Cynthia Vodopivec
Electric Energy, Inc.
Luminant
6555 Sierra Dr.
Irving, TX 75039

November 24, 2020

Sent via email

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

Re: Joppa Power Station Revised Alternative Closure Demonstration

Dear Administrator Wheeler:

Electric Energy, Inc. (Electric Energy) submits this revised 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)(2) for the East Ash Pond located at the Joppa Power Station near Joppa, Illinois. Electric Energy is requesting an extension pursuant to 40 C.F.R. § 257.103(f)(2) so that the East Ash Pond may continue to receive CCR and non-CCR wastestreams after April 11, 2021, and complete closure no later than October 17, 2028.

The enclosed demonstration prepared by Burns & McDonnell replaces the demonstration that was previously submitted by Electric Energy to EPA on November 16, 2020. This demonstration addresses all of the criteria in 40 C.F.R. § 257.103(f)(2)(i)-(iv) and contains the documentation required by 40 C.F.R. § 257.103(f)(2)(v). 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. The demonstration is also available on Electric Energy's publicly available website: https://www.luminant.com/ccr/

Sincerely,

Cynthia Vodopivec
VP - Environmental Health & Safety

Enclosure

cc: Kirsten Hillyer
Frank Behan
Richard Huggins

CCR Surface Impoundment Demonstration for a Site-Specific Alternative to Initiation of Closure Deadline

Electric Energy, Inc.

Joppa Power Station
Project No. 122702

Revision 2
11/24/2020

CCR Surface Impoundment Demonstration for a Site-Specific Alternative to Initiation of Closure Deadline

prepared for

Electric Energy, Inc.
Joppa Power Station
Joppa, Illinois

Project No. 122702

Revision 2
11/24/2020

prepared by

Burns & McDonnell Engineering Company, Inc.
Kansas City, Missouri

INDEX AND CERTIFICATION

Electric Energy, Inc.
CCR Surface Impoundment
Demonstration for a Site-Specific Alternative to Initiation of Closure Deadline
Project No. 122702

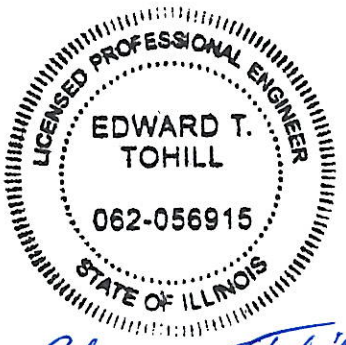
Report Index

Certification

I hereby certify, as a Professional Engineer in the state of Illinois, that the information in this document as noted in the above Report Index was assembled under my direct personal charge. This report is not intended or represented to be suitable for reuse by the Electric Energy, Inc. or others without specific verification or adaptation by the Engineer.

Edward T. Tohill, P.E., (Illinois License No. 062-056915)

Date: 11/24/20



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LIST OF ABBREVIATIONS

Abbreviation	Term/Phrase/Name
CCR	Coal Combustion Residual
CFR	Code of Federal Regulations
Electric Energy	Electric Energy, Inc.
ELG Rule	Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category
EPA	Environmental Protection Agency
IDNR	Illinois Department of Natural Resources
Joppa	Joppa Power Station
OWS	Office of Water Resources
POTW	Publicly Owned Treatment Works
PSD	Prevention of Significant Deterioration
RCRA	Resource Conservation and Recovery Act
SWPPP	Stormwater Pollution Prevention Plan
TSS	total suspended solids

1.0 EXECUTIVE SUMMARY

Electric Energy, Inc. (Electric Energy) 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)(2) —"Permanent Cessation of a Coal-Fired Boiler(s) by a Date Certain"— for the East Ash Pond located at the Joppa Power Station (Joppa) in Illinois. The East Ash Pond is a 111-acre CCR surface impoundment used to manage CCR and non-CCR wastestreams at Joppa. As discussed herein, the six boilers at the station will cease coal-fired operations no later than December 31, 2025, and the impoundment will complete closure no later than October 17, 2028. Therefore, Electric Energy is requesting an extension pursuant to 40 C.F.R. § 257.103(f)(2) so that the East Ash Pond may continue to receive CCR and non-CCR waste streams after April 11, 2021, and complete closure no later than October 17, 2028.

2.0 INTRODUCTION

Joppa is an 802-megawatt, six-unit coal-fueled electric generating station near Joppa, Illinois. The Joppa facility includes a CCR unit (the East Ash Pond) that is the subject of this demonstration. Joppa utilizes the 111-acre East Ash Pond to manage sluiced bottom ash, economizer ash, non-marketable dry fly ash (when not hauled offsite for beneficial use), dredged material from the settling lagoon and cooling water intake, and non-CCR wastewaters. The northern portion of the East Ash Pond was constructed in 1973, and the southern portion of the East Ash Pond was constructed between the years of 1977 and 1985. The East Ash Pond is considered to be a single perched impoundment with an internal separator dike creating the northern portion and the southern portion. The two portions are hydraulically connected by a 36-inch HDPE pipe culvert, which allows water to flow from the southern portion of the pond to the northern portion and ultimately discharge via the permitted outfall. The top of dam elevation of the perimeter embankment is nearly constant around the structure, while the separation dike was constructed at a lower elevation and is maintained slightly lower. The Illinois Department of Natural Resources (IDNR) Office of Water Resources (OWR) – Dam Safety Section regulates the ash pond structure pursuant to 615 ILCS 5/23, 23a and 35. The OWR considers the Joppa East Ash Pond to be a single structure containing two sub-basins for regulatory purposes. Regardless, the north and south sub-basins are both larger than 40 acres[1] meaning that either of them individually, or both of them together as one unit, would still qualify for closure timeframe allowed at 40 C.F.R. § 257.103(f)(2)(iv)(B).

The various non-CCR wastewaters routed to the East Ash Pond originate from the water treatment floor drains, demineralizer regeneration flows, reverse osmosis reject, and stormwater. A site plan is provided on Figure 1 in Appendix A, and the plant water balance diagram is included in Appendix B. Note that the East Ash Pond is referred to as the Ash Pond on the water balance diagram.

On April 17, 2015, the Environmental Protection Agency (EPA) issued the federal Coal Combustion Residual (CCR) Rule, 40 C.F.R. Part 257, Subpart D, to regulate the disposal of CCR materials generated at coal-fueled units. The rule is being administered under Subtitle D of the Resource Conservation and Recovery Act (RCRA, 42 U.S.C. § 6901 et seq.). On August 28, 2020, the EPA Administrator issued revisions to the CCR Rule that require all unlined surface impoundments to initiate closure by April 11, 2021, unless an alternative deadline is requested and approved. 40 C.F.R. § 257.101(a)(1) (85 Fed. Reg. 53,516 (Aug. 28, 2020)). Specifically, owners and operators of a CCR surface impoundment may continue

[1]Table 4 of the History of Construction (AECOM, October 2016) notes surface areas for the North Sub-Basin and South Sub-Basin as 31.8 acres and 63.4 acres, respectively. These areas indicate water storage areas used in the hydraulic analysis and are not representative of the total footprint of each basin.

to receive CCR and non-CCR wastestreams if the facility will cease operation of the coal-fired boiler(s) and complete closure of the impoundments within certain specified timeframes. 40 C.F.R. § 257.103(f)(2). To qualify for an alternative closure deadline under § 257.103(f)(2), a facility must meet the following four criteria:

1. **§ 257.103(f)(2)(i)** – No alternative disposal capacity is available on-site or off-site. An increase in costs or the inconvenience of existing capacity is not sufficient to support qualification.
2. **§ 257.103(f)(2)(ii)** - Potential risks to human health and the environment from the continued operation of the CCR surface impoundment have been adequately mitigated;
3. **§ 257.103(f)(2)(iii)** - The facility is in compliance with the CCR rule, including the requirement to conduct any necessary corrective action; and
4. **§ 257.103(f)(2)(iv)** - The coal-fired boilers must cease operation and closure of the impoundment must be completed within the following timeframes:
    a. For a CCR surface impoundment that is 40 acres or smaller, the coal-fired boiler(s) must cease operation and the CCR surface impoundment must complete closure no later than October 17, 2023.
    b. For a CCR surface impoundment that is larger than 40 acres, the coal-fired boiler(s) must cease operation, and the CCR surface impoundment must complete closure no later than October 17, 2028.

Section 257.103(f)(2)(v) sets out the documentation that must be provided to EPA to demonstrate that the four criteria set out above have been met. Therefore, this demonstration is organized based on the documentation requirements of §§ 257.103(f)(2)(v)(A) – (D).

3.0 DOCUMENTATION OF NO ALTERNATIVE DISPOSAL CAPACITY

To demonstrate that the criteria in § 257.103(f)(2)(i) has been met, the following provides documentation that no alternative disposal capacity is currently available on-site or off-site for each CCR and non-CCR wastestream that IPRG seeks to continue placing into the Ash Pond after April 11, 2021. Consistent with the regulations, neither an increase in costs nor the inconvenience of existing capacity was used to support qualification under this criteria. Instead, as EPA explained in the preamble to the proposed Part A revisions, "it would be illogical to require [] facilities [ceasing power generation] to construct new capacity to manage CCR and non-CCR wastestreams." 84 Fed. Reg. 65,941, 65,956 (Dec. 2, 2019). EPA again reiterated in the preamble to the final revisions that "[i]n contrast to the provision under § 257.103(f)(1), the owner or operator does not need to develop alternative capacity because of the impending closure of the coal fired boiler. Since the coal-fired boiler will shortly cease power generation, it would be illogical to require these facilities to construct new capacity to manage CCR and non-CCR wastestreams." 85 Fed. Reg. at 53,547. Thus, new construction or the development of new alternative disposal capacity was not considered a viable option for any wastestream discussed below.

3.1 Site-Layout and Wastewater Processes

The East Ash Pond receives all CCR sluice flows and a portion of the non-CCR wastewater flows onsite. Many of the remaining plant process flows are routed through the Settling Lagoon for treatment, as shown in Appendix B. The Settling Lagoon is not authorized to receive the CCR sluice flows and is not large enough to independently treat the total volume of the plant process water flows. The Settling Lagoon is 3.15 acres and has a capacity of approximately 10.3 million gallons. The pond located northwest of the closed West Ash Pond system on Figure 1 is the station's permitted and active sanitary sewage treatment pond, which is not permitted to accept any other wastestreams. Electric Energy constructed a new off-site CCR landfill in 2009 to receive scrubber by-products; however, the landfill was never made operational and is unable to receive sluiced materials. The landfill is currently unusable due to the deterioration of the landfill cell freeze protection layer and damage to the leachate collection system and cell perimeter berms. Additionally, since the landfill has never been operated, a landfill operator, leachate hauling contractor, and leachate disposal facility have not been retained.

3.2 CCR Wastestreams

Electric Energy evaluated each CCR wastestream placed in the East Ash Pond at Joppa. For the reasons discussed below in Table 3-1, each of the following CCR wastestreams must continue to be placed in the East Ash Pond at Joppa due to lack of alternative capacity both on and off-site.

Table 3-1: Joppa CCR Wastestreams

CCR Wastestreams	Estimated Average Flow (MGD)	Alternative Capacity Currently Available? YES/NO	Details
Bottom Ash, Economizer Ash, and non-CCR mill rejects Sluice	6.2	NO	Alternative capacity is not currently available on or off-site and would have to be developed. Alternative capacity would need to be designed, permitted, and installed on-site. Off-site alternative capacity would include development of on-site temporary tanks to support transport of sluice material offsite for disposal. Refer to the discussion below for a more detailed evaluation on the development of alternative capacity.
Unmarketable Dry Fly Ash (includes air heater ash)	NA (Dry) 5,300 tons/year in 2019; minimal projected in upcoming years due to a change in ash marketer and more aggressive marketing efforts.	NO	Fly ash is collected dry and is conditioned and disposed in the East Ash Pond intermittently when not hauled offsite for beneficial use. In 2019, approximately 95% of the fly ash was beneficially reused off-site. Electric Energy changed ash marketers in January 2020 and is currently marketing 100% of the fly ash for beneficial reuse off-site. As a result, unmarketable fly ash is projected to be minimal for the remainder of 2020 and over the next several years. Electric Energy does not have a CCR landfill or another CCR surface impoundment located onsite that is available or ready to accept this material. Consequently, there are currently no on-site alternatives for this wastestream, and alternative capacity would need to be designed, permitted, and installed. As discussed above, the offsite CCR landfill constructed for Joppa in 2009 is inactive and would require significant repairs and/or improvements prior to receiving CCR material. Off-site alternative capacity is not currently available and is not considered a feasible option. Refer to the discussion below for a more detailed evaluation on the development of alternative capacity.

Electric Energy evaluated the following on-site and off-site alternative capacity options for these CCR wastestreams:

- Dry fly ash (includes air heater ash; approximately 5,300 tons disposed in East Ash Pond in 2019, but reduced to minimal disposal in 2020):
  - On-site alternative capacity is currently not available and would need to be developed. It should be noted that the landfill located on-site is currently not authorized to accept this wastestream. As previously discussed, the landfill is currently unusable due to the deterioration of the landfill cell freeze protection layer and damage to the leachate collection system and cell perimeter berms. Additionally, since the landfill has never been operated, Electric Energy does not have a landfill operator, leachate hauling contractor, and leachate disposal facility available.
  - Off-site alternative capacity is currently not available and would need to be developed. It should be noted that Electric Energy changed ash marketers in January 2020 and is currently marketing 100% of the fly ash for beneficial reuse off-site. As a result, unmarketable fly ash is projected to be minimal, both in 2020 and over the next several years. Developed off-site alternative capacity for any potential unmarketable fly ash would potentially consist of off-site transportation to a contracted landfill. The unmarketable fly ash is conditioned (to ~10% moisture) in an on-site pug mill, and this low-sulfur Powder River Basin Class C fly ash develops cementitious characteristics when conditioned with water rather quickly. Because of this, and based on the experience of our ash marketers, off-site transportation must be limited to less than a one-hour haul time, or within 40 miles of the station, to prevent the fly ash from setting up and hardening and causing adverse disposal/unloading issues at the offsite landfill. Based on our survey, municipal landfills are not located within 40 miles of the station (see Figure 2 in Appendix A).
- Bottom ash, economizer ash, and non-CCR mill rejects sluice (6.2 MGD):
  - On-site alternative capacity is currently not available and would need to be developed. The Settling Lagoon and sanitary sewage treatment pond are not a CCR surface impoundments and cannot receive CCR materials.
  - Development of on-site alternative capacity would require the design, permitting, and installation of a new treatment system including CCR ponds, clarifiers, and/or storage tank(s), to provide the necessary retention time to meet the NPDES permit limits. The environmental permitting would include a modification to the current individual NPDES permit (to allow for the rerouting of this wastestream to another outfall), general NPDES stormwater construction permit (includes threatened and endangered species and historic preservation assessments), a construction & operating permit under the Illinois CCR rule (35 IAC 845), and a Stormwater

Pollution Prevention Plan (SWPPP) at a minimum. Based on our experience with environmental permitting, this effort could require three to four years.

- Off-site alternative capacity is currently not available and would need to be developed. Developed off-site alternative capacity would consist of both temporary on-site wet storage (frac tanks), and off-site transportation, via tanker trucks. With an average daily flow of 6.2 MGD of sluice water, approximately 295 frac tanks and 827 daily tanker trucks (~7500 gallons per truck to maintain DOT weight restrictions) would be required, if a Publicly Owned Treatment Works (POTW) could be identified to receive it. The daily tanker truck traffic would result in increased potential for safety and noise impacts and further increases in fugitive dust, greenhouse gas emissions and carbon footprint which may require a PSD permit and modification under the Clean Air Act Permit Program if the calculated increases in emissions are over the PSD limits. Setting up contractual arrangements for a local POTW to accept the sandy wastewater would prove to be difficult since this amount of wastewater would most likely upset their treatment systems causing them to exceed their NPDES discharge limits. The potential for leaks/spills from the tank system or transportation of the wastewater offsite exist as well. Furthermore, the temporary wet storage needed to accommodate off-site disposal would require reconfiguration, design, installation, and associated environmental permitting which would require a minimum of three years to implement. For all of these reasons, Electric Energy has determined that offsite disposal is not feasible for these flows at Joppa.

As stated previously, because Electric Energy has elected to pursue the option to permanently cease coal-fired operations of the six boilers at the station by no later than December 31, 2025, developing alternative disposal capacity is "illogical," to use EPA's words, and also counterproductive to the work to cease coal-fired operations of the boilers and close the impoundments. As long as Electric Energy continues to wet handle the bottom ash, economizer ash, and mill reject materials, there are no other onsite CCR impoundments to receive and treat these flows and it is not feasible to dispose of the wet-handled material offsite. 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) ("[W]hile it is possible to transport dry ash off-site to [an] alternate disposal facility that is simply not feasible for wet-generated CCR. Nor can facilities immediately convert to dry handling systems."). As a result, the conditions at Joppa satisfy the demonstration requirement in § 257.103(f)(2)(i).

Consequently, in order to continue to operate and generate electricity, Joppa must continue to use the 111-acre CCR surface impoundment to manage the CCR wastestreams discussed above. Accordingly, the projected minimal amounts of non-marketable fly ash must be placed in the only available onsite disposal location (i.e., the East Ash Pond) when not hauled offsite for beneficial use due to seasonal market impacts.

3.3 Non-CCR Wastestreams

Electric Energy evaluated each non-CCR wastestream placed in the East Ash Pond at Joppa. For the reasons discussed below in Table 3-2, each of the following non-CCR wastestreams must continue to be placed in the East Ash Pond at Joppa due to lack of alternative capacity both on and off-site.

Table 3-2: Joppa Non-CCR Wastestreams

Non-CCR Wastestreams	Estimated Average Flow (MGD)	Alternative Capacity Currently Available? YES/NO	Details
Settling Lagoon and Cooling Water Intake Dredged Material	0.96 during intermittent dredging operations	NO	The Settling Lagoon and cooling water intake require dredging to ensure the capacity of the systems are maintained. The dredged material is then placed in the East Ash Pond. This stream requires significant retention time for TSS removal to meet the permitted discharge limits. Currently, alternative capacity is not available on or off-site and would have to be developed. Alternative capacity would need to be designed, permitted, and installed on-site. Off-site alternative capacity would include development of on-site temporary tanks to support transport of this material offsite for disposal. Refer to the discussion below for a more detailed evaluation on the development of alternative capacity.
Water Treatment Building Floor Drains (including wash waters and demineralizer regeneration flows)	0.05	NO	Currently, alternative capacity is not available on or off-site and would have to be developed. Alternative capacity would need to be designed, permitted, and installed on-site. Off-site alternative capacity would include development of on-site temporary tanks to support transport of this material offsite for disposal. Refer to the discussion below for a more detailed evaluation on the development of alternative capacity.

Non-CCR Wastestreams	Estimated Average Flow (MGD)	Alternative Capacity Currently Available? YES/NO	Details
Reverse Osmosis Reject	0.2	YES	As required by the NPDES permit, this wastestream is currently piped to both the East Ash Pond and Settling Lagoon. The Settling Lagoon will serve as the alternative disposal capacity for this wastestream after April 11, 2021.

The reverse osmosis reject wastewater can be discharged to the Settling Lagoon, as allowed by the NPDES permit. The Settling Lagoon serves as current and practical alternative disposal capacity for this wastestream; therefore, it is not a part of this request. Electric Energy evaluated the following on-site and off-site alternative capacity options for the remaining non-CCR wastestreams:

- Settling lagoon and cooling water intake dredged material (0.96 MGD during discharge):
  - On-site alternative capacity is currently not available and would need to be developed. The East Ash Pond is the only impoundment onsite that can receive this flow and provide adequate retention time for treatment to remove the total suspended solids (TSS) and comply with the site NPDES discharge permit limits.
  - Development of on-site alternative capacity would require the design, permitting, and installation of a new treatment system including non-CCR ponds, clarifiers, and/or storage tank(s), to provide the necessary retention time for TSS removal to meet the NPDES permit limits. The environmental permitting would include a modification to the current individual NPDES permit (to allow for the rerouting of this wastestream to another outfall); general NPDES stormwater construction permit; a construction & operating permit, and a SWPPP at a minimum.
  - Off-site alternative capacity is currently not available and would need to be developed. Off-site alternative capacity would consist of both temporary on-site wet storage (frac tanks) and off-site transportation, via tanker trucks. Approximately 46 frac tanks and 128 daily tanker trucks (assuming 7,500 gallons per truck) would be required when discharging, if a local POTW could be identified to receive these flows. Setting up arrangements for a POTW to accept the wastewater would prove to be difficult since this large increase in flow could upset their treatment system causing them to exceed their NPDES discharge limits. The potential for leaks/spills from the tank system or transportation of the wastewater offsite exists as well. Furthermore, the temporary wet storage needed to accommodate off-site disposal would

require reconfiguration, design, installation, and associated environmental permitting which would require a minimum of three years to implement. For all of these reasons, Electric Energy has determined that offsite disposal is not feasible for these flows at Joppa.

- Water treatment building floor drains (including wash waters and demineralizer regeneration flows (0.05 MGD):
  - On-site alternative capacity is currently not available and would need to be developed. Rerouting this to the Settling Lagoon would require over 1,000 feet of new piping, a neutralization tank, and potentially new pumps and power supply. The environmental permitting would include a modification to the current individual NPDES permit (to allow for the rerouting of this wastestream to another outfall); general NPDES stormwater construction permit; a construction & operating permit, and a SWPPP at a minimum. This reroute would require a minimum of three years to design and implement.
  - Off-site alternative capacity is currently not available and would need to be developed. Developed off-site alternative capacity would consist of both temporary on-site wet storage (frac tanks) and off-site transportation, via tanker trucks. Approximately three frac tank and seven daily tanker trucks (assuming 7,500 gallons per truck) would be required, if a local POTW could be identified to receive it. Setting up arrangements for a POTW to accept the wastewater would prove to be difficult since this increase in flow and contaminants could upset their treatment system causing them to exceed their NPDES discharge limits. The potential for leaks/spills from the tank system or transportation of the wastewater offsite does exist. Furthermore, the temporary wet storage needed to accommodate off-site disposal would require reconfiguration, design, installation, and associated environmental permitting which would require a minimum of three years to implement. For all of these reasons, Electric Energy has determined that offsite disposal is not feasible for these flows at Joppa.

As stated previously, because Electric Energy has elected to pursue the option to permanently cease coal-fired operations of the six boilers at the station by no later than December 31, 2025, developing alternative disposal capacity is “illogical,” to use EPA’s words, and also counterproductive to the work to cease coal-fired operation of the boilers and close the impoundments. There is currently no existing installed infrastructure at the plant to support reroute of these flows (except the reverse osmosis reject). For the reasons discussed above, each of the remaining non-CCR wastestreams (except the reverse osmosis reject) must continue to be placed in the East Ash Pond due to lack of alternative capacity both on and off-site. Consequently, in order to continue to operate and generate electricity, Joppa must continue to use the 111-acre East Ash Pond to manage the non-CCR wastestreams discussed above.

4.0 RISK MITIGATION PLAN

To demonstrate that the criteria in § 257.103(f)(2)(ii) has been met, Electric Energy has prepared and attached a Risk Mitigation Plan for the Joppa East Ash Pond (see Attachment 1). Per § 257.103(f)(2)(v)(B), this Risk Mitigation Plan is only required for the specific CCR Unit(s) that are the subject of this demonstration.

5.0 DOCUMENTATION AND CERTIFICATION OF COMPLIANCE

In the Part A rule preamble, EPA reiterates that compliance with the CCR rule is a prerequisite to qualifying for an alternative closure extension, as it "provides some guarantee that the risks at the facility are properly managed and adequately mitigated." 85 Fed. Reg. at 53,543. EPA further stated that it "must be able to affirmatively conclude that facility meets this criterion prior to any continued operation." 85 Fed. Reg. at 53,543. Accordingly, EPA "will review a facility's current compliance with the requirements governing groundwater monitoring systems." 85 Fed. Reg. at 53,543. In addition, EPA will also "require and examine a facility's corrective action documentation, structural stability documents and other pertinent compliance information." 85 Fed. Reg. at 53,543. Therefore, EPA is requiring a certification of compliance and specific compliance documentation be submitted as part of the demonstration. 40 C.F.R. § 257.103(f)(2)(v)(C).

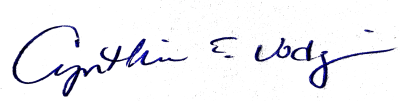
The Joppa facility includes a CCR unit (the East Ash Pond) that is the subject of this demonstration. The Joppa Power Station CCR Landfill referenced on the Joppa CCR compliance website requires a two to three-mile haul route from the Joppa site, across public roadways with several landowners located between the plant and the landfill site. As this CCR unit is not located on contiguous land, this unit is part of a separate facility. 40 C.F.R. § 257.53. Consequently, Electric Energy has not included compliance documents for this unit as part of this submittal for the Joppa facility.

To demonstrate that the criteria in § 257.103(f)(2)(iii) has been met, Electric Energy is submitting the following information as required by § 257.103(f)(2)(v)(C):

5.1 Owner's Certification of Compliance - § 257.103(f)(2)(v)(C)(1)

I hereby certify that, based on my inquiry of those persons who are immediately responsible for compliance with environmental regulations for Joppa, the facility is in compliance with all of the requirements contained in 40 C.F.R. Part 257, Subpart D – Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. The Joppa CCR compliance website is up-to-date and contains all the necessary documentation and notification postings.

On behalf of Electric Energy:



Cynthia Vodopivec
VP - Environmental Health & Safety
November 24, 2020

5.2 Visual representation of hydrogeologic information - § 257.103(f)(2)(v)(C)(2)

Consistent with the requirements of § 257.103(f)(2)(v)(C)(2)(i) – (iii), Electric Energy has attached the following items to this demonstration:

- Map(s) of groundwater monitoring well locations in relation to the CCR unit (Attachment 2)
- Well construction diagrams and drilling logs for all groundwater monitoring wells (Attachment 3)
- Maps that characterize the direction of groundwater flow accounting for seasonal variations (Attachment 4)

5.3 Groundwater monitoring results - § 257.103(f)(2)(v)(C)(3)

Tables summarizing constituent concentrations at each groundwater monitoring well through the first 2020 semi-annual monitoring period are included as Attachment 5. Samples were taken for the second 2020 semi-annual monitoring period, but results are still under review.

5.4 Description of site hydrogeology including stratigraphic cross-sections - § 257.103(f)(2)(v)(C)(4)

A description of the site hydrogeology and stratigraphic cross-sections of the site are included as Attachment 6.

5.5 Corrective measures assessment - § 257.103(f)(2)(v)(C)(5)

Background sampling began at Joppa in late 2015 and continued for eight consecutive quarters. The first semiannual detection monitoring samples were collected in November 2017. The first assessment monitoring samples were collected in June 2018. The results, through the 2020 monitoring period, indicate that the Joppa East Ash Pond is currently in assessment monitoring, with no exceedances of the Appendix IV parameters. Accordingly, an assessment of corrective measures is not currently required at the site. Joppa will continue to conduct groundwater monitoring in accordance with all state and federal requirements.

5.6 Remedy selection progress report - § 257.103(f)(2)(v)(C)(6)

As noted above, an assessment of corrective measures and the resulting selection of remedy is not currently required for the East Ash Pond.

5.7 Structural stability assessment - § 257.103(f)(2)(v)(C)(7)

Pursuant to § 257.73(d), the initial structural stability assessment for the East Ash Pond was prepared in October 2016 and is included as Attachment 7, as well as a memorandum which confirms the structural stability assessment.

5.8 Safety factor assessment - § 257.103(f)(2)(v)(C)(8)

Pursuant to § 257.73(e), the initial safety factor assessment for the East Ash Pond was prepared in October 2016 and is included as Attachment 8.

6.0 DOCUMENTATION OF CLOSURE COMPLETION TIMEFRAME

To demonstrate that the criteria in § 257.103(f)(2)(iv) has been met, "the owner or operator must submit the closure plan required by § 257.102(b) and a narrative that specifies and justifies the date by which they intend to cease receipt of waste into the unit in order to meet the closure deadlines." The closure plan for the East Ash Pond, along with an addendum, is included as Attachment 9.

In order for a CCR surface impoundment over 40 acres to continue to receive CCR and non-CCR wastestreams after the initial April 11, 2021 deadline, the coal-fired boiler(s) at the facility must cease operation and the CCR surface impoundment must complete closure no later than October 17, 2028. As discussed below, Joppa will begin construction of the East Ash Pond closure by October 17, 2025, the six boilers will cease coal-fired operations no later than December 31, 2025, and Joppa will cease placing wastestreams into the East Ash Pond no later than July 17, 2027, in order for closure to be completed by this deadline.

Table 6-1 is included below to summarize the major tasks and durations associated with closing the East Ash Pond in place. These durations are consistent with the durations experienced with the closure of approximately 500 acres of other CCR impoundments already completed by Electric Energy and its affiliates to date as noted below:

- Baldwin Fly Ash Pond System – 230 acres closed in-place with an approximate 30-month construction schedule
- Hennepin West Ash Ponds System – 35 acres closed in-place with an approximate 24-month construction schedule (includes closure by removal of an adjacent 6-acre settling pond and installing a sheet pile wall)
- Hennepin East Ash Ponds 2 and 4 – 25 acres closed in-place with an approximate 6-month construction schedule
- Coffeen Ash Pond 2 – 60 acres closed in-place with an approximate 24-month construction schedule
- Duck Creek Ash Ponds 1 and 2 – 130 acres closed in-place with an approximate 24-month construction schedule

Each CCR impoundment closure indicated above utilized a closely coordinated passive or gravity dewatering method, which consisted of the use of trenches excavated to lower the phreatic surface in portions of the impoundment to obtain a stable ash surface to permit the safe construction of the final cover system. The phreatic water in the trenches flows by gravity to sumps constructed within the impoundment.

The major benefit associated with this passive or gravity dewatering method is that the sumps are designed to provide holding time to allow the TSS to settle within the impoundment prior to discharge (an active dewatering method with wells would result in potential discharges of unsettled TSS). After solids settling, the water is discharged through the NPDES outfall in compliance with permitted limits.

Construction progressed sequentially as the dewatering of an area stabilized the ash surface. The CCR was graded to subgrade level, then overlain with the compacted clay layers and/or geomembrane liners. Vegetative soil cover was then placed on top of the infiltration layer. As each section of the impoundment was closed, this sequencing progressed to the completion of the pond closure. A similar process will be utilized to close the Joppa East Ash Pond in order to allow the final open section of the impoundment to be large enough for the impoundment to remain in operation until the pond ceases the receipt of waste on July 17, 2027. This would provide sufficient time for closure to be completed by October 17, 2028.

The first construction effort will involve modifying the pond operations by relocating the influent lines, minimizing the pond water levels, and isolating flow to a smaller portion of the current 111-acre impoundment that can be closed during the last two construction seasons. The smaller active portion of the pond will remain in operation while Electric Energy begins dewatering and closing the impoundment as described above. This reduction in footprint may require the addition of chemical feeds to provide adequate treatment but that has not been the case at our other sequenced closures. This approach simultaneously allows for continued operation of the plant to maintain generating capacity for the MISO markets and minimizes the risk to the environment both by minimizing the pond size and the potential for any impacts to groundwater and by opening up a significant portion of the remaining impoundment to allow for dewatering, grading, and closure (in Phase 1).

Table 6-1 provides estimates for the estimated durations required to close a portion of the pond footprint after the date noted to begin closure construction (Phase 1), as well as the current estimates for the closure of the active area (Phase 2, or the remaining 40-50 acres). In order to dewater the closure area, Electric Energy will likely release pond water through the existing Outfall 001.

Table 6-1: Joppa East Ash Pond Closure Schedule

Action	Estimated Timeline (Months)
Spec, bid, and Award Engineering Services for CCR Impoundment Closure	3
Finalize CCR unit closure plan and seek IEPA approval for CCR unit closure	12

Action	Estimated Timeline (Months)
Obtain environmental permits (based on IEPA approval of closure plan): • State Waste Pollution Control Construction/Operating Permit • NPDES Industrial Wastewater Permit Modification (*modification would be required to allow the associated ponded and subsurface free liquids generated before the pond closure to be discharged to Waters of the US and to allow reconfiguration of the various wastestreams to either other NPDES-permitted outfalls or newly-constructed NPDES-permitted outfalls*) • General NPDES Permit for Storm Water Discharges from Construction Site Activities and a SWPPP • Proposed 35 Ill. Admin Code 845 operating permit application is due NLT September 2021. Construction permit application is anticipated to be due NLT July 2022.	21
Spec, bid, and Award Construction Services for CCR Impoundment Closure	3
Begin Construction of Closure	October 17, 2025
Minimize Active Area of Impoundment / Dewater Phase 1 Area	6
Cease Coal-Fired Operations of the Six Boilers onsite (No Later Than)	December 31, 2025
Regrade CCR Material in Phase 1 Area	12
Install Cover System – Phase 1 Area*	7
Establish Vegetation – Phase 1 Area**	2
Cease Placement of Waste (No Later Than, allowing for plant cleanup and dredging of Settling Lagoon following coal pile and plant closure)	July 17, 2027
Dewater Impoundment – Phase 2 Area	3
Regrade CCR Material – Phase 2 Area	6
Install Cover System – Phase 2 Area	5

Action	Estimated Timeline (Months)
Establish Vegetation, Perform Site Restoration Activities, Complete Closure, and Initiate Post-Closure Care**	2
Total Estimated Time to Complete Closure	75 months
Date by Which Closure Must be Complete	October 17, 2028

* Activity expected to overlap with grading operations, finishing 2 months after grading is completed.

** Activity expected to overlap with cover system installation, finishing 1 month after cover installation is completed.

7.0 CONCLUSION

Based upon the information included in and attached to this demonstration, Electric Energy has demonstrated that the requirements of 40 C.F.R. § 257.103(f)(2) are satisfied for the 111-acre East Ash Pond at Joppa. This CCR surface impoundment is needed to continue to manage the CCR and non-CCR wastestreams identified in Section 3.2 and 3.3 above, is larger than 40 acres, the six boilers at the station will cease coal-fired operations no later than December 31, 2025, and the East Ash Pond will be closed by the October 17, 2028, deadline. Therefore, this CCR unit qualifies for the site-specific alternative deadline for the initiation of closure authorized by 40 C.F.R. § 257.103(f)(2).

Therefore, it is requested that EPA approve Electric Energy's demonstration and authorize the East Ash Pond at Joppa to continue to receive CCR and non-CCR wastestreams notwithstanding the deadline in § 257.101(a)(1) and to grant the alternative deadline of October 17, 2028, by which to complete closure of the impoundment.

APPENDIX A – SITE PLAN AND NEARBY LANDFILLS

PRELIMINARY - NOT FOR CONSTRUCTION

0 400' 800' 1600'

SCALE IN FEET

N

BURNS McDONNELL

date 03/23/2020

designed A. MYERS

LUMINANT

JOPPA POWER STATION
SITE PLAN

project 122702

contract -

dwg **FIGURE 1** -

11/16/2020

\\bmcd\dfs\Clients\ENR\VistraEnergy\122702_ALTuseDisposal\Design\Civil\Dwgs\Sketches\Joppa_Figure1.dgn

Illinois EPA Landfills

Find address or place

Legend

Active Municipal Solid Waste Landfill

Landfill In Post Closure

Landfill Certified Post Closure

Landfill In Voluntary Sites Program

Landfill In State Sites Program

Pope County Municipal

Joppa Power Station

Joppa, IL

Kentucky Waste Landfill Facility (~46 miles from Joppa)

Figure 2

APPENDIX B – WATER BALANCE DIAGRAM

00040552

Notes:
1. Flows shown as: Average (Maximum)
2. Flow units = Million Gallons per Day
3. Outfall Average flows calculated from 2015 NPDES Permit and NDPES Outfall Average Flow Data
4. Maximum flows for Service Water, Circ. Water, Ash Handling, and Sumps calculated from pump maximum capacities
5. Wastewaters from rinsing/flushing:
   Exteriors of Process Pumps
   Heat Exchangers Flushing
   Exteriors of Fans
   Cool Conveyor Galleries/ Tripper Room
   Exteriors of Cool Mills
   I-Beams
   Exteriors of Boiler & Auxiliary Equipment
   Exteriors of Air Compressors
   Floors & Walls
   Misc. Exteriors of Process Equipment
6. Unnamed tributory of the Ohio River

Note 6
0.1 (0.3)
014
Sewage Treatment Plant
0.1 (0.3)
Potable and Sanitory Wastewater
0.1 (0.3)
Ft. Massac Sanitary Water Supply
Note 6
7.2 (7.5)
001
pH Stabilization Note 6
7.2 (7.5)
Ash Pond
Electrical Yard Storm Drains
Storm Water
1.4 (1.8)
Discharge Flume
Basement Floor Drains (Note 5)
1.4
008
Oil/Water Seporator Basin
1.4
Basement Miscelloneous Non-Contact Heat Exchangers
6.2
0.05
0.04
0.2 (0.4)
0.04
Car Dumper Drains & Cool Reclaim Pit Sump Pump Discharge (Note 5)
0.3
0.3
0.0
1.4
Boiler Blow Down
Reverse Osmosis Reject
0.04
4.0 (5.45)
010
Settling Lagoon
1.6
Miscelloneous Non-Contact Heat Exchangers
1.6
Water Treatment Building Floor Drains (Note 5)
Boilers 1-6
Steam 0.26
0.13 (0.4)
0.01
0.30 (0.9)
Note 6
011
Storm Water
0.5
Bottom Ash Hopper Overflow
0.5
Strainers
0.0 (0.0)
Boiler Ash Sluice
Central Demineralizer
Demineralizer "A"
Demineralizer "B"
0.31 (0.9)
Note 6
012
Storm Water
0.9
Main Plant Floor Drains (Note 5)
0.9
4.4 (43.2)
Note 6
013
Storm Water
0.0
Crusher House Drains (Note 5) & Cool Pile Runoff
House Service Water Pumps
0.03
0.0 (0.4)
0.43 (1.4)
Reverse Osmosis Trains
0.0
Plant Area Storm Drains
4.4 (43.2)
592.0 (680.6)
Condenser Cooling Water Units 1-6
0.43 (1.9)
596.8 (738)
Traveling Screens
596.8 (723.8)
Circulating Water Pumps 1-12
Deep Wells No. 1 No. 2 No. 3 No. 4
0.05
0.4 (14.2)
88
Cooling Water intake warming line
0.03
592.0 (680.6)
0.4 (14.2)
005
Screen Backwash
Circulating Water Pump Seals
0.03
0.03
Miscellaneous Seals and Cooling
007
006
Cooling Water Discharge
592.0 (680.6)
OHIO RIVER

Legend for water balance:
o. NPDES Outfall
b. ---------- Intermittent Flows
c. ———— Avg.(Max.) Flows
d. — — — Alternate Flows

NO.	DATE	REVISIONS	BY	CHK'D	APP'D
1	4/12/18	PER FIELD CHANGE BY B.PARKER	CWB	BP	BP
0	1/15/18	RECORD REVISION	CWB	SDB	SDB

JOPPA GENERATING STATION
ELECTRIC ENERGY, INC. JOPPA, ILLINOIS

DWG. TITLE:
WATER BALANCE DIAGRAM

SCALE: NONE
DATE: 1/15/2018
APPROVED BY: S.BLUEMNER 1/15/18
DR. BY: S.BLUEMNER
CH. BY: S.BLUEMNER
FILE NAME:
DRAWING NO. 00040552

ATTACHMENT 1 – RISK MITIGATION PLAN

RISK MITIGATION PLAN - 40 C.F.R. § 257.103(f)(2)(v)(B)

INTRODUCTION

To demonstrate that the criteria in §40 C.F.R. 257.103(f)(2)(ii) has been met, Electric Energy, Inc. ("Electric Energy") has prepared this Risk Mitigation Plan for the East Ash Pond located at the Joppa Power Station ("Joppa") in Joppa, Illinois.

- EPA is requiring a risk mitigation plan to "address the potential risk of continued operation of the CCR surface impoundment while the facility moves towards closure of their coal-fired boiler(s), to be consistent with the court's holding in *USWAG* that RCRA requires EPA to set minimum criteria for sanitary landfills that prevent harm to either human health or the environment." 85 Fed. Reg. at 53,516, 53,548 (Aug. 28, 2020).

As required by § 257.103(f)(2)(v)(B), the Risk Mitigation Plan must describe the "measures that will be taken to expedite any required corrective action," and contain the three following elements:

- First, "a discussion of any physical or chemical measures a facility can take to limit any future releases to groundwater during operation." § 257.103(f)(2)(v)(B)(1). In promulgating this requirement, EPA explained that this "might include stabilization of waste prior to disposition in the impoundment or adjusting the pH of the impoundment waters to minimize solubility of contaminants [and that] [t]his discussion should take into account the potential impacts of these measures on Appendix IV constituents." 85 Fed. Reg. at 53,548.

- Second, "a discussion of the surface impoundment's groundwater monitoring data and any found exceedances; the delineation of the plume (if necessary based on the groundwater monitoring data); identification of any nearby receptors that might be exposed to current or future groundwater contamination; and how such exposures could be promptly mitigated." § 257.103(f)(2)(v)(B)(2).

- Third, "a plan to expedite and maintain the containment of any contaminant plume that is either present or identified during continued operation of the unit." § 257.103(f)(2)(v)(B)(3). In promulgating this final requirement, EPA explained that "the purpose of this plan is to demonstrate that a plume can be fully contained and to define how this could be accomplished in the most accelerated timeframe feasible to prevent further spread and eliminate any potential for exposures." 85 Fed. Reg. at 53,549. In addition, EPA stated that "this plan will be based on relevant site data, which may include groundwater chemistry, the variability of local hydrogeology, groundwater elevation and flow rates, and the presence of any surface water features that would influence rate and direction of contamination movement. For example, based on the rate and direction of groundwater flow and potential for diffusion of the plume, this plan could identify the design and spacing of extraction wells necessary to prevent further downgradient migration of contaminated groundwater." 85 Fed. Reg. at 53,549.

Consistent with these requirements and guidance, Electric Energy plans to continue to mitigate the risks to human health and the environment from the Joppa East Ash Pond as detailed in this Risk Mitigation Plan.

1 OPERATIONAL MEASURES TO LIMIT FUTURE RELEASES TO GROUNDWATER– 40 C.F.R. § 257.101(F)(2)(V)(B)(1)

The Joppa Pond is a 111-acre CCR surface impoundment. Consistent with the requirements of the CCR rule, compliance documents on Joppa's CCR public website reflect the characterization of the Ash Pond as a single unit for purposes of groundwater monitoring and closure activities.

The Joppa CCR surface impoundment receives CCR transport waters from bottom ash and economizer ash plus non-CCR process waters onsite before discharging to the Ohio River via Outfall 001 in accordance with NPDES Permit No. IL0004171.

At Joppa, none of the Appendix IV parameter have reported statistically significant levels (SSLs) above their respective Ground Water Protection Standards (GWPSs), as sampled and analyzed per the CCR surface impoundment's groundwater monitoring program. Therefore, Joppa's current physical treatment operation adequately limits potential risks to human health and the environment during operation. Joppa will continue this treatment process for the CCR surface impoundment until such time as closure is required per 40 CFR 257. The facility's current physical treatment process is discussed below, followed by a discussion of other treatment processes that could be implemented, as required per § 257.103(f)(2)(v)(B)(1).

1.1 CURRENT OPERATION OF PHYSICAL TREATMENT

Fly ash and air heater ash are captured dry. Therefore, current operations do not add fly ash transport waters to the CCR surface impoundment.

As part of normal operations, bottom ash and economizer ash are transported through the sluice lines into the CCR surface impoundment where they are dewatered and transported offsite for beneficial reuse. The CCR surface impoundment is also a wastewater treatment settling system which allows the solids to settle.

Therefore, since fly ash transport water is not conveyed to the CCR surface impoundment and bottom and economizer ash solids are removed from the CCR surface impoundment, the current operation of Joppa's CCR surface impoundment limits future releases to groundwater during operation, and consequently no potential safety impacts or exposure to human health or environmental receptors are expected to result. This is supported by CCR groundwater monitoring results, which show no SSLs above GWPS(s).

If Appendix IV releases are discovered per the facility's groundwater monitoring program, Electric Energy will test, evaluate, and implement a chemical treatment method (i.e. pH adjustment, coagulation, precipitation, or other method as determined) for the Joppa CCR Impoundment to limit potential risks to human health and the environment during operation

2 GROUNDWATER IMPACTS, RECEPTORS, AND POTENTIAL EXPOSURE MITIGATION - 40 C.F.R. § 257.101(F)(2)(V)(B)(2)

The Joppa East Ash Pond, with a footprint of approximately 111 acres (Figure 1), currently remains in assessment monitoring. There have been no SSLs of Appendix IV parameter concentrations since assessment monitoring was established on May 9, 2018, in accordance with 40 CFR § 257.95. The most recent summary of groundwater monitoring activities is provided in the "2019 Annual Groundwater Monitoring and Corrective Action Report, Joppa East Ash Pond, Joppa Power Station" (Ramboll, 2020) [see Attachment 1]. A summary of the assessment monitoring program is provided in Table 1. Since there have been no SSL exceedances of GWPS(s) to date, plume delineation has not been required. However, if one or more Appendix IV constituents are detected at SSLs above the GWPS(s), the nature and extent of the release would be characterized to delineate the contaminant plume. The existing conceptual site model and description of site hydrogeology provides site characterization data that will be used as the basis for executing supplemental plume delineation activities. A demonstration may also be made that a source other than the CCR unit caused the contamination, or that the SSL resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (§257.95(g)(3)(ii)).

Receptors

For constituents of potential concern (COPCs) found in groundwater to pose a risk to human health or the environment, a complete exposure pathway must be present to a receptor with elevated concentrations of COPCs via that pathway.

Should a release of one or more Appendix IV parameters from the Joppa East Ash Pond to groundwater occur in the future, the two primary risks to human health and the environment are via groundwater exposure and surface water exposure. Groundwater exposure would be via ingestion or dermal contact, both of which are likely an incomplete exposure pathway for the reasons discussed below. Impacted groundwater potentially migrating to nearby surface water bodies – specifically the Ohio River bordering Joppa East Ash Pond to the south – is another potential exposure pathway; however, this is also likely incomplete for the reasons discussed below.

Ambient groundwater flow in the Uppermost Aquifer beneath the East Ash Pond is southward towards the Ohio River. Groundwater elevations vary seasonally and may fluctuate by about 10 feet. Slight seasonal variation in groundwater flow directions ranging from southeast to southwest are also observed; however, the major component of groundwater flow direction is consistently south toward the Ohio River, which is the primary discharge area for groundwater near Joppa. Horizontal hydraulic gradients in the Uppermost Aquifer beneath the East Ash Pond typically range from 0.002 to 0.003 ft/ft. Groundwater flow velocity in the Uppermost Aquifer beneath the East Ash Pond ranges from 0.003 to 0.01 feet per day (ft/day) southward towards the Ohio River (refer to the description of hydrogeology attached to the alternative closure demonstration letter).

There are no potable industrial, commercial, CWS or non-CWS water wells in a downgradient or cross-gradient groundwater flow direction relative to the Joppa East Ash Pond that could plausibly be affected by a release of COPCs, thus the risk concern for these receptors is low. There is one domestic (private) well within the Village of Joppa that is located potentially downgradient (south) of the East Ash Pond. Although the property on which this well is located may be served by the Village of Joppa's CWS, the possibility that this well may be used for drinking water cannot be ruled out based on available information. However, since there are currently no

exceedances of GWPS(s) for Appendix IV parameters in any monitoring wells at the East Ash Pond, the identified well, or any other wells within a 2,500-foot search radius of the Joppa Power Plant, are not currently at risk.

There are no surface-water intakes for community water supply (CWS) on the Ohio River identified within a one-mile radius of the Joppa property line. In addition, there are no non-CWS surface water intakes on the Ohio River within 2,500 feet of the site boundary.

Since there have been no SSLs above the GWPS, there is no risk to ecological receptors located near the East Ash Pond. If a release to groundwater were to occur, ecological receptors could potentially be exposed to COPCs through ingestion or direct contact with impacted groundwater; however, should any surface water or sediment come into contact with impacted groundwater, the risk of exposure is likely low due to expected attenuation and dilution. Depending on the magnitude of the release and other factors, it may or may not be possible to estimate potential increases in COPC concentrations in surface water using mixing calculations.

Although current conditions do not pose a risk concern to human health or the environment, measures presented in the Contaminant Plume Containment Plan (Section 3.1 of this RMP) would address any future potential exposures and risks by containing potential groundwater impacts and mitigating impacts to potential receptors.

Exposure Mitigation

Mitigation of future potential exposures to groundwater contamination from continued operation of the Joppa East Ash Pond is discussed in detail in the following section.

3 CONTAMINANT PLUME CONTAINMENT: OPTIONS EVALUATION AND PLAN- 40 C.F.R. § 257.101(F)(2)(V)(B)(3)

Appropriate corrective measure(s) to address future potential impacted groundwater associated with the Joppa East Ash Pond are based on impacts to the Uppermost Aquifer. The Uppermost Aquifer consists of unlithified silty sand, sand, and gravel deposits within the McNairy Formation, which is approximately 85 feet thick near the East Ash Pond. The geometric mean horizontal hydraulic conductivity of the McNairy Formation based on field testing of monitoring wells around the East Ash Pond is 2.4 x 10-4 centimeters per second (cm/s). The overlying material (inclusive of both the Equality and Metropolis Formations) is a confining unit of clay, silty clay, sandy clay, and silt with a measured geometric mean hydraulic conductivity of 5.9 x 10-6 centimeters per second (cm/s). No known wells in the area utilize the Equality and Metropolis Formations for groundwater and most wells obtain groundwater from sands and gravels of the McNairy Formation (i.e. Uppermost Aquifer) or underlying Mississippian-age limestone bedrock, which generally occurs at depths greater than 100 feet (refer to the description of hydrogeology attached to the alternative closure demonstration letter).

If one or more Appendix IV parameters are detected and confirmed in groundwater at a SSL above GWPS(s), and the SSL is not attributed to an alternate source, via an alternate source demonstration (ASD), the first steps to mitigating risk will involve the immediate implementation of source control, which will include installation and operation of a groundwater extraction well or recovery trench system. This immediate source control would allow for capture of impacted groundwater and prevention of further plume migration towards the principal potential receptors. Furthermore, to characterize the nature and extent of the release, plume delineation wells will be installed as necessary to define the magnitude and limits of the groundwater impacts. If applicable, notifications will be made to all persons who own the land or reside on the land that directly overlies any part of the groundwater plume. Additional soil and groundwater data will be collected as necessary to support a Corrective Measures Assessment (CMA), which will be initiated within 90 days of detecting the SSL. Further discussion of short-term and long-term corrective measures is further discussed in Section 3.1.

Since there has been no release of Appendix IV parameters to groundwater above GWPS(s), which would trigger a CMA under 40 C.F.R. § 257.96 based on specific parameter concentrations and contaminant plume dimensions, several options are evaluated to address potential future plume containments. The evaluation criteria for assessing remedial options are the following: performance; reliability; ease of implementation; potential impacts of the remedies (safety, cross-media, and control of exposure to residual contamination); time required to begin and complete the remedy; and, institutional requirements that may substantially affect implementation of the remedy(s), such as permitting, environmental or public health requirements.

Although future potential source control measures (e.g. closure in place, closure by removal to on-site or off-site landfill, in-situ solidification/stabilization) to mitigate groundwater impacts are typically considered as part of a CMA process upon closure of the Joppa East Ash Pond, the shorter-term options considered for mitigating groundwater impacts relative to a potential future release of one or more Appendix IV parameters at Joppa have been identified for discussion as follows:

- Groundwater Extraction
- Groundwater Cutoff Wall
- Permeable Reactive Barrier
- In-Situ Chemical Treatment
- Monitored Natural Attenuation (MNA)

These same groundwater remedial corrective measures will be evaluated for all Appendix IV constituents that present a future risk to human health or the environment.

Groundwater Extraction

This corrective measure includes installation of one or more groundwater pumping wells or trenches to control and extract impacted groundwater. Groundwater extraction captures and contains impacted groundwater and can limit plume expansion and/or off-site migration. Construction of a groundwater extraction system typically includes, but is not limited to, the following primary project components:

- Designing and constructing a groundwater extraction system consisting of a series of extraction wells or trenches located around the perimeter of the contaminant plume and operating at a rate to allow capture of CCR impacted groundwater.
- Designing a system to manage extracted groundwater, which may include modification to the existing NPDES permit, including treatment prior to discharge, if necessary.
- Ongoing inspection and maintenance of the groundwater extraction system.

Installation of a groundwater extraction system, whether wells or trenches, can be expedited with the assumption that there is a good conceptual site model (CSM) of the hydrogeological system around the CCR unit, a groundwater flow and transport model, and aquifer testing. Upon notification of an SSL exceedance of a GWPS for one or more Appendix IV parameters, an aquifer test will be conducted, and groundwater model developed for designing a groundwater extraction system for optimization of contaminant plume capture.

A schematic of a typical groundwater extraction well is shown on Figure 2. Based on site specific hydrogeology and future potential plume width and depth, a groundwater extraction system would likely consist of one to three extraction wells with pitless adapter's manifolded together with HDPE conveyance pipe to a common tank or lined collection vault prior to treatment at the on-site wastewater treatment plant and discharge via the NPDES permitted outfall.

Groundwater Cutoff Wall

Vertical cutoff walls are used to control and/or isolate impacted groundwater. Low permeability cutoff walls can be used to prevent horizontal off-site migration of potentially impacted groundwater. Cutoff walls act as barriers to migration of impacted groundwater and can isolate soils that have been impacted by CCR to prevent contact with unimpacted groundwater. Cutoff walls are often used in conjunction with an interior pumping system to establish a reverse gradient within the cutoff wall. The reverse gradient imparted by the pumping system maintains an inward flow through the wall, keeping it from acting as a groundwater dam and controlling potential end-around or breakout flow of contaminated groundwater.

A commonly used cutoff wall construction technology is the slurry trench method, which consists of excavating a trench and backfilling it with a soil-bentonite mixture, often created with the soils excavated from the trench. The trench is temporarily supported with bentonite slurry that is pumped into the trench as it is excavated. Excavation for cutoff walls is conducted with conventional hydraulic excavators, hydraulic excavators equipped with specialized booms to extend their reach (*i.e.*, long-stick excavators), or chisels and clamshells, depending upon the depth of the trench and the material to be excavated.

Permeable Reactive Barrier

Chemical treatment via a Permeable Reactive Barrier (PRB) is defined as an emplacement of reactive materials in the subsurface designed to intercept a contaminant plume, provide a flow path through the reactive media,

and transform or otherwise render the contaminant(s) into environmentally acceptable forms to attain remediation concentration goals downgradient of the barrier (EPRI, 2006).

As groundwater passes through the PRB under natural gradients, dissolved constituents in the groundwater react with the media and are transformed or immobilized. A variety of media have been used or proposed for use in PRBs. Zero-valent iron has been shown to effectively immobilize CCR constituents, including arsenic, chromium, cobalt, molybdenum, selenium and sulfate. Zero-valent iron has not been proven effective for boron, antimony, or lithium (EPRI, 2006).

System configurations include continuous PRBs, in which the reactive media extends across the entire path of the contaminant plume; and funnel-and-gate systems, where barrier walls are installed to control groundwater flow through a permeable gate containing the reactive media. Continuous PRBs intersect the entire contaminant plume and do not materially impact the groundwater flow system. Design may or may not include keying the PRB into a low-permeability unit at depth. Funnel-and-gate systems utilize a system of barriers to groundwater flow (funnels) to direct the contaminant plume through the reactive gate. The barriers, typically some form of cutoff wall, are keyed into a low-permeability unit at depth to prevent short circuiting of the plume. Funnel-and-gate design must consider the residence time to allow chemical reactions to occur. Directing the contaminant plume through the reactive gate can significantly increase the flow velocity, thus reducing residence time.

Design of PRB systems requires rigorous site investigation to characterize the site hydrogeology and to delineate the contaminant plume. A thorough understanding of the geochemical and redox characteristics of the plume is critical to assess the feasibility of the process and select appropriate reactive media. Laboratory studies, including batch studies and column studies using samples of site groundwater, are needed to determine the effectiveness of the selected reactive media at the site (EPRI, 2006).

This is a potential viable option for groundwater corrective measures, to be evaluated further, but is not a short-term solution that can be implemented expeditiously.

In-Situ Chemical Treatment

In-situ chemical treatment for inorganics are being tested and applied with increasing frequency. In-situ chemical treatment includes the targeted injection of reactive media into the subsurface to mitigate groundwater impacts. Inorganic contaminants are typically remediated through immobilization by reduction or oxidation followed by precipitation or adsorption (EPRI, 2006). Chemical reactants that have been applied or are in development for application in treating inorganic contaminants include ferrous sulfate, nanoscale zero-valent iron, organo-phosphorus nutrient mixture (PrecipiPHOS™) and sodium dithionite (EPRI, 2006). Zero-valent iron has been shown to effectively immobilize cobalt and molybdenum. Implementation of in-situ chemical treatment requires detailed technical analysis of field hydrogeological and geochemical conditions along with laboratory studies.

This is a potential viable option for groundwater corrective measures, to be evaluated further, but is not a short-term solution that can be implemented expeditiously.

Monitored Natural Attenuation (MNA)

Upon notification of a release of one or more Appendix IV constituent(s) to groundwater, MNA will be evaluated with site-specific characterization data and geochemical analysis as a long term remedial option, combined with source control measures, through application of the USEPA's tiered approach to MNA (USEPA 1999, 2007 and 2015):

1. Demonstrate that the area of groundwater impacts is not expanding.

2. Determine the mechanisms and rates of attenuation.

3. Determine that the capacity of the aquifer is sufficient to attenuate the mass of constituents in groundwater and that the immobilized constituents are stable and will not remobilize.

4. Design a performance monitoring program based on the mechanisms of attenuation and establish contingency remedies (tailored to site-specific conditions) should MNA not perform adequately.

MNA is not regarded as a short-term remedial option for contaminant plume containment, but as a potential long- term option following implementation of shorter term control measures.

3.1 CONTAINMENT PLAN

Based on the options evaluated for containment of a future potential groundwater contaminant plume originating from the Joppa East Ash Pond for one or more Appendix IV constituents exceeding their GWPS(s), the most viable short-term option of those evaluated is a groundwater extraction well or recovery trench system, which would allow for capture of impacted groundwater and prevention of further plume migration towards the principal potential receptors, which have been identified as the Ohio River and one domestic (private) well within the Village of Joppa located potentially downgradient of the East Ash Pond.

In circumstances where there is not an immediate concern of endangerment to human health or the environment, other longer-term corrective measures may be more viable and will be further evaluated at the Joppa East Ash Pond.

Depending on the location, depth, and plume geometry of any future potential Appendix IV exceedances of GWPSs, the specific constituent(s) with exceedances, and distance from potential receptors, the other groundwater corrective measures discussed as part of the corrective options evaluation – groundwater cutoff wall, permeable reactive barrier, in-situ chemical treatment and MNA – are all secondary remedial alternatives available for consideration following the current primary option of groundwater extraction for short-term application.

4 REFERENCES

Electric Power Research Institute (EPRI), 2006. Groundwater Remediation of Inorganic Constituents at Coal Combustion Product Management Sites, Overview of Technologies, Focusing on Permeable Reactive Barriers. Electric Power Research Institute, Palo Alto, California. Final Report 1012584, October 2006.

Ramboll, 2020. 2019 Annual Groundwater Monitoring and Corrective Action Report, Joppa East Ash Pond, Joppa Power Station. January 31, 2020.

USEPA, 1999. Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites. Directive No. 9200.U-17P. Washington, D.C.: EPA, Office of Solid Waste and Emergency Response.

USEPA, 2007. Monitored Natural Attenuation of Inorganic Contaminants in Ground Water, Volume 1 – Technical Basis for Assessment. EPA/600/R-07/139. National Risk Management Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio. October 2007.

USEPA, 2015. Use of Monitored Natural Attenuation for Inorganic Contaminants in Groundwater at Superfund Sites. Directive No. 9283.1-36. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. August 2015.

TABLES

Table 1 - Assessment Monitoring Program Summary, Joppa East Ash Pond

Sampling Dates	Analytical Data Receipt Date	Parameters Collected	SSL(s) Appendix IV	SSL(s) Determination Date	ASD Completion Date	CMA Completion / Status
June 19, 2018	August 3, 2018	Appendix III Appendix IV	NA	NA	NA	NA
September 5, 2018	October 23, 2018	Appendix III Appendix IV Detected[1]	None	January 7, 2019	NA	NA
March 27, 2019	April 30, 2019	Appendix III Appendix IV	None	July 29, 2019	NA	NA
September 9, 2019	October 15, 2019	Appendix III Appendix IV Detected[1]	None	January 13, 2020	NA	NA
March 30, 2020	April 28, 2020	Appendix III Appendix IV Detected	None	July 27, 2020	NA	NA

[O: RAB 9/11/20; C: EJT 9/15/20]

Notes:
CMA = Corrective Measures Assessment
NA = Not Applicable
1. Groundwater sample analysis was limited to Appendix IV parameters detected in previous events in accordance with 40 C.F.R. Part 257.95(d)(1).

FIGURES

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

SITE AND WELL LOCATION MAP
JOPPA EAST ASH POND
UNIT ID: 401

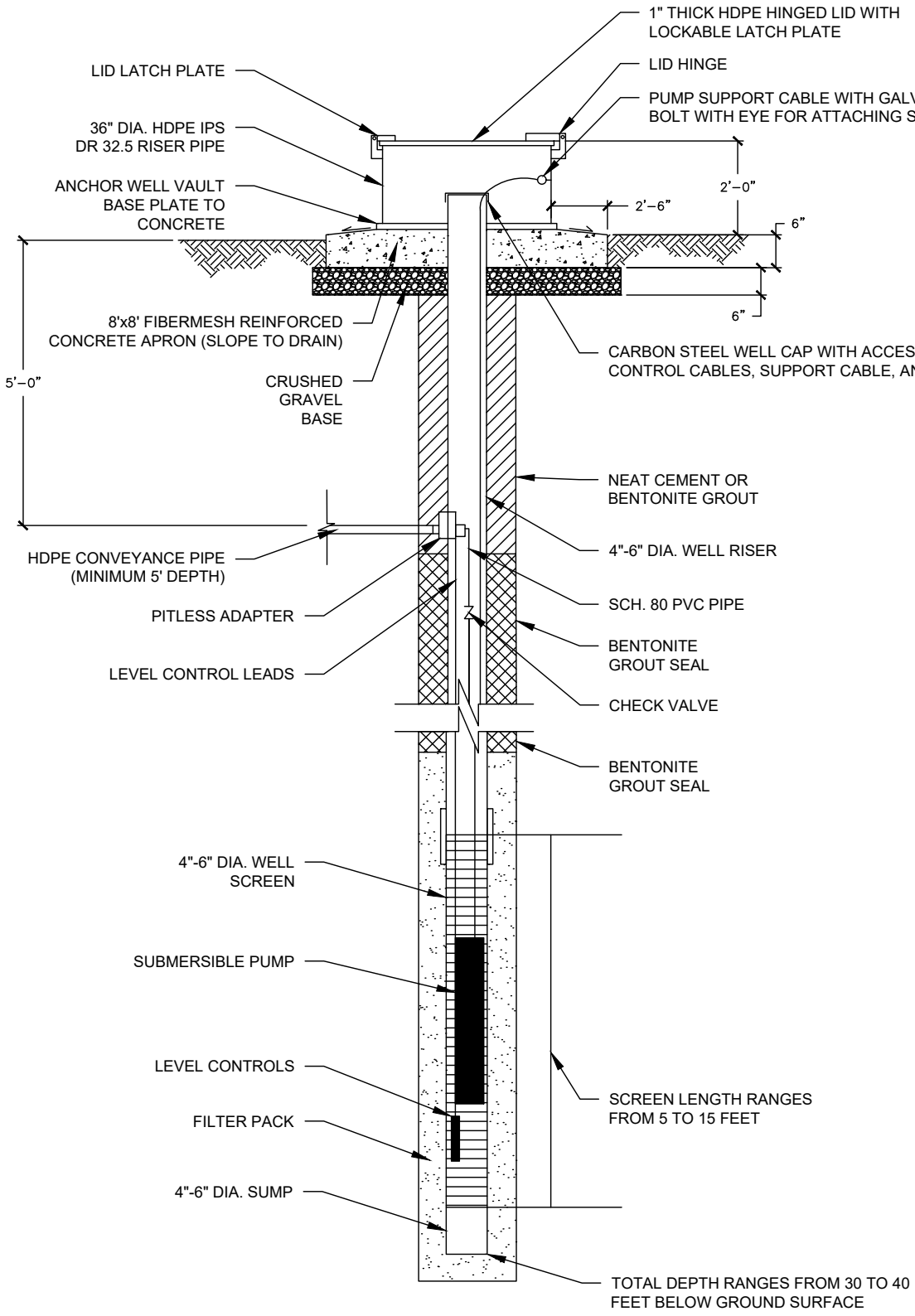
HYDROGEOLOGIC MONITORING PLAN
DYNEGY CCR RULE GROUNDWATER MONITORING
JOPPA POWER STATION
JOPPA, ILLINOIS

DRAWN BY/DATE:
SDS 9/27/17
REVIEWED BY/DATE:
JJW 9/27/17
APPROVED BY/DATE:
SJC 9/28/17

PROJECT NO: 2285.5/1.1

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



NOTES
1. NOT TO SCALE

TYPICAL HYDRAULIC GRADIENT CONTROL WELL DETAIL

FIGURE 2

Electric Energy, Inc.
JOPPA EAST ASH POND
JOPPA, ILLINOIS

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

ATTACHMENT 1

Prepared for

Electric Energy, Inc.

Document type

2019 Annual Groundwater Monitoring and Corrective Action Report

Date

January 31, 2020

2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT

JOPPA EAST ASH POND, JOPPA POWER STATION

RAMBOLL Bright ideas. Sustainable change.

2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
JOPPA EAST ASH POND, JOPPA POWER STATION

Project name	**Joppa Power Station**
Project no.	**72757**
Recipient	**Electric Energy, Inc.**
Document type	**Annual Groundwater Monitoring and Corrective Action Report**
Version	**FINAL**
Date	**January 31, 2020**
Prepared by	**Kristen L. Theesfeld**
Checked by	**Nathaniel R. Keller**
Approved by	**Eric J. Tlachac**
Description	**Annual Report in Support of the CCR Rule Groundwater Monitoring Program**

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Senior Hydrogeologist

CONTENTS

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ACRONYMS AND ABBREVIATIONS

CCR	Coal Combustion Residuals
EAP	East Ash Pond
GWPS	Groundwater Protection Standard
SAP	Sampling and Analysis Plant
SSL	Statistically Significant Level

EXECUTIVE SUMMARY

This report has been prepared to provide the information required by Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257.90(e) for Joppa East Ash Pond (EAP) located at Joppa Power Station near Joppa, Illinois.

Groundwater is being monitored at Joppa EAP in accordance with the Assessment Monitoring Program requirements specified in 40 C.F.R. § 257.95.

No changes were made to the monitoring system in 2019 (no wells were installed or decommissioned).

No Statistically Significant Levels (SSLs) of 40 C.F.R. Part 257 Appendix IV parameters were determined in 2019 and Joppa EAP remains in the Assessment Monitoring Program.

1. INTRODUCTION

This report has been prepared by Ramboll on behalf of Electric Energy, Inc., to provide the information required by 40 C.F.R.§ 257.90(e) for Joppa EAP located at Joppa Power Station near Joppa, Illinois.

In accordance with 40 C.F.R. § 257.90(e), the owner or operator of a Coal Combustion Residuals (CCR) unit must prepare an Annual Groundwater Monitoring and Corrective Action Report for the preceding calendar year that documents the status of the Groundwater Monitoring and Corrective Action Program for the CCR unit, summarizes key actions completed, describes any problems encountered, discusses actions to resolve the problems, and projects key activities for the upcoming year. At a minimum, the Annual Report must contain the following information, to the extent available:

1. A map, aerial image, or diagram showing the CCR unit and all background (or upgradient) and downgradient monitoring wells, to include the well identification numbers, that are part of the groundwater monitoring program for the CCR unit.
2. Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken.
3. In addition to all the monitoring data obtained under §§ 257.90 through 257.98, a summary including the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and whether the sample was required by the Detection Monitoring or Assessment Monitoring Programs.
4. A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from Detection Monitoring to Assessment Monitoring in addition to identifying the constituent(s) detected at a Statistically Significant Increase relative to background levels).
5. Other information required to be included in the Annual Report as specified in §§ 257.90 through 257.98.

This report provides the required information for Joppa EAP for calendar year 2019.

2. MONITORING AND CORRECTIVE ACTION PROGRAM STATUS

No changes have occurred to the Monitoring Program status in calendar year 2019, and Joppa EAP remains in the Assessment Monitoring Program in accordance with 40 C.F.R. § 257.95.

3. KEY ACTIONS COMPLETED IN 2019

The Assessment Monitoring Program is summarized in Table A. The groundwater monitoring system, including the CCR unit and all background and downgradient monitoring wells is presented in Figure 1. No changes were made to the monitoring system in 2019 (no wells were installed or decommissioned). In general, one groundwater sample was collected from each background and downgradient well during each monitoring event. All samples were collected and analyzed in accordance with the Sampling and Analysis Plan (SAP) (NRT/OBG, 2017a). All monitoring data obtained under 40 C.F.R. §§ 257.90 through 257.98 (as applicable) in 2019 are presented in Tables 1 and 2. Analytical data were evaluated in accordance with the Statistical Analysis Plan (NRT/OBG, 2017b) to determine any SSLs of Appendix IV parameters over Groundwater Protection Standards (GWPSs).

Statistical background values are provided in Table 3 and GWPSs in Table 4.

Analytical results for the June and September 2018 sampling events were provided in the 2018 Annual Groundwater Monitoring and Corrective Action Report.

Table A – 2018-2019 Assessment Monitoring Program Summary

Sampling Dates	Analytical Data Receipt Date	Parameters Collected	SSL(s)	SSL(s) Determination Date
June 19, 2018	October 10, 2018	Appendix III Appendix IV	NA	NA
September 5, 2018	October 10, 2018	Appendix III Appendix IV Detected [1]	None	January 7, 2019
March 27, 2019	April 15, 2019	Appendix III Appendix IV	None	July 17, 2019
September 9, 2019	October 15, 2019	Appendix III Appendix IV Detected [1]	NA	TBD

Notes:

NA: Not Applicable
TBD: To Be Determined
1. Groundwater sample analysis was limited to Appendix IV parameters detected in previous events in accordance with 40 C.F.R. § 257.95(d)(1).

4. PROBLEMS ENCOUNTERED AND ACTIONS TO RESOLVE THE PROBLEMS

No problems were encountered with the Groundwater Monitoring Program during 2019. Groundwater samples were collected and analyzed in accordance with the SAP (NRT/OBG, 2017a), and all data were accepted.

5. KEY ACTIVITIES PLANNED FOR 2020

The following key activities are planned for 2020:

- Continuation of the Assessment Monitoring Program with semi-annual sampling scheduled for the first and third quarters of 2020.
- Complete evaluation of analytical data from the downgradient wells, using GWPSs to determine whether an SSL of Appendix IV parameters has occurred.
- If an SSL is identified, potential alternate sources (i.e., a source other than the CCR unit caused the SSL or that that SSL resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality) will be evaluated.
  - If an alternate source is demonstrated to be the cause of the SSL, a written demonstration will be completed within 90 days of SSL determination and included in the 2020 Annual Groundwater Monitoring and Corrective Action Report.
  - If an alternate source(s) is not identified to be the cause of the SSL, the applicable requirements of 40 C.F.R. §§ 257.94 through 257.98 (e.g., assessment of corrective measures) as may apply in 2020 will be met, including associated recordkeeping/notifications required by 40 C.F.R. §§ 257.105 through 257.108.

6. REFERENCES

Natural Resource Technology, an OBG Company (NRT/OBG), 2017a. Sampling and Analysis Plan, Joppa East Ash Pond, Joppa Power Station, Joppa, Illinois, Project No. 2285, Revision 0, October 17, 2017.

Natural Resource Technology, an OBG Company (NRT/OBG), 2017b, Statistical Analysis Plan, Joppa Power Station, Electric Energy, Inc., October 17, 2017.

TABLES

TABLE 1.
2019 ANALYTICAL RESULTS - GROUNDWATER ELEVATION AND APPENDIX III PARAMETERS
2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
JOPPA POWER STATION
UNIT ID 401 - JOPPA EAST ASH POND
JOPPA, ILLINOIS
ASSESSMENT MONITORING PROGRAM

Well Identification Number	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Date & Time Sampled	Depth to Groundwater (ft)[1]	Groundwater Elevation (ft NAVD88)	40 C.F.R. Part 257 Appendix III						
						Boron, total (mg/L) 6020A[2]	Calcium, total (mg/L) 6020A[2]	Chloride, total (mg/L) 9251[2]	Fluoride, total (mg/L) 9214[2]	pH (field) (S.U.) SM 4500 H+B[2]	Sulfate, total (mg/L) 9036[2]	Total Dissolved Solids (mg/L) SM 2540C[2]
Background / Upgradient Monitoring Wells												
G01D	37.220429	-88.857179	3/27/2019 17:20	34.50	329.69	<0.025	25.1	8	0.23	6.7	30	310
			9/9/2019 17:37	42.75	321.44	<0.025	25.6	8	0.23	6.4	37	336
G02D	37.220715	-88.853311	3/27/2019 16:33	34.43	329.22	0.0473	38.7	20	0.20	6.6	20	262
			9/9/2019 17:08	42.37	321.28	0.0429	40.3	18	0.21	6.5	20	264
Downgradient Monitoring Wells												
G51D	37.216016	-88.855653	3/27/2019 16:07	34.57	329.28	0.778	34.7	6	<0.10	5.7	125	350
			9/9/2019 16:43	43.83	320.02	0.501	31.3	6	<0.10	5.3	109	320
G52D	37.209626	-88.852943	3/27/2019 17:49	19.68	328.73	<0.025	59.8	13	0.28	6.4	81	376
			9/9/2019 18:08	22.92	325.49	<0.025	52.2	14	0.27	6.0	78	370
G53D	37.215069	-88.849367	3/27/2019 15:00	27.20	328.27	0.269	30.5	12	0.59	6.6	54	272
			9/9/2019 15:12	36.99	318.48	0.385	42.2	18	0.67	6.2	80	364
G54D	37.212264	-88.857485	3/27/2019 15:45	30.73	326.30	1.03	115	22	0.35	6.8	142	510
			9/9/2019 16:00	42.95	314.08	0.614	79.9	<25	0.32	6.4	136	482

[O: RAB 12/23/19, KLT 12/24/19C:]

Notes:

40 C.F.R. = Title 40 of the Code of Federal Regulations

ft = foot/feet

mg/L = milligrams per liter

NAVD88 = North American Vertical Datum of 1988

S.U. = Standard Units

< = concentration is less than the concentration shown, which corresponds to the reporting limit for the method; estimated concentrations below the reporting limit and associated qualifiers are not provided since not utilized in statistics to determine Statistically Significant Increases (SSIs) over background.

[1]All depths to groundwater were measured on the first day of the sampling event.

[2]4-digit numbers represent SW-846 analytical methods.

TABLE 2.
2019 ANALYTICAL RESULTS - APPENDIX IV PARAMETERS
2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
JOPPA POWER STATION
UNIT ID 401 - JOPPA EAST ASH POND
JOPPA, ILLINOIS
ASSESSMENT MONITORING PROGRAM

Well Identification Number	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Date & Time Sampled	40 C.F.R. Part 257 Appendix IV														
				Antimony, total (mg/L) 6020A[1]	Arsenic, total (mg/L) 6020A[1]	Barium, total (mg/L) 6020A[1]	Beryllium, total (mg/L) 6020A[1]	Cadmium, total (mg/L) 6020A[1]	Chromium, total (mg/L) 6020A[1]	Cobalt, total (mg/L) 6020A[1]	Fluoride, total (mg/L) 6020A[1]	Lead, total (mg/L) 6020A[1]	Lithium, total (mg/L) 6020A[1]	Mercury, total (mg/L) 7470A[1]	Molybdenum, total (mg/L) 6020A[1]	Radium 226/228, Combined (pCi/L) 903/904[1]	Selenium, total (mg/L) 6020A[1]	Thallium, total (mg/L) 6020A[1]
Background / Upgradient Monitoring Wells																		
G01D	37.220429	-88.857179	3/27/2019 17:20	<0.0010	<0.0010	0.129	<0.0010	<0.0010	0.0030	0.0014	0.23	<0.0010	0.0015	<0.00020	<0.0015	0.78	0.0015	<0.0020
			9/9/2019 17:37[2]	NA	<0.0010	0.123	NA	NA	0.0044	0.0014	0.23	0.0012	<0.0030	NA	NA	0.79	0.0011	NA
G02D	37.220715	-88.853311	3/27/2019 16:33	<0.0010	<0.0010	0.235	<0.0010	<0.0010	0.0026	<0.0010	0.20	<0.0010	<0.0015	<0.00020	<0.0015	0.12	0.0030	<0.0020
			9/9/2019 17:08[2]	NA	<0.0010	0.208	NA	NA	<0.0015	<0.0010	0.21	<0.0010	<0.0030	NA	NA	0.49	0.0021	NA
Downgradient Monitoring Wells																		
G51D	37.216016	-88.855653	3/27/2019 16:07	<0.0010	<0.0010	0.0495	<0.0010	<0.0010	0.0016	0.0026	<0.10	<0.0010	0.0059	<0.00020	<0.0015	0.23	0.0050	<0.0020
			9/9/2019 16:43[2]	NA	<0.0010	0.0377	NA	NA	<0.0015	0.0017	<0.10	<0.0010	0.0057	NA	NA	0.36	0.0042	NA
G52D	37.209626	-88.852943	3/27/2019 17:49	<0.0010	0.0064	0.271	<0.0010	<0.0010	<0.0015	0.0069	0.28	<0.0010	0.0028	<0.00020	<0.0015	0.58	<0.0010	<0.0020
			9/9/2019 18:08[2]	NA	0.0021	0.254	NA	NA	<0.0015	0.0022	0.27	<0.0010	<0.0030	NA	NA	1.54	<0.0010	NA
G53D	37.215069	-88.849367	3/27/2019 15:00	<0.0010	<0.0010	0.101	<0.0010	<0.0010	<0.0015	<0.0010	0.59	<0.0010	<0.0015	<0.00020	<0.0015	0.17	<0.0010	<0.0020
			9/9/2019 15:12[2]	NA	<0.0010	0.128	NA	NA	<0.0015	0.0020	0.67	<0.0010	<0.0030	NA	NA	0.03	<0.0010	NA
G54D	37.212264	-88.857485	3/27/2019 15:45	<0.0010	0.0011	0.120	<0.0010	<0.0010	<0.0015	0.0138	0.35	<0.0010	0.0037	<0.00020	<0.0015	0.42	<0.0010	<0.0020
			9/9/2019 16:00[2]	NA	<0.0010	0.128	NA	NA	<0.0015	0.0117	0.32	<0.0010	0.0037	NA	NA	0.84	<0.0010	NA

[O: RAB 12/23/19, C: KLT 12/24/19]

Notes:

40 C.F.R. = Title 40 of the Code of Federal Regulations

mg/L = milligrams per liter

NA = Not Analyzed

pCi/L = picoCuries per liter

< = concentration is less than concentration shown, which corresponds to the reporting limit for the method; estimated concentrations below the reporting limit and associated qualifiers are not provided since not utilized in statistics to determine Statistically Significant Levels (SSLs) over Groundwater Protection Standards.

[1]4-digit numbers represent SW-846 analytical methods and 3-digit numbers represent Clean Water Act analytical methods.

[2]Only the parameters detected during the previous sampling events were analyzed during this sampling event, in accordance with 40 C.F.R. § 257.95(d)(1).

TABLE 3.
STATISTICAL BACKGROUND VALUES
2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
JOPPA POWER STATION
UNIT ID 401 - JOPPA EAST ASH POND
JOPPA, ILLINOIS
ASSESSMENT MONITORING PROGRAM

Parameter	Statistical Background Value (UPL)
40 C.F.R. Part 257 Appendix III	
Boron (mg/L)	0.06
Calcium (mg/L)	46
Chloride (mg/L)	29
Fluoride (mg/L)	0.28
pH (S.U.)	6.2 / 6.9
Sulfate (mg/L)	180
Total Dissolved Solids (mg/L)	526

[O: RAB 12/23/19, C: KLT 12/24/19]

Notes:
40 C.F.R. = Title 40 of the Code of Federal Regulations
mg/L = milligrams per liter
S.U. = Standard Units
UPL = Upper Prediction Limit

TABLE 4.
GROUNDWATER PROTECTION STANDARDS
2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
JOPPA POWER STATION
UNIT ID 401 - JOPPA EAST ASH POND
JOPPA, ILLINOIS
ASSESSMENT MONITORING PROGRAM

Parameter	Groundwater Protection Standard[1]
40 C.F.R. Part 257 Appendix IV	
Antimony (mg/L)	0.006
Arsenic (mg/L)	0.010
Barium (mg/L)	2
Beryllium (mg/L)	0.004
Cadmium (mg/L)	0.005
Chromium (mg/L)	0.10
Cobalt (mg/L)	0.037
Fluoride (mg/L)	4
Lead (mg/L)	0.015
Lithium (mg/L)	0.040
Mercury (mg/L)	0.002
Molybdenum (mg/L)	0.10
Radium 226+228 (pCi/L)	5
Selenium (mg/L)	0.05
Thallium (mg/L)	0.002

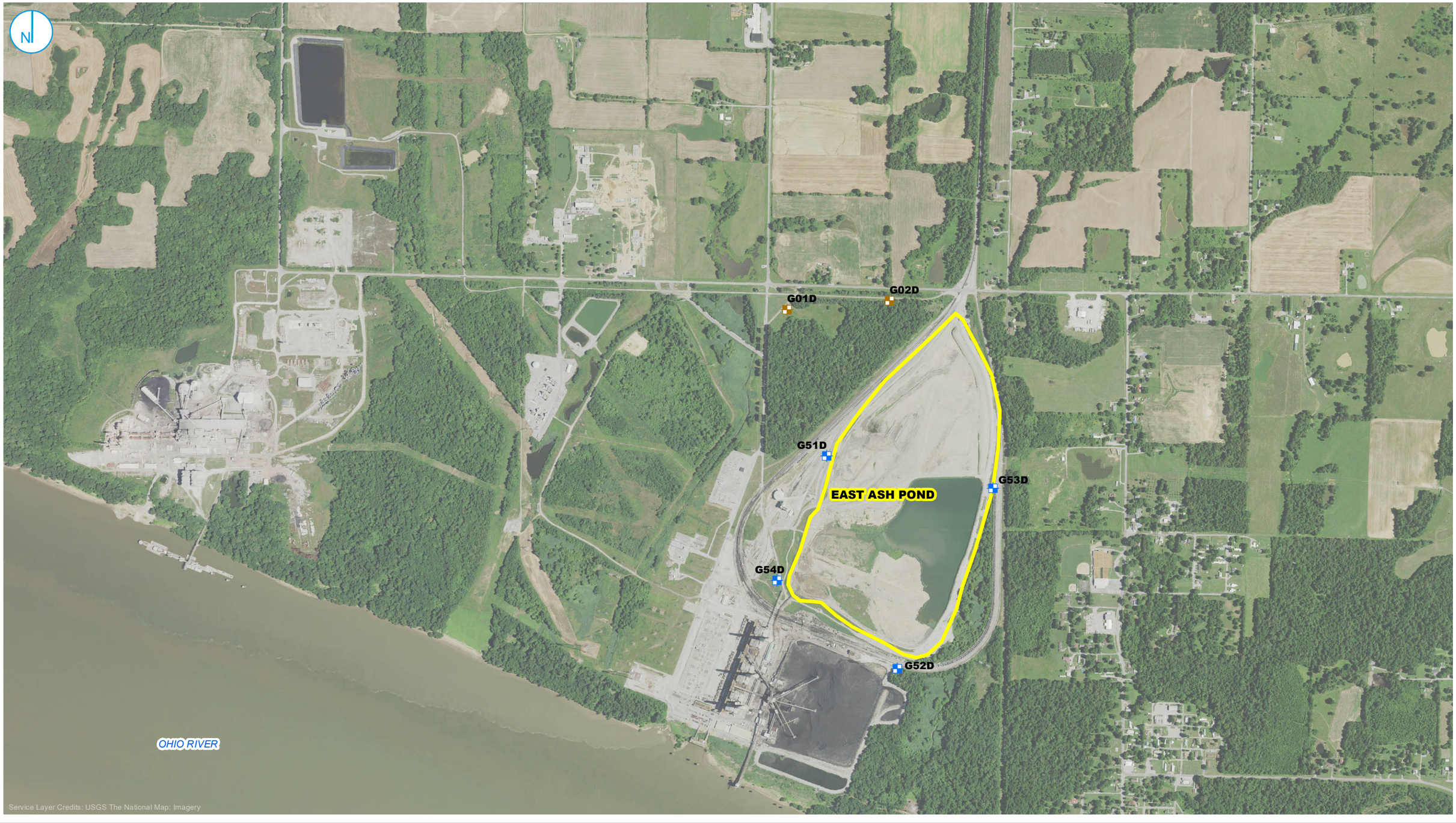
[O: RAB 12/23/19, C: KLT 12/24/19]

Notes:
40 C.F.R. = Title 40 of the Code of Federal Regulations
mg/L = milligrams per liter
pCi/L = picoCuries per liter
[1]Groundwater Protection Standard is the higher of the Maximum Contaminant Level / Health-Based Level or background.

FIGURES

Y:\Mapping\Projects\22\2285\MXD\2019_AnnualGWM_CAR\Figure 1_GWS_WellLoc_JoppaE.mxd

PROJECT: 169000XXXX | DATED: 1/14/2020 | DESIGNER: GALARNMC



UPGRADIENT MONITORING WELL LOCATION
DOWNGRADIENT MONITORING WELL LOCATION
CCR MONITORED UNIT

0 500 1,000 Feet

MONITORING WELL LOCATION MAP
JOPPA EAST ASH POND
UNIT ID:401

2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
VISTRA CCR RULE GROUNDWATER MONITORING
JOPPA POWER STATION
JOPPA, ILLINOIS

FIGURE 1

O'BRIEN & GERE ENGINEERS, INC.
A RAMBOLL COMPANY

RAMBOLL

ATTACHMENT 2 – MAP OF GROUNDWATER MONITORING WELL LOCATIONS

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

SITE AND WELL LOCATION MAP
JOPPA EAST ASH POND
UNIT ID: 401

HYDROGEOLOGIC MONITORING PLAN
DYNEGY CCR RULE GROUNDWATER MONITORING
JOPPA POWER STATION
JOPPA, ILLINOIS

DRAWN BY/DATE:
SDS 9/27/17
REVIEWED BY/DATE:
JJW 9/27/17
APPROVED BY/DATE:
SJC 9/28/17

PROJECT NO: 2285.5/1.1

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

ATTACHMENT 3 – WELL CONSTRUCTION DIAGRAMS AND DRILLING LOGS

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Joppa Power Station
Location: Joppa, Illinois
Project: 15E0030
DATES: **Start:** 8/14/2015
Finish: 8/14/2015
WEATHER: Partly cloudy, calm, warm, mid-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler

FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: S. Keim

BOREHOLE ID: G01D
Well ID: G01D
Surface Elev: 361.50 ft. MSL
Completion: 64.38 ft. BGS
Station: 202,039.30N
831,716.11E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Joppa
Township: 15S;3E
Section 14, **Tier** 15S; **Range** 3E

WATER LEVEL INFORMATION:
▼ = 54.00 - During Drilling
▼ = 45.77 - 8/14/15
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	0/60 *0%*	BD					2			360	
							4			358	
	0/60 *0%*	BD					6			356	
							8			354	
							10	Blind drill - see G101 boring log		352	
	0/60 *0%*	BD					12			350	
							14			348	
							16			346	
	0/60 *0%*	BD					18			344	
							20			342	

NOTE(S): G01D installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Joppa Power Station
Location: Joppa, Illinois
Project: 15E0030
DATES: **Start:** 8/14/2015
Finish: 8/14/2015
WEATHER: Partly cloudy, calm, warm, mid-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: S. Keim

BOREHOLE ID: G01D
Well ID: G01D
Surface Elev: 361.50 ft. MSL
Completion: 64.38 ft. BGS
Station: 202,039.30N
831,716.11E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Joppa
Township: 15S;3E
Section 14, **Tier** 15S; **Range** 3E

WATER LEVEL INFORMATION:
▼ = 54.00 - During Drilling
▼ = 45.77 - 8/14/15
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	0/60 *0%*	BD					22			340	
							24			338	
							26			336	
	0/60 *0%*	BD					28			334	
							30	Blind drill - see G101 boring log *[Continued from previous page]*		332	
	0/60 *0%*	BD					32			330	
							34			328	
							36			326	
	0/60 *0%*	BD					38			324	
							40			322	

NOTE(S): G01D installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Joppa Power Station
Location: Joppa, Illinois
Project: 15E0030
DATES: **Start:** 8/14/2015
Finish: 8/14/2015
WEATHER: Partly cloudy, calm, warm, mid-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: S. Keim

BOREHOLE ID: G01D
Well ID: G01D
Surface Elev: 361.50 ft. MSL
Completion: 64.38 ft. BGS
Station: 202,039.30N
831,716.11E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Joppa
Township: 15S;3E
Section 14, **Tier** 15S; **Range** 3E

WATER LEVEL INFORMATION:
▼ = 54.00 - During Drilling
▼ = 45.77 - 8/14/15
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	0/48 *0%*	BD					42	Blind drill - see G101 boring log *[Continued from previous page]*		320	
							44			318	
9A	24/24 *100%*	SS	*5-13* *6-5* N=19	13		*1.00*		Strong brown (7.5YR5/6), moist, medium dense, silty, very fine- to coarse-grained SAND with trace small gravel.			
9B				20			▼ 46			316	
10A	22/24 *92%*	SS	*2-3* *3-4* N=6	20		*1.50*		Gray (10YR6/1) with 40% yellowish brown (10YR5/6) mottles, moist, stiff, SILT, few to little clay, trace fine- to medium-grained sand.		314	
11A	24/24 *100%*	SS	*1-2* *3-3* N=5	21		*0.80*	48			312	
12A	19/24 *79%*	SS	*1-1* *2-4* N=3	20		*0.50*	50	Gray (10YR6/1) with 30% yellowish brown (10YR5/6) mottles, moist, medium, silty CLAY, few fine- to medium-grained sand.		310	
13A	24/24 *100%*	SS	*woh-1* *2-3* N=3	19		*0.50*	52	Gray (10YR6/1) with 25% yellowish brown (10YR5/6) mottles, moist, medium, CLAY with few very fine- to fine-grained sand and trace silt.		308	
14A	19/24 *79%*	SS	*14-18* *20-24* N=38	14			▼ 54	Light yellowish brown (10YR6/4), moist, dense, silty, very fine- to fine-grained SAND.		306	
15A	16/24 *67%*	SS	*woh-woh* *5-13*	23			56	Light yellowish brown (10YR6/4), wet, dense, silty, very fine- to fine-grained SAND.		304	
16A	20/24 *83%*	SS	*4-21* *25-21* N=46	18			58	Gray (10YR6/1), wet, dense, silty, very fine- to coarse-grained SAND.		302	
							60				

NOTE(S): G01D installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Joppa Power Station
Location: Joppa, Illinois
Project: 15E0030
DATES: **Start:** 8/14/2015
Finish: 8/14/2015
WEATHER: Partly cloudy, calm, warm, mid-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: S. Keim

BOREHOLE ID: G01D
Well ID: G01D
Surface Elev: 361.50 ft. MSL
Completion: 64.38 ft. BGS
Station: 202,039.30N
831,716.11E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Joppa
Township: 15S;3E
Section 14, **Tier** 15S; **Range** 3E

WATER LEVEL INFORMATION:
▼ = 54.00 - During Drilling
▼ = 45.77 - 8/14/15
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
17A	23/24 *96%*	SS	*7-15 32-37* N=47	19				Gray (10YR6/1), wet, dense, silty, very fine- to coarse-grained SAND. *[Continued from previous page]*		300	
18A	15/18 *83%*	SS	*8-25 50/6"*	17			62	Light brownish gray (10YR6/2), wet, dense, silty, very fine- to coarse-grained SAND with trace small gravel.		298	
	0/11 *0%*	BD					64				

End of boring = 64.38 feet

NOTE(S): G01D installed in borehole.

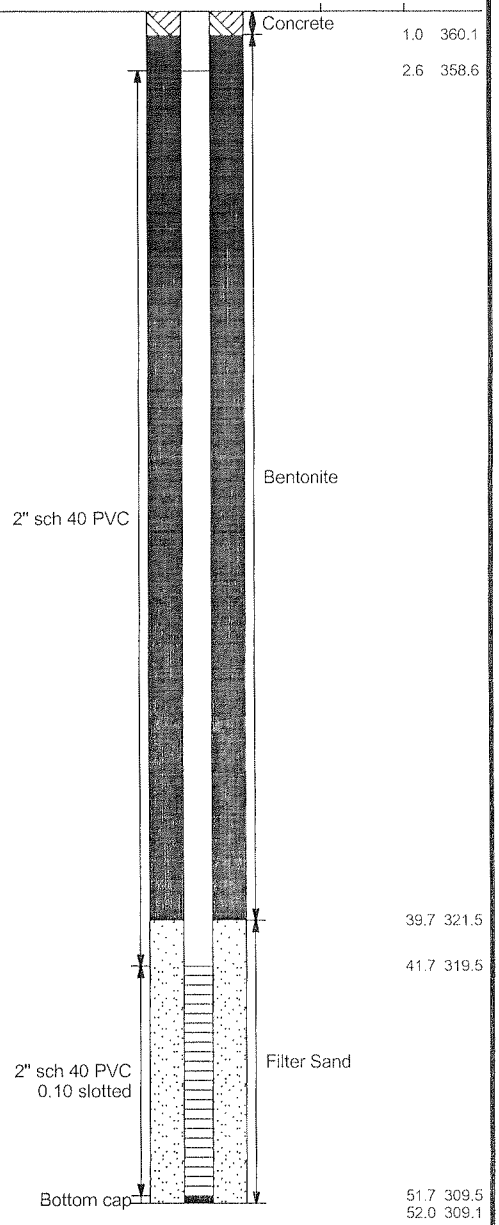
Surface Elevation: 361.12 | Completion Date: _____

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Medium stiff to stiff, brown and gray, silty CLAY - (CL)		2-4-4-5	SS1
	k = 2.8 x 10^{-8}cm/s		2-2-3-4	SS2
5			2-3-4-5	SS3
			5-4-5-6	SS4
			3-5-6-7	SS5
10			3-5-7-9	SS6
			3-4-4-5	SS7
			2-2-4-5	SS8
15			2-4-5-5	SS9
			2-4-6-7	SS10
			2-4-7-5	SS11
20			2-3-4-4	SS12
	trace sand		3-4-6-6	SS13
25			2-4-5-8	SS14
			2-3-4-6	SS15
			2-4-8-18	SS16
30	trace gravel and weathered limestone		15-18-22 -22	SS17
	Weathered LIMESTONE with silty clay		7-7-6-6	SS18
35	Stiff, brown and gray, silty CLAY with sand - CL		2-3-4-4	SS19
	Medium stiff, brown and gray, silty CLAY, trace sand - CL		3-3-4-4	SS20
			1-2-2-1	SS21
40	soft		1-4-6-7	SS22
			4-10-12-6	SS23
45	very stiff, with weathered limestone	▽	3-4-4-4	SS24
			1-2-3-3	SS25
50			2-3-4-6	SS26
	Boring terminated at 52 feet.			

WELL DIAGRAM

Flushmount



GROUNDWATER DATA

ENCOUNTERED AT 48 FEET ▽

DRILLING DATA

___ AUGER ___ HOLLOW STEM

WASHBORING FROM ___ FEET

PH DRILLER BGF LOGGER

___ DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: RDP	App'vd. by: RBP
Date: 7/14/10	Date: 9/20/10	Date: 9/20/10

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ash Pond Evaluation
EEI Facility
Joppa, Illinois

LOG OF BORING: G-101

Project No. J017150.02

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.02ENV - EEI JOPPA.GPJ GTINC 0638301.GPJ 9/22/10

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Joppa Power Station
Location: Joppa, Illinois
Project: 15E0030
DATES: **Start:** 8/12/2015
Finish: 8/13/2015
WEATHER: Sunny, warm, calm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: S. Keim

BOREHOLE ID: G02D
Well ID: G02D
Surface Elev: 360.82 ft. MSL
Completion: 72.36 ft. BGS
Station: 202,137.08N
832,842.99E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Joppa
Township: 15S;3E
Section 14, **Tier** 15S; **Range** 3E

WATER LEVEL INFORMATION:
▼ = 43.00 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
1A	20/24 83%	ss	1-1 2-3 N=3	24		2.00	0	Grayish brown (10YR5/2), moist, soft, SILT with few clay, trace very fine- to medium-grained sand, wood fragments, and roots.		360	
2A	24/24 100%	ss	1-3 5-5 N=8	23		2.50	2	Brown (10YR5/3) with 40% yellowish brown (10YR5/6) mottles, moist, stiff, SILT with few clay, trace very fine-grained sand and roots.		358	
3A	24/24 100%	ss	1-3 5-5 N=8	20		2.00	4			356	
4A	19/24 79%	ss	1-4 4-6 N=8	21		2.30	6	Brown (10YR5/3) with 40% yellowish brown (10YR5/6) and 10% gray (10YR6/1) mottles, moist, stiff, SILT with few clay, trace very fine-grained sand.		354	
5A	24/24 100%	ss	1-4 5-6 N=9	20		3.00	8			352	
6A	20/24 83%	ss	1-2 5-6 N=7	20		2.50	10	Gray (10YR6/1) with 30% yellowish brown (10YR5/6) mottles, moist, very stiff, SILT with few clay and trace very fine- to fine-grained sand.		350	
7A	22/24 92%	ss	1-5 7-11 N=12	18		3.00	12			348	
8A	19/24 79%	ss	2-9 13-18 N=22	15		4.50	14	Yellowish brown (10YR5/8) with 35% grayish brown (10YR5/2) mottles, moist, hard, SILT with few clay and trace very fine- to medium-grained sand.		346	
9A	24/24 100%	ss	4-8 11-15 N=19	17		3.00	16			344	
10A	18/24 75%	ss	1-7 10-14 N=17	16		3.50	18	Gray (10YR6/1) with 30% yellowish brown (10YR5/6) mottles, moist, very stiff, SILT with few clay and trace very fine- to fine-grained sand.		342	
							20				

NOTE(S): G02D installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Joppa Power Station
Location: Joppa, Illinois
Project: 15E0030
DATES: **Start:** 8/12/2015
Finish: 8/13/2015
WEATHER: Sunny, warm, calm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: S. Keim

BOREHOLE ID: G02D
Well ID: G02D
Surface Elev: 360.82 ft. MSL
Completion: 72.36 ft. BGS
Station: 202,137.08N
832,842.99E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Joppa
Township: 15S;3E
Section 14, **Tier** 15S; **Range** 3E

WATER LEVEL INFORMATION:
▼ = 43.00 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
11A	21/24 88%	ss	2-8 12-17 N=20	15		4.00	22			340	
12A	22/24 92%	ss	4-9 12-13 N=21	16		4.00	24	Gray (10YR6/1) with 30% yellowish brown (10YR5/6) mottles, moist, very stiff, SILT with few clay and trace very fine- to fine-grained sand. *[Continued from previous page]*		338	
13A	24/24 100%	ss	3-8 11-11 N=19	17		3.00	26			336	
14A	20/24 83%	ss	2-6 8-9 N=14	16		2.50	28			334	
15A	22/24 92%	ss	1-5 7-8 N=12	19		3.30	30	Gray (10YR6/1) with 30% yellowish brown (10YR5/6) mottles, moist, very stiff, SILT with little clay and trace very fine- to fine-grained sand.		332	
16A	24/24 100%	ss	1-6 8-9 N=14	17		2.30	32	Yellowish brown (10YR5/4) with 10% gray (10YR6/1) mottles, moist, very stiff, SILT with few clay and very fine- to fine-grained sand, trace small gravel.		330	
17A	23/23 100%	ss	2-7 40-50/5" N=47	16		2.80	34	Strong brown (7.5YR4/6), moist, very stiff, SILT with little very fine- to coarse-grained sand and small to large gravel.		328	
18A	18/24 75%	ss	8-25 43-19 N=68	11			36	Strong brown (7.5YR4/6), moist, very dense, silty, very fine- to coarse-grained SAND with little small to large gravel.		326	
19A	24/24 100%	ss	1-3 4-30 N=7	22		0.80	38	Yellowish brown (10YR5/4) with 10% gray (10YR6/1) mottles, moist, medium, silty CLAY with few fine- to medium-grained sand, trace gravel.		324	
20A	12/16 75%	ss	6-35 50/4"	13			40	Strong brown (7.5YR4/6) moist, hard, SILT with little very fine- to coarse-grained sand and little small to large gravel.		322	

NOTE(S): G02D installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Joppa Power Station
Location: Joppa, Illinois
Project: 15E0030
DATES: **Start:** 8/12/2015
Finish: 8/13/2015
WEATHER: Sunny, warm, calm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: S. Keim

BOREHOLE ID: G02D
Well ID: G02D
Surface Elev: 360.82 ft. MSL
Completion: 72.36 ft. BGS
Station: 202,137.08N
832,842.99E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Joppa
Township: 15S;3E
Section 14, **Tier** 15S; **Range** 3E

WATER LEVEL INFORMATION:
▼ = 43.00 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) / % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
21A	9/9 *100%*	ss	*39-50/3"*	11				Strong brown (7.5YR4/6) moist, hard, SILT with little very fine- to coarse-grained sand and little small to large gravel. *[Continued from previous page]*		320	
							42				
22A	8/24 *33%*	ss	*5-14* *17-8* N=31	15			▼	Brownish yellow (10YR6/6), moist, dense, silty, fine-grained SAND with trace medium- to coarse-grained sand.		318	
							44				
23A	24/24 *100%*	ss	*1-2* *3-4* N=5	22		*0.50*		Brownish yellow (10YR6/6), moist, medium, silty CLAY with few very fine- to medium-grained sand.		316	
							46				
24A	18/24 *75%*	ss	*woh-woh* *4-7*	18		*0.50*		Brownish yellow (10YR6/6), moist, soft, CLAY with some very fine- to medium-grained sand and trace coarse-grained sand and trace small gravel.		314	
							48				
25A	20/24 *83%*	ss	*1-2* *6-5* N=8	18		*0.80*		Brownish yellow (10YR6/6), moist, medium, CLAY with some very fine- to medium-grained sand and trace coarse-grained sand and trace small gravel.		312	
							50				
26A	17/24 *71%*	ss	*2-5* *5-8* N=10	23		*2.50*				310	
							52	Gray (10YR6/1) with 40% yellowish brown (10YR5/6) mottles, moist, stiff, silty CLAY with few fine-grained sand.			
27A	22/24 *92%*	ss	*1-3* *3-5* N=6	18		*1.50*				308	
							54				
28A	24/24 *100%*	ss	*woh-3* *3-4* N=6	17		*1.00*		Gray (10YR6/1), moist, medium, CLAY with some fine-grained sand and few silt.		306	
							56				
29A	24/24 *100%*	ss	*woh-4* *5-5* N=9	22		*3.00*				304	
							58	Gray (10YR6/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, stiff, SILT with few clay, trace fine-grained sand.			
30A	20/24 *83%*	ss	*2-4* *6-6* N=10	19		*2.00*				302	
							60				

NOTE(S): G02D installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Joppa Power Station
Location: Joppa, Illinois
Project: 15E0030
DATES: **Start:** 8/12/2015
Finish: 8/13/2015
WEATHER: Sunny, warm, calm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: S. Keim

BOREHOLE ID: G02D
Well ID: G02D
Surface Elev: 360.82 ft. MSL
Completion: 72.36 ft. BGS
Station: 202,137.08N
832,842.99E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Joppa
Township: 15S;3E
Section 14, **Tier** 15S; **Range** 3E

WATER LEVEL INFORMATION:
▼ = 43.00 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
31A	19/24 *79%*	SS	*woh-1 4-14* N=5	20			62	Gray (10YR6/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, medium, SILT with little clay and little very fine- to medium-grained sand.	300	
32A	16/24 *67%*	SS	*3-14 18-25* N=32	20			64	Gray (10YR6/1), wet, dense, very fine- to coarse-grained SAND with some silt.	298	
33A	14/24 *58%*	SS	*5-18 37-33* N=55	18			66	Gray (10YR6/1), wet, dense, very fine- to coarse-grained SAND with some silt and trace small to large gravel.	296	
34A	16/24 *67%*	SS	*18-29 35-21* N=64	13			68	Brownish yellow (10YR6/6), wet, very dense, silty, very fine- to coarse-grained SAND and small to large GRAVEL.	294	
35A	14/24 *58%*	SS	*20-24 30-30* N=54	16			70	Gray (10YR6/1), wet, very dense, silty, very fine- to coarse-grained SAND with trace small to large gravel.	292	
36A	16/24 *67%*	SS	*12-19 37-28* N=56	14					290	
	0/4 *0%*	BD					72			

End of boring = 72.36 feet

NOTE(S): G02D installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Joppa Power Station
Location: Joppa, Illinois
Project: 15E0030
DATES: **Start:** 8/17/2015
Finish: 8/18/2015
WEATHER: Partly cloudy, warm, mid-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: R. Hasenyager

BOREHOLE ID: G51D
Well ID: G51D
Surface Elev: 361.10 ft. MSL
Completion: 59.90 ft. BGS
Station: 200,430.10N
832,151.51E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Joppa
Township: 15S;3E
Section 14, **Tier** 15S; **Range** 3E

WATER LEVEL INFORMATION:
▼ = 39.50 - During Drilling
▼ = 34.91 - 8/18/15
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	0/60 *0%*	BD					0			360	
							2				
							4			358	
							6			356	
	0/60 *0%*	BD					8			354	
							10	Blind drill - see G151 boring log		352	
							12			350	
	0/60 *0%*	BD					14			348	
							16			346	
	0/60 *0%*	BD					18			344	
							20			342	

NOTE(S): G51D installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Joppa Power Station
Location: Joppa, Illinois
Project: 15E0030
DATES: **Start:** 8/17/2015
Finish: 8/18/2015
WEATHER: Partly cloudy, warm, mid-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler

FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: R. Hasenyager

BOREHOLE ID: G51D
Well ID: G51D
Surface Elev: 361.10 ft. MSL
Completion: 59.90 ft. BGS
Station: 200,430.10N
832,151.51E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Joppa
Township: 15S;3E
Section 14, **Tier** 15S; **Range** 3E

WATER LEVEL INFORMATION:
▼ = 39.50 - During Drilling
▼ = 34.91 - 8/18/15
▽ =

SAMPLE Number	SAMPLE Recov / Total (in) % Recovery	SAMPLE Type	TESTING Blows / 6 in N - Value RQD	TESTING Moisture (%)	TESTING Dry Den. (lb/ft³)	TESTING Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	0/60 *0%*	BD					22				
							24			338	
							26			336	
	0/60 *0%*	BD					28			334	
							30	Blind drill - see G151 boring log *[Continued from previous page]*		332	
	0/60 *0%*	BD					32			330	
							34			328	
							▼			326	
	0/60 *0%*	BD					36			324	
							38			322	
							▼				
9A	24/24 *100%*	SS	*6-7* *4-4* N=11	22		*1.50*	40	Yellowish brown (10YR5/8) with 20% gray (10YR5/1) mottles, moist, medium, CLAY with few silt and little very fine- to fine-grained sand.		320	
							42				

NOTE(S): G51D installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Joppa Power Station
Location: Joppa, Illinois
Project: 15E0030
DATES: **Start:** 8/17/2015
Finish: 8/18/2015
WEATHER: Partly cloudy, warm, mid-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: R. Hasenyager

BOREHOLE ID: G51D
Well ID: G51D
Surface Elev: 361.10 ft. MSL
Completion: 59.90 ft. BGS
Station: 200,430.10N
832,151.51E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Joppa
Township: 15S;3E
Section 14, **Tier** 15S; **Range** 3E

WATER LEVEL INFORMATION:
▼ = 39.50 - During Drilling
▼ = 34.91 - 8/18/15
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
10A	24/24 100%	SS	1-2 4-5 N=6	20		1.50	44	Yellowish brown (10YR5/8) with 20% gray (10YR5/1) mottles, moist, medium, CLAY with few silt and little very fine- to fine-grained sand. *[Continued from previous page]*		318	
11A	24/24 100%	SS	3-4 4-4 N=8	16		0.25	46	Yellowish brown (10YR5/8) with 50% gray (10YR6/1) mottles, moist, soft, very fine- to medium-grained SAND with some silt and little clay.		316	
12A	24/24 100%	SS	5-7 10-11 N=17	13		1.50	48	Yellowish brown (10YR5/8) with 50% gray (10YR6/1) mottles, moist, stiff, very fine- to medium-grained SAND with some silt, little clay, and trace small gravel.		314	
13A	20/24 83%	SS	5-12 14-15 N=26	15		0.25	50	Yellowish brown (10YR5/8) with 20% gray (10YR6/1) mottles, wet, loose, very fine- to medium-grained SAND with trace silt, trace clay and trace small gravel.		312	
14A	23/24 96%	SS	5-15 19-21 N=34	15		1.25	52			310	
15A	22/24 92%	SS	3-12 14-7 N=26	15		1.50	54			308	
16A	24/24 100%	SS	1-5 6-11 N=11	17		0.00	56	Strong brown (7.5YR5/8), wet, loose, very fine- to medium-grained SAND with trace silt, trace clay, and trace small gravel.		306	
17A	24/24 100%	SS	2-7 8-11 N=15	19		0.00	58			304	
	0/23 0%	BD								302	Drilled past end of sample interval

End of boring = 59.9 feet

NOTE(S): G51D installed in borehole.

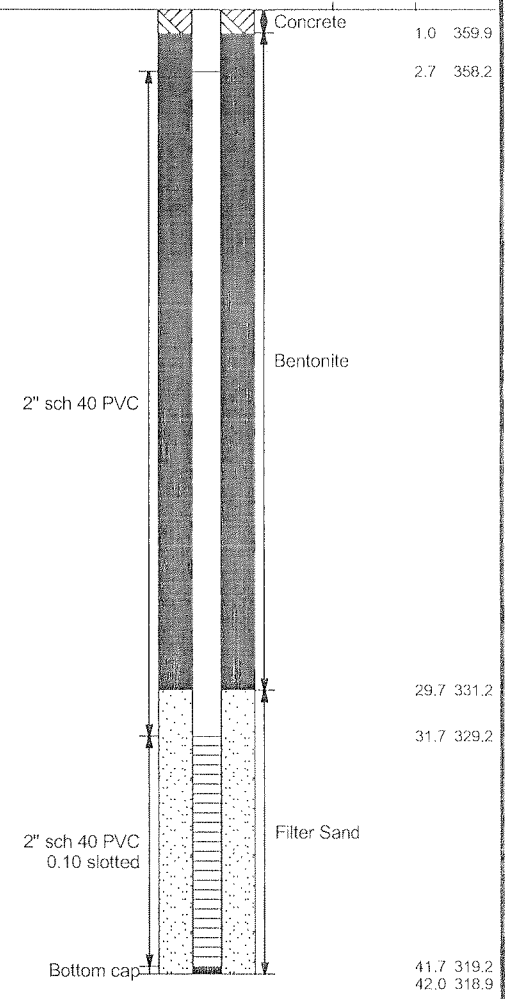
Surface Elevation: 360.9 | Completion Date: 6/19/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	GRAVEL			SS1
	Medium stiff to stiff, brown and gray, silty CLAY - (CL)		3-4-4-5	SS2
5			2-3-3-5	SS3
			3-3-4-4	SS4
	k = 1.6 x 10^{-8}cm/s		1-2-3-5	SS5
10			3-5-5-6	SS6
			2-4-5-6	SS7
15			2-3-4-5	SS8
	Medium stiff to stiff, brown and gray, silty CLAY, trace sand - CL		3-4-6-7	SS9
			3-4-6-6	SS10
20			3-5-7-8	SS11
			3-5-7-9	SS12
25			2-3-5-6	SS13
			3-5-7-6	SS14
			3-5-8-8	SS15
30			4-7-9-4	SS16
			4-4-6-7	SS17
35			2-4-3-5	SS18
	Medium stiff to very stiff, brown and gray, sandy CLAY with silt - CL		5-5-7-14	SS19
			13-13-10 -8	SS20
40			2-4-6-7	SS21
	Boring terminated at 42 feet.			
45				
50				

WELL DIAGRAM

Flushmount



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.02ENV - EEI JOPPA.GPJ GTINC 063301.GPJ 9/22/10

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER ___ HOLLOW STEM

WASHBORING FROM ___ FEET

PH DRILLER BGF LOGGER

___ DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: RJP	App'vd. by: RJP
Date: 7/14/10	Date: 9/20/10	Date: 9/20/10

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ash Pond Evaluation
EEI Facility
Joppa, Illinois

LOG OF BORING: G-151

Project No. J017150.02

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Joppa Power Station
Location: Joppa, Illinois
Project: 15E0030
DATES: **Start:** 8/18/2015
Finish: 8/19/2015
WEATHER: Overcast, humid, mid-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler

FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: R. Hasenyager

BOREHOLE ID: G52D
Well ID: G52D
Surface Elev: 345.88 ft. MSL
Completion: 80.01 ft. BGS
Station: 198,098.93N
832,927.89E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Joppa
Township: 15S;3E
Section 14, **Tier** 15S; **Range** 3E

WATER LEVEL INFORMATION:
▼ = 28.45 - During Drilling
▼ =
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	0/60 *0%*	BD					2			344	
							4			342	
	0/60 *0%*	BD					6			340	
							8			338	
							10	Blind drill - see G152 boring log		336	
	0/60 *0%*	BD					12			334	
							14			332	
							16			330	
	0/60 *0%*	BD					18			328	
							20			326	

NOTE(S): G52D installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Joppa Power Station
Location: Joppa, Illinois
Project: 15E0030
DATES: **Start:** 8/18/2015
Finish: 8/19/2015
WEATHER: Overcast, humid, mid-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: R. Hasenyager

BOREHOLE ID: G52D
Well ID: G52D
Surface Elev: 345.88 ft. MSL
Completion: 80.01 ft. BGS
Station: 198,098.93N
832,927.89E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Joppa
Township: 15S;3E
Section 14, **Tier** 15S; **Range** 3E

WATER LEVEL INFORMATION:
▼ = 28.45 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	0/60 *0%*	BD					22			324	
							24			322	
							26			320	
	0/60 *0%*	BD					28 ▼			318	
							30			316	
							32	Blind drill - see G152 boring log *[Continued from previous page]*		314	
	0/60 *0%*	BD					34			312	
							36			310	
	0/60 *0%*	BD					38			308	
							40			306	
	0/24 *0%*	BD					42			304	

NOTE(S): G52D installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Joppa Power Station
Location: Joppa, Illinois
Project: 15E0030
DATES: **Start:** 8/18/2015
Finish: 8/19/2015
WEATHER: Overcast, humid, mid-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: R. Hasenyager

BOREHOLE ID: G52D
Well ID: G52D
Surface Elev: 345.88 ft. MSL
Completion: 80.01 ft. BGS
Station: 198,098.93N
832,927.89E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Joppa
Township: 15S;3E
Section 14, **Tier** 15S; **Range** 3E

WATER LEVEL INFORMATION:
▼ = 28.45 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
10A	24/24 100%	SS	3-3 5-6 N=8	22		3.75	44	Gray (10YR5/1) with 40% yellowish brown (10YR5/8) mottles, moist, medium, CLAY with some silt and trace very fine-grained sand.		302	
11A	24/24 100%	SS	3-3 4-6 N=7	21		3.75	46			300	
12A				20		3.50					
12B	24/24 100%	SS	3-4 4-7 N=8	23			48	Gray (10YR6/1), moist, medium, SILT with some very fine-grained sand and trace clay.		298	
13A	24/24 100%	SS	2-4 5-6 N=9	23				Gray (10YR5/1) with 30% yellowish brown (10YR5/8) mottles, moist, medium, CLAY with some silt and trace very fine-grained sand.			
14A	24/24 100%	SS	5-7 8-10 N=15	20		4.00	50	Gray (10YR6/1) with 15% yellowish brown (10YR5/8) mottles, moist, stiff, CLAY with some silt and trace very fine-grained sand.		296	
15A	24/24 100%	SS	1-4 4-5 N=8	24		2.50	52	Gray (10YR6/1) with 10% yellowish brown (10YR5/8) mottles, moist, medium, SILT with few very fine-grained sand and little clay.		294	
16A	24/24 100%	SS	2-3 7-7 N=10	24		2.50	54	Gray (10YR6/1), moist, soft, CLAY with some silt and trace very fine-grained sand.		292	
16B				20				Gray (10YR6/1) with 10% yellowish brown (10YR5/8) mottles, moist, soft, SILT with little clay and very fine-grained sand.			
17A	24/24 100%	SS	4-4 7-9 N=11	21		3.75	56	Gray (10YR6/1), moist, soft, CLAY with some silt and trace very fine-grained sand.		290	
18A	24/24 100%	SS	2-6 7-7 N=13	24		3.25		Gray (10YR6/1), moist, medium, SILT and very fine-grained SAND with few clay.			
19A	22/24 92%	SS	3-3 4-4 N=7	20		2.25	58			288	
	24/24		2-3				60	Gray (10YR6/1), moist, medium, interbedded (0.1-0.2') SILT and very fine-grained SAND with few clay and CLAY with some silt and trace very fine-grained sand.		286	
							62	Gray (10YR6/1), moist, medium, SILT with very fine-grained sand and few clay.		284	

NOTE(S): G52D installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Joppa Power Station
Location: Joppa, Illinois
Project: 15E0030
DATES: **Start:** 8/18/2015
Finish: 8/19/2015
WEATHER: Overcast, humid, mid-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: R. Hasenyager

BOREHOLE ID: G52D
Well ID: G52D
Surface Elev: 345.88 ft. MSL
Completion: 80.01 ft. BGS
Station: 198,098.93N
832,927.89E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Joppa
Township: 15S;3E
Section 14, **Tier** 15S; **Range** 3E

WATER LEVEL INFORMATION:
▼ = 28.45 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
20A	100%	SS	5-6 N=8	23		2.25	64			282	
21A	24/24 100%	SS	4-4 6-7 N=10	23		4.25	66	Gray (10YR6/1), moist, medium, SILT with very fine-grained sand and few clay. *[Continued from previous page]*		280	
22A	24/24 100%	SS	3-4 8-9 N=12	19		2.00	68			278	
23A	24/24 100%	SS	2-7 6-6 N=13	22		2.50	70			276	
24A	24/24 100%	SS	wor-6 9-9 N=15	22		2.50	72	Gray (10YR6/1) with 20% yellowish brown (10YR5/8) mottles, moist, stiff, SILT and very fine-grained SAND with few clay.		274	
25A	24/24 100%	SS	wor-3 5-7 N=8	22		2.25	74	Gray (10YR6/1), wet, dense, SILT and very fine-grained SAND with trace clay. Gray (10YR6/1), wet, loose, very fine- to medium-grained SAND with trace silt.		272	
26A				17							
26B	24/24 100%	SS	6-7 8-9 N=15	22		3.25	76			270	Rods dropped, no blows
27A	24/24 100%	SS		22		2.75	78	Yellowish brown (10YR5/8) with 10% gray (10YR5/1) mottles, moist, stiff, CLAY with some silt and trace very fine-grained sand.		268	
28A	22/24 92%	SS	woh-3 6-7 N=9	27		3.25	80			266	

End of boring = 80.01 feet

NOTE(S): G52D installed in borehole.

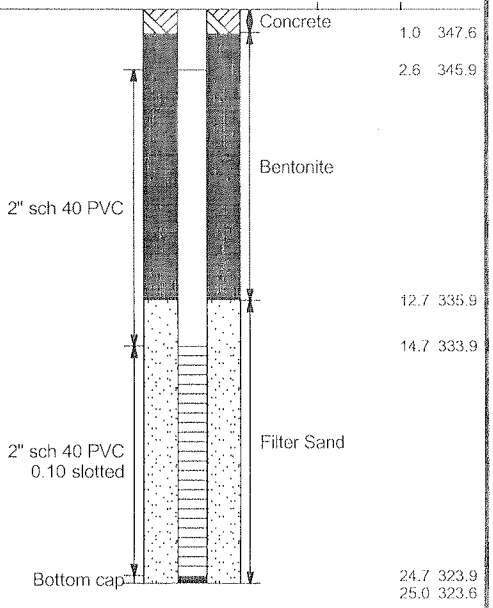
Surface Elevation: 348.56 | Completion Date: _____

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Medium stiff, brown CLAY with organics - CH		2-3-3-4	SS1
	Medium stiff, brown and gray, silty CLAY - (CL)		1-1-2-3	SS2
5			1-2-3-5	SS3
			2-3-4-5	SS4
			1-3-4-4	SS5
10			2-3-5-5	SS6
	becoming stiff		2-5-8-9	SS7
15			2-5-3-6	SS8
			3-5-5-7	SS9
	trace sand to 25 feet		3-4-7-6	SS10
20	k = 1.1 x 10^{-8}cm/s	▽	3-6-10-9	SS11
			2-4-5-5	SS12
25	Boring terminated at 25 feet.			
30				
35				
40				
45				
50				

WELL DIAGRAM

Flushmount



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.02ENV - EEI JOPPA.GPJ GTINC 063301.GPJ 9/22/10

GROUNDWATER DATA

ENCOUNTERED AT 20 FEET ▽

DRILLING DATA

___ AUGER ___ HOLLOW STEM

WASHBORING FROM ___ FEET

PH DRILLER BGF LOGGER

ATV DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: KBP	App'vd. by: KBP
Date: 7/14/10	Date: 9/20/10	Date: 9/20/10

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ash Pond Evaluation
EEI Facility
Joppa, Illinois

LOG OF BORING: G-152

Project No. J017150.02

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Joppa Power Station (EEI)		G152B

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Matt Cooper Bulldog Drilling, Inc.	1/28/2013	1/30/2013	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
G152B	312.3 Feet (NAVD88)	345.2 Feet (NAVD88)	7.8 inches

Local Grid Origin ☒ (estimated: ☐) or Boring Location ☐

State Plane: Illinois East Zone N, E S / C / N

1/4 of 1/4 of Section , T N, R

Lat ° ' "

Long ° ' "

Local Grid Location: ☒ N 198094.58 Feet ☐ S ☒ E 832931.61 Feet ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Massac	Illinois	Joppa

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1	42 19		0 1 2 3	0 - 0.75' **SILTY CLAY** CL, disturbed with gravel, tree limbs, wood from clearing activities; dark brown, wet. 0.75 - 4.5' **SILTY CLAY** CL, light yellowish brown (10YR 6/4), high plasticity, very soft to soft, silty clay with organics (roots), soft, high plasticity, light yellowish brown (10YR 6/4), moist.	CL CL									PP 2 - 2.25
2	60 56		4 5 6 7	4' Silty Clay grading to a Clayey Silt, low plasticity, stiff, light gray (10YR 7/1), with 50% reddish brown mottling, moist. 4.5 - 12.5' **SILT:** ML, non plastic, stiff, very pale brown (10YR 8/2), dry. 7.3' soil horizon with small rootlets, 50% reddish brown mottling.					3.25 3 3 2					
3	60 58		8 9 10 11 12	7.5' very pale brown (10YR 8/2), non plastic, stiff, dry. 9' silt with clay, very stiff, non plastic, very pale brown (10YR 7/3) with 10-25% reddish brown mottling.	ML				1.75 4 3.5 2					

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm	
	Natural Resource Technology 23713 W. Paul Road Suite D, Pewaukee, WI 53072	Tel: (262) 523-9000 Fax: (262) 523-9001

NATURAL RESOURCE TECHNOLOGY

Boring Number G152B

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
									2					
			13	12.5 - 28.5' **SILTY CLAY** CL, medium to stiff, low to medium plasticity, light gray (10YR 7/1), with 50% mottling, moist.					2					
4	60 60		14	13.5' 10-50% reddish brown mottling.					2.5					
			15	15' light gray (10YR 7/1).					2.25					
			16						2.25					
			17						3.25					
			18	18' yellowish brown (10YR 6/8) mottling, moist.										PP 2.5 - 3.5
5	60 60		19	18.5' medium to stiff, medium to high plasticity, light gray (10YR 7/1), with 10-25% reddish brown mottling, moist.					2.25					
			20						2.5					
			21		CL				1.75					
			22						1.75					
			23						1.75					
6	60 60		24	23.5' medium to stiff, high plasticity, light gray (10YR 7/1), with 25-50% reddish brown mottling, moist.					2					
			25						1.5					
			26						1.5					
			27						2.5					
			28						2					
NR	12 0		29	28.5 - 29.5' CL.	CL									stopped sampling for the day (1/28/13), cleaned hole with augers to 29.5' resumed sampling on 1/30/2013
7	60 44		30	29.5 - 44.5' **SILTY CLAY** CL, stiff, medium to high plasticity, gray with >75% light yellowish brown (10YR 6/4) mottling, moist.					2.75					
			31		CL				3.25					
			32	31.5' 25-75% mottling.										

NATURAL RESOURCE TECHNOLOGY

Boring Number G152B

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				29.5 - 44.5' **SILTY CLAY** CL, stiff, medium to high plasticity, gray with >75% light yellowish brown (10YR 6/4) mottling, moist. *(continued)*					3.5					
			33	33' very stiff to hard, gray (10YR 6/1), with < 25% yellowish brown (10YR 6/8) mottling.					4.5					
			34						2.5					
8	60 57		35	34.5' stiff to very stiff, high plasticity.					3.5					
			36						2.5					
			37						4.25					
			38	38' hard, < 10% mottling.	CL				2.5					
			39											PP is >4.5
9	60 55		40	39.5' very stiff to hard, high plasticity, gray (10YR 6/1) with < 10% yellowish brown (10YR 5/6) mottling, moist.					3					
			41						3					
			42						3					
			43						4.5					
			44						3.75					
				44.5' End of Boring.										

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Joppa Power Station
Location: Joppa, Illinois
Project: 15E0030
DATES: **Start:** 8/20/2015
Finish: 8/21/2015
WEATHER: Sunny, mild mid-60s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler

FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: R. Hasenyager

BOREHOLE ID: G53D
Well ID: G53D
Surface Elev: 352.16 ft. MSL
Completion: 58.00 ft. BGS
Station: 200,075.16N
833,980.21E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Joppa
Township: 15S;3E
Section 14, **Tier** 15S; **Range** 3E

WATER LEVEL INFORMATION:
▼ = 43.45 - During Drilling
▼ =
▽ =

SAMPLE			TESTING							
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	0/60 *0%*	BD					0			352	
							2			350	
							4			348	
	0/60 *0%*	BD					6			346	
							8			344	
							10	Blind drill - see G153 boring log		342	
	0/60 *0%*	BD					12			340	
							14			338	
							16			336	
	0/60 *0%*	BD					18			334	
							20			332	

NOTE(S): G55D installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Joppa Power Station
Location: Joppa, Illinois
Project: 15E0030
DATES: **Start:** 8/20/2015
Finish: 8/21/2015
WEATHER: Sunny, mild mid-60s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: R. Hasenyager

BOREHOLE ID: G53D
Well ID: G53D
Surface Elev: 352.16 ft. MSL
Completion: 58.00 ft. BGS
Station: 200,075.16N
833,980.21E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Joppa
Township: 15S;3E
Section 14, **Tier** 15S; **Range** 3E

WATER LEVEL INFORMATION:
▼ = 43.45 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	0/60 *0%*	BD					22			330	
							24			328	
	0/60 *0%*	BD					26			326	
							28			324	
	0/60 *0%*	BD					30	Blind drill - see G153 boring log *[Continued from previous page]*		322	
							32			320	
	0/36 *0%*	BD					34			318	
							36			316	
9A	24/24 *100%*	SS	*3-3* *5-5* N=8	19		*1.25*	38	Gray (10YR5/1) with 30% yellowish brown (10YR5/8) mottles, moist, dense, very fine- to medium-grained SAND with some silt and little clay.		314	
10A	21/24 *88%*	SS	*3-6* *7-8* N=13	17		*1.50*	40	Dark yellowish orange (10YR6/6) with 20% gray (10YR5/1) mottles, wet, dense, very fine- to medium-grained SAND with some silt, little clay, and trace small gravel.		312	
							42				

NOTE(S): G55D installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Joppa Power Station
Location: Joppa, Illinois
Project: 15E0030
DATES: **Start:** 8/20/2015
Finish: 8/21/2015
WEATHER: Sunny, mild mid-60s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: R. Hasenyager

BOREHOLE ID: G53D
Well ID: G53D
Surface Elev: 352.16 ft. MSL
Completion: 58.00 ft. BGS
Station: 200,075.16N
833,980.21E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Joppa
Township: 15S;3E
Section 14, **Tier** 15S; **Range** 3E

WATER LEVEL INFORMATION:
▼ = 43.45 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
11A	24/24 100%	SS	1-3 4-5 N=7	20			44	Dark yellowish orange (10YR6/6) with 20% gray (10YR5/1) mottles, wet, dense, very fine- to medium-grained SAND with some silt, little clay, and trace small gravel. *[Continued from previous page]*		310	
12A	21/24 88%	SS	2-5 12-14 N=17	16			46	Yellowish brown (10YR5/8) with 10% gray (10YR6/10 mottles, wet, dense, very fine- to fine-grained SAND with some silt and trace clay.		308	
13A	23/24 96%	SS	1-1 6-10 N=7	20			48			306	
14A	15/24 63%	SS	wor-wor woh-3	25			50	Gray (10YR6/1) wet, loose, very fine- to medium-grained SAND (micaceous) with little silt and trace clay.		304	
15A	19/24 79%	SS	1-3 8-14 N=11	23			52			302	
16A	20/24 83%	SS	1-4 5-14 N=9	23			54	Gray (10YR6/1) wet, loose, very fine- to medium-grained SAND (micaceous) with little silt and trace clay and small gravel.		300	
17A				22						298	
17B	19/24 79%	SS	4-10 14-20 N=24	16			56	Gray (10YR6/1), wet, loose, very fine- to very coarse-grained SAND with few small to large gravel and little silt.		296	
18A				12							
18B	18/24 75%	SS	1-9 10-11 N=19	21			58	Gray (10YR6/1) wet, loose, very fine- to fine-grained SAND with little silt and trace small gravel.			

End of boring = 58.0 feet

NOTE(S): G55D installed in borehole.

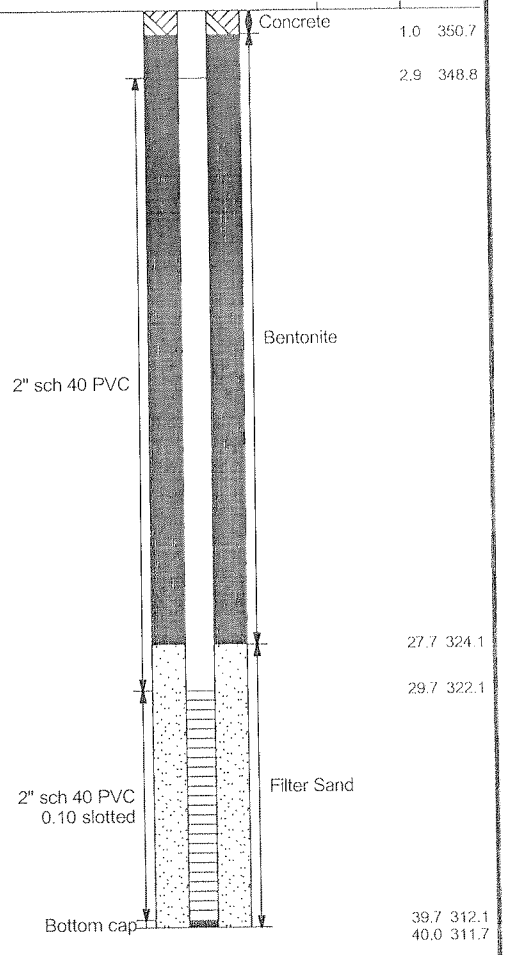
Surface Elevation: 351.73 | Completion Date: 6/18/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Medium stiff, brown and gray CLAY - CH		2-2-3-4	SS1
	Soft, brown and gray CLAY - CH		1-1-2-1	SS2
5	Medium stiff to stiff, brown, silty CLAY, trace sand - (CL)		1-2-4-4	SS3
			2-4-4-5	SS4
			2-3-6-6	SS5
10			3-5-5-6	SS6
			1-4-4-8	SS7
	k = 1.2 x 10^{-6}cm/s		2-4-5-8	SS8
15			2-6-6-7	SS9
			3-5-7-7	SS10
20			2-5-7-8	SS11
			3-5-6-7	SS12
			4-4-6-6	SS13
25	Very stiff to stiff, brown, silty CLAY - CL		4-8-8-11	SS14
			3-4-7-9	SS15
30			4-6-8-10	SS16
	Stiff, brown, sandy CLAY with silt - CL		5-6-6-8	SS17
			3-4-6-8	SS18
35			5-5-7-7	SS19
	Stiff, brown clayey SILT - ML		2-3-6-7	SS20
40	Boring terminated at 40 feet.			
45				
50				

WELL DIAGRAM

Flushmount



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.02ENV - EEI JOPPA.GPJ GTINC 0638301.GPJ 9/22/10

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER ___ HOLLOW STEM

WASHBORING FROM ___ FEET

PH DRILLER BGF LOGGER

ATV DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: KGP	App'vd. by: KGP
Date: 7/14/10	Date: 9/20/10	Date: 9/20/10

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ash Pond Evaluation
EEI Facility
Joppa, Illinois

LOG OF BORING: G-153

Project No. J017150.02

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Joppa Power Station
Location: Joppa, Illinois
Project: 15E0030
DATES: **Start:** 8/11/2015
Finish: 8/11/2015
WEATHER: Sunny, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: S. Keim

BOREHOLE ID: G54D
Well ID: G54D
Surface Elev: 353.71 ft. MSL
Completion: 80.14 ft. BGS
Station: 199,066.83N
831,610.42E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Joppa
Township: 15S;3E
Section 14, **Tier** 15S; **Range** 3E

WATER LEVEL INFORMATION:
▼ = 18.00 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
1A	13/24 54%	ss	3-2 3-4 N=5	21			0	FILL - Black (10YR2/1), moist, medium, SILT with few clay, trace very fine- to medium-grained sand, and trace roots.			
							1	FILL - Yellowish brown (10YR5/4), moist, medium, SILT with few clay, trace very fine- to coarse-grained sand, and trace roots.		352	
2A	16/24 67%	ss	2-4 16-8 N=20	13			2	FILL - Yellowish brown (10YR5/4) with 25% gray (10YR5/1), moist, medium, SILT with few clay, trace very fine- to coarse-grained sand, trace small to large gravel, and trace roots.			
3A	18/24 75%	ss	4-4 5-8 N=9	23		2.00	4			350	
4A	21/24 88%	ss	2-2 4-4 N=6	25		2.00	6	Light gray (10YR7/1) with 20% dark yellowish brown (10YR4/6) mottles, moist, stiff, SILT with few clay, trace very fine- to fine-grained sand.		348	
5A	24/24 100%	ss	1-3 4-6 N=7	23		1.80	8			346	
6A	22/24 92%	ss	1-3 4-5 N=7	22		3.00	10	Brown (10YR5/3) with 20% dark yellowish brown (10YR4/6) mottles, moist, stiff, SILT with few clay, trace very fine-grained sand.		344	
7A	17/24 71%	ss	1-1 2-4 N=3	22		2.00	12			342	
8A	22/24 92%	ss	1-2 4-5 N=6	22		2.00	14	Gray (10YR6/1) with 35% dark yellowish brown (10YR4/6) mottles, moist, stiff, SILT with few clay, trace very fine-grained sand.		340	
9A	17/24 71%	ss	2-3 6-8 N=9	22		1.80	16			338	
							▼ 18			336	
10A	24/24 100%	ss	2-3 6-5 N=9	20		2.50		Yellowish brown (10YR5/6) with 30% gray (10YR6/1) mottles, moist, stiff, silty CLAY with trace very fine-grained sand.			
							20			334	
11A	24/24		1-3	20		1.90					

NOTE(S): G54D installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Joppa Power Station
Location: Joppa, Illinois
Project: 15E0030
DATES: **Start:** 8/11/2015
Finish: 8/11/2015
WEATHER: Sunny, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: S. Keim

BOREHOLE ID: G54D
Well ID: G54D
Surface Elev: 353.71 ft. MSL
Completion: 80.14 ft. BGS
Station: 199,066.83N
831,610.42E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Joppa
Township: 15S;3E
Section 14, **Tier** 15S; **Range** 3E

WATER LEVEL INFORMATION:
▼ = 18.00 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	100%	ss	5-6 N=8				22	Yellowish brown (10YR5/6) with 30% gray (10YR6/1) mottles, moist, stiff, silty CLAY with trace very fine-grained sand. *[Continued from previous page]*		332	
12A	24/24 100%	ss	1-4 6-8 N=10	19		3.00	24			330	
13A	24/24 100%	ss	1-3 4-6 N=7	19		1.80	26			328	
14A	24/24 100%	ss	2-4 7-7 N=11	21		2.00	28	Light brownish gray (10YR6/2) with 35% dark yellowish brown (10YR4/6) mottles, moist, very stiff, SILT with few clay, trace very fine- to medium-grained sand.		326	
15A	22/24 92%	ss	1-3 6-8 N=9	20		2.30	30			324	
16A	20/24 83%	ss	1-3 6-6 N=9	18		2.40	32			322	
17A	24/24 100%	ss	1-4 8-8 N=12	20		3.50	34			320	
18A	22/24 92%	ss	1-3 4-5 N=7	22		2.80	36	Grayish brown (10YR5/2) with 10% dark yellowish brown (10YR4/6) mottles, moist, very stiff, SILT with little clay, trace very fine-grained sand.		318	
19A	24/24 100%	ss	3-4 8-8 N=12	19		3.00	38			316	
20A	24/24 100%	ss	1-4 7-10 N=11	19		2.50	40	Light gray (10YR7/1) with 5% yellowish brown (10YR5/6) mottles, moist, very stiff, SILT with few clay, trace very fine-grained sand.		314	
21A	24/24 100%	ss	1-3 10-10 N=13	17		3.80	42			312	

NOTE(S): G54D installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Joppa Power Station
Location: Joppa, Illinois
Project: 15E0030
DATES: **Start:** 8/11/2015
Finish: 8/11/2015
WEATHER: Sunny, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: S. Keim

BOREHOLE ID: G54D
Well ID: G54D
Surface Elev: 353.71 ft. MSL
Completion: 80.14 ft. BGS
Station: 199,066.83N
831,610.42E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Joppa
Township: 15S;3E
Section 14, **Tier** 15S; **Range** 3E

WATER LEVEL INFORMATION:
▼ = 18.00 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
22A	24/24 100%	ss	5-8 9-10 N=17	16		3.00	44	Light gray (10YR7/1) with 5% yellowish brown (10YR5/6) mottles, moist, very stiff, SILT with few clay, trace very fine-grained sand. *[Continued from previous page]*		310	
23A	24/24 100%	ss	3-6 8-8 N=14	19		3.00	46			308	
24A	24/24 100%	ss	2-4 5-5 N=9	19		3.20	48	Light brownish gray (10YR6/2) with 10% dark yellowish brown (10YR4/4) mottles, moist, very stiff, silty CLAY, trace very fine- to coarse-grained sand.		306	
25A	24/24 100%	ss	4-7 7-6 N=14	18		2.40	50			304	
26A	17/24 71%	ss	1-4 6-8 N=10	18		2.00	52	Gray (10YR6/1) with 15% dark yellowish brown (10YR4/6) mottles, moist, very stiff, silty CLAY with little very fine- to coarse-grained sand and trace small gravel.		302	
27A	22/24 92%	ss	3-3 7-18 N=10	21		3.30	54	Gray (10YR6/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, very stiff, SILT with few clay, trace very fine-grained sand.		300	
28A	21/24 88%	ss	5-11 18-20 N=29	21		4.00	56			298	
29A	11/11 100%	ss	25-50/5"	15		3.80	58	Gray (10YR6/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, hard, SILT with few very fine- to fine-grained sand, trace clay.		296	
30A	20/24 83%	ss	21-19 35-29 N=54	14			60	Gary (10YR6/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, very dense, silty, very fine- to fine-grained sand, trace clay.		294	
31A	17/24 71%	ss	4-6 10-9 N=16	17		1.80	62	Gray (10YR6/1) with 15% dark yellowish brown (10YR4/6) mottles, moist, stiff, SILT with little clay, trace very fine- to fine-grained sand.		292	
32A	22/24		6-8	22		3.30					

NOTE(S): G54D installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Joppa Power Station
Location: Joppa, Illinois
Project: 15E0030
DATES: **Start:** 8/11/2015
Finish: 8/11/2015
WEATHER: Sunny, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: S. Keim

BOREHOLE ID: G54D
Well ID: G54D
Surface Elev: 353.71 ft. MSL
Completion: 80.14 ft. BGS
Station: 199,066.83N
831,610.42E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Joppa
Township: 15S;3E
Section 14, **Tier** 15S; **Range** 3E

WATER LEVEL INFORMATION:
▼ = 18.00 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	92%	SS	5-7 N=13				64	Gray (10YR6/1) with 15% dark yellowish brown (10YR4/6) mottles, moist, stiff, SILT with little clay, trace very fine- to fine-grained sand. *[Continued from previous page]*	290	
33A	24/24 100%	SS	2-4 7-9 N=11	18		2.50	66		288	
34A	24/24 100%	SS	3-5 10-15 N=15	19		2.50		Gray (10YR6/1) with 15% dark yellowish brown (10YR4/6) mottles, moist, stiff, SILT with little clay, few very fine- to coarse-grained sand, trace small gravel.	286	
35A	22/24 92%	SS	1-3 3-5 N=6	23		1.50	68	Yellowish brown (10YR5/6) with 10% gray (10YR6/1) mottles, moist, stiff, SILT with little clay, trace very fine-grained sand.	284	
36A	24/24 100%	SS	woh-1 5-6 N=6	23		1.50	70			
37A	24/24 100%	SS	woh-1 2-4 N=3	23		1.50	72	Gray (10YR6/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, stiff, SILT with little clay, trace very fine- to fine-grained sand.	282	
38A	16/24 67%	SS	30-40 27-34 N=67	11			74		280	
39A	12/15 80%	SS	10-47 50/3"	14			76	Yellowish brown (10YR5/6), moist, very dense, silty, fine- to coarse-grained SAND and small to large GRAVEL.	278	
40A	5/5 100%	SS	50/5"	12			78		276	
	0/21 0%	BD					80		274	

End of boring = 80.14 feet

NOTE(S): G54D installed in borehole.

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Massac County Well #: G01D

Site Name: Joppa Power Station Borehole #: G01D

State Plane Coordinate: X 831,716.1 Y 202,039.3 (or) Latitude: _____ Longitude: _____

Surveyed By: Gary C. Rogers IL Registration #: 035-002957

Drilling Contractor: Bulldog Drilling, Inc. Driller: J. Dittmaier

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): Water

Logged By: Suzanna L. Keim Date Started: 8/14/2015 Date Finished: 8/14/2015

Report Form Completed By: Suzanna L. Keim Date: 8/18/2015

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

Type of Bentonite Seal -- Granular (Pellet) Slurry (choose one)

Installation Method: Gravity

Setting Time: >48 hours

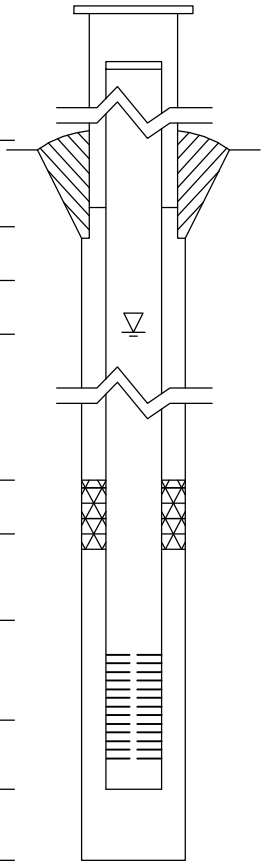
Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
364.50	-3.00	Top of Protective Casing
364.19	-2.69	Top of Riser Pipe
361.50	0.00	Ground Surface
359.50	2.00	Top of Annular Sealant
311.42	50.08	Static Water Level (After Completion) 10/5/2015
310.15	51.35	Top of Seal
308.90	52.60	Top of Sand Pack
307.31	54.19	Top of Screen
297.65	63.85	Bottom of Screen
297.12	64.38	Bottom of Well
297.12	64.38	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	56.88
Bottom of Screen to End Cap	(feet)	0.53
Screen Length (1st slot to last slot)	(feet)	9.66
Total Length of Casing	(feet)	67.07
Screen Slot Size **	(inches)	0.010

Well Completion Form (revised 02/06/02)

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Massac County Well #: G02D

Site Name: Joppa Power Station Borehole #: G02D

State Plane Coordinate: X 832,843.0 Y 202,137.1 (or) Latitude: _____ Longitude: _____

Surveyed By: Gary C. Rogers IL Registration #: 035-002957

Drilling Contractor: Bulldog Drilling, Inc. Driller: J. Dittmaier

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): Water

Logged By: Suzanna L. Keim Date Started: 8/12/2015 Date Finished: 8/13/2015

Report Form Completed By: Suzanna L. Keim Date: 8/18/2015

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

Type of Bentonite Seal -- Granular (Pellet) Slurry (choose one)

Installation Method: Gravity

Setting Time: 45 minutes

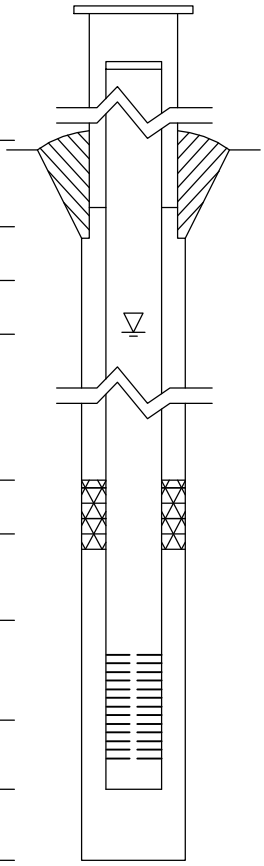
Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: _____



	Elevations (MSL)*	Depths (BGS) (0.01 ft.)
Top of Protective Casing	364.09	-3.27
Top of Riser Pipe	363.65	-2.83
Ground Surface	360.82	0.00
Top of Annular Sealant	358.82	2.00
Static Water Level (After Completion) 10/5/2015	312.82	48.00
Top of Seal	301.82	59.00
Top of Sand Pack	300.42	60.40
Top of Screen	298.61	62.21
Bottom of Screen	288.98	71.84
Bottom of Well	288.46	72.36
Bottom of Borehole	288.46	72.36

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	65.04
Bottom of Screen to End Cap	(feet)	0.52
Screen Length (1st slot to last slot)	(feet)	9.63
Total Length of Casing	(feet)	75.19
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Massac County Well #: G51D

Site Name: Joppa Power Station Borehole #: G51D

State Plane Coordinate: X 832,151.5 Y 200,430.1 (or) Latitude: _____ Longitude: _____

Surveyed By: Gary C. Rogers IL Registration #: 035-002957

Drilling Contractor: Bulldog Drilling, Inc. Driller: J. Dittmaier

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): Water

Logged By: Rhonald W. Hasenyager Date Started: 8/17/2015 Date Finished: 8/18/2015

Report Form Completed By: Suzanna L. Keim Date: 8/28/2015

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

Type of Bentonite Seal -- Granular (Pellet) Slurry (choose one)

Installation Method: Gravity

Setting Time: 70 minutes

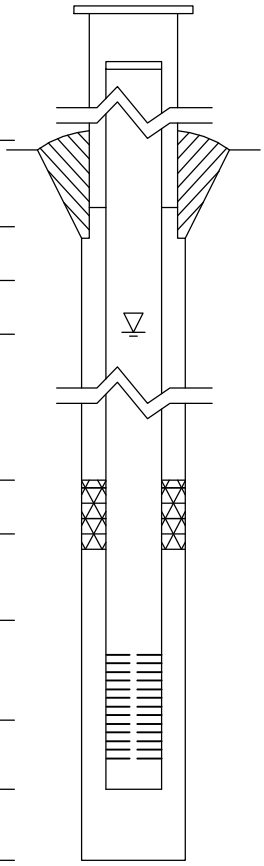
Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: _____



	Elevations (MSL)*	Depths (BGS) (0.01 ft.)
Top of Protective Casing	364.22	-3.12
Top of Riser Pipe	363.85	-2.75
Ground Surface	361.10	0.00
Top of Annular Sealant	359.10	2.00
Static Water Level (After Completion) 10/5/2015	311.65	49.45
Top of Seal	315.42	45.68
Top of Sand Pack	313.59	47.51
Top of Screen	311.49	49.61
Bottom of Screen	301.83	59.27
Bottom of Well	301.20	59.90
Bottom of Borehole	301.20	59.90

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	52.36
Bottom of Screen to End Cap	(feet)	0.63
Screen Length (1st slot to last slot)	(feet)	9.66
Total Length of Casing	(feet)	62.65
Screen Slot Size **	(inches)	0.010

Well Completion Form (revised 02/06/02)

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Massac County Well #: G52D

Site Name: Joppa Power Station Borehole #: G52D

State Plane Coordinate: X 832,927.9 Y 198,098.9 (or) Latitude: _____ Longitude: _____

Surveyed By: Gary C. Rogers IL Registration #: 035-002957

Drilling Contractor: Bulldog Drilling, Inc. Driller: J. Dittmaier

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): Water

Logged By: Rhonald W. Hasenyager Date Started: 8/18/2015 Date Finished: 8/19/2015

Report Form Completed By: Suzanna L. Keim Date: 8/28/2015

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

Type of Bentonite Seal -- Granular (Pellet) Slurry (choose one)

Installation Method: Gravity

Setting Time: 32 minutes

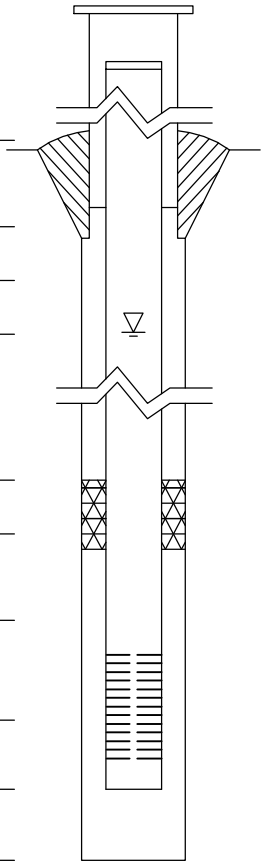
Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: _____



	Elevations (MSL)*	Depths (BGS) (0.01 ft.)
Top of Protective Casing	348.67	-2.79
Top of Riser Pipe	348.41	-2.53
Ground Surface	345.88	0.00
Top of Annular Sealant	343.88	2.00
Static Water Level (After Completion) 10/5/2015	313.46	32.42
Top of Seal	278.91	66.97
Top of Sand Pack	277.22	68.66
Top of Screen	276.03	69.85
Bottom of Screen	266.33	79.55
Bottom of Well	265.87	80.01
Bottom of Borehole	265.87	80.01

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	72.38
Bottom of Screen to End Cap	(feet)	0.46
Screen Length (1st slot to last slot)	(feet)	9.70
Total Length of Casing	(feet)	82.54
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Massac County Well #: G53D

Site Name: Joppa Power Station Borehole #: G53D

State Plane Coordinate: X 833,980.2 Y 200,075.2 (or) Latitude: _____ Longitude: _____

Surveyed By: Gary C. Rogers IL Registration #: 035-002957

Drilling Contractor: Bulldog Drilling, Inc. Driller: J. Dittmaier

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): Water

Logged By: Rhonald W. Hasenyager Date Started: 8/20/2015 Date Finished: 8/21/2015

Report Form Completed By: Suzanna L. Keim Date: 8/28/2015

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

Type of Bentonite Seal -- Granular (Pellet) Slurry (choose one)

Installation Method: Gravity

Setting Time: 65 minutes

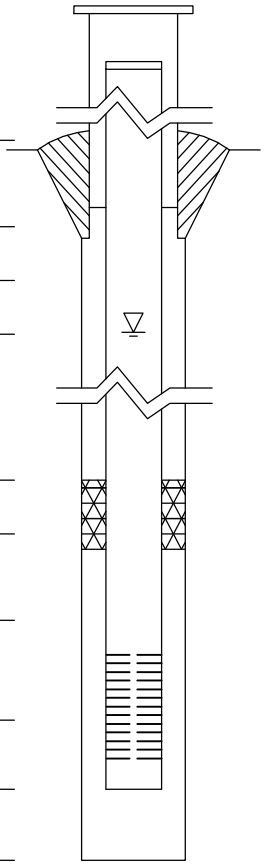
Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: Formation (if applicable)

Installation Method: Drilling



	Elevations (MSL)*	Depths (BGS) (0.01 ft.)
Top of Protective Casing	355.82	-3.66
Top of Riser Pipe	355.47	-3.31
Ground Surface	352.16	0.00
Top of Annular Sealant	350.16	2.00
Static Water Level (After Completion) 10/6/2015	309.91	42.25
Top of Seal	309.77	42.39
Top of Sand Pack	307.85	44.31
Top of Screen	304.87	47.29
Bottom of Screen	295.27	56.89
Bottom of Well	294.83	57.33
Bottom of Borehole	294.16	58.00

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	50.60
Bottom of Screen to End Cap	(feet)	0.44
Screen Length (1st slot to last slot)	(feet)	9.60
Total Length of Casing	(feet)	60.64
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Massac County Well #: G54D

Site Name: Joppa Power Station Borehole #: G54D

State Plane Coordinate: X 831,610.4 Y 199,066.8 (or) Latitude: _____ Longitude: _____

Surveyed By: Gary C. Rogers IL Registration #: 035-002957

Drilling Contractor: Bulldog Drilling, Inc. Driller: J. Dittmaier

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): Water

Logged By: Suzanna L. Keim Date Started: 8/11/2015 Date Finished: 8/11/2015

Report Form Completed By: Suzanna L. Keim Date: 8/18/2015

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

Type of Bentonite Seal -- Granular (Pellet) Slurry (choose one)

Installation Method: Gravity

Setting Time: >48 hours

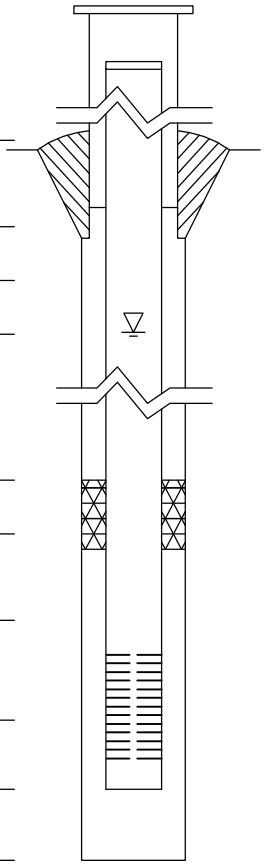
Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS) (0.01 ft.)	
357.39	-3.68	Top of Protective Casing
357.03	-3.32	Top of Riser Pipe
353.71	0.00	Ground Surface
351.71	2.00	Top of Annular Sealant
304.50	49.21	Static Water Level (After Completion) 10/5/2015
286.76	66.95	Top of Seal
285.71	68.00	Top of Sand Pack
283.75	69.96	Top of Screen
274.05	79.66	Bottom of Screen
273.57	80.14	Bottom of Well
273.57	80.14	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

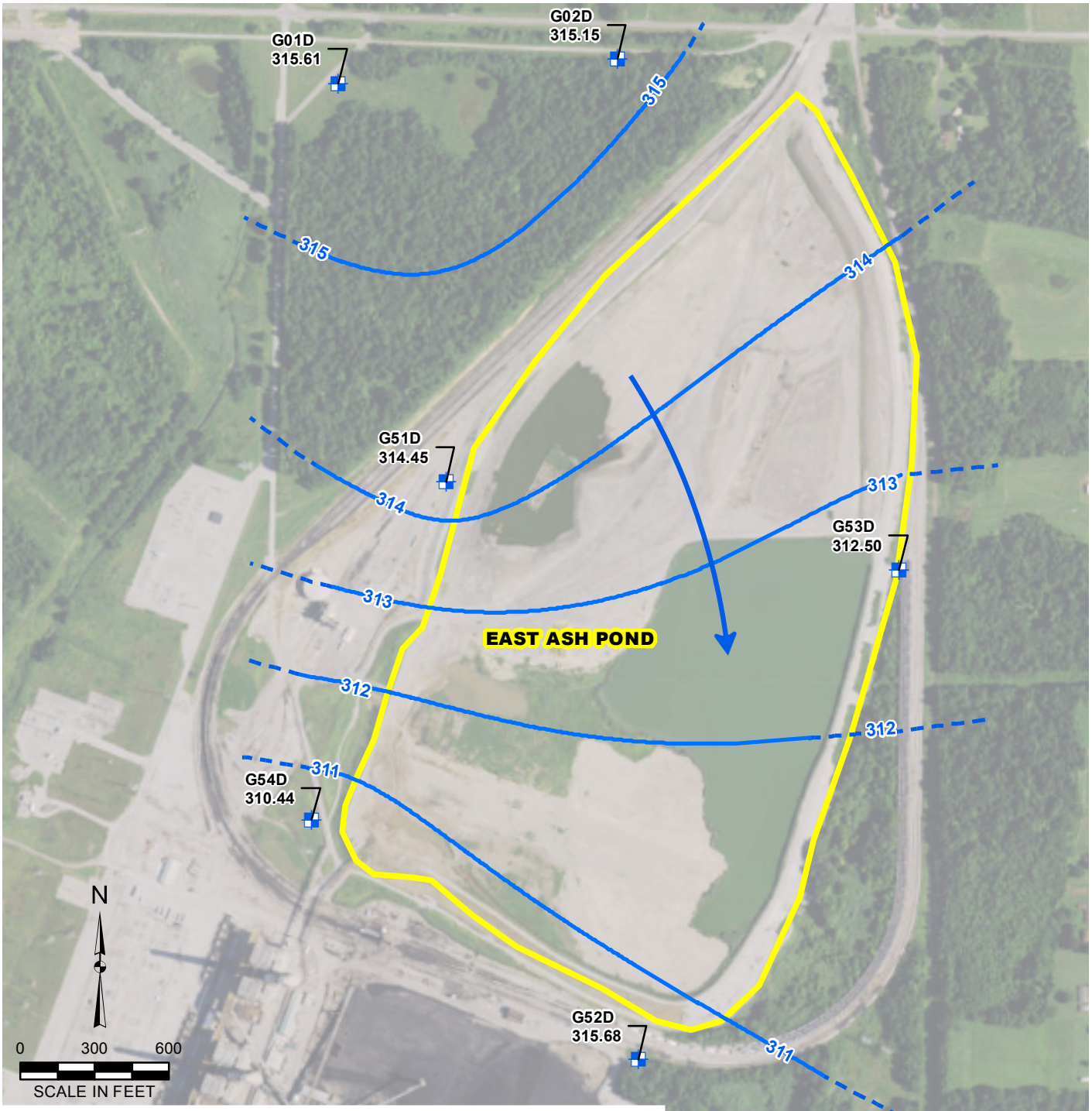
CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	73.28
Bottom of Screen to End Cap	(feet)	0.48
Screen Length (1st slot to last slot)	(feet)	9.70
Total Length of Casing	(feet)	83.46
Screen Slot Size **	(inches)	0.010

Well Completion Form (revised 02/06/02)

**Hand-Slotted Well Screens Are Unacceptable

ATTACHMENT 4 – MAPS OF THE DIRECTION OF GROUNDWATER FLOW



CCR RULE MONITORING WELL LOCATION
GROUNDWATER ELEVATION CONTOUR (1-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
CCR MONITORED UNIT

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

NOTE: G52D GROUNDWATER ELEVATION IS NOT INCLUDED IN POTENTIOMETRIC SURFACE CONTOURS

DRAWN BY/DATE:
SDS 1/23/17
REVIEWED BY/DATE:
ANS 1/25/17
APPROVED BY/DATE:
JJW 2/7/17

JOPPA EAST ASH POND (UNIT ID: 401)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 1: DECEMBER 2, 2015

DYNEGY CCR RULE GROUNDWATER MONITORING
JOPPA POWER STATION
JOPPA, ILLINOIS

PROJECT NO: 2285/1.6

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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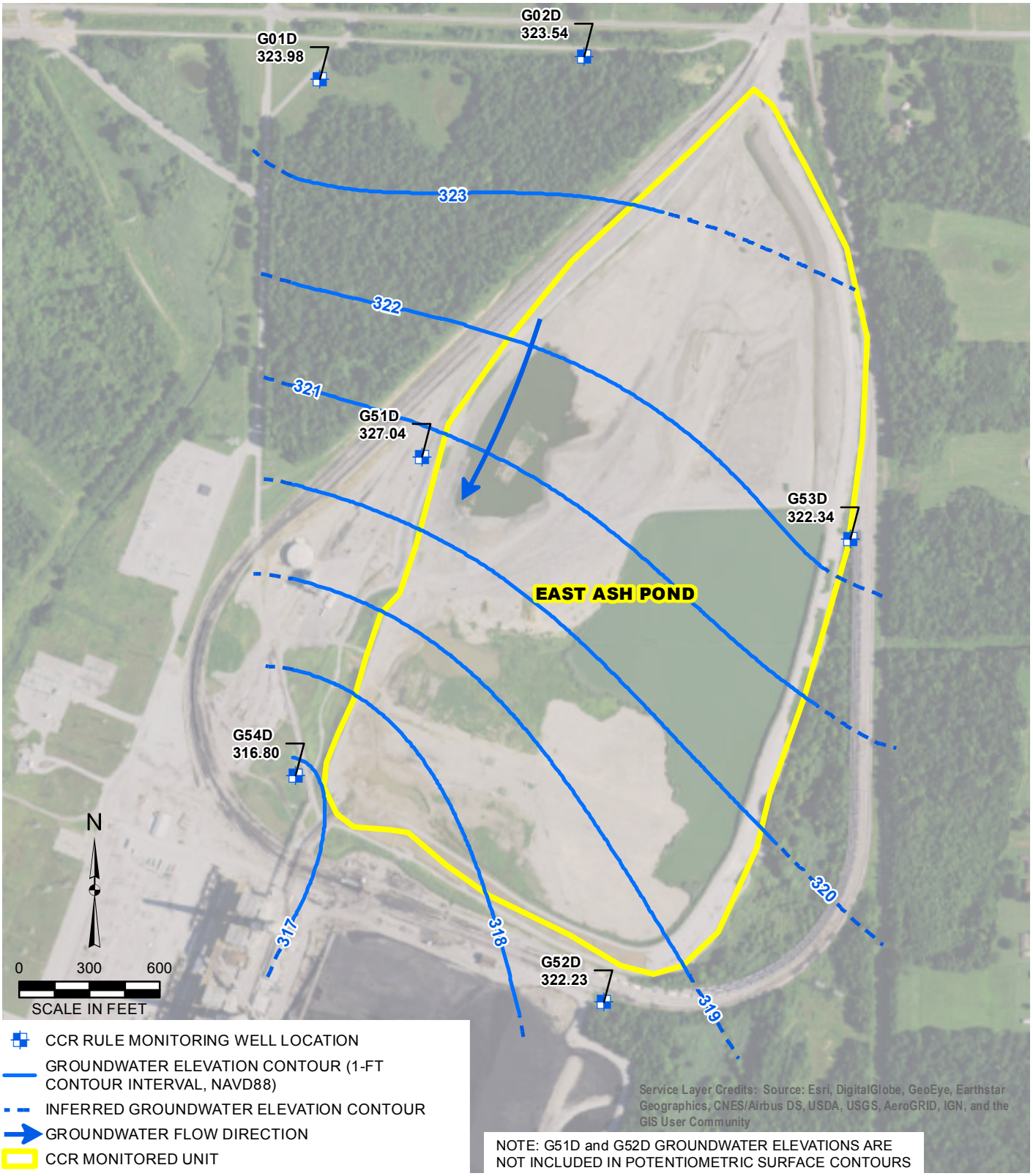

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SDS 1/23/17
REVIEWED BY/DATE:
ANS 1/25/17
APPROVED BY/DATE:
JJW 2/8/17

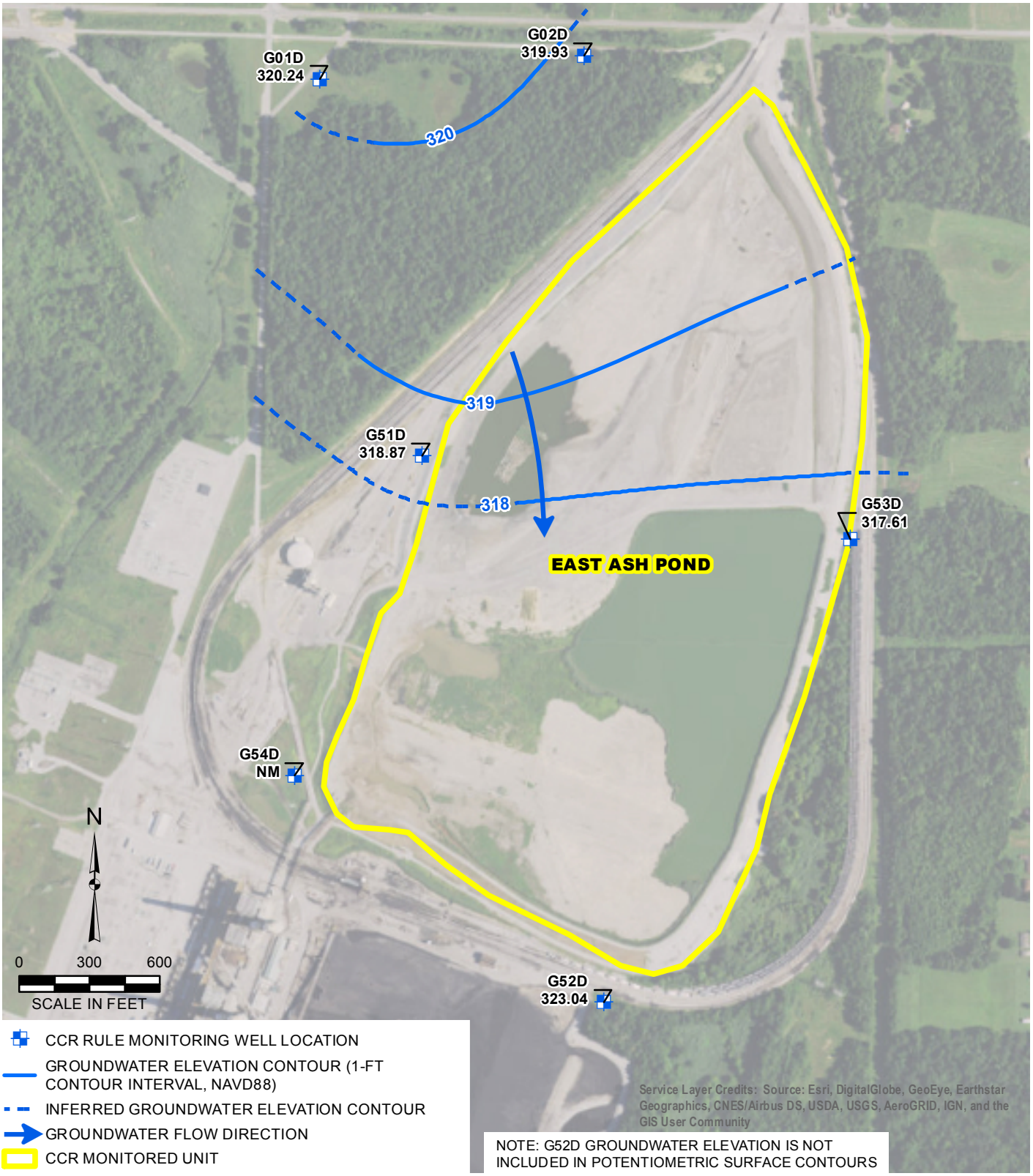
JOPPA EAST ASH POND (UNIT ID: 401)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 2: MARCH 15, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
JOPPA POWER STATION
JOPPA, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



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REVIEWED BY/DATE:
ANS 1/25/17
APPROVED BY/DATE:
JJW 2/8/17

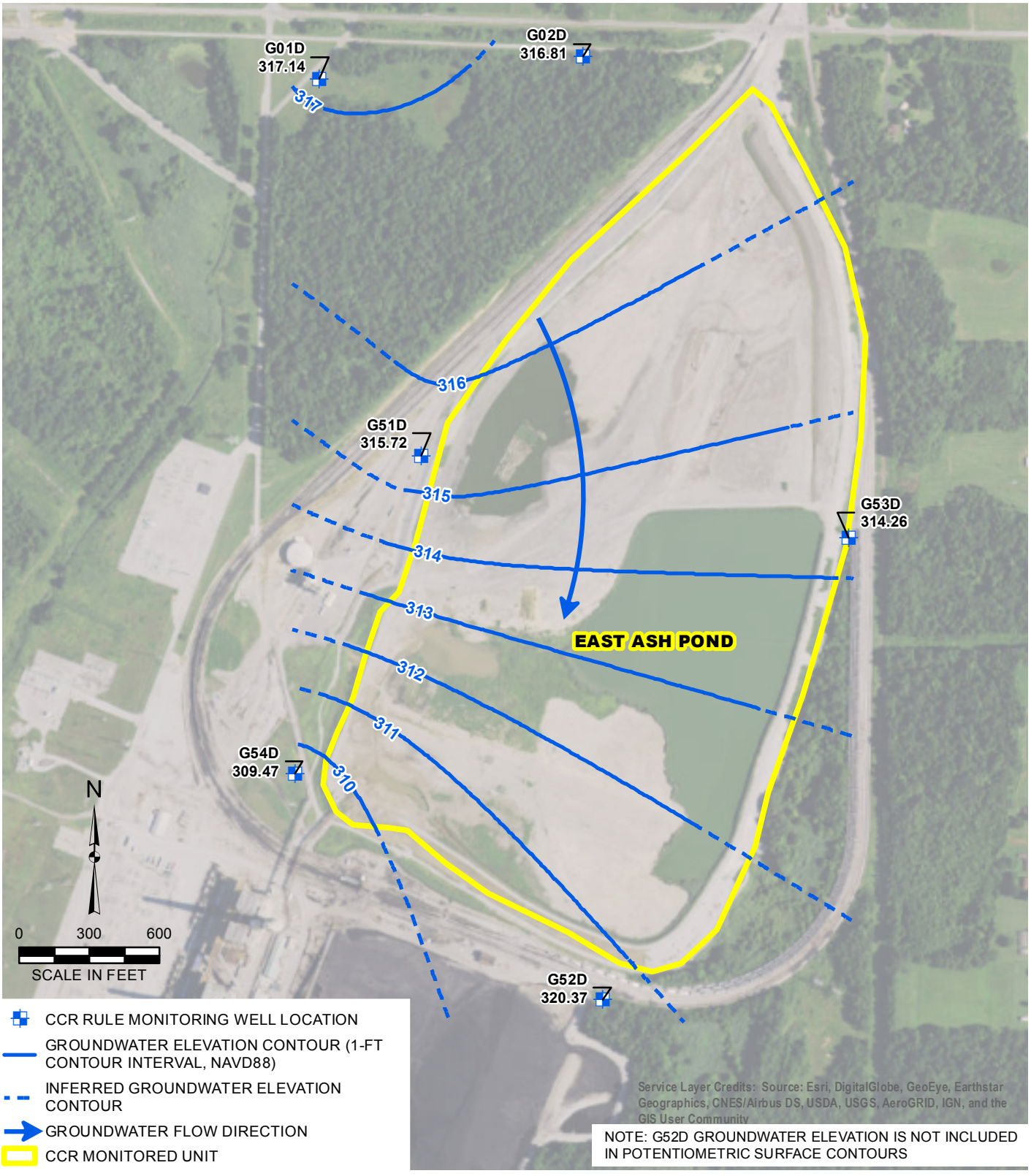
JOPPA EAST ASH POND (UNIT ID: 401)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 3: JUNE 14, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
JOPPA POWER STATION
JOPPA, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



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ANS 1/25/17
APPROVED BY/DATE:
JJW 2/8/17

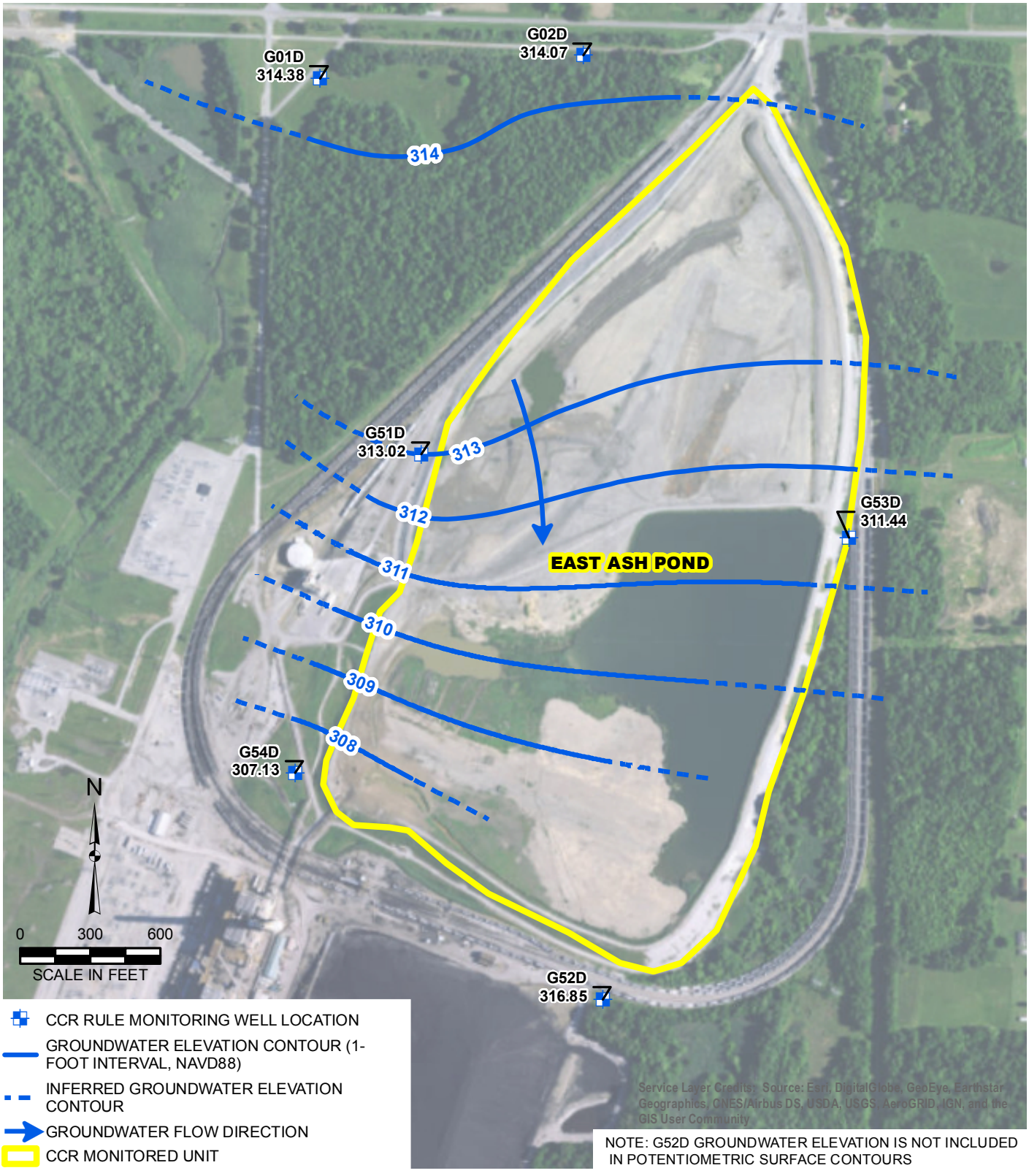
JOPPA EAST ASH POND (UNIT ID: 401)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 4: SEPTEMBER 13, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
JOPPA POWER STATION
JOPPA, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



NOTE: G52D GROUNDWATER ELEVATION IS NOT INCLUDED IN POTENTIOMETRIC SURFACE CONTOURS

DRAWN BY/DATE:
SDS 3/6/17
REVIEWED BY/DATE:
ANS 3/6/17
APPROVED BY/DATE:
JJW 8/30/17

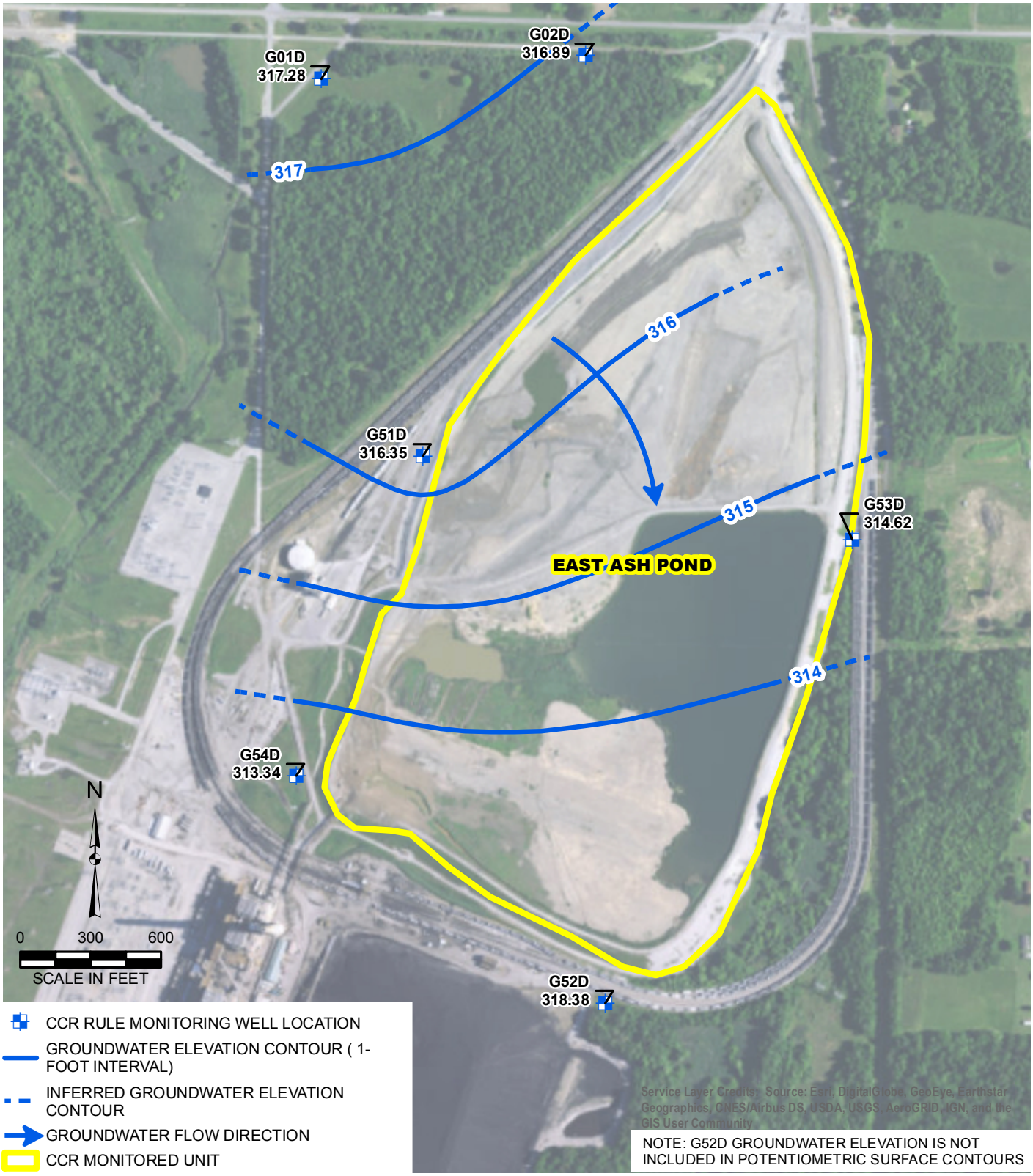
JOPPA EAST ASH POND (UNIT ID: 401)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 5: DECEMBER 14, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
JOPPA POWER STATION
JOPPA, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



NOTE: G52D GROUNDWATER ELEVATION IS NOT INCLUDED IN POTENTIOMETRIC SURFACE CONTOURS

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SDS 7/12/17
REVIEWED BY/DATE:
ANS 7/12/17
APPROVED BY/DATE:
JJW 8/30/17

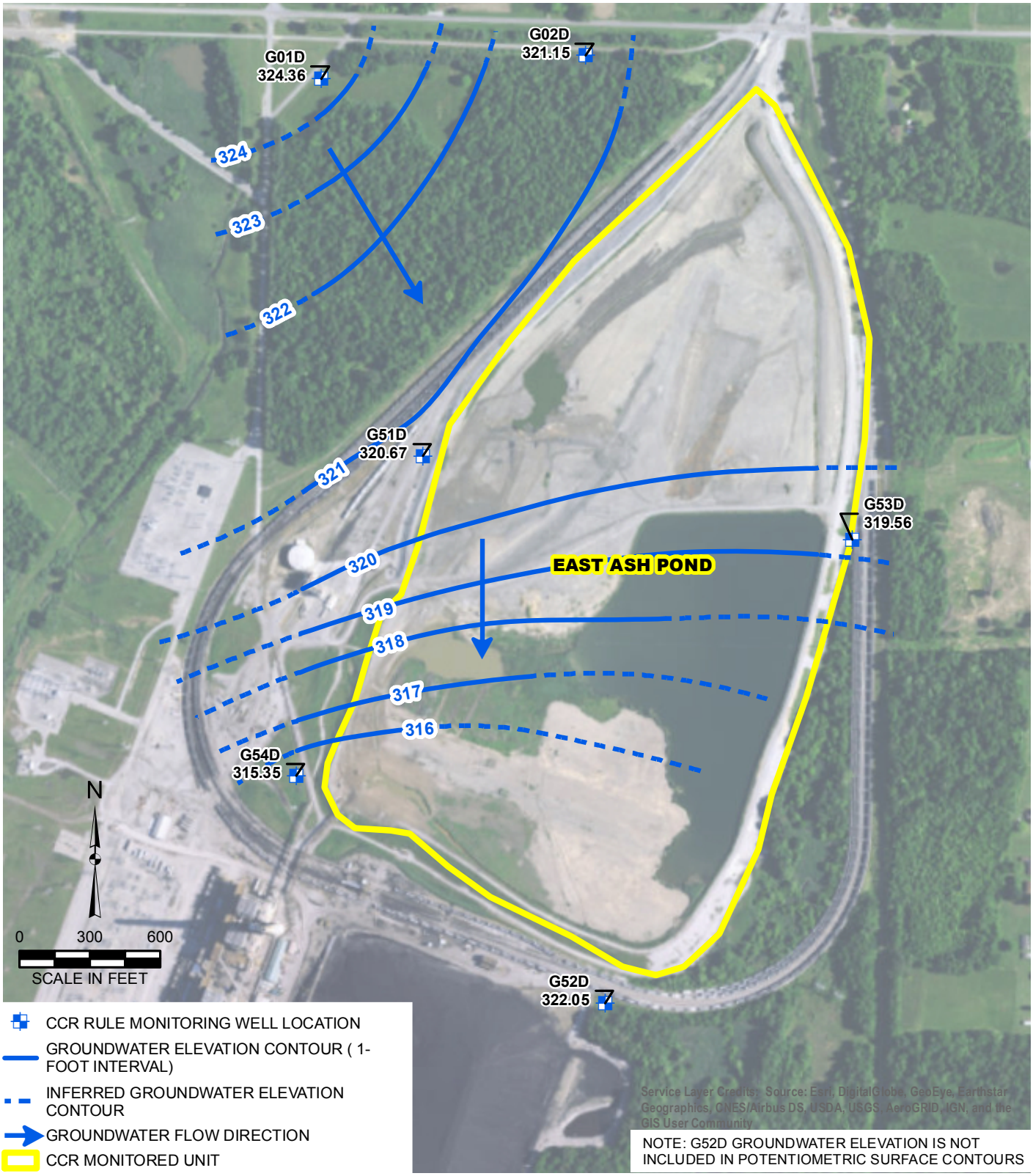
JOPPA EAST ASH POND (UNIT ID: 401)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 6: MARCH 7, 2017

DYNEGY CCR RULE GROUNDWATER MONITORING
JOPPA POWER STATION
JOPPA, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



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REVIEWED BY/DATE:
ANS 7/10/17
APPROVED BY/DATE:
JJW 8/30/17

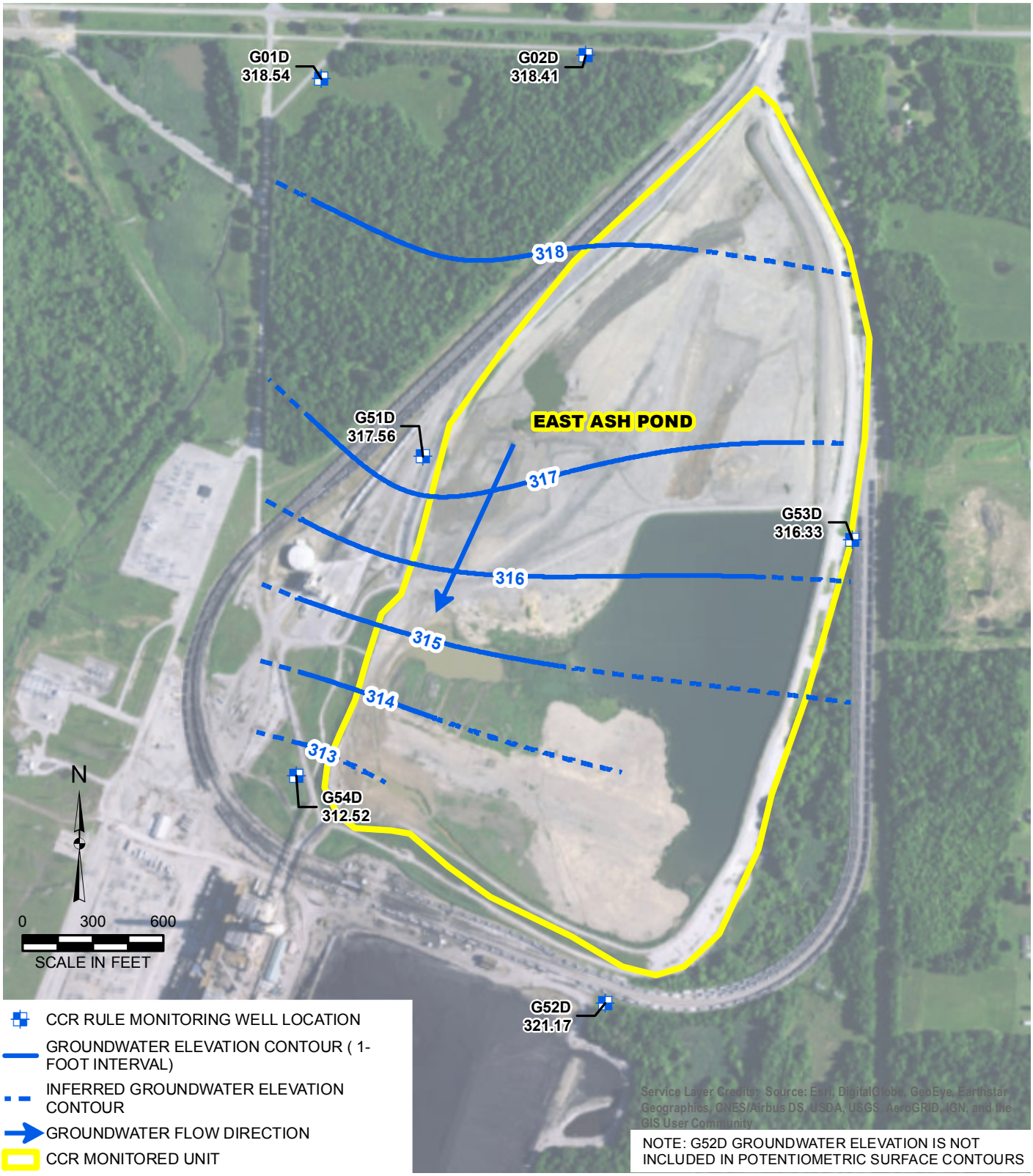
JOPPA EAST ASH POND (UNIT ID: 401)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 7: JUNE 14, 2017

DYNEGY CCR RULE GROUNDWATER MONITORING
JOPPA POWER STATION
JOPPA, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



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REVIEWED BY/DATE:
ANS 8/10/17
APPROVED BY/DATE:
JJW 8/30/17

JOPPA EAST ASH POND (UNIT ID: 401)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 8: JULY 19, 2017

DYNEGY CCR RULE GROUNDWATER MONITORING
JOPPA POWER STATION
JOPPA, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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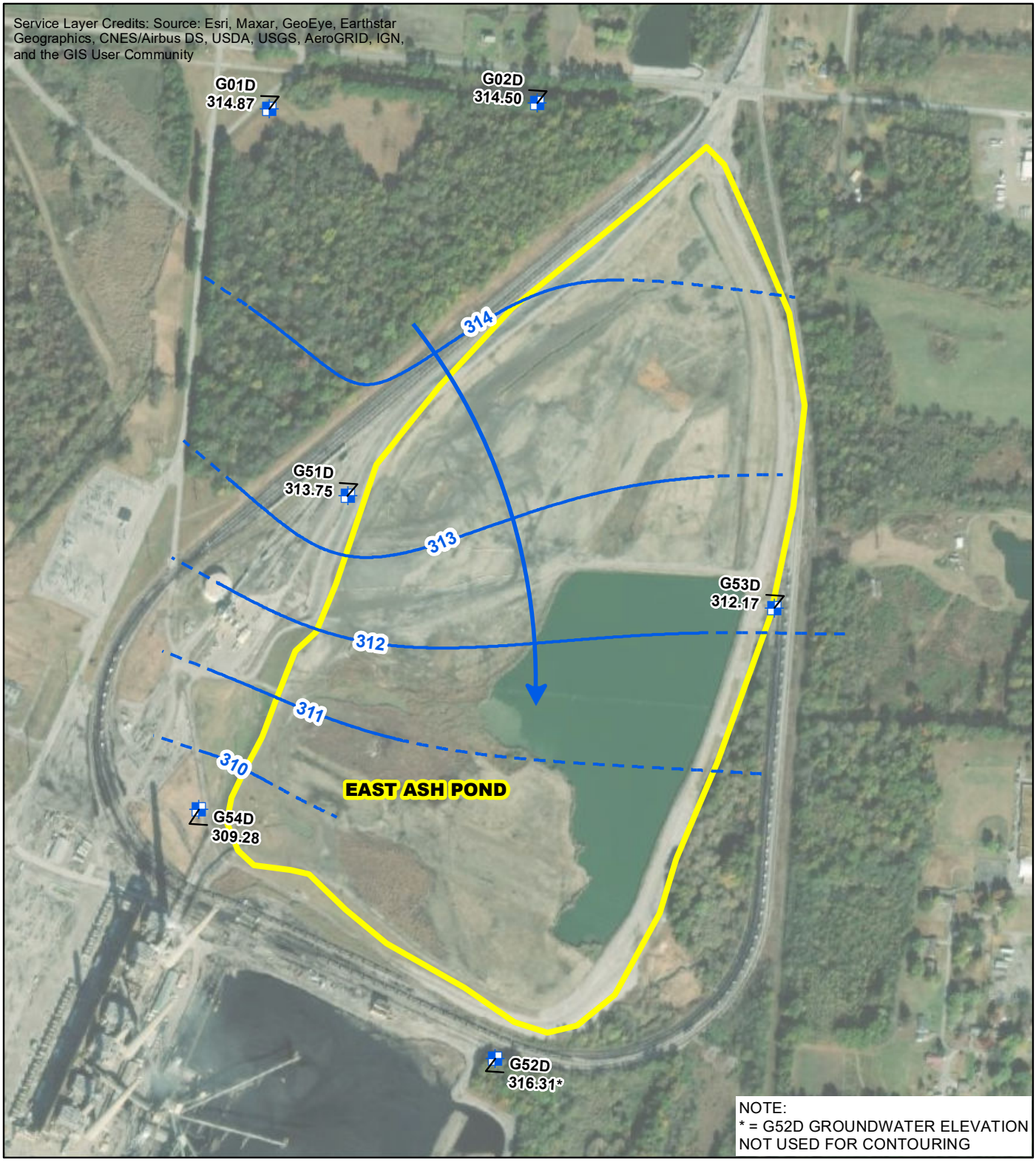

CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (1-FOOT CONTOUR INTERVAL, NAVD88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

CCR MONITORED UNIT

JOPPA EAST ASH POND (UNIT ID: 401)
GROUNDWATER ELEVATION CONTOUR MAP
NOVEMBER 30, 2017

CCR RULE GROUNDWATER MONITORING
JOPPA POWER STATION
JOPPA, ILLINOIS

0 150 300 600
Feet

N

O'BRIEN & GERE ENGINEERS, INC.

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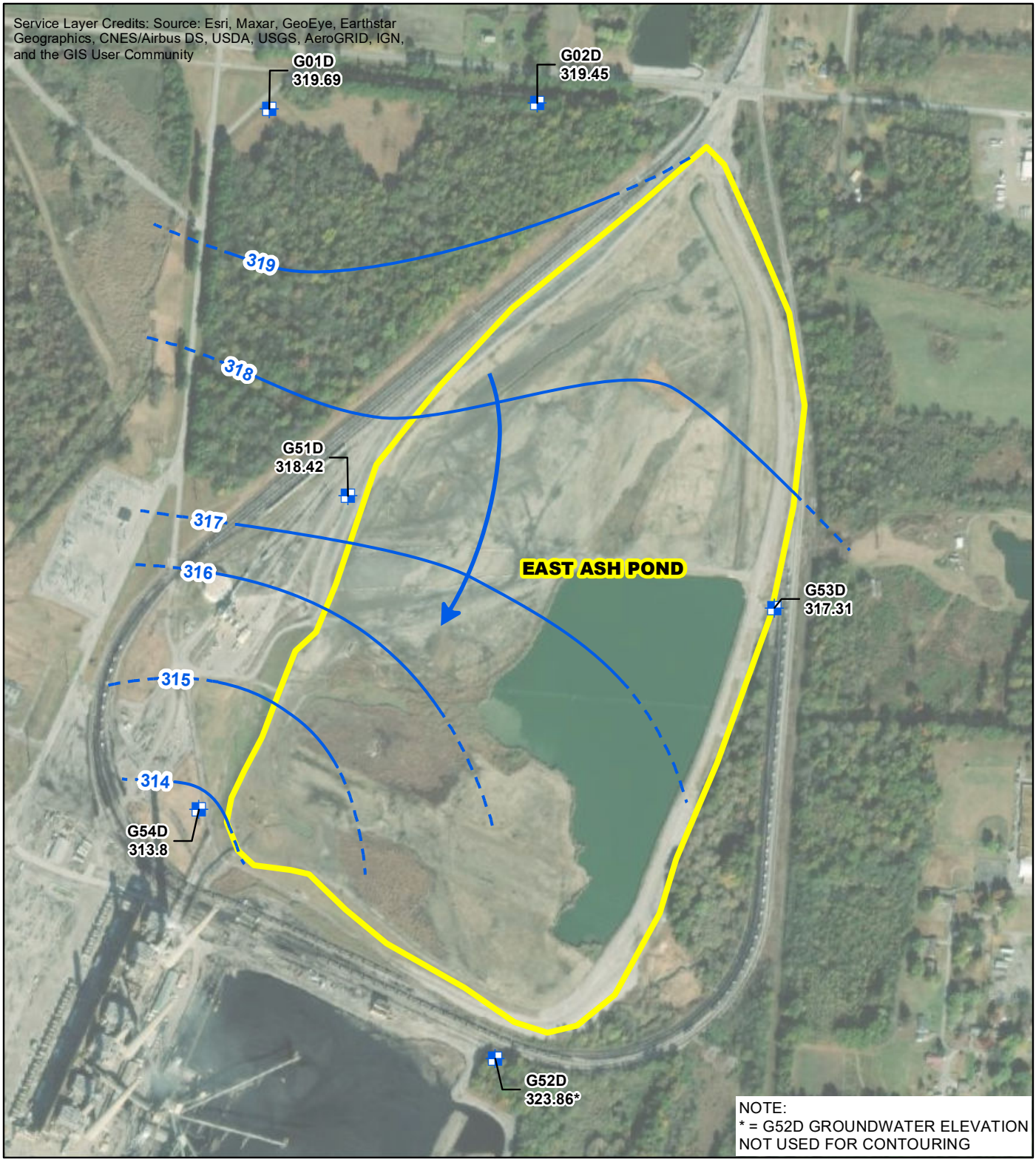

CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (1-FOOT CONTOUR INTERVAL, NAVD88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

CCR MONITORED UNIT

JOPPA EAST ASH POND (UNIT ID: 401)
GROUNDWATER ELEVATION CONTOUR MAP
JUNE 9, 2018

CCR RULE GROUNDWATER MONITORING
JOPPA POWER STATION
JOPPA, ILLINOIS

0 150 300 600
Feet

N

O'BRIEN & GERE ENGINEERS, INC.

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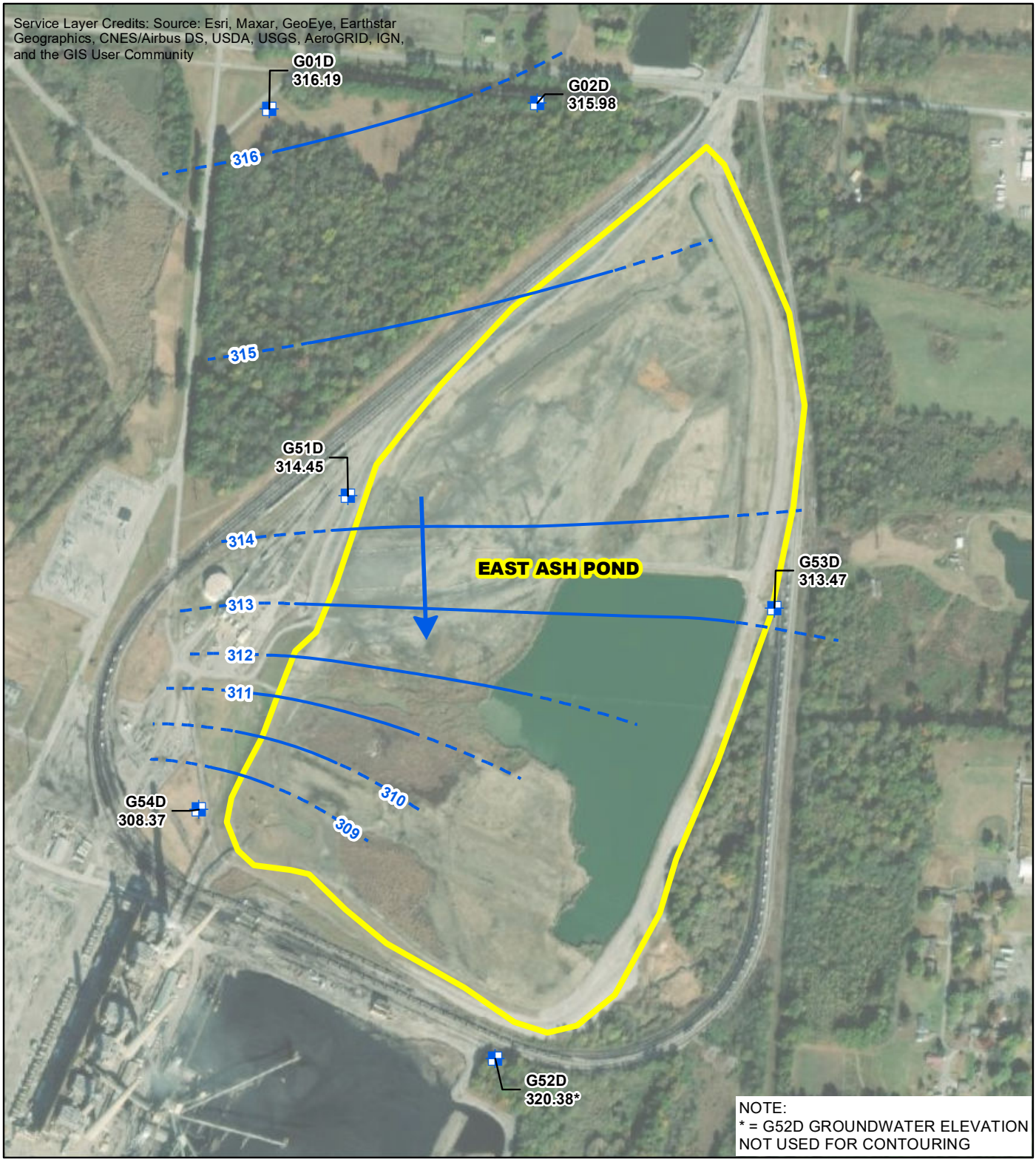

CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (1-FOOT CONTOUR INTERVAL, NAVD 88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

CCR MONITORED UNIT

JOPPA EAST ASH POND (UNIT ID: 401)
GROUNDWATER ELEVATION CONTOUR MAP
SEPTEMBER 5, 2018

CCR RULE GROUNDWATER MONITORING
JOPPA POWER STATION
JOPPA, ILLINOIS

0 150 300 600
Feet

N

O'BRIEN & GERE ENGINEERS, INC.

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CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (1-FOOT CONTOUR INTERVAL, NAVD 88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

CCR MONITORED UNIT

JOPPA EAST ASH POND (UNIT ID: 401)
GROUNDWATER ELEVATION CONTOUR MAP
MARCH 27, 2019

CCR RULE GROUNDWATER MONITORING
JOPPA POWER STATION
JOPPA, ILLINOIS

0 150 300 600
Feet

N

O'BRIEN & GERE ENGINEERS, INC.

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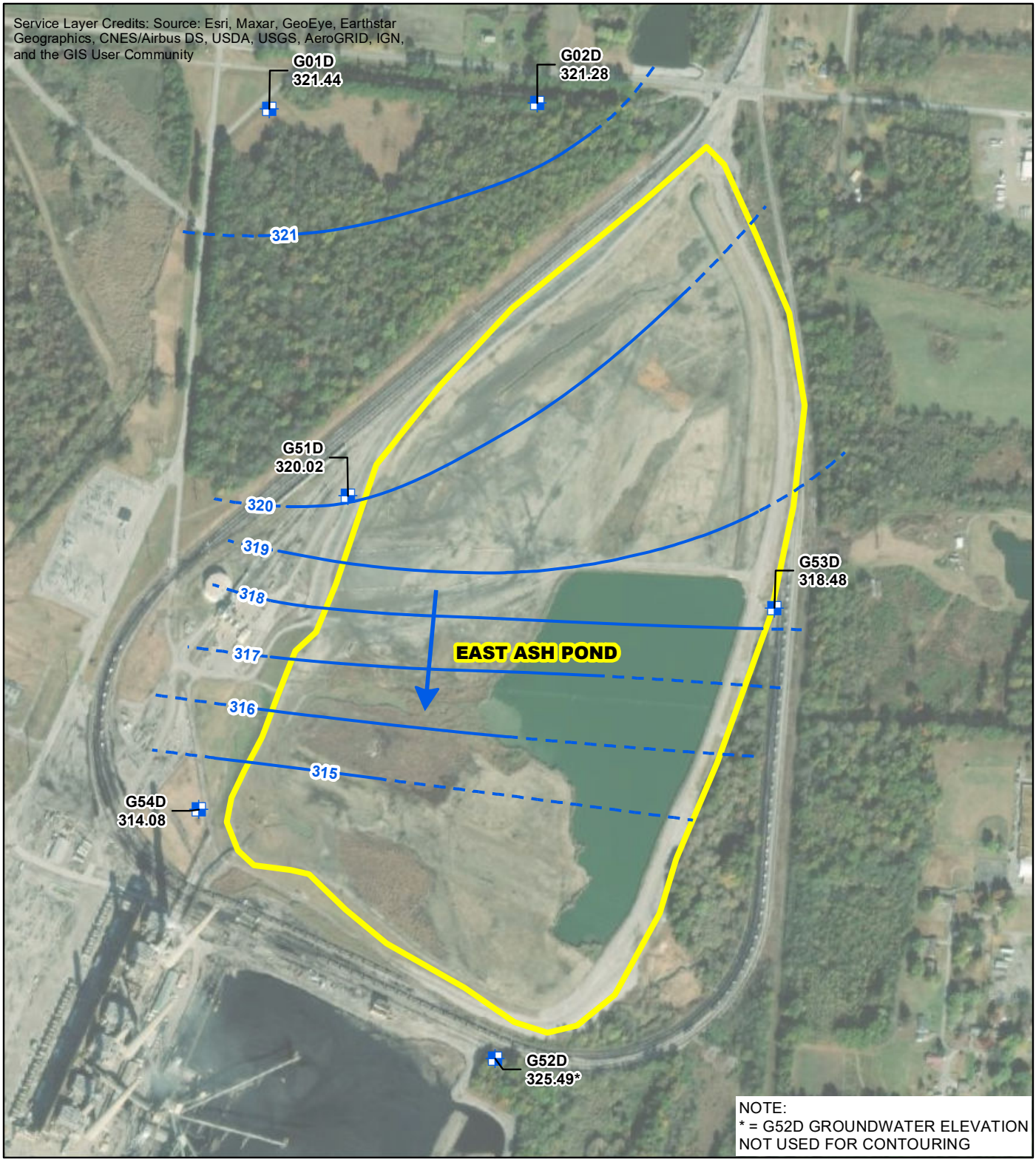

CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (1-FOOT CONTOUR INTERVAL, NAVD 88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

CCR MONITORED UNIT

JOPPA EAST ASH POND (UNIT ID: 401)
GROUNDWATER ELEVATION CONTOUR MAP
SEPTEMBER 9, 2019

CCR RULE GROUNDWATER MONITORING
JOPPA POWER STATION
JOPPA, ILLINOIS

0 150 300 600
Feet

N

O'BRIEN & GERE ENGINEERS, INC.

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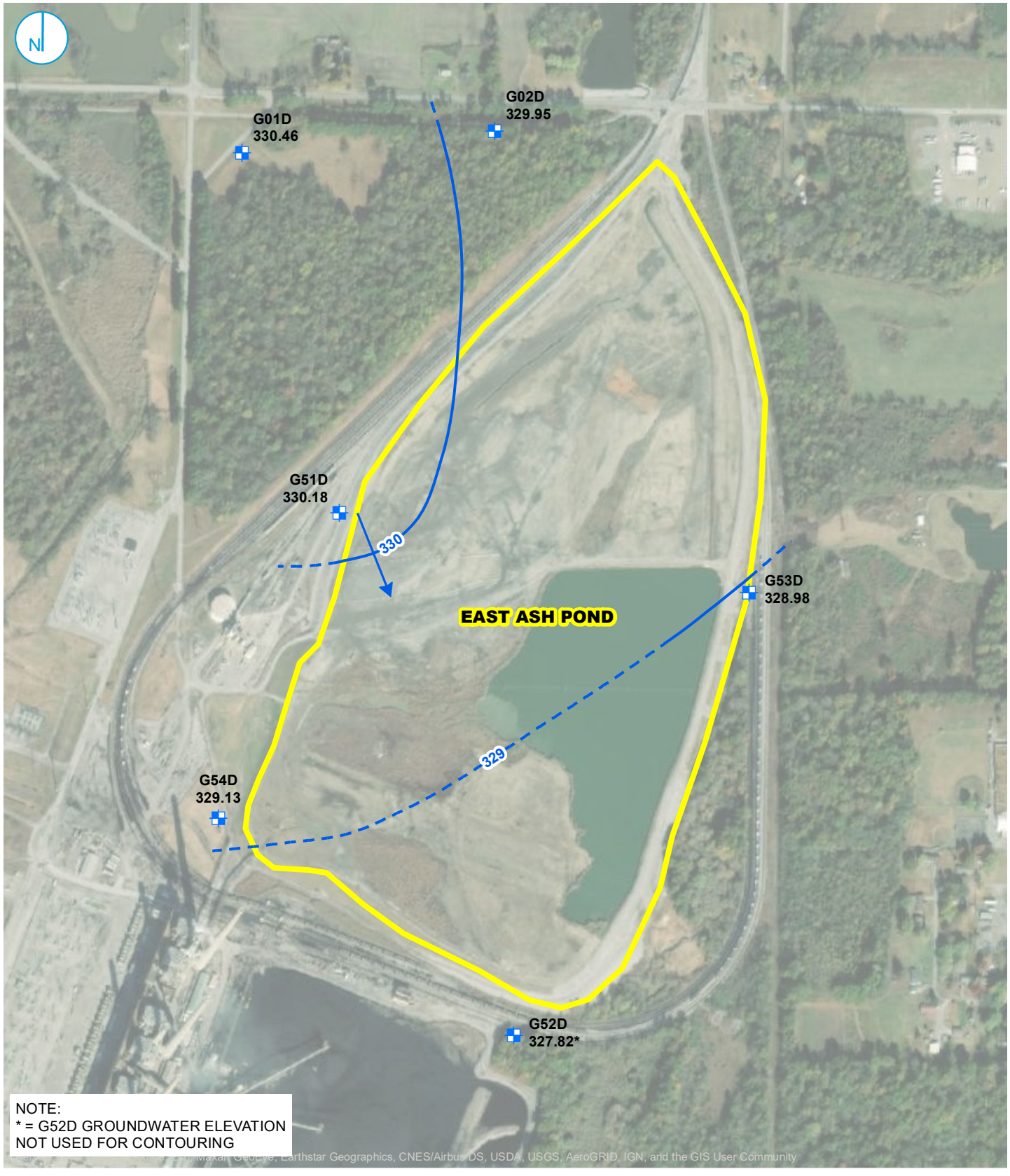

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PROJECT: 169000XXXX | DATED: 8/13/2020 | DESIGNER: STOLZSD

CCR MONITORING WELL

GROUNDWATER ELEVATION CONTOUR (1-FOOT CONTOUR INTERVAL, NAVD 88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

CCR UNIT BOUNDARY, SUBJECT SITE

0 275 550 Feet

GROUNDWATER ELEVATION CONTOUR MAP
MARCH 30, 2020

JOPPA EAST ASH POND (UNIT ID: 401)
VISTRA ENERGY
JOPPA POWER STATION
JOPPA, ILLINOIS

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

ATTACHMENT 5 – TABLES SUMMARIZING CONSTITUENT CONCENTRATIONS AT EACH MONITORING WELL

Analytical Results - Appendix III
Joppa East Ash Pond

Sample Location	Date Sampled	Boron, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Fluoride, total (mg/L)	pH (s.u.)	Sulfate, total (mg/L)	Total Dissolved Solids (mg/L)
Background Wells								
G01D	12/3/2015	<0.025	37.9	13	0.26	6.7	20	216
G01D	3/15/2016	0.0360	45.5	20	0.29	6.7	126	496
G01D	6/15/2016	0.0296	43.9	21	0.25	6.9	157	518
G01D	9/14/2016	0.0416	40.8	21	0.26	6.8	129	498
G01D	12/14/2016	<0.025	35.9	14	0.24	6.8	53	294
G01D	3/7/2017	<0.025	34.9	16	0.22	6.2	72	384
G01D	6/15/2017	<0.025	32.1	15	0.23	6.7	56	372
G01D	7/20/2017	<0.025	29.5	12	0.24	6.8	31	368
G01D	11/30/2017	<0.025	37.2	18	0.22	6.8	117	450
G01D	6/19/2018	<0.025	29.5	13	0.24	6.8	70	394
G01D	9/5/2018	<0.025	30.5	14	0.20	7.0	94	414
G01D	3/27/2019	<0.025	25.1	8	0.23	6.7	30	310
G01D	9/9/2019	<0.025	25.6	8	0.23	6.4	37	336
G01D	3/30/2020	<0.025	22.7	8	0.21	6.8	35	296
G02D	12/3/2015	0.0536	39.9	24	0.24	6.7	16	244
G02D	3/15/2016	0.0494	39.8	24	0.22	6.6	17	256
G02D	6/15/2016	0.0508	38.6	21	0.21	6.8	15	248
G02D	9/14/2016	0.0534	34.7	24	0.20	6.6	22	276
G02D	12/14/2016	0.0552	40.4	24	0.19	6.3	22	266
G02D	3/8/2017	0.0546	40.0	24	0.19	6.9	18	270
G02D	6/14/2017	0.0467	33.2	25	0.19	6.3	20	198
G02D	7/20/2017	0.0440	37.5	22	0.22	6.7	12	264
G02D	11/30/2017	0.0496	40.1	23	0.21	6.9	17	246
G02D	6/19/2018	0.0404	33.9	23	0.21	6.7	17	232
G02D	9/5/2018	0.0468	36.3	23	0.18	6.6	19	252
G02D	3/27/2019	0.0473	38.7	20	0.20	6.6	20	262
G02D	9/9/2019	0.0429	40.3	18	0.21	6.5	20	264
G02D	3/30/2020	0.0449	33.5	20	0.18	6.6	22	222
Downgradient Wells								
G51D	12/3/2015	0.117	39.2	9	0.13	6.2	117	304
G51D	3/15/2016	0.184	39.7	9	0.10	5.9	145	342
G51D	6/15/2016	0.213	42.3	7	<0.1	5.8	139	330
G51D	9/14/2016	0.263	29.6	9	<0.1	5.6	136	360
G51D	12/14/2016	0.171	30.0	11	<0.1	5.9	101	270
G51D	3/8/2017	0.309	32.6	8	<0.1	6.2	146	340
G51D	6/15/2017	0.580	34.0	9	<0.1	5.6	149	340
G51D	7/20/2017	0.332	31.8	8	<0.1	5.9	140	344
G51D	11/30/2017	0.302	34.4	8	<0.1	5.6	138	356
G51D	6/19/2018	0.337	31.1	7	<0.1	5.7	124	324
G51D	9/5/2018	0.263	29.1	7	<0.1	6.0	134	342
G51D	3/27/2019	0.778	34.7	6	<0.1	5.7	125	350
G51D	9/9/2019	0.501	31.3	6	<0.1	5.3	109	320
G51D	3/30/2020	0.697	31.2	6	<0.1	5.6	130	304
G52D	12/3/2015	<0.025	46.6	22	0.25	6.5	65	332
G52D	3/15/2016	<0.025	49.1	22	0.26	6.3	99	310
G52D	6/15/2016	<0.025	69.2	21	0.25	6.6	88	360
G52D	9/14/2016	<0.025	47.6	20	0.26	6.4	84	376
G52D	12/14/2016	<0.025	53.4	20	0.25	6.7	82	356
G52D	3/7/2017	<0.025	55.0	18	0.24	5.9	115	410
G52D	6/14/2017	<0.025	51.0	17	0.24	6.2	112	372
G52D	7/19/2017	<0.025	50.7	15	0.27	6.4	108	412
G52D	11/30/2017	<0.025	54.7	15	0.26	6.0	97	392

Analytical Results - Appendix III
Joppa East Ash Pond

Sample Location	Date Sampled	Boron, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Fluoride, total (mg/L)	pH (s.u.)	Sulfate, total (mg/L)	Total Dissolved Solids (mg/L)
G52D	6/19/2018	<0.025	50.1	15	0.26	6.4	97	388
G52D	9/5/2018	<0.025	49.8	14	0.24	6.3	101	384
G52D	3/27/2019	<0.025	59.8	13	0.28	6.4	81	376
G52D	9/9/2019	<0.025	52.2	14	0.27	6.0	78	370
G52D	3/30/2020	<0.025	48.8	14	0.27	6.4	84	362
G53D	12/3/2015	0.332	62.6	22	0.79	6.8	103	368
G53D	3/15/2016	0.334	50.5	20	0.72	6.7	107	406
G53D	6/15/2016	0.342	47.2	17	0.68	6.6	107	392
G53D	9/14/2016	0.368	44.4	20	0.70	6.5	104	424
G53D	12/14/2016	0.364	44.5	20	0.69	6.8	106	418
G53D	3/8/2017	0.138	23.6	6	0.49	7.2	35	216
G53D	6/15/2017	0.309	38.9	18	0.59	6.6	79	348
G53D	7/20/2017	0.366	40.8	18	0.69	6.8	94	396
G53D	11/30/2017	0.427	44.6	20	0.74	6.6	98	348
G53D	6/19/2018	0.361	37.8	18	0.66	6.6	84	360
G53D	9/5/2018	0.392	40.3	20	0.61	6.8	81	390
G53D	3/27/2019	0.269	30.5	12	0.59	6.6	54	272
G53D	9/9/2019	0.385	42.2	18	0.67	6.2	80	364
G53D	3/30/2020	0.334	34.8	17	0.63	6.7	66	296
G54D	12/3/2015	0.663	103	33	0.38	7.0	191	556
G54D	3/15/2016	0.513	75.2	32	0.38	6.8	176	554
G54D	6/15/2016	0.508	72.8	28	0.34	6.6	160	476
G54D	9/14/2016	0.557	70.4	28	0.34	6.6	149	502
G54D	12/14/2016	0.564	74.3	26	0.32	6.7	144	456
G54D	3/8/2017	0.499	74.1	26	0.30	7.1	131	482
G54D	6/15/2017	0.685	80.5	24	0.32	6.8	170	506
G54D	7/20/2017	0.580	75.7	24	0.32	6.8	151	512
G54D	11/30/2017	0.646	76.2	26	0.33	6.7	136	472
G54D	6/19/2018	0.631	72.7	26	0.34	6.7	146	486
G54D	9/5/2018	0.660	73.6	25	0.30	6.5	152	480
G54D	3/27/2019	1.03	115	22	0.35	6.8	142	510
G54D	9/9/2019	0.614	79.9	<25	0.32	6.4	136	482
G54D	3/30/2020	0.766	84.9	22	0.33	6.8	184	508

Notes:
1. Abbreviations: mg/L - milligrams per liter; s.u. - standard units.

Analytical Results - Appendix IV
Joppa East Ash Pond

Sample Location	Date Sampled	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Cadmium, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	Radium-226 + Radium 228, tot (pCi/L)	Selenium, total (mg/L)	Thallium, total (mg/L)
Background Wells																
G01D	12/3/2015	<0.001	0.0015	0.254	<0.001	<0.001	0.0047	0.0060	0.26	0.0018	0.0018	<0.0002	0.0010	0.07	<0.001	<0.001
G01D	3/15/2016	<0.001	0.0026	0.283	<0.001	<0.001	0.0032	0.0136	0.29	0.0012	0.0017	<0.0002	0.0013	0.96	<0.001	<0.001
G01D	6/15/2016	<0.001	0.0018	0.204	<0.001	<0.001	0.0016	0.0128	0.25	<0.001	0.0015	<0.0002	0.0010	0.44	<0.001	<0.001
G01D	9/14/2016	<0.001	0.0021	0.190	<0.001	<0.001	0.0031	0.0113	0.26	0.0013	0.0024	<0.0002	0.0010	0.58	<0.001	<0.001
G01D	12/14/2016	<0.001	0.0012	0.163	<0.001	<0.001	0.0036	0.0077	0.24	0.0012	0.0024	<0.0002	<0.001	0.40	<0.001	<0.001
G01D	3/7/2017	<0.001	<0.001	0.155	<0.001	<0.001	0.0014	0.0061	0.22	<0.001	0.0013	<0.0002	<0.001	0.24	<0.001	<0.001
G01D	6/15/2017	<0.001	<0.001	0.140	<0.001	<0.001	0.0032	0.0047	0.23	0.0013	0.0018	<0.0002	<0.001	0.93	<0.001	<0.001
G01D	7/20/2017	<0.001	0.001	0.140	<0.001	<0.001	0.0042	0.0035	0.24	0.0014	0.0017	<0.0002	0.0018	0.41	<0.001	<0.001
G01D	11/30/2017	NA	NA	NA	NA	NA	NA	NA	0.22	NA	NA	NA	NA	NA	NA	NA
G01D	6/19/2018	<0.001	0.0019	0.202	<0.001	<0.001	0.0093	0.0057	0.24	0.0034	0.0038	<0.0002	<0.0015	1.41	<0.001	<0.002
G01D	9/5/2018	NA	<0.001	0.147	NA	NA	0.0026	0.0022	0.20	<0.001	0.0017	NA	NA	0.37	0.0010	NA
G01D	3/27/2019	<0.001	<0.001	0.129	<0.001	<0.001	0.003	0.0014	0.23	<0.001	0.0015	<0.0002	<0.0015	0.78	0.0015	<0.002
G01D	9/9/2019	NA	<0.001	0.123	NA	NA	0.0044	0.0014	0.23	0.0012	<0.003	NA	NA	0.79	0.0011	NA
G01D	3/30/2020	<0.001	0.0011	0.130	<0.001	<0.001	0.0065	0.0018	0.21	0.0019	0.0034	<0.0002	<0.0015	1.44	0.0013	<0.002
G02D	12/3/2015	<0.001	<0.001	0.232	<0.001	<0.001	<0.001	0.0024	0.24	<0.001	0.0011	<0.0002	<0.001	1.10	0.0019	<0.001
G02D	3/15/2016	<0.001	<0.001	0.218	<0.001	<0.001	<0.001	<0.001	0.22	<0.001	<0.001	<0.0002	<0.001	0.47	0.0022	<0.001
G02D	6/15/2016	<0.001	<0.001	0.203	<0.001	<0.001	<0.001	<0.001	0.21	<0.001	0.0012	<0.0002	<0.001	0.63	0.0022	<0.001
G02D	9/14/2016	<0.001	<0.001	0.206	<0.001	<0.001	<0.001	<0.001	0.20	<0.001	0.0013	<0.0002	<0.001	0.33	0.0033	<0.001
G02D	12/14/2016	<0.001	<0.001	0.224	<0.001	<0.001	0.0057	0.0019	0.19	<0.001	0.0019	<0.0002	<0.001	0.40	0.0039	<0.001
G02D	3/8/2017	<0.001	<0.001	0.211	<0.001	<0.001	<0.001	<0.001	0.19	<0.001	<0.001	<0.0002	<0.001	1.06	0.0024	<0.001
G02D	6/14/2017	<0.001	<0.001	0.192	<0.001	<0.001	<0.001	<0.001	0.19	<0.001	0.0013	<0.0002	<0.001	0.63	0.0023	<0.001
G02D	7/20/2017	<0.001	<0.001	0.211	<0.001	<0.001	0.0016	<0.001	0.22	<0.001	<0.001	<0.0002	<0.001	1.33	0.0016	<0.001
G02D	11/30/2017	NA	NA	NA	NA	NA	NA	NA	0.21	NA	NA	NA	NA	NA	NA	NA
G02D	6/19/2018	<0.001	<0.001	0.245	<0.001	<0.001	<0.0015	<0.001	0.21	<0.001	<0.0015	<0.0002	<0.0015	0.92	0.0023	<0.002
G02D	9/5/2018	NA	<0.001	0.209	NA	NA	<0.0015	<0.001	0.18	<0.001	<0.0015	NA	NA	0.46	0.002	NA
G02D	3/27/2019	<0.001	<0.001	0.235	<0.001	<0.001	0.0026	<0.001	0.20	<0.001	<0.0015	<0.0002	<0.0015	0.12	0.003	<0.002
G02D	9/9/2019	NA	<0.001	0.208	NA	NA	<0.0015	<0.001	0.21	<0.001	<0.003	NA	NA	0.49	0.0021	NA
G02D	3/30/2020	<0.001	<0.001	0.202	<0.001	<0.001	<0.0015	<0.001	0.18	<0.001	<0.003	<0.0002	<0.0015	0.79	0.0035	<0.002
Downgradient Wells																
G51D	12/3/2015	<0.001	<0.001	0.129	<0.001	<0.001	<0.001	0.0141	0.13	<0.001	0.0035	<0.0002	<0.001	0.02	0.0024	<0.001
G51D	3/15/2016	<0.001	<0.001	0.0702	<0.001	<0.001	0.0014	0.0249	0.10	<0.001	0.0048	<0.0002	<0.001	0.69	0.0019	<0.001
G51D	6/15/2016	<0.001	<0.001	0.0628	<0.001	<0.001	<0.001	0.0198	<0.1	<0.001	0.0059	<0.0002	<0.001	0.43	0.0028	<0.001
G51D	9/14/2016	<0.001	<0.001	0.0536	<0.001	<0.001	<0.001	0.0110	<0.1	<0.001	0.0052	<0.0002	<0.001	0.80	0.0031	<0.001
G51D	12/14/2016	<0.001	<0.001	0.0459	<0.001	<0.001	<0.001	0.0119	<0.1	<0.001	0.0050	<0.0002	<0.001	0.29	0.0031	<0.001
G51D	3/8/2017	<0.001	<0.001	0.0493	<0.001	<0.001	<0.001	0.0082	<0.1	<0.001	0.0045	<0.0002	<0.001	0.52	0.0033	<0.001
G51D	6/15/2017	<0.001	<0.001	0.0442	<0.001	<0.001	<0.001	0.0052	<0.1	<0.001	0.0058	<0.0002	<0.001	0.56	0.0039	<0.001
G51D	7/20/2017	<0.001	<0.001	0.0462	<0.001	<0.001	<0.001	0.0055	<0.1	<0.001	0.0047	<0.0002	<0.001	1.68	0.0035	<0.001
G51D	11/30/2017	NA	NA	NA	NA	NA	NA	NA	<0.1	NA	NA	NA	NA	NA	NA	NA
G51D	6/19/2018	<0.001	<0.001	0.0756	<0.001	<0.001	<0.0015	0.0038	<0.1	<0.001	0.0070	<0.0002	<0.0015	1.22	0.0035	<0.002
G51D	9/5/2018	NA	<0.001	0.0395	#N/A	#N/A	<0.0015	0.0043	<0.1	<0.001	0.0054	NA	NA	0.42	0.0036	NA
G51D	3/27/2019	<0.001	<0.001	0.0495	<0.001	<0.001	0.0016	0.0026	<0.1	<0.001	0.0059	<0.0002	<0.0015	0.23	0.005	<0.002
G51D	9/9/2019	NA	<0.001	0.0377	#N/A	#N/A	<0.0015	0.0017	<0.1	<0.001	0.0057	NA	NA	0.36	0.0042	NA
G51D	3/30/2020	<0.001	<0.001	0.0445	<0.001	<0.001	0.0019	0.0024	<0.1	<0.001	0.0065	<0.0002	<0.0015	0.90	0.0048	<0.002

Analytical Results - Appendix IV
Joppa East Ash Pond

Sample Location	Date Sampled	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Cadmium, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	Radium-226 + Radium 228, tot (pCi/L)	Selenium, total (mg/L)	Thallium, total (mg/L)
G52D	12/3/2015	<0.001	0.0032	0.318	<0.001	<0.001	<0.001	0.0056	0.25	<0.001	0.0026	<0.0002	0.0017	0.31	<0.001	<0.001
G52D	3/15/2016	<0.001	0.0051	0.345	<0.001	<0.001	<0.001	0.0064	0.26	<0.001	0.0023	<0.0002	<0.001	1.16	<0.001	<0.001
G52D	6/15/2016	<0.001	0.0072	0.506	<0.001	<0.001	<0.001	0.0093	0.25	<0.001	0.0040	<0.0002	<0.001	2.18	<0.001	<0.001
G52D	9/14/2016	<0.001	0.0043	0.362	<0.001	<0.001	<0.001	0.0063	0.26	<0.001	0.0027	<0.0002	0.0017	1.81	<0.001	<0.001
G52D	12/14/2016	<0.001	0.0030	0.356	<0.001	<0.001	<0.001	0.0030	0.25	<0.001	0.0036	<0.0002	0.0024	1.24	<0.001	<0.001
G52D	3/7/2017	<0.001	0.0066	0.358	<0.001	<0.001	<0.001	0.0072	0.24	<0.001	0.0024	<0.0002	<0.001	0.80	<0.001	<0.001
G52D	6/14/2017	<0.001	0.0054	0.289	<0.001	<0.001	<0.001	0.0062	0.24	<0.001	0.0030	<0.0002	<0.001	1.28	<0.001	<0.001
G52D	7/19/2017	<0.001	0.0016	0.293	<0.001	<0.001	<0.001	0.0013	0.27	<0.001	0.0028	<0.0002	0.0011	0.80	<0.001	<0.001
G52D	11/30/2017	NA	NA	NA	NA	NA	NA	NA	0.26	NA	NA	NA	NA	NA	NA	NA
G52D	6/19/2018	<0.001	0.0025	0.340	<0.001	<0.001	<0.0015	0.0045	0.26	<0.001	0.0035	<0.0002	<0.0015	1.64	<0.001	<0.002
G52D	9/5/2018	NA	0.0014	0.275	NA	NA	<0.0015	0.0019	0.24	<0.001	0.0032	NA	NA	0.68	<0.001	NA
G52D	3/27/2019	<0.001	0.0064	0.271	<0.001	<0.001	<0.0015	0.0069	0.28	<0.001	0.0028	<0.0002	<0.0015	0.58	<0.001	<0.002
G52D	9/9/2019	NA	0.0021	0.254	NA	NA	<0.0015	0.0022	0.27	<0.001	<0.003	NA	NA	1.54	<0.001	NA
G52D	3/30/2020	<0.001	0.0017	0.254	<0.001	<0.001	<0.0015	0.0033	0.27	<0.001	<0.003	<0.0002	<0.0015	1.30	<0.001	<0.002
G53D	12/3/2015	<0.001	<0.001	0.353	<0.001	<0.001	0.0017	0.0087	0.79	<0.001	0.0020	<0.0002	0.0013	0.28	<0.001	<0.001
G53D	3/15/2016	<0.001	<0.001	0.279	<0.001	<0.001	<0.001	0.0087	0.72	<0.001	0.0015	<0.0002	0.0012	1.24	<0.001	<0.001
G53D	6/15/2016	<0.001	<0.001	0.207	<0.001	<0.001	<0.001	0.0059	0.68	<0.001	0.0017	<0.0002	<0.001	1.11	<0.001	<0.001
G53D	9/14/2016	<0.001	<0.001	0.191	<0.001	<0.001	<0.001	0.002	0.70	<0.001	0.0016	<0.0002	<0.001	0.10	<0.001	<0.001
G53D	12/14/2016	<0.001	<0.001	0.169	<0.001	<0.001	<0.001	0.0029	0.69	<0.001	0.0018	<0.0002	<0.001	0.39	<0.001	<0.001
G53D	3/8/2017	<0.001	<0.001	0.109	<0.001	<0.001	0.0018	0.0027	0.49	<0.001	0.0021	<0.0002	<0.001	0.08	<0.001	<0.001
G53D	6/15/2017	<0.001	<0.001	0.172	<0.001	<0.001	<0.001	<0.001	0.59	<0.001	0.0022	<0.0002	<0.001	0.16	<0.001	<0.001
G53D	7/20/2017	<0.001	<0.001	0.165	<0.001	<0.001	<0.001	0.0011	0.69	<0.001	0.0015	<0.0002	<0.001	1.25	<0.001	<0.001
G53D	11/30/2017	NA	NA	NA	NA	NA	NA	NA	0.74	NA	NA	NA	NA	NA	NA	NA
G53D	6/19/2018	<0.001	<0.001	0.176	<0.001	<0.001	<0.0015	<0.001	0.66	<0.001	0.0019	<0.0002	<0.0015	0.77	<0.001	<0.002
G53D	9/5/2018	NA	<0.001	0.133	NA	NA	<0.0015	0.0016	0.61	<0.001	0.0018	NA	NA	0.55	<0.001	NA
G53D	3/27/2019	<0.001	<0.001	0.101	<0.001	<0.001	<0.0015	<0.001	0.59	<0.001	<0.0015	<0.0002	<0.0015	0.17	<0.001	<0.002
G53D	9/9/2019	NA	<0.001	0.128	NA	NA	<0.0015	0.002	0.67	<0.001	<0.003	NA	NA	0.03	<0.001	NA
G53D	3/30/2020	<0.001	<0.001	0.109	<0.001	<0.001	<0.0015	<0.001	0.63	<0.001	<0.003	<0.0002	<0.0015	1.32	<0.001	<0.002
G54D	12/3/2015	<0.001	0.0020	0.115	<0.001	<0.001	0.0016	0.0268	0.38	<0.001	0.0069	<0.0002	<0.001	0.20	<0.001	<0.001
G54D	3/15/2016	<0.001	0.0025	0.106	<0.001	<0.001	0.0030	0.0183	0.38	<0.001	0.0078	<0.0002	0.0010	0.354	<0.001	<0.001
G54D	6/15/2016	<0.001	0.0020	0.114	<0.001	<0.001	<0.001	0.0158	0.34	<0.001	0.0068	<0.0002	<0.001	1.02	<0.001	<0.001
G54D	9/14/2016	<0.001	0.0026	0.134	<0.001	<0.001	<0.001	0.0167	0.34	<0.001	0.0062	<0.0002	<0.001	0.39	<0.001	<0.001
G54D	12/14/2016	<0.001	0.0033	0.138	<0.001	<0.001	<0.001	0.0178	0.32	<0.001	0.0061	<0.0002	<0.001	1.05	<0.001	<0.001
G54D	3/8/2017	<0.001	0.0025	0.132	<0.001	<0.001	<0.001	0.017	0.30	<0.001	0.0048	<0.0002	<0.001	0.68	<0.001	<0.001
G54D	6/15/2017	<0.001	<0.001	0.105	<0.001	<0.001	0.0018	0.016	0.32	<0.001	0.0047	<0.0002	<0.001	1.67	<0.001	<0.001
G54D	7/20/2017	<0.001	0.0012	0.127	<0.001	<0.001	0.0017	0.0139	0.32	<0.001	0.0044	<0.0002	<0.001	0.32	<0.001	<0.001
G54D	11/30/2017	NA	NA	NA	NA	NA	NA	NA	0.33	NA	NA	NA	NA	NA	NA	NA
G54D	6/19/2018	<0.001	0.0019	0.196	<0.001	<0.001	0.0019	0.0134	0.34	<0.001	0.0060	<0.0002	<0.0015	1.00	<0.001	<0.002
G54D	9/5/2018	NA	0.0010	0.131	NA	NA	0.0020	0.0109	0.30	<0.001	0.0046	NA	NA	1.32	<0.001	NA
G54D	3/27/2019	<0.001	0.0011	0.120	<0.001	<0.001	<0.0015	0.0138	0.35	<0.001	0.0037	<0.0002	<0.0015	0.42	<0.001	<0.002
G54D	9/9/2019	NA	<0.001	0.128	NA	NA	<0.0015	0.0117	0.32	<0.001	0.0037	NA	NA	0.84	<0.001	NA
G54D	3/30/2020	<0.001	<0.001	0.105	<0.001	<0.001	<0.0015	0.013	0.33	<0.001	0.0036	<0.0002	<0.0015	0.89	<0.001	<0.002

Notes:
1. Abbreviations: mg/L - milligrams per liter; NA - not analyzed; pCi/L - picocurie per liter;

ATTACHMENT 6 – SITE HYDROGEOLOGY AND STRATIGRAPHIC CROSS-SECTIONS OF THE SITE

CONCEPTUAL SITE MODEL AND DESCRIPTION OF SITE HYDROGEOLOGY (EAST ASH POND)

The Joppa Power Station (Power Station) conceptual site model (CSM) and Description of Site Hydrogeology for the Joppa East Ash Pond (EAP), located in Joppa, Illinois are described in the following sections.

REGIONAL SETTING

The Power Station is located west of the Village of Joppa in Massac County, Illinois, northeast of the Ohio River in Section 14, Township 15 South, Range 3 East of the 3rd Principal Meridian. The EAP is located in the west half of Section 14 directly north of the Power Station. The Power Station property is bordered by LaFarge North America cement plant to the west, Trunkline Gas Company-Joppa Compressor Station to the north, the Village of Joppa to the east and the Ohio River to the south.

The EAP lies adjacent to and north to northeast of the Ohio River at the southern boundary of the Illinois Basin and the northern edge of the Mississippi Embayment, a relatively low lying area that is part of the Coastal Plain Physiographic Province (Leighton, 1948). Based on stack-unit maps prepared by the Illinois State Geological Survey (Berg and Kempton, 1987) the area is characterized by less than 20 feet of silty and clayey diamictons overlying Cretaceous-age sediments, silts, sands, etc., between depths of 20 to 50 feet. However, in some areas along the Ohio River, the predominant unlithified materials are Quaternary-age sand and gravel outwash deposits belonging to the Henry Formation. The unlithified materials rest on Mississippian-age bedrock. The bedrock dips gently northward toward the center of the Illinois Basin.

SITE GEOLOGY

Previous investigations and reports at Joppa East Ash Pond indicate the surface impoundment is underlain by more than 50-feet of clay-rich deposits (predominantly clay and silty clay deposits with some minor intervals of sandy clay deposits) of the Equality and Metropolis Formations (NRT, 2013).

SITE HYDROGEOLOGY

The CCR groundwater monitoring system consists of six monitoring wells installed in the uppermost aquifer and adjacent to the EAP (G01D, G02D, G51D, G52D, G53D, G54D) (see Monitoring Well Location Map, and Well Construction Diagrams and Drilling Logs attached to this demonstration). The unit utilizes two background monitoring wells (G01D and G02D) as part of the CCR groundwater monitoring system.

The uppermost aquifer consists of intermittent unlithified silty sand deposits within the McNairy Formation. The McNairy Formation was described as a hydrostratigraphic unit with greater permeability than the overlying clay-rich deposits of the Equality and Metropolis Formations in the Phase I Hydrogeologic Site Assessment Report (NRT, 2013). The report indicated the overlying hydrostratigraphic unit (inclusive of both the Equality and Metropolis Formations) is a confining unit, where the geometric mean hydraulic conductivity of the unit was 5.9 x 10-6 centimeters per second (cm/s). No known wells in the area utilize the Equality and Metropolis Formations for groundwater and most wells obtain groundwater from sands and gravels of the McNairy Formation or underlying Mississippian-age limestone bedrock. The McNairy Formation was also identified as the uppermost aquifer in the vicinity of Joppa Landfill, located northwest of the EAP (Hanson, 2009). The uppermost aquifer is laterally continuous across the Power Station and is approximately 85 feet thick in the vicinity of the EAP.

The lower limit of the uppermost aquifer (McNairy Formation) is the Mississippian-age Salem Limestone bedrock. The Mississippian-age bedrock in the vicinity of the EAP is a useable groundwater

resource (NRT,2013). The fractured limestone bedrock has widely variable transmissivities and is estimated to have a thickness of approximately 200 to 500 feet. Bedrock was intercepted at an elevation of approximately 210 feet MSL at plant well 4 located south of the EAP. Bedrock was not encountered in borings performed at the EAP.

Hydraulic Conductivity

Falling/rising head tests were completed in wells screened in the unlithified material of the McNairy Formation (uppermost aquifer) as part of the supplemental site characterization activities completed by NRT in 2017. The single-well falling/rising head tests indicate the McNairy Formation has a moderate hydraulic conductivity ranging from 2.4 x 10-5 to 9.9 x 10-4 cm/s, with the exception of monitoring well location G52D, which exhibited a hydraulic conductivity of 7.1 x 10-8 cm/s. The geometric mean of hydraulic conductivities in the McNairy Formation was 2.4 x 10-4 cm/s. The effective porosity of this aquifer likely ranges significantly in magnitude due to its variable composition. The effective porosity of the aquifer was estimated (20%) from literature values (Smith and Wheatcraft, 1993) to calculate the groundwater velocity.

Groundwater Elevations, Flow Direction and Velocity

Average measured groundwater elevations range from approximately 319 ft MSL in the northern portion of the EAP (upgradient, G01D and G02D), to approximately 312 ft MSL in southern portion of the EAP (downgradient, G54D). Groundwater elevations at downgradient well G52D, located southeast of the EAP, are typically more than 5 feet higher than nearby downgradient well G54D, located southwest of the EAP. A significant portion of the well screen at monitoring well G52D is across primarily clay and silt materials which may influence the hydraulic heads measured at the monitoring well location. Screened materials at G52D were also shown to have a decreased hydraulic conductivity when compared to other monitoring well locations which may influence the measured hydraulic heads.

Groundwater elevations vary seasonally and may fluctuate by about 10 feet. Slight seasonal variation in groundwater flow directions ranging from southeast to southwest are also observed, however, the major component of groundwater flow direction is consistently south toward the Ohio River, which is the primary discharge area in the vicinity of the EAP (NRT, 2013).

Horizontal hydraulic gradients are moderate across the EAP well network and ranged from 0.002 feet per feet (ft/ft) in December 2016 to 0.003 ft/ft in June 2017. Horizontal hydraulic gradients upgradient of the EAP (measured from monitoring wells G01D and G02D) appeared to be slightly lower.

Groundwater flow velocity at the EAP ranged from 0.003 to 0.01 feet per day (ft/day) in December 2016 and June 2017. In December 2016, groundwater flow velocity was 0.008 ft/day as groundwater flowed from northwest to southeast across the central portion of the EAP, while in June 2017 groundwater flow velocity was 0.01 ft/day. Near upgradient monitoring wells G01D and G02D, groundwater flow velocity was 0.003 ft/day in December 2016 and 0.009 ft/day in June 2017.

REFERENCES

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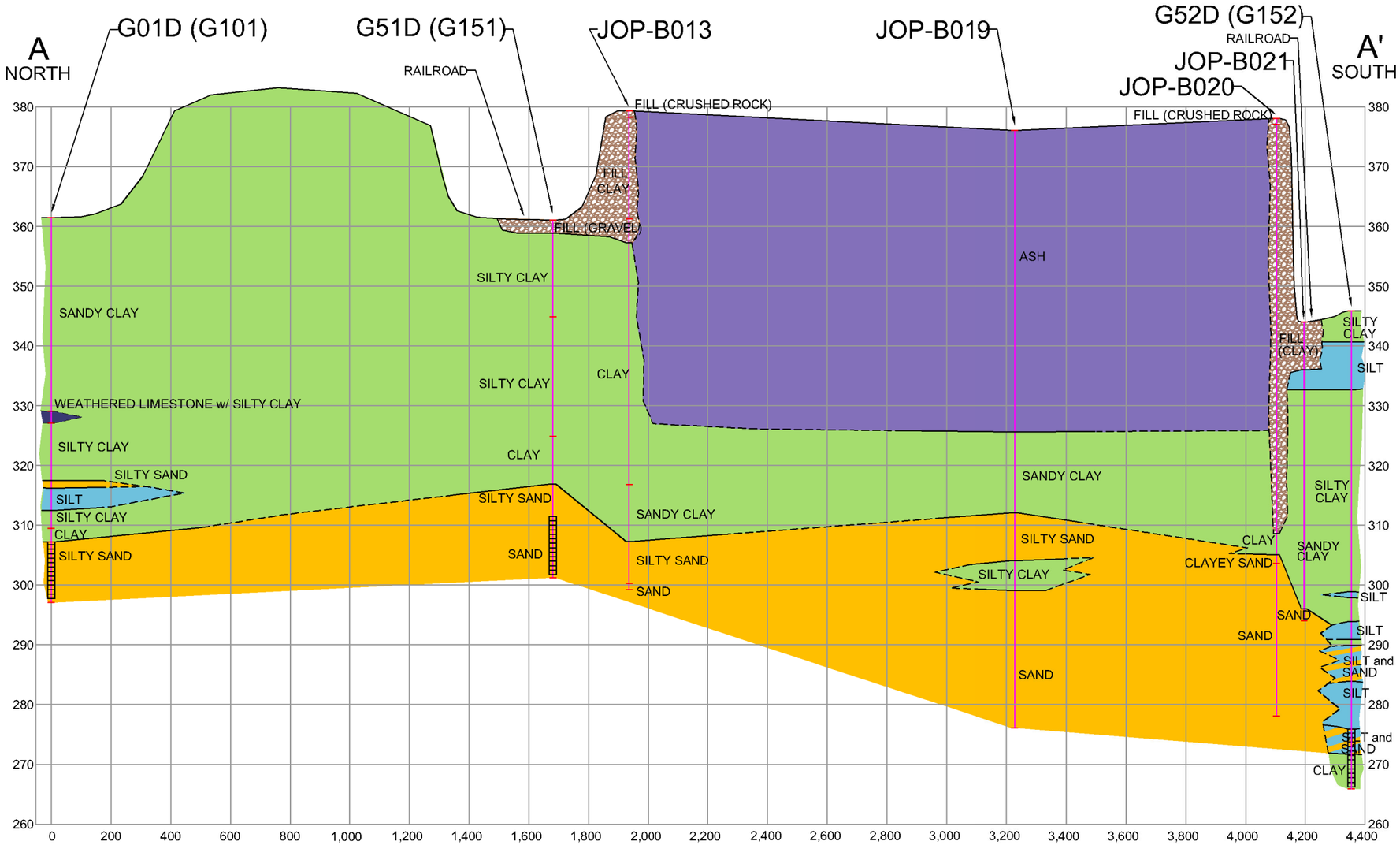
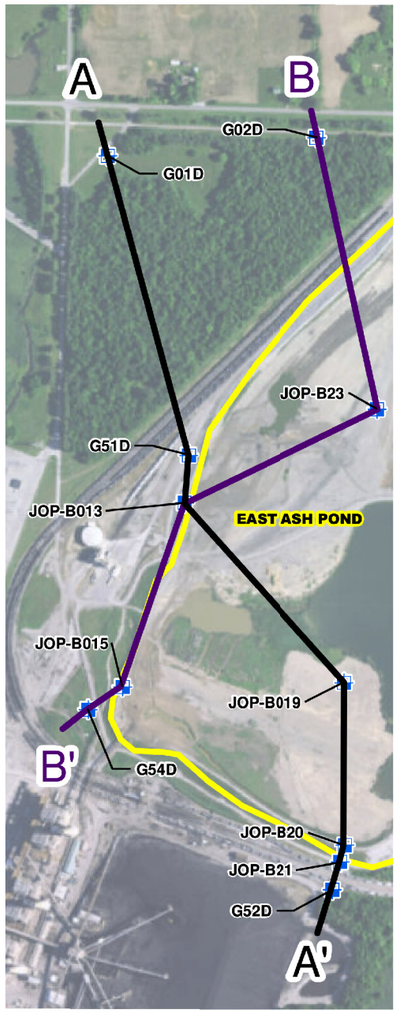
Natural Resource Technology, Inc., 2013. Phase I Hydrogeological Assessment Report, Coal Combustion Product Impoundments, Joppa Generating Station, Joppa, IL, July 23, 2013.

Smith, L., and Wheatcraft, S.W., 1993, Groundwater Flow, in Handbook of Hydrology, D.R. Maidment (ed.), McGraw-Hill Inc., pp. 6.1-6.58, New York, NY.





FILL
ASH
CLAY
SILT
SAND
SILT and SAND
WEATHERED LIMESTONE w/ SILTY CLAY
WELL SCREEN

VERTICAL SCALE IN FEET: 20
HORIZONTAL SCALE IN FEET: 400
VERTICAL EXAGGERATION =20

DRAWN BY: JMO DATE: 09/27/2017
CHECKED BY: JJW DATE: 10/2/2017
APPROVED BY: SJC DATE: 10/2/2017
DRAWING NO: East Ash Pond - Geologic Cross Sections Updated
REFERENCE: .

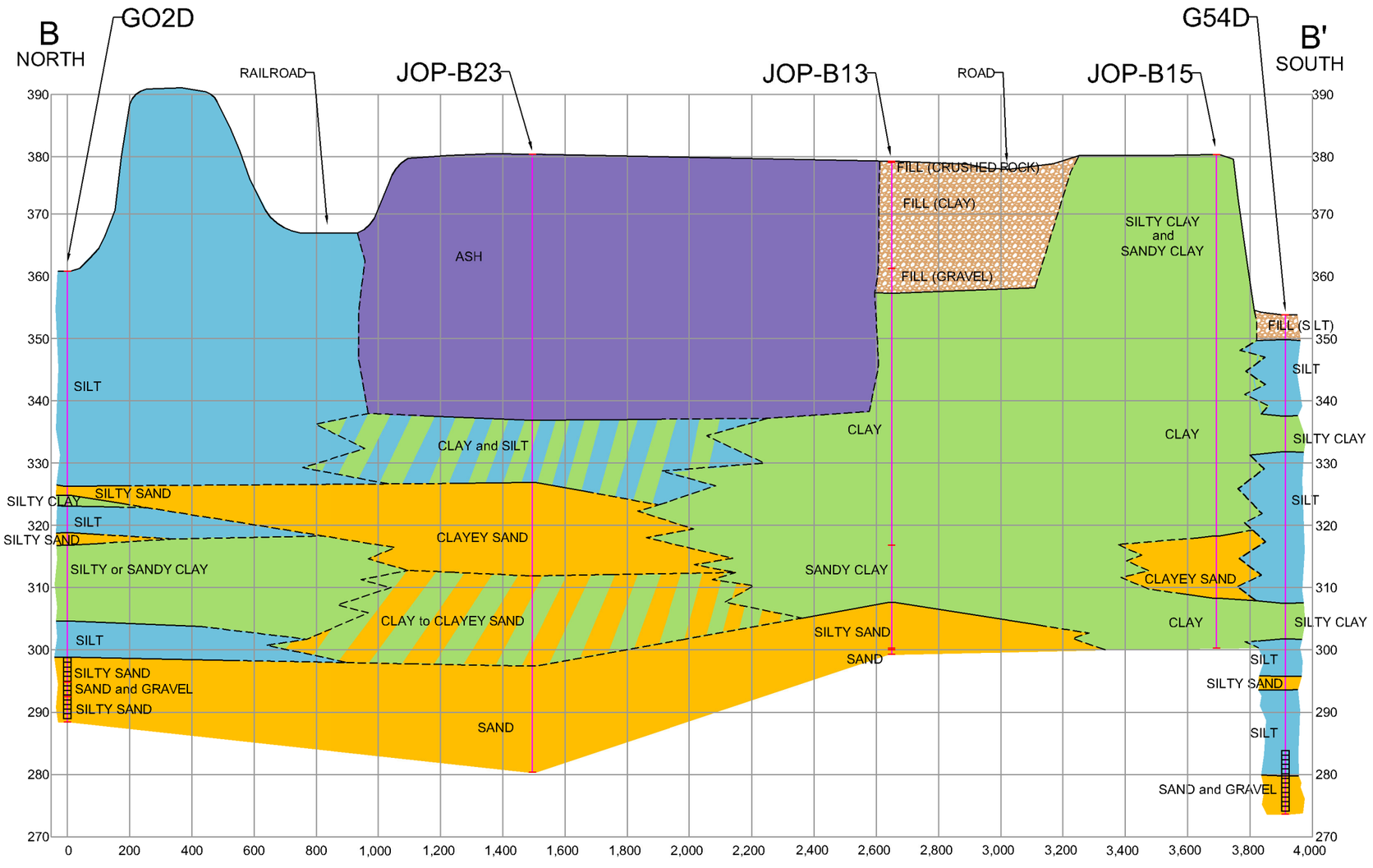
GEOLOGIC CROSS-SECTION A-A'

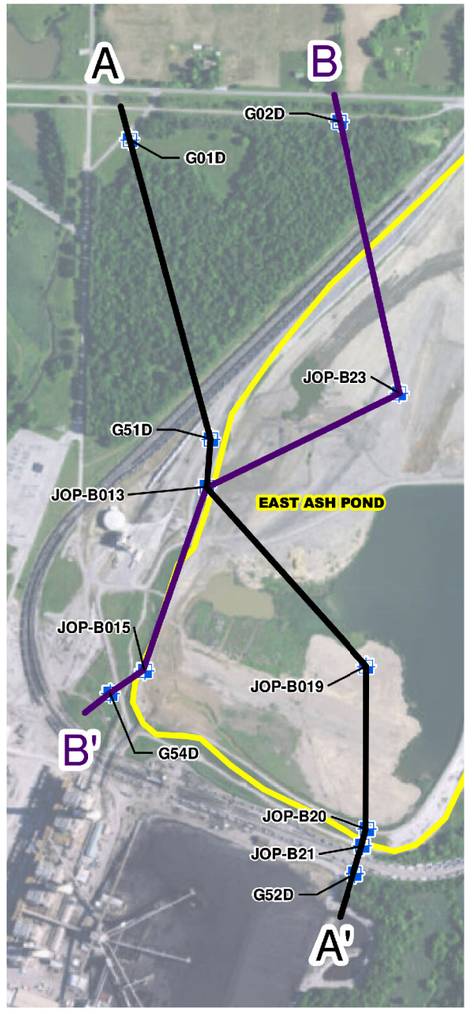
JOPPA EAST ASH POND (UNIT ID: 401)
HYDROGEOLOGIC MONITORING PLAN
DYNEGY CCR RULE GROUNDWATER MONITORING
JOPPA POWER STATION
JOPPA, ILLINOIS

Natural Resource Technology
AN OBG COMPANY

PROJECT NO.
2285.5/1.1

FIGURE NO.
2





FILL
ASH
CLAY
SILT
SAND
CLAY and SILT
CLAY to CLAYEY SAND
WELL SCREEN

VERTICAL SCALE IN FEET: 20
HORIZONTAL SCALE IN FEET: 400

VERTICAL EXAGGERATION =20

DRAWN BY: JMO DATE: 09/29/2017
CHECKED BY: JJW DATE: 10/2/2017
APPROVED BY: SJC DATE: 10/2/2017
DRAWING NO: East Ash Pond - Geologic Cross Sections Updated
REFERENCE: .

GEOLOGIC CROSS-SECTION B-B'

JOPPA EAST ASH POND (UNIT ID: 401)
HYDROGEOLOGIC MONITORING PLAN
DYNEGY CCR RULE GROUNDWATER MONITORING

JOPPA POWER STATION
JOPPA, ILLINOIS

Natural Resource Technology
AN OBG COMPANY

PROJECT NO.
2285.5/1.1

FIGURE NO.
3

ATTACHMENT 7 – STRUCTURAL STABILITY ASSESSMENT

AECOM

Submitted to
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Submitted by
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October 2016

CCR Rule Report: Initial Structural Stability Assessment

For

East Ash Pond

At Joppa Power Station

1 Introduction

This Coal Combustion Residual (CCR) Rule Report documents that the East Ash Pond at the Electric Energy, Inc. (EEI) Joppa Power Station meets the structural stability assessment requirements specified in 40 Code of Federal Regulations (CFR) §257.73(d), except as noted herein. The East Ash Pond is located near Joppa, Illinois in Massac County, approximately 0.1 miles northeast of the Joppa Power Station. The East Ash Pond serves as the wet impoundment basin for CCRs produced by the Joppa Power Station.

The East Ash Pond is an existing CCR surface impoundment as defined by 40 CFR §257.53. The CCR Rule requires that an initial structural stability assessment for an existing CCR surface impoundment be completed by October 17, 2016. In general, the initial structural stability assessment must document that the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices.

The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial structural stability assessment was conducted in accordance with the requirements of 40 CFR §257.73(d). The owner or operator must prepare a periodic structural stability assessment every five years.

2 Initial Structural Stability Assessment

40 CFR §257.73(d)(1)
The owner or operator of the CCR unit must conduct initial and periodic structural stability assessments and document whether the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein. The assessment must, at a minimum, document whether the CCR unit has been designed, constructed, operated, and maintained with [the standards in (d)(1)(i)-(vii)].

An initial structural stability assessment has been performed to document that the design, construction, operation and maintenance of the East Ash Pond is consistent with recognized and generally accepted good engineering practices. The results of the structural stability assessment are discussed in the following sections. Based on the assessment and its results, the design, construction, operation, and maintenance of the Joppa East Ash Pond were found to be consistent with recognized and generally accepted good engineering practices, and meet the standards in §257.73(d)(1)(i)-(vii), except as noted herein.

2.1 Foundations and Abutments (§257.73(d)(1)(i))

CCR unit designed, constructed, operated, and maintained with stable foundations and abutments.

The stability of the foundations was evaluated using soil data from field investigations and reviewing design drawings, operational and maintenance procedures, and conditions observed in the field by AECOM. Additionally, slope stability analyses were performed to evaluate slip surfaces passing through the foundations. The East Ash Pond is a ring dike structure and does not have abutments.

The foundation consists of medium stiff to stiff clay overlying medium dense to dense sand, which indicates stable foundations. Ash placed before 1973 was identified below the compacted embankment of the dike and above the naturally occurring foundation materials near the southeast corner of the East Ash Pond embankment; however this condition was modified by installing a Deep Soil Mixed (DMM), wet soil cement mixed method, zone in 2016. Slope stability analyses exceed the criteria listed in §257.73(e)(1) for slip surfaces passing through the foundation. The slope stability analyses are discussed in the *CCR Rule Report: Initial Safety Factor Assessment for East Ash Pond at Joppa Power Station* (October 2016). Additional slope stability analyses were performed to evaluate the effects of liquefaction in the foundation and were found to satisfy the criteria in §257.73(e)(1)(iv) applicable to dikes. A review of information about operations and maintenance as well as current and past performance of the dikes has determined appropriate processes are in place for continued operational performance.

Based on the conditions observed by AECOM, the East Ash Pond was designed and constructed with stable foundations. Any issues related to the stability of the foundation are addressed during operations and maintenance; therefore, the East Ash Pond meets the requirements in §257.73(d)(1)(i).

2.2 Slope Protection (§257.73(d)(1)(ii))

CCR unit designed, constructed, operated, and maintained with adequate slope protection to protect against surface erosion, wave action and adverse effects of sudden drawdown.

The adequacy of slope protection was evaluated by reviewing design drawings, information about operations and maintenance, and conditions observed in the field by AECOM.

Based on this evaluation, adequate slope protection was designed and constructed at the East Ash Pond. No evidence of significant areas of erosion or wave action was observed. The exterior dike slopes are covered with crushed stone and vegetation for slope protection. EEI regularly maintains the slopes, including repairing observed surface erosion and addressing areas of poor vegetation growth, as required. As the exterior slopes are not adjacent to a downstream water body, they are not susceptible to wave action or sudden drawdown. AECOM observed the vegetation to be adequately protecting against surface erosion.

The interior dike slopes have a 1.5H:1V orientation and are covered with vegetation, stacked CCRs, and some limited areas of crushed stone. Sudden drawdown conditions are not expected to occur due to the characteristics of the outfall structure at the East Ash Pond. EEI regularly maintains the interior slopes, including repairing observed surface erosion and addressing areas of poor vegetation growth, as required. AECOM observed the vegetation to be adequately protecting against surface erosion and wave action. Therefore, the East Ash Pond meets the requirements in §257.73(d)(1)(ii).

2.3 Dike Compaction (§257.73(d)(1)(iii))

C*CR unit designed, constructed, operated, and maintained with dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit.*

The density of the dike materials was evaluated using soil strength data from field investigations and reviewing design drawings, information about operations and maintenance, and conditions observed in the field by AECOM. Additionally, slope stability analyses were performed to evaluate slip surfaces passing through the dike over the range of expected loading conditions as defined within §257.73(e)(1).

Based on this evaluation, the dike consists of medium stiff to stiff material, which is indicative of properly mechanically compacted dikes. Slope stability analyses exceed the criteria listed in §257.73(e)(1) for slip surfaces passing through the dike. The slope stability analyses are discussed in the *CCR Rule Report: Initial Safety Factor Assessment for East Ash Pond at Joppa Power Station* (October 2016); therefore, the original design and construction of the East Ash Pond included sufficient dike compaction. Operational and maintenance procedures are in place to identify and mitigate deficiencies in order to maintain sufficient compaction and density of the dikes to withstand the range of loading conditions. Therefore, the East Ash Pond meets the requirements in §257.73(d)(1)(iii).

2.4 Vegetated Slopes (§257.73(d)(1)(iv))[1]

CCR unit designed, constructed, operated, and maintained with vegetated slopes of dikes and surrounding areas, except for slopes which have an alternate form or forms of slope protection.

The adequacy of slope vegetation was evaluated by reviewing design drawings, information about operations and maintenance, and conditions observed in the field by AECOM.

Based on this evaluation, the vegetation on the exterior slopes is adequate as no substantial bare or overgrown areas were observed. The exterior slopes were vegetated or covered with crushed stone and the interior slopes were covered with vegetation, crushed stone, or mechanically-stacked CCR which are alternate forms of slope protection. Therefore, the original design and construction of the East Ash Pond included adequate vegetation of the dikes and surrounding areas. Adequate operational and maintenance practices are in place to regularly manage vegetation growth, including mowing and seeding any bare areas, as evidenced by the conditions observed by AECOM. Therefore, the East Ash Pond meets the requirements in §257.73(d)(1)(iv).

[1] As modified by court order issued June 14, 2016, Utility Solid Waste Activities Group v. EPA, D.C. Cir. No. 15-1219 (order granting remand and vacatur of specific regulatory provisions).

2.5 Spillways (§257.73(d)(1)(v))

CCR unit designed, constructed, operated, and maintained with a single spillway or a combination of spillways configured as specified in [paragraph (A) and (B)]:

(A) All spillways must be either:

(1) of non-erodible construction and designed to carry sustained flows; or

(2) earth- or grass-lined and designed to carry short-term, infrequent flows at non-erosive velocities where sustained flows are not expected.

(B) The combined capacity of all spillways must adequately manage flow during and following the peak discharge from a:

(1) Probable maximum flood (PMF) for a high hazard potential CCR surface impoundment; or

(2) 1000-year flood for a significant hazard potential CCR surface impoundment; or

(3) 100-year flood for a low hazard potential CCR surface impoundment.

The spillways were evaluated using design drawings, information about operations and maintenance, and conditions observed in the field by AECOM. Additionally, hydrologic and hydraulic analyses were completed to evaluate the capacity of the spillway relative to inflow estimated for the probable maximum flood event for the high hazard potential East Ash Pond.

Two spillway structures are present at the East Ash Pond, including a ductile iron pipe and high-density polyethylene (HDPE) spillway pipe and a reinforced concrete pipe (RCP) spillway. The ductile iron, HDPE, and reinforced concrete are non-erodible materials designed to carry sustained flows. The capacity of the spillways was evaluated using hydrologic and hydraulic analysis performed per §257.82(a). The analysis found that the spillways can adequately manage flow during peak discharge resulting from the probable maximum flood event without overtopping of the embankments. The hydrologic and hydraulic analyses are discussed in the *CCR Rule Report: Initial Inflow Design Flood Control System Plan for East Ash Pond at Joppa Power Station* (October 2016). Therefore, the East Ash Pond meets the requirements in §257.73(d)(1)(v).

2.6 Stability and Structural Integrity of Hydraulic Structures (§257.73(d)(1)(vi))

CCR unit designed, constructed, operated, and maintained with hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit that maintain structural integrity and are free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure.

Two hydraulic structures pass through the dike of the East Ash Pond: the south-sub-basin 26-inch diameter HDPE spillway pipe and the north sub-basin 48-inch RCP spillway pipe. The stability and structural integrity of both pipes were evaluated using design drawings, information about operations and maintenance, inspections, and conditions observed in the field by AECOM. No other hydraulic structures are known to pass through the dike of or underlie the base of the East Ash Pond.

Closed circuit television (CCTV) inspections of both pipes were attempted in 2016. The 48-inch RCP was successfully visually inspected and noted to contain 12-inches of cemented CCR materials. However, the pipe was free of significant deterioration, deformation, distortion, and bedding deficiencies that may negatively affect the operation of the hydraulic structure. The presence of the cemented CCR materials was accounted for in the hydrologic and hydraulic analyses discussed in the *CCR Rule Report: Initial Inflow Design Flood Control System Plan for East Ash Pond at Joppa Power Station* (October 2016), and were not found sufficient enough to negatively affect the operation of the hydraulic structure. The inspection of the HDPE spillway pipe could not be fully completed due to access issues that prevented an inspection of the entire pipe. However, the evaluation of design drawings, operational and maintenance procedures, and conditions observed in the field did not identify any issues with the HDPE spillway pipe.

Based on this evaluation, all East Ash Pond hydraulic structures cannot be certified to meet the requirements of §257.73(d)(1)(vi) because a complete CCTV inspection of the 26-inch HDPE pipe has not yet been performed, thus, precluding completion of the evaluation of the stability and structural integrity of that pipe. In accordance

with §257.73(d)(2), AECOM recommends that a CCTV pipe inspection of the 26-inch HDPE pipe be completed as soon as feasible and that this assessment be updated once the inspection is completed.

2.7 Downstream Slope Inundation/Stability (§257.73(d)(1)(vii))

CCR unit designed, constructed, operated, and maintained with, for CCR units with downstream slopes which can be inundated by the pool of an adjacent water body, such as a river, stream or lake, downstream slopes that maintain structural stability during low pool of the adjacent water body or sudden drawdown of the adjacent water body.

The structural stability of the downstream slope of the East Ash Pond was evaluated by comparing the location of the East Pond relative to published flood maps for the area. The East Ash Pond is located outside of the 100-year flood zone shown on the FEMA Federal Insurance Rate Map (FIRM) map for Massac County, Illinois and the village of Joppa, Illinois. Therefore, adjacent water bodies that could potentially inundate the downstream slopes of the East Ash Pond are not present. Based on this evaluation, the requirements in §257.73(d)(1)(vii) are not applicable to the East Ash Pond, as inundation of the downstream slopes is not expected to occur during 100-year or lesser flood conditions.

3 Certification Statement

CCR Unit: Electric Energy, Inc.; Joppa Power Station; East Ash Pond

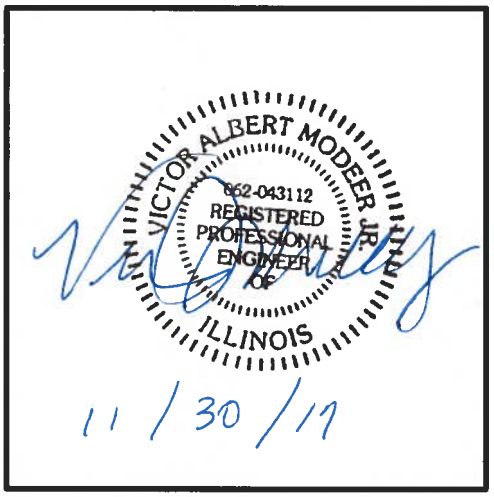
I, Victor A. Modeer, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this CCR Rule Report, and the underlying data in the operating record, has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that the initial structural stability assessment dated October 14, 2016 was conducted in accordance with the requirements of 40 CFR §257.73.

Victor A Modeer Jr

Printed Name

10/14/16

Date



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Luminant

Office Memorandum

Date: November 14, 2020

To: Cynthia Vodopivec

Matt Ballance
Jason Campbell
cc: Charles Koudelka

From: Vic Modeer

East Ash Pond Structural Stability Assessment
Electric Energy, Inc.
Subject: Joppa Power Station

The October 2016 certified "CCR Rule Report: Initial Structural Stability Assessment for the East Ash Pond at the Joppa Power Station" prepared by AECOM describes the outlets for the northern portion and southern portion of the East Ash Pond. The AECOM report states that the 26" (24" inside diameter) HDPE pipe cannot be structurally certified due to inability to complete a closed-circuit television inspection of the pipe. However, the outfall structure and the pipe section from the structure to the bottom of the embankment have been inspected numerous times by me and found to be structurally sufficient.

The 24" pipe was placed at an elevation 1' below the 36" pipe connecting the northern and southern portions of the East Ash Pond. The 24" HDPE outfall has an inlet invert elevation of approximately 372.0' and penetrates the embankment at a 1.0% slope until it reaches the downstream face, at which point the pipe follows the exterior contour of the slope until past the toe. The conduit was laid at grade just off the toe of the embankment back to the north where it outfalls into the acid basin. The interconnecting 36" diameter corrugated metal pipe (CMP) (Water Detention Facilities Inspection, March 17, 2009) was not included in the initial structural stability assessment as it was an internal pipe not affecting the structural stability. However, the 36" CMP pipe is significant because it originally carried the discharge from the southern portion of the East Ash Pond and it will carry any extreme rainfall events and any flow that is greater than 1' above the 24" outlet, and can be used as the main outlet for closure or maintenance of the 24" outlet.

AECOM's 2016 report could not certify that the pipe met the requirements of § 257.73(d)(1)(vi) because of the inability to access the pipe beyond a 90° bend beyond the toe of the dike in order to complete the inspection and was not because of any issues related to structural integrity. It is important to note that the HDPE pipe is not subject to a corrosion related failure based on the material of the pipe. Also, the pipe does not carry abrasive ash at a high enough velocity to cause erosive depletion in the wall thickness. This 24" outlet pipe has a location, configuration and surrounding dike soil conditions that do not lend themselves to a seepage type of failure. As background, in 1992, the 24" outlet, which connects to a 24" HDPE pipe that discharges in the acid basin located in the northeast tip of the north section of the impoundment, was added to allow drying and grading of the northern portion of the pond to reduce pond maintenance.

The embankment soil throughout the dike is a well compacted, very stiff, medium plasticity clay. The stability of the East Ash Pond embankment section at the south main outlet (Cross Section C-C, "CCR Rule Report: Initial Structural Stability Assessment for the East Ash Pond at the Joppa Power Station") had calculated factors of safety of 1.77, (§ 257.73(e)(1)(i) Minimum FS = 1.50), 1.71 (§ 257.73(e)(1)(ii) Minimum = 1.40) and 1.26 (§ 257.73(e)(1)(iii) Minimum = 1.00). The inspection history does not reveal any seepage throughout the entire embankment, including at the south section outlet. The soil type does not meet the criteria to be susceptible to concentrated leak erosion, backward erosion piping, or any other internal erosion process that would result from the low water head and velocity that exists around the south outlet discharge through the embankment (USBR-USACE (US Bureau of Reclamation–US Army Corps of Engineers), 2015. "Best Practices in Dam and Levee Safety Risk Analysis."; USACE, 2014. ER 1110-2-1156, "Safety of dams–Policy and procedures. Engineering and Design"; Briaud, Jean-Louis. "Case histories in soil and rock erosion: Woodrow Wilson bridge, Brazos River Meander, Normandy Cliffs, and New Orleans Levees." Journal of Geotechnical and Geoenvironmental Engineering 134, no. 10 (2008): 1425-1447.).

Please let me know if you have any questions.

Sincerely,

Vic Modeer, PE, D.GE
(IL, MO, IN, KY, OH, LA)
Consulting Engineer

ATTACHMENT 8 – SAFETY FACTOR ASSESSMENT

AECOM

Submitted to
Electric Energy, Inc.
2200 Portland Road
Metropolis, IL 62960

Submitted by
AECOM
1001 Highlands Plaza Drive West
Suite 300
St. Louis, MO 63110

October 2016

CCR Rule Report: Initial Safety Factor Assessment

For

East Ash Pond

At Joppa Power Station

1 Introduction

This Coal Combustion Residual (CCR) Rule Report documents that the East Ash Pond at the Electric Energy, Inc. (EEI) Joppa Power Station meets the safety factor assessment requirements specified in 40 Code of Federal Regulations (CFR) §257.73(e). The East Ash Pond is located near Joppa, Illinois in Massac County, approximately 0.1 miles northeast of the Joppa Power Station. The East Ash Pond serves as the ash impoundment basin for CCRs produced at the Joppa Power Station.

The East Ash Pond is an existing CCR surface impoundment as defined by 40 CFR §257.53. The CCR Rule requires that the initial safety factor assessment for an existing CCR surface impoundment be completed by October 17, 2016.

The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial safety factor assessment meets the requirements of 40 CFR § 257.73(e). The owner or operator must prepare a safety factor assessment every five years.

2 Initial Safety Factor Assessment

40 CFR §257.73(e)(1)
The owner or operator must conduct initial and periodic safety factor assessments for each CCR unit and document whether the calculated factors of safety for each CCR unit achieve the minimum safety factors specified in (e)(1)(i) through (iv) of this section for the critical cross section of the embankment. The critical cross section is the cross section anticipated to be the most susceptible of all cross sections to structural failure based on appropriate engineering considerations, including loading conditions. The safety factor assessments must be supported by appropriate engineering calculations.

(i) The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.
(ii) The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.
(iii) The calculated seismic factor of safety must equal or exceed 1.00.
(iv) For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

A geotechnical investigation program and stability analyses were performed to evaluate the design, performance, and condition of the earthen dikes of the East Ash Pond. The exploration consisted of hollow-stem auger borings, cone penetration testing with seismic wave velocity measurements and pore pressure dissipation testing, piezometer installation and monitoring, and a laboratory program including strength and index testing. Data collected from the geotechnical investigation, available design drawings, construction records, inspection reports, previous engineering investigations, and other pertinent historic documents were utilized to perform the safety factor assessment and geotechnical analyses.

The East Ash Pond embankment is generally medium stiff to stiff and overlies predominantly alluvial foundation materials. The alluvial foundation consists of soft to stiff clay overlying medium dense to dense sand. A zone of sluiced flyash that existed before the embankment dike was constructed was encountered below the compacted embankment in the southeast corner. The zone of sluiced flyash was modified by the installation of Deep Mixing Method (DMM) ground improvement technology using the wet soil mixing method. Explorations were terminated in the soil overburden and were not extended to bedrock. The phreatic surface is typically at or slightly above the embankment/foundation interface.

Six (6) representative cross sections were analyzed using limit equilibrium slope stability analysis software to evaluate stability of the perimeter dike system and foundations. The cross sections were located to represent critical surface geometry, subsurface stratigraphy, and phreatic conditions across the CCR unit. Each cross section was evaluated for each of the loading conditions stipulated in §257.73(e)(1).

The Soils Susceptible to Liquefaction loading condition, §257.73(e)(1)(iv), was not evaluated because a liquefaction susceptibly evaluation did not find soils susceptible to liquefaction within the East Ash Pond dikes. As a result, this loading condition is not applicable to the East Ash Pond at the Joppa Power Station.

Results of the Initial Safety Factor Assessments, for the critical cross-section for each loading condition (i.e., the lowest calculated factor of safety out of the cross sections analyzed for each loading condition), are listed in Table 1.

Table 1 – Summary of Initial Safety Factor Assessments

Loading Conditions	§257.73(e)(1) Subsection	Minimum Factor of Safety	Calculated Factor of Safety
Maximum Storage Pool Loading	(i)	1.50	1.59
Maximum Surcharge Pool Loading	(ii)	1.40	1.57
Seismic	(iii)	1.00	1.01
Soils Susceptible to Liquefaction	(iv)	1.20	Not Applicable

Based on this evaluation, the East Ash Pond meets the requirements in §257.73(e)(1).

3 Certification Statement

CCR Unit: Electric Energy, Inc.; Joppa Power Station; East Ash Pond

I, Victor A. Modeer, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this CCR Rule Report, and the underlying data in the operating record, has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that the initial safety factor assessment dated October 14, 2016 meets the requirements of 40 CFR §257.73.

Victor A. Modeer Jr

Printed Name

10 / 14 / 16

Date

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ATTACHMENT 9 – CLOSURE PLAN

CLOSURE PLAN FOR EXISTING CCR SURFACE IMPOUNDMENT
40 CFR 257.102(b)
REV 0 – 10/17/2016

SITE INFORMATION			
Site Name / Address	Joppa Power Station / 2100 Portland Road, Joppa, IL 62953		
Owner Name / Address	Electric Energy, Inc. / 1500 Eastport Plaza Drive, Collinsville, IL 62234		
CCR Unit	East Ash Pond	Closure Method and Final Cover Type	Close In-Place Clayey Soil Cover with Vegetation

CLOSURE PLAN DESCRIPTION	
(b)(1)(i) – Narrative description of how the CCR unit will be closed in accordance with this section.	The East Ash Pond will be dewatered, as necessary, to facilitate closure by leaving CCR in place. The emplaced CCR in the East Ash Pond will be shaped and graded. The existing transmission tower located within the East Ash Pond will remain and the foundation will be incorporated within the final cover system. The final cover will be sloped to promote drainage and stormwater runoff through a series of drainage channels on the cover system to the existing culvert under the railroad tracks to the southeast. An existing outlet pipe through the berm at the north corner of the East Ash Pond will be removed. In addition, the existing outlet pipe running next to the east edge of the berm will be removed from service. A new stormwater management pipe will be installed. In accordance with 257.102(b)(3), this initial written closure plan will be amended to provide additional details after the final engineering design for the grading and cover system is completed, if the final design would substantially affect this written closure plan. This initial closure plan reflects the information available to date.
(b)(1)(iii) – If closure of the CCR unit will be accomplished by leaving CCR in place, a description of the final cover system and methods and procedures used to install the final cover.	The soils for the final cover system will be placed directly on top of the graded CCR material to achieve final grades and will include (from bottom up): 1) 18" of compacted earthen material with a permeability of less than or equal to the permeability of the natural subsoils present at the site or no greater than $1x10^{-5}$ cm/sec, whichever is less; 2) 6" of soil capable of sustaining native plant growth; and 3) planted native grasses. Emplaced CCR material will be regraded as fill and supplemented with borrow soils as necessary to achieve design grades. Earthen material will be placed, graded, and compacted to meet the thickness and permeability as discussed above for the cover system. Organic earthen material will be placed on top of the 18" of compacted soils to create a 6" soil layer capable of sustaining native plant growth. The final cover surface will be seeded and vegetated. The final cover slope will have a minimum slope of 2% and will be graded to convey stormwater runoff to drainage channels, which lead to the culvert, under the railroad tracks and to the Ohio River.
(b)(1)(iii) – How the final cover system will achieve the performance standards in 257.102(d).	
(d)(1)(i) Control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere.	The permeability of the final cover will be equal to or less than the permeability of the natural subsoils present below the CCR material or permeability no greater than $1x10^{-5}$ cm/sec, whichever is less. Therefore, the permeability of the final cover system will not be greater than $1x10^{-5}$ cm/sec. The final cover system will be graded with a minimum 2% slope.
(d)(1)(ii) – Preclude the probability of future impoundment of water, sediment, or slurry.	The final cover will be installed with a minimum 2% slope. Drainage channels will be installed with a minimum 0.5% slope.
(d)(1)(iii) – Include measures that provide for major slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure care period.	The final cover will have a minimum 2% slope and drainage channels will have minimum 0.5% slope. Drainage channels will be lined with turf reinforced mats where required to reduce the potential for erosion. The final slope of the berms and cover will meet the stability requirements to prevent sloughing or movement of the final cover system.

CLOSURE PLAN DESCRIPTION	
(d)(1)(iv) – Minimize the need for further maintenance of the CCR unit.	The final cover will be vegetated to minimize erosion and maintenance.
(d)(1)(v) – Be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices.	Closure is estimated to be completed no later than five years upon commencement of closure activities.
(d)(2)(i) – Free liquids must be eliminated by removing liquid wastes or solidifying the remaining wastes and waste residue.	The unit will be dewatered sufficiently, as necessary, to remove the free liquids to provide a stable base for the construction of the final cover system.
(d)(2)(ii) – Remaining wastes must be stabilized sufficiently to support the final cover system.	Dewatering as necessary and regrading of existing in-place CCR will sufficiently stabilize the waste such that the final cover will be supported.
(d)(3) – A final cover system must be installed to minimize infiltration and erosion, and at minimum, meets the requirements of (d)(3)(i).	The final cover will consist of a minimum 18" earthen material layer with permeability equal to or less than the permeability of the natural subsoils or no greater than $1x10^{-5}$ cm/sec, whichever is less. Therefore, the permeability of the final cover system will be not greater than $1x10^{-5}$ cm/sec. Erosion will be minimized with a soil layer of no less than 6" of earthen material capable of sustaining native plant growth. The final cover surface will be seeded and vegetated.
(d)(3)(i) – The design of the final cover system must be included in the written closure plan.	When the design of the final cover system is completed, the written closure plan will be amended if the final design would substantially change this written closure plan. The design of the final cover system will meet the requirements of §(d)(3)(i)(A)–(D) as described below.
(d)(3)(i)(A) – The permeability of the final cover system must be less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than $1x10^{-5}$cm/sec, whichever is less.	The permeability of the final cover will be equal to or less than the permeability of the natural subsoils or no greater than $1x10^{-5}$ cm/sec, whichever is less. Therefore, the permeability of the final cover system will be not greater than $1x10^{-5}$ cm/sec.
(d)(3)(i)(B) – The infiltration of liquids through the closed CCR unit must be minimized by the use of an infiltration layer than contains a minimum of 18 inches of earthen material.	The final cover will include a minimum 18" of compacted earthen material with a permeability equal to or less than the permeability of the natural subsoils or no greater than $1x10^{-5}$ cm/sec, whichever is less. Therefore, the permeability of the final cover system will be not greater than $1x10^{-5}$ cm/sec.
(d)(3)(i)(C) – The erosion of the final cover system must be minimized by the use of an erosion layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth.	The final cover will include a minimum 6" of an earthen erosion layer that is capable of sustaining native plant growth. The final cover will be seeded and vegetated.
(d)(3)(i)(D) – The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.	The final cover will be installed with a minimum 2% slope and will incorporate calculated settlement as well as differential settling and subsidence.

INVENTORY AND AREA ESTIMATES	
(b)(1)(iv) – Estimate of the maximum inventory of CCR ever on-site over the active life of the CCR unit	9,720,000 cubic yards
(b)(1)(v) – Estimate of the largest area of the CCR unit ever requiring a final cover	111 acres

CLOSURE SCHEDULE	
(b)(1)(vi) – Schedule for completing all activities necessary to satisfy the closure criteria in this section, including an estimate of the year in which all closure activities for the CCR unit will be completed. The schedule should provide sufficient information to describe the sequential steps that will be taken to close the CCR unit, including major milestones and the estimated timeframes to complete each step or phase of CCR unit closure.	
The milestone and the associated timeframes are initial estimates. Some of the activities associated with the milestones will overlap. Amendments to the milestones and timeframes will be made as more information becomes available.	
Written Closure Plan	October 17, 2016
Notification of Intent to Close Placed in Operating Record	No later than the date closure of the CCR unit is initiated. Closure to commence in accordance with the applicable timeframes in 40 CFR 257.102(e).
Agency coordination and permit acquisition • Coordinating with state agencies for compliance • Acquiring state permits	 Year 1 – 5 (estimated) Year 1 (estimated)
Mobilization	Year 1 (estimated)
Dewater and stabilize CCR • Complete dewatering, as necessary • Complete stabilization of CCR	 Year 2 (estimated) Year 2 (estimated)
Grading • Grading of CCR material in pond to facilitate surface water drainage	Year 2 - 5 (estimated)
Installation of final cover	Year 3 - 5 (estimated)
Estimate of Year in which all closure activities will be completed	Year 5

AMENDMENT AND CERTIFICATION	
(b)(3)(i) – The owner or operator may amend the initial or any subsequent written closure plan developed pursuant to 257.102(b)(1) at any time. (b)(3)(ii) – The owner or operator must amend the written closure plan whenever: (A) There is a change in the operation of the CCR unit that would substantially affect the written closure plan in effect; or (B) Before or after closure activities have commenced, unanticipated events necessitate a revision of the written closure plan. (b)(3)(iii) – The owner or operator must amend the closure plan at least 60 days prior to a planned change in the operation of the facility or CCR unit, or no later than 60 days after an unanticipated event requires the need to revise an existing written closure plan. If a written closure plan is revised after closure activities have commenced for a CCR unit, the owner or operator must amend the current closure plan no later than 30 days following the triggering event.	This initial closure plan will be amended as required by 257.102(b)(3) and, as allowed by 257.102(b)(3), may be amended at any time, including as more information becomes available.
(b)(4) – The owner or operator of the CCR unit must obtain a written certification from a qualified professional engineer that the initial and any amendment of the written closure plan meets the requirements of this 40 CFR 257.102.	Certification by a qualified professional engineer will be appended to this plan.

Certification Statement 40 CFR § 257.102 (d)(3)(iii) – Design of the Final Cover System for a CCR Surface Impoundment

CCR Unit: Electric Energy Inc.; Joppa Power Station; East Ash Pond

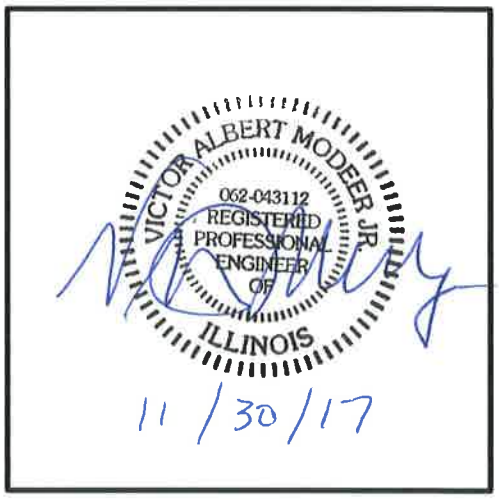
I, Victor Modeer, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the design of the final cover system as included in the initial written closure plan, dated October 17, 2016 meets the requirements of 40 CFR § 257.102.

Victor Modeer, PE, D.GE

Printed Name

10/11/16

Date



Certification Statement 40 CFR § 257.102 (b)(4) – Initial Written Closure Plan for a CCR Surface Impoundment

CCR Unit: Electric Energy Inc.; Joppa Power Station; East Ash Pond

I, Victor Modeer, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the information contained in the initial written closure plan, dated October 17, 2016, meets the requirements of 40 CFR § 257.102.

Victor Modeer, PE, D.GE

Printed Name

10/11/16

Date

ADDENDUM NO. 1
JOPPA EAST ASH POND CLOSURE PLAN

This Addendum No. 1 to the Closure Plan for Existing Coal Combustion Residuals (CCR) Impoundment for the Joppa East Ash Pond at the Joppa Power Station, Revision 0 - October 17, 2016 has been prepared to meet the requirements of Title 40 of the Code of Federal Regulations (40 C.F.R.) Section 257.103(f)(2)(v)(D) as a component of the demonstration that the Joppa East Ash Pond qualifies for a site-specific alternative deadline to initiate closure due to permanent cessation of a coal-fired boiler by a certain date.

The Joppa East Ash Pond will begin construction of closure by October 17, 2025 and cease receipt and placement of CCR and non-CCR wastestreams by no later than July 17, 2027 as indicated in the Joppa Power Station Alternative Closure Demonstration dated September 29, 2020. Closure will be completed by October 17, 2028 within the 5-year timeframe included in the Closure Schedule identified in the Joppa East Ash Pond Closure Plan in accordance with 40 C.F.R. § 257.102(f)(ii).

All other aspects of the Closure Plan remain unchanged.

CERTIFICATION

I, Eric J. Tlachac, a Qualified Professional Engineer in good standing in the State of Illinois, certify that the information in this addendum is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
Ramboll Americas Engineering Solutions, Inc., f/k/a O'Brien & Gere Engineers, Inc.
Date: September 29, 2020

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