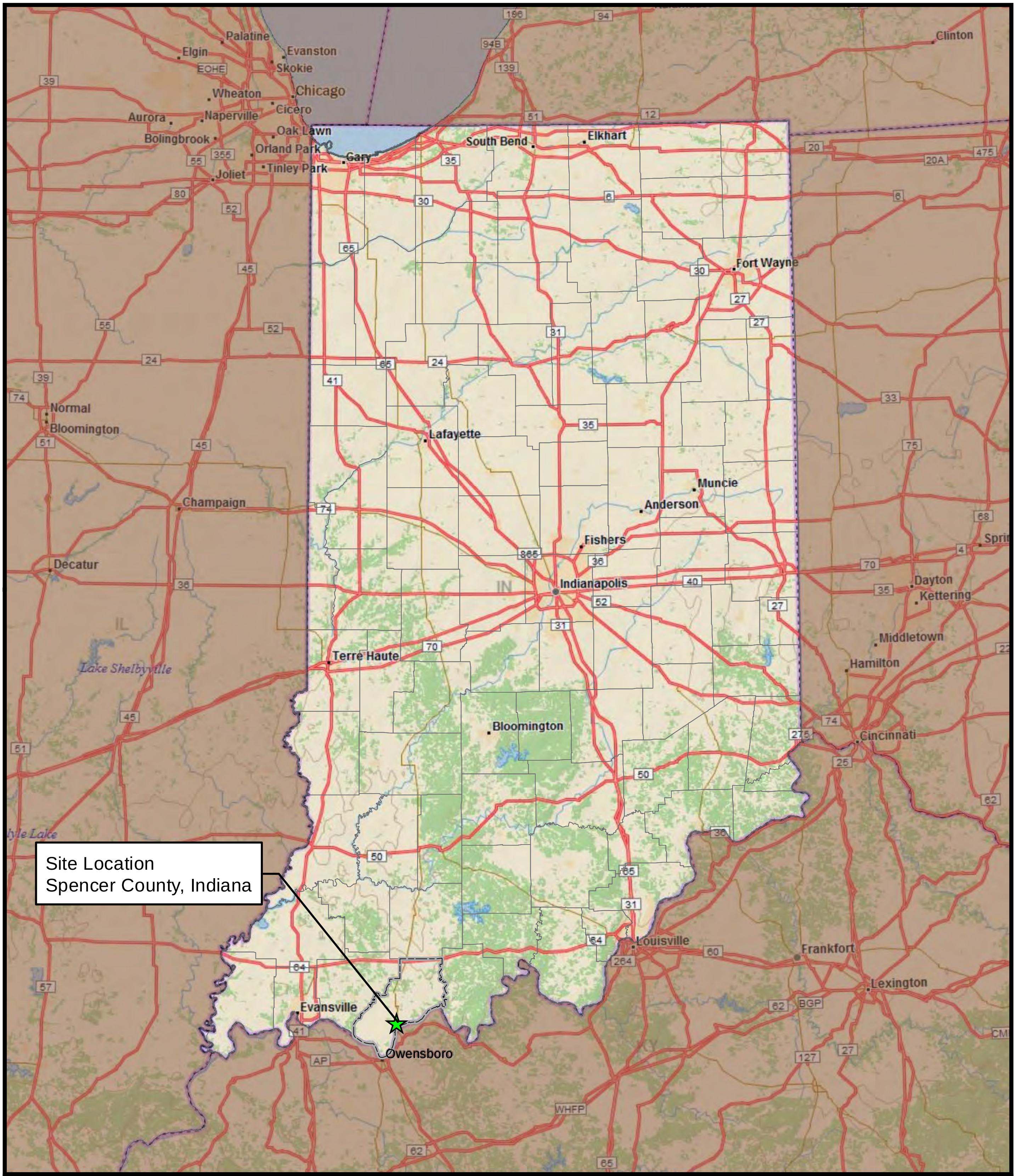
Ray, Louis L., 1965. *Geomorphology and Quaternary Geology of Owensboro Quadrangle, Indiana and Kentucky.* U.S. Geological Survey (USGS) Professional Paper 488, 72 p. (Ray 1965).

Terracon Consulting Engineers and Scientists, February 2012. *Fly Ash Landfill Redesign Construction Drawings, Storage Area 1A, RKP Permit #FP-74-2*. Design drawings prepared for AEP Indiana Michigan Power Company, Rockport Plant. (Terracon 2012).

United States Army Corps of Engineers (USACE), March 2014. *Ohio River Navigation Charts - Cairo, Illinois to Foster, Kentucky*. (USACE 2014)

United States Department of Agriculture–Soil Conservation Service (USDA-SCS), 1973. *Soil Survey of Spencer County, Indiana.* (USDA 1973).

FIGURES



Legend

★ Site Location

Service Layer Credits: Copyright:© 2015 DeLorme

0 40
Miles

NORTH

amec foster wheeler

2456 Fortune Drive, Suite 100
Lexington, Kentucky 40509
Phone: (859) 255-3308

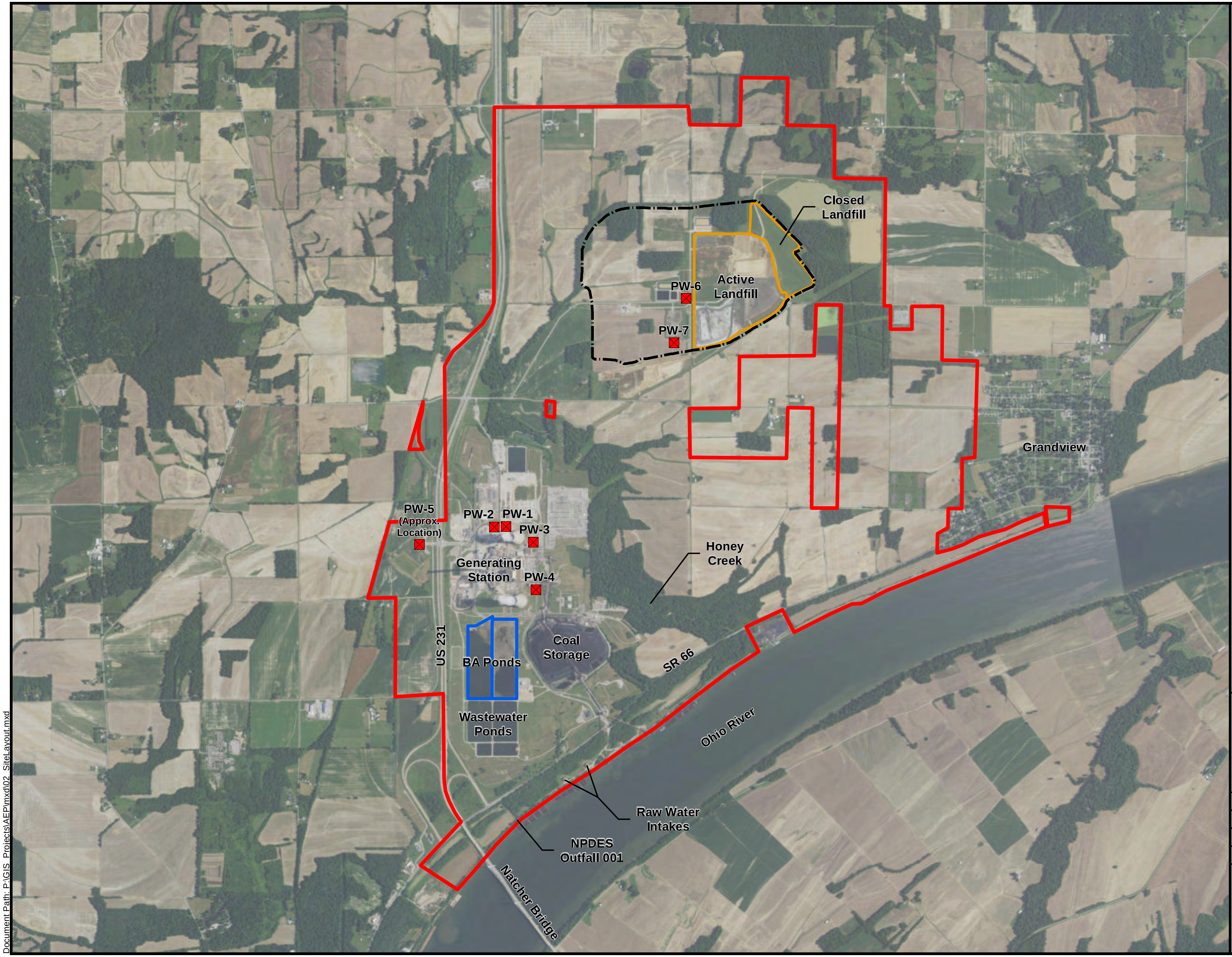
SITE LOCATION MAP

American Electric Power, Rockport Plant
Rockport, Indiana

PROJECT NUMBER: 7382153161

SCALE	1" = 40 miles
DATE	9/11/2015
DRAWN BY	TMR
APPROVED BY	ALD

FIG.
1



Legend

🟥 Property Boundary
▭ 1984 Landfill Permit Boundary (Area 1)
🟧 Landfill Area 1A (Active and Closed)
🟦 Bottom Ash Pond
☒ Water Supply Well

Data Sources

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Date of Photography: May-June 2016
Source of Photography: U.S. Department of Agriculture, National Agriculture Imagery Program (NAIP)

0 1,200 2,400
SCALE IN FEET

SITE LAYOUT MAP

AEP - ROCKPORT, IN

PROJECT NUMBER: 7382153161

SCALE	1" = 2,400'
DATE	9/13/2017
DRAWN BY	TMR
APPROVED BY	ALD

FIG. 2

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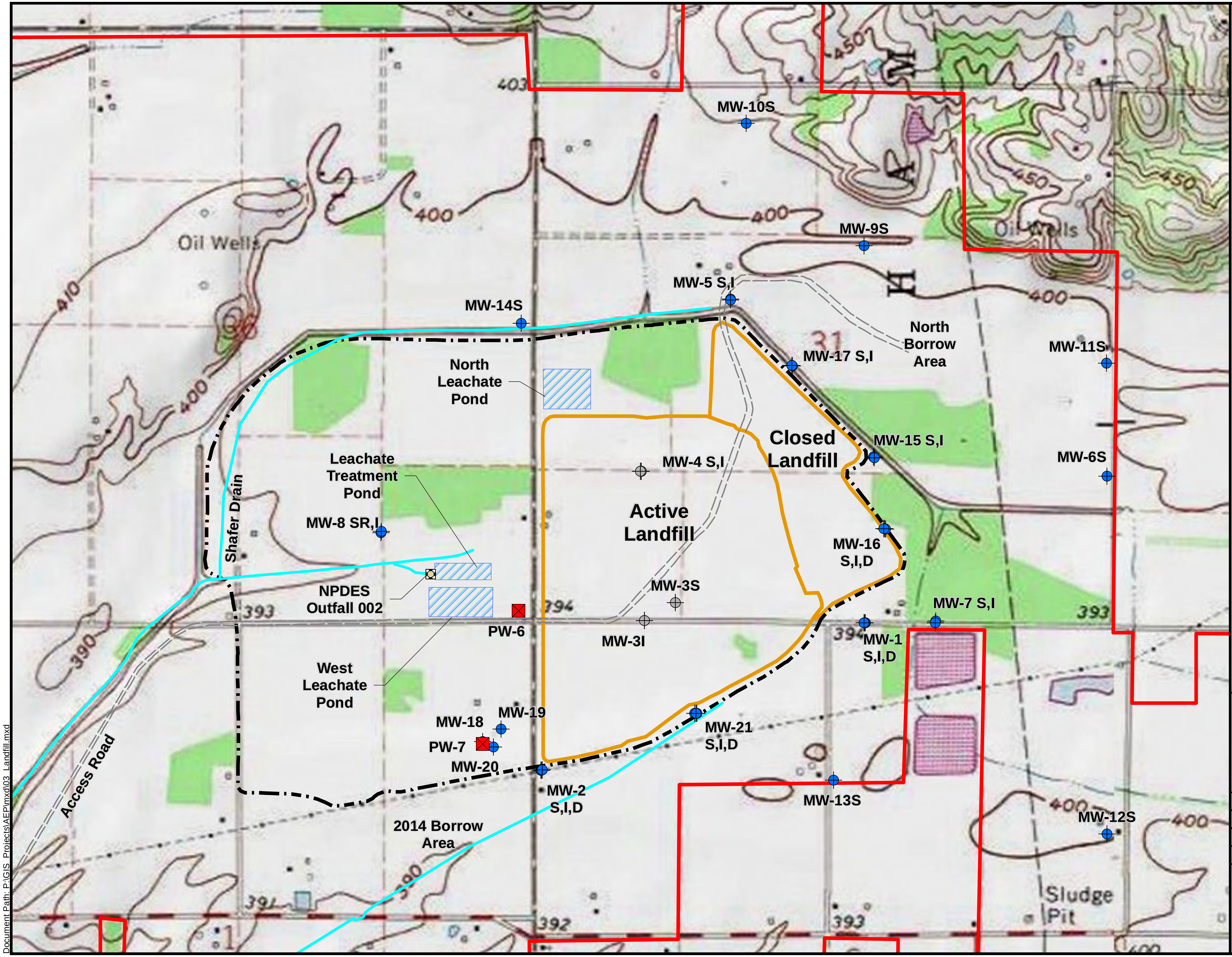
Document Path: P:\GIS_Projects\AEP\mxd\02_SiteLayout.mxd



Document Path: P:\GIS_Projects\AEP\mxd\03_Landfill.mxd

Legend

- ⊠ NPDES Outfall 002
- ⊕ Monitoring Well (Abandoned)
- ⊕ Monitoring Well
- ☒ Water Supply Well
- — · — Access Road
- — Drains / Ditches
- 🟥 Property Boundary
- ▭ 1984 Landfill Permit Boundary (Area
- ▭ Landfill Area 1A (Active and
- ▨ Leachate Ponds

Data Sources

Service Layer Credits: Copyright:© 2013 National Geographic Society, i-cubed

Source: USGS Rockport and Lewisport (IN/KY) Topographic Quadrangle Maps, 1964, photorevised 1982

0 400 800
SCALE IN FEET

LANDFILL LAYOUT

AEP - ROCKPORT, IN

PROJECT NUMBER: 7382153161

SCALE	1" = 800'	FIG. 3
DATE	10/5/2015	
DRAWN BY	TMR	
APPROVED BY	ALD	

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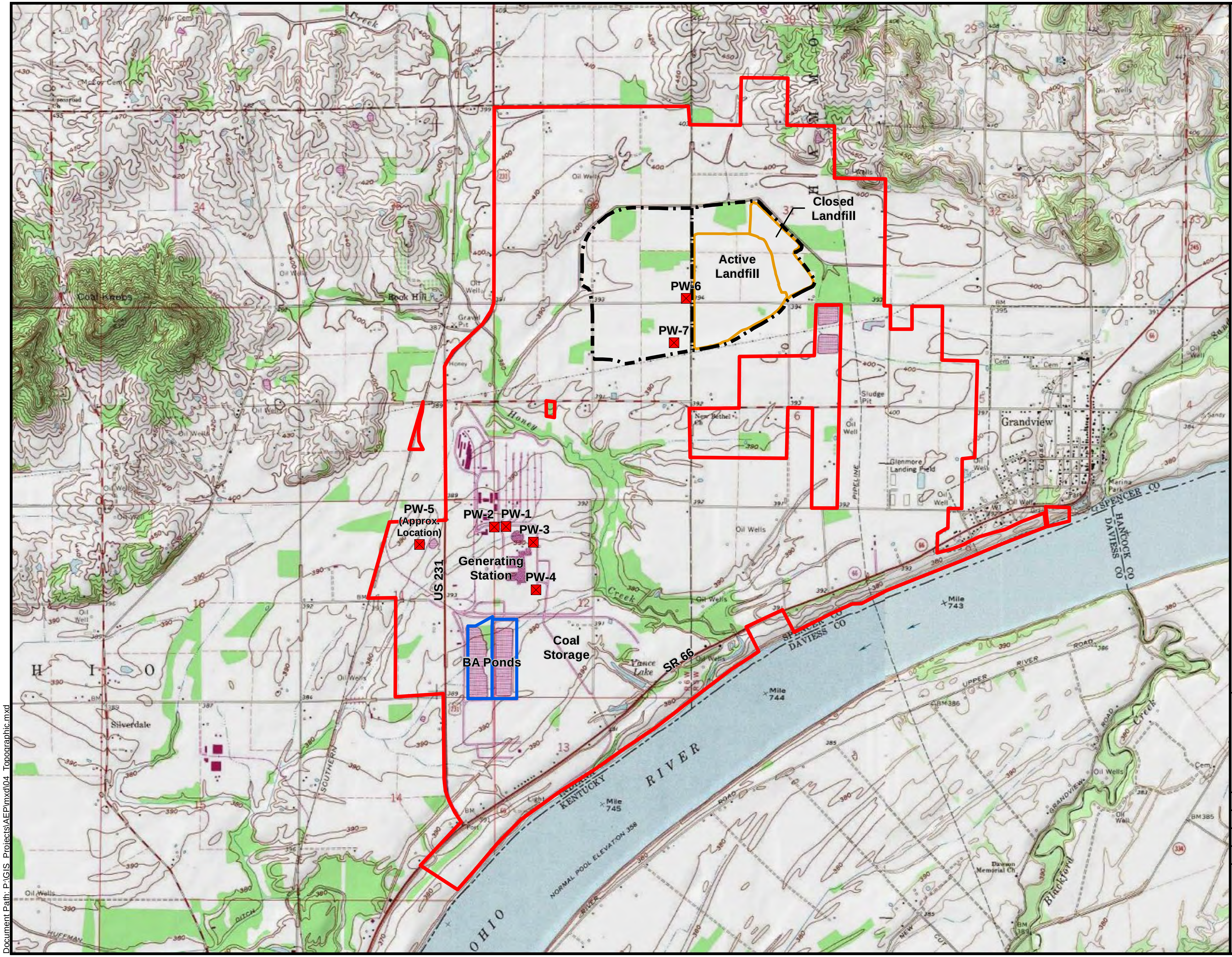

Legend

▭ Property Boundary

▭ 1984 Landfill Permit Boundary (Area 1)

▭ Landfill Area 1A (Active and Closed)

▭ Bottom Ash Pond

☒ Water Supply Well

Data Sources

Service Layer Credits: Copyright:© 2013 National Geographic Society, i-cubed

Source: USGS Rockport and Lewisport (IN/KY) Topographic Quadrangle Maps, 1964, photorevised 1982

0 1,200 2,400
SCALE IN FEET

TOPOGRAPHIC MAP

AEP - ROCKPORT, IN

PROJECT NUMBER: 7382153161

SCALE	1" = 2,400'	FIG. 4
DATE	9/13/2017	
DRAWN BY	TMR	
APPROVED BY	ALD	

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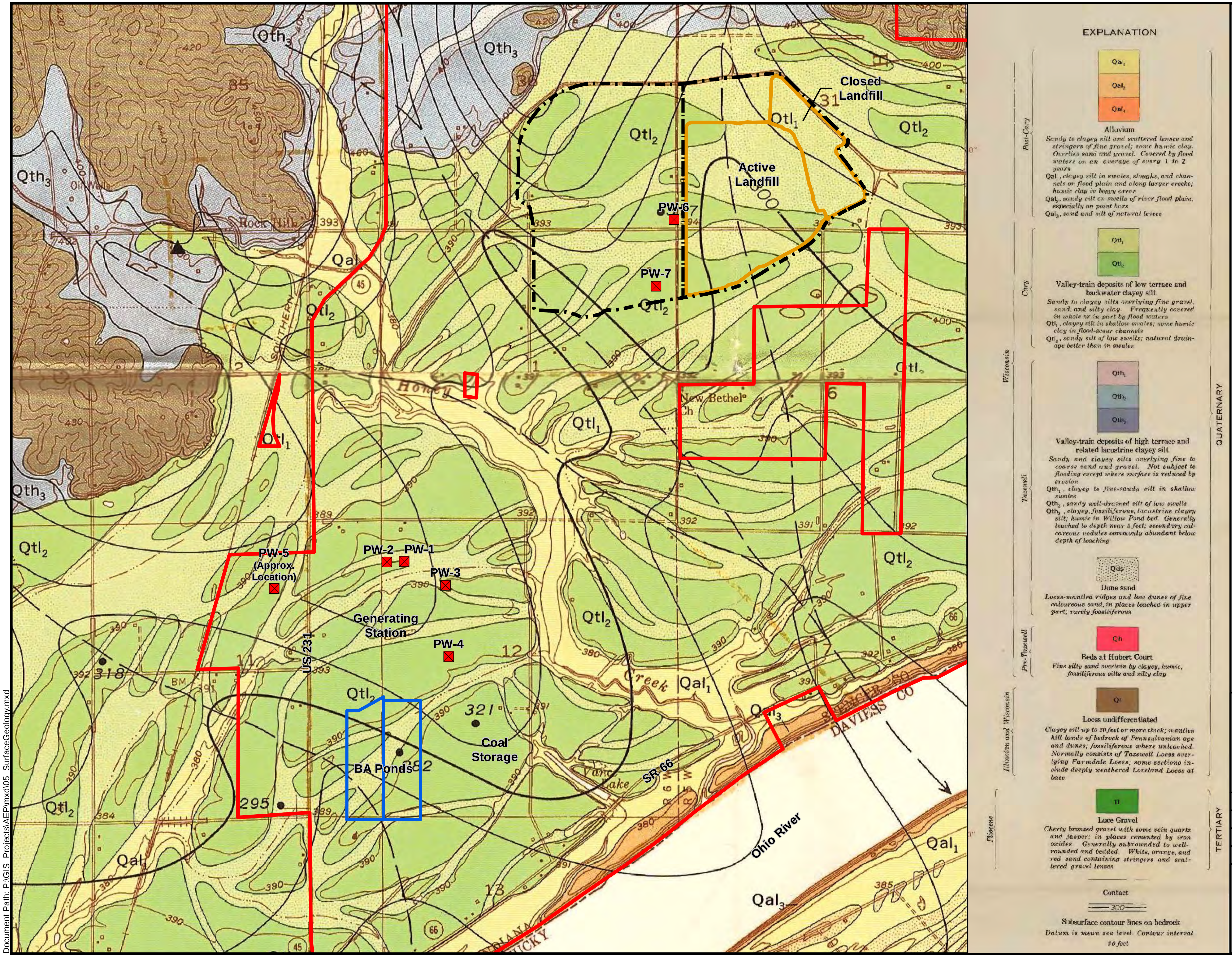
Document Path: P:\GIS_Projects\AEP\mxd\04_Topographic.mxd



EXPLANATION

Qal_1
Qal_2
Qal_3

Alluvium

Sandy to clayey silt and scattered lenses and stringers of fine gravel; some humic clay. Overlies sand and gravel. Covered by flood waters on an average of every 1 to 2 years

Qal_1, *clayey silt in swales, sloughs, and channels on flood plain and along larger creeks; humic clay in boggy areas*

Qal_2, *sandy silt on swells of river flood plain, especially on point bars*

Qal_3, *sand and silt of natural levees*

Post-Cary

Qtl_1
Qtl_2

Valley-train deposits of low terrace and backwater clayey silt

Sandy to clayey silts overlying fine gravel, sand, and silty clay. Frequently covered in whole or in part by flood waters

Qtl_1, *clayey silt in shallow swales; some humic clay in flood-scour channels*

Qtl_2, *sandy silt of low swells; natural drainage better than in swales*

Cary

Qth_1
Qth_2
Qth_3

Valley-train deposits of high terrace and related lacustrine clayey silt

Sandy and clayey silts overlying fine to coarse sand and gravel. Not subject to flooding except where surface is reduced by erosion

Qth_1, *clayey to fine-sandy silt in shallow swales*

Qth_2, *sandy well-drained silt of low swells*

Qth_3, *clayey, fossiliferous, lacustrine clayey silt; humic in Willow Pond bed. Generally leached to depth near 5 feet; secondary calcareous nodules commonly abundant below depth of leaching*

Tazewell

Wisconsin

Qds

Dune sand

Loess-mantled ridges and low dunes of fine calcareous sand, in places leached in upper part; rarely fossiliferous

Qh

Beds at Hubert Court

Fine silty sand overlain by clayey, humic, fossiliferous silts and silty clay

Pre-Tazewell

Ql

Loess undifferentiated

Clayey silt up to 30 feet or more thick; mantles hill lands of bedrock of Pennsylvanian age and dunes; fossiliferous where unleached. Normally consists of Tazewell Loess overlying Farmdale Loess; some sections include deeply weathered Loveland Loess at base

Illinoian and Wisconsin

QUATERNARY

Tl

Luce Gravel

Cherty bronzed gravel with some vein quartz and jasper; in places cemented by iron oxides. Generally subrounded to well-rounded and bedded. White, orange, and red sand containing stringers and scattered gravel lenses

Pliocene

TERTIARY

Contact

300

Subsurface contour lines on bedrock

Datum is mean sea level. Contour interval 20 feet

Legend

- 🟥 Property Boundary
- ▭ 1984 Landfill Permit Boundary (Area 1)
- 🟧 Landfill Area 1A (Active and Closed)
- 🟦 Bottom Ash Pond
- ☒ Water Supply Well

Data Sources

Source: Geologic Map of the Owensboro Quadrangle, Indiana and Kentucky, USGS Professional Paper 488, 1965

0 800 1,600
SCALE IN FEET

SURFACE GEOLOGY MAP

AEP - ROCKPORT, IN

PROJECT NUMBER: 7382153161

SCALE	1" = 1,600'	FIG. 5
DATE	9/13/2017	
DRAWN BY	TMR	
APPROVED BY	ALD	

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Document Path: P:\GIS_Projects\AEP\mxd\05_SurfaceGeology.mxd

TABLE

Table 1
Monitoring Well Construction Details, Landfill Wells
AEP Rockport Plant, Rockport, Indiana

Well ID	Date Installed	Northing SPCS NAD27 IN West MW Log	Easting SPCS NAD27 IN West MW Log	Original Ground Surface Elevation MW Log	Original Reference Point Elevation MW Log	Current Reference Point Elevation 5/31/2016	Length of Screen MW Log	Type of Screen MW Log	Total Depth of Well MW Log	Total Depth of Boring Litho Log	Depth to Top of Bedrock Litho Log	Top of Screen Elevation MW Log	Bottom of Screen Elevation MW Log	Bottom of Well Elevation MW Log	Bottom of Boring Elevation Litho Log	Bedrock Elevation Litho Log	Comments
		(ft)	(ft)	(ft MSL)	(ft MSL)	(ft MSL)	(ft)	PVC	(ft BGS)	(ft BGS)	(ft BGS)	(ft MSL)	(ft MSL)	(ft MSL)	(ft MSL)	(ft MSL)	
MW-1S	4/25/1984	162107.2	521813.6	394.65	397.25	397.33	9.0	2" x 0.010"	39.5	39.5	---	365.2	356.2	355.2	355.2	---	
MW-1I	4/25/1984	162107.0	521807.6	394.44	397.34	397.45	9.0	2" x 0.010"	63.1	63.1	---	341.3	332.3	331.3	331.3	---	
MW-1D	4/24/1984	162106.6	521802.0	394.68	397.32	397.25	9.0	2" x 0.010"	87.7	110.2	110	317.0	308.0	307.0	284.5	284.7	Lithologic boring log 9901 (drilled in April 1999)
MW-2S	5/16/1984	160790.3	518916.4	397.80	399.24	399.27	9.0	2" x 0.010"	40.0	40.0	---	368.8	359.8	357.8	357.8	---	
MW-2I	5/15/1984	160791.1	518924.0	397.76	399.26	399.42	9.0	2" x 0.010"	63.0	63.0	---	344.8	335.8	334.8	334.8	---	
MW-2D	5/15/1984	160793.0	518930.9	397.25	399.28	399.37	9.0	2" x 0.010"	88.0	107.8	107.8	319.3	310.3	309.3	289.5	289.5	Lithologic boring log 9902 (drilled in April 1999)
MW-3S	5/2/1984	162287.4	520118.1	393.53	396.81	---	9.0	2" x 0.010"	40.0	40.0	---	363.5	354.5	353.5	353.5	---	Closed and grouted
MW-3I	5/16/1984	162125.2	519843.6	395.15	397.05	---	9.0	2" x 0.010"	63.0	105.2	105.0	342.2	333.2	332.2	290.0	290.2	Closed and grouted, litho boring log 9903 (drilled in 1999)
MW-4S	5/9/1984	163459.8	519814.2	394.46	396.58	---	9.0	2" x 0.010"	40.0	40.0	---	364.5	355.5	354.5	354.5	---	Closed and grouted
MW-4I	5/9/1984	163460.0	519805.5	395.01	397.02	---	9.0	2" x 0.010"	63.0	84.8	84.1	342.0	333.0	332.0	310.2	310.9	Closed and grouted, litho boring log 9904 (drilled in 1999)
MW-5S	5/10/1984	164993.0	520610.0	394.28	396.00	396.08	9.0	2" x 0.010"	35.2	35.2	21.0	369.1	360.1	359.1	359.1	371	Lithologic boring log 9909 (drilled in April 1999)
MW-5I	5/22/1984	164987.9	520610.6	392 (est)	---	394.17	10.0	2" x 0.010"	40.0	58.6	21.0	362	352	352	334	371	GSE not shown on MW Log, shown as 392.1 on litho log
MW-6S	5/17/1984	163414.6	523969.1	392.85	394.89	394.72	9.0	2" x 0.010"	40.0	40.0	---	362.8	353.8	352.8	352.8	---	no lithologic log
MW-7S	5/1/1984	162123.6	522443.5	390.81	393.66	393.70	9.0	2" x 0.010"	40.0	40.0	---	360.8	351.8	352.8	350.8	---	
MW-7I	5/24/1984	162104.9	522439.6	392.02	393.62	393.49	9.0	2" x 0.010"	63.0	63.0	---	339.0	330.0	329.0	329.0	---	no lithologic log
MW-8S	5/8/1984	162926.4	517492.5	389.81	391.9	---	9.0	2" x 0.010"	39.8	39.8	---	360.0	351.0	350.0	350.0	---	Closed and grouted
MW-8SR	10/30/2013	162910.5	517492.0	392.15	394.66	394.86	9.6	2" x 0.010"	41.1	42.0	---	361.3	351.7	351.1	350.2	---	
MW-8I	11/14/1992	162921.3	517496.0	391.78	393.71	393.52	9.0	2" x NS	65.7	65.7	69.5	336.1	327.1	326.1	326.1	322.3	Lithologic boring log 9244
MW-9S	5/23/1984	165472.1	521801.1	401.04	403.08	404.35	9.0	2" x 0.010"	24.0	44.9	29.0	387.0	378.0	377.0	356.1	372.0	Lithologic boring log 9909 (drilled in April 1999)
MW-10S	5/23/1984	166560.6	520751.6	406.22	408.41	409.16	9.0	2" x 0.010"	23.6	40.0	24.0	392.6	383.6	384.2	366.2	382.2	Lithologic boring log 9910 (drilled in April 1999)
MW-11S	11/16/1992	164421.0	523964.2	397.60	399.97	400.07	9.0	2" x NS	39.6	47.0	49.3	368.0	359.0	358.0	350.6	348.3	Lithologic boring log 9230
MW-12S	11/15/1992	160224.0	523969.0	401.57	403.45	403.58	9.0	2" x NS	55.1	119.8	---	356.5	347.5	346.5	281.8	---	Lithologic boring log 9231
MW-13S	11/17/1992	160702.3	521529.1	397.92	399.91	399.79	9.0	2" x NS	44.5	111.6	111.5	363.4	354.4	353.4	286.3	286.4	Lithologic boring log 9232
MW-14S	12/8/1992	164779.4	518743.8	392.52	394.45	394.78	9.0	2" x NS	32.0	36.4	34.5	370.5	361.5	360.5	356.3	358.0	Lithologic boring log 9234
MW-15S	11/13/1992	163585.0	521886.9	390.53	392.53	392.46	9.0	2" x NS	40.1	40.1	---	360.4	351.4	350.4	350.4	---	
MW-15I	11/13/1992	163578.2	521892.7	390.46	392.70	392.70	9.0	2" x NS	65.8	67.2	66.5	334.7	325.7	324.7	324.7	323.3	Lithologic boring log 9234
MW-16S	12/11/1992	162944.9	521986.6	392.49	394.38	394.35	9.0	2" x NS	38.9	38.9	---	363.6	354.6	353.6	353.6	---	
MW-16I	12/11/1992	162943.9	521995.5	392.64	394.37	394.26	9.0	2" x NS	67.7	67.7	---	334.9	325.9	324.9	324.9	---	
MW-16D	12/9/1992	162946.3	521978.3	392.53	394.47	394.38	9.0	2" x NS	99.7	102.7	101.6	302.8	293.8	292.8	289.8	290.9	Lithologic boring log 9243
MW-17S	11/1/1992	164398.6	521162.5	393.13	395.46	395.34	9.0	2" x NS	40.5	40.5	---	362.5	353.6	352.6	352.6	---	
MW-17I	11/1/1992	164404.4	521157.2	393.28	395.29	395.40	9.6	2" x NS	67.4	69.4	67.4	336.5	326.9	325.9	323.7	325.7	Lithologic boring log 9245
MW-18	10/26/2004	161048.3	518397.6	397.88	400.38	400.65	9.0	2" x 0.020"	109.2	110.5	110.3	298.18	289.2	288.7	287.4	287.6	Lithologic boring log MW-18
MW-19	11/4/2004	161159.0	518561.3	398.74	401.24	401.44	9.0	2" x 0.020"	50.8	50.8	---	358.4	349.4	348.7	347.9	---	Lithologic boring log MW-19
MW-20	11/3/2004	160996.7	518492.4	398.02	400.52	400.78	9.0	2" x 0.020"	51.0	51.0	---	357.2	348.2	347.5	347.0	---	Lithologic boring log MW-20
MW-21S	1/13/2009	161298.6	520310.8	398.57	400.76	400.77	10.5	2" x 0.020"	39.9	40.0	---	369.8	359.3	358.7	358.6	---	
MW-21I	1/13/2009	161299.5	520291.1	398.52	400.74	400.72	9.5	2" x 0.020"	63.2	63.2	---	345.4	335.9	335.3	335.3	---	
MW-21D	1/13/2009	161298.3	520300.3	398.62	400.78	400.67	9.5	2" x 0.020"	108.3	112.2	111.9	300.42	290.92	290.3	286.4	286.7	Lithologic boring log B-0821

Table 1
Monitoring Well Construction Details, Landfill Wells
AEP Rockport Plant, Rockport, Indiana

Notes:

▨ Abandoned (closed and grouted) before 2015
🟦 To be used for downgradient monitoring at the landfill.
🟩 To be used for upgradient monitoring at the landfill.

ft = feet
in = inches
BGS = below ground surface
MSL = above Mean Sea Level, equivalent to the National Geodetic Vertical Datum of 1929 (NGVD29)
NS = screen slot size not specified
SPCS NAD27 = State Plane Coordinate System, Noth American Datum of 1927

At several well locations, borings were drilled for lithologic definition, and one or more additional borings were drilled for well construction.
Total boring depth/elevation and bedrock depth/elevation for the deepest well in any location are based on the lithologic boring log (Litho Log) for that location.
Original ground surface and reference point elevations are the elevations reported on the AEP monitoring well construction log at the time of well installation (MW Log). Well elevations (top and bottom of screen, bottom of well) are as reported on the MW Log.
In some cases, the wellhead has been modified since installation, usually to install a dedicated pump, and the reference elevation has changed. Current reference point elevation is based on a survey performed by AEP on 5/31/2016.

APPENDICES

APPENDIX A

CURRENT LANDFILL PERMIT (2015)

IDEM

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
We Protect Hoosiers and Our Environment.
100 N. Senate Avenue • Indianapolis, IN 46204
(800) 451-6027 • (317) 232-8603 • www.idem.IN.gov

Michael R. Pence
Governor

Thomas W. Easterly
Commissioner

February 10, 2015

American Electric Power
Attn: Dana Sheets, P.E.
1 Riverside Plaza
Columbus, Ohio 43215

Dear Mr. Sheets:

Re: Solid Waste Land Disposal Facility
Permit Renewal
Rockport Plant RWS I
FP 74-02
Spencer County

American Electric Power's permit renewal for the Rockport Plant restricted waste site (RWS) type I landfill is approved. You, the permittee, must comply with Indiana's rules for solid waste land disposal facilities (329 IAC 10) and the terms of this permit. Your attention to the requirements for managing, containing, and disposing of waste and leachate protects public health and the environment in your community. Please feel free to contact us or your compliance inspector if you have any questions.

This permit will expire on **February 11, 2020**. To operate past this date, you must submit a renewal application on or before **October 14, 2019**.

The facility is a restricted waste site type I (RWS I) with a total of 554 acres. 408 of the acres approved for filling are in Area 1; 146 acres approved for filling are in Area 2. The landfill is located at 2791 N. U.S. Highway 231 near Rockport.

Public records for your facility are available in IDEM's Virtual File Cabinet at www.in.gov/idem. Documents related to this approval include the application dated May 2, 2014 (VFC #70151087).

You can review the Indiana Code (IC) and the Indiana Administrative Code (IAC) references in this document at iga.IN.gov. IC references are under the "Laws" link; IAC references are under the "Publications" link.

This permit does not: convey any property rights of any sort or any exclusive privileges; authorize any injury to any person or private property or invasion of other private rights or any infringement of federal, state, or local laws or regulations; or preempt any duty to comply with other state or local requirements (329 IAC 10-13-4(a)).

Please note, as the owner or operator of this facility, and owner of the land upon which it is located, you are liable for any environmental harm caused by the facility (329 IAC 10-13-4(b)).

If you do not comply with the requirements of this permit, IDEM may modify or revoke this permit (329 IAC 10-13-6) or initiate an enforcement action.

If you wish to appeal this decision you must file a request for administrative review with the Office of Environmental Adjudication within 18 days after the postmark of this letter. The enclosed Notice of Decision and Guide to Appeals Process notifies you of additional important details regarding the appeal process and your rights and responsibilities for filing an adequate and timely appeal.

If you have any questions, please contact Cara Kitchen, the permit manager assigned to your facility. She can be reached by dialing (800) 451-6027 and asking for extension 3-0449, by calling her directly at 317-233-0449, or by e-mail at ckitchen@idem.IN.gov.

Sincerely,

Jeffrey L. Sewell, Chief
Permits Branch
Office of Land Quality

Enclosures: Permit Requirements
Notice of Decision
Guide to Appeals Process
Letter to the The Spencer County Journal-Democrat
Letter to the Spencer County Public Library

cc with enclosures: Gibson County Health Department
Gibson County Commissioners
Gibson County Solid Waste Management District
Director, IDEM Southwest Regional Office
The Honorable Harold Goffinet, Mayor of Rockport
The Honorable Connie Hargis, President, Rockport Town Council

PERMIT REQUIREMENTS

A. General Permit Requirements

B. Construction Requirements

C. Pre-operational Requirements

D. Operational Requirements

E. Ground Water Monitoring Requirements

F. Closure Requirements

G. Post-Closure Requirements

H. Financial Responsibility for Closure and Post-Closure

A. GENERAL PERMIT REQUIREMENTS

A1. The permittee must comply with 329 IAC 10 except where alternative specifications or requirements are noted in approved plans or in this permit.

A2. The permittee must construct, operate, and maintain the facility as described in the approved plans and specifications. The permittee must request approval before modifying the facility or facility operating procedures. The permit modification application requirements are in 329 IAC 10-11. Application forms are available from the permit manager listed below.

Certain insignificant modifications defined in 329 IAC 10-2-97.1 are eligible for the streamlined notification or approval procedures described in 329 IAC 10-3-3.

A3. The permittee must call **(888) 233-7745** (IDEM's emergency response line) as soon as possible after learning of any event that may cause an imminent and substantial endangerment to human health or the environment, such as a reportable spill (327 IAC 2-6.1) or a fire or explosion that requires the response of the local fire department.

The permittee must follow up with a written report to the IDEM contact given in Requirement A4 within 5 business days after the event. The report must describe the event, and actions taken or planned to correct the event and prevent its recurrence.

A4. Unless otherwise noted, submittals must be sent to:

Cara Kitchen, Permit Manager
Indiana Department of Environmental Management
Solid Waste Permits
IGCN 1101
100 North Senate Avenue
Indianapolis, IN 46204-2251

Please provide 3 copies printed double-sided. We greatly appreciate an electronic copy, in Acrobat PDF format on CD or DVD, or email, in place of one of the printed copies.

Submittals must be signed as specified in 329 IAC 10-11-3.

A5. The permittee must submit quarterly tonnage reports (329 IAC 10-14-1) to the following address:

Regulatory Reporting Section
Indiana Department of Environmental Management
IGCN 1101
100 North Senate Avenue
Indianapolis, IN 46204-2251

B. CONSTRUCTION REQUIREMENTS

B1. The permittee must notify IDEM in writing at least 15 days before beginning construction of a new area.

B2. The permittee must install boundary markers to identify the limits of construction of each new area.

B3. The permittee must verify and document in a Construction Certification Report (CCR) submitted as specified in Requirement C1 that all leachate collection pipes and sumps are free of obstructions before placing waste in a newly constructed area.

B4. The permittee must construct the base grades for the type I liner as shown on DWG. No.12-30404-A (sheet 5 of 37), titled "Type I Liner sub base Grades," dated March 22, 2012 (VFC #66674065).

B5. Upon selecting the specific materials for the composite liner system, the permittee must test the materials to verify that the interface friction values meet or exceed the values in the approved design. If the tests show that the interface friction values do not achieve the minimum factor of safety assumed in the approved plans, the permittee must select and test alternate materials and rerun the slope stability analysis. The results of the interface friction tests and any new slope stability analyses must be included in the CCR.

B6. The permittee must test and install all liner and final cover components as specified in the approved Construction Quality Assurance and Construction Quality Control (CQA/CQC) Plan, Attachment 8, dated March 21, 2012 (VFC #66690329, pages 48-75), and revised in June 5, 2013 (VFC#68406443, pages 3-28), and revised on May 22, 2014 (VFC #70087597).

B7. The permittee must submit a permit modification application and receive IDEM's approval before beginning modifications to the western half of Area 1 to accommodate for AK Steel power line transmission corridor and upgrade the landfill design to Type I standards.

B8. The permittee is approved to convert approximately 110 of the 408 acres in landfill Area 1 from a restricted waste site (RWS) type II landfill to an RWS type I landfill with the following requirements:

a. The permittee must implement the conversion as specified in the minor modification application dated March 27, 2012 (VFC #6660329), including the Engineering Report by Terracon Consultants, Inc., dated March 22, 2012 (VFC #66690329, pages 77-325), and supplemental information dated June 29, 2012 (VFC #66357542) and dated August 14, 2012 (VFC #66675686). The following VFC document numbers are plan sheets dated March 22, 2012, related to the minor modification application dated March 27, 2012:

66674284
66674283
66674112
66674169
66674170
66674067
66674065
66674248
66674113
66674124
66674171
66674184
66674213
66674064
66674237
66674201
66674173
66674125
66674186
66674214
66674187
66674215
66674040
66674038
66674060
66674202
66674172
66674272
66674158
66674156
66674069
66674269
66674271
66674072
66674236
66674198
66674285
66674270

b. The permittee must install a composite liner system (combination of soil and geomembrane) and a leachate collection system as shown on DWG. NO. 12-30436-A (sheet 7 of 37), dated March 22, 2012 (VFC #66674069).

c. The permittee must construct the composite liner system as listed below, starting from the bottom up:

   a. 5 feet of in-situ soil and/or compacted soil with a hydraulic conductivity of 1×10^{-6} cm/sec;
   b. Type II ash (thickness varies depending on the desired grade for the construction of the composite liner);
   c. 2 feet of compacted soil liner with a hydraulic conductivity of 1×10^{-7} cm/sec;
   d. 30 mil PVC geomembrane;
   e. 10 oz. /sq., nonwoven geotextile as a cushion layer;
   f. 1 foot of bottom ash with a hydraulic conductivity of 1×10^{-2} cm/sec as a drainage layer; and
   g. 1 foot of bottom ash with a hydraulic conductivity of 1×10^{-3} cm/sec as a protective layer.

C. PRE-OPERATIONAL REQUIREMENTS

C1. The permittee must submit a CCR at least 21 days before placing waste in any newly constructed area. An Indiana registered professional engineer must certify that the construction is in compliance with approved plans and specifications. The report must indicate the boundaries of the certified area and include the results of all tests conducted during construction.

Unless notified otherwise by IDEM, the permittee may begin to accept waste in a newly constructed area 21 days after IDEM receives the documents listed above.

D. OPERATIONAL REQUIREMENTS

D1. The permittee must comply with 329 IAC 10-28 (Operational Requirements).

D2. The following wastes generated by American Electric Power-Rockport Plant are approved for disposal in the Restricted Waste Site Type I landfill:

a. Coal combustion wastes that are exempt from the restricted waste classification process according to 329 IAC 10-9-4(d), including:
   (1) fly ash
   (2) bottom ash
   (3) Flue gas desulfurization (FGD) byproducts

b. Wastes that have a valid Type I through Type IV classification under 329 IAC 10-9-4.

The permittee must not dispose of any other wastes in this landfill.

This facility manages coal combustion wastes that are exempt from regulation as hazardous waste under the Bevill Amendment to RCRA (see 329 IAC 3.1-1-7 and 40 CFR 261.4(b)(4)). Bevill exempt wastes are excluded from the hazardous waste characterization process. The wastes listed in Requirement D2.a above are also exempt from the restricted waste classification process according to 329 IAC 10-9-4(d). Bevill wastes not listed in D2.a must have a valid Type I through Type IV waste classification under 329 IAC 10-9-4.

D3. The permittee must maintain permanent, visible facility and solid waste boundary markers for the life of the facility.

D4. The permittee must limit solid waste disposal to the areas delineated by the permitted landfill limits shown on DWG. NO. 12-30405-A (sheet 6 of 37), entitled "Type I Liner Top of Clay Grades," dated March 22, 2012 (VFC #66674067).

D5. The permittee must maintain the site benchmark throughout the entire life and post-closure care period of the facility.

D6. The permittee must control public access to the facility and prevent unauthorized vehicular traffic and illegal dumping.

D7. The permittee must inspect the site monthly for compliance with 329 IAC 10 and this permit. The inspections must evaluate the following: landfill cover, run-off control structures, erosion control structures, drainage ditches, monitoring wells and sumps, dust controls, and the leachate collection system. The permittee must keep the inspection records at the facility office for at least 3 years.

D8. The permittee must manage surface water as shown on DWG. No. 12-30423-A, 12-30424-A and 12-30425-A (sheets 33-35 of 37), titled "Surface Water Ponds and Details," dated March 22, 2012 (VFC#66674270, 66674271 and 66674272) and as specified in the minor modification application referenced in Requirement B8.

The permittee must also meet the following requirements:

a. Divert surface water from the active fill area to minimize surface water contact with the waste and interference with daily operations.
b. Properly maintain drainage ditches and the sedimentation basin to prevent off-site deposition of sediment. Remove waste deposits from drainage ditches as necessary to properly convey storm water.
c. Construct temporary run-off structures in areas which are unable to drain to the sedimentation basin.

D9. The permittee is approved to use other provisions for cover as provided for in 329 IAC 10-28-11(b), based on the site design, dust controls, and variance request dated August 22, 2014 (VFC #70405282).

The permittee must comply with these additional requirements:

a. Apply dust control agents or apply 6 inches of cover soil if facility employees observe fugitive dust or conditions that may lead to fugitive dust.
b. Minimize the working face of the landfill as follows:
    i. Install final cover as specified in Requirement F3 on all areas of the landfill filled to the approved elevations.
    ii. Cover with 6" of clay type soil as an intermediate cover on all other areas that have not received waste for one year.

D10. The permittee must manage waste that generates fugitive dust or fugitive particulate matter in a way that does not violate the rules for fugitive dust (326 IAC 6-4) or fugitive particulate matter (326 IAC 6-5), including 326 IAC 6-5-4(g) for solid waste handling control measures (329 IAC 10-8.2-2).

D11. The permittee must grade intermediate cover to promote surface water drainage and prevent ponding of water, and implement erosion and sediment control measures within 15 days after placement. The erosion/sedimentation control measures may include the following: establishing vegetation, using alternative/synthetic covers or liners, and/or using other applicable erosion and sedimentation control measures.

D12. If the permittee notices changes to the physical appearance of the cover soil or uses borrow sites other than those specified in the application, the permittee must, at a minimum, conduct gradation and Atterberg Limits tests on 3 representative samples of the new cover soil. The permittee must submit the results to IDEM within 15 days after such testing and before using the new soil as cover.

D13. The permittee must meet the following requirements regarding leachate storage at the facility:

a. Maintain an adequate leachate storage capacity in the leachate ponds during the landfill operation and the post-closure period to ensure proper operation of the leachate collection system and compliance with 329 IAC 10-28-16 (Leachate Disposal).
b. Maintain the leachate level in the sumps and manhole at or below the liner system to a maximum of 1 foot head.
c. Operate leachate storage in an environmentally safe manner.

D14. The permittee must meet the following requirements regarding leachate sampling, analysis, and reporting:

c. Conduct leachate sampling and analysis as required by the wastewater treatment plant or other leachate disposal facility, as applicable, and maintain the results in the facility's operating record
d. On or before March 1 of each year, the permittee must submit to IDEM a report for the leachate generated the previous year using the enclosed "Leachate Generation and Recirculation Report" or a similar report developed by the permittee.

D15. The permittee is approved to temporarily store bottom ash as follows:

a. Within subcells 4A and 4B of cell 4 as specified in the approval letter dated May 3, 2013 (VFC#68052917). The permittee must route surface water runoff from the temporary storage areas to the North Pond.
b. Within the approved solid waste boundary for RWS II as specified in the approval letter dated July 12, 2013 (VFC#68545528). The permittee must comply with the following:
   (1) Store a maximum of 300,000 cubic yards of bottom ash in this area.
   (2) Remove the bottom ash from this area before July 12, 2017
   (3) Route surface water runoff from this area to the West Pond.
   (4) Maintain the berms to prevent waste migration.
   (5) Prevent waste migration via wind dispersion.

E. GROUND WATER MONITORING REQUIREMENTS

E1. The permittee must comply with 329 IAC 10-29 (Ground Water Monitoring and Corrective Action).

E2. The permittee must label each ground water monitoring well and each piezometer with a permanent and unique identification. When reporting well and piezometer information, the permittee must include the identification for each well or piezometer.

E3. When abandoning a well or piezometer that is part of the facility's approved ground water monitoring system, the permittee must:

- a. Submit a written proposal for approval explaining the reasons for and detailing the method of abandonment.
- b. Use methods that comply with Indiana Department of Natural Resources (IDNR) regulation 312 IAC 13-10-2.
- c. Notify the IDEM Geology Section by phone, e-mail, or letter at least 10 days before the date the abandonment work will occur.
- d. Provide written notification of abandonment to IDEM and IDNR within 30 days after plugging is complete. (IDNR (312 IAC 13-10-2(f)) requires written notice).

E4. The permittee must secure and maintain the access ways to monitoring wells and piezometers to prevent unauthorized access, and assure they are passable year round.

E5. The permittee must maintain all ground water monitoring wells and piezometers as follows:

- a. Complete necessary repairs, other than replacement (see Requirement E6), within 10 days after discovery.
- b. Keep the monitoring wells securely capped and locked when not in use.
- c. Repair all cracks in and around the casings.
- d. Repair cracks in concrete pads.
- e. Control vegetation height.
- f. Redevelop the monitoring wells as needed.

E6. The permittee must notify IDEM by phone, e-mail, or letter within 10 days after discovering that a ground water monitoring well or piezometer has been destroyed or is not functioning properly. The permittee must repair the well or piezometer if possible. If the well or piezometer cannot be repaired, then within 30 days after discovery, the permittee must submit a proposal for abandoning and replacing the well.

E7. The permittee must submit ground water potentiometric-surface maps or flow maps with each semiannual ground water monitoring report. The maps must contain the following:

a. Location and identification of each ground water monitoring well and piezometer.
b. Static water level relative to mean sea level for each well and piezometer. The permittee must measure all elevations on the same day and as close in time as possible before the purging and sampling event.
c. Date and time of static water level measurement for each well and piezometer.
d. Ground-surface elevation at each well and piezometer.
e. Facility property boundaries.
f. Identification of the aquifer represented, either by a name or elevation.
g. Solid waste fill boundaries.
h. Facility name and county.
i. Map scale, north arrow, ground water flow direction arrows, and potentiometric-surface contour intervals.
j. Indications of which monitoring wells are considered background, upgradient, downgradient, or intrawell.
k. Locations and elevations of all site benchmarks.

E8. If a ground water potentiometric-surface map or flow map indicates that the ground water flow direction is other than that anticipated in the design of the monitoring well system, the permittee must notify IDEM of the difference in the ground water monitoring report submitted for Requirement E12. The notification must include either of the following: information demonstrating that the monitoring well system still complies with 329 IAC 10-29-1(b); or a proposal to revise the monitoring system design for approval.

If design changes to the existing ground water monitoring system listed in Requirement E11 are necessary, the permittee must make the changes within 30 days after receiving approval of the revised design.

E9. The permittee must follow the Sampling and Analysis Plan (SAP) and the Quality Assurance Project Plan (QAPjP), dated November 12, 1999 (VFC #52713207).

If IDEM requests a revision, the permittee must submit a revised SAP and QAPjP for approval. The permittee must submit the revision within 60 days after receiving the request. This submittal must include 1 original paper copy and 1 PDF formatted electronic file.

If the permittee makes design changes to the existing ground water monitoring system listed in Requirement E11, the permittee must submit a revised SAP and QAPjP for approval. The permittee must submit the revision within 30 days after completing all field activities associated with the changes. This submittal must include 1 original paper copy and 1 PDF formatted electronic file.

E10. The permittee must follow the Statistical Evaluation Plan (StEP), dated December 3, 2009 (VFC # 54047681).

If IDEM requests a revision, the permittee must submit a revised StEP for approval. The permittee must submit the revision within 60 days after the request. This submittal must include 1 original paper copy and 1 PDF formatted electronic file. The permittee must not implement a revised StEP before receiving approval.

In the StEP, the permittee must present the data distribution assumptions. The statistical procedures must be appropriate for the data distribution and provide a balance between the probability of falsely identifying a significant difference and the probability of failing to identify a significant difference. To achieve the balance, the permittee should consider the background sample sizes, the number of individual statistical tests performed, and the specific verification resampling method.

If the permittee makes design changes to the existing ground water monitoring system listed in Requirement E11, the permittee must submit a revised StEP for approval. The permittee must submit the revision within 30 days after completing all field activities associated with the changes. This submittal must include 1 original paper copy and 1 PDF formatted electronic file. The permittee must not implement the revised StEP before receiving approval.

E11. The permittee must sample the facility's ground water monitoring well system during May and November of each year. The monitoring well system includes the following wells: MW-1S, MW-1I, MW-1D, MW-15S, MW-15I, MW-16I, MW-16D, MW-17S, MW-17I, MW-21S, MW-21I, and MW-21D. Each sample must be analyzed for the following Phase I parameters:

a. Field pH
b. Field specific conductance
c. Barium (dissolved)
d. Boron (dissolved)
e. Chromium (dissolved)
f. Selenium (dissolved)
g. Sulfate

E12. No later than 60 days after each ground water monitoring event completed for Requirement E11, the permittee must submit the information in a ground water monitoring report to the IDEM Solid Waste Permits Section in 1 unbound paper copy and in 1 electronic version in PDF format. The report must include the following:

a. One original, unbound, laboratory-certified report with analytical and field parameters results, field sheets, and chain-of-custody forms. The laboratory-certified report must include the following: detection limit for each chemical parameter, date samples collected, date the laboratory received the samples, date the laboratory analyzed the samples, date the laboratory prepared the report, method of analysis the laboratory used for each parameter, sample identification number for each sample, and results of all sample analyses.

b. All information specified in Requirement E7 and a table summarizing the static water level for each well.

c. Comments regarding ground water quality, recent notifications of any compliance issues related to a problematic well or piezometer (see Requirement E6), special field observations and procedures, and deviations from the SAP.

d. One original unbound copy of the statistical evaluation report (see Requirement E17).

The permittee may mail the PDF copy and electronic data file specified in Requirement E13 on a CD-ROM or DVD. The permittee must clearly label the PDF copy and data file with the facility name and a brief description of the file. Alternatively, the permittee may e-mail the PDF copy and electronic data file to the IDEM Solid Waste Permit Manager listed in Requirement A4 and carbon copy olqdata@idem.IN.gov. The e-mail must include the facility name and a brief description typed in the e-mail's subject heading.

E13. The permittee must submit 1 electronic data file of the analytical and field parameters results formatted as an ASCII, tab-delimited text file. The electronic data file must contain the facility's name, permit number, and the name of the analytical laboratory. Additionally, the file must include the fields listed below for the analytical results and the following field parameters: pH, specific conductance, temperature, well depth, depth to water, and static water elevation.

a. SamplingDate: Month, day, and year (mm/dd/yyyy). Value should be formatted as a date if possible.

b. SamplePointName: Names of monitoring wells, piezometers, leachate wells, surface water collection points, etc.

c. LaboratorySample ID: ID assigned to the sample by the laboratory.

d. SampleType: Regular, duplicate(s), trip blank(s), equipment blank(s), field blank(s), verification re-sample(s), and replicate(s).

e. SpeciesName: Chloride, sodium, ammonia, field pH, etc. The order of parameters is not critical. However, it is best to reflect the order that is on the laboratory-data sheets and keep all field data grouped together. Metals should indicate "dissolved" phase or "total" phase. Associated static water levels do not have their own header, but must be entered as "GW WaterLevel" under the header "SpeciesName." The actual elevations must be entered under the header "Concentration."

f. Concentration (results): The entry must be a number. Please do not enter text, such as "NA," "ND," or "<."

g. ConcentrationUnits: mg/l, ug/l, standard units for pH, degrees Celsius (^{o}C) or degrees Fahrenheit (^{o}F) for temperature, and umhos/cm for specific conductance.

h. Detected: Yes or no.

i. DetectionLimit.

j. AnalyticalMethods.

k. EstimatedValue: Indicate "Yes" if the reported concentration is an estimated value. If a value recorded was not estimated, enter "No." If a concentration is estimated, use the "Comment" field to explain why the concentration was estimated.

l. Comment: Analytical laboratory and/or field personnel comments regarding the reported results.
m. SampleMedium: Ground water, leachate, surface water, etc.
n. ProgramArea: Solid Waste.

Additional guidance on electronic data file submittals is available on IDEM's website at www.in.gov/idem/5384.htm or by e-mailing questions to olqdata@idem.IN.gov.

E14. The permittee must retain laboratory quality assurance/quality control (QA/QC) documentation from valid analyses of ground water samples for at least 3 years.

Upon IDEM request, the permittee must submit the laboratory QA/QC for a specified ground water monitoring data package, in 1 paper copy and 1 electronic copy in PDF format, within 60 days after receiving the request. The "Solid & Hazardous Waste Programs, Analytical Data Deliverable Requirements: Supplemental Guidance" provides additional information about laboratory QA/QC. The guidance is available on IDEM's website at www.in.gov/idem/4673.htm.

E15. The permittee must conduct ground water monitoring throughout the active life and the post-closure care period of the facility (329 IAC 10-29-3). IDEM may extend the post-closure care period if ground water monitoring results show that the facility has not stabilized (329 IAC 10-31-4).

E16. The permittee must determine the background ground water quality for any background wells added to the facility's ground water monitoring system by sampling each new well for 4 consecutive quarters within 1 year after their installation. The permittee must establish background ground water quality for the following:

a. The Phase I parameters in Requirement E11.
b. The secondary standards in 329 IAC 10-29-7(c).
c. The ground water protection standard in 329 IAC 10-29-10.

E17. The permittee must apply the StEP in Requirement E10 to determine whether there is a statistically significant increase (or pH decrease) over the background for each Phase I or Phase II parameter, except for field temperature. The statistical determination must include the value obtained during each semiannual analysis with the established background (329 IAC 10-29-5).

E18. If the permittee determines there is a statistically significant increase (or pH decrease) over background for 2 or more of the Phase I parameters at any of the downgradient monitoring wells, the permittee must comply with the following requirements:

a. Notify IDEM in writing within 14 days after the finding. The notification must state which Phase I parameters showed statistically significant increases (or pH decrease) over background levels, and which downgradient monitoring well(s) showed the elevated concentrations.

b. Collect and analyze the ground water from all monitoring wells for the parameters in Requirement E11 and the parameters determined from 329 IAC 10-29-7(d). The permittee must submit the results to IDEM within 60 days after determining the statistically significant increases.

c. Establish a Phase II monitoring program based on the results obtained from Requirement E18.b and consult with the IDEM Geology Section within 30 days after completing Requirement E18.b.

The permittee must continue the scheduled Phase I monitoring as described in Requirement E11 and 329 IAC 10-29 throughout the establishment and implementation of a Phase II monitoring program.

E19. In lieu of Requirements E18.b and E18.c, the permittee may attempt to demonstrate that a source other than the solid waste facility caused the increase (or pH decrease) or that the increase (or pH decrease) resulted from error in sampling, analysis, or evaluation. For IDEM to approve the demonstration, the permittee must comply with the following requirements:

a. Notify IDEM in writing of the intent to make a demonstration. The permittee must submit the notification within 7 days after determining a statistically significant increase (or pH decrease).

b. Submit a report to IDEM within 90 days after determining a statistically significant increase (or pH decrease). The report must demonstrate that a source other than the solid waste facility caused the increase (or pH decrease), or that the increase (or pH decrease) resulted from error in sampling, analysis, or evaluation. The report must state what efforts the permittee will take to prevent these errors from recurring.

c. Continue to monitor ground water at all monitoring wells according to the scheduled Phase I monitoring established under 329 IAC 10-29-6.

If a demonstration is not acceptable to IDEM, the permittee must continue with Requirements E18.b and E18.c.

E20. If necessary, the permittee must implement a corrective action program as required under 329 IAC 10-29-9. The corrective action program is complete when ground water protection standards have been met at all points of the plume beyond the monitoring boundary for a period of 3 consecutive years using the statistical procedures outlined in 329 IAC 10-29-5 and procedures approved through this permit.

E21. The permittee must analyze the following constituents in accordance with the sampling schedule specified in Requirement E11 for samples collected from the ground water monitoring wells of the monitoring well system.

a. Alkalinity, bicarbonate (HCO_3)
b. Alkalinity, total (CaCO3)
c. Aluminum (dissolved)
d. Arsenic (dissolved)
e. Cadmium (dissolved)
f. Calcium (dissolved)
g. Chloride
h. Fluoride
i. Iron (dissolved)
j. Lead (dissolved)
k. Magnesium (dissolved)
l. Manganese (dissolved)
m. Molybdenum
n. Mercury (dissolved)
o. Potassium (dissolved)
p. Nitrate (NO_3)
q. Sodium (dissolved)
r. Silver (dissolved)
s. Total Dissolved Solids

The permittee must include the sampling results in the ground water monitoring report (Requirement E12).

The permittee must complete a statistical evaluation or a geochemical evaluation on the constituents identified in this Requirement (E21) when the IDEM Geology Section deems an evaluation is necessary. Until the IDEM Geology Section requests an evaluation, the permittee must include a nonstatistical, qualitative review of the concentrations for these constituents in each statistical evaluation report.

E22. The permittee must include static water levels from the following monitoring wells to develop potentiometric maps required for each ground water submittal (Requirement E7).

MW-2(S, I, and D)
MW-5(S and I)
MW-6(S)
MW-7(S and I)
MW-8(S, R, and I)
MW-9(S)
MW-10(S)
MW-11(S)
MW-12(S)
MW-13(S)
MW-14(S)

E23. The permittee must include time series plots (time vs. concentration) of the facility's ground water data when the IDEM Geology Section requests the plots to be included in the statistical evaluation report (Requirement E12.d).

F. CLOSURE REQUIREMENTS

F1. The permittee must comply with 329 IAC 10-30 (Closure Requirements for Restricted Waste Site Type I Landfill) and follow the facility's approved closure plan dated December 19, 2007 (VFC #27473581, Appendix B, Attachment 17, p. 31-41 of 64), and revisions dated March 27, 2012 (VFC#66690329, p. 21-47 of 325).

F2. The permittee must notify IDEM in writing at least 60 days before the intended date to begin closure of each area.

F3. The permittee must construct the final cover as specified in the approved final grading plan as shown on DWG. NO. 12-30429-A (sheet 10 of 37), titled "Top of Final Cover Grades," dated March 22, 2012 (VFC #66674113), and the applicable requirements of 329 IAC 10-30-2 and 10-28-11. Grading and stabilization of final cover must comply with 329 IAC 10-28-14.

G. POST-CLOSURE REQUIREMENTS

G1. The permittee must perform post-closure monitoring and maintenance as specified in the facility post-closure plan in the permit application dated December 19, 2007 (VFC #27473581, Appendix B, Attachment 17, p. 42-49 of 64), and revisions dated March 27, 2012 (VFC#66690329, p. 21-47 of 325), and the applicable requirements of 329 IAC 10-31.

H. FINANCIAL RESPONSIBILITY FOR CLOSURE AND POST-CLOSURE

H1. The permittee must maintain a financial assurance mechanism for the costs of closure and post-closure using one of the financial assurance mechanisms and the estimating standards described in 329 IAC 10-39. The permittee must submit signed originals of the financial assurance mechanism and updates used to meet this requirement.

H2. The permittee must submit a financial responsibility update by June 15 of each year. The annual update must address the following items as detailed in 329 IAC 10-39-2(c) and (d), and 329 IAC 10-39-3(c):

a. The permittee must adjust the closure and post-closure cost estimates for inflation.

b. The permittee must revise the cost estimates to account for changes which increase the cost of closure or post-closure.

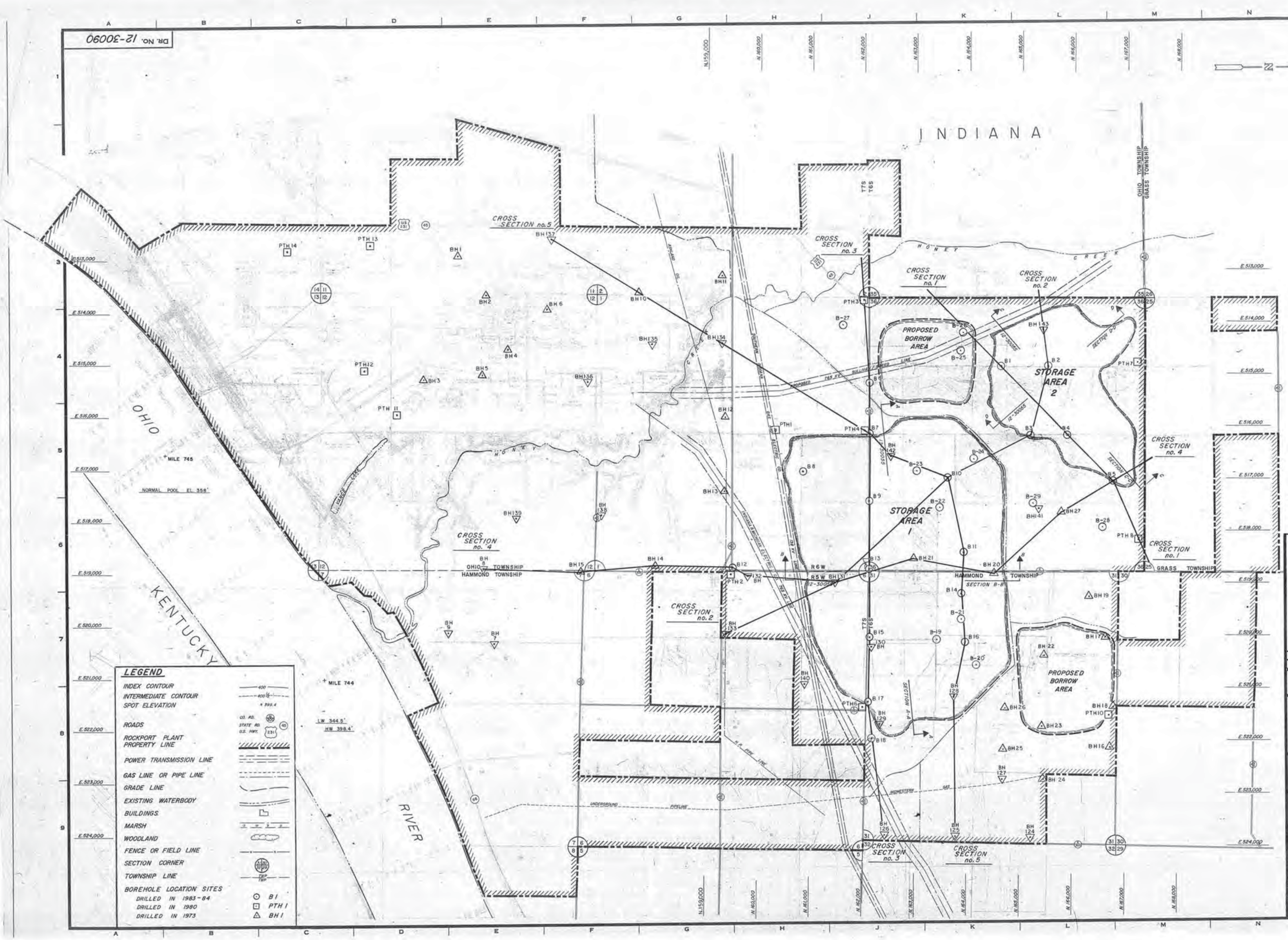
c. The permittee may revise the cost estimates to account for changes which reduce the cost of closure or post-closure. The permittee must provide documentation supporting reduced cost-estimates, for example: letters and maps documenting areas certified as closed.

d. The permittee must submit an existing contour map showing the approved solid waste land disposal facility that delineates the boundaries of all areas into which waste has been placed, and the boundaries of areas certified as closed. The map must be certified by a professional engineer or a registered land surveyor.

e. The permittee must submit documentation showing that the financial assurance mechanism is current and adequate to cover the estimated costs of closure and post-closure. The permittee must submit signed originals of the financial assurance mechanism and updates used to meet this requirement.

APPENDIX B

MAPS AND CROSS-SECTIONS
1983 LANDFILL SITE INVESTIGATION



DATE	No	DESCRIPTION	APPD.

REVISIONS

NOTE:
GRADE ELEVATION HAS BEEN ESTABLISHED AS ELEVATION 100'-0". TO CONVERT TO PLANT DATUM ADD 492'-0" TO ELEVATIONS SHOWN.

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INDIANA & MICHIGAN ELECTRIC CO.
ROCKPORT PLANT
ROCKPORT, INDIANA

ASH DISPOSAL AREAS
SITE INVESTIGATION PLAN

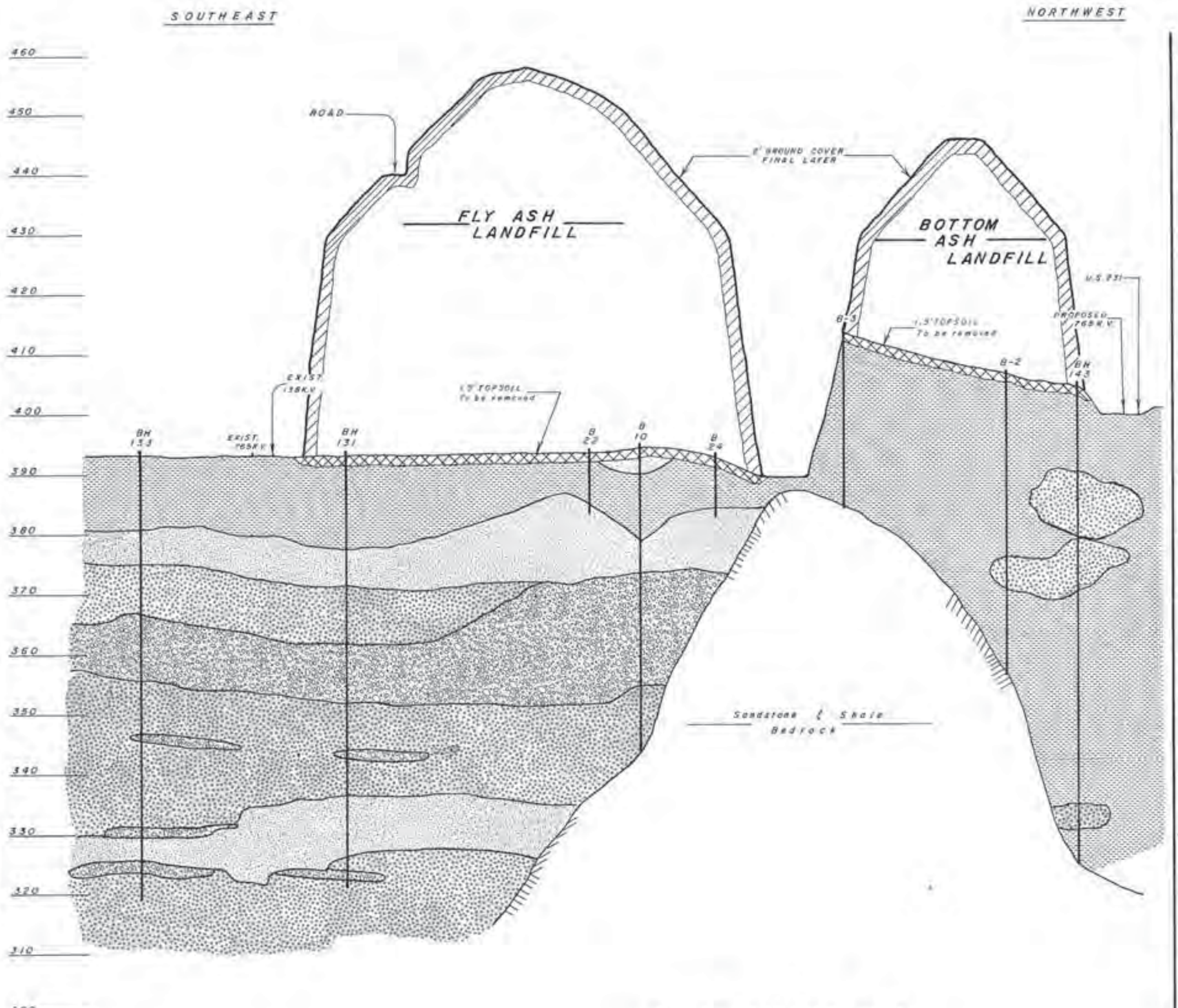
DR. No. 12-30090

ARCH.	–	ELEC.	–	MECH.	–	STR.

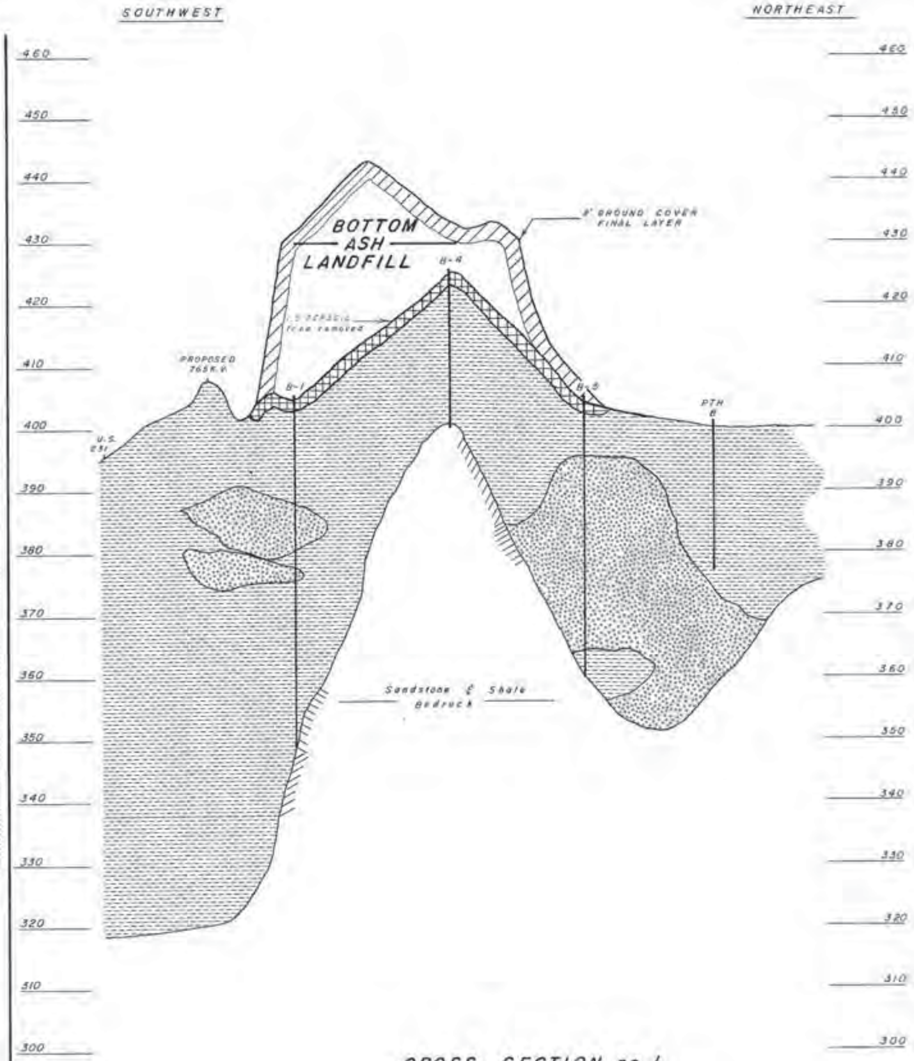
SCALE: 1" = 600'
DR. J. DEEMS
CH. J. M.-N.
SQ. LDR. T. S.
DATE: 3-27-84
APPROVED BY
ENGINEERING DIV.
DESIGN DIV.

AMERICAN ELECTRIC POWER SERVICE CORP.

Dr. No. 12-30091



CROSS SECTION no. 2



CROSS SECTION no. 1

SCALE:
Horizontal 1" = 600'
Vertical 1" = 10'

LEGEND

GROUND COVER ▨
TOP SOIL ☒
SILTY SANDY CLAY ▤
FINE SAND ░
SAND ▒
SAND & GRAVEL ▓

DATE	NO.	DESCRIPTION	APPD.

REVISIONS

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INDIANA & MICHIGAN ELECTRIC CO.
ROCKPORT PLANT
ROCKPORT, INDIANA

ASH DISPOSAL AREAS
GEOLOGIC X-SECTIONS
Nº 1 & Nº 2

DR. NO. 12-30091

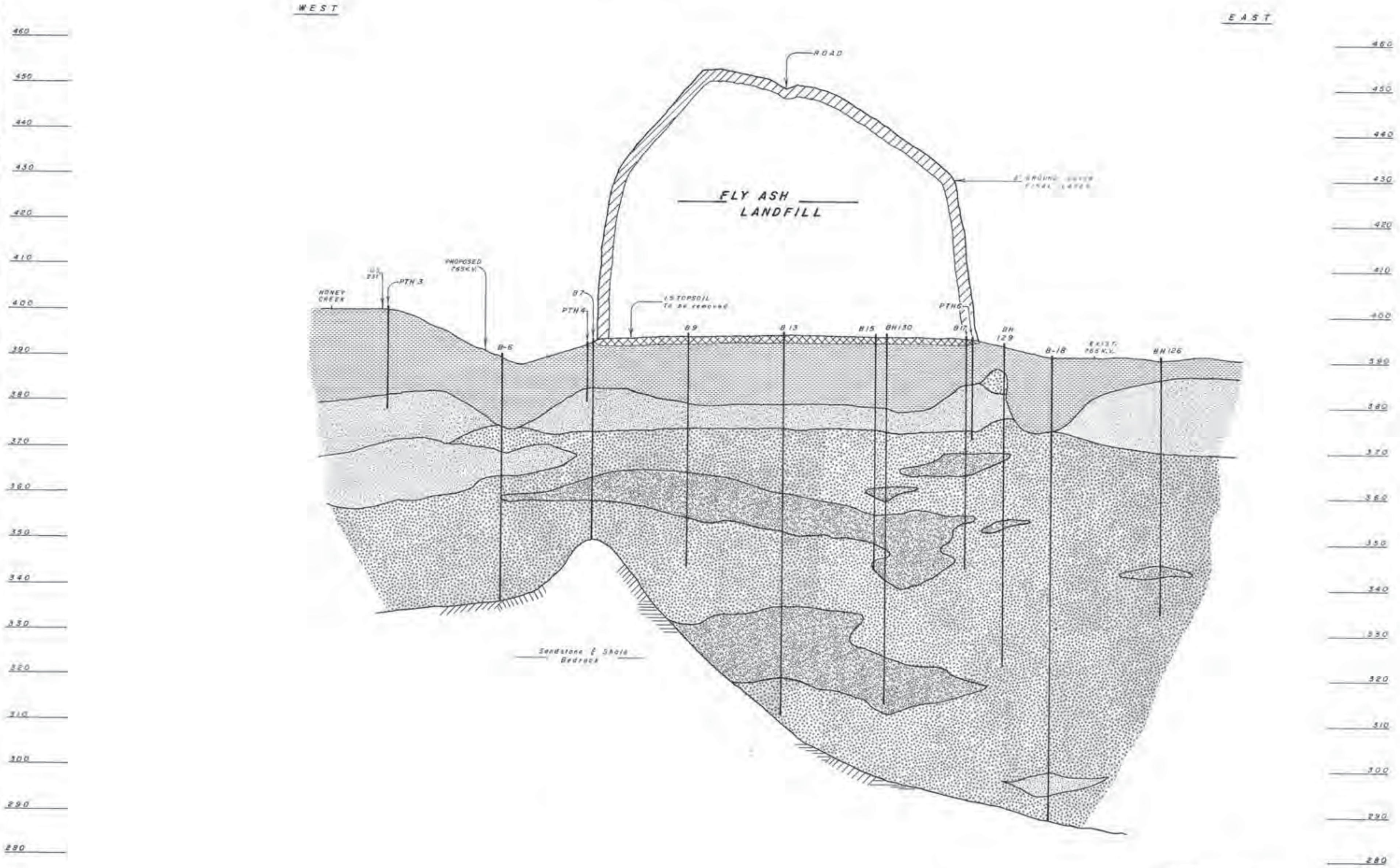
ARCH.	–	ELEC.	–	MECH.	–	STR.	–

SCALE: AS SHOWN
DR. J. Drews
CH. J.M.-N.
SQ. LDR. T.D.
DATE 3-27-84

APPROVED BY
ENGINEERING DIV
DESIGN DIV
VO Lepore

AMERICAN ELECTRIC POWER SERVICE CORP.

DR. No. 12-30092



SCALE:
Horizontal 1" = 600'
Vertical 1" = 10'

CROSS SECTION no. 3

LEGEND

GROUND COVER	▨
TOP SOIL	☒
SILTY SANDY CLAY	▤
FINE SAND	░
SAND	▒
SAND & GRAVEL	▓

DATE	NO.	DESCRIPTION	APPD.

REVISIONS

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INDIANA & MICHIGAN ELECTRIC CO
ROCKPORT PLANT
ROCKPORT, INDIANA

ASH DISPOSAL AREAS
GEOLOGIC X-SECTION
Nº 3

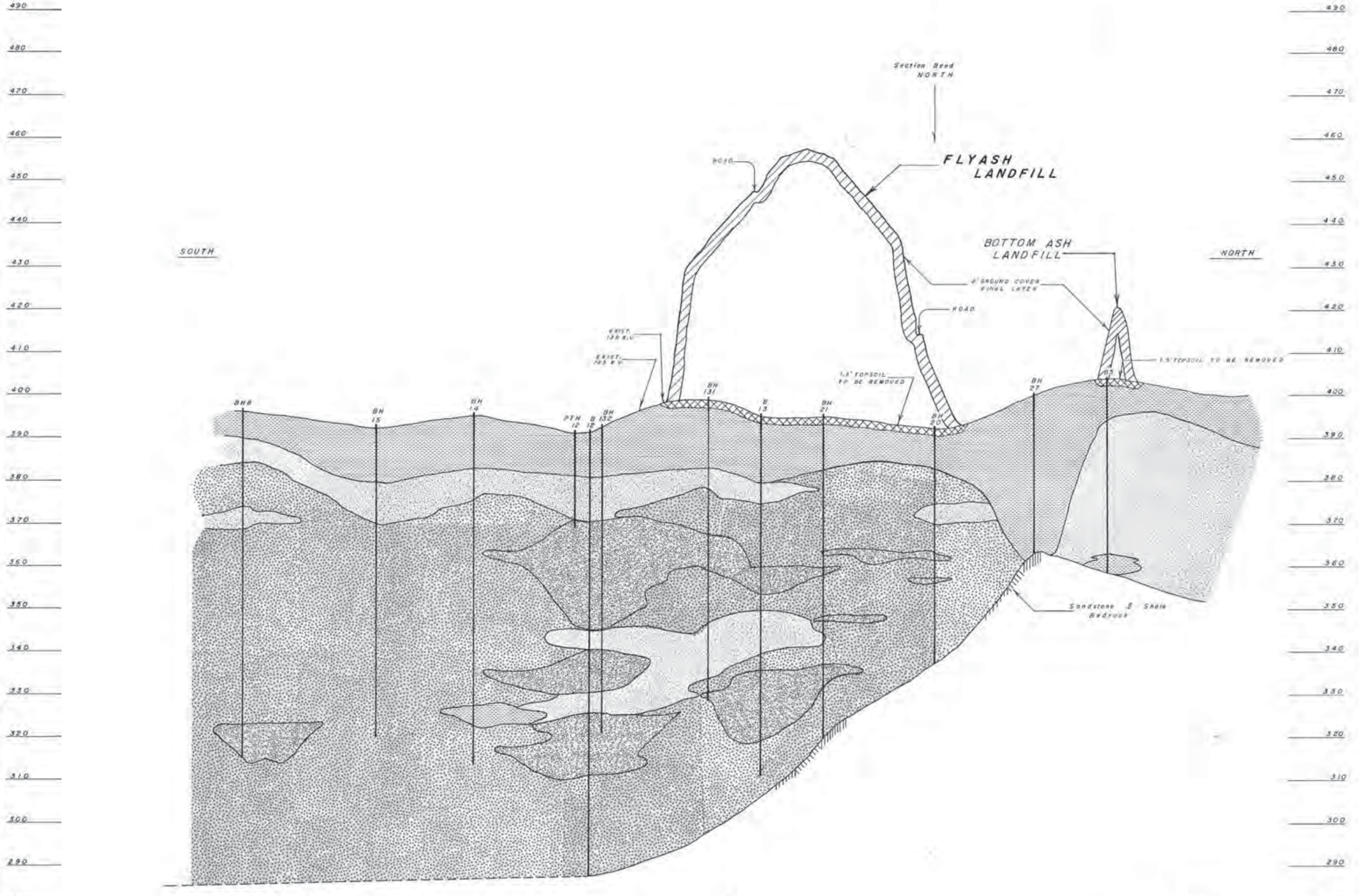
DR. NO. 12-30092

ARCH. – ELEC. – MECH. STR. –

SCALE: AS SHOWN
DR. J. DEAN
CH. J.M.-M.
SQ. LDR. F.S.
DATE 3-27-84
APPROVED BY
ENGINEERING DIV
DESIGN DIV
PHA

AMERICAN ELECTRIC POWER SERVICE CORP.

Dr. No. 12-30093



SCALE:
Horizontal 1" = 600'
Vertical 1" = 10'

CROSS SECTION no. 4

LEGEND

GROUND COVER	▨
TOP SOIL	☒
SILTY SANDY CLAY	▤
FINE SAND	░
SAND	▒
SAND & GRAVEL	▓

DATE	NO.	DESCRIPTION	APPD.

REVISIONS

INDIANA & MICHIGAN ELECTRIC CO.
ROCKPORT PLANT
ROCKPORT, INDIANA

ASH DISPOSAL AREAS
GEOLOGIC X-SECTION
Nº 4

DR. NO. 12-30093

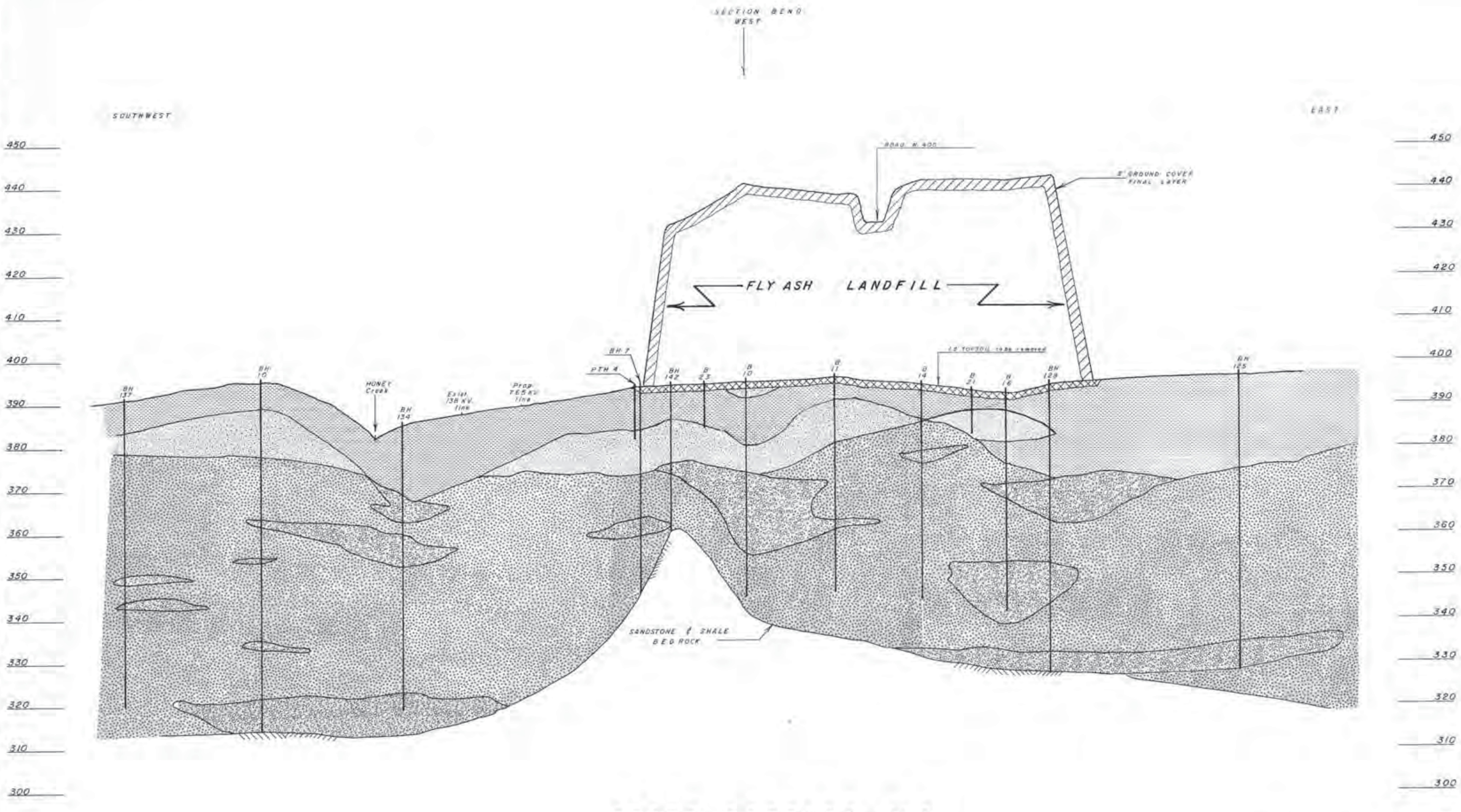
ARCH.		ELEC	—	MECH.	—	STR.	

SCALE: As Shown
DR. J. Deems
CH. J.M.-N.
RG. LDR. T.S.
DATE 2-27-86

APPROVED BY
ENGINEERING DIV. PMB
DESIGN DIV. VD

AMERICAN ELECTRIC POWER SERVICE CORP.

Dr. No. 12-30094



CROSS SECTION no. 5

SCALE:
Horizontal 1" = 400'
Vertical 1" = 10'

LEGEND

GROUND COVER ▨
TOP SOIL ☒
SILTY SANDY CLAY ▒
FINE SAND ░
SAND ▒
SAND & GRAVEL ▓

DATE	NO.	DESCRIPTION	APPD.

REVISIONS

INDIANA & MICHIGAN ELECTRIC CO.
ROCKPORT PLANT
ROCKPORT, INDIANA

ASH DISPOSAL AREAS
GEOLOGIC X-SECTION
Nº 5

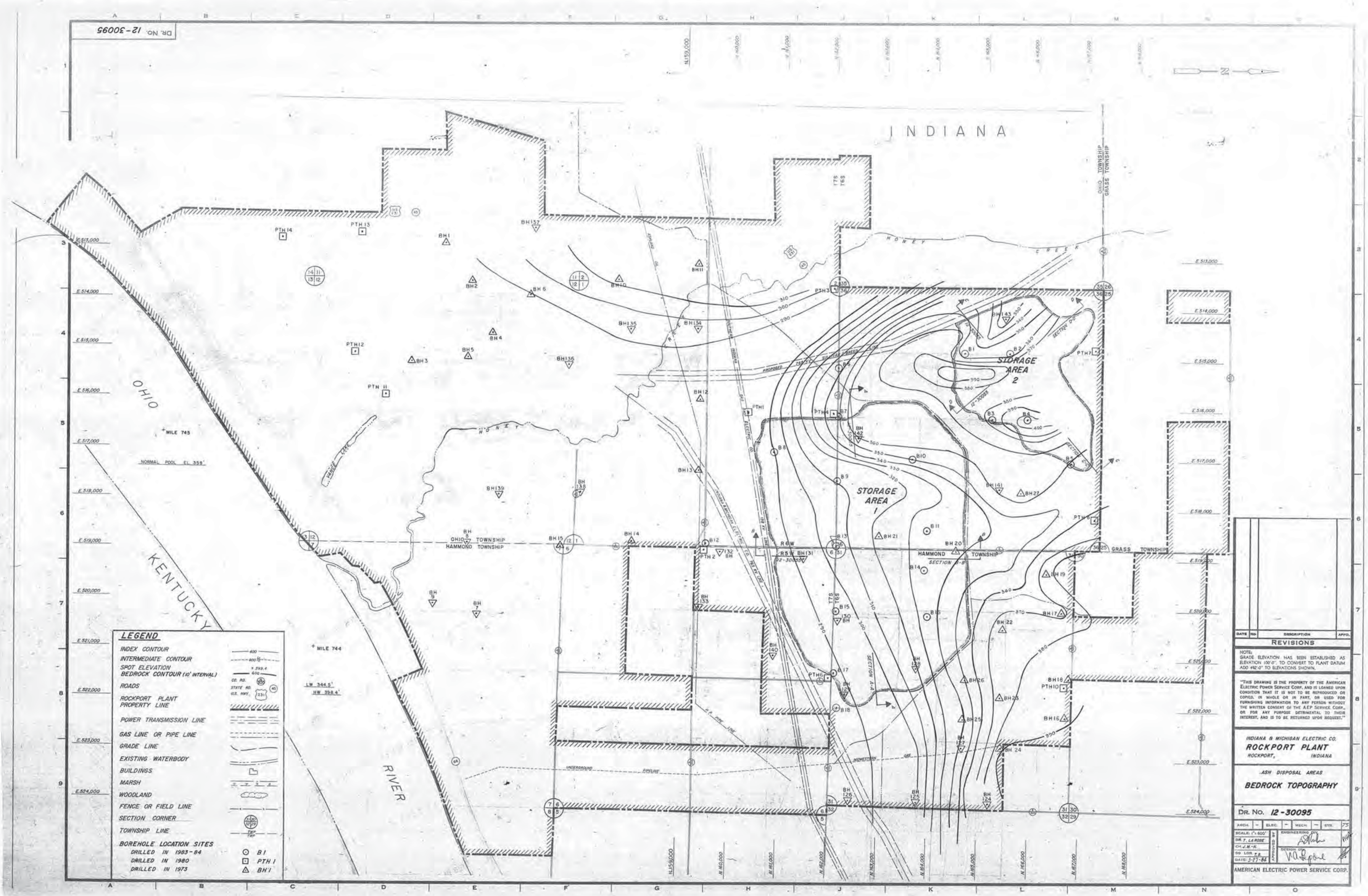
DR. NO. 12-30094

ARCH. - ELEC. - MECH. - STR.

SCALE: AS SHOWN
DR. J. Deems
CH. J.M.-K
SQ. LDR. T.S.
DATE 3-17-88

APPROVED BY
ENGINEERING DIV.
DESIGN DIV.

AMERICAN ELECTRIC POWER SERVICE CORP.



DATE	NO	DESCRIPTION	APPD.

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INDIANA & MICHIGAN ELECTRIC CO.
ROCKPORT PLANT
ROCKPORT, INDIANA

ASH DISPOSAL AREAS
BEDROCK TOPOGRAPHY

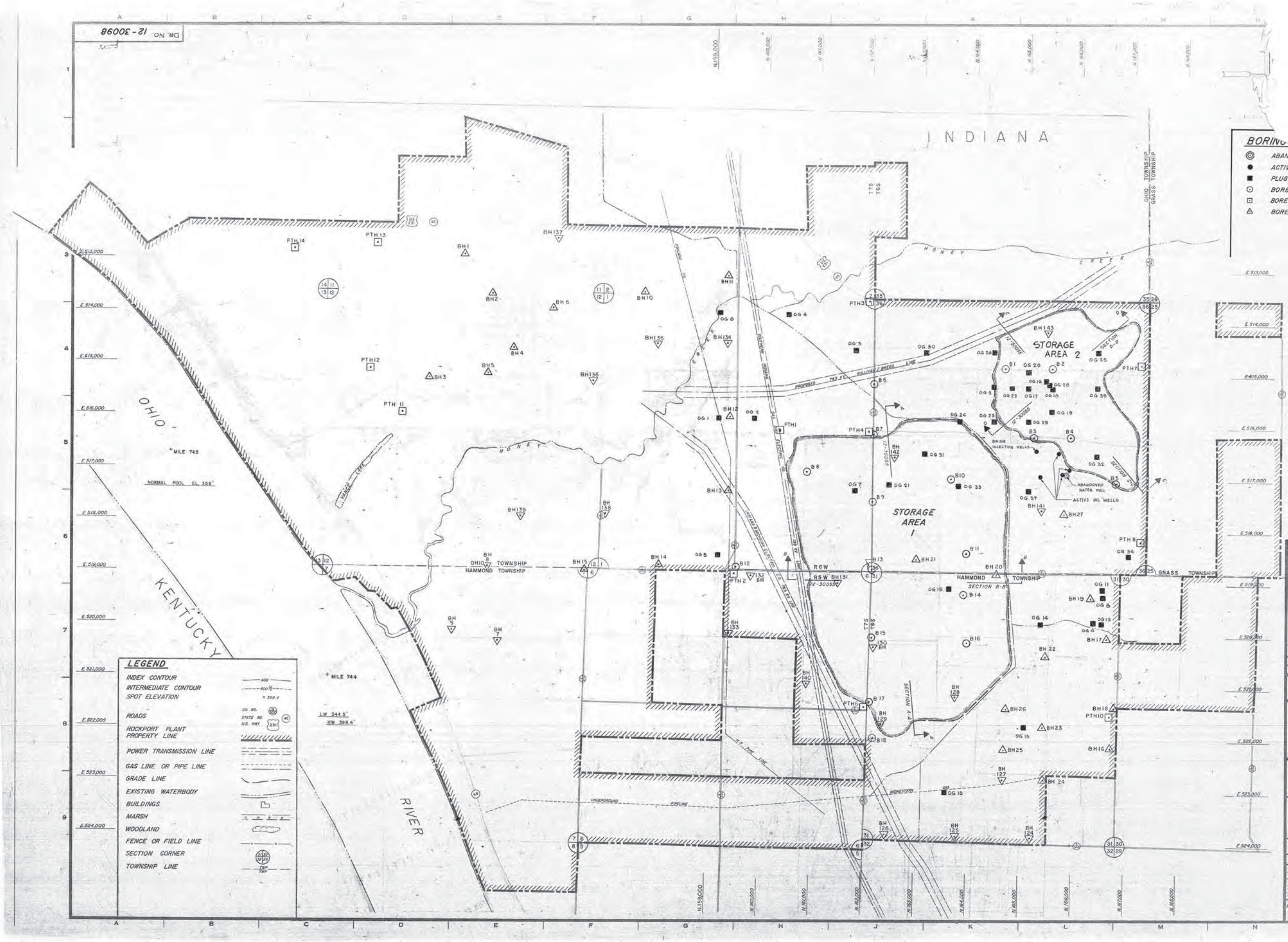
DR. NO. 12-30095

ARCH. – ELEC. – MECH. – STR. 75

SCALE: 1" = 600'
DR. T. LAROSE
CH. J.M.-N.
SQ. LDR. T.S.
DATE: 3-27-84

APPROVED BY
ENGINEERING DIV.
DESIGN DIV.

AMERICAN ELECTRIC POWER SERVICE CORP.



DATE	No.	DESCRIPTION	APPD.

REVISIONS

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INDIANA & MICHIGAN ELE
ROCKPORT PLAN
ROCKPORT, IND

ASH DISPOSAL AREA
LOCATION OF
OIL / GAS WE S

DR. NO. 12-3009 3

ARCH.	-	ELEC.	-	MEC	-	STR.	-

SCALE: 1"=600'
DR. T. LAROSE
CH. J.M.-N.
SQ. LDR. T.S.
DATE 3-27-84
APPROVED BY
ENGINEERING
DESIGN DIV.

AMERICAN ELECTRIC POWER SERVICE CORP.

APPENDIX C

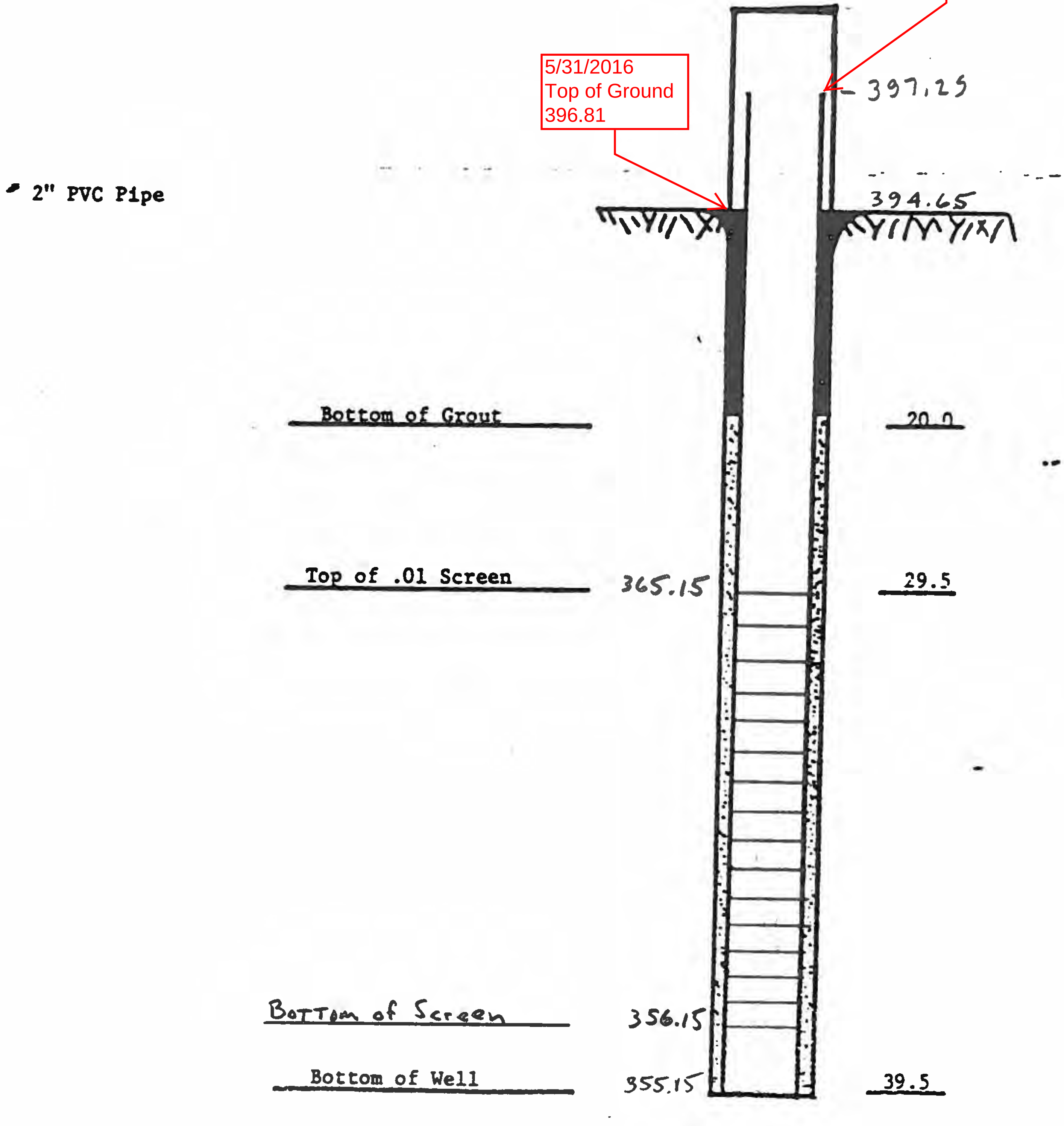
WELL CONSTRUCTION AND LITHOLOGIC LOGS
LANDFILL MONITORING WELLS

I & M
Rockport Plant
Ash Storage Area
Well No. 1S
4-25-84

MW-1S

5/31/2016
Reference Point
397.33
(top of 4" coupler,
lid removed)

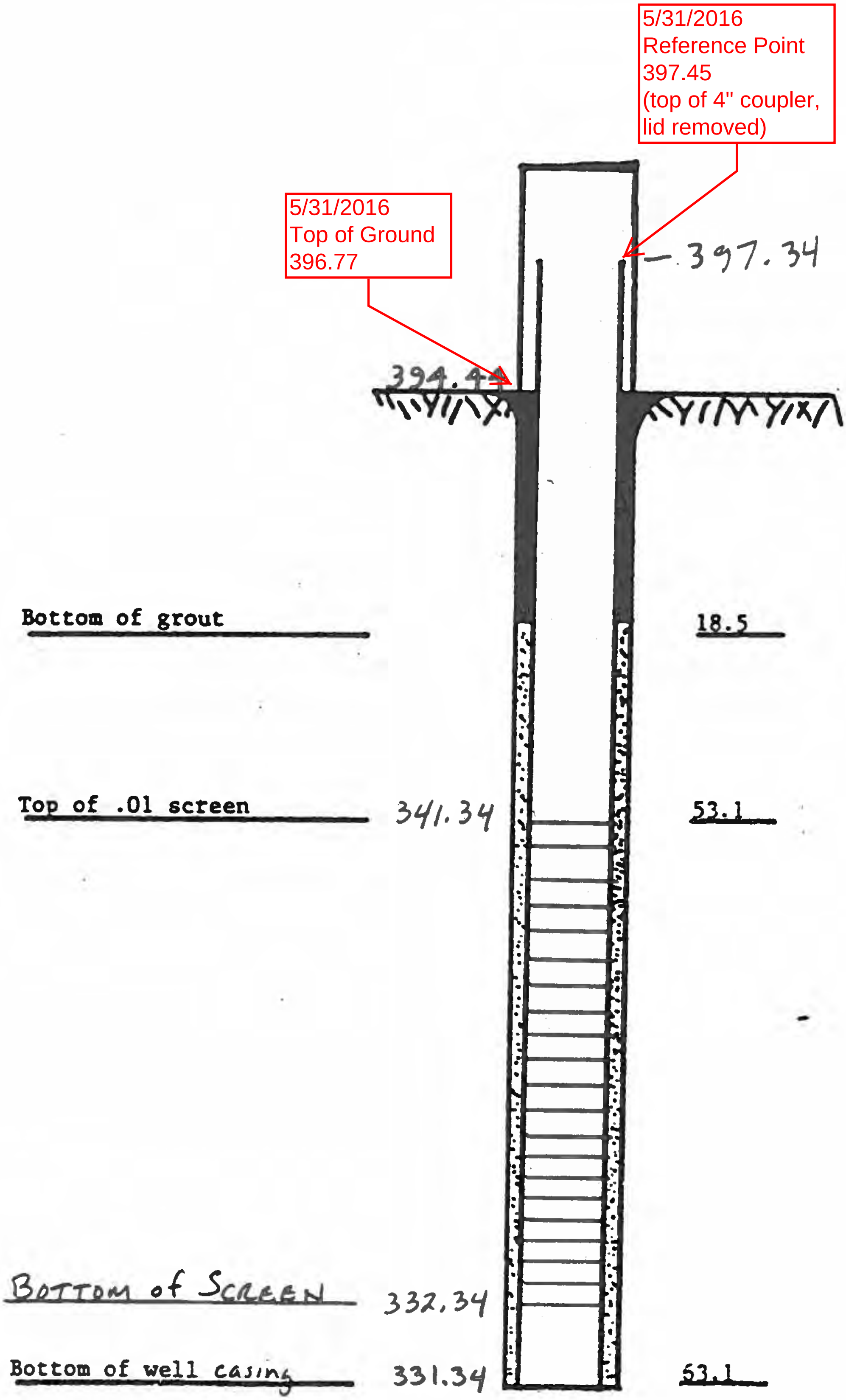
5/31/2016
Top of Ground
396.81



I & M
Rockport Plant
Ash Storage Area
Well No. 1-M
4-25-84

MW-1I

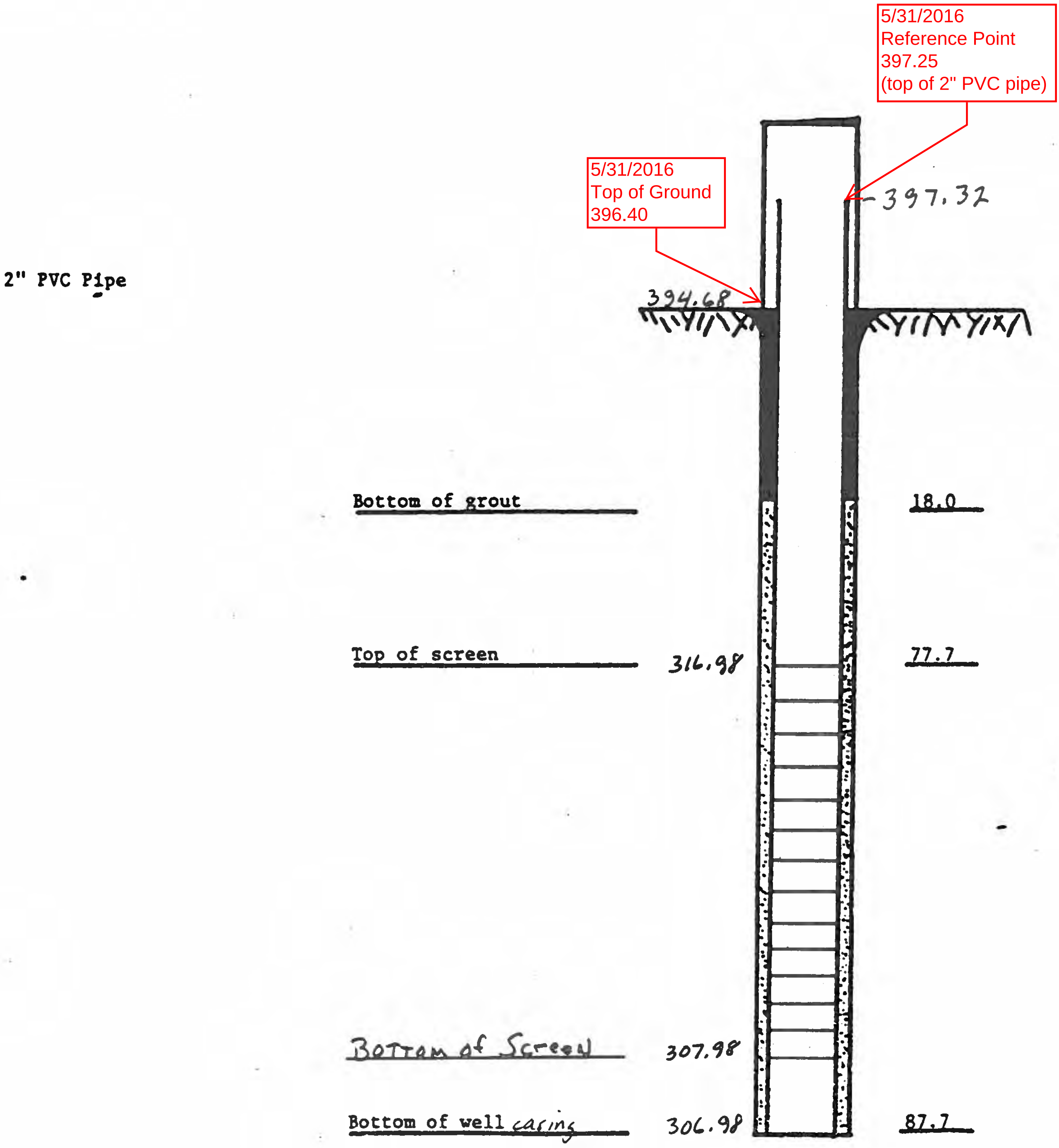
2" PVC Pipe


5/31/2016
Reference Point
397.45
(top of 4" coupler,
lid removed)

5/31/2016
Top of Ground
396.77

I & M
Rockport Plant
Ash Storage Area
Well No. 1-D
4-24-84

MW-1D



AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

AEP

JOB NUMBER ____

COMPANY INDIANA MICHIGAN POWER COMPANY

PROJECT ROCKPORT PLANT

COORDINATES N 162,107.2 E 521,813.6

GROUND ELEVATION 395.2 SYSTEM ____

BORING NO. 9901 MW-1 DATE 4/27/99 SHEET 1 OF 3

BORING START 1/18/99 BORING FINISH 1/28/99

PIEZOMETER TYPE ____ WELL TYPE OW

HGT. RISER ABOVE GROUND ____ DIA ____

DEPTH TO TOP OF WELL SCREEN ____ BOTTOM ____

WELL DEVELOPMENT ____ BACKFILL Grout

FIELD PARTY MCR-DLB RIG BK-81

WATER LEVEL	▽	▼	▼
TIME			
DATE			

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	USCS	SOIL / ROCK IDENTIFICATION	DRILLER'S NOTES
1	SS	0.0	1.5	1-2-2	1.4			CL	**BROWN SILTY CLAY** With organic in top 0.8'; moist	Water for drilling came from fire protection well at the plant.
2	SS	1.5	3.0	2-2-3	1.3			CL	**BROWN SILTY CLAY** Moist	
3	SS	3.0	4.5	3-4-6	1.5			CL	**BROWNISH GRAY SILTY CLAY** Dry	
~~4~~	~~SS~~	~~4.5~~	~~6.0~~	~~5-7-7~~	~~1.5~~		5			
5	SS	6.0	7.5	5-7-6	1.5					Used approx. 300 gallons of mud to drill boring - 3 bags.
6	SS	7.5	9.0	2-4-5	1.5			SP	**REDDISH BROWN SAND** Medium grain; dry.	
7	SS	9.0	10.5	3-4-6	1.5		10	CL	**BROWN SILTY CLAY** Wet	
8	SS	10.5	12.0	4-6-7	1.5			CL	**BROWN SILTY CLAY** Dry	Used approx. 125 gallons of grout with 5 bags. Grouted from 110.2' to grade.
9	SS	12.0	13.5	3-6-8	1.5			SP	**BROWN SAND** Medium grain; dry.	
10	SS	13.5	15.0	3-3-4	1.5					
11	SS	15.0	16.5	4-4-4	1.5		15	SP	**BROWN SAND** Medium grain with pea size gravel; dry.	
12	SS	16.5	18.0	3-6-6	1.5					
13	SS	18.0	19.5	6-6-8	1.5					
~~14~~	~~SS~~	~~19.5~~	~~21.0~~	~~6-10-10~~	~~1.5~~		20			
15	SS	21.0	22.5	7-9-11	1.5					
16	SS	22.5	24.0	7-8-8	1.5			SP	**BROWN SAND** With BB to 1/2" gravel; dry.	
17	SS	24.0	25.5	7-8-12	1.5		25			
18	SS	26.9	28.4	5-5-10	1.5			SP	**BROWN SAND** With BB to 1/2" gravel; wet.	
~~19~~	~~SS~~	~~29.5~~	~~31.0~~	~~3-5-9~~	~~1.5~~		30			
20	SS	31.0	32.5	4-5-6	1.5					
21	SS	32.5	34.0	4-8-9	1.5					
22	SS	34.0	35.5	3-3-3	1.5		35	SP	**SAND** Medium grain with pea size gravel; wet.	
23	SS	35.5	37.0	6-8-11	1.5			SP	**SAND** Medium grain with pea to 1/2" gravel; wet.	
24	SS	37.0	38.5	5-12-12	1.5					
25	SS	38.5	40.0	8-6-6	1.5					

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 DLB

AME AN ELECTRIC POWER SERVICE COF RATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER ____________

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **9901** DATE **4/27/99** SHEET **2** OF **3**

PROJECT **ROCKPORT PLANT** BORING START **1/18/99** BORING FINISH **1/28/99**

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
26	SS	41.9	43.4	9-12-14	1.5							
27	SS	46.9	48.4	8-8-8	1.5		45					
28	SS	51.9	53.4	4-8-11	1.5		50					
29	SS	53.4	54.9	5-10-12	1.5							
30	SS	54.9	56.4	4-7-9	1.3		55		SP	**LIGHT BROWN POORLY GRADED SAND** With fine to 3/4" gravel; wet.		
31	SS	56.4	57.9	10-9-10	1.4				SP	**SAND** Medium grain with few pea size gravel; wet.		
32	SS	57.9	59.4	7-14-12	1.5				SP	**SAND** Medium grain with pea to 3/4" gravel; wet.		
33	SS	59.4	60.9	6-10-13	1.5		60		SP	**POORLY GRADED SAND** Wet.		
34	SS	60.9	62.4	9-13-12	1.5				SW	**LIGHT BROWN WELL GRADED SAND** Medium grain; wet.		
35	SS	62.4	63.9	7-7-10	1.5							
36	SS	66.9	68.4	7-11-16	1.5		65					
37	SS	71.9	73.4	7-7-10	1.5		70		SP	**LIGHT BROWN POORLY GRADED SAND** Fine to medium grained; wet.		
38	SS	76.9	78.4	4-5-5	1.5		75		SP	**POORLY GRADED SAND** With pea size gravel; wet.		
39	SS	78.4	80.4	4-4-5-7	1.9							Started SPT on 2.0' centers at 78.4'.
40	SS	80.4	82.4	3-4-5-6	1.8		80		SW	**LIGHT BROWN WELL GRADED SAND** Medium grain; wet.		
41	SS	82.4	84.4	2-3-5-5	2.0				SP	**LIGHT BROWN POORLY GRADED SAND** Wet.		
42	SS	84.4	86.4	1-3-4-6	2.0		85		SP	**POORLY GRADED SAND** With fine gravel; wet.		
43	SS	86.4	88.4	3-4-9-10	2.0				SP	**SAND** Medium grain with few 1/2" gravel; wet.		
							90					

Continued Next Page

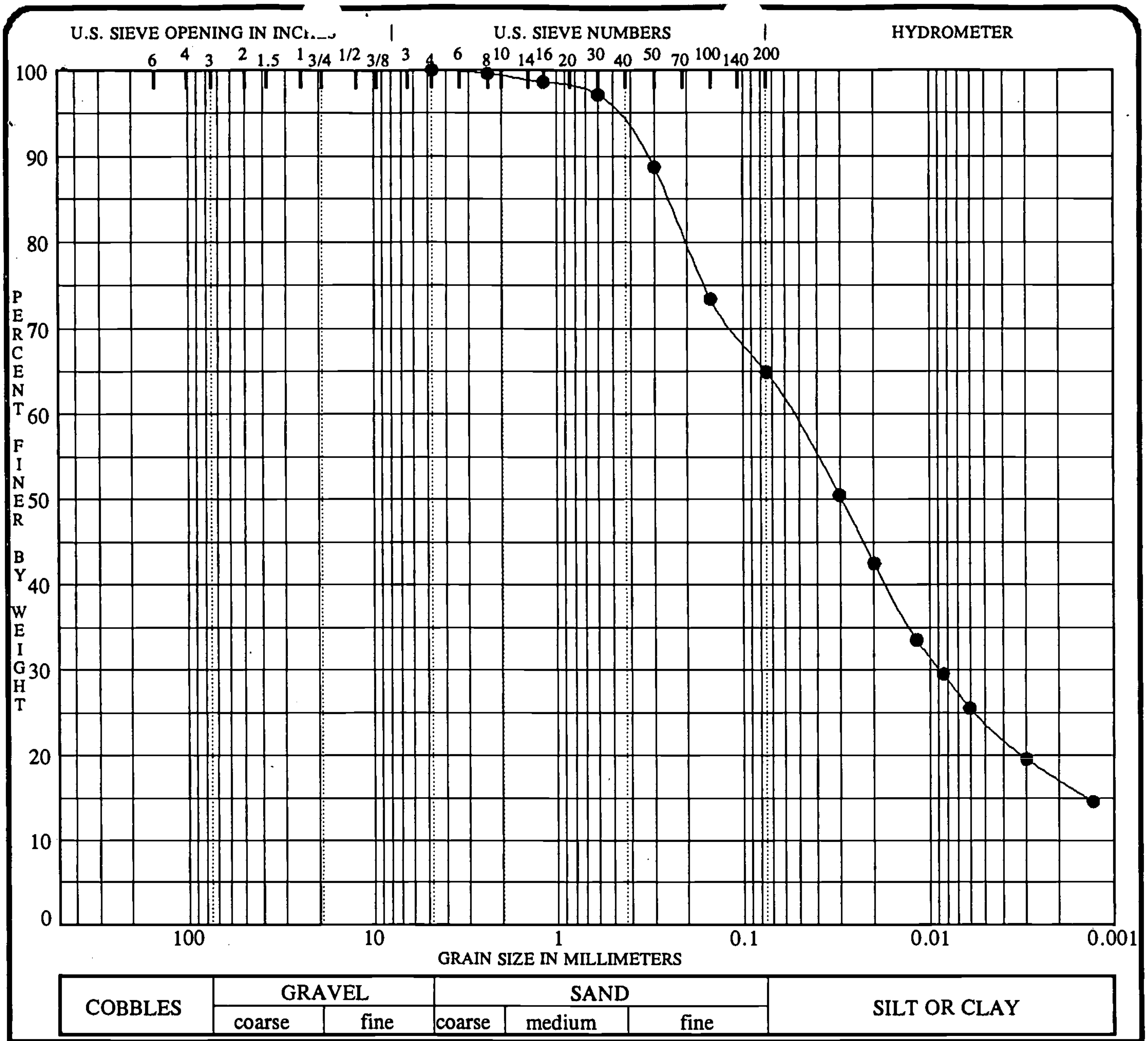
LOG OF BORING

JOB NUMBER ____________________

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **9901** DATE **4/27/99** SHEET **3** OF **3**

PROJECT **ROCKPORT PLANT** BORING START **1/18/99** BORING FINISH **1/28/99**

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
44	SS	91.9	93.9	9-10-14-13	2.0		95					
45	SS	96.9	98.9	5-9-14-20	2.0		100					
46	SS	101.9	103.4	11-12-15	1.5		105		SP	**SAND** Medium grained with few 1/2" gravel; wet.		
47	SS	106.9	108.4	3-14-20	1.4				CL	**SANDY CLAY** With 3/4" gravel.		
~~48~~	~~SS~~	~~109.5~~	~~110.1~~	~~30-50/1~~	~~0.5~~		110			**COAL**		Spoon refusal at 110.1' Auger refusal at 110.2'



	Specimen Identification		Classification	MC%	LL	PL	PI	Sp.Gr.	
●	9901	1.5			26.0	15.9	10.1		
			SANDY LEAN CLAY CL						
			COMPOSITE 1.5'-6.0'						

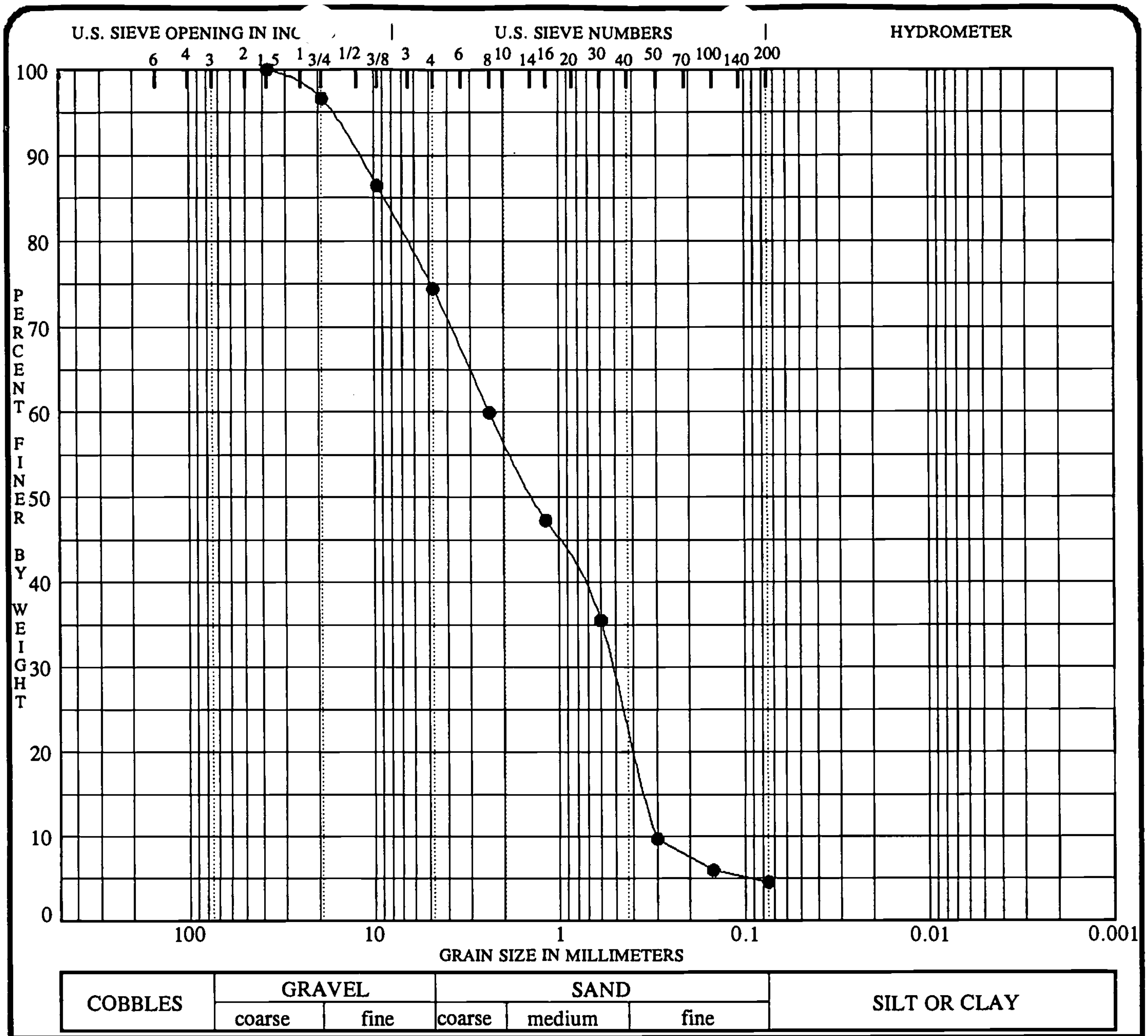
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
●	9901	1.5	4.750	0.055	0.009		0.0	35.1	64.9	17.2

PROJECT ROCKPORT PLANT - ROCKPORT, INDIANA

JOB NO. WO#SC3750
DATE 06/01/99

GRADATION CURVES

American Electric Power Service Corp.
Groveport, Ohio



Specimen Identification		Classification	MC%	LL	PL	PI	Sp.Gr.	
● 9901	29.5			NP	NP	NP		
		POORLY GRADED SAND with SILT and GRAVEL SP-SM						
		WELL #1-S COMPOSITE SAMPLE 29.5'-40.0'						

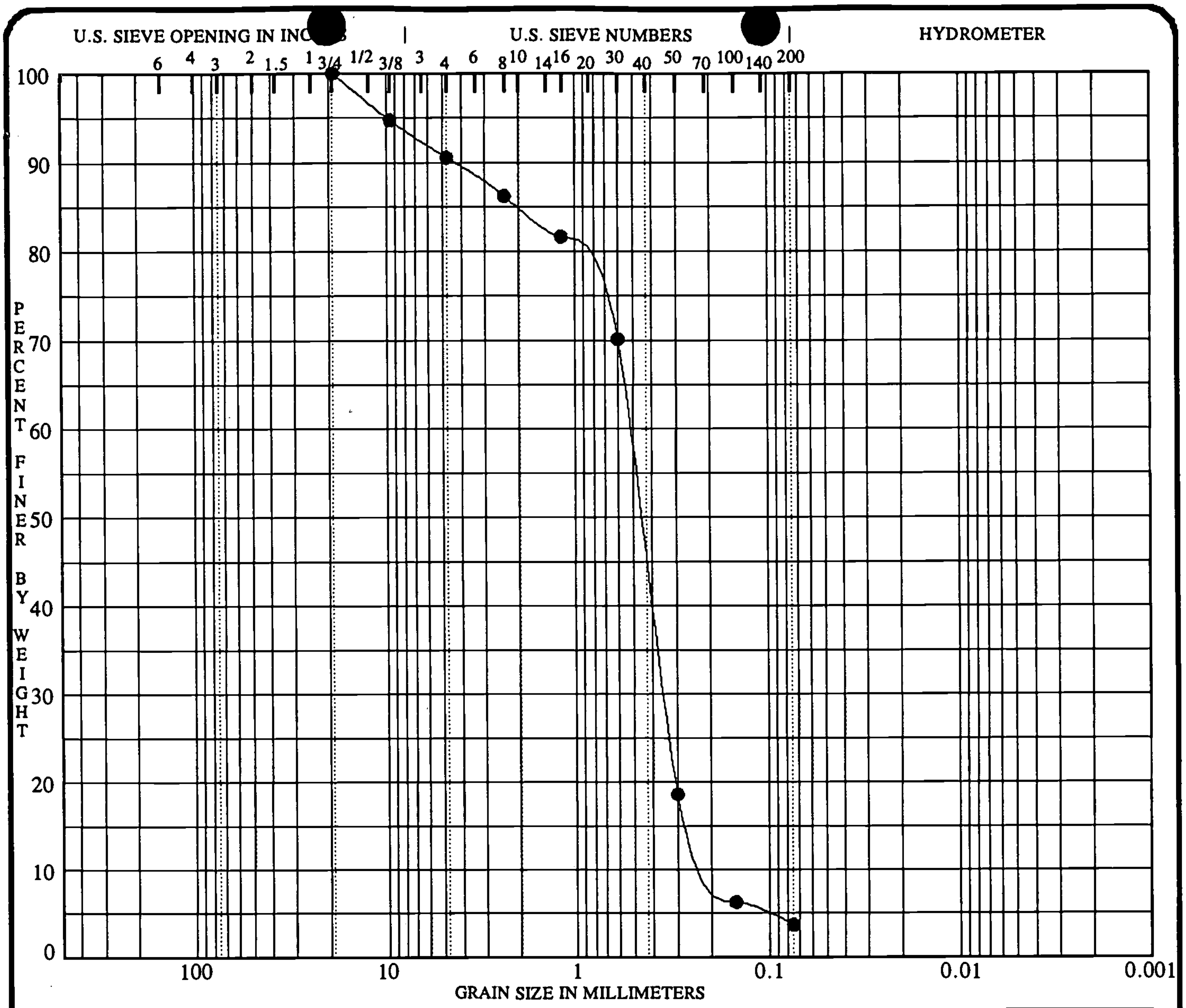
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● 9901	29.5	37.500	2.371	0.518	0.302	25.6	69.8	4.6	

PROJECT ROCKPORT PLANT - ROCKPORT, INDIANA

JOB NO. WO#1352
DATE 04/22/99

GRADATION CURVES

American Electric Power Service Corp.
Groveport, Ohio



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI	Sp.Gr.	
●	9901	51.9			NP	NP	NP		
			POORLY GRADED SAND SP						
			WELL #1-I COMPOSITE SAMPLE 51.9'-63.9'						

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
●	9901	51.9	19.000	0.524	0.350	0.185	9.5	86.8	3.7	

PROJECT ROCKPORT PLANT - ROCKPORT, INDIANA

JOB NO. WO#1352

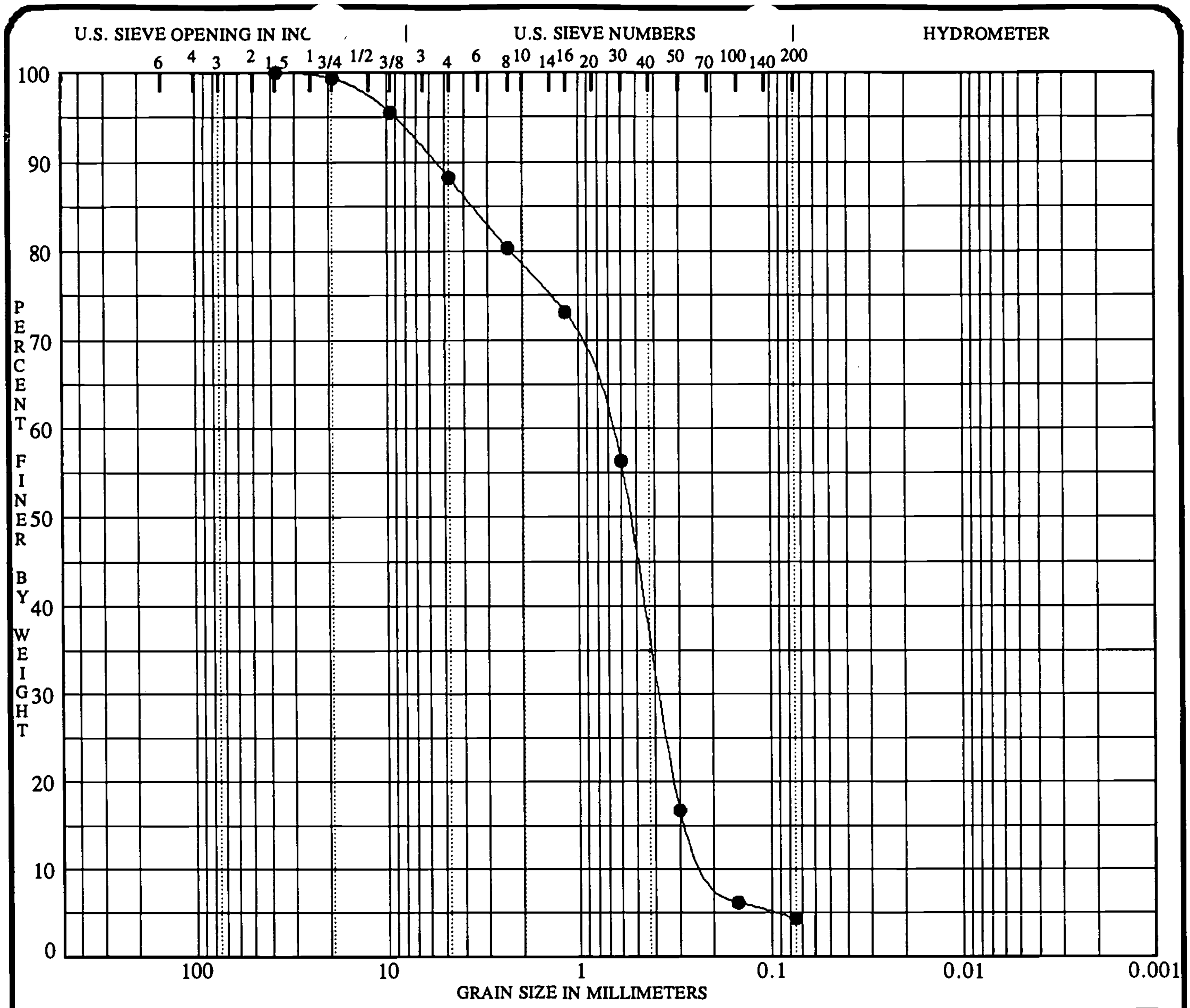
DATE 04/22/99

GRADATION CURVES

American Electric Power Service Corp.

Groveport, Ohio

AEP



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	MC%	LL	PL	PI	Sp.Gr.	
● 9901	76.9			NP	NP	NP		
		POORLY GRADED SAND SP						
		WELL #1-D COMPOSITE SAMPLE 76.9'-88.4'						

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● 9901	76.9	37.500	0.696	0.379	0.193	11.8	83.8	4.4	

PROJECT ROCKPORT PLANT - ROCKPORT, INDIANA

JOB NO. WO#1352

DATE 04/22/99

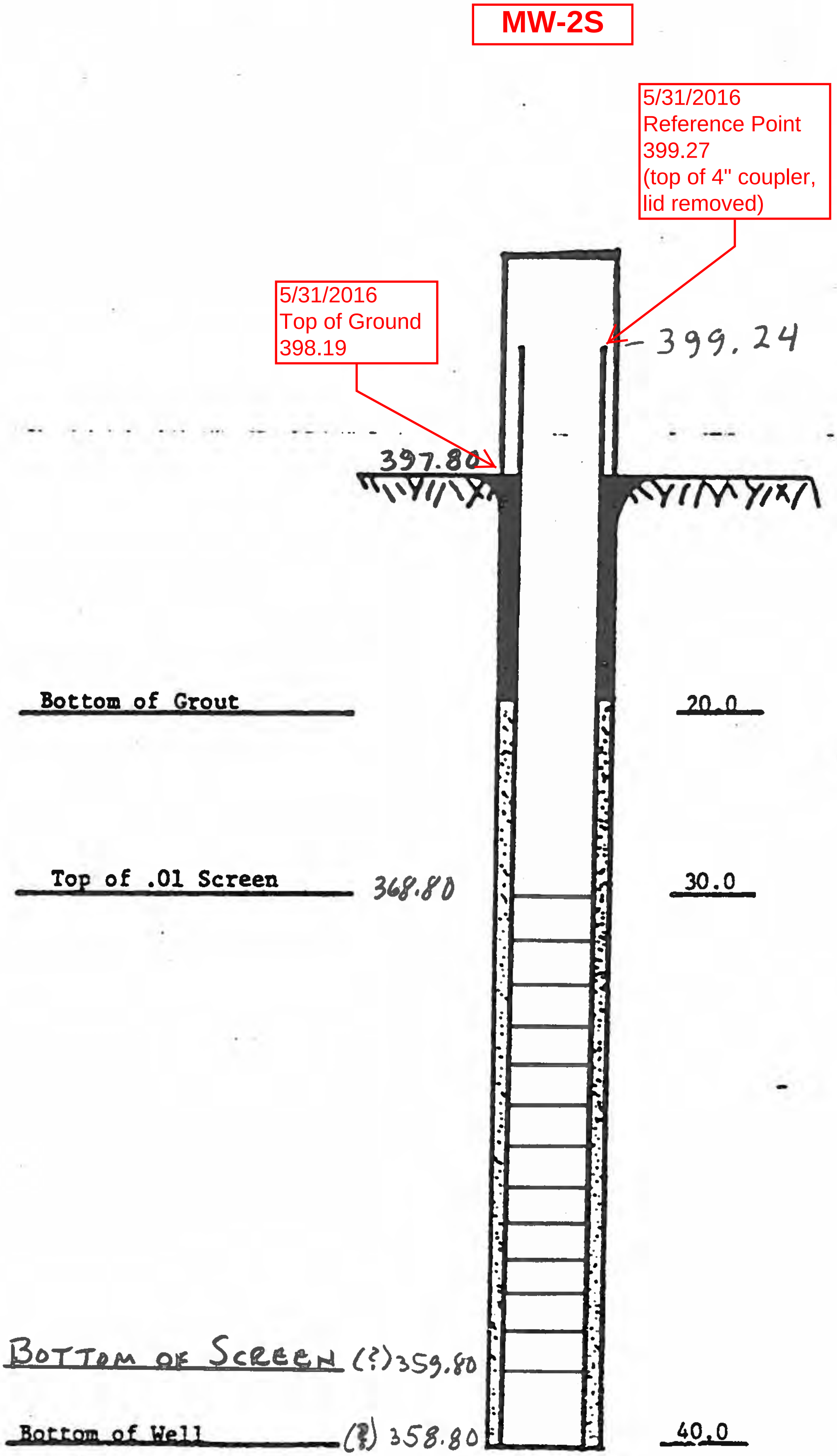
GRADATION CURVES

American Electric Power Service Corp.

Groveport, Ohio

AEP

I & M
Rockport Plant
Ash Storage Area
Well No. 2S
5-16-84

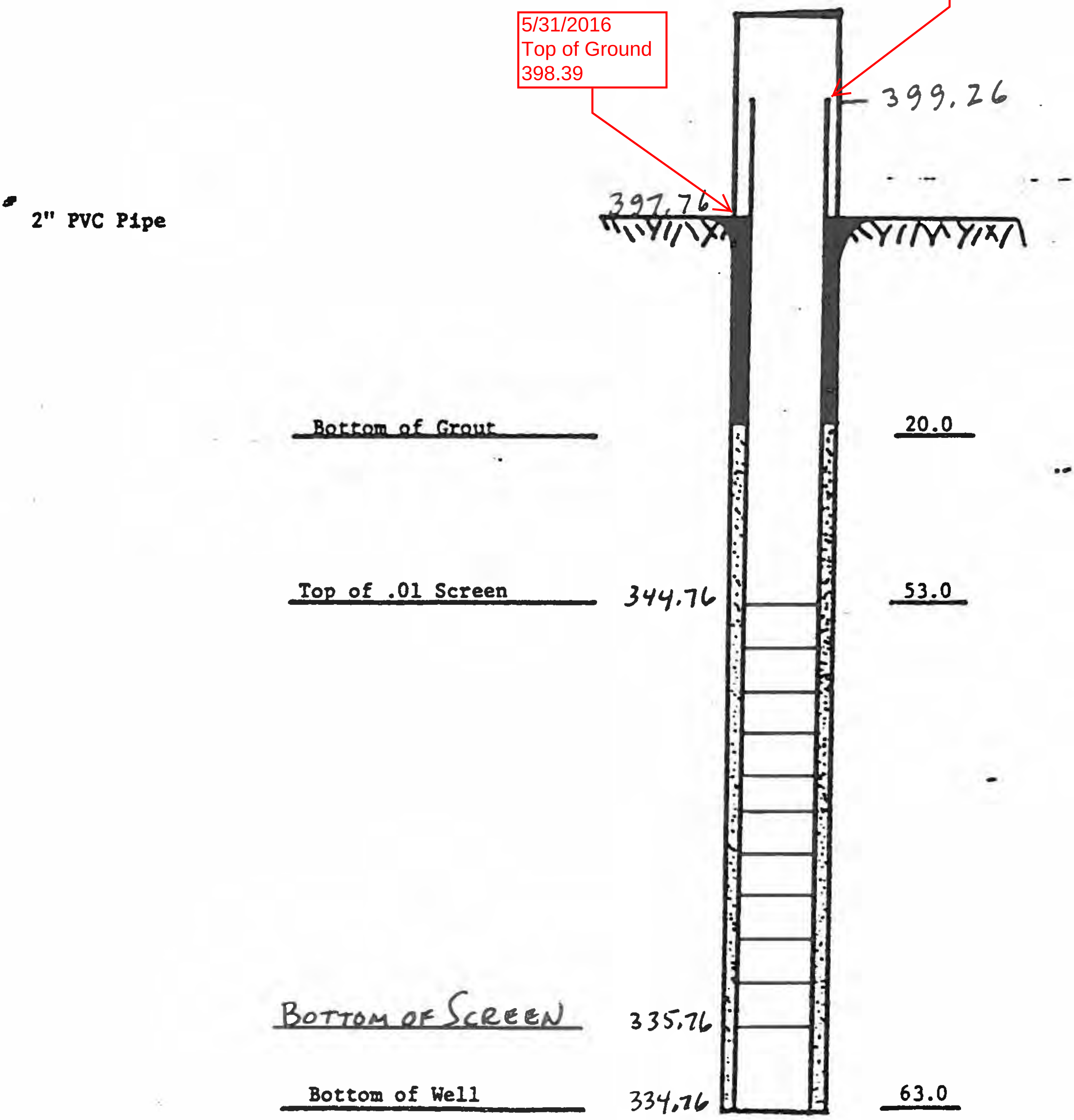


I & M
Rockport Plant
Ash Storage Area
Well No. 2I
5-15-84

MW-2I

5/31/2016
Reference Point
399.42
(top of 4" coupler,
lid removed)

5/31/2016
Top of Ground
398.39

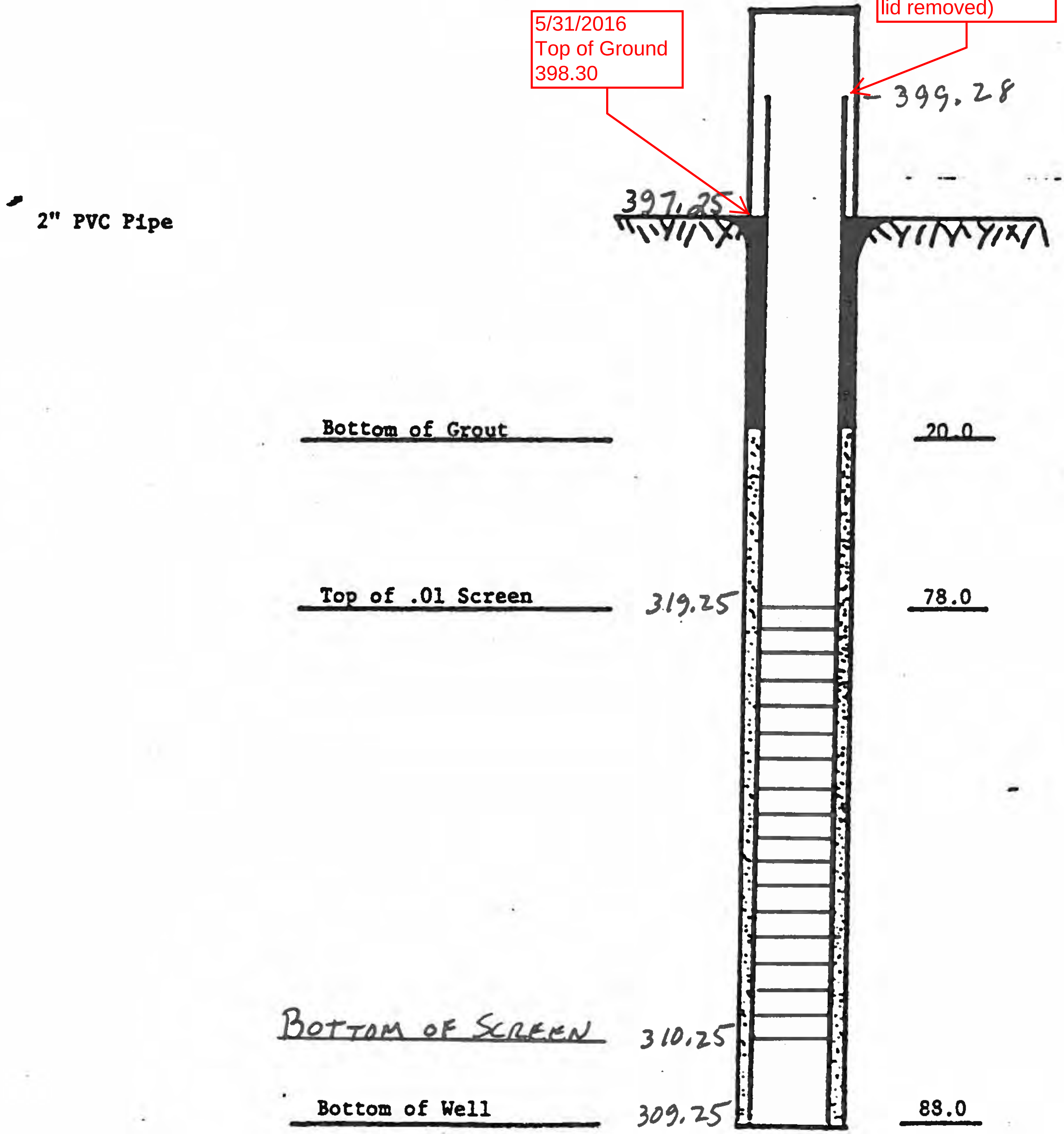


I & M
Rockport Plant
Ash Storage Area
Well No. 2D
5-15-84

MW-2D

5/31/2016
Reference Point
399.37
(top of 4" coupler, lid removed)

5/31/2016
Top of Ground
398.30



AME ;AN ELECTRIC POWER SERVICE COI RATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER ____________

COMPANY INDIANA MICHIGAN POWER COMPANY

PROJECT ROCKPORT PLANT

COORDINATES N 160,790.3 E 518,916.4

GROUND ELEVATION 397.3 SYSTEM ____________

MW-2

BORING NO. 9902 DATE 4/27/99 SHEET 1 OF 3

BORING START 1/14/99 BORING FINISH 1/15/99

PIEZOMETER TYPE ____________ WELL TYPE OW

HGT. RISER ABOVE GROUND ____________ DIA ____________

DEPTH TO TOP OF WELL SCREEN ____________ BOTTOM ____________

WELL DEVELOPMENT ____________ BACKFILL Grout

FIELD PARTY MCR-DLB RIG BK-81

WATER LEVEL	▽	▼	⊻
TIME			
DATE			

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	1.5	1-2-3	1.0				CL	LIGHT BROWN FINE GRAIN SANDY CLAY Dry		Water for drilling and grouting from fire protection well at Rockport Plant.
2	SS	1.5	3.0	1-2-2	1.0							
3	SS	3.0	4.5	3-4-5	1.5							
~~4~~	~~SS~~	~~4.5~~	~~6.0~~	~~4-6-6~~	~~1.5~~		5		SP	DARK BROWN MEDIUM GRAIN SAND Dry		
5	SS	6.0	7.5	3-6-4	1.5				CL SP	BROWN SANDY CLAY Moist		Grouted from 107.8' to grade; used approx. 100 gallons (4 bags).
6	SS	7.5	9.0	2-3-3	1.5				CL	BROWN MEDIUM GRAIN SAND Moist		
7	SS	9.0	10.5	3-3-5	1.5		10					
8	SS	10.5	12.0	3-5-6	1.5					BROWN SILTY CLAY Moist		
9	SS	12.0	13.5	3-5-7	1.5				SP CL	BROWN MEDIUM GRAIN SAND BROWN SILTY CLAY		Used approx. 150 gallons (3 bags) drill mud while drilling hole.
10	SS	13.5	15.0	6-12-13	1.3				SP	LIGHT BROWN MEDIUM GRAIN SAND Dry		
11	SS	15.0	16.5	7-10-10	1.5		15		CL	BROWN SILTY CLAY		
12	SS	16.5	18.0	5-5-5	1.5				SP	MEDIUM GRAIN BROWN SAND Dry		
13	SS	18.0	19.5	4-5-7	1.5							
~~14~~	~~SS~~	~~19.5~~	~~21.0~~	~~5-6-8~~	~~1.5~~		20					
15	SS	21.0	22.5	5-7-9	1.5							
16	SS	22.5	24.0	4-5-6	1.3							
17	SS	24.0	25.5	3-5-7	1.5		25		SP	BROWN MEDIUM GRAIN SAND With BB size gravel, dry.		
18	SS	26.4	27.9	8-8-6	1.3				SP	BROWN MEDIUM GRAIN SAND With pea size gravel, dry.		
19	SS	30.0	31.5	5-9-12	1.5		30		SP	BROWN SAND With pea to 1/2" gravel, wet.		Water on A-rods at 30.5'
20	SS	31.5	33.0	6-6-8	1.5							
21	SS	33.0	34.5	4-5-5	1.3							Started using drill mud to prevent heaving sands at 33.0'.
~~22~~	~~SS~~	~~34.5~~	~~36.0~~	~~4-5-5~~	~~1.5~~		35					
23	SS	36.0	37.5	5-4-7	1.5							
24	SS	37.5	39.0	3-4-6	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 DLB

AME ;AN ELECTRIC POWER SERVICE CO)RATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

AEP

JOB NUMBER ____________

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **9902** DATE **4/27/99** SHEET **2** OF **3**

PROJECT **ROCKPORT PLANT** BORING START **1/14/99** BORING FINISH **1/15/99**

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
25	SS	39.0	40.5	8-8-8	1.5							
26	SS	41.4	42.9	4-7-17	1.5							
							45					
27	SS	46.4	47.9	3-8-7	1.5							
							50					
28	SS	51.4	52.9	10-10-13	1.5							
29	SS	53.0	54.5	5-5-7	1.5				SP SP	**FINE SAND** With BB size gravel,wet. **BROWN MEDIUM GRAIN SAND** With pea to 1/2" gravel, wet.		
~~30~~	~~SS~~	~~54.5~~	~~56.0~~	~~4-5-7~~	~~1.5~~		55					
31	SS	56.0	57.5	8-7-8	1.5				SP	**MEDIUM GRAIN SAND** With pea size gravel, wet.		
32	SS	57.5	59.0	4-6-8	1.5				SP	**FINE GRAIN SAND** With BB size gravel, wet.		
33	SS	59.0	60.5	4-6-8	1.5							
							60					
34	SS	60.5	62.0	4-6-8	1.5							
35	SS	62.0	63.5	4-7-8	1.5							
							65					
36	SS	66.9	68.4	6-6-8	1.5				SP	**MEDIUM GRAIN SAND** With pea to 1/2" gravel, wet.		
							70					
37	SS	71.9	73.4	5-6-8	1.5				CL	**GRAY SILTY CLAY** Moist		
							75					
38	SS	76.9	78.4	7-5-4	1.5				SP	**BROWN MEDIUM GRAIN SAND** With pea size gravel, wet.		
39	SS	78.4	79.9	3-3-3	1.5							
							80					
40	SS	79.9	81.4	3-5-6	1.5							
41	SS	81.4	82.9	4-6-6	1.5							
42	SS	82.9	84.4	5-4-6	1.5							
							85					
43	SS	84.9	85.9	4-4-5	1.5							
44	SS	85.9	87.4	2-4-6	1.5							
45	SS	87.4	88.9	4-5-6	1.5				SP	**BROWN FINE GRAIN SAND** With BB size gravel, wet.		
							90					

Continued Next Page

AEP CIVIL ENGINEERING LABORATORY

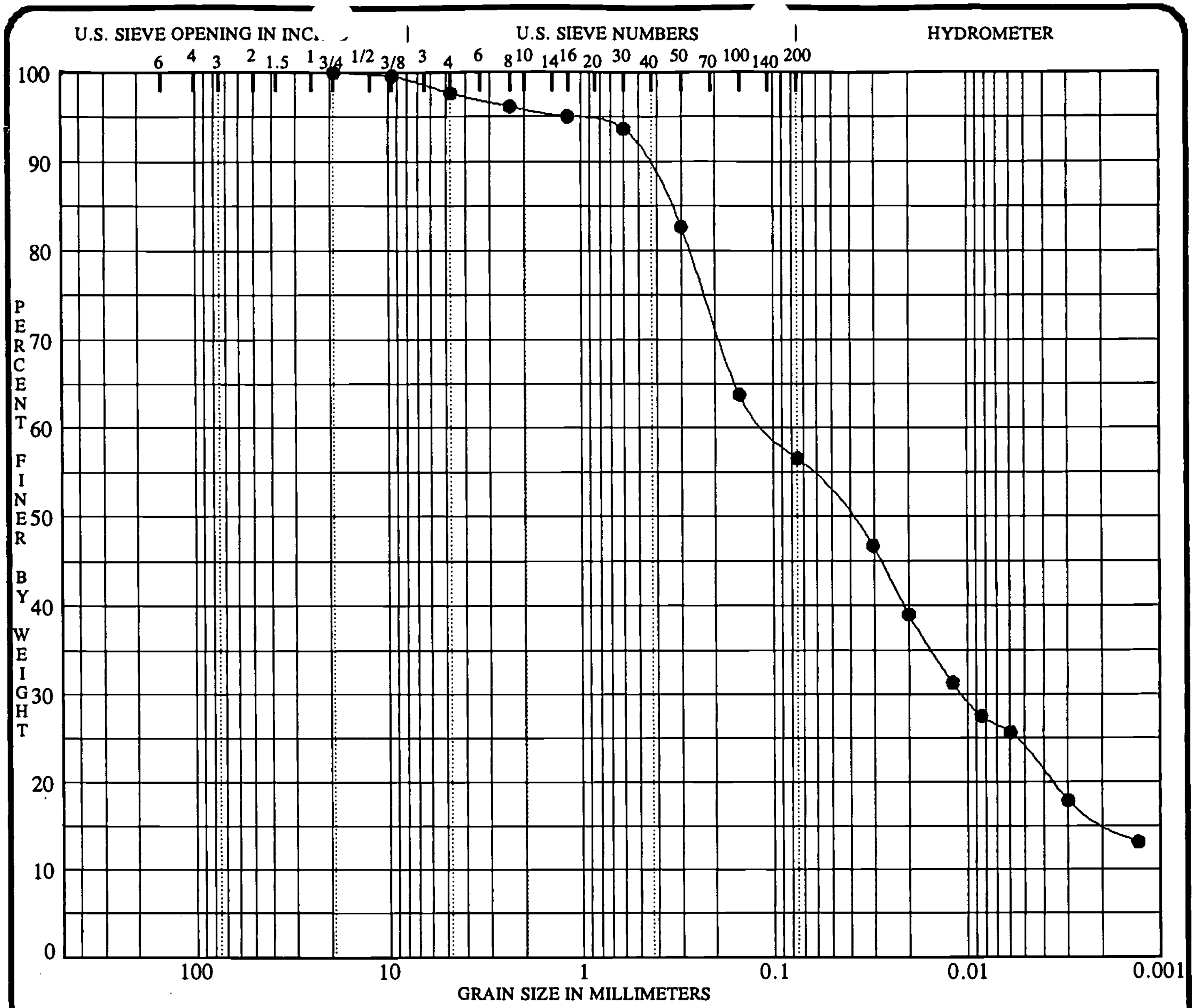
LOG OF BORING

JOB NUMBER

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **9902** DATE **4/27/99** SHEET **3** OF **3**

PROJECT **ROCKPORT PLANT** BORING START **1/14/99** BORING FINISH **1/15/99**

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
46	SS	91.4	92.9	5-5-6	1.5		95					
47	SS	96.4	97.9	5-5-5	1.5		100		SP	**MEDIUM GRAIN SAND** With BB to pea size gravel, wet.		
48	SS	101.4	102.9	6-7-8	1.5		105		SP	**BROWN MEDIUM GRAIN SAND** With pea to 1/2" gravel, wet.		
49	SS	106.4	107.8	4-6-50/4	1.3				SP	**BROWN MEDIUM GRAIN SAND** With BB to pea size gravel, wet. **SHALE**		Spoon refusal at 107.8' Stopped boring at 107.8'



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI	Sp.Gr.	
●	9902	1.5			24.3	15.8	8.5		
			SANDY LEAN CLAY CL						
			COMPOSITE 1.5'-4.5'						

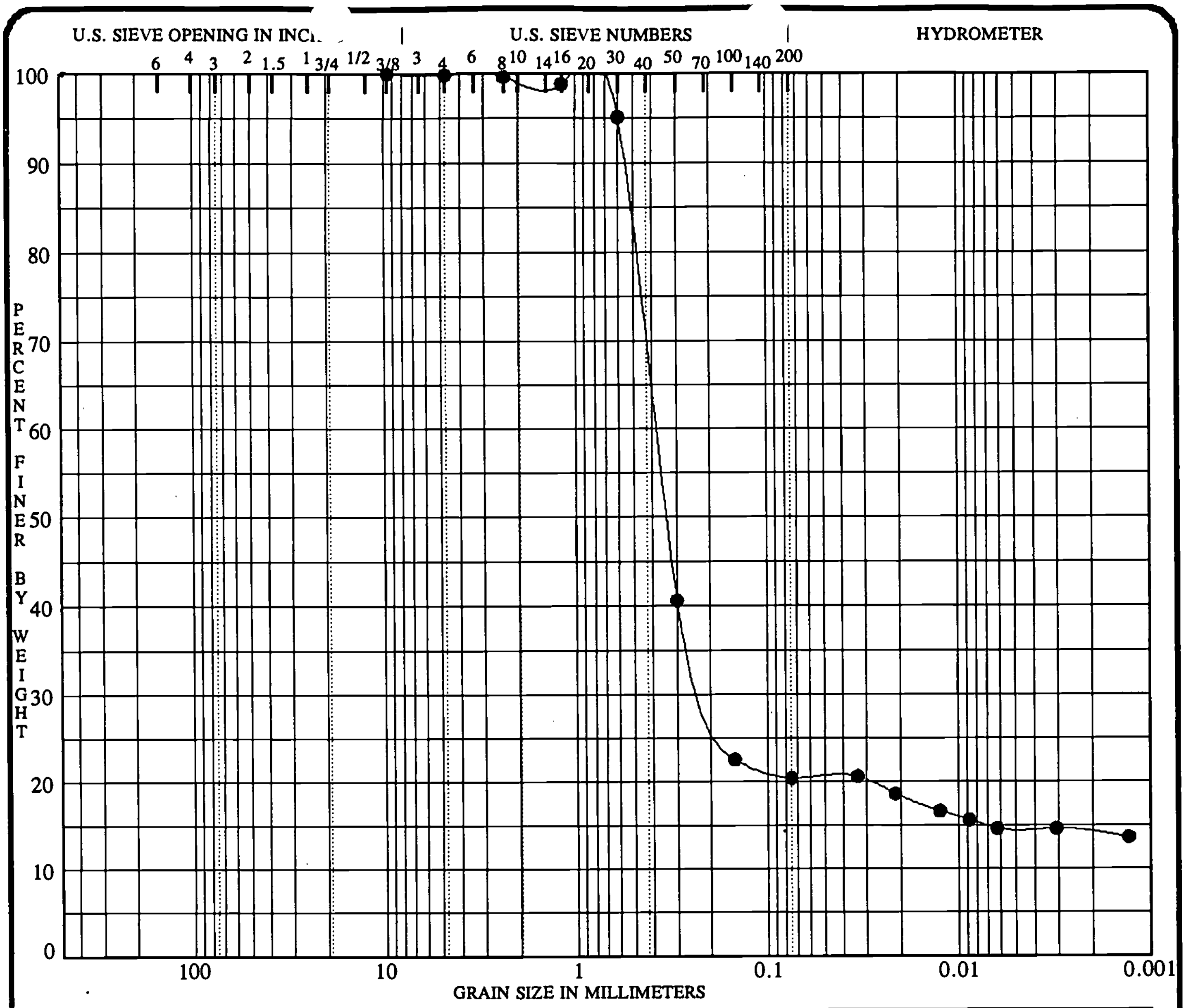
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Fines	% < .002
●	9902	1.5	19.000	0.105	0.011		2.4	41.1	56.5	15.6

PROJECT ROCKPORT PLANT - ROCKPORT, INDIANA

JOB NO. WO#SC3750
DATE 06/01/99

GRADATION CURVES

American Electric Power Service Corp.
Groveport, Ohio



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI	Sp.Gr.	
●	9902	4.5			NP	NP	NP		
			SILTY SAND SM						
			SAMPLE 4 - 4.5'-6.0'						

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Fines	% < .002
●	9902	4.5	9.500	0.384	0.200		0.2	79.4	20.4	14.1

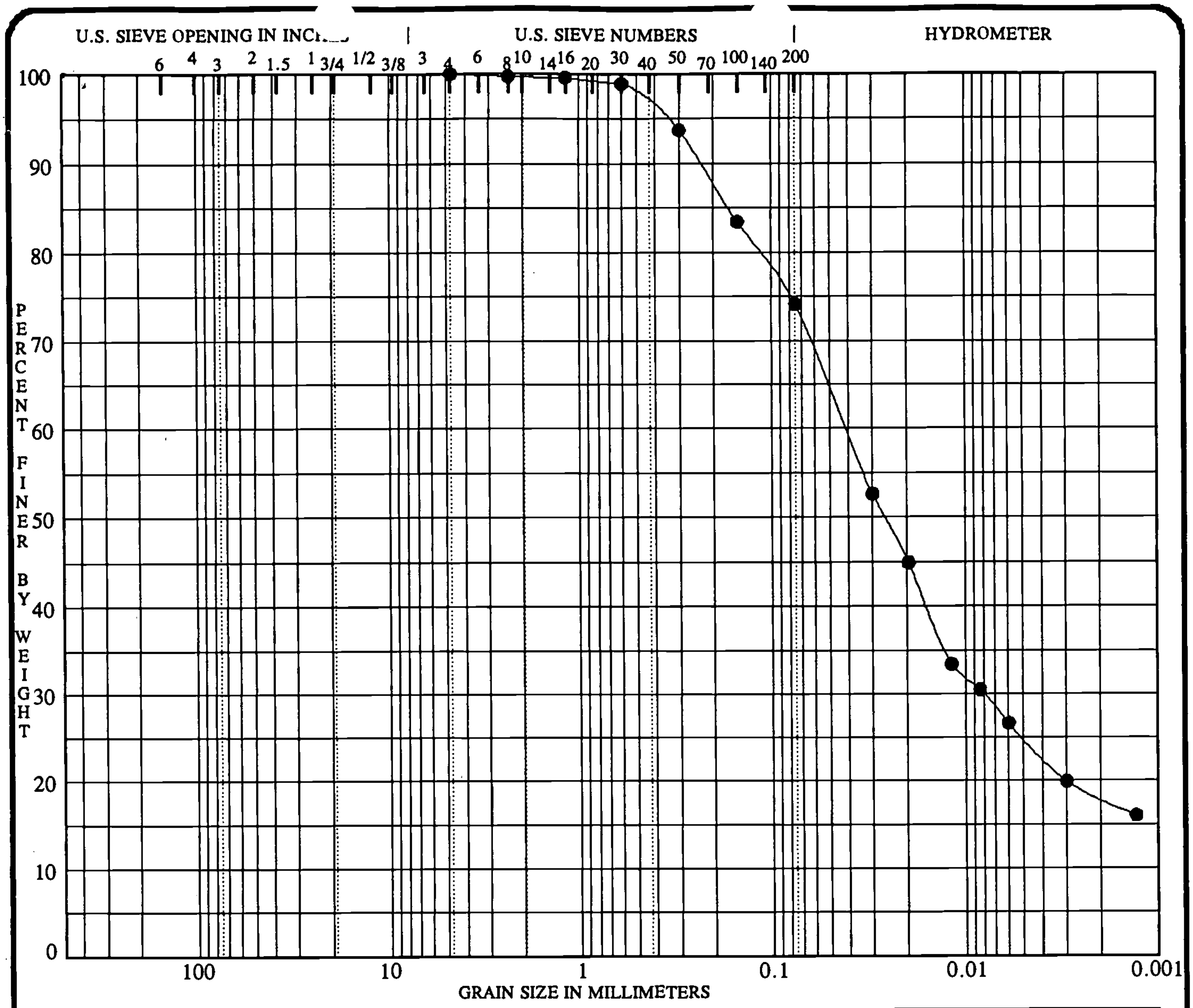
PROJECT ROCKPORT PLANT - ROCKPORT, INDIANA

JOB NO. WO#SC3750
DATE 06/01/99

GRADATION CURVES

American Electric Power Service Corp.
Groveport, Ohio

AEP



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI	Sp.Gr.	
●	9902	6.0			27.1	16.6	10.5		
			LEAN CLAY with SAND CL						
			COMPOSITE 6.0'-13.5'						

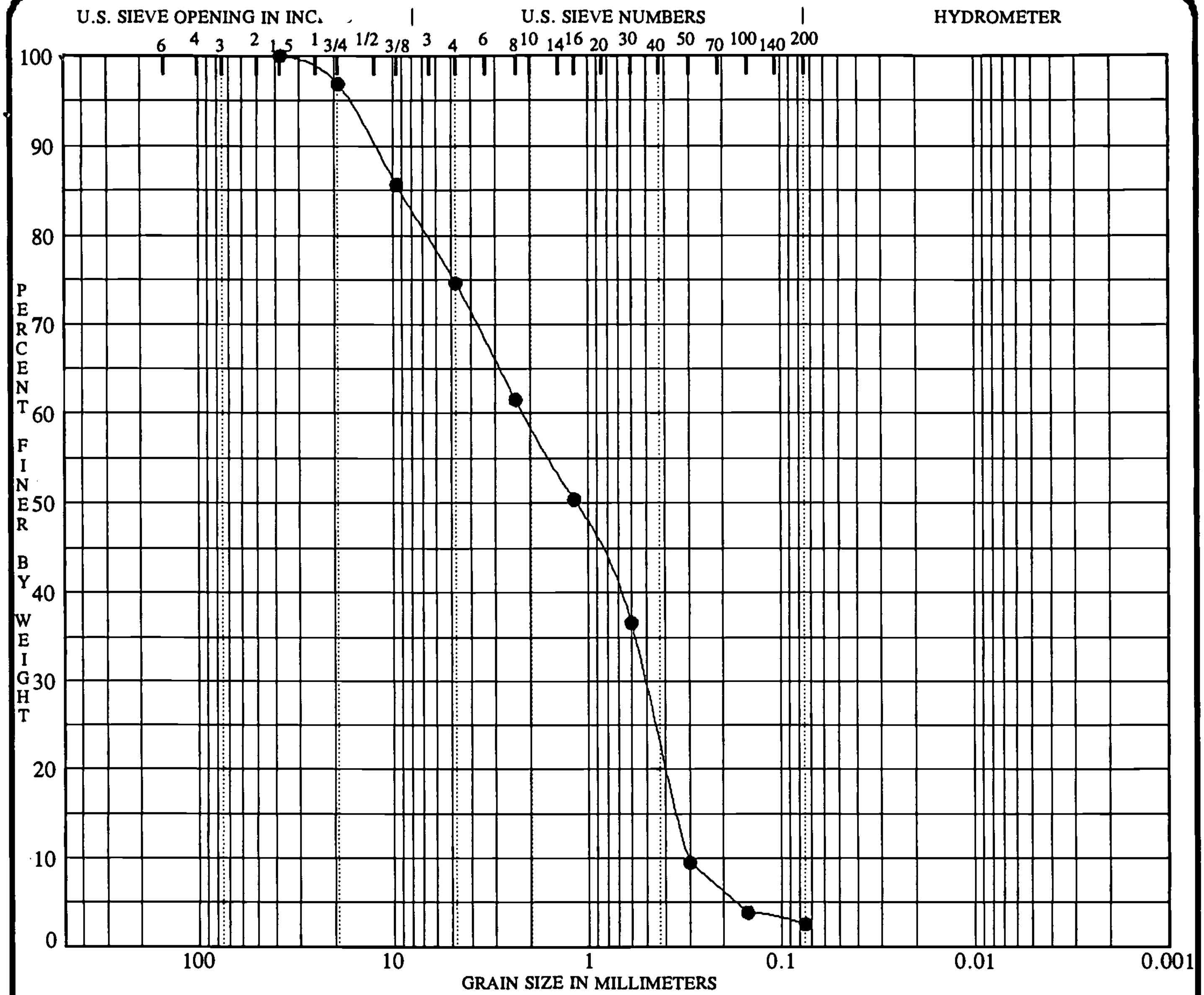
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
●	9902	6.0	4.750	0.041	0.008		0.0	25.9	74.1	18.0

PROJECT **ROCKPORT PLANT - ROCKPORT, INDIANA**

JOB NO. **WO#SC3750**
DATE **06/01/99**

GRADATION CURVES

American Electric Power Service Corp.
Groveport, Ohio



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	MC%	LL	PL	PI	Sp.Gr.	
●	9902	30.0			NP	NP	NP		
			POORLY GRADED SAND with GRAVEL SP						
			WELL #2-S COMPOSITE SAMPLE 30.0'-40.5'						

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
●	9902	30.0	37.500	2.149	0.507	0.304	25.4	72.0	2.6	

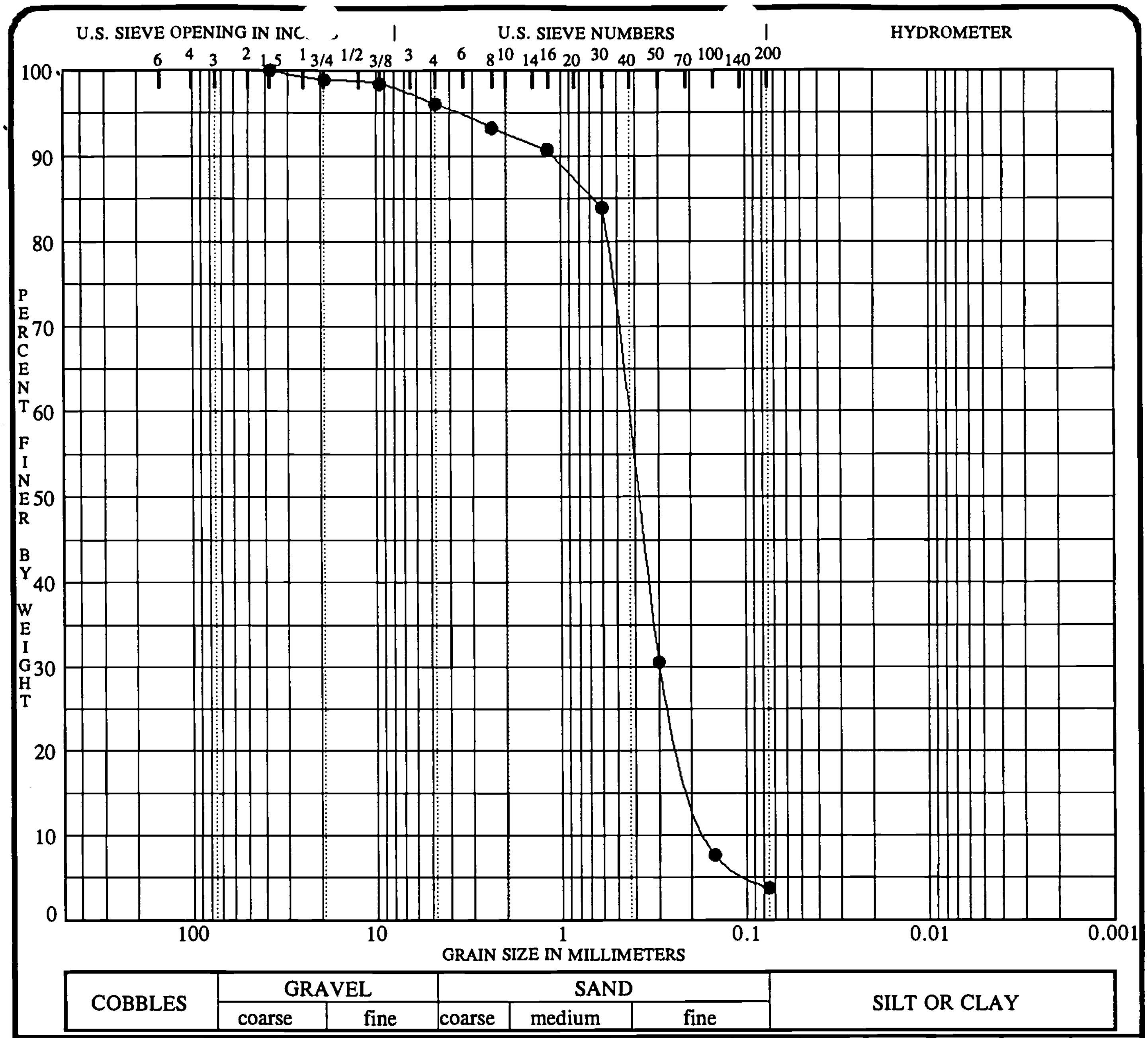
PROJECT ROCKPORT PLANT - ROCKPORT, INDIANA

JOB NO. WO#1352
DATE 04/22/99

GRADATION CURVES

American Electric Power Service Corp.
Groveport, Ohio

AEP



	Specimen Identification		Classification	MC%	LL	PL	PI	Sp.Gr.	
●	9902	53.0			NP	NP	NP		
			POORLY GRADED SAND SP						
			WELL #2-I COMPOSITE SAMPLE 53.0'-63.5'						

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
●	9902	53.0	37.500	0.440	0.295	0.161	4.0	92.2	3.8	

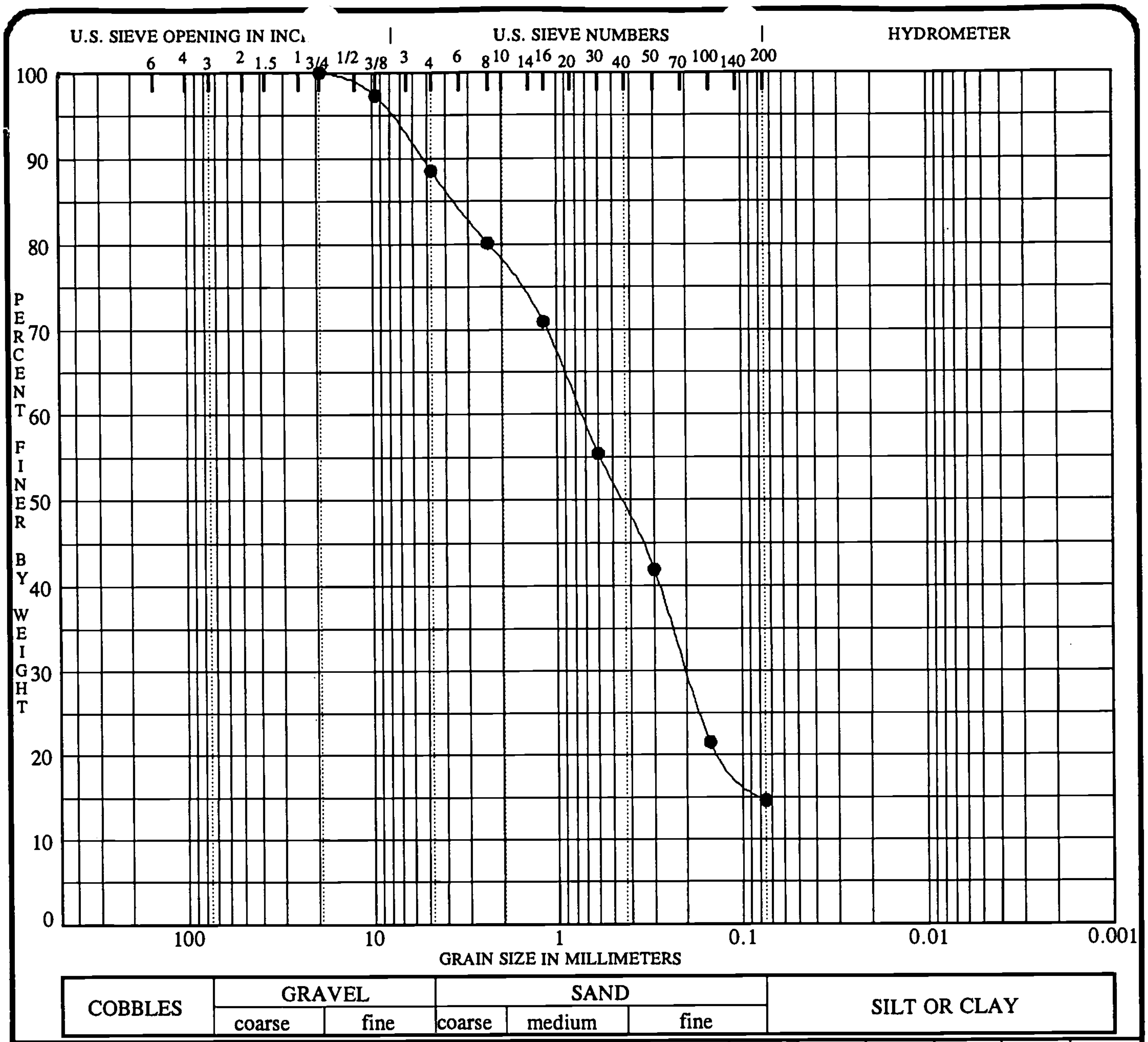
PROJECT ROCKPORT PLANT - ROCKPORT, INDIANA

JOB NO. WO#1352
DATE 04/22/99

GRADATION CURVES

American Electric Power Service Corp.
Groveport, Ohio

AEP



	Specimen Identification		Classification	MC%	LL	PL	PI	Sp.Gr.	
●	9902	76.9			NP	NP	NP		
			SILTY SAND SM						
			WELL #2-D COMPOSITE SAMPLE 76.9'-88.9'						

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
●	9902	76.9	19.000	0.733	0.200		11.5	73.9	14.6	

PROJECT ROCKPORT PLANT - ROCKPORT, INDIANA

JOB NO. WO#1352
DATE 04/22/99

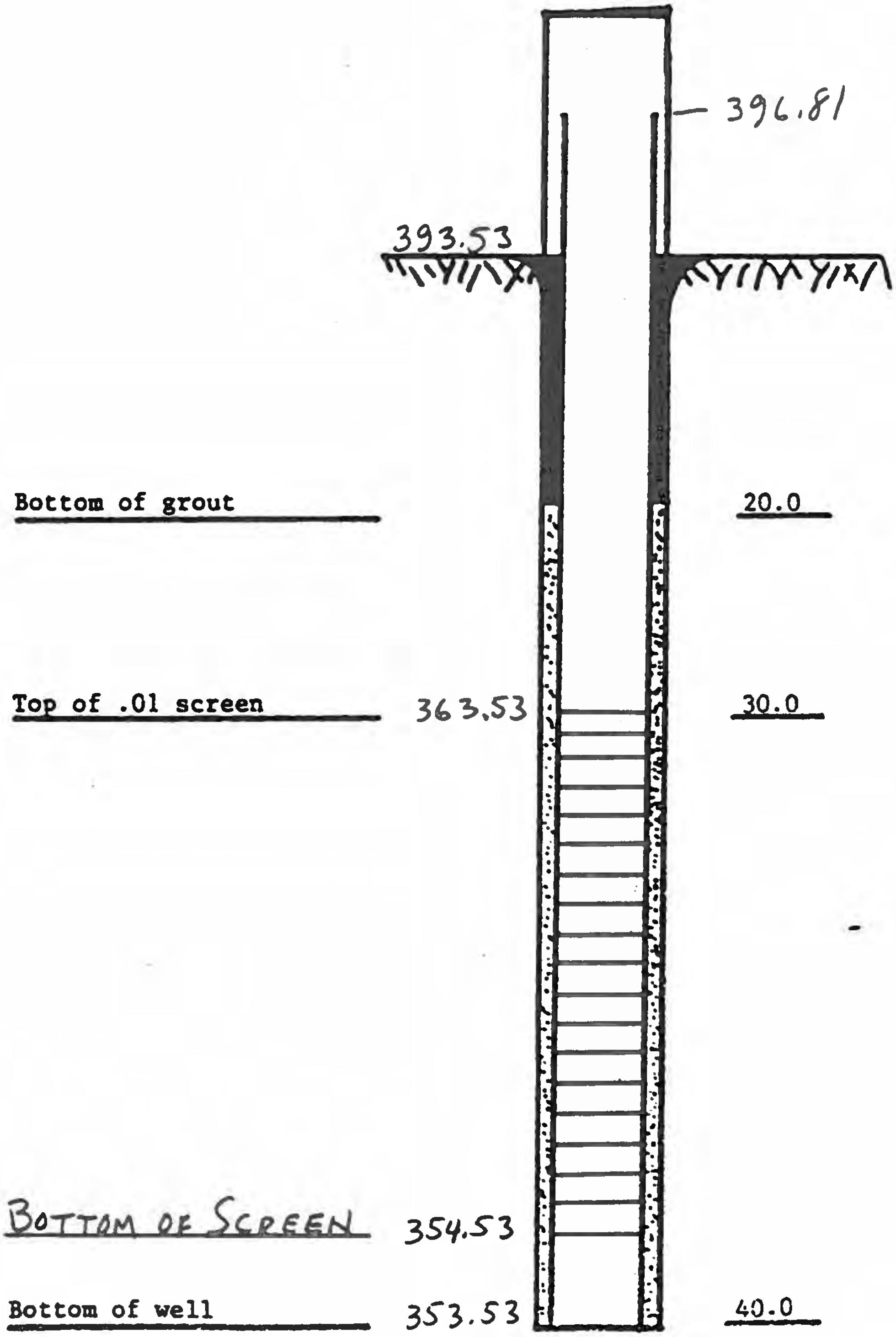
GRADATION CURVES

American Electric Power Service Corp.
Groveport, Ohio

I & M.
Rockport Plant
Ash Storage Area
Well No. 3-S
5-2-84

MW-3S
(Abandoned)

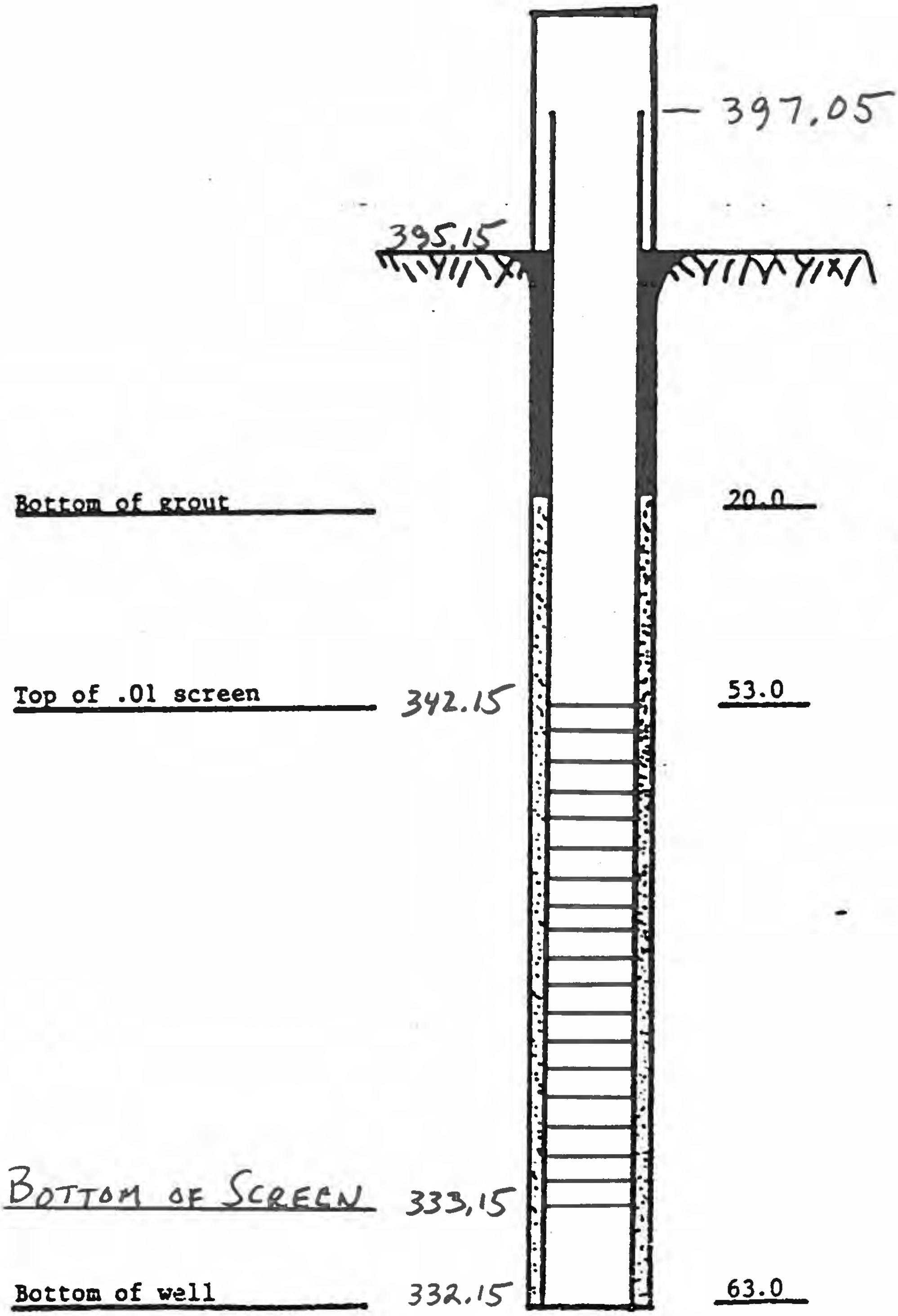
2" PVC Pipe



I & M
Rockport Plant
Ash Storage Area
Well No. 3-I
5-16-84

MW-3I
(Abandoned)

2" PVC Pipe



AME ;AN ELECTRIC POWER SERVICE COI RATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

AEP

JOB NUMBER

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 162,287.4 E 520,118.1**

GROUND ELEVATION **394.7** SYSTEM

MW-3

BORING NO. **9903** DATE **4/27/99** SHEET **1** OF **3**

BORING START **1/15/99** BORING FINISH **1/16/99**

PIEZOMETER TYPE WELL TYPE **OW**

HGT. RISER ABOVE GROUND DIA

DEPTH TO TOP OF WELL SCREEN BOTTOM

WELL DEVELOPMENT BACKFILL **Grout**

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

WATER LEVEL	▽	▼	⊽
TIME			
DATE			

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	SAMPLE DEPTH IN FEET TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %
1	SS	0.0	1.5	1-1-2	1.3	
2	SS	1.5	3.0	2-2-3	1.5	
3	SS	3.0	4.5	3-5-8	1.5	
~~4~~	~~SS~~	~~4.5~~	~~6.0~~	~~6-8-10~~	~~1.5~~	
5	SS	6.0	7.5	4-3-4	1.5	
6	SS	7.5	9.0	1-3-4	1.5	
7	SS	9.0	10.5	3-5-8	1.5	
8	SS	10.5	12.0	3-5-8	1.5	
9	SS	12.0	13.5	3-4-5	1.5	
10	SS	13.5	15.0	2-3-5	1.5	
11	SS	15.0	16.5	5-10-10	1.5	
12	SS	16.5	18.0	6-9-10	1.5	
13	SS	18.0	19.5	7-10-12	1.5	
~~14~~	~~SS~~	~~19.5~~	~~21.0~~	~~7-8-9~~	~~1.5~~	
15	SS	21.0	22.5	8-10-13	1.5	
16	SS	22.5	24.0	8-10-12	1.5	
17	SS	24.0	25.5	10-10-11	1.5	
18	SS	27.0	28.5	5-5-5	1.5	
19	SS	30.0	31.5	4-4-4	1.5	
20	SS	31.5	33.0	2-3-4	1.5	
21	SS	33.0	34.5	2-3-4	1.5	
~~22~~	~~SS~~	~~34.5~~	~~36.0~~	~~8-13-20~~	~~1.5~~	
23	SS	36.0	37.5	5-8-9	1.5	
24	SS	37.5	39.0	6-9-15	1.5	

DEPTH IN FEET: 5, 10, 15, 20, 25, 30, 35

USCS	SOIL / ROCK IDENTIFICATION
CL	**BROWNISH GRAY CLAY** With organic, moist.
CL	**BROWNISH GRAY CLAY** Moist
CL	**REDDISH BROWN CLAY** Stiff, dry.
CL	**REDDISH BROWN SANDY CLAY** Dry
CL	**REDDISH BROWN SILTY CLAY** Dry
CL	**REDDISH BROWN SILTY CLAY** With vertical strip of gray clay, dry.
CL	**REDDISH BROWN SILTY CLAY** Dry
CL	**REDDISH BROWN SANDY CLAY** Dry
CL	**REDDISH BROWN SILTY CLAY** Dry
SP	**BROWN MEDIUM GRAIN SAND** Dry
SP	**BROWN MEDIUM GRAIN SAND** With few pea size gravel, dry
SP	**MEDIUM GRAIN SAND** With pea to 1/2" gravel, wet

DRILLER'S NOTES

Water for drilling and grouting from fire protection well at Rockport Plant.

Grouted from 105.2' to grade; used approx. 100 gallons (4 bags).

Used approx. 200 gallons drill mud (2 bags) while drilling hole.

Water on A-rods at 27.5'.

Started using drill mud to prevent heaving sands at 34.5'.

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 **DLB**

AME ,AN ELECTRIC POWER SERVICE COF RATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER ____________________

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **9903** DATE **4/27/99** SHEET **2** OF **3**

PROJECT **ROCKPORT PLANT** BORING START **1/15/99** BORING FINISH **1/16/99**

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
25	SS	39.0	40.5	5-6-6	1.5							
26	SS	42.0	43.5	10-11-9	1.5		45		SP	**MEDIUM GRAIN SAND** With pea to 1/2" gravel and small bits of wood,wet		
27	SS	47.0	48.5	3-6-7	1.5		50		SP	**MEDIUM GRAIN SAND** With pea size gravel, wet		
28	SS	52.0	53.5	6-8-9	1.5		55		SP	**BROWN MEDIUM GRAIN SAND** With pea to 1/2" gravel, wet		
29	SS	57.0	58.5	5-6-7	1.5		60					
30	SS	62.0	63.5	8-9-8	1.5		65					
31	SS	67.0	68.5	7-7-12	1.5		70					
32	SS	72.0	73.5	10-10-12	1.5		75					
33	SS	77.0	78.5	3-4-7	1.5		80					
34	SS	82.0	83.5	5-6-6	1.5		85					
35	SS	87.0	88.5	4-5-8	1.5		90		SP	**BROWN MEDIUM GRAIN SAND** With pea size gravel, wet		

Continued Next Page

AME AN ELECTRIC POWER SERVICE COF RATION

AEP CIVIL ENGINEERING LABORATORY

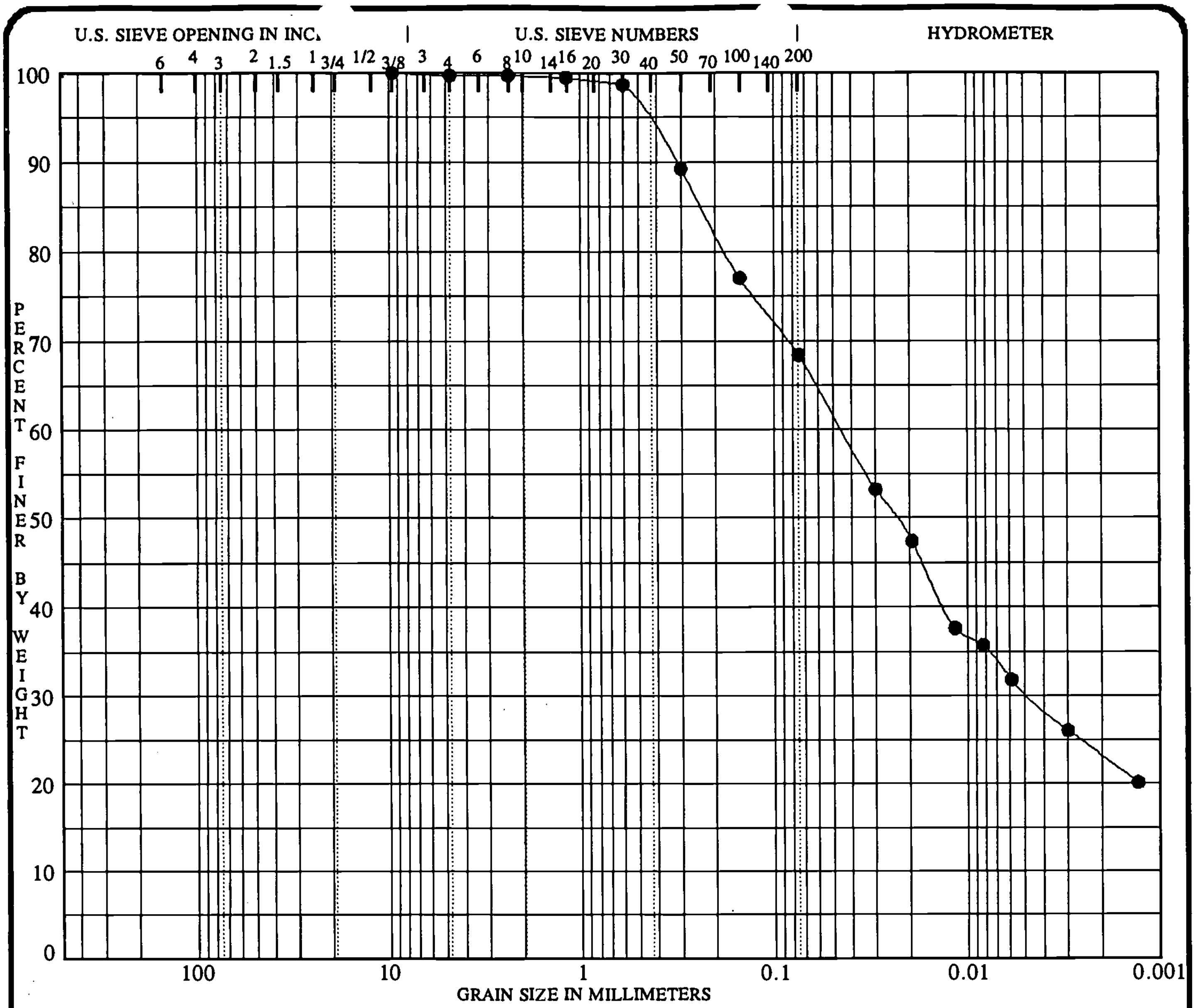
LOG OF BORING

JOB NUMBER ____________

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **9903** DATE **4/27/99** SHEET **3** OF **3**

PROJECT **ROCKPORT PLANT** BORING START **1/15/99** BORING FINISH **1/16/99**

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
36	SS	92.0	93.5	4-6-6	1.5		95		SP GP	**BROWN FINE SAND** Wet **PEA SIZE GRAVEL** Wet		
37	SS	97.0	98.5	5-7-6	1.5		100		SP	**MEDIUM GRAIN SAND** With pea size gravel, wet.		
38	SS	102.0	103.5	8-10-11	1.5		105		SP	**MEDIUM GRAIN SAND** With pea to 3/4" gravel, wet		
39	SS	105.0	105.2	50/2	.2					**GRAY FINE GRAIN SANDY CLAY SHALE**		Auger refusal at 105.0' Spoon refusal at 105.2' Stopped boring at 105.2'



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

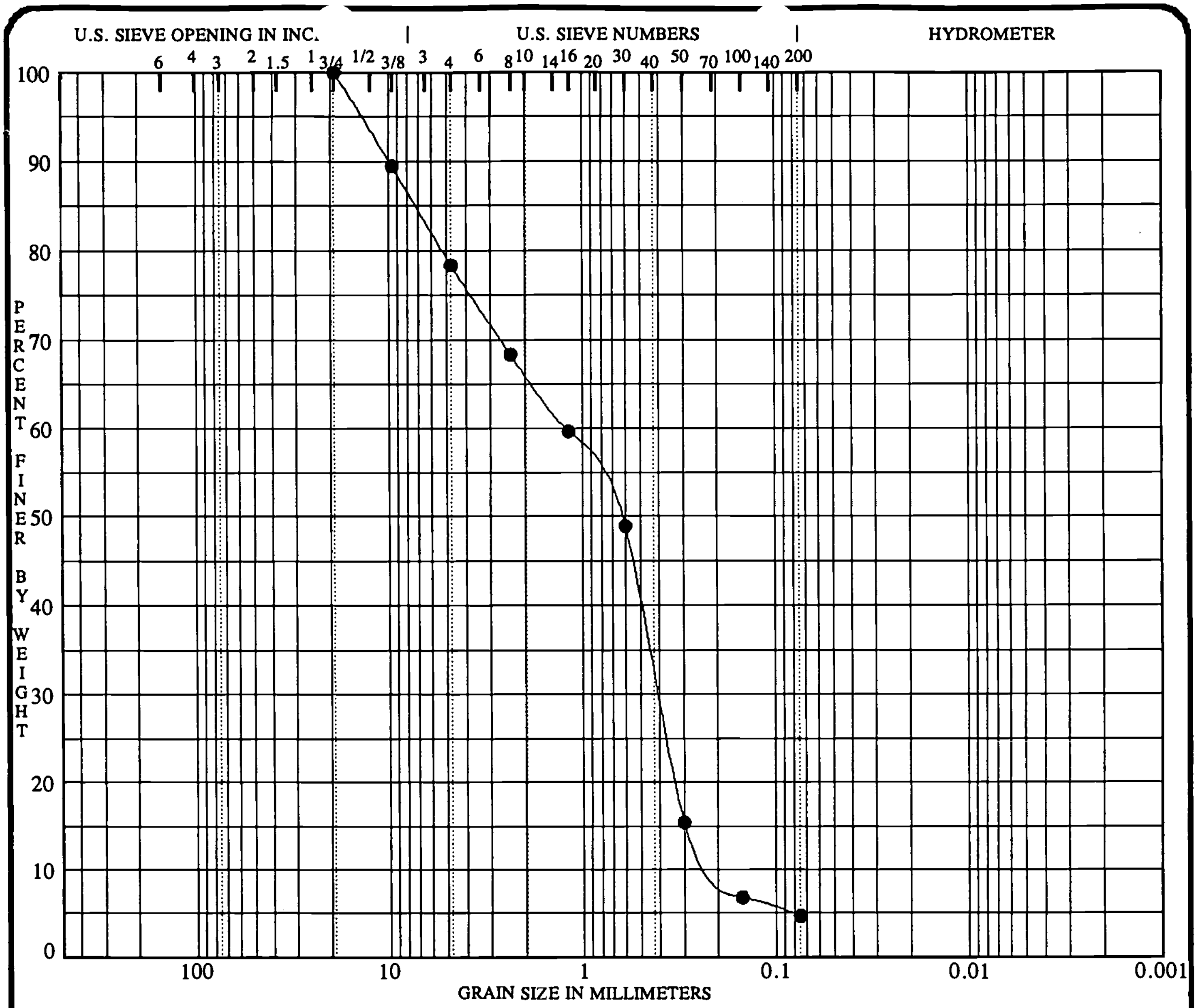
	Specimen Identification		Classification	MC%	LL	PL	PI	Sp.Gr.	
●	9903	1.5			27.7	15.6	12.1		
			SANDY LEAN CLAY CL						
			COMPOSITE 1.5'-15.0'						

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
●	9903	1.5	9.500	0.045	0.005		0.3	31.3	68.4	23.1

PROJECT ROCKPORT PLANT - ROCKPORT, INDIANA
JOB NO. WO#SC3750
DATE 06/01/99

GRADATION CURVES

American Electric Power Service Corp.
Groveport, Ohio



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI	Sp.Gr.
●	9903	30.0			NP	NP	NP	
			POORLY GRADED SAND with SILT and GRAVEL SP-SM					
			WELL #3-S COMPOSITE SAMPLE 30.0'-40.5'					

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Fines	% < .002
●	9903	30.0	19.000	1.209	0.406	0.194	21.7	73.6	4.7	

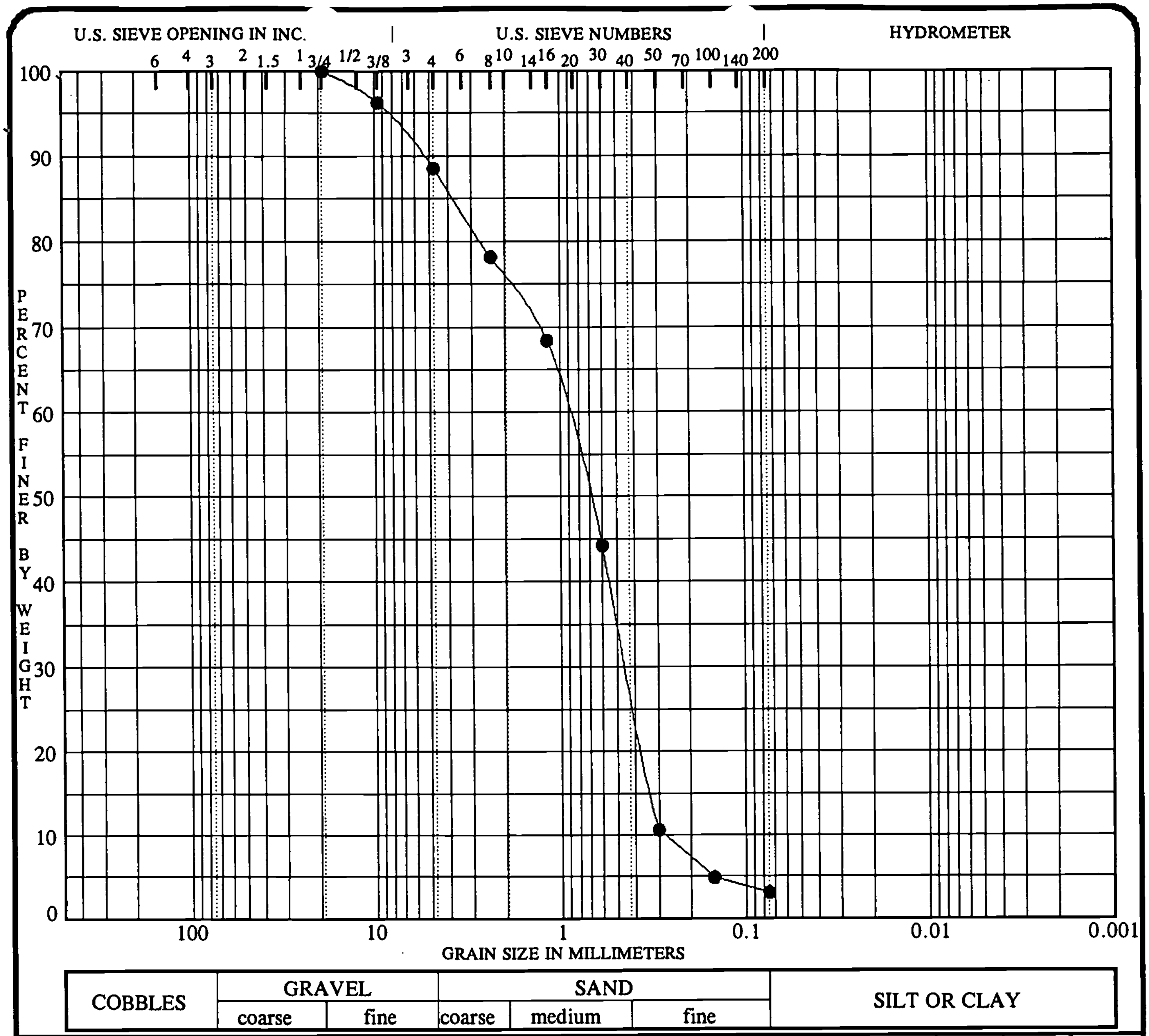
PROJECT ROCKPORT PLANT - ROCKPORT, INDIANA

JOB NO. WO#1352
DATE 04/22/99

GRADATION CURVES

American Electric Power Service Corp.
Groveport, Ohio

AEP



Specimen Identification		Classification	MC%	LL	PL	PI	Sp.Gr.	
● 9903	52.0			NP	NP	NP		
		POORLY GRADED SAND SP						
		WELL #3-I COMPOSITE SAMPLE 52.0'-63.5'						

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● 9903	52.0	19.000	0.933	0.448	0.279	11.5	85.4	3.1	

PROJECT ROCKPORT PLANT - ROCKPORT, INDIANA

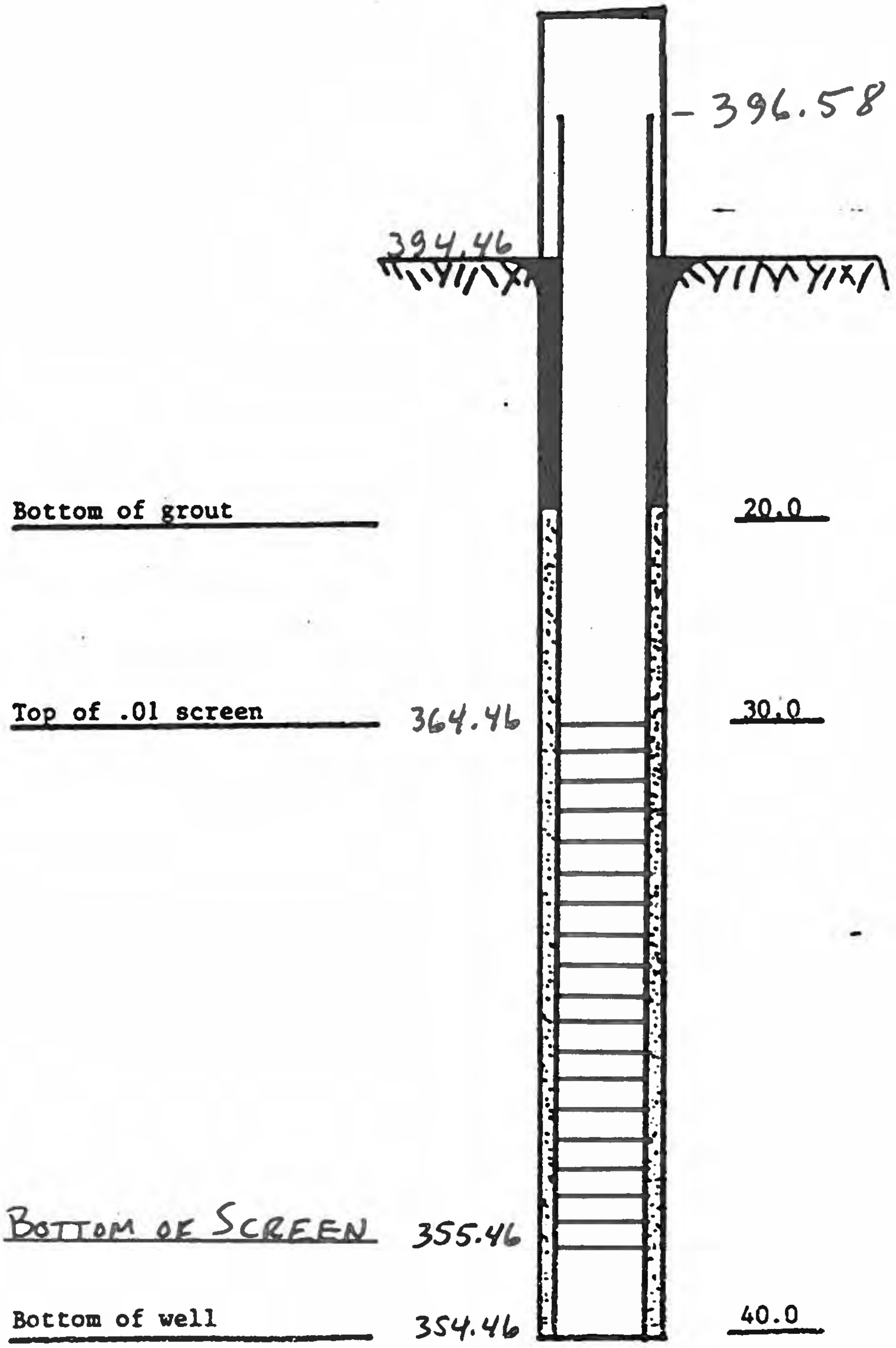
JOB NO. WO#1352
DATE 04/22/99

GRADATION CURVES

American Electric Power Service Corp.
Groveport, Ohio

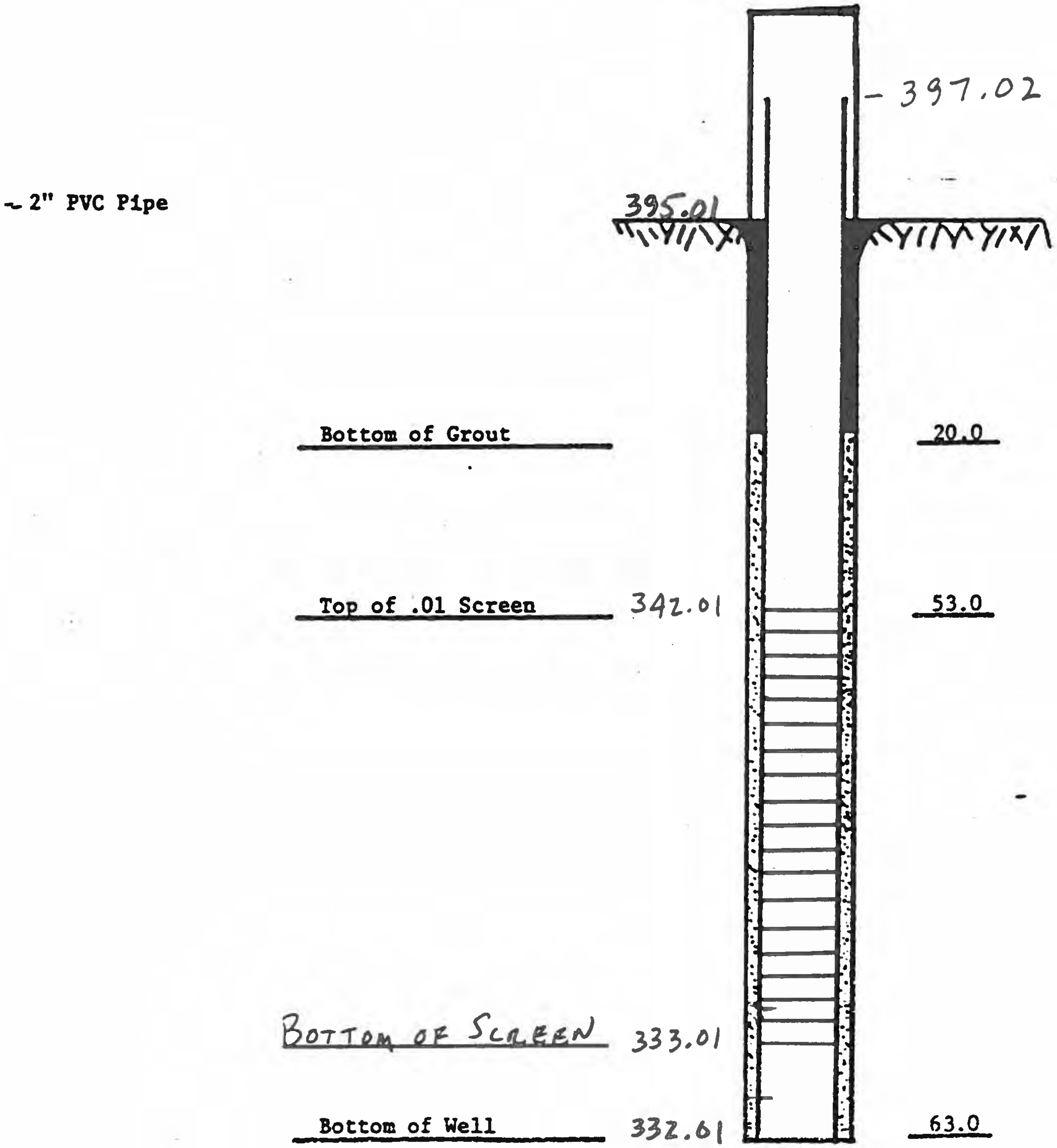
I & M
Rockport Plant
Ash Storage Area
Well No. 4-S
5-9-84

MW-4S
(Abandoned)



I & M
Rockport Plant
Ash Storage Area
Well No. 4I
5-09-84

**MW-4I
(Abandoned)**



AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

MW-4

JOB NUMBER ____________

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 163,459.8 E 519,814.2**

GROUND ELEVATION **394.6** SYSTEM ____________

BORING NO. **9904** DATE **4/27/99** SHEET **1** OF **2**

BORING START **1/31/99** BORING FINISH **2/1/99**

PIEZOMETER TYPE ____________ WELL TYPE **OW**

HGT. RISER ABOVE GROUND ____________ DIA ____________

DEPTH TO TOP OF WELL SCREEN ____ BOTTOM ____________

WELL DEVELOPMENT ____________ BACKFILL **Grout**

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

WATER LEVEL	▽	▼	▼
TIME			
DATE			

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	2.0	1-1-2-3	2.0				CL	**BROWN CLAY** With organic in top 0.5, moist		Water for drilling & grouting came from fire protection wells at Rockport Plant
2	SS	2.0	4.0	2-3-3-4	2.0				CL	**BROWN SILTY CLAY**		
3	SS	4.0	6.0	2-3-3-4	2.0		5					
4	SS	6.0	8.0	3-2-3-5	2.0				SW CL	**BROWN SAND** Well graded, medium grain,Wet **BROWN SILTY CLAY** Wet at 6.0; Moist at 8.0		Used approximately 300 gallons of quick grout to drill and grout with 5 bags.
5	SS	8.0	10.0	2-3-4-4	2.0							
6	SS	10.0	12.0	3-4-6-8	2.0		10		SP	**BROWN SAND** Poorly graded, dry		
7	SS	12.0	14.0	3-4-6-8	2.0				SP	**SAND** Medium grain, Dry		
8	SS	14.0	16.0	2-2-3-3	2.0		15					
9	SS	16.0	18.0	3-6-8-10	2.0				SP	**SAND** Medium grain, with pea gravel, dry at 16.0; wet at 24.0		
10	SS	18.0	20.0	2-5-7-8	2.0		20					
11	SS	20.0	22.0	5-8-10-13	2.0							
12	SS	22.0	24.0	3-7-10-13	2.0							
13	SS	24.0	26.0	7-9-11-12	2.0		25					
14	SS	30.0	32.0	2-2-3-3	2.0		30		SP	**SAND** Medium grain, with pea to 1/2" gravel,wet		
15	SS	32.0	34.0	2-2-3-4	2.0							
16	SS	34.0	36.0	9-11-12-14	1.5		35		SP	**SAND** Medium grain,wet		Instead of using muc to prevent heaving sands, started inducing quick grout at 34'.
17	SS	36.0	38.0	2-2-2-4	2.0				SP	**SAND** Medium grain,with pea to 1/2" gravel,wet		
18	SS	38.0	40.0	1-1-2-5	2.0							

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TYPE OF CASING USED

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

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

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

RECORDER **DLB**

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

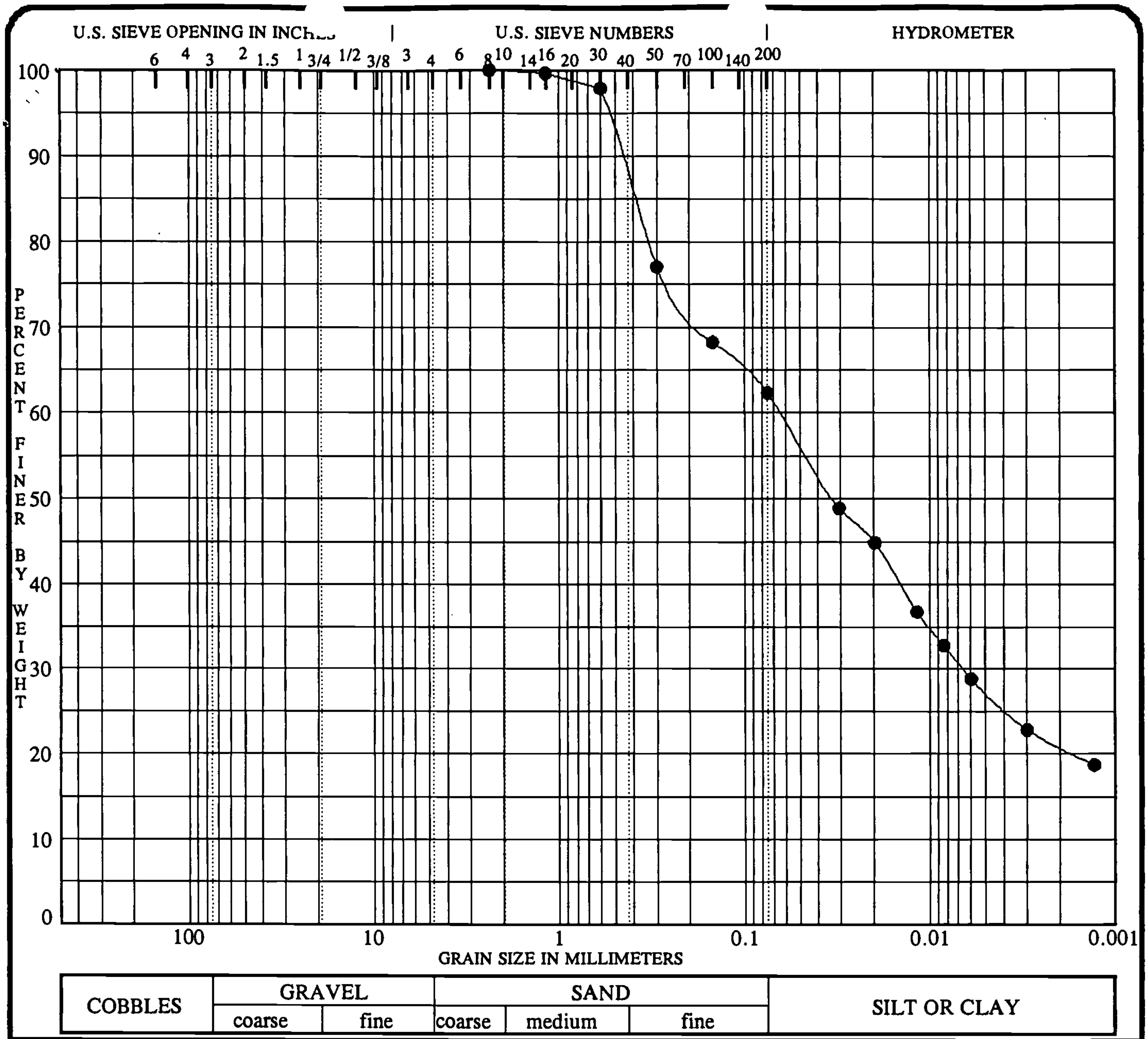
AEP

JOB NUMBER ____________________

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. 9904 DATE 4/27/99 SHEET 2 OF 2

PROJECT **ROCKPORT PLANT** BORING START 1/31/99 BORING FINISH 2/1/99

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
19	SS	41.6	43.1	3-5-8	1.5				SW	**SAND** Well grain, medium grain,wet		
							45					
20	SS	46.6	48.1	3-6-11	1.5				SP	**SAND** Medium grain, with pea gravel, wet		
							50					
21	SS	51.6	53.1	4-7-8	1.5				SW	**SAND** Well graded, medium grain, wet		
22	SS	53.1	55.1	4-5-7-9	2.0							
							55					
23	SS	55.1	57.1	4-8-9-11	2.0							
24	SS	57.1	59.1	2-3-8-10	2.0							
25	SS	59.1	61.1	8-11-11-18	2.0				SP	**SAND** Medium grain,with pea to 1/2" gravel, wet		
							60					
26	SS	61.1	63.1	9-11-12-16	2.0				SP	**SAND** Medium grain,with pea gravel, few coal particles, wet		
							65					
27	SS	66.6	68.1	7-9-12	1.5				SP	**SAND** Medium grain, with pea to 3/4" gravel,wet		
							70					
28	SS	71.6	73.1	6-8-6	1.5				SP	**SAND** Medium grain, with pea to 1/2" gravel,wet		
							75					
29	SS	76.6	78.1	10-12-14	1.5				SP	**SAND** Medium grain,with pea to 3/4" gravel,wet		
							80					
30	SS	81.6	83.1	5-5-8	1.5				CL CL	**GRAY SILTY CLAY** Moist **BLUISH GRAY SANDY CLAY**		
31	SS	84.1	84.8	16-50/2	0.8				CL	**BLUISH GRAY SILTY CLAY** **SHALE**		Auger refusal 84.1' Spoon refusal 84.8'. Stopped boring at 84.8



	Specimen Identification		Classification	MC%	LL	PL	PI	Sp.Gr.	
●	9904	2.0			34.0	18.4	15.6		
			SANDY LEAN CLAY CL						
			COMPOSITE - 2.0'-5.0'						

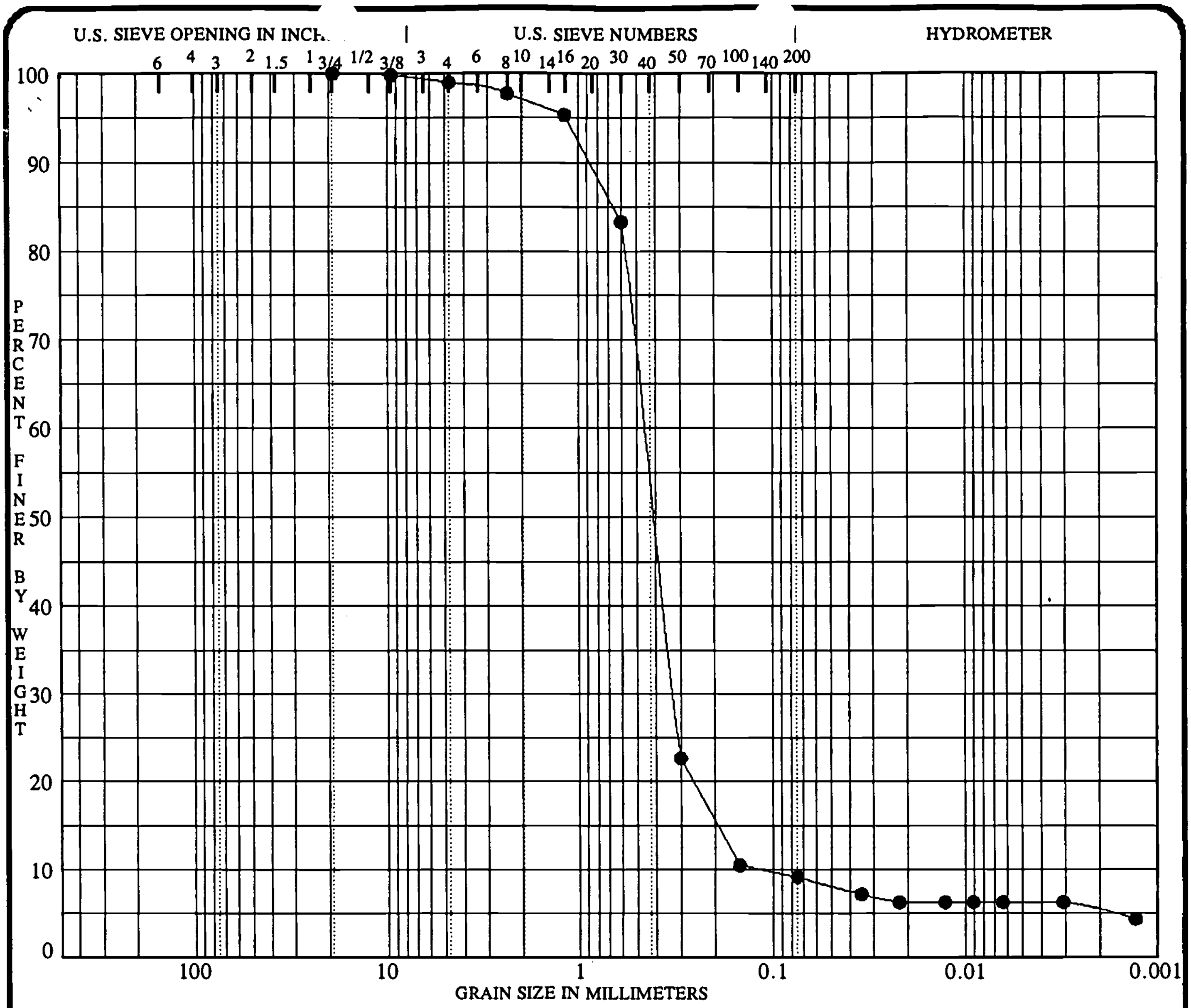
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
●	9904	2.0	2.360	0.064	0.007		0.0	37.7	62.3	20.8

PROJECT ROCKPORT PLANT - ROCKPORT, INDIANA
JOB NO. WO#SC3750
DATE 06/01/99

GRADATION CURVES

American Electric Power Service Corp.
Groveport, Ohio

AEP



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	MC%	LL	PL	PI	Sp.Gr.	
●	9904 5.0			NP	NP	NP		
		POORLY GRADED SAND with SILT SP-SM						
		COMPOSITE 5.0'-8.0'						

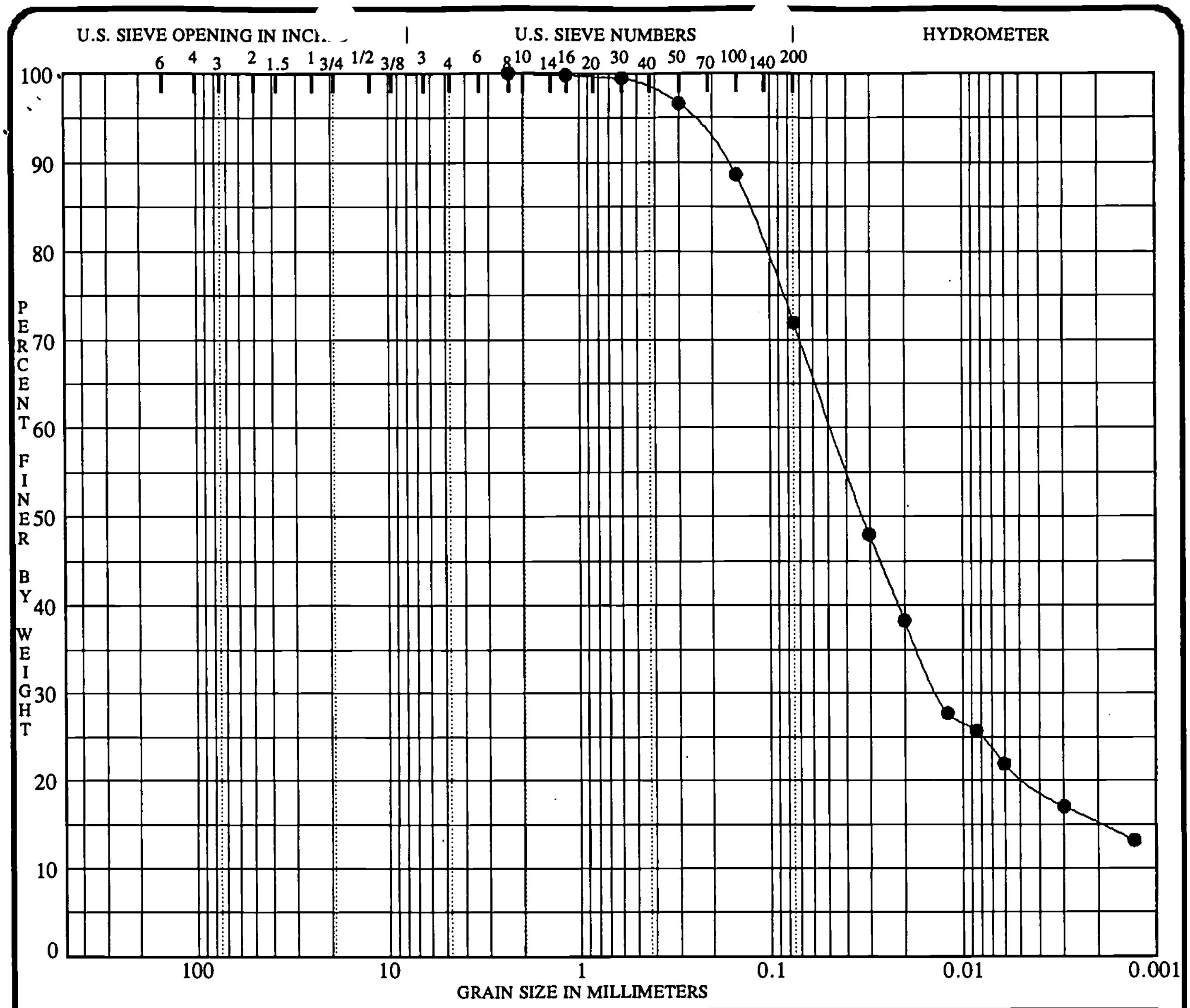
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Fines	% < .002
●	9904 5.0	19.000	0.460	0.327	0.115	1.0	89.8	9.2	5.3

PROJECT ROCKPORT PLANT - ROCKPORT, INDIANA

JOB NO. WO#SC3750
DATE 06/01/99

GRADATION CURVES

American Electric Power Service Corp.
Groveport, Ohio



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI	Sp.Gr.	
●	9904	8.0			26.6	17.7	8.9		
			LEAN CLAY with SAND CL						
			COMPOSITE 8.0'-11.0'						

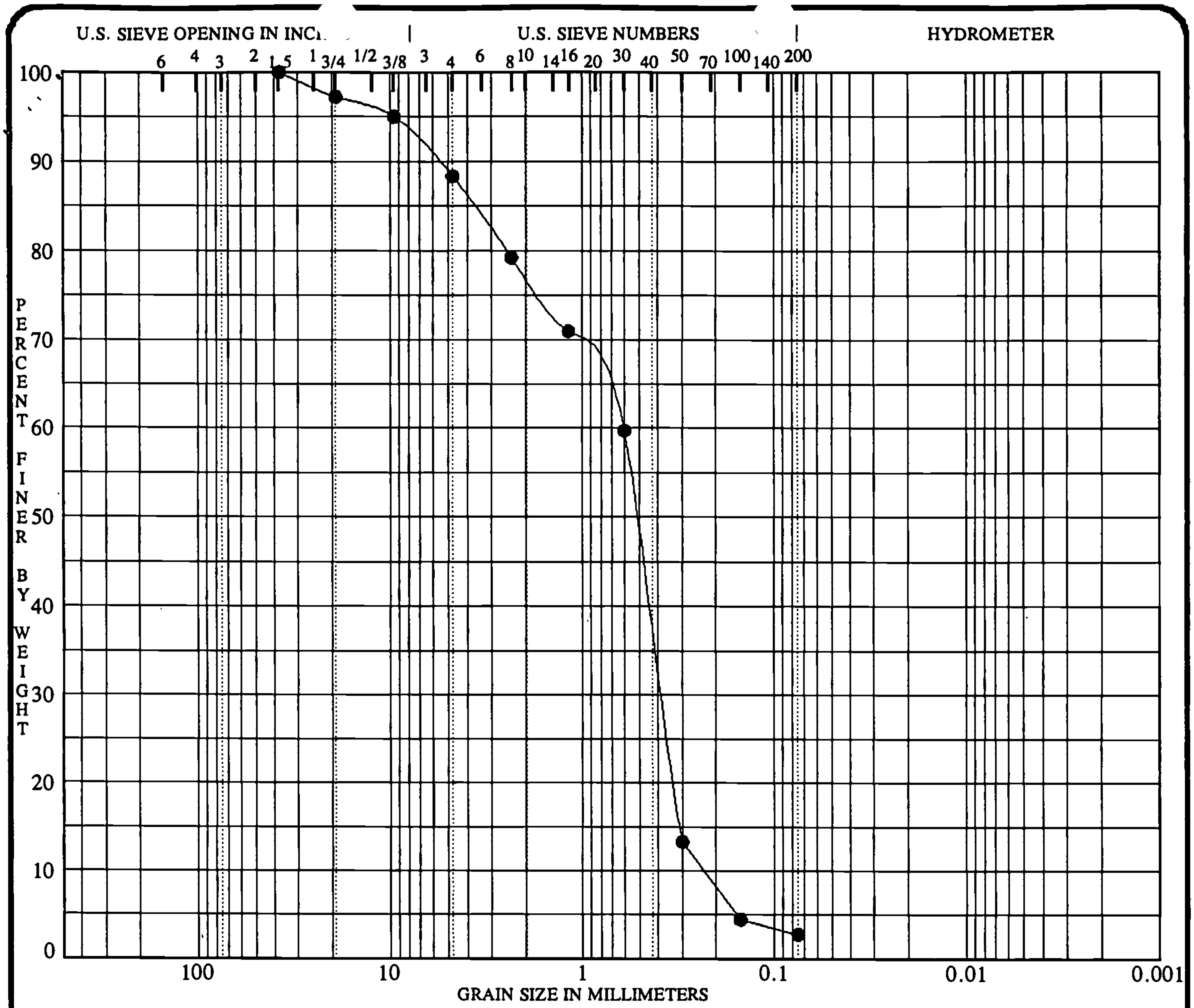
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Fines	% < .002
●	9904	8.0	2.360	0.048	0.013		0.0	28.1	71.9	15.2

PROJECT **ROCKPORT PLANT - ROCKPORT, INDIANA**

JOB NO. **WO#SC3750**
DATE **06/01/99**

GRADATION CURVES

American Electric Power Service Corp.
Groveport, Ohio



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI	Sp.Gr.	
●	9904	30.0			NP	NP	NP		
			POORLY GRADED SAND SP						
			WELL #4-S COMPOSITE SAMPLE 30.0'-40.0'						

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
●	9904	30.0	37.500	0.611	0.385	0.231	11.7	85.5	2.8	

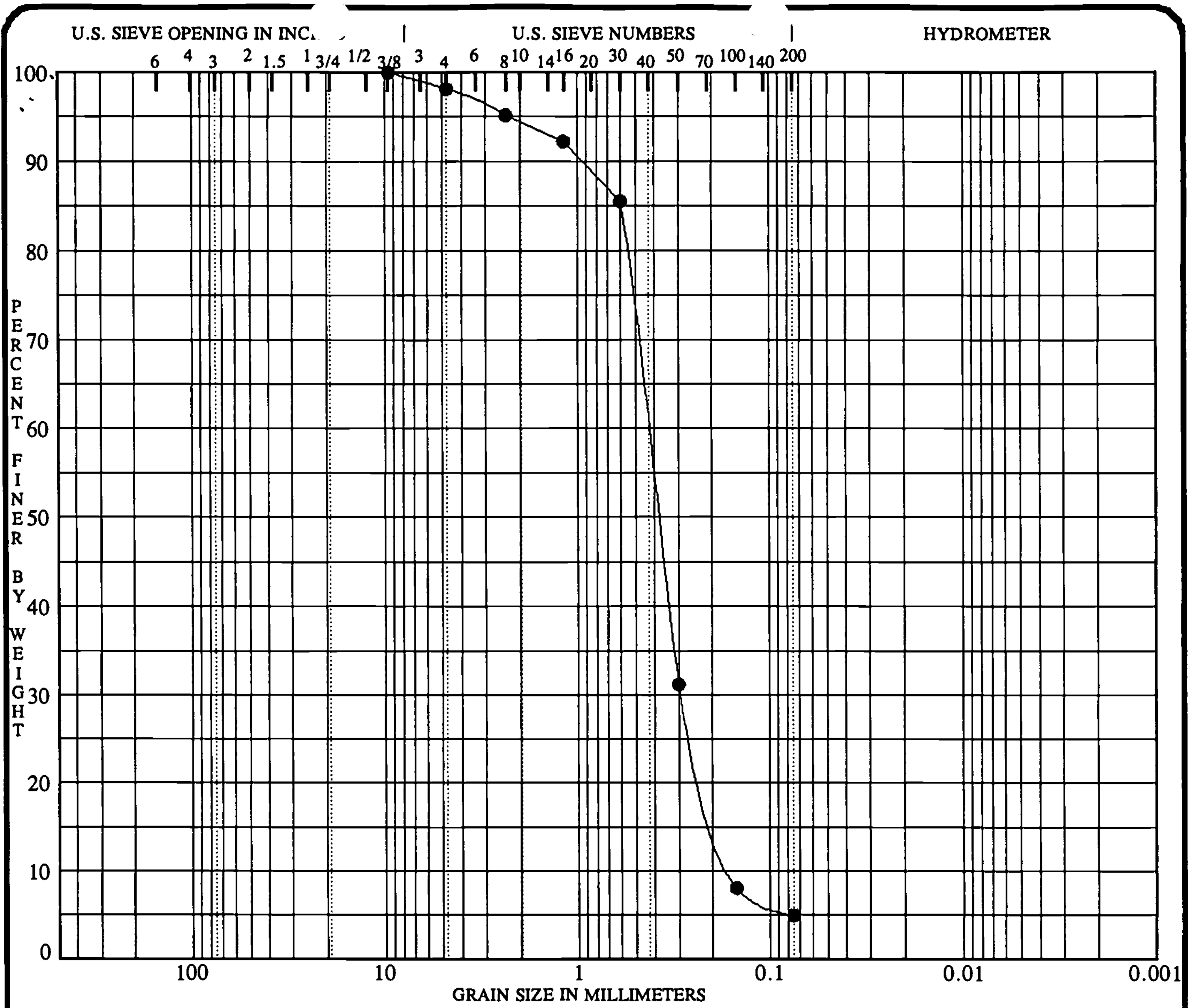
PROJECT ROCKPORT PLANT - ROCKPORT, INDIANA

JOB NO. WO#1352
DATE 04/22/99

GRADATION CURVES

American Electric Power Service Corp.
Groveport, Ohio

AEP



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI	Sp.Gr.	
●	9904	53.1			NP	NP	NP		
			POORLY GRADED SAND with SILT SP-SM						
			WELL #4-I COMPOSITE SAMPLE 53.1'-63.1'						

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
●	9904	53.1	9.500	0.433	0.289	0.159	1.9	93.1	5.0	

PROJECT **ROCKPORT PLANT - ROCKPORT, INDIANA**

JOB NO. **WO#1352**
DATE **04/22/99**

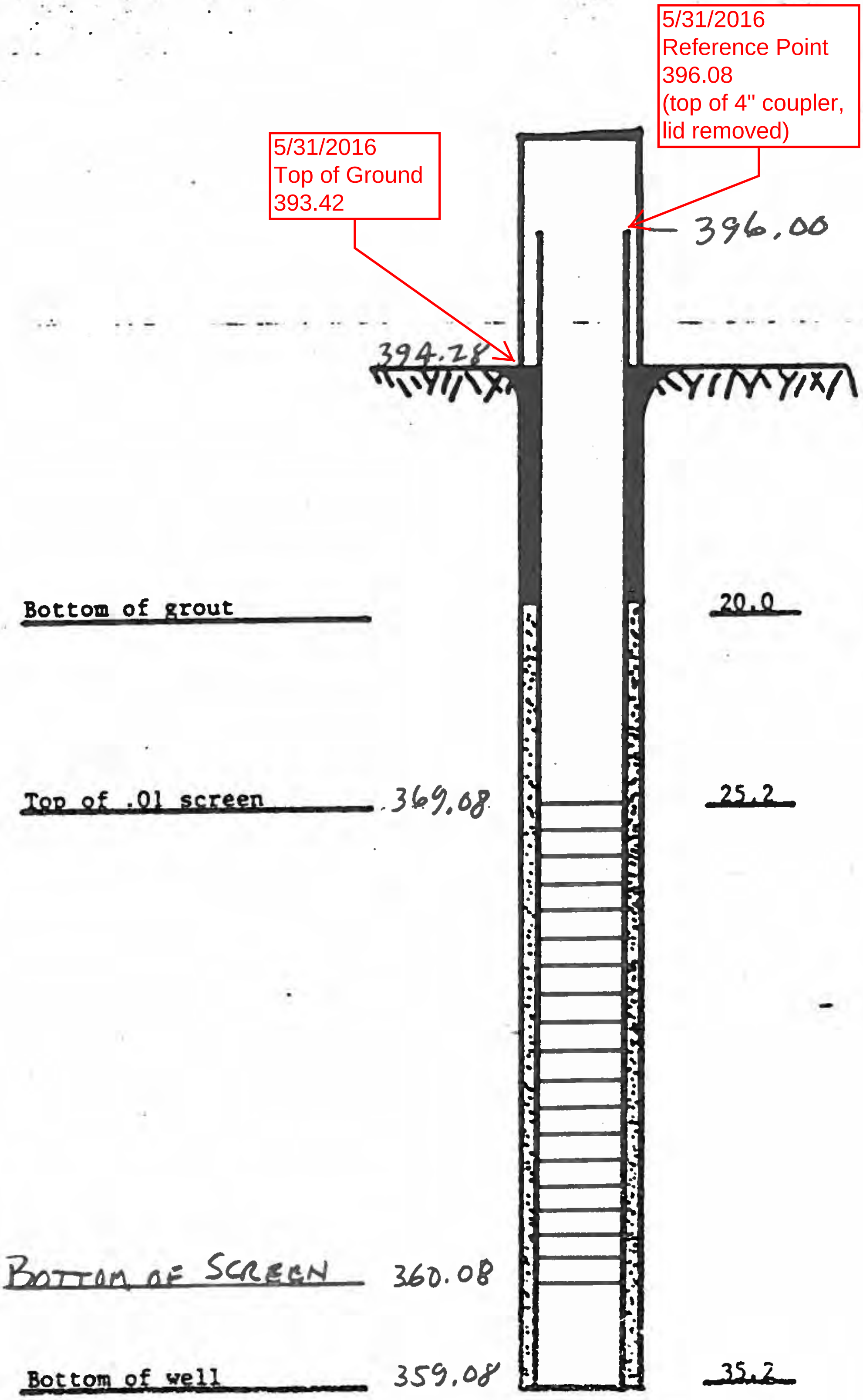
GRADATION CURVES

American Electric Power Service Corp.
Groveport, Ohio

I & M
Rockport Plant
Ash Storage Area
Well No. 5-S
5-10-84

MW-5S

2" PVC Pipe

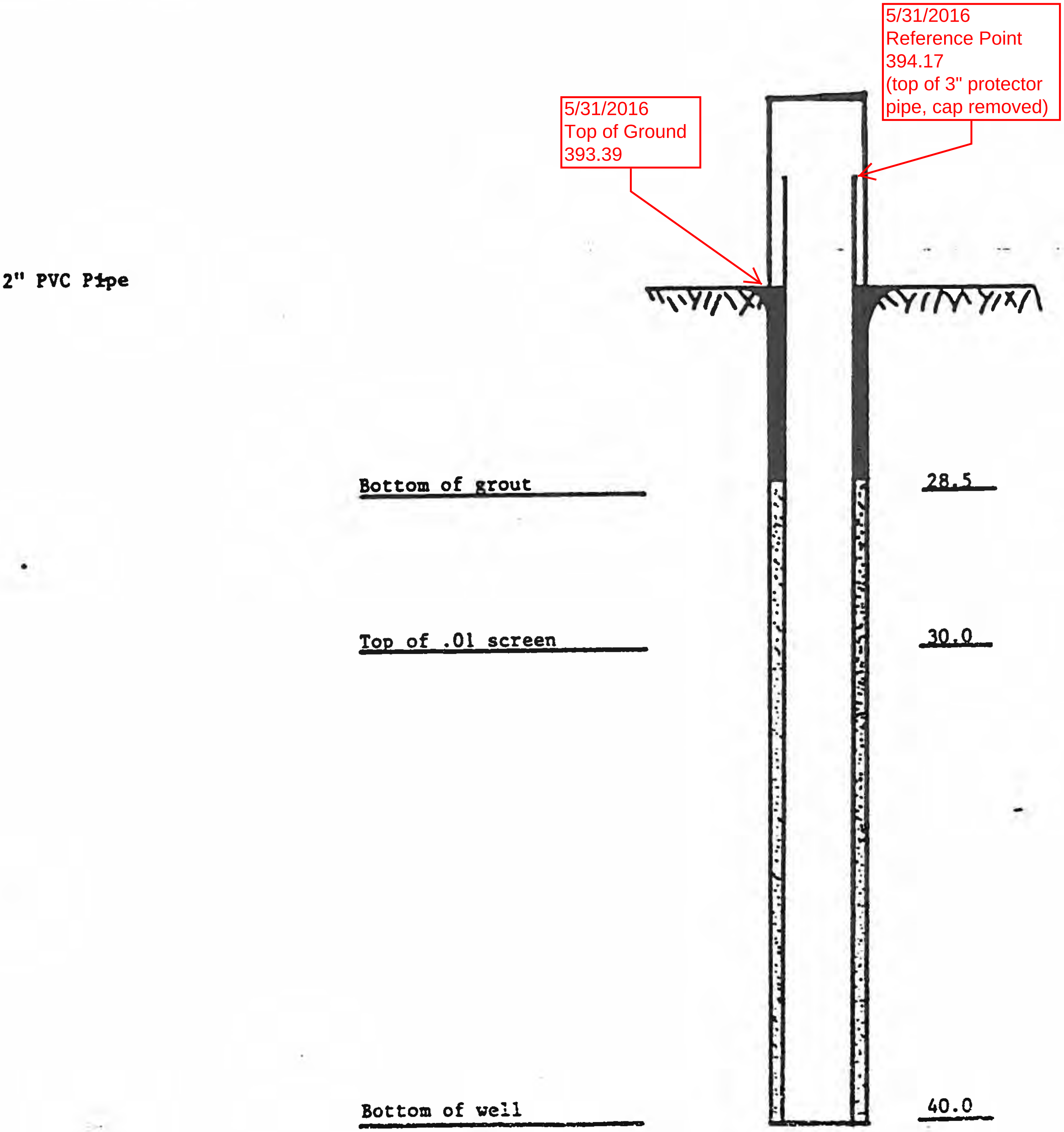


5/31/2016
Reference Point
396.08
(top of 4" coupler,
lid removed)

5/31/2016
Top of Ground
393.42

I & M
Rockport Plant
Ash Storage Area
Well No. 5-I
5-22-84

MW-5I



5/31/2016
Reference Point
394.17
(top of 3" protector pipe, cap removed)

5/31/2016
Top of Ground
393.39

AME ,AN ELECTRIC POWER SERVICE COF RATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

AEP

JOB NUMBER ____

MW-5

COMPANY INDIANA MICHIGAN POWER COMPANY

PROJECT ROCKPORT PLANT

COORDINATES N 164,993.0 E 520,610.0

GROUND ELEVATION 392.1 SYSTEM ____

BORING NO. 9905 DATE 4/27/99 SHEET 1 OF 2

BORING START 2/12/99 BORING FINISH 2/12/99

PIEZOMETER TYPE ____ WELL TYPE OW

HGT. RISER ABOVE GROUND ____ DIA ____

DEPTH TO TOP OF WELL SCREEN ____ BOTTOM ____

WELL DEVELOPMENT ____ BACKFILL Grout

FIELD PARTY MCR-DLB RIG BK-81

WATER LEVEL	▽	▼	▼
TIME			
DATE			

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	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	2.0	1-1-2-2	2.0			CL CL	**BROWN CLAY** With organics **GRAY CLAY** Moist		Water from fire protection well at Rockport Plant was used for drilling and grouting.
2	SS	2.0	4.0	2-2-3-3	2.0						
3	SS	4.0	6.0	2-2-3-4	2.0		5				
4	SS	6.0	8.0	2-3-3-4	2.0						Decon drill and hand tools before drilling.
5	SS	8.0	10.0	1-2-2-2	2.0			CL	**BROWNISH GRAY SILTY CLAY** Dry		
6	SS	10.0	12.0	1-1-2-2	2.0		10				No drill mud used. Grouted from 58.6' to grade. Used approx. 50 gallons; 2 bags.
7	SS	12.0	14.0	1-1-1-1	2.0			CL	**GRAY CLAY** Soft, wet		
8	SS	14.0	16.0	0-0-0-0	2.0		15	CL	**BLUISH GRAY SILTY CLAY** Soft, moist		
9	SS	16.0	18.0	1-1-2-3	2.0						
10	SS	18.0	20.0	1-1-2-2	2.0			CL	**BLUISH SANDY CLAY** Wet		
11	SS	20.0	21.9	10-15-25-50/.2	1.7		20	SP	**SAND** With pea to 1/2" gravel, wet		
12	NQ-2	21.9	24.6		2.2				**BLUISH GRAY SHALE** Dry **BLUISH GRAY SANDY CLAYSTONE** **BLUISH GRAY SANDY SHALE**		
~~13~~	~~NQ-2~~	~~24.6~~	~~33.6~~		~~4.8~~		25		**LIGHT GRAY LIMESTONE**		
							30				
14	NQ-2	33.6	43.6		10		35		**TOP 5.0 - DARK GRAY SHALE** **BOTTOM 5.0 - DARK GRAY SANDY SHALE**		

Continued Next Page

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 DLB

AME AN ELECTRIC POWER SERVICE COR RATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

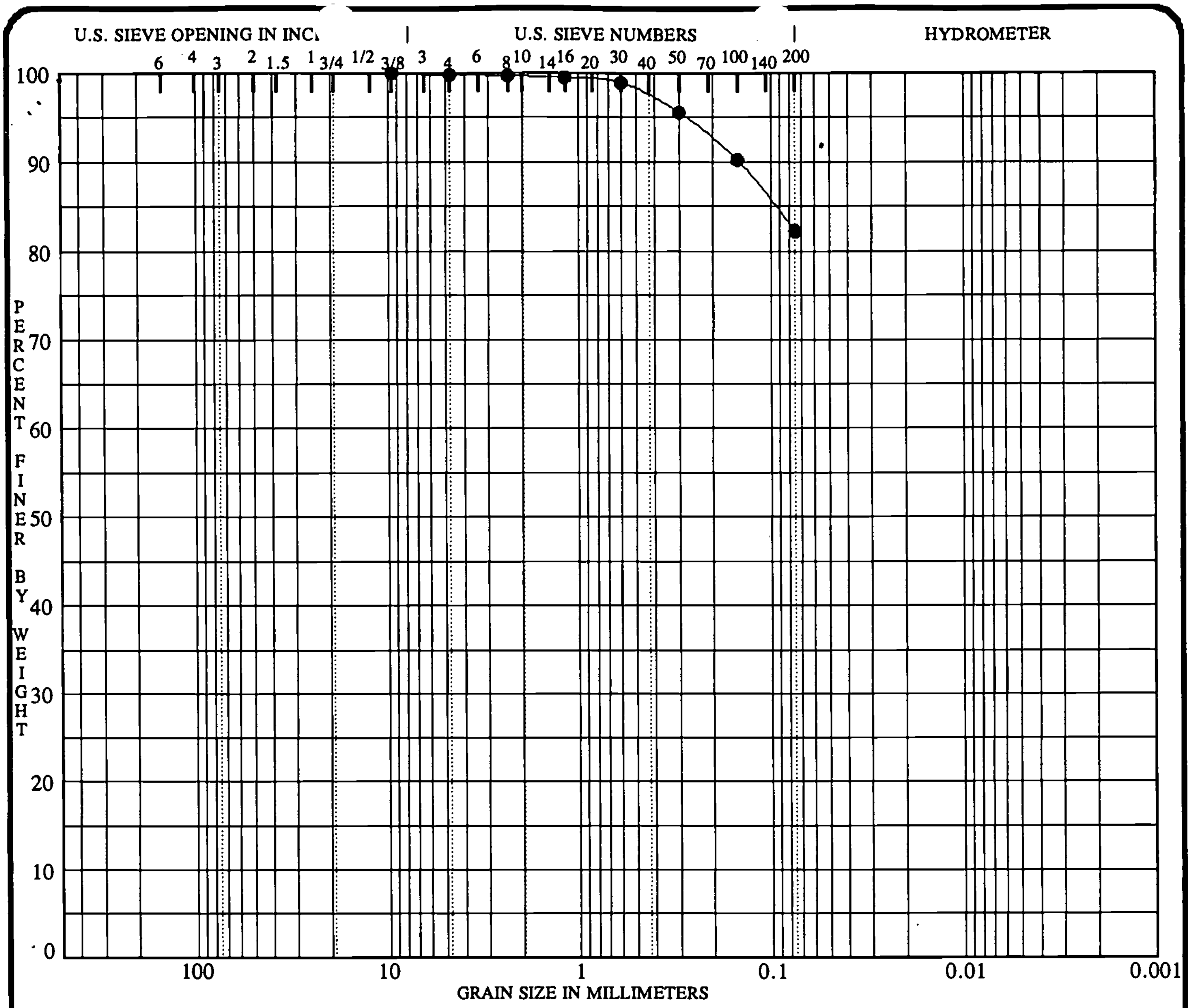
AEP

JOB NUMBER ____________

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **9905** DATE **4/27/99** SHEET **2** OF **2**

PROJECT **ROCKPORT PLANT** BORING START **2/12/99** BORING FINISH **2/12/99**

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
15	NQ-2	43.6	53.6		9.6		45			TOP 1.5 - DARK GRAY SANDY SHALE 0.5 - COAL, fractured 0.6 - DARK GRAY CLAYSTONE 7.0 - GRAY CLAYSTONE		
							50					
16	NQ-2	53.6	58.6		5.5		55			LIGHT GRAY SANDY SHALE		
												Stopped boring at 58.6' on 2/12/99



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI	Sp.Gr.	
●	9905	2.0			NP	NP	NP		
			SILT with SAND ML						
			COMPOSITE SAMPLE 2.0'-20.0'						

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
●	9905	2.0	9.500				0.2	17.6	82.2	

PROJECT ROCKPORT PLANT - ROCKPORT, INDIANA

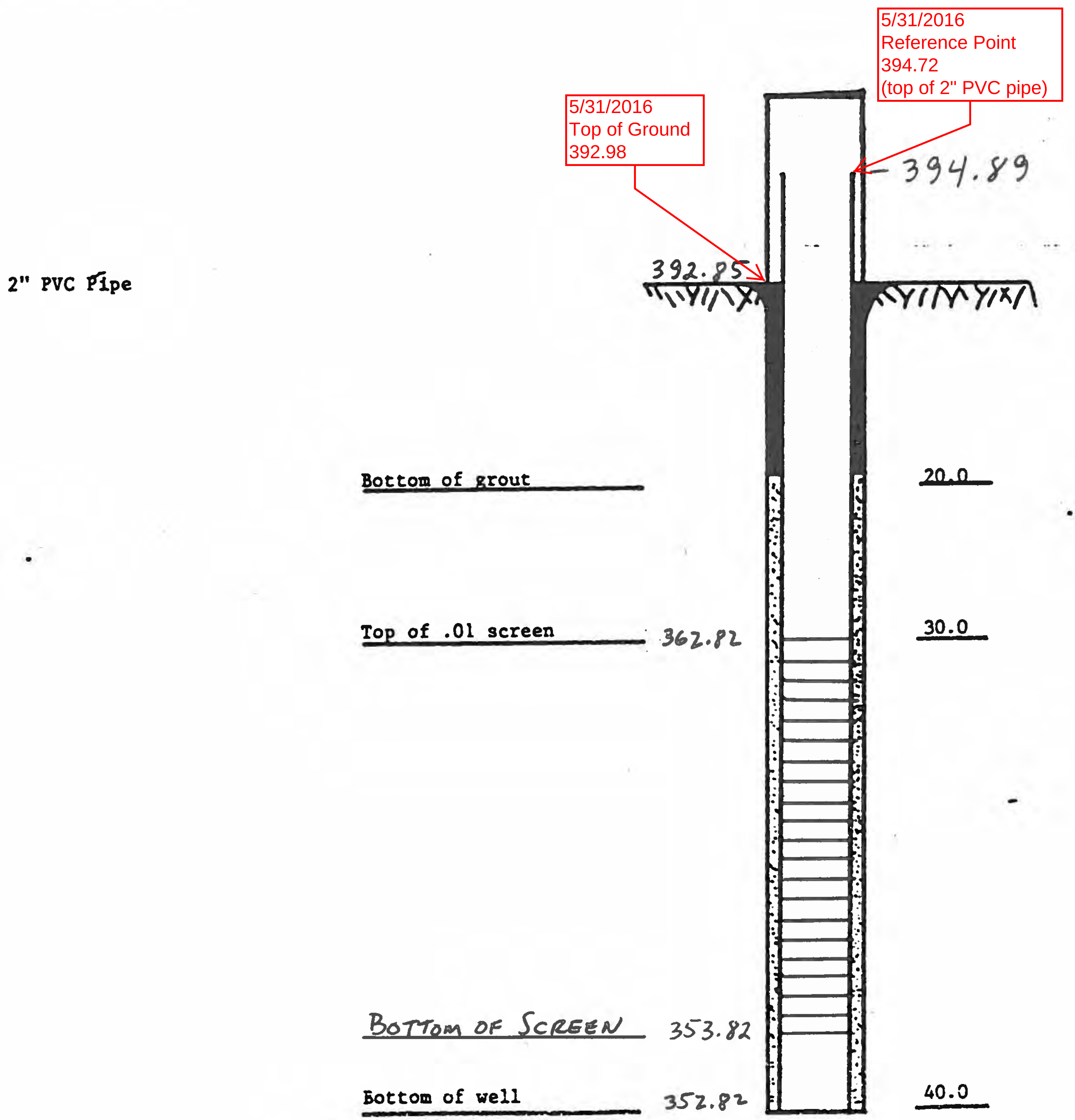
JOB NO. WO#1352
DATE 04/22/99

GRADATION CURVES

American Electric Power Service Corp.
Groveport, Ohio

I & M.
Rockport Plant
Ash Storage Area
Well No. 6-S
5-17-84

MW-6S



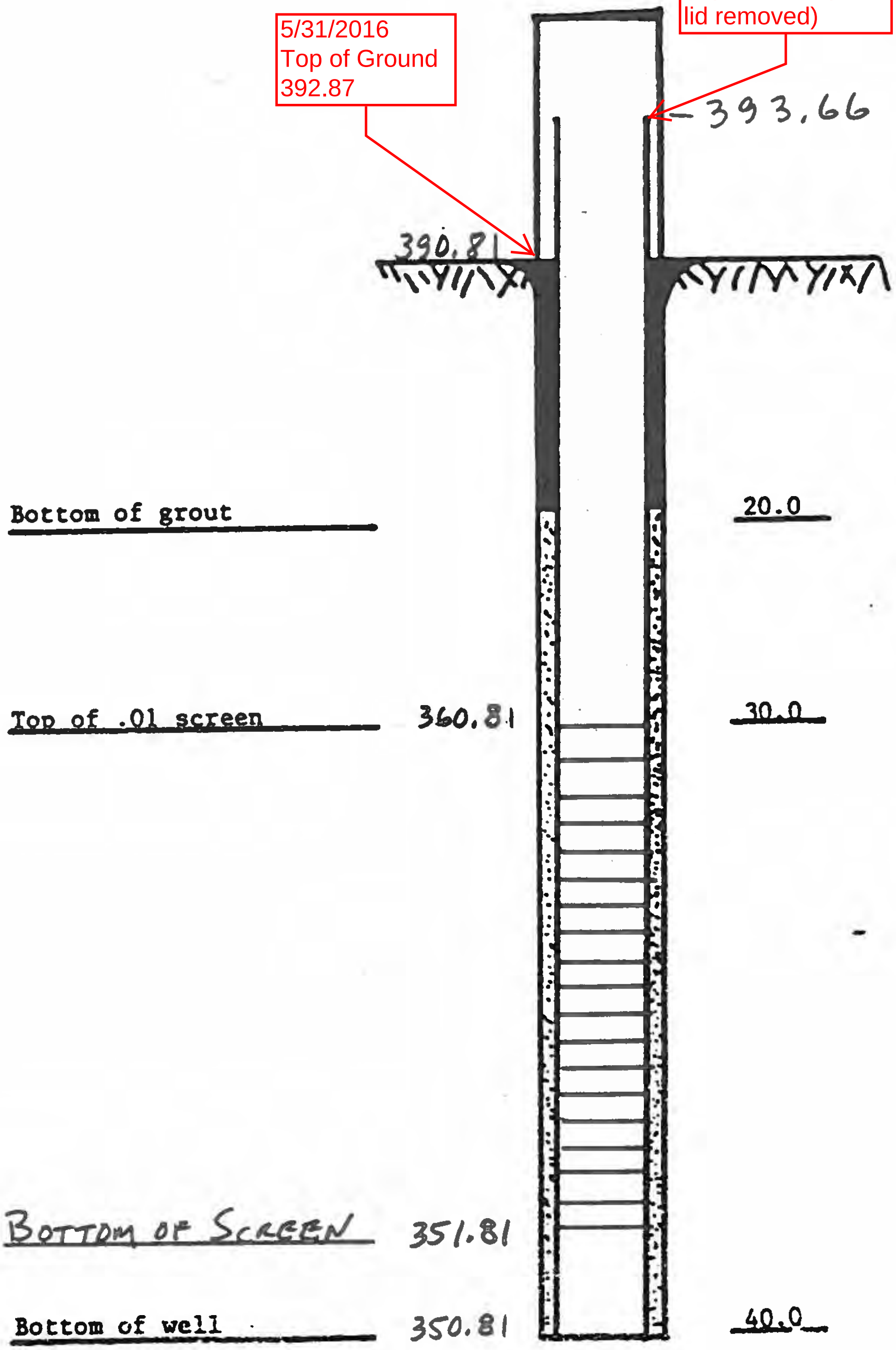
5/31/2016
Reference Point
394.72
(top of 2" PVC pipe)

5/31/2016
Top of Ground
392.98

I & M
Rockport Plant
Ash Storage Area
Well No. 7-S
5-1-84

MW-7S

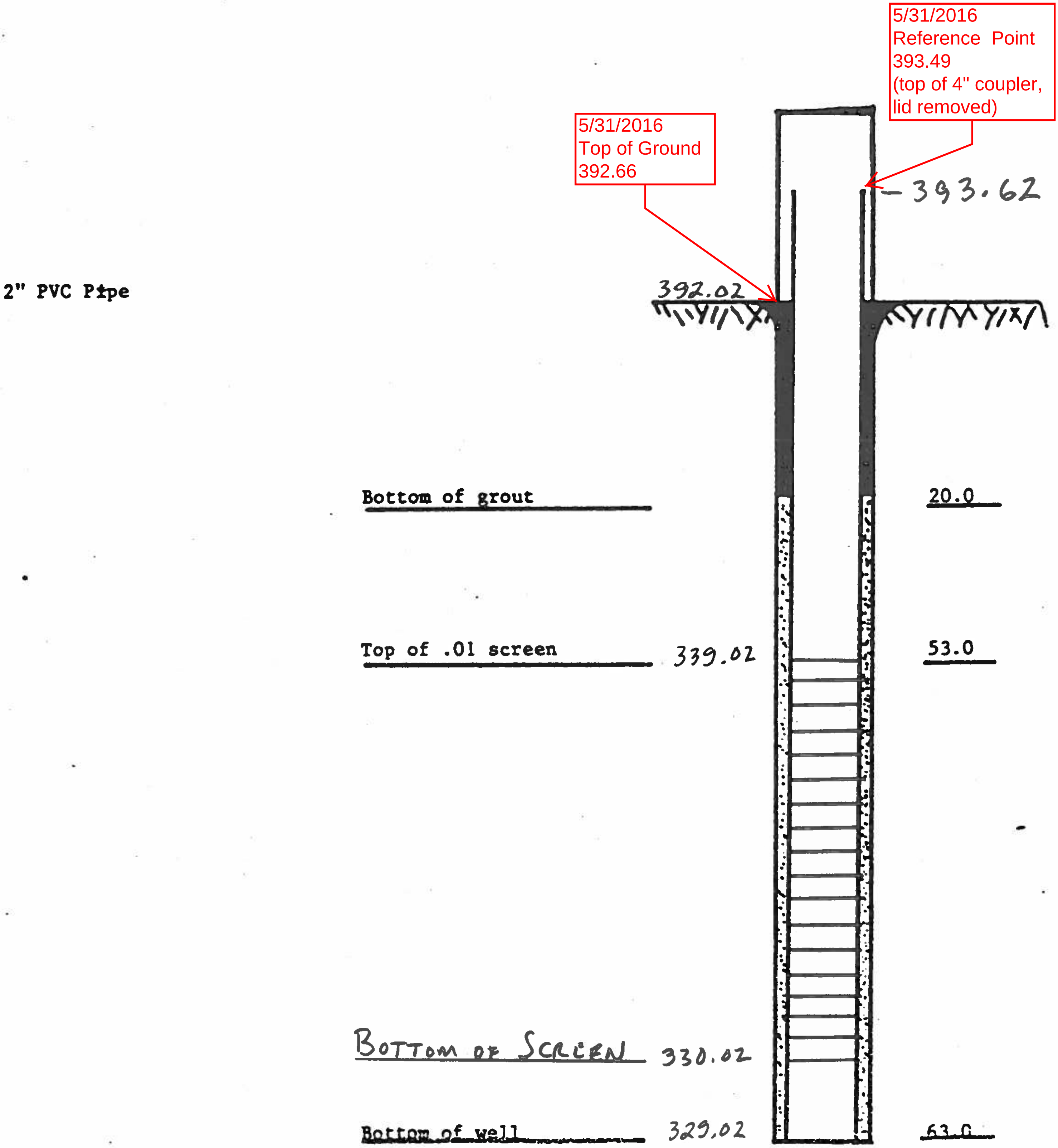
2" PVC Pipe


5/31/2016
Reference Point
393.70
(top of 4" coupler,
lid removed)

5/31/2016
Top of Ground
392.87

I & M.
Rockport Plant
Ash Storage Area
Well No. 7-I
5-24-84

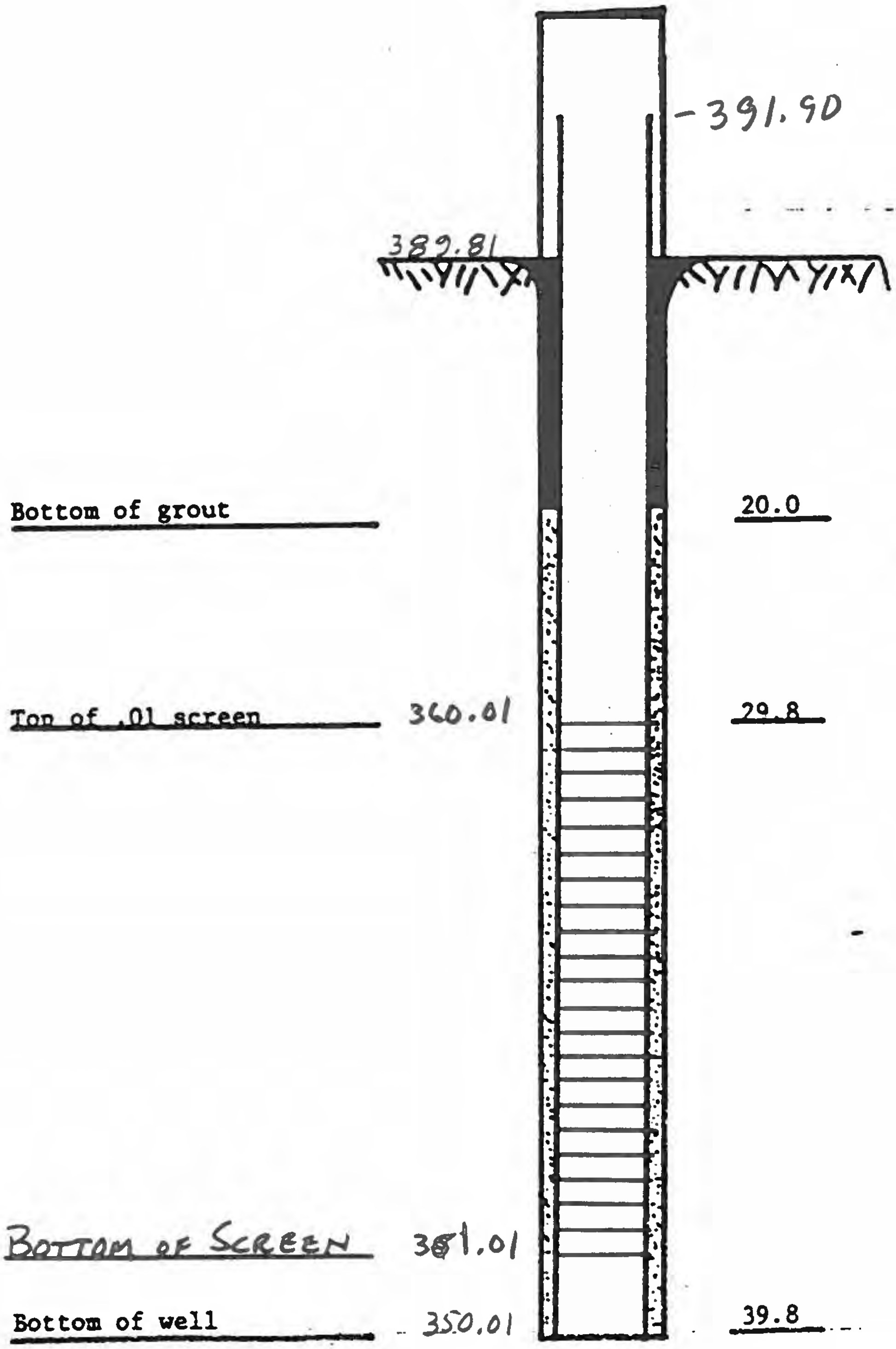
MW-7I


5/31/2016
Reference Point
393.49
(top of 4" coupler, lid removed)

5/31/2016
Top of Ground
392.66

I & M
Rockport Plant
Ash Storage Area
Well No. 8-S
5-8-84

MW-8S
(Abandoned)



RECORD OF WATER WELL
State Form 35680 (R5 / 9-04)

Fill in completely

Driller—Mail complete record in 30 days to:
INDIANA DEPT. OF NATURAL RESOURCES
Division of Water
402 W. Washington St., Rm. W264
Indianapolis, IN 46204-2641
(877) 928-3755 toll-free or (317) 232-4160

County Permit Number:
DNR Variance Number:
Include if applicable

WELL LOCATION

County where drilled: Spencer
Civil township name: Ohio
Township number (N-S): 6-S
Range number (E-W): 5-W
Section: 31

Driving directions to the well location (include trip origin, street & road names, intersecting roads, and compass directions). Show well address below and subdivision in box at lower right. There is space for a map on the reverse side.

US231 ~5 mi. to CR350 (E of 231). ~2 mi. to entrance of landfill on N side of CR350.

UTM Northing: 1629?26.8
UTM Easting: 517492.5
Datum ☑ NAD 27 ☐ NAD 83
GPS used:
Subdivision name & lot number (if applicable):

Well address:

If drilled for water supply, this well is: ☐ First well on property ☐ Replacement well ☐ Additional well on property ☐ Dry hole

OWNER - CONTRACTOR

Well owner—name: I+M Rockport Plant
Telephone number: 812-649-9171
Address (number and street, city, state, ZIP code): 2791 N US Hwy. 231, Rockport, IN, 47635
Building contractor—name: AEP Dolan Lab
Address (number and street, city, state, ZIP code): 4001 Bixby Rd, Groveport, OH 43125
Telephone number: 614-836-4200
Drilling contractor—name: AEP Dolan Lab
Address (number and street, city, state, ZIP code): 4001 Bixby Rd, Groveport, OH, 43125
Telephone number: 614-836-4200
Equipment operator—name: Rick E. Banks
License number of operator:
Date of well completion: 10/30/13

CONSTRUCTION DETAILS

Use of well
☐ Home
☐ Public supply
☐ Industrial / commercial
☐ Livestock
☐ Irrigation
☐ Monitoring / environ.
☐ Test hole
Other: ______

Drilling method
☐ Rotary
☐ Reverse rotary
☐ Cable tool
☐ Jet
☐ Bucket / bore
☐ Auger (including HSA)
☐ Direct push
Other: ______

Type of pump
☐ Submersible
☐ Shallow-well jet
☐ Deep-well jet
☐ No pump installed
Other: ______

Pump depth setting (feet):

Total depth of well (feet):
Borehole diameter (in.):
Gravel pack inserted ☐ Yes ☐ No
Casing length (feet):
Casing diameter (in.):
Casing material ☐ PVC ☐ Steel Other: ______
Screen length (feet):
Screen diameter (in.):
Screen material ☐ PVC ☐ Steel Other: ______
Screen slot size:
Water quality (clear, odor, etc.):

WELL CAPACITY TEST

Test method ☐ Air ☐ Bailing ☐ Pumping
Static level below surface: feet
Gallons per min.:
Hours tested:
Drawdown (change in level): feet

GROUTING

Grout material:
Grout depth from to
Installation method:
No. of bags used:

WELL ABANDONMENT

Sealing material: Lean Cement Grout
Depth filled from 42 to 0
Installation method: Tremie Grout
No. of bags used: 4

WELL LOG

FORMATIONS: Type of material	From (feet)	To (feet)
From Top of Pipe		
SWL 25.15'		
From Top of PVC		
Bottom of Well 43.9'		
100 Gals of lean cement grout to fill hole		
AEP MW-85		

Additional space for well log and comments on reverse side

I hereby swear or affirm, under the penalties for perjury, that the information submitted herewith is, to the best of my knowledge and belief, true, accurate, and complete.

Signature of drilling contractor or authorized representative MUST BE SIGNED OR STAMPED: Rick Banks
Date: 11/25/13

WELL CLOSURE / ABANDONMENT

American Electric Power Service Corporation / Rockport Plant

Well 8S

Spencer County / Township 6S / Range 5W / Section 31

- Removed monitoring well pump and recorded static water and sounding of bottom of well.

- Removed steel casing protector and concrete pad.

- Proceeded to drill 4.25" hollow stem auger over 2" PVC well to bottom.

- Once augers reached bottom of well, a 3 7/8" tri-cone roller bit and A rods were placed inside and lowered to a depth of 42.0' below grade. The PVC was pulled from inside of augers.

- Flushed out old cuttings.

- Finished project by tremie grouting from 42.0' to grade using 100 gallons of lean cement grout.

RECORD OF WATER WELL

State Form 35680 (R5 / 9-04)

Driller—Mail complete record in 30 days to:
INDIANA DEPT. OF NATURAL RESOURCES
Division of Water
402 W. Washington St., Rm. W264
Indianapolis, IN 46204-2641
(877) 928-3755 toll-free or (317) 232-4160

County Permit Number:

DNR Variance Number:

Include if applicable

Fill in completely

WELL LOCATION

County where drilled	Civil township name	Township number (N-S)	Range number (E-W)	Section
Spencer	Ohio	6-S	5-W	31

Driving directions to the well location (*include trip origin, street & road names, intersecting roads, and compass directions*). Show well address below and subdivision in box at lower right. There is space for a map on the reverse side.

US231 ~5 mi. to CR350 (E of 231). ~2 mi. to entrance of landfill on N side of CR350.

Well address:

UTM Northing 162910.454

UTM Easting 517492.008

Datum ☑ NAD 27 ☐ NAD 83

GPS used

Subdivision name & lot number (if applicable)

If drilled for water supply, this well is: ☐ First well on property ☐ Replacement well ☐ Additional well on property ☐ Dry hole

OWNER - CONTRACTOR

Well owner–name: I&M Rockport Plant

Telephone number: 812-649-9171

Address (number and street, city, state, ZIP code): 2791 N US Hwy 231, Rockport, IN, 47635

Building contractor–name: ABP- Dolan Lab

Address (number and street, city, state, ZIP code): 4001 Bixby Rd. Groveport, OH 43125

Telephone number: 614-836-4200

Drilling contractor–name: ABP- Dolan Lab

Address (number and street, city, state, ZIP code): 4001 Bixby Rd. Groveport, OH, 43125

Telephone number: 614-836-4200

Equipment operator–name: Rick B. Bankes

License number of operator:

Date of well completion: 10/30/13

CONSTRUCTION DETAILS

Use of well
- ☐ Home
- ☐ Public supply
- ☐ Industrial / commercial
- ☐ Livestock
- ☐ Irrigation
- ☑ Monitoring / environ.
- ☐ Test hole
- Other:

Drilling method
- ☐ Rotary
- ☐ Reverse rotary
- ☐ Cable tool
- ☐ Jet
- ☐ Bucket / bore
- ☑ Auger (including HSA)
- ☐ Direct push
- Other:

Type of pump
- ☑ Submersible
- ☐ Shallow-well jet
- ☐ Deep-well jet
- ☐ No pump installed
- Other:

Pump depth setting (feet): 40.0

Total depth of well (feet): 42.0

Borehole diameter (in.): 6.25

Gravel pack inserted: ☑ Yes ☐ No

Casing length (feet): 43.6

Casing diameter (in.): 2.0

Casing material: ☑ PVC ☐ Steel Other:

Screen length (feet): 9.6

Screen diameter (in.): 2.0

Screen material: ☑ PVC ☐ Steel Other:

Screen slot size: .010

Water quality (clear, odor, etc.): clear

WELL CAPACITY TEST

Test method	Static level below surface	Gallons per min.	Hours tested	Drawdown (change in level)
☐ Air ☐ Bailing ☑ Pumping	26.12 feet			N/A feet

GROUTING

Grout material	Grout depth from	Grout depth to
Holeplug	42	0

Installation method	No. of bags used
Tremie	14

WELL ABANDONMENT

Sealing material	Depth filled from	Depth filled to

Installation method	No. of bags used

WELL LOG

FORMATIONS: Type of material	From (feet)	To (feet)
ABP MW-85R		
Sandy Clay	0	9
Med- Fine Sand	9	42

Additional space for well log and comments on reverse side

I hereby swear or affirm, under the penalties for perjury, that the information submitted herewith is, to the best of my knowledge and belief, true, accurate, and complete.

Signature of drilling contractor or authorized representative MUST BE SIGNED OR STAMPED: Rick Bankes

Date: 11/26/13

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
MONITORING WELL CONSTRUCTION

JOB NUMBER ____________________

COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No **MW-8SR** BORING No **MW-8SR** INSTALLED **10/30/13**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 182,910.5 E 517,492.0**

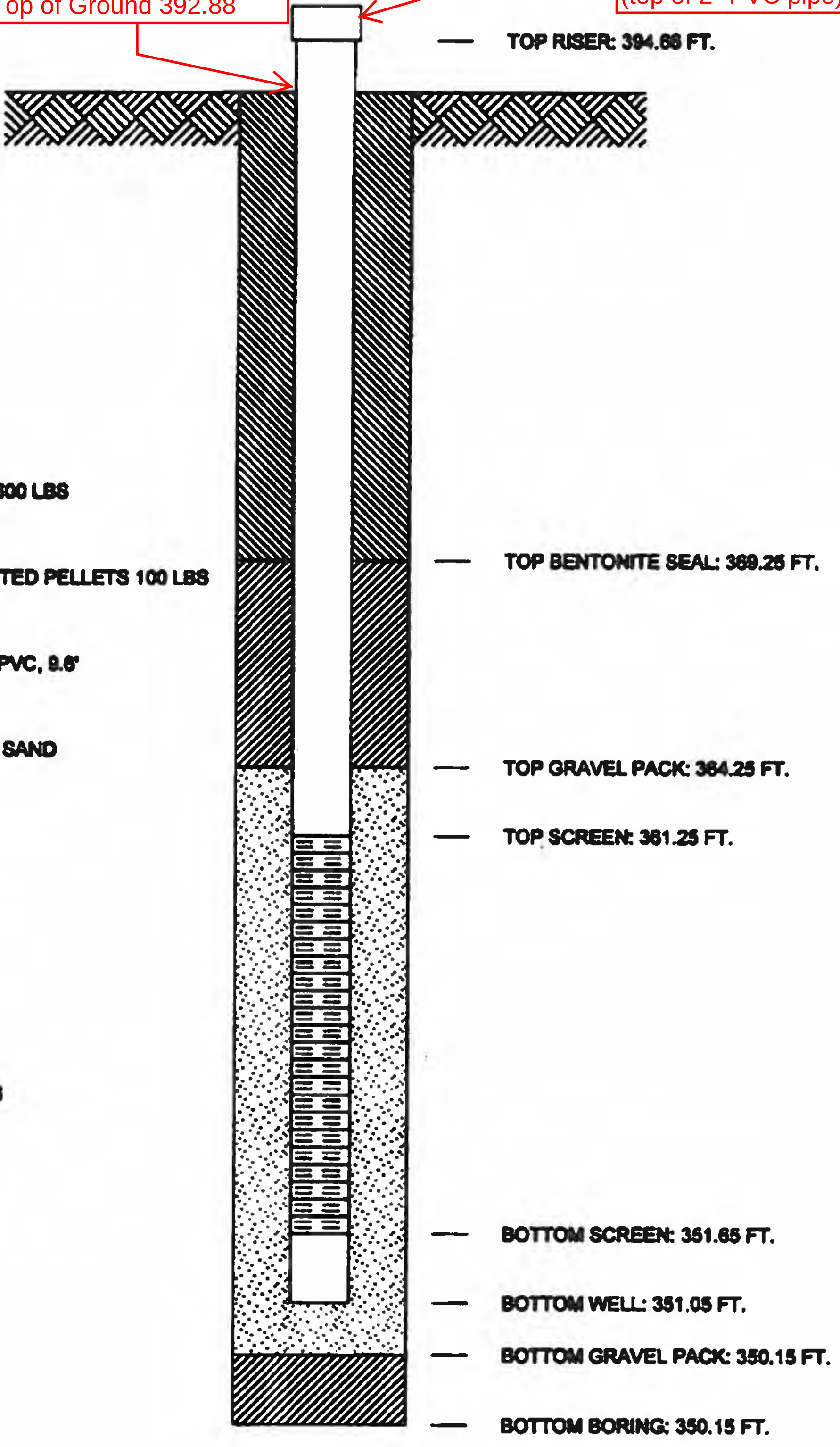
SYSTEM ____________

MW-8SR

5/31/2016
Reference Point
394.86
(top of 2" PVC pipe)

5/31/2016
Top of Ground 392.88

GROUND ELEVATION 392.15 FT.



▧ GROUT SEAL: HOLE PLUG 600 LBS

▨ BENTONITE SEAL: 3/8" COATED PELLETS 100 LBS

☰ SCREEN: 2" dia., .010 SLOT PVC, 9.6'

▒ GRAVEL PACK: #5 COARSE SAND

☐ RISER PIPE: 2", dia., PVC

∿ SPACERS, DEPTH: N/A

To replace abandoned MW-8S

GEOMCNST ROCKPORT PLANT.GPJ AEP.GDT 11/22/13

COMPANY INDIAN AND MICHIGAN POWER CO.
PROJECT ROCKPORT ASH LANDFILL
COORDINATES N.162921.29 E.517496.00
DATE INSTALLED 11-14-92

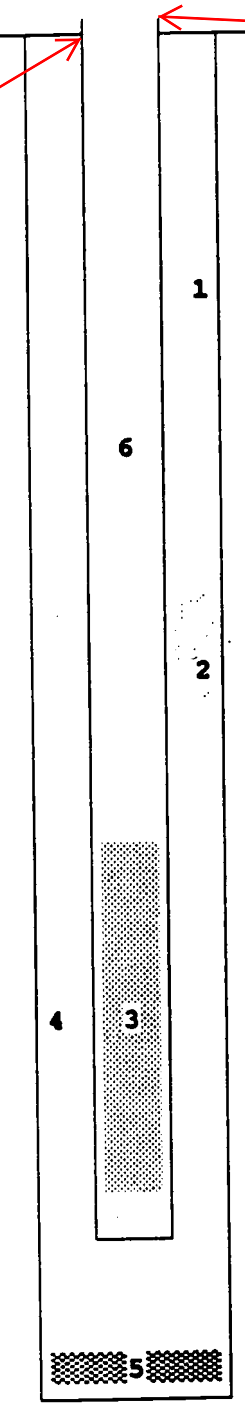
WELL CONSTRUCTION
SUMMARY ELEVATION
(ft. NGVD)
WELL NO. 8-I
REF. DATUM PT. 393.71
GRADE 391.78

MW-8I

NOTE: CASING PROTECTOR DETAILS
NOT SHOWN

5/31/2016
Reference Point
393.52
(top of 2" PVC cap)

5/31/2016
Top of Ground 392.42



1 GROUT SEAL VOLCLAY
2 BENTONITE SEAL
3 SCREEN 9.0 FEET
4 GRAVEL PACK
5 N.A.
6 RISER PIPE 2.0 INCH

TOP OF BENTONITE SEAL 341.8

TOP OF GRAVEL PACK 336.8

TOP OF SCREEN 336.1

BOTTOM OF SCREEN 327.1

BOTTOM OF GRAVEL PACK 326.1

BOTTOM OF BORE HOLE 326.1

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

AMERICAN ELECTRIC POWER SERVICE CORPORATION

OBSERVATION
WELL

CDS-04

AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

AEP

JOB NUMBER

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 162,921.3 E 517,496.0**

GROUND ELEVATION **391.8** SYSTEM

BORING NO. **9244** DATE SHEET **1** OF **2**

BORING START **10/07/92** BORING FINISH **10/08/92**

PIEZOMETER TYPE WELL TYPE **SS**

HGT. RISER ABOVE GROUND DIA **2.0**

DEPTH TO TOP OF WELL SCREEN BOTTOM

WELL DEVELOPMENT BACKFILL **VOLCLAY**

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

WATER LEVEL	▽ 24.8	▽	▽
TIME			
DATE	10-7-92		

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	USCS	SOIL / ROCK IDENTIFICATION	DRILLER'S NOTES
1	SS	0.0	1.5	2-4-5	1.1				**BROWN AND GRAY CLAYEY SILT** moist	WELL NO. 8-I Second hole was drilled to install well.
2	SS	1.5	3.0	2-3-6	1.5				TRACE OF SAND,BLACK ORGANIC MATERIAL.	
3	SS	3.0	5.0	2-4-6-5	1.8					
4	ST	5.0	7.0		1.65		5		**LIGHT BROWN CLAYEY SILT** with trace of fine grain sand.	5.0 to 7.0 push 2.0, recovery 1.65, time 5, psi 500
5	ST	7.0	9.0		2.0				**BROWN SILTY CLAY**	7.0 to 9.0 2.0, recovery, push 2.0, time 5, psi 400.
6	SS	9.0	10.0	2-2	1.0		10		**BROWNISH RED SILTY CLAY**	
7	ST	10.0	12.0		2.0				**BROWN SAND** poorly graded fine to medium grain,dry.	10.0 to 12.0 push 2.0, recovery 2.0, time 5, psi 250.
8	SS	12.0	13.5	10-12-15	1.5				dry to moist.	
9	SS	13.5	15.0	10-15-23	1.4					
10	SS	15.0	16.5	12-16-25	1.4		15		**BROWN SAND** well graded, moist, quartz.	
11	SS	16.5	18.0	15-17-18	1.0					
12	SS	18.0	19.5	10-12-15	1.2				**BROWN GRAVELLY SAND** MOIST, 1"MAXIMUM SIZE, QUARTZ.	
13	SS	19.5	21.0	15-17-21	1.0		20			
14	SS	21.0	22.5	15-19-28	1.2				**BROWN SAND** MOIST, WELL GRADED, QUARTZ.	
15	SS	22.5	24.0	12-20-24	1.5				SATURATED	
16	SS	24.0	25.5	9-16-19	1.2		25			
17	SS	25.5	27.0	7-9-9	1.5					
18	SS	27.0	28.5	4-6-11	1.4				**BROWN SAND AND GRAVEL** saturated, quartz, 1/2 maximum.	
19	SS	28.5	30.0	5-7-9	1.2					
20	SS	30.0	31.5	4-5-6	1.2		30		**BROWN SAND** saturated, quartz, well graded. trace of small gravel.	
21	SS	31.5	33.0	3-4-4	1.5					
22	SS	33.0	34.5	4-5-5	1.1					
23	SS	34.5	36.0	7-10-13	1.5		35			
24	SS	36.0	37.5	8-12-16	.8					36.0 started washing out hole with mud to keep plug out.
25	SS	37.5	39.0	5-13-17	1.2				trace of small gravel.	
26	SS	39.0	40.5	4-8-17	1.0		40		**BROWN SAND** medium to fine grain, saturated, quartz.	
27	SS	41.9	43.4	5-9-10	1.2					
28	SS	44.4	45.9	12-16-19	1.5		45			
29	SS	46.9	48.4	5-14-16	1.4				**BROWN SAND** fine grain, saturated, quartz.	

Continued Next Page

TYPE OF CASING USED

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

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

WELL TYPE: OW = OPEN TUBE, GM = GEOMON

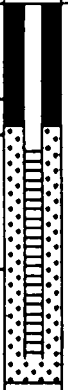
RECORDER

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NUMBER ____________

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. 9244 DATE ________ SHEET 2 OF 2

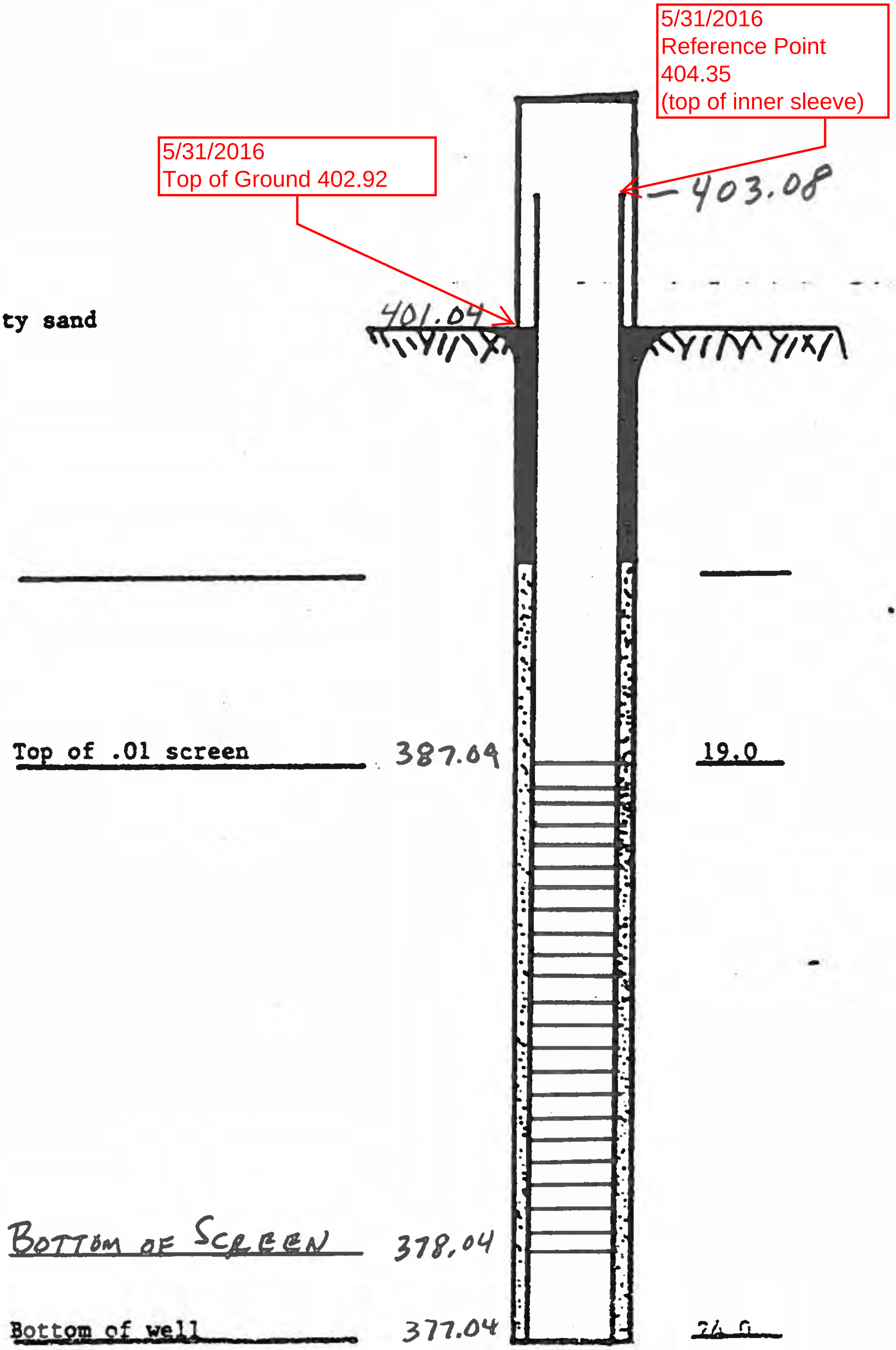
PROJECT **ROCKPORT PLANT** BORING START 10/07/92 BORING FINISH 10/08/92

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
30	SS	49.4	50.9	8-12-15	1.5							50.0 top of bentonite seal.
31	SS	50.9	52.4	10-16-17	1.0							
32	SS	52.4	53.9	7-8-10	1.3							
33	SS	53.9	55.4	10-12-13	1.3		55			**GRAY SAND** fine to course grain, saturated, quartz.		
34	SS	55.4	56.9	11-17-18	1.5					**GRAY SAND** fine grain, saturated, quartz.		55.0 top of gravel pack.
35	SS	56.9	58.4	9-12-16	1.5							55.5 to 56.9 spacer.
36	SS	58.4	59.9	5-10-23	1.5					1" LAYER OF LIGNITE		55.7 top of screen.
							60					
37	SS	61.9	63.4	8-10-14	1.1					**GRAY SAND** well graded, saturated, quartz.		
~~38~~	~~SS~~	~~64.4~~	~~65.9~~	~~9-10-12~~	~~1.2~~		65					64.0 to 65.4 spacer. 64.7 bottom of screen.
39	SS	66.9	68.4	2-3-7-	1.5					**GRAY SAND** fine to medium grain, saturated, quartz.		65.7 Bottom of gravel pack.
40	SS	69.4	69.8	50/4	-					**GRAY CLAY SHALE**		Hole drilled with 6.25 augers with stainless steel plate remaining in bottom of hole and using new premade bentonite donuts.

I & M
Rockport Plant
Ash Storage Area
Well No. 9-S
5-23-84

MW-9S

2" PVC Pipe
Installed well 10 ft. into silty sand



AME. ,AN ELECTRIC POWER SERVICE COR. ,RATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

AEP

MW-9

JOB NUMBER

COMPANY INDIANA MICHIGAN POWER COMPANY

PROJECT ROCKPORT PLANT

COORDINATES N 165,472.1 E 521,801.1

GROUND ELEVATION 401.6 SYSTEM

BORING NO. 9909 DATE 4/27/99 SHEET 1 OF 1

BORING START 2/11/99 BORING FINISH 2/11/99

PIEZOMETER TYPE WELL TYPE OW

HGT. RISER ABOVE GROUND DIA

DEPTH TO TOP OF WELL SCREEN BOTTOM

WELL DEVELOPMENT BACKFILL Grout

FIELD PARTY MCR-DLB RIG BK-81

WATER LEVEL	▽	▼	▼
TIME			
DATE			

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	SAMPLE DEPTH IN FEET TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	2.0	1-1-2-2	2.0		CL	BROWN FINE GRAIN SANDY CLAY Dry		Water for drilling and grouting came from fire protection well at Rockport Plant.
2	SS	2.0	4.0	2-2-2-3	2.0		CL	TAN to LIGHT BROWN SILTY CLAY With trace of fine grain sand, dry.		
3	SS	4.0	6.0	2-2-2-4	2.0					Grouted from 44.9' to grade; used approx. 40 gallons (1.5 bags).
4	SS	6.0	8.0	2-3-4-5	2.0					
5	SS	8.0	10.0	3-3-4-5	1.8		SP	REDDISH BROWN FINE GRAIN SILTY SAND Moist.		
6	SS	10.0	12.0	1-1-1-2	1.7		SP	BROWN FINE GRAIN SAND Wet.		No quick gel used when soil sampling.
7	SS	12.0	14.0	2-2-3-4	2.0		SP	DARK BROWN to LIGHT BROWN FINE GRAIN SAND Moist.		
8	SS	14.0	16.0	2-2-2-3	2.0					
9	SS	16.0	18.0	1-1-4-5	2.0		SP	LIGHT BROWN FINE to MEDIUM GRAIN SAND Wet.		
10	SS	18.0	20.0	5-16-7-6	2.0		SW	LIGHT BROWN to DARK BROWN WELL GRADED MEDIUM GRAIN SAND Moist.		
11	SS	20.0	22.0	3-3-5-8	2.0					
12	SS	22.0	24.0	3-4-5-8	2.0					
13	SS	24.0	26.0	5-8-13-37	2.0					
							SP	POORLY GRADED SAND With pea to 1/2" gravels, moist.		
14	NQ-2	29.0	29.9		0			NO RECOVERY		Auger refusal at 29.0' Pulled tools. Inner tube not latching. Took this core from inside of core barrel. All return drill water showed gray clay shale.
15	NQ-2	29.9	34.9		3.0			BLUISH GRAY SHALE		
16	NQ-2	34.9	39.9					GRAY FINE GRAIN SANDY CLAY SHALE		
17	NQ-2	39.9	44.9							
										Stopped boring at 44.9' on 2/11/99

TYPE OF CASING USED

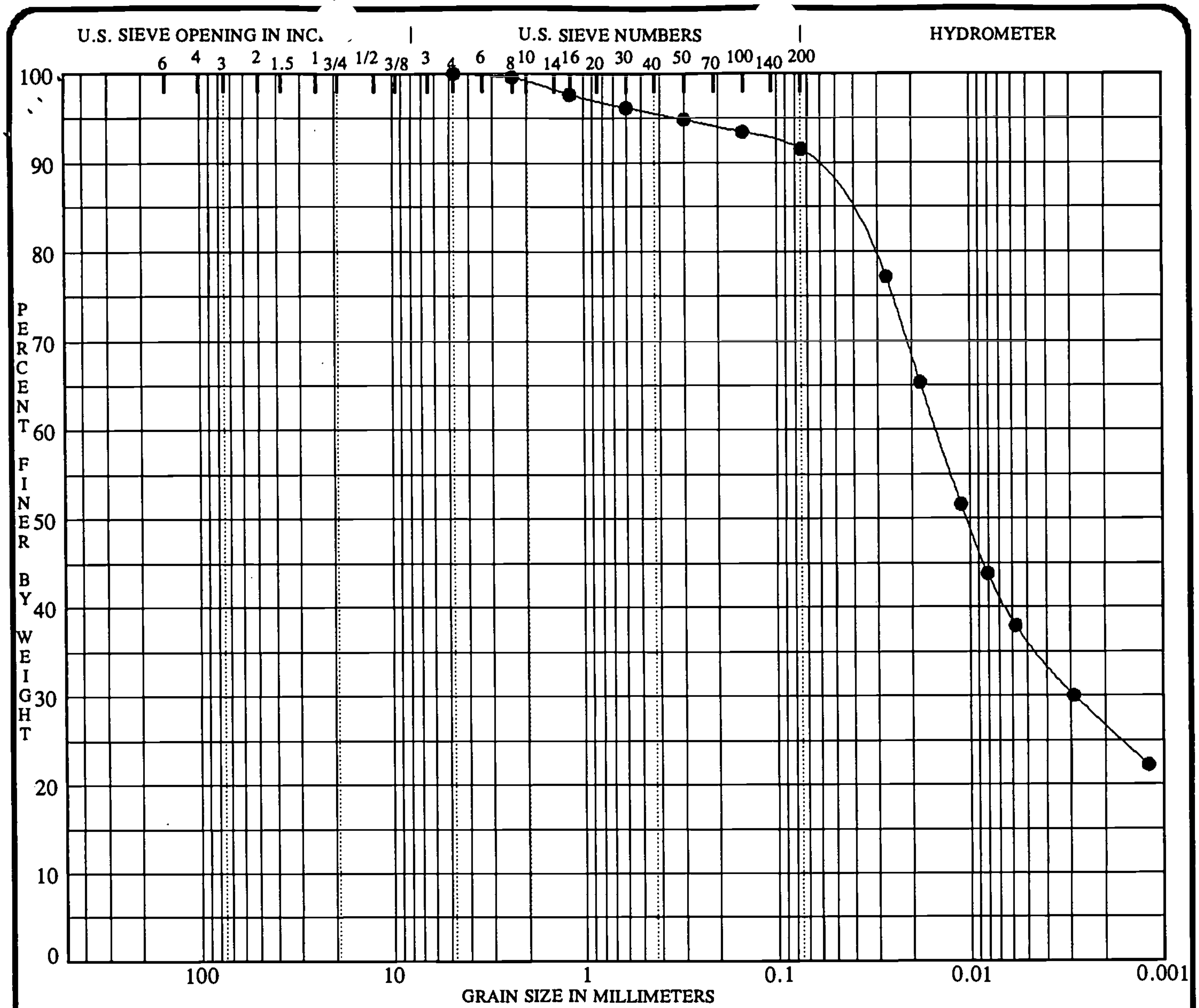
X	NQ-2 ROCK CORE	
X	6" x 3.25 HSA	
	9" x 6.25 HSA	
	HW CASING ADVANCER	4"
	NW CASING	3"
	SW CASING	6"
	AIR HAMMER	8"

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 DLB

AEP RKPT.GPJ AEP_FULL.GDT 4/27/99



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI	Sp.Gr.	
●	9909	2.0			35.0	18.8	16.2		
			LEAN CLAY CL						
			COMPOSITE 2.0'-8.0'						

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
●	9909	2.0	4.750	0.015	0.003		0.0	8.5	91.5	26.7

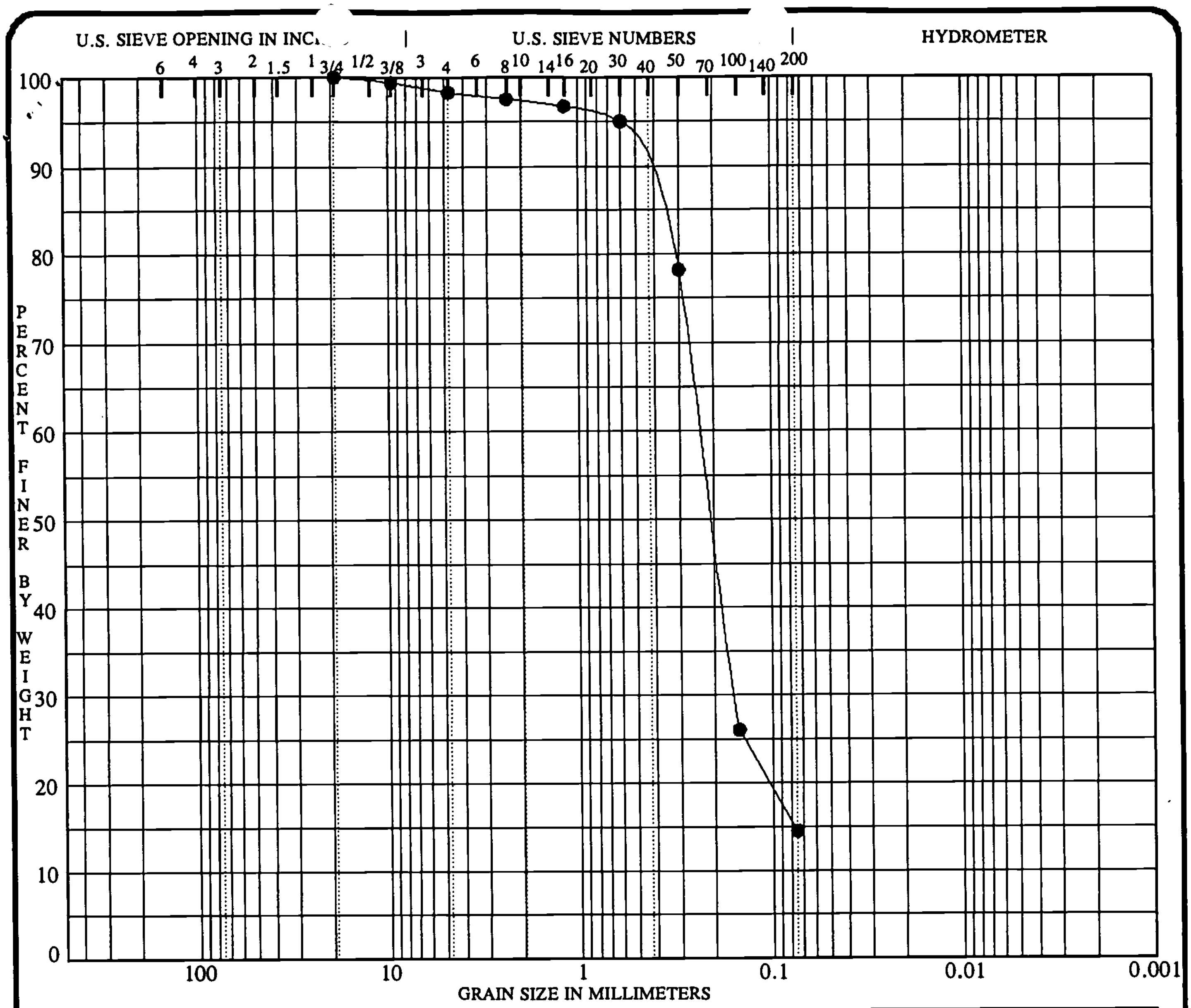
PROJECT ROCKPORT PLANT - ROCKPORT, INDIANA

JOB NO. WO#SC3750
DATE 06/01/99

GRADATION CURVES

American Electric Power Service Corp.
Groveport, Ohio

AEP



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
●	9909 16.0			NP	NP	NP		
		SILTY SAND SM						
		COMPOSITE SAMPLE 16.0'-26.0'						

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
●	9909 16.0	19.000	0.236	0.158		1.7	83.8	14.5	

PROJECT ROCKPORT PLANT - ROCKPORT, INDIANA

JOB NO. WO#1352
DATE 04/22/99

GRADATION CURVES

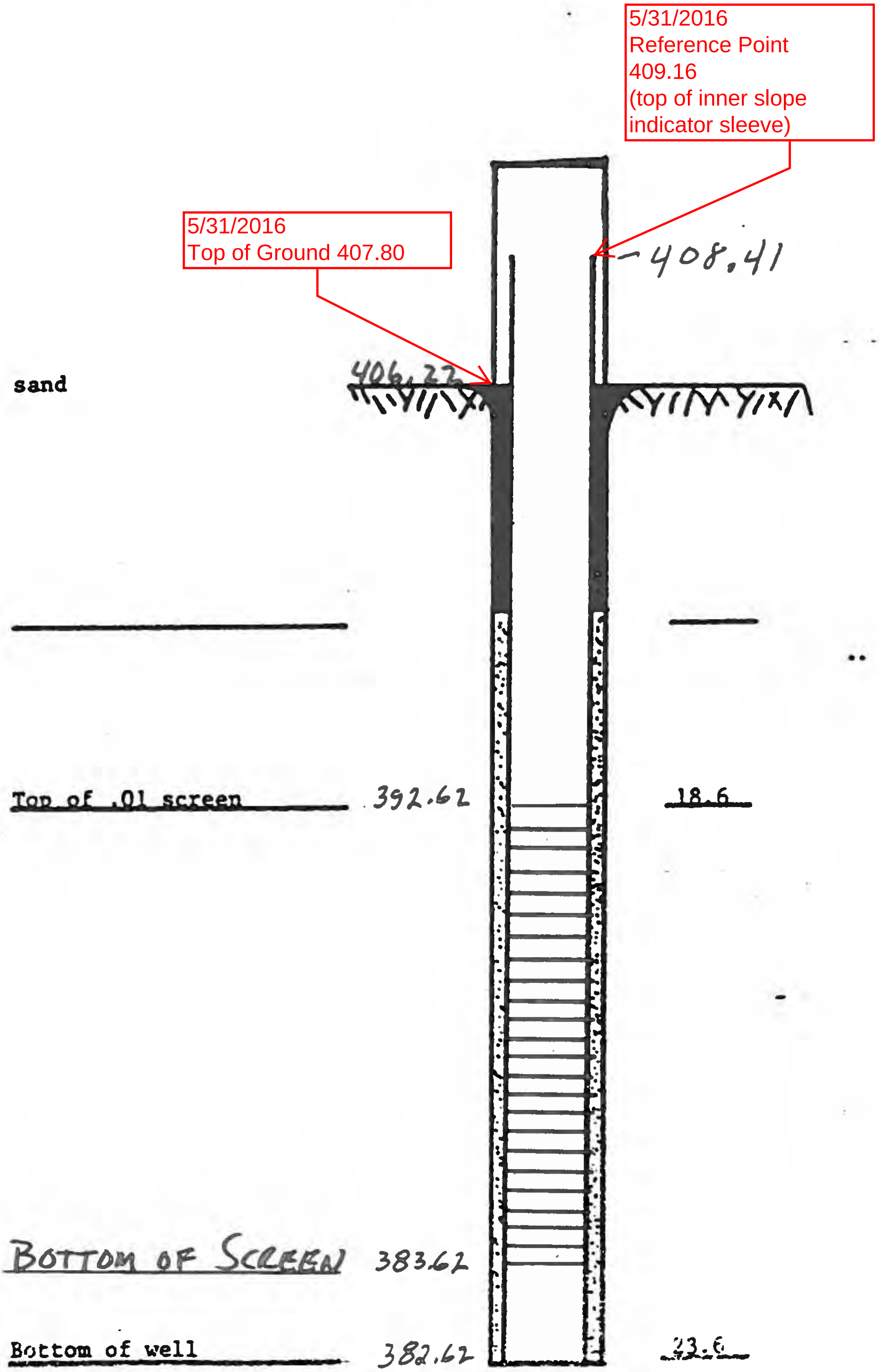
American Electric Power Service Corp.
Groveport, Ohio

AEP

I & M
Rockport Plant
Ash Storage Area
Well No. 10-S
5-23-84

MW-10S

2" PVC Pipe
Installed well 10 ft. in silty sand



5/31/2016
Reference Point
409.16
(top of inner slope indicator sleeve)

5/31/2016
Top of Ground 407.80

AME AN ELECTRIC POWER SERVICE COR RATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER ____________

COMPANY INDIANA MICHIGAN POWER COMPANY

PROJECT ROCKPORT PLANT

COORDINATES N 166,560.6 E 520,751.6

GROUND ELEVATION 406.4 SYSTEM ____________

MW-10

BORING NO. 9910 DATE 4/27/99 SHEET 1 OF 2

BORING START 2/11/99 BORING FINISH 2/11/99

PIEZOMETER TYPE ____________ WELL TYPE OW

HGT. RISER ABOVE GROUND ____________ DIA ____________

DEPTH TO TOP OF WELL SCREEN ____________ BOTTOM ____________

WELL DEVELOPMENT ____________ BACKFILL Grout

FIELD PARTY MCR-DLB RIG BK-81

WATER LEVEL	▽	▼	▼
TIME			
DATE			

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET		STANDARD PENETRATION RESISTANCE	TOTAL LENGTH RECOVERY	RQD	DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
		FROM	TO	BLOWS / 6"		%						
1	SS	0.0	2.0	1-1-1-1	2.0				CL CL	BROWN CLAY With organic BROWN SILTY CLAY Moist		Water for drilling and grouting came from fire protection well at Rockport Plant.
2	SS	2.0	4.0	1-1-1-2	2.0				CL	LIGHT BROWN SILTY CLAY Moist		
3	SS	4.0	6.0	2-2-3-4	2.0		5		CL	BROWN CLAY Stiff; moist.		Grouted from 40.0' to grade using approx. 40 gallons of grout - 1.5 bags.
4	SS	6.0	8.0	3-4-4-6	2.0				CL CL	BROWNISH GRAY CLAY Stiff BROWN CLAY Moist		
5	SS	8.0	10.0	1-2-2-3	2.0				CL	SILTY CLAY Wet		No quick gel used when soil sampling.
6	SS	10.0	12.0	2-2-3-4	2.0		10		CL	BROWN SILTY CLAY Moist		
7	SS	12.0	14.0	2-1-2-4	2.0							
8	SS	14.0	16.0	1-1-2-2	2.0		15		SW	WELL GRADED SAND Medium grained; wet.		
9	SS	16.0	18.0	2-4-4-7	2.0							
10	SS	18.0	20.0	2-3-7-9	2.0				CL	BROWN CLAY Stiff, dry.		
11	SS	20.0	22.0	9-12-15-18	2.0		20		CL	BROWN SILTY CLAY Moist		
12	SS	22.0	24.0	6-8-10-14	2.0				CL CL CL	GRAY CLAY Stiff, dry. BROWN CLAY LIGHT BROWN CLAY Stiff, moist.		
13	SS	24.0	24.7	28-50/2	0.7					LIGHT BROWN SHALE		

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 DLB

AME ,AN ELECTRIC POWER SERVICE COF RATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

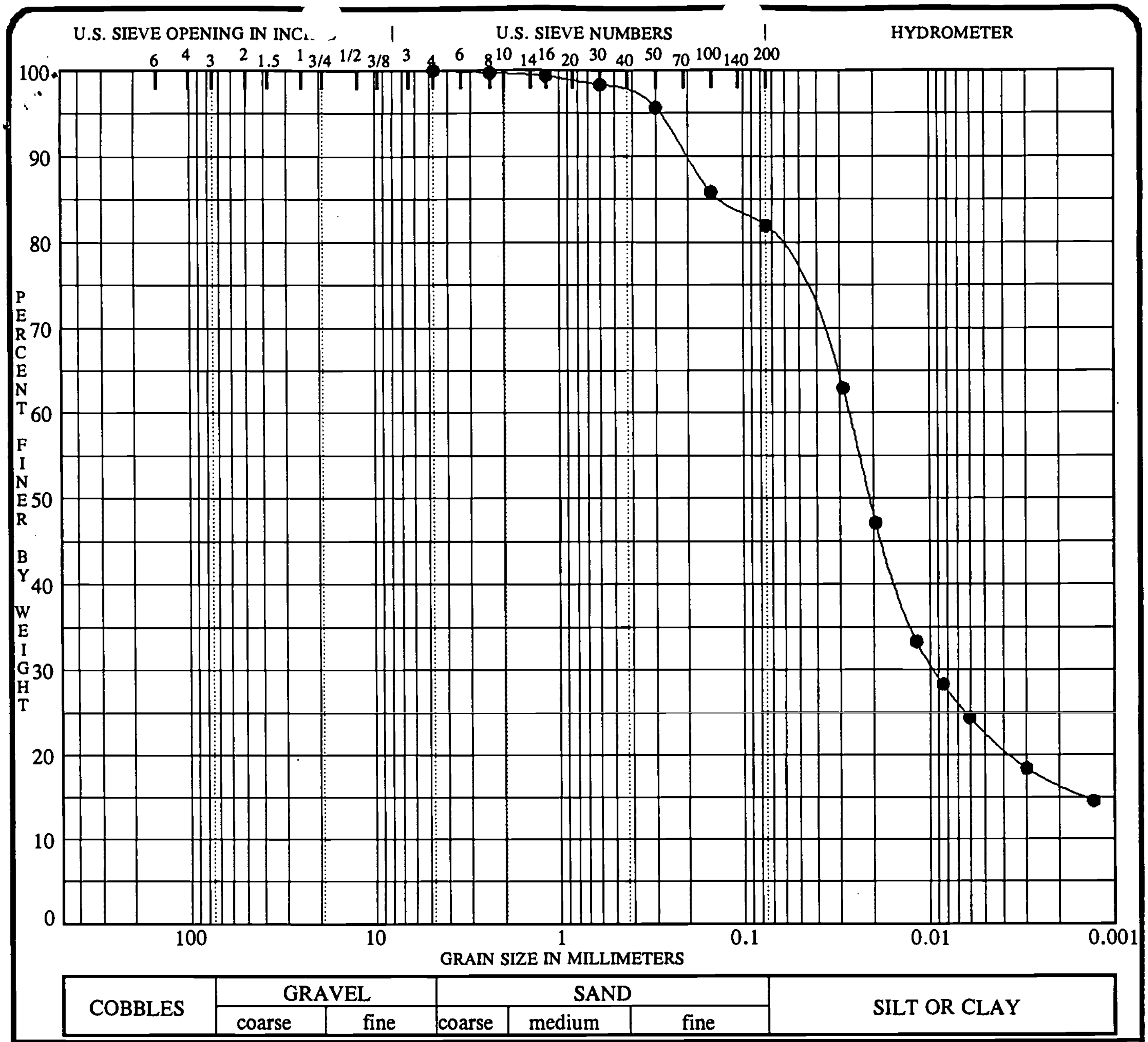
COMPANY **INDIANA MICHIGAN POWER COMPANY**

BORING NO. **9910** DATE **4/27/99** SHEET **2** OF **2**

PROJECT **ROCKPORT PLANT**

BORING START **2/11/99** BORING FINISH **2/11/99**

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
14	NQ-2	24.7	28.8		0.5					**BROWN SHALE**		Looking at core showed fine grain sand from overburden inbedded in core which was not letting core slide into inner tube and causing it to be washed away.
15	NQ-2	28.8	33.0		5.2		30			**GRAY FINE GRAIN SANDY CLAY SHALE** Medium hard, somewhat cemented.		
16	NQ-2	33.0	40.0		7.0		35					
							40					Stopped boring at 40.0' on 2/11/99



	Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
●	9910 2.0			29.5	18.1	11.5		
		LEAN CLAY with SAND CL						
		COMPOSITE 2.0'-14.0'						

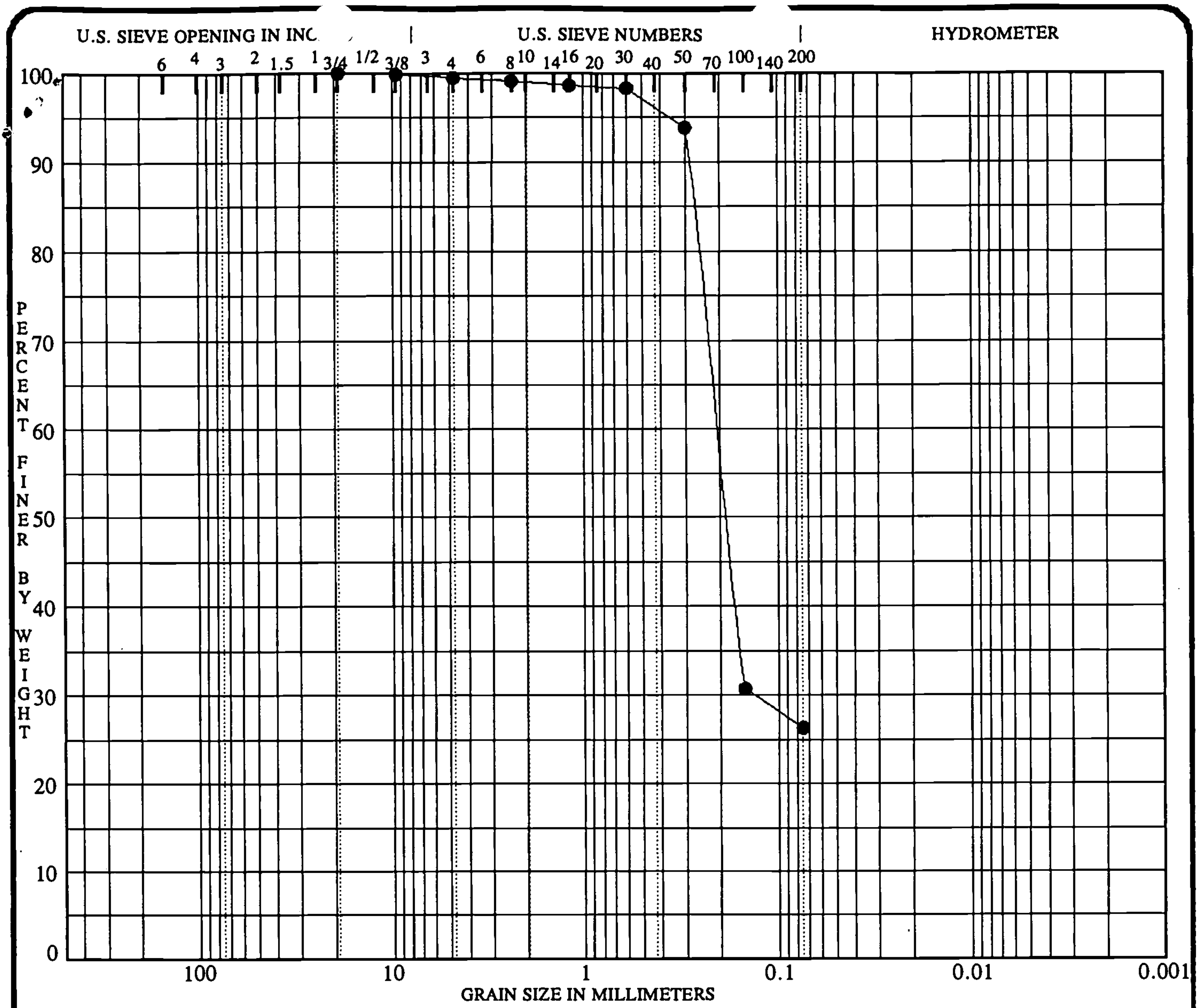
	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
●	9910 2.0	4.750	0.027	0.010		0.0	18.1	81.9	16.5

PROJECT ROCKPORT PLANT - ROCKPORT, INDIANA

JOB NO. WO#SC3750
DATE 06/01/99

GRADATION CURVES

American Electric Power Service Corp.
Groveport, Ohio



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI	Sp.Gr.	
●	9910	14.0			NP	NP	NP		
			SILTY SAND SM						
			COMPOSITE SAMPLE 14.0'-20.0'						

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Fines	% < .002
●	9910	14.0	19.000	0.207	0.134		0.5	73.2	26.3	

PROJECT **ROCKPORT PLANT - ROCKPORT, INDIANA**

JOB NO. **WO#1352**

DATE **04/22/99**

GRADATION CURVES

American Electric Power Service Corp.

Groveport, Ohio

AEP

COMPANY INDIAN AND MICHIGAN POWER CO.
PROJECT ROCKPORT ASH LANDFILL
COORDINATES N.164421.03 E.523964.21
DATE INSTALLED 11-16-92

WELL CONSTRUCTION
SUMMARY ELEVATION
(ft. NGVD)
WELL NO. 11-S
REF. DATUM PT. 399.97
GRADE 397.60

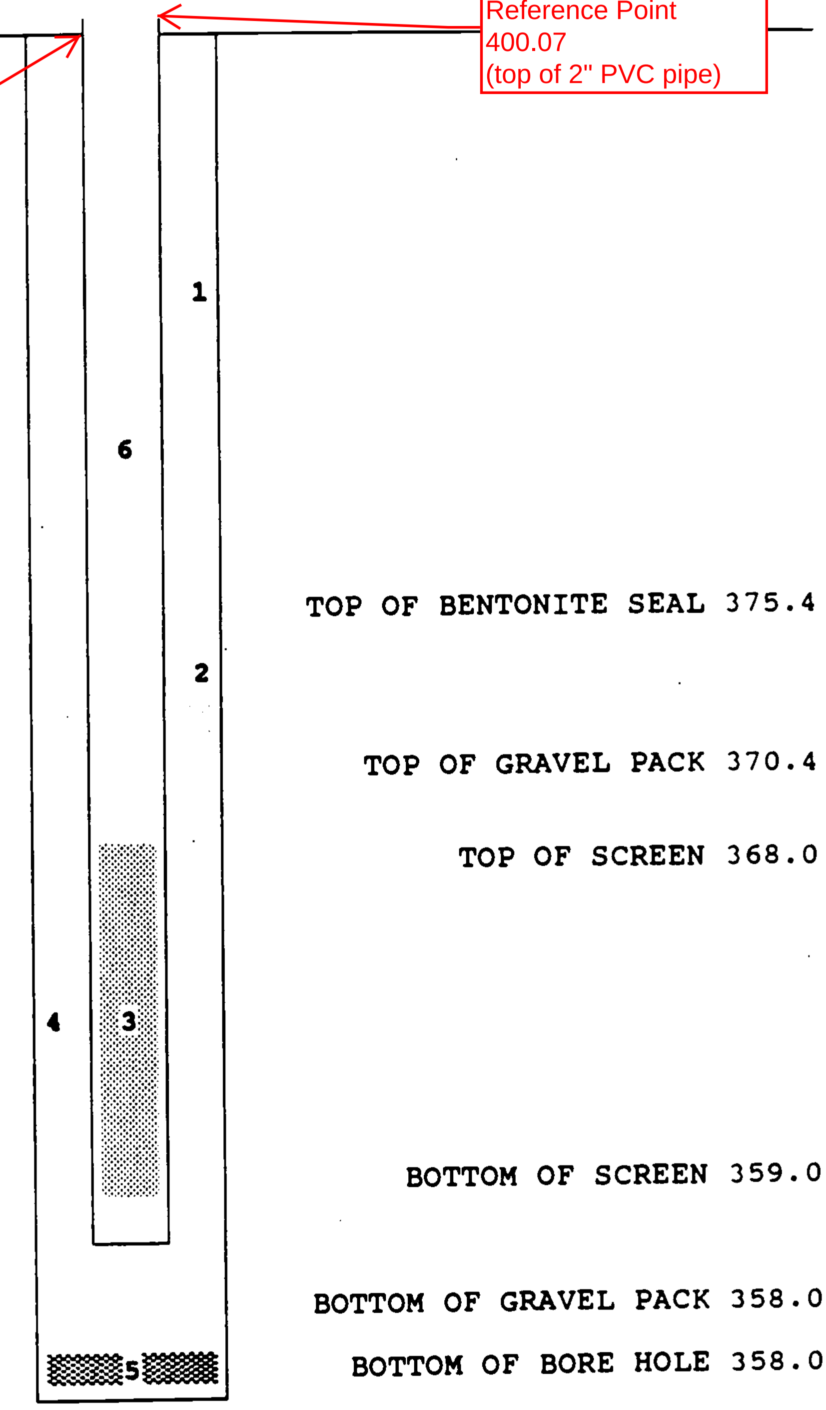
MW-11S

NOTE: CASING PROTECTOR DETAILS
NOT SHOWN

5/31/2016
Reference Point
400.07
(top of 2" PVC pipe)

5/31/2016
Top of Ground 398.22

1 GROUT SEAL VOLCLAY
2 BENTONITE SEAL
3 SCREEN 9.0 FEET
4 GRAVEL PACK
5 N.A.
6 RISER PIPE 2.0 INCH



TOP OF BENTONITE SEAL 375.4
TOP OF GRAVEL PACK 370.4
TOP OF SCREEN 368.0
BOTTOM OF SCREEN 359.0
BOTTOM OF GRAVEL PACK 358.0
BOTTOM OF BORE HOLE 358.0

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

AMERICAN ELECTRIC POWER SERVICE CORPORATION

OBSERVATION WELL

CDS-04

AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

AEP

JOB NUMBER ____
COMPANY **INDIANA MICHIGAN POWER COMPANY**
PROJECT **ROCKPORT PLANT**
COORDINATES **N 164,421.0 E 523,964.2**
GROUND ELEVATION **397.6** SYSTEM ____

BORING NO. **9230** DATE ____ SHEET **1** OF **2**
BORING START **09/25/92** BORING FINISH **09/27/92**
PIEZOMETER TYPE ____ WELL TYPE **SS**
HGT. RISER ABOVE GROUND ____ DIA **2"**
DEPTH TO TOP OF WELL SCREEN ____ BOTTOM ____
WELL DEVELOPMENT ____ BACKFILL **VOLCLAY**
FIELD PARTY **ROUSH/FOLGER** RIG **BK-81**

WATER LEVEL	▽ 34.4	▼	▼
TIME			
DATE	9-27-92		

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SPT	1.9	3.4	9-17-19	1.5					**BROWN CLAYEY SILT**, dry		WELL 11-S Hole drilled with 6.25 augers using stainless plates remaining in borings. New premade bentonite type donuts. Water induced in hole to make seal. 27.4 to 28.8 spacer. 37.9 to 39.3 spacer. Second hole drilled to install well.
2	SPT	4.4	5.9	8-9-11	1.5		5			**BROWN CLAYEY SAND**, very fine grain, dry. moist		
3	SPT	6.9	8.4		1.3							
4	SPT	9.4	10.9	6-7-7	1.0		10			**BROWN SAND**, fine to medium grain, moist.		
5	SPT	11.9	13.4	4-6-6	1.5							
6	SPT	14.4	15.9	5-7-7	1.1		15					
7	SPT	16.9	18.4	7-8-28	1.4					**SAND w/PEA GRAVEL**, medium to coarse grain, some 1/4" to 1/2" gravel.		
8	SPT	19.4	20.9	8-12-19	1.0		20					
9	SPT	21.9	23.4	7-14-27	1.5							22.2 top of bentonite seal.
10	SPT	24.4	25.9	12-20-25	1.1		25					
11	SPT	26.9	28.4	9-10-14	1.2							27.2 top of gravel pack.
12	SPT	29.4	30.9	8-14-21	1.4		30			**BROWN SAND w/PEA GRAVEL**, fine to medium grain.		29.6 top of screen.
13	SPT	31.9	33.4	5-8-14	1.0					**GRAY SAND w/PEA GRAVEL**, medium to coarse grain, wet.		
14	SPT	34.4	35.9	7-9-16	1.2		35			**BROWN SAND**, fine to medium grain with some pea gravel and 1/4" gravel.		Hit water.
15	SPT	36.9	38.4	8-10-12	.9							
16	SPT	39.4	40.9	4-6-7	.9		40					38.6 bottom of screen. Began using drill mud. 39.6 bottom of gravel pack.
17	SPT	41.9	43.4	5-7-9	1.3							
18	SPT	44.4	45.9	7-8-12	1.1		45			**BROWN SAND**, medium grain with 1" lens black organic.		
19	SPT	46.9	46.9	50/0	0							

Continued Next Page

TYPE OF CASING USED

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

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

WELL TYPE: OW = OPEN TUBE, GM = GEOMON

RECORDER ____

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **9230** DATE SHEET **2** OF **2**

PROJECT **ROCKPORT PLANT** BORING START **09/25/92** BORING FINISH **09/27/92**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
												Grouted hole with Vol-clay grout. 49.3 auger refusal. broken piece of limestone in auger.

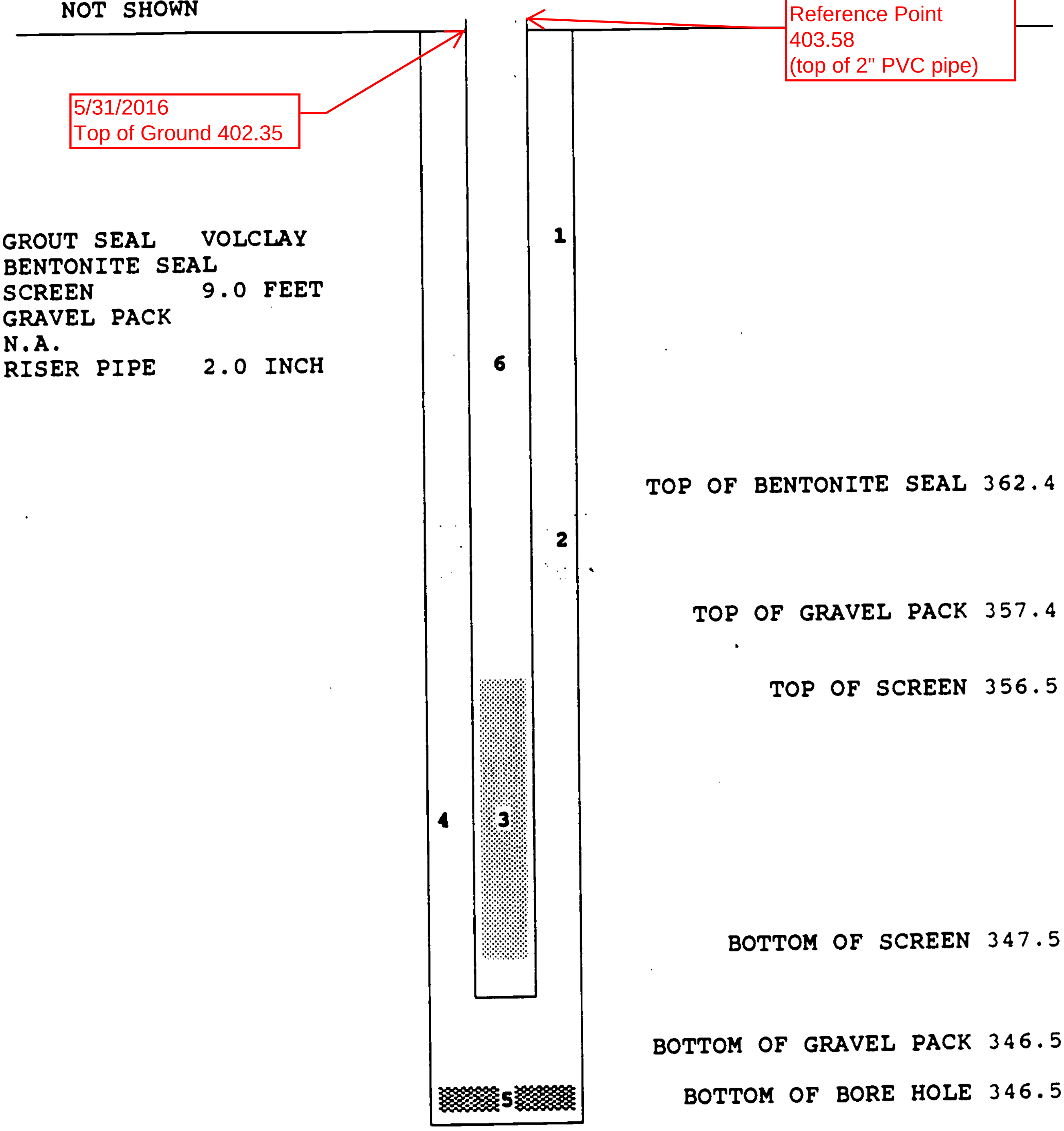
COMPANY INDIAN AND MICHIGAN POWER CO.
PROJECT ROCKPORT ASH LANDFILL
COORDINATES N.160223.99 E.523968.99
DATE INSTALLED 11-15-92

WELL CONSTRUCTION SUMMARY ELEVATION (ft. NGVD)

WELL NO.	12-S
REF. DATUM PT.	403.45
GRADE	401.57

MW-12S

NOTE: CASING PROTECTOR DETAILS
NOT SHOWN



5/31/2016
Reference Point
403.58
(top of 2" PVC pipe)

5/31/2016
Top of Ground 402.35

1	GROUT SEAL	VOLCLAY
2	BENTONITE SEAL	
3	SCREEN	9.0 FEET
4	GRAVEL PACK	
5	N.A.	
6	RISER PIPE	2.0 INCH

TOP OF BENTONITE SEAL	362.4
TOP OF GRAVEL PACK	357.4
TOP OF SCREEN	356.5
BOTTOM OF SCREEN	347.5
BOTTOM OF GRAVEL PACK	346.5
BOTTOM OF BORE HOLE	346.5

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

AMERICAN ELECTRIC POWER SERVICE CORPORATION

OBSERVATION WELL

CDS-04

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 160,224.0 E 523,969.0**

GROUND ELEVATION **401.6** SYSTEM

BORING NO. **9231** DATE SHEET **1** OF **3**

BORING START **10/28/92** BORING FINISH **11/03/92**

PIEZOMETER TYPE WELL TYPE **SS**

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

DEPTH TO TOP OF WELL SCREEN BOTTOM

WELL DEVELOPMENT BACKFILL **VOLCLAY**

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

WATER LEVEL	▽ 39.0	▼	▽
TIME			
DATE	10-28-92		

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	GRAPH LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	1.8	3.3	3-6-6	1.2					**BROWN SILT** trace of v-fine sand.		Well NO. 12-S Second hole was drilled to install well.
~~2~~	~~SS~~	~~4.3~~	~~5.8~~	~~3-5-7~~	~~1.4~~		5			**BROWN SAND** v-fine grain.		
3	SS	6.8	8.3	10-11-13	1.5					**BROWN SAND** medium grain.		
~~4~~	~~SS~~	~~9.3~~	~~10.8~~	~~1-2-1~~	~~1.5~~		10			**GRAY CLAY** moist,trace of very fine sand.		
5	SS	11.8	13.3	1-2-3	1.5					**BROWN SILTY CLAY** moist.		
~~6~~	~~SS~~	~~14.3~~	~~15.8~~	~~1-1-2~~	~~1.5~~		15					
7	SS	16.8	18.3	1-1-2	1.5					**16.8 moist to wet.**		
~~8~~	~~SS~~	~~19.3~~	~~20.8~~	~~6-8-10~~	~~1.0~~		20			**BROWN SAND** fine grain, moist to wet.		
9	SS	21.8	23.3	10-12-14	.6					**SAND** fine to medium grain.		
~~10~~	~~SS~~	~~24.3~~	~~25.8~~	~~7-12-16~~	~~.9~~		25					
11	SS	26.8	28.3	6-6-11	1.3							
~~12~~	~~SS~~	~~29.3~~	~~30.8~~	~~7-10-11~~	~~1.2~~		30					
13	SS	31.8	33.3	9-10-14	1.0							
~~14~~	~~SS~~	~~34.3~~	~~35.8~~	~~9-8-12~~	~~1.0~~		35					
15	SS	36.8	38.3	8-14-16	1.0					**BROWN GRAVELLY SAND** moist to wet.		
~~16~~	~~SS~~	~~39.3~~	~~40.8~~	~~12-16-17~~	~~.9~~		40			39.3 saturated.		39.1 Top of bentonite seal.
17	SS	41.8	43.3	8-12-13	1.2							41.8 STARTED USE DRILL MUD TO WASH OUT PLUG.
~~18~~	~~SS~~	~~44.3~~	~~45.8~~	~~6-10-15~~	~~1.0~~		45					44.1 Top of gravel pack.
19	SS	46.8	48.3	4-6-9	1.5					**BROWN SAND** fine grain.		45.0 Top of screen.

Continued Next Page

TYPE OF CASING USED

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

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

WELL TYPE: OW = OPEN TUBE, GM = GEOMON

RECORDER

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NUMBER
COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **9231** DATE SHEET **2** OF **3**
PROJECT **ROCKPORT PLANT** BORING START **10/28/92** BORING FINISH **11/03/92**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
20	SS	49.3	50.8	5-10-11	1.5					1/4" black seam of organic material.		
21	SS	51.8	53.3	4-8-7	1.0					**BROWN/GRAY SAND** medium to course grain.		
22	SS	54.3	55.8	5-10-12	1.3		55			**BROWN/GRAY GRAVELLY SAND**		54.0 Bottom of screen. 55.0 Bottom of gravel pack. Hole drilled with 6.25 augers and stainless plates remaining in hole. Bentonite seal premade bentonite donuts. 45.2-47.6 spacer. 53.3-54.7 spacer.
23	SS	56.8	58.3	10-14-17	1.5					**BROWN SAND** fine grain		
24	SS	59.3	60.8	8-12-15	.9		60			**GRAY GRAVELLY SAND**		
25	SS	61.8	63.3	10-12-14	1.2					**BROWN/GRAY SAND** medium grain		
26	SS	64.3	65.8	11-14-16	1.0		65			fine to medium grain		
27	SS	66.8	68.3	10-14-16	1.2					**GRAY SAND** medium to course grain.		
28	SS	69.3	70.8	8-12-14	1.5		70					
29	SS	71.8	73.3	4-6-7	1.3							
30	SS	74.3	75.8	10-10-15	1.2		75			**GRAY GRAVELLY SAND**		
31	SS	76.8	78.3	9-14-14	.9					**GRAY SAND**medium grain.		
32	SS	79.3	80.8	14-10-14	.9		80			**GRAY GRAVELLY SAND**		
33	SS	81.8	83.3	15-14-14	1.0					**BROWN SAND** medium to course grain.		
34	SS	84.3	85.8	25-12-10	.2		85					
35	SS	86.8	88.3	6-12-7	.9					**BROWN SAND AND GRAVEL**		
36	SS	89.3	90.8	21-20-24	1.4		90					
37	SS	91.8	93.3	19-25-26	1.3					**BROWN SAND** COURSE GRAIN,		
38	SS	94.3	95.8	14-11-13	1.2		95					95.0 started drilling through cobbles
39	SS	96.8	98.3	26-50-50/2	.9					**BROWN SAND** fine to medium grain.		
40	SS	99.3	100.8	8-10-13	7.		100			medium grain		
41	SS	101.8	103.3	10-10-16	1.5					medium grain with top 3" gray silt.		
42	SS	104.3	105.8	5-5-10	1.5		105			silt layer .1 at top of spoon.		
43	SS	106.8	108.3	6-9-9	1.0					**GRAY SAND** medium to fine grain.		
44	SS	109.3	110.8	3-3-5			110			**GRAY SAND** fine grain with .1 reddish brown silt.		
45	SS	111.8	113.3	8-11-12	1.5					**GRAY SAND** fine grain.		

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NUMBER
COMPANY **INDIANA MICHIGAN POWER COMPANY**
PROJECT **ROCKPORT PLANT**
BORING NO. **9231** DATE SHEET **3** OF **3**
BORING START **10/28/92** BORING FINISH **11/03/92**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
46	SS	114.3	115.8	3-4-8	1.1							
47	SS	116.8	118.3	5-10-12	1.3					**GRAY SAND** medium to fine grain.		
48	SS	118.3	119.8	10-14-18								
												119.8 STOPPED BORING PER J.T. MASSEY-NORTON. volclay grout to surface

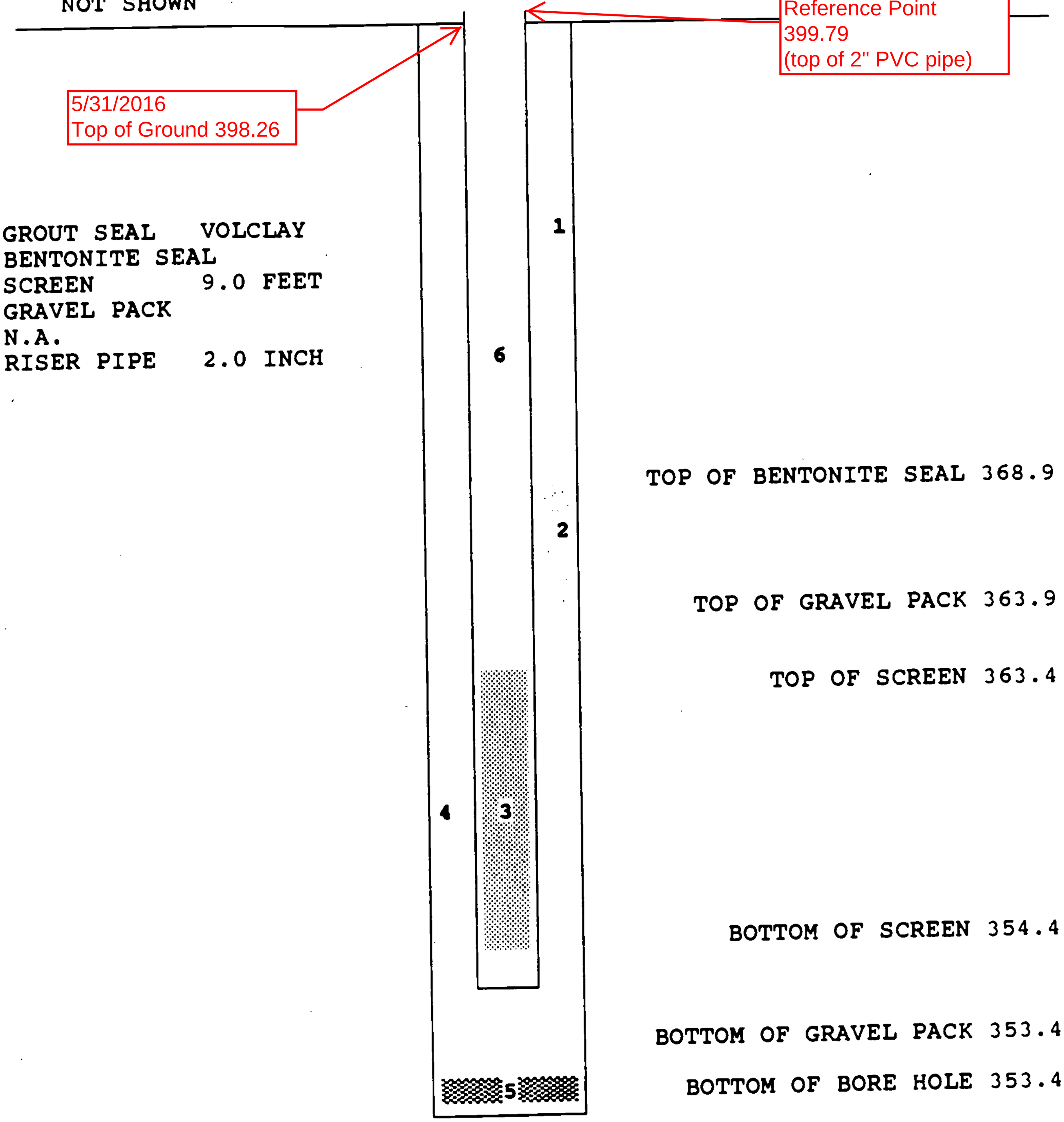
COMPANY INDIAN AND MICHIGAN POWER CO.
PROJECT ROCKPORT ASH LANDFILL
COORDINATES N.160702.32 E.521529.05
DATE INSTALLED 11-17-92

MW-13S

WELL CONSTRUCTION
SUMMARY ELEVATION
(ft. NGVD)

WELL NO.	13-S
REF. DATUM PT.	399.91
GRADE	397.92

NOTE: CASING PROTECTOR DETAILS
NOT SHOWN



5/31/2016
Reference Point
399.79
(top of 2" PVC pipe)

5/31/2016
Top of Ground 398.26

1	GROUT SEAL	VOLCLAY
2	BENTONITE SEAL	
3	SCREEN	9.0 FEET
4	GRAVEL PACK	
5	N.A.	
6	RISER PIPE	2.0 INCH

TOP OF BENTONITE SEAL	368.9
TOP OF GRAVEL PACK	363.9
TOP OF SCREEN	363.4
BOTTOM OF SCREEN	354.4
BOTTOM OF GRAVEL PACK	353.4
BOTTOM OF BORE HOLE	353.4

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

AMERICAN ELECTRIC POWER SERVICE CORPORATION

OBSERVATION
WELL

CDS-04

AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NUMBER

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 160,702.3 E 521,529.1**

GROUND ELEVATION **397.9** SYSTEM

BORING NO. **9232** DATE SHEET **1** OF **3**

BORING START **10/18/92** BORING FINISH **10/19/92**

PIEZOMETER TYPE WELL TYPE **SS**

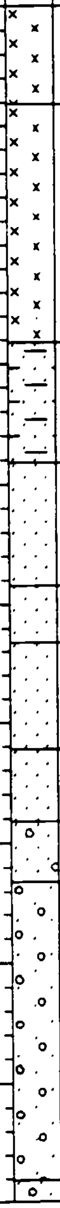
HGT. RISER ABOVE GROUND DIA **2.0**

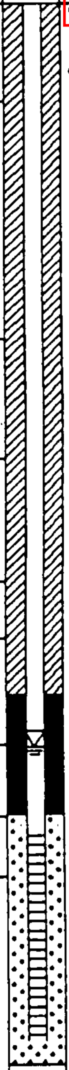
DEPTH TO TOP OF WELL SCREEN BOTTOM

WELL DEVELOPMENT BACKFILL **VOLCLAY**

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

WATER LEVEL	∇ 31.2	▼	∇
TIME			
DATE	11-18-92		





SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	1.6	3.1	3-6-8	1.5					**BROWN/GRAY CLAYEY SILT** dry		Well no. 13-S Second hole was drilled to install well.
2	SS	4.1	5.6	4-8-9	1.5		5			**BROWN SANDY CLAYEY SILT** very fine grain, dry to moist.		
3	SS	6.6	8.1	1-1-5	1.5							
4	SS	9.1	10.6	3-4-6	1.5		10					
5	SS	11.6	13.1	3-4-6	1.5							
6	SS	14.1	15.6	3-3-6	1.5		15			**CLAYEY SAND** fine grain, moist.		
7	SS	16.6	18.1	3-3-8	1.5							
8	SS	19.1	20.6	4-5-6	1.2		20			**sand** fine grain.		
9	SS	21.6	23.1	4-6-9	1.3							
10	SS	24.1	25.6	8-11-11	1.0		25			**BROWN SAND** medium grain, with some pea size gravel, moist.		
11	SS	26.6	28.1	5-7-10	1.2					**BROWN SAND** medium to course grain with pea size gravel.		
12	SS	29.1	30.6	4-7-10	1.3		30					29.0 Top of bentonite seal.
13	SS	31.6	33.1	6-8-9	1.2					**BROWN SAND** medium to course grain, moist to wet.		
14	SS	34.1	35.6	6-9-11	1.0		35			**BROWN GRAVELLY SAND** maximum size 1", saturated		34.0 Top of gravel pack. 34.0 Began washing hole with drill mud to keep out plug.
15	SS	36.6	38.1	8-12-15	1.0					**BROWN SAND AND GRAVEL**		34.5 Top of screen.
16	SS	39.1	40.6	8-11-13	1.0		40					
17	SS	41.6	43.1	10-14-16	.8							
18	SS	44.1	45.6	9-11-16	1.2		45					43.5 Bottom of screen. 44.5 Bottom of gravel pack.
19	SS	46.6	48.1	8-18-24	1.0					grading to more sand 46.6.		Hole drilled with

Continued Next Page

TYPE OF CASING USED

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

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

WELL TYPE: OW = OPEN TUBE, GM = GEOMON

RECORDER

AMERICAN ELECTRIC POWER SERVICE CORPORATION

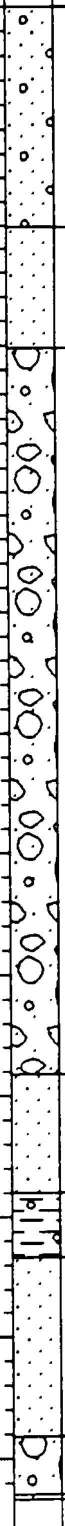
AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER ____________

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. 9232 DATE ________ SHEET 2 OF 3

PROJECT **ROCKPORT PLANT** BORING START 10/18/92 BORING FINISH 10/19/92



SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
20	SS	49.1	50.6	9-16-17	1.0				**BROWN GRAVELLY SAND** medium to course grain, pea size gravel with 1.5" limestone gravel.		6.25 augers and stainless steel plate remaining in boring. Seal made with prepacked bentonite donute.34.3-35.7 Spacer. 42.8-44.2 Spacer.
21	SS	51.6	53.1	10-18-26	1.1						
22	SS	54.1	55.6	13-18-28	1.3		55		3" LAYER OF FINE GRAIN BROWN SAND 54.3 TO 54.6.		
23	SS	56.6	58.1	11-14-18	1.5						
24	SS	59.1	60.6	7-10-12	1.5		60		**GRAY SAND** fine to medium grain with some pea size gravel.		
25	SS	61.6	63.1	6-11-11	1.2						
26	SS	64.1	65.6	8-10-12	1.0		65		**GRAY GRAVELLY SAND** medium to course grain, maximum size 1".		
27	SS	66.6	68.1	8-12-25	1.0						
28	SS	69.1	70.6	6-9-15	1.2		70				
29	SS	71.6	73.1	10-18-28	1.0						
30	SS	74.1	75.6	9-12-15	1.2		75				
31	SS	76.6	78.1	12-15-15	1.5						
32	SS	79.1	80.6	11-15-20	1.3		80				
33	SS	81.6	83.1	12-19-30	1.0						
34	SS	84.1	85.6	12-24-30	1.2		85		3"seam of pea gravel		
35	SS	86.6	88.1	13-17-28	1.3						
36	SS	89.1	90.6	6-9-14	1.0		90				
37	SS	91.6	93.1	1-2-5	0						
38	SS	94.1	95.6	13-18-26	1.5		95		**GRAY SAND** fine to medium grain, with gray sandy clay layer 94.7 to 95.0. medium grain		
39	SS	96.6	98.1	5-10-24	1.5						
40	SS	99.1	100.6	21-31-21	1.5		100		**GREENISH GRAY SILTY GRAVELLY CLAY** fine to medium grain.		
41	SS	101.6	103.1	7-10-11	1.5				**GREENISH/GRAY SILTY SAND** v-fine grain.		
42	SS	104.1	105.6	10-12-13	1.5		105		104.0 to 105.6 gravelly sand course grain		
43	SS	106.6	108.1	11-12-20	.6						
44	SS	109.1	110.6	4-6-8	1.2		110		**GRAY SAND AND GRAVEL** 1" maximum size.		
.1	SS	111.5	111.6	50/1	45				**GRAY LIMESTONE**		111.6 Auger refusal, volclay grout top 30.0 feet of hole.

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

AEP

JOB NUMBER ____________

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **9232** DATE ________ SHEET **3** OF **3**

PROJECT **ROCKPORT PLANT** BORING START **10/18/92** BORING FINISH **10/19/92**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
												This boring was off site, going to set piezometer on company property 10 to 12 feet north. Per farmer, Carl Scaggs and J. Massey-Norton.

COMPANY INDIAN AND MICHIGAN POWER CO.
PROJECT ROCKPORT ASH LANDFILL
COORDINATES N.164779.40 E.518743.82
DATE INSTALLED 12-8-922

MW-14S

WELL CONSTRUCTION
SUMMARY ELEVATION
(ft. NGVD)

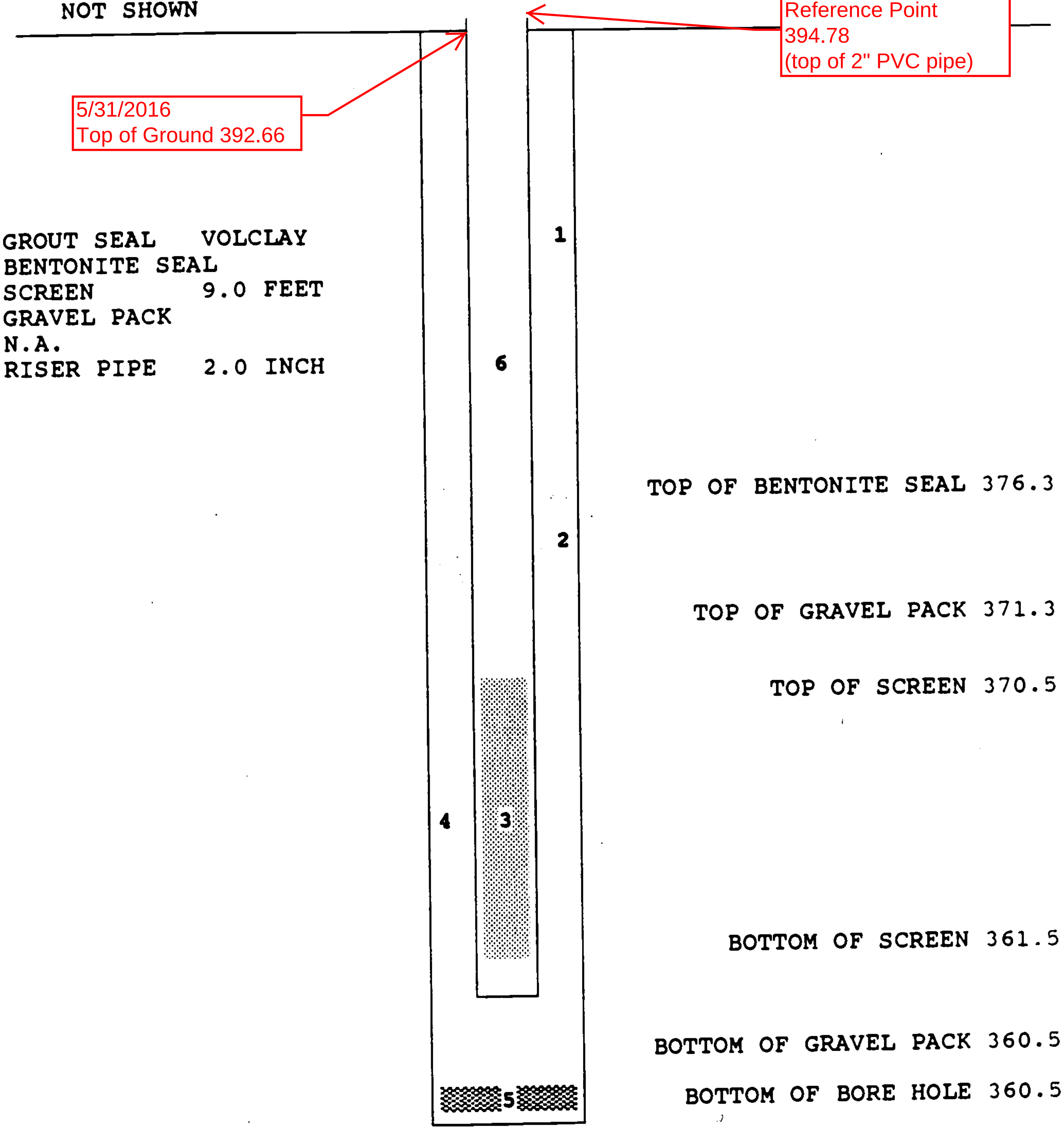
WELL NO.	14-S
REF. DATUM PT.	394.45
GRADE	392.52

5/31/2016
Reference Point
394.78
(top of 2" PVC pipe)

NOTE: CASING PROTECTOR DETAILS
NOT SHOWN

5/31/2016
Top of Ground 392.66

1 GROUT SEAL VOLCLAY
2 BENTONITE SEAL
3 SCREEN 9.0 FEET
4 GRAVEL PACK
5 N.A.
6 RISER PIPE 2.0 INCH



TOP OF BENTONITE SEAL 376.3
TOP OF GRAVEL PACK 371.3
TOP OF SCREEN 370.5
BOTTOM OF SCREEN 361.5
BOTTOM OF GRAVEL PACK 360.5
BOTTOM OF BORE HOLE 360.5

GEOTECHNICAL ENGINEERING SECTION
`IVIL ENGINEERING DESIGN

AMERICAN ELECTRIC POWER SERVICE CORPORATION

OBSERVATION WELL

CDS-04

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER			
COMPANY	INDIANA MICHIGAN POWER COMPANY	BORING NO.	9233
DATE		SHEET	1 OF 1
PROJECT	ROCKPORT PLANT	BORING START	09/27/92
BORING FINISH	09/28/92	COORDINATES	N 164,779.4 E 518,743.8
PIEZOMETER TYPE		WELL TYPE	SS
GROUND ELEVATION	392.5	SYSTEM	
HGT. RISER ABOVE GROUND		DIA	2"
DEPTH TO TOP OF WELL SCREEN		BOTTOM	
WELL DEVELOPMENT		BACKFILL	VOLCLAY
FIELD PARTY	ROUSH/FOLGER	RIG	B-81

WATER LEVEL	∇ 26.1	∇	∇
TIME			
DATE	9-28-92		

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	GRAPH LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SPT	1.7	3.2	3-9-16	1.5					**GRAY AND BROWN SILTY CLAY**, dry to moist.		Well no. 14-S Second hole was drilled to install well.
2	SS	5.0	7.0		2.0		5					
3	SS	7.0	9.0		2.0							
4	SS	10.0	12.0		2.0		10					
5	SS	12.0	14.0		.8							
6	SS	15.0	17.0		.4		15			**BROWN SAND GRAVEL**		16.2 Top of bentonite seal.
7	SS	17.0	17.2	33-50/.2	.2					**REDDISH BROWN SAND w/PEA GRAVEL**, medium to coarse grain sand, some 1/4" gravel, dry.		
8	SPT	17.2	18.5		.6							
9	SPT	19.5	21.0	8-20-25	1.4		20					21.2 Top of gravel pack. 22.0 Top of screen.
10	SPT	22.0	23.5	12-13-16	.8							
11	SPT	24.5	26.0	10-15-24	.9		25					Hit water.
12	SPT	27.0	28.5	6-5-5	1.1					**BROWN CLAYEY SAND**, medium grain, wet.		
13	SPT	29.5	31.0	4-7-12	1.3		30			**BROWN SAND**, fine to medium grain, some pea gravel, wet.		31.0 Bottom of screen.
14	SPT	32.0	33.5	4-9-11								32.0 Bottom of gravel pack.
15	SPT	34.5	34.8	50/.3	.3		35			**BROWN TO TAN SILTY CLAY SHALE**		Hole drilled with 6.25 augers and stainless steel plates remaining in hole. Seal made with prepacked bentonite donuts and water placed on seal. 22.2-23.6 Spacer. 30.3-31.7 Spacer
16	A	34.8	36.4									

TYPE OF CASING USED

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

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

WELL TYPE: OW = OPEN TUBE, GM = GEOMON

RECORDER

COMPANY INDIAN AND MICHIGAN POWER CO.
PROJECT ROCKPORT ASH LANDFILL
COORDINATES N.163584.97 E.521886.93
DATE INSTALLED 11-13-92

WELL CONSTRUCTION
SUMMARY ELEVATION
(ft. NGVD)
WELL NO. 15-S
REF. DATUM PT. 392.53
GRADE 390.53

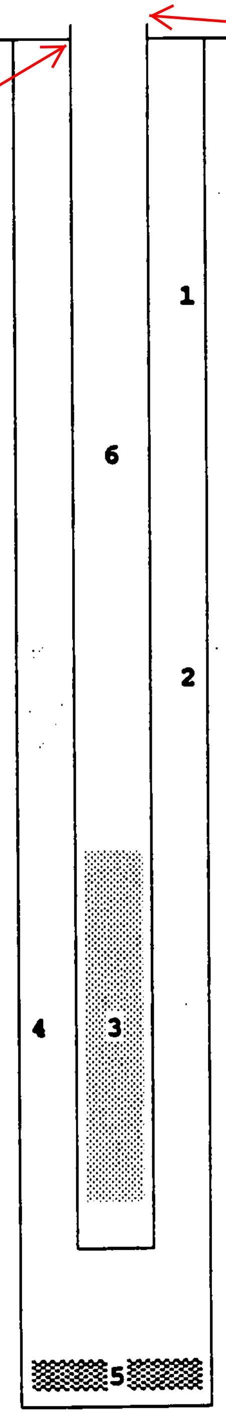
MW-15S

NOTE: CASING PROTECTOR DETAILS
NOT SHOWN

5/31/2016
Reference Point
392.46
(top of 2" PVC cap)

5/31/2016
Top of Ground 391.53

1	GROUT SEAL	VOLCLAY
2	BENTONITE SEAL	
3	SCREEN	9.0 FEET
4	GRAVEL PACK	
5	N.A.	
6	RISER PIPE	2.0 INCH



TOP OF BENTONITE SEAL 366.5
TOP OF GRAVEL PACK 361.5
TOP OF SCREEN 360.4
BOTTOM OF SCREEN 351.4
BOTTOM OF GRAVEL PACK 350.4
BOTTOM OF BORE HOLE 350.4

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

AMERICAN ELECTRIC POWER SERVICE CORPORATION

OBSERVATION
WELL

CDS-04

COMPANY INDIAN AND MICHIGAN POWER CO.
PROJECT ROCKPORT ASH LANDFILL
COORDINATES N.163578.20 E.521892.67
DATE INSTALLED 11-13-92

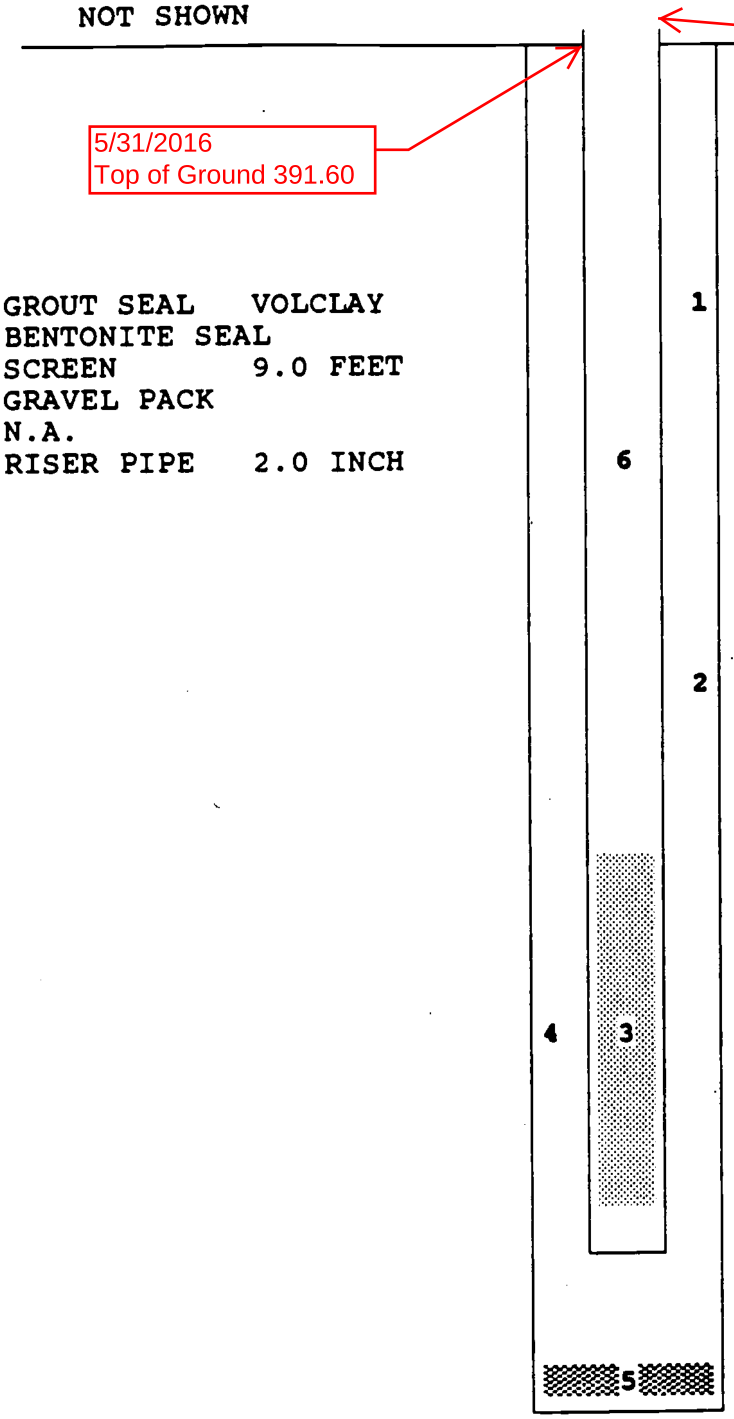
WELL CONSTRUCTION
SUMMARY ELEVATION
(ft. NGVD)
WELL NO. 15-I
REF. DATUM PT. 392.70
GRADE 390.46

MW-15I

NOTE: CASING PROTECTOR DETAILS
NOT SHOWN

5/31/2016
Reference Point
392.70
(top of 2" PVC cap)

5/31/2016
Top of Ground 391.60



1 GROUT SEAL VOLCLAY
2 BENTONITE SEAL
3 SCREEN 9.0 FEET
4 GRAVEL PACK
5 N.A.
6 RISER PIPE 2.0 INCH

TOP OF BENTONITE SEAL 340.1

TOP OF GRAVEL PACK 335.1

TOP OF SCREEN 334.7

BOTTOM OF SCREEN 325.7

BOTTOM OF GRAVEL PACK 324.7

BOTTOM OF BORE HOLE 324.7

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

AMERICAN ELECTRIC POWER SERVICE CORPORATION

OBSERVATION WELL
CDS-04

AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NUMBER

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 163,585.0 E 521,886.9**

GROUND ELEVATION **390.5** SYSTEM

BORING NO. **9234** DATE SHEET **1** OF **2**

BORING START **09/12/92** BORING FINISH **09/24/92**

PIEZOMETER TYPE WELL TYPE **SS**

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

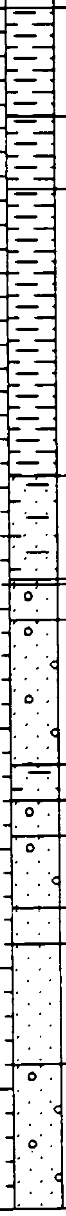
DEPTH TO TOP OF WELL SCREEN BOTTOM

WELL DEVELOPMENT BACKFILL **VOLCLAY**

FIELD PARTY **ROUSH/FOLGER** RIG **BK-81**

WATER LEVEL	▽ 24.5	▼	▽
TIME			
DATE	9-13-92		

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SPT	0.0	1.5	6-7-10	1.5					**BROWN-GRAY SILTY CLAY**, dry.		Well no. 15-S 15-I Second and third hole drilled to install wells.
2	SPT	1.5	3.0	4-4-8	1.3							
3	SPT	3.0	4.5	3-4-5	1.5							
4	SPT	4.5	6.0	5-6-9	1.5		5			**BROWN-GRAY SILTY CLAY**, with a trace of very fine grain sand, dry to moist.		
5	SPT	6.0	7.5	4-7-10	1.5							
6	SPT	7.5	9.0	3-7-9	1.5					**BROWN w/some GRAY CLAYEY SAND**, seams of each throughout.		
7	SPT	9.0	10.5	3-5-10	1.5		10					
8	SPT	10.5	12.0	3-6-9	1.1							
9	SPT	12.0	13.5	3-7-10	1.5							
10	SPT	13.5	15.0	3-4-5	1.5							
11	SPT	15.0	16.5	3-4-6	1.5		15			**BROWN SILTY CLAY, with some fine grain sand.**		
12	SPT	16.5	18.0	4-5-7	1.5							
13	SPT	18.0	19.5	2-4-4	1.5							
14	SPT	19.5	21.0	2-2-4	1.5		20			**BROWN-GRAY CLAYEY SAND, fine grain, moist.**		
15	SPT	21.0	22.5	2-2-3	1.5							
16	SPT	22.5	24.0	2-5-9	1.3							
17	SPT	24.0	25.5	12-16-20	.9		25			**BROWN CLAYEY SAND**, medium to coarse grain, moist.		24.0 Top of bentonite seal. Hit water. Water level 9-13-92.
18	SPT	25.5	27.0	8-9-12	1.2					**RUSTY BROWN SAND w/PEA GRAVEL**, medium to coarse grain, wet.		
19	SPT	27.0	28.5	6-7-8	1.3							
20	SPT	28.5	30.0	4-5-6	1.4		30					29.0 Top of gravel pack. 30.1 Top of screen.
21	SPT	30.0	31.5	7-9-14	1.5					**GRAY SAND w/PEA GRAVEL**, medium to coarse grain. some 1/4" to 1/2" gravel		
22	SPT	31.5	33.0	9-12-18	1.5							Began using drill mud.
23	SPT	33.0	34.5	7-7-10	.8					**BROWN SAND**, medium to coarse grain, with lens clay.		
24	SPT	34.5	36.0	5-7-16	1.0		35			**BROWN SAND w/GRAVEL**, medium to coarse grain.		
25	SPT	36.0	37.5	8-17-19	1.0							
26	SPT	37.5	39.0	8-11-20	1.1					**TAN-BROWN SAND w/PEA GRAVEL**, medium to coarse grain, some 1/4" to 1/2" gravel.		39.1 Bottom of screen.
27	SPT	39.0	40.5	7-14-18	1.0		40					40.1 Botttom of gravel pack.
28	SPT	41.5	43.0	10-22-24	.8					**SAND**, fine to medium grain with lens black organic.		
29	SPT	44.0	45.5	9-14-17	1.3		45			**GRAY SAND**, medium to coarse grain.		
30	SPT	46.5	48.0	7-14-20	1.0					**GRAY SAND w/PEA GRAVEL**, medium to coarse grain, 1/2" lens organic, some 1/4" to 1/2" gravel.		



Continued Next Page

TYPE OF CASING USED

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

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

WELL TYPE: OW = OPEN TUBE, GM = GEOMON

RECORDER

AMERICAN ELECTRIC POWER SERVICE CORPORATION

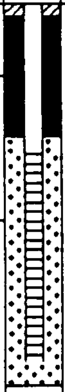
AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER ____________

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. 9234 DATE ________ SHEET 2 OF 2

PROJECT **ROCKPORT PLANT** BORING START 09/12/92 BORING FINISH 09/24/92

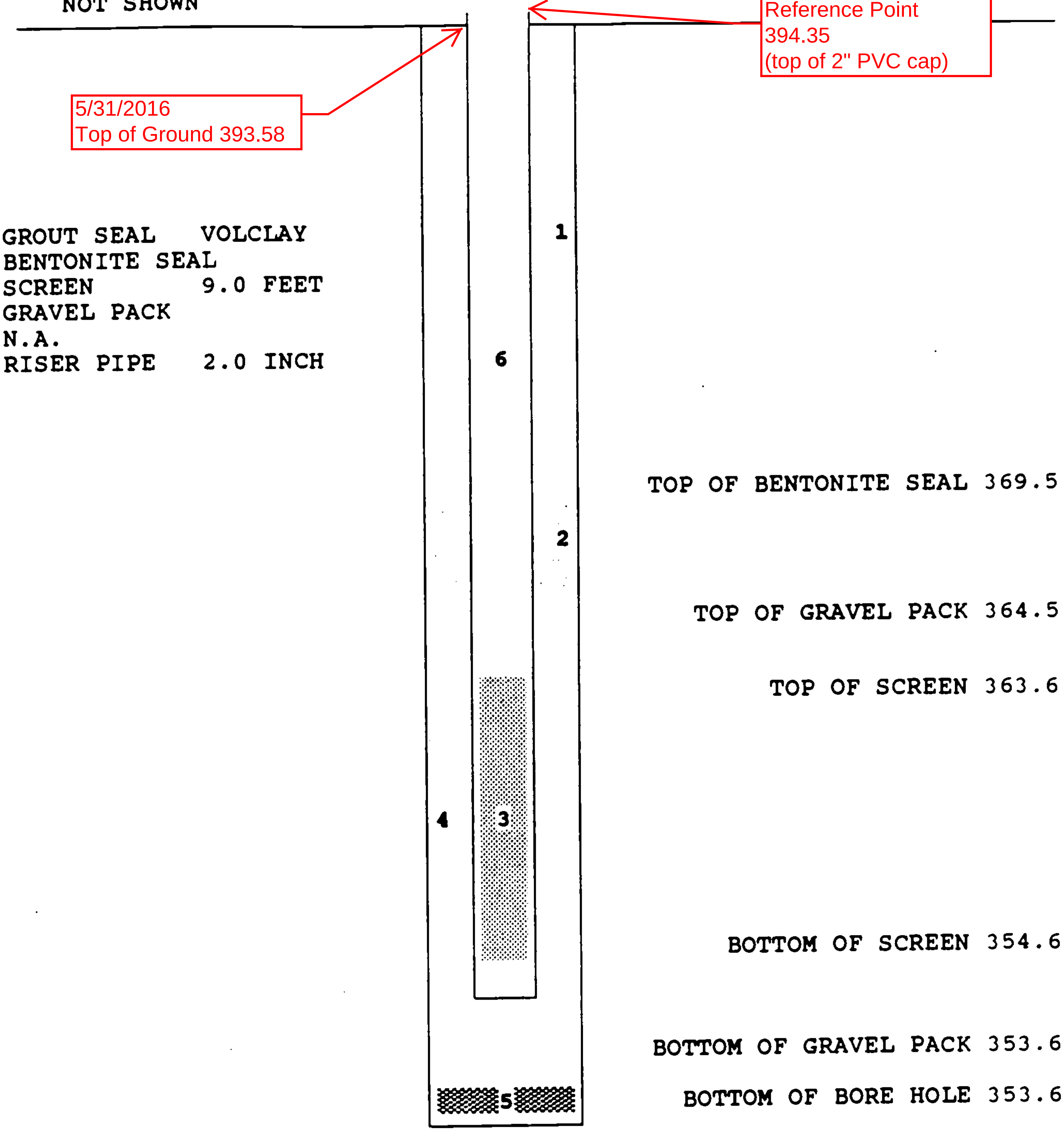
SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
31	SPT	49.0	50.0	10-15	1.0							50.5 Top of bentonite seal.
32	SPT	50.0	51.5	9-11-15	1.4							
33	SPT	51.5	53.0	12-16-18	1.4							
34	SPT	53.0	54.5	12-15-19	1.1					**GRAY SAND w/PEA GRAVEL** medium to coarse grain.		
35	SPT	54.5	56.0	10-15-22	1.5		55					
36	SPT	56.0	57.5	8-15-22	1.0							55.5 Top of gravel pack.
37	SPT	57.5	59.0	10-18-24	1.3					1/2" gravel and limestone fragments.		55.9 Top of screen.
38	SPT	59.0	60.5	14-19-27	1.4		60			**GRAVEL**, 1/4 to 3/4" with some limestone fragments and coarse grain sand.		
39	SPT	61.5	63.0	13-18-24	1.0							
40	SPT	64.0	65.5	15-19-30	1.3		65			1/4" lens of tan very fine sand, some gray clay shale.		64.9 Bottom of screen.
41	SPT	66.5	66.7	50/.2	.2					**GRAY CLAY SHALE**		65.9 Bottom of gravel pack. Holed drilled with 6.25 augers and stainless steel plate remaining in hole. Seal premade bentonite donuts . 55.7-57.1 Spacer. 64.2-65.6 Spacer 30.3-31.7 Spacer. 38.4-39.8 Spacer.
42	A	66.7	67.2									

COMPANY INDIAN AND MICHIGAN POWER CO.
PROJECT ROCKPORT ASH LANDFILL
COORDINATES N.162944.89 E.521986.62
DATE INSTALLED 12-11-92

WELL CONSTRUCTION
SUMMARY ELEVATION
(ft. NGVD)
WELL NO. 16-S
REF. DATUM PT. 394.38
GRADE 392.49

MW-16S

NOTE: CASING PROTECTOR DETAILS
NOT SHOWN



5/31/2016
Reference Point
394.35
(top of 2" PVC cap)

5/31/2016
Top of Ground 393.58

1 GROUT SEAL VOLCLAY
2 BENTONITE SEAL
3 SCREEN 9.0 FEET
4 GRAVEL PACK
5 N.A.
6 RISER PIPE 2.0 INCH

TOP OF BENTONITE SEAL	369.5
TOP OF GRAVEL PACK	364.5
TOP OF SCREEN	363.6
BOTTOM OF SCREEN	354.6
BOTTOM OF GRAVEL PACK	353.6
BOTTOM OF BORE HOLE	353.6

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

AMERICAN ELECTRIC POWER SERVICE CORPORATION

OBSERVATION
WELL

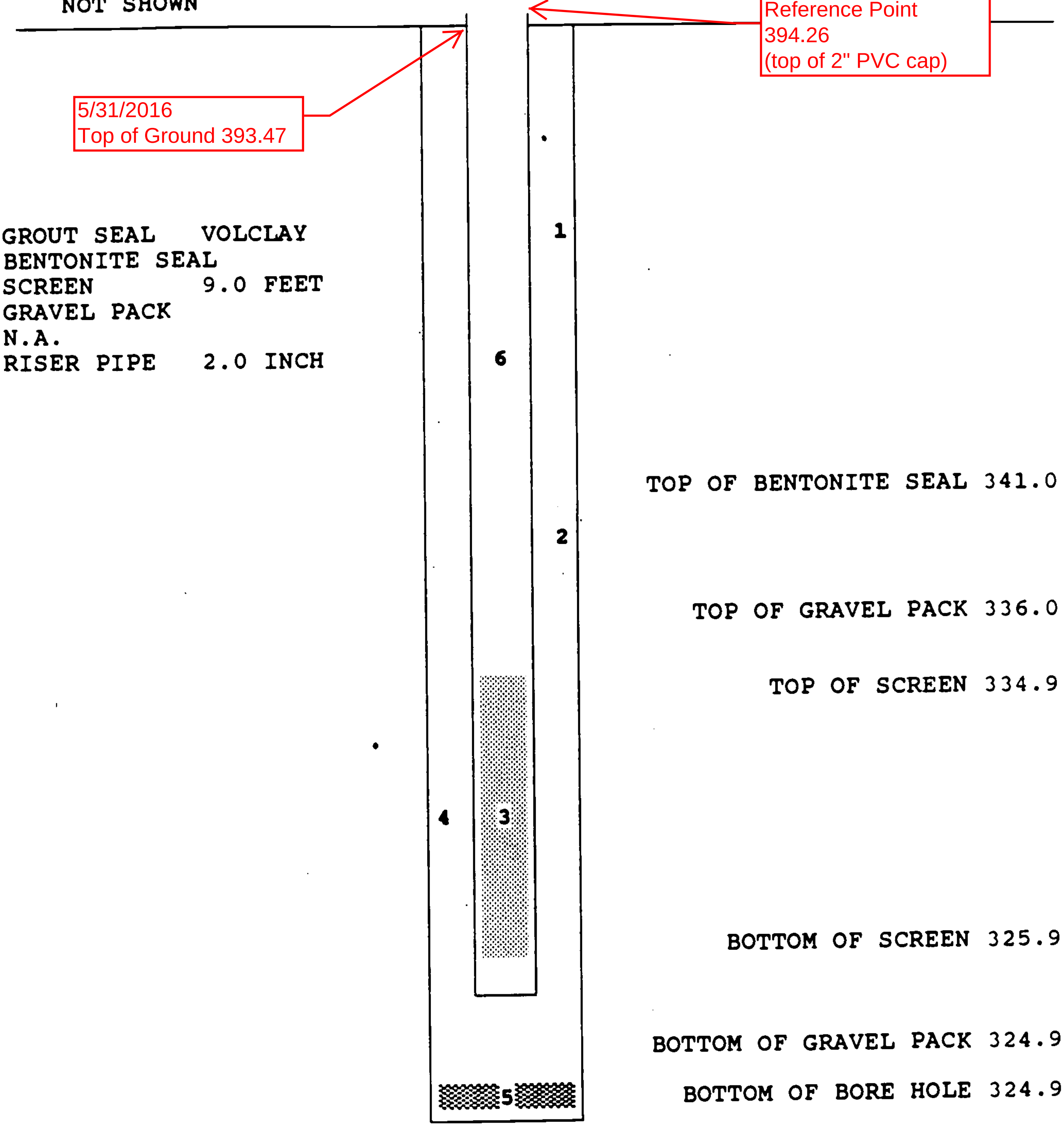
CDS-04

COMPANY INDIAN AND MICHIGAN POWER CO.
PROJECT ROCKPORT ASH LANDFILL
COORDINATES N.162943.87 E.521995.51
DATE INSTALLED 12-11-92

MW-16I

WELL CONSTRUCTION
SUMMARY ELEVATION
(ft. NGVD)
WELL NO. 16-I
REF. DATUM PT. 394.38
GRADE 392.64

NOTE: CASING PROTECTOR DETAILS
NOT SHOWN



5/31/2016
Reference Point
394.26
(top of 2" PVC cap)

5/31/2016
Top of Ground 393.47

1 GROUT SEAL VOLCLAY
2 BENTONITE SEAL
3 SCREEN 9.0 FEET
4 GRAVEL PACK
5 N.A.
6 RISER PIPE 2.0 INCH

TOP OF BENTONITE SEAL 341.0
TOP OF GRAVEL PACK 336.0
TOP OF SCREEN 334.9
BOTTOM OF SCREEN 325.9
BOTTOM OF GRAVEL PACK 324.9
BOTTOM OF BORE HOLE 324.9

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

AMERICAN ELECTRIC POWER SERVICE CORPORATION

OBSERVATION WELL
CDS-04

COMPANY INDIAN AND MICHIGAN POWER CO.
PROJECT ROCKPORT ASH LANDFILL
COORDINATES N.162946.25 E.521978.31
DATE INSTALLED 12-9-92

WELL CONSTRUCTION
SUMMARY ELEVATION
(ft. NGVD)

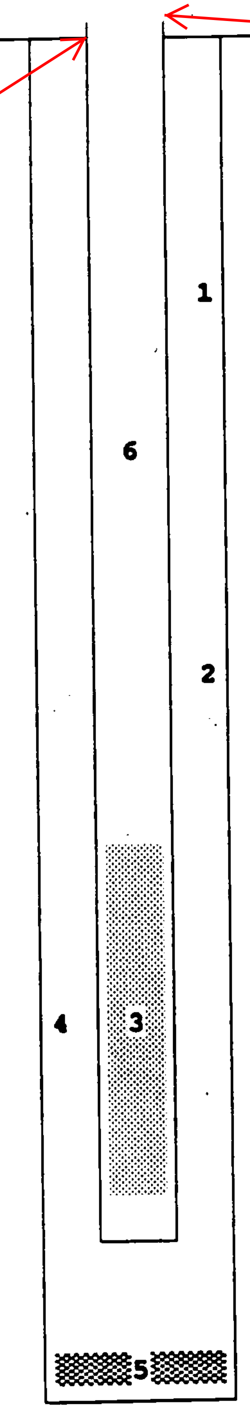
WELL NO.	16-D
REF. DATUM PT.	394.47
GRADE	392.53

MW-16D

NOTE: CASING PROTECTOR DETAILS
NOT SHOWN

5/31/2016
Reference Point
394.38
(top of 2" PVC cap)

5/31/2016
Top of Ground 393.83



1	GROUT SEAL	VOLCLAY
2	BENTONITE SEAL	
3	SCREEN	9.0 FEET
4	GRAVEL PACK	
5	N.A.	
6	RISER PIPE	2.0 INCH

TOP OF BENTONITE SEAL	308.5
TOP OF GRAVEL PACK	303.5
TOP OF SCREEN	302.8
BOTTOM OF SCREEN	293.8
BOTTOM OF GRAVEL PACK	292.8
BOTTOM OF BORE HOLE	292.8

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

AMERICAN ELECTRIC POWER SERVICE CORPORATION

OBSERVATION
WELL

CDS-04

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

AEP

JOB NUMBER ______
COMPANY **INDIANA MICHIGAN POWER COMPANY**
PROJECT **ROCKPORT PLANT**
COORDINATES **N 162,944.9 E 521,986.6**
GROUND ELEVATION **392.5** SYSTEM ______

WATER LEVEL	▽ 27.5	▼	▽
TIME			
DATE	10-14-92		

BORING NO. **9243** DATE ______ SHEET **1** OF **3**
BORING START **10/14/92** BORING FINISH **10/17/92**
PIEZOMETER TYPE ______ WELL TYPE **SS**
HGT. RISER ABOVE GROUND ______ DIA **2.0**
DEPTH TO TOP OF WELL SCREEN ______ BOTTOM ______
WELL DEVELOPMENT ______ BACKFILL ______
FIELD PARTY **MCR-GCF** RIG **BK-81**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %
1	SS	0.0	1.5	1-2-3	.8	
2	SS	1.5	3.0	11-12-13	.3	
3	SS	3.0	5.0	10-12-12	1.5	
4	ST	5.0	7.0		.2	
5	ST	7.0	9.0		0	
6	SS	9.0	10.0	20	0	
7	ST	10.0	12.0		2.0	
8	ST	12.0	14.0		2.0	
9	SS	14.0	15.0	12-15	1.0	
10	ST	15.0	17.0		1.7	
11	SS	17.0	19.0	9-13-15	1.5	
12	SS	19.0	20.5	5-8-10	1.2	
13	SS	20.5	22.0	5-10-9	1.2	
14	SS	22.0	23.5	4-5-14	1.5	
15	SS	23.5	25.0	6-18-18	1.3	
16	SS	25.0	26.5	12-13-15	1.0	
17	SS	26.5	28.0	5-9-13	1.0	
18	SS	28.0	29.5	5-6-7	1.2	
19	SS	29.5	31.0	4-6-8	1.0	
20	SS	31.0	32.5	5-5-7	1.1	
21	SS	32.5	34.0	6-9-11	1.1	
22	SS	34.0	35.5	6-6-10	1.0	
23	SS	35.5	37.0	5-5-7	.8	
24	SS	37.0	38.5	4-4-6	.7	
25	SS	38.5	40.0	13-13-9	1.0	
26	SS	41.6	43.1	7-11-15	.9	
27	SS	44.1	45.6	8-14-16	1.5	
28	SS	46.6	48.1	8-11-13	1.5	

DEPTH IN FEET: 5, 10, 15, 20, 25, 30, 35, 40, 45

GRAPH LOG

U S C S

SOIL / ROCK IDENTIFICATION

BROWN SILT dry
BROWN/GRAY SILT dry

TAN TO BROWN CLAYEY SILT

BROWN SILT with trace of very fine sand
BROWN CLAYEY SILT

REDDISH BROWN GRAY SANDY SILT fine grain.
BROWN TO TAN CLAYEY SILT with a trace of very fine sand.
BROWN SANDY SILT fine grain.
BROWN SANDY CLAYEY SILT fine grain.

BROWN/GRAY SANDY CLAY fine grain.

REDDISH/BROWN SAND medium grain with some pea size gravel,dry to moist.

BROWN GRAVELLY SAND medium to course grain, 1/2" maximum size, dry to moist.
WET

SAND medium to course grain, saturated.

BROWN SAND AND GRAVEL 1/2" maximum size.
SAME WITH 3/4" MAXIMUM SIZE.

WELL

DRILLER'S NOTES

Well no. 16-S,16-I,16-D Wells were installed in three holes.

push 2.0, recovery 2.0, time 8, psi 1200

push 2.0, recovery 1.7, time 10 psi 1500

23.0 Top of bentonite seal.

28.0 Top of gravel pack.
28.9 Top of screen.

Began useing drill mud to keep out plug.

37.9 Bottom of screen.
38.9 Bottom of gravel pack.

Continued Next Page

TYPE OF CASING USED

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

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

WELL TYPE: OW = OPEN TUBE, GM = GEOMON

RECORDER ______

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NUMBER ____________
COMPANY INDIANA MICHIGAN POWER COMPANY
BORING NO. 9243 DATE ____________ SHEET 2 OF 3
PROJECT ROCKPORT PLANT
BORING START 10/14/92 BORING FINISH 10/17/92

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
29	SS	49.1	50.6	8-11-12	.8					GRAY SAND medium to course grain		
30	SS	50.6	52.1	2-12-22	.9							51.6 Top of bentonite seal.
31	SS	52.1	53.6	7-11-16	1.0							
32	SS	53.6	55.1	6-11-17	.8							
33	SS	55.1	56.6	8-14-14	1.2		55					
34	SS	56.6	58.1	6-11-16	1.3							56.6 Top of gravel pack.
35	SS	58.1	59.6	11-11-16	1.4							57.7 Top of screen.
36	SS	59.6	61.1	6-12-15	0		60					
37	SS	61.6	63.1	13-15-15	1.1							
38	SS	64.1	65.6	14-15-15	1.0		65					
39	SS	66.6	68.1	14-16-21	1.2							66.7 Bottom of screen.
40	SS	69.1	70.6	22-26-21	1.0		70					67.7 Bottom of gravel pack.
41	SS	71.6	73.1	12-12-10	1.1							
42	SS	74.1	75.6	6-6-10	.9		75					
43	SS	76.6	78.1	7-8-10	1.5					BROWN SAND fine grain.		
44	SS	79.1	80.6	7-7-9	1.3		80					
45	SS	80.6	82.1	8-11-13	1.3							
46	SS	82.1	83.6	8-12-17	1.2							
47	SS	83.6	85.1	6-11-15	1.3							84.0 Top of bentonite seal.
48	SS	85.1	86.6	7-9-14	1.5		85					
49	SS	86.6	88.1	6-11-15	1.5							
50	SS	88.1	89.6	4-8-13	1.3		90					89.0 Top of gravel pack.
51	SS	91.6	93.1	4-6-8	1.4							89.7 Top of screen.
52	SS	94.1	95.6	5-5-8	1.3		95			BROWN SAND fine to medium grain.		
53	SS	96.6	98.1	6-7-11	1.2					medium grain.		
54	SS	99.1	100.6	4-8-11	.9		100			BROWN SAND 100.4 TO 100.5 SEAM OF CLAYEY PEA SIZE GRAVEL.		98.7 Bottom of screen.
55	SS	101.6	102.3	50-50/2	.6					BROWN CLAY SHALE weathered.		99.7 Bottom of gravel pack. 28.7-31.1 and 37.2-38.6 spacer. 57.5-58.9 and 66.0-67.4 spacer. 89.5-90.9 and 98.0-99.4 spacer. Hole was drilled with 6.25 augers and stainless steel plate remaining in hole.

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NUMBER

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **9243** DATE SHEET **3** OF **3**

PROJECT **ROCKPORT PLANT** BORING START **10/14/92** BORING FINISH **10/17/92**

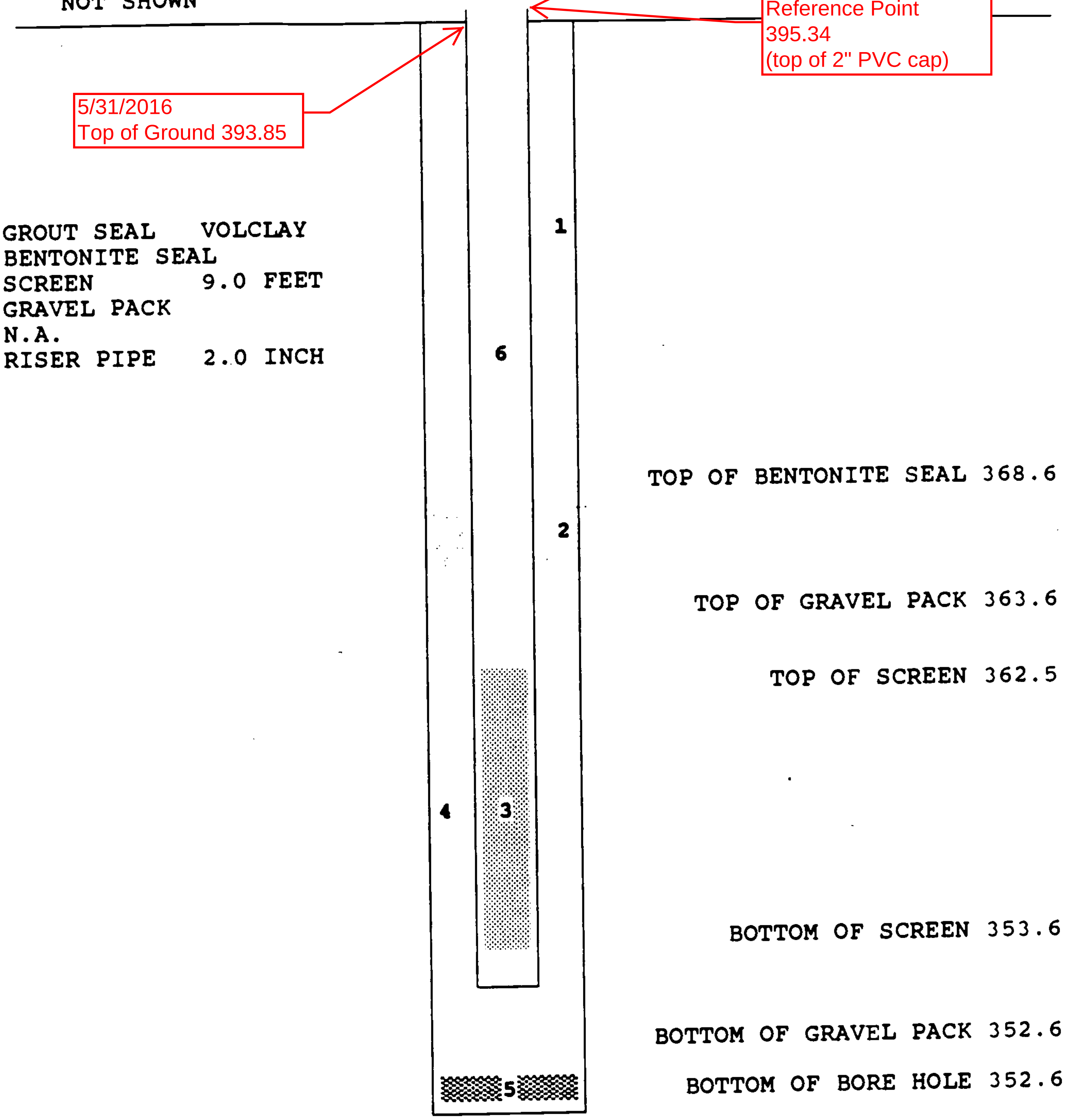
SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
												Seal was premade bentonite donuts. 102.7 Auger refusal at 102.7, volclay grouted top of boring.

COMPANY INDIAN AND MICHIGAN POWER CO.
PROJECT ROCKPORT ASH LANDFILL
COORDINATES N.164398.59 E.521162.54
DATE INSTALLED 11-1-92

MW-17S

WELL CONSTRUCTION
SUMMARY ELEVATION
(ft. NGVD)
WELL NO. 17-S
REF. DATUM PT. 395.46
GRADE 393.13

NOTE: CASING PROTECTOR DETAILS
NOT SHOWN



5/31/2016
Reference Point
395.34
(top of 2" PVC cap)

5/31/2016
Top of Ground 393.85

1	GROUT SEAL	VOLCLAY
2	BENTONITE SEAL	
3	SCREEN	9.0 FEET
4	GRAVEL PACK	
5	N.A.	
6	RISER PIPE	2.0 INCH

TOP OF BENTONITE SEAL 368.6
TOP OF GRAVEL PACK 363.6
TOP OF SCREEN 362.5
BOTTOM OF SCREEN 353.6
BOTTOM OF GRAVEL PACK 352.6
BOTTOM OF BORE HOLE 352.6

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN

AMERICAN ELECTRIC POWER SERVICE CORPORATION

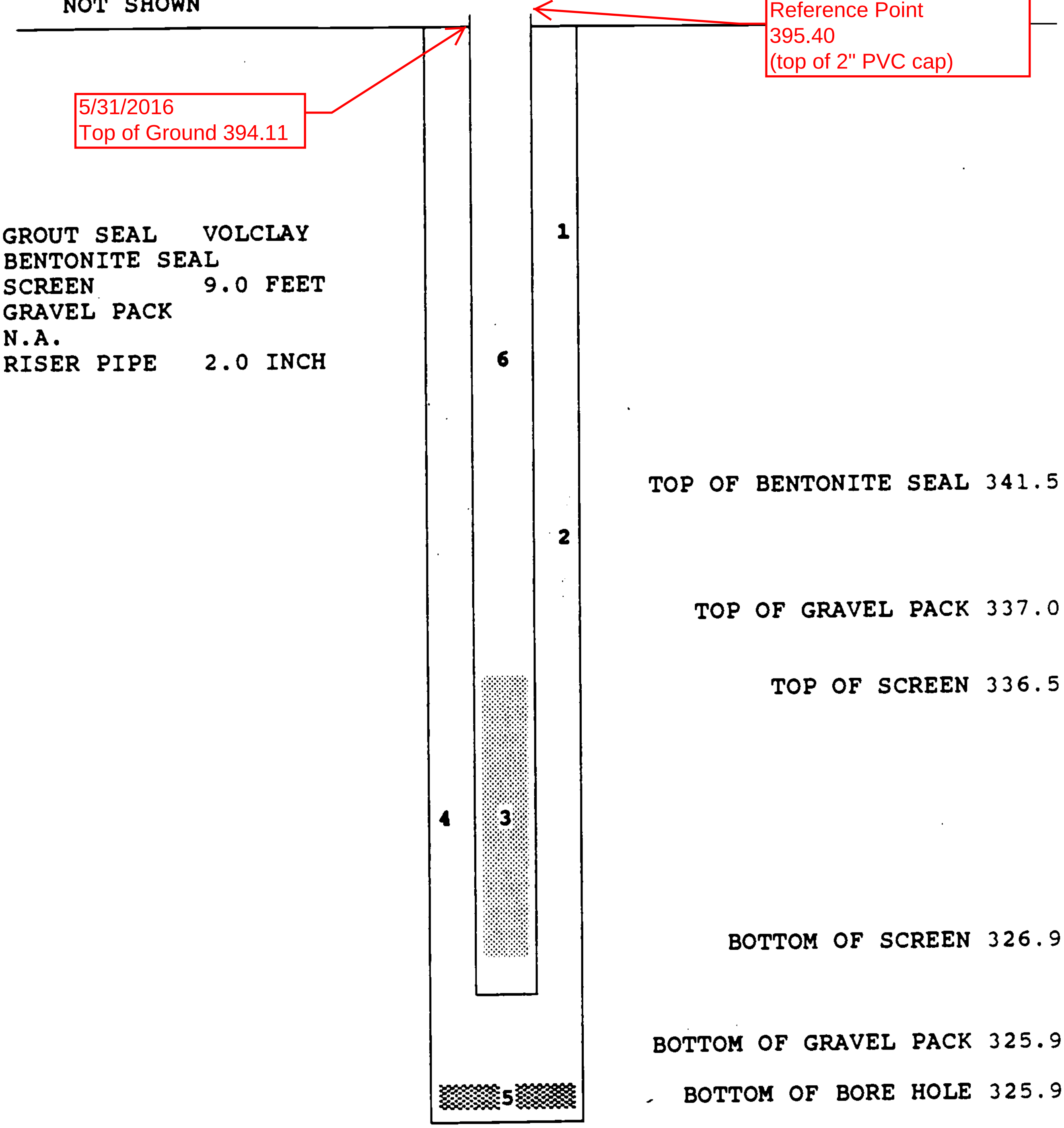
OBSERVATION WELL
CDS-04

COMPANY INDIAN AND MICHIGAN POWER CO.
PROJECT ROCKPORT ASH LANDFILL
COORDINATES N.164404.36 E.521157.17
DATE INSTALLED 11-1-92

WELL CONSTRUCTION SUMMARY ELEVATION (ft. NGVD)
WELL NO. 17-I
REF. DATUM PT. 395.29
GRADE 393.28

MW-17I

NOTE: CASING PROTECTOR DETAILS
NOT SHOWN



5/31/2016
Reference Point
395.40
(top of 2" PVC cap)

5/31/2016
Top of Ground 394.11

1 GROUT SEAL VOLCLAY
2 BENTONITE SEAL
3 SCREEN 9.0 FEET
4 GRAVEL PACK
5 N.A.
6 RISER PIPE 2.0 INCH

TOP OF BENTONITE SEAL 341.5
TOP OF GRAVEL PACK 337.0
TOP OF SCREEN 336.5
BOTTOM OF SCREEN 326.9
BOTTOM OF GRAVEL PACK 325.9
BOTTOM OF BORE HOLE 325.9

GEOTECHNICAL ENGINEERING SECTION
CIVIL ENGINEERING DESIGN
AMERICAN ELECTRIC POWER SERVICE CORPORATION

OBSERVATION WELL
CDS-04

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NUMBER ______
COMPANY **INDIANA MICHIGAN POWER COMPANY**
PROJECT **ROCKPORT PLANT**
COORDINATES **N 164,398.6 E 521,162.5**
GROUND ELEVATION **393.1** SYSTEM ______

BORING NO. **9245** DATE ______ SHEET **1** OF **2**
BORING START **09/28/92** BORING FINISH **10/06/92**
PIEZOMETER TYPE ______ WELL TYPE **SS**
HGT. RISER ABOVE GROUND ______ DIA **2.0**
DEPTH TO TOP OF WELL SCREEN ______ BOTTOM ______
WELL DEVELOPMENT ______ BACKFILL **VOLCLAY**
FIELD PARTY **MCR-GCF** RIG **BK-81**

WATER LEVEL	▽ 27.8	▼	▼
TIME			
DATE	9-28-92		

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %
1	SS	0.0	1.5	4-6-8	1.5	
2	SS	1.5	3.0	2-2-3	1.5	
3	SS	3.0	5.0	2-3-3-4	1.7	
4	ST	5.0	7.0			
5	ST	7.0	9.0			
6	SS	9.0	10.0	7-11	1.0	
7	ST	10.0	12.0		2.0	
8	ST	12.0	14.0		2.0	
9	SS	14.0	15.0	2-4	1.0	
10	ST	15.0	17.0		100	
11	ST	17.0	19.0		100	
12	SS	19.0	20.5	3-6-7	1.5	
13	SS	20.5	22.0	4-5-6	1.5	
14	SS	22.0	23.5	5-8-11	1.5	
15	SS	23.5	25.0	3-6-7	1.3	
16	SS	25.0	26.5	6-20-26	1.1	
17	SS	26.5	28.0	9-16-23	1.4	
18	SS	28.0	29.5	13-22-24	1.0	
19	SS	29.5	31.0	9-17-22	1.2	
20	SS	31.0	32.5	14-22-24	1.5	
21	SS	32.5	34.0	11-18-25	1.4	
22	SS	34.0	35.5	11-9-10	1.5	
23	SS	35.5	37.0	12-15-20	1.2	
24	SS	37.0	38.5	12-14-25	1.1	
25	SS	38.5	40.0	12-18-25	1.3	
26	SS	41.7	43.2	12-18-20	1.0	
27	SS	44.2	45.7	11-16-19	1.3	
28	SS	46.7	48.2	8-11-12	1.5	

DEPTH IN FEET: 5, 10, 15, 20, 25, 30, 35, 40, 45

GRAPH LOG

USCS

SOIL / ROCK IDENTIFICATION

BROWN/GRAY SILTY CLAY dry to moist.
more clay
REDDISH BROWN CLAY
BROWN SILTY CLAY
BROWN SANDY CLAY fine grain, dry to moist.
BROWN SILTY CLAY
BROWN/GRAY SILTY CLAY moist.
BROWN SANDY CLAY fine grain, dry to moist.
BROWN CLAYEY SAND fine grain, moist.
SANDY SILTY CLAY fine grain
BROWN SANDY CLAY fine grain, dry to moist.
more sand
BROWN SAND medium to course grain, moist to wet.
BROWN SAND medium grain.
GRAY SAND medium to course grain with 1" layer of orgainc material.
GRAY SAND AND GRAVEL 1/2" maximum size.

WELL

DRILLER'S NOTES

Well no. 17-S 17-I
Wells were installed in two holes.
24.5 Top of bentonite seal.
29.5 Top of gravel pack.
30.5 Top of screen.
39.5 Bottom of screen.
40.5 Bottom of gravel pack.

Continued Next Page

TYPE OF CASING USED

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

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

WELL TYPE: OW = OPEN TUBE, GM = GEOMON

RECORDER ______

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NUMBER ____________
COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **9245** DATE ________ SHEET **2** OF **2**
PROJECT **ROCKPORT PLANT** BORING START **09/28/92** BORING FINISH **10/06/92**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
29	SS	49.2	50.7	10-11-12	.9							
30	SS	50.7	52.2	9-16-26	1.2							51.8 Top of bentonite seal.
31	SS	52.2	53.7	8-19-22	1.4					**GRAY SAND** medium grain.		
32	SS	53.7	55.2	10-14-17	1.0		55					
33	SS	55.2	56.7	11-16-23	1.0					MEDIUM TO COURSE GRAIN WITH 1" SEAM OF COAL 55.3 TO 55.4.		56.3 Top of screen. 56.8 Top of gravel pack.
34	SS	56.7	58.2	8-14-20	1.0							
35	SS	58.2	59.7	10-16-24	1.5		60					
36	SS	61.7	63.2	8-14-17	1.2							
~~37~~	~~SS~~	~~64.2~~	~~65.7~~	~~14-17-19~~	~~.9~~		65					
38	SS	66.7	68.2	15-35-29	1.3					**GRAY CLAY SHALE**		66.4 Bottom of screen. 67.4 Bottom of gravel pack.
39	SS	69.2	69.4	50/2	.1							Holes were drilled with 6.25 augers and stainless steel platesremaining in hole. Seal were premade bentonite donuts. 56.5-57.9 and 65.7-67.1 spacer.

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

COMPANY **INDIANA MICHIGAN POWER COMPANY** WELL No. **MW-18** BORING No. **MW-18** INSTALLED **10/26/04**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 161,048.3 E 518,397.6**

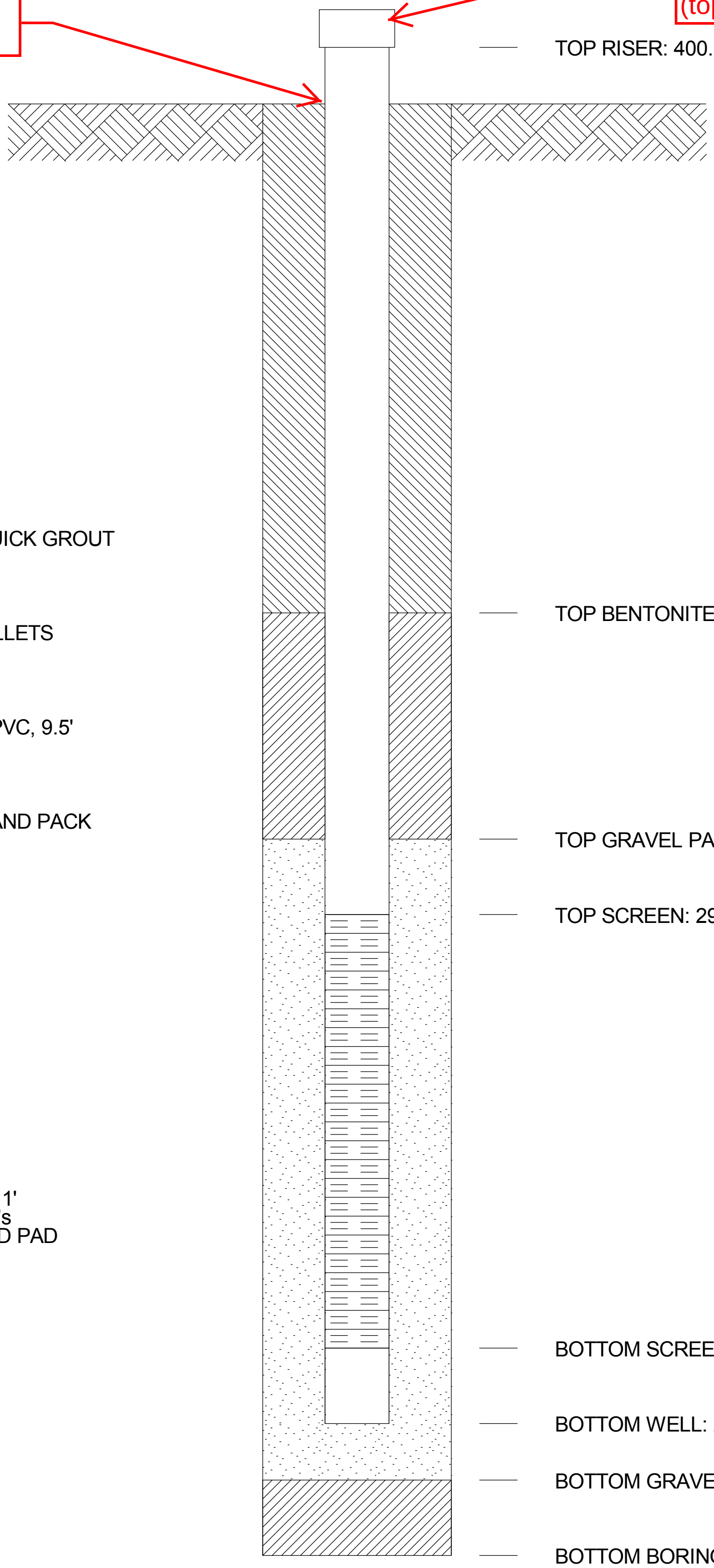
SYSTEM

MW-18

5/31/2016
Reference Point
400.65
(top of 2" PVC pipe)

5/31/2016
Top of Ground 398.30

GROUND ELEVATION 397.88 FT.



TOP RISER: 400.38 FT.

TOP BENTONITE SEAL: 302.68 FT.

TOP GRAVEL PACK: 301.08 FT.

TOP SCREEN: 298.18 FT.

BOTTOM SCREEN: 289.18 FT.

BOTTOM WELL: 288.68 FT.

BOTTOM GRAVEL PACK: 287.38 FT.

BOTTOM BORING: 287.38 FT.

▧	GROUT SEAL: 300 gallons QUICK GROUT
▨	BENTONITE SEAL: 50 lbs PELLETS
☰	SCREEN: 2" dia., .020 SLOT PVC, 9.5'
⛆	GRAVEL PACK: NATURAL SAND PACK
☐	RISER PIPE: 2", dia., PVC
∿	SPACERS, DEPTH:

-SWL @ INSTALLATION = 42.1'
-INSTALLED WITH 4.25" HSA's
-SET PROTECTOR & POURED PAD

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 161,048.3 E 518,397.6**

GROUND ELEVATION **397.9** SYSTEM

BORING NO. **MW-18** DATE **9/9/15** SHEET **1** OF **4**

BORING START **10/25/04** BORING FINISH **10/26/04**

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

HGT. RISER ABOVE GROUND **2.5** DIA **2"**

DEPTH TO TOP OF WELL SCREEN **99.7** BOTTOM **108.7**

WELL DEVELOPMENT BACKFILL **QUICK GROUT**

FIELD PARTY **MCR / TLS** RIG **BK-81**

Water Level, ft	▽	▼	▼
TIME			
DATE			

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD 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	2.0									Boring drilled for the Effluent Dilution System.
1	SS	2.0	3.5	2-3-4	1.3					**MEDIUM STIFF 5Y 5/6 LIGHT OLIVE BROWN CLAY** 1.0 tsf, w/ little amount of fine sand, dry		
2	SS	7.0	8.5	3-4-9	1.5		5			**STIFF 5Y 4/4 MODERATE OLIVE BROWN CLAY** 2.5 tsf, w/ some fine sand, dry		
3	SS	12.0	13.5	2-2-4	1.5		10			**MEDIUM STIFF 10YR 6/6 DARK YELLOWISH ORANGE CLAY** 1.0 tsf, w/ trace of fine sand, moist		
4	SS	17.0	18.5	6-8-10	1.5		15			**MEDIUM DENSE 5YR 6/4 LIGHT BROWN MEDIUM GRAIN SAND** w/ little amount of clay, moist		
5	SS	22.0	23.5	6-8-12	1.5		20					
6	SS	27.0	28.5	5-6-11	1.3		25			**MEDIUM DENSE 5YR 5/6 LIGHT BROWN MEDIUM GRAIN SAND** w/ fine gravel, wet		

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 **TLS**

JOB NUMBER					
COMPANY	**INDIANA MICHIGAN POWER COMPANY**	BORING NO.	**MW-18**	DATE	**9/9/15**
				SHEET	**2** OF **4**
PROJECT	**ROCKPORT PLANT**	BORING START	**10/25/04**	BORING FINISH	**10/26/04**

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
7	SS	32.0	33.5	4-4-4	1.5		35			**LOOSE 5YR 5/6 LIGHT BROWN MEDIUM GRAIN SAND** w/ little amount of fine gravel, wet		
8	SS	37.0	38.5	6-8-11	1.3		40			**MEDIUM DENSE 10YR 5/4 MODERATE YELLOWISH BROWN MEDIUM GRAIN SAND** w/ fine gravel, wet		With HSA's to 37', had a 15 hour SWL of 27.5' Washed heaving sand out of HSA's @ 37.0'. Started inducing water into HSA's @ 37' to prevent heaving sands.
9	SS	42.0	43.5	6-12-13	1.5		45					
10	SS	47.0	48.5	4-5-4	1.5		50			**LOOSE 5YR 5/6 LIGHT BROWN FINE GRAIN SAND** wet **LOOSE 10YR 4/2 DARK YELLOWISH BROWN FINE GRAVEL** wet		
11	SS	52.0	53.5	5-6-10	1.5		55			**MEDIUM DENSE 10YR 5/4 MODERATE YELLOWISH BROWN MEDIUM GRAIN SAND** w/ some fine gravel, wet Trace to little coal		
12	SS	57.0	58.5	4-4-5	1.5		60					
13	SS	62.0	63.5	10-8-8	1.5		65			**MEDIUM DENSE 10YR 6/2 PALE YELLOWISH BROWN COARSE GRAIN SAND** w/ little amount of fine gravel, trace of coal, wet		
14	SS	67.0	68.5	6-8-8	1.5					**MEDIUM DENSE 5YR 5/6 LIGHT BROWN COARSE GRAIN SAND** w/ fine gravel, wet		

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-18** DATE **9/9/15** SHEET **3** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **10/25/04** BORING FINISH **10/26/04**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD 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	72.0	73.5	14-5-8	1.5		70					
16	SS	77.0	78.5	5-5-6	1.5		75			**MEDIUM DENSE 5YR 4/4 MODERATE BROWN COARSE GRAIN SAND** w/ little amount of fine gravel, wet		
17	SS	82.0	83.5	4-4-7	0.9		80			Trace of coal		
18	SS	87.0	88.5	6-4-5	1.5		85					
19	SS	92.0	93.5	4-4-6	1.3		90			**LOOSE 10YR 4/2 DARK YELLOWISH BROWN COARSE GRAIN SAND** w/ little amount of fine gravel, trace of coal, wet		
20	SS	97.0	98.5	5-5-8	1.5		95			**MEDIUM DENSE 5YR 5/6 LIGHT BROWN MEDIUM GRAIN SAND** w/ trace of fine gravel, wet		
21	SS	102.0	103.5	2-4-5	1.5		100			**LOOSE 5YR 5/6 LIGHT BROWN MEDIUM GRAIN SAND** w/ trace of fine gravel, wet		
22	SS	107.0	108.5	15-15-20	1.1		105			**DENSE 5YR 5/6 LIGHT BROWN COARSE**		

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-18** DATE **9/9/15** SHEET **4** OF **4**

PROJECT **ROCKPORT PLANT** BORING START **10/25/04** BORING FINISH **10/26/04**

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
							110			**GRAIN SAND** w/ some fine gravel, wet		
23	SS	110.3	110.5	50/.2	0.2					**GRAY CLAY SHALE** Dry		Auger refusal @ 110.3' Stopped boring @ 110.5' on 10/26/04. Installed 2" well. See well log.

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

COMPANY **INDIANA MICHIGAN POWER COMPANY**

WELL No. **MW-19** BORING No. **MW-19** INSTALLED **11/4/04**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 161,159.0 E 518,561.3**

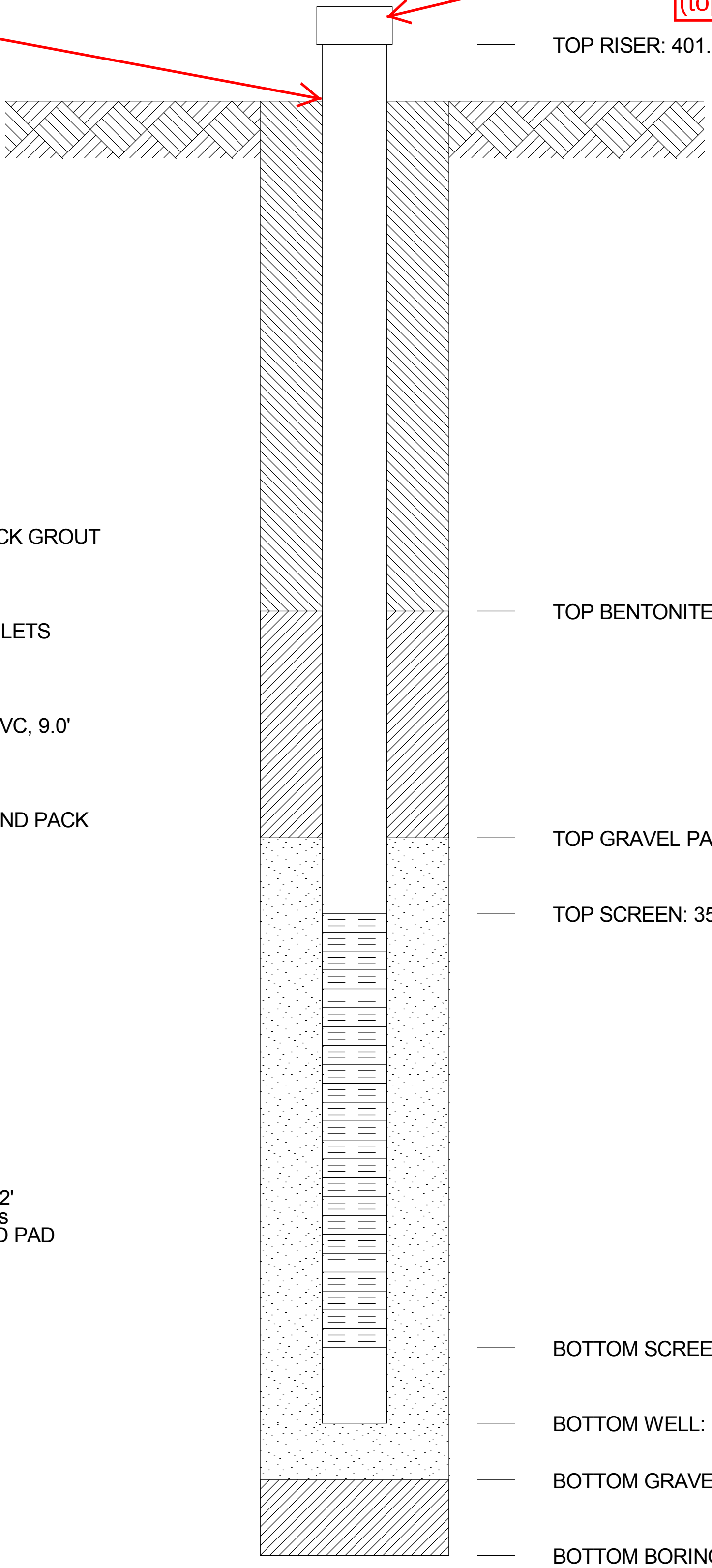
SYSTEM

MW-19

5/31/2016
Reference Point
401.44
(top of 2" PVC pipe)

5/31/2016
Top of Ground 399.15

GROUND ELEVATION 398.74 FT.



TOP RISER: 401.24 FT.

TOP BENTONITE SEAL: 362.44 FT.

TOP GRAVEL PACK: 360.14 FT.

TOP SCREEN: 358.44 FT.

BOTTOM SCREEN: 349.44 FT.

BOTTOM WELL: 348.74 FT.

BOTTOM GRAVEL PACK: 347.94 FT.

BOTTOM BORING: 347.94 FT.

▧ GROUT SEAL: 80 gallons QUICK GROUT

▨ BENTONITE SEAL: 40 lbs PELLETS

☰ SCREEN: 2" dia., .020 SLOT PVC, 9.0'

⬚ GRAVEL PACK: NATURAL SAND PACK

☐ RISER PIPE: 2", dia., PVC

∿ SPACERS, DEPTH:

-SWL @ INSTALLATION = 30.2'
-INSTALLED WITH 4.25" HSA's
-SET PROTECTOR & POURED PAD

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 161,159.0 E 518,561.3**

GROUND ELEVATION **398.7** SYSTEM

BORING NO. **MW-19** DATE **9/9/15** SHEET **1** OF **2**

BORING START **11/3/04** BORING FINISH **11/4/04**

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

HGT. RISER ABOVE GROUND **2.5** DIA **2"**

DEPTH TO TOP OF WELL SCREEN **40.3** BOTTOM **49.3**

WELL DEVELOPMENT BACKFILL **QUICK GROUT**

FIELD PARTY **MCR / CB** RIG **BK-81**

Water Level, ft	▽	▼	▼
TIME			
DATE			

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD 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	1.9									Boring drilled for the Effluent Dilution System.
1	SS	1.9	3.4	3-3-5	1.5		5			**MEDIUM STIFF 10YR 5/4 MODERATE YELLOWISH BROWN SILTY CLAY** 0.75 tsf, w/ some fine sand, dry		
2	SS	6.9	8.4	5-6-8	1.5		10			**STIFF 10YR 5/4 MODERATE YELLOWISH BROWN SILTY CLAY** 2.25 tsf, w/ trace of fine sand, dry **LOOSE 5YR 5/6 LIGHT BROWN FINE SAND**		
3	SS	11.9	13.4	2-2-3	1.5		15			**MEDIUM STIFF 5YR 4/4 MODERATE BROWN SILT** w/ little amount of fine sand, moist		
4	SS	16.9	18.4	3-6-8	0.8		20			**MEDIUM DENSE 10YR 6/6 DARK YELLOWISH ORANGE FINE GRAIN SAND** dry		
5	SS	21.9	23.4	7-9-10	1.0		25			**MEDIUM DENSE 10YR 6/6 DARK YELLOWISH ORANGE FINE GRAIN SAND** w/ trace of fine gravel, dry		
6	SS	26.9	28.4	3-3-5	0.8					**LOOSE 10YR 5/4 MODERATE YELLOWISH BROWN FINE GRAIN SAND** 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"

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 **MCR**

LOG OF BORING

JOB NUMBER

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-19** DATE **9/9/15** SHEET **2** OF **2**

PROJECT **ROCKPORT PLANT** BORING START **11/3/04** BORING FINISH **11/4/04**

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
7	SS	31.9	33.4	2-3-3	0.8		35			**LOOSE 10YR 4/2 DARK YELLOWISH BROWN MEDIUM GRAIN SAND** w/ little fine gravel, wet		
8	SS	36.9	38.4	4-6-9	0.7		40			**MEDIUM DENSE 10YR 4/2 DARK YELLOWISH BROWN MEDIUM GRAIN SAND** w/ little fine gravel, wet		
9	SS	41.9	43.4	3-6-7	0.8		45			**MEDIUM DENSE 10YR 5/4 MODERATE YELLOWISH BROWN FINE GRAIN SAND** moist		
10	SS	46.9	48.4	7-10-11	0.5		50			**MEDIUM DENSE 10YR 4/2 DARK YELLOWISH BROWN MEDIUM GRAIN SAND** w/ little fine gravel, wet		
												Stopped boring @ 50.8' on 11/04/04. Installed 2" well. See well log.

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER

COMPANY **INDIANA MICHIGAN POWER COMPANY**

WELL No. **MW-20**

BORING No. **MW-20**

INSTALLED **11/3/04**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 160,996.7 E 518,492.4**

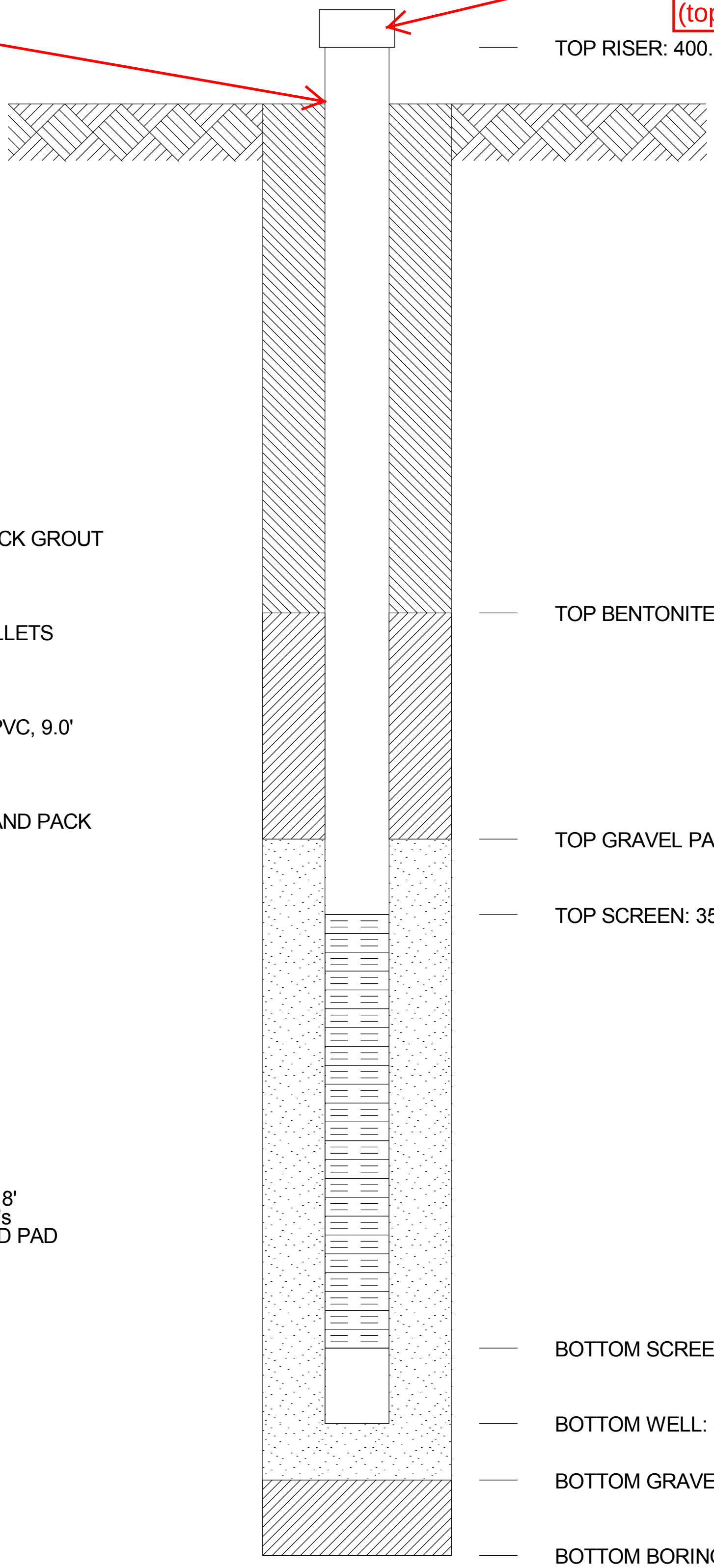
SYSTEM

MW-20

5/31/2016
Reference Point
400.78
(top of 2" PVC pipe)

5/31/2016
Top of Ground 398.49

GROUND ELEVATION 398.02 FT.



TOP RISER: 400.52 FT.

TOP BENTONITE SEAL: 361.32 FT.

TOP GRAVEL PACK: 359.62 FT.

TOP SCREEN: 357.22 FT.

BOTTOM SCREEN: 348.22 FT.

BOTTOM WELL: 347.52 FT.

BOTTOM GRAVEL PACK: 347.52 FT.

BOTTOM BORING: 347.02 FT.

▧ GROUT SEAL: 80 gallons QUICK GROUT

▨ BENTONITE SEAL: 50 lbs PELLETS

☰ SCREEN: 2" dia., .020 SLOT PVC, 9.0'

░ GRAVEL PACK: NATURAL SAND PACK

☐ RISER PIPE: 2", dia., PVC

∿ SPACERS, DEPTH:

-SWL @ INSTALLATION = 34.8'
-INSTALLED WITH 4.25" HSA's
-SET PROTECTOR & POURED PAD

GEOMCNST RK PLANT.GPJ AEP.GDT 9/9/15

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 160,996.7 E 518,492.4**

GROUND ELEVATION **398.0** SYSTEM

BORING NO. **MW-20** DATE **9/9/15** SHEET **1** OF **2**

BORING START **10/27/04** BORING FINISH **11/3/04**

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

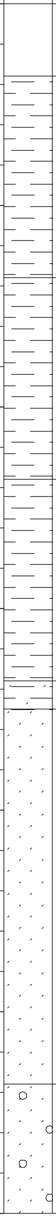
HGT. RISER ABOVE GROUND **2.5** DIA **2"**

DEPTH TO TOP OF WELL SCREEN **40.8** BOTTOM **49.8**

WELL DEVELOPMENT BACKFILL **QUICK GROUT**

FIELD PARTY **MCR / TLS** RIG **BK-81**

Water Level, ft	▽	▼	▼
TIME			
DATE			



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
		0.0	1.8									Boring drilled for the Effluent Dilution System.
1	SS	1.8	3.3	4-6-5	1.5					**STIFF 5YR 5/6 LIGHT BROWN CLAY** 1.5 tsf, w/ some fine sand		
2	SS	6.8	8.3	2-4-4	1.5		5			**MEDIUM STIFF MOTTLED 5YR 5/6 LIGHT BROWN & 10Y 6/2 PALE OLIVE CLAY** 1.75 tsf, w/ little fine sand		
3	SS	11.8	13.3	0-0-0	1.4		10			**SOFT 5YR 3/2 GRAYISH BROWN CLAY** 0 tsf		Weight of hammer pushed spoon
4	SS	16.8	18.3	3-6-7	1.5		15			**MEDIUM STIFF 10YR 5/4 MODERATE YELLOWISH BROWN CLAY w/ SAND** 0.5 tsf **MEDIUM DENSE 5YR 5/6 LIGHT BROWN COARSE SAND**		
5	SS	21.8	23.3	4-6-8	1.5		20					With HSA's to 38.3', had a 168 hour SWL of 23.4'
6	SS	26.8	28.3	4-7-9	1.5		25			**MEDIUM DENSE 10YR 5/4 MODERATE YELLOWISH BROWN COARSE SAND** w/ some fine gravel		

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 **TLS**

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-20** DATE **9/9/15** SHEET **2** OF **2**

PROJECT **ROCKPORT PLANT** BORING START **10/27/04** BORING FINISH **11/3/04**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD 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	31.8	33.3	3-5-6	1.5					**MEDIUM DENSE 10YR 4/4 MODERATE BROWN COARSE SAND** w/ some fine gravel		
8	SS	36.8	38.3	3-6-7	1.0		35					
9	SS	41.8	43.3	7-7-13	1.0		40			**MEDIUM DENSE 10YR 4/2 DARK YELLOWISH BROWN MEDIUM GRAIN SAND** w/ little fine gravel, wet		
10	SS	46.8	48.3	6-6-14	1.0		45			**MEDIUM DENSE 5YR 5/2 PALE BROWN MEDIUM GRAIN SAND** w/ trace of fine gravel, wet		
							50					Stopped boring @ 51.0' on 11/03/04. Installed 2" well. See well log.

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER 40881154-01

COMPANY AMERICAN ELECTRIC POWER

PROJECT ROCKPORT LANDFILL

COORDINATES N 161,298.6 E 520,310.8

SYSTEM

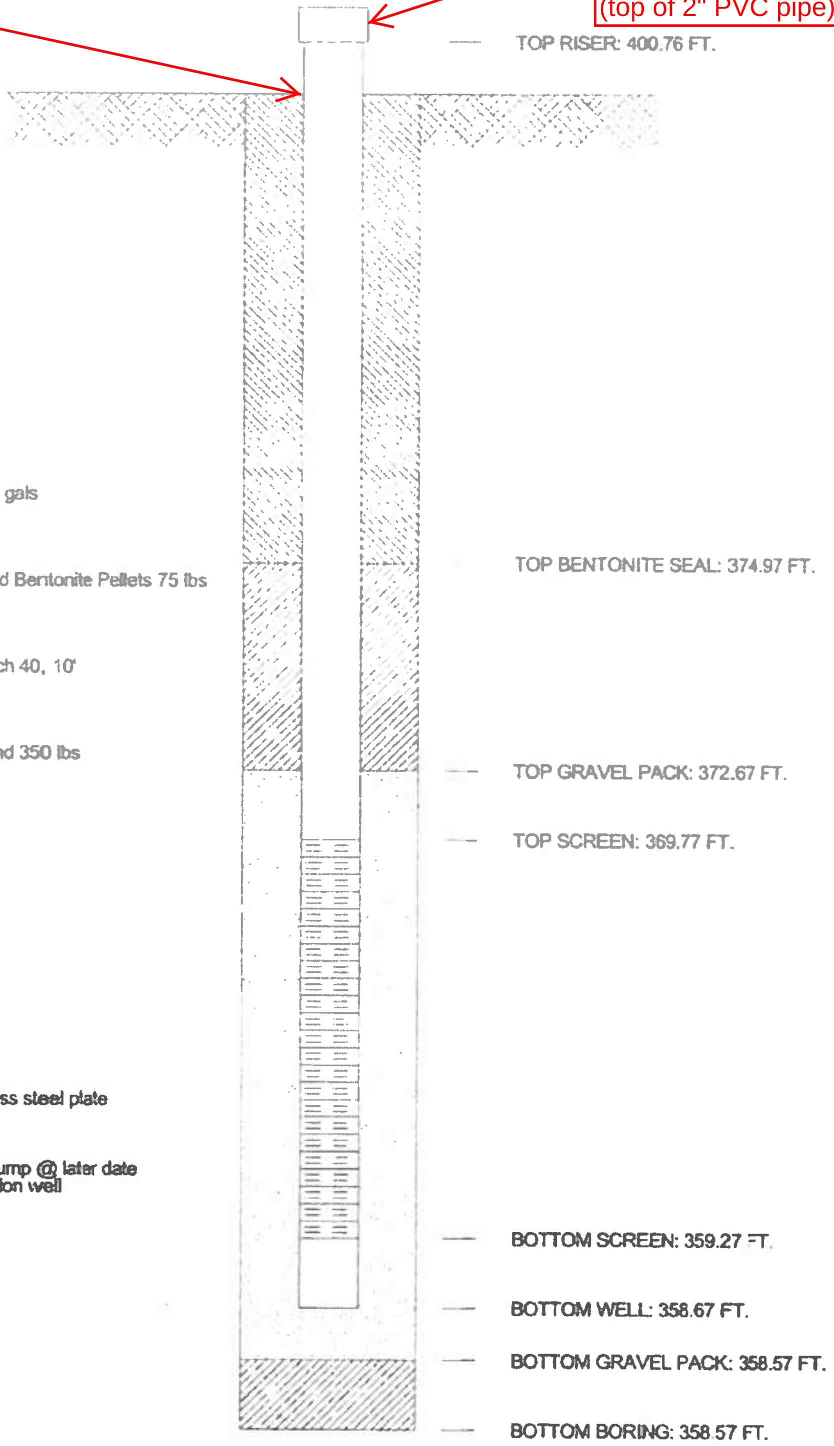
WELL No. S-21 BORING No. B-0821S INSTALLED 1/13/09

MW-21S

5/31/2016
Reference Point
400.77
(top of 2" PVC pipe)

5/31/2016
Top of Ground 398.70

GROUND ELEVATION 398.57 FT.



▨ GROUT SEAL: Quick Grout 75 gals

▨ BENTONITE SEAL: 3/8" Coated Bentonite Pellets 75 lbs

▤ SCREEN: 2" dia., 0.020 Slot Sch 40, 10'

☐ GRAVEL PACK: #4 Quartz Sand 350 lbs

☐ RISER PIPE: 2", dia., Sch 40

☐ SPACERS, DEPTH: 20'

-Drilled w/6.25" HSA's w/stainless steel plate
-SWL @ Install N/A
-Added water to hydrate pellets
-Developed well
-Installing well wizard bladder pump @ later date
-Drill water from on site production well

GEOMCNST ROCKPORT LANDFILL.GPJ AEP.GDT 2/10/09

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
MONITORING WELL CONSTRUCTION

JOB NUMBER 40881154-01
COMPANY AMERICAN ELECTRIC POWER
PROJECT ROCKPORT LANDFILL
COORDINATES N 161,299.5 E 520,291.1
SYSTEM

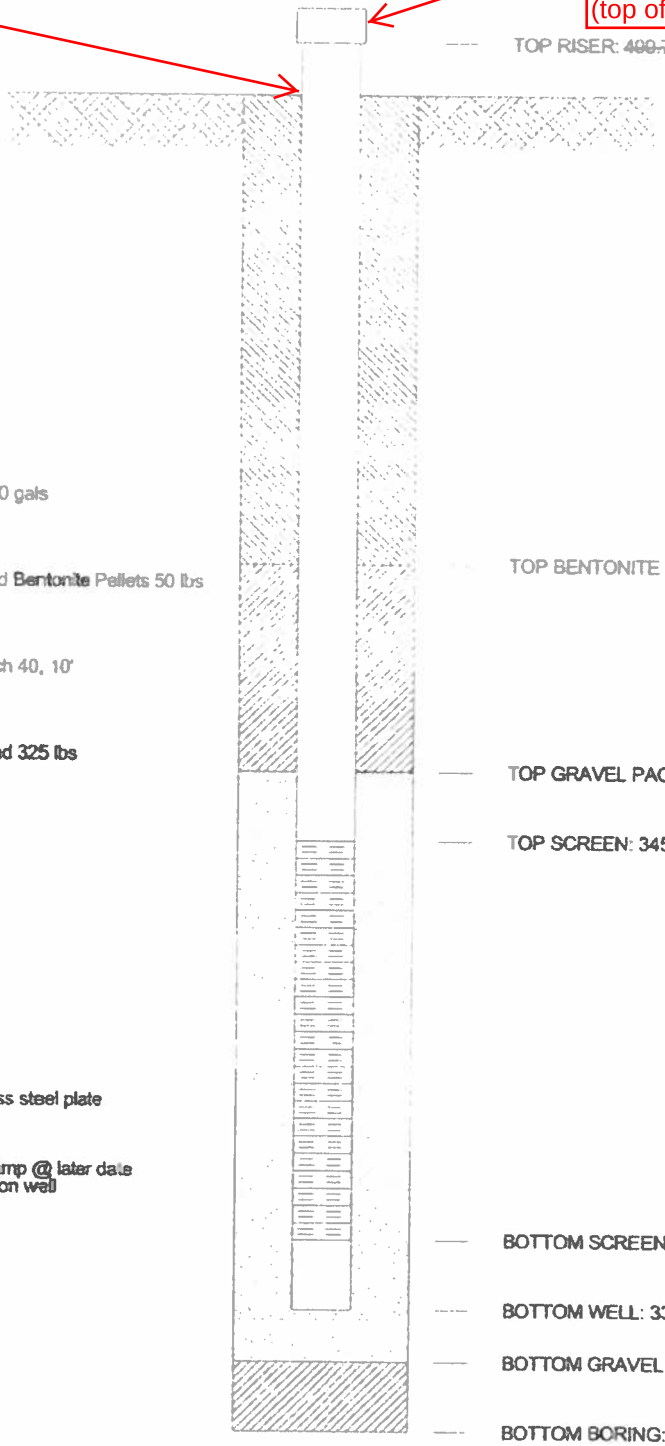
WELL No. I-21 BORING No. B-0821I INSTALLED 1/13/09

MW-21I

5/31/2016
Reference Point
400.72
(top of 2" PVC pipe)

5/31/2016
Top of Ground 398.23

GROUND ELEVATION 398.52 FT.



TOP RISER: ~~400.74 FT~~.

TOP BENTONITE SEAL: 350.12 FT.

TOP GRAVEL PACK: 347.52 FT.

TOP SCREEN: 345.42 FT.

BOTTOM SCREEN: 335.92 FT.

BOTTOM WELL: 335.32 FT.

BOTTOM GRAVEL PACK: 335.32 FT.

BOTTOM BORING: 335.32 FT.

▨ GROUT SEAL: Quick Grout 250 gals

▨ BENTONITE SEAL: 3/8" Coated Bentonite Pellets 50 lbs

▤ SCREEN: 2" dia., 0.020 Slot Sch 40, 10'

☐ GRAVEL PACK: #4 Quartz Sand 325 lbs

☐ RISER PIPE: 2", dia., Sch 40

☐ SPACERS, DEPTH: 40'

-Drilled w/6.25" HSA's w/stainless steel plate
-SWL @ Install N/A
-Added water to hydrate pellets
-Developed well
-Installing well wizard bladder pump @ later date
-Drill water from on site production well

GEOMCNST ROCKPORT LANDFILL.GPJ AEP.GDT 2/10/09

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

MONITORING WELL CONSTRUCTION

JOB NUMBER 40881154-01
COMPANY AMERICAN ELECTRIC POWER
PROJECT ROCKPORT LANDFILL
COORDINATES N 161,298.3 E 520,300.3
SYSTEM

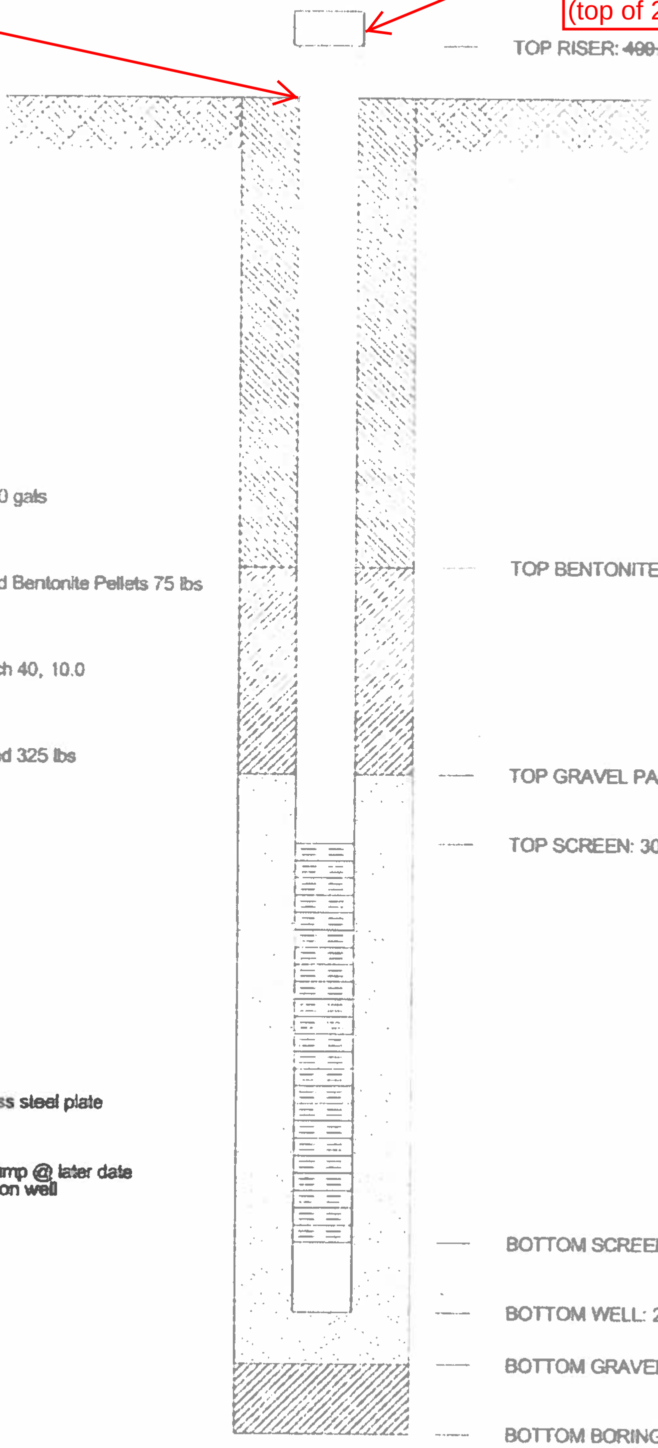
WELL No D-21 BORING No. B-0821D INSTALLED 1/13/09

MW-21D

5/31/2016
Reference Point
400.67
(top of 2" PVC pipe)

5/31/2016
Top of Ground 398.58

GROUND ELEVATION 398.62 FT.



TOP RISER: ~~400.78 FT.~~

TOP BENTONITE SEAL: 304.52 FT.

TOP GRAVEL PACK: 302.62 FT.

TOP SCREEN: 300.42 FT.

BOTTOM SCREEN: 290.92 FT.

BOTTOM WELL: 290.32 FT.

BOTTOM GRAVEL PACK: 288.62 FT.

BOTTOM BORING: 288.62 FT.

GROUT SEAL: Quick Grout 650 gals

BENTONITE SEAL: 3/8" Coated Bentonite Pellets 75 lbs

SCREEN: 2" dia., 0.020 Slot Sch 40, 10.0

GRAVEL PACK: #4 Quartz Sand 325 lbs

RISER PIPE: 2", dia., Sch 40

SPACERS, DEPTH: 80', 30'

-Drilled w/6.25" HSA's w/stainless steel plate
-SWL @ Install N/A
-Added water to hydrate pellets
-Developed well
-Installing well wizard bladder pump @ later date
-Drill water from on site production well

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

AEP

JOB NUMBER 40881154-01

COMPANY AMERICAN ELECTRIC POWER

PROJECT ROCKPORT LANDFILL

COORDINATES N 161,298.3 E 520,300.3

GROUND ELEVATION 398.6 SYSTEM State Plane using NAD27/29

Water Level, ft	▽	▼	▽
TIME			
DATE			

BORING NO. B-0821 DATE 4/29/09 SHEET 1 OF 5

BORING START 1/6/09 BORING FINISH 1/13/09

PIEZOMETER TYPE ____ WELL TYPE ____

HGT. RISER ABOVE GROUND ____ DIA ____

DEPTH TO TOP OF WELL SCREEN ____ BOTTOM ____

WELL DEVELOPMENT ____ BACKFILL ____

FIELD PARTY ZLR / RMP RIG D-120

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
	AUGER	0.0	1.9							OVERBURDEN		SAMPLES COLLECTED JAN 6-13, 2009, BY AEP DRILLERS AND LOGGED ON JAN 30, 2009, BY M K ADKINS.
1	SPT	1.9	3.4	4-7-11	1.5					CLAY STIFF, SILTY, ABUNDANT Fe STAINING, MINOR ROOT TRACES, MINOR SIDERITE CONCRETIONS, 5Y 7/2		
							5					NOTE #1: NO REFERENCE TO MOISTURE CONTENT BECAUSE ALL SAMPLES WERE DAMP TO SATURATED AND HAD BEEN IN STORAGE.
2	SPT	6.9	8.4	3-3-5	1.5					SAND MEDIUM TO DARK BROWN, SILTY, MINOR CLAY, FINE GRAIN, 5YR 5/2 TO 5YR 3/2		
							10					NOTE #2: NO REFERENCE TO SORTING BECAUSE SAMPLES HAD BEEN DISTURBED DURING COLLECTION.
3	SPT	11.9	13.4	3-4-5	1.2					SAND MEDIUM DARK BROWN, SLIGHTLY SILTY, FINE GRAIN, 5YR 3/2		
							15					
4	SPT	16.9	18.4	6-9-11	1.2					SAND MEDIUM DARK BROWN, SLIGHTLY SILTY, MINOR FINE TO MEDIUM GRAIN, VERY MINOR (<1%) WELL ROUNDED QUARTZ PEBBLES, ~0.25 CM DIAMETER, 5YR 3/2		NOTE #3: SAMPLES WERE COLLECTED OVER 1.5' INTERVALS SPACED @ 2.5'.

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 MKA

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

AEP

JOB NUMBER 40881154-01

COMPANY AMERICAN ELECTRIC POWER

PROJECT ROCKPORT LANDFILL

BORING NO. B-0821 DATE 4/29/09 SHEET 2 OF 5

BORING START 1/6/09 BORING FINISH 1/13/09

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
5	SPT	21.9	23.4	11-14-18	1.3					SAND MEDIUM DARK BROWN, SLIGHTLY SILTY, FINE TO MEDIUM GRAIN, W/ ~15% WELL ROUNDED QUARTZ PEBBLES, UP TO 1 CM DIAMETER, 5YR 3/2		
							25					
6	SPT	26.9	28.4	8-11-14	1.3					SAND MEDIUM DARK BROWN, SLIGHTLY SILTY, FINE TO COARSE GRAIN, W/ ~1% WELL ROUNDED QUARTZ PEBBLES, UP TO 1 CM DIAMETER, 5YR 3/2		
							30					
7	SPT	31.9	33.4	7-8-12	1.4					SAND MEDIUM DARK BROWN, SLIGHTLY SILTY, FINE TO COARSE GRAIN, W/ ~10-15% WELL ROUNDED QUARTZ PEBBLES, UP TO 1 CM DIAMETER, 5YR 3/2		
							35					
8	SPT	36.9	38.4	9-10-9	1.5					SAND MEDIUM DARK BROWN, SLIGHTLY SILTY, FINE TO COARSE GRAIN, W/ ~30% WELL ROUNDED QUARTZ PEBBLES, UP TO 1.5 CM DIAMETER, 5YR 3/2		
							40					
9	SPT	41.9	43.4	5-7-11	1.2					SAND MEDIUM DARK BROWN SLIGHTLY SILTY, FINE TO COARSE GRAIN, W/ ~5-10% WELL ROUNDED QUARTZ PEBBLES, UP TO 1 CM DIAMETER, 5YR 3/2		
							45					

Continued ext Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER 40881154-01

COMPANY AMERICAN ELECTRIC POWER

PROJECT ROCKPORT LANDFILL

BORING NO. B-0821 DATE 4/29/09 SHEET 3 OF 5

BORING START 1/6/09 BORING FINISH 1/13/09

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
10	SPT	46.9	48.4	5-7-14	1.5					SAND MEDIUM DARK BROWN, SLIGHTLY SILTY, FINE TO COARSE GRAIN, W/ ~5-10% WELL ROUNDED QUARTZ PEBBLES, UP TO 1 CM DIAMETER, 5YR 3/2		
							50					
11	SPT	51.9	53.4	5-9-13	1.3					SAND MEDIUM DARK BROWN, SLIGHTLY SILTY, FINE TO COARSE GRAIN, W/ ~5-10% WELL ROUNDED QUARTZ PEBBLES, UP TO 1 CM DIAMETER, 5YR 3/2		
							55					
12	SPT	56.9	58.4	8-6-14	1.3					SAND MEDIUM DARK BROWN, SLIGHTLY SILTY, FINE TO COARSE GRAIN, FRAGMENTS UP TO 2 CM DIAMETER, 5YR 3/2		
							60					
13	SPT	61.9	63.4	5-6-11	1.5					SAND MEDIUM DARK BROWN, SLIGHTLY SILTY, FINE TO COARSE GRAIN, W/ ~15% WELL ROUNDED QUARTZ PEBBLES, UP TO 0.5 CM DIAMETER, 5YR 3/2		
							65					
14	SPT	66.6	68.1	4-11-18	1.5					SAND MEDIUM DARK BROWN, SLIGHTLY SILTY, FINE TO COARSE GRAIN, W/ ~15% WELL ROUNDED QUARTZ PEBBLES, UP TO 0.5 CM DIAMETER, 5YR 3/2		
							70					

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

AEP

JOB NUMBER 40881154-01

COMPANY AMERICAN ELECTRIC POWER

PROJECT ROCKPORT LANDFILL

BORING NO. B-0821 DATE 4/29/09 SHEET 4 OF 5

BORING START 1/6/09 BORING FINISH 1/13/09

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
15	SPT	71.9	73.4	12-28-7	1.5					SAND FINE TO MEDIUM GRAIN, 5YR 3/2, W/SANDSTONE FRAGMENTS, POORLY CEMENTED, OLIVE GRAY 5GY 6/1		
							75					
16	SPT	76.9	78.4	7-11-12	1.5					SAND FINE TO COARSE GRAIN, W/15-20% WELL ROUNDED QUARTZ PEBBLES, UP TO 0.5 CM DIAMETER, 5YR 3/2		
							80					
17	SPT	81.9	83.4	2-5-5	1.5					SAND FINE TO COARSE GRAIN, W/15-20% WELL ROUNDED QUARTZ PEBBLES, UP TO 0.5 CM DIAMETER, 5YR 3/2		
							85					
18	SPT	86.9	88.4	2-3-7	1.5					SAND FINE TO COARSE GRAIN, W/15-20% WELL ROUNDED QUARTZ PEBBLES, UP TO 0.5 CM DIAMETER, 5YR 3/2		
							90					
19	SPT	91.9	93.4	3-5-9	1.5					SAND FINE TO COARSE GRAIN, W/5-10% WELL ROUNDED QUARTZ PEBBLES, W/~ 0.5 CM DIAMETER, 5YR 3/2		
							95					
20	SPT	96.9	98.4	5-6-9	.9					SAND FINE TO COARSE GRAIN, W/5-10% WELL ROUNDED QUARTZ PEBBLES, W/~ 0.5		

Continued Next Page

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER 40881154-01

COMPANY AMERICAN ELECTRIC POWER

PROJECT ROCKPORT LANDFILL

BORING NO. B-0821 DATE 4/29/09 SHEET 5 OF 5

BORING START 1/6/09 BORING FINISH 1/13/09

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
										CM DIAMETER, 5YR 3/2		
							100					
21	SPT	101.9	103.4	3-3-6	1.0					SAND FINE GRAIN, W/5-10% WELL ROUNDED QUARTZ PEBBLES, W/~ 0.5 CM DIAMETER, 5YR 4/4		
							105					
22	SPT	106.9	108.4	5-5-17	1.5					SAND FINE TO COARSE GRAIN, W/~15% WELL ROUNDED QUARTZ PEBBLES, W/~ 0.25 CM DIAMETER, 10YR 4/2		
23	SPT	108.9	109.8	2-50/.4	.7					SAND FINE TO COARSE GRAIN, W/5-10% WELL ROUNDED QUARTZ PEBBLES, W/~ 0.25 CM DIAMETER, 10YR 4/2		
							110					
24	SPT	111.9	112.2	50/.3	.3					SANDSTONE POORLY CEMENTED W/INTERBEDDED CLAY/CLAYSTONE, 5B 7/1 TO 5B 5/1		

APPENDIX D

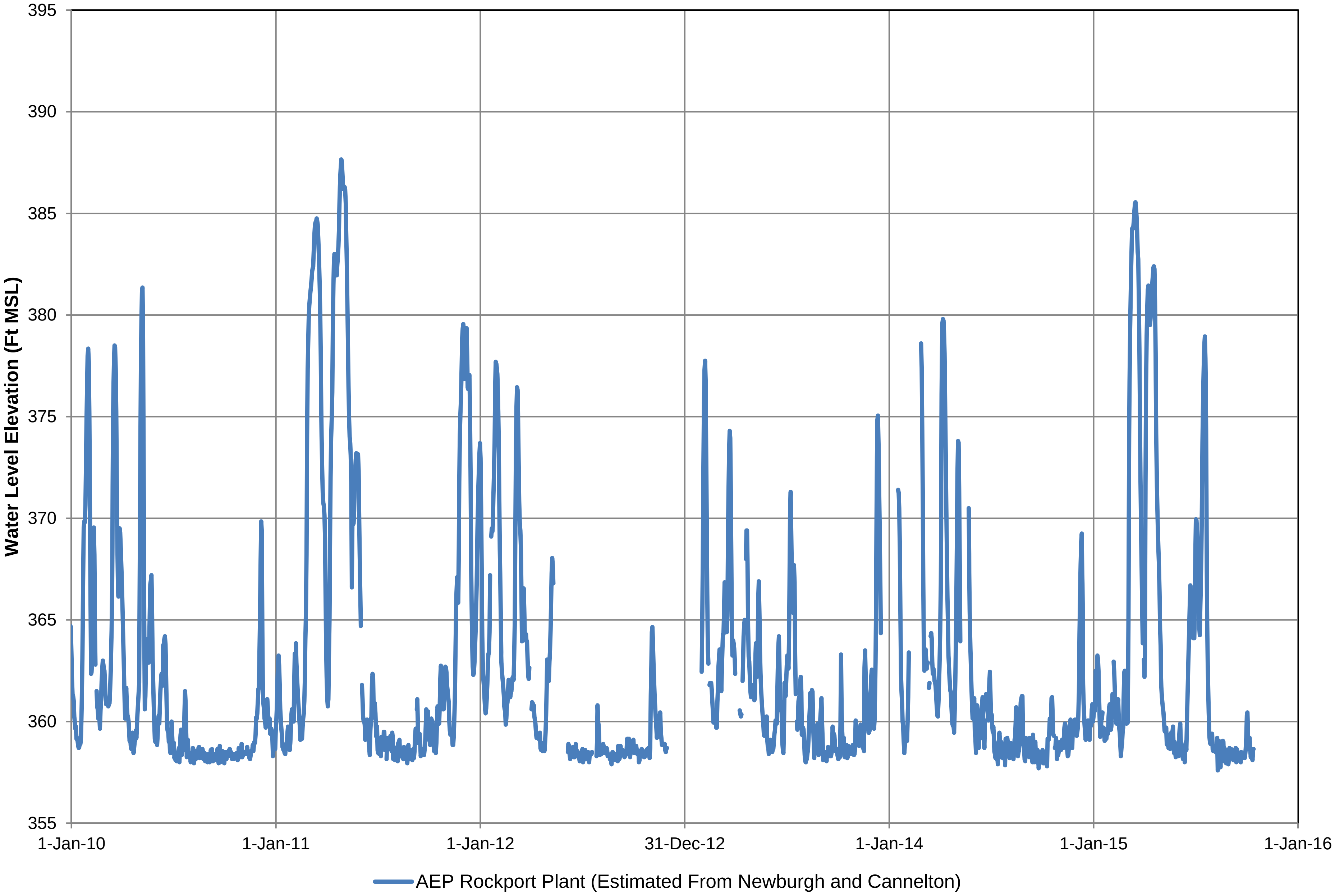
PIEZOMETRIC DATA

Appendix D-1

Ohio River Hydrograph, 2010-2015

AEP Rockport Plant

Ohio River Hydrograph, 2010-2015

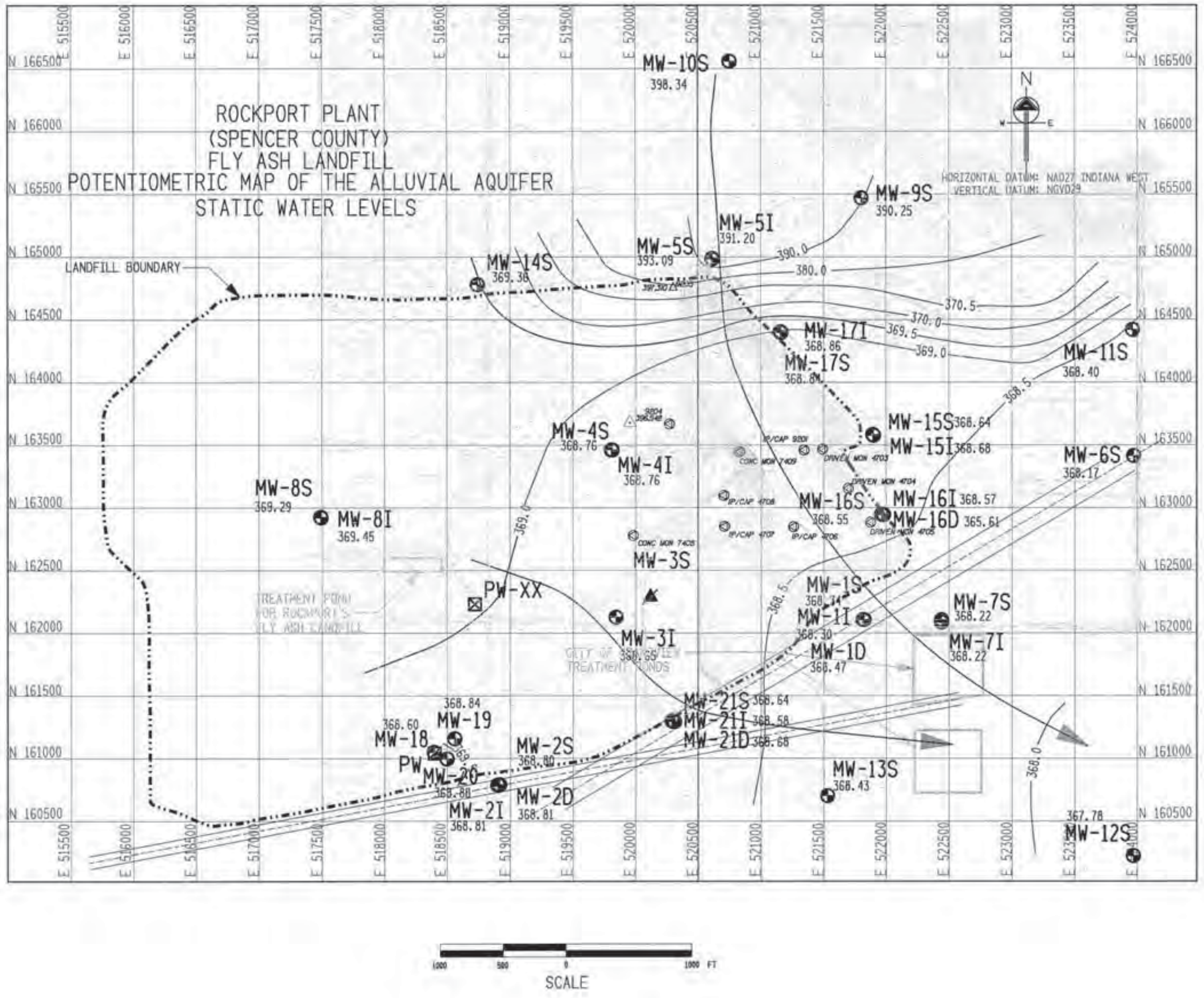


Appendix D-2

Landfill Piezometric Maps, 2010-2013

DWG. NO. 12-30105

MAY 18, 2010


ROCKPORT PLANT
(SPENCER COUNTY)
FLY ASH LANDFILL
POTENTIOMETRIC MAP OF THE ALLUVIAL AQUIFER
STATIC WATER LEVELS

AMERICAN ELECTRIC POWER
ROCKPORT PLANT FLYASH LANDFILL GROUNDWATER SAMPLING
SAMPLED BY: CAREY SANDERS HAHUS
DATE/FIELD CONDITIONS: May 18, 2010/CLOUDY, 60 DEGREES F, STATIC WATER LEVELS MEASURED May 18, 2010.

	WELL NO.	REF. DATUM POINT FT. (A)	** FEET TO STATIC LEVEL (B)	CALC. STATIC LEVEL (C)	*** 3 WELL VOLUMES (GAL)	ACTUAL AMT. PURGED GAL.	FIELD pH (S.U.)	FIELD Temp (Deg F)	FIELD COND (umhos)	TIME OF SAMPLING	NOTES
INTRAWELL	1S	397.29	28.95	368.34	5.9	7.5	7.46	60.0	608	1204	Clear
	1I	397.34	29.04	368.30	17.2	25.8	7.39	59.9	517	1136	Clear
	1D	397.32	28.85	368.47	28.9	34.0	7.39	59.9	563	1200	Clear
	15S	392.62	23.98	368.64	8.9	13.9	7.59	61.4	686.5	1331	Clear
	15I	392.82	24.14	368.68	20.7	22.4	7.30	61.2	2318	1321	Clear
	16S	394.39	25.84	368.55	7.0	7.8	7.27	64.2	639	1243	Clear
	16I	394.37	25.80	368.57	20.5	22.1	7.49	60.9	660	1325	Clear
	16D	394.49	28.88	365.61	34.6	45.2	7.37	62.0	600	1321	Clear
	17S	395.49	26.65	368.84	7.8	8.5	7.49	60.2	722	1403	Clear
	17I	395.36	26.50	368.86	20.7	22.2	7.02	61.8	1677	1440	Clear
STATIC ONLY	2S	399.24	30.44	368.80							
	2I	399.26	30.45	368.81							
	2D	399.28	30.47	368.81							
	3S	396.81	CLOSED	5-8-08							
	3I	397.05	28.40	368.65							
	4S	396.58	27.82	368.76	6.5	7.1	5.61	59.4	204.8	845	Clear
	4I	397.02	28.26	368.76	17.9	18.4	6.97	57.7	470.6	911	Clear
	5S	396.00	2.91	393.09	13.2	17.0	7.39	59.8	2645	948	Clear
	5I	392.10	0.90	391.20							
	6S	394.89	26.72	368.17							
	7S	393.66	25.44	368.22							
	7I	393.62	25.40	368.22							
	8S	393.91	24.62	369.29	8.3	11.2	7.50	57.5	545	853	Clear
	8I	393.70	24.25	369.45	20.8	23.8	7.31	58.7	606	1001	Clear
	9S	403.08	12.83	390.25							
	10S	408.41	10.07	398.34							
	11S	399.98	31.58	368.40							
	12S	403.65	35.87	367.78							
	13S	399.92	31.49	368.43							
	14S	394.68	25.32	369.36							
	18	400.38	31.78	368.60							
	19	401.24	32.40	368.84							
	20	400.52	31.64	368.88							
	21S	400.76	32.12	368.64	2.1	2.7	7.56	58.1	623.5	1028	Slightly turbid, brown
	21I	400.63	32.05	368.58	13.2	14	7.05	59.9	523.5	1004	Clear
	21D	400.73	32.05	368.68	34.8	48.6	7.68	59.1	575.1	1150	Clear

**STATIC LEVELS ARE TO BE TAKEN ON EACH WELL AT EVERY SAMPLING EVENT (A-B=C)
***(REF. DATUM POINT - FEET TO STATIC LEVEL) -BOTTOM OF WELL ELEV.) X .16 X 3 = 3 WELL VOLUMES (GAL)

LEGEND

IP/CAP 4706 ⊗	FIELD BENCHMARK
MW-8S ●	MONITORING WELL
—371—	POTENTIOMETRIC CONTOUR (BASED ON SHALLOW "S" WELLS)
–··–··►	DIRECTION OF GROUNDWATER FLOW
⊠	WATER SUPPLY WELL
▲	CLOSED MONITORING WELL
–··–··–	LANDFILL BOUNDARY
═	TRANSMISSION LINES

REFERENCE DRAWINGS

12-30104	WELL LOCATION PLAN
12-30101	ASH AREA MONITORING WELLS CONSTRUCTION DETAILS TABLE
12-30550	ASH AREA AS BUILT MAPPING

REVISIONS

DATE	NO.	DESCRIPTION	APPD.
7/9/2010	Y	STATIC WATER LEVELS MEASURED MAY 18, 2010.	PJA
1/7/10	X	DELETED PREVIOUS REVISIONS A THRU W. REVISED TO SHOW STATIC WATER LEVELS MEASURED NOV. 9, 2009.	PJA

S:/RK/12/Geo_Hydro_Site/30105.dgn

INDIANA MICHIGAN POWER CO
ROCKPORT PLANT
ROCKPORT INDIANA

POTENTIOMETRIC MAP

DWG. NO. 12-30105-Y

SCALE: AS SHOWN
CIVIL ENGINEERING
DR: KJJ
CH: JT M-N
ENGR:
PROJ ENGR:
DATE: 12-1-08
APPROVED BY: J. T. Massey-Norton

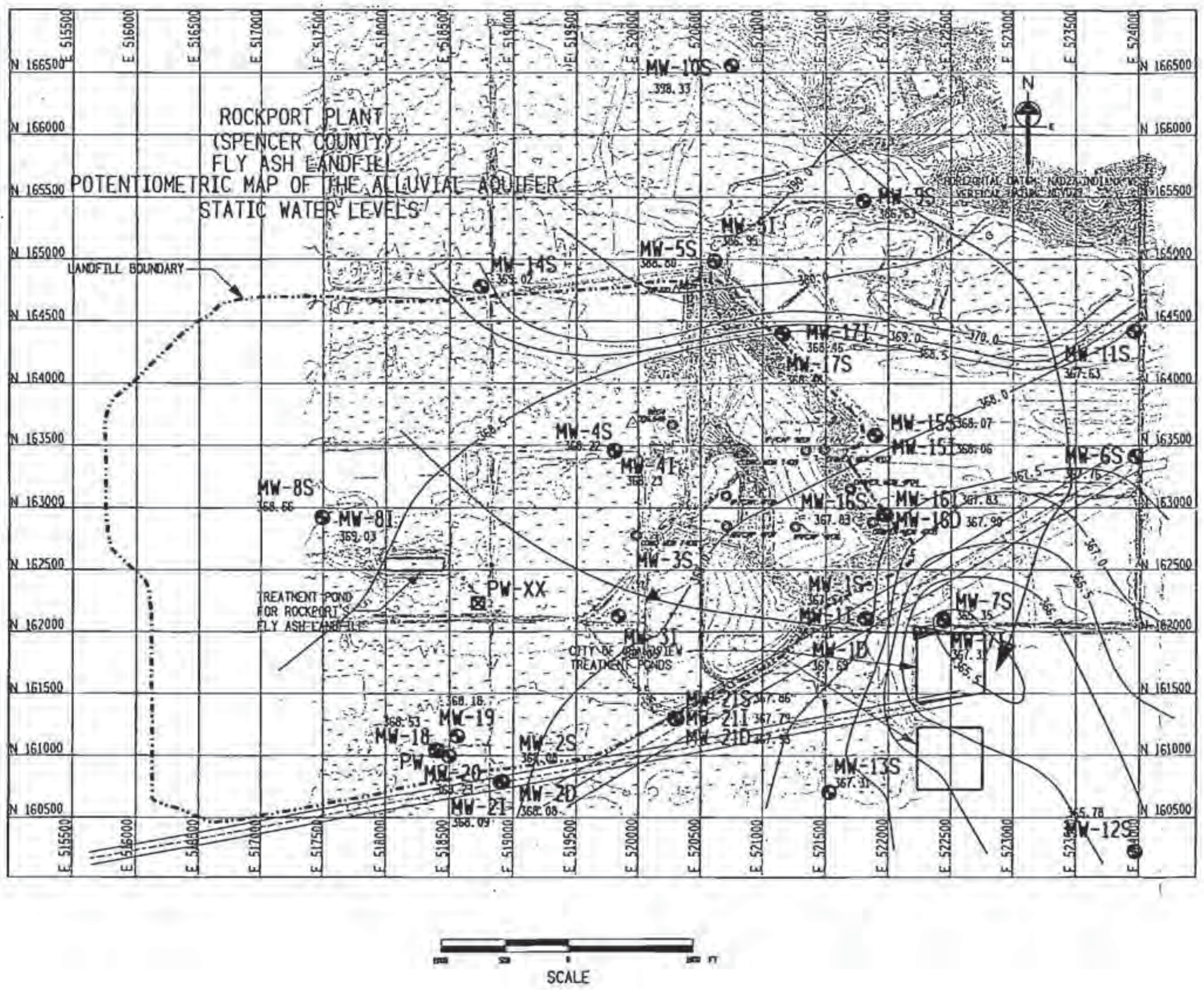
AMERICAN ELECTRIC POWER

AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

SYSTEM DATE-7/8/2010
SYSTEM TIME-8:14:22 AM

DWG NO. 12-30105

NOVEMBER 2, 2010



AMERICAN ELECTRIC POWER
ROCKPORT PLANT FLYASH LANDFILL GROUNDWATER SAMPLING
SAMPLED BY: CAREY SANDERS HAHUS
DATE/FIELD CONDITIONS: NOV. 3, 2010/CLOUDY/WINDY, 53 DEGREES F, STATIC WATER LEVELS MEASURED NOV 3, 2010.

	WELL NO.	REF. DATUM POINT FT. (A)	** FEET TO STATIC LEVEL (B)	CALC. STATIC LEVEL (C)	*** 3 WELL VOLUMES (GAL)	ACTUAL AMT. PURGED GAL.	FIELD pH (S.U.)	FIELD Temp (Deg F)	FIELD COND (umhos)	TIME OF SAMPLING	NOTES
INTRAWELL	1S	397.29	29.75	367.54	5.5	7.0	7.61	56.7	646	1104	Clear
	1I	397.34	29.83	367.51	16.8	18.5	7.40	57.2	542	1136	Clear
	1D	397.32	29.63	367.69	28.6	30.7	7.39	57.7	585	1208	Clear
	15S	392.62	24.55	368.07	8.7	9.6	7.29	57.4	706	1239	Clear
	15I	392.82	24.76	368.06	20.4	22.8	7.24	57.4	1912	1324	Clear
	16S	394.39	26.56	367.83	6.7	7.2	7.60	57.8	672	1200	Clear
	16I	394.37	26.54	367.83	20.2	21.2	7.74	58.7	667	1243	Clear
	16D	394.49	26.59	367.90	35.7	36.9	7.66	58.5	640	1308	Clear
	17S	395.49	27.03	368.46	7.6	8.0	7.37	56.9	840	1345	Clear
	17I	395.36	26.90	368.46	20.5	20.9	7.14	57.5	1607	1420	Clear
STATIC ONLY	2S	399.24	31.16	368.08							
	2I	399.26	31.17	368.09							
	2D	399.28	31.20	368.08							
	3S	396.81	CLOSED	5-8-08							
	3I	397.05	29.00	368.05							
	4S	396.58	28.36	368.22	6.2	7.5	7.80	56.0	191	902	Clear
	4I	397.02	28.79	368.23	17.7	19.0	7.45	56.0	481	930	Clear
	5S	396.00	7.20	388.80	11.2	14.8	7.34	56.0	2060	1036	Clear
	5I	392.10	5.15	386.95							
	6S	394.89	27.13	367.76							
	7S	393.66	28.31	365.35							
	7I	393.62	26.30	367.32							
	8S	393.91	25.25	368.66	7.9	9.2	8.05	56.0	542	944	Clear
	8I	393.70	24.67	369.03	20.6	21.8	7.57	56.9	675	955	Clear
	9S	403.08	16.45	386.63							
	10S	408.41	10.08	398.33							
	11S	399.98	32.35	367.63							
	12S	403.65	37.87	365.78							
	13S	399.92	32.61	367.31							
	14S	394.68	25.66	369.02							
	18	400.38	31.85	368.53							
	19	401.24	33.06	368.18							
	20	400.52	32.29	368.23							
	21S	400.76	32.90	367.86	1.7	2.7	7.94	57.0	516	1028	Clear
	21I	400.63	32.84	367.79	12.8	14.3	7.63	57.0	530	1034	Clear
	21D	400.73	32.80	367.93	34.4	36.0	7.81	56.8	592	1130	Clear

**STATIC LEVELS ARE TO BE TAKEN ON EACH WELL AT EVERY SAMPLING EVENT (A-B=C)
***(REF. DATUM POINT - FEET TO STATIC LEVEL) -BOTTOM OF WELL ELEV.) X .16 X 3 = 3 WELL VOLUMES (GAL)

LEGEND

●	FIELD BENCHMARK
MW-8S ●	MONITORING WELL
—371—	POTENTIOMETRIC CONTOUR (BASED ON SHALLOW "S" WELLS)
···–··→	DIRECTION OF GROUNDWATER FLOW
☒	WATER SUPPLY WELL
▲	CLOSED MONITORING WELL
–··–··–	LANDFILL BOUNDARY
═	TRANSMISSION LINES

REFERENCE DRAWINGS

12-30104	WELL LOCATION PLAN
12-30101	ASH AREA MONITORING WELLS CONSTRUCTION DETAILS TABLE
12-30550	ASH AREA AS BUILT MAPPING

REVISIONS

DATE	NO.	DESCRIPTION	APPD.
	Z	STATIC WATER LEVELS MEASURED NOV. 3, 2010.	
7/9/10	Y	STATIC WATER LEVELS MEASURED MAY 18, 2010.	PJA
1/7/10	X	DELETED PREVIOUS REVISIONS A THRU W. REVISED TO SHOW STATIC WATER LEVELS MEASURED NOV. 9, 2009.	PJA

S:/RX/12/Geo_Hydro_Site/30105.dgn

INDIANA MICHIGAN POWER CO
ROCKPORT PLANT
ROCKPORT INDIANA

POTENTIOMETRIC MAP

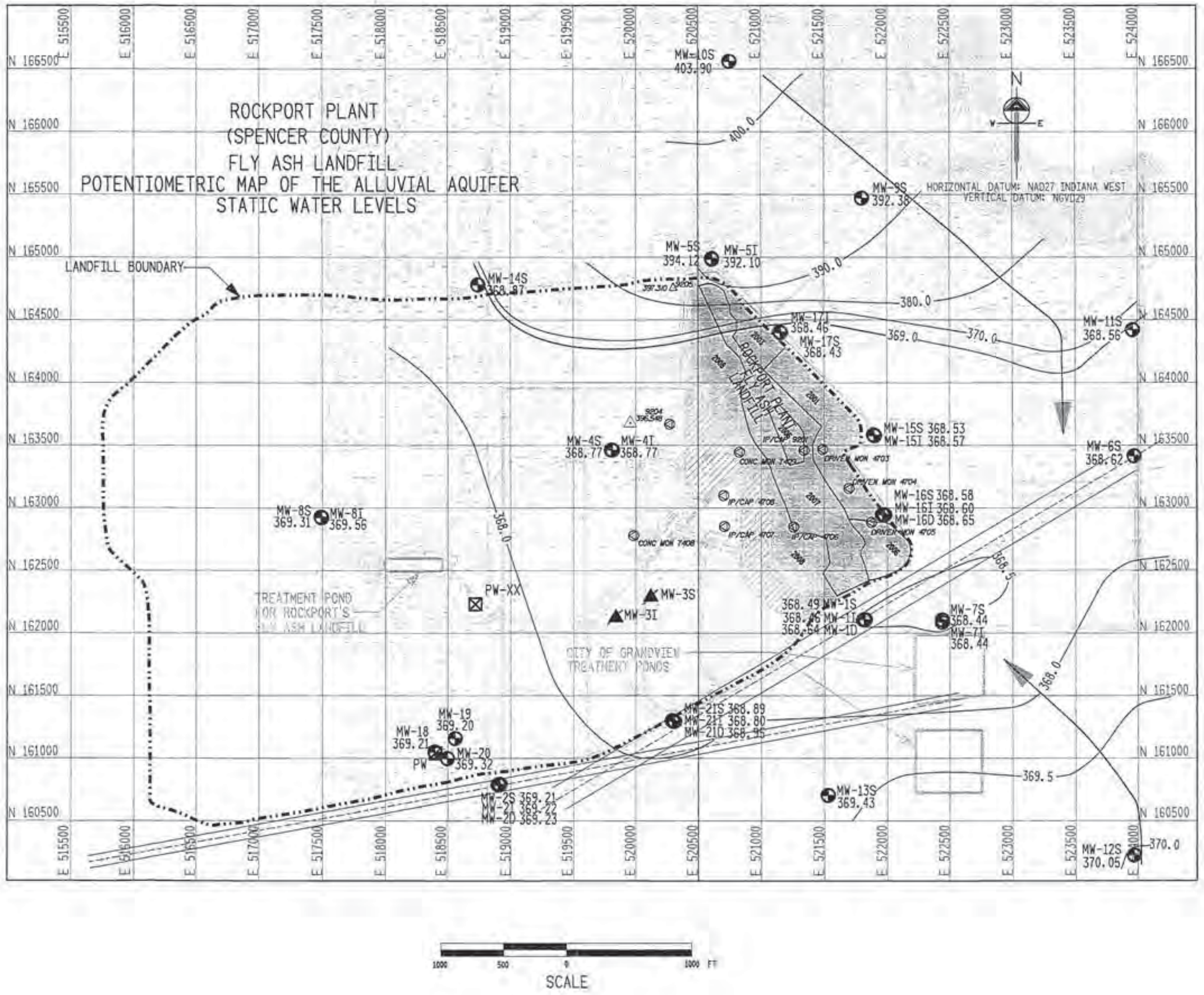
DWG. NO. 12-30105-Z

SCALE: AS SHOWN
CIVIL ENGINEERING
APPROVED BY
J. T. Massey-Norton

AMERICAN ELECTRIC POWER
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

DWG. NO. 12-30105

MAY 10, 2011



AMERICAN ELECTRIC POWER
ROCKPORT PLANT FLYASH LANDFILL GROUNDWATER SAMPLING
SAMPLED BY: CAREY SANDERS HAHUS
DATE/FIELD CONDITIONS: MAY 12, 2011/CLEAR 72 DEG F, STATIC WATER LEVELS MEASURED MAY 10, 2011.

	WELL NO.	REF. DATUM POINT FT. (A)	** FEET TO STATIC LEVEL (B)	CALC. STATIC LEVEL (C)	*** 3 WELL VOLUMES (GAL)	ACTUAL AMT. PURGED GAL.	FIELD pH (S.U.)	FIELD Temp (Deg F)	FIELD COND (umhos)	TIME OF SAMPLING	NOTES
INTRAWELL	1S	397.29	28.80	368.49	5.9	6.9	7.29	61.9	580	1019	Clear
	1I	397.34	28.88	368.46	17.3	19.1	7.32	66.4	580	1118	Clear
	1D	397.32	28.68	368.64	29.0	31.2	7.31	65.7	557	1016	Clear
	15S	392.62	24.09	368.53	8.9	9.6	7.38	63.2	689	1205	Clear
	15I	392.82	24.25	368.57	20.7	22.8	7.17	62.8	1870	1245	Clear
	16S	394.39	25.81	368.58	7.0	8.5	7.63	63.2	714	1155	Clear
	16I	394.37	25.77	368.60	20.5	21.5	7.54	63.0	662	1306	Clear
	16D	394.49	25.84	368.65	36.1	38.9	7.56	63.0	645	1115	Clear
	17S	395.49	27.06	368.43	7.6	9.6	7.20	63.2	756	1315	Clear
	17I	395.36	26.90	368.46	20.5	22.3	7.14	60.8	1561	1320	Clear
STATIC ONLY	2S	399.24	30.03	369.21							
	2I	399.26	30.04	369.22							
	2D	399.28	30.05	369.23							
	3S	396.81	CLOSED	5-8-08							
	3I	397.05	CLOSED	4-25-11							
	4S	396.58	27.81	368.77	6.5	7.6	7.25	59.1	217.2	718	Clear
	4I	397.02	28.25	368.77	17.9	19.8	7.04	60.8	470.0	745	Clear
	5S	396.00	1.88	394.12	13.7	18.7	7.32	62.0	3110	920	Clear
	5I	392.10	0.00	392.10							
	6S	394.89	26.27	368.62							
	7S	393.66	25.22	368.44							
	7I	393.62	25.18	368.44							
	8S	393.91	24.60	369.31	8.3	10.7	7.62	59.2	526	720	Clear
	8I	393.70	24.14	369.56	20.9	21.9	7.45	60.1	681.5	752	Clear
	9S	403.08	10.70	392.38							
	10S	408.41	4.51	403.90							
	11S	399.98	31.42	368.56							
	12S	403.65	33.60	370.05							
	13S	399.92	30.49	369.43							
	14S	394.68	25.81	368.87							
	18	400.38	31.17	369.21							
	19	401.24	32.04	369.20							
	20	400.52	31.20	369.32							
	21S	400.76	31.87	368.89	2.2	3.5	7.46	61.8	435	818	Clear
	21I	400.63	31.83	368.80	13.3	14.1	7.36	63.3	526	853	Clear
	21D	400.73	31.78	368.95	34.9	36.4	7.53	64.1	581	953	Clear

**STATIC LEVELS ARE TO BE TAKEN ON EACH WELL AT EVERY SAMPLING EVENT (A-B=C)
***(REF. DATUM POINT - FEET TO STATIC LEVEL) -BOTTOM OF WELL ELEV.) X .16 X 3 = 3 WELL VOLUMES (GAL)

LEGEND

IP/CAP 4706 ⊛	FIELD BENCHMARK
MW-8S ●	MONITORING WELL
—371—	POTENTIOMETRIC CONTOUR (BASED ON SHALLOW "S" WELLS)
-··-··→	DIRECTION OF GROUNDWATER FLOW
⊠	WATER SUPPLY WELL
▲	CLOSED MONITORING WELL
-··-··-	LANDFILL BOUNDARY
═	TRANSMISSION LINES
▨	30" COVER PLACED

REFERENCE DRAWINGS

12-30104	WELL LOCATION PLAN
12-30101	ASH AREA MONITORING WELLS CONSTRUCTION DETAILS TABLE
12-30550	ASH AREA AS BUILT MAPPING

DATE	NO.	DESCRIPTION	APPD.
7/7/2011	AB	CLOSED WELL MW-3I. STATIC WATER LEVELS MEASURED MAY 10, 2011.	AFZ
4/5/11	AA	ADDED 2010 AS-BUILT MAPPING.	GFZ
12/20/10	Z	STATIC WATER LEVELS MEASURED NOV. 3, 2010.	GFZ
7/9/10	Y	STATIC WATER LEVELS MEASURED MAY 18, 2010.	PJA
1/7/10	X	DELETED PREVIOUS REVISIONS A THRU W. REVISED TO SHOW STATIC WATER LEVELS MEASURED NOV. 9, 2009.	PJA

REVISIONS

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INDIANA MICHIGAN POWER CO
ROCKPORT PLANT
ROCKPORT INDIANA

POTENTIOMETRIC MAP

DWG. NO. 12-30105-AB

SCALE: AS SHOWN
CIVIL ENGINEERING
DR: RJU
CH: JT M-N
ENGR:
PROJ ENGR:
DATE: 12-1-00
APPROVED BY J. T. Massey-Norton

AMERICAN ELECTRIC POWER
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

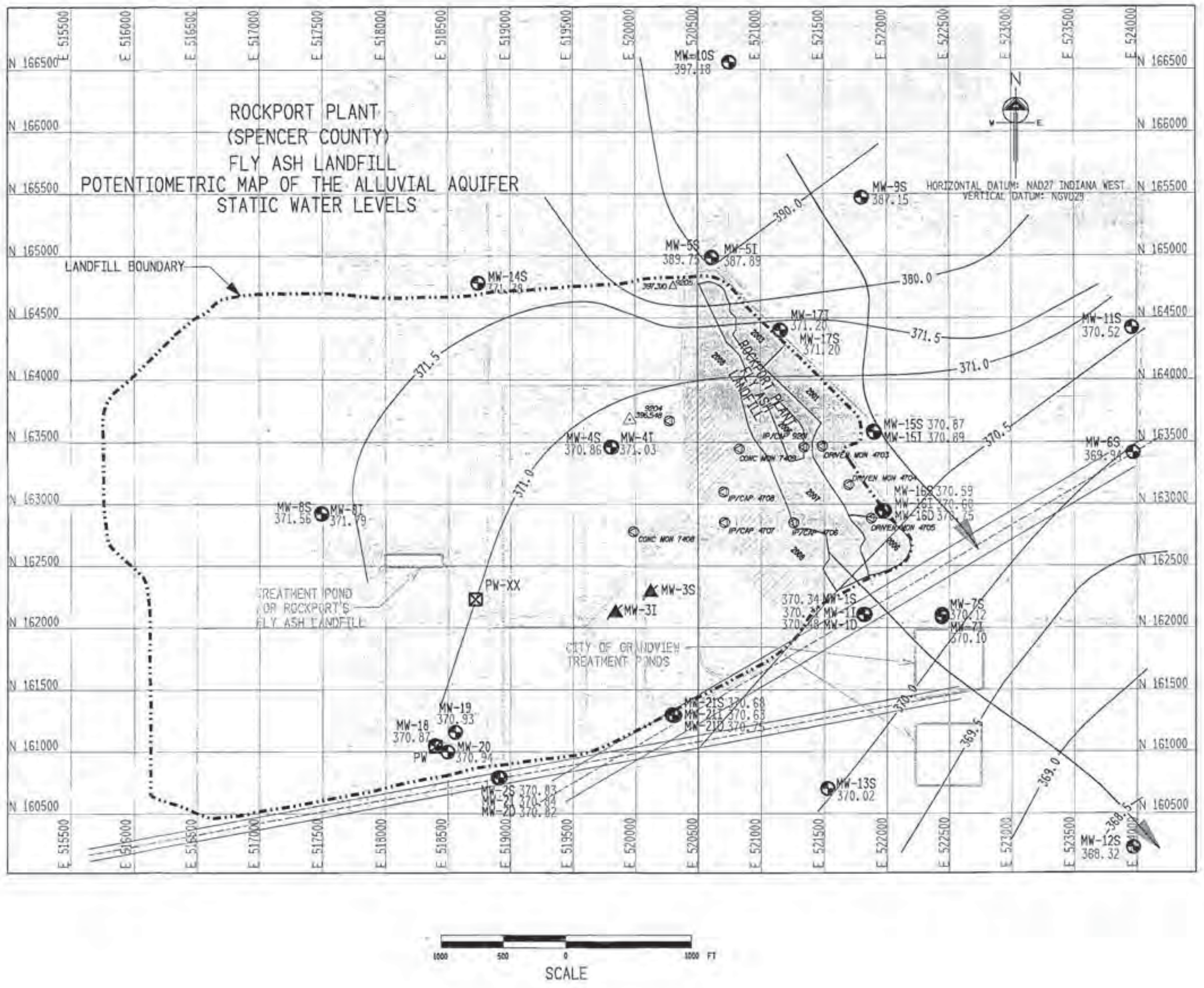
74-02

RECEIVED
JUL 12 2011
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF LAND QUALITY

SYSTEM DATE=7/7/2011
0 74-02

12-30105
DRAWING NUMBER

NOVEMBER 8, 2011



AMERICAN ELECTRIC POWER
ROCKPORT PLANT FLYASH LANDFILL GROUNDWATER SAMPLING
SAMPLED BY: CAREY SANDERS HAHUS
DATE/FIELD CONDITIONS: NOV. 10, 2011/SUNNY, WINDY, 48 DEG F, STATIC WATER LEVELS MEASURED NOV. 8, 2011.

	WELL NO.	REF. DATUM POINT FT. (A)	** FEET TO STATIC LEVEL (B)	CALC. STATIC LEVEL (C)	*** 3 WELL VOLUMES (GAL)	ACTUAL AMT. PURGED GAL.	FIELD pH (S.U.)	FIELD Temp (Deg F)	FIELD COND (umhos)	TIME OF SAMPLING	NOTES
INTRAWELL	1S	397.29	26.95	370.34	6.8	8.2	7.58	57.2	630.7	939	Clear
	1I	397.34	27.03	370.31	18.1	20.5	7.21	58.1	536.6	1006	Clear
	1D	397.32	26.84	370.48	29.9	34.8	7.34	58.1	579.7	1043	Clear
	15S	392.62	21.75	370.87	10.0	10.5	7.30	57.9	690	1204	Clear
	15I	392.82	21.93	370.89	21.8	23.8	7.26	57.3	1805	1245	Clear
	16S	394.39	23.80	370.59	8.0	8.5	7.50	58.3	644	1033	Clear
	16I	394.37	23.77	370.60	21.5	22.8	7.71	58.0	648	1112	Clear
	16D	394.49	23.74	370.75	37.1	40.8	7.66	57.6	649	1136	Clear
	17S	395.49	24.29	371.20	8.9	9.2	7.28	56.3	789	1250	Clear
	17I	395.36	24.16	371.20	21.8	22.3	7.35	55.8	1428	1318	Clear
STATIC ONLY	2S	399.24	28.41	370.83							
	2I	399.26	28.42	370.84							
	2D	399.28	28.46	370.82							
	3S	396.81	CLOSED	5-8-08							
	3I	397.05	CLOSED	4-25-11							
	4S	396.58	25.72	370.86	7.5	8.2	6.30	56.5	225	831	Clear
	4I	397.02	25.99	371.03	19.0	19.4	7.21	55.6	505.9	858	Clear
	5S	396.00	6.25	389.75	11.6	15.6	7.39	57.2	2286	953	Clear
	5I	392.10	4.21	387.89							
	6S	394.89	24.95	369.94							
	7S	393.66	23.54	370.12							
	7I	393.62	23.52	370.10							
	8S	393.91	22.35	371.56	9.3	13.6	7.03	56.7	538.5	835	Clear
	8I	393.70	21.91	371.79	21.9	24.1	7.41	56.8	698.2	852	Clear
	9S	403.08	15.93	387.15							
	10S	408.41	11.23	397.18							
	11S	399.98	29.46	370.52							
	12S	403.65	35.33	368.32							
	13S	399.92	29.90	370.02							
	14S	394.68	22.90	371.78							
	18	400.38	29.51	370.87							
	19	401.24	30.31	370.93							
	20	400.52	29.58	370.94							
	21S	400.76	30.08	370.68	3.1	3.6	7.53	57.4	540.9	1145	Clear
	21I	400.63	30.00	370.63	14.2	14.8	7.71	57.5	499.6	1125	Clear
	21D	400.73	29.98	370.75	35.8	38.0	7.61	56.5	595.8	1220	Clear

**STATIC LEVELS ARE TO BE TAKEN ON EACH WELL AT EVERY SAMPLING EVENT (A-B=C)
***(REF. DATUM POINT - FEET TO STATIC LEVEL) -BOTTOM OF WELL ELEV.) X .16 X 3 = 3 WELL VOLUMES (GAL)

LEGEND

IP/CAP 4706 ⊚	FIELD BENCHMARK
MW-8S ●	MONITORING WELL
—371—	POTENTIOMETRIC CONTOUR (BASED ON SHALLOW "S" WELLS)
-··-··→	DIRECTION OF GROUNDWATER FLOW
☒	WATER SUPPLY-WELL
▲	CLOSED MONITORING WELL
-··-··-	LANDFILL BOUNDARY
═	TRANSMISSION LINES
▨	30" COVER PLACED

REFERENCE DRAWINGS

12-30104	WELL LOCATION PLAN
12-30101	ASH AREA MONITORING WELLS CONSTRUCTION DETAILS TABLE
12-30550	ASH AREA AS-BUILT MAPPING

RECEIVED
JAN 05 2012
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF LAND QUALITY

DATE	NO.	DESCRIPTION	APPD.
12/08/11	ac	STATIC WATER LEVELS MEASURED NOV. 10, 2010.	JAN GF

REVISIONS

THIS DRAWING IS CLASSIFIED AS:
AEP PUBLIC
REFERENCE AEP's CORPORATE INFORMATION SECURITY POLICY

INDIANA MICHIGAN POWER COMPANY
ROCKPORT PLANT
ROCKPORT INDIANA
GEOTECHNICAL
POTENTIOMETRIC MAP

UNIT: 12
DRAWING NUMBER: 30105
REV: ac
SCALE: AS SHOWN
CIVIL ENGINEERING
DR: KJW
CH: JT M-N
SUR:
ENG:
DATE: SEE REV 0
APPROVED BY: J. T. Massey-Norton

AMERICAN ELECTRIC POWER
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

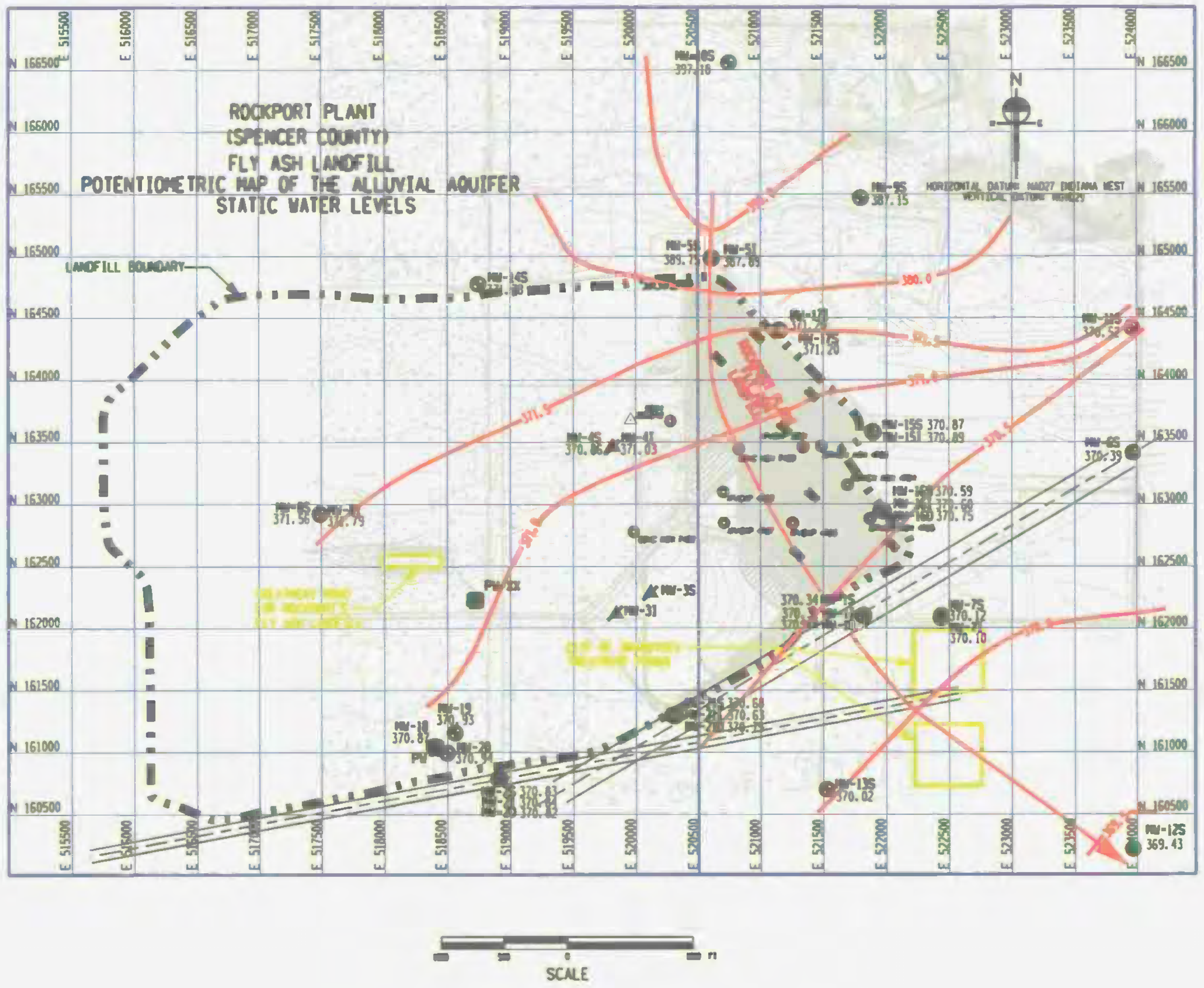
74-02
AI 100126
Spencer Co.

74-02
12-30105

CROSS REFS:

12-30105

MAY 7, 2012



AMERICAN ELECTRIC POWER
ROCKPORT PLANT FLYASH LANDFILL GROUNDWATER SAMPLING
SAMPLED BY: CAREY SANDERS
DATE/FIELD CONDITIONS: MAY 8, 2012/SUNNY, 70 DEG F, STATIC WATER LEVELS MEASURED MAY 7, 2012.

	WELL NO.	REF. DATUM POINT FT. (A)	** FEET TO STATIC LEVEL (B)	CALC. STATIC LEVEL (C)	*** 3 WELL VOLUMES (GAL)	ACTUAL AMT. PURGED GAL.	FIELD pH (S.U.)	FIELD Temp (Deg F)	FIELD COND (umhos)	TIME OF SAMPLING	NOTES
INTRA WELL	1S	397.29	26.72	370.57	6.9	11.8	7.28	60.7	613	1033	Clear
	1I	397.34	26.80	370.54	18.3	22.8	7.44	60.0	521	1100	Clear
	1D	397.32	26.62	370.70	30.0	1.2	7.27	59.7	550	1131	Clear
	15S	392.62	21.62	371.00	10.1	11.5	7.28	60.6	700	1139	Clear
	15I	392.82	21.81	371.01	21.8	23.0	7.28	59.4	1793	1157	Clear
	16S	394.39	23.55	370.84	8.1	10.1	7.49	61.7	665	1058	Clear
	16I	394.37	23.54	370.83	21.6	23.4	7.60	51.5	632	1119	Clear
	16D	394.49	23.59	370.90	37.1	39.0	4.54	60.9	627	1028	Clear
	17S	395.49	24.28	371.21	8.9	11.0	7.27	59.9	759	1218	Clear
	17I	395.36	24.11	371.25	21.8	23.8	7.17	59.4	1397	1226	Clear
STATIC ONLY	2S	399.24	28.30	370.94							
	2I	399.26	28.30	370.96							
	2D	399.28	28.33	370.95							
	3S	396.81	CLOSED	5-8-08							
	3I	397.05	CLOSED	4-25-11							
	4S	396.58	CLOSED	4-17-12							
	4I	397.02	CLOSED	4-17-12							
	5S	396.00	4.54	391.46	12.5	16.1	7.67	61.2	2177	1002	Clear
	5I	392.10	2.55	389.55							
	6S	394.89	24.50	370.39							
	7S	393.66	23.25	370.41							
	7I	393.62	23.21	370.41							
	8S	393.91	22.45	371.46	9.3	12.1	7.82	58.7	479	852	Clear
	8I	393.70	22.00	371.70	21.9	23.2	7.51	59.9	664	926	Clear
	9S	403.08	14.47	388.61							
	10S	408.41	7.23	401.18							
	11S	399.98	29.23	370.75							
	12S	403.65	34.22	369.43							
	13S	399.92	29.41	370.51							
	14S	394.68	23.08	371.60							
	18	400.38	29.34	371.04							
	19	401.24	30.25	370.99							
	20	400.52	29.48	371.04							
	21S	400.76	29.95	370.81	3.1	3.6	7.43	60.3	453	1154	Clear
	21I	400.63	29.90	370.73	14.2	16.5	7.56	60.0	526	1254	Clear
	21D	400.73	29.88	370.85	35.8	38.0	7.69	62.5	546	1325	Clear

**STATIC LEVELS ARE TO BE TAKEN ON EACH WELL AT EVERY SAMPLING EVENT (A-B=C)
***(REF. DATUM POINT - FEET TO STATIC LEVEL) -BOTTOM OF WELL ELEV.) X .65 X 3 = 3 WELL VOLUMES (GAL)

LEGEND

- SPOT ELEVATION
- INTERMEDIATE CONTOUR
- INDEX CONTOUR
- DEPRESSION CONTOUR
- TREES AND TREELINE
- STRUCTURE AND BUILDING
- FENCE
- POLE
- ROADS
- EDGE OF WATER
- MANHOLES / CATCH BASIN
- POWER POLE
- PIPES
- FIELD BENCHMARK
- MONITORING WELL
- POTENTIOMETRIC CONTOUR BASED ON SHALLOW "S" WELLS
- DIRECTION OF GROUNDWATER FLOW
- WATER SUPPLY WELL
- CLOSED MONITORING WELL
- LANDFILL BOUNDARY
- TRANSMISSION LINES

REFERENCE DRAWINGS

12-30097A	BASELINE GROUND WATER QUALITY & POTENTIOMETRIC ELEVATIONS FOR 9/10/85
12-30550	ASH AREA AS BUILT MAPPING
12-30100	ASH AREA BORING LOCATION PLAN ACTIVE FILL AREA 1993
12-30101	ASH AREA MONITORING WELLS CONSTRUCTION DETAILS TABLE
12-30104	WELL LOCATION PLAN

DATE	NO.	DESCRIPTION	APPD.
6/14/12	ad	STATIC WATER LEVELS MEASURED MAY 9, 2012. CLOSED MONITORING WELL MW-4S & MW-4I. UPDATED REFERENCES.	

REVISIONS

THIS DRAWING IS CLASSIFIED AS:

AEP PUBLIC

REFERENCE AEP's CORPORATE INFORMATION SECURITY POLICY

INDIANA MICHIGAN POWER COMPANY

ROCKPORT PLANT

ROCKPORT INDIANA

GEOTECHNICAL

POTENTIOMETRIC MAP

12	DRAWING NUMBER 30105	REV. ad

SCALE:
DR: RM
CH:
SUP:
ENG:
DATE: SEE REV 0

CIVIL ENGINEERING

APPROVED BY J. T. Massey-Norton

AMERICAN ELECTRIC POWER

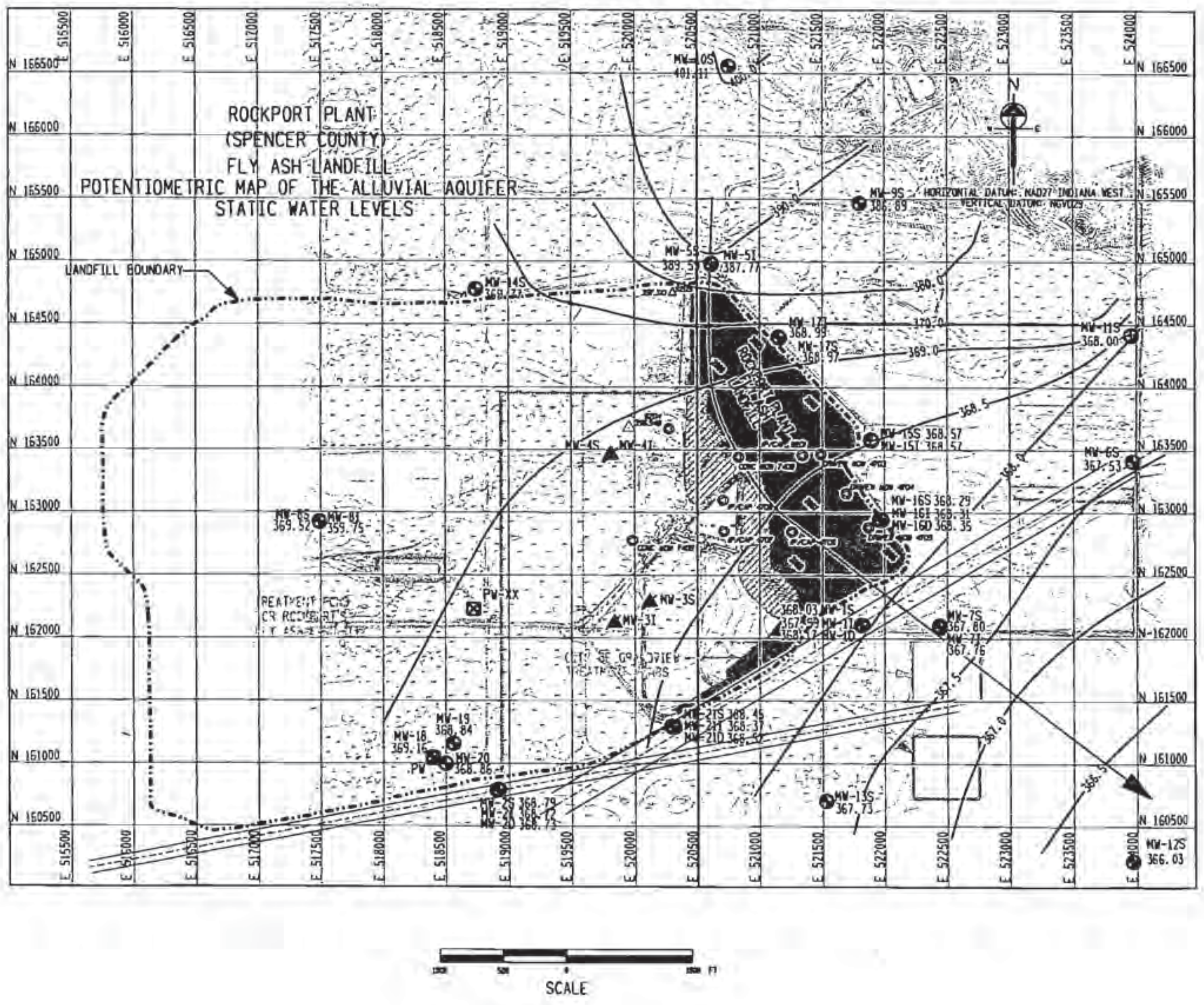
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

CROSS REFS:

12-30105

12-30105

NOVEMBER 5, 2012



AMERICAN ELECTRIC POWER
ROCKPORT PLANT FLYASH LANDFILL GROUNDWATER SAMPLING
SAMPLED BY:CAREY SANDERS MAHUS
DATE/FIELD CONDITIONS: NOV 7, 2012/CLOUDY, WINDY, COOL 50 DEG F, STATIC WATER LEVELS MEASURED NOV 5, 2012.

	WELL NO.	REF. DATUM POINT FT. (A)	** FEET TO STATIC LEVEL (B)	CALC. STATIC LEVEL (C)	*** 3 WELL VOLUMES (GAL)	ACTUAL AMT. PURGED GAL.	FIELD pH (S.U.)	FIELD Temp (Deg F)	FIELD COND (umhos)	TIME OF SAMPLING	NOTES
INTRA WELL	1S	397.29	29.26	368.03	5.7	8.2	8.18	57.2	637	1024	Clear
	1I	397.34	29.35	367.99	17.0	19.4	8.04	24.3	529	955	Clear
	1D	397.32	29.15	368.17	28.8	32.7	8.00	56.7	552	1030	Clear
	15S	392.62	24.05	368.57	8.9	11.8	7.21	57.5	719	1107	Clear
	15I	392.82	24.25	368.57	20.7	24.6	7.24	57.5	1485	1102	Clear
	16S	394.39	26.10	368.29	6.9	9.0	7.42	59.0	684	1002	Clear
	16I	394.37	26.06	368.31	20.4	28.5	7.54	59.0	650	935	Clear
	16D	394.49	26.14	368.35	35.9	37.8	7.58	58.5	627	954	Clear
	17S	395.49	26.52	368.97	7.9	9.0	7.22	57.5	816	1149	Clear
	17I	395.36	26.37	368.99	20.7	21.6	7.13	57.0	1393	1223	Clear
STATIC ONLY	2S	399.24	30.45	368.79							
	2I	399.26	30.54	368.72							
	2D	399.28	30.55	368.73							
	3S	396.81	CLOSED	5-8-08							
	3I	397.05	CLOSED	4-25-11							
	4S	396.58	CLOSED	4-17-12							
	4I	397.02	CLOSED	4-17-12							
	5S	396.00	6.41	389.59	11.6	15.1	7.44	58.5	2100	922	Clear
	5I	392.10	4.33	387.77							
	6S	394.89	27.36	367.53							
	7S	393.66	25.86	367.80							
	7I	393.62	25.86	367.76							
	8S	393.91	24.39	369.52	8.4	13.1	7.87	54.5	545	841	Clear
	8I	393.70	33.95	359.75	16.1	19.3	7.96	52.8	642	846	Clear
	9S	403.08	16.19	386.89							
	10S	408.41	7.30	401.11							
	11S	399.98	31.98	368.00							
	12S	403.65	37.62	366.03							
	13S	399.92	32.19	367.73							
	14S	394.68	24.91	369.77							
	18	400.38	31.22	369.16							
	19	401.24	32.40	368.84							
	20	400.52	31.66	368.86							
	21S	400.76	32.31	368.45	2.0	8.5	7.69	54.3	482	1105	Clear
	21I	400.63	32.26	368.37	13.1	14.8	7.92	57.3	530	1121	Clear
	21D	400.73	32.21	368.52	34.7	35.6	7.89	57.0	579	1237	Clear

**STATIC LEVELS ARE TO BE TAKEN ON EACH WELL AT EVERY SAMPLING EVENT (A-B=C)
***(REF. DATUM POINT - FEET TO STATIC LEVEL) -BOTTOM OF WELL ELEV.) X .16 X 3 = 3 WELL VOLUMES (GAL)

LEGEND

+509.5	SPOT ELEVATION
	INTERMEDIATE CONTOUR
520	INDEX CONTOUR
	DEPRESSION CONTOUR
	TREES AND TREELINE
	STRUCTURE AND BUILDING
	FENCE
	POLE
	ROADS
	EDGE OF WATER
	MANHOLES / CATCH BASIN
	POWER POLE
	PIPES
	TOWER
	FIELD BENCHMARK
●	MONITORING WELL
—371—	POTENTIOMETRIC CONTOUR (BASED ON SHALLOW "S" WELLS)
→	DIRECTION OF GROUNDWATER FLOW
⊠	WATER SUPPLY WELL
▲	CLOSED MONITORING WELL
	LANDFILL BOUNDARY
	TRANSMISSION LINES
	30" COVER PLACED

REFERENCE DRAWINGS

12-30097A	BASELINE GROUND WATER QUALITY & POTENTIOMETRIC ELEVATIONS FOR 9/10/85
12-30550	ASH AREA AS BUILT MAPPING
12-30100	ASH AREA BORING LOCATION PLAN ACTIVE FILL AREA 1993
12-30101	ASH AREA MONITORING WELLS CONSTRUCTION DETAILS TABLE
12-30104	WELL LOCATION PLAN

DATE	NO.	DESCRIPTION	APPD.
12/XX/12	AE	STATIC WATER LEVELS MEASURED NOV. 5, 2012.	

REVISIONS

THIS DRAWING IS CLASSIFIED AS:

AEP PUBLIC

REFERENCE AEP'S CORPORATE INFORMATION SECURITY POLICY

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INDIANA MICHIGAN POWER COMPANY

ROCKPORT PLANT

ROCKPORT INDIANA

GEOTECHNICAL

POTENTIOMETRIC MAP

UNIT: 12
DRAWING NUMBER: 30105
REV: AE
SCALE: AS SHOWN
CIVIL ENGINEERING
DR: KV
CH: JT M-N
SUP:
ENG:
DATE: SEE REV #
APPROVED BY: J. T. Massey-Norton

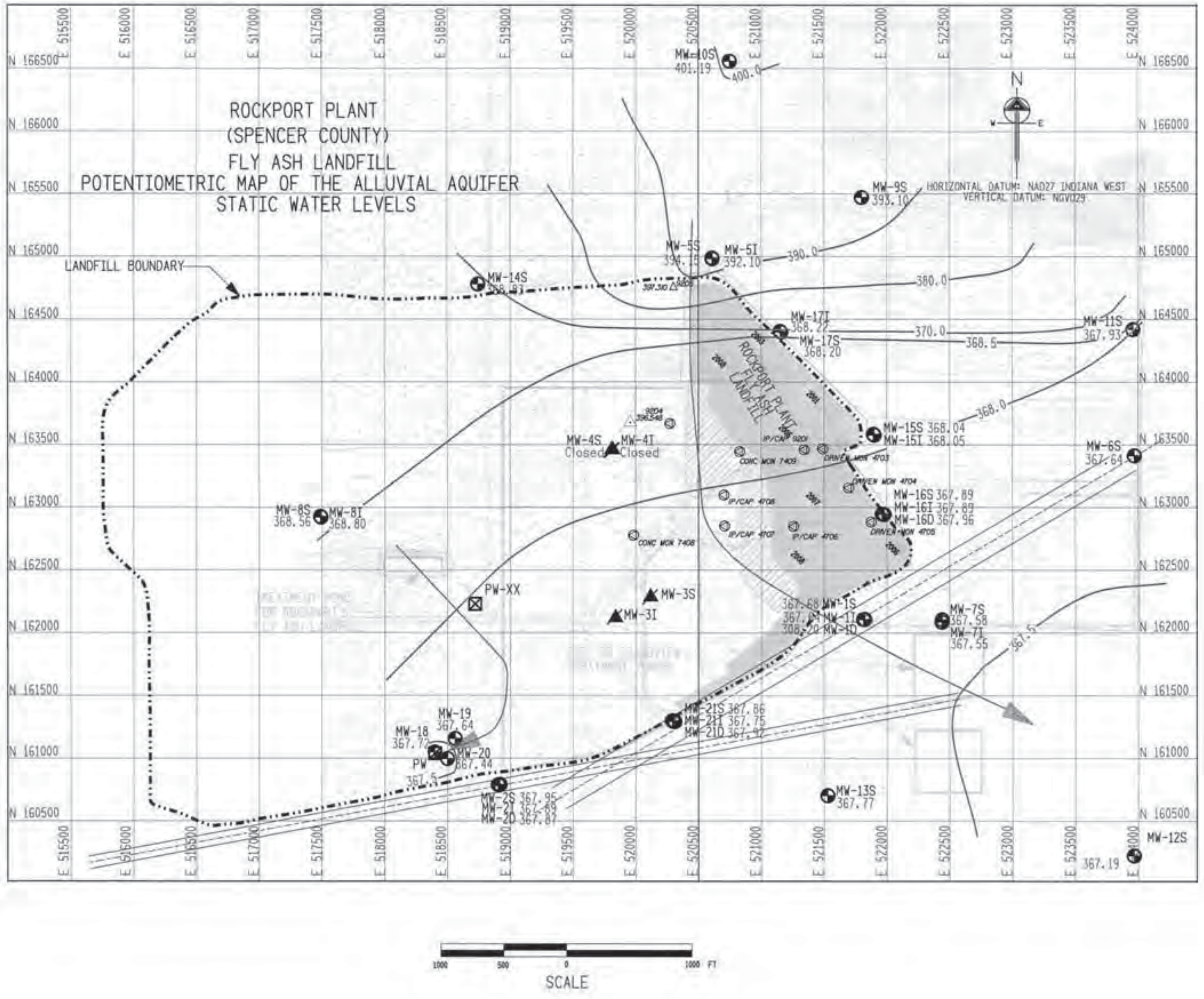
AEP AMERICAN ELECTRIC POWER

AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

7402

12-30105

MAY 13, 2013



AMERICAN ELECTRIC POWER
ROCKPORT PLANT FLYASH LANDFILL GROUNDWATER SAMPLING
SAMPLED BY:CAREY SANDERS HAHUS
DATE/FIELD CONDITIONS: MAY 16,2013/SUNNY, WARM 80 DEG F, STATIC WATER LEVELS MEASURED MAY 13, 2013.

	WELL NO.	REF. DATUM POINT FT. (A)	** FEET TO STATIC LEVEL (B)	CALC. STATIC LEVEL (C)	*** 3 WELL VOLUMES (GAL)	ACTUAL AMT. PURGED GAL.	FIELD pH (S.U.)	FIELD Temp (Deg F)	FIELD COND (umhos)	TIME OF SAMPLING	NOTES
I	1S	397.29	29.61	367.68	5.6	6.3	7.28	60.2	622	917	Clear
N	1I	397.34	29.70	367.64	16.9	20.9	7.53	60.0	528	1026	Clear
T	1D	397.32	29.50	367.82	28.6	31.9	7.58	59.6	546	1033	Clear
R	15S	392.62	24.58	368.04	8.7	8.7	7.17	59.0	727	1128	Clear
A	15I	392.82	24.77	368.05	20.4	21.2	7.21	58.7	1675	1134	Clear
W	16S	394.39	26.50	367.89	6.7	7.5	7.39	60.5	682	949	Clear
E	16I	394.37	26.48	367.89	20.2	21.3	7.67	60.0	657	1048	Clear
L	16D	394.49	26.53	367.96	35.7	36.8	7.47	59.5	636	1057	Clear
L	17S	395.49	27.29	368.20	7.5	7.9	7.31	58.4	778	1208	Clear
	17I	395.36	24.14	368.22	20.4	21.1	7.23	58.2	1411	1200	Clear
	2S	399.24	31.29	367.95	5.1	5.7	7.58	59.0	382.5	1108	Clear
S	2I	399.26	31.37	367.89	16.1	16.4	8.00	58.90	481.3	1156	Clear
T	2D	399.28	31.41	367.87	26.1	29.6	7.73	58.4	591.7	1208	Clear
	3S	396.81	CLOSED	5/8/2008							
A	3I	397.05	CLOSED	4/25/2011							
T	4S	396.58	CLOSED	4/17/2012							
	4I	397.02	CLOSED	4/17/2012							
I	5S	396.00	1.85	394.15	13.8	17.9	7.59	59.5	2970	1010	Clear
C	5I	392.10	0.00	392.10							
	6S	394.89	27.25	367.64							
	7S	393.66	26.08	367.58							
	7I	393.62	26.07	367.55							
O	8S	393.91	25.35	368.56	7.9	11.1	7.66	58.5	586	850	Clear
N	8I	393.70	24.90	368.80	20.5	21.2	7.55	58.5	622	910	Clear
	9S	403.08	11.14	393.10							
L	10S	408.41	7.22	401.19							
Y	11S	399.98	32.05	367.93							
	12S	403.65	36.46	367.19							
	13S	399.92	32.15	367.77							
	14S	394.68	25.85	368.83							
	18	400.38	32.66	367.72							
	19	401.24	33.60	367.64							
	20	400.52	33.08	367.44							
	21S	400.76	32.90	367.86	1.7	1.8	8.04	59.7	505	1215	Clear
	21I	400.63	32.88	367.75	12.8	13.2	7.53	59.8	531	1258	Clear
	21D	400.73	32.81	367.92	34.4	37.0	7.86	59.3	577	1350	Clear

**STATIC LEVELS ARE TO BE TAKEN ON EACH WELL AT EVERY SAMPLING EVENT (A-B=C)
***(REF. DATUM POINT - FEET TO STATIC LEVEL) -BOTTOM OF WELL ELEV.) X .16 X 3 = 3 WELL VOLUMES (GAL)

LEGEND

	SPOT ELEVATION
	INTERMEDIATE CONTOUR
	INDEX CONTOUR
	DEPRESSION CONTOUR
	TREES AND TREELINE
	STRUCTURE AND BUILDING
	FENCE
	POLE
	ROADS
	EDGE OF WATER
	MANHOLES / CATCH BASIN
	POWER POLE
	PIPES
	TOWER
IP/CAP 4706 ◎	FIELD BENCHMARK
MW-8S ●	MONITORING WELL
—371—	POTENTIOMETRIC CONTOUR (BASED ON SHALLOW "S" WELLS)
→	DIRECTION OF GROUNDWATER FLOW
☒	WATER SUPPLY WELL
▲	CLOSED MONITORING WELL
—··—···	LANDFILL BOUNDARY
	TRANSMISSION LINES
	30" COVER PLACED

REFERENCE DRAWINGS

12-30097A	BASELINE GROUND WATER QUALITY & POTENTIOMETRIC ELEVATIONS FOR 9/10/85
12-30550	ASH AREA AS BUILT MAPPING
12-30100	ASH AREA BORING LOCATION PLAN ACTIVE FILL AREA 1993
12-30101	ASH AREA MONITORING WELLS CONSTRUCTION DETAILS TABLE
12-30104	WELL LOCATION PLAN

DATE	NO.	DESCRIPTION	APPD.
07/02/13	AF	STATIC WATER LEVELS MEASURED MAY 13, 2013.	JMN GF

REVISIONS

THIS DRAWING IS CLASSIFIED AS:

AEP PUBLIC

REFERENCE AEP's CORPORATE INFORMATION SECURITY POLICY

INDIANA MICHIGAN POWER COMPANY

ROCKPORT PLANT

ROCKPORT INDIANA

GEOTECHNICAL

POTENTIOMETRIC MAP

UNIT:	DRAWING NUMBER:	REV:
12	30105	AF

SCALE: AS SHOWN
DR: KRJ
CH: JT 8-8
SUP:
ENG:
DATE: SEE REV #

CIVIL ENGINEERING

APPROVED BY: J. T. Massey-Norton

AMERICAN ELECTRIC POWER
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

12-30105

CROSS REFS:

Appendix D-3

Landfill Piezometric Data

Appendix D-3
Landfill Monitoring Well Piezometric Data
AEP Rockport Plant, Indiana

Well ID	**1S**	**1I**	**1D**	**2S**	**2I**	**2D**	**3S**	**3I**
Min	365.88	365.84	365.89	366.86	366.94	366.96	366.81	366.84
Max	371.54	371.48	371.53	370.94	370.96	370.95	370.69	370.7
Date								
11/18/1992								
5/5/1995								
11/28/1995								
6/6/1996								
11/12/1998					370.09	370.09		
5/27/1999	368.88	368.90	368.90					
11/17/1999		367.13	367.17					
5/10/2000	366.90	366.85	366.91	367.59	367.59	367.59	367.29	367.35
11/8/2000	366.32	365.84	366.33	366.86	366.94	366.96	366.81	366.84
12/29/2000					366.94			
5/8/2001	366.57	366.54	366.57	367.15	367.17	367.14	366.92	367.00
5/29/2001								
11/7/2001	365.88	365.84	365.89					
11/13/2001								
5/29/2002	367.39	367.64	367.70					
8/1/2002								
11/13/2002	367.78	367.75	367.78					
5/14/2003	368.62	368.62	368.63					
11/6/2003	369.39	369.35	369.41					
5/19/2004	370.48	370.44	370.47	370.84	370.85	370.85	370.69	370.70
11/9/2004	370.02	369.99	370.03					
5/17/2005	371.54	371.48	371.53					
11/8/2005	369.15	369.13	369.16	369.74	369.75	369.73	369.70	369.74
5/9/2006	367.99	367.94	368.27					
11/8/2006	367.24	367.20	367.25					
5/9/2007	369.19	369.15	369.20					
11/12/2007	367.68	367.65	367.71	368.24				
5/6/2008	369.68	369.62	369.65					
11/20/2008	369.12	369.07	369.12					
5/20/2009	368.02	368.00	368.04					
7/14/2009								
9/9/2009								
11/10/2009	367.62	367.59	367.74					
1/19/2010								
3/17/2010								
5/18/2010	368.34	368.30	368.47					
11/3/2010	367.54	367.51	367.69					
1/4/2011								
1/10/2011								
1/17/2011								
2/8/2011								
2/14/2011								
3/2/2011								
3/22/2011								
5/12/2011	368.49	368.46	368.64					
11/10/2011	370.34	370.31	370.48					
5/8/2012	370.57	370.54	370.70	370.94	370.96	370.95		
11/7/2012	368.03	367.99	368.17	368.72	368.72	368.73		
5/16/2013	367.68	367.64	367.82	367.88	367.89	367.87		
8/21/2013				368.49	368.48	368.46		
11/4/2013	367.46	367.40	367.59	367.74	367.74	367.73		
1/20/2014				367.52	367.49	367.52		
5/7/2014	368.37	368.35	368.52	368.34	368.21	368.23		
11/11/2014	367.98	367.95	368.13	368.28	368.28	368.29		
5/5/2015	367.59	367.55	367.73	368.25	368.21	368.20		

Note: Elevations in feet above Mean Sea Level (MSL, equivalent to NGVD29)

Appendix D-3
Landfill Monitoring Well Piezometric Data
AEP Rockport Plant, Indiana

Well ID	4S	4I	5S	5I	6S	7S	7I	8S
Min	366.52	366.5	388.8	387.63	365.95	366.15	366.31	367.1
Max	371.89	371.86	394.52	392.9	370.65	370.41	371.9	371.56
Date								
11/18/1992								
5/5/1995								
11/28/1995								
6/6/1996								
11/12/1998	370.28	370.26	390.41					370.87
5/27/1999	369.35	369.47	392.50					370.05
11/17/1999	367.99	367.99	389.20					368.71
5/10/2000	367.39	367.40	392.93	391.00	366.61	366.79	366.78	368.06
11/8/2000	367.05	367.04	391.56	389.63	365.95	366.15	366.31	367.70
12/29/2000								
5/8/2001	367.13	367.13	392.11	390.34	366.33	366.41	366.40	367.72
5/29/2001								
11/7/2001	366.52	366.50	391.51					367.10
11/13/2001								
5/29/2002	368.01	368.00	393.72					368.58
8/1/2002								
11/13/2002	368.40	368.42	390.96					368.91
5/14/2003	368.98	368.98	394.52					369.53
11/6/2003	369.92	369.90	390.61					370.32
5/19/2004	370.76	370.78	393.85	391.95	370.65	370.37	370.35	371.21
11/9/2004	370.96	370.65		390.87				371.20
5/17/2005	371.89	371.86		392.90			371.90	
11/8/2005	369.97	369.97	389.50	387.63	368.75	368.98	368.94	370.61
5/9/2006	368.45	368.45	393.30					369.02
11/8/2006	367.66	367.64	394.29					368.17
5/9/2007	369.37	369.38	392.90					369.81
11/12/2007	368.44	368.47	389.40					369.45
5/6/2008	369.68	368.69	392.81					370.22
11/20/2008	369.85	369.87	389.49					370.50
5/20/2009	368.58	368.59	394.29					369.24
7/14/2009								
9/9/2009								
11/10/2009	368.28	368.31	393.55					368.91
1/19/2010								
3/17/2010								
5/18/2010	368.76	368.76	393.09					369.29
11/3/2010	368.22	368.23	388.80					368.66
1/4/2011								
1/10/2011								
1/17/2011								
2/8/2011								
2/14/2011								
3/2/2011								
3/22/2011								
5/12/2011	368.77	368.77	394.12					369.31
11/10/2011	370.86	371.03	389.75					371.56
5/8/2012			391.46	389.55	370.39	370.41	370.41	371.46
11/7/2012			389.59	387.77	367.53	367.80	367.76	369.52
5/16/2013				392.10	367.64	367.58	367.55	368.56
8/21/2013								
11/4/2013			390.76	388.96	367.33	367.32	367.29	368.23
1/20/2014								
5/7/2014			394.43					368.59
11/11/2014			390.60					368.84
5/5/2015			393.54					368.34

Appendix D-3
Landfill Monitoring Well Piezometric Data
AEP Rockport Plant, Indiana

Well ID	**8I**	**9S**	**10S**	**11S**	**12S**	**13S**	**14S**	**15S**
Min	367.23	386.89	400.09	366.33	364.85	366.2	367.85	366.24
Max	372.48	393.1	402.92	370.75	370.05	370.56	371.6	371.76
Date								
11/18/1992				368.96				
5/5/1995								
11/28/1995								
6/6/1996								
11/12/1998	371.00							
5/27/1999	370.20							369.18
11/17/1999	368.85							367.58
5/10/2000	368.25	390.35	400.79	366.76	366.59	367.15	368.05	367.11
11/8/2000	367.85	389.11	400.09	366.33	364.85	366.20	367.85	366.75
12/29/2000								
5/8/2001	367.96	390.01	400.65	366.65	365.75	366.62	367.90	366.86
5/29/2001								367.88
11/7/2001	367.23							366.24
11/13/2001								368.21
5/29/2002	368.76							367.88
8/1/2002								369.23
11/13/2002	369.09							368.21
5/14/2003	369.70							368.87
11/6/2003	370.49							369.82
5/19/2004	371.38	391.89	402.92	370.67	370.05	370.56	371.29	370.82
11/9/2004	371.34							370.40
5/17/2005	372.48							371.76
11/8/2005	370.79	387.77	402.81	369.32	367.11	368.87	370.95	369.65
5/9/2006	369.19							368.29
11/8/2006	368.33							367.54
5/9/2007	369.96							369.38
11/12/2007	369.18							368.14
5/6/2008	370.38							369.67
11/20/2008	370.65							369.63
5/20/2009	369.40							368.37
7/14/2009								
9/9/2009								
11/10/2009	369.09							368.07
1/19/2010								
3/17/2010								
5/18/2010	369.45							368.64
11/3/2010	369.03							368.07
1/4/2011								
1/10/2011								
1/17/2011								
2/8/2011								
2/14/2011								
3/2/2011								
3/22/2011								
5/12/2011	369.56				370.05			368.53
11/10/2011	371.79				368.32			370.87
5/8/2012	371.70	388.61	401.18	370.75	369.43	370.51	371.60	371.00
11/7/2012		386.89	401.11	368.00	366.03	367.73	369.77	368.57
5/16/2013	368.80	393.10	401.19	367.93	367.19	367.77	368.83	368.04
8/21/2013								
11/4/2013	368.65	388.04	401.18	367.78	365.97	367.26	368.70	367.99
1/20/2014								
5/7/2014	368.89							368.69
11/11/2014	369.14							368.56
5/5/2015	368.62							367.86

Appendix D-3
Landfill Monitoring Well Piezometric Data
AEP Rockport Plant, Indiana

Well ID	15I	16S	16I	16D	17S	17I	18	19
Min	366.25	366.09	366.11	366.14	366.55	366.56	367.64	367.64
Max	371.79	371.73	371.75	370.9	371.88	371.25	367.72	367.79
Date								
11/18/1992								
5/5/1995			368.02					
11/28/1995		368.30	368.33	368.33	368.84	368.85		
6/6/1996						369.66		
11/12/1998								
5/27/1999	369.16	369.08	369.08	369.11	369.41	369.42		
11/17/1999	367.65	367.38	367.38	367.44	367.97	367.98		
5/10/2000	367.12	367.05	367.06	367.10	367.23	367.27		
11/8/2000	366.76	366.58	366.62	366.61	367.08	367.05		
12/29/2000								
5/8/2001	366.88	366.76	366.77	366.79	367.08	367.05		
5/29/2001								
11/7/2001	366.25	366.09	366.11	366.14	366.55	366.56		
11/13/2001								
5/29/2002	367.90	367.86	367.92	367.94	367.92	367.91		
8/1/2002	369.25			369.23		369.26		
11/13/2002	368.22	368.04	367.98	368.09	368.50	368.51		
5/14/2003	368.90	368.85	368.83	368.90	368.95	368.98		
11/6/2003	369.86	369.70	369.64	369.72	370.04	370.08		
5/19/2004	370.73	370.67	370.71	370.74	370.84	370.81		
11/9/2004	370.45	370.28	370.28	370.34	370.69	370.71		
5/17/2005	371.79	371.73	371.75	370.80	371.88			
11/8/2005	369.68	369.43	369.44	369.49	370.06	370.06		
5/9/2006	368.33	368.20	368.19	368.24	368.49	368.52		
11/8/2006	367.57	367.49	367.43	367.50	367.74	367.76		
5/9/2007	369.42	369.34	369.39	369.48	369.42	369.44		
11/12/2007	368.18	367.98	367.97	368.04	368.54	368.55		
5/6/2008	369.67	369.80	369.82	369.84	369.59			
11/20/2008	369.65	369.40	369.34	369.45	369.98	369.95		
5/20/2009	368.42	368.25	368.26	368.32	368.64	368.65		
7/14/2009								
9/9/2009								
11/10/2009	368.10	367.88	367.86	367.93	368.49	368.51		
1/19/2010								
3/17/2010								
5/18/2010	368.68	368.55	368.57		368.84	368.86		
11/3/2010	368.06	367.83	367.83	367.90	368.46	368.46		
1/4/2011				367.15				
1/10/2011				367.03				
1/17/2011		366.99	366.98	367.03				
2/8/2011		366.58	366.59	366.63				
2/14/2011		366.59	366.59	366.64				
3/2/2011		366.40	366.41	366.46				
3/22/2011		366.79	366.79	366.84				
5/12/2011	368.57	368.58	368.60	368.65	368.43	368.46		
11/10/2011	370.89	370.59	370.60	370.75	371.20	371.20		
5/8/2012	371.01	370.84	370.83	370.90	371.21	371.25		
11/7/2012	368.57	368.29	368.31	368.35	368.97	368.99		
5/16/2013	368.05		367.89	367.96	368.20	368.22	367.72	367.64
8/21/2013								
11/4/2013	367.98	367.73	367.75	367.82	368.35	368.27	367.64	367.79
1/20/2014								
5/7/2014	368.68	368.61	368.63	368.69	368.81	368.81		
11/11/2014	368.57	368.29	368.30	368.38	368.94	368.94		
5/5/2015	367.83	367.77		367.84	367.87	367.87		

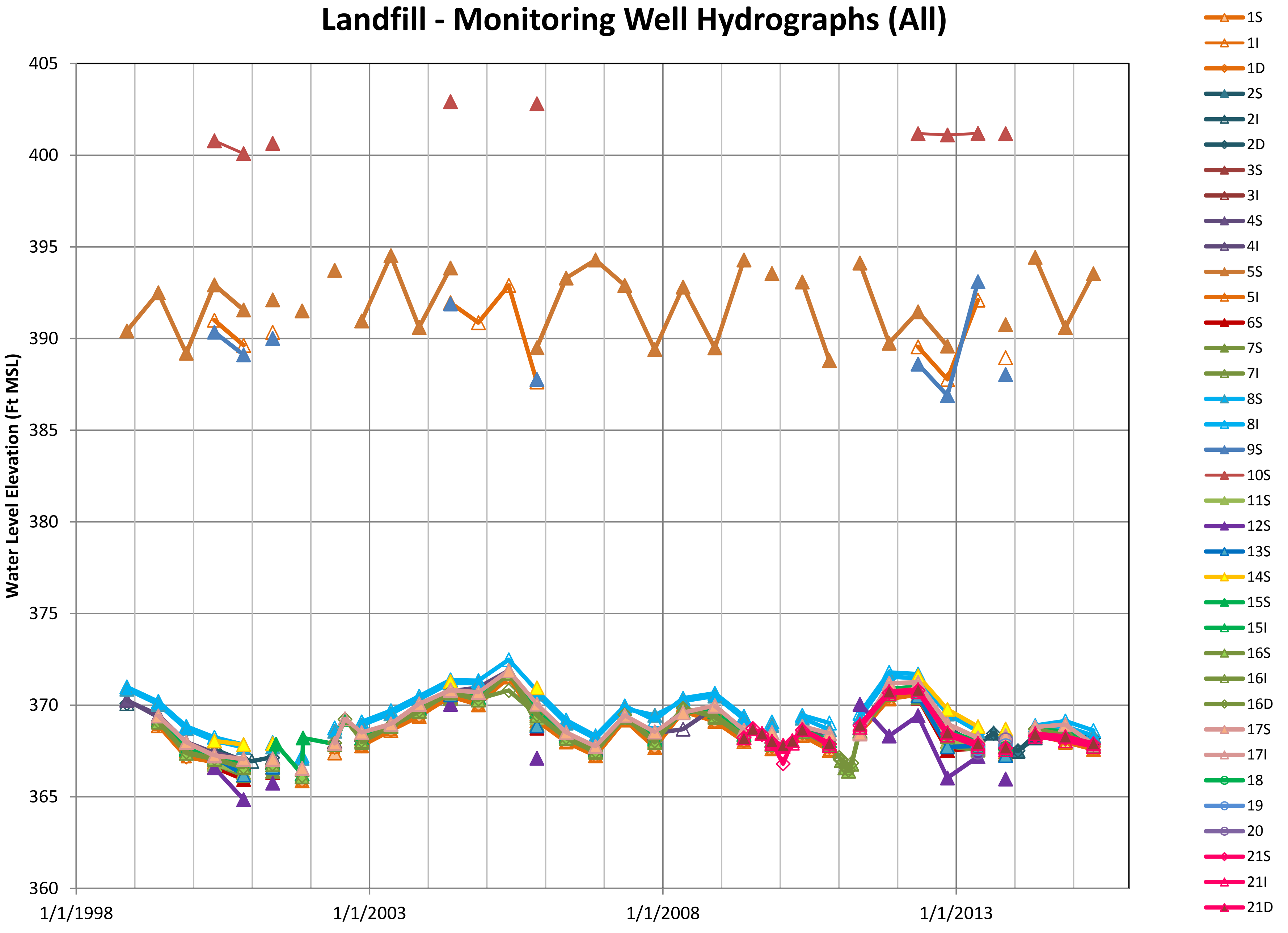
Appendix D-3
Landfill Monitoring Well Piezometric Data
AEP Rockport Plant, Indiana

Well ID	20	21S	21I	21D
Min	367.44	366.8	367.57	367.7
Max	368.11	370.81	370.73	370.85
Date				
11/18/1992				
5/5/1995				
11/28/1995				
6/6/1996				
11/12/1998				
5/27/1999				
11/17/1999				
5/10/2000				
11/8/2000				
12/29/2000				
5/8/2001				
5/29/2001				
11/7/2001				
11/13/2001				
5/29/2002				
8/1/2002				
11/13/2002				
5/14/2003				
11/6/2003				
5/19/2004				
11/9/2004				
5/17/2005				
11/8/2005				
5/9/2006				
11/8/2006				
5/9/2007				
11/12/2007				
5/6/2008				
11/20/2008				
5/20/2009		368.23	368.22	368.21
7/14/2009		368.73	368.72	368.72
9/9/2009		368.40	368.46	368.46
11/10/2009		367.98	367.92	368.04
1/19/2010		366.80	367.76	367.82
3/17/2010		368.01	367.93	368.07
5/18/2010		368.64	368.68	368.68
11/3/2010		367.86	367.79	367.93
1/4/2011				
1/10/2011				
1/17/2011				
2/8/2011				
2/14/2011				
3/2/2011				
3/22/2011				
5/12/2011		368.89	368.80	368.95
11/10/2011		370.68	370.63	370.75
5/8/2012		370.81	370.73	370.85
11/7/2012		368.45	368.37	368.52
5/16/2013	367.44	367.86	367.75	367.92
8/21/2013				
11/4/2013	368.11	367.66	367.57	367.70
1/20/2014				
5/7/2014		368.33	368.30	368.45
11/11/2014		368.20	368.06	368.30
5/5/2015		367.87	367.75	367.92

Appendix D-4

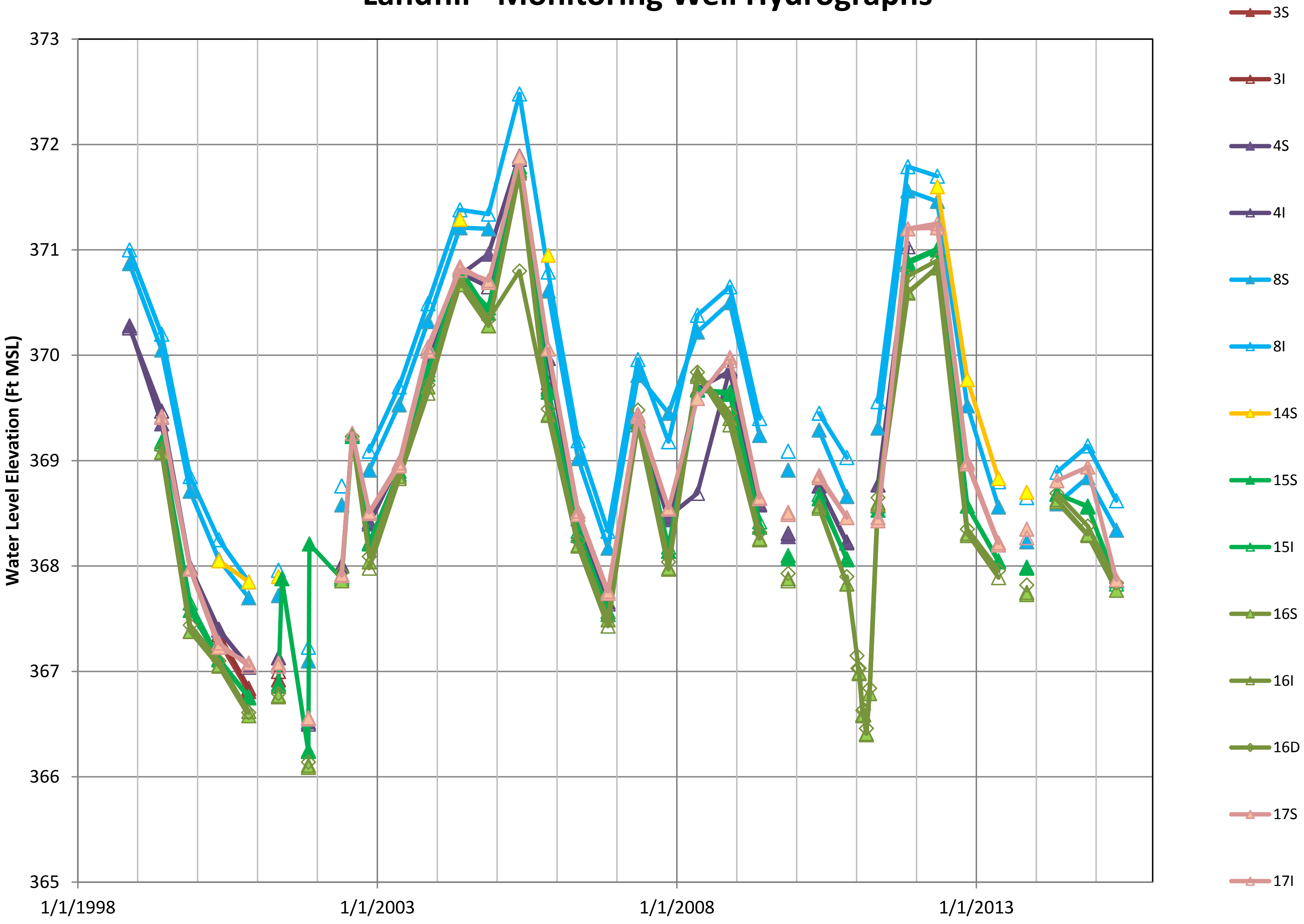
Landfill Monitoring Well Hydrographs

AEP Rockport Plant



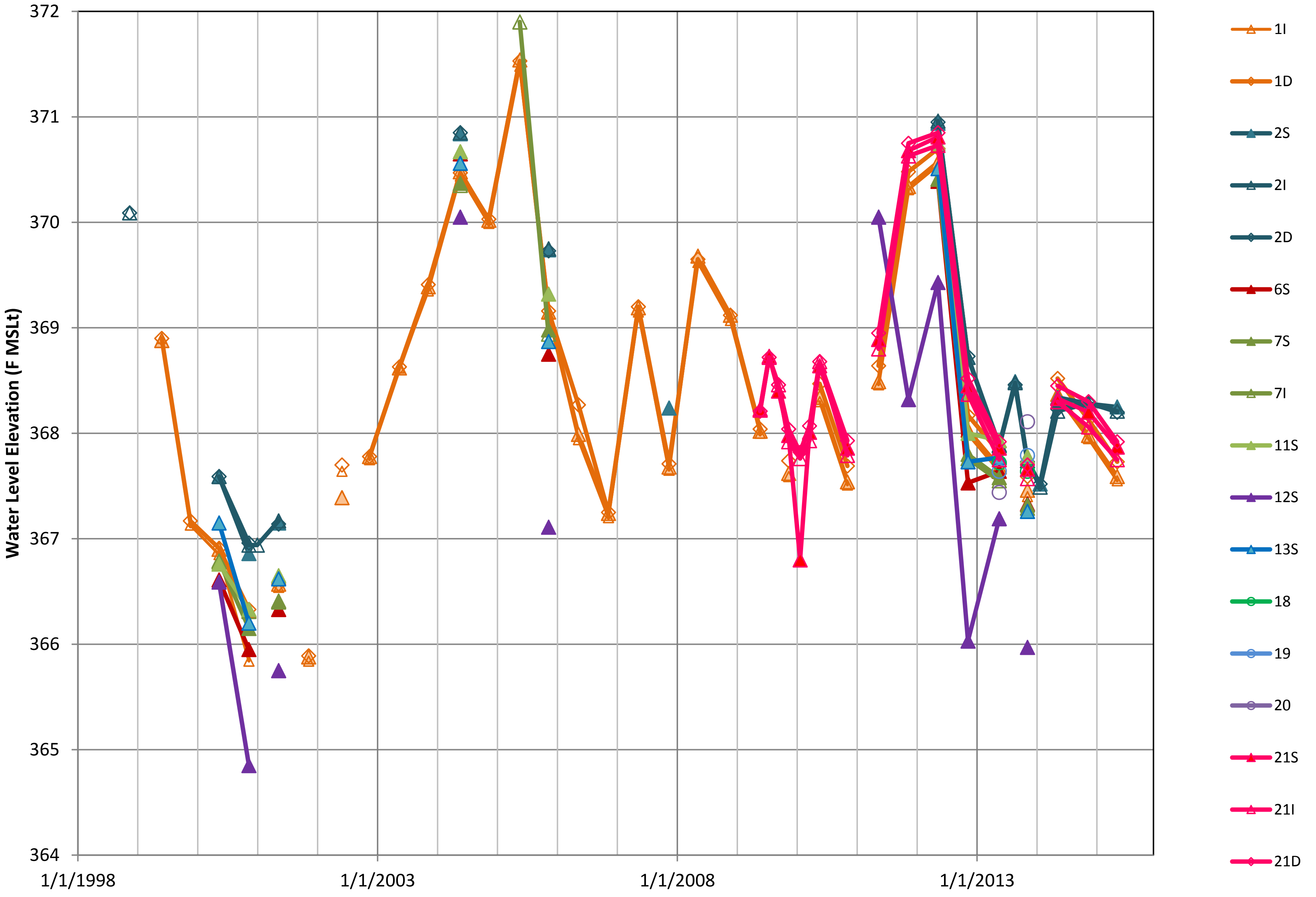
AEP Rockport Plant

Landfill - Monitoring Well Hydrographs



AEP Rockport Plant

Landfill - Monitoring Well Hydrographs



Appendix F

Annual Groundwater Monitoring and Corrective Action Reports

for

Rockport Plant's

Bottom Ash Pond Complex

and

Landfill

INDIANA
MICHIGAN
POWER

An AEP Company

BOUNDLESS ENERGY

Annual Groundwater Monitoring Report

Indiana Michigan Power Company

Rockport Plant

Bottom Ash Pond CCR Management Units

Rockport, Indiana

January 31, 2020

Prepared by:
American Electric Power Service Corporation
1 Riverside Plaza
Columbus, Ohio 43215

I. Overview

This *Annual Groundwater Monitoring and Corrective Action Report* (Report) has been prepared to report the status of activities for the year 2019 at the bottom ash pond (BAP) CCR unit at Indiana Michigan Power Company's (I&M) Rockport Plant. The Indiana Michigan Power Company is wholly owned subsidiary of American Electric Power Company (AEP). The USEPA's CCR rules require that the Annual Groundwater Monitoring and Corrective Action Report covering 2019 groundwater monitoring activities be posted to the operating record no later than January 31, 2020.

In general, the following activities were completed during 2019:

- As required by the CCR assessment monitoring rules in 40 CFR 257.95(b) and (d), three rounds of sampling to include the Appendix III and IV parameters as required were performed in May, June, and September 2019. The results were compared to calculated statistical limits for the Appendix III parameters and the calculated groundwater protection standards (GWPS) for the Appendix IV parameters.
- Analytical results of the May, June, and September rounds of sampling are listed in Appendix 1. Also shown are the groundwater flow rates and flow directions.
- Groundwater data underwent various validation tests, including tests for completeness, valid values, transcription errors, and consistent units;
- Statistical analysis reports of the May 2019 samples and the June/September 2019 samples are attached as Appendix 2 and 3 respectively. Whereas there were statistically significant increases in Appendix III indicator parameters, there were no exceedances of Appendix IV groundwater protection standards.
- Because an alternate source for the Appendix III SSIs could not be identified, the bottom ash pond remained in Assessment Monitoring status.

The major components of this annual report, to the extent applicable at this time, are presented in sections that follow:

- A map/aerial photograph showing the BAP CCR management units, all CCR 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.
- Results of the required statistical analysis of groundwater monitoring results.
- Discussion of the unsuccessful alternate source demonstration.

- 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.
- 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. <u>Groundwater Monitoring Well Locations and Identification Numbers</u>

Figure 1 below depicts the PE-certified BAP groundwater monitoring network, the monitoring well locations, and their corresponding identification numbers. Rather than separate groundwater monitoring systems for the East and West bottom ash ponds, the groundwater network monitors both of the bottom ash ponds as a single unit as allowed by 40 CFR 257.91(d). The CCR monitoring wells are listed as follows:

- Twelve Upgradient Wells: MW 1600 shallow, intermediate, and deep (S, I, D); MW 1601 S, I, D; MW 1701 S,I,D; and MW 1702 S,I,D.
- Fifteen Downgradient Wells: MW 1002, MW 1602 I,D ; MW 1603 S,I,D ; MW 1604 S,I,D ; MW 1605 S,I,D ; and MW 1606 S,I,D.

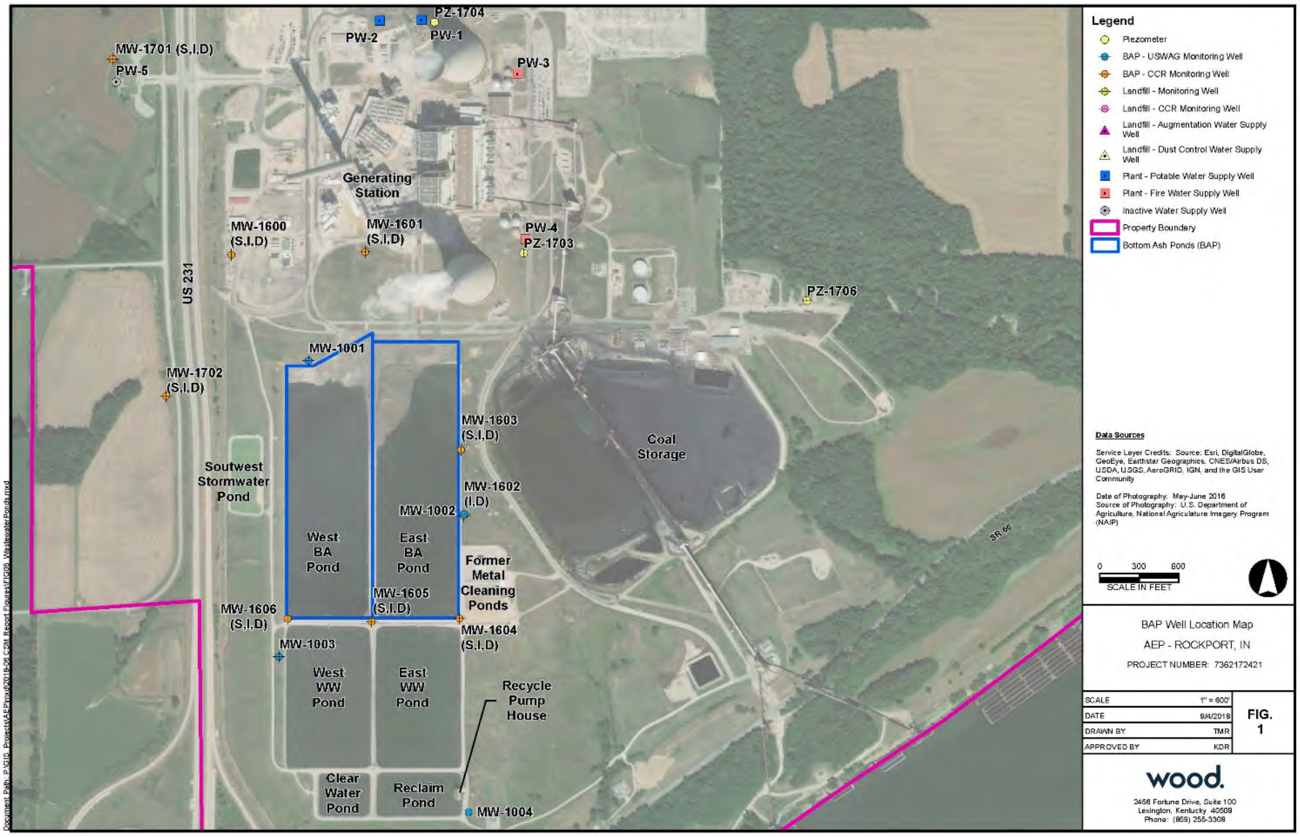


FIG. 1

III. Monitoring Wells Installed or Decommissioned

There were no new groundwater monitoring wells installed or decommissioned during 2019.

IV. Groundwater Quality Data and Static Water Elevation Data, With Flow Rates and Flow Directions

Appendix 1 contains tables showing the groundwater quality data collected during 2019. Table 1 shows the results of May, June, and September 2019 assessment monitoring samples as required by 40 CFR 257.95 (b) and (d). Table 1 also identifies the background concentrations as required by 40 CFR 257.95(d)(3).

Static water elevation data from each monitoring event also are shown in Appendix 1, along with the groundwater flow rates (Table 2) and flow directions developed after each sampling event.

V. Groundwater Quality Data Statistical Analysis

Appendix 2 contains the statistical analysis report of the first assessment monitoring samples taken in May 2019. Statistically significant increases (SSIs) in the Appendix III parameters of boron, calcium, chloride, fluoride, pH, TDS, and sulfate were documented in the report. A subsequent evaluation of Appendix IV parameter concentrations concluded that there were no exceedances of Appendix IV groundwater protection standards (GWPS).

Appendix 3 contains the statistical analysis report of the assessment monitoring samples taken in June and September of 2019. Statistically significant increases (SSIs) in the Appendix III parameters of boron, calcium, chloride, fluoride, pH, TDS, and sulfate were documented in the report. A subsequent evaluation of Appendix IV parameter concentrations concluded that there were no exceedances of Appendix IV groundwater protection standards (GWPS).

Since there were exceedances of Appendix III parameters during each of the three sampling rounds in 2019 but no exceedances of any Appendix IV groundwater protection standards, the BAP will remain in Assessment Monitoring status for the year 2020.

VI. Alternate Source Demonstrations

An alternate source demonstration (ASD) investigation relative to past Appendix III SSIs was completed in April 2018. That demonstration concluded that the groundwater quality and Appendix III indicator parameter SSIs identified in the statistical evaluations were potentially influenced by a release from the BAP to the groundwater. An alternate source could not be identified. Therefore, an alternate source demonstration investigation was not undertaken for the 2019 exceedances of Appendix III parameters.

VII. Discussion About Transition Between Monitoring Requirements or Alternate Monitoring Frequency

Because an alternate source for the Appendix III SSIs could not be identified, an assessment monitoring program was established at Rockport's BAP complex on April 15, 2018. Assessment monitoring continued through the 2019 calendar year.

The BAP will remain in assessment monitoring unless all Appendix III and IV parameters are below background values for two consecutive monitoring events (return to detection monitoring) as prescribed by 40 CFR 257.95(e). If an Appendix IV parameter exceeds its respective GWPS due to a release from the BAP, an assessment of corrective measures will be undertaken as required by 40 CFR 257.96.

Regarding defining an alternate monitoring frequency, the groundwater velocity and monitoring well production are high enough at this facility that no modification to the semiannual assessment monitoring frequency is needed.

VIII. Other Information Required

The BAP has progressed from detection monitoring to its current status in assessment monitoring. All required information has been included in this annual groundwater monitoring report.

IX. Description of Any Problems Encountered in 2018 and Actions Taken

No significant problems were encountered. The low flow sampling effort went smoothly and the schedule was met to support the 2019 annual groundwater report preparation covering the year 2019 groundwater monitoring activities.

X. A Projection of Key Activities for the Upcoming Year

Key activities for 2020 include:

- Continue in assessment monitoring and sample all CCR wells at the BAP for the Appendix III and IV parameters as required by 40 CFR 257.95.
- Perform statistical analysis on the sampling results for the Appendix III and Appendix IV parameters.
- Determine applicable GWPSs for the Appendix IV parameters, and compare the results of Appendix IV concentrations in downgradient wells to the GWPSs.
- If no GWPSs are exceeded, the BAP will remain in assessment monitoring.
- If a GWPS is exceeded in a downgradient well the following activities will be undertaken:
    - Characterize the nature and extent of a release by installing additional GW wells as necessary, estimate the quantity of material released and the concentrations

    of Appendix IV parameters that are in the material, and sample all wells to characterize the nature and extent of the release.

  - If contaminants have migrated off-site, notify all persons who own land that directly overlies any part of the plume of contamination.
  - Perform an alternate source demonstration (ASD) investigating whether the exceedance was caused by a source other than the BAP or was a result of an error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.
  - If a successful ASD cannot be made, initiate an assessment of corrective measures and follow all of those requirements.

- Respond to any new data received in light of what the CCR rule requires.
- Prepare the annual groundwater report covering 2020 groundwater monitoring activities to be filed not later than January 31, 2021.

APPENDIX 1

ROCKPORT PLANT CCR
BOTTOM ASH PONDS

ANNUAL GROUNDWATER MONITORING REPORT COVERING 2019 ACTIVITIES

GW QUALITY DATA, GW FLOW DIRECTIONS, GW FLOW RATES

Table 1 - Groundwater Data Summary: MW-1002
Rockport - 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
6/7/2016	Background	1.77	33.2	58.9	1.05	7.0	390	149
7/18/2016	Background	1.70	32.3	57.8	1.03	7.1	385	154
9/20/2016	Background	1.57	40.1	54.0	0.98	6.8	399	164
11/15/2016	Background	1.67	49.4	53.0	0.87	6.5	405	178
1/9/2017	Background	1.57	55.6	59.0	0.74	6.3	440	190
3/7/2017	Background	1.32	76.3	81.1	0.73	6.5	503	228
5/8/2017	Background	1.04	78.1	75.5	0.73	6.7	498	215
7/17/2017	Background	1.28	50.0	59.9	0.73	6.7	430	184
10/3/2017	Detection	1.63	36.4	54.4	0.80	7.1	403	166
12/12/2017	Detection	- -	- -	52.5	0.97	7.3	- -	177
1/11/2018	Detection	1.71	- -	53.2	0.91	7.0	- -	183
6/5/2018	Assessment	1.66	40.8	51.4	1.02	8.1	425	165
8/15/2018	Assessment	1.88	41.3	57.4	1.02	7.2	453	182
5/24/2019	Assessment	1.61	32.9	55.9	1.13	7.4	435	169
6/27/2019	Assessment	1.82	36.0	57.1	1.10	7.1	425	173
9/12/2019	Assessment	1.78	33.5	54.7	1.03	6.7	418	178

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-1002
Rockport - 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**
6/7/2016	Background	0.05	0.32	12.3	<0.005 U	0.02	0.3	0.830	0.1116	1.05	0.034	0.002	<0.002 U	1.92	0.08 J	0.02 J
7/18/2016	Background	0.05	0.29	14.2	<0.005 U	0.03	0.7	0.931	0.741	1.03	0.026	0.016	<0.002 U	2.54	0.1 J	0.03 J
9/20/2016	Background	0.04 J	0.24	18.5	<0.005 U	0.03	0.1	0.699	1.377	0.98	0.01 J	0.004	<0.002 U	3.38	0.1 J	0.02 J
11/15/2016	Background	0.06	0.24	23.5	0.006 J	0.15	0.075	0.664	0.686	0.87	0.031	0.010	<0.002 U	2.47	0.08 J	0.04 J
1/9/2017	Background	0.05 J	0.25	26.9	<0.005 U	0.04	0.078	0.692	1.052	0.74	0.022	0.006	<0.002 U	3.16	0.06 J	0.03 J
3/7/2017	Background	0.05	0.20	35.6	<0.005 U	0.07	0.331	0.568	0.483	0.73	0.163	0.003	<0.002 U	2.69	0.1 J	0.04 J
5/8/2017	Background	0.05	0.24	26.8	<0.004 U	0.05	0.177	0.526	0.2337	0.73	0.037	0.009	<0.002 U	2.69	0.06 J	0.02 J
7/17/2017	Background	0.04 J	0.21	21.4	<0.004 U	0.03	0.107	0.665	3.029	0.73	0.02 J	0.009	<0.002 U	3.05	0.07 J	0.04 J
6/5/2018	Assessment	0.07	0.44	12.7	0.004	0.03	0.04 J	0.768	0.569	1.02	0.031	0.011	<0.002 U	6.19	0.06	0.03 J
8/15/2018	Assessment	0.05 J	0.28	13.8	<0.004 U	0.03	0.281	0.820	0.766	1.02	0.02 J	<0.0002 U	- -	7.86	0.07 J	0.03 J
5/24/2019	Assessment	0.05 J	0.23	13.3	<0.02 U	0.03 J	0.09 J	0.754	0.1886	1.13	<0.02 U	<0.009 U	<0.002 U	8.67	0.05 J	<0.1 U
6/27/2019	Assessment	0.05 J	0.24	14.8	<0.02 U	0.03 J	0.07 J	0.805	0.682	1.10	0.03 J	<0.009 U	<0.002 U	10.4	0.08 J	<0.1 U
9/12/2019	Assessment	0.05 J	0.22	15.8	<0.02 U	0.02 J	0.469	0.635	0.384	1.03	<0.05 U	0.00438	<0.002 U	10.2	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

Table 1 - Groundwater Data Summary: MW-1600D
Rockport - 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
6/8/2016	Background	0.016	83.5	31.5	0.20	7.6	444	43.9
7/19/2016	Background	0.015	74.9	32.2	0.22	7.2	413	44.9
9/19/2016	Background	<0.002 U	85.6	30.9	0.20	7.1	385	38.7
11/16/2016	Background	0.024	83.1	30.9	0.17	7.2	415	35.9
1/10/2017	Background	0.014	87.8	31.0	0.22	7.1	384	42.5
3/7/2017	Background	0.036	84.9	31.6	0.19	7.0	374	39.2
5/8/2017	Background	0.037	89.1	32.6	0.21	6.5	402	38.4
7/17/2017	Background	0.038	73.6	31.6	0.17	6.5	389	40.1
10/3/2017	Detection	0.040	78.3	31.5	0.20	7.3	398	40.8
12/12/2017	Detection	- -	- -	31.5	0.20	7.1	- -	42.5
6/4/2018	Assessment	0.079	83.5	32.8	0.23	7.3	397	39.2
8/14/2018	Assessment	0.085	86.6	31.5	0.24	7.1	400	41.0
5/20/2019	Assessment	<0.02 U	76.5	31.4	0.21	7.2	394	43.0
6/25/2019	Assessment	0.03 J	84.2	31.0	0.22	7.1	407	37.7
9/10/2019	Assessment	<0.02 U	90.1	31.1	0.23	7.2	404	41.3

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-1600D
Rockport - 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**
6/8/2016	Background	0.01 J	15.4	940	0.006 J	<0.004 U	0.2	0.109	2.148	0.20	0.095	<0.0002 U	<0.002 U	1.94	<0.03 U	0.01 J
7/19/2016	Background	0.02 J	17.2	946	0.005 J	<0.004 U	0.2	0.094	1.615	0.22	0.021	0.020	<0.002 U	2.19	0.05 J	0.054
9/19/2016	Background	0.01 J	15.1	910	<0.005 U	<0.004 U	0.9	0.071	1.636	0.20	0.020	0.011	<0.002 U	1.75	<0.03 U	0.01 J
11/16/2016	Background	<0.01 U	15.8	997	<0.005 U	<0.004 U	0.128	0.085	1.402	0.17	0.064	0.008	<0.002 U	1.79	0.04 J	<0.01 U
1/10/2017	Background	<0.01 U	15.2	877	<0.005 U	<0.004 U	0.115	0.1	2.265	0.22	0.053	0.009	<0.002 U	1.65	<0.03 U	<0.01 U
3/7/2017	Background	<0.01 U	16.2	986	<0.005 U	<0.004 U	0.427	0.081	1.322	0.19	0.038	0.008	<0.002 U	1.78	0.05 J	<0.01 U
5/8/2017	Background	0.01 J	15.9	914	0.004 J	<0.005 U	0.170	0.096	1.104	0.21	0.073	0.006	<0.002 U	1.64	0.05 J	<0.01 U
7/17/2017	Background	0.03 J	15.0	817	0.004 J	<0.005 U	0.180	0.112	2.223	0.17	0.076	0.009	<0.002 U	1.56	0.04 J	<0.01 U
6/4/2018	Assessment	0.02 J	13.8	766	0.01 J	0.02 J	0.112	0.297	0.833	0.23	0.102	0.009	<0.002 U	1.62	<0.03 U	0.02 J
8/14/2018	Assessment	<0.01 U	15.1	840	<0.004 U	<0.005 U	0.073	0.079	2.858	0.24	0.023	0.004	- -	1.62	<0.03 U	<0.01 U
5/20/2019	Assessment	<0.02 U	20.3	873	<0.02 U	0.08	0.274	0.176	1.948	0.21	0.238	<0.009 U	<0.002 U	2 J	<0.03 U	<0.1 U
6/25/2019	Assessment	<0.02 U	16.6	867	<0.02 U	<0.01 U	0.1 J	0.146	1.121	0.22	0.135	0.01 J	<0.002 U	2 J	0.05 J	<0.1 U
9/10/2019	Assessment	<0.02 U	16.1	884	<0.02 U	<0.01 U	0.2 J	0.132	1.621	0.23	0.1 J	0.00627	<0.002 U	2 J	<0.03 U	<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-1600I
Rockport - 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
6/8/2016	Background	0.019	79.2	33.5	0.23	- -	442	52.2
7/19/2016	Background	0.019	76.0	26.7	0.23	7.3	423	55.3
9/19/2016	Background	0.004 J	77.6	24.9	0.21	7.2	404	48.4
11/16/2016	Background	0.031	76.0	24.5	0.17	7.2	408	44.5
1/10/2017	Background	0.016	76.5	23.7	0.19	7.1	394	45.8
3/7/2017	Background	0.049	75.5	26.4	0.20	7.2	392	49.2
5/8/2017	Background	0.033	80.2	25.0	0.22	6.8	406	48.5
7/17/2017	Background	0.046	71.5	24.4	0.17	9.3	398	48.0
10/3/2017	Detection	0.051	71.1	24.4	0.21	7.3	400	50.7
12/12/2017	Detection	- -	- -	24.7	0.21	- -	- -	52.4
6/4/2018	Assessment	0.046	72.8	25.4	0.24	7.5	396	50.0
8/14/2018	Assessment	0.057	78.6	25.6	0.25	7.1	426	50.3
5/20/2019	Assessment	0.03 J	71.0	25.4	0.22	7.3	411	52.8
6/25/2019	Assessment	0.02 J	76.0	25.0	0.23	7.1	401	46.7
9/10/2019	Assessment	0.02 J	81.1	25.6	0.24	7.2	404	50.8

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-1600I
Rockport - 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**
6/8/2016	Background	0.05 J	15.9	832	<0.005 U	0.005 J	0.4	1.27	7.25	0.23	0.107	0.003	<0.002 U	1.68	<0.03 U	0.02 J
7/19/2016	Background	0.03 J	17.9	805	<0.005 U	<0.004 U	0.3	1.38	1.902	0.23	0.099	0.010	<0.002 U	1.83	0.03 J	<0.01 U
9/19/2016	Background	0.03 J	16.0	778	<0.005 U	0.01 J	0.2	1.13	1.55	0.21	0.037	0.010	<0.002 U	1.89	0.06 J	0.065
11/16/2016	Background	0.03 J	16.3	801	<0.005 U	0.01 J	0.081	1.14	2.47	0.17	0.01 J	0.013	<0.002 U	1.63	<0.03 U	0.02 J
1/10/2017	Background	0.02 J	16.7	736	<0.005 U	<0.004 U	0.158	1.20	0.9137	0.19	0.006 J	0.005	<0.002 U	1.64	<0.03 U	0.02 J
3/7/2017	Background	0.02 J	16.8	696	<0.005 U	0.02 J	0.270	1.13	1.624	0.20	0.054	0.005	<0.002 U	1.67	0.04 J	0.03 J
5/8/2017	Background	0.02 J	17.0	762	<0.004 U	<0.005 U	0.095	1.26	1.75	0.22	0.01 J	0.011	<0.002 U	1.54	<0.03 U	0.02 J
7/17/2017	Background	0.02 J	16.8	710	<0.004 U	<0.005 U	0.397	1.27	2.009	0.17	0.108	0.010	<0.002 U	1.53	<0.03 U	0.02 J
6/4/2018	Assessment	0.04 J	20.6	820	<0.004 U	<0.005 U	0.061	1.48	2.59	0.24	0.02 J	0.012	<0.002 U	1.98	<0.03 U	0.03 J
8/14/2018	Assessment	0.02 J	17.5	726	<0.004 U	<0.005 U	0.087	1.29	1.797	0.25	0.025	0.007	- -	1.64	<0.03 U	0.03 J
5/20/2019	Assessment	<0.02 U	17.7	737	<0.02 U	<0.01 U	0.1 J	1.24	1.988	0.22	<0.02 U	<0.009 U	<0.002 U	2 J	<0.03 U	<0.1 U
6/25/2019	Assessment	<0.02 U	17.2	740	<0.02 U	<0.01 U	<0.04 U	1.23	2.301	0.23	<0.02 U	0.009 J	<0.002 U	2 J	<0.03 U	<0.1 U
9/10/2019	Assessment	<0.02 U	16.9	722	<0.02 U	<0.01 U	0.1 J	1.29	1.22	0.24	<0.05 U	0.0072	<0.002 U	2 J	<0.03 U	<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-1600S
Rockport - 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**
6/8/2016	Background	0.045	69.8	32.0	0.33	6.6	491	75.8
7/19/2016	Background	0.045	67.0	29.9	0.34	6.8	448	76.0
9/19/2016	Background	0.026	63.2	21.3	0.32	6.4	408	60.8
11/16/2016	Background	0.061	63.5	27.1	0.28	6.8	426	54.4
1/10/2017	Background	0.034	68.5	23.7	0.32	6.5	433	53.1
3/7/2017	Background	0.129	63.2	25.0	0.37	6.8	402	58.5
5/8/2017	Background	0.039	69.0	26.0	0.40	6.6	427	54.6
7/17/2017	Background	0.068	58.0	18.0	0.36	9.5	393	41.0
10/3/2017	Detection	0.049	61.4	27.8	0.37	6.8	430	54.9
12/13/2017	Detection	- -	- -	36.1	0.36	6.7	- -	68.0
6/4/2018	Assessment	0.076	60.9	36.5	0.56	7.3	412	41.3
8/15/2018	Assessment	0.088	63.7	44.9	0.51	7.0	416	42.3
5/21/2019	Assessment	0.05 J	57.4	27.9	0.44	6.9	423	57.4
6/25/2019	Assessment	0.05 J	62.7	21.4	0.47	6.8	398	40.9
9/10/2019	Assessment	0.04 J	64.8	23.9	0.46	6.9	383	45.0

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-1600S
Rockport - 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**
6/8/2016	Background	0.02 J	0.67	36.1	<0.005 U	0.02 J	0.2	0.243	0.149	0.33	0.118	0.003	0.002 J	0.61	0.5	<0.01 U
7/19/2016	Background	0.02 J	0.67	37.9	<0.005 U	0.02 J	0.4	0.099	0.52826	0.34	0.048	0.038	<0.002 U	0.56	0.3	0.01 J
9/19/2016	Background	0.02 J	0.58	30.9	<0.005 U	0.01 J	0.2	0.129	0.0715	0.32	0.087	0.019	<0.002 U	0.56	0.3	0.02 J
11/16/2016	Background	0.04 J	0.75	32.9	0.008 J	0.03	0.284	0.690	0.505	0.28	0.360	0.024	<0.002 U	0.64	0.4	0.04 J
1/10/2017	Background	0.02 J	0.65	29.3	0.006 J	0.01 J	0.892	0.306	1.8182	0.32	0.151	0.016	<0.002 U	0.60	0.4	0.01 J
3/7/2017	Background	0.03 J	0.70	30.5	0.008 J	0.02 J	0.459	0.587	1.697	0.37	0.319	0.013	<0.002 U	0.66	0.5	0.01 J
5/8/2017	Background	0.02 J	0.65	26.9	<0.004 U	0.02 J	0.163	0.398	0.305	0.40	0.195	0.019	<0.002 U	0.56	0.5	<0.01 U
7/17/2017	Background	0.02 J	0.61	26.1	0.006 J	0.02 J	0.302	0.441	0.117	0.36	0.233	0.019	<0.002 U	0.74	0.5	0.02 J
6/4/2018	Assessment	0.03 J	0.49	22.7	0.005 J	0.01 J	0.109	0.128	1.573	0.56	0.069	0.019	<0.002 U	0.72	0.5	0.02 J
8/15/2018	Assessment	0.02 J	0.45	23.7	<0.004 U	0.01 J	0.277	0.105	0.646	0.51	0.053	0.014	- -	0.65	0.4	0.02 J
5/21/2019	Assessment	0.03 J	0.50	26.7	<0.02 U	0.01 J	1.34	0.127	0.6234	0.44	0.07 J	0.01 J	<0.002 U	0.7 J	0.6	<0.1 U
6/25/2019	Assessment	<0.02 U	0.48	22.0	<0.02 U	0.01 J	0.08 J	0.193	0.528	0.47	0.09 J	0.03 J	<0.002 U	0.5 J	0.4	<0.1 U
9/10/2019	Assessment	<0.02 U	0.46	21.9	<0.02 U	0.01 J	0.2 J	0.149	0.2093	0.46	0.08 J	0.0126	<0.002 U	0.6 J	0.5	<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-1601D
Rockport - 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
6/27/2016	Background	0.038	79.7	21.8	0.22	7.5	460	21.9
7/19/2016	Background	0.035	89.0	18.9	0.22	7.4	412	18.9
9/20/2016	Background	0.026	87.0	22.6	0.17	7.2	410	20.4
11/16/2016	Background	0.035	89.5	21.8	0.15	7.4	413	18.0
1/10/2017	Background	0.029	90.7	19.5	0.19	6.8	407	20.3
3/7/2017	Background	0.055	85.2	28.7	0.17	7.1	392	25.4
5/9/2017	Background	0.038	90.8	22.5	0.17	6.7	399	21.3
7/17/2017	Background	0.090	77.7	21.3	0.17	6.8	393	21.4
10/4/2017	Detection	0.044	86.8	17.9	0.16	7.3	390	18.8
12/12/2017	Detection	- -	- -	18.8	0.16	7.2	- -	20.2
6/5/2018	Assessment	0.075	87.6	23.8	0.19	6.4	393	25.0
8/15/2018	Assessment	0.122	86.5	19.4	0.17	7.3	418	19.6
5/24/2019	Assessment	0.03 J	85.4	23.6	0.19	7.1	414	24.9
6/26/2019	Assessment	0.04 J	85.9	18.7	0.16	7.2	409	22.9
9/9/2019	Assessment	0.03 J	84.4	19.9	0.18	7.2	404	18.2

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-1601D
Rockport - 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
6/27/2016	Background	0.03 J	6.04	491	0.024	0.12	0.8	1.36	1.116	0.22	1.05	0.003	<0.002 U	2.54	0.1	0.01 J
7/19/2016	Background	0.02 J	8.20	540	<0.005 U	0.01 J	0.4	0.502	2.248	0.22	0.031	0.005	<0.002 U	3.96	0.07 J	0.055
9/20/2016	Background	0.01 J	8.59	602	<0.005 U	<0.004 U	0.2	0.224	1.732	0.17	0.01 J	<0.0002 U	<0.002 U	3.08	<0.03 U	<0.01 U
11/16/2016	Background	0.02 J	9.20	616	<0.005 U	0.01 J	0.089	0.174	0.946	0.15	0.022	0.015	<0.002 U	3.14	<0.03 U	0.04 J
1/10/2017	Background	<0.01 U	8.95	527	<0.005 U	<0.004 U	0.293	0.197	1.929	0.19	0.006 J	0.004	<0.002 U	3.10	<0.03 U	<0.01 U
3/7/2017	Background	<0.01 U	9.32	582	<0.005 U	<0.004 U	0.417	0.148	0.868	0.17	0.021	0.004	<0.002 U	2.66	<0.03 U	<0.01 U
5/9/2017	Background	0.02 J	9.47	583	0.01 J	0.01 J	0.121	0.152	0.983	0.17	0.026	0.008	<0.002 U	2.84	0.03 J	0.03 J
7/17/2017	Background	<0.01 U	9.38	532	<0.004 U	0.006 J	0.129	0.103	3.139	0.17	0.031	0.006	<0.002 U	2.67	<0.03 U	<0.01 U
6/5/2018	Assessment	0.03 J	11.4	552	<0.004 U	<0.005 U	0.055	0.149	2.095	0.19	0.022	0.007	<0.002 U	3.34	<0.03 U	<0.01 U
8/15/2018	Assessment	0.02 J	10.3	540	<0.004 U	0.01 J	0.387	0.120	1.188	0.17	0.084	<0.0002 U	- -	3.11	<0.03 U	0.02 J
5/24/2019	Assessment	<0.02 U	10.3	638	<0.02 U	<0.01 U	0.06 J	0.090	0.977	0.19	<0.02 U	0.01 J	<0.002 U	2.63	0.03 J	<0.1 U
6/26/2019	Assessment	<0.02 U	9.80	542	<0.02 U	<0.01 U	0.07 J	0.075	0.986	0.16	0.02 J	0.02 J	<0.002 U	2.94	<0.03 U	<0.1 U
9/9/2019	Assessment	<0.02 U	11	575	<0.02 U	<0.01 U	0.08 J	0.054	0.702	0.18	<0.05 U	0.0017	<0.002 U	3.15	<0.03 U	<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-1601I
Rockport - 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
6/8/2016	Background	0.024	84.9	26.3	0.21	7.4	419	54.0
7/19/2016	Background	0.023	84.1	33.3	0.25	7.2	430	5.40
9/20/2016	Background	0.043	85.2	32.3	0.22	7.1	432	49.1
11/16/2016	Background	0.026	91.6	31.7	0.19	7.2	434	46.7
1/10/2017	Background	0.018	92.6	31.3	0.19	6.7	429	47.7
3/7/2017	Background	0.029	84.0	32.5	0.22	7.1	427	48.5
5/9/2017	Background	0.079	90.0	33.1	0.21	6.8	422	49.1
7/17/2017	Background	0.039	82.0	32.0	0.19	9.5	418	49.9
10/4/2017	Detection	0.088	77.5	31.6	0.20	6.8	428	51.8
12/12/2017	Detection	- -	- -	30.5	0.21	7.1	- -	52.8
6/5/2018	Assessment	0.052	87.8	31.4	0.24	7.6	424	50.0
8/15/2018	Assessment	0.054	91.7	31.3	0.25	7.3	429	49.9
6/26/2019	Assessment	0.03 J	85.0	31.2	0.21	7.2	439	50.8
9/9/2019	Assessment	0.02 J	85.1	30.8	0.22	7.1	426	42.7

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-1601I
Rockport - 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
6/8/2016	Background	0.02 J	11.4	612	<0.005 U	<0.004 U	0.1	1.84	1.432	0.21	0.042	0.003	<0.002 U	2.80	<0.03 U	<0.01 U
7/19/2016	Background	0.02 J	14.6	620	<0.005 U	<0.004 U	0.9	1.98	1.036	0.25	0.045	0.004	<0.002 U	2.81	<0.03 U	<0.01 U
9/20/2016	Background	0.02 J	14.9	681	<0.005 U	<0.004 U	0.2	1.68	2.329	0.22	0.02 J	0.008	<0.002 U	2.53	<0.03 U	0.01 J
11/16/2016	Background	0.02 J	16.2	689	<0.005 U	0.007 J	0.110	1.68	1.451	0.19	0.030	0.002	<0.002 U	2.36	<0.03 U	0.02 J
1/10/2017	Background	0.01 J	16.2	605	<0.005 U	<0.004 U	0.387	1.58	0.993	0.19	0.02 J	0.007	<0.002 U	2.24	<0.03 U	0.02 J
3/7/2017	Background	0.03 J	16.9	650	<0.005 U	<0.004 U	0.267	1.59	0.986	0.22	0.070	0.010	<0.002 U	2.74	0.06 J	0.03 J
5/9/2017	Background	0.02 J	17.9	634	<0.004 U	<0.005 U	0.156	1.69	1.064	0.21	0.052	0.014	<0.002 U	2.23	0.05 J	0.02 J
7/17/2017	Background	0.02 J	18.0	613	<0.004 U	<0.005 U	0.160	1.74	1.276	0.19	0.042	0.011	<0.002 U	2.13	<0.03 U	0.02 J
6/5/2018	Assessment	0.02 J	18.6	631	0.008 J	0.01 J	0.210	1.73	1.538	0.24	0.201	0.013	<0.002 U	2.48	0.05 J	0.04 J
8/15/2018	Assessment	0.02 J	19.1	626	<0.004 U	0.009 J	0.074	1.63	2.274	0.25	0.067	0.009	- -	2.21	<0.03 U	0.02 J
6/26/2019	Assessment	<0.02 U	18.0	619	<0.02 U	<0.01 U	0.06 J	1.50	1.862	0.21	0.04 J	0.02 J	<0.002 U	2.28	<0.03 U	<0.1 U
9/9/2019	Assessment	0.04 J	39.5	670	<0.02 U	0.07	0.250	1.63	1.522	0.22	0.251	0.00672	<0.002 U	2.26	0.04 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-1601S
Rockport - 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**
6/8/2016	Background	0.108	76.9	45.9	0.34	7.6	440	39.2
7/19/2016	Background	0.106	71.8	46.4	0.36	7.2	415	40.1
9/20/2016	Background	0.094	74.2	43.5	0.33	7.2	442	37.6
11/16/2016	Background	0.100	78.2	42.3	0.26	7.2	442	36.4
1/10/2017	Background	0.113	78.5	42.0	0.28	6.8	424	35.9
3/7/2017	Background	0.098	79.2	41.1	0.30	7.2	413	42.5
5/8/2017	Background	0.092	86.7	41.9	0.31	6.8	389	44.0
7/17/2017	Background	0.077	76.8	41.7	0.25	6.6	443	40.5
10/4/2017	Detection	0.113	73.5	40.9	0.29	7.3	441	41.6
12/12/2017	Detection	- -	- -	36.9	0.33	7.2	- -	43.0
6/5/2018	Assessment	0.142	66.5	34.8	0.41	7.4	366	26.5
8/15/2018	Assessment	0.208	70.8	33.7	0.42	7.2	374	31.3
5/24/2019	Assessment	0.06 J	77.2	38.5	0.36	7.2	451	41.8
6/25/2019	Assessment	0.07 J	75.9	35.3	0.31	7.3	456	51.4
9/9/2019	Assessment	0.068	79.6	37.6	0.31	7.2	445	52.9

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-1601S
Rockport - 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
6/8/2016	Background	0.02 J	1.90	49.4	0.006 J	0.01 J	0.2	0.957	0.788	0.34	0.220	<0.0002 U	<0.002 U	2.17	1.3	0.05 J
7/19/2016	Background	0.02 J	2.12	47.7	<0.005 U	0.007 J	0.6	0.478	1.26	0.36	0.114	0.024	<0.002 U	1.91	1.3	<0.01 U
9/20/2016	Background	0.02 J	1.99	41.6	<0.005 U	0.006 J	0.2	0.381	0.4671	0.33	0.127	0.005	<0.002 U	1.40	1.3	0.03 J
11/16/2016	Background	0.03 J	2.00	39.0	<0.005 U	0.01 J	0.123	0.274	0.1634	0.26	0.084	0.009	<0.002 U	2.17	1.3	0.03 J
1/10/2017	Background	0.05 J	2.00	43.5	<0.005 U	0.03	0.279	0.520	0.717	0.28	0.247	0.006	<0.002 U	1.61	1.4	0.104
3/7/2017	Background	0.02 J	2.25	50.7	<0.005 U	0.01 J	1.52	0.980	0.1969	0.30	0.348	0.010	<0.002 U	1.49	1.4	0.01 J
5/8/2017	Background	0.02 J	2.02	42.6	<0.004 U	<0.005 U	0.192	0.411	0.3203	0.31	0.119	0.010	<0.002 U	1.24	1.7	0.01 J
7/17/2017	Background	0.05	2.70	70.0	0.01 J	0.03	1.05	2.67	1.812	0.25	0.807	0.012	0.003 J	1.46	1.8	0.04 J
6/5/2018	Assessment	0.04 J	2.45	44.0	0.02 J	0.24	0.579	0.615	0.261	0.41	0.349	0.012	<0.002 U	1.79	0.5	<0.01 U
8/15/2018	Assessment	0.03 J	2.28	38.0	0.005 J	0.009 J	0.114	0.557	0.398	0.42	0.141	0.004	- -	1.81	1.1	0.05 J
5/24/2019	Assessment	<0.02 U	2.05	37.2	<0.02 U	<0.01 U	0.08 J	0.02 J	0.0711	0.36	0.03 J	0.01 J	<0.002 U	1 J	1.7	<0.1 U
6/25/2019	Assessment	<0.02 U	2.06	44.2	<0.02 U	<0.01 U	0.1 J	0.649	0.248	0.31	0.165	0.01 J	<0.002 U	1 J	1.4	<0.1 U
9/9/2019	Assessment	0.02 J	2.30	51.4	<0.02 U	0.02 J	0.452	1.14	0.914	0.31	0.325	0.00691	<0.002 U	1 J	1.2	<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-1602D
Rockport - 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
6/7/2016	Background	0.058	69.7	138	0.36	5.1	528	20.5
7/18/2016	Background	0.065	77.6	166	0.34	8.2	574	18.5
9/20/2016	Background	0.047	71.7	172	0.30	7.8	580	12.9
11/15/2016	Background	0.078	78.0	177	0.33	7.1	601	17.4
1/9/2017	Background	0.084	75.3	178	0.34	7.3	594	11.4
3/7/2017	Background	0.076	66.8	158	0.31	7.3	586	14.5
5/8/2017	Background	0.073	71.9	124	0.31	7.0	520	16.1
7/17/2017	Background	0.091	64.6	112	0.26	7.0	472	17.5
10/3/2017	Detection	0.064	68.3	135	0.29	7.4	518	16.0
12/12/2017	Detection	- -	- -	141	0.30	7.4	- -	16.9
1/3/2018	Detection	- -	- -	146	- -	7.8	574	- -
6/5/2018	Assessment	0.060	66.0	92.8	0.35	7.8	440	21.6
8/13/2018	Assessment	0.098	73.0	131	0.31	7.2	521	18.0
5/24/2019	Assessment	0.04 J	67.9	68.3	0.33	7.4	418	20.5
6/27/2019	Assessment	0.06 J	69.8	68.7	0.33	7.3	429	20.3
9/12/2019	Assessment	0.059	57.8	65.1	0.28	7.1	440	20.2

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-1602D
Rockport - 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**
6/7/2016	Background	0.02 J	7.35	380	<0.005 U	<0.004 U	0.3	0.227	1.147	0.36	0.061	0.001	<0.002 U	4.69	0.03 J	<0.01 U
7/18/2016	Background	0.01 J	8.54	507	<0.005 U	<0.004 U	0.5	0.166	2.43	0.34	0.02 J	0.022	<0.002 U	3.89	<0.03 U	<0.01 U
9/20/2016	Background	0.02 J	8.24	487	<0.005 U	<0.004 U	0.2	0.116	1.128	0.30	0.022	0.007	<0.002 U	3.31	0.03 J	<0.01 U
11/15/2016	Background	0.03 J	8.32	585	0.01 J	0.02	0.338	0.248	4.204	0.33	0.195	0.012	<0.002 U	3.31	0.05 J	0.066
1/9/2017	Background	0.01 J	7.92	503	<0.005 U	<0.004 U	0.187	0.112	0.976	0.34	0.01 J	0.005	<0.002 U	3.36	<0.03 U	0.02 J
3/7/2017	Background	0.01 J	8.04	458	<0.005 U	<0.004 U	0.395	0.106	0.705	0.31	0.029	0.004	<0.002 U	3.88	0.05 J	0.02 J
5/8/2017	Background	0.01 J	9.08	436	<0.004 U	0.07	0.232	0.115	0.5884	0.31	0.056	0.007	<0.002 U	3.93	<0.03 U	<0.01 U
7/17/2017	Background	0.01 J	8.51	419	0.005 J	<0.005 U	0.268	0.110	1.349	0.26	0.036	0.003	<0.002 U	3.60	<0.03 U	<0.01 U
6/5/2018	Assessment	0.02 J	10.0	442	0.006 J	0.01 J	0.210	0.157	1.861	0.35	0.103	0.008	<0.002 U	3.93	<0.03 U	<0.01 U
8/13/2018	Assessment	0.01 J	9.28	459	0.008 J	<0.005 U	0.201	0.173	1.021	0.31	0.113	0.002	- -	3.18	0.05 J	<0.01 U
5/24/2019	Assessment	<0.02 U	9.29	405	<0.02 U	<0.01 U	0.05 J	0.065	0.71	0.33	<0.02 U	0.01 J	<0.002 U	3.23	0.03 J	<0.1 U
6/27/2019	Assessment	<0.02 U	9.05	386	<0.02 U	<0.01 U	0.06 J	0.066	0.688	0.33	0.02 J	<0.009 U	<0.002 U	3.12	0.03 J	<0.1 U
9/12/2019	Assessment	0.17	10.3	433	0.02 J	0.03 J	0.763	0.373	1.13	0.28	0.437	0.00286	<0.002 U	3.64	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-1602I
Rockport - 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
6/7/2016	Background	0.047	78.6	33.0	0.32	7.1	424	84.1
7/18/2016	Background	0.043	81.1	32.3	0.30	7.4	452	89.4
9/20/2016	Background	0.037	79.9	30.2	0.28	7.3	412	77.7
11/15/2016	Background	0.057	87.6	28.7	0.29	7.1	457	85.3
1/9/2017	Background	0.039	80.6	27.8	0.26	7.4	420	77.6
3/7/2017	Background	0.061	71.1	27.5	0.27	7.3	388	77.8
5/8/2017	Background	0.108	79.7	27.6	0.28	6.9	430	78.4
7/17/2017	Background	0.052	68.8	27.1	0.23	6.9	421	76.3
10/3/2017	Detection	0.065	69.2	27.5	0.26	7.3	414	80.8
12/12/2017	Detection	- -	- -	28.3	0.26	7.3	- -	82.8
1/3/2018	Detection	- -	- -	- -	- -	7.7	- -	82.3
6/5/2018	Assessment	0.060	71.3	29.8	0.31	7.8	410	77.6
8/13/2018	Assessment	0.109	76.0	28.5	0.28	7.4	405	75.0
5/24/2019	Assessment	0.05 J	74.6	29.0	0.30	7.4	410	65.9
6/27/2019	Assessment	0.06 J	76.2	29.2	0.30	7.3	405	67.4
9/12/2019	Assessment	0.051	83.1	28.7	0.30	7.3	404	70.7

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-1602I
Rockport - 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
6/7/2016	Background	0.02 J	16.5	135	<0.005 U	0.005 J	0.2	1.35	0.983	0.32	0.096	0.003	<0.002 U	2.61	<0.03 U	<0.01 U
7/18/2016	Background	0.02 J	18.7	145	<0.005 U	0.006 J	0.2	1.70	1.526	0.30	0.074	0.006	<0.002 U	2.68	0.03 J	0.01 J
9/20/2016	Background	0.02 J	15.5	123	<0.005 U	<0.004 U	0.2	1.34	1.421	0.28	0.045	0.006	<0.002 U	2.31	0.05 J	0.01 J
11/15/2016	Background	0.03 J	18.2	136	<0.005 U	0.006 J	0.075	1.44	1.19	0.29	0.02 J	0.015	<0.002 U	2.13	0.04 J	0.03 J
1/9/2017	Background	0.02 J	18.3	126	<0.005 U	<0.004 U	0.161	1.38	0.7655	0.26	0.045	0.003	<0.002 U	2.23	<0.03 U	0.02 J
3/7/2017	Background	0.03 J	20.0	122	0.005 J	<0.004 U	0.484	1.43	0.845	0.27	0.178	0.009	<0.002 U	2.21	0.06 J	0.02 J
5/8/2017	Background	0.14	25.5	123	0.008 J	0.01 J	0.459	1.69	1.024	0.28	0.292	0.009	<0.002 U	2.08	0.05 J	0.02 J
7/17/2017	Background	0.05	27.3	127	0.006 J	0.006 J	0.193	1.52	0.8024	0.23	0.167	0.010	<0.002 U	2.01	<0.03 U	0.04 J
6/5/2018	Assessment	0.10	38.6	128	0.01 J	0.01 J	0.338	1.80	0.968	0.31	0.374	0.013	<0.002 U	2.42	0.07 J	0.03 J
8/13/2018	Assessment	0.05 J	26.9	111	0.006 J	0.007 J	0.086	1.31	0.9	0.28	0.092	0.001	- -	2.10	<0.03 U	0.03 J
5/24/2019	Assessment	0.08 J	29.6	121	<0.02 U	0.03 J	0.305	1.75	0.819	0.30	0.354	0.009 J	<0.002 U	2.03	0.04 J	<0.1 U
6/27/2019	Assessment	0.03 J	22.4	115	<0.02 U	<0.01 U	0.2 J	1.39	0.733	0.30	0.06 J	<0.009 U	<0.002 U	2 J	<0.03 U	<0.1 U
9/12/2019	Assessment	0.04 J	30.0	120	<0.02 U	<0.01 U	0.1 J	1.32	1.312	0.30	0.1 J	0.00572	<0.002 U	2.11	0.03 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-1603D
Rockport - 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
6/8/2016	Background	0.073	70.8	26.7	0.31	7.1	433	59.0
7/18/2016	Background	0.074	79.6	26.7	0.33	6.9	430	55.3
10/10/2016	Background	0.065	81.2	26.0	0.32	7.3	406	47.2
11/15/2016	Background	0.062	90.5	25.5	0.30	7.1	399	50.6
1/9/2017	Background	0.055	91.9	25.1	0.26	7.3	401	49.7
3/7/2017	Background	0.061	86.8	26.1	0.29	7.2	392	47.7
5/8/2017	Background	0.082	91.1	26.3	0.27	7.2	417	47.1
7/17/2017	Background	0.080	80.4	25.9	0.24	6.7	400	45.9
10/3/2017	Detection	0.054	79.4	26.2	0.26	7.1	393	44.6
12/12/2017	Detection	- -	- -	27.0	0.27	7.0	- -	42.3
6/5/2018	Assessment	0.081	80.6	30.1	0.30	7.2	412	40.9
8/13/2018	Assessment	0.147	87.9	25.4	0.27	7.1	385	39.1
5/21/2019	Assessment	0.04 J	71.6	25.3	0.28	7.2	397	38.5
6/27/2019	Assessment	0.06 J	77.9	25.0	0.30	7.6	388	32.8
9/11/2019	Assessment	0.04 J	82.8	26.1	0.30	7.2	407	36.4

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-1603D
Rockport - 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
6/8/2016	Background	0.01 J	10.2	112	<0.005 U	<0.004 U	0.2	1.34	1.206	0.31	0.02 J	0.003	<0.002 U	6.70	<0.03 U	<0.01 U
7/18/2016	Background	0.02 J	11.0	120	<0.005 U	0.007 J	0.3	1.30	0.66	0.33	0.01 J	0.008	<0.002 U	6.39	0.04 J	0.068
10/10/2016	Background	0.09	9.91	122	0.049	0.03	23.8	2.01	0.954	0.32	1.38	0.007	<0.002 U	6.82	0.3	0.04 J
11/15/2016	Background	0.03 J	11.3	113	<0.01 U	0.01 J	0.08 J	0.703	1.275	0.30	0.02 J	0.011	<0.002 U	5.02	<0.06 U	<0.02 U
1/9/2017	Background	0.01 J	11.3	111	<0.005 U	0.009 J	0.143	0.584	0.343	0.26	0.029	0.012	<0.002 U	4.98	<0.03 U	<0.01 U
3/7/2017	Background	0.01 J	11.3	108	<0.005 U	<0.004 U	0.220	0.553	0.838	0.29	0.024	0.007	<0.002 U	5.11	0.04 J	0.02 J
5/8/2017	Background	0.01 J	11.3	103	<0.004 U	<0.005 U	0.238	0.586	0.982	0.27	0.068	0.006	<0.002 U	4.78	0.07 J	<0.01 U
7/17/2017	Background	0.02 J	12.1	114	<0.004 U	<0.005 U	0.112	0.525	1.696	0.24	0.006 J	0.008	<0.002 U	4.68	<0.03 U	<0.01 U
6/5/2018	Assessment	0.02 J	12.3	109	0.009 J	<0.005 U	0.251	0.441	1.607	0.30	0.207	0.008	<0.002 U	4.09	0.09 J	0.03 J
8/13/2018	Assessment	0.02 J	12.5	105	<0.004 U	<0.005 U	0.097	0.409	0.84	0.27	0.040	0.005	- -	4.38	<0.03 U	0.02 J
5/21/2019	Assessment	<0.02 U	12.6	111	<0.02 U	<0.01 U	0.05 J	0.354	0.73	0.28	0.04 J	<0.009 U	<0.002 U	4.56	<0.03 U	<0.1 U
6/27/2019	Assessment	<0.02 U	13.2	111	<0.02 U	<0.01 U	0.06 J	0.327	0.766	0.30	<0.02 U	<0.009 U	<0.002 U	3.98	<0.03 U	<0.1 U
9/11/2019	Assessment	<0.02 U	13.2	112	<0.02 U	<0.01 U	0.2 J	0.327	0.957	0.30	0.08 J	0.0038	<0.002 U	4.10	0.03 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-1603I
Rockport - 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
6/8/2016	Background	0.151	89.2	37.7	0.39	7.6	465	71.9
7/18/2016	Background	0.157	93.9	38.8	0.43	7.2	502	83.8
9/20/2016	Background	0.153	99.8	40.1	0.39	7.3	500	111
11/15/2016	Background	0.173	101	37.4	0.42	7.2	481	88.5
1/9/2017	Background	0.147	94.7	34.6	0.38	7.2	478	75.3
3/7/2017	Background	0.187	85.0	34.7	0.40	7.3	460	73.2
5/8/2017	Background	0.187	87.2	36.8	0.40	7.3	452	71.0
7/17/2017	Background	0.196	79.3	35.1	0.35	9.8	449	74.9
10/3/2017	Detection	0.134	80.9	35.6	0.39	7.2	442	74.1
12/12/2017	Detection	- -	- -	57.4	0.52	6.8	- -	201
1/3/2018	Detection	0.166	- -	- -	- -	7.9	- -	65.1
6/5/2018	Assessment	0.131	77.7	37.3	0.46	7.3	424	62.0
8/13/2018	Assessment	0.130	85.9	31.5	0.43	7.4	434	66.2
5/21/2019	Assessment	0.06 J	81.4	39.4	0.45	7.3	467	74.6
6/27/2019	Assessment	0.07 J	78.6	37.7	0.47	8.1	560	66.9
9/11/2019	Assessment	0.087	80.1	38.7	0.46	7.3	443	58.2

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-1603I
Rockport - 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
6/8/2016	Background	0.05 J	13.0	81.1	<0.005 U	0.004 J	0.3	1.36	0.593	0.39	0.117	<0.0002 U	<0.002 U	8.86	<0.03 U	0.03 J
7/18/2016	Background	0.03 J	12.8	83.1	<0.005 U	<0.004 U	0.8	1.3	1.821	0.43	0.053	0.013	<0.002 U	9.76	<0.03 U	0.02 J
9/20/2016	Background	0.03 J	12.2	94.2	<0.005 U	<0.004 U	0.1	1.3	0.904	0.39	0.008 J	0.009	<0.002 U	9.85	0.04 J	0.04 J
11/15/2016	Background	0.04 J	12.2	86.6	<0.005 U	0.007 J	0.074	1.17	1.583	0.42	0.021	0.015	<0.002 U	9.21	<0.03 U	0.03 J
1/9/2017	Background	0.03 J	12.9	84.6	<0.005 U	<0.004 U	0.232	1.26	1.417	0.38	0.066	0.008	<0.002 U	9.47	<0.03 U	0.03 J
3/7/2017	Background	0.03 J	12.5	82.5	<0.005 U	<0.004 U	0.743	1.10	1.076	0.40	0.057	0.009	<0.002 U	8.79	0.05 J	0.05 J
5/8/2017	Background	0.03 J	13.0	76.8	<0.004 U	<0.005 U	0.145	1.24	0.824	0.40	0.174	0.009	<0.002 U	8.86	<0.03 U	0.03 J
7/17/2017	Background	0.03 J	12.5	85.3	<0.004 U	<0.005 U	0.109	1.30	2.746	0.35	0.02 J	0.013	<0.002 U	8.27	<0.03 U	0.05 J
6/5/2018	Assessment	0.10	12.7	88.4	0.01 J	0.02 J	1.11	1.40	2.348	0.46	0.374	0.012	<0.002 U	7.31	0.07 J	0.03 J
8/13/2018	Assessment	0.03 J	12.4	80.0	<0.004 U	<0.005 U	0.081	1.27	1.152	0.43	0.030	0.002	- -	7.67	<0.03 U	0.04 J
5/21/2019	Assessment	0.02 J	12.9	81.6	<0.02 U	<0.01 U	0.08 J	1.39	0.832	0.45	<0.02 U	<0.009 U	<0.002 U	6.45	<0.03 U	<0.1 U
6/27/2019	Assessment	0.07 J	12.7	84.3	<0.02 U	0.01 J	0.678	1.58	0.966	0.47	0.312	<0.009 U	<0.002 U	6.29	0.07 J	<0.1 U
9/11/2019	Assessment	0.08 J	13.2	83.0	<0.02 U	<0.01 U	0.355	1.36	1.41	0.46	0.2 J	0.00711	<0.002 U	7.48	<0.03 U	<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-1603S
Rockport - 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
6/8/2016	Background	1.77	49.6	60.3	0.44	7.6	480	197
7/18/2016	Background	1.77	46.4	53.6	0.50	7.2	445	171
9/20/2016	Background	1.83	59.3	57.6	0.39	7.0	479	197
11/15/2016	Background	2.19	71.9	50.9	0.43	6.9	469	208
1/9/2017	Background	2.22	74.8	55.6	0.40	6.5	483	220
3/7/2017	Background	1.72	99.4	67.6	0.33	6.7	581	261
5/8/2017	Background	1.25	81.7	55.1	0.36	6.9	466	203
7/17/2017	Background	1.94	68.1	52.9	0.27	9.6	482	222
10/3/2017	Detection	1.84	51.5	20.8	0.17	6.9	481	75.1
12/12/2017	Detection	- -	- -	33.9	0.41	7.1	- -	65.8
1/3/2018	Detection	1.67	- -	- -	- -	7.5	514	218
6/5/2018	Assessment	1.40	42.2	54.3	0.63	7.0	504	178
8/13/2018	Assessment	1.70	52.0	69.7	0.56	7.0	558	243
5/21/2019	Assessment	1.47	62.6	56.0	0.55	6.6	506	187
6/27/2019	Assessment	1.65	67.2	57.8	0.59	7.3	530	205
9/11/2019	Assessment	2.16	55.1	51.1	0.69	7.1	482	224

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-1603S
Rockport - 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
6/8/2016	Background	0.04 J	0.36	13.0	<0.005 U	0.02	0.2	0.648	0.485	0.44	0.171	<0.0002 U	<0.002 U	1.36	0.04 J	0.02 J
7/18/2016	Background	0.05 J	0.27	12.5	<0.005 U	0.02	0.2	0.656	1.123	0.50	0.130	0.013	<0.002 U	0.74	<0.03 U	0.02 J
9/20/2016	Background	0.04 J	0.21	16.7	<0.005 U	0.02 J	0.3	0.310	1.373	0.39	0.025	0.007	<0.002 U	0.50	0.7	0.04 J
11/15/2016	Background	0.06	0.19	18.4	0.008 J	0.03	0.104	0.233	0.508	0.43	0.072	0.013	<0.002 U	0.39	0.2	0.091
1/9/2017	Background	0.04 J	0.20	16.2	<0.005 U	0.02 J	0.653	0.176	0.391	0.40	0.023	0.002	<0.002 U	0.47	0.06 J	0.02 J
3/7/2017	Background	0.06	0.18	22.3	<0.005 U	0.06	0.530	0.092	0.2002	0.33	0.037	0.005	<0.002 U	0.23	0.2	0.02 J
5/8/2017	Background	0.03 J	0.23	16.3	<0.004 U	<0.005 U	0.325	0.219	0.4136	0.36	0.116	0.006	<0.002 U	0.15	<0.03 U	0.03 J
7/17/2017	Background	0.04 J	0.19	16.2	<0.004 U	0.03	0.154	0.349	2.9307	0.27	0.042	0.007	<0.002 U	0.20	0.06 J	0.02 J
6/5/2018	Assessment	0.06	0.36	12.4	0.01 J	0.03	0.261	0.881	2.059	0.63	0.339	0.012	<0.002 U	2.74	0.1	0.03 J
8/13/2018	Assessment	0.04 J	0.20	10.5	0.01 J	0.02	0.058	0.506	0.762	0.56	0.047	0.002	- -	1.78	0.04 J	0.054
5/21/2019	Assessment	0.03 J	0.17	14.0	<0.02 U	0.02 J	0.09 J	0.417	0.5289	0.55	<0.02 U	<0.009 U	<0.002 U	<0.4 U	0.08 J	<0.1 U
6/27/2019	Assessment	0.03 J	0.17	13.7	<0.02 U	0.03 J	0.06 J	0.383	0.555	0.59	<0.02 U	<0.009 U	<0.002 U	0.5 J	1.5	<0.1 U
9/11/2019	Assessment	0.04 J	0.22	12.0	<0.02 U	0.02 J	0.04 J	0.266	0.172	0.69	<0.05 U	0.00414	<0.002 U	0.6 J	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-1604D
Rockport - 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**
6/7/2016	Background	0.032	70.8	19.6	0.30	7.1	292	39.1
7/18/2016	Background	0.022	67.8	19.3	0.28	6.9	332	38.6
9/19/2016	Background	0.010	69.8	17.8	0.26	7.3	280	31.9
11/15/2016	Background	0.025	74.9	18.0	0.27	7.1	320	35.0
1/9/2017	Background	0.016	72.9	17.1	0.24	7.2	326	29.6
3/7/2017	Background	0.075	67.2	17.4	0.24	7.3	290	30.4
5/8/2017	Background	0.050	71.8	17.3	0.26	7.2	318	29.2
7/18/2017	Background	0.095	63.7	16.9	0.21	7.2	304	28.7
10/3/2017	Detection	0.075	62.7	16.5	0.24	7.3	318	28.7
12/13/2017	Detection	- -	- -	16.3	0.24	7.3	- -	29.3
6/6/2018	Assessment	0.037	67.6	16.1	0.28	7.3	308	26.3
8/14/2018	Assessment	0.052	70.5	16.4	0.26	7.1	311	26.2
5/21/2019	Assessment	0.03 J	69.3	16.1	0.27	7.2	309	27.4
6/26/2019	Assessment	0.03 J	69.5	15.8	0.28	7.3	326	23.2
9/10/2019	Assessment	0.02 J	74.7	15.9	0.28	7.3	326	24.7

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-1604D
Rockport - 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
6/7/2016	Background	0.02 J	14.6	216	<0.005 U	<0.004 U	0.2	0.119	0.374	0.30	0.098	0.002	<0.002 U	3.96	<0.03 U	<0.01 U
7/18/2016	Background	0.01 J	17.9	239	<0.005 U	<0.004 U	0.2	0.086	0.8422	0.28	0.022	0.010	<0.002 U	3.33	0.04 J	<0.01 U
9/19/2016	Background	0.01 J	16.2	234	<0.005 U	<0.004 U	0.1	0.052	0.377	0.26	0.02 J	0.004	<0.002 U	2.82	<0.03 U	<0.01 U
11/15/2016	Background	0.03 J	16.7	247	<0.005 U	0.008 J	0.117	0.047	0.454	0.27	0.02 J	0.009	<0.002 U	2.80	<0.03 U	0.02 J
1/9/2017	Background	0.02 J	16.9	243	<0.005 U	0.007 J	0.158	0.057	2.235	0.24	0.01 J	<0.0002 U	<0.002 U	3.04	0.03 J	0.095
3/7/2017	Background	0.02 J	18.4	267	<0.005 U	<0.004 U	0.267	0.070	0.868	0.24	0.061	0.003	0.002 J	3.20	0.06 J	<0.01 U
5/8/2017	Background	0.04 J	18.1	226	<0.004 U	<0.005 U	0.128	0.091	0.744	0.26	0.043	0.004	<0.002 U	2.90	0.04 J	<0.01 U
7/18/2017	Background	0.02 J	16.8	249	<0.004 U	<0.005 U	0.165	0.072	1.079	0.21	0.02 J	0.002	<0.002 U	2.61	<0.03 U	<0.01 U
6/6/2018	Assessment	0.04 J	22.1	266	0.004 J	<0.005 U	0.057	0.117	0.942	0.28	0.034	0.007	<0.002 U	3.56	<0.03 U	<0.01 U
8/14/2018	Assessment	0.01 J	16.6	237	<0.004 U	<0.005 U	0.04 J	0.059	0.617	0.26	0.005 J	<0.0002 U	- -	2.50	<0.03 U	0.01 J
5/21/2019	Assessment	<0.02 U	18.3	235	<0.02 U	<0.01 U	0.04 J	0.051	0.771	0.27	0.06 J	<0.009 U	<0.002 U	2.52	<0.03 U	<0.1 U
6/26/2019	Assessment	<0.02 U	18.2	263	<0.02 U	<0.01 U	0.06 J	0.067	1.164	0.28	0.04 J	<0.009 U	<0.002 U	2.58	<0.03 U	<0.1 U
9/10/2019	Assessment	<0.02 U	18.0	257	<0.02 U	<0.01 U	0.09 J	0.052	0.859	0.28	<0.05 U	0.00157	<0.002 U	2.70	<0.03 U	<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-1604I
Rockport - 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
6/7/2016	Background	0.111	76.5	50.4	0.34	7.1	530	138
7/18/2016	Background	0.185	79.7	53.6	0.33	7.4	548	152
9/19/2016	Background	0.320	73.1	46.5	0.29	7.5	504	120
11/15/2016	Background	0.368	78.7	46.2	0.32	7.3	521	130
1/9/2017	Background	0.241	72.4	39.5	0.31	7.5	456	99.8
3/7/2017	Background	0.252	68.7	41.6	0.31	7.4	448	104
5/9/2017	Background	0.363	81.3	53.4	0.34	7.5	546	139
7/18/2017	Background	0.379	73.5	49.3	0.27	7.3	522	139
10/3/2017	Detection	0.442	69.5	45.2	0.30	7.5	502	129
12/12/2017	Detection	- -	- -	45.6	0.32	7.5	- -	132
1/4/2018	Detection	0.385	- -	- -	- -	7.9	504	119
6/6/2018	Assessment	0.188	62.9	39.4	0.37	7.6	442	95.4
8/14/2018	Assessment	0.193	73.8	43.7	0.33	7.4	487	112
5/21/2019	Assessment	0.254	78.2	70.1	0.34	7.3	618	181
6/27/2019	Assessment	0.278	75.2	63.5	0.38	7.5	622	167
9/11/2019	Assessment	0.269	71.5	43.6	0.35	7.4	515	127

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-1604I
Rockport - 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
6/7/2016	Background	0.02 J	19.5	124	<0.005 U	0.12	0.1	0.893	1.118	0.34	0.02 J	0.004	<0.002 U	2.59	0.03 J	0.01 J
7/18/2016	Background	0.02 J	19.1	132	<0.005 U	<0.004 U	0.4	0.875	1.299	0.33	0.02 J	0.011	<0.002 U	2.48	<0.03 U	0.01 J
9/19/2016	Background	0.03 J	20.4	123	<0.005 U	<0.004 U	0.4	0.742	0.624	0.29	0.02 J	0.008	<0.002 U	2.87	0.07 J	0.078
11/15/2016	Background	0.04 J	19.4	123	<0.005 U	0.009 J	0.153	0.704	1.664	0.32	0.045	0.015	<0.002 U	2.49	<0.03 U	0.02 J
1/9/2017	Background	0.02 J	20.2	114	<0.005 U	<0.004 U	0.114	0.696	1.455	0.31	0.01 J	0.003	<0.002 U	2.84	<0.03 U	0.02 J
3/7/2017	Background	0.02 J	20.0	117	<0.005 U	<0.004 U	0.573	0.743	0.671	0.31	0.024	0.009	<0.002 U	3.08	0.05 J	0.02 J
5/9/2017	Background	0.06	26.4	125	<0.004 U	<0.005 U	0.112	1.03	0.844	0.34	0.043	0.013	<0.002 U	3.02	0.03 J	0.02 J
7/18/2017	Background	0.24	19.0	130	<0.004 U	0.005 J	0.208	0.877	1.059	0.27	0.093	0.009	<0.002 U	2.75	<0.03 U	0.02 J
6/6/2018	Assessment	0.03 J	18.7	107	0.004 J	<0.005 U	0.05 J	0.792	1.089	0.37	0.01 J	0.012	<0.002 U	3.00	0.03 J	0.02 J
8/14/2018	Assessment	0.03 J	18.5	110	<0.004 U	<0.005 U	0.075	0.737	0.183	0.33	0.007 J	0.004	- -	2.50	<0.03 U	0.052
5/21/2019	Assessment	0.02 J	21.2	151	<0.02 U	<0.01 U	0.05 J	1.03	1.458	0.34	<0.02 U	0.01 J	<0.002 U	2.54	0.1 J	<0.1 U
6/27/2019	Assessment	0.02 J	18.5	135	<0.02 U	<0.01 U	0.09 J	0.979	0.888	0.38	<0.02 U	<0.009 U	<0.002 U	2.51	0.1 J	<0.1 U
9/11/2019	Assessment	0.03 J	20.7	119	<0.02 U	<0.01 U	0.1 J	0.735	0.819	0.35	<0.05 U	0.00772	<0.002 U	2.26	0.05 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-1604S
Rockport - 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
6/7/2016	Background	0.653	84.5	62.6	0.89	7.2	532	187
7/20/2016	Background	0.530	79.8	60.8	0.88	7.3	526	186
9/19/2016	Background	0.650	68.1	50.3	0.92	7.5	456	141
11/15/2016	Background	0.736	82.9	58.3	0.83	- -	533	165
1/9/2017	Background	0.721	83.9	63.5	0.91	7.4	535	173
3/7/2017	Background	0.725	79.1	64.1	0.94	7.5	528	170
5/8/2017	Background	0.554	111	88.0	0.81	7.5	672	251
5/18/2017	Background	- -	- -	- -	- -	7.3	- -	- -
7/17/2017	Background	0.473	98.6	76.0	0.76	7.3	657	234
10/3/2017	Detection	0.562	67.8	55.3	0.87	7.7	462	123
12/12/2017	Detection	- -	- -	53.9	0.97	7.7	- -	112
1/4/2018	Detection	0.778	- -	54.5	1.02	8.0	- -	104
6/6/2018	Assessment	0.521	72.5	53.7	1.04	7.7	474	134
8/14/2018	Assessment	0.582	92.6	73.0	0.90	7.4	583	187
5/20/2019	Assessment	0.451	80.4	57.2	0.99	7.5	572	179
6/26/2019	Assessment	0.667	75.8	81.4	0.91	7.5	718	246
9/10/2019	Assessment	0.802	53.1	57.6	1.63	7.5	506	134

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
Rockport - 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
6/7/2016	Background	0.06	0.41	19.2	0.007 J	0.02	0.2	0.548	0.3437	0.89	0.315	0.011	<0.002 U	2.57	0.07 J	0.02 J
7/20/2016	Background	0.13	0.76	21.7	0.059	0.09	0.6	0.955	0.9695	0.88	0.911	0.006	<0.002 U	2.33	0.2	0.057
9/19/2016	Background	0.06	0.24	13.3	<0.005 U	0.01 J	0.5	0.325	1.126	0.92	0.060	0.008	<0.002 U	2.51	0.07 J	0.05 J
11/15/2016	Background	0.07	0.24	18.5	0.005 J	0.03	0.081	0.326	0.377	0.83	0.045	0.014	<0.002 U	4.79	0.05 J	0.096
1/9/2017	Background	0.06	0.31	17.3	<0.005 U	0.02 J	0.701	0.338	1.629	0.91	0.02 J	0.013	<0.002 U	2.59	0.06 J	0.04 J
3/7/2017	Background	0.05	0.20	16.0	<0.005 U	0.01 J	0.326	0.321	0.151	0.94	0.027	0.013	<0.002 U	2.61	0.07 J	0.03 J
5/8/2017	Background	0.07	0.30	18.8	<0.004 U	0.02 J	0.079	0.355	0.579	0.81	0.050	0.018	0.004 J	2.16	0.09 J	0.02 J
7/17/2017	Background	0.07	0.24	20.7	<0.004 U	0.02 J	0.136	0.285	0.731	0.76	0.064	0.014	<0.002 U	1.88	0.03 J	0.02 J
6/6/2018	Assessment	0.06	0.20	14.1	<0.004 U	0.02 J	0.056	0.407	1.058	1.04	0.040	0.014	<0.002 U	2.50	0.05 J	0.02 J
8/14/2018	Assessment	0.05 J	0.20	16.3	<0.004 U	0.02 J	0.088	0.365	0.444	0.90	0.009 J	0.009	- -	2.21	0.2	0.03 J
5/20/2019	Assessment	0.06 J	0.18	18.8	<0.02 U	0.03 J	0.219	0.352	0.677	0.99	0.03 J	<0.009 U	<0.002 U	2.29	0.07 J	<0.1 U
6/26/2019	Assessment	0.04 J	0.47	46.1	<0.02 U	0.02 J	0.1 J	1.13	0.565	0.91	0.122	0.01 J	<0.002 U	1 J	0.2	<0.1 U
9/10/2019	Assessment	0.06 J	0.26	12.0	<0.02 U	0.02 J	0.202	0.207	0.115	1.63	<0.05 U	0.00913	<0.002 U	4.72	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-1605D
Rockport - 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
6/7/2016	Background	0.027	81.7	31.9	0.25	7.1	406	59.7
7/18/2016	Background	0.021	85.7	31.5	0.22	7.2	408	61.6
9/19/2016	Background	0.002 J	84.2	29.8	0.19	7.1	370	54.1
11/16/2016	Background	0.021	93.9	28.8	0.21	7.1	400	56.2
1/10/2017	Background	0.014	89.9	27.4	0.21	7.3	794	55.1
1/11/2017	Background	- -	- -	- -	- -	7.2	- -	- -
3/7/2017	Background	0.045	88.5	29.4	0.19	7.2	386	58.4
5/9/2017	Background	0.021	90.1	29.2	0.19	6.9	400	58.5
7/18/2017	Background	0.025	84.6	28.6	0.17	9.5	416	59.1
10/3/2017	Detection	0.022	83.1	26.4	0.18	7.1	390	56.8
12/11/2017	Detection	- -	- -	25.8	0.19	- -	- -	56.4
6/6/2018	Assessment	0.030	81.5	24.2	0.16	7.3	388	49.2
8/15/2018	Assessment	0.024	88.6	23.8	0.23	7.1	379	48.7
5/24/2019	Assessment	0.02 J	75.7	22.1	0.24	6.9	364	38.9
6/25/2019	Assessment	<0.02 U	82.1	22.1	0.21	7.3	379	40.3
9/12/2019	Assessment	<0.02 U	84	23.7	0.22	7.0	388	45.1

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
Rockport - 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
6/7/2016	Background	0.02 J	17.5	400	<0.005 U	<0.004 U	0.2	0.284	1.094	0.25	0.051	0.004	<0.002 U	7.65	0.03 J	<0.01 U
7/18/2016	Background	0.01 J	17.4	434	<0.005 U	<0.004 U	0.3	0.170	1.666	0.22	0.051	0.005	<0.002 U	3.19	<0.03 U	<0.01 U
9/19/2016	Background	0.01 J	18.1	488	<0.005 U	<0.004 U	0.3	0.118	0.873	0.19	0.009 J	0.006	<0.002 U	2.72	<0.03 U	<0.01 U
11/16/2016	Background	0.01 J	18.6	453	<0.005 U	<0.004 U	0.259	0.097	1.371	0.21	0.008 J	0.006	<0.002 U	2.21	<0.03 U	0.01 J
1/10/2017	Background	0.01 J	19.0	430	<0.005 U	<0.004 U	0.128	0.086	1.589	0.21	<0.004 U	0.004	<0.002 U	2.21	<0.03 U	<0.01 U
3/7/2017	Background	0.02 J	19.1	490	<0.005 U	0.006 J	0.322	0.107	1.104	0.19	0.045	0.006	<0.002 U	2.44	0.03 J	<0.01 U
5/9/2017	Background	0.04 J	18.3	420	0.01 J	<0.005 U	0.131	0.108	0.4527	0.19	0.037	0.003	<0.002 U	2.08	<0.03 U	<0.01 U
7/18/2017	Background	0.02 J	17.9	457	<0.004 U	<0.005 U	0.119	0.111	1.657	0.17	0.009 J	0.005	<0.002 U	1.98	<0.03 U	0.03 J
6/6/2018	Assessment	0.02 J	18.2	382	0.01 J	<0.005 U	0.272	0.188	1.978	0.16	0.273	0.007	<0.002 U	1.97	0.04 J	<0.01 U
8/15/2018	Assessment	0.01 J	20.3	443	<0.004 U	<0.005 U	0.077	0.079	0.605	0.23	0.035	0.003	- -	1.94	<0.03 U	<0.01 U
5/24/2019	Assessment	0.05 J	13.9	385	<0.02 U	<0.01 U	0.06 J	0.255	1.116	0.24	<0.02 U	<0.009 U	<0.002 U	2.60	<0.03 U	<0.1 U
6/25/2019	Assessment	<0.02 U	18.3	365	<0.02 U	<0.01 U	0.2 J	0.104	0.655	0.21	0.05 J	<0.009 U	<0.002 U	2 J	<0.03 U	<0.1 U
9/12/2019	Assessment	<0.02 U	21.2	471	<0.02 U	<0.01 U	0.652	0.084	0.896	0.22	<0.05 U	0.00176	<0.002 U	2.08	<0.03 U	<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-1605I
Rockport - 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
6/7/2016	Background	0.027	89.5	45.6	0.21	7.0	522	130
7/19/2016	Background	0.027	92.5	46.8	0.22	7.3	544	135
9/19/2016	Background	0.020	97.9	45.6	0.18	7.3	548	140
11/16/2016	Background	0.034	103	44.4	0.19	7.1	567	140
1/10/2017	Background	0.020	91.3	43.5	0.19	7.2	534	119
3/7/2017	Background	0.046	81.9	44.7	0.17	7.3	474	115
5/9/2017	Background	0.043	93.5	41.8	0.19	7.0	508	115
7/18/2017	Background	0.036	79.9	39.7	0.1 J	7.0	488	116
10/3/2017	Detection	0.041	82.5	40.7	0.19	7.2	494	120
12/11/2017	Detection	- -	- -	41.3	0.18	7.3	- -	135
1/4/2018	Detection	- -	- -	- -	- -	7.6	536	144
6/6/2018	Assessment	0.129	79.2	39.1	0.16	7.3	500	120
8/15/2018	Assessment	0.158	83.4	38.0	0.23	7.3	483	114
5/24/2019	Assessment	0.08 J	73.8	36.8	0.23	7.3	443	89.2
6/25/2019	Assessment	0.126	83.4	38.3	0.21	7.4	471	104
9/12/2019	Assessment	0.199	89.4	41.7	0.20	7.4	524	128

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-1605I
Rockport - 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
6/7/2016	Background	0.02 J	17.3	151	<0.005 U	<0.004 U	0.2	1.67	1.219	0.21	0.122	0.004	<0.002 U	1.42	0.03 J	0.02 J
7/19/2016	Background	0.03 J	20.1	178	<0.005 U	<0.004 U	1.2	1.79	2.288	0.22	0.032	0.005	<0.002 U	1.39	0.07 J	0.02 J
9/19/2016	Background	0.04 J	19.5	180	<0.005 U	0.005 J	0.2	1.66	2.171	0.18	0.160	0.008	<0.002 U	1.23	<0.03 U	0.03 J
11/16/2016	Background	0.04 J	18.0	168	<0.005 U	0.008 J	0.091	1.58	1.912	0.19	0.079	0.017	<0.002 U	1.07	<0.03 U	0.03 J
1/10/2017	Background	0.03 J	18.5	161	<0.005 U	<0.004 U	0.110	1.52	1.823	0.19	0.02 J	0.004	<0.002 U	1.43	0.04 J	0.183
3/7/2017	Background	0.03 J	18.6	156	<0.005 U	0.008 J	0.214	1.48	1.721	0.17	0.063	0.007	<0.002 U	1.33	0.04 J	0.03 J
5/9/2017	Background	0.05	20.1	148	<0.004 U	<0.005 U	0.137	1.56	1.139	0.19	0.037	0.010	<0.002 U	1.18	<0.03 U	0.03 J
7/18/2017	Background	0.05 J	26.2	153	<0.004 U	<0.005 U	0.104	1.49	2.173	0.1 J	0.137	0.010	<0.002 U	1.16	<0.03 U	0.03 J
6/6/2018	Assessment	0.03 J	17.0	135	0.004 J	<0.005 U	0.04 J	1.47	2.27	0.16	0.184	0.011	<0.002 U	1.06	<0.03 U	0.04 J
8/15/2018	Assessment	0.03 J	18.8	149	0.004 J	<0.005 U	0.116	1.45	1.167	0.23	0.095	0.005	- -	1.12	<0.03 U	0.04 J
5/24/2019	Assessment	0.04 J	25.3	157	<0.02 U	<0.01 U	0.07 J	1.12	1.054	0.23	0.04 J	0.01 J	<0.002 U	1 J	0.04 J	<0.1 U
6/25/2019	Assessment	<0.10 U	17.8	134	<0.1 U	<0.05 U	<0.2 U	1.29	2.118	0.21	<0.1 U	0.01 J	<0.002 U	<2 U	<0.2 U	<0.5 U
9/12/2019	Assessment	0.05 J	22.3	154	<0.02 U	<0.01 U	0.1 J	1.42	1.679	0.20	0.1 J	0.00628	<0.002 U	1 J	<0.03 U	<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
Rockport - 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
6/7/2016	Background	0.480	76.6	51.0	0.55	7.1	576	167
7/19/2016	Background	0.438	72.6	53.1	0.55	7.2	586	174
9/19/2016	Background	0.482	79.1	54.0	0.51	7.3	594	179
11/16/2016	Background	0.584	84.0	49.7	0.53	7.1	599	186
1/10/2017	Background	0.533	78.5	48.2	0.43	7.2	584	170
3/7/2017	Background	0.608	71.2	52.0	0.55	7.2	564	180
5/9/2017	Background	0.470	79.9	50.1	0.50	7.2	606	181
7/17/2017	Background	0.490	68.6	47.5	0.43	7.1	582	177
10/3/2017	Detection	0.539	71.6	44.1	0.46	7.1	578	175
12/11/2017	Detection	- -	- -	42.5	0.53	7.2	- -	164
1/4/2018	Detection	0.616	- -	- -	0.48	7.7	614	168
6/5/2018	Assessment	0.461	71.0	46.5	0.58	7.6	592	154
8/15/2018	Assessment	0.029	45.8	46.5	0.59	7.1	573	153
5/24/2019	Assessment	0.415	76.0	46.1	0.61	7.3	586	147
6/27/2019	Assessment	0.438	72.0	46.3	0.63	7.2	595	150
9/12/2019	Assessment	0.431	77.0	49.4	0.54	7.0	593	162

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
Rockport - 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
6/7/2016	Background	0.04 J	0.52	8.07	<0.005 U	0.03	0.2	0.471	0.2307	0.55	0.116	0.130	<0.002 U	2.52	1.3	0.02 J
7/19/2016	Background	0.10	0.60	8.65	<0.005 U	0.04	0.4	0.856	0.39	0.55	0.223	0.017	<0.002 U	2.20	1.0	0.02 J
9/19/2016	Background	0.04 J	0.42	7.61	<0.005 U	0.03	0.9	0.443	0.15	0.51	0.049	0.015	<0.002 U	1.83	1.0	0.03 J
11/16/2016	Background	0.05	0.36	7.76	<0.005 U	0.04	0.108	0.355	0.964	0.53	0.021	0.021	<0.002 U	1.79	1.1	0.03 J
1/10/2017	Background	0.06	0.50	8.33	<0.005 U	0.04	0.135	0.401	1.6248	0.43	0.02 J	0.016	<0.002 U	2.01	1.1	0.06
3/7/2017	Background	0.04 J	0.39	8.72	<0.005 U	0.03	0.279	0.307	0.339	0.55	0.033	0.015	<0.002 U	1.85	0.5	0.03 J
5/9/2017	Background	0.05	0.45	8.41	<0.004 U	0.03	0.247	0.370	0.255	0.05	0.02 J	0.013	<0.002 U	1.81	0.9	0.02 J
7/17/2017	Background	0.04 J	0.42	8.55	<0.004 U	0.03	0.113	0.336	1.254	0.43	0.026	0.015	<0.002 U	1.73	1.2	0.03 J
6/5/2018	Assessment	0.04 J	0.42	8.63	0.004 J	0.03	0.093	0.321	0.705	0.58	0.042	0.016	<0.002 U	1.75	0.6	0.05 J
8/15/2018	Assessment	0.04 J	0.20	10.9	<0.004 U	0.03	0.078	0.087	0.1783	0.59	0.041	0.007	- -	1.13	5.4	0.02 J
5/24/2019	Assessment	0.15	2.84	15.4	0.04 J	0.11	0.636	3.91	0.2689	0.61	1.96	0.02 J	<0.002 U	2 J	0.3	<0.1 U
6/27/2019	Assessment	0.11	2.44	12.5	0.04 J	0.07	0.536	2.46	0.245	0.63	1.52	<0.009 U	<0.002 U	2 J	0.5	0.1 J
9/12/2019	Assessment	0.04 J	0.61	6.72	<0.02 U	0.04 J	0.09 J	0.469	0.00129	0.54	0.1 J	0.0108	<0.002 U	2.07	2.0	<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-1606D
Rockport - 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**
6/7/2016	Background	0.020	67.5	21.3	0.23	7.1	290	13.9
7/19/2016	Background	0.018	69.9	20.8	0.20	5.9	298	12.8
9/19/2016	Background	0.020	72.3	21.7	0.19	7.3	290	13.2
11/16/2016	Background	0.017	77.1	22.0	0.19	7.2	301	16.4
1/10/2017	Background	0.012	75.5	21.6	0.16	7.2	284	12.8
3/6/2017	Background	0.073	69.9	22.3	0.18	7.2	325	8.7
5/9/2017	Background	0.034	78.1	22.3	0.17	6.9	308	14.4
7/18/2017	Background	0.028	69.3	21.6	0.15	8.4	307	13.5
10/3/2017	Detection	0.022	74.4	22.3	0.16	7.0	308	17.1
12/11/2017	Detection	- -	- -	22.6	0.17	7.1	- -	19.4
6/6/2018	Assessment	0.044	72.0	23.1	0.19	8.0	331	19.9
8/15/2018	Assessment	0.028	80.5	23.9	0.20	7.3	329	21.5
5/24/2019	Assessment	0.02 J	75.7	25.0	0.20	7.2	330	19.6
6/24/2019	Assessment	0.02 J	80.8	25.2	0.19	7.3	329	21.0
9/12/2019	Assessment	<0.02 U	76.7	26.9	0.18	7.3	361	25.6

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-1606D
Rockport - 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
6/7/2016	Background	0.03 J	11.5	327	0.01 J	<0.004 U	0.5	0.508	0.551	0.23	0.214	0.003	<0.002 U	3.82	0.06 J	<0.01 U
7/19/2016	Background	0.02 J	13.7	372	<0.005 U	<0.004 U	0.3	0.178	0.464	0.20	0.086	0.009	<0.002 U	2.10	0.05 J	<0.01 U
9/19/2016	Background	0.01 J	13.4	378	<0.005 U	<0.004 U	0.1	0.113	1.152	0.19	<0.004 U	0.002	<0.002 U	2.00	<0.03 U	<0.01 U
11/16/2016	Background	0.01 J	14.4	419	<0.005 U	<0.004 U	0.138	0.102	0.333	0.19	<0.004 U	0.002	<0.002 U	2.21	<0.03 U	<0.01 U
1/10/2017	Background	0.03 J	13.9	383	0.034	0.02 J	0.160	0.109	1.612	0.16	0.023	<0.0002 U	<0.002 U	2.46	0.04 J	0.124
3/6/2017	Background	0.01 J	13.5	374	<0.005 U	<0.004 U	0.667	0.098	0.924	0.18	0.02 J	0.007	<0.002 U	2.00	<0.03 U	<0.01 U
5/9/2017	Background	0.01 J	14.3	370	<0.004 U	<0.005 U	0.153	0.086	2.3	0.17	0.004 J	0.004	<0.002 U	2.07	<0.03 U	<0.01 U
7/18/2017	Background	0.02 J	14.8	401	<0.004 U	<0.005 U	0.131	0.084	1.584	0.15	0.01 J	0.006	<0.002 U	1.85	<0.03 U	<0.01 U
6/6/2018	Assessment	<0.01 U	14.7	392	0.004 J	<0.005 U	0.04 J	0.070	1.5971	0.19	0.008 J	0.005	<0.002 U	1.77	<0.03 U	0.03 J
8/15/2018	Assessment	0.04 J	16.9	431	0.006 J	0.007 J	0.148	0.117	0.56	0.20	0.141	0.002	- -	1.77	<0.03 U	0.02 J
5/24/2019	Assessment	<0.02 U	17.4	447	<0.02 U	<0.01 U	0.1 J	0.066	0.946	0.20	<0.02 U	<0.009 U	<0.002 U	2 J	<0.03 U	<0.1 U
6/24/2019	Assessment	<0.02 U	17.5	431	<0.02 U	<0.01 U	0.1 J	0.068	0.809	0.19	0.02 J	<0.009 U	<0.002 U	2 J	<0.03 U	<0.1 U
9/12/2019	Assessment	<0.02 U	17.4	458	<0.02 U	<0.01 U	0.09 J	0.085	0.593	0.18	<0.05 U	0.000651	<0.002 U	2 J	<0.03 U	<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-1606I
Rockport - 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
6/7/2016	Background	0.011	66.6	23.9	0.22	7.0	300	42.3
7/19/2016	Background	0.013	62.0	25.1	0.21	5.0	350	42.9
9/19/2016	Background	<0.002 U	62.8	24.2	0.19	7.2	314	36.7
11/16/2016	Background	0.014	70.7	25.0	0.21	7.3	325	42.6
1/10/2017	Background	0.007	68.0	24.5	0.17	7.4	326	39.3
3/6/2017	Background	0.025	64.1	23.8	0.19	7.4	317	37.8
5/9/2017	Background	0.070	67.8	23.0	0.19	7.4	318	36.8
7/18/2017	Background	0.023	55.5	22.6	0.17	6.7	304	37.1
10/3/2017	Detection	0.021	57.8	23.0	0.18	7.1	304	38.4
12/11/2017	Detection	- -	- -	23.0	0.19	7.1	- -	37.9
6/6/2018	Assessment	0.053	78.2	31.5	0.20	8.1	392	52.4
8/15/2018	Assessment	0.031	86.3	25.4	0.21	7.3	387	50.3
5/21/2019	Assessment	0.02 J	79.5	29.8	0.16	8.6	407	55.5
6/25/2019	Assessment	<0.02 U	86.8	31.5	0.18	7.2	406	51.0
9/12/2019	Assessment	<0.02 U	72.8	20.1	0.18	7.4	367	47.9

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-1606I
Rockport - 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**
6/7/2016	Background	0.03 J	3.00	49.4	<0.005 U	0.004 J	0.2	0.929	1.347	0.22	0.166	0.004	<0.002 U	1.64	0.05 J	0.03 J
7/19/2016	Background	0.03 J	3.99	54.0	<0.005 U	<0.004 U	0.4	0.823	1.286	0.21	0.037	0.013	<0.002 U	1.57	<0.03 U	0.03 J
9/19/2016	Background	0.02 J	4.99	46.7	<0.005 U	<0.004 U	0.1	0.733	1.104	0.19	0.02 J	0.009	<0.002 U	1,50	<0.03 U	0.03 J
11/16/2016	Background	0.02 J	4.59	48.1	<0.005 U	<0.004 U	0.070	0.700	0.951	0.21	<0.004 U	0.008	<0.002 U	1.83	<0.03 U	0.04 J
1/10/2017	Background	0.02 J	5.11	53.6	0.007 J	0.01 J	0.138	0.921	4.283	0.17	0.022	0.005	<0.002 U	2.12	<0.03 U	0.05 J
3/6/2017	Background	0.02 J	5.07	54.7	<0.005 U	<0.004 U	0.524	0.95	0.934	0.19	0.032	0.007	<0.002 U	1.78	0.03 J	0.04 J
5/9/2017	Background	0.05	4.81	49.9	<0.004 U	<0.005 U	0.179	1.26	0.677	0.19	0.071	0.008	<0.002 U	1.27	0.06 J	0.04 J
7/18/2017	Background	0.02 J	4.72	51.1	<0.004 U	<0.005 U	0.097	1.06	0.813	0.17	0.043	0.008	<0.002 U	1.11	<0.03 U	0.04 J
6/6/2018	Assessment	0.03 J	5.69	67.3	<0.004 U	<0.005 U	0.083	1.49	1.252	0.20	0.026	0.007	<0.002 U	0.98	<0.03 U	0.05 J
8/15/2018	Assessment	0.03 J	9.11	85.2	<0.004 U	0.005 J	0.061	1.95	0.3912	0.21	0.034	0.006	- -	1.34	<0.03 U	0.083
5/21/2019	Assessment	<0.02 U	7.69	74.5	<0.02 U	<0.01 U	<0.04 U	1.56	0.562	0.16	<0.02 U	<0.009 U	<0.002 U	0.8 J	<0.03 U	<0.1 U
6/25/2019	Assessment	<0.10 U	7.96	78.1	<0.1 U	<0.05 U	<0.2 U	1.80	1.214	0.18	<0.1 U	0.01 J	<0.002 U	<2 U	<0.2 U	<0.5 U
9/12/2019	Assessment	0.02 J	11.2	76.7	<0.02 U	<0.01 U	0.1 J	1.58	0.947	0.18	<0.05 U	0.00405	<0.002 U	1 J	<0.03 U	<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
Rockport - 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
6/7/2016	Background	0.024	55.8	30.6	0.46	6.9	410	47.6
7/19/2016	Background	0.019	46.0	24.0	0.43	7.1	386	38.1
9/19/2016	Background	<0.002 U	44.4	18.7	0.40	7.1	316	31.8
11/16/2016	Background	0.020	54.1	26.6	0.40	6.9	358	40.0
1/10/2017	Background	0.014	48.5	22.1	0.31	6.7	351	30.5
3/7/2017	Background	0.054	47.2	23.9	0.41	7.1	331	33.2
5/9/2017	Background	0.020	52.7	24.7	0.38	7.0	377	37.5
7/18/2017	Background	0.090	44.7	22.8	0.37	6.9	367	36.8
10/3/2017	Detection	0.026	43.4	24.1	0.41	6.6	363	35.6
12/11/2017	Detection	- -	- -	24.0	0.41	6.6	- -	36.8
1/4/2018	Detection	- -	- -	- -	0.42	7.4	- -	- -
6/6/2018	Assessment	0.029	50.9	25.5	0.46	7.8	398	52.6
8/15/2018	Assessment	0.563	76.1	20.7	0.47	6.9	316	34.9
5/21/2019	Assessment	0.05 J	48.9	26.6	0.47	7.9	416	64.5
6/25/2019	Assessment	0.03 J	49.8	25.0	0.45	7.0	380	41.7
9/12/2019	Assessment	0.02 J	44.4	24.4	0.54	7.0	376	41.9

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-1606S
Rockport - 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
6/7/2016	Background	0.08	0.26	12.5	<0.005 U	0.02	0.1	0.09	0.7867	0.46	0.145	0.012	<0.002 U	1.91	3.3	0.02 J
7/19/2016	Background	0.06	0.23	11.5	<0.005 U	0.02 J	0.5	0.052	0.94	0.43	0.034	0.017	<0.002 U	1.56	4.0	<0.01 U
9/19/2016	Background	0.05 J	0.22	9.34	<0.005 U	0.01 J	0.2	0.038	0.75	0.40	0.020	0.010	<0.002 U	1.32	5.7	0.01 J
11/16/2016	Background	0.05 J	0.20	11.1	<0.005 U	0.02 J	0.148	0.038	0.574	0.40	0.004 J	0.013	<0.002 U	1.02	3.1	0.01 J
1/10/2017	Background	0.04 J	0.24	10.7	0.01 J	0.02 J	1.29	0.141	2.025	0.31	0.097	0.006	<0.002 U	1.11	4.2	0.02 J
3/7/2017	Background	0.07	0.60	16.7	0.024	0.06	1.25	0.883	1.822	0.41	1.33	0.011	<0.002 U	1.22	4.5	0.03 J
5/9/2017	Background	0.05 J	0.29	12.0	0.01 J	0.03	0.277	0.371	0.193	0.38	0.355	0.010	<0.002 U	0.90	6.0	0.02 J
7/18/2017	Background	0.05	0.32	12.6	0.01 J	0.03	0.259	0.363	0.268	0.37	0.386	0.010	<0.002 U	1.08	4.7	0.02 J
6/6/2018	Assessment	0.05 J	0.20	13.6	0.005 J	0.03	0.108	0.092	0.496	0.46	0.032	0.012	<0.002 U	1.19	2.7	0.03 J
8/15/2018	Assessment	0.04 J	0.44	8.22	0.004 J	0.04	0.251	0.338	1.146	0.47	0.028	0.013	- -	1.89	1.6	0.078
5/21/2019	Assessment	0.14	0.19	16.7	<0.02 U	0.05 J	0.1 J	0.094	0.668	0.47	<0.02 U	<0.009 U	<0.002 U	0.9 J	3.3	<0.1 U
6/25/2019	Assessment	<0.10 U	0.2 J	14.4	<0.1 U	0.06 J	<0.2 U	<0.1 U	0.0646	0.45	<0.1 U	0.01 J	<0.002 U	<2 U	2.9	<0.5 U
9/12/2019	Assessment	0.03 J	0.17	11.8	<0.02 U	0.03 J	0.08 J	0.051	0.1052	0.54	<0.05 U	0.00814	<0.002 U	1 J	2.8	<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-1701D
Rockport - 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**
12/12/2017	Detection	0.054	71.8	20.1	0.28	7.3	378	44.0
2/8/2018	Detection	0.066	70.8	19.9	0.30	7.5	402	45.3
6/5/2018	Assessment	0.041	68.1	13.7	0.34	7.3	700	36.8
8/14/2018	Assessment	0.060	77.0	14.1	0.36	7.2	369	39.8
9/24/2018	Detection	0.047	71.6	15.2	0.33	7.5	366	40.0
10/29/2018	Assessment	0.125	76.5	15.4	0.32	7.8	362	40.7
11/12/2018	Assessment	0.114	76.7	15.7	0.35	7.1	358	40.0
5/20/2019	Assessment	0.02 J	66.8	14.0	0.32	7.2	371	43.5
6/25/2019	Assessment	0.02 J	70.8	14.9	0.32	7.1	387	39.0
9/9/2019	Assessment	0.02 J	70.5	16.0	0.31	7.0	376	36.6

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-1701D
Rockport - 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
12/12/2017	Detection	0.06	10.2	72.9	0.043	0.08	1.58	3.34	1.163	0.28	1.54	0.012	0.002	2.13	0.3	0.051
2/8/2018	Detection	0.03 J	9.30	65.0	<0.004 U	0.009 J	0.104	1.75	1.33	0.30	0.065	0.010	<0.002 U	1.37	0.04 J	0.03 J
6/5/2018	Assessment	0.02 J	10.6	63.7	0.005 J	0.02 J	0.103	1.56	2.346	0.34	0.096	0.012	<0.002 U	1.38	<0.03 U	0.03 J
8/14/2018	Assessment	0.01 J	10.2	65.2	<0.004 U	<0.005 U	0.060	1.68	0.929	0.36	0.021	0.008	- -	1.38	<0.03 U	0.03 J
9/24/2018	Detection	<0.01 U	10.1	64.0	<0.004 U	0.005 J	0.076	1.71	0.564	0.33	0.074	<0.0002 U	- -	1.33	<0.03 U	0.02 J
10/29/2018	Assessment	<0.02 U	9.79	65.9	<0.02 U	<0.01 U	0.1 J	1.66	0.417	0.32	0.04 J	<0.009 U	- -	1 J	<0.03 U	<0.1 U
11/12/2018	Assessment	<0.02 U	9.10	62.2	<0.02 U	<0.01 U	0.1 J	1.60	0.972	0.35	0.04 J	<0.009 U	- -	1 J	<0.03 U	<0.1 U
5/20/2019	Assessment	<0.02 U	9.55	65.1	<0.02 U	<0.01 U	0.2 J	1.59	0.702	0.32	<0.02 U	<0.009 U	<0.002 U	1 J	<0.03 U	<0.1 U
6/25/2019	Assessment	<0.10 U	9.58	64.6	<0.1 U	<0.05 U	<0.2 U	1.62	2.63	0.32	<0.1 U	0.01 J	<0.002 U	<2 U	0.2 J	<0.5 U
9/9/2019	Assessment	<0.02 U	9.37	65.0	<0.02 U	<0.01 U	0.2 J	1.53	0.341	0.31	<0.05 U	0.00691	<0.002 U	1 J	<0.03 U	<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-1701I
Rockport - 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
12/12/2017	Detection	0.066	65.4	13.5	0.33	7.3	338	40.7
2/8/2018	Detection	0.095	63.7	14.5	0.38	7.7	363	43.1
6/5/2018	Assessment	0.044	65.5	14.1	0.44	7.4	328	36.5
8/14/2018	Assessment	0.052	67.9	14.5	0.39	7.2	352	34.8
9/24/2018	Detection	0.038	68.9	14.9	0.41	7.6	346	35.0
10/31/2018	Detection	0.104	62.4	14.8	0.40	7.9	338	34.8
11/12/2018	Assessment	0.166	71.7	14.5	0.42	7.3	322	35.0
5/20/2019	Assessment	0.02 J	59.6	12.8	0.40	7.3	345	39.8
6/25/2019	Assessment	0.02 J	69.4	12.8	0.41	7.7	388	36.3
9/9/2019	Assessment	<0.02 U	65.1	12.9	0.38	7.3	339	34.5

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-1701I
Rockport - 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
12/12/2017	Detection	0.05	8.86	50.9	0.01	0.01	0.505	2.14	2.192	0.33	0.505	0.011	0.002	2.96	0.07	- -
2/8/2018	Detection	0.07	9.17	46.8	<0.004 U	0.01 J	0.184	1.34	1.06	0.38	0.260	0.007	<0.002 U	2.52	0.07 J	0.03 J
6/5/2018	Assessment	0.05	8.07	42.7	0.021	0.02 J	0.446	1.87	0.658	0.44	0.564	0.010	<0.002 U	1.15	0.2	0.05 J
8/14/2018	Assessment	0.04 J	6.42	38.3	0.004 J	0.01 J	0.085	1.10	0.3144	0.39	0.108	0.002	- -	1.01	<0.03 U	0.02 J
9/24/2018	Detection	0.23	9.38	41.2	0.008 J	0.02 J	0.371	1.62	0.335	0.41	0.497	0.002	- -	1.67	0.1	0.01 J
10/31/2018	Detection	0.25	6.69	40.7	<0.02 U	0.03 J	0.337	1.12	0.304	0.40	0.403	0.02 J	- -	1 J	0.07 J	<0.1 U
11/12/2018	Assessment	0.10	6.77	40.3	<0.02 U	<0.01 U	0.2 J	1.19	0.579	0.42	0.09 J	<0.009 U	- -	1 J	<0.03 U	<0.1 U
5/20/2019	Assessment	0.14	12.8	41.5	<0.02 U	0.02 J	0.09 J	1.16	0.628	0.40	0.09 J	<0.009 U	<0.002 U	1 J	<0.03 U	<0.1 U
6/25/2019	Assessment	<0.10 U	9.47	41.9	<0.1 U	<0.05 U	<0.2 U	1.16	0.116	0.41	<0.1 U	0.01 J	<0.002 U	<2 U	<0.2 U	<0.5 U
9/9/2019	Assessment	0.21	7.92	40.6	<0.02 U	<0.01 U	0.08 J	0.843	0.781	0.38	0.08 J	0.00561	<0.002 U	1 J	<0.03 U	<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-1701S
Rockport - 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
12/12/2017	Detection	0.051	58.1	18.6	0.35	7.5	288	21.1
2/8/2018	Detection	0.025	56.6	19.0	0.36	7.8	334	21.6
6/4/2018	Assessment	0.032	59.2	19.4	0.38	7.4	368	21.3
8/14/2018	Assessment	0.056	64.1	19.6	0.36	7.3	329	20.4
9/25/2018	Detection	0.035	60.7	19.6	0.37	6.6	316	20.3
10/29/2018	Assessment	0.129	63.7	19.1	0.38	7.2	312	18.8
11/12/2018	Assessment	0.139	63.6	19.1	0.39	7.5	318	18.9
5/20/2019	Assessment	<0.02 U	56.5	19.7	0.42	7.2	320	20.0
6/25/2019	Assessment	0.02 J	63.5	19.6	0.37	7.3	353	20.7
9/9/2019	Assessment	<0.02 U	57.0	20.0	0.37	7.2	332	17.8

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-1701S
Rockport - 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
12/12/2017	Detection	0.04	0.36	10.0	0.004	0.02	0.177	0.134	1.792	0.35	0.075	0.010	0.002	1.61	0.3	0.02 J
2/8/2018	Detection	0.14	0.39	9.51	<0.004 U	0.03	0.256	0.198	0.356	0.36	0.176	0.007	<0.002 U	0.85	0.4	0.03 J
6/4/2018	Assessment	0.07	0.38	5.20	<0.004 U	0.009 J	0.05 J	0.087	1.053	0.38	0.023	0.009	<0.002 U	0.68	0.6	0.01 J
8/14/2018	Assessment	0.04 J	0.37	9.34	<0.004 U	0.008 J	0.065	0.092	0.3729	0.36	0.028	0.002	- -	0.69	0.4	0.02 J
9/25/2018	Detection	0.12	0.38	8.55	<0.004 U	0.008 J	0.03 J	0.096	1.02	0.37	0.021	0.002	- -	0.69	0.4	<0.01 U
10/29/2018	Assessment	0.07 J	0.39	13.2	<0.02 U	0.02 J	0.1 J	0.091	0.1291	0.38	0.06 J	<0.009 U	- -	0.7 J	0.4	<0.1 U
11/12/2018	Assessment	0.08 J	0.37	8.20	<0.02 U	0.01 J	0.2 J	0.092	0.2239	0.39	0.05 J	<0.009 U	- -	0.7 J	0.4	<0.1 U
5/20/2019	Assessment	0.06 J	0.41	18.7	<0.02 U	0.04 J	0.2 J	0.053	0.0249	0.42	0.06 J	<0.009 U	<0.002 U	0.7 J	0.3	<0.1 U
6/25/2019	Assessment	<0.10 U	0.4 J	8.08	<0.1 U	<0.05 U	<0.2 U	0.2 J	0.931	0.37	<0.1 U	0.01 J	<0.002 U	<2 U	0.5 J	<0.5 U
9/9/2019	Assessment	0.16	0.38	16.8	<0.02 U	<0.01 U	0.1 J	0.073	0.327	0.37	<0.05 U	0.00556	<0.002 U	0.7 J	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-1702D
Rockport - 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
12/12/2017	Detection	0.105	74.3	30.3	0.19	7.2	362	39.9
2/9/2018	Detection	0.042	76.1	30.5	0.19	8.0	386	41.3
6/4/2018	Assessment	0.024	78.5	31.6	0.24	7.1	372	39.9
8/14/2018	Assessment	0.071	80.7	30.7	0.20	6.8	379	38.1
9/26/2018	Detection	0.096	80.0	31.2	0.20	7.1	392	37.8
10/30/2018	Assessment	0.06 J	87.2	30.9	0.20	8.2	394	37.3
11/12/2018	Assessment	0.06 J	89.8	31.5	0.21	7.4	374	37.3
5/20/2019	Assessment	0.02 J	78.7	30.5	0.18	7.0	402	38.9
6/26/2019	Assessment	0.02 J	80.0	30.4	0.17	7.6	388	39.0
9/10/2019	Assessment	<0.02 U	86.6	30.6	0.20	7.1	384	37.9

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-1702D
Rockport - 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**
12/12/2017	Detection	0.29	28.0	233	0.022	0.03	0.572	1.45	1.271	0.19	0.761	0.009	0.002	8.67	0.2	0.03 J
2/9/2018	Detection	0.25	22.5	212	<0.004 U	0.02 J	0.389	0.877	0.977	0.19	0.270	0.007	<0.002 U	5.91	0.09 J	0.03 J
6/4/2018	Assessment	0.18	25.2	208	0.005 J	0.02	0.105	0.698	1.345	0.24	0.052	0.009	<0.002 U	4.18	<0.03 U	0.02 J
8/14/2018	Assessment	0.15	21.3	191	<0.004 U	0.02 J	0.091	0.590	0.949	0.20	0.026	0.002	- -	3.68	<0.03 U	0.03 J
9/26/2018	Detection	0.18	22.0	211	<0.004 U	0.01 J	0.069	0.564	1.084	0.20	0.230	0.008	- -	3.38	<0.03 U	0.02 J
10/30/2018	Assessment	0.10	22.5	204	<0.02 U	0.01 J	0.08 J	0.581	0.784	0.20	0.02 J	<0.009 U	- -	2.77	0.03 J	<0.1 U
11/12/2018	Assessment	0.08 J	20.2	199	<0.02 U	0.02 J	0.1 J	0.498	1.167	0.21	0.03 J	<0.009 U	- -	2.53	<0.03 U	<0.1 U
5/20/2019	Assessment	0.08 J	25.6	223	<0.02 U	0.02 J	0.1 J	0.686	1.207	0.18	0.04 J	<0.009 U	<0.002 U	2.43	<0.03 U	<0.1 U
6/26/2019	Assessment	0.07 J	24.4	209	<0.02 U	0.02 J	0.08 J	0.601	0.689	0.17	0.07 J	0.02 J	<0.002 U	2.15	0.03 J	<0.1 U
9/10/2019	Assessment	0.04 J	22.1	203	<0.02 U	<0.01 U	0.1 J	0.536	0.639	0.20	<0.05 U	0.00456	<0.002 U	2.16	<0.03 U	<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-1702I
Rockport - 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
12/12/2017	Detection	0.037	76.2	27.1	0.20	7.2	376	45.4
2/9/2018	Detection	0.045	72.7	27.6	0.22	7.8	377	46.6
6/4/2018	Assessment	0.081	76.2	28.7	0.24	7.1	760	43.4
8/13/2018	Assessment	0.051	81.1	29.0	0.22	6.6	382	41.5
9/25/2018	Detection	0.056	78.9	29.8	0.23	6.8	398	41.9
10/30/2018	Assessment	0.07 J	81.7	29.2	0.23	7.8	392	41.9
11/12/2018	Assessment	0.07 J	82.7	29.9	0.24	6.8	364	41.9
5/20/2019	Assessment	0.02 J	73.2	28.8	0.21	6.9	376	44.5
6/25/2019	Assessment	0.02 J	74.7	28.5	0.20	7.3	376	44.7
9/10/2019	Assessment	<0.02 U	80.2	28.9	0.24	7.1	384	43.6

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-1702I
Rockport - 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**
12/12/2017	Detection	0.13	21.6	116	0.007	0.02	0.304	2.65	3.201	0.20	0.298	0.009	0.002	4.09	0.1	0.04 J
2/9/2018	Detection	0.05 J	42.3	109	0.007 J	0.01 J	1.49	2.15	1.324	0.22	0.337	0.004	<0.002 U	7.90	0.1	0.04 J
6/4/2018	Assessment	0.07	28.1	109	0.007 J	0.06	0.129	1.29	1.969	0.24	0.247	0.009	<0.002 U	1.91	0.08 J	0.054
8/13/2018	Assessment	0.10	28.9	102	0.004 J	0.02 J	0.146	1.35	1.243	0.22	0.074	0.002	- -	1.89	0.05 J	0.102
9/25/2018	Detection	0.44	39.6	114	<0.004 U	0.01 J	0.05	1.70	0.3854	0.23	0.087	0.003	- -	2.04	0.04 J	0.05 J
10/30/2018	Assessment	0.14	43.0	113	<0.02 U	0.22	0.1 J	1.57	1.364	0.23	0.129	<0.009 U	- -	2 J	0.05 J	<0.1 U
11/12/2018	Assessment	0.18	37.3	109	<0.02 U	0.05	0.1 J	1.52	0.746	0.24	0.09 J	<0.009 U	- -	2 J	0.04 J	<0.1 U
5/20/2019	Assessment	0.07 J	49.5	115	<0.02 U	0.01 J	0.05 J	1.43	1.519	0.21	0.05 J	<0.009 U	<0.002 U	2 J	0.05 J	<0.1 U
6/25/2019	Assessment	0.07 J	54.1	114	<0.02 U	0.02 J	0.07 J	1.78	0.467	0.20	0.1 J	0.02 J	<0.002 U	2 J	0.07 J	<0.1 U
9/10/2019	Assessment	0.08 J	55.8	112	<0.02 U	<0.01 U	0.1 J	1.60	0.584	0.24	0.06 J	0.00469	<0.002 U	2.03	<0.03 U	<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-1702S
Rockport - BAP
Appendix III Constituents

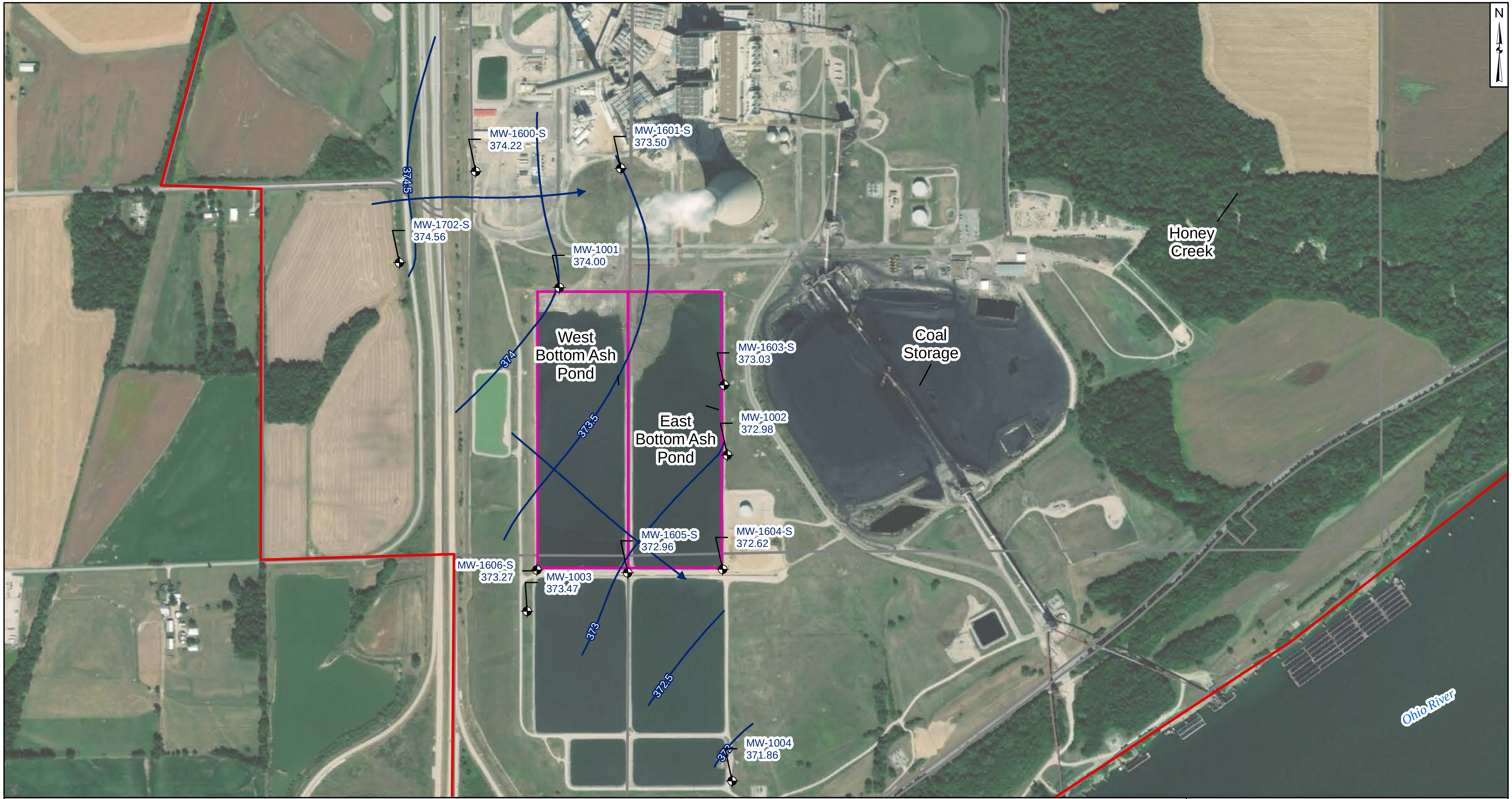
Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
12/12/2017	Detection	0.051	33.6	13.4	0.49	7.3	254	22.7
2/9/2018	Detection	0.042	29.7	14.0	0.62	7.9	281	22.2
6/4/2018	Assessment	0.059	38.4	14.4	0.57	7.0	276	26.7
8/13/2018	Assessment	0.057	36.9	13.6	0.55	6.3	272	22.0
9/25/2018	Detection	0.041	36.2	14.1	0.54	6.6	266	20.7
10/30/2018	Assessment	0.09 J	34.9	14.1	0.61	7.5	256	17.1
11/12/2018	Assessment	0.1 J	41.5	14.5	0.56	6.8	246	21.5
5/20/2019	Assessment	0.03 J	27.1	14.7	0.70	6.8	272	20.8
6/25/2019	Assessment	0.04 J	36.7	14.6	0.59	7.2	284	22.3
9/10/2019	Assessment	0.04 J	35.6	16.5	0.63	6.7	284	19.2

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-1702S
Rockport - 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
12/12/2017	Detection	0.08	0.88	12.1	0.008	0.01	4.13	0.403	0.984	0.49	0.324	0.003	0.002	2.18	1.1	0.01 J
2/9/2018	Detection	0.05 J	0.72	9.81	<0.004 U	0.006 J	0.212	0.258	0.00483	0.62	0.223	<0.0002 U	<0.002 U	1.09	1.1	0.01 J
6/4/2018	Assessment	0.05 J	0.45	7.67	<0.004 U	0.04	0.124	0.070	1.231	0.57	0.077	0.006	<0.002 U	1.42	3.8	0.01 J
8/13/2018	Assessment	0.13	0.47	7.14	0.005 J	0.05	0.175	0.173	0.1628	0.55	0.188	<0.0002 U	- -	1.15	1.8	0.03 J
9/25/2018	Detection	0.08	0.44	5.97	<0.004 U	0.008 J	0.13	0.104	0.421	0.54	0.079	<0.0002 U	- -	1.2	1.2	<0.01 U
10/30/2018	Assessment	0.05 J	0.48	5.50	<0.02 U	0.11	0.2 J	0.05 J	0.0859	0.61	0.08 J	<0.009 U	- -	1 J	1.0	<0.1 U
11/12/2018	Assessment	0.04 J	0.42	6.27	<0.02 U	0.03 J	0.2 J	0.272	0.107	0.56	0.229	<0.009 U	- -	1 J	1.5	<0.1 U
5/20/2019	Assessment	0.09 J	0.45	5.92	<0.02 U	0.28	0.475	0.058	0.56253	0.70	0.373	<0.009 U	<0.002 U	1 J	1.5	<0.1 U
6/25/2019	Assessment	<0.10 U	0.4 J	5.71	<0.1 U	<0.05 U	0.2 J	<0.1 U	0.357	0.59	<0.1 U	<0.009 U	<0.002 U	<2 U	2.4	<0.5 U
9/10/2019	Assessment	0.08 J	0.43	4.87	<0.02 U	0.01 J	0.215	0.096	0.2432	0.63	0.1 J	0.00127	<0.002 U	1 J	1.3	<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



Legend
- ⊕ Groundwater Monitoring Well
- → Approximate Groundwater Flow Direction
- — Groundwater Elevation Contour
- 🟥 Property Boundary
- ▢ Parcel Boundaries
- ▢ Bottom Ash Ponds

Notes
- Monitoring well coordinates and water level data (collected on May 20, 2019) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (AMEC, 2016) provided by AEP.
- Property and parcel boundaries taken from Spencer County Assessor.
- Only shallow screened wells were used for generating groundwater contours.
- Groundwater elevation units are feet above mean sea level.

750 375 0 750
Feet

Potentiometric Surface Map - Uppermost Aquifer
May 2019

AEP-Rockport Power Plant - Bottom Ash Ponds
Rockport, Indiana

Geosyntec consultants

Columbus, Ohio | 2019/12/11

Figure
X

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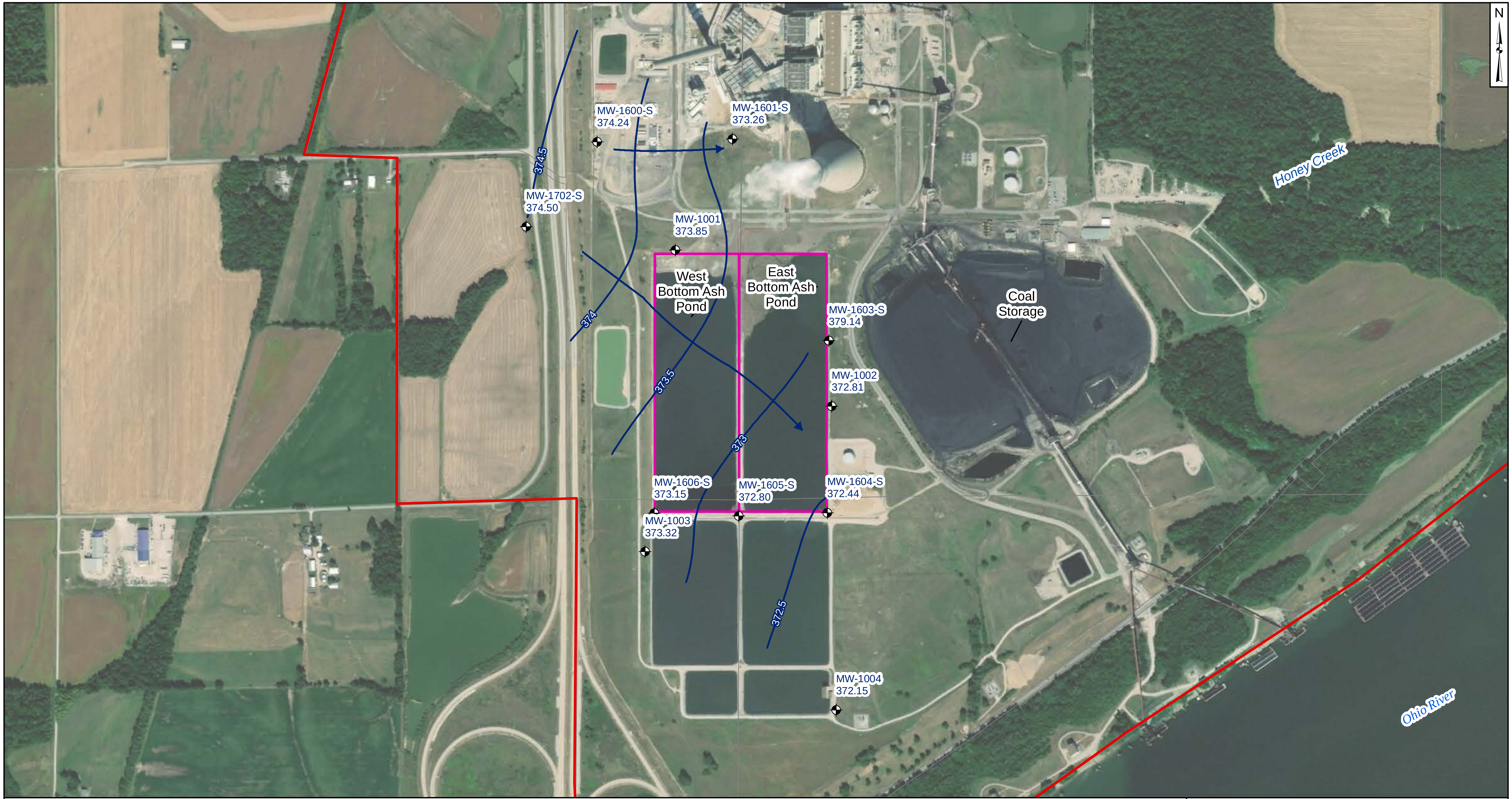

Legend

- ✦ Groundwater Monitoring Well
- → Approximate Groundwater Flow Direction
- — Groundwater Elevation Contour
- 🟪 Bottom Ash Ponds
- 🟥 Property Boundary
- ☐ Parcel Boundaries

Notes

- Monitoring well coordinates and water level data (collected on June 24, 2019) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (AMEC, 2016) provided by AEP.
- Property and parcel boundaries taken from Spencer County Assessor.
- Only shallow screened wells were used for generating groundwater contours.
- Groundwater elevation units are feet above mean sea level.
- MW-1603-S was not used in contouring due to anamolous or inconsistent data.

750 375 0 750
Feet

Potentiometric Surface Map - Uppermost Aquifer
June 2019

AEP-Rockport Power Plant - Bottom Ash Ponds
Rockport, Indiana

Geosyntec
consultants

Columbus, Ohio	2019/12/11

Figure

X

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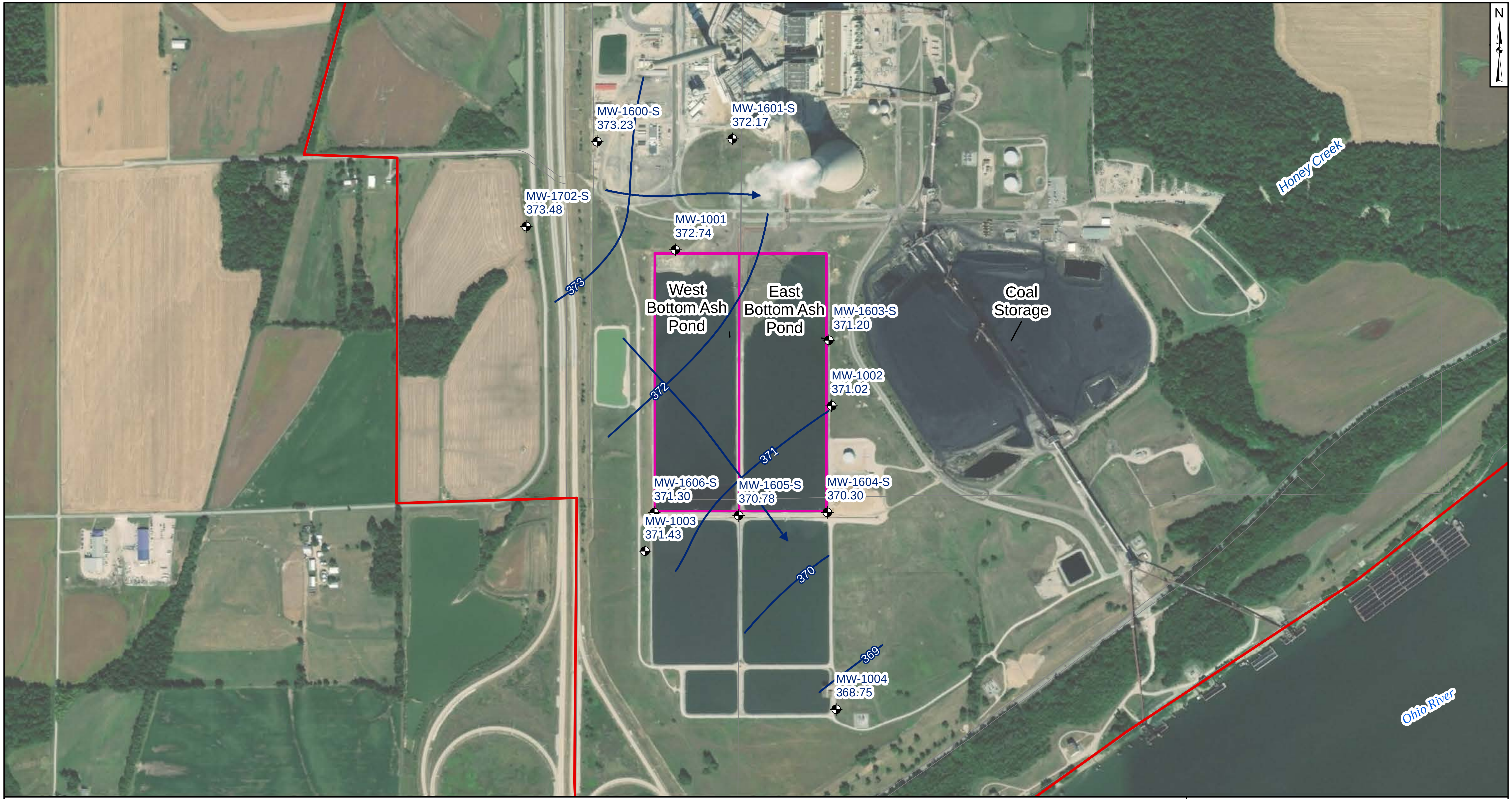

Legend

- ⯐ Groundwater Monitoring Well
- → Approximate Groundwater Flow Direction
- — Groundwater Elevation Contour
- 🟪 Bottom Ash Ponds
- 🟥 Property Boundary
- ☐ Parcel Boundaries

Notes

- Monitoring well coordinates and water level data (collected on September 9, 2019) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (AMEC, 2016) provided by AEP.
- Property and parcel boundaries taken from Spencer County Assessor.
- Only shallow screened wells were used for generating groundwater contours.
- Groundwater elevation units are feet above mean sea level.

750 375 0 750
Feet

Potentiometric Surface Map - Uppermost Aquifer
September 2019

AEP-Rockport Power Plant - Bottom Ash Ponds
Rockport, Indiana

Geosyntec
consultants

Columbus, Ohio	2019/12/12

Figure
X

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Table 2: Residence Time Calculation Summary Rockport - Bottom Ash Ponds

			2019-05		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 Ponds	MW-1600D [1]	2.0	94	0.65	371	0.16	22	2.7
	MW-1600I [1]	2.0	228	0.27	482	0.13	289	0.21
	MW-1600S [1]	2.0	295	0.21	549	0.11	511	0.12
	MW-1601D [1]	2.0	166	0.37	293	0.21	430	0.14
	MW-1601I [1]	2.0	300	0.20	407	0.15	502	0.12
	MW-1601S [1]	2.0	517	0.12	603	0.10	662	0.09
	MW-1002 [2]	2.0	223	0.27	303	0.20	564	0.11
	MW-1602D [2]	2.0	2,786	0.02	780	0.08	771	0.08
	MW-1602I [2]	2.0	1,671	0.04	589	0.10	674	0.09
	MW-1603D [2]	2.0	569	0.11	180	0.34	209	0.29
	MW-1603I [2]	2.0	399	0.15	1,981	0.03	237	0.26
	MW-1603S [2]	2.0	399	0.15	1,889	0.03	279	0.22
	MW-1604D [2]	2.0	451	0.13	940	0.06	820	0.07
	MW-1604I [2]	2.0	400	0.15	646	0.09	763	0.08
	MW-1604S [2]	2.0	389	0.16	352	0.17	660	0.09
	MW-1605D [2]	2.0	586	0.10	594	0.10	224	0.27
	MW-1605I [2]	2.0	358	0.17	291	0.21	863	0.07
	MW-1605S [2]	2.0	402	0.15	349	0.17	703	0.09
	MW-1606D [2]	2.0	370	0.16	345	0.18	668	0.09
	MW-1606I [2]	2.0	347	0.18	249	0.24	739	0.08
	MW-1606S [2]	2.0	303	0.20	287	0.21	528	0.12

Notes:
[1] - Upgradient Well
[2] - Downgradient Well

APPENDIX 2

ROCKPORT PLANT CCR
BOTTOM ASH PONDS

ANNUAL GROUNDWATER MONITORING REPORT COVERING 2019 ACTIVITIES

STATISTICAL ANALYSES SUMMARY OF MAY 2019 SAMPLING EVENT

STATISTICAL ANALYSIS SUMMARY

Bottom Ash Pond
Rockport Plant
Rockport, Indiana

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

October 11, 2019

CHA8473

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LIST OF ATTACHMENTS

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 Rockport Power Plant located in Rockport, Indiana.

Based on detection monitoring conducted in 2017 and 2018, statistically significant increases (SSIs) over background were concluded for boron, chloride, fluoride, 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. No SSLs were identified during these events and the unit remained in assessment monitoring. A semi-annual assessment monitoring event was also completed in May 2019, with the results of the May 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. No SSLs were identified, but Appendix III concentrations for boron, chloride, fluoride, sulfate, and TDS remained above background. Thus, either the unit will remain in assessment monitoring or an alternative source demonstration (ASD) will be conducted to evaluate if the unit can return to detection monitoring. Certification of the selected statistical methods by a qualified professional engineer is documented in Attachment A.

SECTION 2

LANDFILL 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 May 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. Tolerance limits were calculated parametrically with 95% coverage and 95% confidence for chromium, combined radium, and molybdenum. Non-parametric tolerance limits were calculated for antimony, arsenic, barium, beryllium, cadmium, cobalt, fluoride, lead, lithium, selenium, and thallium due to apparent non-normal distributions and for 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.

No SSLs were identified at the Rockport BAP.

2.2.3 Evaluation of Potential Appendix III SSIs

The CCR rule allows CCR units to move from assessment monitoring to detection monitoring if all Appendix III and Appendix IV parameters were at or below background levels for two consecutive sampling events [40 CFR 257.95(e)]. Since no Appendix IV SSLs were identified, Appendix III results were analyzed 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 calcium and pH, whereas interwell tests were used to evaluate potential SSIs for boron, chloride, fluoride, sulfate, and TDS.

Prediction limits for the interwell tests were recalculated using data collected during the May 2019 assessment monitoring event. Twelve data points (i.e., one sample from twelve 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, 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 calcium and pH. Thus, the prediction limits for the intrawell parameters continued to use a one-of-three retesting procedure.

Data collected during the May 2019 assessment monitoring event from each compliance well were compared to the prediction limits to evaluate results above background values. Verification sampling was completed in June and September 2019. The results from these events 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 UPL of 0.133 mg/L at MW-1002 (1.61 mg/L and 1.82 mg/L), MW-1603S (1.47 mg/L and 1.65 mg/L), MW-1604I (0.254 mg/L and 0.278 mg/L), MW-1604S (0.451 mg/L and 0.667 mg/L), and MW-1605S (0.415 mg/L and 0.438 mg/L).

- Chloride concentrations exceeded the interwell UPL of 46.4 at MW-1002 (55.9 mg/L and 57.1 mg/L), MW-1602D (68.3 mg/L and 68.7 mg/L), MW-1603S (56.0 mg/L and 57.8 mg/L), MW-1604I (70.1 mg/L and 63.5 mg/L), and MW-1604S (57.2 mg/L and 81.4 mg/L).

- Fluoride concentrations exceeded the interwell UPL of 0.70 mg/L at MW-1002 (1.13 mg/L and 1.10 mg/L) and MW-1604S (0.99 mg/L and 0.91 mg/L).

- Sulfate concentrations exceeded the interwell UPL of 76.0 mg/L at MW-1002 (169 mg/L and 173 mg/L), MW-1603S (187 mg/L and 205 mg/L), MW-1604I (181 mg/L and 167 mg/L), MW-1604S (179 mg/L and 246 mg/L), MW-1605I (89.2 mg/L and 104 mg/L), and MW-1605S (147 mg/L and 150 mg/L).

- TDS concentrations exceeded the interwell UPL of 465 mg/L at MW-1603I (467 mg/L and 560 mg/L), MW-1603S (506 mg/L and 530 mg/L), MW-1604I (618 mg/L and 622 mg/L), MW-1604S (572 mg/L and 718 mg/L), and MW-1605S (586 mg/L and 595 mg/L).

Based on these results, concentrations of six Appendix III parameters exceeded background levels at compliance wells at the Rockport BAP during assessment monitoring. As a result, the Rockport BAP CCR unit will remain in 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 May 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. No SSLs were identified.

The Appendix III results were evaluated to assess whether concentrations of Appendix III parameters exceeded background levels. Interwell tests were used to evaluate potential SSIs for boron, chloride, fluoride, sulfate, and TDS, and intrawell tests were used to evaluate potential SSIs for calcium and pH. The prediction limits for the interwell tests were updated with additional data collected from the background wells. Prediction limits were recalculated using a one-of-two retesting procedure for interwell parameters and a one-of-three retesting procedure for intrawell parameters. The prediction limits calculated during detection monitoring were used for the intrawell tests. SSIs were identified for boron, chloride, fluoride, sulfate, and TDS.

Based on this evaluation, either the Rockport BAP CCR unit will remain in assessment monitoring or an ASD will be conducted to evaluate if the unit can return to detection monitoring.

SECTION 3

REFERENCES

American Electric Power (AEP). 2017. Statistical Analysis Plan – Rockport Plant. January 2017.

Geosyntec Consultants (Geosyntec). 2018. Statistical Analysis Summary –Bottom Ash Pond, Rockport Plant, Rockport, Indiana. January 15, 2018.

TABLES

Table 1 - Groundwater Data Summary
Rockport - Bottom Ash Pond

Parameter	Unit	MW-1002	MW-1600D	MW-1600I	MW-1600S	MW-1601D	MW-1601S	MW-1602D	MW-1602I	MW-1603D	MW-1603I	MW-1603S	MW-1604D	MW-1604I	MW-1604S
		5/24/2019	5/20/2019	5/20/2019	5/21/2019	5/24/2019	5/24/2019	5/24/2019	5/24/2019	5/21/2019	5/21/2019	5/21/2019	5/21/2019	5/21/2019	5/20/2019
Antimony	µg/L	0.0500 J	0.100 U	0.100 U	0.0300 J	0.100 U	0.100 U	0.100 U	0.0800 J	0.100 U	0.0200 J	0.0300 J	0.100 U	0.0200 J	0.0600 J
Arsenic	µg/L	0.230	20.3	17.7	0.500	10.3	2.05	9.29	29.6	12.6	12.9	0.170	18.3	21.2	0.180
Barium	µg/L	13.3	873	737	26.7	638	37.2	405	121	111	81.6	14.0	235	151	18.8
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	0.100 U	0.100 U	0.100 U
Boron	mg/L	1.61	0.100 U	0.0300 J	0.0500 J	0.0300 J	0.0600 J	0.0400 J	0.0500 J	0.0400 J	0.0600 J	1.47	0.0300 J	0.254	0.451
Cadmium	µg/L	0.0300 J	0.0800	0.0500 U	0.0100 J	0.0500 U	0.0500 U	0.0500 U	0.0300 J	0.0500 U	0.0500 U	0.0200 J	0.0500 U	0.0500 U	0.0300 J
Calcium	mg/L	32.9	76.5	71.0	57.4	85.4	77.2	67.9	74.6	71.6	81.4	62.6	69.3	78.2	80.4
Chloride	mg/L	55.9	31.4	25.4	27.9	23.6	38.5	68.3	29.0	25.3	39.4	56.0	16.1	70.1	57.2
Chromium	µg/L	0.0900 J	0.274	0.100 J	1.34	0.0600 J	0.0800 J	0.0500 J	0.305	0.0500 J	0.0800 J	0.0900 J	0.0400 J	0.0500 J	0.219
Cobalt	µg/L	0.754	0.176	1.24	0.127	0.0900	0.0200 J	0.0650	1.75	0.354	1.39	0.417	0.0510	1.03	0.352
Combined Radium	pCi/L	0.189	1.95	1.99	0.623	0.977	0.0711	0.710	0.819	0.730	0.832	0.529	0.771	1.46	0.677
Fluoride	mg/L	1.13	0.210	0.220	0.440	0.190	0.360	0.330	0.300	0.280	0.450	0.550	0.270	0.340	0.990
Lead	µg/L	0.100 U	0.238	0.100 U	0.0700 J	0.100 U	0.0300 J	0.100 U	0.354	0.0400 J	0.100 U	0.100 U	0.0600 J	0.100 U	0.0300 J
Lithium	mg/L	0.0300 U	0.0300 U	0.0300 U	0.0100 J	0.0100 J	0.0100 J	0.0100 J	0.00900 J	0.0300 U	0.0300 U	0.0300 U	0.0300 U	0.0100 J	0.0300 U
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	0.00500 U	0.00500 U
Molybdenum	µg/L	8.67	2.00 J	2.00 J	0.700 J	2.63	1.00 J	3.23	2.03	4.56	6.45	2.00 U	2.52	2.54	2.29
Selenium	µg/L	0.0500 J	0.200 U	0.200 U	0.600	0.0300 J	1.70	0.0300 J	0.0400 J	0.200 U	0.200 U	0.0800 J	0.200 U	0.100 J	0.0700 J
Total Dissolved Solids	mg/L	435	394	411	423	414	451	418	410	397	467	506	309	618	572
Sulfate	mg/L	169	43.0	52.8	57.4	24.9	41.8	20.5	65.9	38.5	74.6	187	27.4	181	179
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	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U
pH	SU	7.38	7.17	7.29	6.94	7.06	7.15	7.43	7.42	7.19	7.25	6.59	7.24	7.33	7.48

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 1 - Groundwater Data Summary
Rockport - Bottom Ash Pond

Parameter	Unit	MW-1605D	MW-1605I	MW-1605S	MW-1606D	MW-1606I	MW-1606S	MW-1701D	MW-1701I	MW-1701S	MW-1702D	MW-1702I	MW-1702S
		5/24/2019	5/24/2019	5/24/2019	5/24/2019	5/21/2019	5/21/2019	5/20/2019	5/20/2019	5/20/2019	5/20/2019	5/20/2019	5/20/2019
Antimony	µg/L	0.0500 J	0.0400 J	0.150	0.100 U	0.100 U	0.140	0.100 U	0.140	0.0600 J	0.0800 J	0.0700 J	0.0900 J
Arsenic	µg/L	13.9	25.3	2.84	17.4	7.69	0.190	9.55	12.8	0.410	25.6	49.5	0.450
Barium	µg/L	385	157	15.4	447	74.5	16.7	65.1	41.5	18.7	223	115	5.92
Beryllium	µg/L	0.100 U	0.100 U	0.0400 J	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
Boron	mg/L	0.0200 J	0.0800 J	0.415	0.0200 J	0.0200 J	0.0500 J	0.0200 J	0.0200 J	0.100 U	0.0200 J	0.0200 J	0.0300 J
Cadmium	µg/L	0.0500 U	0.0500 U	0.110	0.0500 U	0.0500 U	0.0500 J	0.0500 U	0.0200 J	0.0400 J	0.0200 J	0.0100 J	0.280
Calcium	mg/L	75.7	73.8	76.0	75.7	79.5	48.9	66.8	59.6	56.5	78.7	73.2	27.1
Chloride	mg/L	22.1	36.8	46.1	25.0	29.8	26.6	14.0	12.8	19.7	30.5	28.8	14.7
Chromium	µg/L	0.0600 J	0.0700 J	0.636	0.100 J	0.200 U	0.100 J	0.200 J	0.0900 J	0.200 J	0.100 J	0.0500 J	0.475
Cobalt	µg/L	0.255	1.12	3.91	0.0660	1.56	0.0940	1.59	1.16	0.0530	0.686	1.43	0.0580
Combined Radium	pCi/L	1.12	1.05	0.269	0.946	0.562	0.668	0.702	0.628	0.0249	1.21	1.52	0.563
Fluoride	mg/L	0.240	0.230	0.610	0.200	0.160	0.470	0.320	0.400	0.420	0.180	0.210	0.700
Lead	µg/L	0.100 U	0.0400 J	1.96	0.100 U	0.100 U	0.100 U	0.100 U	0.0900 J	0.0600 J	0.0400 J	0.0500 J	0.373
Lithium	mg/L	0.0300 U	0.0100 J	0.0200 J	0.0300 U	0.0300 U	0.0300 U	0.0300 U	0.0300 U	0.0300 U	0.0300 U	0.0300 U	0.0300 U
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	2.60	1.00 J	2.00 J	2.00 J	0.800 J	0.900 J	1.00 J	1.00 J	0.700 J	2.43	2.00 J	1.00 J
Selenium	µg/L	0.200 U	0.0400 J	0.300	0.200 U	0.200 U	3.30	0.200 U	0.200 U	0.300	0.200 U	0.0500 J	1.50
Total Dissolved Solids	mg/L	364	443	586	330	407	416	371	345	320	402	376	272
Sulfate	mg/L	38.9	89.2	147	19.6	55.5	64.5	43.5	39.8	20.0	38.9	44.5	20.8
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	0.500 U	0.500 U	0.500 U	0.500 U
pH	SU	6.92	7.30	7.26	7.15	8.56	7.85	7.20	7.32	7.16	6.97	6.87	6.82

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
Rockport Plant - Bottom Ash Pond

Constituent Name	MCL	CCR Rule-Specified	Background Limit
Antimony, Total (mg/L)	0.006		0.0004
Arsenic, Total (mg/L)	0.01		0.05
Barium, Total (mg/L)	2		1.00
Beryllium, Total (mg/L)	0.004		0.0001
Cadmium, Total (mg/L)	0.005		0.00028
Chromium, Total (mg/L)	0.1		0.0011
Cobalt, Total (mg/L)	n/a	0.006	0.003
Combined Radium, Total (pCi/L)	5		3.3
Fluoride, Total (mg/L)	4		0.70
Lead, Total (mg/L)	n/a	0.015	0.0015
Lithium, Total (mg/L)	n/a	0.04	0.038
Mercury, Total (mg/L)	0.002		0.000005
Molybdenum, Total (mg/L)	n/a	0.1	0.004
Selenium, Total (mg/L)	0.05		0.0038
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: Appendix III Data Summary
Rockport Plant - Bottom Ash Pond

Geosyntec Consultants, Inc.

Parameter	Units	Description	MW-1002		MW-1602D		MW-1602I	MW-1603D	MW-1603I		MW-1603S		MW-1604D	MW-1604I		MW-1604S	
			5/24/2019	6/27/2019	5/24/2019	6/27/2019	5/24/2019	5/21/2019	5/21/2019	6/27/2019	5/21/2019	6/27/2019	5/21/2019	5/21/2019	6/27/2019	5/20/2019	6/26/2019
Boron	mg/L	Interwell Background Value (UPL)	0.133														
		Detection Monitoring Result	**1.61**	**1.82**	0.04	--	0.05	0.04	0.06	--	**1.47**	**1.65**	0.03	**0.254**	**0.278**	**0.451**	**0.667**
Calcium	mg/L	Intrawell Background Value (UPL)	94.3		83.7		92.7	101.7	109.2		110.7		78.4	85.8		117.6	
		Detection Monitoring Result	32.9		67.9	--	74.6	71.6	81.4	--	62.6	--	69.3	78.2	--	80.4	--
Chloride	mg/L	Interwell Background Value (UPL)	46.4														
		Detection Monitoring Result	**55.9**	**57.1**	**68.3**	**68.7**	29	25.3	39.4	--	**56.0**	**57.8**	16.1	**70.1**	**63.5**	**57.2**	**81.4**
Fluoride	mg/L	Interwell Background Value (UPL)	0.70														
		Detection Monitoring Result	**1.13**	**1.10**	0.33	--	0.3	0.28	0.45	--	0.55	--	0.27	0.34	--	**0.99**	**0.91**
pH	SU	Intrawell Background Value (UPL)	7.3		9.3		7.6	7.5	7.6		7.9		7.5	7.7		7.7	
		Intrawell Background Value (LPL)	6.0		4.9		6.7	6.7	7.2		6.0		6.9	7.0		7.1	
		Detection Monitoring Result	**7.4**	7.1	7.4	--	7.4	7.2	7.3	--	6.6	--	7.2	7.3	--	7.5	--
Sulfate	mg/L	Interwell Background Value (UPL)	76.0														
		Detection Monitoring Result	**169**	**173**	20.5	--	65.9	38.5	74.6	--	**187**	**205**	27.4	**181**	**167**	**179**	**246**
Total Dissolved Solids	mg/L	Interwell Background Value (UPL)	465														
		Detection Monitoring Result	435	--	418	--	410	397	**467**	**560**	**506**	**530**	309	**618**	**622**	**572**	**718**

Parameter	Units	Description	MW-1605D	MW-1605I		MW-1605S		MW-1606D	MW-1606I			MW-1606S	
			5/24/2019	5/24/2019	6/25/2019	5/24/2019	6/27/2019	5/24/2019	5/21/2019	6/25/2019	9/12/2019	5/21/2019	6/25/2019
Boron	mg/L	Interwell Background Value (UPL)	0.133										
		Detection Monitoring Result	0.02	0.08	--	**0.415**	**0.438**	0.02	0.02	--	--	0.05	--
Calcium	mg/L	Intrawell Background Value (UPL)	96.9	109.6		88.7		82.0	76.1			59.9	
		Detection Monitoring Result	75.7	73.8	--	76	--	75.7	**79.5**	**86.8**	72.8	48.9	--
Chloride	mg/L	Interwell Background Value (UPL)	46.4										
		Detection Monitoring Result	22.1	36.8	--	46.1	--	25	29.8	--	--	26.6	--
Fluoride	mg/L	Interwell Background Value (UPL)	0.70										
		Detection Monitoring Result	0.24	0.23	--	0.61	--	0.2	0.16	--	--	0.47	--
pH	SU	Intrawell Background Value (UPL)	7.5	7.5		7.3		8.8	8.0			7.3	
		Intrawell Background Value (LPL)	6.8	6.8		7.0		5.5	4.5			6.6	
		Detection Monitoring Result	6.9	7.3	--	7.3	--	7.2	**8.6**	7.2	--	**7.9**	7.0
Sulfate	mg/L	Interwell Background Value (UPL)	76.0										
		Detection Monitoring Result	38.9	**89.2**	**104**	**147**	**150**	19.6	55.5	--	--	64.5	--
Total Dissolved Solids	mg/L	Interwell Background Value (UPL)	465										
		Detection Monitoring Result	364	443	--	**586**	**595**	330	407	--	--	416	--

Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit
*: Designates results for a duplicate sample
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 Rockport BAP 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

DAVID ANTHONY MILLER
No. 11700730

11700730
License Number

INDIANA
Licensing State

10.14.19
Date

ATTACHMENT B

Statistical Analysis Output

GROUNDWATER STATS
CONSULTING

August 12, 2019

Geosyntec Consultants
Attn: Ms. Allison Kreinberg
941 Chatham Lane, #103
Columbus, OH 43221

Re: Rockport Bottom Ash Pond
Assessment Monitoring Event 2019

Dear Ms. Kreinberg,

Groundwater Stats Consulting (GSC), formerly the statistical consulting division of Sanitas Technologies, is pleased to provide the statistical analysis of background groundwater data for American Electric Power Inc.'s Rockport 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-1600D, MW-1600I, MW-1600S, MW-1601D, MW-1601I, MW-1601S; MW-1701S, MW-1702D, MW-1702I, MW-1702S, MW-1701D, and MW-1701I
- **Downgradient wells:** MW-1002, MW-1602D, MW-1602I, MW-1603D, MW-1603I, MW-1603S, MW-1604D, MW-1604I, MW-1604S, MW-1605D, MW-1605I, MW-1605S, MW-1606D, MW-1606I, and MW-1606S

Data were sent electronically and the statistical analysis was reviewed by Dr. Jim Loftis, Civil & Environmental Engineering professor emeritus at Colorado State University and Senior Advisor to Groundwater Stats Consulting. The statistical analysis was conducted according to the January 2018 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 and box plots for Appendix III and IV parameters are provided for all wells and constituents; and are used to evaluate concentrations over the entire record (Figures A and B). The background screening was conducted on all wells during January 2018, except for the 1700 series wells which were added to the monitoring well network and approved for use as background wells during 2018.

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 submitted with the background screening and demonstrated that the selected statistical methods for Appendix III parameters comply with the USEPA Unified Guidance recommendations as discussed below.

Tukey's box plot method was used during the screening evaluations to identify outliers which were flagged in the database and deselected prior to construction of statistical limits. A summary of all previously flagged outliers identified during the background screening follows this letter (Figure C).

No seasonal patterns were apparent 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 during the background screening to evaluate all Appendix III data at each well to identify statistically significant increasing or decreasing trends. The results of those findings were submitted with the screening evaluation. 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. All of the trends identified during the screening were relatively low in magnitude when compared to average concentrations; therefore, no adjustments were made to the data sets.

Prediction Limit Summary - Appendix III Parameters

As a result of the background screening, interwell prediction limits were constructed using all screened upgradient well data, combined with a 1-of-2 verification strategy for boron, chloride, fluoride, sulfate and TDS (Figure D). Intrawell limits combined with a 1-of-3 verification strategy were constructed using screened background data through July 2017 for calcium and pH (Figure E). Note that the upgradient 1700 series wells do not yet have the recommended minimum 8 background samples and, therefore, intrawell prediction limits were not included for these wells.

Prediction limits were constructed based on the following:

Number of Sample Events Per Year: 2
Interwell Prediction Limits and 1-of-2 Resamples
Intrawell Prediction Limits and 1-of-3 Resamples
Number of Analytes: 7
Number of Downgradient Wells: 15

In the event of an initial exceedance of compliance well data, the 1-of-2 resample plan allows for collection of one additional sample, and the 1-of-3 resample plan allows up to 2 resamples, to determine whether the initial exceedance is confirmed. When the resamples confirm 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 a resample falls within the statistical limit, the initial exceedance is considered a false positive result and, therefore, no further action is necessary.

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.

Several exceedances were noted for the Appendix III parameters. The results of those findings may be found in the Prediction Limit Summary tables following this letter.

The Sen's Slope/Mann-Kendall trend test is performed on all well/constituent pairs found to exceed their respective prediction limit to determine whether concentrations are increasing, decreasing or stabilizing. Upgradient wells are included in the trend tests to determine whether similar patterns exist both upgradient and downgradient of the facility which would suggest naturally changing groundwater unrelated to practices at the facility. No statistically significant increasing trends were found in any of the wells. One statistically significant decreasing trend was noted for chloride in upgradient well MW-1601S.

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) (Figure G). 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 Rule Specified 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 (Figure H).

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 (Figure I). Only when the entire confidence interval is above a GWPS is the well/constituent pair considered to exceed its respective standard. No confidence intervals exceedances were found for any of the downgradient wells. 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 Rockport Bottom Ash Pond. If you have any questions or comments, please feel free to contact me.

For Groundwater Stats Consulting,

Kristina Rayner

Kristina L. Rayner
Groundwater Statistician

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

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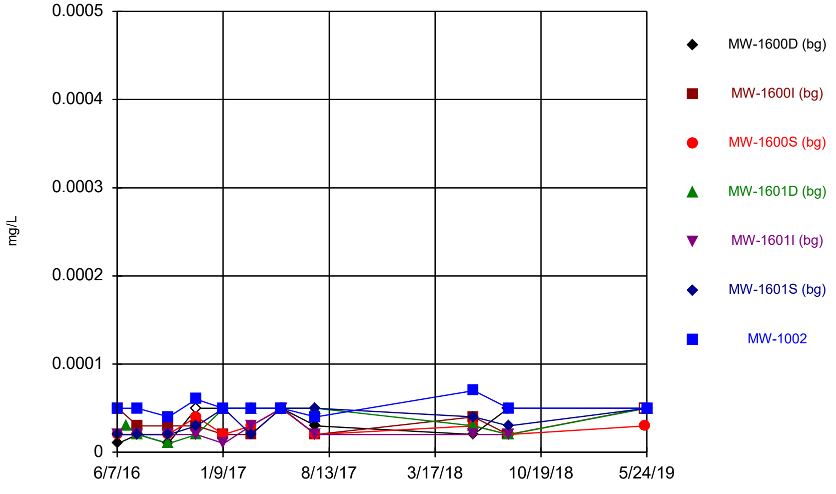

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Hollow symbols indicate censored values.

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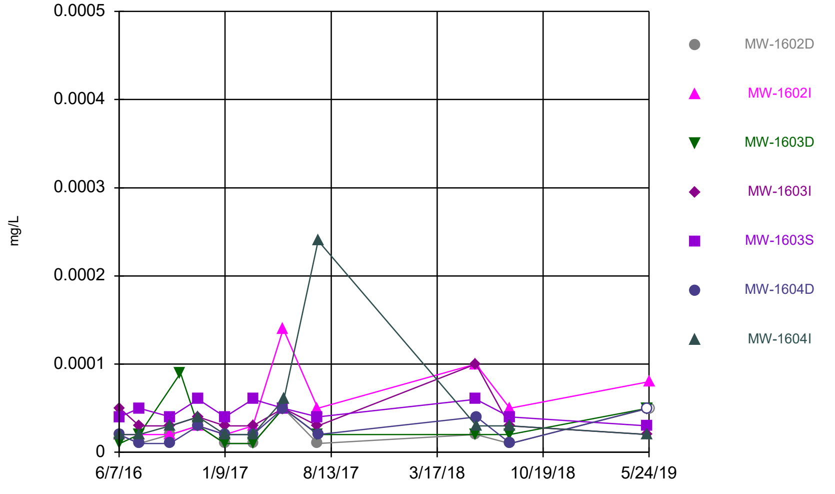

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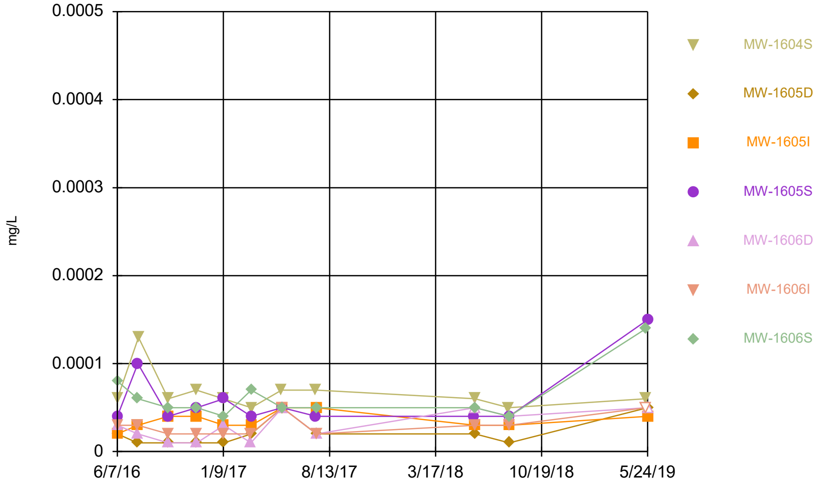

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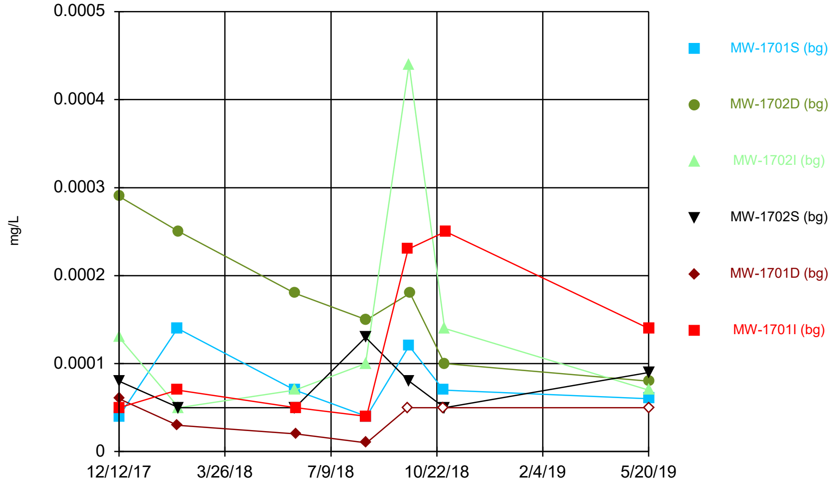

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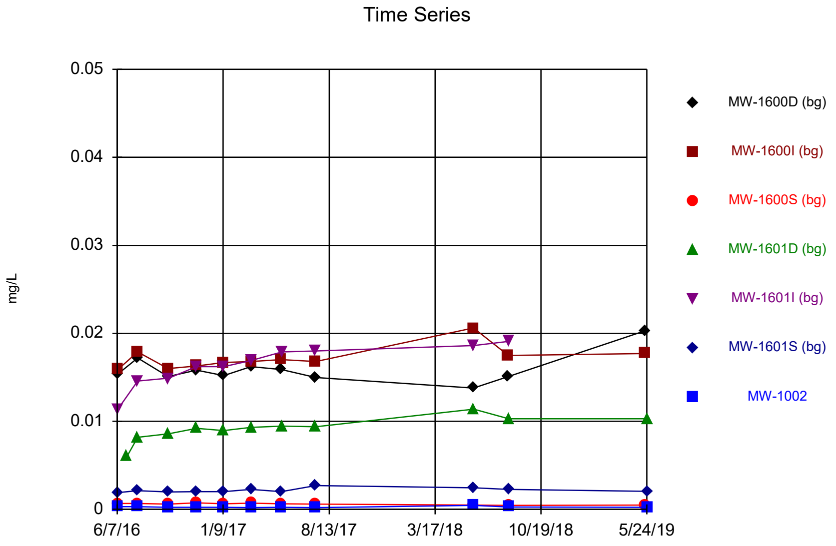

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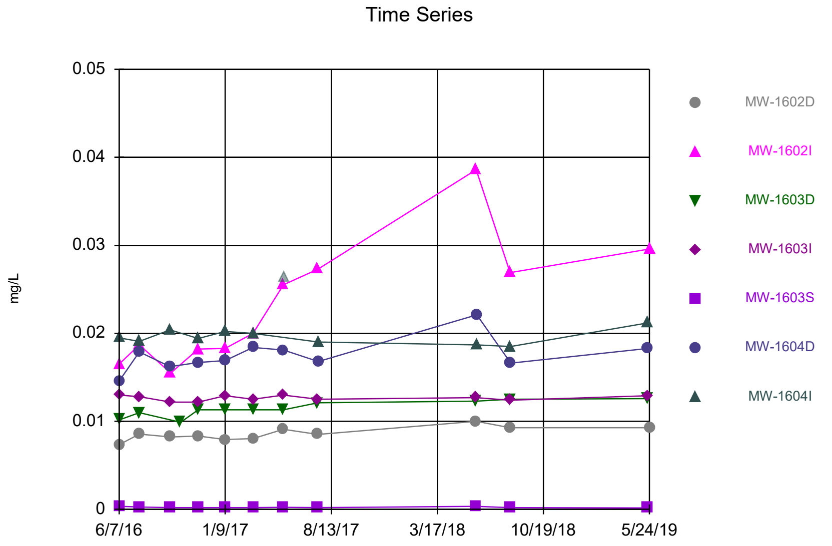

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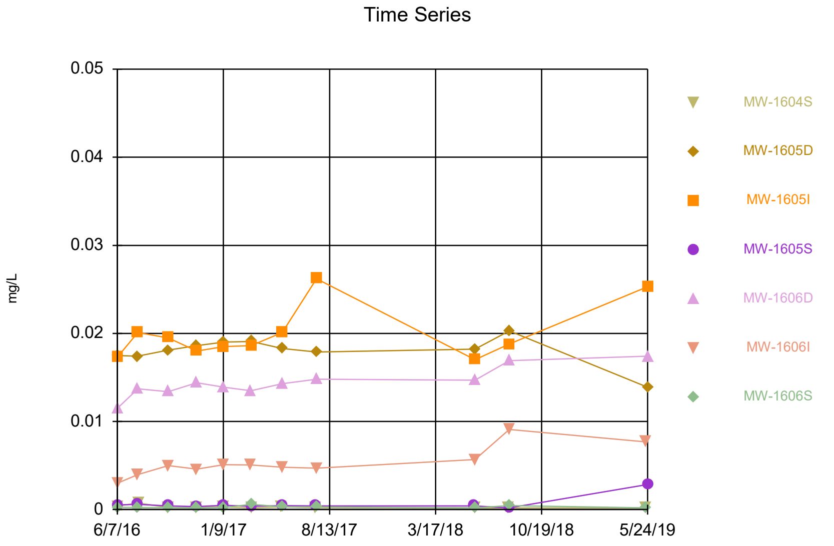

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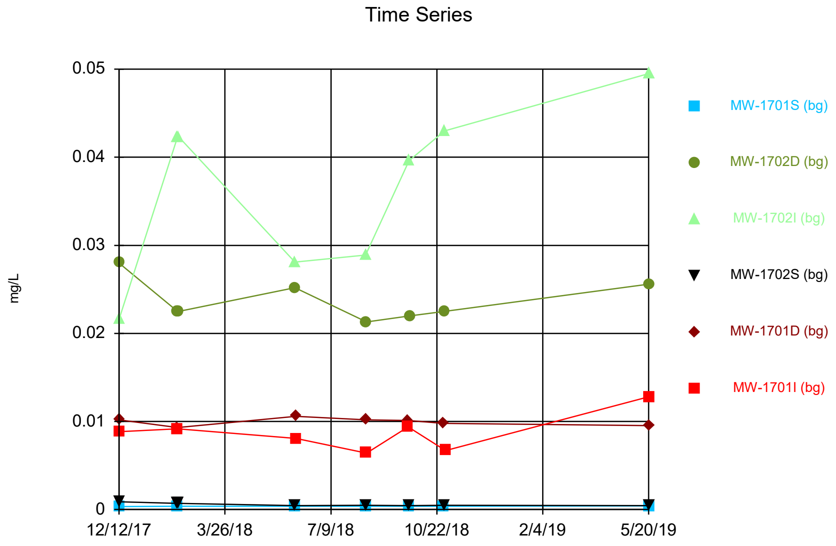

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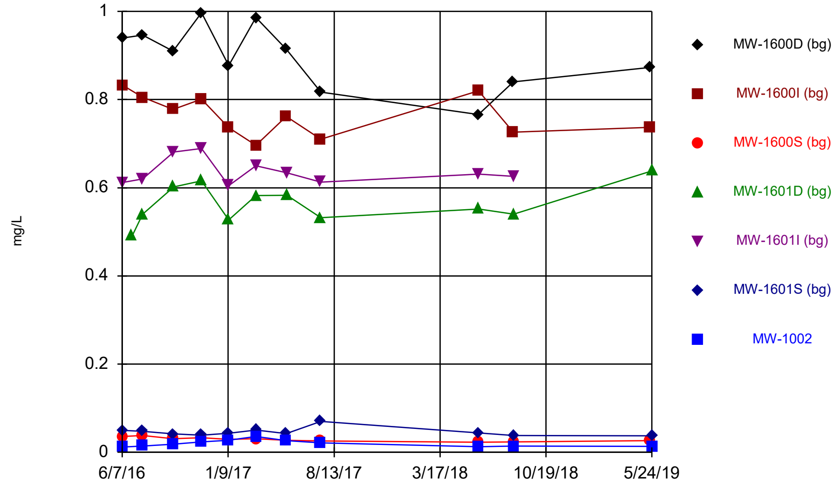

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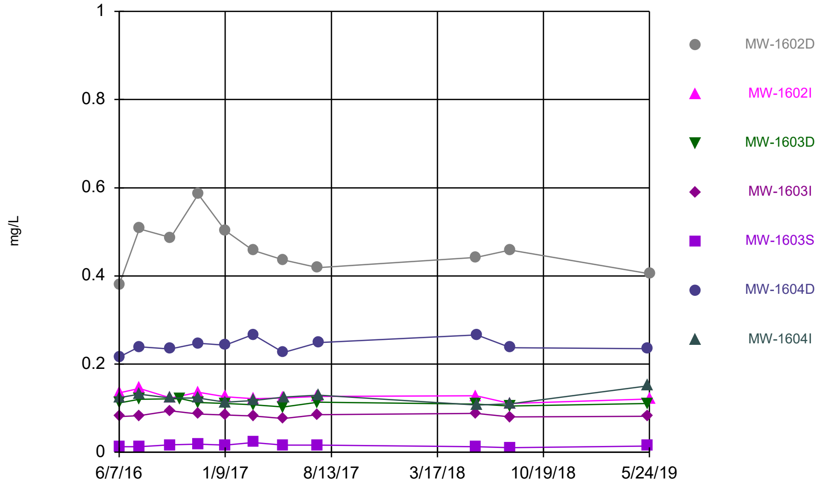

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Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

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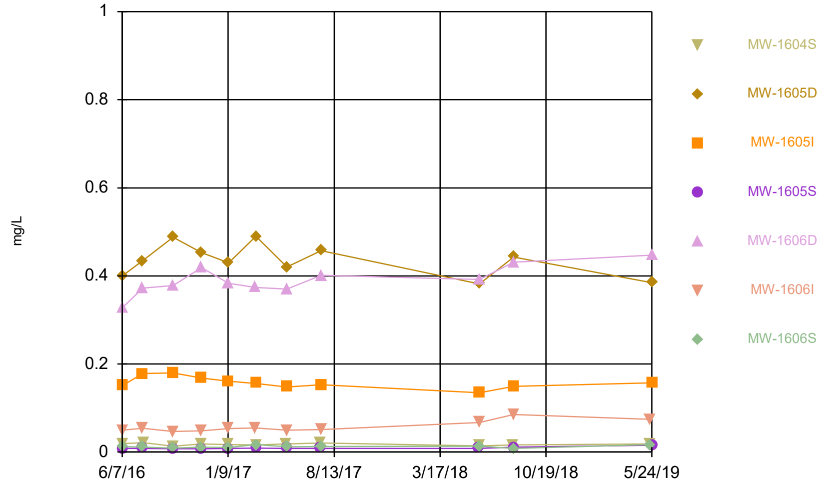

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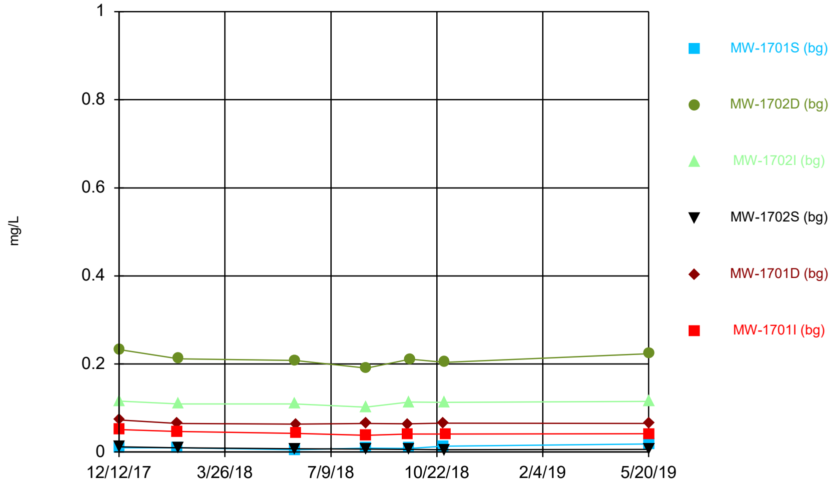

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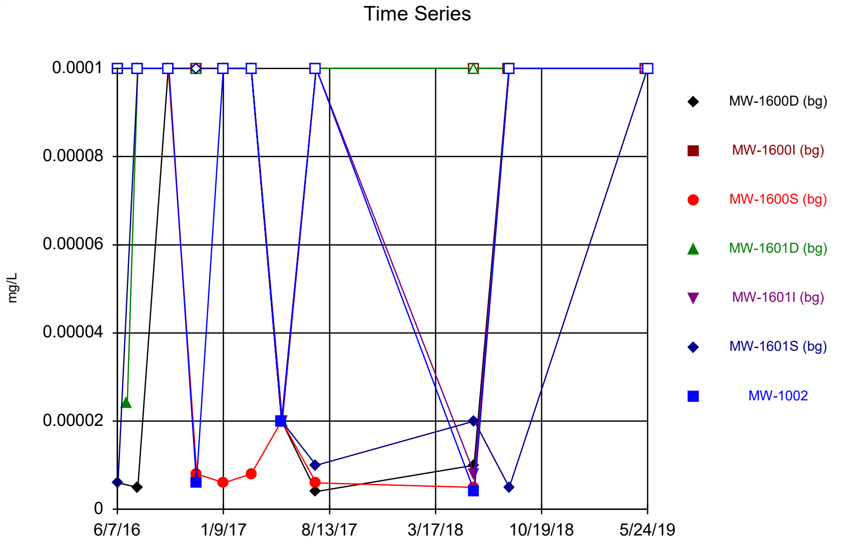

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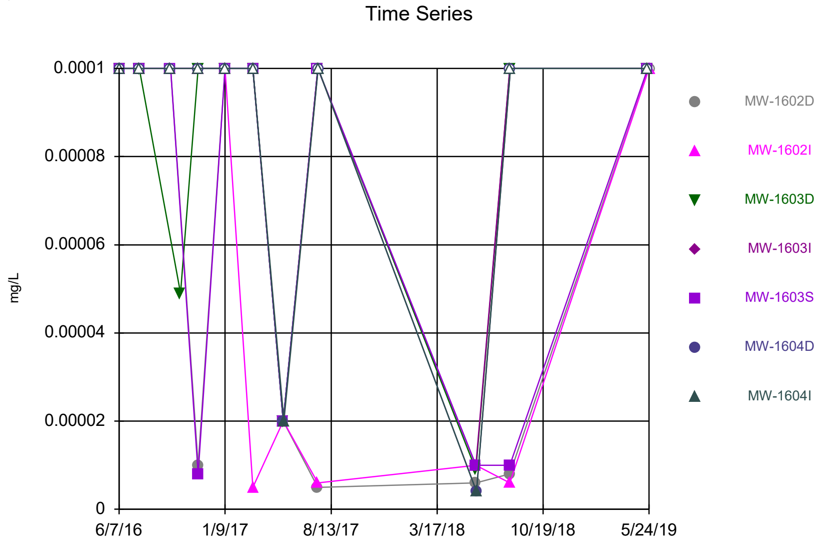

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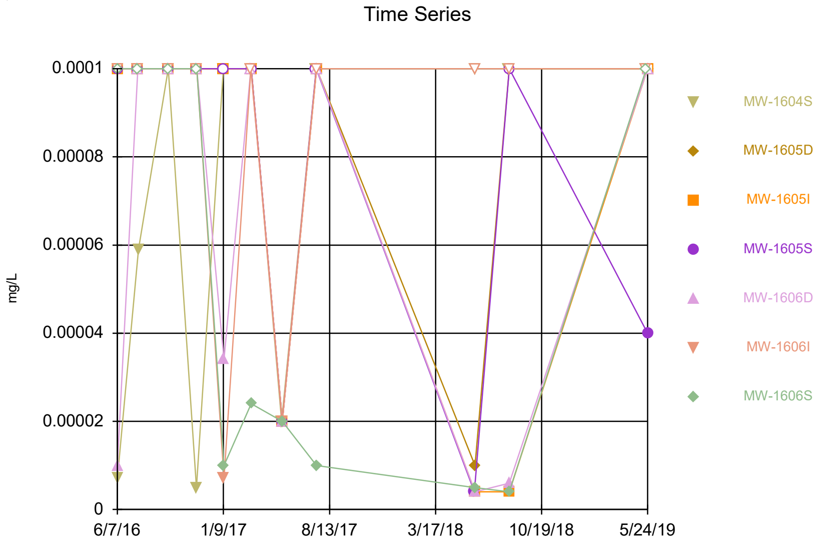

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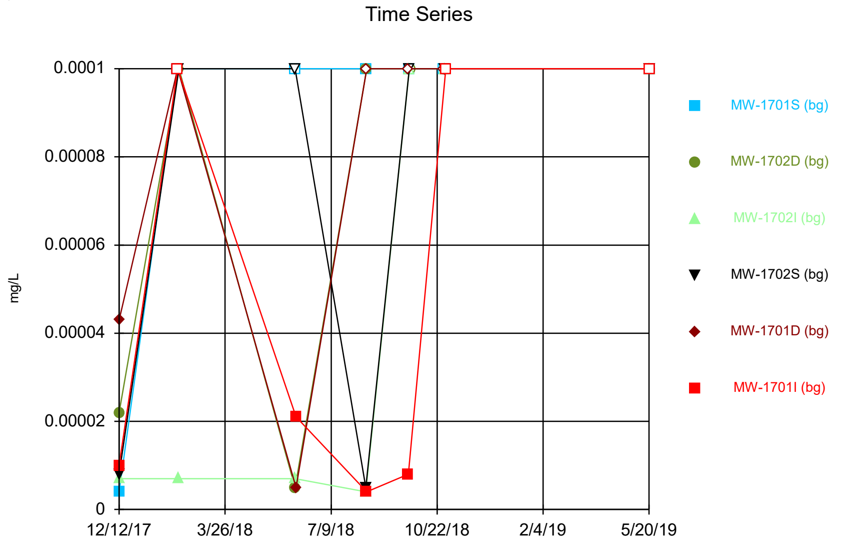

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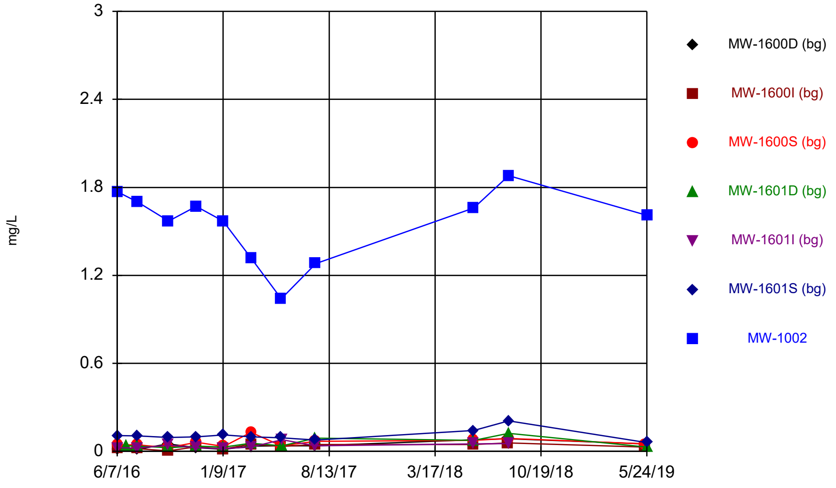
Hollow symbols indicate censored values.

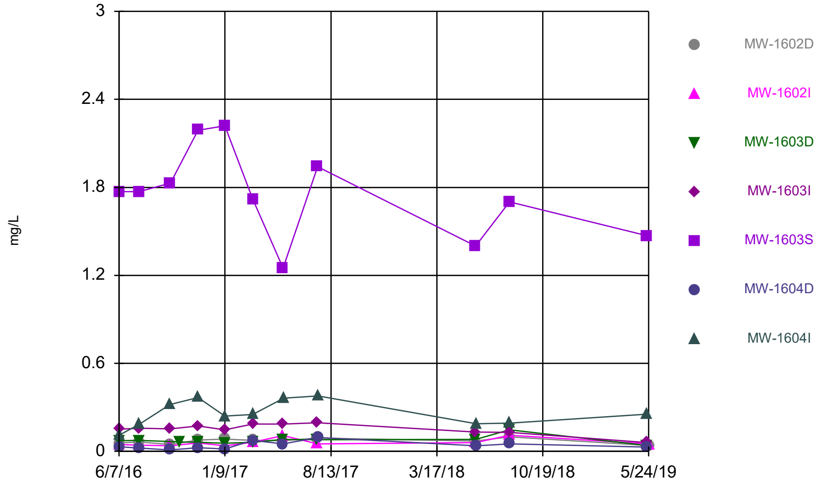
Time Series



Constituent: Boron, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

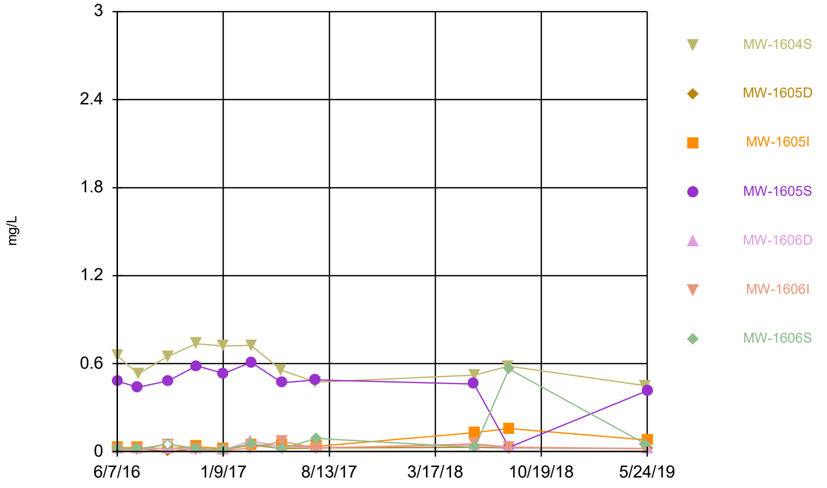
Time Series



Constituent: Boron, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

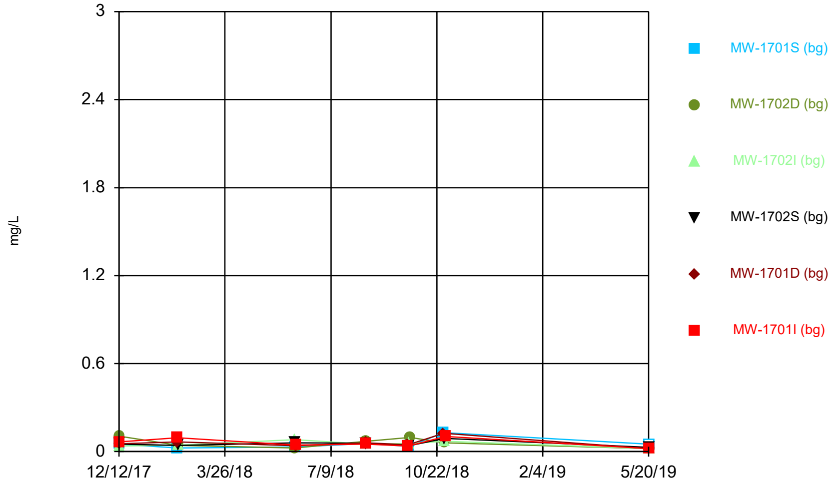
Time Series



Constituent: Boron, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



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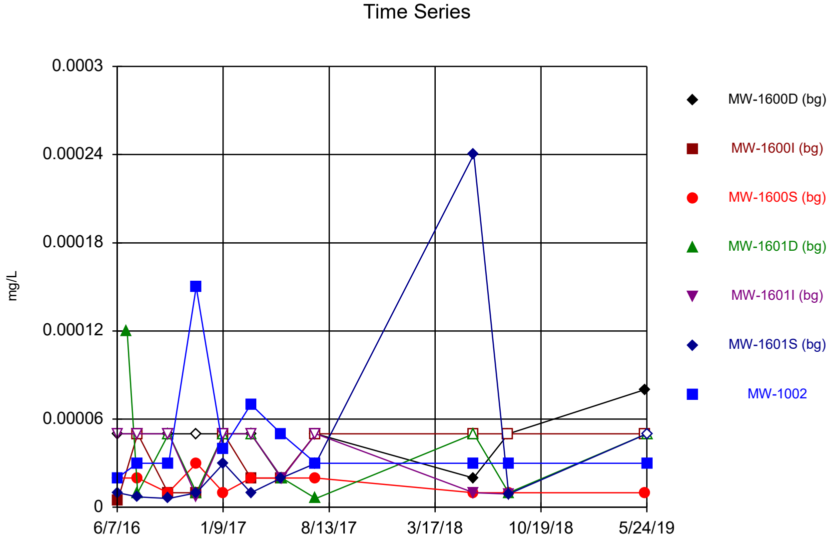
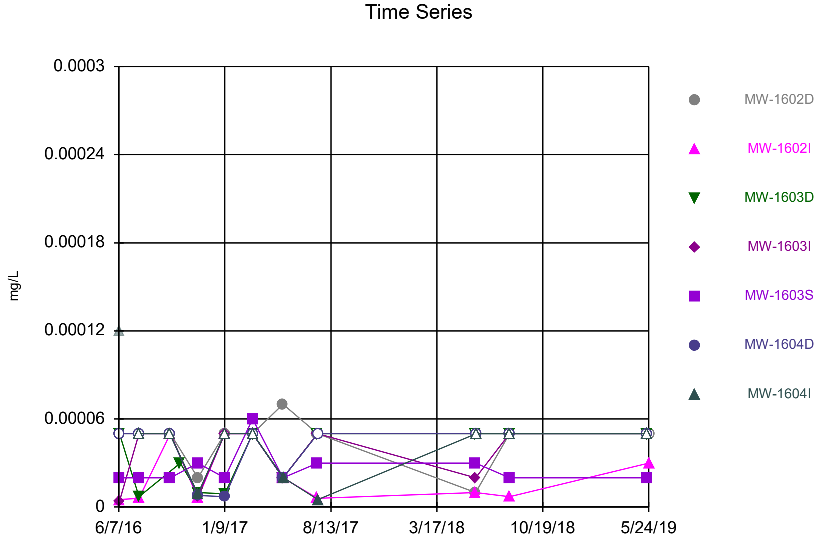
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



Constituent: Cadmium, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



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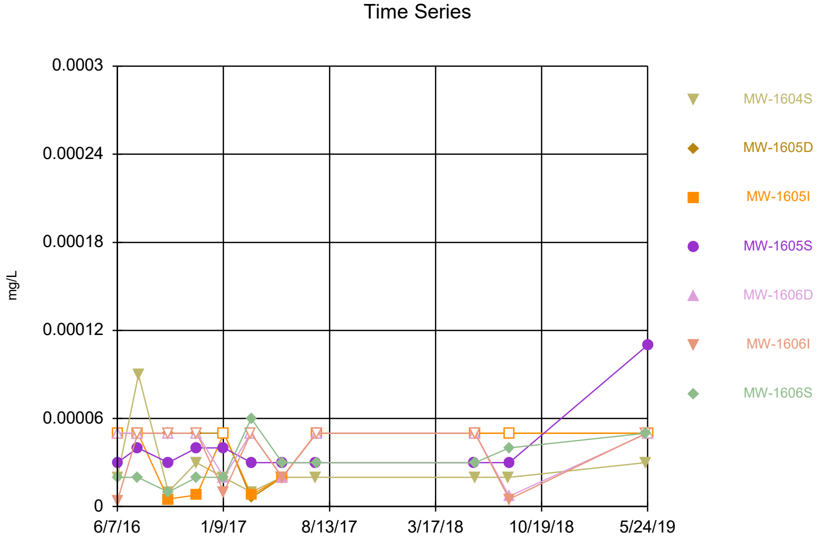
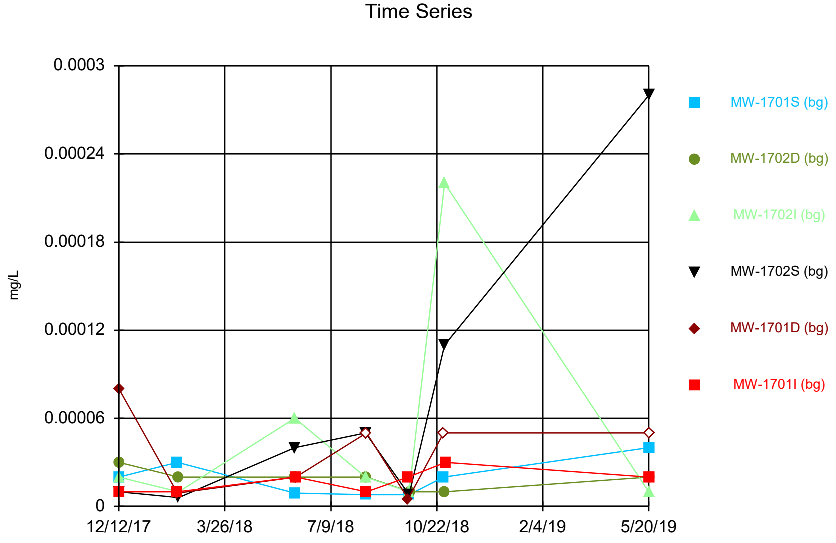
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



Constituent: Cadmium, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

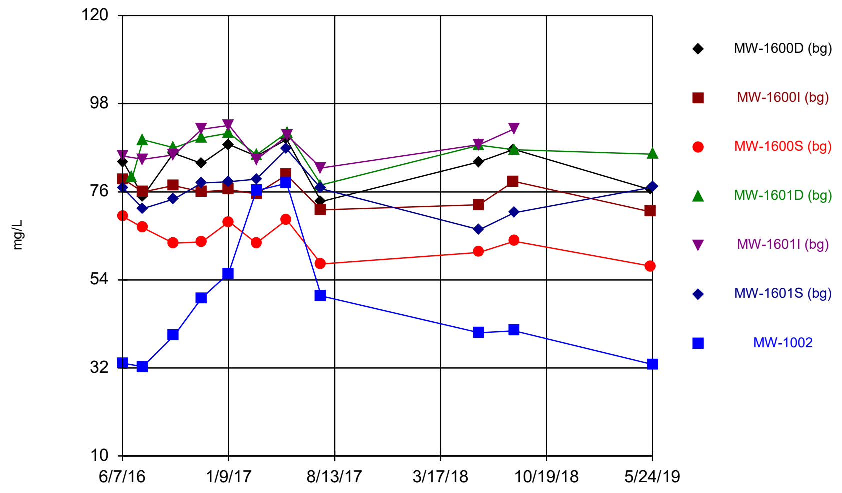
Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



Constituent: Cadmium, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

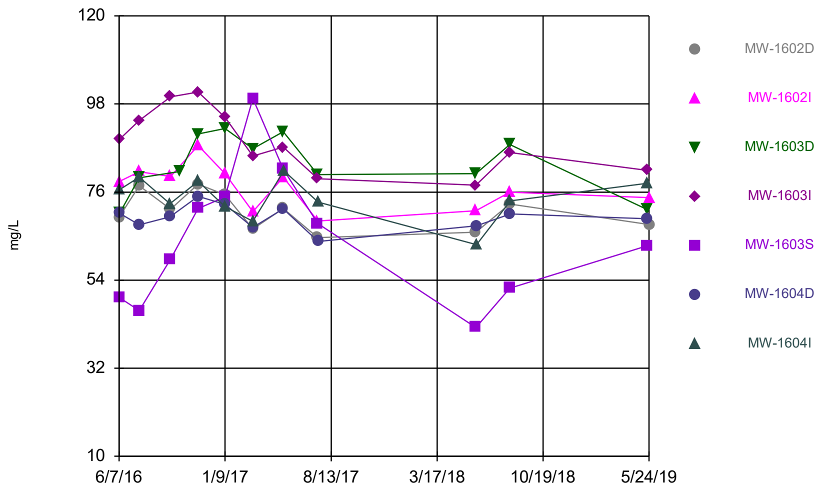
Time Series



Constituent: Calcium, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

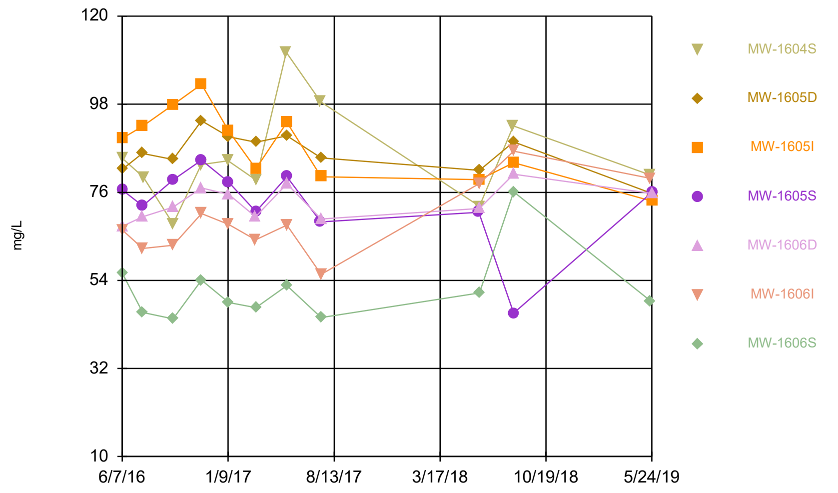
Time Series



Constituent: Calcium, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

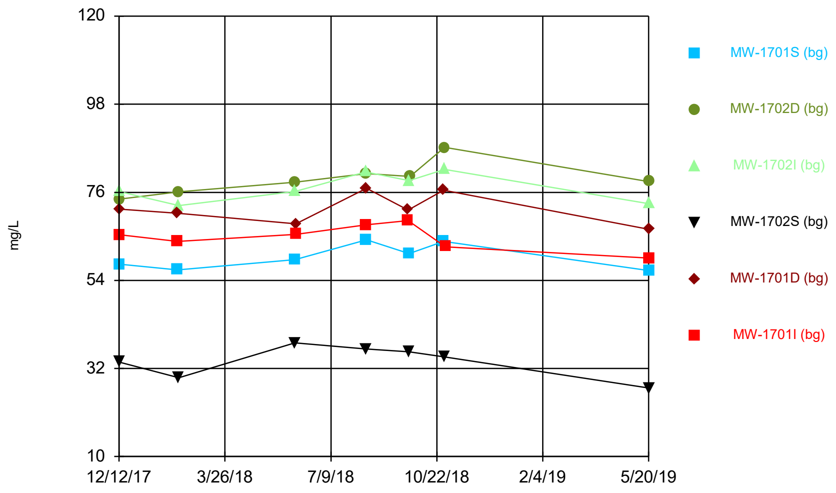
Time Series



Constituent: Calcium, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

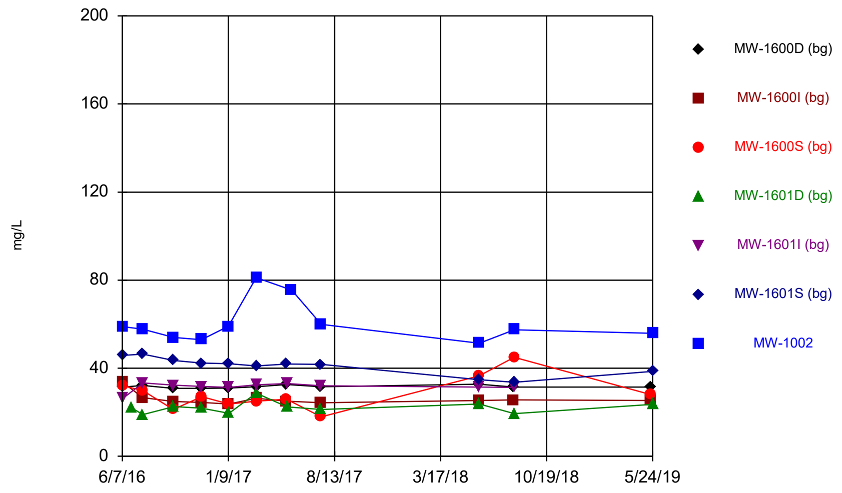
Time Series



Constituent: Calcium, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

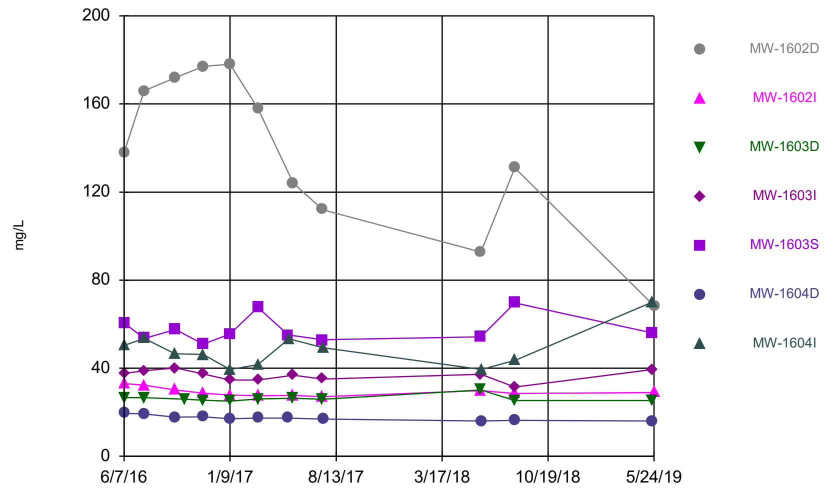
Time Series



Constituent: Chloride, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

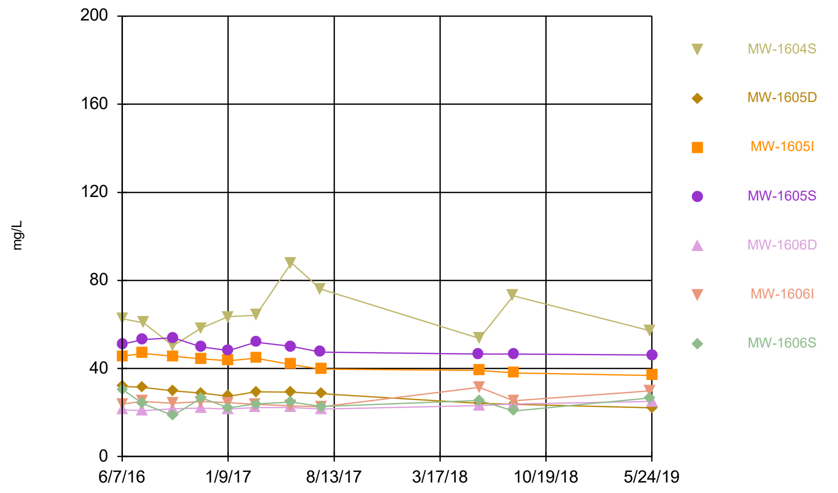
Time Series



Constituent: Chloride, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

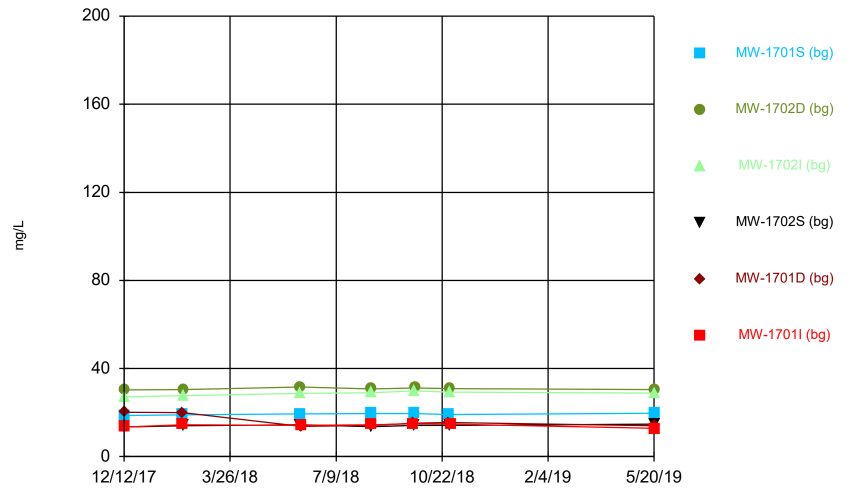
Time Series



Constituent: Chloride, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series



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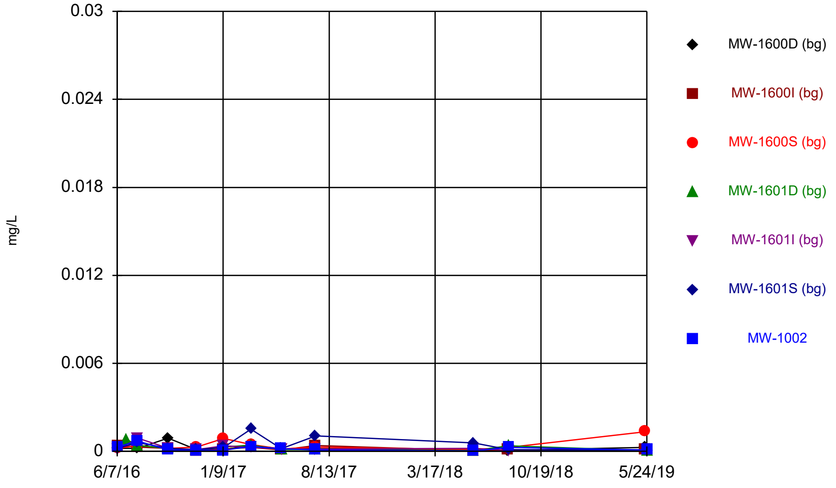
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

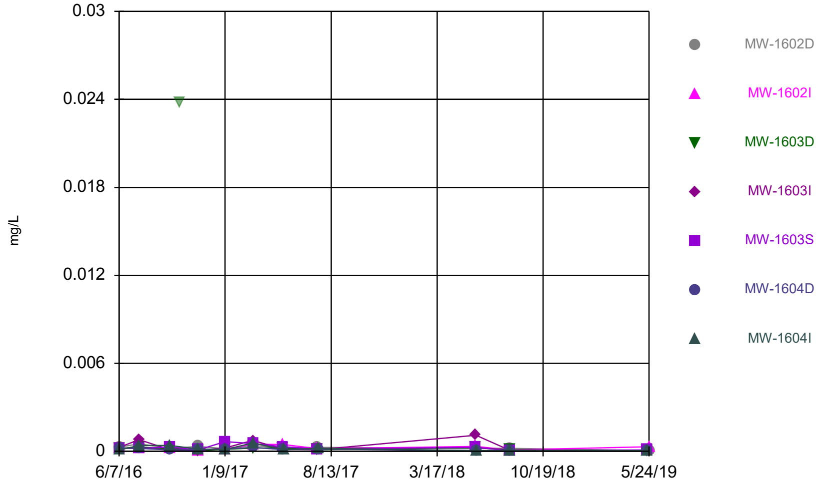
Time Series



Constituent: Chromium, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

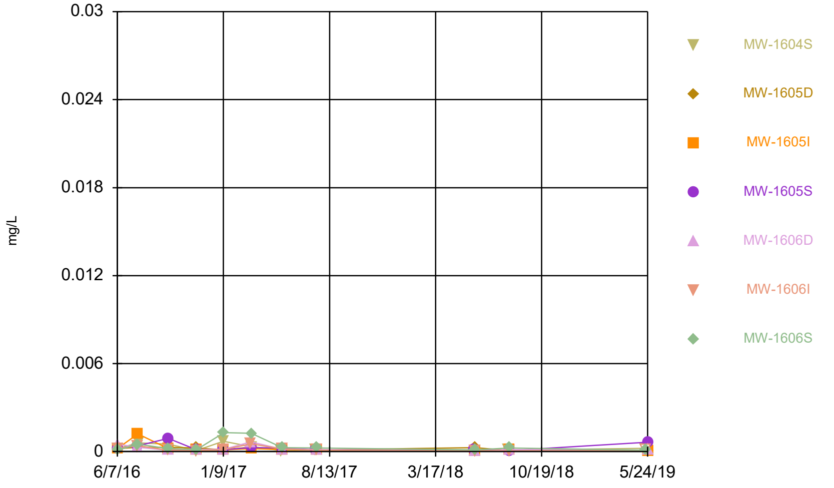
Time Series



Constituent: Chromium, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

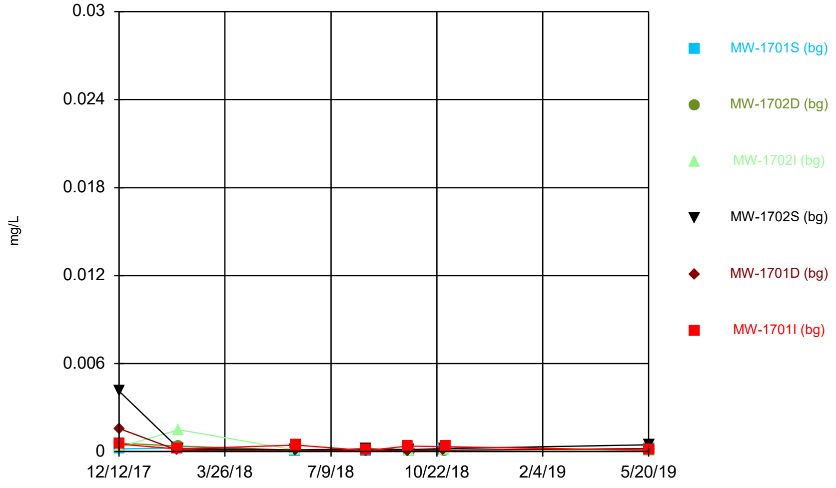
Time Series



Constituent: Chromium, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

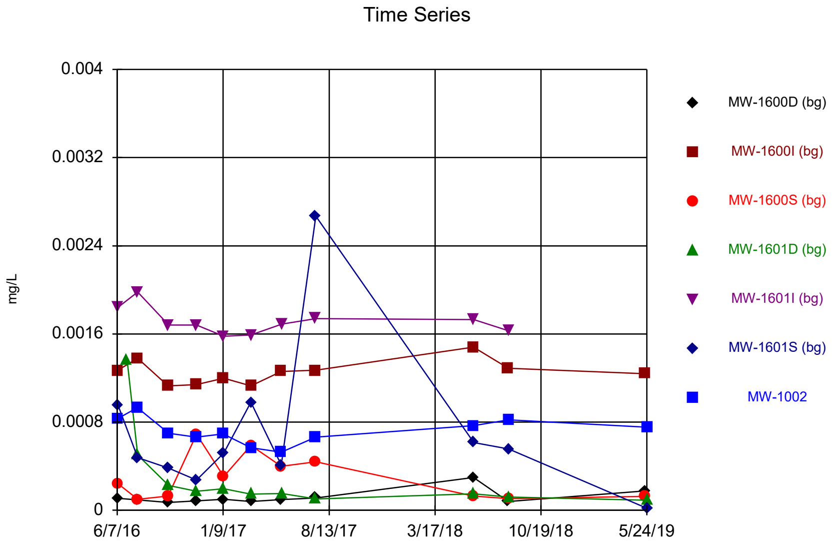
Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series



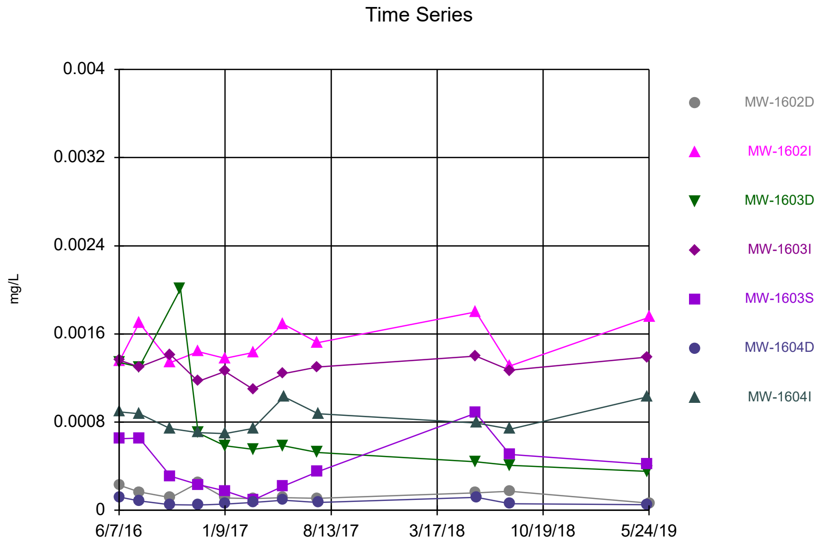
Constituent: Chromium, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



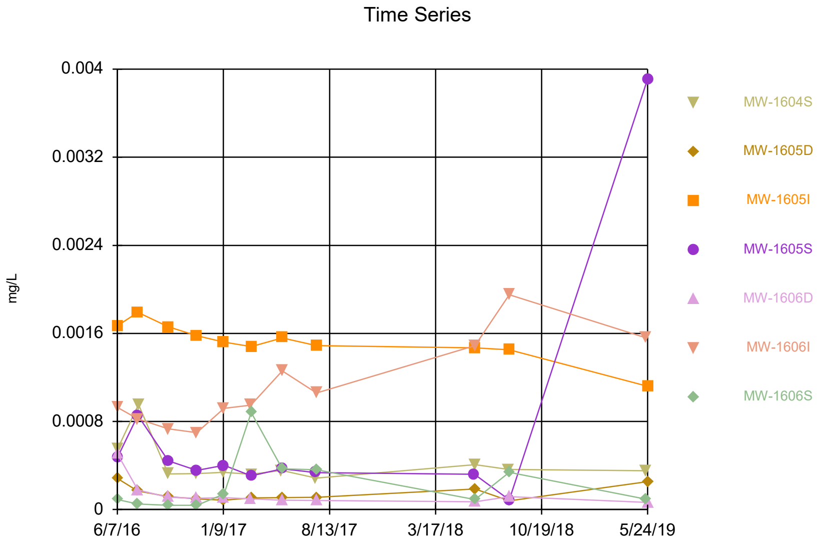
Constituent: Cobalt, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



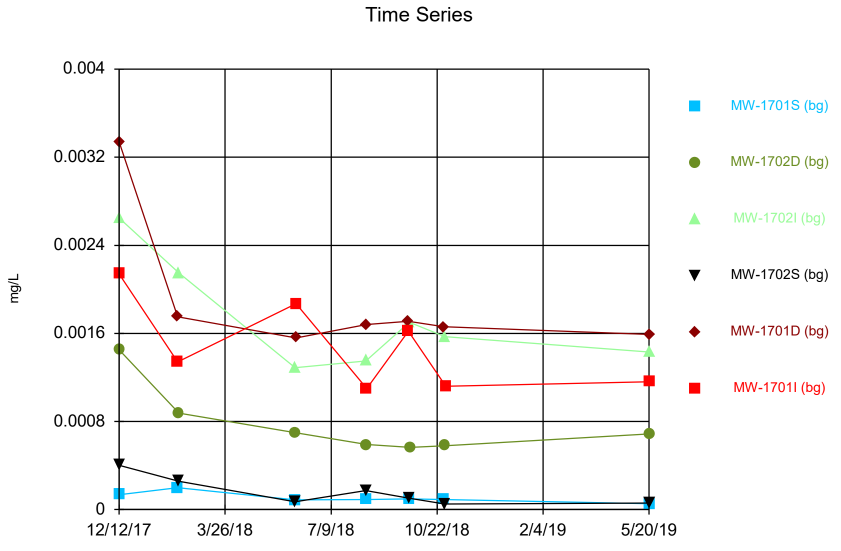
Constituent: Cobalt, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



Constituent: Cobalt, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

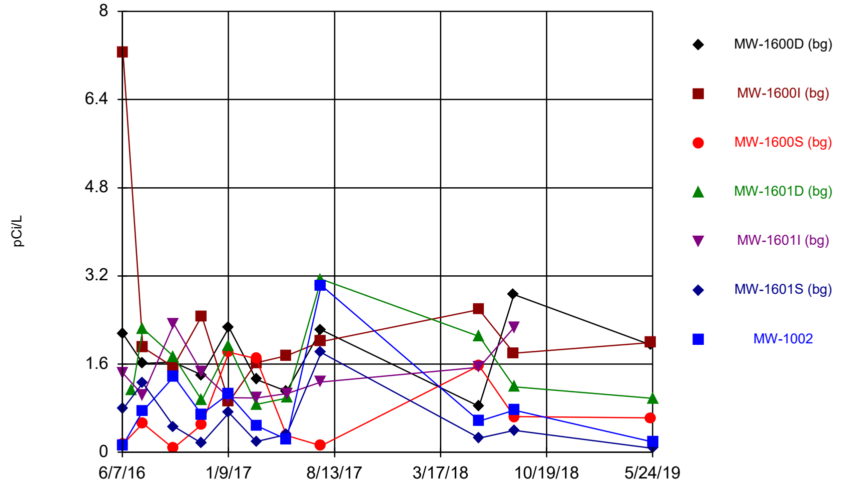
Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



Constituent: Cobalt, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series

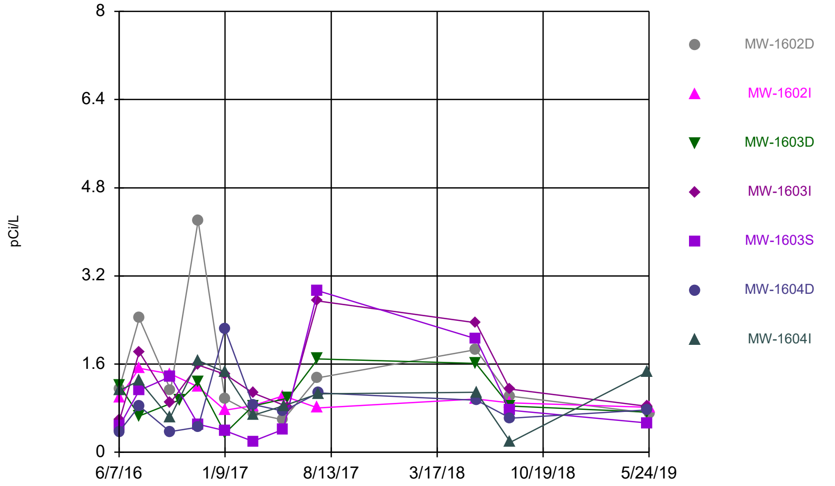


Constituent: Combined Radium 226 + 228   Analysis Run 8/10/2019 9:57 AM   View: Descriptive

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series

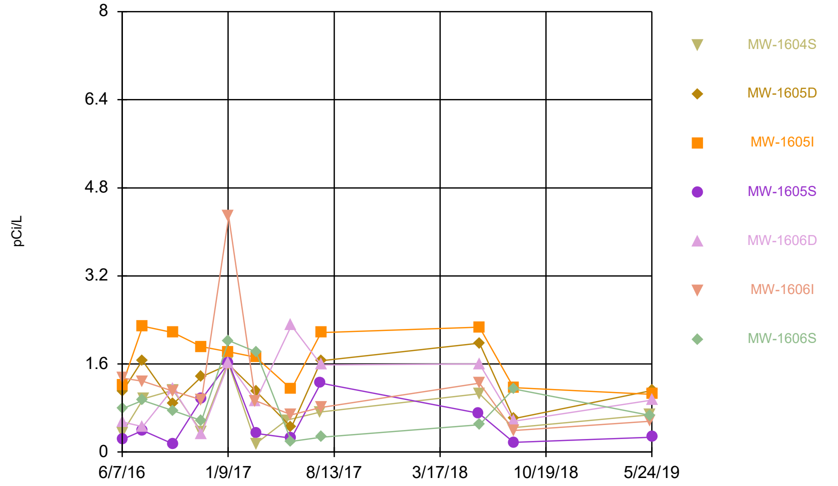


Constituent: Combined Radium 226 + 228   Analysis Run 8/10/2019 9:57 AM   View: Descriptive

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series

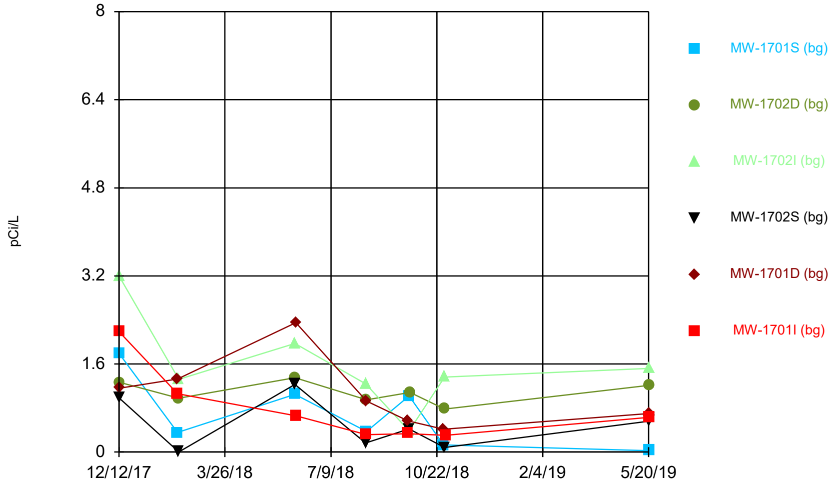


Constituent: Combined Radium 226 + 228   Analysis Run 8/10/2019 9:57 AM   View: Descriptive

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series

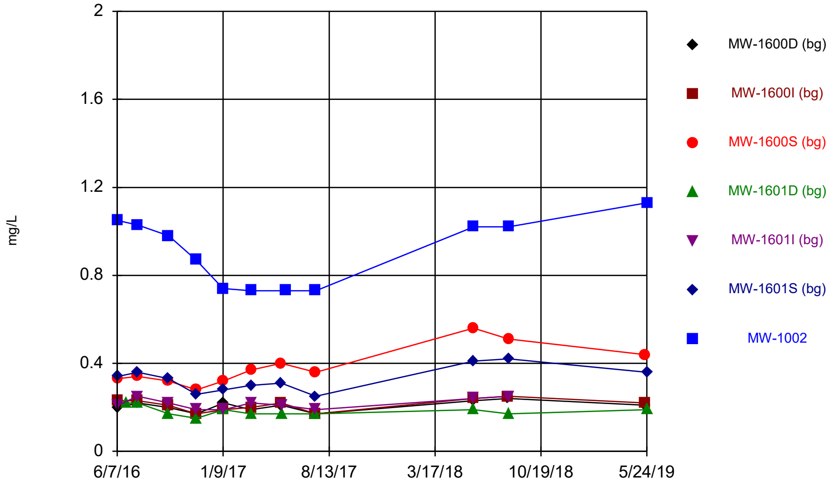


Constituent: Combined Radium 226 + 228   Analysis Run 8/10/2019 9:57 AM   View: Descriptive

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

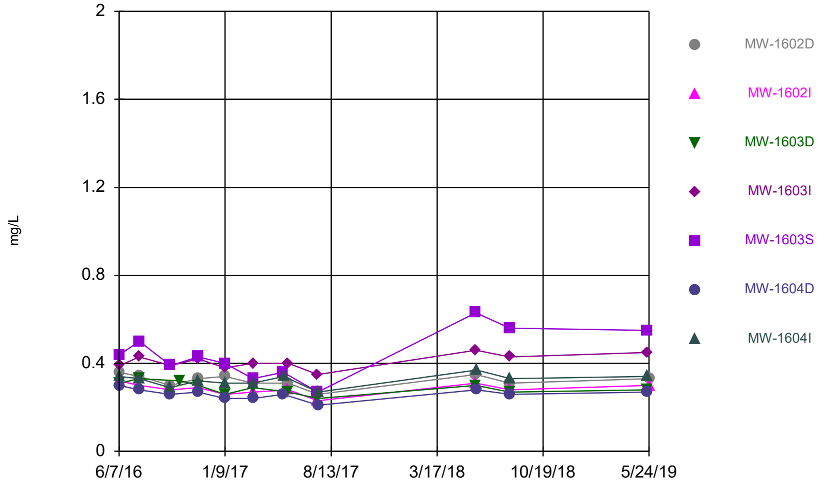
Time Series



Constituent: Fluoride, total   Analysis Run 8/10/2019 9:57 AM   View: Descriptive
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

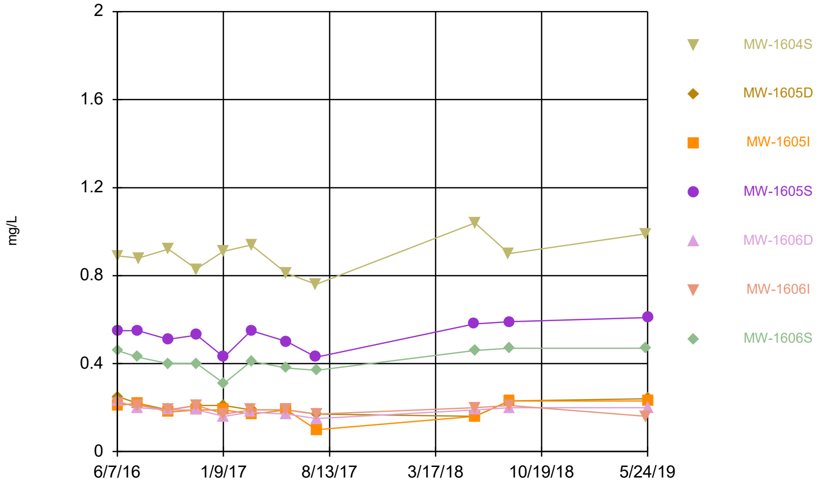
Time Series



Constituent: Fluoride, total   Analysis Run 8/10/2019 9:57 AM   View: Descriptive
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series



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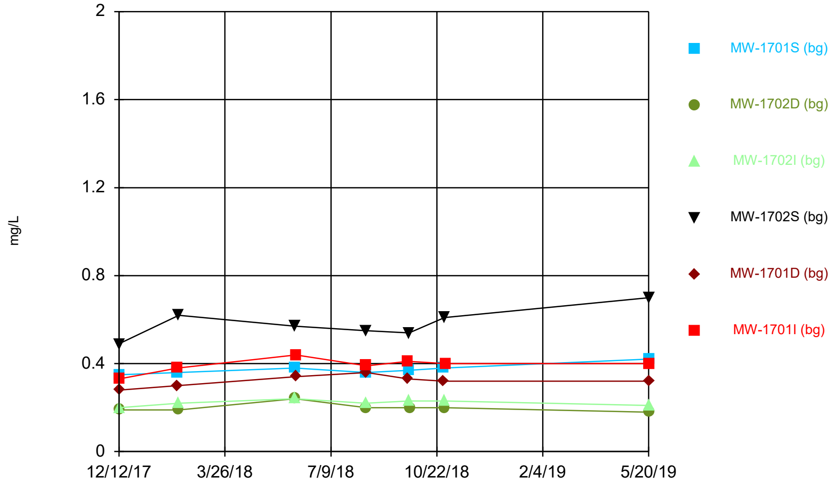
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

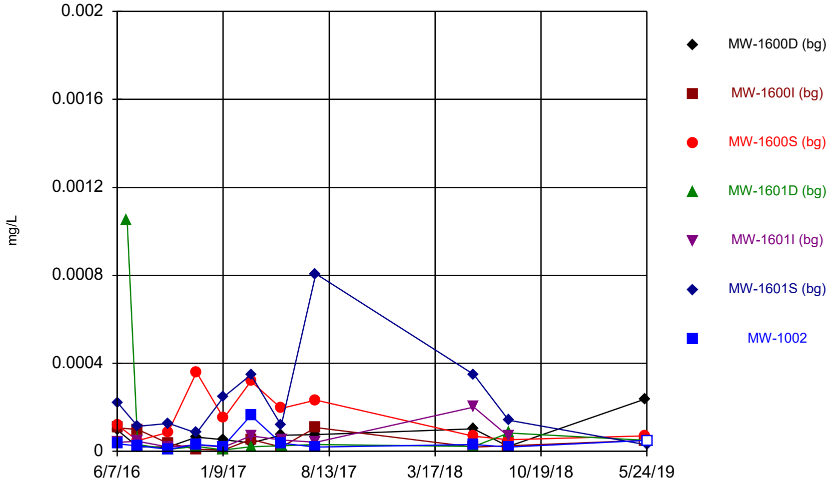
Time Series



Constituent: Fluoride, total   Analysis Run 8/10/2019 9:57 AM   View: Descriptive
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

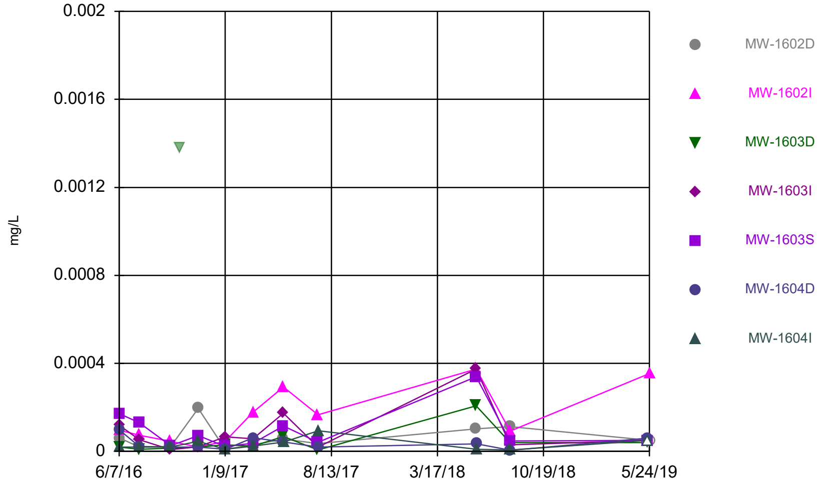
Time Series



Constituent: Lead, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

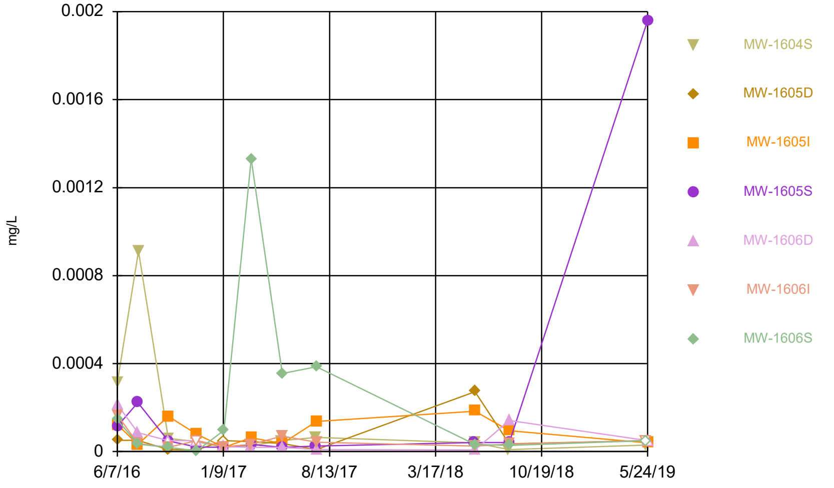
Time Series



Constituent: Lead, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

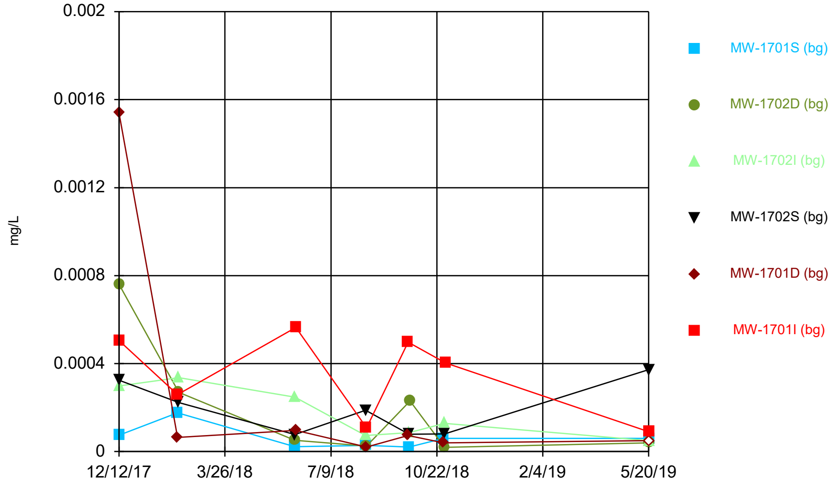
Time Series



Constituent: Lead, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

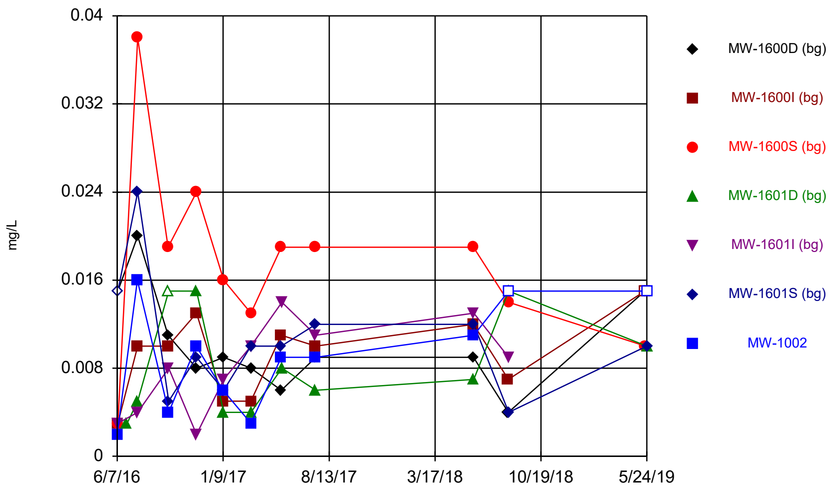
Time Series



Constituent: Lead, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

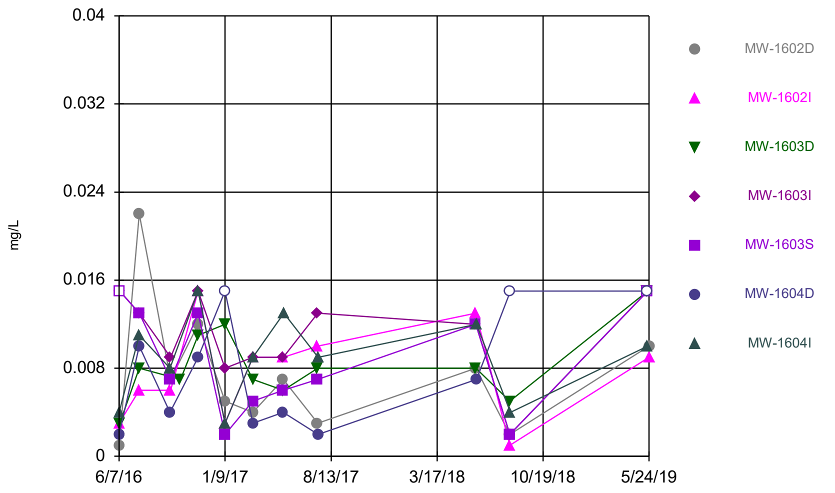
Time Series



Constituent: Lithium, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

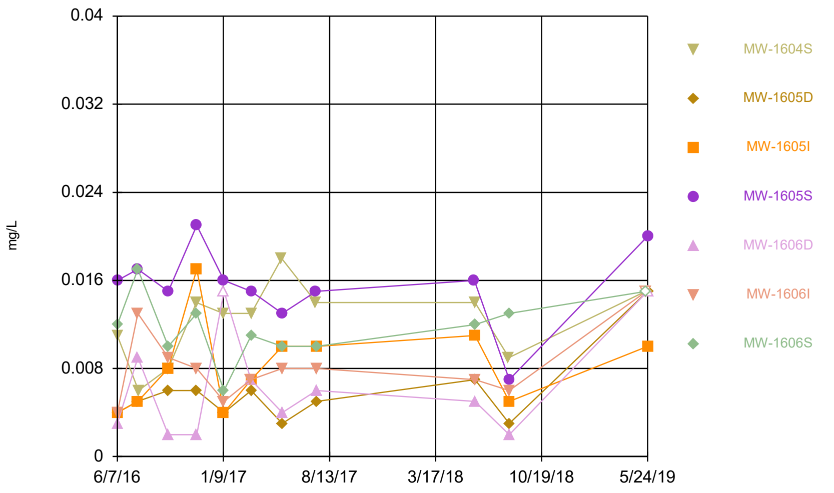
Time Series



Constituent: Lithium, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

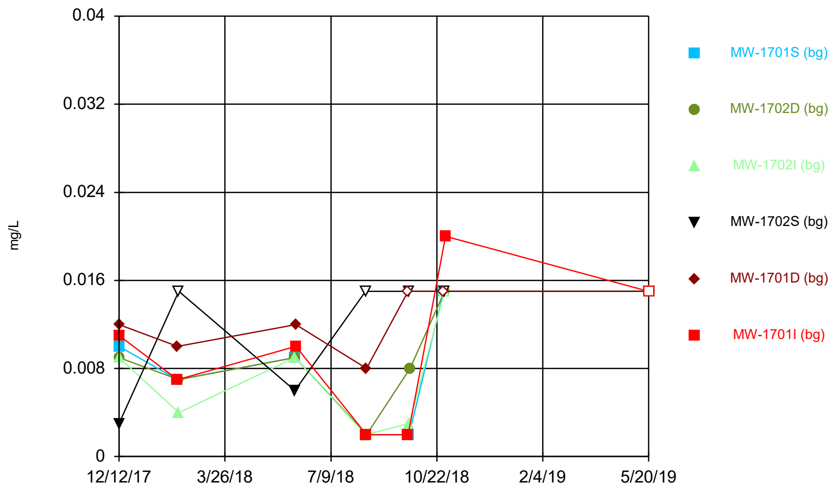
Time Series



Constituent: Lithium, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

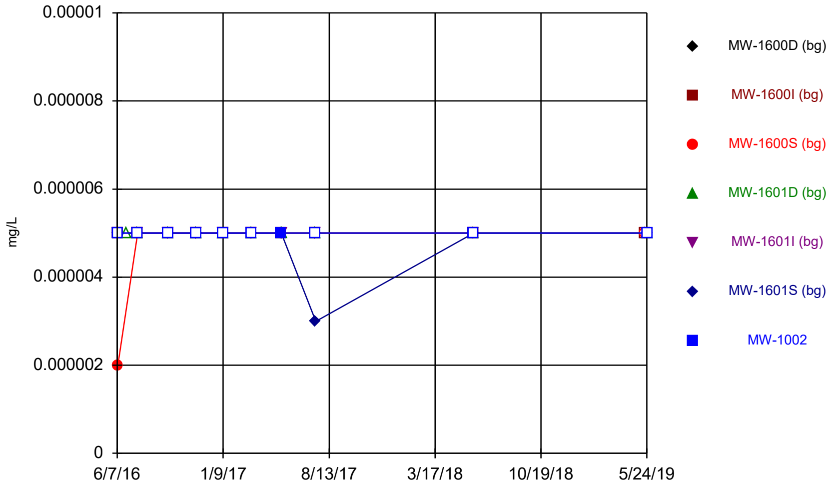
Time Series



Constituent: Lithium, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

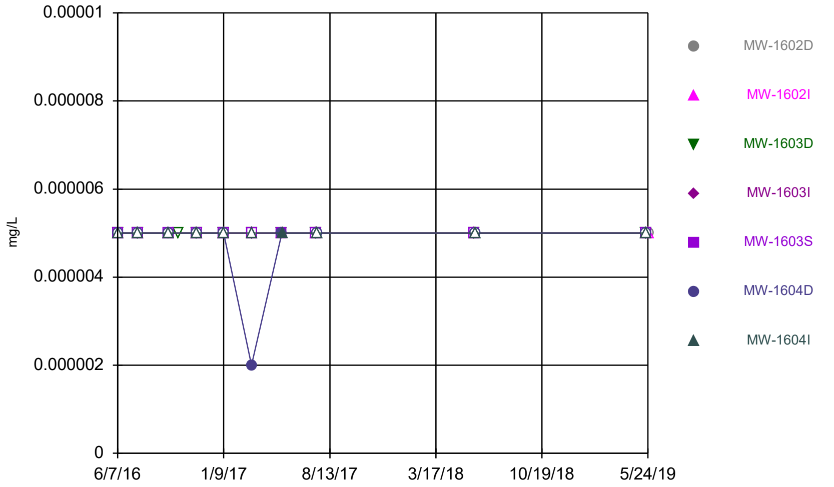
Time Series



Constituent: Mercury, total   Analysis Run 8/10/2019 9:57 AM   View: Descriptive
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

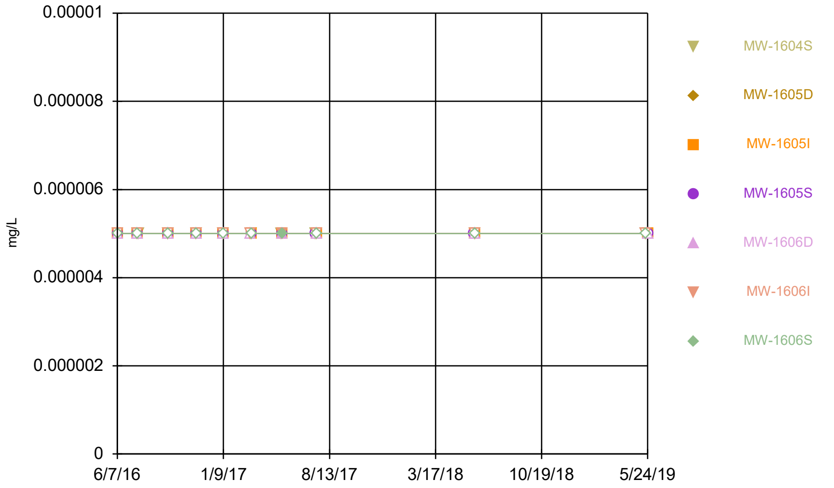
Time Series



Constituent: Mercury, total   Analysis Run 8/10/2019 9:57 AM   View: Descriptive
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

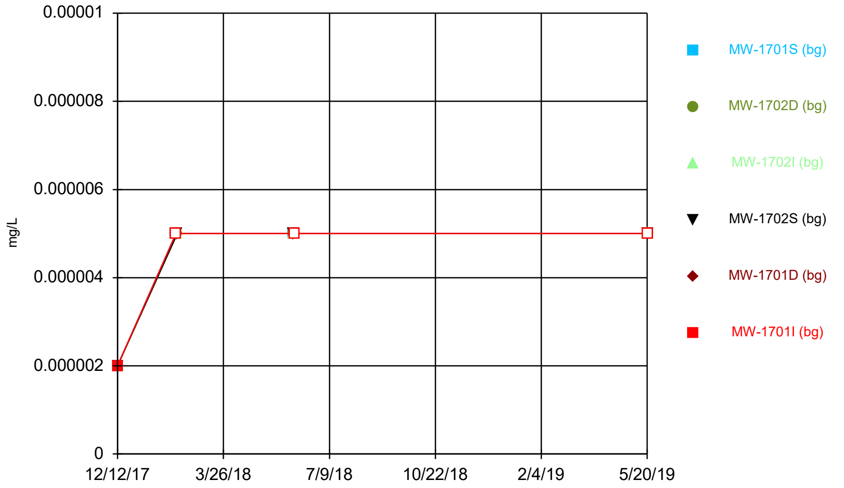
Time Series



Constituent: Mercury, total   Analysis Run 8/10/2019 9:57 AM   View: Descriptive
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

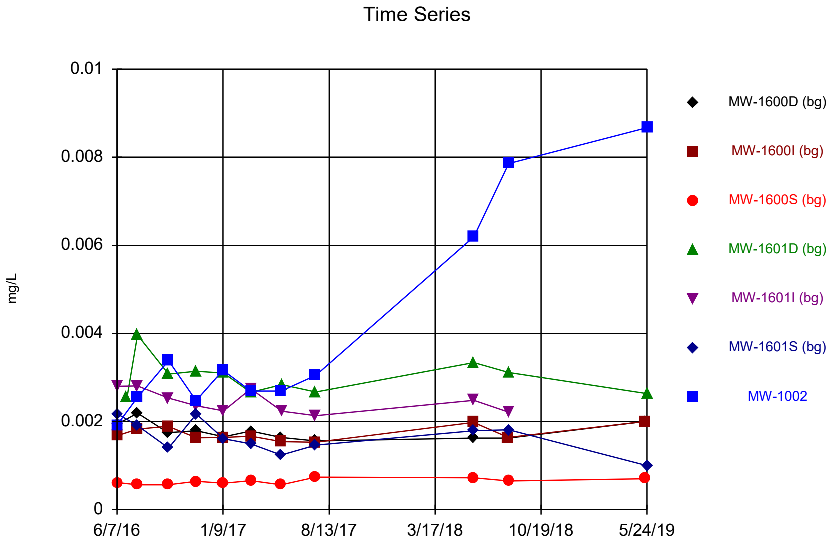
Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



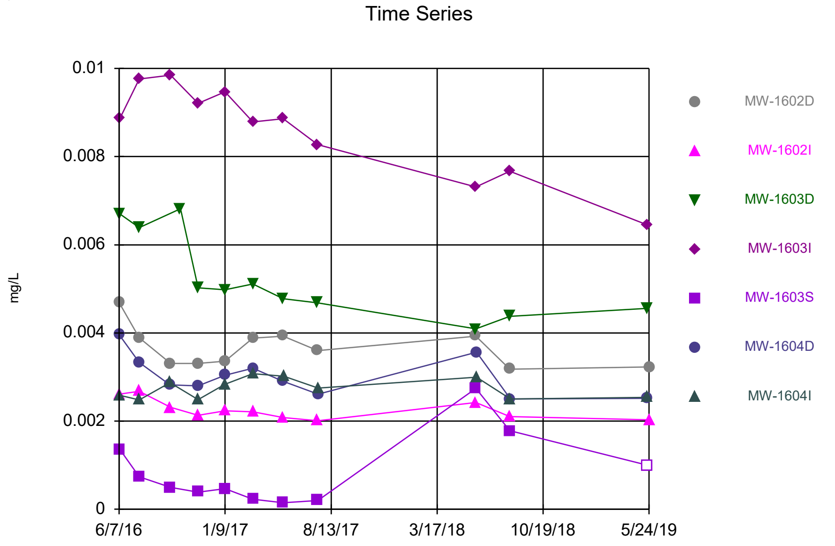
Constituent: Mercury, total   Analysis Run 8/10/2019 9:57 AM   View: Descriptive
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



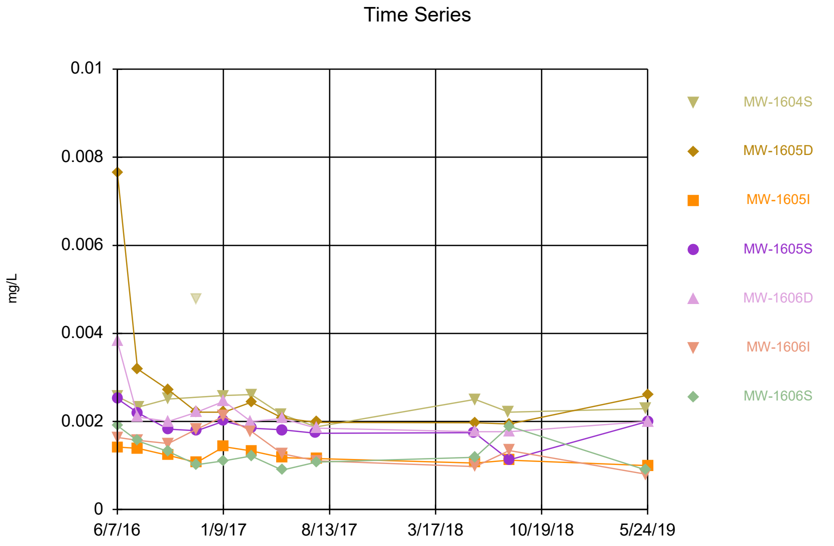
Constituent: Molybdenum, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



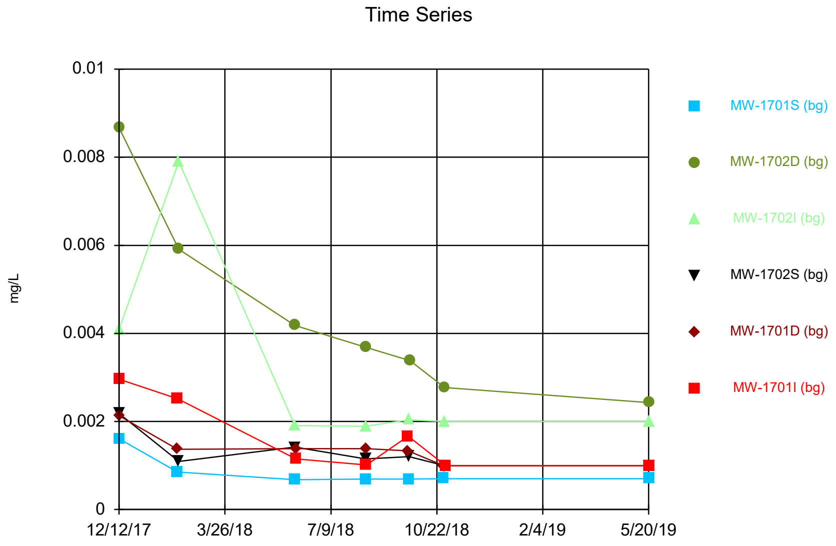
Constituent: Molybdenum, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



Constituent: Molybdenum, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

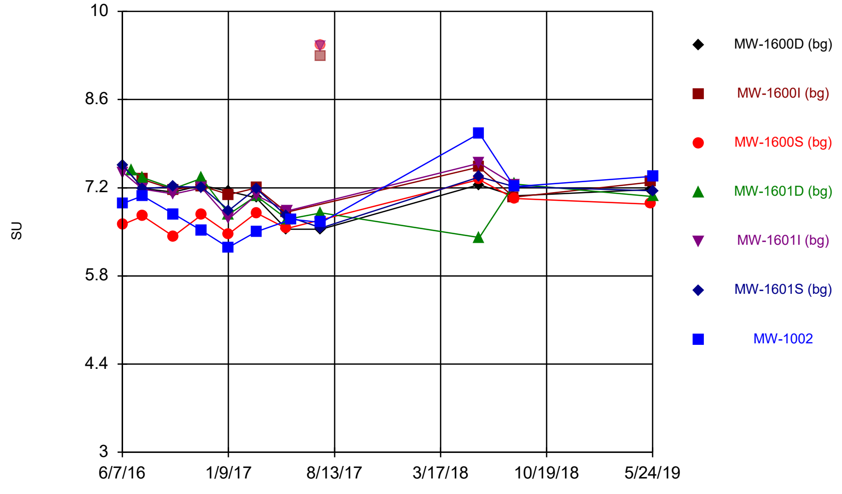
Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



Constituent: Molybdenum, total Analysis Run 8/10/2019 9:57 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

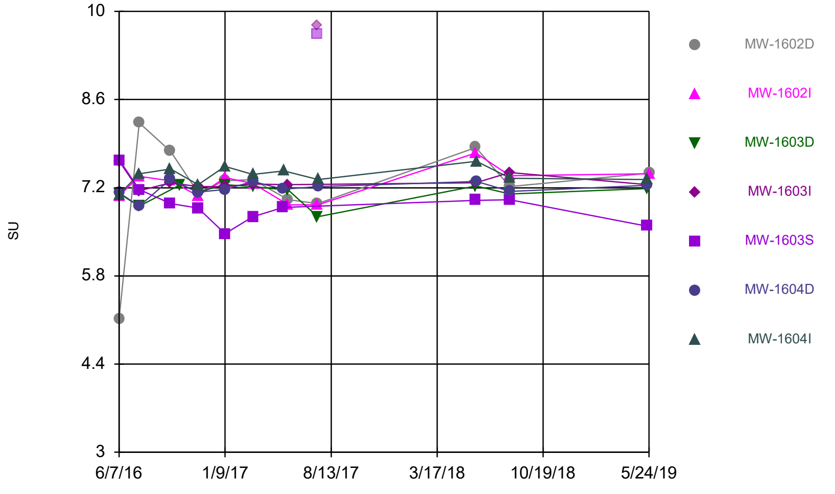
Time Series



Constituent: pH, field Analysis Run 8/10/2019 9:58 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

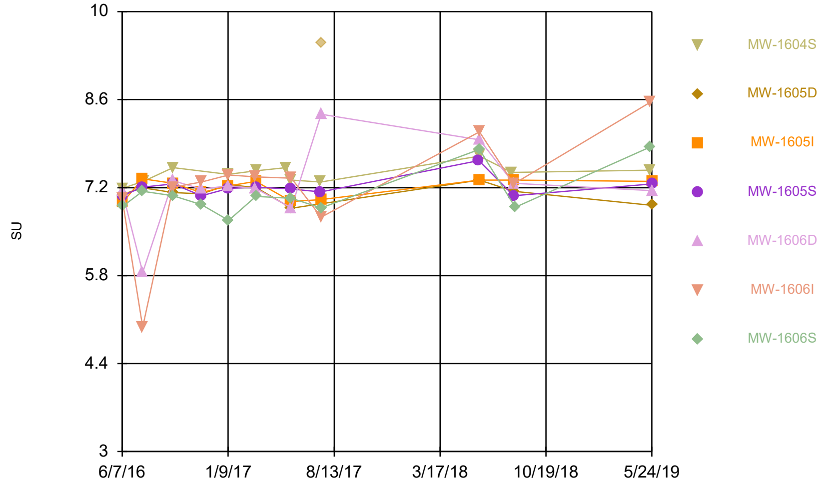
Time Series



Constituent: pH, field Analysis Run 8/10/2019 9:58 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

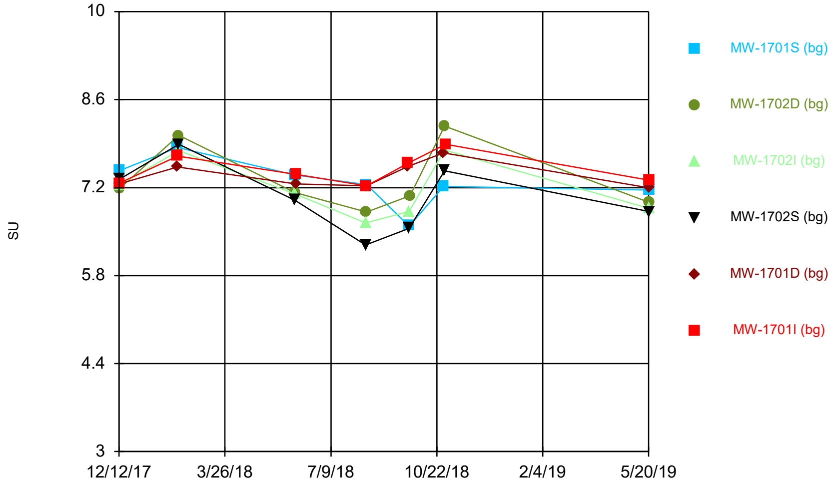
Time Series



Constituent: pH, field Analysis Run 8/10/2019 9:58 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

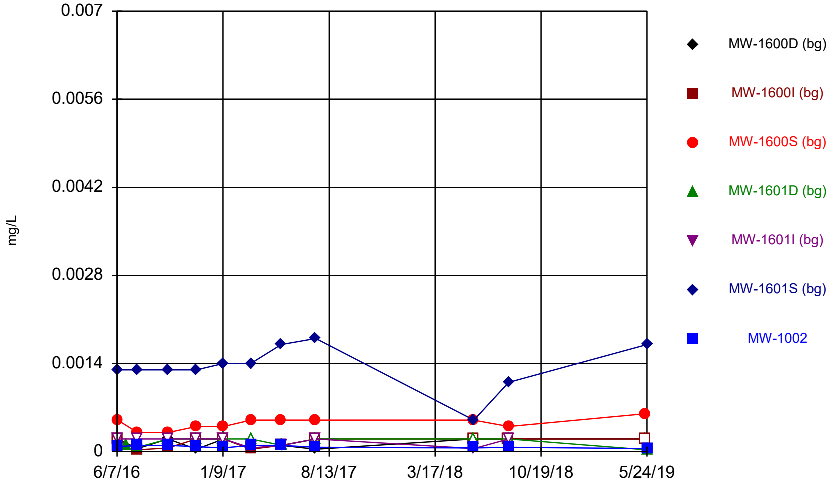
Time Series



Constituent: pH, field Analysis Run 8/10/2019 9:58 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

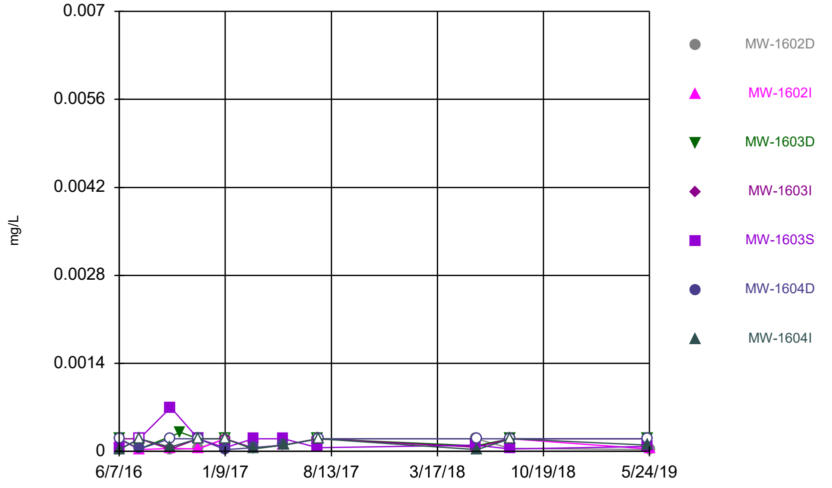
Time Series



Constituent: Selenium, total Analysis Run 8/10/2019 9:58 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

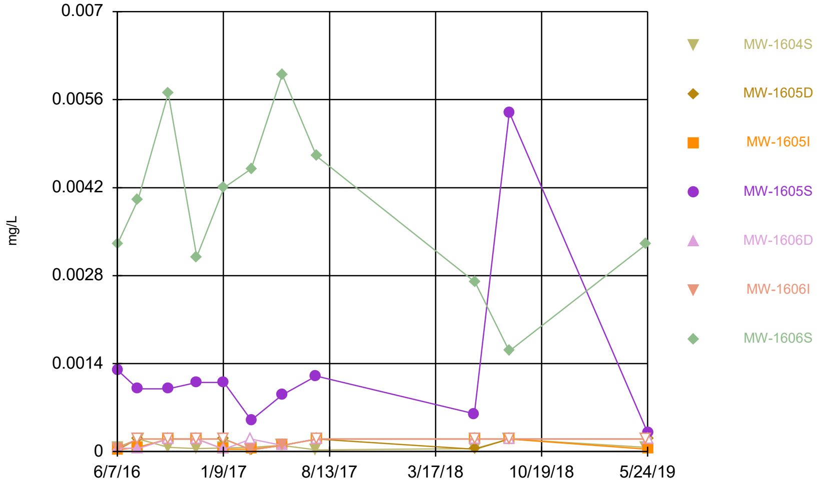
Time Series



Constituent: Selenium, total Analysis Run 8/10/2019 9:58 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

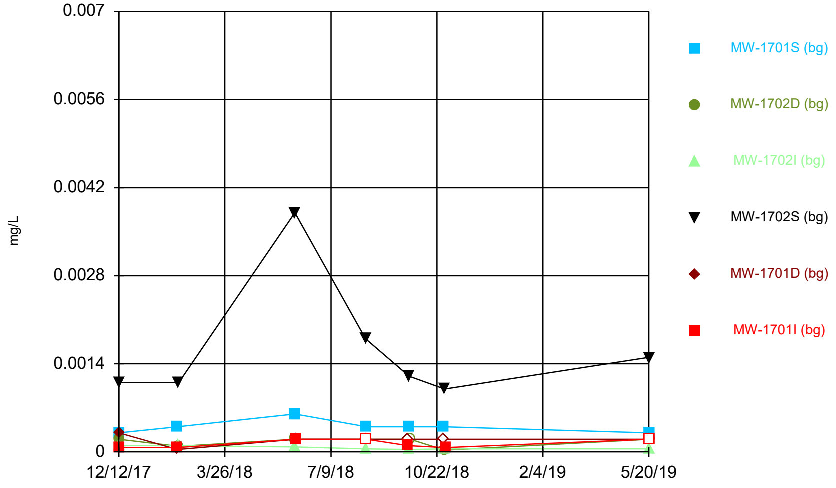
Time Series



Constituent: Selenium, total Analysis Run 8/10/2019 9:58 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

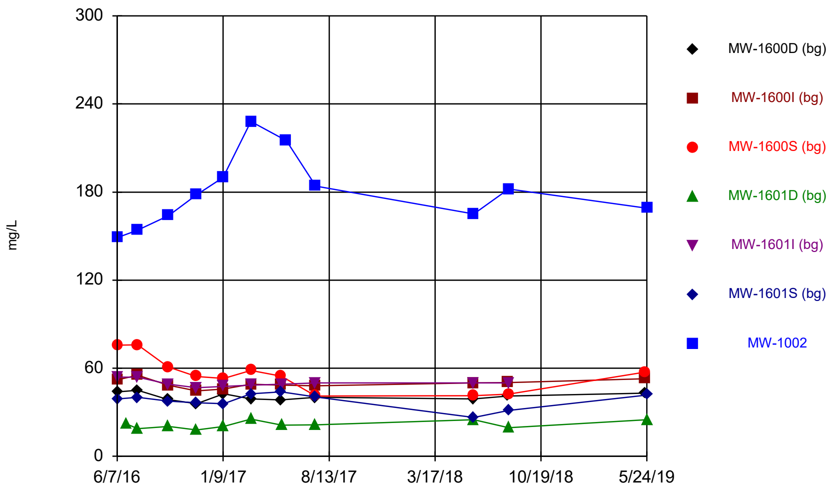
Time Series



Constituent: Selenium, total Analysis Run 8/10/2019 9:58 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series

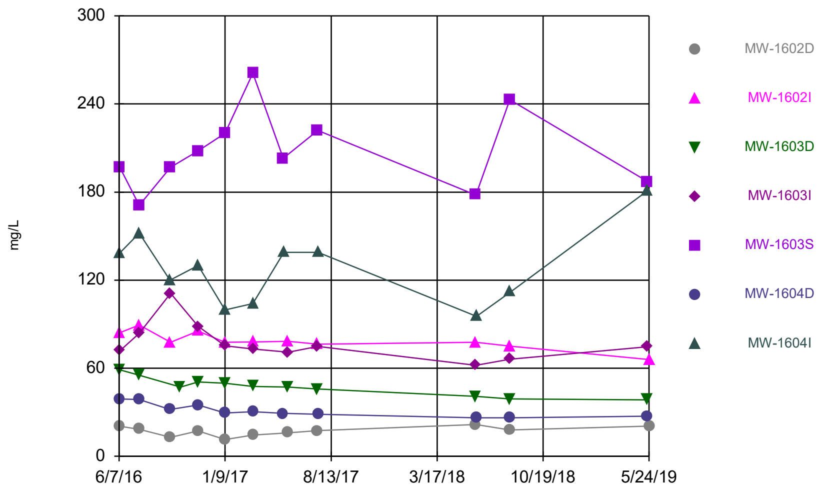


Constituent: Sulfate, total Analysis Run 8/10/2019 9:58 AM View: Descriptive

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series

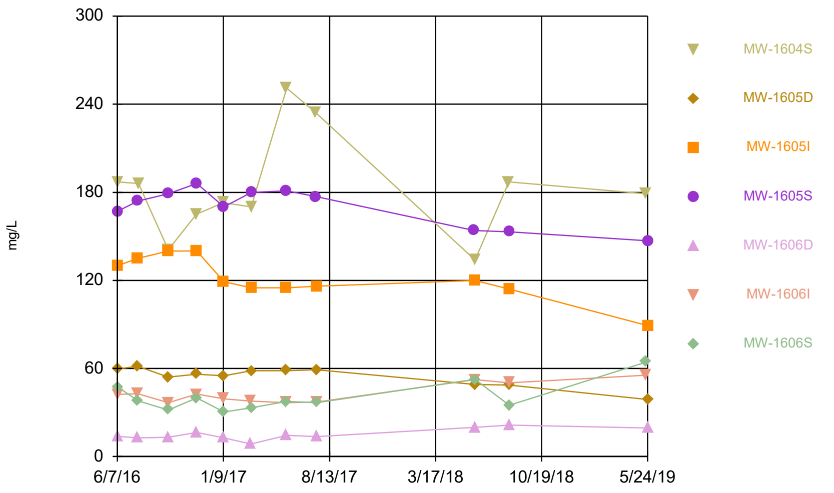


Constituent: Sulfate, total Analysis Run 8/10/2019 9:58 AM View: Descriptive

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series

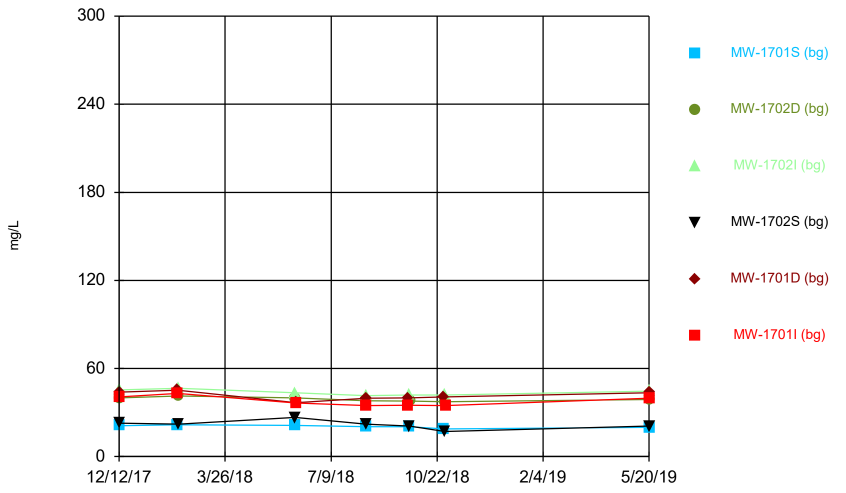


Constituent: Sulfate, total Analysis Run 8/10/2019 9:58 AM View: Descriptive

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series

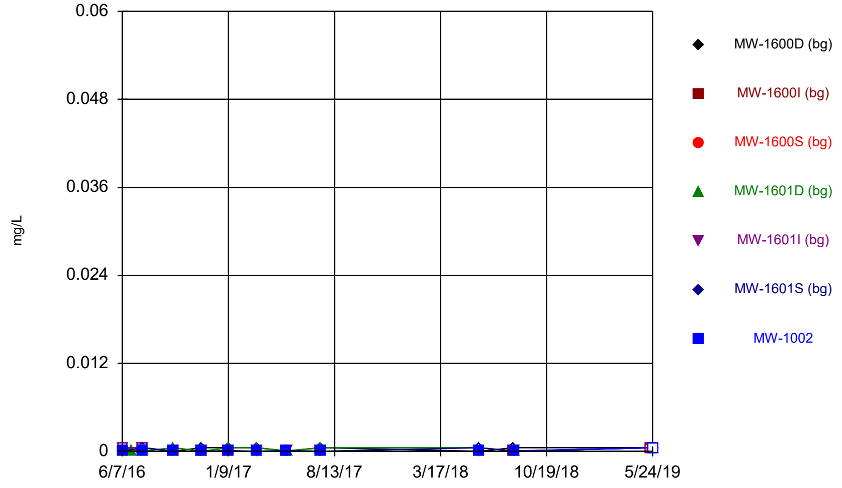


Constituent: Sulfate, total Analysis Run 8/10/2019 9:58 AM View: Descriptive

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

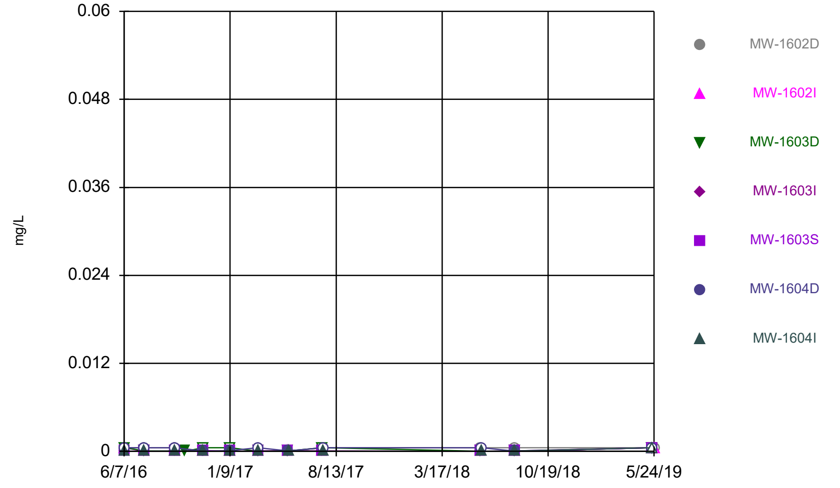
Time Series



Constituent: Thallium, total Analysis Run 8/10/2019 9:58 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

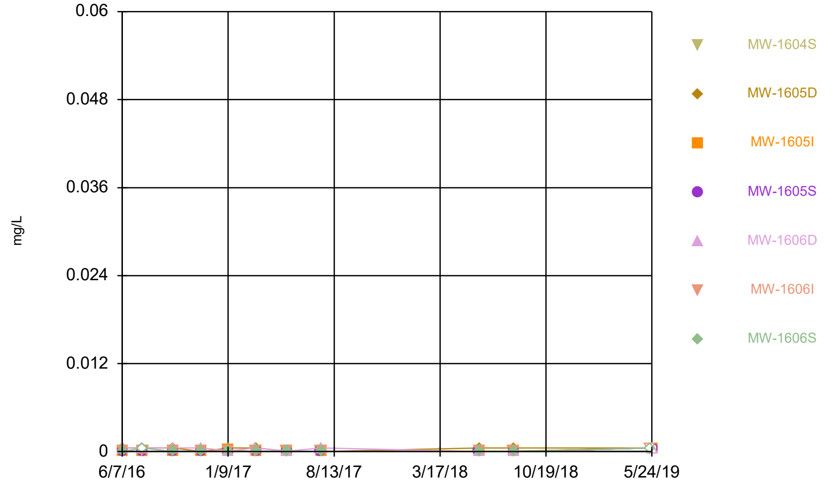
Time Series



Constituent: Thallium, total Analysis Run 8/10/2019 9:58 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

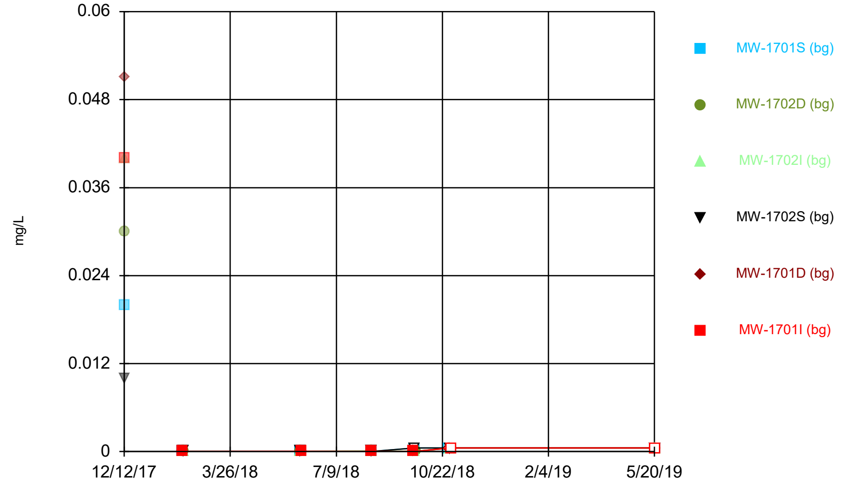
Time Series



Constituent: Thallium, total Analysis Run 8/10/2019 9:58 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

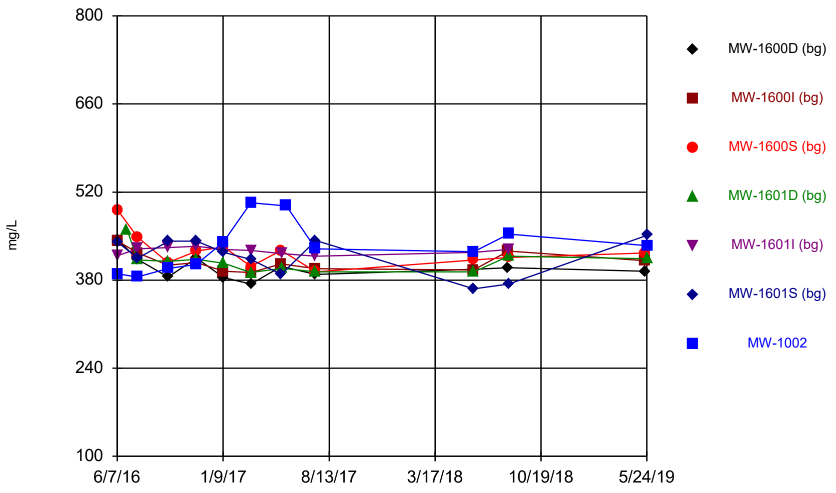
Time Series



Constituent: Thallium, total Analysis Run 8/10/2019 9:58 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

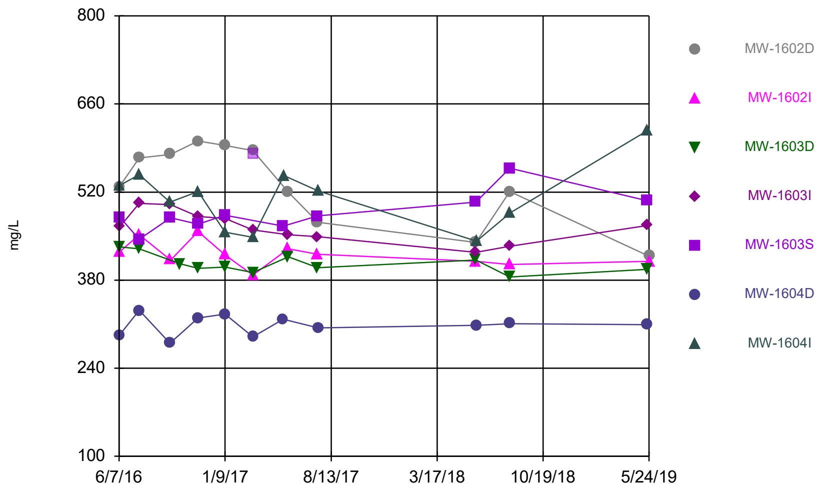
Time Series



Constituent: Total Dissolved Solids [TDS] Analysis Run 8/10/2019 9:58 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

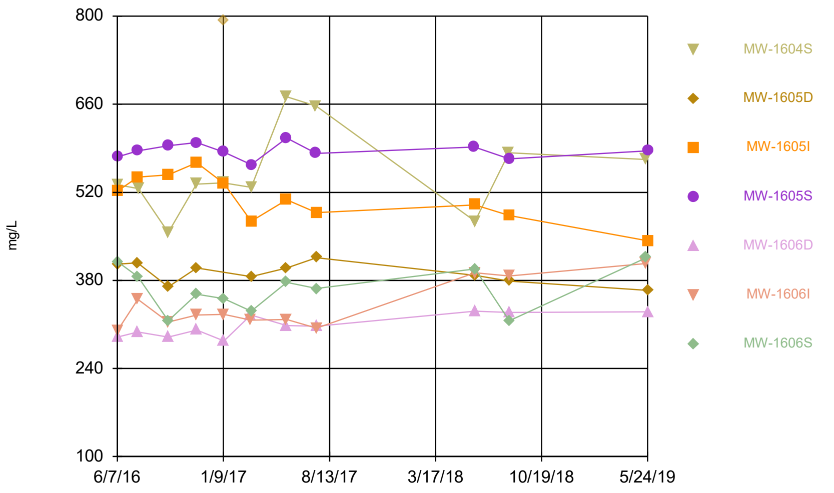
Time Series



Constituent: Total Dissolved Solids [TDS] Analysis Run 8/10/2019 9:58 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

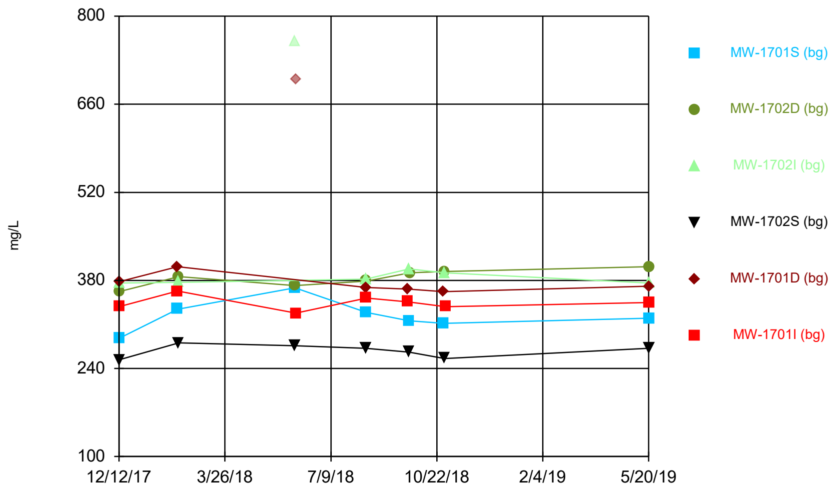
Time Series



Constituent: Total Dissolved Solids [TDS] Analysis Run 8/10/2019 9:58 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

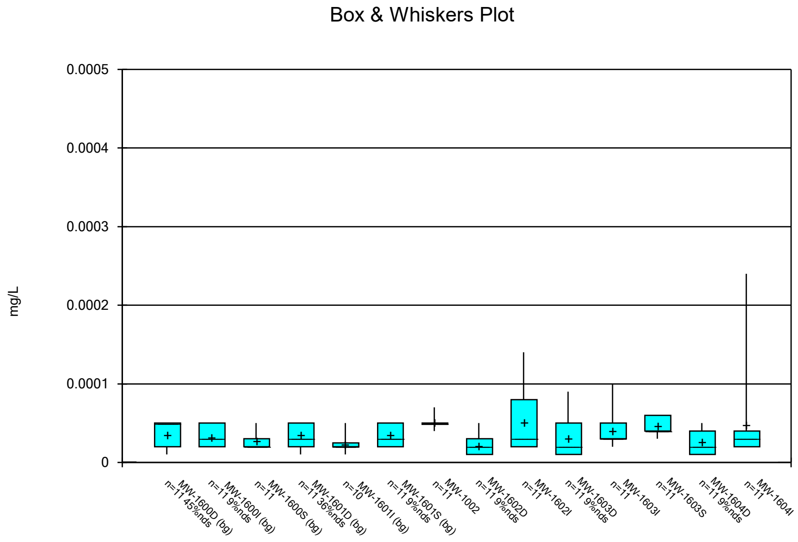
Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series



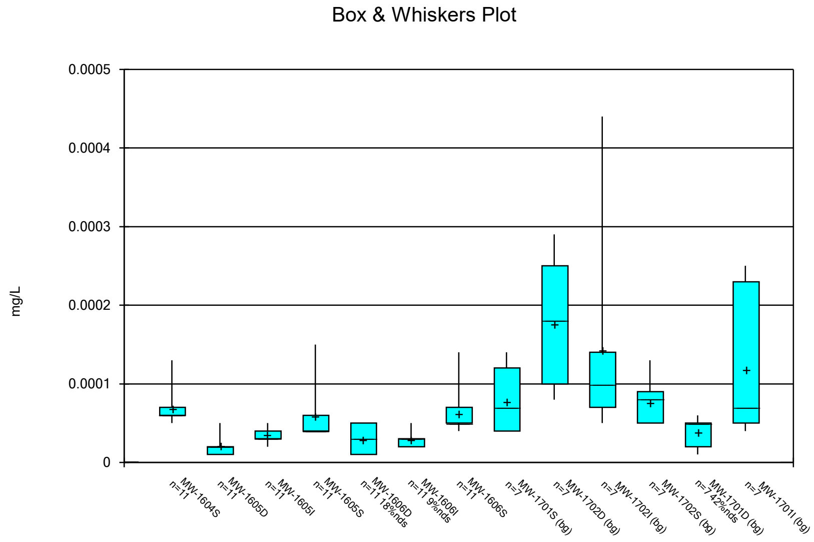
Constituent: Total Dissolved Solids [TDS] Analysis Run 8/10/2019 9:58 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



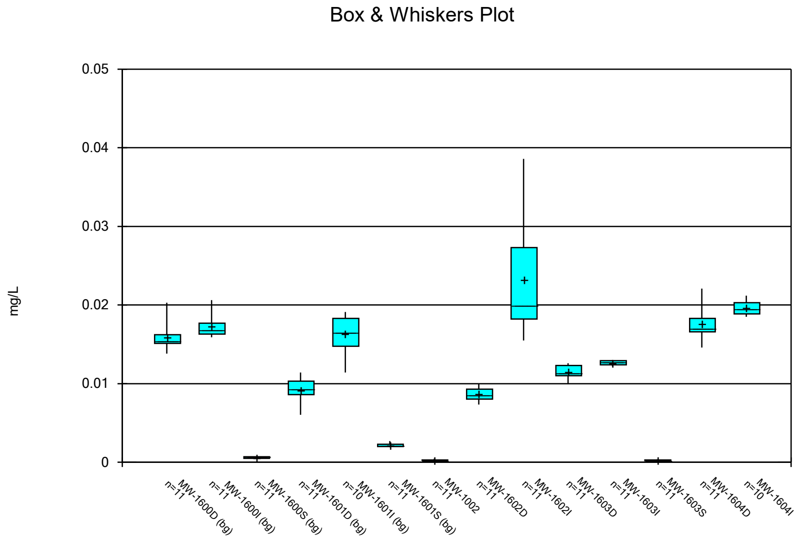
Constituent: Antimony, total Analysis Run 8/10/2019 10:10 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



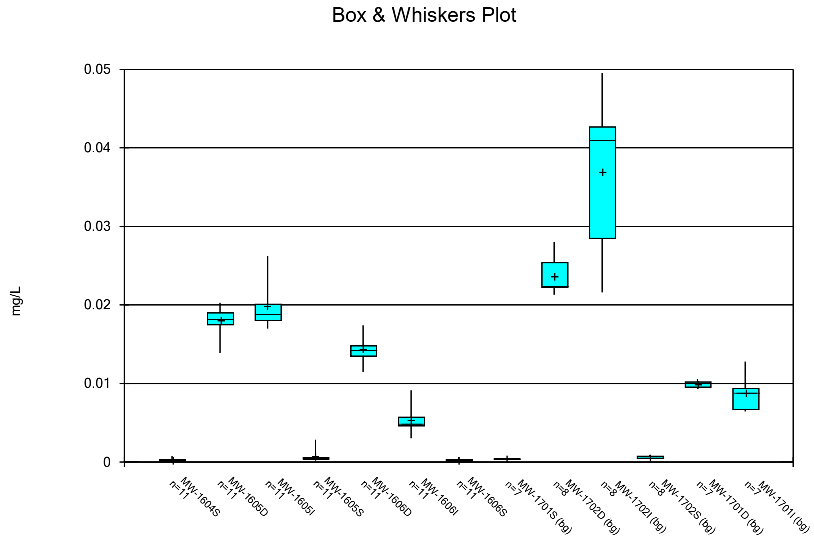
Constituent: Antimony, total Analysis Run 8/10/2019 10:10 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



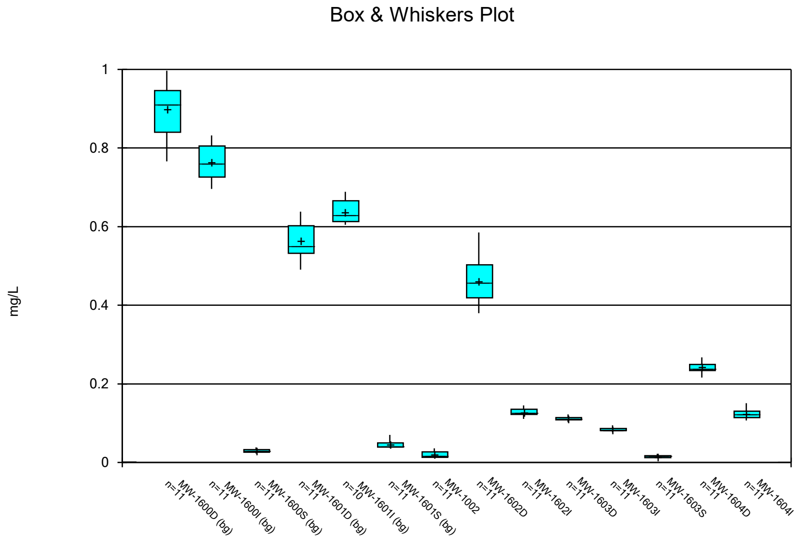
Constituent: Arsenic, total Analysis Run 8/10/2019 10:10 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



Constituent: Arsenic, total Analysis Run 8/10/2019 10:10 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

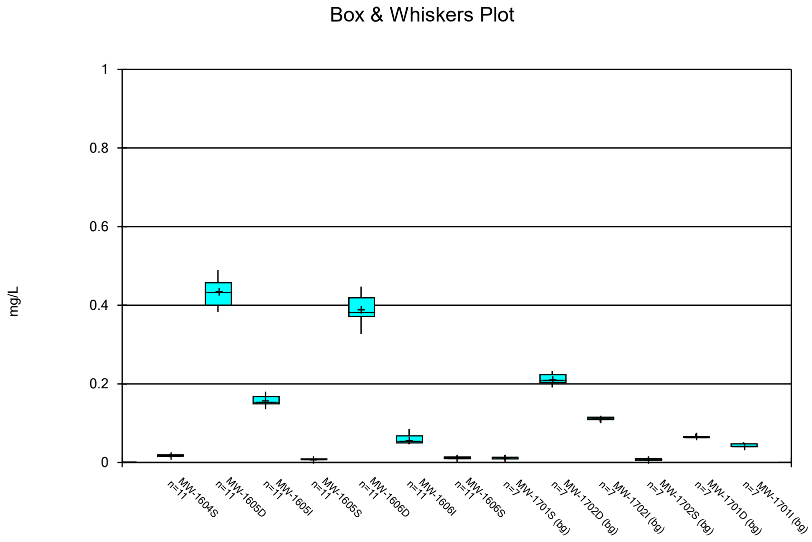
Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



Constituent: Barium, total Analysis Run 8/10/2019 10:10 AM View: Descriptive

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



Constituent: Barium, total Analysis Run 8/10/2019 10:10 AM View: Descriptive

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Constituent: Beryllium, total Analysis Run 8/10/2019 10:10 AM View: Descriptive

Rockport BAP Client: Geosyntec Data: Rockport_BAP

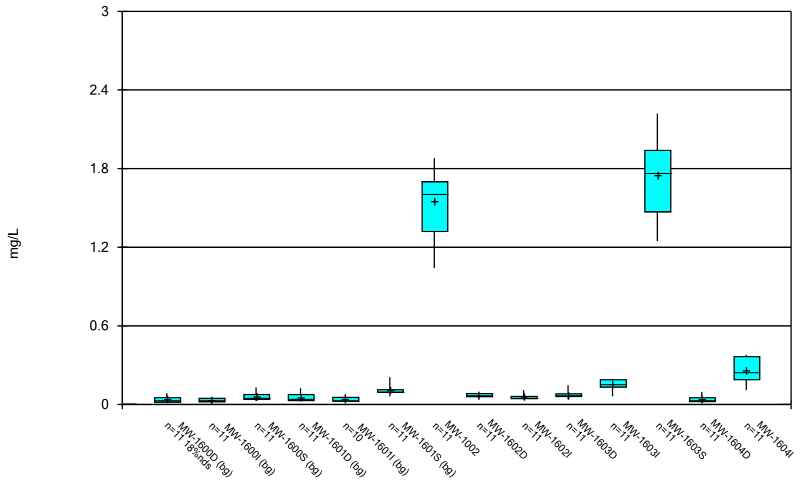
Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Constituent: Beryllium, total Analysis Run 8/10/2019 10:10 AM View: Descriptive

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

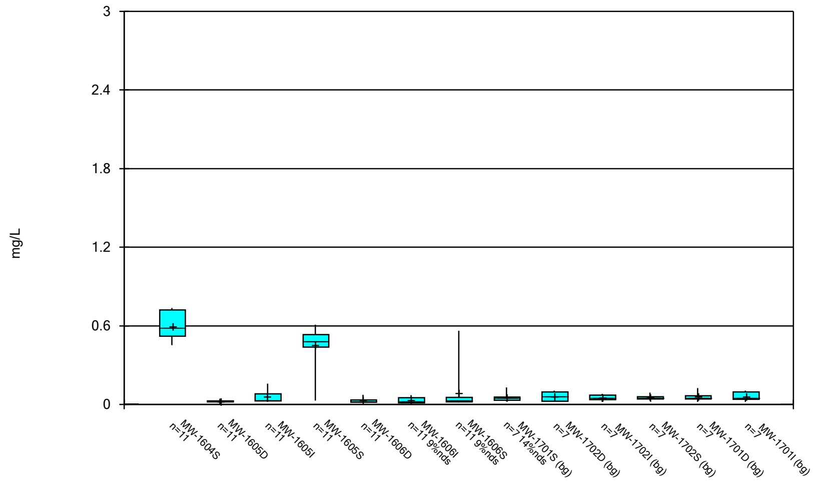
Box & Whiskers Plot



Constituent: Boron, total   Analysis Run 8/10/2019 10:10 AM   View: Descriptive
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

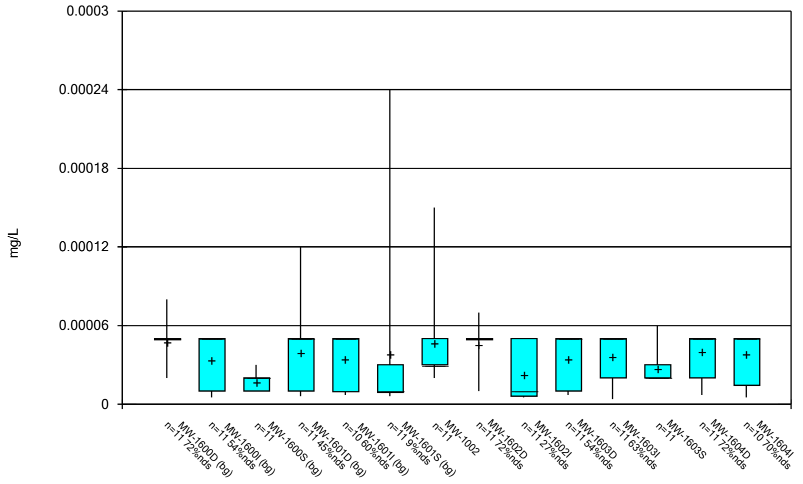
Box & Whiskers Plot



Constituent: Boron, total   Analysis Run 8/10/2019 10:10 AM   View: Descriptive
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

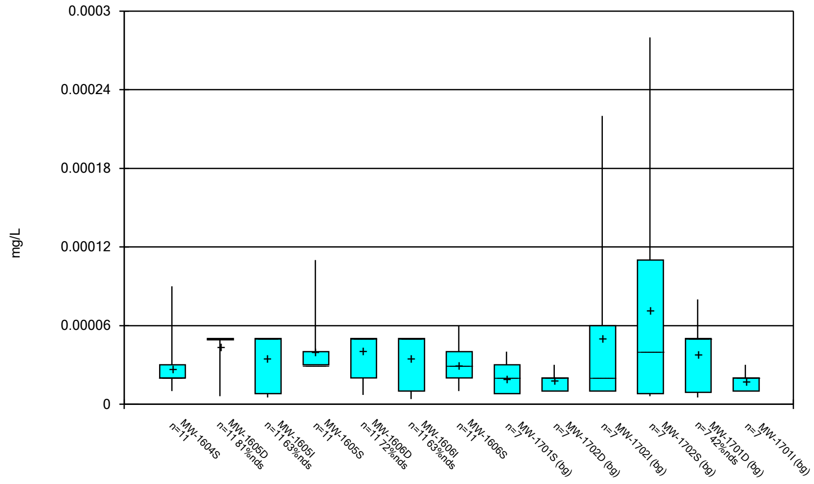
Box & Whiskers Plot



Constituent: Cadmium, total   Analysis Run 8/10/2019 10:10 AM   View: Descriptive
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

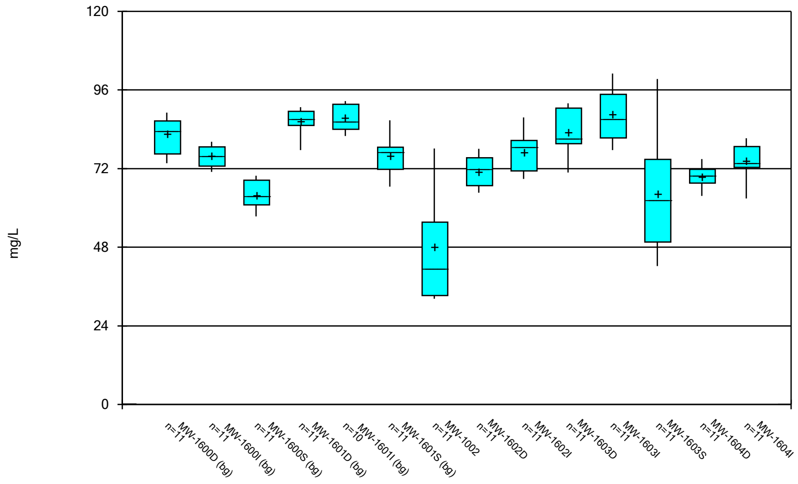
Box & Whiskers Plot



Constituent: Cadmium, total   Analysis Run 8/10/2019 10:10 AM   View: Descriptive
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

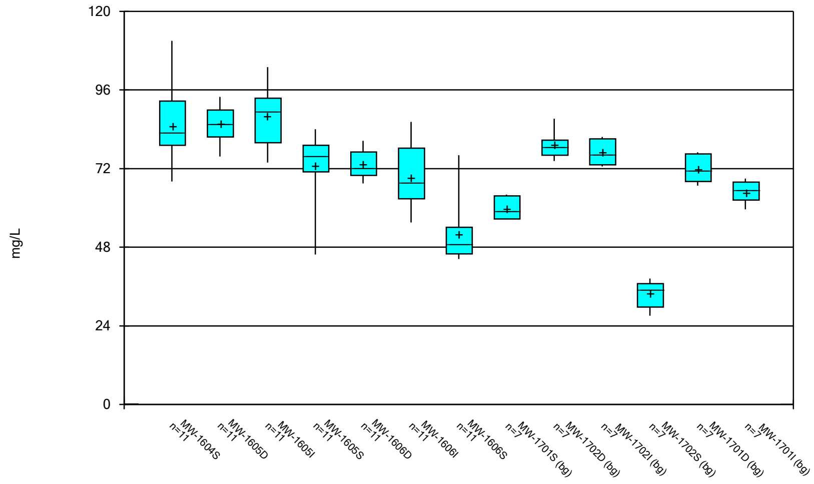
Box & Whiskers Plot



Constituent: Calcium, total Analysis Run 8/10/2019 10:10 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

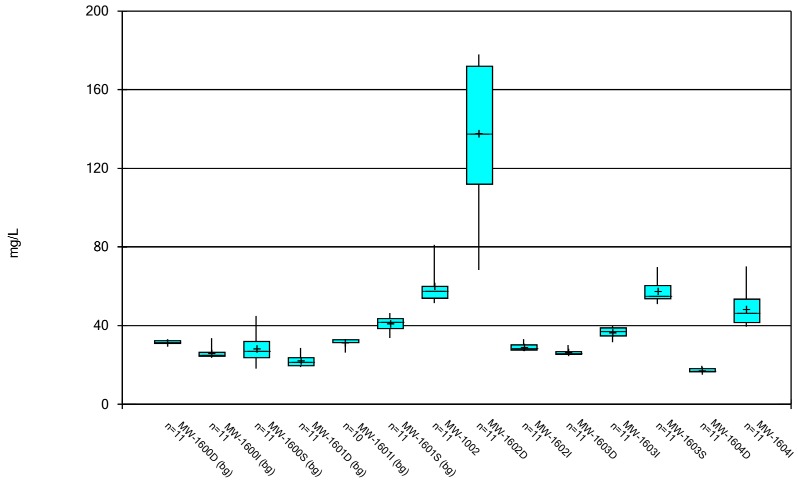
Box & Whiskers Plot



Constituent: Calcium, total Analysis Run 8/10/2019 10:10 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

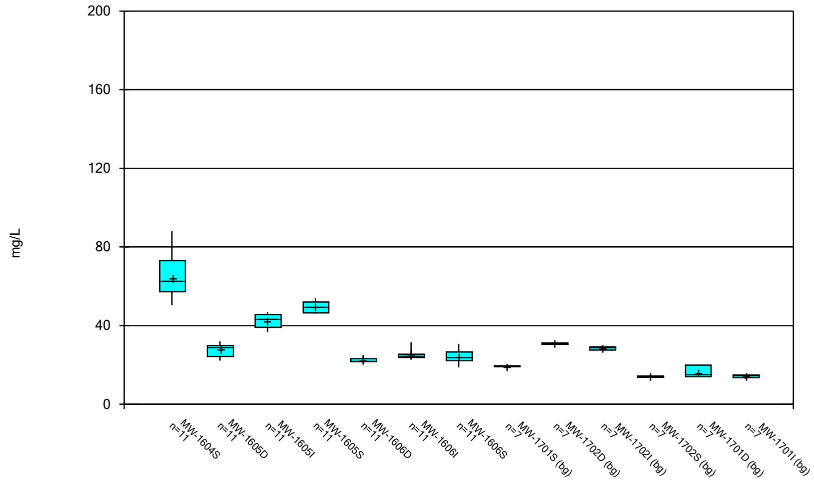
Box & Whiskers Plot



Constituent: Chloride, total Analysis Run 8/10/2019 10:10 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

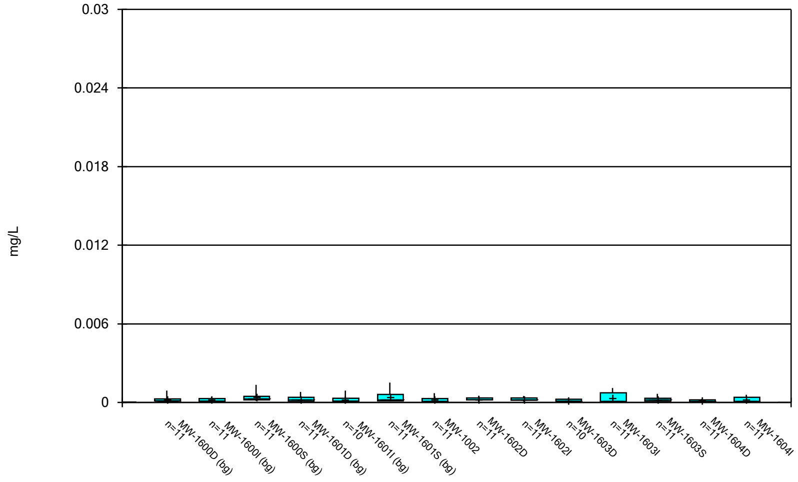
Box & Whiskers Plot



Constituent: Chloride, total Analysis Run 8/10/2019 10:10 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

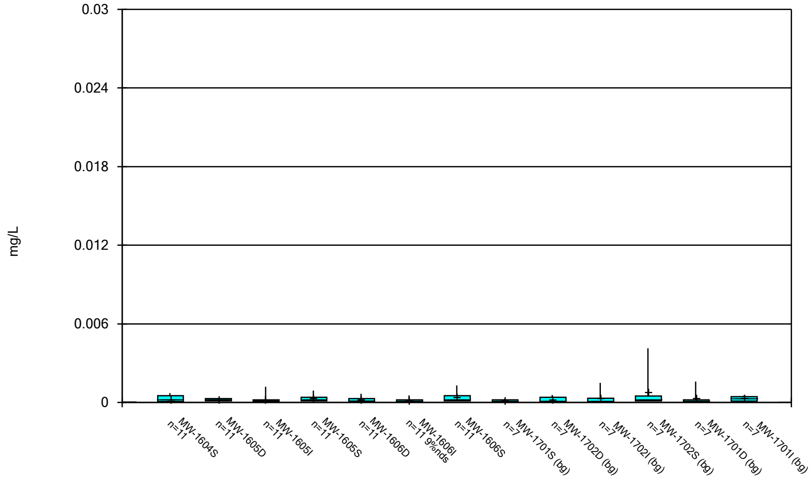
Box & Whiskers Plot



Constituent: Chromium, total Analysis Run 8/10/2019 10:10 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

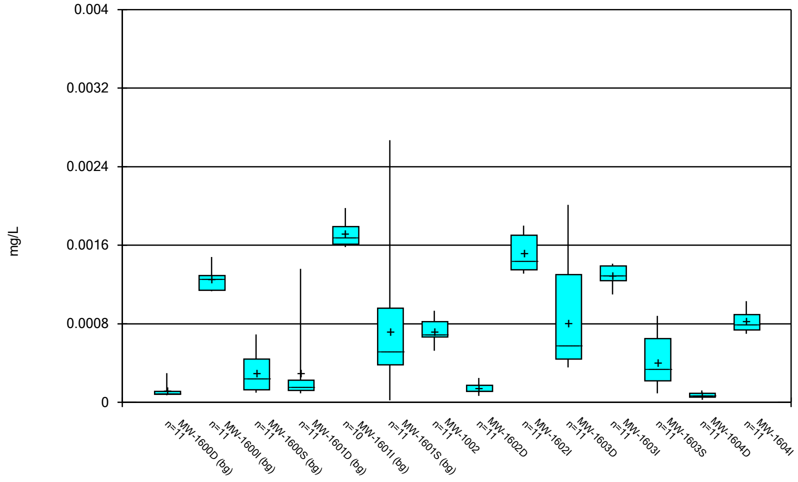
Box & Whiskers Plot



Constituent: Chromium, total Analysis Run 8/10/2019 10:10 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

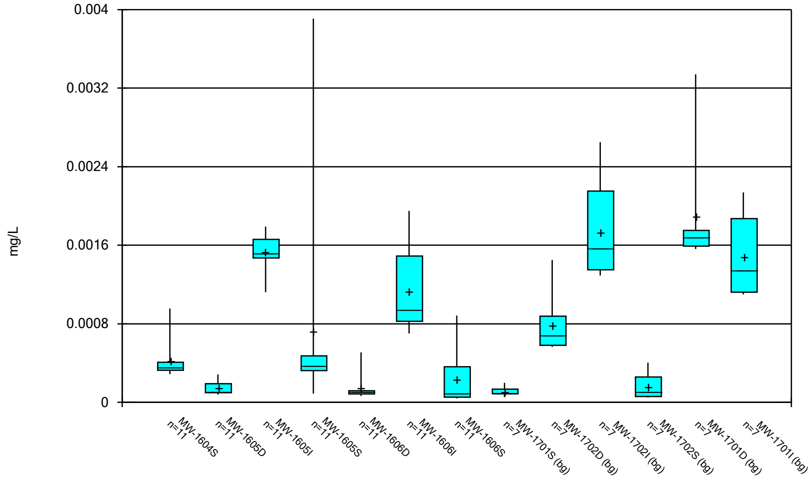
Box & Whiskers Plot



Constituent: Cobalt, total Analysis Run 8/10/2019 10:10 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

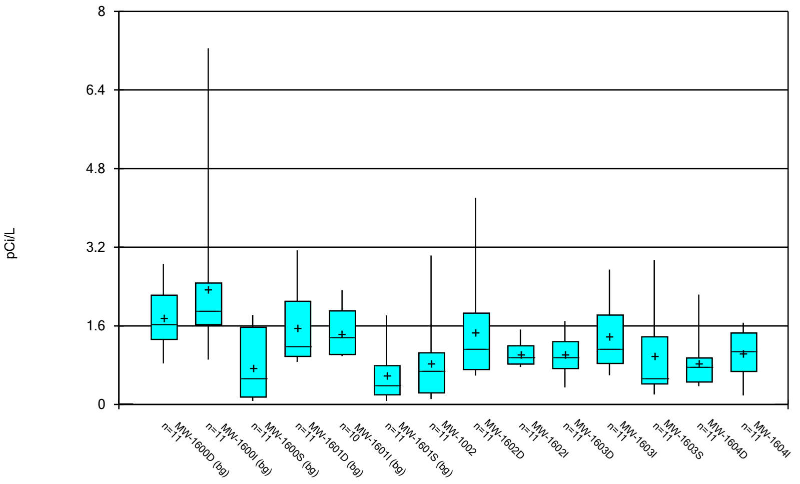
Box & Whiskers Plot



Constituent: Cobalt, total Analysis Run 8/10/2019 10:10 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

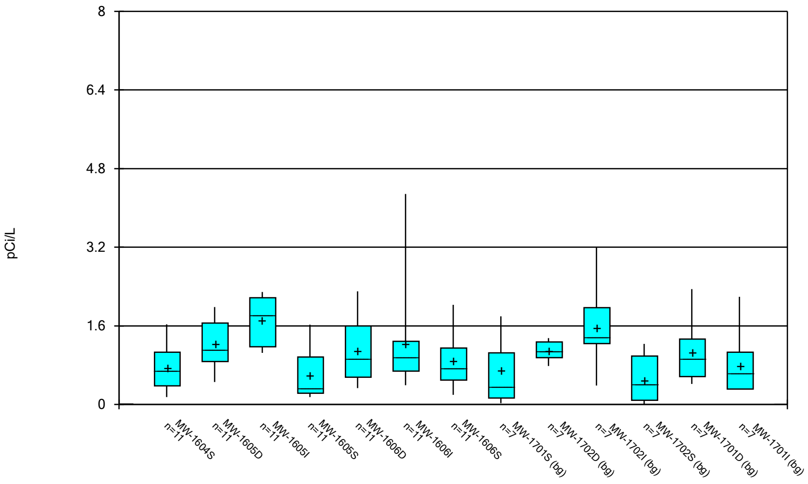
Box & Whiskers Plot



Constituent: Combined Radium 226 + 228 Analysis Run 8/10/2019 10:10 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

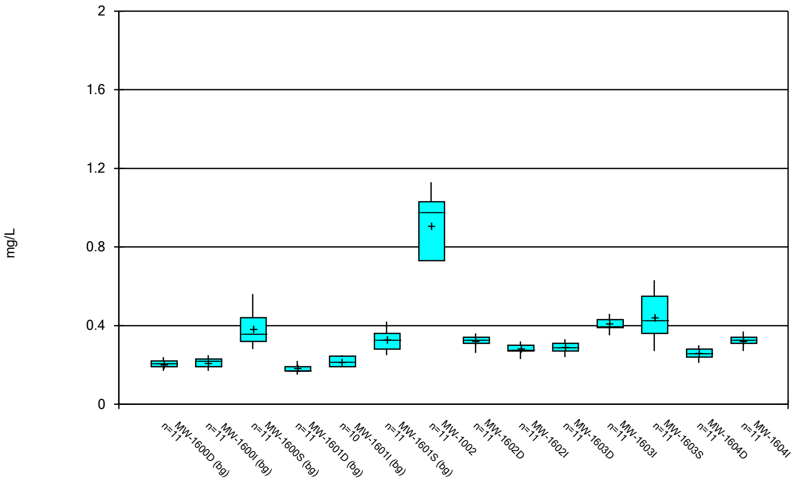
Box & Whiskers Plot



Constituent: Combined Radium 226 + 228 Analysis Run 8/10/2019 10:10 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

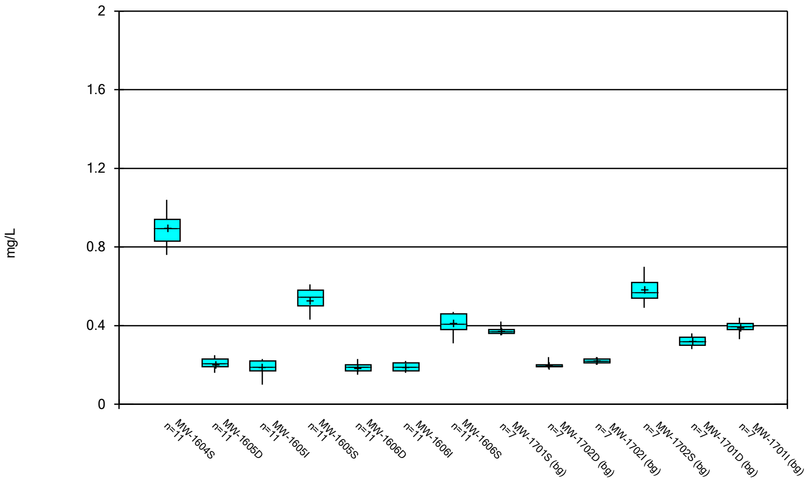
Box & Whiskers Plot



Constituent: Fluoride, total Analysis Run 8/10/2019 10:10 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

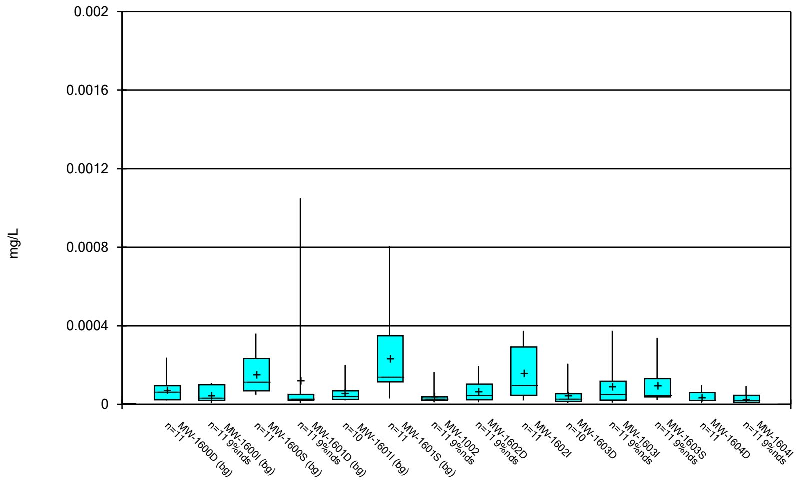
Box & Whiskers Plot



Constituent: Fluoride, total Analysis Run 8/10/2019 10:10 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Box & Whiskers Plot

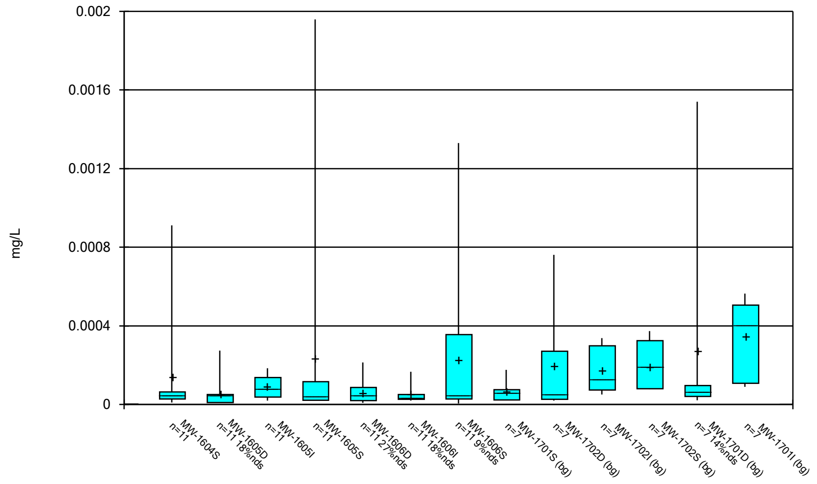


Constituent: Lead, total   Analysis Run 8/10/2019 10:10 AM   View: Descriptive

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Box & Whiskers Plot

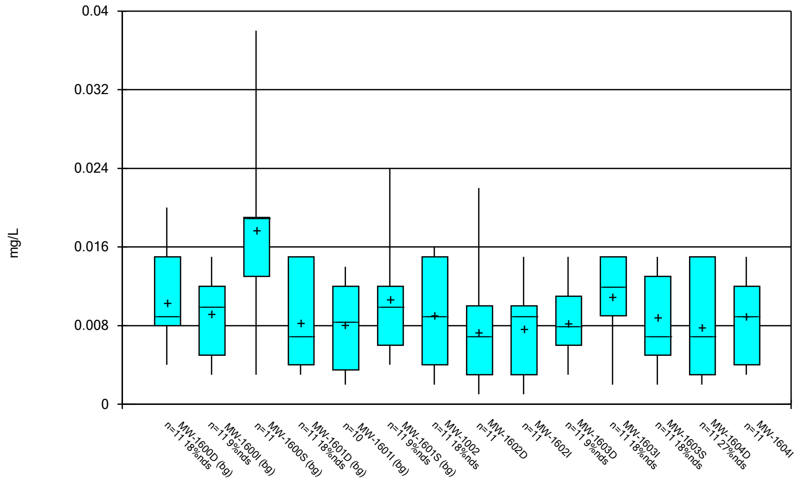


Constituent: Lead, total   Analysis Run 8/10/2019 10:10 AM   View: Descriptive

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Box & Whiskers Plot

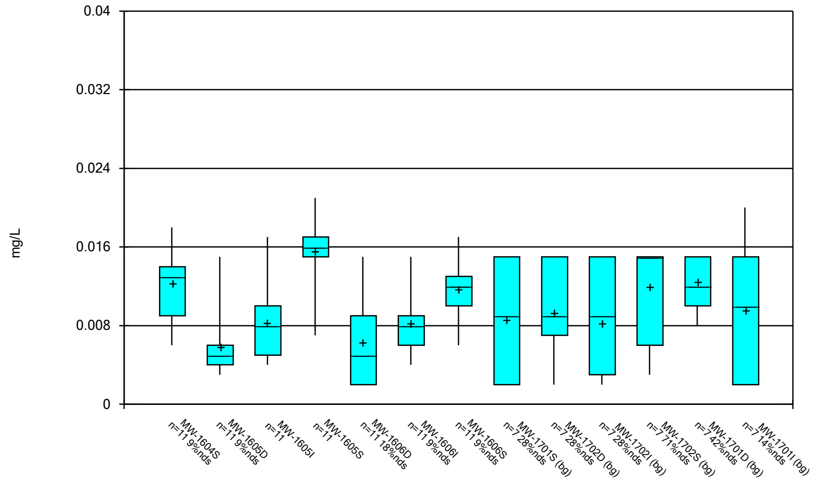


Constituent: Lithium, total   Analysis Run 8/10/2019 10:10 AM   View: Descriptive

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

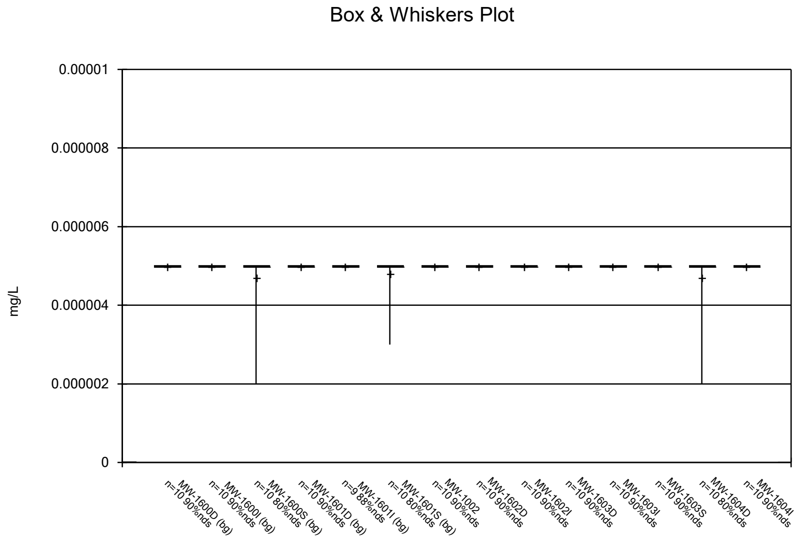
Box & Whiskers Plot



Constituent: Lithium, total   Analysis Run 8/10/2019 10:10 AM   View: Descriptive

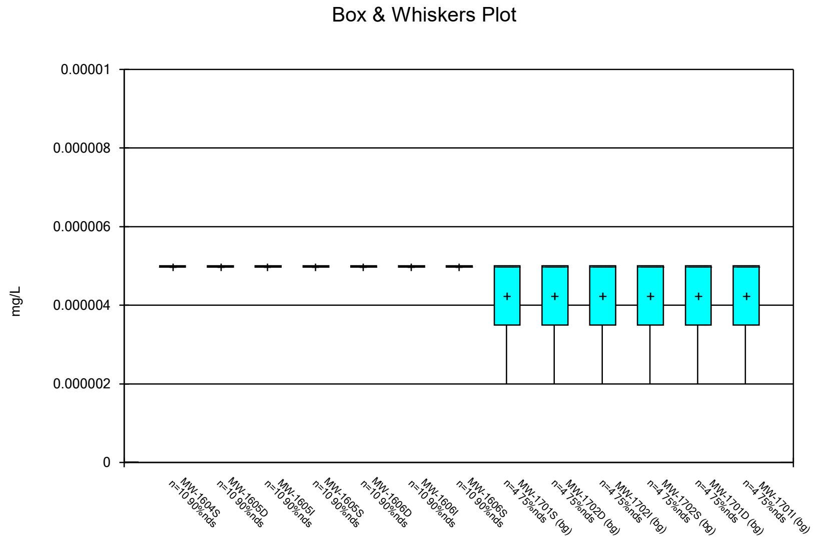
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



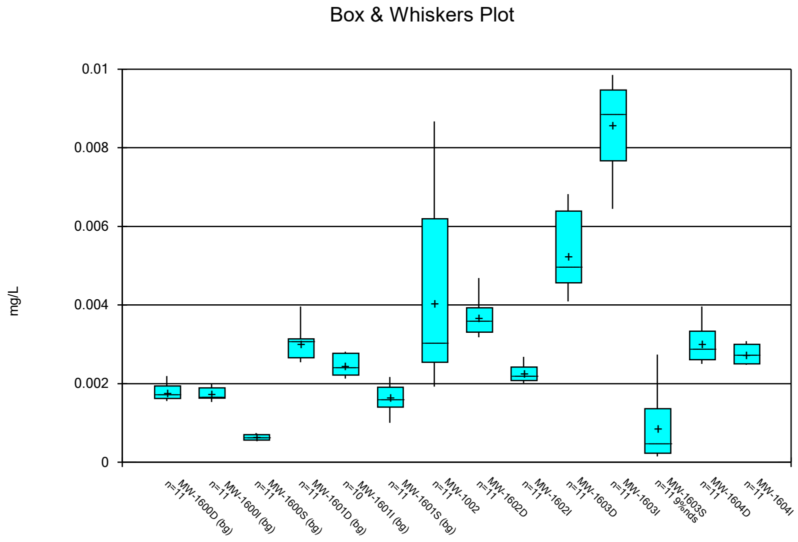
Constituent: Mercury, total Analysis Run 8/10/2019 10:10 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



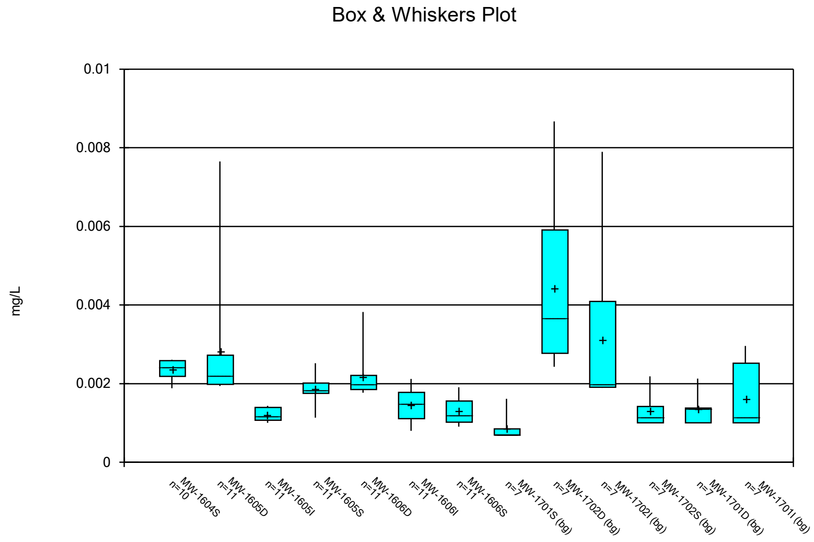
Constituent: Mercury, total Analysis Run 8/10/2019 10:10 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



Constituent: Molybdenum, total Analysis Run 8/10/2019 10:10 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

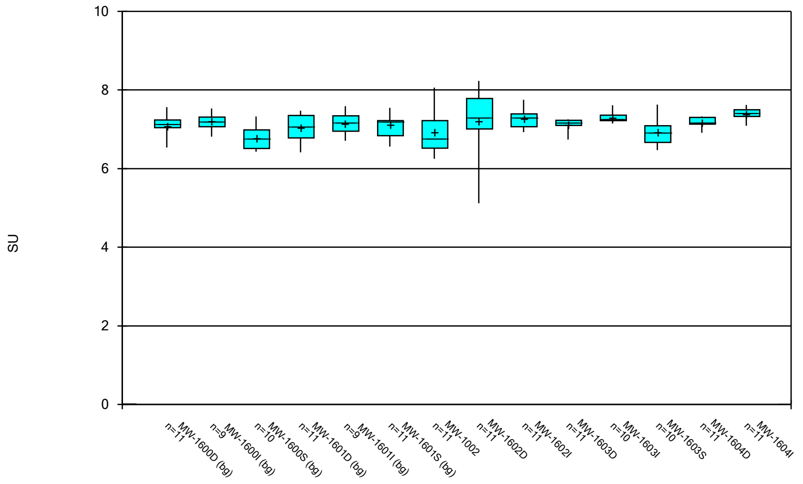
Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



Constituent: Molybdenum, total Analysis Run 8/10/2019 10:10 AM View: Descriptive
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

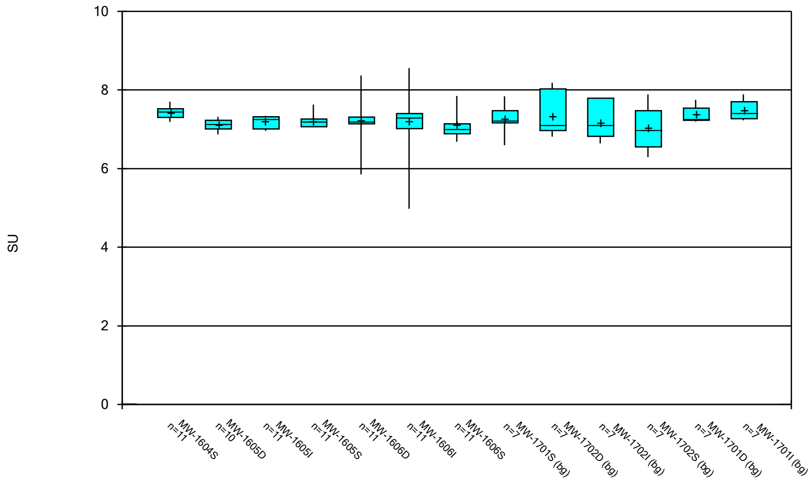
Box & Whiskers Plot



Constituent: pH, field   Analysis Run 8/10/2019 10:10 AM   View: Descriptive
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

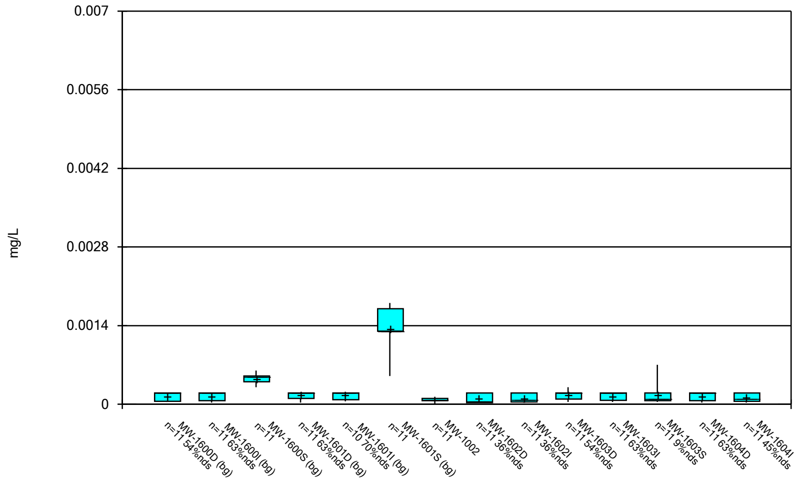
Box & Whiskers Plot



Constituent: pH, field   Analysis Run 8/10/2019 10:10 AM   View: Descriptive
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

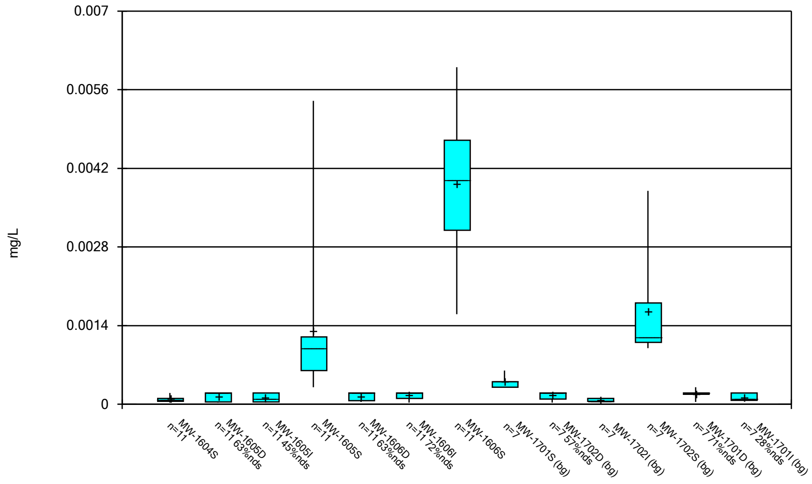
Box & Whiskers Plot



Constituent: Selenium, total   Analysis Run 8/10/2019 10:10 AM   View: Descriptive
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

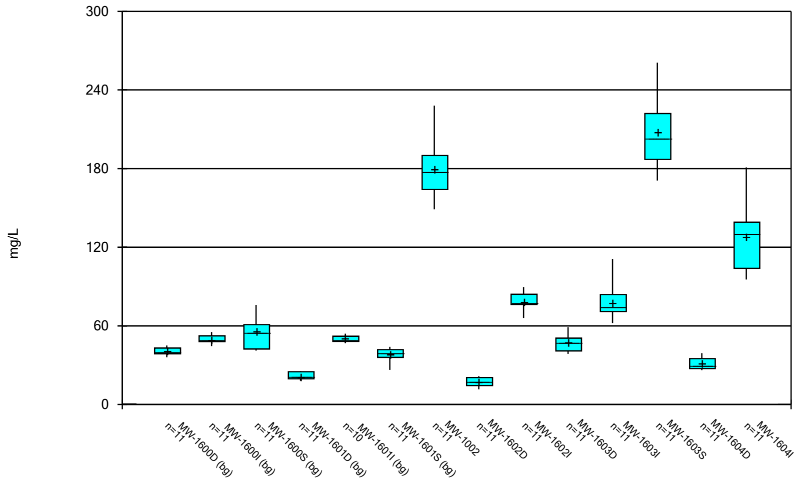
Box & Whiskers Plot



Constituent: Selenium, total   Analysis Run 8/10/2019 10:10 AM   View: Descriptive
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

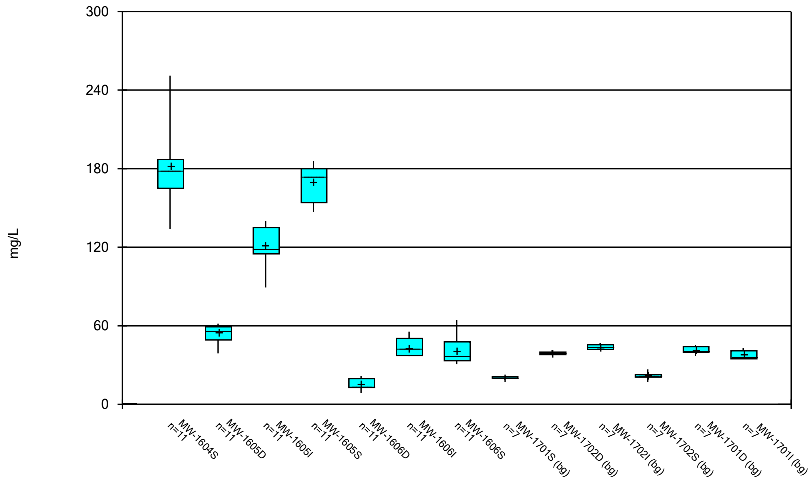
Box & Whiskers Plot



Constituent: Sulfate, total   Analysis Run 8/10/2019 10:10 AM   View: Descriptive
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

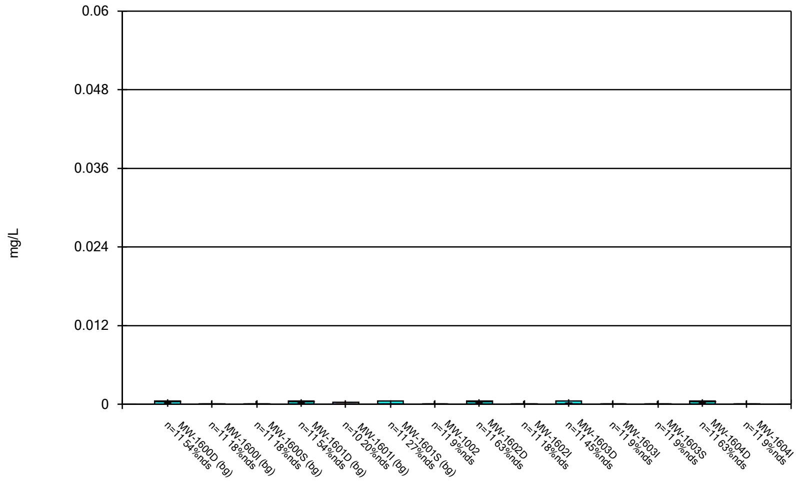
Box & Whiskers Plot



Constituent: Sulfate, total   Analysis Run 8/10/2019 10:10 AM   View: Descriptive
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

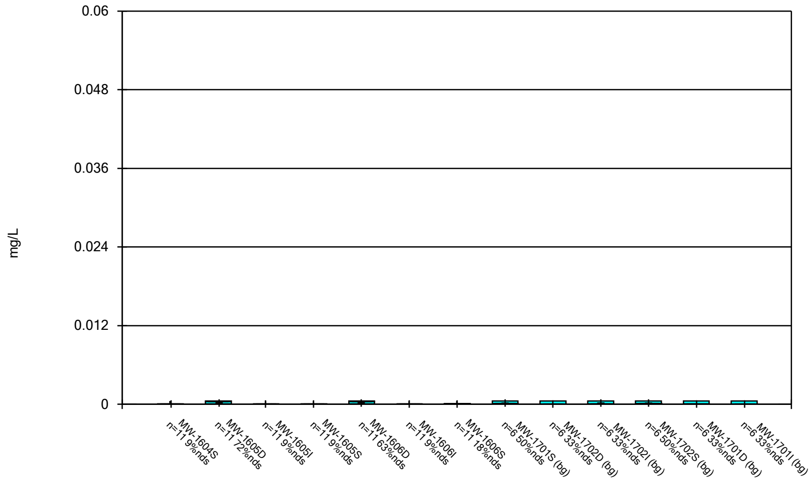
Box & Whiskers Plot



Constituent: Thallium, total   Analysis Run 8/10/2019 10:10 AM   View: Descriptive
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

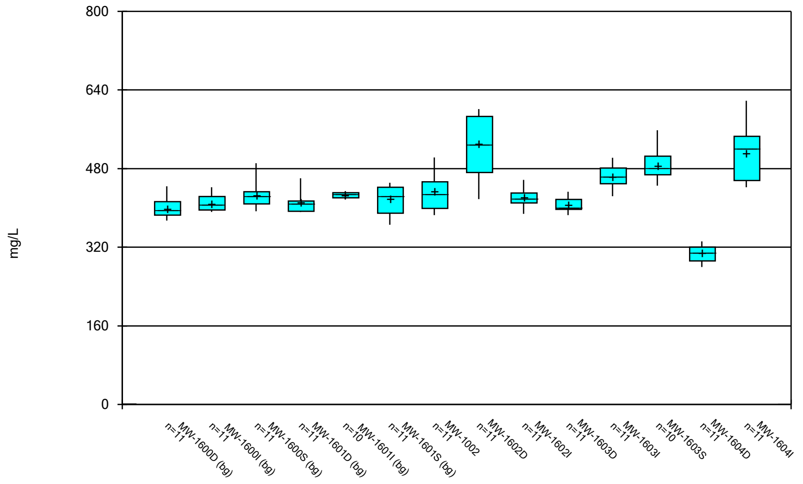
Box & Whiskers Plot



Constituent: Thallium, total   Analysis Run 8/10/2019 10:10 AM   View: Descriptive
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Box & Whiskers Plot

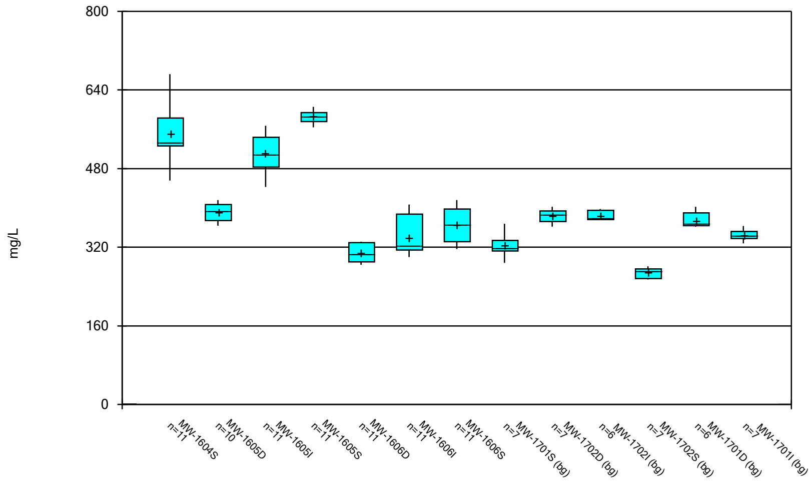


Constituent: Total Dissolved Solids [TDS]   Analysis Run 8/10/2019 10:11 AM   View: Descriptive

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Box & Whiskers Plot



Constituent: Total Dissolved Solids [TDS]   Analysis Run 8/10/2019 10:11 AM   View: Descriptive

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Outlier Summary

Rockport BAP Client: Geosyntec Data: Rockport_BAP Printed 8/10/2019, 10:17 AM

	MW-1604I Arsenic, total (mg/L)	MW-1604I Cadmium, total (mg/L)	MW-1603D Chromium, total (mg/L)	MW-1603D Lead, total (mg/L)	MW-1604S Molybdenum, total (mg/L)	MW-1600I pH, field (SU)	MW-1600S pH, field (SU)	MW-1601I pH, field (SU)	MW-1603I pH, field (SU)	MW-1603S pH, field (SU)
6/7/2016		0.00012 (o)								
10/10/2016			0.0238 (o)	0.00138 (o)						
11/15/2016					0.00479 (o)					
1/10/2017										
3/7/2017										
5/9/2017	0.0264 (o)									
7/17/2017						9.29 (o)	9.46 (o)	9.45 (o)	9.78 (o)	9.63 (o)
7/18/2017										
12/12/2017										
6/4/2018										
6/5/2018										

	MW-1605D pH, field (SU)	MW-1701S Thallium, total (mg/L)	MW-1702D Thallium, total (mg/L)	MW-1702I Thallium, total (mg/L)	MW-1702S Thallium, total (mg/L)	MW-1701D Thallium, total (mg/L)	MW-1701I Thallium, total (mg/L)	MW-1603S Total Dissolved Solids [TDS] (mg/L)	MW-1605D Total Dissolved Solids [TDS] (mg/L)	MW-1702I Total Dissolved Solids [TDS] (mg/L)
6/7/2016										
10/10/2016										
11/15/2016										
1/10/2017									794 (o)	
3/7/2017								581 (o)		
5/9/2017										
7/17/2017										
7/18/2017	9.51 (o)									
12/12/2017		0.02 (o)	0.03 (o)	0.04 (o)	0.01 (o)	0.051 (o)	0.04 (o)			
6/4/2018										760 (o)
6/5/2018										

	MW-1701D Total Dissolved Solids [TDS] (mg/L)
6/7/2016	
10/10/2016	
11/15/2016	
1/10/2017	
3/7/2017	
5/9/2017	
7/17/2017	
7/18/2017	
12/12/2017	
6/4/2018	
6/5/2018	700 (o)

Interwell Prediction Limit Summary - Sigificant Results

Rockport BAP Client: Geosyntec Data: Rockport_BAP Printed 8/9/2019, 8:36 AM

Constituent	Well	Upper Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron, total (mg/L)	MW-1002	0.1334	5/24/2019	1.61	Yes	107	0.2265	0.06738	2.804	None	sqrt(x)	0.0005016	Param 1 of 2
Boron, total (mg/L)	MW-1603S	0.1334	5/21/2019	1.47	Yes	107	0.2265	0.06738	2.804	None	sqrt(x)	0.0005016	Param 1 of 2
Boron, total (mg/L)	MW-1604I	0.1334	5/21/2019	0.254	Yes	107	0.2265	0.06738	2.804	None	sqrt(x)	0.0005016	Param 1 of 2
Boron, total (mg/L)	MW-1604S	0.1334	5/20/2019	0.451	Yes	107	0.2265	0.06738	2.804	None	sqrt(x)	0.0005016	Param 1 of 2
Boron, total (mg/L)	MW-1605S	0.1334	5/24/2019	0.415	Yes	107	0.2265	0.06738	2.804	None	sqrt(x)	0.0005016	Param 1 of 2
Chloride, total (mg/L)	MW-1002	46.4	5/24/2019	55.9	Yes	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Chloride, total (mg/L)	MW-1602D	46.4	5/24/2019	68.3	Yes	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Chloride, total (mg/L)	MW-1603S	46.4	5/21/2019	56	Yes	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Chloride, total (mg/L)	MW-1604I	46.4	5/21/2019	70.1	Yes	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Chloride, total (mg/L)	MW-1604S	46.4	5/20/2019	57.2	Yes	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Fluoride, total (mg/L)	MW-1002	0.7	5/24/2019	1.13	Yes	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Fluoride, total (mg/L)	MW-1604S	0.7	5/20/2019	0.99	Yes	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Sulfate, total (mg/L)	MW-1002	76	5/24/2019	169	Yes	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Sulfate, total (mg/L)	MW-1603S	76	5/21/2019	187	Yes	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Sulfate, total (mg/L)	MW-1604I	76	5/21/2019	181	Yes	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Sulfate, total (mg/L)	MW-1604S	76	5/20/2019	179	Yes	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Sulfate, total (mg/L)	MW-1605I	76	5/24/2019	89.2	Yes	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Sulfate, total (mg/L)	MW-1605S	76	5/24/2019	147	Yes	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1603I	464.7	5/21/2019	467	Yes	105	6.1e7	1.9e7	0	None	x^3	0.0005016	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1603S	464.7	5/21/2019	506	Yes	105	6.1e7	1.9e7	0	None	x^3	0.0005016	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1604I	464.7	5/21/2019	618	Yes	105	6.1e7	1.9e7	0	None	x^3	0.0005016	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1604S	464.7	5/20/2019	572	Yes	105	6.1e7	1.9e7	0	None	x^3	0.0005016	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1605S	464.7	5/24/2019	586	Yes	105	6.1e7	1.9e7	0	None	x^3	0.0005016	Param 1 of 2

Interwell Prediction Limit Summary - All Results

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP   Printed 8/9/2019, 8:36 AM

Constituent	Well	Upper Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron, total (mg/L)	**MW-1002**	**0.1334**	**5/24/2019**	**1.61**	**Yes**	**107**	**0.2265**	**0.06738**	**2.804**	**None**	**sqrt(x)**	**0.0005016**	Param 1 of 2
Boron, total (mg/L)	MW-1602D	0.1334	5/24/2019	0.04	No	107	0.2265	0.06738	2.804	None	sqrt(x)	0.0005016	Param 1 of 2
Boron, total (mg/L)	MW-1602I	0.1334	5/24/2019	0.05	No	107	0.2265	0.06738	2.804	None	sqrt(x)	0.0005016	Param 1 of 2
Boron, total (mg/L)	MW-1603D	0.1334	5/21/2019	0.04	No	107	0.2265	0.06738	2.804	None	sqrt(x)	0.0005016	Param 1 of 2
Boron, total (mg/L)	MW-1603I	0.1334	5/21/2019	0.06	No	107	0.2265	0.06738	2.804	None	sqrt(x)	0.0005016	Param 1 of 2
Boron, total (mg/L)	**MW-1603S**	**0.1334**	**5/21/2019**	**1.47**	**Yes**	**107**	**0.2265**	**0.06738**	**2.804**	**None**	**sqrt(x)**	**0.0005016**	Param 1 of 2
Boron, total (mg/L)	MW-1604D	0.1334	5/21/2019	0.03	No	107	0.2265	0.06738	2.804	None	sqrt(x)	0.0005016	Param 1 of 2
Boron, total (mg/L)	**MW-1604I**	**0.1334**	**5/21/2019**	**0.254**	**Yes**	**107**	**0.2265**	**0.06738**	**2.804**	**None**	**sqrt(x)**	**0.0005016**	Param 1 of 2
Boron, total (mg/L)	**MW-1604S**	**0.1334**	**5/20/2019**	**0.451**	**Yes**	**107**	**0.2265**	**0.06738**	**2.804**	**None**	**sqrt(x)**	**0.0005016**	Param 1 of 2
Boron, total (mg/L)	MW-1605D	0.1334	5/24/2019	0.02	No	107	0.2265	0.06738	2.804	None	sqrt(x)	0.0005016	Param 1 of 2
Boron, total (mg/L)	MW-1605I	0.1334	5/24/2019	0.08	No	107	0.2265	0.06738	2.804	None	sqrt(x)	0.0005016	Param 1 of 2
Boron, total (mg/L)	**MW-1605S**	**0.1334**	**5/24/2019**	**0.415**	**Yes**	**107**	**0.2265**	**0.06738**	**2.804**	**None**	**sqrt(x)**	**0.0005016**	Param 1 of 2
Boron, total (mg/L)	MW-1606D	0.1334	5/24/2019	0.02	No	107	0.2265	0.06738	2.804	None	sqrt(x)	0.0005016	Param 1 of 2
Boron, total (mg/L)	MW-1606I	0.1334	5/21/2019	0.02	No	107	0.2265	0.06738	2.804	None	sqrt(x)	0.0005016	Param 1 of 2
Boron, total (mg/L)	MW-1606S	0.1334	5/21/2019	0.05	No	107	0.2265	0.06738	2.804	None	sqrt(x)	0.0005016	Param 1 of 2
Chloride, total (mg/L)	**MW-1002**	**46.4**	**5/24/2019**	**55.9**	**Yes**	**107**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.0001715**	NP (normality) 1 of 2
Chloride, total (mg/L)	**MW-1602D**	**46.4**	**5/24/2019**	**68.3**	**Yes**	**107**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.0001715**	NP (normality) 1 of 2
Chloride, total (mg/L)	MW-1602I	46.4	5/24/2019	29	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Chloride, total (mg/L)	MW-1603D	46.4	5/21/2019	25.3	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Chloride, total (mg/L)	MW-1603I	46.4	5/21/2019	39.4	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Chloride, total (mg/L)	**MW-1603S**	**46.4**	**5/21/2019**	**56**	**Yes**	**107**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.0001715**	NP (normality) 1 of 2
Chloride, total (mg/L)	MW-1604D	46.4	5/21/2019	16.1	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Chloride, total (mg/L)	**MW-1604I**	**46.4**	**5/21/2019**	**70.1**	**Yes**	**107**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.0001715**	NP (normality) 1 of 2
Chloride, total (mg/L)	**MW-1604S**	**46.4**	**5/20/2019**	**57.2**	**Yes**	**107**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.0001715**	NP (normality) 1 of 2
Chloride, total (mg/L)	MW-1605D	46.4	5/24/2019	22.1	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Chloride, total (mg/L)	MW-1605I	46.4	5/24/2019	36.8	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Chloride, total (mg/L)	MW-1605S	46.4	5/24/2019	46.1	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Chloride, total (mg/L)	MW-1606D	46.4	5/24/2019	25	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Chloride, total (mg/L)	MW-1606I	46.4	5/21/2019	29.8	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Chloride, total (mg/L)	MW-1606S	46.4	5/21/2019	26.6	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Fluoride, total (mg/L)	**MW-1002**	**0.7**	**5/24/2019**	**1.13**	**Yes**	**107**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.0001715**	NP (normality) 1 of 2
Fluoride, total (mg/L)	MW-1602D	0.7	5/24/2019	0.33	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Fluoride, total (mg/L)	MW-1602I	0.7	5/24/2019	0.3	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Fluoride, total (mg/L)	MW-1603D	0.7	5/21/2019	0.28	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Fluoride, total (mg/L)	MW-1603I	0.7	5/21/2019	0.45	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Fluoride, total (mg/L)	MW-1603S	0.7	5/21/2019	0.55	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Fluoride, total (mg/L)	MW-1604D	0.7	5/21/2019	0.27	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Fluoride, total (mg/L)	MW-1604I	0.7	5/21/2019	0.34	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Fluoride, total (mg/L)	**MW-1604S**	**0.7**	**5/20/2019**	**0.99**	**Yes**	**107**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.0001715**	NP (normality) 1 of 2
Fluoride, total (mg/L)	MW-1605D	0.7	5/24/2019	0.24	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Fluoride, total (mg/L)	MW-1605I	0.7	5/24/2019	0.23	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Fluoride, total (mg/L)	MW-1605S	0.7	5/24/2019	0.61	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Fluoride, total (mg/L)	MW-1606D	0.7	5/24/2019	0.2	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Fluoride, total (mg/L)	MW-1606I	0.7	5/21/2019	0.16	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Fluoride, total (mg/L)	MW-1606S	0.7	5/21/2019	0.47	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Sulfate, total (mg/L)	**MW-1002**	**76**	**5/24/2019**	**169**	**Yes**	**107**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.0001715**	NP (normality) 1 of 2
Sulfate, total (mg/L)	MW-1602D	76	5/24/2019	20.5	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Sulfate, total (mg/L)	MW-1602I	76	5/24/2019	65.9	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Sulfate, total (mg/L)	MW-1603D	76	5/21/2019	38.5	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Sulfate, total (mg/L)	MW-1603I	76	5/21/2019	74.6	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2

Interwell Prediction Limit Summary - All Results

Rockport BAP Client: Geosyntec Data: Rockport_BAP Printed 8/9/2019, 8:36 AM

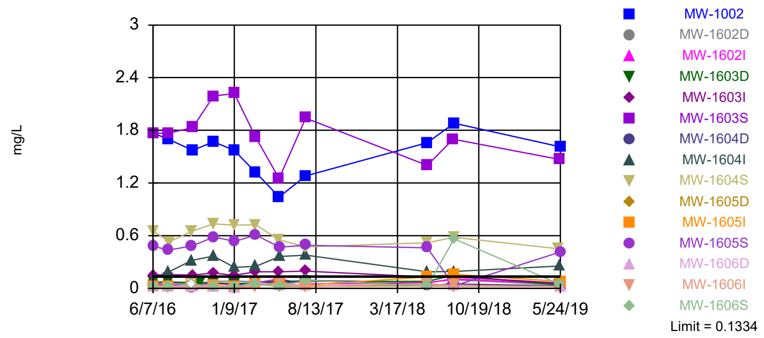
Constituent	Well	Upper Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Sulfate, total (mg/L)	**MW-1603S**	**76**	**5/21/2019**	**187**	**Yes**	**107**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.0001715**	NP (normality) 1 of 2
Sulfate, total (mg/L)	MW-1604D	76	5/21/2019	27.4	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Sulfate, total (mg/L)	**MW-1604I**	**76**	**5/21/2019**	**181**	**Yes**	**107**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.0001715**	NP (normality) 1 of 2
Sulfate, total (mg/L)	**MW-1604S**	**76**	**5/20/2019**	**179**	**Yes**	**107**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.0001715**	NP (normality) 1 of 2
Sulfate, total (mg/L)	MW-1605D	76	5/24/2019	38.9	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Sulfate, total (mg/L)	**MW-1605I**	**76**	**5/24/2019**	**89.2**	**Yes**	**107**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.0001715**	NP (normality) 1 of 2
Sulfate, total (mg/L)	**MW-1605S**	**76**	**5/24/2019**	**147**	**Yes**	**107**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.0001715**	NP (normality) 1 of 2
Sulfate, total (mg/L)	MW-1606D	76	5/24/2019	19.6	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Sulfate, total (mg/L)	MW-1606I	76	5/21/2019	55.5	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Sulfate, total (mg/L)	MW-1606S	76	5/21/2019	64.5	No	107	n/a	n/a	0	n/a	n/a	0.0001715	NP (normality) 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1002	464.7	5/24/2019	435	No	105	6.1e7	1.9e7	0	None	x^3	0.0005016	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1602D	464.7	5/24/2019	418	No	105	6.1e7	1.9e7	0	None	x^3	0.0005016	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1602I	464.7	5/24/2019	410	No	105	6.1e7	1.9e7	0	None	x^3	0.0005016	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1603D	464.7	5/21/2019	397	No	105	6.1e7	1.9e7	0	None	x^3	0.0005016	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	**MW-1603I**	**464.7**	**5/21/2019**	**467**	**Yes**	**105**	**6.1e7**	**1.9e7**	**0**	**None**	**x^3**	**0.0005016**	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	**MW-1603S**	**464.7**	**5/21/2019**	**506**	**Yes**	**105**	**6.1e7**	**1.9e7**	**0**	**None**	**x^3**	**0.0005016**	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1604D	464.7	5/21/2019	309	No	105	6.1e7	1.9e7	0	None	x^3	0.0005016	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	**MW-1604I**	**464.7**	**5/21/2019**	**618**	**Yes**	**105**	**6.1e7**	**1.9e7**	**0**	**None**	**x^3**	**0.0005016**	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	**MW-1604S**	**464.7**	**5/20/2019**	**572**	**Yes**	**105**	**6.1e7**	**1.9e7**	**0**	**None**	**x^3**	**0.0005016**	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1605D	464.7	5/24/2019	364	No	105	6.1e7	1.9e7	0	None	x^3	0.0005016	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1605I	464.7	5/24/2019	443	No	105	6.1e7	1.9e7	0	None	x^3	0.0005016	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	**MW-1605S**	**464.7**	**5/24/2019**	**586**	**Yes**	**105**	**6.1e7**	**1.9e7**	**0**	**None**	**x^3**	**0.0005016**	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1606D	464.7	5/24/2019	330	No	105	6.1e7	1.9e7	0	None	x^3	0.0005016	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1606I	464.7	5/21/2019	407	No	105	6.1e7	1.9e7	0	None	x^3	0.0005016	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1606S	464.7	5/21/2019	416	No	105	6.1e7	1.9e7	0	None	x^3	0.0005016	Param 1 of 2

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Exceeds Limit: MW-1002, MW-1603S, MW-1604I, MW-1604S, MW-1605S

Prediction Limit

Interwell Parametric



Background Data Summary (based on square root transformation): Mean=0.2265, Std. Dev.=0.06738, n=107, 2.804% NDs. Normality test: Chi Squared @alpha = 0.01, calculated = 6.925, critical = 14.07. Kappa = 2.059 (c=7, w=15, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.0005016. Comparing 15 points to limit.

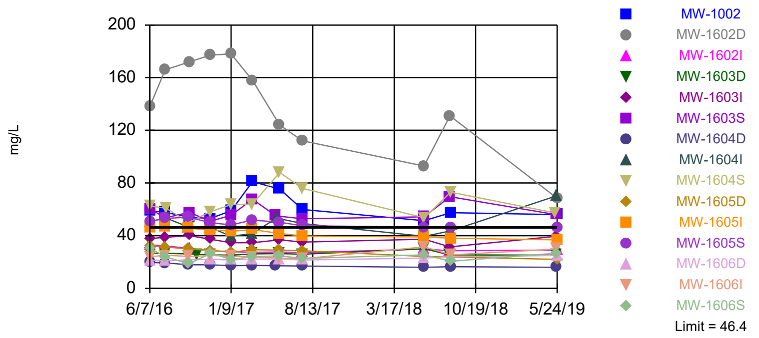
Constituent: Boron, total Analysis Run 8/9/2019 8:33 AM View: PL's - Interwell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limit: MW-1002, MW-1602D, MW-1603S, MW-1604I, MW-1604S

Prediction Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Chi Squared normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 107 background values. Annual per-constituent alpha = 0.005132. Individual comparison alpha = 0.0001715 (1 of 2). Comparing 15 points to limit.

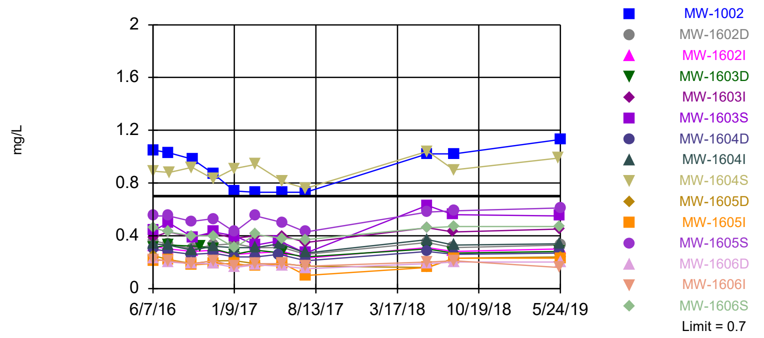
Constituent: Chloride, total Analysis Run 8/9/2019 8:33 AM View: PL's - Interwell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limit: MW-1002, MW-1604S

Prediction Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Chi Squared normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 107 background values. Annual per-constituent alpha = 0.005132. Individual comparison alpha = 0.0001715 (1 of 2). Comparing 15 points to limit.

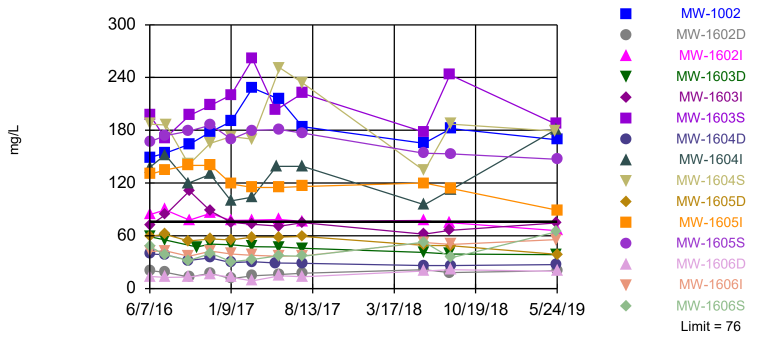
Constituent: Fluoride, total Analysis Run 8/9/2019 8:33 AM View: PL's - Interwell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limit: MW-1002, MW-1603S, MW-1604I, MW-1604S, MW-1605I, MW-1605S

Prediction Limit

Interwell Non-parametric



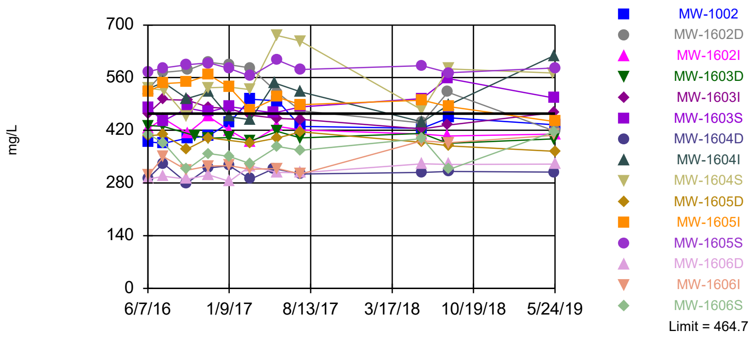
Non-parametric test used in lieu of parametric prediction limit because the Chi Squared normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 107 background values. Annual per-constituent alpha = 0.005132. Individual comparison alpha = 0.0001715 (1 of 2). Comparing 15 points to limit.

Constituent: Sulfate, total Analysis Run 8/9/2019 8:33 AM View: PL's - Interwell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Exceeds Limit: MW-1603I, MW-1603S, MW-1604I, MW-1604S, MW-1605S

Prediction Limit

Interwell Parametric



Background Data Summary (based on cube transformation): Mean=6.1e7, Std. Dev.=1.9e7, n=105. Normality test: Chi Squared @alpha = 0.01, calculated = 5.19, critical = 14.07. Kappa = 2.06 (c=7, w=15, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.0005016. Comparing 15 points to limit.

Constituent: Total Dissolved Solids [TDS] Analysis Run 8/9/2019 8:33 AM View: PL's - Interwell

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Intrawell Prediction Limit Summary - Significant Results

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP   Printed 8/10/2019, 9:36 AM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Calcium, total (mg/L)	**MW-1606I**	**76.05**	**n/a**	**5/21/2019**	**79.5**	**Yes**	**8**	**64.69**	**4.721**	**0**	**None**	**No**	**0.0005016**	**Param Intra 1 of 3**
pH, field (SU)	**MW-1002**	**7.307**	**6.048**	**5/24/2019**	**7.38**	**Yes**	**8**	**6.678**	**0.2616**	**0**	**None**	**No**	**0.0002508**	**Param Intra 1 of 3**
pH, field (SU)	**MW-1606I**	**8.009**	**4.524**	**5/21/2019**	**8.56**	**Yes**	**8**	**17422**	**6451**	**0**	**None**	**x^5**	**0.0002508**	**Param Intra 1 of 3**
pH, field (SU)	**MW-1606S**	**7.312**	**6.61**	**5/21/2019**	**7.85**	**Yes**	**8**	**6.961**	**0.1457**	**0**	**None**	**No**	**0.0002508**	**Param Intra 1 of 3**

Intrawell Prediction Limit Summary - All Results

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP   Printed 8/10/2019, 9:36 AM

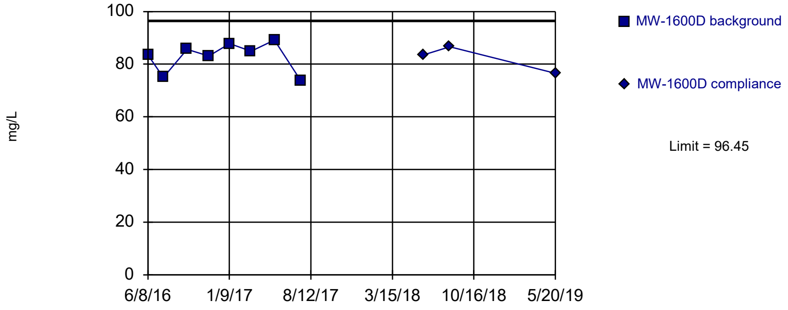
Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Calcium, total (mg/L)	MW-1600D	96.45	n/a	5/20/2019	76.5	No	8	82.81	5.664	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1600I	82.91	n/a	5/20/2019	71	No	8	76.56	2.637	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1600S	74.92	n/a	5/21/2019	57.4	No	8	65.28	4.007	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1601D	98.28	n/a	5/24/2019	85.4	No	8	86.2	5.018	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1601I	96.4	n/a	8/15/2018	91.7	No	8	86.8	3.987	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1601S	88.26	n/a	5/24/2019	77.2	No	8	77.79	4.352	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1002	94.34	n/a	5/24/2019	32.9	No	8	51.88	17.64	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1602D	83.65	n/a	5/24/2019	67.9	No	8	71.95	4.861	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1602I	92.7	n/a	5/24/2019	74.6	No	8	78.43	5.93	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1603D	101.7	n/a	5/21/2019	71.6	No	8	84.04	7.342	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1603I	109.2	n/a	5/21/2019	81.4	No	8	91.26	7.46	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1603S	110.7	n/a	5/21/2019	62.6	No	8	68.9	17.36	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1604D	78.42	n/a	5/21/2019	69.3	No	8	69.86	3.557	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1604I	85.79	n/a	5/21/2019	78.2	No	8	75.49	4.278	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1604S	117.6	n/a	5/20/2019	80.4	No	8	85.99	13.13	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1605D	96.88	n/a	5/24/2019	75.7	No	8	87.33	3.972	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1605I	109.6	n/a	5/24/2019	73.8	No	8	91.19	7.636	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1605S	88.65	n/a	5/24/2019	76	No	8	76.31	5.127	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1606D	82	n/a	5/24/2019	75.7	No	8	72.45	3.97	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	**MW-1606I**	**76.05**	**n/a**	**5/21/2019**	**79.5**	**Yes**	**8**	**64.69**	**4.721**	**0**	**None**	**No**	**0.0005016**	**Param Intra 1 of 3**
Calcium, total (mg/L)	MW-1606S	59.86	n/a	5/21/2019	48.9	No	8	49.18	4.437	0	None	No	0.0005016	Param Intra 1 of 3
pH, field (SU)	MW-1600D	7.887	6.208	5/20/2019	7.17	No	8	7.048	0.3486	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1600I	7.679	6.598	5/21/2019	7.29	No	6	7.138	0.1789	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1600S	7.034	6.22	5/21/2019	6.94	No	7	6.627	0.15	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1601D	7.811	6.369	5/24/2019	7.06	No	8	7.09	0.2994	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1601I	7.736	6.418	8/15/2018	7.25	No	7	7.077	0.2428	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1601S	7.834	6.294	5/24/2019	7.15	No	8	7.064	0.3199	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	**MW-1002**	**7.307**	**6.048**	**5/24/2019**	**7.38**	**Yes**	**8**	**6.678**	**0.2616**	**0**	**None**	**No**	**0.0002508**	**Param Intra 1 of 3**
pH, field (SU)	MW-1602D	9.295	4.918	5/24/2019	7.43	No	8	7.106	0.9093	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1602I	7.615	6.715	5/24/2019	7.42	No	8	7.165	0.187	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1603D	7.531	6.659	5/21/2019	7.19	No	8	7.095	0.181	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1603I	7.61	7.15	5/21/2019	7.25	No	7	n/a	n/a	0	n/a	n/a	0.01734	NP Intra (normality) 1 of 3
pH, field (SU)	MW-1603S	7.948	5.975	5/21/2019	6.59	No	7	6.961	0.3635	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1604D	7.481	6.859	5/21/2019	7.24	No	8	7.17	0.1292	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1604I	7.733	7.019	5/21/2019	7.33	No	8	7.376	0.1483	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1604S	7.669	7.086	5/20/2019	7.48	No	8	7.378	0.1209	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1605D	7.457	6.78	5/24/2019	6.92	No	7	7.119	0.1248	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1605I	7.521	6.782	5/24/2019	7.3	No	8	7.151	0.1535	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1605S	7.331	6.999	5/24/2019	7.26	No	8	7.165	0.06887	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1606D	8.793	5.495	5/24/2019	7.15	No	8	7.144	0.6851	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	**MW-1606I**	**8.009**	**4.524**	**5/21/2019**	**8.56**	**Yes**	**8**	**17422**	**6451**	**0**	**None**	**x^5**	**0.0002508**	**Param Intra 1 of 3**
pH, field (SU)	**MW-1606S**	**7.312**	**6.61**	**5/21/2019**	**7.85**	**Yes**	**8**	**6.961**	**0.1457**	**0**	**None**	**No**	**0.0002508**	**Param Intra 1 of 3**

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=82.81, Std. Dev.=5.664, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8699, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

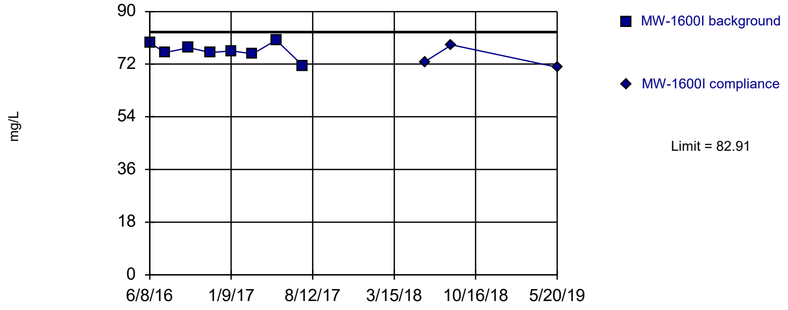
Constituent: Calcium, total Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=76.56, Std. Dev.=2.637, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9344, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

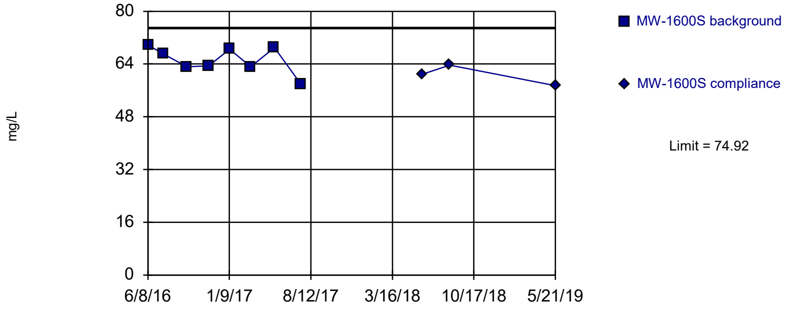
Constituent: Calcium, total Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=65.28, Std. Dev.=4.007, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9068, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

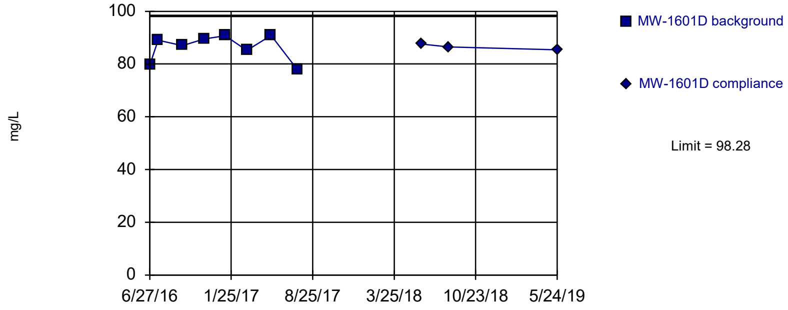
Constituent: Calcium, total Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=86.2, Std. Dev.=5.018, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8541, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

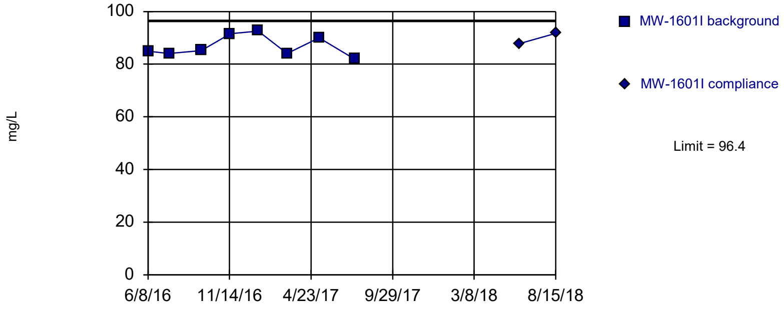
Constituent: Calcium, total Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=86.8, Std. Dev.=3.987, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8747, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

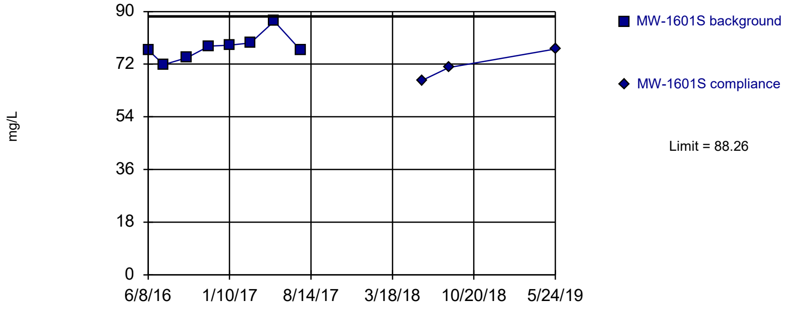
Constituent: Calcium, total Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=77.79, Std. Dev.=4.352, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9074, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

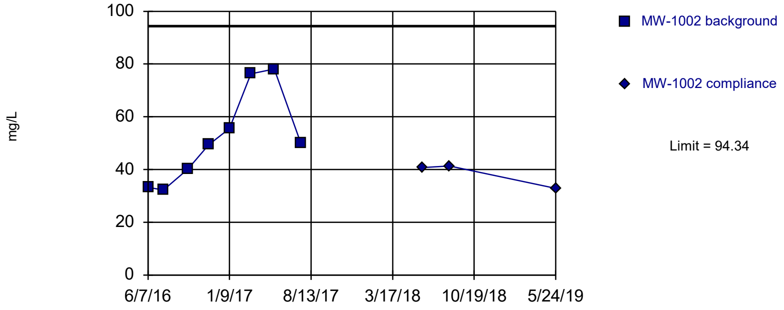
Constituent: Calcium, total Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=51.88, Std. Dev.=17.64, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8924, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

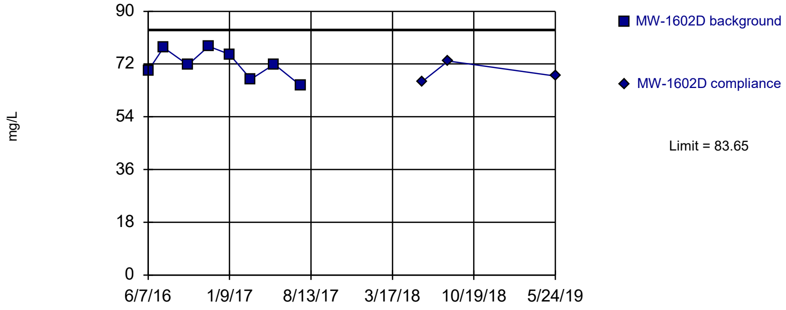
Constituent: Calcium, total Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=71.95, Std. Dev.=4.861, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9467, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

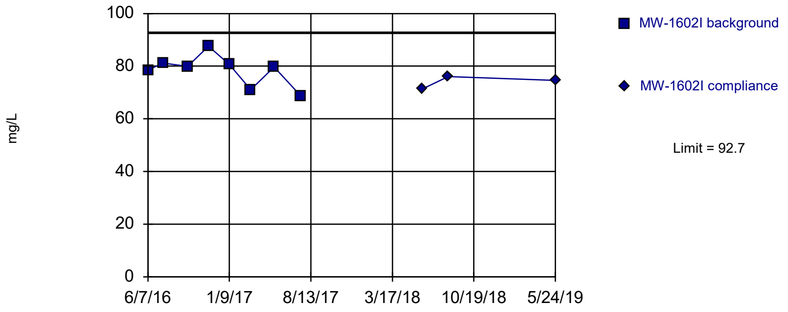
Constituent: Calcium, total Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=78.43, Std. Dev.=5.93, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.902, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

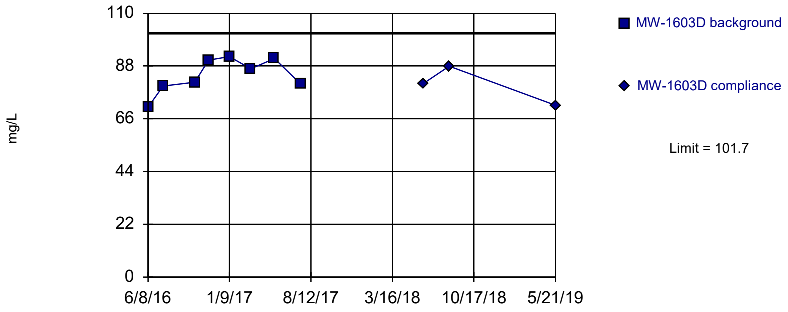
Constituent: Calcium, total Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=84.04, Std. Dev.=7.342, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9054, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

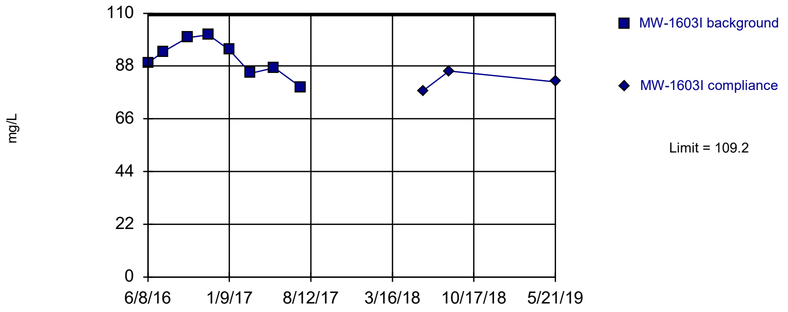
Constituent: Calcium, total Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=91.26, Std. Dev.=7.46, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9648, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

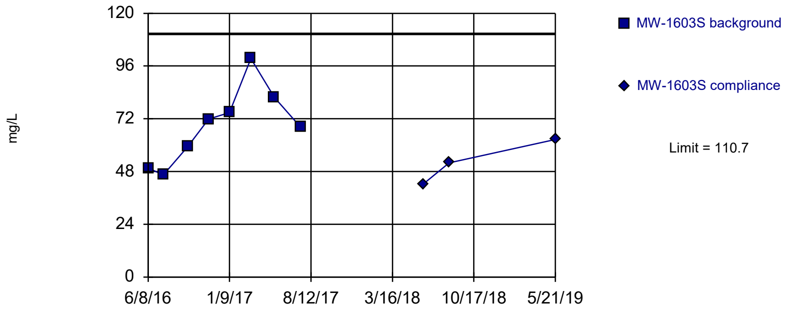
Constituent: Calcium, total Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=68.9, Std. Dev.=17.36, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9662, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

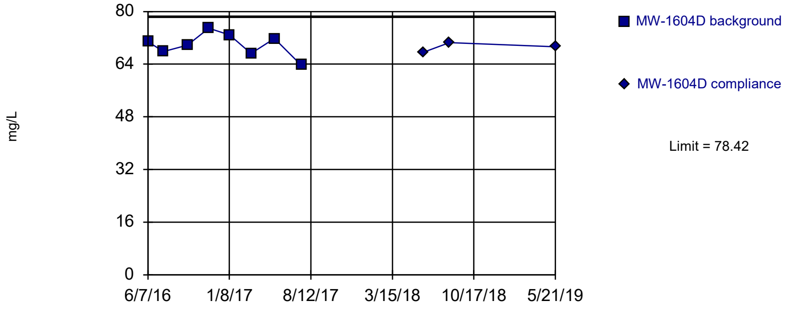
Constituent: Calcium, total Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=69.86, Std. Dev.=3.557, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.984, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

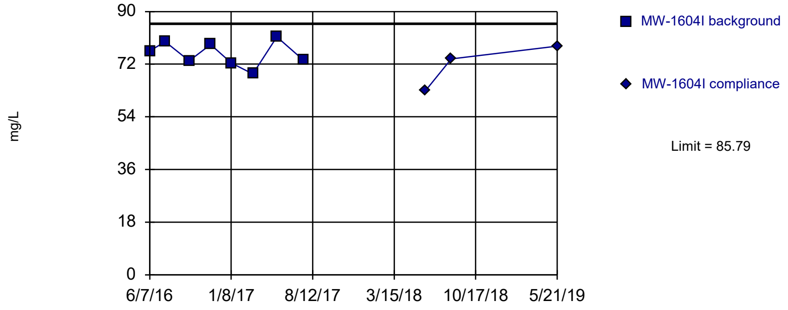
Constituent: Calcium, total Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=75.49, Std. Dev.=4.278, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9581, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

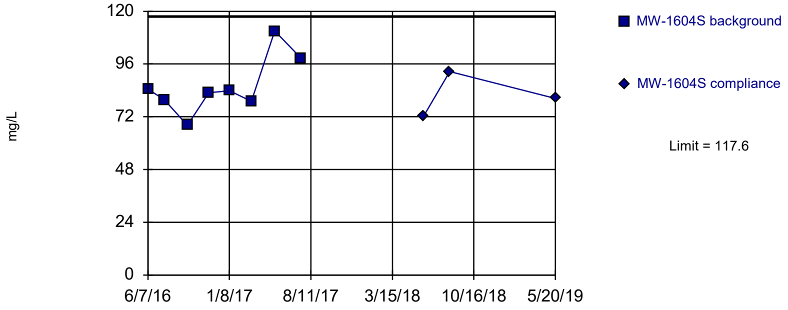
Constituent: Calcium, total Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=85.99, Std. Dev.=13.13, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9031, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

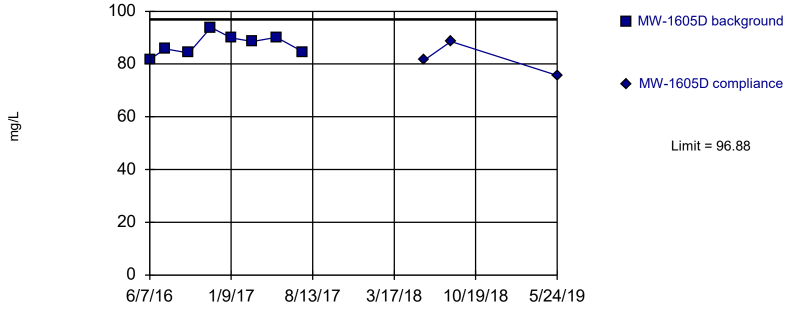
Constituent: Calcium, total Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=87.33, Std. Dev.=3.972, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9666, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

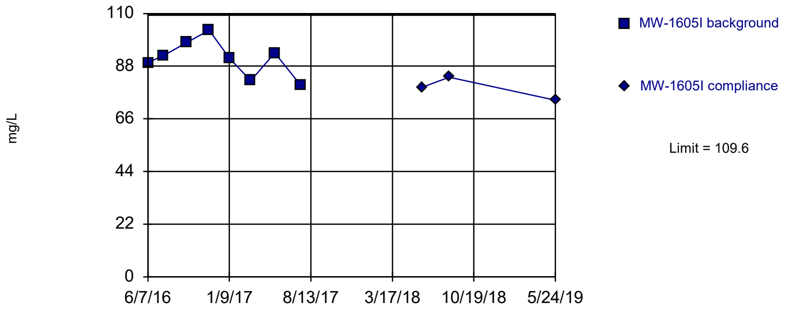
Constituent: Calcium, total Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=91.19, Std. Dev.=7.636, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9611, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

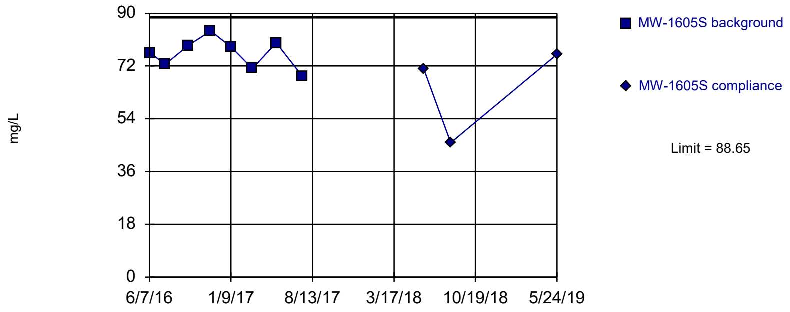
Constituent: Calcium, total Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=76.31, Std. Dev.=5.127, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9631, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

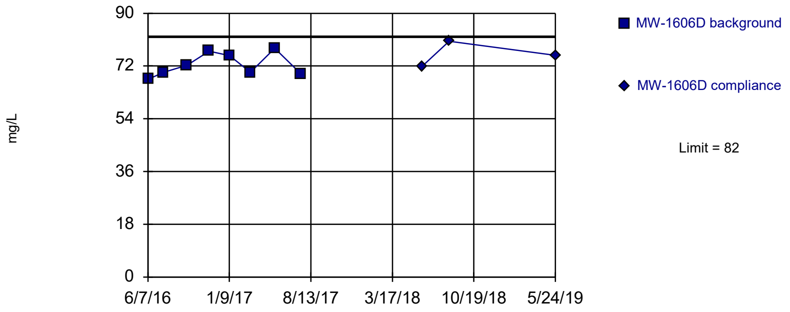
Constituent: Calcium, total Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=72.45, Std. Dev.=3.97, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9055, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

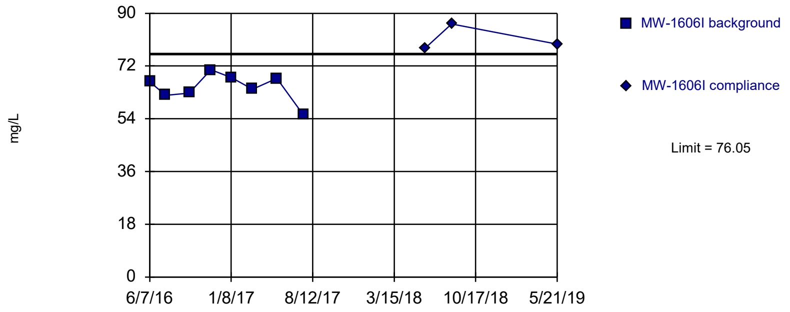
Constituent: Calcium, total Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=64.69, Std. Dev.=4.721, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9399, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

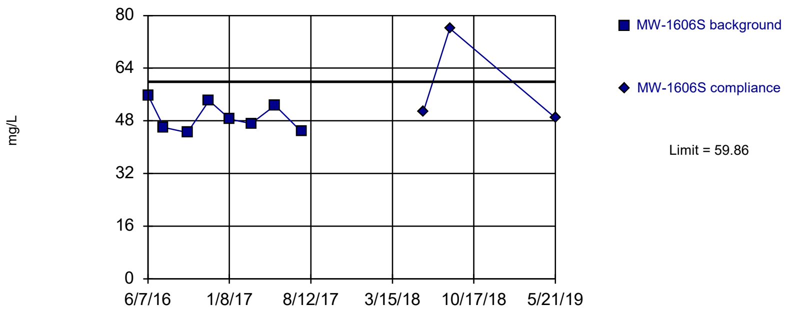
Constituent: Calcium, total Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=49.18, Std. Dev.=4.437, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8962, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

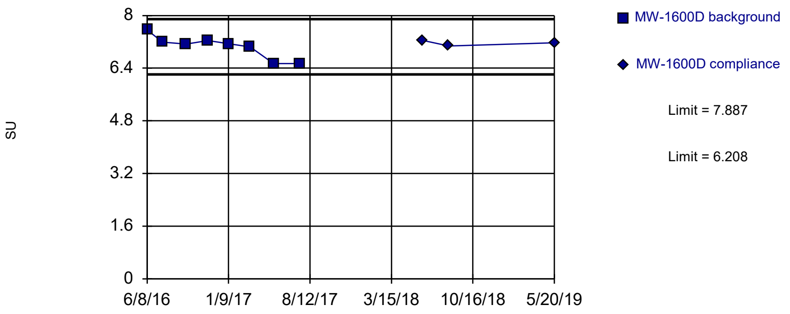
Constituent: Calcium, total Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.048, Std. Dev.=0.3486, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8807, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

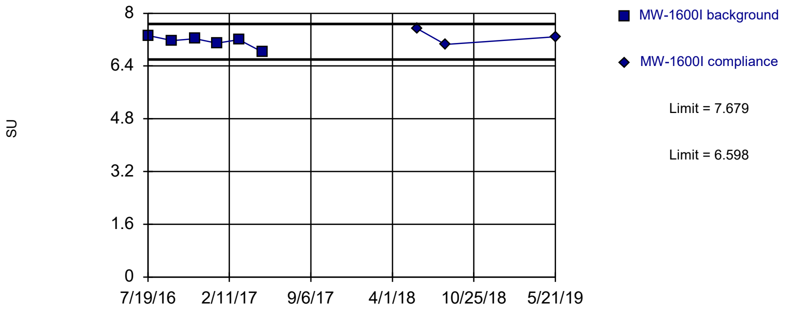
Constituent: pH, field Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.138, Std. Dev.=0.1789, n=6. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8846, critical = 0.713. Kappa = 3.019 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

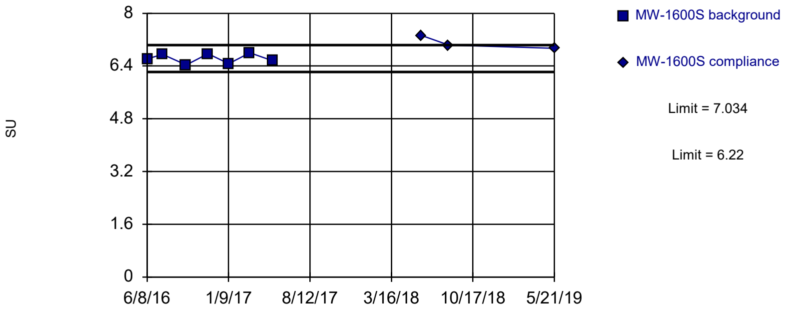
Constituent: pH, field Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=6.627, Std. Dev.=0.15, n=7. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9056, critical = 0.73. Kappa = 2.713 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

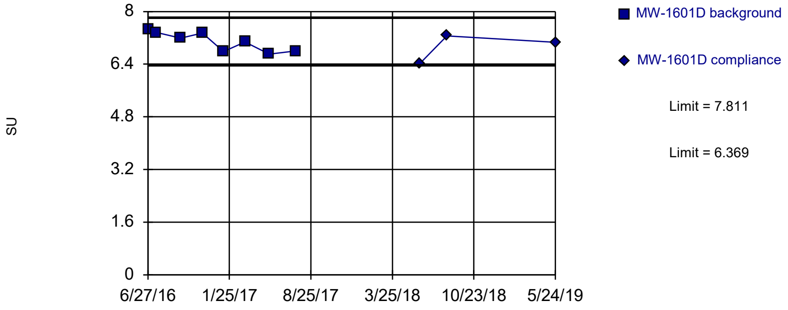
Constituent: pH, field Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.09, Std. Dev.=0.2994, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9013, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

Constituent: pH, field   Analysis Run 8/10/2019 9:32 AM   View: PL's - Intrawell

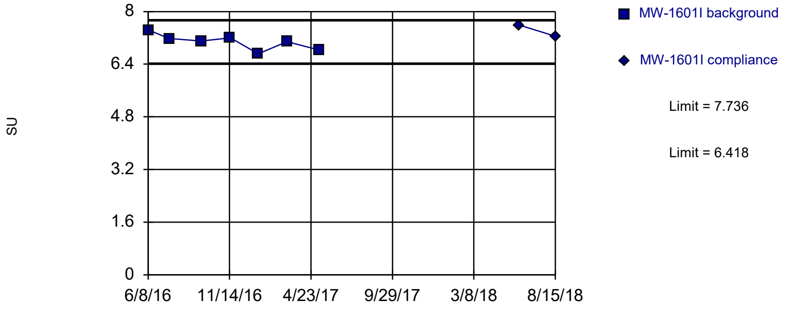
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.077, Std. Dev.=0.2428, n=7. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9548, critical = 0.73. Kappa = 2.713 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

Constituent: pH, field   Analysis Run 8/10/2019 9:32 AM   View: PL's - Intrawell

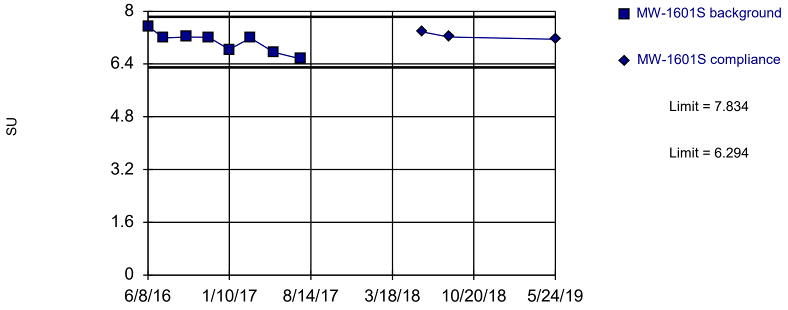
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.064, Std. Dev.=0.3199, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9212, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

Constituent: pH, field   Analysis Run 8/10/2019 9:32 AM   View: PL's - Intrawell

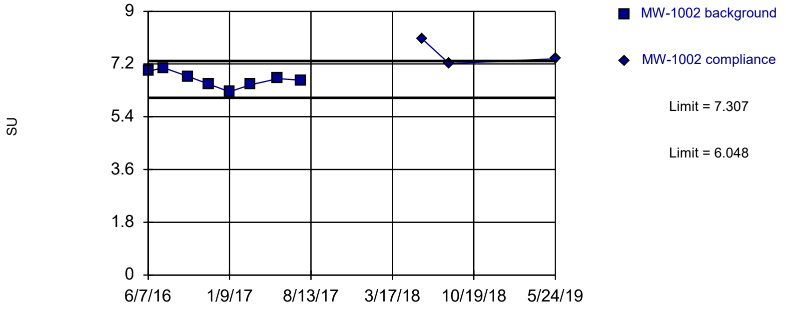
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=6.678, Std. Dev.=0.2616, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9843, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

Constituent: pH, field   Analysis Run 8/10/2019 9:32 AM   View: PL's - Intrawell

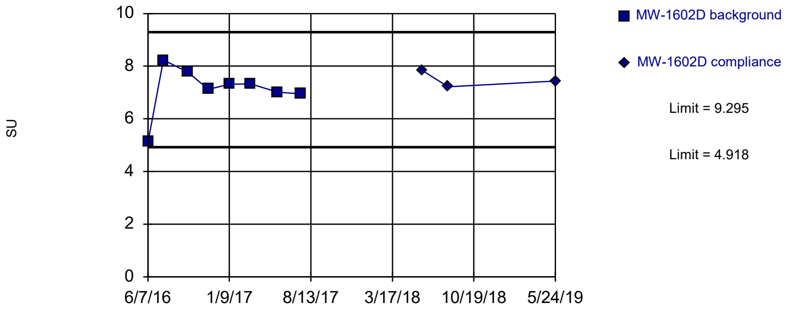
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.106, Std. Dev.=0.9093, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8449, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

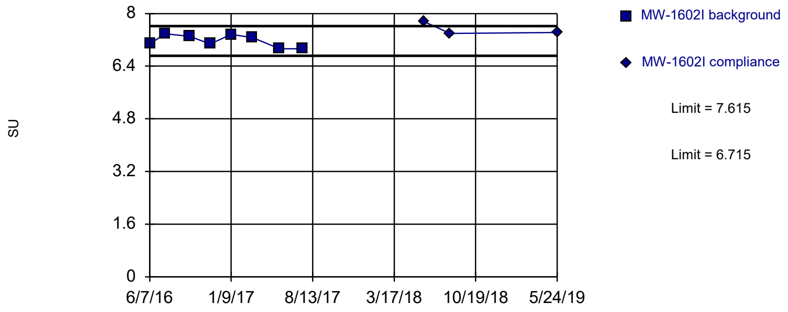
Constituent: pH, field Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.165, Std. Dev.=0.187, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8698, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

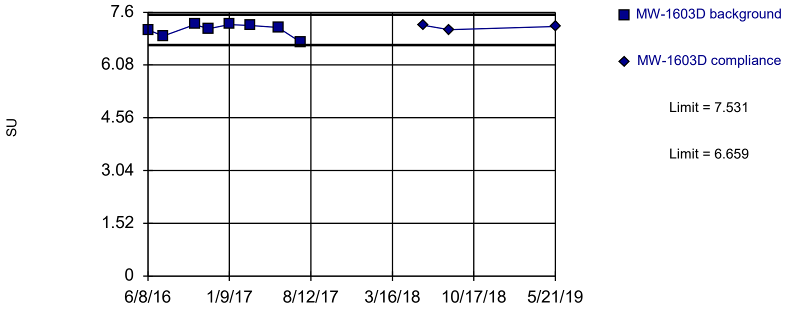
Constituent: pH, field Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.095, Std. Dev.=0.181, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8394, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

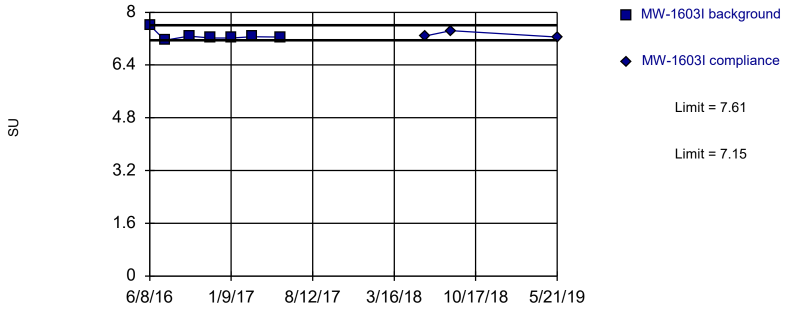
Constituent: pH, field Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f 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 = 0.03452. Individual comparison alpha = 0.01734 (1 of 3).

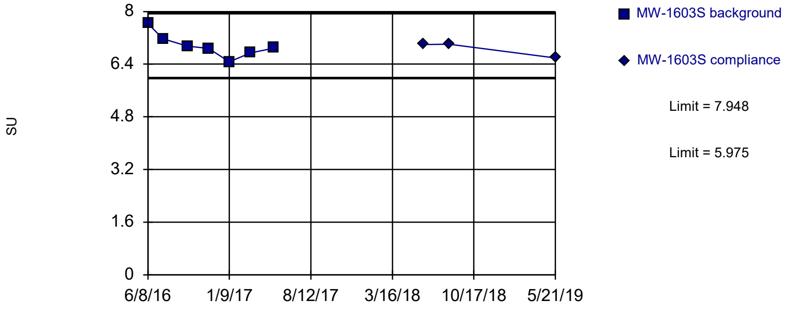
Constituent: pH, field Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=6.961, Std. Dev.=0.3635, n=7. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9397, critical = 0.73. Kappa = 2.713 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

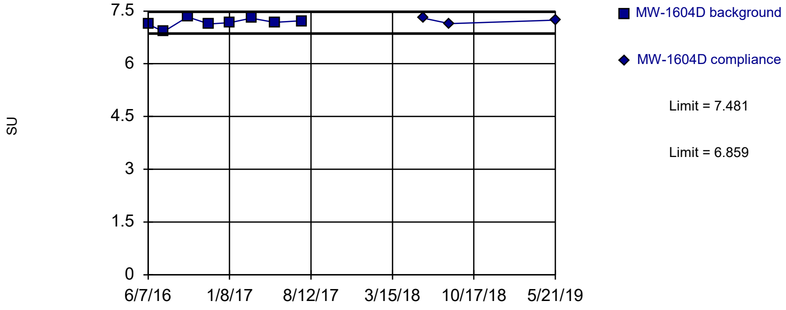
Constituent: pH, field Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.17, Std. Dev.=0.1292, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9176, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

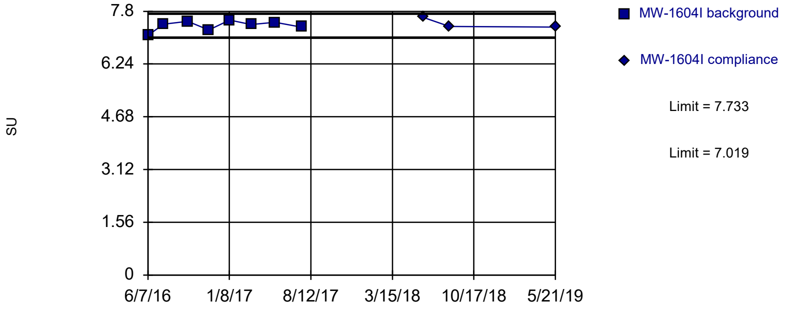
Constituent: pH, field Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.376, Std. Dev.=0.1483, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9201, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

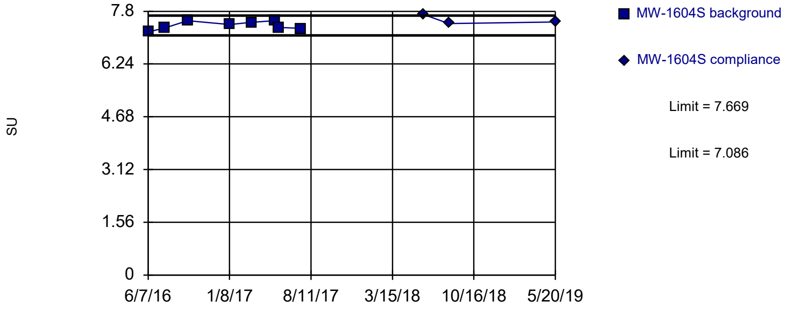
Constituent: pH, field Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.378, Std. Dev.=0.1209, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9219, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

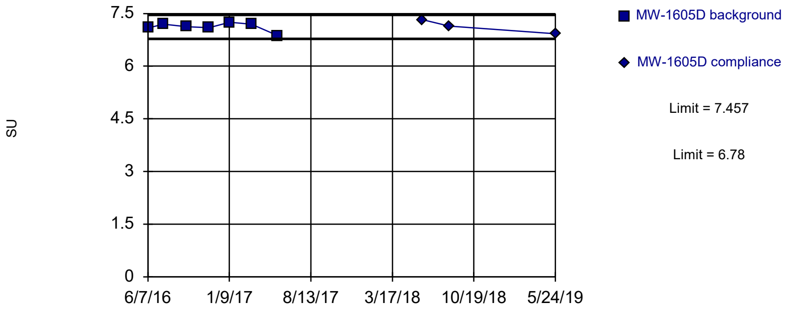
Constituent: pH, field Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.119, Std. Dev.=0.1248, n=7. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.864, critical = 0.73. Kappa = 2.713 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

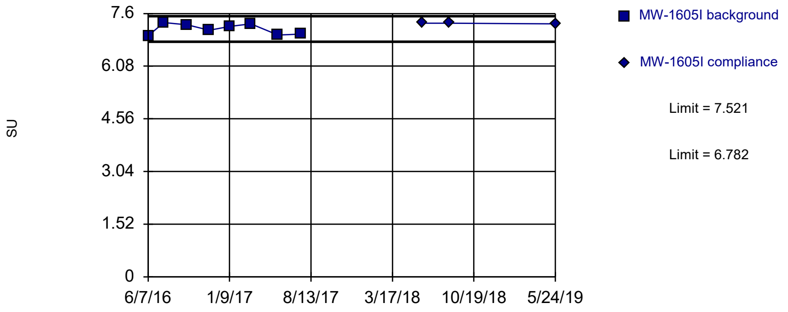
Constituent: pH, field Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.151, Std. Dev.=0.1535, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8883, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

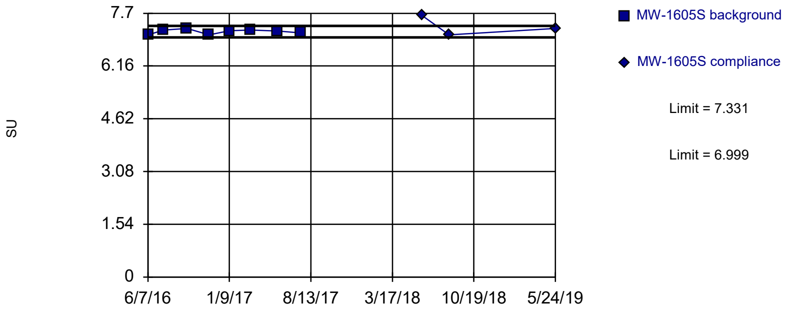
Constituent: pH, field Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.165, Std. Dev.=0.06887, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9097, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

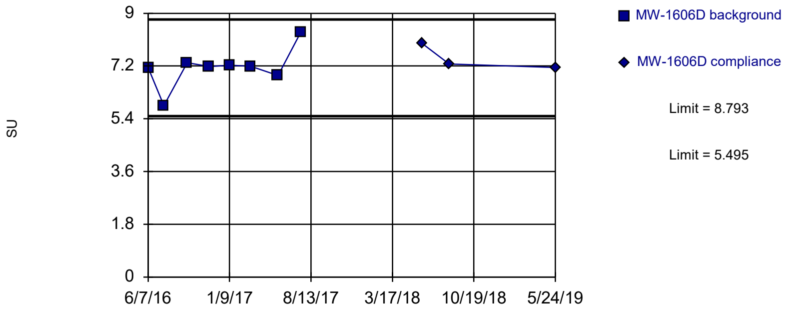
Constituent: pH, field Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



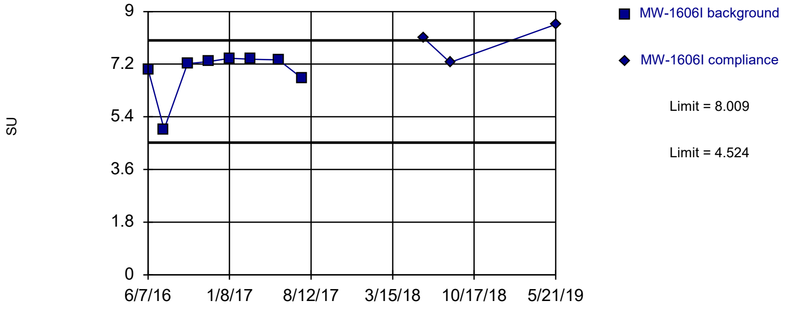
Background Data Summary: Mean=7.144, Std. Dev.=0.6851, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8564, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

Constituent: pH, field Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Exceeds Limits

Prediction Limit

Intrawell Parametric



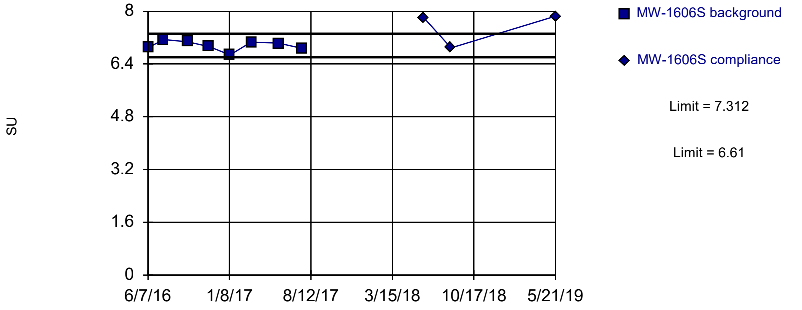
Background Data Summary (based on x^5 transformation): Mean=17422, Std. Dev.=6451, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7638, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

Constituent: pH, field Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Exceeds Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=6.961, Std. Dev.=0.1457, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9307, critical = 0.749. Kappa = 2.407 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016.

Constituent: pH, field Analysis Run 8/10/2019 9:32 AM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Trend Test Summary Table - Significant Results

Rockport BAP Client: Geosyntec Data: Rockport_BAP Printed 8/8/2019, 5:09 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Chloride, total (mg/L)	**MW-1601S (bg)**	**-4.928**	**-45**	**-34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**

Trend Test Summary Table - All Results

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP   Printed 8/8/2019, 5:09 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Boron, total (mg/L)	MW-1600D (bg)	0.02295	32	34	No	11	18.18	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1600I (bg)	0.01492	25	34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1600S (bg)	0.01547	20	34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1601D (bg)	0.02128	19	34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1601I (bg)	0.01406	23	30	No	10	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1601S (bg)	-0.01272	-9	-34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1002	-0.05402	-12	-34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1603S	-0.1056	-16	-34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1604I	0.02645	13	34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1604S	-0.06609	-21	-34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1605S	-0.02503	-15	-34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1701S (bg)	0.01877	7	18	No	7	14.29	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1702D (bg)	-0.05065	-7	-18	No	7	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1702I (bg)	0.01761	3	18	No	7	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1702S (bg)	-0.009419	-3	-18	No	7	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1701D (bg)	-0.01171	-3	-18	No	7	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1701I (bg)	-0.02761	-7	-18	No	7	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1600D (bg)	0.2584	2	34	No	11	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1600I (bg)	-2.043	-20	-34	No	11	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1600S (bg)	-2.79	-24	-34	No	11	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1601D (bg)	-0.5984	-3	-34	No	11	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1601I (bg)	1.456	7	30	No	10	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1601S (bg)	0.1014	1	34	No	11	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1606I	5.808	23	34	No	11	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1701S (bg)	3.307	3	18	No	7	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1702D (bg)	7.617	13	18	No	7	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1702I (bg)	3.434	6	18	No	7	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1702S (bg)	-5.942	-5	-18	No	7	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1701D (bg)	-1.36	-3	-18	No	7	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1701I (bg)	-3.211	-3	-18	No	7	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1600D (bg)	0.1862	10	34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1600I (bg)	-0.4585	-8	-34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1600S (bg)	1.315	5	34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1601D (bg)	0.6192	8	34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1601I (bg)	-0.2483	-6	-30	No	10	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	**MW-1601S (bg)**	**-4.928**	**-45**	**-34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	MW-1002	-0.6852	-5	-34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1602D	-27.62	-27	-34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1603S	0.3719	3	34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1604I	-1.432	-7	-34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1604S	3.671	9	34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1701S (bg)	0.646	14	18	No	7	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1702D (bg)	0.3925	4	18	No	7	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1702I (bg)	2.221	13	18	No	7	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1702S (bg)	0.7935	12	18	No	7	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1701D (bg)	-2.517	-7	-18	No	7	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1701I (bg)	0.6404	4	18	No	7	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1600D (bg)	0.007157	11	34	No	11	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1600I (bg)	0.005028	6	34	No	11	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1600S (bg)	0.0765	30	34	No	11	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1601D (bg)	0	-7	-34	No	11	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1601I (bg)	0	5	30	No	10	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1601S (bg)	0.0266	8	34	No	11	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1002	-0.005313	-7	-34	No	11	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1604S	0.0338	9	34	No	11	0	n/a	n/a	0.01	NP

Trend Test Summary Table - All Results

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP   Printed 8/8/2019, 5:09 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Fluoride, total (mg/L)	MW-1701S (bg)	0.047	15	18	No	7	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1702D (bg)	0	-1	-18	No	7	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1702I (bg)	0.006966	3	18	No	7	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1702S (bg)	0.09865	7	18	No	7	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1701D (bg)	0.02776	4	18	No	7	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1701I (bg)	0.02755	8	18	No	7	0	n/a	n/a	0.01	NP
pH, field (SU)	MW-1600D (bg)	-0.1043	-16	-34	No	11	0	n/a	n/a	0.01	NP
pH, field (SU)	MW-1600I (bg)	-0.04412	-4	-25	No	9	0	n/a	n/a	0.01	NP
pH, field (SU)	MW-1600S (bg)	0.1596	21	30	No	10	0	n/a	n/a	0.01	NP
pH, field (SU)	MW-1601D (bg)	-0.27	-27	-34	No	11	0	n/a	n/a	0.01	NP
pH, field (SU)	MW-1601I (bg)	-0.06518	-2	-25	No	9	0	n/a	n/a	0.01	NP
pH, field (SU)	MW-1601S (bg)	-0.06577	-15	-34	No	11	0	n/a	n/a	0.01	NP
pH, field (SU)	MW-1002	0.2071	11	34	No	11	0	n/a	n/a	0.01	NP
pH, field (SU)	MW-1606I	0.5034	25	34	No	11	0	n/a	n/a	0.01	NP
pH, field (SU)	MW-1606S	-0.01798	-3	-30	No	10	0	n/a	n/a	0.01	NP
pH, field (SU)	MW-1701S (bg)	-0.3278	-15	-18	No	7	0	n/a	n/a	0.01	NP
pH, field (SU)	MW-1702D (bg)	-0.1463	-5	-18	No	7	0	n/a	n/a	0.01	NP
pH, field (SU)	MW-1702I (bg)	-0.2577	-3	-18	No	7	0	n/a	n/a	0.01	NP
pH, field (SU)	MW-1702S (bg)	-0.5829	-5	-18	No	7	0	n/a	n/a	0.01	NP
pH, field (SU)	MW-1701D (bg)	0	0	18	No	7	0	n/a	n/a	0.01	NP
pH, field (SU)	MW-1701I (bg)	0.1177	3	18	No	7	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1600D (bg)	0	0	34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1600I (bg)	0.9374	9	34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1600S (bg)	-11.24	-27	-34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1601D (bg)	1.598	13	34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1601I (bg)	0	2	30	No	10	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1601S (bg)	-1.076	-3	-34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1002	8.975	17	34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1603S	9.522	12	34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1604I	-3.131	-2	-34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1604S	0.4834	2	34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1605I	-12.79	-31	-34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1605S	-8.343	-17	-34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1701S (bg)	-1.253	-15	-18	No	7	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1702D (bg)	-2.682	-12	-18	No	7	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1702I (bg)	-3.699	-6	-18	No	7	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1702S (bg)	-2.544	-13	-18	No	7	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1701D (bg)	1.78	1	18	No	7	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1701I (bg)	-4.193	-8	-18	No	7	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1600D (bg)	-6.7	-13	-34	No	11	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1600I (bg)	-7.276	-9	-34	No	11	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1600S (bg)	-13.97	-19	-34	No	11	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1601D (bg)	-10.11	-12	-34	No	11	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1601I (bg)	-2.407	-10	-30	No	10	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1601S (bg)	-21.36	-8	-34	No	11	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1603I	-26.97	-33	-34	No	11	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1603S	14.97	25	30	No	10	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1604I	-8.941	-7	-34	No	11	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1604S	16.24	17	34	No	11	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1605S	-1.17	-2	-34	No	11	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1701S (bg)	-10.97	-3	-18	No	7	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1702D (bg)	27.86	17	18	No	7	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1702I (bg)	8.975	4	14	No	6	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1702S (bg)	-7.065	-4	-18	No	7	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1701D (bg)	-18.19	-7	-14	No	6	0	n/a	n/a	0.01	NP

Trend Test Summary Table - All Results

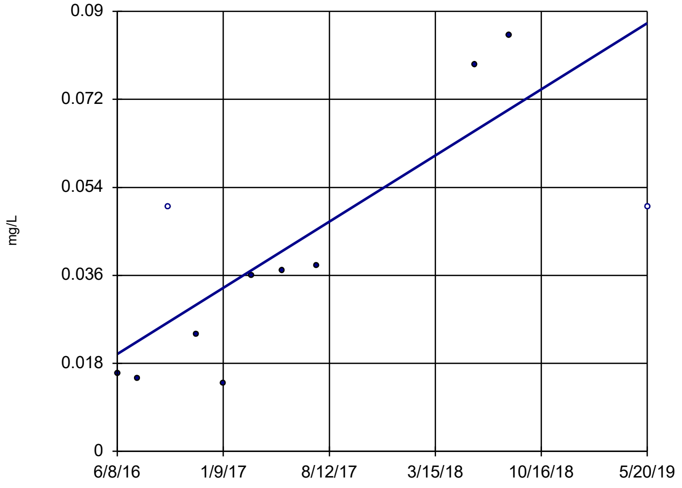
Rockport BAP Client: Geosyntec Data: Rockport_BAP Printed 8/8/2019, 5:09 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Total Dissolved Solids [TDS] (mg/L)	MW-1701I (bg)	-1.534	-2	-18	No	7	0	n/a	n/a	0.01	NP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

MW-1600D (bg)



n = 11

Slope = 0.02295 units per year.

Mann-Kendall statistic = 32 critical = 34

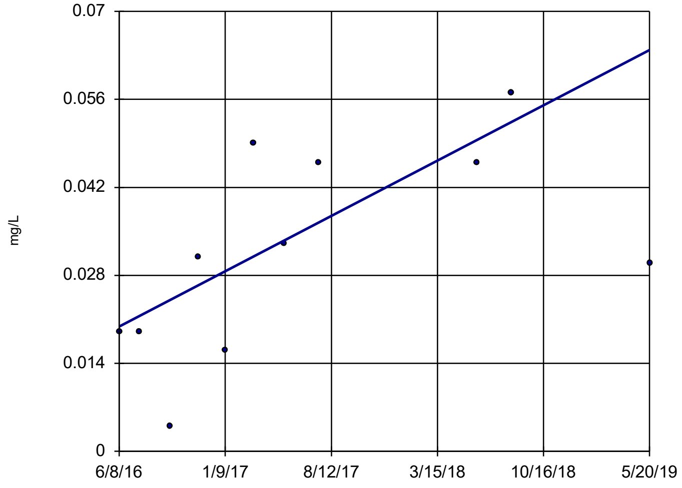
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total   Analysis Run 8/8/2019 5:05 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1600I (bg)



n = 11

Slope = 0.01492 units per year.

Mann-Kendall statistic = 25 critical = 34

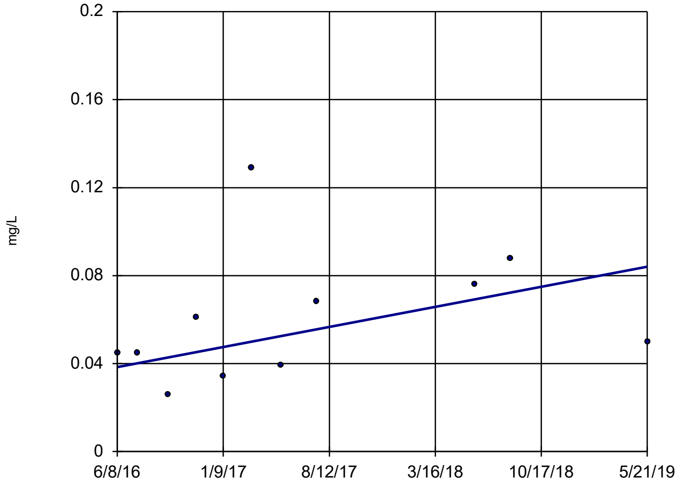
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total   Analysis Run 8/8/2019 5:05 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1600S (bg)



n = 11

Slope = 0.01547 units per year.

Mann-Kendall statistic = 20 critical = 34

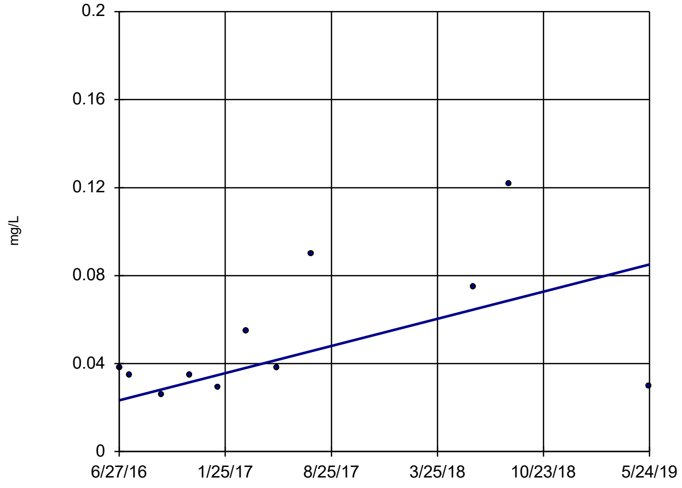
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total   Analysis Run 8/8/2019 5:05 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1601D (bg)



n = 11

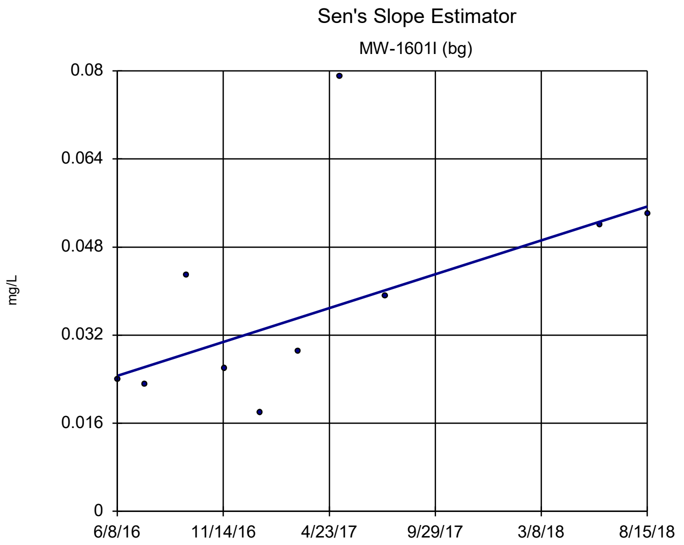
Slope = 0.02128 units per year.

Mann-Kendall statistic = 19 critical = 34

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total   Analysis Run 8/8/2019 5:05 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



n = 10

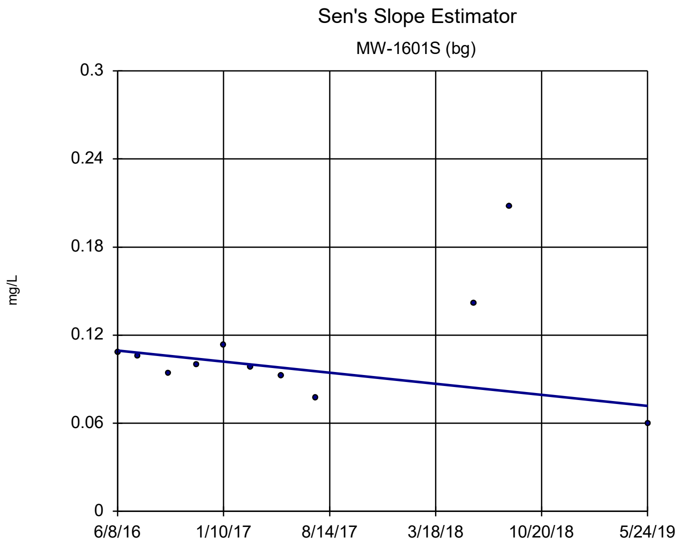
Slope = 0.01406
units per year.

Mann-Kendall
statistic = 23
critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 8/8/2019 5:05 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



n = 11

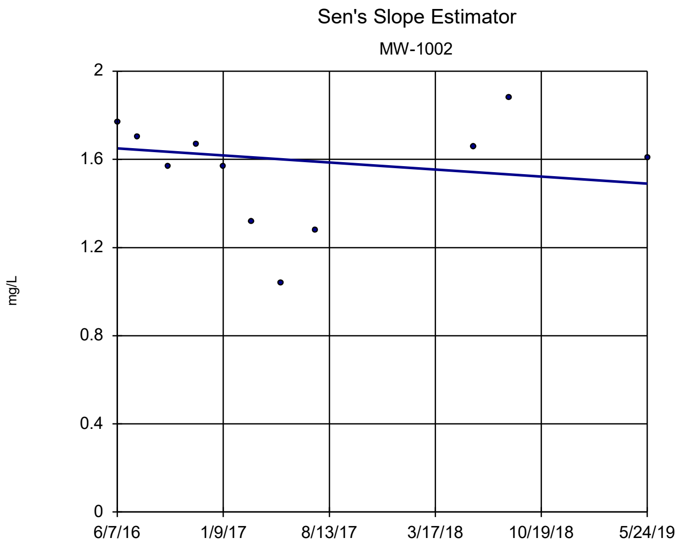
Slope = -0.01272
units per year.

Mann-Kendall
statistic = -9
critical = -34

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 8/8/2019 5:05 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



n = 11

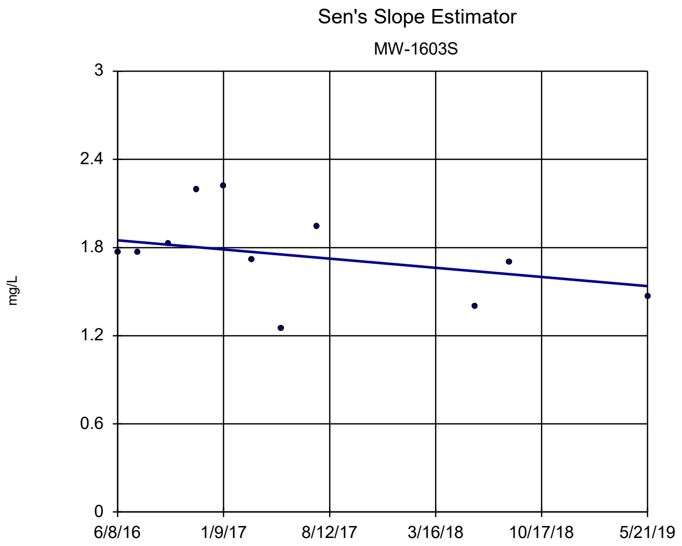
Slope = -0.05402
units per year.

Mann-Kendall
statistic = -12
critical = -34

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 8/8/2019 5:05 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



n = 11

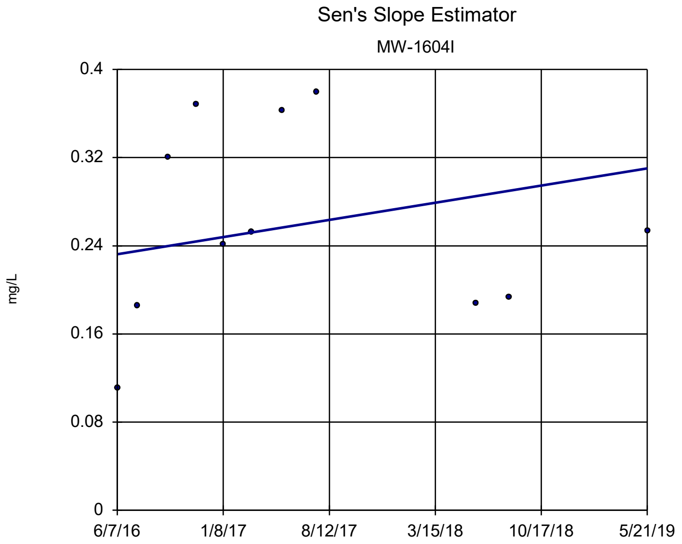
Slope = -0.1056
units per year.

Mann-Kendall
statistic = -16
critical = -34

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 8/8/2019 5:05 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



n = 11

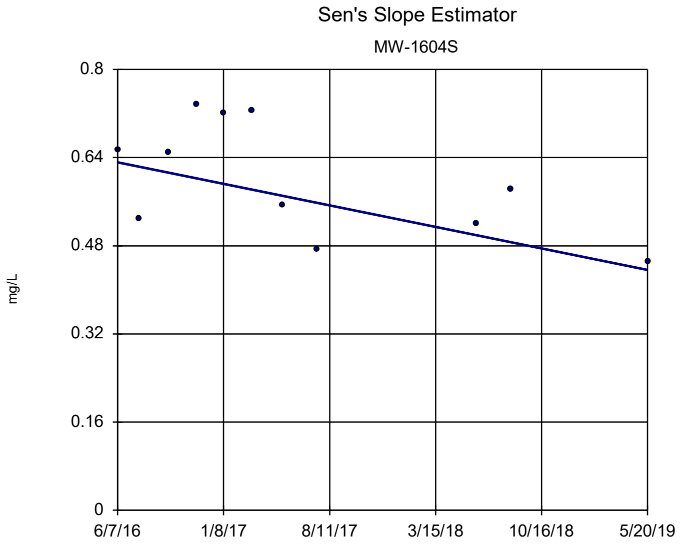
Slope = 0.02645
units per year.

Mann-Kendall
statistic = 13
critical = 34

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total   Analysis Run 8/8/2019 5:05 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



n = 11

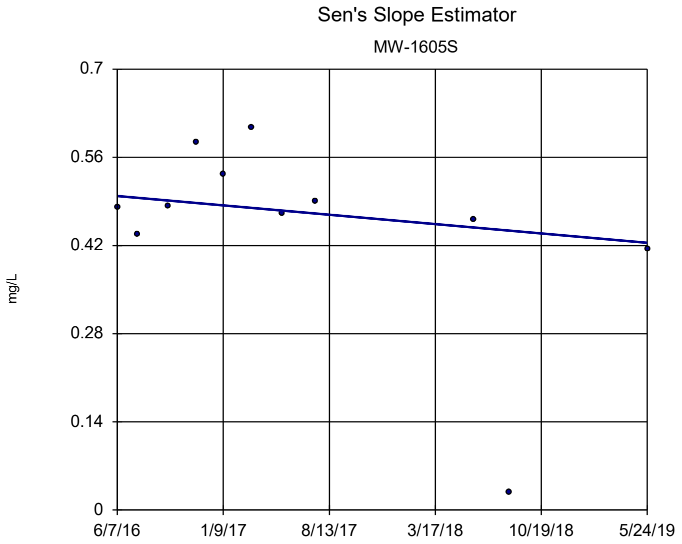
Slope = -0.06609
units per year.

Mann-Kendall
statistic = -21
critical = -34

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total   Analysis Run 8/8/2019 5:05 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



n = 11

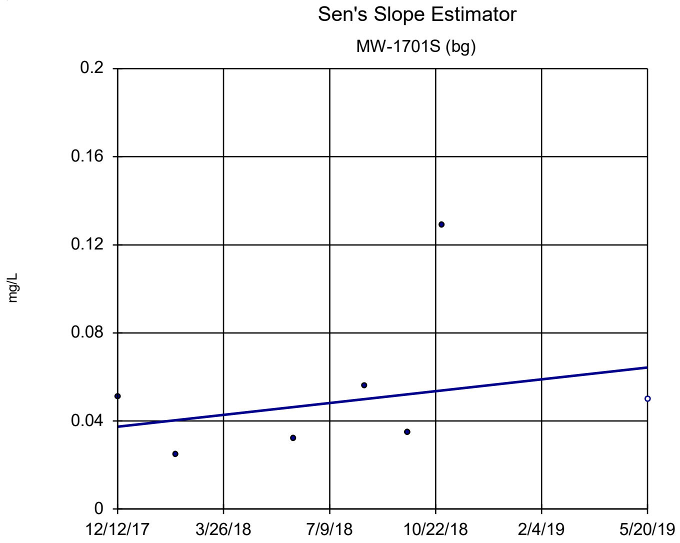
Slope = -0.02503
units per year.

Mann-Kendall
statistic = -15
critical = -34

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total   Analysis Run 8/8/2019 5:05 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



n = 7

Slope = 0.01877
units per year.

Mann-Kendall
statistic = 7
critical = 18

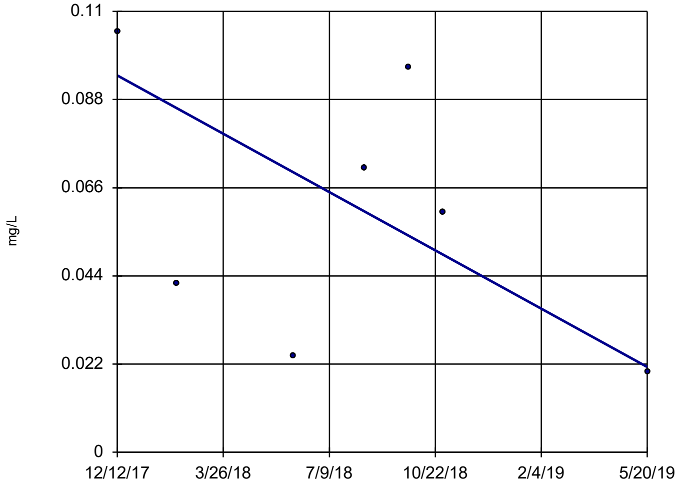
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total   Analysis Run 8/8/2019 5:05 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1702D (bg)



n = 7

Slope = -0.05065 units per year.

Mann-Kendall statistic = -7 critical = -18

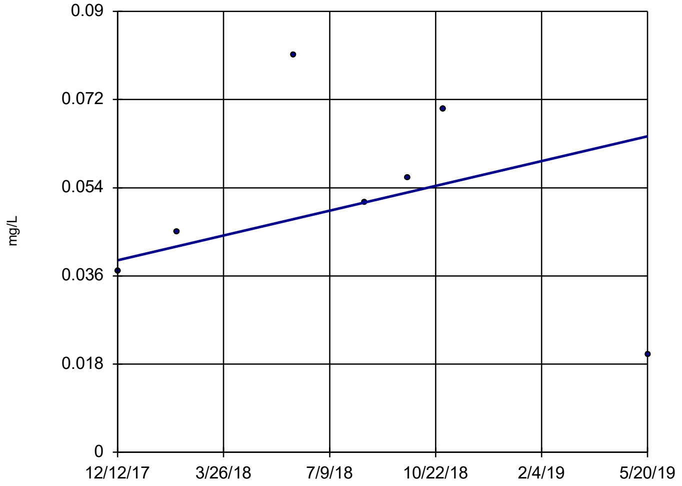
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 8/8/2019 5:05 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1702I (bg)



n = 7

Slope = 0.01761 units per year.

Mann-Kendall statistic = 3 critical = 18

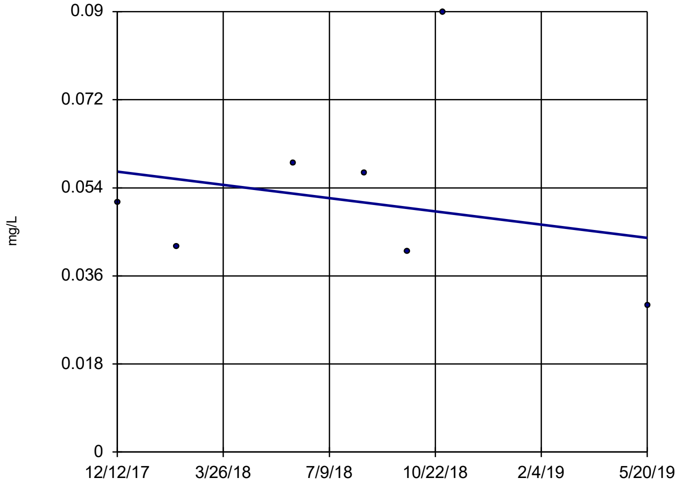
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 8/8/2019 5:05 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1702S (bg)



n = 7

Slope = -0.009419 units per year.

Mann-Kendall statistic = -3 critical = -18

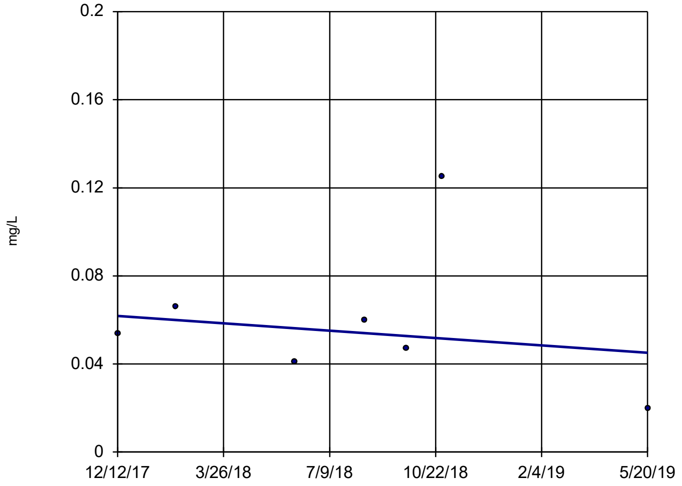
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 8/8/2019 5:05 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1701D (bg)



n = 7

Slope = -0.01171 units per year.

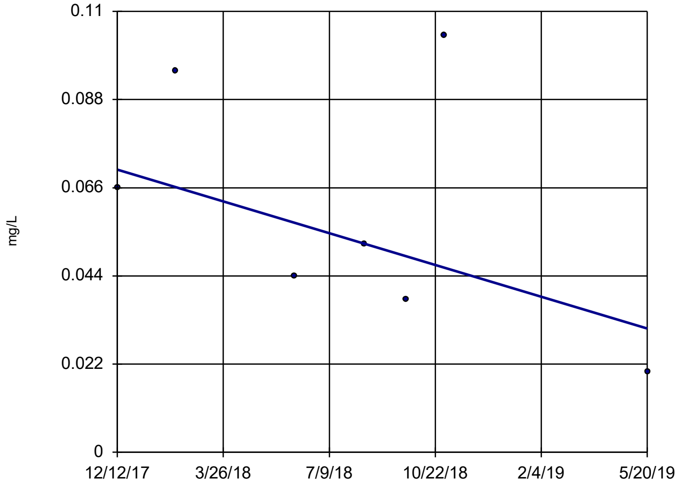
Mann-Kendall statistic = -3 critical = -18

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 8/8/2019 5:05 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sen's Slope Estimator

MW-1701I (bg)



n = 7

Slope = -0.02761 units per year.

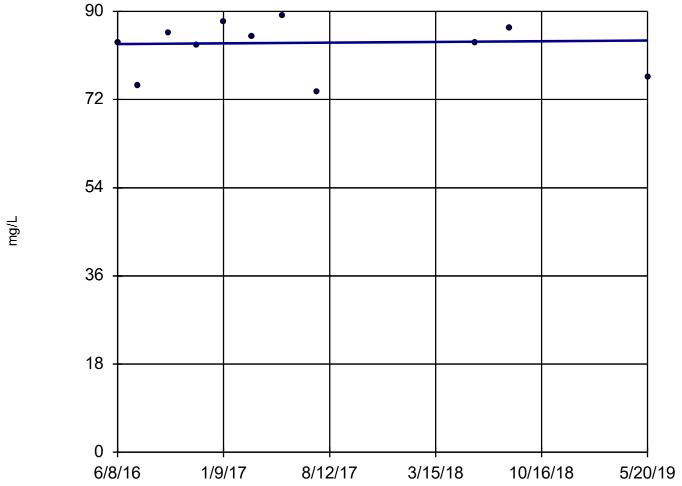
Mann-Kendall statistic = -7 critical = -18

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 8/8/2019 5:05 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sen's Slope Estimator

MW-1600D (bg)



n = 11

Slope = 0.2584 units per year.

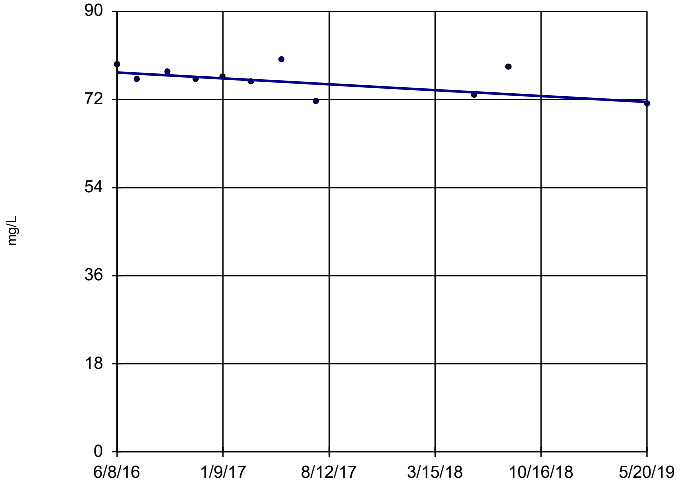
Mann-Kendall statistic = 2 critical = 34

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total Analysis Run 8/8/2019 5:05 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sen's Slope Estimator

MW-1600I (bg)



n = 11

Slope = -2.043 units per year.

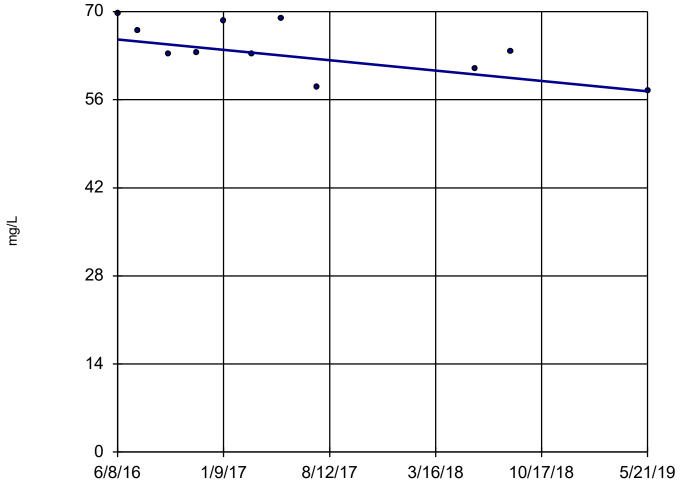
Mann-Kendall statistic = -20 critical = -34

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total Analysis Run 8/8/2019 5:05 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sen's Slope Estimator

MW-1600S (bg)



n = 11

Slope = -2.79 units per year.

Mann-Kendall statistic = -24 critical = -34

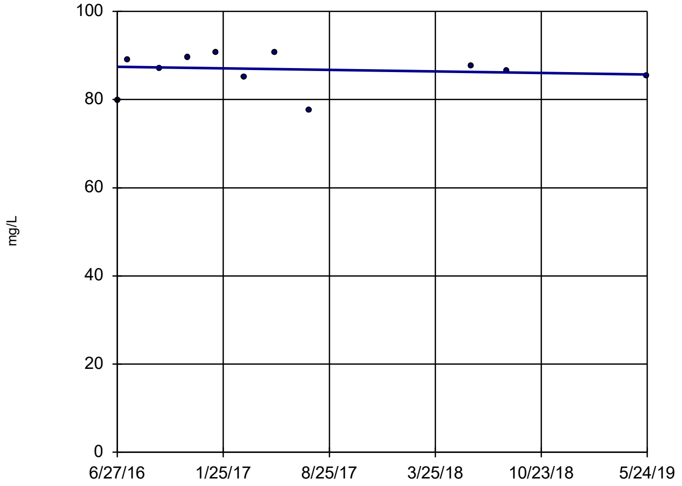
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total Analysis Run 8/8/2019 5:05 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1601D (bg)



n = 11

Slope = -0.5984 units per year.

Mann-Kendall statistic = -3 critical = -34

Trend not significant at 99% confidence level (α = 0.005 per tail).

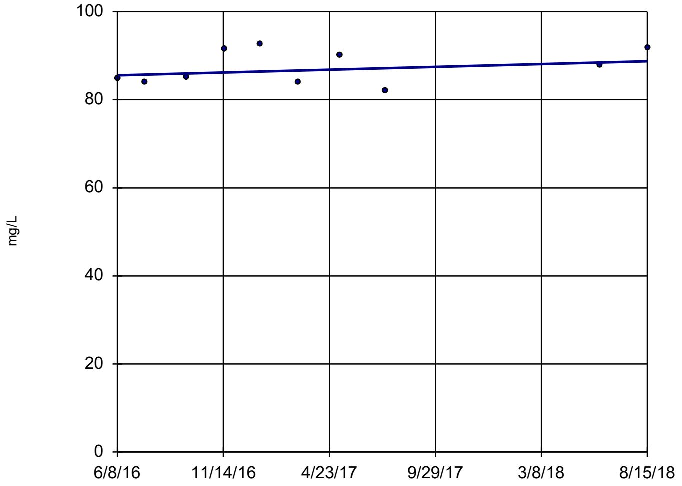
Constituent: Calcium, total Analysis Run 8/8/2019 5:05 PM View: Trend Tests

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1601I (bg)



n = 10

Slope = 1.456 units per year.

Mann-Kendall statistic = 7 critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

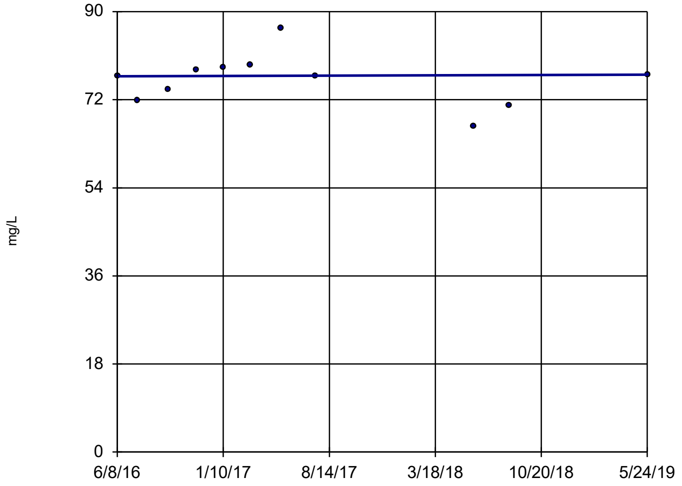
Constituent: Calcium, total Analysis Run 8/8/2019 5:05 PM View: Trend Tests

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1601S (bg)



n = 11

Slope = 0.1014 units per year.

Mann-Kendall statistic = 1 critical = 34

Trend not significant at 99% confidence level (α = 0.005 per tail).

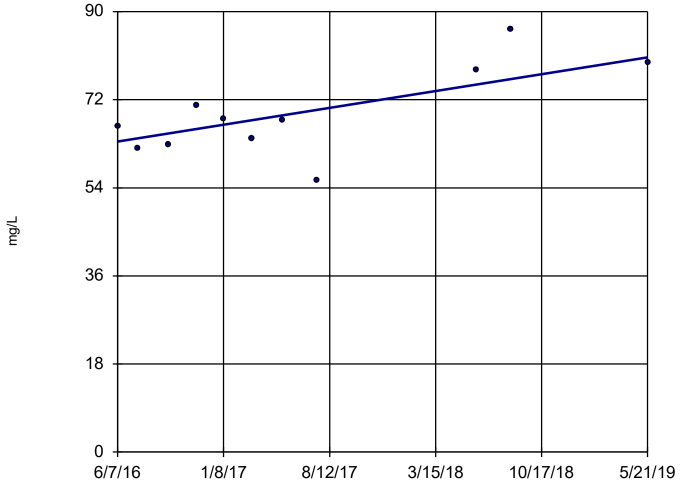
Constituent: Calcium, total Analysis Run 8/8/2019 5:05 PM View: Trend Tests

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1606I



n = 11

Slope = 5.808 units per year.

Mann-Kendall statistic = 23 critical = 34

Trend not significant at 99% confidence level (α = 0.005 per tail).

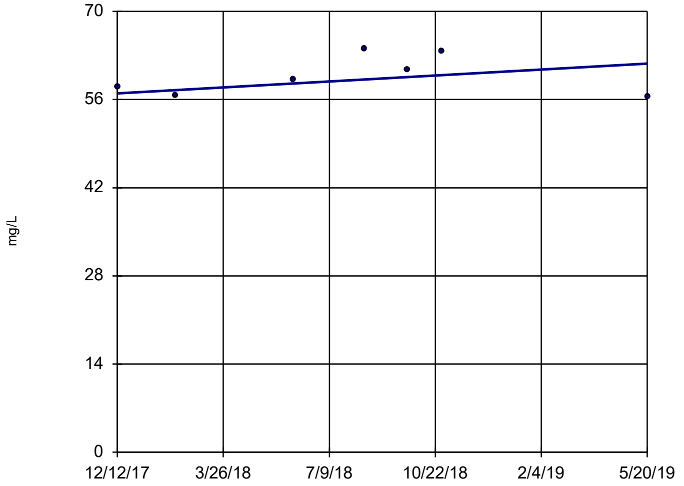
Constituent: Calcium, total Analysis Run 8/8/2019 5:05 PM View: Trend Tests

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1701S (bg)



n = 7

Slope = 3.307 units per year.

Mann-Kendall statistic = 3 critical = 18

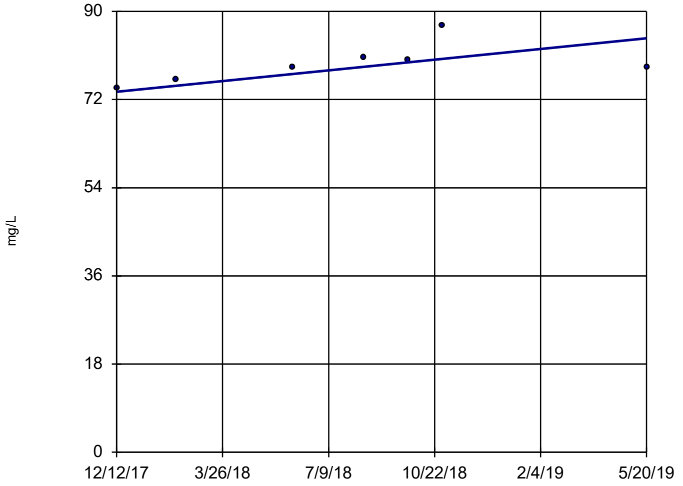
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total   Analysis Run 8/8/2019 5:05 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1702D (bg)



n = 7

Slope = 7.617 units per year.

Mann-Kendall statistic = 13 critical = 18

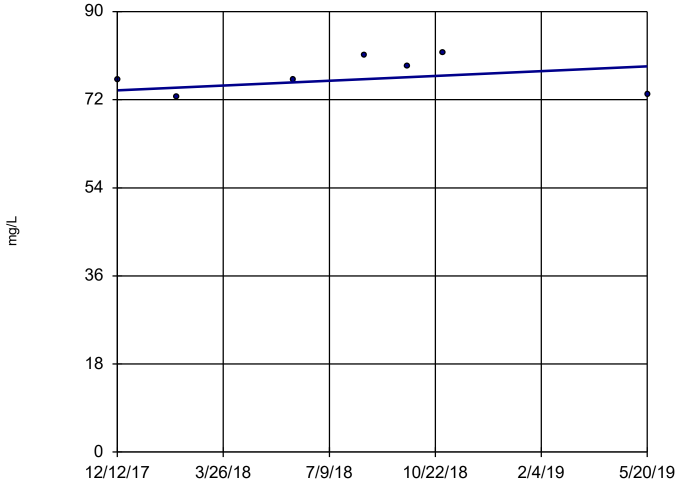
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total   Analysis Run 8/8/2019 5:05 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1702I (bg)



n = 7

Slope = 3.434 units per year.

Mann-Kendall statistic = 6 critical = 18

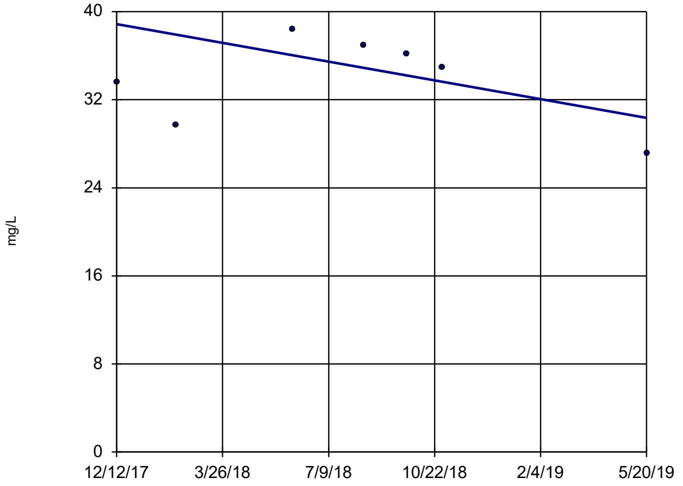
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total   Analysis Run 8/8/2019 5:05 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1702S (bg)



n = 7

Slope = -5.942 units per year.

Mann-Kendall statistic = -5 critical = -18

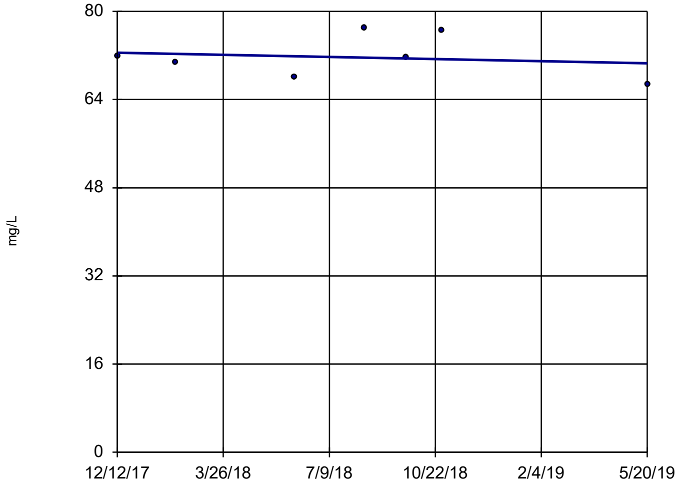
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total   Analysis Run 8/8/2019 5:05 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1701D (bg)



n = 7

Slope = -1.36 units per year.

Mann-Kendall statistic = -3 critical = -18

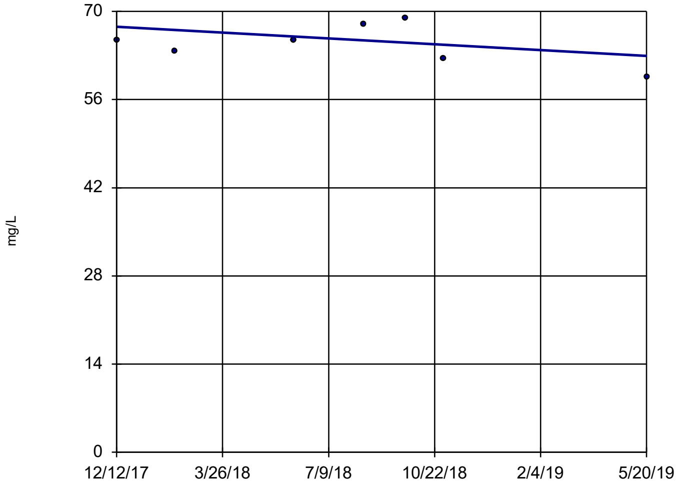
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total Analysis Run 8/8/2019 5:05 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1701I (bg)



n = 7

Slope = -3.211 units per year.

Mann-Kendall statistic = -3 critical = -18

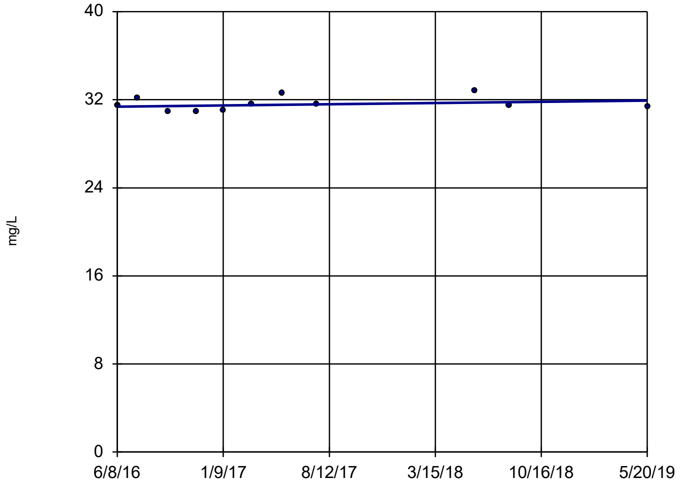
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total Analysis Run 8/8/2019 5:05 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1600D (bg)



n = 11

Slope = 0.1862 units per year.

Mann-Kendall statistic = 10 critical = 34

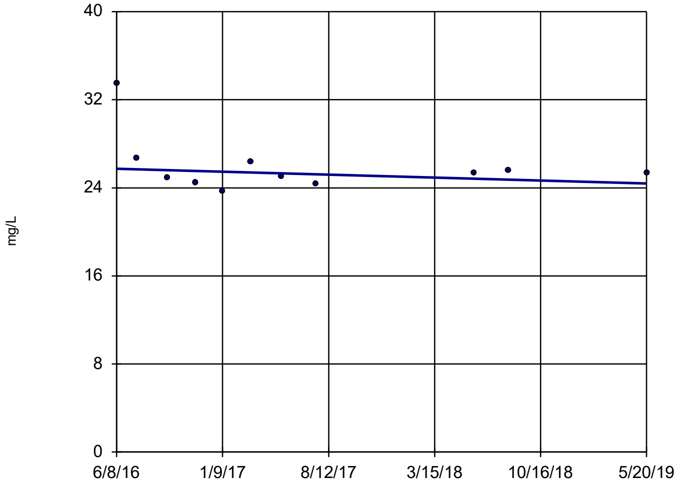
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 8/8/2019 5:05 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1600I (bg)



n = 11

Slope = -0.4585 units per year.

Mann-Kendall statistic = -8 critical = -34

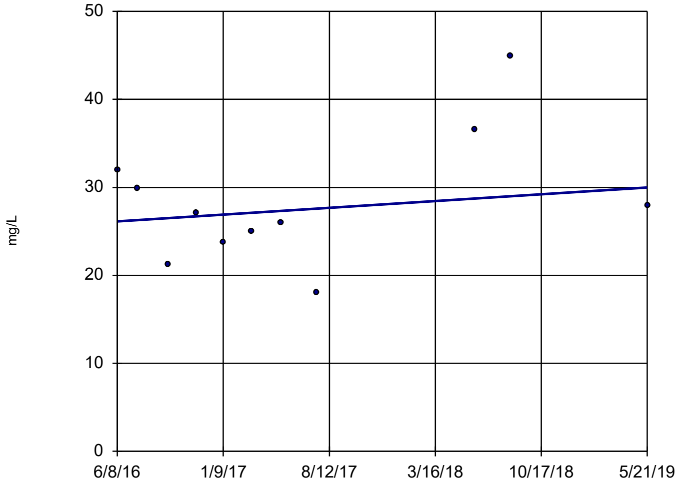
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 8/8/2019 5:05 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1600S (bg)



n = 11

Slope = 1.315 units per year.

Mann-Kendall statistic = 5 critical = 34

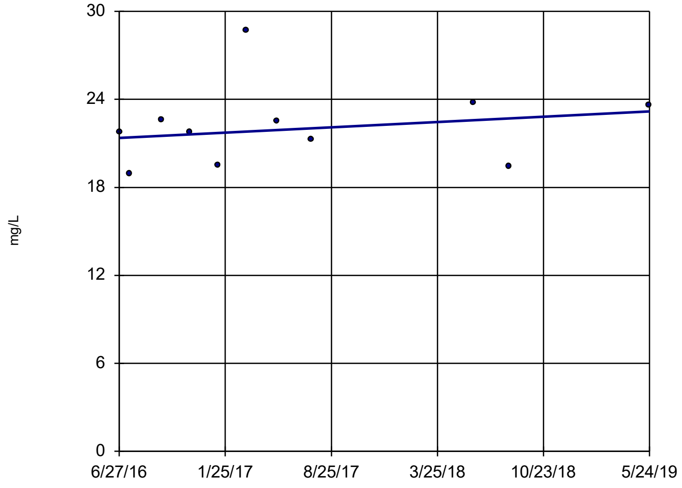
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1601D (bg)



n = 11

Slope = 0.6192 units per year.

Mann-Kendall statistic = 8 critical = 34

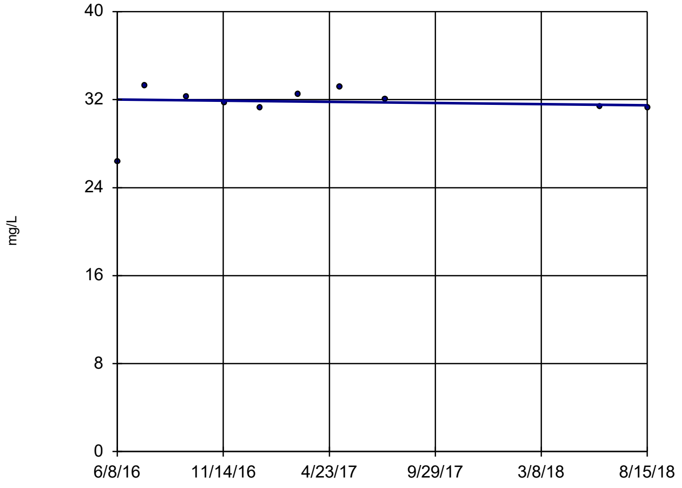
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1601I (bg)



n = 10

Slope = -0.2483 units per year.

Mann-Kendall statistic = -6 critical = -30

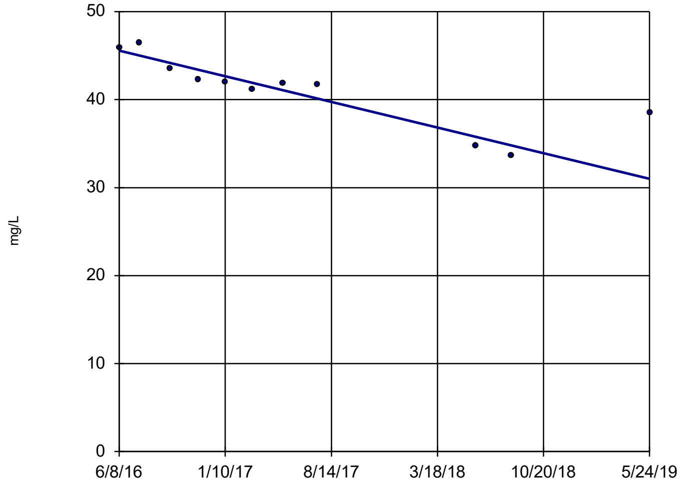
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1601S (bg)



n = 11

Slope = -4.928 units per year.

Mann-Kendall statistic = -45 critical = -34

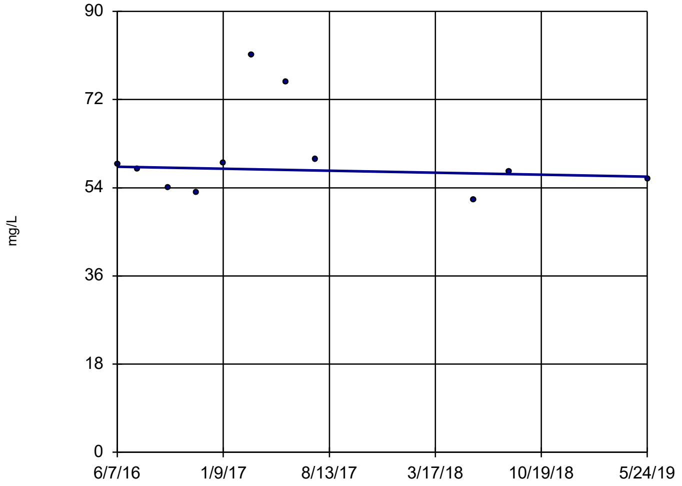
Decreasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1002



n = 11

Slope = -0.6852 units per year.

Mann-Kendall statistic = -5 critical = -34

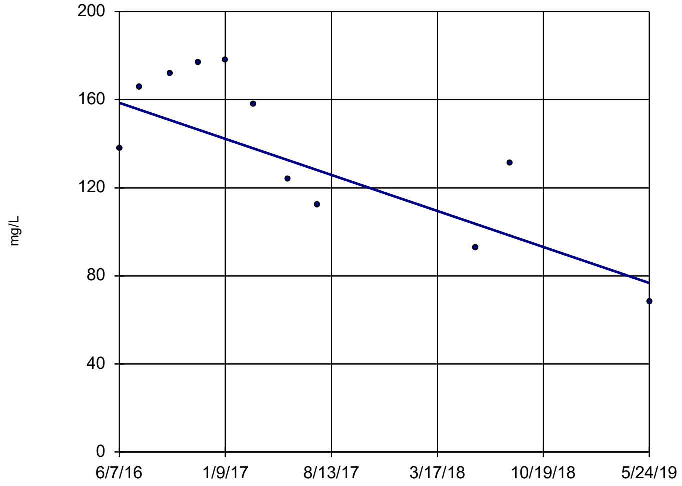
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1602D



n = 11

Slope = -27.62 units per year.

Mann-Kendall statistic = -27 critical = -34

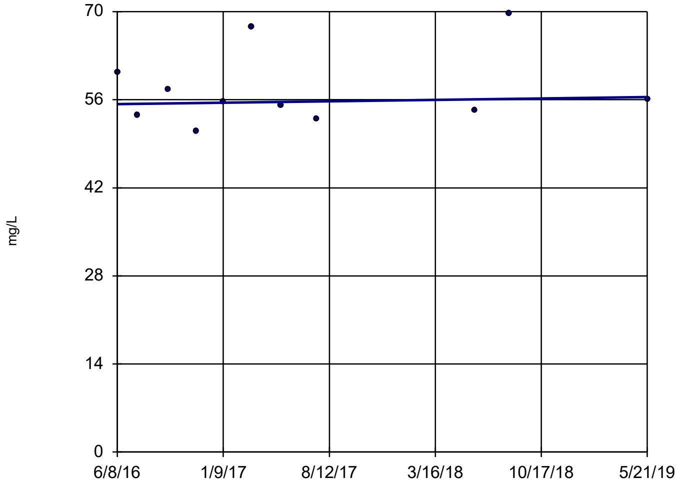
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1603S



n = 11

Slope = 0.3719 units per year.

Mann-Kendall statistic = 3 critical = 34

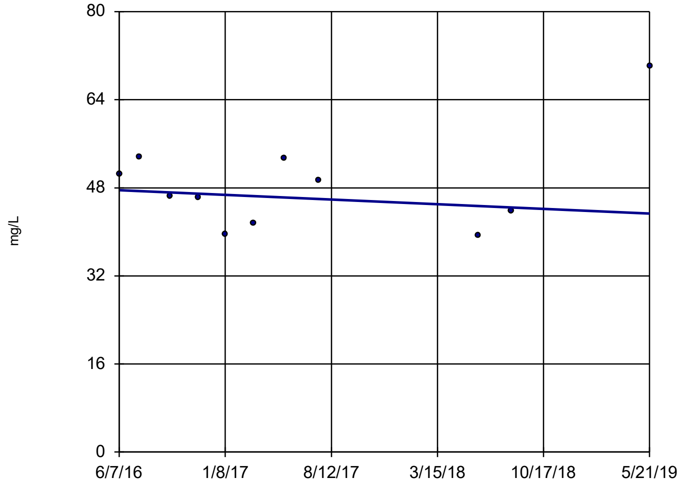
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1604I



n = 11

Slope = -1.432 units per year.

Mann-Kendall statistic = -7 critical = -34

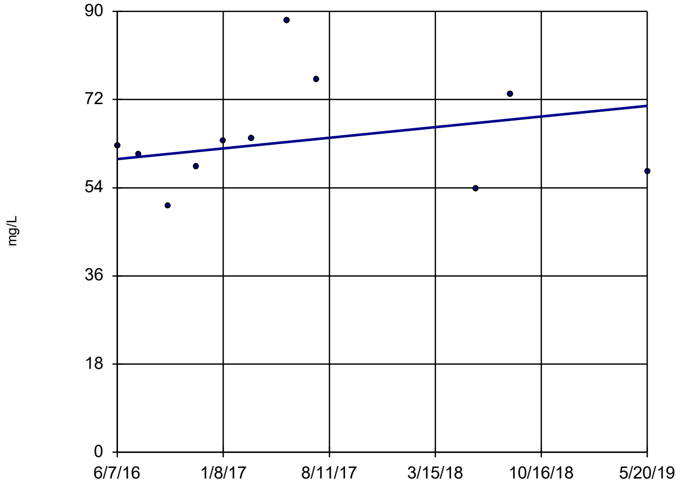
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1604S



n = 11

Slope = 3.671 units per year.

Mann-Kendall statistic = 9 critical = 34

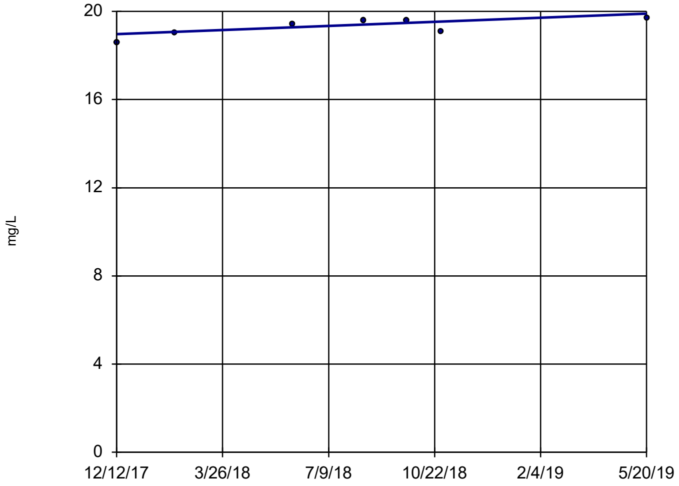
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total   Analysis Run 8/8/2019 5:06 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1701S (bg)



n = 7

Slope = 0.646 units per year.

Mann-Kendall statistic = 14 critical = 18

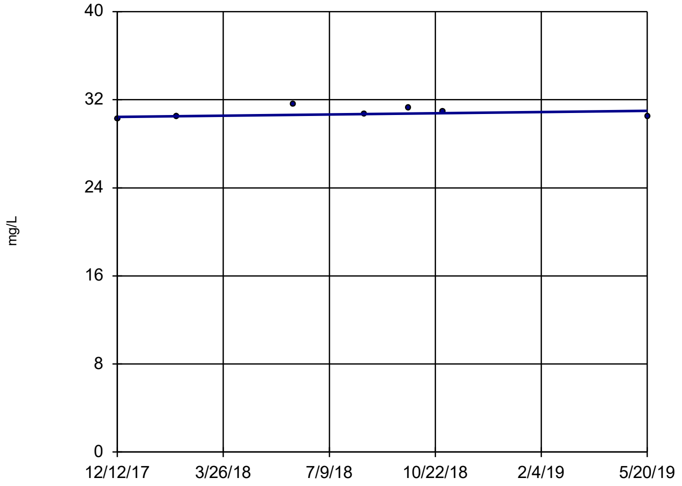
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total   Analysis Run 8/8/2019 5:06 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1702D (bg)



n = 7

Slope = 0.3925 units per year.

Mann-Kendall statistic = 4 critical = 18

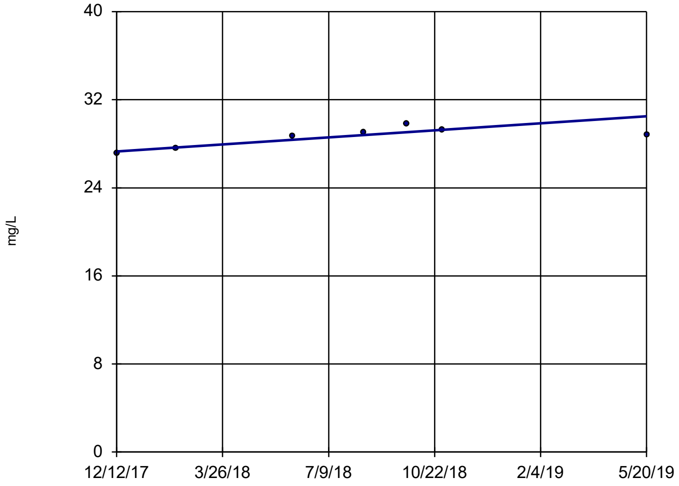
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total   Analysis Run 8/8/2019 5:06 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1702I (bg)



n = 7

Slope = 2.221 units per year.

Mann-Kendall statistic = 13 critical = 18

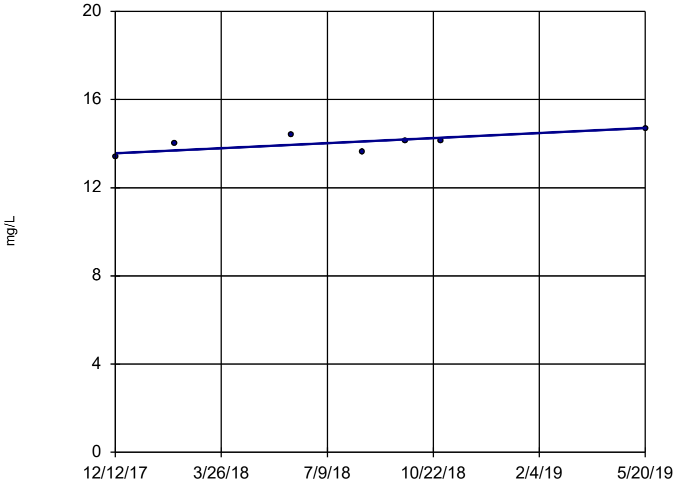
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total   Analysis Run 8/8/2019 5:06 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1702S (bg)



n = 7

Slope = 0.7935 units per year.

Mann-Kendall statistic = 12 critical = 18

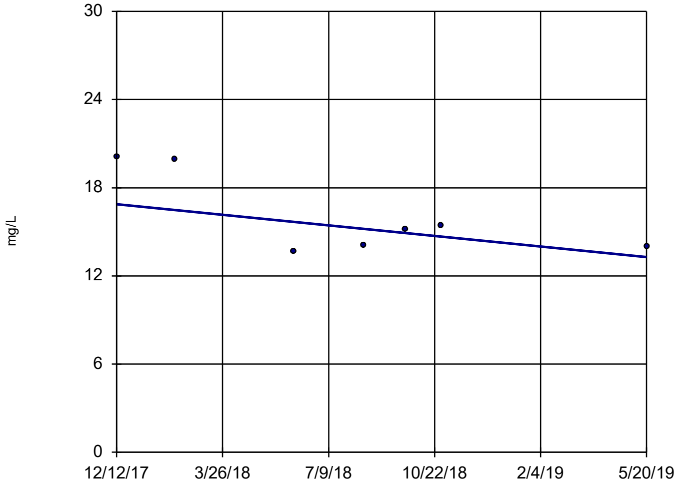
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1701D (bg)



n = 7

Slope = -2.517 units per year.

Mann-Kendall statistic = -7 critical = -18

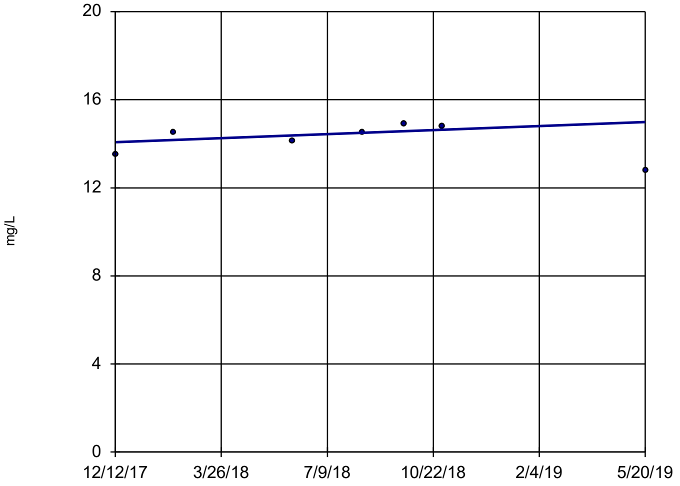
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1701I (bg)



n = 7

Slope = 0.6404 units per year.

Mann-Kendall statistic = 4 critical = 18

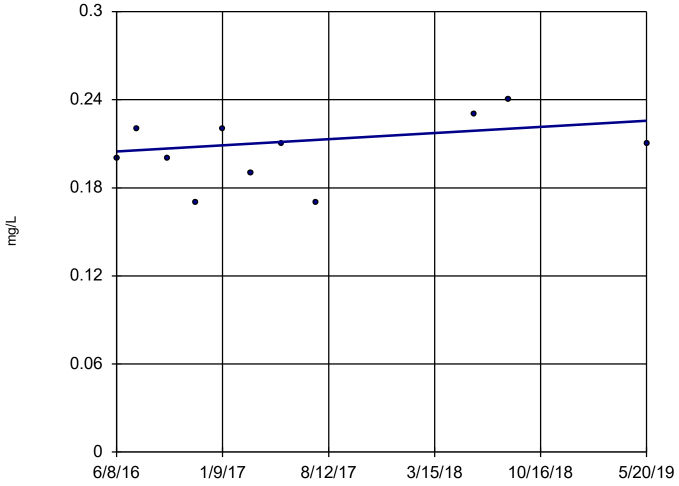
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1600D (bg)



n = 11

Slope = 0.007157 units per year.

Mann-Kendall statistic = 11 critical = 34

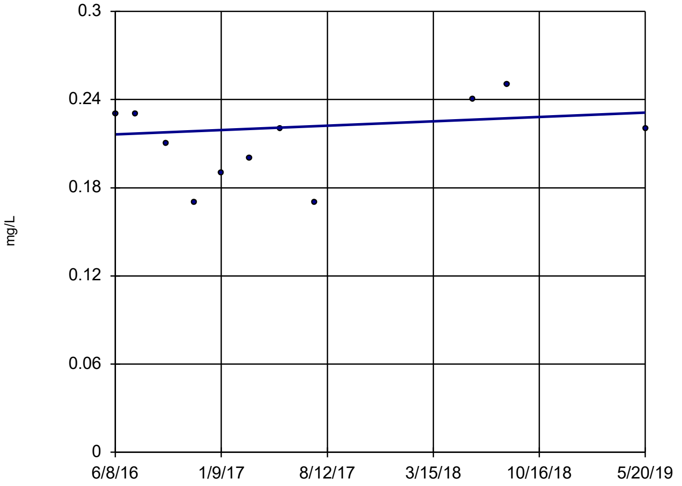
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Fluoride, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1600I (bg)



n = 11

Slope = 0.005028 units per year.

Mann-Kendall statistic = 6 critical = 34

Trend not significant at 99% confidence level (α = 0.005 per tail).

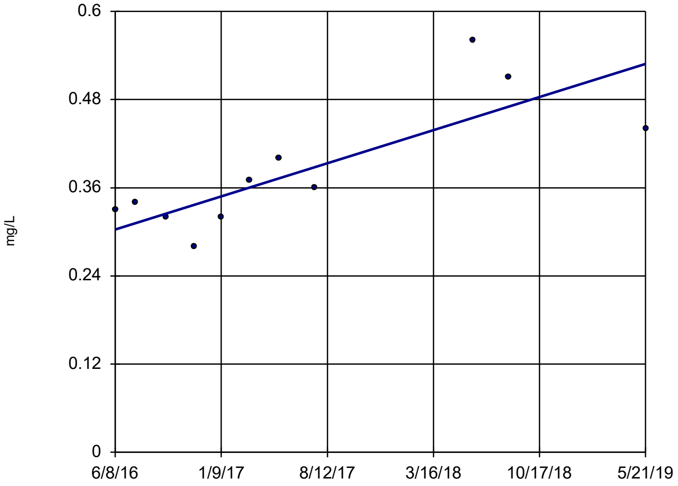
Constituent: Fluoride, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1600S (bg)



n = 11

Slope = 0.0765 units per year.

Mann-Kendall statistic = 30 critical = 34

Trend not significant at 99% confidence level (α = 0.005 per tail).

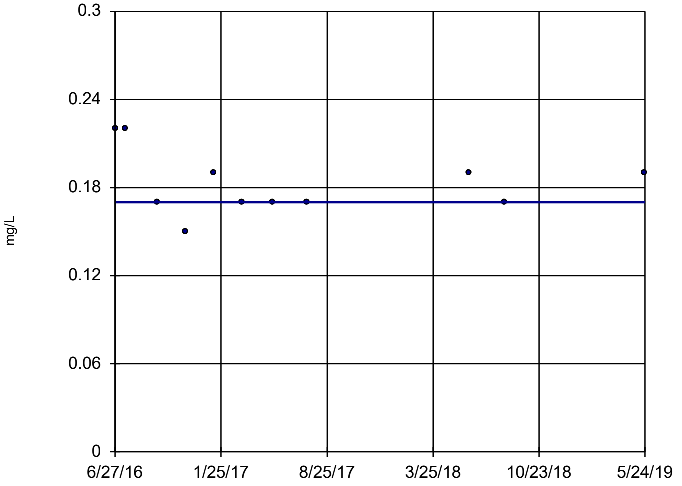
Constituent: Fluoride, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1601D (bg)



n = 11

Slope = 0 units per year.

Mann-Kendall statistic = -7 critical = -34

Trend not significant at 99% confidence level (α = 0.005 per tail).

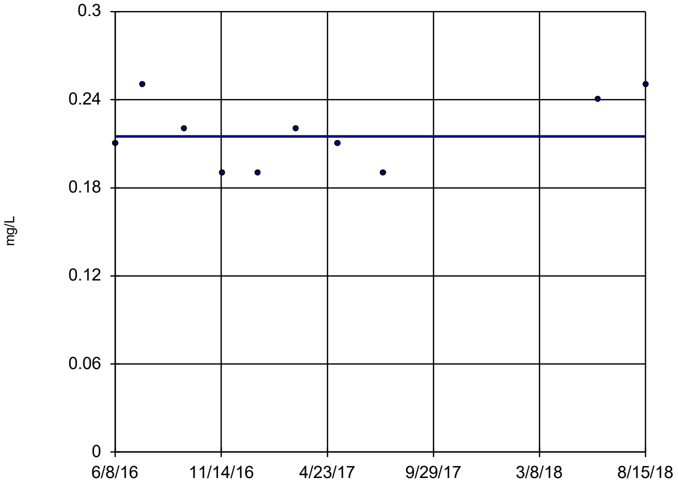
Constituent: Fluoride, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1601I (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).

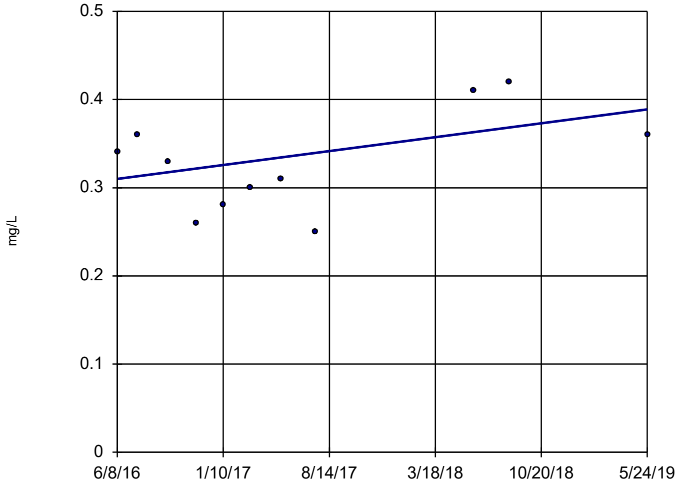
Constituent: Fluoride, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1601S (bg)



n = 11

Slope = 0.0266 units per year.

Mann-Kendall statistic = 8 critical = 34

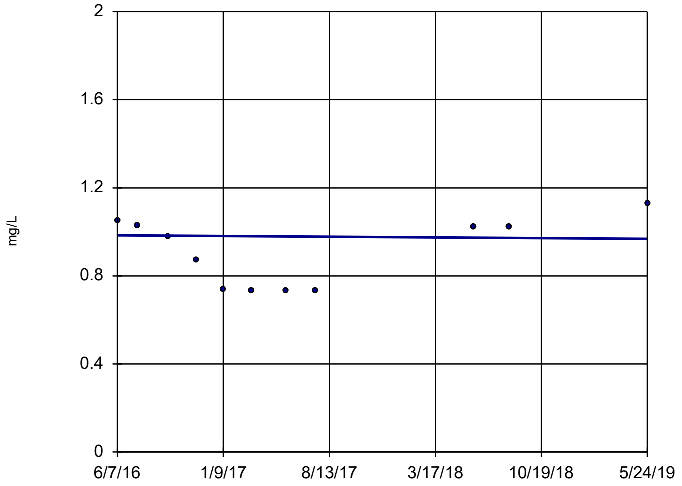
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Fluoride, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1002



n = 11

Slope = -0.005313 units per year.

Mann-Kendall statistic = -7 critical = -34

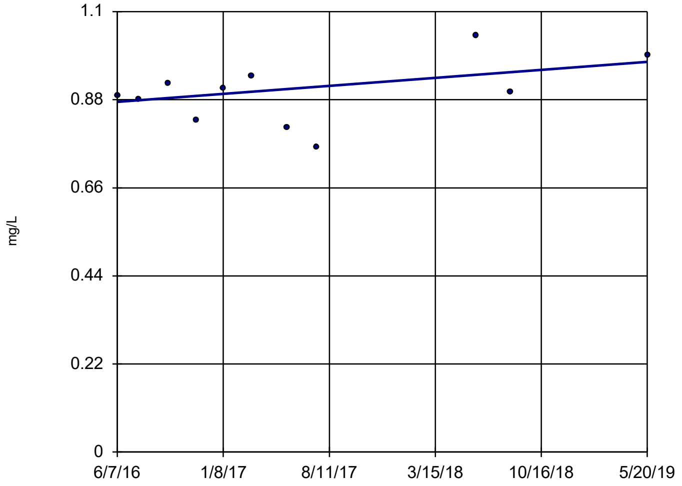
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Fluoride, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1604S



n = 11

Slope = 0.0338 units per year.

Mann-Kendall statistic = 9 critical = 34

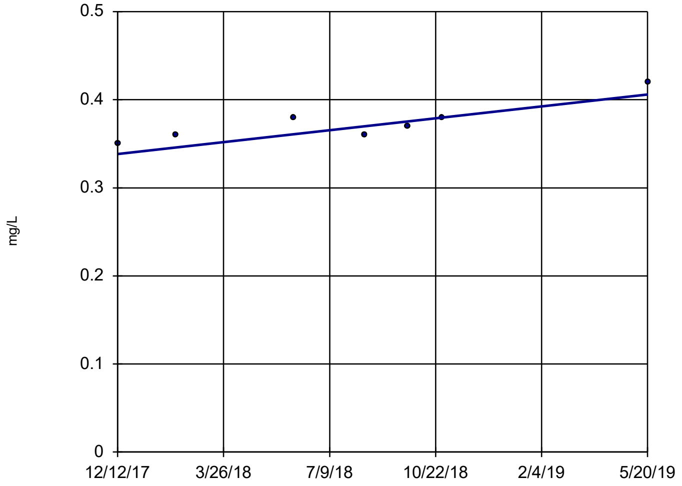
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Fluoride, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1701S (bg)



n = 7

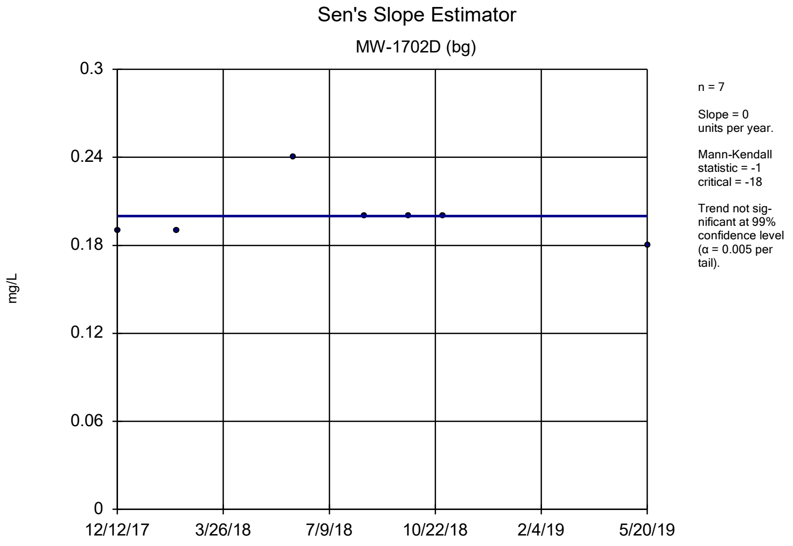
Slope = 0.047 units per year.

Mann-Kendall statistic = 15 critical = 18

Trend not significant at 99% confidence level (α = 0.005 per tail).

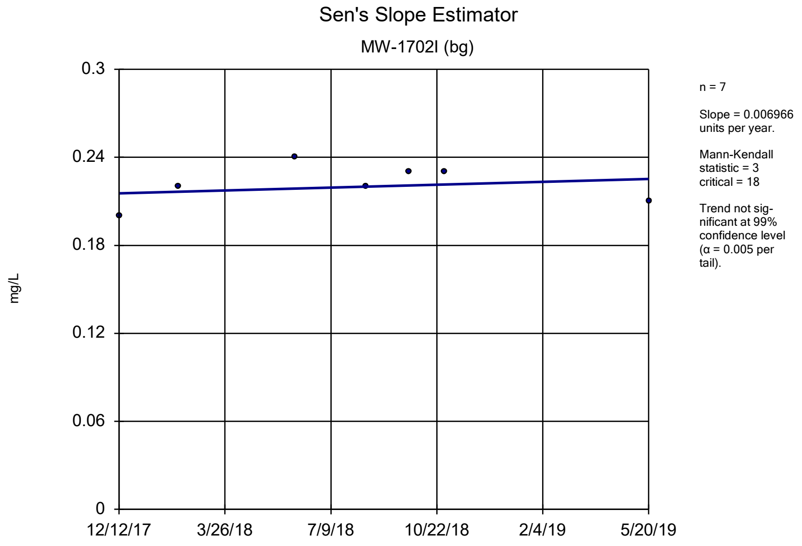
Constituent: Fluoride, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



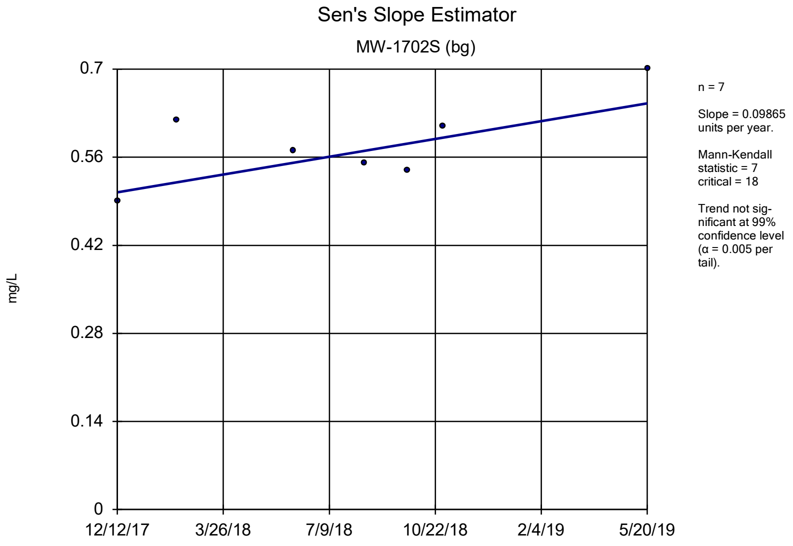
Constituent: Fluoride, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



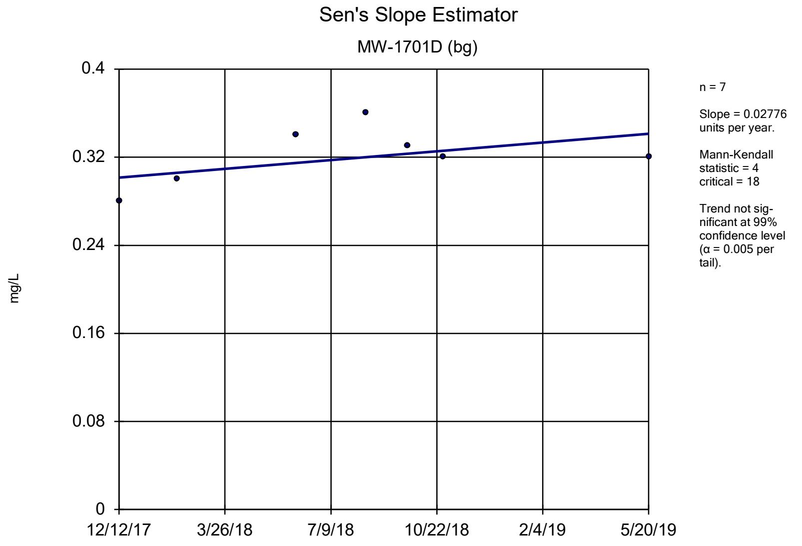
Constituent: Fluoride, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



Constituent: Fluoride, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

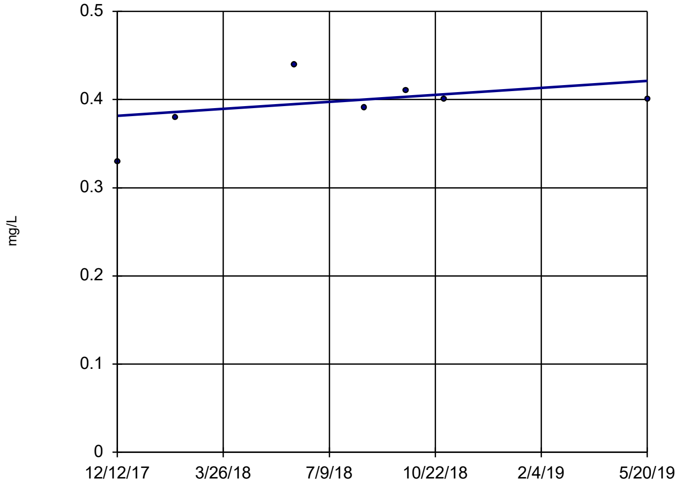


Constituent: Fluoride, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1701I (bg)



n = 7

Slope = 0.02755 units per year.

Mann-Kendall statistic = 8 critical = 18

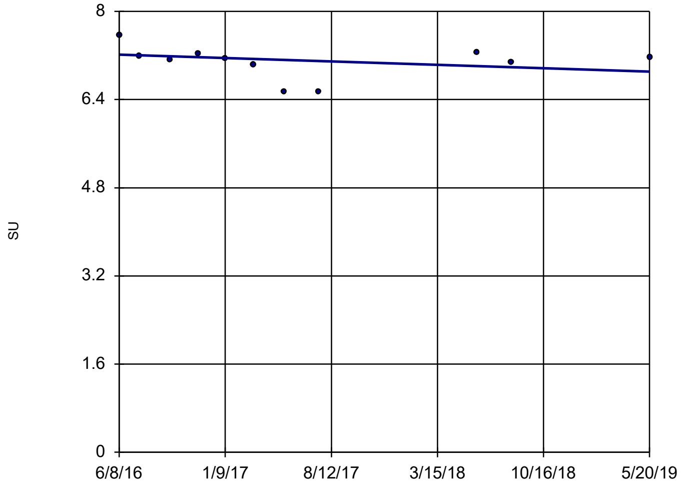
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Fluoride, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1600D (bg)



n = 11

Slope = -0.1043 units per year.

Mann-Kendall statistic = -16 critical = -34

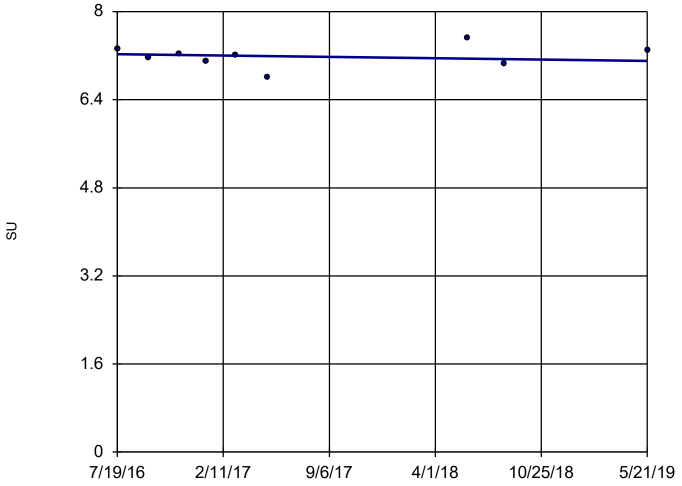
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: pH, field Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1600I (bg)



n = 9

Slope = -0.04412 units per year.

Mann-Kendall statistic = -4 critical = -25

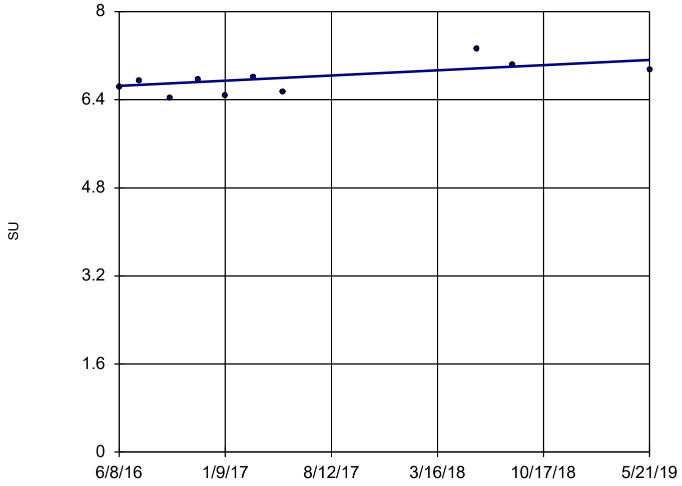
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: pH, field Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1600S (bg)



n = 10

Slope = 0.1596 units per year.

Mann-Kendall statistic = 21 critical = 30

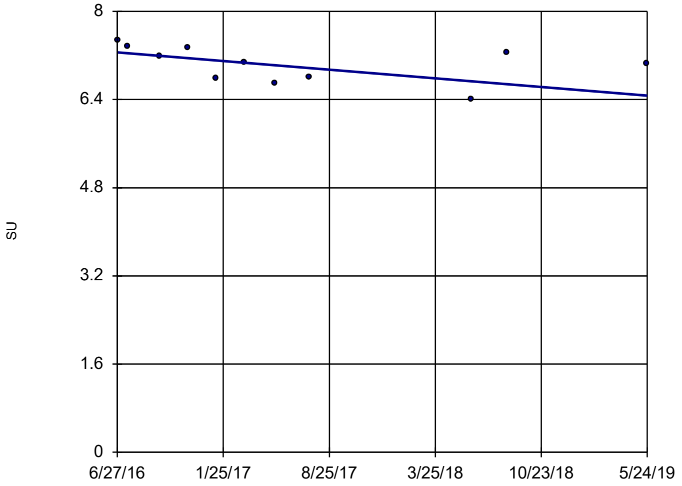
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: pH, field Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1601D (bg)



n = 11

Slope = -0.27
units per year.

Mann-Kendall
statistic = -27
critical = -34

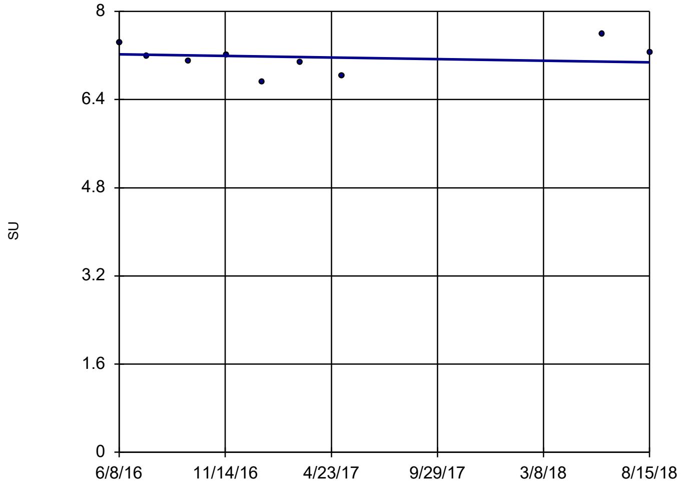
Trend not significant at 99%
confidence level
(α = 0.005 per
tail).

Constituent: pH, field Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1601I (bg)



n = 9

Slope = -0.06518
units per year.

Mann-Kendall
statistic = -2
critical = -25

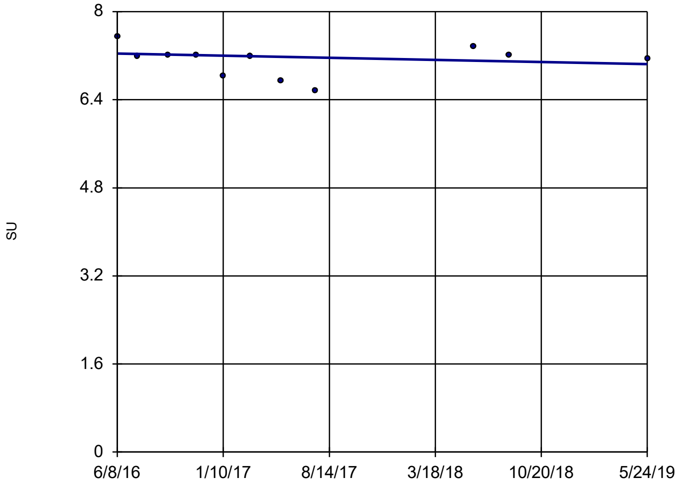
Trend not significant at 99%
confidence level
(α = 0.005 per
tail).

Constituent: pH, field Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1601S (bg)



n = 11

Slope = -0.06577
units per year.

Mann-Kendall
statistic = -15
critical = -34

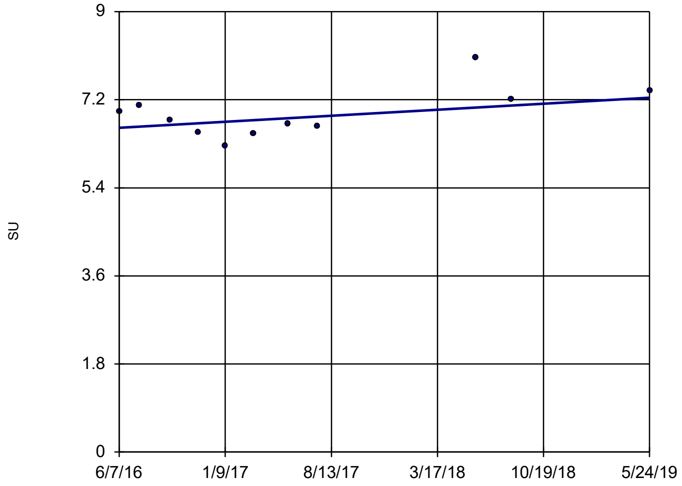
Trend not significant at 99%
confidence level
(α = 0.005 per
tail).

Constituent: pH, field Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1002



n = 11

Slope = 0.2071
units per year.

Mann-Kendall
statistic = 11
critical = 34

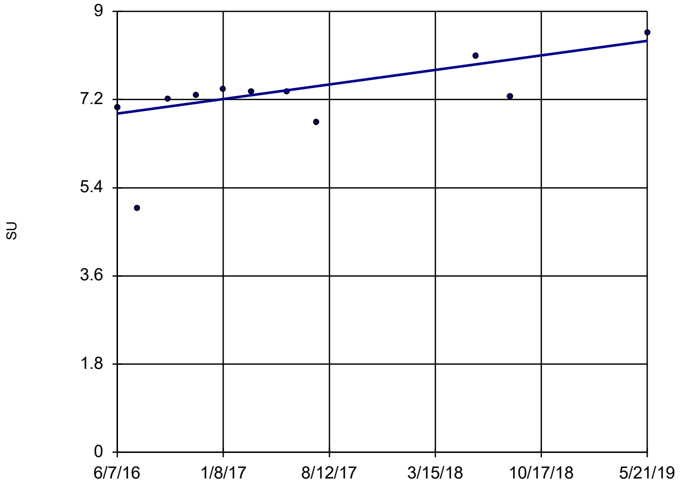
Trend not significant at 99%
confidence level
(α = 0.005 per
tail).

Constituent: pH, field Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1606I



n = 11

Slope = 0.5034 units per year.

Mann-Kendall statistic = 25 critical = 34

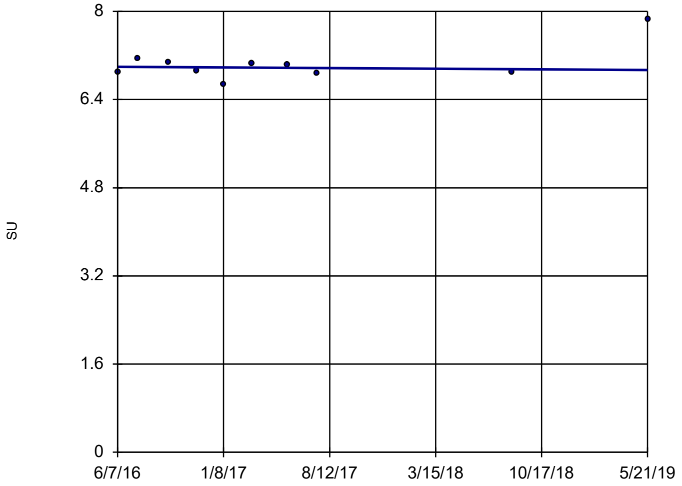
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: pH, field Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1606S



n = 10

Slope = -0.01798 units per year.

Mann-Kendall statistic = -3 critical = -30

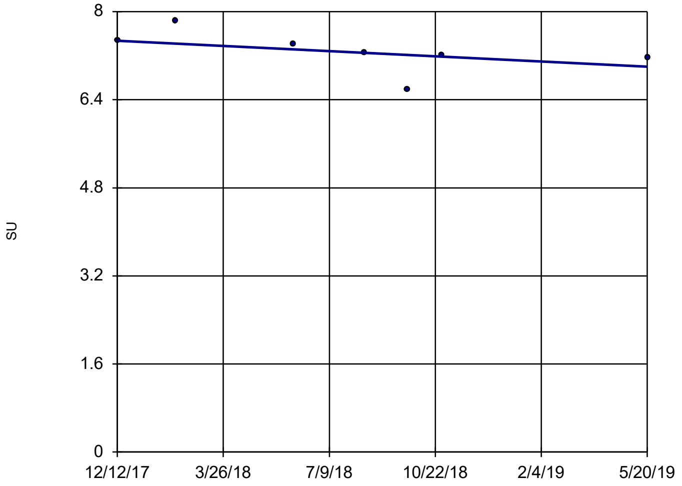
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: pH, field Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1701S (bg)



n = 7

Slope = -0.3278 units per year.

Mann-Kendall statistic = -15 critical = -18

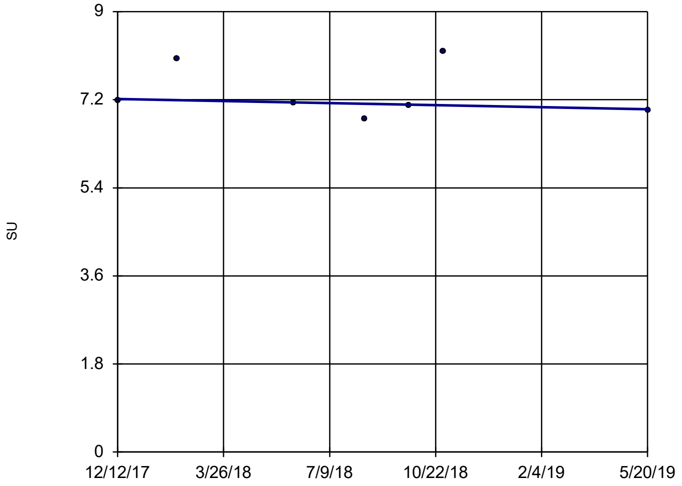
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: pH, field Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1702D (bg)



n = 7

Slope = -0.1463 units per year.

Mann-Kendall statistic = -5 critical = -18

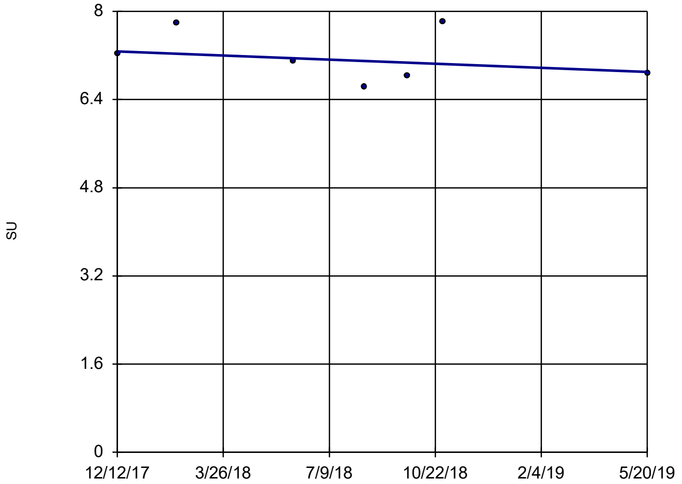
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: pH, field Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1702I (bg)



n = 7

Slope = -0.2577 units per year.

Mann-Kendall statistic = -3 critical = -18

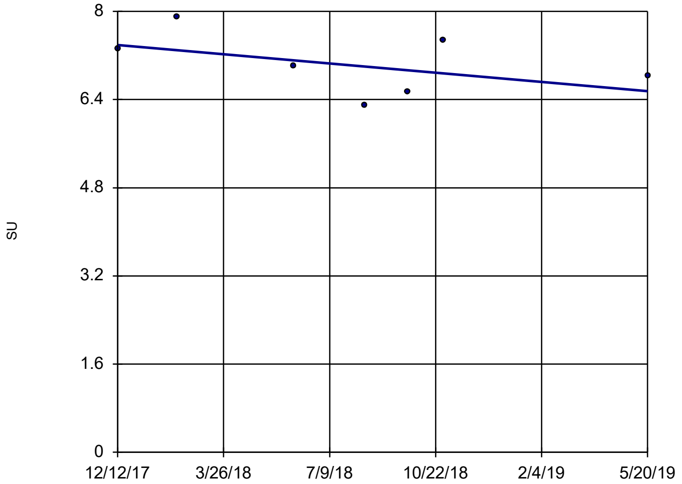
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: pH, field Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1702S (bg)



n = 7

Slope = -0.5829 units per year.

Mann-Kendall statistic = -5 critical = -18

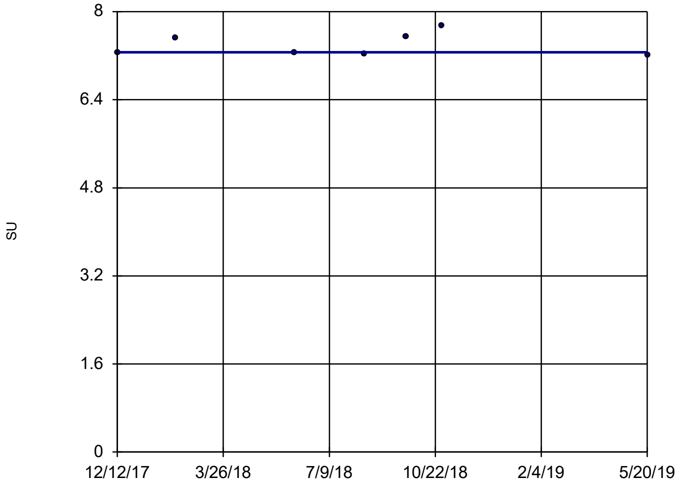
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: pH, field Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1701D (bg)



n = 7

Slope = 0 units per year.

Mann-Kendall statistic = 0 critical = 18

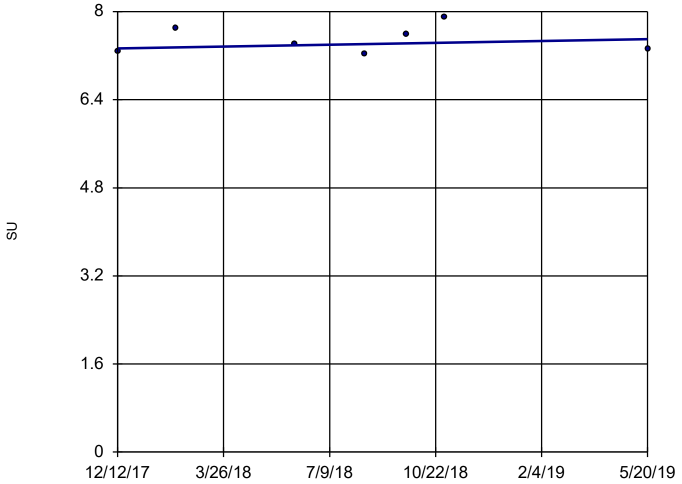
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: pH, field Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1701I (bg)



n = 7

Slope = 0.1177 units per year.

Mann-Kendall statistic = 3 critical = 18

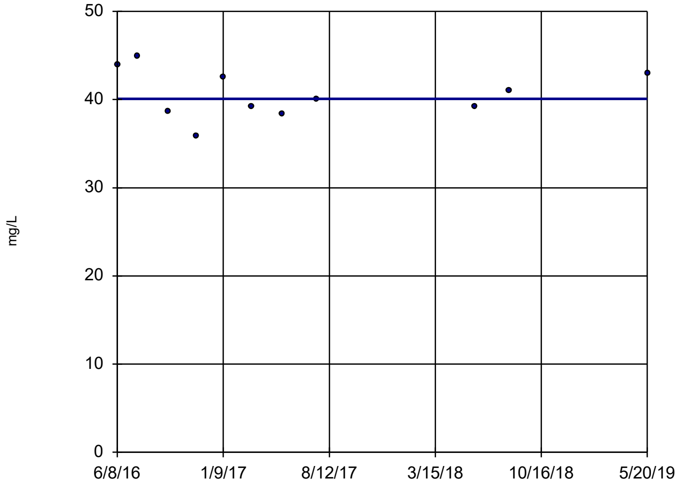
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: pH, field Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1600D (bg)



n = 11

Slope = 0
units per year.

Mann-Kendall
statistic = 0
critical = 34

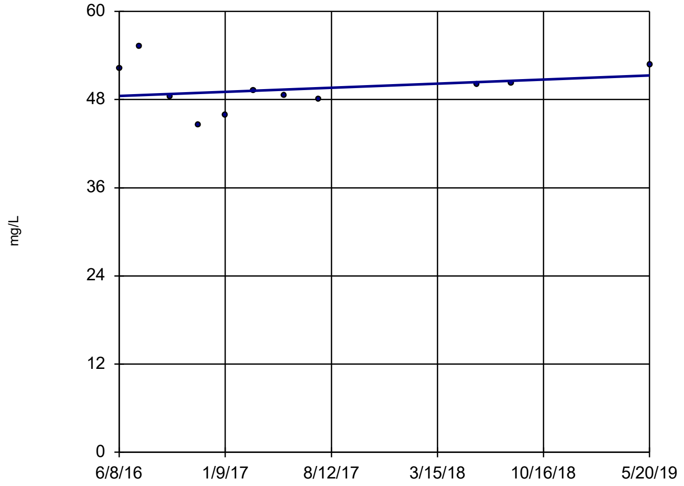
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1600I (bg)



n = 11

Slope = 0.9374
units per year.

Mann-Kendall
statistic = 9
critical = 34

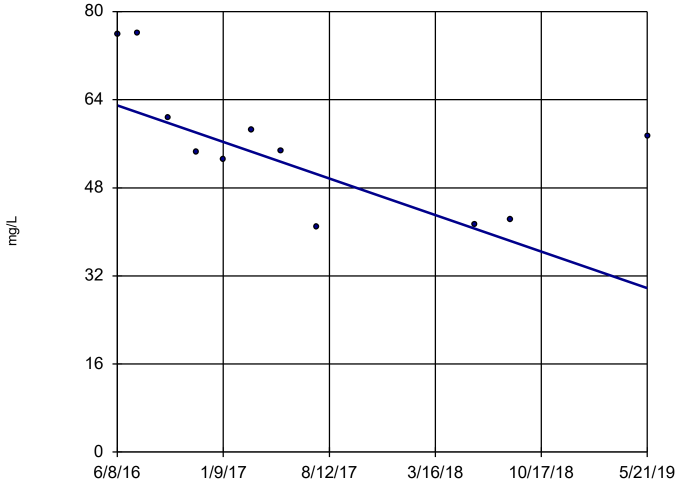
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1600S (bg)



n = 11

Slope = -11.24
units per year.

Mann-Kendall
statistic = -27
critical = -34

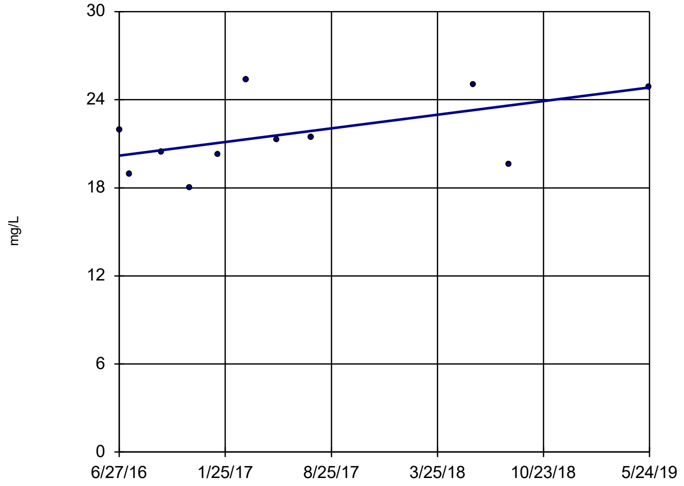
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1601D (bg)



n = 11

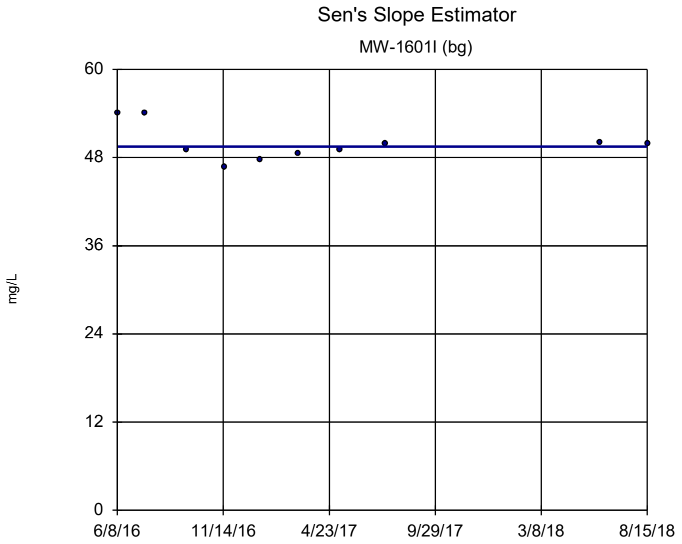
Slope = 1.598
units per year.

Mann-Kendall
statistic = 13
critical = 34

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



n = 10

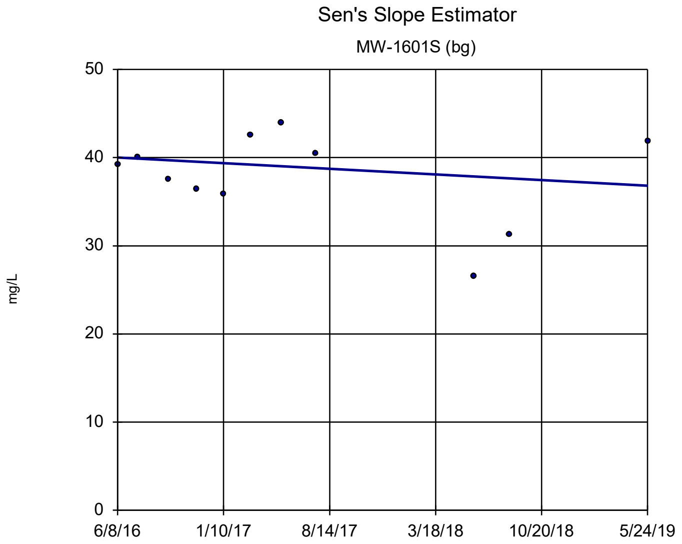
Slope = 0
units per year.

Mann-Kendall
statistic = 2
critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total   Analysis Run 8/8/2019 5:06 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



n = 11

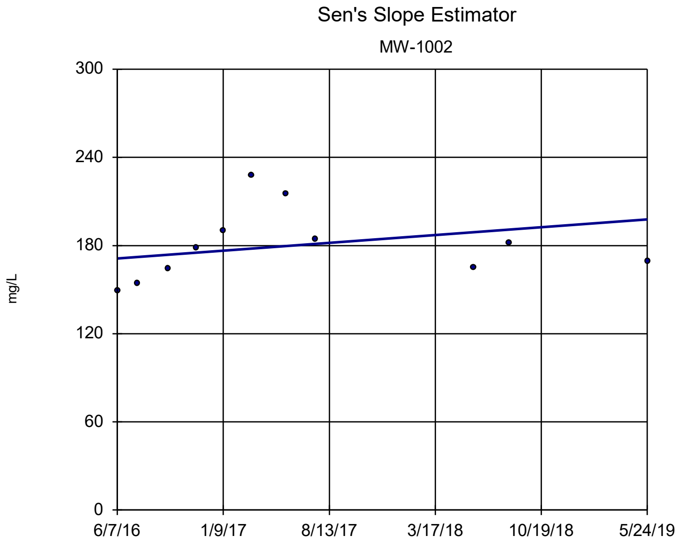
Slope = -1.076
units per year.

Mann-Kendall
statistic = -3
critical = -34

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total   Analysis Run 8/8/2019 5:06 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



n = 11

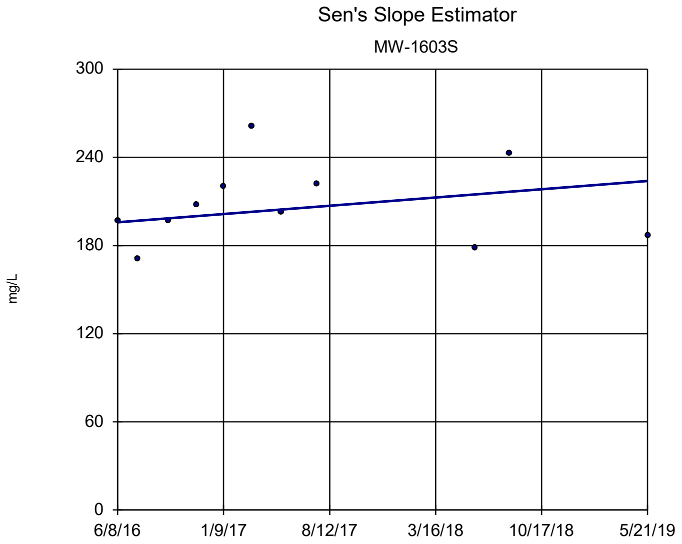
Slope = 8.975
units per year.

Mann-Kendall
statistic = 17
critical = 34

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total   Analysis Run 8/8/2019 5:06 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



n = 11

Slope = 9.522
units per year.

Mann-Kendall
statistic = 12
critical = 34

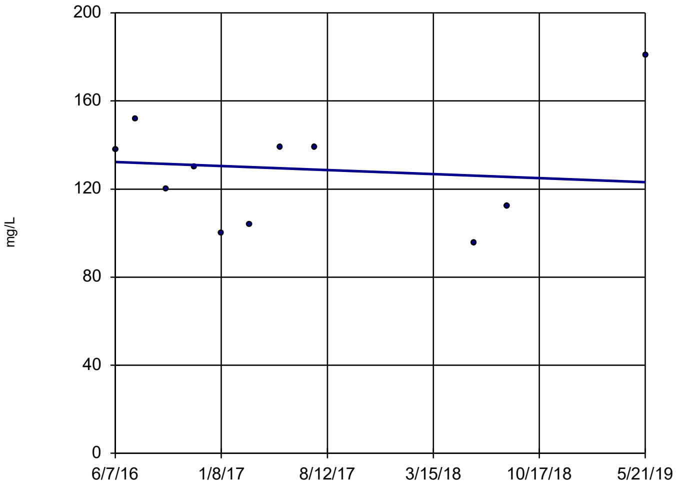
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total   Analysis Run 8/8/2019 5:06 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1604I



n = 11

Slope = -3.131 units per year.

Mann-Kendall statistic = -2 critical = -34

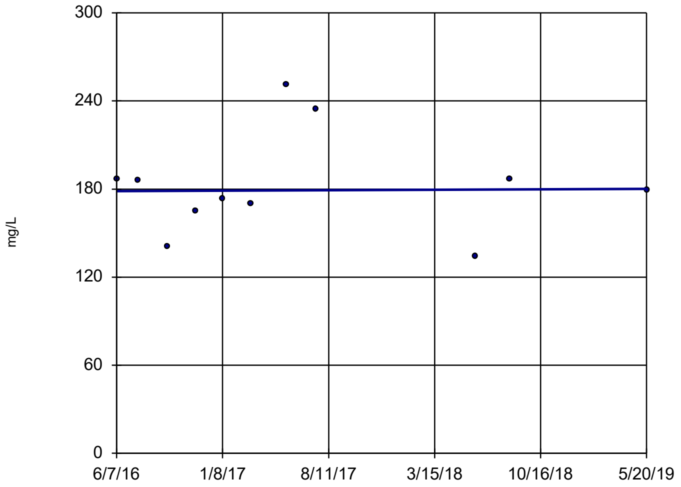
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total   Analysis Run 8/8/2019 5:06 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1604S



n = 11

Slope = 0.4834 units per year.

Mann-Kendall statistic = 2 critical = 34

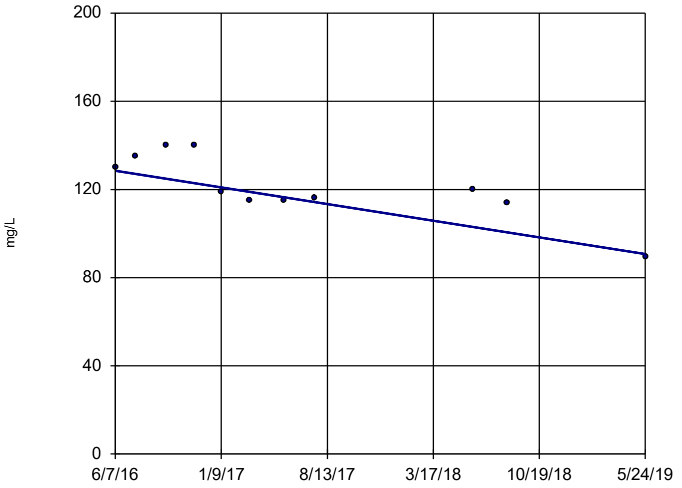
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total   Analysis Run 8/8/2019 5:06 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1605I



n = 11

Slope = -12.79 units per year.

Mann-Kendall statistic = -31 critical = -34

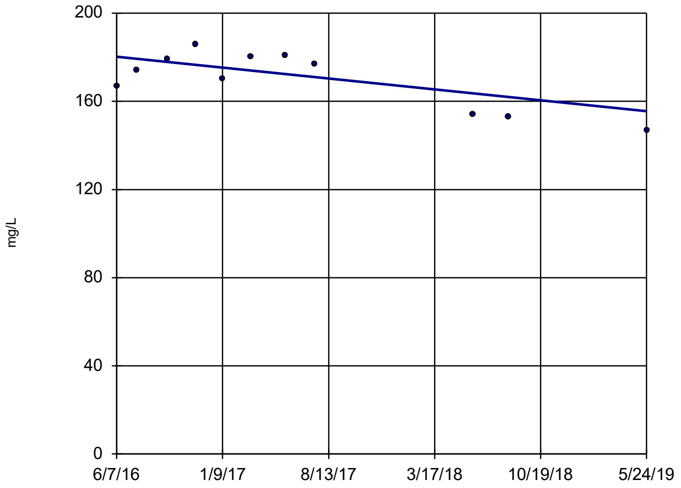
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total   Analysis Run 8/8/2019 5:06 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1605S



n = 11

Slope = -8.343 units per year.

Mann-Kendall statistic = -17 critical = -34

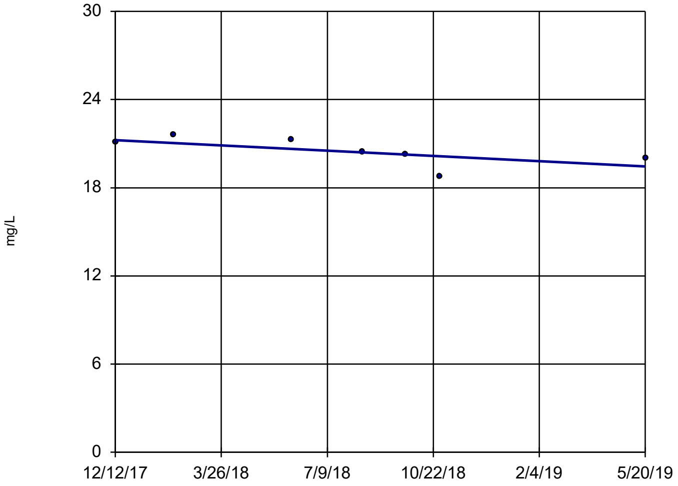
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total   Analysis Run 8/8/2019 5:06 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1701S (bg)



n = 7

Slope = -1.253 units per year.

Mann-Kendall statistic = -15 critical = -18

Trend not significant at 99% confidence level (α = 0.005 per tail).

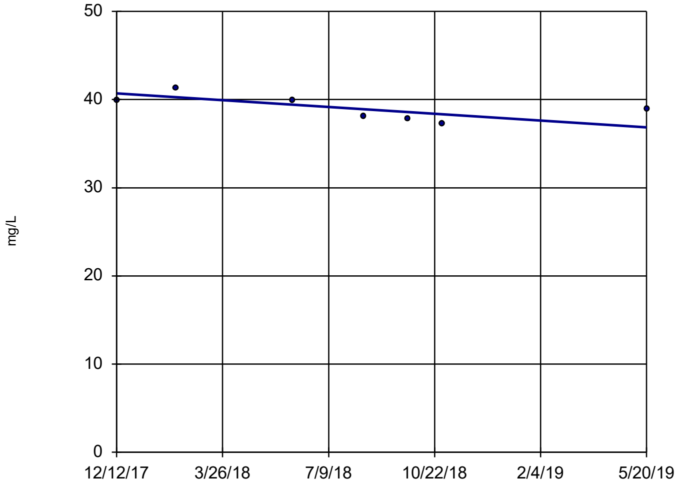
Constituent: Sulfate, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1702D (bg)



n = 7

Slope = -2.682 units per year.

Mann-Kendall statistic = -12 critical = -18

Trend not significant at 99% confidence level (α = 0.005 per tail).

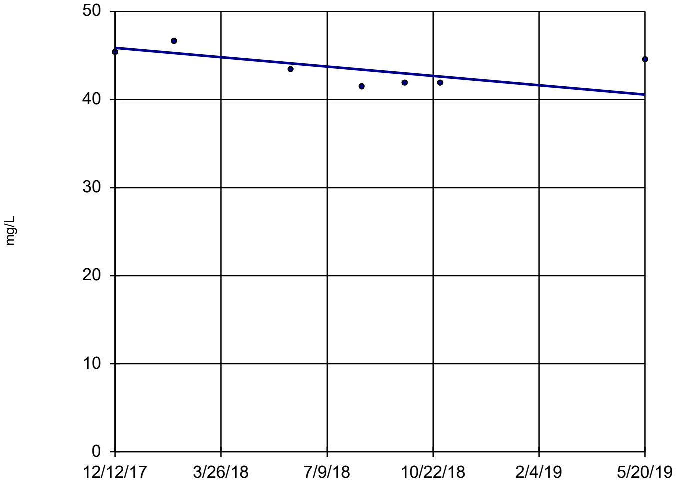
Constituent: Sulfate, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1702I (bg)



n = 7

Slope = -3.699 units per year.

Mann-Kendall statistic = -6 critical = -18

Trend not significant at 99% confidence level (α = 0.005 per tail).

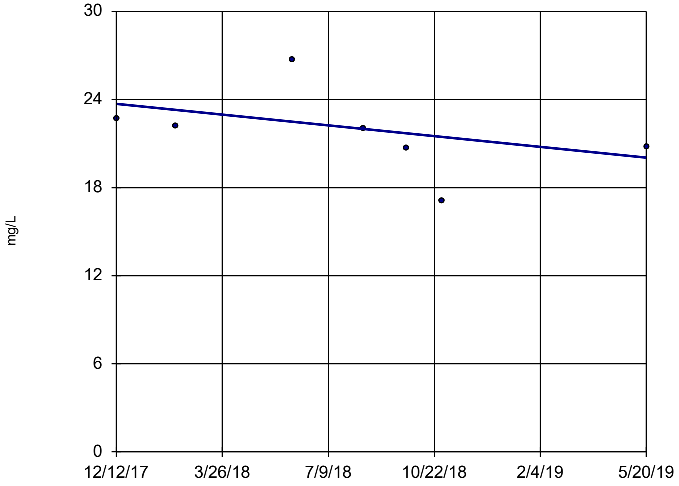
Constituent: Sulfate, total Analysis Run 8/8/2019 5:06 PM View: Trend Tests

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1702S (bg)



n = 7

Slope = -2.544 units per year.

Mann-Kendall statistic = -13 critical = -18

Trend not significant at 99% confidence level (α = 0.005 per tail).

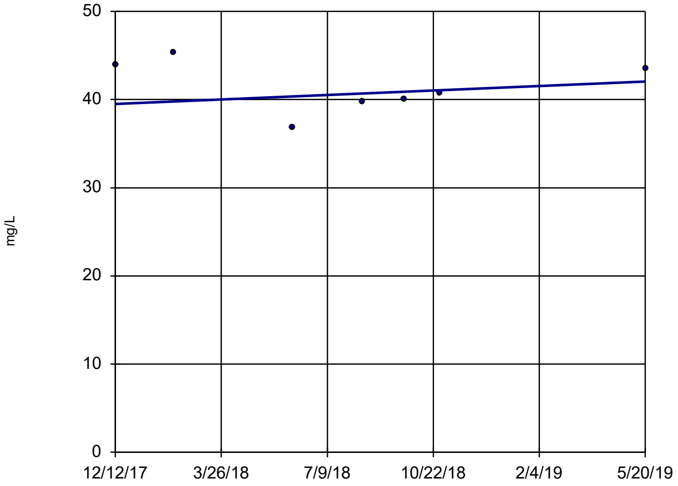
Constituent: Sulfate, total Analysis Run 8/8/2019 5:07 PM View: Trend Tests

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1701D (bg)



n = 7

Slope = 1.78
units per year.

Mann-Kendall
statistic = 1
critical = 18

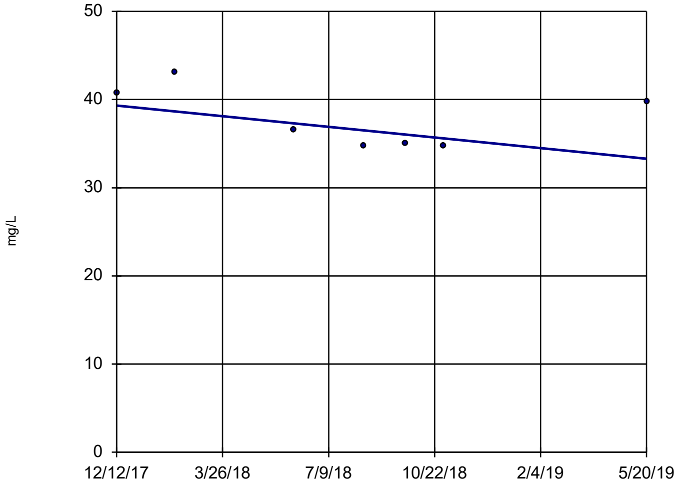
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total   Analysis Run 8/8/2019 5:07 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1701I (bg)



n = 7

Slope = -4.193
units per year.

Mann-Kendall
statistic = -8
critical = -18

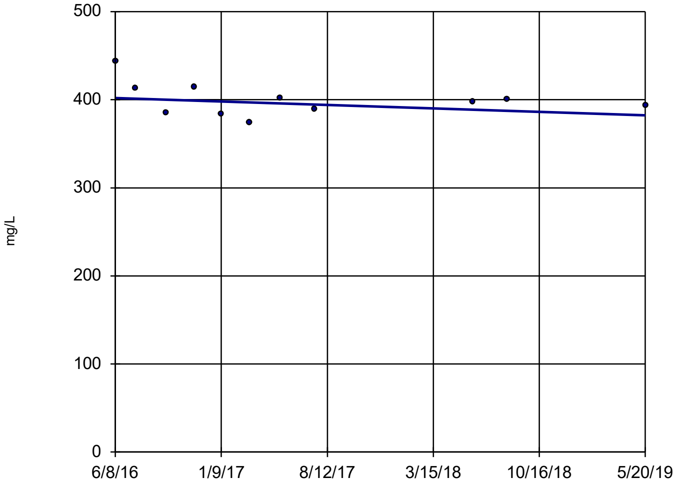
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total   Analysis Run 8/8/2019 5:07 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1600D (bg)



n = 11

Slope = -6.7
units per year.

Mann-Kendall
statistic = -13
critical = -34

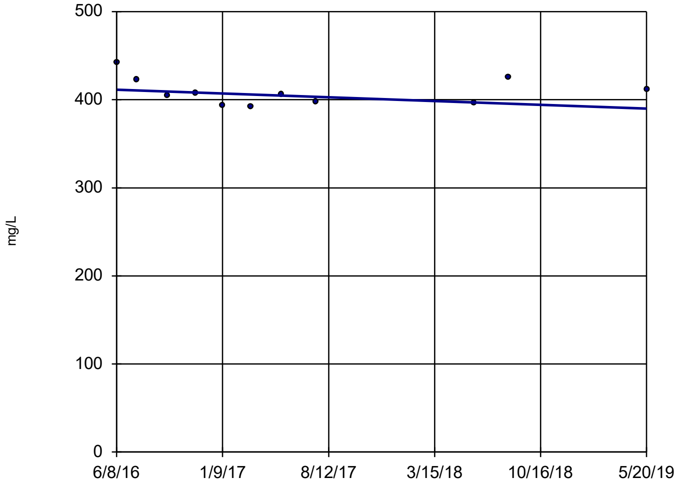
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS]   Analysis Run 8/8/2019 5:07 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1600I (bg)



n = 11

Slope = -7.276
units per year.

Mann-Kendall
statistic = -9
critical = -34

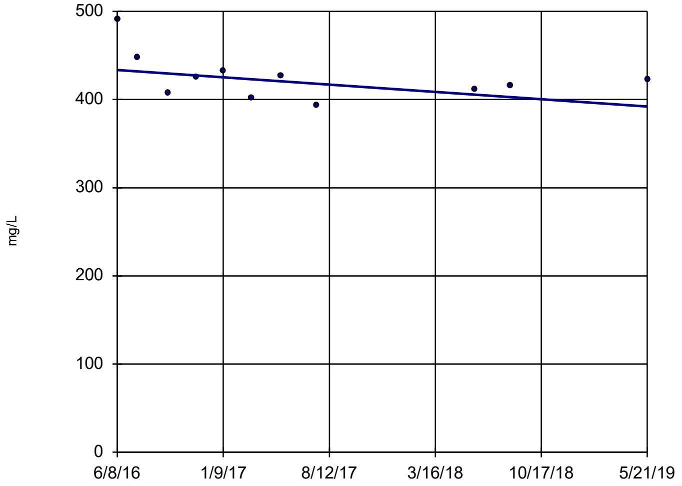
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS]   Analysis Run 8/8/2019 5:07 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1600S (bg)



n = 11

Slope = -13.97 units per year.

Mann-Kendall statistic = -19 critical = -34

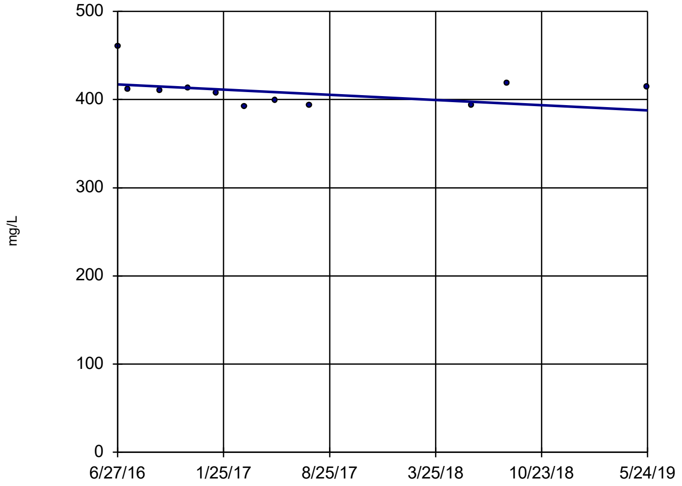
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 8/8/2019 5:07 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1601D (bg)



n = 11

Slope = -10.11 units per year.

Mann-Kendall statistic = -12 critical = -34

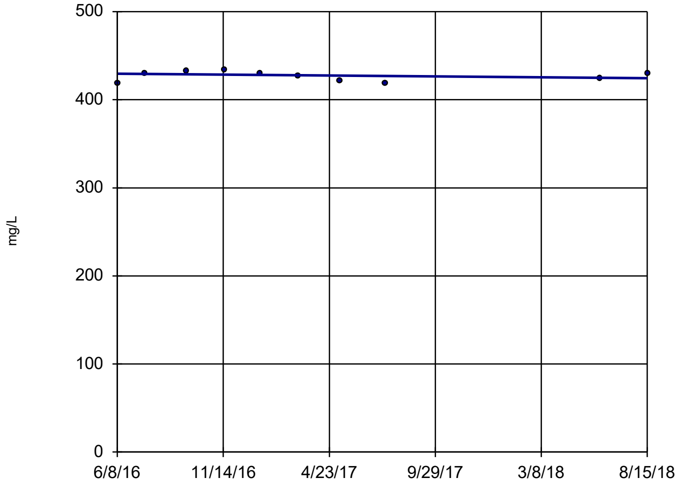
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 8/8/2019 5:07 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1601I (bg)



n = 10

Slope = -2.407 units per year.

Mann-Kendall statistic = -10 critical = -30

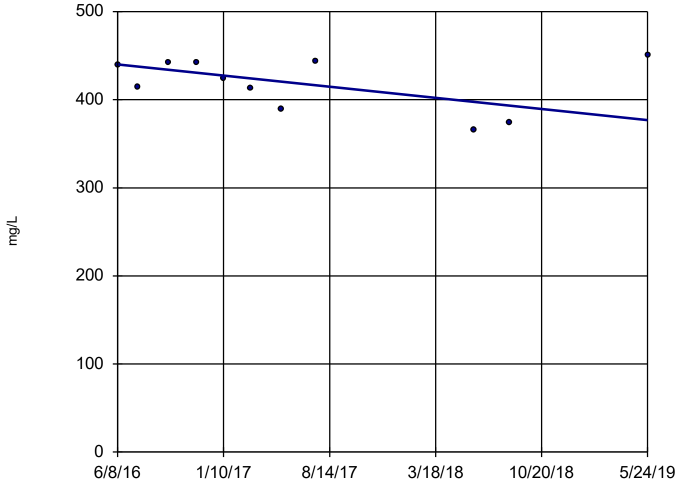
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 8/8/2019 5:07 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1601S (bg)



n = 11

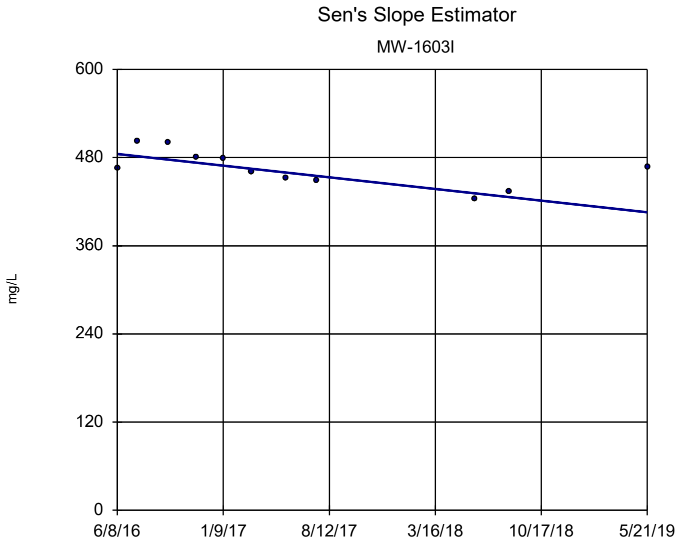
Slope = -21.36 units per year.

Mann-Kendall statistic = -8 critical = -34

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 8/8/2019 5:07 PM View: Trend Tests
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



n = 11

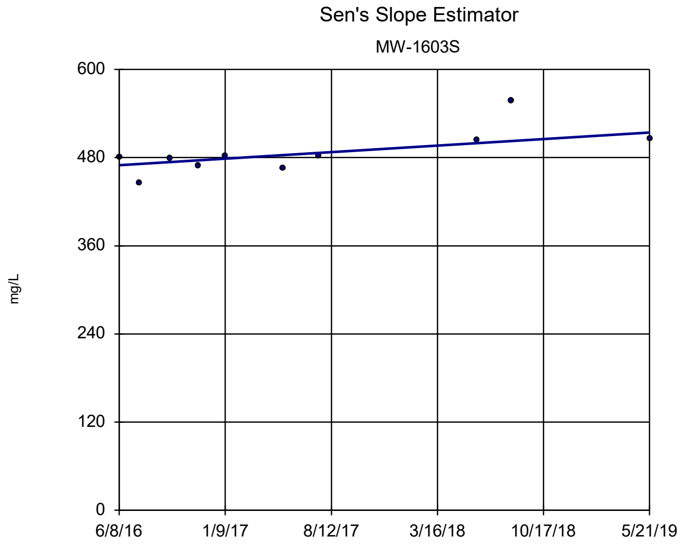
Slope = -26.97 units per year.

Mann-Kendall statistic = -33 critical = -34

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS]   Analysis Run 8/8/2019 5:07 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



n = 10

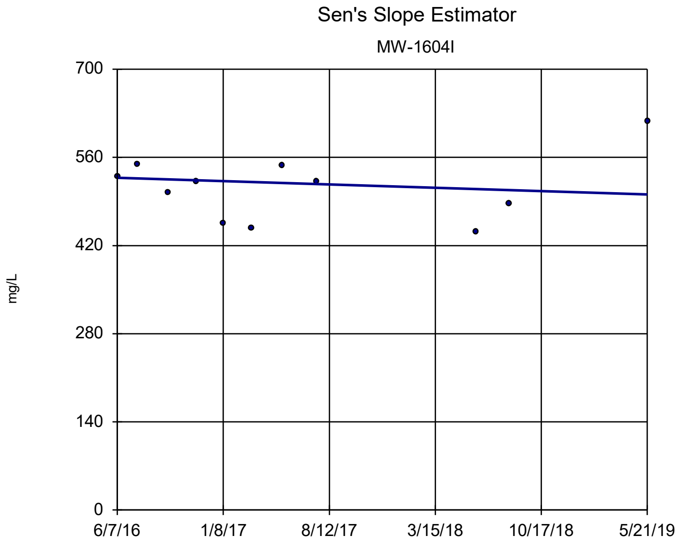
Slope = 14.97 units per year.

Mann-Kendall statistic = 25 critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS]   Analysis Run 8/8/2019 5:07 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



n = 11

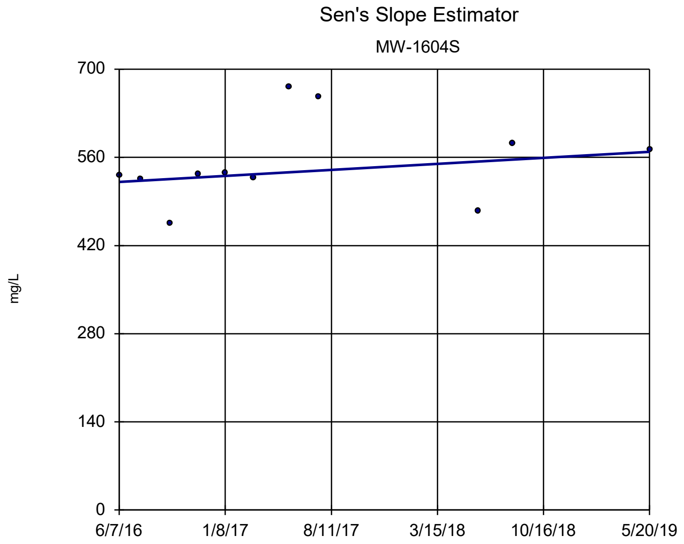
Slope = -8.941 units per year.

Mann-Kendall statistic = -7 critical = -34

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS]   Analysis Run 8/8/2019 5:07 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



n = 11

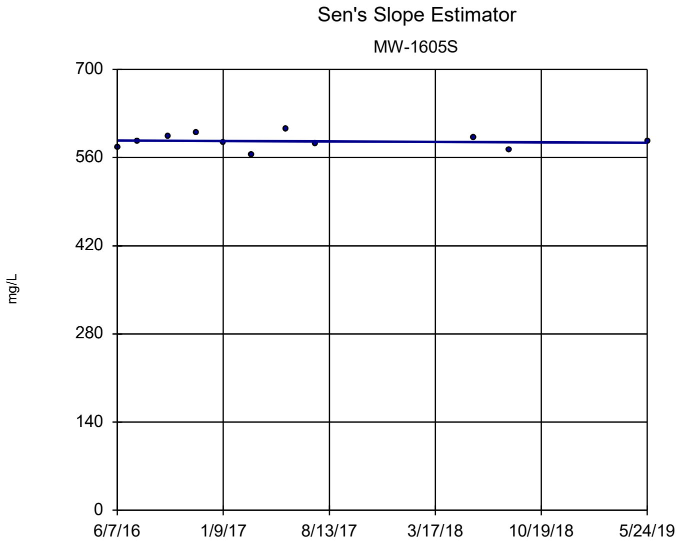
Slope = 16.24 units per year.

Mann-Kendall statistic = 17 critical = 34

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS]   Analysis Run 8/8/2019 5:07 PM   View: Trend Tests
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



Sen's Slope Estimator

MW-1605S

n = 11

Slope = -1.17 units per year.

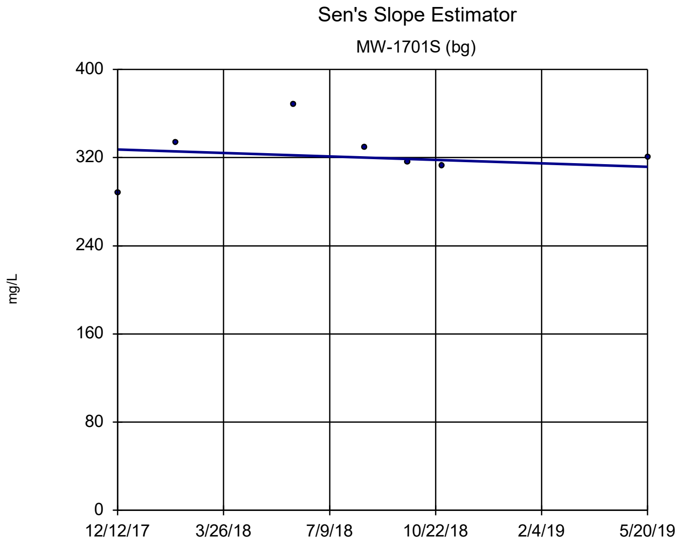
Mann-Kendall statistic = -2 critical = -34

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 8/8/2019 5:07 PM View: Trend Tests

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



Sen's Slope Estimator

MW-1701S (bg)

n = 7

Slope = -10.97 units per year.

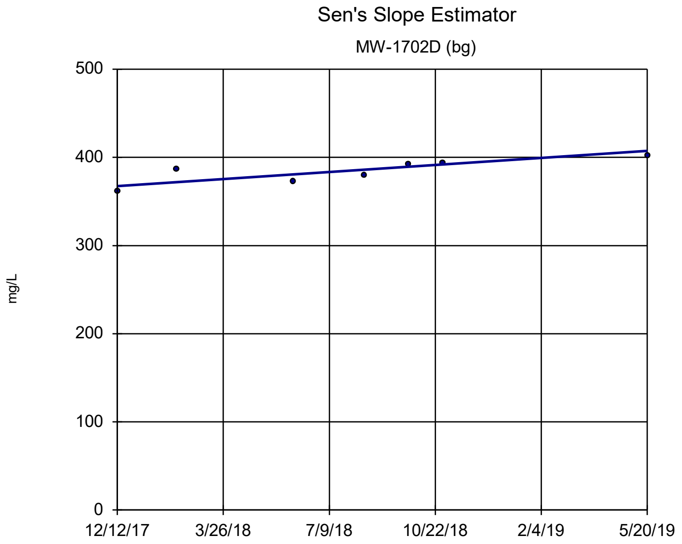
Mann-Kendall statistic = -3 critical = -18

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 8/8/2019 5:07 PM View: Trend Tests

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



Sen's Slope Estimator

MW-1702D (bg)

n = 7

Slope = 27.86 units per year.

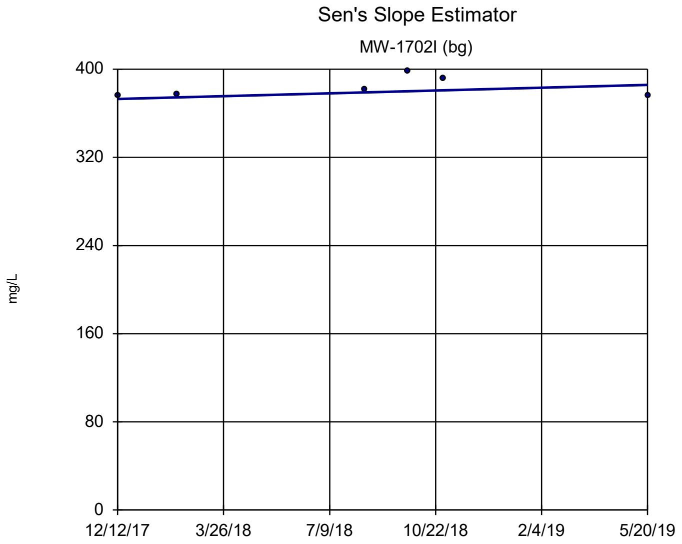
Mann-Kendall statistic = 17 critical = 18

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 8/8/2019 5:07 PM View: Trend Tests

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG



Sen's Slope Estimator

MW-1702I (bg)

n = 6

Slope = 8.975 units per year.

Mann-Kendall statistic = 4 critical = 14

Trend not significant at 99% confidence level (α = 0.005 per tail).

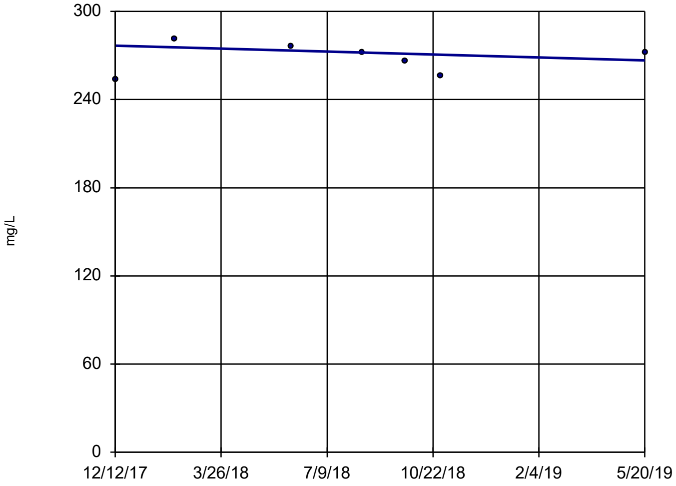
Constituent: Total Dissolved Solids [TDS] Analysis Run 8/8/2019 5:07 PM View: Trend Tests

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1702S (bg)



n = 7

Slope = -7.065 units per year.

Mann-Kendall statistic = -4 critical = -18

Trend not significant at 99% confidence level (α = 0.005 per tail).

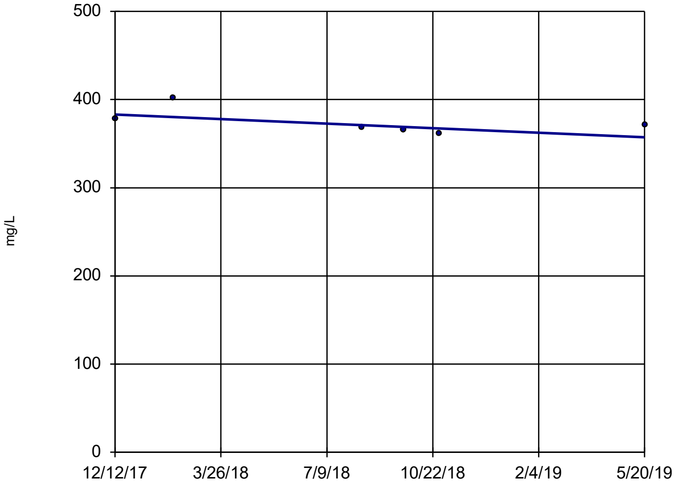
Constituent: Total Dissolved Solids [TDS] Analysis Run 8/8/2019 5:07 PM View: Trend Tests

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1701D (bg)



n = 6

Slope = -18.19 units per year.

Mann-Kendall statistic = -7 critical = -14

Trend not significant at 99% confidence level (α = 0.005 per tail).

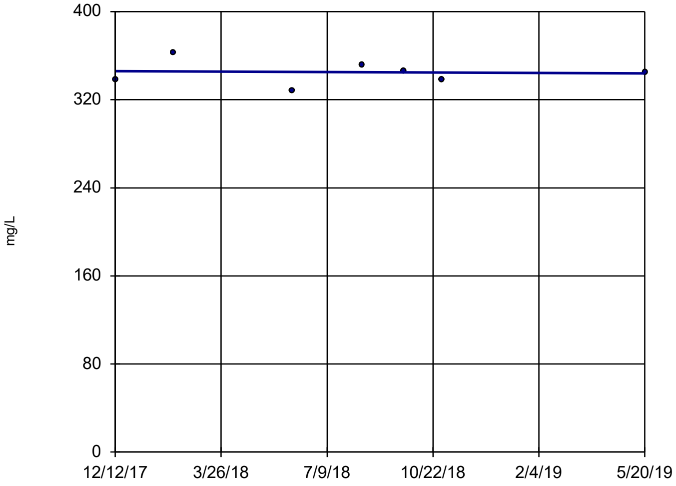
Constituent: Total Dissolved Solids [TDS] Analysis Run 8/8/2019 5:07 PM View: Trend Tests

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1701I (bg)



n = 7

Slope = -1.534 units per year.

Mann-Kendall statistic = -2 critical = -18

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 8/8/2019 5:07 PM View: Trend Tests

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Tolerance Limit Summary Table

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP   Printed 8/8/2019, 1:03 PM

Constituent	Well	Upper Lim.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony, total (mg/L)	n/a	0.00044	107	n/a	n/a	13.08	n/a	n/a	0.004135	NP Inter(normality)
Arsenic, total (mg/L)	n/a	0.0495	110	n/a	n/a	0	n/a	n/a	0.003545	NP Inter(normality)
Barium, total (mg/L)	n/a	0.997	107	n/a	n/a	0	n/a	n/a	0.004135	NP Inter(normality)
Beryllium, total (mg/L)	n/a	0.0001	107	n/a	n/a	66.36	n/a	n/a	0.004135	NP Inter(normality)
Cadmium, total (mg/L)	n/a	0.00028	107	n/a	n/a	27.1	n/a	n/a	0.004135	NP Inter(normality)
Chromium, total (mg/L)	n/a	0.001088	107	-8.529	0.8908	0	None	ln(x)	0.05	Inter
Cobalt, total (mg/L)	n/a	0.00334	107	n/a	n/a	0	n/a	n/a	0.004135	NP Inter(normality)
Combined Radium 226 + 228 (pCi/L)	n/a	3.301	107	1.028	0.412	0	None	sqrt(x)	0.05	Inter
Fluoride, total (mg/L)	n/a	0.7	107	n/a	n/a	0	n/a	n/a	0.004135	NP Inter(normality)
Lead, total (mg/L)	n/a	0.00154	107	n/a	n/a	2.804	n/a	n/a	0.004135	NP Inter(normality)
Lithium, total (mg/L)	n/a	0.038	107	n/a	n/a	19.63	n/a	n/a	0.004135	NP Inter(normality)
Mercury, total (mg/L)	n/a	0.000005	83	n/a	n/a	83.13	n/a	n/a	0.01416	NP Inter(NDs)
Molybdenum, total (mg/L)	n/a	0.004418	107	0.04251	0.01251	0	None	sqrt(x)	0.05	Inter
Selenium, total (mg/L)	n/a	0.0038	107	n/a	n/a	35.51	n/a	n/a	0.004135	NP Inter(normality)
Thallium, total (mg/L)	n/a	0.0005	101	n/a	n/a	34.65	n/a	n/a	0.005625	NP Inter(normality)

Confidence Interval Summary Table - All Results (No Significant)

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP   Printed 8/8/2019, 5:04 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Lower Compl.	Sig.	N	%NDs	Transform	Alpha	Method
Antimony, total (mg/L)	MW-1002	0.00006	0.00004	0.006	n/a	No	11	0	No	0.006	NP (normality)
Antimony, total (mg/L)	MW-1602D	0.00005	0.00001	0.006	n/a	No	11	9.091	No	0.006	NP (normality)
Antimony, total (mg/L)	MW-1602I	0.00007607	0.00002144	0.006	n/a	No	11	0	x^(1/3)	0.01	Param.
Antimony, total (mg/L)	MW-1603D	0.00004625	0.00001203	0.006	n/a	No	11	9.091	sqrt(x)	0.01	Param.
Antimony, total (mg/L)	MW-1603I	0.00005	0.00003	0.006	n/a	No	11	0	No	0.006	NP (normality)
Antimony, total (mg/L)	MW-1603S	0.00005492	0.00003781	0.006	n/a	No	11	0	No	0.01	Param.
Antimony, total (mg/L)	MW-1604D	0.00003685	0.00001313	0.006	n/a	No	11	9.091	sqrt(x)	0.01	Param.
Antimony, total (mg/L)	MW-1604I	0.00006	0.00002	0.006	n/a	No	11	0	No	0.006	NP (normality)
Antimony, total (mg/L)	MW-1604S	0.00007	0.00005	0.006	n/a	No	11	0	No	0.006	NP (normality)
Antimony, total (mg/L)	MW-1605D	0.00005	0.00001	0.006	n/a	No	11	0	No	0.006	NP (normality)
Antimony, total (mg/L)	MW-1605I	0.00004324	0.00002767	0.006	n/a	No	11	0	No	0.01	Param.
Antimony, total (mg/L)	MW-1605S	0.0001	0.00004	0.006	n/a	No	11	0	No	0.006	NP (normality)
Antimony, total (mg/L)	MW-1606D	0.00007329	0.000009279	0.006	n/a	No	11	18.18	No	0.01	Param.
Antimony, total (mg/L)	MW-1606I	0.00005	0.00002	0.006	n/a	No	11	9.091	No	0.006	NP (normality)
Antimony, total (mg/L)	MW-1606S	0.00008	0.00004	0.006	n/a	No	11	0	No	0.006	NP (normality)
Arsenic, total (mg/L)	MW-1002	0.0003182	0.0002148	0.05	n/a	No	11	0	sqrt(x)	0.01	Param.
Arsenic, total (mg/L)	MW-1602D	0.009226	0.007969	0.05	n/a	No	11	0	No	0.01	Param.
Arsenic, total (mg/L)	MW-1602I	0.02907	0.01731	0.05	n/a	No	11	0	No	0.01	Param.
Arsenic, total (mg/L)	MW-1603D	0.01217	0.0107	0.05	n/a	No	11	0	No	0.01	Param.
Arsenic, total (mg/L)	MW-1603I	0.0129	0.01239	0.05	n/a	No	11	0	No	0.01	Param.
Arsenic, total (mg/L)	MW-1603S	0.00036	0.00018	0.05	n/a	No	11	0	No	0.006	NP (normality)
Arsenic, total (mg/L)	MW-1604D	0.01908	0.01594	0.05	n/a	No	11	0	No	0.01	Param.
Arsenic, total (mg/L)	MW-1604I	0.02035	0.01885	0.05	n/a	No	10	0	No	0.01	Param.
Arsenic, total (mg/L)	MW-1604S	0.00041	0.0002	0.05	n/a	No	11	0	No	0.006	NP (normality)
Arsenic, total (mg/L)	MW-1605D	0.0193	0.0168	0.05	n/a	No	11	0	x^2	0.01	Param.
Arsenic, total (mg/L)	MW-1605I	0.0253	0.0173	0.05	n/a	No	11	0	No	0.006	NP (normality)
Arsenic, total (mg/L)	MW-1605S	0.0006	0.00036	0.05	n/a	No	11	0	No	0.006	NP (normality)
Arsenic, total (mg/L)	MW-1606D	0.01576	0.01305	0.05	n/a	No	11	0	No	0.01	Param.
Arsenic, total (mg/L)	MW-1606I	0.006753	0.003933	0.05	n/a	No	11	0	No	0.01	Param.
Arsenic, total (mg/L)	MW-1606S	0.0003663	0.000201	0.05	n/a	No	11	0	ln(x)	0.01	Param.
Barium, total (mg/L)	MW-1002	0.02627	0.01355	2	n/a	No	11	0	No	0.01	Param.
Barium, total (mg/L)	MW-1602D	0.5093	0.4145	2	n/a	No	11	0	No	0.01	Param.
Barium, total (mg/L)	MW-1602I	0.1345	0.1195	2	n/a	No	11	0	No	0.01	Param.
Barium, total (mg/L)	MW-1603D	0.1164	0.1069	2	n/a	No	11	0	No	0.01	Param.
Barium, total (mg/L)	MW-1603I	0.0879	0.08013	2	n/a	No	11	0	No	0.01	Param.
Barium, total (mg/L)	MW-1603S	0.01808	0.01256	2	n/a	No	11	0	No	0.01	Param.
Barium, total (mg/L)	MW-1604D	0.2545	0.2289	2	n/a	No	11	0	No	0.01	Param.
Barium, total (mg/L)	MW-1604I	0.1333	0.1132	2	n/a	No	11	0	No	0.01	Param.
Barium, total (mg/L)	MW-1604S	0.01987	0.01553	2	n/a	No	11	0	No	0.01	Param.
Barium, total (mg/L)	MW-1605D	0.4653	0.4041	2	n/a	No	11	0	No	0.01	Param.
Barium, total (mg/L)	MW-1605I	0.1689	0.1467	2	n/a	No	11	0	No	0.01	Param.
Barium, total (mg/L)	MW-1605S	0.0109	0.00776	2	n/a	No	11	0	No	0.006	NP (normality)
Barium, total (mg/L)	MW-1606D	0.418	0.3627	2	n/a	No	11	0	No	0.01	Param.
Barium, total (mg/L)	MW-1606I	0.0745	0.0481	2	n/a	No	11	0	No	0.006	NP (normality)
Barium, total (mg/L)	MW-1606S	0.01448	0.01005	2	n/a	No	11	0	No	0.01	Param.
Beryllium, total (mg/L)	MW-1002	0.0001	0.000006	0.004	n/a	No	11	72.73	No	0.006	NP (normality)
Beryllium, total (mg/L)	MW-1602D	0.0001	0.000006	0.004	n/a	No	11	54.55	No	0.006	NP (normality)
Beryllium, total (mg/L)	MW-1602I	0.0001	0.000006	0.004	n/a	No	11	54.55	No	0.006	NP (normality)
Beryllium, total (mg/L)	MW-1603D	0.0001	0.00002	0.004	n/a	No	11	72.73	No	0.006	NP (normality)
Beryllium, total (mg/L)	MW-1603I	0.0001	0.00002	0.004	n/a	No	11	81.82	No	0.006	NP (NDs)
Beryllium, total (mg/L)	MW-1603S	0.0001	0.00001	0.004	n/a	No	11	63.64	No	0.006	NP (normality)
Beryllium, total (mg/L)	MW-1604D	0.0001	0.00002	0.004	n/a	No	11	81.82	No	0.006	NP (NDs)
Beryllium, total (mg/L)	MW-1604I	0.0001	0.00002	0.004	n/a	No	11	81.82	No	0.006	NP (NDs)
Beryllium, total (mg/L)	MW-1604S	0.0001	0.000007	0.004	n/a	No	11	63.64	No	0.006	NP (normality)
Beryllium, total (mg/L)	MW-1605D	0.0001	0.00002	0.004	n/a	No	11	81.82	No	0.006	NP (NDs)

Confidence Interval Summary Table - All Results (No Significant)

Rockport BAP Client: Geosyntec Data: Rockport_BAP Printed 8/8/2019, 5:04 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Lower Compl.	Sig.	N	%NDs	Transform	Alpha	Method
Beryllium, total (mg/L)	MW-1605I	0.0001	0.000004	0.004	n/a	No	11	72.73	No	0.006	NP (normality)
Beryllium, total (mg/L)	MW-1605S	0.0001	0.00002	0.004	n/a	No	11	72.73	No	0.006	NP (normality)
Beryllium, total (mg/L)	MW-1606D	0.0001	0.000006	0.004	n/a	No	11	54.55	No	0.006	NP (normality)
Beryllium, total (mg/L)	MW-1606I	0.0001	0.00002	0.004	n/a	No	11	81.82	No	0.006	NP (NDs)
Beryllium, total (mg/L)	MW-1606S	0.0001	0.000005	0.004	n/a	No	11	45.45	No	0.006	NP (normality)
Cadmium, total (mg/L)	MW-1002	0.00007	0.00003	0.005	n/a	No	11	0	No	0.006	NP (normality)
Cadmium, total (mg/L)	MW-1602D	0.00005	0.00002	0.005	n/a	No	11	72.73	No	0.006	NP (normality)
Cadmium, total (mg/L)	MW-1602I	0.00005	0.000006	0.005	n/a	No	11	27.27	No	0.006	NP (normality)
Cadmium, total (mg/L)	MW-1603D	0.00005	0.000009	0.005	n/a	No	11	54.55	No	0.006	NP (normality)
Cadmium, total (mg/L)	MW-1603I	0.00005	0.000007	0.005	n/a	No	11	63.64	No	0.006	NP (normality)
Cadmium, total (mg/L)	MW-1603S	0.00003	0.00002	0.005	n/a	No	11	0	No	0.006	NP (normality)
Cadmium, total (mg/L)	MW-1604D	0.00005	0.000008	0.005	n/a	No	11	72.73	No	0.006	NP (normality)
Cadmium, total (mg/L)	MW-1604I	0.00005	0.000009	0.005	n/a	No	10	70	No	0.011	NP (normality)
Cadmium, total (mg/L)	MW-1604S	0.00003	0.00001	0.005	n/a	No	11	0	No	0.006	NP (normality)
Cadmium, total (mg/L)	MW-1605D	0.00005	0.00002	0.005	n/a	No	11	81.82	No	0.006	NP (NDs)
Cadmium, total (mg/L)	MW-1605I	0.00005	0.000008	0.005	n/a	No	11	63.64	No	0.006	NP (normality)
Cadmium, total (mg/L)	MW-1605S	0.00004	0.00003	0.005	n/a	No	11	0	No	0.006	NP (normality)
Cadmium, total (mg/L)	MW-1606D	0.00005	0.00002	0.005	n/a	No	11	72.73	No	0.006	NP (normality)
Cadmium, total (mg/L)	MW-1606I	0.00005	0.000005	0.005	n/a	No	11	63.64	No	0.006	NP (normality)
Cadmium, total (mg/L)	MW-1606S	0.00004236	0.00001764	0.005	n/a	No	11	0	No	0.01	Param.
Chromium, total (mg/L)	MW-1002	0.0003302	0.00006919	0.1	n/a	No	11	0	sqrt(x)	0.01	Param.
Chromium, total (mg/L)	MW-1602D	0.0003617	0.0001621	0.1	n/a	No	11	0	No	0.01	Param.
Chromium, total (mg/L)	MW-1602I	0.0003589	0.0001321	0.1	n/a	No	11	0	No	0.01	Param.
Chromium, total (mg/L)	MW-1603D	0.000244	0.00009422	0.1	n/a	No	10	0	No	0.01	Param.
Chromium, total (mg/L)	MW-1603I	0.0004897	0.00008994	0.1	n/a	No	11	0	ln(x)	0.01	Param.
Chromium, total (mg/L)	MW-1603S	0.0004163	0.0001064	0.1	n/a	No	11	0	No	0.01	Param.
Chromium, total (mg/L)	MW-1604D	0.0001945	0.00007314	0.1	n/a	No	11	0	No	0.01	Param.
Chromium, total (mg/L)	MW-1604I	0.000322	0.00007026	0.1	n/a	No	11	0	sqrt(x)	0.01	Param.
Chromium, total (mg/L)	MW-1604S	0.0004327	0.00009056	0.1	n/a	No	11	0	sqrt(x)	0.01	Param.
Chromium, total (mg/L)	MW-1605D	0.0002782	0.000116	0.1	n/a	No	11	0	No	0.01	Param.
Chromium, total (mg/L)	MW-1605I	0.0002919	0.00006915	0.1	n/a	No	11	0	ln(x)	0.01	Param.
Chromium, total (mg/L)	MW-1605S	0.0004596	0.00009993	0.1	n/a	No	11	0	sqrt(x)	0.01	Param.
Chromium, total (mg/L)	MW-1606D	0.0003471	0.00008179	0.1	n/a	No	11	0	sqrt(x)	0.01	Param.
Chromium, total (mg/L)	MW-1606I	0.0002646	0.0000738	0.1	n/a	No	11	9.091	x^(1/3)	0.01	Param.
Chromium, total (mg/L)	MW-1606S	0.0005712	0.0001235	0.1	n/a	No	11	0	ln(x)	0.01	Param.
Cobalt, total (mg/L)	MW-1002	0.0008177	0.0006218	0.006	n/a	No	11	0	No	0.01	Param.
Cobalt, total (mg/L)	MW-1602D	0.0001912	0.00009884	0.006	n/a	No	11	0	No	0.01	Param.
Cobalt, total (mg/L)	MW-1602I	0.001671	0.001367	0.006	n/a	No	11	0	No	0.01	Param.
Cobalt, total (mg/L)	MW-1603D	0.001136	0.0004195	0.006	n/a	No	11	0	x^(1/3)	0.01	Param.
Cobalt, total (mg/L)	MW-1603I	0.001373	0.001209	0.006	n/a	No	11	0	No	0.01	Param.
Cobalt, total (mg/L)	MW-1603S	0.0006096	0.0002063	0.006	n/a	No	11	0	No	0.01	Param.
Cobalt, total (mg/L)	MW-1604D	0.00009601	0.00005326	0.006	n/a	No	11	0	No	0.01	Param.
Cobalt, total (mg/L)	MW-1604I	0.0009302	0.0007278	0.006	n/a	No	11	0	No	0.01	Param.
Cobalt, total (mg/L)	MW-1604S	0.000548	0.000321	0.006	n/a	No	11	0	No	0.006	NP (normality)
Cobalt, total (mg/L)	MW-1605D	0.0001974	0.00009093	0.006	n/a	No	11	0	sqrt(x)	0.01	Param.
Cobalt, total (mg/L)	MW-1605I	0.001668	0.001385	0.006	n/a	No	11	0	No	0.01	Param.
Cobalt, total (mg/L)	MW-1605S	0.000856	0.000307	0.006	n/a	No	11	0	No	0.006	NP (normality)
Cobalt, total (mg/L)	MW-1606D	0.000178	0.00007	0.006	n/a	No	11	0	No	0.006	NP (normality)
Cobalt, total (mg/L)	MW-1606I	0.001454	0.0007958	0.006	n/a	No	11	0	No	0.01	Param.
Cobalt, total (mg/L)	MW-1606S	0.0003797	0.0000514	0.006	n/a	No	11	0	sqrt(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1002	1.353	0.2606	5	n/a	No	11	0	sqrt(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1602D	2.161	0.7086	5	n/a	No	11	0	sqrt(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1602I	1.234	0.8102	5	n/a	No	11	0	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1603D	1.35	0.674	5	n/a	No	11	0	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1603I	1.958	0.8227	5	n/a	No	11	0	No	0.01	Param.

Confidence Interval Summary Table - All Results (No Significant)

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP   Printed 8/8/2019, 5:04 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Lower Compl.	Sig.	N	%NDs	Transform	Alpha	Method
Combined Radium 226 + 228 (pCi/L)	MW-1603S	1.539	0.3557	5	n/a	No	11	0	sqrt(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1604D	1.198	0.4669	5	n/a	No	11	0	sqrt(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1604I	1.405	0.6796	5	n/a	No	11	0	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1604S	1.093	0.377	5	n/a	No	11	0	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1605D	1.624	0.8329	5	n/a	No	11	0	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1605I	2.131	1.311	5	n/a	No	11	0	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1605S	0.9138	0.2031	5	n/a	No	11	0	sqrt(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1606D	1.609	0.5776	5	n/a	No	11	0	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1606I	1.679	0.6058	5	n/a	No	11	0	ln(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1606S	1.368	0.3911	5	n/a	No	11	0	No	0.01	Param.
Fluoride, total (mg/L)	MW-1002	1.042	0.788	4	n/a	No	11	0	x^2	0.01	Param.
Fluoride, total (mg/L)	MW-1602D	0.345	0.2986	4	n/a	No	11	0	No	0.01	Param.
Fluoride, total (mg/L)	MW-1602I	0.3045	0.2628	4	n/a	No	11	0	No	0.01	Param.
Fluoride, total (mg/L)	MW-1603D	0.3108	0.2656	4	n/a	No	11	0	No	0.01	Param.
Fluoride, total (mg/L)	MW-1603I	0.4361	0.3821	4	n/a	No	11	0	No	0.01	Param.
Fluoride, total (mg/L)	MW-1603S	0.5322	0.3514	4	n/a	No	11	0	No	0.01	Param.
Fluoride, total (mg/L)	MW-1604D	0.2811	0.2407	4	n/a	No	11	0	No	0.01	Param.
Fluoride, total (mg/L)	MW-1604I	0.3454	0.3	4	n/a	No	11	0	No	0.01	Param.
Fluoride, total (mg/L)	MW-1604S	0.9633	0.8312	4	n/a	No	11	0	No	0.01	Param.
Fluoride, total (mg/L)	MW-1605D	0.2291	0.1818	4	n/a	No	11	0	No	0.01	Param.
Fluoride, total (mg/L)	MW-1605I	0.2193	0.157	4	n/a	No	11	0	No	0.01	Param.
Fluoride, total (mg/L)	MW-1605S	0.5793	0.4807	4	n/a	No	11	0	No	0.01	Param.
Fluoride, total (mg/L)	MW-1606D	0.2056	0.169	4	n/a	No	11	0	No	0.01	Param.
Fluoride, total (mg/L)	MW-1606I	0.209	0.1764	4	n/a	No	11	0	No	0.01	Param.
Fluoride, total (mg/L)	MW-1606S	0.4563	0.3728	4	n/a	No	11	0	No	0.01	Param.
Lead, total (mg/L)	MW-1002	0.00005474	0.00001718	0.015	n/a	No	11	9.091	ln(x)	0.01	Param.
Lead, total (mg/L)	MW-1602D	0.00009997	0.00002205	0.015	n/a	No	11	9.091	sqrt(x)	0.01	Param.
Lead, total (mg/L)	MW-1602I	0.0002644	0.00005141	0.015	n/a	No	11	0	No	0.01	Param.
Lead, total (mg/L)	MW-1603D	0.00007637	0.00001059	0.015	n/a	No	10	0	x^(1/3)	0.01	Param.
Lead, total (mg/L)	MW-1603I	0.0001481	0.00001871	0.015	n/a	No	11	9.091	sqrt(x)	0.01	Param.
Lead, total (mg/L)	MW-1603S	0.0001537	0.00003026	0.015	n/a	No	11	9.091	sqrt(x)	0.01	Param.
Lead, total (mg/L)	MW-1604D	0.00005885	0.00001261	0.015	n/a	No	11	0	No	0.01	Param.
Lead, total (mg/L)	MW-1604I	0.00004832	0.00001198	0.015	n/a	No	11	9.091	sqrt(x)	0.01	Param.
Lead, total (mg/L)	MW-1604S	0.0001598	0.00001906	0.015	n/a	No	11	0	ln(x)	0.01	Param.
Lead, total (mg/L)	MW-1605D	0.000051	0.000009	0.015	n/a	No	11	18.18	No	0.006	NP (Cohens/xfrm)
Lead, total (mg/L)	MW-1605I	0.0001348	0.00004141	0.015	n/a	No	11	0	No	0.01	Param.
Lead, total (mg/L)	MW-1605S	0.000223	0.00002	0.015	n/a	No	11	0	No	0.006	NP (normality)
Lead, total (mg/L)	MW-1606D	0.000141	0.00001	0.015	n/a	No	11	27.27	No	0.006	NP (Cohens/xfrm)
Lead, total (mg/L)	MW-1606I	0.000071	0.000022	0.015	n/a	No	11	18.18	No	0.006	NP (Cohens/xfrm)
Lead, total (mg/L)	MW-1606S	0.0003511	0.00001595	0.015	n/a	No	11	9.091	x^(1/3)	0.01	Param.
Lithium, total (mg/L)	MW-1002	0.02225	0.003231	0.04	n/a	No	11	18.18	No	0.01	Param.
Lithium, total (mg/L)	MW-1602D	0.01228	0.002444	0.04	n/a	No	11	0	No	0.01	Param.
Lithium, total (mg/L)	MW-1602I	0.01124	0.004037	0.04	n/a	No	11	0	No	0.01	Param.
Lithium, total (mg/L)	MW-1603D	0.01099	0.005373	0.04	n/a	No	11	9.091	No	0.01	Param.
Lithium, total (mg/L)	MW-1603I	0.02296	0.005964	0.04	n/a	No	11	18.18	No	0.01	Param.
Lithium, total (mg/L)	MW-1603S	0.02206	0.002892	0.04	n/a	No	11	18.18	No	0.01	Param.
Lithium, total (mg/L)	MW-1604D	0.02684	0.00138	0.04	n/a	No	11	27.27	No	0.01	Param.
Lithium, total (mg/L)	MW-1604I	0.01217	0.005651	0.04	n/a	No	11	0	No	0.01	Param.
Lithium, total (mg/L)	MW-1604S	0.01516	0.009384	0.04	n/a	No	11	9.091	No	0.01	Param.
Lithium, total (mg/L)	MW-1605D	0.007618	0.003603	0.04	n/a	No	11	9.091	ln(x)	0.01	Param.
Lithium, total (mg/L)	MW-1605I	0.01152	0.005022	0.04	n/a	No	11	0	No	0.01	Param.
Lithium, total (mg/L)	MW-1605S	0.01858	0.01251	0.04	n/a	No	11	0	No	0.01	Param.
Lithium, total (mg/L)	MW-1606D	0.015	0.002	0.04	n/a	No	11	18.18	No	0.006	NP (Cohens/xfrm)
Lithium, total (mg/L)	MW-1606I	0.01089	0.005473	0.04	n/a	No	11	9.091	No	0.01	Param.
Lithium, total (mg/L)	MW-1606S	0.01415	0.00931	0.04	n/a	No	11	9.091	No	0.01	Param.

Confidence Interval Summary Table - All Results (No Significant)

Rockport BAP Client: Geosyntec Data: Rockport_BAP Printed 8/8/2019, 5:04 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Lower Compl.	Sig.	N	%NDs	Transform	Alpha	Method
Mercury, total (mg/L)	MW-1002	0.000005	0.000005	0.002	n/a	No	10	90	No	0.011	NP (NDs)
Mercury, total (mg/L)	MW-1602D	0.000005	0.000005	0.002	n/a	No	10	90	No	0.011	NP (NDs)
Mercury, total (mg/L)	MW-1602I	0.000005	0.000005	0.002	n/a	No	10	90	No	0.011	NP (NDs)
Mercury, total (mg/L)	MW-1603D	0.000005	0.000005	0.002	n/a	No	10	90	No	0.011	NP (NDs)
Mercury, total (mg/L)	MW-1603I	0.000005	0.000005	0.002	n/a	No	10	90	No	0.011	NP (NDs)
Mercury, total (mg/L)	MW-1603S	0.000005	0.000005	0.002	n/a	No	10	90	No	0.011	NP (NDs)
Mercury, total (mg/L)	MW-1604D	0.000005	0.000005	0.002	n/a	No	10	80	No	0.011	NP (NDs)
Mercury, total (mg/L)	MW-1604I	0.000005	0.000005	0.002	n/a	No	10	90	No	0.011	NP (NDs)
Mercury, total (mg/L)	MW-1604S	0.000005	0.000005	0.002	n/a	No	10	90	No	0.011	NP (NDs)
Mercury, total (mg/L)	MW-1605D	0.000005	0.000005	0.002	n/a	No	10	90	No	0.011	NP (NDs)
Mercury, total (mg/L)	MW-1605I	0.000005	0.000005	0.002	n/a	No	10	90	No	0.011	NP (NDs)
Mercury, total (mg/L)	MW-1605S	0.000005	0.000005	0.002	n/a	No	10	90	No	0.011	NP (NDs)
Mercury, total (mg/L)	MW-1606D	0.000005	0.000005	0.002	n/a	No	10	90	No	0.011	NP (NDs)
Mercury, total (mg/L)	MW-1606I	0.000005	0.000005	0.002	n/a	No	10	90	No	0.011	NP (NDs)
Mercury, total (mg/L)	MW-1606S	0.000005	0.000005	0.002	n/a	No	10	90	No	0.011	NP (NDs)
Molybdenum, total (mg/L)	MW-1002	0.005438	0.002343	0.1	n/a	No	11	0	ln(x)	0.01	Param.
Molybdenum, total (mg/L)	MW-1602D	0.004043	0.003286	0.1	n/a	No	11	0	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1602I	0.002446	0.002065	0.1	n/a	No	11	0	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1603D	0.006024	0.004432	0.1	n/a	No	11	0	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1603I	0.009483	0.007699	0.1	n/a	No	11	0	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1603S	0.001404	0.0002648	0.1	n/a	No	11	9.091	sqrt(x)	0.01	Param.
Molybdenum, total (mg/L)	MW-1604D	0.003403	0.00264	0.1	n/a	No	11	0	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1604I	0.002935	0.002548	0.1	n/a	No	11	0	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1604S	0.002575	0.002155	0.1	n/a	No	10	0	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1605D	0.00319	0.00197	0.1	n/a	No	11	0	No	0.006	NP (normality)
Molybdenum, total (mg/L)	MW-1605I	0.001346	0.001089	0.1	n/a	No	11	0	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1605S	0.002159	0.001591	0.1	n/a	No	11	0	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1606D	0.00246	0.00177	0.1	n/a	No	11	0	No	0.006	NP (normality)
Molybdenum, total (mg/L)	MW-1606I	0.001778	0.00112	0.1	n/a	No	11	0	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1606S	0.001581	0.000983	0.1	n/a	No	11	0	No	0.01	Param.
Selenium, total (mg/L)	MW-1002	0.00009466	0.00006352	0.05	n/a	No	11	0	No	0.01	Param.
Selenium, total (mg/L)	MW-1602D	0.0002	0.00003	0.05	n/a	No	11	36.36	No	0.006	NP (normality)
Selenium, total (mg/L)	MW-1602I	0.0002	0.00004	0.05	n/a	No	11	36.36	No	0.006	NP (Cohens/xfrm)
Selenium, total (mg/L)	MW-1603D	0.0002289	0.00009296	0.05	n/a	No	11	54.55	No	0.01	Param.
Selenium, total (mg/L)	MW-1603I	0.0002	0.00005	0.05	n/a	No	11	63.64	No	0.006	NP (normality)
Selenium, total (mg/L)	MW-1603S	0.0002414	0.00005584	0.05	n/a	No	11	9.091	ln(x)	0.01	Param.
Selenium, total (mg/L)	MW-1604D	0.0002	0.00004	0.05	n/a	No	11	63.64	No	0.006	NP (normality)
Selenium, total (mg/L)	MW-1604I	0.0002	0.00003	0.05	n/a	No	11	45.45	No	0.006	NP (normality)
Selenium, total (mg/L)	MW-1604S	0.0001208	0.00004676	0.05	n/a	No	11	0	ln(x)	0.01	Param.
Selenium, total (mg/L)	MW-1605D	0.0002	0.00003	0.05	n/a	No	11	63.64	No	0.006	NP (normality)
Selenium, total (mg/L)	MW-1605I	0.0002	0.00004	0.05	n/a	No	11	45.45	No	0.006	NP (normality)
Selenium, total (mg/L)	MW-1605S	0.001788	0.00054	0.05	n/a	No	11	0	ln(x)	0.01	Param.
Selenium, total (mg/L)	MW-1606D	0.0002	0.00005	0.05	n/a	No	11	63.64	No	0.006	NP (normality)
Selenium, total (mg/L)	MW-1606I	0.0002	0.00005	0.05	n/a	No	11	72.73	No	0.006	NP (normality)
Selenium, total (mg/L)	MW-1606S	0.004999	0.002837	0.05	n/a	No	11	0	No	0.01	Param.
Thallium, total (mg/L)	MW-1002	0.00005	0.00002	0.002	n/a	No	11	9.091	No	0.006	NP (normality)
Thallium, total (mg/L)	MW-1602D	0.0005	0.00002	0.002	n/a	No	11	63.64	No	0.006	NP (normality)
Thallium, total (mg/L)	MW-1602I	0.0005	0.00001	0.002	n/a	No	11	18.18	No	0.006	NP (normality)
Thallium, total (mg/L)	MW-1603D	0.0005	0.00002	0.002	n/a	No	11	45.45	No	0.006	NP (normality)
Thallium, total (mg/L)	MW-1603I	0.00005	0.00003	0.002	n/a	No	11	9.091	No	0.006	NP (normality)
Thallium, total (mg/L)	MW-1603S	0.000091	0.00002	0.002	n/a	No	11	9.091	No	0.006	NP (normality)
Thallium, total (mg/L)	MW-1604D	0.0005	0.00002	0.002	n/a	No	11	63.64	No	0.006	NP (normality)
Thallium, total (mg/L)	MW-1604I	0.000078	0.00001	0.002	n/a	No	11	9.091	No	0.006	NP (normality)
Thallium, total (mg/L)	MW-1604S	0.000096	0.00002	0.002	n/a	No	11	9.091	No	0.006	NP (normality)
Thallium, total (mg/L)	MW-1605D	0.0005	0.00003	0.002	n/a	No	11	72.73	No	0.006	NP (normality)

Confidence Interval Summary Table - All Results (No Significant)

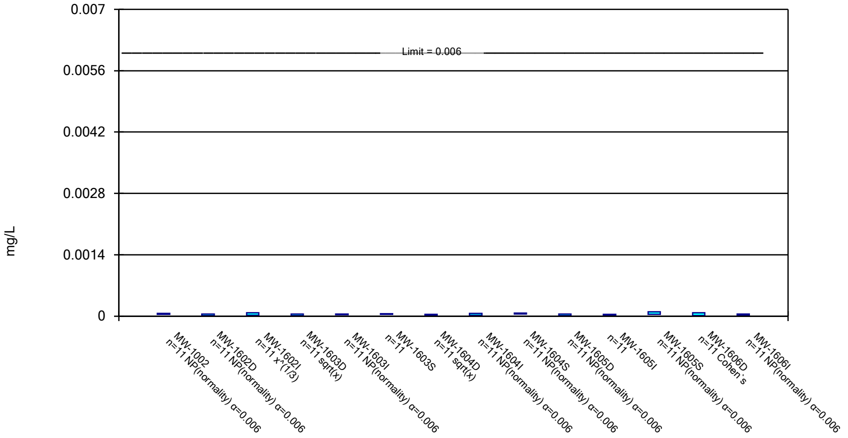
Rockport BAP Client: Geosyntec Data: Rockport_BAP Printed 8/8/2019, 5:04 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Lower Compl.	Sig.	N	%NDs	Transform	Alpha	Method
Thallium, total (mg/L)	MW-1605I	0.000183	0.00002	0.002	n/a	No	11	9.091	No	0.006	NP (normality)
Thallium, total (mg/L)	MW-1605S	0.00006	0.00002	0.002	n/a	No	11	9.091	No	0.006	NP (normality)
Thallium, total (mg/L)	MW-1606D	0.0005	0.00003	0.002	n/a	No	11	63.64	No	0.006	NP (normality)
Thallium, total (mg/L)	MW-1606I	0.000083	0.00003	0.002	n/a	No	11	9.091	No	0.006	NP (normality)
Thallium, total (mg/L)	MW-1606S	0.0005	0.00001	0.002	n/a	No	11	18.18	No	0.006	NP (normality)

Sanitas™ v.9.6.19f 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.

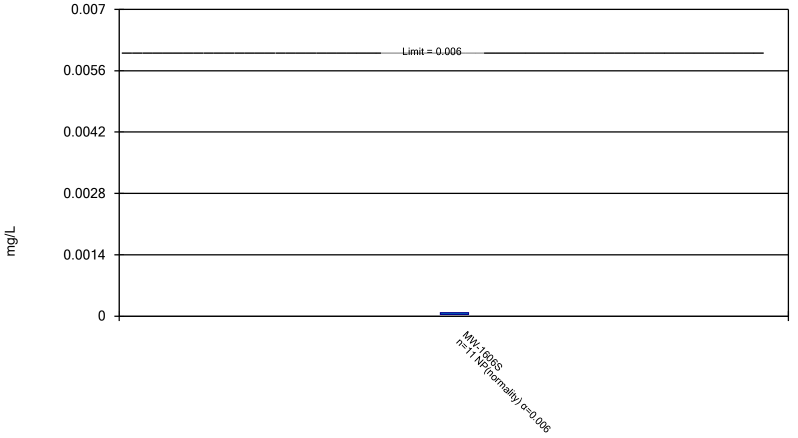


Constituent: Antimony, total Analysis Run 8/8/2019 5:02 PM View: Confidence Intervals - App IV
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.

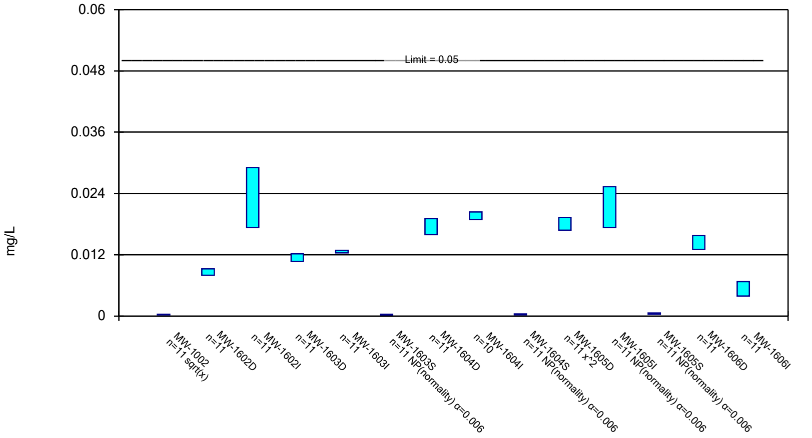


Constituent: Antimony, total Analysis Run 8/8/2019 5:02 PM View: Confidence Intervals - App IV
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f 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.

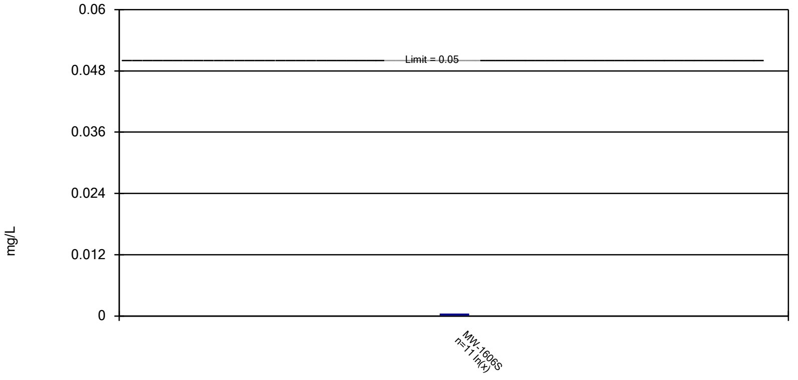


Constituent: Arsenic, total Analysis Run 8/8/2019 5:02 PM View: Confidence Intervals - App IV
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f 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.

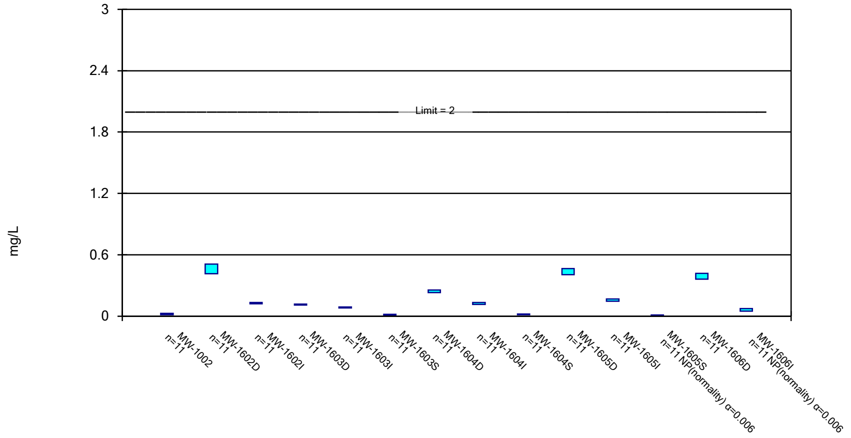


Constituent: Arsenic, total Analysis Run 8/8/2019 5:02 PM View: Confidence Intervals - App IV
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f 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.

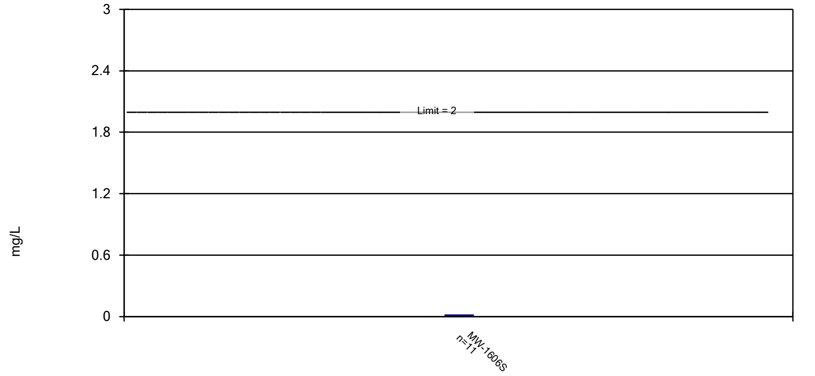


Constituent: Barium, total Analysis Run 8/8/2019 5:02 PM View: Confidence Intervals - App IV
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f 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.

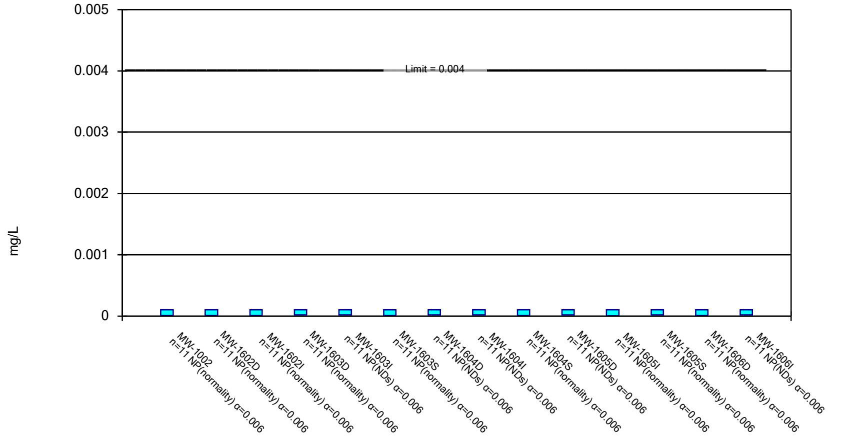


Constituent: Barium, total Analysis Run 8/8/2019 5:02 PM View: Confidence Intervals - App IV
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Constituent: Beryllium, total Analysis Run 8/8/2019 5:02 PM View: Confidence Intervals - App IV
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

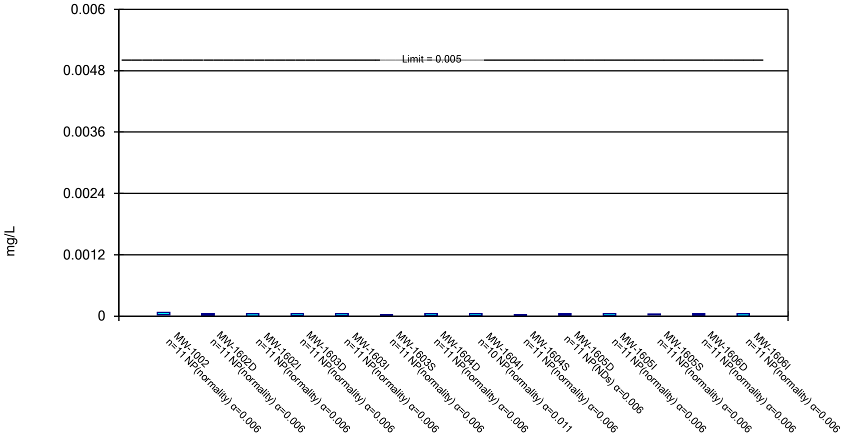
Compliance Limit is not exceeded.

Constituent: Beryllium, total Analysis Run 8/8/2019 5:02 PM View: Confidence Intervals - App IV
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.

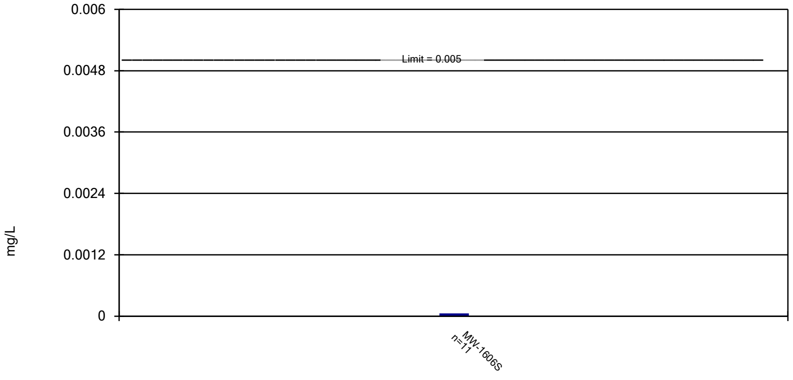


Constituent: Cadmium, total Analysis Run 8/8/2019 5:02 PM View: Confidence Intervals - App IV
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f 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.

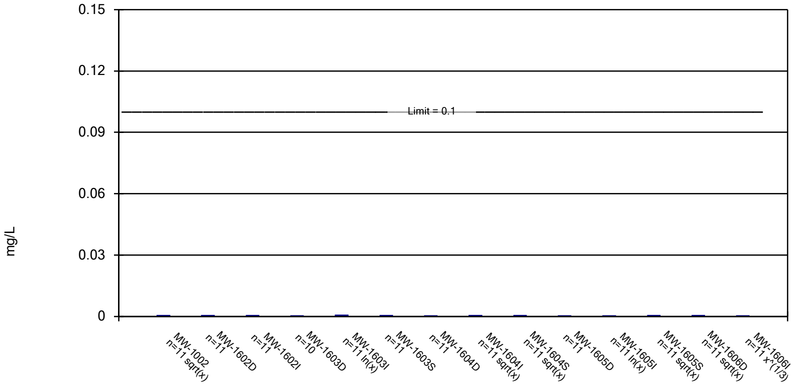


Constituent: Cadmium, total Analysis Run 8/8/2019 5:02 PM View: Confidence Intervals - App IV
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f 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.

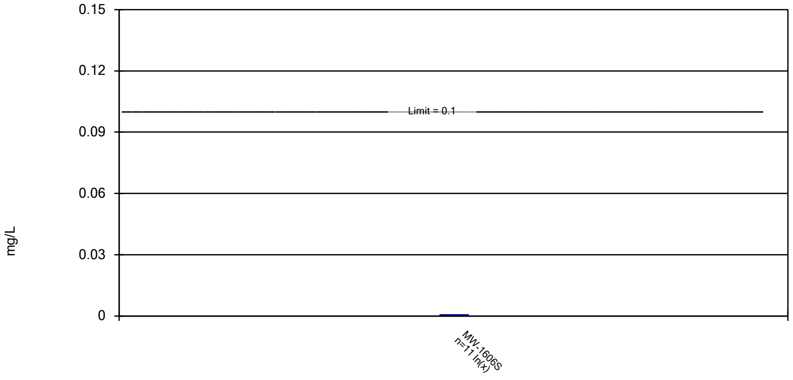


Constituent: Chromium, total Analysis Run 8/8/2019 5:02 PM View: Confidence Intervals - App IV
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f 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.

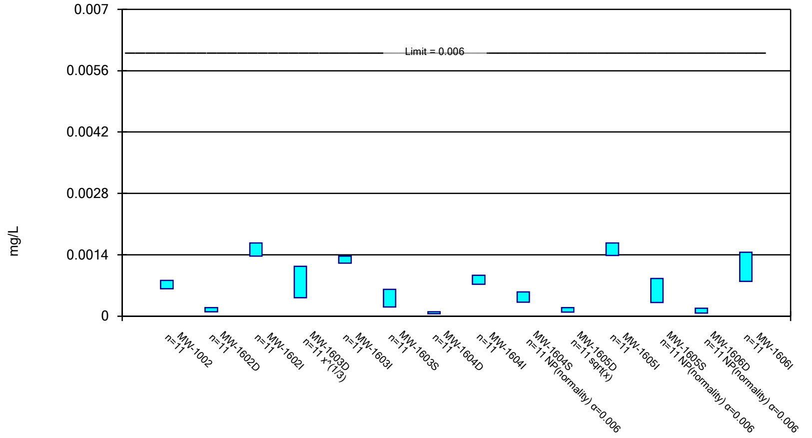


Constituent: Chromium, total Analysis Run 8/8/2019 5:02 PM View: Confidence Intervals - App IV
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f 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.



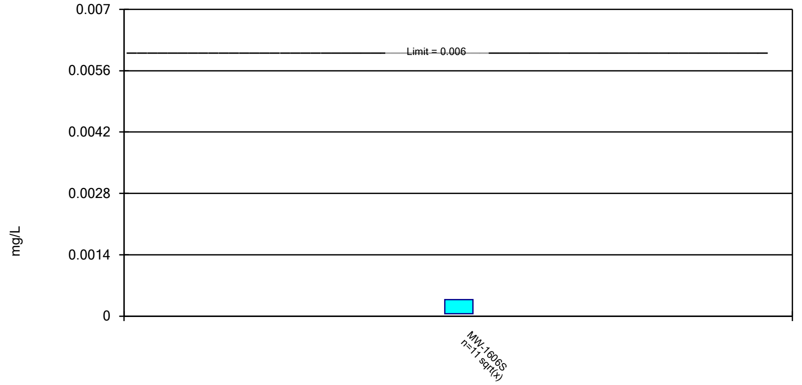
Constituent: Cobalt, total Analysis Run 8/8/2019 5:02 PM View: Confidence Intervals - App IV

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f 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.



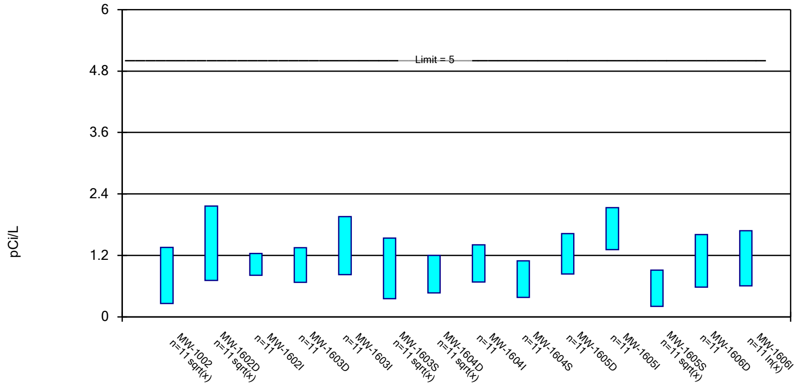
Constituent: Cobalt, total Analysis Run 8/8/2019 5:02 PM View: Confidence Intervals - App IV

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f 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.



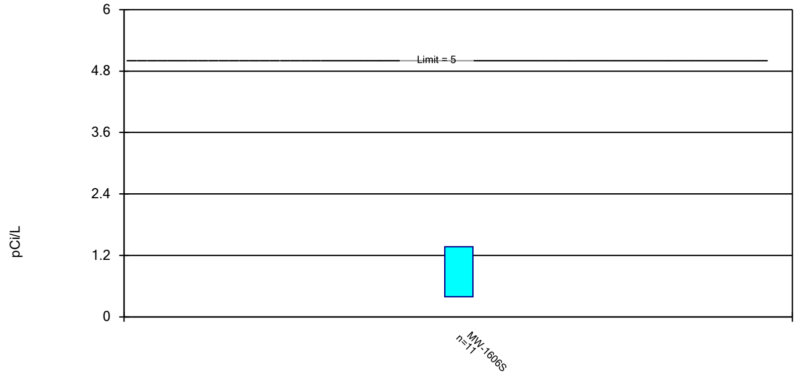
Constituent: Combined Radium 226 + 228 Analysis Run 8/8/2019 5:02 PM View: Confidence Intervals - A

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f 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.



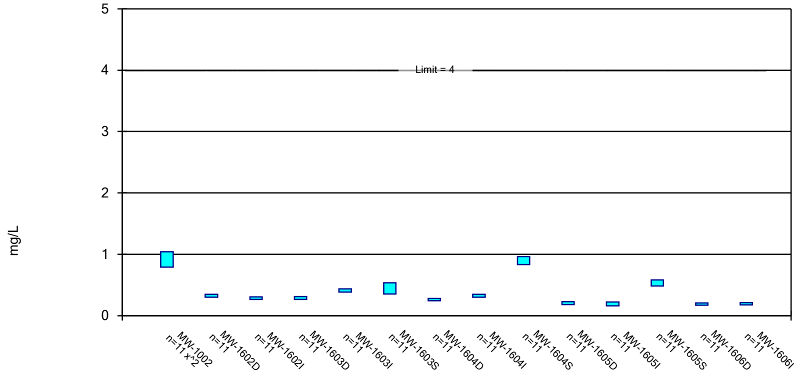
Constituent: Combined Radium 226 + 228 Analysis Run 8/8/2019 5:02 PM View: Confidence Intervals - A

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f 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.

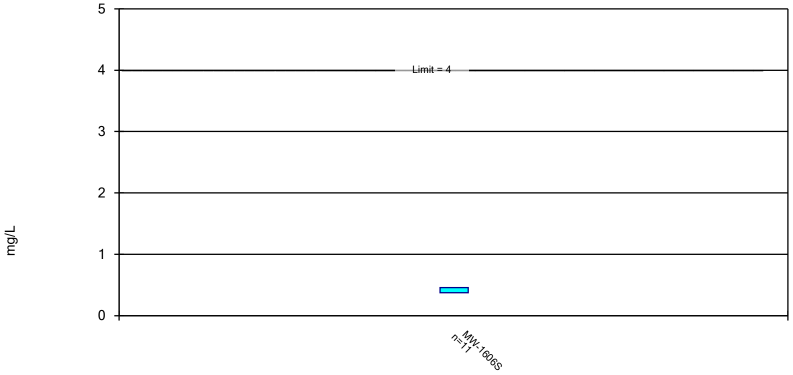


Constituent: Fluoride, total   Analysis Run 8/8/2019 5:02 PM   View: Confidence Intervals - App IV
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f 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.

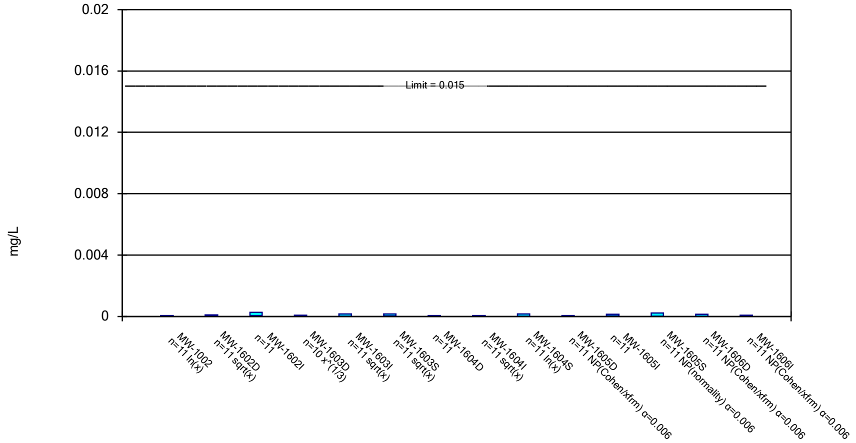


Constituent: Fluoride, total   Analysis Run 8/8/2019 5:02 PM   View: Confidence Intervals - App IV
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f 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.

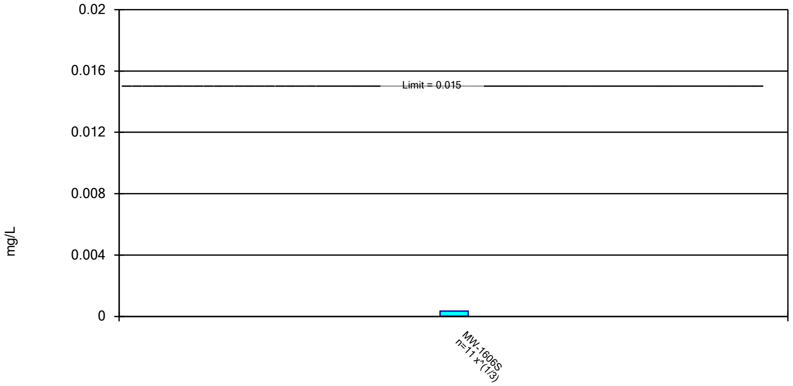


Constituent: Lead, total   Analysis Run 8/8/2019 5:02 PM   View: Confidence Intervals - App IV
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f 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.

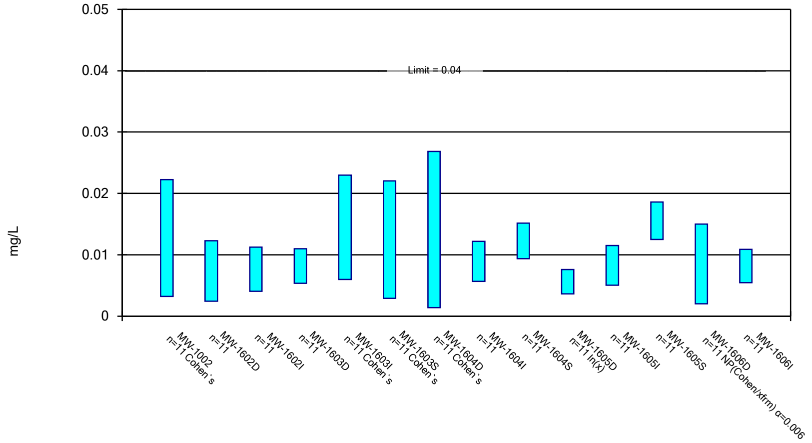


Constituent: Lead, total   Analysis Run 8/8/2019 5:02 PM   View: Confidence Intervals - App IV
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f 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.

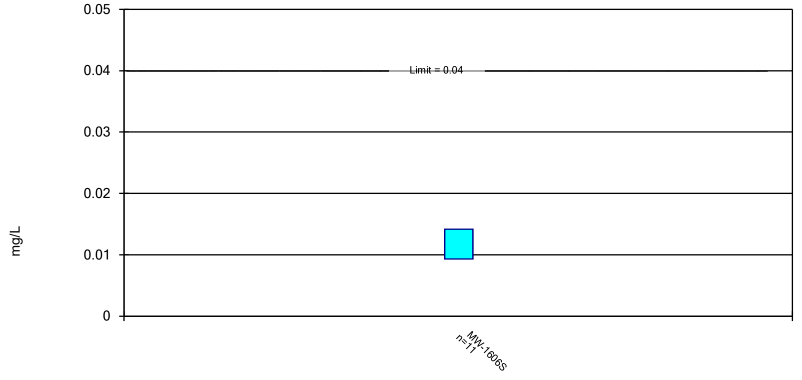


Constituent: Lithium, total   Analysis Run 8/8/2019 5:02 PM   View: Confidence Intervals - App IV
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f 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.

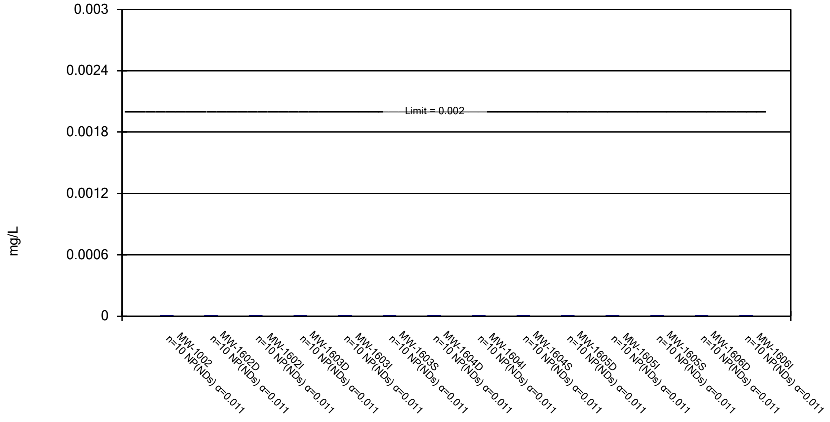


Constituent: Lithium, total   Analysis Run 8/8/2019 5:02 PM   View: Confidence Intervals - App IV
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.

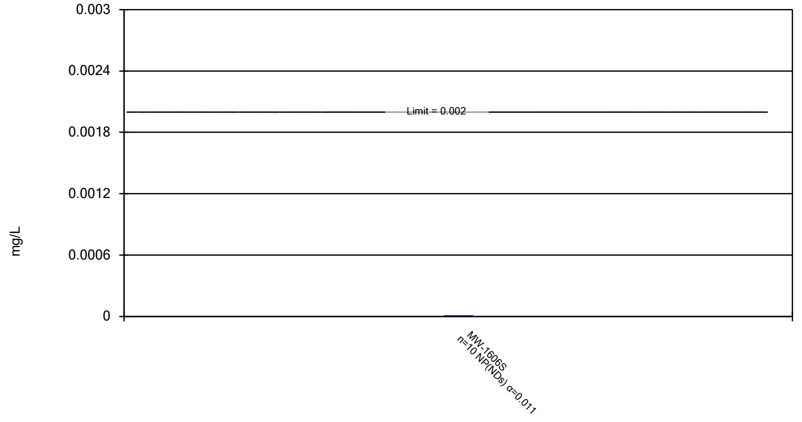


Constituent: Mercury, total   Analysis Run 8/8/2019 5:02 PM   View: Confidence Intervals - App IV
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.

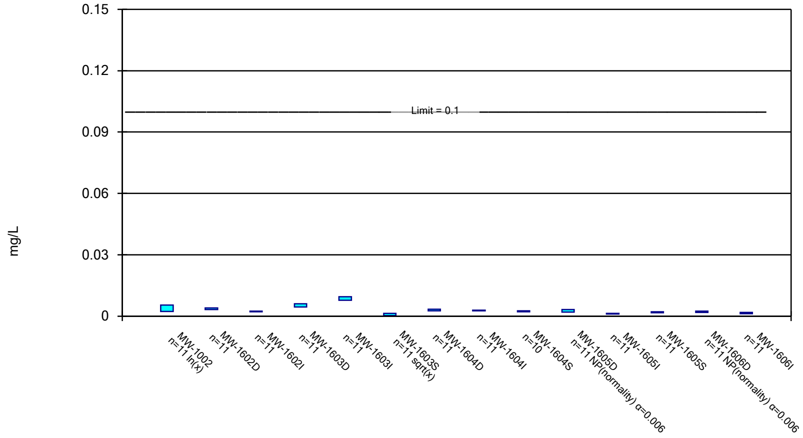


Constituent: Mercury, total   Analysis Run 8/8/2019 5:02 PM   View: Confidence Intervals - App IV
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.19f 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.

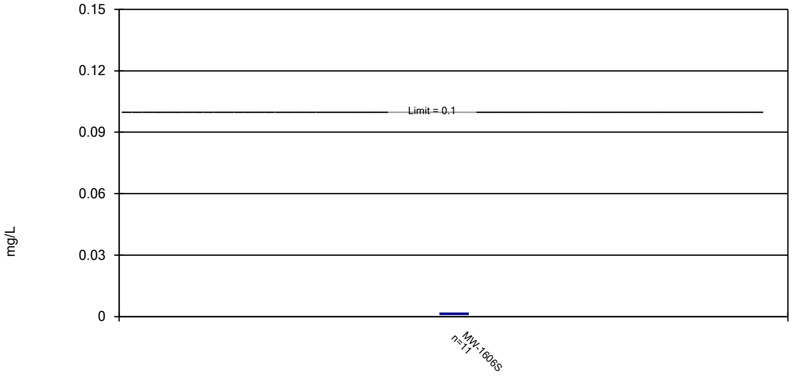


Constituent: Molybdenum, total Analysis Run 8/8/2019 5:02 PM View: Confidence Intervals - App IV
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f 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.

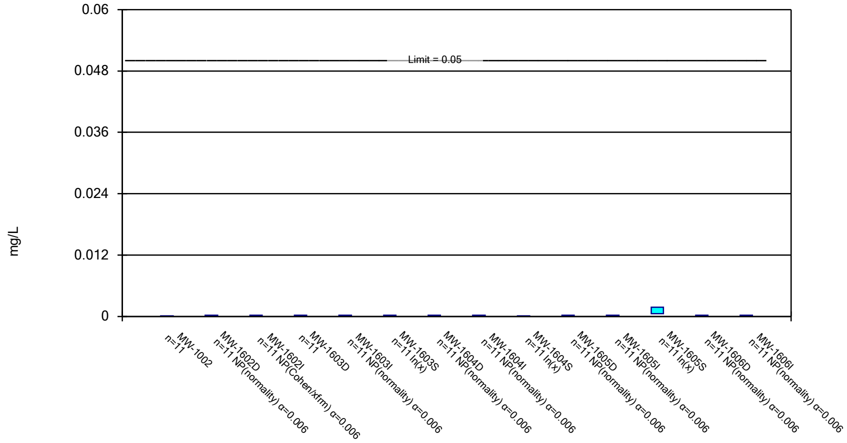


Constituent: Molybdenum, total Analysis Run 8/8/2019 5:02 PM View: Confidence Intervals - App IV
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f 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.

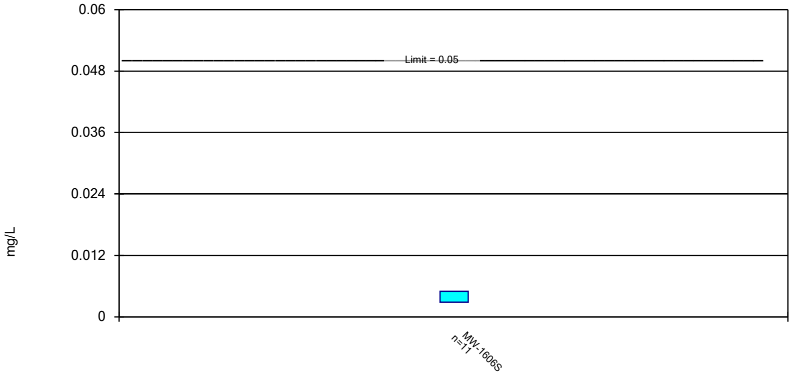


Constituent: Selenium, total Analysis Run 8/8/2019 5:02 PM View: Confidence Intervals - App IV
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f 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.

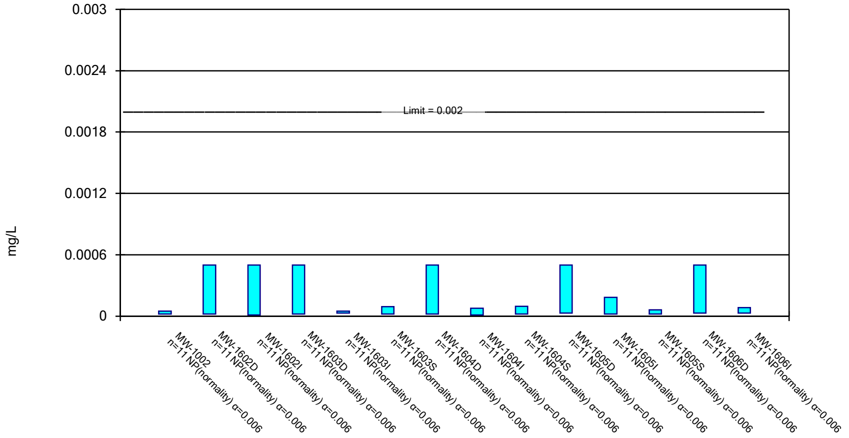


Constituent: Selenium, total Analysis Run 8/8/2019 5:02 PM View: Confidence Intervals - App IV
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.

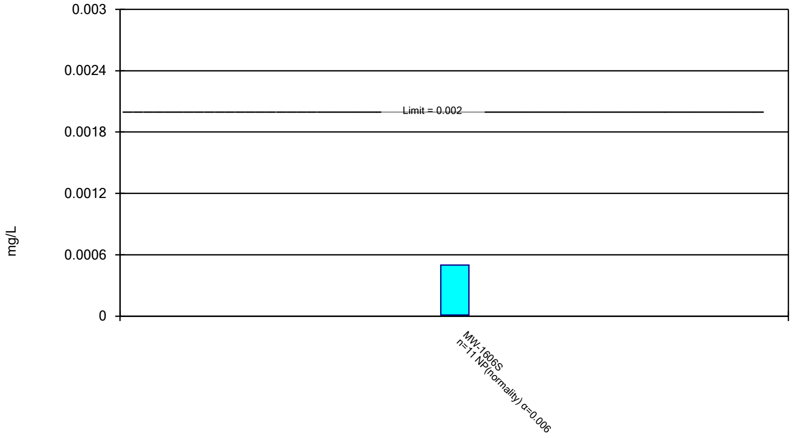


Constituent: Thallium, total Analysis Run 8/8/2019 5:02 PM View: Confidence Intervals - App IV
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.19f Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Constituent: Thallium, total Analysis Run 8/8/2019 5:02 PM View: Confidence Intervals - App IV
Rockport BAP Client: Geosyntec Data: Rockport_BAP

APPENDIX 3

ROCKPORT PLANT CCR
BOTTOM ASH PONDS

ANNUAL GROUNDWATER MONITORING REPORT COVERING 2019 ACTIVITIES

STATISTICAL ANALYSES SUMMARY OF JUNE AND SEPTEMBER 2019 SAMPLING EVENTS

STATISTICAL ANALYSIS SUMMARY
BOTTOM ASH POND
Rockport Plant
Rockport, Indiana

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

December 19, 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
SSI	Statistically Significant Increase
SSL	Statistically Significant Level
SU	Standard Unit
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 Rockport Power Plant located in Rockport, Indiana.

Based on detection monitoring conducted in 2017 and 2018, statistically significant increases (SSIs) over background were concluded for boron, chloride, fluoride, total dissolved solids (TDS), and sulfate at the BAP. An alternative source was not identified at the time, so the BAP has been in assessment monitoring since. The most recent assessment event was the second semiannual assessment monitoring event of 2018, which was completed in May 2019 in accordance with 40 CFR 257.95(d). No SSLs were identified during this event, as previously reported (Geosyntec, 2019).

Two assessment monitoring events were conducted at the BAP in June 2019 and September 2019 in accordance with 40 CFR 257.95(b) and 40 CFR 257.95(d), respectively. The results of these assessment 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. No SSLs were identified. Prediction limits were calculated for Appendix III parameters. When compared to the revised prediction limits, concentrations for boron, calcium, chloride, fluoride, pH, sulfate, and TDS remained above background. Thus, either the unit will remain in assessment monitoring or an alternative source demonstration (ASD) will be conducted to evaluate if the unit can return to detection 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) (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. An outlier for arsenic was identified in the June 2019 data at MW-1605S and was removed from the dataset. Additionally, where molybdenum was not detected during the June 2019 event it was replaced with a reporting limit of 0.01 mg/L, which is much higher than previous events. These values were flagged as outliers.

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, arsenic, barium, beryllium, cadmium, chromium, cobalt, fluoride, lithium, molybdenum, selenium, and thallium due to apparent non-normal distributions and for 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.

No SSLs were identified at the Rockport BAP.

2.2.3 Establishment of Appendix III Prediction Limits

Upper prediction limits (UPLs) were previously established for all Appendix III parameters following the background monitoring period (Geosyntec, 2018). Intrawell tests were used to evaluate potential SSIs for calcium and pH, whereas interwell tests were used to evaluate potential SSIs for boron, 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 (June 2016 - July 2017) to the new compliance samples (October 2017 – May 2019) for calcium and 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.

The complete Mann-Whitney test results and a summary of the significant findings can be found in Appendix B. A statistically significant difference was identified for pH at MW-1002. Because the majority of the recent concentrations are very similar to historical measurements, the background was updated to include all data through May 2019.

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 May 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 calcium and pH, whereas interwell tests continued to be used to evaluate potential SSIs for boron, chloride, fluoride, sulfate, and TDS. For intrawell tests, the UPLs were calculated for a one-of-three retesting procedure; i.e., if at least one sample in a series of three 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 will not be collected. The interwell tests were calculated for a one-of-two retesting procedure. 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

The CCR rule allows CCR units to move from assessment monitoring to detection monitoring if all Appendix III and Appendix IV parameters were at or below background levels for two consecutive sampling events [40 CFR 257.95(e)]. Since no Appendix IV SSLs were identified, Appendix III results were analyzed to assess whether concentrations of Appendix III parameters at the compliance wells exceeded background concentrations.

Data collected during the June 2019 and August 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 UPLs were noted:

- Boron concentrations exceeded the interwell UPL of 0.135 mg/L at MW-1002 (1.82 mg/L and 1.78 mg/L), MW-1603S (1.65 mg/L and 2.16 mg/L), MW-1604I (0.278 mg/L and 0.269 mg/L), MW-1604S (0.667 mg/L and 0.802 mg/L), MW-1605I (0.199 mg/L) and MW-1605S (0.438 mg/L and 0.431 mg/L).

- Calcium concentrations exceeded the intrawell UPL of 86.3 mg/L at MW-1606I (86.8 mg/L).

- Chloride concentrations exceeded the interwell UPL of 46.4 mg/L at MW-1002 (57.1 mg/L and 54.7 mg/L), MW-1602D (68.7 mg/L and 65.1 mg/L), MW-1603S (57.8 mg/L and 51.1 mg/L), MW-1604I (63.5 mg/L), MW-1604S (81.4 mg/L and 57.6 mg/L), and MW-1605S (49.4 mg/L).

- Fluoride concentrations exceeded the interwell UPL of 0.700 mg/L at MW-1002 (1.10 mg/L and 1.03 mg/L) and MW-1604S (0.910 mg/L and 1.63 mg/L).

- The pH measurement exceeded the intrawell UPL of 7.4 SU at MW-1603D (7.6 SU), the intrawell UPL of 7.8 SU at MW-1603I (8.1 SU). The pH measurement at MW-1605S was below the intrawell LPL of 7.1 SU (7.0 SU).

- Sulfate concentrations exceeded the interwell UPL of 76.0 mg/L at MW-1002 (173 mg/L and 178 mg/L), MW-1603S (205 mg/L and 224 mg/L), MW-1604I (167 mg/L and 127 mg/L), MW-1604S (246 mg/L and 134 mg/L), MW-1605I (104 mg/L and 128 mg/L), and MW-1605S (150 mg/L and 162 mg/L).

- TDS concentrations exceeded the interwell UPL of 465 mg/L at MW-1603I (560 mg/L), MW-1603S (530 mg/L and 482 mg/L), MW-1604I (622 mg/L and 515 mg/L), MW-1604S (718 mg/L and 506 mg/L), MW-1605I (471 mg/L and 524 mg/L), and MW-1605S (595 mg/L and 593 mg/L).

Based on these results, concentrations of Appendix III parameters exceeded background levels at compliance wells at the Rockport BAP during assessment monitoring. As a result, the Rockport BAP CCR unit will remain in 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 non-detect molybdenum values from the June 2019 event and an arsenic value at MW-1605S. 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. No SSLs were identified.

Revised prediction limits were calculated for Appendix III parameters. Intrawell tests continued to be used to evaluate potential SSIs for calcium and pH, whereas interwell tests continued to be used to evaluate potential SSIs for boron, chloride, fluoride, sulfate, and TDS. Prediction limits were recalculated using a one-of-three retesting procedure for intrawell tests and a one-of-two retesting procedure for interwell tests. The Appendix III results were evaluated to assess whether concentrations of Appendix III parameters exceeded background levels. Boron, calcium, chloride, fluoride, pH, sulfate, and TDS results exceeded background levels.

Based on this evaluation, either the Rockport BAP CCR unit will remain in assessment monitoring or an ASD will be conducted to evaluate if the unit can return to detection monitoring.

SECTION 3

REFERENCES

American Electric Power (AEP). 2017. Statistical Analysis Plan – Rockport Plant. January 2017.

Geosyntec Consultants (Geosyntec). 2018. Statistical Analysis Summary – Bottom Ash Pond, Rockport Plant, Rockport, Indiana. January 15, 2018.

Geosyntec Consultants (Geosyntec). 2019. Statistical Analysis Summary – Bottom Ash Pond, Rockport Plant, Rockport, Indiana. October 11, 2019.

TABLES

Table 1: Groundwater Data Summary
Rockport Plant - Bottom Ash Pond

Component	**Unit**	**MW-1002**		**MW-1600D**		**MW-1600I**		**MW-1600S**		**MW-1601D**	
		6/27/2019	**9/12/2019**	**6/25/2019**	**9/10/2019**	**6/25/2019**	**9/10/2019**	**6/25/2019**	**9/10/2019**	**6/26/2019**	**9/9/2019**
Antimony	µg/L	0.0500 J	0.0500 J	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U
Arsenic	µg/L	0.240	0.220	16.6	16.1	17.2	16.9	0.480	0.460	9.80	11.0
Barium	µg/L	14.8	15.8	867	884	740	722	22.0	21.9	542	575
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
Boron	mg/L	1.82	1.78	0.0300 J	0.0500 U	0.0200 J	0.0200 J	0.0500 J	0.0400 J	0.0400 J	0.0300 J
Cadmium	µg/L	0.0300 J	0.0200 J	0.0500 U	0.0500 U	0.0500 U	0.0500 U	0.0100 J	0.0100 J	0.0500 U	0.0500 U
Calcium	mg/L	36.0	33.5	84.2	90.1	76.0	81.1	62.7	64.8	85.9	84.4
Chloride	mg/L	57.1	54.7	31.0	31.1	25.0	25.6	21.4	23.9	18.7	19.9
Chromium	µg/L	0.0700 J	0.469	0.100 J	0.200 J	0.200 U	0.100 J	0.0800 J	0.200 J	0.0700 J	0.0800 J
Cobalt	µg/L	0.805	0.635	0.146	0.132	1.23	1.29	0.193	0.149	0.0750	0.0540
Combined Radium	pCi/L	0.682	0.384	1.12	1.62	2.30	1.22	0.528	0.209	0.986	0.702
Fluoride	mg/L	1.10	1.03	0.220	0.230	0.230	0.240	0.470	0.460	0.160	0.180
Lead	µg/L	0.0300 J	0.200 U	0.135	0.100 J	0.100 U	0.200 U	0.0900 J	0.0800 J	0.0200 J	0.200 U
Lithium	mg/L	0.0300 U	0.00438	0.0100 J	0.00627	0.00900 J	0.00720	0.0300 J	0.0126	0.0200 J	0.00170
Mercury	mg/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
Molybdenum	µg/L	10.4	10.2	2.00 J	2.00 J	2.00 J	2.00 J	0.500 J	0.600 J	2.94	3.15
Selenium	µg/L	0.0800 J	0.0600 J	0.0500 J	0.200 U	0.200 U	0.200 U	0.400	0.500	0.200 U	0.200 U
Total Dissolved Solids	mg/L	425	418	407	404	401	404	398	383	409	404
Sulfate	mg/L	173	178	37.7	41.3	46.7	50.8	40.9	45.0	22.9	18.2
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	0.500 U	0.500 U
pH	SU	7.05	6.65	7.12	7.18	7.10	7.19	6.82	6.87	7.21	7.16

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

Table 1: Groundwater Data Summary
Rockport Plant - Bottom Ash Pond

Component	Unit	MW-1601I		MW-1601S		MW-1602D		MW-1602I		MW-1603D	
		6/26/2019	**9/9/2019**	**6/25/2019**	**9/9/2019**	**6/27/2019**	**9/12/2019**	**6/27/2019**	**9/12/2019**	**6/27/2019**	**9/11/2019**
Antimony	µg/L	0.100 U	0.0400 J	0.100 U	0.0200 J	0.100 U	0.170	0.0300 J	0.0400 J	0.100 U	0.100 U
Arsenic	µg/L	18.0	39.5	2.06	2.30	9.05	10.3	22.4	30.0	13.2	13.2
Barium	µg/L	619	670	44.2	51.4	386	433	115	120	111	112
Beryllium	µg/L	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.0200 J	0.100 U	0.100 U	0.100 U	0.100 U
Boron	mg/L	0.0300 J	0.0200 J	0.0700 J	0.0680	0.0600 J	0.0590	0.0600 J	0.0510	0.0600 J	0.0400 J
Cadmium	µg/L	0.0500 U	0.0700	0.0500 U	0.0200 J	0.0500 U	0.0300 J	0.0500 U	0.0500 U	0.0500 U	0.0500 U
Calcium	mg/L	85.0	85.1	75.9	79.6	69.8	57.8	76.2	83.1	77.9	82.8
Chloride	mg/L	31.2	30.8	35.3	37.6	68.7	65.1	29.2	28.7	25.0	26.1
Chromium	µg/L	0.0600 J	0.250	0.100 J	0.452	0.0600 J	0.763	0.200 J	0.100 J	0.0600 J	0.200 J
Cobalt	µg/L	1.50	1.63	0.649	1.14	0.0660	0.373	1.39	1.32	0.327	0.327
Combined Radium	pCi/L	1.86	1.52	0.248	0.914	0.688	1.13	0.733	1.31	0.766	0.957
Fluoride	mg/L	0.210	0.220	0.310	0.310	0.330	0.280	0.300	0.300	0.300	0.300
Lead	µg/L	0.0400 J	0.251	0.165	0.325	0.0200 J	0.437	0.0600 J	0.100 J	0.100 U	0.0800 J
Lithium	mg/L	0.0200 J	0.00672	0.0100 J	0.00691	0.0300 U	0.00286	0.0300 U	0.00572	0.0300 U	0.00380
Mercury	mg/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
Molybdenum	µg/L	2.28	2.26	1.00 J	1.00 J	3.12	3.64	2.00 J	2.11	3.98	4.10
Selenium	µg/L	0.200 U	0.0400 J	1.40	1.20	0.0300 J	0.0900 J	0.200 U	0.0300 J	0.200 U	0.0300 J
Total Dissolved Solids	mg/L	439	426	456	445	429	440	405	404	388	407
Sulfate	mg/L	50.8	42.7	51.4	52.9	20.3	20.2	67.4	70.7	32.8	36.4
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	0.500 U	0.500 U
pH	SU	7.21	7.06	7.31	7.20	7.32	7.14	7.25	7.26	7.58	7.21

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

Table 1: Groundwater Data Summary
Rockport Plant - Bottom Ash Pond

Component	Unit	MW-1603I		MW-1603S		MW-1604D		MW-1604I		MW-1604S	
		6/27/2019	**9/11/2019**	**6/27/2019**	**9/11/2019**	**6/26/2019**	**9/10/2019**	**6/27/2019**	**9/11/2019**	**6/26/2019**	**9/10/2019**
Antimony	µg/L	0.0700 J	0.0800 J	0.0300 J	0.0400 J	0.100 U	0.100 U	0.0200 J	0.0300 J	0.0400 J	0.0600 J
Arsenic	µg/L	12.7	13.2	0.170	0.220	18.2	18.0	18.5	20.7	0.470	0.260
Barium	µg/L	84.3	83.0	13.7	12.0	263	257	135	119	46.1	12.0
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
Boron	mg/L	0.0700 J	0.0870	1.65	2.16	0.0300 J	0.0200 J	0.278	0.269	0.667	0.802
Cadmium	µg/L	0.0100 J	0.0500 U	0.0300 J	0.0200 J	0.0500 U	0.0500 U	0.0500 U	0.0500 U	0.0200 J	0.0200 J
Calcium	mg/L	78.6	80.1	67.2	55.1	69.5	74.7	75.2	71.5	75.8	53.1
Chloride	mg/L	37.7	38.7	57.8	51.1	15.8	15.9	63.5	43.6	81.4	57.6
Chromium	µg/L	0.678	0.355	0.0600 J	0.0400 J	0.0600 J	0.0900 J	0.0900 J	0.100 J	0.100 J	0.202
Cobalt	µg/L	1.58	1.36	0.383	0.266	0.0670	0.0520	0.979	0.735	1.13	0.207
Combined Radium	pCi/L	0.966	1.41	0.555	0.172	1.16	0.859	0.888	0.819	0.565	0.115
Fluoride	mg/L	0.470	0.460	0.590	0.690	0.280	0.280	0.380	0.350	0.910	1.63
Lead	µg/L	0.312	0.200 J	0.100 U	0.200 U	0.0400 J	0.200 U	0.100 U	0.200 U	0.122	0.200 U
Lithium	mg/L	0.0300 U	0.00711	0.0300 U	0.00414	0.0300 U	0.00157	0.0300 U	0.00772	0.0100 J	0.00913
Mercury	mg/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
Molybdenum	µg/L	6.29	7.48	0.500 J	0.600 J	2.58	2.70	2.51	2.26	1.00 J	4.72
Selenium	µg/L	0.0700 J	0.200 U	1.50	0.300	0.200 U	0.200 U	0.100 J	0.0500 J	0.200	0.100 J
Total Dissolved Solids	mg/L	560	443	530	482	326	326	622	515	718	506
Sulfate	mg/L	66.9	58.2	205	224	23.2	24.7	167	127	246	134
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	0.500 U	0.500 U
pH	SU	8.07	7.31	7.30	7.10	7.29	7.28	7.50	7.42	7.50	7.52

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

Table 1: Groundwater Data Summary
Rockport Plant - Bottom Ash Pond

Component	Unit	MW-1605D		MW-1605I		MW-1605S		MW-1606D		MW-1606I	
		6/25/2019	9/12/2019	6/25/2019	9/12/2019	6/27/2019	9/12/2019	6/24/2019	9/12/2019	6/25/2019	9/12/2019
Antimony	µg/L	0.100 U	0.100 U	0.500 U	0.0500 J	0.110	0.0400 J	0.100 U	0.100 U	0.500 U	0.0200 J
Arsenic	µg/L	18.3	21.2	17.8	22.3	2.44	0.610	17.5	17.4	7.96	11.2
Barium	µg/L	365	471	134	154	12.5	6.72	431	458	78.1	76.7
Beryllium	µg/L	0.100 U	0.100 U	0.500 U	0.100 U	0.0400 J	0.100 U	0.100 U	0.100 U	0.500 U	0.100 U
Boron	mg/L	0.100 U	0.0500 U	0.126	0.199	0.438	0.431	0.0200 J	0.0500 U	0.100 U	0.0500 U
Cadmium	µg/L	0.0500 U	0.0500 U	0.200 U	0.0500 U	0.0700	0.0400 J	0.0500 U	0.0500 U	0.200 U	0.0500 U
Calcium	mg/L	82.1	84.0	83.4	89.4	72.0	77.0	80.8	76.7	86.8	72.8
Chloride	mg/L	22.1	23.7	38.3	41.7	46.3	49.4	25.2	26.9	31.5	20.1
Chromium	µg/L	0.200 J	0.652	1.00 U	0.100 J	0.536	0.0900 J	0.100 J	0.0900 J	1.00 U	0.100 J
Cobalt	µg/L	0.104	0.0840	1.29	1.42	2.46	0.469	0.0680	0.0850	1.80	1.58
Combined Radium	pCi/L	0.655	0.896	2.12	1.68	0.245	0.00129	0.809	0.593	1.21	0.947
Fluoride	mg/L	0.210	0.220	0.210	0.200	0.630	0.540	0.190	0.180	0.180	0.180
Lead	µg/L	0.0500 J	0.200 U	0.500 U	0.100 J	1.52	0.100 J	0.0200 J	0.200 U	0.500 U	0.200 U
Lithium	mg/L	0.0300 U	0.00176	0.0100 J	0.00628	0.0300 U	0.0108	0.0300 U	0.000651	0.0100 J	0.00405
Mercury	mg/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
Molybdenum	µg/L	2.00 J	2.08	10.0 U	1.00 J	2.00 J	2.07	2.00 J	2.00 J	10.0 U	1.00 J
Selenium	µg/L	0.200 U	0.200 U	1.00 U	0.200 U	0.500	2.00	0.200 U	0.200 U	1.00 U	0.200 U
Total Dissolved Solids	mg/L	379	388	471	524	595	593	329	361	406	367
Sulfate	mg/L	40.3	45.1	104	128	150	162	21.0	25.6	51.0	47.9
Thallium	µg/L	0.500 U	0.500 U	2.00 U	0.500 U	0.100 J	0.500 U	0.500 U	0.500 U	2.00 U	0.500 U
pH	SU	7.30	6.98	7.35	7.40	7.17	7.04	7.26	7.25	7.21	7.36

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

Table 1: Groundwater Data Summary
Rockport Plant - Bottom Ash Pond

Component	Unit	MW-1606S		MW-1701D		MW-1701I		MW-1701S		MW-1702D	
		6/25/2019	9/12/2019	6/25/2019	9/9/2019	6/25/2019	9/9/2019	6/25/2019	9/9/2019	6/26/2019	9/10/2019
Antimony	µg/L	0.500 U	0.0300 J	0.500 U	0.100 U	0.500 U	0.210	0.500 U	0.160	0.0700 J	0.0400 J
Arsenic	µg/L	0.200 J	0.170	9.58	9.37	9.47	7.92	0.400 J	0.380	24.4	22.1
Barium	µg/L	14.4	11.8	64.6	65.0	41.9	40.6	8.08	16.8	209	203
Beryllium	µg/L	0.500 U	0.100 U	0.500 U	0.100 U	0.500 U	0.100 U	0.500 U	0.100 U	0.100 U	0.100 U
Boron	mg/L	0.0300 J	0.0200 J	0.0200 J	0.0200 J	0.0200 J	0.0500 U	0.0200 J	0.0500 U	0.0200 J	0.0500 U
Cadmium	µg/L	0.0600 J	0.0300 J	0.200 U	0.0500 U	0.200 U	0.0500 U	0.200 U	0.0500 U	0.0200 J	0.0500 U
Calcium	mg/L	49.8	44.4	70.8	70.5	69.4	65.1	63.5	57.0	80.0	86.6
Chloride	mg/L	25.0	24.4	14.9	16.0	12.8	12.9	19.6	20.0	30.4	30.6
Chromium	µg/L	1.00 U	0.0800 J	1.00 U	0.200 J	1.00 U	0.0800 J	1.00 U	0.100 J	0.0800 J	0.100 J
Cobalt	µg/L	0.200 U	0.0510	1.62	1.53	1.16	0.843	0.200 J	0.0730	0.601	0.536
Combined Radium	pCi/L	0.0646	0.105	2.63	0.341	0.116	0.781	0.931	0.327	0.689	0.639
Fluoride	mg/L	0.450	0.540	0.320	0.310	0.410	0.380	0.370	0.370	0.170	0.200
Lead	µg/L	0.500 U	0.200 U	0.500 U	0.200 U	0.500 U	0.0800 J	0.500 U	0.200 U	0.0700 J	0.200 U
Lithium	mg/L	0.0100 J	0.00814	0.0100 J	0.00691	0.0100 J	0.00561	0.0100 J	0.00556	0.0200 J	0.00456
Mercury	mg/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
Molybdenum	µg/L	10.0 U	1.00 J	10.0 U	1.00 J	10.0 U	1.00 J	10.0 U	0.700 J	2.15	2.16
Selenium	µg/L	2.90	2.80	0.200 J	0.200 U	1.00 U	0.200 U	0.500 J	0.300	0.0300 J	0.200 U
Total Dissolved Solids	mg/L	380	376	387	376	388	339	353	332	388	384
Sulfate	mg/L	41.7	41.9	39.0	36.6	36.3	34.5	20.7	17.8	39.0	37.9
Thallium	µg/L	2.00 U	0.500 U	2.00 U	0.500 U	2.00 U	0.500 U	2.00 U	0.500 U	0.500 U	0.500 U
pH	SU	6.98	7.02	7.12	7.04	7.65	7.27	7.25	7.22	7.63	7.10

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

Table 1: Groundwater Data Summary
Rockport Plant - Bottom Ash Pond

Component	**Unit**	**MW-1702I**		**MW-1702S**	
		6/25/2019	**9/10/2019**	**6/25/2019**	**9/10/2019**
Antimony	µg/L	0.0700 J	0.0800 J	0.500 U	0.0800 J
Arsenic	µg/L	54.1	55.8	0.400 J	0.430
Barium	µg/L	114	112	5.71	4.87
Beryllium	µg/L	0.100 U	0.100 U	0.500 U	0.100 U
Boron	mg/L	0.0200 J	0.0500 U	0.0400 J	0.0400 J
Cadmium	µg/L	0.0200 J	0.0500 U	0.200 U	0.0100 J
Calcium	mg/L	74.7	80.2	36.7	35.6
Chloride	mg/L	28.5	28.9	14.6	16.5
Chromium	µg/L	0.0700 J	0.100 J	0.200 J	0.215
Cobalt	µg/L	1.78	1.60	0.200 U	0.0960
Combined Radium	pCi/L	0.467	0.584	0.357	0.243
Fluoride	mg/L	0.200	0.240	0.590	0.630
Lead	µg/L	0.100 J	0.0600 J	0.500 U	0.100 J
Lithium	mg/L	0.0200 J	0.00469	0.0300 U	0.00127
Mercury	mg/L	0.00500 U	0.00500 U	0.00500 U	0.00500 U
Molybdenum	µg/L	2.00 J	2.03	10.0 U	1.00 J
Selenium	µg/L	0.0700 J	0.200 U	2.40	1.30
Total Dissolved Solids	mg/L	376	384	284	284
Sulfate	mg/L	44.7	43.6	22.3	19.2
Thallium	µg/L	0.500 U	0.500 U	2.00 U	0.500 U
pH	SU	7.31	7.07	7.23	6.74

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

Table 2: Groundwater Protection Standards - September 2019
Rockport Plant - Bottom Ash Pond

Constituent Name	MCL	CCR Rule-Specified (EPA Regional Screening Level)	Calculated UTL	GWPS
Antimony, Total (mg/L)	0.006		0.00050	0.006
Arsenic, Total (mg/L)	0.01		0.056	0.056
Barium, Total (mg/L)	2		0.997	2
Beryllium, Total (mg/L)	0.004		0.0005	0.004
Cadmium, Total (mg/L)	0.005		0.00028	0.005
Chromium, Total (mg/L)	0.1		0.0016	0.1
Cobalt, Total (mg/L)	n/a	0.006	0.0033	0.006
Combined Radium, Total (pCi/L)	5		2.5	5
Fluoride, Total (mg/L)	4		0.7	4
Lead, Total (mg/L)	n/a	0.015	0.0011	0.015
Lithium, Total (mg/L)	n/a	0.04	0.038	0.04
Mercury, Total (mg/L)	0.002		0.000005	0.002
Molybdenum, Total (mg/L)	n/a	0.1	0.0087	0.1
Selenium, Total (mg/L)	0.05		0.0038	0.05
Thallium, Total (mg/L)	0.002		0.0020	0.002

Notes:

MCL = Maximum Contaminant Level

GWPS = Groundwater Protection Standard

Calculated UTL (Upper Tolerance Limit) represents site-specific background values.

UTLs were revised in December 2019 using data through September 2019.

Table 3: Revised Prediction Limits - December 2019
Rockport - Bottom Ash Pond

Parameter	Unit	Description	MW-1002	MW-1602D	MW-1602I	MW-1603D	MW-1603I	MW-1603S	MW-1604D	MW-1604I
Boron	mg/L	Interwell Background Value (UPL)	0.135							
Calcium	mg/L	Intrawell Background Value (UPL)	78.3	79.7	87.8	96.7	104	96.2	76.1	84.4
Chloride	mg/L	Interwell Background Value (UPL)	46.4							
Fluoride	mg/L	Interwell Background Value (UPL)	0.700							
pH	SU	Intrawell Background Value (UPL)	7.8	8.2	7.8	7.4	7.8	7.6	7.4	7.8
		Intrawell Background Value (LPL)	6.1	6.7	6.8	6.8	6.8	6.4	7.0	7.1
Sulfate	mg/L	Interwell Background Value (UPL)	76.0							
Total Dissolved Solids	mg/L	Interwell Background Value (UPL)	465							

Parameter	Unit	Description	MW-1604S	MW-1605D	MW-1605I	MW-1605S	MW-1606D	MW-1606I	MW-1606S
Boron	mg/L	Interwell Background Value (UPL)	0.135						
Calcium	mg/L	Intrawell Background Value (UPL)	108	95.3	104	88.6	81.4	86.3	68.1
Chloride	mg/L	Interwell Background Value (UPL)	46.4						
Fluoride	mg/L	Interwell Background Value (UPL)	0.700						
pH	SU	Intrawell Background Value (UPL)	7.9	7.4	7.6	7.7	8.4	8.3	7.8
		Intrawell Background Value (LPL)	7.1	6.9	6.9	7.1	6.9	6.4	6.3
Sulfate	mg/L	Interwell Background Value (UPL)	76.0						
Total Dissolved Solids	mg/L	Interwell Background Value (UPL)	465						

Notes:

UPL: Upper prediction limit

LPL: Lower prediction limit

Bold values exceed the background value.

Background values are shaded gray.

Revised prediction limits were calculated using data available through May 2019.

Table 4: Appendix III Data Summary
Rockport Plant - Bottom Ash Pond

Parameter	Unit	Description	MW-1002		MW-1602D		MW-1602I		MW-1603D		MW-1603I		MW-1603S		MW-1604D		MW-1604I	
			6/27/2019	9/12/2019	6/27/2019	9/12/2019	6/27/2019	9/12/2019	6/27/2019	9/11/2019	6/27/2019	9/11/2019	6/27/2019	9/11/2019	6/26/2019	9/10/2019	6/27/2019	9/11/2019
Boron	mg/L	Interwell Background Value (UPL)	0.135															
		Detection Monitoring Result	**1.82**	**1.78**	0.0600	0.0590	0.0600	0.0510	0.0600	0.0400	0.0700	0.0870	**1.65**	**2.16**	0.0300	0.0200	**0.278**	**0.269**
Calcium	mg/L	Intrawell Background Value (UPL)	78.3		79.7		87.8		96.7		104		96.2		76.1		84.4	
		Detection Monitoring Result	36.0	33.5	69.8	57.8	76.2	83.1	77.9	82.8	78.6	80.1	67.2	55.1	69.5	74.7	75.2	71.5
Chloride	mg/L	Interwell Background Value (UPL)	46.4															
		Detection Monitoring Result	**57.1**	**54.7**	**68.7**	**65.1**	29.2	28.7	25.0	26.1	37.7	38.7	**57.8**	**51.1**	15.8	15.9	**63.5**	43.6
Fluoride	mg/L	Interwell Background Value (UPL)	0.700															
		Detection Monitoring Result	**1.10**	**1.03**	0.330	0.280	0.300	0.300	0.300	0.300	0.470	0.460	0.590	0.690	0.280	0.280	0.380	0.350
pH	SU	Intrawell Background Value (UPL)	7.8		8.2		7.8		7.4		7.8		7.6		7.4		7.8	
		Intrawell Background Value (LPL)	6.1		6.7		6.8		6.8		6.8		6.4		7.0		7.1	
		Detection Monitoring Result	7.1	6.7	7.3	7.1	7.3	7.3	**7.6**	7.2	**8.1**	7.3	7.3	7.1	7.3	7.3	7.5	7.4
Sulfate	mg/L	Interwell Background Value (UPL)	76.0															
		Detection Monitoring Result	**173**	**178**	20.3	20.2	67.4	70.7	32.8	36.4	66.9	58.2	**205**	**224**	23.2	24.7	**167**	**127**
Total Dissolved Solids	mg/L	Interwell Background Value (UPL)	465															
		Detection Monitoring Result	425	418	429	440	405	404	388	407	**560**	443	**530**	**482**	326	326	**622**	**515**

Parameter	Unit	Description	MW-1604S		MW-1605D		MW-1605I		MW-1605S		MW-1606D		MW-1606I		MW-1606S	
			6/26/2019	9/10/2019	6/25/2019	9/12/2019	6/25/2019	9/12/2019	6/27/2019	9/12/2019	6/24/2019	9/12/2019	6/25/2019	9/12/2019	6/25/2019	9/12/2019
Boron	mg/L	Interwell Background Value (UPL)	0.135													
		Detection Monitoring Result	**0.667**	**0.802**	0.0200	0.0200	0.126	**0.199**	**0.438**	**0.431**	0.0200	0.0200	0.0200	0.0200	0.0300	0.0200
Calcium	mg/L	Intrawell Background Value (UPL)	108		95.3		104		88.6		81.4		86.3		68.1	
		Detection Monitoring Result	75.8	53.1	82.1	84.0	83.4	89.4	72.0	77.0	80.8	76.7	**86.8**	72.8	49.8	44.4
Chloride	mg/L	Interwell Background Value (UPL)	46.4													
		Detection Monitoring Result	**81.4**	**57.6**	22.1	23.7	38.3	41.7	46.3	**49.4**	25.2	26.9	31.5	20.1	25.0	24.4
Fluoride	mg/L	Interwell Background Value (UPL)	0.700													
		Detection Monitoring Result	**0.910**	**1.63**	0.210	0.220	0.210	0.200	0.630	0.540	0.190	0.180	0.180	0.180	0.450	0.540
pH	SU	Intrawell Background Value (UPL)	7.9		7.4		7.6		7.7		8.4		8.3		7.8	
		Intrawell Background Value (LPL)	7.1		6.9		6.9		7.1		6.9		6.4		6.3	
		Detection Monitoring Result	7.5	7.5	7.3	7.0	7.4	7.4	7.2	**7.0**	7.3	7.3	7.2	7.4	7.0	7.0
Sulfate	mg/L	Interwell Background Value (UPL)	76.0													
		Detection Monitoring Result	**246**	**134**	40.3	45.1	**104**	**128**	**150**	**162**	21.0	25.6	51.0	47.9	41.7	41.9
Total Dissolved Solids	mg/L	Interwell Background Value (UPL)	465													
		Detection Monitoring Result	**718**	**506**	379	388	**471**	**524**	**595**	**593**	329	361	406	367	380	376

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 Rockport Bottom Ash Pond CCR management area and that the requirements of 40 CFR 257.93(f) have been met.

DAVID ANTHONY MILLER
No. 11700730

DAVID ANTHONY MILLER
Printed Name of Licensed Professional Engineer

David Anthony Miller
Signature

11700730
License Number

INDIANA
Licensing State

01.03.20
Date

ATTACHMENT B

Statistical Analysis Output

GROUNDWATER STATS
CONSULTING

December 16, 2019

Geosyntec Consultants
Attn: Ms. Allison Kreinberg
941 Chatham Lane, #103
Columbus, OH 43221

Re: Rockport Bottom Ash Pond
Background Update 2019

Dear Ms. Kreinberg,

Groundwater Stats Consulting (GSC), formerly the statistical consulting division of Sanitas Technologies, is pleased to provide background update of groundwater data for American Electric Power Inc.'s Rockport 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-1600D, MW-1600I, MW-1600S, MW-1601D, MW-1601I, MW-1601S; MW-1701S, MW-1702D, MW-1702I, MW-1702S, MW-1701D, and MW-1701I
- **Downgradient wells:** MW-1002, MW-1602D, MW-1602I, MW-1603D, MW-1603I, MW-1603S, MW-1604D, MW-1604I, MW-1604S, MW-1605D, MW-1605I, MW-1605S, MW-1606D, MW-1606I, and MW-1606S

Data were sent electronically 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 GSC. The statistical analysis was conducted according to the January 2018 screening evaluation prepared by GSC and approved by Dr. Kirk Cameron.

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 and box plots for Appendix III and IV parameters are provided for all wells and constituents; and are used to evaluate concentrations over the entire record (Figures A and B). The initial background screening was conducted on all wells during January 2018, except for the 1700 series wells which were added to the monitoring well network and approved for use as background wells during 2018. A summary of those findings is provided below. During this analysis, the background data sets for the Appendix III parameters were evaluated for the purpose of updating the prediction limits.

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 submitted with the initial background screening and demonstrated 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-3 resample plan for calcium and pH;
2) Interwell prediction limits combined with a 1-of-2 resample plan for boron, 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.

Historical Summary – Evaluation of Appendix III Parameters – January 2018

Outlier Evaluation

Tukey's box plot method was used during the screening evaluations to identify outliers which were flagged in the database and deselected prior to construction of statistical limits. Suspected outliers at all wells for Appendix III 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.

No seasonal patterns were apparent 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 during the background screening to evaluate all Appendix III data at each well to identify statistically significant increasing or decreasing trends. The results of those findings were submitted with the previous screening evaluation. 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. All of the trends identified during the screening were relatively low in magnitude when compared to average concentrations; therefore, no adjustments were made to the data sets.

Statistical Limits

Interwell prediction limits were constructed using all screened upgradient well data, combined with a 1-of-2 verification strategy for boron, chloride, fluoride, sulfate and TDS. Intrawell limits combined with a 1-of-3 verification strategy were constructed using screened background data through July 2017 for calcium and pH. The statistical method selected for each parameter was determined based on the results of the evaluation performed in January 2018; and all proposed background data were screened for outliers and trends at that time. The findings of those reports were submitted with that analysis. Note that the upgradient 1700 series wells did not yet have the recommended minimum 8 background samples and, therefore, intrawell prediction limits were not included for these wells.

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 2018. 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.

Prediction limits were constructed based on the following:

- Number of Sample Events Per Year: 2
- Interwell Prediction Limits and 1-of-2 Resamples
- Intrawell Prediction Limits and 1-of-3 Resamples
- Number of Analytes: 7
- Number of Downgradient Wells: 15

In the event of an initial exceedance of compliance well data, the 1-of-2 resample plan allows for collection of one additional sample, and the 1-of-3 resample plan allows up to 2 resamples, to determine whether the initial exceedance is confirmed. When the resamples confirm 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 a resample falls within the statistical limit, the initial exceedance is considered a false positive result and, therefore, no further action is necessary.

The Sen's Slope/Mann-Kendall trend test was performed on all well/constituent pairs found to exceed their respective prediction limit to determine whether concentrations are increasing, decreasing or stabilizing. Upgradient wells were included in the trend tests to determine whether similar patterns existed both upgradient and downgradient of the facility which would suggest naturally changing groundwater unrelated to practices at the facility. No statistically significant increasing trends were found in any of the wells. One statistically significant decreasing trend was noted for chloride in upgradient well MW-1601S.

Appendix III Background Update – December 2019

Prior to updating background data, samples were re-evaluated for all wells for intrawell parameters and all upgradient wells for interwell parameters using Tukey's outlier test and visual screening with the May 2019 samples (Figure C). Both high and low values were noted for pH in several wells. All of the single high values identified were flagged as outliers in the database. For the multiple outliers identified in wells MW-1606D and MW-1606I, only the lowest values were flagged as all other measurements were similar to remaining measurements within these wells. No outliers were flagged for pH at well 1606S for the same reason.

When Tukey's outlier test was used on pooled upgradient well data, in some cases, a cluster of data points were identified as outliers by the test. However, when neighboring upgradient wells have similar reported values for two or more events, these values are not flagged in the database as they represent natural variation in groundwater quality upgradient of the facility. 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 July 2017 to the new compliance samples at each well through May 2019 to evaluate whether the groups are statistically different at the 99% confidence level (Figure D). If no differences are noted, background may be updated with compliance data. No significant differences were noted except for pH in downgradient well MW-1002. While the medians may be slightly different, the majority of the recent concentrations are very similar to historical measurements; therefore, the background was updated to include data through May 2019 for construction of prediction limits. A summary of these results follows this letter and the significant test results are included with the Mann Whitney test section at the end of this report.

Intrawell prediction limits using all historical data through May 2019, combined with a 1-of-3 resample plan, were constructed and a summary of the updated limits follows this letter (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). No statistically significant increasing or decreasing trends were noted except for a decreasing trend for chloride in upgradient well MW-1601S and an increasing trend for fluoride in upgradient well MW-1600S. The magnitude of these trends was low relative to average concentrations in these wells; therefore, no adjustment was required at this time. A summary of those results is included with the trend tests that had significant results.

Interwell prediction limits, combined with a 1-of-2 resample plan, were updated using all available data from upgradient wells for the same time period for boron, 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 2018

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. Tukey's test identified several values that were flagged accordingly in the database. However, several values were not identified as outliers through Tukey's test, but because they are considerably higher than the other measurements and do not appear to represent the population at their respective well, these values were flagged as outliers and deselected prior to the construction of upper tolerance limits and confidence intervals (i.e. combined radium 226 + 228 in well MW-1606I; lead in wells

MW-1603D and MW-1604S; and selenium in well MW-1605S). Note that the reporting limit during the June 2019 event for molybdenum in many of the wells was 0.01 mg/L, which is higher than the historical reporting limit of 0.002 mg/L, as well as higher than all of the detected values for these wells. This reporting limit was flagged as an outlier.

While Tukey's outlier test on pooled upgradient wells identified several outliers, some values that were flagged in the database, but not identified by Tukey's, were a result of values which did not accurately represent the populations within their respective wells (i.e. antimony in well MW-1702I, lead in well MW-1701D, molybdenum in well MW-1702S, selenium in well MW-1605S, and thallium in wells MW-1701D, MW-1701I, MW-1701S, MW-1702D, MW-1702I, and MW-1702S). 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 intervals exceedances were found for any of the downgradient wells. 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 Rockport Bottom Ash Pond. If you have any questions or comments, please feel free to contact us.

For Groundwater Stats Consulting,

ACollins

Andrew T. Collins
Groundwater Analyst

Kristina Rayner

Kristina L. Rayner
Groundwater Statistician

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Hollow symbols indicate censored values.

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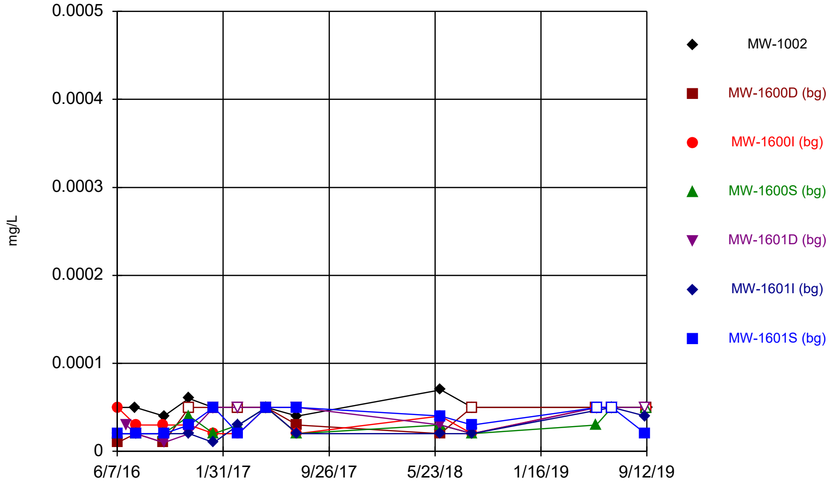

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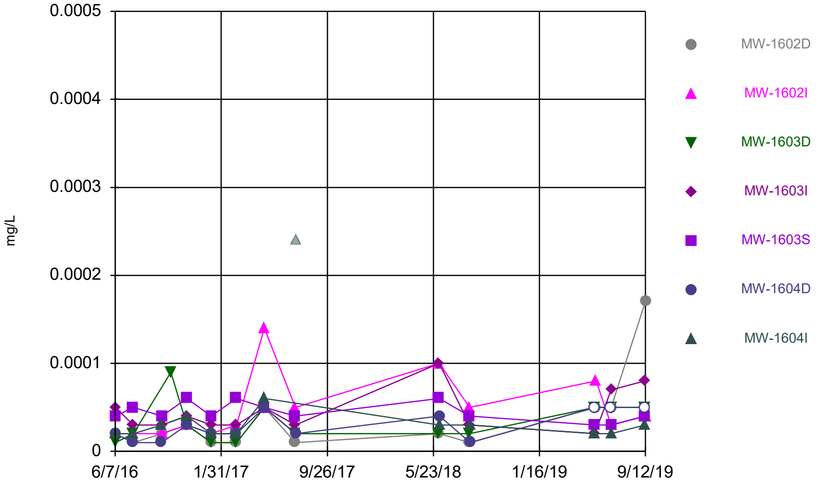

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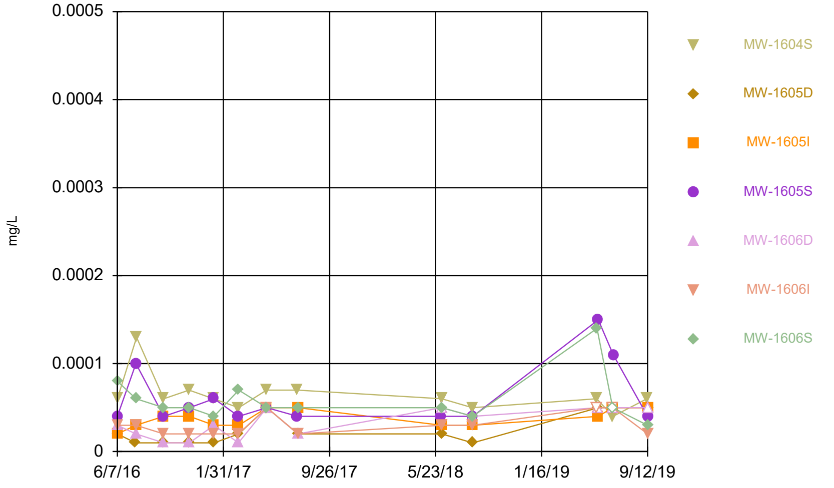

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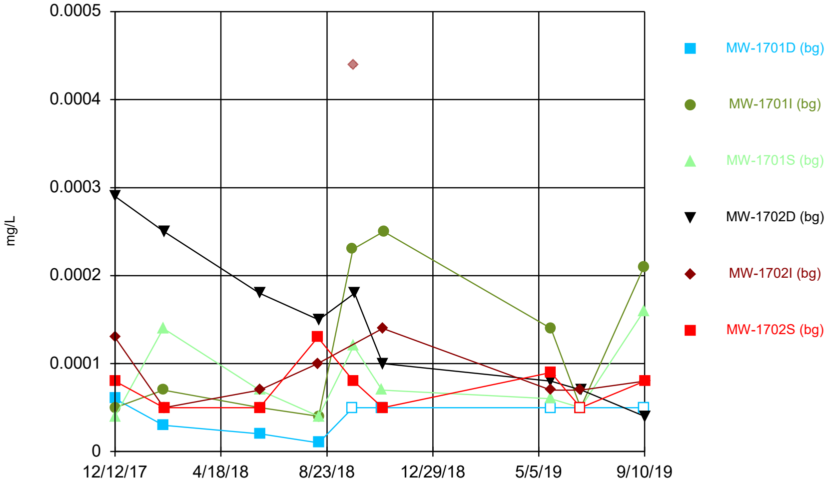

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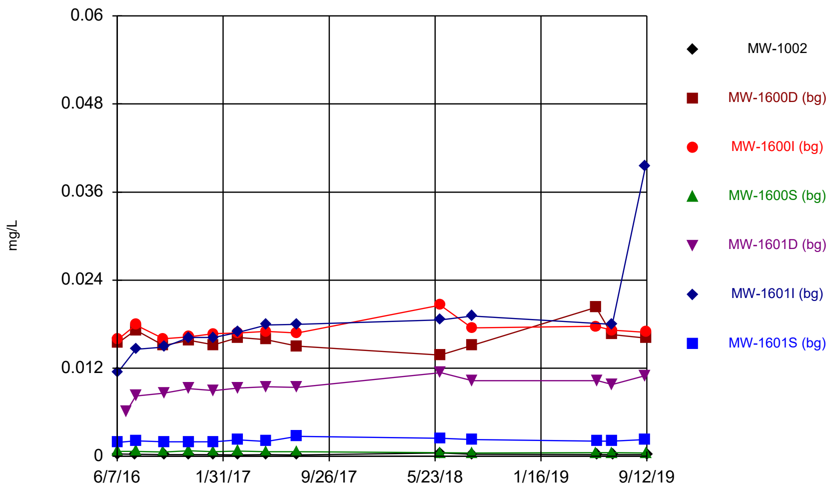

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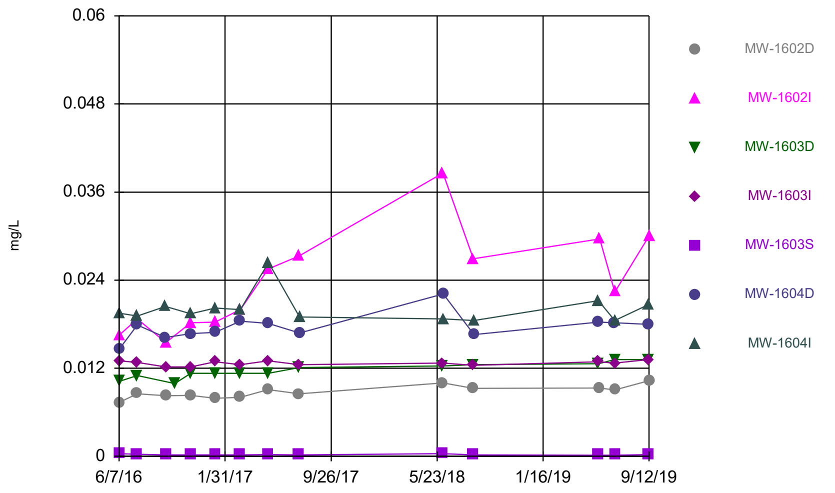

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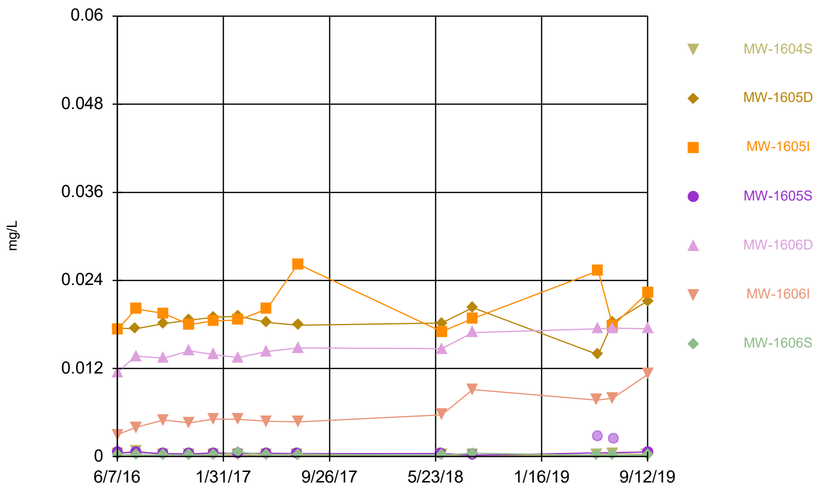

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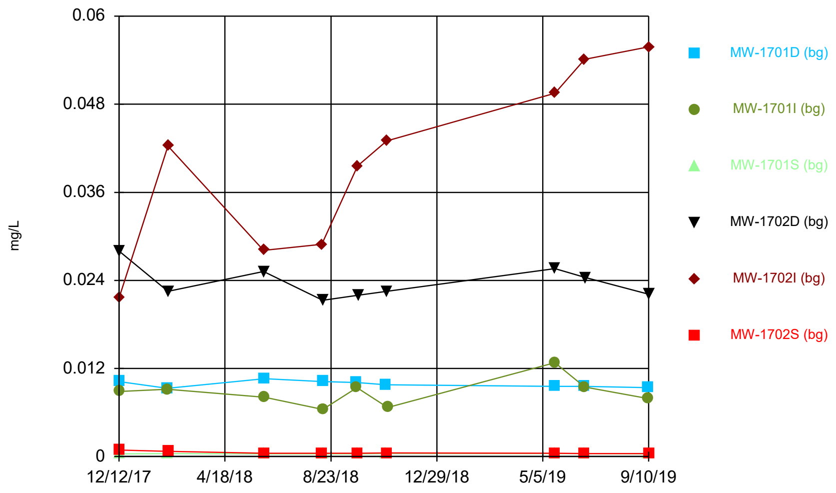

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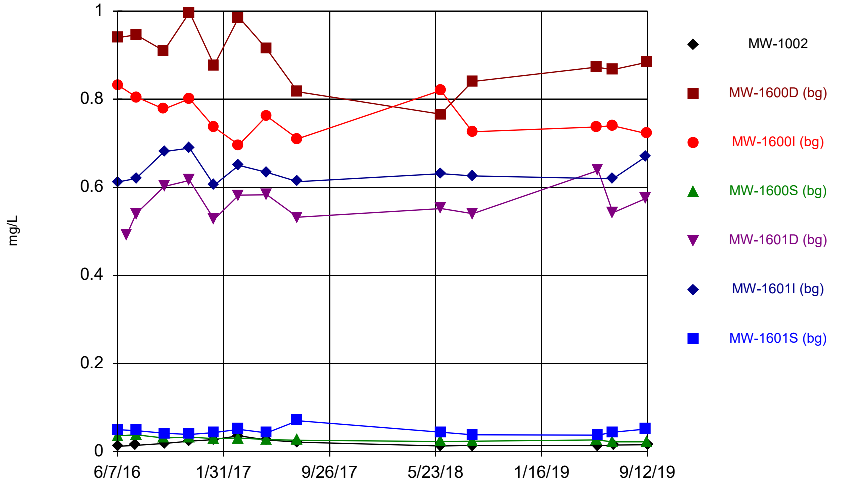

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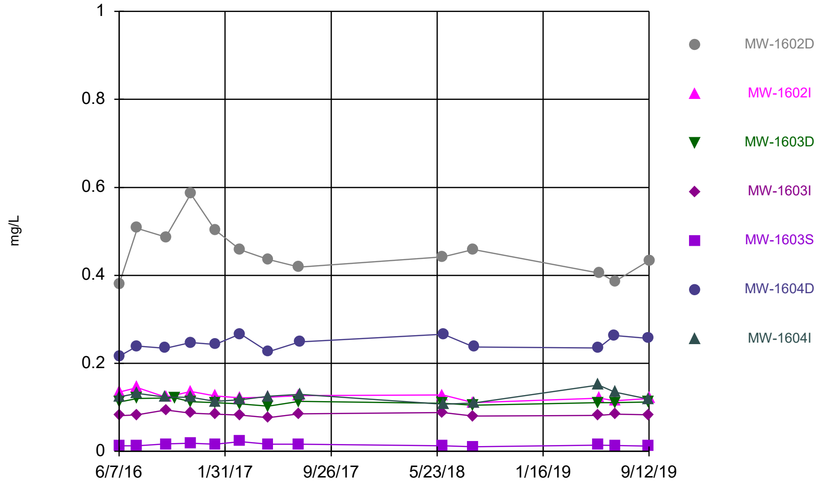

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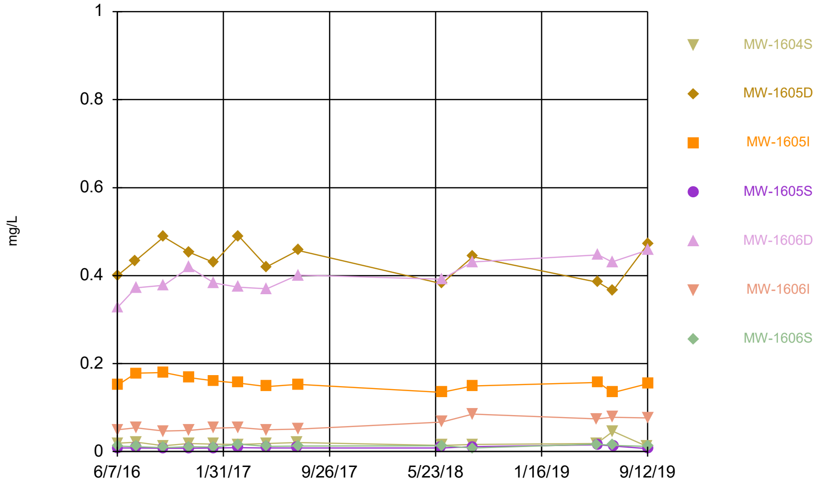

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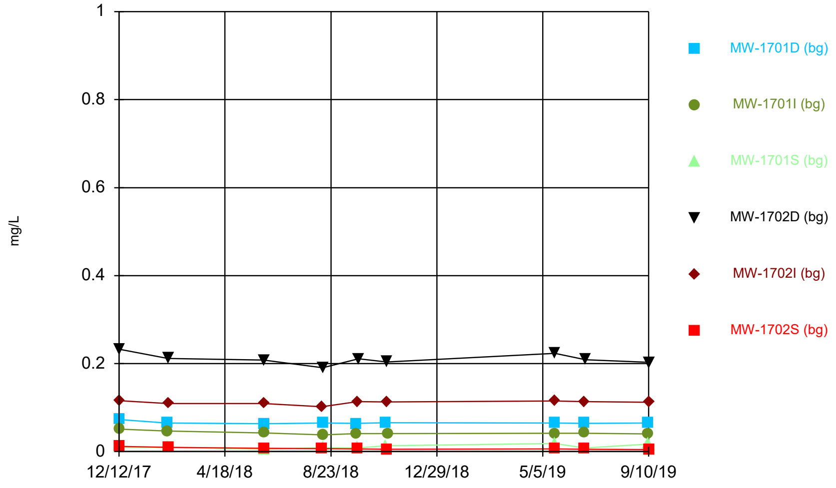

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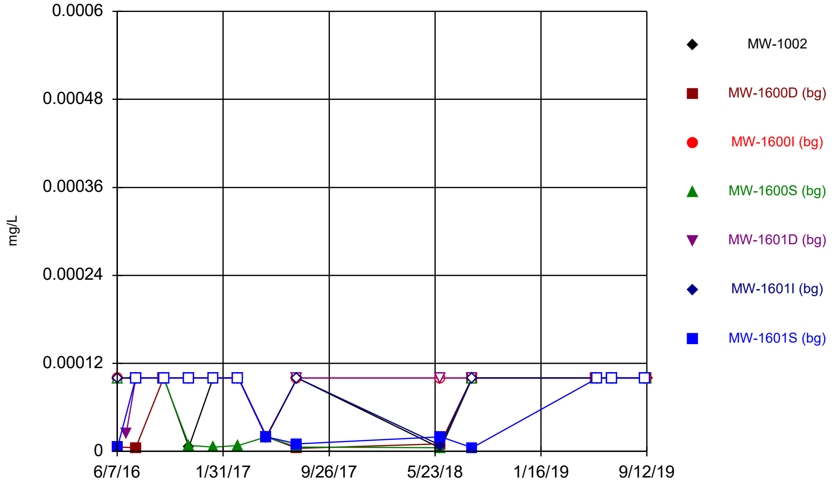

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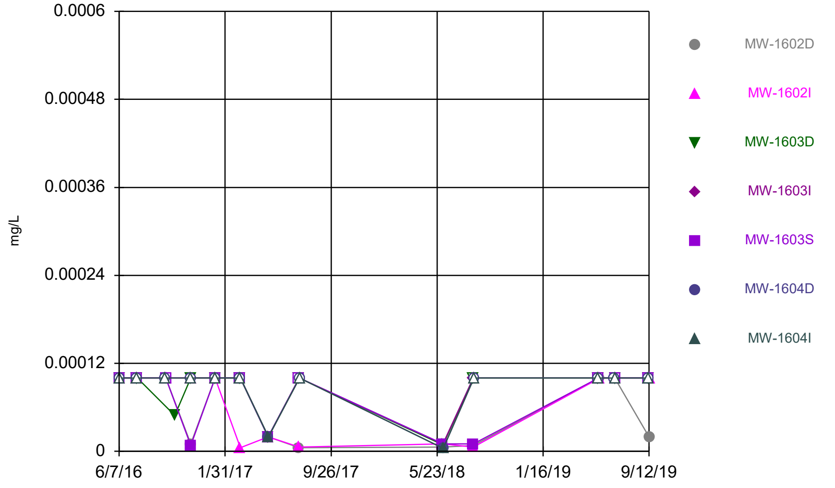

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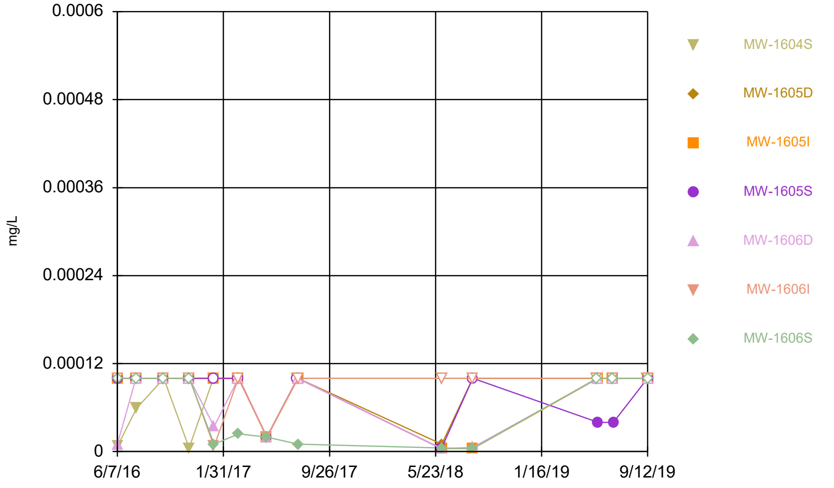

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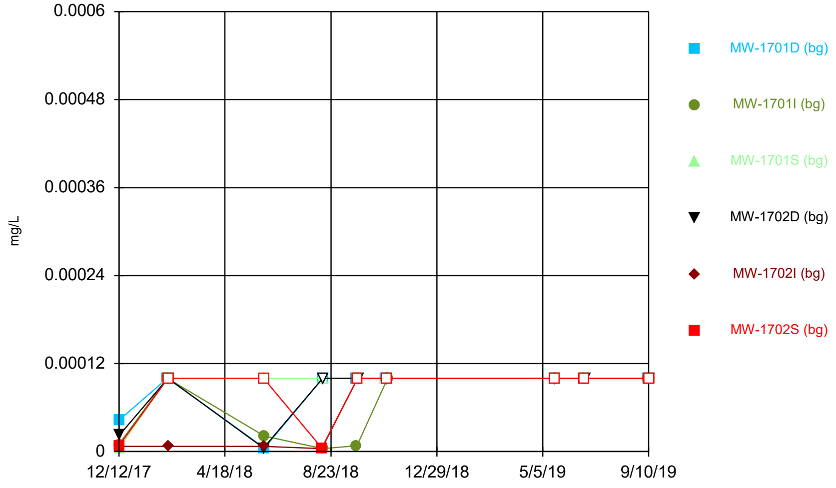

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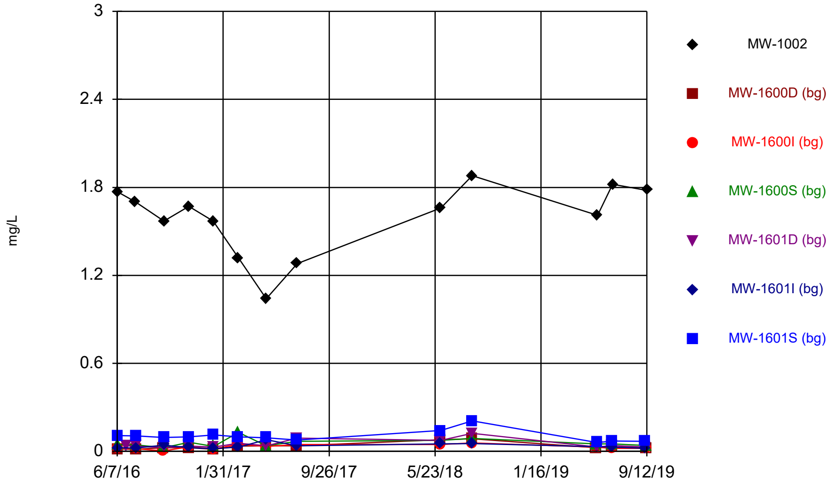

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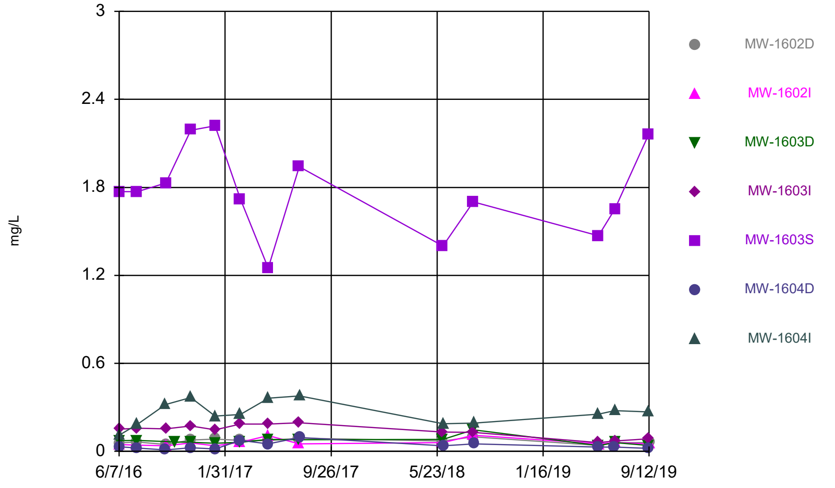

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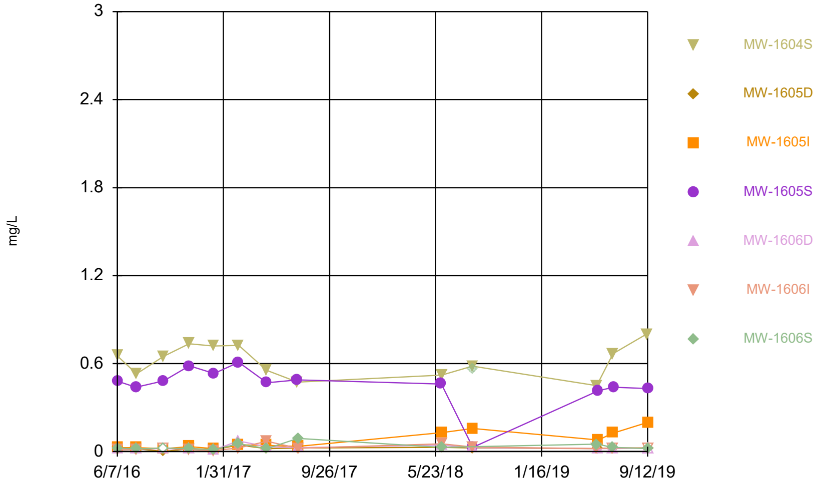

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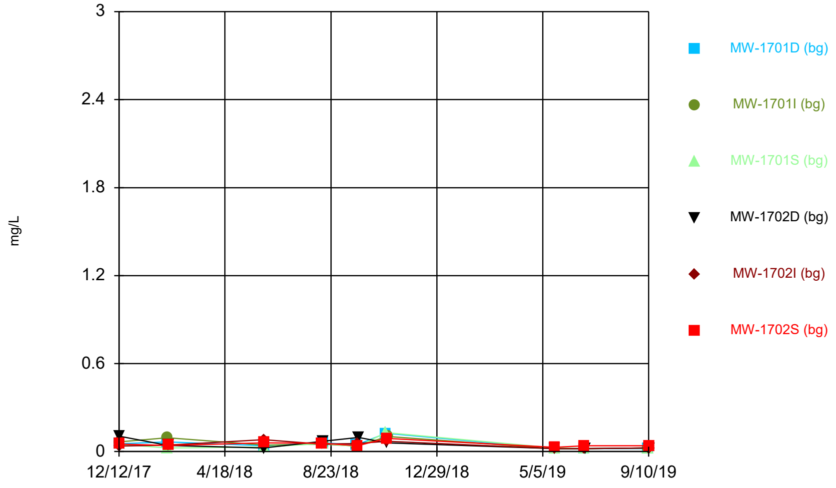

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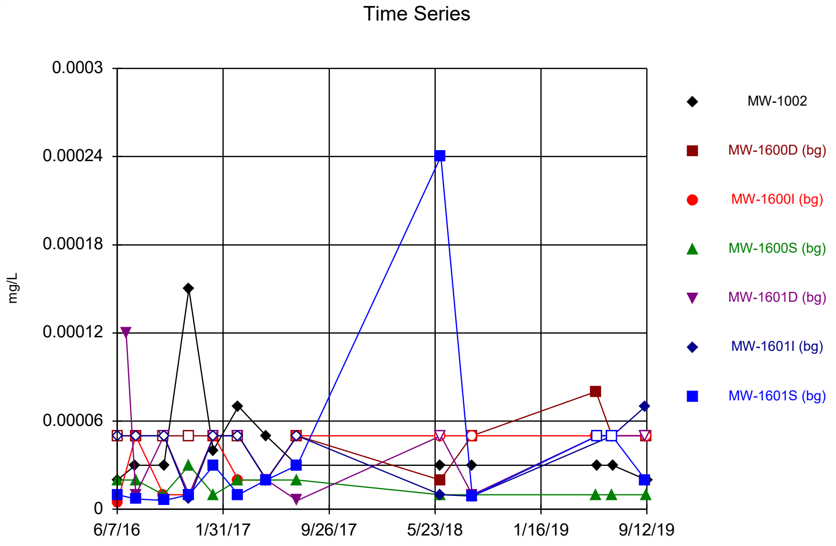

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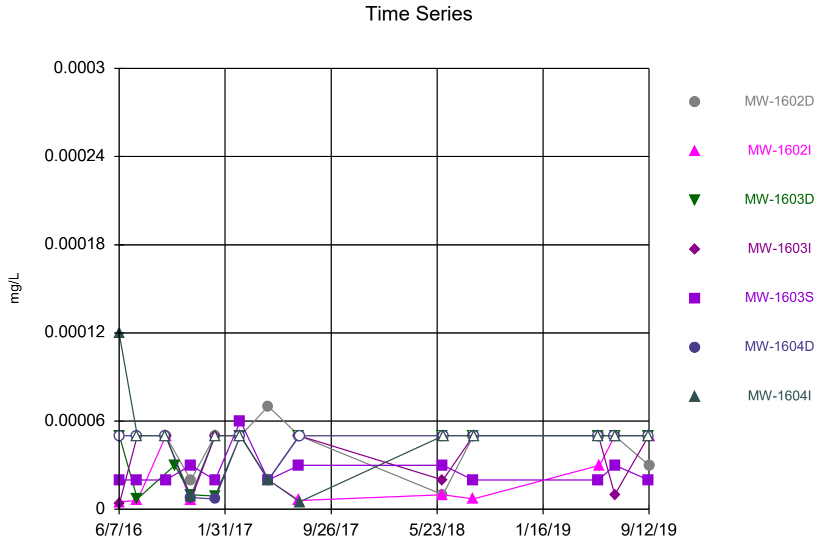

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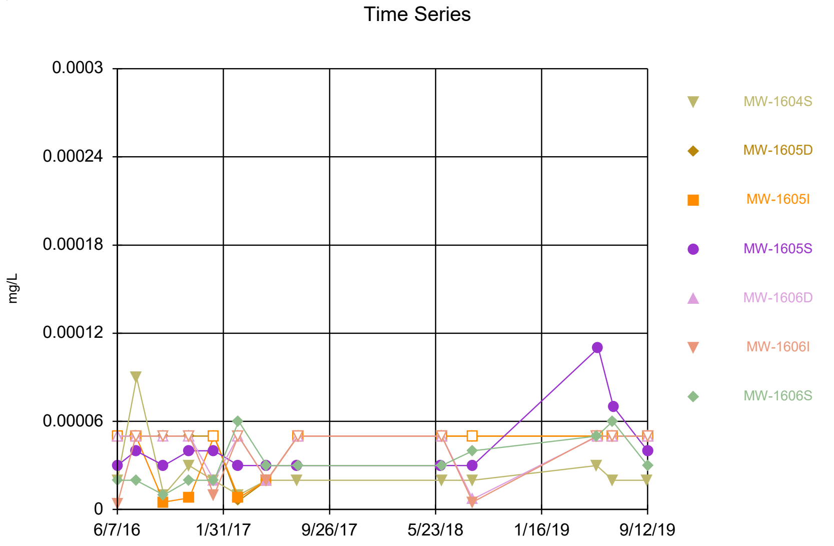

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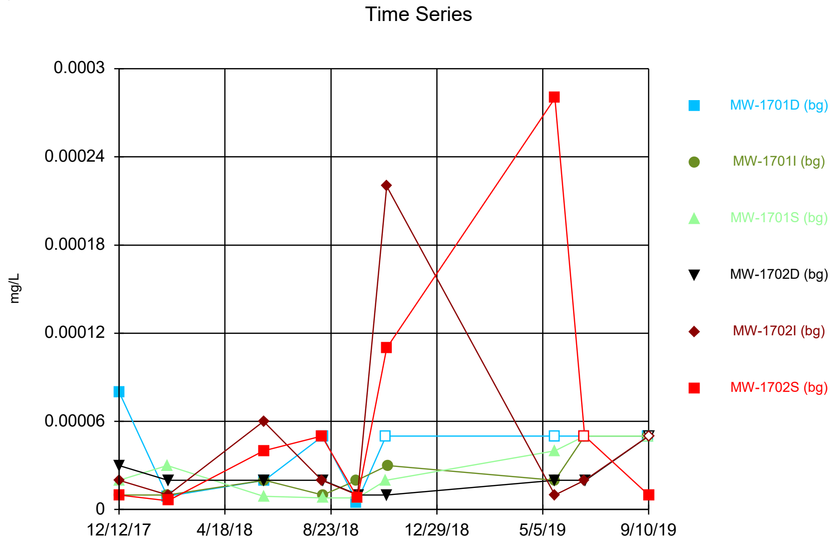

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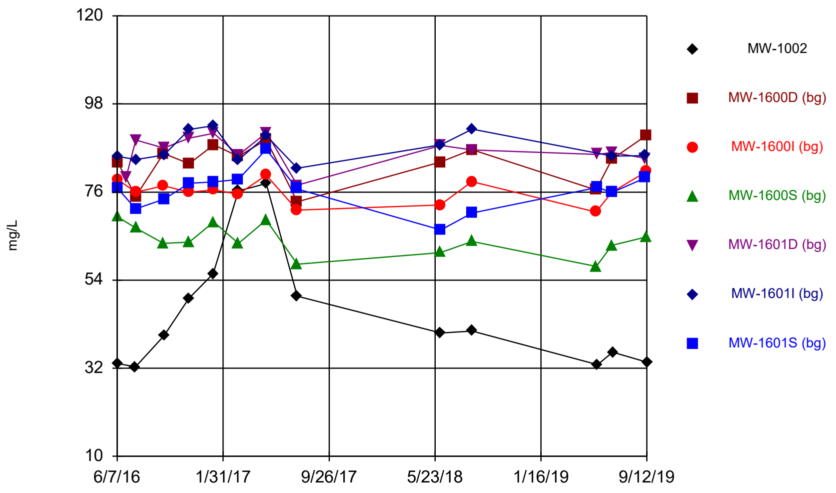

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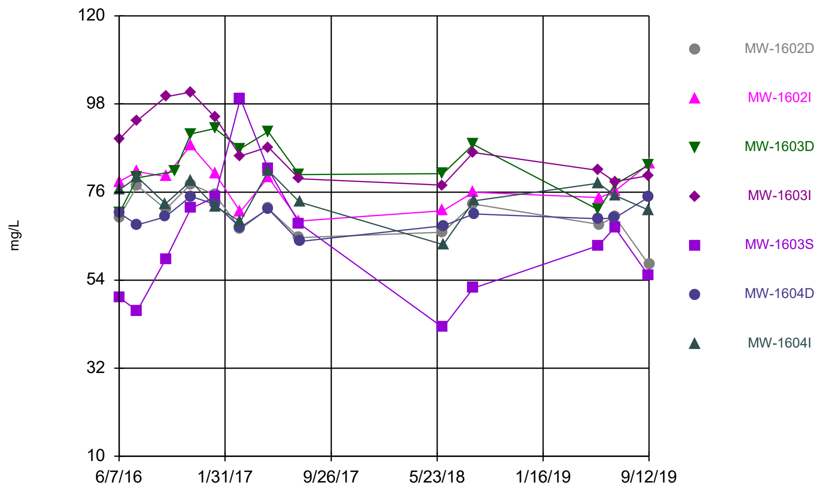

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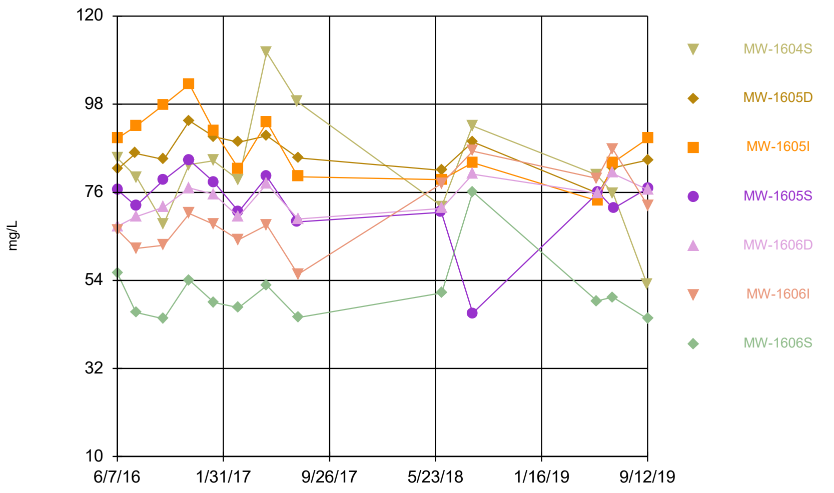

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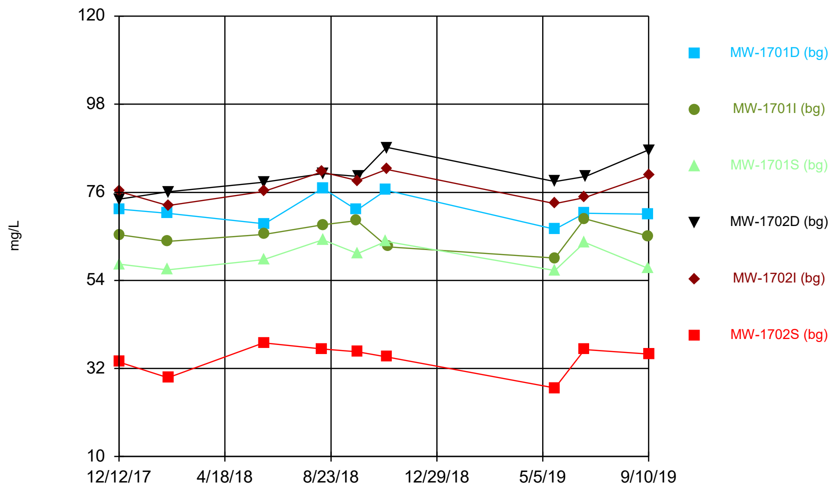
Time Series



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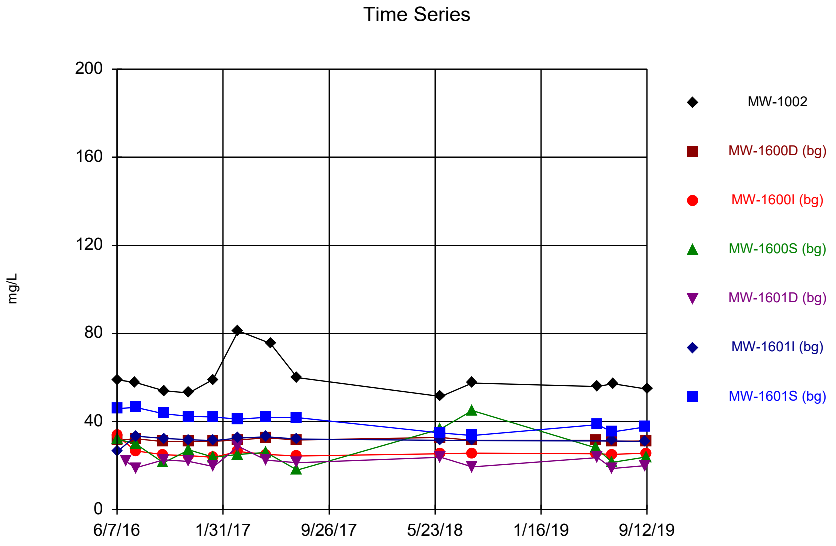

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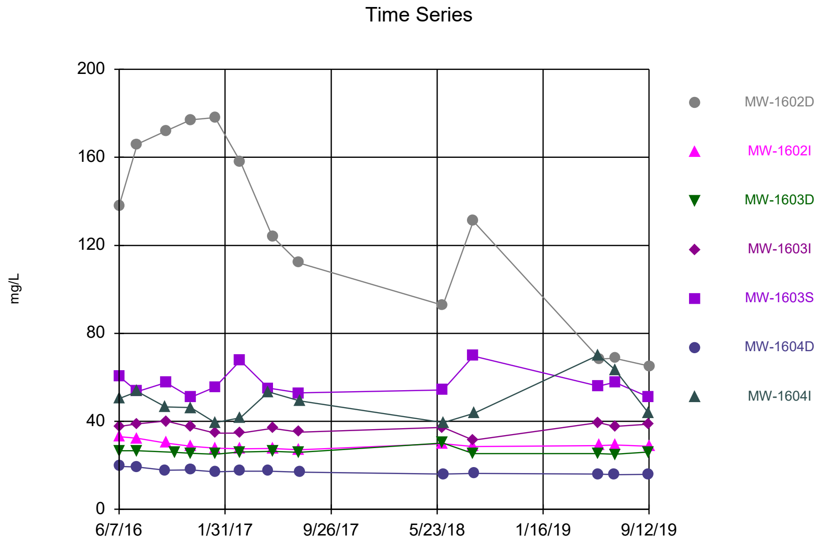
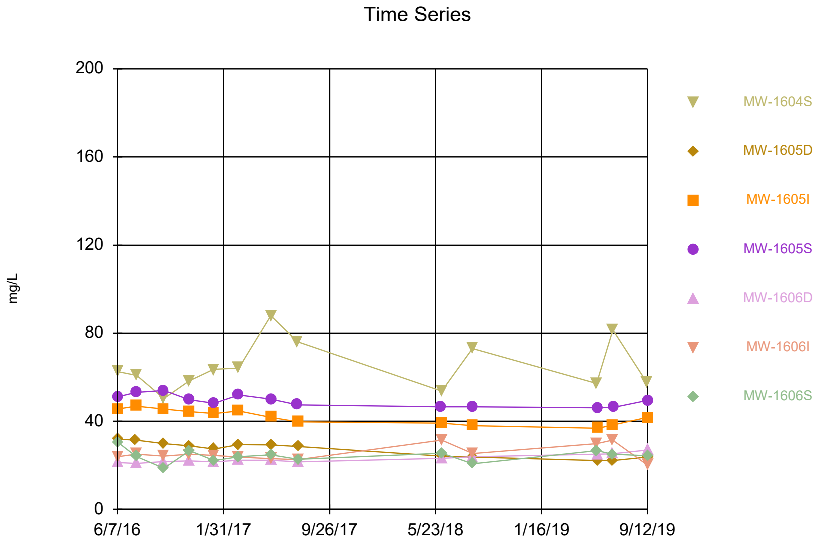
Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



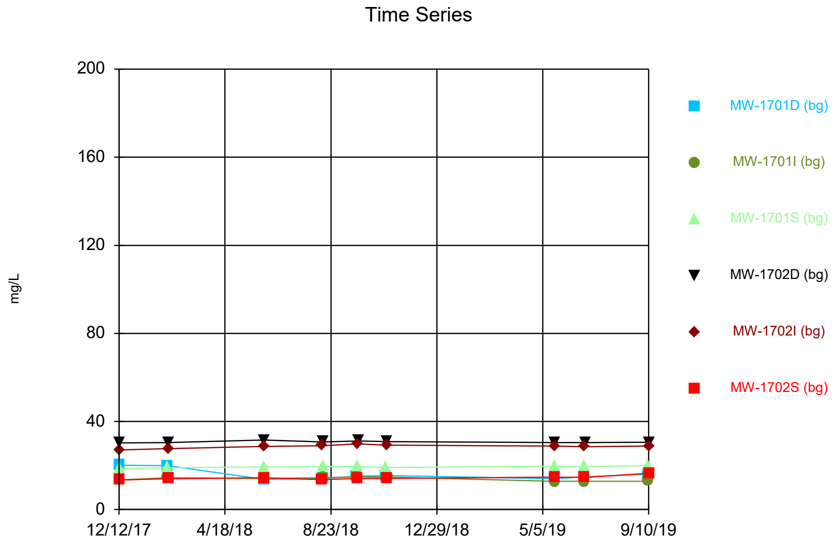
Constituent: Chloride, total Analysis Run 12/5/2019 11:20 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



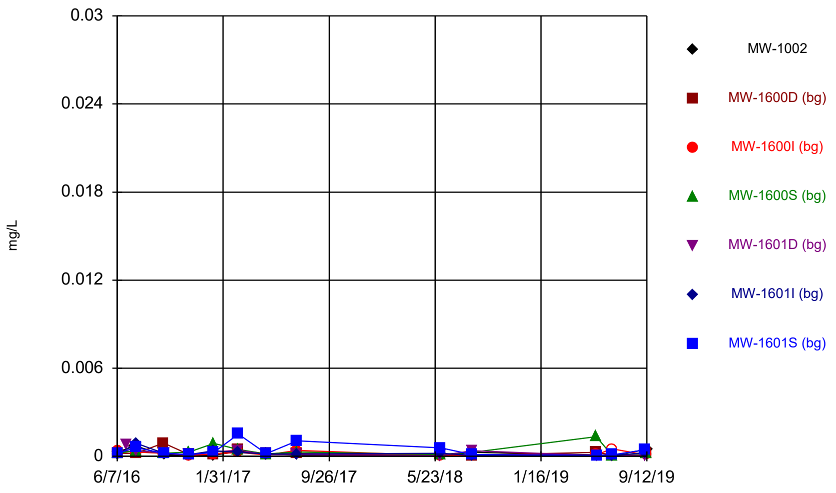
Constituent: Chloride, total Analysis Run 12/5/2019 11:20 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



Constituent: Chloride, total Analysis Run 12/5/2019 11:20 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

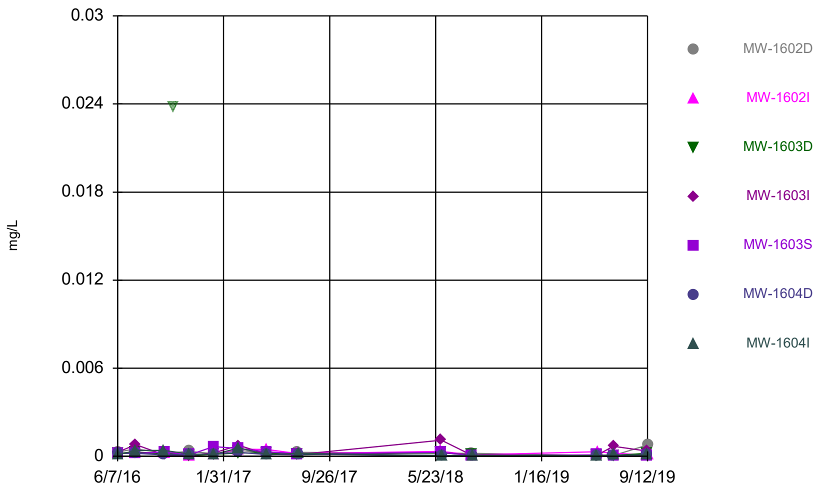
Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



Time Series

Constituent: Chromium, total Analysis Run 12/5/2019 11:20 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

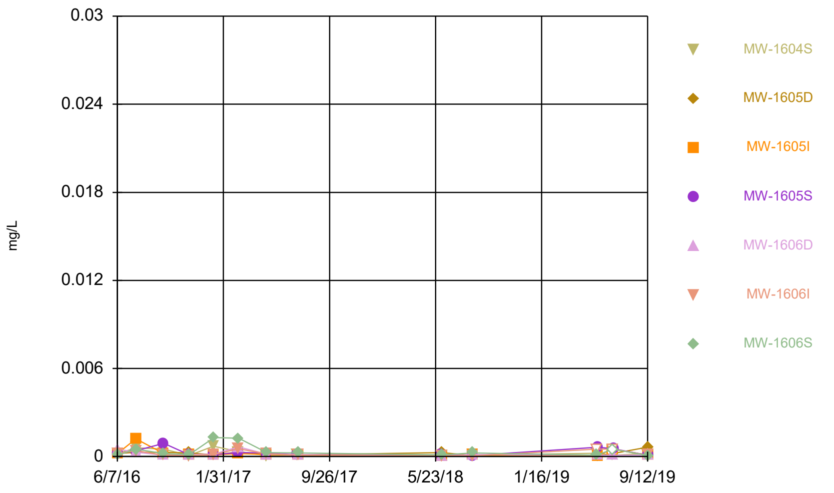
Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



Time Series

Constituent: Chromium, total Analysis Run 12/5/2019 11:20 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

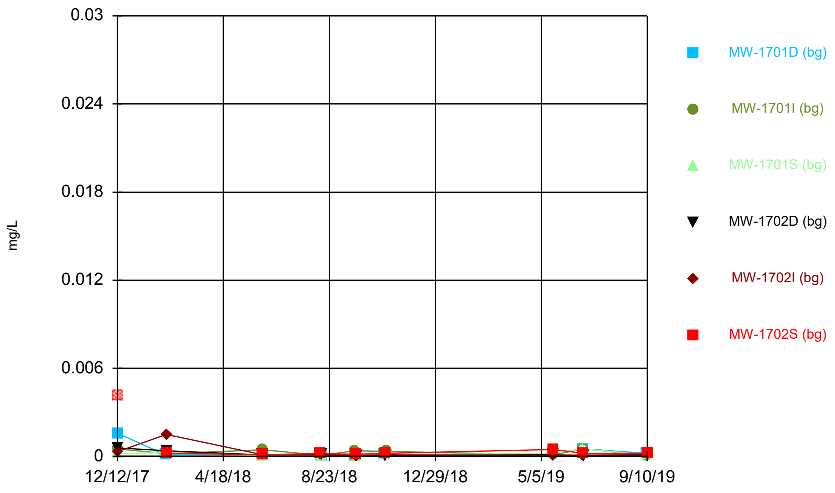
Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



Time Series

Constituent: Chromium, total Analysis Run 12/5/2019 11:20 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

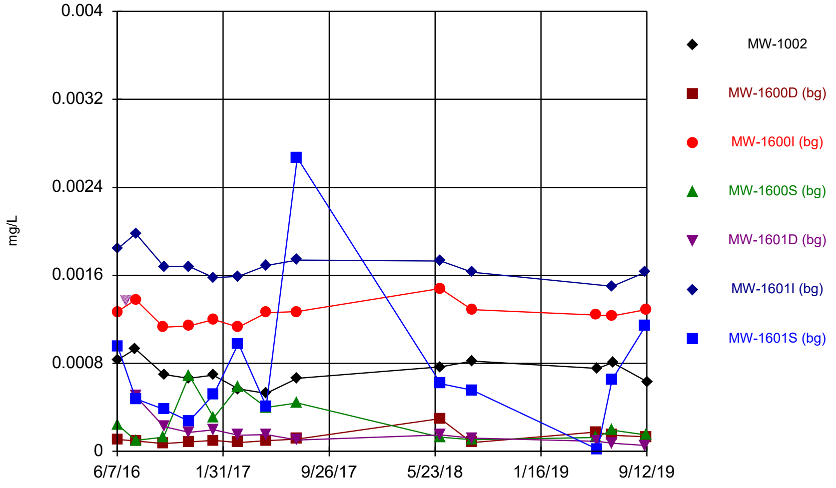


Time Series

Constituent: Chromium, total Analysis Run 12/5/2019 11:20 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

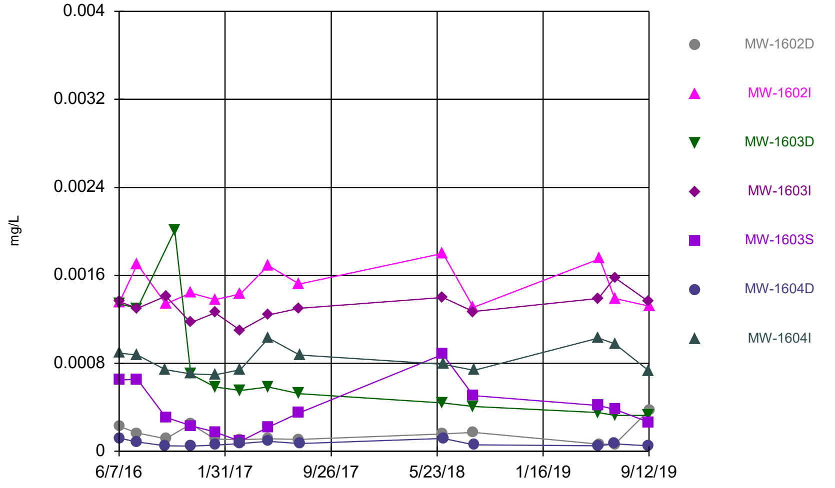
Time Series



Constituent: Cobalt, total   Analysis Run 12/5/2019 11:20 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

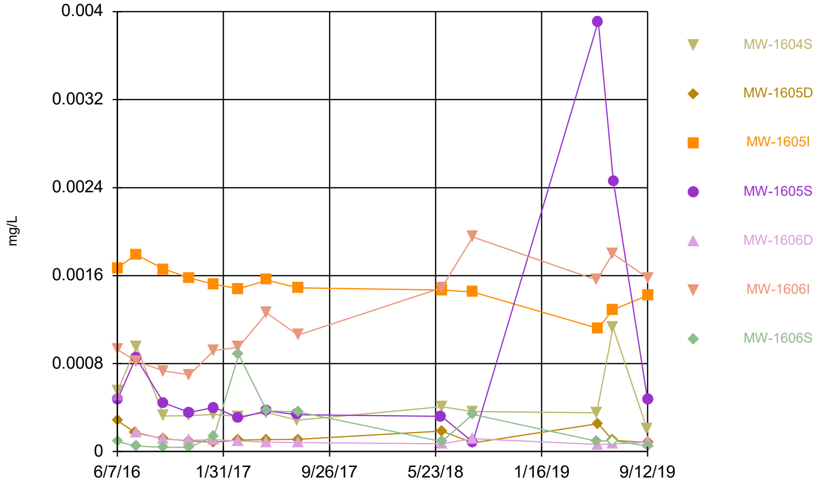
Time Series



Constituent: Cobalt, total   Analysis Run 12/5/2019 11:20 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

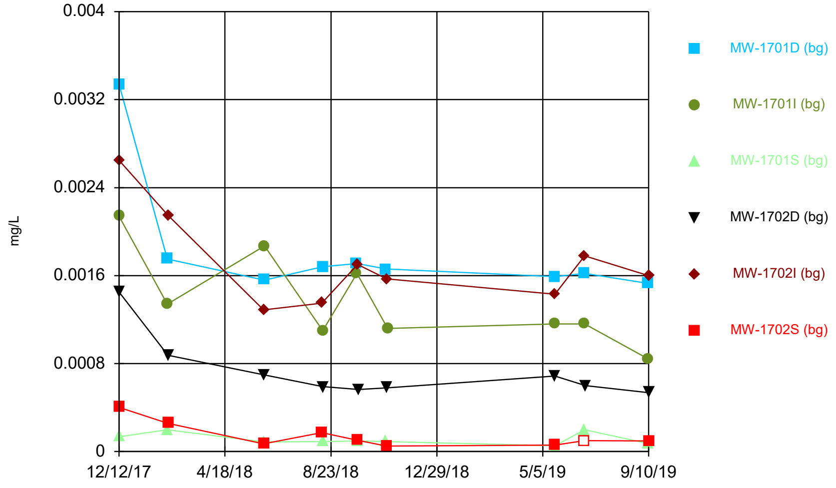
Time Series



Constituent: Cobalt, total   Analysis Run 12/5/2019 11:21 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

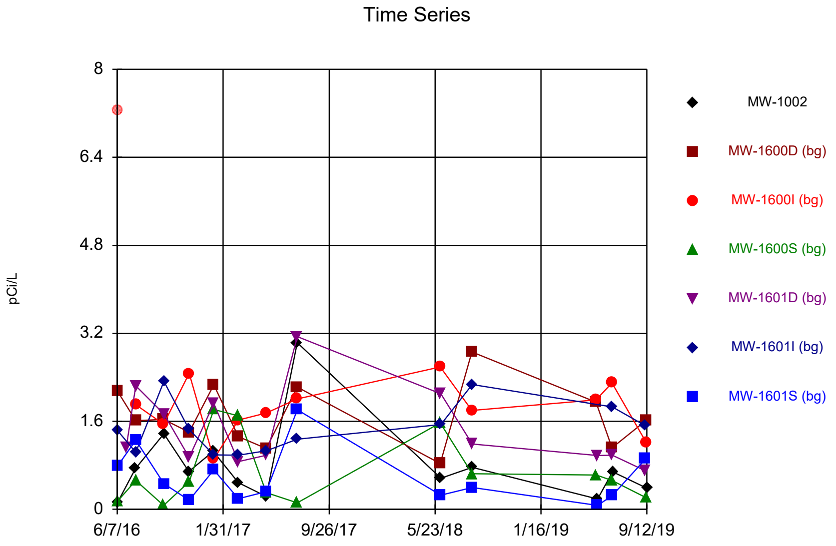
Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



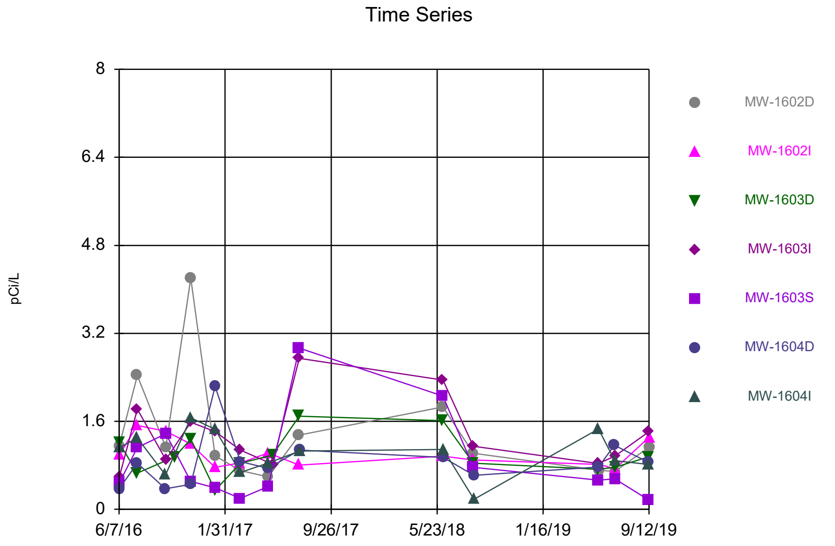
Constituent: Cobalt, total   Analysis Run 12/5/2019 11:21 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



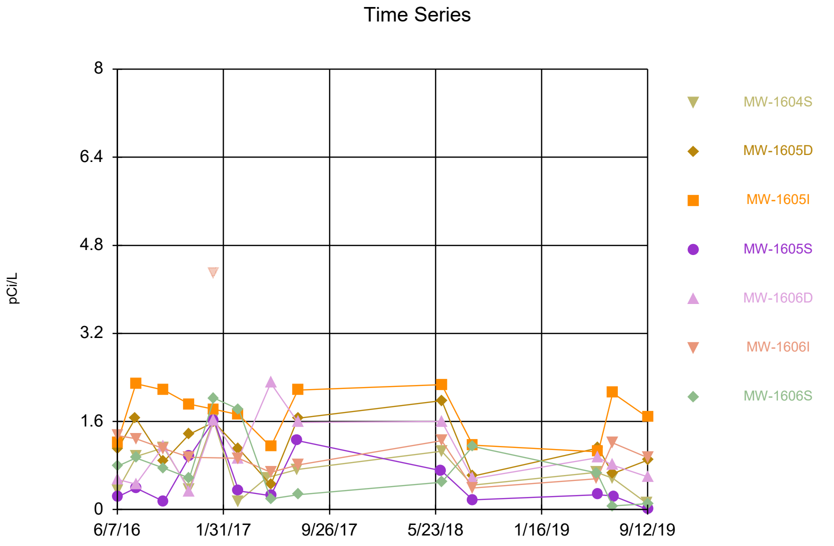
Constituent: Combined Radium 226 + 228 Analysis Run 12/5/2019 11:21 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



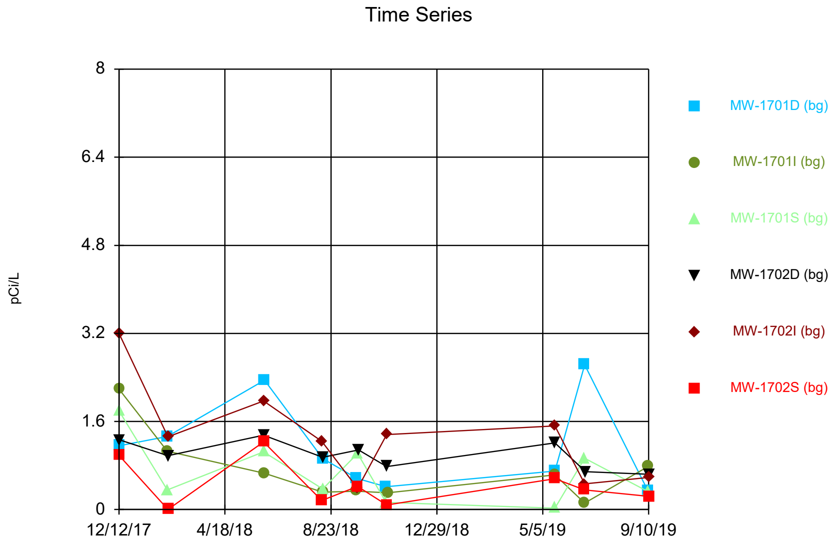
Constituent: Combined Radium 226 + 228 Analysis Run 12/5/2019 11:21 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



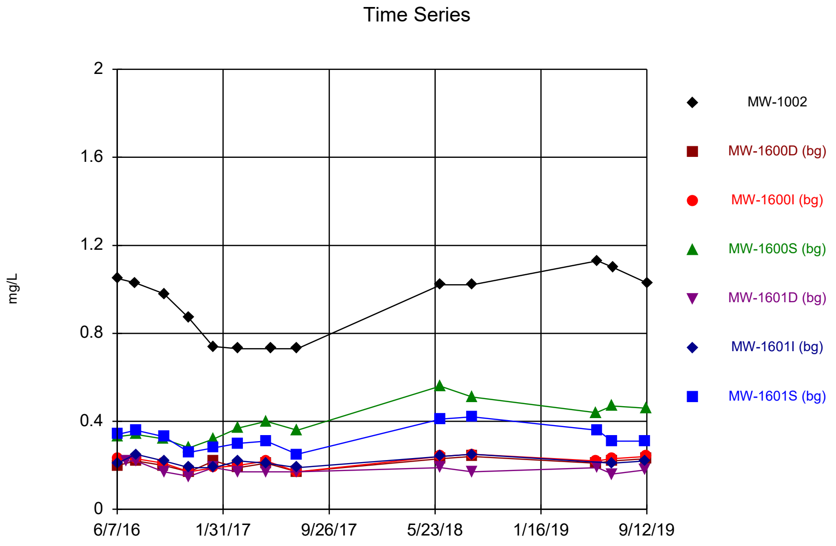
Constituent: Combined Radium 226 + 228 Analysis Run 12/5/2019 11:21 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



Constituent: Combined Radium 226 + 228 Analysis Run 12/5/2019 11:21 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

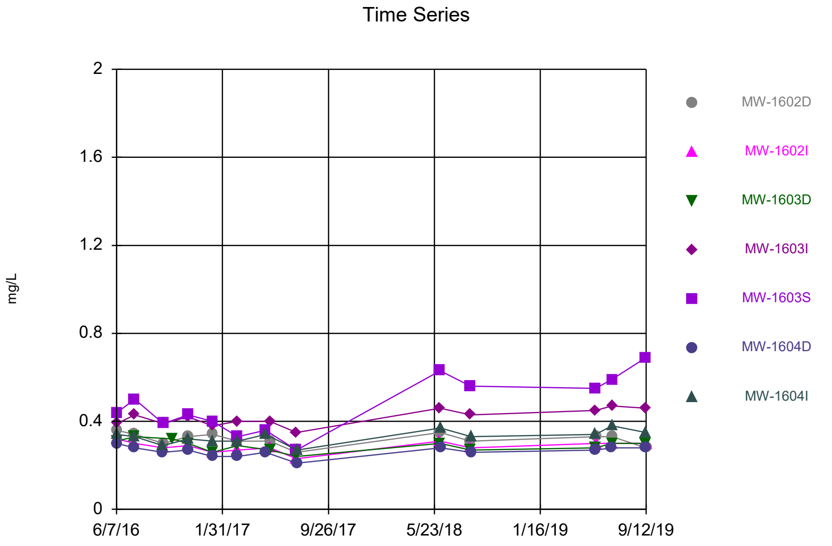
Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG


Time Series

Constituent: Fluoride, total Analysis Run 12/5/2019 11:21 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

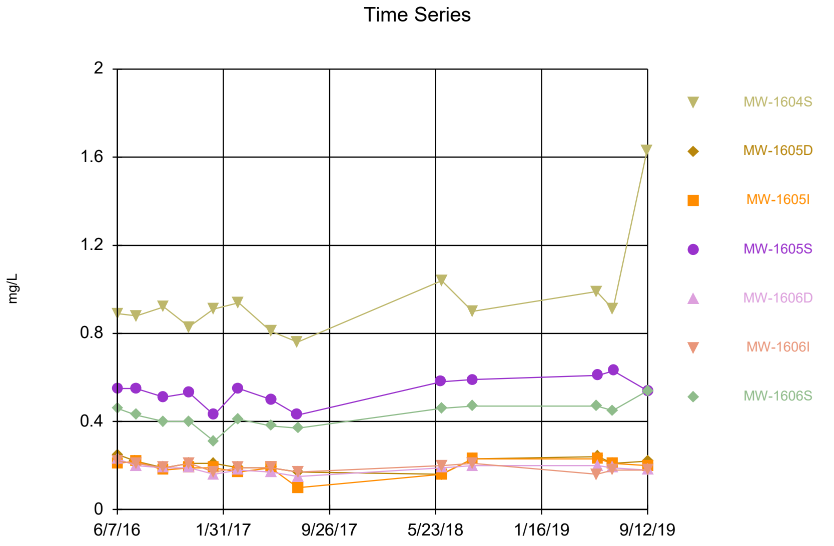
Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG


Time Series

Constituent: Fluoride, total Analysis Run 12/5/2019 11:21 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

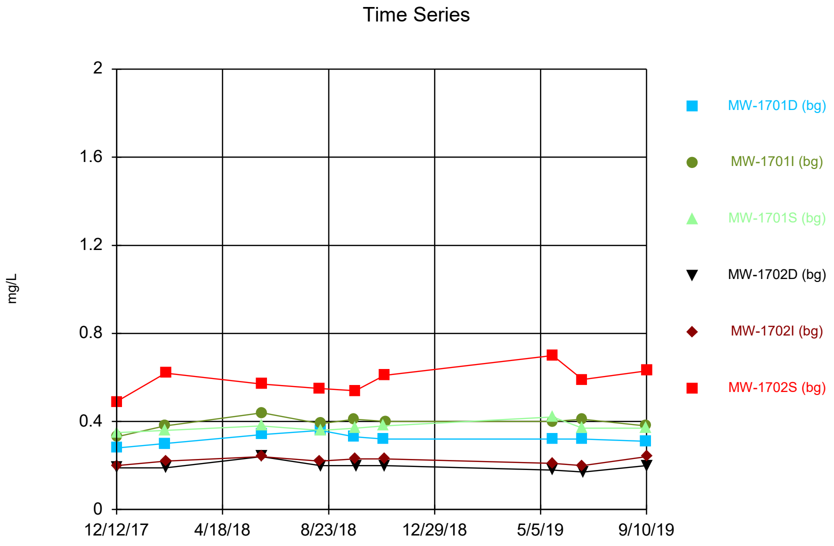
Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG


Time Series

Constituent: Fluoride, total Analysis Run 12/5/2019 11:21 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

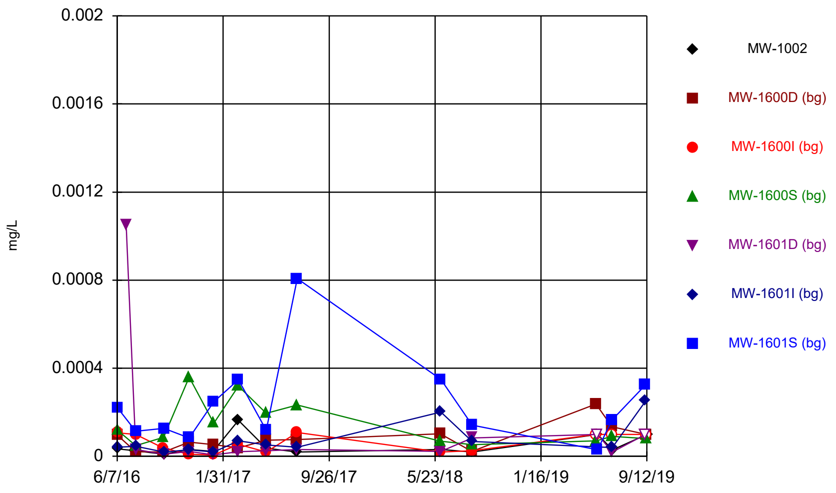

Time Series

Constituent: Fluoride, total Analysis Run 12/5/2019 11:21 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

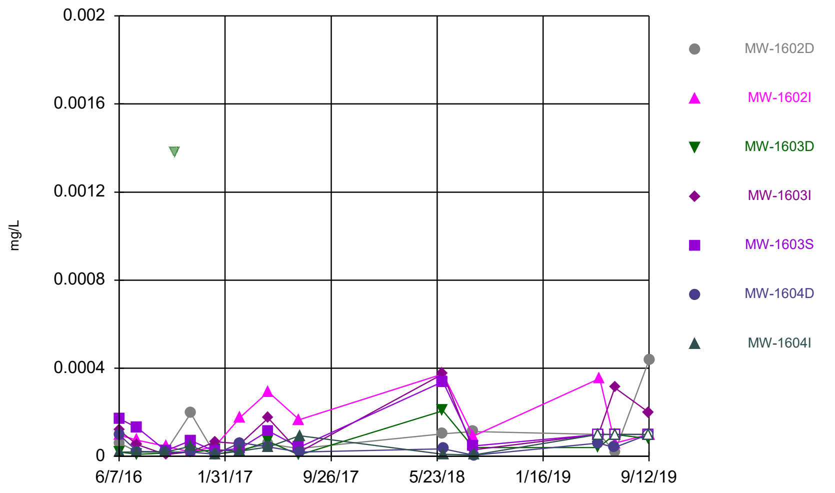
Time Series



Constituent: Lead, total Analysis Run 12/5/2019 11:21 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

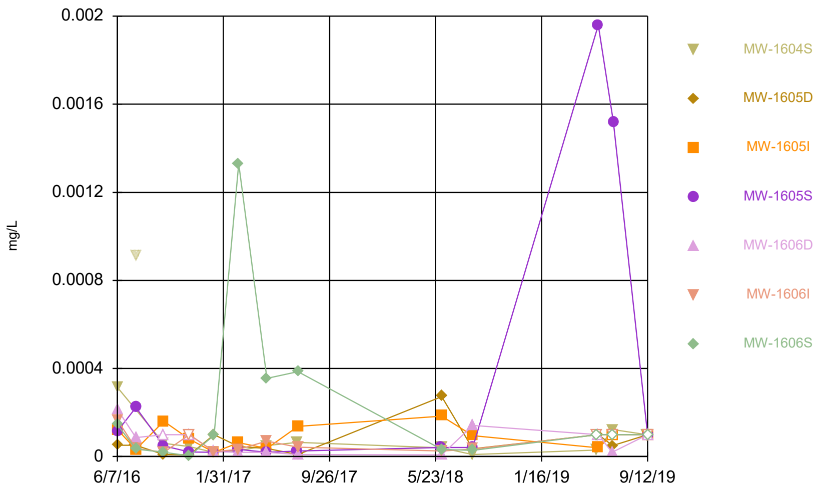
Time Series



Constituent: Lead, total Analysis Run 12/5/2019 11:21 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

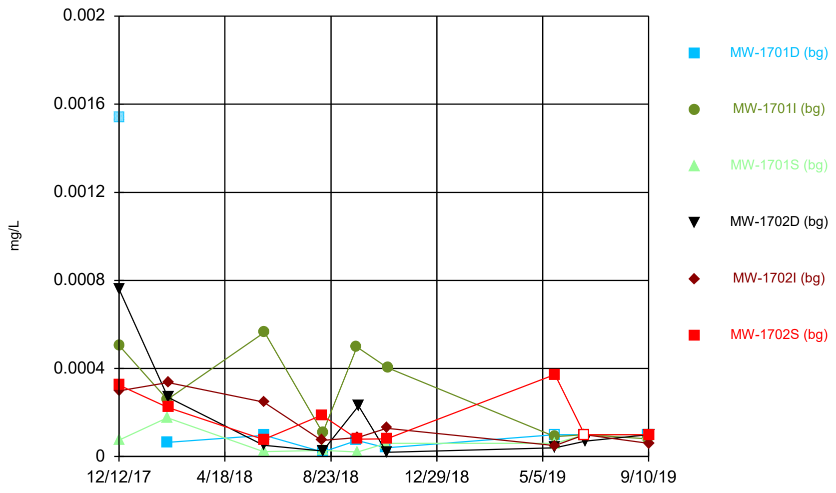
Time Series



Constituent: Lead, total Analysis Run 12/5/2019 11:21 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

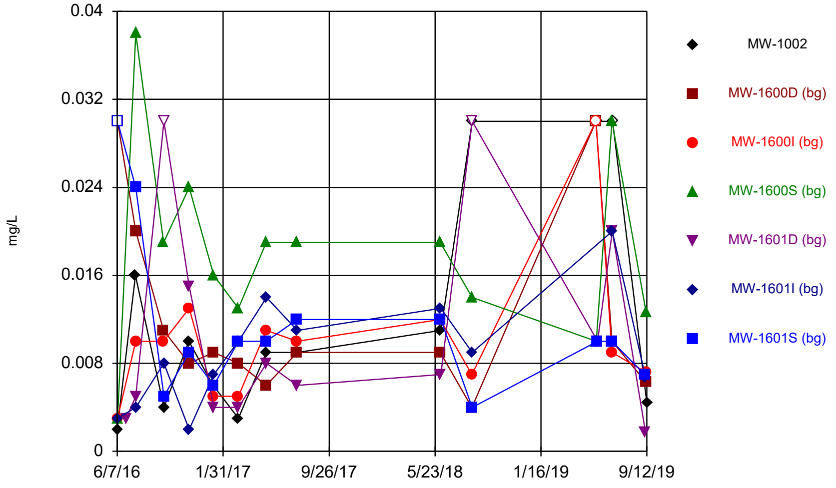
Time Series



Constituent: Lead, total Analysis Run 12/5/2019 11:21 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

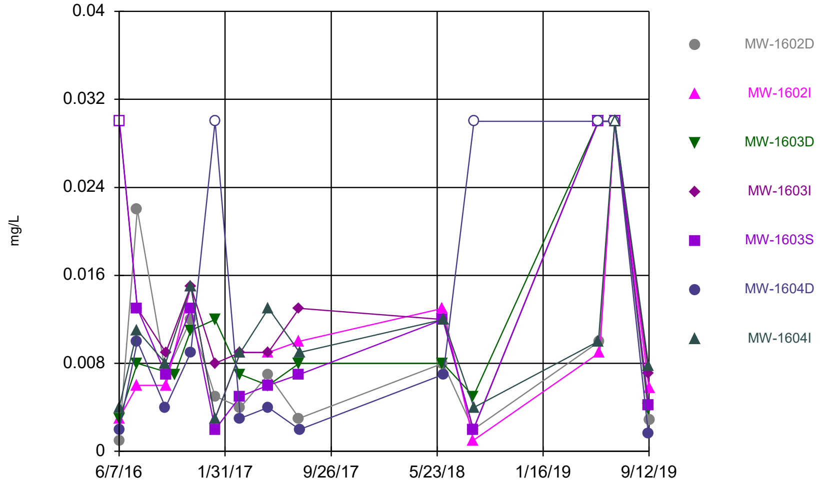
Time Series



Constituent: Lithium, total Analysis Run 12/5/2019 11:21 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

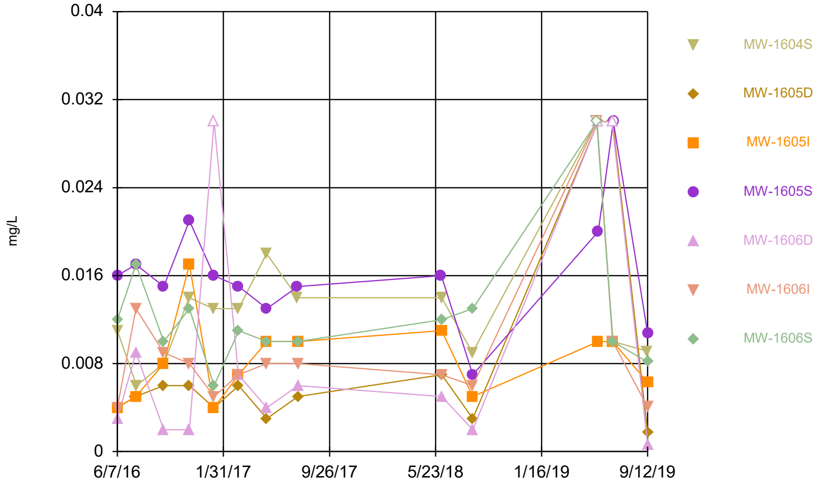
Time Series



Constituent: Lithium, total Analysis Run 12/5/2019 11:21 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

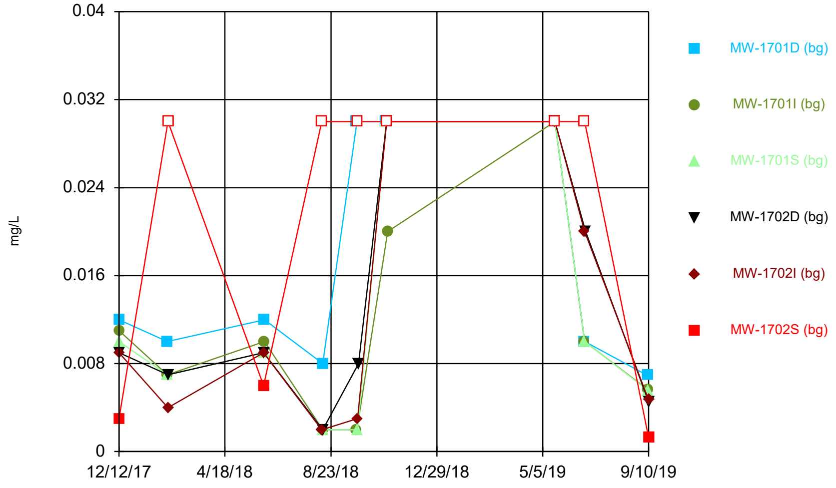
Time Series



Constituent: Lithium, total Analysis Run 12/5/2019 11:21 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

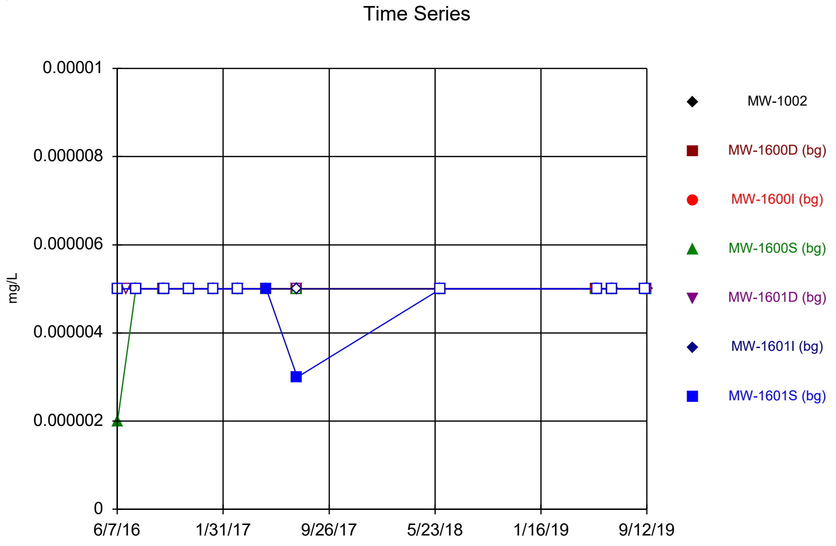
Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



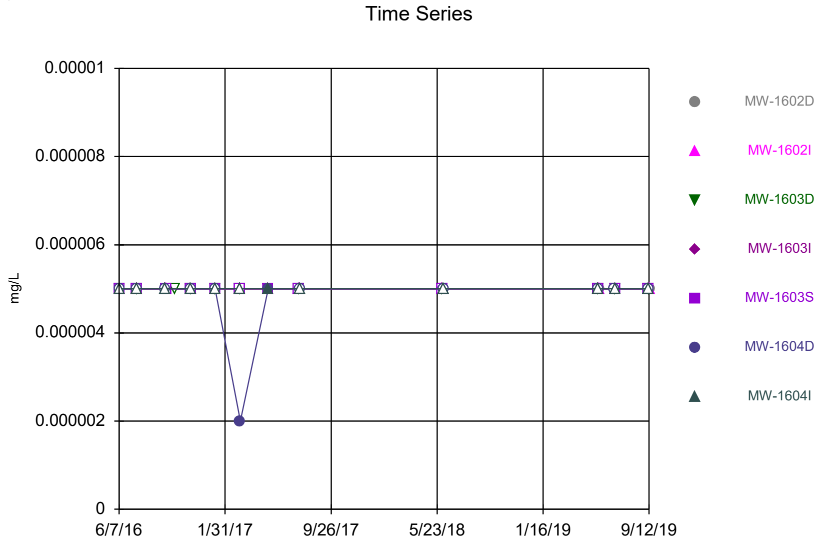
Constituent: Lithium, total Analysis Run 12/5/2019 11:21 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



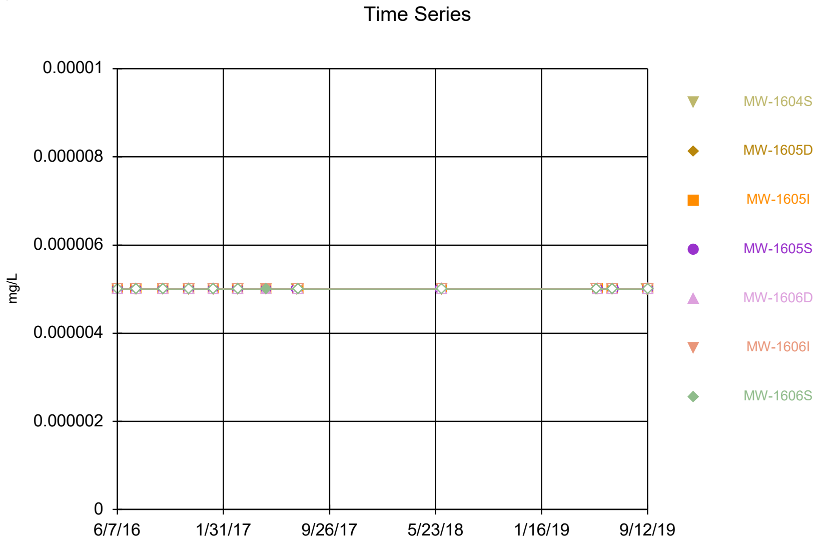
Constituent: Mercury, total   Analysis Run 12/5/2019 11:21 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



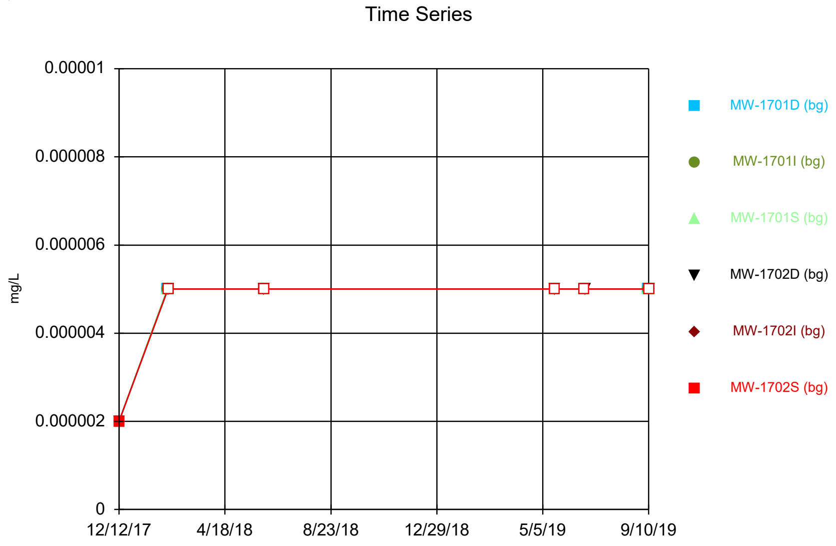
Constituent: Mercury, total   Analysis Run 12/5/2019 11:21 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



Constituent: Mercury, total   Analysis Run 12/5/2019 11:21 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

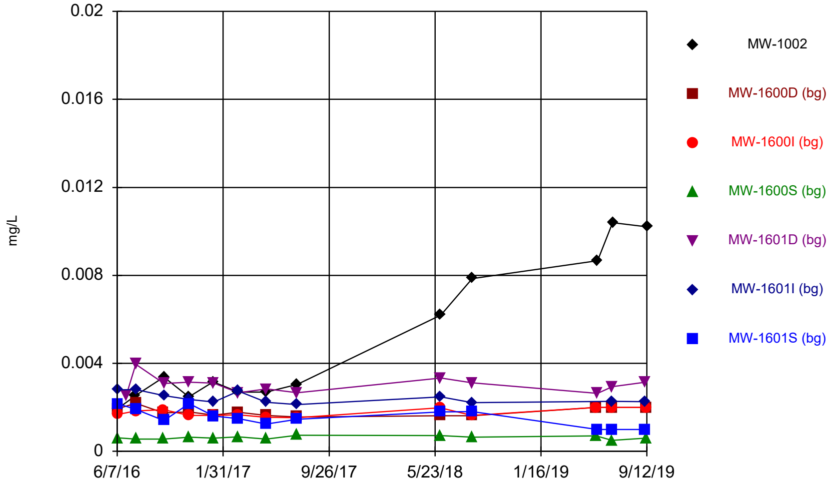
Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



Constituent: Mercury, total   Analysis Run 12/5/2019 11:21 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Time Series

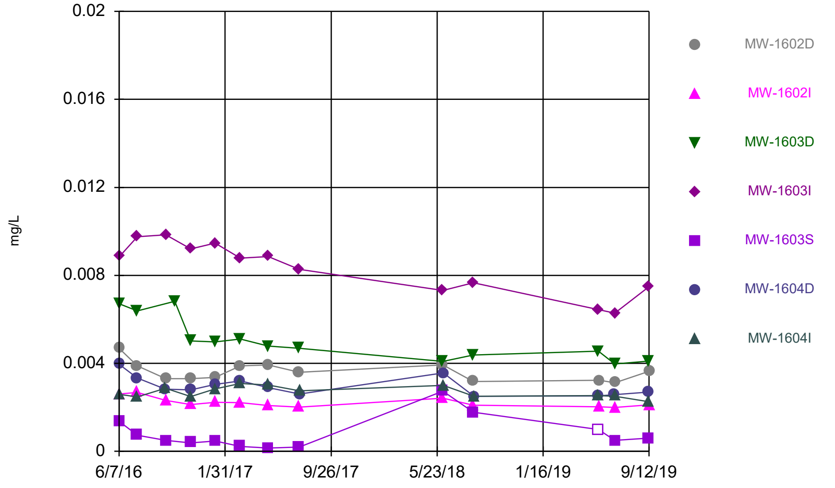


Constituent: Molybdenum, total Analysis Run 12/5/2019 11:21 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series

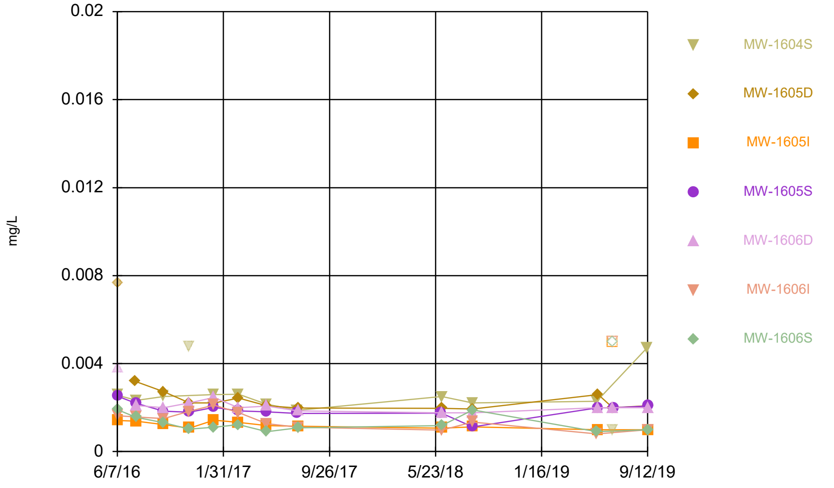


Constituent: Molybdenum, total Analysis Run 12/5/2019 11:21 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series

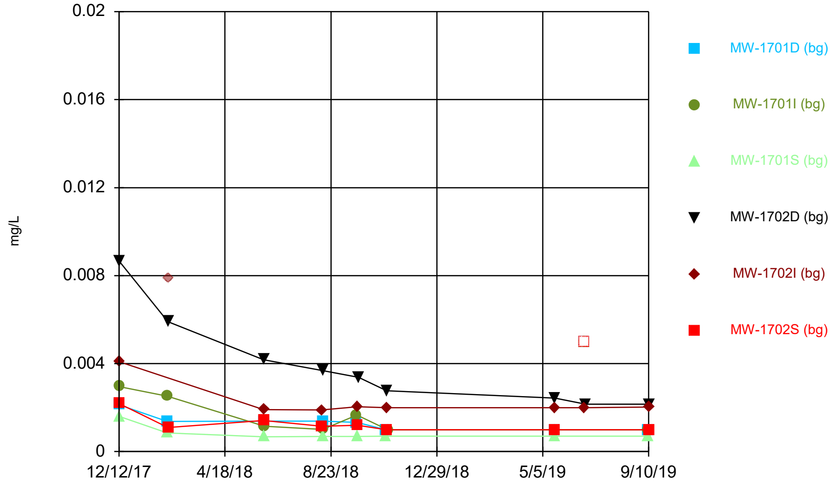


Constituent: Molybdenum, total Analysis Run 12/5/2019 11:21 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

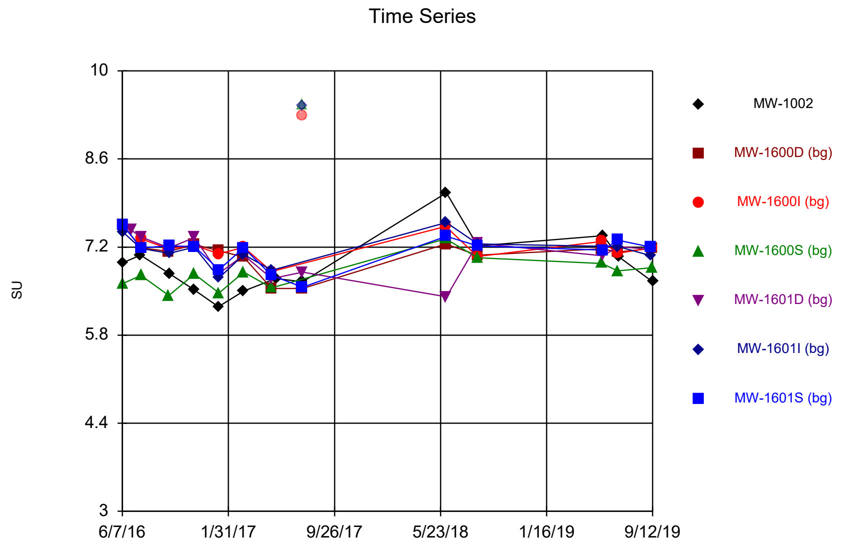
Time Series



Constituent: Molybdenum, total Analysis Run 12/5/2019 11:21 AM

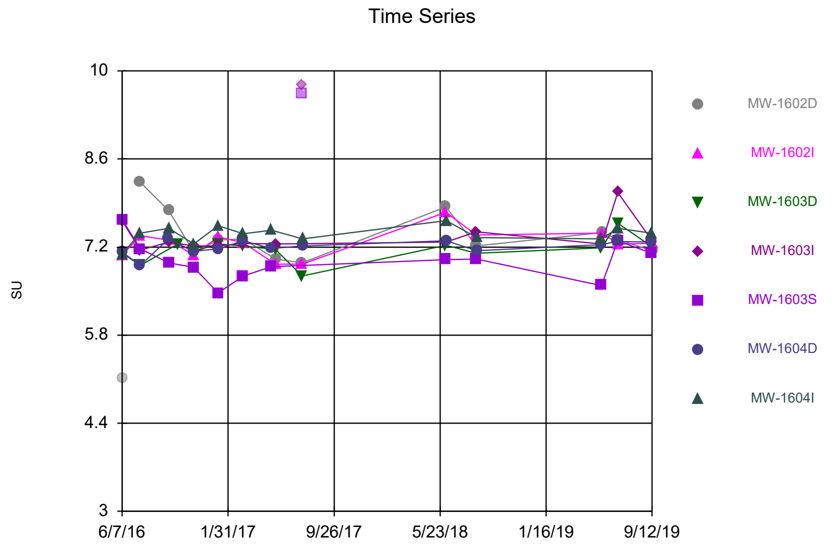
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



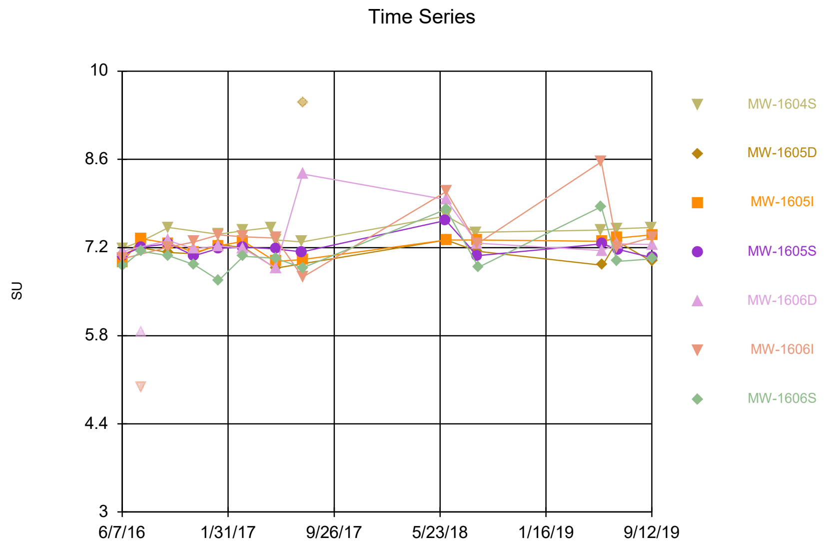
Constituent: pH, field Analysis Run 12/5/2019 11:21 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



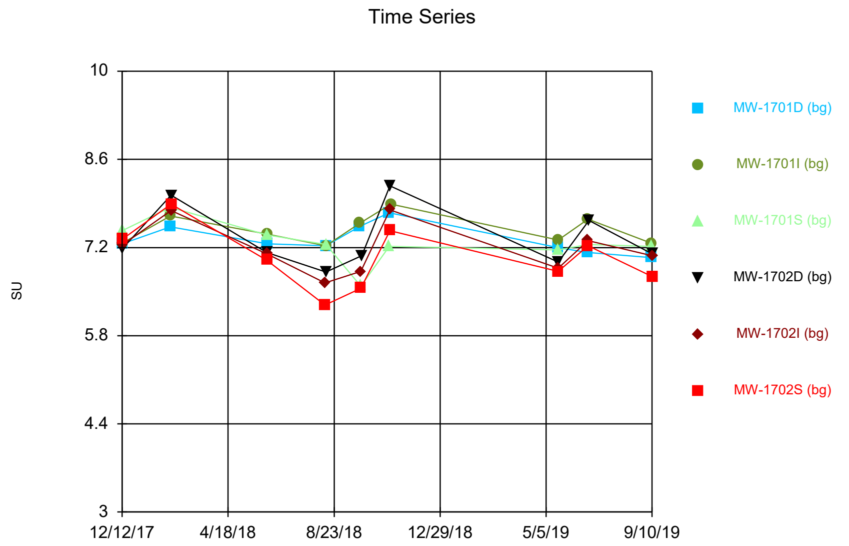
Constituent: pH, field Analysis Run 12/5/2019 11:21 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



Constituent: pH, field Analysis Run 12/5/2019 11:21 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

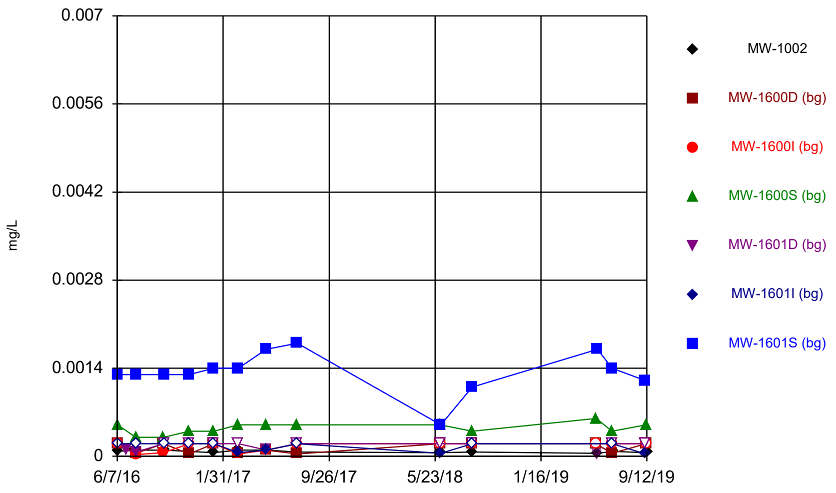
Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



Constituent: pH, field Analysis Run 12/5/2019 11:21 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

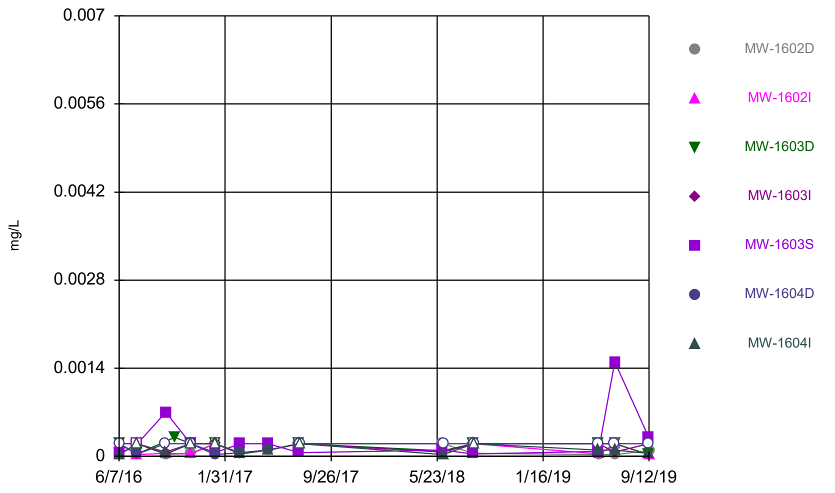
Time Series



Constituent: Selenium, total   Analysis Run 12/5/2019 11:21 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

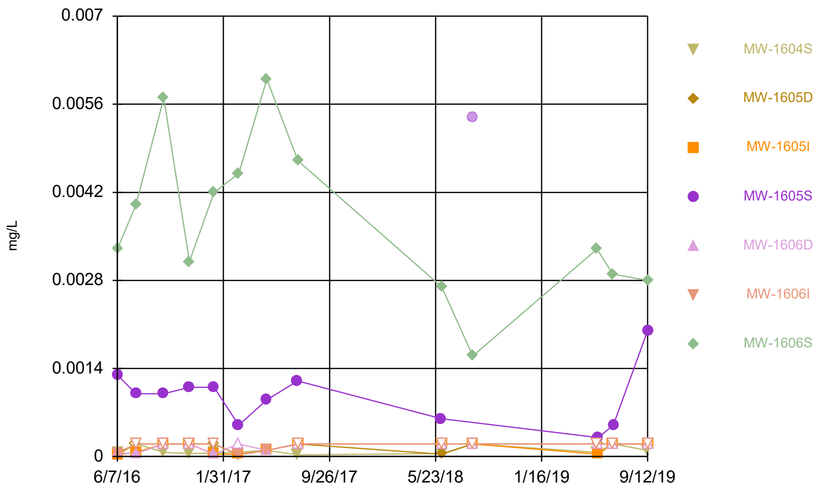
Time Series



Constituent: Selenium, total   Analysis Run 12/5/2019 11:21 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

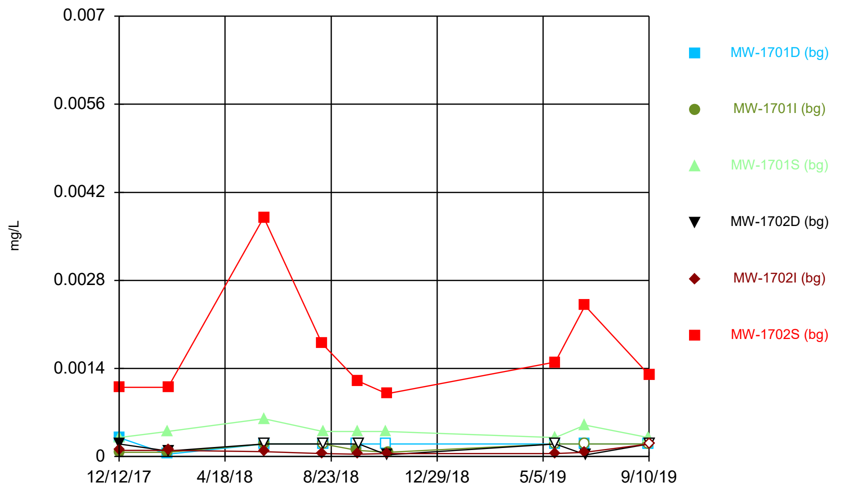
Time Series



Constituent: Selenium, total   Analysis Run 12/5/2019 11:21 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

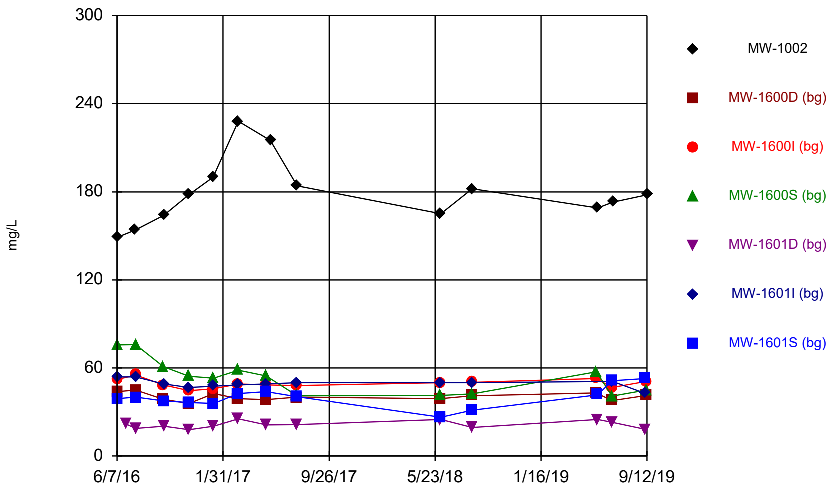
Time Series



Constituent: Selenium, total   Analysis Run 12/5/2019 11:21 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

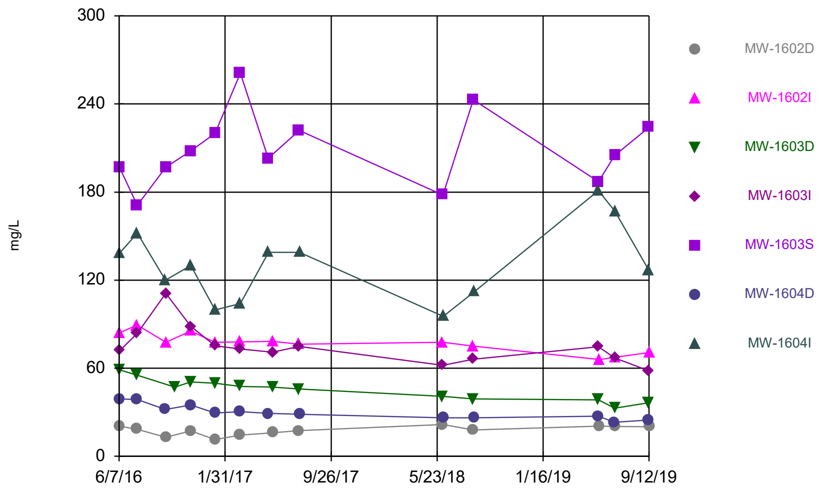
Time Series



Constituent: Sulfate, total Analysis Run 12/5/2019 11:21 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

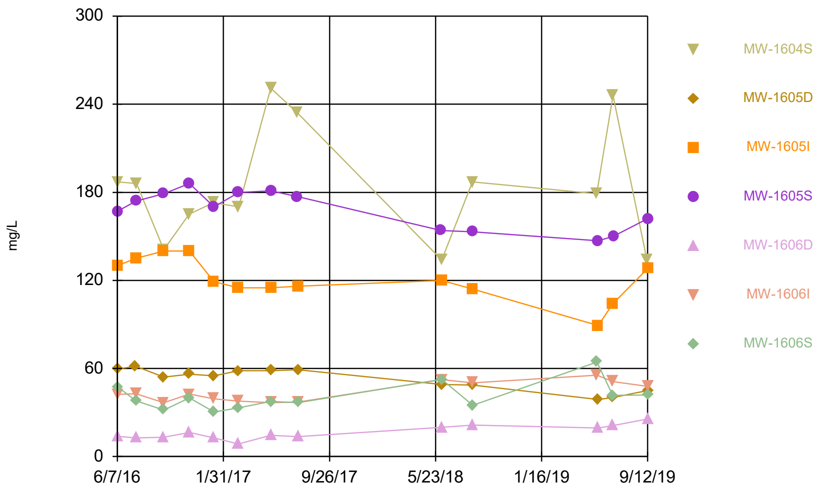
Time Series



Constituent: Sulfate, total Analysis Run 12/5/2019 11:21 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

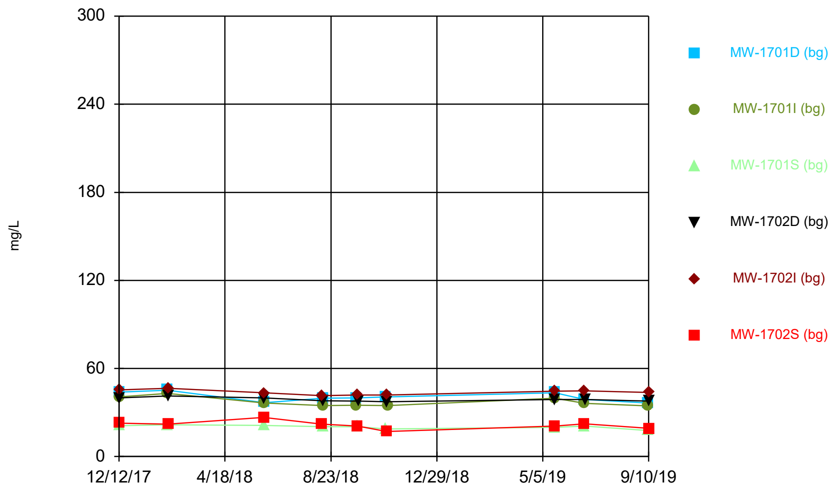
Time Series



Constituent: Sulfate, total Analysis Run 12/5/2019 11:21 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

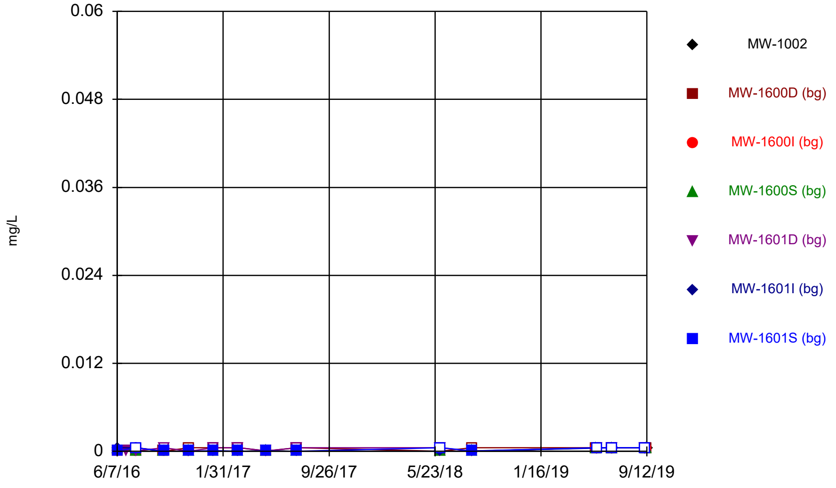
Time Series



Constituent: Sulfate, total Analysis Run 12/5/2019 11:21 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

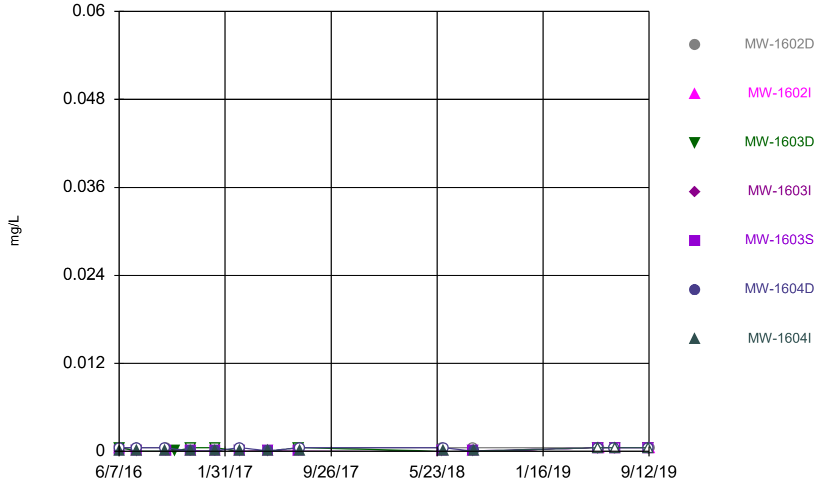
Time Series



Constituent: Thallium, total Analysis Run 12/5/2019 11:21 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

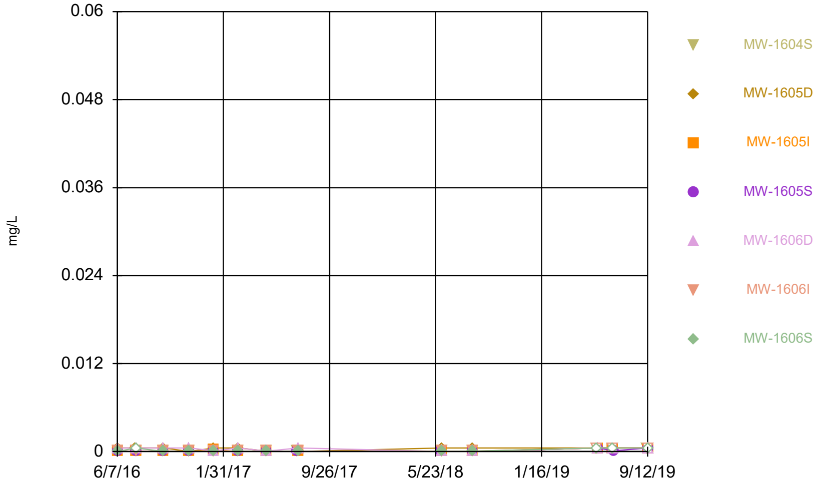
Time Series



Constituent: Thallium, total Analysis Run 12/5/2019 11:21 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

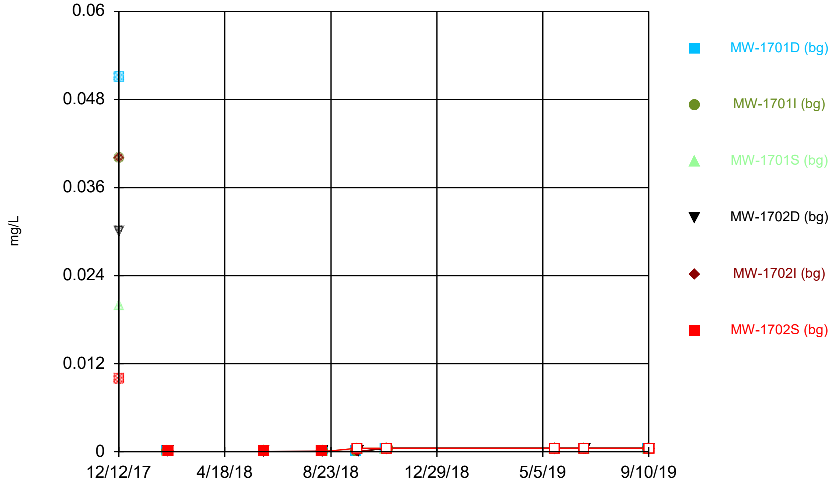
Time Series



Constituent: Thallium, total Analysis Run 12/5/2019 11:21 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

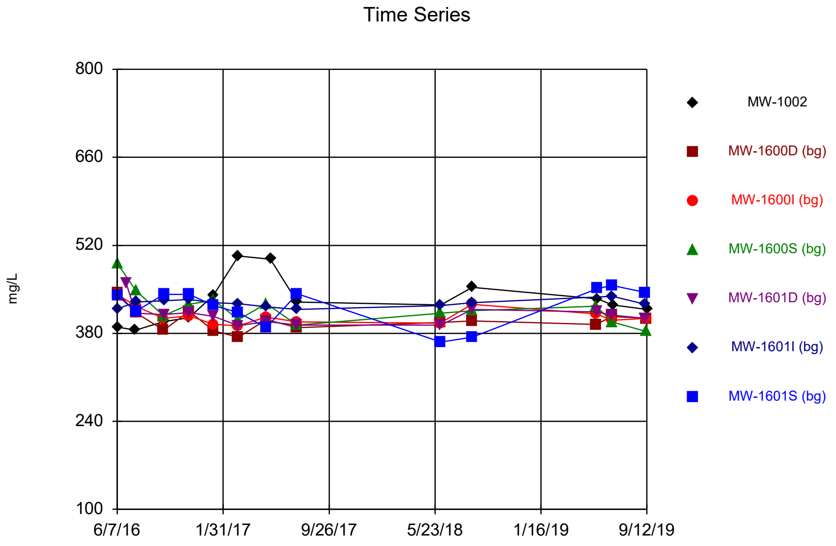
Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



Constituent: Thallium, total Analysis Run 12/5/2019 11:21 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

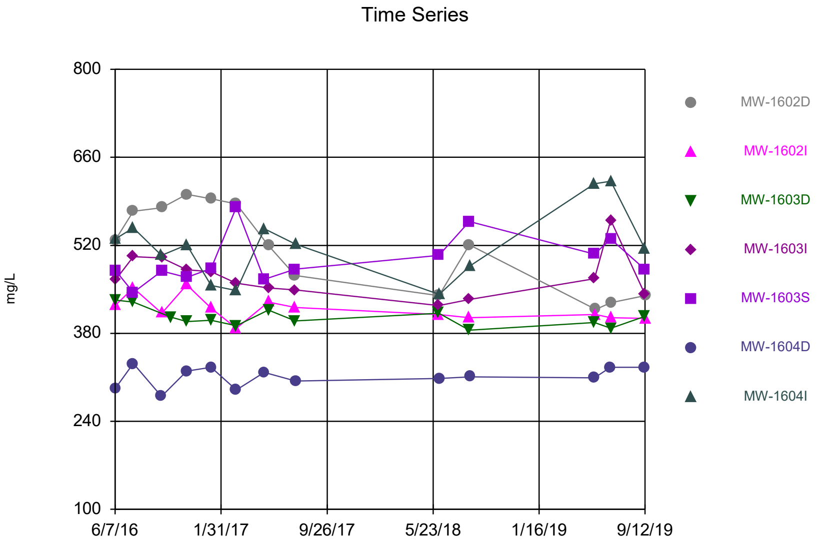
Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



Constituent: Total Dissolved Solids [TDS]   Analysis Run 12/5/2019 11:21 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

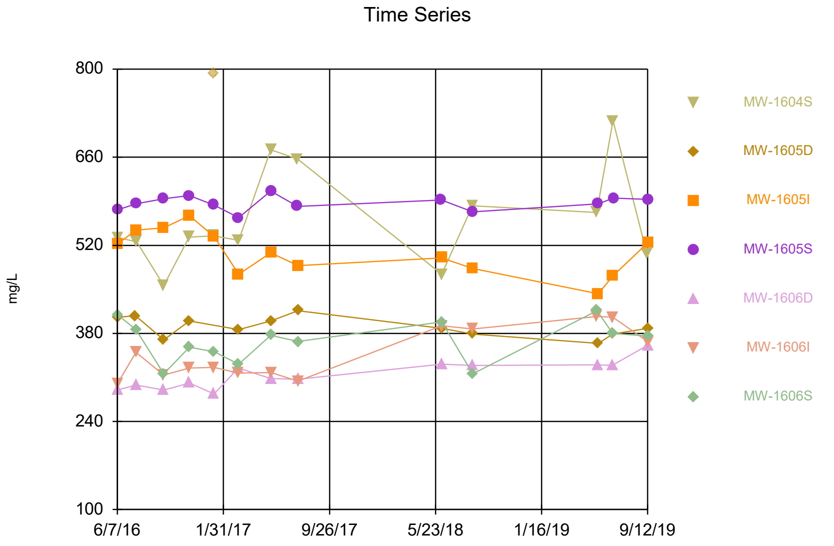
Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



Constituent: Total Dissolved Solids [TDS]   Analysis Run 12/5/2019 11:21 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

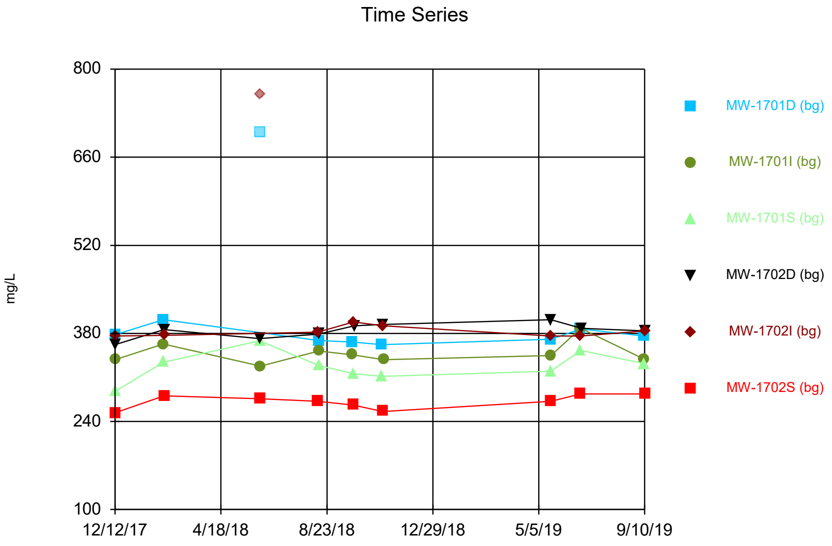
Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



Constituent: Total Dissolved Solids [TDS]   Analysis Run 12/5/2019 11:21 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

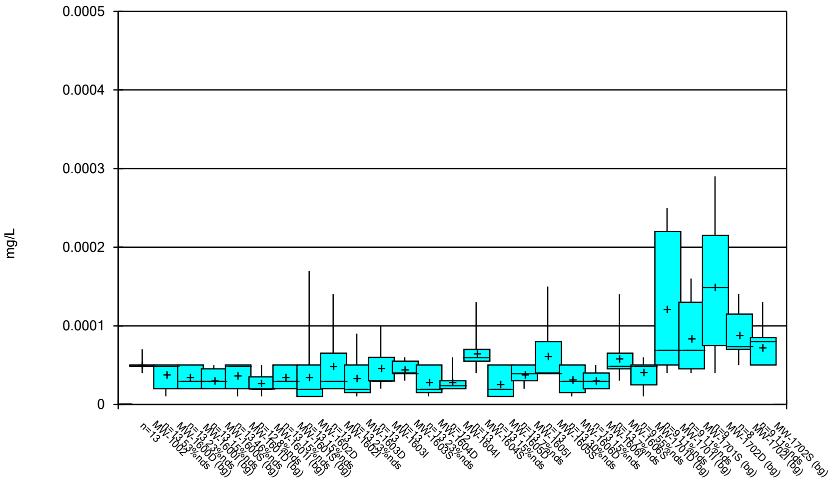


Constituent: Total Dissolved Solids [TDS]   Analysis Run 12/5/2019 11:21 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Box & Whiskers Plot

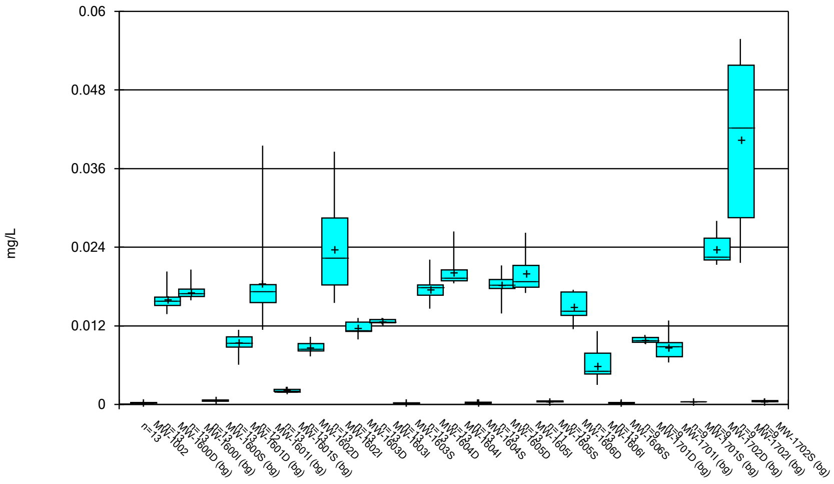


Constituent: Antimony, total Analysis Run 12/5/2019 11:26 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Box & Whiskers Plot

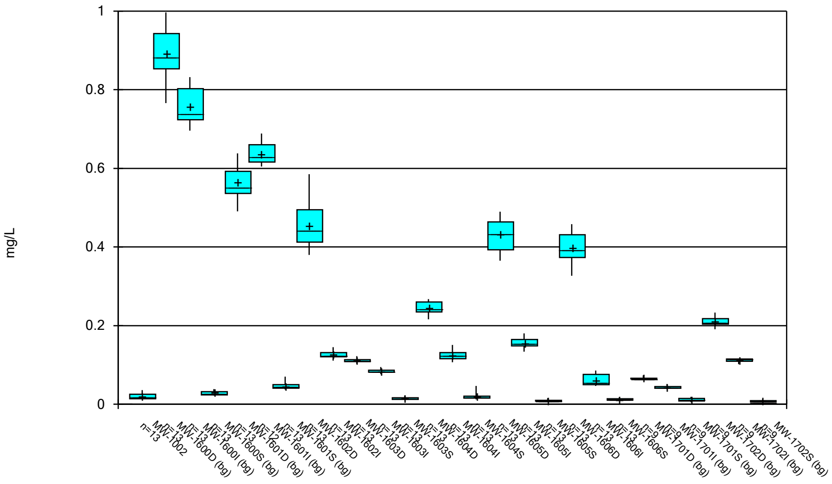


Constituent: Arsenic, total Analysis Run 12/5/2019 11:26 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Box & Whiskers Plot

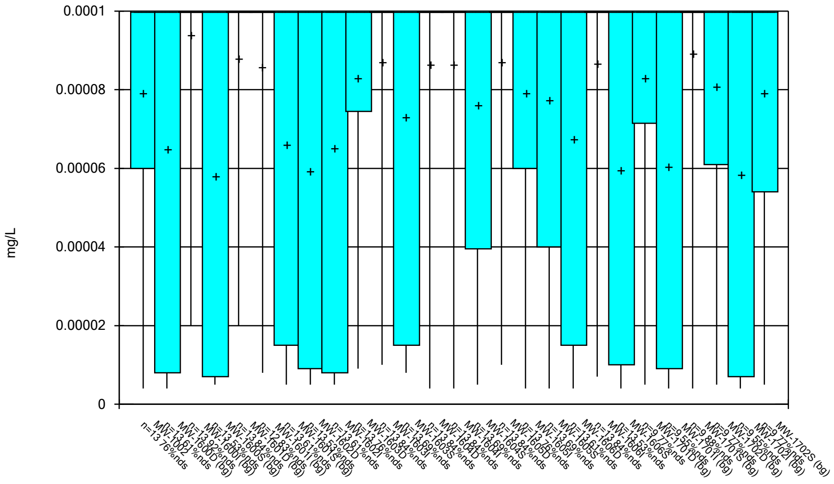


Constituent: Barium, total Analysis Run 12/5/2019 11:26 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Box & Whiskers Plot

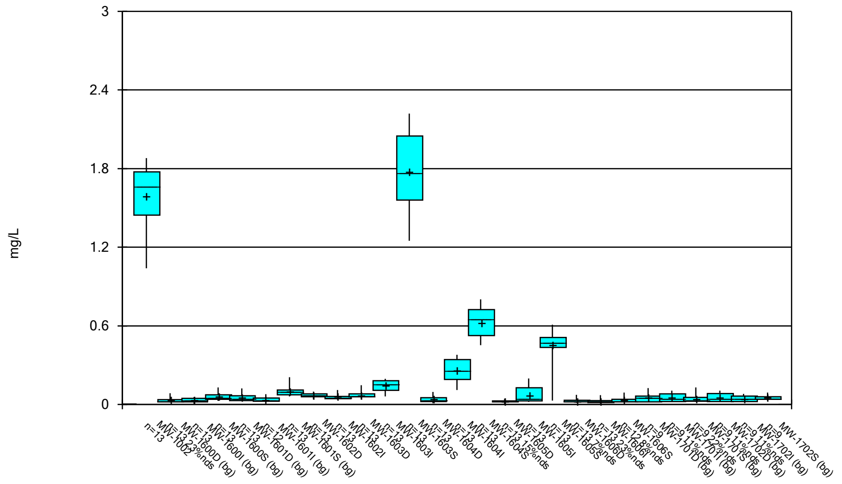


Constituent: Beryllium, total Analysis Run 12/5/2019 11:26 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Box & Whiskers Plot

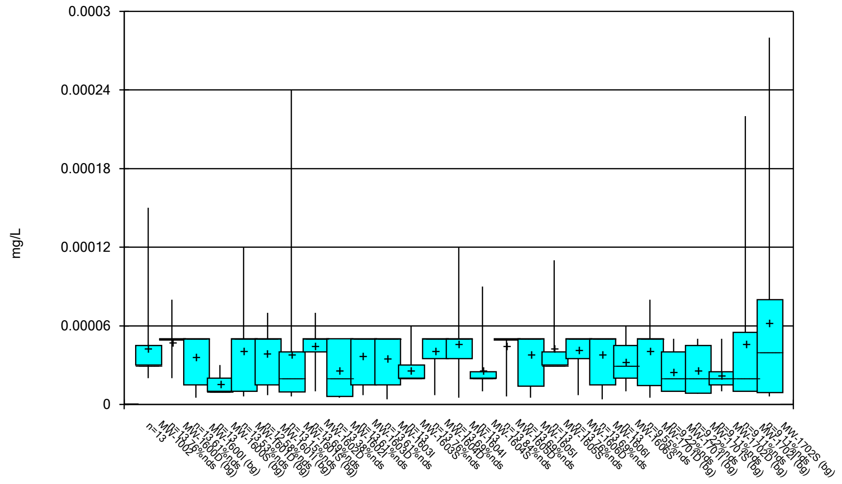


Constituent: Boron, total   Analysis Run 12/5/2019 11:26 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Box & Whiskers Plot

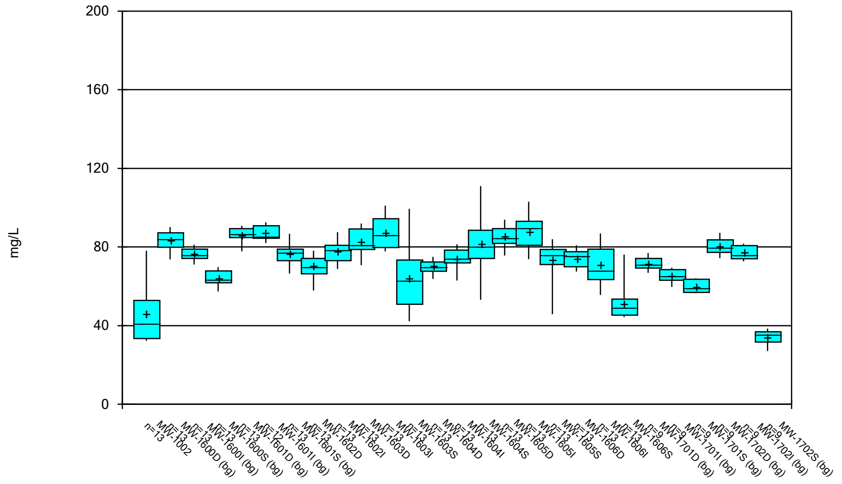


Constituent: Cadmium, total   Analysis Run 12/5/2019 11:26 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Box & Whiskers Plot

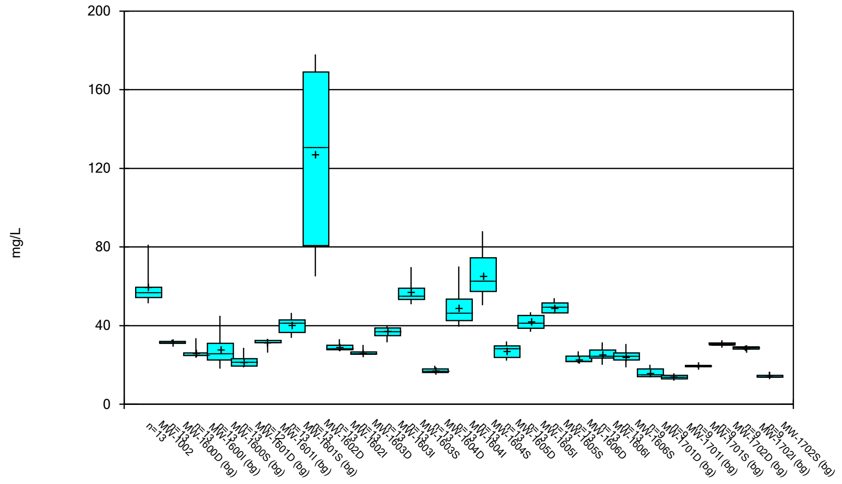


Constituent: Calcium, total   Analysis Run 12/5/2019 11:26 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Box & Whiskers Plot

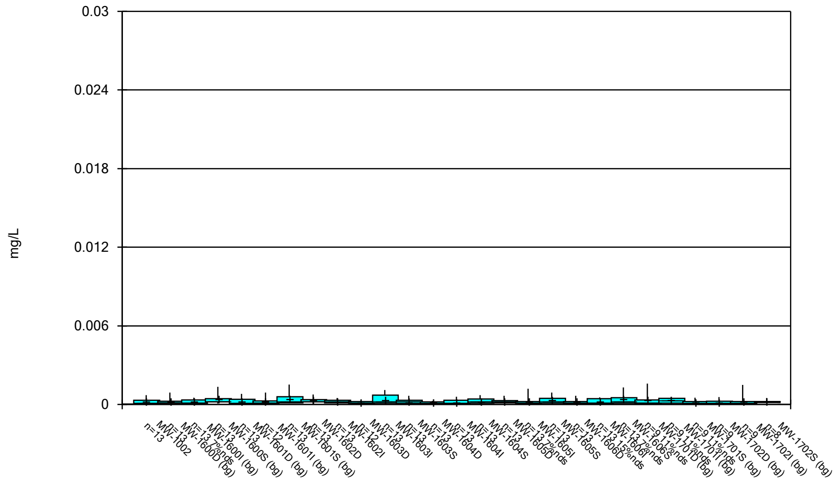


Constituent: Chloride, total   Analysis Run 12/5/2019 11:26 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Box & Whiskers Plot

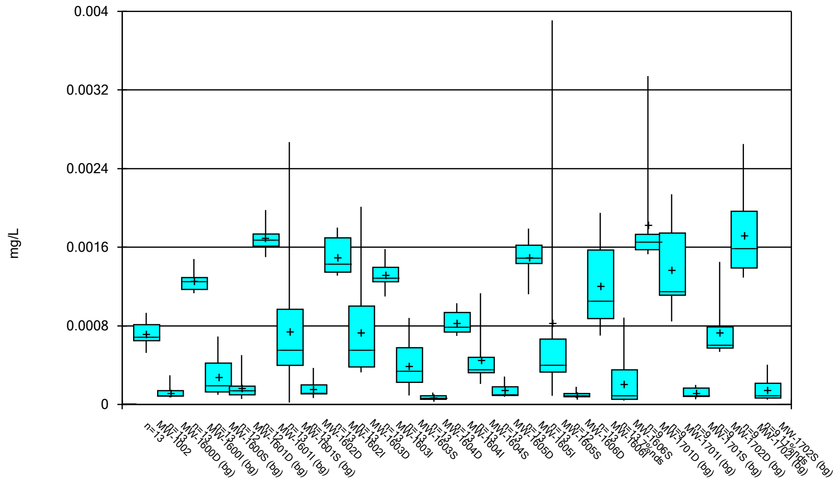


Constituent: Chromium, total Analysis Run 12/5/2019 11:26 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Box & Whiskers Plot

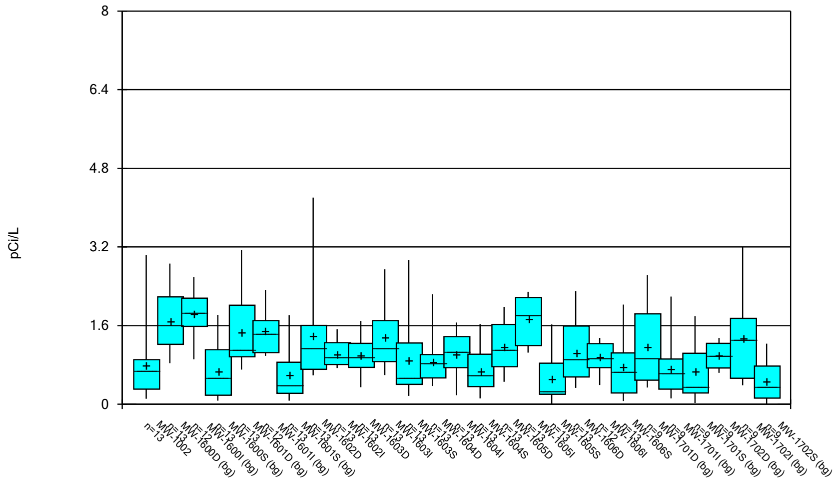


Constituent: Cobalt, total Analysis Run 12/5/2019 11:26 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Box & Whiskers Plot

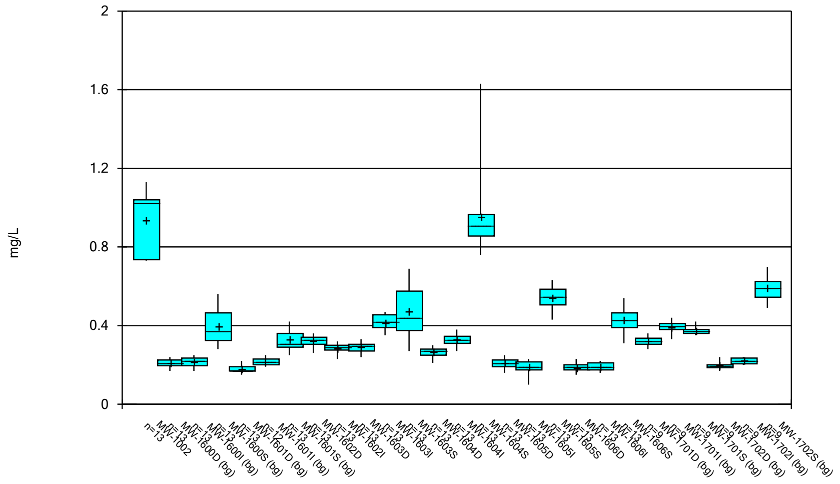


Constituent: Combined Radium 226 + 228 Analysis Run 12/5/2019 11:26 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Box & Whiskers Plot

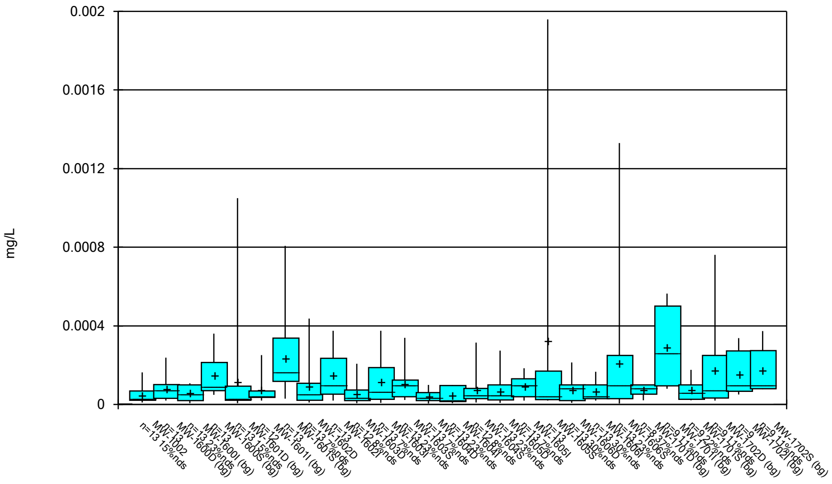


Constituent: Fluoride, total Analysis Run 12/5/2019 11:26 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Box & Whiskers Plot

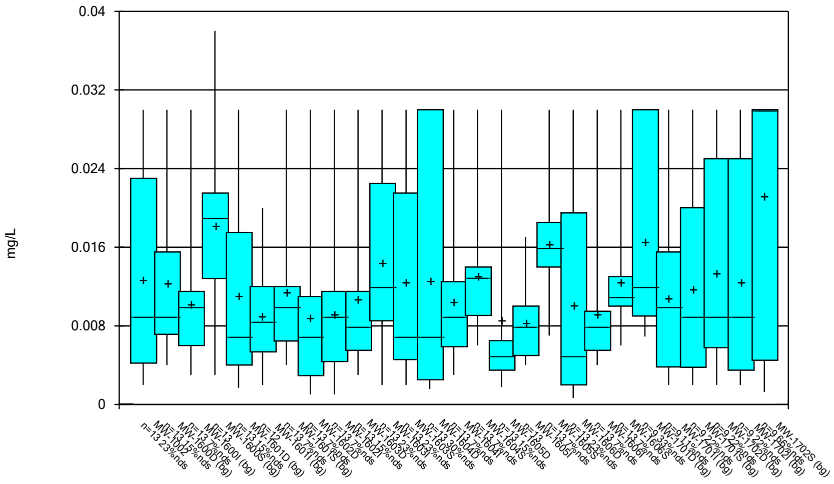


Constituent: Lead, total   Analysis Run 12/5/2019 11:26 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Box & Whiskers Plot

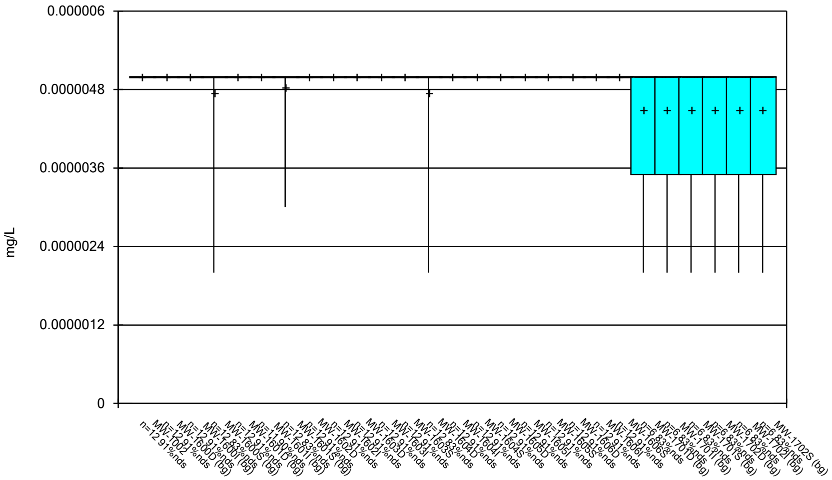


Constituent: Lithium, total   Analysis Run 12/5/2019 11:27 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Box & Whiskers Plot

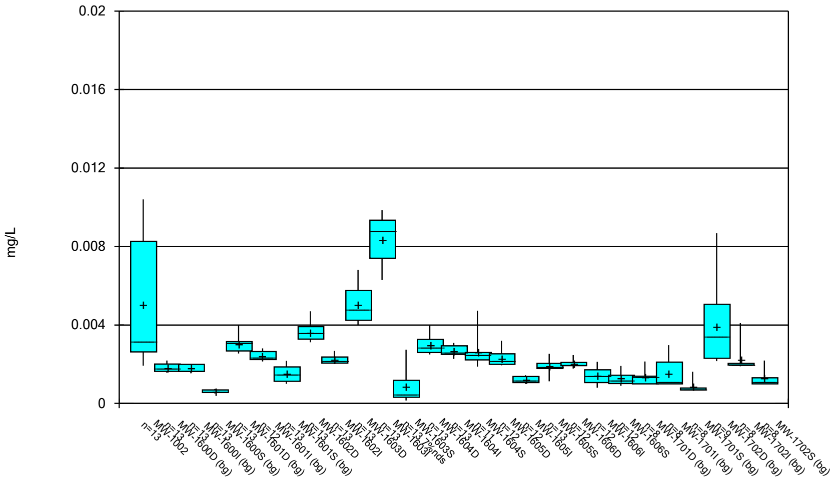


Constituent: Mercury, total   Analysis Run 12/5/2019 11:27 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

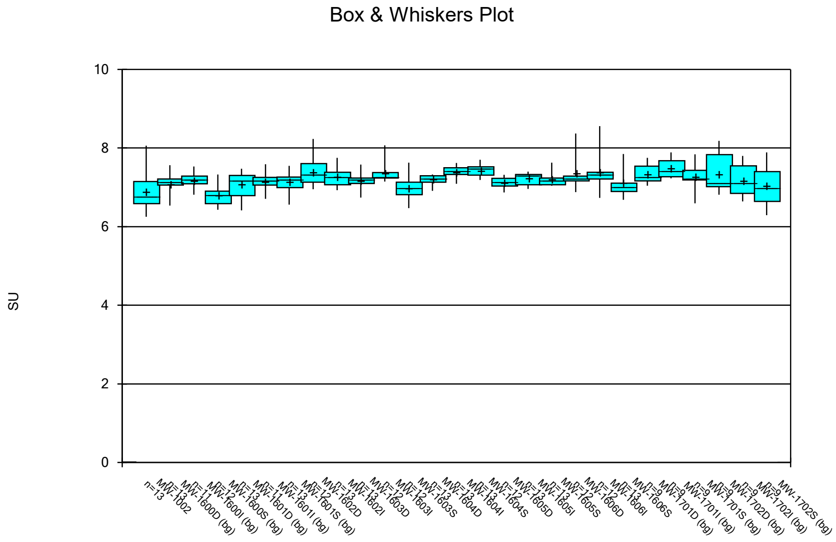
Box & Whiskers Plot



Constituent: Molybdenum, total   Analysis Run 12/5/2019 11:27 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

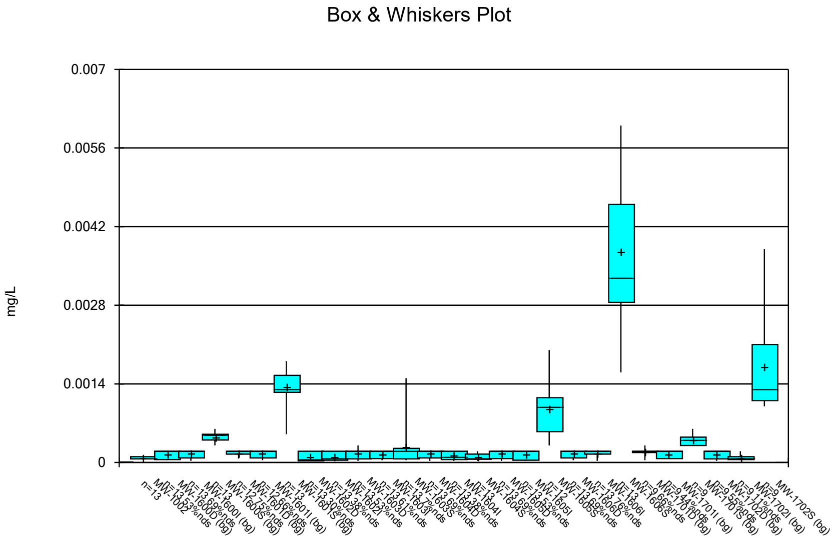
Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



Constituent: pH, field Analysis Run 12/5/2019 11:27 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

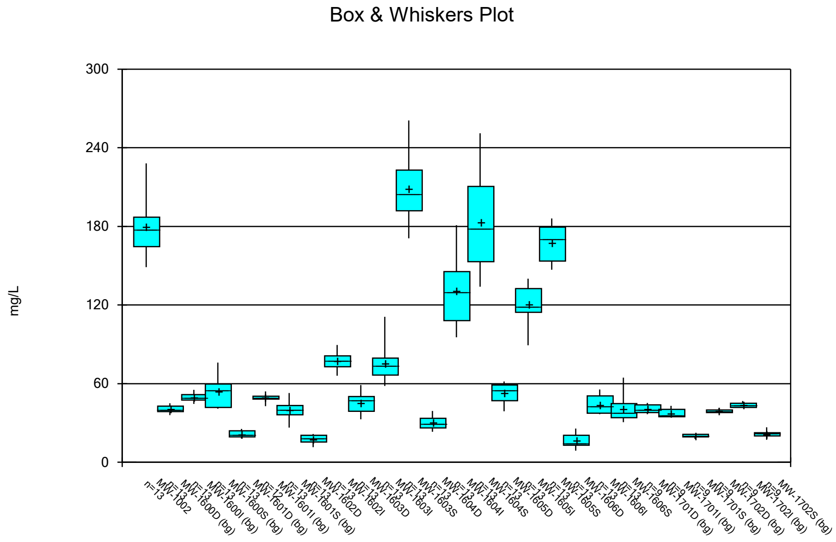
Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



Constituent: Selenium, total Analysis Run 12/5/2019 11:27 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

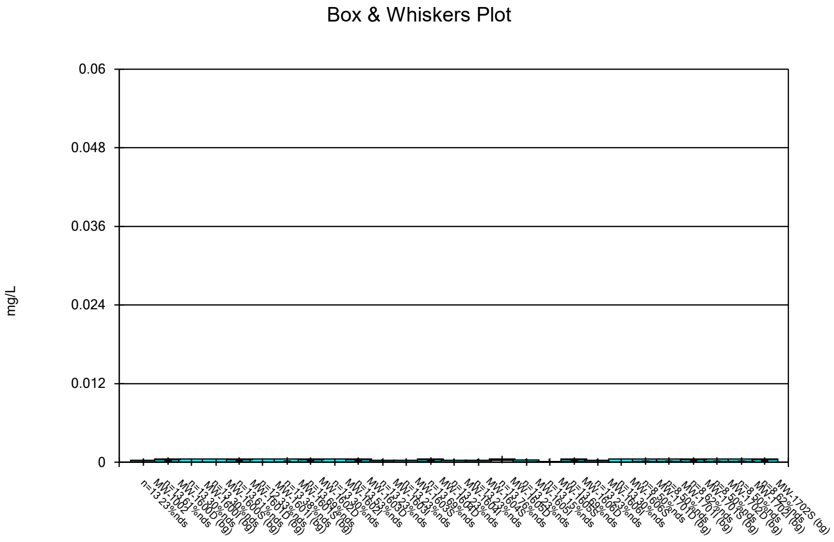
Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



Constituent: Sulfate, total Analysis Run 12/5/2019 11:27 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

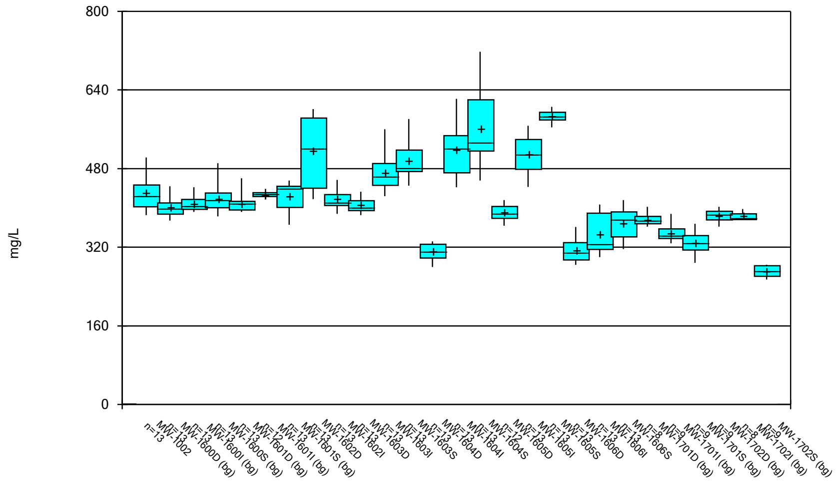
Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



Constituent: Thallium, total Analysis Run 12/5/2019 11:27 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Box & Whiskers Plot



Constituent: Total Dissolved Solids [TDS]   Analysis Run 12/5/2019 11:27 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Outlier Summary

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP   Printed 12/8/2019, 2:02 PM

	MW-1604I Antimony, total (mg/L)	MW-1702I Antimony, total (mg/L)	MW-1605S Arsenic, total (mg/L)	MW-1606S Boron, total (mg/L)	MW-1603D Chromium, total (mg/L)	MW-1702S Chromium, total (mg/L)	MW-1601D Cobalt, total (mg/L)	MW-1606D Cobalt, total (mg/L)	MW-1600I Combined Radium 226 + 228 (pCi/L)	MW-1606I Combined Radium 226 + 228 (pCi/L)
6/7/2016								0.000508 (o)		
6/8/2016									7.25 (o)	
6/27/2016							0.00136 (o)			
7/19/2016										
7/20/2016										
10/10/2016					0.0238 (o)					
11/15/2016										
1/10/2017										4.283 (o)
3/7/2017										
7/17/2017										
7/18/2017	0.00024 (o)									
12/12/2017						0.00413 (o)				
2/9/2018										
6/4/2018										
6/5/2018										
8/15/2018				0.563 (o)						
9/25/2018		0.00044 (o)								
5/24/2019			0.00284 (o)							
6/25/2019										
6/27/2019			0.00244 (o)							

Outlier Summary

Rockport BAP Client: Geosyntec Data: Rockport_BAP Printed 12/8/2019, 2:02 PM

	MW-1603D Lead, total (mg/L)	MW-1604S Lead, total (mg/L)	MW-1701D Lead, total (mg/L)	MW-1604S Molybdenum, total (mg/L)	MW-1605D Molybdenum, total (mg/L)	MW-1605I Molybdenum, total (mg/L)	MW-1606D Molybdenum, total (mg/L)	MW-1606I Molybdenum, total (mg/L)	MW-1606S Molybdenum, total (mg/L)	MW-1701S Molybdenum, total (mg/L)
6/7/2016					0.00765 (o)		0.00382 (o)			
6/8/2016										
6/27/2016										
7/19/2016										
7/20/2016		0.000911 (o)								
10/10/2016	0.00138 (o)									
11/15/2016				0.00479 (o)						
1/10/2017										
3/7/2017										
7/17/2017										
7/18/2017										
12/12/2017			0.00154 (o)							
2/9/2018										
6/4/2018										
6/5/2018										
8/15/2018										
9/25/2018										
5/24/2019										
6/25/2019						<0.01 (o)		<0.01 (o)	<0.01 (o)	<0.01 (o)
6/27/2019										

Outlier Summary

Rockport BAP Client: Geosyntec Data: Rockport_BAP Printed 12/8/2019, 2:02 PM

	MW-1702I Molybdenum, total (mg/L)	MW-1702S Molybdenum, total (mg/L)	MW-1701D Molybdenum, total (mg/L)	MW-1701I Molybdenum, total (mg/L)	MW-1600I pH, field (SU)	MW-1600S pH, field (SU)	MW-1601I pH, field (SU)	MW-1602D pH, field (SU)	MW-1603I pH, field (SU)	MW-1603S pH, field (SU)
6/7/2016								5.12 (o)		
6/8/2016										
6/27/2016										
7/19/2016										
7/20/2016										
10/10/2016										
11/15/2016										
1/10/2017										
3/7/2017										
7/17/2017					9.29 (o)	9.46 (o)	9.45 (o)		9.78 (o)	9.63 (o)
7/18/2017										
12/12/2017										
2/9/2018	0.0079 (o)									
6/4/2018										
6/5/2018										
8/15/2018										
9/25/2018										
5/24/2019										
6/25/2019		<0.01 (o)	<0.01 (o)	<0.01 (o)						
6/27/2019										

Outlier Summary

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP   Printed 12/8/2019, 2:02 PM

	MW-1605D pH, field (SU)	MW-1606D pH, field (SU)	MW-1606I pH, field (SU)	MW-1605S Selenium, total (mg/L)	MW-1701S Thallium, total (mg/L)	MW-1702D Thallium, total (mg/L)	MW-1702I Thallium, total (mg/L)	MW-1702S Thallium, total (mg/L)	MW-1701D Thallium, total (mg/L)	MW-1701I Thallium, total (mg/L)
6/7/2016										
6/8/2016										
6/27/2016										
7/19/2016		5.85 (o)	4.98 (o)							
7/20/2016										
10/10/2016										
11/15/2016										
1/10/2017										
3/7/2017										
7/17/2017										
7/18/2017	9.51 (o)									
12/12/2017					0.02 (o)	0.03 (o)	0.04 (o)	0.01 (o)	0.051 (o)	0.04 (o)
2/9/2018										
6/4/2018										
6/5/2018										
8/15/2018				0.0054 (o)						
9/25/2018										
5/24/2019										
6/25/2019										
6/27/2019										

Outlier Summary

Rockport BAP Client: Geosyntec Data: Rockport_BAP Printed 12/8/2019, 2:02 PM

	MW-1603S Total Dissolved Solids [TDS] (mg/L)	MW-1605D Total Dissolved Solids [TDS] (mg/L)	MW-1702I Total Dissolved Solids [TDS] (mg/L)	MW-1701D Total Dissolved Solids [TDS] (mg/L)
6/7/2016				
6/8/2016				
6/27/2016				
7/19/2016				
7/20/2016				
10/10/2016				
11/15/2016				
1/10/2017		794 (o)		
3/7/2017	581 (o)			
7/17/2017				
7/18/2017				
12/12/2017				
2/9/2018				
6/4/2018			760 (o)	
6/5/2018				700 (o)
8/15/2018				
9/25/2018				
5/24/2019				
6/25/2019				
6/27/2019				

Upgradient Outlier Analysis - Significant Results

Rockport BAP Client: Geosyntec Data: Rockport_BAP Printed 12/5/2019, 10:19 AM

Constituent	Well	Outlier	Value(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Arsenic, total (mg/L)	**MW-1600D,MW-1600I...**	**Yes**	**0.0395,0.028,0.0225,0.0225,0.0252,0.0213,0.022,0.**	**NP**	**NaN**	**131**	**0.01193**	**0.01141**	**x^6**	**ChiSquared**
Barium, total (mg/L)	**MW-1600D,MW-1600I...**	**Yes**	**0.94,0.946,0.91,0.997,0.877,0.986,0.914,0.817,0.8**	**NP**	**NaN**	**131**	**0.3165**	**0.3335**	**x^6**	**ChiSquared**
Boron, total (mg/L)	**MW-1600D,MW-1600I...**	**Yes**	**0.085,0.129,0.129,0.088,0.09,0.09,0.122,0.108,0.1**	**NP**	**NaN**	**131**	**0.05068**	**0.03264**	**x^6**	**ChiSquared**
Chloride, total (mg/L)	**MW-1600D,MW-1600I...**	**Yes**	**44.9,45.9,46.4,43.5,42.3,42,41.1,41.9,41.7**	**NP**	**NaN**	**131**	**25.91**	**8.271**	**x^6**	**ChiSquared**
Combined Radium 226 + 228 (pCi/L)	**MW-1600D,MW-1600I...**	**Yes**	**2.148,2.265,2.223,2.86,7.25,2.47,2.59,2.301,2.248**	**NP**	**NaN**	**131**	**1.163**	**0.9081**	**x^6**	**ChiSquared**
Fluoride, total (mg/L)	**MW-1600D,MW-1600I...**	**Yes**	**0.56,0.51,0.47,0.46,0.49,0.62,0.57,0.55,0.54,0.61**	**NP**	**NaN**	**131**	**0.2954**	**0.1184**	**x^6**	**ChiSquared**
Lithium, total (mg/L)	**MW-1600D,MW-1600I...**	**Yes**	**0.03,0.03,0.03,0.03,0.03,0.03,0.03,0.03,0.03,0.03**	**NP**	**NaN**	**131**	**0.013**	**0.009518**	**x^6**	**ChiSquared**
Sulfate, total (mg/L)	**MW-1600D,MW-1600I...**	**Yes**	**75.8,76,60.8,58.5**	**NP**	**NaN**	**131**	**38.78**	**12.04**	**x^6**	**ChiSquared**
Total Dissolved Solids [TDS] (mg/L)	**MW-1600D,MW-1600I...**	**Yes**	**491,700,760**	**NP**	**NaN**	**131**	**392.8**	**62.3**	**x^6**	**ChiSquared**

Upgradient Outlier Analysis - All Results

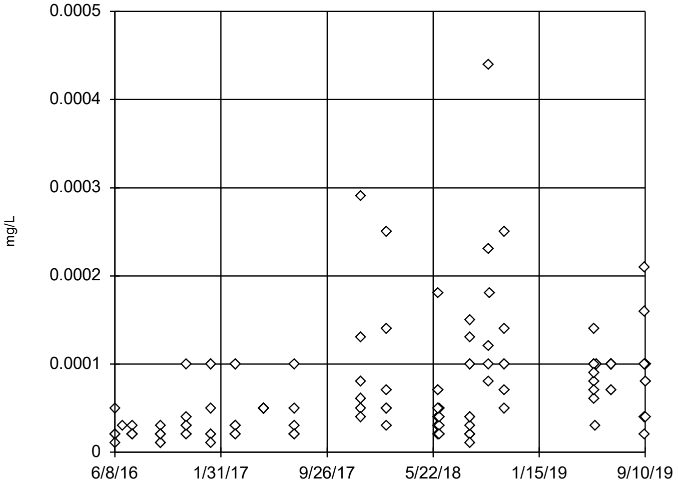
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP   Printed 12/5/2019, 10:19 AM

Constituent	Well	Outlier	Value(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Antimony, total (mg/L)	MW-1600D,MW-1600I...	n/a	n/a	NP	NaN	131	0.00007183	0.00006257	unknown	ChiSquared
Arsenic, total (mg/L)	**MW-1600D,MW-1600I...**	**Yes**	**0.0395,0.028,0.0225,0.0225,0.0252,0.0213,0.022,0.**	**NP**	**NaN**	**131**	**0.01193**	**0.01141**	**x^6**	**ChiSquared**
Barium, total (mg/L)	**MW-1600D,MW-1600I...**	**Yes**	**0.94,0.946,0.91,0.997,0.877,0.986,0.914,0.817,0.8**	**NP**	**NaN**	**131**	**0.3165**	**0.3335**	**x^6**	**ChiSquared**
Beryllium, total (mg/L)	MW-1600D,MW-1600I...	n/a	n/a	NP	NaN	131	0.00007566	0.00003995	unknown	ChiSquared
Boron, total (mg/L)	**MW-1600D,MW-1600I...**	**Yes**	**0.085,0.129,0.129,0.088,0.09,0.09,0.122,0.108,0.1**	**NP**	**NaN**	**131**	**0.05068**	**0.03264**	**x^6**	**ChiSquared**
Cadmium, total (mg/L)	MW-1600D,MW-1600I...	n/a	n/a	NP	NaN	131	0.00003643	0.00003909	unknown	ChiSquared
Chloride, total (mg/L)	**MW-1600D,MW-1600I...**	**Yes**	**44.9,45.9,46.4,43.5,42.3,42,41.1,41.9,41.7**	**NP**	**NaN**	**131**	**25.91**	**8.271**	**x^6**	**ChiSquared**
Chromium, total (mg/L)	MW-1600D,MW-1600I...	n/a	n/a	NP	NaN	131	0.0002983	0.0004447	unknown	ChiSquared
Cobalt, total (mg/L)	MW-1600D,MW-1600I...	n/a	n/a	NP	NaN	131	0.0008243	0.0007206	unknown	ChiSquared
Combined Radium 226 + 228 (pCi/L)	**MW-1600D,MW-1600I...**	**Yes**	**2.148,2.265,2.223,2.86,7.25,2.47,2.59,2.301,2.248**	**NP**	**NaN**	**131**	**1.163**	**0.9081**	**x^6**	**ChiSquared**
Fluoride, total (mg/L)	**MW-1600D,MW-1600I...**	**Yes**	**0.56,0.51,0.47,0.46,0.49,0.62,0.57,0.55,0.54,0.61**	**NP**	**NaN**	**131**	**0.2954**	**0.1184**	**x^6**	**ChiSquared**
Lead, total (mg/L)	MW-1600D,MW-1600I...	n/a	n/a	NP	NaN	131	0.0001455	0.0002012	unknown	ChiSquared
Lithium, total (mg/L)	**MW-1600D,MW-1600I...**	**Yes**	**0.03,0.03,0.03,0.03,0.03,0.03,0.03,0.03,0.03,0.03**	**NP**	**NaN**	**131**	**0.013**	**0.009518**	**x^6**	**ChiSquared**
Mercury, total (mg/L)	MW-1600D,MW-1600I...	n/a	n/a	NP	NaN	107	0.000004785	7.7e-7	unknown	ChiSquared
Molybdenum, total (mg/L)	MW-1600D,MW-1600I...	n/a	n/a	NP	NaN	131	0.002013	0.001308	unknown	ChiSquared
Selenium, total (mg/L)	MW-1600D,MW-1600I...	n/a	n/a	NP	NaN	131	0.0004187	0.0005572	unknown	ChiSquared
Sulfate, total (mg/L)	**MW-1600D,MW-1600I...**	**Yes**	**75.8,76,60.8,58.5**	**NP**	**NaN**	**131**	**38.78**	**12.04**	**x^6**	**ChiSquared**
Thallium, total (mg/L)	MW-1600D,MW-1600I...	n/a	n/a	NP	NaN	131	0.001699	0.007252	unknown	ChiSquared
Total Dissolved Solids [TDS] (mg/L)	**MW-1600D,MW-1600I...**	**Yes**	**491,700,760**	**NP**	**NaN**	**131**	**392.8**	**62.3**	**x^6**	**ChiSquared**

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1600D,MW-1600I,MW-1600S,MW-1601D...



n = 131

No outliers found.
Tukey's method selected by user.

Data were x^6 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.

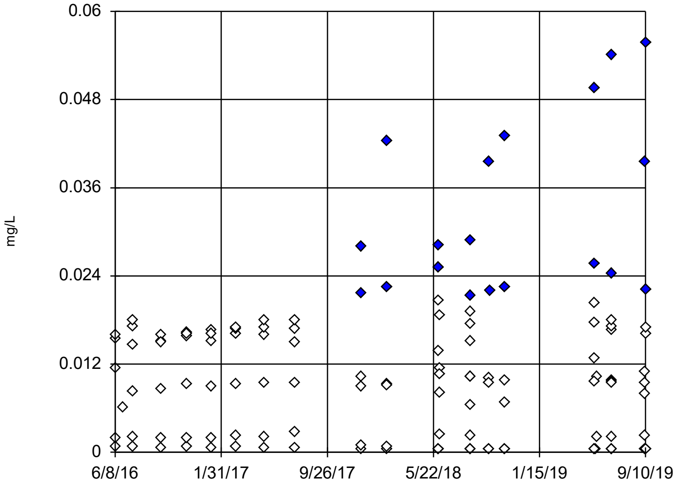
Constituent: Antimony, total Analysis Run 12/5/2019 10:17 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1600D,MW-1600I,MW-1600S,MW-1601D...



n = 131

Outliers are drawn as solid.
Tukey's method selected by user.

Data were x^6 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.02129, low cutoff = -0.0203, based on IQR multiplier of 3.

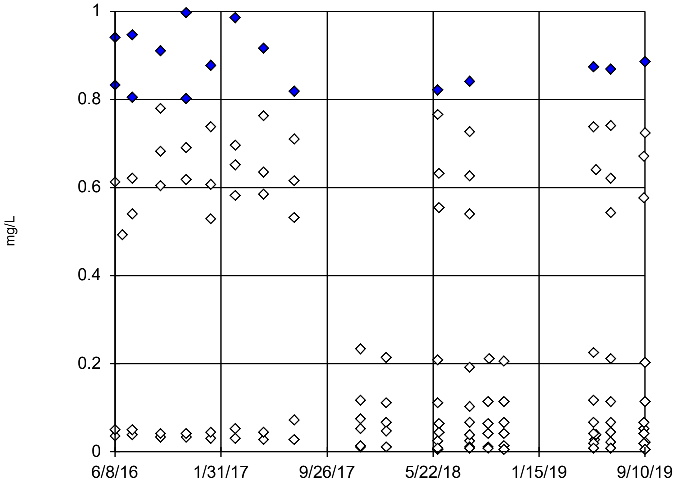
Constituent: Arsenic, total Analysis Run 12/5/2019 10:17 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1600D,MW-1600I,MW-1600S,MW-1601D...



n = 131

Outliers are drawn as solid.
Tukey's method selected by user.

Data were x^6 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.795, low cutoff = -0.7578, based on IQR multiplier of 3.

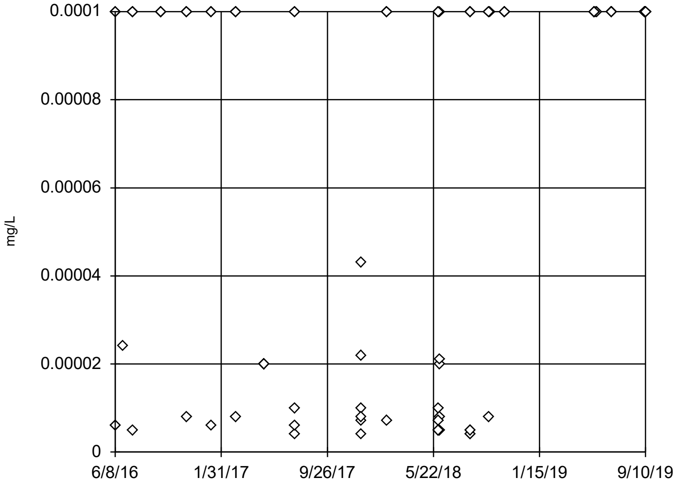
Constituent: Barium, total Analysis Run 12/5/2019 10:17 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1600D,MW-1600I,MW-1600S,MW-1601D...



n = 131

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.

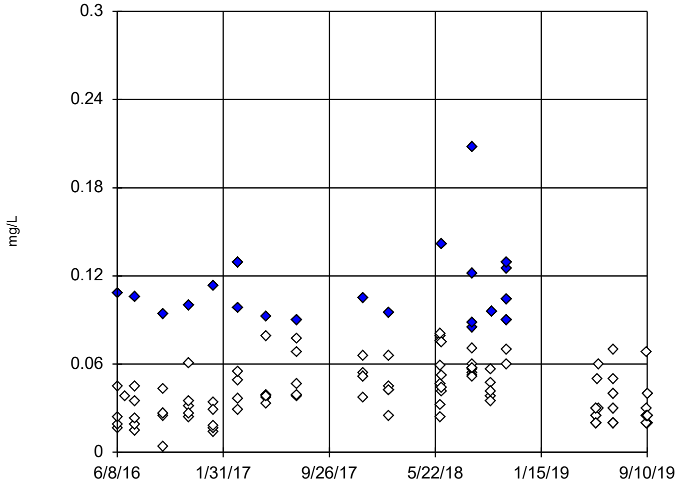
Constituent: Beryllium, total Analysis Run 12/5/2019 10:17 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1600D,MW-1600I,MW-1600S,MW-1601D...



n = 131

Outliers are drawn as solid.
Tukey's method selected by user.

Data were x^6 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.08312, low cutoff = -0.07921, based on IQR multiplier of 3.

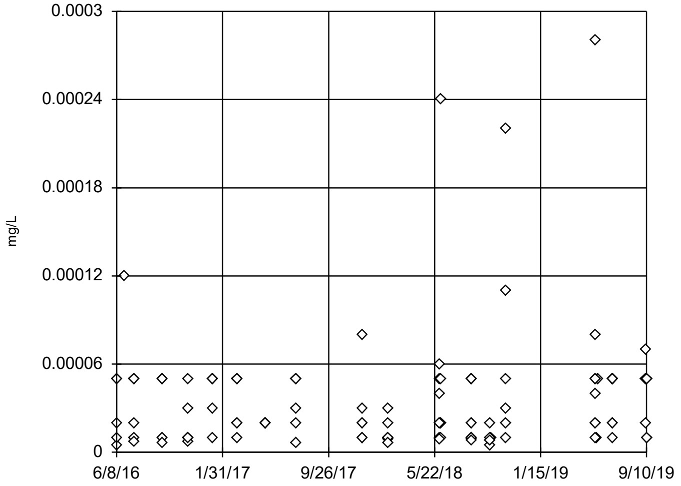
Constituent: Boron, total   Analysis Run 12/5/2019 10:17 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1600D,MW-1600I,MW-1600S,MW-1601D...



n = 131

No outliers found.
Tukey's method selected by user.

Data were x^6 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.

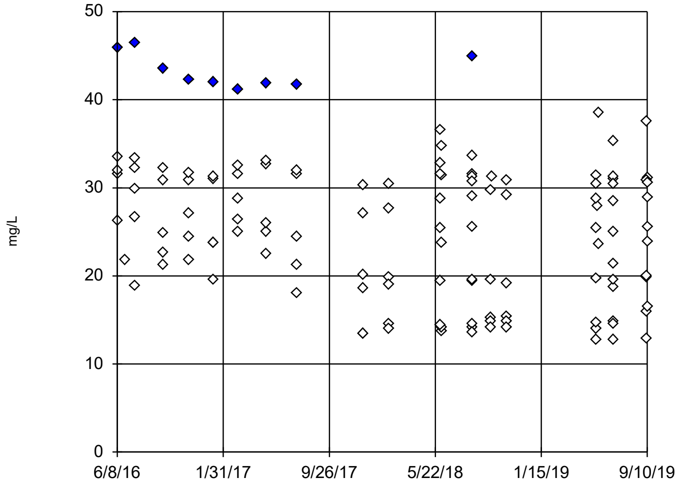
Constituent: Cadmium, total   Analysis Run 12/5/2019 10:17 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1600D,MW-1600I,MW-1600S,MW-1601D...



n = 131

Outliers are drawn as solid.
Tukey's method selected by user.

Data were x^6 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 39.28, low cutoff = -37.23, based on IQR multiplier of 3.

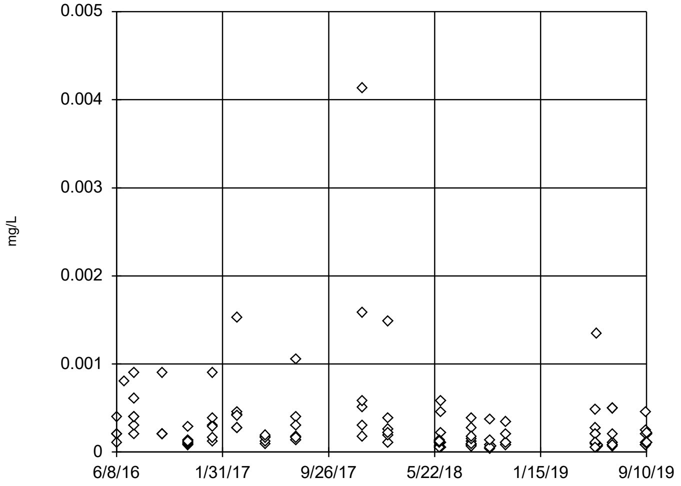
Constituent: Chloride, total   Analysis Run 12/5/2019 10:17 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1600D,MW-1600I,MW-1600S,MW-1601D...



n = 131

No outliers found.
Tukey's method selected by user.

Data were x^6 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.

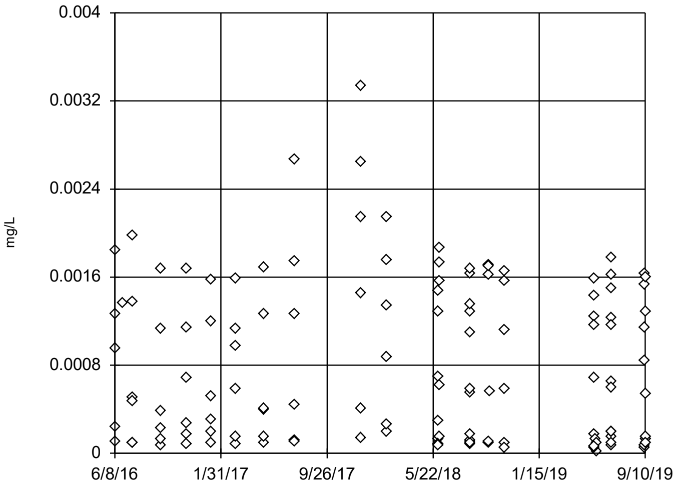
Constituent: Chromium, total   Analysis Run 12/5/2019 10:17 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1600D,MW-1600I,MW-1600S,MW-1601D...



n = 131

No outliers found. Tukey's method selected by user.

Data were x^6 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.

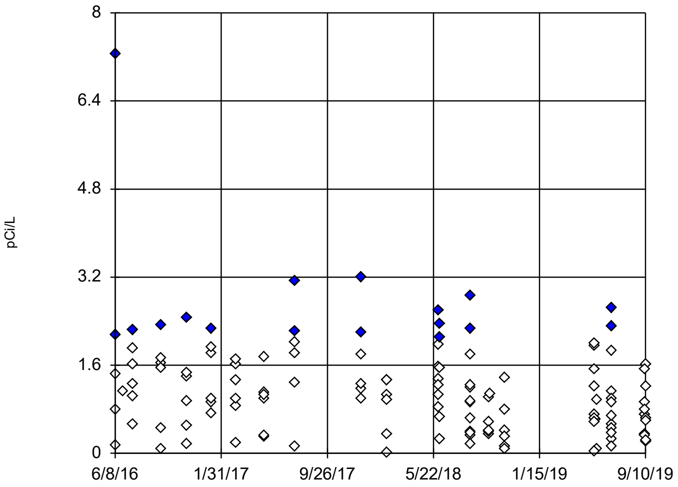
Constituent: Cobalt, total Analysis Run 12/5/2019 10:17 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1600D,MW-1600I,MW-1600S,MW-1601D...



n = 131

Outliers are drawn as solid.
Tukey's method selected by user.

Data were x^6 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 2.046, low cutoff = -1.95, based on IQR multiplier of 3.

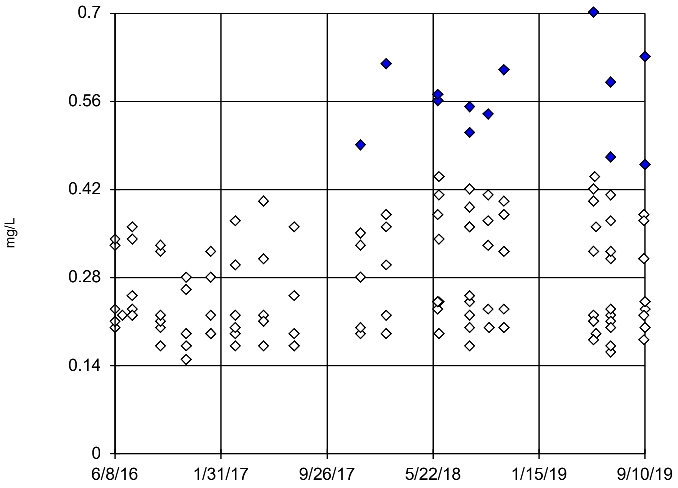
Constituent: Combined Radium 226 + 228 Analysis Run 12/5/2019 10:17 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1600D,MW-1600I,MW-1600S,MW-1601D...



n = 131

Outliers are drawn as solid.
Tukey's method selected by user.

Data were x^6 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.4519, low cutoff = -0.4295, based on IQR multiplier of 3.

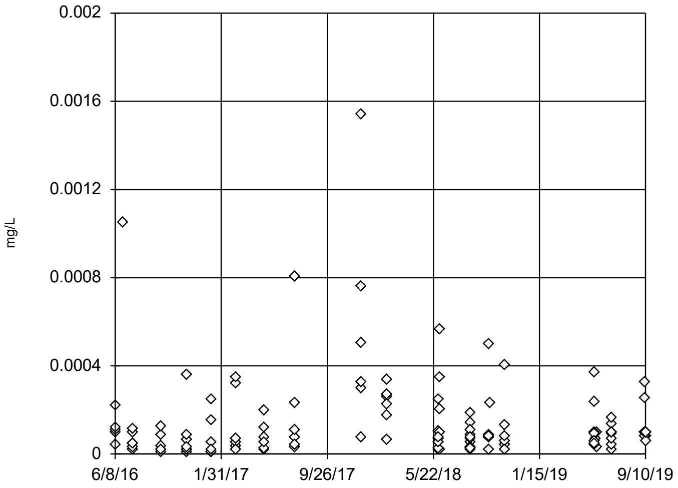
Constituent: Fluoride, total Analysis Run 12/5/2019 10:17 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1600D,MW-1600I,MW-1600S,MW-1601D...



n = 131

No outliers found. Tukey's method selected by user.

Data were x^5 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.

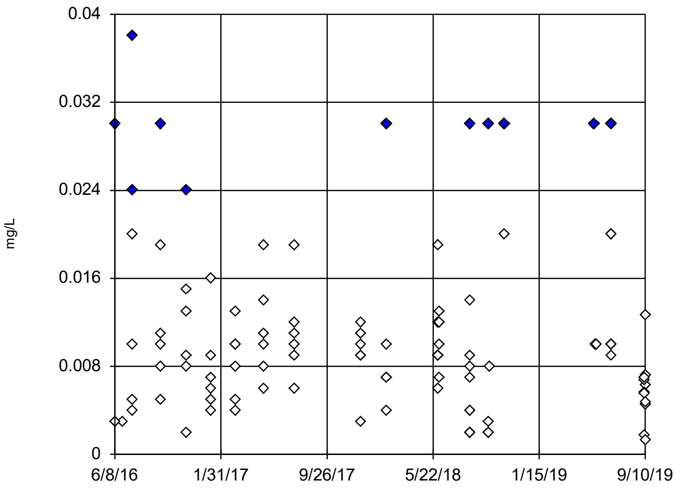
Constituent: Lead, total Analysis Run 12/5/2019 10:17 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1600D,MW-1600I,MW-1600S,MW-1601D...



n = 131

Outliers are drawn as solid.
Tukey's method selected by user.

Data were x^6 transformed to achieve best W statistic (graph shown in original units).

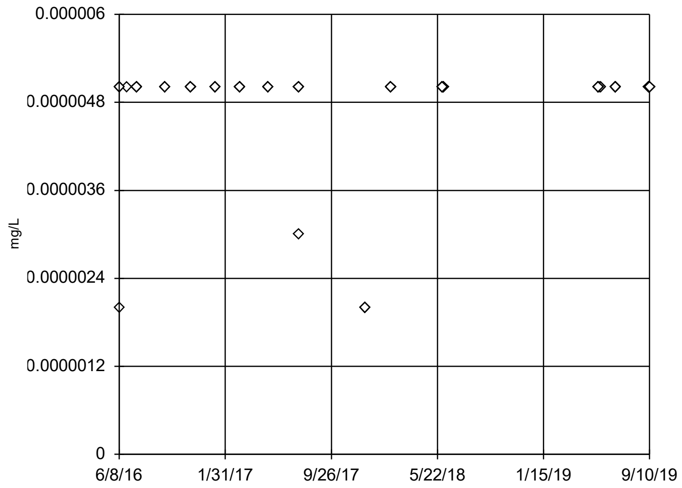
High cutoff = 0.02394, low cutoff = -0.02281, based on IQR multiplier of 3.

Constituent: Lithium, total Analysis Run 12/5/2019 10:17 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1600D,MW-1600I,MW-1600S,MW-1601D...



n = 107

No outliers found.
Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

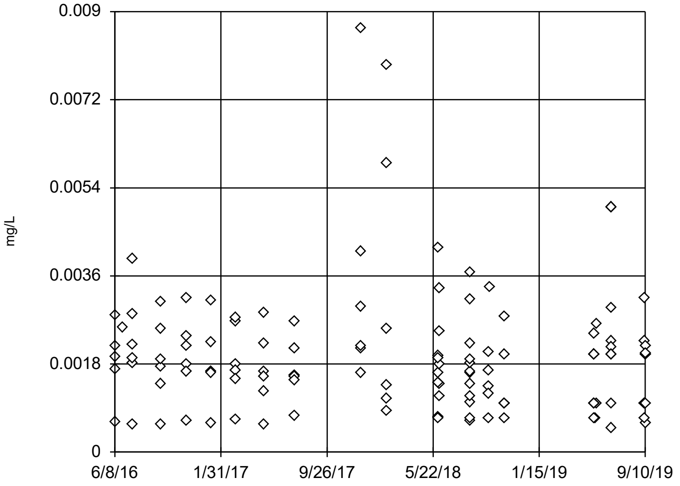
The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Mercury, total Analysis Run 12/5/2019 10:17 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1600D,MW-1600I,MW-1600S,MW-1601D...



n = 131

No outliers found.
Tukey's method selected by user.

Data were x^6 transformed to achieve best W statistic (graph shown in original units).

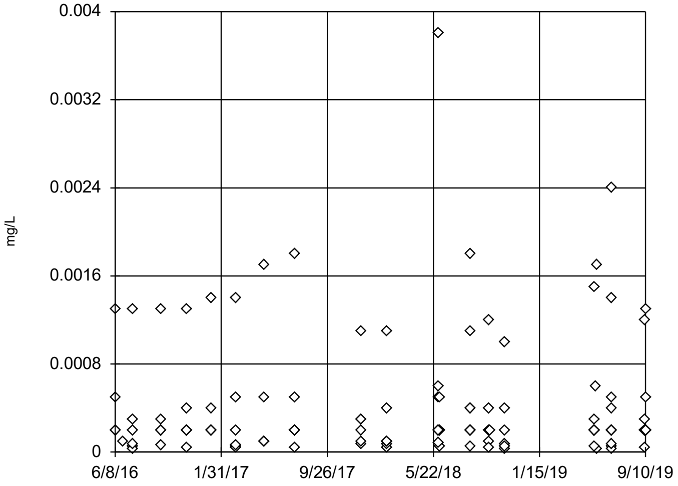
The results were invalidated, because both the lower and upper quartiles represent reporting limits.

Constituent: Molybdenum, total Analysis Run 12/5/2019 10:17 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1600D,MW-1600I,MW-1600S,MW-1601D...



n = 131

No outliers found.
Tukey's method selected by user.

Data were x^6 transformed to achieve best W statistic (graph shown in original units).

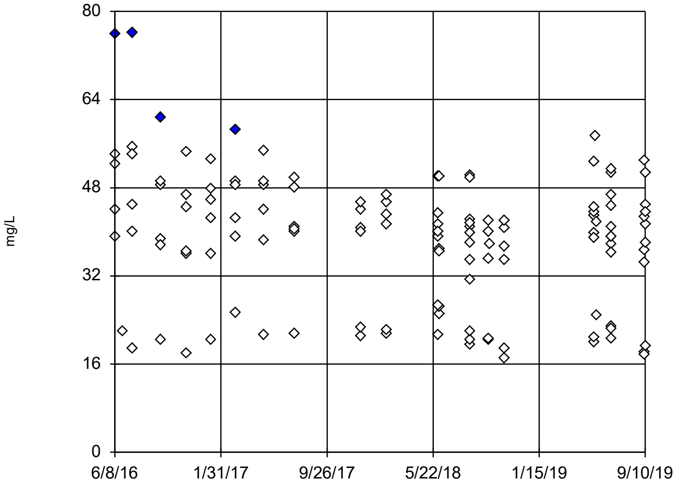
The results were invalidated, because both the lower and upper quartiles represent reporting limits.

Constituent: Selenium, total Analysis Run 12/5/2019 10:17 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1600D,MW-1600I,MW-1600S,MW-1601D...



n = 131

Outliers are drawn as solid.
Tukey's method selected by user.

Data were x^6 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 58.02, low cutoff = -54.76, based on IQR multiplier of 3.

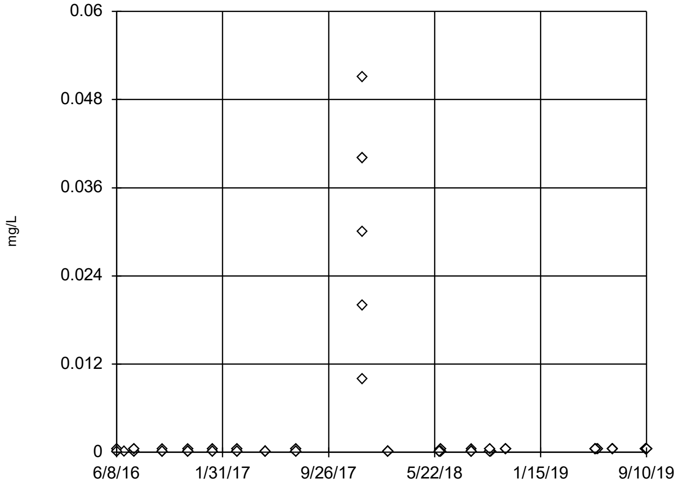
Constituent: Sulfate, total   Analysis Run 12/5/2019 10:17 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1600D,MW-1600I,MW-1600S,MW-1601D...



n = 131

No outliers found.
Tukey's method selected by user.

Data were x^5 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.

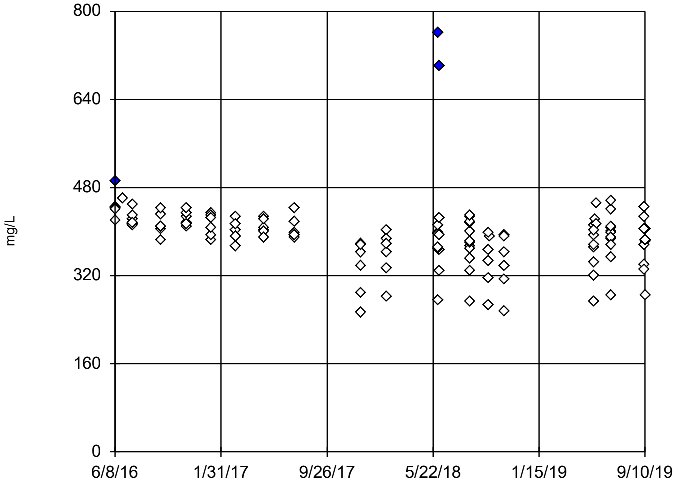
Constituent: Thallium, total   Analysis Run 12/5/2019 10:17 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

MW-1600D,MW-1600I,MW-1600S,MW-1601D...



n = 131

Outliers are drawn as solid.
Tukey's method selected by user.

Data were x^6 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 487.3, low cutoff = -418.9, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS]   Analysis Run 12/5/2019 10:17 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Outlier Analysis - Significant Results

Rockport BAP Client: Geosyntec Data: Rockport_BAP Printed 12/5/2019, 10:15 AM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Antimony, total (mg/L)	**MW-1604I**	**Yes**	**0.00024**	**7/18/2017**	**NP**	**NaN**	**13**	**0.00004462**	**0.00005981**	**ln(x)**	**ShapiroWilk**
Antimony, total (mg/L)	**MW-1605I**	**Yes**	**0.00025**	**6/25/2019**	**NP**	**NaN**	**13**	**0.00005308**	**0.00005991**	**ln(x)**	**ShapiroWilk**
Arsenic, total (mg/L)	**MW-1605S**	**Yes**	**0.00284,0.00244**	**5/24/2019,6/27/2019**	**NP**	**NaN**	**13**	**0.0007823**	**0.0008351**	**ln(x)**	**ShapiroWilk**
Beryllium, total (mg/L)	**MW-1002**	**Yes**	**0.000004**	**6/5/2018**	**NP**	**NaN**	**13**	**0.00007923**	**0.00003963**	**ln(x)**	**ShapiroWilk**
Cadmium, total (mg/L)	**MW-1002**	**Yes**	**0.00015**	**11/15/2016**	**NP**	**NaN**	**13**	**0.00004308**	**0.00003473**	**ln(x)**	**ShapiroWilk**
Cadmium, total (mg/L)	**MW-1602D**	**Yes**	**0.00007**	**5/8/2017**	**NP**	**NaN**	**13**	**0.00004462**	**0.00001561**	**x^2**	**ShapiroWilk**
Cadmium, total (mg/L)	**MW-1604S**	**Yes**	**0.00009,0.00001,0.00001**	**7/20/2016,9/19/2016,3/7/2017**	**NP**	**NaN**	**13**	**0.00002538**	**0.00002025**	**ln(x)**	**ShapiroWilk**
Cadmium, total (mg/L)	**MW-1605S**	**Yes**	**0.00011**	**5/24/2019**	**NP**	**NaN**	**13**	**0.00004231**	**0.00002315**	**ln(x)**	**ShapiroWilk**
Chromium, total (mg/L)	**MW-1603D**	**Yes**	**0.0238**	**10/10/2016**	**NP**	**NaN**	**13**	**0.001981**	**0.006556**	**ln(x)**	**ShapiroWilk**
Cobalt, total (mg/L)	**MW-1606D**	**Yes**	**0.000508**	**6/7/2016**	**NP**	**NaN**	**13**	**0.0001295**	**0.0001174**	**ln(x)**	**ShapiroWilk**
Fluoride, total (mg/L)	**MW-1604S**	**Yes**	**1.63**	**9/10/2019**	**NP**	**NaN**	**13**	**0.9546**	**0.2155**	**ln(x)**	**ShapiroWilk**
Molybdenum, total (mg/L)	**MW-1604S**	**Yes**	**0.00479,0.001,0.00472**	**11/15/2016,6/26/2019,9/10/2019**	**NP**	**NaN**	**13**	**0.002628**	**0.001037**	**ln(x)**	**ShapiroWilk**
Molybdenum, total (mg/L)	**MW-1605D**	**Yes**	**0.00765**	**6/7/2016**	**NP**	**NaN**	**13**	**0.002698**	**0.001533**	**ln(x)**	**ShapiroWilk**
Molybdenum, total (mg/L)	**MW-1605I**	**Yes**	**0.005**	**6/25/2019**	**NP**	**NaN**	**13**	**0.001492**	**0.001065**	**ln(x)**	**ShapiroWilk**
Molybdenum, total (mg/L)	**MW-1606D**	**Yes**	**0.00382**	**6/7/2016**	**NP**	**NaN**	**13**	**0.002158**	**0.0005314**	**ln(x)**	**ShapiroWilk**
pH, field (SU)	**MW-1600I (bg)**	**Yes**	**9.29**	**7/17/2017**	**NP**	**NaN**	**12**	**7.357**	**0.6329**	**ln(x)**	**ShapiroWilk**
pH, field (SU)	**MW-1600S (bg)**	**Yes**	**9.46**	**7/17/2017**	**NP**	**NaN**	**13**	**6.988**	**0.781**	**ln(x)**	**ShapiroWilk**
pH, field (SU)	**MW-1601I (bg)**	**Yes**	**9.45**	**7/17/2017**	**NP**	**NaN**	**12**	**7.342**	**0.7042**	**ln(x)**	**ShapiroWilk**
pH, field (SU)	**MW-1603I**	**Yes**	**9.78**	**7/17/2017**	**NP**	**NaN**	**13**	**7.548**	**0.7132**	**ln(x)**	**ShapiroWilk**
pH, field (SU)	**MW-1603S**	**Yes**	**9.63**	**7/17/2017**	**NP**	**NaN**	**13**	**7.182**	**0.7937**	**ln(x)**	**ShapiroWilk**
pH, field (SU)	**MW-1605D**	**Yes**	**9.51**	**7/18/2017**	**NP**	**NaN**	**13**	**7.308**	**0.6758**	**ln(x)**	**ShapiroWilk**
pH, field (SU)	**MW-1606D**	**Yes**	**5.85,8.37,7.96**	**7/19/2016,7/18/2017,6/6/2018**	**NP**	**NaN**	**13**	**7.234**	**0.5691**	**x^2**	**ShapiroWilk**
pH, field (SU)	**MW-1606I**	**Yes**	**4.98,8.09,8.56**	**7/19/2016,6/6/2018,5/21/2019**	**NP**	**NaN**	**13**	**7.218**	**0.8139**	**x^4**	**ShapiroWilk**
pH, field (SU)	**MW-1606S**	**Yes**	**7.81,7.85**	**6/6/2018,5/21/2019**	**NP**	**NaN**	**13**	**7.095**	**0.3457**	**ln(x)**	**ShapiroWilk**
Selenium, total (mg/L)	**MW-1606I**	**Yes**	**0.00003**	**3/6/2017**	**NP**	**NaN**	**13**	**0.0001677**	**0.00006313**	**sqrt(x)**	**ShapiroWilk**

Outlier Analysis - All Results

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Constituent	Well	Outlier	Value(s)	Date(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Antimony, total (mg/L)	MW-1002	n/a	n/a	n/a	NP	NaN	13	0.00005077	0.000007596	unknown	ShapiroWilk
Antimony, total (mg/L)	MW-1602D	No	n/a	n/a	NP	NaN	13	0.00003538	0.00004352	ln(x)	ShapiroWilk
Antimony, total (mg/L)	MW-1602I	No	n/a	n/a	NP	NaN	13	0.00004846	0.00003693	ln(x)	ShapiroWilk
Antimony, total (mg/L)	MW-1603D	No	n/a	n/a	NP	NaN	13	0.00003308	0.00002359	ln(x)	ShapiroWilk
Antimony, total (mg/L)	MW-1603I	No	n/a	n/a	NP	NaN	13	0.00004538	0.00002402	ln(x)	ShapiroWilk
Antimony, total (mg/L)	MW-1603S	No	n/a	n/a	NP	NaN	13	0.00004462	0.0000105	ln(x)	ShapiroWilk
Antimony, total (mg/L)	MW-1604D	No	n/a	n/a	NP	NaN	13	0.00002923	0.00001656	x^(1/3)	ShapiroWilk
Antimony, total (mg/L)	**MW-1604I**	**Yes**	**0.00024**	**7/18/2017**	**NP**	**NaN**	**13**	**0.00004462**	**0.00005981**	**ln(x)**	**ShapiroWilk**
Antimony, total (mg/L)	MW-1604S	No	n/a	n/a	NP	NaN	13	0.00006462	0.00002145	ln(x)	ShapiroWilk
Antimony, total (mg/L)	MW-1605D	No	n/a	n/a	NP	NaN	13	0.00002538	0.00001761	ln(x)	ShapiroWilk
Antimony, total (mg/L)	**MW-1605I**	**Yes**	**0.00025**	**6/25/2019**	**NP**	**NaN**	**13**	**0.00005308**	**0.00005991**	**ln(x)**	**ShapiroWilk**
Antimony, total (mg/L)	MW-1605S	No	n/a	n/a	NP	NaN	13	0.00006154	0.00003555	ln(x)	ShapiroWilk
Antimony, total (mg/L)	MW-1606D	No	n/a	n/a	NP	NaN	13	0.00003231	0.00001691	normal	ShapiroWilk
Antimony, total (mg/L)	MW-1606I	No	n/a	n/a	NP	NaN	13	0.00006077	0.00008441	ln(x)	ShapiroWilk
Antimony, total (mg/L)	MW-1606S	No	n/a	n/a	NP	NaN	13	0.00007385	0.00005966	ln(x)	ShapiroWilk
Arsenic, total (mg/L)	MW-1002	No	n/a	n/a	NP	NaN	13	0.0002615	0.00006296	ln(x)	ShapiroWilk
Arsenic, total (mg/L)	MW-1602D	No	n/a	n/a	NP	NaN	13	0.008763	0.0008383	ln(x)	ShapiroWilk
Arsenic, total (mg/L)	MW-1602I	No	n/a	n/a	NP	NaN	13	0.02365	0.006719	ln(x)	ShapiroWilk
Arsenic, total (mg/L)	MW-1603D	No	n/a	n/a	NP	NaN	13	0.01171	0.001043	x^2	ShapiroWilk
Arsenic, total (mg/L)	MW-1603I	No	n/a	n/a	NP	NaN	13	0.01269	0.0003148	x^6	ShapiroWilk
Arsenic, total (mg/L)	MW-1603S	No	n/a	n/a	NP	NaN	13	0.0002269	0.00006486	ln(x)	ShapiroWilk
Arsenic, total (mg/L)	MW-1604D	No	n/a	n/a	NP	NaN	13	0.0176	0.001735	ln(x)	ShapiroWilk
Arsenic, total (mg/L)	MW-1604I	No	n/a	n/a	NP	NaN	13	0.02012	0.002072	ln(x)	ShapiroWilk
Arsenic, total (mg/L)	MW-1604S	No	n/a	n/a	NP	NaN	13	0.0003085	0.0001604	ln(x)	ShapiroWilk
Arsenic, total (mg/L)	MW-1605D	No	n/a	n/a	NP	NaN	13	0.01829	0.001699	x^4	ShapiroWilk
Arsenic, total (mg/L)	MW-1605I	No	n/a	n/a	NP	NaN	13	0.01996	0.002928	ln(x)	ShapiroWilk
Arsenic, total (mg/L)	**MW-1605S**	**Yes**	**0.00284,0.00244**	**5/24/2019,6/27/2019**	**NP**	**NaN**	**13**	**0.0007823**	**0.0008351**	**ln(x)**	**ShapiroWilk**
Arsenic, total (mg/L)	MW-1606D	No	n/a	n/a	NP	NaN	13	0.01488	0.001874	ln(x)	ShapiroWilk
Arsenic, total (mg/L)	MW-1606I	No	n/a	n/a	NP	NaN	13	0.005995	0.002314	ln(x)	ShapiroWilk
Arsenic, total (mg/L)	MW-1606S	No	n/a	n/a	NP	NaN	13	0.0002738	0.0001213	ln(x)	ShapiroWilk
Barium, total (mg/L)	MW-1002	No	n/a	n/a	NP	NaN	13	0.0192	0.007186	ln(x)	ShapiroWilk
Barium, total (mg/L)	MW-1602D	No	n/a	n/a	NP	NaN	13	0.4538	0.05637	ln(x)	ShapiroWilk
Barium, total (mg/L)	MW-1602I	No	n/a	n/a	NP	NaN	13	0.1255	0.009061	ln(x)	ShapiroWilk
Barium, total (mg/L)	MW-1603D	No	n/a	n/a	NP	NaN	13	0.1116	0.005205	ln(x)	ShapiroWilk
Barium, total (mg/L)	MW-1603I	No	n/a	n/a	NP	NaN	13	0.08396	0.004266	ln(x)	ShapiroWilk
Barium, total (mg/L)	MW-1603S	No	n/a	n/a	NP	NaN	13	0.01494	0.003178	ln(x)	ShapiroWilk
Barium, total (mg/L)	MW-1604D	No	n/a	n/a	NP	NaN	13	0.2445	0.01565	x^(1/3)	ShapiroWilk
Barium, total (mg/L)	MW-1604I	No	n/a	n/a	NP	NaN	13	0.1238	0.01159	ln(x)	ShapiroWilk
Barium, total (mg/L)	MW-1604S	No	n/a	n/a	NP	NaN	13	0.01945	0.0085	ln(x)	ShapiroWilk
Barium, total (mg/L)	MW-1605D	No	n/a	n/a	NP	NaN	13	0.4322	0.0404	x^2	ShapiroWilk
Barium, total (mg/L)	MW-1605I	No	n/a	n/a	NP	NaN	13	0.1557	0.01386	ln(x)	ShapiroWilk
Barium, total (mg/L)	MW-1605S	No	n/a	n/a	NP	NaN	13	0.00925	0.002361	ln(x)	ShapiroWilk
Barium, total (mg/L)	MW-1606D	No	n/a	n/a	NP	NaN	13	0.3987	0.03692	normal	ShapiroWilk
Barium, total (mg/L)	MW-1606I	No	n/a	n/a	NP	NaN	13	0.06072	0.01359	ln(x)	ShapiroWilk
Barium, total (mg/L)	MW-1606S	No	n/a	n/a	NP	NaN	13	0.0124	0.002504	ln(x)	ShapiroWilk
Beryllium, total (mg/L)	**MW-1002**	**Yes**	**0.000004**	**6/5/2018**	**NP**	**NaN**	**13**	**0.00007923**	**0.00003963**	**ln(x)**	**ShapiroWilk**
Beryllium, total (mg/L)	MW-1602D	No	n/a	n/a	NP	NaN	13	0.00005915	0.00004613	ln(x)	ShapiroWilk
Beryllium, total (mg/L)	MW-1602I	No	n/a	n/a	NP	NaN	13	0.00006515	0.00004602	ln(x)	ShapiroWilk
Beryllium, total (mg/L)	MW-1603D	No	n/a	n/a	NP	NaN	13	0.00008292	0.00003353	normal	ShapiroWilk
Beryllium, total (mg/L)	MW-1603I	n/a	n/a	n/a	NP	NaN	13	0.00008692	0.00003199	unknown	ShapiroWilk
Beryllium, total (mg/L)	MW-1603S	No	n/a	n/a	NP	NaN	13	0.00007292	0.00004236	ln(x)	ShapiroWilk
Beryllium, total (mg/L)	MW-1604D	n/a	n/a	n/a	NP	NaN	13	0.00008646	0.00003321	unknown	ShapiroWilk
Beryllium, total (mg/L)	MW-1604I	n/a	n/a	n/a	NP	NaN	13	0.00008646	0.00003321	unknown	ShapiroWilk
Beryllium, total (mg/L)	MW-1604S	No	n/a	n/a	NP	NaN	13	0.00007623	0.00003917	normal	ShapiroWilk
Beryllium, total (mg/L)	MW-1605D	n/a	n/a	n/a	NP	NaN	13	0.00008692	0.00003199	unknown	ShapiroWilk

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Constituent	Well	Outlier	Value(s)	Date(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Beryllium, total (mg/L)	MW-1605I	No	n/a	n/a	NP	NaN	13	0.00007908	0.00003994	x^(1/3)	ShapiroWilk
Beryllium, total (mg/L)	MW-1605S	No	n/a	n/a	NP	NaN	13	0.00007723	0.0000366	sqrt(x)	ShapiroWilk
Beryllium, total (mg/L)	MW-1606D	No	n/a	n/a	NP	NaN	13	0.00006723	0.00004373	ln(x)	ShapiroWilk
Beryllium, total (mg/L)	MW-1606I	n/a	n/a	n/a	NP	NaN	13	0.00008669	0.00003259	unknown	ShapiroWilk
Beryllium, total (mg/L)	MW-1606S	No	n/a	n/a	NP	NaN	13	0.00005946	0.00004587	ln(x)	ShapiroWilk
Cadmium, total (mg/L)	**MW-1002**	**Yes**	**0.00015**	**11/15/2016**	**NP**	**NaN**	**13**	**0.00004308**	**0.00003473**	**ln(x)**	**ShapiroWilk**
Cadmium, total (mg/L)	**MW-1602D**	**Yes**	**0.00007**	**5/8/2017**	**NP**	**NaN**	**13**	**0.00004462**	**0.00001561**	**x^2**	**ShapiroWilk**
Cadmium, total (mg/L)	MW-1602I	No	n/a	n/a	NP	NaN	13	0.00002615	0.0000208	ln(x)	ShapiroWilk
Cadmium, total (mg/L)	MW-1603D	No	n/a	n/a	NP	NaN	13	0.00003662	0.00001849	x^(1/3)	ShapiroWilk
Cadmium, total (mg/L)	MW-1603I	No	n/a	n/a	NP	NaN	13	0.00003546	0.00001962	x^(1/3)	ShapiroWilk
Cadmium, total (mg/L)	MW-1603S	No	n/a	n/a	NP	NaN	13	0.00002615	0.00001121	ln(x)	ShapiroWilk
Cadmium, total (mg/L)	MW-1604D	No	n/a	n/a	NP	NaN	13	0.00004115	0.00001707	sqrt(x)	ShapiroWilk
Cadmium, total (mg/L)	MW-1604I	No	n/a	n/a	NP	NaN	13	0.00004646	0.0000279	sqrt(x)	ShapiroWilk
Cadmium, total (mg/L)	**MW-1604S**	**Yes**	**0.00009,0.00001,0.00001**	**7/20/2016,9/19/2016,3/7/2017**	**NP**	**NaN**	**13**	**0.00002538**	**0.00002025**	**ln(x)**	**ShapiroWilk**
Cadmium, total (mg/L)	MW-1605D	n/a	n/a	n/a	NP	NaN	13	0.00004431	0.00001419	unknown	ShapiroWilk
Cadmium, total (mg/L)	MW-1605I	No	n/a	n/a	NP	NaN	13	0.00003777	0.00001938	ln(x)	ShapiroWilk
Cadmium, total (mg/L)	**MW-1605S**	**Yes**	**0.00011**	**5/24/2019**	**NP**	**NaN**	**13**	**0.00004231**	**0.00002315**	**ln(x)**	**ShapiroWilk**
Cadmium, total (mg/L)	MW-1606D	No	n/a	n/a	NP	NaN	13	0.00004208	0.00001536	sqrt(x)	ShapiroWilk
Cadmium, total (mg/L)	MW-1606I	No	n/a	n/a	NP	NaN	13	0.00003762	0.00001968	x^(1/3)	ShapiroWilk
Cadmium, total (mg/L)	MW-1606S	No	n/a	n/a	NP	NaN	13	0.00003231	0.00001589	x^(1/3)	ShapiroWilk
Calcium, total (mg/L)	MW-1002	No	n/a	n/a	NP	NaN	13	46.12	15.63	ln(x)	ShapiroWilk
Calcium, total (mg/L)	MW-1600D (bg)	No	n/a	n/a	NP	NaN	13	83.34	5.249	x^6	ShapiroWilk
Calcium, total (mg/L)	MW-1600I (bg)	No	n/a	n/a	NP	NaN	13	76.31	3.135	x^6	ShapiroWilk
Calcium, total (mg/L)	MW-1600S (bg)	No	n/a	n/a	NP	NaN	13	63.98	3.884	x^2	ShapiroWilk
Calcium, total (mg/L)	MW-1601D (bg)	No	n/a	n/a	NP	NaN	13	86.11	3.896	x^6	ShapiroWilk
Calcium, total (mg/L)	MW-1601I (bg)	No	n/a	n/a	NP	NaN	12	87	3.592	ln(x)	ShapiroWilk
Calcium, total (mg/L)	MW-1601S (bg)	No	n/a	n/a	NP	NaN	13	76.33	4.903	normal	ShapiroWilk
Calcium, total (mg/L)	MW-1602D	No	n/a	n/a	NP	NaN	13	70.01	5.584	x^3	ShapiroWilk
Calcium, total (mg/L)	MW-1602I	No	n/a	n/a	NP	NaN	13	77.58	5.284	normal	ShapiroWilk
Calcium, total (mg/L)	MW-1603D	No	n/a	n/a	NP	NaN	13	82.55	6.886	x^2	ShapiroWilk
Calcium, total (mg/L)	MW-1603I	No	n/a	n/a	NP	NaN	13	87.22	8.018	ln(x)	ShapiroWilk
Calcium, total (mg/L)	MW-1603S	No	n/a	n/a	NP	NaN	13	63.87	15.84	ln(x)	ShapiroWilk
Calcium, total (mg/L)	MW-1604D	No	n/a	n/a	NP	NaN	13	70.04	3.13	x^2	ShapiroWilk
Calcium, total (mg/L)	MW-1604I	No	n/a	n/a	NP	NaN	13	74.27	4.945	x^5	ShapiroWilk
Calcium, total (mg/L)	MW-1604S	No	n/a	n/a	NP	NaN	13	81.72	14.18	normal	ShapiroWilk
Calcium, total (mg/L)	MW-1605D	No	n/a	n/a	NP	NaN	13	85.42	4.765	x^2	ShapiroWilk
Calcium, total (mg/L)	MW-1605I	No	n/a	n/a	NP	NaN	13	87.59	8.219	ln(x)	ShapiroWilk
Calcium, total (mg/L)	MW-1605S	No	n/a	n/a	NP	NaN	13	73.25	9.313	x^6	ShapiroWilk
Calcium, total (mg/L)	MW-1606D	No	n/a	n/a	NP	NaN	13	74.25	4.391	sqrt(x)	ShapiroWilk
Calcium, total (mg/L)	MW-1606I	No	n/a	n/a	NP	NaN	13	70.85	9.511	ln(x)	ShapiroWilk
Calcium, total (mg/L)	MW-1606S	No	n/a	n/a	NP	NaN	13	51.04	8.386	ln(x)	ShapiroWilk
Calcium, total (mg/L)	MW-1701D (bg)	No	n/a	n/a	NP	NaN	9	71.54	3.372	ln(x)	ShapiroWilk
Calcium, total (mg/L)	MW-1701I (bg)	No	n/a	n/a	NP	NaN	9	65.32	3.164	x^4	ShapiroWilk
Calcium, total (mg/L)	MW-1701S (bg)	No	n/a	n/a	NP	NaN	9	59.93	3.167	ln(x)	ShapiroWilk
Calcium, total (mg/L)	MW-1702D (bg)	No	n/a	n/a	NP	NaN	9	80.23	4.287	ln(x)	ShapiroWilk
Calcium, total (mg/L)	MW-1702I (bg)	No	n/a	n/a	NP	NaN	9	77.21	3.388	ln(x)	ShapiroWilk
Calcium, total (mg/L)	MW-1702S (bg)	No	n/a	n/a	NP	NaN	9	34.34	3.682	x^6	ShapiroWilk
Chromium, total (mg/L)	MW-1002	No	n/a	n/a	NP	NaN	13	0.0002168	0.0001951	ln(x)	ShapiroWilk
Chromium, total (mg/L)	MW-1602D	No	n/a	n/a	NP	NaN	13	0.0002849	0.0001889	sqrt(x)	ShapiroWilk
Chromium, total (mg/L)	MW-1602I	No	n/a	n/a	NP	NaN	13	0.0002308	0.0001309	ln(x)	ShapiroWilk
Chromium, total (mg/L)	**MW-1603D**	**Yes**	**0.0238**	**10/10/2016**	**NP**	**NaN**	**13**	**0.001981**	**0.006556**	**ln(x)**	**ShapiroWilk**
Chromium, total (mg/L)	MW-1603I	No	n/a	n/a	NP	NaN	13	0.0003698	0.0003461	ln(x)	ShapiroWilk
Chromium, total (mg/L)	MW-1603S	No	n/a	n/a	NP	NaN	13	0.0002288	0.0001874	ln(x)	ShapiroWilk
Chromium, total (mg/L)	MW-1604D	No	n/a	n/a	NP	NaN	13	0.0001248	0.00007031	sqrt(x)	ShapiroWilk
Chromium, total (mg/L)	MW-1604I	No	n/a	n/a	NP	NaN	13	0.0001865	0.0001651	ln(x)	ShapiroWilk

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Constituent	Well	Outlier	Value(s)	Date(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Chromium, total (mg/L)	MW-1604S	No	n/a	n/a	NP	NaN	13	0.0002529	0.0002154	ln(x)	ShapiroWilk
Chromium, total (mg/L)	MW-1605D	No	n/a	n/a	NP	NaN	13	0.0002323	0.0001543	ln(x)	ShapiroWilk
Chromium, total (mg/L)	MW-1605I	No	n/a	n/a	NP	NaN	13	0.0002371	0.0003116	ln(x)	ShapiroWilk
Chromium, total (mg/L)	MW-1605S	No	n/a	n/a	NP	NaN	13	0.0002935	0.000256	ln(x)	ShapiroWilk
Chromium, total (mg/L)	MW-1606D	No	n/a	n/a	NP	NaN	13	0.0002021	0.0001828	ln(x)	ShapiroWilk
Chromium, total (mg/L)	MW-1606I	No	n/a	n/a	NP	NaN	13	0.0002271	0.0001826	ln(x)	ShapiroWilk
Chromium, total (mg/L)	MW-1606S	No	n/a	n/a	NP	NaN	13	0.0003895	0.0004145	ln(x)	ShapiroWilk
Cobalt, total (mg/L)	MW-1002	No	n/a	n/a	NP	NaN	13	0.0007198	0.0001128	normal	ShapiroWilk
Cobalt, total (mg/L)	MW-1602D	No	n/a	n/a	NP	NaN	13	0.0001565	0.00008524	ln(x)	ShapiroWilk
Cobalt, total (mg/L)	MW-1602I	No	n/a	n/a	NP	NaN	13	0.001494	0.000178	ln(x)	ShapiroWilk
Cobalt, total (mg/L)	MW-1603D	No	n/a	n/a	NP	NaN	13	0.0007276	0.0005086	ln(x)	ShapiroWilk
Cobalt, total (mg/L)	MW-1603I	No	n/a	n/a	NP	NaN	13	0.001318	0.0001205	ln(x)	ShapiroWilk
Cobalt, total (mg/L)	MW-1603S	No	n/a	n/a	NP	NaN	13	0.0003951	0.0002244	x^(1/3)	ShapiroWilk
Cobalt, total (mg/L)	MW-1604D	No	n/a	n/a	NP	NaN	13	0.00007231	0.00002429	ln(x)	ShapiroWilk
Cobalt, total (mg/L)	MW-1604I	No	n/a	n/a	NP	NaN	13	0.0008333	0.000122	ln(x)	ShapiroWilk
Cobalt, total (mg/L)	MW-1604S	No	n/a	n/a	NP	NaN	13	0.0004549	0.000274	ln(x)	ShapiroWilk
Cobalt, total (mg/L)	MW-1605D	No	n/a	n/a	NP	NaN	13	0.0001378	0.00006674	ln(x)	ShapiroWilk
Cobalt, total (mg/L)	MW-1605I	No	n/a	n/a	NP	NaN	13	0.0015	0.0001702	x^3	ShapiroWilk
Cobalt, total (mg/L)	MW-1605S	No	n/a	n/a	NP	NaN	13	0.0008297	0.001099	ln(x)	ShapiroWilk
Cobalt, total (mg/L)	**MW-1606D**	**Yes**	**0.000508**	**6/7/2016**	**NP**	**NaN**	**13**	**0.0001295**	**0.0001174**	**ln(x)**	**ShapiroWilk**
Cobalt, total (mg/L)	MW-1606I	No	n/a	n/a	NP	NaN	13	0.001212	0.0004209	ln(x)	ShapiroWilk
Cobalt, total (mg/L)	MW-1606S	No	n/a	n/a	NP	NaN	13	0.0002039	0.0002391	ln(x)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-1002	No	n/a	n/a	NP	NaN	13	0.7926	0.7578	ln(x)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-1602D	No	n/a	n/a	NP	NaN	13	1.38	0.9913	ln(x)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-1602I	No	n/a	n/a	NP	NaN	13	1.022	0.2606	ln(x)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-1603D	No	n/a	n/a	NP	NaN	13	0.989	0.3768	sqrt(x)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-1603I	No	n/a	n/a	NP	NaN	13	1.359	0.6332	ln(x)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-1603S	No	n/a	n/a	NP	NaN	13	0.8848	0.8092	ln(x)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-1604D	No	n/a	n/a	NP	NaN	13	0.8712	0.4788	ln(x)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-1604I	No	n/a	n/a	NP	NaN	13	1.013	0.404	normal	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-1604S	No	n/a	n/a	NP	NaN	13	0.6744	0.4294	sqrt(x)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-1605D	No	n/a	n/a	NP	NaN	13	1.159	0.468	sqrt(x)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-1605I	No	n/a	n/a	NP	NaN	13	1.749	0.4628	x^3	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-1605S	No	n/a	n/a	NP	NaN	13	0.5081	0.4877	sqrt(x)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-1606D	No	n/a	n/a	NP	NaN	13	1.033	0.5854	ln(x)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-1606I	No	n/a	n/a	NP	NaN	13	1.212	0.9672	ln(x)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-1606S	No	n/a	n/a	NP	NaN	13	0.7571	0.6125	x^(1/3)	ShapiroWilk
Fluoride, total (mg/L)	MW-1002	No	n/a	n/a	NP	NaN	13	0.9354	0.1531	x^6	ShapiroWilk
Fluoride, total (mg/L)	MW-1602D	No	n/a	n/a	NP	NaN	13	0.3192	0.02813	x^5	ShapiroWilk
Fluoride, total (mg/L)	MW-1602I	No	n/a	n/a	NP	NaN	13	0.2862	0.02364	x^5	ShapiroWilk
Fluoride, total (mg/L)	MW-1603D	No	n/a	n/a	NP	NaN	13	0.29	0.02517	x^3	ShapiroWilk
Fluoride, total (mg/L)	MW-1603I	No	n/a	n/a	NP	NaN	13	0.4177	0.03632	normal	ShapiroWilk
Fluoride, total (mg/L)	MW-1603S	No	n/a	n/a	NP	NaN	13	0.4723	0.1256	sqrt(x)	ShapiroWilk
Fluoride, total (mg/L)	MW-1604D	No	n/a	n/a	NP	NaN	13	0.2638	0.02329	x^4	ShapiroWilk
Fluoride, total (mg/L)	MW-1604I	No	n/a	n/a	NP	NaN	13	0.3292	0.03013	x^2	ShapiroWilk
Fluoride, total (mg/L)	**MW-1604S**	**Yes**	**1.63**	**9/10/2019**	**NP**	**NaN**	**13**	**0.9546**	**0.2155**	**ln(x)**	**ShapiroWilk**
Fluoride, total (mg/L)	MW-1605D	No	n/a	n/a	NP	NaN	13	0.2069	0.02626	x^2	ShapiroWilk
Fluoride, total (mg/L)	MW-1605I	No	n/a	n/a	NP	NaN	13	0.1908	0.03475	x^3	ShapiroWilk
Fluoride, total (mg/L)	MW-1605S	No	n/a	n/a	NP	NaN	13	0.5385	0.06067	x^4	ShapiroWilk
Fluoride, total (mg/L)	MW-1606D	No	n/a	n/a	NP	NaN	13	0.1869	0.02016	sqrt(x)	ShapiroWilk
Fluoride, total (mg/L)	MW-1606I	No	n/a	n/a	NP	NaN	13	0.1908	0.01847	sqrt(x)	ShapiroWilk
Fluoride, total (mg/L)	MW-1606S	No	n/a	n/a	NP	NaN	13	0.4269	0.05779	normal	ShapiroWilk
Lead, total (mg/L)	MW-1002	No	n/a	n/a	NP	NaN	13	0.000048	0.00004474	ln(x)	ShapiroWilk
Lead, total (mg/L)	MW-1602D	No	n/a	n/a	NP	NaN	13	0.00008862	0.0001166	ln(x)	ShapiroWilk
Lead, total (mg/L)	MW-1602I	No	n/a	n/a	NP	NaN	13	0.0001459	0.0001206	ln(x)	ShapiroWilk

Outlier Analysis - All Results

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP   Printed 12/5/2019, 10:15 AM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Lead, total (mg/L)	MW-1603D	No	n/a	n/a	NP	NaN	13	0.0001518	0.0003727	ln(x)	ShapiroWilk
Lead, total (mg/L)	MW-1603I	No	n/a	n/a	NP	NaN	13	0.000114	0.000118	ln(x)	ShapiroWilk
Lead, total (mg/L)	MW-1603S	No	n/a	n/a	NP	NaN	13	0.0001002	0.00008456	ln(x)	ShapiroWilk
Lead, total (mg/L)	MW-1604D	No	n/a	n/a	NP	NaN	13	0.000041	0.00003094	x^(1/3)	ShapiroWilk
Lead, total (mg/L)	MW-1604I	No	n/a	n/a	NP	NaN	13	0.00004554	0.00003829	ln(x)	ShapiroWilk
Lead, total (mg/L)	MW-1604S	No	n/a	n/a	NP	NaN	13	0.0001379	0.0002454	ln(x)	ShapiroWilk
Lead, total (mg/L)	MW-1605D	No	n/a	n/a	NP	NaN	13	0.00006677	0.00007019	x^(1/3)	ShapiroWilk
Lead, total (mg/L)	MW-1605I	No	n/a	n/a	NP	NaN	13	0.0001015	0.00006795	x^(1/3)	ShapiroWilk
Lead, total (mg/L)	MW-1605S	No	n/a	n/a	NP	NaN	13	0.0003208	0.0006387	ln(x)	ShapiroWilk
Lead, total (mg/L)	MW-1606D	No	n/a	n/a	NP	NaN	13	0.00007246	0.00006239	x^(1/3)	ShapiroWilk
Lead, total (mg/L)	MW-1606I	No	n/a	n/a	NP	NaN	13	0.00006546	0.00004458	ln(x)	ShapiroWilk
Lead, total (mg/L)	MW-1606S	No	n/a	n/a	NP	NaN	13	0.0002101	0.0003575	ln(x)	ShapiroWilk
Lithium, total (mg/L)	MW-1002	No	n/a	n/a	NP	NaN	13	0.009183	0.005016	sqrt(x)	ShapiroWilk
Lithium, total (mg/L)	MW-1602D	No	n/a	n/a	NP	NaN	13	0.007605	0.005961	x^(1/3)	ShapiroWilk
Lithium, total (mg/L)	MW-1602I	No	n/a	n/a	NP	NaN	13	0.008055	0.004492	sqrt(x)	ShapiroWilk
Lithium, total (mg/L)	MW-1603D	No	n/a	n/a	NP	NaN	13	0.008369	0.003861	x^(1/3)	ShapiroWilk
Lithium, total (mg/L)	MW-1603I	No	n/a	n/a	NP	NaN	13	0.01093	0.00398	x^2	ShapiroWilk
Lithium, total (mg/L)	MW-1603S	No	n/a	n/a	NP	NaN	13	0.008934	0.00503	sqrt(x)	ShapiroWilk
Lithium, total (mg/L)	MW-1604D	No	n/a	n/a	NP	NaN	13	0.00789	0.005569	ln(x)	ShapiroWilk
Lithium, total (mg/L)	MW-1604I	No	n/a	n/a	NP	NaN	13	0.009286	0.003975	normal	ShapiroWilk
Lithium, total (mg/L)	MW-1604S	No	n/a	n/a	NP	NaN	13	0.01186	0.003329	normal	ShapiroWilk
Lithium, total (mg/L)	MW-1605D	No	n/a	n/a	NP	NaN	13	0.006212	0.004167	ln(x)	ShapiroWilk
Lithium, total (mg/L)	MW-1605I	No	n/a	n/a	NP	NaN	13	0.008252	0.003642	ln(x)	ShapiroWilk
Lithium, total (mg/L)	MW-1605S	No	n/a	n/a	NP	NaN	13	0.01514	0.003575	x^2	ShapiroWilk
Lithium, total (mg/L)	MW-1606D	No	n/a	n/a	NP	NaN	13	0.006589	0.005316	ln(x)	ShapiroWilk
Lithium, total (mg/L)	MW-1606I	No	n/a	n/a	NP	NaN	13	0.008004	0.003235	ln(x)	ShapiroWilk
Lithium, total (mg/L)	MW-1606S	No	n/a	n/a	NP	NaN	13	0.01132	0.002856	normal	ShapiroWilk
Mercury, total (mg/L)	MW-1002	n/a	n/a	n/a	NP	NaN	12	0.000005	3.6e-14	unknown	ShapiroWilk
Mercury, total (mg/L)	MW-1602D	n/a	n/a	n/a	NP	NaN	12	0.000005	3.6e-14	unknown	ShapiroWilk
Mercury, total (mg/L)	MW-1602I	n/a	n/a	n/a	NP	NaN	12	0.000005	3.6e-14	unknown	ShapiroWilk
Mercury, total (mg/L)	MW-1603D	n/a	n/a	n/a	NP	NaN	12	0.000005	3.6e-14	unknown	ShapiroWilk
Mercury, total (mg/L)	MW-1603I	n/a	n/a	n/a	NP	NaN	12	0.000005	3.6e-14	unknown	ShapiroWilk
Mercury, total (mg/L)	MW-1603S	n/a	n/a	n/a	NP	NaN	12	0.000005	3.6e-14	unknown	ShapiroWilk
Mercury, total (mg/L)	MW-1604D	n/a	n/a	n/a	NP	NaN	12	0.00000475	8.7e-7	unknown	ShapiroWilk
Mercury, total (mg/L)	MW-1604I	n/a	n/a	n/a	NP	NaN	12	0.000005	3.6e-14	unknown	ShapiroWilk
Mercury, total (mg/L)	MW-1604S	n/a	n/a	n/a	NP	NaN	12	0.000005	3.6e-14	unknown	ShapiroWilk
Mercury, total (mg/L)	MW-1605D	n/a	n/a	n/a	NP	NaN	12	0.000005	3.6e-14	unknown	ShapiroWilk
Mercury, total (mg/L)	MW-1605I	n/a	n/a	n/a	NP	NaN	12	0.000005	3.6e-14	unknown	ShapiroWilk
Mercury, total (mg/L)	MW-1605S	n/a	n/a	n/a	NP	NaN	12	0.000005	3.6e-14	unknown	ShapiroWilk
Mercury, total (mg/L)	MW-1606D	n/a	n/a	n/a	NP	NaN	12	0.000005	3.6e-14	unknown	ShapiroWilk
Mercury, total (mg/L)	MW-1606I	n/a	n/a	n/a	NP	NaN	12	0.000005	3.6e-14	unknown	ShapiroWilk
Mercury, total (mg/L)	MW-1606S	n/a	n/a	n/a	NP	NaN	12	0.000005	3.6e-14	unknown	ShapiroWilk
Molybdenum, total (mg/L)	MW-1002	No	n/a	n/a	NP	NaN	13	0.005017	0.003184	ln(x)	ShapiroWilk
Molybdenum, total (mg/L)	MW-1602D	No	n/a	n/a	NP	NaN	13	0.003621	0.000441	ln(x)	ShapiroWilk
Molybdenum, total (mg/L)	MW-1602I	No	n/a	n/a	NP	NaN	13	0.002225	0.0002226	ln(x)	ShapiroWilk
Molybdenum, total (mg/L)	MW-1603D	No	n/a	n/a	NP	NaN	13	0.005045	0.0009801	ln(x)	ShapiroWilk
Molybdenum, total (mg/L)	MW-1603I	No	n/a	n/a	NP	NaN	13	0.008328	0.001194	x^3	ShapiroWilk
Molybdenum, total (mg/L)	MW-1603S	No	n/a	n/a	NP	NaN	13	0.00082	0.0007461	ln(x)	ShapiroWilk
Molybdenum, total (mg/L)	MW-1604D	No	n/a	n/a	NP	NaN	13	0.002963	0.0004425	ln(x)	ShapiroWilk
Molybdenum, total (mg/L)	MW-1604I	No	n/a	n/a	NP	NaN	13	0.002687	0.0002558	ln(x)	ShapiroWilk
Molybdenum, total (mg/L)	**MW-1604S**	**Yes**	**0.00479,0.001,0.00472**	**11/15/2016,6/26/2019,9/10/2019**	**NP**	**NaN**	**13**	**0.002628**	**0.001037**	**ln(x)**	**ShapiroWilk**
Molybdenum, total (mg/L)	**MW-1605D**	**Yes**	**0.00765**	**6/7/2016**	**NP**	**NaN**	**13**	**0.002698**	**0.001533**	**ln(x)**	**ShapiroWilk**
Molybdenum, total (mg/L)	**MW-1605I**	**Yes**	**0.005**	**6/25/2019**	**NP**	**NaN**	**13**	**0.001492**	**0.001065**	**ln(x)**	**ShapiroWilk**
Molybdenum, total (mg/L)	MW-1605S	No	n/a	n/a	NP	NaN	13	0.001899	0.0003172	x^2	ShapiroWilk
Molybdenum, total (mg/L)	**MW-1606D**	**Yes**	**0.00382**	**6/7/2016**	**NP**	**NaN**	**13**	**0.002158**	**0.0005314**	**ln(x)**	**ShapiroWilk**

Outlier Analysis - All Results

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP   Printed 12/5/2019, 10:15 AM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Molybdenum, total (mg/L)	MW-1606I	No	n/a	n/a	NP	NaN	13	0.001688	0.001066	ln(x)	ShapiroWilk
Molybdenum, total (mg/L)	MW-1606S	No	n/a	n/a	NP	NaN	13	0.001546	0.001091	ln(x)	ShapiroWilk
pH, field (SU)	MW-1002	No	n/a	n/a	NP	NaN	13	6.906	0.4689	ln(x)	ShapiroWilk
pH, field (SU)	MW-1600D (bg)	No	n/a	n/a	NP	NaN	13	7.09	0.2748	x^6	ShapiroWilk
pH, field (SU)	**MW-1600I (bg)**	**Yes**	**9.29**	**7/17/2017**	**NP**	**NaN**	**12**	**7.357**	**0.6329**	**ln(x)**	**ShapiroWilk**
pH, field (SU)	**MW-1600S (bg)**	**Yes**	**9.46**	**7/17/2017**	**NP**	**NaN**	**13**	**6.988**	**0.781**	**ln(x)**	**ShapiroWilk**
pH, field (SU)	MW-1601D (bg)	No	n/a	n/a	NP	NaN	13	7.063	0.3068	x^6	ShapiroWilk
pH, field (SU)	**MW-1601I (bg)**	**Yes**	**9.45**	**7/17/2017**	**NP**	**NaN**	**12**	**7.342**	**0.7042**	**ln(x)**	**ShapiroWilk**
pH, field (SU)	MW-1601S (bg)	No	n/a	n/a	NP	NaN	13	7.135	0.2669	x^6	ShapiroWilk
pH, field (SU)	MW-1602D	No	n/a	n/a	NP	NaN	13	7.215	0.7266	x^6	ShapiroWilk
pH, field (SU)	MW-1602I	No	n/a	n/a	NP	NaN	13	7.261	0.2235	ln(x)	ShapiroWilk
pH, field (SU)	MW-1603D	No	n/a	n/a	NP	NaN	13	7.159	0.194	x^2	ShapiroWilk
pH, field (SU)	**MW-1603I**	**Yes**	**9.78**	**7/17/2017**	**NP**	**NaN**	**13**	**7.548**	**0.7132**	**ln(x)**	**ShapiroWilk**
pH, field (SU)	**MW-1603S**	**Yes**	**9.63**	**7/17/2017**	**NP**	**NaN**	**13**	**7.182**	**0.7937**	**ln(x)**	**ShapiroWilk**
pH, field (SU)	MW-1604D	No	n/a	n/a	NP	NaN	13	7.201	0.1132	x^6	ShapiroWilk
pH, field (SU)	MW-1604I	No	n/a	n/a	NP	NaN	13	7.402	0.1368	x^6	ShapiroWilk
pH, field (SU)	MW-1604S	No	n/a	n/a	NP	NaN	13	7.435	0.1331	sqrt(x)	ShapiroWilk
pH, field (SU)	**MW-1605D**	**Yes**	**9.51**	**7/18/2017**	**NP**	**NaN**	**13**	**7.308**	**0.6758**	**ln(x)**	**ShapiroWilk**
pH, field (SU)	MW-1605I	No	n/a	n/a	NP	NaN	13	7.223	0.1523	x^6	ShapiroWilk
pH, field (SU)	MW-1605S	No	n/a	n/a	NP	NaN	13	7.192	0.1511	ln(x)	ShapiroWilk
pH, field (SU)	**MW-1606D**	**Yes**	**5.85,8.37,7.96**	**7/19/2016,7/18/2017,6/6/2018**	**NP**	**NaN**	**13**	**7.234**	**0.5691**	**x^2**	**ShapiroWilk**
pH, field (SU)	**MW-1606I**	**Yes**	**4.98,8.09,8.56**	**7/19/2016,6/6/2018,5/21/2019**	**NP**	**NaN**	**13**	**7.218**	**0.8139**	**x^4**	**ShapiroWilk**
pH, field (SU)	**MW-1606S**	**Yes**	**7.81,7.85**	**6/6/2018,5/21/2019**	**NP**	**NaN**	**13**	**7.095**	**0.3457**	**ln(x)**	**ShapiroWilk**
pH, field (SU)	MW-1701D (bg)	No	n/a	n/a	NP	NaN	9	7.326	0.2305	ln(x)	ShapiroWilk
pH, field (SU)	MW-1701I (bg)	No	n/a	n/a	NP	NaN	9	7.481	0.2342	ln(x)	ShapiroWilk
pH, field (SU)	MW-1701S (bg)	No	n/a	n/a	NP	NaN	9	7.267	0.3283	x^4	ShapiroWilk
pH, field (SU)	MW-1702D (bg)	No	n/a	n/a	NP	NaN	9	7.343	0.4858	ln(x)	ShapiroWilk
pH, field (SU)	MW-1702I (bg)	No	n/a	n/a	NP	NaN	9	7.182	0.4051	ln(x)	ShapiroWilk
pH, field (SU)	MW-1702S (bg)	No	n/a	n/a	NP	NaN	9	7.036	0.4962	ln(x)	ShapiroWilk
Selenium, total (mg/L)	MW-1002	No	n/a	n/a	NP	NaN	13	0.00007769	0.00001787	ln(x)	ShapiroWilk
Selenium, total (mg/L)	MW-1602D	No	n/a	n/a	NP	NaN	13	0.00006615	0.00003203	ln(x)	ShapiroWilk
Selenium, total (mg/L)	MW-1602I	No	n/a	n/a	NP	NaN	13	0.0001092	0.00007686	ln(x)	ShapiroWilk
Selenium, total (mg/L)	MW-1603D	No	n/a	n/a	NP	NaN	13	0.0001538	0.00008392	normal	ShapiroWilk
Selenium, total (mg/L)	MW-1603I	No	n/a	n/a	NP	NaN	13	0.0001485	0.00006914	ln(x)	ShapiroWilk
Selenium, total (mg/L)	MW-1603S	No	n/a	n/a	NP	NaN	13	0.0002754	0.0004083	ln(x)	ShapiroWilk
Selenium, total (mg/L)	MW-1604D	No	n/a	n/a	NP	NaN	13	0.0001562	0.00007018	ln(x)	ShapiroWilk
Selenium, total (mg/L)	MW-1604I	No	n/a	n/a	NP	NaN	13	0.00007923	0.000029	sqrt(x)	ShapiroWilk
Selenium, total (mg/L)	MW-1604S	No	n/a	n/a	NP	NaN	13	0.00009769	0.00006126	ln(x)	ShapiroWilk
Selenium, total (mg/L)	MW-1605D	No	n/a	n/a	NP	NaN	13	0.0001538	0.000074	sqrt(x)	ShapiroWilk
Selenium, total (mg/L)	MW-1605I	No	n/a	n/a	NP	NaN	13	0.0001323	0.00007801	ln(x)	ShapiroWilk
Selenium, total (mg/L)	MW-1605S	No	n/a	n/a	NP	NaN	13	0.0013	0.001307	ln(x)	ShapiroWilk
Selenium, total (mg/L)	MW-1606D	No	n/a	n/a	NP	NaN	13	0.0001577	0.00006735	ln(x)	ShapiroWilk
Selenium, total (mg/L)	**MW-1606I**	**Yes**	**0.00003**	**3/6/2017**	**NP**	**NaN**	**13**	**0.0001677**	**0.00006313**	**sqrt(x)**	**ShapiroWilk**
Selenium, total (mg/L)	MW-1606S	No	n/a	n/a	NP	NaN	13	0.003754	0.001251	sqrt(x)	ShapiroWilk
Thallium, total (mg/L)	MW-1002	No	n/a	n/a	NP	NaN	13	0.0001408	0.000205	ln(x)	ShapiroWilk
Thallium, total (mg/L)	MW-1602D	No	n/a	n/a	NP	NaN	13	0.0003582	0.0002218	ln(x)	ShapiroWilk
Thallium, total (mg/L)	MW-1602I	No	n/a	n/a	NP	NaN	13	0.0001723	0.0002276	ln(x)	ShapiroWilk
Thallium, total (mg/L)	MW-1603D	No	n/a	n/a	NP	NaN	13	0.0002868	0.00024	ln(x)	ShapiroWilk
Thallium, total (mg/L)	MW-1603I	No	n/a	n/a	NP	NaN	13	0.0001438	0.0002032	ln(x)	ShapiroWilk
Thallium, total (mg/L)	MW-1603S	No	n/a	n/a	NP	NaN	13	0.0001435	0.0002043	ln(x)	ShapiroWilk
Thallium, total (mg/L)	MW-1604D	No	n/a	n/a	NP	NaN	13	0.0003596	0.00022	ln(x)	ShapiroWilk
Thallium, total (mg/L)	MW-1604I	No	n/a	n/a	NP	NaN	13	0.0001385	0.000207	ln(x)	ShapiroWilk
Thallium, total (mg/L)	MW-1604S	No	n/a	n/a	NP	NaN	13	0.0001472	0.0002022	ln(x)	ShapiroWilk
Thallium, total (mg/L)	MW-1605D	No	n/a	n/a	NP	NaN	13	0.0003915	0.0002063	ln(x)	ShapiroWilk
Thallium, total (mg/L)	MW-1605I	No	n/a	n/a	NP	NaN	13	0.0001518	0.0002029	ln(x)	ShapiroWilk

Outlier Analysis - All Results

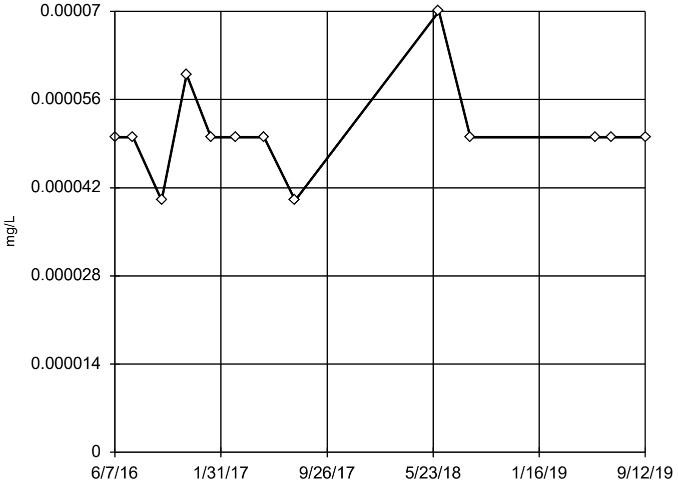
Rockport BAP Client: Geosyntec Data: Rockport_BAP Printed 12/5/2019, 10:15 AM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Thallium, total (mg/L)	MW-1605S	No	n/a	n/a	NP	NaN	13	0.0001108	0.0001741	ln(x)	ShapiroWilk
Thallium, total (mg/L)	MW-1606D	No	n/a	n/a	NP	NaN	13	0.0003634	0.0002146	ln(x)	ShapiroWilk
Thallium, total (mg/L)	MW-1606I	No	n/a	n/a	NP	NaN	13	0.0001495	0.0002003	ln(x)	ShapiroWilk
Thallium, total (mg/L)	MW-1606S	No	n/a	n/a	NP	NaN	13	0.0001745	0.0002266	ln(x)	ShapiroWilk

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1002



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.

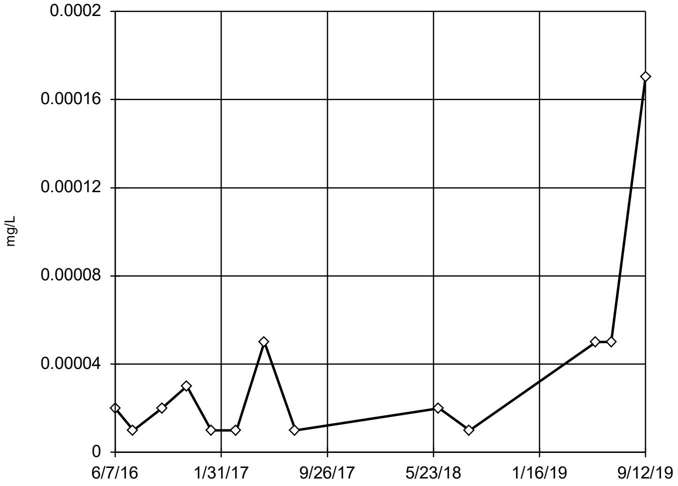
Constituent: Antimony, total   Analysis Run 12/5/2019 10:08 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602D



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 = 0.00625, low cutoff = 8.0e-8, based on IQR multiplier of 3.

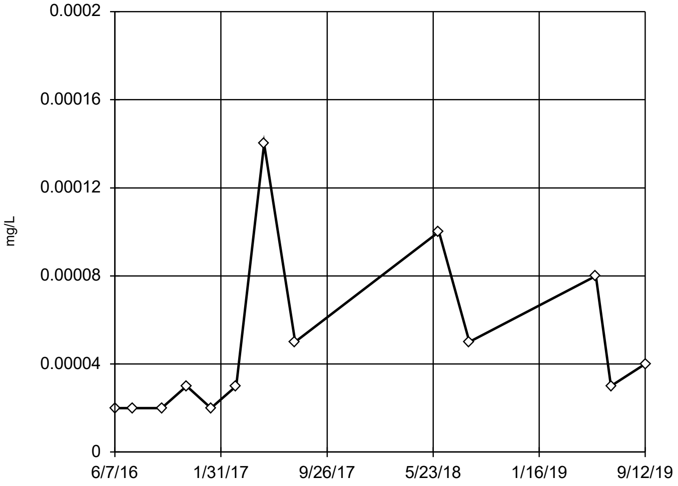
Constituent: Antimony, total   Analysis Run 12/5/2019 10:08 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602I



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 = 0.002, low cutoff = 6.3e-7, based on IQR multiplier of 3.

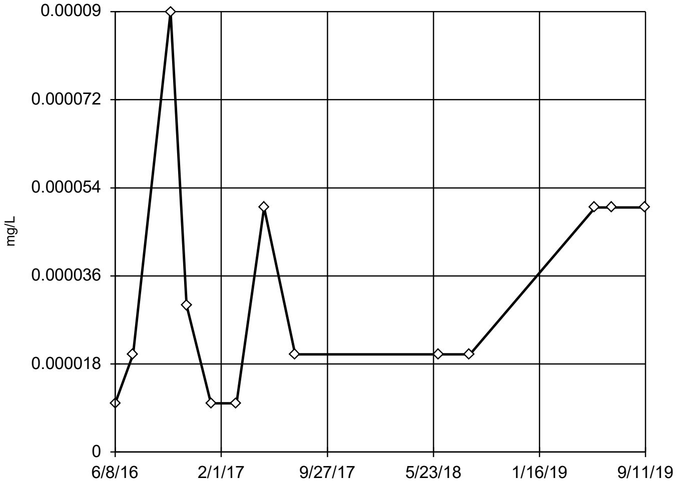
Constituent: Antimony, total   Analysis Run 12/5/2019 10:08 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603D



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 = 0.00221, low cutoff = 3.2e-7, based on IQR multiplier of 3.

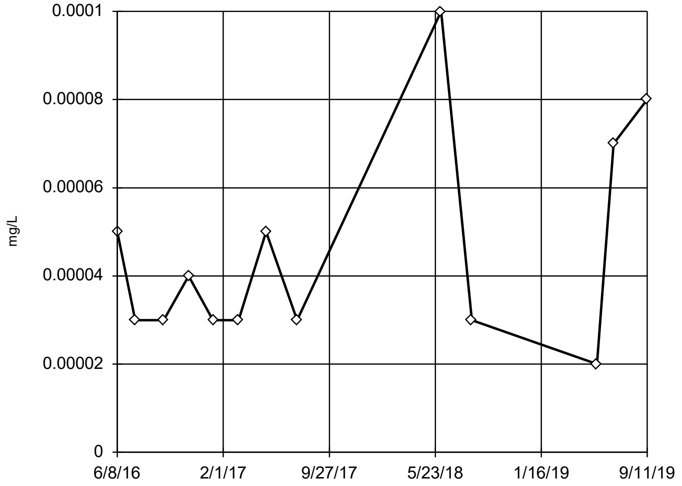
Constituent: Antimony, total   Analysis Run 12/5/2019 10:08 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603I



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 = 0.0004537, low cutoff = 0.000003912, based on IQR multiplier of 3.

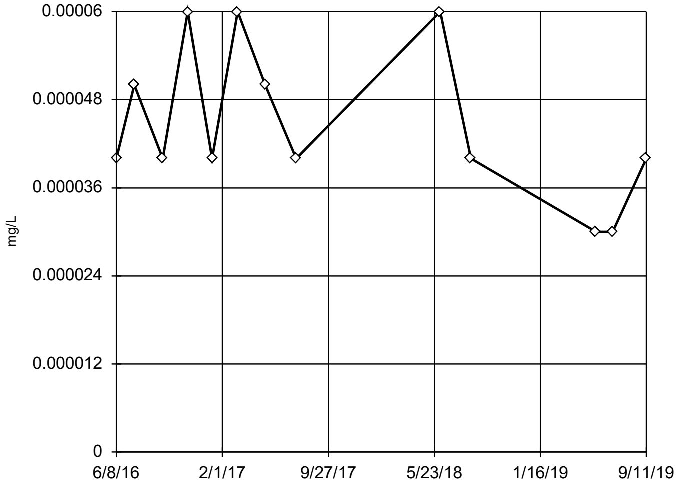
Constituent: Antimony, total Analysis Run 12/5/2019 10:08 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603S



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 = 0.0001406, low cutoff = 0.00001558, based on IQR multiplier of 3.

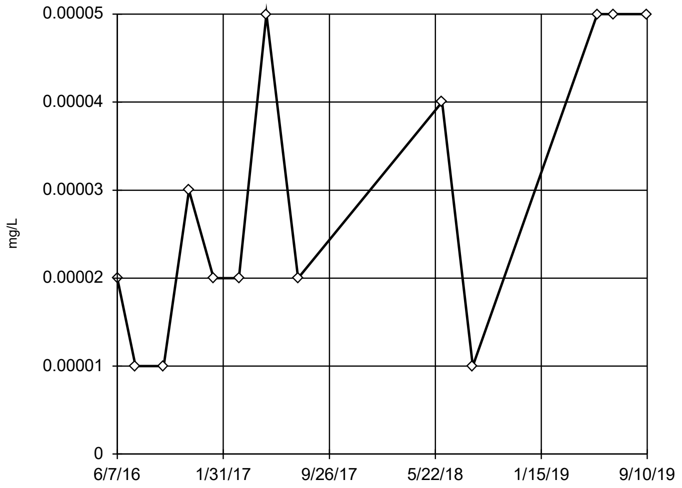
Constituent: Antimony, total Analysis Run 12/5/2019 10:08 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604D



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 = 0.0004106, low cutoff = -0.000002271, based on IQR multiplier of 3.

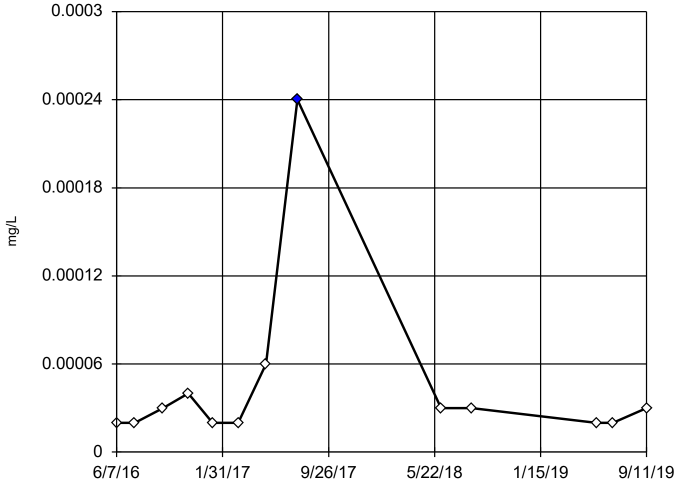
Constituent: Antimony, total Analysis Run 12/5/2019 10:08 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604I



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 = 0.00018, low cutoff = 0.000003849, based on IQR multiplier of 3.

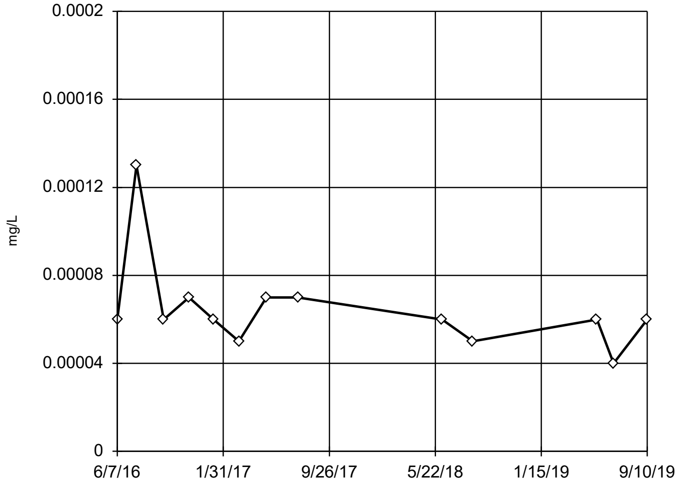
Constituent: Antimony, total Analysis Run 12/5/2019 10:08 AM

Rockport BAP Client: Geosyntec Data: Rockport_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 = 0.0001461, low cutoff = 0.00002624, based on IQR multiplier of 3.

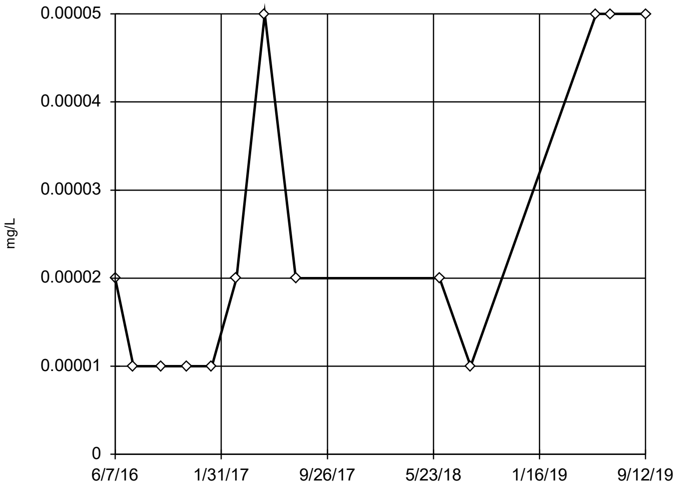
Constituent: Antimony, total Analysis Run 12/5/2019 10:08 AM

Rockport BAP Client: Geosyntec Data: Rockport_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 = 0.00625, low cutoff = 8.0e-8, based on IQR multiplier of 3.

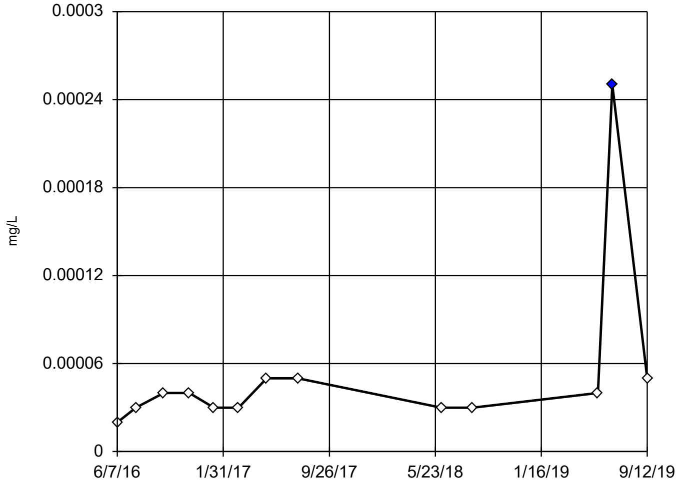
Constituent: Antimony, total Analysis Run 12/5/2019 10:08 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605I



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 = 0.0002315, low cutoff = 0.00000648, based on IQR multiplier of 3.

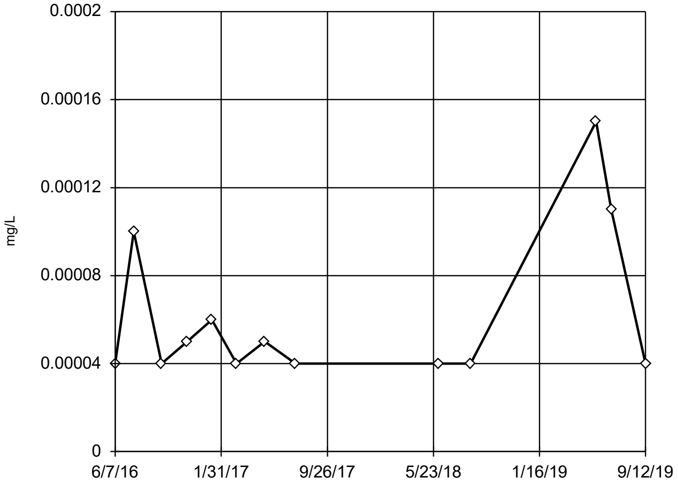
Constituent: Antimony, total Analysis Run 12/5/2019 10:08 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605S



n = 13

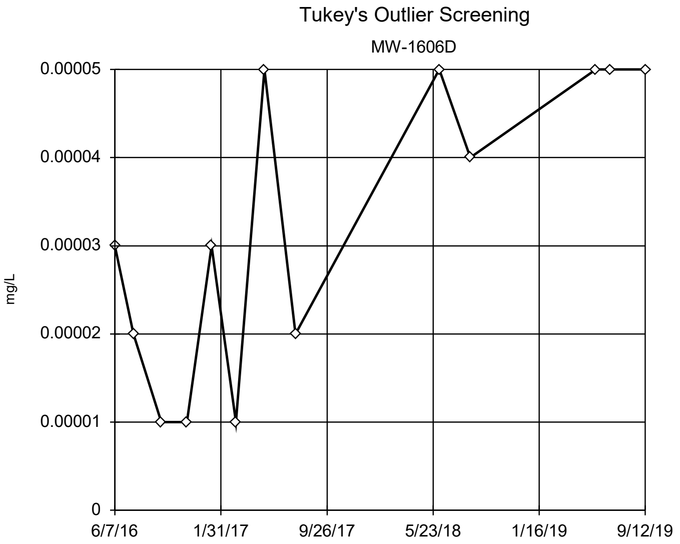
No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.0005625, low cutoff = 0.000005508, based on IQR multiplier of 3.

Constituent: Antimony, total Analysis Run 12/5/2019 10:08 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP



n = 13

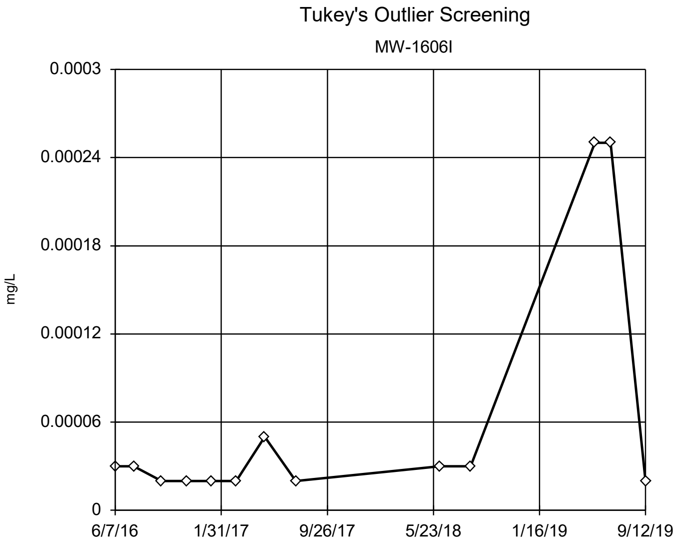
No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

High cutoff = 0.000155, low cutoff = -0.00009, based on IQR multiplier of 3.

Constituent: Antimony, total   Analysis Run 12/5/2019 10:08 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP



n = 13

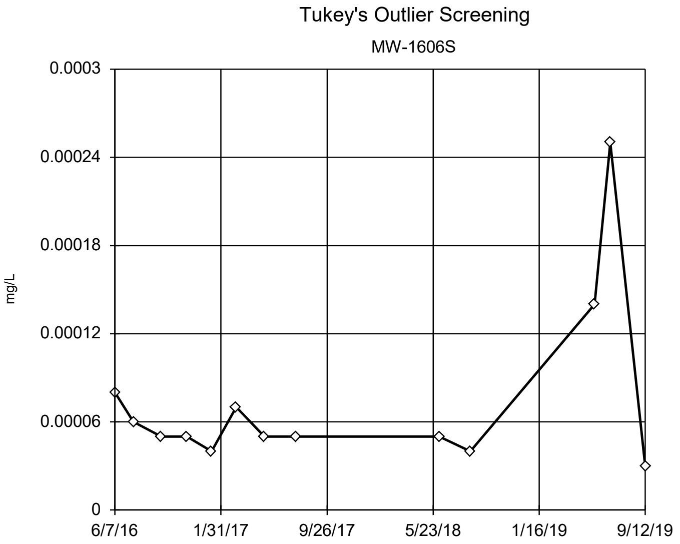
No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.0002813, low cutoff = 0.000002754, based on IQR multiplier of 3.

Constituent: Antimony, total   Analysis Run 12/5/2019 10:08 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP



n = 13

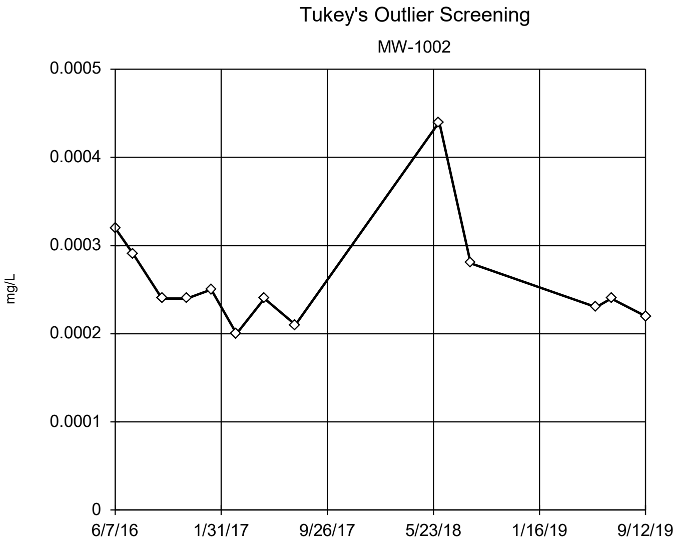
No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.0003506, low cutoff = 0.000009545, based on IQR multiplier of 3.

Constituent: Antimony, total   Analysis Run 12/5/2019 10:08 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP



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 = 0.0005793, low cutoff = 0.0001107, based on IQR multiplier of 3.

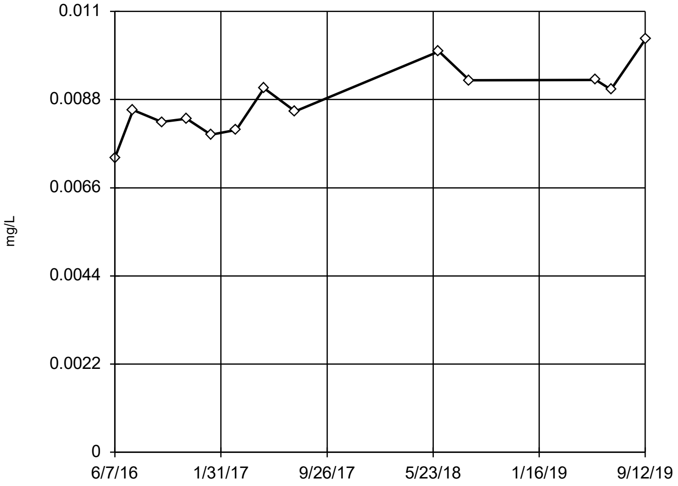
Constituent: Arsenic, total   Analysis Run 12/5/2019 10:08 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602D



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).

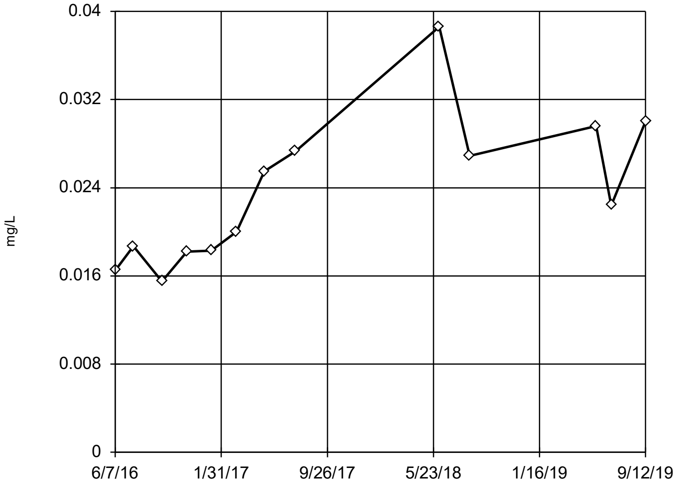
High cutoff = 0.01378, low cutoff = 0.005483, based on IQR multiplier of 3.

Constituent: Arsenic, total   Analysis Run 12/5/2019 10:08 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602I



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).

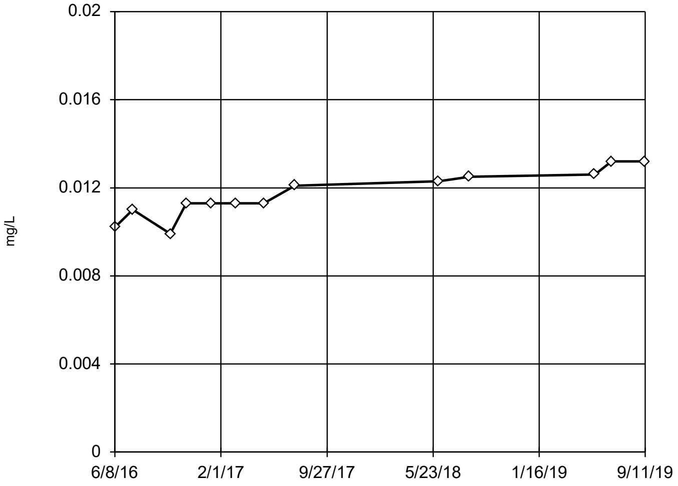
High cutoff = 0.1074, low cutoff = 0.004829, based on IQR multiplier of 3.

Constituent: Arsenic, total   Analysis Run 12/5/2019 10:08 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603D



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).

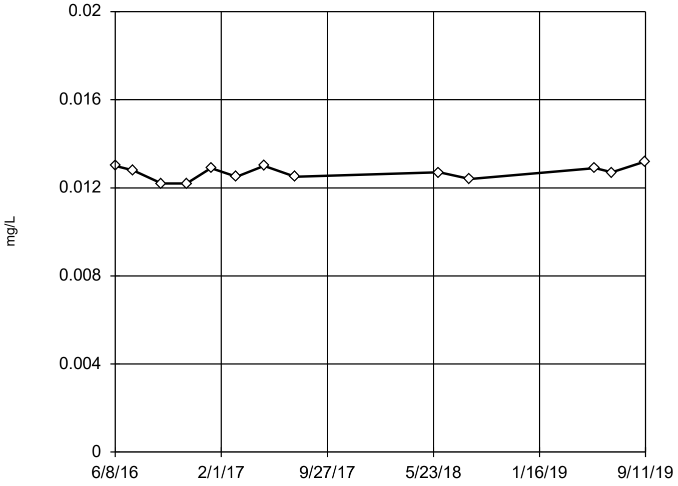
High cutoff = 0.01603, low cutoff = 0.004986, based on IQR multiplier of 3.

Constituent: Arsenic, total   Analysis Run 12/5/2019 10:08 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603I



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).

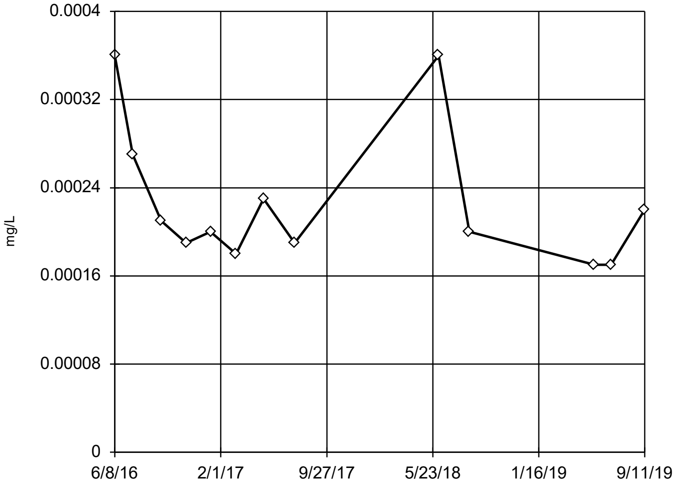
High cutoff = 0.01405, low cutoff = 0.009526, based on IQR multiplier of 3.

Constituent: Arsenic, total   Analysis Run 12/5/2019 10:08 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603S



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).

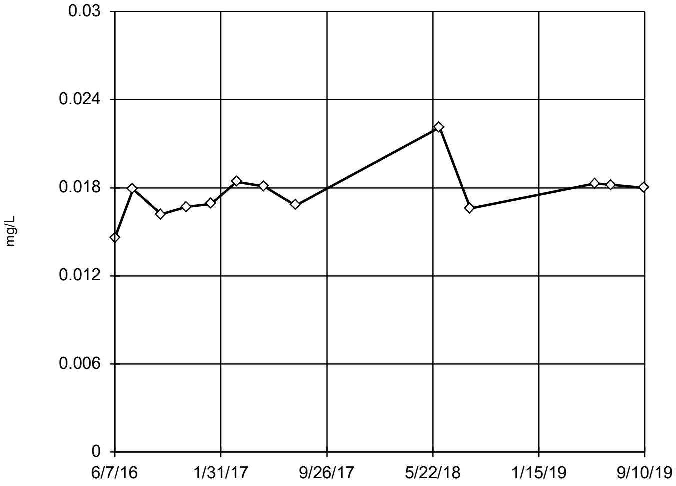
High cutoff = 0.0006097, low cutoff = 0.00007558, based on IQR multiplier of 3.

Constituent: Arsenic, total   Analysis Run 12/5/2019 10:08 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

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).

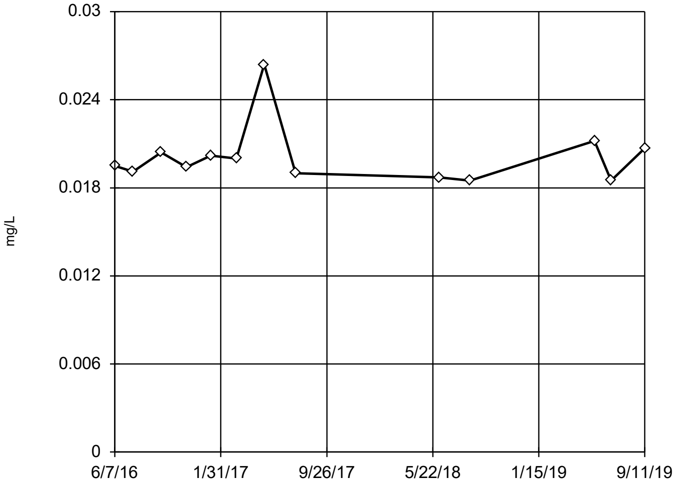
High cutoff = 0.02403, low cutoff = 0.01264, based on IQR multiplier of 3.

Constituent: Arsenic, total   Analysis Run 12/5/2019 10:08 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604I



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).

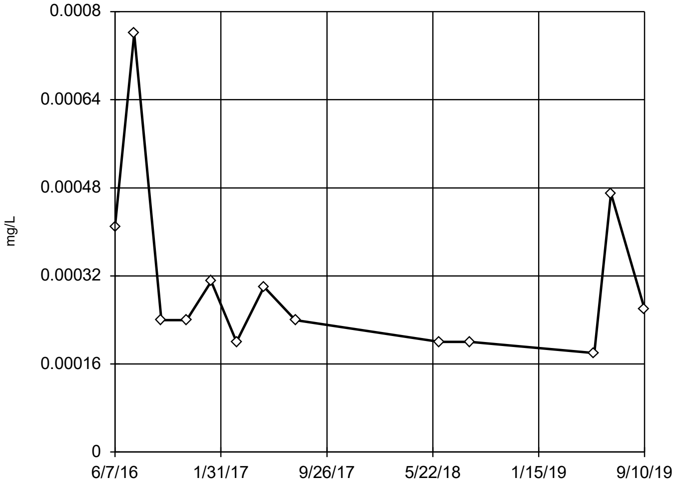
High cutoff = 0.02663, low cutoff = 0.01455, based on IQR multiplier of 3.

Constituent: Arsenic, total   Analysis Run 12/5/2019 10:08 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_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).

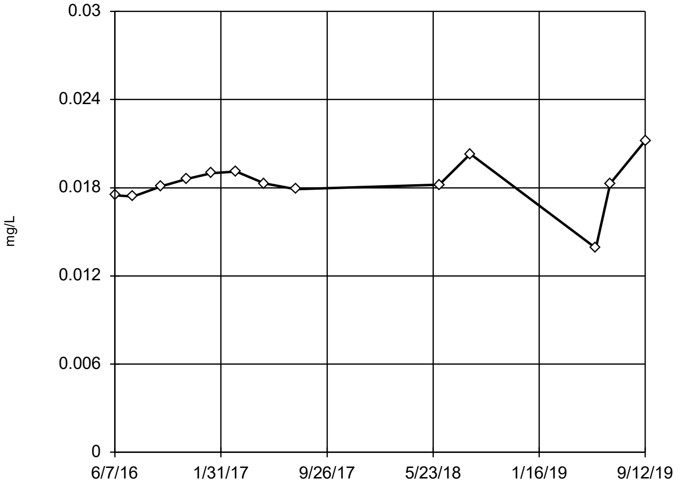
High cutoff = 0.002019, low cutoff = 0.00003531, based on IQR multiplier of 3.

Constituent: Arsenic, total   Analysis Run 12/5/2019 10:08 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_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).

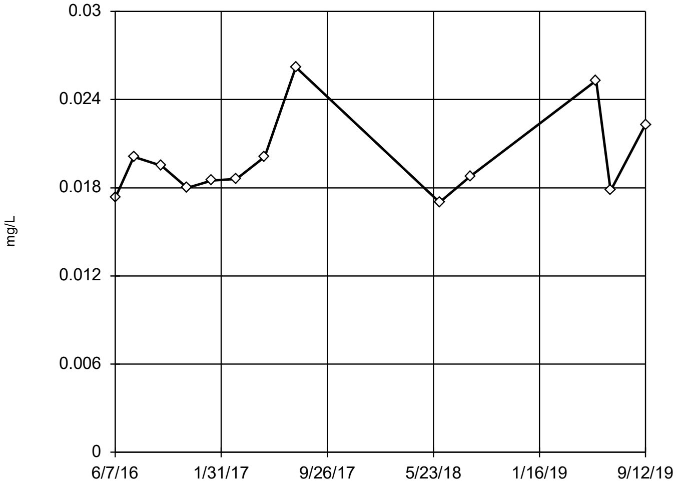
High cutoff = 0.02195,
low cutoff = -0.006855,
based on IQR multiplier of 3.

Constituent: Arsenic, total Analysis Run 12/5/2019 10:09 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605I



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).

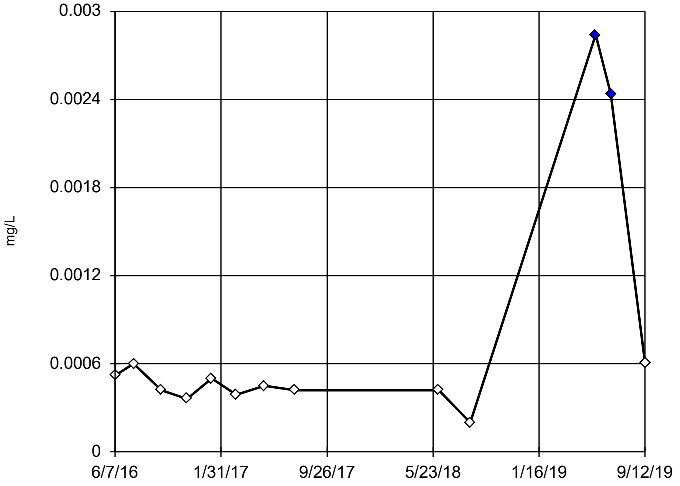
High cutoff = 0.03503,
low cutoff = 0.01082,
based on IQR multiplier of 3.

Constituent: Arsenic, total Analysis Run 12/5/2019 10:09 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605S



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).

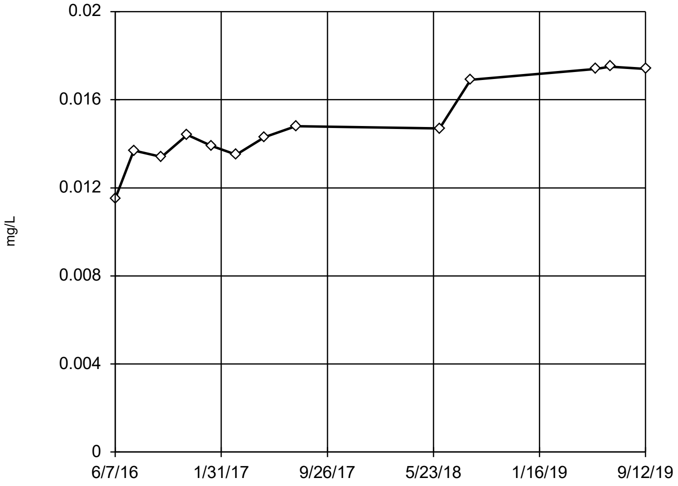
High cutoff = 0.002021,
low cutoff = 0.0001212,
based on IQR multiplier of 3.

Constituent: Arsenic, total Analysis Run 12/5/2019 10:09 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

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).

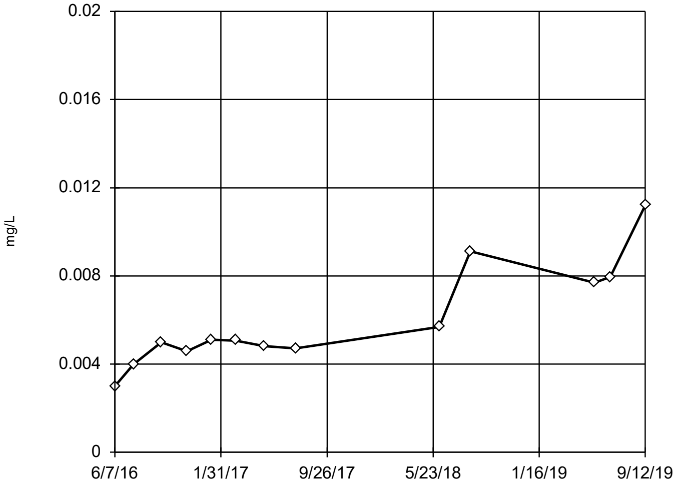
High cutoff = 0.03438,
low cutoff = 0.006784,
based on IQR multiplier of 3.

Constituent: Arsenic, total Analysis Run 12/5/2019 10:09 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606I



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 = 0.03716, low cutoff = 0.0009801, based on IQR multiplier of 3.

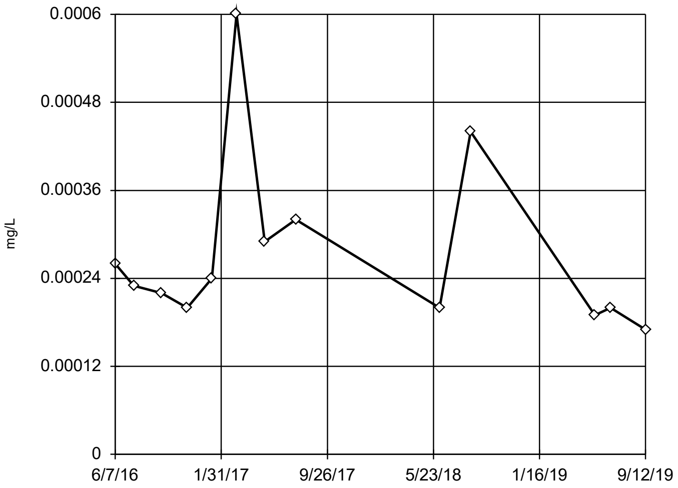
Constituent: Arsenic, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_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 = 0.001076, low cutoff = 0.0000566, based on IQR multiplier of 3.

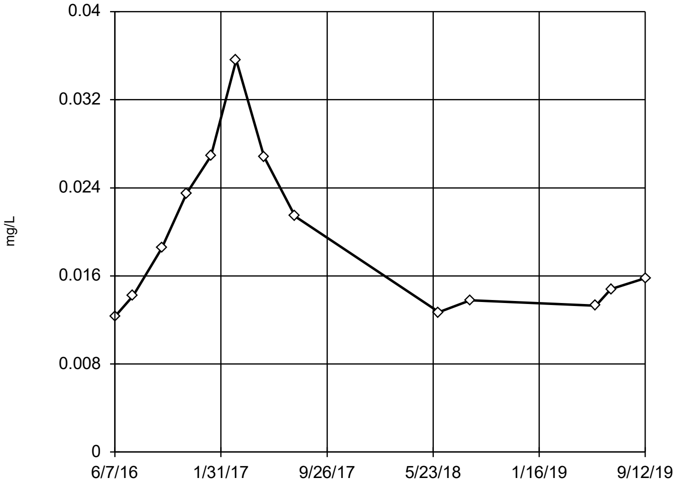
Constituent: Arsenic, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1002



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 = 0.1595, low cutoff = 0.002131, based on IQR multiplier of 3.

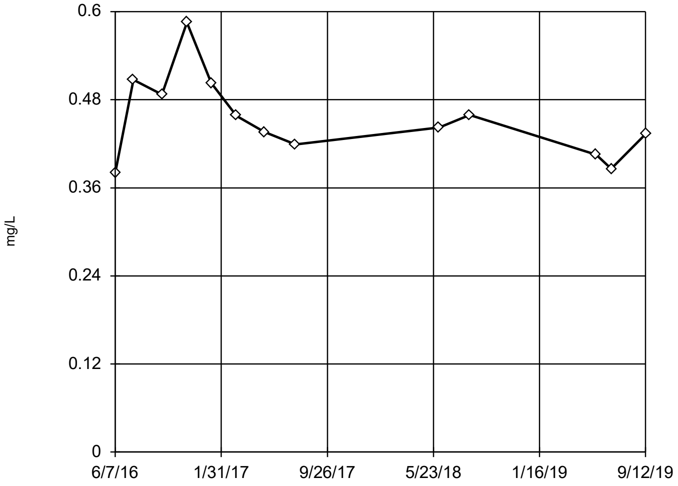
Constituent: Barium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602D



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 = 0.8584, low cutoff = 0.2375, based on IQR multiplier of 3.

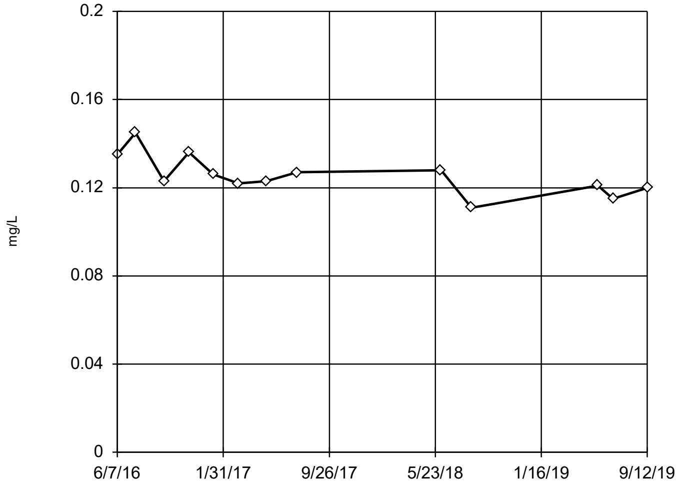
Constituent: Barium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602I



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 = 0.1707, low cutoff = 0.09281, based on IQR multiplier of 3.

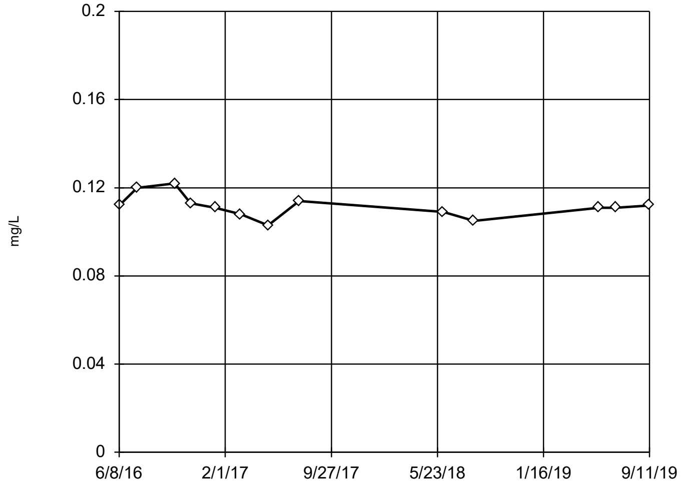
Constituent: Barium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603D



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 = 0.1299, low cutoff = 0.09478, based on IQR multiplier of 3.

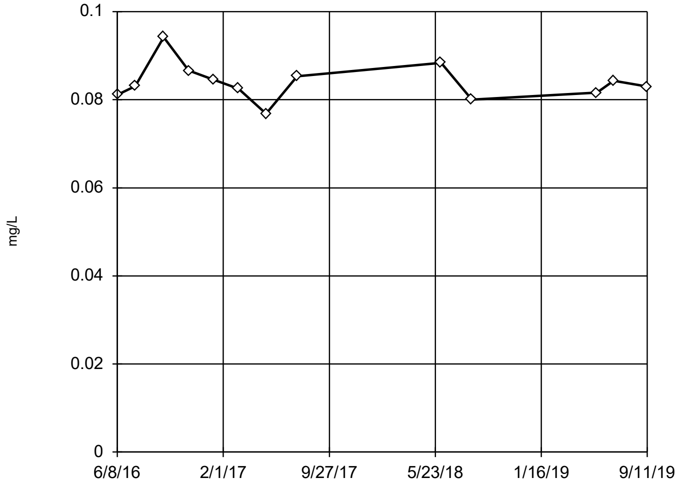
Constituent: Barium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603I



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 = 0.1014, low cutoff = 0.06898, based on IQR multiplier of 3.

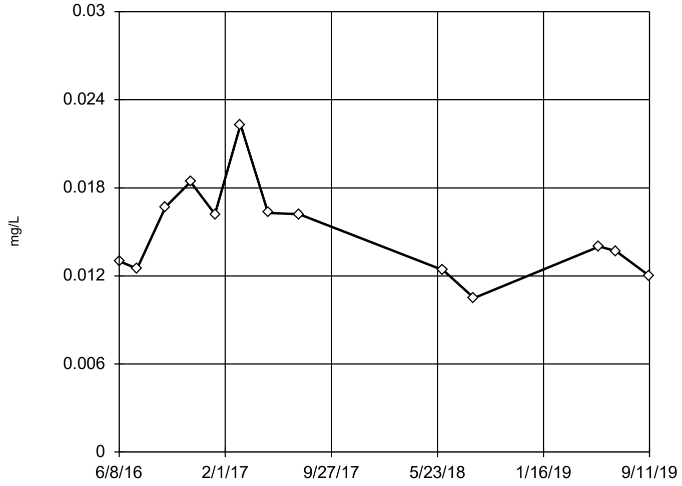
Constituent: Barium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603S



n = 13

No outliers found. Tukey's method selected by user.

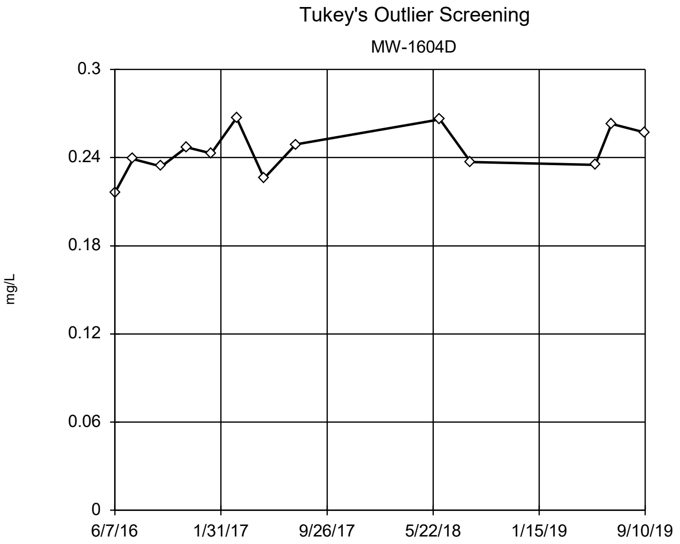
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.0384, low cutoff = 0.005349, based on IQR multiplier of 3.

Constituent: Barium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



n = 13

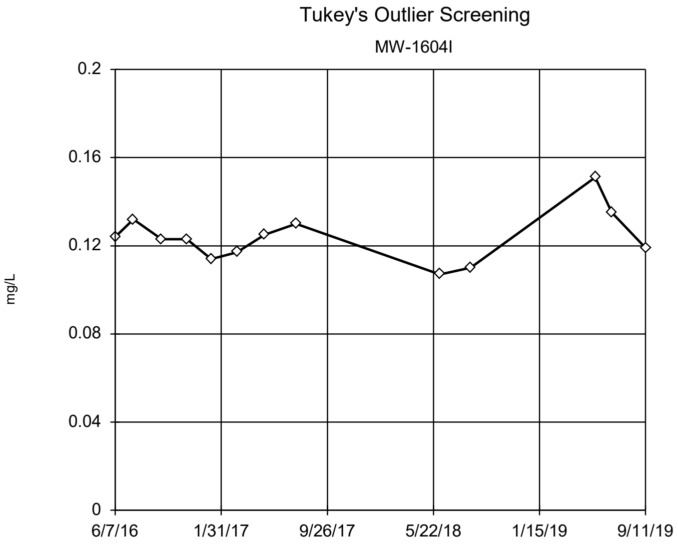
No outliers found. Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.3474, low cutoff = 0.1681, based on IQR multiplier of 3.

Constituent: Barium, total Analysis Run 12/5/2019 10:09 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



n = 13

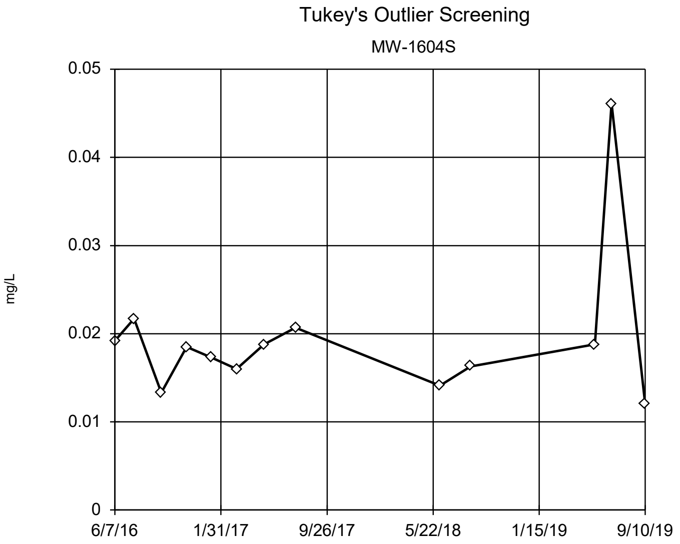
No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.1912, low cutoff = 0.07914, based on IQR multiplier of 3.

Constituent: Barium, total Analysis Run 12/5/2019 10:09 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



n = 13

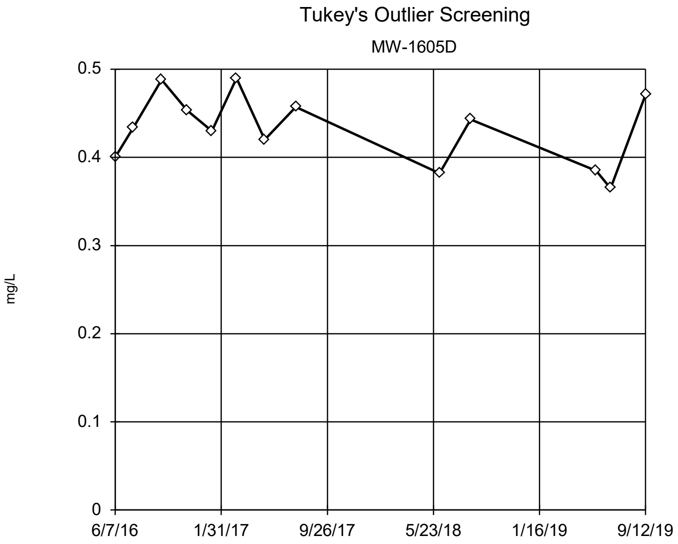
No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.04662, low cutoff = 0.006423, based on IQR multiplier of 3.

Constituent: Barium, total Analysis Run 12/5/2019 10:09 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



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).

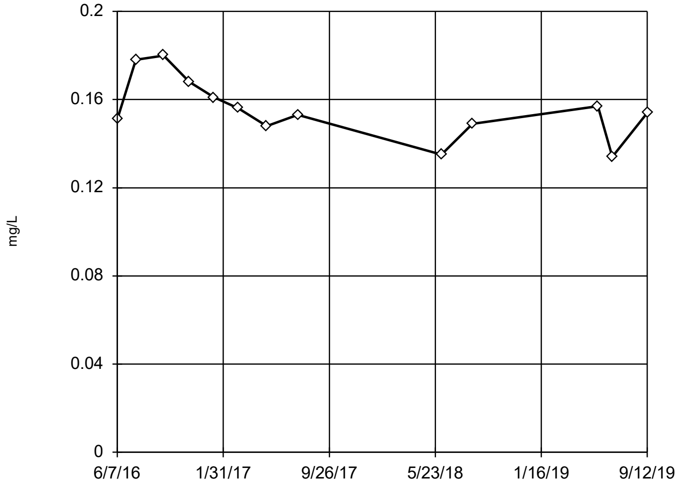
High cutoff = 0.6317, low cutoff = -0.172, based on IQR multiplier of 3.

Constituent: Barium, total Analysis Run 12/5/2019 10:09 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605I



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).

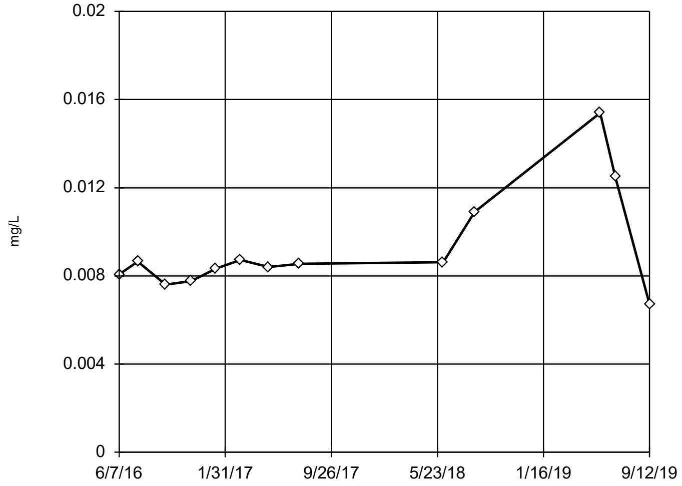
High cutoff = 0.2234, low cutoff = 0.1093, based on IQR multiplier of 3.

Constituent: Barium, total   Analysis Run 12/5/2019 10:09 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_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).

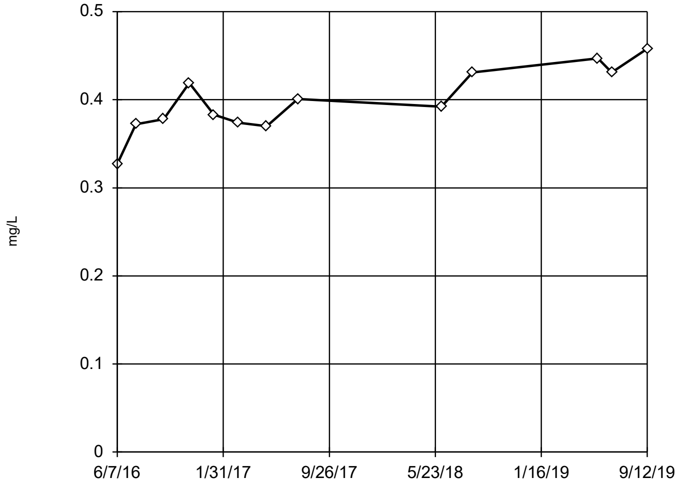
High cutoff = 0.01823, low cutoff = 0.004232, based on IQR multiplier of 3.

Constituent: Barium, total   Analysis Run 12/5/2019 10:09 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606D



n = 13

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

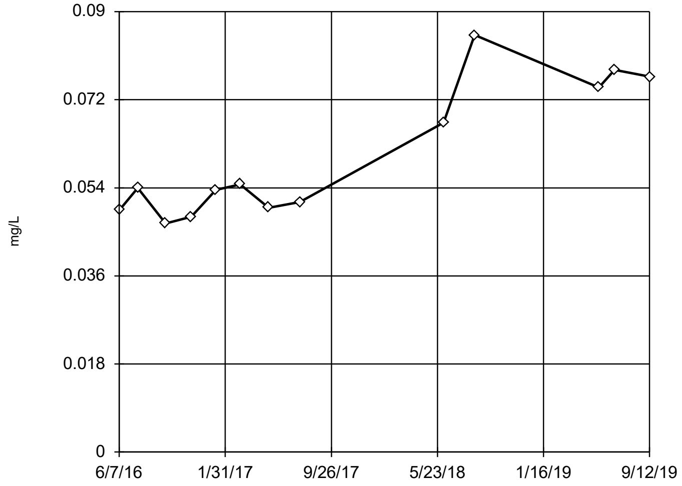
High cutoff = 0.605, low cutoff = 0.199, based on IQR multiplier of 3.

Constituent: Barium, total   Analysis Run 12/5/2019 10:09 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606I



n = 13

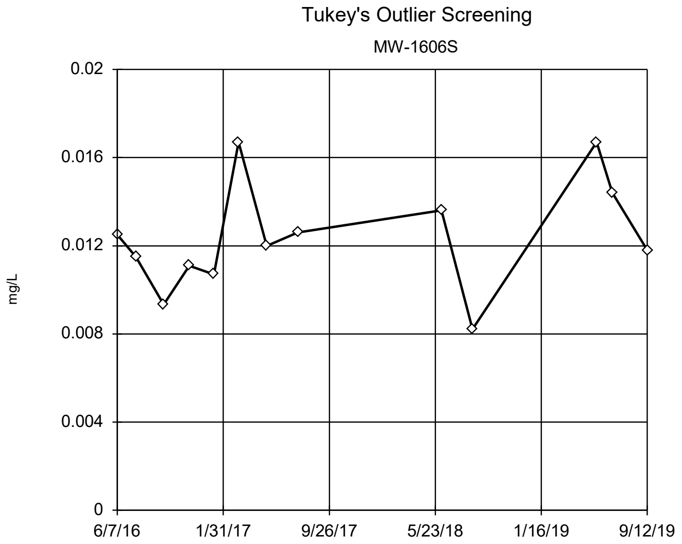
No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.2668, low cutoff = 0.01407, based on IQR multiplier of 3.

Constituent: Barium, total   Analysis Run 12/5/2019 10:09 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



n = 13

No outliers found. Tukey's method selected by user.

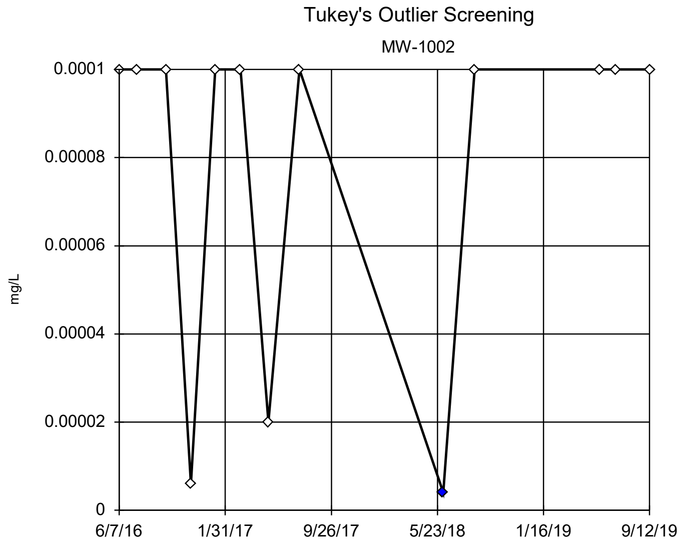
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.02963, low cutoff = 0.005147, based on IQR multiplier of 3.

Constituent: Barium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



n = 13

Outlier is drawn as solid. Tukey's method selected by user.

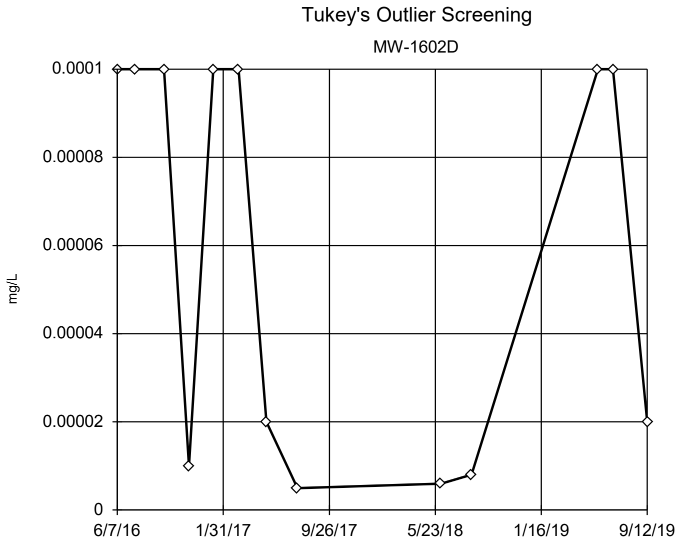
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.001118, low cutoff = 0.000004, based on IQR multiplier of 3.

Constituent: Beryllium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



n = 13

No outliers found. Tukey's method selected by user.

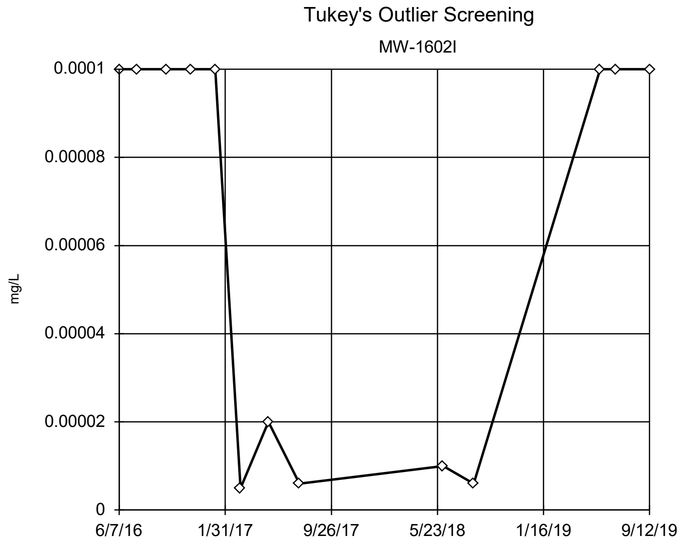
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.1398, low cutoff = 6.4e-9, based on IQR multiplier of 3.

Constituent: Beryllium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



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 = 0.2152, low cutoff = 3.6e-9, based on IQR multiplier of 3.

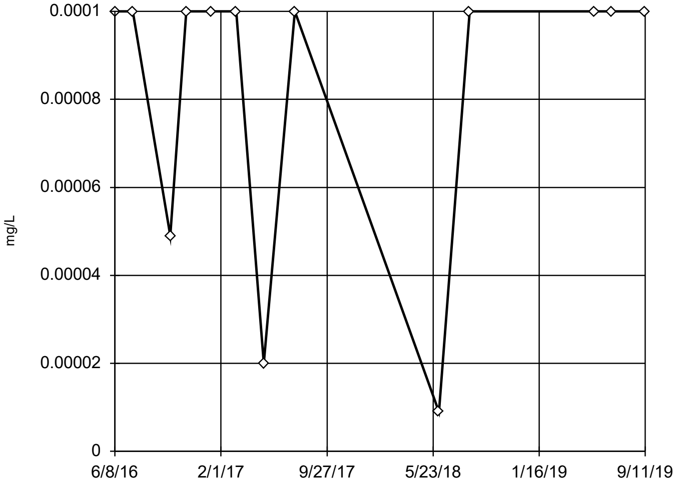
Constituent: Beryllium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603D



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 = 0.0001765, low cutoff = -0.000002, based on IQR multiplier of 3.

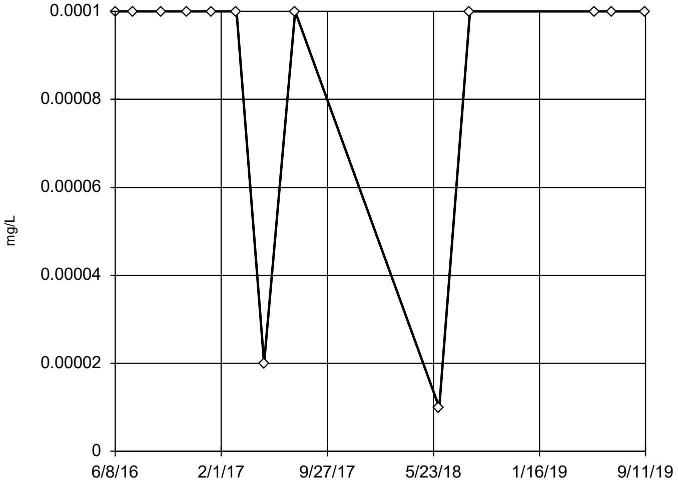
Constituent: Beryllium, total   Analysis Run 12/5/2019 10:09 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603I



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.

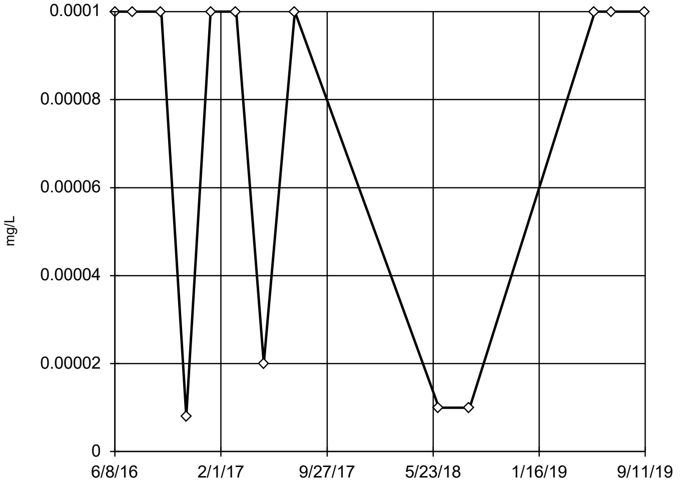
Constituent: Beryllium, total   Analysis Run 12/5/2019 10:09 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603S



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 = 0.03536, low cutoff = 4.0e-8, based on IQR multiplier of 3.

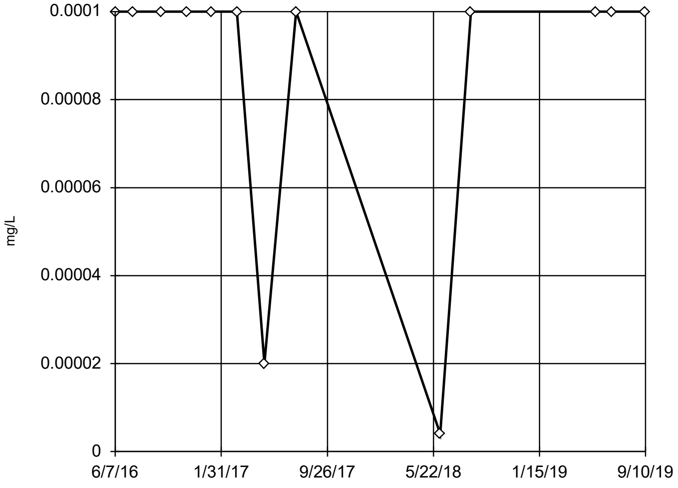
Constituent: Beryllium, total   Analysis Run 12/5/2019 10:09 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

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.

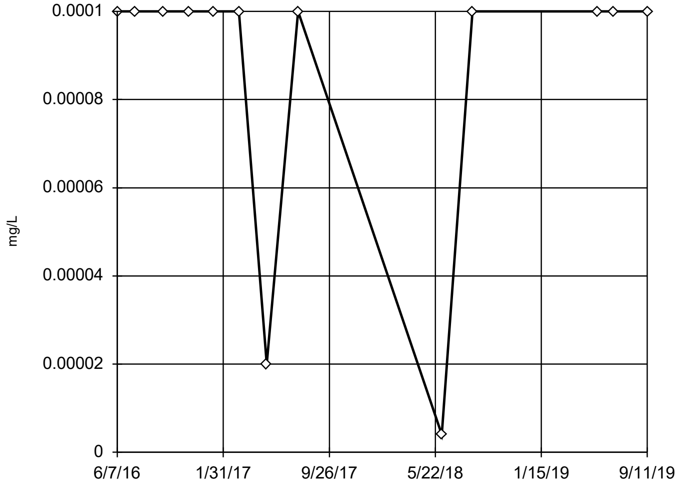
Constituent: Beryllium, total   Analysis Run 12/5/2019 10:09 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604I



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.

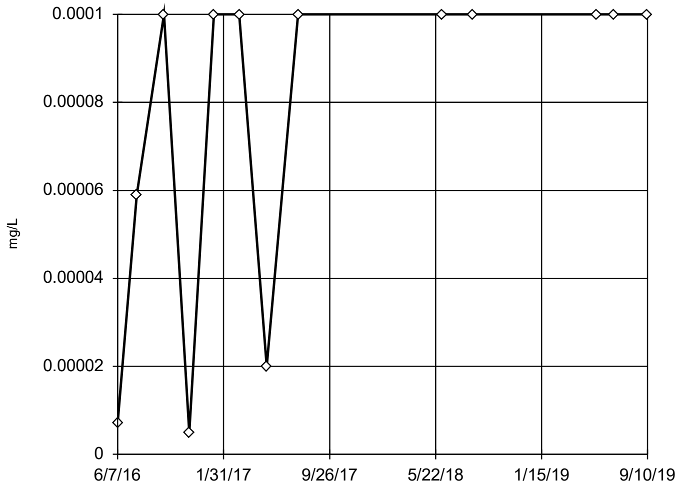
Constituent: Beryllium, total   Analysis Run 12/5/2019 10:09 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_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 = 0.0002815, low cutoff = -0.000142, based on IQR multiplier of 3.

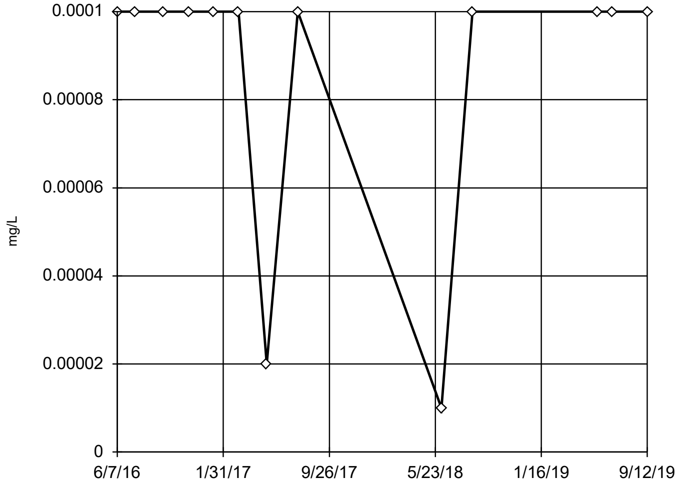
Constituent: Beryllium, total   Analysis Run 12/5/2019 10:09 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_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).

The results were invalidated, because the lower and upper quartiles are equal.

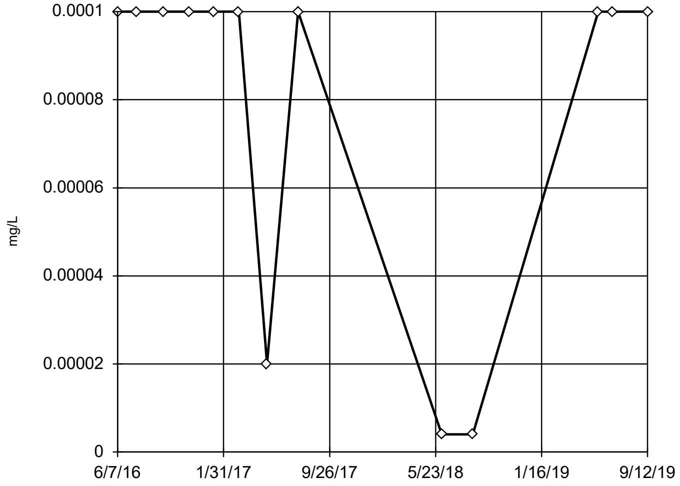
Constituent: Beryllium, total   Analysis Run 12/5/2019 10:09 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605I



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 = 0.0004274, low cutoff = 4.9e-7, based on IQR multiplier of 3.

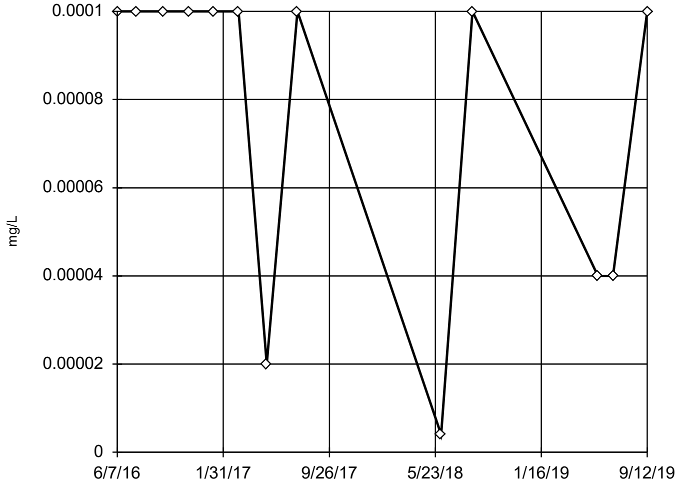
Constituent: Beryllium, total   Analysis Run 12/5/2019 10:09 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_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 square root transformed to achieve best W statistic (graph shown in original units).

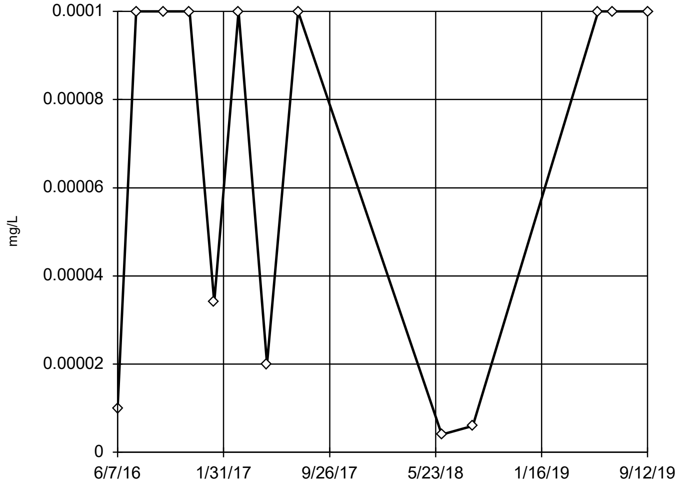
High cutoff = 0.0004421, low cutoff = -0.00002211, based on IQR multiplier of 3.

Constituent: Beryllium, total   Analysis Run 12/5/2019 10:09 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

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).

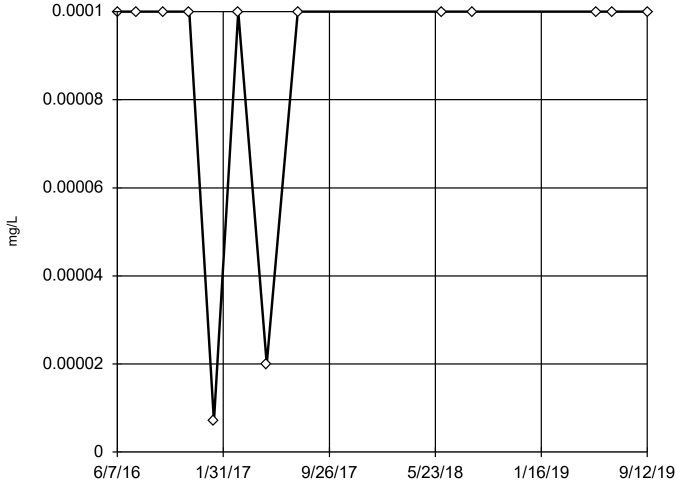
High cutoff = 0.03536, low cutoff = 4.0e-8, based on IQR multiplier of 3.

Constituent: Beryllium, total   Analysis Run 12/5/2019 10:09 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606I



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).

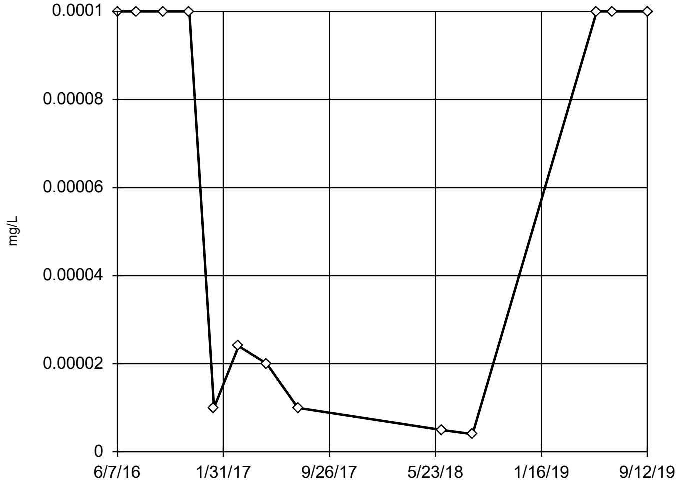
The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Beryllium, total   Analysis Run 12/5/2019 10:09 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606S



n = 13

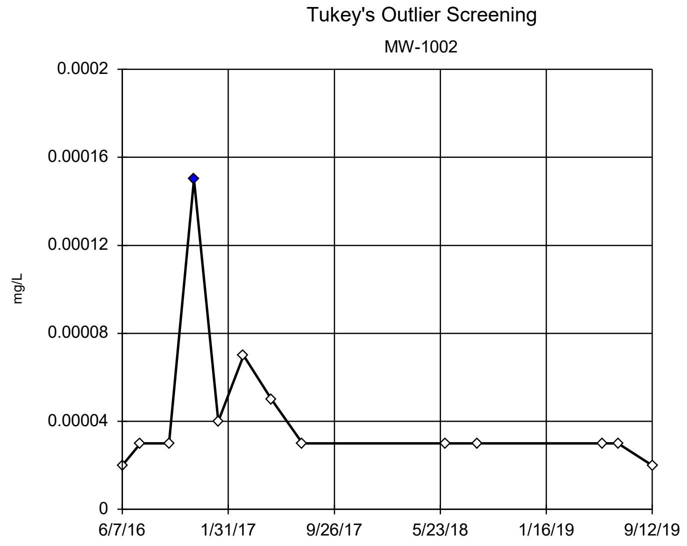
No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.1, low cutoff = 1.0e-8, based on IQR multiplier of 3.

Constituent: Beryllium, total   Analysis Run 12/5/2019 10:09 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



n = 13

Outlier is drawn as solid. Tukey's method selected by user.

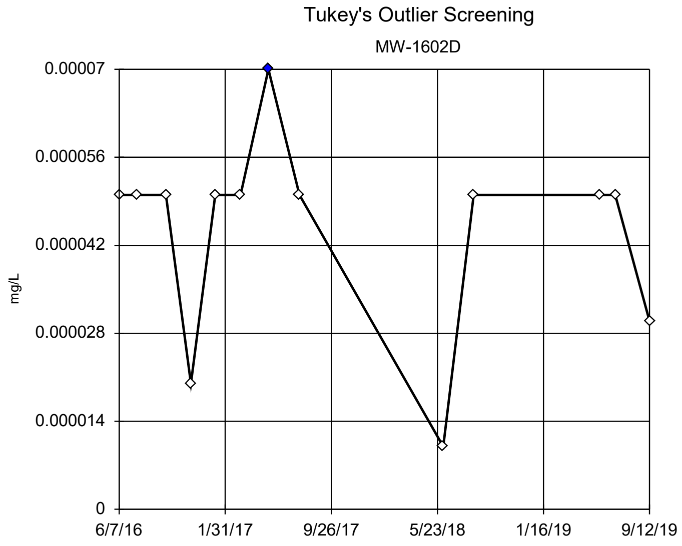
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.0001481, low cutoff = 0.000009056, based on IQR multiplier of 3.

Constituent: Cadmium, total   Analysis Run 12/5/2019 10:09 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



n = 13

Outlier is drawn as solid. Tukey's method selected by user.

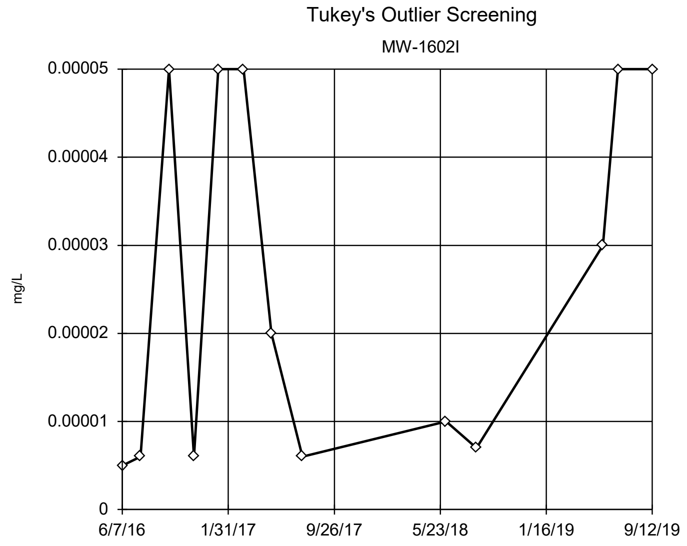
Data were square transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.00007, low cutoff = -0.00002646, based on IQR multiplier of 3.

Constituent: Cadmium, total   Analysis Run 12/5/2019 10:09 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



n = 13

No outliers found. Tukey's method selected by user.

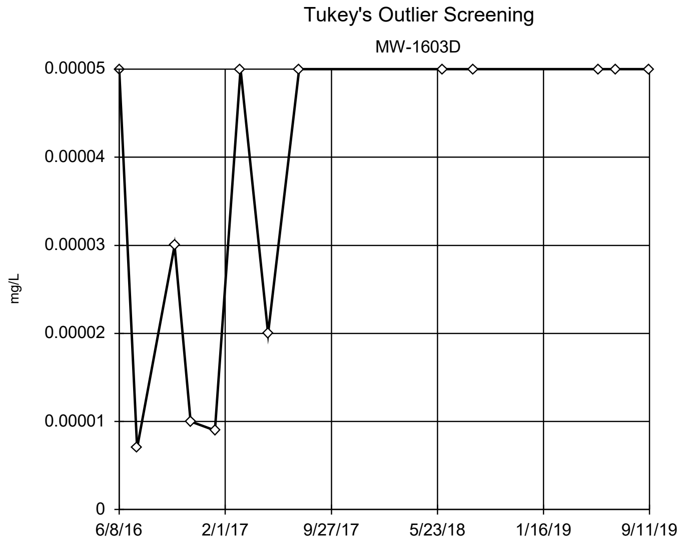
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.02894, low cutoff = 1.0e-8, based on IQR multiplier of 3.

Constituent: Cadmium, total   Analysis Run 12/5/2019 10:09 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



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 = 0.0004106, low cutoff = -0.000002271, based on IQR multiplier of 3.

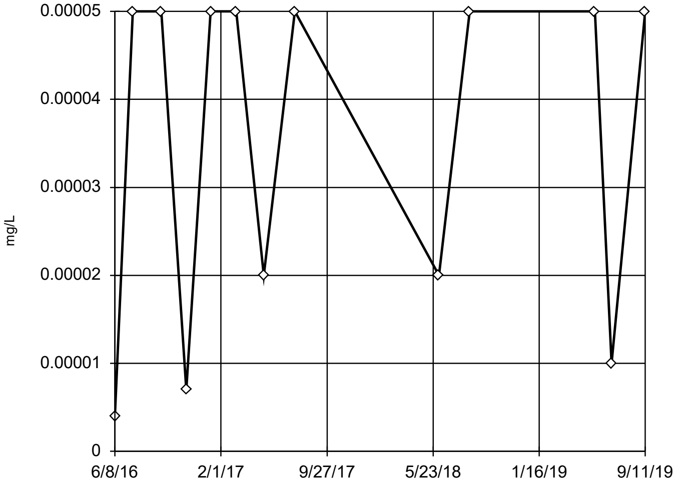
Constituent: Cadmium, total   Analysis Run 12/5/2019 10:09 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603I



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 = 0.0004106, low cutoff = -0.000002271, based on IQR multiplier of 3.

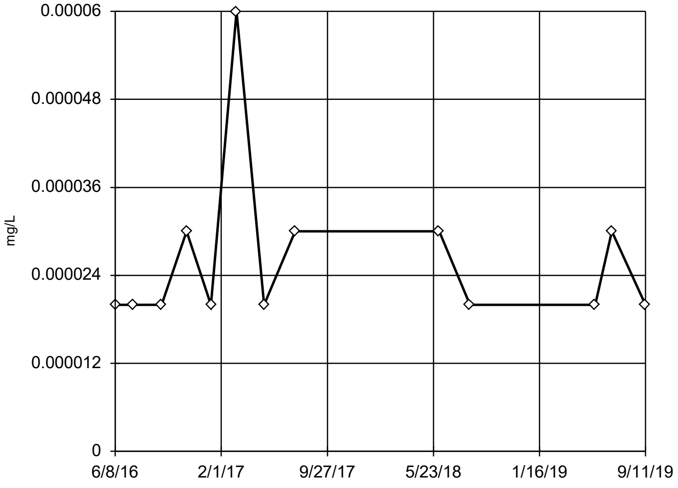
Constituent: Cadmium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603S



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 = 0.0001013, low cutoff = 0.000005926, based on IQR multiplier of 3.

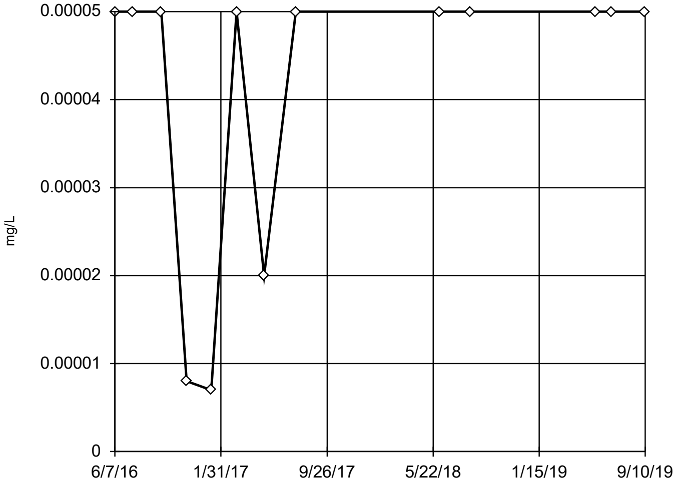
Constituent: Cadmium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

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).

High cutoff = 0.0001203, low cutoff = 0.000003509, based on IQR multiplier of 3.

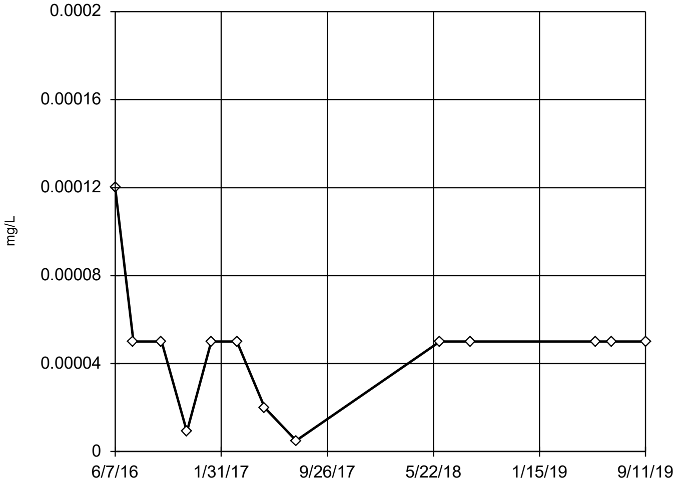
Constituent: Cadmium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604I



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 = 0.0001203, low cutoff = 0.000003509, based on IQR multiplier of 3.

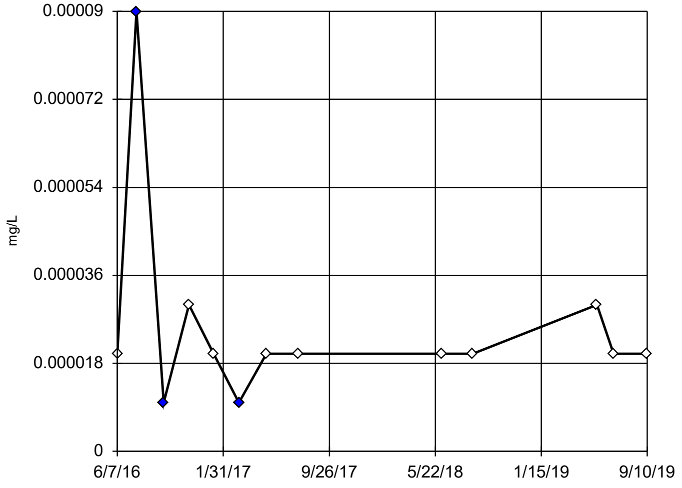
Constituent: Cadmium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604S



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 = 0.000045, low cutoff = 0.00001089, based on IQR multiplier of 3.

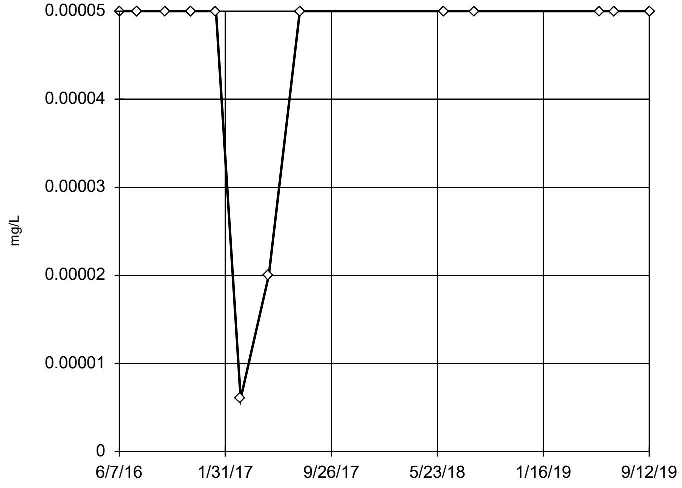
Constituent: Cadmium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_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.

The results were invalidated, because the lower and upper quartiles are equal.

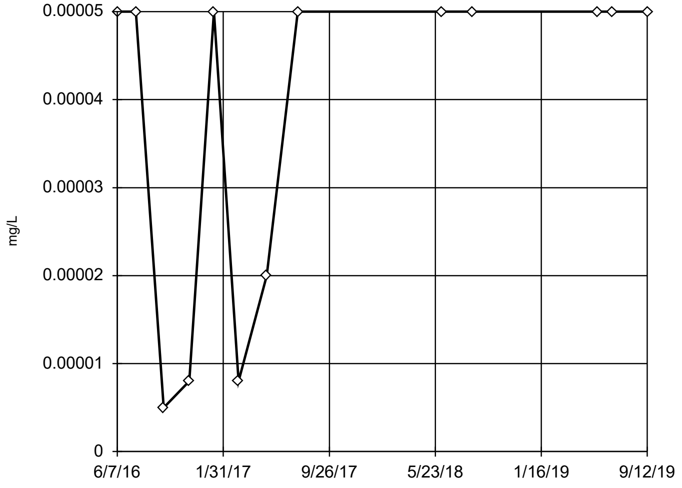
Constituent: Cadmium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605I



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 = 0.003088, low cutoff = 2.0e-7, based on IQR multiplier of 3.

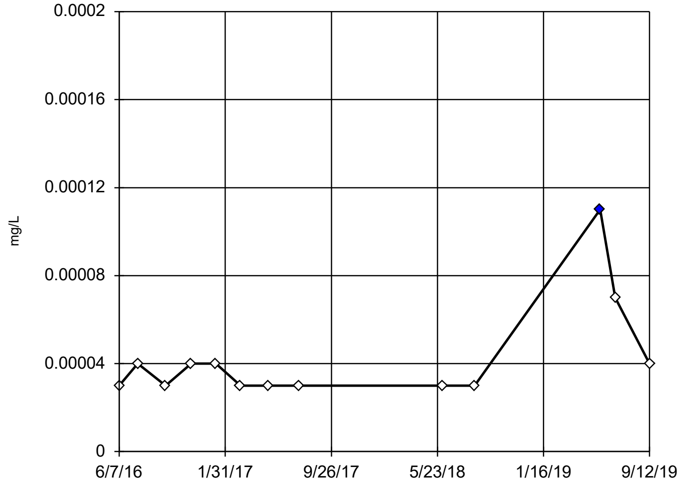
Constituent: Cadmium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605S



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).

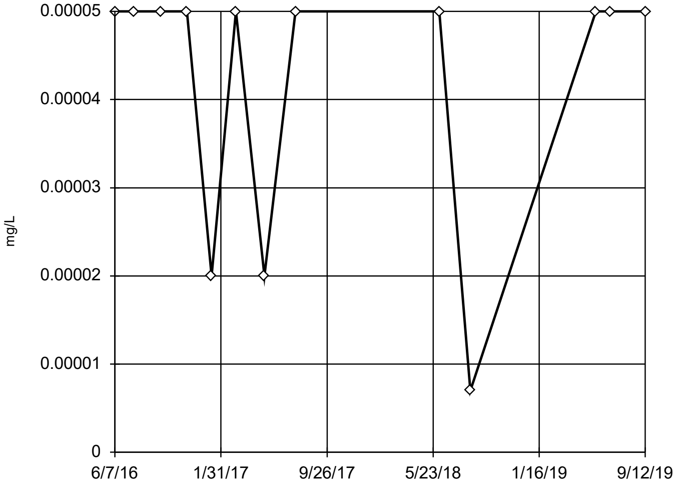
High cutoff = 0.00009481, low cutoff = 0.00001266, based on IQR multiplier of 3.

Constituent: Cadmium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Tukey's Outlier Screening

MW-1606D



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).

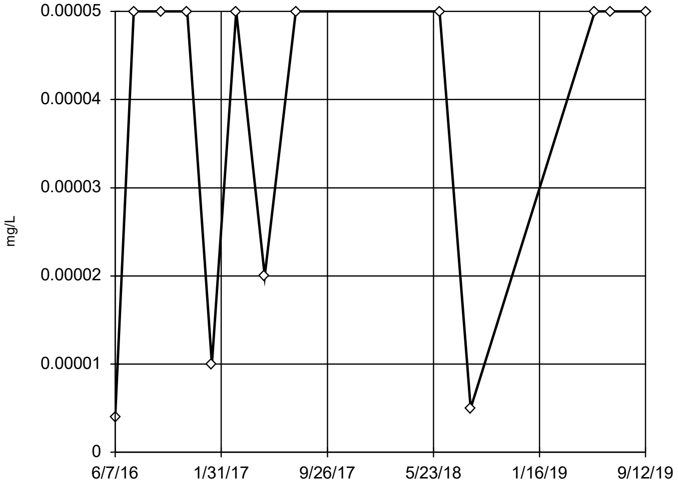
High cutoff = 0.0001203, low cutoff = 0.000003509, based on IQR multiplier of 3.

Constituent: Cadmium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Tukey's Outlier Screening

MW-1606I



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).

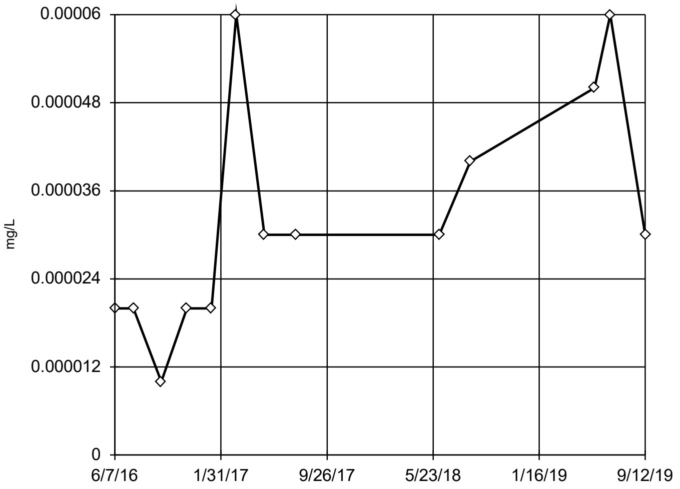
High cutoff = 0.0004106, low cutoff = -0.000002271, based on IQR multiplier of 3.

Constituent: Cadmium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

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).

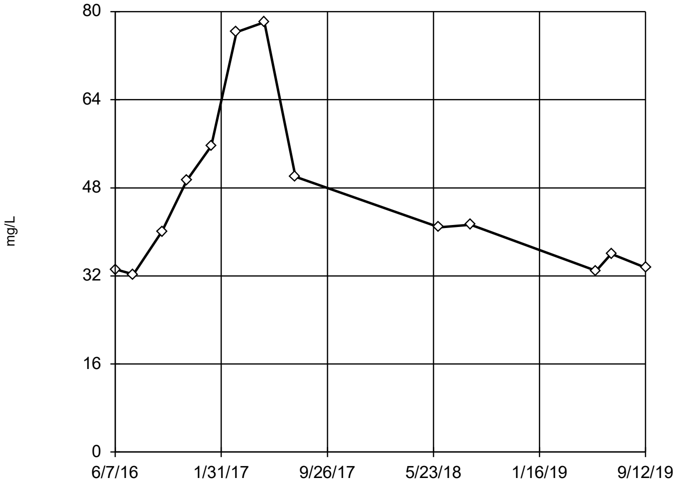
High cutoff = 0.0002231, low cutoff = 8.2e-9, based on IQR multiplier of 3.

Constituent: Cadmium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Tukey's Outlier Screening

MW-1002



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 = 208.4, low cutoff = 8.439, based on IQR multiplier of 3.

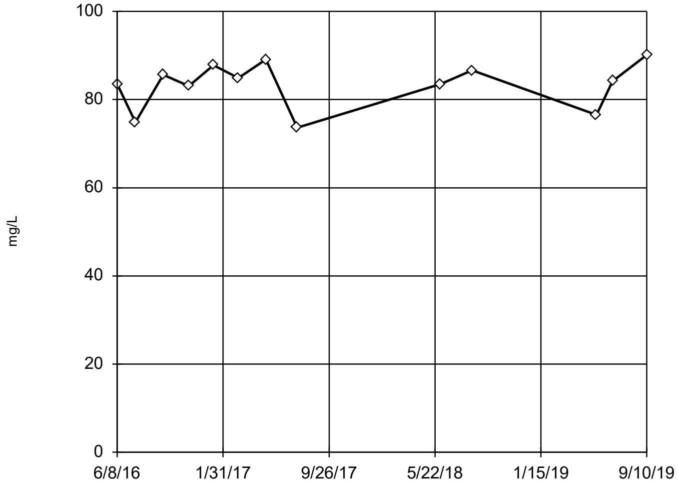
Constituent: Calcium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1600D (bg)



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).

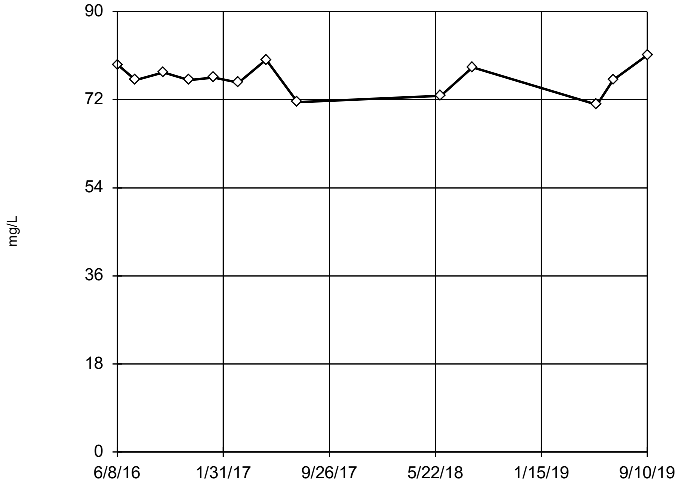
High cutoff = 99.41, low cutoff = -79.91, based on IQR multiplier of 3.

Constituent: Calcium, total Analysis Run 12/5/2019 10:09 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1600I (bg)



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).

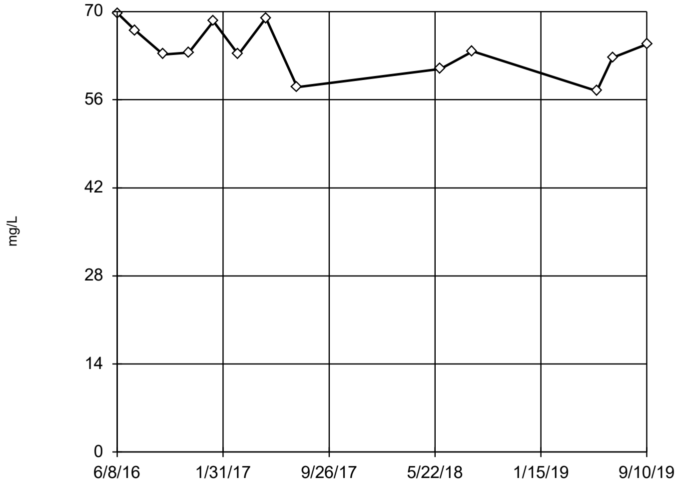
High cutoff = 87.99, low cutoff = -61.8, based on IQR multiplier of 3.

Constituent: Calcium, total Analysis Run 12/5/2019 10:09 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1600S (bg)



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).

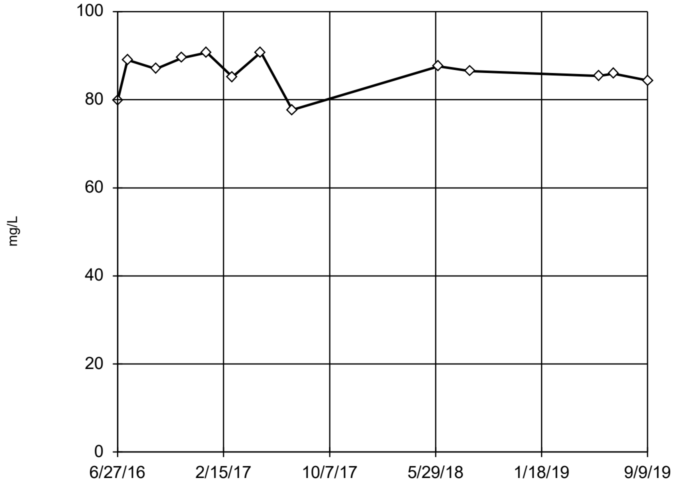
High cutoff = 83.08, low cutoff = 38.84, based on IQR multiplier of 3.

Constituent: Calcium, total Analysis Run 12/5/2019 10:09 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1601D (bg)



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).

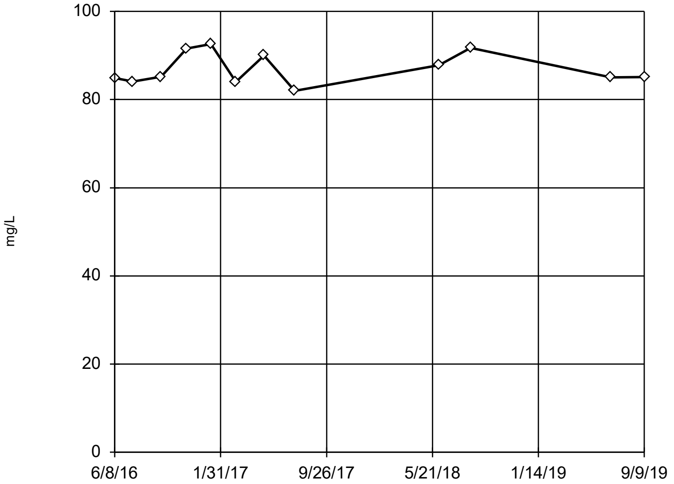
High cutoff = 98.37, low cutoff = -55.27, based on IQR multiplier of 3.

Constituent: Calcium, total Analysis Run 12/5/2019 10:09 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1601I (bg)



n = 12

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 = 112.6, low cutoff = 68.11, based on IQR multiplier of 3.

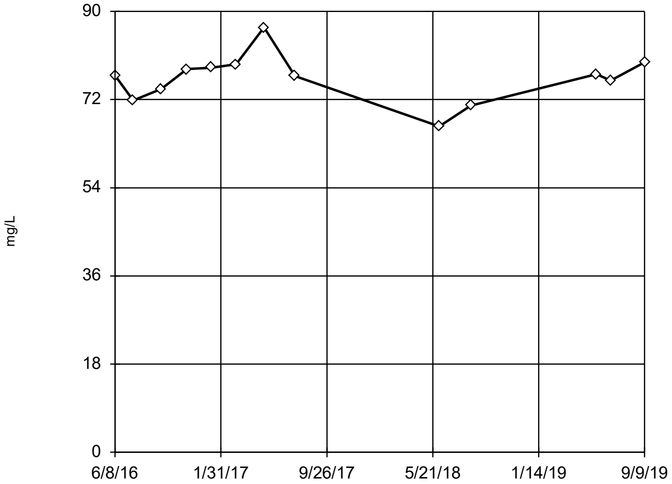
Constituent: Calcium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1601S (bg)



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 = 96.4, low cutoff = 55.45, based on IQR multiplier of 3.

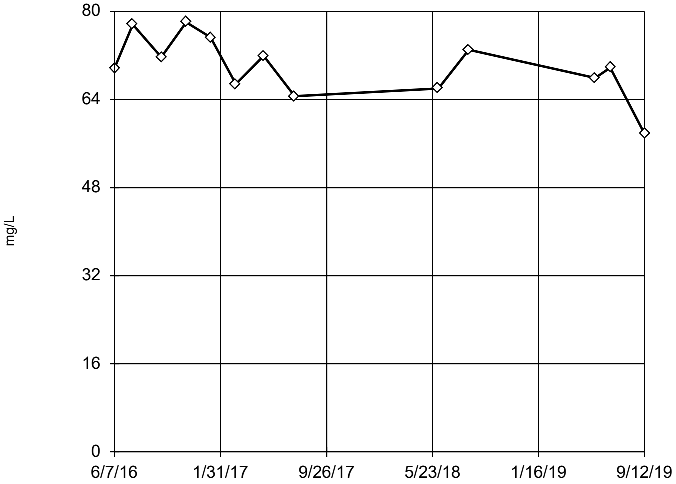
Constituent: Calcium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602D



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 = 91, low cutoff = -37.52, based on IQR multiplier of 3.

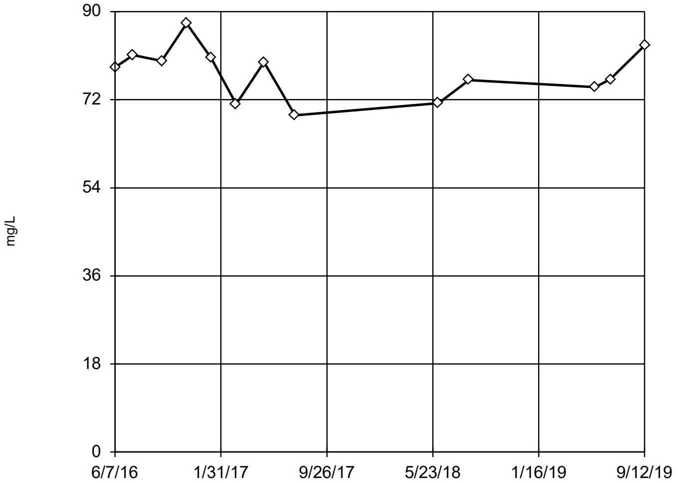
Constituent: Calcium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602I



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 = 104.6, low cutoff = 49.25, based on IQR multiplier of 3.

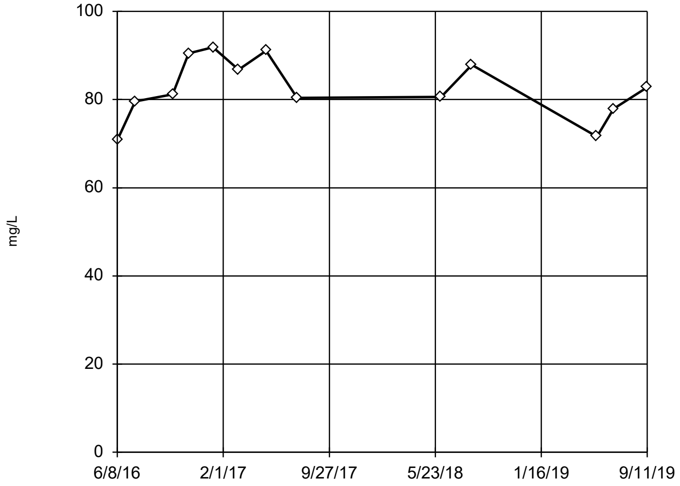
Constituent: Calcium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603D



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 = 115, low cutoff = 30.56, based on IQR multiplier of 3.

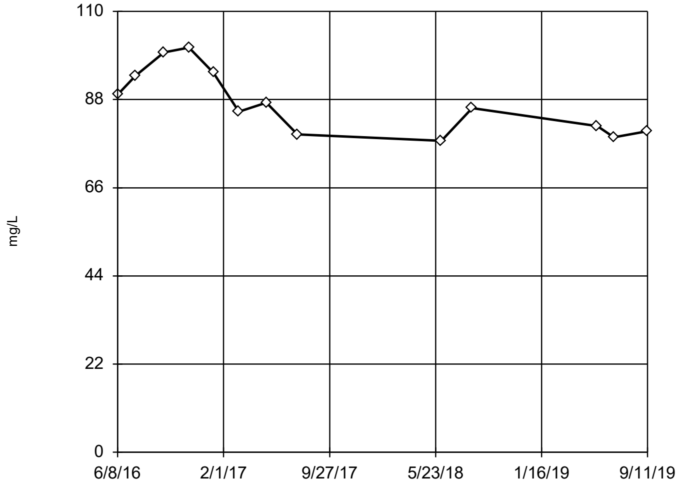
Constituent: Calcium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603I



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 = 156.2, low cutoff = 48.12, based on IQR multiplier of 3.

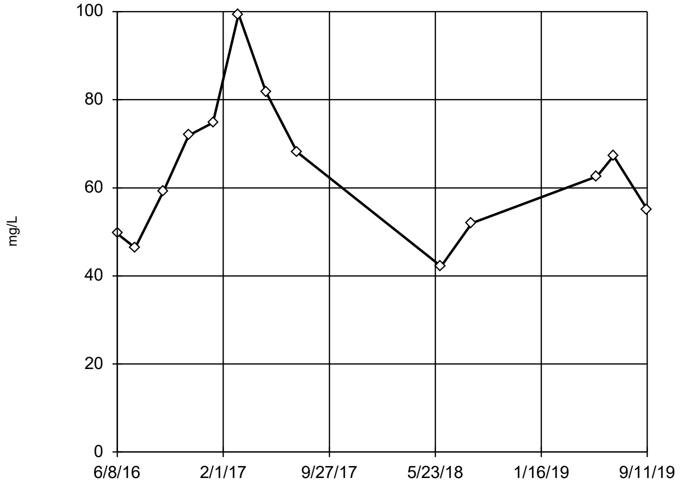
Constituent: Calcium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603S



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 = 220.8, low cutoff = 16.87, based on IQR multiplier of 3.

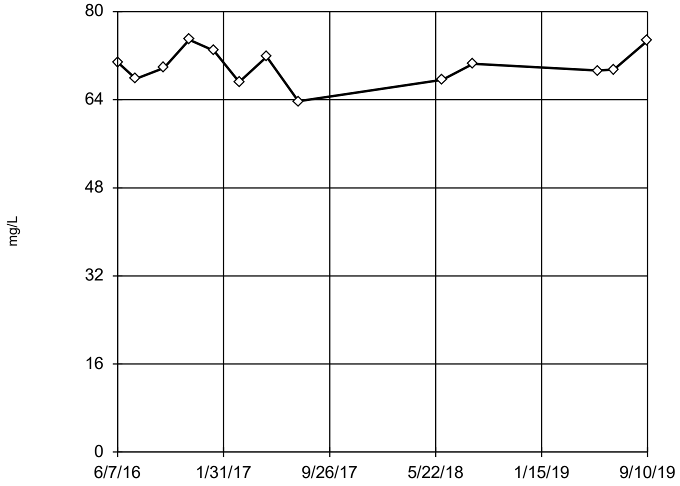
Constituent: Calcium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604D



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 = 84.79, low cutoff = 51.27, based on IQR multiplier of 3.

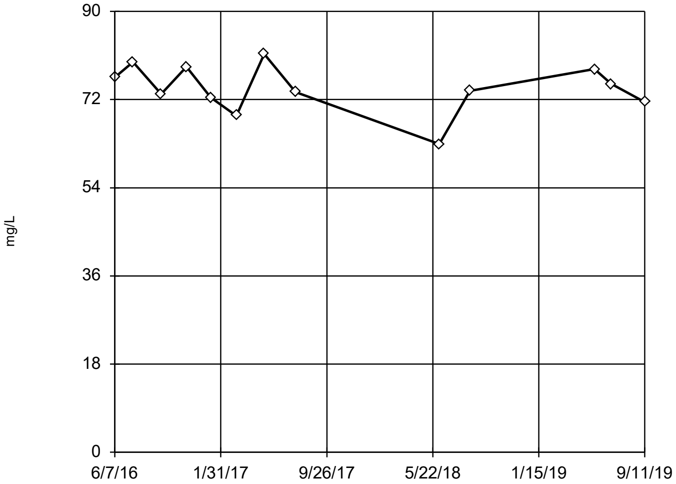
Constituent: Calcium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604I



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).

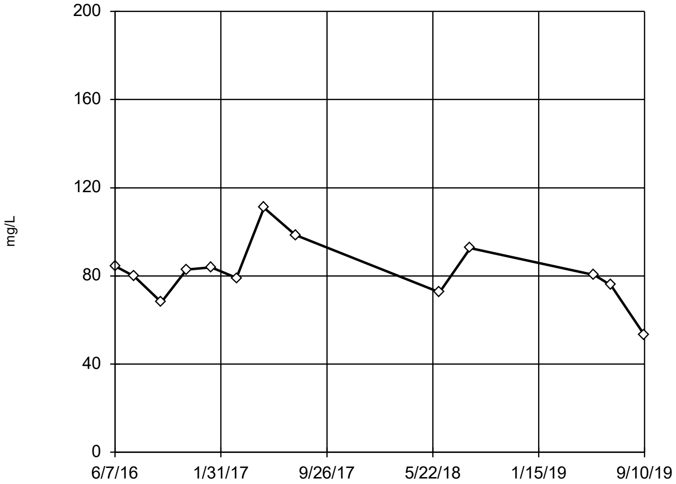
High cutoff = 90.59, low cutoff = -65.43, based on IQR multiplier of 3.

Constituent: Calcium, total   Analysis Run 12/5/2019 10:09 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_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.

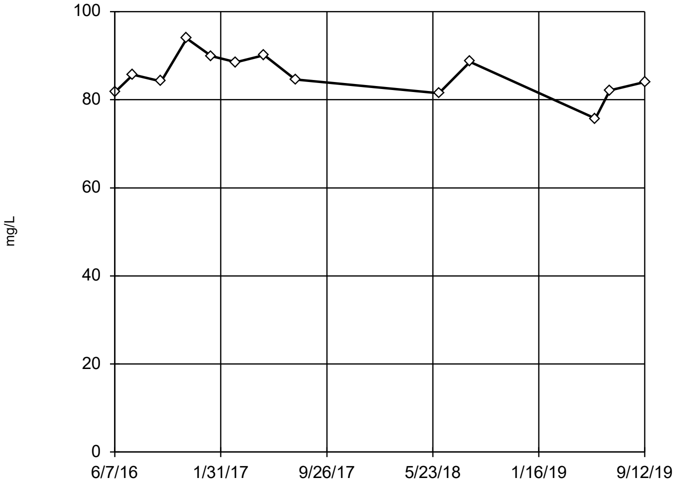
High cutoff = 131.8, low cutoff = 30.95, based on IQR multiplier of 3.

Constituent: Calcium, total   Analysis Run 12/5/2019 10:09 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_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).

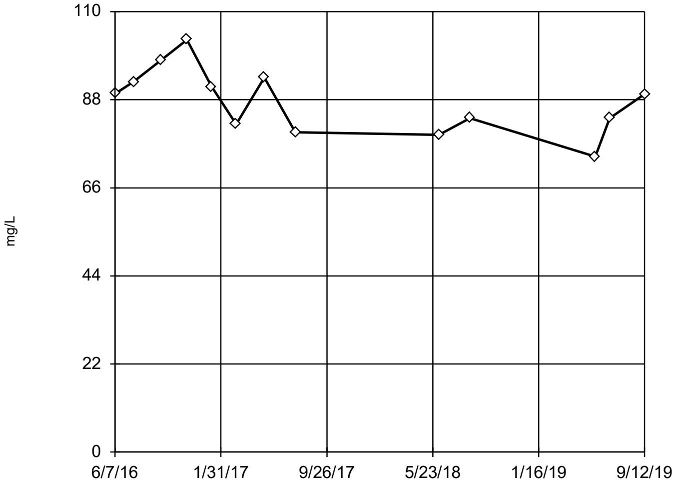
High cutoff = 108.4, low cutoff = 54.15, based on IQR multiplier of 3.

Constituent: Calcium, total   Analysis Run 12/5/2019 10:09 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605I



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).

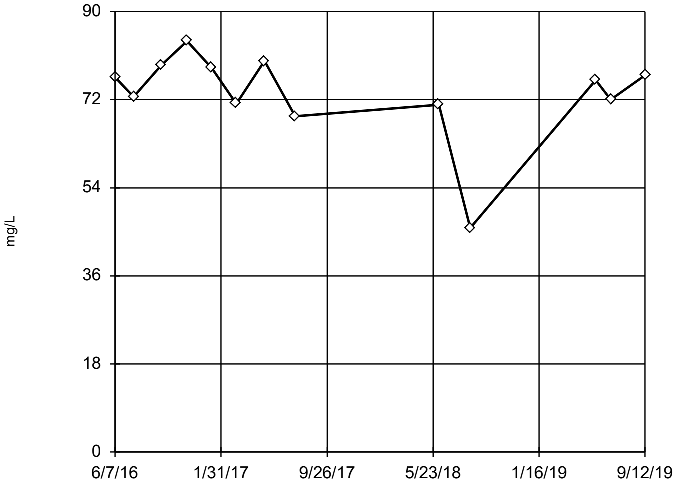
High cutoff = 141.3, low cutoff = 53.24, based on IQR multiplier of 3.

Constituent: Calcium, total   Analysis Run 12/5/2019 10:09 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_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 x^6 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 91.07, low cutoff = -76.58, based on IQR multiplier of 3.

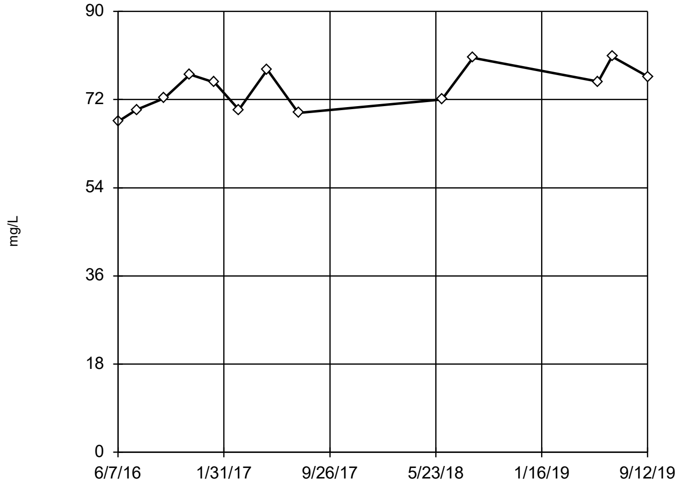
Constituent: Calcium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606D



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 = 103.1, low cutoff = 49.22, based on IQR multiplier of 3.

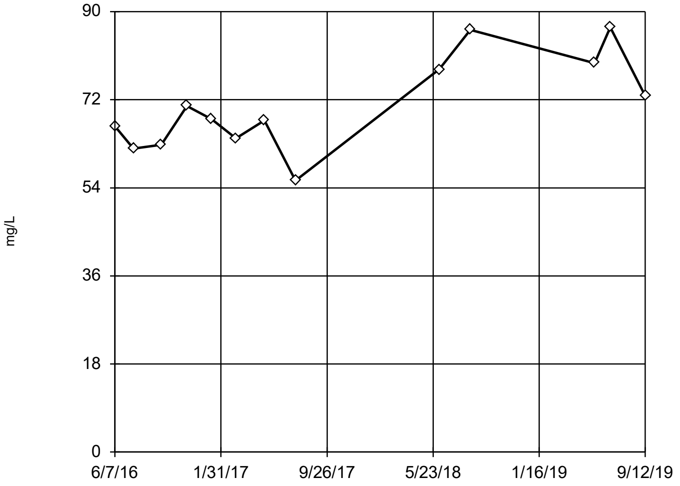
Constituent: Calcium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606I



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 = 151.3, low cutoff = 33.06, based on IQR multiplier of 3.

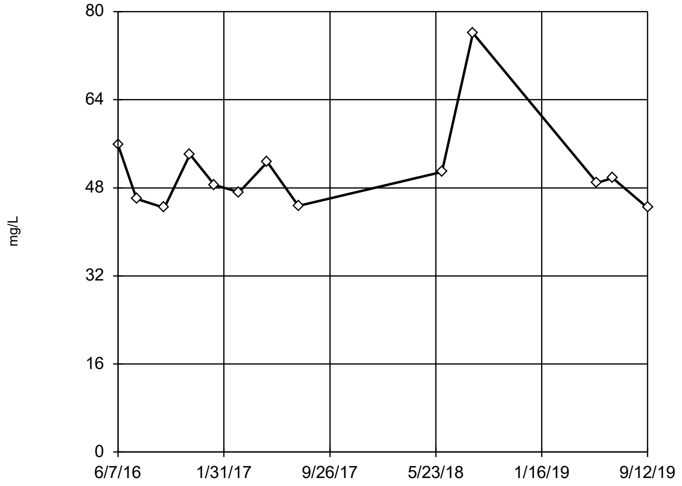
Constituent: Calcium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_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 = 87.18, low cutoff = 27.77, based on IQR multiplier of 3.

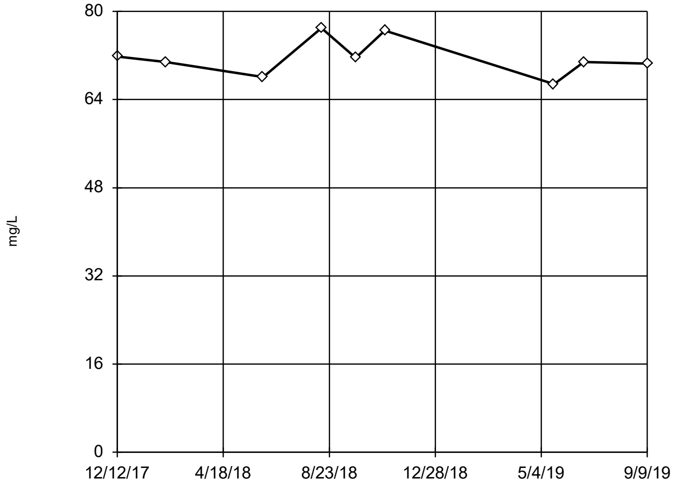
Constituent: Calcium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1701D (bg)



n = 9

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 = 90.69, low cutoff = 56.62, based on IQR multiplier of 3.

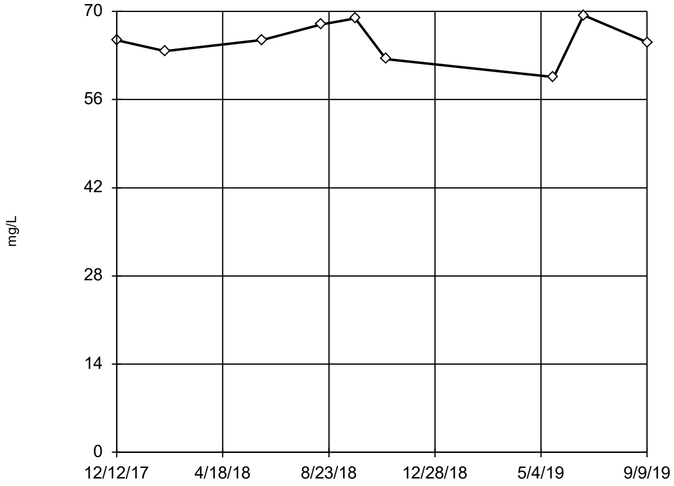
Constituent: Calcium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1701I (bg)



n = 9

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 = 79.6, low cutoff = -39.5, based on IQR multiplier of 3.

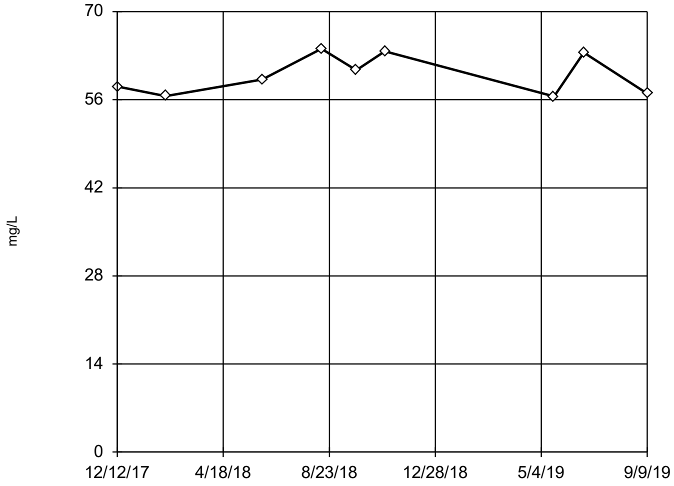
Constituent: Calcium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1701S (bg)



n = 9

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 = 89.29, low cutoff = 40.46, based on IQR multiplier of 3.

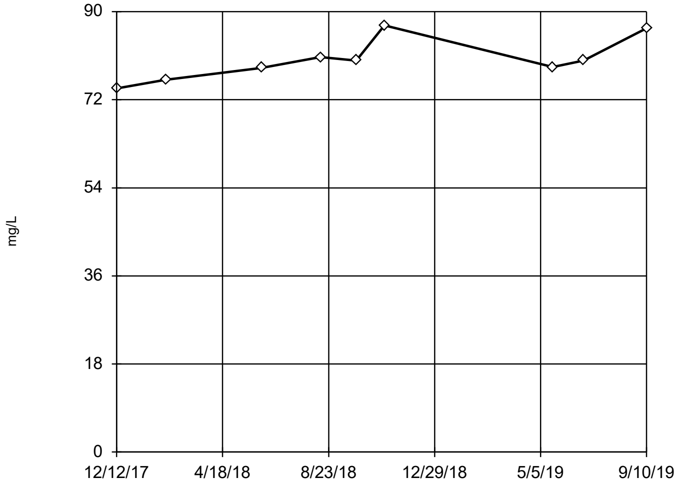
Constituent: Calcium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1702D (bg)



n = 9

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 = 105.8, low cutoff = 61.08, based on IQR multiplier of 3.

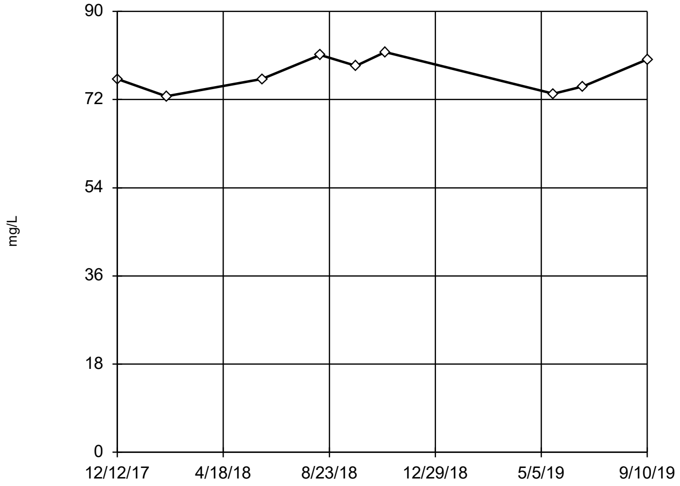
Constituent: Calcium, total Analysis Run 12/5/2019 10:09 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1702I (bg)



n = 9

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 = 104.6, low cutoff = 57, based on IQR multiplier of 3.

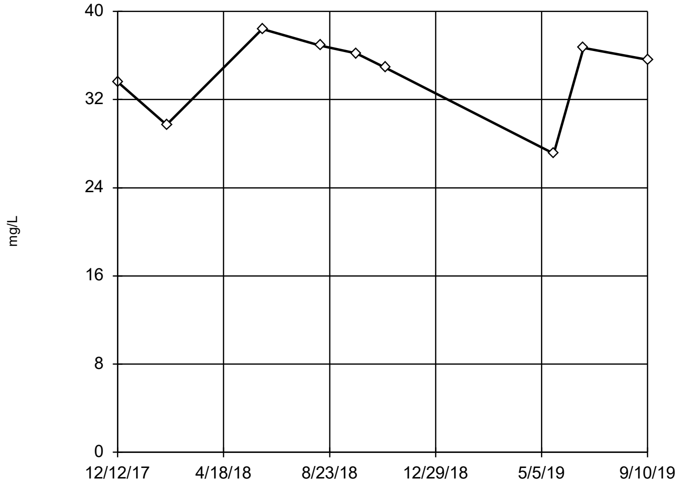
Constituent: Calcium, total   Analysis Run 12/5/2019 10:09 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1702S (bg)



n = 9

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 = 43.47, low cutoff = -38.39, based on IQR multiplier of 3.

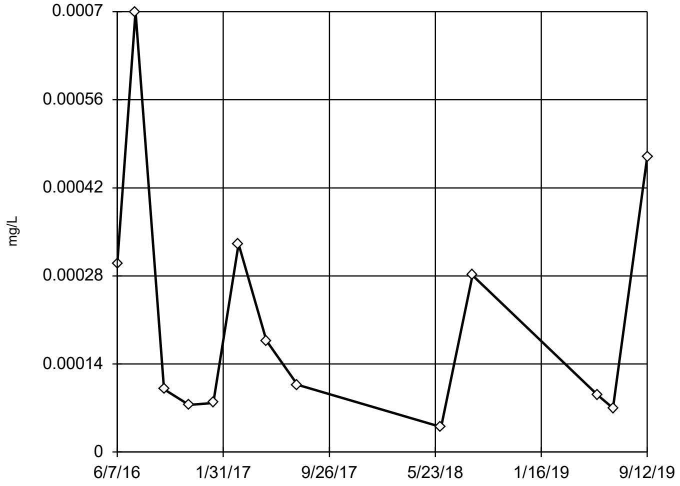
Constituent: Calcium, total   Analysis Run 12/5/2019 10:09 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1002



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 = 0.02204, low cutoff = 0.000001094, based on IQR multiplier of 3.

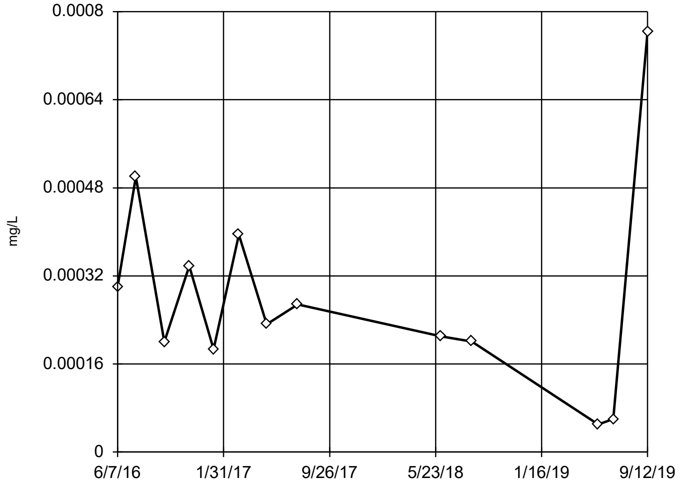
Constituent: Chromium, total   Analysis Run 12/5/2019 10:09 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602D



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 = 0.001211, low cutoff = -0.000003081, based on IQR multiplier of 3.

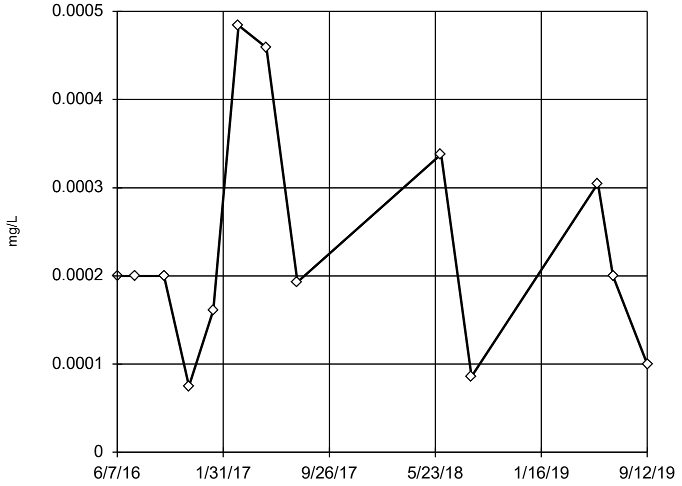
Constituent: Chromium, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602I



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 = 0.005202, low cutoff = 0.000007831, based on IQR multiplier of 3.

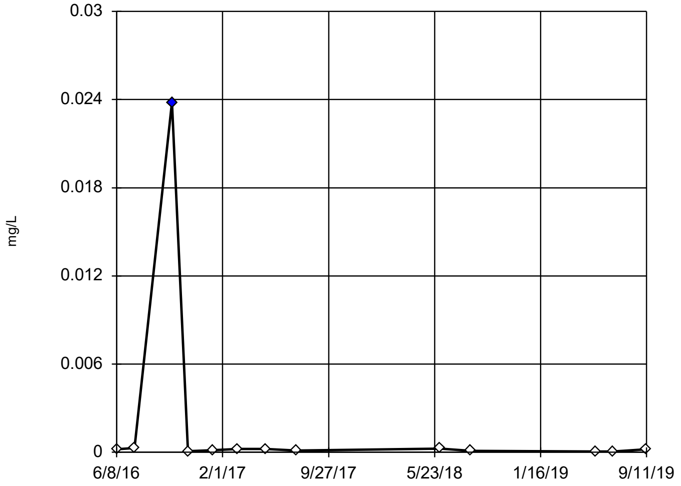
Constituent: Chromium, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603D



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 = 0.00522, low cutoff = 0.000004124, based on IQR multiplier of 3.

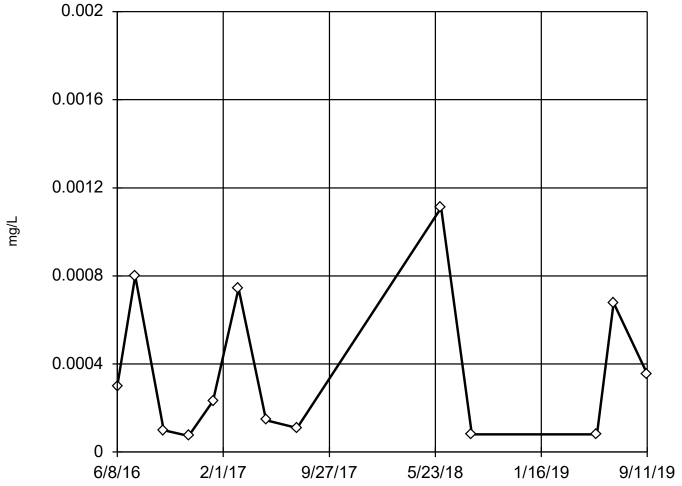
Constituent: Chromium, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603I



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 = 0.3481, low cutoff = 1.8e-7, based on IQR multiplier of 3.

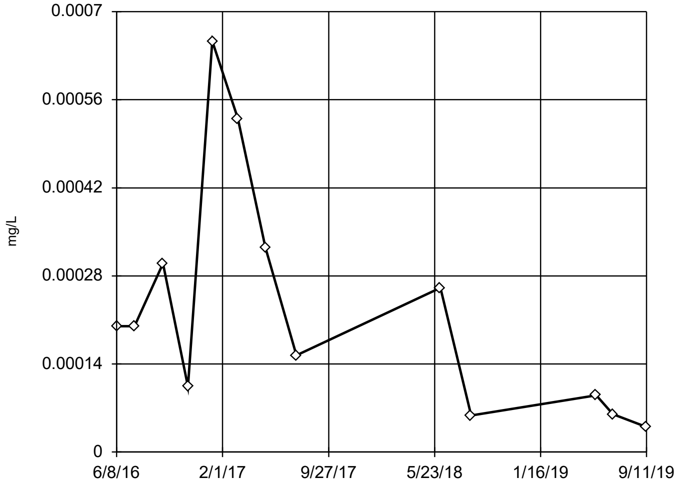
Constituent: Chromium, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603S



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 = 0.02396, low cutoff = 9.6e-7, based on IQR multiplier of 3.

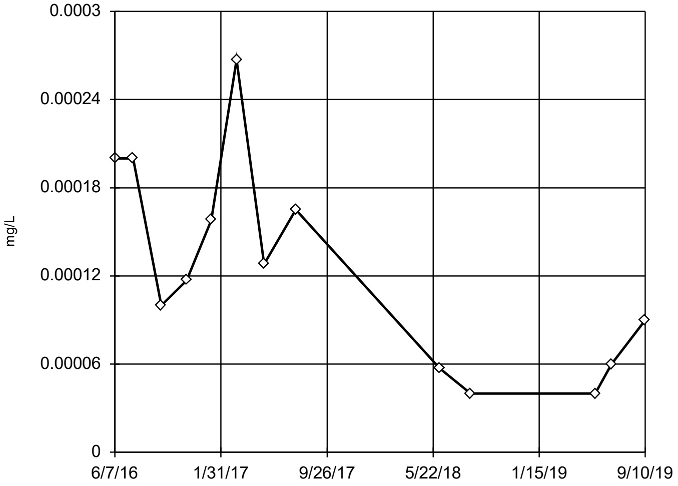
Constituent: Chromium, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

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).

High cutoff = 0.0009629, low cutoff = -0.0000978, based on IQR multiplier of 3.

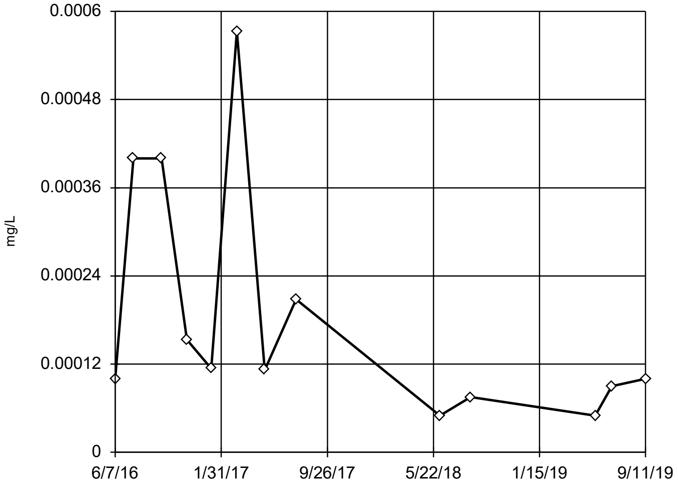
Constituent: Chromium, total Analysis Run 12/5/2019 10:10 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604I



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 = 0.01248, low cutoff = 0.000001899, based on IQR multiplier of 3.

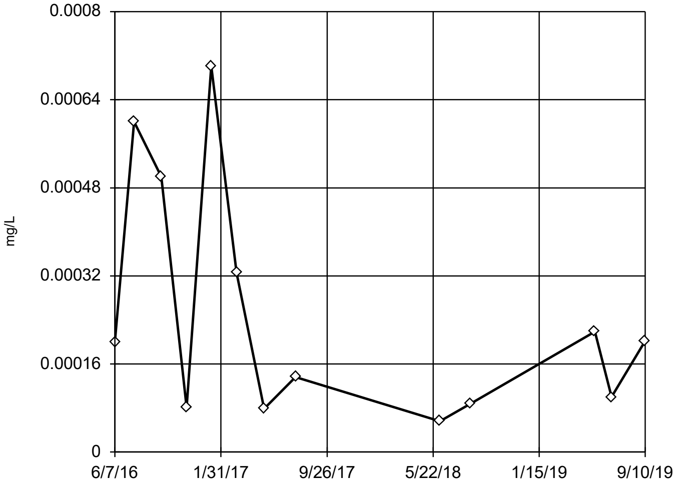
Constituent: Chromium, total Analysis Run 12/5/2019 10:10 AM

Rockport BAP Client: Geosyntec Data: Rockport_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 = 0.04415, low cutoff = 7.7e-7, based on IQR multiplier of 3.

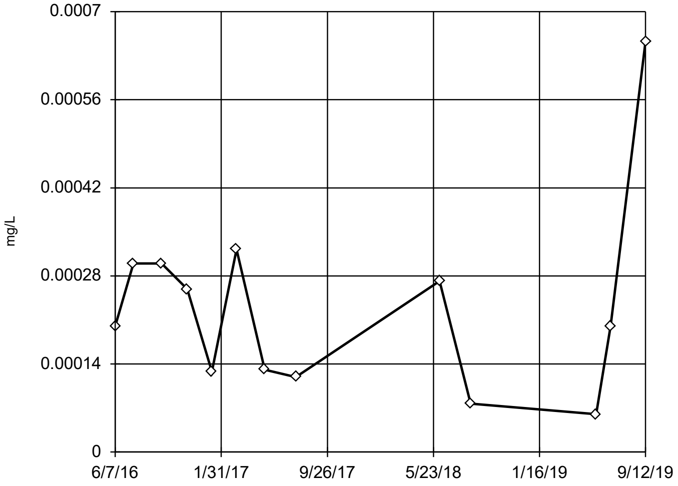
Constituent: Chromium, total Analysis Run 12/5/2019 10:10 AM

Rockport BAP Client: Geosyntec Data: Rockport_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 = 0.004309, low cutoff = 0.000008593, based on IQR multiplier of 3.

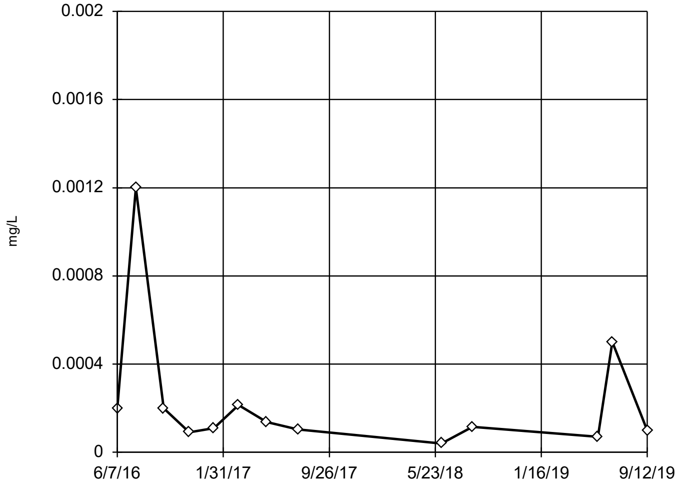
Constituent: Chromium, total Analysis Run 12/5/2019 10:10 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605I



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).

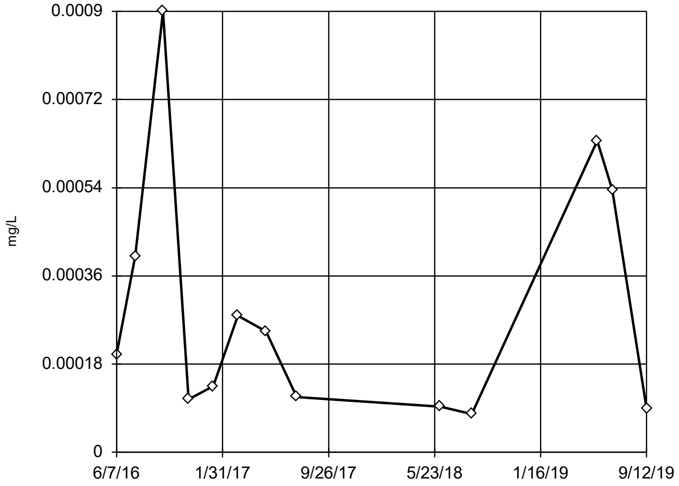
High cutoff = 0.00211, low cutoff = 0.000009352, based on IQR multiplier of 3.

Constituent: Chromium, total Analysis Run 12/5/2019 10:10 AM
Rockport BAP Client: Geosyntec Data: Rockport_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).

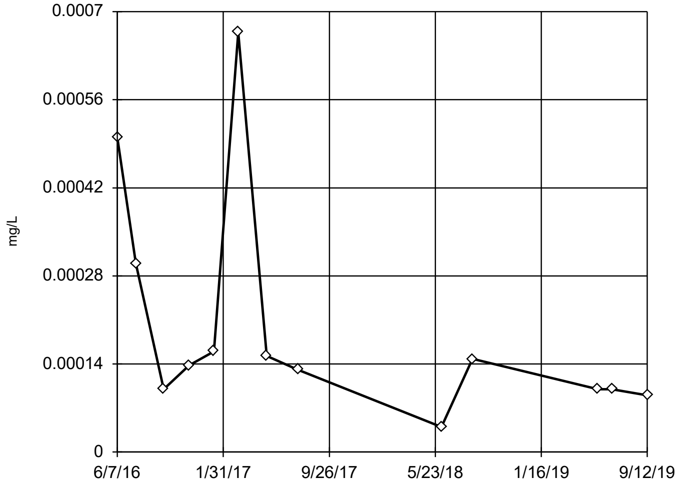
High cutoff = 0.04567, low cutoff = 0.000001016, based on IQR multiplier of 3.

Constituent: Chromium, total Analysis Run 12/5/2019 10:10 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

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).

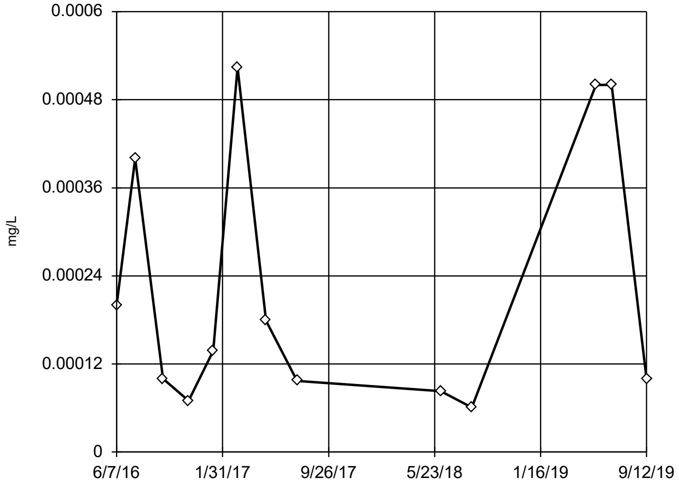
High cutoff = 0.002304, low cutoff = 0.000009509, based on IQR multiplier of 3.

Constituent: Chromium, total Analysis Run 12/5/2019 10:10 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606I



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).

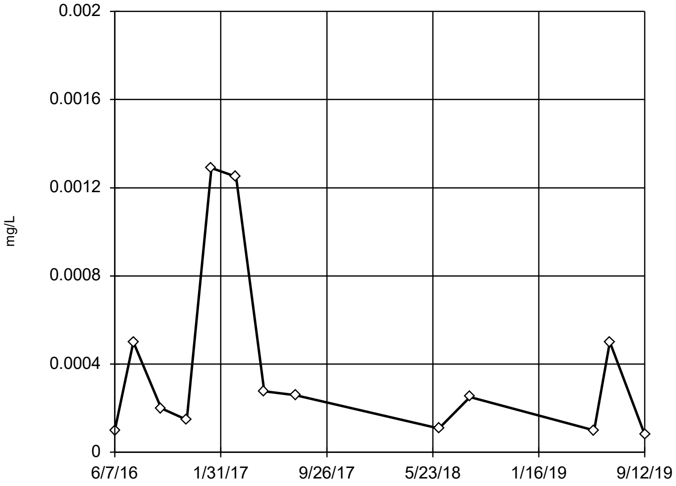
High cutoff = 0.05537, low cutoff = 7.2e-7, based on IQR multiplier of 3.

Constituent: Chromium, total Analysis Run 12/5/2019 10:10 AM
Rockport BAP Client: Geosyntec Data: Rockport_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 = 0.05569, low cutoff = 9.3e-7, based on IQR multiplier of 3.

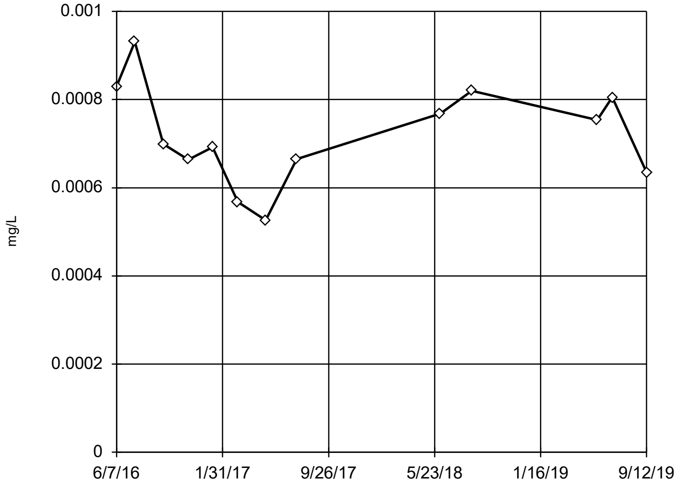
Constituent: Chromium, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1002



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 = 0.001302, low cutoff = 0.0001605, based on IQR multiplier of 3.

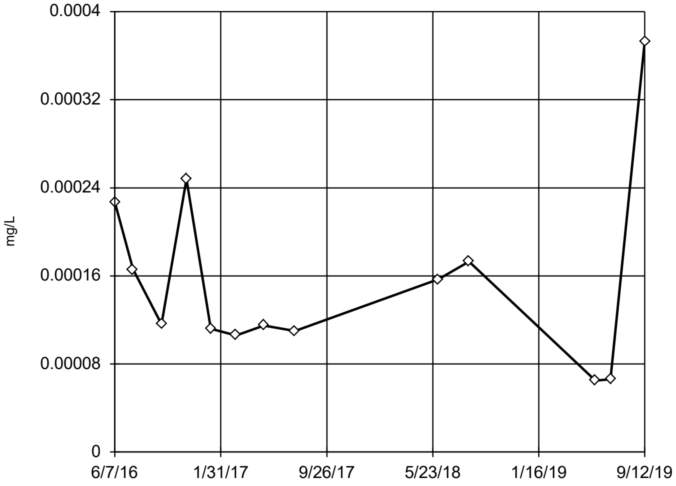
Constituent: Cobalt, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602D



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 = 0.001225, low cutoff = 0.00001747, based on IQR multiplier of 3.

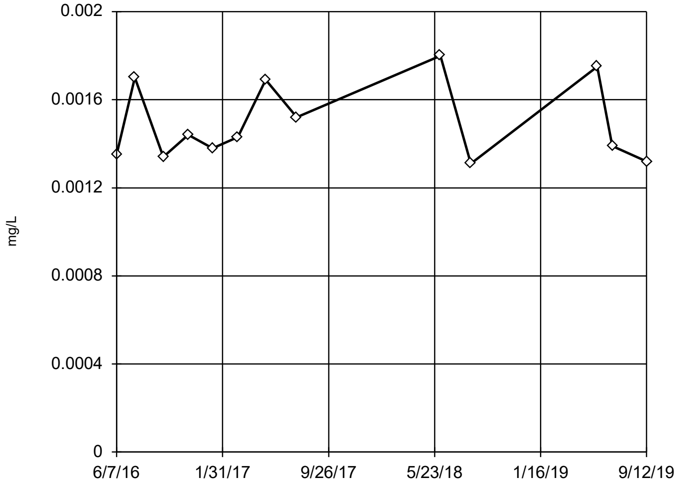
Constituent: Cobalt, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602I



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 = 0.003392, low cutoff = 0.000672, based on IQR multiplier of 3.

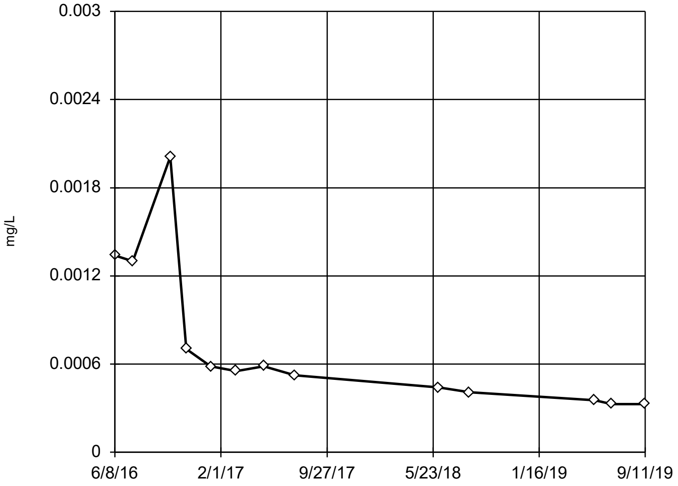
Constituent: Cobalt, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603D



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 = 0.01516, low cutoff = 0.00002399, based on IQR multiplier of 3.

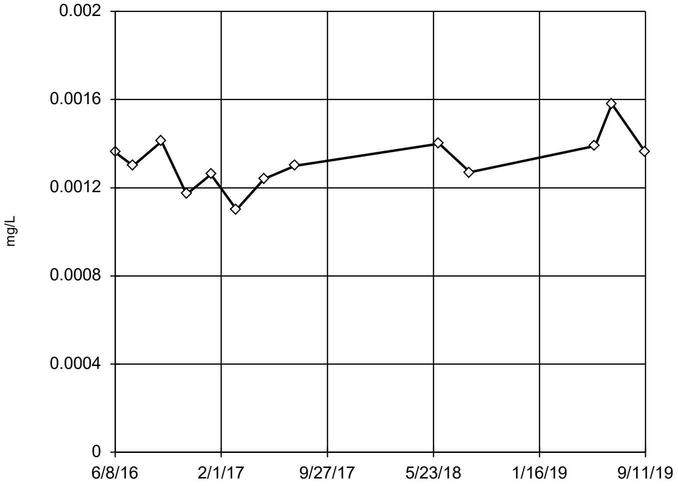
Constituent: Cobalt, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603I



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 = 0.001939, low cutoff = 0.0008992, based on IQR multiplier of 3.

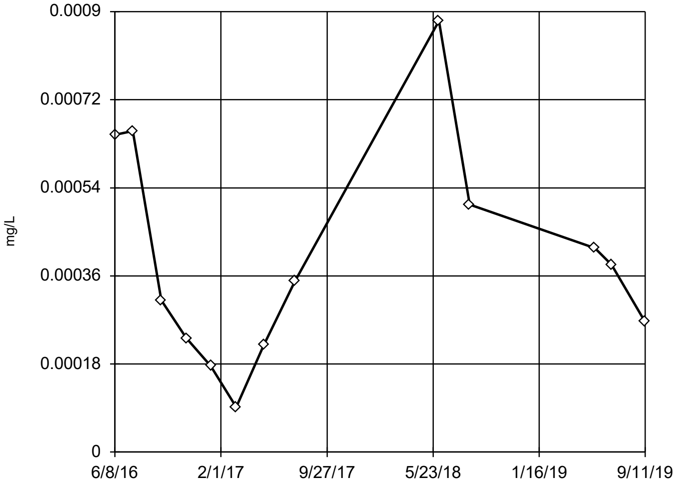
Constituent: Cobalt, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603S



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 = 0.003357, low cutoff = -1.9e-7, based on IQR multiplier of 3.

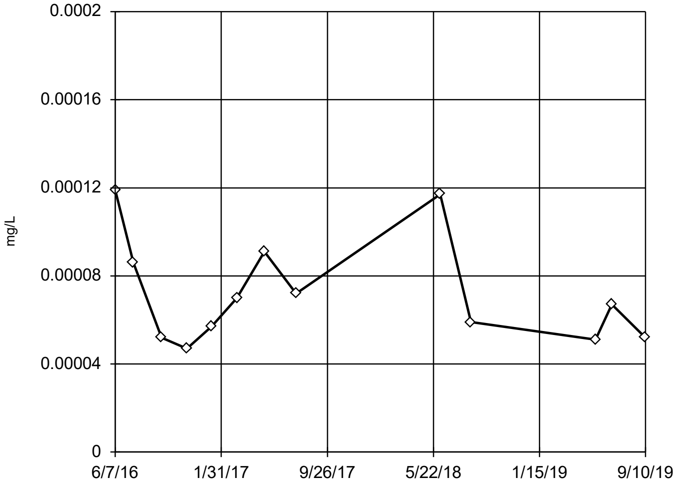
Constituent: Cobalt, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604D



n = 13

No outliers found. Tukey's method selected by user.

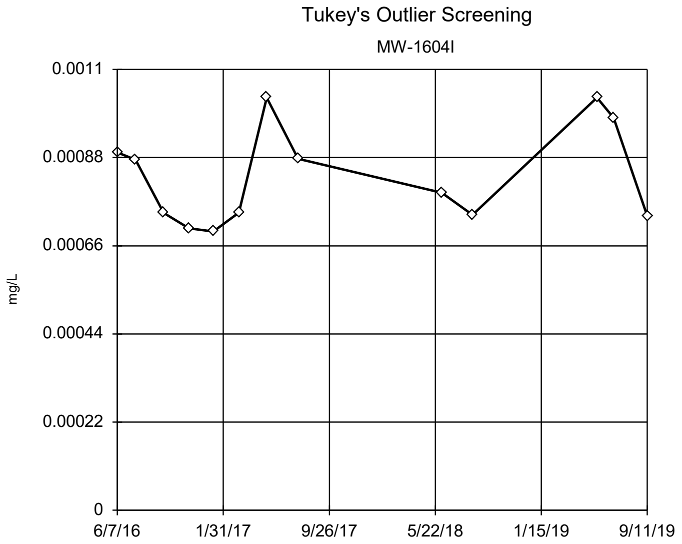
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.0004356, low cutoff = 0.00001056, based on IQR multiplier of 3.

Constituent: Cobalt, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



n = 13

No outliers found. Tukey's method selected by user.

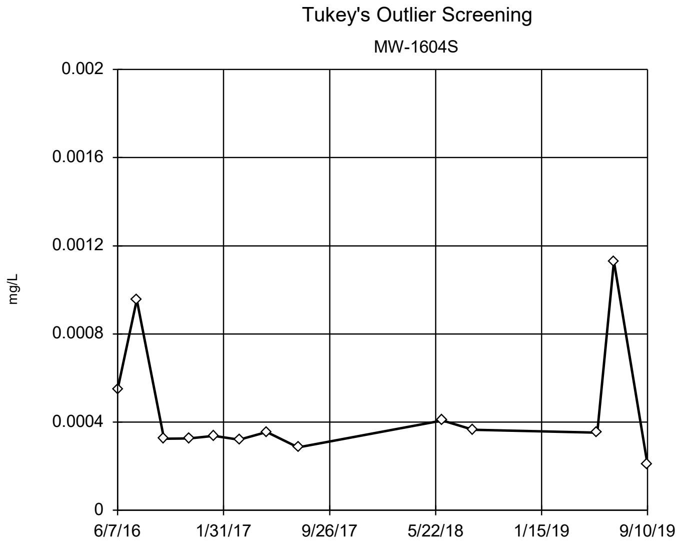
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.001917, low cutoff = 0.000359, based on IQR multiplier of 3.

Constituent: Cobalt, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



n = 13

No outliers found. Tukey's method selected by user.

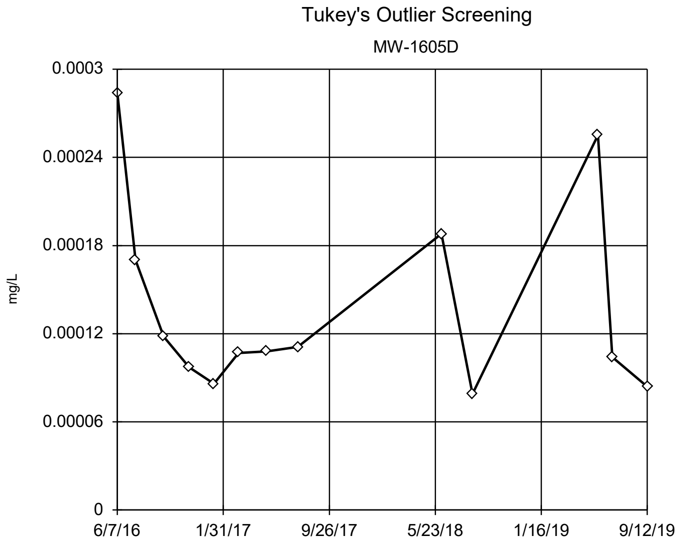
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.001476, low cutoff = 0.0001033, based on IQR multiplier of 3.

Constituent: Cobalt, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



n = 13

No outliers found. Tukey's method selected by user.

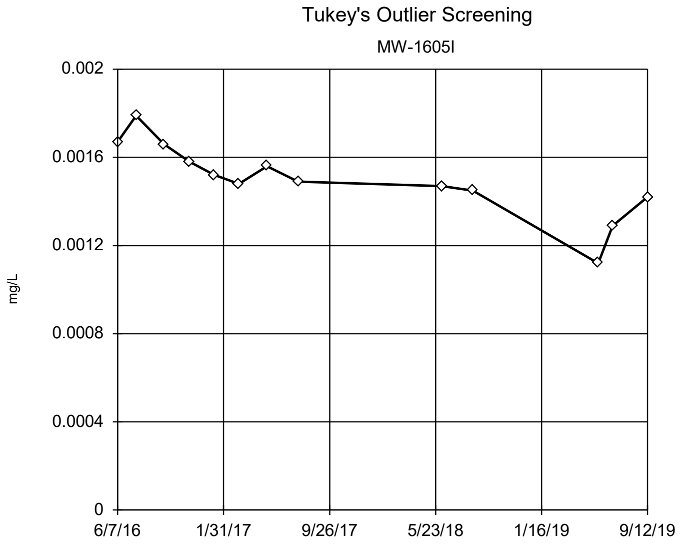
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.001341, low cutoff = 0.00001218, based on IQR multiplier of 3.

Constituent: Cobalt, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



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 = 0.002014, low cutoff = -0.0009845, based on IQR multiplier of 3.

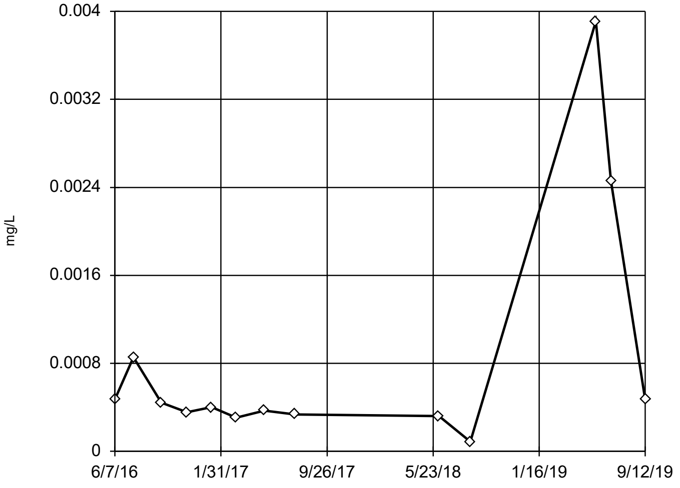
Constituent: Cobalt, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_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 = 0.004589, low cutoff = 0.00004544, based on IQR multiplier of 3.

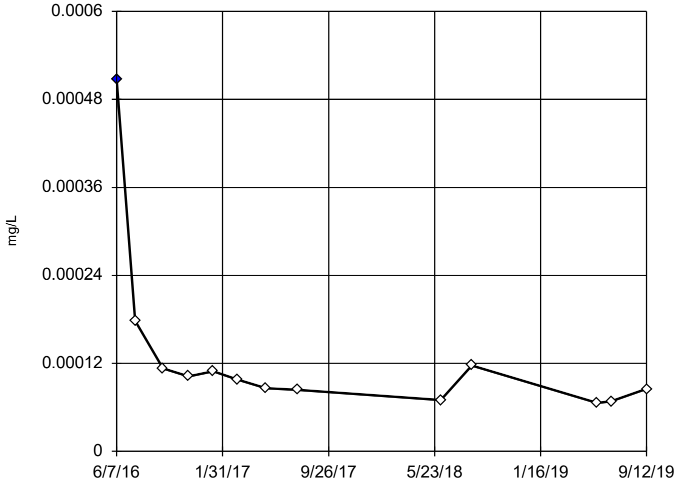
Constituent: Cobalt, total Analysis Run 12/5/2019 10:10 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606D



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 = 0.0003877, low cutoff = 0.00002274, based on IQR multiplier of 3.

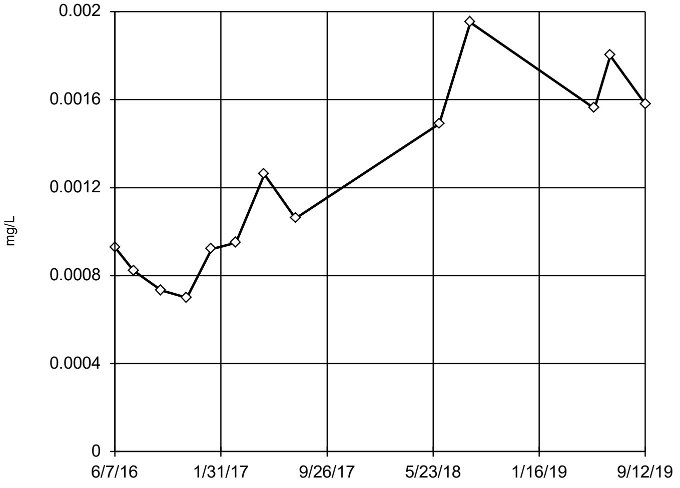
Constituent: Cobalt, total Analysis Run 12/5/2019 10:10 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606I



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 = 0.009206, low cutoff = 0.0001485, based on IQR multiplier of 3.

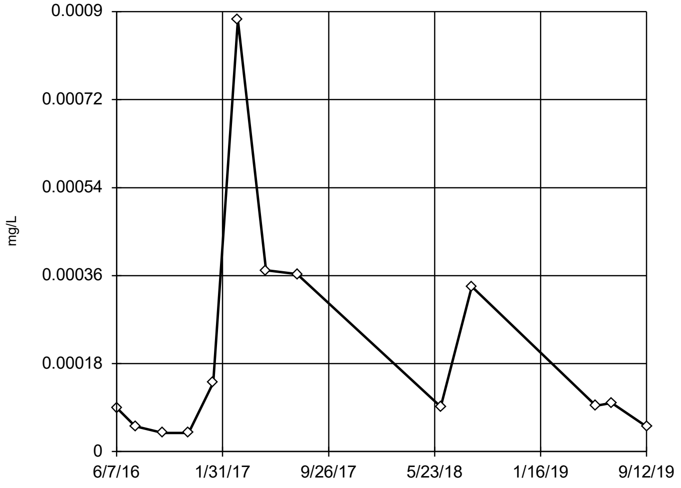
Constituent: Cobalt, total Analysis Run 12/5/2019 10:10 AM

Rockport BAP Client: Geosyntec Data: Rockport_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 = 0.1102, low cutoff = 1.6e-7, based on IQR multiplier of 3.

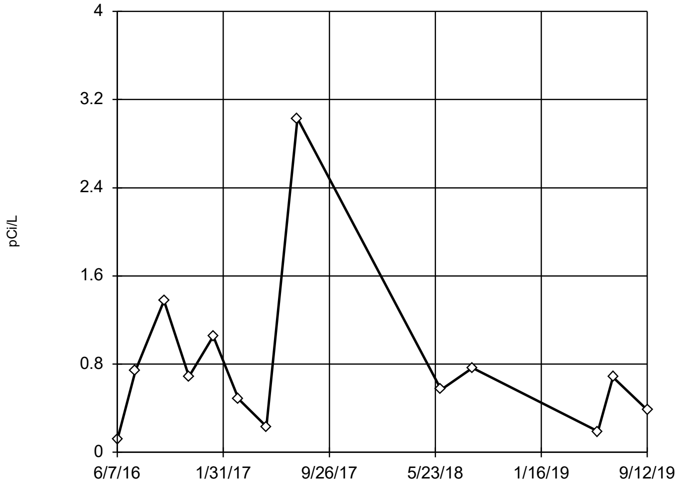
Constituent: Cobalt, total Analysis Run 12/5/2019 10:10 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1002



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 = 24.15, low cutoff = 0.01113, based on IQR multiplier of 3.

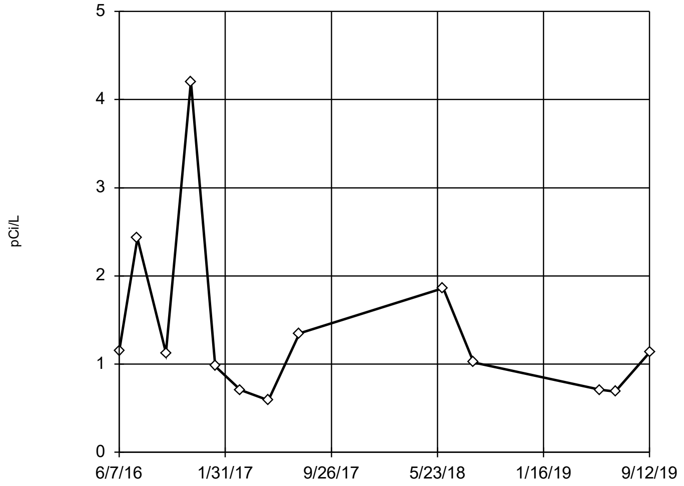
Constituent: Combined Radium 226 + 228   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602D



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 = 17.78, low cutoff = 0.06304, based on IQR multiplier of 3.

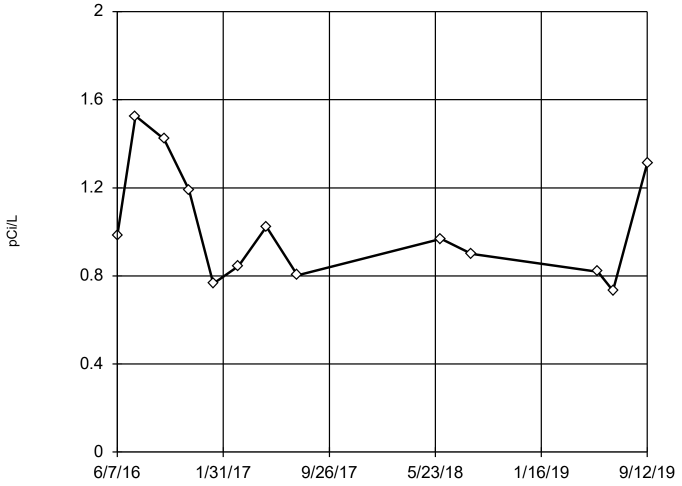
Constituent: Combined Radium 226 + 228   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602I



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 = 4.576, low cutoff = 0.2214, based on IQR multiplier of 3.

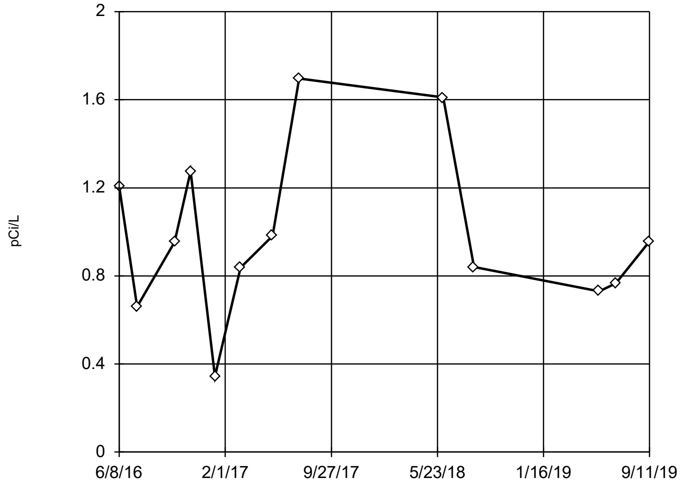
Constituent: Combined Radium 226 + 228   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603D



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 = 3.461, low cutoff = 0.01398, based on IQR multiplier of 3.

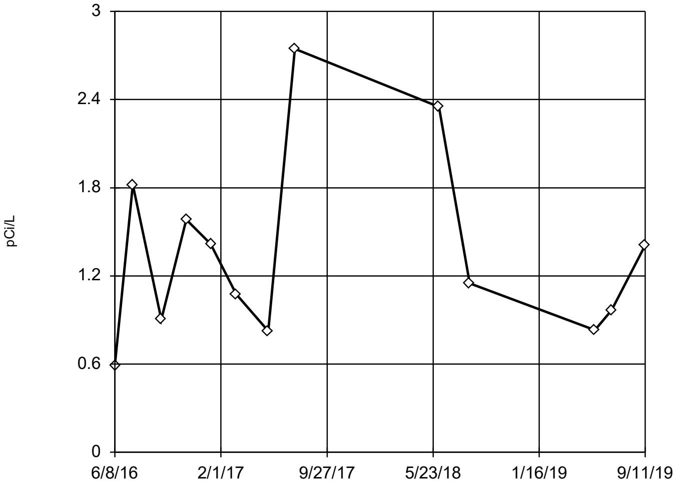
Constituent: Combined Radium 226 + 228   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603I



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 = 12.74, low cutoff = 0.1156, based on IQR multiplier of 3.

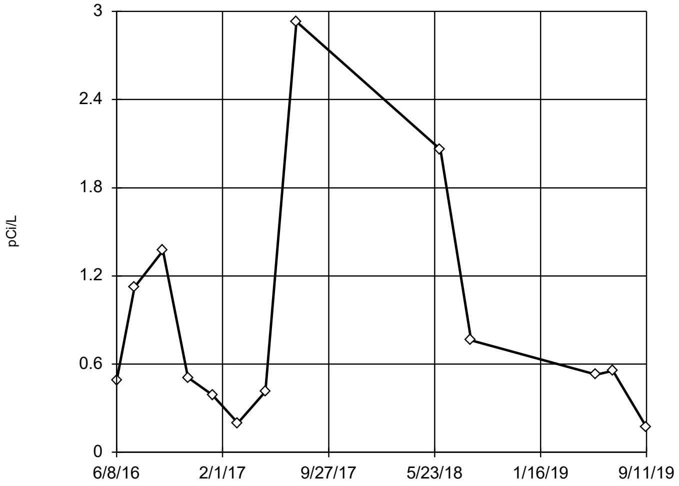
Constituent: Combined Radium 226 + 228 Analysis Run 12/5/2019 10:10 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603S



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 = 36.56, low cutoff = 0.01366, based on IQR multiplier of 3.

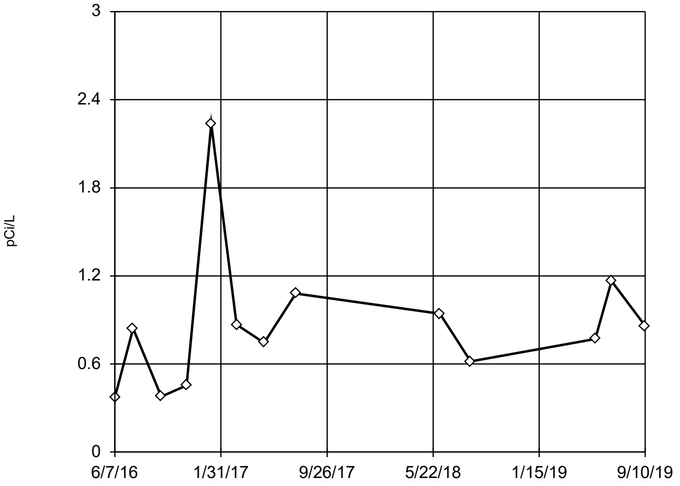
Constituent: Combined Radium 226 + 228 Analysis Run 12/5/2019 10:10 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

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 = 6.968, low cutoff = 0.07657, based on IQR multiplier of 3.

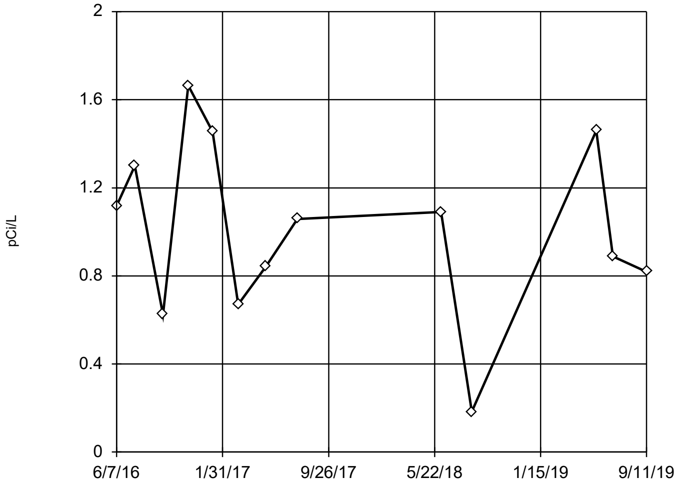
Constituent: Combined Radium 226 + 228 Analysis Run 12/5/2019 10:10 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604I



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 = 3.273, low cutoff = -1.151, based on IQR multiplier of 3.

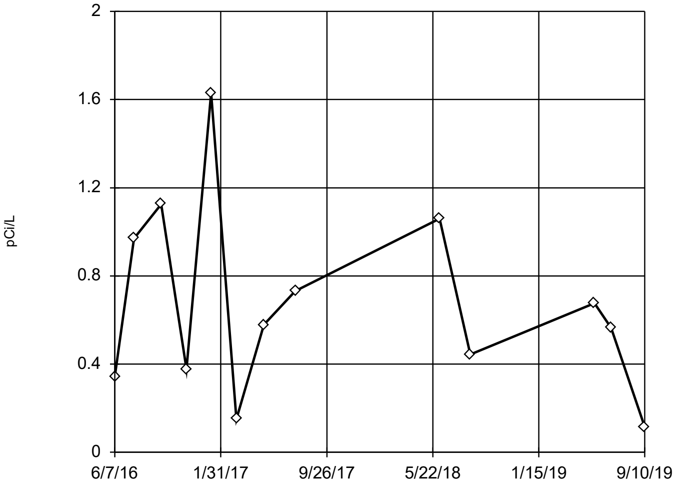
Constituent: Combined Radium 226 + 228 Analysis Run 12/5/2019 10:10 AM

Rockport BAP Client: Geosyntec Data: Rockport_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 = 4.964, low cutoff = -0.3854, based on IQR multiplier of 3.

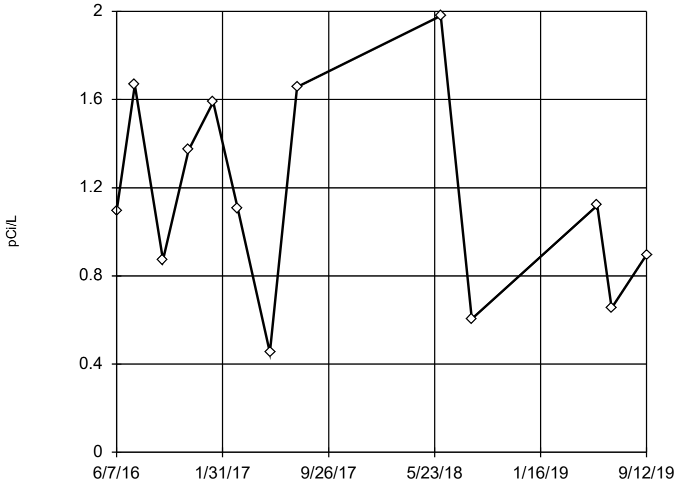
Constituent: Combined Radium 226 + 228   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_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).

High cutoff = 6.151, low cutoff = -0.1118, based on IQR multiplier of 3.

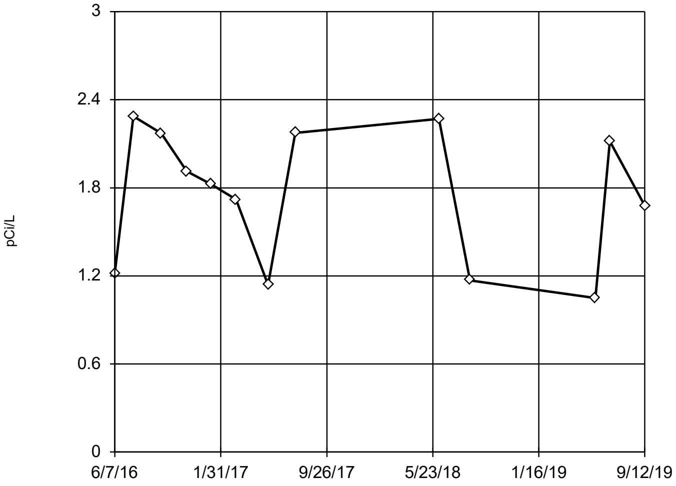
Constituent: Combined Radium 226 + 228   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605I



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 = 3.298, low cutoff = -2.881, based on IQR multiplier of 3.

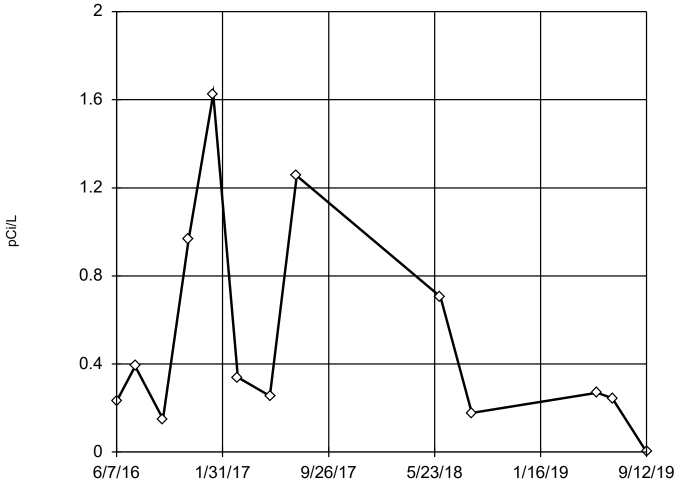
Constituent: Combined Radium 226 + 228   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_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 square root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 5.242, low cutoff = -0.8608, based on IQR multiplier of 3.

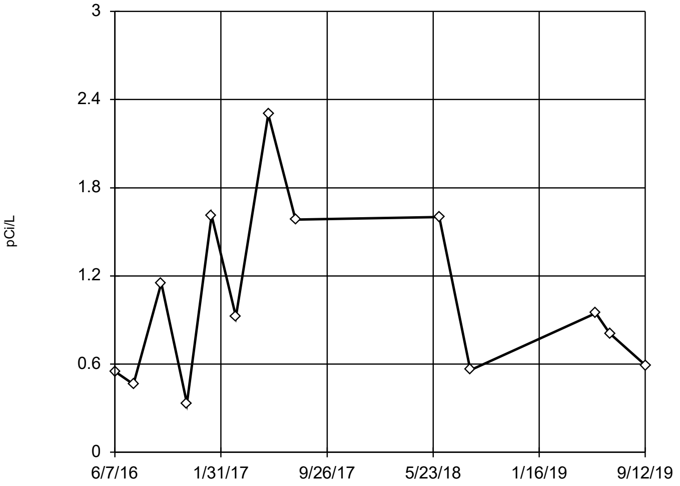
Constituent: Combined Radium 226 + 228   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

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).

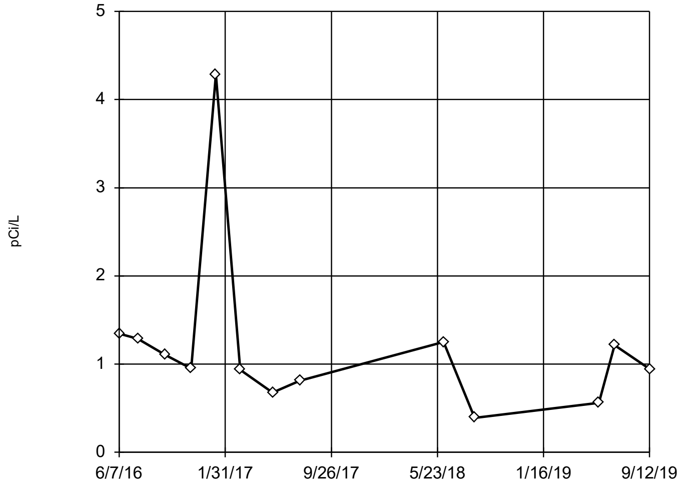
High cutoff = 37.47, low cutoff = 0.0236, based on IQR multiplier of 3.

Constituent: Combined Radium 226 + 228 Analysis Run 12/5/2019 10:10 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606I



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).

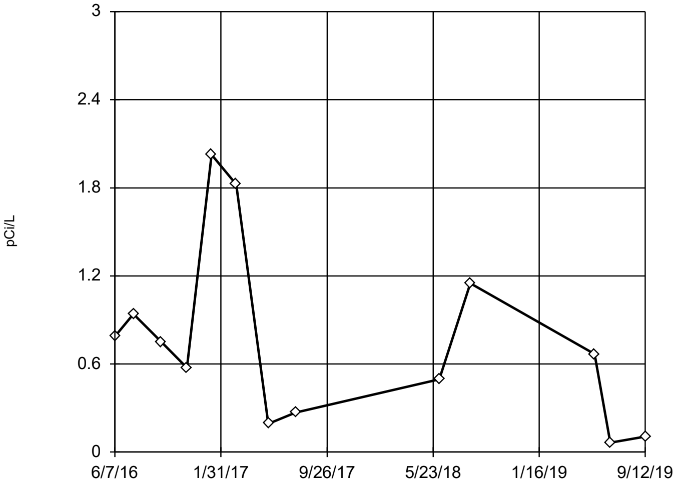
High cutoff = 6.328, low cutoff = 0.1486, based on IQR multiplier of 3.

Constituent: Combined Radium 226 + 228 Analysis Run 12/5/2019 10:10 AM
Rockport BAP Client: Geosyntec Data: Rockport_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).

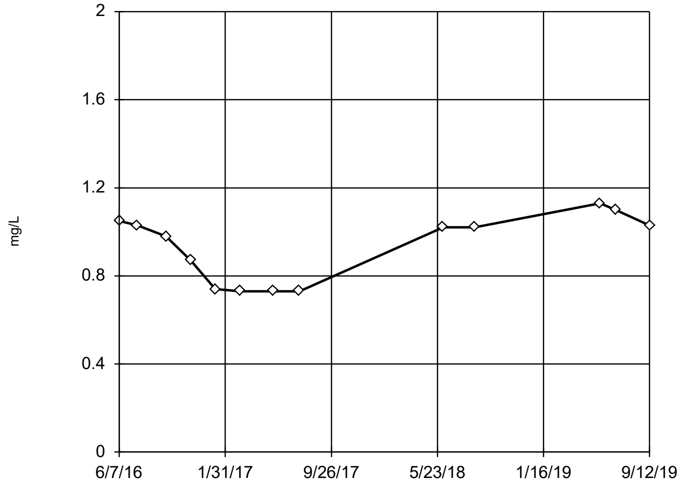
High cutoff = 10.95, low cutoff = -0.2113, based on IQR multiplier of 3.

Constituent: Combined Radium 226 + 228 Analysis Run 12/5/2019 10:10 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1002



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).

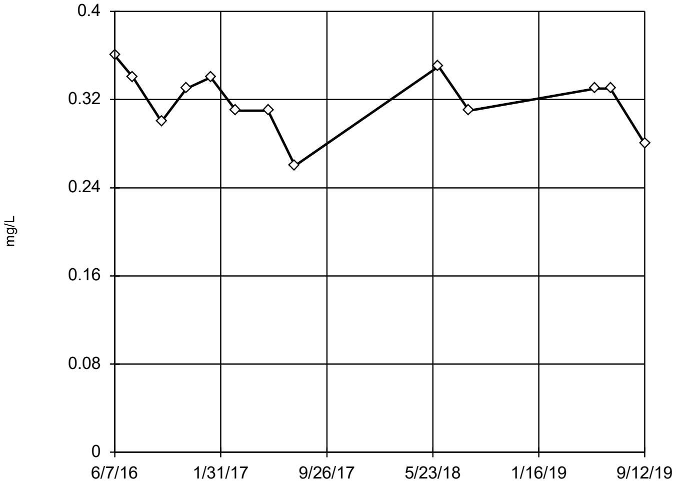
High cutoff = 1.289, low cutoff = -1.212, based on IQR multiplier of 3.

Constituent: Fluoride, total Analysis Run 12/5/2019 10:10 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602D



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 = 0.4, low cutoff = -0.3138, based on IQR multiplier of 3.

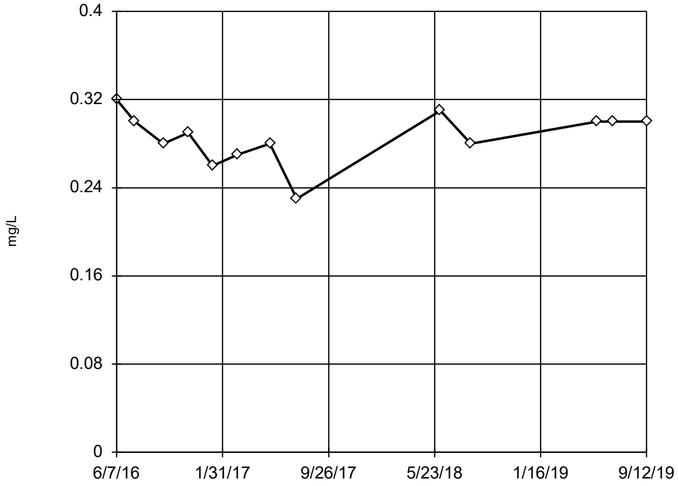
Constituent: Fluoride, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602I



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 = 0.3464, low cutoff = -0.2501, based on IQR multiplier of 3.

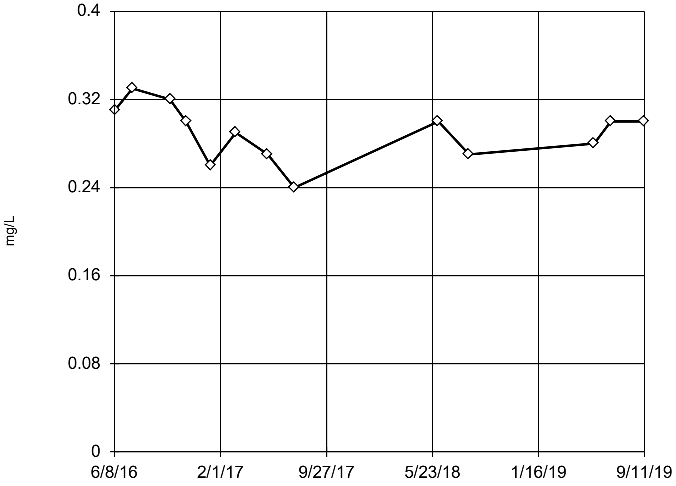
Constituent: Fluoride, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603D



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 = 0.3792, low cutoff = -0.1862, based on IQR multiplier of 3.

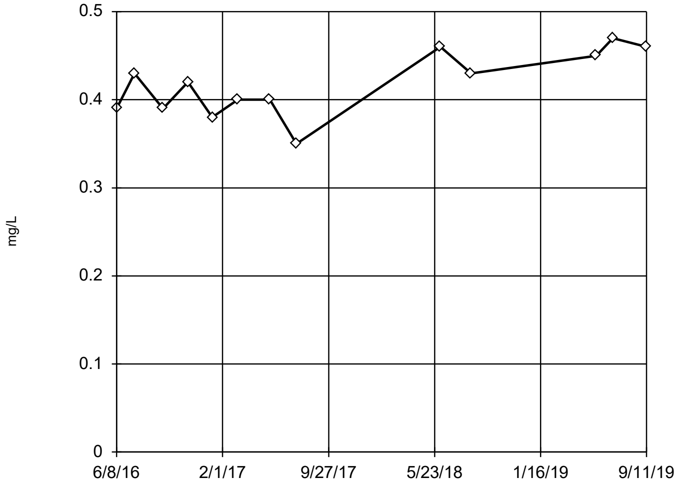
Constituent: Fluoride, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603I



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 = 0.65, low cutoff = 0.195, based on IQR multiplier of 3.

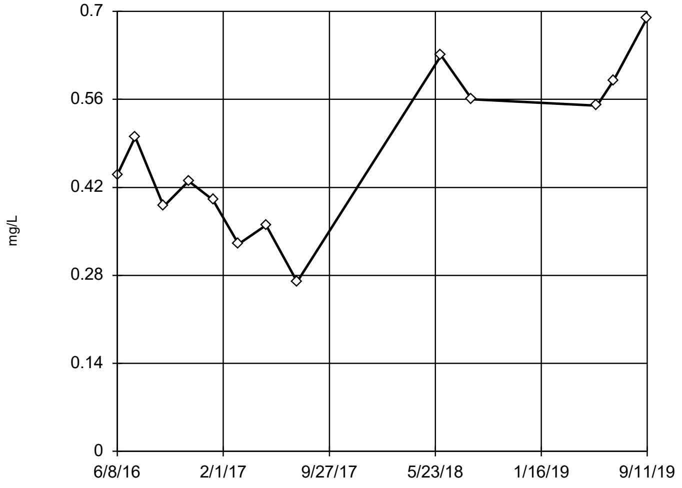
Constituent: Fluoride, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603S



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 = 1.431, low cutoff = 0.03039, based on IQR multiplier of 3.

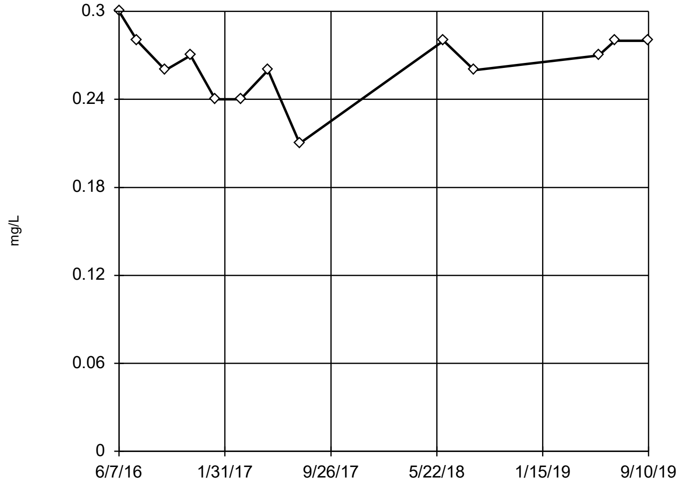
Constituent: Fluoride, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604D



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 = 0.3361, low cutoff = -0.2272, based on IQR multiplier of 3.

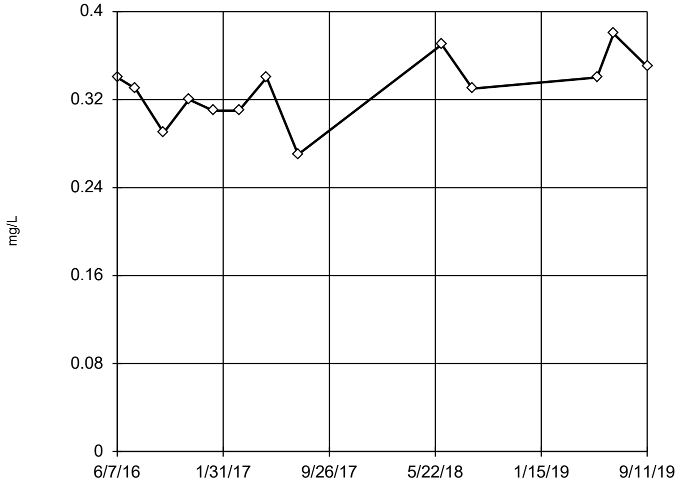
Constituent: Fluoride, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604I



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 = 0.4335, low cutoff = 0.1651, based on IQR multiplier of 3.

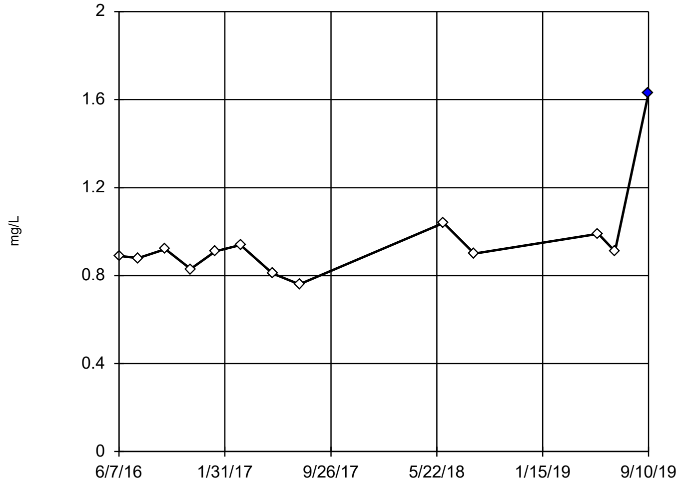
Constituent: Fluoride, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604S



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 = 1.387, low cutoff = 0.5943, based on IQR multiplier of 3.

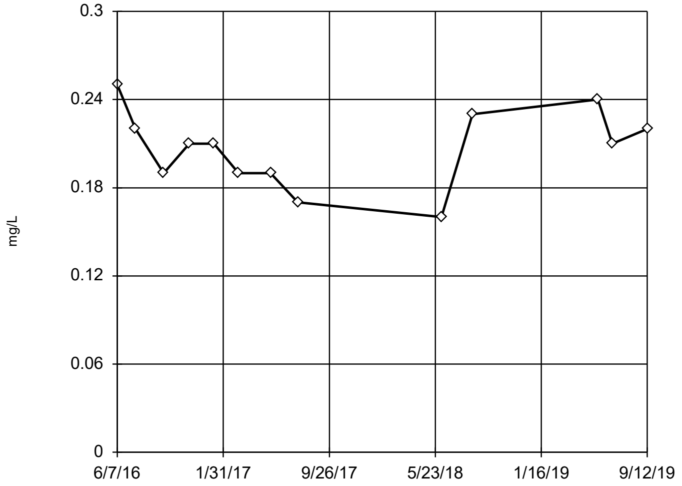
Constituent: Fluoride, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_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 = 0.3071, low cutoff = -0.08689, based on IQR multiplier of 3.

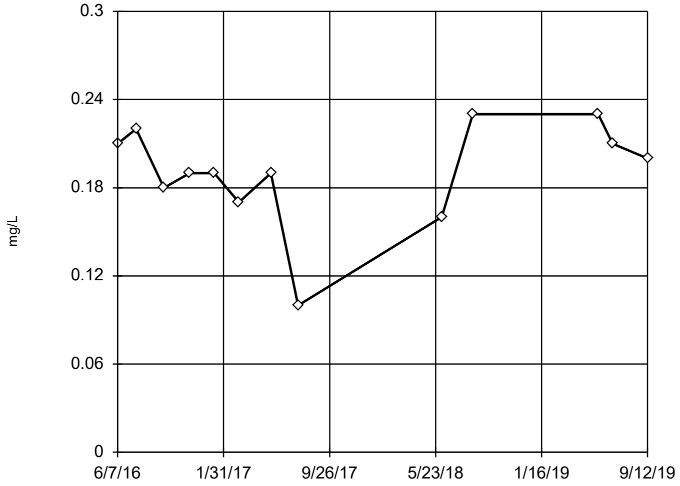
Constituent: Fluoride, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605I



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 = 0.2872, low cutoff = -0.2031, based on IQR multiplier of 3.

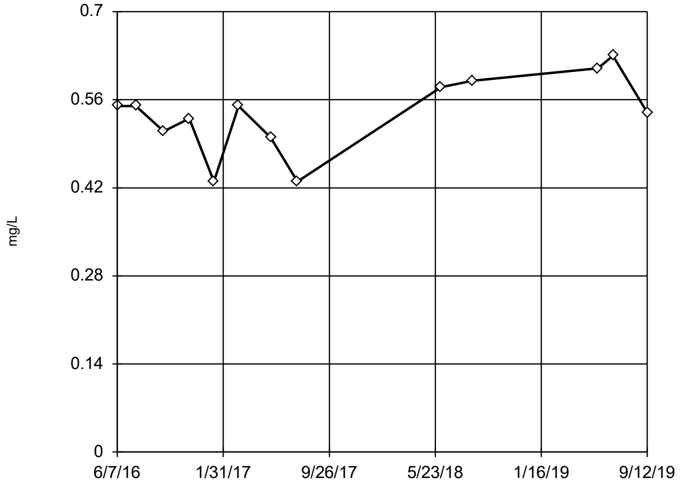
Constituent: Fluoride, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_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 x^4 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.7231, low cutoff = -0.5495, based on IQR multiplier of 3.

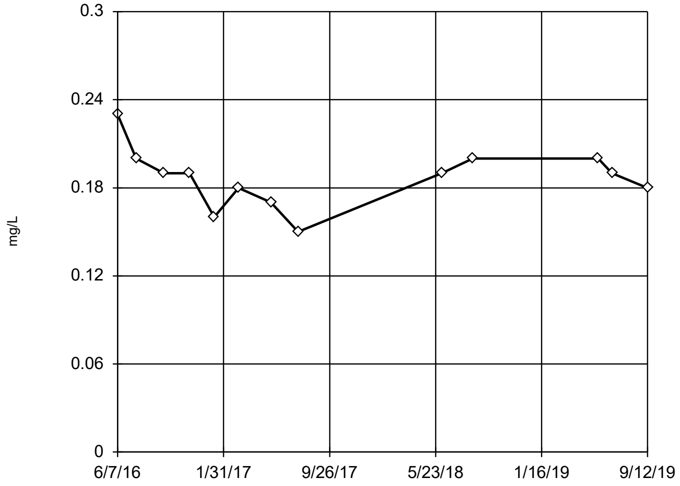
Constituent: Fluoride, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606D



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).

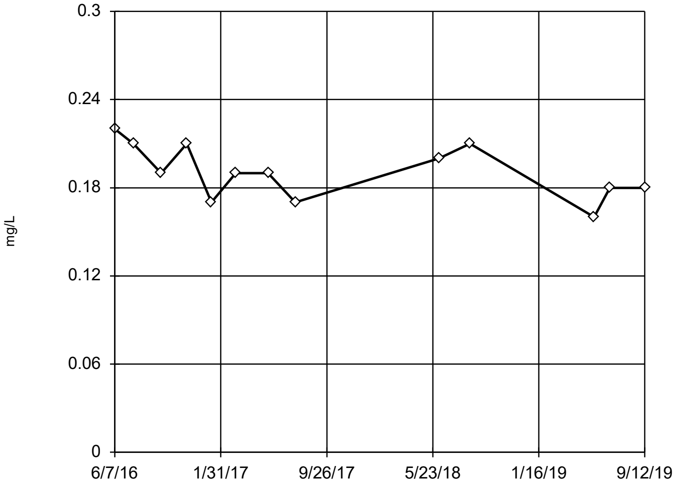
High cutoff = 0.2851, low cutoff = 0.1099, based on IQR multiplier of 3.

Constituent: Fluoride, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Tukey's Outlier Screening

MW-1606I



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).

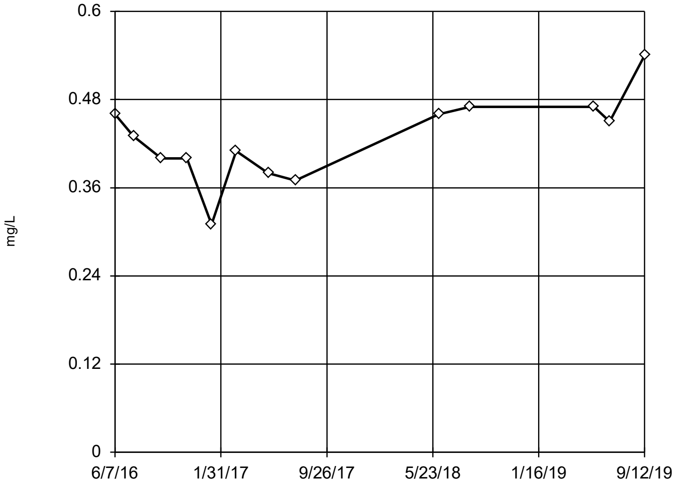
High cutoff = 0.3343, low cutoff = 0.08903, based on IQR multiplier of 3.

Constituent: Fluoride, total Analysis Run 12/5/2019 10:10 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

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.

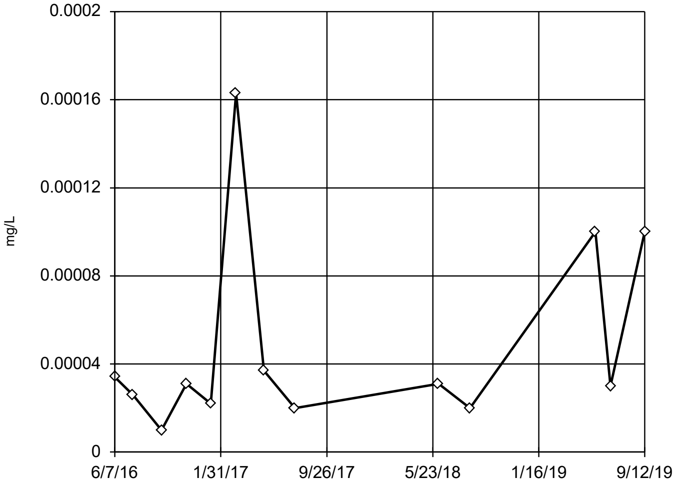
High cutoff = 0.69, low cutoff = 0.165, based on IQR multiplier of 3.

Constituent: Fluoride, total Analysis Run 12/5/2019 10:10 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Tukey's Outlier Screening

MW-1002



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).

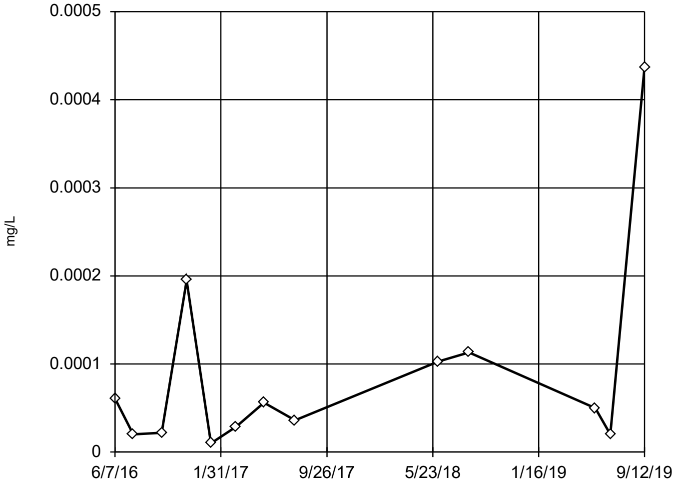
High cutoff = 0.001483, low cutoff = 8.6e-7, based on IQR multiplier of 3.

Constituent: Lead, total Analysis Run 12/5/2019 10:10 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Tukey's Outlier Screening

MW-1602D



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 = 0.01468, low cutoff = 1.5e-7, based on IQR multiplier of 3.

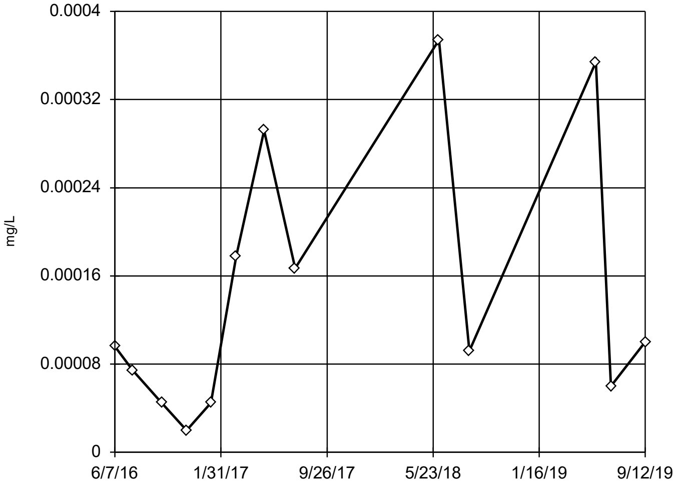
Constituent: Lead, total Analysis Run 12/5/2019 10:10 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602I



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 = 0.01926, low cutoff = 6.2e-7, based on IQR multiplier of 3.

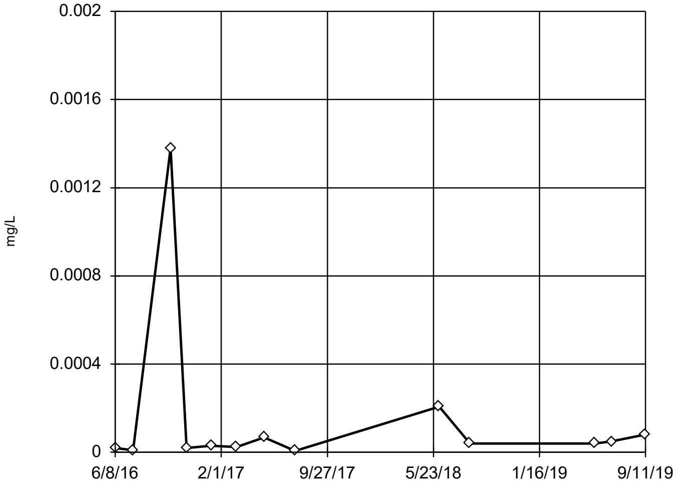
Constituent: Lead, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603D



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 = 0.003699, low cutoff = 4.0e-7, based on IQR multiplier of 3.

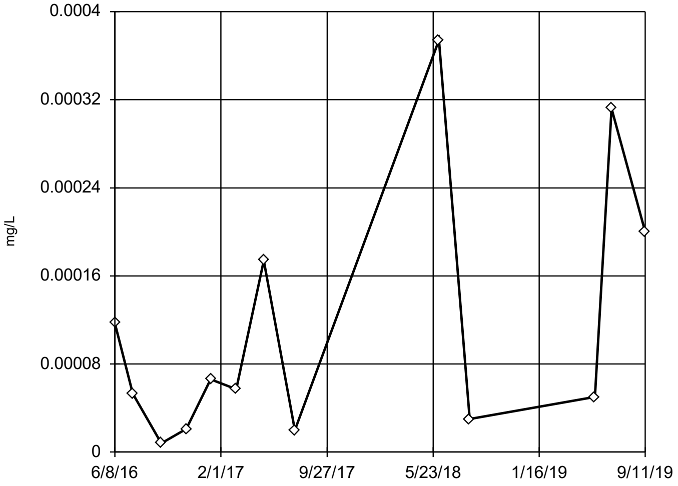
Constituent: Lead, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603I



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 = 0.07659, low cutoff = 6.1e-8, based on IQR multiplier of 3.

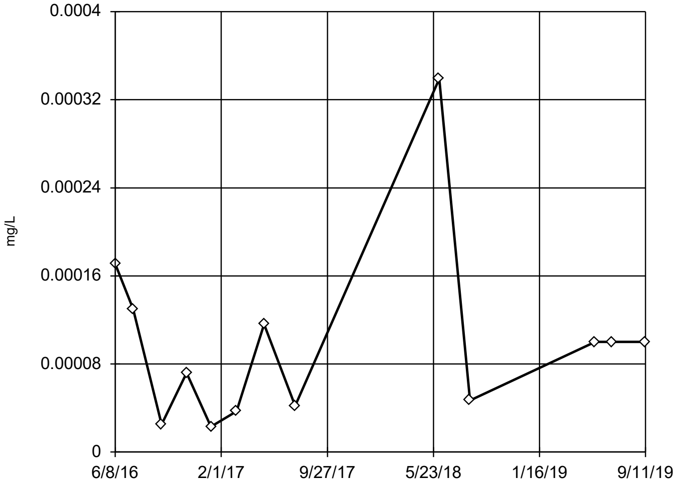
Constituent: Lead, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603S



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 = 0.003712, low cutoff = 0.000001304, based on IQR multiplier of 3.

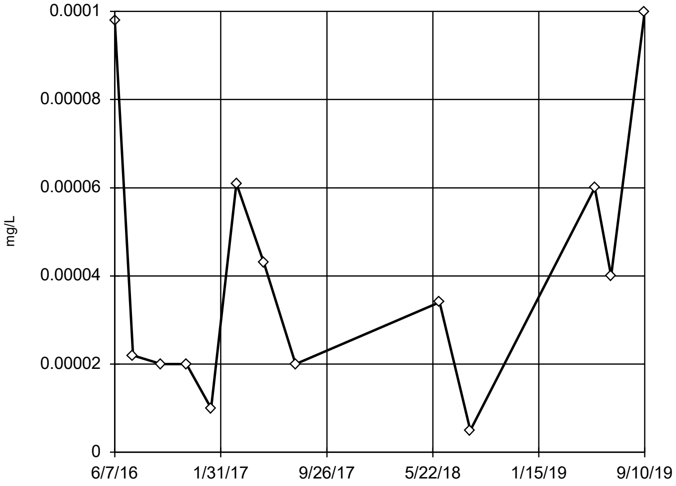
Constituent: Lead, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604D



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 = 0.000432, low cutoff = -7.8e-7, based on IQR multiplier of 3.

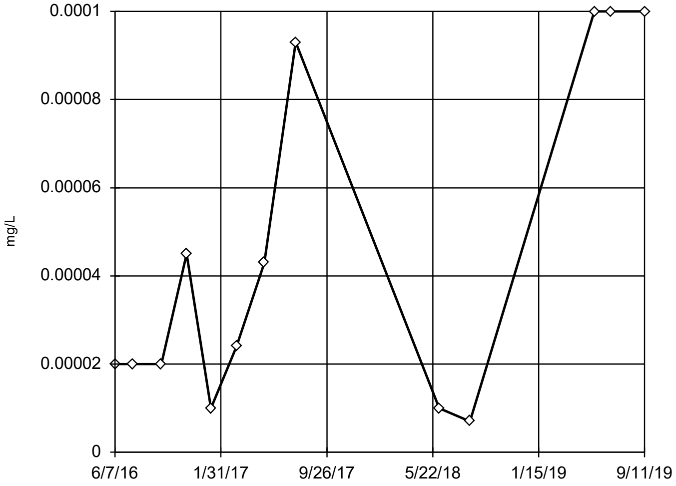
Constituent: Lead, total Analysis Run 12/5/2019 10:10 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604I



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 = 0.03058, low cutoff = 4.5e-8, based on IQR multiplier of 3.

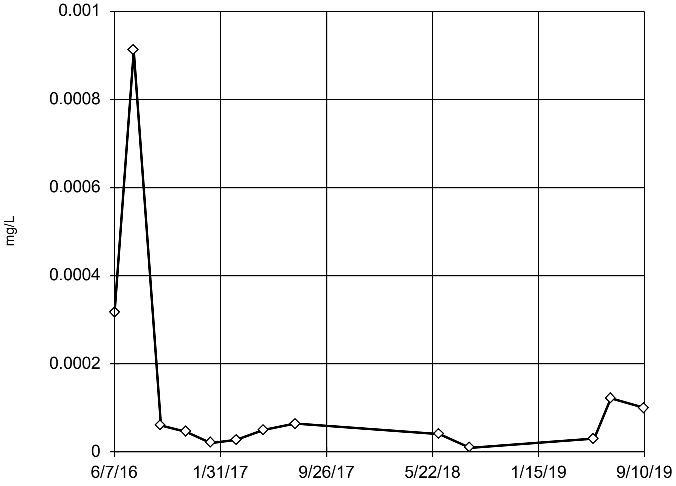
Constituent: Lead, total Analysis Run 12/5/2019 10:10 AM

Rockport BAP Client: Geosyntec Data: Rockport_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 = 0.006456, low cutoff = 4.9e-7, based on IQR multiplier of 3.

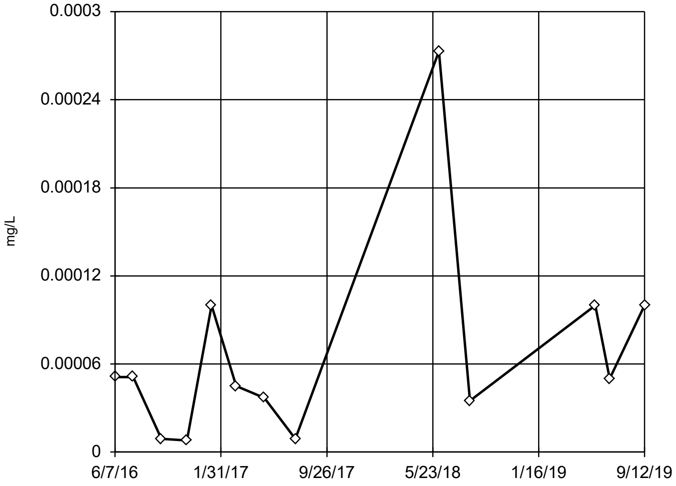
Constituent: Lead, total Analysis Run 12/5/2019 10:10 AM

Rockport BAP Client: Geosyntec Data: Rockport_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).

High cutoff = 0.001171, low cutoff = -0.00003346, based on IQR multiplier of 3.

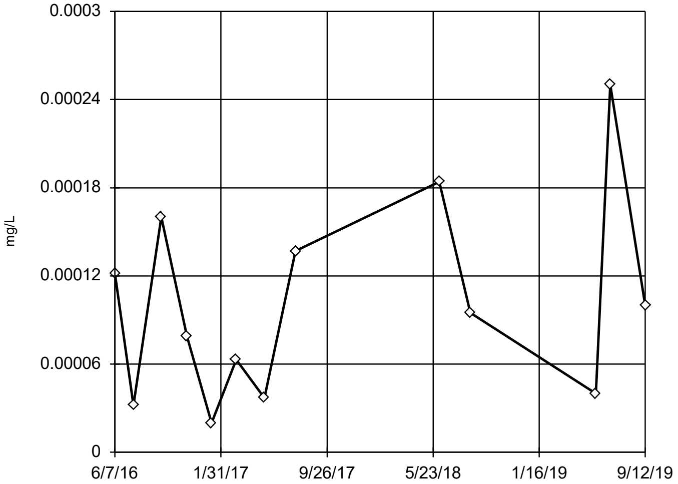
Constituent: Lead, total Analysis Run 12/5/2019 10:10 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605I



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 = 0.001345, low cutoff = -0.00001334, based on IQR multiplier of 3.

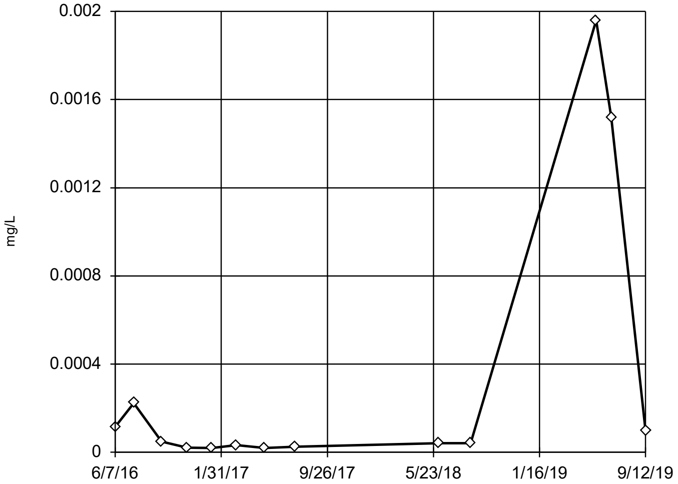
Constituent: Lead, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_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 = 0.05245, low cutoff = 7.2e-8, based on IQR multiplier of 3.

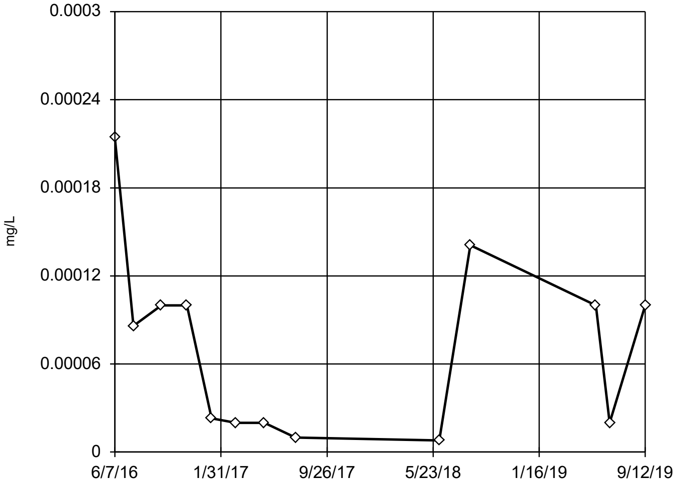
Constituent: Lead, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

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 = 0.001132, low cutoff = -0.00002885, based on IQR multiplier of 3.

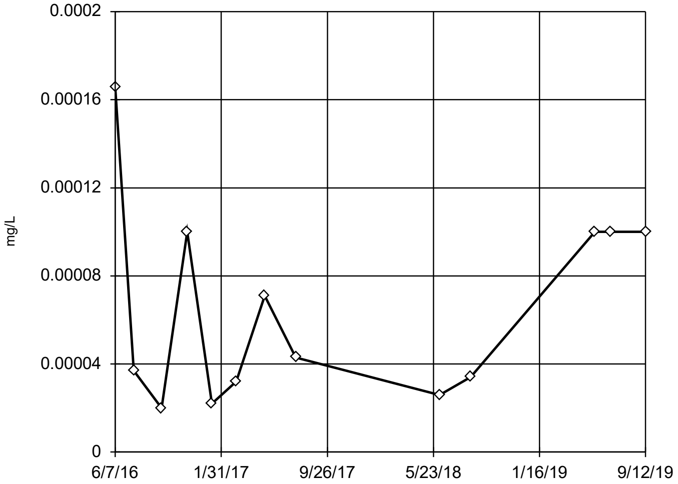
Constituent: Lead, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606I



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 = 0.004167, low cutoff = 6.9e-7, based on IQR multiplier of 3.

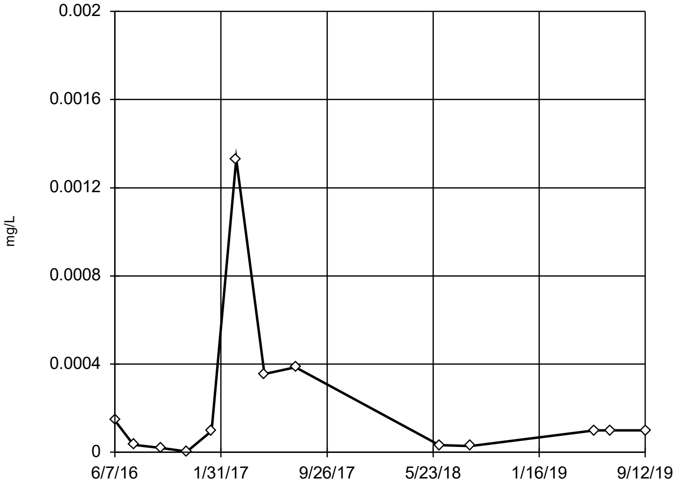
Constituent: Lead, total   Analysis Run 12/5/2019 10:10 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_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 = 0.09879, low cutoff = 6.9e-8, based on IQR multiplier of 3.

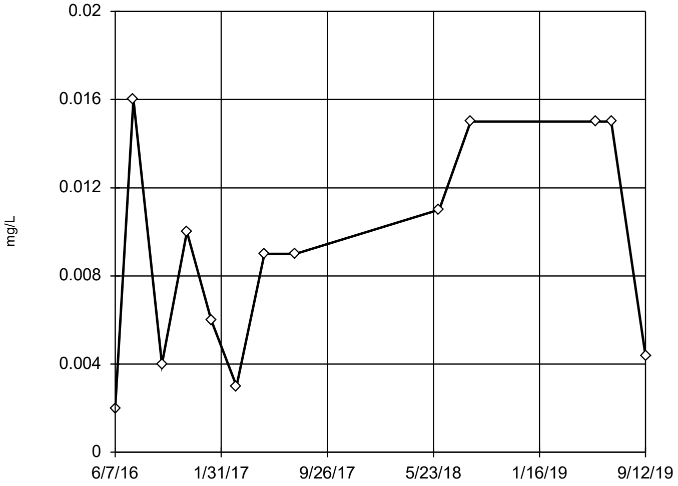
Constituent: Lead, total Analysis Run 12/5/2019 10:10 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1002



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 = 0.08747, low cutoff = -0.01179, based on IQR multiplier of 3.

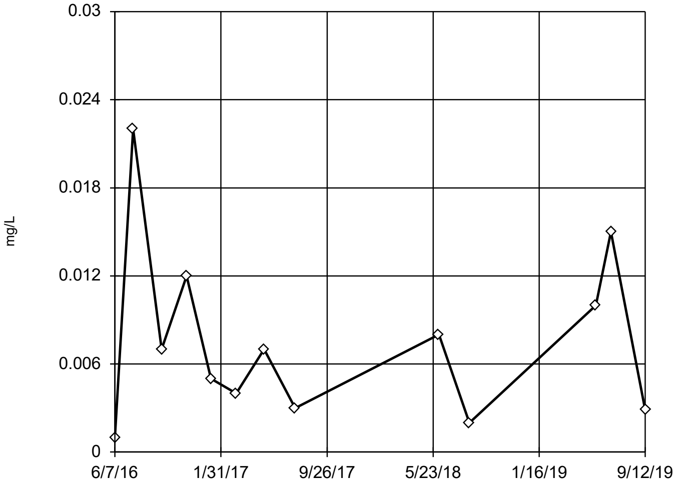
Constituent: Lithium, total Analysis Run 12/5/2019 10:10 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602D



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 = 0.09703, low cutoff = -0.0008369, based on IQR multiplier of 3.

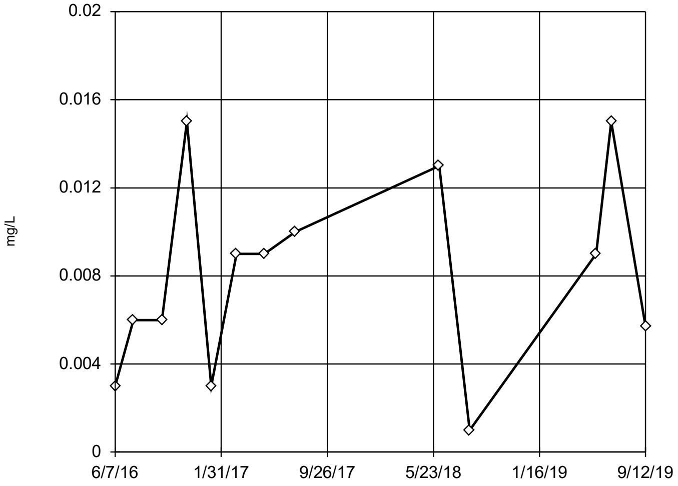
Constituent: Lithium, total Analysis Run 12/5/2019 10:10 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602I



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 = 0.05402, low cutoff = -0.003627, based on IQR multiplier of 3.

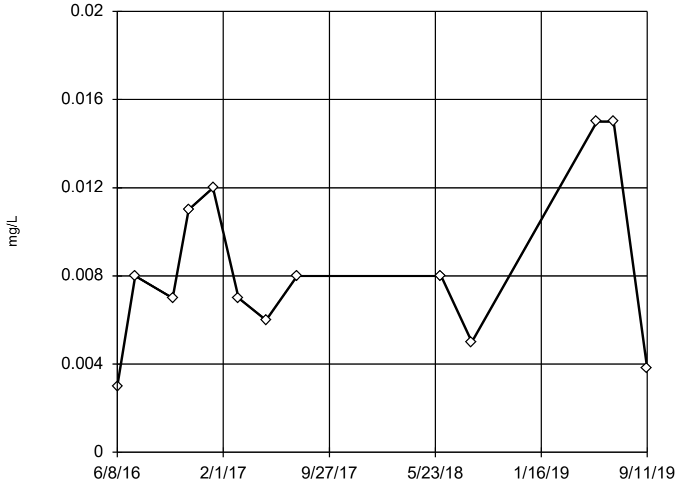
Constituent: Lithium, total Analysis Run 12/5/2019 10:10 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603D



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).

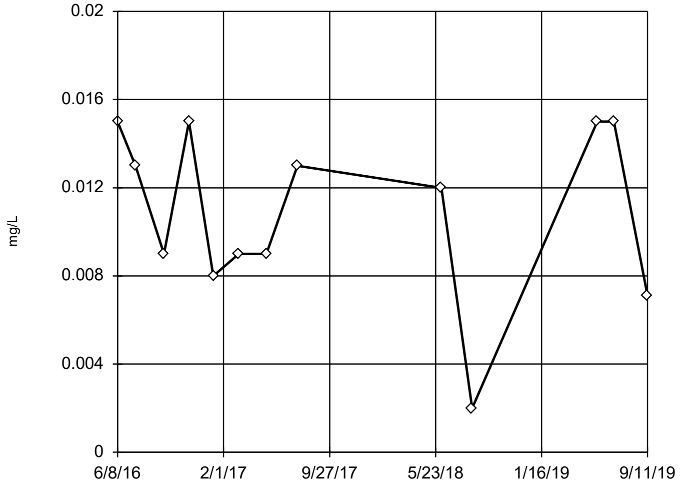
High cutoff = 0.05215, low cutoff = 0.00002293, based on IQR multiplier of 3.

Constituent: Lithium, total   Analysis Run 12/5/2019 10:10 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603I



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).

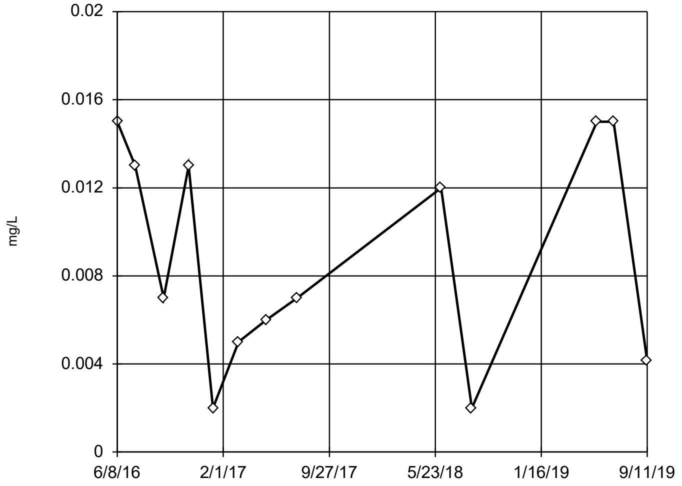
High cutoff = 0.02612, low cutoff = -0.01962, based on IQR multiplier of 3.

Constituent: Lithium, total   Analysis Run 12/5/2019 10:10 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603S



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).

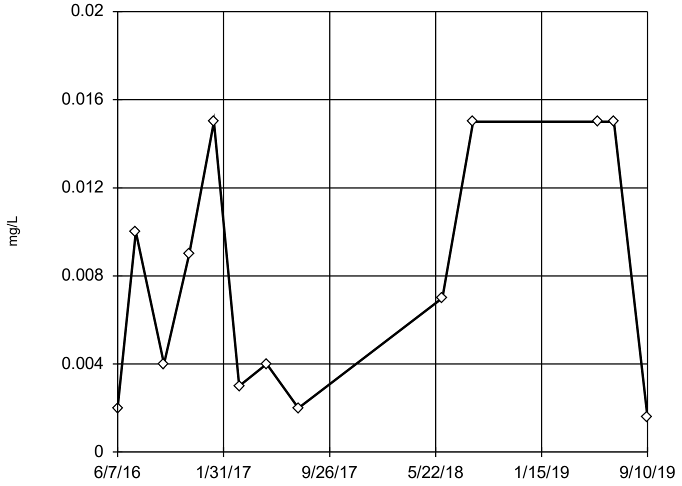
High cutoff = 0.07312, low cutoff = -0.007162, based on IQR multiplier of 3.

Constituent: Lithium, total   Analysis Run 12/5/2019 10:10 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

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).

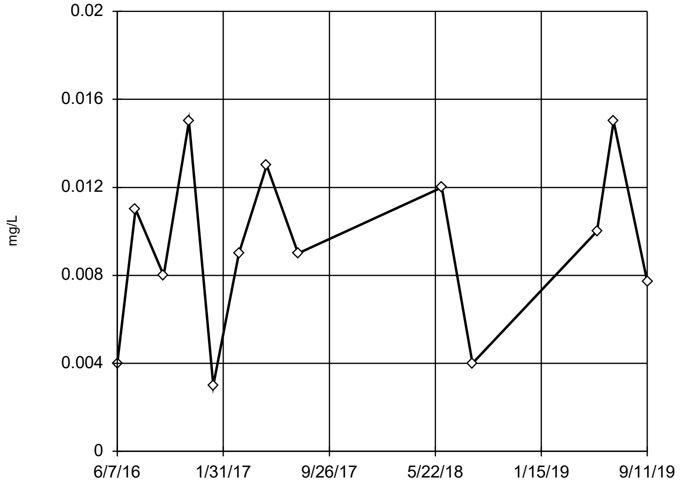
High cutoff = 3.445, low cutoff = 0.00001067, based on IQR multiplier of 3.

Constituent: Lithium, total   Analysis Run 12/5/2019 10:10 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604I



n = 13

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

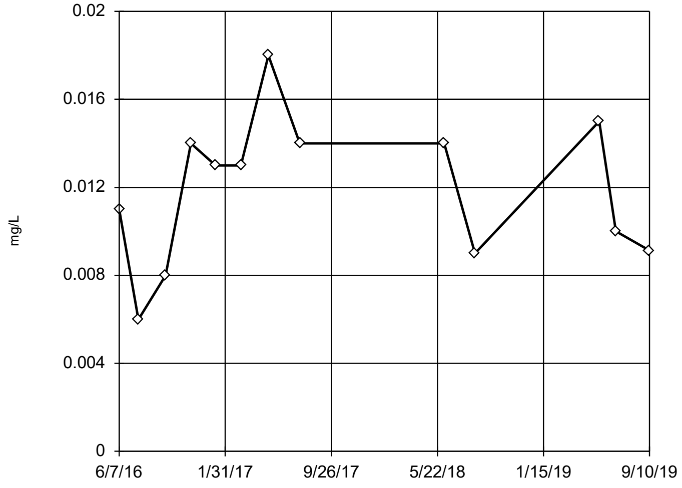
High cutoff = 0.03242, low cutoff = -0.01406, based on IQR multiplier of 3.

Constituent: Lithium, total   Analysis Run 12/5/2019 10:11 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_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.

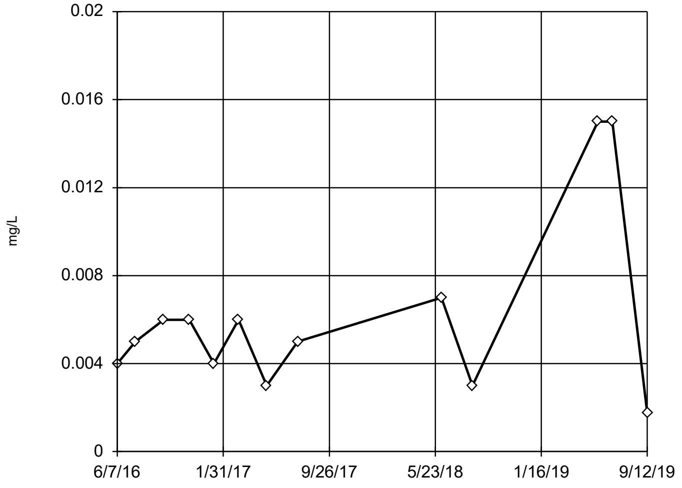
High cutoff = 0.02881, low cutoff = -0.00574, based on IQR multiplier of 3.

Constituent: Lithium, total   Analysis Run 12/5/2019 10:11 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_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).

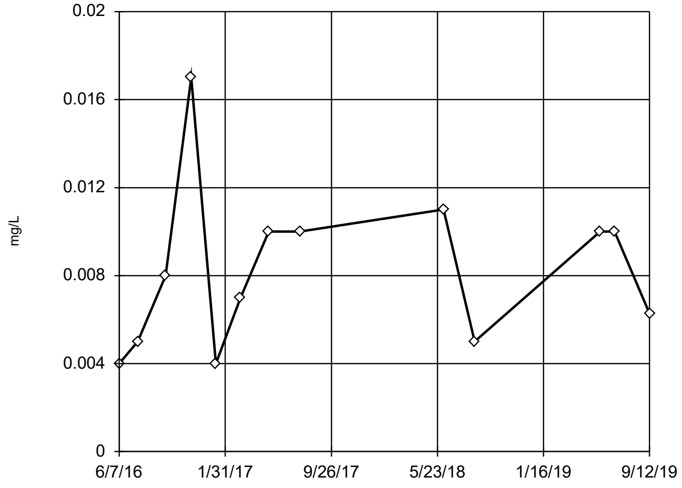
High cutoff = 0.04244, low cutoff = 0.000529, based on IQR multiplier of 3.

Constituent: Lithium, total   Analysis Run 12/5/2019 10:11 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605I



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).

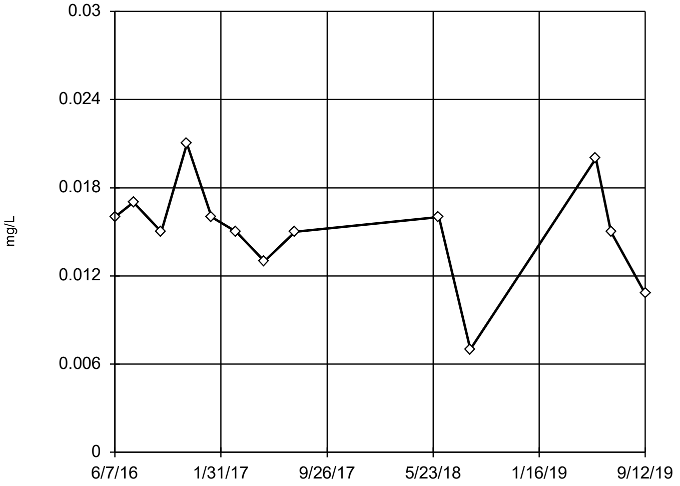
High cutoff = 0.08, low cutoff = 0.000625, based on IQR multiplier of 3.

Constituent: Lithium, total   Analysis Run 12/5/2019 10:11 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_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 square transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.02234, low cutoff = -0.005431, based on IQR multiplier of 3.

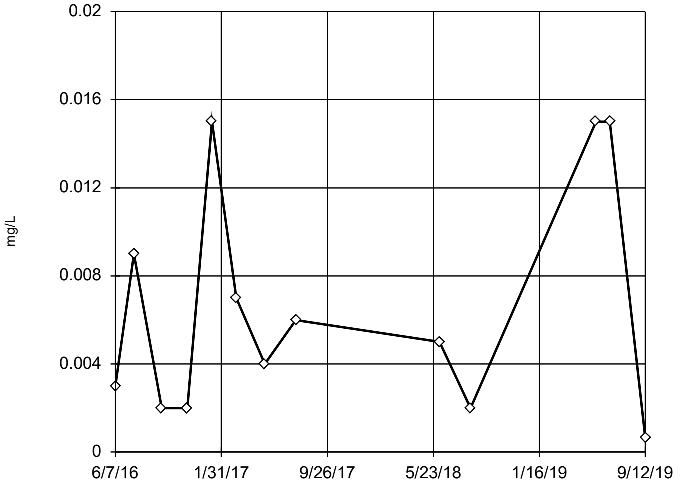
Constituent: Lithium, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

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 = 2.278, low cutoff = 0.0000102, based on IQR multiplier of 3.

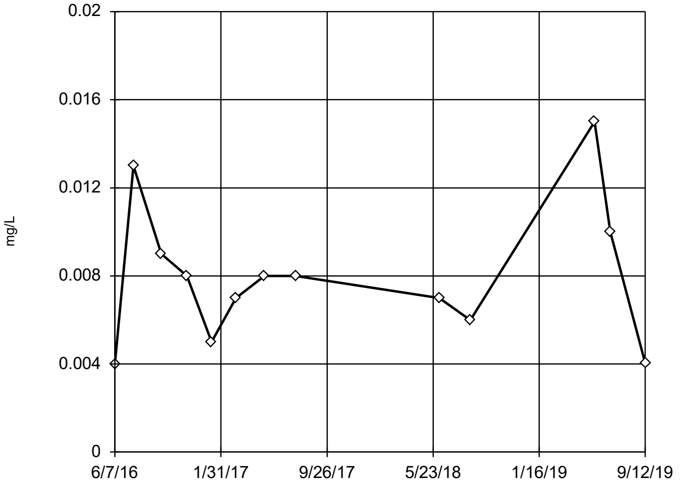
Constituent: Lithium, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606I



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 = 0.0493, low cutoff = 0.001054, based on IQR multiplier of 3.

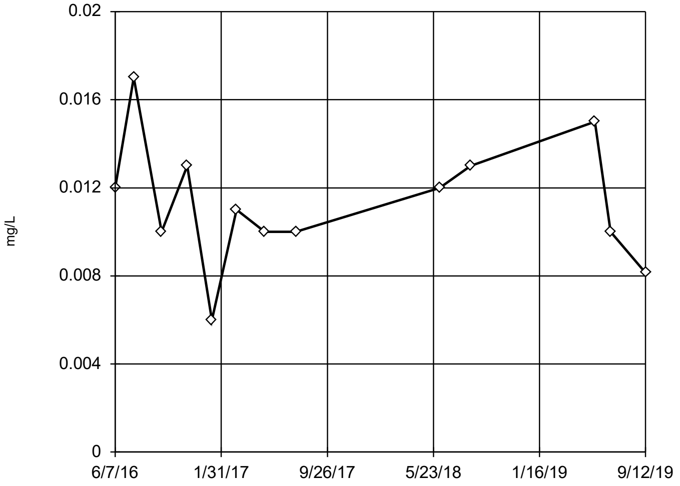
Constituent: Lithium, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_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.

High cutoff = 0.022, low cutoff = 0.001, based on IQR multiplier of 3.

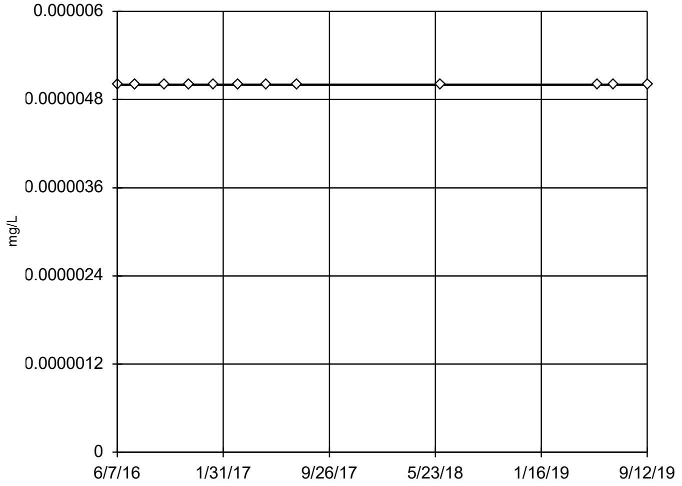
Constituent: Lithium, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1002



n = 12

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.

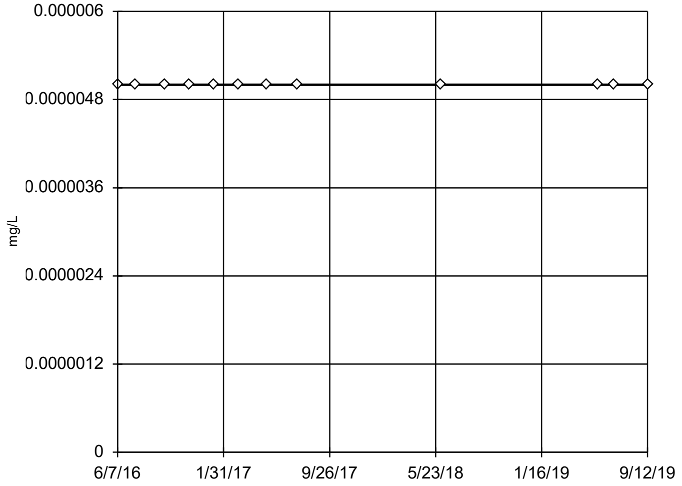
Constituent: Mercury, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602D



n = 12

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.

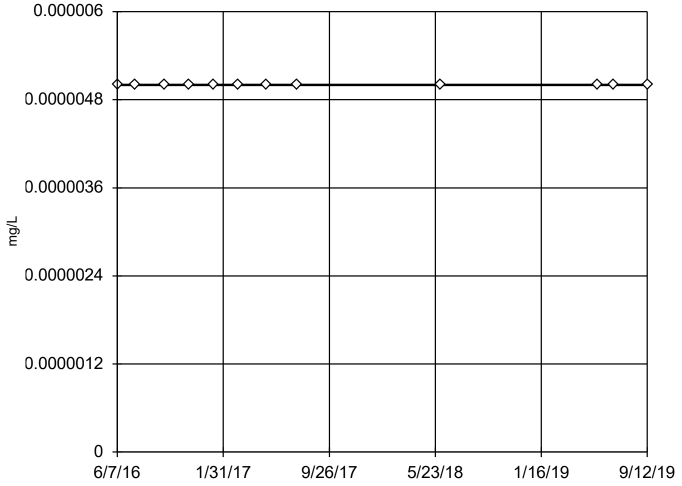
Constituent: Mercury, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602I



n = 12

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.

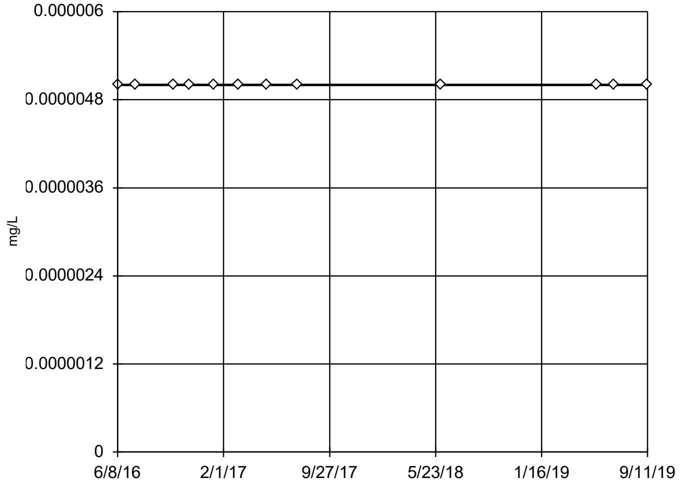
Constituent: Mercury, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603D



n = 12

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.

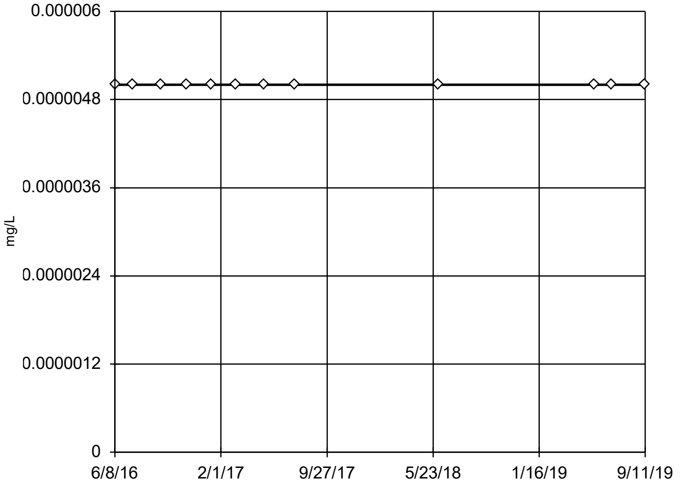
Constituent: Mercury, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603I



n = 12

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

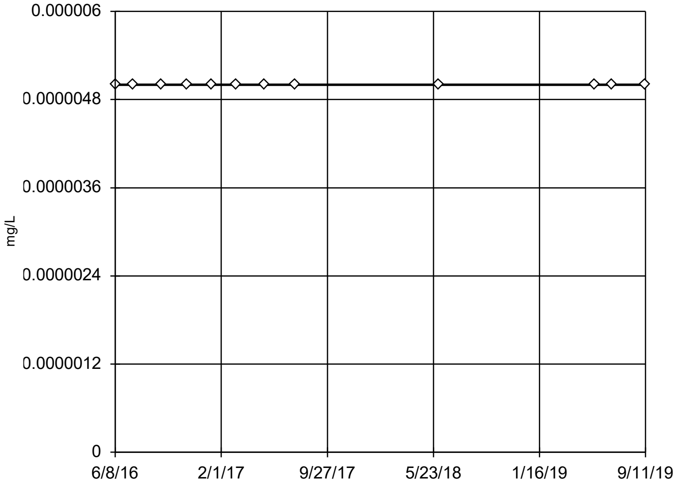
The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Mercury, total Analysis Run 12/5/2019 10:11 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603S



n = 12

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

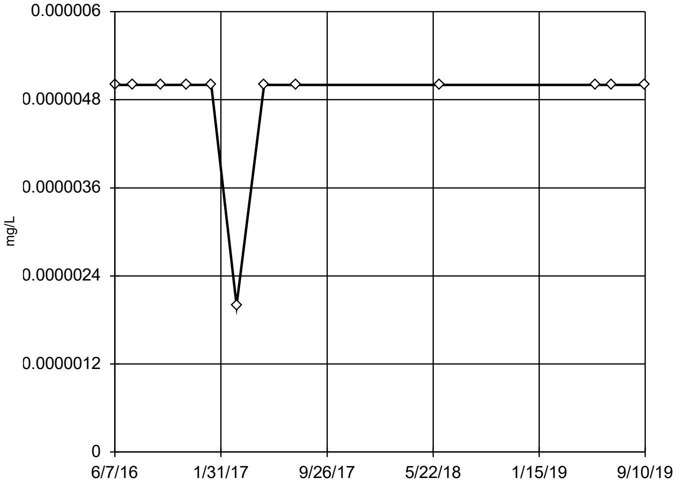
The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Mercury, total Analysis Run 12/5/2019 10:11 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604D



n = 12

No outliers found. Tukey's method selected by user.

Data were cube transformed to achieve best W statistic (graph shown in original units).

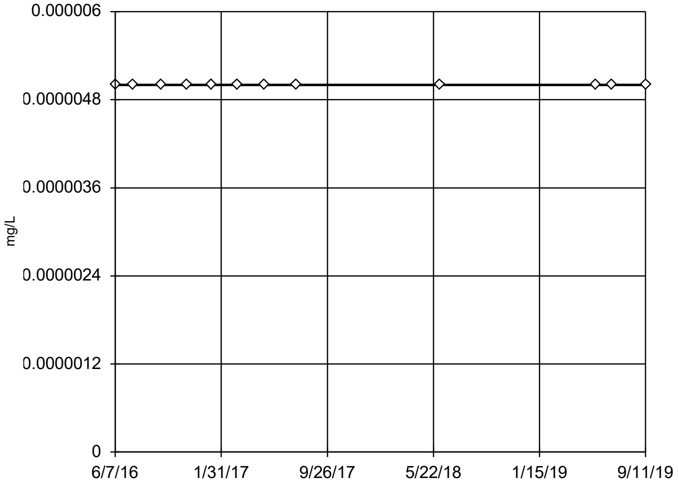
The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Mercury, total Analysis Run 12/5/2019 10:11 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604I



n = 12

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

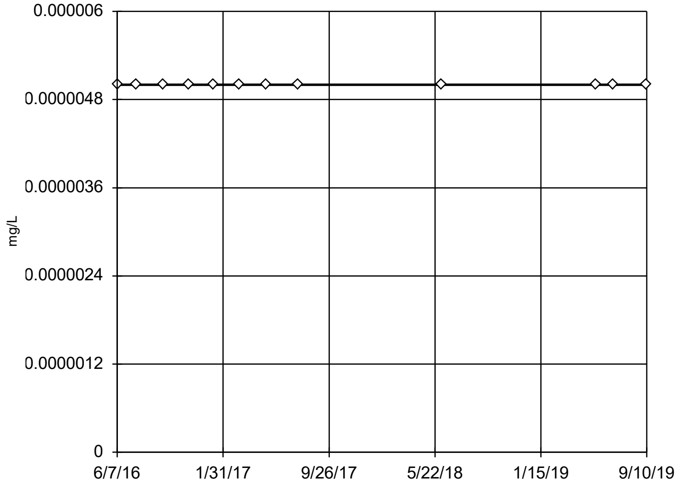
The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Mercury, total Analysis Run 12/5/2019 10:11 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604S



n = 12

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.

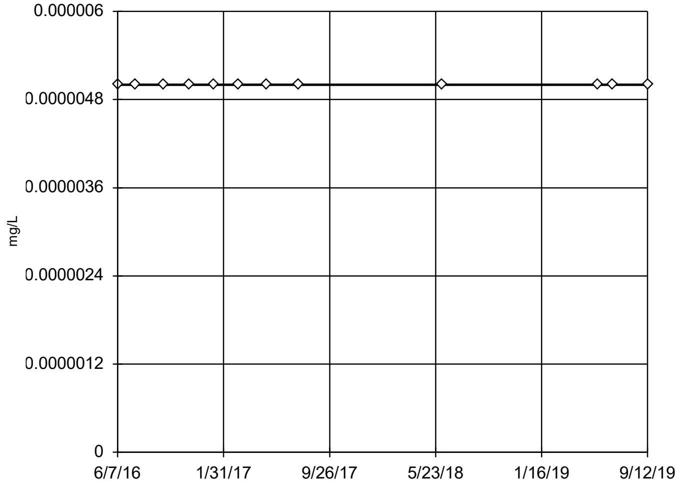
Constituent: Mercury, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605D



n = 12

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.

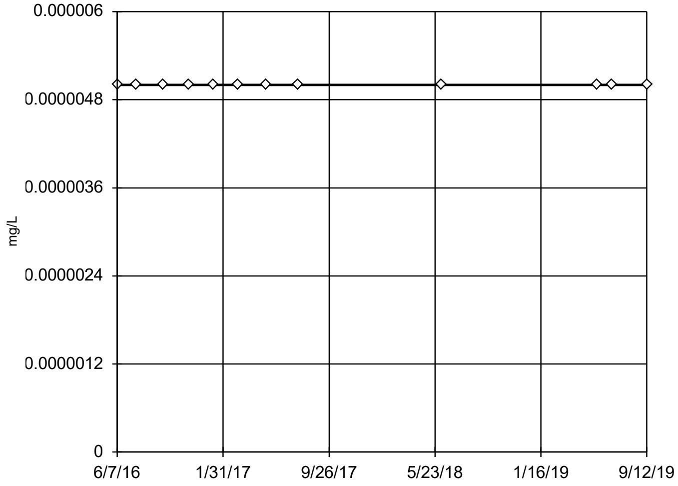
Constituent: Mercury, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605I



n = 12

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.

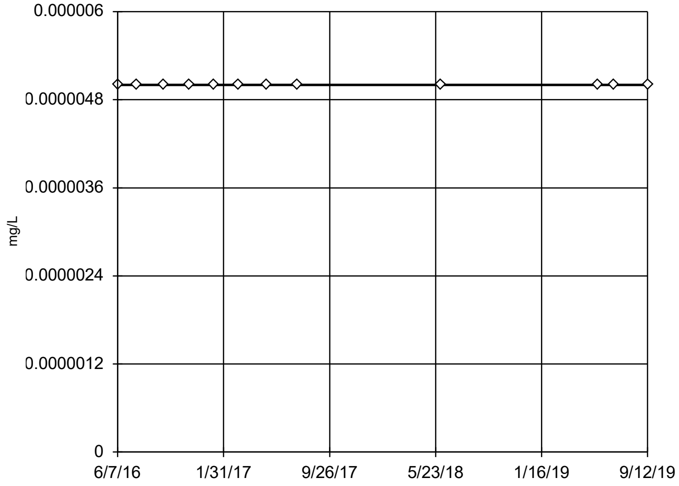
Constituent: Mercury, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605S



n = 12

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

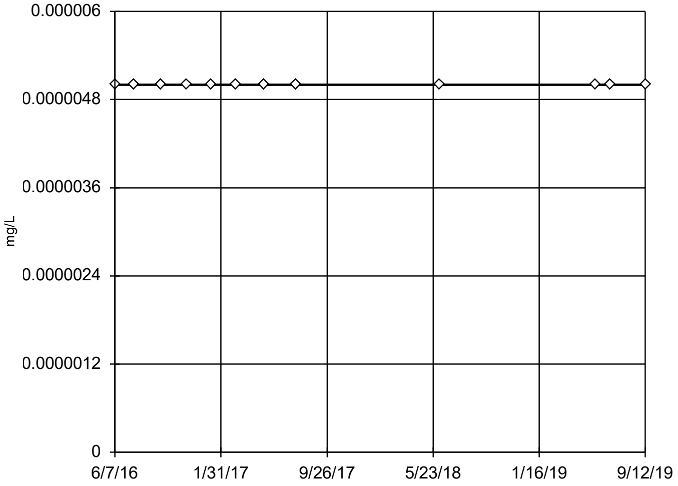
The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Mercury, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Tukey's Outlier Screening

MW-1606D



n = 12

No outliers found. Tukey's method selected by user.

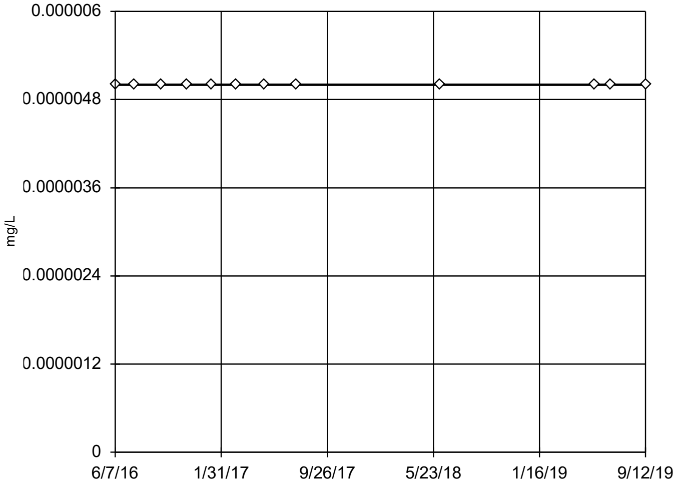
Ladder of Powers transformations did not improve normality; analysis run on raw data.

The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Mercury, total Analysis Run 12/5/2019 10:11 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Tukey's Outlier Screening

MW-1606I



n = 12

No outliers found. Tukey's method selected by user.

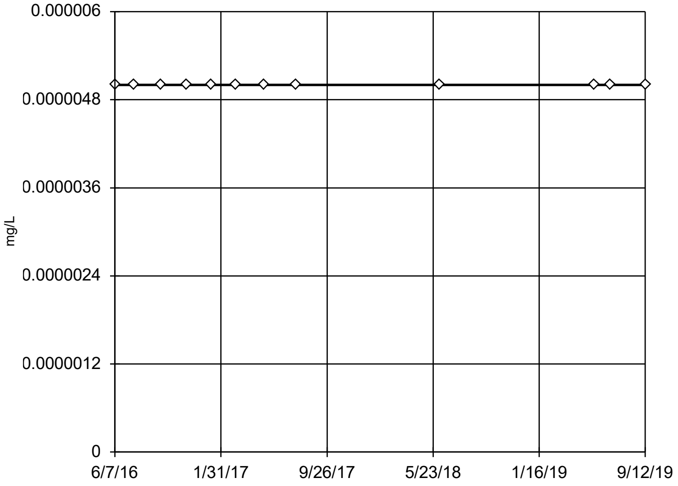
Ladder of Powers transformations did not improve normality; analysis run on raw data.

The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Mercury, total Analysis Run 12/5/2019 10:11 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Tukey's Outlier Screening

MW-1606S



n = 12

No outliers found. Tukey's method selected by user.

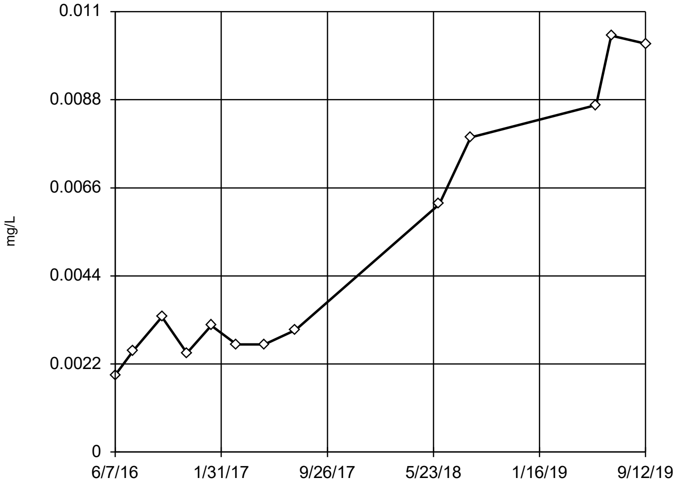
Ladder of Powers transformations did not improve normality; analysis run on raw data.

The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Mercury, total Analysis Run 12/5/2019 10:11 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Tukey's Outlier Screening

MW-1002



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).

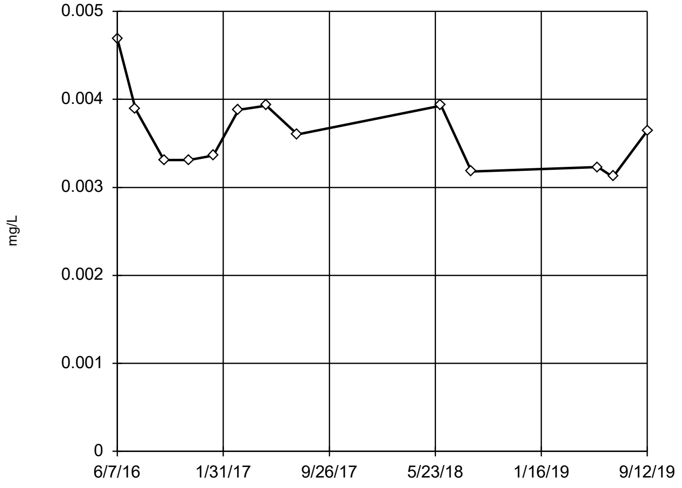
High cutoff = 0.26, low cutoff = 0.00008299, based on IQR multiplier of 3.

Constituent: Molybdenum, total Analysis Run 12/5/2019 10:11 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602D



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).

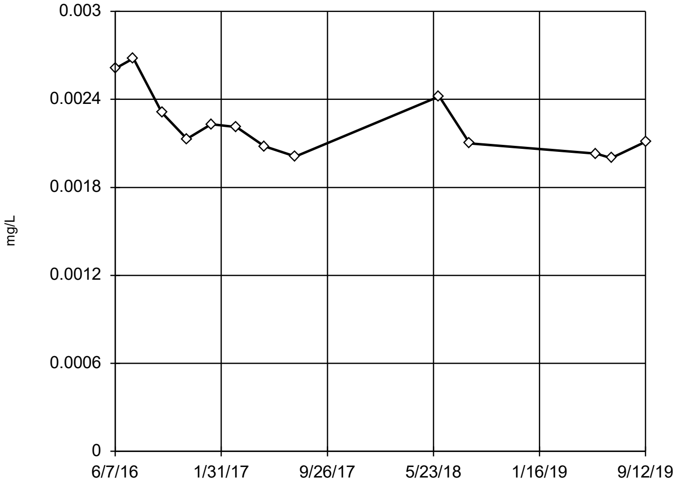
High cutoff = 0.006686, low cutoff = 0.001912, based on IQR multiplier of 3.

Constituent: Molybdenum, total   Analysis Run 12/5/2019 10:11 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602I



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).

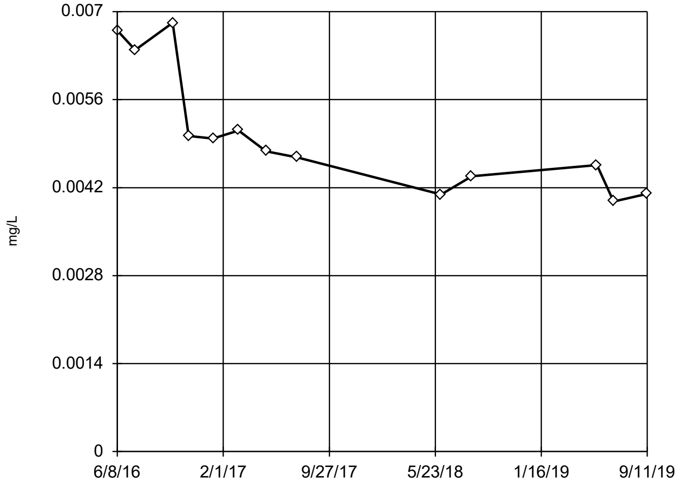
High cutoff = 0.003602, low cutoff = 0.001349, based on IQR multiplier of 3.

Constituent: Molybdenum, total   Analysis Run 12/5/2019 10:11 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603D



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).

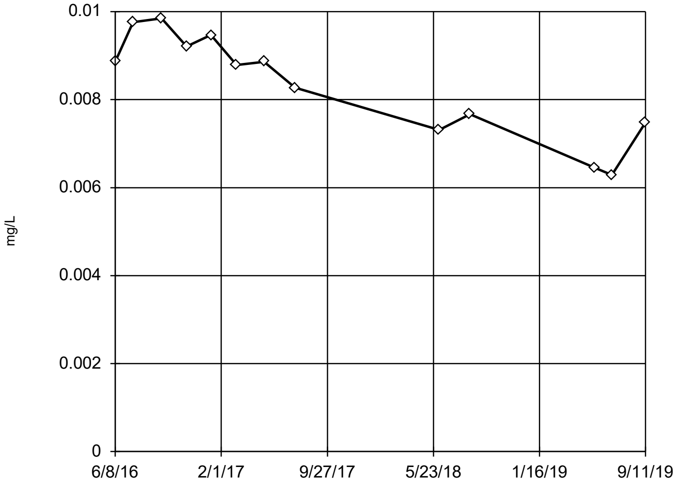
High cutoff = 0.01401, low cutoff = 0.001728, based on IQR multiplier of 3.

Constituent: Molybdenum, total   Analysis Run 12/5/2019 10:11 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603I



n = 13

No outliers found. Tukey's method selected by user.

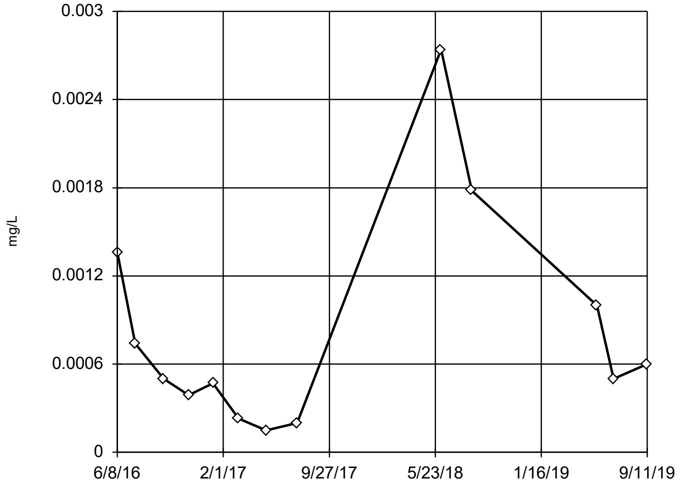
Data were cube transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.0127, low cutoff = -0.009388, based on IQR multiplier of 3.

Constituent: Molybdenum, total   Analysis Run 12/5/2019 10:11 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Tukey's Outlier Screening

MW-1603S



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).

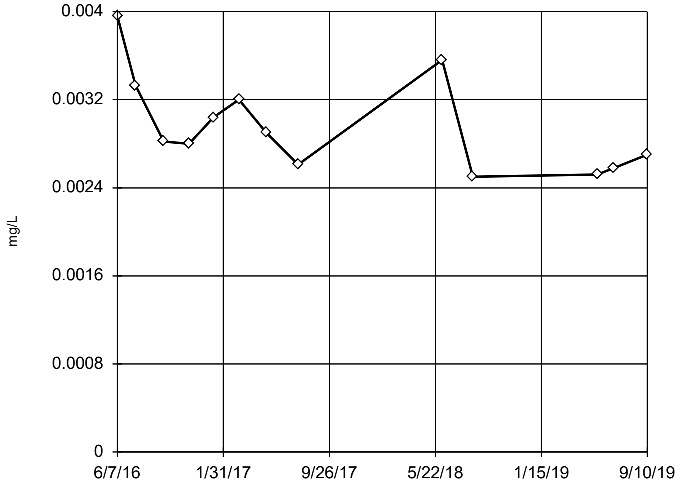
High cutoff = 0.06885, low cutoff = 0.000005073, based on IQR multiplier of 3.

Constituent: Molybdenum, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_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).

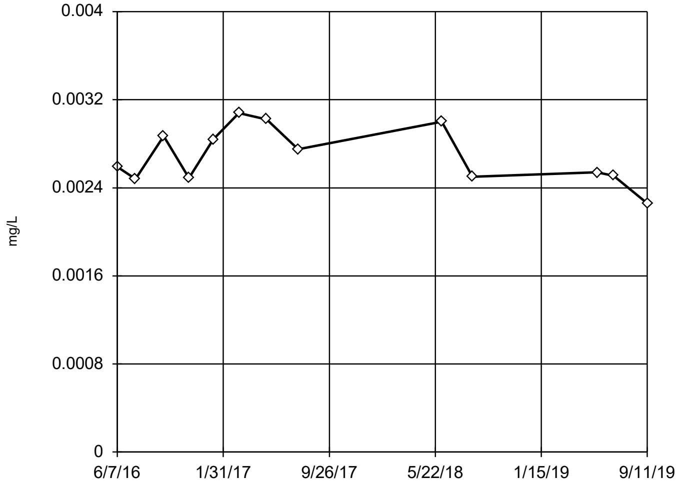
High cutoff = 0.006498, low cutoff = 0.001304, based on IQR multiplier of 3.

Constituent: Molybdenum, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Tukey's Outlier Screening

MW-1604I



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).

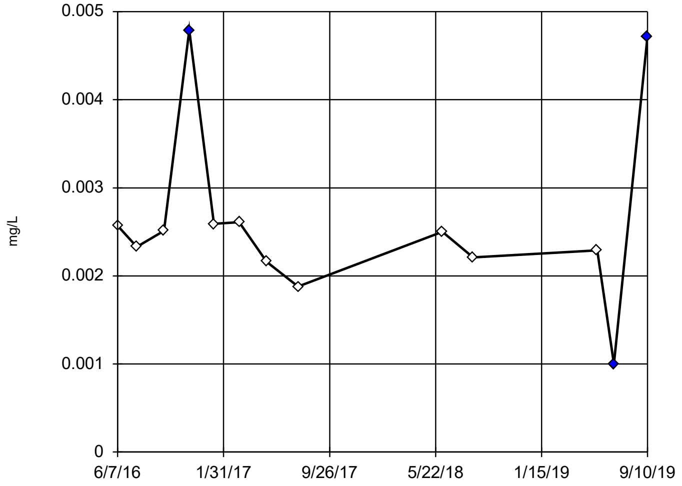
High cutoff = 0.004773, low cutoff = 0.001534, based on IQR multiplier of 3.

Constituent: Molybdenum, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Tukey's Outlier Screening

MW-1604S



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).

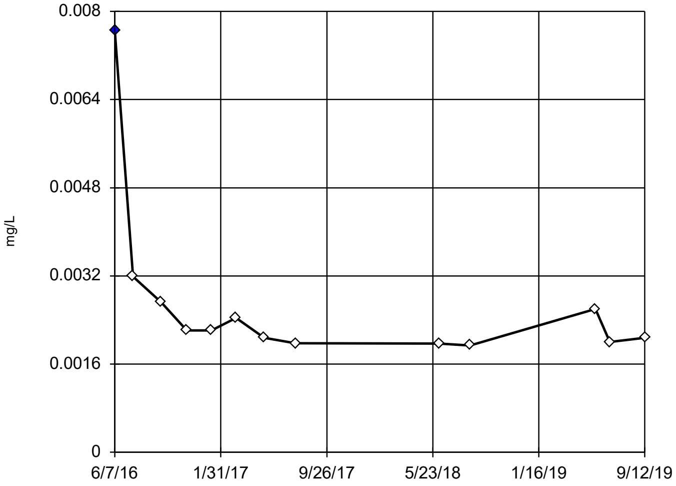
High cutoff = 0.004381, low cutoff = 0.001297, based on IQR multiplier of 3.

Constituent: Molybdenum, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

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).

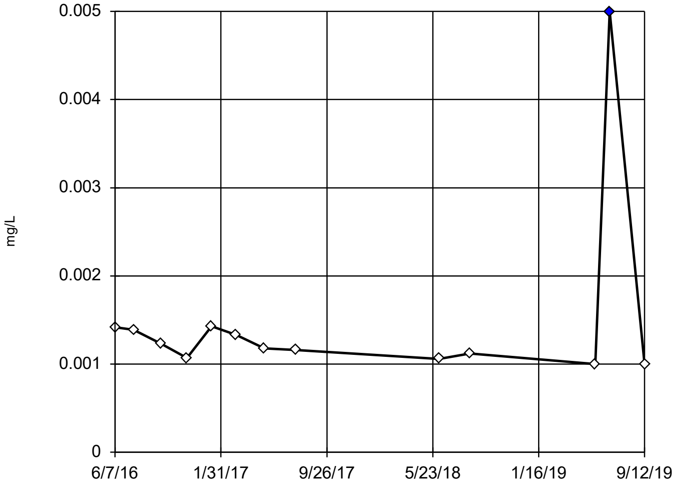
High cutoff = 0.006347, low cutoff = 0.0008338, based on IQR multiplier of 3.

Constituent: Molybdenum, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Tukey's Outlier Screening

MW-1605I



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).

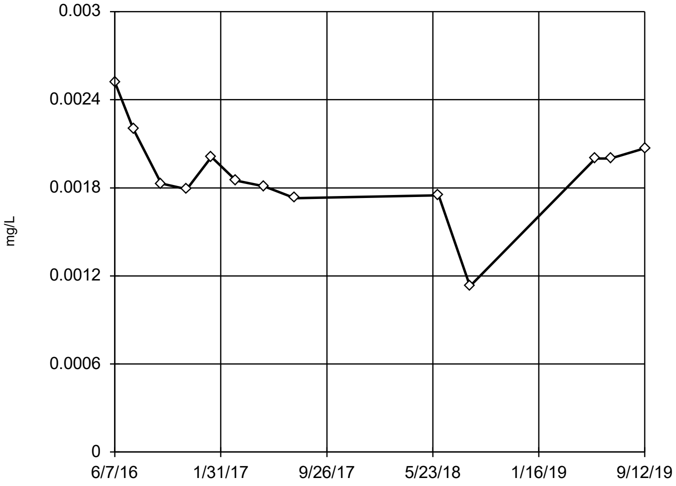
High cutoff = 0.003225, low cutoff = 0.0004639, based on IQR multiplier of 3.

Constituent: Molybdenum, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Tukey's Outlier Screening

MW-1605S



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).

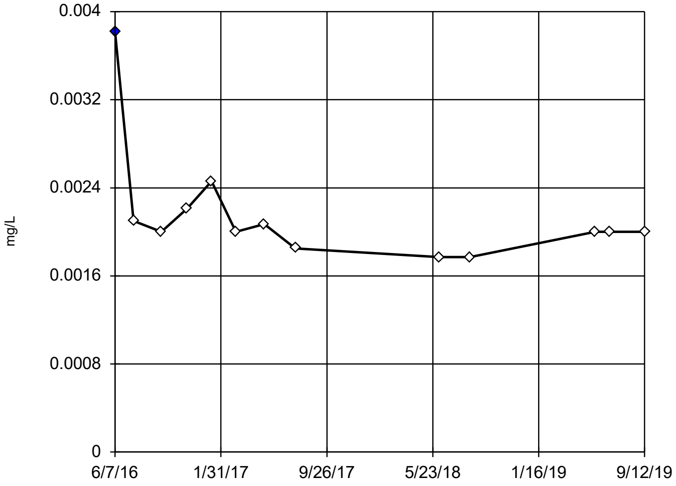
High cutoff = 0.002693, low cutoff = 0.0002138, based on IQR multiplier of 3.

Constituent: Molybdenum, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Tukey's Outlier Screening

MW-1606D



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 = 0.003026, low cutoff = 0.001369, based on IQR multiplier of 3.

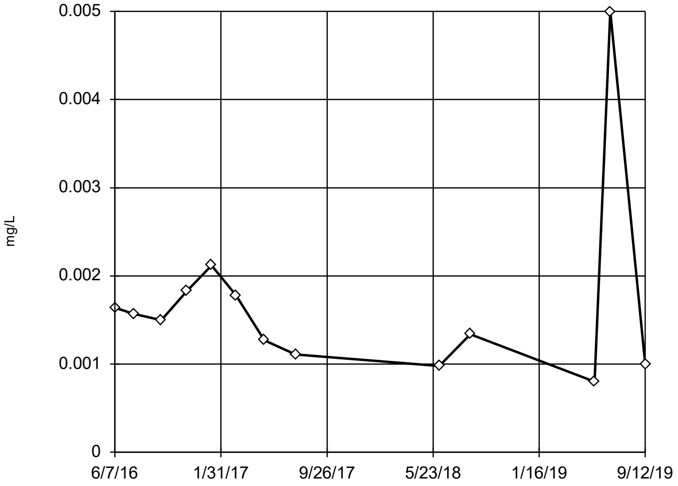
Constituent: Molybdenum, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606I



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 = 0.009073, low cutoff = 0.0002096, based on IQR multiplier of 3.

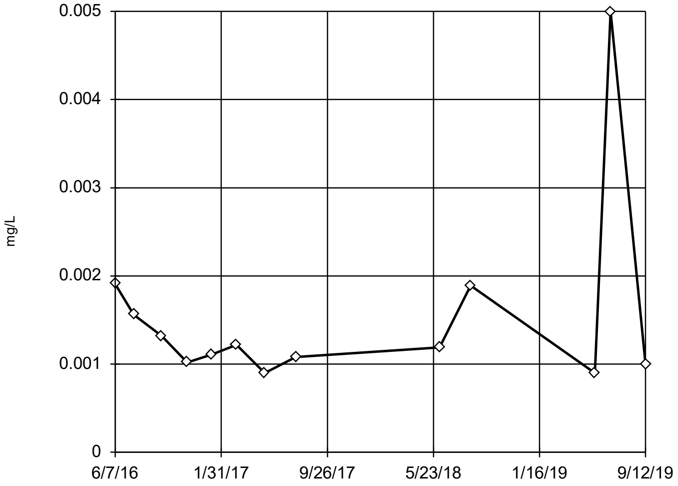
Constituent: Molybdenum, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_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 = 0.008439, low cutoff = 0.0002055, based on IQR multiplier of 3.

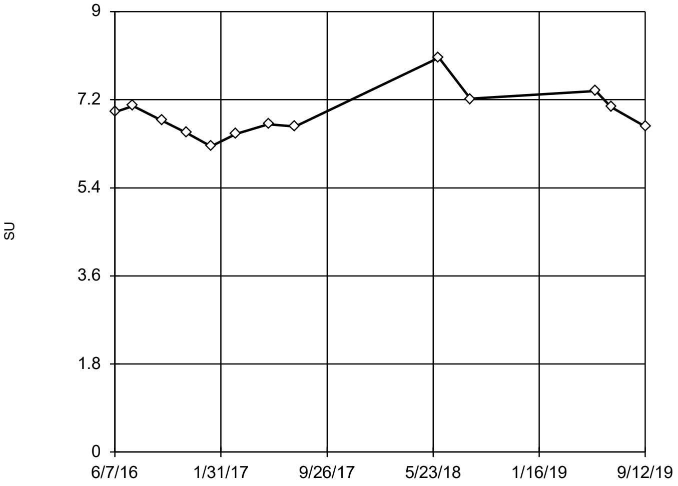
Constituent: Molybdenum, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1002



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 = 9.127, low cutoff = 5.155, based on IQR multiplier of 3.

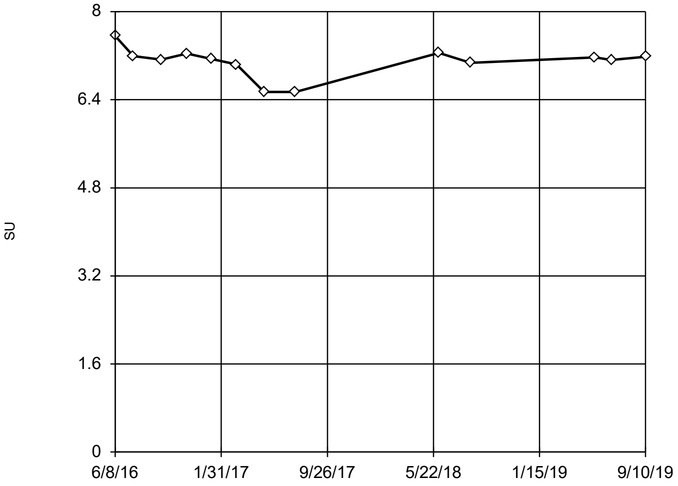
Constituent: pH, field Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1600D (bg)



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).

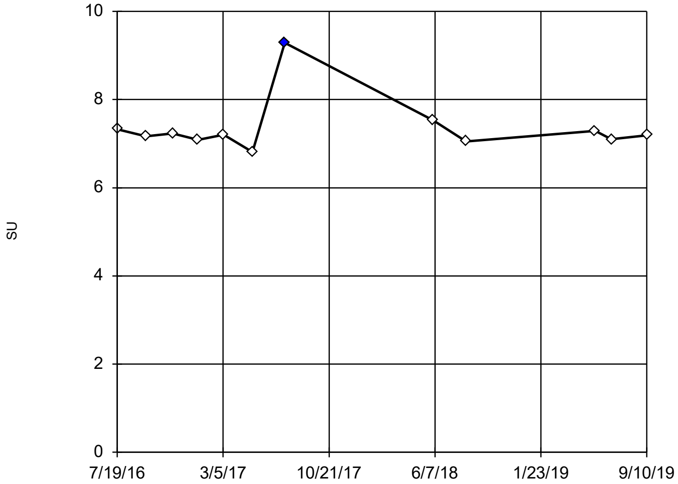
High cutoff = 7.611, low cutoff = 6.419, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Tukey's Outlier Screening

MW-1600I (bg)



n = 12

Outlier is drawn as solid. Tukey's method selected by user.

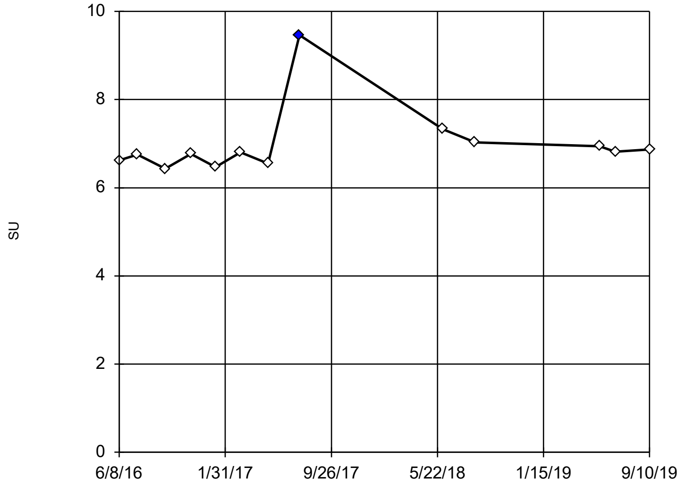
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 7.995, low cutoff = 6.487, based on IQR multiplier of 3.

Constituent: pH, field   Analysis Run 12/5/2019 10:11 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Tukey's Outlier Screening

MW-1600S (bg)



n = 13

Outlier is drawn as solid. Tukey's method selected by user.

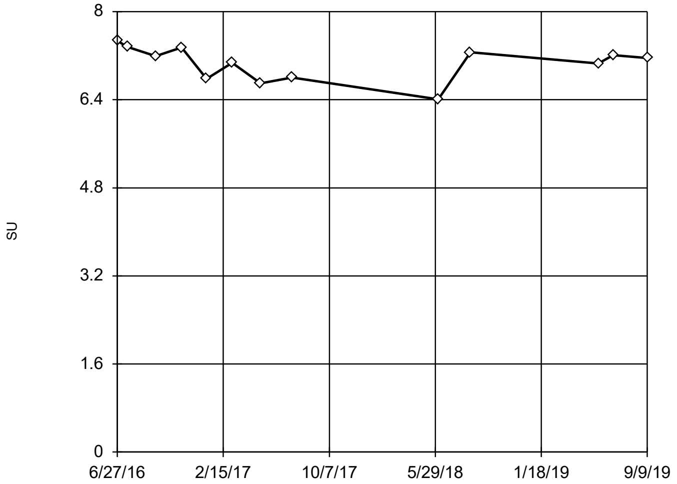
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 8.336, low cutoff = 5.517, based on IQR multiplier of 3.

Constituent: pH, field   Analysis Run 12/5/2019 10:11 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Tukey's Outlier Screening

MW-1601D (bg)



n = 13

No outliers found. Tukey's method selected by user.

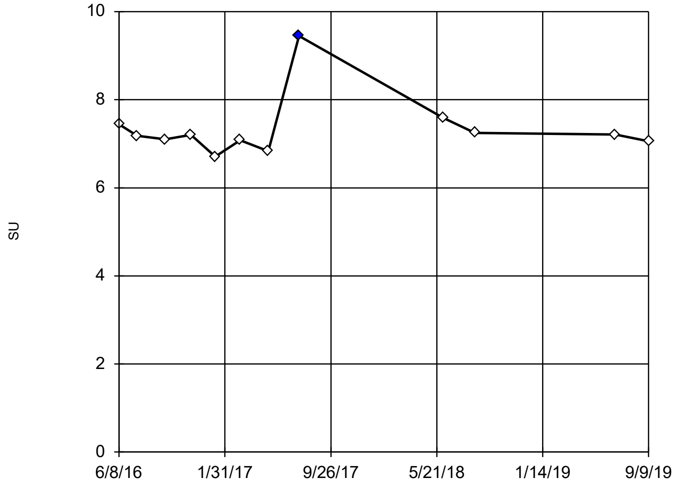
Data were x^6 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 8.245, low cutoff = -6.327, based on IQR multiplier of 3.

Constituent: pH, field   Analysis Run 12/5/2019 10:11 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Tukey's Outlier Screening

MW-1601I (bg)



n = 12

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).

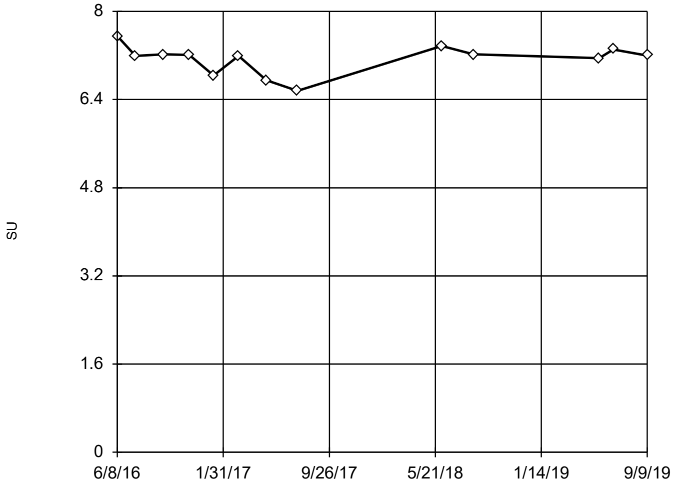
High cutoff = 8.233, low cutoff = 6.307, based on IQR multiplier of 3.

Constituent: pH, field   Analysis Run 12/5/2019 10:11 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1601S (bg)



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 = 7.852, low cutoff = 5.595, based on IQR multiplier of 3.

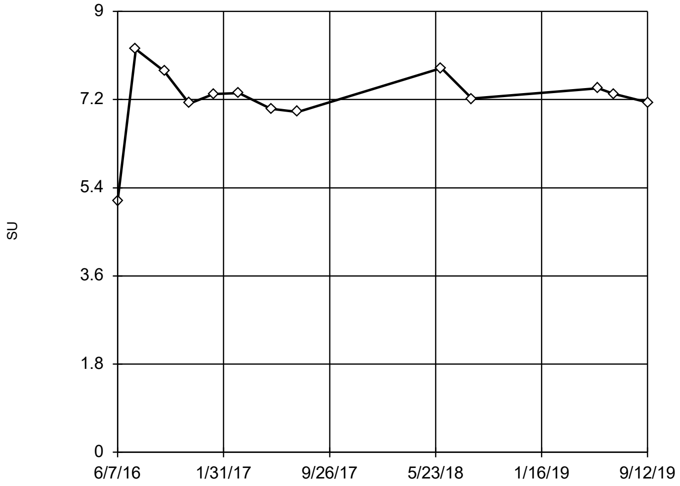
Constituent: pH, field   Analysis Run 12/5/2019 10:11 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602D



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 = 8.607, low cutoff = -6.658, based on IQR multiplier of 3.

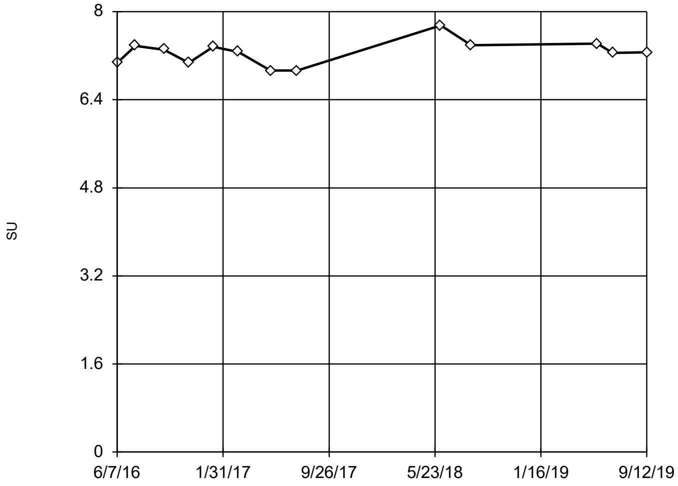
Constituent: pH, field   Analysis Run 12/5/2019 10:11 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602I



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 = 8.417, low cutoff = 6.203, based on IQR multiplier of 3.

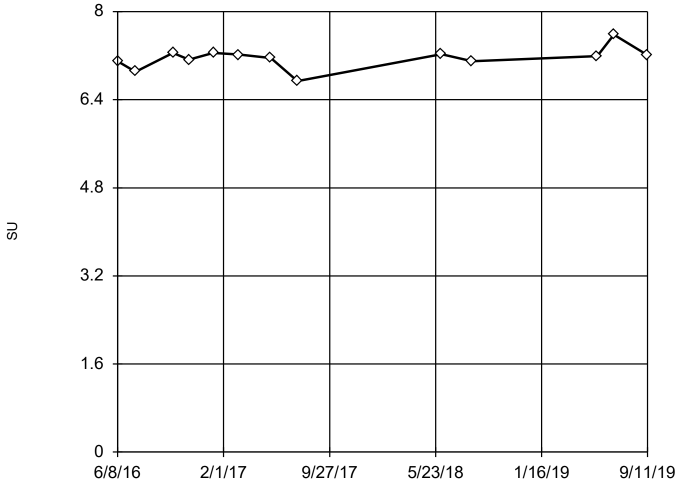
Constituent: pH, field   Analysis Run 12/5/2019 10:11 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603D



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 = 7.645, low cutoff = 6.662, based on IQR multiplier of 3.

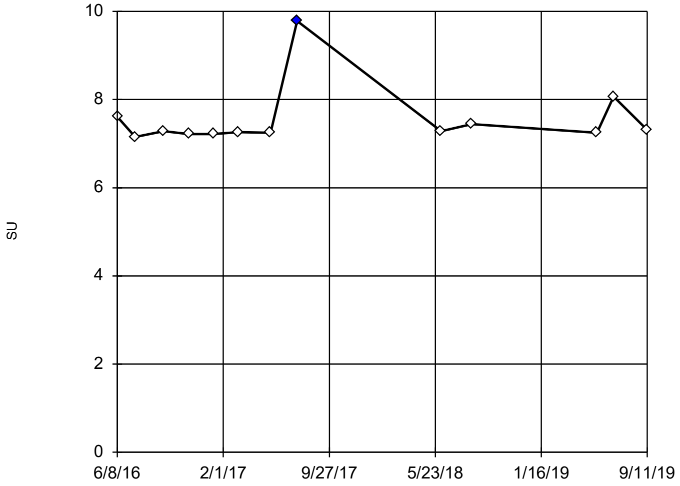
Constituent: pH, field   Analysis Run 12/5/2019 10:11 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603I



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 = 8.465, low cutoff = 6.432, based on IQR multiplier of 3.

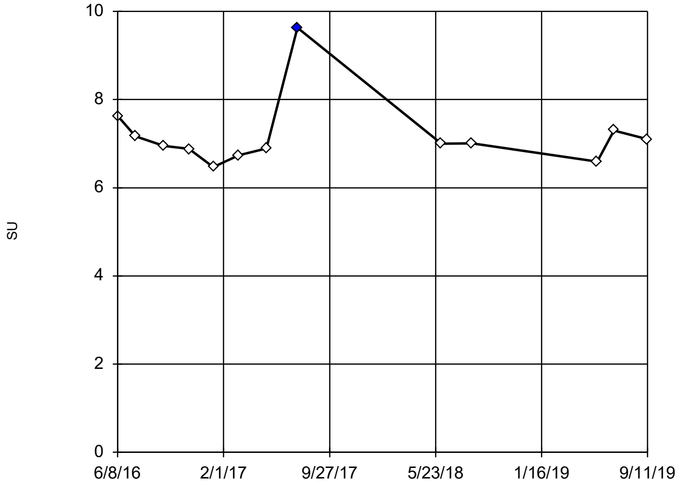
Constituent: pH, field Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603S



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 = 8.676, low cutoff = 5.679, based on IQR multiplier of 3.

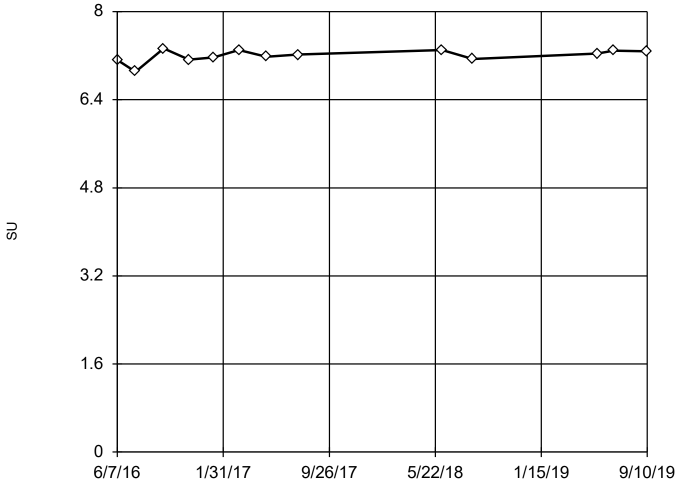
Constituent: pH, field Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

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 = 7.692, low cutoff = 6.503, based on IQR multiplier of 3.

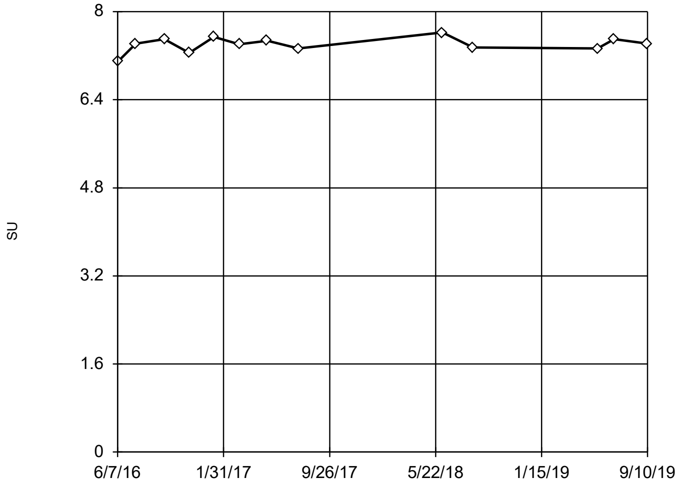
Constituent: pH, field Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604I



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).

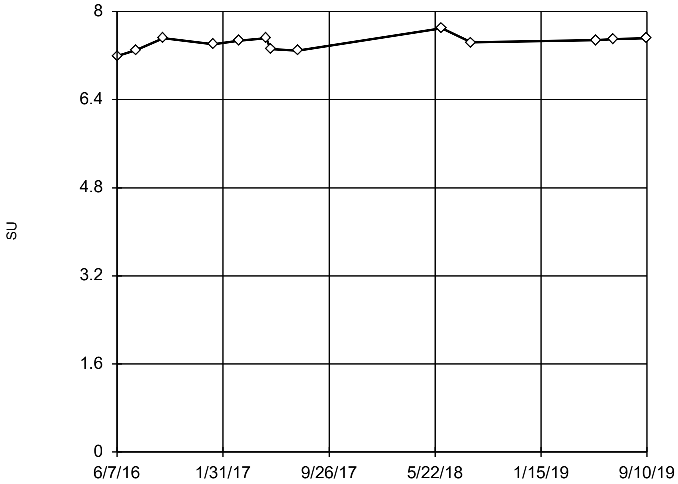
High cutoff = 7.919, low cutoff = 6.65, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

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).

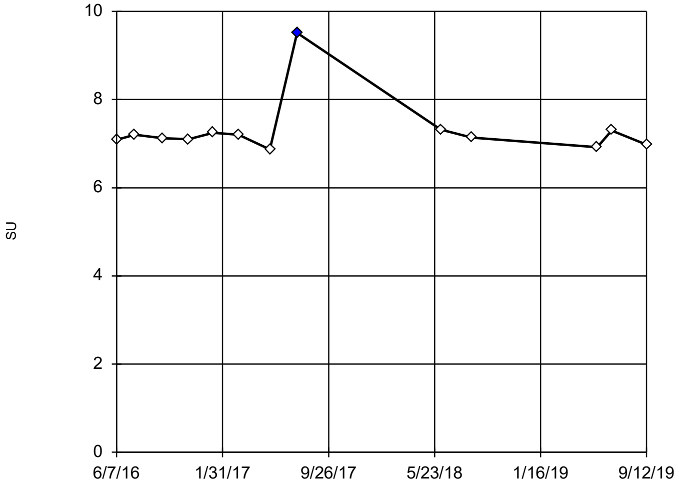
High cutoff = 8.168, low cutoff = 6.698, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

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).

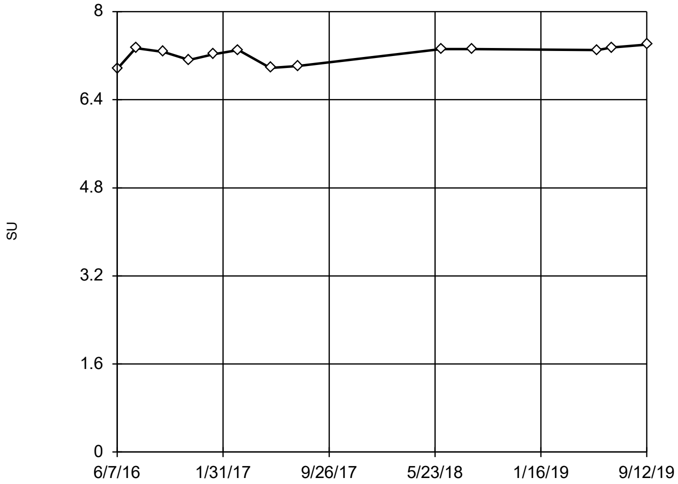
High cutoff = 8.046, low cutoff = 6.361, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Tukey's Outlier Screening

MW-1605I



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).

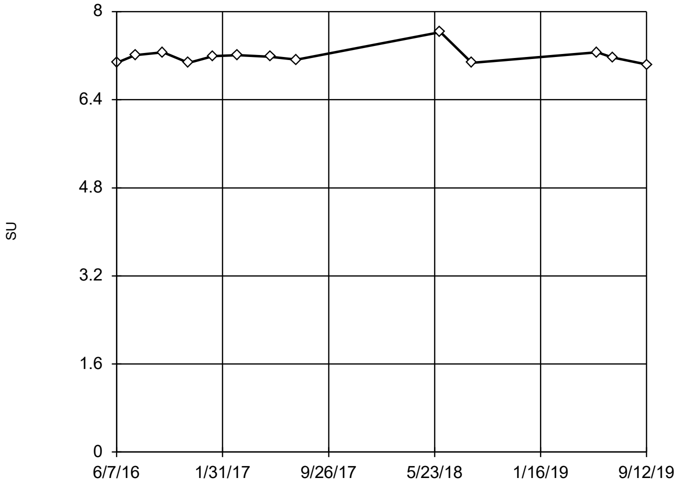
High cutoff = 7.921, low cutoff = 5.651, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Tukey's Outlier Screening

MW-1605S



n = 13

No outliers found. Tukey's method selected by user.

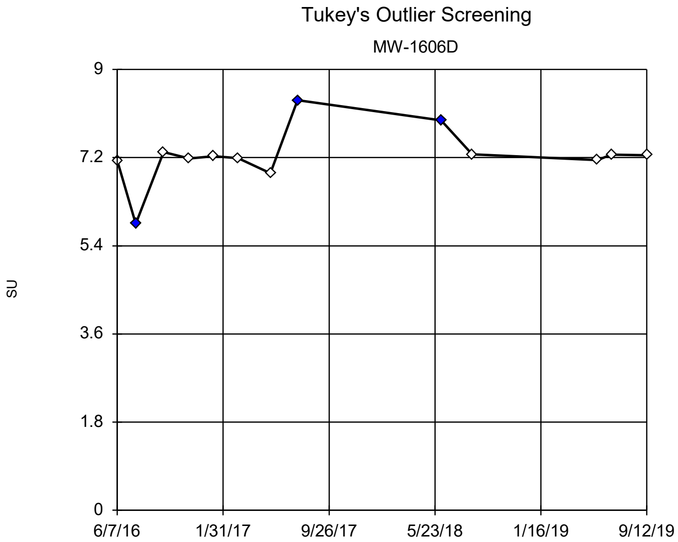
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 7.753, low cutoff = 6.597, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG


Tukey's Outlier Screening

MW-1606D

n = 13

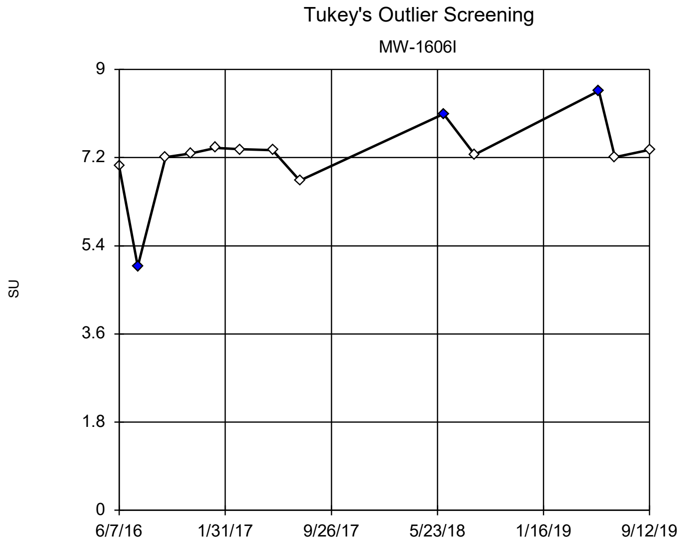
Outliers are drawn as solid.
Tukey's method selected by user.

Data were square transformed to achieve best W statistic (graph shown in original units).

High cutoff = 7.709, low cutoff = 6.691, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 12/5/2019 10:11 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG


Tukey's Outlier Screening

MW-1606I

n = 13

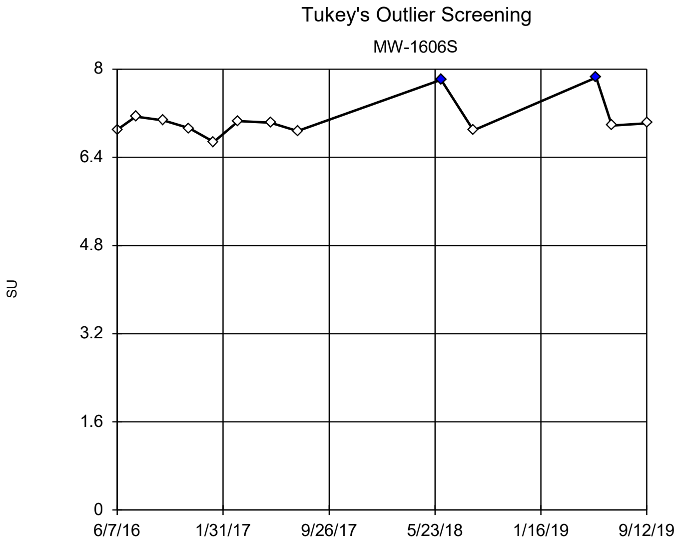
Outliers are drawn as solid.
Tukey's method selected by user.

Data were x^4 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 8.051, low cutoff = 6.048, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 12/5/2019 10:11 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG


Tukey's Outlier Screening

MW-1606S

n = 13

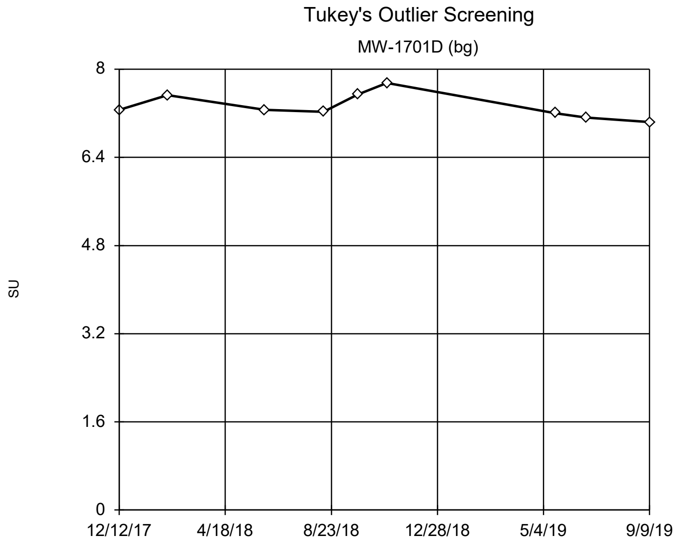
Outliers are drawn as solid.
Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 7.774, low cutoff = 6.302, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 12/5/2019 10:11 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG


Tukey's Outlier Screening

MW-1701D (bg)

n = 9

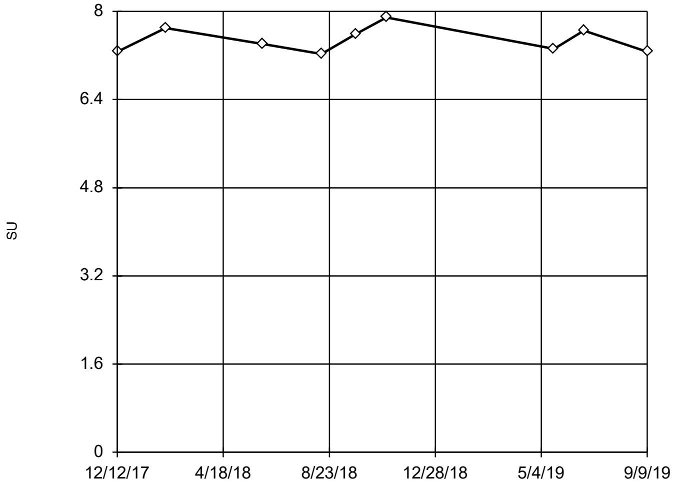
No outliers found.
Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 8.782, low cutoff = 6.143, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 12/5/2019 10:11 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



Tukey's Outlier Screening

MW-1701I (bg)

n = 9

No outliers found. Tukey's method selected by user.

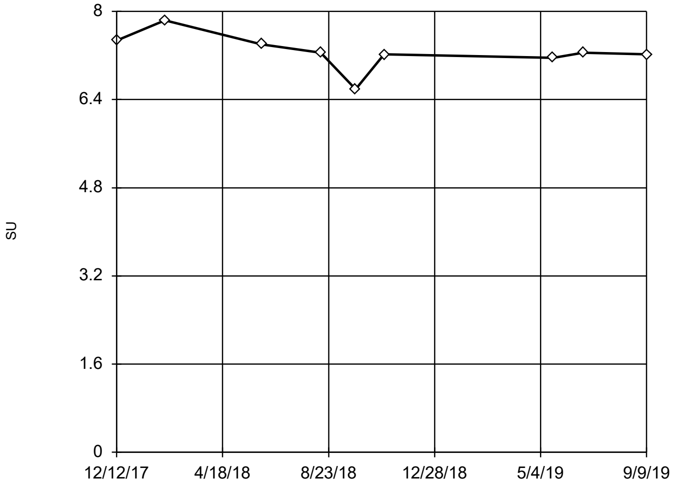
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 9.03, low cutoff = 6.179, based on IQR multiplier of 3.

Constituent: pH, field   Analysis Run 12/5/2019 10:11 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



Tukey's Outlier Screening

MW-1701S (bg)

n = 9

No outliers found. Tukey's method selected by user.

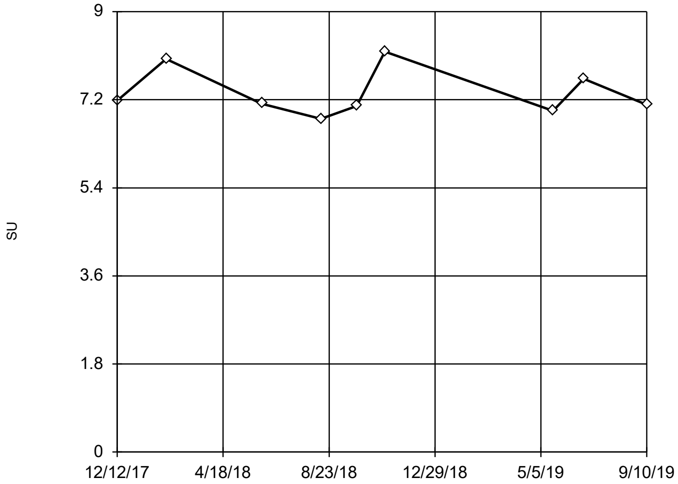
Data were x^4 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 8.053, low cutoff = 6.247, based on IQR multiplier of 3.

Constituent: pH, field   Analysis Run 12/5/2019 10:11 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



Tukey's Outlier Screening

MW-1702D (bg)

n = 9

No outliers found. Tukey's method selected by user.

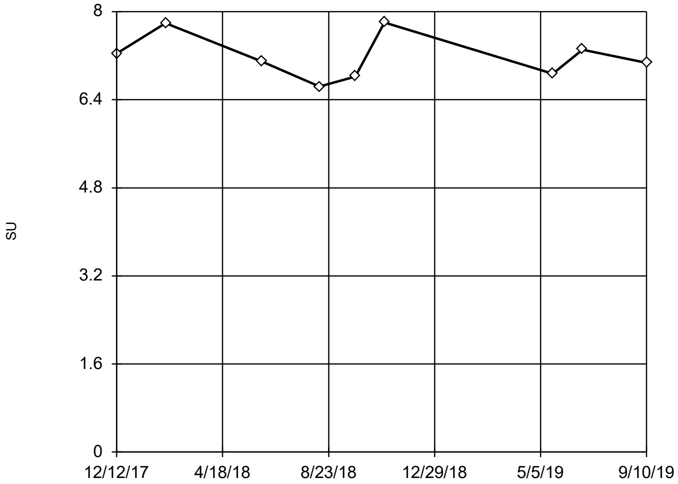
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 10.85, low cutoff = 5.063, based on IQR multiplier of 3.

Constituent: pH, field   Analysis Run 12/5/2019 10:11 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



Tukey's Outlier Screening

MW-1702I (bg)

n = 9

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 = 10.11, low cutoff = 5.109, based on IQR multiplier of 3.

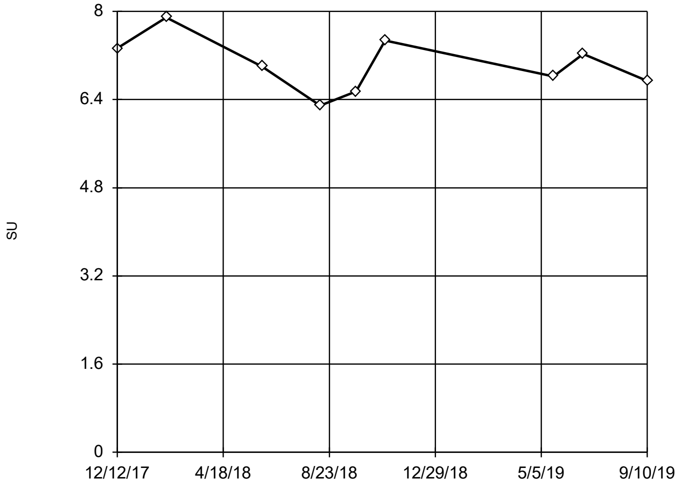
Constituent: pH, field   Analysis Run 12/5/2019 10:11 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1702S (bg)



n = 9

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

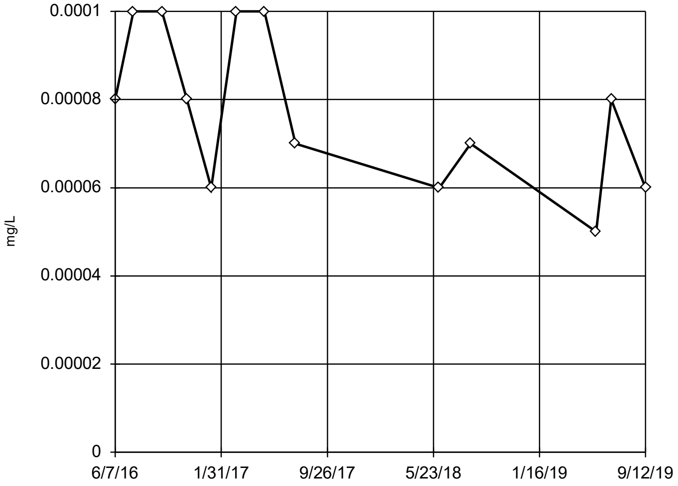
High cutoff = 10.22, low cutoff = 4.81, based on IQR multiplier of 3.

Constituent: pH, field   Analysis Run 12/5/2019 10:11 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1002



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).

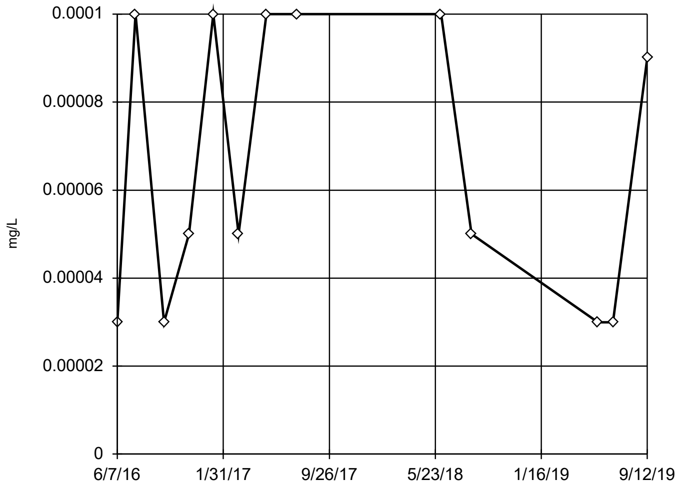
High cutoff = 0.000463, low cutoff = 0.00001296, based on IQR multiplier of 3.

Constituent: Selenium, total   Analysis Run 12/5/2019 10:11 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602D



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).

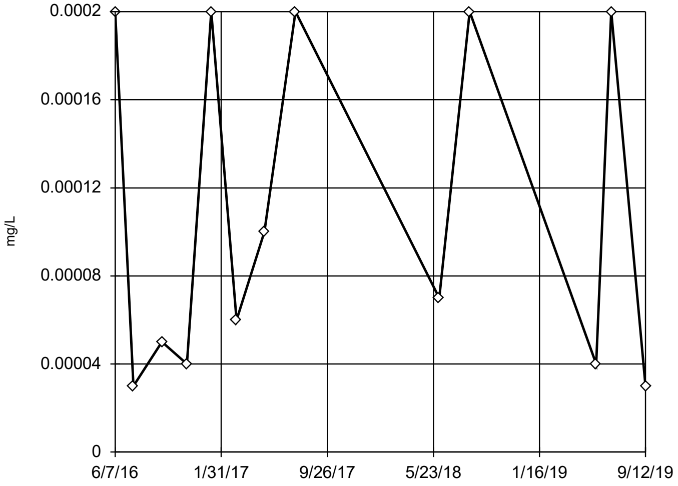
High cutoff = 0.003704, low cutoff = 8.1e-7, based on IQR multiplier of 3.

Constituent: Selenium, total   Analysis Run 12/5/2019 10:11 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602I



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).

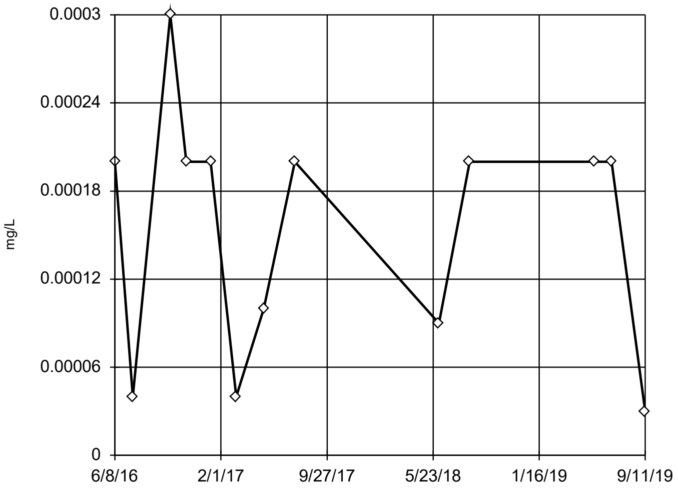
High cutoff = 0.025, low cutoff = 3.2e-7, based on IQR multiplier of 3.

Constituent: Selenium, total   Analysis Run 12/5/2019 10:11 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603D



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 = 0.000605, low cutoff = -0.00034, based on IQR multiplier of 3.

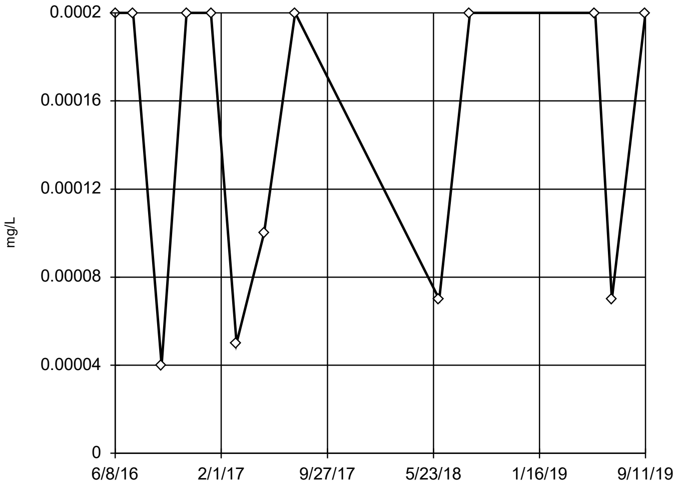
Constituent: Selenium, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603I



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 = 0.004665, low cutoff = 0.000003001, based on IQR multiplier of 3.

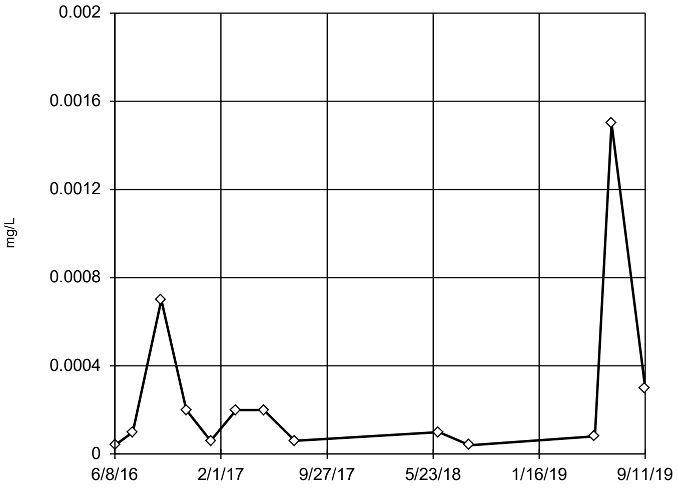
Constituent: Selenium, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603S



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 = 0.01667, low cutoff = 8.8e-7, based on IQR multiplier of 3.

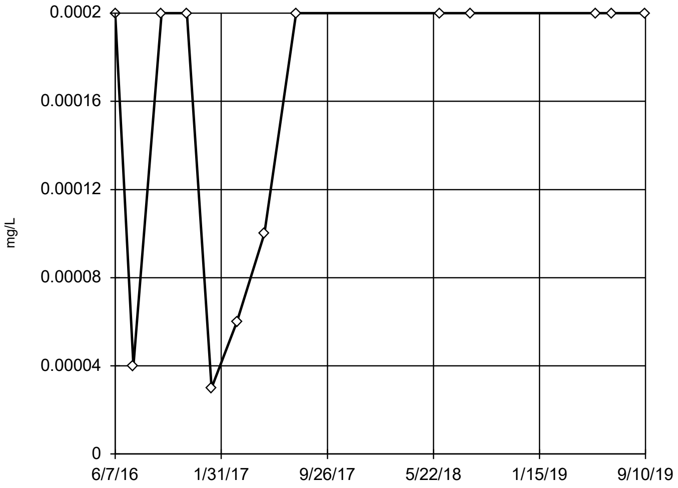
Constituent: Selenium, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604D



n = 13

No outliers found. Tukey's method selected by user.

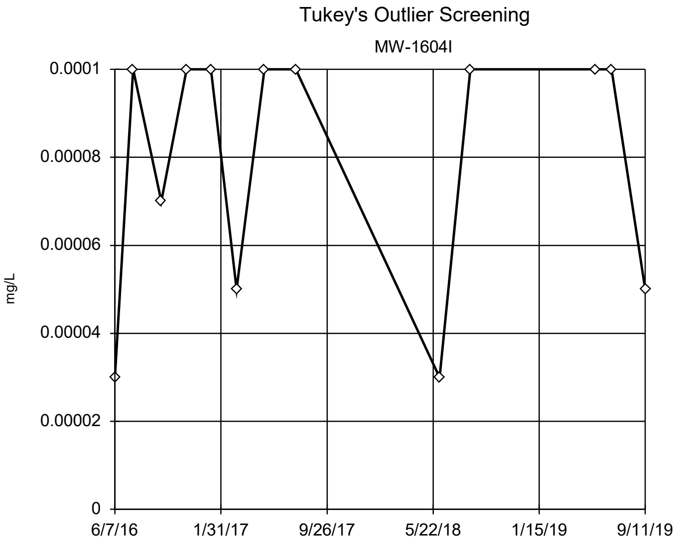
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.003443, low cutoff = 0.0000045, based on IQR multiplier of 3.

Constituent: Selenium, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG


Tukey's Outlier Screening

MW-1604I

n = 13

No outliers found. Tukey's method selected by user.

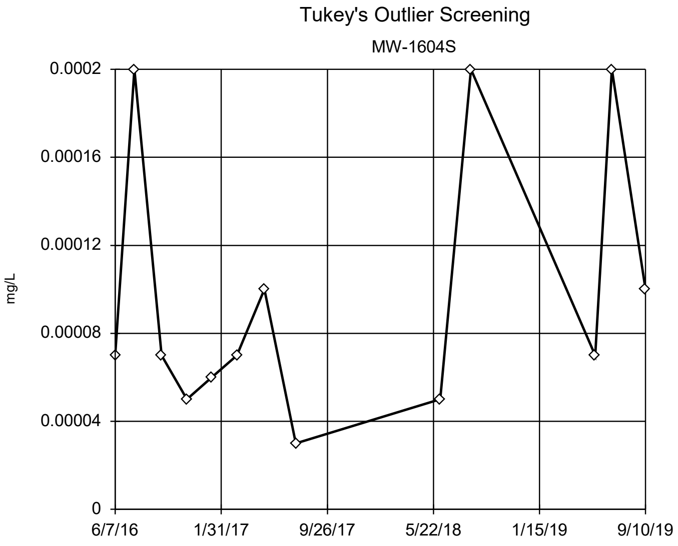
Data were square root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.0003529, low cutoff = -0.000002944, based on IQR multiplier of 3.

Constituent: Selenium, total   Analysis Run 12/5/2019 10:11 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_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.

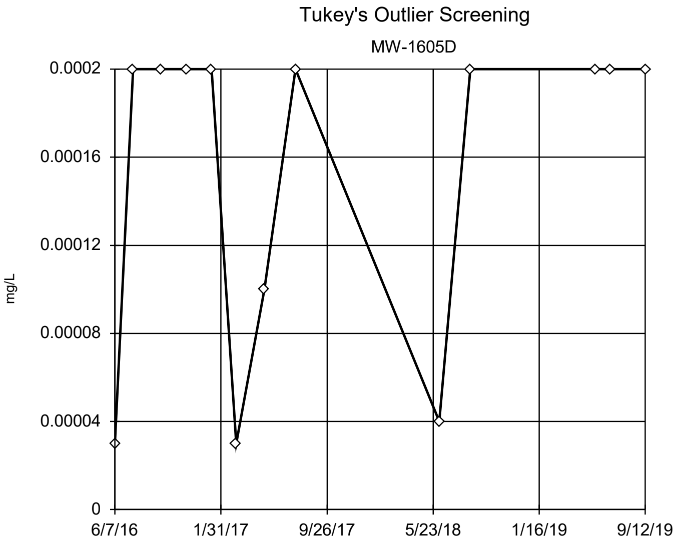
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.002434, low cutoff = 0.000003182, based on IQR multiplier of 3.

Constituent: Selenium, total   Analysis Run 12/5/2019 10:11 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_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.

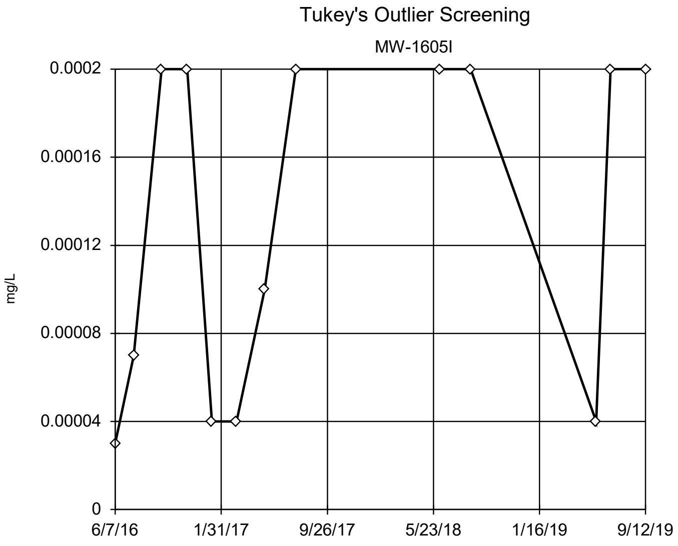
Data were square root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.001029, low cutoff = -0.0000956, based on IQR multiplier of 3.

Constituent: Selenium, total   Analysis Run 12/5/2019 10:11 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG


Tukey's Outlier Screening

MW-1605I

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 = 0.025, low cutoff = 3.2e-7, based on IQR multiplier of 3.

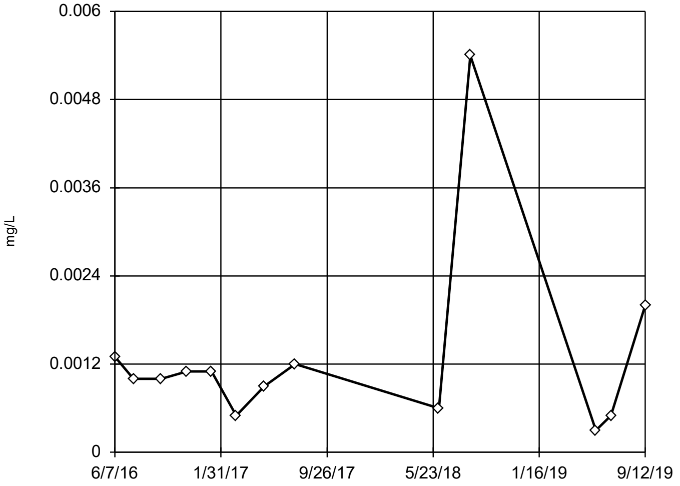
Constituent: Selenium, total   Analysis Run 12/5/2019 10:11 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_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 = 0.01481, low cutoff = 0.00004619, based on IQR multiplier of 3.

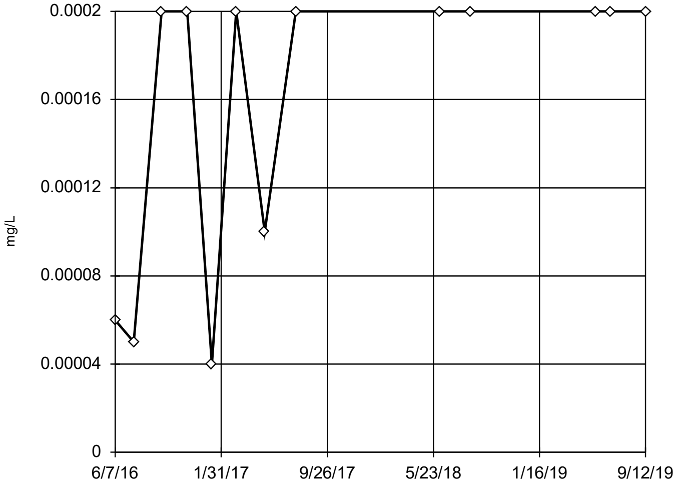
Constituent: Selenium, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

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 = 0.003443, low cutoff = 0.0000045, based on IQR multiplier of 3.

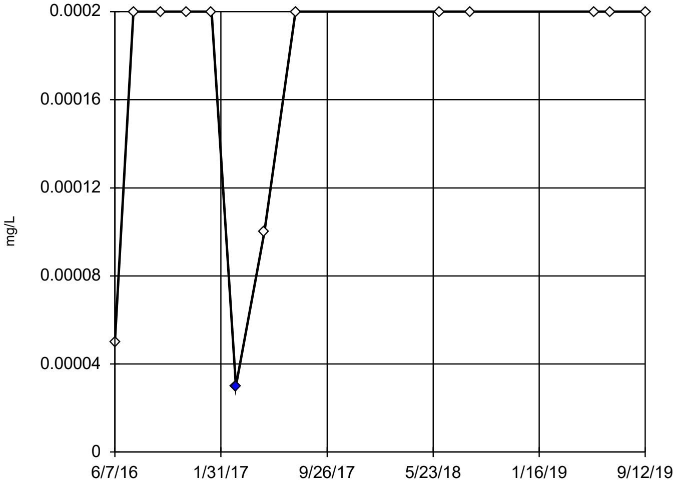
Constituent: Selenium, total Analysis Run 12/5/2019 10:11 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606I



n = 13

Outlier is 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 = 0.0004143, low cutoff = 0.00003431, based on IQR multiplier of 3.

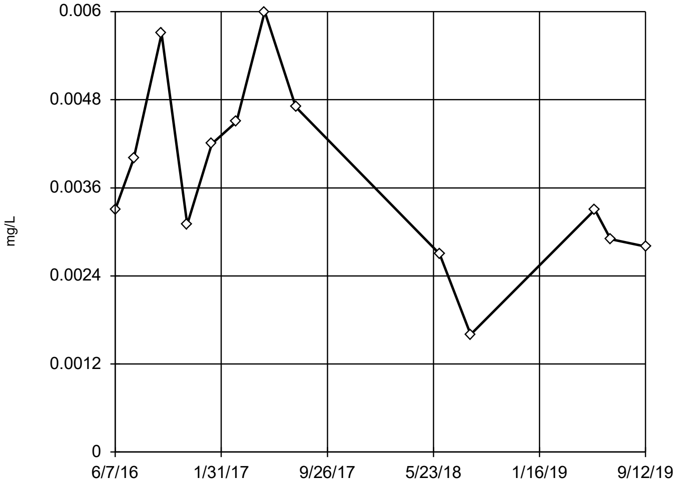
Constituent: Selenium, total Analysis Run 12/5/2019 10:12 AM

Rockport BAP Client: Geosyntec Data: Rockport_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 = 0.01235, low cutoff = 0.0001015, based on IQR multiplier of 3.

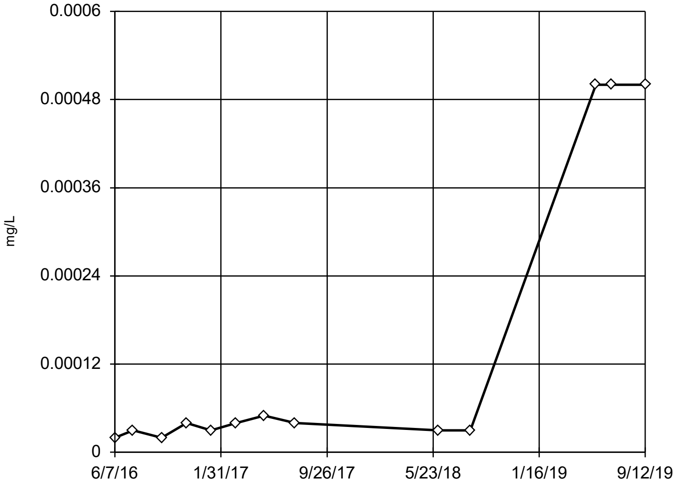
Constituent: Selenium, total Analysis Run 12/5/2019 10:12 AM

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1002



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).

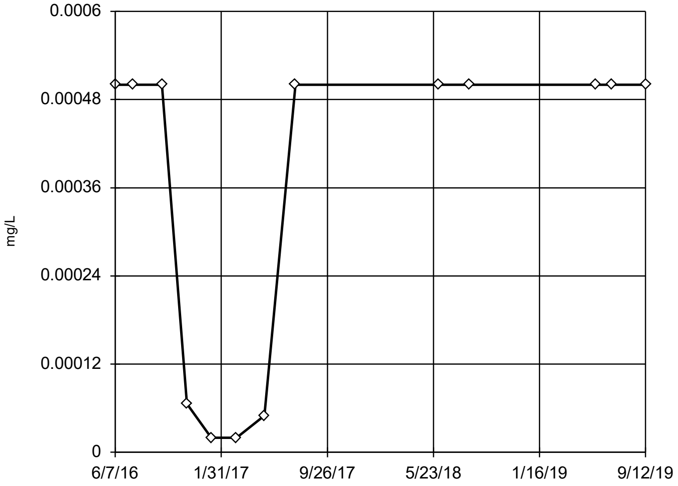
High cutoff = 0.02315, low cutoff = 2.0e-7, based on IQR multiplier of 3.

Constituent: Thallium, total   Analysis Run 12/5/2019 10:12 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602D



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).

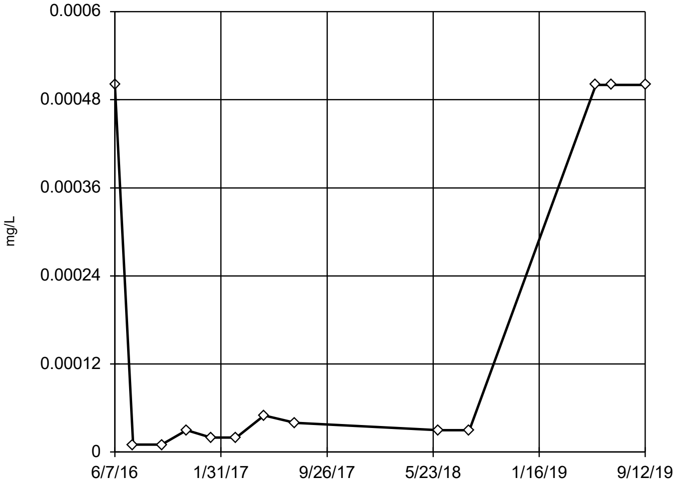
High cutoff = 0.3297, low cutoff = 8.7e-8, based on IQR multiplier of 3.

Constituent: Thallium, total   Analysis Run 12/5/2019 10:12 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1602I



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).

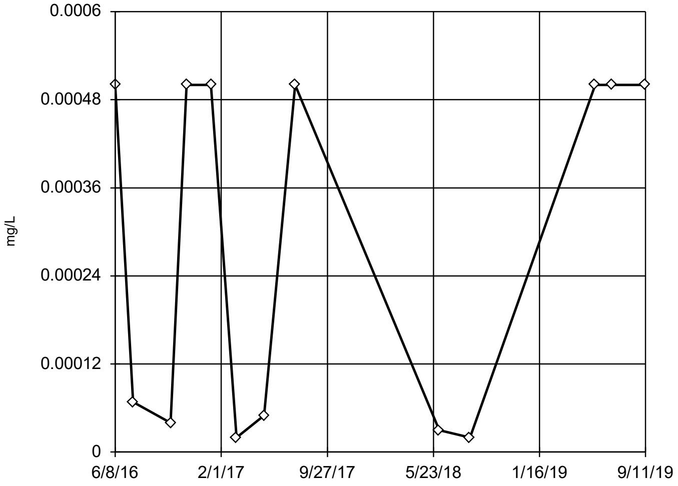
High cutoff = 7.813, low cutoff = 1.3e-9, based on IQR multiplier of 3.

Constituent: Thallium, total   Analysis Run 12/5/2019 10:12 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603D



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).

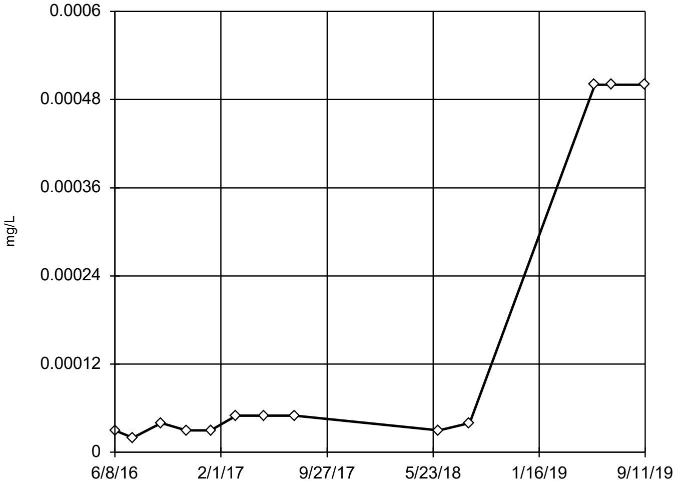
High cutoff = 1.504, low cutoff = 1.2e-8, based on IQR multiplier of 3.

Constituent: Thallium, total   Analysis Run 12/5/2019 10:12 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603I



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 = 0.02315, low cutoff = 2.0e-7, based on IQR multiplier of 3.

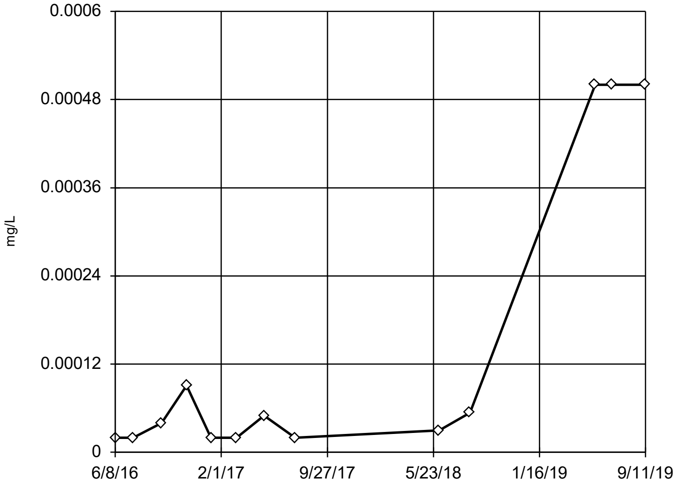
Constituent: Thallium, total   Analysis Run 12/5/2019 10:12 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1603S



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 = 0.2588, low cutoff = 1.6e-8, based on IQR multiplier of 3.

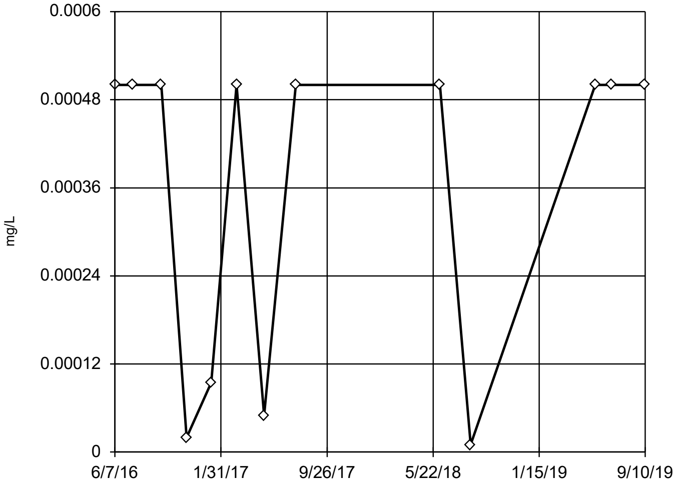
Constituent: Thallium, total   Analysis Run 12/5/2019 10:12 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

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 = 0.1909, low cutoff = 1.8e-7, based on IQR multiplier of 3.

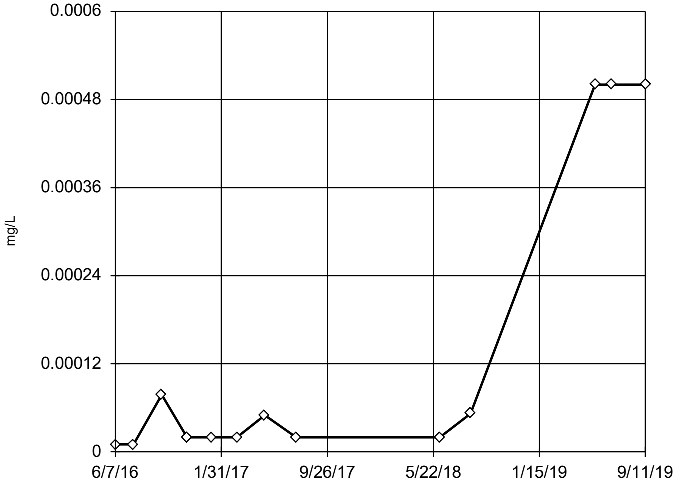
Constituent: Thallium, total   Analysis Run 12/5/2019 10:12 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1604I



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 = 0.1901, low cutoff = 2.1e-8, based on IQR multiplier of 3.

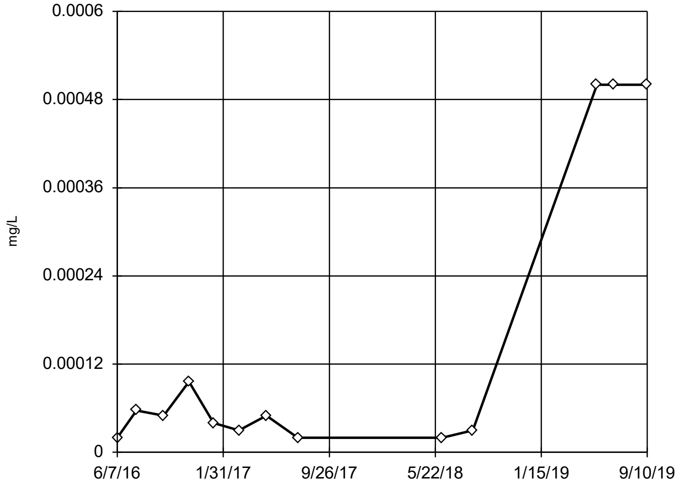
Constituent: Thallium, total   Analysis Run 12/5/2019 10:12 AM

Rockport BAP   Client: Geosyntec   Data: Rockport_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).

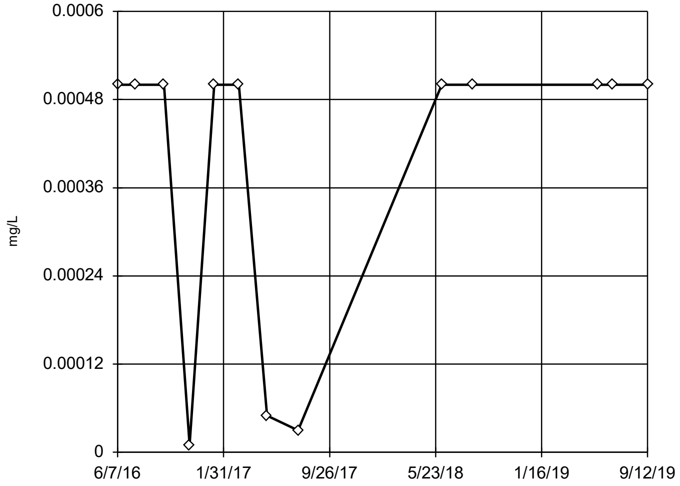
High cutoff = 0.1568, low cutoff = 3.4e-8, based on IQR multiplier of 3.

Constituent: Thallium, total Analysis Run 12/5/2019 10:12 AM
Rockport BAP Client: Geosyntec Data: Rockport_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).

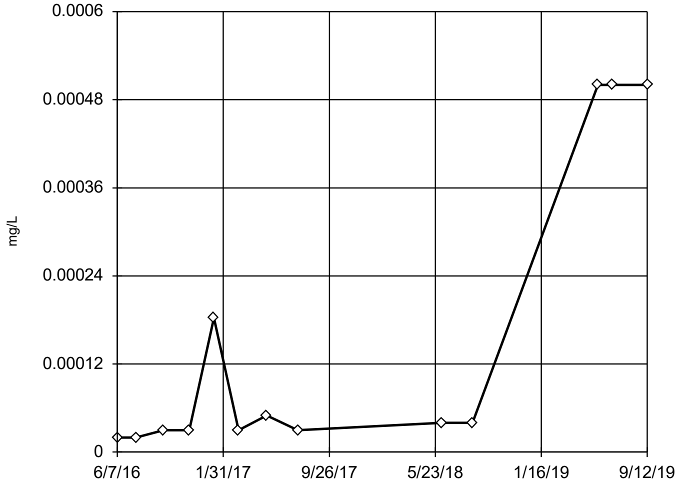
High cutoff = 0.01581, low cutoff = 0.000005, based on IQR multiplier of 3.

Constituent: Thallium, total Analysis Run 12/5/2019 10:12 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1605I



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).

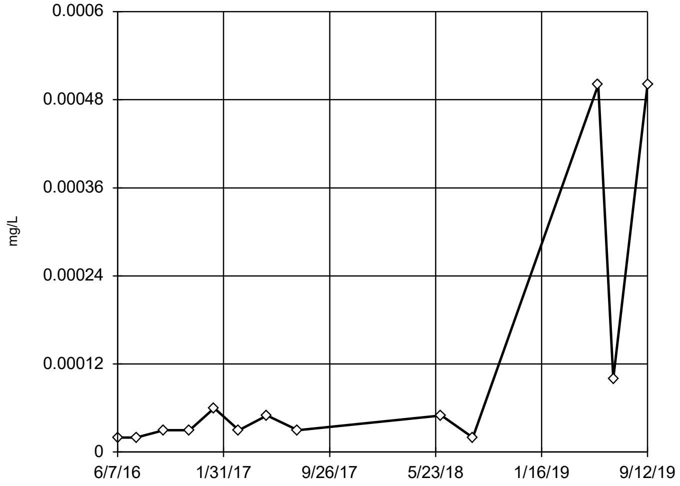
High cutoff = 0.3101, low cutoff = 2.9e-8, based on IQR multiplier of 3.

Constituent: Thallium, total Analysis Run 12/5/2019 10:12 AM
Rockport BAP Client: Geosyntec Data: Rockport_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).

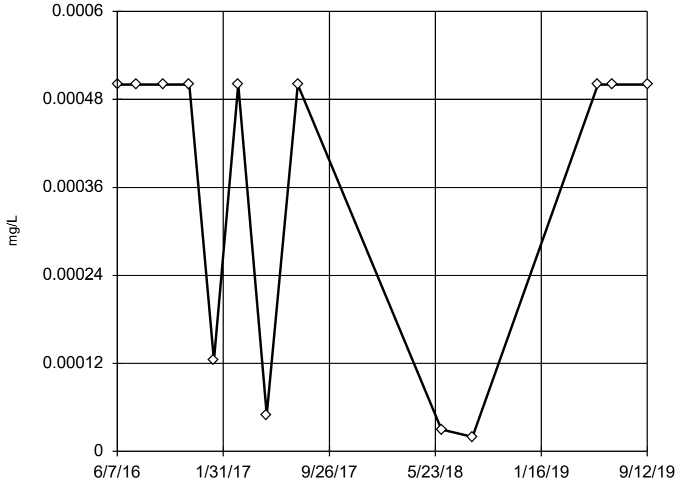
High cutoff = 0.002449, low cutoff = 7.7e-7, based on IQR multiplier of 3.

Constituent: Thallium, total Analysis Run 12/5/2019 10:12 AM
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

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).

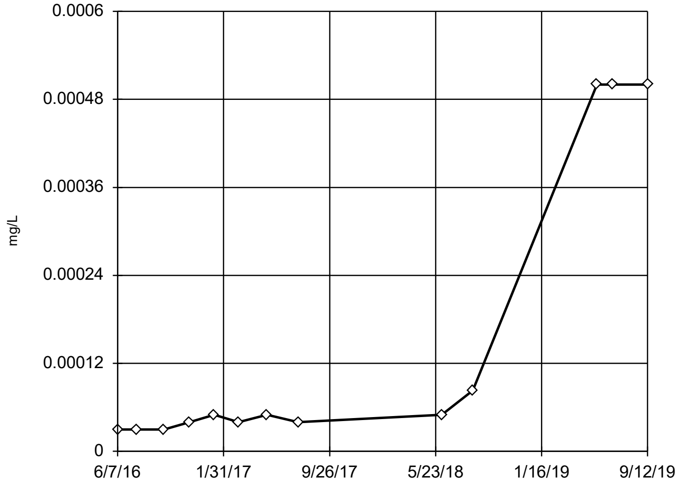
High cutoff = 0.128, low cutoff = 3.1e-7, based on IQR multiplier of 3.

Constituent: Thallium, total   Analysis Run 12/5/2019 10:12 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Tukey's Outlier Screening

MW-1606I



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).

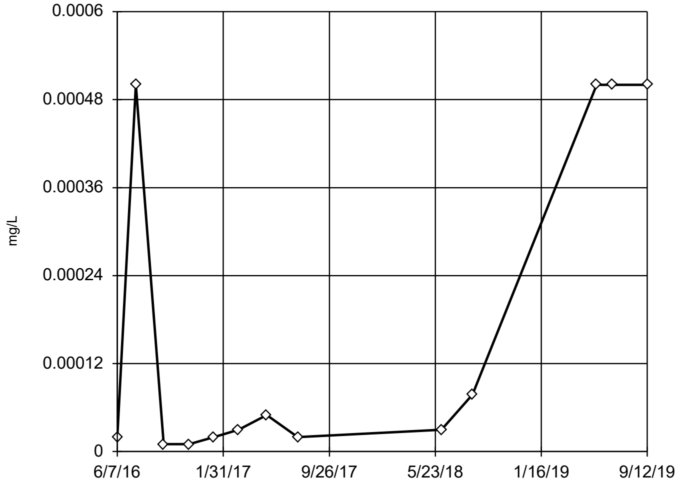
High cutoff = 0.04143, low cutoff = 1.7e-7, based on IQR multiplier of 3.

Constituent: Thallium, total   Analysis Run 12/5/2019 10:12 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_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 = 7.813, low cutoff = 1.3e-9, based on IQR multiplier of 3.

Constituent: Thallium, total   Analysis Run 12/5/2019 10:12 AM
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Mann-Whitney - Significant Results

Rockport BAP Client: Geosyntec Data: Rockport_BAP Printed 12/8/2019, 2:07 PM

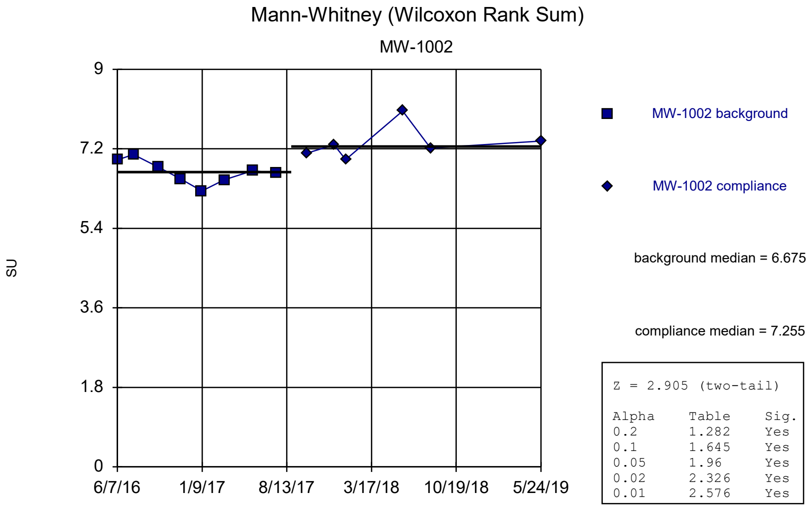
Constituent	Well	Calc.	0.01	Sig.	Method
pH, field (SU)	**MW-1002**	**2.905**	**Yes**	**Yes**	**Mann-W**

Mann-Whitney - All Results

Rockport BAP Client: Geosyntec Data: Rockport_BAP Printed 12/8/2019, 2:07 PM

Constituent	Well	Calc.	0.01	Sig.	Method
Calcium, total (mg/L)	MW-1600D (bg)	-0.5104	No	No	Mann-W
Calcium, total (mg/L)	MW-1600I (bg)	-1.616	No	No	Mann-W
Calcium, total (mg/L)	MW-1600S (bg)	-1.786	No	No	Mann-W
Calcium, total (mg/L)	MW-1601D (bg)	-0.5944	No	No	Mann-W
Calcium, total (mg/L)	MW-1601I (bg)	-0.1021	No	No	Mann-W
Calcium, total (mg/L)	MW-1601S (bg)	-1.953	No	No	Mann-W
Calcium, total (mg/L)	MW-1002	-1.274	No	No	Mann-W
Calcium, total (mg/L)	MW-1602D	-1.104	No	No	Mann-W
Calcium, total (mg/L)	MW-1602I	-1.613	No	No	Mann-W
Calcium, total (mg/L)	MW-1603D	-1.104	No	No	Mann-W
Calcium, total (mg/L)	MW-1603I	-2.123	No	No	Mann-W
Calcium, total (mg/L)	MW-1603S	-1.613	No	No	Mann-W
Calcium, total (mg/L)	MW-1604D	-1.274	No	No	Mann-W
Calcium, total (mg/L)	MW-1604I	-1.104	No	No	Mann-W
Calcium, total (mg/L)	MW-1604S	-1.104	No	No	Mann-W
Calcium, total (mg/L)	MW-1605D	-1.783	No	No	Mann-W
Calcium, total (mg/L)	MW-1605I	-2.123	No	No	Mann-W
Calcium, total (mg/L)	MW-1605S	-1.783	No	No	Mann-W
Calcium, total (mg/L)	MW-1606D	1.106	No	No	Mann-W
Calcium, total (mg/L)	MW-1606I	1.444	No	No	Mann-W
Calcium, total (mg/L)	MW-1606S	0.2548	No	No	Mann-W
pH, field (SU)	MW-1600D (bg)	0.6615	No	No	Mann-W
pH, field (SU)	MW-1600I (bg)	0.9594	No	No	Mann-W
pH, field (SU)	MW-1600S (bg)	1.949	No	No	Mann-W
pH, field (SU)	MW-1601D (bg)	-0.5123	No	No	Mann-W
pH, field (SU)	MW-1601I (bg)	0.4725	No	No	Mann-W
pH, field (SU)	MW-1601S (bg)	1.174	No	No	Mann-W
pH, field (SU)	**MW-1002**	**2.905**	**Yes**	**Yes**	**Mann-W**
pH, field (SU)	MW-1602D	1.073	No	No	Mann-W
pH, field (SU)	MW-1602I	2.461	No	No	Mann-W
pH, field (SU)	MW-1603D	-0.2936	No	No	Mann-W
pH, field (SU)	MW-1603I	0.5021	No	No	Mann-W
pH, field (SU)	MW-1603S	0.6429	No	No	Mann-W
pH, field (SU)	MW-1604D	1.466	No	No	Mann-W
pH, field (SU)	MW-1604I	1.1	No	No	Mann-W
pH, field (SU)	MW-1604S	2.391	No	No	Mann-W
pH, field (SU)	MW-1605D	0.1898	No	No	Mann-W
pH, field (SU)	MW-1605I	1.749	No	No	Mann-W
pH, field (SU)	MW-1605S	1.043	No	No	Mann-W
pH, field (SU)	MW-1606D	-0.4872	No	No	Mann-W
pH, field (SU)	MW-1606I	0.4872	No	No	Mann-W
pH, field (SU)	MW-1606S	0.1939	No	No	Mann-W

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



```
Z = 2.905 (two-tail)

Alpha    Table    Sig.
0.2      1.282    Yes
0.1      1.645    Yes
0.05     1.96     Yes
0.02     2.326    Yes
0.01     2.576    Yes
```

Constituent: pH, field   Analysis Run 12/8/2019 2:05 PM   View: Mann Whitney

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Intrawell Prediction Limit Summary

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP   Printed 12/8/2019, 2:14 PM

Constituent	Well	Upper Lim.	Lower Lim.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Calcium, total (mg/L)	MW-1600D	92.5	n/a	n/a	12	82.28	5.189	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1600I	81.85	n/a	n/a	12	75.5	3.222	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1600S	71.88	n/a	n/a	12	63.8	4.101	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1601D	94.27	n/a	n/a	12	86.33	4.036	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1601I	96.14	n/a	n/a	11	86.49	4.709	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1601S	85.85	n/a	n/a	12	75.86	5.071	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1002	78.34	n/a	n/a	12	47.2	15.81	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1602D	79.68	n/a	n/a	12	70.9	4.456	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1602I	87.81	n/a	n/a	12	76.54	5.721	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1603D	96.67	n/a	n/a	12	82.65	7.117	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1603I	103.5	n/a	n/a	12	88	7.858	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1603S	96.21	n/a	n/a	12	63.29	16.71	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1604D	76.07	n/a	n/a	12	69.08	3.547	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1604I	84.43	n/a	n/a	12	74.03	5.283	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1604S	108	n/a	n/a	12	83.43	12.49	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1605D	95.28	n/a	n/a	12	85.63	4.902	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1605I	104.3	n/a	n/a	12	87.37	8.608	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1605S	88.64	n/a	n/a	12	5401	1247	0	None	x^2	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1606D	81.4	n/a	n/a	12	73.52	4	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1606I	86.27	n/a	n/a	12	68.28	9.136	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1606S	68.13	n/a	n/a	12	3.921	0.1523	0	None	ln(x)	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1701S	68.34	n/a	n/a	7	59.84	3.133	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1702D	90.49	n/a	n/a	7	79.36	4.104	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1702I	86.84	n/a	n/a	7	77.14	3.573	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1702S	44.88	n/a	n/a	7	33.83	4.072	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1701D	82.24	n/a	n/a	7	71.8	3.848	0	None	No	0.0005016	Param Intra 1 of 3
Calcium, total (mg/L)	MW-1701I	73.44	n/a	n/a	7	64.77	3.196	0	None	No	0.0005016	Param Intra 1 of 3
pH, field (SU)	MW-1600D	7.626	6.557	n/a	13	7.092	0.2774	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1600I	7.599	6.791	n/a	10	7.195	0.1899	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1600S	7.258	6.272	n/a	12	6.765	0.2503	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1601D	7.667	6.47	n/a	13	7.068	0.3106	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1601I	7.661	6.57	n/a	11	7.115	0.266	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1601S	7.65	6.621	n/a	13	7.135	0.2669	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1002	7.818	6.101	n/a	14	6.959	0.4557	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1602D	8.148	6.728	n/a	13	7.438	0.3685	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1602I	7.769	6.838	n/a	14	7.304	0.2471	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1603D	7.393	6.827	n/a	13	7.11	0.1468	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1603I	7.792	6.797	n/a	13	7.295	0.2583	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1603S	7.614	6.369	n/a	13	6.992	0.3233	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1604D	7.439	6.977	n/a	13	7.208	0.1199	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1604I	7.784	7.093	n/a	14	7.439	0.1832	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1604S	7.874	7.116	n/a	14	7.495	0.2014	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1605D	7.391	6.851	n/a	11	7.121	0.1319	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1605I	7.555	6.909	n/a	14	7.232	0.1713	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1605S	7.67	7.07	n/a	14	n/a	n/a	0	n/a	n/a	0.003199	NP Intra (normality) 1 of 3
pH, field (SU)	MW-1606D	8.37	6.88	n/a	12	n/a	n/a	0	n/a	n/a	0.004347	NP Intra (normality) 1 of 3
pH, field (SU)	MW-1606I	8.342	6.403	n/a	12	7.373	0.4922	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1606S	7.796	6.333	n/a	14	7.064	0.3882	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1701S	8.302	6.249	n/a	7	7.276	0.3784	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1702D	8.801	5.873	n/a	7	7.337	0.5395	0	None	No	0.0002508	Param Intra 1 of 3

Intrawell Prediction Limit Summary

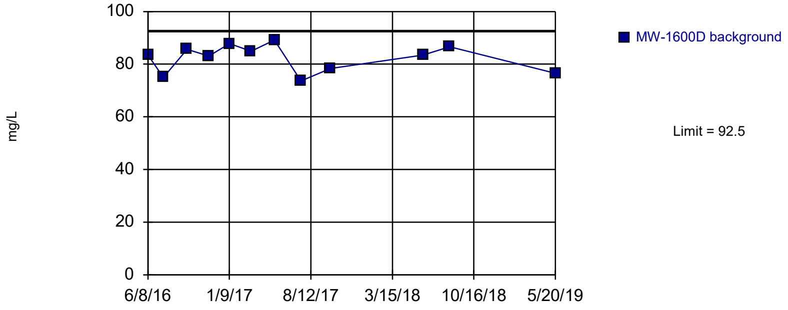
Rockport BAP Client: Geosyntec Data: Rockport_BAP Printed 12/8/2019, 2:14 PM

Constituent	Well	Upper Lim.	Lower Lim.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
pH, field (SU)	MW-1702I	8.435	5.925	n/a	7	7.18	0.4626	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1702S	8.554	5.546	n/a	7	7.05	0.5543	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1701D	7.968	6.823	n/a	7	7.396	0.2109	0	None	No	0.0002508	Param Intra 1 of 3
pH, field (SU)	MW-1701I	8.157	6.818	n/a	7	7.487	0.2468	0	None	No	0.0002508	Param Intra 1 of 3

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1600D (bg)



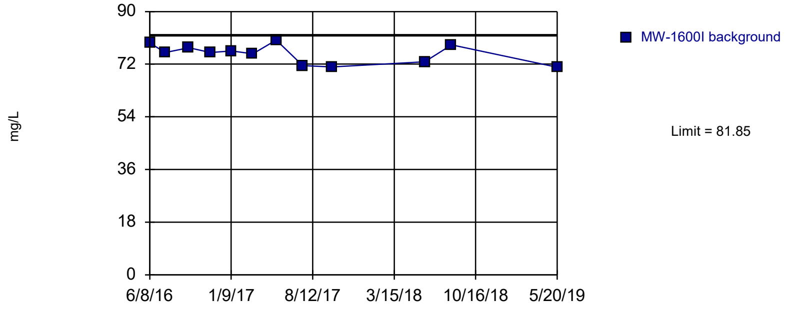
Background Data Summary: Mean=82.28, Std. Dev.=5.189, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9157, critical = 0.805. Kappa = 1.97 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1600I (bg)



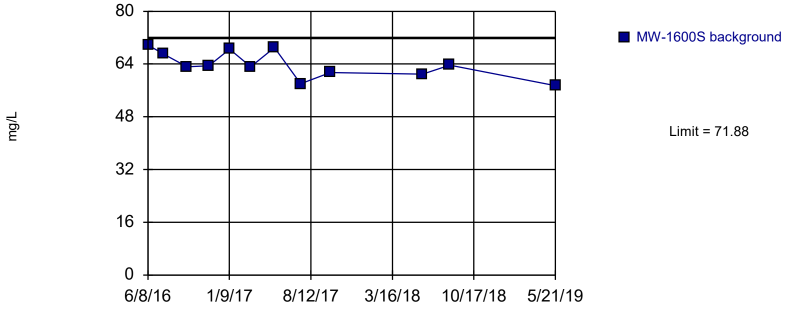
Background Data Summary: Mean=75.5, Std. Dev.=3.222, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.92, critical = 0.805. Kappa = 1.97 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1600S (bg)



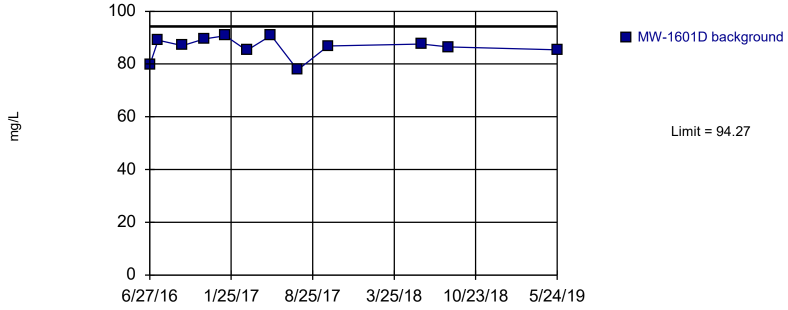
Background Data Summary: Mean=63.8, Std. Dev.=4.101, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9383, critical = 0.805. Kappa = 1.97 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1601D (bg)



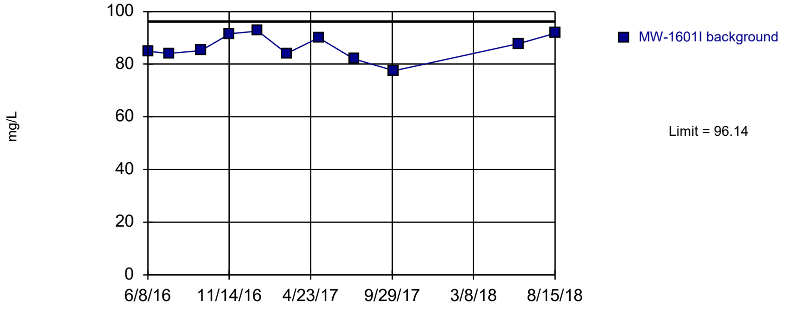
Background Data Summary: Mean=86.33, Std. Dev.=4.036, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8746, critical = 0.805. Kappa = 1.97 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1601I (bg)



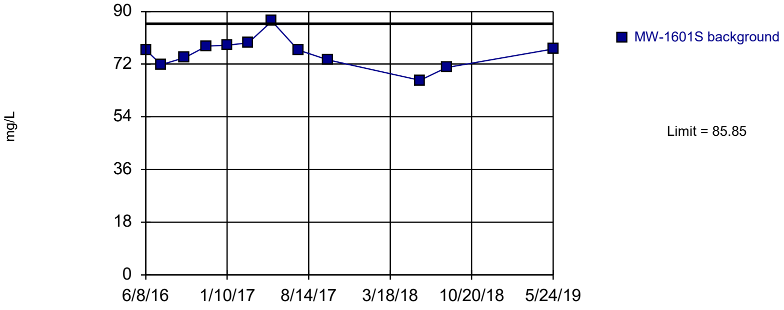
Background Data Summary: Mean=86.49, Std. Dev.=4.709, n=11. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9399, critical = 0.792. Kappa = 2.05 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1601S (bg)



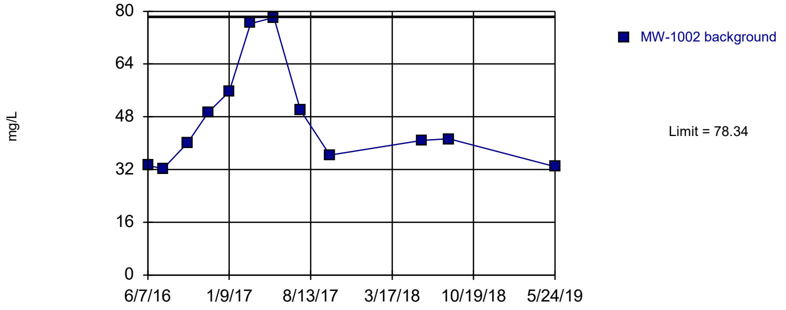
Background Data Summary: Mean=75.86, Std. Dev.=5.071, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9566, critical = 0.805. Kappa = 1.97 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1002



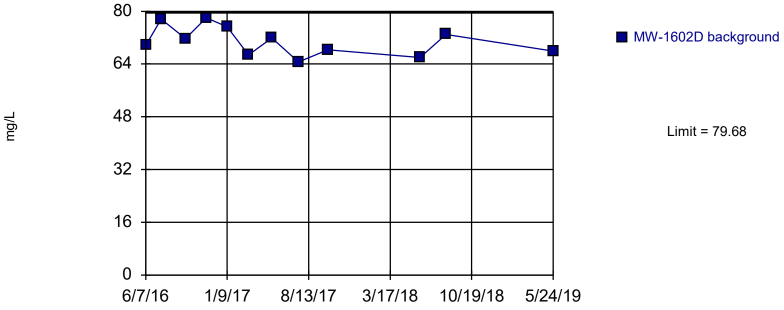
Background Data Summary: Mean=47.2, Std. Dev.=15.81, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8305, critical = 0.805. Kappa = 1.97 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1602D



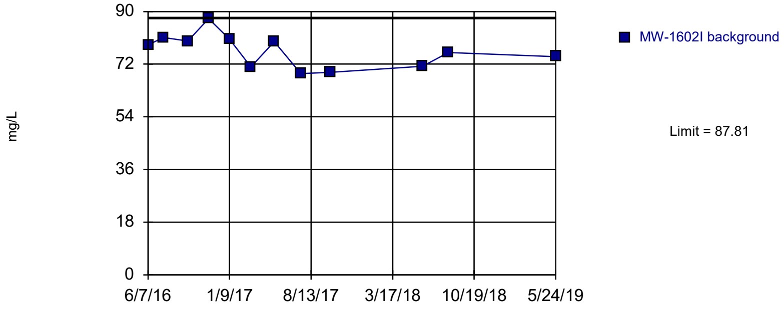
Background Data Summary: Mean=70.9, Std. Dev.=4.456, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.948, critical = 0.805. Kappa = 1.97 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1602I



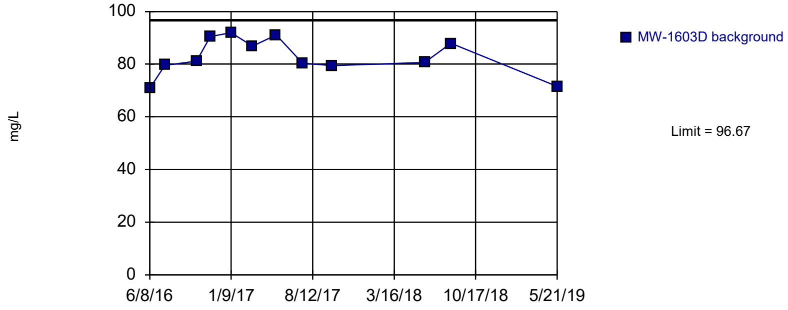
Background Data Summary: Mean=76.54, Std. Dev.=5.721, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9396, critical = 0.805. Kappa = 1.97 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1603D



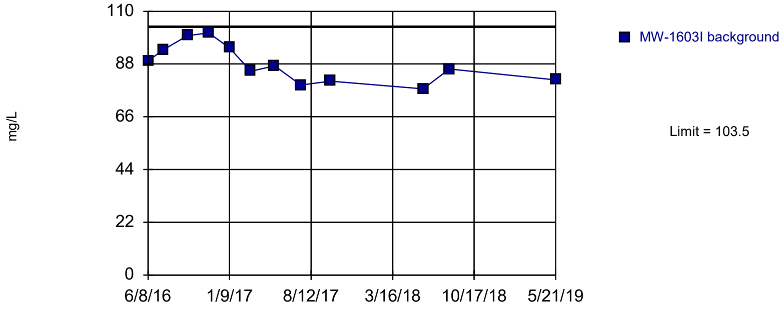
Background Data Summary: Mean=82.65, Std. Dev.=7.117, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.914, critical = 0.805. Kappa = 1.97 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1603I



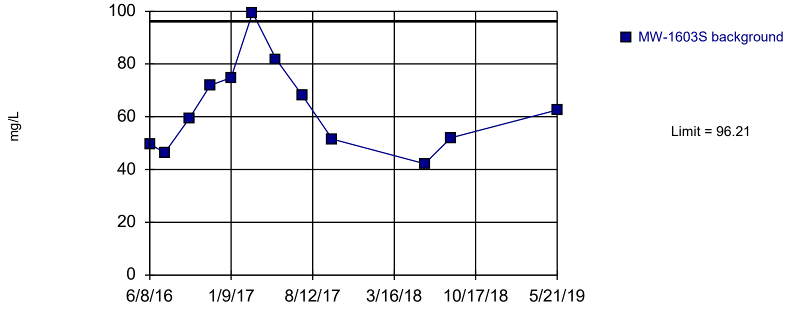
Background Data Summary: Mean=88, Std. Dev.=7.858, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9366, critical = 0.805. Kappa = 1.97 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1603S



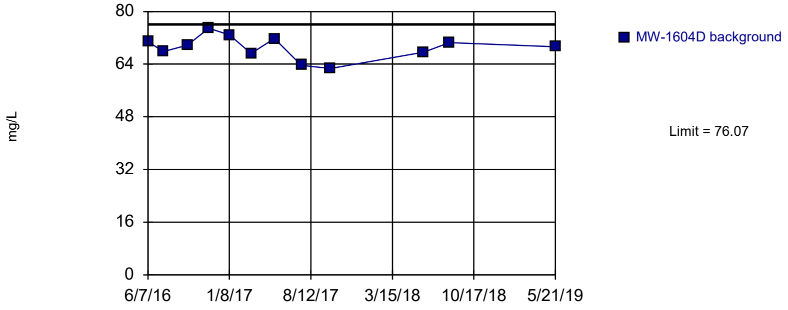
Background Data Summary: Mean=63.29, Std. Dev.=16.71, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9415, critical = 0.805. Kappa = 1.97 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1604D



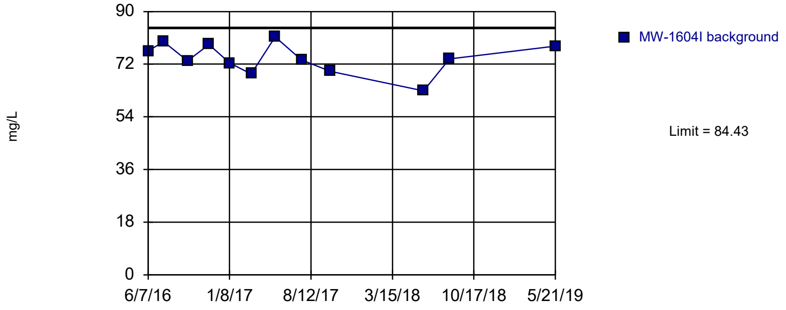
Background Data Summary: Mean=69.08, Std. Dev.=3.547, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9704, critical = 0.805. Kappa = 1.97 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1604I



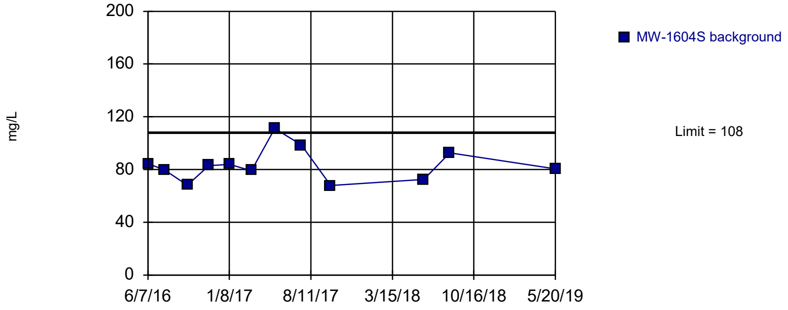
Background Data Summary: Mean=74.03, Std. Dev.=5.283, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9563, critical = 0.805. Kappa = 1.97 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1604S



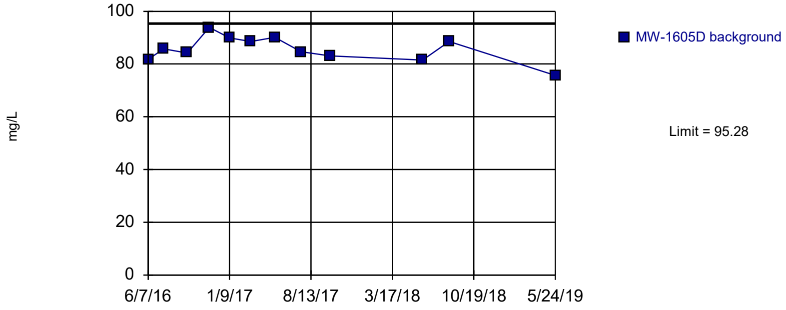
Background Data Summary: Mean=83.43, Std. Dev.=12.49, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9242, critical = 0.805. Kappa = 1.97 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1605D



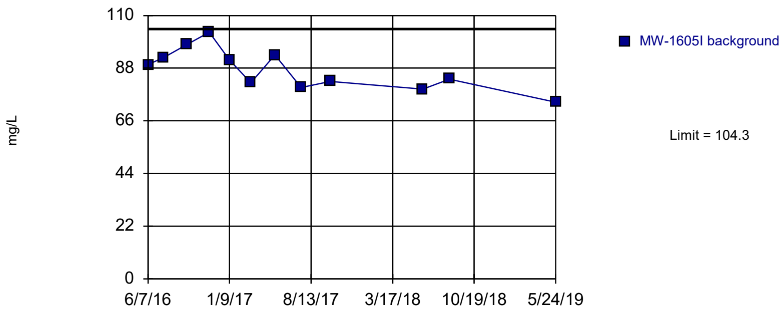
Background Data Summary: Mean=85.63, Std. Dev.=4.902, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9748, critical = 0.805. Kappa = 1.97 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1605I



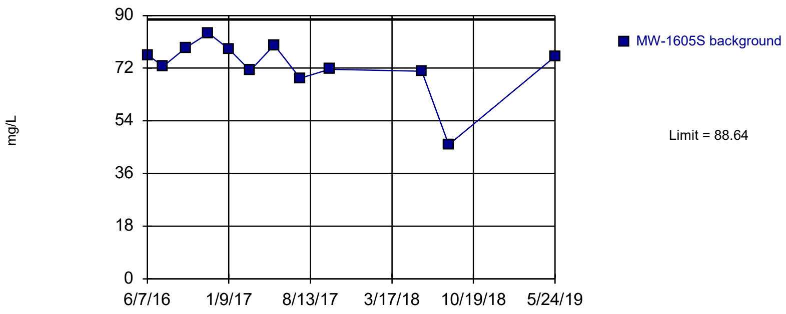
Background Data Summary: Mean=87.37, Std. Dev.=8.608, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9669, critical = 0.805. Kappa = 1.97 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1605S



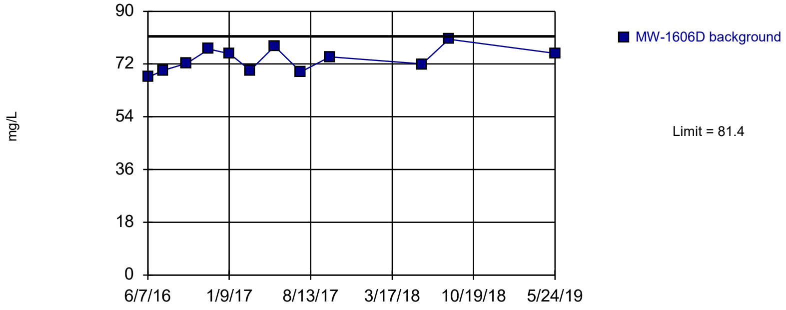
Background Data Summary (based on square transformation): Mean=5401, Std. Dev.=1247, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.851, critical = 0.805. Kappa = 1.97 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1606D



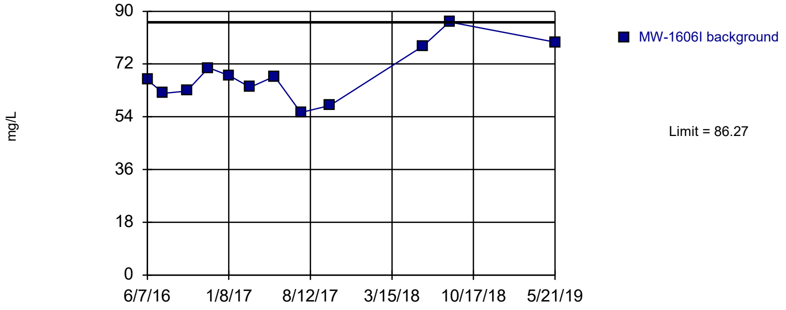
Background Data Summary: Mean=73.52, Std. Dev.=4, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.966, critical = 0.805. Kappa = 1.97 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1606I



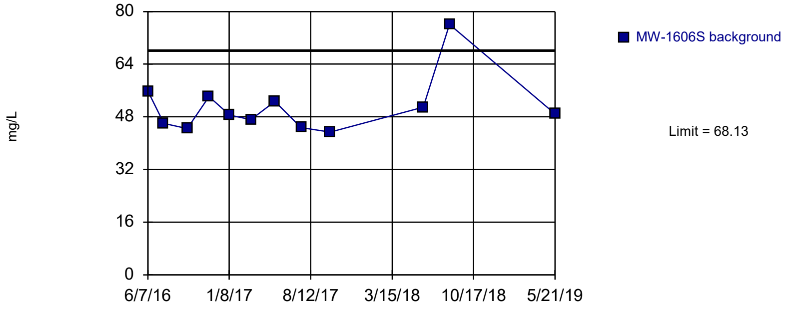
Background Data Summary: Mean=68.28, Std. Dev.=9.136, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9498, critical = 0.805. Kappa = 1.97 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1606S



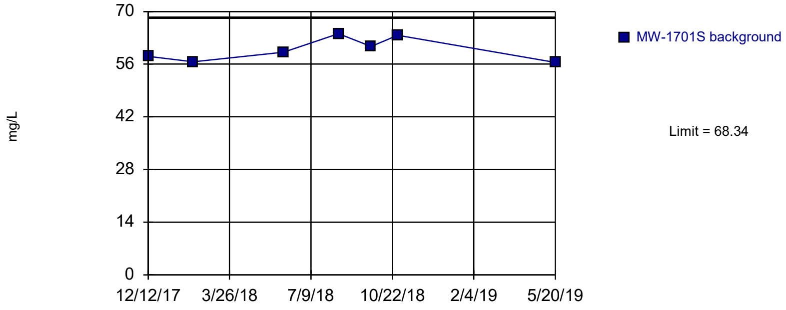
Background Data Summary (based on natural log transformation): Mean=3.921, Std. Dev.=0.1523, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8188, critical = 0.805. Kappa = 1.97 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1701S (bg)



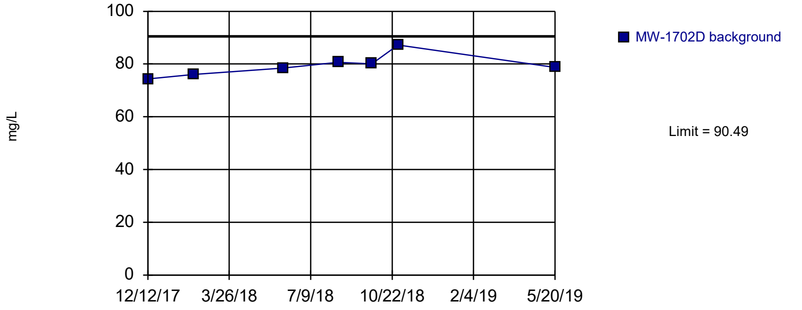
Background Data Summary: Mean=59.84, Std. Dev.=3.133, n=7. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8936, critical = 0.73. Kappa = 2.713 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1702D (bg)



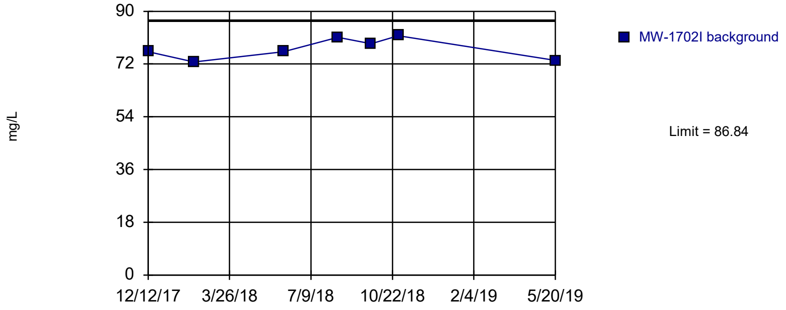
Background Data Summary: Mean=79.36, Std. Dev.=4.104, n=7. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9203, critical = 0.73. Kappa = 2.713 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1702I (bg)



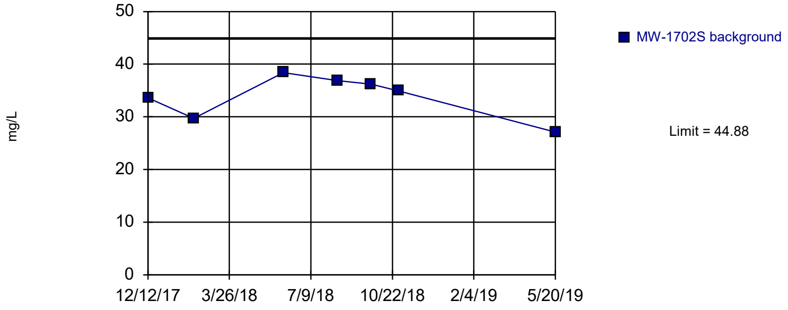
Background Data Summary: Mean=77.14, Std. Dev.=3.573, n=7. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9176, critical = 0.73. Kappa = 2.713 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1702S (bg)



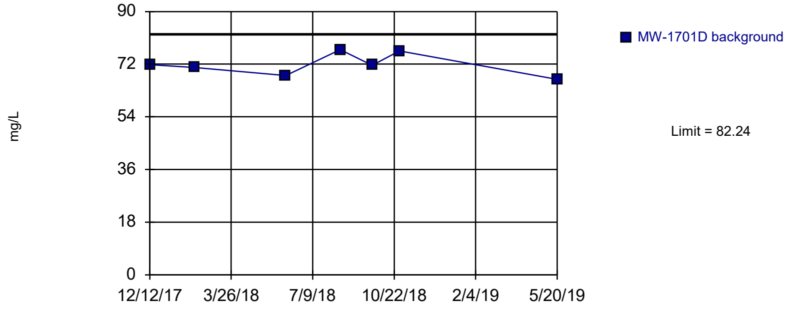
Background Data Summary: Mean=33.83, Std. Dev.=4.072, n=7. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9245, critical = 0.73. Kappa = 2.713 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1701D (bg)



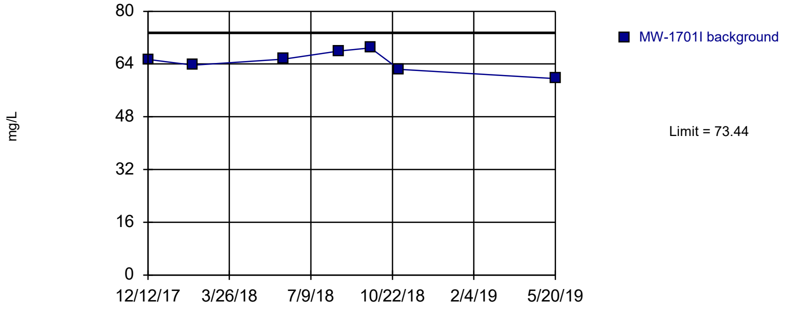
Background Data Summary: Mean=71.8, Std. Dev.=3.848, n=7. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9204, critical = 0.73. Kappa = 2.713 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1701I (bg)



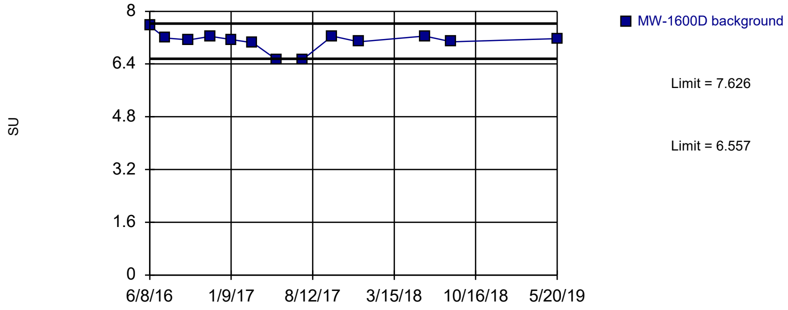
Background Data Summary: Mean=64.77, Std. Dev.=3.196, n=7. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9716, critical = 0.73. Kappa = 2.713 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1600D (bg)



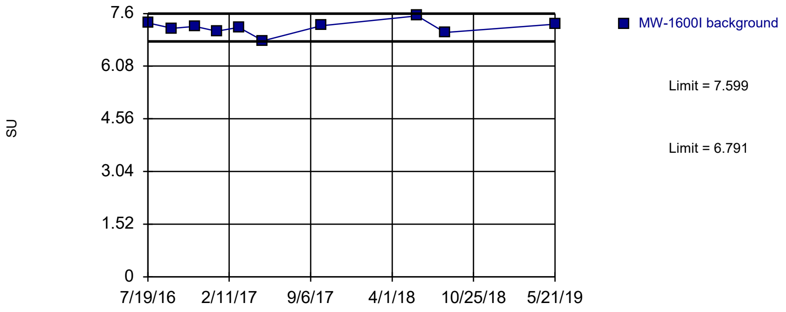
Background Data Summary: Mean=7.092, Std. Dev.=0.2774, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8343, critical = 0.814. Kappa = 1.927 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1600I (bg)



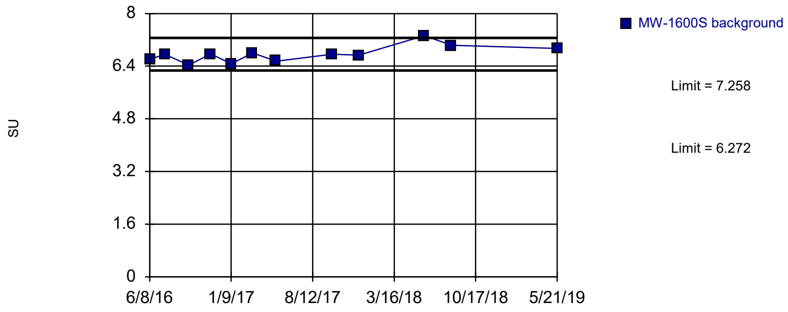
Background Data Summary: Mean=7.195, Std. Dev.=0.1899, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9631, critical = 0.781. Kappa = 2.13 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1600S (bg)



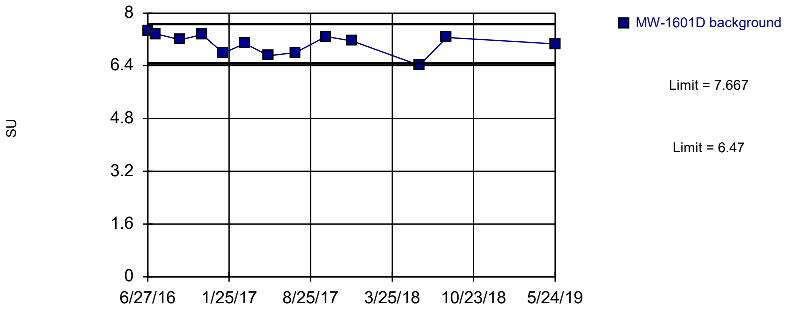
Background Data Summary: Mean=6.765, Std. Dev.=0.2503, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9355, critical = 0.805. Kappa = 1.97 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1601D (bg)



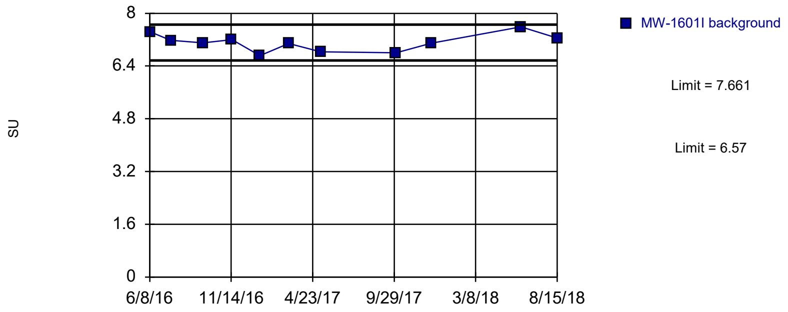
Background Data Summary: Mean=7.068, Std. Dev.=0.3106, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9293, critical = 0.814. Kappa = 1.927 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1601I (bg)



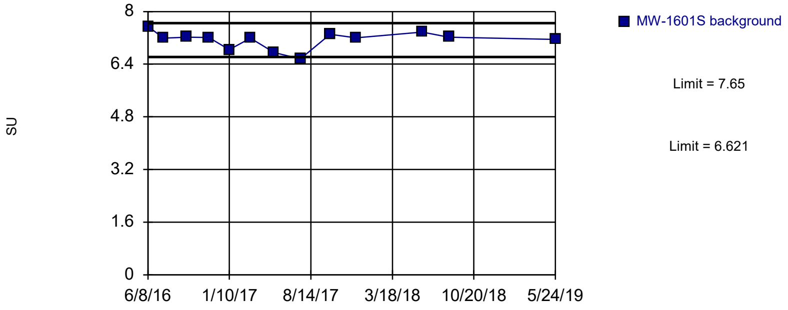
Background Data Summary: Mean=7.115, Std. Dev.=0.266, n=11. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9583, critical = 0.792. Kappa = 2.05 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1601S (bg)



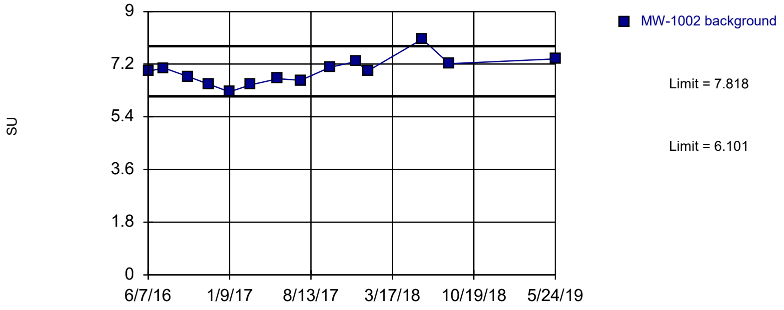
Background Data Summary: Mean=7.135, Std. Dev.=0.2669, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8784, critical = 0.814. Kappa = 1.927 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1002



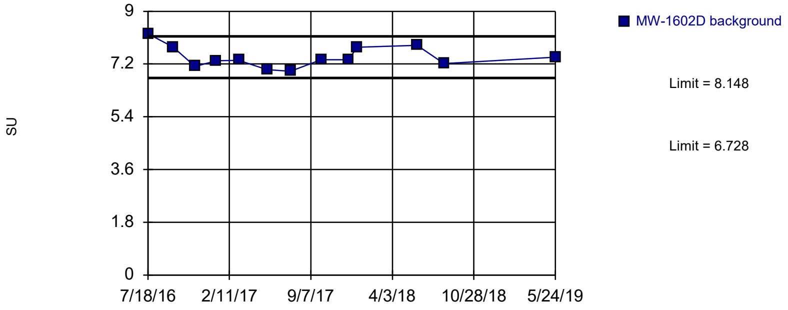
Background Data Summary: Mean=6.959, Std. Dev.=0.4557, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9546, critical = 0.825. Kappa = 1.884 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1602D



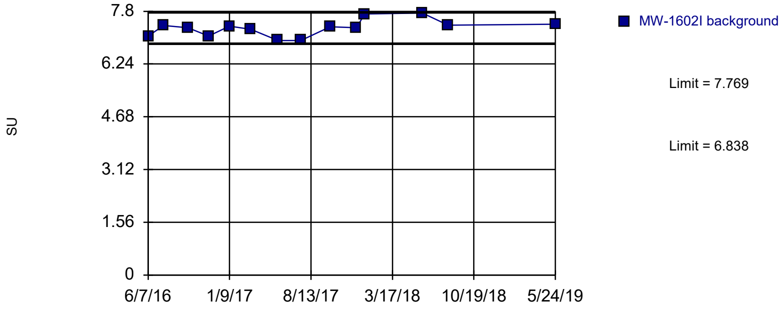
Background Data Summary: Mean=7.438, Std. Dev.=0.3685, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9273, critical = 0.814. Kappa = 1.927 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1602I

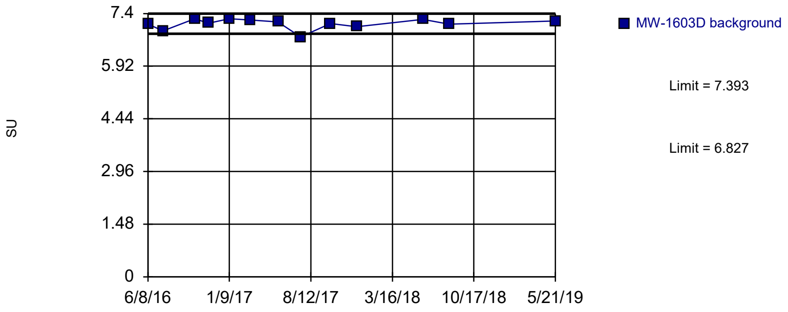


Background Data Summary: Mean=7.304, Std. Dev.=0.2471, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9201, critical = 0.825. Kappa = 1.884 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Prediction Limit

Intrawell Parametric, MW-1603D

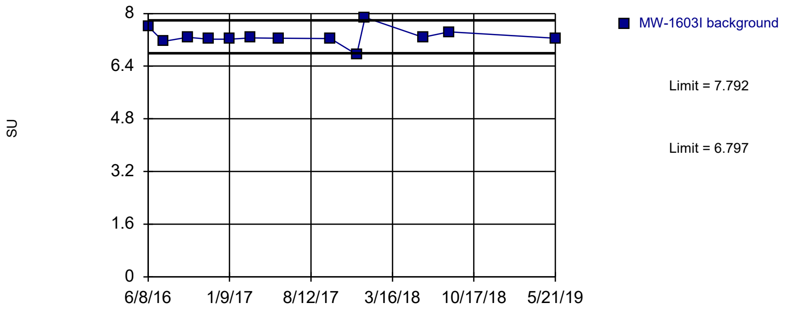


Background Data Summary: Mean=7.11, Std. Dev.=0.1468, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8438, critical = 0.814. Kappa = 1.927 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Prediction Limit

Intrawell Parametric, MW-1603I

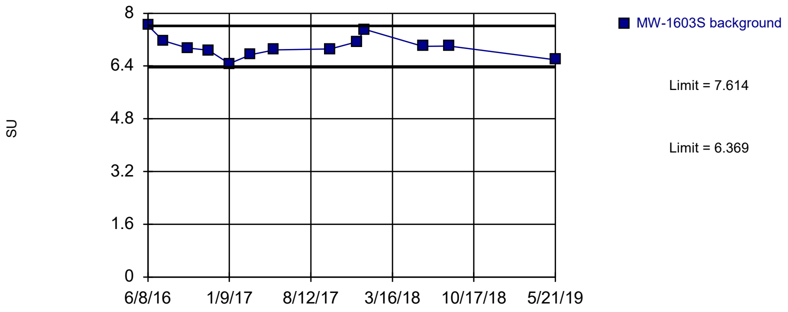


Background Data Summary: Mean=7.295, Std. Dev.=0.2583, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8539, critical = 0.814. Kappa = 1.927 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Prediction Limit

Intrawell Parametric, MW-1603S

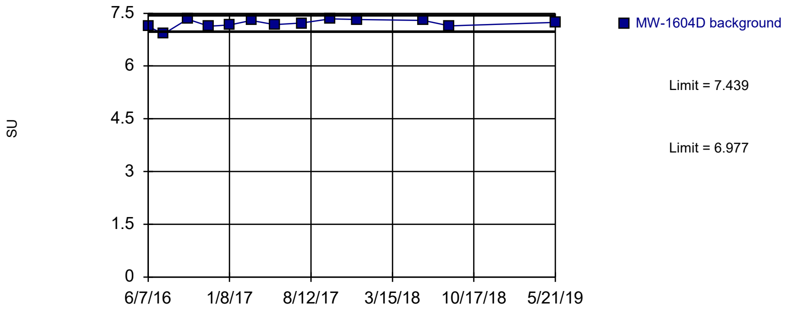


Background Data Summary: Mean=6.992, Std. Dev.=0.3233, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.95, critical = 0.814. Kappa = 1.927 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Prediction Limit

Intrawell Parametric, MW-1604D



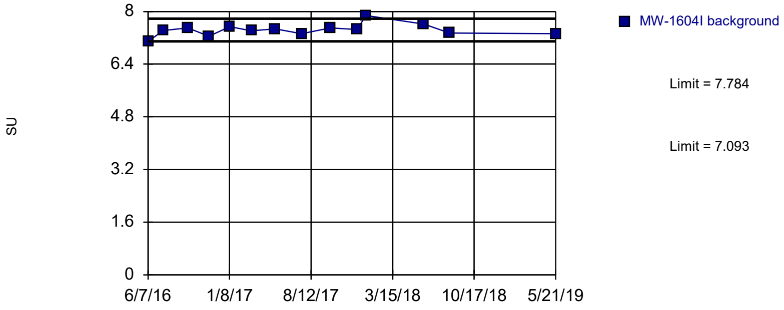
Background Data Summary: Mean=7.208, Std. Dev.=0.1199, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8863, critical = 0.814. Kappa = 1.927 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1604I



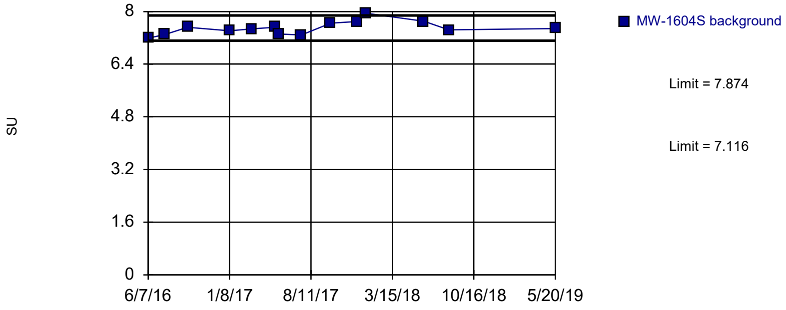
Background Data Summary: Mean=7.439, Std. Dev.=0.1832, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9492, critical = 0.825. Kappa = 1.884 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1604S



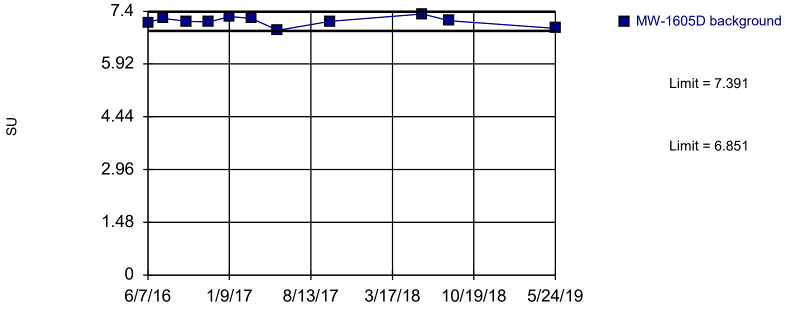
Background Data Summary: Mean=7.495, Std. Dev.=0.2014, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9569, critical = 0.825. Kappa = 1.884 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1605D



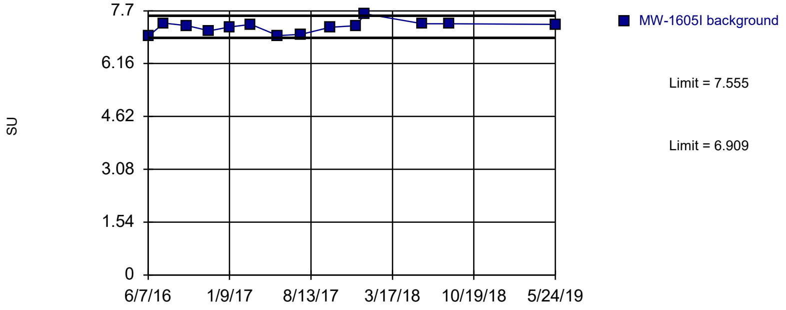
Background Data Summary: Mean=7.121, Std. Dev.=0.1319, n=11. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9292, critical = 0.792. Kappa = 2.05 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1605I



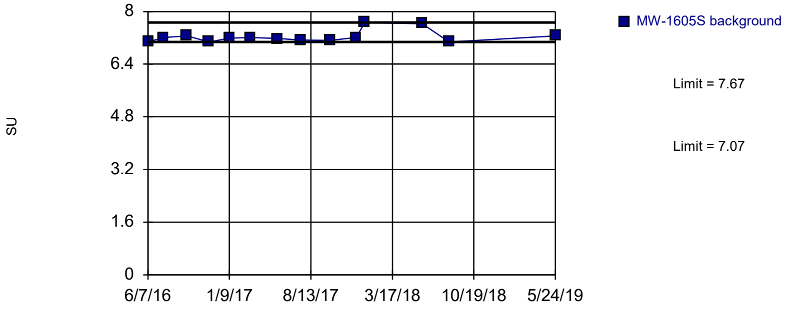
Background Data Summary: Mean=7.232, Std. Dev.=0.1713, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9062, critical = 0.825. Kappa = 1.884 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Non-parametric, MW-1605S



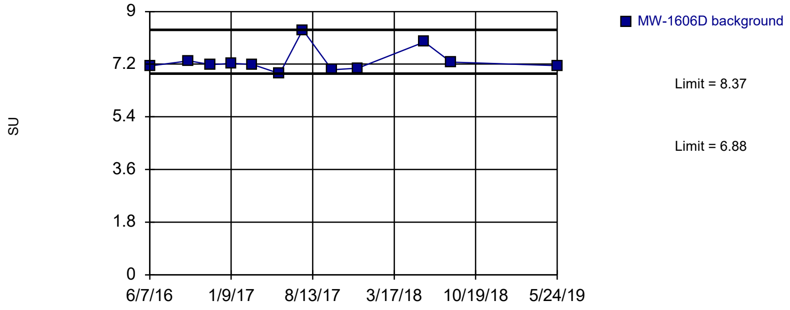
Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limits are highest and lowest of 14 background values. Well-constituent pair annual alpha = 0.006393. Individual comparison alpha = 0.003199 (1 of 3). Assumes 1 future value.

Constituent: pH, field   Analysis Run 12/8/2019 2:13 PM   View: PL's - Intrawell
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Non-parametric, MW-1606D



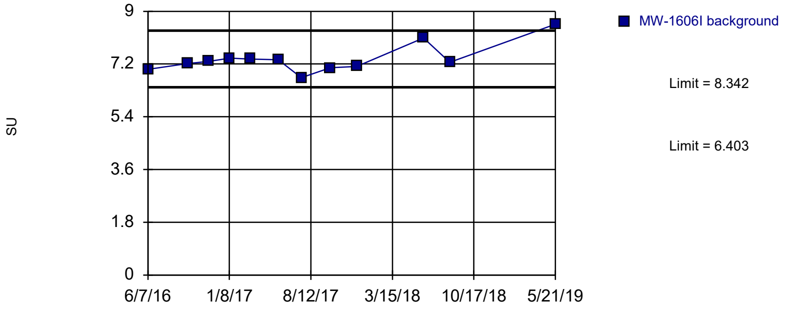
Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limits are highest and lowest of 12 background values. Well-constituent pair annual alpha = 0.008684. Individual comparison alpha = 0.004347 (1 of 3). Assumes 1 future value.

Constituent: pH, field   Analysis Run 12/8/2019 2:13 PM   View: PL's - Intrawell
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1606I



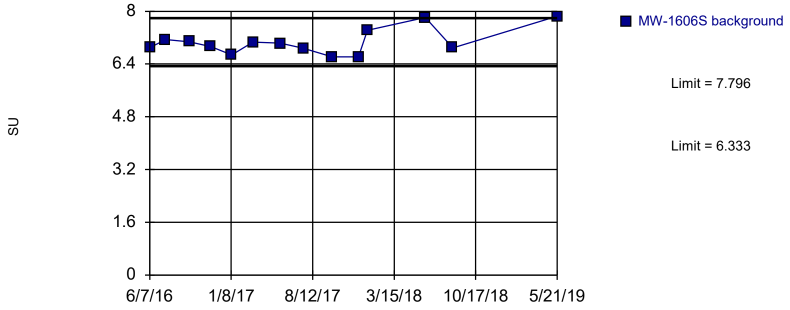
Background Data Summary: Mean=7.373, Std. Dev.=0.4922, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8317, critical = 0.805. Kappa = 1.97 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: pH, field   Analysis Run 12/8/2019 2:13 PM   View: PL's - Intrawell
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1606S



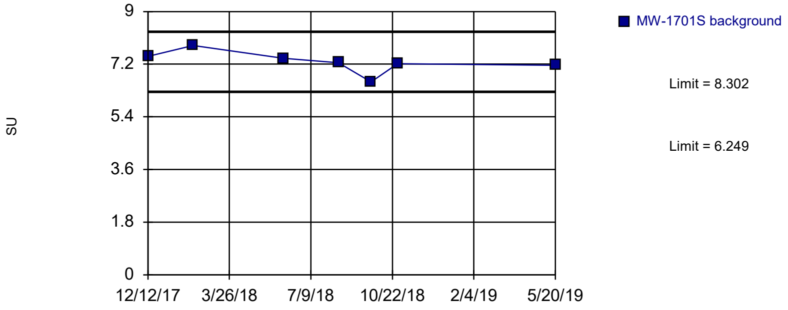
Background Data Summary: Mean=7.064, Std. Dev.=0.3882, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8707, critical = 0.825. Kappa = 1.884 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: pH, field   Analysis Run 12/8/2019 2:13 PM   View: PL's - Intrawell
Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1701S (bg)



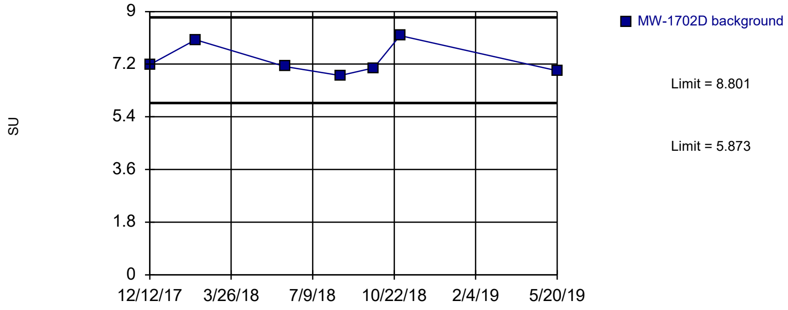
Background Data Summary: Mean=7.276, Std. Dev.=0.3784, n=7. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9394, critical = 0.73. Kappa = 2.713 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1702D (bg)



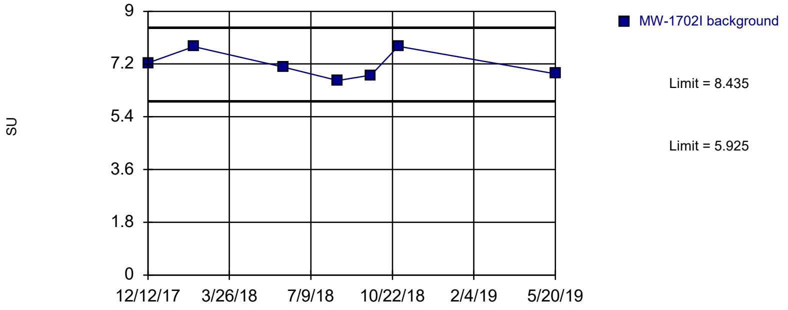
Background Data Summary: Mean=7.337, Std. Dev.=0.5395, n=7. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8117, critical = 0.73. Kappa = 2.713 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1702I (bg)



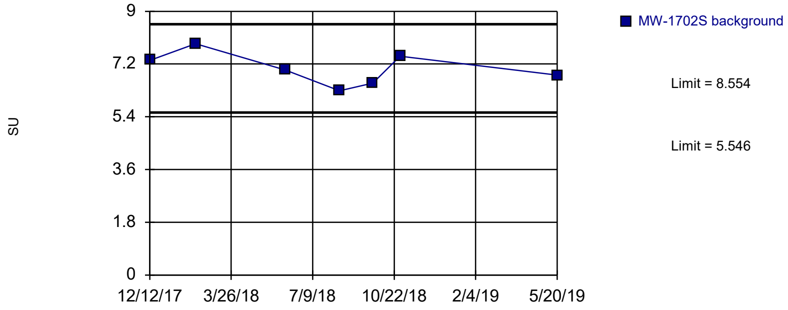
Background Data Summary: Mean=7.18, Std. Dev.=0.4626, n=7. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8899, critical = 0.73. Kappa = 2.713 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, MW-1702S (bg)

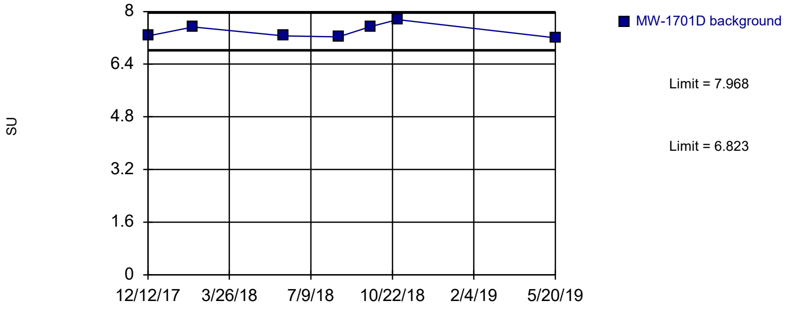


Background Data Summary: Mean=7.05, Std. Dev.=0.5543, n=7. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9851, critical = 0.73. Kappa = 2.713 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Prediction Limit

Intrawell Parametric, MW-1701D (bg)

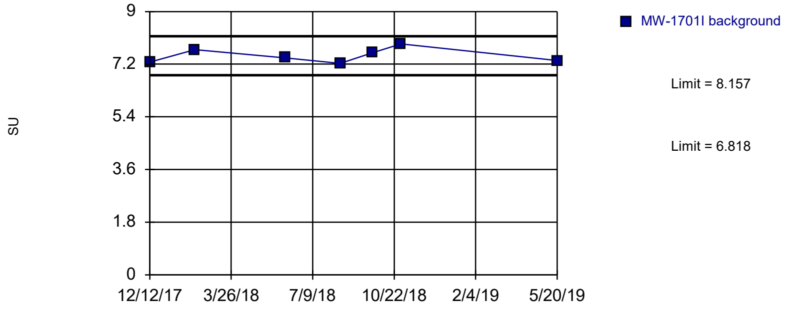


Background Data Summary: Mean=7.396, Std. Dev.=0.2109, n=7. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8437, critical = 0.73. Kappa = 2.713 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Prediction Limit

Intrawell Parametric, MW-1701I (bg)



Background Data Summary: Mean=7.487, Std. Dev.=0.2468, n=7. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9193, critical = 0.73. Kappa = 2.713 (c=7, w=15, 1 of 3, event alpha = 0.05132). Report alpha = 0.0005016. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/8/2019 2:13 PM View: PL's - Intrawell
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Trend Test Summary Table - Significant Results

Rockport BAP Client: Geosyntec Data: Rockport_BAP Printed 12/8/2019, 2:21 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Chloride, total (mg/L)	**MW-1601S (bg)**	**-3.479**	**-81**	**-53**	**Yes**	**15**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Fluoride, total (mg/L)	**MW-1600S (bg)**	**0.04815**	**60**	**53**	**Yes**	**15**	**0**	**n/a**	**n/a**	**0.01**	**NP**

Trend Test Summary Table - All Results

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP   Printed 12/8/2019, 2:21 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Boron, total (mg/L)	MW-1600D (bg)	0.01234	45	48	No	14	21.43	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1600I (bg)	0.005378	24	48	No	14	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1600S (bg)	0.003029	19	48	No	14	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1601D (bg)	0.001917	18	48	No	14	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1601I (bg)	0.006247	18	43	No	13	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1601S (bg)	-0.01137	-22	-48	No	14	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1701S (bg)	-0.004583	-5	-25	No	9	22.22	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1702D (bg)	-0.04169	-15	-25	No	9	11.11	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1702I (bg)	-0.01224	-7	-25	No	9	11.11	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1702S (bg)	-0.006736	-13	-25	No	9	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1701D (bg)	-0.02206	-15	-25	No	9	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1701I (bg)	-0.02515	-17	-25	No	9	11.11	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1600D (bg)	0	-6	-53	No	15	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1600I (bg)	0	-1	-53	No	15	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1600S (bg)	0.3188	7	53	No	15	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1601D (bg)	-0.3255	-14	-53	No	15	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1601I (bg)	-0.4142	-34	-48	No	14	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	**MW-1601S (bg)**	**-3.479**	**-81**	**-53**	**Yes**	**15**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	MW-1701S (bg)	0.6	25	25	No	9	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1702D (bg)	-0.03635	-1	-25	No	9	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1702I (bg)	0.9242	12	25	No	9	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1702S (bg)	0.8979	25	25	No	9	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1701D (bg)	-0.5816	-4	-25	No	9	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1701I (bg)	-0.4719	-6	-25	No	9	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1600D (bg)	0.008538	35	53	No	15	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1600I (bg)	0.009159	32	53	No	15	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	**MW-1600S (bg)**	**0.04815**	**60**	**53**	**Yes**	**15**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Fluoride, total (mg/L)	MW-1601D (bg)	-0.003617	-18	-53	No	15	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1601I (bg)	0	12	48	No	14	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1601S (bg)	0.01035	12	53	No	15	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1701S (bg)	0.01231	15	25	No	9	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1702D (bg)	0	-5	-25	No	9	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1702I (bg)	0.003483	4	25	No	9	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1702S (bg)	0.06438	14	25	No	9	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1701D (bg)	0	-1	-25	No	9	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-1701I (bg)	0.01553	7	25	No	9	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1600D (bg)	0	-1	-53	No	15	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1600I (bg)	0.6307	15	53	No	15	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1600S (bg)	-6.933	-45	-53	No	15	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1601D (bg)	0.3336	3	53	No	15	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1601I (bg)	0	-2	-48	No	14	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1601S (bg)	3.528	31	53	No	15	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1701S (bg)	-1.206	-22	-25	No	9	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1702D (bg)	-1.624	-15	-25	No	9	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1702I (bg)	-0.5416	-3	-25	No	9	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1702S (bg)	-1.95	-16	-25	No	9	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1701D (bg)	-2.792	-12	-25	No	9	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1701I (bg)	-2.726	-17	-25	No	9	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1600D (bg)	-1.577	-3	-48	No	14	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1600I (bg)	-2.687	-12	-48	No	14	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1600S (bg)	-14.9	-43	-48	No	14	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1601D (bg)	-5.587	-20	-48	No	14	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1601I (bg)	-0.4403	-3	-43	No	13	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1601S (bg)	1.536	14	48	No	14	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1701S (bg)	9.988	4	25	No	9	0	n/a	n/a	0.01	NP

Trend Test Summary Table - All Results

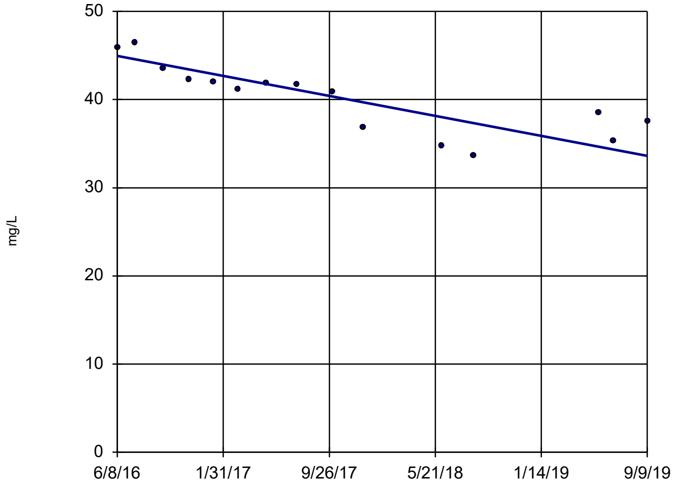
Rockport BAP Client: Geosyntec Data: Rockport_BAP Printed 12/8/2019, 2:21 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Total Dissolved Solids [TDS] (mg/L)	MW-1702D (bg)	13.53	16	25	No	9	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1702I (bg)	0.9288	3	21	No	8	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1702S (bg)	6.936	10	25	No	9	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1701D (bg)	-3.012	-2	-21	No	8	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW-1701I (bg)	0.87	3	25	No	9	0	n/a	n/a	0.01	NP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1601S (bg)



n = 15

Slope = -3.479 units per year.

Mann-Kendall statistic = -81 critical = -53

Decreasing trend significant at 99% confidence level (α = 0.005 per tail).

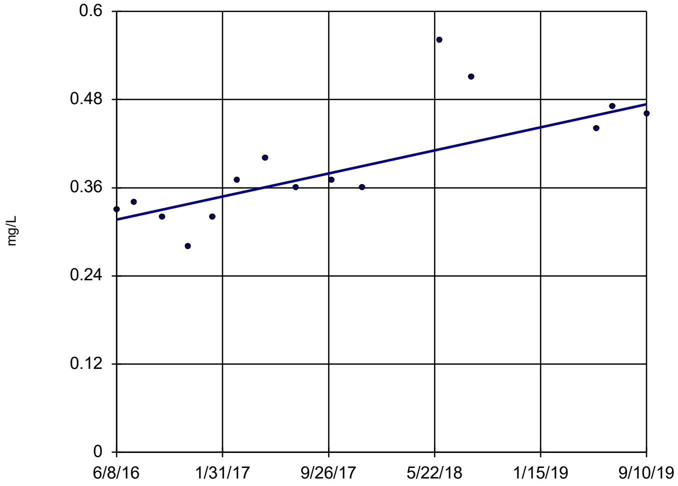
Constituent: Chloride, total   Analysis Run 12/8/2019 2:19 PM   View: Trend Tests

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1600S (bg)



n = 15

Slope = 0.04815 units per year.

Mann-Kendall statistic = 60 critical = 53

Increasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Fluoride, total   Analysis Run 12/8/2019 2:19 PM   View: Trend Tests

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Interwell Prediction Limit Summary

Rockport BAP Client: Geosyntec Data: Rockport_BAP Printed 12/8/2019, 2:17 PM

Constituent	Well	Upper Lim.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron, total (mg/L)	n/a	0.1351	n/a	113	0.2261	0.06881	2.655	None	sqrt(x)	0.0005016	Param 1 of 2
Chloride, total (mg/L)	n/a	46.4	n/a	119	n/a	n/a	0	n/a	n/a	0.0001371	NP (normality) 1 of 2
Fluoride, total (mg/L)	n/a	0.7	n/a	119	n/a	n/a	0	n/a	n/a	0.0001371	NP (normality) 1 of 2
Sulfate, total (mg/L)	n/a	76	n/a	119	n/a	n/a	0	n/a	n/a	0.0001371	NP (normality) 1 of 2
Total Dissolved Solids [TDS] (mg/L)	n/a	464.8	n/a	111	6.1e7	1.9e7	0	None	x^3	0.0005016	Param 1 of 2

Tolerance Limit Summary Table

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP   Printed 12/8/2019, 2:25 PM

Constituent	Well	Upper Lim.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony, total (mg/L)	n/a	0.0005	130	n/a	n/a	22.31	n/a	n/a	0.001271	NP Inter(normality)
Arsenic, total (mg/L)	n/a	0.0558	131	n/a	n/a	0	n/a	n/a	0.001207	NP Inter(normality)
Barium, total (mg/L)	n/a	0.997	131	n/a	n/a	0	n/a	n/a	0.001207	NP Inter(normality)
Beryllium, total (mg/L)	n/a	0.0005	131	n/a	n/a	72.52	n/a	n/a	0.001207	NP Inter(normality)
Cadmium, total (mg/L)	n/a	0.00028	131	n/a	n/a	35.11	n/a	n/a	0.001207	NP Inter(normality)
Chromium, total (mg/L)	n/a	0.00158	130	n/a	n/a	3.077	n/a	n/a	0.001271	NP Inter(normality)
Cobalt, total (mg/L)	n/a	0.00334	130	n/a	n/a	0.7692	n/a	n/a	0.001271	NP Inter(normality)
Combined Radium 226 + 228 (pCi/L)	n/a	2.505	130	1.117	0.736	0	None	No	0.05	Inter
Fluoride, total (mg/L)	n/a	0.7	143	n/a	n/a	0	n/a	n/a	0.0006523	NP Inter(normality)
Lead, total (mg/L)	n/a	0.0005761	130	-9.401	1.029	10	None	ln(x)	0.05	Inter
Lithium, total (mg/L)	n/a	0.038	131	n/a	n/a	16.79	n/a	n/a	0.001207	NP Inter(normality)
Mercury, total (mg/L)	n/a	0.000005	107	n/a	n/a	86.92	n/a	n/a	0.004135	NP Inter(NDs)
Molybdenum, total (mg/L)	n/a	0.00867	126	n/a	n/a	0	n/a	n/a	0.00156	NP Inter(normality)
Selenium, total (mg/L)	n/a	0.0038	131	n/a	n/a	37.4	n/a	n/a	0.001207	NP Inter(normality)
Thallium, total (mg/L)	n/a	0.002	125	n/a	n/a	47.2	n/a	n/a	0.001642	NP Inter(normality)

ROCKPORT BAP GWPS				
Constituent Name	**MCL**	**Rule Specified**	**Background Limit**	**GWPS**
Antimony, Total (mg/L)	0.006		0.0005	0.006
Arsenic, Total (mg/L)	0.01		0.056	0.056
Barium, Total (mg/L)	2		1	2
Beryllium, Total (mg/L)	0.004		0.0005	0.004
Cadmium, Total (mg/L)	0.005		0.00028	0.005
Chromium, Total (mg/L)	0.1		0.0016	0.1
Cobalt, Total (mg/L)	n/a	0.006	0.0033	0.006
Combined Radium, Total (pCi/L)	5		2.51	5
Fluoride, Total (mg/L)	4		0.7	4
Lead, Total (mg/L)	0.015		0.00058	0.015
Lithium, Total (mg/L)	n/a	0.04	0.038	0.04
Mercury, Total (mg/L)	0.002		0.000005	0.002
Molybdenum, Total (mg/L)	n/a	0.1	0.0087	0.1
Selenium, Total (mg/L)	0.05		0.0038	0.05
Thallium, Total (mg/L)	0.002		0.002	0.002

**Grey cell indicates background is higher than MCL.*

**MCL = Maximum Contaminant Level*

**GWPS = Groundwater Protection Standard*

Confidence Interval Summary Table - All Results (No Significant)

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP   Printed 12/8/2019, 2:29 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony, total (mg/L)	MW-1002	0.00006	0.00004	0.006	No	13	0.00005077	0.000007596	0	None	No	0.01	NP (normality)
Antimony, total (mg/L)	MW-1602D	0.00005	0.00001	0.006	No	13	0.00003538	0.00004352	15.38	None	No	0.01	NP (normality)
Antimony, total (mg/L)	MW-1602I	0.00006349	0.00002396	0.006	No	13	0.00004846	0.00003693	0	None	ln(x)	0.01	Param.
Antimony, total (mg/L)	MW-1603D	0.00005	0.00001	0.006	No	13	0.00003308	0.00002359	23.08	None	No	0.01	NP (Cohens/xfrm)
Antimony, total (mg/L)	MW-1603I	0.00005955	0.00002841	0.006	No	13	0.00004538	0.00002402	0	None	x^(1/3)	0.01	Param.
Antimony, total (mg/L)	MW-1603S	0.00005211	0.00003667	0.006	No	13	0.00004462	0.0000105	0	None	sqrt(x)	0.01	Param.
Antimony, total (mg/L)	MW-1604D	0.00005	0.00001	0.006	No	13	0.00002923	0.00001656	23.08	None	No	0.01	NP (normality)
Antimony, total (mg/L)	MW-1604I	0.00004	0.00002	0.006	No	12	0.00002833	0.00001193	0	None	No	0.01	NP (normality)
Antimony, total (mg/L)	MW-1604S	0.00007	0.00005	0.006	No	13	0.00006462	0.00002145	0	None	No	0.01	NP (normality)
Antimony, total (mg/L)	MW-1605D	0.00005	0.00001	0.006	No	13	0.00002538	0.00001761	15.38	None	No	0.01	NP (normality)
Antimony, total (mg/L)	MW-1605I	0.00005	0.00002	0.006	No	13	0.00005308	0.00005991	7.692	None	No	0.01	NP (normality)
Antimony, total (mg/L)	MW-1605S	0.00011	0.00004	0.006	No	13	0.00006154	0.00003555	0	None	No	0.01	NP (normality)
Antimony, total (mg/L)	MW-1606D	0.00005	0.00001	0.006	No	13	0.00003038	0.00001613	30.77	None	No	0.01	NP (Cohens/xfrm)
Antimony, total (mg/L)	MW-1606I	0.00005	0.00002	0.006	No	13	0.00004538	0.0000624	15.38	None	No	0.01	NP (normality)
Antimony, total (mg/L)	MW-1606S	0.00014	0.00004	0.006	No	13	0.00007385	0.00005966	7.692	None	No	0.01	NP (normality)
Arsenic, total (mg/L)	MW-1002	0.00032	0.00021	0.056	No	13	0.0002615	0.00006296	0	None	No	0.01	NP (normality)
Arsenic, total (mg/L)	MW-1602D	0.009386	0.00814	0.056	No	13	0.008763	0.0008383	0	None	No	0.01	Param.
Arsenic, total (mg/L)	MW-1602I	0.02865	0.01866	0.056	No	13	0.02365	0.006719	0	None	No	0.01	Param.
Arsenic, total (mg/L)	MW-1603D	0.01248	0.01093	0.056	No	13	0.01171	0.001043	0	None	No	0.01	Param.
Arsenic, total (mg/L)	MW-1603I	0.01293	0.01246	0.056	No	13	0.01269	0.0003148	0	None	No	0.01	Param.
Arsenic, total (mg/L)	MW-1603S	0.00036	0.00018	0.056	No	13	0.0002269	0.00006486	0	None	No	0.01	NP (normality)
Arsenic, total (mg/L)	MW-1604D	0.01889	0.01631	0.056	No	13	0.0176	0.001735	0	None	No	0.01	Param.
Arsenic, total (mg/L)	MW-1604I	0.0212	0.0187	0.056	No	13	0.02012	0.002072	0	None	No	0.01	NP (normality)
Arsenic, total (mg/L)	MW-1604S	0.0003827	0.0002074	0.056	No	13	0.0003085	0.0001604	0	None	ln(x)	0.01	Param.
Arsenic, total (mg/L)	MW-1605D	0.01956	0.01703	0.056	No	13	0.01829	0.001699	0	None	No	0.01	Param.
Arsenic, total (mg/L)	MW-1605I	0.02191	0.01786	0.056	No	13	0.01996	0.002928	0	None	ln(x)	0.01	Param.
Arsenic, total (mg/L)	MW-1605S	0.0005403	0.0003488	0.056	No	11	0.0004445	0.0001149	0	None	No	0.01	Param.
Arsenic, total (mg/L)	MW-1606D	0.01627	0.01348	0.056	No	13	0.01488	0.001874	0	None	No	0.01	Param.
Arsenic, total (mg/L)	MW-1606I	0.007715	0.004274	0.056	No	13	0.005995	0.002314	0	None	No	0.01	Param.
Arsenic, total (mg/L)	MW-1606S	0.0003344	0.0001955	0.056	No	13	0.0002738	0.0001213	0	None	ln(x)	0.01	Param.
Barium, total (mg/L)	MW-1002	0.02397	0.01398	2	No	13	0.0192	0.007186	0	None	sqrt(x)	0.01	Param.
Barium, total (mg/L)	MW-1602D	0.4958	0.4119	2	No	13	0.4538	0.05637	0	None	No	0.01	Param.
Barium, total (mg/L)	MW-1602I	0.1323	0.1188	2	No	13	0.1255	0.009061	0	None	No	0.01	Param.
Barium, total (mg/L)	MW-1603D	0.1155	0.1077	2	No	13	0.1116	0.005205	0	None	No	0.01	Param.
Barium, total (mg/L)	MW-1603I	0.08713	0.08079	2	No	13	0.08396	0.004266	0	None	No	0.01	Param.
Barium, total (mg/L)	MW-1603S	0.0173	0.01258	2	No	13	0.01494	0.003178	0	None	No	0.01	Param.
Barium, total (mg/L)	MW-1604D	0.2562	0.2329	2	No	13	0.2445	0.01565	0	None	No	0.01	Param.
Barium, total (mg/L)	MW-1604I	0.1325	0.1152	2	No	13	0.1238	0.01159	0	None	No	0.01	Param.
Barium, total (mg/L)	MW-1604S	0.0217	0.0133	2	No	13	0.01945	0.0085	0	None	No	0.01	NP (normality)
Barium, total (mg/L)	MW-1605D	0.4622	0.4021	2	No	13	0.4322	0.0404	0	None	No	0.01	Param.
Barium, total (mg/L)	MW-1605I	0.166	0.1454	2	No	13	0.1557	0.01386	0	None	No	0.01	Param.
Barium, total (mg/L)	MW-1605S	0.0125	0.00761	2	No	13	0.00925	0.002361	0	None	No	0.01	NP (normality)
Barium, total (mg/L)	MW-1606D	0.4261	0.3712	2	No	13	0.3987	0.03692	0	None	No	0.01	Param.
Barium, total (mg/L)	MW-1606I	0.0781	0.0481	2	No	13	0.06072	0.01359	0	None	No	0.01	NP (normality)
Barium, total (mg/L)	MW-1606S	0.01426	0.01054	2	No	13	0.0124	0.002504	0	None	No	0.01	Param.
Beryllium, total (mg/L)	MW-1002	0.0001	0.000006	0.004	No	13	0.00003615	0.00003681	76.92	None	No	0.01	NP (NDs)
Beryllium, total (mg/L)	MW-1602D	0.0001	0.000006	0.004	No	13	0.00002838	0.00003234	53.85	None	No	0.01	NP (normality)
Beryllium, total (mg/L)	MW-1602I	0.0001	0.000006	0.004	No	13	0.00003438	0.00003789	61.54	None	No	0.01	NP (normality)
Beryllium, total (mg/L)	MW-1603D	0.0001	0.000009	0.004	No	13	0.00004138	0.0000349	76.92	None	No	0.01	NP (NDs)
Beryllium, total (mg/L)	MW-1603I	0.0001	0.00001	0.004	No	13	0.00003769	0.00003563	84.62	None	No	0.01	NP (NDs)
Beryllium, total (mg/L)	MW-1603S	0.0001	0.00001	0.004	No	13	0.000036	0.00003676	69.23	None	No	0.01	NP (normality)
Beryllium, total (mg/L)	MW-1604D	0.0001	0.000004	0.004	No	13	0.00003723	0.00003605	84.62	None	No	0.01	NP (NDs)
Beryllium, total (mg/L)	MW-1604I	0.0001	0.000004	0.004	No	13	0.00003723	0.00003605	84.62	None	No	0.01	NP (NDs)
Beryllium, total (mg/L)	MW-1604S	0.0001	0.000007	0.004	No	13	0.00003931	0.00003682	69.23	None	No	0.01	NP (normality)
Beryllium, total (mg/L)	MW-1605D	0.0001	0.00001	0.004	No	13	0.00003769	0.00003563	84.62	None	No	0.01	NP (NDs)

Confidence Interval Summary Table - All Results (No Significant)

Rockport BAP Client: Geosyntec Data: Rockport_BAP Printed 12/8/2019, 2:29 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Beryllium, total (mg/L)	MW-1605I	0.0001	0.000004	0.004	No	13	0.00006677	0.0001339	76.92	None	No	0.01	NP (NDs)
Beryllium, total (mg/L)	MW-1605S	0.00004	0.000004	0.004	No	13	0.000028	0.00002349	69.23	None	No	0.01	NP (normality)
Beryllium, total (mg/L)	MW-1606D	0.0001	0.000006	0.004	No	13	0.00003646	0.000037	61.54	None	No	0.01	NP (Cohens/xfrm)
Beryllium, total (mg/L)	MW-1606I	0.0001	0.000007	0.004	No	13	0.00006823	0.0001333	84.62	None	No	0.01	NP (NDs)
Beryllium, total (mg/L)	MW-1606S	0.0001	0.000005	0.004	No	13	0.00006562	0.0001344	53.85	None	No	0.01	NP (Cohens/xfrm)
Cadmium, total (mg/L)	MW-1002	0.00007	0.00002	0.005	No	13	0.00004308	0.00003473	0	None	No	0.01	NP (normality)
Cadmium, total (mg/L)	MW-1602D	0.00005	0.00001	0.005	No	13	0.00002846	0.00001725	69.23	None	No	0.01	NP (normality)
Cadmium, total (mg/L)	MW-1602I	0.00003	0.000006	0.005	No	13	0.00001923	0.00001574	38.46	None	No	0.01	NP (Cohens/xfrm)
Cadmium, total (mg/L)	MW-1603D	0.00005	0.000009	0.005	No	13	0.00002508	0.00001542	61.54	None	No	0.01	NP (Cohens/xfrm)
Cadmium, total (mg/L)	MW-1603I	0.00005	0.000007	0.005	No	13	0.00002162	0.00001382	61.54	None	No	0.01	NP (normality)
Cadmium, total (mg/L)	MW-1603S	0.00003	0.00002	0.005	No	13	0.00002615	0.00001121	0	None	No	0.01	NP (normality)
Cadmium, total (mg/L)	MW-1604D	0.00005	0.000008	0.005	No	13	0.000025	0.00001497	76.92	None	No	0.01	NP (NDs)
Cadmium, total (mg/L)	MW-1604I	0.00005	0.000009	0.005	No	13	0.00003262	0.00003024	69.23	None	No	0.01	NP (Cohens/xfrm)
Cadmium, total (mg/L)	MW-1604S	0.00003	0.00001	0.005	No	13	0.00002538	0.00002025	0	None	No	0.01	NP (normality)
Cadmium, total (mg/L)	MW-1605D	0.00005	0.000006	0.005	No	13	0.00002585	0.00001429	84.62	None	No	0.01	NP (NDs)
Cadmium, total (mg/L)	MW-1605I	0.00005	0.000008	0.005	No	13	0.00003546	0.00005132	69.23	None	No	0.01	NP (Cohens/xfrm)
Cadmium, total (mg/L)	MW-1605S	0.00007	0.00003	0.005	No	13	0.00004231	0.00002315	0	None	No	0.01	NP (normality)
Cadmium, total (mg/L)	MW-1606D	0.00005	0.000007	0.005	No	13	0.00002592	0.00001418	76.92	None	No	0.01	NP (NDs)
Cadmium, total (mg/L)	MW-1606I	0.00005	0.000005	0.005	No	13	0.00003531	0.00005143	69.23	None	No	0.01	NP (Cohens/xfrm)
Cadmium, total (mg/L)	MW-1606S	0.00004412	0.00002049	0.005	No	13	0.00003231	0.00001589	0	None	No	0.01	Param.
Chromium, total (mg/L)	MW-1002	0.0003252	0.00008096	0.1	No	13	0.0002168	0.0001951	0	None	sqrt(x)	0.01	Param.
Chromium, total (mg/L)	MW-1602D	0.0004254	0.0001444	0.1	No	13	0.0002849	0.0001889	0	None	No	0.01	Param.
Chromium, total (mg/L)	MW-1602I	0.0003282	0.0001335	0.1	No	13	0.0002308	0.0001309	0	None	No	0.01	Param.
Chromium, total (mg/L)	MW-1603D	0.0002277	0.00009747	0.1	No	12	0.0001626	0.00008298	0	None	No	0.01	Param.
Chromium, total (mg/L)	MW-1603I	0.0005654	0.0001185	0.1	No	13	0.0003698	0.0003461	0	None	sqrt(x)	0.01	Param.
Chromium, total (mg/L)	MW-1603S	0.0003682	0.0000895	0.1	No	13	0.0002288	0.0001874	0	None	No	0.01	Param.
Chromium, total (mg/L)	MW-1604D	0.0001771	0.00007249	0.1	No	13	0.0001248	0.00007031	0	None	No	0.01	Param.
Chromium, total (mg/L)	MW-1604I	0.0002665	0.00007579	0.1	No	13	0.0001865	0.0001651	0	None	x^(1/3)	0.01	Param.
Chromium, total (mg/L)	MW-1604S	0.0003766	0.00009942	0.1	No	13	0.0002529	0.0002154	0	None	sqrt(x)	0.01	Param.
Chromium, total (mg/L)	MW-1605D	0.0003262	0.000122	0.1	No	13	0.0002323	0.0001543	0	None	sqrt(x)	0.01	Param.
Chromium, total (mg/L)	MW-1605I	0.0002912	0.0000797	0.1	No	13	0.0002371	0.0003116	7.692	None	ln(x)	0.01	Param.
Chromium, total (mg/L)	MW-1605S	0.0004374	0.0001146	0.1	No	13	0.0002935	0.000256	0	None	sqrt(x)	0.01	Param.
Chromium, total (mg/L)	MW-1606D	0.0002652	0.0000874	0.1	No	13	0.0002021	0.0001828	0	None	ln(x)	0.01	Param.
Chromium, total (mg/L)	MW-1606I	0.0005	0.00007	0.1	No	13	0.0001963	0.0001657	15.38	None	No	0.01	NP (Cohens/xfrm)
Chromium, total (mg/L)	MW-1606S	0.0005057	0.0001279	0.1	No	13	0.0003895	0.0004145	7.692	None	ln(x)	0.01	Param.
Cobalt, total (mg/L)	MW-1002	0.0008036	0.0006359	0.006	No	13	0.0007198	0.0001128	0	None	No	0.01	Param.
Cobalt, total (mg/L)	MW-1602D	0.0002098	0.00009571	0.006	No	13	0.0001565	0.00008524	0	None	sqrt(x)	0.01	Param.
Cobalt, total (mg/L)	MW-1602I	0.00175	0.00132	0.006	No	13	0.001494	0.000178	0	None	No	0.01	NP (normality)
Cobalt, total (mg/L)	MW-1603D	0.0009397	0.0003979	0.006	No	13	0.0007276	0.0005086	0	None	ln(x)	0.01	Param.
Cobalt, total (mg/L)	MW-1603I	0.001408	0.001229	0.006	No	13	0.001318	0.0001205	0	None	No	0.01	Param.
Cobalt, total (mg/L)	MW-1603S	0.0005619	0.0002282	0.006	No	13	0.0003951	0.0002244	0	None	No	0.01	Param.
Cobalt, total (mg/L)	MW-1604D	0.00008865	0.00005459	0.006	No	13	0.00007231	0.00002429	0	None	sqrt(x)	0.01	Param.
Cobalt, total (mg/L)	MW-1604I	0.000924	0.0007426	0.006	No	13	0.0008333	0.000122	0	None	No	0.01	Param.
Cobalt, total (mg/L)	MW-1604S	0.000955	0.000285	0.006	No	13	0.0004549	0.000274	0	None	No	0.01	NP (normality)
Cobalt, total (mg/L)	MW-1605D	0.0001721	0.00009224	0.006	No	13	0.0001378	0.00006674	0	None	ln(x)	0.01	Param.
Cobalt, total (mg/L)	MW-1605I	0.001627	0.001373	0.006	No	13	0.0015	0.0001702	0	None	No	0.01	Param.
Cobalt, total (mg/L)	MW-1605S	0.00246	0.000307	0.006	No	13	0.0008297	0.001099	0	None	No	0.01	NP (normality)
Cobalt, total (mg/L)	MW-1606D	0.0001196	0.00007509	0.006	No	12	0.000098	0.00003066	0	None	sqrt(x)	0.01	Param.
Cobalt, total (mg/L)	MW-1606I	0.001525	0.000899	0.006	No	13	0.001212	0.0004209	0	None	No	0.01	Param.
Cobalt, total (mg/L)	MW-1606S	0.0002605	0.0000593	0.006	No	13	0.0002039	0.0002391	7.692	None	ln(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1002	1.186	0.3022	5	No	13	0.7926	0.7578	0	None	sqrt(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1602D	1.768	0.7723	5	No	13	1.38	0.9913	0	None	ln(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1602I	1.216	0.8284	5	No	13	1.022	0.2606	0	None	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1603D	1.269	0.7088	5	No	13	0.989	0.3768	0	None	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1603I	1.83	0.8885	5	No	13	1.359	0.6332	0	None	No	0.01	Param.

Confidence Interval Summary Table - All Results (No Significant)

Rockport BAP Client: Geosyntec Data: Rockport_BAP Printed 12/8/2019, 2:29 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Combined Radium 226 + 228 (pCi/L)	MW-1603S	1.322	0.3399	5	No	13	0.8848	0.8092	0	None	sqrt(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1604D	1.163	0.5394	5	No	13	0.8712	0.4788	0	None	sqrt(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1604I	1.314	0.713	5	No	13	1.013	0.404	0	None	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1604S	0.9937	0.3551	5	No	13	0.6744	0.4294	0	None	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1605D	1.507	0.8107	5	No	13	1.159	0.468	0	None	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1605I	2.093	1.405	5	No	13	1.749	0.4628	0	None	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1605S	0.7836	0.1495	5	No	13	0.5081	0.4877	0	None	sqrt(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1606D	1.468	0.5976	5	No	13	1.033	0.5854	0	None	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1606I	1.194	0.7186	5	No	12	0.9563	0.303	0	None	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1606S	1.213	0.3017	5	No	13	0.7571	0.6125	0	None	No	0.01	Param.
Fluoride, total (mg/L)	MW-1002	1.023	0.8437	4	No	16	0.9275	0.1415	0	None	x^2	0.01	Param.
Fluoride, total (mg/L)	MW-1602D	0.3346	0.2974	4	No	15	0.316	0.02746	0	None	No	0.01	Param.
Fluoride, total (mg/L)	MW-1602I	0.2988	0.2666	4	No	15	0.2827	0.02374	0	None	No	0.01	Param.
Fluoride, total (mg/L)	MW-1603D	0.3036	0.2697	4	No	15	0.2867	0.02498	0	None	No	0.01	Param.
Fluoride, total (mg/L)	MW-1603I	0.4523	0.3931	4	No	15	0.4227	0.04367	0	None	No	0.01	Param.
Fluoride, total (mg/L)	MW-1603S	0.5431	0.3529	4	No	15	0.448	0.1403	0	None	No	0.01	Param.
Fluoride, total (mg/L)	MW-1604D	0.2763	0.245	4	No	15	0.2607	0.02314	0	None	No	0.01	Param.
Fluoride, total (mg/L)	MW-1604I	0.3463	0.307	4	No	15	0.3267	0.02895	0	None	No	0.01	Param.
Fluoride, total (mg/L)	MW-1604S	1.02	0.83	4	No	16	0.9544	0.1947	0	None	No	0.01	NP (normality)
Fluoride, total (mg/L)	MW-1605D	0.2213	0.1867	4	No	15	0.204	0.02558	0	None	No	0.01	Param.
Fluoride, total (mg/L)	MW-1605I	0.2111	0.172	4	No	15	0.19	0.03229	0	None	x^2	0.01	Param.
Fluoride, total (mg/L)	MW-1605S	0.5679	0.4909	4	No	16	0.5294	0.05916	0	None	No	0.01	Param.
Fluoride, total (mg/L)	MW-1606D	0.1977	0.1703	4	No	15	0.184	0.02028	0	None	No	0.01	Param.
Fluoride, total (mg/L)	MW-1606I	0.2017	0.1783	4	No	15	0.19	0.01732	0	None	No	0.01	Param.
Fluoride, total (mg/L)	MW-1606S	0.4582	0.3905	4	No	16	0.4244	0.05202	0	None	No	0.01	Param.
Lead, total (mg/L)	MW-1002	0.0001	0.00002	0.015	No	13	0.00004415	0.00004196	15.38	None	No	0.01	NP (Cohens/xfrm)
Lead, total (mg/L)	MW-1602D	0.0001283	0.00002242	0.015	No	13	0.00008862	0.0001166	7.692	None	x^(1/3)	0.01	Param.
Lead, total (mg/L)	MW-1602I	0.0002171	0.00005766	0.015	No	13	0.0001459	0.0001206	0	None	sqrt(x)	0.01	Param.
Lead, total (mg/L)	MW-1603D	0.00007808	0.00001485	0.015	No	12	0.0000495	0.00005437	8.333	None	sqrt(x)	0.01	Param.
Lead, total (mg/L)	MW-1603I	0.0001771	0.00003074	0.015	No	13	0.000114	0.000118	7.692	None	sqrt(x)	0.01	Param.
Lead, total (mg/L)	MW-1603S	0.000171	0.000025	0.015	No	13	0.00009246	0.00008663	23.08	None	No	0.01	NP (Cohens/xfrm)
Lead, total (mg/L)	MW-1604D	0.000064	0.000018	0.015	No	13	0.000041	0.00003094	7.692	None	No	0.01	Param.
Lead, total (mg/L)	MW-1604I	0.000093	0.00001	0.015	No	13	0.00003785	0.00003018	23.08	None	No	0.01	NP (Cohens/xfrm)
Lead, total (mg/L)	MW-1604S	0.0001159	0.00002207	0.015	No	12	0.0000735	0.00008269	8.333	None	sqrt(x)	0.01	Param.
Lead, total (mg/L)	MW-1605D	0.0001	0.000009	0.015	No	13	0.000056	0.00007006	23.08	None	No	0.01	NP (Cohens/xfrm)
Lead, total (mg/L)	MW-1605I	0.000152	0.00005093	0.015	No	13	0.0001015	0.00006795	7.692	None	No	0.01	Param.
Lead, total (mg/L)	MW-1605S	0.00152	0.000021	0.015	No	13	0.0003208	0.0006387	0	None	No	0.01	NP (normality)
Lead, total (mg/L)	MW-1606D	0.000141	0.00001	0.015	No	13	0.00005477	0.00006369	30.77	None	No	0.01	NP (Cohens/xfrm)
Lead, total (mg/L)	MW-1606I	0.000166	0.00002	0.015	No	13	0.00006623	0.0000693	30.77	None	No	0.01	NP (Cohens/xfrm)
Lead, total (mg/L)	MW-1606S	0.000386	0.00002	0.015	No	13	0.0002178	0.0003578	23.08	None	No	0.01	NP (Cohens/xfrm)
Lithium, total (mg/L)	MW-1002	0.02381	0.004436	0.04	No	13	0.008068	0.005223	23.08	Cohen`s	No	0.01	Param.
Lithium, total (mg/L)	MW-1602D	0.01204	0.003172	0.04	No	13	0.007605	0.005961	7.692	None	No	0.01	Param.
Lithium, total (mg/L)	MW-1602I	0.0114	0.004715	0.04	No	13	0.008055	0.004492	7.692	None	No	0.01	Param.
Lithium, total (mg/L)	MW-1603D	0.01882	0.003793	0.04	No	13	0.008369	0.003861	15.38	Cohen`s	No	0.01	Param.
Lithium, total (mg/L)	MW-1603I	0.02438	0.00705	0.04	No	13	0.009816	0.00471	23.08	Cohen`s	No	0.01	Param.
Lithium, total (mg/L)	MW-1603S	0.02366	0.004112	0.04	No	13	0.007818	0.005178	23.08	Cohen`s	No	0.01	Param.
Lithium, total (mg/L)	MW-1604D	0.01	0.00157	0.04	No	13	0.005659	0.005128	30.77	None	No	0.01	NP (Cohens/xfrm)
Lithium, total (mg/L)	MW-1604I	0.01224	0.006331	0.04	No	13	0.009286	0.003975	7.692	None	No	0.01	Param.
Lithium, total (mg/L)	MW-1604S	0.01433	0.009381	0.04	No	13	0.01186	0.003329	7.692	None	No	0.01	Param.
Lithium, total (mg/L)	MW-1605D	0.007	0.003	0.04	No	13	0.006212	0.004167	15.38	None	No	0.01	NP (Cohens/xfrm)
Lithium, total (mg/L)	MW-1605I	0.01096	0.005545	0.04	No	13	0.008252	0.003642	0	None	No	0.01	Param.
Lithium, total (mg/L)	MW-1605S	0.0178	0.01248	0.04	No	13	0.01514	0.003575	7.692	None	No	0.01	Param.
Lithium, total (mg/L)	MW-1606D	0.009	0.000651	0.04	No	13	0.005473	0.00491	23.08	None	No	0.01	NP (Cohens/xfrm)
Lithium, total (mg/L)	MW-1606I	0.01041	0.005598	0.04	No	13	0.008004	0.003235	7.692	None	No	0.01	Param.
Lithium, total (mg/L)	MW-1606S	0.01344	0.009195	0.04	No	13	0.01132	0.002856	7.692	None	No	0.01	Param.

Confidence Interval Summary Table - All Results (No Significant)

Rockport BAP Client: Geosyntec Data: Rockport_BAP Printed 12/8/2019, 2:29 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Mercury, total (mg/L)	MW-1002	0.000005	0.000005	0.002	No	12	0.000005	3.6e-14	91.67	None	No	0.01	NP (NDs)
Mercury, total (mg/L)	MW-1602D	0.000005	0.000005	0.002	No	12	0.000005	3.6e-14	91.67	None	No	0.01	NP (NDs)
Mercury, total (mg/L)	MW-1602I	0.000005	0.000005	0.002	No	12	0.000005	3.6e-14	91.67	None	No	0.01	NP (NDs)
Mercury, total (mg/L)	MW-1603D	0.000005	0.000005	0.002	No	12	0.000005	3.6e-14	91.67	None	No	0.01	NP (NDs)
Mercury, total (mg/L)	MW-1603I	0.000005	0.000005	0.002	No	12	0.000005	3.6e-14	91.67	None	No	0.01	NP (NDs)
Mercury, total (mg/L)	MW-1603S	0.000005	0.000005	0.002	No	12	0.000005	3.6e-14	91.67	None	No	0.01	NP (NDs)
Mercury, total (mg/L)	MW-1604D	0.000005	0.000002	0.002	No	12	0.00000475	8.7e-7	83.33	None	No	0.01	NP (NDs)
Mercury, total (mg/L)	MW-1604I	0.000005	0.000005	0.002	No	12	0.000005	3.6e-14	91.67	None	No	0.01	NP (NDs)
Mercury, total (mg/L)	MW-1604S	0.000005	0.000005	0.002	No	12	0.000005	3.6e-14	91.67	None	No	0.01	NP (NDs)
Mercury, total (mg/L)	MW-1605D	0.000005	0.000005	0.002	No	12	0.000005	3.6e-14	91.67	None	No	0.01	NP (NDs)
Mercury, total (mg/L)	MW-1605I	0.000005	0.000005	0.002	No	12	0.000005	3.6e-14	91.67	None	No	0.01	NP (NDs)
Mercury, total (mg/L)	MW-1605S	0.000005	0.000005	0.002	No	12	0.000005	3.6e-14	91.67	None	No	0.01	NP (NDs)
Mercury, total (mg/L)	MW-1606D	0.000005	0.000005	0.002	No	12	0.000005	3.6e-14	91.67	None	No	0.01	NP (NDs)
Mercury, total (mg/L)	MW-1606I	0.000005	0.000005	0.002	No	12	0.000005	3.6e-14	91.67	None	No	0.01	NP (NDs)
Mercury, total (mg/L)	MW-1606S	0.000005	0.000005	0.002	No	12	0.000005	3.6e-14	91.67	None	No	0.01	NP (NDs)
Molybdenum, total (mg/L)	MW-1002	0.0102	0.00247	0.1	No	13	0.005017	0.003184	0	None	No	0.01	NP (normality)
Molybdenum, total (mg/L)	MW-1602D	0.003949	0.003293	0.1	No	13	0.003621	0.000441	0	None	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1602I	0.002385	0.002061	0.1	No	13	0.002225	0.0002226	0	None	sqrt(x)	0.01	Param.
Molybdenum, total (mg/L)	MW-1603D	0.005733	0.004325	0.1	No	13	0.005045	0.0009801	0	None	sqrt(x)	0.01	Param.
Molybdenum, total (mg/L)	MW-1603I	0.009216	0.007441	0.1	No	13	0.008328	0.001194	0	None	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1603S	0.001227	0.0003115	0.1	No	13	0.00082	0.0007461	7.692	None	sqrt(x)	0.01	Param.
Molybdenum, total (mg/L)	MW-1604D	0.003292	0.002634	0.1	No	13	0.002963	0.0004425	0	None	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1604I	0.002877	0.002497	0.1	No	13	0.002687	0.0002558	0	None	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1604S	0.00261	0.00188	0.1	No	12	0.002448	0.0008436	0	None	No	0.01	NP (normality)
Molybdenum, total (mg/L)	MW-1605D	0.002564	0.001994	0.1	No	12	0.002285	0.0003837	0	None	x^(1/3)	0.01	Param.
Molybdenum, total (mg/L)	MW-1605I	0.001324	0.001074	0.1	No	12	0.001199	0.0001596	0	None	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1605S	0.002135	0.001663	0.1	No	13	0.001899	0.0003172	0	None	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1606D	0.002168	0.001871	0.1	No	12	0.002019	0.0001894	0	None	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1606I	0.001724	0.001099	0.1	No	12	0.001412	0.0003981	0	None	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1606S	0.001513	0.0009896	0.1	No	12	0.001258	0.0003515	0	None	sqrt(x)	0.01	Param.
Selenium, total (mg/L)	MW-1002	0.00009098	0.00006441	0.05	No	13	0.00007769	0.00001787	0	None	No	0.01	Param.
Selenium, total (mg/L)	MW-1602D	0.0001	0.00003	0.05	No	13	0.00006615	0.00003203	30.77	None	No	0.01	NP (normality)
Selenium, total (mg/L)	MW-1602I	0.0001	0.00003	0.05	No	13	0.00007846	0.00004652	38.46	None	No	0.01	NP (Cohens/xfrm)
Selenium, total (mg/L)	MW-1603D	0.0002	0.00004	0.05	No	13	0.0001231	0.0000792	53.85	None	No	0.01	NP (Cohens/xfrm)
Selenium, total (mg/L)	MW-1603I	0.0001	0.00005	0.05	No	13	0.0001023	0.00004816	61.54	None	No	0.01	NP (Cohens/xfrm)
Selenium, total (mg/L)	MW-1603S	0.0003244	0.00006406	0.05	No	13	0.0002754	0.0004083	7.692	None	ln(x)	0.01	Param.
Selenium, total (mg/L)	MW-1604D	0.0002	0.00004	0.05	No	13	0.00011	0.00005686	69.23	None	No	0.01	NP (normality)
Selenium, total (mg/L)	MW-1604I	0.0001	0.00003	0.05	No	13	0.00007923	0.000029	38.46	None	No	0.01	NP (normality)
Selenium, total (mg/L)	MW-1604S	0.000133	0.00005369	0.05	No	13	0.00009769	0.00006126	0	None	x^(1/3)	0.01	Param.
Selenium, total (mg/L)	MW-1605D	0.0002	0.00004	0.05	No	13	0.0001077	0.0000596	69.23	None	No	0.01	NP (normality)
Selenium, total (mg/L)	MW-1605I	0.0002	0.00004	0.05	No	13	0.0001554	0.0002577	53.85	None	No	0.01	NP (normality)
Selenium, total (mg/L)	MW-1605S	0.001316	0.0006004	0.05	No	12	0.0009583	0.0004562	0	None	No	0.01	Param.
Selenium, total (mg/L)	MW-1606D	0.0002	0.00005	0.05	No	13	0.0001115	0.00005475	69.23	None	No	0.01	NP (normality)
Selenium, total (mg/L)	MW-1606I	0.0002	0.00005	0.05	No	13	0.0001754	0.0002522	76.92	None	No	0.01	NP (NDs)
Selenium, total (mg/L)	MW-1606S	0.004684	0.002824	0.05	No	13	0.003754	0.001251	0	None	No	0.01	Param.
Thallium, total (mg/L)	MW-1002	0.0005	0.00002	0.002	No	13	0.0001408	0.000205	23.08	None	No	0.01	NP (normality)
Thallium, total (mg/L)	MW-1602D	0.0005	0.00002	0.002	No	13	0.0001505	0.0001997	69.23	None	No	0.01	NP (normality)
Thallium, total (mg/L)	MW-1602I	0.0005	0.00001	0.002	No	13	0.0001377	0.0002069	30.77	None	No	0.01	NP (normality)
Thallium, total (mg/L)	MW-1603D	0.0005	0.00003	0.002	No	13	0.0001522	0.0001994	53.85	None	No	0.01	NP (normality)
Thallium, total (mg/L)	MW-1603I	0.0005	0.00003	0.002	No	13	0.0001438	0.0002032	23.08	None	No	0.01	NP (normality)
Thallium, total (mg/L)	MW-1603S	0.0005	0.00002	0.002	No	13	0.0001435	0.0002043	23.08	None	No	0.01	NP (normality)
Thallium, total (mg/L)	MW-1604D	0.0005	0.00002	0.002	No	13	0.0001519	0.0001994	69.23	None	No	0.01	NP (normality)
Thallium, total (mg/L)	MW-1604I	0.0005	0.00001	0.002	No	13	0.0001385	0.000207	23.08	None	No	0.01	NP (normality)
Thallium, total (mg/L)	MW-1604S	0.0005	0.00002	0.002	No	13	0.0001472	0.0002022	23.08	None	No	0.01	NP (normality)
Thallium, total (mg/L)	MW-1605D	0.0005	0.00003	0.002	No	13	0.0001492	0.0002003	76.92	None	No	0.01	NP (NDs)

Confidence Interval Summary Table - All Results (No Significant)

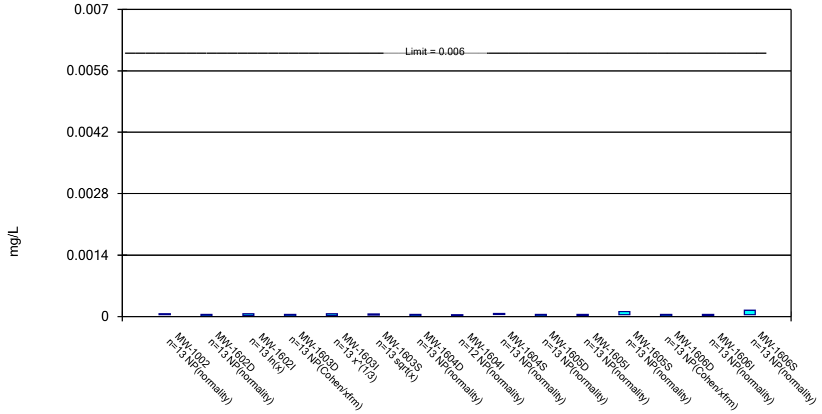
Rockport BAP Client: Geosyntec Data: Rockport_BAP Printed 12/8/2019, 2:29 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Thallium, total (mg/L)	MW-1605I	0.0005	0.00002	0.002	No	13	0.0002672	0.0005489	23.08	None	No	0.01	NP (normality)
Thallium, total (mg/L)	MW-1605S	0.0001	0.00002	0.002	No	13	0.0001108	0.0001741	15.38	None	No	0.01	NP (normality)
Thallium, total (mg/L)	MW-1606D	0.0005	0.00003	0.002	No	13	0.0001557	0.0001977	69.23	None	No	0.01	NP (normality)
Thallium, total (mg/L)	MW-1606I	0.0005	0.00003	0.002	No	13	0.0002648	0.0005485	23.08	None	No	0.01	NP (normality)
Thallium, total (mg/L)	MW-1606S	0.0005	0.00001	0.002	No	13	0.0002552	0.0005528	30.77	None	No	0.01	NP (normality)

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.

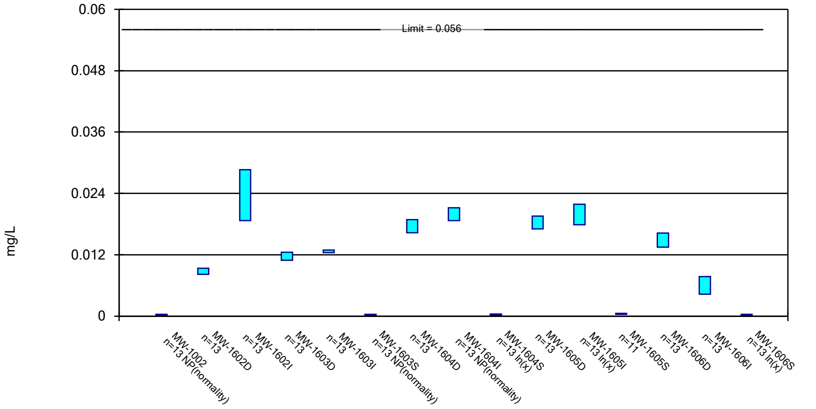


Constituent: Antimony, total Analysis Run 12/8/2019 2:27 PM View: Confidence Intervals - App IV
Rockport BAP Client: Geosyntec Data: Rockport_BAP

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.

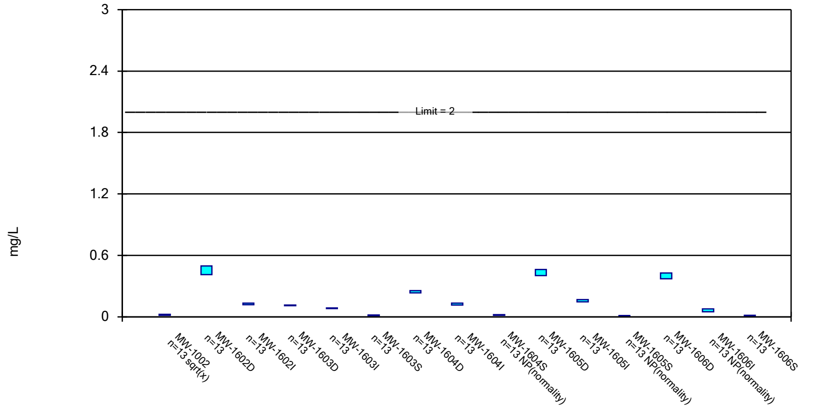


Constituent: Arsenic, total Analysis Run 12/8/2019 2:27 PM View: Confidence Intervals - App IV
Rockport BAP Client: Geosyntec Data: Rockport_BAP

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.

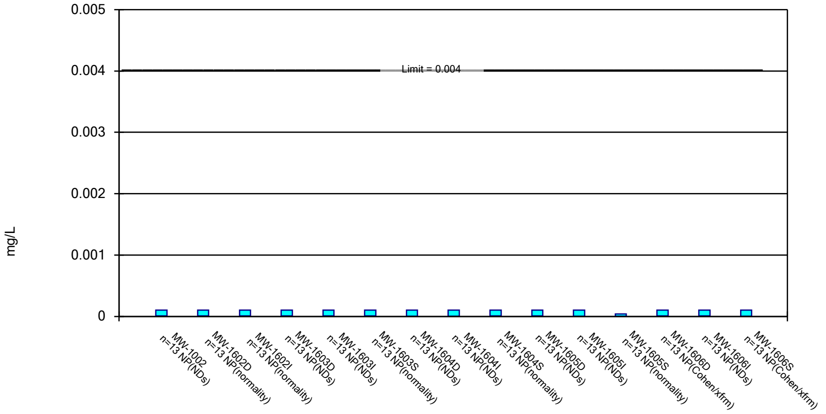


Constituent: Barium, total Analysis Run 12/8/2019 2:27 PM View: Confidence Intervals - App IV
Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01.

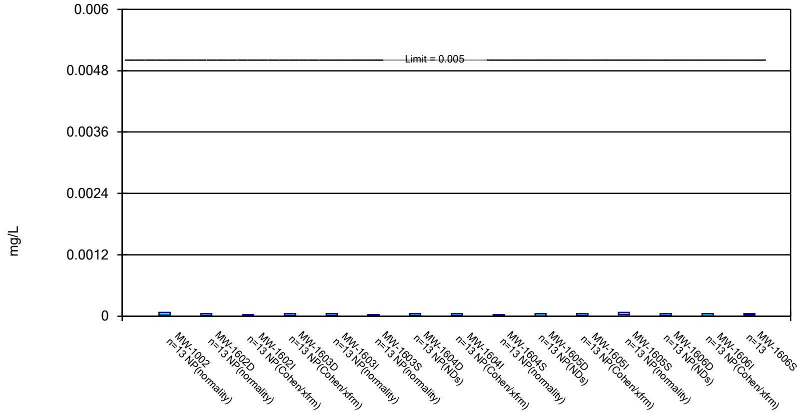


Constituent: Beryllium, total Analysis Run 12/8/2019 2:27 PM View: Confidence Intervals - App IV
Rockport BAP Client: Geosyntec Data: Rockport_BAP

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.

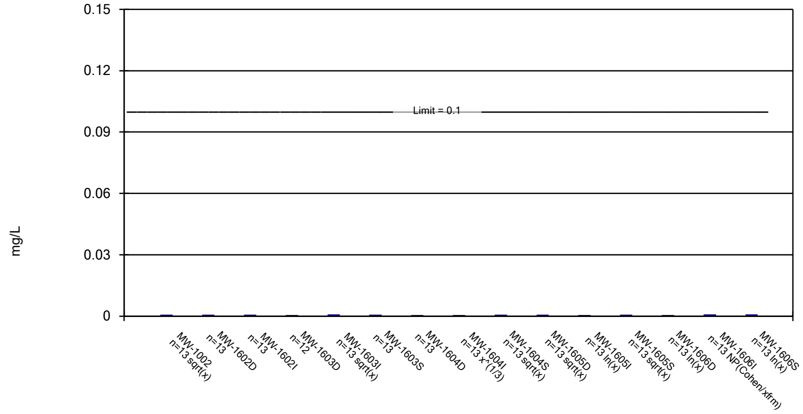


Constituent: Cadmium, total Analysis Run 12/8/2019 2:27 PM View: Confidence Intervals - App IV
Rockport BAP Client: Geosyntec Data: Rockport_BAP

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.

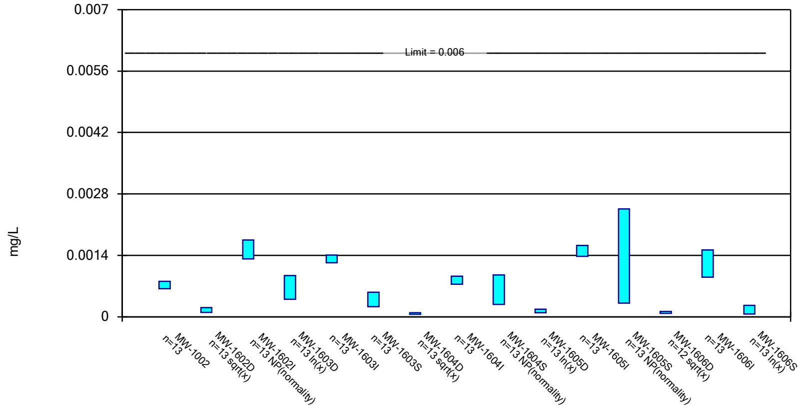


Constituent: Chromium, total Analysis Run 12/8/2019 2:27 PM View: Confidence Intervals - App IV
Rockport BAP Client: Geosyntec Data: Rockport_BAP

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.

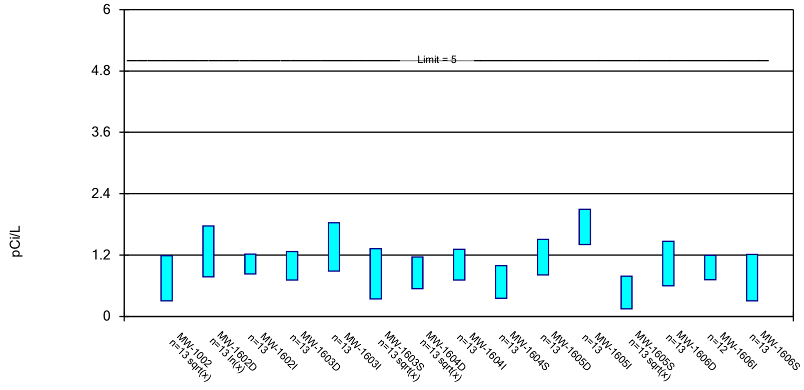


Constituent: Cobalt, total Analysis Run 12/8/2019 2:27 PM View: Confidence Intervals - App IV
Rockport BAP Client: Geosyntec Data: Rockport_BAP

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.

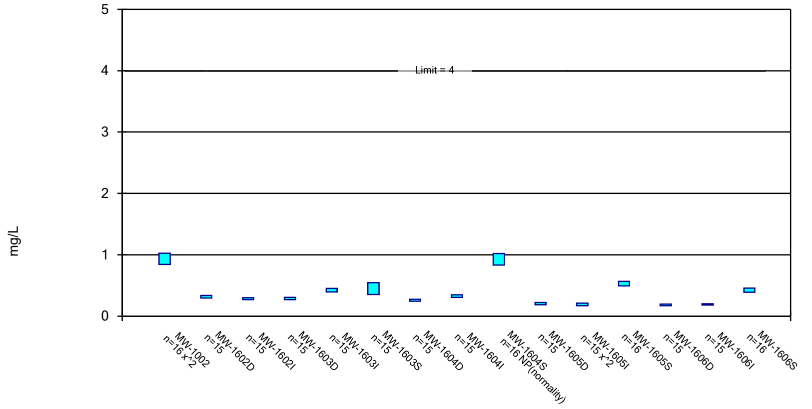


Constituent: Combined Radium 226 + 228 Analysis Run 12/8/2019 2:27 PM View: Confidence Intervals -
Rockport BAP Client: Geosyntec Data: Rockport_BAP

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.



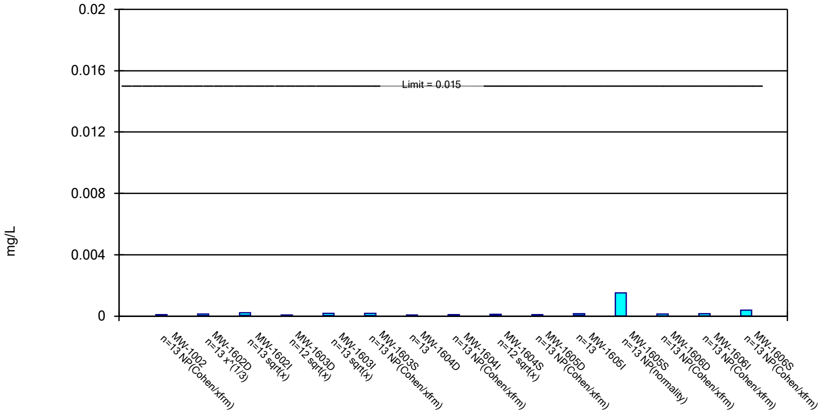
Constituent: Fluoride, total Analysis Run 12/8/2019 2:27 PM View: Confidence Intervals - App IV

Rockport BAP Client: Geosyntec Data: Rockport_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.



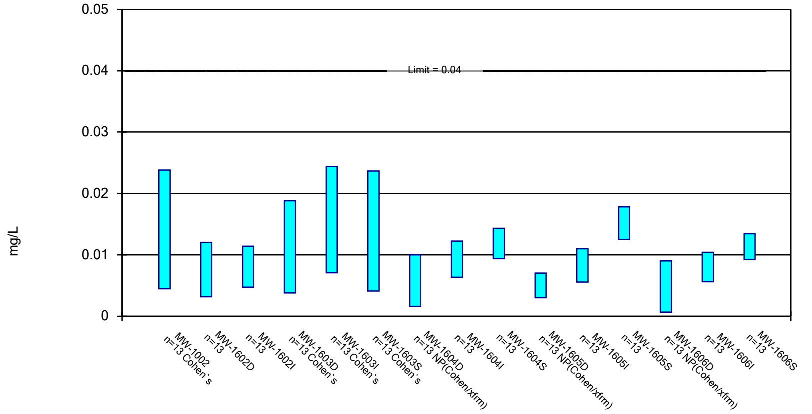
Constituent: Lead, total Analysis Run 12/8/2019 2:27 PM View: Confidence Intervals - App IV

Rockport BAP Client: Geosyntec Data: Rockport_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.



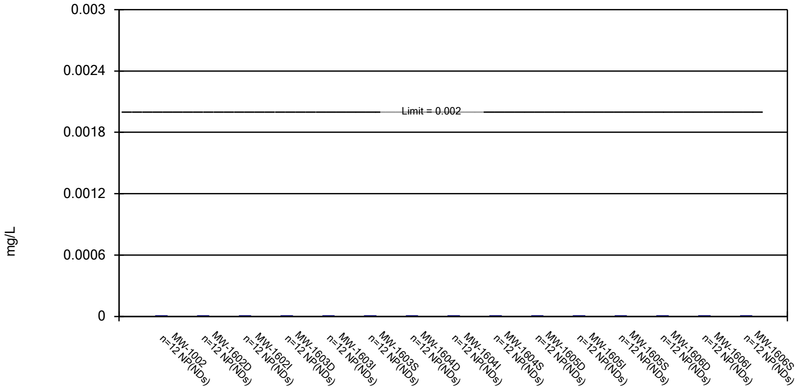
Constituent: Lithium, total Analysis Run 12/8/2019 2:27 PM View: Confidence Intervals - App IV

Rockport BAP Client: Geosyntec Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01.



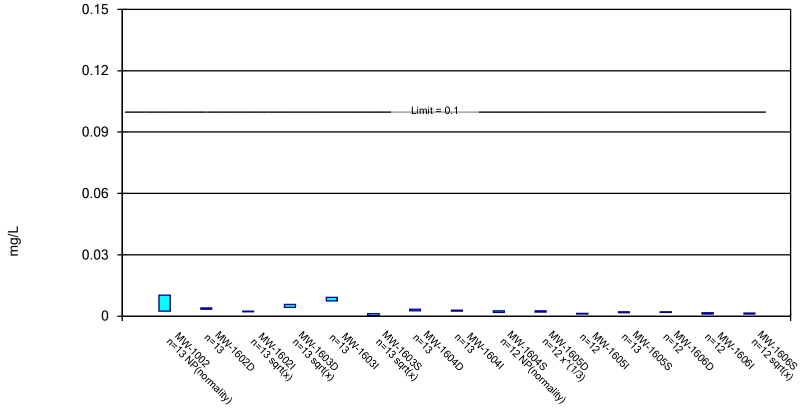
Constituent: Mercury, total Analysis Run 12/8/2019 2:27 PM View: Confidence Intervals - App IV

Rockport BAP Client: Geosyntec Data: Rockport_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.



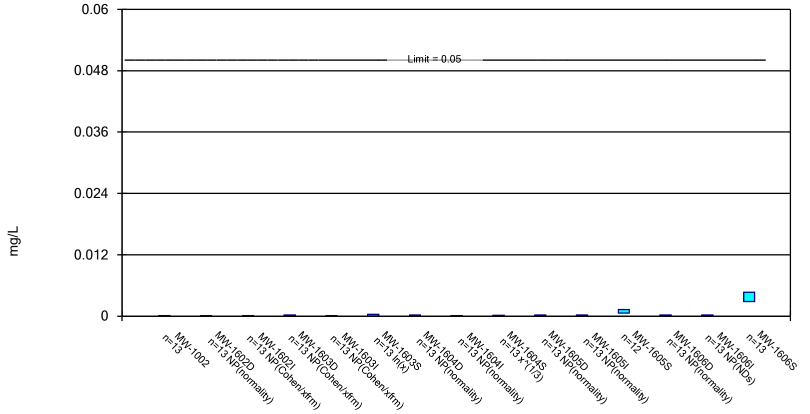
Constituent: Molybdenum, total   Analysis Run 12/8/2019 2:27 PM   View: Confidence Intervals - App IV

Rockport BAP   Client: Geosyntec   Data: Rockport_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.



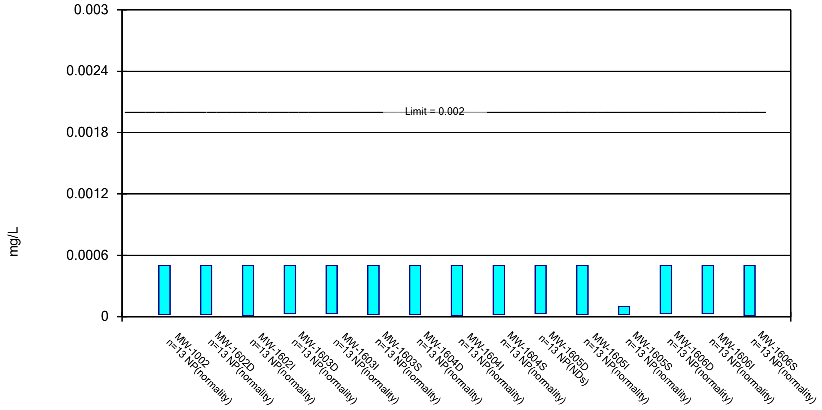
Constituent: Selenium, total   Analysis Run 12/8/2019 2:27 PM   View: Confidence Intervals - App IV

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01.



Constituent: Thallium, total   Analysis Run 12/8/2019 2:27 PM   View: Confidence Intervals - App IV

Rockport BAP   Client: Geosyntec   Data: Rockport_BAP

Annual Groundwater Monitoring Report

Indiana Michigan Power Company

Rockport Plant

Landfill CCR Management Unit

Rockport, Indiana

January 31, 2020

Prepared by:
American Electric Power Service Corporation
1 Riverside Plaza
Columbus, Ohio 43215

Table of Contents

I. Overview

This *Annual Groundwater Monitoring and Corrective Action Report* (Report) has been prepared to report the status of activities for the year 2019 for the CCR landfill at Indiana Michigan Power Company's (I&M) Rockport Plant. The Indiana Michigan Power Company is wholly-owned subsidiary of American Electric Power Company (AEP). The USEPA's CCR rules require that the Annual Groundwater Monitoring and Corrective Action Report covering 2019 groundwater monitoring activities be posted to the operating record no later than January 31, 2020.

In general, the following 2019 activities were completed:

- Semiannual detection monitoring samples were obtained in November of 2018 and May and November of 2019. Data for the November 2018 sampling was expanded to include results of verification sampling which were not available for the 2018 annual report because analysis of the samples was completed after the January 31, 2019 annual report deadline.
- Groundwater data underwent various validation tests, including tests for completeness, valid values, transcription errors, and consistent units;
- Statistical analysis of Appendix III indicator parameters was performed on the results of the November 2018 and the May 2019 detection monitoring samples. Statistical analysis of the November 2019 samples was not performed because the analytical data necessary to complete the statistical analysis is not yet available.
- Alternative source demonstrations were investigated and completed.

The major components of this annual report, to the extent applicable at this time, are presented in sections that follow:

- A map/aerial photograph showing the CCR landfill unit, all groundwater monitoring wells and monitoring well identification numbers.
- Identification of any monitoring wells that were installed as part of the CCR groundwater monitoring system 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).
- Statistical analyses of Appendix III parameters. (Attached as Appendix 2 and 3).
- Alternate source demonstrations (ASDs) for Appendix III parameters (Attached as Appendix 4 and 5).

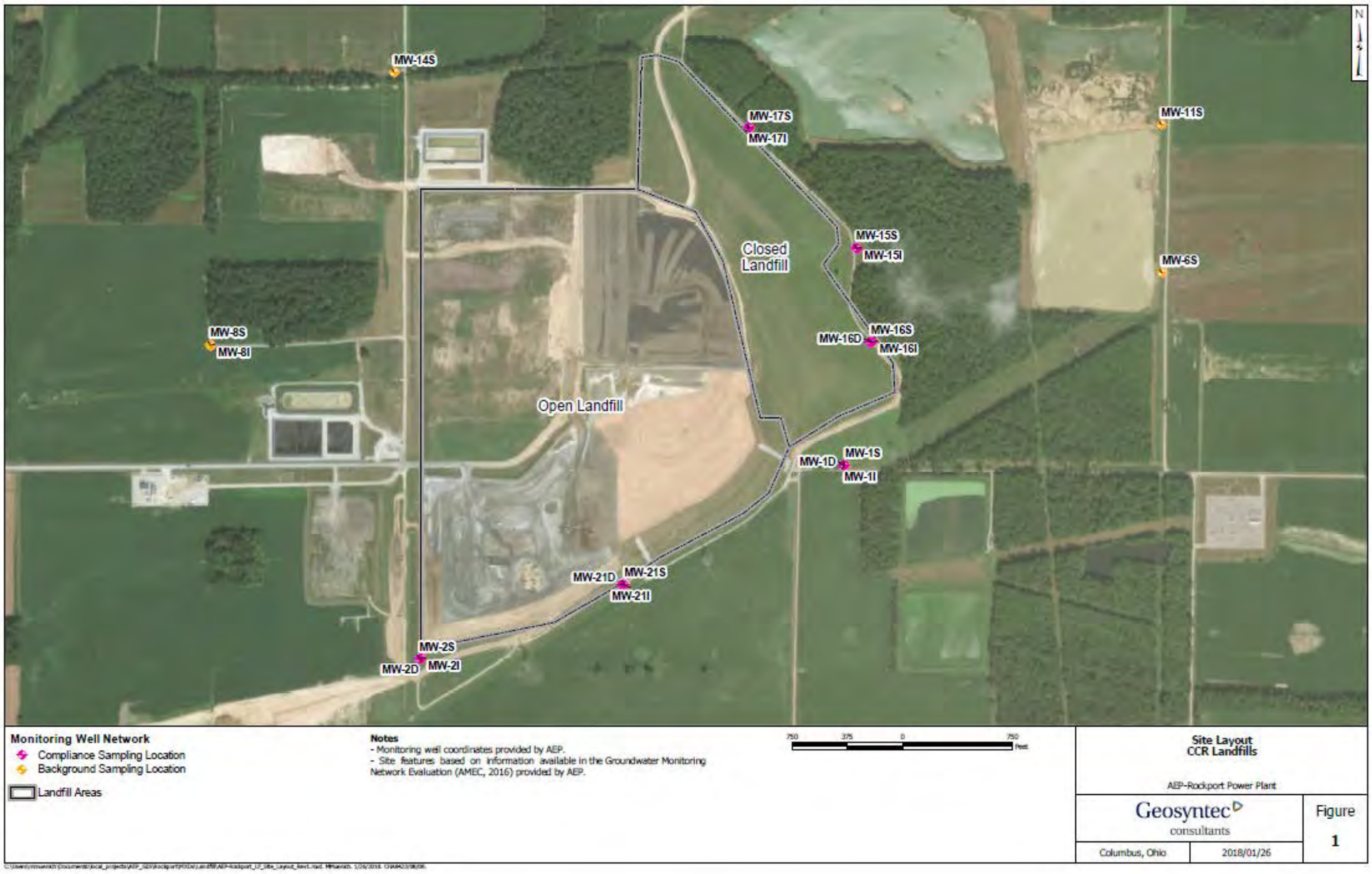
- A summary of any transition between monitoring programs or an alternate monitoring frequency, for example the date and circumstances for transitioning from detection monitoring to assessment monitoring, in addition to identifying the constituents detected at a statistically significant increase over background concentrations.
- Other information required to be included in the annual report such as 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 CCR landfill groundwater monitoring network, the monitoring well locations, and their corresponding identification numbers. The CCR landfill monitoring wells are listed as follows (S=shallow, I=Intermediate, D=Deep):

- Five Upgradient/Off Gradient Wells: MW 6S; MW 8 S,I; MW 11S; MW 14S.
- Sixteen Downgradient Wells: MW 17 S,I; MW 15 S,I; MW 16 S,I,D; MW 1 S,I,D; MW 21 S,I,D; and MW 2 S,I,D.



III. Monitoring Wells Installed or Decommissioned

There were no CCR monitoring wells installed or decommissioned in 2019. The network design, as summarized in the *Groundwater Monitoring Network Design Report* (*Amec Foster Wheeler, 2017)* and as posted at the CCR web site for Rockport 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. The web site is located at *AEP.com/Required Internet Postings/CCR Rule Compliance Data and Information/Rockport Plant/Landfill*.

IV. Groundwater Quality Data and Static Water Elevation Data, With Flow Rates and Flow Directions

Appendix 1 contains Table 1 that shows the groundwater quality data collected during the second detection monitoring event of 2018 consisting of monitoring results from samples taken in November 2018 and verification samples taken in February and April 2019. Also included are results from the first semiannual sampling event in May 2019 and subsequent verification samples taken in July and September.

Static water elevation data from each monitoring event are shown in Appendix 1, along with the groundwater flow rates (Table 2) and flow directions developed after each sampling event.

Note that the second semiannual sampling event of 2019 occurred in November and the lab results were not complete in 2019. Therefore, the November 2019 sample results will be included and discussed in the 2020 annual groundwater report due January 31, 2021.

V. Groundwater Quality Data Statistical Analysis

November 2018 Samples.

Statistical analysis of the detection monitoring samples taken in November 2018 with verification samples taken in February and April 2019 was completed. Statistically significant increases (SSIs) in the Appendix III parameters of chloride, fluoride, and TDS were documented in the May 1, 2019 statistical analysis report contained in Appendix 2.

May 2019 Samples

Statistical analysis of the first 2019 semiannual detection monitoring samples taken in May with verification samples taken in July and September was completed. Statistically significant increases (SSIs) in the Appendix III parameters of calcium, chloride, fluoride, and TDS were documented in the October 3, 2019 statistical analysis report as shown in Appendix 3.

VI. Alternate Source Demonstrations

November 2018 Samples.

An alternate source demonstration (ASD) by Wood Environment & Infrastructure Solutions Inc. relative to the Appendix III SSIs resulting from the November 2018 sampling was undertaken and completed by report dated June 28, 2019. The demonstration concluded that the groundwater quality and Appendix III indicator parameter SSIs identified in the statistical evaluation were not the result of a release of leachate from the landfill but were due to natural groundwater variation. The successful ASD is included in Appendix 4.

Because the ASD for the November 2018 samples was successful, the landfill remained in detection monitoring for the first semiannual samples of 2019 taken in May.

May 2019 Samples

The first semiannual detection monitoring samples of 2019 were taken in May with verification samples taken in July and September. As discussed above, there were SSIs for Appendix III parameters. An ASD by Wood Environment & Infrastructure Solutions Inc. relative to the Appendix III SSIs was undertaken and completed by report dated December 10, 2019. The demonstration concluded that the groundwater quality and Appendix III indicator parameter SSIs identified in the statistical evaluation were not the result of a release of leachate from the landfill but were due to natural groundwater variation and impacts from historical oil and gas operations in the vicinity. The successful ASD is included in Appendix 5.

Because the ASD for the May 2019 samples was successful, the BAP remained in detection monitoring for the second semiannual samples of 2019 taken in November.

VII. Discussion About Transition Between Monitoring Requirements or Alternate Monitoring Frequency

Because an ASD was successful for the Appendix III SSIs resulting from the statistical analyses of results from both the November 2018 and May 2019 sampling events, the landfill remained in detection monitoring for the November 2019 sampling event. Completion of verification sampling and statistical analyses of results for the November 2019 sampling event will be completed in early 2020.

If there are no SSIs of Appendix III parameters resulting from statistical analyses of the November 2019 sampling results, the landfill will remain in detection monitoring. If SSIs for the Appendix III indicator parameters are identified, an ASD will be investigated. If the ASD is successful, the landfill will remain in detection monitoring. If an ASD is not successful, then the landfill will proceed with assessment monitoring as required by 40 CFR 257.95.

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. Other Information Required

The landfill is currently in detection monitoring. All required information has been included in this annual groundwater monitoring report.

IX. Description of Any Problems Encountered in 2018 and Actions Taken

No significant problems were encountered. The low flow sampling effort went smoothly and the schedule was met to support 2019 annual groundwater report preparation covering the 2019 groundwater monitoring activities.

X. A Projection of Key Activities for the Upcoming Year

Key activities for 2020 include:

- Completion of verification sampling (if needed) and statistical analyses of results from the November 2019 sampling event.
- Detection monitoring on a twice per year schedule (May and November) for 2020.
- Evaluation of the semiannual detection monitoring results from a statistical analysis viewpoint, looking for any statistically significant increases, or decreases when pH is considered.
- Alternate source demonstrations or assessment monitoring activities as necessary or required.
- Responding to any new data received in light of what the CCR rule requires.
- Preparation of the fourth annual groundwater report.

APPENDIX 1

ROCKPORT PLANT CCR LANDFILL

ANNUAL GROUNDWATER MONITORING REPORT COVERING 2019 ACTIVITIES

GW QUALITY DATA, GW FLOW DIRECTIONS, GW FLOW RATES

Table 1 - Groundwater Data Summary: MW-001D
Rockport - LF
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
6/8/2016	Background	0.017	63.6	27.3	0.28	7.6	331	40.2
7/19/2016	Background	0.015	57.9	29.8	0.3	7.1	329	40.6
9/20/2016	Background	0.016	65.2	29.8	0.28	7.4	288	32.3
11/16/2016	Background	0.018	69.3	39.3	0.29	7.5	339	33.6
1/11/2017	Background	0.006	63.4	40.6	0.26	7.4	323	36.4
3/8/2017	Background	0.055	70.0	40.3	0.26	7.3	330	37.0
5/9/2017	Background	0.046	67.8	40.9	0.28	7.3	342	39.5
7/18/2017	Background	0.019	63.9	39.3	0.24	8.1	338	39.6
10/4/2017	Detection	0.002 J	65.7	10.3	0.85	7.3	339	10.4
1/22/2018	Detection	- -	- -	- -	0.31	- -	- -	- -
6/7/2018	Detection	0.103	70.9	43.1	0.30	8.2	345	39.5
8/16/2018	Detection	0.020	- -	43.8	- -	7.4	- -	- -
11/14/2018	Detection	0.100	71.9	46.9	0.30	7.8	340	39.8
2/13/2019	Detection	<0.02 U	- -	- -	- -	7.4	- -	- -
5/23/2019	Detection	0.02 J	73.6	32.1	0.27	7.2	346	45.3
7/23/2019	Detection	- -	- -	- -	- -	7.3	- -	39.2

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-001D
Rockport - 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
6/8/2016	Background	0.05	1.29	255	0.01 J	0.13	0.3	3.64	1.084	0.28	1.13	<0.0002 U	0.002 J	3.44	0.07 J	0.04 J
7/19/2016	Background	0.03 J	0.73	147	<0.005 U	0.07	1.5	0.373	0.195	0.30	1.37	0.017	<0.002 U	3.59	0.03 J	0.02 J
9/20/2016	Background	0.03 J	1.07	160	0.007 J	0.04	0.3	0.836	1.457	0.28	0.500	0.0005 J	<0.002 U	3.60	0.07 J	0.056
11/16/2016	Background	0.03 J	0.65	147	<0.005 U	0.04	0.072	0.329	7.296	0.29	0.222	0.004	<0.002 U	3.24	0.03 J	0.02 J
1/11/2017	Background	0.03 J	0.77	162	<0.005 U	0.15	0.439	0.577	0.649	0.26	0.807	0.007	<0.002 U	2.43	0.03 J	0.05 J
3/8/2017	Background	0.02 J	0.58	139	<0.005 U	0.04	0.687	0.173	0.2384	0.26	1.92	0.007	<0.002 U	3.40	0.03 J	0.03 J
5/9/2017	Background	0.02 J	0.75	142	0.006 J	0.04	0.174	0.440	0.724	0.28	0.419	0.009	<0.002 U	3.05	0.06 J	0.04 J
7/18/2017	Background	0.02 J	0.59	139	<0.004 U	0.05	0.131	0.212	0.946	0.24	0.355	0.002	<0.002 U	2.94	<0.03 U	0.03 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-001I
Rockport - LF
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
6/9/2016	Background	0.075	67.4	24.9	0.37	6.7	323	44.3
7/19/2016	Background	0.014	60.0	24.8	0.40	7.0	315	46.7
9/20/2016	Background	0.018	64.5	24.3	0.37	7.4	331	42.4
11/16/2016	Background	0.015	63.9	24.1	0.31	7.1	334	40.7
1/11/2017	Background	0.004 J	60.9	24.4	0.33	7.6	316	41.4
3/8/2017	Background	0.045	66.9	24.1	0.35	7.4	300	41.2
5/9/2017	Background	0.049	65.7	26.5	0.38	7.2	323	43.8
7/18/2017	Background	0.047	64.8	26.5	0.34	6.9	330	43.3
10/4/2017	Detection	0.018	68.1	27.5	0.37	7.1	327	44.1
6/6/2018	Detection	0.110	66.4	28.6	0.42	7.5	321	42.0
8/16/2018	Detection	0.056	- -	- -	- -	7.3	- -	- -
11/14/2018	Detection	0.05 J	65.5	28.8	0.41	7.8	308	40.7
2/13/2019	Detection	- -	- -	30.1	- -	7.5	- -	- -
4/1/2019	Detection	- -	- -	34.1	- -	7.4	- -	- -
5/23/2019	Detection	0.02 J	67.7	33.1	0.42	7.0	341	40.2
7/23/2019	Detection	- -	- -	30.6	- -	7.2	- -	- -
9/11/2019	Detection	- -	- -	33.5	- -	7.3	- -	- -

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-001I
Rockport - 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
6/9/2016	Background	0.04 J	0.86	85.5	<0.005 U	0.08	0.2	0.341	0.3903	0.37	0.851	0.005	<0.002 U	2.47	<0.03 U	0.03 J
7/19/2016	Background	0.04 J	0.78	86.1	<0.005 U	0.10	1.0	0.364	1.675	0.40	1.25	0.022	0.002 J	2.85	0.04 J	0.02 J
9/20/2016	Background	0.01 J	0.92	84.9	<0.005 U	0.02	0.2	0.401	1.696	0.37	0.156	0.007	<0.002 U	2.89	<0.03 U	0.02 J
11/16/2016	Background	0.02 J	0.80	93.4	<0.005 U	0.02 J	0.051	0.381	1.312	0.31	0.059	0.005	<0.002 U	3.27	<0.03 U	0.03 J
1/11/2017	Background	0.02 J	0.82	90.5	0.005 J	0.02 J	0.390	0.424	0.621	0.33	0.099	0.005	<0.002 U	3.33	<0.03 U	0.104
3/8/2017	Background	0.03 J	0.69	76.7	<0.005 U	0.05	0.686	0.054	0.15	0.35	0.427	0.006	<0.002 U	1.82	0.04 J	0.03 J
5/9/2017	Background	0.04 J	0.89	85.0	<0.004 U	0.01 J	0.155	0.558	0.63	0.38	0.068	0.008	<0.002 U	2.87	<0.03 U	0.02 J
7/18/2017	Background	0.02 J	0.86	94.3	<0.004 U	0.007 J	0.112	0.569	2.533	0.34	0.137	0.0005 J	<0.002 U	2.85	<0.03 U	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-001S
Rockport - LF
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
6/9/2016	Background	0.037	70.7	29.6	0.59	8.1	392	33.7
7/19/2016	Background	0.015	62.9	31.1	0.65	7.2	392	35.5
9/20/2016	Background	0.022	68.0	31.4	0.60	7.1	411	32.4
11/16/2016	Background	0.020	74.4	31.9	0.54	7.3	398	30.7
1/11/2017	Background	0.005 J	65.0	32.0	0.57	7.4	392	30.7
3/8/2017	Background	0.030	71.5	30.7	0.59	7.1	384	30.5
5/9/2017	Background	0.031	72.6	31.3	0.63	7.2	402	33.3
7/18/2017	Background	0.028	69.2	30.4	0.58	7.3	406	33.6
10/4/2017	Detection	0.044	67.6	33.1	0.57	7.1	396	34.6
1/3/2018	Detection	- -	- -	39.9	- -	7.6	- -	- -
6/6/2018	Detection	0.046	71.8	34.9	0.61	7.5	386	34.2
8/16/2018	Detection	- -	- -	37.3	- -	7.3	- -	- -
11/14/2018	Detection	0.04 J	71.9	38.1	0.63	7.5	410	32.3
2/13/2019	Detection	- -	- -	40.4	- -	7.5	- -	- -
4/1/2019	Detection	- -	- -	38.5	- -	7.4	- -	- -
5/23/2019	Detection	<0.02 U	73.7	33.7	0.55	7.9	388	36.3
7/23/2019	Detection	- -	- -	30.0	- -	7.4	- -	- -

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-001S
Rockport - 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
6/9/2016	Background	0.03 J	0.43	18.5	<0.01 U	0.02 J	0.3	0.171	0.0665	0.59	0.204	0.004	<0.002 U	0.65	1.1	<0.02 U
7/19/2016	Background	0.20	0.69	21.9	0.160	0.22	0.7	0.398	0.819	0.65	0.572	0.024	<0.002 U	0.80	1.1	0.168
9/20/2016	Background	0.02 J	0.38	17.2	<0.005 U	0.005 J	0.3	0.014	0.244	0.60	0.01 J	0.002	<0.002 U	0.68	0.9	<0.01 U
11/16/2016	Background	0.02 J	0.38	17.9	<0.005 U	0.007 J	0.207	0.01 J	0.296	0.54	0.022	0.010	<0.002 U	0.74	0.9	<0.01 U
1/11/2017	Background	0.04 J	0.43	17.7	<0.005 U	0.02	0.720	0.052	0.934	0.57	0.076	0.008	<0.002 U	0.59	1.0	<0.01 U
3/8/2017	Background	0.04 J	0.76	36.5	0.023	0.09	1.38	1.21	0.0407	0.59	1.26	0.010	<0.002 U	0.97	1.1	0.03 J
5/9/2017	Background	0.05 J	0.50	22.3	0.01 J	0.22	0.552	0.164	0.0324	0.63	0.526	0.009	<0.002 U	1.64	1.1	<0.01 U
7/18/2017	Background	0.02 J	0.39	17.3	<0.004 U	0.01 J	0.255	0.02 J	0.309	0.58	0.033	0.0007 J	<0.002 U	0.64	1.2	<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-002D
Rockport - LF
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
6/9/2016	Background	<0.002 U	75.6	24.2	0.19	7.9	341	42.1
7/20/2016	Background	0.010	65.8	24.2	0.21	7.5	339	44.2
9/21/2016	Background	0.013	66.7	22.8	0.20	7.3	338	39.6
11/17/2016	Background	0.014	73.9	22.2	0.19	7.1	327	35.4
1/11/2017	Background	<0.002 U	64.2	22.3	0.19	7.4	318	38.3
3/8/2017	Background	0.030	74.2	21.7	0.20	7.4	318	37.6
5/9/2017	Background	0.027	70.8	23.1	0.21	7.3	343	40.5
7/19/2017	Background	0.073	64.7	23.0	0.18	8.5	340	40.5
10/4/2017	Detection	0.041	67.7	22.4	0.20	7.2	332	42.3
6/7/2018	Detection	0.076	78.6	43.1	0.22	7.6	361	39.8
8/16/2018	Detection	0.038	- -	93.0	- -	7.3	- -	- -
11/12/2018	Detection	0.07 J	72.4	51.3	0.20	7.4	348	36.1
2/13/2019	Detection	- -	- -	40.9	- -	7.3	- -	- -
4/1/2019	Detection	- -	- -	69.4	- -	7.5	- -	- -
5/22/2019	Detection	<0.02 U	98.5	135	0.18	7.3	531	33.3
7/24/2019	Detection	- -	114	156	- -	6.3	540	- -
9/11/2019	Detection	- -	103	110	- -	7.2	443	- -

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-002D
Rockport - 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
6/9/2016	Background	0.03 J	0.78	185	<0.005 U	0.12	0.2	0.473	0.0495	0.19	0.648	0.002	<0.002 U	2.11	<0.03 U	0.02 J
7/20/2016	Background	0.06	0.82	195	0.006 J	0.12	0.4	0.439	0.328	0.21	0.359	0.018	<0.002 U	2.16	<0.03 U	0.02 J
9/21/2016	Background	0.02 J	0.81	180	0.007 J	0.07	0.3	0.425	0.451	0.20	0.247	0.002	<0.002 U	1.97	0.05 J	0.03 J
11/17/2016	Background	0.02 J	0.61	172	<0.005 U	0.10	0.05 J	0.212	2.243	0.19	0.021	0.007	<0.002 U	2.09	0.09 J	0.01 J
1/11/2017	Background	0.03 J	0.62	157	<0.005 U	0.26	0.277	0.327	1.278	0.19	0.378	0.007	<0.002 U	1.80	0.08 J	0.02 J
3/8/2017	Background	0.03 J	0.59	160	<0.005 U	0.09	0.562	0.252	1.295	0.20	0.045	0.008	<0.002 U	2.13	0.03 J	0.02 J
5/9/2017	Background	0.04 J	0.65	159	<0.004 U	0.08	0.188	0.335	0.4554	0.21	0.144	0.011	<0.002 U	1.90	0.06 J	0.02 J
7/19/2017	Background	0.02 J	0.62	169	<0.004 U	0.08	0.162	0.353	0.372	0.18	0.075	0.0006 J	<0.002 U	1.89	0.04 J	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-002I
Rockport - LF
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
6/9/2016	Background	0.019	74.0	28.6	0.30	7.9	332	42.9
7/20/2016	Background	0.009	67.5	29.7	0.33	7.1	363	45.7
9/21/2016	Background	0.025	66.8	28.0	0.31	7.5	330	41.1
11/17/2016	Background	0.013	73.9	25.8	0.36	7.3	326	36.9
1/11/2017	Background	<0.002 U	63.9	27.1	0.30	7.7	314	39.2
3/8/2017	Background	0.024	71.5	25.8	0.31	7.6	312	39.2
5/9/2017	Background	0.034	71.0	28.6	0.31	8.4	343	42.4
7/19/2017	Background	0.025	68.9	29.7	0.28	7.0	346	44.1
10/4/2017	Detection	0.03	72.5	29.8	0.28	7.2	343	45.5
1/4/2018	Detection	- -	- -	28.8	- -	7.8	- -	- -
6/6/2018	Detection	0.052	72.7	31.8	0.32	7.6	356	43.2
8/16/2018	Detection	0.03	- -	31.5	- -	7.5	- -	- -
11/13/2018	Detection	0.05 J	64.8	27.9	0.32	7.2	308	39.0
2/13/2019	Detection	<0.02 U	- -	- -	- -	7.6	- -	- -
5/22/2019	Detection	<0.02 U	64.3	25.4	0.32	7.3	328	39.2

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-002I
Rockport - 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
6/9/2016	Background	0.06	0.64	78.5	<0.005 U	0.03	0.2	0.606	0.398	0.30	0.208	0.005	<0.002 U	4.91	0.7	0.051
7/20/2016	Background	0.06	0.68	84.0	0.006 J	0.05	0.6	0.760	0.962	0.33	0.454	0.021	<0.002 U	5.00	0.7	0.04 J
9/21/2016	Background	0.07	0.55	67.1	<0.005 U	0.05	0.1	0.415	0.508	0.31	0.178	0.002	<0.002 U	4.21	0.6	0.04 J
11/17/2016	Background	0.13	0.61	60.1	<0.005 U	0.07	0.143	0.260	0.425	0.36	0.231	0.006	<0.002 U	3.14	0.4	0.02 J
1/11/2017	Background	0.10	0.65	59.4	<0.005 U	0.16	0.154	0.280	0.845	0.30	0.383	0.007	<0.002 U	2.07	0.2	0.03 J
3/8/2017	Background	0.10	0.74	58.4	0.01 J	0.22	1.01	0.581	0.435	0.31	0.588	0.005	<0.002 U	2.06	0.2	0.03 J
5/9/2017	Background	0.15	0.90	59.3	0.022	0.09	0.829	1.28	0.491	0.31	1.39	0.007	<0.002 U	2.17	0.4	<0.01 U
7/19/2017	Background	0.11	0.76	62.9	0.020	0.05	0.567	0.995	0.536	0.28	1.19	<0.0002 U	<0.002 U	2.07	0.2	0.064

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-002S
Rockport - LF
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
6/9/2016	Background	<0.002 U	59.4	21.5	0.26	6.4	298	26.0
7/20/2016	Background	0.015	51.6	21.8	0.29	7.7	265	27.6
9/21/2016	Background	0.014	57.4	23.8	0.26	7.6	301	26.2
11/17/2016	Background	0.018	62.4	21.8	0.26	7.3	316	24.1
1/11/2017	Background	0.004 J	51.6	21.2	0.25	7.7	284	25.9
3/8/2017	Background	0.069	57.9	21.0	0.26	7.7	285	26.6
5/9/2017	Background	0.084	59.0	20.8	0.26	7.1	321	30.3
7/19/2017	Background	0.052	53.3	19.6	0.23	7.5	308	33.8
10/4/2017	Detection	0.045	60.7	21.2	0.25	7.2	323	30.0
6/6/2018	Detection	0.073	57.0	25.3	0.29	7.6	329	28.9
11/13/2018	Detection	0.06 J	54.7	24.8	0.28	7.5	272	24.7
2/13/2019	Detection	- -	- -	26.5	- -	7.8	- -	- -
4/1/2019	Detection	- -	- -	26.1	- -	7.7	- -	- -
5/22/2019	Detection	<0.02 U	51.3	26.4	0.3	7.7	352	26.2
7/23/2019	Detection	- -	- -	26.8	0.3	7.5	339	- -
9/11/2019	Detection	- -	- -	26.6	- -	7.3	- -	- -

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-002S
Rockport - 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**
6/9/2016	Background	<0.02 U	0.97	16.0	<0.01 U	0.01 J	0.4	0.177	0	0.26	0.158	0.0004 J	<0.002 U	2.03	0.3	<0.02 U
7/20/2016	Background	0.02 J	1.09	14.0	<0.005 U	0.01 J	0.6	0.090	0.66	0.29	0.105	0.018	<0.002 U	2.39	0.3	<0.01 U
9/21/2016	Background	0.04 J	0.94	12.4	<0.005 U	0.02 J	0.3	0.017	0.172	0.26	0.101	0.005	<0.002 U	2.07	0.2	<0.01 U
11/17/2016	Background	0.02 J	0.94	12.4	<0.005 U	0.02	0.337	0.019	0.371	0.26	0.022	0.008	<0.002 U	1.91	0.3	<0.01 U
1/11/2017	Background	0.02 J	0.92	11.0	<0.005 U	0.09	0.329	0.014	0.654	0.25	0.063	0.009	<0.002 U	2.14	0.4	0.074
3/8/2017	Background	0.02 J	0.95	12.3	<0.005 U	0.009 J	0.670	0.051	0.5205	0.26	0.042	0.0007 J	<0.002 U	1.92	0.3	<0.01 U
5/9/2017	Background	0.04 J	0.95	12.3	<0.004 U	0.01 J	0.370	0.064	0.434	0.26	0.047	0.002	<0.002 U	1.75	0.2	<0.01 U
7/19/2017	Background	0.12	0.96	13.6	<0.004 U	0.03	0.410	0.121	0.6927	0.23	0.243	0.005	<0.002 U	1.81	0.3	0.03 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-6S
Rockport - LF
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
6/8/2016	Background	0.012	46.1	8.44	0.73	7.9	294	18.8
7/18/2016	Background	0.014	46.3	8.35	0.79	7.5	290	18.3
9/20/2016	Background	0.012	44.4	6.04	0.73	7.4	266	10.9
11/16/2016	Background	0.028	50.8	7.04	0.69	8.1	279	14.3
1/10/2017	Background	0.006	47.8	7.03	0.65	7.9	287	14.0
3/8/2017	Background	0.032	53.2	3.32	0.25	7.9	296	6.9
5/8/2017	Background	0.051	50.3	8.68	0.69	7.6	305	17.5
7/18/2017	Background	0.078	47.0	4.88	0.57	7.7	274	9.6
10/3/2017	Detection	0.094	44.8	3.28	0.71	7.3	261	7.5
6/5/2018	Detection	0.090	45.2	2.38	0.89	7.5	225	3.8
8/15/2018	Detection	0.101	52.8	11.9	0.81	7.7	277	15.6
9/26/2018	Detection	0.08 J	44.1	6.83	0.84	- -	261	9.8
11/1/2018	Detection	0.04 J	42.3	3.52	0.86	7.3	225	4.9
11/15/2018	Detection	0.04 J	38.8	3.91	0.88	7.9	196	5.2
5/23/2019	Detection	0.02 J	52.5	9.64	0.95	7.4	315	16.8

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-6S
Rockport - 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
6/8/2016	Background	0.02 J	0.28	13.9	<0.005 U	0.006 J	0.4	0.097	0.156	0.73	0.396	<0.0002 U	0.002 J	5.99	0.4	<0.01 U
7/18/2016	Background	0.03 J	0.26	13.6	0.005 J	0.25	0.4	0.052	0.101	0.79	0.074	0.015	<0.002 U	3.28	0.3	0.01 J
9/20/2016	Background	0.03 J	0.26	13.6	<0.005 U	0.02	0.3	0.019	0.8651	0.73	0.034	0.004	<0.002 U	3.34	0.2	<0.01 U
11/16/2016	Background	0.03 J	0.26	14.1	<0.005 U	0.02 J	0.200	0.027	0.202	0.69	0.050	0.006	<0.002 U	2.80	0.3	<0.01 U
1/10/2017	Background	0.03 J	0.28	14.8	<0.005 U	0.008 J	0.599	0.045	0.5825	0.65	0.032	0.014	<0.002 U	2.93	0.4	0.01 J
3/8/2017	Background	0.03 J	0.26	15.8	<0.005 U	0.05	1.37	0.049	0.297	0.25	0.113	0.009	<0.002 U	3.29	0.7	<0.01 U
5/8/2017	Background	0.03 J	0.28	15.4	<0.004 U	0.009 J	0.583	0.061	0.12	0.69	0.083	0.011	<0.002 U	2.73	0.8	<0.01 U
7/18/2017	Background	0.02 J	0.27	14.3	<0.004 U	0.04	0.291	0.026	0.954	0.57	0.056	<0.0002 U	<0.002 U	4.36	0.4	<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-008I
Rockport - LF
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**
6/7/2016	Background	0.017	72.0	21.7	0.35	7.2	370	87.5
7/19/2016	Background	0.016	67.9	22.0	0.34	7.2	358	86.3
9/21/2016	Background	0.017	67.4	21.5	0.29	7.4	376	79.2
11/17/2016	Background	0.028	77.5	21.3	0.29	7.6	387	77.5
1/10/2017	Background	0.006	79.5	20.9	0.25	7.6	371	80.0
3/6/2017	Background	0.083	74.7	20.7	0.28	7.4	391	80.3
5/9/2017	Background	0.045	71.9	21.2	0.28	7.2	376	81.9
7/18/2017	Background	0.026	72.2	20.9	0.25	7.3	379	83.4
10/4/2017	Detection	0.096	74.7	20.1	0.27	7.6	378	85.9
12/12/2017	Detection	- -	- -	19.3	0.29	7.9	- -	87.1
6/4/2018	Detection	0.044	76.7	20.9	0.29	7.7	407	79.0
11/14/2018	Detection	0.06 J	67.7	20.6	0.33	7.2	390	68.2
5/23/2019	Detection	0.03 J	70.7	21.0	0.34	7.2	371	62.3

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-008I
Rockport - 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
6/7/2016	Background	0.12	5.86	61.4	<0.005 U	0.04	0.1	0.800	0.538	0.35	0.083	0.006	<0.002 U	2.85	6.2	0.063
7/19/2016	Background	0.27	11.5	70.1	0.119	0.28	0.5	0.961	1.2515	0.34	0.242	0.007	<0.002 U	3.00	7.5	0.166
9/21/2016	Background	0.07	2.08	57.0	<0.005 U	0.02 J	0.1	0.643	0.678	0.29	0.02 J	0.008	<0.002 U	2.34	2.7	0.03 J
11/17/2016	Background	0.10	1.39	58.4	<0.005 U	0.04	0.055	0.646	1.166	0.29	0.032	0.009	<0.002 U	2.47	3.0	0.03 J
1/10/2017	Background	0.08	2.58	54.9	<0.005 U	0.02 J	0.817	0.671	1.825	0.25	0.025	0.005	<0.002 U	2.31	2.3	0.04 J
3/6/2017	Background	0.08	2.78	56.9	<0.005 U	0.04	0.511	0.656	1.015	0.28	0.032	0.010	<0.002 U	2.73	2.9	0.05 J
5/9/2017	Background	0.08	2.09	57.8	<0.004 U	0.05	0.230	0.770	1.011	0.28	0.054	0.001	<0.002 U	2.29	4.5	0.03 J
7/18/2017	Background	0.07	1.31	60.4	<0.004 U	0.02 J	0.077	0.672	1.079	0.25	0.01 J	<0.0002 U	<0.002 U	2.58	4.7	0.03 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-008S
Rockport - LF
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
6/7/2016	Background	0.010	42.7	23.7	0.56	7.3	345	26.5
7/19/2016	Background	0.012	41.5	23.5	0.56	7.2	321	26.4
9/21/2016	Background	0.011	42.7	22.1	0.54	7.1	332	23.4
11/17/2016	Background	0.032	42.9	21.1	0.55	7.9	322	21.7
1/9/2017	Background	<0.002 U	45.8	20.8	0.47	7.6	300	22.1
3/7/2017	Background	0.043	44.8	21.4	0.52	7.6	320	21.7
5/9/2017	Background	0.028	42.9	22.8	0.52	7.4	319	21.8
7/18/2017	Background	0.022	44.4	22.7	0.47	7.4	319	22.3
10/4/2017	Detection	0.016	39.8	22.4	0.52	7.8	317	23.1
12/12/2017	Detection	- -	- -	22.5	0.56	7.7	- -	24.9
6/5/2018	Detection	0.058	42.3	23.8	0.59	7.6	324	21.2
11/13/2018	Detection	0.04 J	35.6	22.9	0.57	7.6	288	19.5
5/23/2019	Detection	<0.02 U	35.9	23.6	0.58	7.4	312	20.4

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-008S
Rockport - 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**
6/7/2016	Background	0.02 J	1.61	15.4	<0.005 U	0.07	0.3	0.400	0.204	0.56	0.207	0.004	<0.002 U	0.81	0.4	<0.01 U
7/19/2016	Background	0.30	1.78	13.1	0.232	0.31	0.6	0.453	0.577	0.56	0.364	0.025	<0.002 U	1.10	0.6	0.276
9/21/2016	Background	0.02 J	1.33	12.2	<0.005 U	0.02 J	0.4	0.125	1.291	0.54	0.066	0.001	<0.002 U	0.80	0.2	0.03 J
11/17/2016	Background	0.03 J	1.26	10.9	<0.005 U	0.05	0.156	0.113	0.49	0.55	0.065	0.002	<0.002 U	0.71	0.2	<0.01 U
1/9/2017	Background	0.02 J	1.56	13.8	0.006 J	0.01 J	1.04	0.447	0.676	0.47	0.190	0.002	<0.002 U	0.77	0.2	0.01 J
3/7/2017	Background	0.04 J	1.53	14.5	0.009 J	0.26	0.881	0.433	0.3161	0.52	0.278	0.006	<0.002 U	1.56	0.2	0.170
5/9/2017	Background	0.03 J	2.09	16.9	0.01 J	0.09	0.423	0.981	0.127	0.52	0.389	0.006	<0.002 U	0.75	0.3	<0.01 U
7/18/2017	Background	0.02 J	1.19	10.9	<0.004 U	0.13	0.277	0.052	1.653	0.47	0.038	0.001	0.015	0.83	0.2	<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-11S
Rockport - LF
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
6/8/2016	Background	0.062	41.6	1.82	0.74	7.9	212	10.9
7/18/2016	Background	0.062	38.8	1.83	0.76	7.3	201	10.6
9/20/2016	Background	0.077	45.1	1.62	0.73	7.3	196	5.3
11/16/2016	Background	0.053	37.3	1.54	0.92	8.4	182	4.1
1/10/2017	Background	0.029	40.4	2.12	0.96	8.1	179	7.6
3/7/2017	Background	0.057	42.8	4.63	1.00	7.9	197	13.7
5/9/2017	Background	0.047	41.2	9.87	0.86	7.8	239	16.4
7/18/2017	Background	0.067	44.2	8.19	0.75	7.7	224	15.6
10/3/2017	Detection	0.090	43.7	3.68	0.89	7.2	200	9.3
12/13/2017	Detection	- -	- -	2.40	0.82	8.3	- -	8.0
6/5/2018	Detection	0.076	55.8	6.98	0.62	7.2	276	21.7
11/14/2018	Detection	0.110	56.4	1.79	0.72	7.6	238	5.9
5/23/2019	Detection	0.08 J	54.3	1.62	0.82	7.7	279	14.7

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-11S
Rockport - 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
6/8/2016	Background	0.05 J	0.47	10.4	<0.005 U	0.006 J	0.4	0.113	0.422	0.74	0.046	<0.0002 U	<0.002 U	4.70	0.07 J	<0.01 U
7/18/2016	Background	0.04 J	0.53	9.79	<0.005 U	0.03	0.5	0.043	0.815	0.76	0.02 J	0.024	<0.002 U	4.36	0.08 J	0.01 J
9/20/2016	Background	0.04 J	0.42	11.3	<0.005 U	0.03	0.8	0.029	0.741	0.73	0.046	0.004	<0.002 U	3.37	0.1	0.01 J
11/16/2016	Background	0.05 J	0.45	7.91	<0.005 U	0.02	0.416	0.027	0.288	0.92	0.027	0.005	<0.002 U	4.71	0.07 J	0.02 J
1/10/2017	Background	0.04 J	0.52	6.52	<0.005 U	0.01 J	0.725	0.022	2.101	0.96	0.02 J	0.003	<0.002 U	6.09	0.05 J	0.01 J
3/7/2017	Background	0.04 J	0.52	7.09	<0.005 U	0.007 J	1.25	0.027	0.1865	1.00	0.02 J	0.013	0.002 J	6.03	0.2	0.01 J
5/9/2017	Background	0.04 J	0.48	7.73	<0.004 U	0.03	0.567	0.030	0.1247	0.86	0.023	0.009	0.002 J	4.86	0.2	0.01 J
7/18/2017	Background	<0.05 U	0.50	8.16	<0.02 U	<0.02 U	0.568	0.02 J	0.7935	0.75	0.06 J	0.002	<0.002 U	4.69	0.3 J	0.2 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-014S
Rockport - LF
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
6/7/2016	Background	0.011	59.2	28.6	0.39	7.2	368	34.9
7/20/2016	Background	0.008	56.3	29.4	0.39	7.1	364	36.5
9/21/2016	Background	0.010	59.5	28.1	0.36	7.0	361	32.5
11/17/2016	Background	0.008	65.4	27.8	0.35	7.7	362	29.1
1/9/2017	Background	<0.002 U	65.7	27.2	0.33	7.5	344	30.7
3/7/2017	Background	0.031	63.4	26.8	0.36	7.4	354	29.9
5/9/2017	Background	0.017	59.8	29.4	0.37	7.0	376	32.3
7/18/2017	Background	0.03	65.6	29.6	0.33	7.3	377	33.1
10/4/2017	Detection	0.042	67.0	29.9	0.34	7.0	376	34.8
12/12/2017	Detection	- -	- -	30.0	0.34	7.6	- -	35.5
6/5/2018	Detection	0.046	61.1	27.1	0.39	7.6	360	29.4
11/13/2018	Detection	0.04 J	59.2	29.0	0.37	6.8	344	30.8
5/23/2019	Detection	<0.02 U	66.9	28.6	0.37	7.2	390	32.4

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-014S
Rockport - 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
6/7/2016	Background	0.06	2.33	29.7	0.02 J	0.32	1.0	1.49	0.512	0.39	1.02	<0.0002 U	0.002 J	12.7	1.4	0.01 J
7/20/2016	Background	0.02 J	1.54	31.0	0.008 J	0.21	0.3	0.573	0.594	0.39	0.307	0.018	<0.002 U	1.51	1.4	<0.01 U
9/21/2016	Background	0.02 J	1.29	27.8	0.005 J	0.07	0.3	0.333	0.9	0.36	0.310	0.006	<0.002 U	1.43	1.2	<0.01 U
11/17/2016	Background	0.03 J	0.75	26.3	<0.005 U	0.03	0.162	0.088	1.106	0.35	0.549	0.004	<0.002 U	1.26	1.2	0.02 J
1/9/2017	Background	0.02 J	0.91	27.0	<0.005 U	0.05	0.575	0.187	0.78	0.33	0.115	0.006	<0.002 U	1.62	1.1	0.054
3/7/2017	Background	0.02 J	0.76	26.3	<0.005 U	0.01 J	0.660	0.083	0.0525	0.36	0.061	0.005	<0.002 U	1.84	1.1	0.055
5/9/2017	Background	0.06	0.75	25.0	<0.004 U	0.08	0.301	0.065	0.0316	0.37	0.071	0.001	<0.002 U	1.35	1.2	0.01 J
7/18/2017	Background	<0.05 U	0.70	27.0	<0.02 U	<0.02 U	0.258	0.03 J	1.883	0.33	0.116	<0.0002 U	<0.002 U	1.67	1.3	0.07 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-015I
Rockport - LF
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
6/7/2016	Background	0.060	44.1	59.3	0.25	7.2	380	42.5
7/19/2016	Background	0.032	44.6	53.8	0.25	7.1	356	41.0
9/21/2016	Background	0.030	46.1	43.4	0.23	7.1	334	34.0
11/16/2016	Background	0.022	51.4	44.9	0.25	7.5	340	33.6
1/10/2017	Background	0.019	46.5	48.3	0.34	7.7	351	35.4
3/7/2017	Background	0.047	51.1	38.5	0.32	7.5	331	31.1
5/10/2017	Background	0.038	46.6	32.7	0.31	7.2	322	29.7
7/18/2017	Background	0.050	43.9	27.1	0.22	7.2	300	26.6
10/4/2017	Detection	0.080	44.6	23.7	0.23	7.3	287	27.3
12/12/2017	Detection	- -	- -	22.8	0.22	7.8	- -	26.7
1/4/2018	Detection	0.040	- -	- -	- -	7.8	- -	- -
6/6/2018	Detection	0.066	47.0	25.1	0.26	8.1	279	25.3
8/16/2018	Detection	- -	- -	- -	- -	7.4	- -	- -
11/13/2018	Detection	0.07 J	39.9	23.7	0.25	7.6	248	25.3
5/23/2019	Detection	0.03 J	47.8	18.0	0.26	7.3	260	20.9

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-015I
Rockport - 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
6/7/2016	Background	0.01 J	25.2	118	<0.005 U	0.02 J	0.2	1.24	0.863	0.25	0.026	0.005	<0.002 U	5.76	<0.03 U	0.04 J
7/19/2016	Background	0.25	27.9	132	0.165	0.23	0.5	1.66	1.091	0.25	0.254	0.018	<0.002 U	6.74	0.2	0.273
9/21/2016	Background	0.01 J	21.1	119	<0.005 U	0.009 J	0.1	1.32	0.504	0.23	0.026	0.004	<0.002 U	5.75	<0.03 U	0.03 J
11/16/2016	Background	0.04 J	23.6	107	0.005 J	0.06	0.132	1.03	1.747	0.25	0.213	0.004	<0.002 U	6.73	<0.03 U	0.04 J
1/10/2017	Background	0.01 J	20.2	91.2	<0.005 U	0.005 J	0.350	1.00	0.869	0.34	0.01 J	0.011	<0.002 U	7.63	<0.03 U	0.04 J
3/7/2017	Background	0.02 J	20.4	88.9	<0.005 U	0.03	0.700	0.903	0.865	0.32	0.065	0.006	<0.002 U	7.91	0.07 J	0.112
5/10/2017	Background	0.02 J	20.2	86.1	<0.004 U	0.03	0.134	1.02	0.189	0.31	0.090	0.002	<0.002 U	6.52	0.04 J	0.03 J
7/18/2017	Background	0.02 J	23.6	94.8	<0.004 U	0.02	0.089	1.25	1.643	0.22	0.082	<0.0002 U	<0.002 U	5.58	<0.03 U	0.04 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-015S
Rockport - LF
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
6/7/2016	Background	0.011	46.9	21.2	0.65	7.2	338	30.3
7/19/2016	Background	0.012	43.6	18.7	0.65	7.1	319	27.7
9/21/2016	Background	0.008	46.6	18.9	0.63	7.2	329	25.1
11/16/2016	Background	<0.002 U	52.3	18.3	0.50	7.7	338	23.2
1/11/2017	Background	<0.002 U	63.6	21.9	0.36	7.2	374	28.3
3/7/2017	Background	0.084	62.9	16.1	0.42	7.2	342	23.4
5/10/2017	Background	0.077	45.7	14.1	0.65	7.3	294	21.0
7/19/2017	Background	0.073	44.4	11.8	0.66	7.3	263	20.3
10/4/2017	Detection	0.095	48.3	13.3	0.62	7.4	300	23.2
6/5/2018	Detection	0.078	44.7	8.84	0.69	7.2	274	16.3
11/13/2018	Detection	0.04 J	41.8	8.78	0.72	7.5	232	13.1
5/23/2019	Detection	<0.02 U	41.3	8.88	0.88	7.5	207	10.2
7/23/2019	Detection	- -	- -	- -	0.87	5.7	- -	- -
9/11/2019	Detection	- -	- -	- -	0.81	7.4	- -	- -

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-015S
Rockport - 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**
6/7/2016	Background	0.04 J	0.32	4.71	0.007 J	0.14	0.2	3.03	0.4175	0.65	0.286	0.007	<0.002 U	2.52	0.4	0.03 J
7/19/2016	Background	0.04 J	0.24	5.85	<0.005 U	0.25	1.7	1.17	0	0.65	0.101	0.022	0.002 J	2.89	0.7	<0.01 U
9/21/2016	Background	0.02 J	0.21	3.21	<0.005 U	0.05	0.5	1.09	0.418	0.63	0.098	0.005	<0.002 U	2.54	0.5	0.02 J
11/16/2016	Background	0.04 J	0.18	3.27	<0.005 U	0.05	0.058	0.794	1.249	0.50	0.037	0.005	<0.002 U	1.57	0.3	0.02 J
1/11/2017	Background	0.04 J	0.26	6.05	<0.005 U	0.06	0.493	1.75	0.189	0.36	0.039	0.008	<0.002 U	0.78	0.3	0.03 J
3/7/2017	Background	0.03 J	0.21	4.98	<0.005 U	0.04	0.934	1.26	0.0973	0.42	0.024	0.008	<0.002 U	1.17	0.5	0.04 J
5/10/2017	Background	0.04 J	0.21	3.54	0.005 J	0.05	0.198	1.20	0.241	0.65	0.062	0.003	<0.002 U	2.08	0.5	0.02 J
7/19/2017	Background	0.02 J	0.23	3.11	<0.004 U	0.05	0.096	1.25	0.0916	0.66	0.083	0.0009 J	<0.002 U	2.87	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-016D
Rockport - LF
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
6/9/2016	Background	0.033	84.3	68.7	0.20	6.8	350	36.4
7/19/2016	Background	0.013	68.7	69.6	0.22	7.3	321	37.4
9/20/2016	Background	0.012	70.5	67.6	0.22	7.3	342	33.4
11/17/2016	Background	0.014	77.9	63.6	0.17	7.3	356	33.2
1/11/2017	Background	0.004 J	72.4	67.9	0.21	7.5	343	34.0
3/8/2017	Background	0.023	79.2	65.4	0.22	7.4	347	35.3
5/10/2017	Background	0.102	75.8	69.9	0.22	7.5	367	37.2
7/18/2017	Background	0.017	71.7	69.6	0.17	9.0	363	36.8
10/4/2017	Detection	0.059	80.4	81.5	0.22	7.6	383	40.0
1/4/2018	Detection	- -	80.1	86.0	- -	7.7	- -	37.9
6/6/2018	Detection	0.033	90.2	108	0.22	7.3	434	38.6
8/16/2018	Detection	- -	83.8	99.7	- -	7.3	447	- -
11/14/2018	Detection	0.07 J	84.1	102	0.21	7.4	434	38.6
2/11/2019	Detection	- -	- -	109	- -	7.4	439	- -
4/1/2019	Detection	- -	- -	107	- -	7.3	429	- -
5/22/2019	Detection	0.03 J	88.5	104	0.20	7.3	460	38.0
7/24/2019	Detection	- -	95.6	106	- -	7.0	457	- -
9/11/2019	Detection	- -	109	125	- -	7.3	523	- -

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-016D
Rockport - 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**
6/9/2016	Background	0.02 J	0.48	240	<0.005 U	0.08	0.3	0.617	0.0514	0.20	0.078	0.001	<0.002 U	2.06	0.04 J	0.03 J
7/19/2016	Background	0.02 J	0.40	246	<0.005 U	0.08	0.4	0.547	0.294	0.22	0.040	0.013	<0.002 U	2.31	0.04 J	0.069
9/20/2016	Background	0.02 J	0.31	221	<0.005 U	0.02 J	0.1	0.418	1.348	0.22	0.021	0.003	<0.002 U	1.96	<0.03 U	0.02 J
11/17/2016	Background	0.02 J	0.32	217	<0.005 U	0.05	1.21	0.452	0.909	0.17	0.066	0.006	<0.002 U	1.98	<0.03 U	0.02 J
1/11/2017	Background	0.01 J	0.34	210	<0.005 U	0.02 J	0.112	0.354	1.716	0.21	0.008 J	0.013	<0.002 U	1.99	<0.03 U	0.02 J
3/8/2017	Background	0.02 J	0.31	224	<0.005 U	0.01 J	0.188	0.401	0.811	0.22	0.022	0.007	<0.002 U	2.27	0.05 J	0.04 J
5/10/2017	Background	0.03 J	0.33	212	<0.004 U	0.07	0.151	0.466	0.151	0.22	0.070	0.008	<0.002 U	1.90	<0.03 U	0.02 J
7/18/2017	Background	0.03 J	0.39	247	<0.004 U	0.10	0.141	0.571	0.514	0.17	0.103	0.0006 J	<0.002 U	2.03	<0.03 U	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-016I
Rockport - LF
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
6/9/2016	Background	0.031	110	80.4	0.1 J	7.7	539	38.7
7/20/2016	Background	0.027	93.9	86.8	0.15	7.6	532	42.2
9/21/2016	Background	0.026	95.9	90.2	0.1 J	7.4	544	36.8
11/17/2016	Background	0.024	96.2	59.1	0.1 J	7.1	508	33.0
1/11/2017	Background	0.015	89.3	44.1	0.1 J	7.4	481	34.0
3/8/2017	Background	0.100	101	39.3	0.16	7.3	460	35.4
5/19/2017	Background	0.032	86.7	39.4	0.15	7.0	455	35.4
7/18/2017	Background	0.044	91.3	50.2	0.08 J	7.2	465	36.1
10/4/2017	Detection	0.050	84.0	70.8	0.1 J	7.5	495	40.4
1/4/2018	Detection	- -	71.9	71.2	- -	7.7	487	- -
6/6/2018	Detection	0.046	82.9	58.6	0.17	7.4	480	38.7
8/16/2018	Detection	- -	61.6	61.1	- -	7.2	456	- -
11/14/2018	Detection	0.139	53.7	47.8	0.17	7.3	408	32.5
2/11/2019	Detection	0.02 J	- -	- -	- -	7.4	- -	- -
5/22/2019	Detection	0.03 J	56.0	45.5	0.17	7.4	405	33.2

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-016I
Rockport - 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**
6/9/2016	Background	0.02 J	0.71	267	<0.005 U	0.06	0.1	0.602	0.592	0.1 J	0.023	0.005	<0.002 U	1.02	0.2	0.085
7/20/2016	Background	0.01 J	0.75	267	<0.005 U	0.03	0.2	0.627	1.576	0.15	0.025	0.005	<0.002 U	1.02	0.2	0.060
9/21/2016	Background	0.01 J	0.75	262	<0.005 U	0.03	0.1	0.576	1.225	0.1 J	0.023	0.006	<0.002 U	1.03	0.1	0.074
11/17/2016	Background	0.05	0.67	234	<0.005 U	0.05	0.082	0.546	0.587	0.1 J	0.053	0.013	<0.002 U	0.93	0.2	0.069
1/11/2017	Background	0.01 J	0.72	220	<0.005 U	0.04	0.085	0.514	2.632	0.1 J	0.01 J	0.010	<0.002 U	1.00	0.1	0.071
3/8/2017	Background	0.02 J	0.68	221	<0.005 U	0.03	0.422	0.580	0.581	0.16	0.034	0.013	<0.002 U	1.17	0.2	0.075
5/19/2017	Background	0.06	0.70	206	<0.004 U	0.08	0.204	0.707	0.938	0.15	0.153	0.010	<0.002 U	0.91	0.4	0.075
7/18/2017	Background	0.02 J	0.73	238	<0.004 U	0.03	0.118	0.599	0.787	0.08 J	0.065	0.003	<0.002 U	1.07	0.2	0.070

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-016S
Rockport - LF
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
6/9/2016	Background	0.028	96.2	18.7	0.44	7.5	483	46.9
7/20/2016	Background	0.025	83.0	19.0	0.46	7.1	471	50.1
9/21/2016	Background	0.024	93.5	17.1	0.38	7.3	509	42.1
11/17/2016	Background	0.025	96.4	16.4	0.30	6.9	486	38.3
1/11/2017	Background	0.017	94.6	17.5	0.35	7.2	474	39.2
3/8/2017	Background	0.038	106	19.3	0.36	7.1	473	39.6
5/10/2017	Background	0.082	105	22.9	0.38	8.3	499	42.3
7/19/2017	Background	0.037	91.8	19.8	0.33	6.3	484	40.7
10/4/2017	Detection	0.061	108	19.3	0.41	7.3	503	45.0
1/4/2018	Detection	- -	109	- -	- -	7.3	517	- -
6/6/2018	Detection	0.109	108	17.3	0.42	7.2	520	40.8
8/16/2018	Detection	0.034	109	- -	- -	7.1	533	- -
11/14/2018	Detection	0.107	104	16.2	0.39	7.0	548	40.3
2/11/2019	Detection	0.02 J	- -	- -	- -	7.1	517	- -
5/22/2019	Detection	0.03 J	99.2	18.0	0.38	7.1	493	34.5

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-016S
Rockport - 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**
6/9/2016	Background	0.03 J	0.37	32.3	<0.005 U	0.03	0.2	0.073	0.163	0.44	0.074	0.007	<0.002 U	1.15	0.6	0.01 J
7/20/2016	Background	0.03 J	0.37	29.9	<0.005 U	0.03	0.5	0.025	1.047	0.46	0.057	0.031	<0.002 U	1.21	0.6	<0.01 U
9/21/2016	Background	0.25	0.38	29.5	<0.005 U	0.10	0.3	0.070	0.0255	0.38	0.182	0.005	<0.002 U	1.11	0.8	<0.01 U
11/17/2016	Background	0.02 J	0.34	25.3	<0.005 U	0.006 J	1.03	0.028	0.2943	0.30	<0.004 U	0.018	<0.002 U	1.19	0.4	<0.01 U
1/11/2017	Background	0.02 J	0.42	25.1	<0.005 U	0.008 J	0.081	0.014	1.993	0.35	0.039	0.013	<0.002 U	1.21	0.4	0.02 J
3/8/2017	Background	0.02 J	0.31	25.7	<0.005 U	0.004 J	0.463	0.012	0.282	0.36	0.006 J	0.013	<0.002 U	1.32	0.4	0.02 J
5/10/2017	Background	0.02 J	0.39	29.8	<0.004 U	0.01 J	0.196	0.063	0.145	0.38	0.027	0.008	<0.002 U	1.14	0.3	0.01 J
7/19/2017	Background	0.02 J	0.33	25.6	<0.004 U	0.04	0.101	0.01 J	2.8533	0.33	0.01 J	0.01	<0.002 U	0.98	0.4	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-17I
Rockport - LF
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
6/8/2016	Background	0.058	73.7	195	0.57	7.6	609	43.1
7/20/2016	Background	0.056	83.1	209	0.56	7.2	569	49.3
9/20/2016	Background	0.051	88.9	214	0.52	7.1	620	48.1
11/16/2016	Background	0.041	80.0	164	0.56	7.8	540	44.1
1/10/2017	Background	0.034	72.3	159	0.56	7.5	513	43.2
3/7/2017	Background	0.079	81.4	158	0.58	7.5	549	44.9
5/9/2017	Background	0.083	69.6	151	0.61	7.2	528	43.5
7/19/2017	Background	0.052	64.4	145	0.63	7.3	509	44.7
10/4/2017	Detection	0.061	63.0	115	0.66	7.4	486	46.6
12/13/2017	Detection	- -	- -	86.0	0.76	7.5	- -	44.8
1/4/2018	Detection	- -	- -	110	0.65	7.8	471	- -
6/5/2018	Detection	0.081	51.2	80.2	0.87	7.4	418	41.0
8/16/2018	Detection	- -	- -	61.1	0.98	7.5	376	- -
9/26/2018	Detection	- -	- -	- -	1.03	- -	- -	- -
11/13/2018	Detection	0.07 J	36.5	50.1	1.00	7.6	328	29.6
2/11/2019	Detection	- -	- -	- -	1.05	7.7	- -	- -
4/1/2019	Detection	- -	- -	- -	1.08	7.6	- -	- -
5/23/2019	Detection	0.04 J	45.1	60.2	1.07	7.5	352	32.8
7/23/2019	Detection	- -	- -	- -	1.06	6.7	- -	- -
9/11/2019	Detection	- -	- -	- -	1.08	7.6	- -	- -

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-17I
Rockport - 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
6/8/2016	Background	0.07	7.14	168	0.020	0.12	0.6	1.24	1.925	0.57	1.19	<0.0002 U	0.003 J	3.60	0.1	0.03 J
7/20/2016	Background	0.05 J	7.41	190	0.006 J	0.13	2.1	0.778	1.167	0.56	0.284	0.004	<0.002 U	3.66	0.05 J	0.02 J
9/20/2016	Background	0.04 J	6.45	198	<0.005 U	0.04	0.1	0.472	1.587	0.52	0.133	0.005	<0.002 U	3.08	0.05 J	0.02 J
11/16/2016	Background	0.03 J	3.38	149	<0.005 U	0.04	0.059	0.370	0.762	0.56	0.049	0.006	<0.002 U	3.37	<0.03 U	0.056
1/10/2017	Background	0.02 J	3.94	148	<0.005 U	0.008 J	0.254	0.391	1.51	0.56	0.02 J	0.009	<0.002 U	3.20	<0.03 U	0.02 J
3/7/2017	Background	0.02 J	4.61	159	<0.005 U	0.007 J	0.776	0.406	1.023	0.58	0.026	0.008	<0.002 U	3.62	0.05 J	0.02 J
5/9/2017	Background	0.02 J	3.61	133	<0.004 U	0.03	0.196	0.394	1.007	0.61	0.115	0.005	<0.002 U	3.26	0.03 J	0.01 J
7/19/2017	Background	0.02 J	3.76	140	<0.004 U	0.02 J	0.127	0.372	0.8141	0.63	0.02 J	<0.0002 U	<0.002 U	3.42	<0.03 U	0.05 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-17S
Rockport - LF
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
6/8/2016	Background	0.015	36.9	13.9	0.85	7.8	272	14.3
7/20/2016	Background	0.016	34.8	15.4	0.86	7.3	235	14.8
9/20/2016	Background	0.016	34.8	12.3	0.73	7.7	233	10.9
11/16/2016	Background	0.017	35.9	11.4	0.70	7.7	232	10.5
1/10/2017	Background	0.006	32.3	11.0	0.48	7.6	262	10.7
3/7/2017	Background	0.058	40.0	10.7	0.46	7.5	251	12.0
5/9/2017	Background	0.041	35.5	10.4	0.58	7.3	250	13.1
7/19/2017	Background	0.020	34.4	10.8	0.82	7.5	201	10.2
10/4/2017	Detection	0.033	34.1	10.5	0.89	7.4	214	10.7
6/5/2018	Detection	0.045	32.4	10.8	0.98	7.4	214	9.5
11/13/2018	Detection	0.05 J	33.1	11.5	0.91	7.5	196	8.4
5/23/2019	Detection	0.03 J	32.7	12.0	1.08	7.6	217	7.7

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-17S
Rockport - 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**
6/8/2016	Background	0.01 J	0.24	2.12	<0.005 U	0.02	0.5	0.047	1.036	0.85	0.024	<0.0002 U	<0.002 U	3.98	0.07 J	0.01 J
7/20/2016	Background	0.03 J	0.26	2.74	<0.005 U	0.08	0.2	0.105	0.0439	0.86	0.098	0.020	0.002 J	4.20	0.06 J	0.01 J
9/20/2016	Background	0.02 J	0.22	2.24	<0.005 U	0.01 J	0.1	0.034	0.0759	0.73	0.025	0.003	<0.002 U	4.08	0.08 J	0.01 J
11/16/2016	Background	0.03 J	0.20	2.40	<0.005 U	0.02	0.066	0.029	1.594	0.70	0.020	0.004	<0.002 U	3.39	0.1	0.053
1/10/2017	Background	0.03 J	0.21	3.45	<0.005 U	0.02 J	0.489	0.04	0.17	0.48	0.02 J	0.003	<0.002 U	0.44	0.2	0.02 J
3/7/2017	Background	0.04 J	0.20	3.94	<0.005 U	0.09	0.776	0.076	0.47	0.46	0.079	0.008	0.002 J	0.70	0.1	0.02 J
5/9/2017	Background	0.04 J	0.22	4.37	<0.004 U	0.02 J	0.233	0.138	0.433	0.58	0.108	0.003	<0.002 U	1.14	0.1	<0.01 U
7/19/2017	Background	0.02 J	0.22	2.25	<0.004 U	0.06	0.124	0.053	1.748	0.82	0.038	<0.0002 U	<0.002 U	4.38	0.08 J	0.03 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-021D
Rockport - LF
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
6/9/2016	Background	0.022	74.2	19.2	0.36	8.1	328	39.2
7/19/2016	Background	0.015	60.6	19.6	0.38	7.8	299	41.0
9/21/2016	Background	0.015	70.4	18.9	0.36	7.7	315	35.5
11/16/2016	Background	0.013	74.7	19.1	0.33	7.5	346	32.0
1/11/2017	Background	0.004 J	67.3	19.4	0.36	7.2	332	34.4
3/8/2017	Background	0.024	76.2	18.9	0.33	7.6	304	35.1
5/9/2017	Background	0.062	71.5	19.9	0.35	7.4	339	37.1
7/19/2017	Background	0.015	70.9	19.5	0.30	8.5	332	36.5
10/4/2017	Detection	0.092	67.8	18.5	0.32	7.5	339	37.4
1/11/2018	Detection	0.088	- -	- -	- -	7.0	- -	- -
6/6/2018	Detection	0.030	70.7	19.9	0.40	7.7	347	38.4
11/13/2018	Detection	0.04 J	62.1	18.8	0.34	7.7	314	35.2
5/22/2019	Detection	<0.02 U	69.3	19.1	0.36	7.5	348	36.8

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-021D
Rockport - LF
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
6/9/2016	Background	0.08	1.07	241	<0.005 U	0.02	0.2	0.216	0.567	0.107	0.002	<0.002 U	6.31	0.2	0.03 J
7/19/2016	Background	0.08	1.06	240	<0.005 U	0.03	0.3	0.210	1.428	0.075	0.025	<0.002 U	6.66	0.2	0.02 J
9/21/2016	Background	0.06	0.95	226	<0.005 U	0.02 J	0.1	0.195	0.834	0.066	0.005	<0.002 U	6.13	0.3	0.03 J
11/16/2016	Background	0.06	0.86	206	<0.005 U	0.03	0.05 J	0.171	1.078	0.056	0.007	<0.002 U	5.33	0.3	0.02 J
1/11/2017	Background	0.07	0.99	220	0.01 J	0.02	0.124	0.202	1.144	0.091	0.009	<0.002 U	6.09	0.2	0.04 J
3/8/2017	Background	0.07	0.92	220	<0.005 U	0.02	0.433	0.182	0.938	0.092	0.005	<0.002 U	5.68	0.5	0.02 J
5/9/2017	Background	0.08	0.97	216	<0.004 U	0.04	0.165	0.208	0.4495	0.118	0.013	<0.002 U	5.07	0.6	0.02 J
7/19/2017	Background	0.12	1.04	226	<0.004 U	0.02	0.110	0.203	0.856	0.089	0.0005 J	<0.002 U	5.29	0.5	0.03 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-021I
Rockport - LF
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
6/9/2016	Background	0.007	69.0	21.1	0.33	8.0	331	46.2
7/19/2016	Background	0.012	64.7	21.7	0.36	7.6	334	47.9
9/21/2016	Background	0.011	65.1	20.4	0.34	7.6	305	43.2
11/16/2016	Background	0.012	68.4	20.0	0.34	7.3	317	40.4
1/11/2017	Background	<0.002 U	59.5	19.9	0.30	7.4	292	41.0
3/8/2017	Background	0.028	66.5	19.6	0.32	7.5	275	39.6
5/9/2017	Background	0.027	62.9	21.0	0.34	8.6	306	42.4
7/19/2017	Background	0.080	60.1	20.4	0.30	7.4	322	43.6
10/4/2017	Detection	0.029	63.9	20.5	0.31	7.4	306	45.7
6/6/2018	Detection	0.034	66.5	20.6	0.38	7.5	317	44.6
11/13/2018	Detection	0.08 J	61.5	20.2	0.36	7.7	294	43.4
5/21/2019	Detection	<0.02 U	62.4	18.1	0.36	7.3	278	36.0

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-021I
Rockport - 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**
6/9/2016	Background	0.02 J	1.55	127	<0.005 U	0.02	0.1	0.514	0.349	0.33	0.02 J	<0.0002 U	<0.002 U	4.92	<0.03 U	0.03 J
7/19/2016	Background	0.02 J	1.67	136	<0.005 U	0.02	0.2	0.558	1.406	0.36	0.021	0.019	<0.002 U	5.25	0.05 J	0.03 J
9/21/2016	Background	0.02 J	1.55	121	<0.005 U	0.02	0.1	0.422	0.981	0.34	0.046	0.004	<0.002 U	4.46	0.03 J	0.02 J
11/16/2016	Background	0.02 J	1.41	126	<0.005 U	0.04	0.386	0.524	0.6556	0.34	0.035	0.006	<0.002 U	4.40	0.09 J	0.02 J
1/11/2017	Background	0.02 J	1.39	126	0.01 J	0.02 J	1.04	0.437	2.733	0.30	<0.004 U	0.005	<0.002 U	4.63	0.07 J	0.04 J
3/8/2017	Background	0.03 J	1.08	123	<0.005 U	0.01 J	0.349	0.437	0.882	0.32	0.01 J	0.007	<0.002 U	4.31	0.07 J	0.02 J
5/9/2017	Background	0.05	1.19	116	<0.004 U	0.01 J	0.125	0.412	0.591	0.34	0.022	0.008	<0.002 U	4.06	0.05 J	0.03 J
7/19/2017	Background	0.03 J	1.38	123	<0.004 U	0.01 J	0.143	0.517	1.225	0.3	0.033	0.004	<0.002 U	4.18	0.05 J	0.03 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-021S
Rockport - LF
Appendix III Constituents

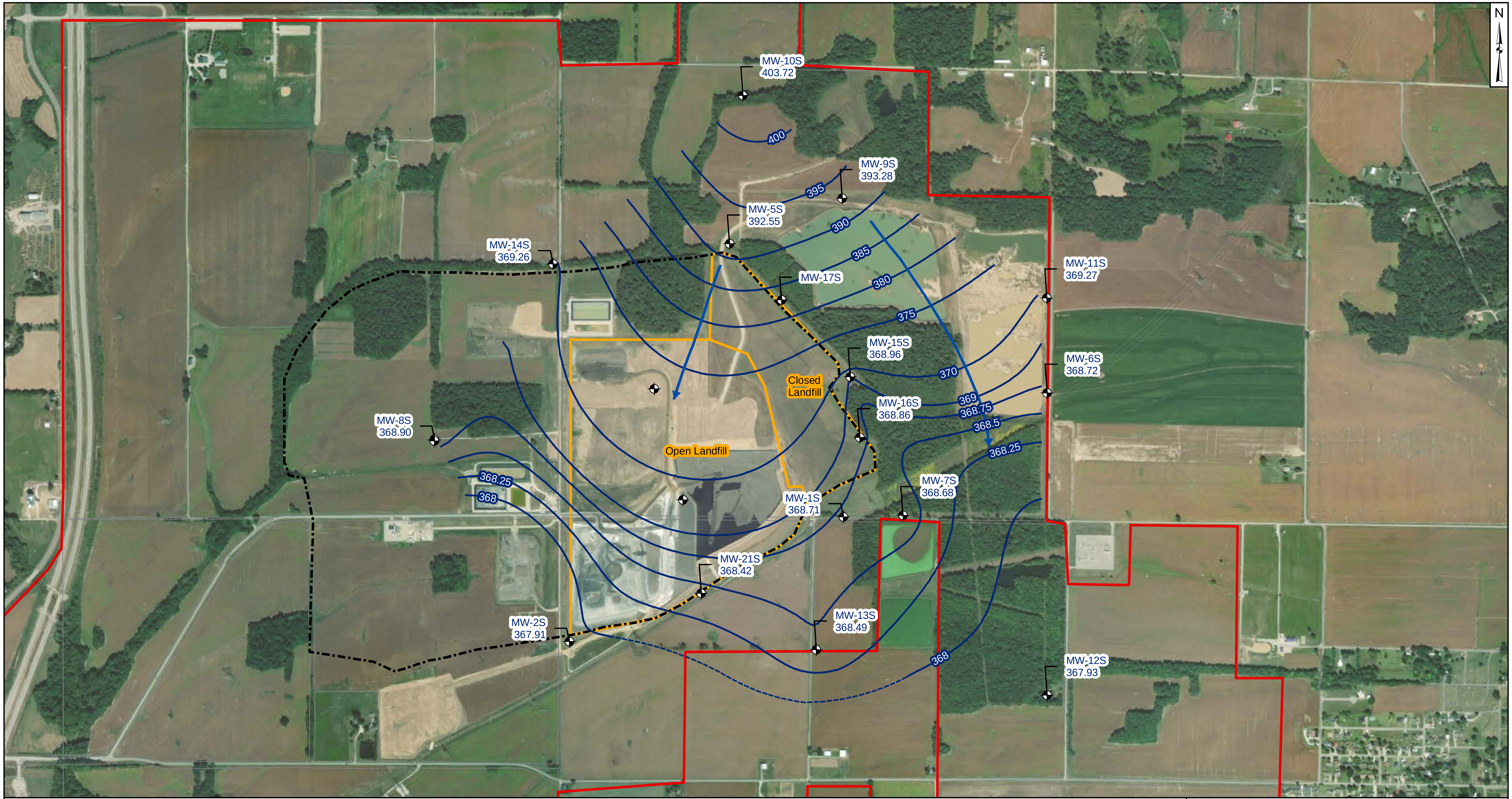
Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
6/9/2016	Background	0.002 J	55.1	15.0	0.61	6.6	275	21.2
7/19/2016	Background	0.011	52.8	15.1	0.64	7.5	292	21.2
9/21/2016	Background	0.007	52.0	14.7	0.62	7.6	285	17.4
11/16/2016	Background	0.015	60.0	14.7	0.63	7.5	294	14.9
1/11/2017	Background	0.002 J	54.4	14.4	0.54	7.3	287	15.9
3/8/2017	Background	0.018	59.0	14.8	0.58	7.6	298	16.5
5/9/2017	Background	0.033	56.0	15.7	0.60	8.9	296	17.6
7/19/2017	Background	0.034	55.9	15.9	0.54	7.2	304	18.8
10/4/2017	Detection	0.027	59.8	17.7	0.60	7.5	300	20.1
12/12/2017	Detection	- -	- -	18.0	0.60	8.0	- -	21.1
6/6/2018	Detection	0.039	52.8	17.5	0.66	7.8	283	18.7
11/14/2018	Detection	0.06 J	55.0	17.9	0.66	7.3	278	17.0
2/11/2019	Detection	<0.02 U	- -	17.9	- -	7.7	- -	- -
4/1/2019	Detection	- -	- -	17.5	- -	7.8	- -	- -
5/21/2019	Detection	<0.02 U	52.5	16.0	0.65	7.6	258	14.1

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-021S
Rockport - 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
6/9/2016	Background	0.03 J	0.53	18.5	<0.005 U	0.02	0.4	0.104	0.1599	0.61	0.095	0.003	<0.002 U	1.78	0.7	0.01 J
7/19/2016	Background	0.02 J	0.47	19.6	<0.005 U	0.02 J	0.7	0.033	0.5728	0.64	0.042	0.013	<0.002 U	1.85	0.5	0.01 J
9/21/2016	Background	0.02 J	0.46	19.4	<0.005 U	0.006 J	0.3	0.030	0.452	0.62	0.025	0.003	<0.002 U	1.74	0.2	<0.01 U
11/16/2016	Background	0.02 J	0.43	19.1	<0.005 U	0.02	0.292	0.023	0.484	0.63	0.023	0.009	<0.002 U	1.63	0.2	<0.01 U
1/11/2017	Background	0.03 J	0.47	19.3	0.006 J	0.01 J	0.401	0.022	2.067	0.54	0.024	0.007	<0.002 U	1.74	0.1	0.058
3/8/2017	Background	0.03 J	0.49	21.9	<0.005 U	0.01 J	0.536	0.053	0.0305	0.58	0.095	0.002	<0.002 U	2.00	0.1	<0.01 U
5/9/2017	Background	0.04 J	0.47	17.7	<0.004 U	0.01 J	0.300	0.027	0.2351	0.60	0.023	0.005	<0.002 U	1.62	0.1	<0.01 U
7/19/2017	Background	0.05 J	0.42	21.9	<0.004 U	0.01 J	0.272	0.006 J	1.098	0.54	0.024	<0.0002 U	<0.002 U	2.31	0.2	<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



Legend

⊕	Groundwater Monitoring Well
→	Approximate Groundwater Flow Direction
—	Groundwater Elevation Contour
- - -	Groundwater Elevation Contour (Inferred)
🟥	Property Boundary
☐	Parcel Boundaries
▭	1984 Landfill Permit Boundary (Area 1)
🟧	Landfill Area 1A (Active and Closed)

Notes
- Monitoring well coordinates and water level data (collected on November 12, 2018) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (AMEC, 2016) provided by AEP.
- Property and parcel boundaries taken from Spencer County Assessor.
- The water level from the shallowest screen interval in each well cluster was used in groundwater contouring.
- Groundwater elevation units are feet above mean sea level.
- MW-17S was not used in contouring due to unusual/anomalous reading (groundwater elevation of 368.74 feet).

1,000 500 0 1,000
Feet

Potentiometric Surface Contours - Uppermost Aquifer
November 2018

AEP-Rockport Power Plant - CCR Landfill
Rockport, Indiana

Geosyntec
consultants

Figure
3

Columbus, Ohio
2019/01/23

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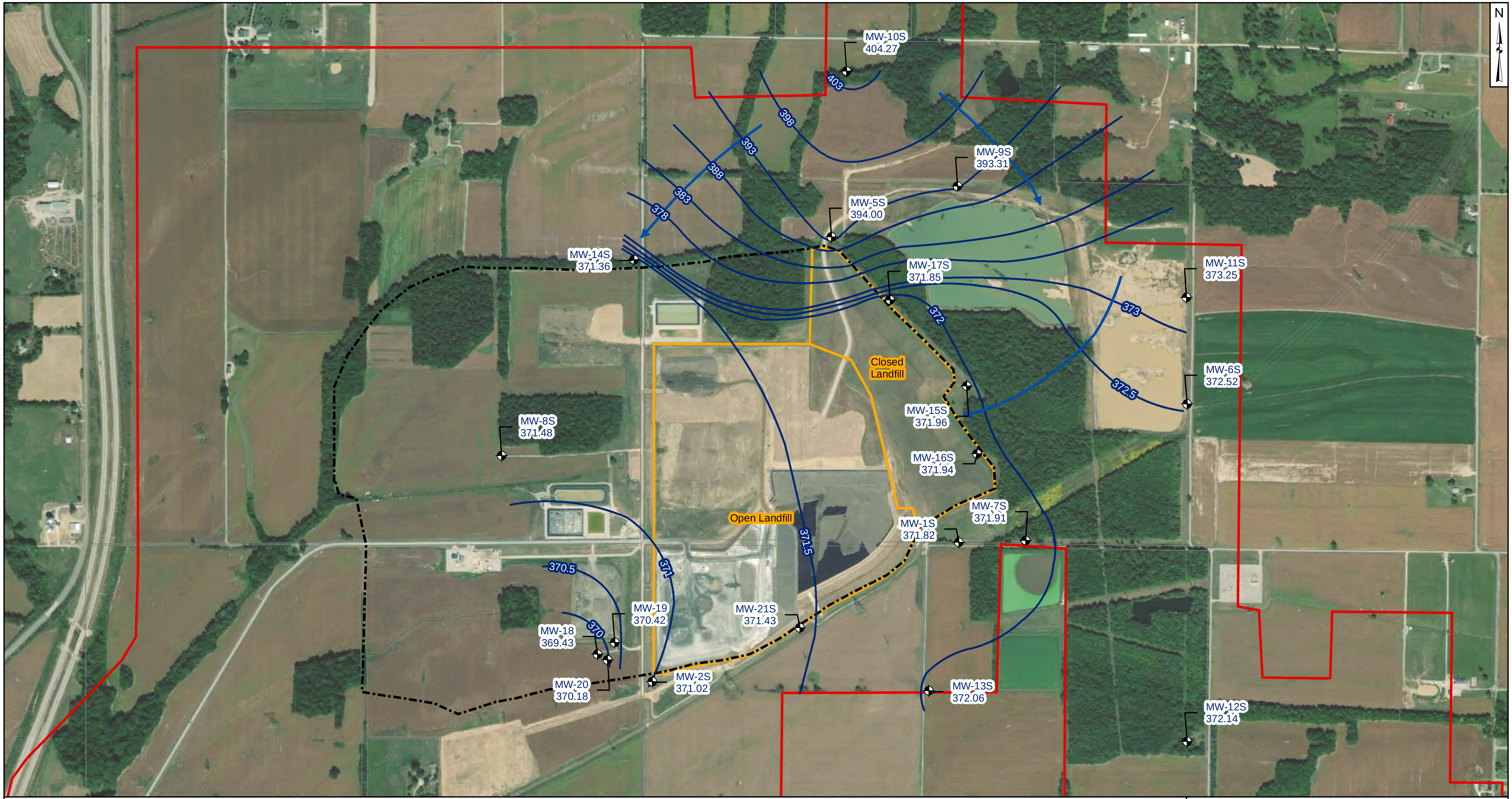

Legend

⊕ Groundwater Monitoring Well
→ Approximate Groundwater Flow Direction
— Groundwater Elevation Contour
--- Groundwater Elevation Contour (Inferred)
⬚ 1984 Landfill Permit Boundary (Area 1)
🟥 Property Boundary
🟧 Landfill Area 1A (Active and Closed)

Notes
- Monitoring well coordinates and water level data (collected on May 20, 2019) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (AMEC, 2016) provided by AEP.
- Property and parcel boundaries taken from Spencer County Assessor.
- The water level from the shallowest screen interval in each well cluster was used in groundwater contouring.
- Groundwater elevation units are feet above mean sea level.

1,000 500 0 1,000
Feet

Potentiometric Surface Contours - Uppermost Aquifer
May 2019

AEP-Rockport Power Plant - CCR Landfill
Rockport, Indiana

Geosyntec
consultants

Figure
X

Columbus, Ohio
2020/01/07

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Table 2: Residence Time Calculation Summary
Rockport - Landfill

			2018-06		2018-08		2018-11	
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)
Landfill	MW-11S [1]	2.0	5,799	0.010	5,419	0.011	5,125	0.012
	MW-14S [1]	2.0	10,043	0.006	9,336	0.007	9,942	0.006
	MW-15I [2]	2.0	9,193	0.007	2,097	0.029	528	0.12
	MW-15S [2]	2.0	9,211	0.007	1,873	0.032	426	0.14
	MW-16D [2]	2.0	689	0.088	1,432	0.042	901	0.068
	MW-16I [2]	2.0	844	0.072	661	0.092	225	0.270
	MW-16S [2]	2.0	844	0.072	1,322	0.046	826	0.074
	MW-17I [2]	2.0	23,838	0.003	17,221	0.004	NC	NC
	MW-17S [2]	2.0	23,793	0.003	18,011	0.003	NC	NC
	MW-1D [2]	2.0	516	0.12	54	1.12	151	0.402
	MW-1I [2]	2.0	715	0.085	63	0.96	76	0.80
	MW-1S [2]	2.0	669	0.091	91	0.67	303	0.20
	MW-21D [2]	2.0	502	0.12	124	0.49	303	0.20
	MW-21I [2]	2.0	670	0.091	124	0.49	326	0.19
	MW-21S [2]	2.0	550	0.11	113	0.54	396	0.15
	MW-2D [2]	2.0	89	0.68	199	0.31	241	0.25
	MW-2I [2]	2.0	84	0.73	180	0.34	80	0.76
	MW-2S [2]	2.0	33	1.82	199	0.31	241	0.25
	MW-6S [1]	2.0	99	0.62	371	0.16	207	0.29
	MW-8I [1]	2.0	82	0.74	202	0.30	6,214	0.010
	MW-8S [1]	2.0	224	0.27	806	0.075	961	0.063

Notes:
[1] - Upgradient Well
[2] - Downgradient Well
NC - No groundwater residence time calculated due to an anomalous water level reading

Table 1: Residence Time Calculation Summary
Rockport - Landfill

CCR Management Unit	Monitoring Well	Well Diameter (inches)	2019-05 Groundwater Velocity (ft/year)	2019-05 Groundwater Residence Time (days)
Landfill	MW-11S [1]	2.0	514	0.12
	MW-14S [1]	2.0	8,562	0.007
	MW-15I [2]	2.0	89	0.69
	MW-15S [2]	2.0	354	0.17
	MW-16D [2]	2.0	120	0.51
	MW-16I [2]	2.0	419	0.15
	MW-16S [2]	2.0	180	0.34
	MW-17I [2]	2.0	11,847	0.005
	MW-17S [2]	2.0	12,205	0.005
	MW-1D [2]	2.0	125	0.49
	MW-1I [2]	2.0	110	0.55
	MW-1S [2]	2.0	141	0.43
	MW-21D [2]	2.0	444	0.14
	MW-21I [2]	2.0	400	0.15
	MW-21S [2]	2.0	311	0.20
	MW-2D [2]	2.0	229	0.27
	MW-2I [2]	2.0	154	0.39
	MW-2S [2]	2.0	224	0.27
	MW-6S [1]	2.0	182	0.33
	MW-8I [1]	2.0	526	0.12
	MW-8S [1]	2.0	665	0.092

Notes:
[1] - Upgradient Well
[2] - Downgradient Well

APPENDIX 2

ROCKPORT PLANT CCR LANDFILL

ANNUAL GROUNDWATER MONITORING REPORT COVERING 2019 ACTIVITIES

STATISTICAL ANALYSES OF THE NOVEMBER 2018 SAMPLING EVENT

Geosyntec
consultants

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Memorandum

Date:	May 1, 2019
To:	David Miller (AEP)
Copies to:	Dana Sheets (AEP)
From:	Allison Kreinberg and Bruce Sass, Ph.D. (Geosyntec)
Subject:	Evaluation of Detection Monitoring Data at Rockport Plant's Landfill (LF)

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"), semiannual detection monitoring events were completed at the Landfill (LF), an existing CCR unit at the Rockport Power Plant located in Rockport, Indiana. Sampling for the second semi-annual detection monitoring event occurred on November 14, 2018, February 11-13, 2019, and April 1, 2019.

Eight background monitoring events were conducted at the Rockport LF prior to this detection monitoring event, 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 January 7, 2019 which resulted in a revision to the calculated prediction limits for calcium, chloride, and total dissolved solids (TDS).

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 intrawell analysis with a one-of-three retesting procedure for all Appendix III parameters. With this procedure, a statistically significant increase (SSI) is only concluded if all three samples exceed the UPL. In practice, if the initial result did not exceed the UPL, a second sample was not collected or analyzed.

Detection monitoring results and the relevant background values for the second semiannual detection monitoring event are compared in Table 1 and noted exceedances are described in the list below.

- Chloride concentrations exceeded the intrawell UPL of 33.0 mg/L in the initial (38.1 mg/L), second (40.4 mg/L), and third (38.5 mg/L) samples collected at MW-001S; the intrawell UPL of 27.4 mg/L in the initial (28.8 mg/L), second (30.1 mg/L), and third (34.1 mg/L) samples collected at MW-001I; the intrawell UPL of 24.3 mg/L in the initial (24.8 mg/L), second (26.4 mg/L), and third (26.1 mg/L) samples collected at MW-002S; the intrawell UPL of 25.0 mg/L in the initial (51.3 mg/L), second (40.9 mg/L), and third (69.4 mg/L) samples collected at MW-002D; the intrawell UPL of 73.3 mg/L in the initial (102 mg/L), second (109 mg/L), and third (107 mg/L) samples collected at MW-016D; and the intrawell UPL of 16.3 mg/L in the initial (17.9 mg/L), second (17.9 mg/L), and third (17.5 mg/L) samples collected at MW-021S. Therefore, SSIs over background are concluded for chloride at MW-001S, MW-001I, MW-002S, MW-002D, MW-016D, and MW-021S.

- Fluoride concentrations exceeded the intrawell UPL of 0.656 mg/L in the initial (1.00 mg/L), second (1.05 mg/L), and third (1.08 mg/L) samples collected at MW-17I, Therefore, an SSI over background is concluded for fluoride at MW-17I.

- TDS concentrations exceeded the intrawell UPL of 384 mg/L in the initial (434 mg/L), second (439 mg/L), and third (429 mg/L) samples collected at MW-016D. Therefore, an SSI over background is concluded for TDS at MW-016D.

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 Rockport LF caused the increases will be completed in accordance with 40 CFR 257.94(e)(2). If the ASD is successful, the Rockport 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
Rockport Plant - Landfill

Parameter	Units	Description	MW-001S			MW-001I			MW-001D		MW-002S			MW-002I		MW-002D			MW-015S	MW-015I
			11/14/2018	2/13/2019	4/1/2019	11/14/2018	2/13/2019	4/1/2019	11/14/2018	2/13/2019	11/13/2018	2/13/2019	4/1/2019	11/13/2018	2/13/2019	11/12/2018	2/13/2019	4/1/2019	11/13/2018	11/13/2018
Boron	mg/L	Intrawell Background Value (UPL)	0.048			0.093			0.066		0.109			0.0428		0.074			0.150	0.072
		Detection Monitoring Result	0.04	–	–	0.05	–	–	**0.1**	0.02	0.06	–	–	**0.05**	0.02	0.07	–	–	0.04	0.07
Calcium	mg/L	Intrawell Background Value (UPL)	78.7			70.7			74.7		66.3			78.4		80.9			70.6	54.0
		Detection Monitoring Result	71.9	–	–	66	–	–	72	–	55	–	–	65	–	72	–	–	42	40
Chloride	mg/L	Intrawell Background Value (UPL)	33.0			27.4			50.2		24.3			31.7		25.1			26.0	69.5
		Detection Monitoring Result	**38.1**	**40.4**	**38.5**	**28.8**	**30.1**	**34.1**	47	–	**24.8**	**26.5**	**26.1**	27.9	–	**51.3**	**40.9**	**69.4**	8.78	23.7
Fluoride	mg/L	Intrawell Background Value (UPL)	0.677			0.428			0.321		0.299			0.371		0.222			0.860	0.382
		Detection Monitoring Result	0.63	–	–	0.41	–	–	0.30	–	0.28	–	–	0.32	–	0.20	–	–	0.72	0.25
pH	SU	Intrawell Background Value (UPL)	8.14			7.90			8.16		8.44			8.69		8.63			7.70	7.86
		Intrawell Background Value (LPL)	7.09			6.43			6.74		6.30			6.43		6.45			7.10	6.77
		Detection Monitoring Result	7.48	–	–	7.75	–	–	7.77	–	7.53	–	–	7.20	–	7.36	–	–	7.46	7.60
Sulfate	mg/L	Intrawell Background Value (UPL)	37.0			47.8			45.1		35.1			48.5		46.4			33.7	47.4
		Detection Monitoring Result	32.3	–	–	40.7	–	–	39.8	–	24.7	–	–	39	–	36.1	–	–	13.1	25.3
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	419			348.5			369.3		343			375		358			407	398
		Detection Monitoring Result	410	–	–	308	–	–	340	–	272	–	–	308	–	348	–	–	232	248

Parameter	Units	Description	MW-016S		MW-016I		MW-016D			MW-17S	MW-17I			MW-021S			MW-021I	MW-021D
			11/14/2018	2/11/2019	11/14/2018	2/11/2019	11/14/2018	2/11/2019	4/1/2019	11/13/2018	11/13/2018	2/11/2019	4/1/2019	11/14/2018	2/11/2019	4/1/2019	11/13/2018	11/13/2018
Boron	mg/L	Intrawell Background Value (UPL)	0.088		0.107		0.113			0.0653	0.0981			0.0460			0.092	0.071
		Detection Monitoring Result	**0.107**	0.02	**0.139**	0.02	0.07	–	–	0.05	0.07	–	–	**0.06**	0.02	–	0.08	0.04
Calcium	mg/L	Intrawell Background Value (UPL)	114		114		87.8			41.0	96.3			62.4			73.1	82.9
		Detection Monitoring Result	104	–	54	–	84.1	–	–	33	37	–	–	55	–	–	62	62
Chloride	mg/L	Intrawell Background Value (UPL)	23.8		114		73.3			16.4	241			16.3			22.2	20.2
		Detection Monitoring Result	16.2	–	48	–	**102**	**109**	**107**	11.5	50	–	–	**17.9**	**17.9**	**17.5**	20.2	18.8
Fluoride	mg/L	Intrawell Background Value (UPL)	0.506		0.192		0.251			1.08	0.656			0.689			0.380	0.407
		Detection Monitoring Result	0.39	–	0.17	–	0.21	–	–	0.91	**1.00**	**1.05**	**1.08**	0.66	–	–	0.36	0.34
pH	SU	Intrawell Background Value (UPL)	8.55		7.90		9.13			7.97	7.96			9.07			8.69	8.73
		Intrawell Background Value (LPL)	5.88		6.73		6.04			7.11	6.82			5.99			6.63	6.71
		Detection Monitoring Result	7.02	–	7.30	–	7.35	–	–	7.51	7.55	–	–	7.34	–	–	7.69	7.66
Sulfate	mg/L	Intrawell Background Value (UPL)	52		43.51		39.7			16.5	50.8			23.6			50	43
		Detection Monitoring Result	40.3	–	32.5	–	38.6	–	–	8.4	29.6	–	–	17.0	–	–	43.4	35.2
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	517		589		384			269	657			313			359	365
		Detection Monitoring Result	**548**	517	408	–	**434**	**439**	**429**	196	328	–	–	278	–	–	294	314

Notes

UPL Upper prediction limit

LPL Lower prediction limit

Bold values exceed the background value.

Background values are shaded gray

A 1-of-3 sampling regime was used for all parameters

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 Rockport 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

DAVID ANTHONY MILLER
No. 11700730

11700730
License Number

INDIANA
Licensing State

05.15.19
Date

APPENDIX 3

ROCKPORT PLANT CCR LANDFILL

ANNUAL GROUNDWATER MONITORING REPORT COVERING 2019 ACTIVITIES

STATISTICAL ANALYSES OF THE MAY 2019 SAMPLING EVENT

Geosyntec consultants

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Memorandum

Date:	October 3, 2019
To:	David Miller (AEP)
Copies to:	Dana Sheets (AEP)
From:	Allison Kreinberg and Bruce Sass, Ph.D. (Geosyntec)
Subject:	Evaluation of Detection Monitoring Data at Rockport Plant's Landfill (LF)

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"), semiannual detection monitoring events were completed at the Landfill (LF), an existing CCR unit at the Rockport Power Plant located in Rockport, Indiana. Sampling for the first semi-annual detection monitoring event occurred on May 21-23, 2019, July 23-24, 2019, and September 11-12, 2019.

Eight background monitoring events were conducted at the Rockport LF prior to this detection monitoring event, 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 January 7, 2019 which resulted in a revision to the calculated prediction limits for calcium, chloride, and total dissolved solids (TDS).

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 intrawell analysis with a one-of-three retesting procedure for all Appendix III parameters. With this procedure, a statistically significant increase (SSI) is only concluded if all three samples exceed the UPL. In practice, if the initial result did not exceed the UPL, a second sample was not collected or analyzed.

Detection monitoring results and the relevant background values for the first semiannual detection monitoring event are compared in Table 1 and noted exceedances are described in the list below.

- Calcium concentrations exceeded the intrawell UPL of 80.9 mg/L in the initial (98.5 mg/L), the second (114 mg/L), and the third (103 mg/L) samples at MW-002D, and the intrawell UPL of 87.8 mg/L in the initial (88.5 mg/L), second (95.6 mg/L) and third (109 mg/L) samples at MW-016D. Therefore, SSIs over background are concluded for calcium at MW-MW-002D and MW-016D.

- Chloride concentrations exceeded the intrawell UPL of 27.4 mg/L in the initial (33.1 mg/L), second (30.6 mg/L), and third (33.5 mg/L) samples at MW-001I; the intrawell UPL of 25.1 mg/L in the initial (135 mg/L), second (156 mg/L), and third (110 mg/L) samples at MW-002D; the intrawell UPL of 24.3 mg/L in the initial (26.4 mg/L), second (28.6 mg/L), and third (26.6 mg/L) samples at MW-002S; and the intrawell UPL of 73.3 mg/L in the first (104 mg/L), the second (95.6 mg/L), and the third (125 mg/L) samples at MW-016D. Therefore, SSIs over background are concluded for chloride at MW-001I, MW-002D, MW-002S, and MW-016D.

- Fluoride concentrations exceeded the intrawell UPL of 0.656 mg/L in the first (1.07 mg/L), the second (1.06 mg/L) and the third (1.08 mg/L) samples at MW-017I. Therefore, an SSI over background is concluded for fluoride at MW-017I.

- TDS concentrations exceeded the intrawell UPL of 358 mg/L in the first (531 mg/L), the second (540 mg/L), and the third (443 mg/L) samples at MW-002D, and the intrawell UPL of 384 mg/L in the first (460 mg/L), the second (457 mg/L), and the third (523 mg/L) samples at MW-016D. Therefore, SSIs over background are concluded for TDS at MW-002D and MW-016D.

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 Rockport LF caused the increases will be completed in accordance with 40 CFR 257.94(e)(2). If the ASD is successful, the Rockport 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
Rockport - Landfill

Parameter	**Units**	**Description**	MW-001D		MW-001I			MW-001S		MW-002D			MW-002I	MW-002S		
			5/23/2019	7/23/2019	5/23/2019	7/23/2019	9/11/2019	5/23/2019	7/23/2019	5/22/2019	7/24/2019	9/11/2019	5/22/2019	5/22/2019	7/23/2019	9/11/2019
Boron	mg/L	Intrawell Background Value (UPL)	0.0655		0.0926			0.0484		0.0736			0.0428	0.109		
		Detection Monitoring Data	0.0200	--	0.0200	--	--	0.0200	--	0.0200	--	--	0.0200	0.0200	--	--
Calcium	mg/L	Intrawell Background Value (UPL)	74.7		70.7			78.7		80.9			78.4	66.3		
		Detection Monitoring Data	73.6	--	67.7	--	--	73.7	--	**98.5**	**114**	**103**	64.3	51.3	--	--
Chloride	mg/L	Intrawell Background Value (UPL)	50.2		27.4			33.0		25.1			31.7	24.3		
		Detection Monitoring Data	32.1	--	**33.1**	**30.6**	**33.5**	**33.7**	30.0	**135**	**156**	**110**	25.4	**26.4**	**26.8**	**26.6**
Fluoride	mg/L	Intrawell Background Value (UPL)	0.32		0.43			0.68		0.22			0.37	0.30		
		Detection Monitoring Data	0.27	--	0.42	--	--	0.55	--	0.18	--	--	0.32	0.30	--	--
pH	SU	Intrawell Background Value (UPL)	8.2		7.9			8.1		8.6			8.7	8.4		
		Intrawell Background Value (LPL)	6.7		6.4			7.1		6.4			6.4	6.3		
		Detection Monitoring Data	7.2	--	7.0	--	--	7.9	--	7.3	--	--	7.3	7.7	--	--
Sulfate	mg/L	Intrawell Background Value (UPL)	45.1		47.8			37.0		46.4			48.5	35.1		
		Detection Monitoring Data	**45.3**	39.2	40.2	--	--	36.3	--	33.3	--	--	39.2	26.2	--	--
TDS	mg/L	Intrawell Background Value (UPL)	369		349			419		358			375	343		
		Detection Monitoring Data	346	--	341	--	--	388	--	**531**	**540**	**443**	328	**352**	339	--

Parameter	**Units**	**Description**	MW-015I	MW-015S			MW-016D			MW-016I	MW-016S	MW-017I			MW-017S	MW-021D	MW-021I	MW-021S
			5/23/2019	5/23/2019	7/23/2019	9/11/2019	5/22/2019	7/24/2019	9/11/2019	5/22/2019	5/22/2019	5/23/2019	7/23/2019	9/11/2019	5/23/2019	5/22/2019	5/21/2019	5/21/2019
Boron	mg/L	Intrawell Background Value (UPL)	0.0721	0.150			0.113			0.107	0.0880	0.0981			0.0653	0.0709	0.0921	0.0460
		Detection Monitoring Data	0.0300	0.0200	--	--	0.0300	--	--	0.0300	0.0300	0.0400	--	--	0.0300	0.0200	0.0200	0.0200
Calcium	mg/L	Intrawell Background Value (UPL)	54.0	70.6			87.8			113.5	113.7	96.3			41.0	82.9	73.1	62.4
		Detection Monitoring Data	47.8	41.3	--	--	**88.5**	**95.6**	**109**	56.0	99.2	45.1	--	--	32.7	69.3	62.4	52.5
Chloride	mg/L	Intrawell Background Value (UPL)	69.5	26.0			73.3			113.7	23.8	241.0			16.4	20.2	22.2	16.3
		Detection Monitoring Data	18.0	8.88	--	--	**104**	**106**	**125**	45.5	18.0	60.2	--	--	12.0	19.1	18.1	16.0
Fluoride	mg/L	Intrawell Background Value (UPL)	0.38	0.86			0.251			0.192	0.506	0.656			1.08	0.407	0.380	0.689
		Detection Monitoring Data	0.26	**0.88**	**0.87**	0.81	0.200	--	--	0.170	0.380	**1.07**	**1.06**	**1.08**	1.08	0.360	0.360	0.650
pH	SU	Intrawell Background Value (UPL)	7.9	7.7			9.1			7.9	8.5	8.0			8.0	8.7	8.7	9.1
		Intrawell Background Value (LPL)	6.8	7.1			6.0			6.7	5.9	6.8			7.1	6.7	6.6	6.0
		Detection Monitoring Data	7.3	7.5	--	--	7.3	--	--	7.4	7.1	7.5	--	--	7.6	7.5	7.5	7.6
Sulfate	mg/L	Intrawell Background Value (UPL)	47.4	33.7			39.7			43.5	52.4	50.8			16.5	43.2	50.0	23.6
		Detection Monitoring Data	20.9	10.2	--	--	38.0	--	--	33.2	34.5	32.8	--	--	7.70	36.8	36.0	14.1
TDS	mg/L	Intrawell Background Value (UPL)	398	407			384			589	517	657			296	365	359	313
		Detection Monitoring Data	260	207	--	--	**460**	**457**	**523**	405	493	352	--	--	217	348	278	258

Notes

UPL: Upper prediction limit

LPL: Lower prediction limit

TDS: Total dissolved solids

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 statistical method, described above and in the January 15, 2018 *Statistical Analysis Summary* report, is appropriate for evaluating the groundwater monitoring data for the Rockport 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

DAVID ANTHONY MILLER
No. 11700730

11700730
License Number

INDIANA
Licensing State

10.07.19
Date

APPENDIX 4

ROCKPORT PLANT CCR LANDFILL

ANNUAL GROUNDWATER MONITORING REPORT COVERING 2019 ACTIVITIES

ALTERNATE SOURCE DEMONSTRATION

JUNE 28, 2019

Alternative Source Demonstration for Appendix III Constituents, CCR Landfill

American Electric Power Service Corporation
Rockport Generating Station, Rockport, Spencer County, Indiana
Project # 7362192684

Prepared for:

American Electric Power Service Corporation
1 Riverside Plaza, Columbus, Ohio 43215

28 June 2019

Wood Environment & Infrastructure Solutions, Inc.
2456 Fortune Drive, Suite 100
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T: 859-255-3308
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28 June 2019

Mr. David Miller
Director, Land Environment & Remediation Services
American Electric Power Service Corporation
1 Riverside Plaza
Columbus, OH 43215
Email: damiller@aep.com

Dear Mr. Miller:

Wood Environment & Infrastructure Solutions, Inc. (Wood) has prepared this Alternative Source Demonstration (ASD) for the CCR Landfill located at the AEP Rockport Plant in Rockport, Indiana. As detailed in this report, the results of this ASD conclude that statistically significant increases (SSIs) identified in samples from the waste boundary monitoring wells are not caused by releases from the CCR Landfill. We are available to discuss the details of this report at your convenience should you require additional information.

We very much appreciate working with AEP on this project. If you require additional information about this report, please feel free to contact Kathleen Regan at (859) 566-3724.

Sincerely,

Wood Environment & Infrastructure Solutions, Inc.

Kathleen D. Regan

Konrad W. Quast, PhD
Senior Hydrogeologist

Kathleen D. Regan, PE
Senior Associate Engineer
Project Manager

Attachments

/kdr

cc:	Dana Sheets, PE, American Electric Power Service Corporation

Alternative Source Demonstration for Appendix III Constituents, CCR Landfill

American Electric Power Service Corporation
Rockport Generating Station, Rockport, Spencer County, Indiana
Project # 7362192684

Prepared for:

American Electric Power Service Corporation
1 Riverside Plaza, Columbus, Ohio 43215

Prepared by:

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28 June 2019

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Third-party disclaimer

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Executive Summary

American Electric Power (AEP) operates two units at the Rockport Plant for management of coal combustion residuals (CCR): the bottom ash ponds (BAP), and the CCR Landfill. Both are regulated under the federal CCR Rule (40 CFR Part 257) that became effective in October 2015 and modified in July 2018.

The CCR Landfill has been in the detection phase of groundwater monitoring as part of its compliance with the rule. The most recent statistical analysis of Appendix III constituents identified eight statistically significant increases (SSIs) above background, distributed among seven waste boundary monitoring wells. Six waste boundary monitoring wells exhibited SSIs for chloride (MW-1S, MW-1I, MW-2S, MW-2D, MW-16D and MW-21S). One of the six wells, MW-16D, also exhibited a SSI for total dissolved solids (TDS). The remaining SSI was observed for fluoride in monitoring well MW-17I, which did not exhibit any other SSI.

This alternative source demonstration (ASD) evaluates the occurrence of SSIs in terms of site geochemistry, hydrogeologic setting, and with respect to supplementary data collected to support the evaluation. Based on the analysis presented in this ASD, CCR Landfill leachate can be excluded as a source of Appendix III SSLs for the following reasons:

- Boron occurs naturally at low concentration in site groundwater, in similar concentrations in background and downgradient wells. Boron occurs at concentrations approximately three orders-of-magnitude in the Landfill leachate as compared to site groundwater, and is a conservative ion, making it an excellent indicator for impacts from landfill leachate impacts in groundwater. If landfill leachate were impacting groundwater, boron would be expected to be occurring in multiple waste boundary wells and at statistically significant concentrations above background. It does not.

- Sulfate is another typical indicator for CCR leachate impacts, which also occurs naturally in site groundwater (at similar concentration ranges in background and downgradient wells), and is elevated in the CCR Landfill leachate at concentrations approximately three orders-of-magnitude above background monitoring wells. No SSIs for sulfate were determined in any of the waste boundary well samples.

- Chloride is a naturally occurring and conservative ion, which occurs in the CCR Landfill leachate at concentrations about two orders-of-magnitude above groundwater concentrations. Spatial trends can be observed in **Exhibits 3-5** and **3-6**, and indicate that chloride concentrations tend to increase in groundwater moving downgradient from recharge areas. However, because the SSIs indicated for chloride are not associated with SSIs for boron and sulfate, the CCR Landfill leachate is not considered a source for the chloride detected in groundwater.

- The same conclusion can be drawn in regard to total dissolved solids (TDS) and fluoride, for which occasional SSIs are not consistently associated with boron, sulfate, or each other. The SSIs indicated for these constituents appear to be related to the natural variation in groundwater quality, along with a spatial trend of increasing TDS with distance from recharge area.

- Monitoring well MW-17I is associated with an SSI for fluoride. This well, along with MW-17S and the well cluster MW-15S/I are located cross-gradient of potential source materials. Groundwater monitored by these wells is not hydraulically influenced by the CCR Landfill.

1.0 Objective

American Electric Power (AEP) operates a CCR Landfill that is used for the management of coal combustion residuals (CCR). The landfill is regulated under the federal CCR Rule (40 CFR Part 257) that became effective in October 2015. During the initial phase of groundwater monitoring (detection monitoring), the CCR Rule requires the owners or operators of regulated units to collect at least eight independent samples from at least one background location and at least three waste boundary wells, analyzed for constituents listed in Appendix III and Appendix IV of the CCR rule. That sampling was completed in July 2017.

The first detection monitoring event was conducted in October 2017. A statistical analysis was conducted for Appendix III constituents by Geosyntec Consultants, Inc. (Geosyntec) in conjunction with Groundwater Stats Consulting, LLC and MacStat Consulting, LTD. The results were documented in a report by Geosyntec dated January 15, 2018. The statistical evaluation identified 10 statistically significant increases (SSIs) above background distributed among 7 waste boundary monitoring wells.

An alternate source demonstration (ASD) for the October 2017 sample results was prepared by Wood Environmental & Infrastructure , Inc. (Wood) that focused on the site geochemistry. The ASD showed, through multiple lines of evidence, that the SSIs identified in the October 2017 detection monitoring event were not the result of a release of leachate from the CCR landfill. The ASD was placed on the Rockport Plant CCR website. As a result, the landfill remained in detection monitoring.

The next semiannual detection monitoring event occurred in June 2018. A statistical analysis of the resulting groundwater data by Geosyntec and Groundwater Stats Consulting identified 13 verified statistically significant exceedances above background of Appendix III parameters at 8 waste boundary wells.

An ASD for the June 2018 sample results was investigated by Geosyntec and completed by report dated January 4, 2019. The report concluded that the groundwater quality and the Appendix III indicator parameter SSIs identified in the statistical evaluation were not the result of a release of leachate from the landfill but were due to natural groundwater variation and impacts from historical oil and gas operations in the vicinity. The ASD was placed on the Rockport Plant CCR website as part of the Annual Groundwater Monitoring Report for 2018 dated January 31, 2019. Because the ASD was successful, the landfill remained in detection monitoring for the second semiannual samples for 2018 taken in November.

Sampling for the second semiannual detection monitoring event in 2018 occurred during the week of November 14. A statistical analysis of the resulting groundwater data by Geosyntec and Groundwater Stats Consulting identified 8 verified statistically significant exceedances above background of Appendix III parameters at 7 waste boundary wells.

The objective of this ASD is to investigate whether the verified SSIs of Appendix III indicator parameters resulting from the statistical analyses of the November 14, 2018 samples were the result of a release from the landfill or due to an alternate source.

1.1 Scope

As stated in 40 CFR 257.94(e)(2), the CCR Rule allows 90 days after the initial identification of Appendix III SSIs for the owner or operator to demonstrate that a source other than the regulated unit is responsible for identified SSIs. The regulations allow the ASD to address a number of potential causes of SSIs other than a release from the regulated unit, including error[s] in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.

AEP has retained Wood Environment & Infrastructure Solutions, Inc. (Wood) to reevaluate the ASDs for the CCR Landfill in light of the change in statistical methodology. The scope of this ASD is focused on evaluating whether leachate from the CCR Landfill is a likely source of the SSIs identified in the statistical analysis, or whether these SSIs result from natural variation in groundwater quality. This report does not include evaluations of potential errors in sampling and analysis, or the statistical approaches which were used to identify the SSIs.

1.2 Approach

The ASD presented in this document is based on a geochemical and hydrologic evaluation of groundwater quality at the CCR Landfill. The purpose of this ASD is to evaluate the identified SSIs within the larger geochemical context of the CCR Landfill groundwater flow system, in order to assess the likelihood that these SSIs are the result of releases from the CCR Landfill. In addition to the groundwater analytical data collected for compliance with the CCR rule, used to support the statistical evaluation, Wood relied on supplemental analytical data, including analyses of the CCR Landfill leachate and monitoring well groundwater analyses of the isotopes of boron and strontium.

1.3 Report Organization

This ASD has been prepared following the *Guidelines for Development of Alternative Source Demonstrations at Coal Combustion Residual Sites* (EPRI, 2017) to the extent applicable. **Section 2** presents a summary the CCR Landfill setting, and a summary of the results from the statistical evaluation of the Appendix III detection monitoring parameters. **Section 3** presents the primary and secondary lines of evidence developed from a geochemical evaluation of the site. Section 4 presents the technical findings of the ASD and includes certification by an Indiana-licensed Professional Engineer (PE). References are included in **Section 4**.

2.0 Background

2.1 Site Description

The Rockport Power Plant is located in southwest Indiana in Spencer County, on property extending into three Townships: Ohio, Hammond and Grass. Two CCR-regulated units are located on the property, two adjacent bottom ash ponds (BAP) and the CCR Landfill. The general layout of the property and the locations of the CCR units are shown on **Figure 1**. The CCR Landfill, or Landfill, is located about 8,000 feet (1.5 miles) northeast of the generating plant. **Figure 2** shows the general layout of the CCR Landfill and the monitoring well locations.

2.1.1 Landfill Operation

The CCR Landfill is an active disposal unit that primarily contains fly ash, with materials generated by the emission control systems added beginning in 2007. These materials include sodium sulfate generated by the removal of sulfur dioxide by the dry sorbent injection (DSI) system, and granular brominated activated carbon used for mercury removal. To a lesser extent, some bottom ash has also been placed within the CCR Landfill. As shown on Figure 2, the active portion of the CCR Landfill directly adjoins a closed portion of the landfill to the northeast.

The CCR Landfill is currently permitted by the Indiana Department of Environmental Management (IDEM) Office of Land Quality, Solid Waste Permits Section, as a Restricted Waste Site (RWS) under Indiana Administrative Code (IAC) 329 Title 10 (Solid Waste CCR Landfill Disposal Facilities) Rule 9-4. The active

CCR Landfill is permitted as a RWS Type I, which requires a liner and leachate collection system. The permit was most recently renewed on 10 February 2015.

Leachate from the CCR Landfill cells is collected in lined ponds located north and west of the active CCR Landfill area. These ponds also collect storm water runoff from the CCR Landfill area. Prior to discharge, the leachate commingled with runoff is transferred to the Leachate Treatment Pond (north of the West Leachate Pond). Effluent from the Leachate Treatment Pond is discharged and monitored under National Pollution Discharge Elimination System (NPDES) Permit No. IN0051845 at Station 002.

2.1.2 Groundwater Flow

The principal groundwater flow zone underlying the CCR Landfill consists of the saturated section of the unconsolidated glaciofluvial sand and sand and gravel valley train sediments that fill the Ohio River valley in this area. The depth to water in this zone typically ranges from 20 to 35 feet (ft) below ground surface (BGS), and the saturated thickness (which generally increases to the southeast) ranges from less than 15 ft to more than 80 ft. A generalized cross-section is presented in **Figure 3**.

Groundwater primarily occurs under unconfined conditions, or semi-confined conditions where the saturated zone is directly overlain by surficial silt and clay. Piezometric data collected from clustered monitoring wells indicate that vertical gradients within the saturated zone are minor, and groundwater flow is primarily horizontal. Groundwater flows into the plant and landfill area from the north, northwest and west, continues flowing under the property generally to the south and east, towards Honey Creek and/or the Ohio River. Potentiometric contour maps illustrating typical groundwater flow conditions are presented in **Figures 4 through 7**.

2.1.3 Existing Groundwater Monitoring System

In 2015, when the CCR Rule took effect, a monitoring well network was already present at the CCR Landfill for groundwater monitoring under IDEM permit. While the valley train sediments are considered a single well-connected aquifer system, the saturated thickness of the sediments allowed for wells at the CCR Landfill to be installed in clusters, to monitor up to three levels (shallow – "S", intermediate – "I", and deep – "D") within the principal flow zone. However, the valley train sediments that make up the flow zone thin to the north, leaving less unsaturated overburden upgradient of the CCR Landfill. As a result, only one or two levels could be monitored in some locations.

The official CCR groundwater monitoring network includes five background or cross-gradient wells (MW-6S, MW-8S/I, MW-11S and MW-14S) and 16 waste boundary wells (MW-1S/I/D, MW-2S/I/D, MW-15S/I, MW-16S/I/D, MW-17S/I and MW-21S/I/D). At most locations, the saturated overburden was thick enough to allow installation of screens at three different levels, with the deepest wells being completed just above bedrock at depths of 88 to 100 ft BGS. Two clusters, MW-15 and MW-17, are located just east of the CCR Landfill in an area of relatively shallow bedrock. Therefore, the deeper wells at these locations (designated "I") have completed depths just above bedrock at 66 to 67 ft BGS. A comprehensive summary of analytical data for the groundwater monitoring network since June 2016 is presented on **Table A-1** in **Appendix A**.

2.2 Summary of SSIs

Eight baseline monitoring events and one initial detection monitoring event for the CCR Landfill were completed prior to 17 October 2017. On behalf of AEP, Geosyntec submitted these results to Groundwater Stats Consulting, LLC for statistical analysis. Oversight on the use of statistical calculations was provided by Dr. Kirk Cameron of MacStat Consulting, Ltd.

According to the report (*Statistical Analysis Summary, Landfill,* Geosyntec 2018), the initial eight rounds of baseline data were used to calculate the upper prediction limits (UPLs) for each of the Appendix III constituents to represent background values. Results from the initial detection monitoring event were then compared to the UPLs established from the eight baseline rounds in order identify SSIs compared to background. The initial statistical evaluation identified 11 SSIs for calcium (2), chloride (6), fluoride (1) and TDS (3). An initial ASD was prepared by Wood focusing on site geochemistry. The ASD demonstrated, through multiple lines of evidence, that the SSIs identified in the statistical analysis of the initial detection monitoring event data are not the result of a release of leachate from the CCR Landfill.

The first semiannual detection monitoring event of 2018 was conducted in June, with verification sampling conducted in August and September 2018. Geosyntec evaluated the new data and based on multiple lines of evidence, revised the statistical approach for some monitoring wells. Initially, the statistical evaluation included a mixture of interwell (between wells) and intrawell (within one well) techniques. The interwell analysis compares data from waste boundary wells against a background data set composed of results from upgradient and cross-gradient well data. The intrawell approach compares each waste boundary well against a background composed of its own historical data and is used to detect statistically significant increases within samples from an individual well over time (Horsey, HR et. al., 2001). Spatial and temporal variability observed in samples from the background monitoring wells caused Geosyntec to select an intrawell approach for all Appendix III constituents in all waste boundary monitoring wells.

After using an intrawell approach, the number of SSIs was reduced to eight, distributed among seven waste boundary wells. In January 2019 Geosyntec published an ASD to document changes to the statistical methodologies and attributed the observed SSIs to impacts from historic off-site oil and gas operations. Sampling for the second semi-annual detection monitoring event occurred on November 2018, with verification sampling conducted in February and April 2019. Geosyntec evaluated the second round of detection monitoring results which identified nine previously-identified SSIs, indicated by black diamonds in the **Exhibit 2-1** summary table below:

Exhibit 2-1. Summary of SSIs, Second Semiannual Sampling Events of 2018

Parameter	MW-1S	MW-1I	MW-2S	MW-2D	MW-16S	MW-16D	MW-17I	MW-21S
Chloride	◆	◆	◆	◆		◆		◆
Fluoride							◆	
TDS					◆	◆		

A table of all groundwater monitoring results for the CCR Landfill since June 2016 is presented on **Table A-1** in **Appendix A**. The Wood ASD (2018) concluded that the SSIs are due to natural variation in groundwater quality and the Geosyntec ASD identified impacts from historic off-site oil and gas operations as a potential source of impacts. Since both ASDs identified multiple lines of evidence and supporting data that indicate a release from the CCR unit has not occurred, the unit continues in detection monitoring under the federal CCR Rule, and a statistical evaluation of Appendix IV constituents has not been required.

3.0 Alternative Source Demonstration

The ASD presented below relies on multiple lines of evidence that the SSIs identified in the statistical analysis are not caused by releases of landfill leachate into the groundwater flow system. When taken as a whole, these lines of evidence present a compelling case that the SSIs are the result of natural variation in groundwater quality.

In order to evaluate the potential of a release from the CCR Landfill to groundwater, Wood evaluated groundwater quality data, including isotopes, in the context of the geochemical characteristics of CCR Landfill leachate. The results of this evaluation support that CCR Landfill leachate at the Rockport site can be ruled out as a source of the SSIs identified in waste boundary monitoring wells, through primary and supporting lines of evidence, each of which are described in more detail within this section.

Primary lines of evidence focus on the relationship between source material that could be released into the subsurface (in this case, landfill leachate) and the type and distribution of SSIs identified in groundwater. The lines of evidence supporting the conclusion of this ASD can be summarized as follows:

- SSIs are not identified for the site-specific primary indicator constituents of the Rockport CCR Landfill leachate.
- Geochemical evaluations of the CCR Landfill support that leachate has not affected water quality.
  - Conservative ion ratios and major ion chemistry do not indicate a release from the CCR Landfill.
  - Isotopes of boron and strontium do not indicate a release from the CCR Landfill.
- Recent potentiometric data indicate the MW-17 cluster (where an SSI for fluoride has been identified) is located downgradient from the borrow area stormwater ponds and is cross-gradient of the CCR Landfill.

Each of these lines of evidence are described in detail below.

3.1 SSIs Are Not Identified for Primary Indicator Constituents

The primary indicators for CCR leachate typically have much higher concentrations in leachate than in natural groundwater. They are mobile and relatively non-reactive in groundwater, so that groundwater impacted by a CCR leachate release should have elevated concentrations of the indicator constituents relative to background and to the other constituents analyzed. These elevated concentrations result in SSIs identified by statistical evaluation of the data from the downgradient waste boundary wells, and the SSIs would be expected to be generally consistent between downgradient wells. The primary lines of evidence presented below compare the occurrence of SSIs in groundwater to the composition of landfill leachate.

3.1.1 Site-Specific Leachate Analysis for Primary Indicator Constituents

The composition of landfill leachate is governed by the types of materials placed in the unit, and identifying the leachate's primary constituents is key to assessing a potential release to groundwater. Since all Appendix III constituents are naturally-occurring, the best indicators of CCR impacts are those constituents that are found at concentrations much higher in the source material than are seen in natural groundwater. AEP conducted sampling of its leachate collection system to identify relative concentrations of Appendix III and IV constituents in the Rockport CCR Landfill leachate.

The leachate collection system for the Landfill discharges into the North and West Leachate Collection Ponds, shown on **Figure 2**, discharge to the Leachate Treatment Pond, directly north of the West Leachate Pond. Five samples were collected from both the West and North Leachate Collection Ponds between 31 October 2018 and 20 March 2019 and results are detailed on **Table A-2** in **Appendix A**. A summary of the range of Appendix III constituent results for leachate pond samples, compared to background and waste boundary well samples, is provided below in **Exhibit 3-1**.

Exhibit 3-1. Summary of Landfill Leachate Pond and Groundwater Concentrations for Appendix III Constituents

Parameter, Units in mg/L	Range for Leachate Ponds		Range for Upgradient (Background) Wells		Range for Downgradient Waste Boundary Wells	
	Min	Max	Min	Max	Min	Max
Boron	9.18	12.3	<0.004	0.115	0.002	0.139
Calcium	166	368	35.6	79.5	32.3	110
Chloride	847	1,250	1.54	30.0	1.54	214
Fluoride	<1.50	<1.50	0.25	1.0	0.08	1.08
Total Dissolved Solids (TDS)	22,100	30,900	179	407	196	620
Sulfate	14,100	19,000	3.8	87.5	8.4	54.7

Because the CCR Landfill leachate ponds also receive some storm water runoff, concentrations in at least some of these samples are likely to be diluted compared to concentrated leachate from landfilled materials (depending on the amount of recent rainfall). Nevertheless, pond samples serve as reliable indicators of the relative composition of leachate. As seen in **Exhibit 3-1**, boron and sulfate occur at concentrations as much as three orders-of-magnitude above background groundwater levels. Results for chloride and TDS are as much as two orders-of-magnitude above background concentrations. Calcium and fluoride concentrations are within the same orders-of-magnitude as those detected in background groundwater. These results indicate that boron and sulfate are the best indicator constituents of CCR impacts, followed by TDS and chloride, based on their elevated occurrence in landfill leachate compared natural groundwater.

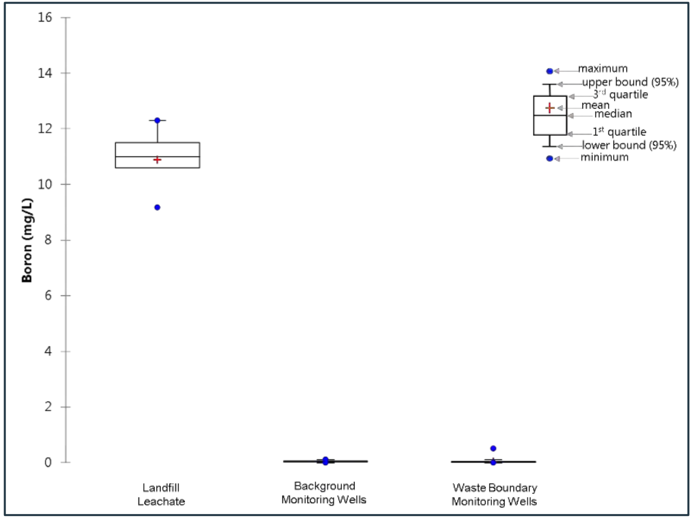
3.1.2 Occurrence of Primary indicator Constituents in Waste Boundary Monitoring Well Samples

Four primary indicator compounds are identified for the Rockport CCR Landfill leachate: boron, sulfate, TDS and chloride. Six SSIs have been identified for chloride, one for TDS and one for fluoride. However, no SSIs were identified in waste boundary wells for either boron or sulfate. Given the predominance of boron and sulfate in the CCR Landfill leachate, and that neither of these constituents are elevated above background, it is unlikely that Landfill leachate is the source of the observed SSIs. This assumption is supported by a more in-depth review of the indicator constituents, presented below.

Boron

No SSIs have been identified for boron. Boron has been identified in background wells at concentrations ranging from <0.004 to 0.115 mg/L. Concentrations in waste boundary well samples range from 0.002 to 0.52 mg/L, with a landfill leachate from 9.18 to 12.3 mg/L. These results are plotted graphically on **Exhibit 3-2**, which illustrates the range of results for leachate (at the left of the chart) compared to and background and waste boundary groundwater samples. It should be noted that the highest concentration of boron observed in waste boundary groundwater samples (0.52 mg/L) occurred in MW-16D and did not represent an SSI for that well.

Exhibit 3-2. CCR monitoring well and landfill leachate ponds boron concentrations

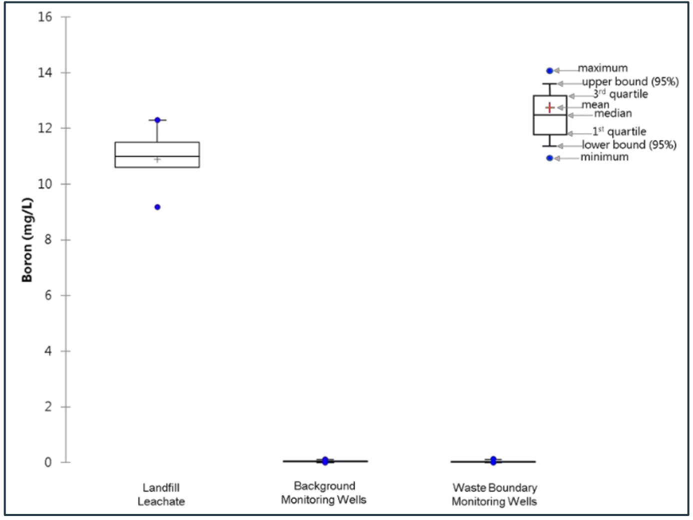


If a release of landfill leachate had occurred, boron concentrations in waste boundary well samples should be clearly higher than the range of background well results, and SSIs would likely be found in at least some of the monitoring wells with other identified SSIs.

Sulfate

No SSIs have been identified for sulfate. Sulfate has been identified in background wells at concentrations ranging from 3.8 to 87.5 mg/L. Concentrations in waste boundary well samples range from 8.4 to 54.7 mg/L, with landfill leachate concentrations ranging from 14,100 to 19,000 mg/L. These results are plotted graphically on **Exhibit 3-3**, which clearly shows that leachate concentrations of sulfate are orders-of-magnitude higher than all groundwater samples, and that no discernable difference is present between the background and waste boundary samples. Furthermore, the highest monitoring well concentrations are seen in samples from background well MW-8I (68.2 to 87.1 mg/L).

Exhibit 3-3. CCR monitoring well and landfill leachate ponds sulfate concentrations



In conclusion, it is expected that a release of landfill leachate would elevate groundwater concentrations of all Appendix III constituents present in the leachate in relatively similar proportions. Even if all constituents were not exhibiting statistically significant increases, a pattern of related SSIs would be observed if the increases were caused by landfill leachate. Since all SSIs occurred in absence of a boron or sulfate SSI, it is concluded that these SSIs are caused by the natural variation in groundwater quality and not by releases from the CCR Landfill.

3.2 Geochemical Evaluations

While the CCR rule requires the use of statistical analyses of samples collected from groundwater monitoring wells to assess potential impacts from CCR units (SSIs), the approach does not consider the site specific hydrogeochemical interactions that can often be complex due to simultaneous operations and natural variation within the context of the local hydrogeologic setting. Since geochemical evaluations rely on interpretation of graphical data, the discussion includes reduced size exhibits imbedded in the text. Full size exhibits are included in **Appendix B**. The major observations and conclusions from the geochemical evaluation are summarized in the sections below.

3.2.1 Indicator Parameter Cross-Plots and Major Ion Chemistry

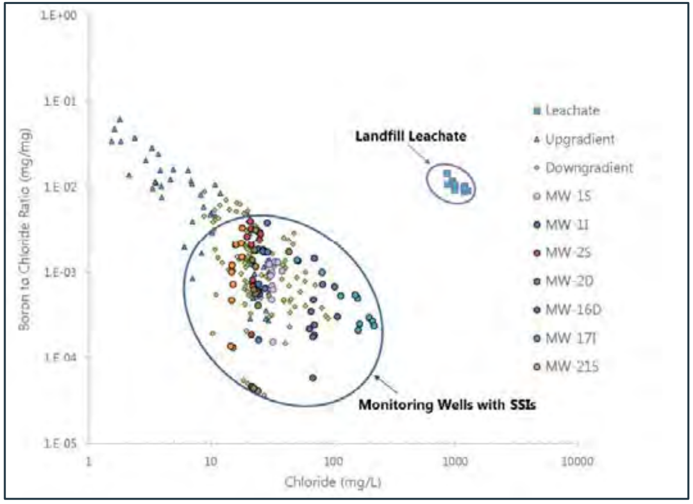
To aid in the interpretation of individual Appendix III and other potential indicator parameters for the assessment of potential releases from the CCR Landfill, ratios of selected Appendix III indicator parameters were calculated and plotted versus concentrations of the conservative ion chloride, and major ion chemistry was assessed as a whole system using Piper trilinear diagrams. The use of these plotting techniques typically provides groupings of end members (sources of water such as background groundwater or landfill leachate), and potential trends of mixing that are not readily identifiable by analysis of individual indicator parameters on their own.

Plots of the B/Cl and SO4/Cl ratios versus chloride in waste boundary monitoring wells show distinct end member groupings from that of the landfill leachate and support the conclusion that there are no discernable impacts from the CCR Landfill on any of the waste boundary monitoring wells. The graphics presented here include data for all wells in the CCR Landfill system and show that chloride concentrations tend to increase in groundwater moving downgradient from recharge areas represented by upgradient monitoring wells.

Boron to Chloride ratio Versus Chloride Concentration

The plotting of B/Cl versus chloride groundwater data shows primarily a single cluster that is similar to what is hypothesized as background based on the composition of leachate samples (**Exhibit 3-4**). The landfill data are plotted on log-log scales due to the large range of concentrations and ratios making the separation in groupings appear closer than they are. The Landfill leachate clearly plots as a separate trend of water quality having greater B/Cl ratios, while the monitoring well data plots along a trend of what can be described as natural variability. Background monitoring well MW-11S plots as upgradient recharge with increasing chloride concentrations and salinity along the flow path represented by downgradient monitoring wells due to geochemical evolution of groundwater. While chloride increases, boron does not increase at the same rate, resulting in the decreasing trend of B/Cl ratios as chloride concentrations and residence time increases. Thus, it is hypothesized that MW-11S represents an extreme end member of recent recharge, or relatively fresh groundwater, and after flow through the shallow overburden groundwater evolves geochemically to a

Exhibit 3-4. Boron to chloride ratio versus chloride concentration for CCR Landfill groundwater monitoring wells and leachate for comparison.

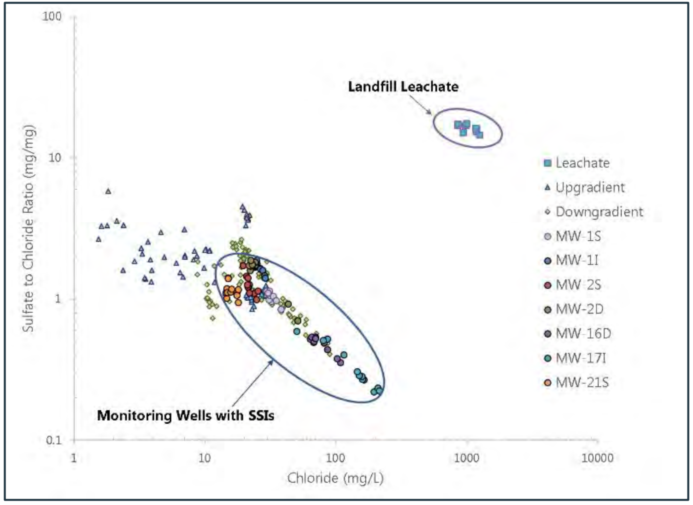


lower B/Cl ratio, as chloride increases, approaching the larger background cluster values that represent older more mineralized groundwater without a significant source of boron in the aquifer matrix. The extreme end of the groundwater dataset is represented by MW-17I due to its higher chloride concentration, but with a low B/Cl ratio. This plot supports that these wells are not impacted by CCR Landfill leachate but could be influenced by infiltration from the storm water holding ponds.

Sulfate to Chloride Ratio Versus Chloride Concentration

Plotting of the SO_4/Cl ratio versus chloride also shows similar results to the B/Cl ratios versus chloride concentration plot supporting the conclusion that there are no discernable impacts from the CCR Landfill on groundwater (**Exhibit 3-5**). The SO_4/Cl ratios for leachate are much higher than groundwater values, typically around 15 mg/mg or higher, while groundwater ratios are below a value of 6. The extreme end of the groundwater data set is represented by MW-17I variability due to its high chloride concentration that is clearly different from leachate.

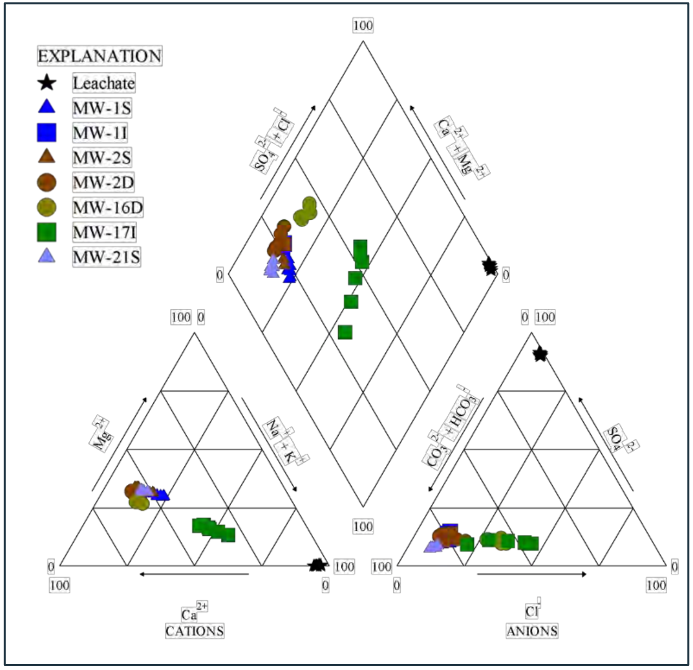
Exhibit 3-5. Sulfate to chloride ratio versus chloride concentration for CCR Landfill groundwater monitoring wells and leachate for comparison.



CCR Landfill Major Ion Water Quality

During the sixth round of sampling, additional analytes were included in the analyses making it possible to create major ion Piper trilinear diagrams for graphical comparison of water types for the CCR Landfill monitoring wells and leachate samples. Inferences of different groundwater source end members are supported by the Piper diagram shown on **Exhibit 3-6**. All of the major ion chemistry are plotted on a single diagram and results are supportive of the observations found when reviewing the cross-plots of ion ratios versus chloride concentrations. Leachate plots as a sodium sulfate water type while the majority of monitoring wells, including those identified with SSIs in this ASD, are associated with a calcium bicarbonate water type with the exception of MW-17I. Monitoring well MW-17I shows a different major ion water type that is influenced by greater contributions of sodium and chloride, but not sulfate.

Exhibit 3-6. Piper diagram of major ion water quality for CCR Landfill monitoring wells with SSIs and leachate for comparison.



3.2.2 Isotope Analyses of CCR Related Water Quality and Materials

General Overview of Isotope Analyses

Water samples were collected from selected CCR Landfill monitoring wells and CCR Landfill leachate and submitted for isotope analyses of boron, strontium, and oxygen and hydrogen of water. The results of the isotope analyses serve as additional supporting lines of evidence for interpretations made using major ion and indicator parameter concentrations and reinforce the lack of leachate impacts to groundwater at the CCR Landfill.

Boron and its isotope ratio ($\delta^{11}B$) have been successfully used to identify groundwater pollution sources versus background or naturally occurring detections of constituents of concern (Davidson and Bassett 1993; Vengosh et al. 1994; Kendall et al., 1995; Ruhl et al. 2014; Harkness et al. 2017). In particular, boron isotopes have been successfully used to assess CCR related impacts in groundwater. Similarly, strontium and its isotopes ($^{87}Sr/^{86}Sr$) have also been successfully used to identify different groundwater source end members, mixing, and to determine anthropogenic versus geogenic processes associated with constituents of concern and associated with CCR impacts to groundwater (Kendall and Bullen 1995; Ruhl et al. 2014; Meredith 2016; Harkness et al. 2017; Nigro et al. 2017).

CCR Landfill Isotope Results

Stable isotope analyses are typically performed on a pair of isotopes (e.g. ^{11}B and ^{10}B, or ^{87}Sr and ^{86}Sr) and are reported as a ratio relative to internal standards, in per mil (‰) using Greek "delta" notation (δ). Deviations based on analysis of the standard are corrected for, to provide values that can be compared between different laboratories and equipment. Isotopes commonly reported relative to a standard include boron (eq. 1), where the standard for boron is the National Institute of Standards and Technology (NIST) Standard Reference Material (SRM) NIST SRM 951:

$$\delta^{11}B(‰) = \frac{\left(\frac{^{11}B}{^{10}B}\right)_{Sample} - \left(\frac{^{11}B}{^{10}B}\right)_{Standard}}{\left(\frac{^{11}B}{^{10}B}\right)_{Standard}} \times 1000 \qquad \text{eq. 1}$$

Isotope ratios of strontium can be reported relative to a standard value but are commonly reported as the actual ratio ^{87}Sr/^{86}Sr. The values for strontium reported here are the actual ratios, but they have been corrected to the National Institute of Standards and Technology (NIST) Standard Reference Material (SRM) NIST SRM 987.

Background monitoring wells for the CCR Landfill show lower boron concentrations and higher δ^{11}B values compared to Landfill leachate samples (**Exhibit 3-7**). While only a limited number of background and waste boundary wells were tested (including two with SSIs, MW-17I and MW-21S), there is a clear distinction between all the CCR Landfill monitoring wells and the Landfill leachate which indicates that the wells represented are not impacted by the Landfill, and that boron in the monitoring wells is of a different source other than leachate.

In addition, while there is a variation in the leachate boron concentrations, the δ^{11}B values remain approximately equivalent. This supports the hypothesis that boron is δ^{11}B values in leachate and BAP water are dominated by the CCR materials and that the increase in boron concentration observed for BAP waste boundary monitoring wells beyond the BAP water concentration is related to additional leaching of in place ash material that has the same δ^{11}B values, thus resulting in a range of boron concentrations above background having a similar δ^{11}B value.

Strontium isotope results also support the boron isotope, major ion, and indicator parameter interpretations that there are no identifiable impacts on groundwater from the landfill. There are noticeably lower strontium concentrations and ratios for all CCR Landfill monitoring wells sampled compared to Landfill leachate (**Exhibit 3-8**).

Exhibit 3-7. Boron isotope ratio ($\delta^{11}B$) versus boron concentration for CCR Landfill leachate and monitoring wells for comparison.

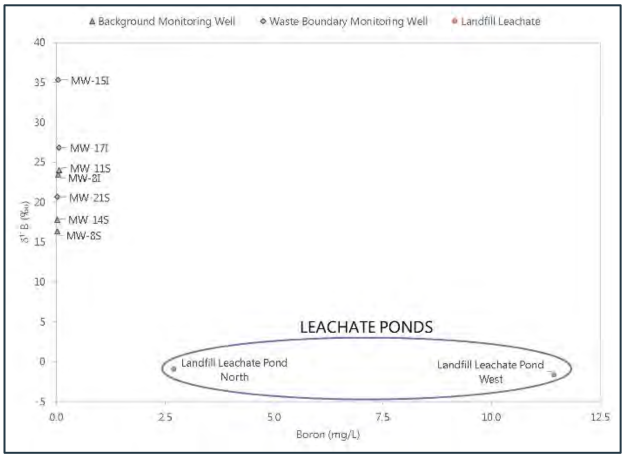
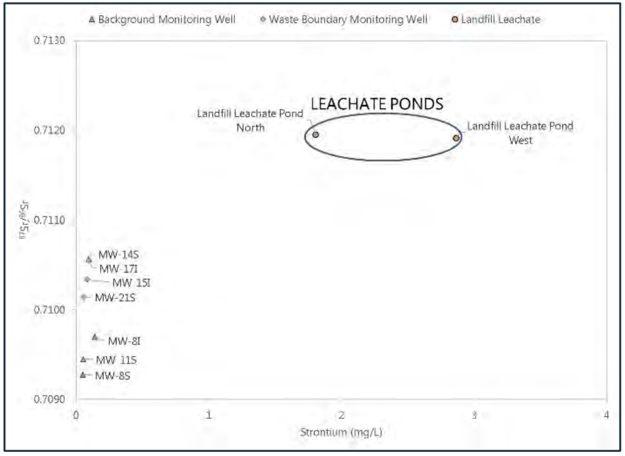


Exhibit 3-8. Strontium isotope ratio ($^{87}Sr/^{86}Sr$) versus strontium concentration for CCR Landfill leachate and monitoring wells for comparison.



3.3 Hydraulic Connection to the CCR Landfill

The groundwater monitoring network and the relationship of the wells to the regulated CCR Landfill are shown on **Figure 2**. Recent potentiometric flow data available for the site consistently indicate a local groundwater flow direction in the vicinity of MW-17 to the south and southeast. Four potentiometric surface maps are presented on **Figures 4 through 7**. As shown on these figures, well cluster MW-17 is located cross-gradient from the CCR Landfill and at least sometimes downgradient of the borrow area stormwater ponds. Therefore, groundwater monitored by this well cluster is hypothesized to be unaffected by potential releases from unit.

3.4 Summary

As summarized in **Exhibit 2-1** above, in the initial detection monitoring event, SSIs were identified in only seven of 16 downgradient monitoring wells, for the following Appendix III constituents (the number of wells with SSIs is indicated in parentheses): chloride (6), fluoride (1) and TDS (1). The following statements summarize how the lines of evidence discussed above apply to each of the constituents with identified SSIs:

- Boron occurs naturally at low concentration in site groundwater, in similar concentrations in background and downgradient wells. Boron occurs at concentrations approximately three orders-of-magnitude in the CCR Landfill leachate as compared to site groundwater, and is a conservative ion, making it an excellent indicator for impacts from landfill leachate impacts in groundwater. If Landfill leachate were impacting groundwater, boron would be expected to be detected in multiple waste boundary wells and at statistically significant concentrations above background but it does not.

- Sulfate is another typical indicator for CCR leachate impacts, which also occurs naturally in site groundwater (at similar concentration ranges in background and downgradient wells), and is elevated in the CCR Landfill leachate at concentrations approximately three orders-of-magnitude above background monitoring wells. No SSIs for sulfate were determined in any of the waste boundary well samples.

- Chloride is a naturally occurring and conservative ion, which occurs in the CCR Landfill leachate at concentrations about two orders-of-magnitude above groundwater concentrations. Spatial trends can be observed in **Exhibits 3-4** and **3-5**, and indicate that chloride concentrations tend to increase in groundwater moving downgradient from recharge areas. However, because the SSIs indicated for chloride are not associated with SSIs for boron and sulfate, the CCR Landfill leachate is not considered a source for the chloride detected in groundwater.

- The same conclusion can be drawn in regard to TDS and fluoride, for which occasional SSIs are not consistently associated with boron, sulfate, or each other. The SSIs indicated for these constituents appear to be related to the natural variation in groundwater quality, along with a spatial trend of increasing TDS with distance from recharge area.
- Monitoring well MW-17I is associated with an SSI for fluoride. This well, along with MW-17S and the well cluster MW-15S/I are located cross-gradient of potential source materials. Groundwater monitored by these wells is not hydraulically influenced by the CCR Landfill.

3.5 Conclusion

This ASD has demonstrated, through multiple lines of evidence, that the SSIs identified in the statistical analysis of the initial detection monitoring event data are not the result of a release of leachate from the CCR Landfill. Therefore, the unit will continue in detection monitoring.

3.6 Professional Engineer Certification

I certify that the above described Alternative Source demonstration is appropriate for evaluating the groundwater monitoring data for the Rockport Plant CCR Landfill and that the requirements of 40 CFR 257.95(h)(8)(3)(ii) have been met.

Kathleen D. Regan

Kathleen D. Regan, PE
Indiana Registered Engineer PE1400182

28 June 2019
Date

4.0 References

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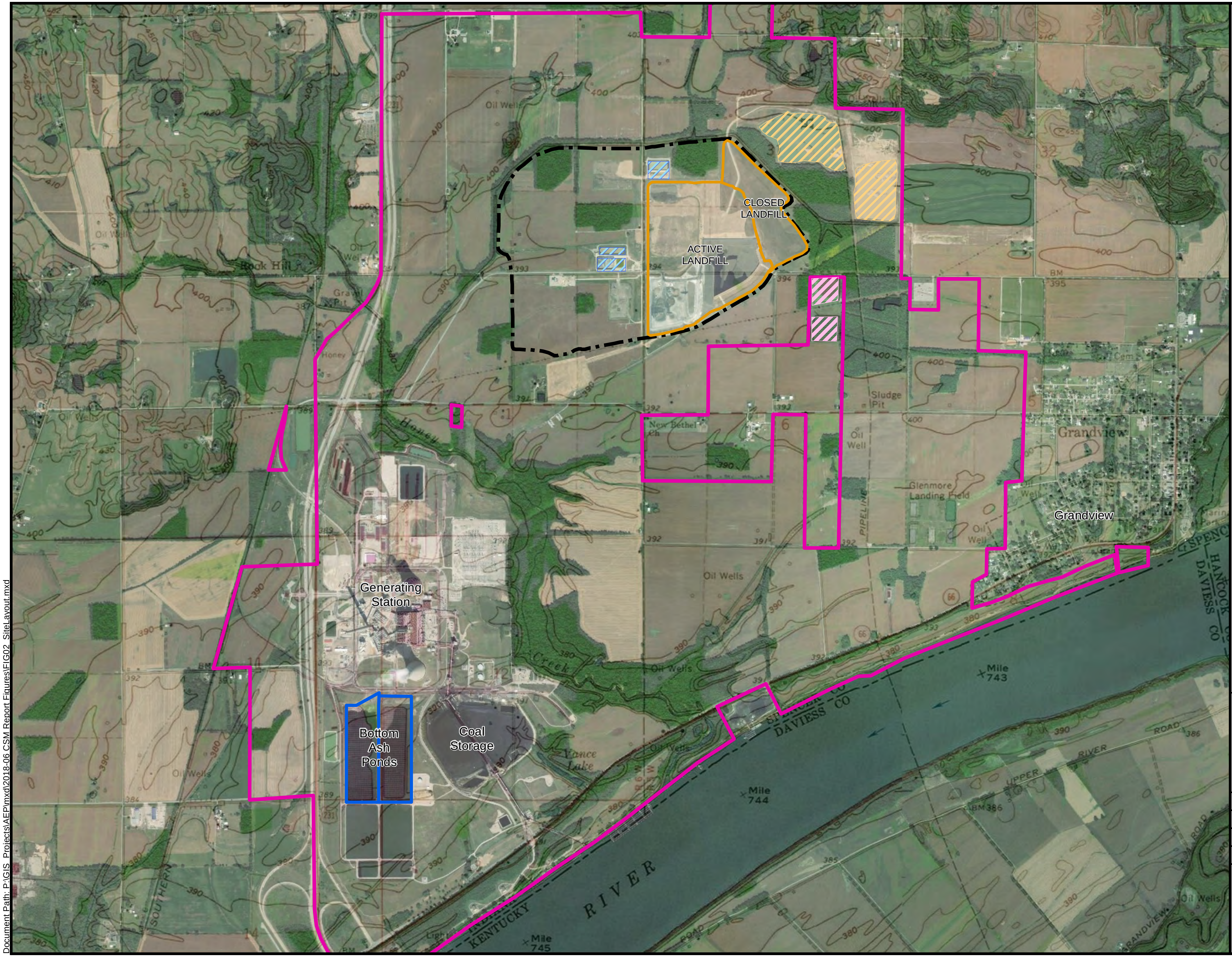
Figures



Legend

- ▨ Stormwater Ponds
- ▨ Landfill Leachate Ponds
- ▨ Grandview Wastewater Ponds
- ☐ Property Boundary
- ☐ Bottom Ash Ponds (BAP)
- ☐ Landfill Area 1A (Active and Closed)
- ☐ 1984 Landfill Permit Boundary (Area 1)

Data Sources

Date of Photography: 2016
Source of Photography: U.S. Department of Agriculture, National Agriculture Imagery Program (NAIP)

USGS Rockport and Lewisport (IN/KY) Topographic Quadrangle Maps

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SCALE IN FEET

SITE LAYOUT

AEP - ROCKPORT, IN

PROJECT NUMBER: 7362192684

SCALE	1" = 1,800'
DATE	9/4/2018
DRAWN BY	TMR
APPROVED BY	KDR

FIG. 1

wood.

2456 Fortune Drive, Suite 100
Lexington, Kentucky 40509
Phone: (859) 255-3308

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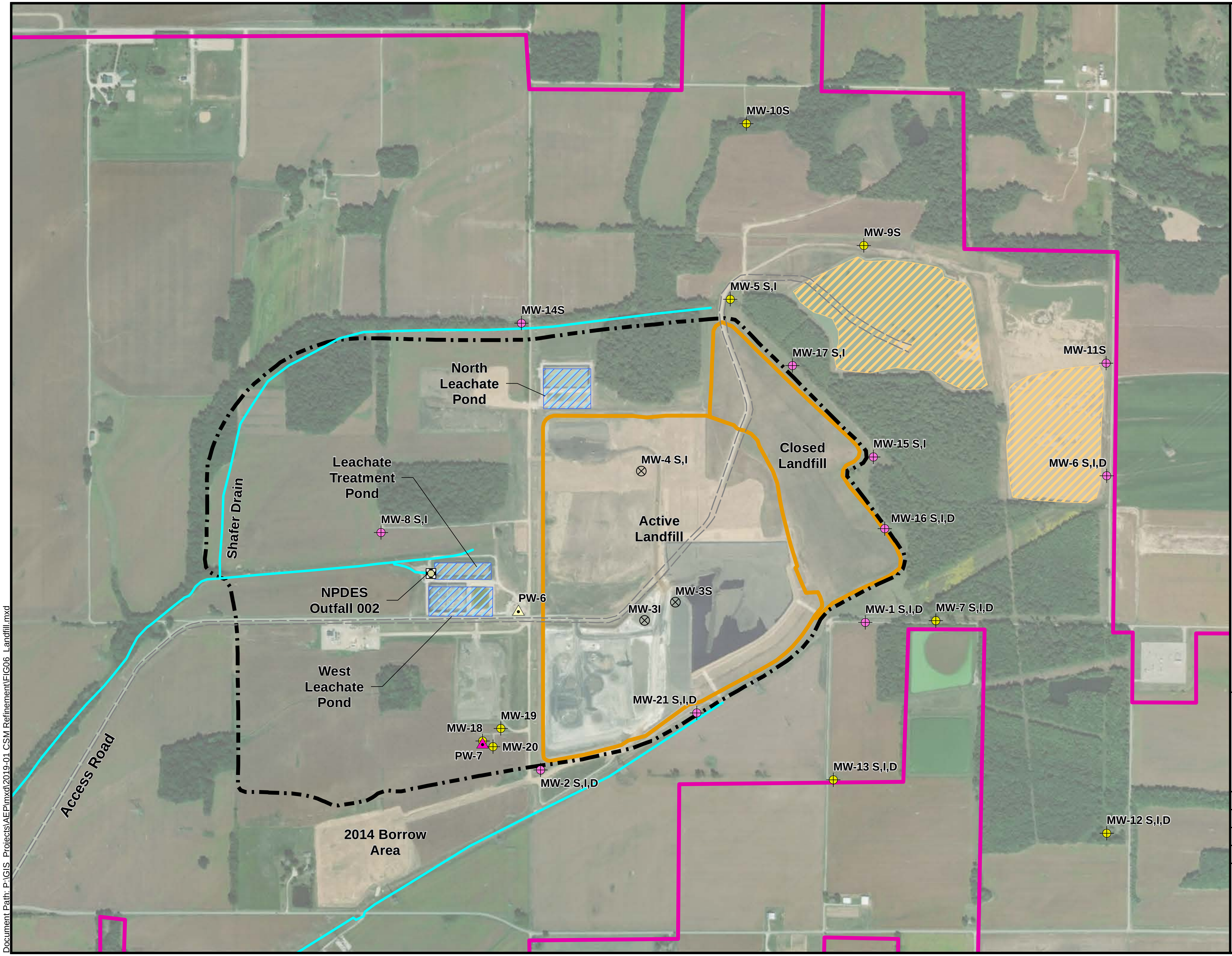

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Legend

- ⊕ Landfill - Monitoring Well
- ⊕ Landfill - CCR Monitoring Well
- ▲ Landfill - Augmentation Water Supply Well
- △ Landfill - Dust Control Water Supply Well
- ⊗ Abandoned Monitoring Well
- ⊠ NPDES Outfall 002
- – – Access Road
- — Drains / Ditches
- ▨ Stormwater Ponds
- ▨ Landfill Leachate Ponds
- ☐ Property Boundary
- ☐ 1984 Landfill Permit Boundary (Area 1)
- ☐ Landfill Area 1A (Active and Closed)

Data Sources

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Source: USGS Rockport and Lewisport (IN/KY) Topographic Quadrangle Maps, 1964, photorevised 1982

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SCALE IN FEET

LANDFILL LAYOUT

AEP - ROCKPORT, IN

PROJECT NUMBER: 7362192684

SCALE	1" = 800'	FIG. 2
DATE	3/6/2019	
DRAWN BY	TMR	
APPROVED BY	KDR	

wood.

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Lexington, Kentucky 40509
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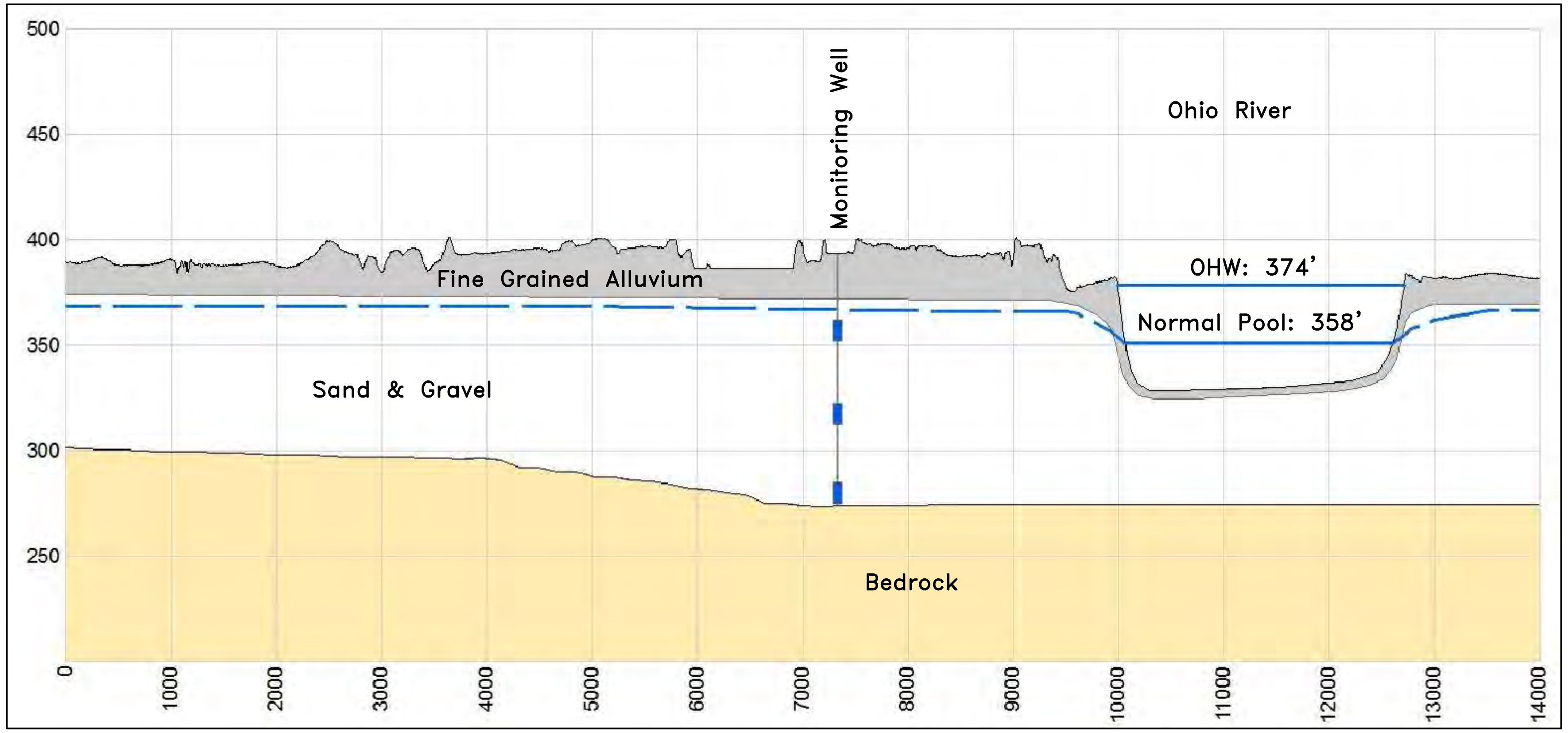
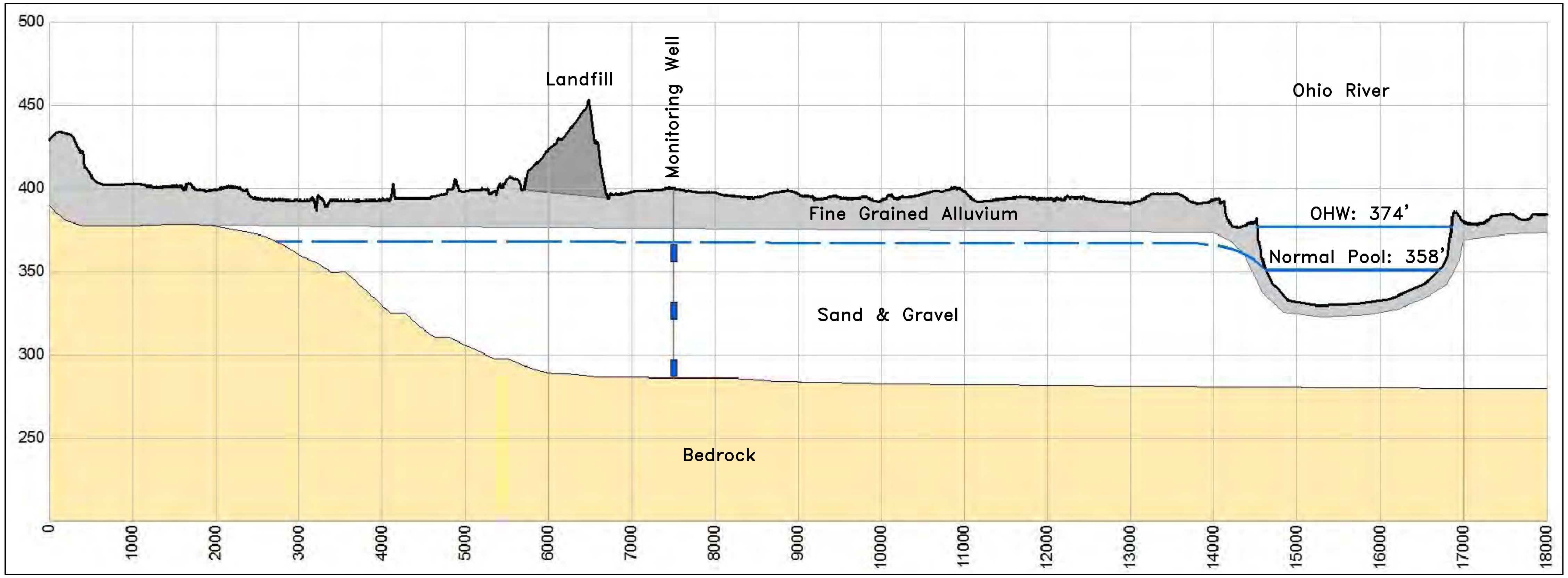




SCALE: As Shown
VERTICAL EXAGGERATION: 4X

2456 Fortune Drive, Suite 100
Lexington, KY 40509
Phone: (859) 255-3308

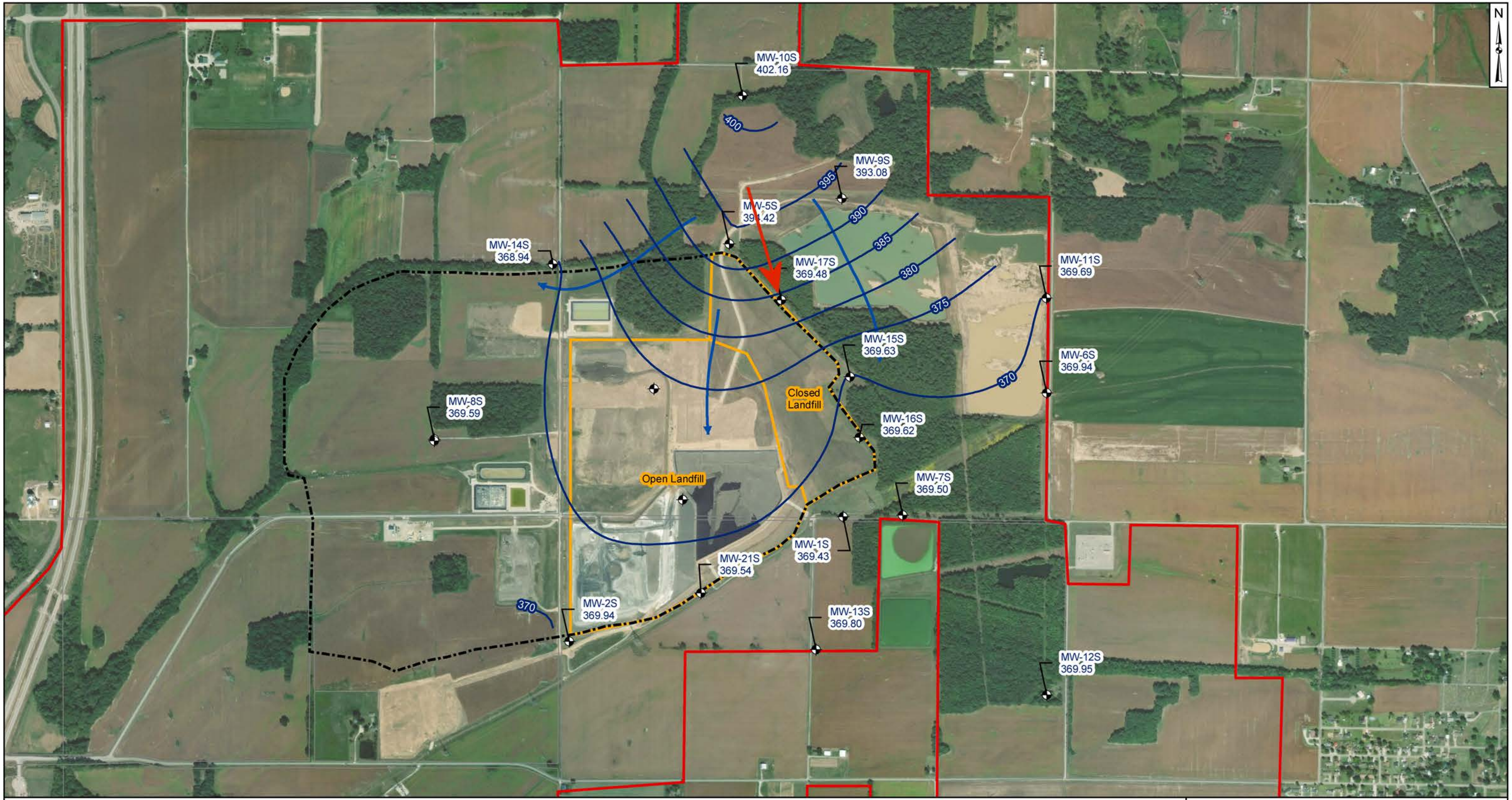
BOTTOM ASH PONDS
AEP - ROCKPORT, INDIANA

GENERALIZED CROSS-SECTIONS

PROJECT NUMBER: 7362192684

SCALE	As Shown
DATE	9/28/2017
DRAWN BY	TMR
APPROVED BY	ALD

FIG
3



Legend

- Groundwater Monitoring Well
- Groundwater Elevation Contour
- Approximate Groundwater Flow Direction
- Property Boundary
- Parcel Boundaries
- 1984 Landfill Permit Boundary (Area 1)
- Landfill Area 1A (Active and Closed)

Notes

- Monitoring well coordinates and water level data (collected on June 4, 2018) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (AMEC, 2016) provided by AEP.
- Property and parcel boundaries taken from Spencer County Assessor.
- The water level from the shallowest screen interval in each well cluster was used in groundwater contouring.
- Groundwater elevation units are feet above mean sea level.

Aprroximate Groundwater Flow Direction

Potentiometric Surface Contours - Uppermost Aquifer June 2018

AEP-Rockport Power Plant - CCR Landfill
Rockport, Indiana

Geosyntec consultants

Columbus, Ohio

2018/11/19

Figure

4

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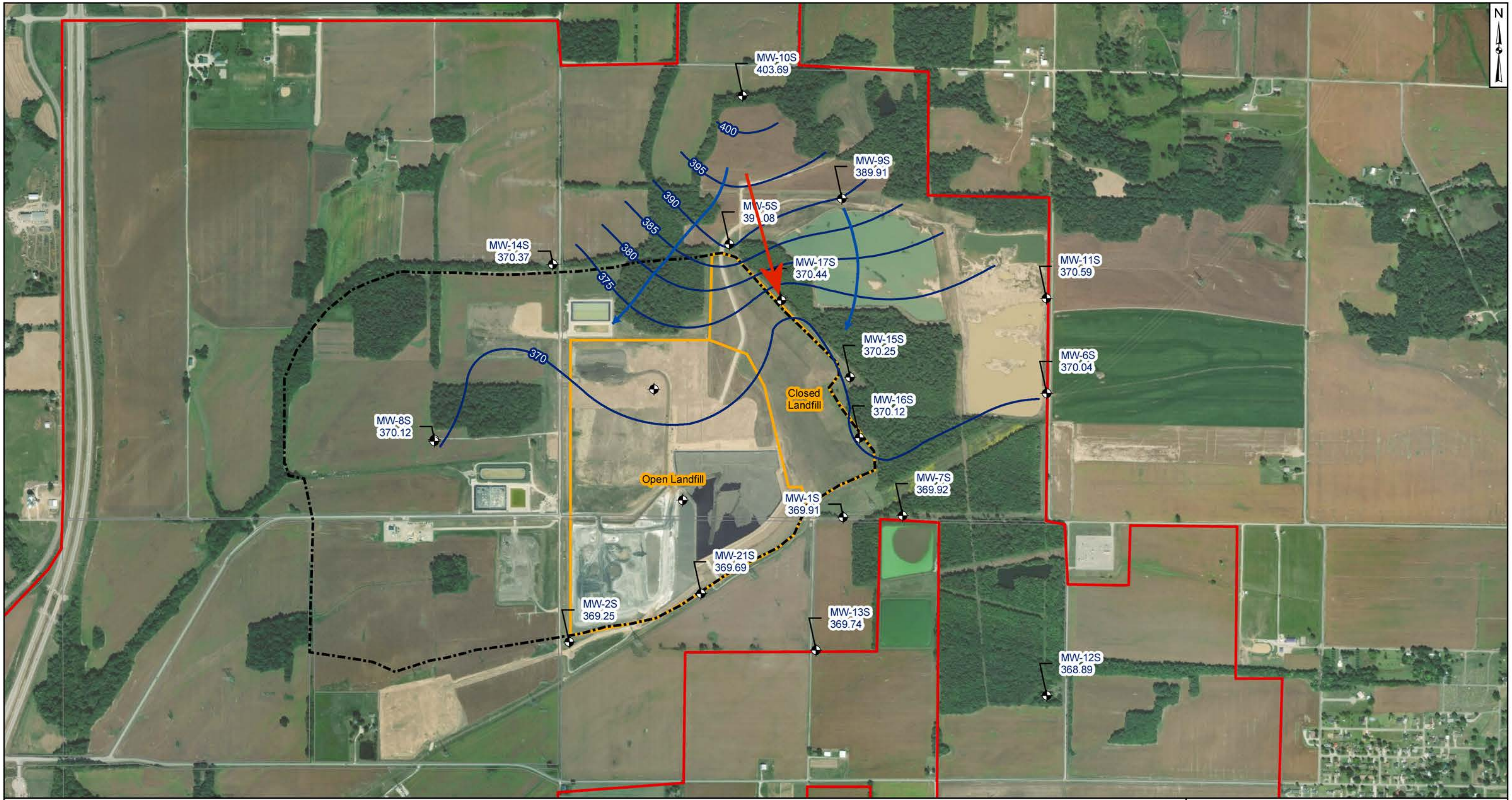

Legend

- ⯐ Groundwater Monitoring Well
- — Groundwater Elevation Contour
- → Approximate Groundwater Flow Direction
- 🟥 Property Boundary
- ☐ Parcel Boundaries
- ⬚ 1984 Landfill Permit Boundary (Area 1)
- 🟧 Landfill Area 1A (Active and Closed)

Notes

- Monitoring well coordinates and water level data (collected on August 13, 2018) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (AMEC, 2016) provided by AEP.
- Property and parcel boundaries taken from Spencer County Assessor.
- The water level from the shallowest screen interval in each well cluster was used in groundwater contouring.
- Groundwater elevation units are feet above mean sea level.

1,000 500 0 1,000
Feet

→ **Aprroximate Groundwater Flow Direction**

Potentiometric Surface Contours - Uppermost Aquifer August 2018

AEP-Rockport Power Plant - CCR Landfill
Rockport, Indiana

Geosyntec consultants

Columbus, Ohio
2018/11/26

Figure
5

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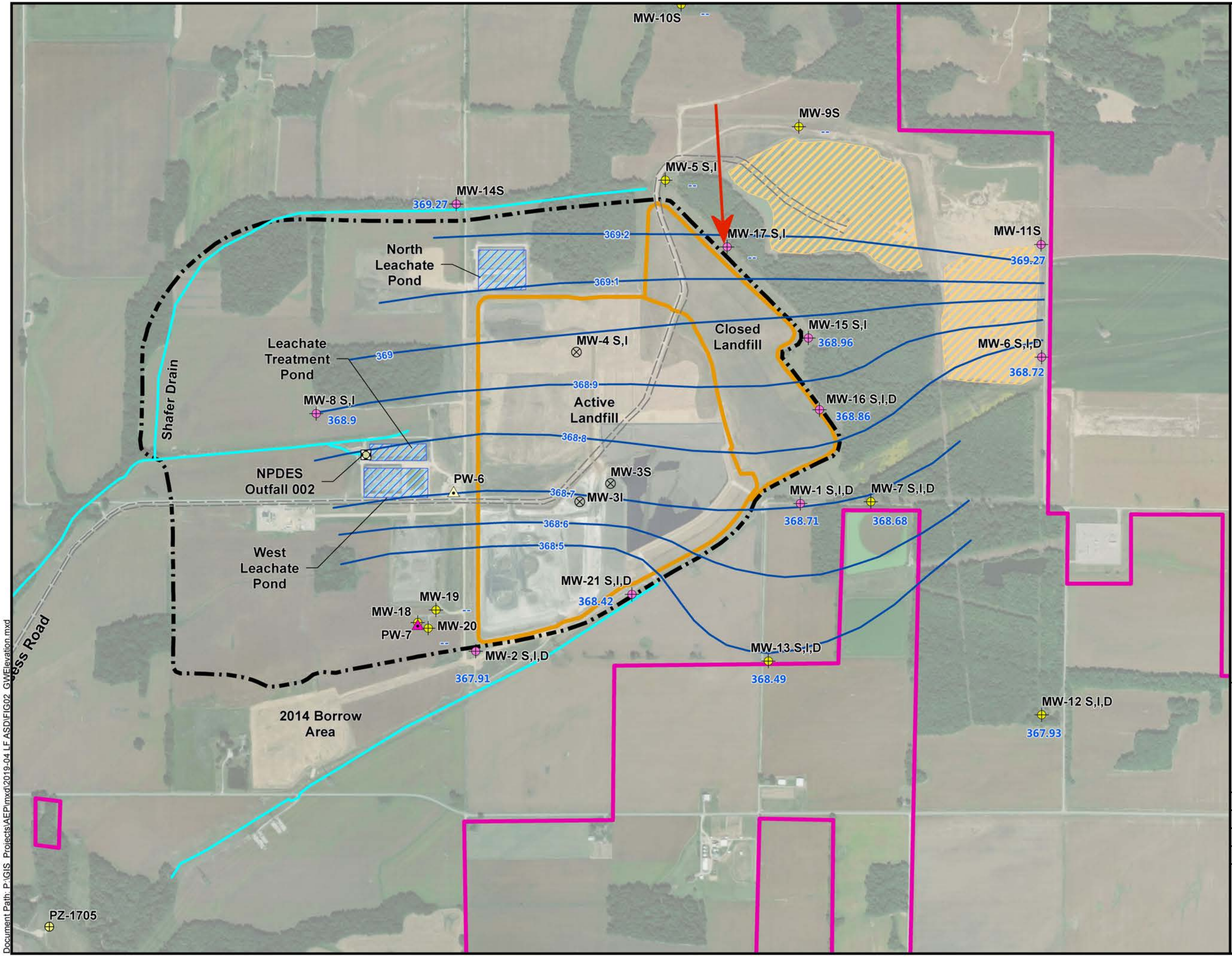

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Legend

- ⊕ Piezometer
- ⊕ Landfill - Monitoring Well
- ⊕ Landfill - CCR Monitoring Well
- ▲ Landfill - Augmentation Water Supply Well
- △ Landfill - Dust Control Water Supply Well
- ⊗ Abandoned Monitoring Well
- ⊠ NPDES Outfall 002

Date

- — 2018-11-12
- -- Access Road
- — Drains / Ditches
- ▨ Stormwater Ponds
- ▨ Landfill Leachate Ponds
- ☐ Property Boundary
- ☐ 1984 Landfill Permit Boundary (Area 1)
- ☐ Landfill Area 1A (Active and Closed)

↘ **Aproximate Groundwater Flow Direction**

Data Sources

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Source: USGS Rockport and Lewisport (IN/KY) Topographic Quadrangle Maps, 1964, photorevised 1982

0 400 800
SCALE IN FEET

POTENTIOMETRIC SURFACE CONTOURS 12 NOVEMBER 2018

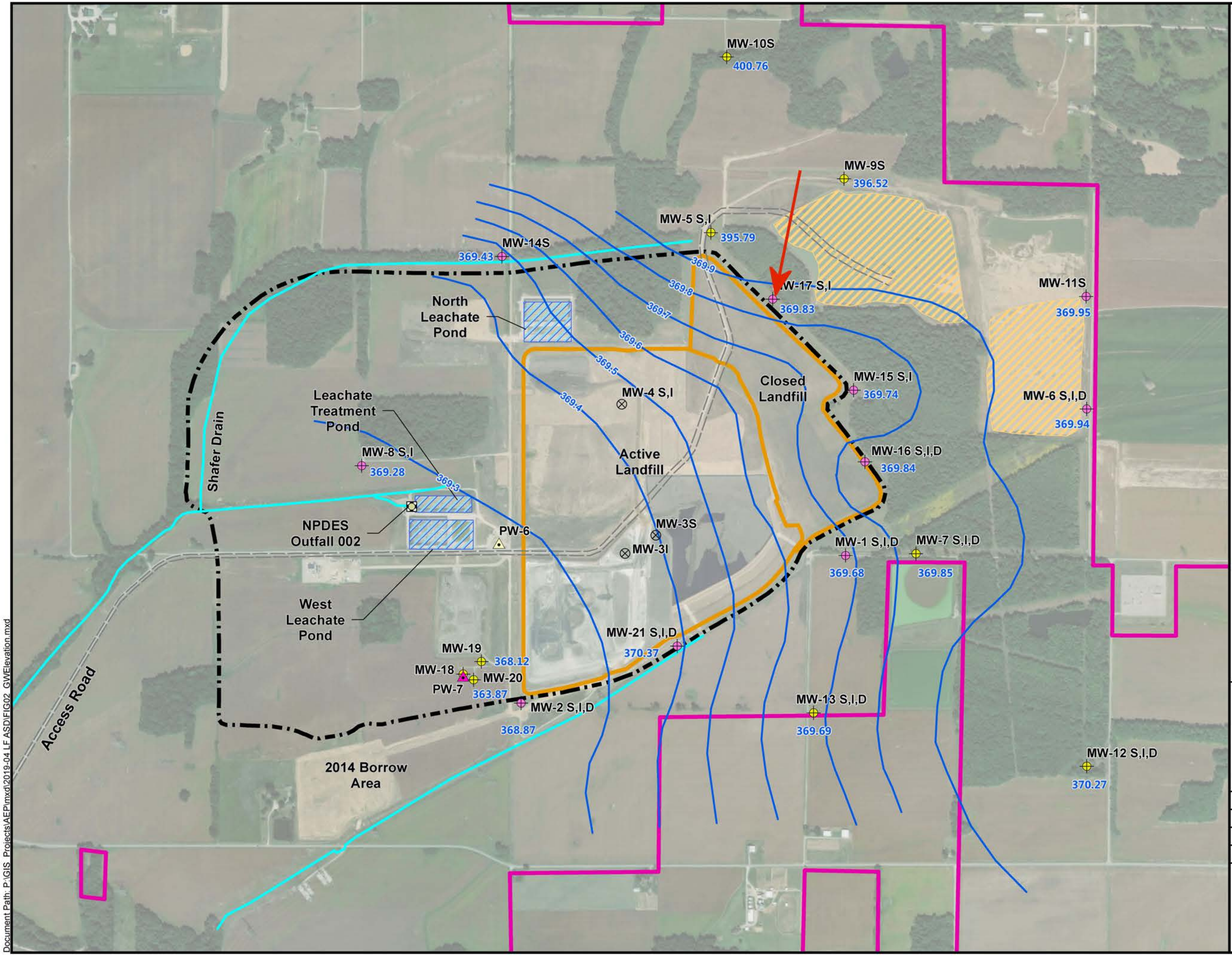
AEP - ROCKPORT, IN

PROJECT NUMBER: 7362182624

SCALE	1" = 800'	FIG. 6
DATE	4/26/2019	
DRAWN BY	TMR	
APPROVED BY	KDR	

wood.

2456 Fortune Drive, Suite 100
Lexington, Kentucky 40509
Phone: (859) 255-3308



Legend

- Landfill - Monitoring Well
- Landfill - CCR Monitoring Well
- ▲ Landfill - Augmentation Water Supply Well
- △ Landfill - Dust Control Water Supply Well
- ⊗ Abandoned Monitoring Well
- ☒ NPDES Outfall 002
- GW_Elev_LF
- Access Road
- Drains / Ditches
- ▨ Stormwater Ponds
- ▨ Landfill Leachate Ponds
- ☐ Property Boundary
- ☐ 1984 Landfill Permit Boundary (Area
- ☐ Landfill Area 1A (Active and Closed)

Arroximate Groundwater Flow Direction

Data Sources

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Source: USGS Rockport and Lewisport (IN/KY) Topographic Quadrangle Maps, 1964, photorevised 1982

0 400 800
SCALE IN FEET

POTENTIOMETRIC SURFACE CONTOURS 11 FEBRUARY 2019

AEP - ROCKPORT, IN

PROJECT NUMBER: 7362182624

SCALE	1" = 800'	FIG. 7
DATE	4/9/2019	
DRAWN BY	TMR	
APPROVED BY	KDR	

wood.

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Appendices

Appendix A
Analytical Data Tables

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-1S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/9/2016	7/19/2016	9/20/2016	11/16/2016	1/11/2017	3/8/2017	5/9/2017	7/18/2017	10/4/2017	1/3/2018	6/6/2018	8/16/2018	11/14/2018	2/13/2019	4/1/2019
Field Parameters																		
Elevation	ft NGVD	--	--	369.45	369.29	368.81	368.29	367.61	367.69	367.66	368.33	368.01	366.11	369.43	369.91	368.71	369.68	370.56
pH	S.U.	--	7.09 - 8.14	8.14	7.2	7.09	7.34	7.4	7.1	7.19	7.26	7.08	7.64	7.48	7.3	7.48	7.46	7.35
Specific Conductance	µmhos/cm	--	--	687	612	703	657	470	300	567	536	635	686	590	658	535	530	892
Turbidity	NTU	--	--	0.23	1.5	0.34	0.65	1	2	0.63	0.78	0.4	1.31	1.12	0	0.56	0.8	1.15
Dissolved Oxygen	mg/L	--	--	3.37	4	2.82	3.46	5	4	2.48	2.72	3	3.06	0.61	4.59	2.3	1.1	1.09
Temperature	°C	--	--	15.04	18.9	19.09	15.17	14.8	15.7	16.81	15.81	15.63	12.81	16.23	15.38	14.7	14.9	14.6
ORP	mV	--	--	89.2	111	77.1	52.9	105	46	53.7	16.2	43.8	-20.8	-76.5	302	100.5	172	126.4
Laboratory Parameters																		
Antimony	µg/L	6	--	0.03	0.2	0.02	0.02	0.04	0.04	0.05	0.02	--	--	--	--	0.05	--	--
Arsenic	µg/L	10	--	0.43	0.69	0.38	0.38	0.43	0.76	0.5	0.39	--	--	--	--	0.34	--	--
Barium	µg/L	2000	--	18.5	21.9	17.2	17.9	17.7	36.5	22.3	17.3	--	--	--	--	17.8	--	--
Beryllium	µg/L	4	--	<0.01	0.16	<0.005	<0.005	<0.005	0.023	0.01	<0.004	--	--	--	--	0.03	--	--
Cadmium	µg/L	5	--	0.02	0.22	0.005	0.007	0.02	0.09	0.22	0.01	--	--	--	--	<0.01	--	--
Chromium	µg/L	100	--	0.3	0.7	0.3	0.207	0.72	1.38	0.552	0.255	--	--	--	--	0.25	--	--
Cobalt	µg/L	6	--	0.171	0.398	0.014	0.01	0.052	1.21	0.164	0.02	--	--	--	--	<0.02	--	--
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.15	0.74	--	0.09	--	1.3	--	--
Lead	µg/L	15	--	0.204	0.572	0.01	0.022	0.076	1.26	0.526	0.033	--	--	--	--	0.12	--	--
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	--	--	--	--
Molybdnum	µg/L	100	--	0.65	0.8	0.68	0.74	0.59	0.97	1.64	0.64	--	--	--	--	0.6	--	--
Selenium	µg/L	50	--	1.1	1.1	0.9	0.9	1	1.1	1.1	1.2	--	--	--	--	0.8	--	--
Thallium	µg/L	2	--	<0.02	0.168	<0.01	<0.01	<0.01	0.03	<0.01	<0.01	--	--	--	--	<0.1	--	--
Zinc	µg/L	--	--	--	--	--	--	--	--	--	2	4.5	--	0.7	--	2	--	--
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	19.5	19.7	22.4	--	19.5	--	19.7	--	--
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	5.55	4.29	--	3.8	--	1	--	--
Boron	mg/L	--	0.048	0.037	0.015	0.022	0.02	0.005	0.03	0.031	0.028	0.044	--	0.046	--	0.04	--	--
Calcium	mg/L	--	(79.5) 79	70.7	62.9	68	74.4	65	71.5	72.6	69.2	67.6	--	71.8	--	71.9	--	--
Lithium	mg/L	0.04	--	0.004	0.024	0.002	0.01	0.008	0.01	0.009	0.0007	--	--	--	--	0.03	--	--
Magnesium	mg/L	--	--	--	--	--	--	--	27.3	26.9	26.9	25.6	--	26.8	--	26.8	--	--
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.0015	--	--	0.0027	--	0.0022	--	--
Potassium	mg/L	--	--	--	--	--	--	--	1.32	1.24	1.16	1.15	--	1.19	--	1.16	--	--
Sodium	mg/L	--	--	--	--	--	--	--	40.6	35.2	39.6	36.1	--	31.2	--	35	--	--
Strontium	mg/L	--	--	--	--	--	--	--	0.11	0.12	0.105	0.104	--	0.11	--	0.108	--	--
Alkalinity	mg/L	--	--	--	--	--	--	--	278	273	271	269	--	250	--	273	--	--
Bromide	mg/L	--	--	--	--	--	--	--	0.086	0.108	0.104	0.109	--	0.106	--	0.1	--	--
Chloride	mg/L	--	(29.6) 33	29.6	31.1	31.4	31.9	32	30.7	31.3	30.4	33.1	39.9	34.9	37.3	38.1	40.4	38.5
Fluoride	mg/L	4	0.677	0.59	0.65	0.6	0.54	0.57	0.59	0.63	0.58	0.57	--	0.61	--	0.63	--	--
TDS	mg/L	--	(412.7) 419	392	392	411	398	392	384	402	406	396	--	386	--	410	--	--
Sulfate	mg/L	--	(36.95) 37	33.7	35.5	32.4	30.7	30.7	30.5	33.3	33.6	34.6	--	34.2	--	32.3	--	--
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	--	<0.4	--	<0.07	--	--
Radium-228	pCi/L	--	--	-0.185	0.445	0.244	-0.00464	0.447	-0.172	-0.122	0.133	--	--	--	--	-0.0731	--	--
Radium-226	pCi/L	--	--	0.0665	0.374	-0.00261	0.296	0.487	0.0407	0.0324	0.176	--	--	--	--	0.108	--	--
Radium-226/228	pCi/L	5	--	-0.1185	0.819	0.24139	0.29136	0.934	-0.1313	-0.0896	0.309	--	--	--	--	0.108	--	--
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.28	--	--	0.4	--	1.65	--	--
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2	--	--	9	--	1	--	--
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	1	--	--	0.8	--	6.24	--	--
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	<0.0004	<0.0004	0.049	0.014	--	<0.002	--	0.035	--	--
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	<0.0001	0.0002	<0.0001	0.0002	--	<0.0002	--	0.0026	--	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-1I

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/9/2016	7/19/2016	9/20/2016	11/16/2016	1/11/2017	3/8/2017	5/9/2017	7/18/2017	10/4/2017	6/6/2018	8/16/2018	11/14/2018	2/13/2019	4/1/2019
Field Parameters																	
Elevation	ft NGVD	--	--	369.42	369.25	368.8	368.24	367.58	367.63	367.62	368.28	367.25	369.39	397.45	368.74	369.73	370.51
pH	S.U.	--	6.43 - 7.90	6.7	7	7.4	7.09	7.6	7.4	7.24	6.89	7.1	7.5	7.31	7.75	7.5	7.37
Specific Conductance	µmhos/cm	--	--	461	479	570	544	370	500	443	402	424	480	533	425	443	802
Turbidity	NTU	--	--	0.9	0.7	0.24	0.35	1	1	0.6	0.36	1	0.32	0	0.61	1	1.06
Dissolved Oxygen	mg/L	--	--	0.4	0.3	1.07	0	0.3	1	0.46	27.63	0.5	0.87	0.22	0.19	2	1.28
Temperature	°C	--	--	17.5	18.2	16.99	14.53	14.4	15.7	15.44	16.52	16.4	16.25	16.03	14.68	14.7	14.6
ORP	mV	--	--	-21	205	-2.1	4.4	10	36	-26.2	-118.8	-23	-102.2	253	62.9	155	134.2
Laboratory Parameters																	
Antimony	µg/L	6	--	0.04	0.04	0.01	0.02	0.02	0.01	0.04	0.02	--	--	--	<0.02	--	--
Arsenic	µg/L	10	--	0.86	0.78	0.92	0.8	0.82	0.69	0.89	0.86	--	--	--	0.82	--	--
Barium	µg/L	2000	--	85.5	86.1	84.9	93.4	90.5	76.7	85	94.3	--	--	--	85.6	--	--
Beryllium	µg/L	4	--	<0.005	<0.005	<0.005	<0.005	0.005	<0.005	<0.004	<0.004	--	--	--	<0.02	--	--
Cadmium	µg/L	5	--	0.08	0.1	0.02	0.02	0.02	0.05	0.01	0.007	--		--	0.02	--	--
Chromium	µg/L	100	--	0.2	1	0.2	0.051	0.39	0.686	0.155	0.112	--	--	--	<0.04	--	--
Cobalt	µg/L	6	--	0.341	0.364	0.401	0.381	0.424	0.054	0.558	0.569	--	--	--	0.48	--	--
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.12	0.2	0.48	--	0.22	--	--
Lead	µg/L	15	--	0.851	1.25	0.156	0.059	0.099	0.427	0.068	0.137	--	--	--	0.07	--	--
Mercury	µg/L	2	--	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	--	--	--
Molybdnum	µg/L	100	--	2.47	2.85	2.89	3.27	3.33	1.82	2.87	2.85	--	--	--	2.96	--	--
Selenium	µg/L	50	--	<0.03	0.04	<0.03	<0.03	<0.03	0.04	<0.03	<0.03	--	--	--	<0.03	--	--
Thallium	µg/L	2	--	0.03	0.02	0.02	0.03	0.104	0.03	0.02	0.02	--	--	--	<0.1	--	--
Zinc	µg/L	--	--	--	--	--	--	--	--	--	2	1	4.2	--	1	--	--
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	18.5	18.9	20.7	17.8	--	18.2	--	--
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	1	2	2.96	--	3	--	--
Boron	mg/L	--	0.093	0.075	0.014	0.018	0.015	0.004	0.045	0.049	0.047	0.018	0.11	0.056	0.05	--	--
Calcium	mg/L	--	(79.5) 71	67.4	60	64.5	63.9	60.9	66.9	65.7	64.8	68.1	66.4	--	65.5	--	--
Lithium	mg/L	0.04	--	0.005	0.022	0.007	0.005	0.005	0.006	0.008	0.0005	--	--	--	0.03	--	--
Magnesium	mg/L	--	--	--	--	--	--	--	20.8	21.2	20.6	21.5	21	--	20.6	--	--
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.599	--	0.316	--	0.515	--	--
Potassium	mg/L	--	--	--	--	--	--	--	1.34	1.08	0.98	0.92	1.31	--	0.97	--	--
Sodium	mg/L	--	--	--	--	--	--	--	19.8	19.5	19.1	19.2	18.1	--	18.5	--	--
Strontium	mg/L	--	--	--	--	--	--	--	0.0934	0.0926	0.086	0.0911	0.093	--	0.0882	--	--
Alkalinity	mg/L	--	--	--	--	--	--	--	222	225	226	222	230	--	227	--	--
Bromide	mg/L	--	--	--	--	--	--	--	0.061	0.087	0.081	0.072	0.081	--	0.08	--	--
Chloride	mg/L	--	(29.6) 27.4	24.9	24.8	24.3	24.1	24.4	24.1	26.5	26.5	27.5	28.6	--	28.8	30.1	34.1
Fluoride	mg/L	4	0.428	0.37	0.4	0.37	0.31	0.33	0.35	0.38	0.34	0.37	0.42	--	0.41	--	--
TDS	mg/L	--	(412.7) 349	323	315	331	334	316	300	323	330	327	321	--	308	--	--
Sulfate	mg/L	--	(47.8) 48	44.3	46.7	42.4	40.7	41.4	41.2	43.8	43.3	44.1	42	--	40.7	--	--
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	<0.4	--	<0.07	--	--
Radium-228	pCi/L	--	--	0.0603	0.105	1.42	0.662	0.108	-0.0752	0.3	2.21	--	--	--	0.415	--	--
Radium-226	pCi/L	--	--	0.33	1.57	0.276	0.65	0.513	0.15	0.33	0.323	--	--	--	0.288	--	--
Radium-226/228	pCi/L	5	--	0.3903	1.675	1.696	1.312	0.621	0.0748	0.63	2.533	--	--	--	0.703	--	--
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.37	--	0.4	--	0.12	--	--
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2.3	--	1	--	0.9	--	--
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2.51	--	1	--	<1	--	--
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	0.03	<0.0004	0.035	0.048	0.011	--	0.053	--	--
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	0.583	0.1	0.455	0.445	0.303	--	0.508	--	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-1D

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/8/2016	7/19/2016	9/20/2016	11/16/2016	1/11/2017	3/8/2017	5/9/2017	7/18/2017	10/4/2017	1/3/2018	6/7/2018	8/16/2018	11/14/2018	2/13/2019
Field Parameters																	
Elevation	ft NGVD	--	--	369.6	369.43	368.97	368.42	367.75	367.81	367.81	368.34	367.44	366.27	369.56	369.94	368.73	369.71
pH	S.U.	--	6.74 - 8.16	7.6	7.1	7.36	7.5	7.4	7.33	7.25	8.06	7.3	7.68	8.24	7.35	7.77	7.41
Specific Conductance	µmhos/cm	--	--	496	471	464	842	400	558	394	525	448	539	508	568	457	317
Turbidity	NTU	--	--	8.8	2	6.27	4	5	1.93	2.15	2.47	2	3.89	1.71	0	1.03	2
Dissolved Oxygen	mg/L	--	--	0.5	0.2	0.55	0.8	2	0.25	0.53	0.81	0.4	1.83	0.25	0.26	0.2	10
Temperature	°C	--	--	19.4	16.7	15.77	14.8	14.7	15.14	15.84	21.46	16.5	6.7	15.85	16.71	14.06	14
ORP	mV	--	--	63	220	92.8	252	182	49.6	132.7	152.8	-14	-5.3	-112	200	53	188
Laboratory Parameters																	
Antimony	µg/L	6	--	0.05	0.03	0.03	0.03	0.03	0.02	0.02	0.02	--	--	--	--	0.03	--
Arsenic	µg/L	10	--	1.29	0.73	1.07	0.65	0.77	0.58	0.75	0.59	--	--	--	--	0.62	--
Barium	µg/L	2000	--	255	147	160	147	162	139	142	139	--	--	--	--	101	--
Beryllium	µg/L	4	--	0.01	<0.005	0.007	<0.005	<0.005	<0.005	0.006	<0.004	--	--	--	--	<0.02	--
Cadmium	µg/L	5	--	0.13	0.07	0.04	0.04	0.15	0.04	0.04	0.05	--		--	--	0.02	--
Chromium	µg/L	100	--	0.3	1.5	0.3	0.072	0.439	0.687	0.174	0.131	--	--	--	--	0.07	--
Cobalt	µg/L	6	--	3.64	0.373	0.836	0.329	0.577	0.173	0.44	0.212	--	--	--	--	0.04	--
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.93	1.02	--	0.55	--	0.75	--
Lead	µg/L	15	--	1.13	1.37	0.5	0.222	0.807	1.92	0.419	0.355	--	--	--	--	0.07	--
Mercury	µg/L	2	--	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	--	--	--
Molybdnum	µg/L	100	--	3.44	3.59	3.6	3.24	2.43	3.4	3.05	2.94	--	--	--	--	2	--
Selenium	µg/L	50	--	0.07	0.03	0.07	0.03	0.03	0.03	0.06	<0.03	--	--	--	--	0.04	--
Thallium	µg/L	2	--	0.04	0.02	0.056	0.02	0.05	0.03	0.04	0.03	--	--	--	--	<0.1	--
Zinc	µg/L	--	--	--	--	--	--	--	--	--	4.5	4.5	--	2	--	1	--
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	18.9	19.4	21.3	--	17.9	--	19	--
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	8.08	14.6	--	16.1	--	<1	--
Boron	mg/L	--	0.066	0.017	0.015	0.016	0.018	0.006	0.055	0.046	0.019	0.002	--	0.103	0.02	0.1	<0.02
Calcium	mg/L	--	(79.5) 75	63.6	57.9	65.2	69.3	63.4	70	67.8	63.9	65.7	--	70.9	--	71.9	--
Lithium	mg/L	0.04	--	<0.0002	0.017	0.0005	0.004	0.007	0.007	0.009	0.002	--	--	--	--	0.01	--
Magnesium	mg/L	--	--	--	--	--	--	--	21.9	22.2	20.7	20.9	--	20.4	--	22.1	--
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.511	--	--	0.216	--	0.138	--
Potassium	mg/L	--	--	--	--	--	--	--	1.13	1.13	0.89	0.89	--	1.34	--	1.71	--
Sodium	mg/L	--	--	--	--	--	--	--	19.4	19.3	18.8	18	--	18.2	--	20.9	--
Strontium	mg/L	--	--	--	--	--	--	--	0.0985	0.101	0.0885	0.092	--	0.359	--	0.272	--
Alkalinity	mg/L	--	--	--	--	--	--	--	206	202	206	220	--	218	--	222	--
Bromide	mg/L	--	--	--	--	--	--	--	0.09	0.115	0.109	0.03	--	0.113	--	0.1	--
Chloride	mg/L	--	(29.6) 50	27.3	29.8	29.8	39.3	40.6	40.3	40.9	39.3	10.3	--	43.1	43.8	46.9	43.8
Fluoride	mg/L	4	0.321	0.28	0.3	0.28	0.29	0.26	0.26	0.28	0.24	0.85	0.31	0.3	--	0.3	--
TDS	mg/L	--	(412.7) 369	331	329	288	339	323	330	342	338	339	--	345	--	340	--
Sulfate	mg/L	--	(45.1) 45	40.2	40.6	32.3	33.6	36.4	37	39.5	39.6	10.4	--	39.5	--	39.8	--
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	--	<0.4	--	<0.07	--
Radium-228	pCi/L	--	--	0.558	0.06	0.525	0.566	0.315	0.0844	0.511	0.444	--	--	--	--	0.295	--
Radium-226	pCi/L	--	--	0.526	0.135	0.932	6.73	0.334	0.154	0.213	0.502	--	--	--	--	0.0679	--
Radium-226/228	pCi/L	5	--	1.084	0.195	1.457	7.296	0.649	0.2384	0.724	0.946	--	--	--	--	0.3629	--
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.58	--	--	0.98	--	0.78	--
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	4.2	--	--	11.8	--	2	--
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2	--	--	2	--	5.05	--
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	<0.0004	<0.0004	0.052	0.012	--	<0.002	--	0.02	--
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	0.553	0.62	0.486	0.616	--	0.0605	--	0.144	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-2S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/9/2016	7/20/2016	9/21/2016	11/17/2016	1/11/2017	3/9/2017	5/9/2017	7/19/2017	10/4/2017	6/6/2018	11/13/2018	2/13/2019	4/1/2019
Field Parameters																
Elevation	ft NGVD	--	--	369.34	369.03	369.02	368.77	366.24	368.15	368.06	368.22	366.68	369.94	367.91	368.87	369.97
pH	S.U.	--	6.30 - 8.44	6.4	7.68	7.63	7.34	7.65	7.66	7.12	7.46	7.17	7.62	7.53	7.77	7.72
Specific Conductance	µmhos/cm	--	--	423	465	440	459	341	522	354	409	509	470	425	451	491
Turbidity	NTU	--	--	3.1	1.85	0.51	0.96	0.74	1.31	2.68	4.81	1.55	1.84	2.15	0.8	1.51
Dissolved Oxygen	mg/L	--	--	2.8	1.85	4.67	3.91	4.18	3.63	4.52	2.62	2.63	4.66	3.7	3.1	4.7
Temperature	°C	--	--	17.5	16.34	15.81	16.03	15.1	15.73	15.67	16.06	16.42	16.48	14.51	14.6	14.5
ORP	mV	--	--	34	64	90.4	-19	165	13.1	165.7	-5.9	26.6	59.1	23	71	-17.9
Laboratory Parameters																
Antimony	µg/L	6	--	<0.02	0.02	0.04	0.02	0.02	0.02	0.04	0.12	--	--	0.04	--	--
Arsenic	µg/L	10	--	0.97	1.09	0.94	0.94	0.92	0.95	0.95	0.96	--	--	0.82	--	--
Barium	µg/L	2000	--	16	14	12.4	12.4	11	12.3	12.3	13.6	--	--	16.5	--	--
Beryllium	µg/L	4	--	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.004	<0.004	--	--	<0.02	--	--
Cadmium	µg/L	5	--	0.01	0.01	0.02	0.02	0.09	0.009	0.01	0.03	--		0.11		
Chromium	µg/L	100	--	0.4	0.6	0.3	0.337	0.329	0.67	0.37	0.41	--	--	0.1	--	--
Cobalt	µg/L	6	--	0.177	0.09	0.017	0.019	0.014	0.051	0.064	0.121	--	--	<0.02	--	--
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.33	0.2	1.58	0.28	--	--
Lead	µg/L	15	--	0.158	0.105	0.101	0.022	0.063	0.042	0.047	0.243	--	--	0.04	--	--
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	--	--
Molybdnum	µg/L	100	--	2.03	2.39	2.07	1.91	2.14	1.92	1.75	1.81	--	--	2	--	--
Selenium	µg/L	50	--	0.3	0.3	0.2	0.3	0.4	0.3	0.2	0.3	--	--	0.2	--	--
Thallium	µg/L	2	--	<0.02	<0.01	<0.01	<0.01	0.074	<0.01	<0.01	0.03	--	--	<0.1	--	--
Zinc	µg/L	--	--	--	--	--	--	--	--	--	2	3.3	5.3	89.4	--	--
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	28.6	28.8	31.9	26.7	26.8	--	--
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	36.6	14.7	15.3	7.27	--	--
Boron	mg/L	--	0.109	<0.002	0.015	0.014	0.018	0.004	0.069	0.084	0.052	0.045	0.073	0.06	--	--
Calcium	mg/L	--	(79.5) 66	59.4	51.6	57.4	62.4	51.6	57.9	59	53.3	60.7	57	54.7	--	--
Lithium	mg/L	0.04	--	0.0004	0.018	0.005	0.008	0.009	0.0007	0.002	0.005	--	--	<0.009	--	--
Magnesium	mg/L	--	--	--	--	--	--	--	21.2	21.9	19.5	22.8	21.3	20.9	--	--
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.0124	--	0.0063	0.0025	--	--
Potassium	mg/L	--	--	--	--	--	--	--	0.73	0.81	0.65	0.64	0.68	0.68	--	--
Sodium	mg/L	--	--	--	--	--	--	--	13.4	14	11.8	16.3	22.1	23.7	--	--
Strontium	mg/L	--	--	--	--	--	--	--	0.0837	0.0855	0.0756	0.0888	0.0906	0.086	--	--
Alkalinity	mg/L	--	--	--	--	--	--	--	174	191	188	207	215	207	--	--
Bromide	mg/L	--	--	--	--	--	--	--	0.02	0.071	0.116	0.06	0.063	<0.04	--	--
Chloride	mg/L	--	(29.6) 24	21.5	21.8	23.8	21.8	21.2	21	20.8	19.6	21.2	25.3	24.8	26.5	26.1
Fluoride	mg/L	4	0.299	0.26	0.29	0.26	0.26	0.25	0.26	0.26	0.23	0.25	0.29	0.28	--	--
TDS	mg/L	--	(412.7) 343	298	265	301	316	284	285	321	308	323	329	272	--	--
Sulfate	mg/L	--	(35.08) 35	26	27.6	26.2	24.1	25.9	26.6	30.3	33.8	30	28.9	24.7	--	--
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	<0.4	<0.1	--	--
Radium-228	pCi/L	--	--	-0.035	0.54	0	0.228	0.343	0.0555	-0.0726	0.631	--	--	0.146	--	--
Radium-226	pCi/L	--	--		0.12	0.172	0.143	0.311	0.465	0.434	0.0617	--	--	0.0173	--	--
Radium-226/228	pCi/L	5	--	-0.035	0.66	0.172	0.371	0.654	0.5205	0.3614	0.6927	--	--	0.1633	--	--
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.28	--	0.27	1.84	--	--
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2	--	0.6	5	--	--
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2	--	2	1	--	--
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	<0.0004	<0.0004	0.053	0.013	<0.002	0.003	--	--
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	0.0001	<0.0001	<0.0001	0.0021	0.0003	0.0005	--	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-2I

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/9/2016	7/20/2016	9/21/2016	11/17/2016	1/11/2017	3/8/2017	5/9/2017	7/19/2017	10/4/2017	1/3/2018	6/6/2018	8/16/2018	11/13/2018	2/13/2019
Field Parameters																	
Elevation	ft NGVD	--	--	369.26	368.97	368.94	368.7	366.31	368.06	368.01	368.16	366.64	365.54	369.85	369.32	367.97	368.87
pH	S.U.	--	6.43 - 8.69	7.89	7.14	7.45	7.26	7.7	7.64	8.42	6.98	7.16	7.84	7.55	7.52	7.2	7.55
Specific Conductance	µmhos/cm	--	--	581	542	513	495	370	557	383	431	553	568	802	614	434	435
Turbidity	NTU	--	--	2.02	1.41	0.94	1.83	3.99	16	24.3	6.25	10.3	1.3	0.91	0	17.03	2.8
Dissolved Oxygen	mg/L	--	--	1.54	7.64	1.96	3.62	--	10.86	1.97	22.85	0.71	1.12	1.1	0.06	0.13	10
Temperature	°C	--	--	15.88	15.93	17.11	15.97	14.38	14.74	15.42	16.34	15.68	11.06	15.3	16.03	14.25	14.3
ORP	mV	--	--	65.9	29.8	-29.6	-11.6	161.9	-52.8	156.9	-180.6	-63.4	-51.8	-55.4	-46	36.8	-17
Laboratory Parameters																	
Antimony	µg/L	6	--	0.06	0.06	0.07	0.13	0.1	0.1	0.15	0.11	--	--	--	--	0.02	--
Arsenic	µg/L	10	--	0.64	0.68	0.55	0.61	0.65	0.74	0.9	0.76	--	--	--	--	0.49	--
Barium	µg/L	2000	--	78.5	84	67.1	60.1	59.4	58.4	59.3	62.9	--	--	--	--	95	--
Beryllium	µg/L	4	--	<0.005	0.006	<0.005	<0.005	<0.005	0.01	0.022	0.02	--	--	--	--	<0.02	--
Cadmium	µg/L	5	--	0.03	0.05	0.05	0.07	0.16	0.22	0.09	0.05	--		--	--	0.04	--
Chromium	µg/L	100	--	0.2	0.6	0.1	0.143	0.154	1.01	0.829	0.567	--	--	--	--	0.327	--
Cobalt	µg/L	6	--	0.606	0.76	0.415	0.26	0.28	0.581	1.28	0.995	--	--	--	--	0.492	--
Copper	µg/L	--	--	--	--	--	--	--	--	--	2.21	1.82	--	0.2	--	1.52	--
Lead	µg/L	15	--	0.208	0.454	0.178	0.231	0.383	0.588	1.39	1.19	--	--	--	--	0.467	--
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	<0.002	--	--	--	--	--	--
Molybdnum	µg/L	100	--	4.91	5	4.21	3.14	2.07	2.06	2.17	2.07	--	--	--	--	2	--
Selenium	µg/L	50	--	0.7	0.7	0.6	0.4	0.2	0.2	0.4	0.2	--	--	--	--	0.2	--
Thallium	µg/L	2	--	0.051	0.04	0.04	0.02	0.03	0.03	0.04	0.064	--	--	--	--	<0.1	--
Zinc	µg/L	--	--	--	--	--	--	--	--	--	4.4	3.4	--	20.8	--	35.2	--
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	16.3	16.8	18.9	--	16.3	--	16.9	--
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	315	244	--	9.39	--	91.9	--
Boron	mg/L	--	0.043	0.019	0.009	0.025	0.013	<0.002	0.024	0.034	0.025	0.03	--	0.052	0.03	0.05	<0.02
Calcium	mg/L	--	(79.5) 78	74	67.5	66.8	73.9	63.9	71.5	71	68.9	72.5	--	72.7	--	64.8	--
Lithium	mg/L	0.04	--	0.005	0.021	0.002	0.006	0.007	0.005	0.007	<0.0002	--	--	--	--	<0.009	--
Magnesium	mg/L	--	--	--	--	--	--	--	22.8	23.6	22.8	23.7	--	23.7	--	21.2	--
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.463	--	--	0.564	--	0.576	--
Potassium	mg/L	--	--	--	--	--	--	--	1.09	1.2	1.01	1.05	--	1.14	--	0.89	--
Sodium	mg/L	--	--	--	--	--	--	--	14.7	15.3	15.8	16.8	--	16.9	--	15.3	--
Strontium	mg/L	--	--	--	--	--	--	--	0.0919	0.0977	0.0885	0.0946	--	0.0959	--	0.0864	--
Alkalinity	mg/L	--	--	--	--	--	--	--	223	218	236	252	--	254	--	247	--
Bromide	mg/L	--	--	--	--	--	--	--	0.05	0.071	0.072	0.075	--	0.077	--	0.06	--
Chloride	mg/L	--	(29.6) 32	28.6	29.7	28	25.8	27.1	25.8	28.6	29.7	29.8	28.8	31.8	31.5	27.9	31.5
Fluoride	mg/L	4	0.371	0.3	0.33	0.31	0.36	0.3	0.31	0.31	0.28	0.28	--	0.32	--	0.32	--
TDS	mg/L	--	(412.7) 375	332	363	330	326	314	312	343	346	343	--	356	--	308	--
Sulfate	mg/L	--	(48.53) 49	42.9	54.7	41.1	36.9	39.2	39.2	42.4	44.1	45.5	--	43.2	--	39	--
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	--	<0.4	--	<0.1	--
Radium-228	pCi/L	--	--	-0.0463	0.62	0.241	0.137	0.648	0.146	0.163	0.195	--	--	--	--	0.291	--
Radium-226	pCi/L	--	--	0.398	0.342	0.267	0.288	0.197	0.289	0.328	0.341	--	--	--	--	0.258	--
Radium-226/228	pCi/L	5	--	0.3517	0.962	0.508	0.425	0.845	0.435	0.491	0.536	--	--	--	--	0.549	--
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.28	--	--	1.96	--	0.2	--
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2.3	--	--	21.7	--	2	--
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2	--	--	154	--	<1	--
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	0.053	0.016	0.03	0.054	--	0.238	--	0.037	--
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	0.258	0.331	0.333	0.323	--	0.563	--	0.565	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-2D

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/9/2016	7/20/2016	9/21/2016	11/17/2016	1/11/2017	3/8/2017	5/9/2017	7/19/2017	10/4/2017	6/7/2018	8/16/2018	11/12/2018	2/13/2019
Field Parameters																
Elevation	ft NGVD	--	--	369.22	368.96	368.9	368.68	366.41	368.04	367.96	367.95	366.6	369.84	369.25	367.91	368.89
pH	S.U.	--	6.45 -8.63	7.86	7.47	7.29	7.1	7.4	7.39	7.3	8.51	7.24	7.55	7.33	7.36	7.32
Specific Conductance	µmhos/cm	--	--	586	524	551	516	386	568	388	516	428	460	830	464	391
Turbidity	NTU	--	--	2.31	3.15	3.5	0.79	3.45	2.67	2.32	1.72	1.82	5.05	0	5.4	2.1
Dissolved Oxygen	mg/L	--	--	0.45	0.31	1.77	0.31	5.47	0.79	0.87	0.45	0.84	6.83	0.74	0.86	0.37
Temperature	°C	--	--	15.8	15.79	19.32	15.58	14.22	14.45	15.65	16.06	15.71	15.35	17.83	14.61	13.7
ORP	mV	--	--	-2.7	-168.3	45	-0.7	206.9	-87.3	143.6	-24.8	-41	32.3	-24	-25.4	-164
Laboratory Parameters																
Antimony	µg/L	6	--	0.03	0.06	0.02	0.02	0.03	0.03	0.04	0.02	--	--	--	0.03	--
Arsenic	µg/L	10	--	0.78	0.82	0.81	0.61	0.62	0.59	0.65	0.62	--	--	--	0.58	--
Barium	µg/L	2000	--	185	195	180	172	157	160	159	169	--	--	--	190	--
Beryllium	µg/L	4	--	<0.005	0.006	0.007	<0.005	<0.005	<0.005	<0.004	<0.004	--	--	--	<0.02	--
Cadmium	µg/L	5	--	0.12	0.12	0.07	0.1	0.26	0.09	0.08	0.08	--		--	0.17	--
Chromium	µg/L	100	--	0.2	0.4	0.3	0.05	0.277	0.562	0.188	0.162	--	--	--	0.2	--
Cobalt	µg/L	6	--	0.473	0.439	0.425	0.212	0.327	0.252	0.335	0.353	--	--	--	0.5	--
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.16	1.96	2.09	--	0.22	--
Lead	µg/L	15	--	0.648	0.359	0.247	0.021	0.378	0.045	0.144	0.075	--	--	--	0.14	--
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	--	--
Molybdnum	µg/L	100	--	2.11	2.16	1.97	2.09	1.8	2.13	1.9	1.89	--	--	--	2	--
Selenium	µg/L	50	--	<0.03	<0.03	0.05	0.09	0.08	0.03	0.06	0.04	--	--	--	<0.03	--
Thallium	µg/L	2	--	0.02	0.02	0.03	0.01	0.02	0.02	0.02	0.02	--	--	--	<0.1	--
Zinc	µg/L	--	--	--	--	--	--	--	--	--	1	6	3.5	--	0.9	--
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	17.5	17.9	20.5	17.4	--	17.8	--
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	17.5	20.7	70.5	--	15.4	--
Boron	mg/L	--	0.074	<0.002	0.01	0.013	0.014	<0.002	0.03	0.027	0.073	0.041	0.076	0.038	0.07	--
Calcium	mg/L	--	(79.5) 81	75.6	65.8	66.7	73.9	64.2	74.2	70.8	64.7	67.7	78.6	--	72.4	--
Lithium	mg/L	0.04	--	0.002	0.018	0.002	0.007	0.007	0.008	0.011	0.0006	--	--	--	<0.009	--
Magnesium	mg/L	--	--	--	--	--	--	--	24.3	23.9	21.9	22.6	26.4	--	24.5	--
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.657	--	0.943	--	0.717	--
Potassium	mg/L	--	--	--	--	--	--	--	1.17	1.21	1.32	1.1	1.28	--	0.99	--
Sodium	mg/L	--	--	--	--	--	--	--	17.3	16.9	16	15.8	16.4	--	14.8	--
Strontium	mg/L	--	--	--	--	--	--	--	0.104	0.104	0.0894	0.0952	0.111	--	0.102	--
Alkalinity	mg/L	--	--	--	--	--	--	--	249	248	261	248	263	--	247	--
Bromide	mg/L	--	--	--	--	--	--	--	0.06	0.079	0.156	0.083	0.073	--	<0.04	--
Chloride	mg/L	--	(29.6) 25	24.2	24.2	22.8	22.2	22.3	21.7	23.1	23	22.4	43.1	93.0 ?	51.3	40.9
Fluoride	mg/L	4	0.222	0.19	0.21	0.2	0.19	0.19	0.2	0.21	0.18	0.2	0.22	--	0.2	--
TDS	mg/L	--	(412.7) 358	341	339	338	327	318	318	343	340	332	361	--	348	--
Sulfate	mg/L	--	(46.44) 46	42.1	44.2	39.6	35.4	38.3	37.6	40.5	40.5	42.3	39.8	--	36.1	--
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	<0.4	--	<0.1	--
Radium-228	pCi/L	--	--	0.0495	0.195	0.451	0.473	0.506	1.11	0.0264	0.257	--	--	--	0.0387	--
Radium-226	pCi/L	--	--	-0.0267	0.133	-0.00345	1.77	0.772	0.185	0.429	0.115	--	--	--	0.245	--
Radium-226/228	pCi/L	5	--	0.0228	0.328	0.44755	2.243	1.278	1.295	0.4554	0.372	--	--	--	0.2837	--
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.11	--	0.12	--	0.11	--
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.8	--	0.5	--	1	--
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2.14	--	2.75	--	<1	--
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	<0.0004	<0.0004	0.055	0.017	0.005	--	0.007	--
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	0.565	0.602	0.662	0.619	0.621	--	0.702	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-6S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	7/18/2016	9/20/2016	11/16/2016	1/10/2017	3/8/2017	5/8/2017	7/18/2017	10/3/2017	6/5/2018	8/15/2018	9/26/2018	11/1/2018	11/14/2018	12/12/2018
Field Parameters																	
Elevation	ft NGVD	--	--	369.59	368.99	368.14	367.39	367.54	367.81	368.48	367.6	369.94	370.04	368.35	368.89	368.72	368.4
pH	S.U.	--	7.9	7.5	7.4	8.1	7.9	7.9	7.6	7.7	7.3	7.52	7.7	7.9	7.31	7.91	7.46
Specific Conductance	µmhos/cm	--	--	401	430	741	360	300	441	292	347	330	483	321	430	221	464
Turbidity	NTU	--	--	1	0.5	1	2	1	1	1	1	0.47	0	8	0.51	0.4	0.53
Dissolved Oxygen	mg/L	--	--	7.1	5.7	1	6	5	5	7	7	5.82	8.1	5.1	7.53	5.5	4.42
Temperature	°C	--	--	16.8	19	15	14.8	14.7	15.5	15.2	16.4	16.28	16	15.5	15.04	14.4	14.71
ORP	mV	--	--	53	71	258	146	36	49	74	0.3	-9.3	155	133	115.3	126	196
Laboratory Parameters																	
Antimony	µg/L	6	--	0.03	0.03	0.03	0.03	0.03	0.03	0.02	--	--	0.03	0.03	0.02	0.03	0.03
Arsenic	µg/L	10	--	0.26	0.26	0.26	0.28	0.26	0.28	0.27	--	--	0.25	0.25	0.23	0.23	0.24
Barium	µg/L	2000	--	13.6	13.6	14.1	14.8	15.8	15.4	14.3	--	--	14.8	13.5	12.1	11.8	13.4
Beryllium	µg/L	4	--	0.005	<0.005	<0.005	<0.005	<0.005	<0.004	<0.004	--	--	<0.004	<0.02	<0.02	<0.02	<0.02
Cadmium	µg/L	5	--	0.25	0.02	0.02	0.008	0.05	0.009	0.04	--	--	0.06	0.04	0.01	<0.01	<0.01
Chromium	µg/L	100	--	0.4	0.3	0.2	0.599	1.37	0.583	0.291	--	--	0.42	0.265	0.221	0.218	0.212
Cobalt	µg/L	6	--	0.052	0.019	0.027	0.045	0.049	0.061	0.026	--	--	0.039	<0.02	<0.02	<0.02	<0.02
Copper	µg/L	--	--	--	--	--	--	--	--	0.37	0.31	0.46	0.42	0.29	0.17	0.18	0.26
Lead	µg/L	15	--	0.074	0.034	0.05	0.032	0.113	0.083	0.056	--	--	0.247	0.03	<0.02	0.02	<0.02
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	--	--	--	-----
Molybdnum	µg/L	100	--	3.28	3.34	2.8	2.93	3.29	2.73	4.36	--	--	2.22	2.37	2.38	2.18	2.2
Selenium	µg/L	50	--	0.3	0.2	0.3	0.4	0.7	0.8	0.4	--	--	0.4	0.2	0.2	0.2	0.4
Thallium	µg/L	2	--	0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	--	--	0.01	<0.1	<0.1	<0.1	<0.1
Zinc	µg/L	--	--	--	--	--	--	--	--	1	0.5	2.5	1	0.7	<0.7	1	2
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	14.4	14.6	16.9	15.4	15.2	16.8	15.3	15.2	15.9
Aluminum	µg/L	--	--	--	--	--	--	--	--	8.57	17.8	10.4	13.8	3	2	5.28	3
Boron	mg/L	--	0.012	0.014	0.012	0.028	0.006	0.032	0.051	0.078	0.094	0.09	0.101	0.08	0.04	0.04	0.102
Calcium	mg/L	--	46.1	46.3	44.4	50.8	47.8	53.2	50.3	47	44.8	45.2	52.8	44.1	42.3	38.8	46.8
Lithium	mg/L	0.04	--	0.015	0.004	0.006	0.014	0.009	0.011	<0.0002	--	--	0.005	0.02	<0.009	0.01	<0.009
Magnesium	mg/L	--	--	--	--	--	--	23.3	23.5	20.9	19.8	19.3	24	18.8	19.3	17.5	20.8
Manganese	mg/L	--	--	--	--	--	--	--	--	0.0007	--	0.0024	0.0021	<0.0002	0.0007	0.0002	0.0003
Potassium	mg/L	--	--	--	--	--	--	0.7	0.75	0.82	0.78	0.57	0.91	0.71	0.5	0.92	0.86
Sodium	mg/L	--	--	--	--	--	--	38.9	34.9	26.3	23.2	15.6	25.6	26.1	22	20.2	23.3
Strontium	mg/L	--	--	--	--	--	--	0.0661	0.067	0.0574	0.0548	0.0555	0.065	0.051	0.0519	0.0524	0.0595
Alkalinity	mg/L	--	--	--	--	--	--	260	272	241	249	237	267	241	230	242	247
Bromide	mg/L	--	--	--	--	--	--	<0.02	0.072	<0.05	0.04	0.03	0.04	<0.04	<0.04	<0.04	<0.04
Chloride	mg/L	--	8.44	8.35	6.04	7.04	7.03	3.32	8.68	4.88	3.28	2.38	11.9	6.83	3.52	3.91	6.48
Fluoride	mg/L	4	0.73	0.79	0.73	0.69	0.65	0.25	0.69	0.57	0.71	0.89	0.81	0.84	0.86	0.88	0.88
TDS	mg/L	--	294	290	266	279	287	296	305	274	261	225	277	261	225	196	240
Sulfate	mg/L	--	18.8	18.3	10.9	14.3	14	6.9	17.5	9.6	7.5	3.8	15.6	9.8	4.9	5.2	10
Sulfide	mg/L	--	--	--	--	--	--	--	--	<0.4	--	<0.4	<0.4	<0.1	<0.1	<0.07	<0.07
Radium-228	pCi/L	--	--	0.101	0.798	-0.249	0.501	0.297	-0.337	0.954	--	--	0.328	0.367	0.354	0.387	-0.368
Radium-226	pCi/L	--	--	0	0.0671	0.202	0.0815	-0.00471	0.12	-0.0229	--	--	0.0553	0.089	0.0398	0.0239	0.0533
Radium-226/228	pCi/L	5	--	0.101	0.8651	-0.047	0.5825	0.29229	-0.217	0.954	--	--	0.3833	0.456	0.3938	0.4109	0.0533
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	1.85	--	0.4	2.17	1.86	0.14	0.53	0.17
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	2.2	--	0.9	3.1	3	0.7	<0.7	2
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	4.34	--	1	2.51	109	1	2	8.1
Iron (Dissolved)	mg/L	--	--	--	--	--	--	<0.0004	<0.0004	<0.0004	0.023	<0.002	0.003	0.163	<0.003	0.005	0.01
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	<0.0001	<0.0001	0.0002	0.0007	0.0015	<0.0002	0.0121	0.0003	<0.0002	0.0007

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-7S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	9/26/2018	10/30/2018	11/14/2018	12/12/2018
Field Parameters							
Elevation	ft NGVD	--	--	369.5	368.76	368.68	368.47
pH	S.U.	--	7.4	7.4	7.33	7.31	7.3
Specific Conductance	µmhos/cm	--	--	417	611	455	629
Turbidity	NTU	--	--	106	104	42.6	44
Dissolved Oxygen	mg/L	--	--	0.4	0.32	0.7	0.23
Temperature	°C	--	--	15.4	15.01	13.9	14.43
ORP	mV	--	--	106	85.4	48.2	92
Laboratory Parameters							
Antimony	µg/L	6	--	0.14	0.15	0.06	0.09
Arsenic	µg/L	10	--	1.48	2.01	0.7	1.06
Barium	µg/L	2000	--	18.7	24.3	12.9	15.4
Beryllium	µg/L	4	--	0.101	0.127	0.05	0.07
Cadmium	µg/L	5	--	0.05	0.06	0.02	0.05
Chromium	µg/L	100	--	2.08	2.45	0.831	1.48
Cobalt	µg/L	6	--	6.48	9.82	3.47	4.98
Copper	µg/L	--	--	4.4	5.36	1.91	2.76
Lead	µg/L	15	--	4.69	6.69	2.38	3.56
Mercury	µg/L	2	--	--	--	--	--
Molybdnum	µg/L	100	--	<0.4	<0.4	<0.4	<0.4
Selenium	µg/L	50	--	0.6	0.8	0.3	0.4
Thallium	µg/L	2	--	<0.1	<0.1	<0.1	<0.1
Zinc	µg/L	--	--	7.9	9.5	14	5
Silica (Dissolved)	mg/L	--	--	20.8	18.7	18.6	19.3
Aluminum	µg/L	--	--	1520	1850	681	1170
Boron	mg/L	--	0.079	0.04	0.07	0.135	0.08
Calcium	mg/L	--	70.2	73.7	68.3	66.2	67.1
Lithium	mg/L	0.04	--	0.02	0.01	<0.009	<0.009
Magnesium	mg/L	--	--	25.4	25.7	24.3	24.6
Manganese	mg/L	--	--	0.334	0.49	0.182	0.248
Potassium	mg/L	--	--	1.33	1.39	1.81	1.3
Sodium	mg/L	--	--	17.9	19.1	18.9	18.7
Strontium	mg/L	--	--	0.083	0.0857	0.0883	0.0874
Alkalinity	mg/L	--	--	256	261	255	261
Bromide	mg/L	--	--	0.09	0.09	0.09	0.09
Chloride	mg/L	--	32.8	32.2	33.5	33.2	33.6
Fluoride	mg/L	4	0.52	0.54	0.53	0.54	0.55
TDS	mg/L	--	358	370	358	354	353
Sulfate	mg/L	--	32	32.2	33.1	33.1	33.7
Sulfide	mg/L	--	--	<0.1	<0.1	<00.07	<0.07
Radium-228	pCi/L	--	--	0.48	0.601	0.254	0.191
Radium-226	pCi/L	--	--	0.271	0.245	0.211	0.507
Radium-226/228	pCi/L	5	--	0.751	0.846	0.465	0.698
Copper (Dissolved)	µg/L	--	--	1.01	0.07	1.62	0.2
Zinc (Dissolved)	µg/L	--	--	2	<0.7	3	<0.7
Aluminum (Dissolved)	µg/L	--	--	311	3	2	3
Iron (Dissolved)	mg/L	--	--	0.618	0.004	0.005	0.007
Manganese (Dissolved)	mg/L	--	--	0.0797	0.0021	0.0012	0.0026

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-7I

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	9/26/2018	10/30/2018	11/15/2018	12/12/2018
Field Parameters							Sentinel
Elevation	ft NGVD	--	--	369.01	368.51	368.5	368.27
pH	S.U.	--	7.4	7.5	7.3	7.03	7.27
Specific Conductance	µmhos/cm	--	--	419	613	460	645
Turbidity	NTU	--	--	19	14.4	7.05	19.9
Dissolved Oxygen	mg/L	--	--	0.3	0.36	0.95	0.21
Temperature	°C	--	--	15.5	15.17	13.78	14.46
ORP	mV	--	--	57	-19.2	68.4	44
Laboratory Parameters							
Antimony	µg/L	6	--	0.02	0.03	<0.02	<0.02
Arsenic	µg/L	10	--	0.28	0.43	0.24	0.26
Barium	µg/L	2000	--	175	230	162	147
Beryllium	µg/L	4	--	<0.02	<0.02	<0.02	<0.02
Cadmium	µg/L	5	--	0.05	0.06	0.03	0.03
Chromium	µg/L	100	--	0.2	0.315	0.09	0.07
Cobalt	µg/L	6	--	3.07	8.34	1.11	1.67
Copper	µg/L	--	--	0.55	1.45	0.59	0.76
Lead	µg/L	15	--	0.45	0.6	0.05	0.145
Mercury	µg/L	2	--	--	--	--	--
Molybdnum	µg/L	100	--	4.2	4.31	<0.4	3.45
Selenium	µg/L	50	--	0.05	0.09	0.05	0.05
Thallium	µg/L	2	--	<0.1	0.1	<0.1	<0.1
Zinc	µg/L	--	--	2	15.1	1	2
Silica (Dissolved)	mg/L	--	--	20.5	18.1	18.5	18.8
Aluminum	µg/L	--	--	74.1	304	69.9	39.5
Boron	mg/L	--	0.07	0.04	0.06	0.09	0.08
Calcium	mg/L	--	75.3	75.4	68.8	68.8	73.7
Lithium	mg/L	0.04	--	0.01	<0.009	<0.009	<0.009
Magnesium	mg/L	--	--	21.9	21.7	21.4	22.8
Manganese	mg/L	--	--	2.76	4	1.08	2.89
Potassium	mg/L	--	--	1.22	0.97	1.57	1.19
Sodium	mg/L	--	--	19.8	20.1	21.5	21.3
Strontium	mg/L	--	--	0.0928	0.0932	0.1	0.103
Alkalinity	mg/L	--	--	236	237	233	229
Bromide	mg/L	--	--	0.1	0.1	0.1	0.1
Chloride	mg/L	--	45	45.8	48.2	47.6	48.8
Fluoride	mg/L	4	0.33	0.34	0.34	0.35	0.35
TDS	mg/L	--	312	348	338	354	347
Sulfate	mg/L	--	38.4	38.9	38.9	39	39.1
Sulfide	mg/L	--	--	<0.1	<0.1	<0.07	<0.07
Radium-228	pCi/L	--	--	-0.0705	0.369	0.123	0.089
Radium-226	pCi/L	--	--	4.16	0.513	0.605	0.934
Radium-226/228	pCi/L	5	--	4.16	0.882	0.728	1.023
Copper (Dissolved)	µg/L	--	--	0.93	0.24	1.56	0.72
Zinc (Dissolved)	µg/L	--	--	2	0.9	3	2
Aluminum (Dissolved)	µg/L	--	--	1	10.6	2	137
Iron (Dissolved)	mg/L	--	--	<0.003	0.01	0.006	0.128
Manganese (Dissolved)	mg/L	--	--	0.172	0.51	0.243	3.9

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-7D

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	9/26/2018	10/31/2018	11/15/2018	12/12/2018
Field Parameters							Sentinel
Elevation	ft NGVD	--	--	369.08	368.65	368.57	368.35
pH	S.U.	--	7.2	7.5	6.91	7.26	7.18
Specific Conductance	µmhos/cm	--	--	419	617	444	622
Turbidity	NTU	--	--	10.8	1.02	5.96	0
Dissolved Oxygen	mg/L	--	--	0.7	3.72	11.3	0.52
Temperature	°C	--	--	15.2	14.79	13.32	15.23
ORP	mV	--	--	57	26.4	26.4	-5
Laboratory Parameters							
Antimony	µg/L	6	--	0.04	0.03	0.04	0.06
Arsenic	µg/L	10	--	0.91	0.8	0.87	0.85
Barium	µg/L	2000	--	286	283	268	320
Beryllium	µg/L	4	--	<0.02	<0.02	<0.02	<0.02
Cadmium	µg/L	5	--	0.02	0.02	0.04	<0.01
Chromium	µg/L	100	--	0.2	0.334	0.1	0.1
Cobalt	µg/L	6	--	2.52	2.46	2.24	2.24
Copper	µg/L	--	--	0.34	0.44	0.57	1.59
Lead	µg/L	15	--	0.1	0.164	0.101	0.144
Mercury	µg/L	2	--	--	--	--	--
Molybdnum	µg/L	100	--	4.09	9.76	7.38	5.43
Selenium	µg/L	50	--	0.05	0.05	0.03	<0.03
Thallium	µg/L	2	--	<0.1	<0.1	<0.1	<0.1
Zinc	µg/L	--	--	1	2	4	3
Silica (Dissolved)	mg/L	--	--	216	19.2	19.9	19.8
Aluminum	µg/L	--	--	31.4	56.7	16.5	<1
Boron	mg/L	--	0.06	0.04	0.05	0.07	0.04
Calcium	mg/L	--	80.1	79.2	75	62.8	77.4
Lithium	mg/L	0.04	--	<0.009	0.01	0.02	<0.009
Magnesium	mg/L	--	--	25	25.8	21	25.7
Manganese	mg/L	--	--	1.89	1.66	1.34	1.51
Potassium	mg/L	--	--	1.22	1.07	1.39	1.25
Sodium	mg/L	--	--	14.2	15.4	12.9	15.3
Strontium	mg/L	--	--	0.137	0.141	0.125	0.146
Alkalinity	mg/L	--	--	273	293	296	300
Bromide	mg/L	--	--	0.09	0.08	0.08	0.08
Chloride	mg/L	--	17.3	17.5	17.2	16.9	17.2
Fluoride	mg/L	4	0.27	0.26	0.26	0.26	0.27
TDS	mg/L	--	359	358	3.46	340	344
Sulfate	mg/L	--	36.9	36.3	36	35.4	35.5
Sulfide	mg/L	--	--	<0.1	<0.1	<0.07	<0.07
Radium-228	pCi/L	--	--	0.36	0.202	0.548	0.159
Radium-226	pCi/L	--	--	0.983	0.107	0.45	0.717
Radium-226/228	pCi/L	5	--	1.343	0.309	0.998	0.876
Copper (Dissolved)	µg/L	--	--	0.55	0.17	2.01	0.18
Zinc (Dissolved)	µg/L	--	--	2	2	4	1
Aluminum (Dissolved)	µg/L	--	--	6.36	6.44	2	3
Iron (Dissolved)	mg/L	--	--	0.103	0.081	0.08	0.093
Manganese (Dissolved)	mg/L	--	--	1.76	1.6	1.47	1.35

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-8S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	7/19/2016	9/21/2016	11/17/2016	1/9/2017	3/7/2017	5/9/2017	7/18/2017	10/4/2017	12/12/2017	6/5/2018	11/13/2018
Field Parameters														
Elevation	ft NGVD	--	--	369.78	369.44	369.25	368.53	368.39	368.39	368.81	367.5	366.59	369.59	368.9
pH	S.U.	--	7.3	7.2	7.1	7.9	7.6	7.6	7.4	7.4	7.75	7.7	7.59	7.58
Specific Conductance	µmhos/cm	--	--	516	540	811	450	260	444	410	395	460	400	354
Turbidity	NTU	--	--	1.1	2	2	3	4	8	1	2.46	6	3.48	2.6
Dissolved Oxygen	mg/L	--	--	3.2	3.6	1	2	4	2	3.2	3.12	0.8	2.1	3.8
Temperature	°C	--	--	20.7	21.6	16.2	14	14.2	15.6	15.8	16.57	14.1	15.05	14.4
ORP	mV	--	--	29	18	275	131	50	50	65	29.9	-17	-33.7	158
Laboratory Parameters														
Antimony	µg/L	6	--	0.3	0.02	0.03	0.02	0.04	0.03	0.02	--	--	--	0.05
Arsenic	µg/L	10	--	1.78	1.33	1.26	1.56	1.53	2.09	1.19	--	--	--	1.61
Barium	µg/L	2000	--	13.1	12.2	10.9	13.8	14.5	16.9	10.9	--	--	--	10.4
Beryllium	µg/L	4	--	0.232	<0.005	<0.005	0.006	0.009	0.01	<0.004	--	--	--	<0.02
Cadmium	µg/L	5	--	0.31	0.02	0.05	0.01	0.26	0.09	0.13	--	--		0.03
Chromium	µg/L	100	--	0.6	0.4	0.156	1.04	0.881	0.423	0.277	--	--	--	0.578
Cobalt	µg/L	6	--	0.453	0.125	0.113	0.447	0.433	0.981	0.052	--	--	--	0.207
Copper	µg/L	--	--	--	--	--	--	--	--	0.18	0.12	--	0.25	1.7
Lead	µg/L	15	--	0.364	0.066	0.065	0.19	0.278	0.389	0.038	--	--	--	0.152
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.015	--	--	--	--
Molybdnum	µg/L	100	--	1.1	0.8	0.71	0.77	1.56	0.75	0.83	--	--	--	0.9
Selenium	µg/L	50	--	0.6	0.2	0.2	0.2	0.2	0.3	0.2	--	--	--	0.5
Thallium	µg/L	2	--	0.276	0.03	<0.01	0.01	0.17	<0.01	<0.01	--	--	--	<0.1
Zinc	µg/L	--	--	--	--	--	--	--	--	0.7	0.6	--	1	3
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	21.5	21.2	24.7	--	21.7	21.4
Aluminum	µg/L	--	--	--	--	--	--	--	--	7.37	10.6	--	53	31
Boron	mg/L	--	0.01	0.012	0.011	0.032	<0.002	0.043	0.028	0.022	0.016	--	0.058	0.04
Calcium	mg/L	--	42.7	41.5	42.7	42.9	45.8	44.8	42.9	44.4	39.8	--	42.3	35.6
Lithium	mg/L	0.04	--	0.025	0.001	0.002	0.002	0.006	0.006	0.001	--	--	--	<0.009
Magnesium	mg/L	--	--	--	--	--	--	19.6	20	20	17.6	--	18.8	16
Manganese	mg/L	--	--	--	--	--	--	--	--	0.0021	--	--	0.0323	0.0154
Potassium	mg/L	--	--	--	--	--	--	0.91	0.89	0.77	0.65	--	0.82	0.88
Sodium	mg/L	--	--	--	--	--	--	41.2	40.5	42.1	43.2	--	40.1	34.6
Strontium	mg/L	--	--	--	--	--	--	0.0562	0.0564	0.0543	0.0494	--	0.0555	0.0464
Alkalinity	mg/L	--	--	--	--	--	--	162	181	167	171	--	181	159
Bromide	mg/L	--	--	--	--	--	--	0.03	0.062	0.04	0.06	--	<0.02	<0.04
Chloride	mg/L	--	23.7	23.5	22.1	21.1	20.8	21.4	22.8	22.7	22.4	22.5	23.8	22.9
Fluoride	mg/L	4	0.56	0.56	0.54	0.55	0.47	0.52	0.52	0.47	0.52	0.56	0.59	0.57
TDS	mg/L	--	345	321	332	322	300	320	319	319	317	--	324	288
Sulfate	mg/L	--	26.5	26.4	23.4	21.7	22.1	21.7	21.8	22.3	23.1	24.9	21.2	19.5
Sulfide	mg/L	--	--	--	--	--	--	--	--	<0.4	--	--	<0.4	<0.1
Radium-228	pCi/L	--	--	0.455	1.16	0.343	0.394	0.26	-0.175	1.5	--	--	--	0.346
Radium-226	pCi/L	--	--	0.122	0.131	0.147	0.282	0.0561	0.127	0.153	--	--	--	0.137
Radium-226/228	pCi/L	5	--	0.577	1.291	0.49	0.676	0.3161	-0.048	1.653	--	--	--	0.483
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	0.96	--	--	0.44	0.29
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	2.5	--	--	0.7	2
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	2	--	--	1	1
Iron (Dissolved)	mg/L	--	--	--	--	--	--	<0.004	<0.0004	<0.0004	0.014	--	0.002	0.003
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	0.0002	0.0004	0.0002	0.0004	--	0.0012	0.0006

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-8I

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	7/19/2016	9/21/2016	11/17/2016	1/9/2017	3/6/2017	5/9/2017	7/18/2017	10/4/2017	12/12/2017	6/4/2018	11/14/2018
Field Parameters														
Elevation	ft NGVD	--	--	370.06	369.7	369.51	368.84	368.68	368.68	369.07	367.78	366.87	369.85	367.78
pH	S.U.	--	7.2	7.2	7.44	7.6	7.6	7.4	7.2	7.3	7.56	7.9	7.68	7.22
Specific Conductance	µmhos/cm	--	--	580	455	968	420	80	507	485	471	390	619	453
Turbidity	NTU	--	--	9	3.29	1	5	10	2	1	6.26	1	3.18	9
Dissolved Oxygen	mg/L	--	--	0.6	0.17	0.8	1	4.5	0.3	0.2	0.31	9.7	2.46	0.37
Temperature	°C	--	--	21	15.39	17.1	14	14.4	15	16.2	15.51	14.4	17.42	13.8
ORP	mV	--	--	-60	-63.9	-1	29	25	52	-15	-67.4	111	-75.3	190
Laboratory Parameters														
Antimony	µg/L	6	--	0.27	0.07	0.1	0.08	0.08	0.08	0.07	--	--	--	0.17
Arsenic	µg/L	10	--	11.5	2.08	1.39	2.58	2.78	2.09	1.31	--	--	--	3.41
Barium	µg/L	2000	--	70.1	57	58.4	54.9	56.9	57.8	60.4	--	--	--	57.9
Beryllium	µg/L	4	--	0.119	<0.005	<0.005	<0.005	<0.005	<0.004	<0.004	--	--	--	<0.02
Cadmium	µg/L	5	--	0.28	0.02	0.04	0.02	0.04	0.05	0.02	--	--		0.15
Chromium	µg/L	100	--	0.5	0.1	0.055	0.817	0.511	0.23	0.077	--	--	--	0.07
Cobalt	µg/L	6	--	0.961	0.643	0.646	0.671	0.656	0.77	0.672	--	--	--	1.01
Copper	µg/L	--	--	--	--	--	--	--	--	0.11	0.13	--	0.42	1.45
Lead	µg/L	15	--	0.242	0.02	0.032	0.025	0.032	0.054	0.01	--	--	--	0.111
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	--
Molybdnum	µg/L	100	--	3	2.34	2.47	2.31	2.73	2.29	2.58	--	--	--	2.7
Selenium	µg/L	50	--	7.5	2.7	3	2.3	2.9	4.5	4.7	--	--	--	2.5
Thallium	µg/L	2	--	0.166	0.03	0.03	0.04	0.05	0.03	0.03	--	--	--	<0.1
Zinc	µg/L	--	--	--	--	--	--	--	--	0.7	0.9	--	3.2	9.2
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	14.6	14.7	17.1	--	16.4	14.1
Aluminum	µg/L	--	--	--	--	--	--	--	--	2	1	--	0.8	8.7
Boron	mg/L	--	0.017	0.016	0.017	0.028	0.006	0.083	0.045	0.026	0.096	--	0.044	0.06
Calcium	mg/L	--	72	67.9	67.4	77.5	79.5	74.7	71.9	72.2	74.7	--	76.7	67.7
Lithium	mg/L	0.04	--	0.007	0.008	0.009	0.005	0.01	0.001	<0.0002	--	--	--	0.02
Magnesium	mg/L	--	--	--	--	--	--	22.3	22.9	22.2	22.5	--	23.5	21.4
Manganese	mg/L	--	--	--	--	--	--	--	--	0.357	--	--	0.32	0.509
Potassium	mg/L	--	--	--	--	--	--	1.84	1.73	1.48	2.02	--	1.6	2.28
Sodium	mg/L	--	--	--	--	--	--	29.4	28.5	29.7	28.6	--	32.5	31.5
Strontium	mg/L	--	--	--	--	--	--	0.146	0.148	0.14	0.146	--	0.152	0.139
Alkalinity	mg/L	--	--	--	--	--	--	245	246	247	237	--	268	250
Bromide	mg/L	--	--	--	--	--	--	0.04	0.065	0.062	0.064	--	0.05	<0.04
Chloride	mg/L	--	21.7	22	21.5	21.3	20.9	20.7	21.2	20.9	20.1	19.3	20.9	20.6
Fluoride	mg/L	4	0.35	0.34	0.29	0.29	0.25	0.28	0.28	0.25	0.27	0.29	0.29	0.33
TDS	mg/L	--	370	358	376	387	371	391	376	379	378	--	407	390
Sulfate	mg/L	--	87.5	86.3	79.2	77.5	80	80.3	81.9	83.4	85.9	87.1	79	68.2
Sulfide	mg/L	--	--	--	--	--	--	--	--	<0.4	--	--	<0.4	<0.07
Radium-228	pCi/L	--	--	0.4275	0.157	0.42	1.1	0.372	0.45	0.616	--	--	--	0.354
Radium-226	pCi/L	--	--	0.824	0.521	0.746	0.725	0.643	0.561	0.463	--	--	--	0.676
Radium-226/228	pCi/L	5	--	1.2515	0.678	1.166	1.825	1.015	1.011	1.079	--	--	--	1.03
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	0.52	--	--	0.27	0.17
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	2.4	--	--	16.8	<0.7
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	2.46	--	--	<0.8	<1
Iron (Dissolved)	mg/L	--	--	--	--	--	--	0.36	0.405	0.35	0.515	--	1.08	0.213
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	0.349	0.39	0.324	0.363	--	0.31	0.358

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-11S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	7/18/2016	9/20/2016	11/16/2016	1/9/2017	3/7/2017	5/19/2017	7/18/2017	10/3/2017	12/12/2017	6/5/2018	11/14/2018
Field Parameters														
Elevation	ft NGVD	--	--	369.93	369.4	368.47	367.7	367.51	367.92	368.57	367.86	366.6	369.69	369.27
pH	S.U.	--	7.9	7.3	7.3	8.4	8.1	7.9	7.78	7.7	7.2	8.3	7.21	7.55
Specific Conductance	µmhos/cm	--	--	272	330	433	200	70	307	386	267	260	360	309
Turbidity	NTU	--	--	0.81	0.4	1	0.8	0.3	2.64	0.4	0.5	0.6	0.39	0.2
Dissolved Oxygen	mg/L	--	--	9.3	7.4	2	7	7	6.99	6.1	8	19.4	6.94	6.9
Temperature	°C	--	--	16.1	22.4	14.7	14.8	15	15.7	17.1	15.4	13.4	14.97	13.25
ORP	mV	--	--	24	167	227	126	47	75.6	73	-13	73	-2.7	152
Laboratory Parameters														
Antimony	µg/L	6	--	0.04	0.04	0.05	0.04	0.04	0.04	<0.05	--	--	--	0.05
Arsenic	µg/L	10	--	0.53	0.42	0.45	0.52	0.52	0.48	0.5	--	--	--	0.38
Barium	µg/L	2000	--	9.79	11.3	7.91	6.52	7.09	7.73	8.16	--	--	--	12.5
Beryllium	µg/L	4	--	<0.005	<0.005	<0.005	<0.005	<0.005	<0.004	<0.02	--	--	--	<0.02
Cadmium	µg/L	5	--	0.03	0.03	0.02	0.01	0.007	0.03	<0.02	--	--		0.03
Chromium	µg/L	100	--	0.5	0.8	0.416	0.725	1.25	0.567	0.568	--	--	--	0.384
Cobalt	µg/L	6	--	0.043	0.029	0.027	0.022	0.027	0.03	0.02	--	--	--	<0.02
Copper	µg/L	--	--	--	--	--	--	--	--	0.44	0.26	--	0.25	0.44
Lead	µg/L	15	--	0.02	0.046	0.027	0.02	0.02	0.023	0.06	--	--	--	0.03
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	0.002	0.002	<0.002	--	--	--	--
Molybdnum	µg/L	100	--	4.36	3.37	4.71	6.09	6.03	4.86	4.69	--	--	--	2.4
Selenium	µg/L	50	--	0.08	0.1	0.07	0.05	0.2	0.2	0.3	--	--	--	0.04
Thallium	µg/L	2	--	0.01	0.01	0.02	0.01	0.01	0.01	0.2	--	--	--	<0.1
Zinc	µg/L	--	--	--	--	--	--	--	--	7	<0.4	--	2	<0.7
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	24.9	24.4	27.3	--	25.8	26.6
Aluminum	µg/L	--	--	--	--	--	--	--	--	10	3.63	--	2	3
Boron	mg/L	--	0.062	0.062	0.077	0.053	0.029	0.057	0.047	0.067	0.09	--	0.076	0.11
Calcium	mg/L	--	41.6	38.8	45.1	37.3	40.4	42.8	41.2	44.2	43.7	--	55.8	56.4
Lithium	mg/L	0.04	--	0.024	0.004	0.005	0.003	0.013	0.009	0.002	--	--	--	0.01
Magnesium	mg/L	--	--	--	--	--	--	17.2	17.7	18.8	17.6	--	24.8	19.5
Manganese	mg/L	--	--	--	--	--	--	--	--	<0.0001	--	--	<0.0002	0.0004
Potassium	mg/L	--	--	--	--	--	--	0.42	0.42	0.42	0.48	--	0.37	0.88
Sodium	mg/L	--	--	--	--	--	--	5.72	5.58	6.82	7.26	--	7.11	5.35
Strontium	mg/L	--	--	--	--	--	--	0.0508	0.0535	0.0532	0.0537	--	0.0706	0.0774
Alkalinity	mg/L	--	--	--	--	--	--	153	175	187	167	--	226	246
Bromide	mg/L	--	--	--	--	--	--	<0.02	<0.06	<0.02	<0.02	--	<0.02	<0.04
Chloride	mg/L	--	1.82	1.83	1.62	1.54	2.12	4.63	9.87	8.19	3.68	2.4	6.98	1.79
Fluoride	mg/L	4	0.74	0.76	0.73	0.92	0.96	1	0.86	0.75	0.89	0.82	0.62	0.72
TDS	mg/L	--	212	201	196	182	179	197	239	224	200	--	276	238
Sulfate	mg/L	--	10.9	10.6	5.3	4.1	7.6	13.7	16.4	15.6	9.3	8	21.7	5.9
Sulfide	mg/L	--	--	--	--	--	--	--	--	<0.4	--	--	<0.4	<0.07
Radium-228	pCi/L	--	--	0.231	0.741	0.179	1.96	0.0959	0.0337	0.771	--	--	--	0.419
Radium-226	pCi/L	--	--	0.584	-0.0127	0.109	0.141	0.0906	0.091	0.0225	--	--	--	0.217
Radium-226/228	pCi/L	5	--	0.815	0.7283	0.288	2.101	0.1865	0.1247	0.7935	--	--	--	0.636
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	0.82	--	--	0.63	0.71
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	9	--	--	2	1
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	66.5	--	--	2.92	3
Iron (Dissolved)	mg/L	--	--	--	--	--	--	<0.0004	<0.0004	<0.0004	0.014	--	0.008	0.04
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	<0.0001	0.0002	0.0001	<0.0002	--	<0.002	0.0005

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-12S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	9/26/2018	11/1/2018	11/14/2008	12/11/2018
Field Parameters							Sentinel
Elevation	ft NGVD	--	--	367.81	367.96	367.93	368.21
pH	S.U.	--	7.2	5.9	7.6	6.83	7.12
Specific Conductance	µmhos/cm	--	--	522	551	517	816
Turbidity	NTU	--	--	9	1.14	2.14	23.7
Dissolved Oxygen	mg/L	--	--	0.2	3.13	0.36	0.29
Temperature	°C	--	--	14.5	14.05	13.16	13.36
ORP	mV	--	--	68	-34.8	184.2	-10
Laboratory Parameters							
Antimony	µg/L	6	--	0.06	0.03	0.17	0.06
Arsenic	µg/L	10	--	0.3	0.27	0.25	0.61
Barium	µg/L	2000	--	26.8	26.3	25.3	31
Beryllium	µg/L	4	--	<0.02	<0.02	<0.02	0.02
Cadmium	µg/L	5	--	0.06	0.05	0.13	0.04
Chromium	µg/L	100	--	0.276	0.1	0.1	0.639
Cobalt	µg/L	6	--	0.642	0.4783	0.439	1.23
Copper	µg/L	--	--	0.5	0.36	0.55	1.08
Lead	µg/L	15	--	0.34	0.08	0.08	0.904
Mercury	µg/L	2	--	--	--	--	--
Molybdnum	µg/L	100	--	2	2	2	2
Selenium	µg/L	50	--	0.2	0.07	0.1	0.2
Thallium	µg/L	2	--	<0.1	<0.1	<0.1	<0.1
Zinc	µg/L	--	--	1	0.8	2	2
Silica (Dissolved)	mg/L	--	--	21.5	20	20	20.3
Aluminum	µg/L	--	--	45.2	8.53	3	291
Boron	mg/L	--	0.067	0.04	0.07	0.03	0.12
Calcium	mg/L	--	86.3	87	86.4	80.2	89.3
Lithium	mg/L	0.04	--	0.01	0.01	0.01	<0.009
Magnesium	mg/L	--	--	31.6	33.7	30.5	33
Manganese	mg/L	--	--	0.0864	0.0758	0.0811	0.106
Potassium	mg/L	--	--	1.18	1.26	1.57	1.87
Sodium	mg/L	--	--	30.2	33.9	32.1	32.4
Strontium	mg/L	--	--	0.103	0.111	0.114	0.119
Alkalinity	mg/L	--	--	392	358	374	361
Bromide	mg/L	--	--	0.1	0.1	0.1	0.1
Chloride	mg/L	--	30.1	30.1	29.9	29.4	29.5
Fluoride	mg/L	4	0.35	0.36	0.36	0.37	0.36
TDS	mg/L	--	445	446	434	422	437
Sulfate	mg/L	--	37.2	37.1	37.1	36.4	36.7
Sulfide	mg/L	--	--	<0.1	<0.1	<0.07	<0.1
Radium-228	pCi/L	--	--	0.562	0.306	0.941	0.569
Radium-226	pCi/L	--	--	0.5	0.202	0.244	0.314
Radium-226/228	pCi/L	5	--	1.062	0.508	1.185	0.883
Copper (Dissolved)	µg/L	--	--	0.66	0.38	1.41	0.7
Zinc (Dissolved)	µg/L	--	--	3	2	3	4
Aluminum (Dissolved)	µg/L	--	--	2	1	1	76.2
Iron (Dissolved)	mg/L	--	--	0.025	0.01	0.006	0.238
Manganese (Dissolved)	mg/L	--	--	0.0847	0.0797	0.0677	0.103

MW-12I

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	9/26/2018	11/1/2018	11/14/2018	12/11/2018
Field Parameters							
Elevation	ft NGVD	--	--	369.85	367.84	367.81	368.16
pH	S.U.	--	0	7.15	7.74	7.01	7.12
Specific Conductance	µmhos/cm	--	--	662	622	579	901
Turbidity	NTU	--	--	1.48	8.76	2.54	2.3
Dissolved Oxygen	mg/L	--	--	1.2	2.68	9.27	1.99
Temperature	°C	--	--	15.21	13.94	12.9	12.92
ORP	mV	--	--	-35.1	-87.8	-54.9	-52
Laboratory Parameters							
Antimony	µg/L	6	--	<0.01	<0.02	<0.02	<0.02
Arsenic	µg/L	10	--	10.1	9.24	8.79	9.32
Barium	µg/L	2000	--	370	374	365	377
Beryllium	µg/L	4	--	0.006	<0.02	0.02	<0.02
Cadmium	µg/L	5	--	<0.005	0.02	<0.01	0.17
Chromium	µg/L	100	--	0.101	0.289	0.05	0.2
Cobalt	µg/L	6	--	1.5	1.67	1.42	1.58
Copper	µg/L	--	--	1.15	1.23	0.44	0.56
Lead	µg/L	15	--	0.063	0.21	0.03	0.07
Mercury	µg/L	2	--	--	--	--	--
Molybdnum	µg/L	100	--	2.92	2.87	2.87	3.13
Selenium	µg/L	50	--	0.04	0.06	<0.003	<0.03
Thallium	µg/L	2	--	0.01	<0.1	<0.1	<0.1
Zinc	µg/L	--	--	1	2	1	3
Silica (Dissolved)	mg/L	--	--	20.9	18.8	19.2	12.6
Aluminum	µg/L	--	--	48.8	64.6	5.87	5.67
Boron	mg/L	--	0.115	0.062	0.115	0.03	0.05
Calcium	mg/L	--	94.1	100	94.8	90.9	95.6
Lithium	mg/L	0.04	--	0.009	<0.009	0.03	0.01
Magnesium	mg/L	--	--	32.5	32.6	30.5	31
Manganese	mg/L	--	--	1.17	1.2	1.08	1.12
Potassium	mg/L	--	--	2.03	2.43	2.28	2.26
Sodium	mg/L	--	--	43.2	45	43.9	42
Strontium	mg/L	--	--	0.134	0.138	0.144	0.142
Alkalinity	mg/L	--	--	433	448	433	441
Bromide	mg/L	--	--	0.139	0.1	0.1	0.1
Chloride	mg/L	--	33	34	33.9	33.7	33.1
Fluoride	mg/L	4	0.24	0.25	0.25	0.25	0.23
TDS	mg/L	--	499	506	493	484	485
Sulfate	mg/L	--	31.5	30.9	31	30.7	31
Sulfide	mg/L	--	--	<0.4	<0.1	<0.07	<0.1
Radium-228	pCi/L	--	--	-0.0683	0.788	1.19	1.04
Radium-226	pCi/L	--	--	0.463	0.516	0.51	0.83
Radium-226/228	pCi/L	5	--	0.463	1.304	1.7	1.87
Copper (Dissolved)	µg/L	--	--	0.19	0.35	0.42	1.08
Zinc (Dissolved)	µg/L	--	--	1	10.2	2	8.1
Aluminum (Dissolved)	µg/L	--	--	2.36	5.95	2	3
Iron (Dissolved)	mg/L	--	--	1.15	1.18	1.09	1.16
Manganese (Dissolved)	mg/L	--	--	1.12	1.16	1.06	1.16

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-12D

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	9/26/2018	10/30/2018	11/14/2018	12/11/2018
Field Parameters							Sentinel
Elevation	ft NGVD	--	--	367.91	367.91	367.86	368.25
pH	S.U.	--	7.3	7.16	8.06	7.08	7.17
Specific Conductance	µmhos/cm	--	--	530	510	449	717
Turbidity	NTU	--	--	9.68	12.7	5.25	2.2
Dissolved Oxygen	mg/L	--	--	1.68	1.41	4.9	1.4
Temperature	°C	--	--	15.56	15.16	12	12.56
ORP	mV	--	--	-52.6	-90.9	-40.8	-69
Laboratory Parameters							
Antimony	µg/L	6	--	0.02	0.06	<0.02	<0.02
Arsenic	µg/L	10	--	11.9	9.78	9.95	9.64
Barium	µg/L	2000	--	282	268	272	271
Beryllium	µg/L	4	--	0.006	<0.02	<0.02	<0.02
Cadmium	µg/L	5	--	<0.005	0.05	<0.01	0.01
Chromium	µg/L	100	--	0.108	0.266	0.1	0.2
Cobalt	µg/L	6	--	0.462	0.538	0.378	0.4
Copper	µg/L	--	--	0.51	41	0.64	0.24
Lead	µg/L	15	--	0.127	0.329	0.111	0.05
Mercury	µg/L	2	--	--	--	--	--
Molybdnum	µg/L	100	--	3.09	2.96	2.94	3.13
Selenium	µg/L	50	--	<0.03	0.07	<0.03	<0.03
Thallium	µg/L	2	--	<0.01	<0.1	<0.1	<0.1
Zinc	µg/L	--	--	1	3	2	0.8
Silica (Dissolved)	mg/L	--	--	21.1	18.9	19.5	19.5
Aluminum	µg/L	--	--	14	53.9	26.1	5.83
Boron	mg/L	--	0.098	0.112	0.09	0.03	0.09
Calcium	mg/L	--	90.8	95.1	86.9	86.1	82.9
Lithium	mg/L	0.04	--	0.013	<0.009	<0.009	<0.009
Magnesium	mg/L	--	--	30.3	29.6	28.5	26.7
Manganese	mg/L	--	--	0.989	0.902	0.878	0.743
Potassium	mg/L	--	--	1.16	0.89	1.34	1.45
Sodium	mg/L	--	--	10.5	11.3	11	10.2
Strontium	mg/L	--	--	0.161	0.161	0.171	0.158
Alkalinity	mg/L	--	--	373	353	371	384
Bromide	mg/L	--	--	0.081	0.08	0.07	0.07
Chloride	mg/L	--	16.1	17.2	17	16.6	16.7
Fluoride	mg/L	4	0.27	0.26	0.26	0.26	0.26
TDS	mg/L	--	328	386	381	374	380
Sulfate	mg/L	--	15.6	14.2	14.2	13.8	13.9
Sulfide	mg/L	--	--	<0.04	<0.1	<0.07	<0.1
Radium-228	pCi/L	--	--	0.643	0.405	0.589	1.69
Radium-226	pCi/L	--	--	0.702	0.454	0.608	0.766
Radium-226/228	pCi/L	5	--	1.345	0.859	1.197	2.456
Copper (Dissolved)	µg/L	--	--	0.35	0.21	0.12	0.44
Zinc (Dissolved)	µg/L	--	--	3.3	2	1	1
Aluminum (Dissolved)	µg/L	--	--	7.24	2	2	5.13
Iron (Dissolved)	mg/L	--	--	1.29	0.965	0.996	1.12
Manganese (Dissolved)	mg/L	--	--	0.994	0.88	0.801	0.832

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-13I

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	9/26/2018	10/31/2018	11/15/2018	12/11/2018
Field Parameters							
Elevation	ft NGVD	--	--	368.83	368.45	368.41	368.31
pH	S.U.	--	7.5	7.36	8.12	7.21	7.36
Specific Conductance	µmhos/cm	--	--	411	397	451	555
Turbidity	NTU	--	--	2.14	0.93	0.31	0.45
Dissolved Oxygen	mg/L	--	--	0.37	1.15	8.64	0.57
Temperature	°C	--	--	15.71	15.25	13.17	14.13
ORP	mV	--	--	-15.8	-74.3	44.5	-72
Laboratory Parameters							
Antimony	µg/L	6	--	0.02	<0.02	<0.02	0.04
Arsenic	µg/L	10	--	1.74	1.66	1.6	1.84
Barium	µg/L	2000	--	149	139	141	144
Beryllium	µg/L	4	--	0.006	<0.02	<0.02	<0.02
Cadmium	µg/L	5	--	<0.005	<0.01	<0.01	<0.01
Chromium	µg/L	100	--	0.04	0.1	0.06	0.07
Cobalt	µg/L	6	--	0.5	0.554	0.477	0.574
Copper	µg/L	--	--	0.39	0.62	0.1	0.58
Lead	µg/L	15	--	0.01	0.04	<0.02	<0.02
Mercury	µg/L	2	--	--	--	--	--
Molybdnum	µg/L	100	--	4.49	4.23	4.09	4.29
Selenium	µg/L	50	--	<0.03	<0.03	<0.03	<0.03
Thallium	µg/L	2	--	0.04	<0.1	<0.1	<0.1
Zinc	µg/L	--	--	20.1	61.3	<0.7	2
Silica (Dissolved)	mg/L	--	--	19.6	17.9	17.9	18.4
Aluminum	µg/L	--	--	2.54	10.6	2	<1
Boron	mg/L	--	0.042	0.09	0.05	<0.02	0.04
Calcium	mg/L	--	67.5	66	58.1	59.7	65.6
Lithium	mg/L	0.04	--	0.018	0.01	<0.009	<0.009
Magnesium	mg/L	--	--	20.4	19.1	19.2	20.9
Manganese	mg/L	--	--	0.491	0.448	0.447	0.523
Potassium	mg/L	--	--	1.23	0.93	1.32	1.24
Sodium	mg/L	--	--	15.2	15.4	15.6	16.4
Strontium	mg/L	--	--	0.0781	0.0744	0.0834	0.0879
Alkalinity	mg/L	--	--	231	228	231	241
Bromide	mg/L	--	--	0.04	<0.04	<0.04	<0.04
Chloride	mg/L	--	20	20.6	20.5	20.3	20.4
Fluoride	mg/L	4	0.38	0.38	0.38	0.38	0.38
TDS	mg/L	--	297	319	305	310	310
Sulfate	mg/L	--	40.6	41.6	41.5	41.3	40.7
Sulfide	mg/L	--	--	<0.4	<0.1	<0.07	<0.07
Radium-228	pCi/L	--	--	-0.268	0.658	0.682	0.3
Radium-226	pCi/L	--	--	0.456	0.509	0.669	0.589
Radium-226/228	pCi/L	5	--	0.456	1.167	1.351	0.889
Copper (Dissolved)	µg/L	--	--	0.11	0.39	0.2	0.2
Zinc (Dissolved)	µg/L	--	--	0.7	6.3	<0.7	3
Aluminum (Dissolved)	µg/L	--	--	1	1	1	5
Iron (Dissolved)	mg/L	--	--	0.185	0.189	0.193	0.26
Manganese (Dissolved)	mg/L	--	--	0.493	0.467	0.461	0.483

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-13D

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	9/26/2018	10/31/2018	11/15/2018	12/11/2018
Field Parameters							
Elevation	ft NGVD	--	--	368.79	368.43	368.39	368.29
pH	S.U.	--	7.4	7.03	8.11	7.17	7.29
Specific Conductance	µmhos/cm	--	--	406	382	427	540
Turbidity	NTU	--	--	5.34	10.6	4.66	3.22
Dissolved Oxygen	mg/L	--	--	1.34	1.4	5.45	0.51
Temperature	°C	--	--	16.29	14.99	12.18	14.06
ORP	mV	--	--	-71.4	-95.1	-48.5	-94
Laboratory Parameters							
Antimony	µg/L	6	--	0.01	0.02	0.05	0.03
Arsenic	µg/L	10	--	6.44	5.62	7.55	5.3
Barium	µg/L	2000	--	206	204	198	219
Beryllium	µg/L	4	--	0.007	<0.02	<0.02	<0.02
Cadmium	µg/L	5	--	<0.005	0.04	<0.01	<0.01
Chromium	µg/L	100	--	0.071	0.353	0.209	0.06
Cobalt	µg/L	6	--	1.15	1.31	1.05	0.935
Copper	µg/L	--	--	0.26	1.02	0.55	0.28
Lead	µg/L	15	--	0.071	0.438	0.173	<0.02
Mercury	µg/L	2	--	--	--	--	--
Molybdnum	µg/L	100	--	2.88	2.59	2.77	3.23
Selenium	µg/L	50	--	<0.03	0.1	0.07	<0.03
Thallium	µg/L	2	--	0.02	<0.1	>0.1	<0.1
Zinc	µg/L	--	--	0.6	2	1	2
Silica (Dissolved)	mg/L	--	--	19.3	17.6	17.9	17.9
Aluminum	µg/L	--	--	21.8	162	58.8	2
Boron	mg/L	--	0.037	0.071	0.111	119	0.03
Calcium	mg/L	--	65.9	68.9	63.4	60.8	67.4
Lithium	mg/L	0.04	--	0.016	<0.009	<0.009	<0.009
Magnesium	mg/L	--	--	21.8	21.7	20.1	22.5
Manganese	mg/L	--	--	0.762	0.669	0.648	0.677
Potassium	mg/L	--	--	1.06	1.14	1.45	1.16
Sodium	mg/L	--	--	11.2	11.6	11.4	11.2
Strontium	mg/L	--	--	0.0852	0.0867	0.0913	0.098
Alkalinity	mg/L	--	--	231	243	223	252
Bromide	mg/L	--	--	0.05	<0.04	<0.04	<0.04
Chloride	mg/L	--	16.3	17	16.9	16.6	16.5
Fluoride	mg/L	4	0.28	0.27	0.27	0.28	0.27
TDS	mg/L	--	287	296	299	296	305
Sulfate	mg/L	--	35.5	34.8	34.7	34.1	33.3
Sulfide	mg/L	--	--	<0.4	<0.1	<0.07	<0.07
Radium-228	pCi/L	--	--	0.141	-0.293	-0.157	0.226
Radium-226	pCi/L	--	--	0.501	0.356	0.242	0.389
Radium-226/228	pCi/L	5	--	0.642	0.356	0.242	0.615
Copper (Dissolved)	µg/L	--	--	0.07	0.11	0.09	0.21
Zinc (Dissolved)	µg/L	--	--	0.5	1	<0.7	1
Aluminum (Dissolved)	µg/L	--	--	11	3	2	20.5
Iron (Dissolved)	mg/L	--	--	1.29	0.915	0.995	1.13
Manganese (Dissolved)	mg/L	--	--	0.74	0.625	0.702	0.612

MW-14S

Parameter	**Units**	**GWPS (MCL or RSL)**	**Appendix III UPL**	**7/20/2016**	**9/21/2016**	**11/17/2016**	**1/9/2017**	**3/7/2017**	**5/19/2017**	**7/18/2017**	**10/4/2017**	**12/12/2017**	**6/5/2018**	**11/13/2018**
Field Parameters														
Elevation	ft NGVD	--	--	370.07	369.7	369.34	368.92	368.49	368.63	369.88	368.43	368.41	368.94	369.27
pH	S.U.	--	7.2	7.1	7	7.7	7.5	7.4	6.95	7.3	7	7.6	7.55	7.55
Specific Conductance	µmhos/cm	--	--	576	640	955	530	80	441	496	488	490	450	309
Turbidity	NTU	--	--	3.9	6	1	2	0.7	2.07	1	0.5	1	0.6	0.2
Dissolved Oxygen	mg/L	--	--	3.8	3.3	1	3.4	3	3.82	3.7	4	10.2	5.42	6.9
Temperature	°C	--	--	18.7	22.6	15.2	14.4	13.9	14.54	15.9	15.3	13.5	14.98	13.25
ORP	mV	--	--	43	53	282	147	75	55.6	67	-23	133	-7.9	152
Laboratory Parameters														
Antimony	µg/L	6	--	0.02	0.02	0.03	0.02	0.02	0.06	<0.05	--	--	--	<0.02
Arsenic	µg/L	10	--	1.54	1.29	0.75	0.91	0.76	0.75	0.7	--	--	--	0.64
Barium	µg/L	2000	--	31	27.8	26.3	27	26.3	25	27	--	--	--	27
Beryllium	µg/L	4	--	0.008	0.005	<0.005	<0.005	<0.005	<0.004	<0.02	--	--	--	<0.02
Cadmium	µg/L	5	--	0.21	0.07	0.03	0.05	0.01	0.08	<0.02	--	--		0.05
Chromium	µg/L	100	--	0.3	0.3	0.162	0.575	0.66	0.301	0.258	--	--	--	0.2
Cobalt	µg/L	6	--	0.573	0.333	0.088	0.187	0.083	0.065	0.03	--	--	--	0.03
Copper	µg/L	--	--	--	--	--	--	--	--	2.38	0.15	--	0.38	0.24
Lead	µg/L	15	--	0.307	0.31	0.549	0.115	0.061	0.071	0.116	--	--	--	0.05
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	--
Molybdnum	µg/L	100	--	1.51	1.43	1.26	1.62	1.84	1.35	1.67	--	--	--	1
Selenium	µg/L	50	--	1.4	1.2	1.2	1.1	1.1	1.2	1.3	--	--	--	1.1
Thallium	µg/L	2	--	<0.01	<0.01	0.02	0.054	0.055	0.01	0.07	--	--	--	<0.1
Zinc	µg/L	--	--	--	--	--	--	--	--	9	0.8	--	1	1
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	20.3	20.2	23.3	--	20.4	20.2
Aluminum	µg/L	--	--	--	--	--	--	--	--	11.4	2	--	5.75	7.32
Boron	mg/L	--	0.011	0.008	0.01	0.008	<0.002	0.031	0.017	0.03	0.042	--	0.046	0.04
Calcium	mg/L	--	59.2	56.3	59.5	65.4	65.7	63.4	59.8	65.6	67	--	61.1	59.2
Lithium	mg/L	0.04	--	0.018	0.006	0.004	0.006	0.005	0.001	<0.0002	--	--	--	<0.009
Magnesium	mg/L	--	--	--	--	--	--	27.6	28.1	29.3	29.9	--	27.4	26.4
Manganese	mg/L	--	--	--	--	--	--	--	--	0.0006	--	--	0.0014	0.0015
Potassium	mg/L	--	--	--	--	--	--	0.5	0.54	0.49	0.59	--	0.51	0.55
Sodium	mg/L	--	--	--	--	--	--	33	29.4	30.1	29.9	--	29.2	24.9
Strontium	mg/L	--	--	--	--	--	--	0.101	0.102	0.103	0.106	--	0.101	0.0954
Alkalinity	mg/L	--	--	--	--	--	--	232	258	257	249	--	260	259
Bromide	mg/L	--	--	--	--	--	--	<0.02	<0.06	0.03	0.04	--	<0.02	<0.04
Chloride	mg/L	--	28.6	29.4	28.1	27.8	27.2	26.8	29.4	29.6	29.9	30	27.1	29
Fluoride	mg/L	4	0.39	0.39	0.36	0.35	0.33	0.36	0.37	0.33	0.34	0.34	0.39	0.37
TDS	mg/L	--	368	364	361	362	344	354	376	377	376	--	360	344
Sulfate	mg/L	--	34.9	36.5	32.5	29.1	30.7	29.9	32.3	33.1	34.8	35.5	29.4	30.8
Sulfide	mg/L	--	--	--	--	--	--	--	--	<0.4	--	--	<0.4	<0.1
Radium-228	pCi/L	--	--	-0.343	0.769	0.693	0.601	-0.193	-0.019	1.73	--	--	--	0.334
Radium-226	pCi/L	--	--	0.594	0.131	0.413	0.179	0.0525	0.0316	0.153	--	--	--	0.0534
Radium-226/228	pCi/L	5	--	0.251	0.9	1.106	0.78	-0.1405	0.0126	1.883	--	--	--	0.3874
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	0.94	--	--	0.43	0.64
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	7	--	--	5.7	3
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	11.3	--	--	1	<1
Iron (Dissolved)	mg/L	--	--	--	--	--	--	<0.0004	<0.0004	<0.0004	0.016	--	0.002	<0.003
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	<0.0001	0.0021	0.0001	<0.0002	--	<0.0002	0.0005

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-15S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/7/2016	7/19/2016	9/21/2016	11/16/2016	1/11/2017	3/7/2017	5/10/2017	7/19/2017	10/4/2017	6/5/2018	11/13/2018
Field Parameters														
Elevation	ft NGVD	--	--	370	369.87	369.49	368.87	367.92	367.84	367.86	368.75	367.84	396.63	368.96
pH	S.U.	--	7.1 - 7.7	7.2	7.1	7.2	7.7	7.2	7.2	7.3	7.3	7.35	7.16	7.46
Specific Conductance	µmhos/cm	--	--	512	512	510	904	470	60	419	368	393	416	317
Turbidity	NTU	--	--	7.6	2.2	1	1	1	0.5	2	2	2.34	0.33	0.41
Dissolved Oxygen	mg/L	--	--	0.5	0.5	1	1	1	6	0.4	0.3	0.07	1.9	0.77
Temperature	°C	--	--	16.5	17.7	19.1	15.5	13.8	13.9	14.6	15.7	14.7	14.96	12.94
ORP	mV	--	--	57	124	181	-10	179	64	65	24	18.1	-37.7	19.3
Laboratory Parameters														
Antimony	µg/L	6	--	0.04	0.04	0.02	0.04	0.04	0.03	0.04	0.02	--	--	<0.02
Arsenic	µg/L	10	--	0.32	0.24	0.21	0.18	0.26	0.21	0.21	0.23	--	--	0.13
Barium	µg/L	2000	--	4.71	5.85	3.21	3.27	6.05	4.98	3.54	3.11	--	--	2.46
Beryllium	µg/L	4	--	0.007	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	<0.004	--	--	<0.02
Cadmium	µg/L	5	--	0.14	0.25	0.05	0.05	0.06	0.04	0.05	0.05	--		0.04
Chromium	µg/L	100	--	0.2	1.7	0.5	0.058	0.493	0.934	0.198	0.096	--	--	0.05
Cobalt	µg/L	6	--	3.03	1.17	1.09	0.794	1.75	1.26	1.2	1.25	--	--	0.74
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.4	0.26	0.24	0.37
Lead	µg/L	15	--	0.286	0.101	0.098	0.037	0.039	0.024	0.062	0.083	--	--	0.03
Mercury	µg/L	2	--	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--
Molybdnum	µg/L	100	--	2.52	2.89	2.54	1.57	0.78	1.17	2.08	2.87	--	--	2.54
Selenium	µg/L	50	--	0.4	0.7	0.5	0.3	0.3	0.5	0.5	0.2	--	--	0.1
Thallium	µg/L	2	--	0.03	<0.01	0.02	0.02	0.03	0.04	0.02	0.02	--	--	<0.1
Zinc	µg/L	--	--	--	--	--	--	--	--	--	3.5	1	21	2
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	13.1	12.7	15.8	13.1	12.4
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	15.9	6.68	4.42	6.41
Boron	mg/L	--	0.15	0.011	0.012	0.008	<0.002	<0.002	0.084	0.077	0.073	0.095	0.078	0.04
Calcium	mg/L	--	(79.5) 71	46.9	43.6	46.6	52.3	63.6	62.9	45.7	44.4	48.3	44.7	41.8
Lithium	mg/L	0.04	--	0.007	0.022	0.005	0.005	0.008	0.008	0.003	0.0009	--	--	<0.009
Magnesium	mg/L	--	--	--	--	--	--	--	28.2	19.3	17.2	18.5	16.9	15.1
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.489	--	0.391	0.444
Potassium	mg/L	--	--	--	--	--	--	--	1.07	1.11	1.03	1.27	0.93	1.16
Sodium	mg/L	--	--	--	--	--	--	--	35.5	44.7	39.2	42.3	35.9	27.2
Strontium	mg/L	--	--	--	--	--	--	--	0.0903	0.0711	0.061	0.0662	0.0638	0.0574
Alkalinity	mg/L	--	--	--	--	--	--	--	294	257	235	267	239	226
Bromide	mg/L	--	--	--	--	--	--	--	0.04	0.062	0.05	0.074	0.03	<0.04
Chloride	mg/L	--	(29.6) 26	21.2	18.7	18.9	18.3	21.9	16.1	14.1	11.8	13.3	8.84	8.78
Fluoride	mg/L	4	0.86	0.65	0.65	0.63	0.5	0.36	0.42	0.65	0.66	0.62	0.69	0.72
TDS	mg/L	--	(412.7) 407	338	319	329	338	374	342	294	263	300	274	232
Sulfate	mg/L	--	(33.67) 34	30.3	27.7	25.1	23.2	28.3	23.4	21	20.3	23.2	16.3	13.1
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	<0.4	<0.07
Radium-228	pCi/L	--	--	0.0335	-0.092	0.302	1.11	-0.0122	-0.108	0.106	-0.0928	--	--	0.482
Radium-226	pCi/L	--	--	0.384	--	0.116	0.139	0.189	0.0973	0.135	0.0916	--	--	-0.0262
Radium-226/228	pCi/L	5	--	0.4175	-0.092	0.418	1.249	0.1768	-0.0107	0.241	0.0916	--	--	0.482
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.37	--	0.51	1.59
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2.6	--	1	2
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	3.7	--	2	3
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	<0.0004	<0.0004	<0.0004	0.014	<0.002	0.004
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	0.448	0.361	0.284	0.379	0.349	0.332

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-15I

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/7/2016	7/19/2016	9/21/2016	11/16/2016	1/10/2017	3/7/2017	5/10/2017	7/18/2017	10/4/2017	12/12/2017	1/3/2018	6/6/2018	8/16/2016	11/13/2018
Field Parameters																	
Elevation	ft NGVD	--	--	370	369.88	369.51	368.86	368.12	368.07	368.27	368.74	367.82	366.73	366.49	369.64	370.28	369.01
pH	S.U.	--	6.77 - 7.86	7.2	7.1	7.1	7.5	7.7	7.5	7.2	7.2	7.34	7.8	7.79	8.06	7.36	7.6
Specific Conductance	µmhos/cm	--	--	555	574	530	874	420	60	457	400	368	350	474	420	527	412
Turbidity	NTU	--	--	0.9	0.6	0.7	0.2	1	2	1	1	1.09	1	1.12	0.88	0	0.18
Dissolved Oxygen	mg/L	--	--	0.2	0.4	0.4	1.3	0.2	2	0.3	0.3	0.49	0.9	0.41	1.89	0.25	0.31
Temperature	°C	--	--	15.1	18.2	17.6	15.6	13.9	13.6	14.8	16.3	14.68	12.8	12.38	14.9	17.77	12.52
ORP	mV	--	--	52.5	-86	-54	259	-87	-42	51	-50	-79.7	-52	-77.2	-94	-63	-63.7
Laboratory Parameters																	
Antimony	µg/L	6	--	0.01	0.25	0.01	0.04	0.01	0.02	0.02	0.02	--	--	--	--	--	<0.02
Arsenic	µg/L	10	--	25.2	27.9	21.1	23.6	20.2	20.4	20.2	23.6	--	--	--	--	--	23.8
Barium	µg/L	2000	--	118	132	119	107	91.2	88.9	86.1	94.8	--	--	--	--	--	93.3
Beryllium	µg/L	4	--	<0.005	0.165	<0.005	0.005	<0.005	<0.005	<0.004	<0.004	--	--	--	--	--	<0.02
Cadmium	µg/L	5	--	0.02	0.23	0.009	0.06	0.005	0.03	0.03	0.02	--		--	--	--	<0.01
Chromium	µg/L	100	--	0.2	0.5	0.1	0.132	0.35	0.7	0.134	0.089	--	--	--	--	--	<0.04
Cobalt	µg/L	6	--	1.24	1.66	1.32	1.03	1	0.903	1.02	1.25	--	--	--	--	--	1.12
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.26	0.1	--	--	0.15	--	0.12
Lead	µg/L	15	--	0.026	0.254	0.026	0.213	0.01	0.065	0.09	0.082	--	--	--	--	--	0.03
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	--	--	--
Molybdnum	µg/L	100	--	5.76	6.74	5.75	6.73	7.63	7.91	6.52	5.58	--	--	--	--	--	5.03
Selenium	µg/L	50	--	<0.03	0.2	<0.03	<0.03	<0.03	0.07	0.04	<0.03	--	--	--	--	--	0.04
Thallium	µg/L	2	--	0.04	0.273	0.03	0.04	0.04	0.112	0.03	0.04	--	--	--	--	--	<0.1
Zinc	µg/L	--	--	--	--	--	--	--	--	--	1	0.7	--	--	2.5	--	0.8
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	15	14	16.1	--	--	13.9	--	13.8
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	9.25	6.63	--	--	4.24	--	7.01
Boron	mg/L	--	0.072	0.06	0.032	0.03	0.022	0.019	0.047	0.038	0.05	0.08	--	0.04	0.066	--	0.07
Calcium	mg/L	--	(79.5) 54	44.1	44.6	46.1	51.4	46.5	51.1	46.6	43.9	44.6	--	--	47	--	39.9
Lithium	mg/L	0.04	--	0.005	0.018	0.004	0.004	0.011	0.006	0.002	<0.0002	--	--	--	--	--	<0.009
Magnesium	mg/L	--	--	--	--	--	--	--	13.3	12.7	11.1	11.2	--	--	11.8	--	9.98
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.134	--	--	--	0.13	--	0.106
Potassium	mg/L	--	--	--	--	--	--	--	1.01	1.02	0.94	1.05	--	--	0.96	--	1.21
Sodium	mg/L	--	--	--	--	--	--	--	62.3	56.1	51.8	45.4	--	--	42	--	29.9
Strontium	mg/L	--	--	--	--	--	--	--	0.0865	0.088	0.0841	0.0871	--	--	0.0955	--	0.0827
Alkalinity	mg/L	--	--	--	--	--	--	--	229	239	224	202	--	--	226	--	199
Bromide	mg/L	--	--	--	--	--	--	--	0.084	0.101	0.081	0.067	--	--	0.071	--	0.06
Chloride	mg/L	--	(29.6) 70	59.3	53.8	43.4	44.9	48.3	38.5	32.7	27.1	23.7	22.8	--	25.1	--	23.7
Fluoride	mg/L	4	0.382	0.25	0.25	0.23	0.25	0.34	0.32	0.31	0.22	0.23	0.22	--	0.26	--	0.25
TDS	mg/L	--	(412.7) 398	380	356	334	340	351	331	322	300	287	--	--	279	--	248
Sulfate	mg/L	--	(47.44) 47	42.5	41	34	33.6	35.4	31.1	29.7	26.6	27.3	26.7		25.3	--	25.3
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	--	--	<0.4	--	<0.07
Radium-228	pCi/L	--	--	0.254	0.455	0.076	1.23	0.682	0.155	-0.367	1.49	--	--	--	--	--	0.283
Radium-226	pCi/L	--	--	0.609	0.636	0.428	0.517	0.187	0.71	0.189	0.153	--	--	--	--	--	0.0962
Radium-226/228	pCi/L	5	--	0.863	1.091	0.504	1.747	0.869	0.865	-0.178	1.643	--	--	--	--	--	0.3792
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.28	--	--	--	0.36	--	0.2
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2.1	--	--	--	2	--	0.8
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2.19	--	--	--	1	--	1
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	0.742	0.709	0.789	0.949	--	--	0.879	--	0.848
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	0.138	0.139	0.112	0.119	--	--	0.126	--	0.121

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-16S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/9/2016	7/20/2016	9/21/2016	11/17/2016	1/11/2017	3/8/2017	5/10/2017	7/18/2017	10/4/2017	1/3/2018	6/6/2018	8/16/2018	11/14/2018	2/11/2019
Field Parameters																	
Elevation	ft NGVD	--	--	369.7	369.61	369.16	368.56	367.84	367.87	367.88	368.53	367.58	366.38	369.62	370.12	368.86	369.84
pH	S.U.	--	5.88 - 8.55	7.53	7.1	7.31	6.9	7.16	7.1	8.26	6.34	7.25	7.34	7.23	7.07	7.02	7.12
Specific Conductance	µmhos/cm	--	--	0.822	764	719	669	677	804	581	595	647	872	770	920	720	570
Turbidity	NTU	--	--	0.74	0.34	5.21	0.5	0.25	0.42	1.78	0.57	0.72	0.54	2.2	0	0.3	1.3
Dissolved Oxygen	mg/L	--	--	0.34	0.4	7.29	0.62	0.55	0.18	0.69	22.45	0.31	0.82	7.8	0	1.35	0.41
Temperature	°C	--	--	15.7	16.39	17.48	16.91	14.47	18.48	16.01	15.63	15.99	14.46	15.73	17.04	14.2	14.4
ORP	mV	--	--	112.4	56.2	153.4	233.5	83	56.1	177.3	-118.9	13.6	-12.2	-36.9	147	142	183
Laboratory Parameters																	
Antimony	µg/L	6	--	0.03	0.03	0.25	0.02	0.02	0.02	0.02	0.02	--	--	--	--	0.05	--
Arsenic	µg/L	10	--	0.37	0.37	0.38	0.34	0.42	0.31	0.39	0.33	--	--	--	--	0.34	--
Barium	µg/L	2000	--	32.3	29.9	29.5	25.3	25.1	25.7	29.8	25.6	--	--	--	--	29.9	--
Beryllium	µg/L	4	--	<0.005	<0.005	<0005	<0.005	<0.005	<0.005	<0.004	<0.004	--	--	--	--	<0.02	--
Cadmium	µg/L	5	--	0.03	0.03	0.1	0.006	0.008	0.004	0.01	0.04	--		--	--	0.08	--
Chromium	µg/L	100	--	0.2	0.5	0.3	1.03	0.081	0.463	0.196	0.101	--	--	--	--	0.07	--
Cobalt	µg/L	6	--	0.073	0.025	0.07	0.028	0.014	0.012	0.063	0.01	--	--	--	--	<0.02	--
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.1	0.19	--	1.19	--	1.46	--
Lead	µg/L	15	--	0.074	0.057	0.182	<0.004	0.039	0.006	0.027	0.01	--	--	--	--	0.112	--
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	--	--	--
Molybdnum	µg/L	100	--	1.15	1.21	1.11	1.19	1.21	1.32	1.14	0.98	--	--	--	--	0.9	--
Selenium	µg/L	50	--	0.6	0.6	0.8	0.4	0.4	0.4	0.3	0.4	--	--	--	--	3.2	--
Thallium	µg/L	2	--	0.01	<0.01	<0.01	<0.01	0.02	0.02	0.01	0.01	--	--	--	--	<0.1	--
Zinc	µg/L	--	--	--	--	--	--	--	--	--	2	2	--	5	--	31.6	--
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	24	24.1	27.6	--	24.9	--	24.9	--
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	2.1	7.43	--	5.68	--	3	--
Boron	mg/L	--	0.088	0.028	0.025	0.024	0.025	0.017	0.038	0.082	0.037	0.061	--	0.109	0.034	0.107	0.02
Calcium	mg/L	--	(79.5) 114	96.2	83	93.5	96.4	94.6	106	105	91.8	108	109	108	109	104	--
Lithium	mg/L	0.04	--	0.007	0.031	0.005	0.018	0.013	0.013	0.008	0.01	--	--	--	--	0.02	--
Magnesium	mg/L	--	--	--	--	--	--	--	36.4	36.6	31.4	38.2	--	38.8	--	37.4	--
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.0028	--	--	0.0062	--	0.004	--
Potassium	mg/L	--	--	--	--	--	--	--	1.01	1.3	0.97	1.03	--	1.1	--	1.28	--
Sodium	mg/L	--	--	--	--	--	--	--	36.9	36.7	28.7	35.7	--	38	--	44.4	--
Strontium	mg/L	--	--	--	--	--	--	--	0.129	0.132	0.108	0.133	--	0.137	--	0.138	--
Alkalinity	mg/L	--	--	--	--	--	--	--	423	431	436	438	--	463	--	510	--
Bromide	mg/L	--	--	--	--	--	--	--	0.1	0.158	0.162	0.206	--	0.118	--	0.1	--
Chloride	mg/L	--	(29.6) 24	18.7	19	17.1	16.4	17.5	19.3	22.9	19.8	19.3	--	17.3	--	16.2	--
Fluoride	mg/L	4	0.506	0.44	0.46	0.38	0.3	0.35	0.36	0.38	0.33	0.41	--	0.42	--	0.39	--
TDS	mg/L	--	(412.7) 517	483	471	509	486	474	473	499	484	503	517	520	533	548	517
Sulfate	mg/L	--	(52.4) 52	46.9	50.1	42.1	38.3	39.2	39.6	42.3	40.7	45	--	40.8	--	40.3	--
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	--	<0.4	--	<0.07	--
Radium-228	pCi/L	--	--	-0.0274	0.34	-0.131	0.0963	1.8	0.169	-0.045	2.76	--	--	--	--	0.0697	--
Radium-226	pCi/L	--	--	0.163	0.707	0.0255	0.198	0.193	0.113	0.145	0.0933	--	--	--	--	0.0503	--
Radium-226/228	pCi/L	5	--	0.1356	1.047	-0.1055	0.2943	1.993	0.282	0.1	2.8533	--	--	--	--	0.12	--
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.1	--	--	1.21	--	2.59	--
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	1	--	--	5.2	--	4	--
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.9	--	--	1	--	1	--
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	<0.0004	<0.0004	0.051	0.015	--	0.004	--	<0.003	--
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	0.0013	0.0145	0.0007	0.0127	--	0.0047	--	0.0023	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-16I

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/9/2016	7/20/2016	9/21/2016	11/17/2016	1/11/2017	3/8/2017	5/19/2017	7/18/2017	10/4/2017	1/3/2018	6/6/2018	8/16/2018	11/14/2018	2/11/2019
Field Parameters																	
Elevation	ft NGVD	--	--	369.79	369.62	369.18	368.57	367.84	367.87	367.87	368.58	367.58	366.39	369.62	370.06	368.78	369.77
pH	S.U.	--	6.73 - 7.90	7.69	7.56	7.37	7.08	7.36	7.28	6.96	7.2	7.46	7.68	7.37	7.23	7.3	7.4
Specific Conductance	µmhos/cm	--	--	957	870	867	702	674	779	569	665	644	821	720	797	545	476
Turbidity	NTU	--	--	0.42	0.46	1.37	1.4	0.18	1.41	2.27	3.15	0.7	1.9	0.89	0	0.41	0.8
Dissolved Oxygen	mg/L	--	--	0.29	8.08	0.68	0.53	0.46	0.34	0.21	0.29	0.28	0.38	0.46	0	0.95	0.36
Temperature	°C	--	--	16.2	16.86	15.43	15.64	14.71	15.19	15.48	15.99	15.71	13.08	15.93	15.56	14.42	14.5
ORP	mV	--	--	224.4	-158.9	54.7	242.3	86.1	53.5	49.8	-3.1	4.1	-25.6	-68.4	120	148	122
Laboratory Parameters																	
Antimony	µg/L	6	--	0.02	0.01	0.01	0.05	0.01	0.02	0.06	0.02	--	--	--	--	<0.02	--
Arsenic	µg/L	10	--	0.71	0.75	0.75	0.67	0.72	0.68	0.7	0.73	--	--	--	--	0.66	--
Barium	µg/L	2000	--	267	267	262	234	220	221	206	238	--	--	--	--	153	--
Beryllium	µg/L	4	--	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.004	<0.004	--	--	--	--	<0.02	--
Cadmium	µg/L	5	--	0.06	0.03	0.03	0.05	0.04	0.03	0.08	0.03	--		--	--	0.02	--
Chromium	µg/L	100	--	0.1	0.2	0.1	0.082	0.085	0.422	0.204	0.118	--	--	--	--	0.05	--
Cobalt	µg/L	6	--	0.602	0.627	0.576	0.546	0.514	0.58	0.56	0.599	--	--	--	--	0.336	--
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.56	0.46	--	0.62	--	0.45	--
Lead	µg/L	15	--	0.023	0.025	0.023	0.053	0.01	0.034	0.153	0.065	--	--	--	--	<0.02	--
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	--	--	--
Molybdnum	µg/L	100	--	1.02	1.02	1.03	0.93	1	1.17	0.91	1.07	--	--	--	--	1	--
Selenium	µg/L	50	--	0.2	0.2	0.1	0.2	0.1	0.2	0.4	0.2	--	--	--	--	0.2	--
Thallium	µg/L	2	--	0.085	0.06	0.074	0.069	0.071	0.075	0.075	0.07	--	--	--	--	<0.1	--
Zinc	µg/L	--	--	--	--	--	--	--	--	--	2.7	0.8	--	0.6	--	0.8	--
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	19.9	20	22.8	--	19.8	--	18.5	--
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	15.5	14	--	10.2	--	5	--
Boron	mg/L	--	0.107	0.031	0.027	0.026	0.024	0.015	0.1	0.032	0.044	0.05	--	0.046	--	0.139	0.02
Calcium	mg/L	--	(79.5) 114	110	93.9	95.9	96.2	89.3	101	86.7	91.3	84	71.9	82.9	61.6	53.7	--
Lithium	mg/L	0.04	--	0.005	0.005	0.006	0.013	0.01	0.013	0.01	0.003	--	--	--	--	<0.009	--
Magnesium	mg/L	--	--	--	--	--	--	--	27.6	24.7	25.6	23	--	23.1	--	14.8	--
Manganese	mg/L	--	--	--	--	--	--	--	--	--	1.03	--	--	0.902	--	0.613	--
Potassium	mg/L	--	--	--	--	--	--	--	2.9	2.47	2.62	3.21	--	3.05	--	3.16	--
Sodium	mg/L	--	--	--	--	--	--	--	46.2	41.4	50	69.2	--	66	--	74.4	--
Strontium	mg/L	--	--	--	--	--	--	--	0.155	0.139	0.14	0.135	--	0.136	--	0.09	--
Alkalinity	mg/L	--	--	--	--	--	--	--	368	376	369	359	--	359	--	300	--
Bromide	mg/L	--	--	--	--	--	--	--	0.1	0.152	0.154	0.206	--	0.168	--	0.1	--
Chloride	mg/L	--	(29.6) 114	80.4	86.8	90.2	59.1	44.1	39.3	37.9	50.2	70.8	71.2	58.6	61.1	47.8	--
Fluoride	mg/L	4	0.192	0.1	0.15	0.1	0.1	0.1	0.16	0.1	0.08	0.1	--	0.17	--	0.17	--
TDS	mg/L	--	(412.7) 589	539	532	544	508	481	460	461	465	495	487	480	456	408	--
Sulfate	mg/L	--	(43.51) 44	38.7	42.2	36.8	33	34	35.4	35.1	36.1	40.4	--	38.7	--	32.5	--
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	--	<0.4	--	<0.07	--
Radium-228	pCi/L	--	--	0.357	1	0.977	0.174	2.27	0.182	0.427	0.513	--	--	--	--	0.483	--
Radium-226	pCi/L	--	--	0.235	0.576	0.248	0.413	0.362	0.399	0.511	0.274	--	--	--	--	0.162	--
Radium-226/228	pCi/L	5	--	0.592	1.576	1.225	0.587	2.632	0.581	0.938	0.787	--	--	--	--	0.645	--
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.14	--	--	0.57	--	1.43	--
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	1	--	--	0.7	--	2	--
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2	--	--	0.8	--	1	--
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	<0.0004	<0.0004	0.051	0.014	--	0.024	--	0.004	--
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	1.03	1.06	1.04	0.873	--	0.849	--	0.616	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-16D

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/9/2016	7/19/2016	9/20/2016	11/17/2016	1/11/2017	3/8/2017	5/10/2017	7/18/2017	10/4/2017	1/3/2018	6/6/2018	8/16/2018	11/14/2018	2/11/2019	4/1/2019
Field Parameters																	Verify	Verify
Elevation	ft NGVD	--	--	369.85	369.68	369.23	368.64	367.91	367.94	367.96	368.64	367.68	366.47	369.69	370.13	368.87	369.84	370.82
pH	S.U.	--	6.04 - 9.13	6.8	7.31	7.26	7.29	7.48	7.44	7.54	9.03	7.6	7.74	7.32	7.26	7.35	7.37	7.28
Specific Conductance	µmhos/cm	--	--	519	582	538	613	525	614	436	597	516	692	690	782	607	510	945
Turbidity	NTU	--	--	1.8	0.24	0.31	0.55	0.4	0.81	1.74	0.41	2.95	1.85	0.9	0	0.35	1.4	0.91
Dissolved Oxygen	mg/L	--	--	0.4	--	1.33	0.55	0.49	0.11	0.29	0.32	0.21	0.47	0.44	0	0.94	1.48	0.64
Temperature	°C	--	--	16.8	16.96	16.04	15.1	14.55	15.2	15.46	15.62	15.77	13.14	15.94	15.88	14.45	13.2	13.5
ORP	mV	--	--	-19	23.5	35.7	108	14.6	2.1	36.6	108.9	-26.4	-36.7	-70.7	-11	62.8	60	-16.7
Laboratory Parameters																		
Antimony	µg/L	6	--	0.02	0.02	0.02	0.02	0.01	0.02	0.03	0.03	--	--	--	--	<0.02	--	--
Arsenic	µg/L	10	--	0.48	0.4	0.31	0.32	0.34	0.31	0.33	0.39	--	--	--	--	0.32	--	--
Barium	µg/L	2000	--	240	246	221	217	210	224	212	247	--	--	--	--	270	--	--
Beryllium	µg/L	4	--	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.004	<0.004	--	--	--	--	<0.02	--	--
Cadmium	µg/L	5	--	0.08	0.08	0.02	0.05	0.02	0.01	0.07	0.1	--		--	--	0.04	--	--
Chromium	µg/L	100	--	0.3	0.4	0.1	1.21	0.112	0.188	0.151	0.141	--	--	--	--	0.05	--	--
Cobalt	µg/L	6	--	0.617	0.547	0.418	0.452	0.354	0.401	0.466	0.571	--	--	--	--	0.472	--	--
Copper	µg/L	--	--	--	--	--	--	--	--	--	2.21	0.11	--	0.07	--	0.23	--	--
Lead	µg/L	15	--	0.078	0.04	0.021	0.066	0.008	0.022	0.07	0.103	--	--	--	--	0.03	--	--
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	--		--	--
Molybdnum	µg/L	100	--	2.06	2.31	1.96	1.98	1.99	2.27	1.9	2.03	--	--	--	--	2	--	--
Selenium	µg/L	50	--	0.04	0.04	<0.03	<0.03	<0.03	0.05	<0.03	<0.03	--	--	--	--	0.03	--	--
Thallium	µg/L	2	--	0.03	0.069	0.02	0.02	0.02	0.04	0.02	0.02	--	--	--	--	<0.1	--	--
Zinc	µg/L	--	--	--	--	--	--	--	--	--	12.8	52.4	--	7.1	--	15.4	--	--
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	17.1	17.6	20.3	--	18.5	--	18.2	--	--
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	6.2	3.72	--	2.86	--	1	--	--
Boron	mg/L	--	0.113	0.033	0.013	0.012	0.014	0.004	0.023	0.102	0.017	0.059	--	0.033	--	0.07	--	--
Calcium	mg/L	--	(79.5) 88	84.3	68.7	70.5	77.9	72.4	79.2	75.8	71.7	80.4	80.1	90.2	83.8	84.1	--	--
Lithium	mg/L	0.04	--	0.001	0.013	0.003	0.006	0.013	0.007	0.008	0.0006	--	--	--	--	<0.009	--	--
Magnesium	mg/L	--	--	--	--	--	--	--	22.4	22.2	21	23.3	--	27.1	--	24.3	--	--
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.975	--	--	1.2	--	1	--	--
Potassium	mg/L	--	--	--	--	--	--	--	1.12	1.54	0.97	1.33	--	1.22	--	1.27	--	--
Sodium	mg/L	--	--	--	--	--	--	--	22.3	21.6	22.1	24.7	--	26.7	--	30	--	--
Strontium	mg/L	--	--	--	--	--	--	--	0.142	0.143	0.128	0.146	--	0.18	--	0.166	--	--
Alkalinity	mg/L	--	--	--	--	--	--	--	202	210	215	195	--	235	--	238	--	--
Bromide	mg/L	--	--	--	--	--	--	--	0.15	0.204	<0.05	0.233	--	0.303	--	0.275	--	--
Chloride	mg/L	--	(29.6) 73	68.7	69.6	67.6	63.6	67.9	65.4	69.9	69.6	81.5	86	108	99.7	102	109	107
Fluoride	mg/L	4	0.251	0.2	0.22	0.22	0.17	0.21	0.22	0.22	0.17	0.22	--	0.22	--	0.21	--	--
TDS	mg/L	--	(412.7) 384	350	321	342	356	343	347	367	363	383	--	434	447	434	439	429
Sulfate	mg/L	--	(39.69) 40	36.4	37.4	33.4	33.2	34	35.3	37.2	36.8	40	37.9	38.6	--	38.6	--	--
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	--	<0.4	--	<0.07	--	--
Radium-228	pCi/L	--	--	-0.173	0.294	1.1	0.285	0.92	0.583	-0.121	0.222	--	--	--	--	0.138	--	--
Radium-226	pCi/L	--	--	0.0514	--	0.248	0.624	0.796	0.228	0.151	0.292	--	--	--	--	0.179	--	--
Radium-226/228	pCi/L	5	--	-0.1216	0.294	1.348	0.909	1.716	0.811	0.03	0.514	--	--	--	--	0.317	--	--
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.18	--	--	0.35	--	1.5	--	--
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2	--	--	1	--	3	--	--
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	1	--	--	2	--	2	--	--
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	0.004	0.002	0.098	0.051	--	0.058	--	0.023	--	--
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	0.862	0.948	0.989	0.947	--	1.19	--	1	--	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-17S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/8/2016	7/20/2016	9/20/2016	11/16/2016	1/10/2017	3/7/2017	5/9/2017	7/19/2017	10/4/2017	6/5/2018	11/13/2018
Field Parameters														
Elevation	ft NGVD	--	--	370.14	370.11	369.81	369.37	368.47	368.21	368.24	368.89	373.03	369.48	368.74
pH	S.U.	--	7.11 - 7.97	7.77	7.3	7.65	7.7	7.6	7.5	7.3	7.5	7.44	7.41	7.51
Specific Conductance	µmhos/cm	--	--	350	373	344	146	310	60	357	287	351	319	280
Turbidity	NTU	--	--	0.6	0.7	0.79	1	1	1	3	1	0.47	0.4	0.89
Dissolved Oxygen	mg/L	--	--	0.6	1.2	0.37	0.1	0.2	1	0.2	0.2	0.38	10.12	1.07
Temperature	°C	--	--	14.7	17.9	14.55	14.7	13.8	13.5	14.9	14.3	16.82	14.39	13.45
ORP	mV	--	--	80	44	49.4	-40	62	47	45	30	-50.3	-84.3	121
Laboratory Parameters														
Antimony	µg/L	6	--	0.01	0.03	0.02	0.03	0.03	0.04	0.04	0.02	--	--	0.02
Arsenic	µg/L	10	--	0.24	0.26	0.22	0.2	0.21	0.2	0.22	0.22	--	--	0.17
Barium	µg/L	2000	--	2.12	2.74	2.24	2.4	3.45	3.94	4.37	2.25	--	--	2.11
Beryllium	µg/L	4	--	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.004	<0.004	--	--	<0.02
Cadmium	µg/L	5	--	0.02	0.08	0.01	0.02	0.02	0.09	0.02	0.06	--	--	0.02
Chromium	µg/L	100	--	0.5	0.2	0.1	0.066	0.489	0.776	0.233	0.124	--	--	0.07
Cobalt	µg/L	6	--	0.047	0.105	0.034	0.029	0.04	0.076	0.138	0.053	--	--	0.05
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.38	0.69	0.23	0.21
Lead	µg/L	15	--	0.024	0.098	0.025	0.02	0.02	0.079	0.108	0.038	--	--	0.03
Mercury	µg/L	2	--	<0.002	0.002	<0.002	<0.002	<0.002	0.002	<0.002	<0.002	--	--	--
Molybdnum	µg/L	100	--	3.98	4.2	4.08	3.39	0.44	0.7	1.14	4.38	--	--	3.73
Selenium	µg/L	50	--	0.07	0.06	0.08	0.1	0.2	0.1	0.1	0.08	--	--	0.3
Thallium	µg/L	2	--	0.01	0.01	0.01	0.053	0.02	0.02	<0.01	0.03	--	--	<0.1
Zinc	µg/L	--	--	--	--	--	--	--	--	--	1	5.7	0.7	<0.7
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	14	13.7	15.8	13.5	13.2
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	9.55	10.2	4.01	2
Boron	mg/L	--	0.065	0.015	0.016	0.016	0.017	0.006	0.058	0.041	0.02	0.033	0.045	0.05
Calcium	mg/L	--	(79.5) 41	36.9	34.8	34.8	35.9	32.3	40	35.5	34.4	34.1	32.4	33.1
Lithium	mg/L	0.04	--	<0.0002	0.02	0.003	0.004	0.003	0.008	0.003	<0.0002	--	--	<0.009
Magnesium	mg/L	--	--	--	--	--	--	--	19.2	17.5	13.7	12.9	13	13.7
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.0428	--	0.0311	0.0418
Potassium	mg/L	--	--	--	--	--	--	--	0.88	0.79	0.49	0.47	0.5	0.59
Sodium	mg/L	--	--	--	--	--	--	--	42.5	35.3	31.9	27.7	24.5	25.8
Strontium	mg/L	--	--	--	--	--	--	--	0.0566	0.0529	0.0363	0.0345	0.0357	0.0374
Alkalinity	mg/L	--	--	--	--	--	--	--	231	221	196	189	188	202
Bromide	mg/L	--	--	--	--	--	--	--	0.02	0.05	<0.02	<0.02	0.04	<0.04
Chloride	mg/L	--	(29.6) 16	13.9	15.4	12.3	11.4	11	10.7	10.4	10.8	10.5	10.8	11.5
Fluoride	mg/L	4	1.08	0.85	0.86	0.73	0.7	0.48	0.46	0.58	0.82	0.89	0.98	0.91
TDS	mg/L	--	(412.7) 269	272	235	233	232	262	251	250	201	214	214	196
Sulfate	mg/L	--	(16.46) 16.5	14.3	14.8	10.9	10.5	10.7	12	13.1	10.2	10.7	9.5	8.4
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	<0.4	<0.1
Radium-228	pCi/L	--	--	0.783	-0.0129	0.027	0.791	-0.155	0.36	0.315	1.07	--	--	-0.0735
Radium-226	pCi/L	--	--	0.253	0.0439	0.0489	0.803	0.17	0.11	0.118	0.678	--	--	0.0202
Radium-226/228	pCi/L	5	--	1.036	0.031	0.0759	1.594	0.015	0.47	0.433	1.748	--	--	0.0202
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.35	--	0.56	0.7
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	1	--	1	1
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2.2	--	6.2	2
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	<0.0004	<0.0004	<0.0004	0.026	0.004	0.004
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	0.0028	0.0013	0.0322	0.0881	0.0304	0.041

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-17I

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/8/2016	7/20/2016	9/20/2016	11/16/2016	1/10/2017	3/7/2017	5/9/2017	7/19/2017	10/4/2017	12/12/2017	1/3/2018	6/5/2018	8/16/2018	9/26/2018	11/13/2018	2/11/2019	4/1/2019
Field Parameters																			Verify	Verify
Elevation	ft NGVD	--	--	370.09	370.13	369.82	369.12	368.47	368.23	368.25	368.89	368.07	367.23	366.84	369.46	370.64	370.06	369.35	369.89	369.89
pH	S.U.	--	6.82 - 7.96	7.55	7.2	7.1	7.8	7.5	7.5	7.2	7.3	7.37	7.49	7.8	7.36	7.48	7.48	7.55	7.68	7.68
Specific Conductance	µmhos/cm	--	--	839	914	1000	607	670	60	768	678	786	530	848	652	728	453	450	391	391
Turbidity	NTU	--	--	13.4	9.8	--	0.1	2	9	2	1	74.99	1.74	12	1.28	0	0.58	7.42	6.9	6.9
Dissolved Oxygen	mg/L	--	--	0.8	0.8	0.9	1.3	0.3	1	0.3	0.2	0.26	0.1	2.34	0.2	0.17	0.37	0.76	0.47	0.47
Temperature	°C	--	--	14.1	16.4	18.3	14.4	13.7	13.8	14.7	14.7	17.05	8.97	7.25	15.11	17.06	14.18	12.6	13.5	13.5
ORP	mV	--	--	116	-73	-40	204	-52	8	46	-59	-90.8	-54	-40.5	-99.8	-69	-77.9	-77.4	-55	-55
Laboratory Parameters																				
Antimony	µg/L	6	--	0.07	0.05	0.04	0.03	0.02	0.02	0.02	0.02	--	--	--	--	--	--	0.02	--	--
Arsenic	µg/L	10	--	7.14	7.41	6.45	3.38	3.94	4.61	3.61	3.76	--	--	--	--	--	--	3.65	--	--
Barium	µg/L	2000	--	168	190	198	149	148	159	133	140	--	--	--	--	--	--	86.8	--	--
Beryllium	µg/L	4	--	0.02	0.006	<0.005	<0.005	<0.005	<0.005	<0.004	<0.004	--	--	--	--	--	--	<0.02	--	--
Cadmium	µg/L	5	--	0.12	0.13	0.04	0.04	0.008	0.007	0.03	0.02	--	--	--	--	--	--	0.03	--	--
Chromium	µg/L	100	--	0.6	2.1	0.1	0.059	0.254	0.776	0.196	0.127	--	--	--	--	--	--	<0.04	--	--
Cobalt	µg/L	6	--	1.24	0.778	0.472	0.37	0.391	0.406	0.394	0.372	--	--	--	--	--	--	0.186	--	--
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.26	0.24	--	--	0.52	--	--	0.26	--	--
Lead	µg/L	15	--	1.19	0.284	0.133	0.049	0.02	0.026	0.115	0.02	--	--	--	--	--	--	0.03	--	--
Mercury	µg/L	2	--	0.003	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	--	--	--	--	--	--
Molybdnum	µg/L	100	--	3.6	3.66	3.08	3.37	3.2	3.62	3.26	3.42	--	--	--	--	--	--	4.09	--	--
Selenium	µg/L	50	--	0.1	0.05	0.05	<0.03	<0.03	0.05	0.03	<0.03	--	--	--	--	--	--	<0.03	--	--
Thallium	µg/L	2	--	0.03	0.02	0.02	0.056	0.02	0.02	0.01	0.05	--	--	--	--	--	--	<0.1	--	--
Zinc	µg/L	--	--	--	--	--	--	--	--	--	4.3	30.8	--	--	2.4	--	--	2	--	--
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	17.1	17	19.8	--	--	16.5	--	--	15.8	--	--
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	3.39	21.5	--	--	5.91	--	--	2	--	--
Boron	mg/L	--	0.098	0.058	0.056	0.051	0.041	0.034	0.079	0.083	0.052	0.061	--	--	0.081	--	--	0.07	--	--
Calcium	mg/L	--	(79.5) 96	73.7	83.1	88.9	80	72.3	81.4	69.6	64.4	63	--	--	51.2	--	--	36.5	--	--
Lithium	mg/L	0.04	--	<0.0002	0.004	0.005	0.006	0.009	0.008	0.005	<0.0002	--	--	--	--	--	--	<0.009	--	--
Magnesium	mg/L	--	--	--	--	--	--	--	21	19.6	17.4	16.5	--	--	13.4	--	--	9.44	--	--
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.155	--	--	--	0.122	--	--	0.0779	--	--
Potassium	mg/L	--	--	--	--	--	--	--	1.28	1.36	1.04	1.12	--	--	0.94	--	--	0.83	--	--
Sodium	mg/L	--	--	--	--	--	--	--	101	93.6	95.4	94.6	--	--	89.1	--	--	74.7	--	--
Strontium	mg/L	--	--	--	--	--	--	--	0.153	0.14	0.119	0.12	--	--	0.104	--	--	0.0796	--	--
Alkalinity	mg/L	--	--	--	--	--	--	--	221	226	229	245	--	--	238	--	--	231	--	--
Bromide	mg/L	--	--	--	--	--	--	--	0.347	0.396	0.372	0.283	--	--	0.213	--		0.1	--	--
Chloride	mg/L	--	(29.6) 241	195	209	214	164	159	158	151	145	115	86	110	80.2	61.1	--	50.1	--	--
Fluoride	mg/L	4	0.656	0.57	0.56	0.52	0.56	0.56	0.58	0.61	0.63	0.66	0.76	0.65	0.87	0.98	1.03	1.00	1.05	1.08
TDS	mg/L	--	(412.7) 657	609	569	620	540	513	549	528	509	486	--	471	418	376	--	328	--	--
Sulfate	mg/L	--	(50.8) 51	43.1	49.3	48.1	44.1	43.2	44.9	43.5	44.7	46.6	44.8	--	41	--	--	29.6	--	--
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	--	--	<0.4	--	--	<0.1	--	--
Radium-228	pCi/L	--	--	0.615	0.386	1	0.499	0.531	0.33	0.191	0.791	--	--	--	--	--	--	0.275	--	--
Radium-226	pCi/L	--	--	1.31	0.781	0.587	0.263	0.979	0.693	0.816	0.0231	--	--	--	--	--	--	0.351	--	--
Radium-226/228	pCi/L	5	--	1.925	1.167	1.587	0.762	1.51	1.023	1.007	0.8141	--	--	--	--	--	--	0.626	--	--
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.33	--	--	--	0.57	--	--	1.62	--	--
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2.2	--	--	--	1	--	--	3	--	--
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2	--	--	--	2.64	--	--	3	--	--
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	0.896	0.909	0.741	0.603	--	--	0.546	--	--	0.348	--	--
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	0.185	0.188	0.141	0.144	--	--	0.113	--	--	0.0765	--	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-21S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/9/2016	7/19/2016	9/21/2016	11/16/2016	1/11/2017	3/8/2017	5/9/2017	7/19/2017	10/4/2017	12/12/2017	6/6/2018	11/14/2018	2/11/2019	2/11/2019
Field Parameters																Verify	Verify
Elevation	ft NGVD	--	--	369.38	369.28	368.85	368.52	367.76	366.84	367.86	368.72	367.13	366.24	369.54	368.42	370.37	371.3
pH	S.U.	--	5.99 - 9.07	6.6	7.54	7.59	7.5	7.32	7.6	8.86	7.23	7.53	8	7.77	7.34	7.74	7.8
Specific Conductance	µmhos/cm	--	--	387	450	454	501	410	540	344	398	402	390	400	380	318	404
Turbidity	NTU	--	--	2.5	0.91	0.78	0.46	1.03	2.6	0.71	2.28	3.31	6	2.1	1.67	2.8	2.45
Dissolved Oxygen	mg/L	--	--	2.3	4.37	5.67	4.46	6.66	4.2	3.36	32.59	4.01	6.2	3.36	9.55	7.1	3.89
Temperature	°C	--	--	16.4	17.49	18.53	18.78	15.15	14.9	16.27	18.01	16.21	14.9	16.2	14.14	15.2	14.3
ORP	mV	--	--	36	13.1	48.9	46.9	198.4	150	160.1	-167.7	76.7	56	43	165.5	189	21.1
Laboratory Parameters																	
Antimony	µg/L	6	--	0.03	0.02	0.02	0.02	0.03	0.03	0.04	0.05	--	--	0.04	0.02	--	--
Arsenic	µg/L	10	--	0.53	0.47	0.46	0.43	0.47	0.49	0.47	0.42	--	--	0.45	0.44	--	--
Barium	µg/L	2000	--	18.5	19.6	19.4	19.1	19.3	21.9	17.7	21.9	--	--	18.5	17.8	--	--
Beryllium	µg/L	4	--	<0.005	<0.005	<0.005	<0.005	0.006	<0.005	<0.004	<0.04	--	--	<0.004	<0.02	--	--
Cadmium	µg/L	5	--	0.02	0.02	0.006	0.02	0.01	0.01	0.01	0.01	--		0.01	0.01	--	--
Chromium	µg/L	100	--	0.4	0.7	0.3	0.292	0.401	0.536	0.3	0.272	--	--	0.233	0.232	--	--
Cobalt	µg/L	6	--	0.104	0.033	0.03	0.023	0.022	0.053	0.027	0.006	--	--	0.02	0.06	--	--
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.27	0.35	--	0.52	0.53	--	--
Lead	µg/L	15	--	0.095	0.042	0.025	0.023	0.024	0.095	0.023	0.024	--	--	0.024	0.07	--	--
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	--	--	--
Molybdnum	µg/L	100	--	1.78	1.85	1.74	1.63	1.74	2	1.62	2.31	--	--	2.04	2	--	--
Selenium	µg/L	50	--	0.7	0.5	0.2	0.2	0.1	0.1	0.1	0.2	--	--	0.3	0.3	--	--
Thallium	µg/L	2	--	0.01	0.01	<0.01	<0.01	0.058	<0.01	<0.01	<0.01	--	--	<0.01	<0.1	--	--
Zinc	µg/L	--	--	--	--	--	--	--	--	--	2	214	--	3.7	0.8	--	--
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	23.5	22.8	26.2	--	22.5	23.2	--	--
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	1	16.5	--	6.55	17	--	--
Boron	mg/L	--	0.046	0.002	0.011	0.007	0.015	0.002	0.018	0.033	0.034	0.027	--	0.039	0.06	<0.02	<0.02
Calcium	mg/L	--	(79.5) 62	55.1	52.8	52	60	54.4	59	56	55.9	59.8	--	52.8	55	--	--
Lithium	mg/L	0.04	--	0.003	0.013	0.003	0.009	0.007	0.002	0.005	<0.0002	--	--	0.005	0.03	--	--
Magnesium	mg/L	--	--	--	--	--	--	--	21.3	20.5	20.7	21.8	--	19.2	19.6	--	--
Manganese	mg/L	--	--	--	--	--	--	--	--	--	<0.0001	--	--	0.0008	0.0041	--	--
Potassium	mg/L	--	--	--	--	--	--	--	0.6	0.69	0.57	0.61	--	0.58	0.88	--	--
Sodium	mg/L	--	--	--	--	--	--	--	18.9	16.6	20.6	19.3	--	15.5	17.1	--	--
Strontium	mg/L	--	--	--	--	--	--	--	0.0604	0.0601	0.58	0.061	--	0.0554	0.0553	--	--
Alkalinity	mg/L	--	--	--	--	--	--	--	202	195	212	210	--	183	193	--	--
Bromide	mg/L	--	--	--	--	--	--	--	<0.02	0.03	0.061	<0.02	--	0.02	<0.04	--	--
Chloride	mg/L	--	(29.6) 16	15	15.1	14.7	14.7	14.4	14.8	15.7	15.9	17.7	18	17.5	17.9	--	--
Fluoride	mg/L	4	0.689	0.61	0.064	0.62	0.63	0.54	0.58	0.6	0.54	0.6	0.6	0.66	0.66	--	--
TDS	mg/L	--	(412.7) 313	275	292	285	294	287	298	296	304	300	--	283	278	--	--
Sulfate	mg/L	--	23.6	21.2	21.1	17.4	14.9	15.9	16.5	17.6	18.8	20.1	21.1	18.7	17.0	17.9	17.5
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	--	<0.4	<0.07	--	--
Radium-228	pCi/L	--	--	0.129	0.0598	0.213	0.14	1.71	-0.0315	0.0831	0.989	--	--	--	0.0549	--	--
Radium-226	pCi/L	--	--	0.0309	0.513	0.239	0.344	0.357	0.0305	0.152	0.109	--	--	--	0.0246	--	--
Radium-226/228	pCi/L	5	--	0.1599	0.5728	0.452	0.484	2.067	-0.001	0.2351	1.098	--	--	--	0.0795	--	--
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.2	--	--	0.29	0.13	--	--
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	5.1	--	--	1	<0.7	--	--
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	18.3	--	--	1	2	--	--
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	<0.0004	<0.0004	0.008	0.017	--	0.005	<0.003	--	--
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	<0.0001	0.0001	0.0029	<0.0002	--	<0.0002	<0.0002	--	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-21I

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/9/2016	7/19/2016	9/21/2016	11/16/2016	1/11/2017	3/8/2017	5/9/2017	7/19/2017	10/4/2017	6/6/2018	11/13/2018
Field Parameters														
Elevation	ft NGVD	--	--	369.3	369.19	368.77	368.43	367.68	367.8	368.03	368.24	367	369.44	368.39
pH	S.U.	--	6.63 - 8.69	7.99	7.56	7.56	7.3	7.35	7.5	8.56	7.44	7.44	7.54	7.69
Specific Conductance	µmhos/cm	--	--	548	500	488	432	397	520	361	422	399	430	402
Turbidity	NTU	--	--	0.73	0.65	1.04	0.97	2.82	2.5	1.34	1.02	3.21	1.71	1.18
Dissolved Oxygen	mg/L	--	--	0.5	1.63	1.49	1.88	1.53	0.3	0.55	0.76	0.2	0.17	0.22
Temperature	°C	--	--	16.88	17.39	16.17	16.95	13.68	15.1	16.39	17.11	15.47	15.55	14.87
ORP	mV	--	--	-9.2	-185.2	-16.7	105.2	21.1	-3	160.7	2.1	-10.3	-13.4	8.7
Laboratory Parameters														
Antimony	µg/L	6	--	0.02	0.02	0.02	0.02	0.02	0.03	0.05	0.03	--	0.02	<0.02
Arsenic	µg/L	10	--	1.55	1.67	1.55	1.41	1.39	1.08	1.19	1.38	--	0.98	1.63
Barium	µg/L	2000	--	127	136	121	126	126	123	116	123	--	121	120
Beryllium	µg/L	4	--	<0.005	<0.005	<0.005	<0.005	0.01	<0.005	<0.004	<0.004	--	<0.004	<0.02
Cadmium	µg/L	5	--	0.02	0.02	0.02	0.04	0.02	0.01	0.01	0.01	--		0.03
Chromium	µg/L	100	--	0.1	0.2	0.1	0.386	1.04	0.349	0.125	0.143	--	0.061	0.1
Cobalt	µg/L	6	--	0.514	0.558	0.422	0.524	0.437	0.437	0.412	0.517	--	0.398	0.685
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.07	0.09	0.11	0.51
Lead	µg/L	15	--	0.02	0.021	0.046	0.035	<0.004	0.01	0.022	0.033	--	0.026	0.181
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--
Molybdnum	µg/L	100	--	4.92	5.25	4.46	4.4	4.63	4.31	4.06	4.18	--	4.69	5.13
Selenium	µg/L	50	--	<0.03	0.05	0.03	0.09	0.07	0.07	0.05	0.05	--	<0.03	<0.03
Thallium	µg/L	2	--	0.03	0.03	0.02	0.02	0.04	0.02	0.03	0.03	--	0.03	<0.1
Zinc	µg/L	--	--	--	--	--	--	--	--	--	0.6	0.9	1	11.1
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	17.8	18.1	19.7	17.6	17.7
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	4.55	2.56	3.39	17.2
Boron	mg/L	--	0.092	0.007	0.012	0.011	0.012	<0.002	0.028	0.027	0.08	0.029	0.034	0.08
Calcium	mg/L	--	(979.5) 73	69	64.7	65.1	68.4	59.5	66.5	62.9	60.1	63.9	66.5	61.5
Lithium	mg/L	0.04	--	<0.0002	0.019	0.004	0.006	0.005	0.007	0.008	0.004	--	0.007	<0.009
Magnesium	mg/L	--	--	--	--	--	--	--	20.9	20.1	18.4	20	21.2	19.3
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.428	--	0.476	0.535
Potassium	mg/L	--	--	--	--	--	--	--	0.92	1.08	1.26	0.8	0.9	1.21
Sodium	mg/L	--	--	--	--	--	--	--	16	15.4	13	15	15.5	14.7
Strontium	mg/L	--	--	--	--	--	--	--	0.0931	0.0922	0.0805	0.0889	0.096	0.0887
Alkalinity	mg/L	--	--	--	--	--	--	--	212	222	221	215	230	224
Bromide	mg/L	--	--	--	--	--	--	--	0.03	0.05	<0.02	0.04	0.04	<0.04
Chloride	mg/L	--	(79.5) 22	21.1	21.7	20.4	20	19.9	19.6	21	20.4	20.5	20.6	20.2
Fluoride	mg/L	4	0.38	0.33	0.36	0.34	0.34	0.3	0.32	0.34	0.3	0.31	0.38	0.36
TDS	mg/L	--	(412.7) 359	331	334	305	317	292	275	306	322	306	317	294
Sulfate	mg/L	--	50	46.2	47.9	43.2	40.4	41	39.6	42.4	43.6	45.7	44.6	43.4
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	<0.4	<0.1
Radium-228	pCi/L	--	--	0.126	0.036	0.676	0.0796	1.78	0.281	0.108	0.45	--	--	0.638
Radium-226	pCi/L	--	--	0.223	1.37	0.305	0.576	0.953	0.601	0.483	0.775	--	--	0.315
Radium-226/228	pCi/L	5	--	0.349	1.406	0.981	0.6556	2.733	0.882	0.591	1.225	--	--	0.953
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.09	--	0.11	0.23
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.7	--	1	1
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	1	--	<0.8	<1
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	0.019	<0.0004	0.078	0.062	0.024	0.028
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	0.37	0.427	0.425	0.441	0.427	0.441

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-21D

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/9/2016	7/19/2016	9/21/2016	11/16/2016	1/11/2017	3/8/2017	5/9/2017	7/19/2017	10/4/2017	1/3-11/18	6/6/2018	11/13/2018
Field Parameters															
Elevation	ft NGVD	--	--	369.44	369.34	368.92	368.59	367.86	368.07	367.86	368.42	367.17	366.66	369.58	368.38
pH	S.U.	--	6.71 - 8.73	8.14	7.76	7.69	7.47	7.19	7.6	7.44	8.48	7.48	7.03	7.65	7.66
Specific Conductance	µmhos/cm	--	--	591	544	478	585	441	60	493	531	449	564	470	451
Turbidity	NTU	--	--	2.82	0.48	1.93	0.33	3.09	1.9	1.42	0.55	1.01	1.11	2.43	1.87
Dissolved Oxygen	mg/L	--	--	0.53	0.17	0.49	0	1.82	0.2	0.22	0.47	0.31	18.7	0.18	0.33
Temperature	°C	--	--	15.24	16.81	15.93	15.25	12.99	15	16.7	17.58	16.26	14.93	15.45	14.15
ORP	mV	--	--	80.4	26.3	78.1	51.1	141.4	51	40	168.3	21.3	170.4	25.1	23.2
Laboratory Parameters															
Antimony	µg/L	6	--	0.08	0.08	0.06	0.06	0.07	0.07	0.08	0.12	--	--	0.11	0.07
Arsenic	µg/L	10	--	1.07	1.06	0.95	0.86	0.99	0.92	0.97	1.04	--	--	0.84	0.89
Barium	µg/L	2000	--	241	240	226	206	220	220	216	226	--	--	218	201
Beryllium	µg/L	4	--	<0.005	<0.005	<0.005	<0.005	0.01	<0.005	<0.004	<0.004	--	--	0.005	<0.02
Cadmium	µg/L	5	--	0.02	0.03	0.02	0.03	0.02	0.02	0.04	0.02	--		0.13	0.02
Chromium	µg/L	100	--	0.2	0.3	0.1	0.05	0.124	0.433	0.165	0.11	--	--	0.091	0.06
Cobalt	µg/L	6	--	0.216	0.21	0.195	0.171	0.202	0.182	0.208	0.203	--	--	0.196	0.224
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.11	2.7	--	1.16	0.16
Lead	µg/L	15	--	0.107	0.075	0.066	0.056	0.091	0.092	0.118	0.089	--	--	0.229	0.1
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	--
Molybdnum	µg/L	100	--	6.31	6.66	6.13	5.33	6.09	5.68	5.07	5.29	--	--	5.17	4.76
Selenium	µg/L	50	--	0.2	0.2	0.3	0.3	0.2	0.5	0.6	0.5	--	--	0.2	0.05
Thallium	µg/L	2	--	0.03	0.02	0.03	0.02	0.04	0.02	0.02	0.03	--	--	0.03	<0.1
Zinc	µg/L	--	--	--	--	--	--	--	--	--	1	187	--	6.5	1
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	17.5	17.6	19.6	--	17.6	17
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	6.79	14.1	--	17.2	9.86
Boron	mg/L	--	0.071	0.022	0.015	0.015	0.013	0.004	0.024	0.107	0.015	0.092	0.088	0.03	0.04
Calcium	mg/L	--	(79.5) 83	74.2	60.6	70.4	74.7	67.3	76.2	71.5	70.9	67.8	--	70.7	62.1
Lithium	mg/L	0.04	--	0.002	0.025	0.005	0.007	0.009	0.005	0.013	0.0005	--	--	0.006	0.01
Magnesium	mg/L	--	--	--	--	--	--	--	25	24.3	23.9	22.7	--	23.6	21.3
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.592	--	--	0.596	0.634
Potassium	mg/L	--	--	--	--	--	--	--	2.11	2.41	2.44	3.91	--	1.97	3.95
Sodium	mg/L	--	--	--	--	--	--	--	18.1	17.2	19.7	20.8	--	15.7	17.7
Strontium	mg/L	--	--	--	--	--	--	--	0.144	0.142	0.144	0.168	--	0.147	0.191
Alkalinity	mg/L	--	--	--	--	--	--	--	247	271	277	262	--	268	268
Bromide	mg/L	--	--	--	--	--	--	--	<0.05	0.08	0.07	<0.05	--	0.05	0.05
Chloride	mg/L	--	(29.6) 20	19.2	19.6	18.9	19.1	19.4	18.9	19.9	19.5	18.5	--	19.9	18.8
Fluoride	mg/L	4	0.407	0.36	0.38	0.36	0.33	0.36	0.33	0.35	0.3	0.32	--	0.4	0.34
TDS	mg/L	--	(412.7) 365	328	299	315	346	332	304	339	332	339	--	347	314
Sulfate	mg/L	--	43.22	39.2	41	35.5	32	34.4	35.1	37.1	36.5	37.4	--	38.4	35.2
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	--	<0.4	<0.07
Radium-228	pCi/L	--	--	0.441	0.77	0.604	0.688	0.722	0.518	0.0415	0.501	--	--	--	1.47
Radium-226	pCi/L	--	--	0.126	0.658	0.23	0.39	0.422	0.42	0.408	0.355	--	--	--	0.469
Radium-226/228	pCi/L	5	--	0.567	1.428	0.834	1.078	1.144	0.938	0.4495	0.856	--	--	--	1.939
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.39	--	--	0.08	1.33
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2.4	--	--	0.7	3
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2.16	--	--	2	1
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	<0.0004	<0.0004	0.053	0.016	--	<0.002	0.007
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	0.616	0.625	0.62	0.646	--	0.567	0.657

Notes:

GWPS - Groundwater Protection Standard
MCL - USEPA Maximum Contaminant Levels
RSL - USEPA Generic Tables for Residential Tapwater, May 2018, TR=1E-06, THQ=1.0
Field Parameter Units
  ft NGVD - Feet, National Geodetic Vertical Datum of 1929 (also known as mean sea level (MSL)
  °C - degrees Celcius
  S.U. - Standard Units
  µmhos/cm - micromhos per centimeter
  mg/L - milligrams per liter
  ORP - milliVolts (mV)
  NTU - Nephelometric Turbidity Units
Laboratory Parameter Units
  pCi/L picoCuries per Liter

Table A-2
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

NORTH POND LEACHATE INLET

Parameter	Units	11/26/2018	12/18/2018	1/8/2019	3/20/2019
Antimony	ug/L	<2.00	<4.00	<4.00	<2.00
Arsenic	ug/L	18	24.8	23.4	30.1
Barium	ug/L	71.1	58	82	65.8
Beryllium	ug/L	<2.00	<4.00	<4.00	<2.00
Cadmium	ug/L	<1.00	<2.00	<2.00	<1.00
Chromium	ug/L	36.6	71.2	82.9	58.4
Cobalt	ug/L	1.24	<2.00	<2.00	1.3
Lead	ug/L	<2.00	<4.00	<4.00	<2.00
Mercury	ug/L	<0.010	<0.010	<0.010	<0.010
Molybdnum	ug/L	1660	1230	1900	1530
Nickel	ug/L	53	11	11.1	8.97
Selenium	ug/L	490	586	653	630
Silver	ug/L	<2.00	<4.00	<4.00	<2.00
Thallium	ug/L	<10.0	<20.0	<20.0	<10.0
Zinc	ug/L	<100	<200	<200	<100
Aluminum	ug/L	4770	7280	6080	5950
Boron	mg/L	9.18	12.3	10.6	9.23
Calcium	mg/L	277	277	368	283
Iron	mg/L	0.104	<0.20	<0.200	<0.20
Lithium	mg/L	<0.030	<0.30	<0.300	<0.30
Magnesium	mg/L	3.62	4.43	4.9	3.55
Manganese	mg/L	0.009	0.0104	0.0115	0.0113
Potassium	mg/L	132	113	135	116
Sodium	mg/L	5730	6440	6780	6540
Alkalinity	mg/L	244	257	250	219
Chloride	mg/L	982	847	993	854
Fluoride	mg/L	<1.50	<1.50	<1.50	<1.50
Nitrate	mg/L	3	3.26	3.64	2.85
TDS	mg/L	25,600	24,300	28,400	23,600
Sulfate	mg/L	16,600	14,400	17,400	14,800

Table A-2
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

WEST POND LEACHATE INLET

Parameter	Units	10/31/2018	11/26/2018	12/18/2018	1/8/2019	3/20/2019
Antimony	ug/L	< 4.00	<2.00	<4.00	<4.00	<2.00
Arsenic	ug/L	23	30.4	39.3	46.8	84.8
Barium	ug/L	71.2	71	60.8	72.2	71.1
Beryllium	ug/L	< 4.00	<2.00	<4.00	<4.00	<2.00
Cadmium	ug/L	< 2.00	<1.00	<2.00	<2.00	<1.00
Chromium	ug/L	28.1	57.2	127	72.5	124
Cobalt	ug/L	< 2.0	<1.00	<2.00	<2.00	<1.00
Lead	ug/L	<4.00	<2.00	<4.00	<4.00	<2.00
Mercury	ug/L	<0.010	<0.010	<0.010	0.011	<0.010
Molybdnum	ug/L	2390	2820	2360	3040	3000
Nickel	ug/L	6.94	8.1	8.15	11.3	7.25
Selenium	ug/L	752	943	1000	1190	1310
Silver	ug/L	<4.00	<2.00	<4.00	<4.00	<2.00
Thallium	ug/L	<20.0	<10.0	<20.0	<20.0	<10.0
Zinc	ug/L	<200	<100	<200	<200	<100
Aluminum	ug/L	4410	5690	8110	6220	9850
Boron	mg/L	12.2	10.6	11	11.4	11.5
Calcium	mg/L	284	214	166	240	231
Iron	mg/L	<0.020	<0.020	<0.200	<0.200	<0.200
Lithium	mg/L	0.053	0.031	<0.300	<0.300	<0.300
Magnesium	mg/L	3.16	4.69	8.33	6.98	2.22
Manganese	mg/L	0.0086	0.0064	<0.010	<0.010	0.0129
Potassium	mg/L	182	165	113	149	192
Sodium	mg/L	5390	5220	6120	6780	8240
Alkalinity	mg/L	244	261	310	298	411
Chloride	mg/L	1190	1180	937	1250	1170
Fluoride	mg/L	<1.5	<1.50	<1.50	<1.50	<1.50
Nitrate	mg/L	5.46	5.72	5.76	6.76	7.99
TDS	mg/L	29,400	30,700	22,100	29,600	30,900
Sulfate	mg/L	18,900	18,100	14,100	18,100	19,000

Appendix B
Full Size Geochemical Exhibits

Exhibit 3-3. **CCR monitoring well and landfill leachate ponds boron concentrations.**

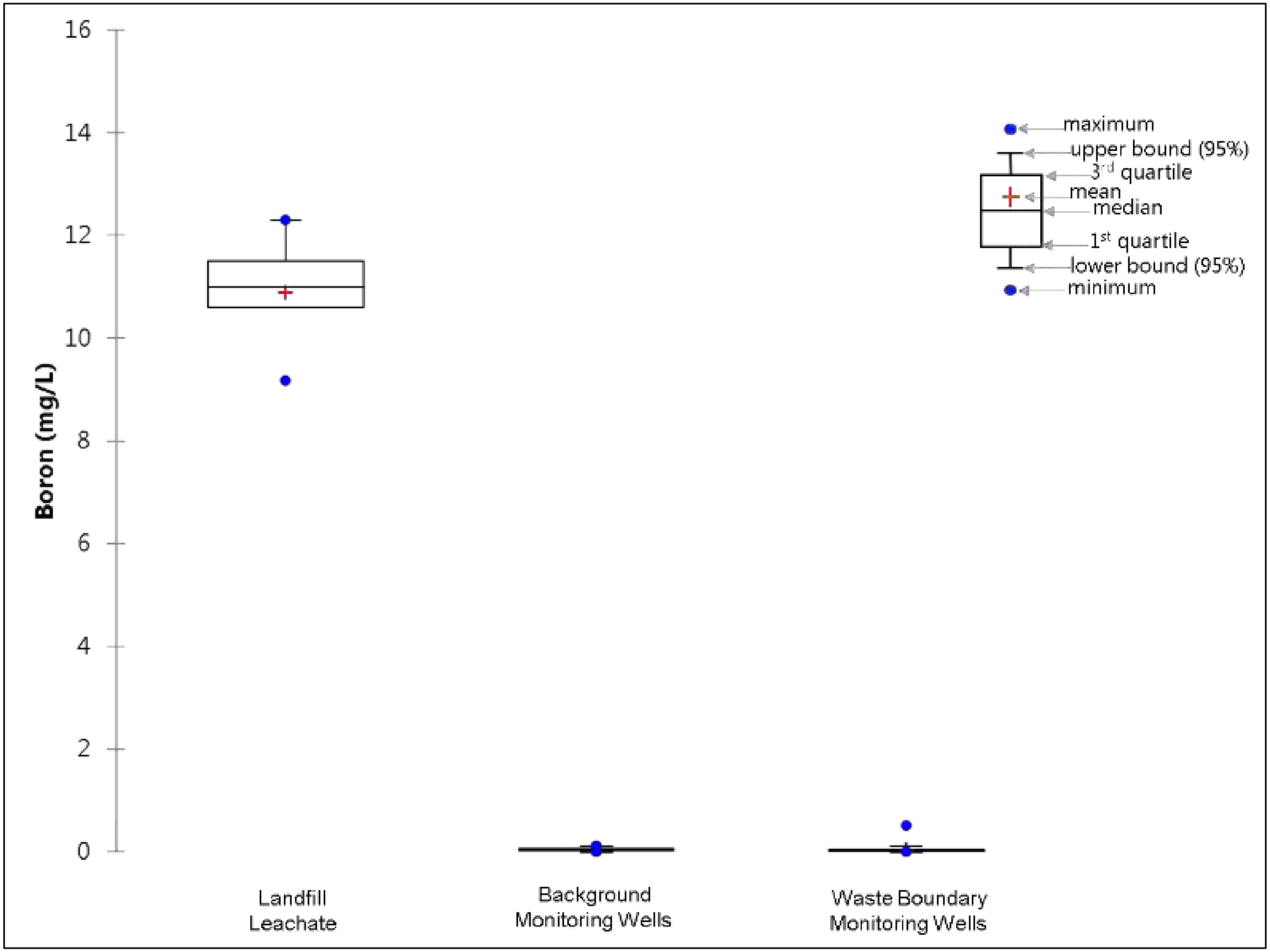


Exhibit 3-4. CCR monitoring well and landfill leachate ponds sulfate concentrations.

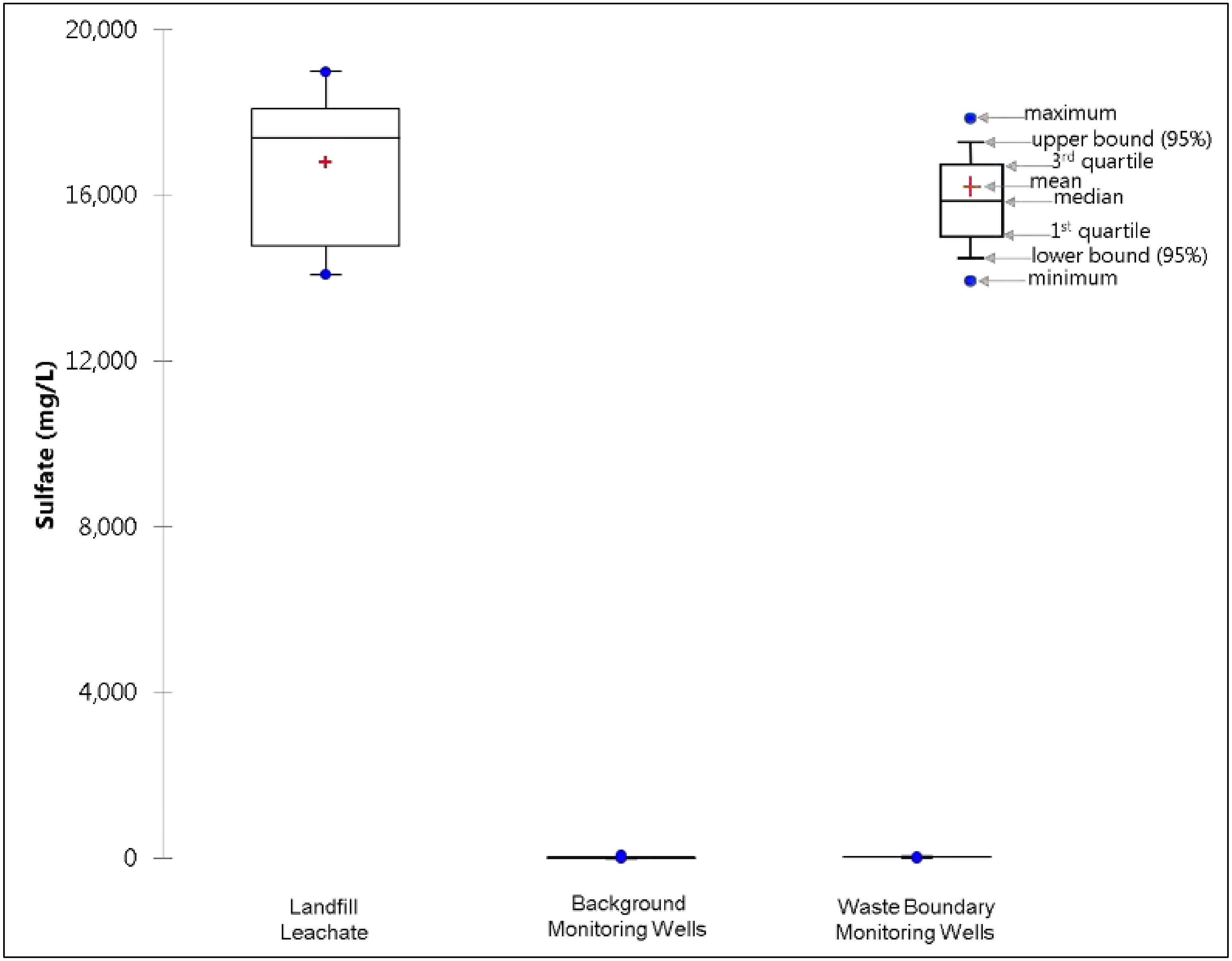


Exhibit 3-5. **Boron to chloride ratio versus chloride concentration for CCR Landfill groundwater monitoring wells and leachate for comparison.**

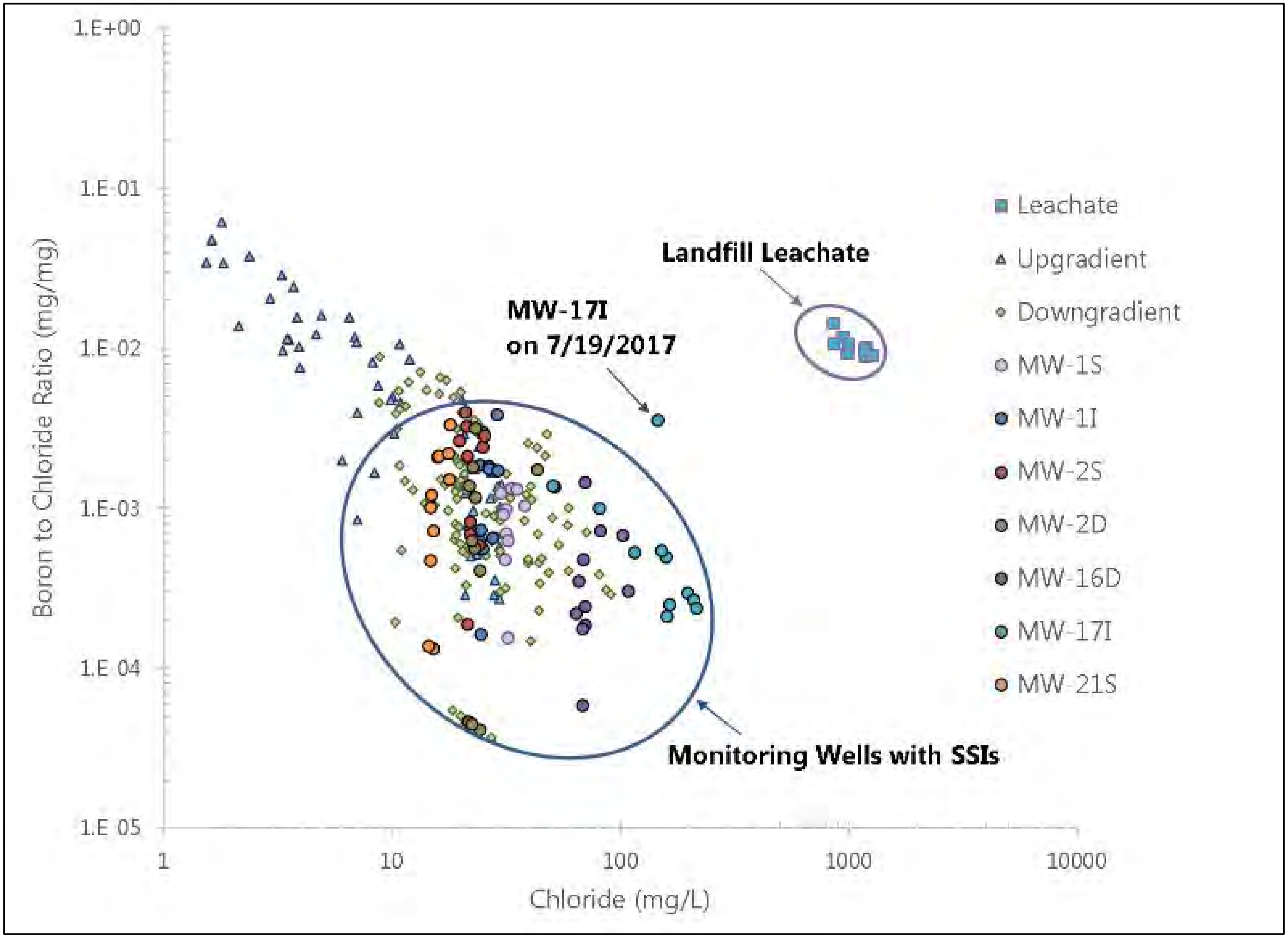


Exhibit 3-6. **Sulfate to chloride ratio versus chloride concentration for CCR Landfill groundwater monitoring wells and leachate for comparison.**

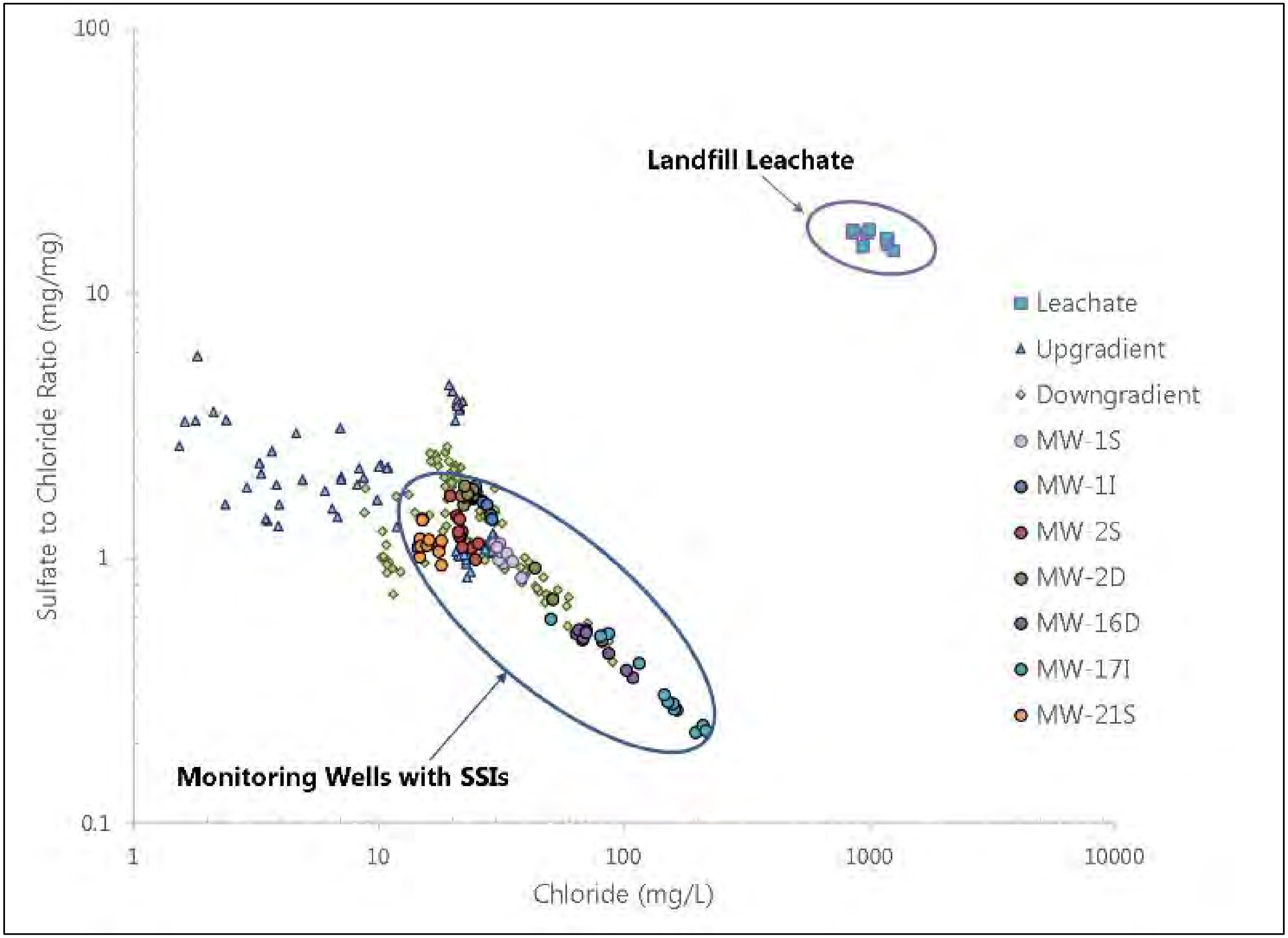


Exhibit 3-7. **Piper diagram of major ion water quality for CCR Landfill monitoring wells with SSIs and leachate for comparison.**

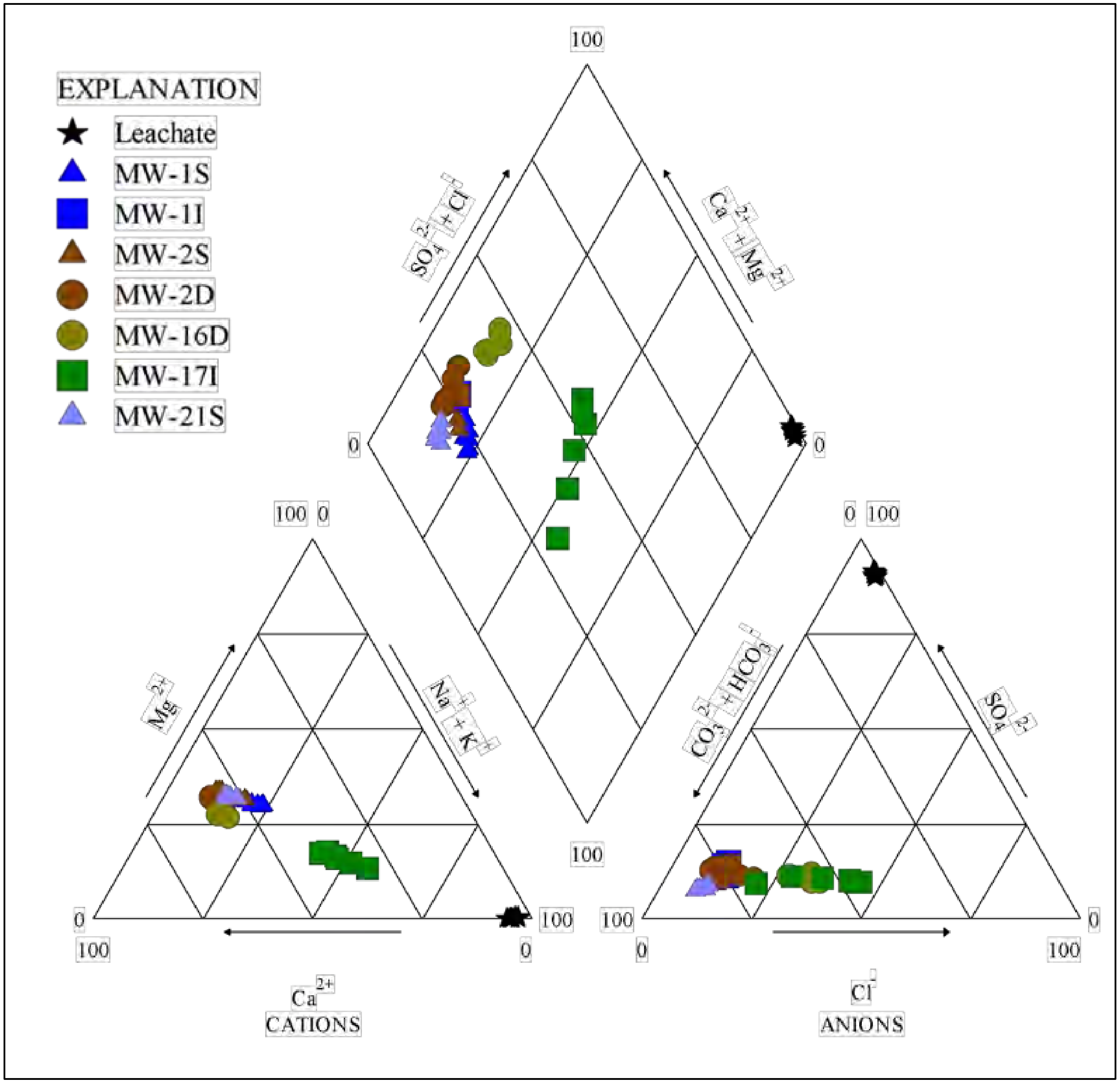


Exhibit 3-8. **Boron isotope ratio (· 11B) versus boron concentration for CCR Landfill leachate and monitoring wells for comparison.**

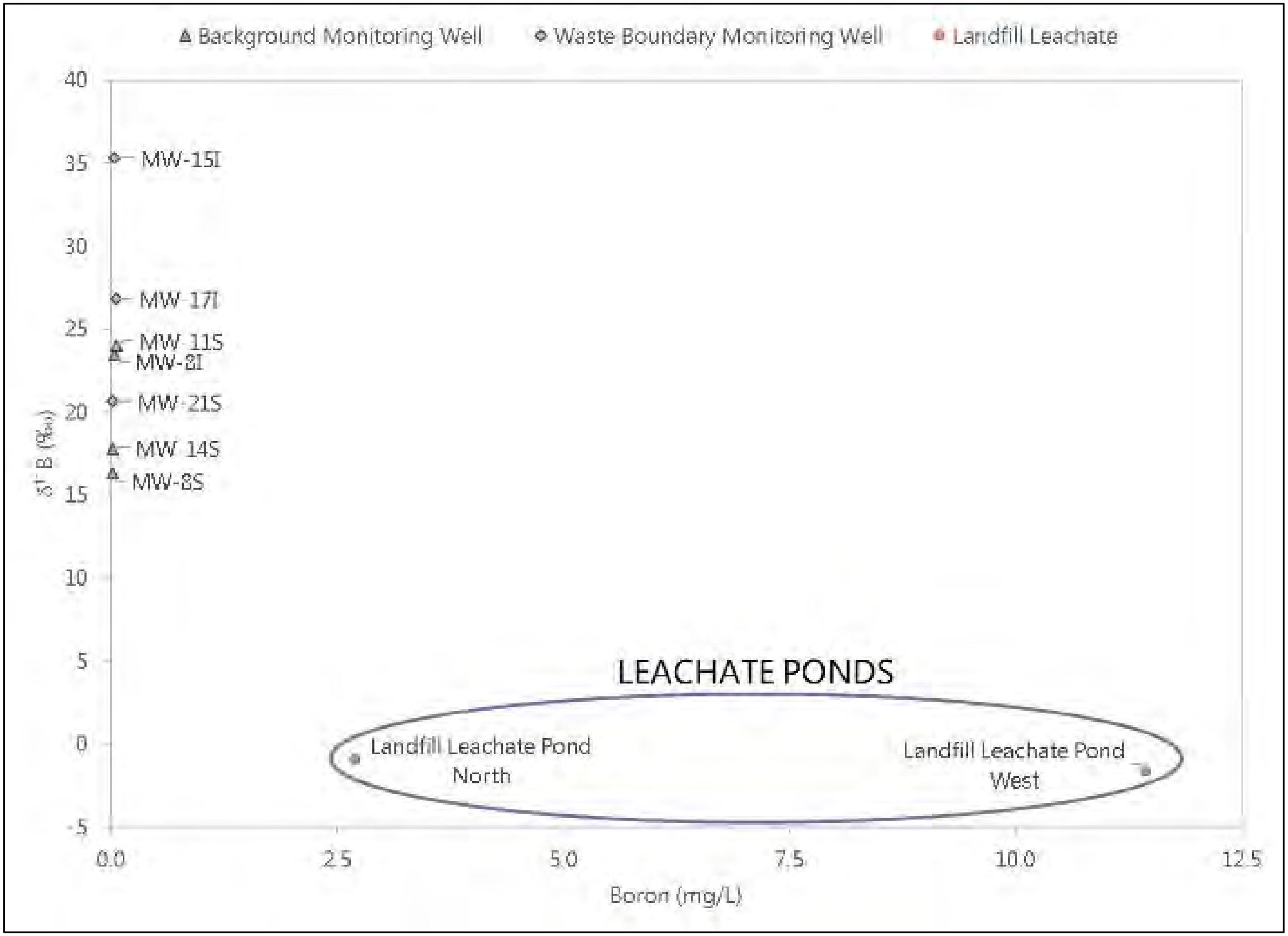
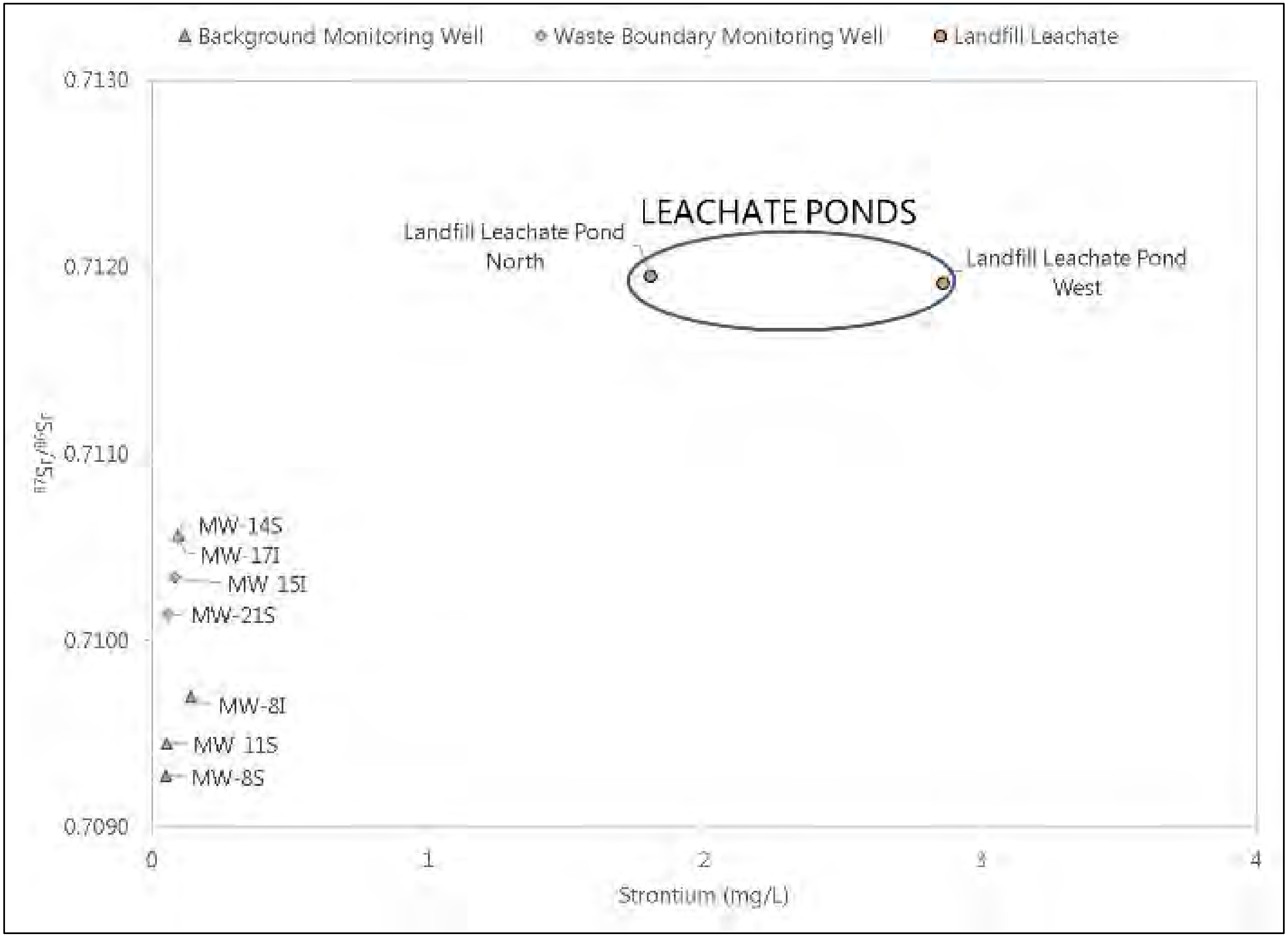


Exhibit 3-9. **Strontium isotope ratio ($^{87}Sr/^{86}Sr$) versus strontium concentration for CCR Landfill leachate and monitoring wells for comparison.**



APPENDIX 5

ROCKPORT PLANT CCR LANDFILL

ANNUAL GROUNDWATER MONITORING REPORT COVERING 2019 ACTIVITIES

ALTERNATE SOURCE DEMONSTRATION

DECEMBER 10, 2019

Alternative Source Demonstration for Appendix III Constituents, CCR Landfill

American Electric Power Service Corporation
Rockport Generating Station, Rockport, Spencer County, Indiana
Project # 7362192733

Prepared for:

American Electric Power Service Corporation
1 Riverside Plaza, Columbus, Ohio 43215

10 December 2019

Wood Environment & Infrastructure Solutions, Inc.
2456 Fortune Drive, Suite 100
Lexington, KY 40509
USA
T: 859-255-3308
www.woodplc.com

10 December 2019

Mr. David Miller
Director, Land Environment & Remediation Services
American Electric Power Service Corporation
1 Riverside Plaza
Columbus, OH 43215
Email: damiller@aep.com

Dear Mr. Miller:

Wood Environment & Infrastructure Solutions, Inc. (Wood) has prepared this Alternative Source Demonstration (ASD) for the CCR Landfill located at the AEP Rockport Plant in Rockport, Indiana. As detailed in this report, the results of this ASD conclude that statistically significant increases (SSIs) identified in samples from the waste boundary monitoring wells are not caused by releases from the CCR Landfill. We are available to discuss the details of this report at your convenience should you require additional information.

We very much appreciate working with AEP on this project. If you require additional information about this report, please feel free to contact Kathleen Regan at (859) 566-3724.

Sincerely,

Wood Environment & Infrastructure Solutions, Inc.

Kathleen D. Regan

Konrad W. Quast, PhD
Senior Hydrogeologist

Kathleen D. Regan, PE
Senior Associate Engineer
Project Manager

Attachments

/kdr

cc: Dana Sheets, PE, American Electric Power Service Corporation

Alternative Source Demonstration for Appendix III Constituents, CCR Landfill

American Electric Power Service Corporation
Rockport Generating Station, Rockport, Spencer County, Indiana
Project # 7362192733

Prepared for:

American Electric Power Service Corporation
1 Riverside Plaza, Columbus, Ohio 43215

Prepared by:

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Lexington, KY 40509
USA
T: 859-255-3308

10 December 2019

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Third-party disclaimer

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Appendices

Executive Summary

American Electric Power (AEP) operates two units at the Rockport Plant for management of coal combustion residuals (CCR): the bottom ash ponds (BAP), and the CCR Landfill. Both are regulated under the federal CCR Rule (40 CFR Part 257) that became effective in October 2015 and modified in July 2018.

The CCR Landfill has been in the detection phase of groundwater monitoring as part of its compliance with the rule. The most recent statistical analysis of Appendix III constituents identified eight statistically significant increases (SSIs) above background, distributed among seven waste boundary monitoring wells. Four waste boundary monitoring wells exhibited SSIs for chloride (MW-1I, MW-2S, MW-2D and MW-16D). One of the six wells, MW-16D, also exhibited a SSI for total dissolved solids (TDS). The remaining SSI was observed for fluoride in monitoring well MW-17I, which did not exhibit any other SSI.

This alternative source demonstration (ASD) evaluates the occurrence of SSIs in terms of site geochemistry, hydrogeologic setting, and with respect to supplementary data collected to support the evaluation. Based on the analysis presented in this ASD, CCR Landfill leachate can be excluded as a source of Appendix III SSLs for the following reasons:

- Boron occurs naturally at low concentration in site groundwater, in similar concentrations in background and downgradient wells. Boron occurs at concentrations approximately three orders-of-magnitude in the Landfill leachate as compared to site groundwater, and is a conservative ion, making it an excellent indicator for impacts from landfill leachate impacts in groundwater. If landfill leachate were impacting groundwater, boron would be expected to be observed in multiple waste boundary wells and at statistically significant concentrations above background. It does not.

- Sulfate is another typical indicator for CCR leachate impacts, which also occurs naturally in site groundwater (at similar concentration ranges in background and downgradient wells) and is elevated in the CCR Landfill leachate at concentrations approximately three orders-of-magnitude above background monitoring wells. No SSIs for sulfate were determined in any of the waste boundary well samples.

- Chloride is a naturally occurring and conservative ion, which occurs in the CCR Landfill leachate at concentrations about two orders-of-magnitude above groundwater concentrations. Spatial trends can be observed in **Exhibits 3-5** and **3-6** and indicate that chloride concentrations tend to increase in groundwater moving downgradient from recharge areas. However, because the SSIs indicated for chloride are not associated with SSIs for boron and sulfate, the CCR Landfill leachate is not considered a source for the chloride detected in groundwater.

- The same conclusion can be drawn in regard to calcium, total dissolved solids (TDS) and fluoride, for which occasional SSIs are not consistently associated with boron, sulfate, or each other. The SSIs indicated for these constituents appear to be related to the natural variation in groundwater quality, along with a spatial trend of increasing TDS with distance from recharge area.

- Monitoring well MW-17I is associated with an SSI for fluoride. This well, along with MW-17S and the well cluster MW-15S/I are located cross-gradient of potential source materials. Groundwater monitored by these wells is not hydraulically influenced by the CCR Landfill.

1.0 Objective

American Electric Power (AEP) operates a CCR Landfill that is used for the management of coal combustion residuals (CCR). The landfill is regulated under the federal CCR Rule (40 CFR Part 257) that became effective in October 2015. During the initial phase of groundwater monitoring (detection monitoring), the CCR Rule requires the owners or operators of regulated units to collect at least eight independent samples from at least one background location and at least three waste boundary wells, analyzed for constituents listed in Appendix III and Appendix IV of the CCR rule. That sampling was completed in July 2017.

Four rounds of detection monitoring have been conducted at the landfill. Each round consists of an initial sampling event, followed by one or two rounds of verification samples based on the results of the initial events. Following completion of the verification sampling for each event, a statistical analysis is conducted to assess whether statistically significant increases (SSIs) above background are detected in the waste boundary monitoring wells for Appendix III constituents. For each semi-annual sampling round where SSIs are detected, an alternate source demonstration (ASD) has been performed to assess whether these SSIs were the result of a release of leachate from the CCR landfill.

Previous ASDs performed by Geosyntec and Wood Environment & Infrastructure Solutions, Inc. (Wood) have indicated that the source of previously-identified SSIs result from natural variation in groundwater quality or potential impacts from historical off-site oil and gas operations. The most recent ASD was completed by Wood in June 2019 for the detection monitoring event of November 2018, with verification samples taken in February and April 2019.

The first semiannual detection monitoring samples for 2019 were taken in May 2019, with verification samples taken in July and September 2019. Again, a statistical evaluation of monitoring results identified SSIs for several Appendix III constituents. The objective of this ASD is to review these results, and to assess whether the findings of the June 2019 ASD remain valid; that is, that the SSIs detected in the waste boundary wells are not the result of a release from the landfill.

1.1 Scope

As stated in 40 CFR 257.94(e)(2), the CCR Rule allows 90 days after the initial identification of Appendix III SSIs for the owner or operator to demonstrate that a source other than the regulated unit is responsible for identified SSIs. The regulations allow the ASD to address a number of potential causes of SSIs other than a release from the regulated unit, including error[s] in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.

The scope of this ASD is focused on evaluating the first semiannual detection monitoring results (including verification samples) and assessing whether the data are consistent with the assessment conducted in the most recent ASD report (Wood, June 2019). The ASD will be undertaken to assess, through multiple lines of evidence, whether an alternative source for the SSIs can be supported, following the guidelines published in October 2017 by the Electric Research Power Institute (EPRI, Guidelines for Development of Alternative Source Demonstrations at Coal Combustion Residual Sites). This report does not include evaluations of potential errors in sampling and analysis, or the statistical approaches which were used to identify the SSIs.

1.2 Approach

The ASD presented in this document is based on a geochemical and hydrologic evaluation of groundwater quality at the CCR Landfill. The purpose of this ASD is to evaluate the identified SSIs within the larger geochemical context of the CCR Landfill groundwater flow system, in order to assess the likelihood that these SSIs are the result of releases from the CCR Landfill. In addition to the groundwater analytical data collected for compliance with the CCR rule, used to support the statistical evaluation, Wood relied on supplemental analytical data, including analyses of the CCR Landfill leachate and monitoring well groundwater analyses of the isotopes of boron and strontium.

1.3 Report Organization

This ASD has been prepared following the *Guidelines for Development of Alternative Source Demonstrations at Coal Combustion Residual Sites* (EPRI, 2017) to the extent applicable. **Section 2** presents a summary the CCR Landfill setting, and a summary of the results from the statistical evaluation of the Appendix III detection monitoring parameters. **Section 3** presents the primary and secondary lines of evidence developed from a geochemical evaluation of the site. **Section 4** presents the technical findings of the ASD and includes certification by an Indiana-licensed Professional Engineer (PE). References are included in **Section 4**.

2.0 Background

2.1 Site Description

The Rockport Power Plant is located in southwest Indiana in Spencer County, on property extending into three Townships: Ohio, Hammond and Grass. Two CCR-regulated units are located on the property, two adjacent bottom ash ponds (BAP) and the CCR Landfill. The general layout of the property and the locations of the CCR units are shown on **Figure 1**. The CCR Landfill, or Landfill, is located about 8,000 feet (1.5 miles) northeast of the generating plant. **Figure 2** shows the general layout of the CCR Landfill and the monitoring well locations.

2.1.1 Landfill Operation

The CCR Landfill is an active disposal unit that primarily contains fly ash, with materials generated by the emission control systems added beginning in 2007. These materials include sodium sulfate generated by the removal of sulfur dioxide by the dry sorbent injection (DSI) system, and granular brominated activated carbon used for mercury removal. To a lesser extent, some bottom ash has also been placed within the CCR Landfill. As shown on Figure 2, the active portion of the CCR Landfill directly adjoins a closed portion of the landfill to the northeast.

The CCR Landfill is currently permitted by the Indiana Department of Environmental Management (IDEM) Office of Land Quality, Solid Waste Permits Section, as a Restricted Waste Site (RWS) under Indiana Administrative Code (IAC) 329 Title 10 (Solid Waste CCR Landfill Disposal Facilities) Rule 9-4. The active CCR Landfill is permitted as a RWS Type I, which requires a liner and leachate collection system. The permit was most recently renewed on 10 February 2015.

Leachate from the CCR Landfill cells is collected in lined ponds located north and west of the active CCR Landfill area. These ponds also collect storm water runoff from the CCR Landfill area. Prior to discharge, the leachate commingled with runoff is transferred to the Leachate Treatment Pond (north of the West Leachate Pond). Effluent from the Leachate Treatment Pond is discharged and monitored under National Pollution Discharge Elimination System (NPDES) Permit No. IN0051845 at Station 002.

2.1.2 Groundwater Flow

The principal groundwater flow zone underlying the CCR Landfill consists of the saturated section of the unconsolidated glaciofluvial sand and sand and gravel valley train sediments that fill the Ohio River valley in this area. The depth to water in this zone typically ranges from 20 to 35 feet (ft) below ground surface (BGS), and the saturated thickness (which generally increases to the southeast) ranges from less than 15 ft to more than 80 ft. A generalized cross-section is presented in **Figure 3**.

Groundwater primarily occurs under unconfined conditions, or semi-confined conditions where the saturated zone is directly overlain by surficial silt and clay. Piezometric data collected from clustered monitoring wells indicate that vertical gradients within the saturated zone are minor, and groundwater flow is primarily horizontal. Groundwater flows into the plant and landfill area from the north, northwest and west, continues flowing under the property generally to the south and east, towards Honey Creek and/or the Ohio River. Potentiometric contour maps illustrating typical groundwater flow conditions are presented in **Figures 4 through 7**.

2.1.3 Existing Groundwater Monitoring System

In 2015, when the CCR Rule took effect, a monitoring well network was already present at the CCR Landfill for groundwater monitoring under IDEM permit. While the valley train sediments are considered a single well-connected aquifer system, the saturated thickness of the sediments allowed for wells at the CCR Landfill to be installed in clusters, to monitor up to three levels (shallow – "S", intermediate – "I", and deep – "D") within the principal flow zone. However, the valley train sediments that make up the flow zone thin to the north, leaving less unsaturated overburden upgradient of the CCR Landfill. As a result, only one or two levels could be monitored in some locations.

The official CCR groundwater monitoring network for the CCR Landfill includes five background or cross-gradient wells (MW-6S, MW-8S/I, MW-11S and MW-14S) and 16 waste boundary wells (MW-1S/I/D, MW-2S/I/D, MW-15S/I, MW-16S/I/D, MW-17S/I and MW-21S/I/D). At most locations, the saturated overburden was thick enough to allow installation of screens at three different levels, with the deepest wells being completed just above bedrock at depths of 88 to 100 ft BGS. Two clusters, MW-15 and MW-17, are located just east of the CCR Landfill in an area of relatively shallow bedrock. Therefore, the deeper wells at these locations (designated "I") have completed depths just above bedrock at 66 to 67 ft BGS. A comprehensive summary of analytical data for the groundwater monitoring network since June 2016 is presented on **Table A-1** in **Appendix A**.

2.2 Summary of SSIs

Eight baseline monitoring events and one initial detection monitoring event for the CCR Landfill were completed prior to 17 October 2017. On behalf of AEP, Geosyntec submitted these results to Groundwater Stats Consulting, LLC for statistical analysis. Oversight on the use of statistical calculations was provided by Dr. Kirk Cameron of MacStat Consulting, Ltd.

According to the report (*Statistical Analysis Summary, Landfill,* Geosyntec 2018), the initial eight rounds of baseline data were used to calculate the upper prediction limits (UPLs) for each of the Appendix III constituents to represent background values. Results from the initial detection monitoring event were then compared to the UPLs established from the eight baseline rounds in order to identify SSIs compared to background. The initial statistical evaluation identified 11 SSIs for calcium (2), chloride (7), fluoride (1) and TDS (3). An initial ASD was prepared by Geosyntec focusing on statistical methods. Variation was noted in background concentrations across the site, and statistical methods were modified to use an intrawell approach for chlorine, calcium and TDS. As a result, no SSIs were identified for calcium, six SSIs were identified for chloride and two SSIs were identified for TDS. Since the statistical method remained unchanged for fluoride, one fluoride SSI remained.

In June 2018, Wood published an ASD which focused on geochemistry, and did not further evaluate statistical methods used at the site. The ASD demonstrated, through multiple lines of evidence, that the

SSIs identified in the statistical analysis of the initial detection monitoring event data are not the result of a release of leachate from the CCR Landfill.

The first semiannual detection monitoring event of 2018 was conducted in June, with verification sampling conducted in August and September 2018. Geosyntec evaluated the new data and based on multiple lines of evidence, revised the statistical approach for some monitoring wells. Initially, the statistical evaluation included a mixture of interwell (between wells) and intrawell (within one well) techniques. The interwell analysis compares data from waste boundary wells against a background data set composed of results from upgradient and cross-gradient well data. The intrawell approach compares each waste boundary well against a background composed of its own historical data and is used to detect statistically significant increases within samples from an individual well over time (Horsey, HR et. al., 2001). Spatial and temporal variability observed in samples from the background monitoring wells caused Geosyntec to select an intrawell approach for all Appendix III constituents in all waste boundary monitoring wells.

After using an intrawell approach, the number of SSIs was reduced to eight, distributed among seven waste boundary wells. In January 2019 Geosyntec published an ASD to document changes to the statistical methodologies and attributed the observed SSIs to impacts from historic off-site oil and gas operations. Sampling for the second semi-annual detection monitoring event in 2018 occurred on November 2018, with verification sampling conducted in February and April 2019. Geosyntec evaluated the second round of detection monitoring results which confirmed nine previously-identified SSIs. These SSIs were the subject of the most recently completed ASD by Wood (June 2019).

The first semiannual detection monitoring samples for 2019 were taken in May 2019, with verification samples taken in July and September 2019. Again, a statistical evaluation of monitoring results identified SSIs for Appendix III constituents. **Exhibit 1** compares the SSIs detected in the second semiannual sampling for 2018 (black) and the first semiannual sampling in 2019 (red). A table of all groundwater monitoring results for the CCR Landfill since June 2016 is presented on **Table A-1** in **Appendix A**.

Exhibit 1. Monitoring Wells and Appendix III Parameters with SSIs

Parameter	MW-1S	MW-1I	MW-2S	MW-2D	MW-16S	MW-16D	MW-17I	MW-21S
Calcium				♦️		♦️		
Chloride	◆	◆♦️	◆♦️	◆♦️		◆♦️		◆
Fluoride							♦️◆	
TDS				♦️	◆	◆♦️		

As shown in **Exhibit 1**, there is significant overlap between the SSIs identified in the second 2018 event and the first 2019 event, as well as several key differences.

- Fewer wells have been identified with SSIs: In the statistical analysis of the 2019 event, no new wells were identified having SSIs, and three wells no longer have identified SSIs (MW-1S, MW-16S and MW-21S).
- New SSIs have been identified for calcium (MW-2D and MW-16D), which previously had not been identified above background concentrations.
- A new SSI for TDS was identified for monitoring well MW-2D, which previously had not been identified.

Wood has reviewed their June 2019 ASD with respect to the statistical evaluation of the new semi-annual sampling event. The evaluation presented in the June 2019 ASD report is still valid, even in light of the new SSIs identified for calcium and TDS. Wood has updated the geochemical analysis that forms the basis of the ASD and has included updated graphics to support the findings in this current ASD report.

3.0 Alternative Source Demonstration

The ASD presented below relies on multiple lines of evidence that the SSIs identified in the statistical analysis are not caused by releases of landfill leachate into the groundwater flow system. When taken as a whole, these lines of evidence present a compelling case that the SSIs are the result of natural variation in groundwater quality. This ASD follows the approach of Wood's June 2019 report, updated with data collected for the first semi-annual sampling event for 2019.

In order to evaluate the potential of a release from the CCR Landfill to groundwater, Wood evaluated groundwater quality data, including isotopes, in the context of the geochemical characteristics of CCR Landfill leachate. The results of this evaluation support that CCR Landfill leachate at the Rockport site can be ruled out as a source of the SSIs identified in waste boundary monitoring wells, through primary and supporting lines of evidence, each of which are described in more detail within this section.

Primary lines of evidence focus on the relationship between source material that could be released into the subsurface (in this case, landfill leachate) and the type and distribution of SSIs identified in groundwater. The lines of evidence supporting the conclusion of this ASD can be summarized as follows:

- SSIs are not identified for the site-specific primary indicator constituents of the Rockport CCR Landfill leachate.
- Geochemical evaluations of the CCR Landfill support that leachate has not affected water quality.
  - Conservative ion ratios and major ion chemistry do not indicate a release from the CCR Landfill.
  - Isotopes of boron and strontium do not indicate a release from the CCR Landfill.
- Recent potentiometric data indicate the MW-17 cluster (where an SSI for fluoride has been identified) is located downgradient from the borrow area stormwater ponds and is cross-gradient of the CCR Landfill.

Each of these lines of evidence are described in detail below.

3.1 SSIs Are Not Identified for Primary Indicator Constituents

The primary indicators for CCR leachate typically have much higher concentrations in leachate than in natural groundwater. They are mobile and relatively non-reactive in groundwater, so that groundwater impacted by a CCR leachate release should have elevated concentrations of the indicator constituents relative to background and with relatively similar contributions. The elevated concentrations would be expected to result in SSIs identified by statistical evaluation of the data from the downgradient waste boundary wells, and the SSIs would be expected to be generally consistent between downgradient wells. The primary lines of evidence presented below compare the occurrence of SSIs in groundwater to the composition of landfill leachate.

3.1.1 Site-Specific Leachate Analysis for Primary Indicator Constituents

The composition of landfill leachate is governed by the types of materials placed in the unit and identifying the leachate's primary constituents is key to assessing a potential release to groundwater. Since all Appendix III constituents are naturally-occurring, the best indicators of CCR impacts are those constituents that are found at concentrations much higher in the source material than are seen in natural groundwater. AEP conducted sampling of its leachate collection system to identify relative concentrations of Appendix III and IV constituents in the Rockport CCR Landfill leachate.

The leachate collection system for the Landfill discharges into the North and West Leachate Collection Ponds, shown on **Figure 2**, discharge to the Leachate Treatment Pond, directly north of the West Leachate Pond. Five samples were collected from both the West and North Leachate Collection Ponds between 31 October 2018 and 20 March 2019 and results are detailed on **Table A-2** in **Appendix A**. A summary of the range of Appendix III constituent results for leachate pond samples, compared to background and waste boundary well samples, is provided below in **Exhibit 3-1**.

Exhibit 3-1. Summary of Landfill Leachate Pond and Groundwater Concentrations for Appendix III Constituents

	Range for Leachate Ponds		Range for Upgradient (Background) Wells		Range for Downgradient Waste Boundary Wells	
Parameter, Units in mg/L	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Boron	9.18	12.3	<0.004	0.115	0.001	0.139
Calcium	166	368	35.6	79.5	32.3	114
Chloride	847	1,250	1.54	30.0	8.78	214
Fluoride	<1.50	<1.50	0.25	1.0	0.064	1.08
Total Dissolved Solids (TDS)	22,100	30,900	179	408	196	620
Sulfate	14,100	19,000	3.8	87.5	7.7	54.7

Because the CCR Landfill leachate ponds also receive some storm water runoff, concentrations in at least some of these samples are likely to be diluted compared to concentrated leachate from landfilled materials (depending on the amount of recent rainfall). Nevertheless, pond samples serve as reliable indicators of the relative composition of leachate. As seen in **Exhibit 3-1**, boron and sulfate occur at concentrations as much as three orders-of-magnitude above background groundwater levels. Results for chloride and TDS are as much as two orders-of-magnitude above background concentrations. Calcium and fluoride concentrations are within the same orders-of-magnitude as those detected in background groundwater. These results indicate that boron and sulfate are the best indicator constituents of CCR impacts, followed by TDS and chloride, based on their elevated occurrence in landfill leachate compared to natural groundwater.

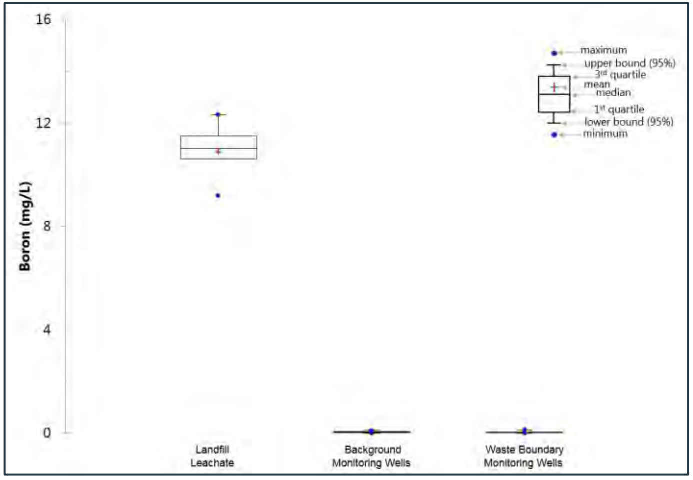
3.1.2 Occurrence of Primary indicator Constituents in Waste Boundary Monitoring Well Samples

Four primary indicator compounds are identified for the Rockport CCR Landfill leachate: boron, sulfate, TDS and chloride. Six SSIs have been identified for chloride, one for TDS and one for fluoride. However, no SSIs were identified in waste boundary wells for either boron or sulfate. Given the predominance of boron and sulfate in the CCR Landfill leachate, and that neither of these constituents are elevated above background, it is unlikely that Landfill leachate is the source of the observed SSIs. This assumption is supported by a more in-depth review of the indicator constituents, presented below.

Boron

No SSIs have been identified for boron. Boron has been identified in background wells at concentrations ranging from <0.004 to 0.115 mg/L. Concentrations in waste boundary well samples range from 0.001 to 0.139 mg/L. Landfill leachate boron concentrations are much higher and range from 9.18 to 12.3 mg/L. The boron results are plotted graphically on **Exhibit 3-2**, which illustrates the range of results for leachate (at the left of the chart) compared to and background and waste boundary groundwater samples. It should be noted that the highest concentration of boron observed in waste boundary groundwater samples (0.139 mg/L) occurred in MW-16I and did not represent an SSI for that well.

Exhibit 3-2. CCR monitoring well and landfill leachate ponds boron concentrations

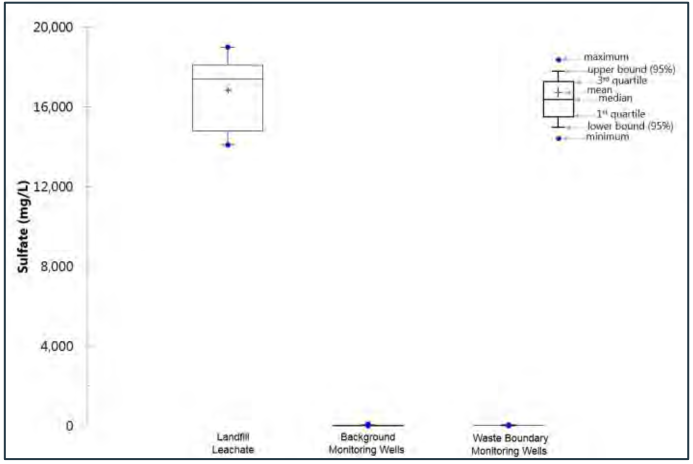


If a release of landfill leachate had occurred, boron concentrations in waste boundary well samples should be clearly higher than the range of background well results, and SSIs would likely be found in at least some of the monitoring wells with other identified SSIs.

Sulfate

No SSIs have been identified for sulfate. Sulfate has been identified in background wells at concentrations ranging from 3.8 to 87.5 mg/L. Concentrations in waste boundary well samples range from 7.7 to 54.7 mg/L. Landfill leachate sulfate concentrations are much higher and range from 14,100 to 19,000 mg/L. The sulfate results are plotted graphically on **Exhibit 3-3**, which clearly shows that leachate concentrations of sulfate are orders-of-magnitude higher than all groundwater samples, and that no discernable difference is present between the background and waste boundary samples. Furthermore, the highest monitoring well concentrations are seen in samples from background well MW-8I (68.2 to 87.5 mg/L).

Exhibit 3-3. CCR monitoring well and landfill leachate ponds sulfate concentrations



In conclusion, it is expected that a release of landfill leachate would elevate groundwater concentrations of all Appendix III constituents present in the leachate in relatively similar proportions. Even if all constituents were not exhibiting statistically significant increases, a pattern of related SSIs would be observed if the increases were caused by landfill leachate. Since all SSIs occurred in absence of a boron or sulfate SSI, it is concluded that these SSIs are caused by the natural variation in groundwater quality and not by releases from the CCR Landfill.

3.2 Geochemical Evaluations

While the CCR rule requires the use of statistical analyses of samples collected from groundwater monitoring wells to assess potential impacts from CCR units (SSIs), the approach does not consider the site specific hydrogeochemical interactions that can often be complex due to simultaneous operations and natural variation within the context of the local hydrogeologic setting. Since geochemical evaluations rely on interpretation of graphical data, the discussion includes reduced size exhibits imbedded in the text. Full size exhibits are included in **Appendix B**. The major observations and conclusions from the geochemical evaluation are summarized in the sections below.

3.2.1 Indicator Parameter Cross-Plots and Major Ion Chemistry

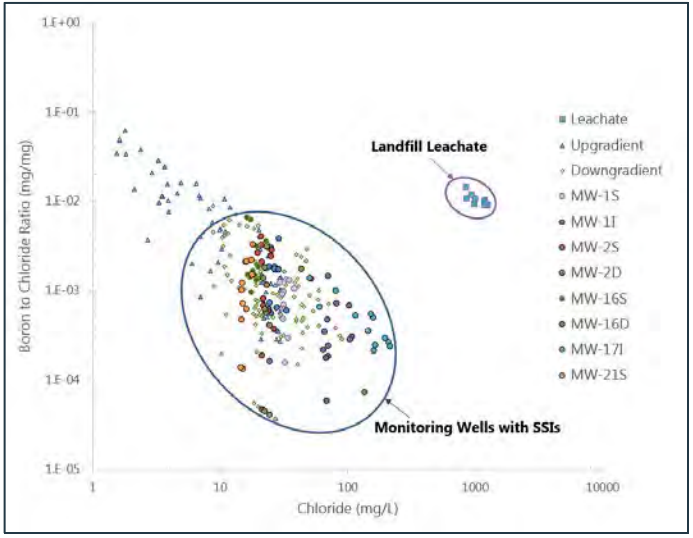
To aid in the interpretation of individual Appendix III and other potential indicator parameters for the assessment of potential releases from the CCR Landfill, ratios of selected Appendix III indicator parameters were calculated and plotted versus concentrations of the conservative ion chloride, and major ion chemistry was assessed as a whole system using Piper trilinear diagrams. The use of these plotting techniques typically provides groupings of end members (sources of water such as background groundwater or landfill leachate), and potential trends of mixing that are not readily identifiable by analysis of individual indicator parameters on their own.

Plots of the B/Cl and SO4/Cl ratios versus chloride in waste boundary monitoring wells show distinct end member groupings from that of the landfill leachate and support the conclusion that there are no discernable impacts from the CCR Landfill on any of the waste boundary monitoring wells. The graphics presented here include data for all wells in the CCR Landfill system and show that chloride concentrations tend to increase in groundwater moving downgradient from recharge areas represented by upgradient monitoring wells.

Boron to Chloride ratio Versus Chloride Concentration

The plotting of B/Cl versus chloride groundwater data shows primarily a single cluster that is similar to what is hypothesized as background based on the composition of leachate samples (**Exhibit 3-4**). The data are plotted on log-log scales due to the large range of concentrations and ratios making the separation in groupings appear closer than they are. The Landfill leachate clearly plots as a separate grouping of water quality having greater B/Cl ratios, while the monitoring well data plots along a trend of what can be described as natural variability. Background monitoring well MW-11S plots as upgradient recharge having lower chloride concentration and a higher B/Cl ratio followed by a trend of increasing chloride concentrations and salinity with decreasing B/Cl ratios along the flow path represented by downgradient monitoring wells due to geochemical evolution of groundwater. While chloride increases, boron does not increase at the same rate, resulting in the decreasing trend of B/Cl ratios as chloride concentrations and residence time increases. Thus, it is hypothesized that MW-11S

Exhibit 3-4. Boron to chloride ratio versus chloride concentration for CCR Landfill groundwater monitoring wells and leachate for comparison.

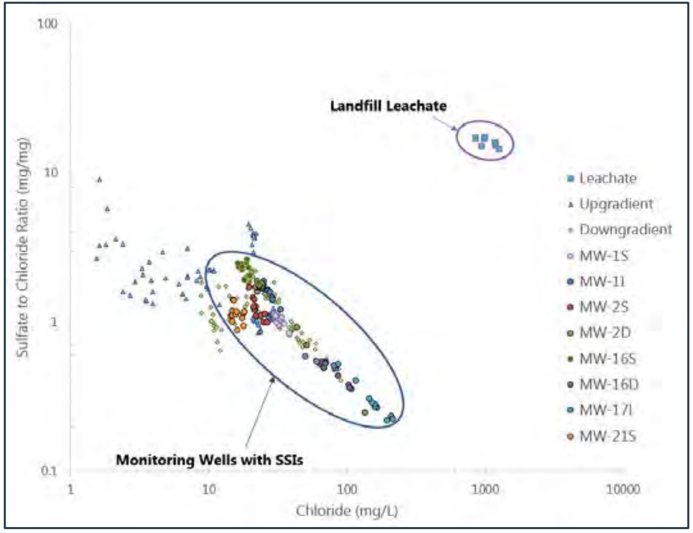


represents an extreme end member of recent recharge, or relatively fresh groundwater, and after flow through the shallow overburden groundwater evolves geochemically to a lower B/Cl ratio, as chloride increases, approaching the larger background cluster values that represent older more mineralized groundwater without a significant source of boron in the aquifer matrix. The extreme end of the groundwater dataset trend is represented by MW-17I, MW-16D, and MW-2D due to higher chloride concentrations, but with lower B/Cl ratios. This plot supports that these wells are not impacted by CCR Landfill leachate but could be influenced by infiltration from the storm water holding ponds.

Sulfate to Chloride Ratio Versus Chloride Concentration

Plotting of the SO_4/Cl ratio versus chloride shows similar results to the B/Cl ratios versus chloride concentration plot supporting the conclusion that there are no discernable impacts from the CCR Landfill on groundwater (**Exhibit 3-5**). The SO_4/Cl ratios for leachate group separately and are much higher than groundwater values. The SO_4/Cl ratios for leachate are typically around 15 mg/mg or higher, while groundwater ratios are below a value of 6 mg/mg. Similar to B/Cl ratios, the SO_4/Cl ratios versus chloride plot along a trend line of decreasing ratios as chloride and residence time increases. The extreme end of the groundwater data set trend is represented by MW-17I, MW-16D, and MW-2D variability due to higher chloride concentrations that is clearly different from leachate. Additionally, there is no trend of mixing of even small quantities of leachate with groundwater which would be shown by a deviation from the groundwater trend toward leachate, and the separation is distinct between downgradient groundwater and leachate.

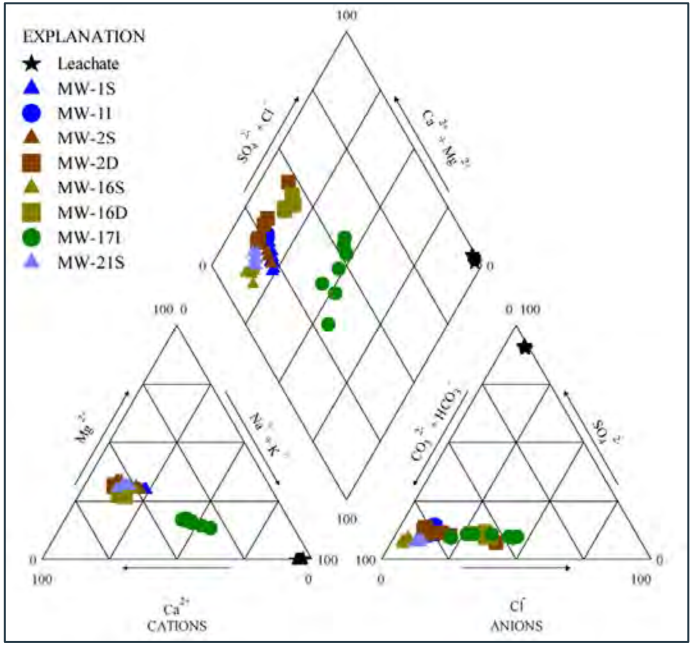
Exhibit 3-5. Sulfate to chloride ratio versus chloride concentration for CCR Landfill groundwater monitoring wells and leachate for comparison.



CCR Landfill Major Ion Water Quality

During the sixth round of sampling, additional analytes were included in the analyses making it possible to create major ion Piper trilinear diagrams for graphical comparison of water types for the CCR Landfill monitoring wells and leachate samples. Inferences of different groundwater source end members are supported by the Piper diagram shown on **Exhibit 3-6**. All of the major ion chemistry is plotted on a single diagram and results are supportive of the observations found when reviewing the cross-plots of ion ratios versus chloride concentrations. Leachate plots as a sodium sulfate water type while the majority of monitoring wells, including those identified with SSIs in this ASD, are associated with a calcium bicarbonate water type with the exception of MW-17I. Monitoring well MW-17I shows a different major ion water type that is influenced by greater contributions of sodium and chloride, but not sulfate, and the higher sodium and chloride is potentially related to the influence of upgradient stormwater ponds.

Exhibit 3-6. Piper diagram of major ion water quality for CCR Landfill monitoring wells with SSIs and leachate for comparison.



3.2.2 Isotope Analyses of CCR Related Water Quality and Materials

General Overview of Isotope Analyses

Water samples were collected from selected CCR Landfill monitoring wells and CCR Landfill leachate and submitted for isotope analyses of boron, strontium, and oxygen and hydrogen of water. The results of the isotope analyses serve as additional supporting lines of evidence for interpretations made using major ion and indicator parameter concentrations and reinforce the lack of leachate impacts to groundwater at the CCR Landfill.

Boron and its isotope ratio ($\delta^{11}B$) have been successfully used to identify groundwater pollution sources versus background or naturally occurring detections of constituents of concern (Davidson and Bassett 1993; Vengosh et al. 1994; Kendall et al., 1995; Ruhl et al. 2014; Harkness et al. 2017). In particular, boron isotopes have been successfully used to assess CCR related impacts in groundwater. Similarly, strontium and its isotopes ($^{87}Sr/^{86}Sr$) have also been successfully used to identify different groundwater source end members, mixing, and to determine anthropogenic versus geogenic processes associated with constituents of concern and associated with CCR impacts to groundwater (Kendall and Bullen 1995; Ruhl et al. 2014; Meredith 2016; Harkness et al. 2017; Nigro et al. 2017).

CCR Landfill Isotope Results

Stable isotope analyses are typically performed on a pair of isotopes (e.g. ^{11}B and ^{10}B, or ^{87}Sr and ^{86}Sr) and are reported as a ratio relative to internal standards, in per mil (‰) using Greek "delta" notation (δ). Deviations based on analysis of the standard are corrected for, to provide values that can be compared between different laboratories and equipment. Isotopes commonly reported relative to a standard include boron (eq. 1), where the standard for boron is the National Institute of Standards and Technology (NIST) Standard Reference Material (SRM) NIST SRM 951:

$$\delta^{11}B(‰) = \frac{\left(\frac{^{11}B}{^{10}B}\right)_{Sample} - \left(\frac{^{11}B}{^{10}B}\right)_{Standard}}{\left(\frac{^{11}B}{^{10}B}\right)_{Standard}} \times 1000 \qquad \text{eq. 1}$$

Isotope ratios of strontium can be reported relative to a standard value but are commonly reported as the actual ratio $^{87}Sr/^{86}Sr$. The values for strontium reported here are the actual ratios, but they have been corrected to the National Institute of Standards and Technology (NIST) Standard Reference Material (SRM) NIST SRM 987.

Background monitoring wells for the CCR Landfill show lower boron concentrations and higher $\delta^{11}B$ values compared to Landfill leachate samples (**Exhibit 3-7**). While only a limited number of background and waste boundary wells were tested (including MW-17I with a previous and current SSI, and MW-21S with a previously reported SSI), there is a clear distinction between all the CCR Landfill monitoring wells and the Landfill leachate which indicates that the wells represented are not impacted by the Landfill, and that boron in the monitoring wells is of a different source other than leachate.

Strontium isotope results also support the boron isotope, major ion, and indicator parameter interpretations that there are no identifiable impacts on groundwater from the landfill. There are noticeably lower strontium concentrations and ratios for all CCR Landfill monitoring wells sampled compared to Landfill leachate (**Exhibit 3-8**).

Exhibit 3-7. Boron isotope ratio ($\delta^{11}B$) versus boron concentration for CCR Landfill leachate and monitoring wells for comparison.

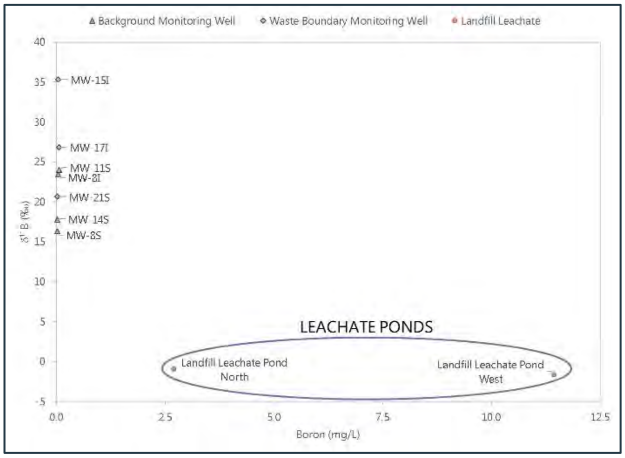
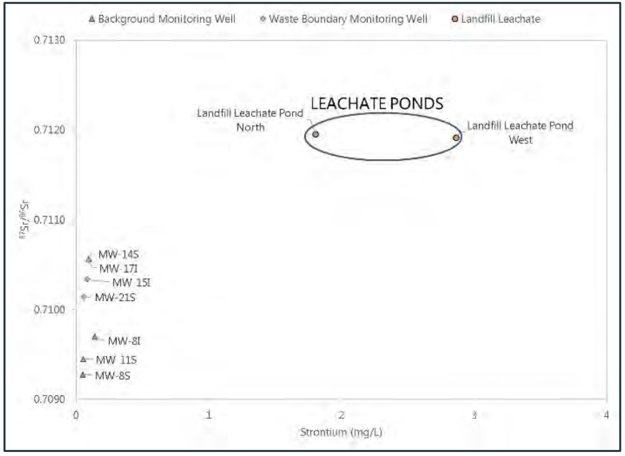


Exhibit 3-8. Strontium isotope ratio ($^{87}Sr/^{86}Sr$) versus strontium concentration for CCR Landfill leachate and monitoring wells for comparison.



3.3 Hydraulic Connection to the CCR Landfill

The groundwater monitoring network and the relationship of the wells to the regulated CCR Landfill are shown on **Figure 2**. Recent potentiometric flow data available for the site consistently indicate a local groundwater flow direction in the vicinity of MW-17 to the south and southeast. Four potentiometric surface maps are presented on **Figures 4 through 7**. As shown on these figures, well cluster MW-17 is located cross-gradient from the CCR Landfill and at least sometimes downgradient of the borrow area stormwater ponds. Therefore, groundwater monitored by this well cluster is hypothesized to be unaffected by potential releases from the CCR Landfill unit.

4.0 Summary

As summarized in **Exhibit 2-1** above, in the initial detection monitoring event, SSIs were identified in only five of 16 downgradient monitoring wells, for the following Appendix III constituents (the number of SSIs is indicated in parentheses): chloride (4), fluoride (1), calcium (2), and TDS (2). The following statements summarize how the lines of evidence discussed above apply to each of the constituents with identified SSIs:

- Boron occurs naturally at low concentration in site groundwater, in similar concentrations in background and downgradient wells. Boron occurs at concentrations approximately three orders-of-magnitude in the CCR Landfill leachate as compared to site groundwater, and is a conservative ion, making it an excellent indicator for impacts from landfill leachate impacts in groundwater. If Landfill leachate were impacting groundwater, boron would be expected to be detected in multiple waste boundary wells and at statistically significant concentrations above background, but it does not and the boron that is present has been shown to be isotopically different.

- Sulfate is another common indicator for CCR leachate impacts, which also occurs naturally in site groundwater (at similar concentration ranges in background and downgradient wells), and is elevated in the CCR Landfill leachate at concentrations approximately three orders-of-magnitude above background monitoring wells. No SSIs for sulfate were determined in any of the waste boundary well samples.

- Chloride is a naturally occurring and conservative ion, which occurs in the CCR Landfill leachate at concentrations about two orders-of-magnitude above groundwater concentrations. Spatial trends can be observed in **Exhibits 3-4** and **3-5** and indicate that chloride concentrations tend to increase in groundwater moving downgradient from recharge areas. However, because the SSIs indicated for chloride are not associated with SSIs for boron and sulfate, the CCR Landfill leachate is not considered a source for the chloride detected in groundwater.

- The same conclusion can be drawn in regard to calcium, TDS and fluoride, for which occasional SSIs are not consistently associated with boron, sulfate, or each other. The SSIs indicated for these constituents appear to be related to the natural variation in groundwater quality, along with a spatial trend of increasing TDS with distance from recharge area.

- Monitoring well MW-17I is associated with an SSI for fluoride. This well, along with MW-17S and the well cluster MW-15S/I are located cross-gradient of potential source materials. Groundwater monitored by these wells is not hydraulically influenced by the CCR Landfill. Additionally, the CCR landfill leachate does not contain significant contributions of fluoride where samples were non-detect (<1.5 mg/L) for fluoride.

4.1 Conclusion

This ASD has demonstrated, through multiple lines of evidence, that the SSIs identified in the statistical analysis of the second detection monitoring event data are not the result of a release of leachate from the CCR Landfill. Therefore, the unit will continue in detection monitoring.

4.2 Professional Engineer Certification

I certify that the above described Alternative Source demonstration is appropriate for evaluating the groundwater monitoring data for the Rockport Plant CCR Landfill and that the requirements of 40 CFR 257.95(h)(8)(3)(ii) have been met.

Kathleen D. Regan

10 December 2019

Kathleen D. Regan, PE
Indiana Registered Engineer PE1400182

Date

5.0 References

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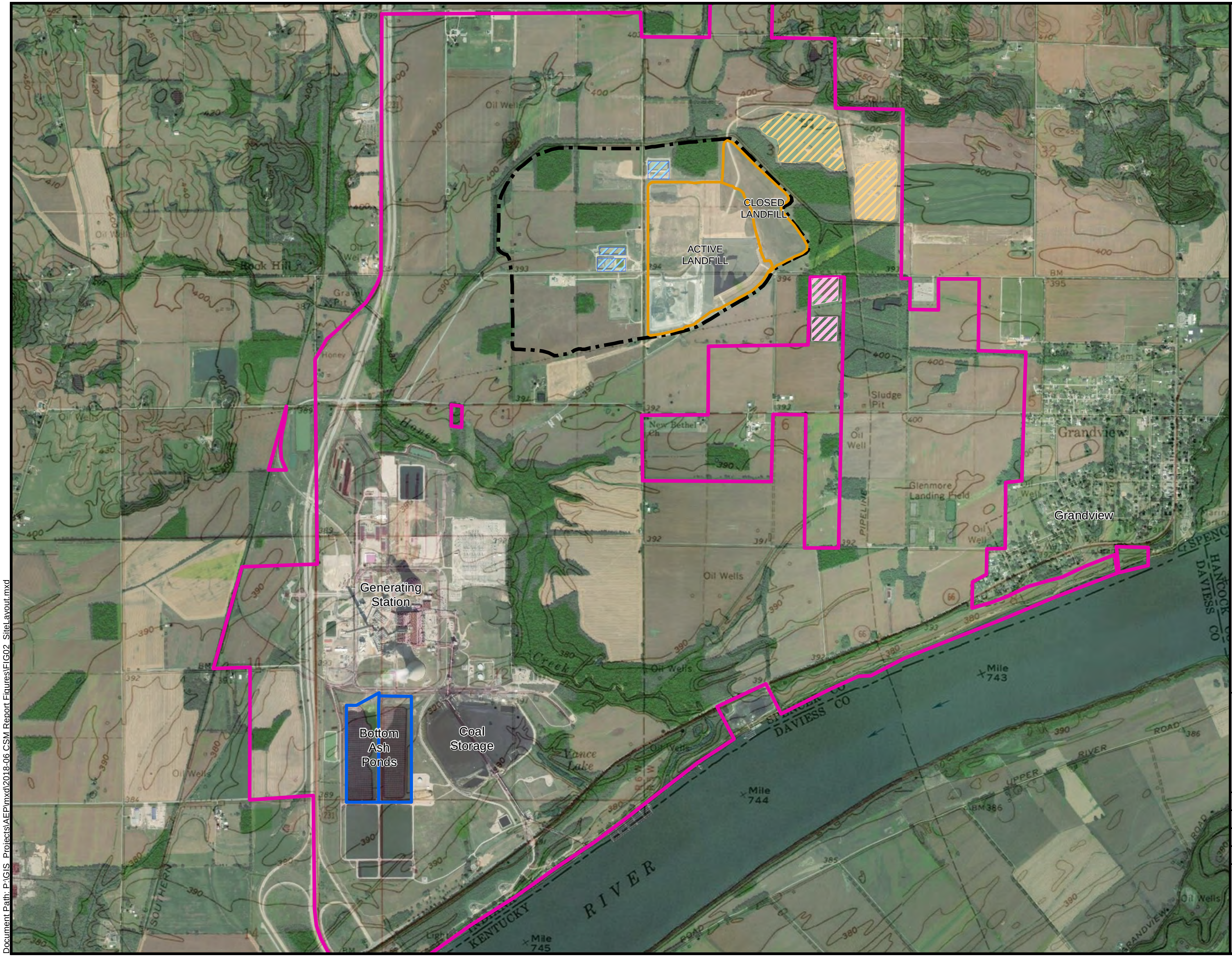
Figures



Legend

- ▨ Stormwater Ponds
- ▨ Landfill Leachate Ponds
- ▨ Grandview Wastewater Ponds
- ☐ Property Boundary
- ☐ Bottom Ash Ponds (BAP)
- ☐ Landfill Area 1A (Active and Closed)
- ☐ 1984 Landfill Permit Boundary (Area 1)

Data Sources

Date of Photography: 2016
Source of Photography: U.S. Department of Agriculture, National Agriculture Imagery Program (NAIP)

USGS Rockport and Lewisport (IN/KY) Topographic Quadrangle Maps

0 900 1,800
SCALE IN FEET

SITE LAYOUT

AEP - ROCKPORT, IN

PROJECT NUMBER: 7362192733

SCALE	1" = 1,800'	FIG. 1
DATE	9/4/2018	
DRAWN BY	TMR	
APPROVED BY	KDR	

wood.

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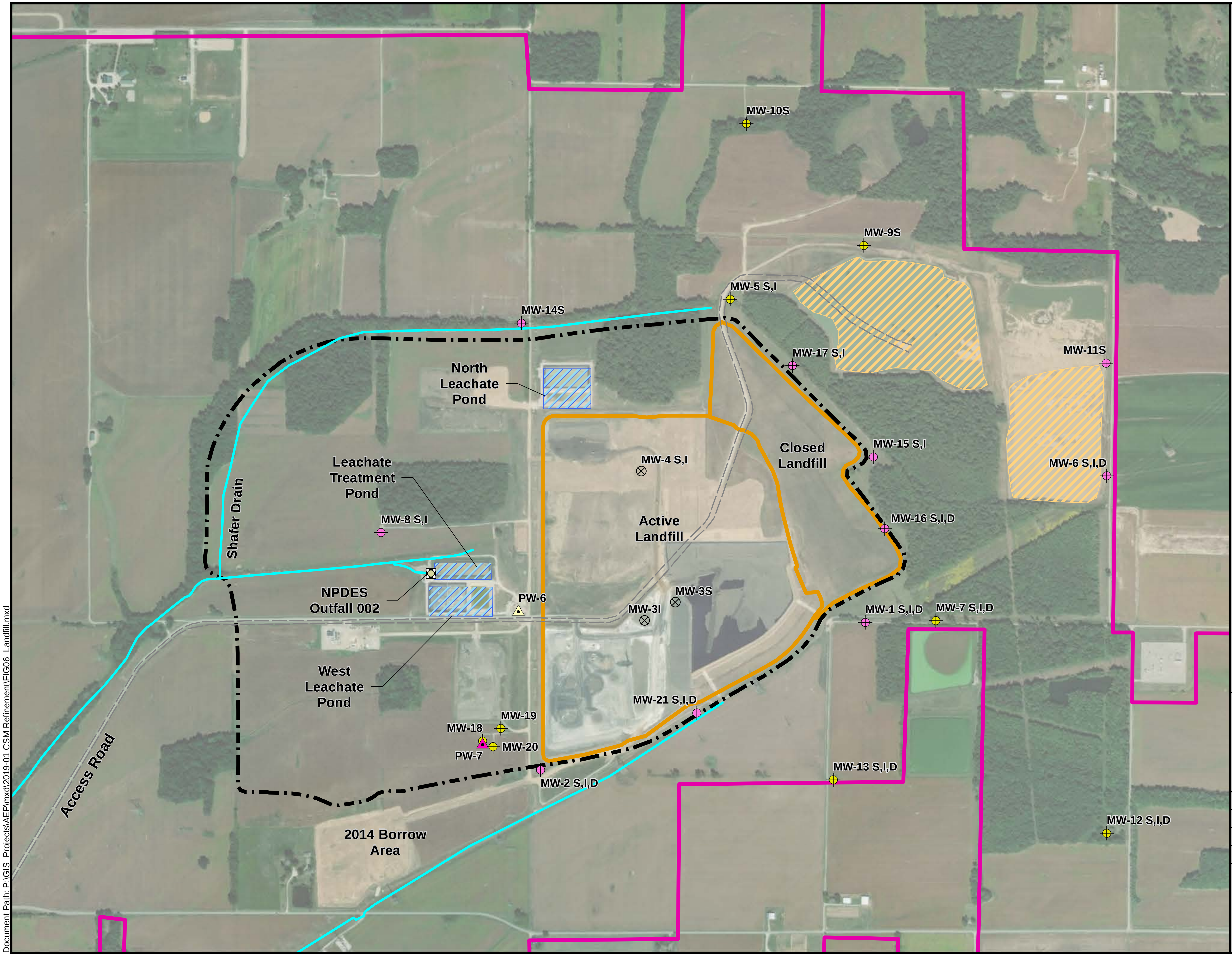

Legend

- ⊕ Landfill - Monitoring Well
- ⊕ Landfill - CCR Monitoring Well
- ▲ Landfill - Augmentation Water Supply Well
- △ Landfill - Dust Control Water Supply Well
- ⊗ Abandoned Monitoring Well
- ⊠ NPDES Outfall 002
- - - Access Road
- — Drains / Ditches
- ▨ Stormwater Ponds
- ▨ Landfill Leachate Ponds
- ▭ Property Boundary
- ▭ 1984 Landfill Permit Boundary (Area 1)
- ▭ Landfill Area 1A (Active and Closed)

Data Sources

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Source: USGS Rockport and Lewisport (IN/KY) Topographic Quadrangle Maps, 1964, photorevised 1982

0 400 800
SCALE IN FEET

LANDFILL LAYOUT

AEP - ROCKPORT, IN

PROJECT NUMBER: 7362192733

SCALE	1" = 800'	FIG. 2
DATE	3/6/2019	
DRAWN BY	TMR	
APPROVED BY	KDR	

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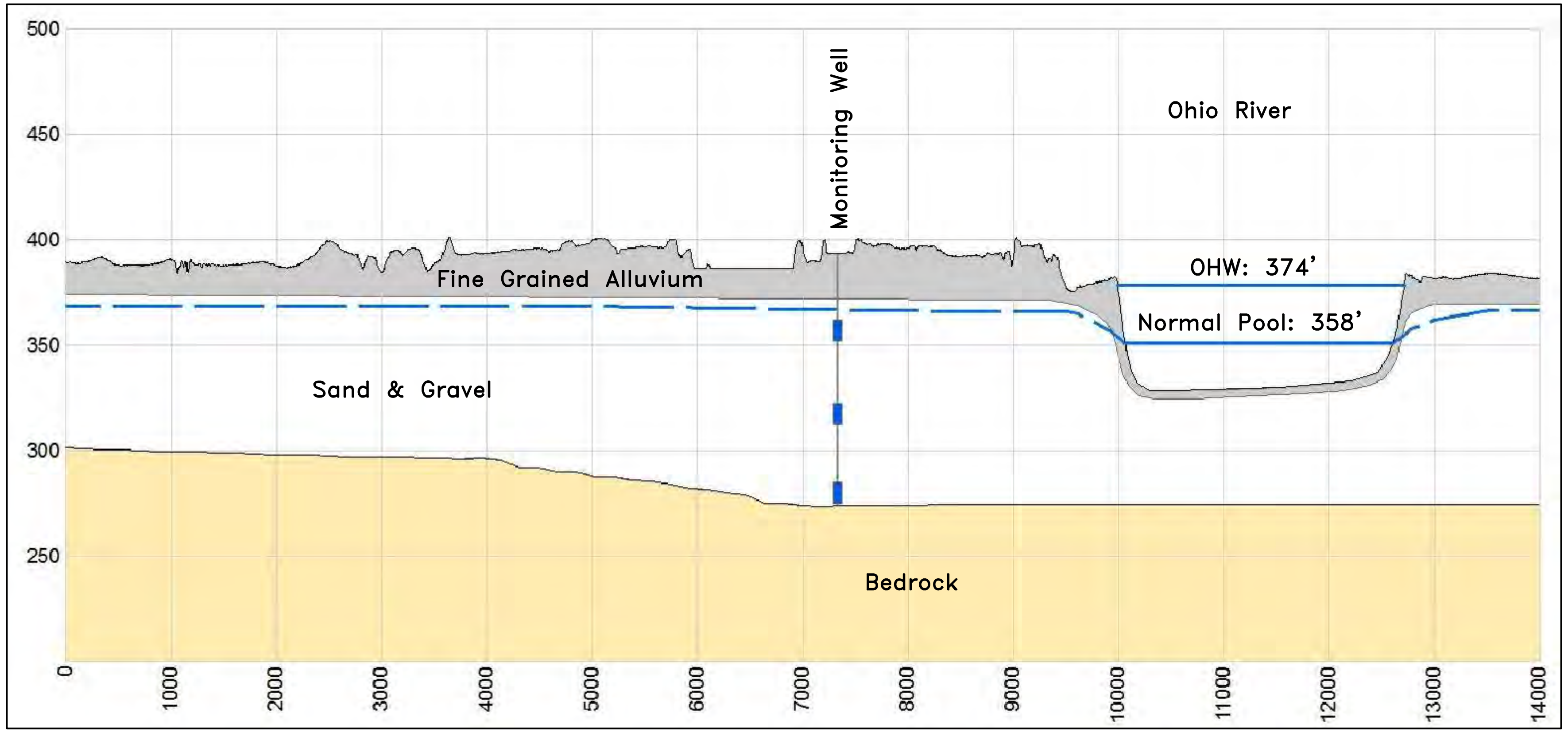

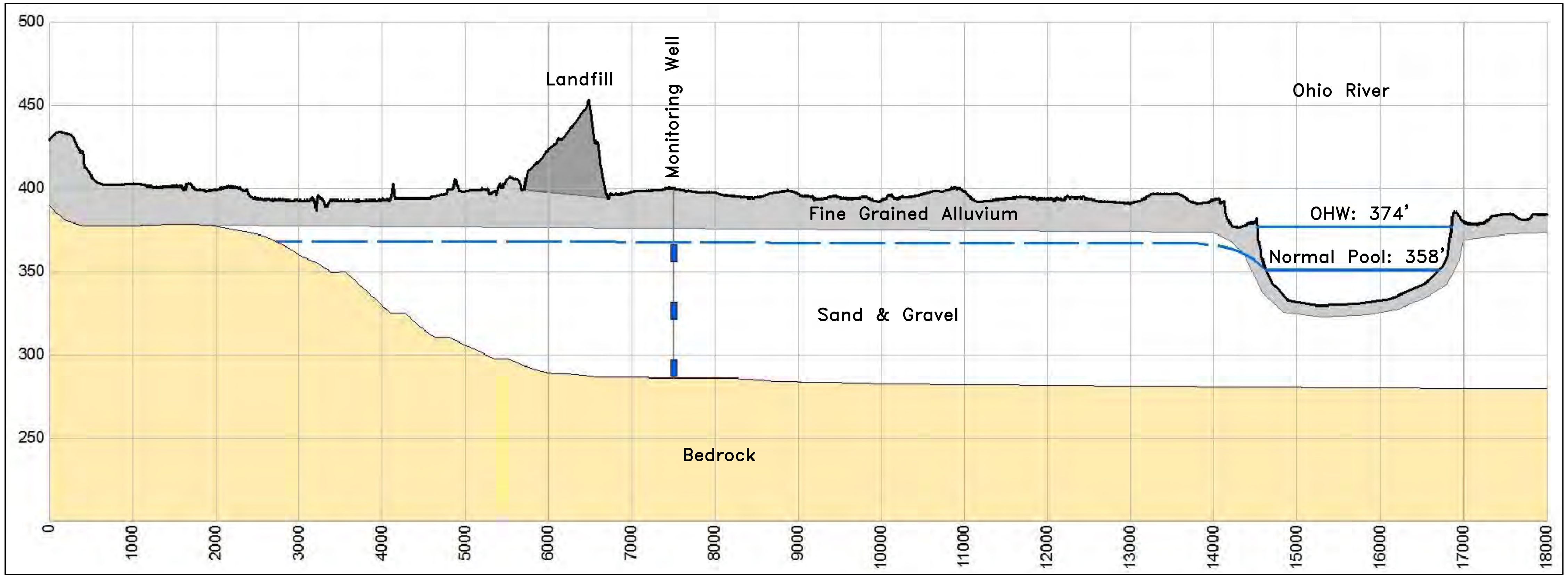

SCALE: As Shown
VERTICAL EXAGGERATION: 4X

wood.

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BOTTOM ASH PONDS
AEP - ROCKPORT, INDIANA

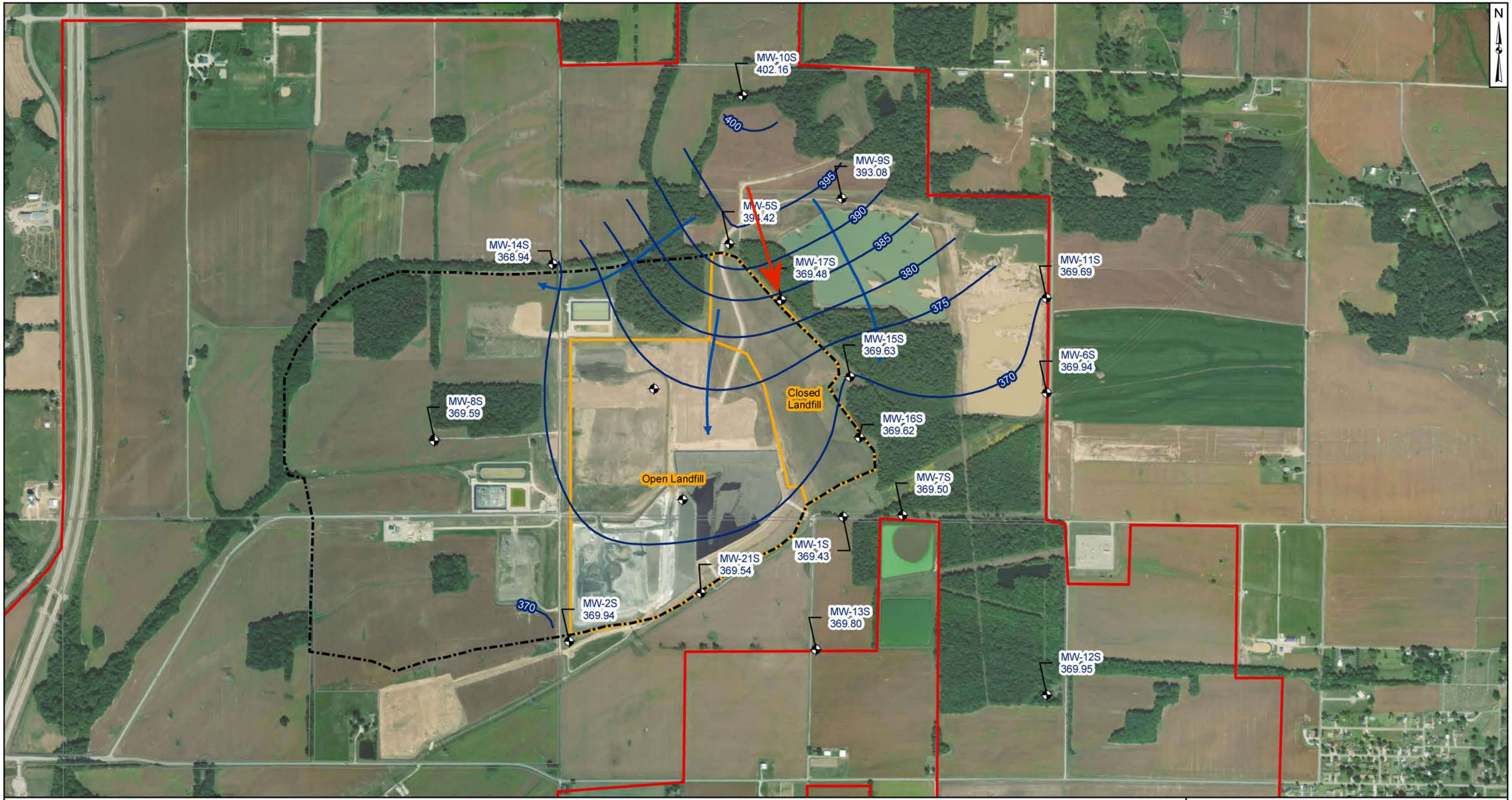
GENERALIZED CROSS-SECTIONS

PROJECT NUMBER: 7362192733

SCALE	As Shown
DATE	9/28/2017
DRAWN BY	TMR
APPROVED BY	ALD

FIG
3

\\LEX-FS1\projects\Projects\17 Projects\7362172421 - AEP CSM Rockport\CAD-GIS\cad\FIG 13 - Generalized Cross-Sections.dwg Sep. 28, 2017 tom.reed



Legend

- ⊕ Groundwater Monitoring Well
- — Groundwater Elevation Contour
- → Approximate Groundwater Flow Direction
- 🟥 Property Boundary
- ☐ Parcel Boundaries
- ⬚ 1984 Landfill Permit Boundary (Area 1)
- 🟧 Landfill Area 1A (Active and Closed)

Notes

- Monitoring well coordinates and water level data (collected on June 4, 2018) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (AMEC, 2016) provided by AEP.
- Property and parcel boundaries taken from Spencer County Assessor.
- The water level from the shallowest screen interval in each well cluster was used in groundwater contouring.
- Groundwater elevation units are feet above mean sea level.

1,000 500 0 1,000
Feet

↘ **Aprroximate Groundwater Flow Direction**

Potentiometric Surface Contours - Uppermost Aquifer June 2018

AEP-Rockport Power Plant - CCR Landfill
Rockport, Indiana

Geosyntec consultants

Columbus, Ohio | 2018/11/19

Figure
4

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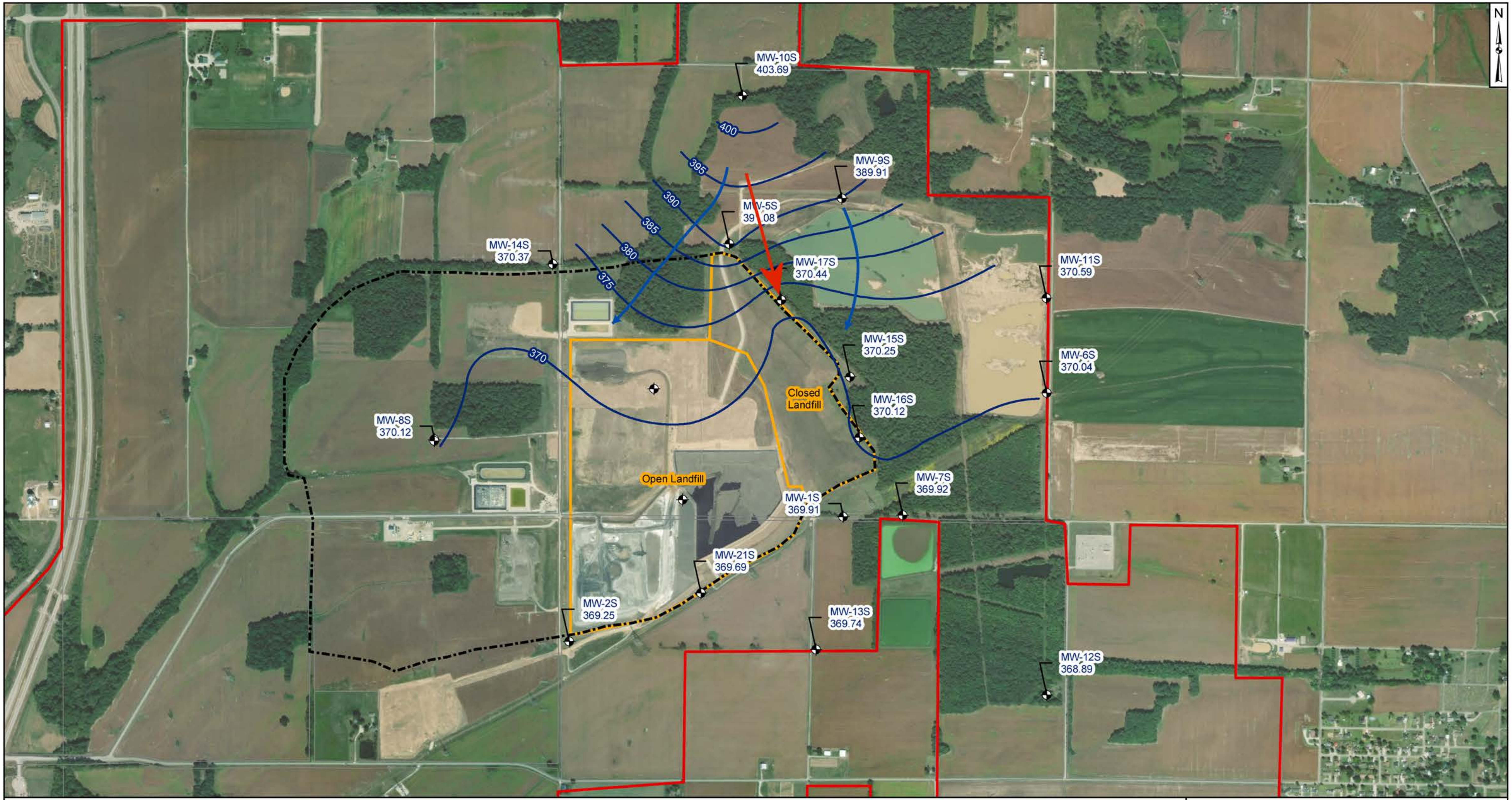

Legend

- ✦ Groundwater Monitoring Well
- — Groundwater Elevation Contour
- → Approximate Groundwater Flow Direction
- 🟥 Property Boundary
- ☐ Parcel Boundaries
- ▭ 1984 Landfill Permit Boundary (Area 1)
- 🟧 Landfill Area 1A (Active and Closed)

Notes

- Monitoring well coordinates and water level data (collected on August 13, 2018) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (AMEC, 2016) provided by AEP.
- Property and parcel boundaries taken from Spencer County Assessor.
- The water level from the shallowest screen interval in each well cluster was used in groundwater contouring.
- Groundwater elevation units are feet above mean sea level.

↘ **Aprroximate Groundwater Flow Direction**

Potentiometric Surface Contours - Uppermost Aquifer August 2018

AEP-Rockport Power Plant - CCR Landfill
Rockport, Indiana

Geosyntec consultants

Columbus, Ohio

2018/11/26

Figure
5

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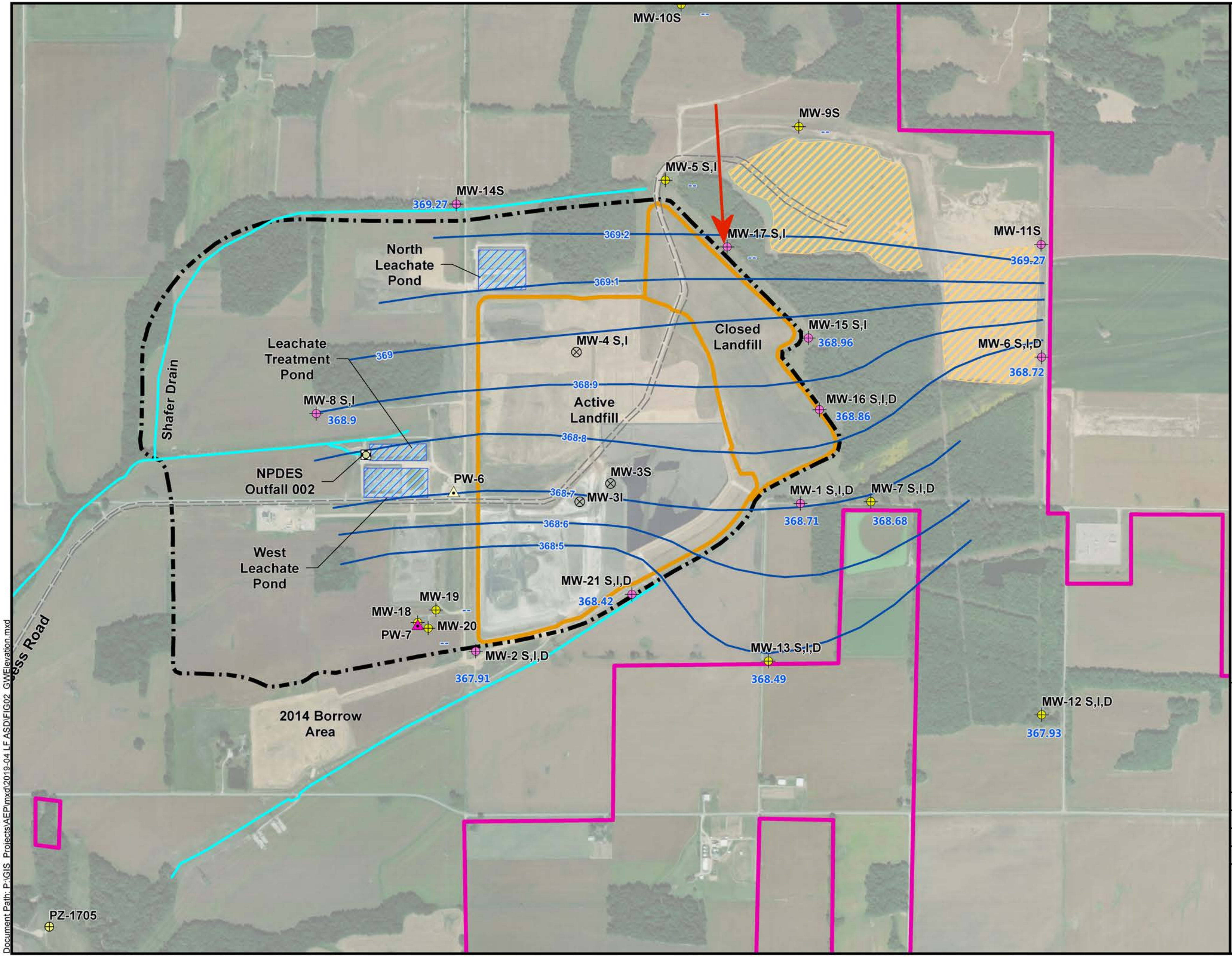

Legend

- ⊕ Piezometer
- ⊕ Landfill - Monitoring Well
- ⊕ Landfill - CCR Monitoring Well
- ▲ Landfill - Augmentation Water Supply Well
- △ Landfill - Dust Control Water Supply Well
- ⊗ Abandoned Monitoring Well
- ⊠ NPDES Outfall 002

Date

- — 2018-11-12
- -·- Access Road
- — Drains / Ditches
- ▨ Stormwater Ponds
- ▨ Landfill Leachate Ponds
- ☐ Property Boundary
- ☐ 1984 Landfill Permit Boundary (Area 1)
- ☐ Landfill Area 1A (Active and Closed)

Aproximate Groundwater Flow Direction

Data Sources

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Source: USGS Rockport and Lewisport (IN/KY) Topographic Quadrangle Maps, 1964, photorevised 1982

0 400 800
SCALE IN FEET

POTENTIOMETRIC SURFACE CONTOURS 12 NOVEMBER 2018

AEP - ROCKPORT, IN

PROJECT NUMBER: 7362192733

SCALE	1" = 800'	FIG. 6
DATE	4/26/2019	
DRAWN BY	TMR	
APPROVED BY	KDR	

wood.

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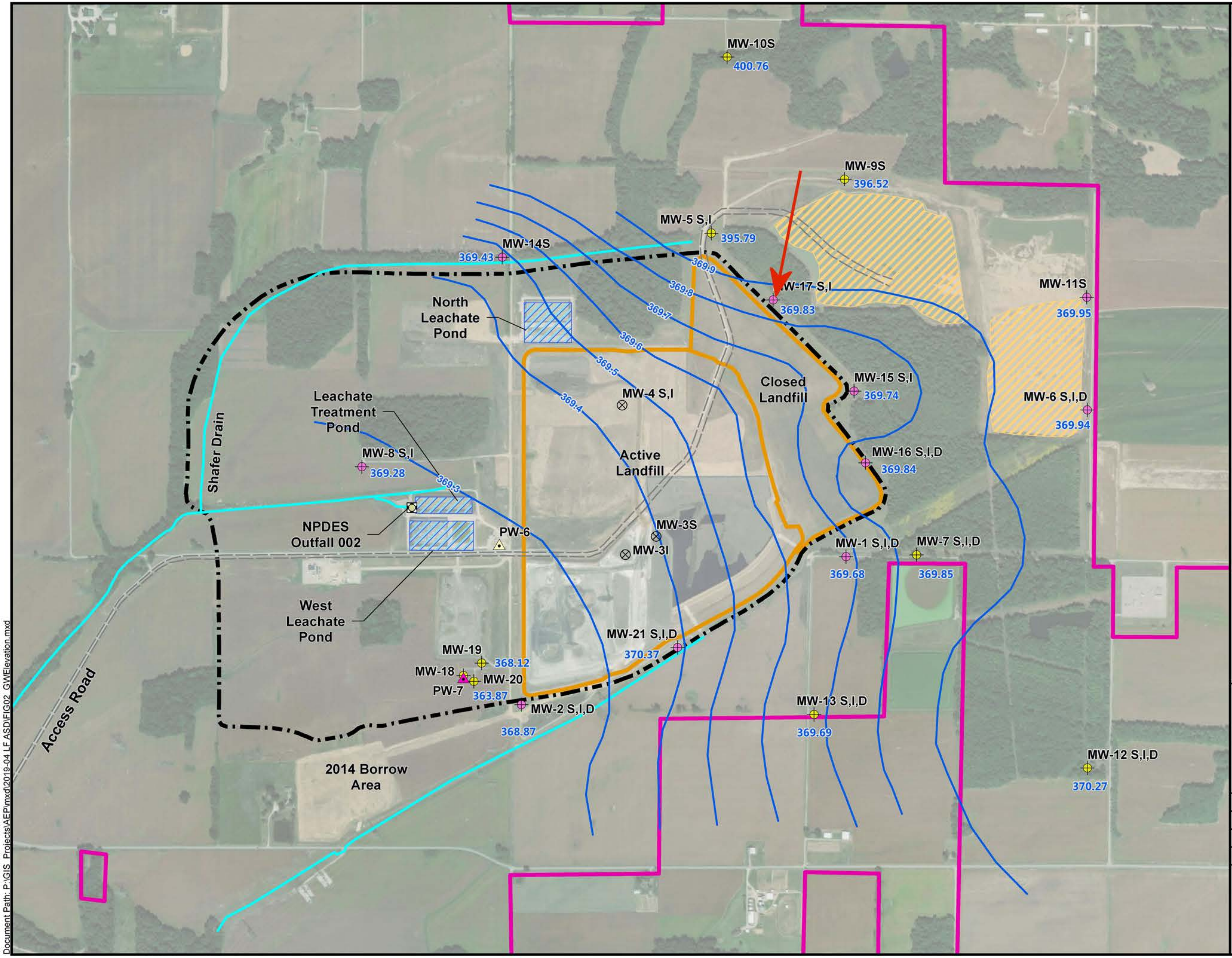

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Legend

- Landfill - Monitoring Well
- Landfill - CCR Monitoring Well
- Landfill - Augmentation Water Supply Well
- Landfill - Dust Control Water Supply Well
- ⊗ Abandoned Monitoring Well
- NPDES Outfall 002
- GW_Elev_LF
- Access Road
- Drains / Ditches
- ▨ Stormwater Ponds
- ▨ Landfill Leachate Ponds
- Property Boundary
- 1984 Landfill Permit Boundary (Area
- Landfill Area 1A (Active and Closed)

Aprroximate Groundwater Flow Direction

Data Sources

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Source: USGS Rockport and Lewisport (IN/KY) Topographic Quadrangle Maps, 1964, photorevised 1982

0 400 800
SCALE IN FEET

POTENTIOMETRIC SURFACE CONTOURS 11 FEBRUARY 2019

AEP - ROCKPORT, IN

PROJECT NUMBER: 7362192733

SCALE	1" = 800'	FIG. 7
DATE	4/9/2019	
DRAWN BY	TMR	
APPROVED BY	KDR	

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Appendices

Appendix A
Analytical Data Tables

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-1S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/9/2016	7/19/2016	9/20/2016	11/16/2016	1/11/2017	3/8/2017	5/9/2017	7/18/2017	10/4/2017	1/3/2018	6/6/2018	8/16/2018	11/14/2018	2/13/2019	4/1/2019
Field Parameters																		
Elevation	ft NGVD	--	--	369.45	369.29	368.81	368.29	367.61	367.69	367.66	368.33	368.01	366.11	369.43	369.91	368.71	369.68	370.56
pH	S.U.	--	7.09 - 8.14	8.14	7.2	7.09	7.34	7.4	7.1	7.19	7.26	7.08	7.64	7.48	7.3	7.48	7.46	7.35
Specific Conductance	µmhos/cm	--	--	687	612	703	657	470	300	567	536	635	686	590	658	535	530	892
Turbidity	NTU	--	--	0.23	1.5	0.34	0.65	1	2	0.63	0.78	0.4	1.31	1.12	0	0.56	0.8	1.15
Dissolved Oxygen	mg/L	--	--	3.37	4	2.82	3.46	5	4	2.48	2.72	3	3.06	0.61	4.59	2.3	1.1	1.09
Temperature	°C	--	--	15.04	18.9	19.09	15.17	14.8	15.7	16.81	15.81	15.63	12.81	16.23	15.38	14.7	14.9	14.6
ORP	mV	--	--	89.2	111	77.1	52.9	105	46	53.7	16.2	43.8	-20.8	-76.5	302	100.5	172	126.4
Laboratory Parameters																		
Antimony	µg/L	6	--	0.03	0.2	0.02	0.02	0.04	0.04	0.05	0.02	--	--	--	--	0.05	--	--
Arsenic	µg/L	10	--	0.43	0.69	0.38	0.38	0.43	0.76	0.5	0.39	--	--	--	--	0.34	--	--
Barium	µg/L	2000	--	18.5	21.9	17.2	17.9	17.7	36.5	22.3	17.3	--	--	--	--	17.8	--	--
Beryllium	µg/L	4	--	<0.01	0.16	<0.005	<0.005	<0.005	0.023	0.01	<0.004	--	--	--	--	0.03	--	--
Cadmium	µg/L	5	--	0.02	0.22	0.005	0.007	0.02	0.09	0.22	0.01	--	--	--	--	<0.01	--	--
Chromium	µg/L	100	--	0.3	0.7	0.3	0.207	0.72	1.38	0.552	0.255	--	--	--	--	0.25	--	--
Cobalt	µg/L	6	--	0.171	0.398	0.014	0.01	0.052	1.21	0.164	0.02	--	--	--	--	<0.02	--	--
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.15	0.74	--	0.09	--	1.3	--	--
Lead	µg/L	15	--	0.204	0.572	0.01	0.022	0.076	1.26	0.526	0.033	--	--	--	--	0.12	--	--
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	--	--	--	--
Molybdnum	µg/L	100	--	0.65	0.8	0.68	0.74	0.59	0.97	1.64	0.64	--	--	--	--	0.6	--	--
Selenium	µg/L	50	--	1.1	1.1	0.9	0.9	1	1.1	1.1	1.2	--	--	--	--	0.8	--	--
Thallium	µg/L	2	--	<0.02	0.168	<0.01	<0.01	<0.01	0.03	<0.01	<0.01	--	--	--	--	<0.1	--	--
Zinc	µg/L	--	--	--	--	--	--	--	--	--	2	4.5	--	0.7	--	2	--	--
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	19.5	19.7	22.4	--	19.5	--	19.7	--	--
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	5.55	4.29	--	3.8	--	1	--	--
Boron	mg/L	--	0.048	0.037	0.015	0.022	0.02	0.005	0.03	0.031	0.028	0.044	--	0.046	--	0.04	--	--
Calcium	mg/L	--	(79.5) 79	70.7	62.9	68	74.4	65	71.5	72.6	69.2	67.6	--	71.8	--	71.9	--	--
Lithium	mg/L	0.04	--	0.004	0.024	0.002	0.01	0.008	0.01	0.009	0.0007	--	--	--	--	0.03	--	--
Magnesium	mg/L	--	--	--	--	--	--	--	27.3	26.9	26.9	25.6	--	26.8	--	26.8	--	--
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.0015	--	--	0.0027	--	0.0022	--	--
Potassium	mg/L	--	--	--	--	--	--	--	1.32	1.24	1.16	1.15	--	1.19	--	1.16	--	--
Sodium	mg/L	--	--	--	--	--	--	--	40.6	35.2	39.6	36.1	--	31.2	--	35	--	--
Strontium	mg/L	--	--	--	--	--	--	--	0.11	0.12	0.105	0.104	--	0.11	--	0.108	--	--
Alkalinity	mg/L	--	--	--	--	--	--	--	278	273	271	269	--	250	--	273	--	--
Bromide	mg/L	--	--	--	--	--	--	--	0.086	0.108	0.104	0.109	--	0.106	--	0.1	--	--
Chloride	mg/L	--	(29.6) 33	29.6	31.1	31.4	31.9	32	30.7	31.3	30.4	33.1	39.9	34.9	37.3	38.1	40.4	38.5
Fluoride	mg/L	4	0.677	0.59	0.65	0.6	0.54	0.57	0.59	0.63	0.58	0.57	--	0.61	--	0.63	--	--
TDS	mg/L	--	(412.7) 419	392	392	411	398	392	384	402	406	396	--	386	--	410	--	--
Sulfate	mg/L	--	(36.95) 37	33.7	35.5	32.4	30.7	30.7	30.5	33.3	33.6	34.6	--	34.2	--	32.3	--	--
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	--	<0.4	--	<0.07	--	--
Radium-228	pCi/L	--	--	-0.185	0.445	0.244	-0.00464	0.447	-0.172	-0.122	0.133	--	--	--	--	-0.0731	--	--
Radium-226	pCi/L	--	--	0.0665	0.374	-0.00261	0.296	0.487	0.0407	0.0324	0.176	--	--	--	--	0.108	--	--
Radium-226/228	pCi/L	5	--	-0.1185	0.819	0.24139	0.29136	0.934	-0.1313	-0.0896	0.309	--	--	--	--	0.108	--	--
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.28	--	--	0.4	--	1.65	--	--
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2	--	--	9	--	1	--	--
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	1	--	--	0.8	--	6.24	--	--
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	<0.0004	<0.0004	0.049	0.014	--	<0.002	--	0.035	--	--
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	<0.0001	0.0002	<0.0001	0.0002	--	<0.0002	--	0.0026	--	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-1S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	5/23/2019	7/23/2019
Field Parameters					
Elevation	ft NGVD	--	--	371.82	372.42
pH	S.U.	--	7.09 - 8.14	7.91	7.36
Specific Conductance	µmhos/cm	--	--	593	618
Turbidity	NTU	--	--	0.05	1.6
Dissolved Oxygen	mg/L	--	--	0.87	1.5
Temperature	°C	--	--	15.6	18.2
ORP	mV	--	--	-28.8	57
Laboratory Parameters					
Antimony	µg/L	6	--	0.02	--
Arsenic	µg/L	10	--	0.29	--
Barium	µg/L	2000	--	17.6	--
Beryllium	µg/L	4	--	<0.02	--
Cadmium	µg/L	5	--	<0.01	--
Chromium	µg/L	100	--	0.2	--
Cobalt	µg/L	6	--	<0.02	--
Copper	µg/L	--	--	0.13	--
Lead	µg/L	15	--	0.03	--
Mercury	µg/L	2	--	<0.002	--
Molybdnum	µg/L	100	--	1	--
Selenium	µg/L	50	--	0.7	--
Thallium	µg/L	2	--	<0.1	--
Zinc	µg/L	--	--	7.8	--
Silica (Dissolved)	mg/L	--	--	<0.06	--
Aluminum	µg/L	--	--	2	--
Boron	mg/L	--	0.048	<0.02	--
Calcium	mg/L	--	(79.5) 79	73.7	--
Lithium	mg/L	0.04	--	0.02	--
Magnesium	mg/L	--	--	26.7	--
Manganese	mg/L	--	--	0.001	--
Potassium	mg/L	--	--	1.24	--
Sodium	mg/L	--	--	25.8	--
Strontium	mg/L	--	--	0.106	--
Alkalinity	mg/L	--	--	303	--
Bromide	mg/L	--	--	0.1	--
Chloride	mg/L	--	(29.6) 33	33.7	30
Fluoride	mg/L	4	0.677	0.55	--
TDS	mg/L	--	(412.7) 419	388	--
Sulfate	mg/L	--	(36.95) 37	36.3	--
Sulfide	mg/L	--	--	<0.1	--
Radium-228	pCi/L	--	--	0.173	--
Radium-226	pCi/L	--	--	1.09	--
Radium-226/228	pCi/L	5	--	1.263	--
Copper (Dissolved)	µg/L	--	--	0.26	--
Zinc (Dissolved)	µg/L	--	--	0.7	--
Aluminum (Dissolved)	µg/L	--	--	<1	--
Iron (Dissolved)	mg/L	--	--	<0.003	--
Manganese (Dissolved)	mg/L	--	--	0.0004	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-1I

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/9/2016	7/19/2016	9/20/2016	11/16/2016	1/11/2017	3/8/2017	5/9/2017	7/18/2017	10/4/2017	6/6/2018	8/16/2018
Field Parameters														
Elevation	ft NGVD	--	--	369.42	369.25	368.8	368.24	367.58	367.63	367.62	368.28	367.25	369.39	397.45
pH	S.U.	--	6.43 - 7.90	6.7	7	7.4	7.09	7.6	7.4	7.24	6.89	7.1	7.5	7.31
Specific Conductance	µmhos/cm	--	--	461	479	570	544	370	500	443	402	424	480	533
Turbidity	NTU	--	--	0.9	0.7	0.24	0.35	1	1	0.6	0.36	1	0.32	0
Dissolved Oxygen	mg/L	--	--	0.4	0.3	1.07	0	0.3	1	0.46	27.63	0.5	0.87	0.22
Temperature	°C	--	--	17.5	18.2	16.99	14.53	14.4	15.7	15.44	16.52	16.4	16.25	16.03
ORP	mV	--	--	-21	205	-2.1	4.4	10	36	-26.2	-118.8	-23	-102.2	253
Laboratory Parameters														
Antimony	µg/L	6	--	0.04	0.04	0.01	0.02	0.02	0.01	0.04	0.02	--	--	--
Arsenic	µg/L	10	--	0.86	0.78	0.92	0.8	0.82	0.69	0.89	0.86	--	--	--
Barium	µg/L	2000	--	85.5	86.1	84.9	93.4	90.5	76.7	85	94.3	--	--	--
Beryllium	µg/L	4	--	<0.005	<0.005	<0.005	<0.005	0.005	<0.005	<0.004	<0.004	--	--	--
Cadmium	µg/L	5	--	0.08	0.1	0.02	0.02	0.02	0.05	0.01	0.007	--		--
Chromium	µg/L	100	--	0.2	1	0.2	0.051	0.39	0.686	0.155	0.112	--	--	--
Cobalt	µg/L	6	--	0.341	0.364	0.401	0.381	0.424	0.054	0.558	0.569	--	--	--
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.12	0.2	0.48	--
Lead	µg/L	15	--	0.851	1.25	0.156	0.059	0.099	0.427	0.068	0.137	--	--	--
Mercury	µg/L	2	--	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--
Molybdnum	µg/L	100	--	2.47	2.85	2.89	3.27	3.33	1.82	2.87	2.85	--	--	--
Selenium	µg/L	50	--	<0.03	0.04	<0.03	<0.03	<0.03	0.04	<0.03	<0.03	--	--	--
Thallium	µg/L	2	--	0.03	0.02	0.02	0.03	0.104	0.03	0.02	0.02	--	--	--
Zinc	µg/L	--	--	--	--	--	--	--	--	--	2	1	4.2	--
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	18.5	18.9	20.7	17.8	--
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	1	2	2.96	--
Boron	mg/L	--	0.093	0.075	0.014	0.018	0.015	0.004	0.045	0.049	0.047	0.018	0.11	0.056
Calcium	mg/L	--	(79.5) 71	67.4	60	64.5	63.9	60.9	66.9	65.7	64.8	68.1	66.4	--
Lithium	mg/L	0.04	--	0.005	0.022	0.007	0.005	0.005	0.006	0.008	0.0005	--	--	--
Magnesium	mg/L	--	--	--	--	--	--	--	20.8	21.2	20.6	21.5	21	--
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.599	--	0.316	--
Potassium	mg/L	--	--	--	--	--	--	--	1.34	1.08	0.98	0.92	1.31	--
Sodium	mg/L	--	--	--	--	--	--	--	19.8	19.5	19.1	19.2	18.1	--
Strontium	mg/L	--	--	--	--	--	--	--	0.0934	0.0926	0.086	0.0911	0.093	--
Alkalinity	mg/L	--	--	--	--	--	--	--	222	225	226	222	230	--
Bromide	mg/L	--	--	--	--	--	--	--	0.061	0.087	0.081	0.072	0.081	--
Chloride	mg/L	--	(29.6) 27.4	24.9	24.8	24.3	24.1	24.4	24.1	26.5	26.5	27.5	28.6	--
Fluoride	mg/L	4	0.428	0.37	0.4	0.37	0.31	0.33	0.35	0.38	0.34	0.37	0.42	--
TDS	mg/L	--	(412.7) 349	323	315	331	334	316	300	323	330	327	321	--
Sulfate	mg/L	--	(47.8) 48	44.3	46.7	42.4	40.7	41.4	41.2	43.8	43.3	44.1	42	--
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	<0.4	--
Radium-228	pCi/L	--	--	0.0603	0.105	1.42	0.662	0.108	-0.0752	0.3	2.21	--	--	--
Radium-226	pCi/L	--	--	0.33	1.57	0.276	0.65	0.513	0.15	0.33	0.323	--	--	--
Radium-226/228	pCi/L	5	--	0.3903	1.675	1.696	1.312	0.621	0.0748	0.63	2.533	--	--	--
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.37	--	0.4	--
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2.3	--	1	--
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2.51	--	1	--
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	0.03	<0.0004	0.035	0.048	0.011	--
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	0.583	0.1	0.455	0.445	0.303	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-1I

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	11/14/2018	2/13/2019	4/1/2019	5/23/2019	7/23/2019	9/11/2019
Field Parameters									
Elevation	ft NGVD	--	--	368.74	369.73	370.51	371.86	372.45	--
pH	S.U.	--	6.43 - 7.90	7.75	7.5	7.37	7.01	7.21	7.25
Specific Conductance	µmhos/cm	--	--	425	443	802	503	493	481
Turbidity	NTU	--	--	0.61	1	1.06	0.06	2.1	0.58
Dissolved Oxygen	mg/L	--	--	0.19	2	1.28	0.73	0.57	0.26
Temperature	°C	--	--	14.68	14.7	14.6	16.79	16.4	17.5
ORP	mV	--	--	62.9	155	134.2	5.2	27	-35.8
Laboratory Parameters									
Antimony	µg/L	6	--	<0.02	--	--	<0.02	--	--
Arsenic	µg/L	10	--	0.82	--	--	0.73	--	--
Barium	µg/L	2000	--	85.6	--	--	83.8	--	--
Beryllium	µg/L	4	--	<0.02	--	--	<0.02	--	--
Cadmium	µg/L	5	--	0.02	--	--	<0.01	--	--
Chromium	µg/L	100	--	<0.04	--	--	0.04	--	--
Cobalt	µg/L	6	--	0.48	--	--	0.368	--	--
Copper	µg/L	--	--	0.22	--	--	0.08	--	--
Lead	µg/L	15	--	0.07	--	--	<0.02	--	--
Mercury	µg/L	2	--	--	--	--	<0.002	--	--
Molybdnum	µg/L	100	--	2.96	--	--	2.38	--	--
Selenium	µg/L	50	--	<0.03	--	--	<0.03	--	--
Thallium	µg/L	2	--	<0.1	--	--	<0.1	--	--
Zinc	µg/L	--	--	1	--	--	0.9	--	--
Silica (Dissolved)	mg/L	--	--	18.2	--	--	18	--	--
Aluminum	µg/L	--	--	3	--	--	<1	--	--
Boron	mg/L	--	0.093	0.05	--	--	0.02	--	--
Calcium	mg/L	--	(79.5) 71	65.5	--	--	67.7	--	--
Lithium	mg/L	0.04	--	0.03	--	--	<0.009	--	--
Magnesium	mg/L	--	--	20.6	--	--	20.6	--	--
Manganese	mg/L	--	--	0.515	--	--	0.37	--	--
Potassium	mg/L	--	--	0.97	--	--	0.98	--	--
Sodium	mg/L	--	--	18.5	--	--	18.2	--	--
Strontium	mg/L	--	--	0.0882	--	--	0.0912	--	--
Alkalinity	mg/L	--	--	227	--	--	243	--	--
Bromide	mg/L	--	--	0.08	--	--	0.09	--	--
Chloride	mg/L	--	(29.6) 27.4	28.8	30.1	34.1	33.1	30.6	33.5
Fluoride	mg/L	4	0.428	0.41	--	--	0.42	--	--
TDS	mg/L	--	(412.7) 349	308	--	--	341	--	--
Sulfate	mg/L	--	(47.8) 48	40.7	--	--	40.2	--	--
Sulfide	mg/L	--	--	<0.07	--	--	<0.1	--	--
Radium-228	pCi/L	--	--	0.415	--	--	0.71	--	--
Radium-226	pCi/L	--	--	0.288	--	--	0.37	--	--
Radium-226/228	pCi/L	5	--	0.703	--	--	1.08	--	--
Copper (Dissolved)	µg/L	--	--	0.12	--	--	0.43	--	--
Zinc (Dissolved)	µg/L	--	--	0.9	--	--	<0.7	--	--
Aluminum (Dissolved)	µg/L	--	--	<1	--	--	1	--	--
Iron (Dissolved)	mg/L	--	--	0.053	--	--	0.034	--	--
Manganese (Dissolved)	mg/L	--	--	0.508	--	--	0.397	--	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-1D

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/8/2016	7/19/2016	9/20/2016	11/16/2016	1/11/2017	3/8/2017	5/9/2017	7/18/2017	10/4/2017	1/3/2018
Field Parameters													
Elevation	ft NGVD	--	--	369.6	369.43	368.97	368.42	367.75	367.81	367.81	368.34	367.44	366.27
pH	S.U.	--	6.74 - 8.16	7.6	7.1	7.36	7.5	7.4	7.33	7.25	8.06	7.3	7.68
Specific Conductance	µmhos/cm	--	--	496	471	464	842	400	558	394	525	448	539
Turbidity	NTU	--	--	8.8	2	6.27	4	5	1.93	2.15	2.47	2	3.89
Dissolved Oxygen	mg/L	--	--	0.5	0.2	0.55	0.8	2	0.25	0.53	0.81	0.4	1.83
Temperature	°C	--	--	19.4	16.7	15.77	14.8	14.7	15.14	15.84	21.46	16.5	6.7
ORP	mV	--	--	63	220	92.8	252	182	49.6	132.7	152.8	-14	-5.3
Laboratory Parameters													
Antimony	µg/L	6	--	0.05	0.03	0.03	0.03	0.03	0.02	0.02	0.02	--	--
Arsenic	µg/L	10	--	1.29	0.73	1.07	0.65	0.77	0.58	0.75	0.59	--	--
Barium	µg/L	2000	--	255	147	160	147	162	139	142	139	--	--
Beryllium	µg/L	4	--	0.01	<0.005	0.007	<0.005	<0.005	<0.005	0.006	<0.004	--	--
Cadmium	µg/L	5	--	0.13	0.07	0.04	0.04	0.15	0.04	0.04	0.05	--	
Chromium	µg/L	100	--	0.3	1.5	0.3	0.072	0.439	0.687	0.174	0.131	--	--
Cobalt	µg/L	6	--	3.64	0.373	0.836	0.329	0.577	0.173	0.44	0.212	--	--
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.93	1.02	--
Lead	µg/L	15	--	1.13	1.37	0.5	0.222	0.807	1.92	0.419	0.355	--	--
Mercury	µg/L	2	--	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--
Molybdnum	µg/L	100	--	3.44	3.59	3.6	3.24	2.43	3.4	3.05	2.94	--	--
Selenium	µg/L	50	--	0.07	0.03	0.07	0.03	0.03	0.03	0.06	<0.03	--	--
Thallium	µg/L	2	--	0.04	0.02	0.056	0.02	0.05	0.03	0.04	0.03	--	--
Zinc	µg/L	--	--	--	--	--	--	--	--	--	4.5	4.5	--
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	18.9	19.4	21.3	--
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	8.08	14.6	--
Boron	mg/L	--	0.066	0.017	0.015	0.016	0.018	0.006	0.055	0.046	0.019	0.002	--
Calcium	mg/L	--	(79.5) 75	63.6	57.9	65.2	69.3	63.4	70	67.8	63.9	65.7	--
Lithium	mg/L	0.04	--	<0.0002	0.017	0.0005	0.004	0.007	0.007	0.009	0.002	--	--
Magnesium	mg/L	--	--	--	--	--	--	--	21.9	22.2	20.7	20.9	--
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.511	--	--
Potassium	mg/L	--	--	--	--	--	--	--	1.13	1.13	0.89	0.89	--
Sodium	mg/L	--	--	--	--	--	--	--	19.4	19.3	18.8	18	--
Strontium	mg/L	--	--	--	--	--	--	--	0.0985	0.101	0.0885	0.092	--
Alkalinity	mg/L	--	--	--	--	--	--	--	206	202	206	220	--
Bromide	mg/L	--	--	--	--	--	--	--	0.09	0.115	0.109	0.03	--
Chloride	mg/L	--	(29.6) 50	27.3	29.8	29.8	39.3	40.6	40.3	40.9	39.3	10.3	--
Fluoride	mg/L	4	0.321	0.28	0.3	0.28	0.29	0.26	0.26	0.28	0.24	0.85	0.31
TDS	mg/L	--	(412.7) 369	331	329	288	339	323	330	342	338	339	--
Sulfate	mg/L	--	(45.1) 45	40.2	40.6	32.3	33.6	36.4	37	39.5	39.6	10.4	--
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	--
Radium-228	pCi/L	--	--	0.558	0.06	0.525	0.566	0.315	0.0844	0.511	0.444	--	--
Radium-226	pCi/L	--	--	0.526	0.135	0.932	6.73	0.334	0.154	0.213	0.502	--	--
Radium-226/228	pCi/L	5	--	1.084	0.195	1.457	7.296	0.649	0.2384	0.724	0.946	--	--
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.58	--	--
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	4.2	--	--
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2	--	--
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	<0.0004	<0.0004	0.052	0.012	--
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	0.553	0.62	0.486	0.616	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-1D

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/7/2018	8/16/2018	11/14/2018	2/13/2019	5/23/2019	7/23/2019
Field Parameters									
Elevation	ft NGVD	--	--	369.56	369.94	368.73	369.71	371.84	372.45
pH	S.U.	--	6.74 - 8.16	8.24	7.35	7.77	7.41	7.18	7.3
Specific Conductance	µmhos/cm	--	--	508	568	457	317	0.504	510
Turbidity	NTU	--	--	1.71	0	1.03	2	0.3	1.5
Dissolved Oxygen	mg/L	--	--	0.25	0.26	0.2	10	3.68	2.1
Temperature	°C	--	--	15.85	16.71	14.06	14	17.02	16.7
ORP	mV	--	--	-112	200	53	188	55.9	44
Laboratory Parameters									
Antimony	µg/L	6	--	--	--	0.03	--	0.05	--
Arsenic	µg/L	10	--	--	--	0.62	--	0.47	--
Barium	µg/L	2000	--	--	--	101	--	99.2	--
Beryllium	µg/L	4	--	--	--	<0.02	--	<0.02	--
Cadmium	µg/L	5	--	--	--	0.02	--	0.02	--
Chromium	µg/L	100	--	--	--	0.07	--	0.1	--
Cobalt	µg/L	6	--	--	--	0.04	--	0.058	--
Copper	µg/L	--	--	0.55	--	0.75	--	0.83	--
Lead	µg/L	15	--	--	--	0.07	--	0.138	--
Mercury	µg/L	2	--	--	--	--	--	<0.002	--
Molybdnum	µg/L	100	--	--	--	2	--	1	--
Selenium	µg/L	50	--	--	--	0.04	--	0.09	--
Thallium	µg/L	2	--	--	--	<0.1	--	<0.1	--
Zinc	µg/L	--	--	2	--	1	--	65.9	--
Silica (Dissolved)	mg/L	--	--	17.9	--	19	--	17.8	--
Aluminum	µg/L	--	--	16.1	--	<1	--	4	--
Boron	mg/L	--	0.066	0.103	0.02	0.1	<0.02	0.02	--
Calcium	mg/L	--	(79.5) 75	70.9	--	71.9	--	73.6	--
Lithium	mg/L	0.04	--	--	--	0.01	--	0.01	--
Magnesium	mg/L	--	--	20.4	--	22.1	--	18.3	--
Manganese	mg/L	--	--	0.216	--	0.138	--	0.169	--
Potassium	mg/L	--	--	1.34	--	1.71	--	1.23	--
Sodium	mg/L	--	--	18.2	--	20.9	--	18.7	--
Strontium	mg/L	--	--	0.359	--	0.272	--	0.553	--
Alkalinity	mg/L	--	--	218	--	222	--	208	--
Bromide	mg/L	--	--	0.113	--	0.1	--	0.09	--
Chloride	mg/L	--	(29.6) 50	43.1	43.8	46.9	43.8	32.1	--
Fluoride	mg/L	4	0.321	0.3	--	0.3	--	0.27	--
TDS	mg/L	--	(412.7) 369	345	--	340	--	346	--
Sulfate	mg/L	--	(45.1) 45	39.5	--	39.8	--	45.3	39.2
Sulfide	mg/L	--	--	<0.4	--	<0.07	--	<0.1	--
Radium-228	pCi/L	--	--	--	--	0.295	--	0.55	--
Radium-226	pCi/L	--	--	--	--	0.0679	--	0.652	--
Radium-226/228	pCi/L	5	--	--	--	0.3629	--	1.202	--
Copper (Dissolved)	µg/L	--	--	0.98	--	0.78	--	0.8	--
Zinc (Dissolved)	µg/L	--	--	11.8	--	2	--	2	--
Aluminum (Dissolved)	µg/L	--	--	2	--	5.05	--	3	--
Iron (Dissolved)	mg/L	--	--	<0.002	--	0.02	--	<0.003	--
Manganese (Dissolved)	mg/L	--	--	0.0605	--	0.144	--	0.148	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-2S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/9/2016	7/20/2016	9/21/2016	11/17/2016	1/11/2017	3/9/2017	5/9/2017	7/19/2017	10/4/2017	6/6/2018
Field Parameters													
Elevation	ft NGVD	--	--	369.34	369.03	369.02	368.77	366.24	368.15	368.06	368.22	366.68	369.94
pH	S.U.	--	6.30 - 8.44	6.4	7.68	7.63	7.34	7.65	7.66	7.12	7.46	7.17	7.62
Specific Conductance	μmhos/cm	--	--	423	465	440	459	341	522	354	409	509	470
Turbidity	NTU	--	--	3.1	1.85	0.51	0.96	0.74	1.31	2.68	4.81	1.55	1.84
Dissolved Oxygen	mg/L	--	--	2.8	1.85	4.67	3.91	4.18	3.63	4.52	2.62	2.63	4.66
Temperature	°C	--	--	17.5	16.34	15.81	16.03	15.1	15.73	15.67	16.06	16.42	16.48
ORP	mV	--	--	34	64	90.4	-19	165	13.1	165.7	-5.9	26.6	59.1
Laboratory Parameters													
Antimony	μg/L	6	--	<0.02	0.02	0.04	0.02	0.02	0.02	0.04	0.12	--	--
Arsenic	μg/L	10	--	0.97	1.09	0.94	0.94	0.92	0.95	0.95	0.96	--	--
Barium	μg/L	2000	--	16	14	12.4	12.4	11	12.3	12.3	13.6	--	--
Beryllium	μg/L	4	--	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.004	<0.004	--	--
Cadmium	μg/L	5	--	0.01	0.01	0.02	0.02	0.09	0.009	0.01	0.03	--	
Chromium	μg/L	100	--	0.4	0.6	0.3	0.337	0.329	0.67	0.37	0.41	--	--
Cobalt	μg/L	6	--	0.177	0.09	0.017	0.019	0.014	0.051	0.064	0.121	--	--
Copper	μg/L	--	--	--	--	--	--	--	--	--	0.33	0.2	1.58
Lead	μg/L	15	--	0.158	0.105	0.101	0.022	0.063	0.042	0.047	0.243	--	--
Mercury	μg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--
Molybdnum	μg/L	100	--	2.03	2.39	2.07	1.91	2.14	1.92	1.75	1.81	--	--
Selenium	μg/L	50	--	0.3	0.3	0.2	0.3	0.4	0.3	0.2	0.3	--	--
Thallium	μg/L	2	--	<0.02	<0.01	<0.01	<0.01	0.074	<0.01	<0.01	0.03	--	--
Zinc	μg/L	--	--	--	--	--	--	--	--	--	2	3.3	5.3
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	28.6	28.8	31.9	26.7
Aluminum	μg/L	--	--	--	--	--	--	--	--	--	36.6	14.7	15.3
Boron	mg/L	--	0.109	<0.002	0.015	0.014	0.018	0.004	0.069	0.084	0.052	0.045	0.073
Calcium	mg/L	--	(79.5) 66	59.4	51.6	57.4	62.4	51.6	57.9	59	53.3	60.7	57
Lithium	mg/L	0.04	--	0.0004	0.018	0.005	0.008	0.009	0.0007	0.002	0.005	--	--
Magnesium	mg/L	--	--	--	--	--	--	--	21.2	21.9	19.5	22.8	21.3
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.0124	--	0.0063
Potassium	mg/L	--	--	--	--	--	--	--	0.73	0.81	0.65	0.64	0.68
Sodium	mg/L	--	--	--	--	--	--	--	13.4	14	11.8	16.3	22.1
Strontium	mg/L	--	--	--	--	--	--	--	0.0837	0.0855	0.0756	0.0888	0.0906
Alkalinity	mg/L	--	--	--	--	--	--	--	174	191	188	207	215
Bromide	mg/L	--	--	--	--	--	--	--	0.02	0.071	0.116	0.06	0.063
Chloride	mg/L	--	(29.6) 24	21.5	21.8	23.8	21.8	21.2	21	20.8	19.6	21.2	25.3
Fluoride	mg/L	4	0.299	0.26	0.29	0.26	0.26	0.25	0.26	0.26	0.23	0.25	0.29
TDS	mg/L	--	(412.7) 343	298	265	301	316	284	285	321	308	323	329
Sulfate	mg/L	--	(35.08) 35	26	27.6	26.2	24.1	25.9	26.6	30.3	33.8	30	28.9
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	<0.4
Radium-228	pCi/L	--	--	-0.035	0.54	0	0.228	0.343	0.0555	-0.0726	0.631	--	--
Radium-226	pCi/L	--	--		0.12	0.172	0.143	0.311	0.465	0.434	0.0617	--	--
Radium-226/228	pCi/L	5	--	-0.035	0.66	0.172	0.371	0.654	0.5205	0.3614	0.6927	--	--
Copper (Dissolved)	μg/L	--	--	--	--	--	--	--	--	--	0.28	--	0.27
Zinc (Dissolved)	μg/L	--	--	--	--	--	--	--	--	--	2	--	0.6
Aluminum (Dissolved)	μg/L	--	--	--	--	--	--	--	--	--	2	--	2
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	<0.0004	<0.0004	0.053	0.013	<0.002
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	0.0001	<0.0001	<0.0001	0.0021	0.0003

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-2S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	11/13/2018	2/13/2019	4/1/2019	5/22/2019	7/23/2019	9/11/2019
Field Parameters									
Elevation	ft NGVD	--	--	367.91	368.87	369.97	371.02	371.37	370.52
pH	S.U.	--	6.30 - 8.44	7.53	7.77	7.72	7.66	7.45	7.33
Specific Conductance	µmhos/cm	--	--	425	451	491	500	486	473
Turbidity	NTU	--	--	2.15	0.8	1.51	1.08	1.7	0.83
Dissolved Oxygen	mg/L	--	--	3.7	3.1	4.7	5.77	1.3	1.78
Temperature	°C	--	--	14.51	14.6	14.5	15.93	16.2	16.4
ORP	mV	--	--	23	71	-17.9	-3.2	55	7.7
Laboratory Parameters									
Antimony	µg/L	6	--	0.04	--	--	0.03	--	--
Arsenic	µg/L	10	--	0.82	--	--	0.78	--	--
Barium	µg/L	2000	--	16.5	--	--	18	--	--
Beryllium	µg/L	4	--	<0.02	--	--	<0.02	--	--
Cadmium	µg/L	5	--	0.11			0.08	--	--
Chromium	µg/L	100	--	0.1	--	--	0.1	--	--
Cobalt	µg/L	6	--	<0.02	--	--	0.02	--	--
Copper	µg/L	--	--	0.28	--	--	0.56	--	--
Lead	µg/L	15	--	0.04	--	--	0.133	--	--
Mercury	µg/L	2	--	--	--	--	<0.002	--	--
Molybdnum	µg/L	100	--	2	--	--	2	--	--
Selenium	µg/L	50	--	0.2	--	--	1	--	--
Thallium	µg/L	2	--	<0.1	--	--	<0.1	--	--
Zinc	µg/L	--	--	89.4	--	--	7.5	--	--
Silica (Dissolved)	mg/L	--	--	26.8	--	--	25	--	--
Aluminum	µg/L	--	--	7.27	--	--	6.68	--	--
Boron	mg/L	--	0.109	0.06	--	--	<0.02	--	--
Calcium	mg/L	--	(79.5) 66	54.7	--	--	51.3	--	--
Lithium	mg/L	0.04	--	<0.009	--	--	<0.009	--	--
Magnesium	mg/L	--	--	20.9	--	--	19	--	--
Manganese	mg/L	--	--	0.0025	--	--	0.0017	--	--
Potassium	mg/L	--	--	0.68	--	--	0.66	--	--
Sodium	mg/L	--	--	23.7	--	--	26	--	--
Strontium	mg/L	--	--	0.086	--	--	0.0803	--	--
Alkalinity	mg/L	--	--	207	--	--	220	--	--
Bromide	mg/L	--	--	<0.04	--	--	<0.04	--	--
Chloride	mg/L	--	(29.6) 24	24.8	26.5	26.1	26.4	26.8	26.6
Fluoride	mg/L	4	0.299	0.28	--	--	0.3	--	--
TDS	mg/L	--	(412.7) 343	272	--	--	352	339	--
Sulfate	mg/L	--	(35.08) 35	24.7	--	--	26.2	--	--
Sulfide	mg/L	--	--	<0.1	--	--	<0.1	--	--
Radium-228	pCi/L	--	--	0.146	--	--	0.54	--	--
Radium-226	pCi/L	--	--	0.0173	--	--	0.0674	--	--
Radium-226/228	pCi/L	5	--	0.1633	--	--	0.6074	--	--
Copper (Dissolved)	µg/L	--	--	1.84	--	--	0.87	--	--
Zinc (Dissolved)	µg/L	--	--	5	--	--	4	--	--
Aluminum (Dissolved)	µg/L	--	--	1	--	--	5.16	--	--
Iron (Dissolved)	mg/L	--	--	0.003	--	--	0.003	--	--
Manganese (Dissolved)	mg/L	--	--	0.0005	--	--	0.0009	--	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-2I

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/9/2016	7/20/2016	9/21/2016	11/17/2016	1/11/2017	3/8/2017	5/9/2017	7/19/2017	10/4/2017	1/3/2018	6/6/2018	8/16/2018
Field Parameters															
Elevation	ft NGVD	--	--	369.26	368.97	368.94	368.7	366.31	368.06	368.01	368.16	366.64	365.54	369.85	369.32
pH	S.U.	--	6.43 - 8.69	7.89	7.14	7.45	7.26	7.7	7.64	8.42	6.98	7.16	7.84	7.55	7.52
Specific Conductance	µmhos/cm	--	--	581	542	513	495	370	557	383	431	553	568	802	614
Turbidity	NTU	--	--	2.02	1.41	0.94	1.83	3.99	16	24.3	6.25	10.3	1.3	0.91	0
Dissolved Oxygen	mg/L	--	--	1.54	7.64	1.96	3.62	--	10.86	1.97	22.85	0.71	1.12	1.1	0.06
Temperature	°C	--	--	15.88	15.93	17.11	15.97	14.38	14.74	15.42	16.34	15.68	11.06	15.3	16.03
ORP	mV	--	--	65.9	29.8	-29.6	-11.6	161.9	-52.8	156.9	-180.6	-63.4	-51.8	-55.4	-46
Laboratory Parameters															
Antimony	µg/L	6	--	0.06	0.06	0.07	0.13	0.1	0.1	0.15	0.11	--	--	--	--
Arsenic	µg/L	10	--	0.64	0.68	0.55	0.61	0.65	0.74	0.9	0.76	--	--	--	--
Barium	µg/L	2000	--	78.5	84	67.1	60.1	59.4	58.4	59.3	62.9	--	--	--	--
Beryllium	µg/L	4	--	<0.005	0.006	<0.005	<0.005	<0.005	0.01	0.022	0.02	--	--	--	--
Cadmium	µg/L	5	--	0.03	0.05	0.05	0.07	0.16	0.22	0.09	0.05	--		--	--
Chromium	µg/L	100	--	0.2	0.6	0.1	0.143	0.154	1.01	0.829	0.567	--	--	--	--
Cobalt	µg/L	6	--	0.606	0.76	0.415	0.26	0.28	0.581	1.28	0.995	--	--	--	--
Copper	µg/L	--	--	--	--	--	--	--	--	--	2.21	1.82	--	0.2	--
Lead	µg/L	15	--	0.208	0.454	0.178	0.231	0.383	0.588	1.39	1.19	--	--	--	--
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	<0.002	--	--	--	--
Molybdnum	µg/L	100	--	4.91	5	4.21	3.14	2.07	2.06	2.17	2.07	--	--	--	--
Selenium	µg/L	50	--	0.7	0.7	0.6	0.4	0.2	0.2	0.4	0.2	--	--	--	--
Thallium	µg/L	2	--	0.051	0.04	0.04	0.02	0.03	0.03	0.04	0.064	--	--	--	--
Zinc	µg/L	--	--	--	--	--	--	--	--	--	4.4	3.4	--	20.8	--
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	16.3	16.8	18.9	--	16.3	--
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	315	244	--	9.39	--
Boron	mg/L	--	0.043	0.019	0.009	0.025	0.013	<0.002	0.024	0.034	0.025	0.03	--	0.052	0.03
Calcium	mg/L	--	(79.5) 78	74	67.5	66.8	73.9	63.9	71.5	71	68.9	72.5	--	72.7	--
Lithium	mg/L	0.04	--	0.005	0.021	0.002	0.006	0.007	0.005	0.007	<0.0002	--	--	--	--
Magnesium	mg/L	--	--	--	--	--	--	--	22.8	23.6	22.8	23.7	--	23.7	--
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.463	--	--	0.564	--
Potassium	mg/L	--	--	--	--	--	--	--	1.09	1.2	1.01	1.05	--	1.14	--
Sodium	mg/L	--	--	--	--	--	--	--	14.7	15.3	15.8	16.8	--	16.9	--
Strontium	mg/L	--	--	--	--	--	--	--	0.0919	0.0977	0.0885	0.0946	--	0.0959	--
Alkalinity	mg/L	--	--	--	--	--	--	--	223	218	236	252	--	254	--
Bromide	mg/L	--	--	--	--	--	--	--	0.05	0.071	0.072	0.075	--	0.077	--
Chloride	mg/L	--	(29.6) 32	28.6	29.7	28	25.8	27.1	25.8	28.6	29.7	29.8	28.8	31.8	31.5
Fluoride	mg/L	4	0.371	0.3	0.33	0.31	0.36	0.3	0.31	0.31	0.28	0.28	--	0.32	--
TDS	mg/L	--	(412.7) 375	332	363	330	326	314	312	343	346	343	--	356	--
Sulfate	mg/L	--	(48.53) 49	42.9	54.7	41.1	36.9	39.2	39.2	42.4	44.1	45.5	--	43.2	--
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	--	<0.4	--
Radium-228	pCi/L	--	--	-0.0463	0.62	0.241	0.137	0.648	0.146	0.163	0.195	--	--	--	--
Radium-226	pCi/L	--	--	0.398	0.342	0.267	0.288	0.197	0.289	0.328	0.341	--	--	--	--
Radium-226/228	pCi/L	5	--	0.3517	0.962	0.508	0.425	0.845	0.435	0.491	0.536	--	--	--	--
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.28	--	--	1.96	--
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2.3	--	--	21.7	--
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2	--	--	154	--
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	0.053	0.016	0.03	0.054	--	0.238	--
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	0.258	0.331	0.333	0.323	--	0.563	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-2I

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	11/13/2018	2/13/2019	5/22/2019
Field Parameters						
Elevation	ft NGVD	--	--	367.97	368.87	371.17
pH	S.U.	--	6.43 - 8.69	7.2	7.55	7.34
Specific Conductance	µmhos/cm	--	--	434	435	481
Turbidity	NTU	--	--	17.03	2.8	0
Dissolved Oxygen	mg/L	--	--	0.13	10	0.71
Temperature	°C	--	--	14.25	14.3	16.09
ORP	mV	--	--	36.8	-17	-83.8
Laboratory Parameters						
Antimony	µg/L	6	--	0.02	--	0.03
Arsenic	µg/L	10	--	0.49	--	0.4
Barium	µg/L	2000	--	95	--	102
Beryllium	µg/L	4	--	<0.02	--	<0.02
Cadmium	µg/L	5	--	0.04	--	0.003
Chromium	µg/L	100	--	0.327	--	0.06
Cobalt	µg/L	6	--	0.492	--	0.347
Copper	µg/L	--	--	1.52	--	0.24
Lead	µg/L	15	--	0.467	--	0.143
Mercury	µg/L	2	--	--	--	<0.002
Molybdnum	µg/L	100	--	2	--	2.13
Selenium	µg/L	50	--	0.2	--	0.05
Thallium	µg/L	2	--	<0.1	--	<0.1
Zinc	µg/L	--	--	35.2	--	7.4
Silica (Dissolved)	mg/L	--	--	16.9	--	15.9
Aluminum	µg/L	--	--	91.9	--	6.25
Boron	mg/L	--	0.043	0.05	<0.02	<0.02
Calcium	mg/L	--	(79.5) 78	64.8	--	64.3
Lithium	mg/L	0.04	--	<0.009	--	<0.009
Magnesium	mg/L	--	--	21.2	--	20.4
Manganese	mg/L	--	--	0.576	--	0.699
Potassium	mg/L	--	--	0.89	--	0.92
Sodium	mg/L	--	--	15.3	--	13.5
Strontium	mg/L	--	--	0.0864	--	0.083
Alkalinity	mg/L	--	--	247	--	241
Bromide	mg/L	--	--	0.06	--	0.05
Chloride	mg/L	--	(29.6) 32	27.9	31.5	25.4
Fluoride	mg/L	4	0.371	0.32	--	0.32
TDS	mg/L	--	(412.7) 375	308	--	328
Sulfate	mg/L	--	(48.53) 49	39	--	39.2
Sulfide	mg/L	--	--	<0.1	--	<0.1
Radium-228	pCi/L	--	--	0.291	--	0.451
Radium-226	pCi/L	--	--	0.258	--	0.194
Radium-226/228	pCi/L	5	--	0.549	--	0.645
Copper (Dissolved)	µg/L	--	--	0.2	--	0.64
Zinc (Dissolved)	µg/L	--	--	2	--	0.9
Aluminum (Dissolved)	µg/L	--	--	<1	--	1
Iron (Dissolved)	mg/L	--	--	0.037	--	0.02
Manganese (Dissolved)	mg/L	--	--	0.565	--	0.643

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-2D

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/9/2016	7/20/2016	9/21/2016	11/17/2016	1/11/2017	3/8/2017	5/9/2017	7/19/2017	10/4/2017	6/7/2018	8/16/2018
Field Parameters														
Elevation	ft NGVD	--	--	369.22	368.96	368.9	368.68	366.41	368.04	367.96	367.95	366.6	369.84	369.25
pH	S.U.	--	6.45 -8.63	7.86	7.47	7.29	7.1	7.4	7.39	7.3	8.51	7.24	7.55	7.33
Specific Conductance	µmhos/cm	--	--	586	524	551	516	386	568	388	516	428	460	830
Turbidity	NTU	--	--	2.31	3.15	3.5	0.79	3.45	2.67	2.32	1.72	1.82	5.05	0
Dissolved Oxygen	mg/L	--	--	0.45	0.31	1.77	0.31	5.47	0.79	0.87	0.45	0.84	6.83	0.74
Temperature	°C	--	--	15.8	15.79	19.32	15.58	14.22	14.45	15.65	16.06	15.71	15.35	17.83
ORP	mV	--	--	-2.7	-168.3	45	-0.7	206.9	-87.3	143.6	-24.8	-41	32.3	-24
Laboratory Parameters														
Antimony	µg/L	6	--	0.03	0.06	0.02	0.02	0.03	0.03	0.04	0.02	--	--	--
Arsenic	µg/L	10	--	0.78	0.82	0.81	0.61	0.62	0.59	0.65	0.62	--	--	--
Barium	µg/L	2000	--	185	195	180	172	157	160	159	169	--	--	--
Beryllium	µg/L	4	--	<0.005	0.006	0.007	<0.005	<0.005	<0.005	<0.004	<0.004	--	--	--
Cadmium	µg/L	5	--	0.12	0.12	0.07	0.1	0.26	0.09	0.08	0.08	--		--
Chromium	µg/L	100	--	0.2	0.4	0.3	0.05	0.277	0.562	0.188	0.162	--	--	--
Cobalt	µg/L	6	--	0.473	0.439	0.425	0.212	0.327	0.252	0.335	0.353	--	--	--
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.16	1.96	2.09	--
Lead	µg/L	15	--	0.648	0.359	0.247	0.021	0.378	0.045	0.144	0.075	--	--	--
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--
Molybdnum	µg/L	100	--	2.11	2.16	1.97	2.09	1.8	2.13	1.9	1.89	--	--	--
Selenium	µg/L	50	--	<0.03	<0.03	0.05	0.09	0.08	0.03	0.06	0.04	--	--	--
Thallium	µg/L	2	--	0.02	0.02	0.03	0.01	0.02	0.02	0.02	0.02	--	--	--
Zinc	µg/L	--	--	--	--	--	--	--	--	--	1	6	3.5	--
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	17.5	17.9	20.5	17.4	--
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	17.5	20.7	70.5	--
Boron	mg/L	--	0.074	<0.002	0.01	0.013	0.014	<0.002	0.03	0.027	0.073	0.041	0.076	0.038
Calcium	mg/L	--	(79.5) 81	75.6	65.8	66.7	73.9	64.2	74.2	70.8	64.7	67.7	78.6	--
Lithium	mg/L	0.04	--	0.002	0.018	0.002	0.007	0.007	0.008	0.011	0.0006	--	--	--
Magnesium	mg/L	--	--	--	--	--	--	--	24.3	23.9	21.9	22.6	26.4	--
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.657	--	0.943	--
Potassium	mg/L	--	--	--	--	--	--	--	1.17	1.21	1.32	1.1	1.28	--
Sodium	mg/L	--	--	--	--	--	--	--	17.3	16.9	16	15.8	16.4	--
Strontium	mg/L	--	--	--	--	--	--	--	0.104	0.104	0.0894	0.0952	0.111	--
Alkalinity	mg/L	--	--	--	--	--	--	--	249	248	261	248	263	--
Bromide	mg/L	--	--	--	--	--	--	--	0.06	0.079	0.156	0.083	0.073	--
Chloride	mg/L	--	(29.6) 25	24.2	24.2	22.8	22.2	22.3	21.7	23.1	23	22.4	43.1	93.0 ?
Fluoride	mg/L	4	0.222	0.19	0.21	0.2	0.19	0.19	0.2	0.21	0.18	0.2	0.22	--
TDS	mg/L	--	(412.7) 358	341	339	338	327	318	318	343	340	332	361	--
Sulfate	mg/L	--	(46.44) 46	42.1	44.2	39.6	35.4	38.3	37.6	40.5	40.5	42.3	39.8	--
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	<0.4	--
Radium-228	pCi/L	--	--	0.0495	0.195	0.451	0.473	0.506	1.11	0.0264	0.257	--	--	--
Radium-226	pCi/L	--	--	-0.0267	0.133	-0.00345	1.77	0.772	0.185	0.429	0.115	--	--	--
Radium-226/228	pCi/L	5	--	0.0228	0.328	0.44755	2.243	1.278	1.295	0.4554	0.372	--	--	--
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.11	--	0.12	--
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.8	--	0.5	--
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2.14	--	2.75	--
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	<0.0004	<0.0004	0.055	0.017	0.005	--
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	0.565	0.602	0.662	0.619	0.621	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-2D

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	11/12/2018	2/13/2019	5/22/2019	7/24/2019	9/11/2019
Field Parameters								
Elevation	ft NGVD	--	--	367.91	368.89	371.01	371.37	-----
pH	S.U.	--	6.45 -8.63	7.36	7.32	7.25	6.28	7.15
Specific Conductance	µmhos/cm	--	--	464	391	803	834	705
Turbidity	NTU	--	--	5.4	2.1	1.25	3	1.9
Dissolved Oxygen	mg/L	--	--	0.86	0.37	2.29	0.9	0.58
Temperature	°C	--	--	14.61	13.7	15.57	15.8	16.5
ORP	mV	--	--	-25.4	-164	-71.2	8	-109
Laboratory Parameters								
Antimony	µg/L	6	--	0.03	--	<0.02	--	--
Arsenic	µg/L	10	--	0.58	--	0.53	--	--
Barium	µg/L	2000	--	190	--	248	--	--
Beryllium	µg/L	4	--	<0.02	--	<0.02	--	--
Cadmium	µg/L	5	--	0.17	--	0.3	--	--
Chromium	µg/L	100	--	0.2	--	<0.04	--	--
Cobalt	µg/L	6	--	0.5	--	0.488	--	--
Copper	µg/L	--	--	0.22	--	0.18	--	--
Lead	µg/L	15	--	0.14	--	0.129	--	--
Mercury	µg/L	2	--	--	--	<0.002	--	--
Molybdnum	µg/L	100	--	2	--	2	--	--
Selenium	µg/L	50	--	<0.03	--	<0.03	--	--
Thallium	µg/L	2	--	<0.1	--	<0.1	--	--
Zinc	µg/L	--	--	0.9	--	533	--	--
Silica (Dissolved)	mg/L	--	--	17.8	--	17.1	--	--
Aluminum	µg/L	--	--	15.4	--	3	--	--
Boron	mg/L	--	0.074	0.07	--	<0.02	--	--
Calcium	mg/L	--	(79.5) 81	72.4	--	98.5	114	103
Lithium	mg/L	0.04	--	<0.009	--	0.02	--	--
Magnesium	mg/L	--	--	24.5	--	32.2	--	--
Manganese	mg/L	--	--	0.717	--	0.941	--	--
Potassium	mg/L	--	--	0.99	--	1.2	--	--
Sodium	mg/L	--	--	14.8	--	20.7	--	--
Strontium	mg/L	--	--	0.102	--	0.138	--	--
Alkalinity	mg/L	--	--	247	--	261	--	--
Bromide	mg/L	--	--	<0.04	--	0.08	--	--
Chloride	mg/L	--	(29.6) 25	51.3	40.9	135	156	110
Fluoride	mg/L	4	0.222	0.2	--	0.18	--	SSI ↓
TDS	mg/L	--	(412.7) 358	348	--	531	540	443
Sulfate	mg/L	--	(46.44) 46	36.1	--	33.3	--	--
Sulfide	mg/L	--	--	<0.1	--	<0.1	--	--
Radium-228	pCi/L	--	--	0.0387	--	0.553	--	--
Radium-226	pCi/L	--	--	0.245	--	0.207	--	--
Radium-226/228	pCi/L	5	--	0.2837	--	0.76	--	--
Copper (Dissolved)	µg/L	--	--	0.11	--	0.39	--	--
Zinc (Dissolved)	µg/L	--	--	1	--	3	--	--
Aluminum (Dissolved)	µg/L	--	--	<1	--	1	--	--
Iron (Dissolved)	mg/L	--	--	0.007	--	0.009	--	--
Manganese (Dissolved)	mg/L	--	--	0.702	--	0.948	--	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-6S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	7/18/2016	9/20/2016	11/16/2016	1/10/2017	3/8/2017	5/8/2017	7/18/2017	10/3/2017	6/5/2018	8/15/2018	9/26/2018
Field Parameters														
Elevation	ft NGVD	--	--	369.59	368.99	368.14	367.39	367.54	367.81	368.48	367.6	369.94	370.04	368.35
pH	S.U.	--	7.9	7.5	7.4	8.1	7.9	7.9	7.6	7.7	7.3	7.52	7.7	7.9
Specific Conductance	µmhos/cm	--	--	401	430	741	360	300	441	292	347	330	483	321
Turbidity	NTU	--	--	1	0.5	1	2	1	1	1	1	0.47	0	8
Dissolved Oxygen	mg/L	--	--	7.1	5.7	1	6	5	5	7	7	5.82	8.1	5.1
Temperature	°C	--	--	16.8	19	15	14.8	14.7	15.5	15.2	16.4	16.28	16	15.5
ORP	mV	--	--	53	71	258	146	36	49	74	0.3	-9.3	155	133
Laboratory Parameters														
Antimony	µg/L	6	--	0.03	0.03	0.03	0.03	0.03	0.03	0.02	--	--	0.03	0.03
Arsenic	µg/L	10	--	0.26	0.26	0.26	0.28	0.26	0.28	0.27	--	--	0.25	0.25
Barium	µg/L	2000	--	13.6	13.6	14.1	14.8	15.8	15.4	14.3	--	--	14.8	13.5
Beryllium	µg/L	4	--	0.005	<0.005	<0.005	<0.005	<0.005	<0.004	<0.004	--	--	<0.004	<0.02
Cadmium	µg/L	5	--	0.25	0.02	0.02	0.008	0.05	0.009	0.04	--	--	0.06	0.04
Chromium	µg/L	100	--	0.4	0.3	0.2	0.599	1.37	0.583	0.291	--	--	0.42	0.265
Cobalt	µg/L	6	--	0.052	0.019	0.027	0.045	0.049	0.061	0.026	--	--	0.039	<0.02
Copper	µg/L	--	--	--	--	--	--	--	--	0.37	0.31	0.46	0.42	0.29
Lead	µg/L	15	--	0.074	0.034	0.05	0.032	0.113	0.083	0.056	--	--	0.247	0.03
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	--
Molybdnum	µg/L	100	--	3.28	3.34	2.8	2.93	3.29	2.73	4.36	--	--	2.22	2.37
Selenium	µg/L	50	--	0.3	0.2	0.3	0.4	0.7	0.8	0.4	--	--	0.4	0.2
Thallium	µg/L	2	--	0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	--	--	0.01	<0.1
Zinc	µg/L	--	--	--	--	--	--	--	--	1	0.5	2.5	1	0.7
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	14.4	14.6	16.9	15.4	15.2	16.8
Aluminum	µg/L	--	--	--	--	--	--	--	--	8.57	17.8	10.4	13.8	3
Boron	mg/L	--	0.012	0.014	0.012	0.028	0.006	0.032	0.051	0.078	0.094	0.09	0.101	0.08
Calcium	mg/L	--	46.1	46.3	44.4	50.8	47.8	53.2	50.3	47	44.8	45.2	52.8	44.1
Lithium	mg/L	0.04	--	0.015	0.004	0.006	0.014	0.009	0.011	<0.0002	--	--	0.005	0.02
Magnesium	mg/L	--	--	--	--	--	--	23.3	23.5	20.9	19.8	19.3	24	18.8
Manganese	mg/L	--	--	--	--	--	--	--	--	0.0007	--	0.0024	0.0021	<0.0002
Potassium	mg/L	--	--	--	--	--	--	0.7	0.75	0.82	0.78	0.57	0.91	0.71
Sodium	mg/L	--	--	--	--	--	--	38.9	34.9	26.3	23.2	15.6	25.6	26.1
Strontium	mg/L	--	--	--	--	--	--	0.0661	0.067	0.0574	0.0548	0.0555	0.065	0.051
Alkalinity	mg/L	--	--	--	--	--	--	260	272	241	249	237	267	241
Bromide	mg/L	--	--	--	--	--	--	<0.02	0.072	<0.05	0.04	0.03	0.04	<0.04
Chloride	mg/L	--	8.44	8.35	6.04	7.04	7.03	3.32	8.68	4.88	3.28	2.38	11.9	6.83
Fluoride	mg/L	4	0.73	0.79	0.73	0.69	0.65	0.25	0.69	0.57	0.71	0.89	0.81	0.84
TDS	mg/L	--	294	290	266	279	287	296	305	274	261	225	277	261
Sulfate	mg/L	--	18.8	18.3	10.9	14.3	14	6.9	17.5	9.6	7.5	3.8	15.6	9.8
Sulfide	mg/L	--	--	--	--	--	--	--	--	<0.4	--	<0.4	<0.4	<0.1
Radium-228	pCi/L	--	--	0.101	0.798	-0.249	0.501	0.297	-0.337	0.954	--	--	0.328	0.367
Radium-226	pCi/L	--	--	0	0.0671	0.202	0.0815	-0.00471	0.12	-0.0229	--	--	0.0553	0.089
Radium-226/228	pCi/L	5	--	0.101	0.8651	-0.047	0.5825	0.29229	-0.217	0.954	--	--	0.3833	0.456
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	1.85	--	0.4	2.17	1.86
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	2.2	--	0.9	3.1	3
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	4.34	--	1	2.51	109
Iron (Dissolved)	mg/L	--	--	--	--	--	--	<0.0004	<0.0004	<0.0004	0.023	<0.002	0.003	0.163
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	<0.0001	<0.0001	0.0002	0.0007	0.0015	<0.0002	0.0121

Table A-1

Summary of Analytical Data

CCR Landfill

Rockport Plant, Rockport, Indiana

MW-6S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	11/1/2018	11/14/2018	12/12/2018	5/23/2019
Field Parameters							
Elevation	ft NGVD	--	--	368.89	368.72	368.4	372.52
pH	S.U.	--	7.9	7.31	7.91	7.46	7.42
Specific Conductance	µmhos/cm	--	--	430	221	464	473
Turbidity	NTU	--	--	0.51	0.4	0.53	1.4
Dissolved Oxygen	mg/L	--	--	7.53	5.5	4.42	6.4
Temperature	°C	--	--	15.04	14.4	14.71	16.6
ORP	mV	--	--	115.3	126	196	70
Laboratory Parameters							
Antimony	µg/L	6	--	0.02	0.03	0.03	0.03
Arsenic	µg/L	10	--	0.23	0.23	0.24	0.22
Barium	µg/L	2000	--	12.1	11.8	13.4	15.9
Beryllium	µg/L	4	--	<0.02	<0.02	<0.02	<0.02
Cadmium	µg/L	5	--	0.01	<0.01	<0.01	0.03
Chromium	µg/L	100	--	0.221	0.218	0.212	0.285
Cobalt	µg/L	6	--	<0.02	<0.02	<0.02	<0.02
Copper	µg/L	--	--	0.17	0.18	0.26	0.51
Lead	µg/L	15	--	<0.02	0.02	<0.02	0.04
Mercury	µg/L	2	--	--	--	-----	<0.002
Molybdnum	µg/L	100	--	2.38	2.18	2.2	2
Selenium	µg/L	50	--	0.2	0.2	0.4	0.6
Thallium	µg/L	2	--	<0.1	<0.1	<0.1	<0.1
Zinc	µg/L	--	--	<0.7	1	2	<0.7
Silica (Dissolved)	mg/L	--	--	15.3	15.2	15.9	15.8
Aluminum	µg/L	--	--	2	5.28	3	2
Boron	mg/L	--	0.012	0.04	0.04	0.102	0.02
Calcium	mg/L	--	46.1	42.3	38.8	46.8	52.5
Lithium	mg/L	0.04	--	<0.009	0.01	<0.009	0.02
Magnesium	mg/L	--	--	19.3	17.5	20.8	22.9
Manganese	mg/L	--	--	0.0007	0.0002	0.0003	0.0003
Potassium	mg/L	--	--	0.5	0.92	0.86	0.62
Sodium	mg/L	--	--	22	20.2	23.3	25.5
Strontium	mg/L	--	--	0.0519	0.0524	0.0595	0.691
Alkalinity	mg/L	--	--	230	242	247	264
Bromide	mg/L	--	--	<0.04	<0.04	<0.04	<0.04
Chloride	mg/L	--	8.44	3.52	3.91	6.48	9.64
Fluoride	mg/L	4	0.73	0.86	0.88	0.88	0.95
TDS	mg/L	--	294	225	196	240	315
Sulfate	mg/L	--	18.8	4.9	5.2	10	16.8
Sulfide	mg/L	--	--	<0.1	<0.07	<0.07	<0.1
Radium-228	pCi/L	--	--	0.354	0.387	-0.368	0.343
Radium-226	pCi/L	--	--	0.0398	0.0239	0.0533	0.0431
Radium-226/228	pCi/L	5	--	0.3938	0.4109	0.0533	0.3861
Copper (Dissolved)	µg/L	--	--	0.14	0.53	0.17	1.22
Zinc (Dissolved)	µg/L	--	--	0.7	<0.7	2	1
Aluminum (Dissolved)	µg/L	--	--	1	2	8.1	1
Iron (Dissolved)	mg/L	--	--	<0.003	0.005	0.01	<0.003
Manganese (Dissolved)	mg/L	--	--	0.0003	<0.0002	0.0007	0.0002

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-6I

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	9/25/2018	10/31/2018	11/15/2018	12/12/2018	5/23/2019
Field Parameters								
Elevation	ft NGVD	--	--	369.18	368.75	368.62	368.48	372.32
pH	S.U.	--	7.6	7.8	7.25	7.35	7.44	7.66
Specific Conductance	µmhos/cm	--	--	332	467	344	458	453
Turbidity	NTU	--	--	6.5	0.76	0.74	0.25	0.36
Dissolved Oxygen	mg/L	--	--	1.7	0.27	2.78	0.79	1.02
Temperature	°C	--	--	16.4	15.9	14.2	14.71	16.5
ORP	mV	--	--	149	24.9	140.5	163	168.8
Laboratory Parameters								
Antimony	µg/L	6	--	0.25	0.25	0.25	0.23	0.23
Arsenic	µg/L	10	--	0.2	0.2	0.19	0.19	0.19
Barium	µg/L	2000	--	31.9	32.2	31.9	30.5	35.8
Beryllium	µg/L	4	--	<0.02	<0.02	<0.02	<0.02	<0.02
Cadmium	µg/L	5	--	0.11	0.01	0.01	0.01	0.01
Chromium	µg/L	100	--	0.05	0.1	<0.04	0.05	0.07
Cobalt	µg/L	6	--	0.313	0.452	0.42	0.362	0.436
Copper	µg/L	--	--	2.36	0.78	0.92	1.21	0.6
Lead	µg/L	15	--	0.05	0.118	<0.02	<0.02	<0.02
Mercury	µg/L	2	--	--	--	--	--	<0.002
Molybdnum	µg/L	100	--	5.31	4.7	4.46	4.17	4.4
Selenium	µg/L	50	--	0.6	0.7	0.8	0.6	0.6
Thallium	µg/L	2	--	<0.1	<0.1	<0.1	<0.1	0.1
Zinc	µg/L	--	--	3	<0.7	0.7	2	1
Silica (Dissolved)	mg/L	--	--	19.9	18.1	18.8	18.6	18.1
Aluminum	µg/L	--	--	6.57	5.88	5.54	3	4
Boron	mg/L	--	0.06	0.06	0.04	0.03	0.06	<0.02
Calcium	mg/L	--	42.2	43.1	42.4	43.1	47.2	47.4
Lithium	mg/L	0.04	--	0.01	<0.009	0.034	<0.009	0.01
Magnesium	mg/L	--	--	13.9	15.1	14.6	16.1	15.7
Manganese	mg/L	--	--	0.185	0.24	0.247	0.249	0.272
Potassium	mg/L	--	--	0.93	0.76	0.78	0.88	1.13
Sodium	mg/L	--	--	35.7	35.9	32.9	32.7	29.9
Strontium	mg/L	--	--	0.0482	0.0528	0.0549	0.061	0.0622
Alkalinity	mg/L	--	--	267	259	246	257	278
Bromide	mg/L	--	--	<0.04	<0.04	<0.04	<0.04	<0.04
Chloride	mg/L	--	5.18	2.91	3.47	3.94	3.84	2.7
Fluoride	mg/L	4	0.89	0.88	0.86	0.86	0.86	0.85
TDS	mg/L	--	281	274	245	248	245	268
Sulfate	mg/L	--	9.9	5.4	4.9	6.3	7.3	4.1
Sulfide	mg/L	--	--	<0.1	<0.1	<0.07	<0.07	<0.1
Radium-228	pCi/L	--	--	0.218	0.216	0.675	0.488	0.496
Radium-226	pCi/L	--	--	0.35	0.323	0.638	0.489	0.557
Radium-226/228	pCi/L	5	--	0.568	0.539	1.313	0.977	1.053
Copper (Dissolved)	µg/L	--	--	2.79	1.09	0.86	0.74	2.58
Zinc (Dissolved)	µg/L	--	--	4	1	<0.7	<0.7	3
Aluminum (Dissolved)	µg/L	--	--	30.9	1	8.05	4	4
Iron (Dissolved)	mg/L	--	--	0.064	<0.003	0.003	0.004	0.003
Manganese (Dissolved)	mg/L	--	--	0.254	0.232	0.246	0.231	0.256

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-6D

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	9/25/2018	10/31/2018	11/14/2018	12/12/2018	5/23/2019
Field Parameters								
Elevation	ft NGVD	--	--	369.15	368.72	369.6	368.44	372.31
pH	S.U.	--	7.5	7.7	7.21	7.54	7.4	7.55
Specific Conductance	µmhos/cm	--	--	369	521	365	513	681
Turbidity	NTU	--	--	9	0	8.4	0.25	1.2
Dissolved Oxygen	mg/L	--	--	0.4	0.34	0.42	0.15	0.9
Temperature	°C	--	--	16.2	16	13.5	15.07	18.6
ORP	mV	--	--	155	54.3	131	110	145
Laboratory Parameters								
Antimony	µg/L	6	--	0.02	0.03	0.03	0.02	<0.02
Arsenic	µg/L	10	--	0.89	1.3	1.05	0.93	0.94
Barium	µg/L	2000	--	77.1	75.7	73.6	76.5	112
Beryllium	µg/L	4	--	<0.02	<0.02	<0.02	<0.02	<0.02
Cadmium	µg/L	5	--	0.03	0.01	0.02	0.01	0.01
Chromium	µg/L	100	--	0.04	0.346	0.2	0.05	0.08
Cobalt	µg/L	6	--	0.392	0.806	0.598	0.404	0.578
Copper	µg/L	--	--	0.45	1.18	1.6	1.64	0.17
Lead	µg/L	15	--	<0.02	0.205	0.167	<0.02	<0.02
Mercury	µg/L	2	--	--	--	--	--	0.002
Molybdnum	µg/L	100	--	3.23	2.79	2.83	3.02	2.81
Selenium	µg/L	50	--	7.3	8.5	8.2	4.3	0.09
Thallium	µg/L	2	--	<0.1	<0.1	<0.1	<0.1	<0.1
Zinc	µg/L	--	--	<0.7	2	73.1	2	<0.7
Silica (Dissolved)	mg/L	--	--	19.5	17.5	17.6	18	18.2
Aluminum	µg/L	--	--	2	142	70.3	3	1
Boron	mg/L	--	0.094	0.05	0.03	0.05	0.115	0.03
Calcium	mg/L	--	61.9	61.7	57.2	53.1	60.1	78.9
Lithium	mg/L	0.04	--	0.02	0.009	0.01	<0.009	0.01
Magnesium	mg/L	--	--	16.8	16.9	15.2	17.1	22.1
Manganese	mg/L	--	--	0.147	0.145	0.156	0.144	0.278
Potassium	mg/L	--	--	1.2	1.04	1.43	1.47	1.29
Sodium	mg/L	--	--	29	27.8	26.5	29	35.5
Strontium	mg/L	--	--	0.0919	0.093	0.0927	0.102	0.14
Alkalinity	mg/L	--	--	260	260	266	271	305
Bromide	mg/L	--	--	<0.04	<0.04	<0.04	<0.04	0.07
Chloride	mg/L	--	12.3	10.9	10.2	10	10.8	25.1
Fluoride	mg/L	4	0.39	0.41	0.41	0.42	0.42	0.36
TDS	mg/L	--	331	310	295	276	296	408
Sulfate	mg/L	--	27.3	24.1	23	22.2	23.6	39.5
Sulfide	mg/L	--	--	<0.1	<0.1	<0.07	<0.07	<0.1
Radium-228	pCi/L	--	--	0.29	0.21	0.275	-0.0272	0.586
Radium-226	pCi/L	--	--	0.295	0.122	0.102	0.423	0.543
Radium-226/228	pCi/L	5	--	0.585	0.332	0.377	0.423	0.423
Copper (Dissolved)	µg/L	--	--	1.27	0.44	0.7	0.5	0.53
Zinc (Dissolved)	µg/L	--	--	2	0.9	2	2	1
Aluminum (Dissolved)	µg/L	--	--	31.6	3	2	45.3	15.6
Iron (Dissolved)	mg/L	--	--	0.082	<0.003	0.004	0.117	0.007
Manganese (Dissolved)	mg/L	--	--	0.127	0.137	0.135	0.142	0.263

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-7S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	9/26/2018	10/30/2018	11/14/2018	12/12/2018	5/22/2019
Field Parameters								
Elevation	ft NGVD	--	--	369.5	368.76	368.68	368.47	371.91
pH	S.U.	--	7.4	7.4	7.33	7.31	7.3	8.39
Specific Conductance	µmhos/cm	--	--	417	611	455	629	527
Turbidity	NTU	--	--	106	104	42.6	44	4.77
Dissolved Oxygen	mg/L	--	--	0.4	0.32	0.7	0.23	0.65
Temperature	°C	--	--	15.4	15.01	13.9	14.43	14.69
ORP	mV	--	--	106	85.4	48.2	92	0.1
Laboratory Parameters								
Antimony	µg/L	6	--	0.14	0.15	0.06	0.09	0.02
Arsenic	µg/L	10	--	1.48	2.01	0.7	1.06	0.11
Barium	µg/L	2000	--	18.7	24.3	12.9	15.4	8.42
Beryllium	µg/L	4	--	0.101	0.127	0.05	0.07	<0.02
Cadmium	µg/L	5	--	0.05	0.06	0.02	0.05	0.02
Chromium	µg/L	100	--	2.08	2.45	0.831	1.48	0.1
Cobalt	µg/L	6	--	6.48	9.82	3.47	4.98	0.255
Copper	µg/L	--	--	4.4	5.36	1.91	2.76	0.51
Lead	µg/L	15	--	4.69	6.69	2.38	3.56	0.205
Mercury	µg/L	2	--	--	--	--	--	<0.002
Molybdnum	µg/L	100	--	<0.4	<0.4	<0.4	<0.4	<0.4
Selenium	µg/L	50	--	0.6	0.8	0.3	0.4	0.2
Thallium	µg/L	2	--	<0.1	<0.1	<0.1	<0.1	<0.1
Zinc	µg/L	--	--	7.9	9.5	14	5	39.1
Silica (Dissolved)	mg/L	--	--	20.8	18.7	18.6	19.3	18.4
Aluminum	µg/L	--	--	1520	1850	681	1170	39.3
Boron	mg/L	--	0.079	0.04	0.07	0.135	0.08	0.03
Calcium	mg/L	--	70.2	73.7	68.3	66.2	67.1	62.4
Lithium	mg/L	0.04	--	0.02	0.01	<0.009	<0.009	<0.009
Magnesium	mg/L	--	--	25.4	25.7	24.3	24.6	21.7
Manganese	mg/L	--	--	0.334	0.49	0.182	0.248	0.0145
Potassium	mg/L	--	--	1.33	1.39	1.81	1.3	0.87
Sodium	mg/L	--	--	17.9	19.1	18.9	18.7	17
Strontium	mg/L	--	--	0.083	0.0857	0.0883	0.0874	0.0803
Alkalinity	mg/L	--	--	256	261	255	261	242
Bromide	mg/L	--	--	0.09	0.09	0.09	0.09	0.1
Chloride	mg/L	--	32.8	32.2	33.5	33.2	33.6	35.4
Fluoride	mg/L	4	0.52	0.54	0.53	0.54	0.55	0.55
TDS	mg/L	--	358	370	358	354	353	353
Sulfate	mg/L	--	32	32.2	33.1	33.1	33.7	34.1
Sulfide	mg/L	--	--	<0.1	<0.1	<00.07	<0.07	<0.1
Radium-228	pCi/L	--	--	0.48	0.601	0.254	0.191	0.27
Radium-226	pCi/L	--	--	0.271	0.245	0.211	0.507	0.0334
Radium-226/228	pCi/L	5	--	0.751	0.846	0.465	0.698	0.3034
Copper (Dissolved)	µg/L	--	--	1.01	0.07	1.62	0.2	0.17
Zinc (Dissolved)	µg/L	--	--	2	<0.7	3	<0.7	<0.7
Aluminum (Dissolved)	µg/L	--	--	311	3	2	3	2
Iron (Dissolved)	mg/L	--	--	0.618	0.004	0.005	0.007	<0.003
Manganese (Dissolved)	mg/L	--	--	0.0797	0.0021	0.0012	0.0026	0.0009

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-7I

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	9/26/2018	10/30/2018	11/15/2018	12/12/2018	5/22/2019
Field Parameters								
Elevation	ft NGVD	--	--	369.01	368.51	368.5	368.27	371.73
pH	S.U.	--	7.4	7.5	7.3	7.03	7.27	8.4
Specific Conductance	µmhos/cm	--	--	419	613	460	645	573
Turbidity	NTU	--	--	19	14.4	7.05	19.9	1.6
Dissolved Oxygen	mg/L	--	--	0.3	0.36	0.95	0.21	0.7
Temperature	°C	--	--	15.5	15.17	13.78	14.46	15.1
ORP	mV	--	--	57	-19.2	68.4	44	-71.2
Laboratory Parameters								
Antimony	µg/L	6	--	0.02	0.03	<0.02	<0.02	0.02
Arsenic	µg/L	10	--	0.28	0.43	0.24	0.26	0.23
Barium	µg/L	2000	--	175	230	162	147	116
Beryllium	µg/L	4	--	<0.02	<0.02	<0.02	<0.02	<0.02
Cadmium	µg/L	5	--	0.05	0.06	0.03	0.03	0.35
Chromium	µg/L	100	--	0.2	0.315	0.09	0.07	0.09
Cobalt	µg/L	6	--	3.07	8.34	1.11	1.67	1.1
Copper	µg/L	--	--	0.55	1.45	0.59	0.76	0.4
Lead	µg/L	15	--	0.45	0.6	0.05	0.145	0.228
Mercury	µg/L	2	--	--	--	--	--	<0.002
Molybdnum	µg/L	100	--	4.2	4.31	<0.4	3.45	3.63
Selenium	µg/L	50	--	0.05	0.09	0.05	0.05	0.04
Thallium	µg/L	2	--	<0.1	0.1	<0.1	<0.1	<0.1
Zinc	µg/L	--	--	2	15.1	1	2	3
Silica (Dissolved)	mg/L	--	--	20.5	18.1	18.5	18.8	18.4
Aluminum	µg/L	--	--	74.1	304	69.9	39.5	27.7
Boron	mg/L	--	0.07	0.04	0.06	0.09	0.08	0.03
Calcium	mg/L	--	75.3	75.4	68.8	68.8	73.7	73.7
Lithium	mg/L	0.04	--	0.01	<0.009	<0.009	<0.009	<0.009
Magnesium	mg/L	--	--	21.9	21.7	21.4	22.8	21.5
Manganese	mg/L	--	--	2.76	4	1.08	2.89	0.821
Potassium	mg/L	--	--	1.22	0.97	1.57	1.19	1.08
Sodium	mg/L	--	--	19.8	20.1	21.5	21.3	18.1
Strontium	mg/L	--	--	0.0928	0.0932	0.1	0.103	0.11
Alkalinity	mg/L	--	--	236	237	233	229	232
Bromide	mg/L	--	--	0.1	0.1	0.1	0.1	0.1
Chloride	mg/L	--	45	45.8	48.2	47.6	48.8	49
Fluoride	mg/L	4	0.33	0.34	0.34	0.35	0.35	0.33
TDS	mg/L	--	312	348	338	354	347	376
Sulfate	mg/L	--	38.4	38.9	38.9	39	39.1	43.1
Sulfide	mg/L	--	--	<0.1	<0.1	<0.07	<0.07	<0.1
Radium-228	pCi/L	--	--	-0.0705	0.369	0.123	0.089	0.643
Radium-226	pCi/L	--	--	4.16	0.513	0.605	0.934	0.155
Radium-226/228	pCi/L	5	--	4.16	0.882	0.728	1.023	0.798
Copper (Dissolved)	µg/L	--	--	0.93	0.24	1.56	0.72	0.15
Zinc (Dissolved)	µg/L	--	--	2	0.9	3	2	2
Aluminum (Dissolved)	µg/L	--	--	1	10.6	2	137	2
Iron (Dissolved)	mg/L	--	--	<0.003	0.01	0.006	0.128	<0.003
Manganese (Dissolved)	mg/L	--	--	0.172	0.51	0.243	3.9	0.121

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-7D

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	9/26/2018	10/31/2018	11/15/2018	12/12/2018	5/22/2019
Field Parameters								
Elevation	ft NGVD	--	--	369.08	368.65	368.57	368.35	371.82
pH	S.U.	--	7.2	7.5	6.91	7.26	7.18	7.91
Specific Conductance	µmhos/cm	--	--	419	617	444	622	549
Turbidity	NTU	--	--	10.8	1.02	5.96	0	0.01
Dissolved Oxygen	mg/L	--	--	0.7	3.72	11.3	0.52	2
Temperature	°C	--	--	15.2	14.79	13.32	15.23	16.25
ORP	mV	--	--	57	26.4	26.4	-5	-40.4
Laboratory Parameters								
Antimony	µg/L	6	--	0.04	0.03	0.04	0.06	0.02
Arsenic	µg/L	10	--	0.91	0.8	0.87	0.85	0.72
Barium	µg/L	2000	--	286	283	268	320	284
Beryllium	µg/L	4	--	<0.02	<0.02	<0.02	<0.02	<0.02
Cadmium	µg/L	5	--	0.02	0.02	0.04	<0.01	<0.01
Chromium	µg/L	100	--	0.2	0.334	0.1	0.1	0.07
Cobalt	µg/L	6	--	2.52	2.46	2.24	2.24	1.88
Copper	µg/L	--	--	0.34	0.44	0.57	1.59	0.08
Lead	µg/L	15	--	0.1	0.164	0.101	0.144	<0.02
Mercury	µg/L	2	--	--	--	--	--	<0.002
Molybdnum	µg/L	100	--	4.09	9.76	7.38	5.43	3.49
Selenium	µg/L	50	--	0.05	0.05	0.03	<0.03	<0.03
Thallium	µg/L	2	--	<0.1	<0.1	<0.1	<0.1	<0.1
Zinc	µg/L	--	--	1	2	4	3	5.1
Silica (Dissolved)	mg/L	--	--	216	19.2	19.9	19.8	19.2
Aluminum	µg/L	--	--	31.4	56.7	16.5	<1	1
Boron	mg/L	--	0.06	0.04	0.05	0.07	0.04	0.02
Calcium	mg/L	--	80.1	79.2	75	62.8	77.4	76.7
Lithium	mg/L	0.04	--	<0.009	0.01	0.02	<0.009	<0.009
Magnesium	mg/L	--	--	25	25.8	21	25.7	24.3
Manganese	mg/L	--	--	1.89	1.66	1.34	1.51	1.49
Potassium	mg/L	--	--	1.22	1.07	1.39	1.25	0.94
Sodium	mg/L	--	--	14.2	15.4	12.9	15.3	13.9
Strontium	mg/L	--	--	0.137	0.141	0.125	0.146	0.138
Alkalinity	mg/L	--	--	273	293	296	300	296
Bromide	mg/L	--	--	0.09	0.08	0.08	0.08	0.009
Chloride	mg/L	--	17.3	17.5	17.2	16.9	17.2	19.1
Fluoride	mg/L	4	0.27	0.26	0.26	0.26	0.27	0.26
TDS	mg/L	--	359	358	3.46	340	344	371
Sulfate	mg/L	--	36.9	36.3	36	35.4	35.5	35.2
Sulfide	mg/L	--	--	<0.1	<0.1	<0.07	<0.07	<0.1
Radium-228	pCi/L	--	--	0.36	0.202	0.548	0.159	0.89
Radium-226	pCi/L	--	--	0.983	0.107	0.45	0.717	0.265
Radium-226/228	pCi/L	5	--	1.343	0.309	0.998	0.876	1.155
Copper (Dissolved)	µg/L	--	--	0.55	0.17	2.01	0.18	0.77
Zinc (Dissolved)	µg/L	--	--	2	2	4	1	3
Aluminum (Dissolved)	µg/L	--	--	6.36	6.44	2	3	2
Iron (Dissolved)	mg/L	--	--	0.103	0.081	0.08	0.093	0.072
Manganese (Dissolved)	mg/L	--	--	1.76	1.6	1.47	1.35	1.5

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-8S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	7/19/2016	9/21/2016	11/17/2016	1/9/2017	3/7/2017	5/9/2017	7/18/2017	10/4/2017	12/12/2017	6/5/2018	11/13/2018	5/23/2019
Field Parameters															
Elevation	ft NGVD	--	--	369.78	369.44	369.25	368.53	368.39	368.39	368.81	367.5	366.59	369.59	368.9	371.48
pH	S.U.	--	7.3	7.2	7.1	7.9	7.6	7.6	7.4	7.4	7.75	7.7	7.59	7.58	7.38
Specific Conductance	µmhos/cm	--	--	516	540	811	450	260	444	410	395	460	400	354	440
Turbidity	NTU	--	--	1.1	2	2	3	4	8	1	2.46	6	3.48	2.6	0.69
Dissolved Oxygen	mg/L	--	--	3.2	3.6	1	2	4	2	3.2	3.12	0.8	2.1	3.8	6.54
Temperature	°C	--	--	20.7	21.6	16.2	14	14.2	15.6	15.8	16.57	14.1	15.05	14.4	16.17
ORP	mV	--	--	29	18	275	131	50	50	65	29.9	-17	-33.7	158	54.2
Laboratory Parameters															
Antimony	µg/L	6	--	0.3	0.02	0.03	0.02	0.04	0.03	0.02	--	--	--	0.05	<0.02
Arsenic	µg/L	10	--	1.78	1.33	1.26	1.56	1.53	2.09	1.19	--	--	--	1.61	1.52
Barium	µg/L	2000	--	13.1	12.2	10.9	13.8	14.5	16.9	10.9	--	--	--	10.4	9.22
Beryllium	µg/L	4	--	0.232	<0.005	<0.005	0.006	0.009	0.01	<0.004	--	--	--	<0.02	<0.02
Cadmium	µg/L	5	--	0.31	0.02	0.05	0.01	0.26	0.09	0.13	--	--		0.03	<0.01
Chromium	µg/L	100	--	0.6	0.4	0.156	1.04	0.881	0.423	0.277	--	--	--	0.578	0.235
Cobalt	µg/L	6	--	0.453	0.125	0.113	0.447	0.433	0.981	0.052	--	--	--	0.207	0.058
Copper	µg/L	--	--	--	--	--	--	--	--	0.18	0.12	--	0.25	1.7	0.13
Lead	µg/L	15	--	0.364	0.066	0.065	0.19	0.278	0.389	0.038	--	--	--	0.152	0.03
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.015	--	--	--	--	<0.002
Molybdnum	µg/L	100	--	1.1	0.8	0.71	0.77	1.56	0.75	0.83	--	--	--	0.9	0.9
Selenium	µg/L	50	--	0.6	0.2	0.2	0.2	0.2	0.3	0.2	--	--	--	0.5	0.6
Thallium	µg/L	2	--	0.276	0.03	<0.01	0.01	0.17	<0.01	<0.01	--	--	--	<0.1	<0.1
Zinc	µg/L	--	--	--	--	--	--	--	--	0.7	0.6	--	1	3	2
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	21.5	21.2	24.7	--	21.7	21.4	<0.06
Aluminum	µg/L	--	--	--	--	--	--	--	--	7.37	10.6	--	53	31	8.03
Boron	mg/L	--	0.01	0.012	0.011	0.032	<0.002	0.043	0.028	0.022	0.016	--	0.058	0.04	<0.02
Calcium	mg/L	--	42.7	41.5	42.7	42.9	45.8	44.8	42.9	44.4	39.8	--	42.3	35.6	35.9
Lithium	mg/L	0.04	--	0.025	0.001	0.002	0.002	0.006	0.006	0.001	--	--	--	<0.009	0.02
Magnesium	mg/L	--	--	--	--	--	--	19.6	20	20	17.6	--	18.8	16	16.1
Manganese	mg/L	--	--	--	--	--	--	--	--	0.0021	--	--	0.0323	0.0154	0.0033
Potassium	mg/L	--	--	--	--	--	--	0.91	0.89	0.77	0.65	--	0.82	0.88	0.76
Sodium	mg/L	--	--	--	--	--	--	41.2	40.5	42.1	43.2	--	40.1	34.6	37.4
Strontium	mg/L	--	--	--	--	--	--	0.0562	0.0564	0.0543	0.0494	--	0.0555	0.0464	0.0458
Alkalinity	mg/L	--	--	--	--	--	--	162	181	167	171	--	181	159	150
Bromide	mg/L	--	--	--	--	--	--	0.03	0.062	0.04	0.06	--	<0.02	<0.04	<0.04
Chloride	mg/L	--	23.7	23.5	22.1	21.1	20.8	21.4	22.8	22.7	22.4	22.5	23.8	22.9	23.6
Fluoride	mg/L	4	0.56	0.56	0.54	0.55	0.47	0.52	0.52	0.47	0.52	0.56	0.59	0.57	0.58
TDS	mg/L	--	345	321	332	322	300	320	319	319	317	--	324	288	312
Sulfate	mg/L	--	26.5	26.4	23.4	21.7	22.1	21.7	21.8	22.3	23.1	24.9	21.2	19.5	20.4
Sulfide	mg/L	--	--	--	--	--	--	--	--	<0.4	--	--	<0.4	<0.1	<0.1
Radium-228	pCi/L	--	--	0.455	1.16	0.343	0.394	0.26	-0.175	1.5	--	--	--	0.346	0.113
Radium-226	pCi/L	--	--	0.122	0.131	0.147	0.282	0.0561	0.127	0.153	--	--	--	0.137	0.0183
Radium-226/228	pCi/L	5	--	0.577	1.291	0.49	0.676	0.3161	-0.048	1.653	--	--	--	0.483	0.1313
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	0.96	--	--	0.44	0.29	0.48
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	2.5	--	--	0.7	2	2
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	2	--	--	1	1	7.36
Iron (Dissolved)	mg/L	--	--	--	--	--	--	<0.004	<0.0004	<0.0004	0.014	--	0.002	0.003	0.007
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	0.0002	0.0004	0.0002	0.0004	--	0.0012	0.0006	0.0007

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-8I

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	7/19/2016	9/21/2016	11/17/2016	1/9/2017	3/6/2017	5/9/2017	7/18/2017	10/4/2017	12/12/2017	6/4/2018	11/14/2018	5/23/2019
Field Parameters															
Elevation	ft NGVD	--	--	370.06	369.7	369.51	368.84	368.68	368.68	369.07	367.78	366.87	369.85	367.78	371.38
pH	S.U.	--	7.2	7.2	7.44	7.6	7.6	7.4	7.2	7.3	7.56	7.9	7.68	7.22	7.22
Specific Conductance	µmhos/cm	--	--	580	455	968	420	80	507	485	471	390	619	453	607
Turbidity	NTU	--	--	9	3.29	1	5	10	2	1	6.26	1	3.18	9	2.4
Dissolved Oxygen	mg/L	--	--	0.6	0.17	0.8	1	4.5	0.3	0.2	0.31	9.7	2.46	0.37	2.53
Temperature	°C	--	--	21	15.39	17.1	14	14.4	15	16.2	15.51	14.4	17.42	13.8	19.41
ORP	mV	--	--	-60	-63.9	-1	29	25	52	-15	-67.4	111	-75.3	190	-8.1
Laboratory Parameters															
Antimony	µg/L	6	--	0.27	0.07	0.1	0.08	0.08	0.08	0.07	--	--	--	0.17	0.17
Arsenic	µg/L	10	--	11.5	2.08	1.39	2.58	2.78	2.09	1.31	--	--	--	3.41	1.07
Barium	µg/L	2000	--	70.1	57	58.4	54.9	56.9	57.8	60.4	--	--	--	57.9	63.8
Beryllium	µg/L	4	--	0.119	<0.005	<0.005	<0.005	<0.005	<0.004	<0.004	--	--	--	<0.02	<0.02
Cadmium	µg/L	5	--	0.28	0.02	0.04	0.02	0.04	0.05	0.02	--	--		0.15	0.02
Chromium	µg/L	100	--	0.5	0.1	0.055	0.817	0.511	0.23	0.077	--	--	--	0.07	0.05
Cobalt	µg/L	6	--	0.961	0.643	0.646	0.671	0.656	0.77	0.672	--	--	--	1.01	0.55
Copper	µg/L	--	--	--	--	--	--	--	--	0.11	0.13	--	0.42	1.45	0.2
Lead	µg/L	15	--	0.242	0.02	0.032	0.025	0.032	0.054	0.01	--	--	--	0.111	<0.02
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	--	<0.002
Molybdnum	µg/L	100	--	3	2.34	2.47	2.31	2.73	2.29	2.58	--	--	--	2.7	2.72
Selenium	µg/L	50	--	7.5	2.7	3	2.3	2.9	4.5	4.7	--	--	--	2.5	3.7
Thallium	µg/L	2	--	0.166	0.03	0.03	0.04	0.05	0.03	0.03	--	--	--	<0.1	<0.1
Zinc	µg/L	--	--	--	--	--	--	--	--	0.7	0.9	--	3.2	9.2	21.9
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	14.6	14.7	17.1	--	16.4	14.1	<0.06
Aluminum	µg/L	--	--	--	--	--	--	--	--	2	1	--	0.8	8.7	<1
Boron	mg/L	--	0.017	0.016	0.017	0.028	0.006	0.083	0.045	0.026	0.096	--	0.044	0.06	0.03
Calcium	mg/L	--	72	67.9	67.4	77.5	79.5	74.7	71.9	72.2	74.7	--	76.7	67.7	70.7
Lithium	mg/L	0.04	--	0.007	0.008	0.009	0.005	0.01	0.001	<0.0002	--	--	--	0.02	0.02
Magnesium	mg/L	--	--	--	--	--	--	22.3	22.9	22.2	22.5	--	23.5	21.4	22.4
Manganese	mg/L	--	--	--	--	--	--	--	--	0.357	--	--	0.32	0.509	0.407
Potassium	mg/L	--	--	--	--	--	--	1.84	1.73	1.48	2.02	--	1.6	2.28	1.76
Sodium	mg/L	--	--	--	--	--	--	29.4	28.5	29.7	28.6	--	32.5	31.5	31.6
Strontium	mg/L	--	--	--	--	--	--	0.146	0.148	0.14	0.146	--	0.152	0.139	0.138
Alkalinity	mg/L	--	--	--	--	--	--	245	246	247	237	--	268	250	250
Bromide	mg/L	--	--	--	--	--	--	0.04	0.065	0.062	0.064	--	0.05	<0.04	<0.04
Chloride	mg/L	--	21.7	22	21.5	21.3	20.9	20.7	21.2	20.9	20.1	19.3	20.9	20.6	21
Fluoride	mg/L	4	0.35	0.34	0.29	0.29	0.25	0.28	0.28	0.25	0.27	0.29	0.29	0.33	0.34
TDS	mg/L	--	370	358	376	387	371	391	376	379	378	--	407	390	371
Sulfate	mg/L	--	87.5	86.3	79.2	77.5	80	80.3	81.9	83.4	85.9	87.1	79	68.2	62.3
Sulfide	mg/L	--	--	--	--	--	--	--	--	<0.4	--	--	<0.4	<0.07	<0.1
Radium-228	pCi/L	--	--	0.4275	0.157	0.42	1.1	0.372	0.45	0.616	--	--	--	0.354	0.43
Radium-226	pCi/L	--	--	0.824	0.521	0.746	0.725	0.643	0.561	0.463	--	--	--	0.676	0.663
Radium-226/228	pCi/L	5	--	1.2515	0.678	1.166	1.825	1.015	1.011	1.079	--	--	--	1.03	1.093
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	0.52	--	--	0.27	0.17	0.45
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	2.4	--	--	16.8	<0.7	2
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	2.46	--	--	<0.8	<1	2
Iron (Dissolved)	mg/L	--	--	--	--	--	--	0.36	0.405	0.35	0.515	--	1.08	0.213	0.334
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	0.349	0.39	0.324	0.363	--	0.31	0.358	0.368

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-11S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	7/18/2016	9/20/2016	11/16/2016	1/9/2017	3/7/2017	5/19/2017	7/18/2017	10/3/2017	12/12/2017	6/5/2018	11/14/2018	5/23/2019
Field Parameters															
Elevation	ft NGVD	--	--	369.93	369.4	368.47	367.7	367.51	367.92	368.57	367.86	366.6	369.69	369.27	373.25
pH	S.U.	--	7.9	7.3	7.3	8.4	8.1	7.9	7.78	7.7	7.2	8.3	7.21	7.55	7.71
Specific Conductance	µmhos/cm	--	--	272	330	433	200	70	307	386	267	260	360	309	440
Turbidity	NTU	--	--	0.81	0.4	1	0.8	0.3	2.64	0.4	0.5	0.6	0.39	0.2	1
Dissolved Oxygen	mg/L	--	--	9.3	7.4	2	7	7	6.99	6.1	8	19.4	6.94	6.9	9
Temperature	°C	--	--	16.1	22.4	14.7	14.8	15	15.7	17.1	15.4	13.4	14.97	13.25	17.3
ORP	mV	--	--	24	167	227	126	47	75.6	73	-13	73	-2.7	152	240
Laboratory Parameters															
Antimony	µg/L	6	--	0.04	0.04	0.05	0.04	0.04	0.04	<0.05	--	--	--	0.05	0.05
Arsenic	µg/L	10	--	0.53	0.42	0.45	0.52	0.52	0.48	0.5	--	--	--	0.38	0.36
Barium	µg/L	2000	--	9.79	11.3	7.91	6.52	7.09	7.73	8.16	--	--	--	12.5	13.7
Beryllium	µg/L	4	--	<0.005	<0.005	<0.005	<0.005	<0.005	<0.004	<0.02	--	--	--	<0.02	0.03
Cadmium	µg/L	5	--	0.03	0.03	0.02	0.01	0.007	0.03	<0.02	--	--		0.03	0.02
Chromium	µg/L	100	--	0.5	0.8	0.416	0.725	1.25	0.567	0.568	--	--	--	0.384	0.483
Cobalt	µg/L	6	--	0.043	0.029	0.027	0.022	0.027	0.03	0.02	--	--	--	<0.02	0.03
Copper	µg/L	--	--	--	--	--	--	--	--	0.44	0.26	--	0.25	0.44	2.07
Lead	µg/L	15	--	0.02	0.046	0.027	0.02	0.02	0.023	0.06	--	--	--	0.03	<0.02
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	0.002	0.002	<0.002	--	--	--	--	<0.002
Molybdnum	µg/L	100	--	4.36	3.37	4.71	6.09	6.03	4.86	4.69	--	--	--	2.4	2.04
Selenium	µg/L	50	--	0.08	0.1	0.07	0.05	0.2	0.2	0.3	--	--	--	0.04	<0.03
Thallium	µg/L	2	--	0.01	0.01	0.02	0.01	0.01	0.01	0.2	--	--	--	<0.1	<0.1
Zinc	µg/L	--	--	--	--	--	--	--	--	7	<0.4	--	2	<0.7	<0.7
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	24.9	24.4	27.3	--	25.8	26.6	24.5
Aluminum	µg/L	--	--	--	--	--	--	--	--	10	3.63	--	2	3	3
Boron	mg/L	--	0.062	0.062	0.077	0.053	0.029	0.057	0.047	0.067	0.09	--	0.076	0.11	0.08
Calcium	mg/L	--	41.6	38.8	45.1	37.3	40.4	42.8	41.2	44.2	43.7	--	55.8	56.4	54.3
Lithium	mg/L	0.04	--	0.024	0.004	0.005	0.003	0.013	0.009	0.002	--	--	--	0.01	0.01
Magnesium	mg/L	--	--	--	--	--	--	17.2	17.7	18.8	17.6	--	24.8	19.5	17.7
Manganese	mg/L	--	--	--	--	--	--	--	--	<0.0001	--	--	<0.0002	0.0004	<0.0002
Potassium	mg/L	--	--	--	--	--	--	0.42	0.42	0.42	0.48	--	0.37	0.88	0.4
Sodium	mg/L	--	--	--	--	--	--	5.72	5.58	6.82	7.26	--	7.11	5.35	4.43
Strontium	mg/L	--	--	--	--	--	--	0.0508	0.0535	0.0532	0.0537	--	0.0706	0.0774	0.0707
Alkalinity	mg/L	--	--	--	--	--	--	153	175	187	167	--	226	246	235
Bromide	mg/L	--	--	--	--	--	--	<0.02	<0.06	<0.02	<0.02	--	<0.02	<0.04	<0.4
Chloride	mg/L	--	1.82	1.83	1.62	1.54	2.12	4.63	9.87	8.19	3.68	2.4	6.98	1.79	1.62
Fluoride	mg/L	4	0.74	0.76	0.73	0.92	0.96	1	0.86	0.75	0.89	0.82	0.62	0.72	0.82
TDS	mg/L	--	212	201	196	182	179	197	239	224	200	--	276	238	279
Sulfate	mg/L	--	10.9	10.6	5.3	4.1	7.6	13.7	16.4	15.6	9.3	8	21.7	5.9	14.7
Sulfide	mg/L	--	--	--	--	--	--	--	--	<0.4	--	--	<0.4	<0.07	<0.1
Radium-228	pCi/L	--	--	0.231	0.741	0.179	1.96	0.0959	0.0337	0.771	--	--	--	0.419	0.805
Radium-226	pCi/L	--	--	0.584	-0.0127	0.109	0.141	0.0906	0.091	0.0225	--	--	--	0.217	0.0772
Radium-226/228	pCi/L	5	--	0.815	0.7283	0.288	2.101	0.1865	0.1247	0.7935	--	--	--	0.636	0.8822
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	0.82	--	--	0.63	0.71	0.26
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	9	--	--	2	1	<0.7
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	66.5	--	--	2.92	3	2
Iron (Dissolved)	mg/L	--	--	--	--	--	--	<0.0004	<0.0004	<0.0004	0.014	--	0.008	0.04	0.004
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	<0.0001	0.0002	0.0001	<0.0002	--	<0.002	0.0005	<0.0002

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-12S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	9/26/2018	11/1/2018	11/14/2008	12/11/2018	5/22/2019
Field Parameters								
Elevation	ft NGVD	--	--	367.81	367.96	367.93	368.21	372.14
pH	S.U.	--	7.2	5.9	7.6	6.83	7.12	7.31
Specific Conductance	µmhos/cm	--	--	522	551	517	816	757
Turbidity	NTU	--	--	9	1.14	2.14	23.7	13.8
Dissolved Oxygen	mg/L	--	--	0.2	3.13	0.36	0.29	0
Temperature	°C	--	--	14.5	14.05	13.16	13.36	14.8
ORP	mV	--	--	68	-34.8	184.2	-10	9
Laboratory Parameters								
Antimony	µg/L	6	--	0.06	0.03	0.17	0.06	0.07
Arsenic	µg/L	10	--	0.3	0.27	0.25	0.61	0.45
Barium	µg/L	2000	--	26.8	26.3	25.3	31	29.7
Beryllium	µg/L	4	--	<0.02	<0.02	<0.02	0.02	<0.02
Cadmium	µg/L	5	--	0.06	0.05	0.13	0.04	0.09
Chromium	µg/L	100	--	0.276	0.1	0.1	0.639	0.476
Cobalt	µg/L	6	--	0.642	0.4783	0.439	1.23	0.924
Copper	µg/L	--	--	0.5	0.36	0.55	1.08	1.59
Lead	µg/L	15	--	0.34	0.08	0.08	0.904	0.538
Mercury	µg/L	2	--	--	--	--	--	0.002
Molybdnum	µg/L	100	--	2	2	2	2	1
Selenium	µg/L	50	--	0.2	0.07	0.1	0.2	0.09
Thallium	µg/L	2	--	<0.1	<0.1	<0.1	<0.1	<0.1
Zinc	µg/L	--	--	1	0.8	2	2	19.3
Silica (Dissolved)	mg/L	--	--	21.5	20	20	20.3	19.3
Aluminum	µg/L	--	--	45.2	8.53	3	291	119
Boron	mg/L	--	0.067	0.04	0.07	0.03	0.12	0.02
Calcium	mg/L	--	86.3	87	86.4	80.2	89.3	84.9
Lithium	mg/L	0.04	--	0.01	0.01	0.01	<0.009	0.01
Magnesium	mg/L	--	--	31.6	33.7	30.5	33	30.3
Manganese	mg/L	--	--	0.0864	0.0758	0.0811	0.106	0.163
Potassium	mg/L	--	--	1.18	1.26	1.57	1.87	1.19
Sodium	mg/L	--	--	30.2	33.9	32.1	32.4	30.5
Strontium	mg/L	--	--	0.103	0.111	0.114	0.119	0.114
Alkalinity	mg/L	--	--	392	358	374	361	354
Bromide	mg/L	--	--	0.1	0.1	0.1	0.1	0.1
Chloride	mg/L	--	30.1	30.1	29.9	29.4	29.5	29.7
Fluoride	mg/L	4	0.35	0.36	0.36	0.37	0.36	0.38
TDS	mg/L	--	445	446	434	422	437	455
Sulfate	mg/L	--	37.2	37.1	37.1	36.4	36.7	37.4
Sulfide	mg/L	--	--	<0.1	<0.1	<0.07	<0.1	<0.1
Radium-228	pCi/L	--	--	0.562	0.306	0.941	0.569	0.568
Radium-226	pCi/L	--	--	0.5	0.202	0.244	0.314	0.379
Radium-226/228	pCi/L	5	--	1.062	0.508	1.185	0.883	0.947
Copper (Dissolved)	µg/L	--	--	0.66	0.38	1.41	0.7	0.33
Zinc (Dissolved)	µg/L	--	--	3	2	3	4	7.5
Aluminum (Dissolved)	µg/L	--	--	2	1	1	76.2	2
Iron (Dissolved)	mg/L	--	--	0.025	0.01	0.006	0.238	0.05
Manganese (Dissolved)	mg/L	--	--	0.0847	0.0797	0.0677	0.103	0.144

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-12I

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	9/26/2018	11/1/2018	11/14/2018	12/11/2018	5/22/2019
Field Parameters								
Elevation	ft NGVD	--	--	369.85	367.84	367.81	368.16	371.95
pH	S.U.	--	0	7.15	7.74	7.01	7.12	7.27
Specific Conductance	µmhos/cm	--	--	662	622	579	901	882
Turbidity	NTU	--	--	1.48	8.76	2.54	2.3	39.5
Dissolved Oxygen	mg/L	--	--	1.2	2.68	9.27	1.99	0.2
Temperature	°C	--	--	15.21	13.94	12.9	12.92	14.8
ORP	mV	--	--	-35.1	-87.8	-54.9	-52	-57
Laboratory Parameters								
Antimony	µg/L	6	--	<0.01	<0.02	<0.02	<0.02	0.12
Arsenic	µg/L	10	--	10.1	9.24	8.79	9.32	12.6
Barium	µg/L	2000	--	370	374	365	377	395
Beryllium	µg/L	4	--	0.006	<0.02	0.02	<0.02	0.04
Cadmium	µg/L	5	--	<0.005	0.02	<0.01	0.17	0.16
Chromium	µg/L	100	--	0.101	0.289	0.05	0.2	1.32
Cobalt	µg/L	6	--	1.5	1.67	1.42	1.58	2.7
Copper	µg/L	--	--	1.15	1.23	0.44	0.56	8.39
Lead	µg/L	15	--	0.063	0.21	0.03	0.07	1.47
Mercury	µg/L	2	--	--	--	--	--	0.002
Molybdnum	µg/L	100	--	2.92	2.87	2.87	3.13	2.8
Selenium	µg/L	50	--	0.04	0.06	<0.003	<0.03	0.1
Thallium	µg/L	2	--	0.01	<0.1	<0.1	<0.1	<0.1
Zinc	µg/L	--	--	1	2	1	3	6.3
Silica (Dissolved)	mg/L	--	--	20.9	18.8	19.2	12.6	19
Aluminum	µg/L	--	--	48.8	64.6	5.87	5.67	581
Boron	mg/L	--	0.115	0.062	0.115	0.03	0.05	0.03
Calcium	mg/L	--	94.1	100	94.8	90.9	95.6	99.2
Lithium	mg/L	0.04	--	0.009	<0.009	0.03	0.01	0.01
Magnesium	mg/L	--	--	32.5	32.6	30.5	31	31.5
Manganese	mg/L	--	--	1.17	1.2	1.08	1.12	2.13
Potassium	mg/L	--	--	2.03	2.43	2.28	2.26	2.13
Sodium	mg/L	--	--	43.2	45	43.9	42	45.7
Strontium	mg/L	--	--	0.134	0.138	0.144	0.142	0.15
Alkalinity	mg/L	--	--	433	448	433	441	458
Bromide	mg/L	--	--	0.139	0.1	0.1	0.1	0.1
Chloride	mg/L	--	33	34	33.9	33.7	33.1	33.4
Fluoride	mg/L	4	0.24	0.25	0.25	0.25	0.23	0.25
TDS	mg/L	--	499	506	493	484	485	532
Sulfate	mg/L	--	31.5	30.9	31	30.7	31	32.5
Sulfide	mg/L	--	--	<0.4	<0.1	<0.07	<0.1	<0.1
Radium-228	pCi/L	--	--	-0.0683	0.788	1.19	1.04	1.17
Radium-226	pCi/L	--	--	0.463	0.516	0.51	0.83	0.565
Radium-226/228	pCi/L	5	--	0.463	1.304	1.7	1.87	1.735
Copper (Dissolved)	µg/L	--	--	0.19	0.35	0.42	1.08	0.64
Zinc (Dissolved)	µg/L	--	--	1	10.2	2	8.1	1
Aluminum (Dissolved)	µg/L	--	--	2.36	5.95	2	3	16.6
Iron (Dissolved)	mg/L	--	--	1.15	1.18	1.09	1.16	1.51
Manganese (Dissolved)	mg/L	--	--	1.12	1.16	1.06	1.16	1.11

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-12D

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	9/26/2018	10/30/2018	11/14/2018	12/11/2018	5/22/2019
Field Parameters								
Elevation	ft NGVD	--	--	367.91	367.91	367.86	368.25	372.03
pH	S.U.	--	7.3	7.16	8.06	7.08	7.17	7.41
Specific Conductance	µmhos/cm	--	--	530	510	449	717	686
Turbidity	NTU	--	--	9.68	12.7	5.25	2.2	1.4
Dissolved Oxygen	mg/L	--	--	1.68	1.41	4.9	1.4	0.7
Temperature	°C	--	--	15.56	15.16	12	12.56	15.1
ORP	mV	--	--	-52.6	-90.9	-40.8	-69	-56
Laboratory Parameters								
Antimony	µg/L	6	--	0.02	0.06	<0.02	<0.02	0.02
Arsenic	µg/L	10	--	11.9	9.78	9.95	9.64	13.3
Barium	µg/L	2000	--	282	268	272	271	282
Beryllium	µg/L	4	--	0.006	<0.02	<0.02	<0.02	<0.02
Cadmium	µg/L	5	--	<0.005	0.05	<0.01	0.01	0.04
Chromium	µg/L	100	--	0.108	0.266	0.1	0.2	0.06
Cobalt	µg/L	6	--	0.462	0.538	0.378	0.4	0.554
Copper	µg/L	--	--	0.51	41	0.64	0.24	0.46
Lead	µg/L	15	--	0.127	0.329	0.111	0.05	0.02
Mercury	µg/L	2	--	--	--	--	--	<0.002
Molybdnum	µg/L	100	--	3.09	2.96	2.94	3.13	3.57
Selenium	µg/L	50	--	<0.03	0.07	<0.03	<0.03	<0.03
Thallium	µg/L	2	--	<0.01	<0.1	<0.1	<0.1	<0.1
Zinc	µg/L	--	--	1	3	2	0.8	1
Silica (Dissolved)	mg/L	--	--	21.1	18.9	19.5	19.5	18.8
Aluminum	µg/L	--	--	14	53.9	26.1	5.83	3
Boron	mg/L	--	0.098	0.112	0.09	0.03	0.09	<0.02
Calcium	mg/L	--	90.8	95.1	86.9	86.1	82.9	84.5
Lithium	mg/L	0.04	--	0.013	<0.009	<0.009	<0.009	0.02
Magnesium	mg/L	--	--	30.3	29.6	28.5	26.7	26.5
Manganese	mg/L	--	--	0.989	0.902	0.878	0.743	0.979
Potassium	mg/L	--	--	1.16	0.89	1.34	1.45	0.76
Sodium	mg/L	--	--	10.5	11.3	11	10.2	9.06
Strontium	mg/L	--	--	0.161	0.161	0.171	0.158	0.147
Alkalinity	mg/L	--	--	373	353	371	384	368
Bromide	mg/L	--	--	0.081	0.08	0.07	0.07	0.07
Chloride	mg/L	--	16.1	17.2	17	16.6	16.7	15.9
Fluoride	mg/L	4	0.27	0.26	0.26	0.26	0.26	0.26
TDS	mg/L	--	328	386	381	374	380	393
Sulfate	mg/L	--	15.6	14.2	14.2	13.8	13.9	14.8
Sulfide	mg/L	--	--	<0.04	<0.1	<0.07	<0.1	<0.1
Radium-228	pCi/L	--	--	0.643	0.405	0.589	1.69	0.698
Radium-226	pCi/L	--	--	0.702	0.454	0.608	0.766	0.548
Radium-226/228	pCi/L	5	--	1.345	0.859	1.197	2.456	1.246
Copper (Dissolved)	µg/L	--	--	0.35	0.21	0.12	0.44	0.25
Zinc (Dissolved)	µg/L	--	--	3.3	2	1	1	0.7
Aluminum (Dissolved)	µg/L	--	--	7.24	2	2	5.13	1
Iron (Dissolved)	mg/L	--	--	1.29	0.965	0.996	1.12	1.62
Manganese (Dissolved)	mg/L	--	--	0.994	0.88	0.801	0.832	1.03

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-13I

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	9/26/2018	10/31/2018	11/15/2018	12/11/2018	5/21/2019
Field Parameters								
Elevation	ft NGVD	--	--	368.83	368.45	368.41	368.31	371.99
pH	S.U.	--	7.5	7.36	8.12	7.21	7.36	7.54
Specific Conductance	µmhos/cm	--	--	411	397	451	555	522
Turbidity	NTU	--	--	2.14	0.93	0.31	0.45	1.4
Dissolved Oxygen	mg/L	--	--	0.37	1.15	8.64	0.57	0.4
Temperature	°C	--	--	15.71	15.25	13.17	14.13	16.5
ORP	mV	--	--	-15.8	-74.3	44.5	-72	-30
Laboratory Parameters								
Antimony	µg/L	6	--	0.02	<0.02	<0.02	0.04	<0.2
Arsenic	µg/L	10	--	1.74	1.66	1.6	1.84	2.41
Barium	µg/L	2000	--	149	139	141	144	151
Beryllium	µg/L	4	--	0.006	<0.02	<0.02	<0.02	<0.02
Cadmium	µg/L	5	--	<0.005	<0.01	<0.01	<0.01	<0.01
Chromium	µg/L	100	--	0.04	0.1	0.06	0.07	<0.04
Cobalt	µg/L	6	--	0.5	0.554	0.477	0.574	0.577
Copper	µg/L	--	--	0.39	0.62	0.1	0.58	0.09
Lead	µg/L	15	--	0.01	0.04	<0.02	<0.02	<0.02
Mercury	µg/L	2	--	--	--	--	--	<0.002
Molybdnum	µg/L	100	--	4.49	4.23	4.09	4.29	4.11
Selenium	µg/L	50	--	<0.03	<0.03	<0.03	<0.03	<0.03
Thallium	µg/L	2	--	0.04	<0.1	<0.1	<0.1	<0.1
Zinc	µg/L	--	--	20.1	61.3	<0.7	2	<0.7
Silica (Dissolved)	mg/L	--	--	19.6	17.9	17.9	18.4	17.6
Aluminum	µg/L	--	--	2.54	10.6	2	<1	1
Boron	mg/L	--	0.042	0.09	0.05	<0.02	0.04	0.02
Calcium	mg/L	--	67.5	66	58.1	59.7	65.6	67.9
Lithium	mg/L	0.04	--	0.018	0.01	<0.009	<0.009	<0.009
Magnesium	mg/L	--	--	20.4	19.1	19.2	20.9	19.4
Manganese	mg/L	--	--	0.491	0.448	0.447	0.523	0.469
Potassium	mg/L	--	--	1.23	0.93	1.32	1.24	0.99
Sodium	mg/L	--	--	15.2	15.4	15.6	16.4	15.7
Strontium	mg/L	--	--	0.0781	0.0744	0.0834	0.0879	0.0831
Alkalinity	mg/L	--	--	231	228	231	241	235
Bromide	mg/L	--	--	0.04	<0.04	<0.04	<0.04	<0.04
Chloride	mg/L	--	20	20.6	20.5	20.3	20.4	20.1
Fluoride	mg/L	4	0.38	0.38	0.38	0.38	0.38	0.37
TDS	mg/L	--	297	319	305	310	310	318
Sulfate	mg/L	--	40.6	41.6	41.5	41.3	40.7	41.6
Sulfide	mg/L	--	--	<0.4	<0.1	<0.07	<0.07	<0.1
Radium-228	pCi/L	--	--	-0.268	0.658	0.682	0.3	0.76
Radium-226	pCi/L	--	--	0.456	0.509	0.669	0.589	0.646
Radium-226/228	pCi/L	5	--	0.456	1.167	1.351	0.889	1.406
Copper (Dissolved)	µg/L	--	--	0.11	0.39	0.2	0.2	0.15
Zinc (Dissolved)	µg/L	--	--	0.7	6.3	<0.7	3	<0.7
Aluminum (Dissolved)	µg/L	--	--	1	1	1	5	<1
Iron (Dissolved)	mg/L	--	--	0.185	0.189	0.193	0.26	0.278
Manganese (Dissolved)	mg/L	--	--	0.493	0.467	0.461	0.483	0.418

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-13D

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	9/26/2018	10/31/2018	11/15/2018	12/11/2018	5/21/2019
Field Parameters								
Elevation	ft NGVD	--	--	368.79	368.43	368.39	368.29	371.95
pH	S.U.	--	7.4	7.03	8.11	7.17	7.29	7.45
Specific Conductance	µmhos/cm	--	--	406	382	427	540	524
Turbidity	NTU	--	--	5.34	10.6	4.66	3.22	2
Dissolved Oxygen	mg/L	--	--	1.34	1.4	5.45	0.51	1.7
Temperature	°C	--	--	16.29	14.99	12.18	14.06	18.7
ORP	mV	--	--	-71.4	-95.1	-48.5	-94	-48
Laboratory Parameters								
Antimony	µg/L	6	--	0.01	0.02	0.05	0.03	0.07
Arsenic	µg/L	10	--	6.44	5.62	7.55	5.3	20.8
Barium	µg/L	2000	--	206	204	198	219	265
Beryllium	µg/L	4	--	0.007	<0.02	<0.02	<0.02	<0.02
Cadmium	µg/L	5	--	<0.005	0.04	<0.01	<0.01	<0.01
Chromium	µg/L	100	--	0.071	0.353	0.209	0.06	0.2
Cobalt	µg/L	6	--	1.15	1.31	1.05	0.935	1.1
Copper	µg/L	--	--	0.26	1.02	0.55	0.28	1.11
Lead	µg/L	15	--	0.071	0.438	0.173	<0.02	0.07
Mercury	µg/L	2	--	--	--	--	--	<0.002
Molybdnum	µg/L	100	--	2.88	2.59	2.77	3.23	3.21
Selenium	µg/L	50	--	<0.03	0.1	0.07	<0.03	0.04
Thallium	µg/L	2	--	0.02	<0.1	>0.1	<0.1	<0.1
Zinc	µg/L	--	--	0.6	2	1	2	1
Silica (Dissolved)	mg/L	--	--	19.3	17.6	17.9	17.9	17.4
Aluminum	µg/L	--	--	21.8	162	58.8	2	12.4
Boron	mg/L	--	0.037	0.071	0.111	119	0.03	0.02
Calcium	mg/L	--	65.9	68.9	63.4	60.8	67.4	66.2
Lithium	mg/L	0.04	--	0.016	<0.009	<0.009	<0.009	<0.009
Magnesium	mg/L	--	--	21.8	21.7	20.1	22.5	19.7
Manganese	mg/L	--	--	0.762	0.669	0.648	0.677	0.997
Potassium	mg/L	--	--	1.06	1.14	1.45	1.16	0.82
Sodium	mg/L	--	--	11.2	11.6	11.4	11.2	9.25
Strontium	mg/L	--	--	0.0852	0.0867	0.0913	0.098	0.0882
Alkalinity	mg/L	--	--	231	243	223	252	237
Bromide	mg/L	--	--	0.05	<0.04	<0.04	<0.04	<0.04
Chloride	mg/L	--	16.3	17	16.9	16.6	16.5	15.9
Fluoride	mg/L	4	0.28	0.27	0.27	0.28	0.27	0.26
TDS	mg/L	--	287	296	299	296	305	303
Sulfate	mg/L	--	35.5	34.8	34.7	34.1	33.3	33.9
Sulfide	mg/L	--	--	<0.4	<0.1	<0.07	<0.07	<0.1
Radium-228	pCi/L	--	--	0.141	-0.293	-0.157	0.226	0.844
Radium-226	pCi/L	--	--	0.501	0.356	0.242	0.389	0.586
Radium-226/228	pCi/L	5	--	0.642	0.356	0.242	0.615	1.43
Copper (Dissolved)	µg/L	--	--	0.07	0.11	0.09	0.21	0.56
Zinc (Dissolved)	µg/L	--	--	0.5	1	<0.7	1	<0.7
Aluminum (Dissolved)	µg/L	--	--	11	3	2	20.5	1
Iron (Dissolved)	mg/L	--	--	1.29	0.915	0.995	1.13	0.866
Manganese (Dissolved)	mg/L	--	--	0.74	0.625	0.702	0.612	0.777

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-14S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	7/20/2016	9/21/2016	11/17/2016	1/9/2017	3/7/2017	5/19/2017	7/18/2017	10/4/2017	12/12/2017	6/5/2018	11/13/2018	5/23/2019
Field Parameters															
Elevation	ft NGVD	--	--	370.07	369.7	369.34	368.92	368.49	368.63	369.88	368.43	368.41	368.94	369.27	371.36
pH	S.U.	--	7.2	7.1	7	7.7	7.5	7.4	6.95	7.3	7	7.6	7.55	7.55	7.15
Specific Conductance	µmhos/cm	--	--	576	640	955	530	80	441	496	488	490	450	309	604
Turbidity	NTU	--	--	3.9	6	1	2	0.7	2.07	1	0.5	1	0.6	0.2	0.61
Dissolved Oxygen	mg/L	--	--	3.8	3.3	1	3.4	3	3.82	3.7	4	10.2	5.42	6.9	2.57
Temperature	°C	--	--	18.7	22.6	15.2	14.4	13.9	14.54	15.9	15.3	13.5	14.98	13.25	17.01
ORP	mV	--	--	43	53	282	147	75	55.6	67	-23	133	-7.9	152	-203.7
Laboratory Parameters															
Antimony	µg/L	6	--	0.02	0.02	0.03	0.02	0.02	0.06	<0.05	--	--	--	<0.02	<0.02
Arsenic	µg/L	10	--	1.54	1.29	0.75	0.91	0.76	0.75	0.7	--	--	--	0.64	0.62
Barium	µg/L	2000	--	31	27.8	26.3	27	26.3	25	27	--	--	--	27	28.9
Beryllium	µg/L	4	--	0.008	0.005	<0.005	<0.005	<0.005	<0.004	<0.02	--	--	--	<0.02	<0.02
Cadmium	µg/L	5	--	0.21	0.07	0.03	0.05	0.01	0.08	<0.02	--	--		0.05	0.01
Chromium	µg/L	100	--	0.3	0.3	0.162	0.575	0.66	0.301	0.258	--	--	--	0.2	0.2
Cobalt	µg/L	6	--	0.573	0.333	0.088	0.187	0.083	0.065	0.03	--	--	--	0.03	0.03
Copper	µg/L	--	--	--	--	--	--	--	--	2.38	0.15	--	0.38	0.24	0.25
Lead	µg/L	15	--	0.307	0.31	0.549	0.115	0.061	0.071	0.116	--	--	--	0.05	0.04
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	--	<0.002
Molybdnum	µg/L	100	--	1.51	1.43	1.26	1.62	1.84	1.35	1.67	--	--	--	1	1
Selenium	µg/L	50	--	1.4	1.2	1.2	1.1	1.1	1.2	1.3	--	--	--	1.1	0.9
Thallium	µg/L	2	--	<0.01	<0.01	0.02	0.054	0.055	0.01	0.07	--	--	--	<0.1	<0.1
Zinc	µg/L	--	--	--	--	--	--	--	--	9	0.8	--	1	1	<0.7
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	20.3	20.2	23.3	--	20.4	20.2	<0.06
Aluminum	µg/L	--	--	--	--	--	--	--	--	11.4	2	--	5.75	7.32	4
Boron	mg/L	--	0.011	0.008	0.01	0.008	<0.002	0.031	0.017	0.03	0.042	--	0.046	0.04	<0.02
Calcium	mg/L	--	59.2	56.3	59.5	65.4	65.7	63.4	59.8	65.6	67	--	61.1	59.2	66.9
Lithium	mg/L	0.04	--	0.018	0.006	0.004	0.006	0.005	0.001	<0.0002	--	--	--	<0.009	0.01
Magnesium	mg/L	--	--	--	--	--	--	27.6	28.1	29.3	29.9	--	27.4	26.4	30
Manganese	mg/L	--	--	--	--	--	--	--	--	0.0006	--	--	0.0014	0.0015	0.0008
Potassium	mg/L	--	--	--	--	--	--	0.5	0.54	0.49	0.59	--	0.51	0.55	0.53
Sodium	mg/L	--	--	--	--	--	--	33	29.4	30.1	29.9	--	29.2	24.9	23.3
Strontium	mg/L	--	--	--	--	--	--	0.101	0.102	0.103	0.106	--	0.101	0.0954	0.109
Alkalinity	mg/L	--	--	--	--	--	--	232	258	257	249	--	260	259	275
Bromide	mg/L	--	--	--	--	--	--	<0.02	<0.06	0.03	0.04	--	<0.02	<0.04	<0.04
Chloride	mg/L	--	28.6	29.4	28.1	27.8	27.2	26.8	29.4	29.6	29.9	30	27.1	29	28.6
Fluoride	mg/L	4	0.39	0.39	0.36	0.35	0.33	0.36	0.37	0.33	0.34	0.34	0.39	0.37	0.37
TDS	mg/L	--	368	364	361	362	344	354	376	377	376	--	360	344	390
Sulfate	mg/L	--	34.9	36.5	32.5	29.1	30.7	29.9	32.3	33.1	34.8	35.5	29.4	30.8	32.4
Sulfide	mg/L	--	--	--	--	--	--	--	--	<0.4	--	--	<0.4	<0.1	<0.1
Radium-228	pCi/L	--	--	-0.343	0.769	0.693	0.601	-0.193	-0.019	1.73	--	--	--	0.334	0.271
Radium-226	pCi/L	--	--	0.594	0.131	0.413	0.179	0.0525	0.0316	0.153	--	--	--	0.0534	0.0483
Radium-226/228	pCi/L	5	--	0.251	0.9	1.106	0.78	-0.1405	0.0126	1.883	--	--	--	0.3874	0.3193
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	0.94	--	--	0.43	0.64	0.31
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	7	--	--	5.7	3	<0.7
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	11.3	--	--	1	<1	1
Iron (Dissolved)	mg/L	--	--	--	--	--	--	<0.0004	<0.0004	<0.0004	0.016	--	0.002	<0.003	<0.003
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	<0.0001	0.0021	0.0001	<0.0002	--	<0.0002	0.0005	<0.0002

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-15S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/7/2016	7/19/2016	9/21/2016	11/16/2016	1/11/2017	3/7/2017	5/10/2017	7/19/2017	10/4/2017	6/5/2018	11/13/2018	5/23/2019	7/23/2019	9/11/2019
Field Parameters																	
Elevation	ft NGVD	--	--	370	369.87	369.49	368.87	367.92	367.84	367.86	368.75	367.84	396.63	368.96	371.96	372.79	372.26
pH	S.U.	--	7.1 - 7.7	7.2	7.1	7.2	7.7	7.2	7.2	7.3	7.3	7.35	7.16	7.46	7.5	5.74	7.38
Specific Conductance	µmhos/cm	--	--	512	512	510	904	470	60	419	368	393	416	317	348	362	269
Turbidity	NTU	--	--	7.6	2.2	1	1	1	0.5	2	2	2.34	0.33	0.41	1.51	8.3	3
Dissolved Oxygen	mg/L	--	--	0.5	0.5	1	1	1	6	0.4	0.3	0.07	1.9	0.77	0.4	1	0
Temperature	°C	--	--	16.5	17.7	19.1	15.5	13.8	13.9	14.6	15.7	14.7	14.96	12.94	15.21	15.8	16.55
ORP	mV	--	--	57	124	181	-10	179	64	65	24	18.1	-37.7	19.3	-218	47	63
Laboratory Parameters																	
Antimony	µg/L	6	--	0.04	0.04	0.02	0.04	0.04	0.03	0.04	0.02	--	--	<0.02	0.02	--	--
Arsenic	µg/L	10	--	0.32	0.24	0.21	0.18	0.26	0.21	0.21	0.23	--	--	0.13	0.12	--	--
Barium	µg/L	2000	--	4.71	5.85	3.21	3.27	6.05	4.98	3.54	3.11	--	--	2.46	2.54	--	--
Beryllium	µg/L	4	--	0.007	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	<0.004	--	--	<0.02	<0.02	--	--
Cadmium	µg/L	5	--	0.14	0.25	0.05	0.05	0.06	0.04	0.05	0.05	--		0.04	0.1	--	--
Chromium	µg/L	100	--	0.2	1.7	0.5	0.058	0.493	0.934	0.198	0.096	--	--	0.05	0.08	--	--
Cobalt	µg/L	6	--	3.03	1.17	1.09	0.794	1.75	1.26	1.2	1.25	--	--	0.74	0.775	--	--
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.4	0.26	0.24	0.37	0.32	--	--
Lead	µg/L	15	--	0.286	0.101	0.098	0.037	0.039	0.024	0.062	0.083	--	--	0.03	0.05	--	--
Mercury	µg/L	2	--	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	<0.002	--	--
Molybdnum	µg/L	100	--	2.52	2.89	2.54	1.57	0.78	1.17	2.08	2.87	--	--	2.54	3.47	--	--
Selenium	µg/L	50	--	0.4	0.7	0.5	0.3	0.3	0.5	0.5	0.2	--	--	0.1	0.06	--	--
Thallium	µg/L	2	--	0.03	<0.01	0.02	0.02	0.03	0.04	0.02	0.02	--	--	<0.1	<0.1	--	--
Zinc	µg/L	--	--	--	--	--	--	--	--	--	3.5	1	21	2	2	--	--
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	13.1	12.7	15.8	13.1	12.4	<0.06	--	--
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	15.9	6.68	4.42	6.41	11.7	--	--
Boron	mg/L	--	0.15	0.011	0.012	0.008	<0.002	<0.002	0.084	0.077	0.073	0.095	0.078	0.04	<0.02	--	--
Calcium	mg/L	--	(79.5) 71	46.9	43.6	46.6	52.3	63.6	62.9	45.7	44.4	48.3	44.7	41.8	41.3	--	--
Lithium	mg/L	0.04	--	0.007	0.022	0.005	0.005	0.008	0.008	0.003	0.0009	--	--	<0.009	<0.009	--	--
Magnesium	mg/L	--	--	--	--	--	--	--	28.2	19.3	17.2	18.5	16.9	15.1	13.9	--	--
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.489	--	0.391	0.444	0.452	--	--
Potassium	mg/L	--	--	--	--	--	--	--	1.07	1.11	1.03	1.27	0.93	1.16	0.68	--	--
Sodium	mg/L	--	--	--	--	--	--	--	35.5	44.7	39.2	42.3	35.9	27.2	17.3	--	--
Strontium	mg/L	--	--	--	--	--	--	--	0.0903	0.0711	0.061	0.0662	0.0638	0.0574	0.0502	--	--
Alkalinity	mg/L	--	--	--	--	--	--	--	294	257	235	267	239	226	197	--	--
Bromide	mg/L	--	--	--	--	--	--	--	0.04	0.062	0.05	0.074	0.03	<0.04	<0.04	--	--
Chloride	mg/L	--	(29.6) 26	21.2	18.7	18.9	18.3	21.9	16.1	14.1	11.8	13.3	8.84	8.78	8.88	--	--
Fluoride	mg/L	4	0.86	0.65	0.65	0.63	0.5	0.36	0.42	0.65	0.66	0.62	0.69	0.72	0.88	0.87	0.81
TDS	mg/L	--	(412.7) 407	338	319	329	338	374	342	294	263	300	274	232	207	--	--
Sulfate	mg/L	--	(33.67) 34	30.3	27.7	25.1	23.2	28.3	23.4	21	20.3	23.2	16.3	13.1	10.2	--	--
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	<0.4	<0.07	<0.1	--	--
Radium-228	pCi/L	--	--	0.0335	-0.092	0.302	1.11	-0.0122	-0.108	0.106	-0.0928	--	--	0.482	0.439	--	--
Radium-226	pCi/L	--	--	0.384	--	0.116	0.139	0.189	0.0973	0.135	0.0916	--	--	-0.0262	0.282	--	--
Radium-226/228	pCi/L	5	--	0.4175	-0.092	0.418	1.249	0.1768	-0.0107	0.241	0.0916	--	--	0.482	0.721	--	--
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.37	--	0.51	1.59	0.53	--	--
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2.6	--	1	2	<0.7	--	--
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	3.7	--	2	3	2	--	--
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	<0.0004	<0.0004	<0.0004	0.014	<0.002	0.004	<0.003	--	--
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	0.448	0.361	0.284	0.379	0.349	0.332	0.289	--	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-15I

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/7/2016	7/19/2016	9/21/2016	11/16/2016	1/10/2017	3/7/2017	5/10/2017	7/18/2017	10/4/2017	12/12/2017	1/3/2018
Field Parameters														
Elevation	ft NGVD	--	--	370	369.88	369.51	368.86	368.12	368.07	368.27	368.74	367.82	366.73	366.49
pH	S.U.	--	6.77 - 7.86	7.2	7.1	7.1	7.5	7.7	7.5	7.2	7.2	7.34	7.8	7.79
Specific Conductance	µmhos/cm	--	--	555	574	530	874	420	60	457	400	368	350	474
Turbidity	NTU	--	--	0.9	0.6	0.7	0.2	1	2	1	1	1.09	1	1.12
Dissolved Oxygen	mg/L	--	--	0.2	0.4	0.4	1.3	0.2	2	0.3	0.3	0.49	0.9	0.41
Temperature	°C	--	--	15.1	18.2	17.6	15.6	13.9	13.6	14.8	16.3	14.68	12.8	12.38
ORP	mV	--	--	52.5	-86	-54	259	-87	-42	51	-50	-79.7	-52	-77.2
Laboratory Parameters														
Antimony	µg/L	6	--	0.01	0.25	0.01	0.04	0.01	0.02	0.02	0.02	--	--	--
Arsenic	µg/L	10	--	25.2	27.9	21.1	23.6	20.2	20.4	20.2	23.6	--	--	--
Barium	µg/L	2000	--	118	132	119	107	91.2	88.9	86.1	94.8	--	--	--
Beryllium	µg/L	4	--	<0.005	0.165	<0.005	0.005	<0.005	<0.005	<0.004	<0.004	--	--	--
Cadmium	µg/L	5	--	0.02	0.23	0.009	0.06	0.005	0.03	0.03	0.02	--		--
Chromium	µg/L	100	--	0.2	0.5	0.1	0.132	0.35	0.7	0.134	0.089	--	--	--
Cobalt	µg/L	6	--	1.24	1.66	1.32	1.03	1	0.903	1.02	1.25	--	--	--
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.26	0.1	--	--
Lead	µg/L	15	--	0.026	0.254	0.026	0.213	0.01	0.065	0.09	0.082	--	--	--
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--
Molybdnum	µg/L	100	--	5.76	6.74	5.75	6.73	7.63	7.91	6.52	5.58	--	--	--
Selenium	µg/L	50	--	<0.03	0.2	<0.03	<0.03	<0.03	0.07	0.04	<0.03	--	--	--
Thallium	µg/L	2	--	0.04	0.273	0.03	0.04	0.04	0.112	0.03	0.04	--	--	--
Zinc	µg/L	--	--	--	--	--	--	--	--	--	1	0.7	--	--
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	15	14	16.1	--	--
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	9.25	6.63	--	--
Boron	mg/L	--	0.072	0.06	0.032	0.03	0.022	0.019	0.047	0.038	0.05	0.08	--	0.04
Calcium	mg/L	--	(79.5) 54	44.1	44.6	46.1	51.4	46.5	51.1	46.6	43.9	44.6	--	--
Lithium	mg/L	0.04	--	0.005	0.018	0.004	0.004	0.011	0.006	0.002	<0.0002	--	--	--
Magnesium	mg/L	--	--	--	--	--	--	--	13.3	12.7	11.1	11.2	--	--
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.134	--	--	--
Potassium	mg/L	--	--	--	--	--	--	--	1.01	1.02	0.94	1.05	--	--
Sodium	mg/L	--	--	--	--	--	--	--	62.3	56.1	51.8	45.4	--	--
Strontium	mg/L	--	--	--	--	--	--	--	0.0865	0.088	0.0841	0.0871	--	--
Alkalinity	mg/L	--	--	--	--	--	--	--	229	239	224	202	--	--
Bromide	mg/L	--	--	--	--	--	--	--	0.084	0.101	0.081	0.067	--	--
Chloride	mg/L	--	(29.6) 70	59.3	53.8	43.4	44.9	48.3	38.5	32.7	27.1	23.7	22.8	--
Fluoride	mg/L	4	0.382	0.25	0.25	0.23	0.25	0.34	0.32	0.31	0.22	0.23	0.22	--
TDS	mg/L	--	(412.7) 398	380	356	334	340	351	331	322	300	287	--	--
Sulfate	mg/L	--	(47.44) 47	42.5	41	34	33.6	35.4	31.1	29.7	26.6	27.3	26.7	
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	--	--
Radium-228	pCi/L	--	--	0.254	0.455	0.076	1.23	0.682	0.155	-0.367	1.49	--	--	--
Radium-226	pCi/L	--	--	0.609	0.636	0.428	0.517	0.187	0.71	0.189	0.153	--	--	--
Radium-226/228	pCi/L	5	--	0.863	1.091	0.504	1.747	0.869	0.865	-0.178	1.643	--	--	--
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.28	--	--	--
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2.1	--	--	--
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2.19	--	--	--
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	0.742	0.709	0.789	0.949	--	--
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	0.138	0.139	0.112	0.119	--	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-15I

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/6/2018	8/16/2016	11/13/2018	5/23/2019
Field Parameters							
Elevation	ft NGVD	--	--	369.64	370.28	369.01	372.01
pH	S.U.	--	6.77 - 7.86	8.06	7.36	7.6	7.29
Specific Conductance	µmhos/cm	--	--	420	527	412	414
Turbidity	NTU	--	--	0.88	0	0.18	0.95
Dissolved Oxygen	mg/L	--	--	1.89	0.25	0.31	1.61
Temperature	°C	--	--	14.9	17.77	12.52	18.94
ORP	mV	--	--	-94	-63	-63.7	-207.7
Laboratory Parameters							
Antimony	µg/L	6	--	--	--	<0.02	<0.02
Arsenic	µg/L	10	--	--	--	23.8	25.8
Barium	µg/L	2000	--	--	--	93.3	95
Beryllium	µg/L	4	--	--	--	<0.02	<0.02
Cadmium	µg/L	5	--	--	--	<0.01	0.01
Chromium	µg/L	100	--	--	--	<0.04	0.06
Cobalt	µg/L	6	--	--	--	1.12	1.12
Copper	µg/L	--	--	0.15	--	0.12	0.1
Lead	µg/L	15	--	--	--	0.03	<0.02
Mercury	µg/L	2	--	--	--	--	<0.002
Molybdnum	µg/L	100	--	--	--	5.03	5.63
Selenium	µg/L	50	--	--	--	0.04	<0.03
Thallium	µg/L	2	--	--	--	<0.1	<0.1
Zinc	µg/L	--	--	2.5	--	0.8	7.9
Silica (Dissolved)	mg/L	--	--	13.9	--	13.8	<0.06
Aluminum	µg/L	--	--	4.24	--	7.01	3
Boron	mg/L	--	0.072	0.066	--	0.07	0.03
Calcium	mg/L	--	(79.5) 54	47	--	39.9	47.8
Lithium	mg/L	0.04	--	--	--	<0.009	0.01
Magnesium	mg/L	--	--	11.8	--	9.98	11.7
Manganese	mg/L	--	--	0.13	--	0.106	0.128
Potassium	mg/L	--	--	0.96	--	1.21	0.9
Sodium	mg/L	--	--	42	--	29.9	29.9
Strontium	mg/L	--	--	0.0955	--	0.0827	0.0942
Alkalinity	mg/L	--	--	226	--	199	208
Bromide	mg/L	--	--	0.071	--	0.06	0.04
Chloride	mg/L	--	(29.6) 70	25.1	--	23.7	18
Fluoride	mg/L	4	0.382	0.26	--	0.25	0.26
TDS	mg/L	--	(412.7) 398	279	--	248	260
Sulfate	mg/L	--	(47.44) 47	25.3	--	25.3	20.9
Sulfide	mg/L	--	--	<0.4	--	<0.07	<0.1
Radium-228	pCi/L	--	--	--	--	0.283	0.423
Radium-226	pCi/L	--	--	--	--	0.0962	0.557
Radium-226/228	pCi/L	5	--	--	--	0.3792	0.98
Copper (Dissolved)	µg/L	--	--	0.36	--	0.2	0.83
Zinc (Dissolved)	µg/L	--	--	2	--	0.8	1
Aluminum (Dissolved)	µg/L	--	--	1	--	1	2
Iron (Dissolved)	mg/L	--	--	0.879	--	0.848	0.826
Manganese (Dissolved)	mg/L	--	--	0.126	--	0.121	0.116

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-16S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/9/2016	7/20/2016	9/21/2016	11/17/2016	1/11/2017	3/8/2017	5/10/2017	7/18/2017	10/4/2017	1/3/2018
Field Parameters													
Elevation	ft NGVD	--	--	369.7	369.61	369.16	368.56	367.84	367.87	367.88	368.53	367.58	366.38
pH	S.U.	--	5.88 - 8.55	7.53	7.1	7.31	6.9	7.16	7.1	8.26	6.34	7.25	7.34
Specific Conductance	µmhos/cm	--	--	0.822	764	719	669	677	804	581	595	647	872
Turbidity	NTU	--	--	0.74	0.34	5.21	0.5	0.25	0.42	1.78	0.57	0.72	0.54
Dissolved Oxygen	mg/L	--	--	0.34	0.4	7.29	0.62	0.55	0.18	0.69	22.45	0.31	0.82
Temperature	°C	--	--	15.7	16.39	17.48	16.91	14.47	18.48	16.01	15.63	15.99	14.46
ORP	mV	--	--	112.4	56.2	153.4	233.5	83	56.1	177.3	-118.9	13.6	-12.2
Laboratory Parameters													
Antimony	µg/L	6	--	0.03	0.03	0.25	0.02	0.02	0.02	0.02	0.02	--	--
Arsenic	µg/L	10	--	0.37	0.37	0.38	0.34	0.42	0.31	0.39	0.33	--	--
Barium	µg/L	2000	--	32.3	29.9	29.5	25.3	25.1	25.7	29.8	25.6	--	--
Beryllium	µg/L	4	--	<0.005	<0.005	<0005	<0.005	<0.005	<0.005	<0.004	<0.004	--	--
Cadmium	µg/L	5	--	0.03	0.03	0.1	0.006	0.008	0.004	0.01	0.04	--	
Chromium	µg/L	100	--	0.2	0.5	0.3	1.03	0.081	0.463	0.196	0.101	--	--
Cobalt	µg/L	6	--	0.073	0.025	0.07	0.028	0.014	0.012	0.063	0.01	--	--
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.1	0.19	--
Lead	µg/L	15	--	0.074	0.057	0.182	<0.004	0.039	0.006	0.027	0.01	--	--
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--
Molybdnum	µg/L	100	--	1.15	1.21	1.11	1.19	1.21	1.32	1.14	0.98	--	--
Selenium	µg/L	50	--	0.6	0.6	0.8	0.4	0.4	0.4	0.3	0.4	--	--
Thallium	µg/L	2	--	0.01	<0.01	<0.01	<0.01	0.02	0.02	0.01	0.01	--	--
Zinc	µg/L	--	--	--	--	--	--	--	--	--	2	2	--
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	24	24.1	27.6	--
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	2.1	7.43	--
Boron	mg/L	--	0.088	0.028	0.025	0.024	0.025	0.017	0.038	0.082	0.037	0.061	--
Calcium	mg/L	--	(79.5) 114	96.2	83	93.5	96.4	94.6	106	105	91.8	108	109
Lithium	mg/L	0.04	--	0.007	0.031	0.005	0.018	0.013	0.013	0.008	0.01	--	--
Magnesium	mg/L	--	--	--	--	--	--	--	36.4	36.6	31.4	38.2	--
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.0028	--	--
Potassium	mg/L	--	--	--	--	--	--	--	1.01	1.3	0.97	1.03	--
Sodium	mg/L	--	--	--	--	--	--	--	36.9	36.7	28.7	35.7	--
Strontium	mg/L	--	--	--	--	--	--	--	0.129	0.132	0.108	0.133	--
Alkalinity	mg/L	--	--	--	--	--	--	--	423	431	436	438	--
Bromide	mg/L	--	--	--	--	--	--	--	0.1	0.158	0.162	0.206	--
Chloride	mg/L	--	(29.6) 24	18.7	19	17.1	16.4	17.5	19.3	22.9	19.8	19.3	--
Fluoride	mg/L	4	0.506	0.44	0.46	0.38	0.3	0.35	0.36	0.38	0.33	0.41	--
TDS	mg/L	--	(412.7) 517	483	471	509	486	474	473	499	484	503	517
Sulfate	mg/L	--	(52.4) 52	46.9	50.1	42.1	38.3	39.2	39.6	42.3	40.7	45	--
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	--
Radium-228	pCi/L	--	--	-0.0274	0.34	-0.131	0.0963	1.8	0.169	-0.045	2.76	--	--
Radium-226	pCi/L	--	--	0.163	0.707	0.0255	0.198	0.193	0.113	0.145	0.0933	--	--
Radium-226/228	pCi/L	5	--	0.1356	1.047	-0.1055	0.2943	1.993	0.282	0.1	2.8533	--	--
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.1	--	--
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	1	--	--
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.9	--	--
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	<0.0004	<0.0004	0.051	0.015	--
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	0.0013	0.0145	0.0007	0.0127	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-16S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/6/2018	8/16/2018	11/14/2018	2/11/2019	5/22/2019
Field Parameters								
Elevation	ft NGVD	--	--	369.62	370.12	368.86	369.84	371.94
pH	S.U.	--	5.88 - 8.55	7.23	7.07	7.02	7.12	7.1
Specific Conductance	µmhos/cm	--	--	770	920	720	570	774
Turbidity	NTU	--	--	2.2	0	0.3	1.3	0.18
Dissolved Oxygen	mg/L	--	--	7.8	0	1.35	0.41	0.34
Temperature	°C	--	--	15.73	17.04	14.2	14.4	14.54
ORP	mV	--	--	-36.9	147	142	183	-211.4
Laboratory Parameters								
Antimony	µg/L	6	--	--	--	0.05	--	0.03
Arsenic	µg/L	10	--	--	--	0.34	--	0.26
Barium	µg/L	2000	--	--	--	29.9	--	21.9
Beryllium	µg/L	4	--	--	--	<0.02	--	<0.02
Cadmium	µg/L	5	--	--	--	0.08	--	0.01
Chromium	µg/L	100	--	--	--	0.07	--	0.1
Cobalt	µg/L	6	--	--	--	<0.02	--	<0.02
Copper	µg/L	--	--	1.19	--	1.46	--	0.66
Lead	µg/L	15	--	--	--	0.112	--	<0.02
Mercury	µg/L	2	--	--	--	--	--	<0.002
Molybdnum	µg/L	100	--	--	--	0.9	--	0.9
Selenium	µg/L	50	--	--	--	3.2	--	0.6
Thallium	µg/L	2	--	--	--	<0.1	--	<0.1
Zinc	µg/L	--	--	5	--	31.6	--	<0.7
Silica (Dissolved)	mg/L	--	--	24.9	--	24.9	--	23.3
Aluminum	µg/L	--	--	5.68	--	3	--	1
Boron	mg/L	--	0.088	0.109	0.034	0.107	0.02	0.03
Calcium	mg/L	--	(79.5) 114	108	109	104	--	99.2
Lithium	mg/L	0.04	--	--	--	0.02	--	0.01
Magnesium	mg/L	--	--	38.8	--	37.4	--	34.5
Manganese	mg/L	--	--	0.0062	--	0.004	--	0.0035
Potassium	mg/L	--	--	1.1	--	1.28	--	0.95
Sodium	mg/L	--	--	38	--	44.4	--	29.4
Strontium	mg/L	--	--	0.137	--	0.138	--	0.21
Alkalinity	mg/L	--	--	463	--	510	--	478
Bromide	mg/L	--	--	0.118	--	0.1	--	0.08
Chloride	mg/L	--	(29.6) 24	17.3	--	16.2	--	18
Fluoride	mg/L	4	0.506	0.42	--	0.39	--	0.38
TDS	mg/L	--	(412.7) 517	520	533	548	517	493
Sulfate	mg/L	--	(52.4) 52	40.8	--	40.3	--	34.5
Sulfide	mg/L	--	--	<0.4	--	<0.07	--	<0.1
Radium-228	pCi/L	--	--	--	--	0.0697	--	0.299
Radium-226	pCi/L	--	--	--	--	0.0503	--	0.0904
Radium-226/228	pCi/L	5	--	--	--	0.12	--	0.3894
Copper (Dissolved)	µg/L	--	--	1.21	--	2.59	--	0.38
Zinc (Dissolved)	µg/L	--	--	5.2	--	4	--	<0.7
Aluminum (Dissolved)	µg/L	--	--	1	--	1	--	3
Iron (Dissolved)	mg/L	--	--	0.004	--	<0.003	--	<0.003
Manganese (Dissolved)	mg/L	--	--	0.0047	--	0.0023	--	<0.0027

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-16I

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/9/2016	7/20/2016	9/21/2016	11/17/2016	1/11/2017	3/8/2017	5/19/2017	7/18/2017	10/4/2017	1/3/2018
Field Parameters													
Elevation	ft NGVD	--	--	369.79	369.62	369.18	368.57	367.84	367.87	367.87	368.58	367.58	366.39
pH	S.U.	--	6.73 - 7.90	7.69	7.56	7.37	7.08	7.36	7.28	6.96	7.2	7.46	7.68
Specific Conductance	µmhos/cm	--	--	957	870	867	702	674	779	569	665	644	821
Turbidity	NTU	--	--	0.42	0.46	1.37	1.4	0.18	1.41	2.27	3.15	0.7	1.9
Dissolved Oxygen	mg/L	--	--	0.29	8.08	0.68	0.53	0.46	0.34	0.21	0.29	0.28	0.38
Temperature	°C	--	--	16.2	16.86	15.43	15.64	14.71	15.19	15.48	15.99	15.71	13.08
ORP	mV	--	--	224.4	-158.9	54.7	242.3	86.1	53.5	49.8	-3.1	4.1	-25.6
Laboratory Parameters													
Antimony	µg/L	6	--	0.02	0.01	0.01	0.05	0.01	0.02	0.06	0.02	--	--
Arsenic	µg/L	10	--	0.71	0.75	0.75	0.67	0.72	0.68	0.7	0.73	--	--
Barium	µg/L	2000	--	267	267	262	234	220	221	206	238	--	--
Beryllium	µg/L	4	--	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.004	<0.004	--	--
Cadmium	µg/L	5	--	0.06	0.03	0.03	0.05	0.04	0.03	0.08	0.03	--	
Chromium	µg/L	100	--	0.1	0.2	0.1	0.082	0.085	0.422	0.204	0.118	--	--
Cobalt	µg/L	6	--	0.602	0.627	0.576	0.546	0.514	0.58	0.56	0.599	--	--
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.56	0.46	--
Lead	µg/L	15	--	0.023	0.025	0.023	0.053	0.01	0.034	0.153	0.065	--	--
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--
Molybdnum	µg/L	100	--	1.02	1.02	1.03	0.93	1	1.17	0.91	1.07	--	--
Selenium	µg/L	50	--	0.2	0.2	0.1	0.2	0.1	0.2	0.4	0.2	--	--
Thallium	µg/L	2	--	0.085	0.06	0.074	0.069	0.071	0.075	0.075	0.07	--	--
Zinc	µg/L	--	--	--	--	--	--	--	--	--	2.7	0.8	--
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	19.9	20	22.8	--
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	15.5	14	--
Boron	mg/L	--	0.107	0.031	0.027	0.026	0.024	0.015	0.1	0.032	0.044	0.05	--
Calcium	mg/L	--	(79.5) 114	110	93.9	95.9	96.2	89.3	101	86.7	91.3	84	71.9
Lithium	mg/L	0.04	--	0.005	0.005	0.006	0.013	0.01	0.013	0.01	0.003	--	--
Magnesium	mg/L	--	--	--	--	--	--	--	27.6	24.7	25.6	23	--
Manganese	mg/L	--	--	--	--	--	--	--	--	--	1.03	--	--
Potassium	mg/L	--	--	--	--	--	--	--	2.9	2.47	2.62	3.21	--
Sodium	mg/L	--	--	--	--	--	--	--	46.2	41.4	50	69.2	--
Strontium	mg/L	--	--	--	--	--	--	--	0.155	0.139	0.14	0.135	--
Alkalinity	mg/L	--	--	--	--	--	--	--	368	376	369	359	--
Bromide	mg/L	--	--	--	--	--	--	--	0.1	0.152	0.154	0.206	--
Chloride	mg/L	--	(29.6) 114	80.4	86.8	90.2	59.1	44.1	39.3	37.9	50.2	70.8	71.2
Fluoride	mg/L	4	0.192	0.1	0.15	0.1	0.1	0.1	0.16	0.1	0.08	0.1	--
TDS	mg/L	--	(412.7) 589	539	532	544	508	481	460	461	465	495	487
Sulfate	mg/L	--	(43.51) 44	38.7	42.2	36.8	33	34	35.4	35.1	36.1	40.4	--
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	--
Radium-228	pCi/L	--	--	0.357	1	0.977	0.174	2.27	0.182	0.427	0.513	--	--
Radium-226	pCi/L	--	--	0.235	0.576	0.248	0.413	0.362	0.399	0.511	0.274	--	--
Radium-226/228	pCi/L	5	--	0.592	1.576	1.225	0.587	2.632	0.581	0.938	0.787	--	--
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.14	--	--
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	1	--	--
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2	--	--
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	<0.0004	<0.0004	0.051	0.014	--
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	1.03	1.06	1.04	0.873	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-16I

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/6/2018	8/16/2018	11/14/2018	2/11/2019	5/22/2019
Field Parameters								
Elevation	ft NGVD	--	--	369.62	370.06	368.78	369.77	371.86
pH	S.U.	--	6.73 - 7.90	7.37	7.23	7.3	7.4	7.31
Specific Conductance	µmhos/cm	--	--	720	797	545	476	641
Turbidity	NTU	--	--	0.89	0	0.41	0.8	0.2
Dissolved Oxygen	mg/L	--	--	0.46	0	0.95	0.36	0.25
Temperature	°C	--	--	15.93	15.56	14.42	14.5	14.58
ORP	mV	--	--	-68.4	120	148	122	-21107
Laboratory Parameters								
Antimony	µg/L	6	--	--	--	<0.02	--	<0.02
Arsenic	µg/L	10	--	--	--	0.66	--	0.64
Barium	µg/L	2000	--	--	--	153	--	151
Beryllium	µg/L	4	--	--	--	<0.02	--	<0.02
Cadmium	µg/L	5	--	--	--	0.02	--	0.02
Chromium	µg/L	100	--	--	--	0.05	--	<0.04
Cobalt	µg/L	6	--	--	--	0.336	--	0.346
Copper	µg/L	--	--	0.62	--	0.45	--	0.46
Lead	µg/L	15	--	--	--	<0.02	--	0.02
Mercury	µg/L	2	--	--	--	--	--	<0.002
Molybdnum	µg/L	100	--	--	--	1	--	1
Selenium	µg/L	50	--	--	--	0.2	--	0.1
Thallium	µg/L	2	--	--	--	<0.1	--	<0.1
Zinc	µg/L	--	--	0.6	--	0.8	--	<0.7
Silica (Dissolved)	mg/L	--	--	19.8	--	18.5	--	18
Aluminum	µg/L	--	--	10.2	--	5	--	4
Boron	mg/L	--	0.107	0.046	--	0.139	0.02	0.03
Calcium	mg/L	--	(79.5) 114	82.9	61.6	53.7	--	56
Lithium	mg/L	0.04	--	--	--	<0.009	--	0.02
Magnesium	mg/L	--	--	23.1	--	14.8	--	15.1
Manganese	mg/L	--	--	0.902	--	0.613	--	0.626
Potassium	mg/L	--	--	3.05	--	3.16	--	2.55
Sodium	mg/L	--	--	66	--	74.4	--	68.4
Strontium	mg/L	--	--	0.136	--	0.09	--	0.0898
Alkalinity	mg/L	--	--	359	--	300	--	261
Bromide	mg/L	--	--	0.168	--	0.1	--	0.1
Chloride	mg/L	--	(29.6) 114	58.6	61.1	47.8	--	45.5
Fluoride	mg/L	4	0.192	0.17	--	0.17	--	0.17
TDS	mg/L	--	(412.7) 589	480	456	408	--	405
Sulfate	mg/L	--	(43.51) 44	38.7	--	32.5	--	33.2
Sulfide	mg/L	--	--	<0.4	--	<0.07	--	<0.1
Radium-228	pCi/L	--	--	--	--	0.483	--	0.269
Radium-226	pCi/L	--	--	--	--	0.162	--	0.156
Radium-226/228	pCi/L	5	--	--	--	0.645	--	0.425
Copper (Dissolved)	µg/L	--	--	0.57	--	1.43	--	1.14
Zinc (Dissolved)	µg/L	--	--	0.7	--	2	--	<0.7
Aluminum (Dissolved)	µg/L	--	--	0.8	--	1	--	1
Iron (Dissolved)	mg/L	--	--	0.024	--	0.004	--	<0.003
Manganese (Dissolved)	mg/L	--	--	0.849	--	0.616	--	0.615

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-16D

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/9/2016	7/19/2016	9/20/2016	11/17/2016	1/11/2017	3/8/2017	5/10/2017	7/18/2017	10/4/2017	1/3/2018
Field Parameters													
Elevation	ft NGVD	--	--	369.85	369.68	369.23	368.64	367.91	367.94	367.96	368.64	367.68	366.47
pH	S.U.	--	6.04 - 9.13	6.8	7.31	7.26	7.29	7.48	7.44	7.54	9.03	7.6	7.74
Specific Conductance	µmhos/cm	--	--	519	582	538	613	525	614	436	597	516	692
Turbidity	NTU	--	--	1.8	0.24	0.31	0.55	0.4	0.81	1.74	0.41	2.95	1.85
Dissolved Oxygen	mg/L	--	--	0.4	--	1.33	0.55	0.49	0.11	0.29	0.32	0.21	0.47
Temperature	°C	--	--	16.8	16.96	16.04	15.1	14.55	15.2	15.46	15.62	15.77	13.14
ORP	mV	--	--	-19	23.5	35.7	108	14.6	2.1	36.6	108.9	-26.4	-36.7
Laboratory Parameters													
Antimony	µg/L	6	--	0.02	0.02	0.02	0.02	0.01	0.02	0.03	0.03	--	--
Arsenic	µg/L	10	--	0.48	0.4	0.31	0.32	0.34	0.31	0.33	0.39	--	--
Barium	µg/L	2000	--	240	246	221	217	210	224	212	247	--	--
Beryllium	µg/L	4	--	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.004	<0.004	--	--
Cadmium	µg/L	5	--	0.08	0.08	0.02	0.05	0.02	0.01	0.07	0.1	--	
Chromium	µg/L	100	--	0.3	0.4	0.1	1.21	0.112	0.188	0.151	0.141	--	--
Cobalt	µg/L	6	--	0.617	0.547	0.418	0.452	0.354	0.401	0.466	0.571	--	--
Copper	µg/L	--	--	--	--	--	--	--	--	--	2.21	0.11	--
Lead	µg/L	15	--	0.078	0.04	0.021	0.066	0.008	0.022	0.07	0.103	--	--
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--
Molybdnum	µg/L	100	--	2.06	2.31	1.96	1.98	1.99	2.27	1.9	2.03	--	--
Selenium	µg/L	50	--	0.04	0.04	<0.03	<0.03	<0.03	0.05	<0.03	<0.03	--	--
Thallium	µg/L	2	--	0.03	0.069	0.02	0.02	0.02	0.04	0.02	0.02	--	--
Zinc	µg/L	--	--	--	--	--	--	--	--	--	12.8	52.4	--
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	17.1	17.6	20.3	--
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	6.2	3.72	--
Boron	mg/L	--	0.113	0.033	0.013	0.012	0.014	0.004	0.023	0.102	0.017	0.059	--
Calcium	mg/L	--	(79.5) 88	84.3	68.7	70.5	77.9	72.4	79.2	75.8	71.7	80.4	80.1
Lithium	mg/L	0.04	--	0.001	0.013	0.003	0.006	0.013	0.007	0.008	0.0006	--	--
Magnesium	mg/L	--	--	--	--	--	--	--	22.4	22.2	21	23.3	--
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.975	--	--
Potassium	mg/L	--	--	--	--	--	--	--	1.12	1.54	0.97	1.33	--
Sodium	mg/L	--	--	--	--	--	--	--	22.3	21.6	22.1	24.7	--
Strontium	mg/L	--	--	--	--	--	--	--	0.142	0.143	0.128	0.146	--
Alkalinity	mg/L	--	--	--	--	--	--	--	202	210	215	195	--
Bromide	mg/L	--	--	--	--	--	--	--	0.15	0.204	<0.05	0.233	--
Chloride	mg/L	--	(29.6) 73	68.7	69.6	67.6	63.6	67.9	65.4	69.9	69.6	81.5	86
Fluoride	mg/L	4	0.251	0.2	0.22	0.22	0.17	0.21	0.22	0.22	0.17	0.22	--
TDS	mg/L	--	(412.7) 384	350	321	342	356	343	347	367	363	383	--
Sulfate	mg/L	--	(39.69) 40	36.4	37.4	33.4	33.2	34	35.3	37.2	36.8	40	37.9
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	--
Radium-228	pCi/L	--	--	-0.173	0.294	1.1	0.285	0.92	0.583	-0.121	0.222	--	--
Radium-226	pCi/L	--	--	0.0514	--	0.248	0.624	0.796	0.228	0.151	0.292	--	--
Radium-226/228	pCi/L	5	--	-0.1216	0.294	1.348	0.909	1.716	0.811	0.03	0.514	--	--
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.18	--	--
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2	--	--
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	1	--	--
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	0.004	0.002	0.098	0.051	--
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	0.862	0.948	0.989	0.947	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-16D

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/6/2018	8/16/2018	11/14/2018	2/11/2019	4/1/2019	5/22/2019	7/23/2019	9/11/2019
Field Parameters											
Elevation	ft NGVD	--	--	369.69	370.13	368.87	369.84	370.82	371.96	372.67	-----
pH	S.U.	--	6.04 - 9.13	7.32	7.26	7.35	7.37	7.28	7.31	7.02	7.28
Specific Conductance	µmhos/cm	--	--	690	782	607	510	945	755	731	813
Turbidity	NTU	--	--	0.9	0	0.35	1.4	0.91	0.3	1.9	0.43
Dissolved Oxygen	mg/L	--	--	0.44	0	0.94	1.48	0.64	0.26	0.5	0.36
Temperature	°C	--	--	15.94	15.88	14.45	13.2	13.5	14.43	15.9	17.5
ORP	mV	--	--	-70.7	-11	62.8	60	-16.7	-216.5	50	-52.5
Laboratory Parameters											
Antimony	µg/L	6	--	--	--	<0.02	--	--	0.02	--	--
Arsenic	µg/L	10	--	--	--	0.32	--	--	0.39	--	--
Barium	µg/L	2000	--	--	--	270	--	--	286	--	--
Beryllium	µg/L	4	--	--	--	<0.02	--	--	<0.02	--	--
Cadmium	µg/L	5	--	--	--	0.04	--	--	<0.01	--	--
Chromium	µg/L	100	--	--	--	0.05	--	--	0.25	--	--
Cobalt	µg/L	6	--	--	--	0.472	--	--	0.64	--	--
Copper	µg/L	--	--	0.07	--	0.23	--	--	0.17	--	--
Lead	µg/L	15	--	--	--	0.03	--	--	0.02	--	--
Mercury	µg/L	2	--	--	--		--	--	<0.002	--	--
Molybdnum	µg/L	100	--	--	--	2	--	--	2	--	--
Selenium	µg/L	50	--	--	--	0.03	--	--	<0.03	--	--
Thallium	µg/L	2	--	--	--	<0.1	--	--	<0.1	--	--
Zinc	µg/L	--	--	7.1	--	15.4	--	--	1	--	--
Silica (Dissolved)	mg/L	--	--	18.5	--	18.2	--	--	17.9	--	--
Aluminum	µg/L	--	--	2.86	--	1	--	--	2	--	--
Boron	mg/L	--	0.113	0.033	--	0.07	--	--	0.03	--	--
Calcium	mg/L	--	(79.5) 88	90.2	83.8	84.1	--	--	88.5	95.6	109
Lithium	mg/L	0.04	--	--	--	<0.009	--	--	0.02	--	--
Magnesium	mg/L	--	--	27.1	--	24.3	--	--	25.4	--	--
Manganese	mg/L	--	--	1.2	--	1	--	--	1.17	--	--
Potassium	mg/L	--	--	1.22	--	1.27	--	--	1.27	--	--
Sodium	mg/L	--	--	26.7	--	30	--	--	30.8	--	--
Strontium	mg/L	--	--	0.18	--	0.166	--	--	0.176	--	--
Alkalinity	mg/L	--	--	235	--	238	--	--	249	--	--
Bromide	mg/L	--	--	0.303	--	0.275	--	--	0.344	--	--
Chloride	mg/L	--	(29.6) 73	108	99.7	102	109	107	104	106	125
Fluoride	mg/L	4	0.251	0.22	--	0.21	--	--	0.2	--	--
TDS	mg/L	--	(412.7) 384	434	447	434	439	429	460	457	523
Sulfate	mg/L	--	(39.69) 40	38.6	--	38.6	--	--	38	--	--
Sulfide	mg/L	--	--	<0.4	--	<0.07	--	--	<0.1	--	--
Radium-228	pCi/L	--	--	--	--	0.138	--	--	0.688	--	--
Radium-226	pCi/L	--	--	--	--	0.179	--	--	0.551	--	--
Radium-226/228	pCi/L	5	--	--	--	0.317	--	--	1.239	--	--
Copper (Dissolved)	µg/L	--	--	0.35	--	1.5	--	--	0.25	--	--
Zinc (Dissolved)	µg/L	--	--	1	--	3	--	--	<0.7	--	--
Aluminum (Dissolved)	µg/L	--	--	2	--	2	--	--	<1	--	--
Iron (Dissolved)	mg/L	--	--	0.058	--	0.023	--	--	0.067	--	--
Manganese (Dissolved)	mg/L	--	--	1.19	--	1	--	--	1.23	--	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-17S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/8/2016	7/20/2016	9/20/2016	11/16/2016	1/10/2017	3/7/2017	5/9/2017	7/19/2017	10/4/2017	6/5/2018	11/13/2018	5/23/2019
Field Parameters															
Elevation	ft NGVD	--	--	370.14	370.11	369.81	369.37	368.47	368.21	368.24	368.89	373.03	369.48	368.74	371.85
pH	S.U.	--	7.11 - 7.97	7.77	7.3	7.65	7.7	7.6	7.5	7.3	7.5	7.44	7.41	7.51	7.58
Specific Conductance	µmhos/cm	--	--	350	373	344	146	310	60	357	287	351	319	280	322
Turbidity	NTU	--	--	0.6	0.7	0.79	1	1	1	3	1	0.47	0.4	0.89	0
Dissolved Oxygen	mg/L	--	--	0.6	1.2	0.37	0.1	0.2	1	0.2	0.2	0.38	10.12	1.07	1.56
Temperature	°C	--	--	14.7	17.9	14.55	14.7	13.8	13.5	14.9	14.3	16.82	14.39	13.45	15
ORP	mV	--	--	80	44	49.4	-40	62	47	45	30	-50.3	-84.3	121	-48.2
Laboratory Parameters															
Antimony	µg/L	6	--	0.01	0.03	0.02	0.03	0.03	0.04	0.04	0.02	--	--	0.02	0.02
Arsenic	µg/L	10	--	0.24	0.26	0.22	0.2	0.21	0.2	0.22	0.22	--	--	0.17	0.18
Barium	µg/L	2000	--	2.12	2.74	2.24	2.4	3.45	3.94	4.37	2.25	--	--	2.11	2.3
Beryllium	µg/L	4	--	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.004	<0.004	--	--	<0.02	<0.02
Cadmium	µg/L	5	--	0.02	0.08	0.01	0.02	0.02	0.09	0.02	0.06	--	--	0.02	0.03
Chromium	µg/L	100	--	0.5	0.2	0.1	0.066	0.489	0.776	0.233	0.124	--	--	0.07	0.06
Cobalt	µg/L	6	--	0.047	0.105	0.034	0.029	0.04	0.076	0.138	0.053	--	--	0.05	0.04
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.38	0.69	0.23	0.21	0.39
Lead	µg/L	15	--	0.024	0.098	0.025	0.02	0.02	0.079	0.108	0.038	--	--	0.03	0.05
Mercury	µg/L	2	--	<0.002	0.002	<0.002	<0.002	<0.002	0.002	<0.002	<0.002	--	--	--	<0.002
Molybdnum	µg/L	100	--	3.98	4.2	4.08	3.39	0.44	0.7	1.14	4.38	--	--	3.73	4.78
Selenium	µg/L	50	--	0.07	0.06	0.08	0.1	0.2	0.1	0.1	0.08	--	--	0.3	0.2
Thallium	µg/L	2	--	0.01	0.01	0.01	0.053	0.02	0.02	<0.01	0.03	--	--	<0.1	<0.1
Zinc	µg/L	--	--	--	--	--	--	--	--	--	1	5.7	0.7	<0.7	14.4
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	14	13.7	15.8	13.5	13.2	<0.06
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	9.55	10.2	4.01	2	17.4
Boron	mg/L	--	0.065	0.015	0.016	0.016	0.017	0.006	0.058	0.041	0.02	0.033	0.045	0.05	0.03
Calcium	mg/L	--	(79.5) 41	36.9	34.8	34.8	35.9	32.3	40	35.5	34.4	34.1	32.4	33.1	32.7
Lithium	mg/L	0.04	--	<0.0002	0.02	0.003	0.004	0.003	0.008	0.003	<0.0002	--	--	<0.009	0.01
Magnesium	mg/L	--	--	--	--	--	--	--	19.2	17.5	13.7	12.9	13	13.7	12.9
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.0428	--	0.0311	0.0418	0.0377
Potassium	mg/L	--	--	--	--	--	--	--	0.88	0.79	0.49	0.47	0.5	0.59	0.62
Sodium	mg/L	--	--	--	--	--	--	--	42.5	35.3	31.9	27.7	24.5	25.8	26.5
Strontium	mg/L	--	--	--	--	--	--	--	0.0566	0.0529	0.0363	0.0345	0.0357	0.0374	0.0347
Alkalinity	mg/L	--	--	--	--	--	--	--	231	221	196	189	188	202	193
Bromide	mg/L	--	--	--	--	--	--	--	0.02	0.05	<0.02	<0.02	0.04	<0.04	<0.04
Chloride	mg/L	--	(29.6) 16	13.9	15.4	12.3	11.4	11	10.7	10.4	10.8	10.5	10.8	11.5	12
Fluoride	mg/L	4	1.08	0.85	0.86	0.73	0.7	0.48	0.46	0.58	0.82	0.89	0.98	0.91	1.08
TDS	mg/L	--	(412.7) 269	272	235	233	232	262	251	250	201	214	214	196	217
Sulfate	mg/L	--	(16.46) 16.5	14.3	14.8	10.9	10.5	10.7	12	13.1	10.2	10.7	9.5	8.4	7.7
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	<0.4	<0.1	<0.1
Radium-228	pCi/L	--	--	0.783	-0.0129	0.027	0.791	-0.155	0.36	0.315	1.07	--	--	-0.0735	0.34
Radium-226	pCi/L	--	--	0.253	0.0439	0.0489	0.803	0.17	0.11	0.118	0.678	--	--	0.0202	0.0449
Radium-226/228	pCi/L	5	--	1.036	0.031	0.0759	1.594	0.015	0.47	0.433	1.748	--	--	0.0202	0.0202
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.35	--	0.56	0.7	2.05
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	1	--	1	1	<0.7
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2.2	--	6.2	2	1
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	<0.0004	<0.0004	<0.0004	0.026	0.004	0.004	0.01
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	0.0028	0.0013	0.0322	0.0881	0.0304	0.041	0.0332

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-17I

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/8/2016	7/20/2016	9/20/2016	11/16/2016	1/10/2017	3/7/2017	5/9/2017	7/19/2017	10/4/2017	12/12/2017	1/3/2018	6/5/2018	8/16/2018	9/26/2018
Field Parameters																	
Elevation	ft NGVD	--	--	370.09	370.13	369.82	369.12	368.47	368.23	368.25	368.89	368.07	367.23	366.84	369.46	370.64	370.06
pH	S.U.	--	6.82 - 7.96	7.55	7.2	7.1	7.8	7.5	7.5	7.2	7.3	7.37	7.49	7.8	7.36	7.48	7.48
Specific Conductance	µmhos/cm	--	--	839	914	1000	607	670	60	768	678	786	530	848	652	728	453
Turbidity	NTU	--	--	13.4	9.8	--	0.1	2	9	2	1	74.99	1.74	12	1.28	0	0.58
Dissolved Oxygen	mg/L	--	--	0.8	0.8	0.9	1.3	0.3	1	0.3	0.2	0.26	0.1	2.34	0.2	0.17	0.37
Temperature	°C	--	--	14.1	16.4	18.3	14.4	13.7	13.8	14.7	14.7	17.05	8.97	7.25	15.11	17.06	14.18
ORP	mV	--	--	116	-73	-40	204	-52	8	46	-59	-90.8	-54	-40.5	-99.8	-69	-77.9
Laboratory Parameters																	
Antimony	µg/L	6	--	0.07	0.05	0.04	0.03	0.02	0.02	0.02	0.02	--	--	--	--	--	--
Arsenic	µg/L	10	--	7.14	7.41	6.45	3.38	3.94	4.61	3.61	3.76	--	--	--	--	--	--
Barium	µg/L	2000	--	168	190	198	149	148	159	133	140	--	--	--	--	--	--
Beryllium	µg/L	4	--	0.02	0.006	<0.005	<0.005	<0.005	<0.005	<0.004	<0.004	--	--	--	--	--	--
Cadmium	µg/L	5	--	0.12	0.13	0.04	0.04	0.008	0.007	0.03	0.02	--	--	--	--	--	--
Chromium	µg/L	100	--	0.6	2.1	0.1	0.059	0.254	0.776	0.196	0.127	--	--	--	--	--	--
Cobalt	µg/L	6	--	1.24	0.778	0.472	0.37	0.391	0.406	0.394	0.372	--	--	--	--	--	--
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.26	0.24	--	--	0.52	--	--
Lead	µg/L	15	--	1.19	0.284	0.133	0.049	0.02	0.026	0.115	0.02	--	--	--	--	--	--
Mercury	µg/L	2	--	0.003	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	--	--	--
Molybdnum	µg/L	100	--	3.6	3.66	3.08	3.37	3.2	3.62	3.26	3.42	--	--	--	--	--	--
Selenium	µg/L	50	--	0.1	0.05	0.05	<0.03	<0.03	0.05	0.03	<0.03	--	--	--	--	--	--
Thallium	µg/L	2	--	0.03	0.02	0.02	0.056	0.02	0.02	0.01	0.05	--	--	--	--	--	--
Zinc	µg/L	--	--	--	--	--	--	--	--	--	4.3	30.8	--	--	2.4	--	--
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	17.1	17	19.8	--	--	16.5	--	--
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	3.39	21.5	--	--	5.91	--	--
Boron	mg/L	--	0.098	0.058	0.056	0.051	0.041	0.034	0.079	0.083	0.052	0.061	--	--	0.081	--	--
Calcium	mg/L	--	(79.5) 96	73.7	83.1	88.9	80	72.3	81.4	69.6	64.4	63	--	--	51.2	--	--
Lithium	mg/L	0.04	--	<0.0002	0.004	0.005	0.006	0.009	0.008	0.005	<0.0002	--	--	--	--	--	--
Magnesium	mg/L	--	--	--	--	--	--	--	21	19.6	17.4	16.5	--	--	13.4	--	--
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.155	--	--	--	0.122	--	--
Potassium	mg/L	--	--	--	--	--	--	--	1.28	1.36	1.04	1.12	--	--	0.94	--	--
Sodium	mg/L	--	--	--	--	--	--	--	101	93.6	95.4	94.6	--	--	89.1	--	--
Strontium	mg/L	--	--	--	--	--	--	--	0.153	0.14	0.119	0.12	--	--	0.104	--	--
Alkalinity	mg/L	--	--	--	--	--	--	--	221	226	229	245	--	--	238	--	--
Bromide	mg/L	--	--	--	--	--	--	--	0.347	0.396	0.372	0.283	--	--	0.213	--	
Chloride	mg/L	--	(29.6) 241	195	209	214	164	159	158	151	145	115	86	110	80.2	61.1	--
Fluoride	mg/L	4	0.656	0.57	0.56	0.52	0.56	0.56	0.58	0.61	0.63	0.66	0.76	0.65	0.87	0.98	1.03
TDS	mg/L	--	(412.7) 657	609	569	620	540	513	549	528	509	486	--	471	418	376	--
Sulfate	mg/L	--	(50.8) 51	43.1	49.3	48.1	44.1	43.2	44.9	43.5	44.7	46.6	44.8	--	41	--	--
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	--	--	<0.4	--	--
Radium-228	pCi/L	--	--	0.615	0.386	1	0.499	0.531	0.33	0.191	0.791	--	--	--	--	--	--
Radium-226	pCi/L	--	--	1.31	0.781	0.587	0.263	0.979	0.693	0.816	0.0231	--	--	--	--	--	--
Radium-226/228	pCi/L	5	--	1.925	1.167	1.587	0.762	1.51	1.023	1.007	0.8141	--	--	--	--	--	--
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.33	--	--	--	0.57	--	--
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2.2	--	--	--	1	--	--
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2	--	--	--	2.64	--	--
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	0.896	0.909	0.741	0.603	--	--	0.546	--	--
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	0.185	0.188	0.141	0.144	--	--	0.113	--	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-17I

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	11/13/2018	2/11/2019	4/1/2019	5/23/2019	7/23/2019	9/11/2019
Field Parameters									
Elevation	ft NGVD	--	--	369.35	369.89	369.89	372.03	373.11	-----
pH	S.U.	--	6.82 - 7.96	7.55	7.68	7.68	7.51	6.65	7.63
Specific Conductance	µmhos/cm	--	--	450	391	391	570	488	363
Turbidity	NTU	--	--	7.42	6.9	6.9	3.67	6.4	5
Dissolved Oxygen	mg/L	--	--	0.76	0.47	0.47	0.91	1.1	0
Temperature	°C	--	--	12.6	13.5	13.5	17.85	14.8	15.49
ORP	mV	--	--	-77.4	-55	-55	-94.3	-5.3	-112
Laboratory Parameters									
Antimony	µg/L	6	--	0.02	--	--	0.02	--	--
Arsenic	µg/L	10	--	3.65	--	--	3.72	--	--
Barium	µg/L	2000	--	86.8	--	--	91.8	--	--
Beryllium	µg/L	4	--	<0.02	--	--	<0.02	--	--
Cadmium	µg/L	5	--	0.03	--	--	<0.01	--	--
Chromium	µg/L	100	--	<0.04	--	--	<0.04	--	--
Cobalt	µg/L	6	--	0.186	--	--	0.22	--	--
Copper	µg/L	--	--	0.26	--	--	0.07	--	--
Lead	µg/L	15	--	0.03	--	--	0.02	--	--
Mercury	µg/L	2	--	--	--	--	<0.002	--	--
Molybdnum	µg/L	100	--	4.09	--	--	3.01	--	--
Selenium	µg/L	50	--	<0.03	--	--	<0.03	--	--
Thallium	µg/L	2	--	<0.1	--	--	<0.1	--	--
Zinc	µg/L	--	--	2	--	--	15.1	--	--
Silica (Dissolved)	mg/L	--	--	15.8	--	--	<0.06	--	--
Aluminum	µg/L	--	--	2	--	--	1	--	--
Boron	mg/L	--	0.098	0.07	--	--	0.04	--	--
Calcium	mg/L	--	(79.5) 96	36.5	--	--	45.1	--	--
Lithium	mg/L	0.04	--	<0.009	--	--	0.01	--	--
Magnesium	mg/L	--	--	9.44	--	--	11.8	--	--
Manganese	mg/L	--	--	0.0779	--	--	0.112	--	--
Potassium	mg/L	--	--	0.83	--	--	0.84	--	--
Sodium	mg/L	--	--	74.7	--	--	60.5	--	--
Strontium	mg/L	--	--	0.0796	--	--	0.098	--	--
Alkalinity	mg/L	--	--	231	--	--	201	--	--
Bromide	mg/L	--	--	0.1	--	--	0.2	--	--
Chloride	mg/L	--	(29.6) 241	50.1	--	--	60.2	--	--
Fluoride	mg/L	4	0.656	1.00	1.05	1.08	1.07	1.06	1.08
TDS	mg/L	--	(412.7) 657	328	--	--	352	--	--
Sulfate	mg/L	--	(50.8) 51	29.6	--	--	32.8	--	--
Sulfide	mg/L	--	--	<0.1	--	--	<0.1	--	--
Radium-228	pCi/L	--	--	0.275	--	--	-0.107	--	--
Radium-226	pCi/L	--	--	0.351	--	--	0.403	--	--
Radium-226/228	pCi/L	5	--	0.626	--	--	0.403	--	--
Copper (Dissolved)	µg/L	--	--	1.62	--	--	1.24	--	--
Zinc (Dissolved)	µg/L	--	--	3	--	--	3	--	--
Aluminum (Dissolved)	µg/L	--	--	3	--	--	5.77	--	--
Iron (Dissolved)	mg/L	--	--	0.348	--	--	0.418	--	--
Manganese (Dissolved)	mg/L	--	--	0.0765	--	--	0.106	--	--

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-21S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/9/2016	7/19/2016	9/21/2016	11/16/2016	1/11/2017	3/8/2017	5/9/2017	7/19/2017	10/4/2017	12/12/2017	6/6/2018
Field Parameters														
Elevation	ft NGVD	--	--	369.38	369.28	368.85	368.52	367.76	366.84	367.86	368.72	367.13	366.24	369.54
pH	S.U.	--	5.99 - 9.07	6.6	7.54	7.59	7.5	7.32	7.6	8.86	7.23	7.53	8	7.77
Specific Conductance	µmhos/cm	--	--	387	450	454	501	410	540	344	398	402	390	400
Turbidity	NTU	--	--	2.5	0.91	0.78	0.46	1.03	2.6	0.71	2.28	3.31	6	2.1
Dissolved Oxygen	mg/L	--	--	2.3	4.37	5.67	4.46	6.66	4.2	3.36	32.59	4.01	6.2	3.36
Temperature	°C	--	--	16.4	17.49	18.53	18.78	15.15	14.9	16.27	18.01	16.21	14.9	16.2
ORP	mV	--	--	36	13.1	48.9	46.9	198.4	150	160.1	-167.7	76.7	56	43
Laboratory Parameters														
Antimony	µg/L	6	--	0.03	0.02	0.02	0.02	0.03	0.03	0.04	0.05	--	--	0.04
Arsenic	µg/L	10	--	0.53	0.47	0.46	0.43	0.47	0.49	0.47	0.42	--	--	0.45
Barium	µg/L	2000	--	18.5	19.6	19.4	19.1	19.3	21.9	17.7	21.9	--	--	18.5
Beryllium	µg/L	4	--	<0.005	<0.005	<0.005	<0.005	0.006	<0.005	<0.004	<0.04	--	--	<0.004
Cadmium	µg/L	5	--	0.02	0.02	0.006	0.02	0.01	0.01	0.01	0.01	--		0.01
Chromium	µg/L	100	--	0.4	0.7	0.3	0.292	0.401	0.536	0.3	0.272	--	--	0.233
Cobalt	µg/L	6	--	0.104	0.033	0.03	0.023	0.022	0.053	0.027	0.006	--	--	0.02
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.27	0.35	--	0.52
Lead	µg/L	15	--	0.095	0.042	0.025	0.023	0.024	0.095	0.023	0.024	--	--	0.024
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--
Molybdnum	µg/L	100	--	1.78	1.85	1.74	1.63	1.74	2	1.62	2.31	--	--	2.04
Selenium	µg/L	50	--	0.7	0.5	0.2	0.2	0.1	0.1	0.1	0.2	--	--	0.3
Thallium	µg/L	2	--	0.01	0.01	<0.01	<0.01	0.058	<0.01	<0.01	<0.01	--	--	<0.01
Zinc	µg/L	--	--	--	--	--	--	--	--	--	2	214	--	3.7
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	23.5	22.8	26.2	--	22.5
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	1	16.5	--	6.55
Boron	mg/L	--	0.046	0.002	0.011	0.007	0.015	0.002	0.018	0.033	0.034	0.027	--	0.039
Calcium	mg/L	--	(79.5) 62	55.1	52.8	52	60	54.4	59	56	55.9	59.8	--	52.8
Lithium	mg/L	0.04	--	0.003	0.013	0.003	0.009	0.007	0.002	0.005	<0.0002	--	--	0.005
Magnesium	mg/L	--	--	--	--	--	--	--	21.3	20.5	20.7	21.8	--	19.2
Manganese	mg/L	--	--	--	--	--	--	--	--	--	<0.0001	--	--	0.0008
Potassium	mg/L	--	--	--	--	--	--	--	0.6	0.69	0.57	0.61	--	0.58
Sodium	mg/L	--	--	--	--	--	--	--	18.9	16.6	20.6	19.3	--	15.5
Strontium	mg/L	--	--	--	--	--	--	--	0.0604	0.0601	0.58	0.061	--	0.0554
Alkalinity	mg/L	--	--	--	--	--	--	--	202	195	212	210	--	183
Bromide	mg/L	--	--	--	--	--	--	--	<0.02	0.03	0.061	<0.02	--	0.02
Chloride	mg/L	--	(29.6) 16	15	15.1	14.7	14.7	14.4	14.8	15.7	15.9	17.7	18	17.5
Fluoride	mg/L	4	0.689	0.61	0.064	0.62	0.63	0.54	0.58	0.6	0.54	0.6	0.6	0.66
TDS	mg/L	--	(412.7) 313	275	292	285	294	287	298	296	304	300	--	283
Sulfate	mg/L	--	23.6	21.2	21.1	17.4	14.9	15.9	16.5	17.6	18.8	20.1	21.1	18.7
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	--	<0.4
Radium-228	pCi/L	--	--	0.129	0.0598	0.213	0.14	1.71	-0.0315	0.0831	0.989	--	--	--
Radium-226	pCi/L	--	--	0.0309	0.513	0.239	0.344	0.357	0.0305	0.152	0.109	--	--	--
Radium-226/228	pCi/L	5	--	0.1599	0.5728	0.452	0.484	2.067	-0.001	0.2351	1.098	--	--	--
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.2	--	--	0.29
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	5.1	--	--	1
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	18.3	--	--	1
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	<0.0004	<0.0004	0.008	0.017	--	0.005
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	<0.0001	0.0001	0.0029	<0.0002	--	<0.0002

MW-21S

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	11/14/2018	2/12/2019	4/1/2019	5/21/2019
Field Parameters							
Elevation	ft NGVD	--	--	368.42	370.37	371.3	371.43
pH	S.U.	--	5.99 - 9.07	7.34	7.74	7.8	7.59
Specific Conductance	µmhos/cm	--	--	380	318	404	424
Turbidity	NTU	--	--	1.67	2.8	2.45	0.29
Dissolved Oxygen	mg/L	--	--	9.55	7.1	3.89	5.26
Temperature	°C	--	--	14.14	15.2	14.3	15.98
ORP	mV	--	--	165.5	189	21.1	-194.8
Laboratory Parameters							
Antimony	µg/L	6	--	0.02	--	--	<0.02
Arsenic	µg/L	10	--	0.44	--	--	0.44
Barium	µg/L	2000	--	17.8	--	--	15.9
Beryllium	µg/L	4	--	<0.02	--	--	<0.02
Cadmium	µg/L	5	--	0.01	--	--	0.01
Chromium	µg/L	100	--	0.232	--	--	0.287
Cobalt	µg/L	6	--	0.06	--	--	0.02
Copper	µg/L	--	--	0.53	--	--	0.13
Lead	µg/L	15	--	0.07	--	--	0.02
Mercury	µg/L	2	--	--	--	--	<0.002
Molybdnum	µg/L	100	--	2	--	--	2
Selenium	µg/L	50	--	0.3	--	--	0.1
Thallium	µg/L	2	--	<0.1	--	--	<0.1
Zinc	µg/L	--	--	0.8	--	--	<0.7
Silica (Dissolved)	mg/L	--	--	23.2	--	--	21.3
Aluminum	µg/L	--	--	17	--	--	5.26
Boron	mg/L	--	0.046	0.06	<0.02	--	<0.02
Calcium	mg/L	--	(79.5) 62	55	--	--	52.5
Lithium	mg/L	0.04	--	0.03	--	--	<0.009
Magnesium	mg/L	--	--	19.6	--	--	17
Manganese	mg/L	--	--	0.0041	--	--	0.0009
Potassium	mg/L	--	--	0.88	--	--	0.55
Sodium	mg/L	--	--	17.1	--	--	13
Strontium	mg/L	--	--	0.0553	--	--	0.0506
Alkalinity	mg/L	--	--	193	--	--	167
Bromide	mg/L	--	--	<0.04	--	--	<0.04
Chloride	mg/L	--	(29.6) 16	17.9	17.9	17.5	16
Fluoride	mg/L	4	0.689	0.66	--	--	0.65
TDS	mg/L	--	(412.7) 313	278	--	--	258
Sulfate	mg/L	--	23.6	17.0	--	--	14.1
Sulfide	mg/L	--	--	<0.07	--	--	<0.1
Radium-228	pCi/L	--	--	0.0549	--	--	0.366
Radium-226	pCi/L	--	--	0.0246	--	--	-0.0257
Radium-226/228	pCi/L	5	--	0.0795	--	--	0.366
Copper (Dissolved)	µg/L	--	--	0.13	--	--	0.27
Zinc (Dissolved)	µg/L	--	--	<0.7	--	--	<0.7
Aluminum (Dissolved)	µg/L	--	--	2	--	--	5
Iron (Dissolved)	mg/L	--	--	<0.003	--	--	<0.003
Manganese (Dissolved)	mg/L	--	--	<0.0002	--	--	<0.0002

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-21I

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/9/2016	7/19/2016	9/21/2016	11/16/2016	1/11/2017	3/8/2017	5/9/2017	7/19/2017	10/4/2017	6/6/2018	11/13/2018	5/21/2019
Field Parameters															
Elevation	ft NGVD	--	--	369.3	369.19	368.77	368.43	367.68	367.8	368.03	368.24	367	369.44	368.39	371.41
pH	S.U.	--	6.63 - 8.69	7.99	7.56	7.56	7.3	7.35	7.5	8.56	7.44	7.44	7.54	7.69	7.31
Specific Conductance	µmhos/cm	--	--	548	500	488	432	397	520	361	422	399	430	402	403
Turbidity	NTU	--	--	0.73	0.65	1.04	0.97	2.82	2.5	1.34	1.02	3.21	1.71	1.18	0
Dissolved Oxygen	mg/L	--	--	0.5	1.63	1.49	1.88	1.53	0.3	0.55	0.76	0.2	0.17	0.22	0.36
Temperature	°C	--	--	16.88	17.39	16.17	16.95	13.68	15.1	16.39	17.11	15.47	15.55	14.87	16.34
ORP	mV	--	--	-9.2	-185.2	-16.7	105.2	21.1	-3	160.7	2.1	-10.3	-13.4	8.7	67.5
Laboratory Parameters															
Antimony	µg/L	6	--	0.02	0.02	0.02	0.02	0.02	0.03	0.05	0.03	--	0.02	<0.02	<0.02
Arsenic	µg/L	10	--	1.55	1.67	1.55	1.41	1.39	1.08	1.19	1.38	--	0.98	1.63	0.65
Barium	µg/L	2000	--	127	136	121	126	126	123	116	123	--	121	120	106
Beryllium	µg/L	4	--	<0.005	<0.005	<0.005	<0.005	0.01	<0.005	<0.004	<0.004	--	<0.004	<0.02	<0.02
Cadmium	µg/L	5	--	0.02	0.02	0.02	0.04	0.02	0.01	0.01	0.01	--		0.03	0.01
Chromium	µg/L	100	--	0.1	0.2	0.1	0.386	1.04	0.349	0.125	0.143	--	0.061	0.1	0.1
Cobalt	µg/L	6	--	0.514	0.558	0.422	0.524	0.437	0.437	0.412	0.517	--	0.398	0.685	0.275
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.07	0.09	0.11	0.51	0.77
Lead	µg/L	15	--	0.02	0.021	0.046	0.035	<0.004	0.01	0.022	0.033	--	0.026	0.181	0.02
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	<0.002
Molybdnum	µg/L	100	--	4.92	5.25	4.46	4.4	4.63	4.31	4.06	4.18	--	4.69	5.13	5.01
Selenium	µg/L	50	--	<0.03	0.05	0.03	0.09	0.07	0.07	0.05	0.05	--	<0.03	<0.03	<0.03
Thallium	µg/L	2	--	0.03	0.03	0.02	0.02	0.04	0.02	0.03	0.03	--	0.03	<0.1	<0.1
Zinc	µg/L	--	--	--	--	--	--	--	--	--	0.6	0.9	1	11.1	1
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	17.8	18.1	19.7	17.6	17.7	16.6
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	4.55	2.56	3.39	17.2	6.03
Boron	mg/L	--	0.092	0.007	0.012	0.011	0.012	<0.002	0.028	0.027	0.08	0.029	0.034	0.08	<0.02
Calcium	mg/L	--	(979.5) 73	69	64.7	65.1	68.4	59.5	66.5	62.9	60.1	63.9	66.5	61.5	62.4
Lithium	mg/L	0.04	--	<0.0002	0.019	0.004	0.006	0.005	0.007	0.008	0.004	--	0.007	<0.009	<0.009
Magnesium	mg/L	--	--	--	--	--	--	--	20.9	20.1	18.4	20	21.2	19.3	17.5
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.428	--	0.476	0.535	0.371
Potassium	mg/L	--	--	--	--	--	--	--	0.92	1.08	1.26	0.8	0.9	1.21	0.82
Sodium	mg/L	--	--	--	--	--	--	--	16	15.4	13	15	15.5	14.7	13.3
Strontium	mg/L	--	--	--	--	--	--	--	0.0931	0.0922	0.0805	0.0889	0.096	0.0887	0.0829
Alkalinity	mg/L	--	--	--	--	--	--	--	212	222	221	215	230	224	199
Bromide	mg/L	--	--	--	--	--	--	--	0.03	0.05	<0.02	0.04	0.04	<0.04	<0.04
Chloride	mg/L	--	(79.5) 22	21.1	21.7	20.4	20	19.9	19.6	21	20.4	20.5	20.6	20.2	18.1
Fluoride	mg/L	4	0.38	0.33	0.36	0.34	0.34	0.3	0.32	0.34	0.3	0.31	0.38	0.36	0.36
TDS	mg/L	--	(412.7) 359	331	334	305	317	292	275	306	322	306	317	294	278
Sulfate	mg/L	--	50	46.2	47.9	43.2	40.4	41	39.6	42.4	43.6	45.7	44.6	43.4	36
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	<0.4	<0.1	<0.1
Radium-228	pCi/L	--	--	0.126	0.036	0.676	0.0796	1.78	0.281	0.108	0.45	--	--	0.638	0.458
Radium-226	pCi/L	--	--	0.223	1.37	0.305	0.576	0.953	0.601	0.483	0.775	--	--	0.315	0.284
Radium-226/228	pCi/L	5	--	0.349	1.406	0.981	0.6556	2.733	0.882	0.591	1.225	--	--	0.953	0.742
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.09	--	0.11	0.23	0.21
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.7	--	1	1	<0.7
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	1	--	<0.8	<1	4
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	0.019	<0.0004	0.078	0.062	0.024	0.028	<0.003
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	0.37	0.427	0.425	0.441	0.427	0.441	0.346

Table A-1
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

MW-21D

Parameter	Units	GWPS (MCL or RSL)	Appendix III UPL	6/9/2016	7/19/2016	9/21/2016	11/16/2016	1/11/2017	3/8/2017	5/9/2017	7/19/2017	10/4/2017	1/3-11/18	6/6/2018	11/13/2018	5/22/2019
Field Parameters																
Elevation	ft NGVD	--	--	369.44	369.34	368.92	368.59	367.86	368.07	367.86	368.42	367.17	366.66	369.58	368.38	371.4
pH	S.U.	--	6.71 - 8.73	8.14	7.76	7.69	7.47	7.19	7.6	7.44	8.48	7.48	7.03	7.65	7.66	7.47
Specific Conductance	µmhos/cm	--	--	591	544	478	585	441	60	493	531	449	564	470	451	511
Turbidity	NTU	--	--	2.82	0.48	1.93	0.33	3.09	1.9	1.42	0.55	1.01	1.11	2.43	1.87	0.87
Dissolved Oxygen	mg/L	--	--	0.53	0.17	0.49	0	1.82	0.2	0.22	0.47	0.31	18.7	0.18	0.33	1.88
Temperature	°C	--	--	15.24	16.81	15.93	15.25	12.99	15	16.7	17.58	16.26	14.93	15.45	14.15	15.44
ORP	mV	--	--	80.4	26.3	78.1	51.1	141.4	51	40	168.3	21.3	170.4	25.1	23.2	37.3
Laboratory Parameters																
Antimony	µg/L	6	--	0.08	0.08	0.06	0.06	0.07	0.07	0.08	0.12	--	--	0.11	0.07	0.08
Arsenic	µg/L	10	--	1.07	1.06	0.95	0.86	0.99	0.92	0.97	1.04	--	--	0.84	0.89	1.04
Barium	µg/L	2000	--	241	240	226	206	220	220	216	226	--	--	218	201	202
Beryllium	µg/L	4	--	<0.005	<0.005	<0.005	<0.005	0.01	<0.005	<0.004	<0.004	--	--	0.005	<0.02	<0.02
Cadmium	µg/L	5	--	0.02	0.03	0.02	0.03	0.02	0.02	0.04	0.02	--		0.13	0.02	0.03
Chromium	µg/L	100	--	0.2	0.3	0.1	0.05	0.124	0.433	0.165	0.11	--	--	0.091	0.06	<0.04
Cobalt	µg/L	6	--	0.216	0.21	0.195	0.171	0.202	0.182	0.208	0.203	--	--	0.196	0.224	0.234
Copper	µg/L	--	--	--	--	--	--	--	--	--	0.11	2.7	--	1.16	0.16	0.16
Lead	µg/L	15	--	0.107	0.075	0.066	0.056	0.091	0.092	0.118	0.089	--	--	0.229	0.1	0.09
Mercury	µg/L	2	--	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	--	<0.002
Molybdnum	µg/L	100	--	6.31	6.66	6.13	5.33	6.09	5.68	5.07	5.29	--	--	5.17	4.76	5.37
Selenium	µg/L	50	--	0.2	0.2	0.3	0.3	0.2	0.5	0.6	0.5	--	--	0.2	0.05	0.04
Thallium	µg/L	2	--	0.03	0.02	0.03	0.02	0.04	0.02	0.02	0.03	--	--	0.03	<0.1	<0.1
Zinc	µg/L	--	--	--	--	--	--	--	--	--	1	187	--	6.5	1	1
Silica (Dissolved)	mg/L	--	--	--	--	--	--	--	--	17.5	17.6	19.6	--	17.6	17	16.9
Aluminum	µg/L	--	--	--	--	--	--	--	--	--	6.79	14.1	--	17.2	9.86	5
Boron	mg/L	--	0.071	0.022	0.015	0.015	0.013	0.004	0.024	0.107	0.015	0.092	0.088	0.03	0.04	<0.02
Calcium	mg/L	--	(79.5) 83	74.2	60.6	70.4	74.7	67.3	76.2	71.5	70.9	67.8	--	70.7	62.1	69.3
Lithium	mg/L	0.04	--	0.002	0.025	0.005	0.007	0.009	0.005	0.013	0.0005	--	--	0.006	0.01	<0.009
Magnesium	mg/L	--	--	--	--	--	--	--	25	24.3	23.9	22.7	--	23.6	21.3	23.1
Manganese	mg/L	--	--	--	--	--	--	--	--	--	0.592	--	--	0.596	0.634	0.717
Potassium	mg/L	--	--	--	--	--	--	--	2.11	2.41	2.44	3.91	--	1.97	3.95	2.81
Sodium	mg/L	--	--	--	--	--	--	--	18.1	17.2	19.7	20.8	--	15.7	17.7	15.1
Strontium	mg/L	--	--	--	--	--	--	--	0.144	0.142	0.144	0.168	--	0.147	0.191	0.189
Alkalinity	mg/L	--	--	--	--	--	--	--	247	271	277	262	--	268	268	286
Bromide	mg/L	--	--	--	--	--	--	--	<0.05	0.08	0.07	<0.05	--	0.05	0.05	0.04
Chloride	mg/L	--	(29.6) 20	19.2	19.6	18.9	19.1	19.4	18.9	19.9	19.5	18.5	--	19.9	18.8	19.1
Fluoride	mg/L	4	0.407	0.36	0.38	0.36	0.33	0.36	0.33	0.35	0.3	0.32	--	0.4	0.34	0.36
TDS	mg/L	--	(412.7) 365	328	299	315	346	332	304	339	332	339	--	347	314	348
Sulfate	mg/L	--	43.22	39.2	41	35.5	32	34.4	35.1	37.1	36.5	37.4	--	38.4	35.2	36.8
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	<0.4	--	--	<0.4	<0.07	<0.1
Radium-228	pCi/L	--	--	0.441	0.77	0.604	0.688	0.722	0.518	0.0415	0.501	--	--	--	1.47	0.59
Radium-226	pCi/L	--	--	0.126	0.658	0.23	0.39	0.422	0.42	0.408	0.355	--	--	--	0.469	0.669
Radium-226/228	pCi/L	5	--	0.567	1.428	0.834	1.078	1.144	0.938	0.4495	0.856	--	--	--	1.939	1.259
Copper (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	0.39	--	--	0.08	1.33	0.85
Zinc (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2.4	--	--	0.7	3	3
Aluminum (Dissolved)	µg/L	--	--	--	--	--	--	--	--	--	2.16	--	--	2	1	2
Iron (Dissolved)	mg/L	--	--	--	--	--	--	--	<0.0004	<0.0004	0.053	0.016	--	<0.002	0.007	0.005
Manganese (Dissolved)	mg/L	--	--	--	--	--	--	--	0.616	0.625	0.62	0.646	--	0.567	0.657	0.684

Table 4
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

Notes:

- GWPS - Groundwater Protection Standard
- MCL - USEPA Maximum Contaminant Levels
- RSL - USEPA Generic Tables for Residential Tapwater, May 2018, TR=1E-06, THQ=1.0
- Field Parameter Units
  - ft NGVD - Feet, National Geodetic Vertical Datum of 1929 (also known as mean sea level (MSL)
  - °C - degrees Celcius
  - S.U. - Standard Units
  - µmhos/cm - micromhos per centimeter
  - mg/L - milligrams per liter
  - ORP - milliVolts (mV)
  - NTU - Nephelometric Turbidity Units
- Laboratory Parameter Units
  - pCi/L picoCuries per Liter

Table A-2
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

NORTH POND LEACHATE INLET

Parameter	**Units**	**11/26/2018**	**12/18/2018**	**1/8/2019**	**3/20/2019**
Antimony	ug/L	<2.00	<4.00	<4.00	<2.00
Arsenic	ug/L	18	24.8	23.4	30.1
Barium	ug/L	71.1	58	82	65.8
Beryllium	ug/L	<2.00	<4.00	<4.00	<2.00
Cadmium	ug/L	<1.00	<2.00	<2.00	<1.00
Chromium	ug/L	36.6	71.2	82.9	58.4
Cobalt	ug/L	1.24	<2.00	<2.00	1.3
Lead	ug/L	<2.00	<4.00	<4.00	<2.00
Mercury	ug/L	<0.010	<0.010	<0.010	<0.010
Molybdnum	ug/L	1660	1230	1900	1530
Nickel	ug/L	53	11	11.1	8.97
Selenium	ug/L	490	586	653	630
Silver	ug/L	<2.00	<4.00	<4.00	<2.00
Thallium	ug/L	<10.0	<20.0	<20.0	<10.0
Zinc	ug/L	<100	<200	<200	<100
Aluminum	ug/L	4770	7280	6080	5950
Boron	mg/L	9.18	12.3	10.6	9.23
Calcium	mg/L	277	277	368	283
Iron	mg/L	0.104	<0.20	<0.200	<0.20
Lithium	mg/L	<0.030	<0.30	<0.300	<0.30
Magnesium	mg/L	3.62	4.43	4.9	3.55
Manganese	mg/L	0.009	0.0104	0.0115	0.0113
Potassium	mg/L	132	113	135	116
Sodium	mg/L	5730	6440	6780	6540
Alkalinity	mg/L	244	257	250	219
Chloride	mg/L	982	847	993	854
Fluoride	mg/L	<1.50	<1.50	<1.50	<1.50
Nitrate	mg/L	3	3.26	3.64	2.85
TDS	mg/L	25,600	24,300	28,400	23,600
Sulfate	mg/L	16,600	14,400	17,400	14,800

Table A-2
Summary of Analytical Data
CCR Landfill
Rockport Plant, Rockport, Indiana

WEST POND LEACHATE INLET

Parameter	**Units**	**10/31/2018**	**11/26/2018**	**12/18/2018**	**1/8/2019**	**3/20/2019**
Antimony	ug/L	< 4.00	<2.00	<4.00	<4.00	<2.00
Arsenic	ug/L	23	30.4	39.3	46.8	84.8
Barium	ug/L	71.2	71	60.8	72.2	71.1
Beryllium	ug/L	< 4.00	<2.00	<4.00	<4.00	<2.00
Cadmium	ug/L	< 2.00	<1.00	<2.00	<2.00	<1.00
Chromium	ug/L	28.1	57.2	127	72.5	124
Cobalt	ug/L	< 2.0	<1.00	<2.00	<2.00	<1.00
Lead	ug/L	<4.00	<2.00	<4.00	<4.00	<2.00
Mercury	ug/L	<0.010	<0.010	<0.010	0.011	<0.010
Molybdnum	ug/L	2390	2820	2360	3040	3000
Nickel	ug/L	6.94	8.1	8.15	11.3	7.25
Selenium	ug/L	752	943	1000	1190	1310
Silver	ug/L	<4.00	<2.00	<4.00	<4.00	<2.00
Thallium	ug/L	<20.0	<10.0	<20.0	<20.0	<10.0
Zinc	ug/L	<200	<100	<200	<200	<100
Aluminum	ug/L	4410	5690	8110	6220	9850
Boron	mg/L	12.2	10.6	11	11.4	11.5
Calcium	mg/L	284	214	166	240	231
Iron	mg/L	<0.020	<0.020	<0.200	<0.200	<0.200
Lithium	mg/L	0.053	0.031	<0.300	<0.300	<0.300
Magnesium	mg/L	3.16	4.69	8.33	6.98	2.22
Manganese	mg/L	0.0086	0.0064	<0.010	<0.010	0.0129
Potassium	mg/L	182	165	113	149	192
Sodium	mg/L	5390	5220	6120	6780	8240
Alkalinity	mg/L	244	261	310	298	411
Chloride	mg/L	1190	1180	937	1250	1170
Fluoride	mg/L	<1.5	<1.50	<1.50	<1.50	<1.50
Nitrate	mg/L	5.46	5.72	5.76	6.76	7.99
TDS	mg/L	29,400	30,700	22,100	29,600	30,900
Sulfate	mg/L	18,900	18,100	14,100	18,100	19,000

Appendix B
Full Size Geochemical Exhibits

Exhibit 3-3. CCR monitoring well and landfill leachate ponds boron concentrations.

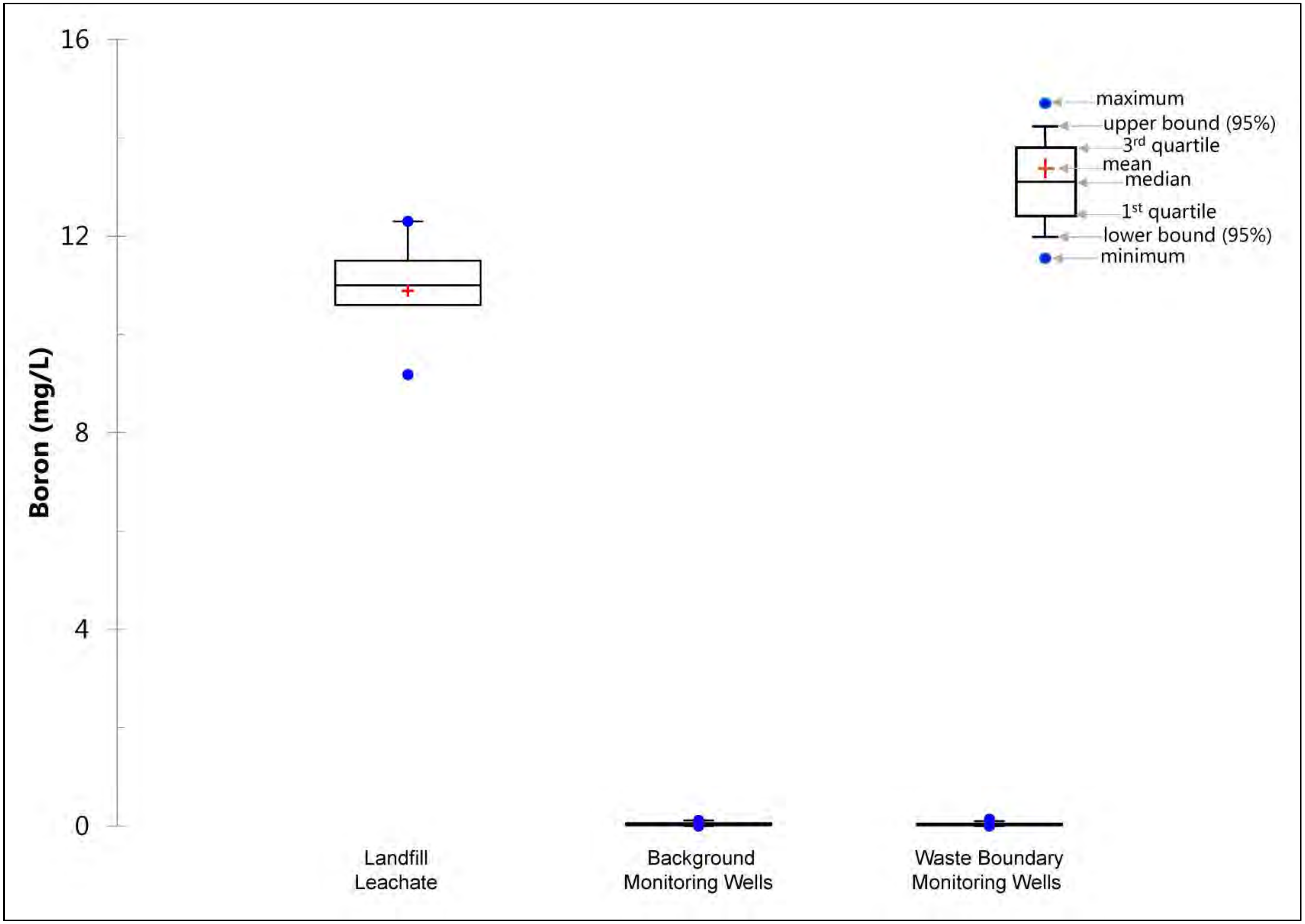


Exhibit 3-4. **CCR monitoring well and landfill leachate ponds sulfate concentrations.**

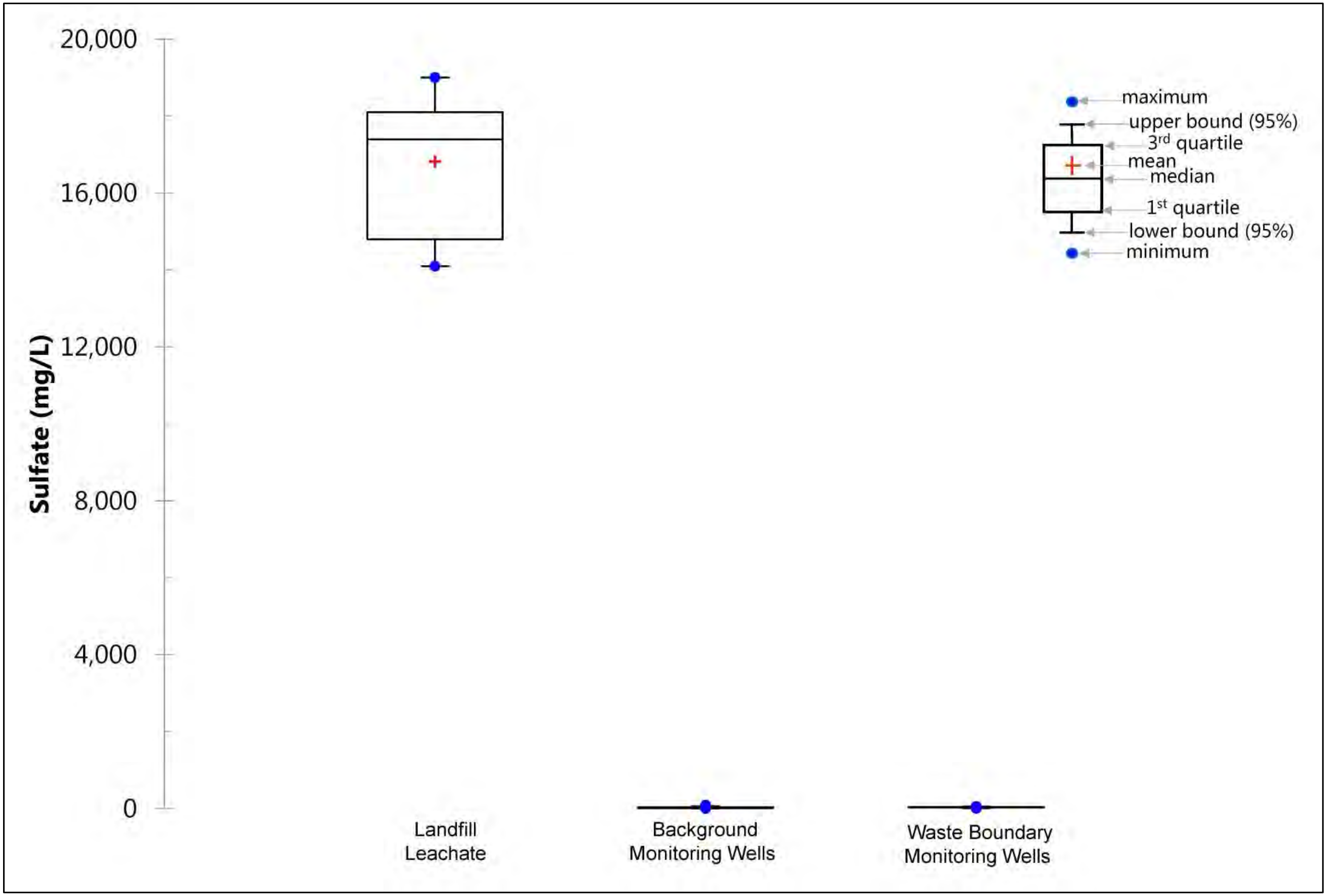


Exhibit 3-5. Boron to chloride ratio versus chloride concentration for CCR Landfill groundwater monitoring wells and leachate for comparison.

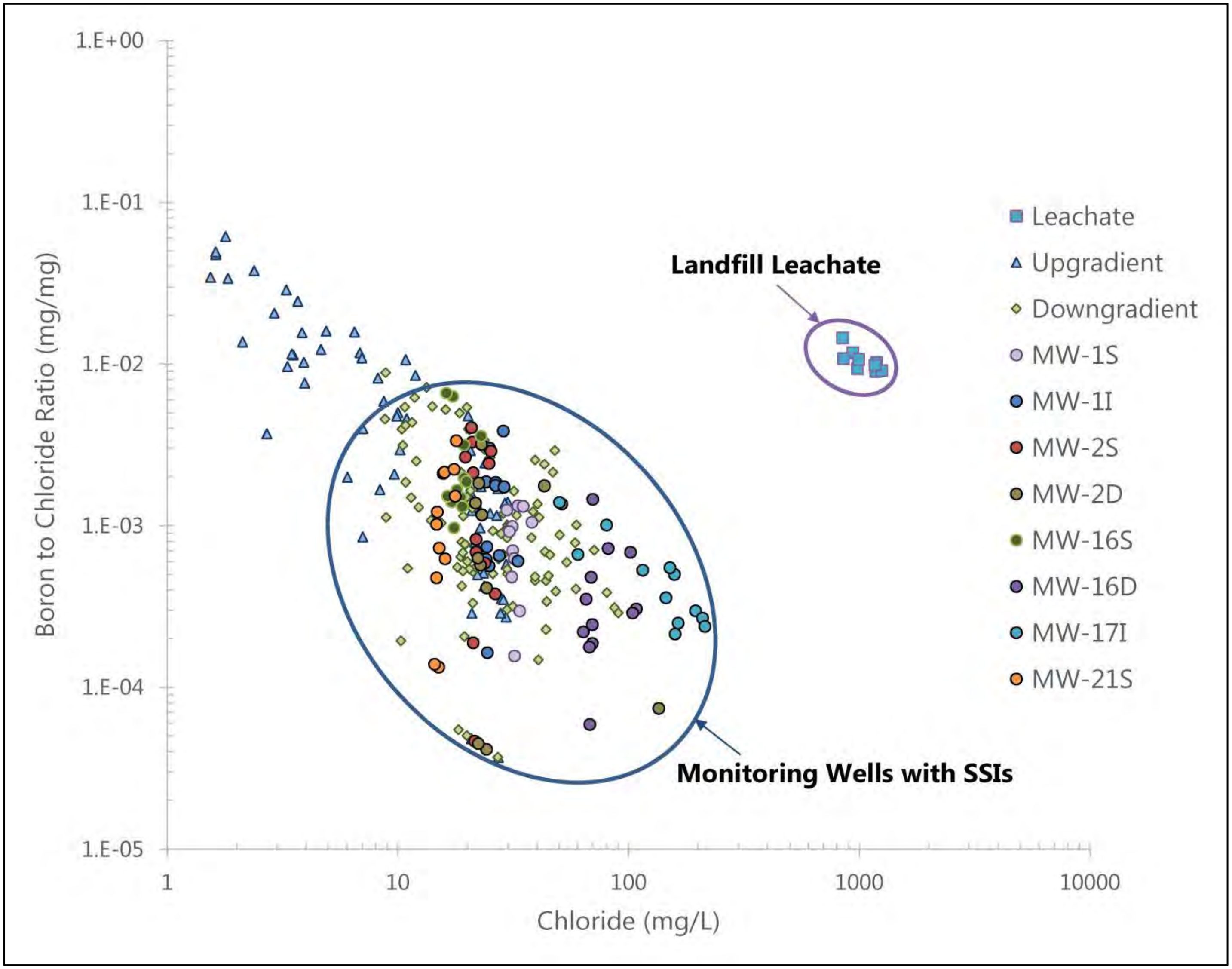


Exhibit 3-6. **Sulfate to chloride ratio versus chloride concentration for CCR Landfill groundwater monitoring wells and leachate for comparison.**

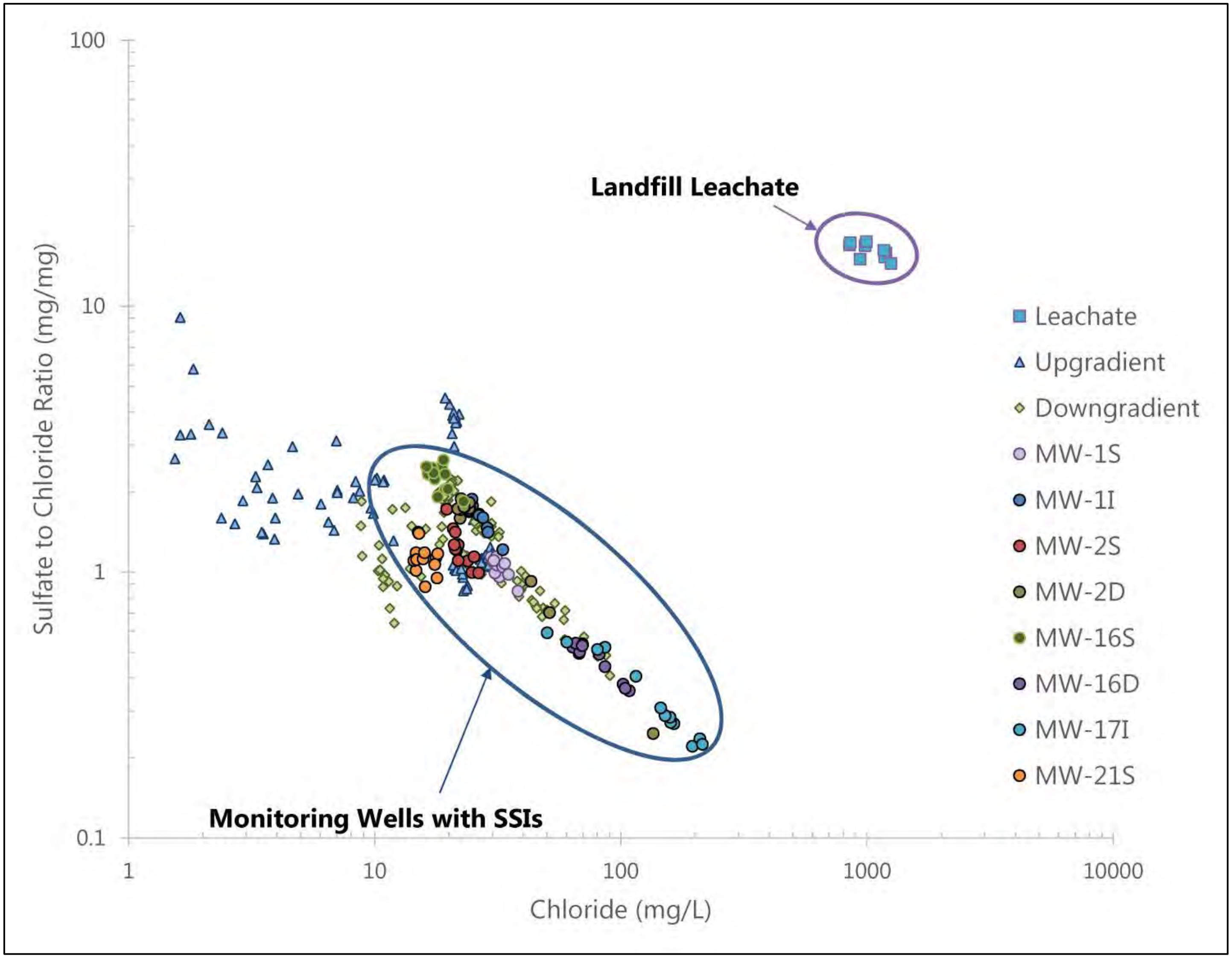


Exhibit 3-7. Piper diagram of major ion water quality for CCR Landfill monitoring wells with SSIs and leachate for comparison.

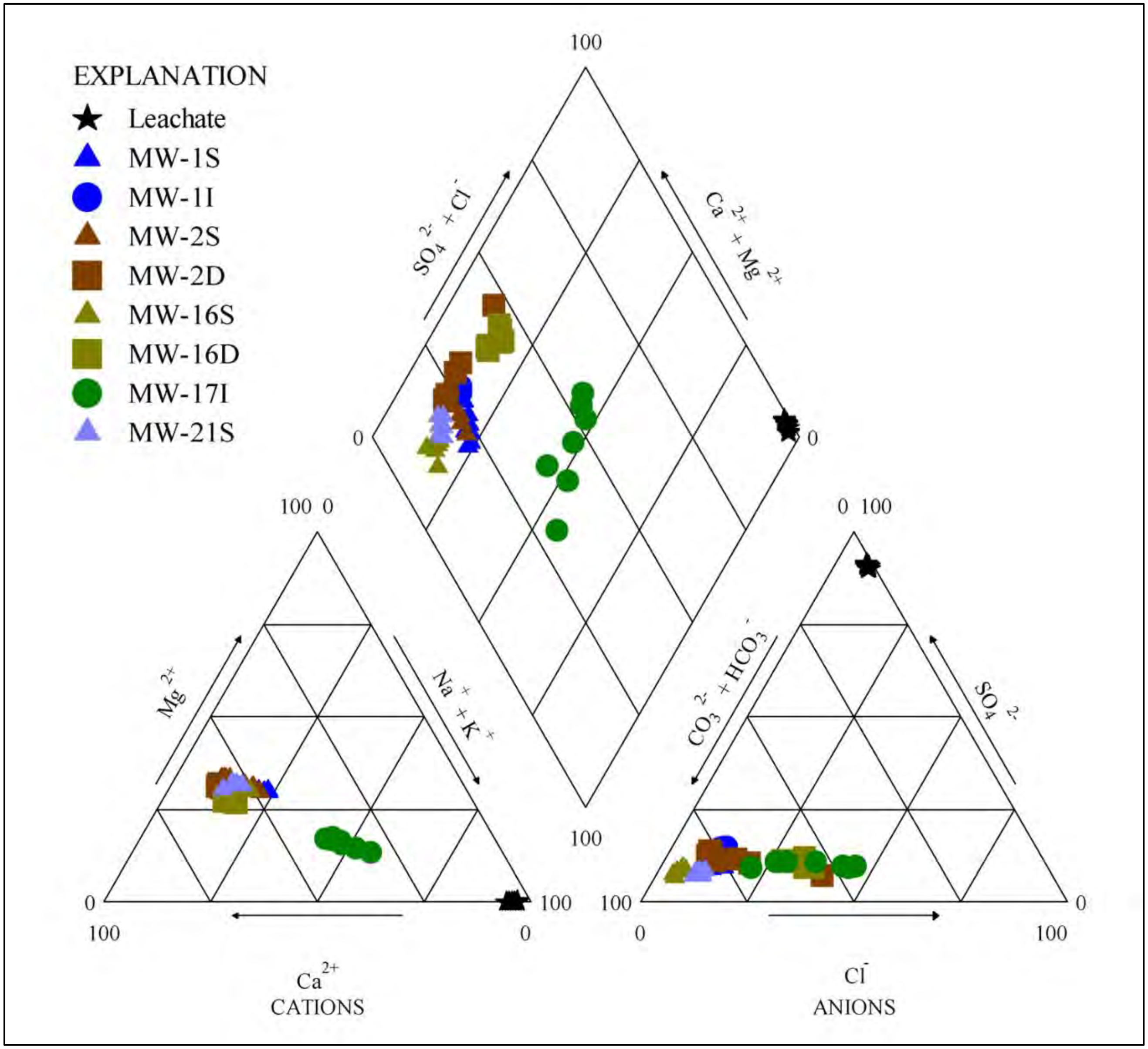


Exhibit 3-8. **Boron isotope ratio (・11B) versus boron concentration for CCR Landfill leachate and monitoring wells for comparison.**

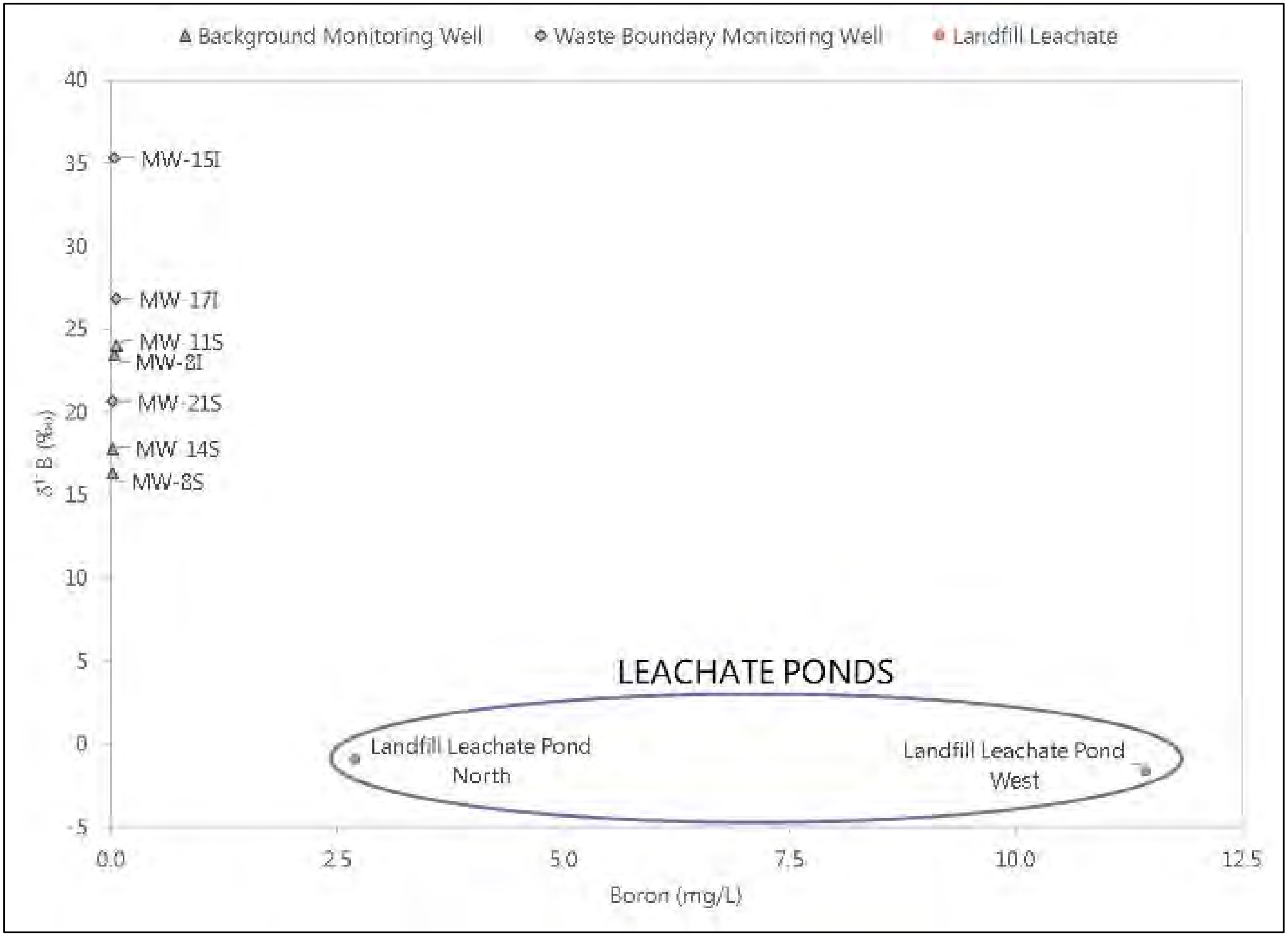


Exhibit 3-9. **Strontium isotope ratio ($^{87}Sr/^{86}Sr$) versus strontium concentration for CCR Landfill leachate and monitoring wells for comparison.**

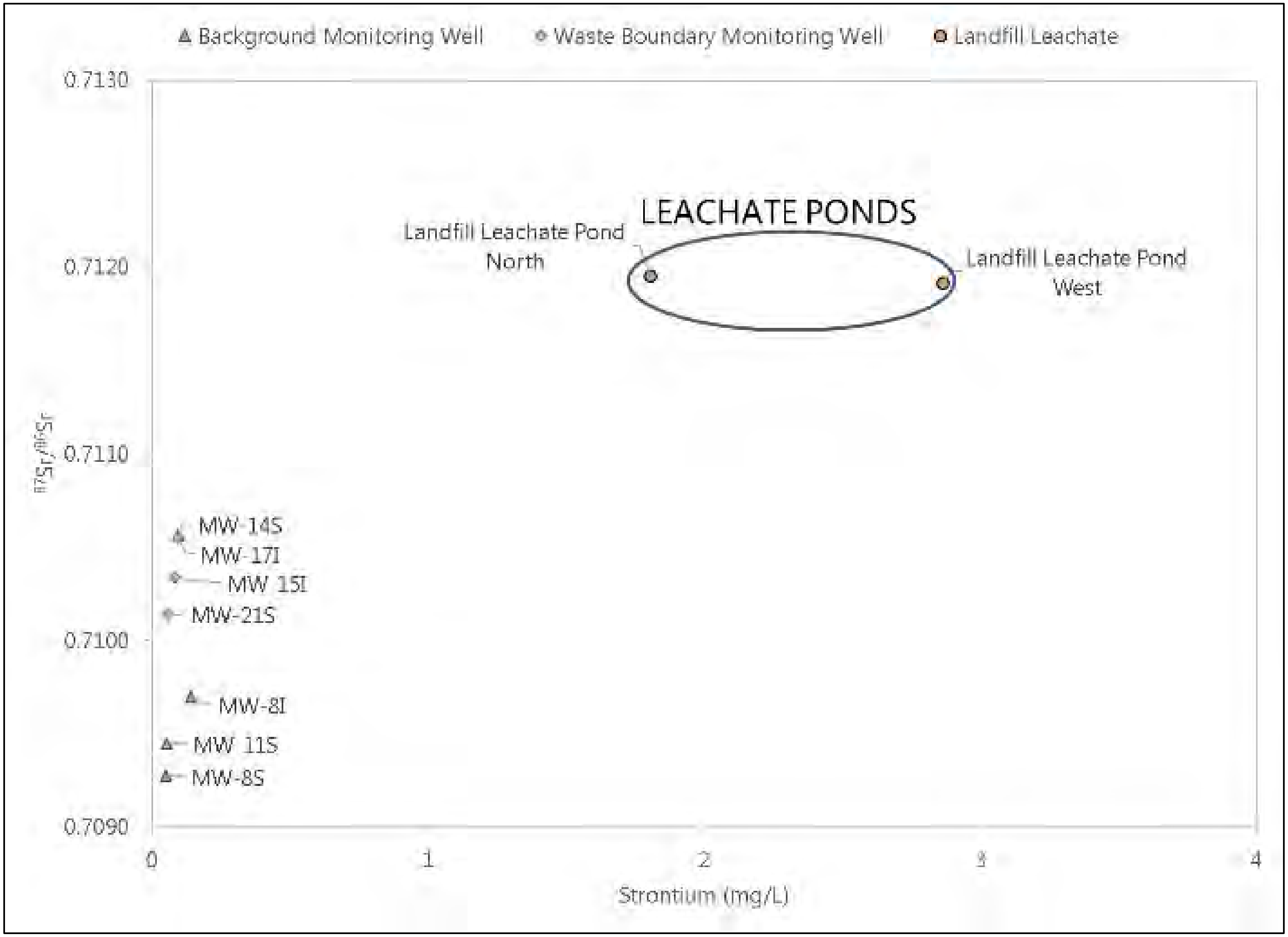


Exhibit 3-7. Piper diagram of major ion water quality for CCR Landfill monitoring wells with SSIs and leachate for comparison.

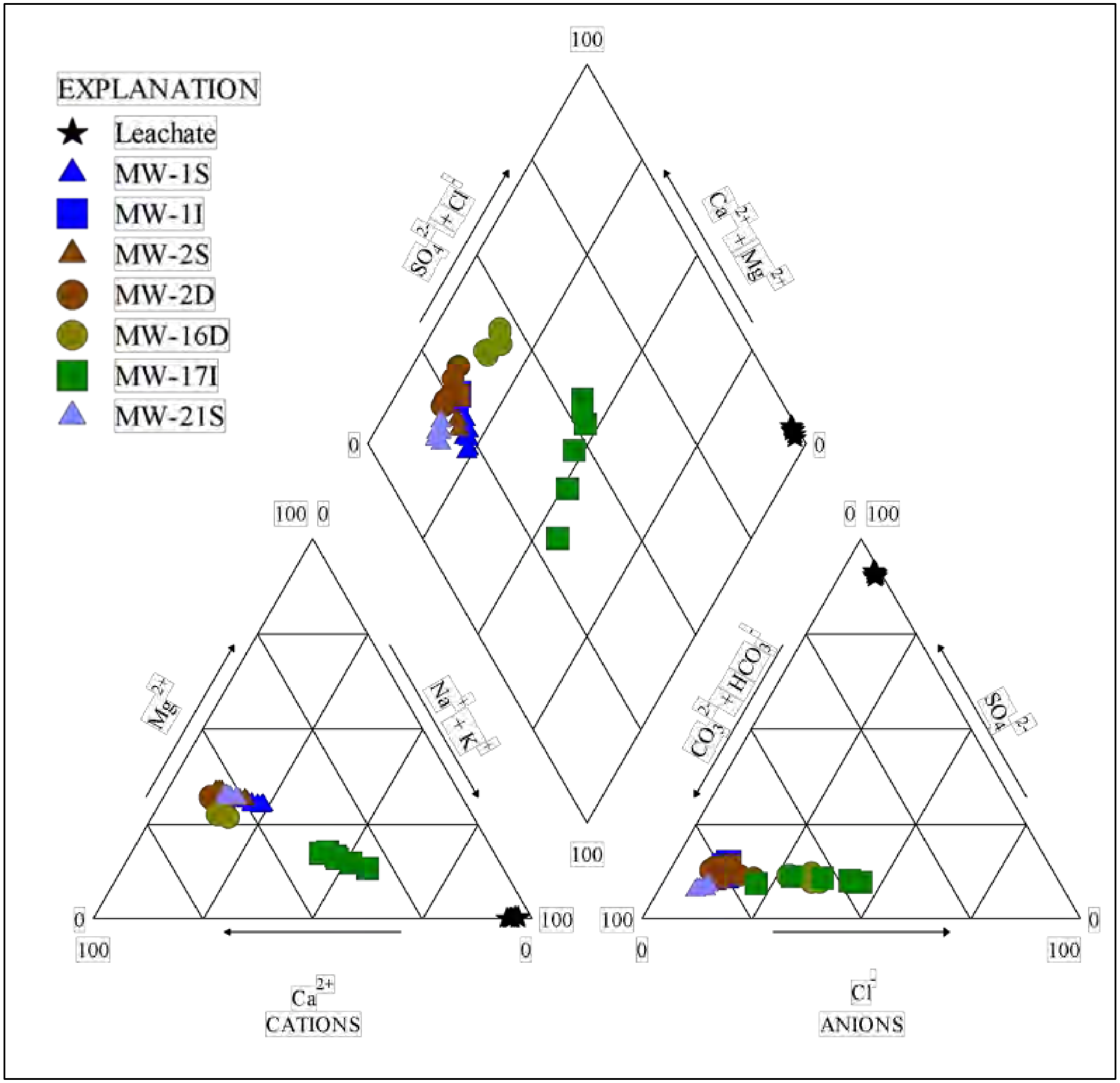


Exhibit 3-8. **Boron isotope ratio (・11B) versus boron concentration for CCR Landfill leachate and monitoring wells for comparison.**

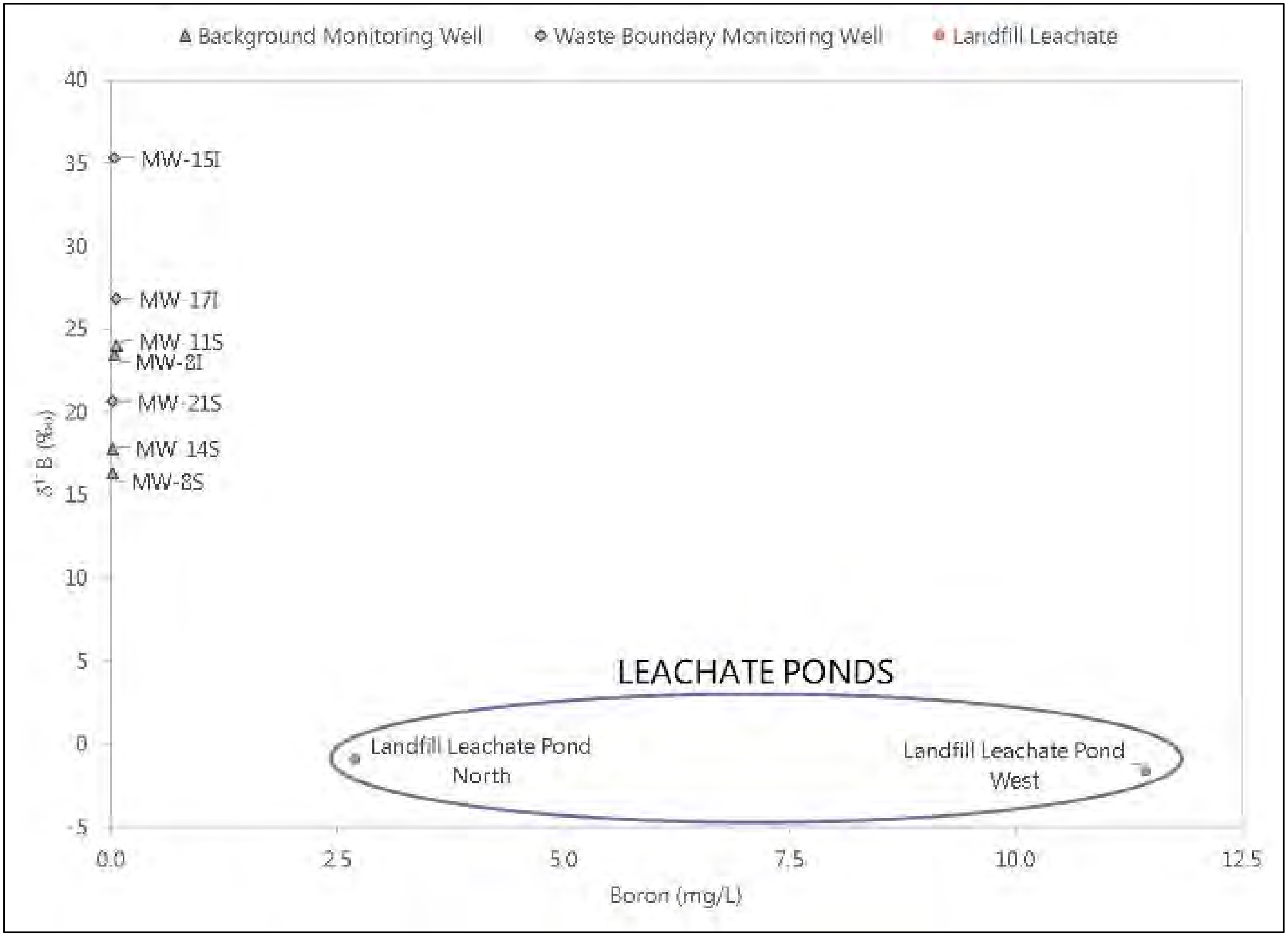
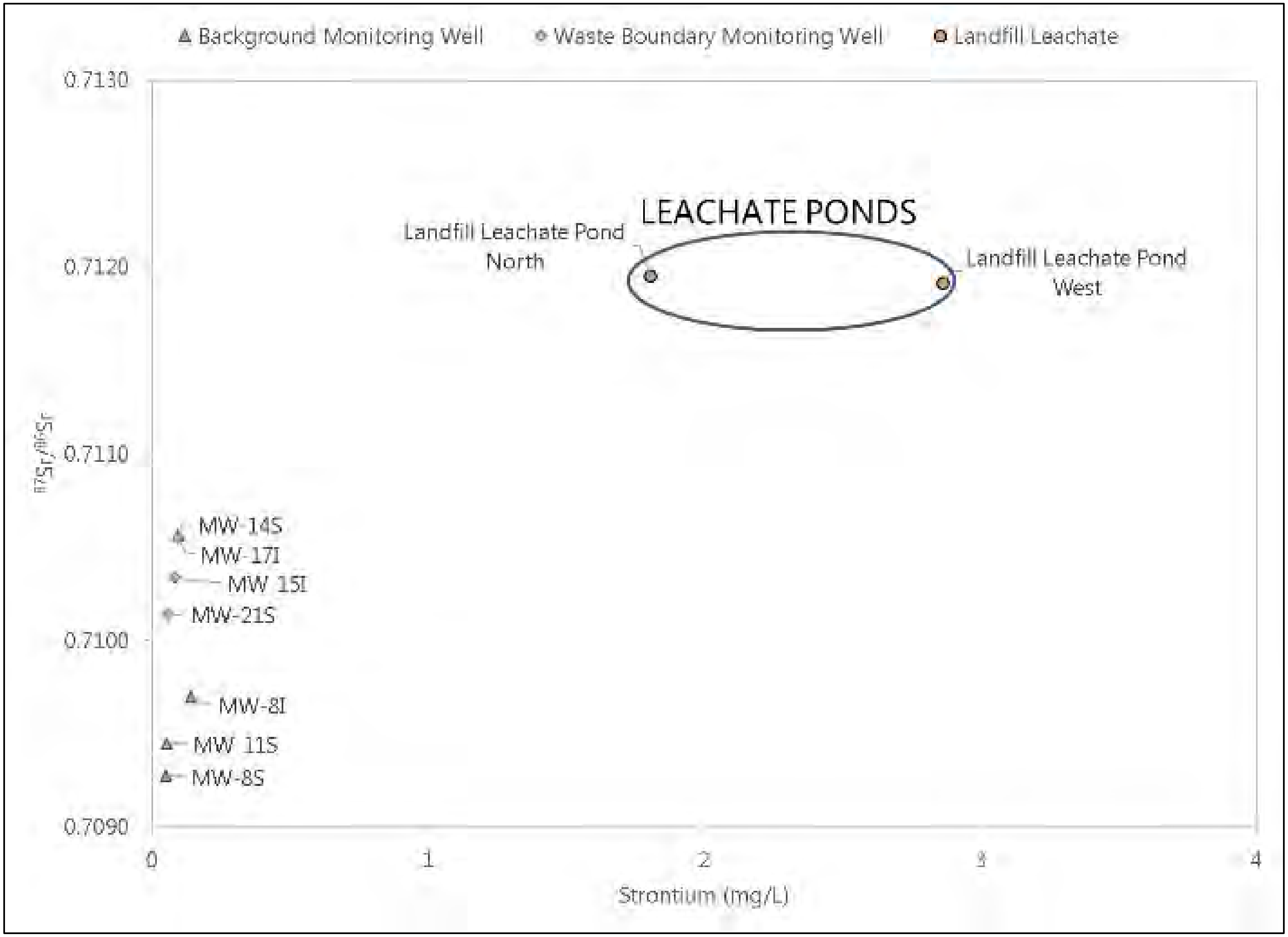


Exhibit 3-9. **Strontium isotope ratio ($^{87}Sr/^{86}Sr$) versus strontium concentration for CCR Landfill leachate and monitoring wells for comparison.**



Appendix G

Structural stability assessment required at § 257.73(d)

for

Rockport Plant's

Bottom Ash Pond Complex

SEISMIC IMPACT ZONES DEMONSTRATION

CFR 257.63

Bottom Ash Complex

Rockport Plant
Town of Rockport, Spencer County, Indiana

January, 2018

Prepared for: INDIANA MICHIGAN POWER COMPANY - Rockport Plant
Town of Rockport, Spencer County, Indiana

Prepared by: Geotechnical Engineering Services
American Electric Power Service Corporation
1 Riverside Plaza
Columbus, OH 43215

GERS-18-004

Seismic Impact Zone Demonstration
CFR 257.63
Bottom Ash Complex
Rockport Plant

GERS-18-004

PREPARED BY ______ **DATE** 1/25/2018
Mohammad A. Ajlouni, Ph.D.,P.E.

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Brett A. Dreger, P.E.

APPROVED BY Gary F. Zych **DATE** 2/13/2018
Gary F. Zych, P.E.
Manager – AEP Geotechnical Engineering

MOHAMMAD A. AJLOUNI
REGISTERED
No. 10809354
STATE OF INDIANA
PROFESSIONAL ENGINEER

I certify to the best of my knowledge, information, and belief that the information contained in this seismic impact zones demonstration meets the requirements of 40 CFR § 257.63

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APPENDIX C :LiquefyPro Analysis Input and Output
APPENDIX D : Structural Calculation SES-CALC-02391

1 OBJECTIVE

This report was prepared by AEP- Geotechnical Engineering Services (GES) section to fulfill requirements of the new Promulgated CCR Rule CFR § 257.63. Per the New Promulgated CCR Rule, New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in seismic impact zones unless the owner or operator demonstrates by the dates specified in paragraph (c) of the referenced section that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

This report will evaluate whether the Bottom Ash Ponds (BAP) Complex at Rockport Plant is located in seismic impact zones, and if so, the report will demonstrate that the all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site

2 DESCRIPTION OF THE PLANT AND THE CCR IMPOUNDMENT

The Rockport Power Plant is located at 791 N US Highway 231, Rockport, IN 47635-8883. The coordinates of the site are 37º55’32” N latitude and 87º02’02” W longitude. A Site Location Map is included as Figure 1. The plant operates two coal fired generating units rated at 1,300 megawatts (MW) each.

Unit 1 and Unit 2 were placed in service in 1984, and 1989, respectively. A Facility Layout Plan is included as Figure 2. Coal Combustion Waste (CCW) that is produced during power generation is managed on-site with a CCW impoundment.
The facility utilizes six contiguous and hydraulically connected impoundments or cells (see Figure 2) known as the BAP Complex for CCW management. The cells are separated by internal divider dikes. The individual cells of the BAC are identified as follows:

- East Bottom Ash Pond
- West Bottom Ash Pond
- East Wastewater Pond
- West Wastewater Pond
- Reclaim Pond
- Clear Water Pond

The wastewater pond complex is a combination incised and diked earthen embankment impoundment. It is incised below grade along most of its perimeter, and is diked only on the west side of the West BA Pond, where the topography decreases in elevation toward a remnant drainage channel.

The embankments, including the west dike, have a crest elevation of 399 feet, and are approximately 30 feet wide. The west dike has a maximum height (from crest to outboard toe) of 13 feet. The inboard slope was constructed at a slope of 2 horizontal to 1 vertical (2H:1V), and the outboard slope at 2.5H:1V. The outer west dike, and the internal splitter dikes (constructed between the BA Ponds, and between each of the BA Ponds and the wastewater ponds to the south) were constructed of natural clayey soils excavated from the interior of the ponds. The inboard slopes were armored with rock riprap. Reportedly, no engineered liner systems are present in the BA Ponds or the other ponds in the wastewater pond complex.

Based on the usage of the above mentioned ponds, only the East Bottom Ash Pond and the West Bottom Ash Pond are considered CCR units. These two ponds the subjects of this demonstration report.

3 SEISMIC IMPACT ZONE DETERMINATION 257.63(a)

Per the CCR Rules Definition, a seismic impact zone means an area having a two (2%) or greater probability that the maximum expected horizontal acceleration, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10 g in 50 years.

The first step toward achieving compliance with this requirement is to identify whether the impoundment site lies within a seismic impact zone as defined above.

The determination of whether Rockport Plant area falls in a seismic impact zone and the level of the seismic acceleration is based on two approaches, the USGS web site as well as a site specific seismic analysis conducted for the plant area.

3.1 USGS MAP/WEB SITE DETERMINATION

The U.S. Geological Survey (USGS) National Seismic Hazard Mapping Program (NSHMP) Interactive Deaggregation website was used to provide the design ground acceleration relating to the design seismic event. For a 2,475-year return period (2% exceedance probability in 50 years), the website output indicates a PGA of 0.14957 g for the hard rock site (Based on URS Report recommendations, APPENDIX A). The corresponding earthquake magnitude (M) was 6.46.

3.2 SITE SPECIFIC SEISMIC ANALYSIS

URS Company (URS), Currently AECOM, performed a site-specific seismic hazard analysis for the Rockport power plant site in Indiana. The objective of the study was to compute the design earthquake response spectrum for the site per the requirements in Chapter 21 of the ASCE 7-05 standard, which is incorporated by reference in the 2006 International Building Code (IBC).

The study also meets the requirements of the Indiana State Building Code, which amends certain sections of the IBC.

The site-specific PGA computed in URS study for a 2,475-year return period is 0.13 g, very comparable to the USGS mapped value. Excerpts of the URS (AECOM) study are included in APPENDIX A.

Based on the results of the two approaches, the design seismic acceleration of the facility is to be taken as 0.14957 g. Therefore, the BAP complex falls in a seismic impact zone and the analysis of this report will attempt to demonstrate that the Structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the 0.14957 g, maximum horizontal acceleration in lithified earth material.

4 DESCRIPTION OF THE FOUNDATION AND EMBANKEMENT MATERIALS 275.73(c)(1)(v)

[A description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is located.]

The description of the BAP Complex embankment and foundations soils were based on the 2016 site investigation and laboratory testing conducted by AEP Civil Engineering Laboratory.

4.1 SITE INVESTIGATION

AEP Civil Engineering Drilling crew conducted a soil site investigation of which two (2) soil test boring series (B-1605 and B-1606) that were drilled through the embankment and the foundation soils (See Figure 2), were selected for this demonstration. Representative but disturbed soil samples were collected in jars/bags and transferred to AEP Civil Engineering Laboratory for classification and testing. The Standard Penetration Resistances ($N1_{60}$-values) varied between a low of 2 to a high of 100 (refusal) blows per foot (bpf) with an average $N1_{60}$-values of 35 bpf.

The soils within the embankment were lean clay extending below the embankment with a total depth of 27-30 ft. The clay layer was underlain by fine to coarse sand deposits. Figure 4 present the soil profile interpreted from the two borings. Bedrock at the plant site is at approximate elevation of 290 ft-msl and comprised of predominantly shale.

Soil Samples from the borings at various depths were tested at AEP Civil Engineering Laboratory for the following tests:

- Moisture Content (ASTM 2216)
- Grain Size Analyses (ASTM D 422)
- Atterberg Limits (ASTM D 4318

Based on the lab soil tests results, the tested soils are non-plastic silty sand with fine content ranging from 14.5 to 28.6% with minor pockets of sandy lean clay. Laboratory test reports are included in APPENDIX B. Soil classification, index properties, and shear strength values obtained from subsurface soil investigation and laboratory tests are summarized in Table 1 below.

Table 1 Soil Properties Obtained in 2016 Investigation Laboratory Testing

Soil Boring ID	Sample Depth (ft)	USCS Classification	Fine Content (%)	Moisture Content (%)	Atterberg Limits		
					LL	PL	PI
MW-1605D	115.0-124.6ft	POORLY GRADED SAND SP	14.5	5.4	NP	NP	NP
MW-1605I	68.6-78.2ft	POORLY GRADED SAND SP	19.7	2.5	NP	NP	NP
MW-1605S	37.6-47.2ft	POORLY GRADED SAND SP	16	2.1	NP	NP	NP
MW-1606D	100.0-109.6ft	POORLY GRADED SAND SP	28.6	7.3	NP	NP	NP
MW-1606I	65.7-75.3ft	POORLY GRADED SAND SP	18.9	5.4	NP	NP	NP
MW-1606S	34.7-44.3ft	POORLY GRADED SAND SP	20.9	1.7	NP	NP	NP

APPENDIX B includes the boring logs for relevant boring 1605 and 1606 as well as the corresponding lab tests.

5 MODES OF FAILURE AND STABILITY DEMONSTRATION

Based on § 257.63 (a) part of the Rules, only East and West bottom Ash Ponds are required to be covered under this demonstration. Seismic impact zones' Structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

5.1 FAULTS

Based on the geological survey of the Pond Complex area, there is no fault exists in the locality under the ponds dikes. This mode of failure is considered not applicable for the bottom ash pond complex.

Based on published data no active faults are known to traverse the site and no surficial evidence of faulting was observed during various field investigation conducted at the site. Figure 5 and Figure 6 present the nearest mapped fault trace considered to be active is one of a group of faults located approximately 5 miles west of the site.

5.2 LIQUEFACTION POTENTIAL

Liquefaction is a condition where seismic ground motions cause excessive pore pressures in soils that result in a loss in shear strength. Liquefaction can cause slope instability and/or settlement. Liquefaction is most likely to occur for (1) loose sands/silts, (2) shallow groundwater conditions, and (3) strong ground motions.

Liquefaction potential analysis was performed using LiquefyPro program developed by CivilTech Software Company. The program evaluates liquefaction potential and calculates the settlement of soil deposits due to seismic loads.

LiquefyPro program is based on the most recent publications of the NCEER Workshop and SP117 Implementation. The user can choose between several different methods for liquefaction evaluation: one method for SPT and four methods for CPT data. Each method has different options that can be changed by the user. The options include Fines Correction, Hammer Type for SPT test, and Average Grain Size (D_{50}) for CPT.

The liquefaction analysis used the standard penetration (SPT) N-values recoded on the logs for the existing testing boring and monitoring wells MW-1605 and 1606. The liquefaction analysis has been performed for $N1_{60}$-values recorded in the upper 100 feet although the “RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities” (U.S.EPA, 1995) states that liquefaction is generally not likely to occur more than 50 feet below the ground surface. At the BAP Complex, groundwater is at 27 to 30 feet below the ground surface.

The results of the liquefaction analysis are summarized in Table 2 and Figure 7 and Figure 8. The detail of the analysis is included in APPENDIX C. The analysis shows that liquefaction is unlikely for the embankment and the foundations soils during the assumed PGA.

Table 2 Summary of Supplemental Liquefaction Potential Results

Section	Minimum Factor of Safety	Required Minimum Factor of Safety	Notes
B-1605	>1.2	1.20	None
B-1606	>1.2	1.20	None

5.3 SEISMIC INDUCED PERMANENT DISPLACEMENT

The computer program LiquefyPro developed by developed by CivilTech Software Company was used to predict the likely magnitude of seismically-induced permanent displacements. LiquefyPro performs numerical double integration of the HEA values that are in excess of the yield acceleration values.

LiquefyPro divides the soil deposit into very thin layers and calculates the settlement for each layer. The calculations are divided into two parts, dry soil settlement and saturated soil settlement. The soil above the groundwater table is referred to as dry soil and soil below the groundwater table is referred to as saturated soil. The total settlement at a certain depth is the sum of the settlements of the saturated and dry soil. The total settlement is presented in the graphical report as a cumulative settlement curve versus depth. LiquefyPro gives settlement in both liquefied and non-liquefied zones.

The results of the permanent displacement analyses using LiquefyPro are presented graphically in Figure 7 and Figure 8. The figures indicate that the seismic induced permanent displacement are very small and range from 0 to 0.01 feet (0 to 0.12 inches).

5.4 SEISMIC SLOPE STABILITY

As a part of the factor of Structural integrity criteria assessment part of the CCR Rule (CFR §257.7 e), Terracon Inc. conducted seismic slope stability analysis in 2016 for the worst section of the bottom ash pond which is the outer dike. Factor of safety of 1.21 and 2.14 were calculated for worst case section shown in Figure 9 Figure 10 for the upstream slopes and downstream slopes, respectively. The figures show the geometry of the worst case section along with their material properties for the various soil layers, the projected slip failure, and the resulting factor of safety.

5.5 OVER TOPPING OF CREST

The west bottom ash pond is comprised of diked embankment to the west and between its respective waste water pond and adjacent east bottom ash pond that directs storm water away from the impoundment and limits runoff to that which falls directly onto the water surface. The land area to the north is an open field area that is not graded toward the Bottom Ash Complex. The east bottom ash pond has a small 13 acre catchment area that will drain into the pond. Flow into the west bottom ash pond was modeled as the pumped influent from the plant (77 ac-ft) and from the storm event (48 ac-ft) and discharged through the pond complex to the Ohio River.

The Bottom Ash Pond Complex has been determined to be a Low Hazard potential CCR impoundment. Based on this hazard classification, the design flood as determined by section 257.82(a)(3) to be the 100 year storm event that would incur 7.23 inches of precipitation in a 24 hour period. Terracon, 2015 conducted hydraulic and hydrogeologic study in which the site was modeled, however, using a greater storm (1,000-year: 10.3 inches of precipitation in 24 hrs) event to provide a more conservative analysis.

The following table provides the maximum inflows, outflows and flood elevations for the west bottom ash pond.

West Bottom Ash Pond*	
Storm Event	1000 yr.
Peak Inflow	470 cfs
Peak Outflow	35 cfs
Maximum Pool Elevation	395 ft.
Crest Elevation	399 ft.

*Reference: Terracon 2015,"Hydrologic and Hydraulic Analysis Report, Rockport Plant Bottom Ash Pond Complex, Rockport Indiana", Terracon Project No. N4155126

It can be concluded from the above results that the Bottom Ash Pond Complex has adequate hydrologic and hydraulic capacity to collect and control the peak discharge resulting from the 1000-year inflow design flood and therefore the overtopping of the crest is not anticipated.

5.6 LINER

The Ponds are CCR surface impoundments that are not equipped with a liner; therefore, this demonstration is not applicable.

5.7 LEACHATE COLLECTION AND REMOVAL SYSTEMS

The Ponds are CCR surface impoundments that are not equipped with a leachate collection and removal systems; therefore, this demonstration is not applicable.

5.8 SURFACE WATER CONTROL SYSTEMS

The surface water control structures were constructed in the late 70s and early 80s for the 2-unit operating plant with a total capacity of approximately 2,600 MW. The structures reviewed in this demonstration are all surface water control units facilitating water flow into and from the bottom ash ponds to the clear water ponds.

The components included in the demonstration can be classified into two groups:

- Group 1: components subjected to lateral loading due to the quakes used for transferring water from bottom ash ponds to waste water ponds including units used to dewater the BA ponds. The components are:
  1. Energy Dissipater structure (EDS - 2 nos.) - approximately 8 plant pipes of 8 - 10 inch diameter pipes discharging into this structure and then transported into the BA pond through the Energy Dissipater troughs/Pond Discharge Inlet Chutes. EDSs are of concrete with steel dissipation flaps.
  2. Energy Dissipater troughs/Pond Discharge Inlet Chutes (EDT)- These are concrete structures partially open at the top and partially covered by yellow steel boxes called Discharge Chute Covers.
  3. Skimmers (SKM)- Timber structures surrounding the waste water discharge chute.
  4. Waste water Discharge shaft (WWDS)- a steel and concrete prismoidal structure for routing waste water into the waste water discharge pipe.

- Group 2: Waste Water Discharge Pipe (WWDP)- Two buried 48 inch (one fiberglass and the other HDPE) pipes that transfer water under the dikes. Because they are buried they are affected by seismic waves and ground displacements.

Details of the analysis and are included in APPENDIX D. Appendix D contains the relevant calculations for the structures with the assumption that the dike stability against any seismic failure including liquefaction can be concluded. With this calculation results, the dike has been found stable. Therefore, the assumption is no more a restraint to use this calculation. The conclusion of the presented analysis indicated that

1. Based on a typical configuration, the seismic analyses of the structures are judged to meet local seismic requirements.

6 SUMMARY AND CONCLUSIONS

The Bottom Ash Pond Complex is a surface impoundment for storing CCR. The Bottom Ash Ponds within the complex are used for primary settling and storage of bottom ash. The Bottom Ash Pond Complex is located in an area having a two (2%) or greater probability that the maximum expected horizontal acceleration, expressed as a percentage of the earth's gravitational pull (g) of 0.1487 g in 50 years, which is in excess of the 0.10 g maximum horizontal acceleration in lithified earth material. Therefore, a demonstration that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site was conducted per the requirements of CFR§257.63 – Seismic Impact Zones.

Based on the analysis conducted in this report, all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration and the Bottom Ash Pond Complex meets the requirements of §257.63 – Seismic Impact Zones.

7 REFERENCES

USEPA, 2015. 40 CFR Parts 257 and 261, Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule. April 17, 2015. 201 pp.

Site-Specific Seismic hazard analysis for AEP power plant site, Rockport, Indiana URS corporation (currently AECOM) (2012).

Terracon 2015,"Hydrologic and Hydraulic Analysis Report, Rockport Plant Bottom Ash Pond Complex, Rockport Indiana", Terracon Project No. N4155126

Terracon, 2016. Geotechnical Engineering Report, AEP Rockport Bottom Ash Complex Professional Engineering Certification.

Figures

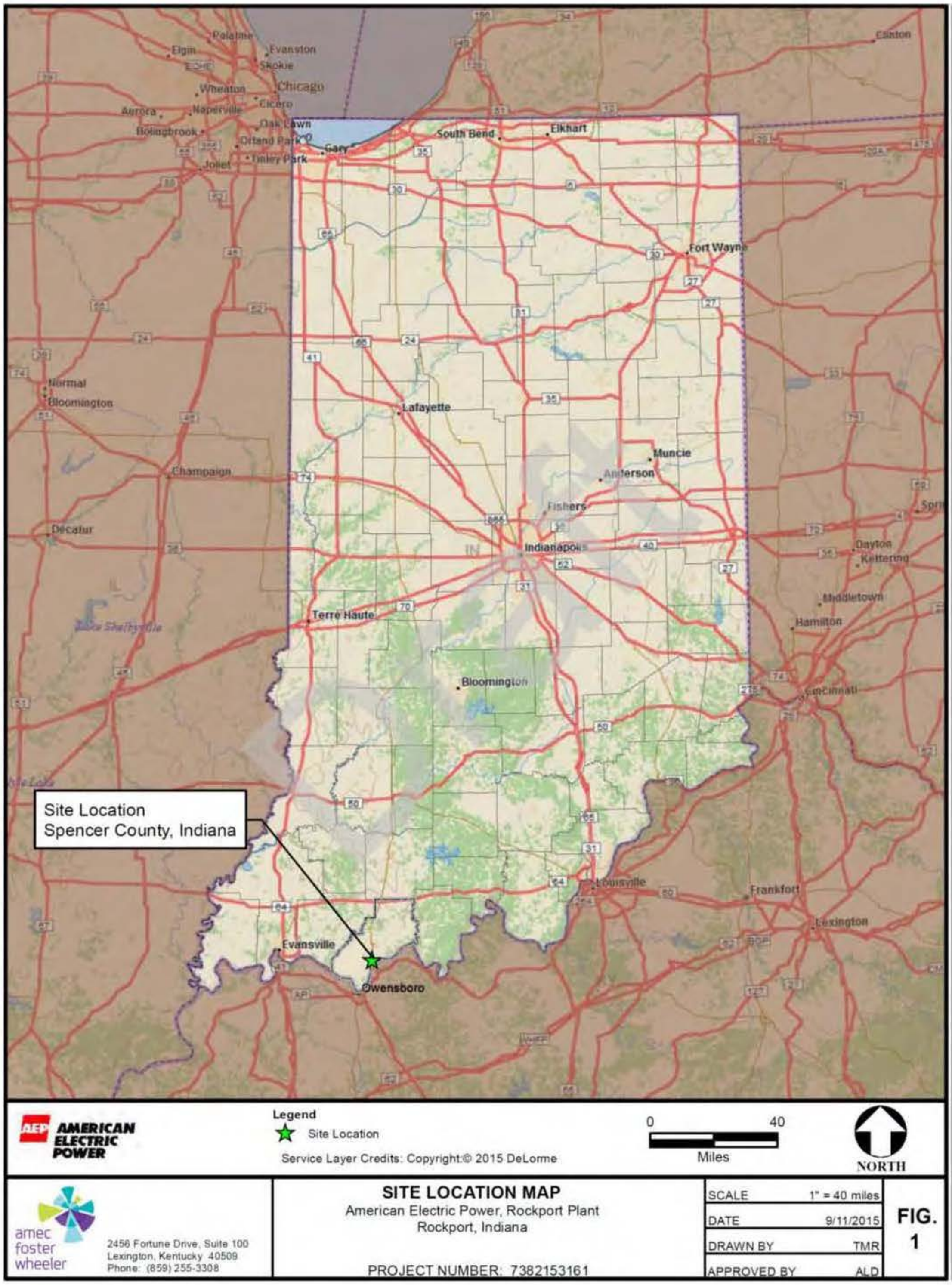
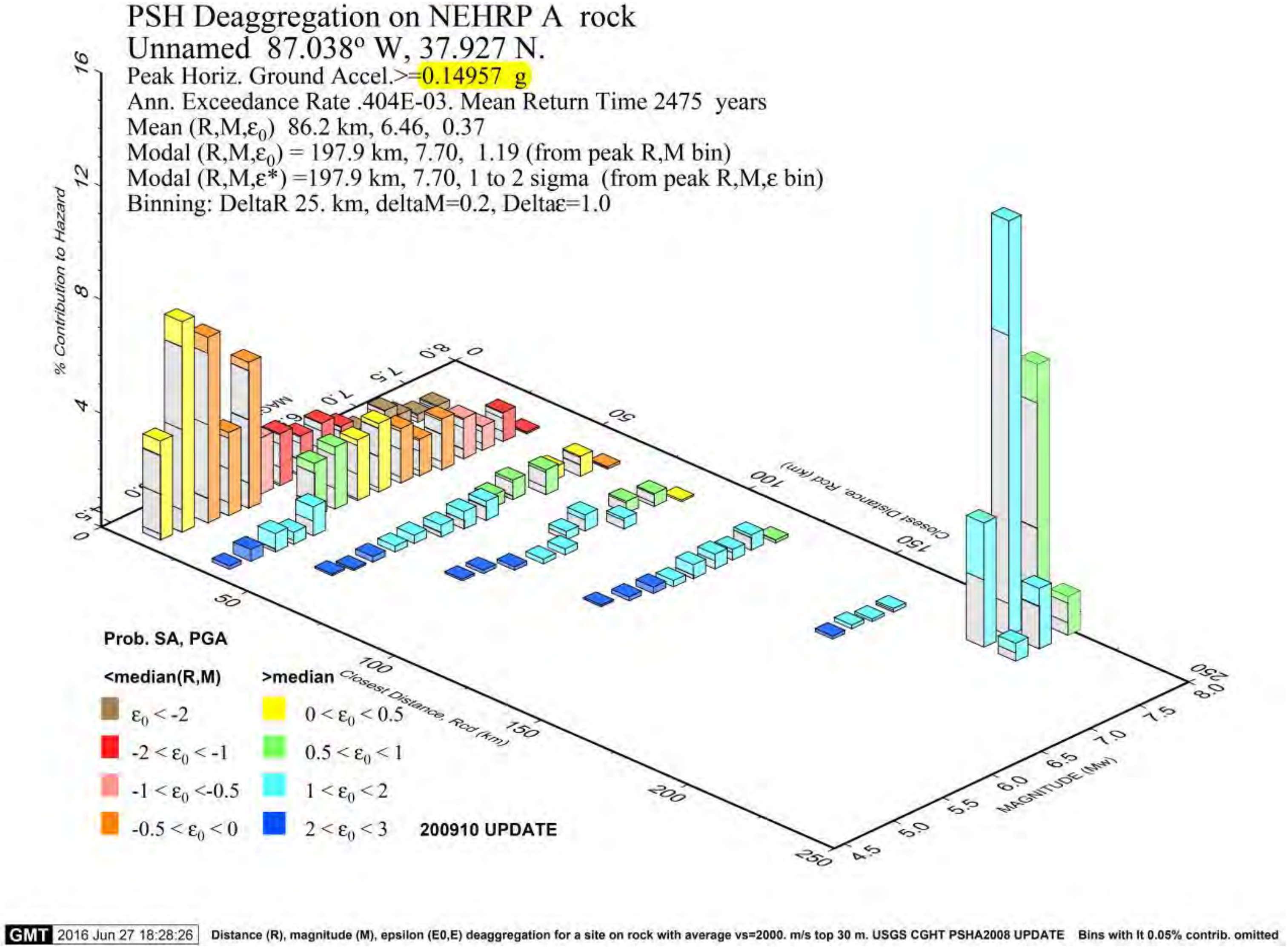


Figure 1 Rockport Power Station’s Bottom Ash pond Complex Location Map

Figure 2 Rockport Power Station’s BAP Plan View (Includes Borings location)



Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on rock with average vs=2000. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted

Figure 3 Maximum expected Earthquake Magnitude and horizontal acceleration based on U.S. Geological Survey Web Site

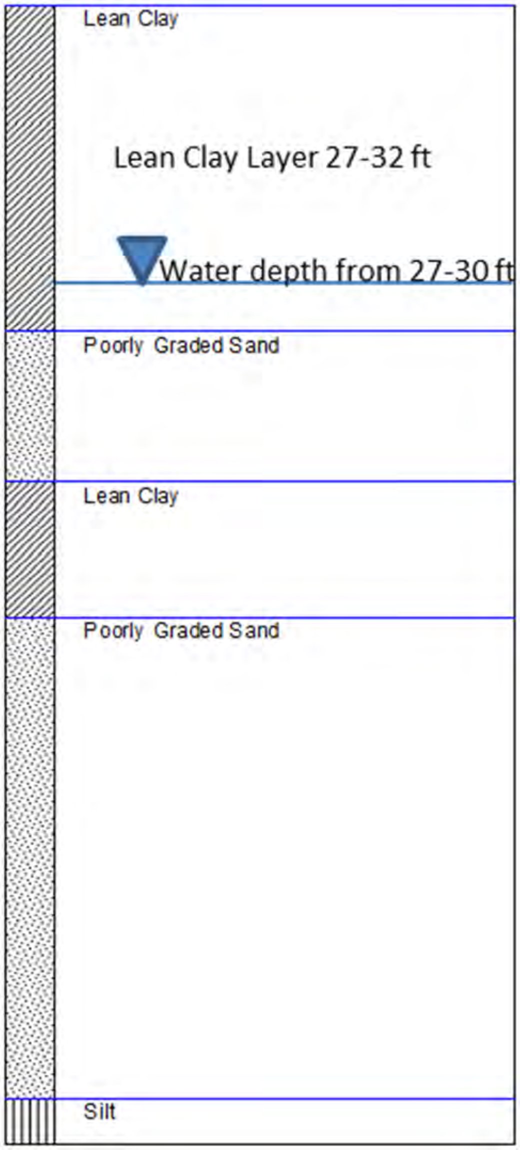


Figure 4 Soil Profile Interpreted from the Two Borings.

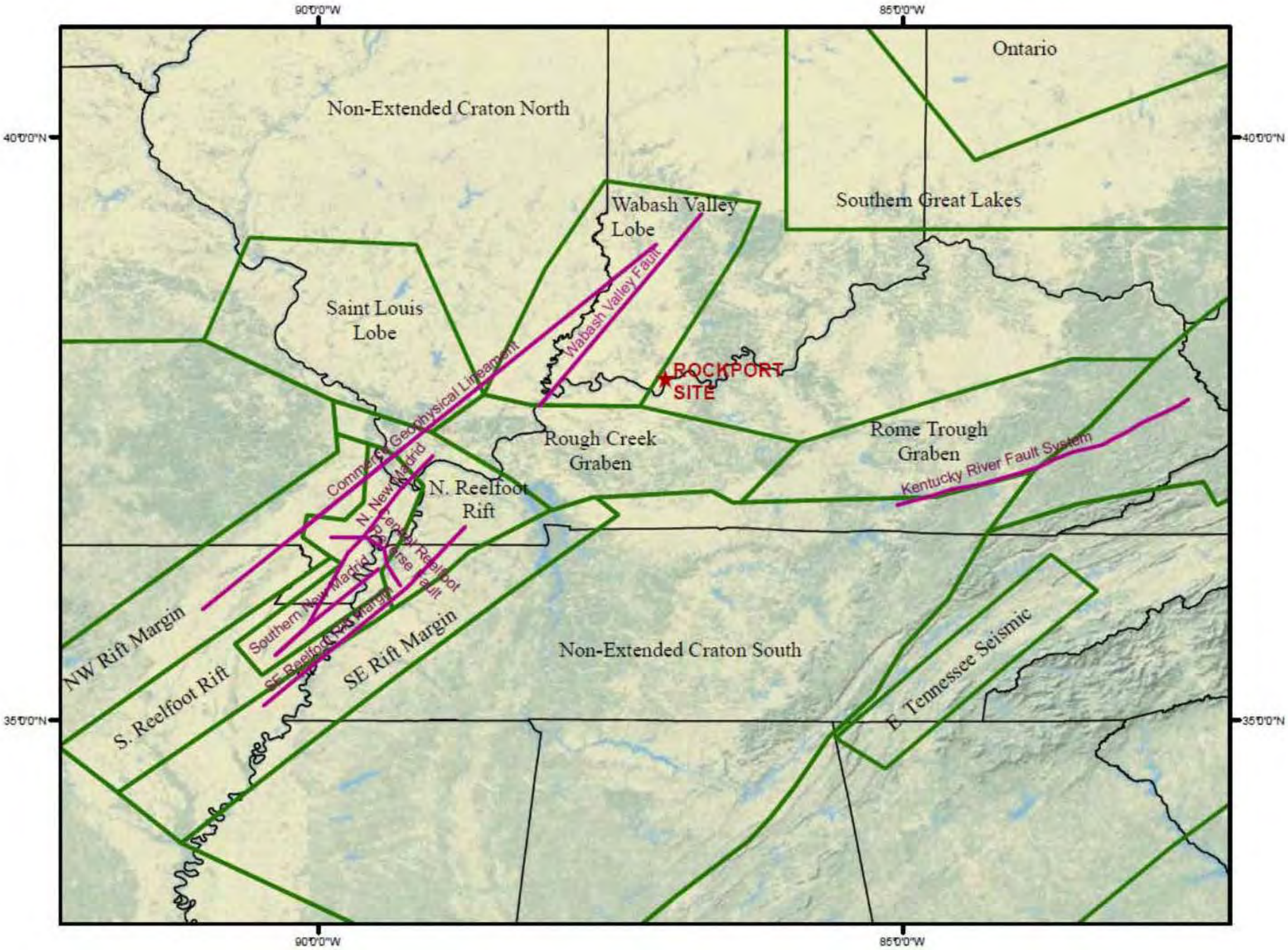


Figure 5 Regional Faults Location Map

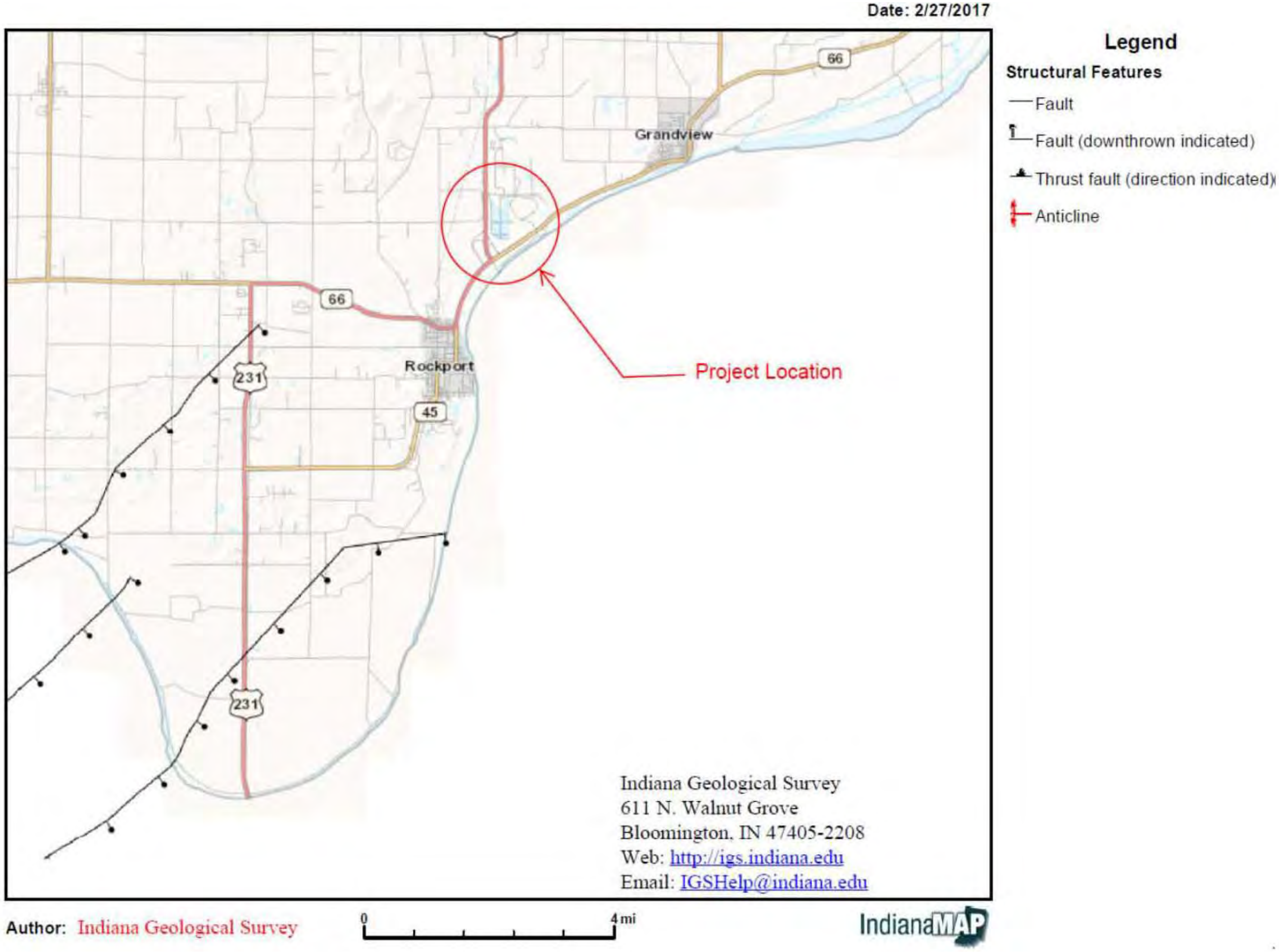


Figure 6 Local Faults Location Map

SEISMIC IMPACT ZONES DEMONSTRATION

Bottom Ash Complex -Rockport Plant

Hole No.=1605   Water Depth=30 ft   Surface Elev.=399

Magnitude=6.46
Acceleration=0.14957g

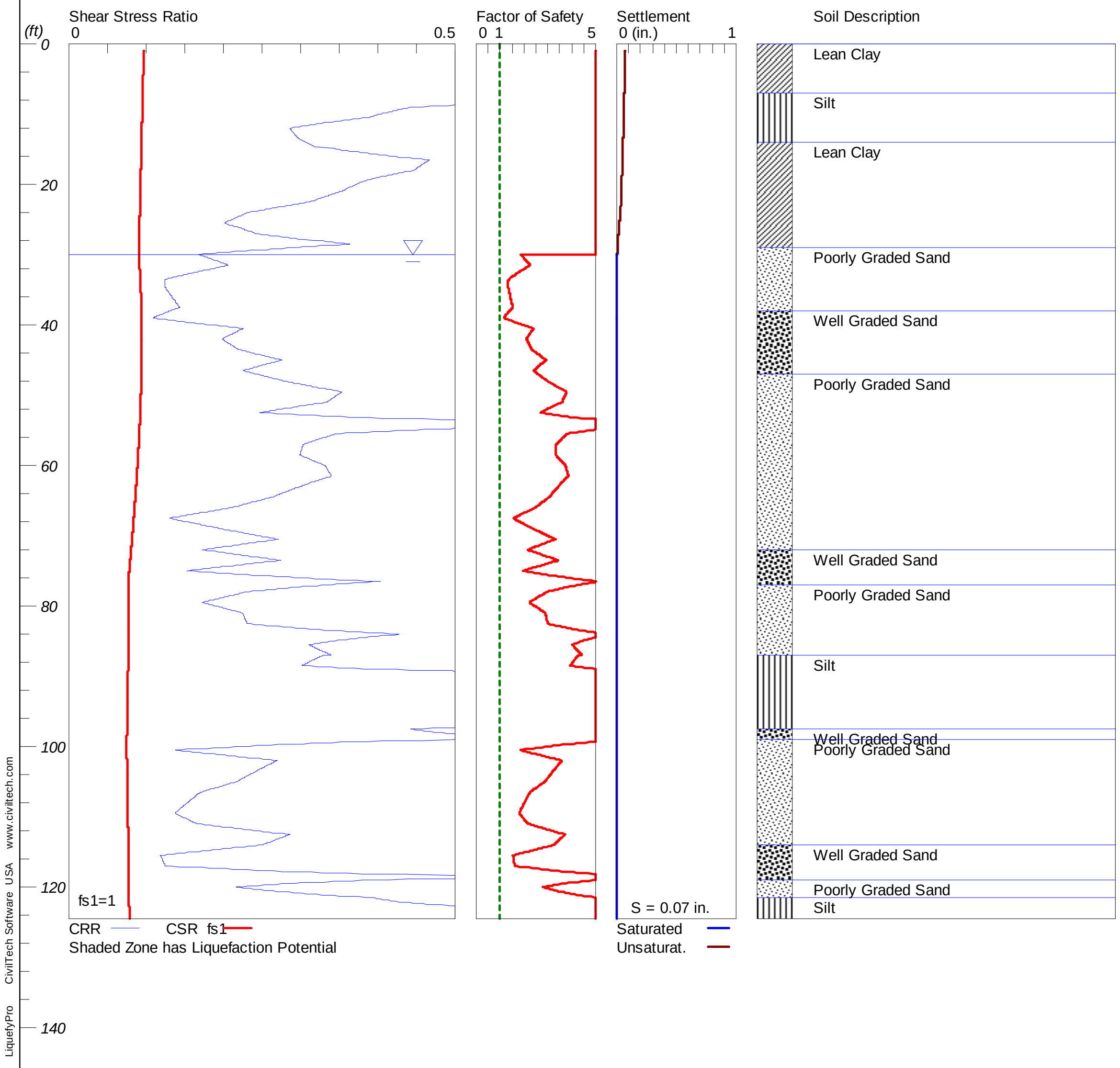


Plate A-1

AMERICAN ELECTRIC POWER
BOUNDLESS ENERGY

American Electric Power Service Corporation

Figure 7 Liquefaction Analysis Results for B-1605Location

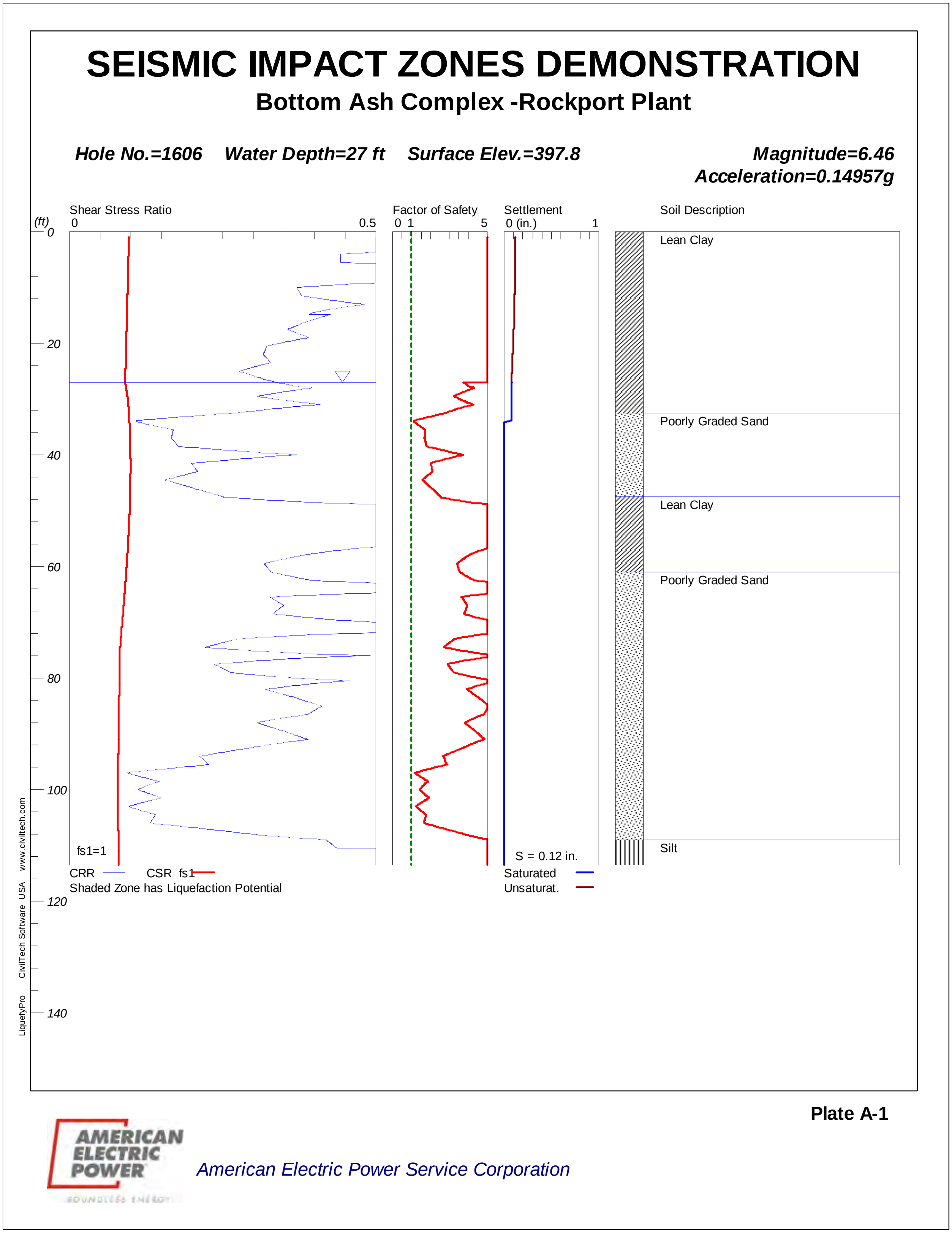


Figure 8 Liquefaction Analysis Results for B-1606Location

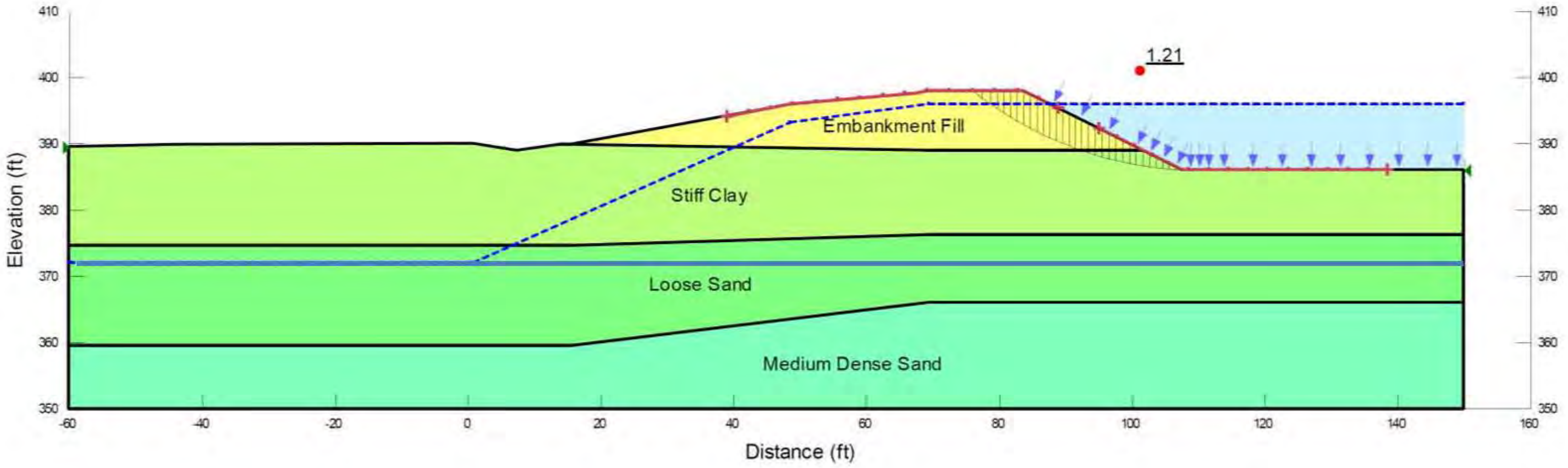


Figure 9 Results of Seismic Stability Analysis (Upstream)

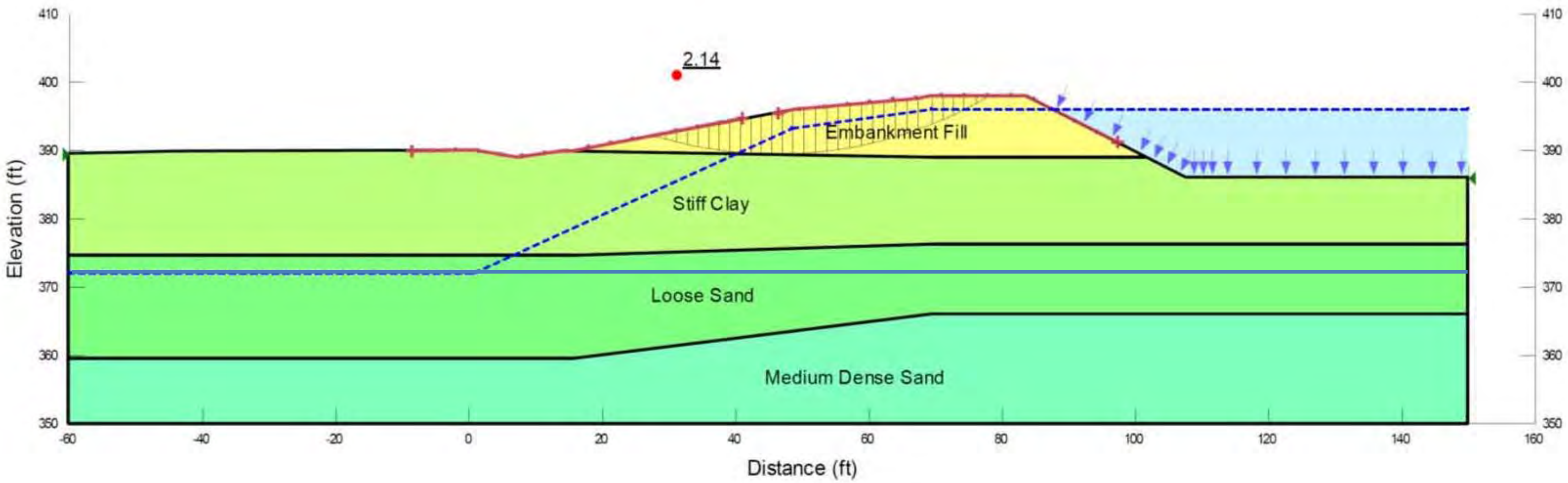


Figure 10 Results of Seismic Stability Analysis (Downstream)

APPENDICIES

APPENDIX A : Excerpts from the SITE-SPECIFIC SEISMIC HAZARD ANALYSIS

REPORT

SITE-SPECIFIC SEISMIC HAZARD ANALYSIS
FOR
AEP POWER PLANT SITE, ROCKPORT, INDIANA

Submitted to:

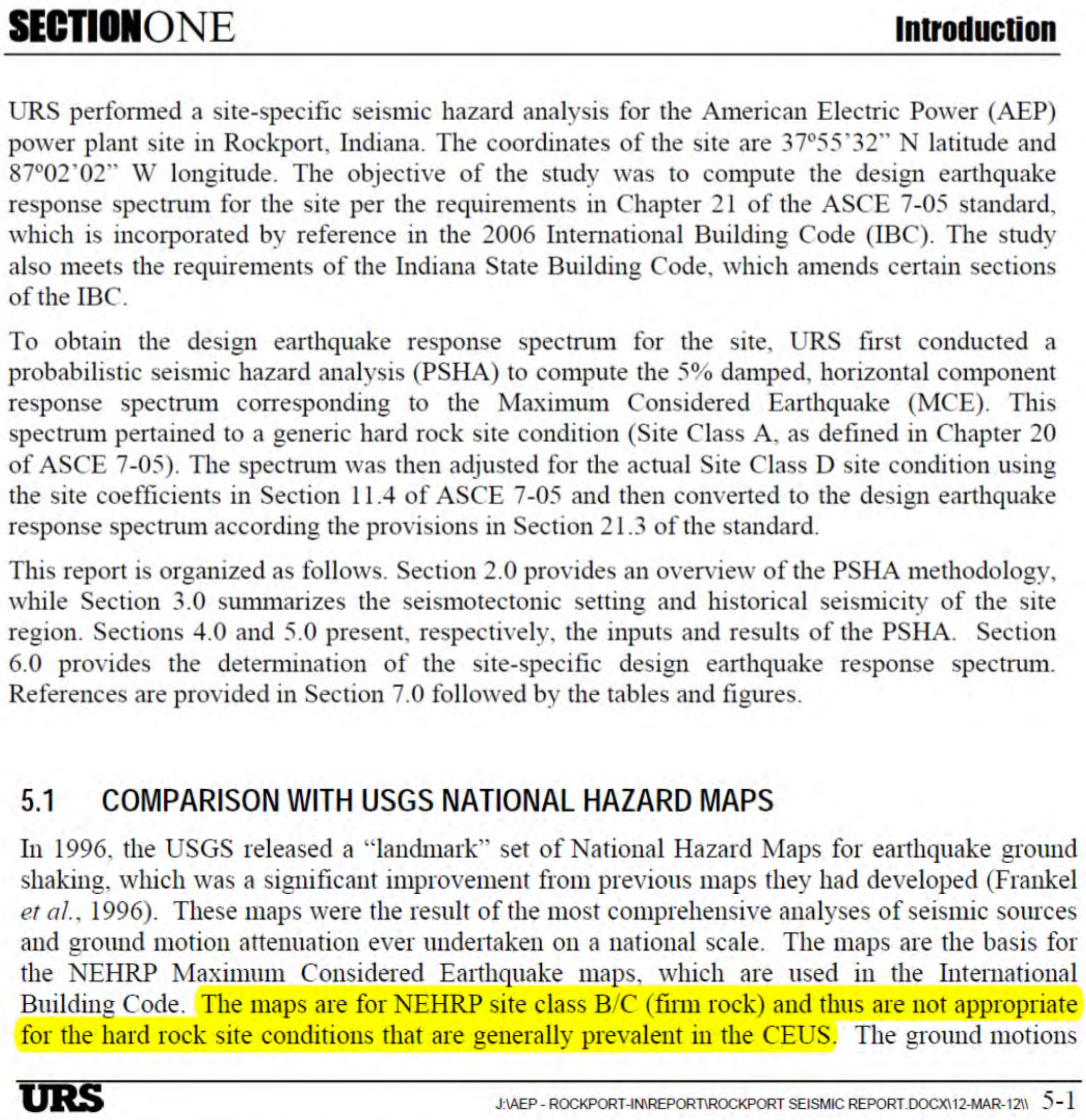
America Electric Power
1 Riverside Plaza
Columbus, Ohio 43215-2373

Prepared by:

URS Corporation
1501 4th Avenue, Suite 1400
Seattle, Washington 98101

URS Job No.: 13814835

March 12, 2012



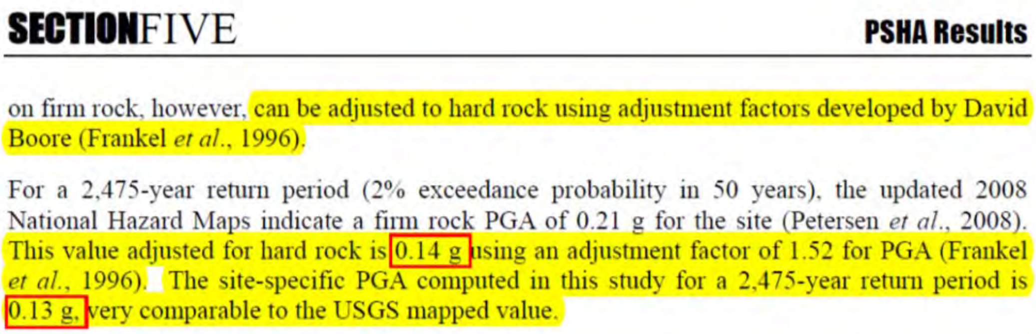
URS performed a site-specific seismic hazard analysis for the American Electric Power (AEP) power plant site in Rockport, Indiana. The coordinates of the site are 37°55’32” N latitude and 87°02’02” W longitude. The objective of the study was to compute the design earthquake response spectrum for the site per the requirements in Chapter 21 of the ASCE 7-05 standard, which is incorporated by reference in the 2006 International Building Code (IBC). The study also meets the requirements of the Indiana State Building Code, which amends certain sections of the IBC.

To obtain the design earthquake response spectrum for the site, URS first conducted a probabilistic seismic hazard analysis (PSHA) to compute the 5% damped, horizontal component response spectrum corresponding to the Maximum Considered Earthquake (MCE). This spectrum pertained to a generic hard rock site condition (Site Class A, as defined in Chapter 20 of ASCE 7-05). The spectrum was then adjusted for the actual Site Class D site condition using the site coefficients in Section 11.4 of ASCE 7-05 and then converted to the design earthquake response spectrum according the provisions in Section 21.3 of the standard.

This report is organized as follows. Section 2.0 provides an overview of the PSHA methodology, while Section 3.0 summarizes the seismotectonic setting and historical seismicity of the site region. Sections 4.0 and 5.0 present, respectively, the inputs and results of the PSHA. Section 6.0 provides the determination of the site-specific design earthquake response spectrum. References are provided in Section 7.0 followed by the tables and figures.

5.1 COMPARISON WITH USGS NATIONAL HAZARD MAPS

In 1996, the USGS released a “landmark” set of National Hazard Maps for earthquake ground shaking, which was a significant improvement from previous maps they had developed (Frankel *et al.*, 1996). These maps were the result of the most comprehensive analyses of seismic sources and ground motion attenuation ever undertaken on a national scale. The maps are the basis for the NEHRP Maximum Considered Earthquake maps, which are used in the International Building Code. The maps are for NEHRP site class B/C (firm rock) and thus are not appropriate for the hard rock site conditions that are generally prevalent in the CEUS. The ground motions on firm rock, however, can be adjusted to hard rock using adjustment factors developed by David Boore (Frankel *et al.*, 1996).



For a 2,475-year return period (2% exceedance probability in 50 years), the updated 2008 National Hazard Maps indicate a firm rock PGA of 0.21 g for the site (Petersen *et al.*, 2008). This value adjusted for hard rock is 0.14 g using an adjustment factor of 1.52 for PGA (Frankel *et al.*, 1996). The site-specific PGA computed in this study for a 2,475-year return period is 0.13 g, very comparable to the USGS mapped value.

APPENDIX B : Soil boring logs along with soil classification sheets

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY	**INDIANA MICHIGAN POWER COMPANY**	BORING NO. **MW-1605D**	DATE **4/27/16**	SHEET **1**	OF **6**
PROJECT	**ROCKPORT PLANT**	BORING START	**2/3/16**	BORING FINISH	**2/3/16**
COORDINATES	**N 151,478.9 E 513,537.1**	PIEZOMETER TYPE		WELL TYPE	**OW**
GROUND ELEVATION **400.4**	SYSTEM **State Plane using NAD27/29**	HGT. RISER ABOVE GROUND	**3.36**	DIA	**2.0**
		DEPTH TO TOP OF WELL SCREEN	**114.6**	BOTTOM	**124.22**
		WELL DEVELOPMENT	**YES**	BACKFILL	
		FIELD PARTY	**ZLR / REB**	RIG	**D-50**

Water Level, ft	▽	▼	▼
TIME			
DATE			

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
1	SS	0.0	1.5	20-13-10	1.25				 CL	Gravel = 6 inches Silty clay, moderate yellowish brown 10R 5/4 and med l. grey N6 mottled, moist, v. stiff @ 1.5' hard @ 3' v. stiff		
2	SS	1.5	3.0	5-15-18	1.25							
3	SS	3.0	4.5	7-9-15	1.41							
4	SS	4.5	6.0	11-12-14	1.5		5					
5	SS	6.0	7.5	4-8-11	1.41							
6	SS	7.5	9.0	3-6-11	1.33				ML	Clayey silt, medium grey N5, moist, med. dense, w/mod. yellowish brown 10R 5/4 silty clay mottled		
7	SS	9.0	10.5	3-4-7	1.41				CL	Silty clay, mod. yellowish brown 10R 5/4, moist, stiff, w/med. grey N5 clayey silt mottled		
8	SS	10.5	12.0	3-4-6	1.5		10					
9	SS	12.0	13.5	2-2-4	1.5				CH	Fat to lean clay, med. l. grey N6, moist, firm		
10	SS	13.5	15.0	2-2-5	1.41				CL ML	Silty clay, mod. reddish brown 10R 4/6 w/med. l. grey N6 fat clay heavily mottled, moist, firm @ 15' stiff @ 15.5' l" shale fragment, angular @ 18' very silty @ 20' trace to some pale yellowish brown 10YR 6/2 silt		
11	SS	15.0	16.5	2-4-5	1.5		15					
12	SS	16.5	18.0	3-5-9	1.5							
13	SS	18.0	19.5	3-6-8	1.41							
14	SS	19.5	21.0	3-5-7	1.41							

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 **AMEC FOSTER WHEELER**

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1605D** DATE **4/27/16** SHEET **2** OF **6**

PROJECT **ROCKPORT PLANT** BORING START **2/3/16** BORING FINISH **2/3/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	SAMPLE DEPTH IN FEET TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %
15	SS	21.0	22.5	3-4-7	1.5	
16	SS	22.5	24.0	4-4-5	1.5	
17	SS	24.0	25.5	1-1-3	1.5	
18	SS	25.5	27.0	1-1-1	1.5	
19	SS	27.0	28.5	2-1-4	1.5	
20	SS	28.5	30.0	5-6-7	1.33	
21	SS	30.0	31.5	3-5-7	1.25	
22	SS	31.5	33.0	5-7-8	1.5	
23	SS	33.0	34.5	3-3-6	1.41	
24	SS	34.5	36.0	2-4-5	1.5	
25	SS	36.0	37.5	2-4-6	1.33	
26	SS	37.5	39.0	4-3-8	1.5	
27	SS	39.0	40.5	3-3-5	1.5	
28	SS	40.5	42.0	11-8-10	1.25	
29	SS	42.0	43.5	4-5-11	1.5	
30	SS	43.5	45.0	8-9-9	1.16	
31	SS	45.0	46.5	6-9-14	1.5	

U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
ML	Clayey silt, pale yellowish brown 10YR 6/2, moist, med. dense, w/silty clay (prev. material), trace sand		
SP	Poorly graded sand, v. fine to fine grained, l. brown 5YR 5/6, moist, loose @ 23.2' 2" clayey silt seam (prev. material)		
ML	Clayey silt, pale yellowish brown 10YR 6/2, moist to wet, v. loose @ 25' 2" l. brown sand seam (prev. material) @ 26' 2" l. brown sand seam @ 26.4' 15" l. brown sand seam @ 26.8' l" l. brown sand seam @ 27' loose @ 28' 2" l. brown sand seam		
SP	Poorly graded sand, fine grained, l. brown 5YR 5/6, moist, med. dense @ 30' d. yellowish orange 10YR 6/6 @ 31' 3" clayey silt seam (prev. material) @ 32.3' trace fine gravel and black silt @ 32.5' no fine gravel or silt @ 33' moist, loose @ 34.1' 2" clayey silt seam (prev. material) @ 34.5' moist to wet, water in spoon @ 34.9' 2.5' clayey silt seam (prev. material)		
SW	Well graded sand, fine grained, l. brown 5YR 5/6, moist to wet, med. dense, w/fine gravel		
SW	Well graded sand, coarse grained, grayish black N2, moist to wet, med. dense, trace fine gravel		
SP	Poorly graded sand, v. fine to fine grained, l. brown 5YR 5/6, moist to wet, med. dense		
SW	Well graded sand, fine to med. grained, moderate yellowish brown 10YR 5/4, moist to wet, loose @ 40.5' med. dense @ 41' 1.5" shale seam w/clay		
SP	Poorly graded sand, v. fine to fine grained, mod. yellowish brown 10YR 5/4, moist to wet, med. dense		
SW	Well graded sand, med. grained, mod. reddish brown 10R 4/6, moist to wet, med. dense @ 44' med. to coarse grained		
SP	Poorly graded sand, fine grained, mod. yellowish		

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LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1605D** DATE **4/27/16** SHEET **3** OF **6**

PROJECT **ROCKPORT PLANT** BORING START **2/3/16** BORING FINISH **2/3/16**

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	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
32	SS	46.5	48.0	6-8-11	1.5			SW	brown 10YR 5/4, moist to wet, mod. dense, some fine gravel		
								SP	Well graded sand, med. to coarse grained, mod. reddish brown 10R 4/6, moist to wet, med. dense, trace fine gravel		
33	SS	48.0	49.5	6-10-14	1.5				Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, moist to wet, med. dense, trace fine gravel @ 48' w/fine gravel, trace coarse gravel @ 49.5' no coarse gravel		
34	SS	49.5	51.0	8-12-18	1.33		50				
35	SS	51.0	52.5	8-11-18	1.41						
36	SS	52.5	54.0	8-9-13	.91			SW	Well graded sand, med. to coarse grained, mod. reddish brown 10R 4/6, moist to wet, mod. dense, trace fine gravel		
37	SS	54.0	55.5	11-20-26	1.25			SP	Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, moist to wet, mod. dense, trace fine gravel @ 54' no fine gravel, dense @ 57' wet, mod. dense @ 60' dense @ 63' mod. dense		
38	SS	55.5	57.0	10-15-16	1.5		55				
39	SS	57.0	58.5	6-12-16	1.33						
40	SS	58.5	60.0	7-10-18	1.33						
41	SS	60.0	61.5	8-9-12	1.33		60				
42	SS	61.5	63.0	10-13-19	1.25						
43	SS	63.0	64.5	9-11-18	1.33						
44	SS	64.5	66.0	9-11-15	1.08		65	SW	Well graded sand, med. to coarse grained, mod. yellowish brown 10YR 5/4, moist to wet, mod. dense, trace black silt		
45	SS	66.0	67.5	7-8-13	1.41			SP	Poorly graded sand, fine grained, mod. yellowish brown 10YR 5/4, moist to wet, mod. dense @ 68.5' trace fine gravel, trace coal fragments @ 70' no fine gravel, no coal fragments @ 70.9' trace fine gravel @ 71.6' no fine gravel, wet		
46	SS	67.5	69.0	5-5-8	1.5						
47	SS	69.0	70.5	6-8-12	1.5						
48	SS	70.5	72.0	0-12-16	1.5		70				

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1605D** DATE **4/27/16** SHEET **4** OF **6**

PROJECT **ROCKPORT PLANT** BORING START **2/3/16** BORING FINISH **2/3/16**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
49	SS	72.0	73.5	8-8-10	1.25				SW	Well graded sand, fine grained d. yellowish brown 10YR 4/2, moist to wet, mod. dense, trace fine gravel @ 73.5' w/fine gravel, trace coarse gravel		
50	SS	73.5	75.0	9-12-17	1.41							
51	SS	75.0	76.5	8-7-9	1.5		75		SW	Well graded sand, coarse grained, brownish grey 5YR 4/1, moist to wet, mod. dense, w/fine gravel, trace coarse gravel		
52	SS	76.5	78.0	10-15-25	1.5				SP	Poorly graded sand, fine grained, pale yellowish brown 10YR 6/2, wet, dense, trace fine gravel @ 78' mod. dense @ 81' v. fine to fine grained @ 82.5' no fine gravel @ 84' dense @ 85' 2" shale fragment @ 85.2' v. fine grained @ 85.5' 3.5" shale fragment @ 87' fine grained, d. yellowish brown 10YR 4/2 @ 88.5' v. fine grained, mod. dense		
53	SS	78.0	79.5	7-13-12	1.33							
54	SS	79.5	81.0	5-7-12	1.5		80					
55	SS	81.0	82.5	6-12-13	1.5							
56	SS	82.5	84.0	8-10-16	1.41							
57	SS	84.0	85.5	10-21-22	1.41		85					
58	SS	85.5	87.0	14-21-14	.5							
59	SS	87.0	88.5	6-13-25	1.41							
60	SS	88.5	90.0	8-9-9	1.16				ML	Clayey silt, med. l. grey N6, moist to wet, mod. dense		
61	SS	90.0	91.5	15-24-7	1.41		90		SP	Poorly graded sand, fine grained, d. yellowish brown 10YR 4/2, moist, dense		
62	SS	91.5	93.0	7-21-28	1.5				ML SW	Clayey silt, med. l. grey N6, moist to wet, dense Well graded sand, coarse grained, med. grey N5, w/fine gravel, some coarse gravel		
63	SS	93.0	94.5	14-18-21	1.5				ML SW	Clayey silt, med. l. grey N6, moist to wet, dense Well graded sand, fine grained, med. grey N5, moist to wet, dense, w/fine gravel		
64	SS	94.5	96.0	12-17-25	1.5		95		ML	Clayey silt, med. l. grey N6, moist to wet, dense		
65	SS	96.0	97.5	20-21-19	1.33				SW	Well graded sand, coarse grained, med. grey N5, moist to wet, dense, w/fine gravel @ 98.7' coal fragments		
66	SS	97.5	99.0	13-11-18	1.41							

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1605D** DATE **4/27/16** SHEET **5** OF **6**

PROJECT **ROCKPORT PLANT** BORING START **2/3/16** BORING FINISH **2/3/16**

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	USCS	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
67	SS	99.0	100.5	15-22-28	1.5			SP	Poorly graded sand, v. fine to fine grained, pale yellowish brown 10YR 6/2, moist to wet, dense, w/fine gravel @ 100.5' no fine gravel, mod. dense @ 102' v. fine, dense @ 105' mod. dense @ 106' trace coal fragments @ 106.3' no coal fragments @ 109.5' moist @ 111' v. moist to wet @ 112.5' moist to wet, dense @ 113' trace fine gravel, trace coarse gravel @ 113.5' no fine gravel, no coarse gravel		
68	SS	100.5	102.0	8-8-9	1.5		100				
69	SS	102.0	103.5	10-16-18	1.5						
70	SS	103.5	105.0	9-13-18	1.41						
71	SS	105.0	106.5	8-12-16	1.5		105				
72	SS	106.5	108.0	6-9-13	1.5						
73	SS	108.0	109.5	7-8-12	1.25						
74	SS	109.5	111.0	6-8-10	1.41		110				
75	SS	111.0	112.5	5-10-12	1.25						
76	SS	112.5	114.0	6-11-27	1.33						
77	SS	114.0	115.5	13-21-13	1.25			SW	Well graded sand, med. to coarse grained, med. grey N5, moist to wet, dense, w/fine gravel, some coarse gavel @ 115.5' coarse grained, mod. dense, trace coarse gravel @ 118.5' v. dense		
78	SS	115.5	117.0	7-7-9	1.33		115				
79	SS	117.0	118.5	9-9-8	1.16						
80	SS	118.5	120.0	12-36-22	1.5			SP	Poorly graded sand, v. fine grained, med. l. grey N6, moist to wet, v. dense @ 120' med. dense, sl. moist @ 122' fine grained, w/fine gravel, dense @ 124.5' trace coarse gravel		
81	SS	120.0	121.5	10-11-19	1.41		120				
82	SS	121.5	123.0	12-20-29	1.5						
83	SS	123.0	124.5	14-16-19	1.5						

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1605D** DATE **4/27/16** SHEET **6** OF **6**

PROJECT **ROCKPORT PLANT** BORING START **2/3/16** BORING FINISH **2/3/16**

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
84	SS	124.5	126.0	18-12-25	1.5		125					
85	SS	126.0	127.5	17-28-50/5	1.5				ML	Clayey silt, l. grey N7, moist, hard, non-durable shale @ 126' flaky, dry to moist Spoon refusal @ 127.4' Auger refusal @127.5' (shale)		
86	SS	127.5	129.0	27-50/2	.66							

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY**

PROJECT **ROCKPORT PLANT**

COORDINATES **N 151,502.1 E 512,881.5**

GROUND ELEVATION **397.8** SYSTEM **State Plane using NAD27/29**

BORING NO. **MW-1606D** DATE **4/27/16** SHEET **1** OF **5**

BORING START **2/12/16** BORING FINISH **2/12/16**

PIEZOMETER TYPE ______ WELL TYPE **OW**

HGT. RISER ABOVE GROUND **2.91** DIA **2.0**

DEPTH TO TOP OF WELL SCREEN **100.2** BOTTOM **109.82**

WELL DEVELOPMENT **YES** BACKFILL ______

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

Water Level, ft	▽	▼	▼
TIME			
DATE			

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION	WELL	DRILLER'S NOTES
1	SS	0.0	1.5	3-5-9	1.5				 CL	Crushed stone gravel (limestone) Lean clay, moderate yellowish brown 10YR 5/4, moist, trace fine grained sand, stiff		
2	SS	1.5	3.0	4-7-9	1.5					@ 1.5' as above, trace coarse grain sand and black decomposed organic staining @ 3' trace fine gravel		
3	SS	3.0	4.5	3-4-6	1.3							
4	SS	4.5	6.0	1-2-8	1.3		5					
5	SS	6.0	7.5	5-9-10	1.5				CL	Lean clay, pale yellow brown 10YR 6/2, moist, some light brown oxide staining @ 6.0' yellow brown and brown 10YR 5/4 @ 7.5' pale yellow brown 10YR 6/2, trace fine roots, trace fine grained sand		
6	SS	7.5	9.0	3-6-9	1.5				CL	Lean clay w/sand, dark yellow brown 10YR 4/2, moist, little fine grained sand		
7	SS	9.0	10.5	2-4-5	1.5		10		CL	Lean clay, light bluish gray 5B 7/1, moist, some brown oxide staining, trace coarse grained sand @ 12.5' as above, becomes moderate brown in color 5YR 4/4 @ 13.5' moderate yellow brown 10YR 5/4 and pale yellow brown 10YR 6/2) mottled @ 13.5' - 15' trace fine grained sand, trace fine gravel @ 19.5' mostly 10YR 6/2 in color		
8	SS	10.5	12.0	3-4-6	1.5							
9	SS	12.0	13.5	3-5-9	1.5							
10	SS	13.5	15.0	4-5-7	1.5		15					
11	SS	15.0	16.5	3-5-6	1.5							
12	SS	16.5	18.0	3-4-6	1.5							
13	SS	18.0	19.5	2-5-7	1.5							
14	SS	19.5	21.0	3-3-6	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 **AMEC FOSTER WHEELER**

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1606D** DATE **4/27/16** SHEET **2** OF **5**

PROJECT **ROCKPORT PLANT** BORING START **2/12/16** BORING FINISH **2/12/16**

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
15	SS	21.0	22.5	3-4-5	1.5				CL ML	Silty clay, pale yellow brown 10YR 6/2, moist, trace to little fine grained sand		
16	SS	22.5	24.0	2-4-6	1.5				SP SM	Poorly graded sand w/silt, pale yellow brown 10YR 6/2, moist, fine to medium grained sand @ 24.9' 3" silt layer		
17	SS	24.0	25.5	1-2-5	1.2		25					
18	SS	25.5	27.0	2-4-6	1.5				CL	Lean clay, moderate yellowish brown 10YR 5/4, moist, few sandy layers <1" thick @ 28.3' SP-SM layer (~3" thick)		
19	SS	27.0	28.5	1-5-9	1.3							
20	SS	28.5	30.0	4-4-5	1.3				SP SM	Poorly graded sand w/silt, dark yellowish orange 10YR 6/6, wet, fine to medium grained sand, little coarse grained sand @ 31.5' trace fine gravel @ 34.5' trace fine gravel		
21	SS	30.0	31.5	5-7-8	1.5		30					
22	SS	31.5	33.0	3-3-4	1.1							
23	SS	33.0	34.5	1-2-5	0							
24	SS	34.5	36.0	3-4-8	.8		35					
25	SS	36.0	37.5	3-5-7	1.0							
26	SS	37.5	39.0	5-6-7	.9				SP	Poorly graded sand, dark yellowish orange 10YR 6/6, wet, fine to medium grained sand, trace to little coarse grained sand @ 37.5' trace gravel		
27	SS	39.0	40.5	4-7-20	1.2		40		SP SM	Poorly graded sand w/silt, dark yellowish orange 10YR 6/6, wet, fine to medium grained sand, trace coarse grained sand		
28	SS	40.5	42.0	7-7-8	1.1				SC SP	Clayey sand, moderate brown 5YR 3/4, wet, fine to medium grained sand Poorly graded sand, dark yellowish orange 10YR 6/6, wet, fine to medium grained sand, trace coarse grained sand & fine gravel @ 42.0' - 43.5' increase in coarse grained sand @ 45.2' - 45.5' color change to moderate brown 5YR 4/4 @ 46.5' increase in coarse grained sand, trace wood fragments (tree bark) @ 48' color change to pale yellowish brown 10YR		
29	SS	42.0	43.5	4-6-10	1.0							
30	SS	43.5	45.0	4-5-7	1.0							
31	SS	45.0	46.5	4-6-10	1.2		45					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1606D** DATE **4/27/16** SHEET **3** OF **5**

PROJECT **ROCKPORT PLANT** BORING START **2/12/16** BORING FINISH **2/12/16**

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
32	SS	46.5	48.0	8-9-11	1.1					6/2, few black decomposed organic layers		
33	SS	48.0	49.5	6-10-13	1.1							
34	SS	49.5	51.0	18-13-13	.9		50		SW SM	Well graded sand w/silt & gravel, wet, pale yellowish brown 10YR 6/2, fine to coarse grained sand, little to some fine gravel, trace coarse gravel		
35	SS	51.0	52.5	7-14-16	1.1				SP SM	Poorly graded sand w/silt, moderate yellowish brown 10YR 5/4, wet, fine to medium grained sand, trace coarse grained sand, few layers of decomposed organics (from 51' - 52.5') @ 54' trace coarse gravel, fines between 5 - 10% @ 55.5' trace fine gravel		
36	SS	52.5	54.0	7-9-15	1.0							
37	SS	54.0	55.5	10-10-14	1.2		55					
38	SS	55.5	57.0	8-10-13	1.2							
39	SS	57.0	58.5	7-9-9	1.3				SW	Well graded sand, med. to coarse grained, dark yellowish brown 10YR 4/2), wet, med. dense, trace fine gravel @ 59' trace coarse gravel		
40	SS	58.5	60.0	4-5-9	1.2							
41	SS	60.0	61.5	6-6-9	1.5		60		SP	Poorly graded sand, fine grained, dusky yellowish brown 10YR 2/2, wet, med. dense, w/fine gravel @ 60.5' 2" shale fragment @ 61.5' dark yellowish brown 10YR 4/2, dense @ 61.8' 2" shale fragment @ 62' some lean clay, pale yellowish brown (prev. material) @ 62.5' no clay, trace fine gravel @ 63' no fine gravel @ 64.5' med. dense @ 65.8' 15" coarse sand seam (prev. material) @ 66' dense @ 67.2' 3" shale seam, med. l. grey N6 @ 67.7' med. grained		
42	SS	61.5	63.0	6-13-21	1.5							
43	SS	63.0	64.5	10-17-31	1.3							
44	SS	64.5	66.0	13-13-17	1.4		65					
45	SS	66.0	67.5	6-14-18	1.5							
46	SS	67.5	69.0	9-14-17	1.5							
47	SS	69.0	70.5	10-20-20	1.1				SP	Poorly graded sand, fine gravel, pale yellowish brown 10YR 6.2, wet, dense @ 69' moist to v. moist @ 72' med. dense, fine grained @ 75' dense, d. yellowish brown 10YR 4.2 @ 76.5' med. dense, trace black silt @ 80.6 3" shale plug (responsible for increase in N value (same material)) @ 81.3' 1.5" shale plug, dense		
48	SS	70.5	72.0	10-19-26	1.4		70					

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AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1606D** DATE **4/27/16** SHEET **4** OF **5**

PROJECT **ROCKPORT PLANT** BORING START **2/12/16** BORING FINISH **2/12/16**

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
49	SS	72.0	73.5	7-10-17	1.3					@ 81.5' no recovery, potential cobble blocking during sampling		
50	SS	73.5	75.0	8-9-13	1.2							
51	SS	75.0	76.5	10-16-25	1.4		75					
52	SS	76.5	78.0	9-10-14	1.4							
53	SS	78.0	79.5	6-9-18	1.5							
54	SS	79.5	81.0	10-17-34	1.5		80					
55	SS	81.0	82.5	31-19-14	1.3							
56	SS	82.5	84.0	10-16-21	1.5				CH SW	Fat clay, med. l. grey N6, moist, firm Well graded sand, med. grained, dark yellowish brown 10YR 4/2, wet, dense, w/fine gravel		
57	SS	84.0	85.5	9-19-21	1.5		85			@ 83' coal fragment (2" diam., 1" thick) @ 83.6' coal fragment (2" diam, 1" thick)		
58	SS	85.5	87.0	7-15-24	1.3				SP	Poorly graded sand, fine grained, pale yellowish brown 10YR 6/2, wet, dense @ 88.5' trace fine gravel @ 91.5' with fine gravel		
59	SS	87.0	88.5	10-13-20	1.2							
60	SS	88.5	90.0	8-14-23	1.4							
61	SS	90.0	91.5	8-13-27	1.3		90					
62	SS	91.5	93.0	8-7-16	1.5							
63	SS	93.0	94.5	7-9-15	1.5							
64	SS	94.5	96.0	12-12-14	1.5		95		SW SP	Well graded sand, med. to coarse grained, dark yellowish brown 10YR 4/2, wet, med. dense, w/fine gravel		
65	SS	96.0	97.5	3-5-5	1.5				SW SP	Poorly graded sand, coarse grained, greyish red 5R 4/2, wet, med. dense, trace fine gravel Well graded sand, med. to coarse grained, dark yellowish brown 10YR 4/2, wet, med. dense, w/fine gravel		
66	SS	97.5	99.0	5-5-6	1.4				SP			

Continued Next Page

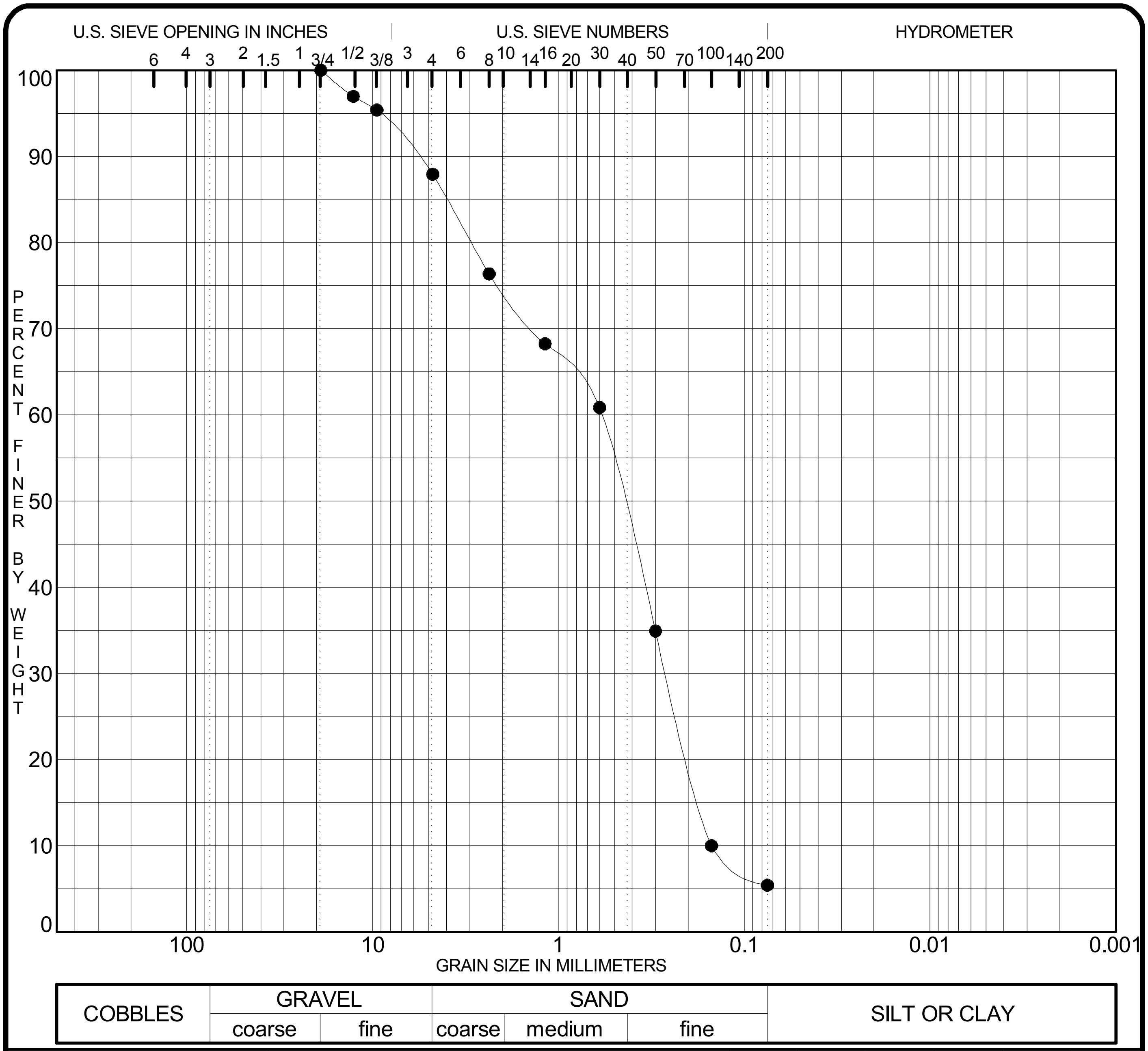
AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NUMBER **42393125-01**

COMPANY **INDIANA MICHIGAN POWER COMPANY** BORING NO. **MW-1606D** DATE **4/27/16** SHEET **5** OF **5**

PROJECT **ROCKPORT PLANT** BORING START **2/12/16** BORING FINISH **2/12/16**

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
										Poorly graded sand, coarse grained, greyish red 5R 4/2, wet, med. dense to loose, trace fine gravel		
67	SS	99.0	100.5	4-5-7	1.5		100			Poorly graded sand, fine grained, pale yellowish brown 10YR 6/2, wet, loose @ 97.5' med. dense, fine grained		
68	SS	100.5	102.0	7-7-10	1.4				SP	Poorly graded sand, fine to fine grained, dusky red 5R 3/4, wet, med. dense @ 102' loose, fine grained, moist @ 103.5' med. dense @ 105' fine grained @ 106.5' dense @ 108' med. dense, trace fine gravel @ 109' no fine gravel @110.6' siltstone fragments to 2.5", moderate brown 5YR 4/4, shiny, angular		
69	SS	102.0	103.5	4-4-6	1.5							
70	SS	103.5	105.0	5-6-10	1.3							
71	SS	105.0	106.5	4-6-9	1.5		105					
72	SS	106.5	108.0	7-11-20	1.4							
73	SS	108.0	109.5	8-13-15	1.5							
74	SS	109.5	111.0	10-18-11	1.3		110					
75	SS	111.0	112.5	14-50/3					ML	Silt, l. grey N7, moist, med. dense, non-durable shale @ 111' clayey silt, hard Spoon refusal @ 111.7' Auger refusal @ 112.9 BT @ 112.9'		
76	SS	112.5	114.0	50/4								



	Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
●	MW-1605D 115.0-124.6ft		14.5					
		SS-78,79,80,81,82,83 (Composite						
		Sample) N 151,478.9 E 513,537.1						
		ELEVATION 400.4						

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
●	MW-1605D 115.0-124.6ft	19.000	0.586	0.262	0.150	12.1	82.5	5.4	

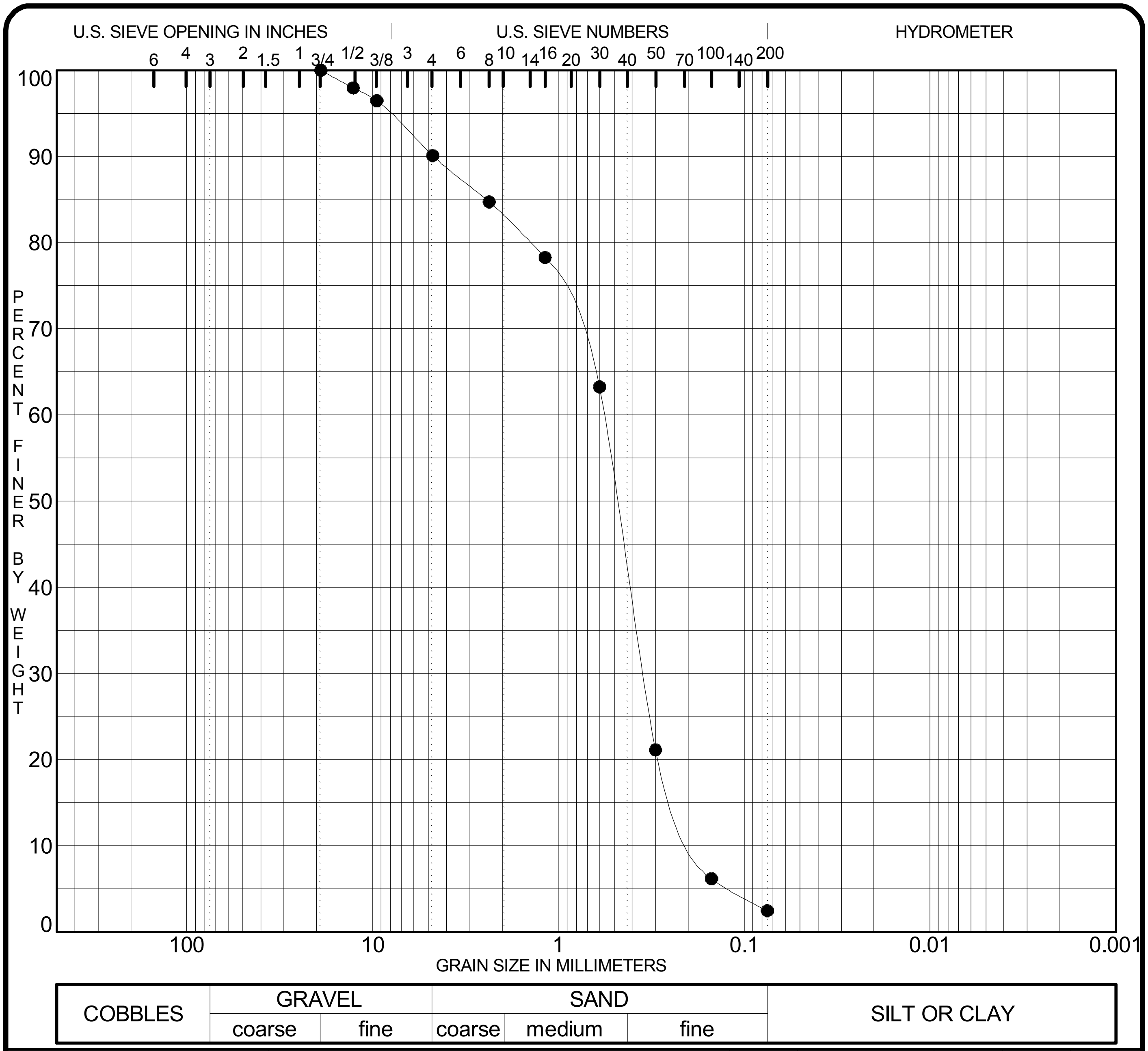
PROJECT **ROCKPORT PLANT -**

JOB NO. **42393125-01**
DATE **3/22/16**

GRADATION CURVES

American Electric Power Service Corp.

AEP



	Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
●	**MW-1605I 68.6-78.2ft**		**19.7**					
		POORLY GRADED SAND SP						
		SS-48,49,50,51,52 (Composite Sample)						
		N 151,478.9 E 513,532.6						
		ELEVATION 400.6						

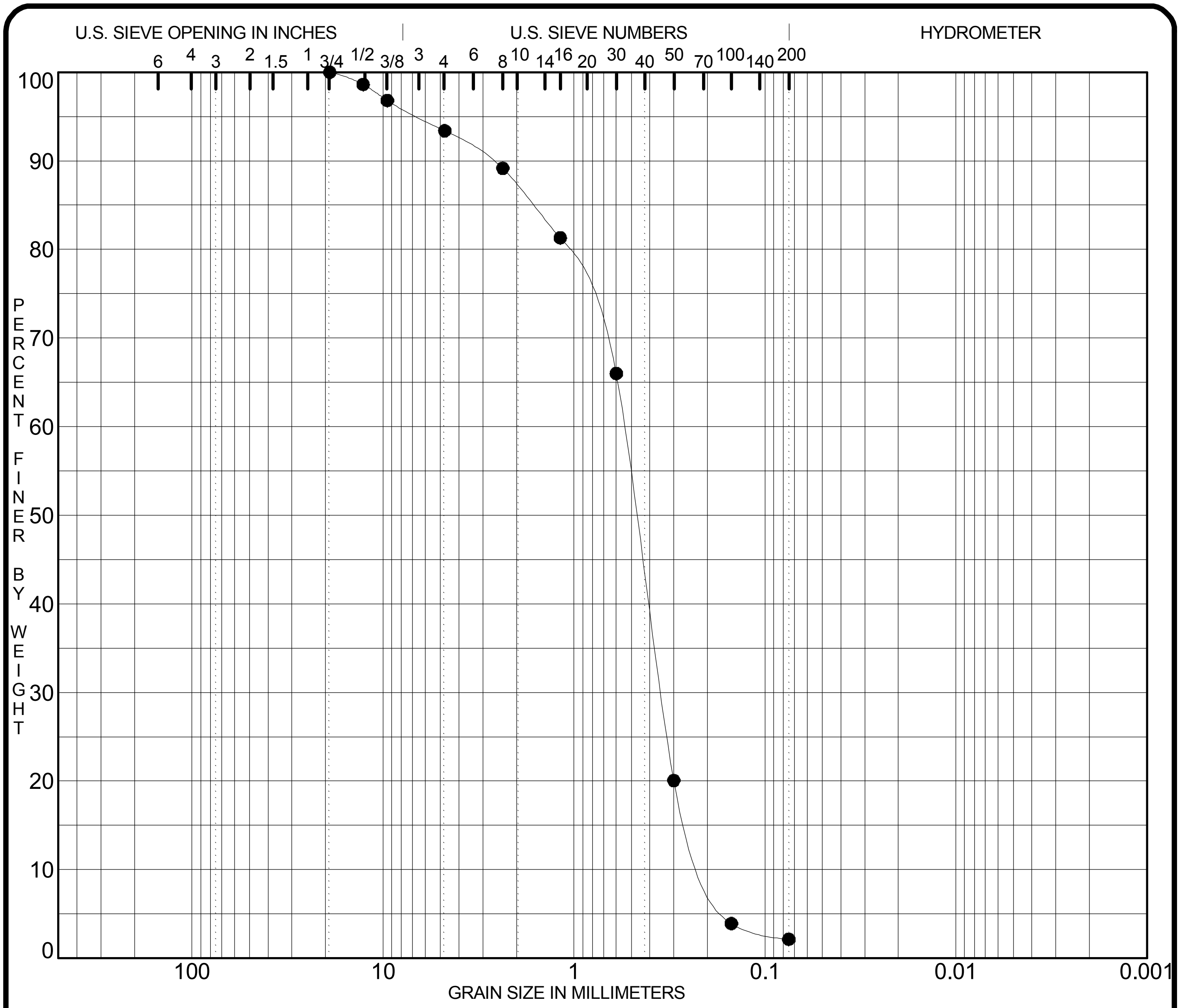
	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
●	**MW-1605I 68.6-78.2ft**	**19.000**	**0.569**	**0.347**	**0.179**	**9.9**	**87.6**	**2.5**	

PROJECT **ROCKPORT PLANT -**

JOB NO. **42393125-01**
DATE **3/22/16**

GRADATION CURVES

American Electric Power Service Corp.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
● **MW-1605S 37.6-47.2ft**		**16.0**					
	POORLY GRADED SAND SP						
	SS-27,28,29,30,31 (Composite Sample)						
	N 151,478.8 E 513,528.4						
	ELEVATION 400.3						

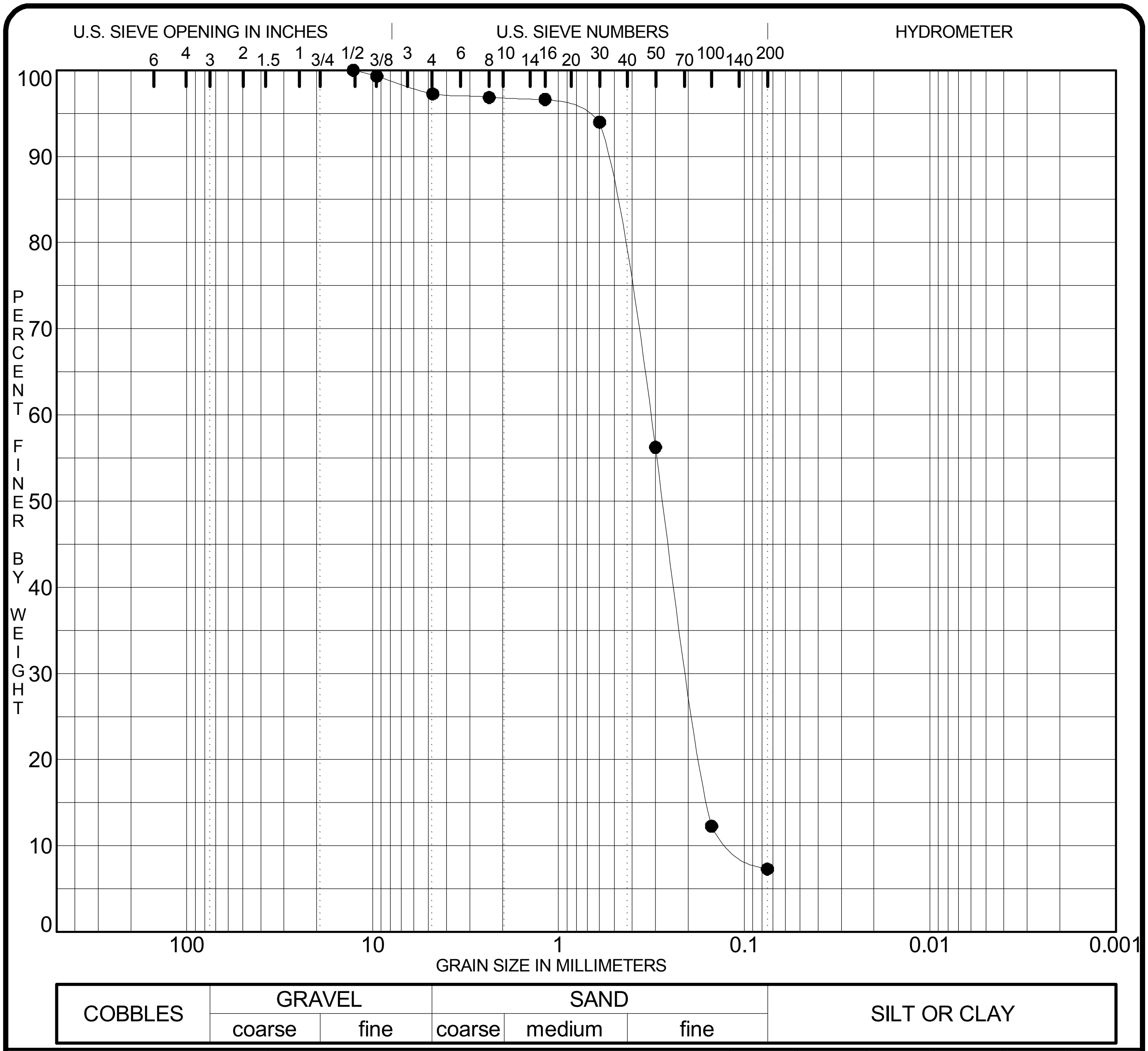
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● **MW-1605S 37.6-47.2ft**	**19.000**	**0.548**	**0.349**	**0.195**	**6.6**	**91.3**	**2.1**	

PROJECT **ROCKPORT PLANT -**

JOB NO. **42393125-01**
DATE **3/22/16**

GRADATION CURVES

American Electric Power Service Corp.



Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
● **MW-1606D100.0-109.6ft**		**28.6**					
	SS-68,69,70,71,72,73 (Composite Sample)						
	N 151,502.1 E 512,881.5						
	ELEVATION 397.8						

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● **MW-1606D100.0-109.6ft**	**12.700**	**0.321**	**0.198**	**0.109**	**2.7**	**90.0**	**7.3**	

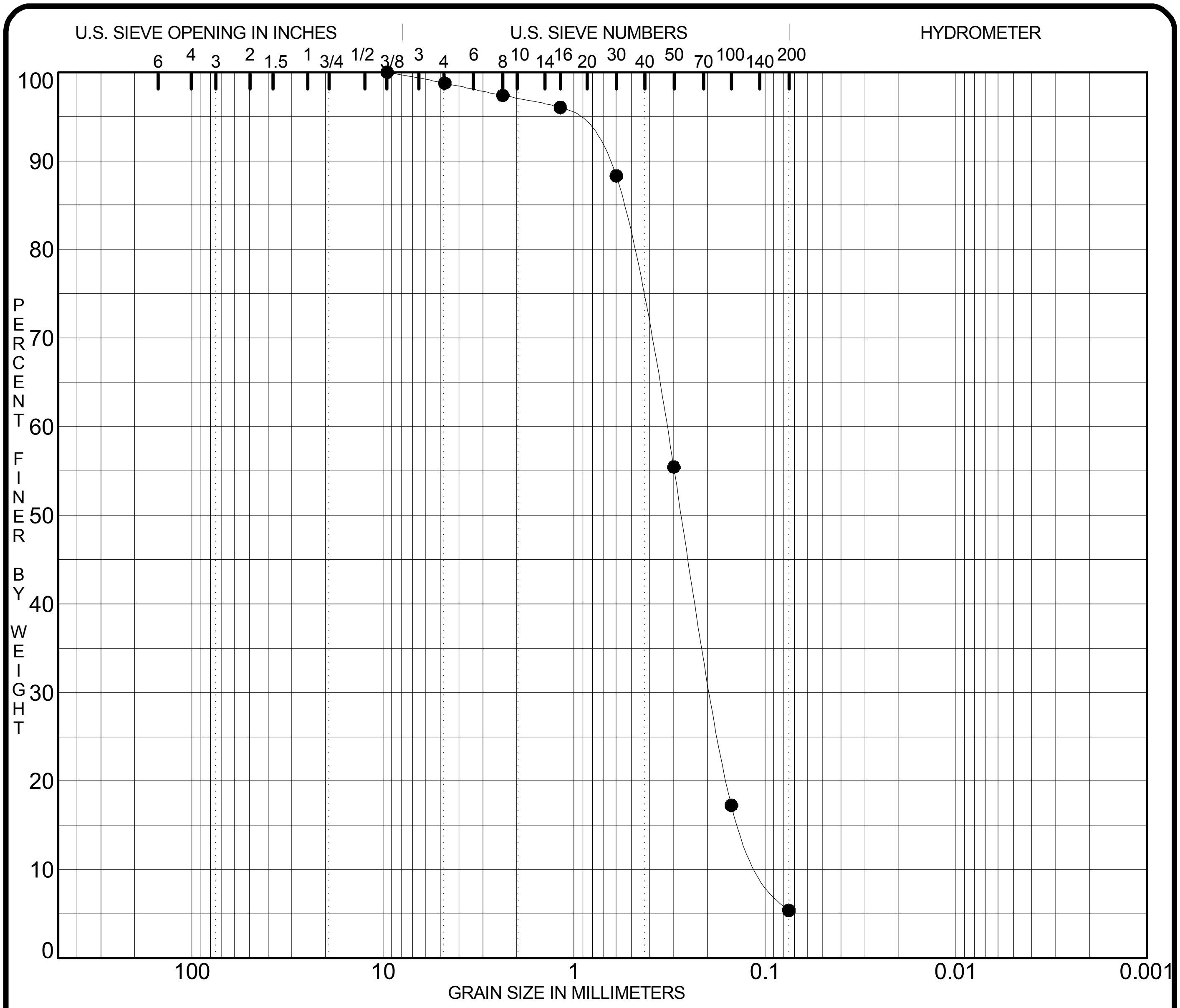
PROJECT **ROCKPORT PLANT -**

JOB NO. **42393125-01**

DATE **3/22/16**

GRADATION CURVES

American Electric Power Service Corp.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	MC%	LL	PL	PI	Sp.Gr.
● **MW-1606I**	**65.7-75.3ft**		**18.9**				
		SS-45,46,47,48,49,50 (Composite Sample)					
		N 151,508.4 E 512,885.5					
		ELEVATION 397.8					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● **MW-1606I**	**65.7-75.3ft**	**9.500**	**0.330**	**0.189**	**0.098**	**1.2**	**93.4**	**5.4**	

PROJECT **ROCKPORT PLANT -**

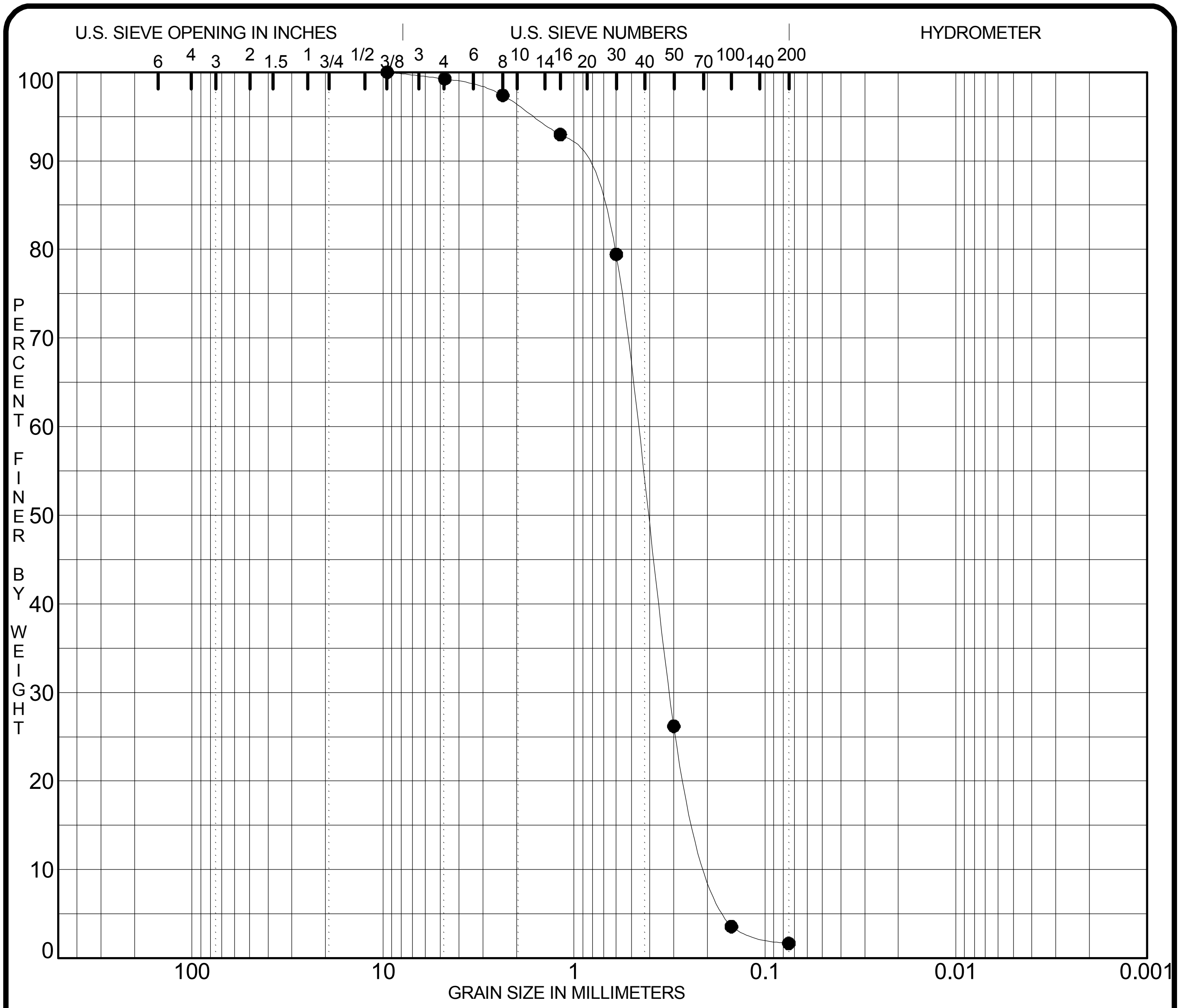
JOB NO. **42393125-01**

DATE **3/22/16**

GRADATION CURVES

American Electric Power Service Corp.

AEP



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.	
● **MW-1606S 34.7-44.3ft**		**20.9**					
	POORLY GRADED SAND SP						
	SS-25,26,27,28,29 (Composite Sample)						
	N 151,498.9 E 512,889.4						
	ELEVATION 397.6						

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● **MW-1606S 34.7-44.3ft**	**9.500**	**0.466**	**0.315**	**0.183**	**0.8**	**97.6**	**1.7**	

PROJECT **ROCKPORT PLANT -**

JOB NO. **42393125-01**
DATE **3/22/16**

GRADATION CURVES

American Electric Power Service Corp.

APPENDIX C :LiquefyPro Analysis Input and Output

SEISMIC IMPACT ZONES DEMONSTRATION

Bottom Ash Complex -Rockport Plant

Hole No.=1605   Water Depth=30 ft   Surface Elev.=399

Magnitude=6.46
Acceleration=0.14957g

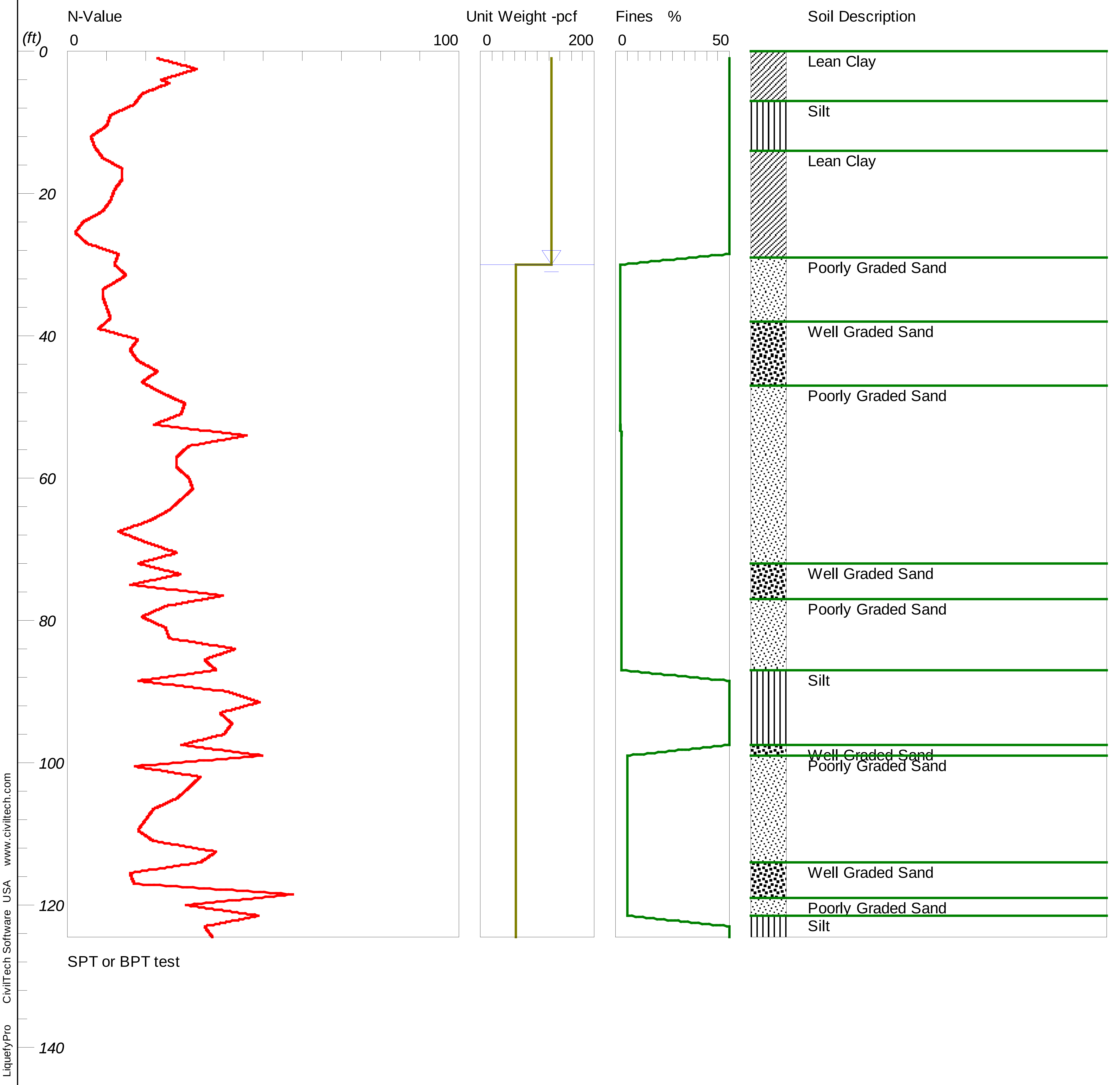


Plate A-1

American Electric Power Service Corporation

SEISMIC IMPACT ZONES DEMONSTRATION

Bottom Ash Complex -Rockport Plant

Hole No.=1605 Water Depth=30 ft Surface Elev.=399

Magnitude=6.46
Acceleration=0.14957g

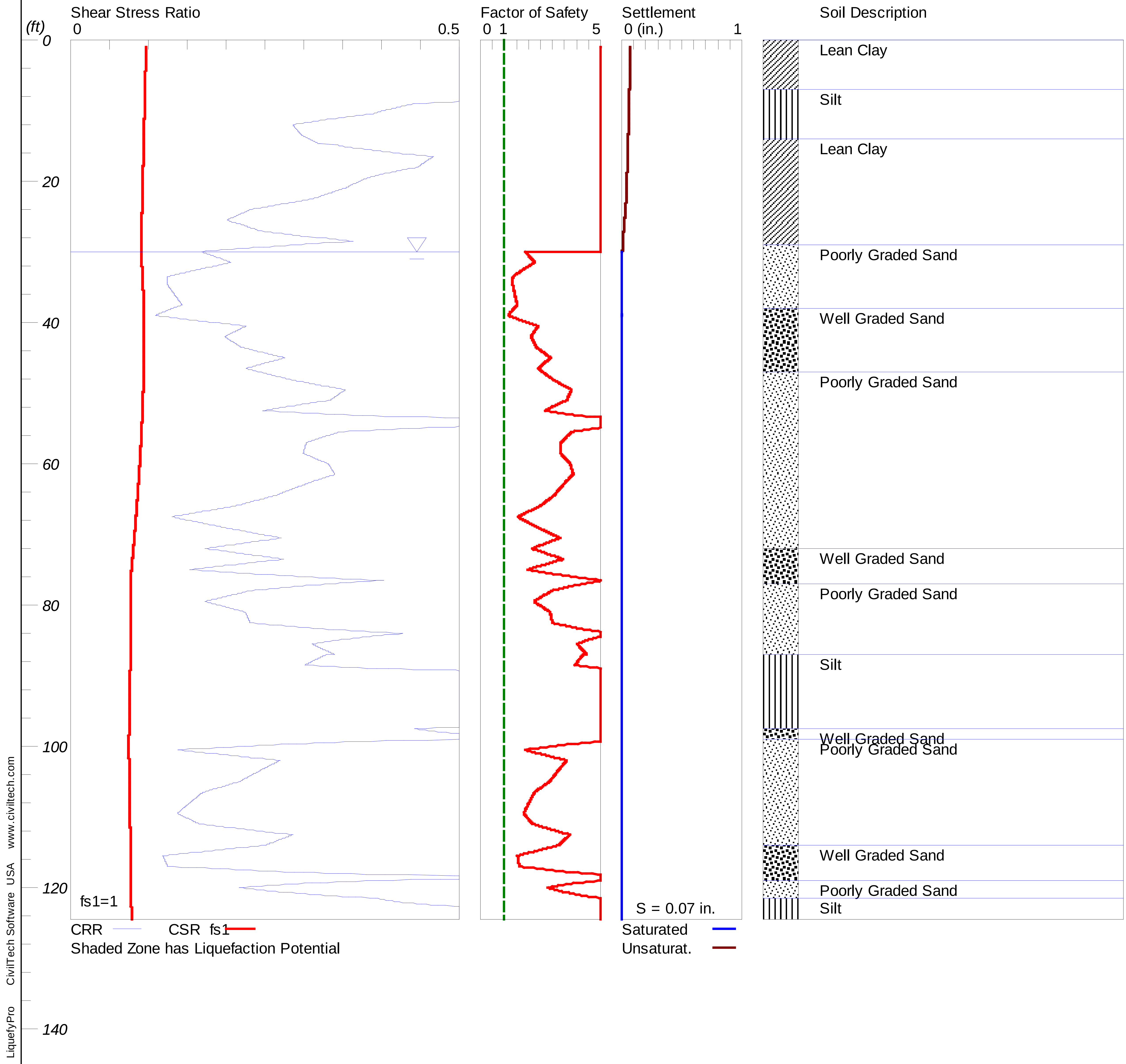


Plate A-1

American Electric Power Service Corporation

SEISMIC IMPACT ZONES DEMONSTRATION

Bottom Ash Complex -Rockport Plant

Hole No.=1606   Water Depth=27 ft   Surface Elev.=397.8

Magnitude=6.46
Acceleration=0.14957g

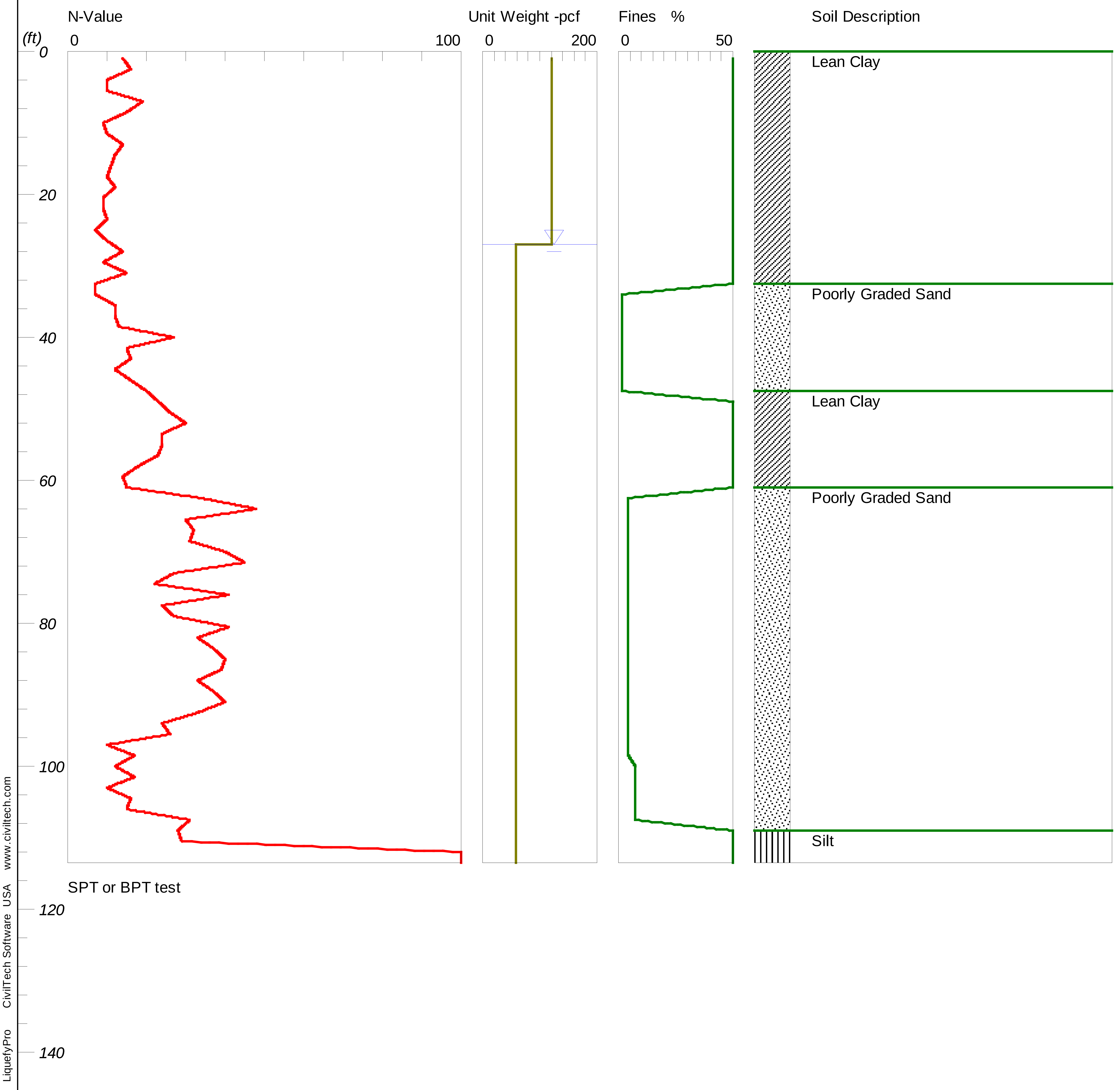


Plate A-1

AMERICAN ELECTRIC POWER
BOUNDLESS ENERGY

American Electric Power Service Corporation

SEISMIC IMPACT ZONES DEMONSTRATION

Bottom Ash Complex -Rockport Plant

Hole No.=1606 Water Depth=27 ft Surface Elev.=397.8

Magnitude=6.46
Acceleration=0.14957g

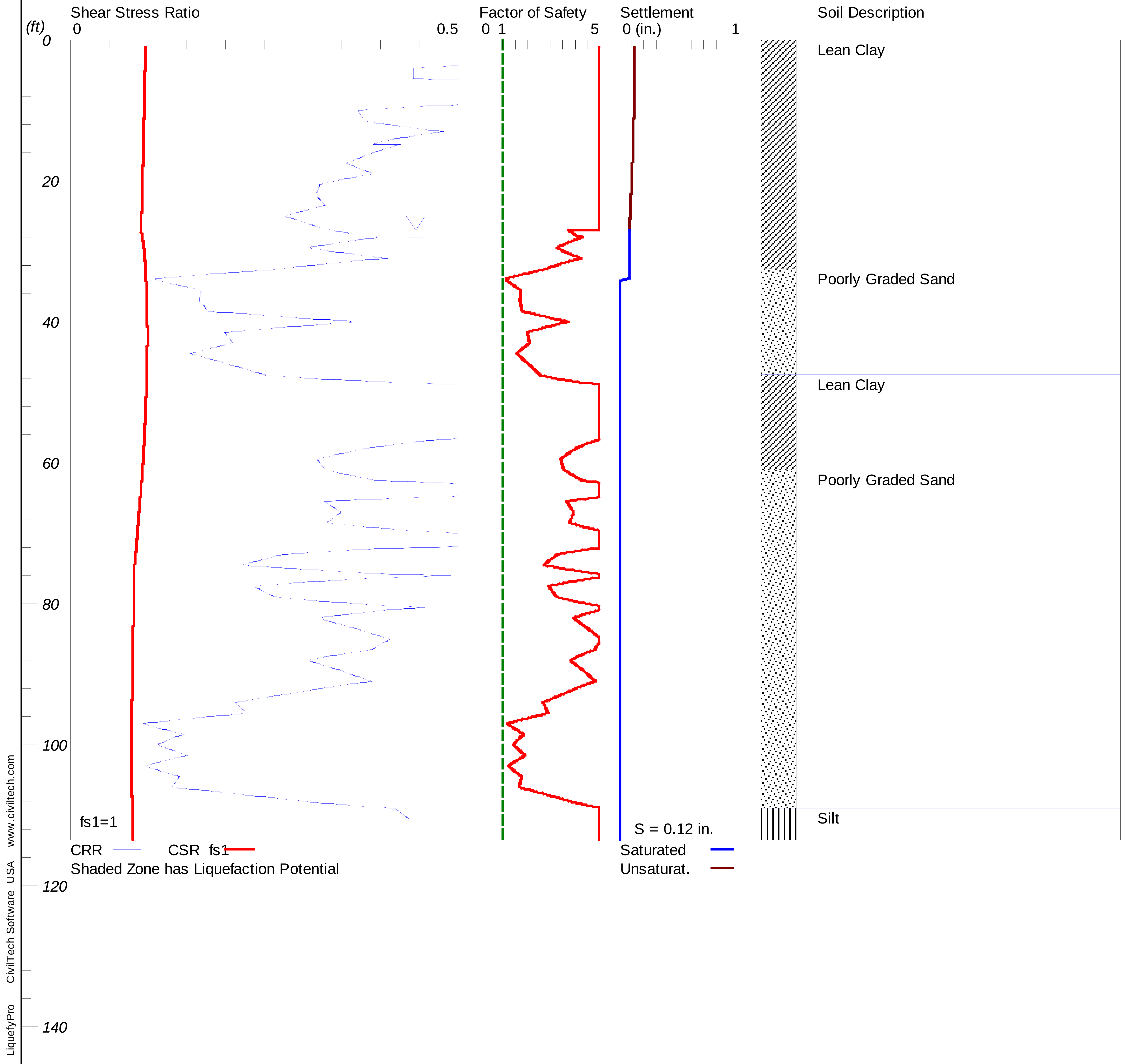


Plate A-1

American Electric Power Service Corporation

APPENDIX D : Structural Calculation SES-CALC-02391

AEP AMERICAN ELECTRIC POWER

1/38

CALCULATION COVER SHEET

PLANT: Rockport **TITLE:** CCR Compliance of Seismic Impact Zone Review of Structures Located on Bottom Ash Ponds

UNIT: 0

CALCULATION NUMBER: SES-CALC- 02391 **REV. NUMBER:** 1

STRUCTURE/SYSTEM/COMPONENT: West and East Bottom ash Ponds

ASSOCIATED DRAWING NUMBERS: 12-30013

PURPOSE OF CALCULATION: to
Validate Compliance with CCR Rules
Rev. 1 provides clarification to corrective action. See page 37.

ALTERNATE CALCULATION PERFORMED TO VALIDATE THIS CALCULATION: (Y/N) _Y_____
IF YES, THE ALTERNATE CALCULATION SHALL BE INCLUDED IN THIS PACKAGE.

PREPARER: Satyananda Chakrabarti **Date:** 9/22/2018

CHECKER: J. Reiniger **Date:** 9/26/2018

ENGINEERING SECTION MANAGER: **Date:** 10-5-18

Total No. of Pages Including Coversheet and Checklist: 38

38

Table of Contents Page No.

Calculation No. SES-CALC- 02391

THIS IS A SUPPORTING CALC FOR GEC-16-007

Units used in this calculation:

Mass: Length: Pressure/Stress: Angularity:

$\mathrm{kip} \equiv 1000 \cdot \mathrm{lbf}$ $\mathrm{lb} \equiv \frac{\mathrm{kip}}{1000}$ $\mathrm{ft} \equiv 1 \cdot \mathrm{L}$ $\mathrm{psi} \equiv \frac{\mathrm{lbf}}{\mathrm{in}^2}$ $\mathrm{Rad} \equiv 1$

$\mathrm{kips} \equiv \mathrm{kip}$ $\mathrm{lbs} \equiv \mathrm{lb}$ $\mathrm{ft} \equiv 12 \cdot \mathrm{in}$ $\mathrm{ksi} \equiv \frac{\mathrm{kip}}{\mathrm{in}^2}$ $\mathrm{deg} \equiv 2 \cdot \pi \cdot \frac{\mathrm{rad}}{360}$

$\mathrm{pcf} \equiv \frac{\mathrm{lbf}}{\mathrm{ft}^3}$ $\mathrm{acc} := 32.2 \cdot \frac{\mathrm{ft}}{\mathrm{sec}^2}$ $\mathrm{psf} \equiv \frac{\mathrm{lbf}}{\mathrm{ft}^2}$

$\mathrm{plinf} := \frac{\mathrm{lbf}}{\mathrm{ft}}$

$\mathrm{ksf} \equiv \frac{\mathrm{kip}}{\mathrm{ft}^2}$

SUMMARY OF CALCULATION

Objective of the calculation: Demonstrate that the structural components of the CCR units West and East Bottom Ash ponds are designed to meet the maximum horizontal acceleration in lithified earth material for the site. This calculation evaluates the seismic impact on the surface water control systems.

ASSUMPTION: This calculation assumes that the stability of the dikes which are currently being investigated for earthquakes will be found to be stable.

Background

1. The CCR rule requires:
§ 257.63 Seismic impact zones.
(a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in seismic impact zones unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site. (b) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of paragraph (a) of this section.

2. The structures were constructed in the late 70s and early 80s for a 2-unit operating plant with

a total capacity of approximately 2,600 MW.

3. The structures reviewed in this evaluation are all surface water control units facilitating water flow from the Bottom Ash Ponds to the Waste water ponds.

4. The units included in the total population can be classified into two groups:

- Group 1: Units subjected to lateral loading due to the quakes used for transfering water from Bottom Ash ponds to waste water ponds including units used to dewater the BA ponds. The units are:

1. Energy Dissipator structure (EDS - 2 nos.) - approximately 8 plant pipes of 8 - 10 inch dia pipes discharging into this structure and then transported into the BA pond through the Energy Dissipator troughs/Pond Discharge Inlet Chutes. EDSs are of concrete with steel dissipation flaps.

2.Energy Dissipator troughs/Pond Discharge Inlet Chutes (EDT) - These are concrete structures partially open at the top and partially covered by yellow steel boxes called Discharge Chute Covers.

3. Skimmers (SKM)- Timber structures surrounding the waste water discharge chute

4. Waste water Discharge shaft (WWDS)- a steel and concrete prismoidal structure for routing waste water into the waste water discharge pipe.

- Group 2: Waste water discharge pipe (WWDP) - Two buried 48 inch (one fiberglass and the other HDPE) pipes that transfer water under the dikes. Because they are buried they are affected by seismic waves and ground displacements.

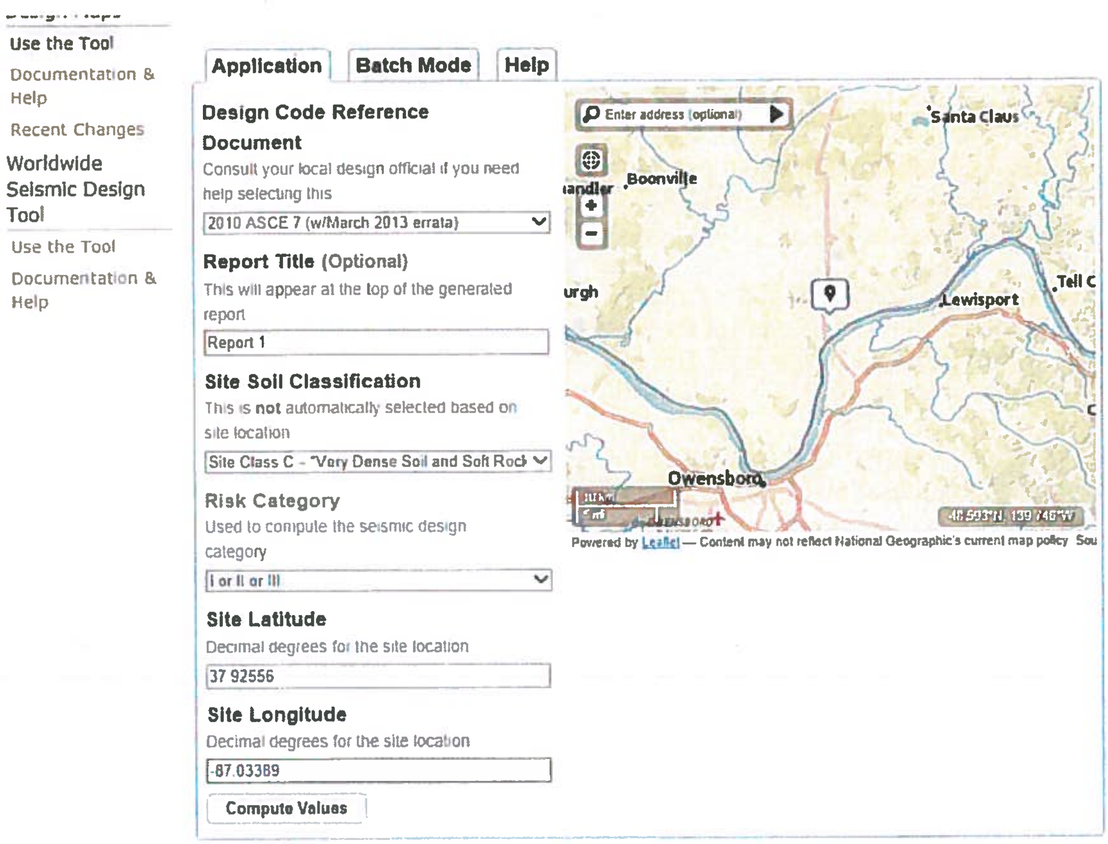
Two sets of analyses have been performed for the two groups.

5. Presentation of the Calculation

A. Part I - Relevant Cross-sections.
CCR Rule list

B. Part II - A - Maximum Considered Earthquake Spectral Acceleration
S_s = Mapped maximum considered earthquake spectral acceleration at 0.2 seconds
S_1 = Mapped maximum considered earthquake spectral acceleration at 1.0 seconds

Get the *"Latitude"* & *"Longitude"* for the site and input as shown below.



Design Code Reference Document
Consult your local design official if you need help selecting this
2010 ASCE 7 (w/March 2013 errata)

Report Title (Optional)
This will appear at the top of the generated report
Report 1

Site Soil Classification
This is **not** automatically selected based on site location
Site Class C - "Very Dense Soil and Soft Rock"

Risk Category
Used to compute the seismic design category
I or II or III

Site Latitude
Decimal degrees for the site location
37.92556

Site Longitude
Decimal degrees for the site location
-87.03389

Part II - B. Apply site coefficients Fa and Fv - these are site amplification factors

Adjust MCE spectral response acceleration S_{MS} and S_{M1}

Derive S_{DS} and S_{D1} 5% damped design spectral response acceleration at 0.2 second period - ASCE 7-05

$S_{DS} = 2/3\ S_{MS}$ $S_{D1} = 2/3\ S_{M1}$

Plot Elastic Design Response Spectra

Part II - C Determine Seismic Design Category and Equivalent Lateral Load without SSI

Determine Risk and seismic category

Value of S_{DS}	Occupancy Category		
	I or II	III	IV
$S_{DS} < 0.16g$	A	A	A
$0.16g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$S_{DS} \ge 0.50g$	D	D	D

Value of S_{D1}	Occupancy Category		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$S_{D1} \ge 0.20g$	D	D	D
$S_{D1} \ge 0.75g$	E	E	F

This section calculates the initial lateral load without soil-structure interaction.

Part II-D Consider Soil-structure Interaction ASCE 7 Chapter 19

Soil Density = 120 pcf Vs = 1,200 ft/sec

Vertical and lateral spring calculated per Hall.

The reduction is minimal and neglected.

Finally vertical force due to vertical earthquake is calculated per ASCE 7 eqn. 12.4.2.2

Part II-E Apply hydrodynamic force

Because the skimmer is constructed of timber materials and its structural condition is deteriorated, it is assumed to fail during earthquake. The subject unit may then be subjected to hydrodynamic forces generated by waves,

The dynamic and static water pressure are then added to other forces for equilibrium.

Part II-F Final Check for equilibrium

Check safety against sliding and overturning

High safety factor obtained and no further check is performed.

This structure was analyzed as a typical structure subject to shear loading. Based on high safety margins, no other shear-susceptible structure was analyzed because by judgment they will be OK,

Part III - Analyses for underground piping

FEMA -ASCE, American Lifelines Alliance, Guidelines for the Design of Buried Steel Pipe, Jul 200

The pipelines (2 nos) one fiberglass and the other HDPE are not specifically addressed by the reference but the the treatment of strains and stresses can be transferred from steel properties to non-steel properties. If high safety factors are obtained, then specific analyses with the specific properties are not needed to evaluate.

11.1 Seismic Wave Propagation

Wave propagation provisions are presented in terms of longitudinal axial strain, that is, strain parallel to the pipe axis induced by ground strain. Flexural strains due to ground curvature are neglected since they are small for typical pipeline diameters.

The axial strain, ε_a, induced in a buried pipe by wave propagation can be approximated using the following equation:

$$\varepsilon_a = \frac{V_g}{\alpha C_s} \tag{11-1}$$

where:

V_g = peak ground velocity generated by ground shaking

C_s = apparent propagation velocity for seismic waves (conservatively assumed to be 2 kilometers per second)

α = 2.0 for C_s associated with shear waves, 1.0 otherwise

The axial strains produced by Equation (11-1) can be assumed to be transferred to the pipeline but need not be taken as larger than the axial strain induced by friction at the soil pipe interface:

$$\varepsilon_a \le \frac{T_u \lambda}{4AE} \tag{11-2}$$

where:

T_u = peak friction force per unit length at soil-pipe interface (see Appendix A)

λ = apparent wavelength of seismic waves at ground surface, sometimes assumed to be 1.0 kilometers without further information

A = pipe cross-sectional area

E = steel modulus of elasticity

Tu is calculated by the eqn. below.

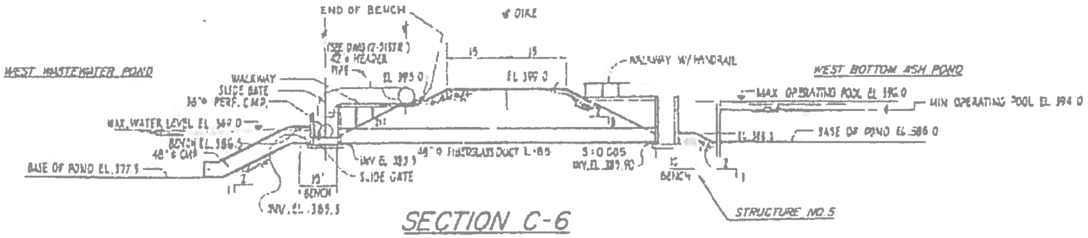
For our case, with cohesionless backfill, the peak force per unit length of the soil-pipe interface (from Appendix B) is:

$$T_u = \frac{\pi}{2} D H \bar{\gamma} \left(1 + K_o\right) \tan \delta$$

PART I

Relevant Cross Sections

Reference drawings:
12-30013, -27



SECTION C-6
SCALE: 1"=20'

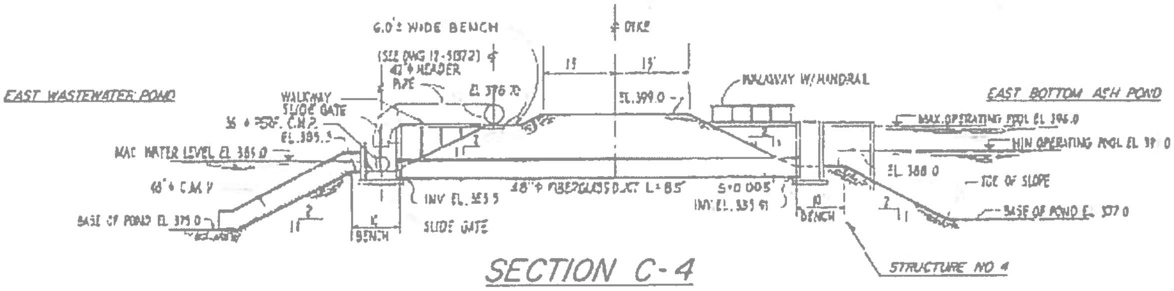
Structures/structural components at Section C-6:

West Bottom Ash Pond Side

C-6-1: 48" Fiberglass Duct
C-6-2: Concrete Inflow Box
C-6-3: Timber box for skimmer
C-6-4: Walkway with handrails

West Wastewater Pond Side

C-6-5: 48" CMP Discharge Line
C-6-6: 36" Perforated CMP
C-6-7: Concrete Inflow Box
C-6-8: Walkway with handrails



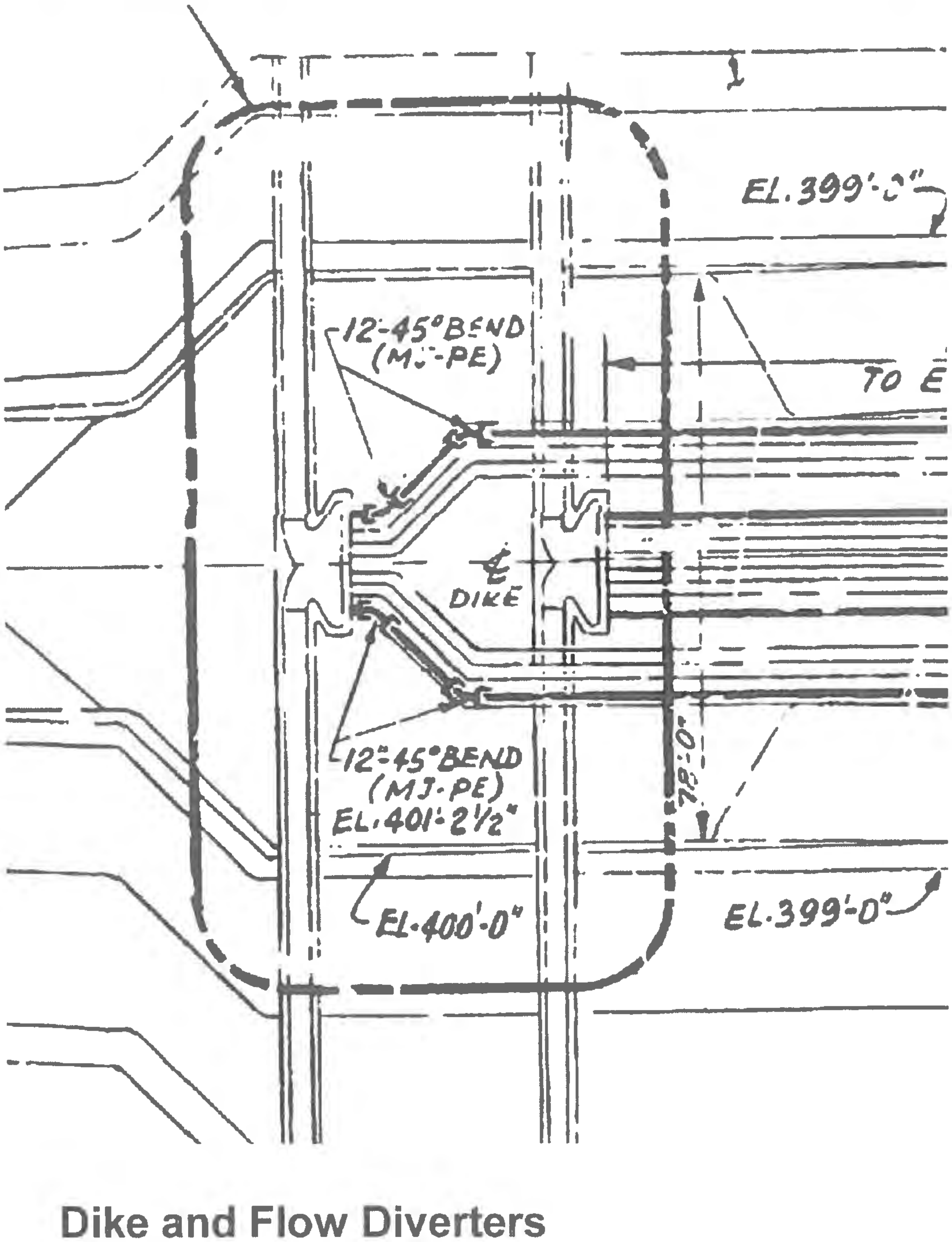
SECTION C-4
SCALE: 1"=20'

East Wastewater Pond Side

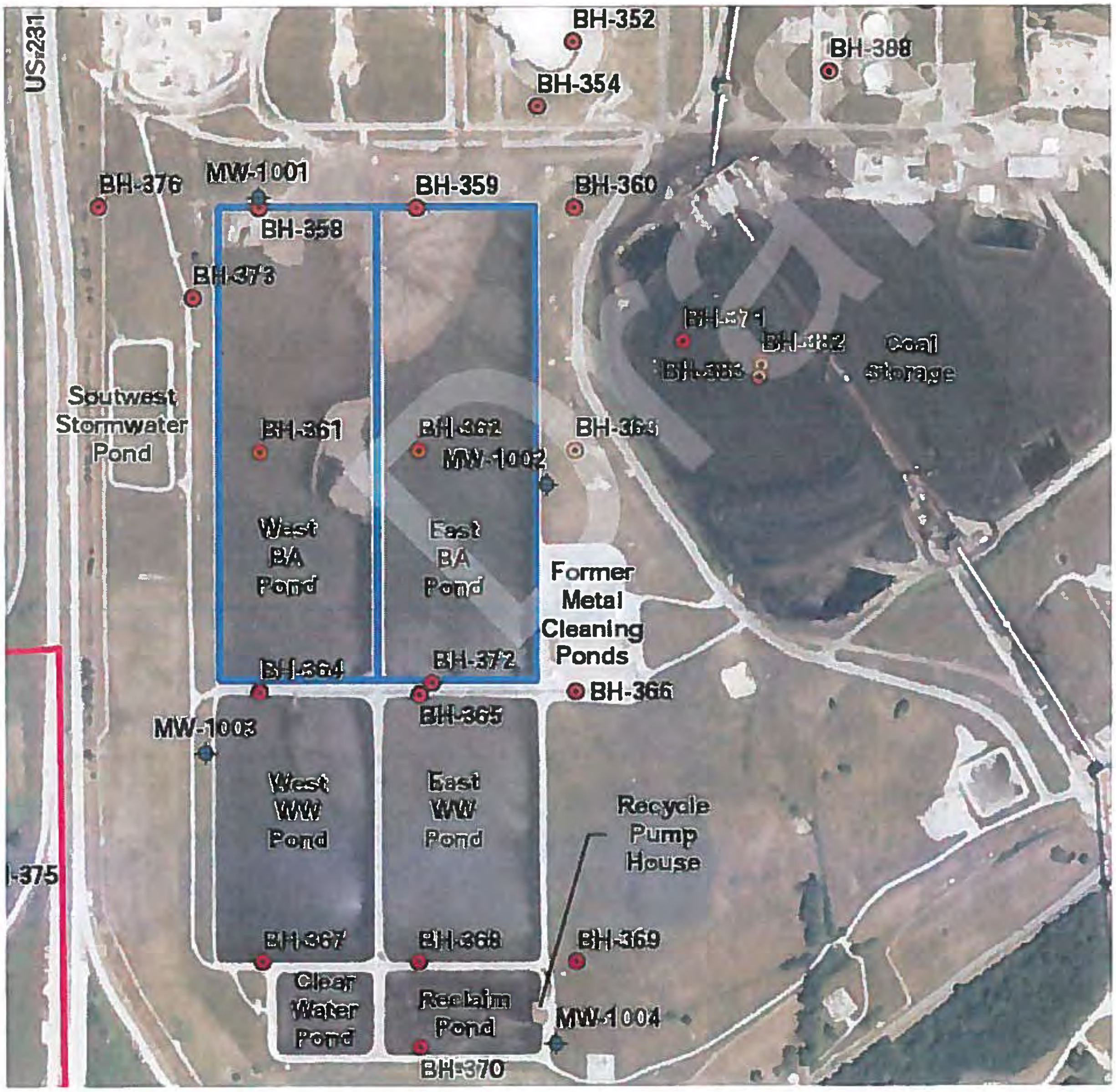
C-4-5: 48" CMP Discharge Line
C-4-6: 36" Perforated CMP
C-4-7: Concrete Inflow Box
C-4-8: Walkway with handrails

East Bottom Ash Pond Side

C-4-1: 48" Fiberglass Duct
C-4-2: Concrete Inflow Box
C-4-3: Timber box for skimmer
C-4-4: Walkway with handrails



Dike and Flow Diverters



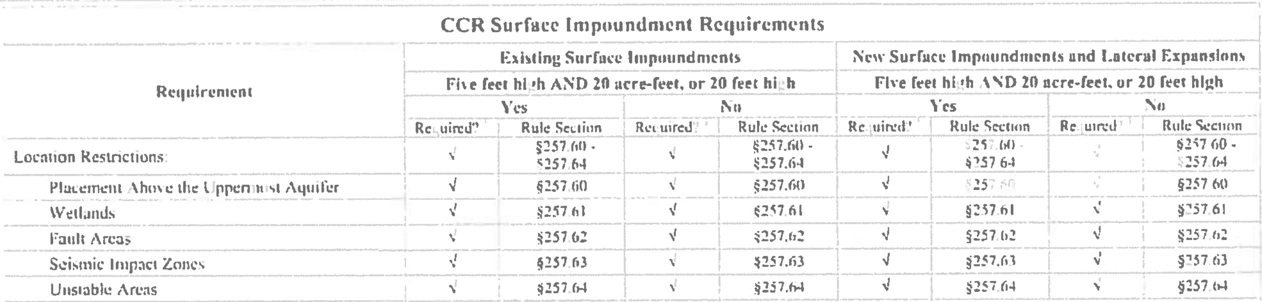
LOCATION OF THE PONDS

NORTH

PART II - A

Maximum Considered Earthquake Spectral Acceleration

CCR Rule



CCR Surface Impoundment Requirements

Requirement	Existing Surface Impoundments				New Surface Impoundments and Lateral Expansions			
	Five feet high AND 20 acre-feet, or 20 feet high				Five feet high AND 20 acre-feet, or 20 feet high			
	Yes		No		Yes		No	
	Required?	Rule Section	Required?	Rule Section	Required?	Rule Section	Required?	Rule Section
Location Restrictions:	√	§257.60 - §257.64	√	§257.60 - §257.64	√	§257.60 - §257.64	√	§257.60 - §257.64
Placement Above the Uppermost Aquifer	√	§257.60	√	§257.60	√	§257.60	√	§257.60
Wetlands	√	§257.61	√	§257.61	√	§257.61	√	§257.61
Fault Areas	√	§257.62	√	§257.62	√	§257.62	√	§257.62
Seismic Impact Zones	√	§257.63	√	§257.63	√	§257.63	√	§257.63
Unstable Areas	√	§257.64	√	§257.64	√	§257.64	√	§257.64

With respect to seismic reviews two issues are relevant:

1. Fault Areas
2. Seismic Impact Zones

Reference : **EVALUATION OF LOCATION RESTRICTIONS, Bottom Ash Ponds, Rockport Plant, Draft Final, 25 sep 2015. p.15:**

"Based on available information, it is our opinion that the site meets the criterion of being located more than 200 feet from the outermost damage zone of a fault with displacement in Holocene time, as set forth in 40 CFR §257.62." End of Fault contributing to earthquake.

SEISMIC IMPACT ZONES **37.925560 Lat. -87.033890 Long.**

The same reference also states that: http://earthquake.usgs.gov/designmaps/us/application.php

"The 2014 USGS National Seismic Hazard Maps (NSHM) display earthquake ground motions for various probability levels across the United States. We have reviewed the USGS National Seismic Hazard Map showing a 2% probability that the maximum expected horizontal acceleration, expressed as a percentage of the earth''s gravitational pull (g), will be exceeded in years (2% exceedance in 50 years, Peak Ground Acceleration (PGA)). The USGS NSHM map is provided as **Figure 9**. Based on the NSHM map for a 2% exceedance in 50 years, we have determined the PGA for this site is 0.2 g."
(Figure 9 not attached).

From CCR Rules: " A Seismic impact zone means an area having a 2% or greater probability that the maximum expected horizontal acceleration, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10 g in 50 years. Seismic zones, which represent areas of the United States with the greatest seismic risk, are mapped by the U.S. Geological Survey and readily available for all the U.S. (http://earthquake.usgs.gov/hazards/apps/)".

References : The following references are used:

1. CCR Publication: Federal Register, April 17, 2015.
2. IBC Code, 2012/ASCE 7
3. FERC, Evaluation of Earthquake Ground Motions, Draft 06.5, FERC Feb 2007

USGS Design Maps Summary Report

User-Specified Input

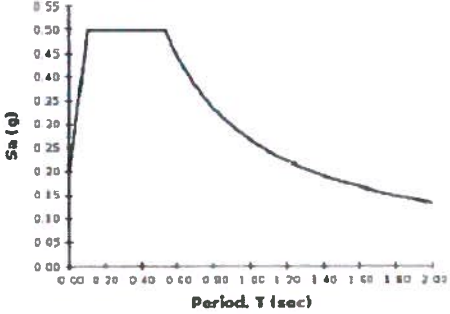
Report Title	USGS Data Sat August 27, 2016 14:53:43 UTC
Building Code Reference Document	ASCE 7-10 Standard (which utilizes USGS hazard data available in 2008)
Site Coordinates	37.92556°N, 87.03389°W
Site Soil Classification	Site Class C – "Very Dense Soil and Soft Rock"
Risk Category	I/II/III

USGS-Provided Output

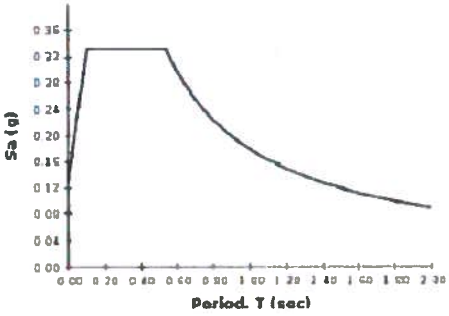
S_S = 0.415 g	S_{MS} = 0.498 g	S_{DS} = 0.332 g
S_1 = 0.163 g	S_{M1} = 0.267 g	S_{D1} = 0.178 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.

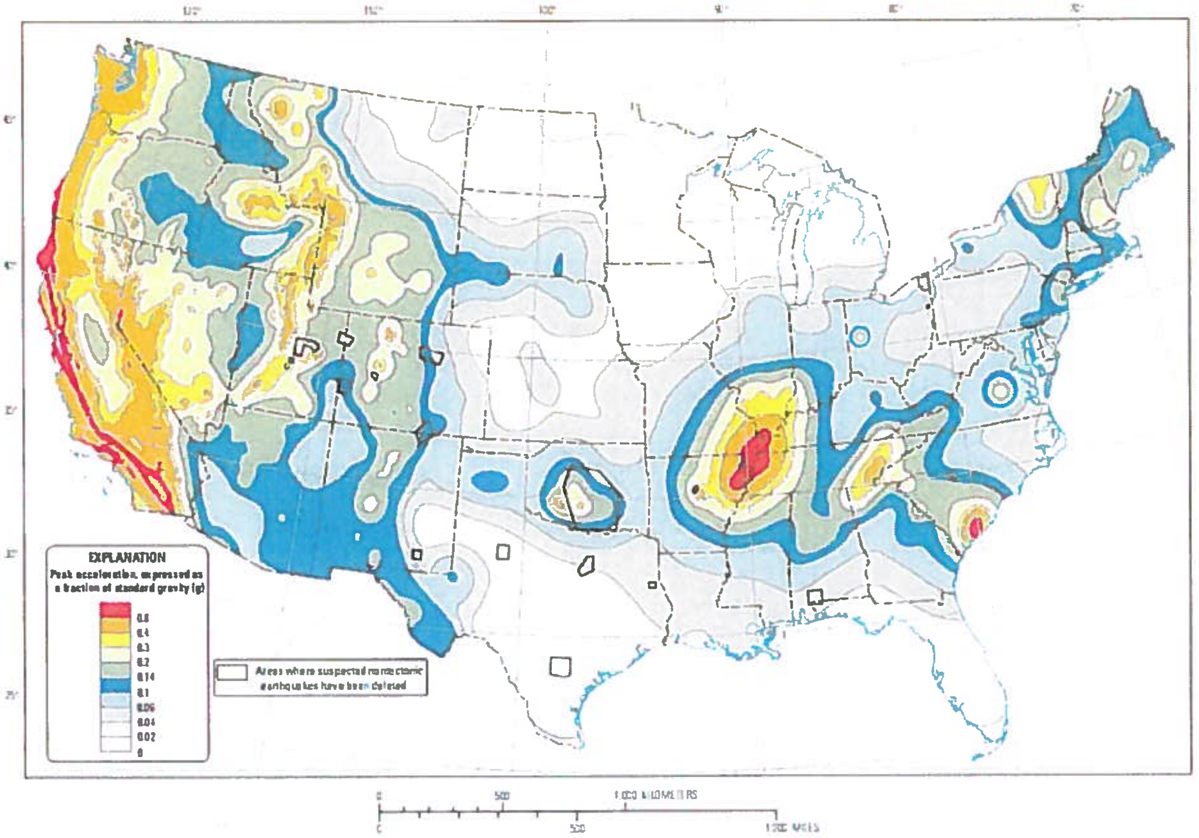
MCE$_R$ Response Spectrum



Design Response Spectrum



For PGA_M, T_L, C_{RS}, and C_{R1} values, please view the detailed report.



Two-percent probability of exceedance in 50 years map of peak ground acceleration

The map indicates PGA = 0.2 g

Determine Building Occupancy: from IBC Section 312, Group U

Determine basic ground motion parameters

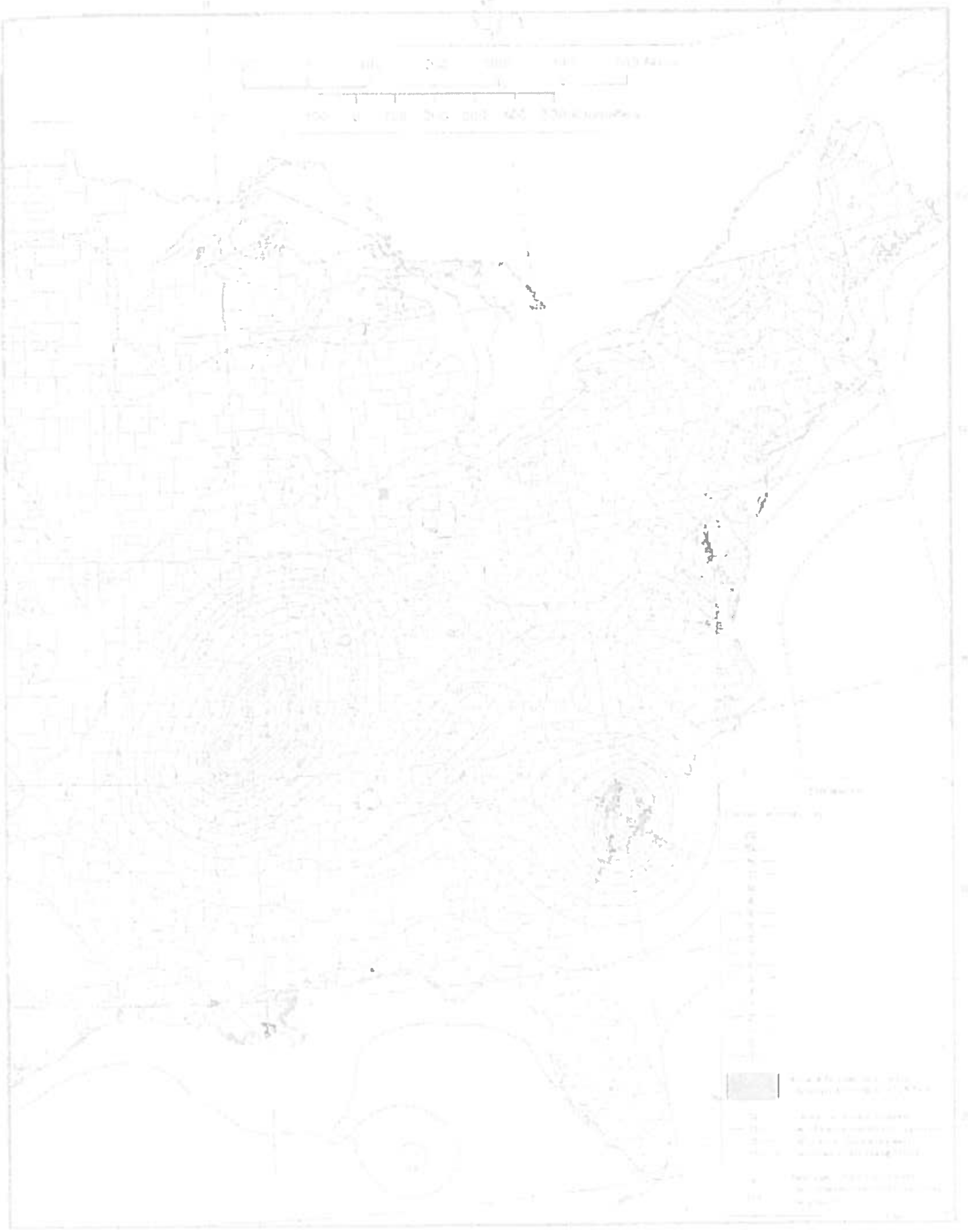


FIGURE 1613.3.1(1)—continued
RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) GROUND MOTION RESPONSE ACCELERATIONS FOR THE CONTERMINOUS UNITED STATES OF 0.2-SECOND SPECTRAL RESPONSE ACCELERATION (5% OF CRITICAL DAMPING), SITE CLASS B

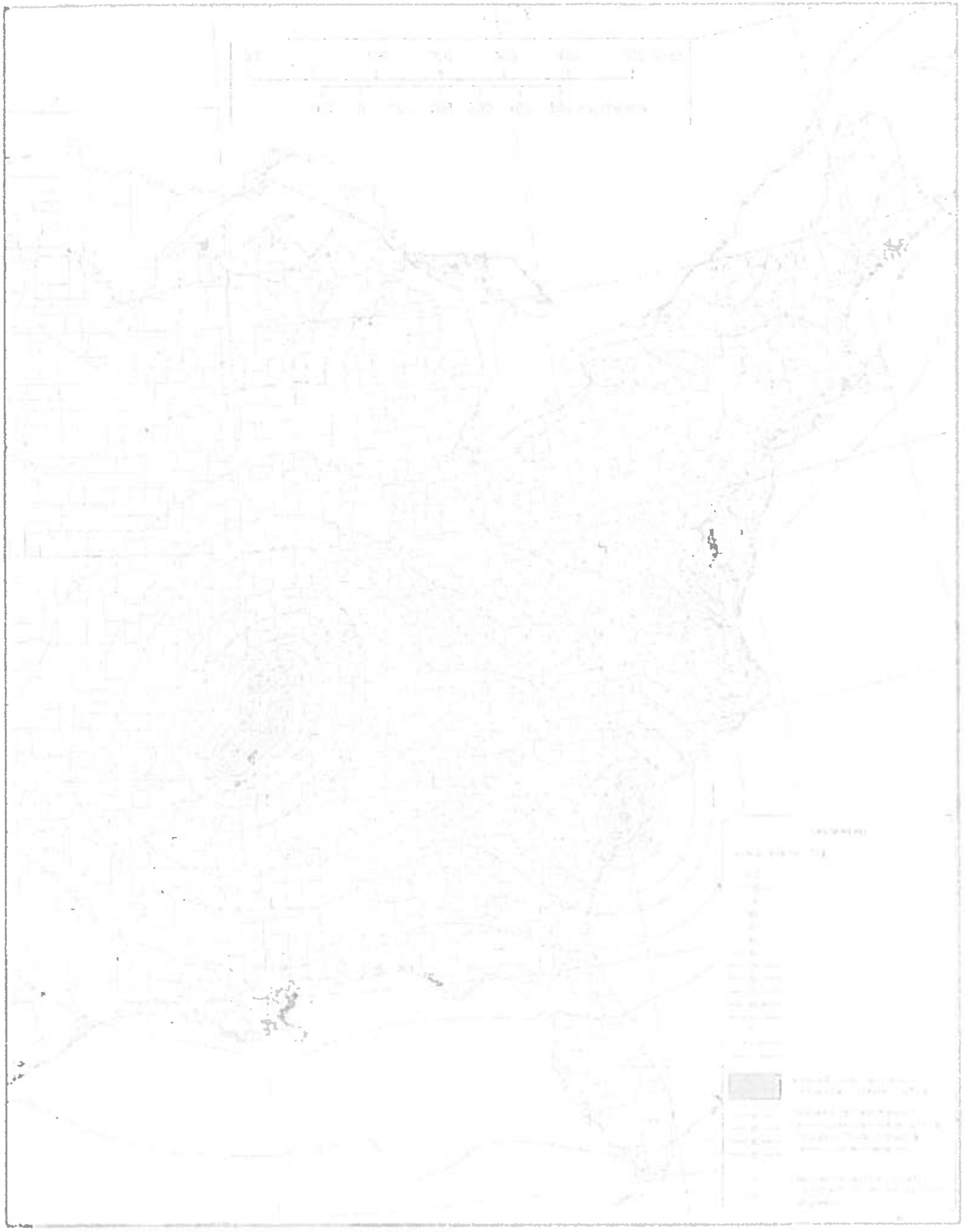


FIGURE 1613.3.1(2)—continued
RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) GROUND MOTION RESPONSE ACCELERATIONS FOR THE CONTERMINOUS UNITED STATES OF 1-SECOND SPECTRAL RESPONSE ACCELERATION (5% OF CRITICAL DAMPING), SITE CLASS B

S_s = Spectral acceleration for 0.2s

$S_s := 0.415 \cdot g$

S_1 = Spectral acceleration for 1s

$S_1 := 0.163 \cdot g$

Part II - B
Apply Site Amplification Factors

Calculate S_{DS} and S_{D1}

S_{DS} and S_{D1} = spectral values from Tables 1613.3.3(1) and 1613.3.3(2) respectively.

$S_{DS} = 2/3*F_a*S_s$ $S_{D1} = 2/3*F_v*S_1$

Fa and Fv are site coefficients.

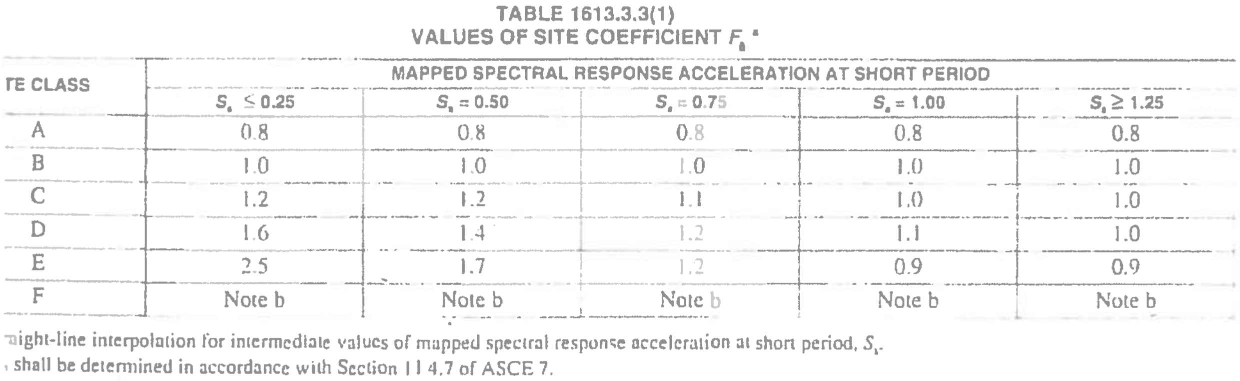


TABLE 1613.3.3(1)
VALUES OF SITE COEFFICIENT F_a ᵃ

TE CLASS	MAPPED SPECTRAL RESPONSE ACCELERATION AT SHORT PERIOD				
	$S_s \le 0.25$	$S_s = 0.50$	$S_s = 0.75$	$S_s = 1.00$	$S_s \ge 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	Note b	Note b	Note b	Note b	Note b

aight-line interpolation for intermediate values of mapped spectral response acceleration at short period, S_s.
, shall be determined in accordance with Section 11 4.7 of ASCE 7.

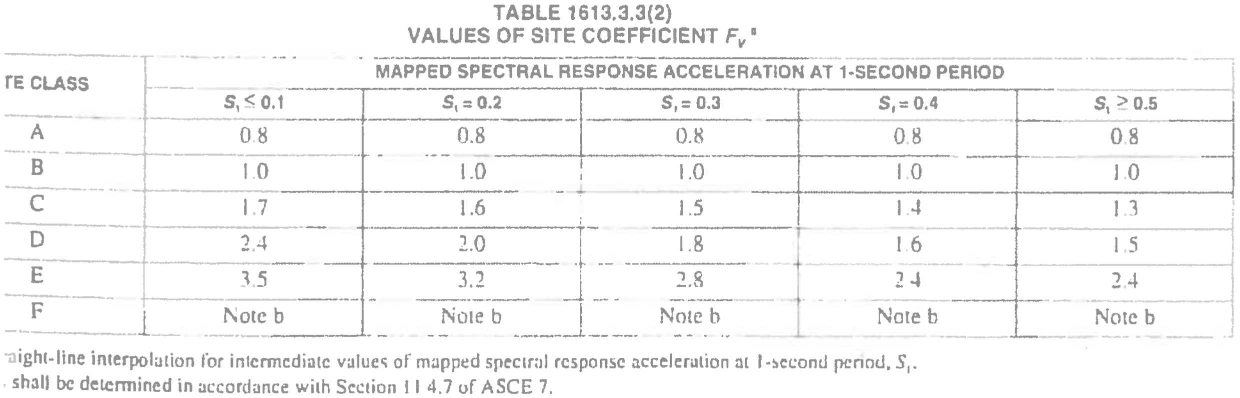
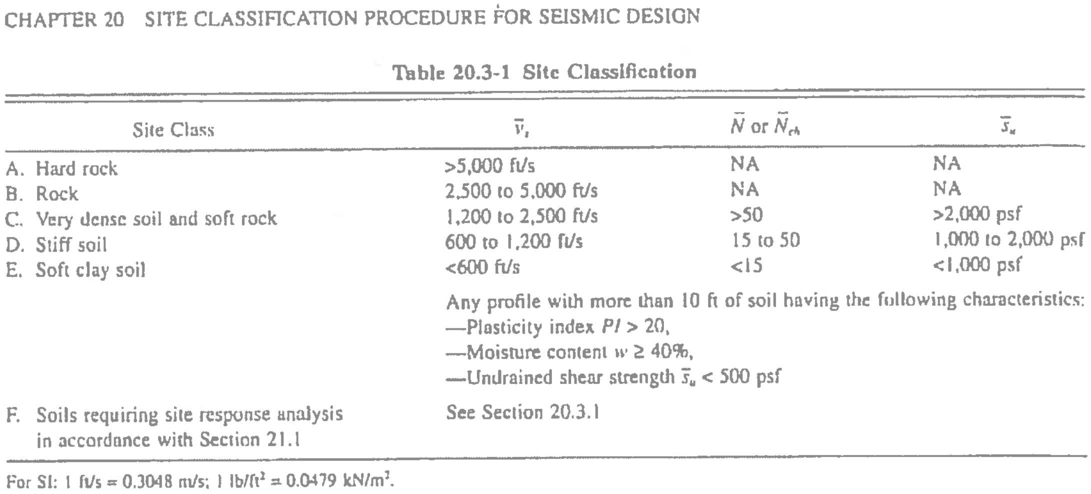


TABLE 1613.3.3(2)
VALUES OF SITE COEFFICIENT F_V ᵃ

TE CLASS	MAPPED SPECTRAL RESPONSE ACCELERATION AT 1-SECOND PERIOD				
	$S_1 \le 0.1$	$S_1 = 0.2$	$S_1 = 0.3$	$S_1 = 0.4$	$S_1 \ge 0.5$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	Note b	Note b	Note b	Note b	Note b

aight-line interpolation for intermediate values of mapped spectral response acceleration at 1-second period, S_1.
. shall be determined in accordance with Section 11 4.7 of ASCE 7.

Table 20.3-1 of ASCE 7 provides definition of Site Class.



CHAPTER 20 SITE CLASSIFICATION PROCEDURE FOR SEISMIC DESIGN

Table 20.3-1 Site Classification

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard rock	>5,000 ft/s	NA	NA
B. Rock	2,500 to 5,000 ft/s	NA	NA
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the following characteristics: —Plasticity index $PI > 20$, —Moisture content $w \geq 40\%$, —Undrained shear strength $\bar{s}_u < 500$ psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1 ft/s = 0.3048 m/s; 1 lb/ft² = 0.0479 kN/m².

Reference: Engineering Report Minor Permit Modification, Mar 2012 provides a geotechnical evaluation of subsurface soi in the area. It estimates that the shear wave velocity is 1200 ft/sec. That makes it a site class C.

For S_s= 0.415g $F_a := 1.2$

For S_1 =0.16 $F_v := 1.7-(1.7-1.6)\cdot\frac{.06}{0.1} = 1.64$

$S_{DS} := \frac{2}{3}\cdot F_a\cdot S_s = 0.332\cdot g$ $S_{D1} := \frac{2}{3}\cdot F_v\cdot S_1 = 0.178\cdot g$

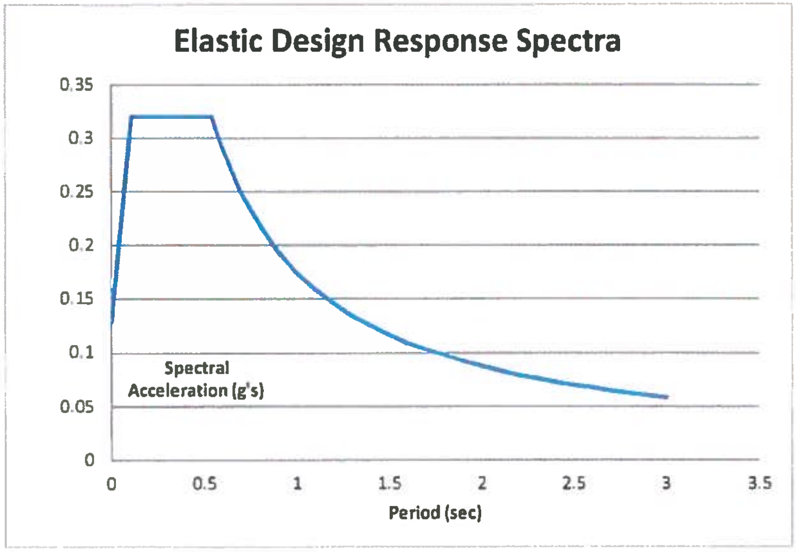
$T_0 := 0.2\cdot\frac{S_{D1}}{S_{DS}}\cdot sec = 0.107$ $T_s := \frac{S_{D1}}{S_{DS}}\cdot sec = 0.537\,s$

For T< T_0 Sa =(0.4+0.6*T/T_0)S_{DS}

For T< T_0 $S_{a1}\left[S_{DS}\cdot\left(0.4+0.6\cdot\frac{1\cdot sec}{T_0}\right) = \blacksquare\right]$

T	S_{DS}	S_{D1}	T_0	T_S	S
	0.32	0.175	0.109	0.547	

T	Sa	
0	0.128	
0.109	0.32	9.17
0.547	0.32	1.83
0.6	0.29	1.67
0.7	0.25	1.43
0.8	0.22	1.25
0.9	0.19	1.11
1	0.18	1.00
1.1	0.16	0.91
1.2	0.15	0.83
1.3	0.13	0.77
1.4	0.13	0.71
1.5	0.12	0.67
1.6	0.11	0.63
1.7	0.10	0.59
1.8	0.10	0.56
1.9	0.09	0.53
2	0.09	0.50
2.1	0.08	0.48
2.2	0.08	0.45
2.3	0.08	0.43
2.4	0.07	0.42
2.5	0.07	0.40
2.6	0.07	0.38
2.7	0.06	0.37
2.8	0.06	0.36
2.9	0.06	0.34
3	0.06	0.33



Part II - C

Determine Seismic Design Category and Equivalent Lateral Load without SSI

RISK CATEGORY

Select Risk Category 1 per Table 1.5-1. below and Seismic Importance Factor =1.00

$Risk_{cat} := 1$

$I_e := 1$

Table 1.5-1 Risk Category of Buildings and Other Structures for Flood, Wind, Snow, Earthquake, and Ice Loads

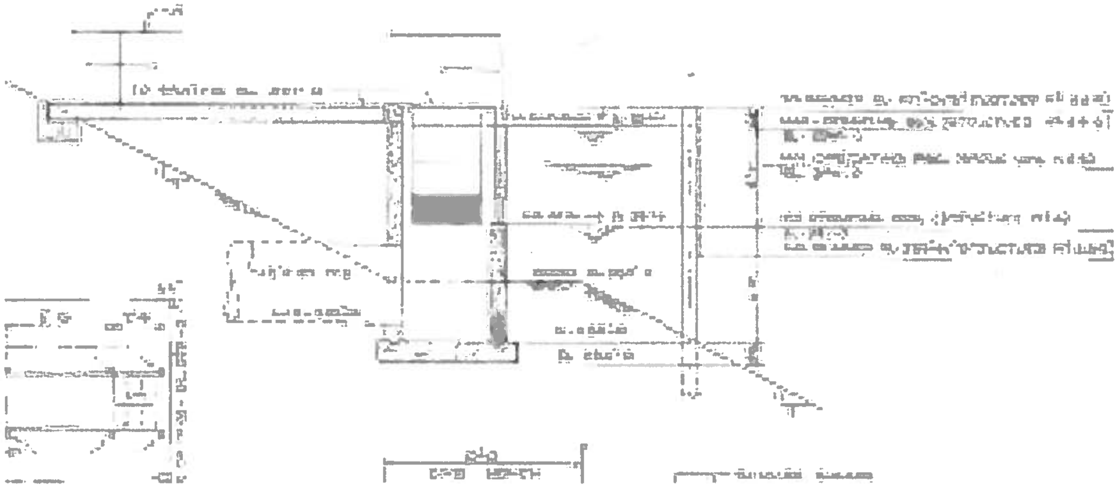
Use or Occupancy of Buildings and Structures	Risk Category
Buildings and other structures that represent a low risk to human life in the event of failure	I
All buildings and other structures except those listed in Risk Categories I, III, and IV	II
Buildings and other structures, the failure of which could pose a substantial risk to human life	III
Buildings and other structures, not included in Risk Category IV, with potential to cause a substantial economic impact and/or mass disruption of day-to-day civilian life in the event of failure	
Buildings and other structures not included in Risk Category IV (including, but not limited to, facilities that manufacture, process, handle, store, use, or dispose of such substances as hazardous fuels, hazardous chemicals, hazardous waste, or explosives) containing toxic or explosive substances where their quantity exceeds a threshold quantity established by the authority having jurisdiction and is sufficient to pose a threat to the public if released.	
Buildings and other structures designated as essential facilities	IV
Buildings and other structures, the failure of which could pose a substantial hazard to the community	
Buildings and other structures (including, but not limited to, facilities that manufacture, process, handle, store, use, or dispose of such substances as hazardous fuels, hazardous chemicals, or hazardous waste) containing sufficient quantities of highly toxic substances where the quantity exceeds a threshold quantity established by the authority having jurisdiction to be dangerous to the public if released and is sufficient to pose a threat to the public if released.[a]	
Buildings and other structures required to maintain the functionality of other Risk Category IV structures.	

[a] Buildings and other structures containing toxic, highly toxic, or explosive substances shall be eligible for classification to a lower Risk Category if it can be demonstrated to the satisfaction of the authority having jurisdiction by a hazard assessment as described in Section 1.5.2 that a release of the substances is commensurate with the risk associated with that Risk Category.

Table 1.5-2 Importance Factors by Risk Category of Buildings and Other Structures for Snow, Ice, and Earthquake Loads[a]

Risk Category from Table 1.5-1	Snow Importance Factor, I_s	Ice Importance Factor—Thickness, I_i	Ice Importance Factor—Wind, I_w	Seismic Importance Factor, I_e
I	0.80	0.80	1.00	1.00
II	1.00	1.00	1.00	1.00
III	1.10	1.25	1.00	1.25
IV	1.20	1.25	1.00	1.50

[a] The component importance factor, I_p, applicable to earthquake loads, is not included in this table because it is dependent on the importance of the individual component rather than that of the building as a whole, or its occupancy. Refer to Section 13.1.3.



Response Modification Factors, R_{xf}

ASCE 7-10, Table 12.2-1

Ordinary Reinforced Concrete Shear wall

$R_{cf} := 4$

$\Omega_{c0} := 2.5$ Overstrength Factor

$C_{cd} := 2.5$ Deflection Amplification Factor

Steel Ordinary Moment Frames

$R_{sf} := 3.5$

$\Omega_{s0} := 3$

$C_{sd} := 3$

Light -framed wood walls (by Judgment)

$R_{wf} := 3.5$

$\Omega_{w0} := 3$

$C_{wd} := 3$

Determine Seismic Response Coefficients - Concrete

Seismic Base shear

ASCE 7, Section 12.8.1.1 Concrete $C_{s\_conc1} := \dfrac{S_{DS}}{\left(\dfrac{R_{cf}}{I_e}\right)} = 0.083 \cdot g$

ASCE 7, Eqn. 12.8-5, C_s shall not be less than

$$C_{s\_min} := \max\left(0.044 \cdot S_{DS} \cdot I_e, 0.01 \cdot g\right) = 0.015 \cdot g$$

Satisfy ASCE 7 eqn. 12.8-3 and 12.8-4 after calculating T_a

Calculate C_t $C_{t\_conc} := 0.02$ ASCE 7 Table 12.8-2

$$x_{ct\_conc} := .75$$

ASCE 7 Page 225 Fig 22-12 $T_{L\_conc} := 12 \cdot sec$

Calculate T_{a_conc}

Method 1: Use ASCE 7, eqn. 12.8-7 $h_n := 13$ Dwg No. 12-3453

$$T_{a\_conc1} := C_{t\_conc} \cdot \left(h_n\right)^{x_{ct\_conc}} \cdot 1 \cdot sec = 0.137\,s$$

$$freq_{a\_conc1} := \frac{1}{T_{a\_conc1}} = 7.303 \cdot Hz$$

Method 2: Use ASCE 7 eqn. 12.8-7

$$N_{conc2} := 1$$

$$T_{a\_conc2} := 0.1 \cdot N_{conc2} \cdot 1 \cdot sec = 0.1\,s$$

$$freq_{a\_conc2} := \frac{1}{T_{a\_conc2}} = 10 \cdot Hz$$

Use average T.a

$$T_{a\_ave} := \frac{\left(T_{a\_conc1} + T_{a\_conc2}\right)}{2} = 0.118\,s$$

$S_{D1} = 0.178 \cdot g$

Determine C_s for $T_{a\_conc} < T_{L\_conc}$

$$C_{s\_conc2} := \frac{S_{D1}}{T_{a\_ave} \cdot \frac{1}{sec} \left(\frac{R_{cf}}{I_e}\right)} = 0.376 \cdot g$$

$$C_{s\_conc1} = 0.083 \cdot g$$

$$C_{s\_conc} := \max\left(\min\left(C_{s\_conc1}, C_{s\_conc2}\right), C_{s\_min}\right) = 0.083 \cdot g$$

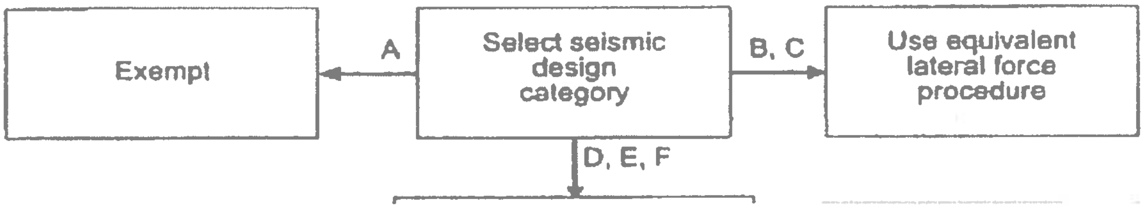
SUMMARY WITHOUT SOIL STRUCTURE INTERACTION

$T_{a\_wossi} := T_{a\_ave} = 0.118\,s$ Period

$C_{s\_conc\_wossi} := C_{s\_conc} = 0.083 \cdot g$

$S_{DS} = 0.332 \cdot g$

$S_{D1} = 0.178 \cdot g$



Part II-D
Consider Soil-structure Interaction ASCE 7 Chapter 19

Consider Soil-Structure Interaction per ASCE 7 Chapter 19

Size of found - 7'-8" by 7'-2"

$$A_{fdn} := 7.67 \cdot ft \cdot 7.17 \cdot ft = 54.994\,ft^2$$

Equivalent Radius $$r_{equiv} := \sqrt{\frac{A_{fdn}}{\pi}} = 4.184\,ft$$

Reference: Engineering Report Minor Permit Modification, Mar 2012 provides a geotechnical evaluation of subsurface soils in tl area. It estimates that the shear wave velocity is 1200 ft/sec.

Because of the small size and the approximate nature of the shear wave velocity, no correction will be made due to G/G_{max} and D/D_{max} for being less than 1.

$$V_s := 1200 \cdot \frac{ft}{sec} = 1.2 \times 10^3 \frac{ft}{s}$$

$$\rho := \frac{120 \cdot \frac{lb}{ft^3}}{32.2 \cdot \frac{ft}{sec^2}} = 3.727 \frac{s^2}{ft} \cdot \frac{lb}{ft^3}$$

$$\nu := 0.3$$

$$G_{ssi} := \rho \cdot V_s^2 = 5.366 \times 10^6 \cdot psf$$

Vibrations of Soils and Foundations, Richart, Hall and Woods, 1970

Sliding stiffness

$$K_{yssi} := 32 \cdot \frac{(1-\nu)}{(7-8\cdot\nu)} \cdot G_{ssi} \cdot r_{equiv} = 1.093 \times 10^8 \cdot \frac{lb}{ft}$$

Rocking

$$K_{\theta ssi} := \frac{8 \cdot \left(\frac{1}{rad}\right) \cdot G_{ssi} \cdot r_{equiv}^3}{3 \cdot (1-\nu)} = 1.497 \times 10^6\,ft \cdot \frac{1}{rad} \cdot kip$$

Calculate W_{bar}

Weight of walls

$$W_{tot1} := \left[\left(5+\frac{4}{12}\right)\cdot\frac{10}{12}\cdot 2+\left(5+\frac{10}{12}\right)\cdot\frac{10}{12}\cdot 2\right]\cdot 13\cdot 150\cdot \mathbf{lbs} = 3.629\times 10^{4}\,\mathbf{lbf}$$

$$W_{tot2} := \left(7+\frac{8}{12}\right)\cdot\left(7+\frac{2}{12}\right)\cdot 1\cdot 150\cdot \mathbf{lbs} = 8.242\times 10^{3}\,\mathbf{lbf}$$ Slab weight

$$W_{tot} := W_{tot1} + W_{tot2} = 4.453\times 10^{4}\,\mathbf{lbf}$$ Weight of wall approximate due to stubby structure

$$T_{a\_ave} = 0.118\,\mathbf{s}$$

$$W_{bar} := .7\cdot W_{tot} = 3.117\times 10^{4}\,\mathbf{lbf}$$

$$k_{bar} := 4\cdot\pi^{2}\cdot\frac{W_{bar}}{32.2\cdot\frac{\mathbf{ft}}{\mathbf{sec}^{2}}\cdot T_{a\_ave}{}^{2}} = 2.723\times 10^{6}\,\frac{\mathbf{1}}{\mathbf{ft}}\cdot\mathbf{lbf}$$

$$T_{bar} := T_{a\_ave}\cdot\sqrt{1+\frac{k_{bar}}{K_{yssi}}\cdot\left[1+\frac{K_{yssi}\cdot(.7\cdot 14\cdot \mathbf{ft})^{2}}{K_{\theta ssi}}\right]} = 0.13\,\mathbf{s}$$

$$freq_{bar} := \frac{1}{T_{bar}} = 7.707\cdot\mathbf{Hz}$$

Parametric Variation + or - 50% in G value or 123% or 70% respectively for V_s

Plugging the limiting shear wave velocities, the periods and freq values are:

$T_{bar150} := .125\cdot\mathbf{sec}$ $T_{bar50} := 0.136\cdot\mathbf{sec}$ $T_{bar} = 0.13\,\mathbf{s}$

$freq_{bar150} := \dfrac{1}{T_{bar150}} = 8\cdot\mathbf{Hz}$ $freq_{bar50} := \dfrac{1}{T_{bar50}} = 7.353\cdot\mathbf{Hz}$

Calculate base shear reduction ASCE 7 Section 19.2

$r_{equiv} = 4.184\,\mathbf{ft}$ $h_{bar} := 0.7 \cdot 12.\mathbf{ft} = 8.4\,\mathbf{ft}$ $L_0 := 7.67 \cdot \mathbf{ft}$

$r_{radgyr} := .289 \cdot \mathbf{7.167} \cdot \mathbf{ft} = 2.071\,\mathbf{ft}$

$b_0 := 7.167$ $d_0 := 7.67$

$$I_0 := \frac{b_0 \cdot d_0^{\,3}}{12} = 269.49$$

$$r_m := 4 \cdot \sqrt{4 \cdot \frac{I_0}{\pi}} \cdot \mathbf{ft} = 74.095\,\mathbf{ft} \qquad \frac{h_{bar}}{r_m} = 0.113$$

Use h/r=0.5 curve

Calculate period lenghening

$$\frac{T_{bar}}{T_{a\_wossi}} = 1.095 \qquad \beta_0 := 0.04$$

ASCE 7 eqn 19.2-9

$$\beta_{bar} := \frac{(\beta_0 \cdot 0.05) \cdot 100}{\left(\frac{T_{bar}}{T_{a\_wossi}}\right)^3} = 0.152$$

No further SSI consideration
Conservative

$C_s := C_{s\_conc} = 0.083 \cdot \mathbf{g}$

FINAL LATERAL LOAD FROM EARTHQUAKE

VERTICAL EARTHQUAKE

$E_{vert} := .2 \cdot S_{DS} = 0.066 \cdot \mathbf{g}$

ASCE 7 Eqn. 12.4.2.2

Part II-E
Apply Hydrodynamic Force

Reference:Hydrodynamic Pressure on Culvert Gates during an Earthquake

Ali Rasekh *2012 SIMULIA Community Conference Attachment 2*

It is accepted in civil engineering to estimate the hydrodynamic pressure on the rigid reservoir dams by the Westergaard hydrodynamic pressure equation, which is

$$p_d = 0.875 \rho_w g k \sqrt{H.h}$$

where is the hydrodynamic pressure, g= acceleration due to gravity, and k is the design seismic coefficient. The value of is two third of the peak ground acceleration in terms of *g (i.e.k=(2/3))* PGA/g. H is the total depth of the water reservoir and is the depth from the reservoir water surface to the point of action of hydrodynamic pressure.

$H_{East} := (394 - 377) \cdot ft = 17 ft$

$h_{EAST} := (394 - 388) \cdot ft = 6 ft$

$PGA := 0.213 \cdot g$

$k_{East} := 2 \cdot \frac{PGA}{3.0 \cdot g} = 0.142$

$H_{East} := 17 ft$

$h_{West} := 6.0 \cdot ft$

$H_{West} := 6.ft$

$p_d := .875 \cdot 62.4 \cdot pcf \cdot k_{East} \cdot \sqrt{H_{West} \cdot h_{West}} = 46.519 \cdot psf$

Total Hydrodynamic force

$P_d := \frac{2 \cdot h_{West} \cdot p_d}{3} = 186.077 \frac{1}{ft} \cdot lbf$

Static water pressure

$$p_{static} := 62.4\,\mathrm{pcf}\cdot H_{West} = 2.6\,\mathrm{psi}$$

$$P_{static} := .5\cdot p_{static}\cdot H_{West} = 1.123\times 10^{3}\,\frac{1}{\mathrm{ft}}\cdot \mathrm{lbf}$$

Total water pressure

$$PW_{total} := P_{static} + P_{d} = 1.309\times 10^{3}\,\frac{1}{\mathrm{ft}}\cdot \mathrm{lbf}$$

$$W_{tot} = 4.453\times 10^{4}\,\mathrm{lbf}$$

Part II-F
Final Check for Equilibrium

CHECK AGAINST SLIDING

$$SEISMIC_{hor} := \frac{C_s\cdot W_{tot}}{1.g} = 3.696\times 10^{3}\cdot \mathrm{lbf}$$

$$Seismic_{ver} := \frac{E_{vert}\cdot W_{tot}}{1.g} = 2.957\times 10^{3}\,\mathrm{lbf}$$

$$Hydro_{stdyn} := PW_{total}\cdot 6.67\cdot \mathrm{ft} = 8.733\times 10^{3}\,\mathrm{lbf}$$

Driving force $P_{dr} := SEISMIC_{hor} + Hydro_{stdyn} = 1.243\times 10^{4}\,\mathrm{lbf}$

active pressure coefficient

Assume $PHI := 30.\mathrm{deg}$

$$PHI_{rad} := 30\cdot\frac{\pi}{180} = 0.524\cdot \mathrm{rad}$$

$K_a := .333$ $K_p := 3$

$$C_c := \cos\left(PHI_{rad}\right) = 0.866$$

For seismic

$$C_{sin} := \sin\left(PHI_{rad}\right) = 0.5$$

$$K_{ae} := \frac{\left(1 + \frac{E_{vert}}{1 \cdot g}\right) \cdot C_c{}^2}{\left(1 + C_{sin}\right)^2} = 0.355$$

$$K_{pe} := \frac{\left(1 + \frac{E_{vert}}{1 \cdot g}\right) \cdot C_c{}^2}{\left(1 - C_{sin}\right)^2} = 3.199$$

Assume both active/passive pressure has the inverted pressure distribution. Conservative.
Net pressure coefficient

$$Net_{aepe} := K_{pe} - K_{ae} = 2.844$$

Net Resisting active/passive force

$$Net_{aepeforce} := .5 \cdot Net_{aepe} \cdot 67.6 \cdot pcf \cdot (3 \cdot ft)^2 \cdot 6.67 \cdot ft = 5.77 \times 10^3 \cdot lbf$$

$$Fric_{coef} := 0.5$$

Resisting force

$$Res_{force} := Fric_{coef} \cdot W_{tot} + Net_{aepeforce} = 2.804 \times 10^4\, lbf$$

$$Res_{force1} := Fric_{coef} \cdot W_{tot} = 2.227 \times 10^4\, lbf$$

$$\boxed{SF_{sliding} := \frac{Res_{force}}{P_{dr}} = 2.256}$$

$$\boxed{SF_{sliding1} := \frac{Res_{force1}}{P_{dr}} = 1.791}$$

Minimum

CHECK OVERTURNING

$\mathbf{SEISMIC_{hor}} = 3.696 \times 10^{3}\,\mathbf{lbf}$ $\quad$ $\mathbf{Hydro_{stdyn}} = 8.733 \times 10^{3}\,\mathbf{lbf}$

$\mathbf{MOMARM_S} := 7 \cdot \mathbf{ft}$ $\quad$ $\mathbf{MOMARM_H} := \mathbf{H_{West}} - \mathbf{h_{West}} + 5 \cdot \mathbf{ft} = 5\,\mathbf{ft}$

Driving Mpment

$$\mathbf{MOM_{DRsei}} := \mathbf{SEISMIC_{hor}} \cdot \mathbf{MOMARM_S} + \mathbf{Hydro_{stdyn}} \cdot \mathbf{MOMARM_H} = 6.954 \times 10^{4}\,\mathbf{ft} \cdot \mathbf{lbf}$$

Restring Moment

$$\mathbf{RESTORING_M} := \mathbf{W_{tot}} \cdot \frac{7.167\mathbf{ft}}{2} = 5.135 \times 10^{6}\,\frac{\mathbf{ft}^2 \cdot \mathbf{lb}}{\mathbf{s}^2}$$

$$\boxed{\mathbf{SF_{Mom}} := \frac{\mathbf{RESTORING_M}}{\mathbf{MOM_{DRsei}}} = 2.295}$$

CHECK BASE SHEAR

$\mathbf{P_{dr}} = 1.243 \times 10^{4}\,\mathbf{lbf}$ $\quad$ Horizontal Base shear

$$\mathbf{Area_{tot}} := \left[\left(5 + \frac{4}{12}\right) \cdot \mathbf{ft} \cdot \frac{10}{12} \cdot \mathbf{ft} \cdot 2 + \left(5 + \frac{10}{12}\right) \cdot \mathbf{ft} \cdot \frac{10}{12} \cdot \mathbf{ft} \cdot 2\right] = 18.611\,\mathbf{ft}^2$$

$$\mathbf{Base_{Shear}} := \frac{\mathbf{P_{dr}}}{\mathbf{Area_{tot}}} = 4.638\,\mathbf{psi}$$

$$\mathbf{f_{cprime}} := 3000 \cdot \mathbf{psi}$$

$$\mathbf{Shear_{allow}} := 1.1 \cdot \frac{\sqrt{\mathbf{f_{cprime}}}}{1 \cdot \sqrt{\mathbf{psi}}} \cdot 1 \cdot \mathbf{psi} = 60.249\,\mathbf{psi}$$

$$\boxed{\mathbf{SF_{shear}} := \frac{\mathbf{Shear_{allow}}}{\mathbf{Base_{Shear}}} = 12.991}$$

Because of the stubbiness of the structure, moment check is not necessary by judgment.

Part III - Analyses for Underground Piping

CHECK BURIED PIPING 48" DIAMETER

The thickness of pipe is not available. Unit wt is available. Derive thickness of pipe

$$R_{pipe} := \frac{48}{2} \cdot in = 2\,ft$$

The density of HDPE can range from 0.93 to 0.97 g/cm3 or 970 kg/m3.

$$HDPE_{den} := 0.95 \cdot \frac{gm}{cm^3} = 59.307 \frac{lb}{ft^3}$$

$$t := \frac{90 \cdot \frac{lbm}{ft}}{2 \cdot \pi \cdot R_{pipe} \cdot HDPE_{den}} = 0.121 \cdot ft \qquad t = 1.449 \cdot in$$

$$\varepsilon_c := 0.175 \cdot \frac{t}{R_{pipe}} = 0.011$$

This

Stiff Soil

Table 11.1-1 ASCE

Assume Moment Magnitude =6.5

$$Ratio_{PGVPGA} := 109 \cdot \frac{\frac{cm}{sec}}{g}$$

$$PGA = 0.213 \cdot g$$

$$PGV := Ratio_{PGVPGA} \cdot PGA = 23.217 \cdot \frac{cm}{sec}$$

$$C_{sasce} := 2 \cdot \frac{km}{sec} = 6.562 \times 10^3 \frac{ft}{s}$$

Apparent wavelength of seismic waves at ground surface approx 2 km/sec

$$\alpha := 1$$

equal to 2 for shear waves and 1 otherwise assumed 1 for maximum

$$\varepsilon_{asce} := \frac{PGV}{\alpha \cdot C_{sasce}} = 0.00012$$

The axial strains produced by Equation (11-1) can be assumed to be transferred to the pipeline but need not be taken as larger than the axial strain induced by friction at the soil pipe interface:

$$\varepsilon_a = T_u \lambda/(4AE)$$

where

T_u = **peak friction force per unit length at soil-pipe interface**

λ = **apparent wavelength of seismic waves at ground surface, sometimes assumed to be 1.0 kilometers without further information**

A = Pipe cs area

E = Modulus elastic

For our case, with cohesionless backfill, the peak force per unit length of the soil-pipe interface (from Appendix B) is:

$$T_u = \frac{\pi}{2} D H \overline{\gamma} (1 + K_o) \tan \delta$$

$$D_{pipe} := 48 \cdot in$$

$$H_{BurDEP} := (399 - 385.5) \cdot ft + \frac{D_{pipe}}{2} = 15.5\,ft$$

$$\gamma_{soil} := 120 \cdot pcf \qquad K_0 := 1$$

$$\delta_{wall} := .8 \cdot 30 \cdot deg = 24 \cdot deg \qquad \tan(\delta_{wall}) = 0.445$$

$$\lambda := 1 \cdot km = 3.281 \times 10^3\,ft$$

$$T_u := \frac{\pi}{2} \cdot D_{pipe} \cdot H_{BurDEP} \cdot \gamma_{soil} \cdot (1 + K_0) \cdot \tan(\delta_{wall}) = 1.041 \times 10^4 \cdot \frac{lb}{ft}$$

$$E_{pipe} := 2 \cdot 10^6 \cdot psi \qquad Area_{pipe} := \left[D_{pipe}^{\,2} - (D_{pipe} - 2 \cdot t)^2\right] \cdot \frac{\pi}{4} = 1.472\,ft^2$$

$$\varepsilon_a := \frac{T_u \cdot \lambda}{4 \cdot Area_{pipe} \cdot E_{pipe}} = 0.02 \qquad \varepsilon_a > \varepsilon_{asce} \qquad \text{OK}$$

Alternate evaluation using "Design Guideline for seismic Resistant Water pipeline Insrtallations", John Eidinger

The Guidelines provide three approaches can be used in the design of buried pipelines:

•Chart method. The simplest approach. Avoids all mathematical models, and allows the designed to pick a style of pipe installation based on parameters such as regional maps for PGV and PGD hazards, and the pipeline function class.

- Equivalent static method. Uses simple quantifiable models to predict the amount of stress, strain and displacement on a pipe for a particular level of earthquake loading.

- Finite element method. This method uses finite element models to examine the seismic loads (whether PGA, PGV or PGD) over the length of the pipeline, and then uses beam on inelastic foundation finite element models (or sometimes use two- or threedimensional mesh models) to examine the state of stress and strain and displacement within the pipeline and pipeline joints.

We select Chart method.

Conditions to meet:

"• Deliver water at serviceable pressure to 65% to 90% of all hydrants within the first hours after the earthquake, as long as there are adequate supply sources; and

• Deliver water via the pipe network to at least 90% of all customers within 3 days following an earthquake;"

These conditions can be met.

Define function classification:

Function	Seismic Importance	Description
I	Very Low to None	Pipelines that represent very low hazard to human life in the event of failure. Not needed for post earthquake system performance. response. or recovery. Widespread damage resulting in long restoration times (weeks or longer) will not materially harm the economic well being of the community.
II	Ordinary. Normal	Normal and ordinary pipeline use. common pipelines in most water systems. All pipes not identified as Function I. III. or IV.
III	Critical	Critical pipelines and appurtenances serving large numbers of customers and present significant economic impact to the community or a substantial hazard to human life and property in the event of failure.
IV	Essential	Essential pipelines required for post-earthquake response and recovery and intended to remain functional and operational during and following a design earthquake.

Table 1. Pipe Function Classifications

We select Class I because the probability of human impact is very low.

The seismic geotechnical analyses indicate there will not be any permanent displacement along the slope of the dike. There is also indication that the dike does not transverse a known fault and will not liquefy. The only load is ground shaking due to seismic waves. A single Design Category defines the earthquake loading.

Inch/sec	Function I	Function II	Function III, IV
$0 < PGV \leq 10$	A	A	A
$10 < PGV \leq 20$	A	A	A
$20 < PGV \leq 30$	A	A	A (with additional valves)
$30 < PGV$	A	A (with additional valves)	B

Table 6. Distribution Pipelines – Ground Shaking

$$PGV = 9.141 \cdot \frac{in}{sec}$$

Design Category = A

Design Category	Cost Effective Design Approach	Notes
A	Standard	
B	Butt Fusion Joints	
C	Butt Fusion Joints	
D	Butt Fusion Joints	
E	Butt Fusion Joints	

Table 17. HDPE Pipe

A standard design approach is in sync with the earlier determination.

Part IV - Condition of the Units and Actions Needed

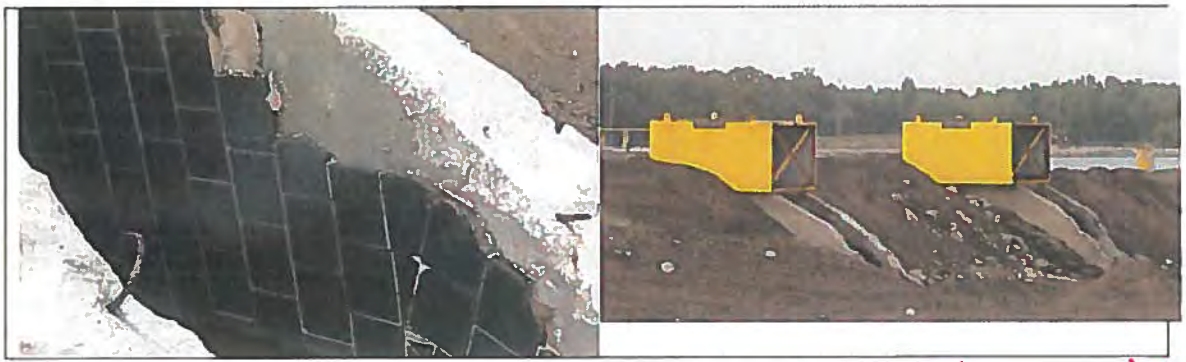
The study reported above is not a new construction. Therefore, a visual inspection of the site was also conducted to ascertain that the structure has not become visibly distressed. The results of that inspection are summarized below.

In general, most units were found to be in decent condition except the following:

- Energy Dissipator Troughs and Covers
- Wooden Skimmer

The actions for maintenance and immediate corrective measures are discussed below.

Institute an inspection program to monitor all structural units included in this list and any other items that, in the event of its failure, would crucially affect plant operation during and/or after an earthquak



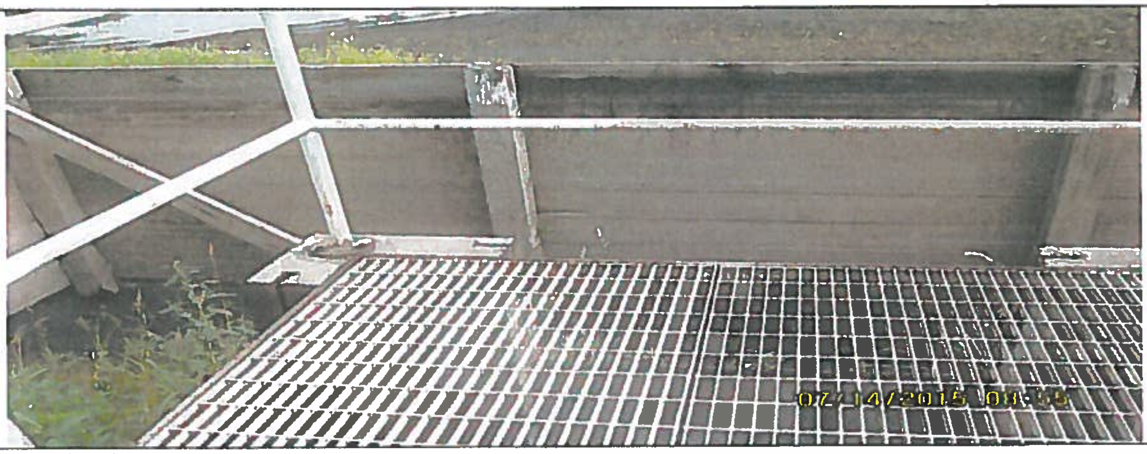
These actions may be implemented within the next 2-3 years from the date of this revision. SL 9/22/18

REV. 1

ACTION 1

The yellow boxes on top of the structure are not anchored and must be provided with anchors or replaced with a different anchored structure.

Also, the concrete inflow box is badly deteriorated and should be replaced with a like structure but with a better corrosion protection cladding.



ACTION 2
The skimmer is a wooden wall that presently is deemed non-effective. Either a more sturdy wall or a maintenance program needs to be initiated.

ACTION 3

Inspect the 48-inch diameter fiberglass/HDPE pipes to verify that the pipes are not distressed inside and out.

ACTION 4

Finally, institute a maintenance prigram that will periodically inspect the structural units against any degeneration.

CONCLUSION

1. Based on a typical configuration, the seismic analyses of the structures are judged to meet local seismic requirements with the following exception.
2. Some of the units are found to be deteriorated and should be remediated by either returning them to original configurations or replaced by new units.

ATTACHMENT 1

USGS Design Maps Summary Report

User-Specified Input

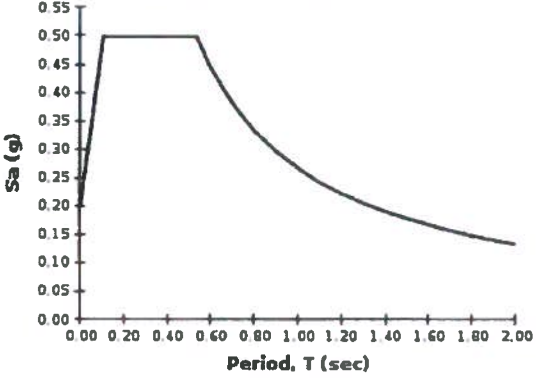
Report Title	USGS Data Sat August 27, 2016 14:53:43 UTC
Building Code Reference Document	ASCE 7-10 Standard (which utilizes USGS hazard data available in 2008)
Site Coordinates	37.92556°N, 87.03389°W
Site Soil Classification	Site Class C – "Very Dense Soil and Soft Rock"
Risk Category	I/II/III

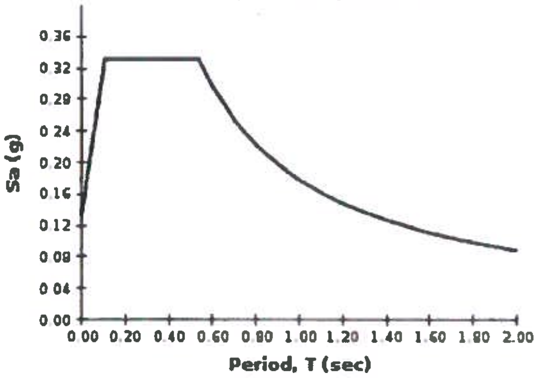
USGS-Provided Output

$S_S =$ 0.415 g $S_{MS} =$ 0.498 g $S_{DS} =$ 0.332 g

$S_1 =$ 0.163 g $S_{M1} =$ 0.267 g $S_{D1} =$ 0.178 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.


MCE$_R$ Response Spectrum


Design Response Spectrum

For PGA$_M$, T$_L$, C$_{RS}$, and C$_{R1}$ values, please view the detailed report.

USGS Design Maps Detailed Report

ASCE 7-10 Standard (37.92556°N, 87.03389°W)

Site Class C – "Very Dense Soil and Soft Rock", Risk Category I/II/III

Section 11.4.1 — Mapped Acceleration Parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2010 ASCE-7 Standard are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 11.4.3.

From Figure 22-1 [1]	$S_S = 0.415$ g
From Figure 22-2 [2]	$S_1 = 0.163$ g

Section 11.4.2 — Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class C, based on the site soil properties in accordance with Chapter 20.

Table 20.3–1 Site Classification

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index $PI > 20$, • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u < 500$ psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 11.4.3 — Site Coefficients and Risk-Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Table 11.4–1: Site Coefficient F_a

Site Class	Mapped MCE $_R$ Spectral Response Acceleration Parameter at Short Period				
	$S_S \leq 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \geq 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_S

For Site Class = C and S_S = 0.415 g, F_a = 1.200

Table 11.4–2: Site Coefficient F_v

Site Class	Mapped MCE $_R$ Spectral Response Acceleration Parameter at 1–s Period				
	$S_1 \leq 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \geq 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_1

For Site Class = C and S_1 = 0.163 g, F_v = 1.637

Equation (11.4-1): $S_{MS} = F_aS_S = 1.200 \times 0.415 = 0.498$ g

---

Equation (11.4-2): $S_{M1} = F_vS_1 = 1.637 \times 0.163 = 0.267$ g

---

Section 11.4.4 — Design Spectral Acceleration Parameters

Equation (11.4-3): $S_{DS} = ⅔ S_{MS} = ⅔ \times 0.498 = 0.332$ g

---

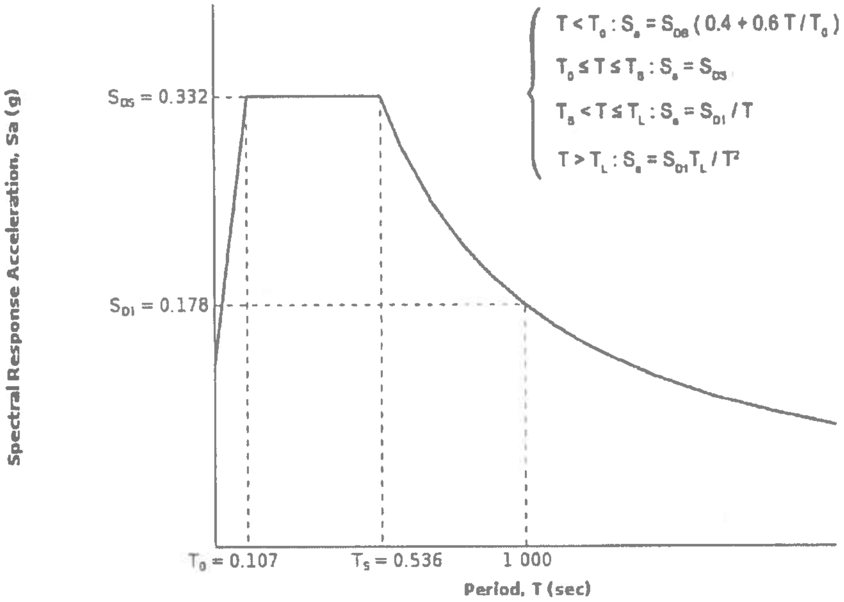
Equation (11.4-4): $S_{D1} = ⅔ S_{M1} = ⅔ \times 0.267 = 0.178$ g

---

Section 11.4.5 — Design Response Spectrum

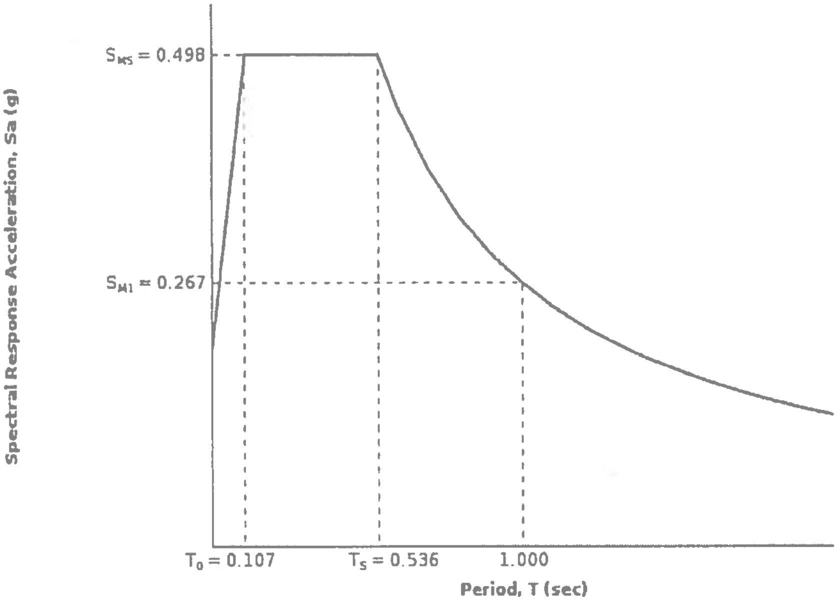
From Figure 22-12 [3] $T_L = 12$ seconds

Figure 11.4-1: Design Response Spectrum



Section 11.4.6 — Risk-Targeted Maximum Considered Earthquake (MCE_R) Response Spectrum

The MCE_R Response Spectrum is determined by multiplying the design response spectrum above by 1.5.



Section 11.8.3 — Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

From Figure 22-7 [4] PGA = 0.213

Equation (11.8–1): $PGA_M = F_{PGA}PGA = 1.187 \times 0.213 = 0.253$ g

---

Table 11.8–1: Site Coefficient F_{PGA}

Site Class	Mapped MCE Geometric Mean Peak Ground Acceleration, PGA				
	PGA ≤ 0.10	PGA = 0.20	PGA = 0.30	PGA = 0.40	PGA ≥ 0.50
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of PGA

For Site Class = C and PGA = 0.213 g, F_{PGA} = 1.187

Section 21.2.1.1 — Method 1 (from Chapter 21 – Site-Specific Ground Motion Procedures for Seismic Design)

From Figure 22-17 [5] C_{RS} = 0.876

From Figure 22-18 [6] C_{R1} = 0.842

Section 11.6 — Seismic Design Category

Table 11.6-1 Seismic Design Category Based on Short Period Response Acceleration Parameter

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

For Risk Category = I and S_{DS} = 0.332 g, Seismic Design Category = C

Table 11.6-2 Seismic Design Category Based on 1-S Period Response Acceleration Parameter

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

For Risk Category = I and S_{D1} = 0.178 g, Seismic Design Category = C

Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 11.6-1 or 11.6-2" = C

Note: See Section 11.6 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 22-1*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-1.pdf
2. *Figure 22-2*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-2.pdf
3. *Figure 22-12*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-12.pdf
4. *Figure 22-7*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-7.pdf
5. *Figure 22-17*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-17.pdf
6. *Figure 22-18*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-18.pdf

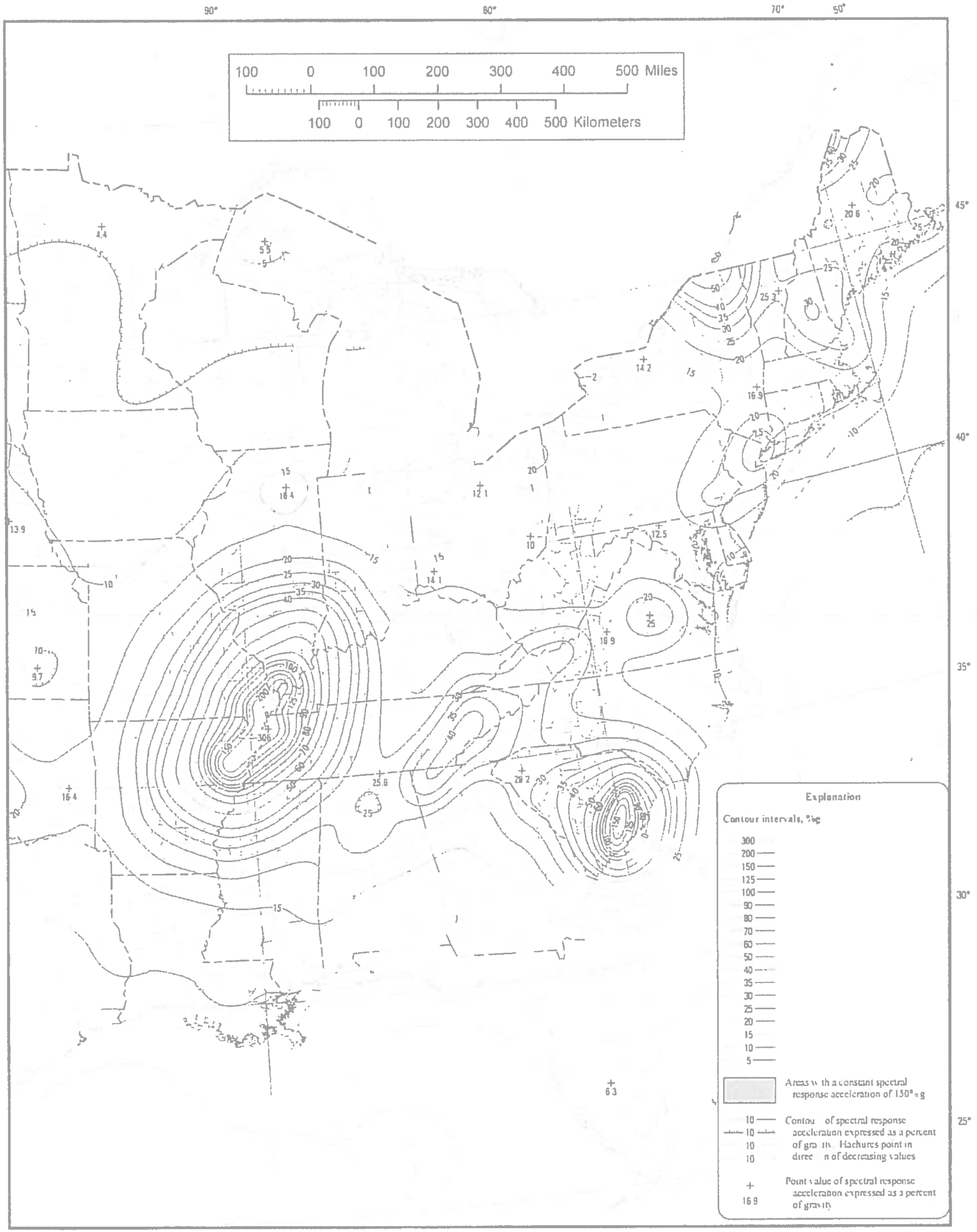
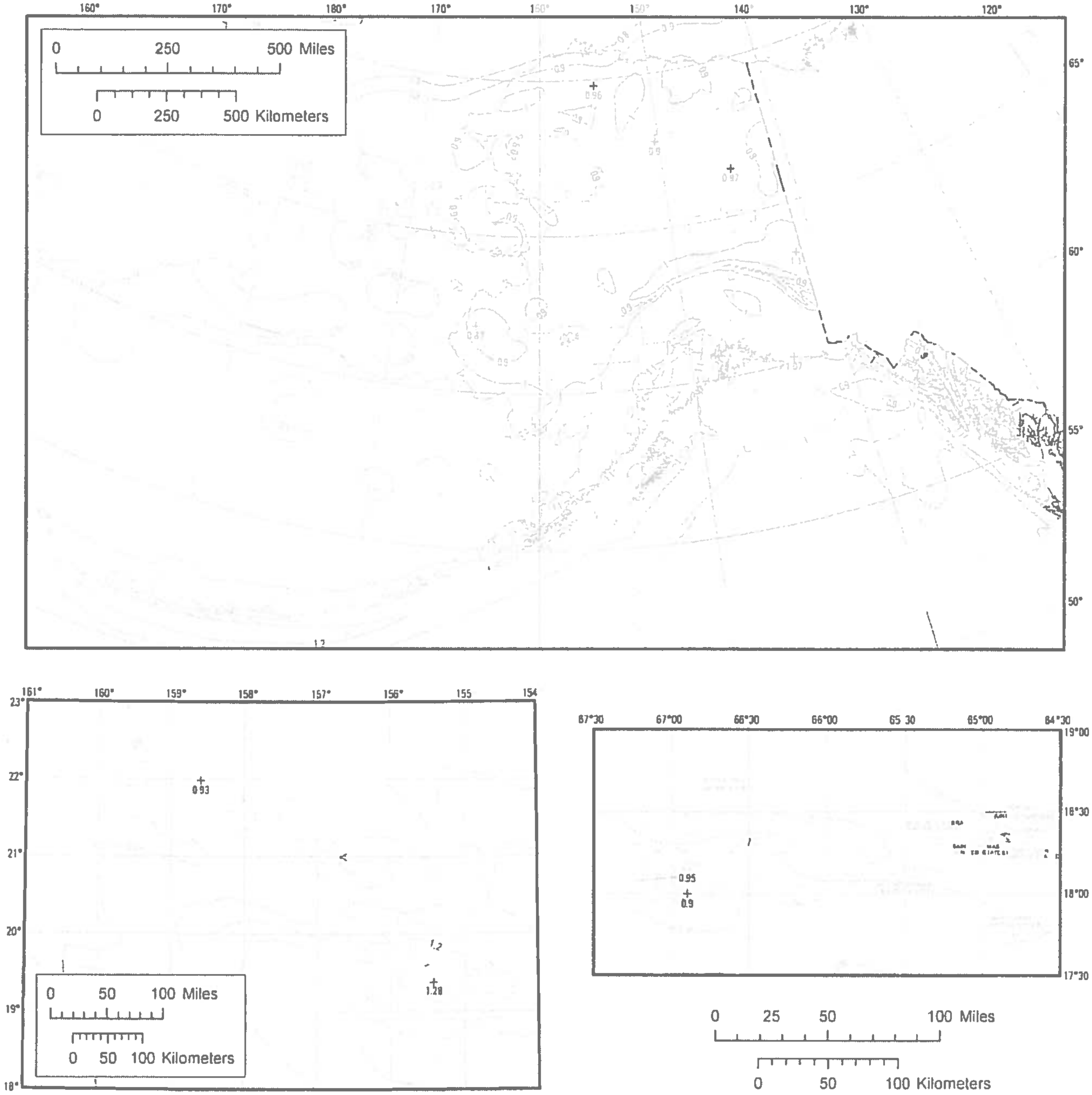


Figure 22-1 *(continued)* S_s Risk-Targeted Maximum Considered Earthquake (MCE_R) Ground Motion Parameter for the Conterminous United States for 0.2 s Spectral Response Acceleration (5% of Critical Damping), Site Class B.

Figure 22-12 (*continued*) Mapped Long-Period Transition Period, T_l (s), for the Conterminous United States.

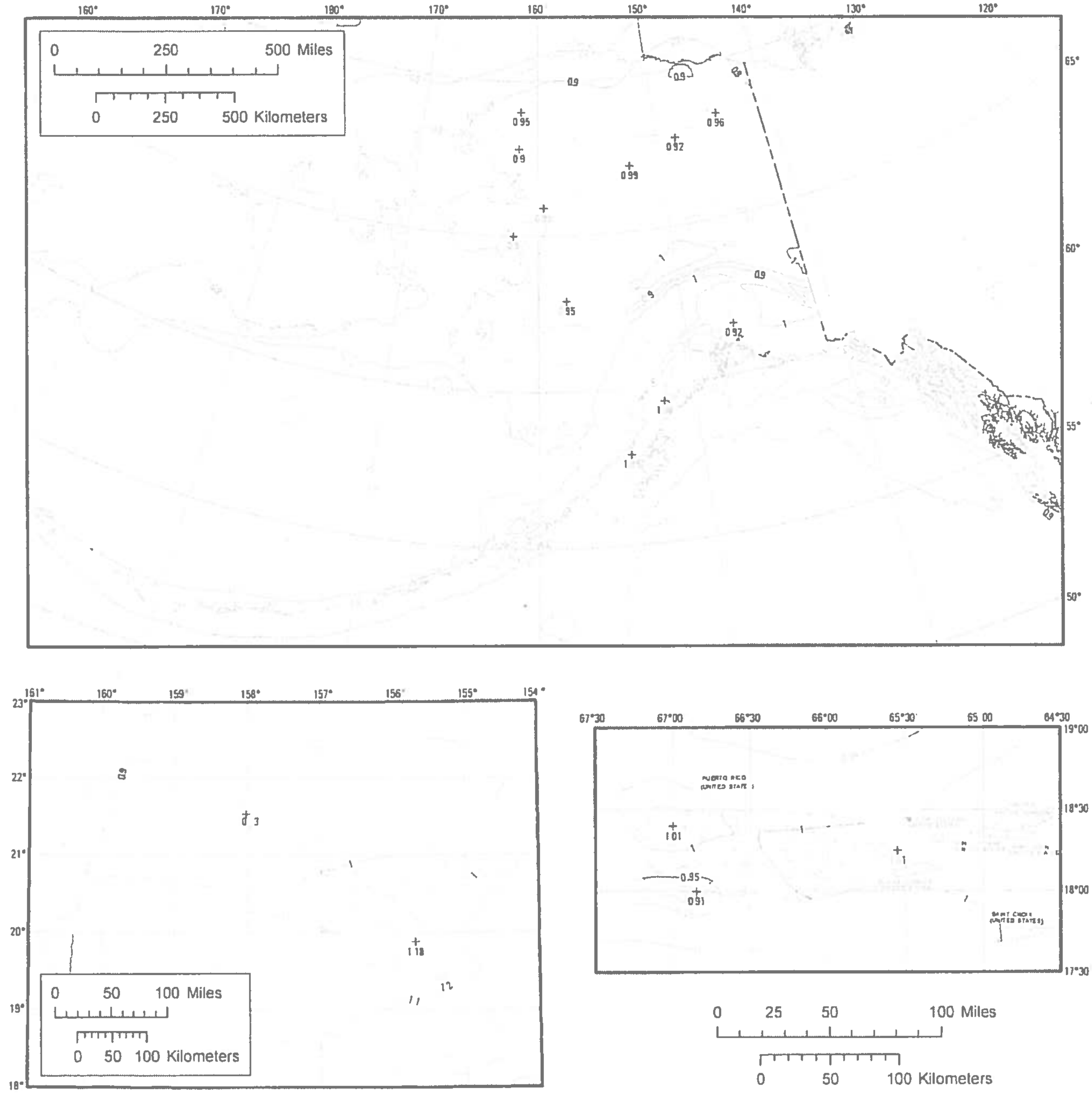
Figure 22-17 Mapped Risk Coefficient at 0.2 s Spectral Response Period, C_{RS}.



Notes:
- Maps prepared by United States Geological Survey (USGS).
- Larger, more detailed versions of these maps are not included because it is recommended that the corresponding USGS web tool (http://earthquake.usgs.gov/designmaps/) be used to determine the mapped value for a specified location.

Figure 22-17 (*continued*) Mapped Risk Coefficient at 0.2 s Spectral Response Period, C_{RS}.

Figure 22-18 Mapped Risk Coefficient at 1.0 s Spectral Response Period, C_{R1}.



Notes:

- Maps prepared by United States Geological Survey (USGS).
- Larger, more detailed versions of these maps are not included because it is recommended that the corresponding USGS web tool (http://earthquake.usgs.gov/designmaps/) be used to determine the mapped value for a specified location.

Figure 22-18 ***(continued)*** **Risk Coefficient at 1.0 s Spectral Response Period, C_{R1}.**

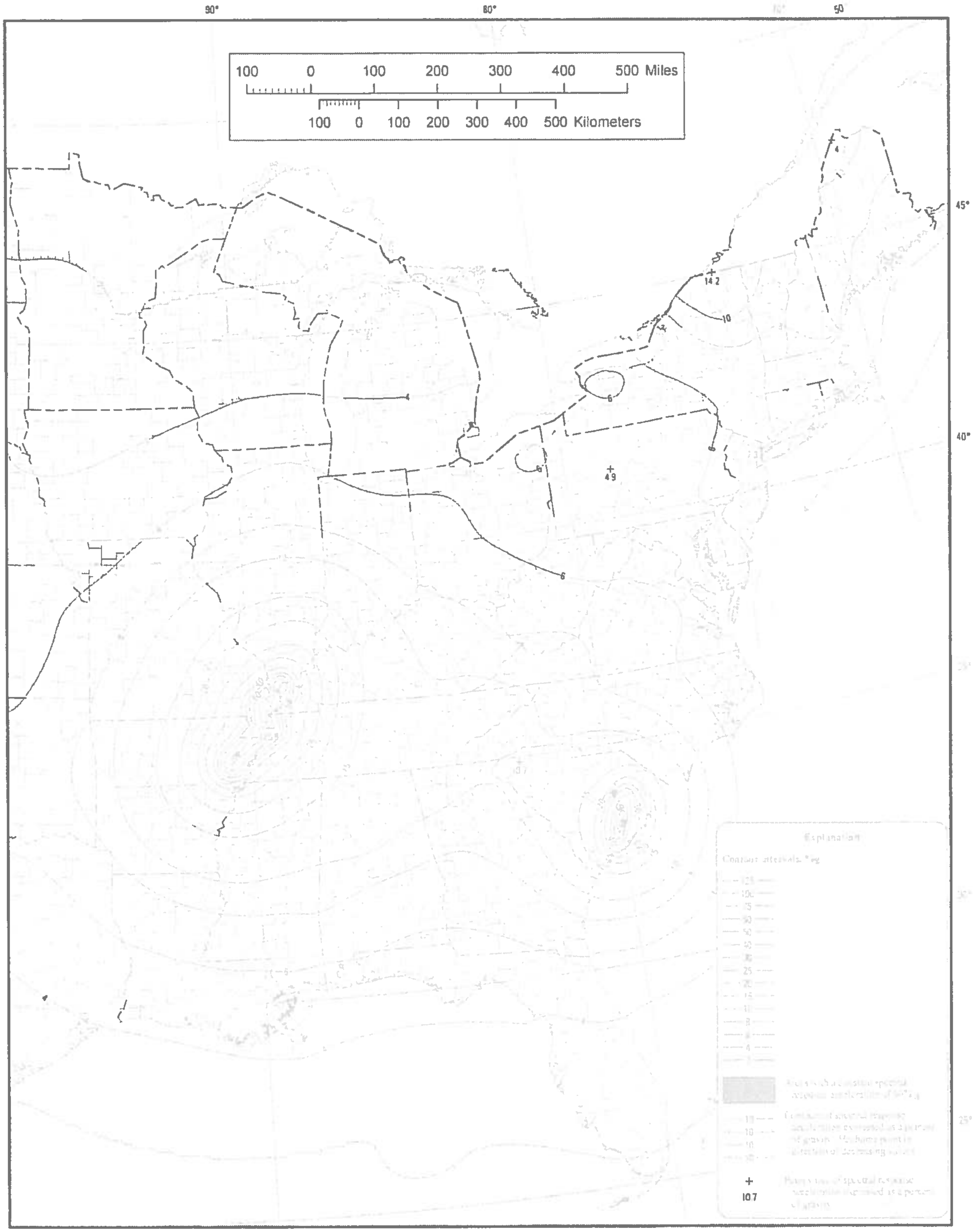


Figure 22-2 (*Continued*) S_1 Risk-Targeted Maximum Considered Earthquake (MCE_R) Ground Motion Parameter for the Conterminous United States for 1.0 s Spectral Response Acceleration (5% of Critical Damping), Site Class B.

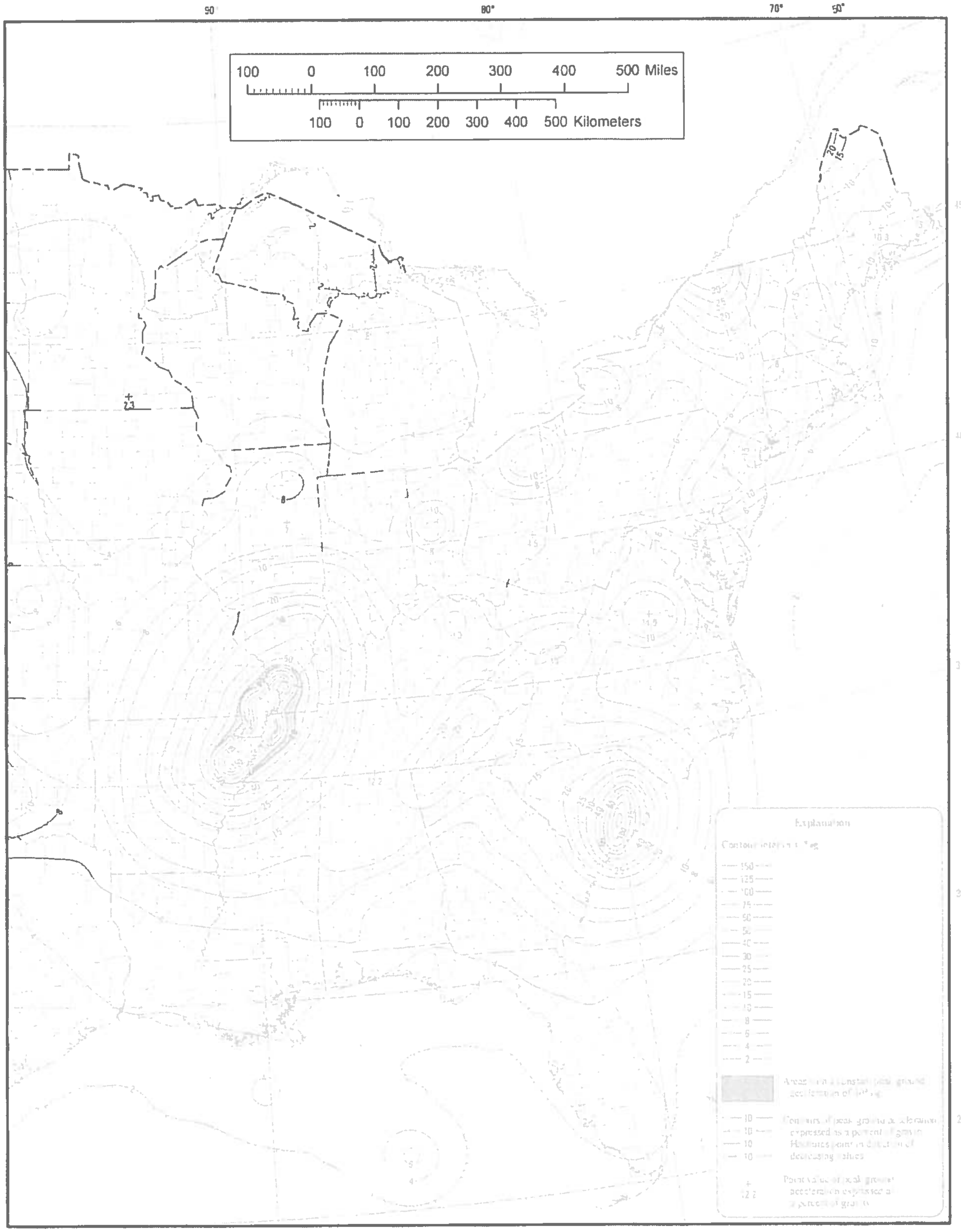


Figure 22-7 (*continued*) Maximum Considered Earthquake Geometric Mean (MCE_G) PGA, %g, Site Class B for the Conterminous United States.

ATTACHMENT 2

ENGINEERING DEPT.
AMERICAN ELECTRIC POWER SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OHIO

DATE 11/14/16 SHEET 38 OF ____
BY JAR CK. ____
COMPANY AEP G.O. ____
PLANT ROCKPORT

SUBJECT CCR COMPLIANCE CHECK

CALCULATE HYDRODYNAMIC FORCES & CHECK STABILITY OF DISCHARGE STRUCTURE

$H_{EAST} = 394 - 377 = 17'$ PGA = 0.213g PG 27

$h_{EAST} = 394 - 388 = 6'$ $K_{EAST} = \frac{2PGA}{3.0} = \frac{2}{3}(.213) = 0.142$

PG 27 $p_d = 0.875\,\rho_w g k \sqrt{Hh}$

$= 0.875 \times 62.4 \times .142 \sqrt{17 \times 6} = 78.3\,psf$

$P_d = \frac{2\,h_{EAST}\,p_d}{3} = \frac{2(6.0)}{3}(78.3) = 313\,lbf/ft$

DL WALLS $= \left[6.17 \times \frac{10}{12} \times 2 \times 12.0 + 5.0 \times 6.0 \times \frac{10}{12} + 2(.75) \times 6.0 \times \frac{10}{12} + (5.0 \times 12 - 2.0^2 \pi)\frac{10}{12}\right]150$

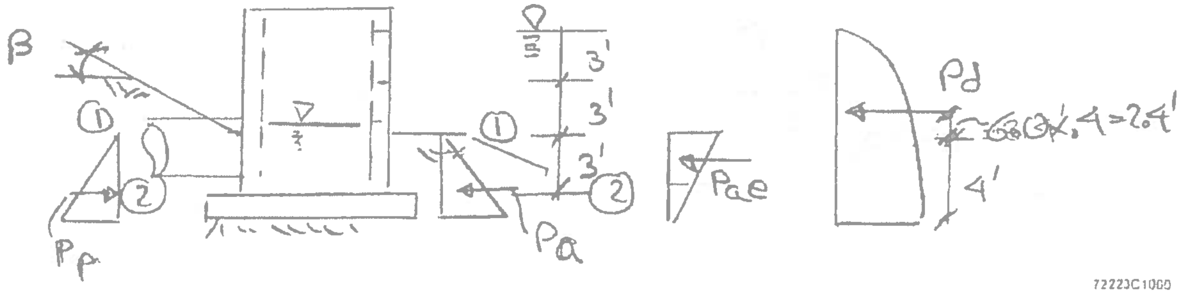
$= 29315\,\#$

DL SLAB $= 7.167 \times 7.067 \times 1.0 \times 150 = 8242\,\#$

$W_{TOT} = 29315 + 8242 = 37557^{lb}$

$SEISMIC_{HOR} = C_s W_{TOT} = .083(37557) = 3117\,\#$

SEISMIC VERT $= E_{VER} W_{TOT} = 0.066(37557) = 2479\,\#$



72223C1000

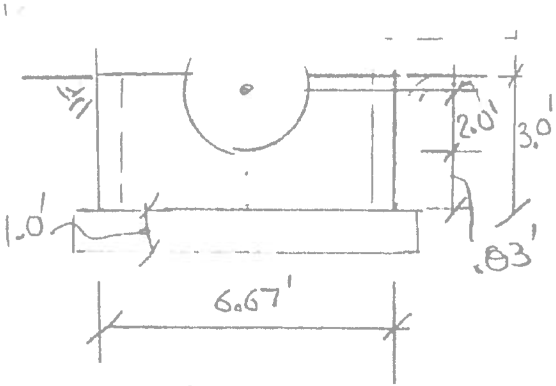
ENGINEERING DEPT.
AMERICAN ELECTRIC POWER SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OHIO

SHEET 39 OF
DATE 11/14/16 BY JAR CK.
COMPANY AEP G.O.
PLANT ROCKPORT

SUBJECT CCR COMPLIANCE CHECK

$\phi = 30°$
$\beta = 0°$ CONSERVATIVE
$\delta = 0°$
$\gamma = 120pcf$
$\gamma_w = 62.4pcf$

SEE PG 42 FOR
K_a, K_{ae}, K_p, K_{pe}



$A_g = 4.0(6.67) = 26.68SF$

$A_{OUT} = 12.56 - 5.62 = 6.94SF$

$P_{ae} = (.478 - 0.355)(4 \times .0676) \times 1/2 \times 4.0 \times 6.67 = 0.42^K$

$P_a = 0.355(4 \times .0676^2) \times 1/2 \times 4.0 \times 6.67 = 1.28$

$P_p = 2.526 \times 4 \times .0676/2 \times \frac{26.68 - 6.94}{26.68} \times 6.67 = 6.74^K$

TOTAL SLIDING FORCE $= 1.28 + 0.313(6.67) + 3.12 + 0.42 = 6.91^K$

$P_{BOUYANT} = [7.17 \times 7.67 \times 1.0 + 6.67 \times 6.17 \times 9.0] \frac{624}{1000} = 26.5^K$

WATER IN SUMP $: 5.0 \times 4.5 \times 4.0 \times .0624 = 5.62^K$

$\mu = 0.5$

SLIDING RESISTANCE $= (37.56 + 5.62 - 26.5)(.9)(1 - .066).5 + 6.74(.9)$
$= 13.08^K$

SAFETY FACTOR $= \frac{13.08}{6.91} = 1.89$

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SUBJECT CCR COMPLIANCE CHECK

$$M_{OV} = .313(6.67)(6.4) + 1.28\left(\frac{4.0}{3}\right) + .42\left(\frac{2\times 4.0}{3}\right) + 25.59$$

EQ ON STRUCTURE

$$= 41.78'\text{-K}$$

P_P

WATER IN STRUCTURE

DL STRUCTURE

$$M_R = (37.56 + 5.62 - 26.5).9(1 - .066)\left(\frac{7.17}{2}\right) + 6.79\left(\frac{4.0}{3}\right)$$

$$= 59.25'\text{-K}$$

$$\text{SAFETY FACTOR} = \frac{59.25}{41.78} = 1.42$$

EAST BOTTOM ASH POND IS WORST CASE, DEPTH OF POND & DEPTH OF WATER ABOVE DISCHARGE WEIR IS LARGEST. CONSERVATIVELY WATER LEVEL IN STRUCTURE IS ASSUMED TO MATCH WASTEWATER POND ELEVATION OF 389 ft.

V_U = SHEAR LOAD ON WALLS = 6.91^K

$$\phi V_C = \frac{0.75 \times 2\sqrt{3000}\,(74)(10)\times 2}{1000} = 121.6^K \gg V_U \text{ OK.}$$

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LATERAL PRESSURE ON WALLS @ TOP OF FILL

1-1 $= \frac{78.3 + 6.0(62.4)}{1000} = 0.453 KSF$

ASSUME WALLS HAVE MINIMUM REINFORCEMENT

$A_s = \frac{0.002(12)(10)}{2} = 0.12 in^2/ft$

$M_u = 5.83^2(.453)/8 = 1.93^{k\text{-}ft}/ft$ $d = 10 - 2 - .625 - \frac{.625}{2} = 7.06''$

$\phi M_n = \frac{0.9(.12)(60)}{12}\left(7.06 - \frac{.59(.12)(60)}{3.0(12)}\right) = 3.75^{k\text{-}ft}/ft > M_u$ O.K.

2-2 $9.0 \times .0624 + .355(4.0 \times .0676) = 0.658 KSF$

$M_u = 5.83^2(.658)/8 = 2.80^{k\text{-}ft} < 3.75^{k\text{-}ft}$ O.K.

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$$K_a = \frac{(1+K_v)\cos^2\phi}{(1+\sin\phi)^2} = 0.355$$

$\phi = 30^\circ$

$$K_p = \frac{(1-K_v)\cos^2\phi}{(1-\sin\phi)^2} = 2.802$$

$$\theta' = \tan^{-1}\left(\frac{K_h}{1 \pm K_v} \cdot \frac{\gamma}{\gamma - \gamma_w}\right)$$

$K_h = 0.083$

$K_v = 0.066$

$\theta' = 9.214^\circ$

10.489°

$$K_{ae} = \frac{(1+K_v)\cos^2(\phi-\theta-\alpha)}{\cos\theta\cos^2\alpha\cos(\alpha+\delta+\theta)\left(1+\sqrt{\frac{\sin(\phi+\delta)\sin(\phi-\beta-\theta)}{\cos(\alpha+\delta+\theta)\cos(\alpha-\beta)}}\right)^2}$$

$$= \frac{(1+.066)\cos^2(30-9.214)}{\cos 9.214\cos^2 0\cos(0+0+9.214)\left(1+\sqrt{\frac{\sin(30)\sin(20.786)}{\cos(9.214)\cos 0}}\right)^2}$$

$$K_{ae} = \frac{0.932}{1.976} = 0.472$$

$$K_{pe} = \frac{(1-K_v)\cos^2(\phi+\alpha-\theta)}{\cos\theta\cos^2\alpha\cos(\alpha-\delta-\theta)\left(1+\sqrt{\frac{\sin(\phi+\delta)\sin(\phi+\beta-\theta)}{\cos(\alpha-\delta-\theta)\cos(\alpha-\beta)}}\right)^2}$$

$$= \frac{(1-.066)\cos^2(20.786)}{\cos 9.214\cos^2 0\cos(-9.214)\left(1-\sqrt{\frac{\sin 30\sin(20.786)}{\cos(-9.214)\cos 0}}\right)^2}$$

$$K_{pe} = \frac{0.816}{0.323} = 2.526$$

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SUBJECT CCR COMPLIANCE CHECK

CHECK UNDERGROUND PIPING

PIPE $\sigma_y = 3300$ psi

$L = 41.5'$ $\sigma_{DESIGN} = \frac{TuL}{2\pi Dt} = \frac{10410 \times 41.5}{2\pi 48 \times 1.45} = 988$ psi

O.K.

$$\epsilon_a = \frac{TuL}{\pi D t E}\left(1 + \cancelto{1.0}{\frac{N}{(1+r)}}\left(\frac{TuL}{2\pi D t \sigma_y}\right)^r\right)$$

$N = 10$
$r = 100$

$$\epsilon_a = \frac{10410 \times 41.5}{2\pi(48)(1.45)(2\times10^6)} = 4.94\times10^{-4} < 0.02 \text{ O.K.}$$

(PG 32)

ATTACHMENT 3

DESIGN GUIDELINE FOR SEISMIC RESISTANT WATER PIPELINE INSTALLATIONS

John Eidinger[1]

ABSTRACT

Seismic design for water pipelines is not explicitly included in current AWWA standards. Compounding this problem, standard water pipeline materials and installation techniques are prone to high damage rates whenever there is significant permanent ground deformations or excessively high levels of ground shaking.

To help improve this situation, a new Design Guideline for Seismic Resistant Water Pipeline Installations (the Guidelines) has been developed. It is intended that the Guidelines be issued in March 2005. For the period from November 2004 through January 2005, the Guidelines are available in draft form for public comment. Comments from U.S., Japanese, Canadian and all other water utilities, pipeline manufacturers, AWWA, JWWA and other interested parties are welcomed.

The Guidelines provide direction for three situations:

- When the pipeline engineer has just rough estimates of the earthquake hazard, does not have the resources to do design by analysis, and wishes to rely on standardized pipeline components. The Guidelines provide the Chart Method. This is the preferred approach for common pipeline installations like 6-inch to 8-inch diameter pipes, fire hydrants and service laterals.

- When the pipeline engineer wishes to perform a limited design by analysis. The Guidelines provide the Equivalent Static Method. This is the preferred approach for medium important pipelines like 12-inch to 24-inch installations, or as a preliminary approach for major transmission pipelines.

- When the pipeline engineer has the resources to perform detailed subsurface investigations, geotechnical engineering and pipe stress analyses. The Guidelines provide the Finite Element Method. This is the preferred approach for essential non-redundant installations, like 36-inch to 120-inch pipelines.

INTRODUCTION

In most every severe earthquake, the largest negative impact to water utilities has been the damage to buried water pipelines. At the past three JWWA-AWWARF workshops (Oakland

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2000, Tokyo 2001, Los Angeles 2003), a great emphasis was placed by many participants on the rate of pipe damage, the causes of pipe damage, and the improved earthquake performance of new types of pipe.

After the Los Angeles workshop, many US participants got together and decided something ought to be done about this. Accordingly, in concert with FEMA, NIBS and the ALA, a team of engineers was assembled to put together the first ever US seismic design guideline for buried water pipelines. The American Lifelines Alliance (ALA) was formed by the Federal Emergency Management Agency (FEMA) in 1998 as a public-private partnership whose goal is to reduce risk to utility and transportation systems from natural hazards and manmade threats. In 2002, FEMA contracted with the National Institute of Building Sciences (NIBS) through its Multihazard Mitigation Council (MMC) to, among other things, assist FEMA in developing these Guidelines. The ALA sponsors this work through funding from NIBS and FEMA.

AmericanLifelinesAlliance

U.S. DEPARTMENT OF HOMELAND SECURITY

FEMA

National Institute of
BUILDING SCIENCES

AUTHORS

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Mr. Luke Cheng	San Francisco Public Utilities Commission
Mr. Frank Collins	Parsons
Mr. Mike Conner	San Diego Water Department
Dr. Craig Davis	Los Angeles Department of Water & Power
Mr. Mike Matson	Raines, Melton and Carella, Inc.
Prof. Mike O'Rourke	Rennselaer Polytechnic Institute
Prof. Tom O'Rourke	Cornell University
Mr. Alex Tang	Nortel Networks, Retired
Mr. Doug Honegger	Consultant (Technical Oversight)
Mr. Joseph Steller	NIBS (Project Management)

The Guidelines would not have been possible without the contributions from numerous staff of the San Francisco Public Utilities Commission, East Bay Municipal Utilities District, City of San Diego Water Department, the Los Angeles Department of Water and Power, and many other participating agencies.

OUTLINE OF THE GUIDELINES

The Guidelines describe the various steps in seismic water pipeline design, with commentary. The main topics included are: Goals; Performance Objectives; Earthquake Hazards; Subsurface Investigations; General Pipeline Design; Analytical Models; Transmission Pipelines; Bypass Pipelines; Distribution Pipelines; Service and Hydrant Laterals; Distribution Pipelines; and Other Components. The Guidelines are meant to be a self-standing document that can be used by pipeline designers in water utilities; as such, it is geared to provide simple procedures to achieve the overall goal. The Guidelines always allow for more detailed procedures to be used by geologists, geotechnical engineers and pipeline engineers when suitable. A link to obtain the entire draft Guidelines is listed in the Conclusions.

For the 4th AWWARF-JWWA workshop, four papers cover the major topic areas of the Guidelines. This paper describes performance goals and the design-by-chart method. The paper by Dr. Craig Davis covers reliability goals and definition of geotechnical hazards. The paper by Mr. Luke Cheng covers design issues for transmission pipelines. The paper by Mr. Bruce Maison covers the two design-by-analysis models and design issues for service laterals.

GOAL OF SEISMIC DESIGN FOR WATER PIPELINES

The goal of the Guidelines is to improve the capability of water pipelines to function and operate during and following design earthquakes for life safety and economic reasons. This is accomplished using a performance based design methodology that provides cost-effective solutions and alternatives to problems resulting from seismic hazards. Improved water pipeline performance will help create a more resilient community for post-earthquake recovery; therefore portions of the Guidelines inherently consider the community impacts if pipeline damage were to occur. The Guidelines do not intend to prevent all pipelines from being damaged.

To achieve this goal, the fundamental intent of the Guidelines is to assure a reasonably low rate of water pipeline damage throughout a water utility system, such that about 90% of customers in a system can be restored with piped water service within about three days after a design basis earthquake.

To achieve this level of performance, an acceptable damage rate will be about 0.03 to 0.06 breaks per 1,000 feet (0.1 to 0.2 breaks per kilometer) of equivalent 6-inch diameter pipe. The commentary of the Guidelines provides a calculation to convert a network of pipes of different diameters that may suffer both breaks and leaks, in conjunction with network redundancy, into a single equivalent break rate per equivalent 6-inch diameter pipe. By minimizing pipeline damage after earthquakes to this level of damage, a typical water utility serving a population of 150,000 people could expect to:

- Deliver water at serviceable pressure to 65% to 90% of all hydrants within the first hours after the earthquake, as long as there are adequate supply sources; and

- Deliver water via the pipe network to at least 90% of all customers within 3 days following an earthquake;

as long as the utility can isolate most of the leaking and broken pipes within one day or so, and repair equivalent 6-inch diameter pipes at a rate of about 20 within the first three days after the earthquake, and 20 per day thereafter.

For water utilities with limited post-earthquake repair capability, or serving pipe networks with limited or no redundancy, it is important to limit the damage rate to the lower range. For water utilities with much greater post-earthquake repair capability, it might be acceptable to sustain damage to the higher range.

NEW INSTALLATIONS AND REPLACEMENT / RETROFIT

It is the intent of the Guidelines that they be used for all new pipeline installations. Over a period of many years, a sufficiently high percentage of pipelines in a network will eventually have been designed per these Guidelines. Thus, it may take decades for some utilities to ultimately achieve the goals, unless a pipeline replacement / retrofit program is also adopted.

The decision to replace older pipes is a complex one. In many networks, many existing pipelines (such as cast iron pipe with caulked joints) will not meet the seismic design capability recommended by the Guidelines. Still, the Guidelines do not recommend replacing older 4-inch to 10-inch diameter cast iron pipes solely on the basis of earthquake improvement, since this is not thought to be cost effective. However, as old pipeline are thought to need replacement because they no longer provide adequate fire flows, or have been observed to require repair at a rate of more than once every 5 years, then the added benefit of improved seismic performance may justify pipe replacement. When replaced, the new pipes should be designed per the Guidelines.

Replacement of larger diameter pipelines (12-inch diameter and upwards) may be cost effective just from a seismic point of view, in areas prone to PGDs.

PIPELINE FUNCTION CLASSES

A pipeline's function within the system identifies its importance in achieving the system performance goal. Table 1 provides the 4 function classes. A pipe function identifies a performance objective of an individual pipe, but not that of an entire system.

Function	Seismic Importance	Description
I	Very Low to None	Pipelines that represent very low hazard to human life in the event of failure. Not needed for post earthquake system performance, response, or recovery. Widespread damage resulting in long restoration times (weeks or longer) will not materially harm the economic well being of the community.
II	Ordinary, Normal	Normal and ordinary pipeline use, common pipelines in most water systems. All pipes not identified as Function I, III, or IV.
III	Critical	Critical pipelines and appurtenances serving large numbers of customers and present significant economic impact to the community or a substantial hazard to human life and property in the event of failure.
IV	Essential	Essential pipelines required for post-earthquake response and recovery and intended to remain functional and operational during and following a design earthquake.

Table 1. Pipe Function Classifications

THREE DESIGN APPROACHES

The Guidelines provide three approaches can be used in the design of buried pipelines.

- Chart method. The simplest approach. Avoids all mathematical models, and allows the designed to pick a style of pipe installation based on parameters such as regional maps for PGV and PGD hazards, and the pipeline function class.
- Equivalent static method. Uses simple quantifiable models to predict the amount of stress, strain and displacement on a pipe for a particular level of earthquake loading. The pipeline can then be designed to meet these quantified values, or pipe styles can be selected that presumably meet these quantified values without a formal capacity to demand check. Pipe selection is usually made by specification from available manufacturer's catalogs.
- Finite element method. This method uses finite element models to examine the seismic loads (whether PGA, PGV or PGD) over the length of the pipeline, and then uses beam on inelastic foundation finite element models (or sometimes use two- or three-dimensional mesh models) to examine the state of stress and strain and displacement within the pipeline and pipeline joints. Pipe design is often shown on contract drawings, covering material selection, joint preparation, trench design and other factors.

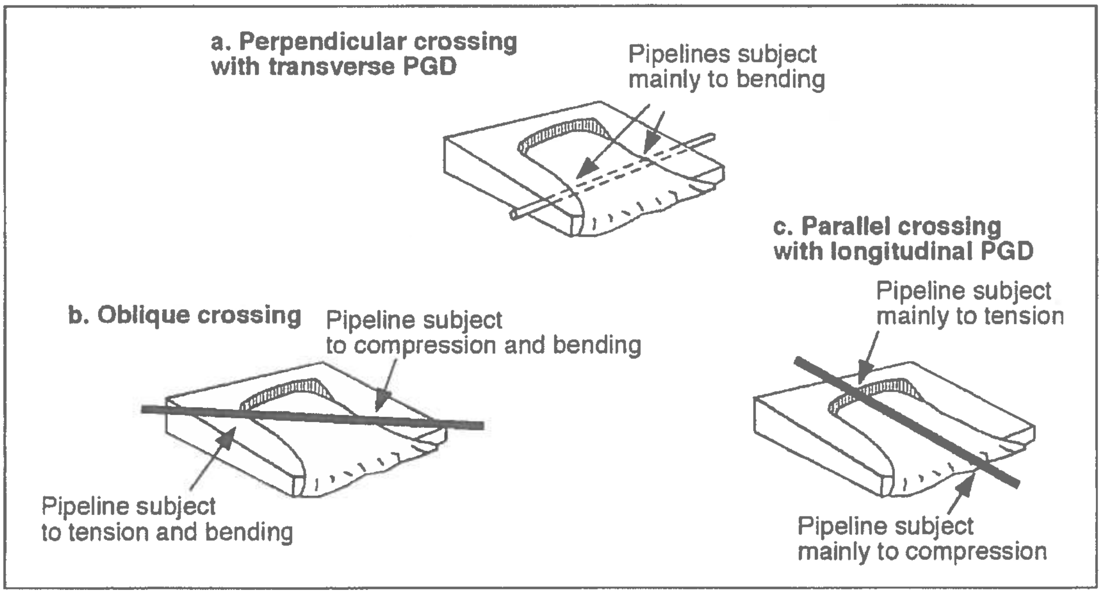


Figure 1. Direction of Permanent Ground Deformation (PGD)

CHART METHOD

Transmission Pipelines

Transmission pipelines may carry raw or treated water. Due to their importance to a great number of people, Function Class I is generally to be avoided except for those pipes whose failure would not impact any customer for 30 days or more.

Tables 2 to 5 set the pipeline design category (A, B, C, D or E). Figure 1 shows the meaning of perpendicular (transverse) and parallel (along the axis) orientations. If a portion of a pipeline has two or more categories for the various hazards (ground shaking, transverse PGDs, parallel PGDs, fault offset PGDs), then the highest category controls.

Inch/sec	Function I	Function II	Function III	Function IV
0 < PGV ≤ 10	A	A	A	A
10 < PGV ≤ 20	A	A	A	B
20 < PGV ≤ 30	A	A	B	C
30 < PGV	A	B	C	D

Table 2. Transmission Pipelines – Ground Shaking

Inches	Function I	Function II	Function III	Function IV
0 < PGD ≤ 2	A	A	A	A – welded steel B - segmented
2 < PGD ≤ 6	A	A	A	B
6 < PGD ≤ 12	A	A	B	C
12 < PGD	A	B	C	D

Table 3. Transmission Pipelines – Liquefaction and Landslide Transverse to Pipeline Alignment

Inches	Function I	Function II	Function III	Function IV
0 < PGD ≤ 2	A	A	B	B
2 < PGD ≤ 6	A	B	B	C
6 < PGD ≤ 12	C	C	C	D
12 < PGD	D	D	D	E

Table 4. Transmission Pipelines -- Liquefaction (Lateral Spread) and Landslide Along Axis of Pipeline

Inches	Function I	Function II	Function III	Function IV
0 < PGD ≤ 2	A	A	B	B
2 < PGD ≤ 6	A	B	B	C
6 < PGD ≤ 12	A	C	C	D
12 < PGD ≤ 24	A	D	D	E
24 < PGD	A	D	E	E

Table 5. Transmission Pipelines – Fault Offset

Distribution Pipelines, Service Laterals and Fire Hydrant Laterals

In most cases, distribution pipelines are in networks. Failure of a single distribution pipeline will not fail the entire network (once the broken pipe is valved out), but the customers on the broken distribution pipeline will have no piped water service until the pipe is repaired. The engineer can assume that distribution pipelines are Function Class II, except in the following cases:

- The pipeline is the only pipe between lower elevation pump station and upper elevation pump station / reservoir in a pressure zone, and the failure of that pipeline will lead to complete loss of supply to the pump station serving a higher zone, or loss of the water in the reservoir for fire fighting purposes. For example, a 12-inch diameter pipe from lower elevation pump station that delivers water to a higher elevation tank within a pressure zone, and that also serves water to higher elevation pump stations.

- The pipeline is the only pipe delivering water to particularly important customers, such as critical care hospitals. For example, an 8-inch diameter pipe that has a service connection to a 200 bed hospital.

Past earthquakes have shown that there can be great quantity of damage to distribution pipelines, especially in areas prone to PGDs or high velocity pulses. While no single distribution pipeline is as important as a transmission pipeline, the large quantity of distribution pipe damage can lead to rapid system-wide depressurization, loss of fire fighting capability, and long outage times due to the great amount of repair work needed. Accordingly, we recommend that most distribution pipes be classified as Function Class II and very few as Function Class I (under ~5% of total pipeline inventory). A few distribution pipes serving essential facilities could be classified as Function III or IV; or they could be designated in suitable emergency response plans as prioritized for prioritized and rapid repair (generally under one day or two days at most). Once the Function Class is set, Tables 6 to 11 define the Design Category.

Inch/sec	Function I	Function II	Function III, IV
$0 < PGV \leq 10$	A	A	A
$10 < PGV \leq 20$	A	A	A
$20 < PGV \leq 30$	A	A	A (with additional valves)
$30 < PGV$	A	A (with additional valves)	B

Table 6. Distribution Pipelines – Ground Shaking

Inches	Function I	Function II	Function III, IV
$0 < PGD \leq 2$	A	A	A (with additional valves)
$2 < PGD \leq 6$	A	A (with additional valves)	B
$6 < PGD \leq 12$	A	B	C
$12 < PGD$	A	C	C

Table 7. Distribution Pipelines – Liquefaction and Landslide Transverse to Pipeline Alignment

Inches	Function I	Function II	Function III, IV
$0 < PGD \leq 2$	A	A	B (with additional valves)
$2 < PGD \leq 6$	A	B	C
$6 < PGD \leq 12$	A	C	D
$12 < PGD$	A	D	D

Table 8. Distribution Pipelines – Lateral Spread and Landslide Along Axis of Pipeline

Inches	Function I	Function II	Function III, IV
$0 < PGD \leq 2$	A	B	B
$2 < PGD \leq 6$	A	B	C
$6 < PGD \leq 12$	A	C	D
$12 < PGD \leq 24$	A	D	E
$24 < PGD$	A	E	E

Table 9. Distribution Pipelines – Fault Offset

Service Laterals and Hydrant Laterals

Inch/sec	Any Lateral
$0 < PGV \leq 10$	A
$10 < PGV \leq 30$	A
$30 < PGV$	B

Table 10. Laterals – Ground Shaking

Inches	Any Lateral
$0 < PGD \leq 2$	A
$2 < PGD \leq 12$	B
$12 < PGD$	C

Table 11. Laterals – Liquefaction, Landslide and Surface Faulting

Design Categories

There are five design categories. Category A denotes standard (non-seismic) design. The following summarizes the general design approach for Categories B, C, D and E:

- B = restrained with extra valves
- C = B + better pipe materials
- D = C + quantified seismic design; or provide bypass system.
- E = D + peer review (it is strongly recommended that FEM method be used for any pipe with Classification E)

Tables 12 to 19 provide guidance for seismic pipe design using the chart method based on the categories A through E. Note. This guidance is based on commonly available pipe and joinery as of 2004. As new pipe products become available, they can be used in the chart method as long as suitable justification (FEM, test, etc.) is provided to show that the pipe meets the intended reliability of the pipe and performance of the pipe network as a whole.

Design Category	Cost Effective Design Approach	Notes
A	Standard	
B	Extended Joints	
C	Restrained Joints	
D	Extended and Restrained Joints	Standard with bypass
E	Special Joints	Standard with bypass

Table 12. Ductile Iron Pipe

Design Category	Cost Effective Design Approach	Notes
A	Standard	
B	Standard with extra insertion	
C	Restrained Joints	
D	Extended and Restrained Joints	Standard with bypass
E	Not recommended	Standard with bypass

Table 13. PVC Pipe

Design Category	Cost Effective Design Approach	Notes
A	Single Lap Weld	
B	Single Lap Weld	Weld t = pipe t
C	Double Lap Weld	Weld t = pipe t
D	Double Lap Weld / Butt Weld	D/t max 110 in PGD zones
E	Butt Weld	D/t max 95 in PGD zones

Table 14. Welded Steel Pipe

Design Category	Cost Effective Design Approach	Notes
A	Standard	
B	Extended Joints	
C	Restrained Joints	
D	Extended and Restrained Joints	Standard with bypass
E	Not recommended	Standard with bypass

Table 15. Gasketed Steel Pipe

Design Category	Cost Effective Design Approach	Notes
A	Gasketed or Single Lap weld	
B	Single Lap Weld	Weld t = pipe t
C	Double Lap Weld	Weld t = pipe t
D	Not recommended	Standard with bypass
E	Not recommended	Standard with bypass

Table 16. CCP & RCCP Pipe

Design Category	Cost Effective Design Approach	Notes
A	Standard	
B	Butt Fusion Joints	
C	Butt Fusion Joints	
D	Butt Fusion Joints	
E	Butt Fusion Joints	

Table 17. HDPE Pipe

Design Category	Cost Effective Design Approach	Notes
A	Standard	
B	Soldered joints	
C	Soldered joints	Expansion loop / Christie box / Other box

Table 18. Copper Pipe

Design Category	Cost Effective Design Approach	Notes
A	Standard	
B	Dresser-type coupling	
C	Multiple dresser couplings	
D	EBAA flextend type couplings	
E	Not recommended	Relocate hydrant

Table 19. Segmented Pipelines Used as Hydrant Laterals

Design Category	Cost Effective Design Approach	Notes
A	Bolted, Single Lap Weld, Fusion Weld	
B	Bolted, Single Lap Weld, Fusion Weld	Weld t = pipe t
C	Bolted, Double Lap Weld, Single Lap Weld with fiber wrap, Fusion Weld	Weld t = pipe t
D	Bolted, Double Lap Weld, Single Lap Weld with fiber wrap, Butt Weld, Fusion Weld	Bolted, Double Lap Weld, Single Lap Weld with fiber wrap, Fusion Weld
E	Bolted, Double Lap Weld, Single Lap Weld with fiber wrap, Butt Weld, Fusion Weld	Bolted, Double Lap Weld, Single Lap Weld with fiber wrap, Fusion Weld

Table 20. Continuous Pipelines Used as Hydrant Laterals

In addition to the design categories in Tables 12 to 20, the following additional requirements are made. These recommendations are cumulative (For C, include B and C recommendations).

- B. Add isolation valves on all pipes within 50 feet of every intersection, for example, four valves on a four-way cross.

- C. Maximum pipe length between connections for segmented pipe is 16 feet, or as otherwise justified by ESM or FEM.

- D. Maximum pipe length between connections for segmented pipe is 12 feet, or as otherwise justified by ESM or FEM.

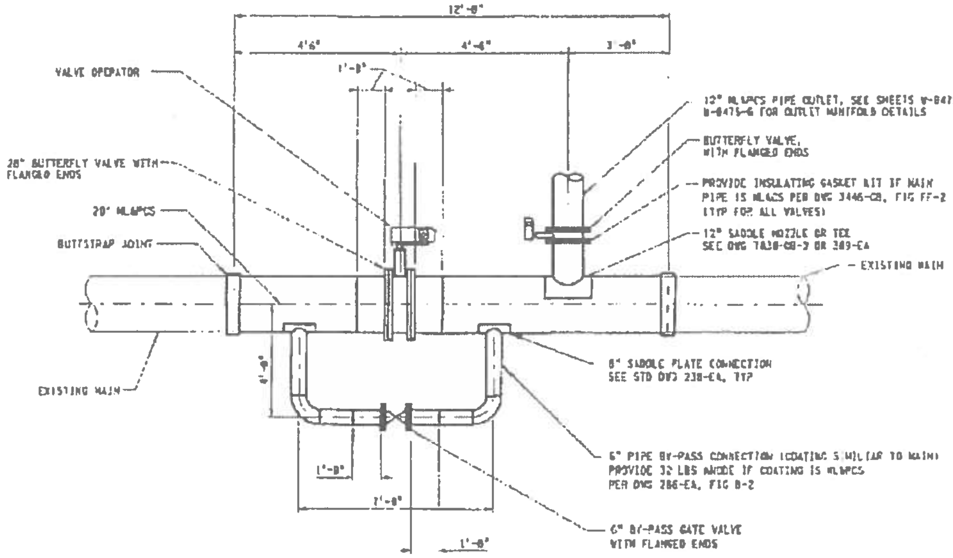
Bypass Pipelines

During design of a pipeline, it is typical to perform some preliminary seismic and hazard investigation. A geotechnical engineer can perform literature search of available publications and assess the seismic setting of the pipeline and identify potential hazards such as fault crossings, landslides, and zones of potential liquefaction.

With this information, the pipeline design engineer can often times route the pipeline to avoid well-defined hazards. This is the most cost-effective approach for minimizing seismic-related damage to a pipeline. However, sometimes there is no feasible way to avoid a hazard and the pipeline must be routed through the hazard.

Instead of using a higher Category Design (such as D or E), the owner can elect to provide a bypass capability, as long as the owner has the ability to install the bypass within about 1 day after the earthquake, and in consideration of the entire post-earthquake response. Bypass capability might be the most cost effective approach to mitigate many fault and landslide crossings for Function Class III pipelines. Bypasses can be used in retrofitting existing pipelines or for new construction where loss of service cannot be tolerated for more than one day.

A typical bypass is illustrated in Figure 2, consisting of a line isolation valve, if none previously existed, and a 12-inch diameter connection and manifold assembly on either side of the defined hazard. In order for the bypass to be used effectively, the hazard must be relatively well defined. Each of the manifolds is configured to accept one or multiple large diameter hose connections. In the event of a seismic event that results in a pipeline failure within the bounds of the hazard, the hazard isolation valves are closed, thereby stopping leakage at the point of failure. The hose is then deployed across the ground between the two manifold assemblies and serves as a temporary pipe bypass, allowing restoration of flows through the system. Figure 3 shows a deployed bypass system at a fault crossing where deployment of three flex hoses was possible.



Typical Isolation Valve with Bypass

Figure 2. Bypass Manifold Assembly

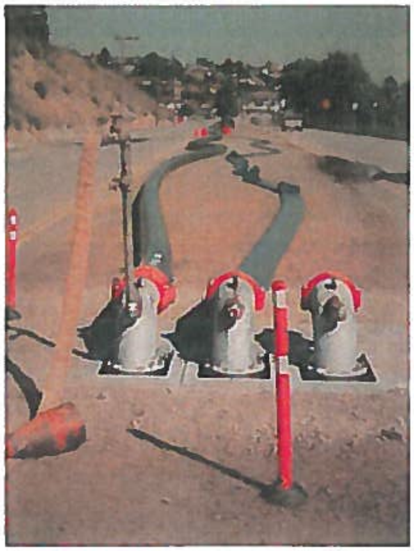


Figure 3. Flex Hose Attached to Manifold Outlets

The criteria for the bypass system components are included in Table 21. So called "large diameter flex hose" (diameter ~5-inches) will generally not provide sufficient flow rate at a reasonable pressure drop, for distances on the order of 1,000 feet between manifolds. So called "ultra large diameter flex hose" (diameter ~12-inches) can provide high flow rates at separation distances of 1,000 feet (or more). There are pros and cons with using either 5-inch or 12-inch hose, including: flow rate and pressure drop; cost; storage life; deployment effort and time; hose breakage and resultant pipe whip; etc.

Description	**Criteria**
Pipe Materials	Mortar-lined and mortar- or tape/epoxy-coated steel pipe Field joints shall be flanged, welded, or mechanically coupled with suitable restraint Design for anticipated internal, external, and transient loading conditions Provide cathodic protection as needed
Manifold Pit	Precast reinforced concrete with seismic design factors suitable for site Traffic rated steel plate cover Sized for easy hose deployment
12-inch Valves and Smaller	Butterfly or Gate
Flexible Hose	12 -inch flex hose, burst pressure ~ 400 psi, operating pressure ~150 psi. Distances up to 1,000 feet or more at flow rates of up to 5,000 gpm 5-inch fire hose from local Fire Department. Distances up to 1,000 feet at flow rates of up to 500 gpm Connections to be coordinated with manifold configuration

Table 21. Bypass System Components Criteria

CONCLUSIONS

It is the intent of these Guidelines to provide a unified, comprehensive and simple approach that can be readily adopted by water utilities for the design of new pipeline installations. The draft Guidelines are available for public comment through January 2005. They may be obtained via the Internet at: http://homepage.mac.com/eidinger/ (follow the link to downloads, and then download Seismic Guidelines.doc.) Comments should be sent to any of the authors.

The Guidelines may result in changes in pipeline installations in moderate and high seismic areas throughout the United States. Given the large economic consequences of widespread pipeline damage, the authors believe that the extra reliability afforded by these changes is worthwhile and cost effective. We hope that the Guidelines will spur water utilities to procure better pipelines in high hazard locations; in turn, the pipeline manufacturers will manufacture and supply better products. This is, in part, a "chicken and egg" process, since prior to the current moment (late 2004 – early 2005) we have not had the Guidelines for water utilities; nor have we always had suitable cost effective pipelines provided by manufacturers to meet the Guidelines.

ABBREVIATIONS AND UNITS

Customary US units (inches, pounds, gallons) are used in this paper. Conversions to SI units are provided below. All pipe sizes are in customary US units; conversion of a customary pipe size (such as 12-inch diameter) to SI units has no precision, as a 12-inch pipe may often have outside diameter anywhere from ~12-inches to ~13-inches.

ALA	American Lifelines Alliance
AWWA	American Water Works Association
AWWARF	American Water Works Association Research Foundation
ESM	Equivalent Static Method
FEM	Finite Element Method
FEMA	Federal Emergency Management Agency
JWWA	Japan Water Works Association
MMC	Multihazard Mitigation Council
NIBS	National Institute of Building Sciences
PGA	Peak Ground Acceleration (g)
PGD	Permanent Ground Deformation (1 inch = 2.54 cm)
PGV	Peak Ground Velocity (1 inch/sec = 2.54 cm/sec)
inch	inch (1 inch = 2.54 cm)
feet	feet (1 foot = 12 inches = 30.48 cm)
g	gravity constant (1g = 386.4 inch/sec^2 = 981 cm/sec^2)
gpm	gallons per minute (1 gpm = 3.785 liters per minute)
psi	pounds per square inch (1 psi = 6.895 kilopascals)
sec	second

Appendix H

Safety factor assessment required at § 257.73(e)

for

Rockport Plant's

Bottom Ash Pond Complex

Geotechnical Engineering Report

AEP Rockport Bottom Ash Complex
Professional Engineering Certification
Rockport, Indiana

January 11, 2016
Terracon Project No. N4155126

Prepared for:
American Electric Power
Columbus, Ohio

Prepared by:
Terracon Consultants, Inc.
Columbus, Ohio

TABLE OF CONTENTS

GEOTECHNICAL ENGINEERING REPORT
AEP ROCKPORT BOTTOM ASH COMPLEX
PROFESSIONAL ENGINEERING CERTIFICATION
ROCKPORT, INDIANA

Terracon Project No. N4155126

January 11, 2016

1.0 INTRODUCTION

This report provides the results of our field and laboratory testing programs, and presents our conclusions and slope stability analysis results to satisfy the criteria set forth by the most recently mandated USEPA rule 40 CFR Part 257, Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities (CCR rules) for the AEP Rockport Bottom Ash Complex in Rockport, Indiana. The subsurface conditions were explored by two (2) borings sampled to depths of about 30 to 44 feet below the existing ground surface. Additionally, a groundwater observation well was installed within the embankment to a depth of about 15 feet, located approximately 10 feet south of Boring B-2.

2.0 PROJECT INFORMATION

In AEP's Stability Assessment of Bottom Ash Pond, West Dike report dated June 21, 2010, AEP conducted geotechnical engineering analyses of the Rockport impoundment and determined the minimum upstream and downstream dike factors of safety against slope failure considering both existing and earthquake loading conditions. 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 Slope Stability Analysis
- Perform Hydrologic and Hydraulic Analysis
- Establish 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 14, 2015 the undersigned representatives of Terracon met with AEP personnel and performed a site reconnaissance of the Rockport Plant Bottom Ash Pond Complex. The only above-grade embankment is along the west side of the West Bottom Ash Pond and West Wastewater Pond. The remaining ponds were constructed by excavating below original grade. Based on conversations with AEP, we understand that no significant modifications have been made to the geometry of the existing impoundment perimeter embankment slopes since the time of AEP's 2010 slope stability analyses. However, based on site observations and information in provided topographic information, the exterior slopes appeared to be flatter than the 2.5H:1V presented in the original design drawings and used in the 2010 analyses. The embankment also appeared to be lower in height than the 13 feet used in the 2010 analyses. Previous modifications to the perimeter embankment of the existing complex are understood to have occurred in 1984. These previous modifications included regrading and redressing of the slopes. Pertinent photographs from the July 14, 2015 site reconnaissance have been included in the Appendix of this report in Appendix E.

4.0 REVIEW OF PREVIOUS SLOPE STABILITY ANALYSES

Terracon has completed a review of the slope stability analyses performed by AEP in 2010. During the previous analyses, an idealized cross-section consisting of a 13-foot high embankment with 2.5H:1V exterior and 2H:1V interior slopes based on the original construction drawings. The profile was determined based on borings performed in 1977 as part of the original investigation for the Rockport Power Plant. As no strength testing was performed during this investigation, the parameters used in the model were assumed typical values for the material encountered.

Considering the AEP 2010 analyses and the limited subsurface exploration, Terracon performed two additional borings at the site (one along the crest and one at the toe of the embankment) to verify the soil conditions and conduct strength testing on the embankment and foundation soils. Additionally, a groundwater monitoring well was installed within the embankment to evaluate the presence of groundwater within the embankment, and updated topographic information provided by AEP was used to develop a cross-section for analysis.

5.0 SUBSURFACE CONDITIONS

5.1 Site Geology

The site of Rockport Bottom Ash Complex is within the flood plain of the Ohio River and the Boonville Hills physiographic province of the Southern Hills and Lowlands physiographic region.

According to the USDA Soil Survey of Spencer County, Indiana (September 2015), the predominant soil in the vicinity of the site is the Ginat silt loam (Gn). The Weinbach silt loam (WcA), Sciotoville silt loam (ScA and ScB2), and Wheeling loam (WhB2) are also present near the facility, but to a lesser extent. A majority of the soils in the vicinity of the site have been altered or removed during site development and are classified as Udorthents (Uaa) or Mine Dumps (Du).

The Ginat consists of poorly-drained silt loam and silty clay loam. The Weinbach consists of somewhat poorly drained silt loam and silty clay loam. The Sciotoville and Wheeling consist of moderately well-drained to well-drained silt loam, clay loam, and loam.

The Bottom Ash Complex is located on the western bank of the Ohio River and is underlain by Quaternary age alluvium consisting of Wisconsinan age undifferentiated outwash. Geotechnical borings performed at the site during the original subsurface investigation indicate clay generally ranging from less than 5 to about 15 feet in thickness, but may extend up to about 30 feet and contain layers or lenses of fine sand. The clay layer was underlain by fine to coarse sand deposits. Historical boring information is presented in Appendix A.

Bedrock consists of the Raccoon Creek Group Formation of Pennsylvanian age and is comprised of predominantly shale and sandstone with thin beds of limestone, clay, and coal. The Raccoon Creek Group is underlain by rocks ranging in age from Middle Devonian to Late Mississippian and is located at about elevation 280 to 300 feet.

Structurally, the area is located within the Illinois Basin, near the eastern border of the Wabash Valley Seismic Zone, which generally consists of vertically-oriented faults buried under layers of sediment.

5.2 Site Characterization

Subsurface conditions were explored by two (2) borings. The approximate locations of the borings are presented on Exhibit A-3 in Appendix A. Logs of the borings are also included in Appendix A. Note that stratification boundaries on the boring logs represent the approximate locations of changes in soil types; in situ, the transition between materials may be gradual. In addition to the borings, one groundwater observation well was installed within the embankment in an offset hole. Well completion details are also presented in Appendix A.

Borings 361, 364, and 367 provided by AEP for the initial design of the power plant were included in this study. The locations and logs of these previous borings are presented in Appendix A.

Laboratory tests were conducted for soil classification and strength measurements. The laboratory testing methods are described in Appendix B. The laboratory test results are presented on the boring logs in Appendix A and laboratory data sheets in Appendix B.

5.3 Typical Profile

Two borings were drilled at the location of the selected critical cross-section, which represented the tallest embankment section. Boring B-1 was performed at the outboard toe of the embankment. Boring B-2 was performed at the crest of the embankment section. At the time the soil borings were performed, the East Bottom Ash Pond was receiving an inflow of Bottom Ash from the plant. The West Bottom Ash Pond did not contain standing water.

Boring B-2 encountered approximately 12 feet of embankment fill consisting of lean clay with varying amounts of sand, and sandy silt, to about elevation 389.5. Beneath the embankment fill, and within Boring B-1, a layer of stiff fat and lean clay was encountered to elevations of approximately 372 to 376 feet. Below the clay, the soils contained a 1 to 2 foot thick transitional layer of loose clayey sand and sandy silt deposits, grading to deposits of loose to medium dense poorly graded sand and silty sand containing varying amounts of gravel to the termination depths of the borings.

5.4 Water Level Observations

The borings were observed while drilling for the presence and level of groundwater. Groundwater was encountered within the sand deposits at depths of approximately 17.5 feet in Boring B-1, and at 25.1 feet in Boring B-2, which correspond to elevations of about 372.2 and 372.3 feet, respectively. At the time the borings were performed, the West Bottom Ash Pond was not in service, and was not filled with standing water.

A groundwater monitoring well was installed in an offset hole within the embankment approximately 10 feet south of Boring B-2 to a depth of about 15 feet below the ground surface. At the time of installation, no water was encountered within the well. The West Bottom Ash Pond was returned to service the week of September 6, 2015. A water reading within the well, obtained on October 13, 2015, indicated water at a depth of 3.36 feet below the top of the well cover, corresponding to a water elevation of about 394.2 feet. This elevation approximately matches the minimum normal operating elevation of the West Bottom Ash Pond. The West Bottom Ash Pond contained standing water at the time of this water reading.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff, ash pond levels, river levels, and other factors not evident at the time the borings were performed. In addition, perched or trapped water can develop over low permeability soils. Therefore, groundwater levels at other times in the life of the ponds may be higher or lower than the levels indicated on the boring logs.

5.5 Laboratory Testing Summary

A summary of the laboratory tests results are included in the following tables. The testing program and test results are presented in Appendix B. Abbreviations used in the tables are as follows:

- USCS = United Soil Classification System
- LL = Liquid Limit
- PI = Plasticity Index
- UU = Unconsolidated Undrained Triaxial Test
- CU = Consolidated Undrained Triaxial Test
- φ = Soil Internal Angle of Friction
- C = Soil Cohesion
- Effective = Effective Stress Parameters
- Total = Total Stress Parameters

The test results are presented for embankment fill and native soils samples collected during the field exploration.

Embankment Fill

Boring	Sample Depth (ft)	USCS Type	LL (%)	PI (%)	UU C (tsf)	CU Effective		CU Total	
						φ (deg)	C (tsf)	φ (deg)	C (tsf)
B-2	0-2	CL	28	13	--	--	--	--	--
B-2	4-6	ML	19	3	--	29.1	0.12	19.4	0.22

Native Soils

Boring	Sample Depth (ft)	USCS Type	LL (%)	PI (%)	UU C (tsf)	CU Effective		CU Total	
						φ (deg)	C (tsf)	φ (deg)	C (tsf)
B-1	2-4	CH	69	43	--	--	--	--	--
B-1	8-10	CL	42	20	--	34.4	0.05	22.0	0.11
B-1	14-16	CL	28	10	1.26	--	--	--	--
B-2	10-12	CL	30	9	3.85	--	--	--	--
B-2	16-18	CL	35	20	--	--	--	--	--

6.0 GEOTECHNICAL ANALYSES

6.1 Slope Stability

To evaluate the stability existing embankment slope, slope stability analyses were performed on the selected “critical” cross-section of the western dike. The critical section was selected based on the tallest embankment height. During the planning of the geotechnical exploration, the critical section was considered to be about 2/3 of the way south along the West Bottom Ash Pond embankment, where the borings were drilled; however, considering the provided topographic mapping, the final cross-section used in analyses is about 3/4 of the way south along the embankment to represent the tallest dike section. The location of this cross-section is shown on Exhibit A-3.

Previous documents for the Rockport Bottom Ash Complex indicate approximately 2H:1V inboard and 2.5H:1V outboard slopes. However, based on our site visits and provided topographic information, the outboard slopes generally range from about 5H:1V to 6H:1V. The existing ground surface was developed from topographic survey mapping provided by AEP, which was performed by Henderson Aerial Surveys, Inc. dated November 10, 2007. The geometry of the inboard slopes and bottoms of the pond were estimated using the 1977 design drawings.

Strength parameters were developed based on the results of the field and laboratory testing. 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 in Appendix D.

Material	Unit Weight (pcf)	Effective Strength Parameters	
		φ (deg)	C (psf)
Embankment Fill	130	29	50
Stiff Clay	123	34	50
Loose Sand	115	30	0
Medium Dense Sand	123	33	0

The following general cases were analyzed:

- Long Term, Steady-State at Maximum Storage Pool Elevation 396 feet – This case represents the expected maximum normal operating elevation.
- Long Term, Steady-State at Maximum Surcharge Pool Elevation 398 feet – This case represents a long-term condition when the pond is completely filled to top of dike and represents an extreme case.
- Seismic – For this case, seismic loading was applied to the “Long Term, Steady-State at Maximum Storage Pool Elevation 396 feet” case and performed using a horizontal seismic coefficient of 0.145. The seismic coefficient considers ½ of the 2008 Peak Ground Acceleration with 2% Probability of Exceedance in 50 Years for firm rock (0.22), with an amplification factor of 1.32.

The stability analyses were performed using the computer program Slope/W 2012 (Version 8.12.3) developed by Geo-Slope International, Ltd. Spencer’s Method was used in the program to perform 2-Dimensional limit equilibrium slope stability analyses with a deterministic approach. Water levels within the embankment were estimated based on piezometric information from the borings during drilling, and from well readings after the borings were performed.

The analyzed factors of safety (FoS) for each case, as well as the minimum FoS values as outlined in the mostly recently mandated USEPA CCR rules, are presented in the following table. Detailed graphical summaries showing the cross-section and critical trial failure surfaces are presented in Appendix D. It should be noted that a minimum failure depth of 5.0 feet was specified to eliminate reporting of local, surficial failure surfaces.

Summary of Stability Analysis Results – Section A-A'

Slope Stability Case	Minimum Factor of Safety from Slope Stability Analysis		Required Minimum Factor of Safety	Exhibits [1]
	Exterior	**Interior**		
Long Term, Maximum Surcharge Pool Loading	4.19	2.13	1.4	D-1, D-2
Long-Term, Maximum Storage Pool Loading	4.31	1.95	1.5	D-3, D-4
Long-Term with Seismic Loading	2.14	1.21	1.0	D-5, D-6

1. *Refers to exhibit designation of slope stability output included in Appendix D of this submittal.*

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 value of 1.20. The west dike is constructed predominantly of lean clay containing varying amounts of sand and is not considered to be susceptible to liquefaction.

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.

7.0 HYDROLOGIC AND HYDRAULIC ANALYSIS

As stated previously, the required hydrologic and hydraulic analysis for the Rockport Plant Bottom Ash Pond Complex is being submitted in a separate report.

8.0 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. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project 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.

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 Rockport 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.

BABA M. YAHAYA
PE11500100
1-11-16

Baba Yahaya

Baba M. Yahaya, P.E.
Certifying Engineer
PE11500100

APPENDIX A
FIELD EXPLORATION

Field Exploration Description

The subsurface exploration consisted of drilling and sampling two (2) borings at the site to depths of about 35 to 44 feet below existing grades. The boring locations were staked in the field by Terracon personnel using existing site features as references. Elevations of the ground surface at each boring location were provided by Chamness Land Surveying. Ground surface elevations indicated on the logs are rounded to the nearest 0.1 foot. Latitude and longitude information was determined from Google Earth based on location information provided by Chamness Land Surveying. The locations and elevations of the borings and test pits should be considered accurate only to the degree implied by the means and methods used to define them. The approximate boring locations are indicated on the attached Boring Location Plan.

The borings were drilled with a track-mounted rotary drill rig using continuous flight hollow-stem augers to advance the boreholes. Samples of the soil encountered in the borings were obtained using the split barrel sampling procedures or Shelby tube (push-tube) samplers.

An observation well was installed in an offset hole within the embankment. The screened interval for the well was determined in the field based on the subsurface conditions encountered in Boring B-2. A well completion record for this well has been included in this appendix.

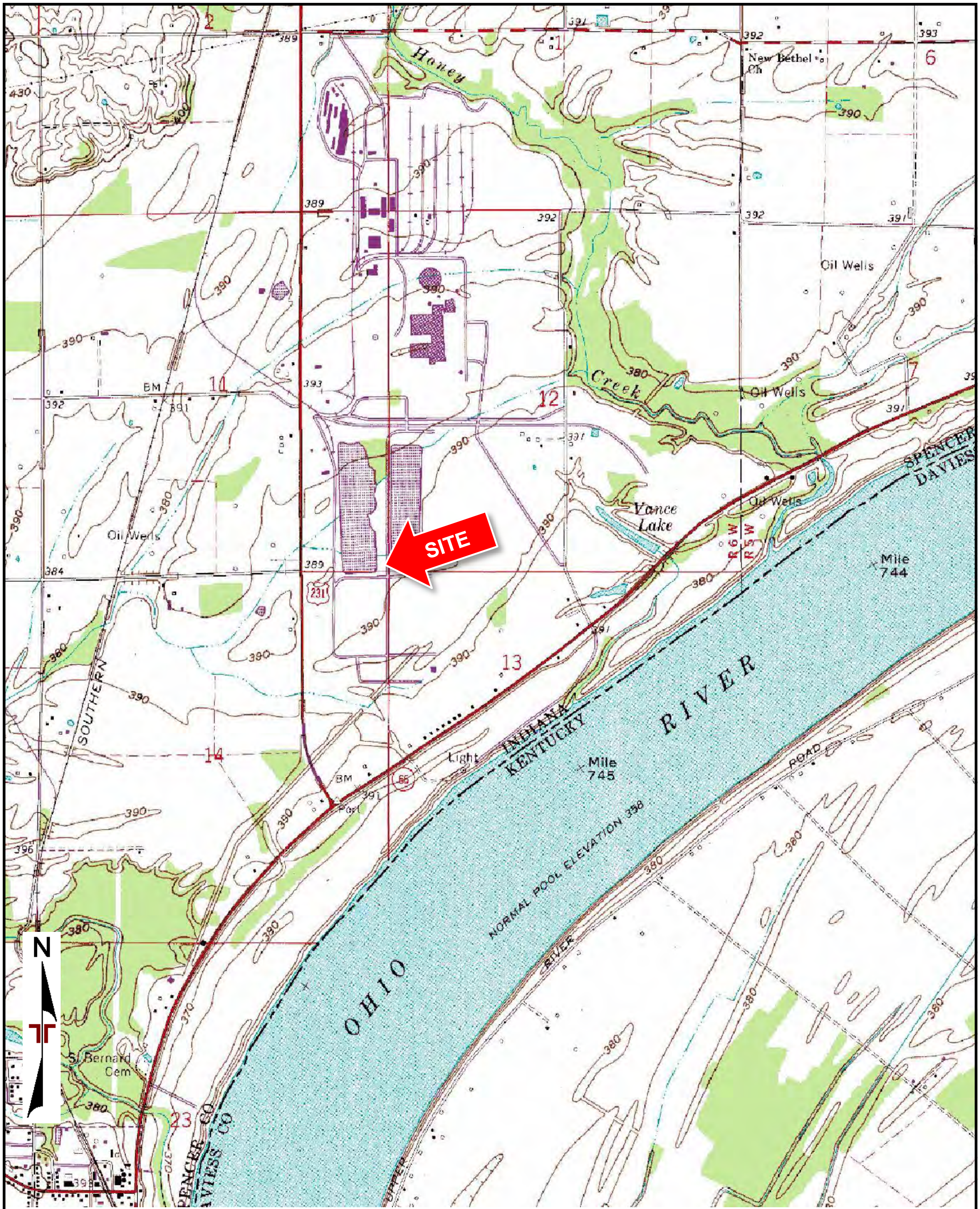
In the split-barrel sampling procedure, the number of blows required to advance a standard 2-inch O.D. split-barrel sampler the last 12 inches of the typical total 18-inch penetration by means of a 140-pound auto-hammer with a free fall of 30 inches, is the standard penetration resistance value (SPT-N). This value is used to estimate the in-situ relative density of cohesionless soils and consistency of cohesive soils.

An automatic SPT hammer was used to advance the split-barrel sampler in the borings performed on this site. A significantly greater efficiency is achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. This higher efficiency has an appreciable effect on the SPT-N value. The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report.

In the push-tube sampling procedure, a thin-walled tube is hydraulically pushed into the soil.

The samples were tagged for identification, sealed to reduce moisture loss, and taken to our laboratory for further examination, testing, and classification. Information provided on the boring logs attached to this report includes soil descriptions, consistency evaluations, boring depths, sampling intervals, and any groundwater conditions. The borings were backfilled with cement/bentonite grout prior to the drill crew leaving the site.

A field log of each boring/test pit was prepared by a Terracon engineer. These logs included visual classifications of the materials encountered during drilling, as well as the engineer’s interpretation of the subsurface conditions between samples. Final boring logs included with this report represent the engineer's interpretation of the field logs and include modifications based on laboratory observation and tests of the samples.



TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY
QUADRANGLES INCLUDE: ROCKPORT, IN (1/1/1982).

Project Manager: MSF
Drawn by: AKB
Checked by: KME
Approved by: KME

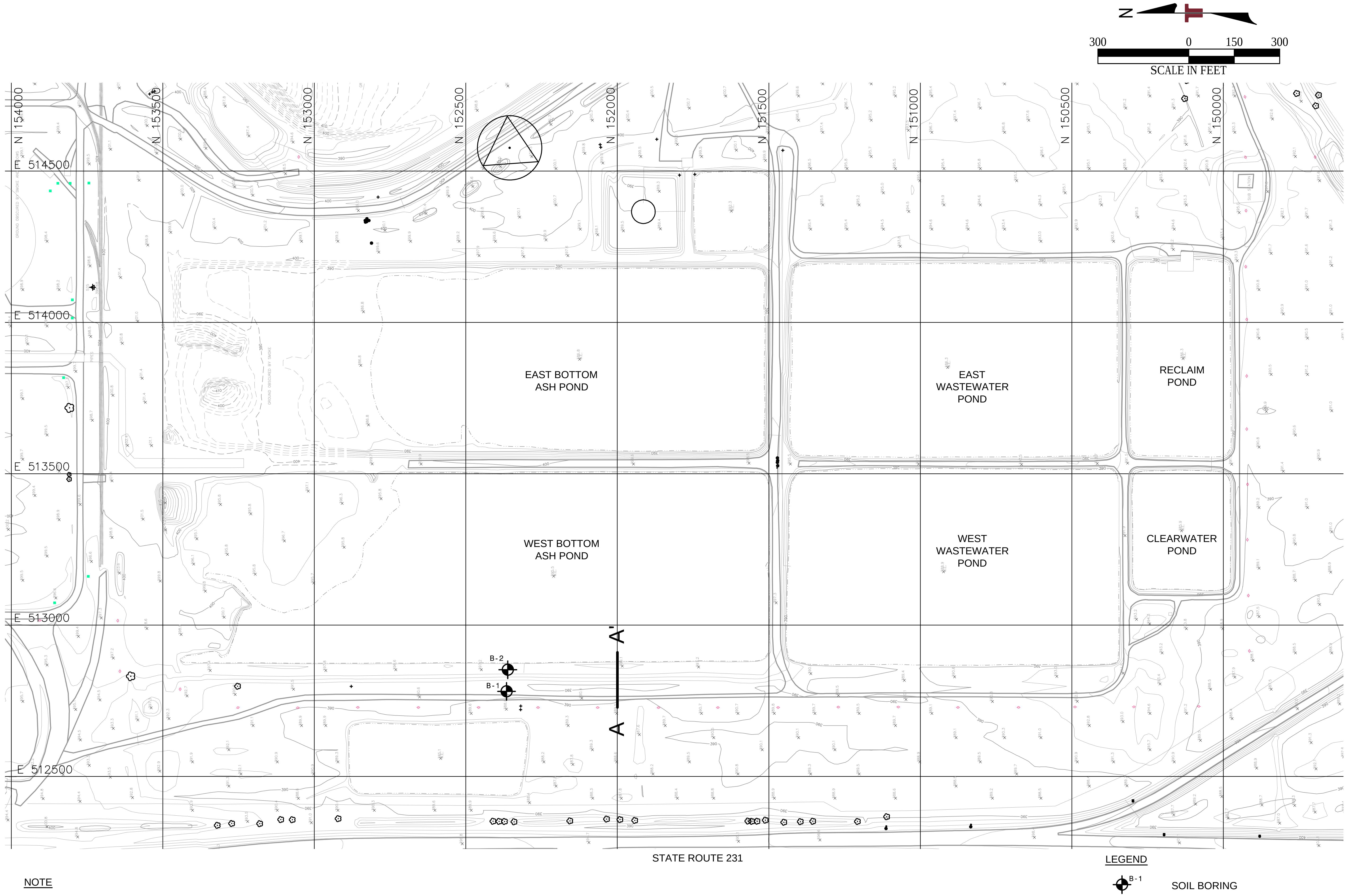
Project No. N4155126
Scale: 1:24,000
File Name: N4155126
Date: Jan. 2016

Terracon
800 Morrison Rd.
Columbus, OH 43230

SITE LOCATION MAP

AEP Rockport Bottom Ash PE Certification
US Highway 231
Rockport, IN

Exhibit
A-2



NOTE

THE AERIAL TOPOGRAPHY WAS OBTAINED FROM HENDERSON AERIAL SURVEYS INC., DATED 11/10/2007.

EXHIBIT A-3

DESIGNED BY:	BMY
DRAWN BY:	DAB
APPVD. BY:	MSF
SCALE:	1"=300'
DATE:	10/15/15
JOB NO.	N4155126
ACAD NO.	PSET2
SHEET NO.:	1 OF 1

SITE PLAN

ROCKPORT PLANT
AMERICAN ELECTRIC POWER
ROCKPORT PLANT BOTTOM ASH POND COMPLEX
ROCKPORT IN

Terracon
Consulting Engineers and Scientists
800 MORRISON ROAD COLUMBUS, OHIO 43230
PH. (614) 863-3113 FAX. (614) 863-0475

REV.	DATE	BY	DESCRIPTION

BORING LOG NO. B-1

Page 1 of 2

PROJECT: Rockport Plant Impoundment Certification

CLIENT: American Electric Power
Columbus, Ohio

SITE:
Rockport, Indiana

LOCATION See Exhibit A-3

Latitude: 37.918487° Longitude: -87.039045°

Surface Elev.: 389.7 (Ft.)

DEPTH		ELEVATION (Ft.)
0.3	**TOPSOIL (3")**	389.5
6.0	**SANDY FAT CLAY (CH)**, trace gravel, brown, stiff	383.5
17.5	**LEAN CLAY (CL)**, trace sand, gray and brown, stiff	372
18.5	**SANDY SILT (ML)**, brown, loose	371
23.0	**POORLY GRADED SAND (SP)**, brown, loose	366.5
	POORLY GRADED SAND (SP), trace gravel, brown, medium dense	

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY TORVANE/HP (tsf)	ATTERBERG LIMITS LL-PL-PI
0–2		☒	14	5-3-4-4 N=7	3.0 (HP)	
2–4		☒	12	5-4-4-5 N=8	1.0 (HP)	69-26-43
4–6 (5)		■	18			
6–8		☒	24	2-3-4-5 N=7	2.0 (HP)	
8–10 (10)		■	24			42-22-20
10–12		☒	24	2-3-5-6 N=8	1.25 (HP)	
12–14		☒	24	2-4-5-6 N=9	2.0 (HP)	
14–16 (15)		■	24			28-18-10
16–18	▽	☒	24	2-3-3-3 N=6	1.25 (HP)	
18–20 (20)		☒	18	2-4-4-4 N=8		
23–25 (25)		☒	24	3-7-8-9 N=15		

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3.25" Hollow Stem Auger

Abandonment Method:
Boring backfilled with cement/bentonite grout upon completion.

See Exhibit A-1 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Water encountered at 17.5 feet while sampling*

Terracon
800 Morrison Road
Columbus, Ohio

Boring Started: 9/3/2015	Boring Completed: 9/4/2015
Drill Rig: Track	Driller: Davis
Project No.: N4155126	Exhibit: A-4

BORING LOG NO. B-1

PROJECT: **Rockport Plant Impoundment Certification**

CLIENT: **American Electric Power**
Columbus, Ohio

SITE:
Rockport, Indiana

LOCATION See Exhibit A-3

Latitude: 37.918487° Longitude: -87.039045°

Surface Elev.: 389.7 (Ft.)

GRAPHIC LOG	DEPTH / ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY TORVANE/HP (tsf)	ATTERBERG LIMITS LL-PL-PI
▨	**POORLY GRADED SAND (SP)**, trace gravel, brown, medium dense *(continued)*							
▨				☒	24	4-5-5-5 N=10		
▨		30						
▨	33.0 — 356.5							
▨	**POORLY GRADED SAND (SP)**, trace gravel, brown, medium dense			☒	24	4-6-7-7 N=13		
▨	35.0 — 354.5	35						
	Boring Terminated at 35 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3.25" Hollow Stem Auger

Abandonment Method:
Boring backfilled with cement/bentonite grout upon completion.

See Exhibit A-1 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Water encountered at 17.5 feet while sampling*

Terracon
800 Morrison Road
Columbus, Ohio

Boring Started: 9/3/2015	Boring Completed: 9/4/2015
Drill Rig: Track	Driller: Davis
Project No.: N4155126	Exhibit: A-4

BORING LOG NO. B-2

Page 1 of 2

PROJECT: Rockport Plant Impoundment Certification

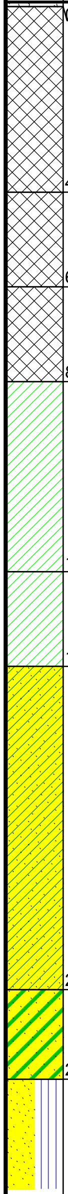
CLIENT: American Electric Power
Columbus, Ohio

SITE:
Rockport, Indiana

LOCATION See Exhibit A-3

Latitude: 37.918457° Longitude: -87.038804°

Surface Elev.: 397.4 (Ft.)



DEPTH	Description	ELEVATION (Ft.)
0.1	**TOPSOIL (1")**	397.5
4.0	**FILL - LEAN CLAY (CL)**, trace sand, brown	393.5
6.0	**FILL - SANDY SILT (ML)**, brown	391.5
8.0	**FILL - SANDY LEAN CLAY (CL)**, trace gravel, gray and brown 5" poorly graded sand seam from 6-6.4'	389.5
12.0	**LEAN CLAY (CL)**, trace sand, gray, very stiff	385.5
14.0	**LEAN CLAY (CL)**, brown, stiff	383.5
20.8	**SANDY LEAN CLAY (CL)**, trace gravel, gray and orange, stiff	376.5
22.7	**CLAYEY SAND (SC)**, brown, loose	374.5
	POORLY GRADED SAND WITH SILT (SP-SM), trace gravel, brown, loose	

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY TORVANE/HP (tsf)	ATTERBERG LIMITS LL-PL-PI
		☒	19	6-10-14-16 N=24		28-15-13
		☒	4	15-12-10-10 N=22		
5		■	24			19-16-3
		☒	23	2-3-5-6 N=8		
		☒	24	3-7-10-17 N=17	3.25 (HP)	
10		■	24			30-21-9
		☒	24	3-4-6-8 N=10	1.5 (HP)	
15		☒	24	3-5-7-9 N=12	1.75 (HP)	
		☒	17	6-10-12-14 N=22	2.75 (HP)	35-15-20
		■	24			
20		☒	24	3-4-4-5 N=8		
		☒	23	3-3-4-5 N=7		
25		☒	21	2-3-4-4		

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3.25" Hollow Stem Auger

Abandonment Method:
Boring backfilled with cement/bentonite grout upon completion.

See Exhibit A-1 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

A monitoring well was installed in an offset hole approximately 10 feet south of the boring.

WATER LEVEL OBSERVATIONS

▽ *Water encountered at 25.1 feet while sampling*

Terracon
800 Morrison Road
Columbus, Ohio

Boring Started: 9/4/2015	Boring Completed: 9/4/2015
Drill Rig: Track	Driller: Davis
Project No.: N4155126	Exhibit: A-5

BORING LOG NO. B-2

PROJECT: Rockport Plant Impoundment Certification

**CLIENT: American Electric Power
Columbus, Ohio**

**SITE:
Rockport, Indiana**

LOCATION See Exhibit A-3

Latitude: 37.918457° Longitude: -87.038804°

Surface Elev.: 397.4 (Ft.)

DEPTH		ELEVATION (Ft.)
25.5	**POORLY GRADED SAND WITH SILT (SP-SM)**, trace gravel, brown, loose to medium dense	372
32.5	**SILTY SAND (SM)**, brown, loose	365
34.0	3" clay seam at 33.7'	363.5
	SILTY SAND (SM), trace gravel, brown, loose	
38.0	**POORLY GRADED SAND (SP)**, trace gravel, brown, loose to medium dense	359.5
42.0	**POORLY GRADED SAND (SP)**, trace gravel, brown, medium dense	355.5
44.0	***Boring Terminated at 44 Feet***	353.5

DEPTH (Ft.): 30, 35, 40

WATER LEVEL OBSERVATIONS: ▽ at 25.1 ft

SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY TORVANE/HP (tsf)	ATTERBERG LIMITS LL-PL-PI
☒	21	N=7		
☒	24	6-6-5-4 N=11		
☒	18	2-2-5-3 N=7		
☒	24	2-3-4-4 N=7		
☒	19	1-2-2-2 N=4		
☒	8	2-3-3-4 N=6		
☒	17	2-2-2-4 N=4		
☒	1	3-4-5-5 N=9		
☒	9	3-5-6-5 N=11		
☒	6	4-6-9-12 N=15		

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3.25" Hollow Stem Auger

Abandonment Method:
Boring backfilled with cement/bentonite grout upon completion.

See Exhibit A-1 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

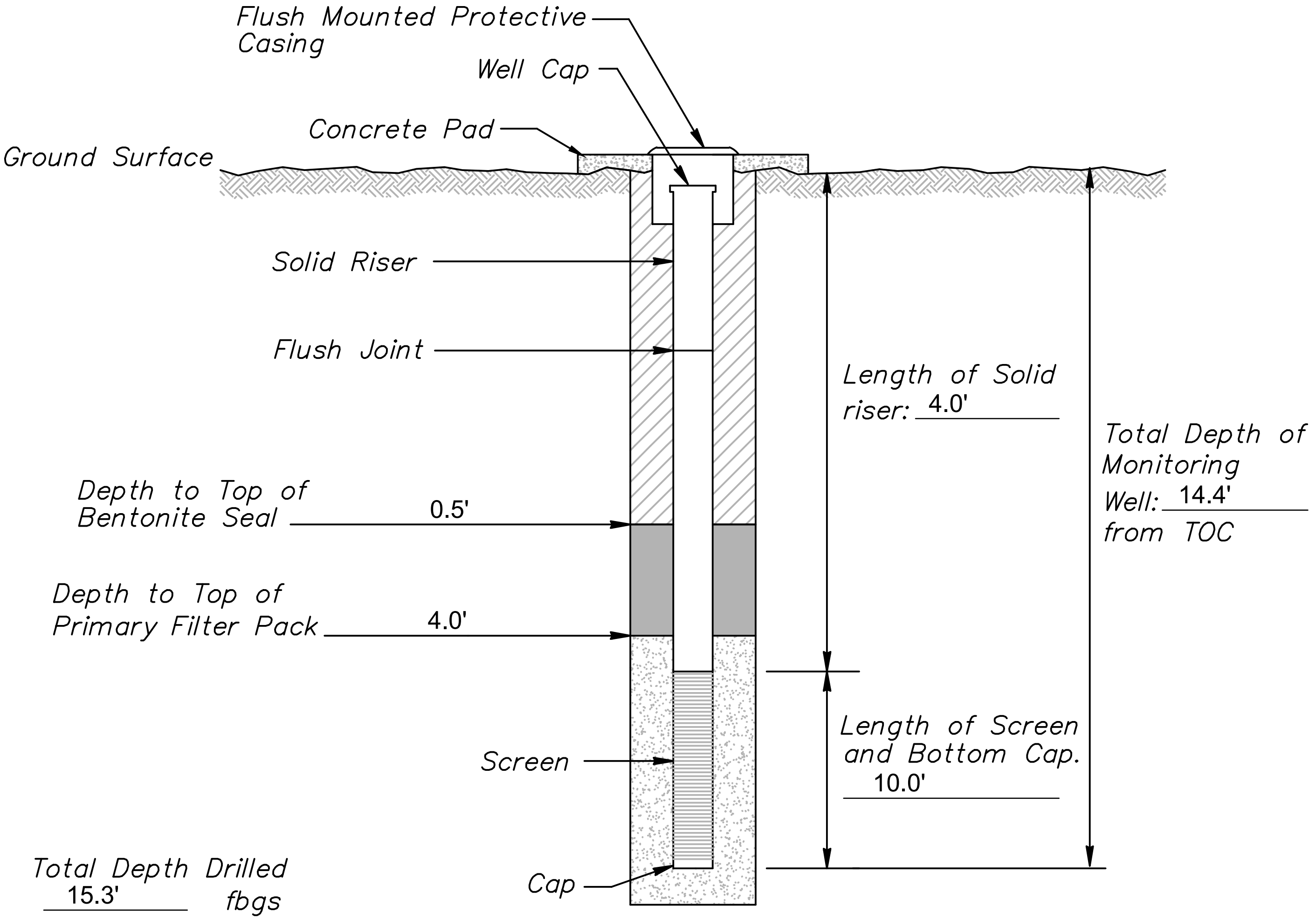
▽ *Water encountered at 25.1 feet while sampling*

Terracon
800 Morrison Road
Columbus, Ohio

Boring Started: 9/4/2015	Boring Completed: 9/4/2015
Drill Rig: Track	Driller: Davis
Project No.: N4155126	Exhibit: A-5

MONITORING WELL INSTALLATION RECORD

Job Name ROCKPORT BOTTOM ASH PE CERTIFICATION
Well Number B-2A
Job Number N4155126
Installation Date 9-4-15
Location 37.918422°N, 87.038781°W
Datum Elevation 397.56
Surface Elevation 397.56
Datum for Water Level Measurement TOP OF METAL WELL COVER
Screen Diameter & Material 1" PVC SCHEDULE 40
Slot Size 0.010"
Riser Diameter & Material 1" PVC SCHEDULE 40
Borehole Diameter 6 5/8" O.D.
Granular Backfill Material GLOBAL #5 SAND
Terracon Representative ALMA BARATTA
Drilling Method 3 1/4" HSA
Drilling Contractor TERRACON



Length of Solid riser: 4.0'

Total Depth of Monitoring Well: 14.4' from TOC

Depth to Top of Bentonite Seal 0.5'

Depth to Top of Primary Filter Pack 4.0'

Length of Screen and Bottom Cap. 10.0'

Total Depth Drilled 15.3' fbgs

(Not to Scale)

▨ Portland/Bentonite Grout

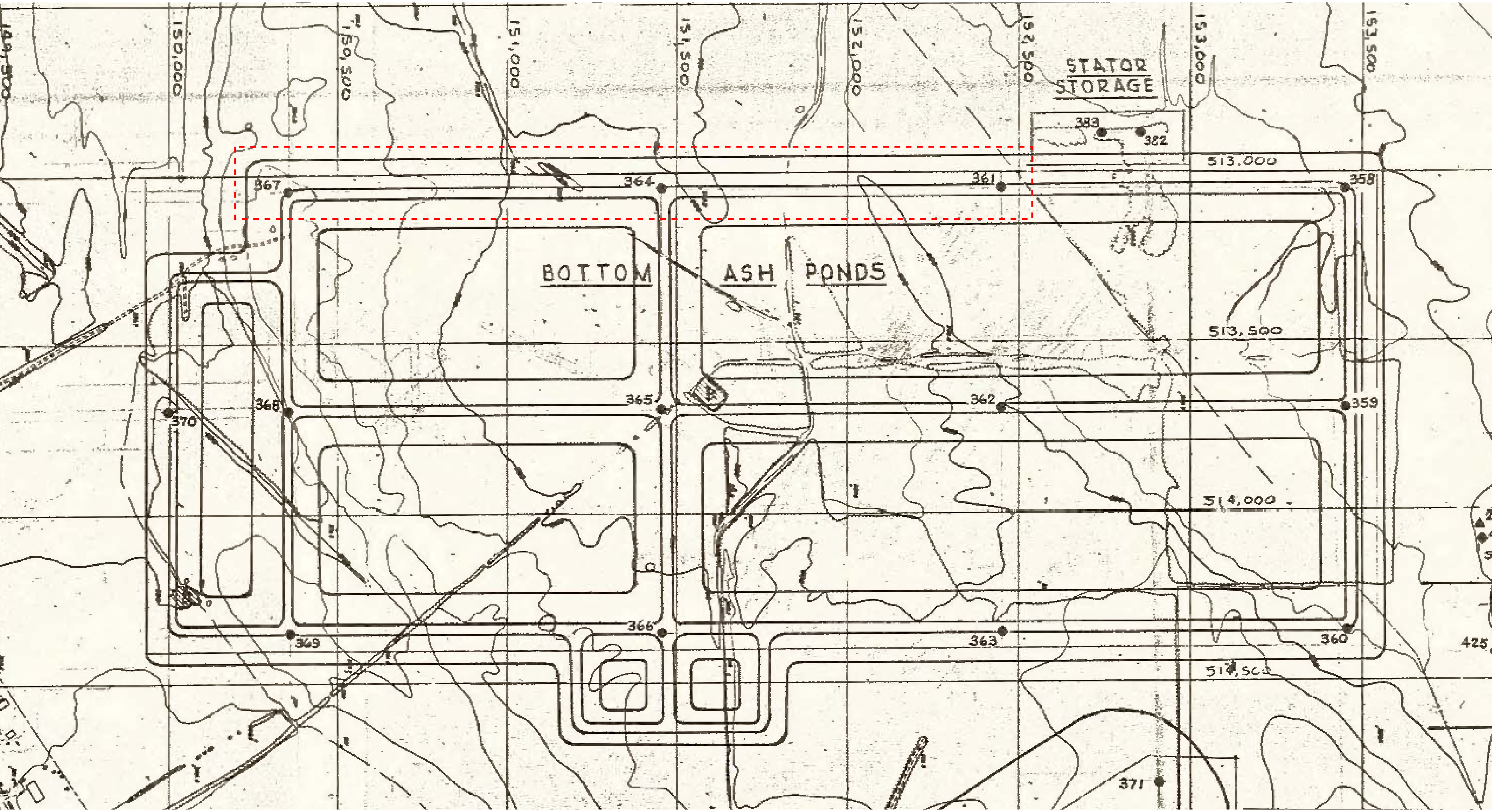
■ Bentonite Pellet Plug

░ Granular Backfill

NOTE: LOCATION/ELEVATION DATA FROM CHAMNESS LAND SURVEYING ON 9/29/2015

Terracon
Consulting Engineers and Scientists
800 MORRISON ROAD COLUMBUS, OHIO 43230
PH. (614) 863-3113 FAX. (614) 863-0475

MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: N4155126
WELL NUMBER: B-2A
DRAWING NUMBER: form-mw-b-2a
CHECKED BY: KME



- - - - Extent of borings included for slope stability analyses

NOTE: This figure is from historical planning documents, and the points shown do not necessarily represent current conditions.

Exhibit A-7

PROJECT: Rockport Site PROJECT NO. W6-1482 BORING: BH-361

DATE: 3/17/77 DRILLER: G. Powers CREW: J. Hardman/J. Selbe SURFACE ELEV.

DEPTH		SOIL STRATA				DEPTH					
FROM	TO	SOIL DESCRIPTION AND REMARKS	TIME	TYPE	NO.	FROM	TO	FIRST 6"	2ND 6"	3RD 6"	REC
	1.0	Topsoil									
1.0		Very stiff brown and gray silty clay		SS	1	5.0	6.5	5	8	11	10
	13.0	Very stiff brown and gray silty clay		SS	2	10.0	11.5	8	13	14	9
13.0	19.0	Firm brown silty fine sand		SS	3	15.0	16.5	5	5	6	8
19.0		Very loose brown silty fine sand		SS	4	20.0	21.5	1	2	2	1
	30.0	Very loose brown silty fine sand		SS	5	25.0	26.5	1	2	2	16
30.0	34.0	Very dense dark brown silty fine sand		SS	6	30.0	31.5	66	43	30	16
34.0	41.0	Firm brown medium to coarse silty sand		SS	7	35.0	36.5	9	10	13	8
41.0	44.0	Firm brown silty fine sand		SS	8	40.0	41.5	9	11	13	16
44.0	48.0	Firm brown medium and coarse sand		SS	9	45.0	46.5	8	11	19	16
48.0	51.5	Dense grayish brown silty fine to medium sand		SS	10	50.0	51.5	21	21	24	14
		Boring Terminated @ 51.5 3/17/77									

ETHOD OF DRILLING (Check One)

a. AUGER XXXX Rod SIZE A

b. WASH XX WATER MUD XX

ORING SIZE BIT USED 2-7/8" Side Discharge

G: SIZE N/W LENGTH 5.0

TURBED SAMPLES: NO. SIZE

SAMPLES: NO.

TER LOSSES % DEPTH

ECIAL TESTS (Hrs & Explain)

WEATHER Overcast 45 degrees

NON-DRILLING TIME (Hrs.)

BORING LAYOUT MOVING

HAULING WATER STANDBY

WATER LEVEL: @ DATE TIME

@ DATE TIME

CAVE-IN DEPTH: @ DATE TIME

REMARKS: (All remarks should be explained on the back of white copy) THIS IS A DRILLER'S LOG AND THE CLASSIFICATIONS HAVE NOT BEEN REVIEWED BY AN ENGINEER

Exhibit A-7

AW ENGINEERING TESTING COMPANY

TEST BORING FIELD RECORD

ROJECT: Rockport Site PROJECT NO. W6-1482 BORING: BH-364

DATE: 3/15/77 DRILLER: G. Powers CREW: J. Hardman/J. Selbe SURFACE ELEV. 389.5

DEPTH		SOIL STRATA	TIME	TYPE	NO.	DEPTH		FIRST 6"	2ND 6"	3RD 6"	REC.
M	TO	SOIL DESCRIPTION AND REMARKS				FROM	TO				
0		Topsoil									
	1.4										
1.4		Stiff brown and gray silty clay traces		SS	1	5.0	6.5	4	6	7	16
		fine sand									
		Stiff brown and gray silty clay traces		SS	2	10.0	11.5	3	4	6	12
	13.0	fine sand									
13.0		Loose brown silty fine sand		SS	3	15.0	16.5	3	4	3	17
		Loose brown silty fine sand		SS	4	20.0	21.5	3	3	3	8
	24.0										
24.0		Firm brown fine to medium sand		SS	5	25.0	26.5	6	8	8	7
		Firm brown fine to medium sand		SS	6	30.0	31.5	6	8	9	8
	34.5										
34.5		Firm brown medium to coarse sand		SS	7	35.0	36.5	5	8	10	8
		Firm brown medium to coarse sand		SS	8	40.0	41.5	5	6	8	7
	43.0										
43.0		Loose brown medium to coarse sand & gravel		SS	9	45.0	46.5	4	3	3	8
	47.0										
47.0	51.5	Firm brown medium to coarse sand		SS	10	50.0	51.5	8	9	13	8
		traces gravel									
		Boring Terminated @ 51.5 3/15/77									

METHOD OF DRILLING (Check One)

a. ~~AUGER~~ Rod SIZE A

b. WASH XX WATER MUD XX

B NG SIZE BIT USED 2-7/8" Side Discharge

CASING: SIZE NW LENGTH 5'

UNDISTURBED SAMPLES: NO. SIZE

BAG SAMPLES: NO

WATER LOSSES, @ DEPTH

SPECIAL TESTS (Hrs & Explain)

WEATHER 70 degrees clear

NON-DRILLING TIME (Hrs.)

BORING LAYOUT MOVING

HAULING WATER STANDBY

WATER LEVEL: @ DATE TIME

@ DATE TIME

CAVE-IN DEPTH: @ DATE TIME

REMARKS. (All remarks should be explained on the back of white copy) THIS IS A DRILLER'S LOG THE CLASSIFICATIONS [illegible]

Exhibit A-7

PROJECT: Rockport Site PROJECT NO. W6-1482 BORING: Bh-367

DATE: 3/16/77 DRILLER: G. Powers CREW: J. Hardman/J. Selbe SURFACE ELEV.

DEPTH		SOIL STRATA				DEPTH					
FROM	TO	SOIL DESCRIPTION AND REMARKS	TIME	TYPE	NO.	FROM	TO	FIRST 6"	2ND 6"	3RD 6"	REC
0		Topsoil									
	1.2										
1.2		Firm brown silty fine sand traces clay		SS	1	5.0	6.5	3	4	7	14
	8.0										
8.0		Loose brown silty fine sand		SS	2	10.0	11.5	3	3	5	12
		Loose brown silty fine sand		SS	3	15.0	16.5	3	3	4	10
		Loose brown silty fine sand		SS	4	20.0	21.5	3	5	5	8
	23.0										
23.0		Firm brown silty fine to medium sand		SS	5	25.0	26.5	7	10	14	7
		Firm brown silty fine to medium sand		SS	6	30.0	31.5	7	8	9	6
		Firm brown silty fine to medium sand		SS	7	35.0	36.5	5	7	10	6
		Firm brown silty fine to medium sand		SS	8	40.0	41.5	8	11	14	6
	44.0										
44.0		Firm brown silty medium to coarse sand		SS	9	45.0	46.5	10	15	13	8
	51.5	Firm brown silty medium to coarse sand		SS	10	50.0	51.5	7	12	11	10
		Boring Terminated @ 51.5									

ETHOD OF DRILLING (Check One)

a. XXXX ~~AUGER~~ Rod SIZE A

b. WASH XX WATER MUD XX

ORING SIZE BIT USED 2-7/8" Side Discharge

ASING: SIZE NW LENGTH 5.0'

NL URBED SAMPLES: NO. SIZE

AG SAMPLES: NO.

ATER LOSSES % DEPTH

ECIAL TESTS (Hrs & Explain)

WEATHER Clear 60 degrees

NON-DRILLING TIME (Hrs.)

BORING LAYOUT MOVING

HAULING WATER STANDBY

WATER LEVEL: @ DATE TIME

@ DATE TIME

CAVE-IN DEPTH: @ DATE TIME

REMARKS: (All remarks should be explained on the back of white copy) THIS IS A DRILLER'S LOG AND THE CLASSIFICATIONS HAVE NOT BEEN REVIEWED BY AN ENGINEER

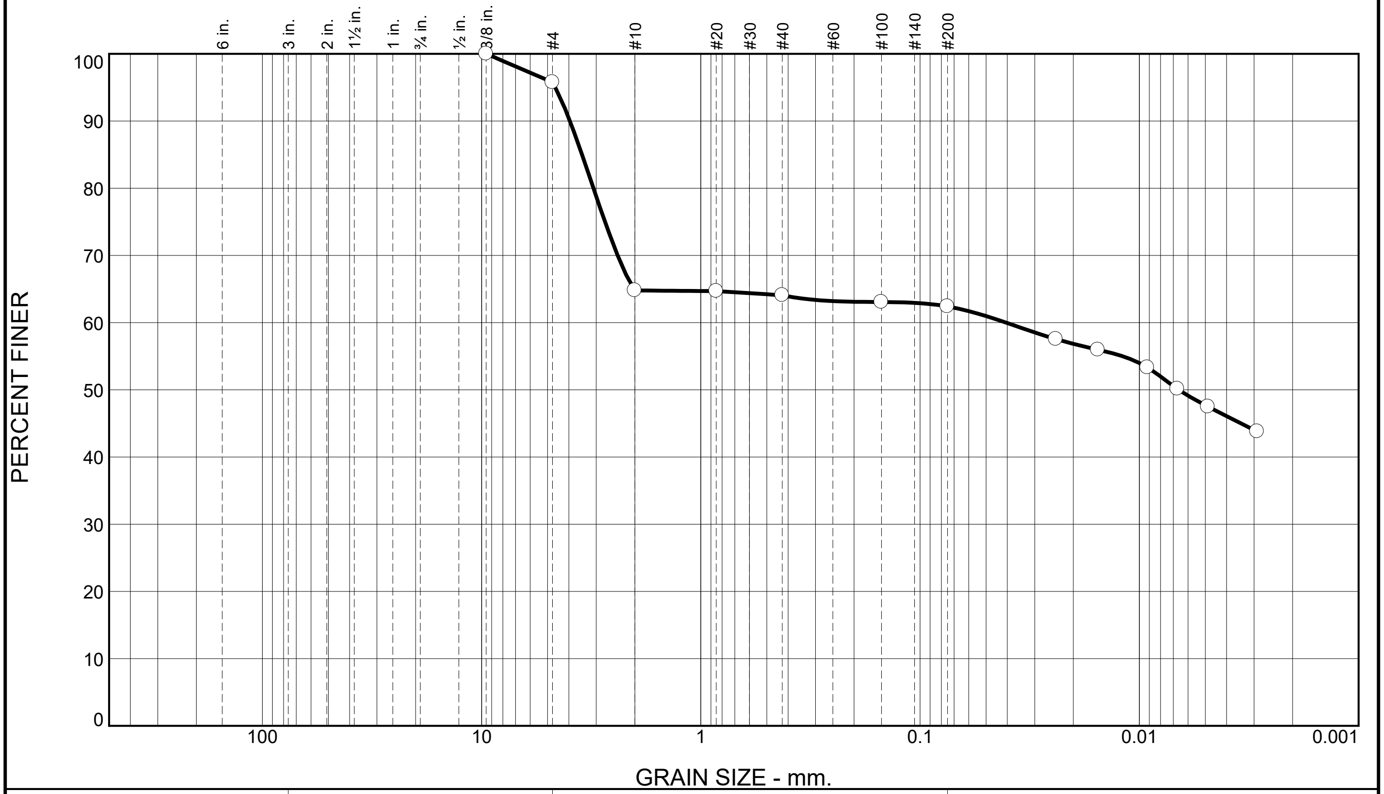
Exhibit A-7

APPENDIX B
LABORATORY TESTING

Laboratory Testing

As a part of the laboratory testing program, the soil samples were classified in the field based on visual observation, and texture. The soil descriptions presented on the boring logs for native soils are in accordance with our enclosed General Notes and Unified Soil Classification System (USCS). A brief description of the Unified System is included in this report. Classification was predominantly by visual manual procedures. Moisture content, Atterberg Limits, grain size distribution, unconsolidated undrained triaxial, and consolidated undrained triaxial with pore-water pressure measurements, were performed on selected samples. Testing followed ASTM procedures. The results of this laboratory testing are presented on the boring logs and laboratory data sheets are included in Appendix B.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.2	31.0	0.7	1.7	14.7	47.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8	100.0		
#4	95.8		
#10	64.8		
#20	64.7		
#40	64.1		
#100	63.1		
#200	62.4		
0.0240 mm.	57.5		
0.0155 mm.	56.0		
0.0092 mm.	53.3		
0.0067 mm.	50.1		
0.0049 mm.	47.5		
0.0029 mm.	43.8		

* (no specification provided)

Soil Description

Brown SANDY FAT CLAY, trace gravel

Atterberg Limits

PL= 26 LL= 69 PI= 43

Coefficients

D_{90}= 3.9559 D_{85}= 3.4817 D_{60}= 0.0406
D_{50}= 0.0066 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CH AASHTO= A-7-6(25)

Remarks

F.M.=1.79

Source of Sample: B-1 **Depth:** 2.0'-4.0'
Sample Number: S-2

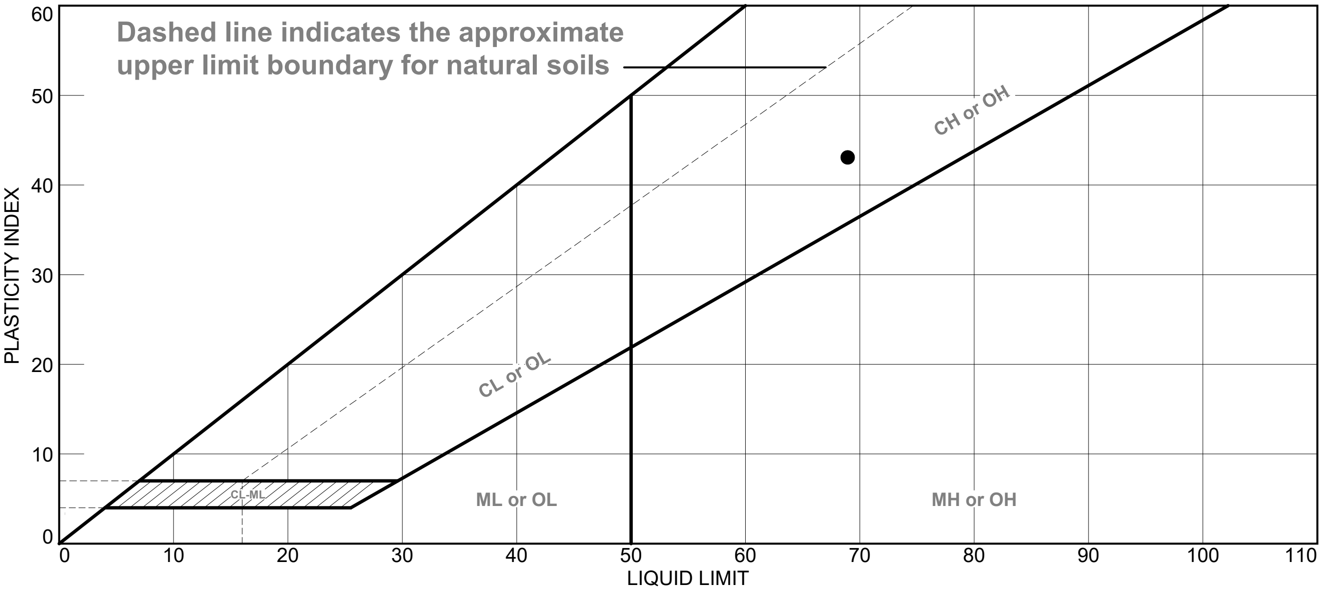
Date: 9-21-15

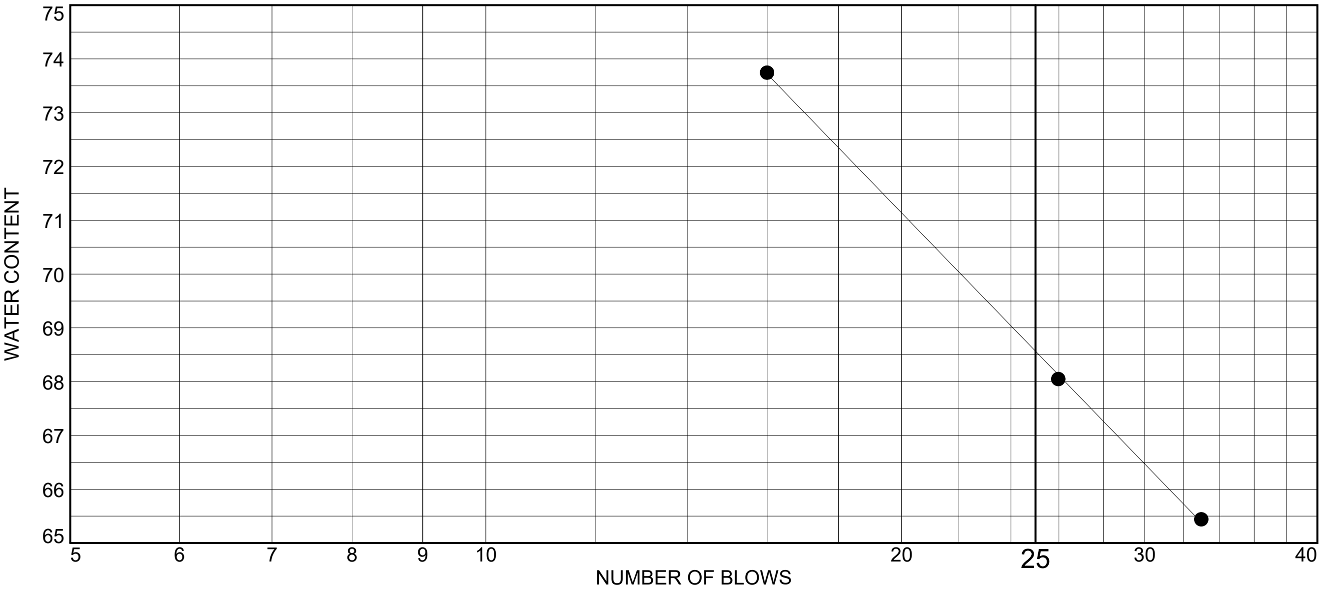
TERRACON
CONSULTANTS, INC.
Columbus, Ohio

Client: American Electric Power
Project: Rockport Plant Impoundment Certification
Project No: N4155126 **Exhibit** B-2

Tested By: DS **Checked By:** AM

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown SANDY FAT CLAY, trace gravel	69	26	43	64.1	62.4	CH

Project No. N4155126 **Client:** American Electric Power

Project: Rockport Plant Impoundment Certification

Source of Sample: B-1 **Depth:** 2.0'-4.0'
Sample Number: S-2

Remarks:
●Date: 9-21-15

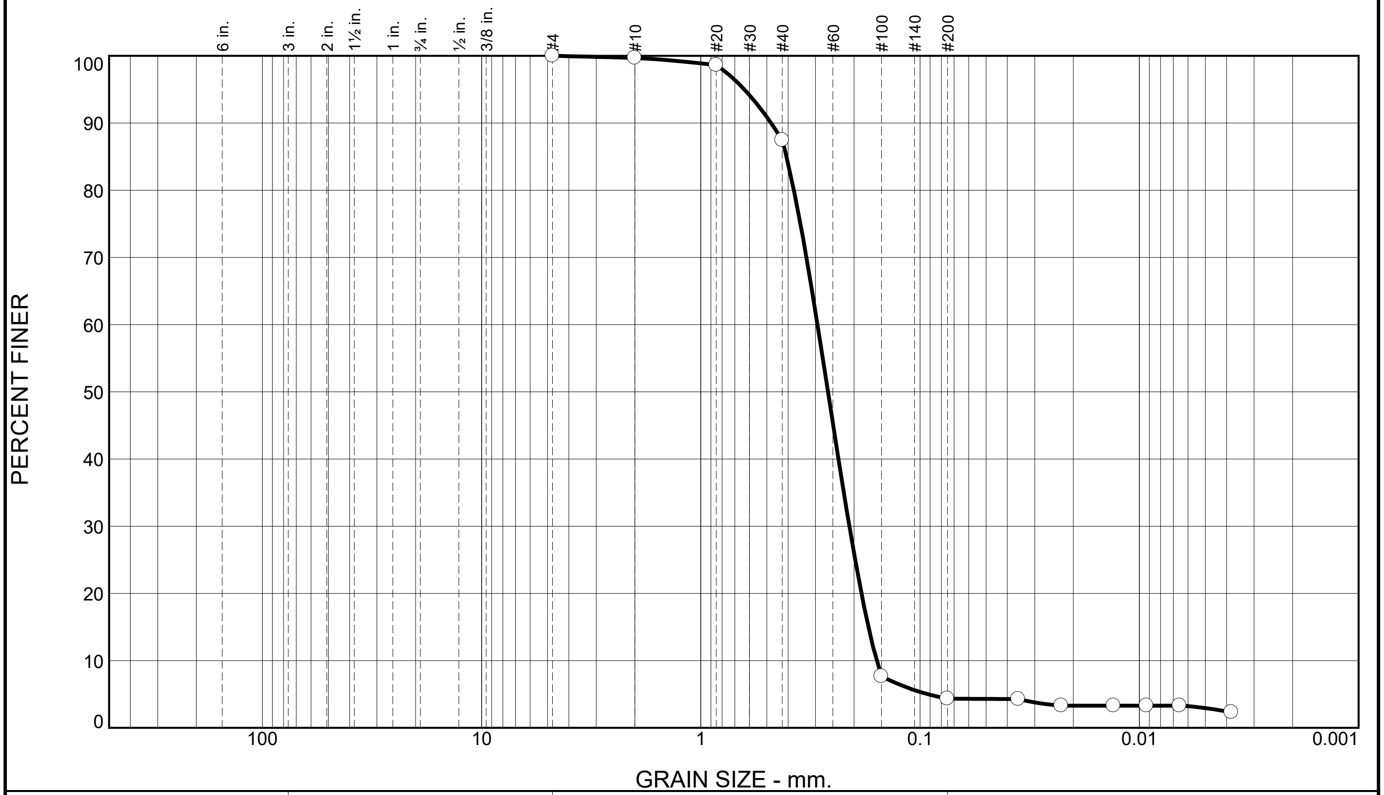
TERRACON CONSULTANTS, INC.

Columbus, Ohio

Exhibit B-3

Tested By: DS **Checked By:** AM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.3	12.3	83.1	1.4	2.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.7		
#20	98.6		
#40	87.4		
#100	7.7		
#200	4.3		
0.0357 mm.	4.3		
0.0227 mm.	3.3		
0.0131 mm.	3.3		
0.0093 mm.	3.3		
0.0066 mm.	3.3		
0.0038 mm.	2.3		

* (no specification provided)

Soil Description

Brown poorly graded SAND

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.4785 D_{85}= 0.4068 D_{60}= 0.2938
D_{50}= 0.2631 D_{30}= 0.2102 D_{15}= 0.1721
D_{10}= 0.1577 C_u= 1.86 C_c= 0.95

Classification

USCS= SP AASHTO= A-3

Remarks

F.M.=1.37

Source of Sample: B-1 **Depth:** 18.0'-20.0'
Sample Number: S-7

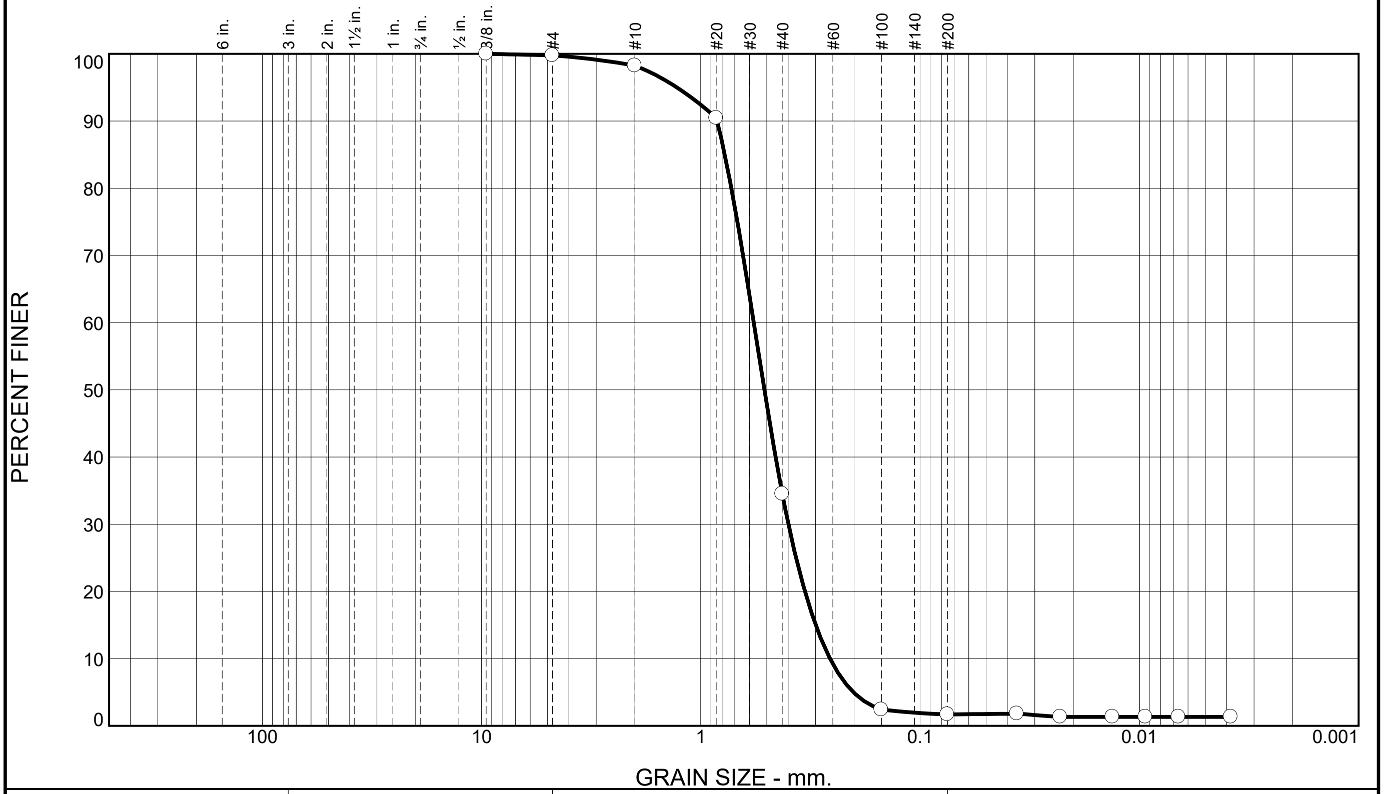
Date: 9-21-15

TERRACON
CONSULTANTS, INC.
Columbus, Ohio

Client: American Electric Power
Project: Rockport Plant Impoundment Certification
Project No: N4155126 **Exhibit** B-4

Tested By: DS **Checked By:** AM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	1.6	63.7	32.8	0.4	1.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8	100.0		
#4	99.8		
#10	98.2		
#20	90.4		
#40	34.5		
#100	2.4		
#200	1.7		
0.0362 mm.	1.8		
0.0229 mm.	1.3		
0.0132 mm.	1.3		
0.0094 mm.	1.3		
0.0066 mm.	1.3		
0.0038 mm.	1.3		

* (no specification provided)

Soil Description

Brown poorly graded SAND, trace gravel

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.8432 D_{85}= 0.7776 D_{60}= 0.5735
D_{50}= 0.5129 D_{30}= 0.3986 D_{15}= 0.2992
D_{10}= 0.2576 C_u= 2.23 C_c= 1.08

Classification

USCS= SP AASHTO= A-1-b

Remarks

F.M.=2.26

Source of Sample: B-1 **Depth:** 28.0'-30.0'
Sample Number: S-9

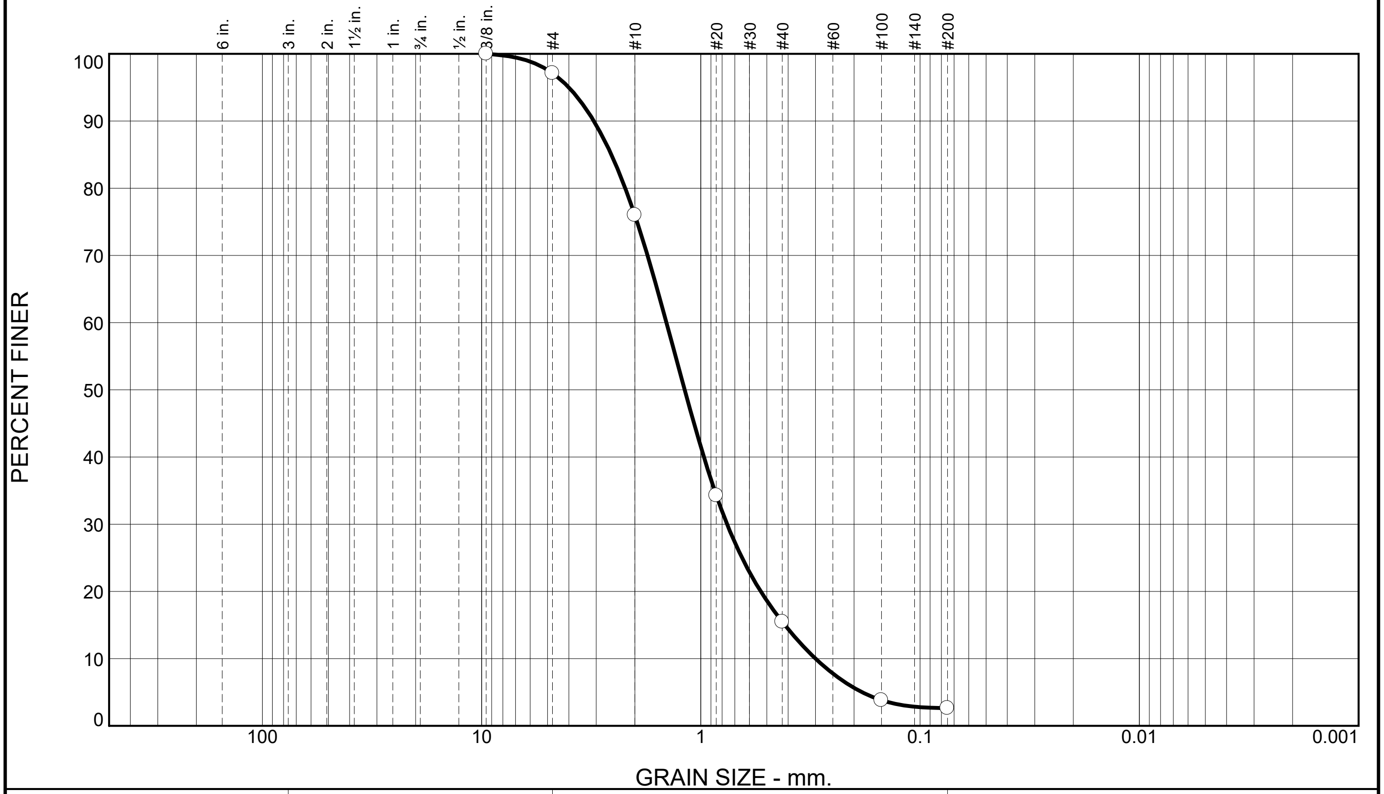
Date: 9-21-15

TERRACON
CONSULTANTS, INC.
Columbus, Ohio

Client: American Electric Power
Project: Rockport Plant Impoundment Certification
Project No: N4155126 **Exhibit** B-5

Tested By: DS **Checked By:** AM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.9	21.1	60.5	12.9	2.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8	100.0		
#4	97.1		
#10	76.0		
#20	34.3		
#40	15.5		
#100	3.8		
#200	2.6		

* (no specification provided)

Soil Description

Brown poorly graded SAND, trace gravel

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 3.0772 D_{85}= 2.5603 D_{60}= 1.4351
D_{50}= 1.1849 D_{30}= 0.7595 D_{15}= 0.4140
D_{10}= 0.2999 C_u= 4.79 C_c= 1.34

Classification

USCS= SP AASHTO= A-1-b

Remarks

F.M.=3.34

Source of Sample: B-1 **Depth:** 33.0'-35.0'
Sample Number: S-10

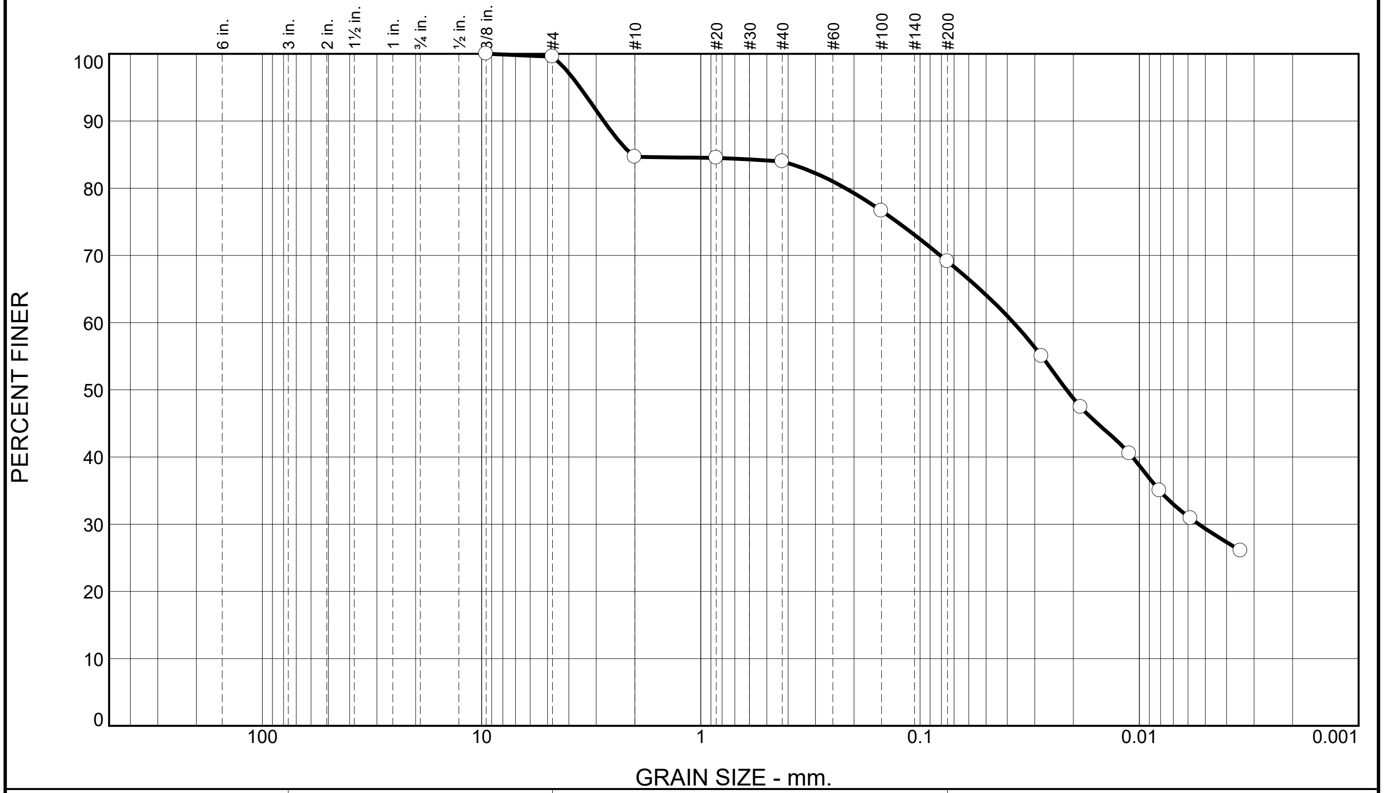
Date: 9-21-15

TERRACON
CONSULTANTS, INC.
Columbus, Ohio

Client: American Electric Power
Project: Rockport Plant Impoundment Certification
Project No: N4155126 **Exhibit** B-6

Tested By: DS **Checked By:** AM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.4	14.9	0.7	14.9	39.8	29.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8	100.0		
#4	99.6		
#10	84.7		
#20	84.5		
#40	84.0		
#100	76.6		
#200	69.1		
0.0279 mm.	55.0		
0.0185 mm.	47.4		
0.0111 mm.	40.5		
0.0081 mm.	35.0		
0.0058 mm.	30.9		
0.0034 mm.	26.1		

* (no specification provided)

Soil Description

FILL: Brown sandy lean clay, trace gravel

Atterberg Limits

PL= 15 LL= 28 PI= 13

Coefficients

D_{90}= 2.7745 D_{85}= 2.0607 D_{60}= 0.0375
D_{50}= 0.0215 D_{30}= 0.0054 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(6)

Remarks

F.M.=0.86

Source of Sample: B-2 **Depth:** 0.0'-2.0'
Sample Number: S-1

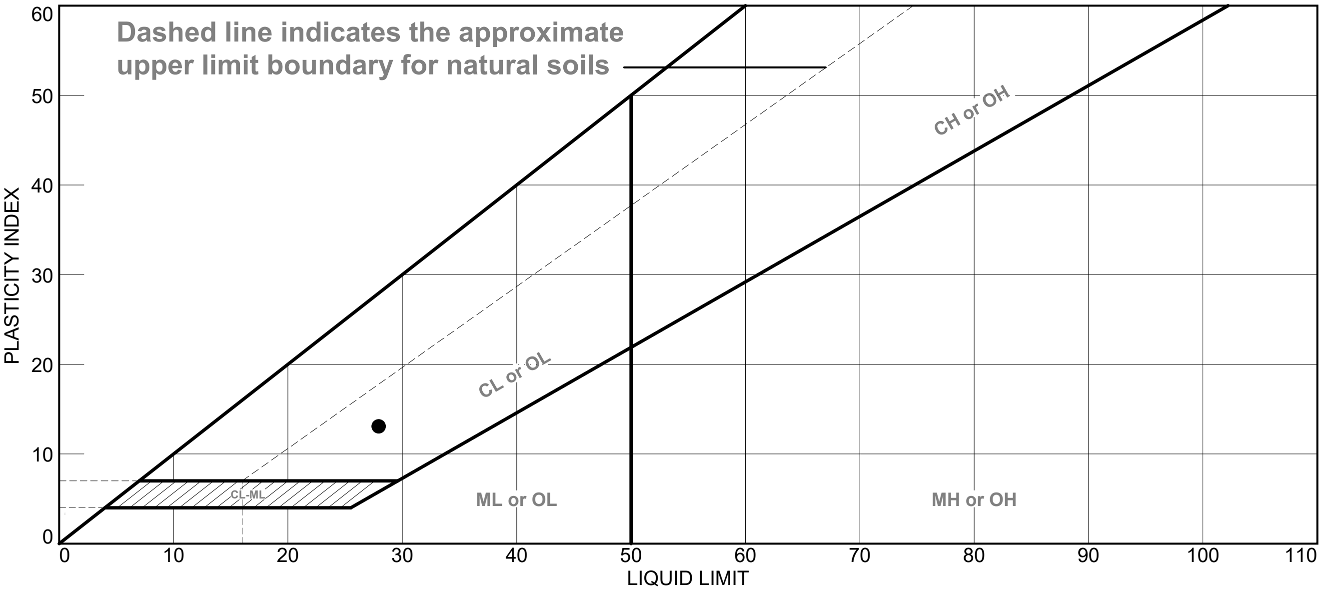
Date: 9-21-15

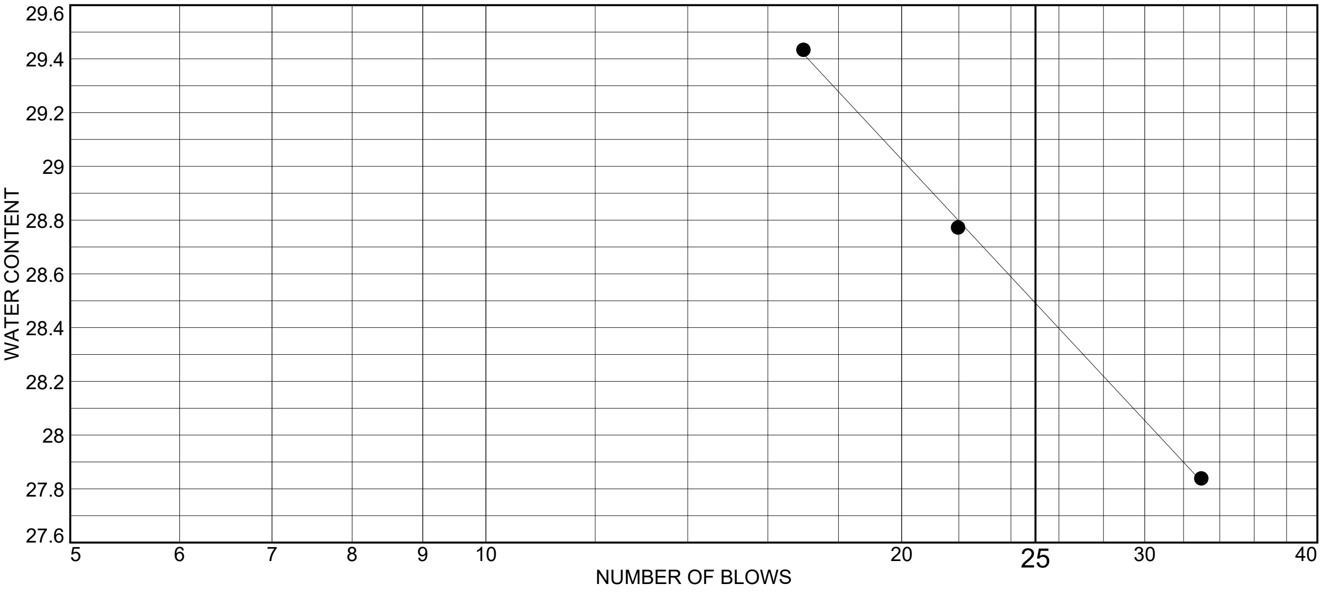
TERRACON
CONSULTANTS, INC.
Columbus, Ohio

Client: American Electric Power
Project: Rockport Plant Impoundment Certification
Project No: N4155126 **Exhibit** B-7

Tested By: DS **Checked By:** AM

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	FILL: Brown sandy lean clay, trace gravel	28	15	13	84.0	69.1	CL

Project No. N4155126 **Client:** American Electric Power

Project: Rockport Plant Impoundment Certification

Source of Sample: B-2 **Depth:** 0.0'-2.0'
Sample Number: S-1

Remarks:
●Date: 9-21-15

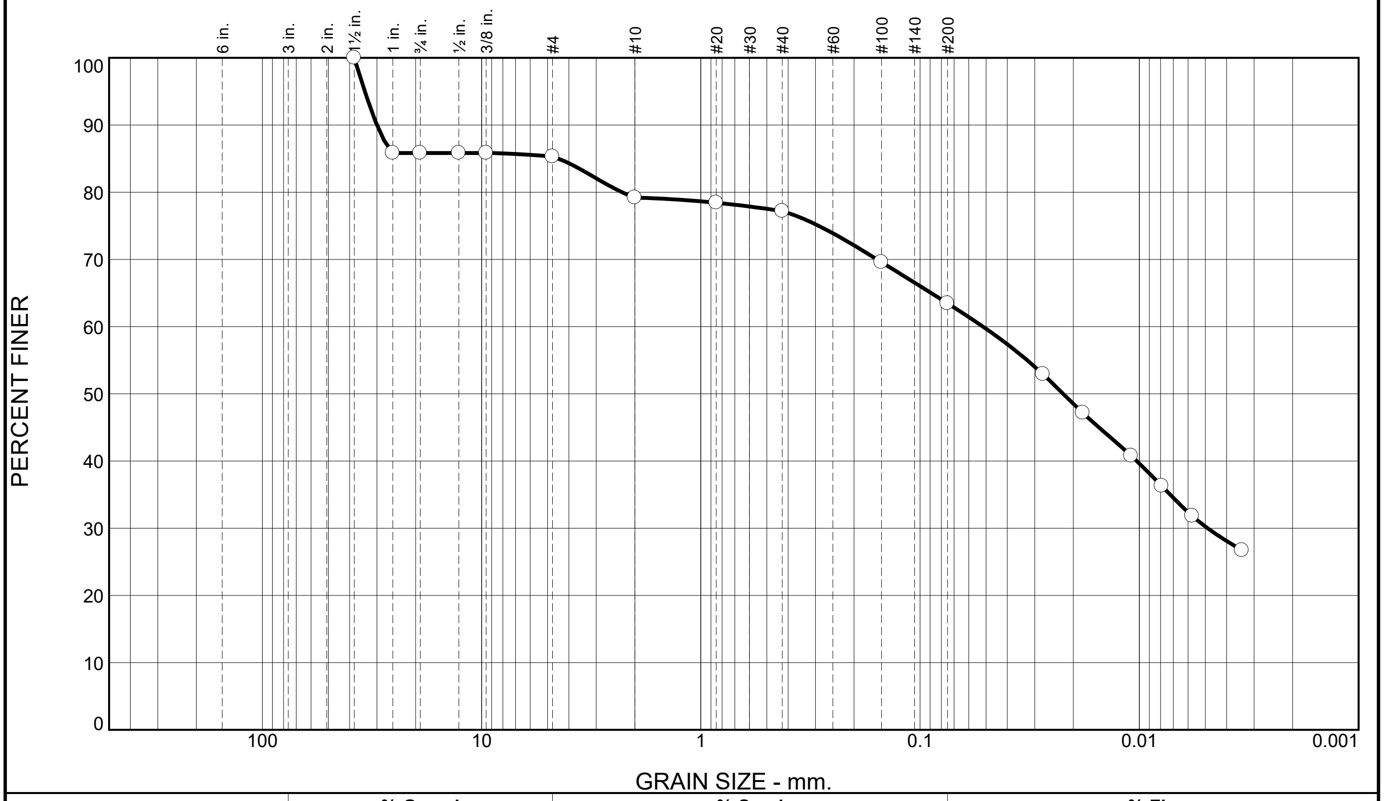
TERRACON CONSULTANTS, INC.

Columbus, Ohio

Exhibit B-8

Tested By: DS **Checked By:** AM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	14.2	0.5	6.1	2.0	13.7	33.3	30.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1.0	85.8		
3/4	85.8		
1/2	85.8		
3/8	85.8		
#4	85.3		
#10	79.2		
#20	78.4		
#40	77.2		
#100	69.6		
#200	63.5		
0.0275 mm.	52.9		
0.0181 mm.	47.2		
0.0109 mm.	40.8		
0.0079 mm.	36.3		
0.0057 mm.	31.8		
0.0034 mm.	26.7		

* (no specification provided)

Soil Description

Gray and orange SANDY LEAN CLAY, trace gravel

Atterberg Limits

PL= 15 LL= 35 PI= 20

Coefficients

D_{90}= 30.0206 D_{85}= 4.4748 D_{60}= 0.0517
D_{50}= 0.0223 D_{30}= 0.0049 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(10)

Remarks

F.M.=1.61

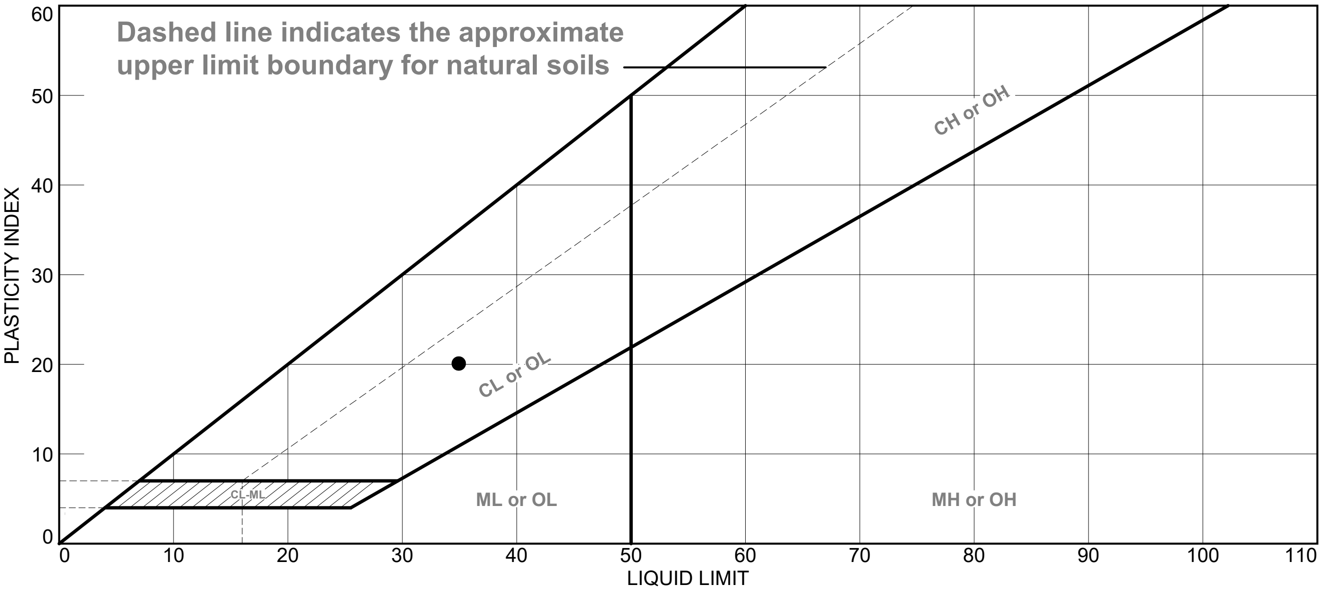
Source of Sample: B-2 **Depth:** 16.0'-18.0'
Sample Number: S-7
Date: 9-21-15

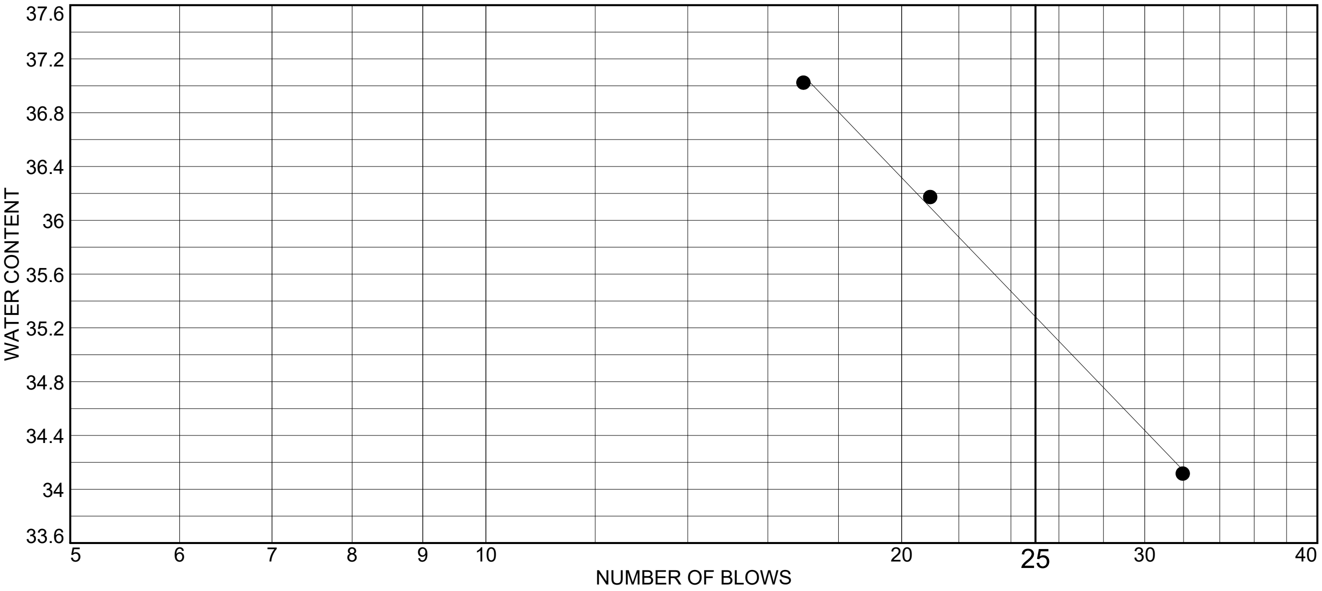
TERRACON
CONSULTANTS, INC.
Columbus, Ohio

Client: American Electric Power
Project: Rockport Plant Impoundment Certification
Project No: N4155126 **Exhibit** B-9

Tested By: DS **Checked By:** AM

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray and orange SANDY LEAN CLAY, trace gravel	35	15	20	77.2	63.5	CL

Project No. N4155126 **Client:** American Electric Power

Project: Rockport Plant Impoundment Certification

Source of Sample: B-2 **Depth:** 16.0'-18.0'
Sample Number: S-7

Remarks:
●Date: 9-21-15

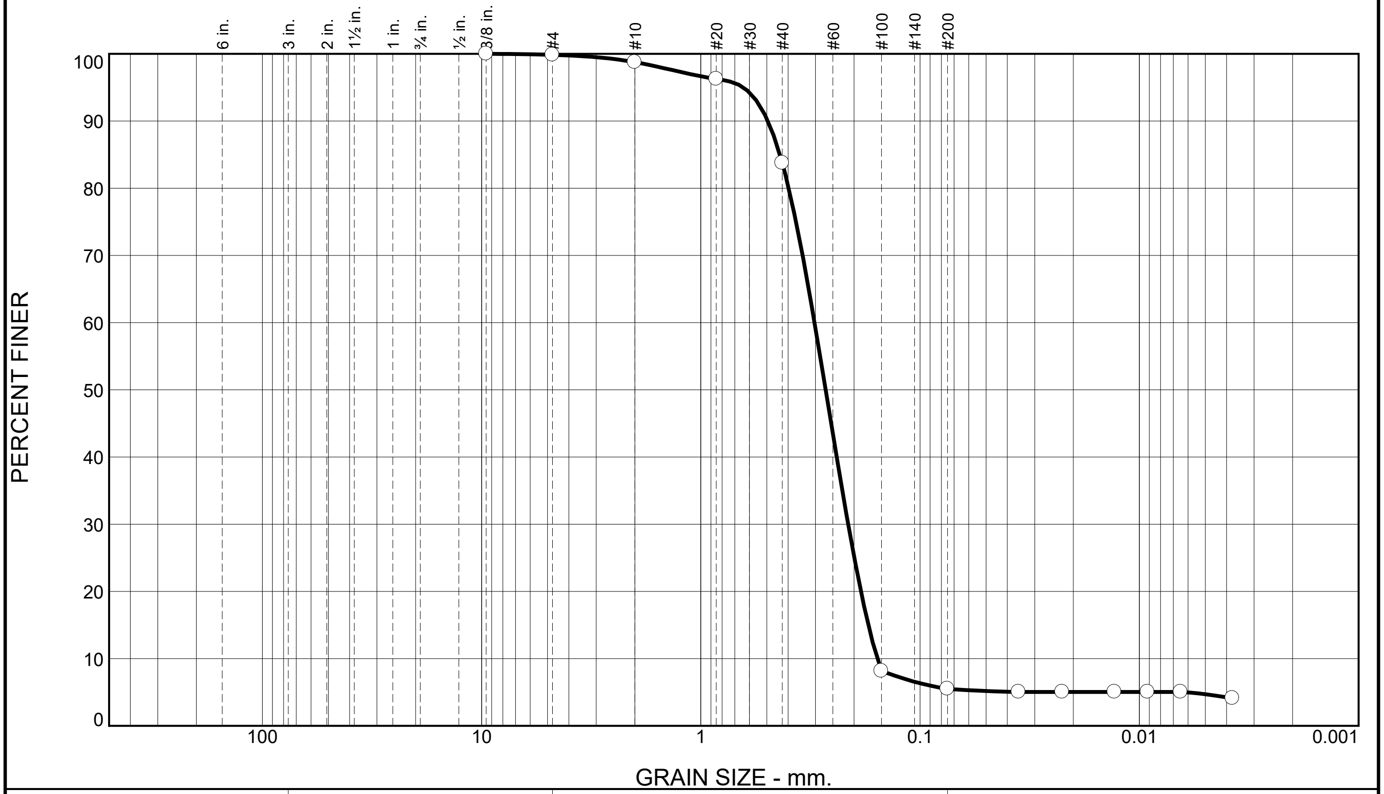
TERRACON CONSULTANTS, INC.

Columbus, Ohio

Exhibit B-10

Tested By: DS **Checked By:** AM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	1.0	15.0	78.3	0.8	4.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8	100.0		
#4	99.8		
#10	98.8		
#20	96.2		
#40	83.8		
#100	8.2		
#200	5.5		
0.0355 mm.	5.0		
0.0224 mm.	5.0		
0.0130 mm.	5.0		
0.0092 mm.	5.0		
0.0065 mm.	5.0		
0.0038 mm.	4.1		

* (no specification provided)

Soil Description

Brown poorly graded SAND with silt, trace gravel

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.4948 D_{85}= 0.4358 D_{60}= 0.3031
D_{50}= 0.2696 D_{30}= 0.2128 D_{15}= 0.1722
D_{10}= 0.1566 C_u= 1.94 C_c= 0.95

Classification

USCS= SP-SM AASHTO= A-3

Remarks

F.M.=1.42

Source of Sample: B-2 **Depth:** 22.0'-24.0'
Sample Number: S-9

Date: 9-21-15

TERRACON
CONSULTANTS, INC.
Columbus, Ohio

Client: American Electric Power
Project: Rockport Plant Impoundment Certification
Project No: N4155126 **Exhibit** B-11

Tested By: DS **Checked By:** AM

Particle Size Distribution Report

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.2	9.5	47.4	36.0	5.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8	100.0		
#4	98.8		
#10	89.3		
#20	75.1		
#40	41.9		
#100	8.4		
#200	5.9		

* (no specification provided)

Soil Description

Brown poorly graded SAND with silt, trace gravel

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 2.1334 D_{85}= 1.3167 D_{60}= 0.6037
D_{50}= 0.4980 D_{30}= 0.3271 D_{15}= 0.2100
D_{10}= 0.1667 C_u= 3.62 C_c= 1.06

Classification

USCS= SP-SM AASHTO= A-1-b

Remarks

F.M.=2.32

Source of Sample: B-2 **Depth:** 28.0'-30.0'
Sample Number: S-12

Date: 9-21-15

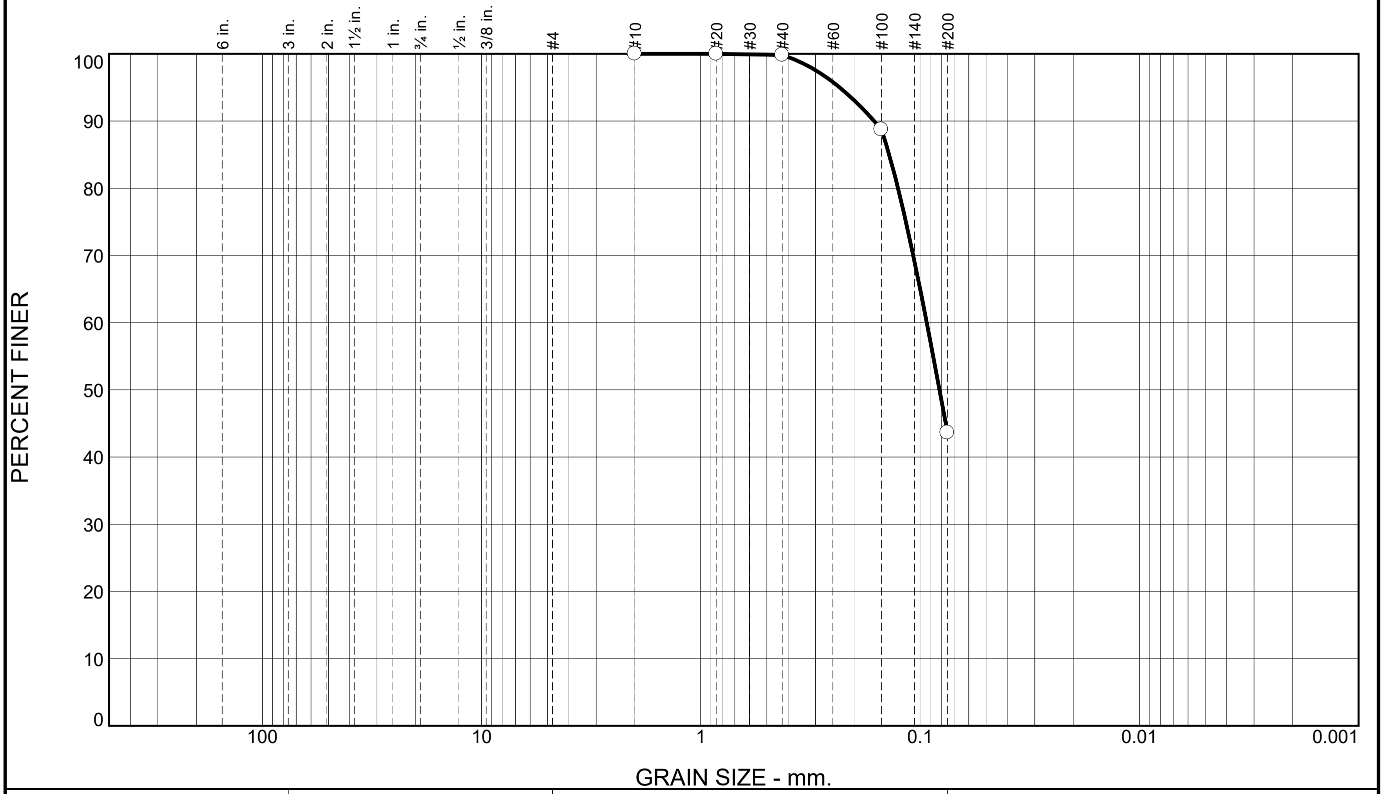
TERRACON
CONSULTANTS, INC.
Columbus, Ohio

Client: American Electric Power
Project: Rockport Plant Impoundment Certification

Project No: N4155126 **Exhibit** B-12

Tested By: DS **Checked By:** AM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.2	56.2	43.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	100.0		
#40	99.8		
#100	88.7		
#200	43.6		

* (no specification provided)

Soil Description

Brown SILTY SAND

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.1621 D_{85}= 0.1384 D_{60}= 0.0932
D_{50}= 0.0815 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

F.M.=0.14

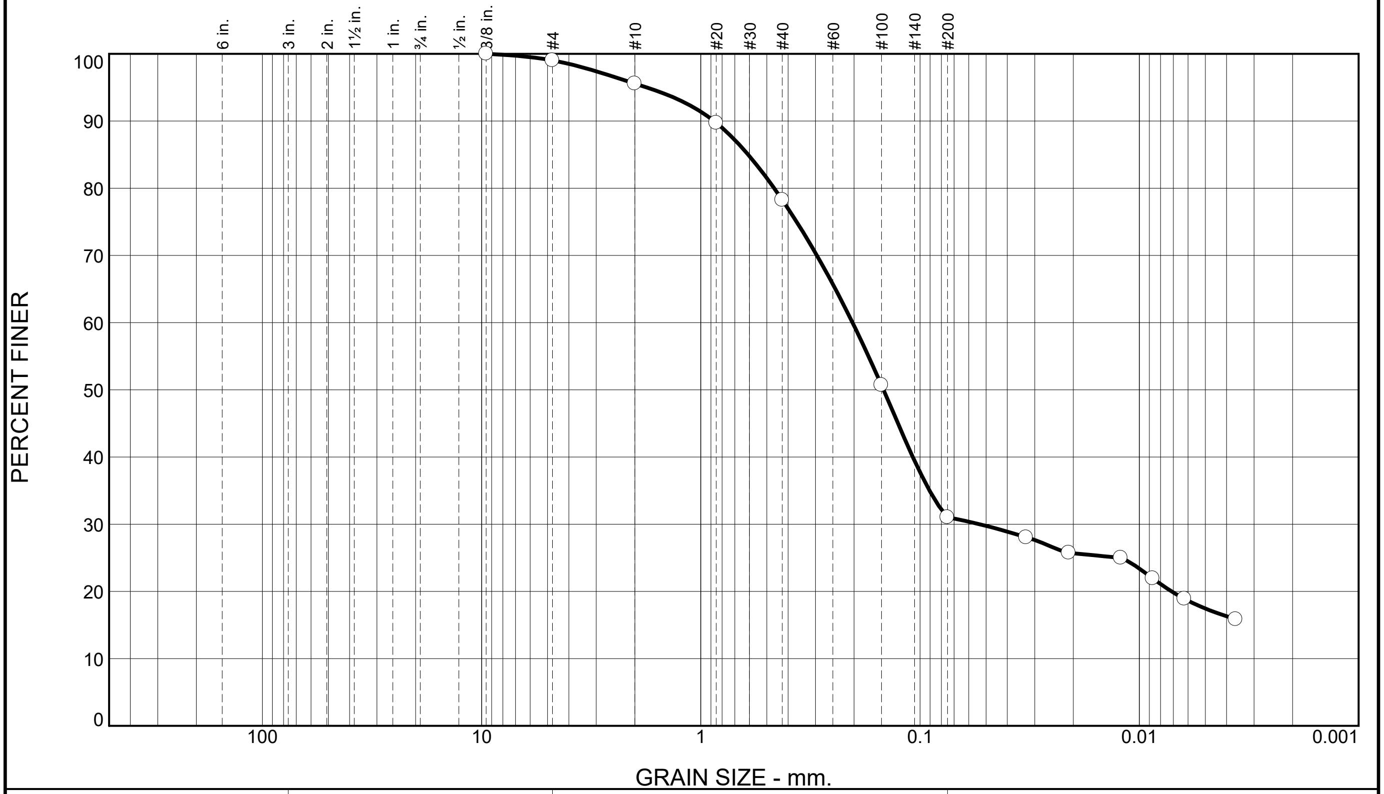
Source of Sample: B-2 **Depth:** 32.0'-33.7'
Sample Number: S-14A **Date:** 9-21-15

TERRACON
CONSULTANTS, INC.
Columbus, Ohio

Client: American Electric Power
Project: Rockport Plant Impoundment Certification
Project No: N4155126 **Exhibit** B-13

Tested By: DS **Checked By:** AM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.0	3.4	17.4	47.2	13.5	17.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8	100.0		
#4	99.0		
#10	95.6		
#20	89.7		
#40	78.2		
#100	50.7		
#200	31.0		
0.0328 mm.	28.0		
0.0210 mm.	25.7		
0.0121 mm.	25.0		
0.0087 mm.	21.9		
0.0062 mm.	18.9		
0.0036 mm.	15.8		

* (no specification provided)

Soil Description

Brown SILTY SAND, trace gravel

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.8715 D_{85}= 0.6088 D_{60}= 0.2033

D_{50}= 0.1468 D_{30}= 0.0537 D_{15}=

D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

F.M.=1.06

Source of Sample: B-2 **Depth:** 34.0'-36.0'
Sample Number: S-15

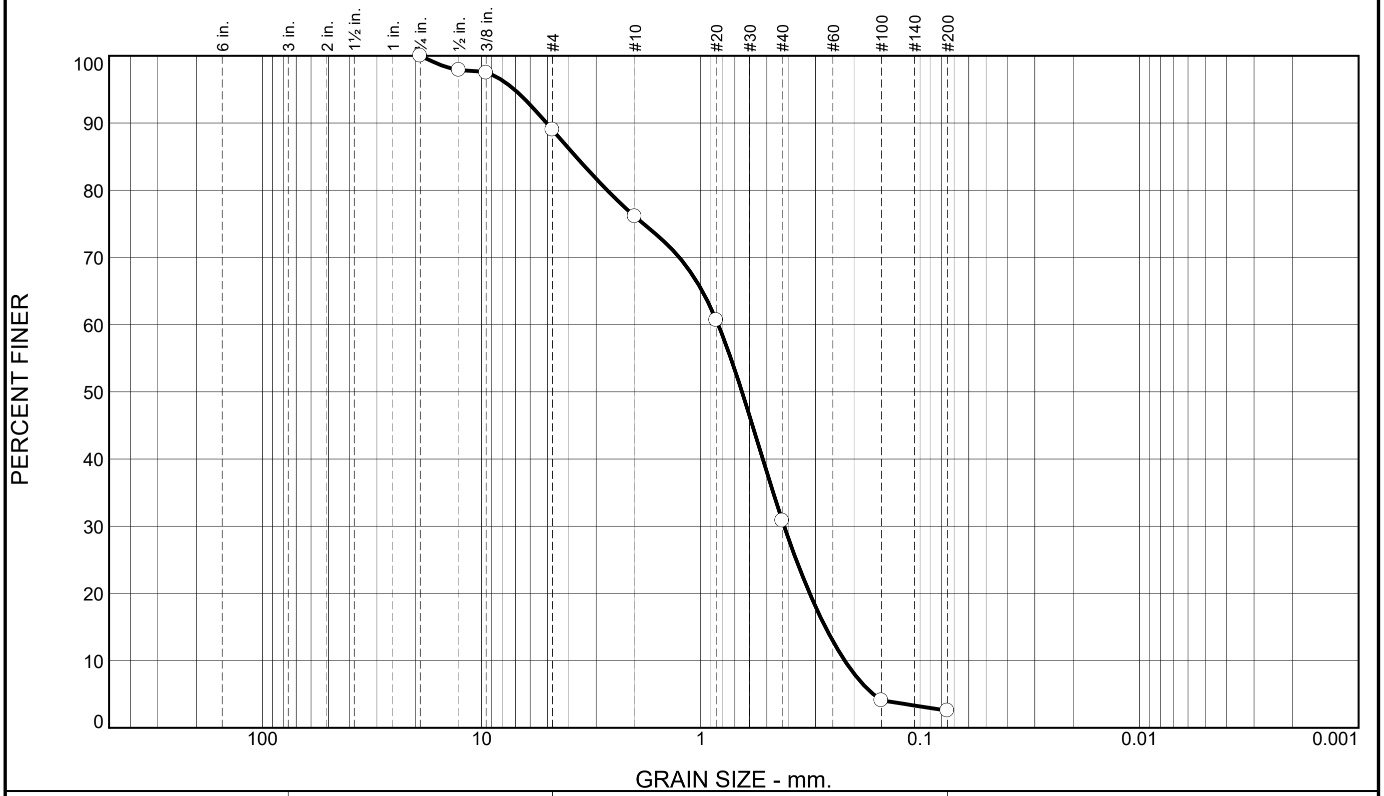
Date: 9-21-15

TERRACON
CONSULTANTS, INC.
Columbus, Ohio

Client: American Electric Power
Project: Rockport Plant Impoundment Certification
Project No: N4155126 **Exhibit** B-14

Tested By: DS **Checked By:** AM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	11.0	12.9	45.3	28.3	2.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4	100.0		
1/2	97.9		
3/8	97.5		
#4	89.0		
#10	76.1		
#20	60.7		
#40	30.8		
#100	4.1		
#200	2.5		

* (no specification provided)

Soil Description

Brown poorly graded SAND, trace gravel

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 5.0561 D_{85}= 3.7126 D_{60}= 0.8336
D_{50}= 0.6494 D_{30}= 0.4167 D_{15}= 0.2704
D_{10}= 0.2206 C_u= 3.78 C_c= 0.94

Classification

USCS= SP AASHTO= A-1-b

Remarks

F.M.=2.98

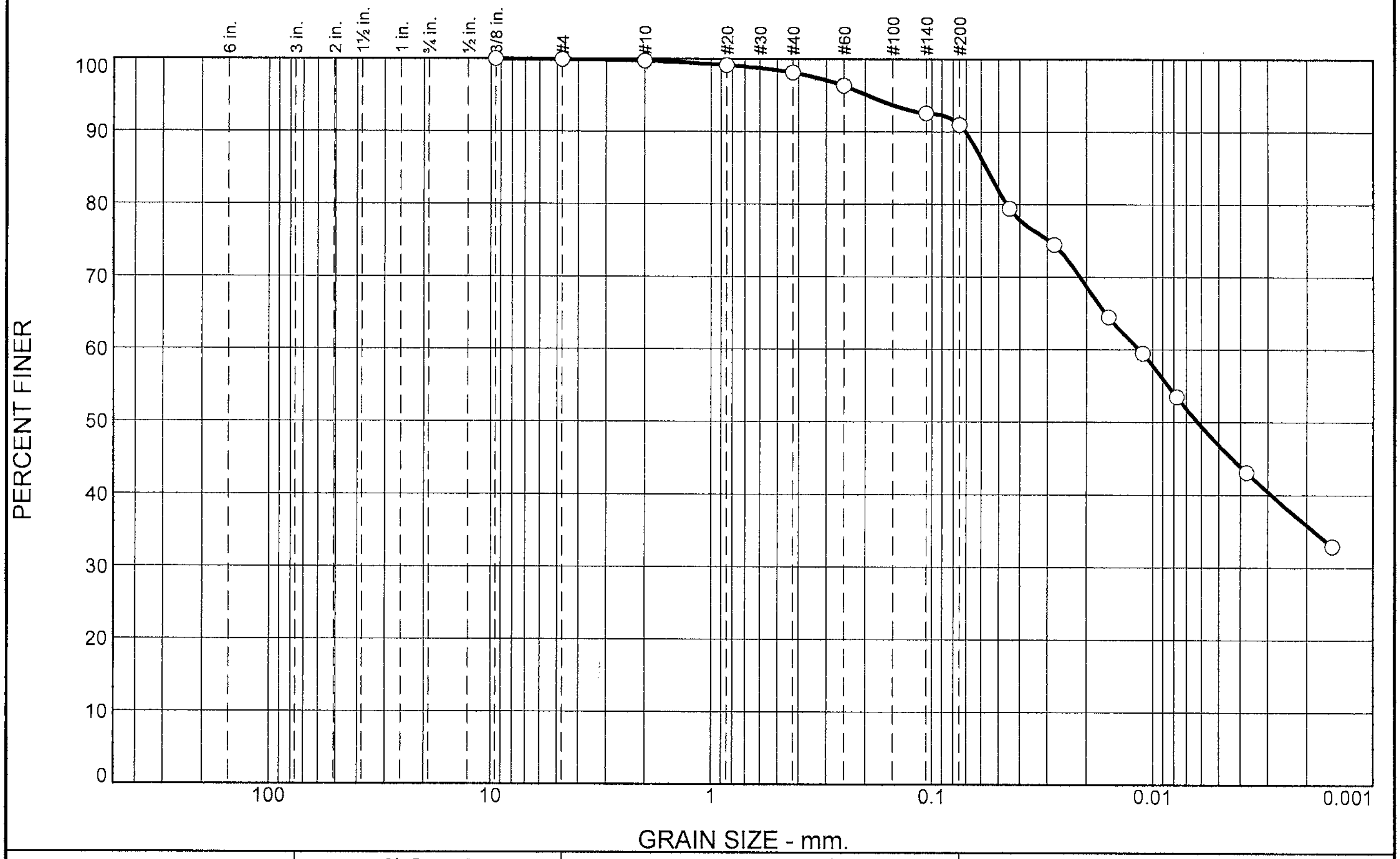
Source of Sample: B-2 **Depth:** 42.0'-44.0'
Sample Number: S-19
Date: 9-21-15

TERRACON
CONSULTANTS, INC.
Columbus, Ohio

Client: American Electric Power
Project: Rockport Plant Impoundment Certification
Project No: N4155126 **Exhibit** B-15

Tested By: DS **Checked By:** AM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.1	0.2	1.5	7.2	55.1	35.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.9		
#10	99.7		
#20	99.2		
#40	98.2		
#60	96.4		
#140	92.6		
#200	91.0		

* (no specification provided)

Material Description

BROWN GRAY LEAN CLAY

Atterberg Limits

PL= 22 LL= 42 PI= 20

Coefficients

D_{90}= 0.0705 D_{85}= 0.0568 D_{60}= 0.0115
D_{50}= 0.0062 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(19)

Remarks

Source of Sample: B-1 **Depth:** 8-10'
Sample Number: ST-2

Date: 9-28-15

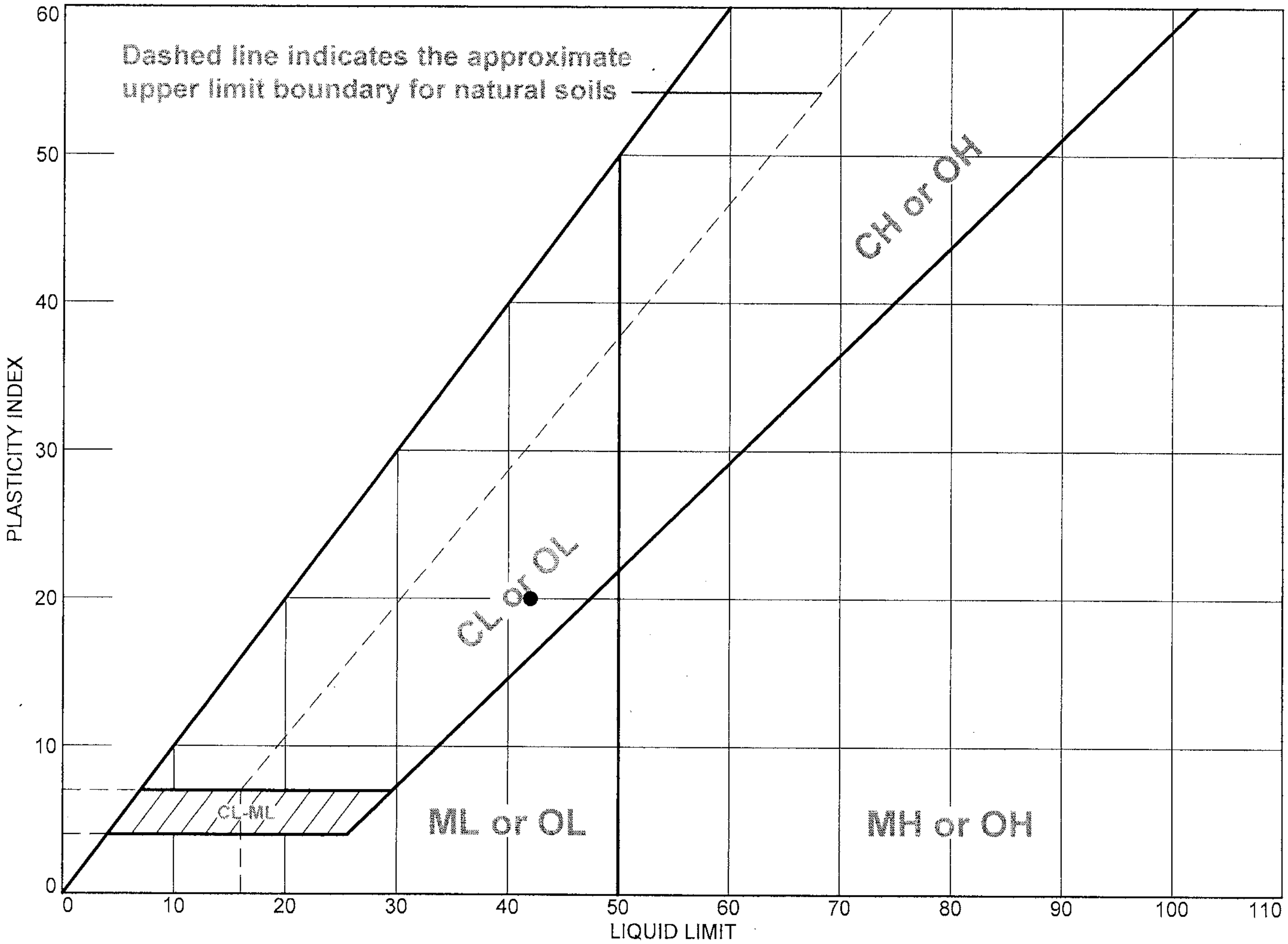
Terracon, Inc.

Cincinnati, Ohio

Client: AEP
Project: ROCKPORT PLANT IMPROVEMENT CERTIFICATION
Project No: N4155126 **Exhibit** 7353

Tested By: DR **Checked By:** GS

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN GRAY LEAN CLAY	42	22	20	98.2	91.0	CL

Project No. N4155126 **Client:** AEP

Project: ROCKPORT PLANT IMPROVEMENT CERTIFICATION

● **Source of Sample:** B-1 **Depth:** 8-10' **Sample Number:** ST-2

Remarks:

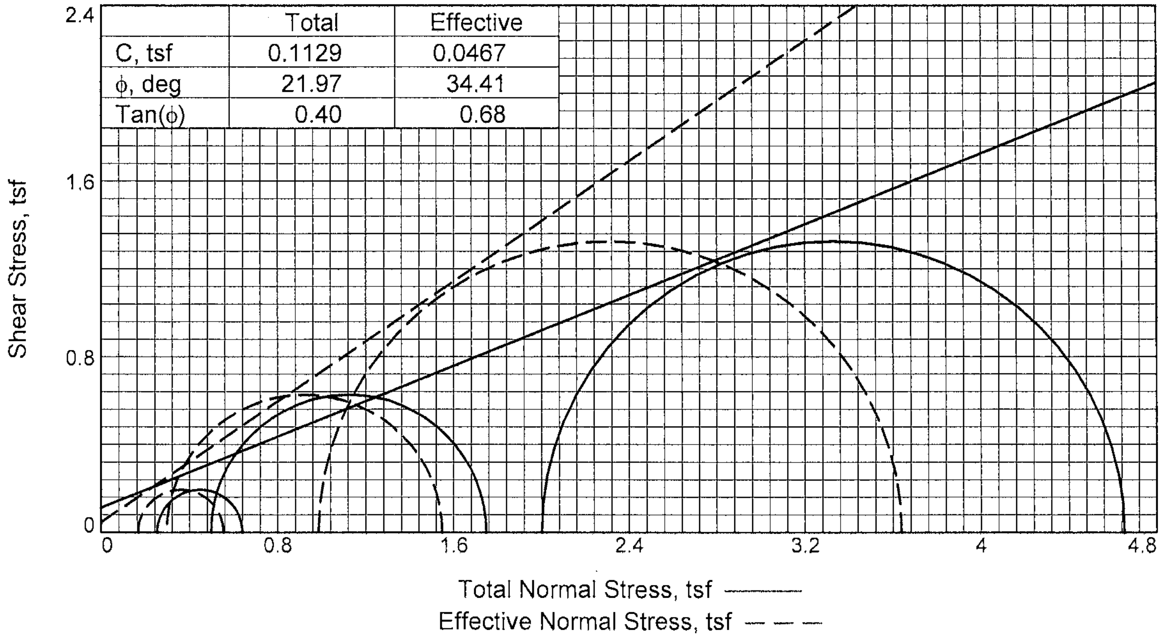
Terracon, Inc.

Cincinnati, Ohio

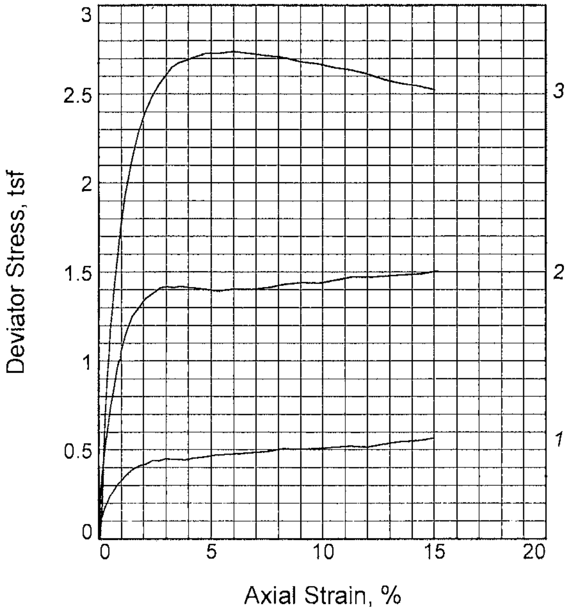
Exhibit 7353

Tested By: MD **Checked By:** GS

Exhibit B-17



	Total	Effective
C, tsf	0.1129	0.0467
ϕ, deg	21.97	34.41
Tan(ϕ)	0.40	0.68



	Sample No.	1	2	3
Initial	Water Content, %	25.2	28.6	27.0
	Dry Density, pcf	99.0	94.6	97.1
	Saturation, %	96.6	98.7	98.9
	Void Ratio	0.7033	0.7825	0.7364
	Diameter, in.	2.867	2.885	2.862
	Height, in.	5.748	5.717	5.757
At Test	Water Content, %	25.2	27.8	24.9
	Dry Density, pcf	100.4	96.3	100.7
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.6794	0.7499	0.6736
	Diameter, in.	2.854	2.867	2.827
	Height, in.	5.721	5.682	5.687
	Strain rate, in./min.	0.000	0.000	0.000
	Back Pressure, tsf	3.600	3.600	3.600
	Cell Pressure, tsf	3.852	4.097	5.602
	Fail. Stress, tsf	0.388	1.252	2.652
	Total Pore Pr., tsf	3.686	3.802	4.615
	Ult. Stress, tsf			
	Total Pore Pr., tsf			
	$\bar{\sigma}_1$ Failure, tsf	0.554	1.547	3.638
	$\bar{\sigma}_3$ Failure, tsf	0.166	0.295	0.986

Type of Test:
CU with Pore Pressures

Sample Type: ST

Description: BROWN GRAY LEAN CLAY

LL= 42 **PL=** 22 **PI=** 20

Assumed Specific Gravity= 2.70

Remarks:

Exhibit 7353

Client: AEP

Project: ROCKPORT PLANT IMPROVEMENT CERTIFICATION

Source of Sample: B-1 **Depth:** 8-10'

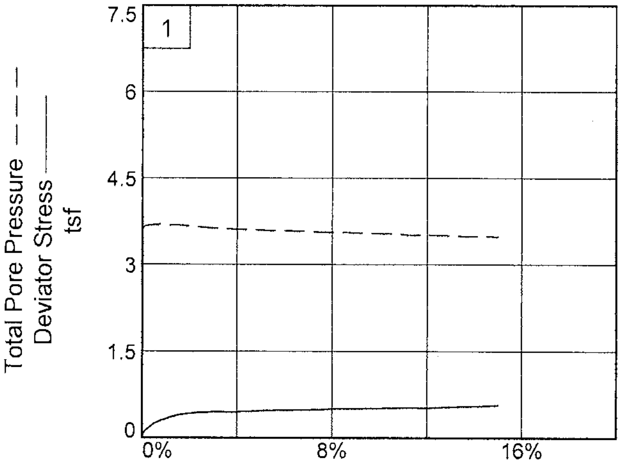
Sample Number: ST-2

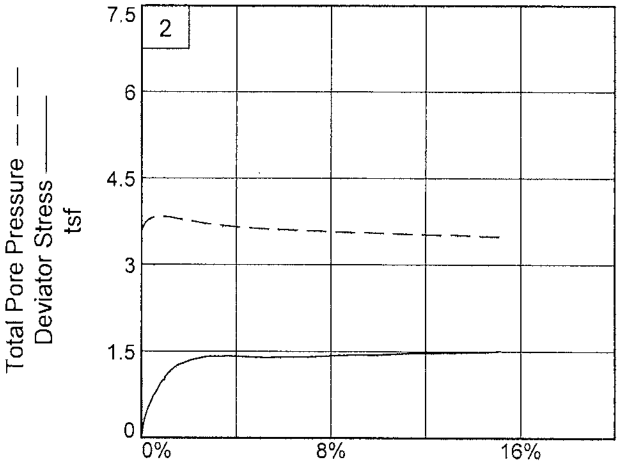
Proj. No.: N4155126 **Date Sampled:** 9-28-15

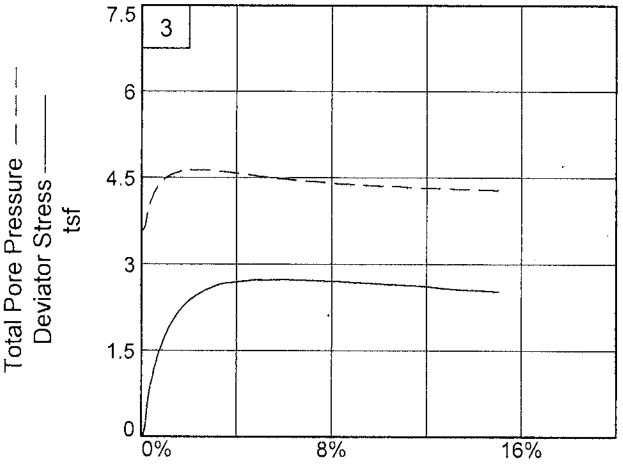
TRIAXIAL SHEAR TEST REPORT

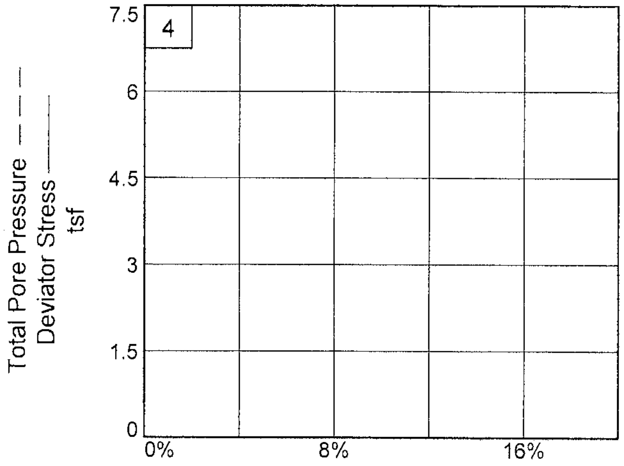
Terracon, Inc.
Cincinnati, Ohio

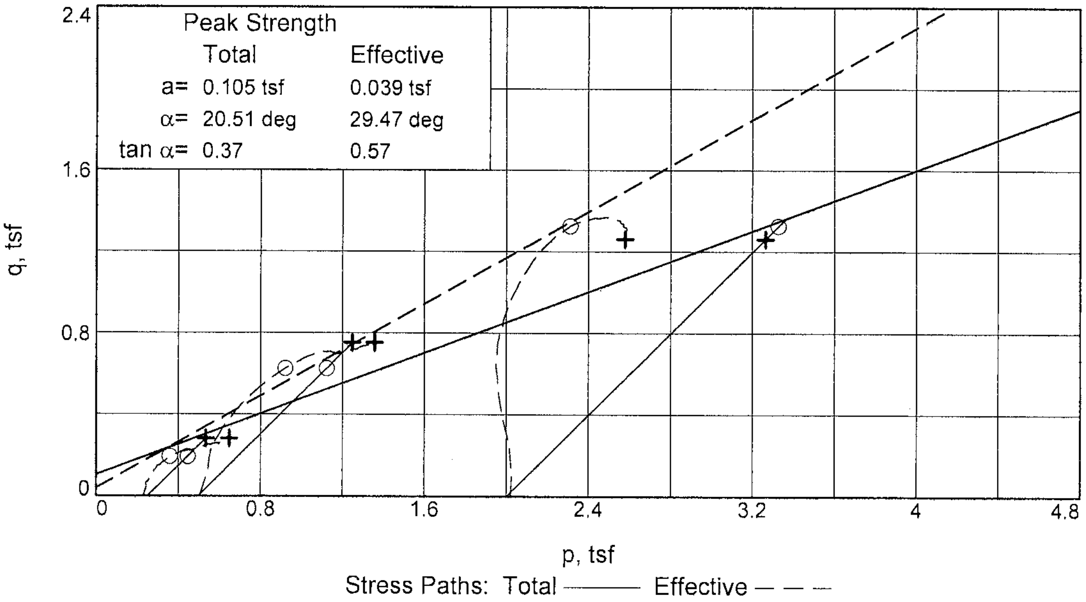
Tested By: FCE **Checked By:** GS










Peak Strength

	Total	Effective
a=	0.105 tsf	0.039 tsf
α=	20.51 deg	29.47 deg
tan α=	0.37	0.57

Client: AEP

Project: ROCKPORT PLANT IMPROVEMENT CERTIFICATION

Source of Sample: B-1 **Depth:** 8-10' **Sample Number:** ST-2

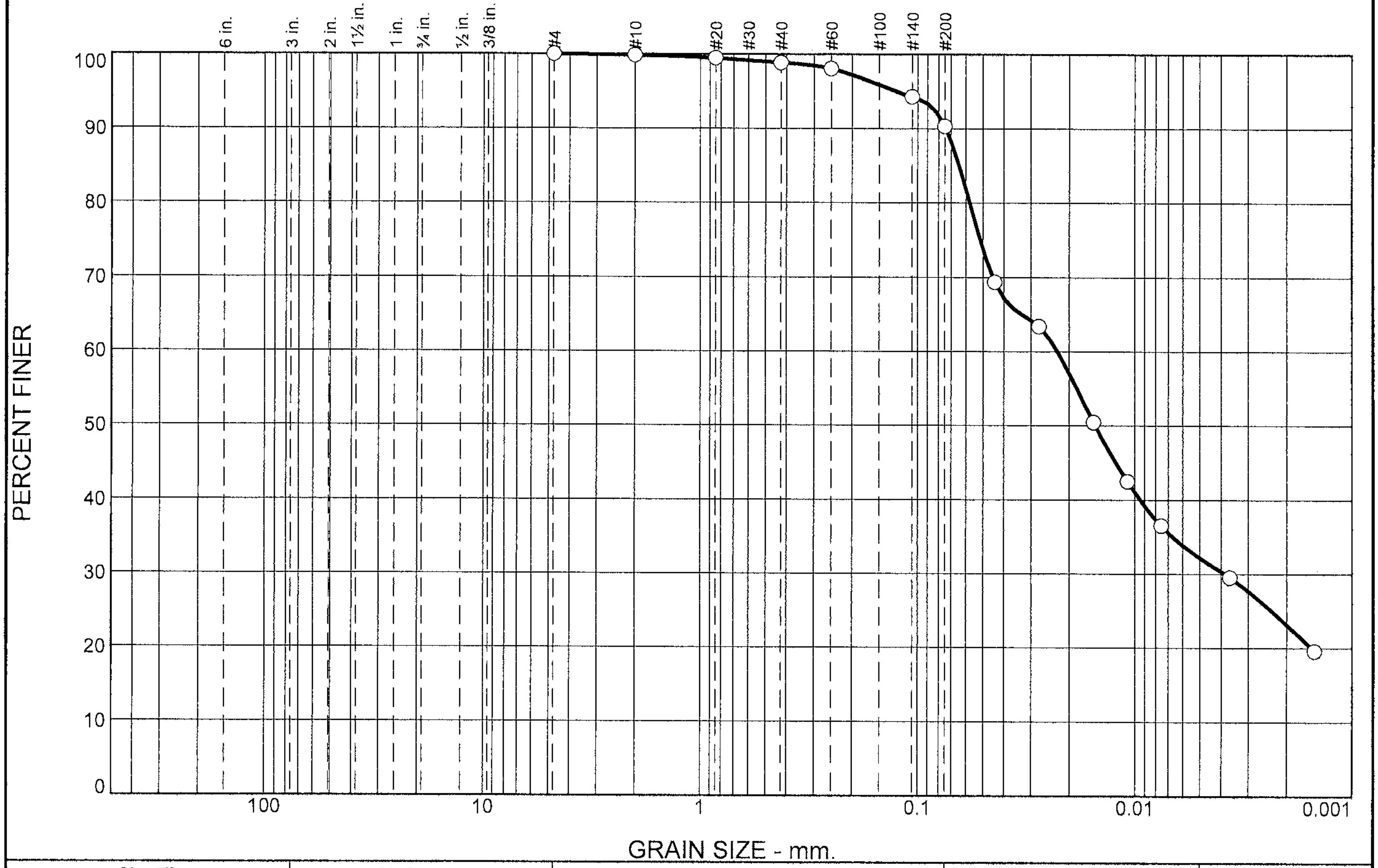
Project No.: N4155126 **Exhibit** ________

Terracon, Inc.

Tested By: FCE **Checked By:** GS

Exhibit B-19

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	0.0	9.7	58.1	32.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#20	99.5		
#40	98.9		
#60	98.1		
#140	94.3		
#200	90.3		

* (no specification provided)

Material Description

BROWN GRAY LEAN CLAY

Atterberg Limits

PL= 18 LL= 28 PI= 10

Coefficients

D_{90}= 0.0742 D_{85}= 0.0645 D_{60}= 0.0227
D_{50}= 0.0152 D_{30}= 0.0038 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-4(8)

Remarks

Source of Sample: B-1 **Depth:** 14-16'
Sample Number: ST-3

Date: 10-05-15

Terracon, Inc.

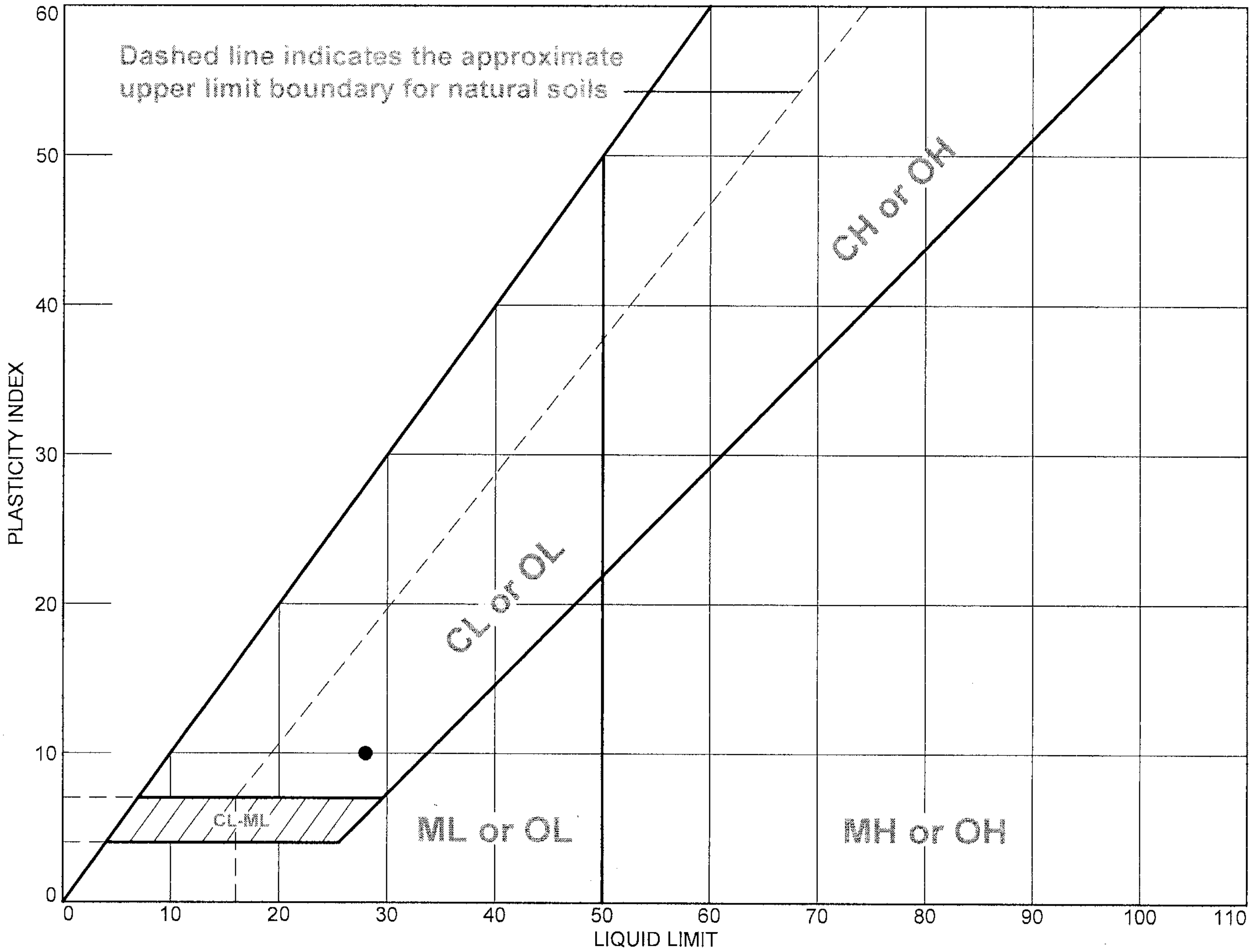
Cincinnati, Ohio

Client: AEP
Project: ROCKPORT PLANT IMPROVEMENT CERTIFICATION
Project No: N4155126 **Exhibit**

Tested By: JB **Checked By:** GS

Exhibit B-20

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN GRAY LEAN CLAY	28	18	10	98.9	90.3	CL

Project No. N4155126 **Client:** AEP

Project: ROCKPORT PLANT IMPROVEMENT CERTIFICATION

● **Source of Sample:** B-1 **Depth:** 14-16' **Sample Number:** ST-3

Remarks:

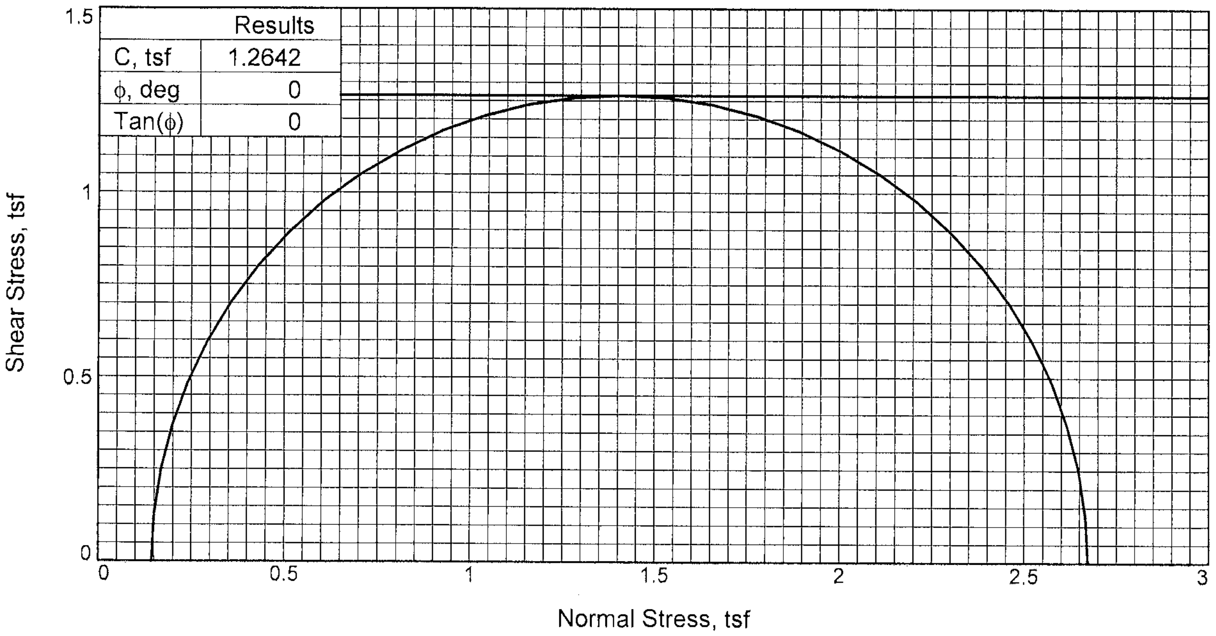
● MC - 22.5%

Terracon, Inc.

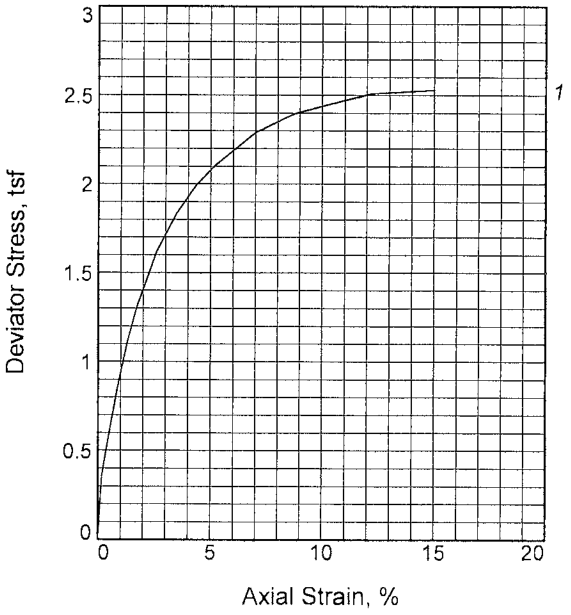
Cincinnati, Ohio

Exhibit

Exhibit B-21



Results	
C, tsf	1.2642
ϕ, deg	0
Tan(ϕ)	0



Sample No.		1
Initial	Water Content, %	22.5
	Dry Density, pcf	104.7
	Saturation, %	99.5
	Void Ratio	0.6095
	Diameter, in.	2.860
	Height, in.	5.734
At Test	Water Content, %	22.9
	Dry Density, pcf	104.7
	Saturation, %	101.4
	Void Ratio	0.6095
	Diameter, in.	2.860
	Height, in.	5.734
Strain rate, in./min.		0.057
Back Pressure, tsf		0.000
Cell Pressure, tsf		0.144
Fail. Stress, tsf		2.528
Ult. Stress, tsf		
σ_1 Failure, tsf		2.672
σ_3 Failure, tsf		0.144

Type of Test:
Unconsolidated Undrained

Sample Type: ST

Description: BROWN GRAY LEAN CLAY

LL= 28 **PL=** 18 **PI=** 10

Assumed Specific Gravity= 2.70

Remarks:

Exhibit 7354

Client: AEP

Project: ROCKPORT PLANT IMPROVEMENT CERTIFICATION

Source of Sample: B-1 **Depth:** 14-16'

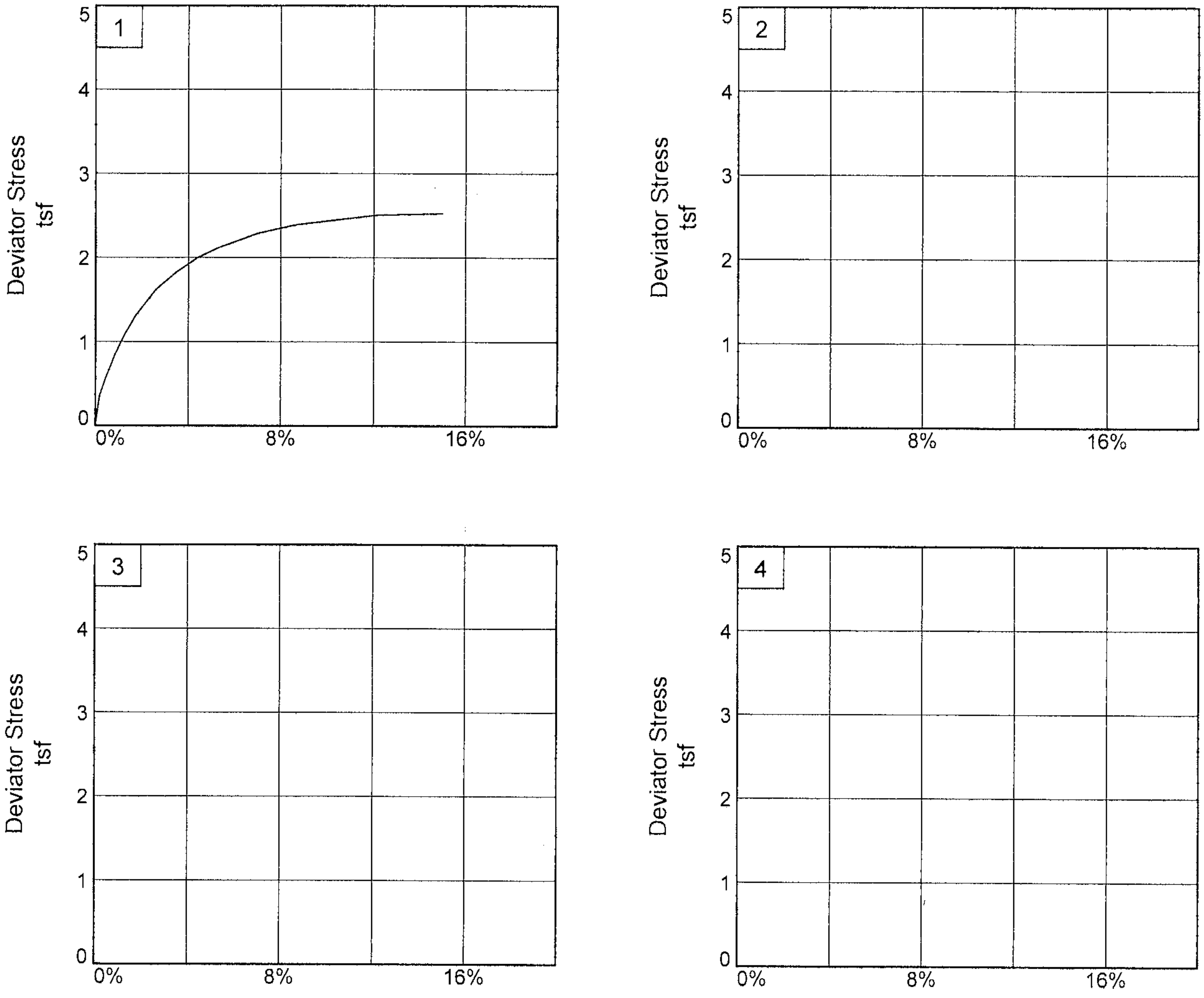
Sample Number: ST-3

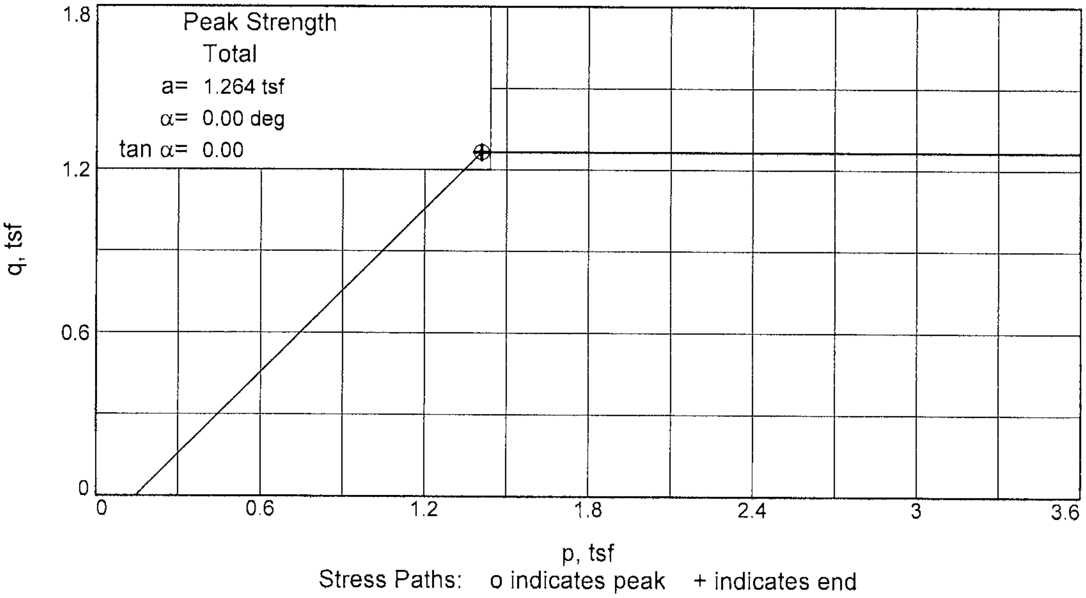
Proj. No.: N4155126 **Date Sampled:** 10-05-15

TRIAXIAL SHEAR TEST REPORT

Terracon, Inc.
Cincinnati, Ohio

Tested By: FCE **Checked By:** GS





Client: AEP

Project: ROCKPORT PLANT IMPROVEMENT CERTIFICATION

Source of Sample: B-1 **Depth:** 14-16' **Sample Number:** ST-3

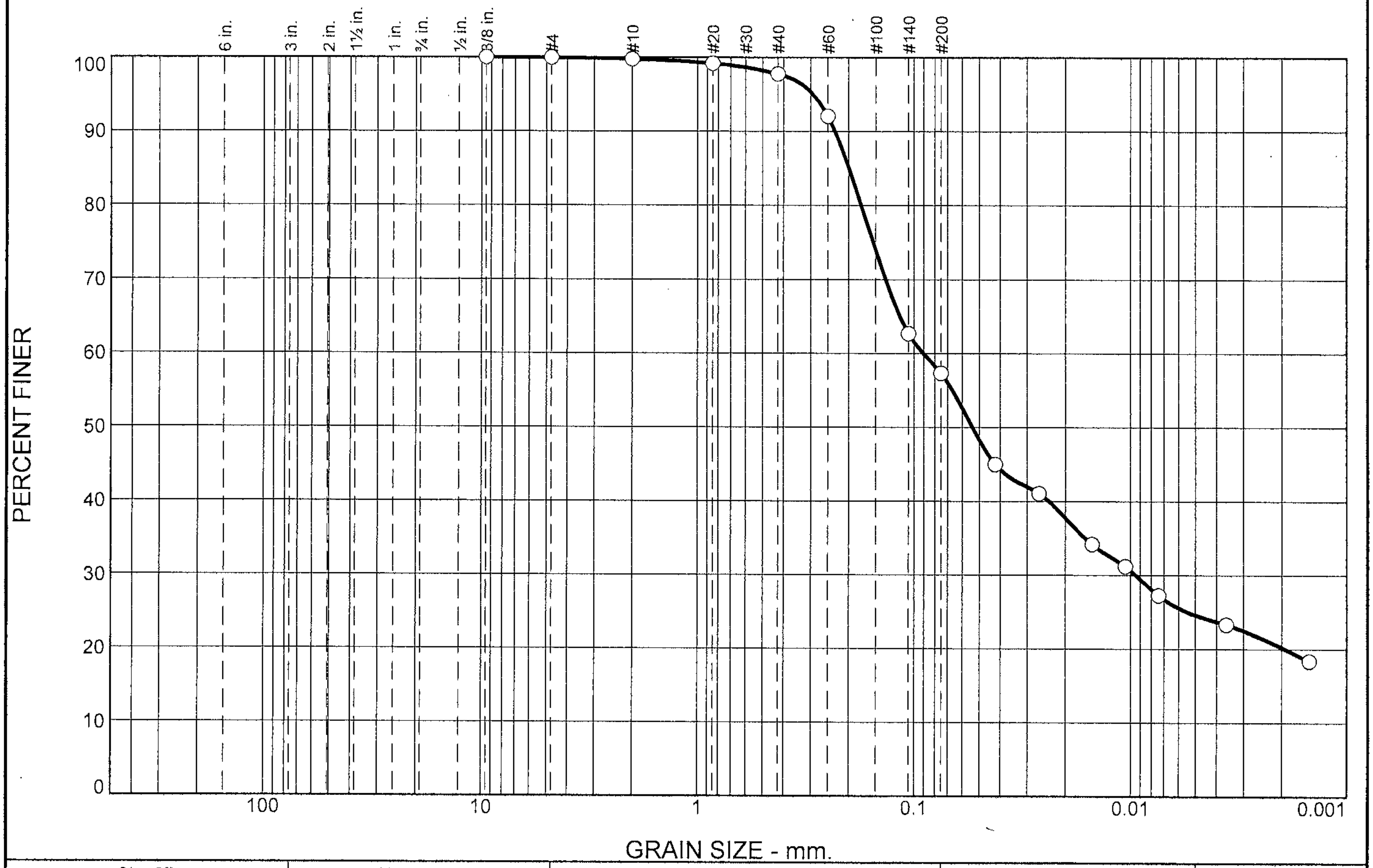
Project No.: N4155126 **Exhibit** ________

Terracon, Inc.

Tested By: FCE **Checked By:** GS

Exhibit B-23

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	0.0	42.7	32.7	24.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	100.0		
#10	99.8		
#20	99.2		
#40	97.8		
#60	92.1		
#140	62.7		
#200	57.3		

* (no specification provided)

Material Description

BROWN SANDY SILT

Atterberg Limits

PL= 16 LL= 19 PI= 3

Coefficients

D_{90}= 0.2316 D_{85}= 0.1995 D_{60}= 0.0905
D_{50}= 0.0538 D_{30}= 0.0094 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Source of Sample: B-2 **Depth:** 4-6'
Sample Number: ST-1

Date: 10-5-15

Terracon, Inc.

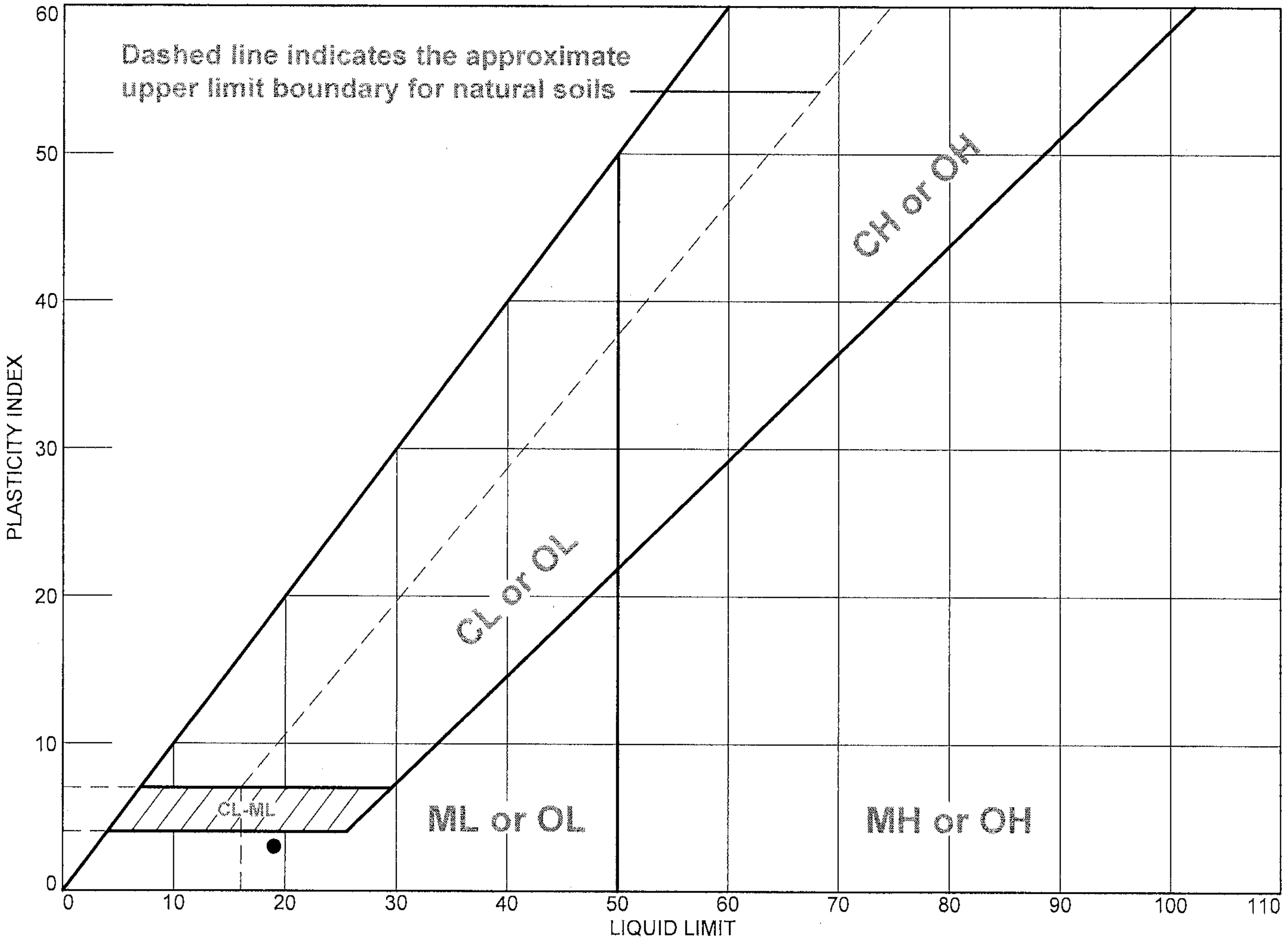
Cincinnati, Ohio

Client: AEP
Project: ROCKPORT PLANT IMPROVEMENT CERTIFICATION
Project No: N4155126 **Exhibit**

Tested By: JB **Checked By:** GS

Exhibit B-24

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN SANDY SILT	19	16	3	97.8	57.3	ML

Project No. N4155126 **Client:** AEP

Project: ROCKPORT PLANT IMPROVEMENT CERTIFICATION

● **Source of Sample:** B-2 **Depth:** 4-6' **Sample Number:** ST-1

Remarks:

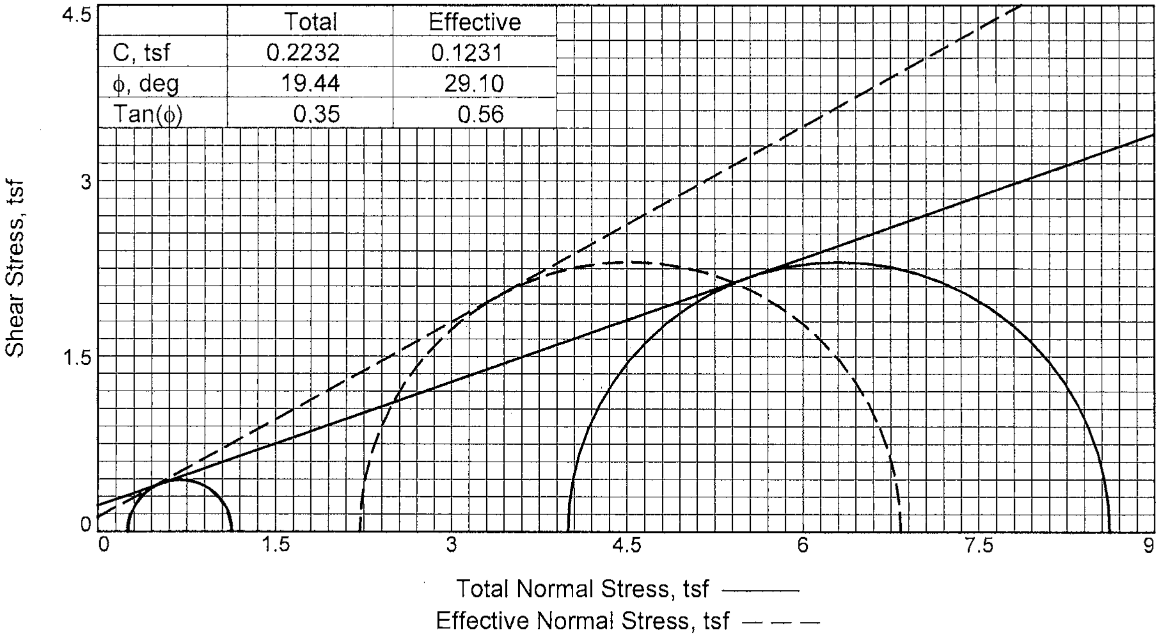
Terracon, Inc.

Cincinnati, Ohio

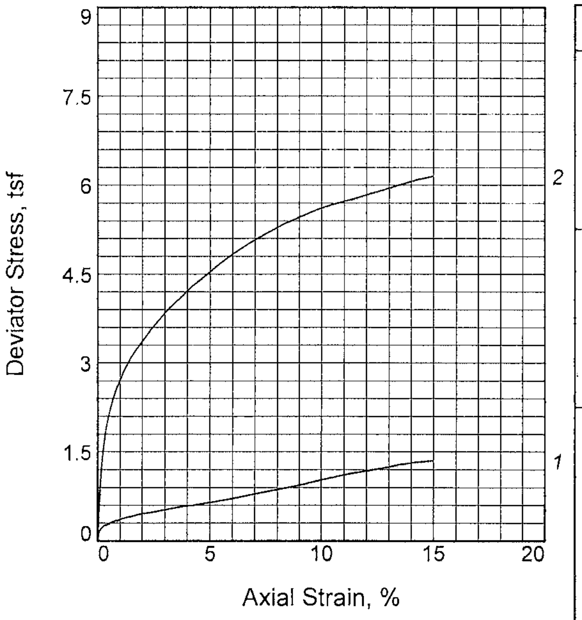
Exhibit

Tested By: VD **Checked By:** GS

Exhibit B-25



	Total	Effective
C, tsf	0.2232	0.1231
ϕ, deg	19.44	29.10
Tan(ϕ)	0.35	0.56



	Sample No.	1	2
Initial	Water Content, %	15.6	17.3
	Dry Density, pcf	110.4	114.3
	Saturation, %	80.0	98.5
	Void Ratio	0.5262	0.4741
	Diameter, in.	2.853	2.844
	Height, in.	5.704	5.702
At Test	Water Content, %	18.1	15.8
	Dry Density, pcf	113.2	118.0
	Saturation, %	100.0	100.0
	Void Ratio	0.4887	0.4279
	Diameter, in.	2.829	2.814
	Height, in.	5.657	5.642
	Strain rate, in./min.	0.001	0.001
	Back Pressure, tsf	3.600	3.600
	Cell Pressure, tsf	3.852	7.596
	Fail. Stress, tsf	0.883	4.618
	Total Pore Pr., tsf	3.607	5.378
	Ult. Stress, tsf		
	Total Pore Pr., tsf		
	$\bar{\sigma}_1$ Failure, tsf	1.127	6.836
	$\bar{\sigma}_3$ Failure, tsf	0.245	2.218

Type of Test:
CU with Pore Pressures

Sample Type: ST

Description: BROWN SANDY SILT

LL= 19 **PL=** 16 **PI=** 3

Assumed Specific Gravity= 2.70

Remarks:

Exhibit 7355

Client: AEP

Project: ROCKPORT PLANT IMPROVEMENT CERTIFICATION

Source of Sample: B-2 **Depth:** 4-6'

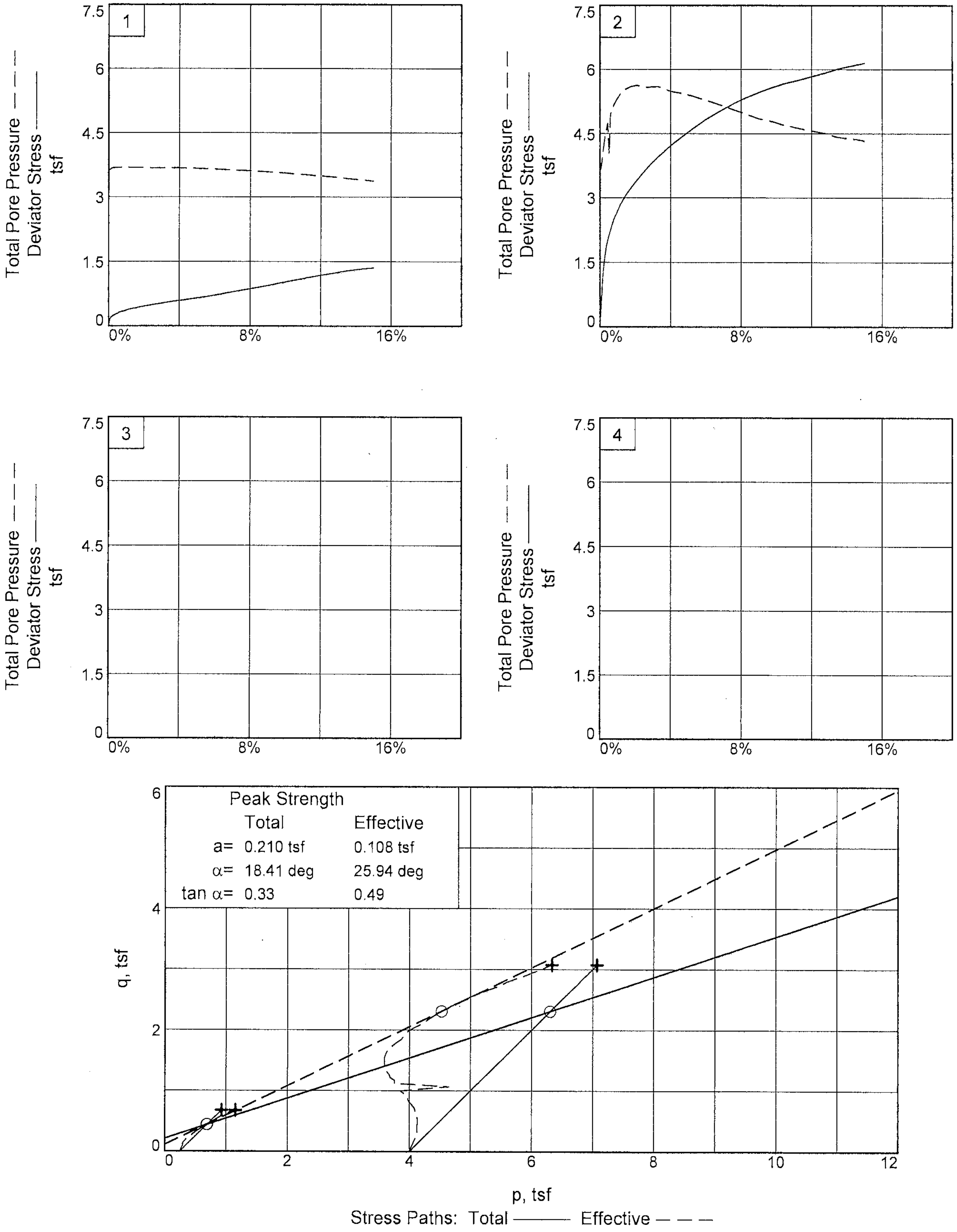
Sample Number: ST-1

Proj. No.: N4155126 **Date Sampled:** 10-5-15

TRIAXIAL SHEAR TEST REPORT

Terracon, Inc.
Cincinnati, Ohio

Tested By: FCE **Checked By:** GS



Peak Strength

	Total	Effective
a=	0.210 tsf	0.108 tsf
α=	18.41 deg	25.94 deg
tan α=	0.33	0.49

Stress Paths: Total ——— Effective — — —

Client: AEP

Project: ROCKPORT PLANT IMPROVEMENT CERTIFICATION

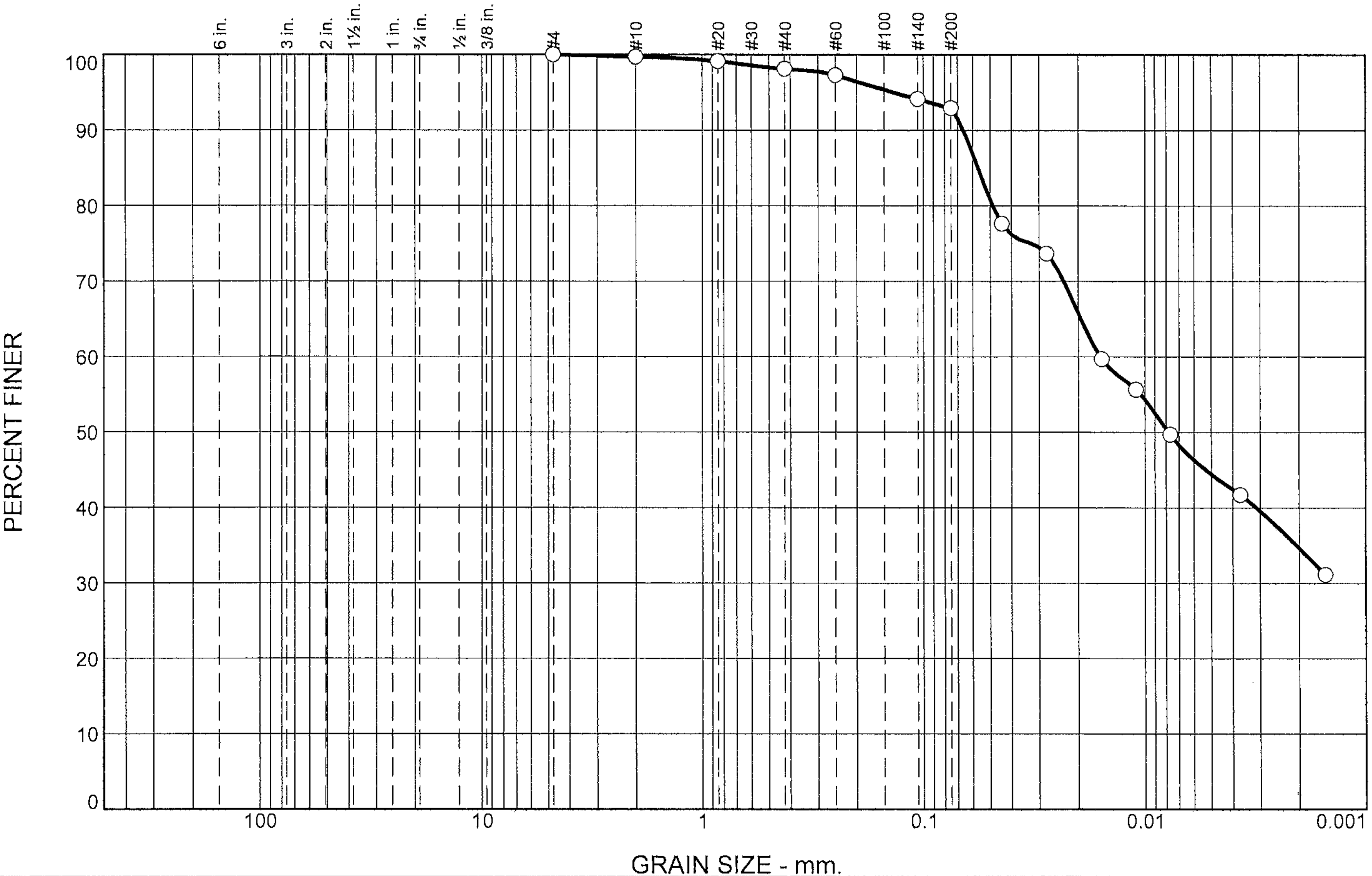
Source of Sample: B-2 **Depth:** 4-6' **Sample Number:** ST-1

Project No.: N4155126 **Exhibit** ________

Terracon, Inc.

Tested By: FCE **Checked By:** GS

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	0.0	7.0	48.5	44.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.7		
#20	99.1		
#40	98.1		
#60	97.3		
#140	94.2		
#200	93.0		

* (no specification provided)

Material Description

GRAY LEAN CLAY

Atterberg Limits

PL= 21 LL= 30 PI= 9

Coefficients

D_{90}= 0.0662 D_{85}= 0.0568 D_{60}= 0.0159
D_{50}= 0.0078 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-4(8)

Remarks

Source of Sample: B-2 **Depth:** 10-12'
Sample Number: ST-2

Date: 10-13-15

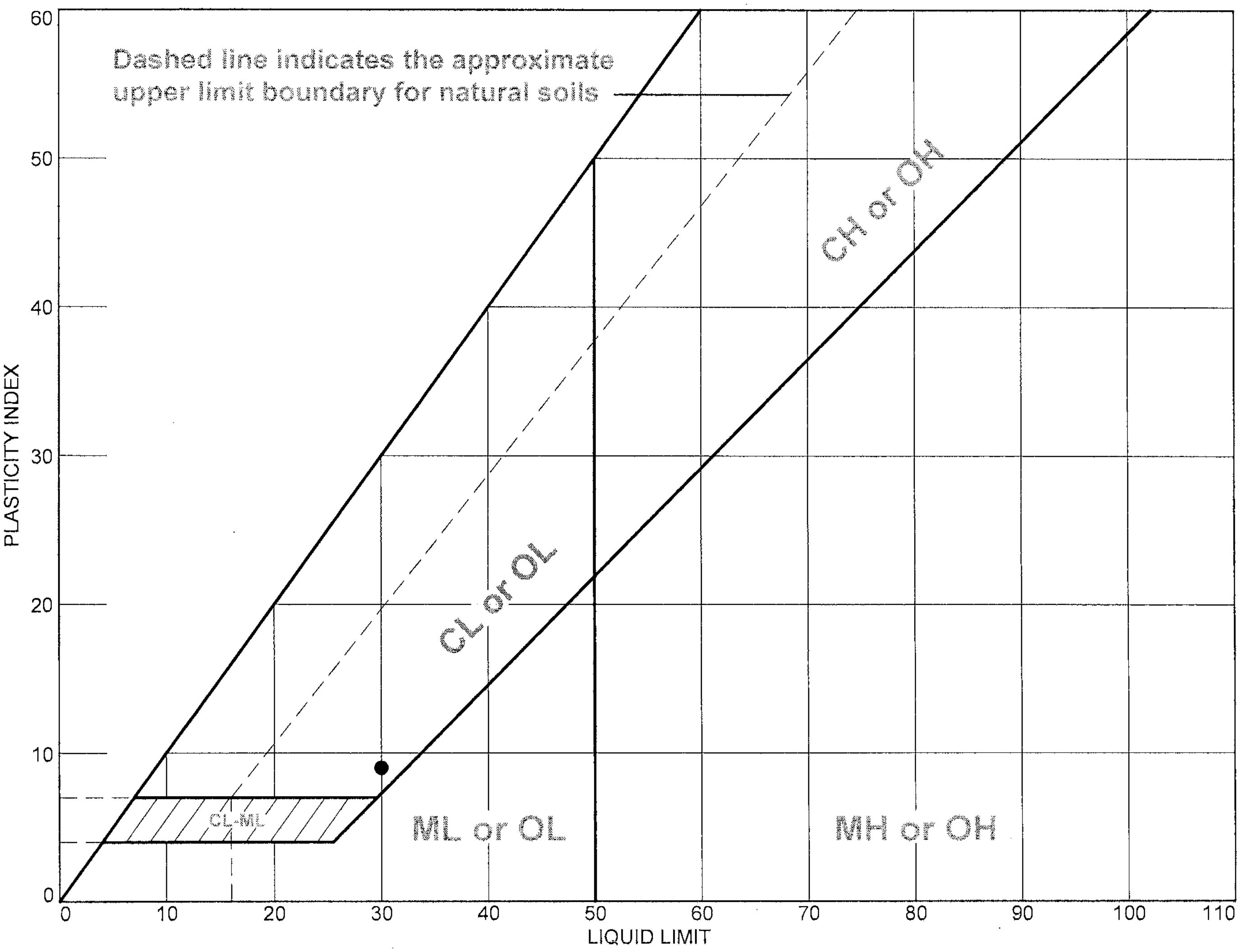
Terracon, Inc.
Cincinnati, Ohio

Client: AEP
Project: ROCKPORT PLANT IMPROVEMENT CERTIFICATION
Project No: N4155126 **Exhibit**

Tested By: DR **Checked By:** GS

Exhibit B-28

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY LEAN CLAY	30	21	9	98.1	93.0	CL

Project No. N4155126 **Client:** AEP

Project: ROCKPORT PLANT IMPROVEMENT CERTIFICATION

● **Source of Sample:** B-2 **Depth:** 10-12' **Sample Number:** ST-2

Remarks:

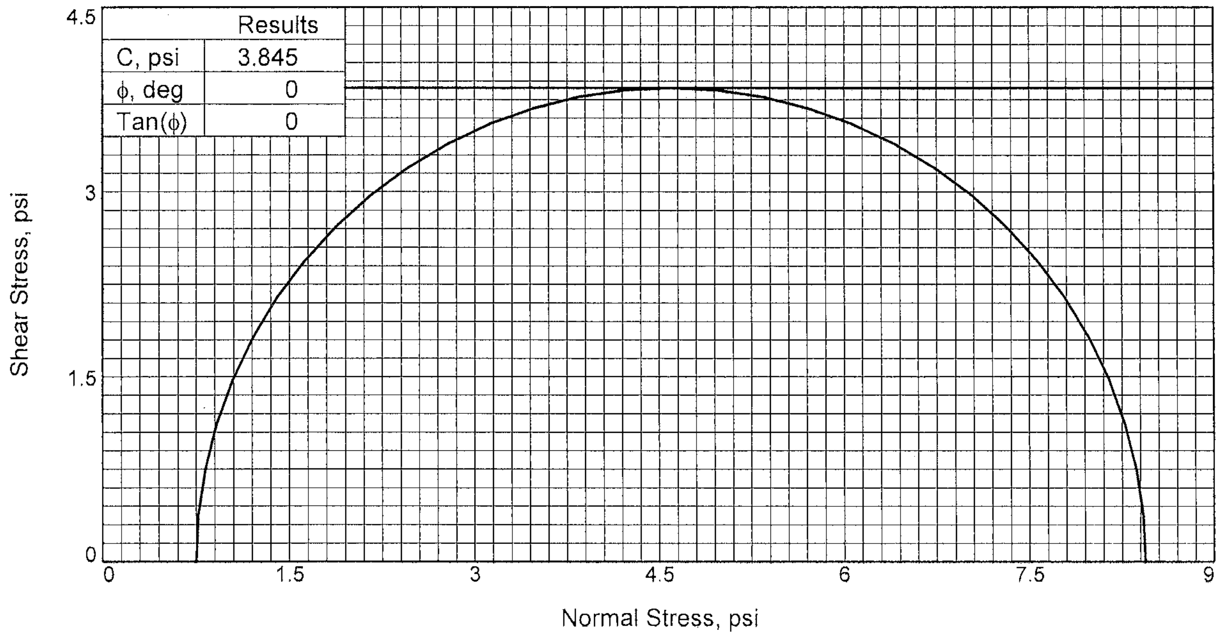
● Initial MC - 27.2%

Terracon, Inc.

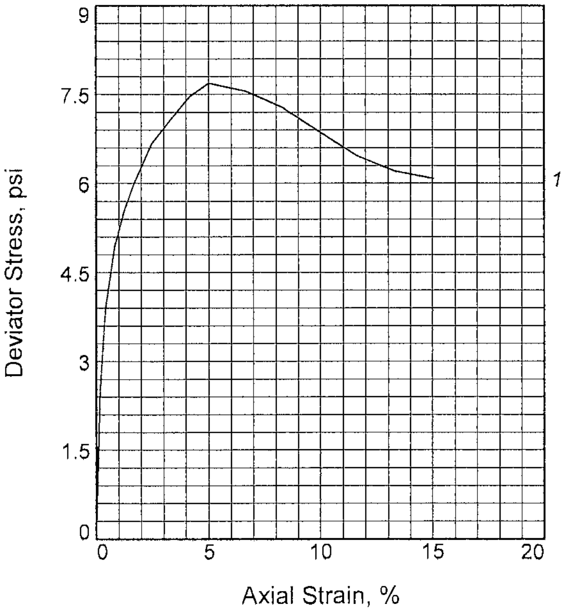
Cincinnati, Ohio

Exhibit

Exhibit B-29



Results	
C, psi	3.845
ϕ, deg	0
Tan(ϕ)	0



	Sample No.	1
Initial	Water Content, %	27.2
	Dry Density, pcf	94.9
	Saturation, %	94.7
	Void Ratio	0.7768
	Diameter, in.	2.860
	Height, in.	6.020
At Test	Water Content, %	27.2
	Dry Density, pcf	94.9
	Saturation, %	94.7
	Void Ratio	0.7768
	Diameter, in.	2.860
	Height, in.	6.020
	Strain rate, in./min.	0.060
	Back Pressure, psi	0.000
	Cell Pressure, psi	0.750
	Fail. Stress, psi	7.691
	Ult. Stress, psi	
	σ_1 Failure, psi	8.441
	σ_3 Failure, psi	0.750

Type of Test:
Unconsolidated Undrained

Sample Type: ST

Description: GRAY LEAN CLAY

LL= 30 **PL=** 21 **PI=** 9

Assumed Specific Gravity= 2.70

Remarks:

Exhibit 7356

Client: AEP

Project: ROCKPORT PLANT IMPROVEMENT CERTIFICATION

Source of Sample: B-2 **Depth:** 10-12'

Sample Number: ST-2

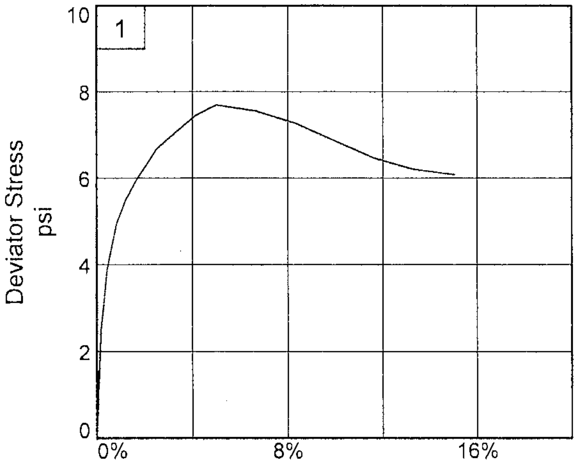
Proj. No.: N4155126 **Date Sampled:** 10-13-15

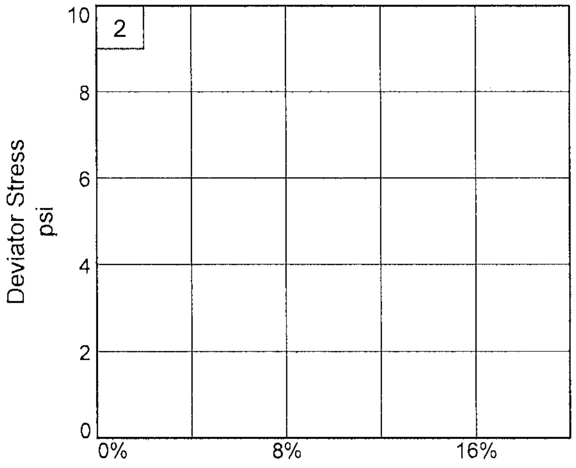
TRIAXIAL SHEAR TEST REPORT

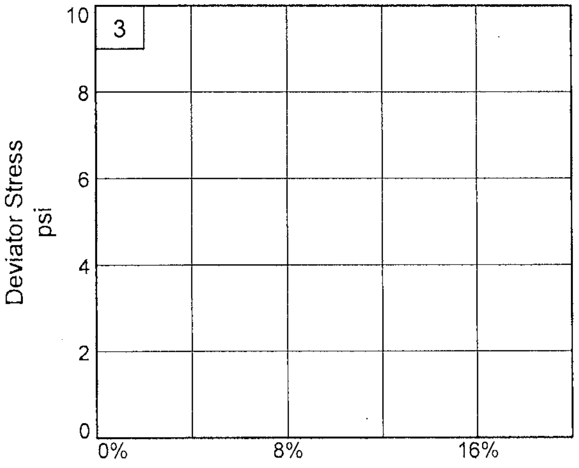
Terracon, Inc.

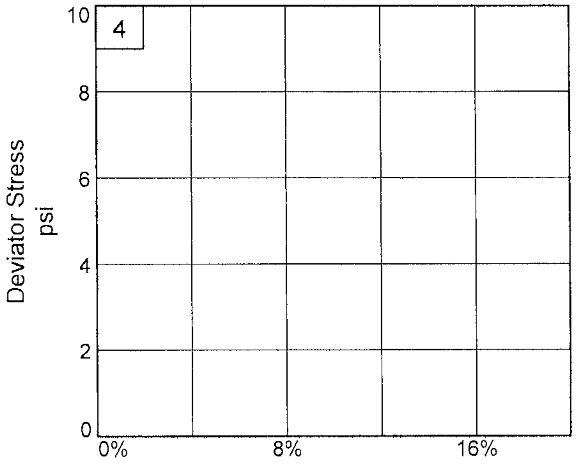
Cincinnati, Ohio

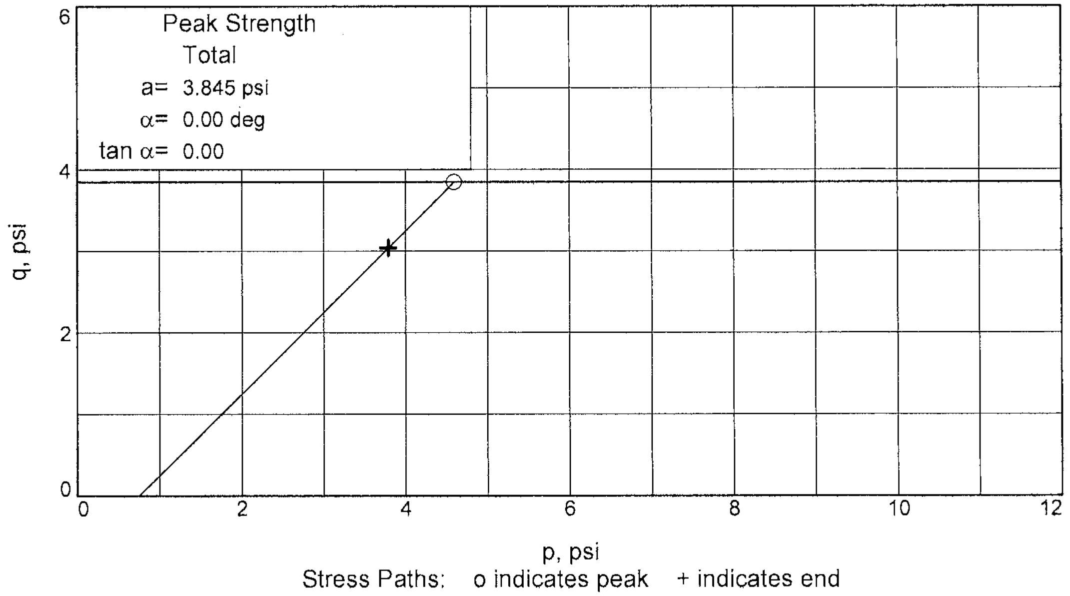
Tested By: FCE **Checked By:** GS











Client: AEP

Project: ROCKPORT PLANT IMPROVEMENT CERTIFICATION

Source of Sample: B-2 **Depth:** 10-12' **Sample Number:** ST-2

Project No.: N4155126 **Exhibit** ________

Terracon, Inc.

Tested By: FCE **Checked By:** GS

Exhibit B-31

APPENDIX C
SUPPORTING DOCUMENTS

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING

Auger	**Split Spoon**
Shelby Tube	**Macro Core**
Ring Sampler	**Rock Core**
Grab Sample	**No Recovery**

WATER LEVEL

▽	**Water Initially Encountered**
▽	**Water Level After a Specified Period of Time**
▼	**Water Level After a Specified Period of Time**

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

(HP)	**Hand Penetrometer**
(T)	**Torvane**
(b/f)	**Standard Penetration Test (blows per foot)**
(PID)	**Photo-Ionization Detector**
(OVA)	**Organic Vapor Analyzer**

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.			**CONSISTENCY OF FINE-GRAINED SOILS** (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength, Qu, tsf**	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**
Very Loose	0 - 3	0 - 6	Very Soft	less than 0.25	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	0.25 to 0.50	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium-Stiff	0.50 to 1.00	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	1.00 to 2.00	8 - 15	10 - 18
Very Dense	> 50	≥ 99	Very Stiff	2.00 to 4.00	15 - 30	19 - 42
			Hard	> 4.00	> 30	> 42

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

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Exhibit C-1

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]					Soil Classification	
					Group Symbol	Group Name[B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines[C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$[E]		GW	Well-graded gravel[F]
			$Cu < 4$ and/or $1 > Cc > 3$[E]		GP	Poorly graded gravel[F]
		Gravels with Fines: More than 12% fines[C]	Fines classify as ML or MH		GM	Silty gravel[F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel[F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines[D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$[E]		SW	Well-graded sand[I]
			$Cu < 6$ and/or $1 > Cc > 3$[E]		SP	Poorly graded sand[I]
		Sands with Fines: More than 12% fines[D]	Fines classify as ML or MH		SM	Silty sand[G,H,I]
			Fines classify as CL or CH		SC	Clayey sand[G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	$PI > 7$ and plots on or above "A" line[J]		CL	Lean clay[K,L,M]
			$PI < 4$ or plots below "A" line[J]		ML	Silt[K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay[K,L,M,N]
			Liquid limit - not dried			Organic silt[K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay[K,L,M]
			PI plots below "A" line		MH	Elastic Silt[K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay[K,L,M,P]
			Liquid limit - not dried			Organic silt[K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $$Cu = D_{60}/D_{10} \qquad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] $PI \geq 4$ and plots on or above "A" line.

[O] $PI < 4$ or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.

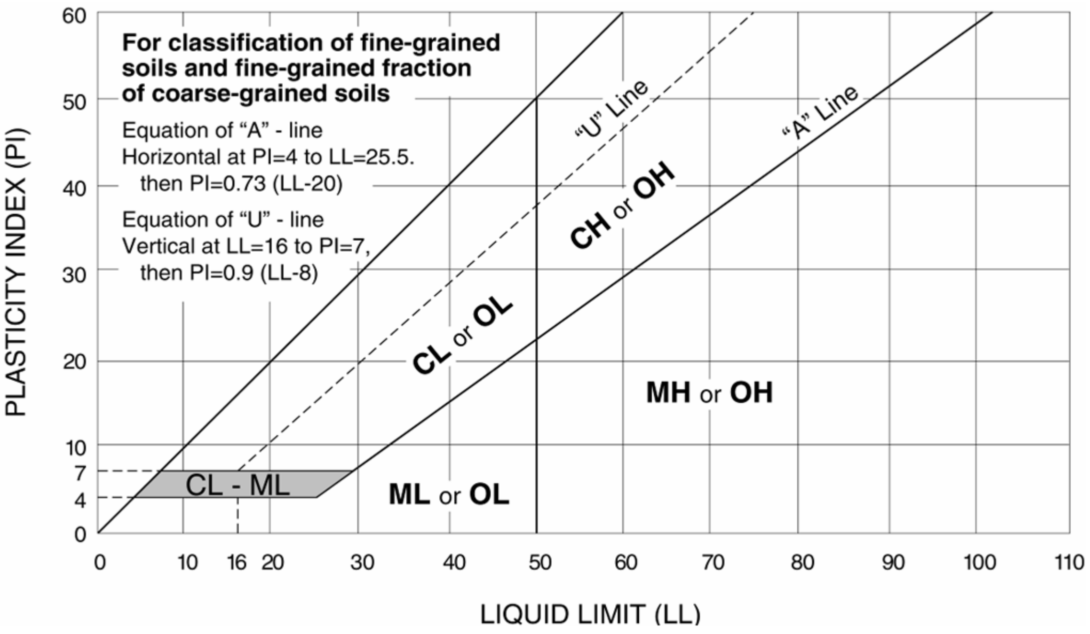
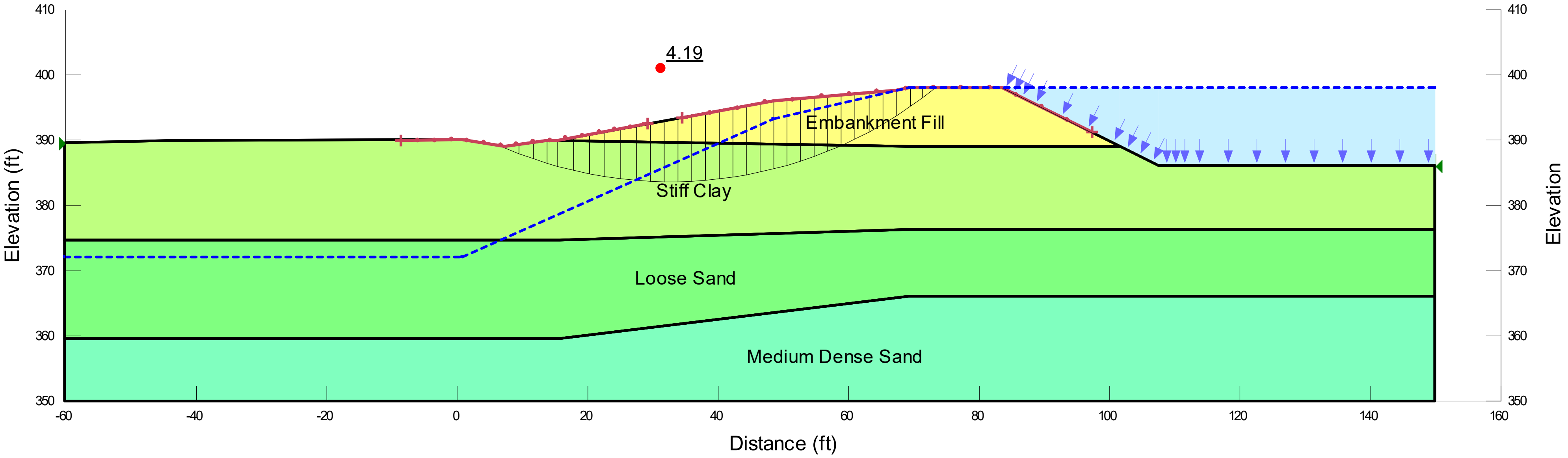


Exhibit C-2

APPENDIX D
SLOPE STABILITY ANALYSES

MAXIMUM SURCHARGE POOL WATER LEVEL: EXTERIOR



Name: Embankment Fill Unit Weight: 130 pcf Cohesion': 50 psf Phi': 29 ° Piezometric Line: 1
Name: Stiff Clay Unit Weight: 123 pcf Cohesion': 50 psf Phi': 34 ° Piezometric Line: 1
Name: Loose Sand Unit Weight: 115 pcf Cohesion': 0 psf Phi': 30 ° Piezometric Line: 1
Name: Medium Dense Sand Unit Weight: 123 pcf Cohesion': 0 psf Phi': 33 ° Piezometric Line: 1

Method: Spencer

Project Manager:	KME	**Project No.**	N4155126
Drawn by:	AKB	**Scale:**	N.T.S.
Checked by:	KME	**File Name:**	N4155126SS
Approved by:	KME	**Date:**	Jan 2016

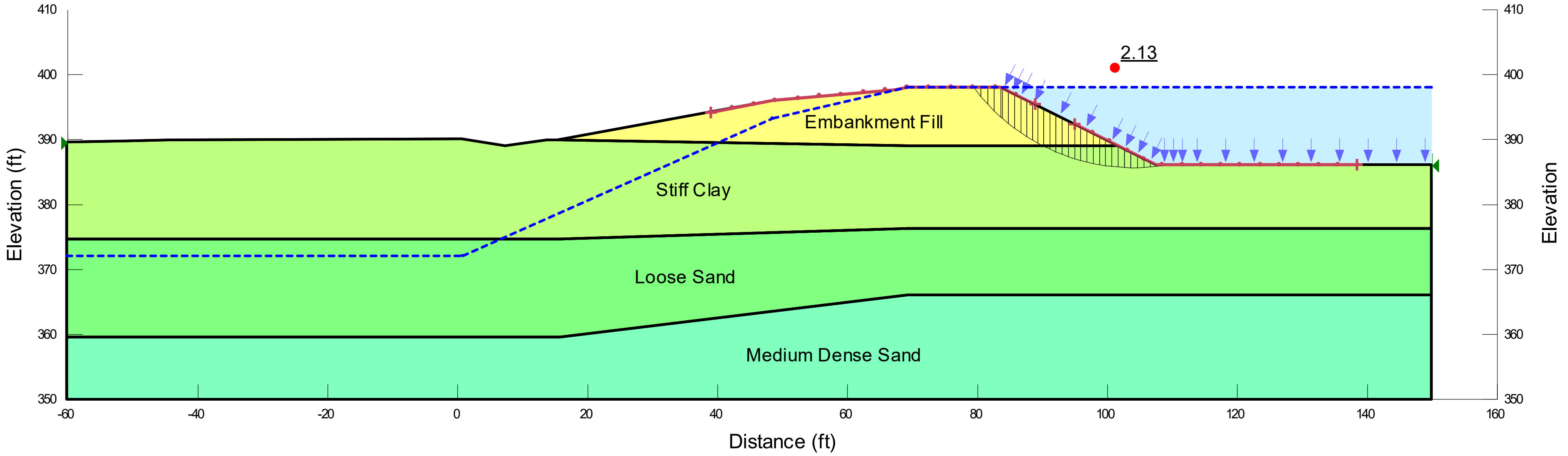
Terracon
Consulting Engineers & Scientists
800 Morrison Road Columbus, Ohio 43230
PH. (614) 863-3113 FAX. (614) 863-0475

SLOPE/W MODEL SECTION A-A'

AMERICAN ELECTRIC POWER
AEP ROCKPORT BOTTOM ASH COMPLEX PE CERTIFICATION
ROCKPORT, INDIANA

Exhibit
D-1

MAXIMUM SURCHARGE POOL WATER LEVEL: INTERIOR



Name: Embankment Fill Unit Weight: 130 pcf Cohesion': 50 psf Phi': 29 ° Piezometric Line: 1
Name: Stiff Clay Unit Weight: 123 pcf Cohesion': 50 psf Phi': 34 ° Piezometric Line: 1
Name: Loose Sand Unit Weight: 115 pcf Cohesion': 0 psf Phi': 30 ° Piezometric Line: 1
Name: Medium Dense Sand Unit Weight: 123 pcf Cohesion': 0 psf Phi': 33 ° Piezometric Line: 1

Method: Spencer

Project Manager: KME
Drawn by: AKB
Checked by: KME
Approved by: KME

Project No. N4155126
Scale: N.T.S.
File Name: N4155126SS
Date: Jan 2016

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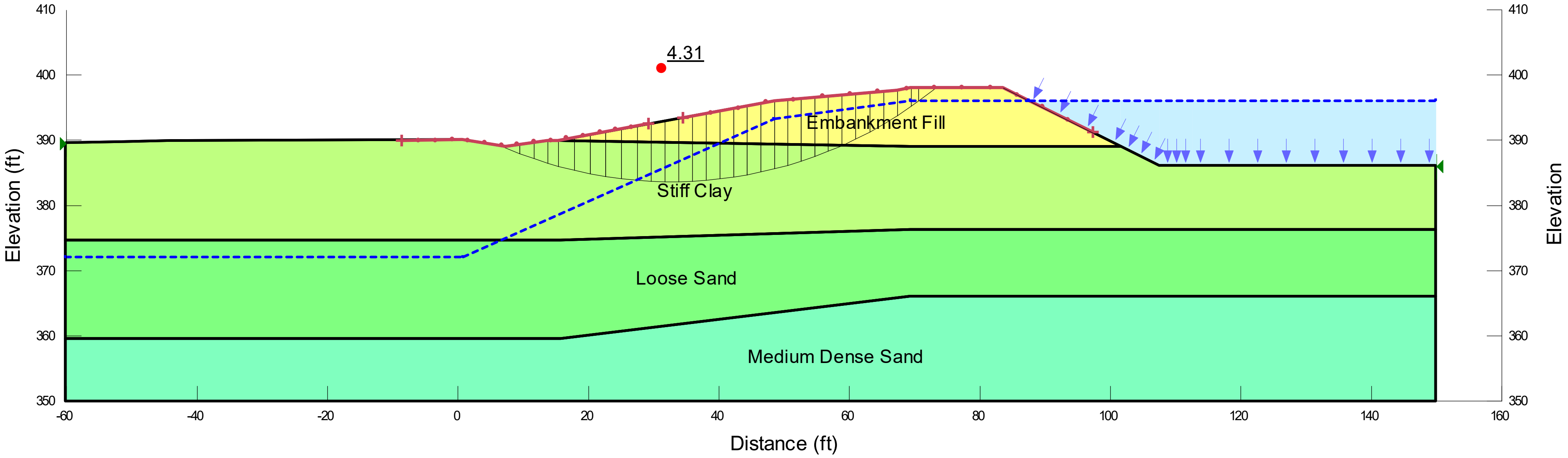
SLOPE/W MODEL SECTION A-A'
AMERICAN ELECTRIC POWER
AEP ROCKPORT BOTTOM ASH COMPLEX PE CERTIFICATION
ROCKPORT, INDIANA

Exhibit
D-2

MAXIMUM STORAGE POOL WATER LEVEL: EXTERIOR



Name: Embankment Fill Unit Weight: 130 pcf Cohesion': 50 psf Phi': 29 ° Piezometric Line: 1
Name: Stiff Clay Unit Weight: 123 pcf Cohesion': 50 psf Phi': 34 ° Piezometric Line: 1
Name: Loose Sand Unit Weight: 115 pcf Cohesion': 0 psf Phi': 30 ° Piezometric Line: 1
Name: Medium Dense Sand Unit Weight: 123 pcf Cohesion': 0 psf Phi': 33 ° Piezometric Line: 1

Method: Spencer

Project Manager: KME	Project No. N4155126
Drawn by: AKB	Scale: N.T.S.
Checked by: KME	File Name: N4155126SS
Approved by: KME	Date: Jan 2016

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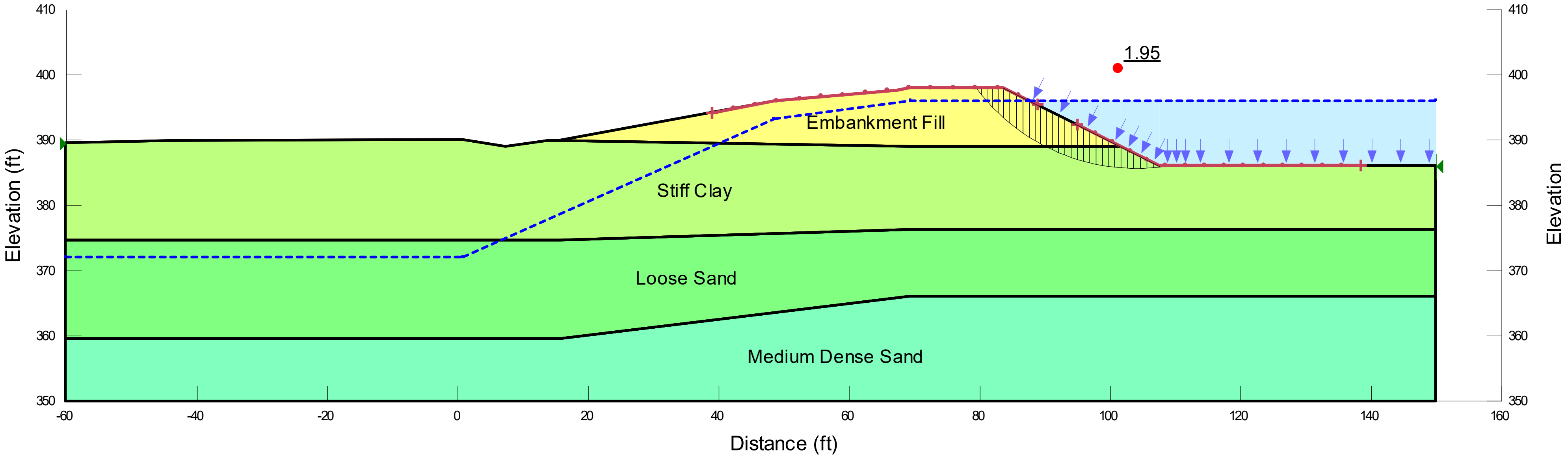
SLOPE/W MODEL SECTION A-A'

AMERICAN ELECTRIC POWER
AEP ROCKPORT BOTTOM ASH COMPLEX PE CERTIFICATION
ROCKPORT, INDIANA

Exhibit
D-3

MAXIMUM STORAGE POOL WATER LEVEL: INTERIOR



Name: Embankment Fill Unit Weight: 130 pcf Cohesion': 50 psf Phi': 29 ° Piezometric Line: 1
Name: Stiff Clay Unit Weight: 123 pcf Cohesion': 50 psf Phi': 34 ° Piezometric Line: 1
Name: Loose Sand Unit Weight: 115 pcf Cohesion': 0 psf Phi': 30 ° Piezometric Line: 1
Name: Medium Dense Sand Unit Weight: 123 pcf Cohesion': 0 psf Phi': 33 ° Piezometric Line: 1

Method: Spencer

Project Manager:	KME
Drawn by:	AKB
Checked by:	KME
Approved by:	KME
Project No.	N4155126
Scale:	N.T.S.
File Name:	N4155126SS
Date:	Jan 2016

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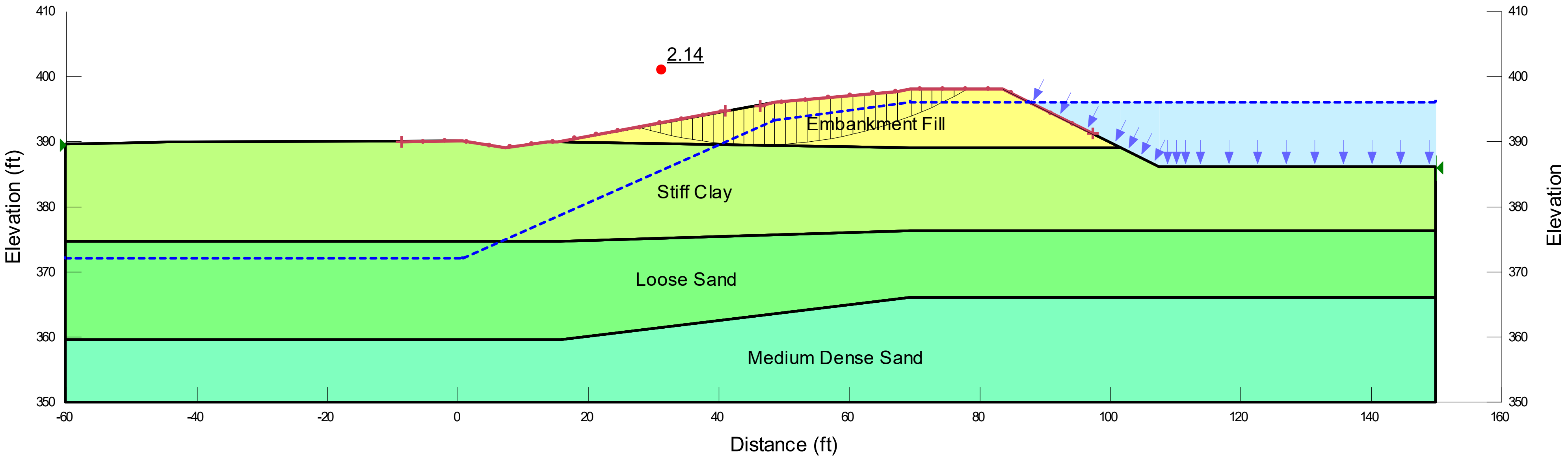
SLOPE/W MODEL SECTION A-A’
AMERICAN ELECTRIC POWER
AEP ROCKPORT BOTTOM ASH COMPLEX PE CERTIFICATION
ROCKPORT, INDIANA

Exhibit
D-4

MAXIMUM STORAGE POOL WATER LEVEL (SEISMIC): EXTERIOR



Name: Embankment Fill Unit Weight: 130 pcf Cohesion': 50 psf Phi': 29 ° Piezometric Line: 1
Name: Stiff Clay Unit Weight: 123 pcf Cohesion': 50 psf Phi': 34 ° Piezometric Line: 1
Name: Loose Sand Unit Weight: 115 pcf Cohesion': 0 psf Phi': 30 ° Piezometric Line: 1
Name: Medium Dense Sand Unit Weight: 123 pcf Cohesion': 0 psf Phi': 33 ° Piezometric Line: 1

Method: Spencer

Project Manager:	KME	**Project No.**	N4155126
Drawn by:	AKB	**Scale:**	N.T.S.
Checked by:	KME	**File Name:**	N4155126SS
Approved by:	KME	**Date:**	Jan 2016

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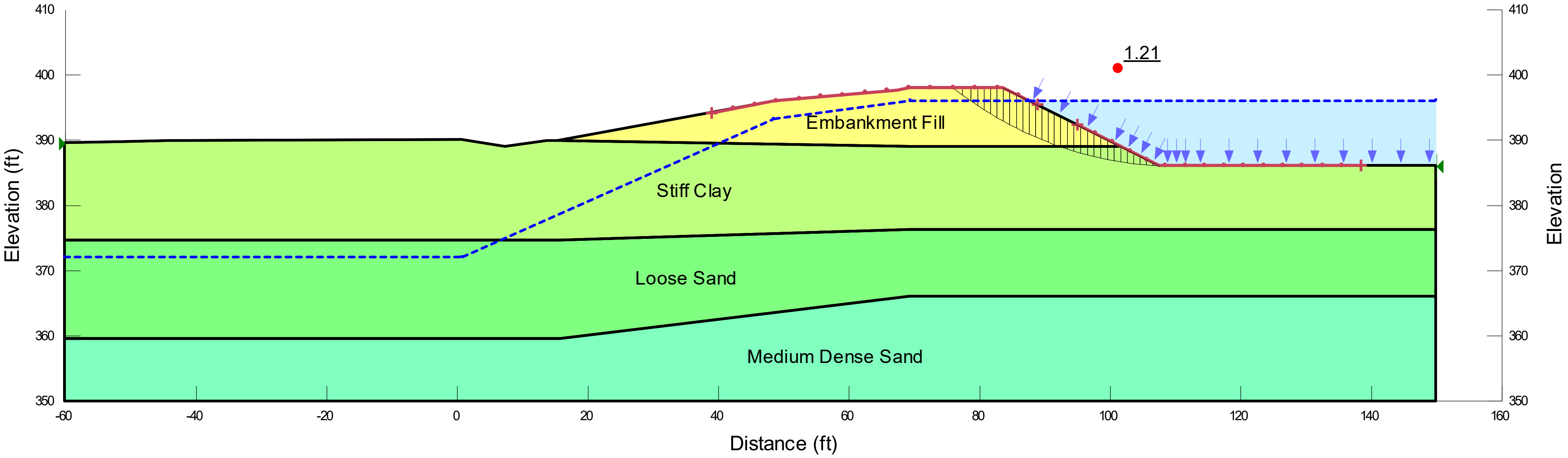
SLOPE/W MODEL SECTION A-A’

AMERICAN ELECTRIC POWER
AEP ROCKPORT BOTTOM ASH COMPLEX PE CERTIFICATION
ROCKPORT, INDIANA

Exhibit
D-5

MAXIMUM STORAGE POOL WATER LEVEL (SEISMIC): INTERIOR



Name: Embankment Fill Unit Weight: 130 pcf Cohesion': 50 psf Phi': 29 ° Piezometric Line: 1
Name: Stiff Clay Unit Weight: 123 pcf Cohesion': 50 psf Phi': 34 ° Piezometric Line: 1
Name: Loose Sand Unit Weight: 115 pcf Cohesion': 0 psf Phi': 30 ° Piezometric Line: 1
Name: Medium Dense Sand Unit Weight: 123 pcf Cohesion': 0 psf Phi': 33 ° Piezometric Line: 1

Method: Spencer

Project Manager:	KME
Drawn by:	AKB
Checked by:	KME
Approved by:	KME

Project No.	N4155126
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SLOPE/W MODEL SECTION A-A'
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Exhibit
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APPENDIX E
PHOTO LOG

Photo 1: West Bottom Ash Pond, west dike: exterior slope (facing north).

Photo 2: West Bottom Ash Pond, west dike: exterior slope (facing south).

Photo 3: West Bottom Ash Pond, west dike: ponded water at exterior toe.

Photo 4: West Bottom Ash Pond, west dike: crest and interior slope (facing south).

Photo 5: West Bottom Ash Pond, west dike: crest and interior slope (facing north).

Photo 6: West Bottom Ash Pond, west dike: bottom ash pond interior.

Photo 7: West Bottom Ash Pond, west dike: bottom ash pond interior.