Luminant

Dynegy Midwest Generation, LLC
1500 Eastport Plaza Dr.
Collinsville, IL 62234

October 25, 2021

Illinois Environmental Protection Agency
DWPC – Permits MC #15
Attn: Part 845 Coal Combustion Residual Rule Submittal
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

**Re: Hennepin Power Plant East Ash Pond; IEPA ID W1550100002-05**

Dear Mr. LeCrone:

In accordance with 35 I.A.C. § 845.200, Dynegy Midwest Generation, LLC (DMG) is submitting an operating permit application for the Hennepin Power Plant East Ash Pond (IEPA ID W1550100002-05). One hardcopy and one digital copy are provided with this submittal.

The permit application was prepared in accordance with 35 I.A.C. § 845.230(d)(2) (Existing, Inactive and Inactive Closed CCR Surface Impoundment that have not completed an Agency approved closure before July 30, 2021). This submittal includes the completed permit forms as required by § 845.210.

Sincerely,

Cynthia E Vody

Cynthia Vodopivec
SVP-Environmental Health and Safety

Enclosures

*Prepared for*

**Dynegy Midwest Generation, LLC**
1500 Eastport Plaza Drive
Collinsville, Illinois 62234

# INITIAL OPERATING PERMIT

## HENNEPIN EAST ASH POND

*Prepared by*

BURNS McDONNELL

425 South Woods Mill Road, Suite 300
St. Louis, MO 63017

October 25, 2021

## ATTACHMENTS

| | |
|---|---|
| Attachment A | Legal Description |
| Attachment B | History of Construction (845.220) |
| Attachment C | Chemical Constituent Analysis – CCR, Waste Streams |
| Attachment D | Fault Areas (845.320) |
| Attachment D | Placement Above the Uppermost Aquifer (845.300) |
| Attachment D | Seismic Impact Zones (845.330) |
| Attachment D | Unstable Areas and Floodplains (845.340) |
| Attachment D | Wetlands (845.310) |
| Attachment E | Permanent Markers (845.130) |
| Attachment F | Initial Emergency Action Plan (845.520) |
| Attachment G | Fugitive Dust Control Plan (845.500) |
| Attachment H | Hydrogeologic Site Characterization (845.620) |
| Attachment I | Groundwater Sampling and Analysis Program (845.640) |
| Attachment J | Slope Maintenance (845.320) |
| Attachment K | Post Closure Care Plan (845.780) |
| Attachment M | History of Known Groundwater Exceedances (845.600) |
| Attachment N | Financial Assurance Requirements (845.900) |
| Attachment O | Hazard Potential Classification Assessment (845.440) |
| Attachment P | Structural Stability Assessment (845.450) |
| Attachment Q | Safety Factor Assessment (845.460) |
| Attachment R | Inflow Design Flood Control System Plan (845.510) |
| Attachment S | Safety and Health Plan (845.530) |
| Attachment T | Proposed Closure Priority Categorization (845.700) |
| Attachment U | 5-Year Updates |

# 1. INTRODUCTION

Dynegy Midwest Generation, LLC (DMG) is operator of the inactive coal-fired Hennepin Power Plant (Plant) located in Putnam County near Hennepin, Illinois. The IEPA assigned identification number assigned to the Hennepin East Ash Pond is: W1550100002-05. The National Inventory of Dams (NID) number assigned for the Hennepin East Ash Pond by the Illinois Department of Natural Resources (IDNR) is IL50363.

This initial operating permit application was developed in accordance with 35 Ill. Admin. Code 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Part 845).

This initial operating permit application is for the East Ash Pond.

## 1.1. Facility Information

> *Section 845.210(b)(1): All permit applications must contain the name, address, email address and telephone number of the operator, or duly authorized agent, and the property owner to whom all inquiries and correspondence shall be addressed.*

| | |
|---|---|
| Facility: | Hennepin East Ash Pond<br>Hennepin Power Plant<br>13498 East 800th Street<br>Hennepin, IL 61327 |
| Owner/Operator: | Dynegy Midwest Generation, LLC<br>1500 Eastport Plaza Drive<br>Collinsville, Illinois 62234 |

## 1.2. Owner Signatures

<u>Section 845.210(b)(2):</u> *All permit applications must be signed by the owner, operator or a duly authorized agent of the operator.*

The owner of the Hennepin Power Plant is a corporation.

> <u>Section 845.210(b)(3):</u> *An application submitted by a corporation must be signed by a principal executive officer of at least the level of vice president, or his or her duly authorized representative, if that representative is responsible for the overall operation of the facility described in the application form.*

The signature of Cynthia Vodopivec on behalf of Dynegy Midwest Generation, LLC can be found in the permit applications located in Section 3.

## 1.3. Legal Description

<u>Section 845.210(c):</u> *All permit applications must contain a legal description of the facility boundary and a description of the boundaries of all units included in the facility.*

A legal description has been developed in compliance with Section 845.210(c) and is included in Attachment A.

## 1.4. Previous Assessments

<u>Section 845.210(d):</u> *Previous Assessments, Investigations Plans, and Programs*

Previous assessments were performed in accordance with 40 CFR § 257 and are referenced within the permit application and included in the appropriate Attachments.

> <u>Section 845.210(d)(1):</u> *The Agency may approve the use of any hydrogeologic site investigation or characterization, groundwater monitoring well or system, or groundwater monitoring plan, bearing the seal and signature of an Illinois Licensed Professional Geologist or Licensed Professional Engineer, completed before April 21, 2021 to satisfy the requirements of this Part.*

A previous hydrogeologic site investigation or characterization, groundwater monitoring well or system, or groundwater monitoring plan have been completed with a seal from an Illinois Licensed Professional Geologist or Licensed Professional Engineer. However, field investigations have been completed that supplement that work that will be utilized in the following sections of this report.

*Section 845.210(d)(2): For existing CCR surface impoundments, the owner or operator of the CCR surface impoundment may use a previously completed location restriction demonstration required by Section 845.300 (Placement Above the Uppermost Aquifer), Section 845.310 (Wetlands), Section 845.320 (Fault Areas), Section 845.330 (Seismic Impact Zones), and Section 845.340 (Unstable Areas) provided that the previously completed assessments meet the applicable requirements of those Sections.*

Previous assessments are provided for Section 845.300 (Placement Above the Uppermost Aquifer), Section 845.310 (Wetlands), Section 845.320 (Fault Areas), Section 845.330 (Seismic Impact Zones), and Section 845.340 (Unstable Areas) in Attachment D.

*Section 845.210(d)(3): For existing CCR surface impoundments, the owner or operator of the CCR surface impoundment may use a previously completed assessment to serve as the initial assessment required by Section 845.440 (Hazard Potential Classification Assessment), Section 845.450 (Structural Stability Assessment) and Section 845.460 (Safety Factor Assessment) provided that the previously completed assessment: A) Was not completed more than five years ago; and B) Meets the applicable requirements of those Sections.*

Previous assessments are provided for Section 845.440 (Hazard Potential Classification Assessment), Section 845.450 (Structural Stability Assessment) and Section 845.460 (Safety Factor Assessment) in Attachments O, P, and Q respectively. The addendum and certification for the Hazard Potential Classification Assessment, Structural Stability Assessment and Safety Factor Assessment are located in Attachment U.

*Section 845.210(d)(4): For inactive closed CCR surface impoundments, the owner or operator of the CCR surface impoundment may use a post-closure care plan previously approved by the Agency.*

No post-closure care plan was previously approved by the Agency.

# 2. OPERATING PERMIT

## 2.1. Initial Operating Permit

> <u>Section 845.230(d):</u> *Initial Operating Permit for Existing, Inactive and Inactive Closed CCR Surface Impoundments*

The Hennepin East Ash Pond is defined by the IEPA as an existing CCR surface impoundment that has not completed post-closure care. Per Part 845, DMG is submitting an initial operating permit application to IEPA by October 31, 2021. The permit applications (CCR-1 and CCR-2E) are provided in Section 3.

The following sections contain information or references to documents required for the Operating Permit application (Section 845.230).

## 2.2. History of Construction

> <u>Section 845.230(d)(2)(A):</u> *The history of construction specified in Section 845.220(a)(1);*

The history of construction prepared in 2016 pursuant to 40 CFR § 257.73(c) is provided in Attachment B. An amendment to the history of construction has been prepared in compliance with Section 845.220(a)(1) and is provided in Attachment U.

## 2.3. Chemical Constituents

> <u>Section 845.230(d)(2)(B):</u> *An analysis of the chemical constituents found within the CCR to be placed in the CCR surface impoundment;*

An analysis of the chemical constituents found within the CCR placed within the Hennepin East Ash Pond is provided in Attachment C.

> <u>Section 845.230(d)(2)(C):</u> *An analysis of the chemical constituents of all waste streams, chemical additives and sorbent materials entering or contained in the CCR surface impoundment;*

An analysis of the chemical constituents of all waste streams, chemical additives and sorbent materials entering or contained within the Hennepin East Ash Pond is provided in Attachment C.

## 2.4. Location Standards Demonstration

> <u>*Section 845.230(d)(2)(D):*</u> *A demonstration that the CCR surface impoundment, as built, meets, or an explanation of how the CCR surface impoundments fails to meet, the location standards in the following Sections:*

The Hennepin East Ash Pond location standards as specified in Section 845.230(d)(2)(D) are described in the following sections.

<u>*Section 845.230(d)(2)(D)(i):*</u> *Placement Above the Uppermost Aquifer;*

The previous upper aquifer demonstration was certified by a qualified professional engineer stating that the demonstration meets the requirements of 40 C.F.R. § 257.60. The requirements described in 40 C.F.R. § 257.60 are identical to the requirements contained in Section 845.300. Pursuant to Section 845.210(d)(2), a certification is not required for this demonstration. The previously completed upper aquifer demonstration is included in Attachment D.

<u>*Section 845.230(d)(2)(D)(ii):*</u> *Wetlands;*

The previous wetlands demonstration was certified by a qualified professional engineer stating that the demonstration meets the requirements of 40 C.F.R. § 257.61. The requirements described in 40 C.F.R. § 257.61 are identical to the requirements contained in Section 845.310. Pursuant to Section 845.210(d)(2), a certification is not required for this demonstration. The previously completed wetlands demonstration is included in Attachment D.

<u>*Section 845.230(d)(2)(D)(iii):*</u> *Fault Areas;*

The previous fault area demonstration was certified by a qualified professional engineer stating that the demonstration meets the requirements of 40 C.F.R. § 257.62. The requirements described in 40 C.F.R. § 257.62 are identical to the requirements contained in Section 845.320. Pursuant to Section 845.210(d)(2), a certification is not required for this demonstration. The previously completed fault area demonstration is included in Attachment D.

<u>*Section 845.230(d)(2)(D)(iv):*</u> *Seismic Impact Zone; and*

The previous seismic impact zone demonstration was certified by a qualified professional engineer stating that the demonstration meets the requirements of 40 C.F.R. § 257.63. The requirements described in 40 C.F.R. § 257.63 are identical to the requirements contained in Section 845.330. Pursuant to Section 845.210(d)(2), a certification is not required for this demonstration. The previously completed seismic impact zone demonstration is included in Attachment D.

*<u>Section 845.230(d)(2)(D)(v):</u> Unstable Areas and Floodplains;*

The previous unstable area demonstration was certified by a qualified professional engineer stating that the demonstration meets the requirements of 40 C.F.R. § 257.64. The requirements described in 40 C.F.R. § 257.64 are identical to the requirements contained in Section 845.340. Pursuant to Section 845.210(d)(2), a certification is not required for the unstable area demonstration. The previously completed unstable area demonstration is included in Attachment D.

The boundaries of the impoundment were determined by a survey conducted by a professional surveyor licensed in the State of Illinois. The boundaries of the Ash Pond were compared to the existing FEMA floodplain map, and it was determined that the Ash Pond is located within the floodplain. A demonstration was performed to evaluate compliance with 35 I.A.C. Section 845.340(c). A certification attesting to compliance is provided in Attachment D.

## 2.5. Permanent Markers

*<u>Section 845.230(d)(2)(E):</u> Evidence of permanent markers required by Section 845.130 have been installed;*

Evidence of permanent markers at the Hennepin East Ash Pond as required by Section 845.130 is provided in Attachment E.

## 2.6. Slope Maintenance

*<u>Section 845.230(d)(2)(F):</u> Documentation that the CCR surface impoundment, if not incised, will be operated and maintained with one of the forms of slope protection specified in Section 845.430;*

The Hennepin East Ash Pond is not incised. Documentation of slope protection as required by Section 845.430 is provided in Attachment J.

## 2.7. Initial Emergency Action Plan

*<u>Section 845.230(d)(2)(G):</u> Initial Emergency Action Plan and accompanying certification (see Section 845.520(e));*

The initial emergency action plan and certification has been completed as specified by Section 845.520(e) and is provided in Attachment F.

## 2.8. Fugitive Dust Control Plan

*Section 845.230(d)(2)(H): Fugitive dust control plan and accompanying certification (see Section 845.500(b)(7));*

The fugitive dust control plan and certification has been completed as specified by Section 845.500(b)(7) and is provided in Attachment G.

## 2.9. Groundwater Monitoring

*Section 845.230(d)(2)(I): Groundwater monitoring information:*

The groundwater monitoring information for the Hennepin East Ash Pond are described in the following sections.

*Section 845.230(d)(2)(I)(i): Hydrogeologic site characterization (see Section 845.620);*

Hydrogeologic site characterization for the Hennepin East Ash Pond is provided in Attachment H.

*Section 845.230(d)(2)(I)(ii): Design and construction plans of a groundwater monitoring system (see Section 845.630);*

Design and construction plans of a groundwater monitoring system are provided in Attachment I.

*Section 845.230(d)(2)(I)(iii): A groundwater sampling and analysis program that includes selection of the statistical procedures to be used for evaluating groundwater monitoring data (see Section 845.640); and*

A groundwater sampling and analysis program that meets the requirements of Section 845.640 is provided in Attachment I.

*Section 845.230(d)(2)(I)(iv): Proposed groundwater monitoring program that includes a minimum of eight independent samples for each background and downgradient well (see Section 845.650(b));*

A proposed groundwater monitoring program that meets the requirements of Section 845.650(b) is provided in Attachment I.

## 2.10. Initial Post-Closure Care Plan

*Section 845.230(d)(2)(K): Initial written post-closure care plan, if applicable (see Section 845.780(d));*

The Hennepin East Ash Pond closure will be completed by capping the CCR in place. The initial post closure care plan was developed in accordance with Section 845.780 and is provided in Attachment K.

## 2.11. History of Groundwater Exceedances

> <u>Section 845.230(d)(2)(M):</u> *History of known exceedances of the groundwater protection standards in Section 845.600, and any corrective action taken to remediate the groundwater;*

A history of known exceedances and any corrective action taken is provided in Attachment M.

## 2.12. Financial Assurance Requirements

> <u>Section 845.230(d)(2)(N):</u> *A certification that the owner or operator meets the financial assurance requirements of Subpart I;*

A certification meeting the requirement of Section 845.230(d)(2)(N) stating that the Owner meets the financial assurance requirements of *Subpart I* is provided in Attachment N.

## 2.13. Hazard Potential Classification

> <u>Section 845.230(d)(2)(O):</u> *Hazard potential classification assessment and accompanying certification (see Section 845.440(a)(2));*

The previous Hazard Potential Classification Assessment completed in compliance with 40 CFR §257.73(a) is provided in Attachment O. The addendum to the Hazard Potential Classification Assessment and certification as required by Section 845.440(a) is provided in Attachment U.

## 2.14. Structural Stability Assessment

> <u>Section 845.230(d)(2)(P):</u> *Structural stability assessment and accompanying certification (see Section 845.450(c));*

The previous Structural Stability Assessment completed in compliance with 40 CFR §257.73(d) is provided in Attachment P. The addendum to the Structural Stability Assessment and certification as required by Section 845.450(c) is provided in Attachment U.

## 2.15. Safety Factor Assessment

> Section 845.230(d)(2)(Q): *Safety factor assessment and accompanying certification (see Section 845.460(b));*

The previous Safety Factor Assessment completed in compliance with 40 CFR §257.73(e) is provided in Attachment Q. The addendum to the Safety Factor Assessment and certification as required by Section 845.460(b) is provided in Attachment U.

## 2.16. Inflow Design Flood Control System Plan

> Section 845.230(d)(2)(R): *Inflow design flood control system plan and accompanying certification (see Section 845.510(c)(3));*

The previous Inflow Design Flood Control System Plan Assessment completed in compliance with 40 CFR §257.82 is provided in Attachment R. The addendum to the Inflow Design Flood Control Plan Assessmentas required by Section 845.510(c)(3) is provided in Attachment U.

## 2.17. Safety and Health Plan

> Section 845.230(d)(2)(S): *Safety and health plan (see Section 845.530); and*

The safety and health plan in accordance with Section 845.530 is included in Attachment S.

## 2.18. Proposed Closure Priority Categorization

> Section 845.230(d)(2)(T): *For CCR surface impoundments required to close under 845.700, the proposed closure priority categorization required by Section 845.700(g).*

A CCR Surface Impoundment Category Designation and Justification letter was submitted to IEPA on May 19, 2021. The Hennepin East Ash Pond was designated as Category 3 Existing CCR surface impoundment in compliance with groundwater protection standards in Section 845.600. This letter is provided in Attachment T.

# 3. PERMIT APPLICATION

All permit applications must be made on the forms prescribed by the Agency  and must be mailed or delivered to the address designated by the Agency on the forms.   The permit applications (CCR-1 and CCR-2E) are provided below.

| Form CCR 1 | Illinois Environmental Protection Agency<br>CCR Surface Impoundment Permit Application<br>Form CCR 1 – General Provisions |
|---|---|

| | |
|---|---|
| **Bureau of Water ID Number:**<br>W1550100002-05<br>**CCR Permit Number:**<br>Initial Permit<br>**Facility Name:**<br>Hennepin Power Plant | For IEPA Use Only |

## SECTION 1: FACILITY, OPERATOR, AND OWNER INFORMATION (35 Ill. Adm. Code 845.210(b))

Facility, Operator, and Owner Information

| | | | |
|---|---|---|---|
| 1.1 | Facility Name | | |
| | Hennepin Power Plant | | |
| 1.2 | Illinois EPA CCR Permit Number (if applicable) | | |
| | Initial Permit | | |
| 1.3 | Facility Contact Information | | |
| | Name (first and last)<br>Phil Morris | Title<br>Senior Director - Environmental | Phone Number<br>618-343-7794 |
| | Email address<br>phil.morris@vistracorp.com | | |
| 1.4 | Facility Mailing Address | | |
| | Street or P.O. box<br>1500 Eastport Plaza Dr | | |
| | City or town<br>Collinsville | State<br>IL | Zip Code<br>62234 |
| 1.5 | Facility Location | | |
| | Street, route number, or other specific identifier<br>13498 East 800th Street | | |
| | County name<br>Putnam | County code (if known) | |
| | City or town<br>Hennepin | State<br>Illinois | Zip Code<br>61327 |
| 1.6 | Name of Owner/Operator | | |
| | Dynegy Midwest Generation, LLC | | |

| Facility, Operator, and Owner Info | | | | |
|---|---|---|---|---|
| 1.7 | Owner/Operator Contact Information | | | |
| | Name (first and last): Phil Morris | Title: Senior Director - Environmental | Phone Number: 618-343-7794 | |
| | Email address: phil.morris@vistracorp.com | | | |
| 1.8 | Owner/Operator Mailing Address | | | |
| | Street or P.O. box: 1500 Eastport Plaza Dr | | | |
| | City or town: Collinsville | State: IL | Zip Code: 62234 | |

## SECTION 2: LEGAL DESCRIPTION (35 Ill. Adm. Code 845.210(c))

**Legal Description**

| | |
|---|---|
| 2.1 | Legal Description of the facility boundary |
| | See Attachment A. |

## SECTION 3: PUBLICLY ACCESSIBLE INTERNET SITE REQUIREMENTS (35 Ill. Adm. Code 845.810)

**Internet Site**

| | |
|---|---|
| 3.1 | Web Address(es) to publicly accessible internet site(s) (CCR website) |
| | www.luminant.com/illinois-ccr/ |
| 3.2 | Is/are the website(s) titled "Illinois CCR Rule Compliance Data and Information" |
| | ☑ Yes ☐ No |

## SECTION 4: IMPOUNDMENT IDENTIFICATION

**Impoundment Identification**

4.1 List all the impoundment identification numbers for your facility and check the corresponding box to indicate that you have attached a written description for each impoundment.

| Impoundment ID | | |
|---|---|---|
| W1550100002-05 (see Attachment A) | ☑ | Attached written description |
| | ☐ | Attached written description |
| | ☐ | Attached written description |
| | ☐ | Attached written description |
| | ☐ | Attached written description |
| | ☐ | Attached written description |

| | | | | |
|---|---|---|---|---|
| | | | ☐ | Attached written description |
| | | | ☐ | Attached written description |
| | | | ☐ | Attached written description |
| | | | ☐ | Attached written description |

## SECTION 5: CHECKLIST AND CERTIFICATION STATEMENT

**Checklist and Certification Statement**

5.1 In Column 1 below, mark the sections of Form 1 that you have completed and are submitting with your application. For each section, specify in Column 2 any attachments that you are enclosing.

| Column 1 | | Column 2 | |
|---|---|---|---|
| Section 1: Facility, Operator, and Owner Information | ✔ | w/attachments | ☐ |
| Section 2: Legal Description | ✔ | w/attachments | ✔ |
| Section 3: Publicly Accessible Internet Site Requirement | ✔ | w/attachments | ☐ |
| Section 4: Impoundment Identification | ✔ | w/attachments | ✔ |

5.2 **Certification Statement**

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

| Name (print or type first and last name) of Owner/Operator | Official Title |
|---|---|
| Cynthia Vodopivec | SVP - Environmental |
| Signature Cynthia E. Vodopivec | Date Signed 10/25/2021 |

| Form CCR 2E | Illinois Environmental Protection Agency<br>**CCR Surface Impoundment Permit Application**<br>**Form CCR 2E – Initial Operating Permit for Existing or Inactive CCR Surface Impoundments That Have Not Completed an Agency-approved Closure Before July 30, 2021** |
|---|---|

| | |
|---|---|
| **Bureau of Water ID Number:**<br>W1550100002-05<br>**CCR Permit Number:**<br>Initial Permit<br>**Facility Name:**<br>Hennepin Power Plant | For IEPA Use Only |

**SECTION 1: CONSTRUCTION HISTORY (35 Ill. Adm. Code 845.220 AND 35 Ill. Adm. Code 845.230)**

Construction History

| | |
|---|---|
| 1.1 | CCR surface impoundment name. |
| | East Ash Pond |
| 1.2 | Identification number of the CCR surface impoundment (if one has been assigned by the Agency). |
| | W1550100002-05 |
| 1.3 | Description of the boundaries of the CCR surface impoundment (35 Ill. Adm. Code 845.210(c)). |
| | See Attachment A. |
| 1.4 | State the purpose for which the CCR surface impoundment is being used. |
| | See Attachment B. |
| 1.5 | How long has the CCR surface impoundment been in operation? |
| | See Attachment B. |
| 1.6 | List the types of CCR that have been placed in the CCR surface impoundment. |
| | See Attachment C. |

| Construction History (Continued) | | | |
|---|---|---|---|
| | 1.7 | List name of the watershed within which the CCR surface impoundment is located. | |
| | | See Attachment B. | |
| | 1.8 | Size in acres of the watershed within which the CCR surface impoundment is located. | |
| | | See Attachment B. | |
| | 1.9 | Check the corresponding box to indicate that you have attached the following: | |
| | | ✔ | Description of the physical and engineering properties of the foundation and abutment materials on which the CCR surface impoundment is constructed. |
| | | ✔ | Description of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR surface impoundment. |
| | | ✔ | Describe the method of site preparation and construction of each zone of the CCR surface impoundment. |
| | | ✔ | A listing of the approximate dates of construction of each successive stage of construction of the CCR surface impoundment. |
| | | ✔ | Drawing satisfying the requirements of 35 Ill. Adm. Code 845.220(a)(1)(F). |
| | | ✔ | Description of the type, purpose, and location of existing instrumentation. |
| | | ✔ | Area capacity curves for the CCR Impoundment. |
| | | ✔ | Description of each spillway and diversion design features and capacities and provide the calculations used in their determination. |
| | | ✔ | Construction specifications and provisions for surveillance, maintenance, and repair of the CCR surface impoundment. |
| | 1.10.1 | Is there any record or knowledge of structural instability of the CCR surface impoundment? | |
| | | ☐ Yes ✔ No | |
| | 1.10.2 | If you answered yes to Item 1.10.1, provide detailed explanation of the structural instability. | |
| | | | |

**SECTION 2: ANALYSIS OF CHEMICAL CONSTITUENTS (35 Ill. Adm. Code 845.230(d)(2)(B))**

| Constituents | | | |
|---|---|---|---|
| | 2.1 | Check the corresponding boxes to indicate you have attached the following: | |
| | | ✔ | An analysis of the chemical constituents found within the CCR to be placed in the CCR surface impoundment. |
| | | ✔ | An analysis of the chemical constituents of all waste streams, chemical additives and sorbent materials entering or contained in the CCR surface impoundment. |

| SECTION 3: DEMONSTRATIONS AND CERTIFICATIONS (35 Ill. Adm. Code 845.230(d)(2)(D)) | | | | | | |
|---|---|---|---|---|---|---|
| Demonstrations | 3.1 | Indicate whether you have attached a demonstration that the CCR surface impoundment, as built, meets, or an explanation of how the CCR surface impoundments fails to meet, the location standards in the following sections: | | | | |
| | | 35 Ill. Adm. Code 845.300 (Placement Above the Uppermost Aquifer) | ☑ | Demonstration | ☐ | Explanation |
| | | 35 Ill. Adm. Code 845.310 (Wetlands) | ☑ | Demonstration | ☐ | Explanation |
| | | 35 Ill. Adm. Code 845.320 (Fault Areas) | ☑ | Demonstration | ☐ | Explanation |
| | | 35 Ill. Adm. Code 845.330 (Seismic Impact Zones) | ☑ | Demonstration | ☐ | Explanation |
| | | 35 Ill. Adm. Code 845.340 (Unstable Areas and Floodplains) | ☑ | Demonstration | ☐ | Explanation |

| SECTION 4: ATTACHMENTS | | | |
|---|---|---|---|
| Attachments | 4.1 | Check the corresponding boxes to indicate that you have attached the following: | |
| | | ☑ | Evidence that the permanent markers required by 35 Ill. Adm. Code 845.130 have been installed. |
| | | ☑ | Documentation that the CCR surface impoundment, if not incised, will be operated and maintained with one of the forms of slope protection specified in 35 Ill. Adm. Code 845.430. |
| | | ☑ | Initial Emergency Action Plan and accompanying certification required by 35 Ill. Adm. Code 845.520(e). |
| | | ☑ | Fugitive dust control plan and accompanying certification required by 35 Ill. Adm. Code 845.500(b)(7). |
| | | ☐ | Preliminary written closure plan as specified in 35 Ill. Adm. Code 845.720(a). |
| | | ☑ | Initial written post-closure care plan as specified in 35 Ill. Adm. Code 845.780(d), if applicable. |
| | | ☐ | A certification as specified in 35 Ill. Adm. Code 845.400(h), or a statement that the CCR surface impoundment does not have a liner than meets the requirements of 35 Ill. Adm. Code 845.400(b) or (c). |
| | | ☑ | History of known exceedances of the groundwater protection standards in 35 Ill. Adm. Code 845.600, and any corrective action taken to remediate the groundwater. |
| | | ☑ | Safety and health plan, as required by 35 Ill. Adm. Code 845.530. |
| | | ☑ | For CCR surface impoundments required to close under 35 Ill. Adm. Code 845.700, the proposed closure priority categorization required by 35 Ill. Adm. Code 845.700(g). |

| SECTION 5: GROUNDWATER MONITORING | | | |
|---|---|---|---|
| Groundwater | 5.1 | Check the corresponding boxes to indicate you have attached the following groundwater monitoring information: | |
| | | ☑ | A hydrogeologic site characterization meeting the requirements of 35 Ill. Adm. Code 845.620. |
| | | ☑ | Design and construction plans of a groundwater monitoring system meeting the requirements of 35 Ill. Adm. Code 845.630. |

| | | | |
|---|---|---|---|
| | | ✔ | A groundwater sampling and analysis program that includes section of the statistical procedures to be used for evaluating groundwater monitoring data, required by 35 Ill. Adm. Code 845.640. |
| | | ✔ | Proposed groundwater monitoring program that includes a minimum of eight independent samples for each background and downgradient well, required by 35 Ill. Adm. Code 845.650(b). |
| **SECTION 6: CERTIFICATIONS** | | | |
| **Certifications** | 6.1 | Check the corresponding boxes to indicate you have attached the following certifications: | |
| | | ✔ | A certification that the owner or operator meets the financial assurance requirements of Subpart I, as required by 35 Ill. Adm. Code 845.230(d)(2)(N). |
| | | ✔ | Hazard potential classification assessment and accompanying certifications required by 35 Ill. Adm. Code 845.440(a)(2). |
| | | ✔ | Structural stability assessment and accompanying certification, required by 35 Ill. Adm. Code 845.450(c). |
| | | ✔ | Safety factor assessment and accompanying certification, as required by 35 Ill. Adm. Code 845.460(b). |
| | | ✔ | Inflow design flood control system plan and accompanying certification, as required by 35 Ill. Adm. Code 845.510(c)(3). |

# ATTACHMENT A

| CONTROL MONUMENTATION TABLE | | | | |
|---|---|---|---|---|
| POINT # | NORTHING | EASTING | ELEVATION | DESCRIPTION |
| 2007 | 1688860.60 | 2534632.47 | 526.23 | FOUND MAG NAIL |
| 2026 | 1687419.25 | 2526768.08 | 448.87 | BRASS PLUG IN PVC CONCRETE MONUMENT |
| 4204 | 1688760.04 | 2526732.99 | 443.25 | FOUND IRON PIN |

Luminant

# DYNEGY MIDWEST GENERATION, LLC
# HENNEPIN POWER PLANT

| CCR FACILITY BOUNDARY CORNERS | | | | |
|---|---|---|---|---|
| Point # | Northing | Easting | Elevation | Description |
| 1013 | 1689896.08 | 2533261.65 | 497.75 | SET I.P. |
| 1014 | 1689723.50 | 2532799.73 | 495.69 | SET I.P. |
| 1015 | 1689102.71 | 2533256.07 | 499.11 | SET I.P. |
| 1017 | 1688845.48 | 2533445.15 | 0.00 | |
| 1018 | 1688966.30 | 2533356.34 | 0.00 | |
| 1019 | 1690108.87 | 2533782.87 | 0.00 | |
| 1020 | 1690050.50 | 2533941.18 | 0.00 | |
| 1021 | 1689488.89 | 2534231.22 | 0.00 | |
| 1022 | 1689385.42 | 2534193.84 | 0.00 | |
| 1023 | 1689087.06 | 2533489.66 | 0.00 | |

LEGEND
- SECTION LINE
- RESTRICTED USE BOUNDARY
- FACILITY BOUNDARY
- ● FOUND SURVEY MARKER AS NOTED

SURVEY NOTE:
THIS DRAWING AND THE INFORMATION SHOWN HERE ON WAS OBTAINED FROM DATA COLLECTED FROM A FIELD SURVEY MADE BY INGENAE, LLC BETWEEN FEBRUARY 12 THROUGH JULY 21, 2021. SURVEY COORDINATES, BEARINGS & DISTANCES ARE REFERENCED TO ILLINOIS WEST 1202 STATE PLANE COORDINATE SYSTEM NAD 1983.

N

0' 100' 200'

**Land Description of the Hennepin Power Plant**
**East New Primary Ash Pond Facility Boundary**
**21.08 Acres**

Part of the North Half of Section 26 Township 33 North, Range 2 West of the Third Principal Meridian, Putnam County, Illinois being more particularly described as follows:

Commencing at the found Magnetic Nail at the East Quarter Corner of Section 26, from which bears an Iron Pin at the Center of Section 27, South 89 degrees 16 minutes 15 seconds West a distance of 7900.12 feet; thence from said commencement point at the East Quarter Corner of Section 26, South 89 degrees 16 minutes 15 seconds West a distance of 1187.42 feet; thence North 36 degrees 19 minutes 09 seconds West a distance of 149.95 feet to the Point of Beginning of the Tract described herein; thence continuing North 36 degrees 19 minutes 09 seconds West a distance of 939.76 feet; thence North 69 degrees 30 minutes 49 seconds East a distance of 493.10 feet; thence North 67 degrees 47 minutes 30 seconds East a distance of 562.99 feet; thence along a curve to the right having a radius of 125.00, feet a curve length of 185.21 feet, a chord bearing South 69 degrees 45 minutes 39 seconds East a chord distance of 168.73 feet; thence South 27 degrees 18 minutes 48 seconds East a distance of 632.08 feet; thence along a curve to the right having a radius of 75.00 feet, a curve length of 123.51 feet, a chord bearing South 19 degrees 51 minutes 44 seconds West a chord distance of 110.02 feet; thence South 67 degrees 02 minutes 16 seconds West a distance of 764.78 feet; thence South 47 degrees 49 minutes 49 seconds West a distance of 179.89 feet to the Point of Beginning and containing 21.08 Acres.

SURVEYOR CERTIFICATE:
THIS IS TO CERTIFY THAT WE, INGENAE, LLC, HAVE AT THE REQUEST OF AND FOR THE EXCLUSIVE USE OF THE OWNERS, PERFORMED A SURVEY OF THE TRACT AS SHOWN HEREON AND THAT THIS IS A TRUE REPRESENTATION OF THAT SURVEY. THIS PLAT AND THE SURVEY FROM WHICH IT IS BASED WERE DONE IN ACCORDANCE WITH THE "MINIMUM STANDARDS OF PRACTICE" FOR LAND SURVEYING IN THE STATE OF ILLINOIS.

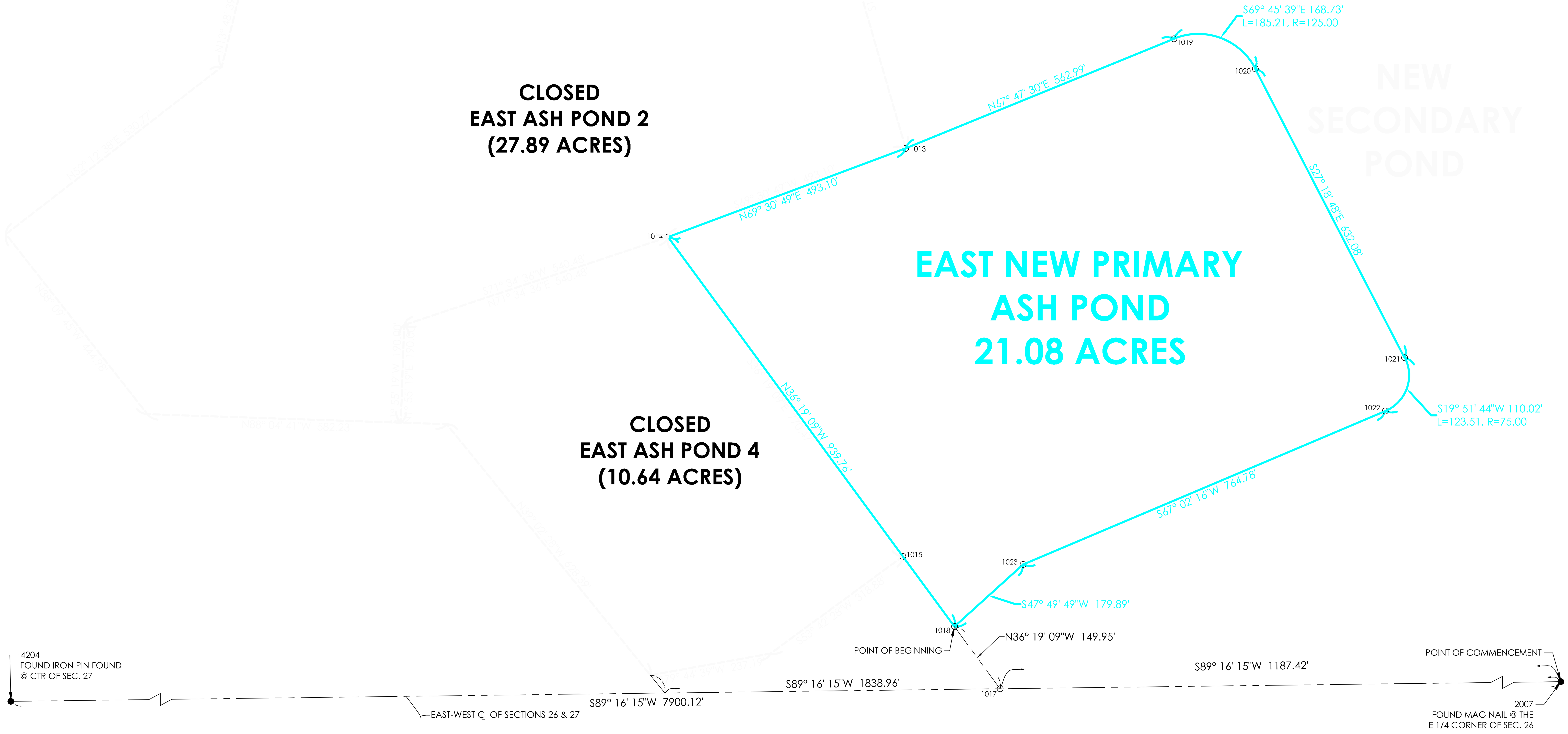
INGENAE, LLC
PROFESSIONAL DESIGN FIRM
LICENSE NO. 184.007588-0010

STATE OF ILLINOIS
MICHAEL J. GRAMINSKI
035-2901

Sept 20, 2021

MICHAEL J. GRAMINSKI
I.P.L.S. NO. 035.002901
EXPIRES: 11/30/2022

DATE





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502 Earth City Plaza, Suite 120
Earth City, MO 63045
www.ingenae.com


| Submissions / Revisions: | Date: |
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Luminant

Project Name & Location:

HENNEPIN
POWER PLANT
13498 EAST 800TH STREET
HENNEPIN, IL
61327



Drawing Name:
CCR FACILITY BOUNDARY EXHIBIT

| | |
|---|---|
| Date: 9/21/2021 | Project No. |
| Type: SITE | Drawing No. 1 |
| Drawn By: CB | |
| Approved By: MG | |
| Scale: AS NOTED | |

| CONTROL MONUMENTATION TABLE | | | | |
|---|---|---|---|---|
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| 4204 | 1688760.04 | 2526732.99 | 443.25 | FOUND IRON PIN |

Luminant

# DYNEGY MIDWEST GENERATION, LLC
# HENNEPIN POWER PLANT

| CCR FACILITY BOUNDARY CORNERS | | | | |
|---|---|---|---|---|
| Point # | Northing | Easting | Elevation | Description |
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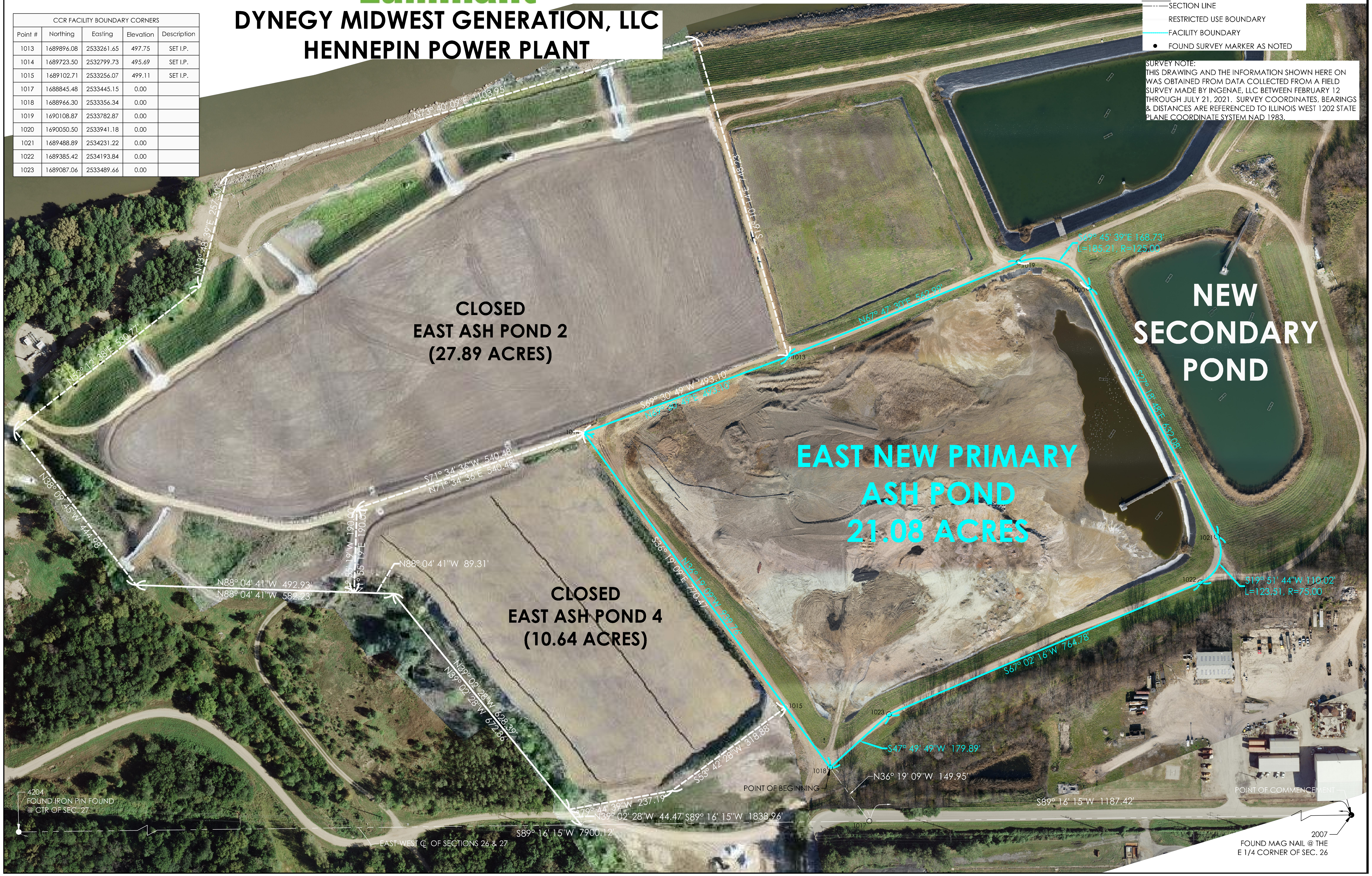
| 1014 | 1689723.50 | 2532799.73 | 495.69 | SET I.P. |
| 1015 | 1689102.71 | 2533256.07 | 499.11 | SET I.P. |
| 1017 | 1688845.48 | 2533445.15 | 0.00 | |
| 1018 | 1688966.30 | 2533356.34 | 0.00 | |
| 1019 | 1690108.87 | 2533782.87 | 0.00 | |
| 1020 | 1690050.50 | 2533941.18 | 0.00 | |
| 1021 | 1689488.89 | 2534231.22 | 0.00 | |
| 1022 | 1689385.42 | 2534193.84 | 0.00 | |
| 1023 | 1689087.06 | 2533489.66 | 0.00 | |

0' 100' 200'

LEGEND
SECTION LINE
RESTRICTED USE BOUNDARY
FACILITY BOUNDARY
FOUND SURVEY MARKER AS NOTED

SURVEY NOTE:
THIS DRAWING AND THE INFORMATION SHOWN HERE ON WAS OBTAINED FROM DATA COLLECTED FROM A FIELD SURVEY MADE BY INGENAE, LLC BETWEEN FEBRUARY 12 THROUGH JULY 21, 2021. SURVEY COORDINATES, BEARINGS & DISTANCES ARE REFERENCED TO ILLINOIS WEST 1202 STATE PLANE COORDINATE SYSTEM NAD 1983.





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502 Earth City Plaza, Suite 120
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| Submissions / Revisions: | Date: |
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Luminant

Project Name & Location:

HENNEPIN
POWER PLANT
13498 EAST 800TH STREET
HENNEPIN, IL
61327



DO NOT SCALE PLANS
Copying, Printing, Software and other processes required to produce these prints can stretch or shrink the actual paper or layout. Therefore, scaling of this drawing may be inaccurate. Contact IngenAE with any need for additional dimensions or clarifications.

Drawing Name:
CCR FACILITY BOUNDARY EXHIBIT

| | |
|---|---|
| Date: 9/21/2021 | Project No. |
| Type: SITE | Drawing No. 2 |
| Drawn By: CB | |
| Approved By: MG | |
| Scale: AS NOTED | |

# ATTACHMENT B

AECOM

October 2016

Dynegy Midwest Generation, LLC
13498 E 800th St.
Hennepin, IL 61327

**RE: History of Construction**
**USEPA Final CCR Rule, 40 CFR § 257.73(c)**
**Hennepin Power Station**
**Hennepin, Illinois**

On behalf of Dynegy Midwest Generation, LLC, AECOM has prepared the following history of construction for the Old West Polishing Pond, Old West Ash Pond, Ash Pond No. 2, and East Ash Pond at the Hennepin Power Station in accordance with 40 CFR § 257.73(c).

**BACKGROUND**

40 CFR § 257.73(c)(1) requires the owner or operator of an existing coal combustion residual (CCR) surface impoundment that either (1) has a height of five feet or more and a storage volume of 20 acre-feet or more, or (2) has a height of 20 feet or more to compile a history of construction by October 17, 2016 that contains, to the extent feasible, the information specified in 40 CFR § 257.73(c)(1)(i)–(xii).

The history of construction presented herein was compiled based on existing documentation, to the extent that it is reasonably and readily available (see 80 Fed. Reg. 21302, 21380 [April 17, 2015]), and AECOM's site experience. AECOM's document review included construction drawings, geotechnical investigations, operation and maintenance information, etc. for Old West Polishing Pond, Old West Ash Pond, Ash Pond No. 2, and East Ash Pond at the Hennepin Power Station.

## HISTORY OF CONSTRUCTION

***§ 257.73(c)(1)(i): The name and address of the person(s) owning or operating the CCR unit; the name associated with the CCR unit; and the identification number of the CCR unit if one has been assigned by the state.***

Owner: Dynegy Midwest Generation, LLC

Address: 1500 Eastport Plaza Drive
Collinsville, IL 62234

CCR Units: Old West Polishing Pond
Old West Ash Pond (Pond No. 1 and Pond No. 3)
Ash Pond No. 2
East Ash Pond, IDNR Dam ID No. IL50363

The Old West Polishing Pond, Old West Ash Pond, and Ash Pond No. 2 do not have a state assigned identification number.

***§ 257.73(c)(1)(ii): The location of the CCR unit identified on the most recent USGS 7$^{1}/_{2}$ or 15 minute topographic quadrangle map or a topographic map of equivalent scale if a USGS map is not available.***

The locations of the Old West Polishing Pond, Old West Ash Pond, Ash Pond No. 2, and East Ash Pond have been identified on an USGS 7-1/2 minute topographic quadrangle map in **Appendix A**.

***§ 257.73(c)(1)(iii): A statement of the purpose for which the CCR unit is being used.***

The following captures the purpose of each CCR unit:

- The Old West Polishing Pond (inactive) was used to store and dispose fly ash and bottom ash and is currently being used to clarify stormwater runoff from the Old West Ash Pond prior to discharge in accordance with the station’s NPDES permit.
- The Old West Ash Pond (inactive) was used to store and dispose fly ash and bottom ash.
- The Ash Pond No. 2 (inactive) was used to store and dispose fly ash, bottom ash, and other non-CCR waste streams including coal pile runoff.
- The East Ash Pond is being used to store and dispose bottom ash, fly ash, and other non-CCR waste and to clarify process water prior to discharge in accordance with the station’s NPDES permit.

Notice of intent to close the Old West Polishing Pond, Old West Ash Pond, and Ash Pond No. 2 was provided in November 2015.[1]

[1] This history of construction report was prepared on a facility-wide basis for CCR surface impoundments at the Hennepin Power Station. The inclusion of the Old West Polishing Pond, Old West Ash Pond, and Ash Pond No. 2 in this history of construction report does not concede and should not be construed to concede that the Old

***§ 257.73(c)(1)(iv): The name and size in acres of the watershed where the CCR unit is located.***

The Hennepin Power Station and the above-referenced CCR units are located at the western edge of the Depue Lake-Illinois River Watershed with a 12-digit Hydrologic Unit Code (HUC) of 071300010804 and a drainage area of 44,525 acres (USGS 2016).

***§ 257.73(c)(1)(v): A description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is constructed.***

Physical properties of the foundation materials for the Old West Polishing Pond and Old West Ash Pond are described as cohesive material underlain by granular material. The cohesive material consists of lean clay, gravelly clay, silt, clayey silt, and sandy silt. The consistency of the cohesive material varies from very soft to medium stiff. The granular material consists of silty sand and clayey gravel. The relative density of the granular materials varies from loose to very dense and generally increases with depth. An available summary of the engineering properties of the foundation materials for the Old West Polishing Pond and Old West Ash Pond is presented in **Table 1** below. The engineering properties are based on previous geotechnical explorations and laboratory testing.

**Table 1. Summary of Material Engineering Properties for the Old West Polishing Pond and Old West Ash Pond**

| Layer | Unit Weight (pcf) | Total (undrained) Shear Strength Parameters | | Effective (drained) Shear Strength Parameters | |
|---|---|---|---|---|---|
| | | ***ϕ (deg)*** | ***c (psf)*** | ***ϕ′ (deg)*** | ***c′ (psf)*** |
| CL (soft) | 120 | 0 | 500 | 28 | 0 |
| CL (medium stiff gravely clay) | 120 | 28 | 0 | 28 | 0 |
| ML (soft to medium stiff) | 125 | 28 | 0 | 28 | 0 |
| CL-ML (very soft) | 120 | 0 | 400 | 26 | 0 |
| SM (very loose) | 125 | 28 | 0 | 28 | 0 |
| GC (dense) | 130 | 34 | 0 | 34 | 0 |
| GC (very dense) | 130 | 36 | 0 | 36 | 0 |
| Fill: GC (very dense) | 130 | 34 | 50 | 34 | 0 |

West Polishing Pond, Old West Ash Pond, and Ash Pond No. 2 are subject to the Design Criteria or all Operating Criteria in the CCR Rule.

The Old West Polishing Pond and Old West Ash Pond are enclosed impoundments with dikes and do not have abutments.

Physical properties of the foundation and abutment materials for Ash Pond No. 2 and the East Ash Pond are described as gravel materials with varying amounts of silt and clay. The relative density of the gravel is medium dense to very dense. An available summary of the engineering properties of the foundation materials for Ash Pond No. 2 and the East Ash Pond is presented in **Table 2** below. The engineering properties are based on previous geotechnical explorations and laboratory testing.

**Table 2. Summary of Foundation and Abutment Material Engineering Properties for the Ash Pond No. 2 and East Ash Pond**

| Material | Unit Weight (pcf) | Effective (drained) Shear Strength Parameters | | Total (undrained) Shear Strength Parameters | |
|---|---|---|---|---|---|
| | | c' (psf) | Φ' (°) | c (psf) | Φ (°) |
| Alluvial Foundation | 135 | 0 | 38 | 0 | 38 |

***§ 257.73(c)(1)(vi): A statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR unit; the method of site preparation and construction of each zone of the CCR unit; and the approximate dates of construction of each successive stage of construction of the CCR unit.***

Physical properties of the embankment materials for the Old West Polishing Pond and Old West Ash Pond are described as gravel with occasional zones of clayey sand and lean clay. The gravel has a general relative density of very dense. An available summary of the engineering properties of the embankment materials for the Old West Polishing Pond and Old West Ash Pond is presented in **Table 1** above. The engineering properties are based on previous geotechnical explorations and laboratory testing.

The physical properties of Ash Pond No. 2 embankment construction materials are described in this paragraph. The original embankments are constructed of sand with varying amounts of coal pieces and gravel. The initial embankment raise is constructed of silty clay, clayey sand, sand, and gravel and the later embankment raise is constructed with layers of lean clay, silty clay, clayey silt, clayey, and gravel. An available summary of the engineering properties of the embankment materials for Ash Pond No. 2 is presented in **Table 3** below. The engineering properties are based on previous geotechnical explorations and laboratory testing.

**Table 3. Summary of Construction Material Engineering Properties for Ash Pond No. 2**

| Material | Unit Weight (pcf) | Effective (drained) Shear Strength Parameters | | Total (undrained) Shear Strength Parameters | |
|---|---|---|---|---|---|
| | | c' (psf) | Φ' (°) | c (psf) | Φ (°) |
| Fill: GP-GM (medium dense) | 125 | 0 | 32 | 0 | 32 |
| Fill: CL (hard) | 120 | 0 | 32 | 4000 | 0 |
| Fill: ML (hard) | 120 | 0 | 32 | 4500 | 0 |
| Fill: SC (medium dense) | 120 | 0 | 28 | 0 | 28 |

Physical properties of the embankment materials for the East Ash Pond are described as clayey silt and clay. The consistency of both the clayey silt and clay ranges from stiff to hard. The original pond surface is lined with a 4-foot thick compacted clay layer of 1.0 x $10^{-7}$ cm/s underlain by a 1-foot thick sand layer. The liner system of the embankment raise consists of a (from top to bottom) 45 mil reinforced polyethylene geomembrane, a 1-foot thick clay layer, and an 8 oz/sy polypropylene geotextile. A typical cross section profile of the liner system is shown on drawing C-56 presented in **Appendix B**. An available summary of the construction material engineering properties for the East Ash Pond is presented in **Table 4** below. The engineering properties are based on previous geotechnical explorations and laboratory testing.

**Table 4. Summary of Construction Material Engineering Properties for the East Ash Pond**

| Material | Unit Weight (pcf) | Effective (drained) Shear Strength Parameters | | Total (undrained) Shear Strength Parameters | |
|---|---|---|---|---|---|
| | | c' (psf) | Φ' (°) | c (psf) | Φ (°) |
| Embankment Fill | 105 | 30 | 32 | 2500 | 0 |
| Liner System | 120 | 60 | 30 | 2500 | 0 |

The method of site preparation and construction of the Old West Polishing Pond, Old West Ash Pond, Ash Pond No. 2, and the original East Ash Pond are not reasonably and readily available. Site preparation and construction of the 2003 East Ash Pond liner raise were completed in accordance with the applicable construction specification (see § 257.73(c)(1)(xi) below).

Reasonably and readily available approximate dates of construction of each successive stage of construction of the Old West Polishing Pond, Old West Ash Pond, Ash Pond No. 2, and East Ash Pond are provided in **Table 5** below.

**Table 5. Approximate dates of construction of each successive stage of construction.**

| Date | Event |
|---|---|
| 1951 to 1952 | Construction of historical Ash Pond No. 1 |
| 1958 | Construction of Ash Pond No. 2 |
| Late 1960's | Construction of historical Ash Pond No. 3 |
| 1978 | Embankment raise of Ash Pond No. 2 |
| 1985 | Embankment raise of Ash Pond No. 2 to elevation 484 feet and Ash Pond No. 3 (Old West Ash Pond) to elevation 460 feet |
| 1988 to 1989 | Embankment raise of Old West Ash Pond to elevation 465 feet that merged historical Ash Pond No. 1 and Ash Pond No. 3 into one single pond and created the Old West Polishing Pond |
| 1989 | Embankment raise of Ash Pond No. 2 to elevation 494 feet |
| 1995 to 1996 | Construction of East Ash Pond |
| 2003 | Embankment liner raise of East Ash Pond |
| 2009 to 2010 | Eastern portion of Ash Pond No. 2 was removed to facilitate construction of the Leachate Pond |
| 2011 | Landfill Cell 1 was constructed over placed CCR in Ash Pond No. 2 adjacent to the Leachate Pond |
| 2014 | North Embankment tree removal, grading, and vegetation re-establishment of Ash Pond No. 2 |

***§ 257.73(c)(1)(vii): At a scale that details engineering structures and appurtenances relevant to the design, construction, operation, and maintenance of the CCR unit, detailed dimensional drawings of the CCR unit, including a plan view and cross sections of the length and width of the CCR unit, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection, in addition to the normal operating pool surface elevation and the maximum pool surface elevation following peak discharge from the inflow design flood, the expected maximum depth of CCR within the CCR surface impoundment, and any identifiable natural or manmade features that could adversely affect operation of the CCR unit due to malfunction or mis-operation.***

Drawings that contain items pertaining to the requested information for the Old West Polishing Pond, Old West Ash Pond, Ash Pond No. 2, and East Ash Pond are listed in **Table 6** below. Items marked as "Not Available" are items not found during a review of the reasonably and readily available record documentation.

AECOM

**Table 6. List of drawings containing items pertaining to the information requested in § 257.73(c)(1)(vii).**

| | Old West Polishing Pond | Old West Ash Pond | Ash Pond No. 2 | East Ash Pond |
|---|---|---|---|---|
| **Dimensional plan view (all zones)** | HEN1-B460-2 | HEN1-B460-1 to 2 | HEN1-B461, HEN1-C117 | HEN1-C55 |
| **Dimensional cross sections** | HEN1-B452 to B457 | HEN1-B452 to B457 | HEN1-B458-1 to 7, Berm Modification Drawings 7 to 9 | HEN1-C56 to C59 |
| **Foundation Improvements** | Not Applicable | Not Applicable | Not Applicable | Not Applicable |
| **Drainage Provisions** | Not Applicable | Not Applicable | Not Applicable | Not Applicable |
| **Spillways and Outlets** | Not Available | Not Available | Not Applicable | HEN1-C8 to C9, HEN1-C109, HEN1-C113 |
| **Diversion Ditches** | Not Applicable | Not Applicable | Not Applicable | Not Applicable |
| **Instrument Locations** | Figure 2D | Figure 2C | Figure 2A | Figure 2B |
| **Slope Protection** | Not Available | Not Available | Berm Modification Drawings 3 to 9 | HEN1-C56 to C59 |
| **Normal Operating Pool Elevation** | Not Available | Not Available | Not Available | Not Available |
| **Maximum Pool Elevation** | Not Available | Not Available | Not Available | Not Available |
| **Approximate Maximum Depth of CCR in 2016** | 11 feet | 15 feet | 46 feet | 35 feet |

All drawings referenced in **Table 6** above can be found in **Appendix B** and **Appendix C**.

Based on the review of the drawings listed above, no natural or manmade features that could adversely affect operation of these CCR units due to malfunction or mis-operation were identified.

***§ 257.73(c)(1)(viii): A description of the type, purpose, and location of existing instrumentation.***

Existing instrumentation consists of open-standpipe piezometers installed in 2015. The purpose of the piezometers is to measure the pore water pressures within the embankments of the Old West Polishing Pond, Old West Ash Pond, Ash Pond No. 2, and East Ash Pond. There are seven (7) existing piezometers within the Old West Polishing Pond, Old West Ash Pond, Ash Pond No. 2, and East Ash Pond. A location map of the existing instrumentation is presented in **Appendix C**.

***§ 257.73(c)(1)(ix): Area-capacity curves for the CCR unit.***

Area-capacity curves for the Old West Polishing Pond, Old West Ash Pond, Ash Pond No. 2, and East Ash Pond are not reasonably and readily available.

***§ 257.73(c)(1)(x): A description of each spillway and diversion design features and capacities and calculations used in their determination.***

The Old West Polishing Pond contains a 24-inch diameter corrugated metal pipe (CMP) outlet that discharges stormwater to the Illinois River in accordance with the station's NPDES permit. Current capacity and calculation information for the Old West Polishing Pond's discharge capability is not reasonably and readily available.

The Old West Ash Pond contains a 24-inch dia. pipe culvert. Stormwater collected within the CCR unit drains via surface flow and through the pipe culvert into the Old West Polishing Pond. Current capacity and calculation information for the Old West Ash Pond's discharge capability is not reasonably and readily available.

The Ash Pond No. 2 does not contain a spillway or diversion feature. Stormwater collected within the CCR unit drains via surface flow into the East Ash Pond. Current capacity and calculation information for the Ash Pond No. 2's discharge capability is not reasonably and readily available.

The East Ash Pond contains two outlet structures. The southeast outlet is a 5-foot wide stop-log structure that is connected to a 36-inch diameter reinforced concrete pipe (RCP). The 36-inch diameter RCP discharges into the East Polishing Pond. The northeast outlet, located on the northeast corner of the East Ash Pond, is a headwall structure connected to an 18-inch diameter RCP. The 18-inch diameter RCP discharges into the East Leachate Pond. In 2016, the discharge capacity of the East Ash Pond was evaluated using HydroCAD 10 software modeling a 1,000-year, 24-hour rainfall event. The model results indicate that the East Ash Pond has enough storage capacity and will not overtop the embankment during the 1,000-year, 24-hour storm event. The results of the HydroCAD 10 analysis are presented below in **Table 7**.

**Table 7. Results of HydroCAD 10 analysis**

| | East Ash Pond |
|---|---|
| **Approximate Minimum Berm Elevation[1] (ft)** | 493.0 |
| **Approximate Emergency Spillway Elevation[1] (ft)** | Not Applicable |
| **Starting Pool Elevation[1] (ft)** | 490.4 |
| **Peak Elevation[1] (ft)** | 492..2 |
| **Time to Peak (hr)** | 12.5 |
| **Surface Area (ac)** | 6.5 |
| **Storage[2] (ac-ft)** | 8.4 |

Note: 1. Elevations are based on NAVD88 datum
2. Storage given is from Starting Pool Elevation to Peak Elevation.

***§ 257.73(c)(1)(xi): The construction specifications and provisions for surveillance, maintenance, and repair of the CCR unit.***

The construction specifications for Old West Polishing Pond, Old West Ash Pond, Ash Pond No. 2, and the original East Ash Pond are not reasonably and readily available. The construction specification for the 2003 East Ash Pond liner raise is located in *Specification J-2616, Rev. A* (presented in **Appendix D**).

The provisions for surveillance, maintenance, and repair of the Old West Polishing Pond and Old West Ash Pond are located in *Hennepin Power Station; West Ash Disposal Pond Maintenance Plan* (2013) (presented in **Appendix E**). The provisions for surveillance, maintenance, and repair of Ash Pond No. 2 are located in *Hennepin Power Station; Old East Ash Disposal Pond Maintenance Plan* (2013) (presented in **Appendix F**). The provisions for surveillance, maintenance, and repair of the East Ash Pond are located in *Hennepin Power Station; East Ash Disposal Pond Maintenance Plan* (2014) (presented in **Appendix G**).

The operations and maintenance plans for the Old West Polishing Pond, Old West Ash Pond, Ash Pond No. 2, and East Ash Pond are currently being revised by Dynegy Midwest Generation, LLC.

***§ 257.73(c)(1)(xii): Any record or knowledge of structural instability of the CCR unit.***

There is no record or knowledge of structural instability of the Old West Polishing Pond, Old West Ash Pond, Ash Pond No. 2, and East Ash Pond at the Hennepin Power Station.

AECOM

**LIMITATIONS**

The signature of AECOM's authorized representative on this document represents that to the best of AECOM's knowledge, information and belief in the exercise of its professional judgment, it is AECOM's professional opinion that the aforementioned information is accurate as of the date of such signature. Any recommendation, opinion or decisions by AECOM are made on the basis of AECOM's experience, qualifications and professional judgment and are not to be construed as warranties or guaranties. In addition, opinions relating to environmental, geologic, and geotechnical conditions or other estimates are based on available data and that actual conditions may vary from those encountered at the times and locations where data are obtained, despite the use of due care.

Sincerely,

Claudia Prado
Project Manager

Victor Modeer, P.E., D.GE
Senior Project Manager

**REFERENCES**

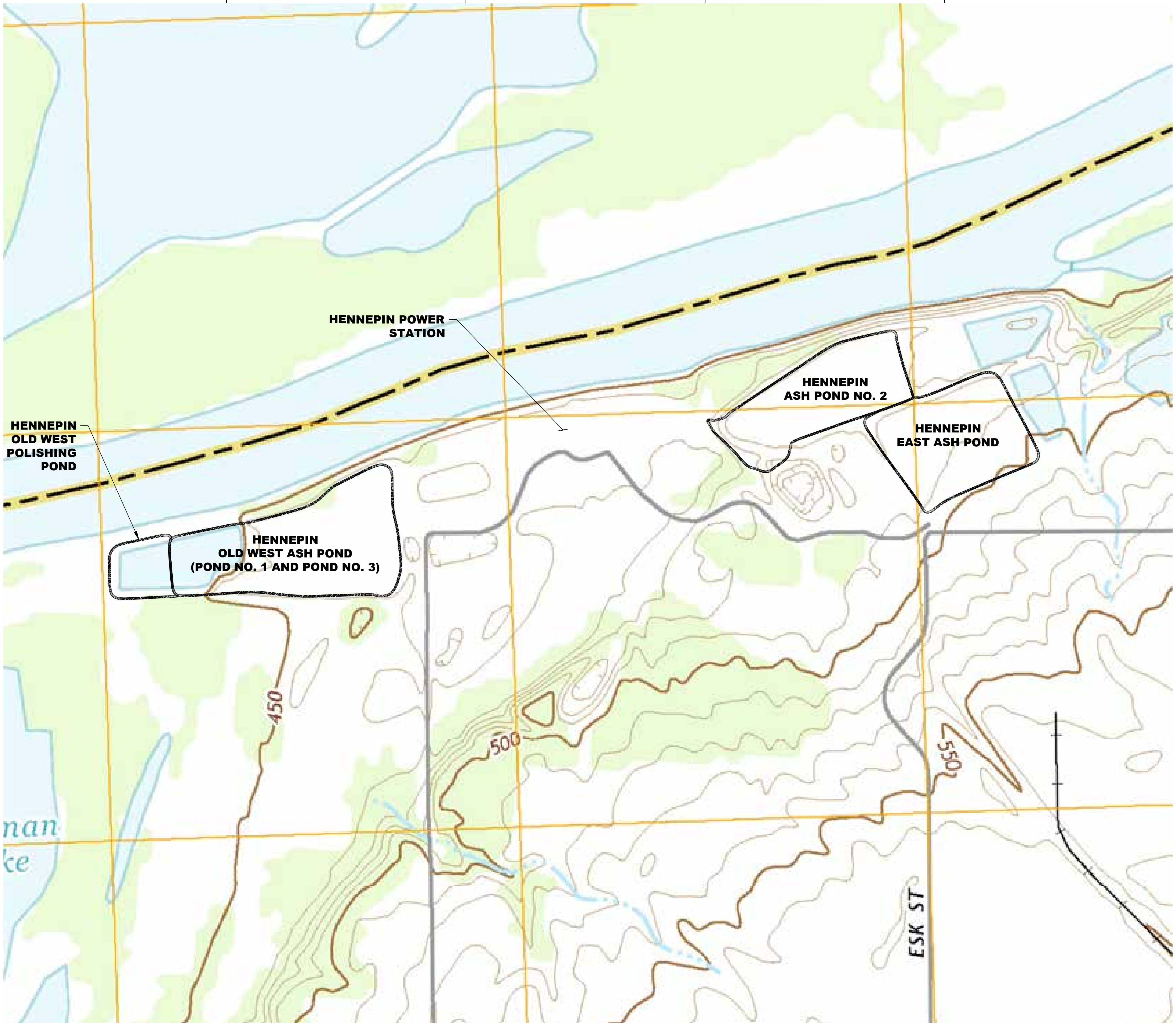
United States Environmental Protection Agency (USEPA). (2015). *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule.* 40 CFR Parts 257 and 261, 80 Fed. Reg. 21302, 21380 April 17, 2015.

United States Geological Survey (USGS). (2016). The National Map Viewer. http://viewer.nationalmap.gov/viewer/. USGS data first accessed in March of 2016.

**APPENDICES**

Appendix A: History of Construction Vicinity Map
Appendix B: Hennepin Power Station Drawings
Appendix C: Hennepin Power Station Piezometer Locations
Appendix D: Specification J-2616, Rev. A, Primary Ash Pond Modifications
Appendix E: Hennepin Power Station; West Ash Disposal Pond Maintenance Plan (2013)
Appendix F: Hennepin Power Station; Old East Ash Disposal Pond Maintenance Plan (2013)
Appendix G: Hennepin Power Station; East Ash Disposal Pond Maintenance Plan (2014)

**Appendix A: History of Construction Vicinity Map**




LEGEND

CCR UNITS

SOURCE:
MAP PROVIDED FROM ELECTRONIC USGS DIGITAL RASTER GRAPHIC 7.5 MINUTE TOPOGRAPHIC MAP OF DEPUE ILLINOIS, REVISED 2015.


N

0 400 800 1200
SCALE IN FEET


AECOM
1001 Highlands Plaza Drive, Suite 300
St. Louis, Mo. 63110
314 429-0100 (phone)
314-429-0462 (fax)


DYNEGY MIDWEST GENERATION, L.L.C.
13498 East 800th Street
Hennepin, IL 61327

HISTORY OF CONSTRUCTION

HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

ISSUED FOR BIDDING — DATE BY

ISSUED FOR CONSTRUCTION — DATE BY

REVISIONS

| NO. | DESCRIPTION | DATE |
|---|---|---|
| △ | | |
| △ | | |
| △ | | |
| △ | | |
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| | |
|---|---|
| AECOM PROJECT NO: | 60489731 |
| DRAWN BY: | DJD |
| DESIGNED BY: | DJD |
| CHECKED BY: | MN |
| DATE CREATED: | 2016-04-13 |
| PLOT DATE: | |
| SCALE: | 1" = 400' |
| ACAD VER: | 2014 |

SHEET TITLE

HISTORY OF CONSTRUCTION VICINITY MAP

01

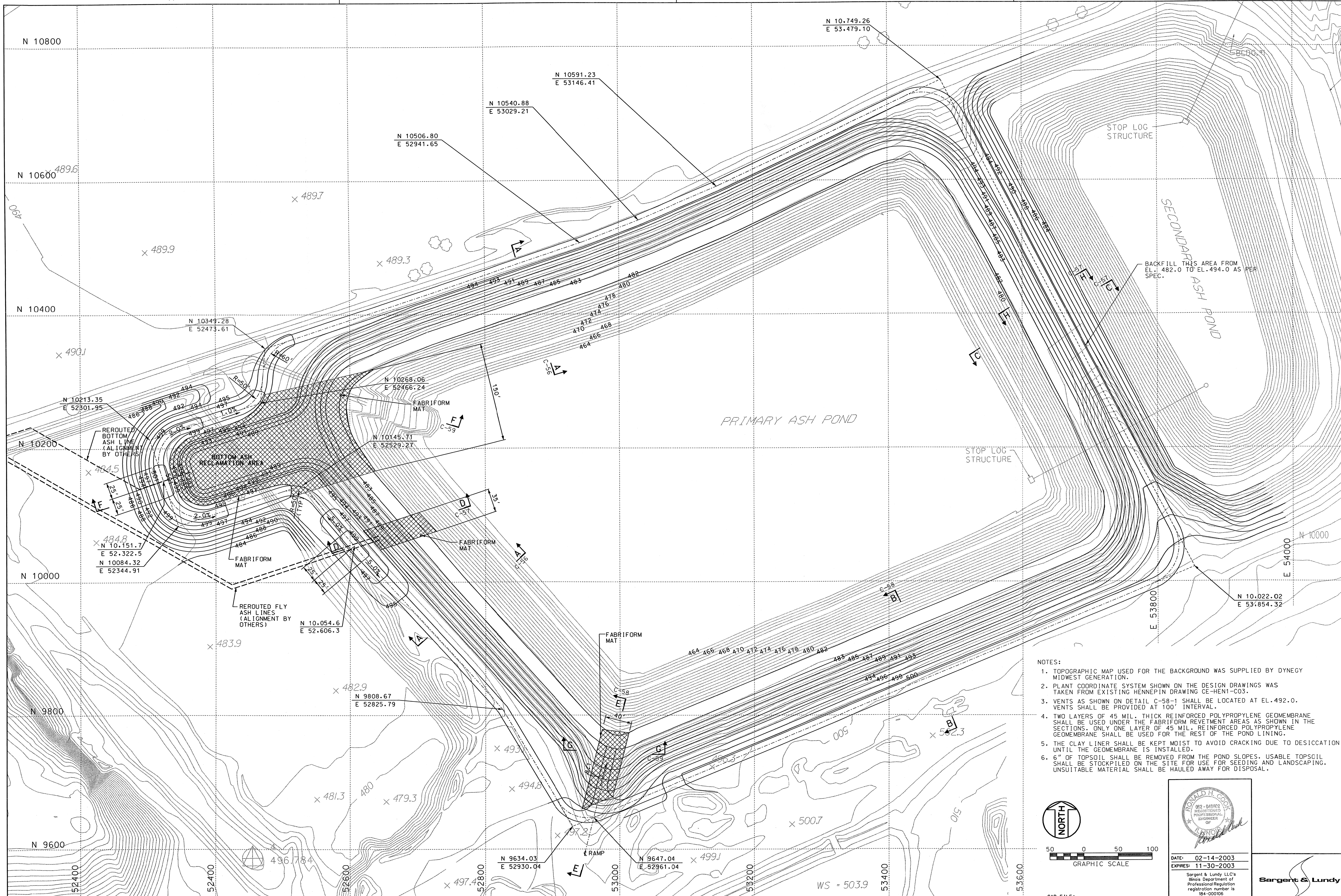
AECOM DRAWING PATH: P:\Projects\Geotech\60428794_DynegyCCR\13_Construction History\04 Technical Production\4_Hennepin\Reference Documents\Vicinity Location Map References\Figures\C-01 History of Construction Vicinity Map (Hennepin) -- MJN.dwg NANAK, MATT, 9/28/2016 4:11 PM

**Appendix B: Hennepin Power Station Drawings**

1. “Plan of Primary Ash Pond, Modification to Primary Ash Pond”, Drawing No. C-55, Revision 0.1, 14 February, 2003, Sargent & Lundy, LLC.
2. “Sections and Details – Sheet 1, Modification to Primary Ash Pond”, Drawing No. C-56, Revision 0.1, 14 February, 2003, Sargent & Lundy, LLC.
3. “Sections and Details – Sheet 2, Modification to Primary Ash Pond”, Drawing No. C-57, Revision 0.1, 14 February, 2003, Sargent & Lundy, LLC.
4. “Sections and Details – Sheet 3, Modification to Primary Ash Pond”, Drawing No. C-58, Revision 0.1, 14 February, 2003, Sargent & Lundy, LLC.
5. “Sections and Details – Sheet 4, Modification to Primary Ash Pond”, Drawing No. C-59, Revision 0.1, 14 February, 2003, Sargent & Lundy, LLC.
6. “Cross Sections of Ash Pond Berm Extension, Sta 1+00, 5+00 & 9+50”, Drawing No. E-HEN1-B452, Revision 0, 4 November, 1997, Illinois Power Company.
7. “Cross Sections of Ash Pond Berm Extension, Sta 14+25, 20+80 & 26+00”, Drawing No. E-HEN1-B453, Revision 0, 4 November, 1997, Illinois Power Company.
8. “Cross Sections of Ash Pond Berm Extension, Sta 30+00, 35+00 & 39+00”, Drawing No. E-HEN1-B454, Revision 0, 4 November, 1997, Illinois Power Company.
9. “Cross Sections of Ash Pond Berm Extension, Sta 40+00, 42+00, 44+90”, Drawing No. E-HEN1-B455, Revision 0, 4 November, 1997, Illinois Power Company.
10. “Cross Sections of Ash Pond Berm Extension, Sta 47+00, 51+00 & 56+00”, Drawing No. E-HEN1-B456, Revision 0, 4 November, 1997, Illinois Power Company.
11. “Cross Sections of Ash Pond Berm Extension, Sta 61+50”, Drawing No. E-HEN1-B457, Revision 0, 4 November, 1997, Illinois Power Company.
12. “Cross Sections, East Ash Pond Extension”, Drawing No. E-HEN1-B458-1, Revision 0, 8 March, 1990, Illinois Power Company.
13. “Cross Sections, East Ash Pond Extension”, Drawing No. E-HEN1-B458-2, Revision 0, 8 March, 1990, Illinois Power Company.
14. “Cross Sections, East Ash Pond Extension”, Drawing No. E-HEN1-B458-3, Revision 0, 8 March, 1990, Illinois Power Company.
15. “Cross Sections, East Ash Pond Extension”, Drawing No. E-HEN1-B458-4, Revision 0, 8 March, 1990, Illinois Power Company.
16. “Cross Sections, East Ash Pond Extension”, Drawing No. E-HEN1-B458-5, Revision 0, 8 March, 1990, Illinois Power Company.
17. “Cross Sections, East Ash Pond Extension”, Drawing No. E-HEN1-B458-6, Revision 0, 8 March, 1990, Illinois Power Company.
18. “Cross Sections, East Ash Pond Extension”, Drawing No. E-HEN1-B458-7, Revision 0, 8 March, 1990, Illinois Power Company.
19. “Plan-Unit #1 Ash Pond Extension, Sheet #1”, Drawing No. E-HEN1-B460-1, 2 February, 1988, Illinois Power Company.
20. “Plan-Unit #1 Ash Pond Extension, Sheet #2”, Drawing No. E-HEN1-B460-2, 2 February, 1988, Illinois Power Company.

**Appendix B: Hennepin Power Station Drawings (continued)**

21. “Contour and Grading Plan, Unit #2 Ash Pond Extension”, Drawing No. CE-HEN1-B461, Revision 0, 8 March, 1990, Illinois Power Company.
22. “Pond 2 East, Flexible Membrane Liner and Structures”, Drawing No. HEN1-C109, Revision 0, 28 July, 2010, Civil & Environmental Consultants, Inc.
23. “Pond 2 East, Details”, Drawing No. HEN1-C113, Revision 0, 28 July, 2010, Civil & Environmental Consultants, Inc.
24. “Landfill Phase 1 Construction, Existing Conditions”, Drawing No. HEN1-C117, Revision 0, 28 November, 2010, Civil & Environmental Consultants, Inc.
25. “Layout-Pond Discharge Structures, 1995 Ash Facility”, Drawing No. CE-HEN1-C8, Revision 0, 17 September, 1996, Illinois Power Company.
26. “Details: Pond Discharge Structure, 1995 Ash Facility”, Drawing No. CE-HEN1-C9, Revision 0, 17 September, 1996, Illinois Power Company.
27. “East Berm Modification, Existing Site Conditions”, Drawing No. 3, Revision 3, 4 February, 2015, Civil & Environmental Consultants, Inc.
28. “East Berm Modification, Proposed Site Plan”, Drawing No. 4, Revision 3, 4 February, 2015, Civil & Environmental Consultants, Inc.
29. “East Berm Modification, Proposed Grading Plan 1 of 2”, Drawing No. 5, Revision 3, 4 February, 2015, Civil & Environmental Consultants, Inc.
30. “East Berm Modification, Proposed Grading Plan 2 of 2”, Drawing No. 6, Revision 3, 4 February, 2015, Civil & Environmental Consultants, Inc.
31. “East Berm Modification, Proposed Sections Sta 1+00 to 15+00”, Drawing No. 7, Revision 3, 4 February, 2015, Civil & Environmental Consultants, Inc.
32. “East Berm Modification, Proposed Sections Sta 16+00 to 23+50”, Drawing No. 8, Revision 3, 4 February, 2015, Civil & Environmental Consultants, Inc.
33. “East Berm Modification, Berm and Erosion Control Details”, Drawing No. 9, Revision 3, 4 February, 2015, Civil & Environmental Consultants, Inc.




NOTES:

1. TOPOGRAPHIC MAP USED FOR THE BACKGROUND WAS SUPPLIED BY DYNEGY MIDWEST GENERATION.
2. PLANT COORDINATE SYSTEM SHOWN ON THE DESIGN DRAWINGS WAS TAKEN FROM EXISTING HENNEPIN DRAWING CE-HEN1-C03.
3. VENTS AS SHOWN ON DETAIL C-58-1 SHALL BE LOCATED AT EL.492.0. VENTS SHALL BE PROVIDED AT 100' INTERVAL.
4. TWO LAYERS OF 45 MIL. THICK REINFORCED POLYPROPYLENE GEOMEMBRANE SHALL BE USED UNDER THE FABRIFORM REVETMENT AREAS AS SHOWN IN THE SECTIONS. ONLY ONE LAYER OF 45 MIL. REINFORCED POLYPROPYLENE GEOMEMBRANE SHALL BE USED FOR THE REST OF THE POND LINING.
5. THE CLAY LINER SHALL BE KEPT MOIST TO AVOID CRACKING DUE TO DESICCATION UNTIL THE GEOMEMBRANE IS INSTALLED.
6. 6" OF TOPSOIL SHALL BE REMOVED FROM THE POND SLOPES. USABLE TOPSOIL SHALL BE STOCKPILED ON THE SITE FOR USE FOR SEEDING AND LANDSCAPING. UNSUITABLE MATERIAL SHALL BE HAULED AWAY FOR DISPOSAL.

RONALD H. COOK
062-048602
REGISTERED PROFESSIONAL ENGINEER
ILLINOIS

DATE: 02-14-2003
EXPIRES: 11-30-2003

Sargent & Lundy LLC's Illinois Department of Professional Regulation registration number is 184-000106

Sargent & Lundy LLC

CAD FILE:



REFERENCE DRAWINGS

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SCALE: 1"=50'
DWN. M.DOWNS DATE 02-12-03
CHK. V.PATEL DATE 02-14-03
APPV. DATE

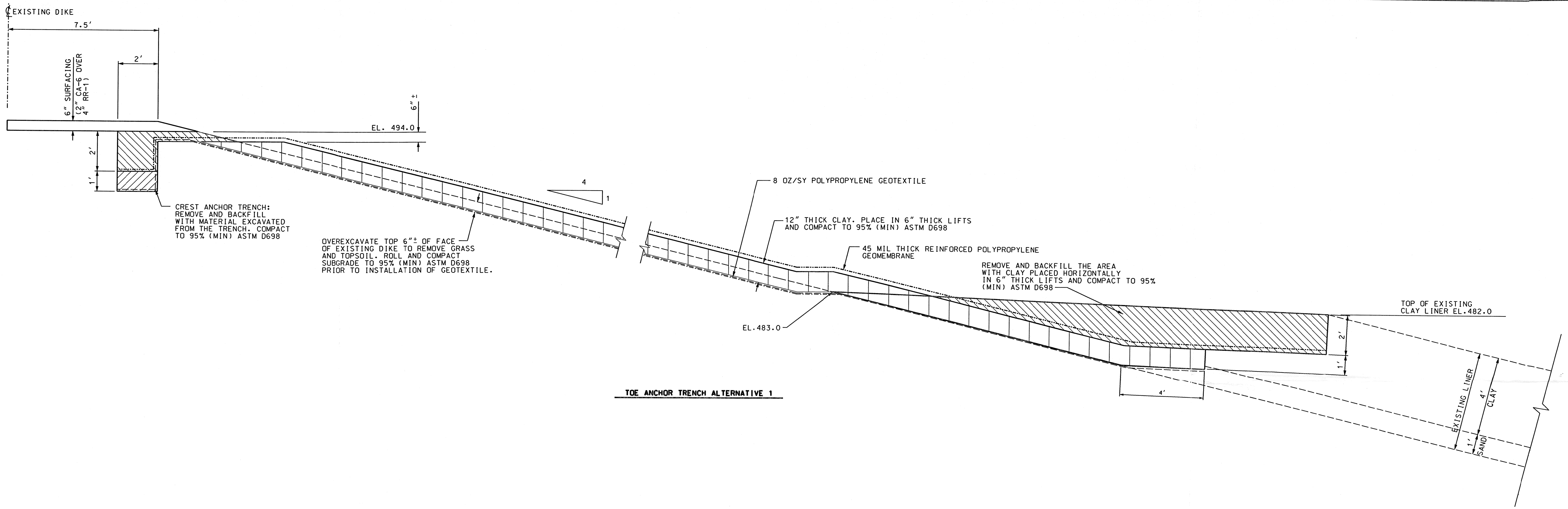
DYNEGY

PLAN OF PRIMARY ASH POND

MODIFICATION TO PRIMARY ASH POND
HENNEPIN POWER STATION

PROJECT NO.: 08820-331
CLIENT: DYNEGY MIDWEST GENERATION
DWG. NO.: C-55
REV. 0.1

E-WOR1-E157-1.DGN VAV
07-10-2001
02-13-03 ALS

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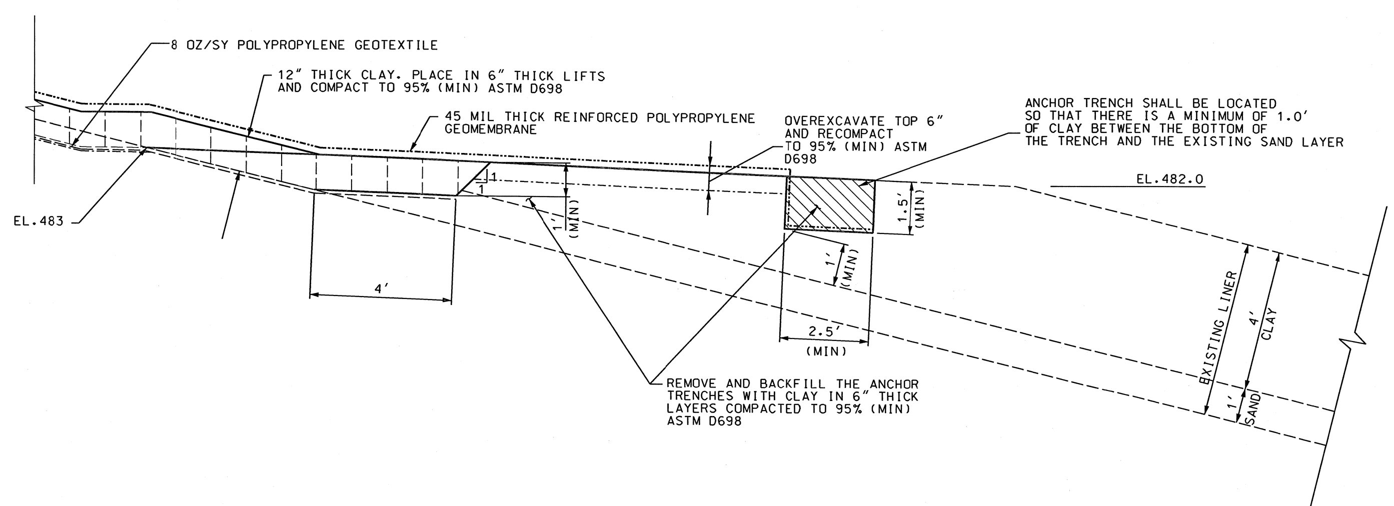


TOE ANCHOR TRENCH ALTERNATIVE 2

## SECTION A

SEE DWG C-55

GRAPHIC SCALE HOR 1/2"=1'-0" (2 0 2 4)

GRAPHIC SCALE VER 1/2"=1'-0" (2 0 2 4)

NOTES:

1. CONTRACTOR SHALL BE RESPONSIBLE FOR CHECKING EXISTING ELEVATIONS AND DIMENSIONS PRIOR TO FABRICATION OF THE GEOMEMBRANE LINER.
2. CONTRACTOR MAY USE EITHER ALTENATIVE 1 OR ALTERNATIVE 2 AS APPROVED BY THE BUYER FOR ALL TOE ANCHOR TRENCH DETAILS.
3. DIMENSIONS WERE TAKEN FROM TYPICAL SECTION ON DRAWING CH-HEN1-C6.1 DATED 12-9-93.

RONALD H. COOK 062-045802 REGISTERED PROFESSIONAL ENGINEER OF ILLINOIS

DATE: 02-14-2003
EXPIRES: 11-30-2003

Sargent & Lundy LLC's Illinois Department of Professional Regulation registration number is 184-000106

Sargent & Lundy LLC

CAD FILE:



REFERENCE DRAWINGS

| NO. | DATE | REVISION | PREP'D | REV'D | APPR'D | NO. | DATE | REVISION | PREP'D | REV'D | APPR'D |
|---|---|---|---|---|---|---|---|---|---|---|---|
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SCALE:
DWN. M.DOWNS DATE 02-12-02
CHK. V.PATEL DATE 02-14-03
APPV. DATE

DYNEGY

SECTIONS AND DETAILS - SHEET 1

MODIFICATION TO PRIMARY ASH POND
HENNEPIN POWER STATION

PROJECT NO.: 08820-331
CLIENT: DYNEGY MIDWEST GENERATION
DWG. NO.: C-56
REV. 0.1

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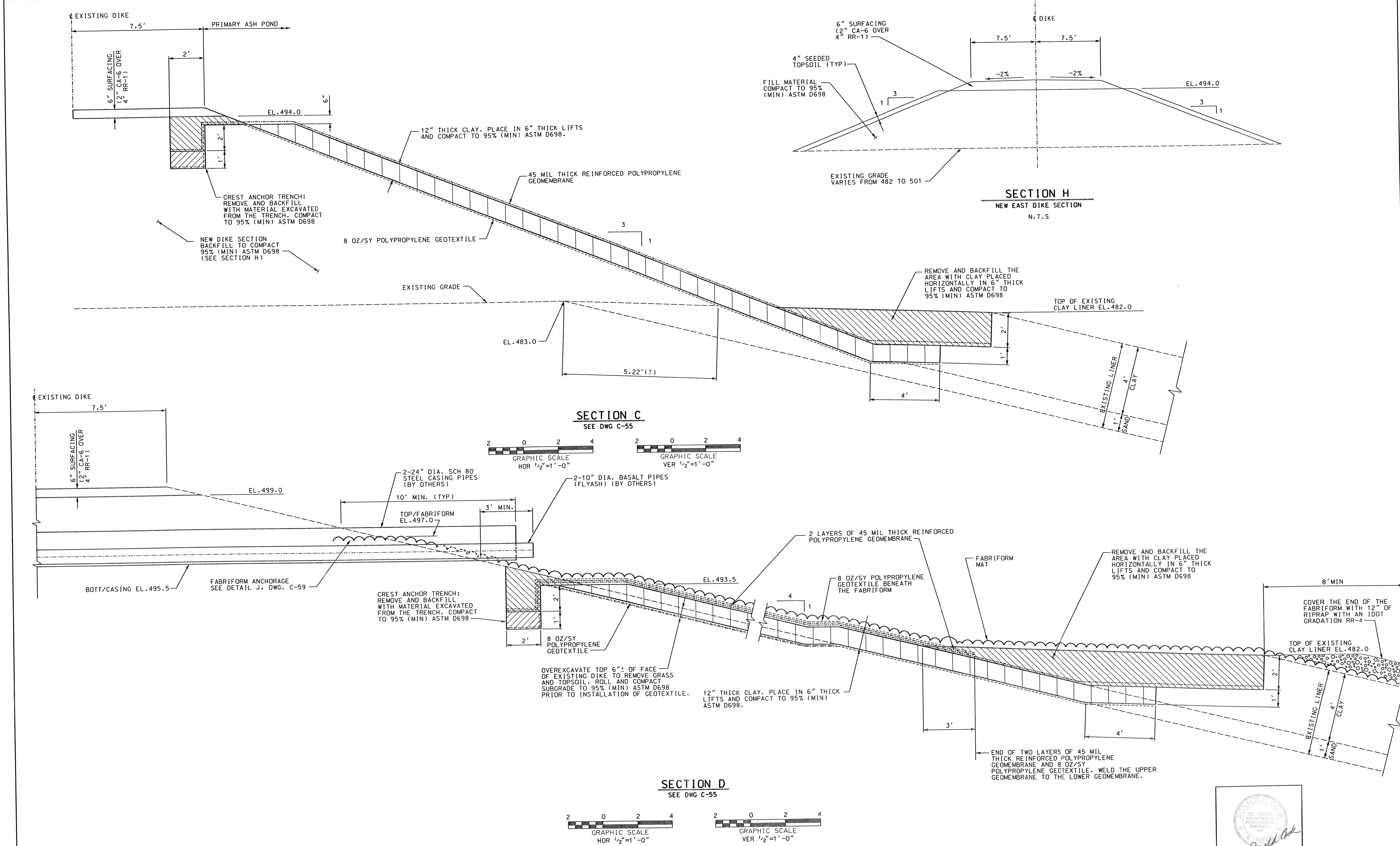
02-13-03 ALS




DATE: 02-14-2003
EXPIRES: 11-30-2003
Sargent & Lundy LLC's Illinois Department of Professional Regulation registration number is 184-000106

Sargent & Lundy LLC

CAD FILE:

DYNEGY CONFIDENTIAL
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REFERENCE DRAWINGS

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SCALE: 1/2"=1'-0"
DWN. M.DOWNS DATE 02-12-02
CHK. V.PATEL DATE 02-14-03
APPV. DATE

DYNEGY

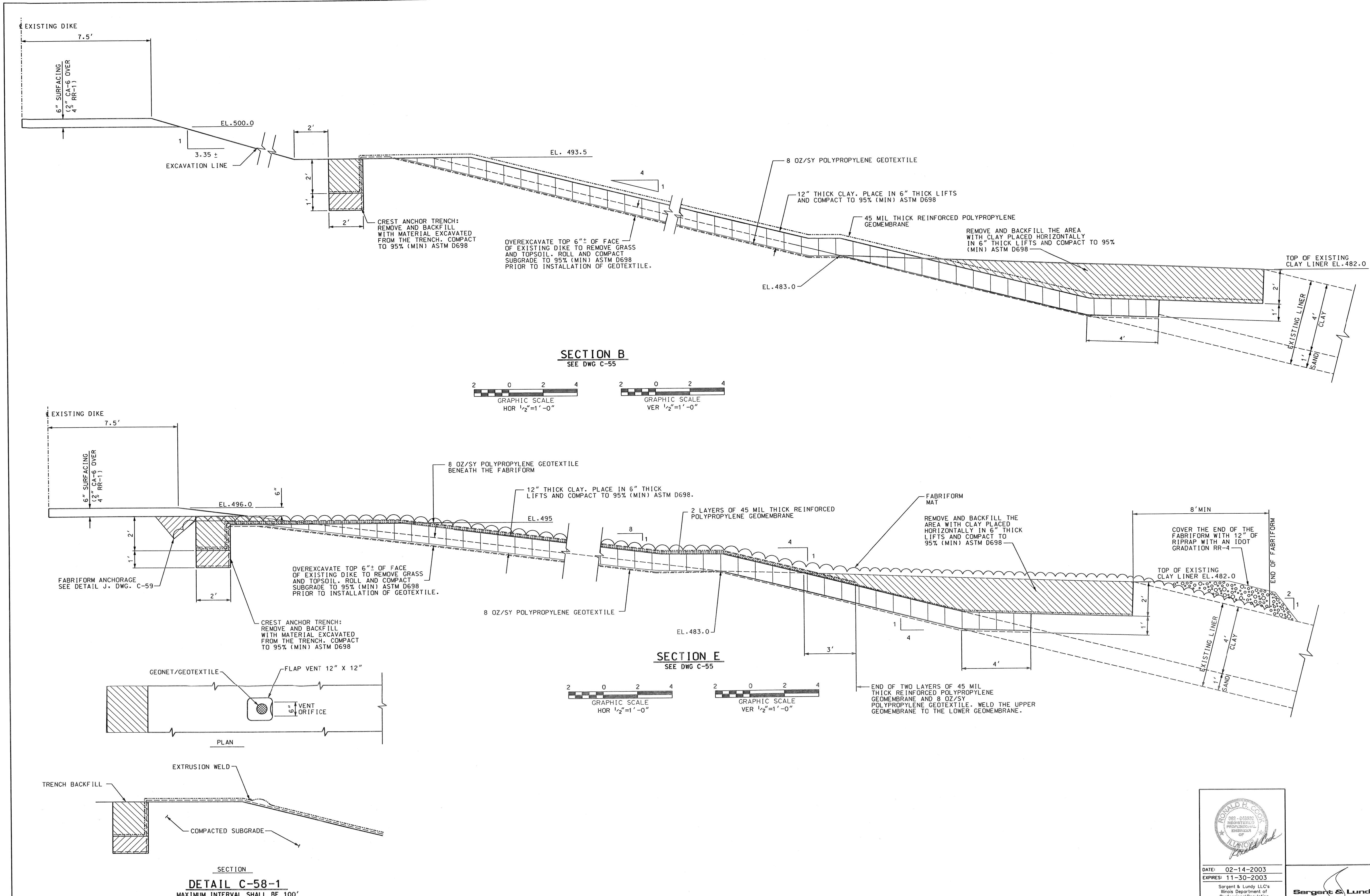
SECTIONS AND DETAILS - SHEET 2

MODIFICATION TO PRIMARY ASH POND
HENNEPIN POWER STATION

PROJECT NO.: 08820-331
CLIENT: DYNEGY MIDWEST GENERATION
DWG. NO.: C-57
REV. 0.1

E-WDR1-E157-1.DGN VAV 07-10-2001

02-13-03 ALS




RONALD H. COOK 062-040835 REGISTERED PROFESSIONAL ENGINEER OF ILLINOIS

DATE: 02-14-2003
EXPIRES: 11-30-2003

Sargent & Lundy LLC's Illinois Department of Professional Regulation registration number is 184-000106

Sargent & Lundy LLC

CAD FILE:

DYNEGY CONFIDENTIAL
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REFERENCE DRAWINGS

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SCALE: 1/2"=1'-0"
DWN. M.DOWNS DATE 02-14-03
CHK. V.PATEL DATE 02-14-03
APPV. DATE

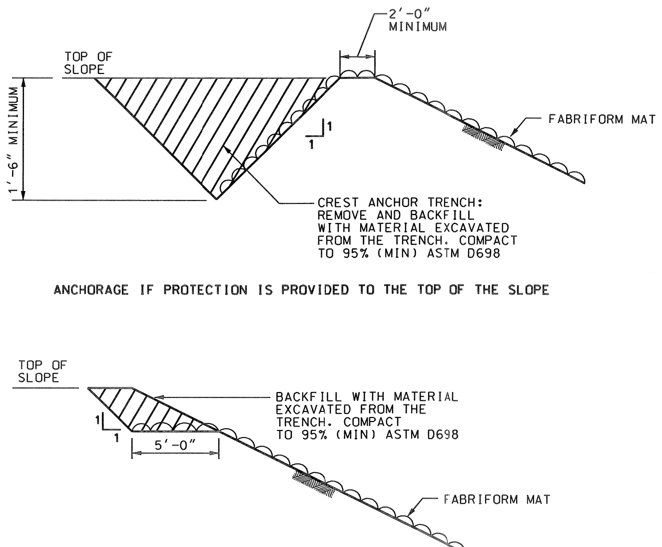
DYNEGY

SECTIONS AND DETAILS - SHEET 3

MODIFICATION TO PRIMARY ASH POND
HENNEPIN POWER STATION

PROJECT NO.: 08820-331
CLIENT: DYNEGY MIDWEST GENERATION
DWG. NO.: C-58
REV. 0.1

02-12-03 ALS
E-WOR1-E157-1.DGN VAV
07-10-2001




DETAIL J
ANCHORAGE FOR FABRIFORM MAT
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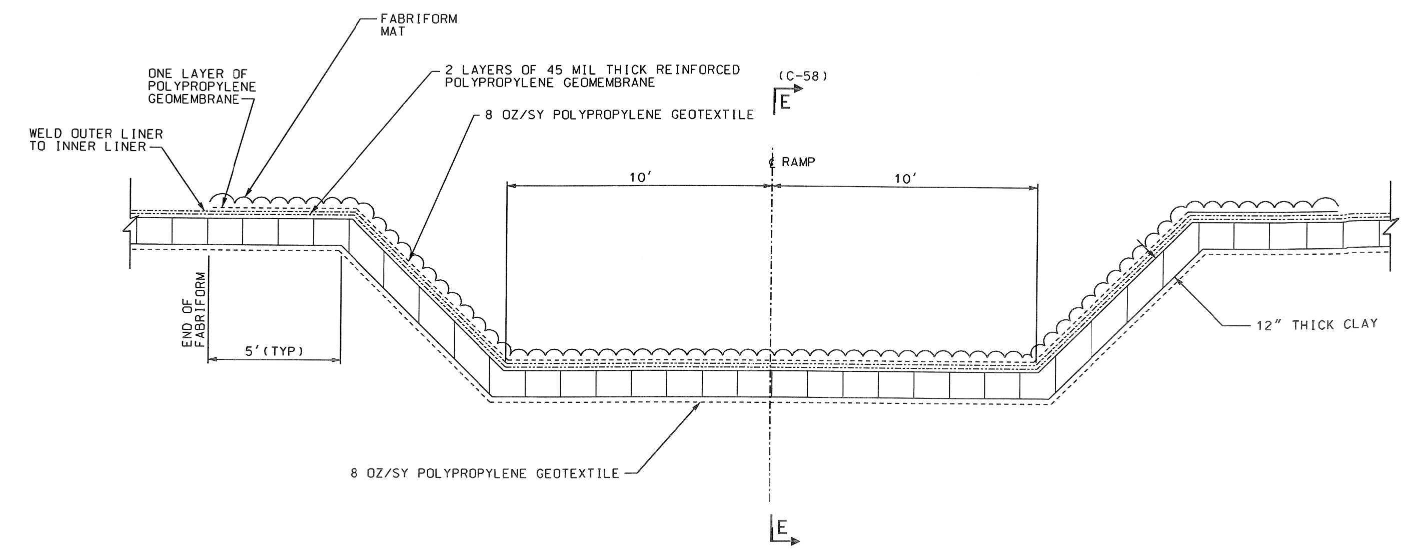


SECTION G
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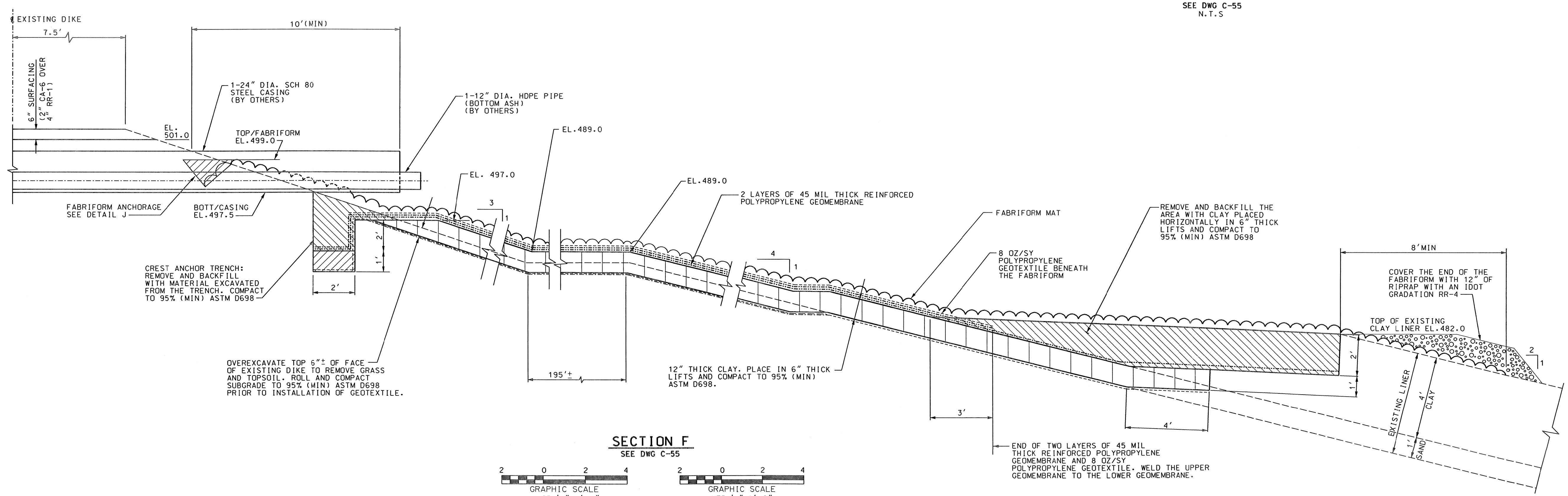


SECTION F
SEE DWG C-55

DATE: 02-14-2003
EXPIRES: 11-30-2003
Sargent & Lundy LLC's Illinois Department of Professional Regulation registration number is 184-000106

Sargent & Lundy LLC

CAD FILE:



REFERENCE DRAWINGS

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SCALE: 1/4"=1'-0"
DWN. M.DOWNS DATE 02-12-02
CHK. V.PATEL DATE 02-14-03
APPV. DATE

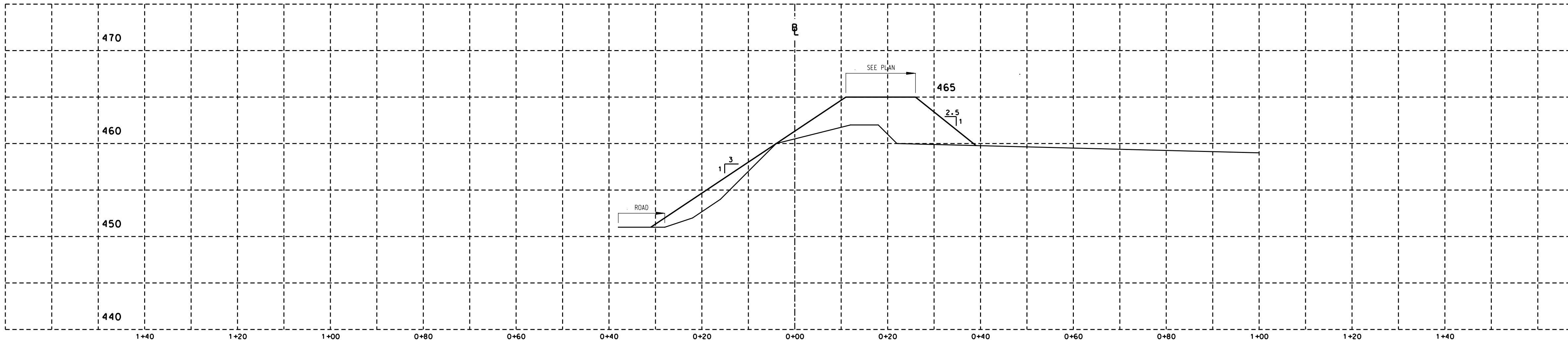
DYNEGY

SECTIONS AND DETAILS - SHEET 4

MODIFICATION TO PRIMARY ASH POND
HENNEPIN POWER STATION

PROJECT NO.: 08820-331
CLIENT: DYNEGY MIDWEST GENERATION
DWG. NO.: C-59
REV. 0.1

E-WDR1-E157-1.DGN VAV
07-10-2001
02-13-03 ALS

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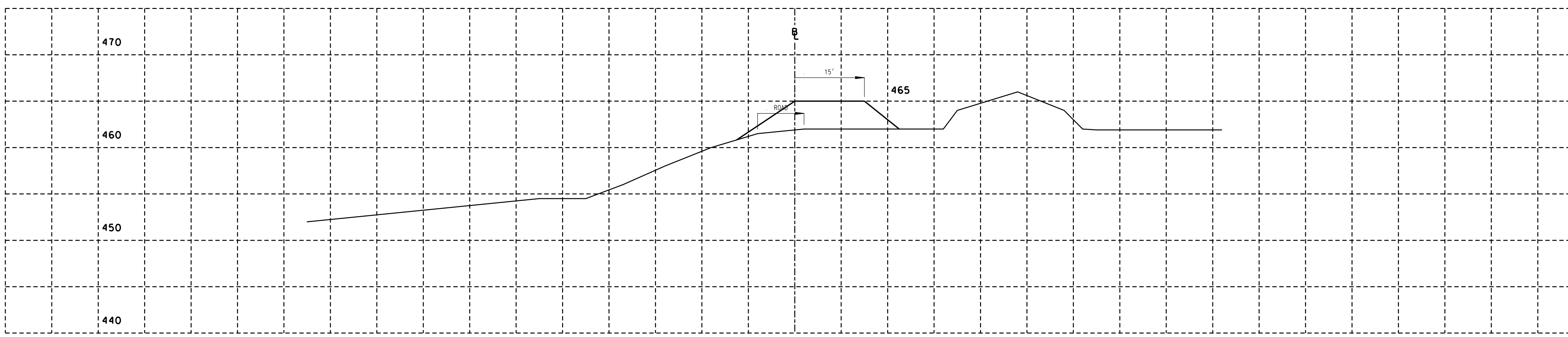


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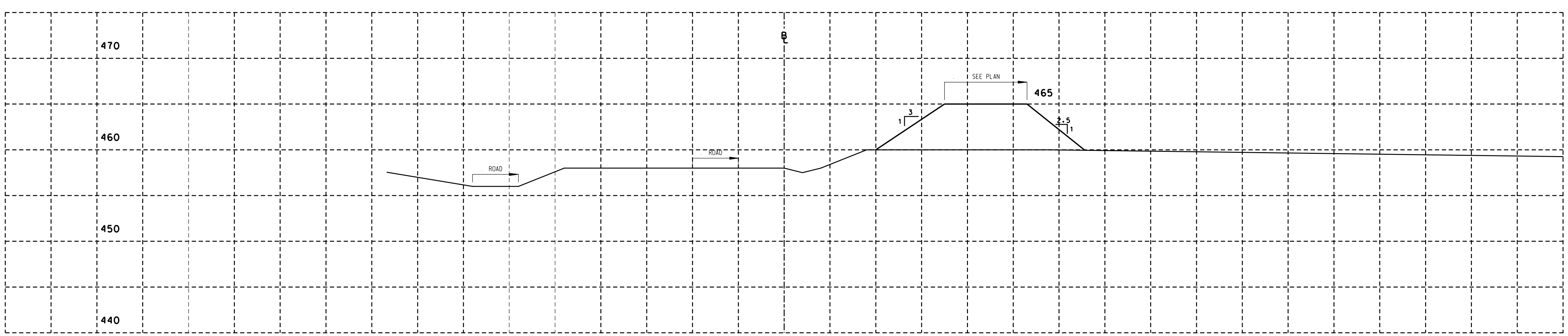


STATION 1+00

LEDGEND

- REFERENCE BASE LINE SHOWN ON PLAN
- OLD BERM
- NEW BERM
- WATER LINE
- * ESTIMATED ELEVATION

E-HEN1-B452

| NO | DATE | DRF | DESCRIPTION | E | C | A | NO | DATE | DRF | DESCRIPTION | E | C | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | | |

NOTES

REFERENCES

REVISION STATUS
□ -CONSTRUCTION
○ -RECORD
0

ILLINOIS POWER COMPANY
DECATUR

CROSS SECTIONS OF
ASH POND BERM EXTENSION
STA 1+00, 5+00 & 9+50
HENNEPIN POWER STATION

| | | |
|---|---|---|
| DR GRH | CAD EM | DATE 12-30-87 |
| OK | CKD | SCALE 1"=10'H,1"=5'V |
| APP | PLOTTED 11-4-97 | E-HEN1-B452 |
| APP | | |

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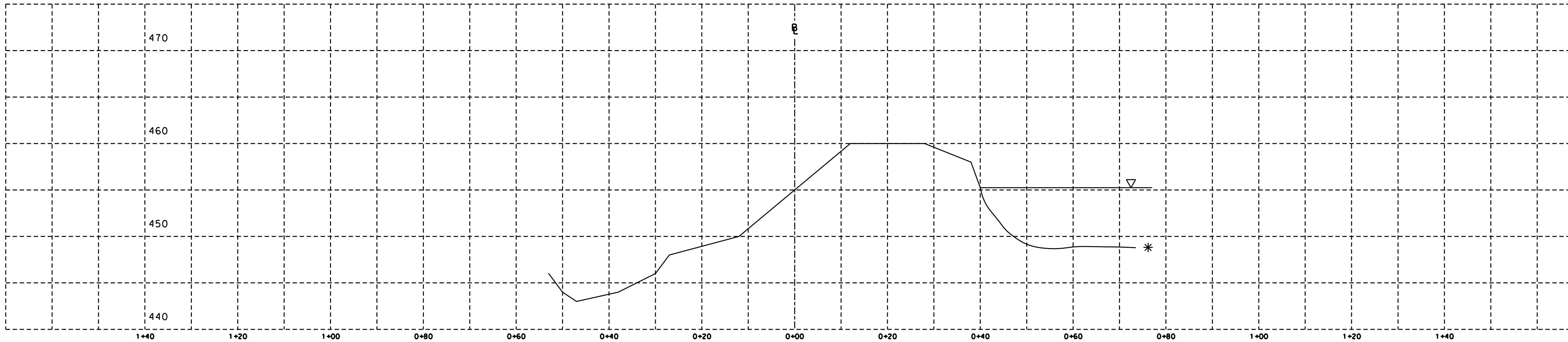


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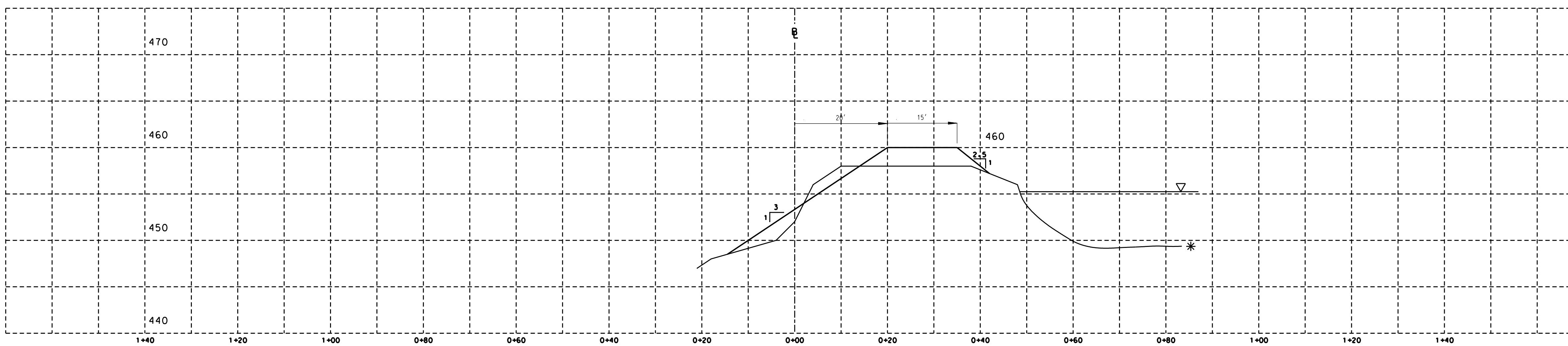


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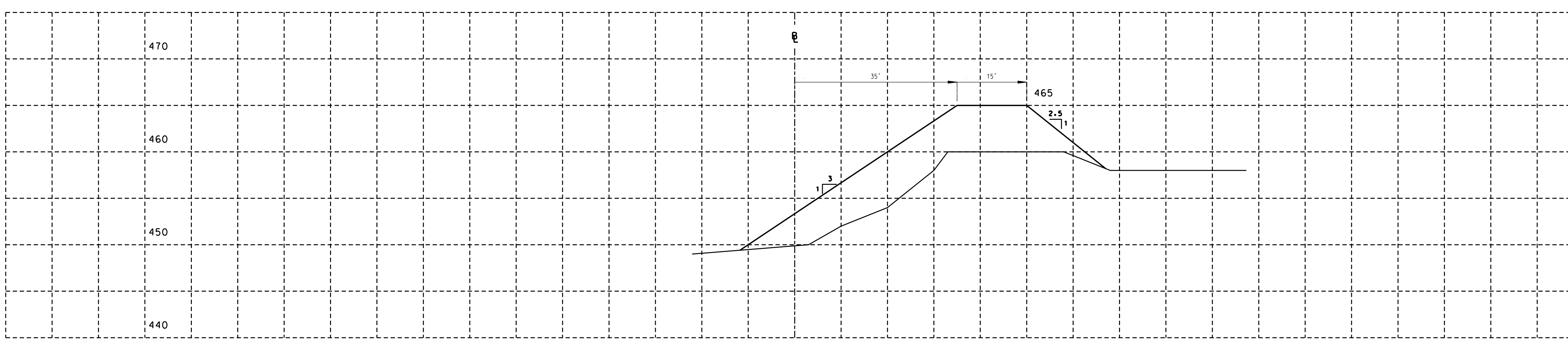


STATION 14+25

LEDGEND

℄ REFERENCE BASE LINE SHOWN ON PLAN

OLD BERM

NEW BERM

▽ WATER LINE

✳ ESTIMATED ELEVATION

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | | |

NOTES

REFERENCES

REVISION STATUS
□ -CONSTRUCTION
○ -RECORD
0

ILLINOIS POWER COMPANY
DECATUR

CROSS SECTIONS OF
ASH POND BERM EXTENSION
STA 14+25, 20+80 & 26+00
HENNEPIN POWER STATION

| | | |
|---|---|---|
| DR GRH | CAD EM | DATE 12-30-87 |
| OK | CKD | SCALE 1"=10'H, 1"=5'V |
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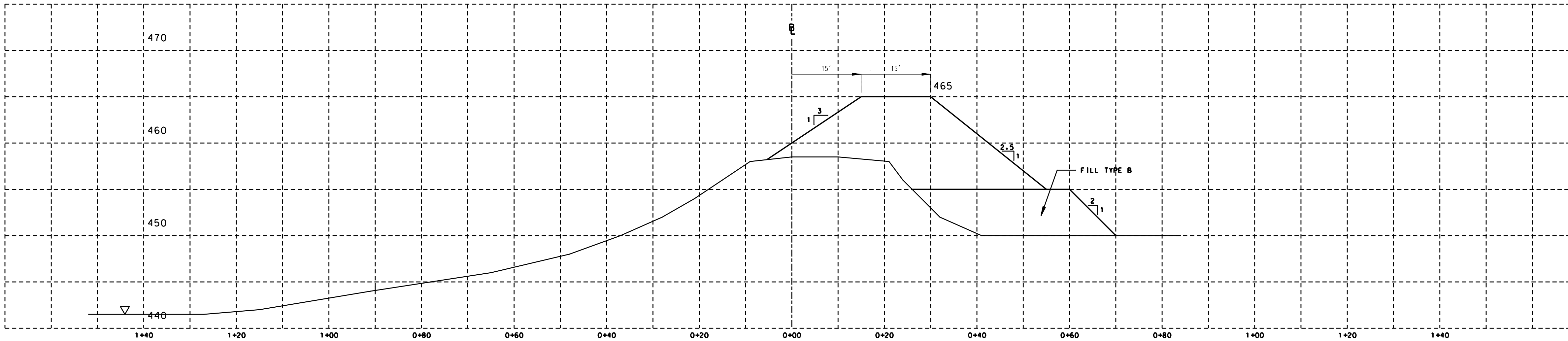
| APP | | |

E-HEN1-B453

COMPUTER DWG. - DO NOT REVISE MANUALLY

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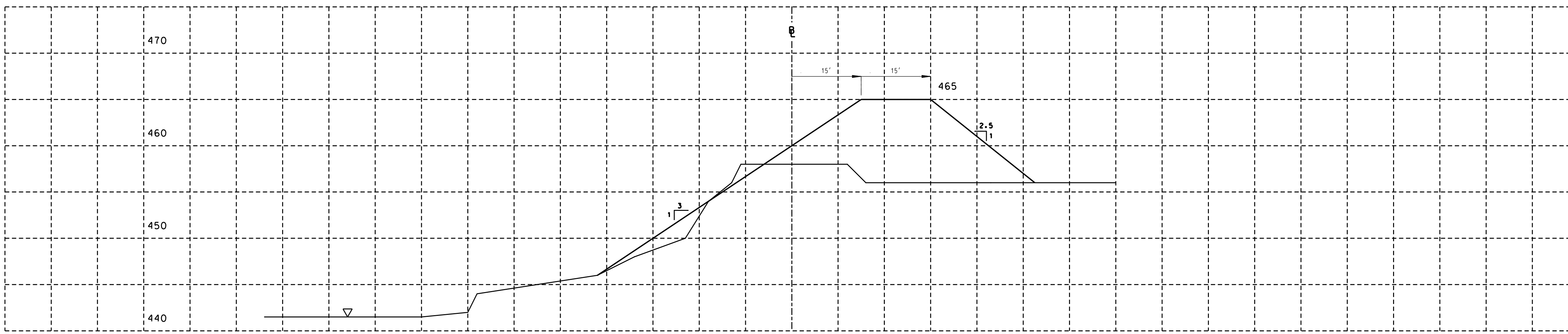
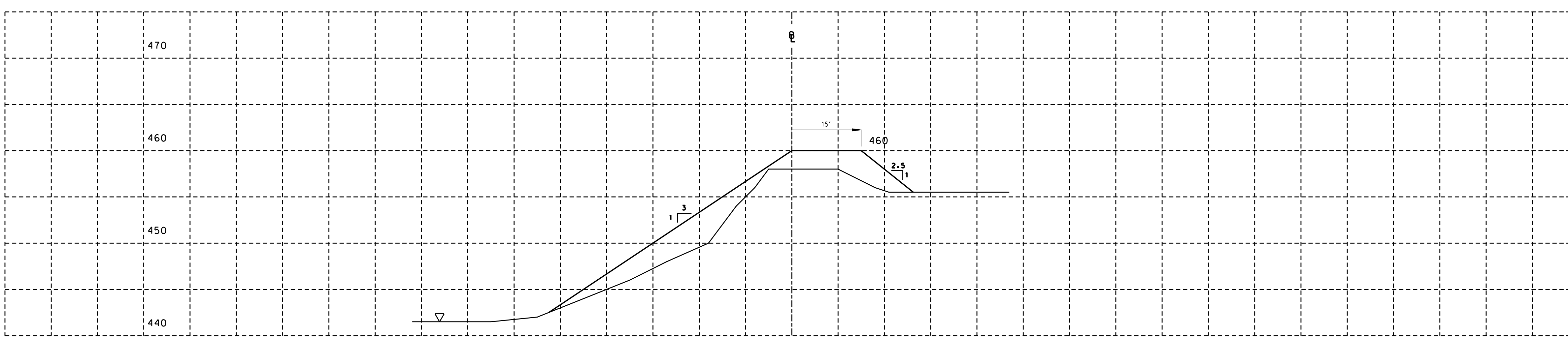



STATION 35+00




STATION 30+00

LEDGEND

℄ REFERENCE BASE LINE SHOWN ON PLAN

OLD BERM

NEW BERM

▽ WATER LINE

✳ ESTIMATED ELEVATION

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | | |

NOTES

REFERENCES

REVISION STATUS
□ -CONSTRUCTION
○ -RECORD
0

ILLINOIS POWER COMPANY
DECATUR

CROSS SECTIONS OF
ASH POND BERM EXTENSION
STA 30+00, 35+00 & 39+00
HENNEPIN POWER STATION

| | | |
|---|---|---|
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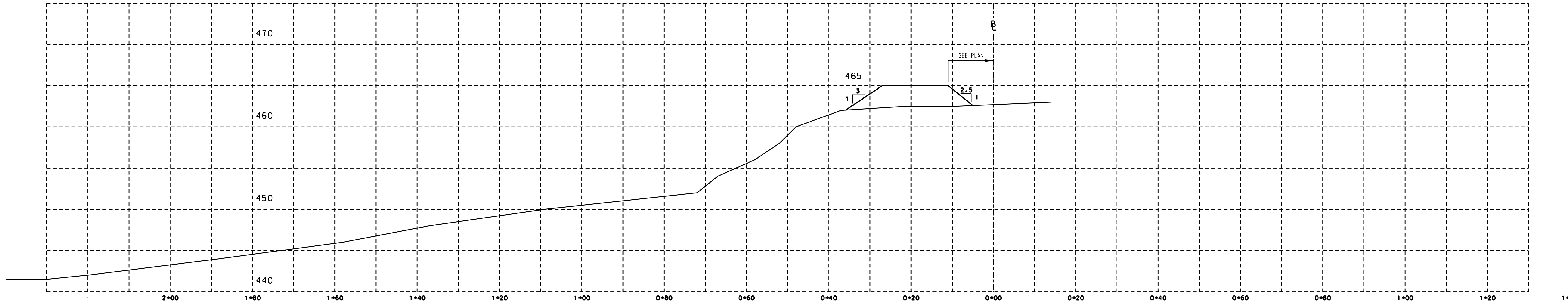
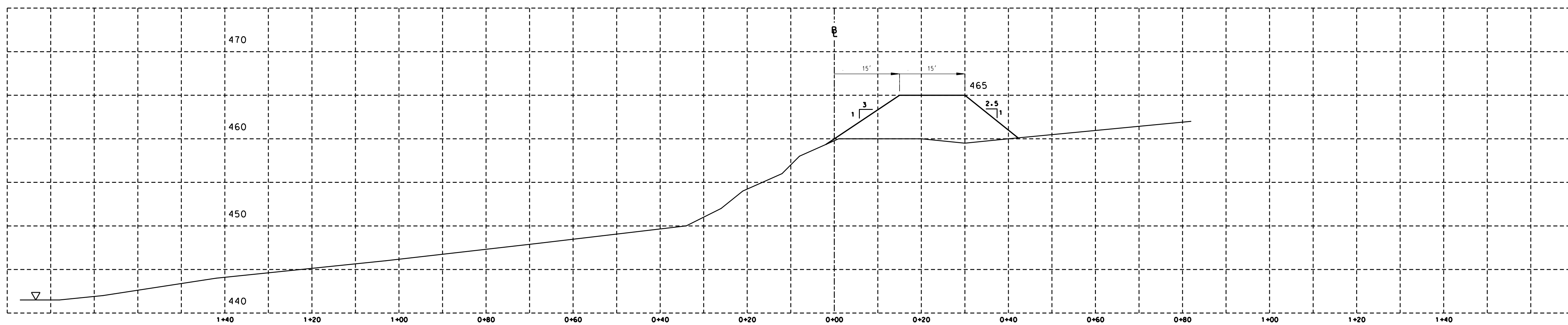
| APP | | |

E-HEN1-B454

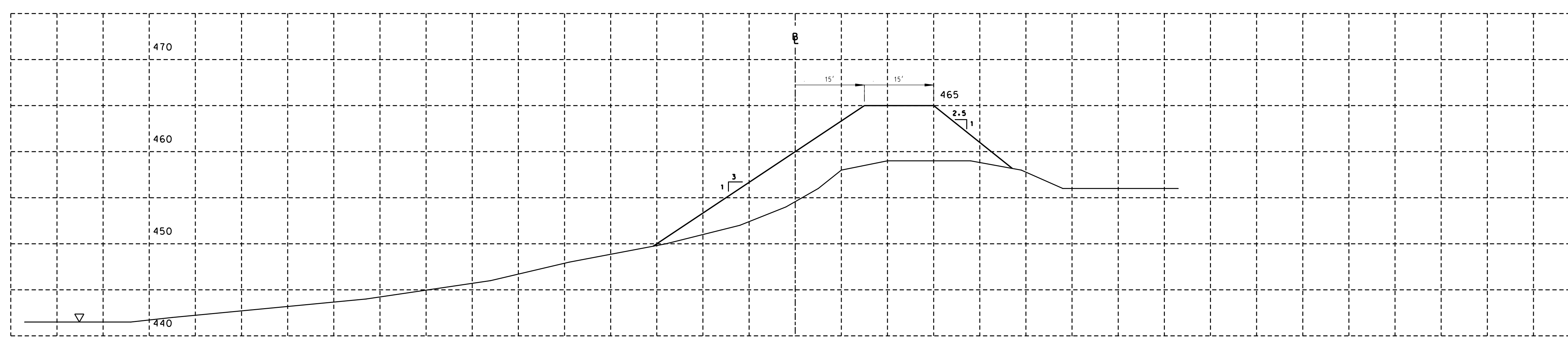
COMPUTER DWG. - DO NOT REVISE MANUALLY




STATION 44+90




STATION 42+00




STATION 40+00

LEDGEND

- ℄ REFERENCE BASE LINE SHOWN ON PLAN
- OLD BERM
- NEW BERM
- ▽ WATER LINE
- ✳ ESTIMATED ELEVATION

E-HEN1-B455

| NO | DATE | DRF | DESCRIPTION | E | C | A | NO | DATE | DRF | DESCRIPTION | E | C | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | | |

NOTES

REFERENCES

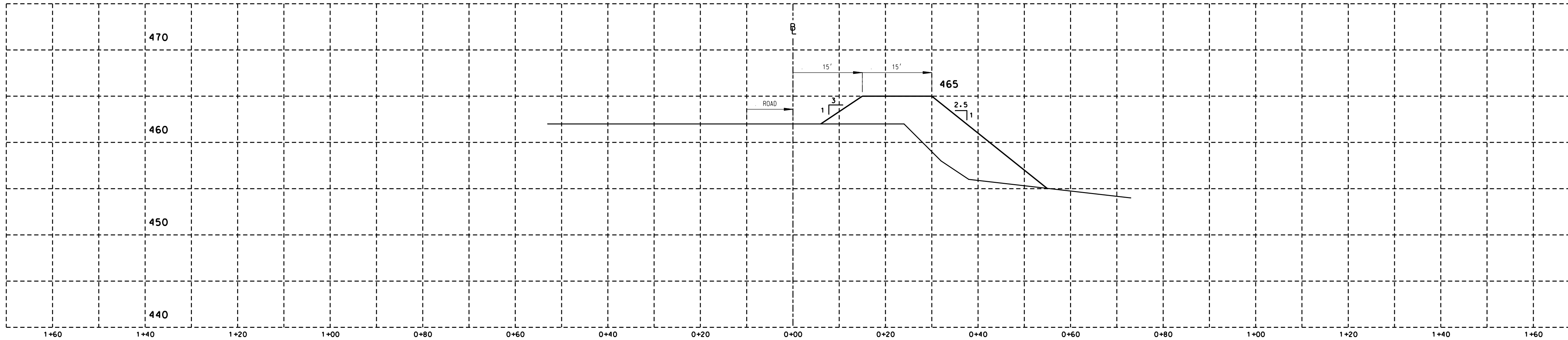
REVISION STATUS
□ -CONSTRUCTION
○ -RECORD
0

ILLINOIS POWER COMPANY
DECATUR

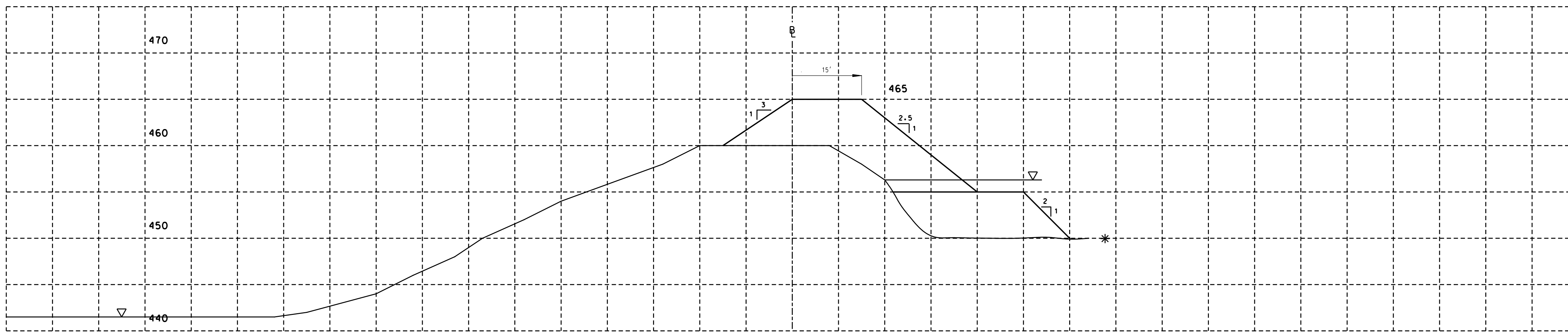
CROSS SECTIONS OF
ASH POND BERM EXTENSION
STA 40+00, 42+00 & 44+90
HENNEPIN POWER STATION

| | | |
|---|---|---|
| DR GRH | CAD EM | DATE 12-30-87 |
| OK | CKD | SCALE 1"=10'H, 1"=5'V |
| APP | PLOTTED 11-4-97 | E-HEN1-B455 |
| APP | | |

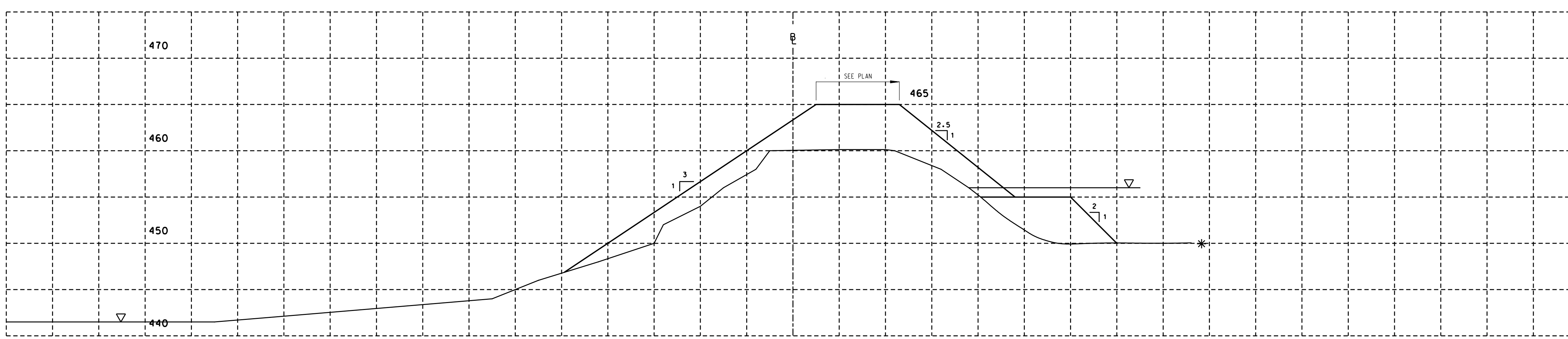
COMPUTER DWG. - DO NOT REVISE MANUALLY




STATION 56+00




STATION 51+00




STATION 47+00

LEDGEND

- ℄ REFERENCE BASE LINE SHOWN ON PLAN
- OLD BERM
- NEW BERM
- ▽ WATER LINE
- * ESTIMATED ELEVATION

E-HEN1-B456

| NO | DATE | DRF | DESCRIPTION | E | C | A | NO | DATE | DRF | DESCRIPTION | E | C | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | | |

NOTES

REFERENCES

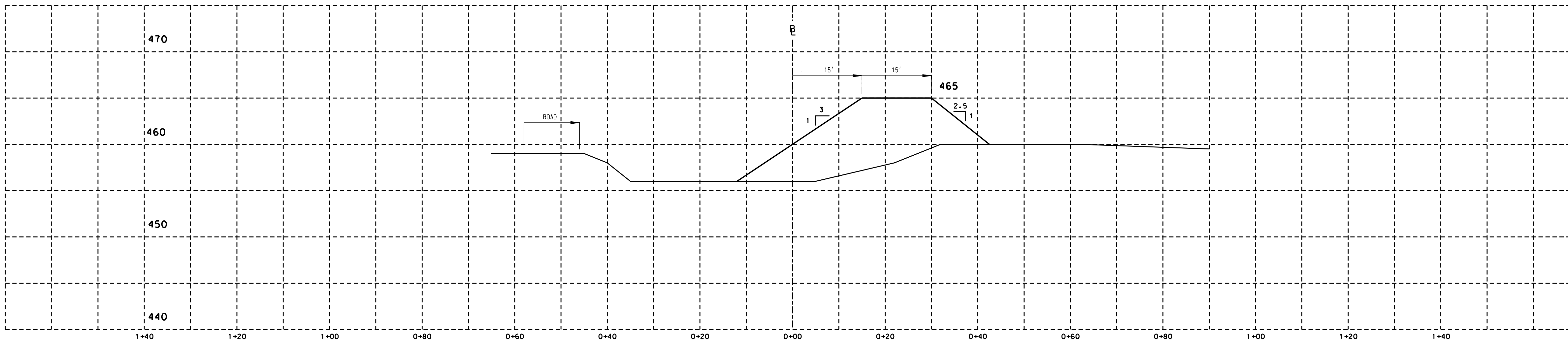
REVISION STATUS
□ -CONSTRUCTION
○ -RECORD
0

ILLINOIS POWER COMPANY
DECATUR

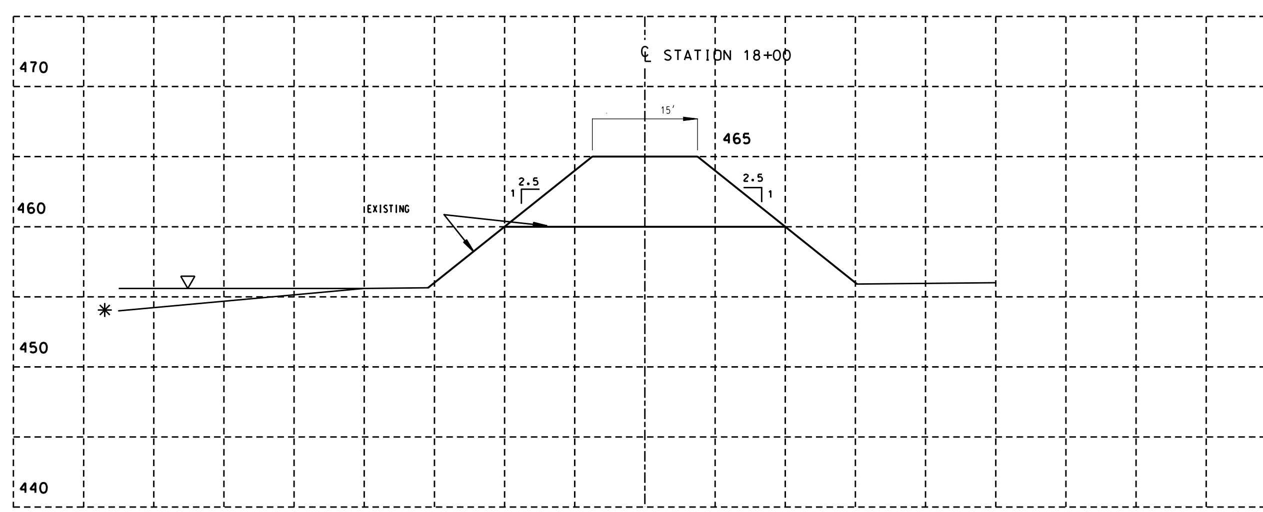
CROSS SECTIONS OF
ASH POND BERM EXTENSION
STA 47+00, 51+00 & 56+00
HENNEPIN POWER STATION

| | | |
|---|---|---|
| DR GRH | CAD EM | DATE 12-30-87 |
| OK | CKD | SCALE 1"=10'H, 1"=5'V |
| APP | PLOTTED 11-4-97 | E-HEN1-B456 |
| APP | | |

COMPUTER DWG. - DO NOT REVISE MANUALLY

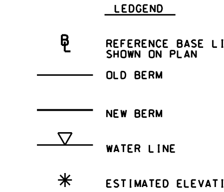



STATION 61+50




SECTION A-A

LEDGEND




| NO | DATE | DRF | DESCRIPTION | E | C | A | NO | DATE | DRF | DESCRIPTION | E | C | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | | |

NOTES

REFERENCES

REVISION STATUS
□ -CONSTRUCTION
○ -RECORD

0

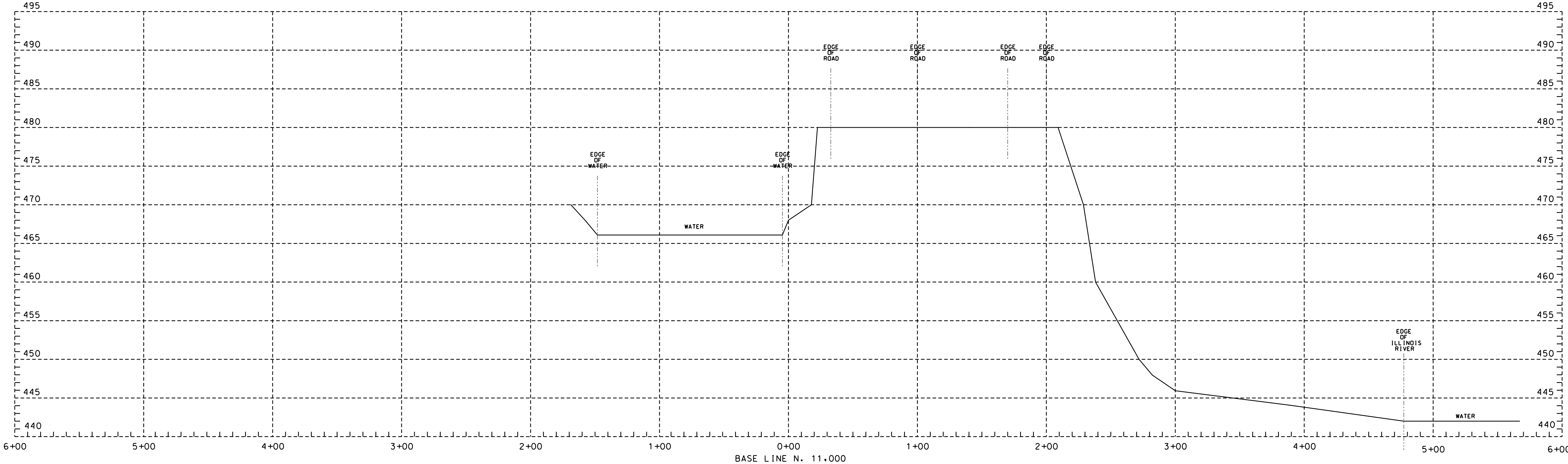
ILLINOIS POWER COMPANY
DECATUR

CROSS SECTIONS OF
ASH POND BERM EXTENSION
STA 61+50
HENNEPIN POWER STATION

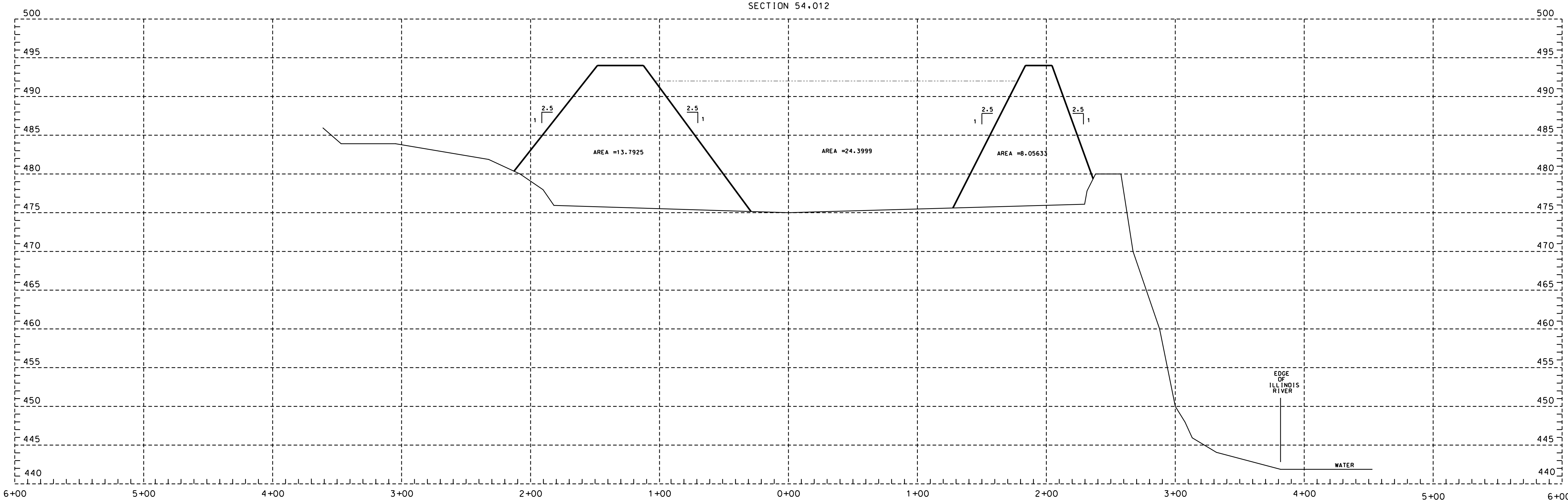
| | | |
|---|---|---|
| DR GRH | CAD EM | DATE 12-30-87 |
| OK | CKD | SCALE 1"=10'H.1"=5'V |
| APP | PLOTTED 11-4-97 | E-HEN1-B457 |
| APP | | |

E-HEN1-B457

COMPUTER DWG. - DO NOT REVISE MANUALLY




SECTION 54.012




SECTION E. 53.812

| NO | DATE | DRF | DESCRIPTION | E | C | A | NO | DATE | DRF | DESCRIPTION | E | C | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | | |

NOTES

1. DATA COLLECTED FROM TOPO ON DWG. CE-HEN1-B-450 DATED NOV. 4, 1987, REV. 0
2. COORDINATES WERE SUPPLIED BY G. DECKARD FIELD INFORMATION TIEING TO J.L. FISHER'S PANELS.

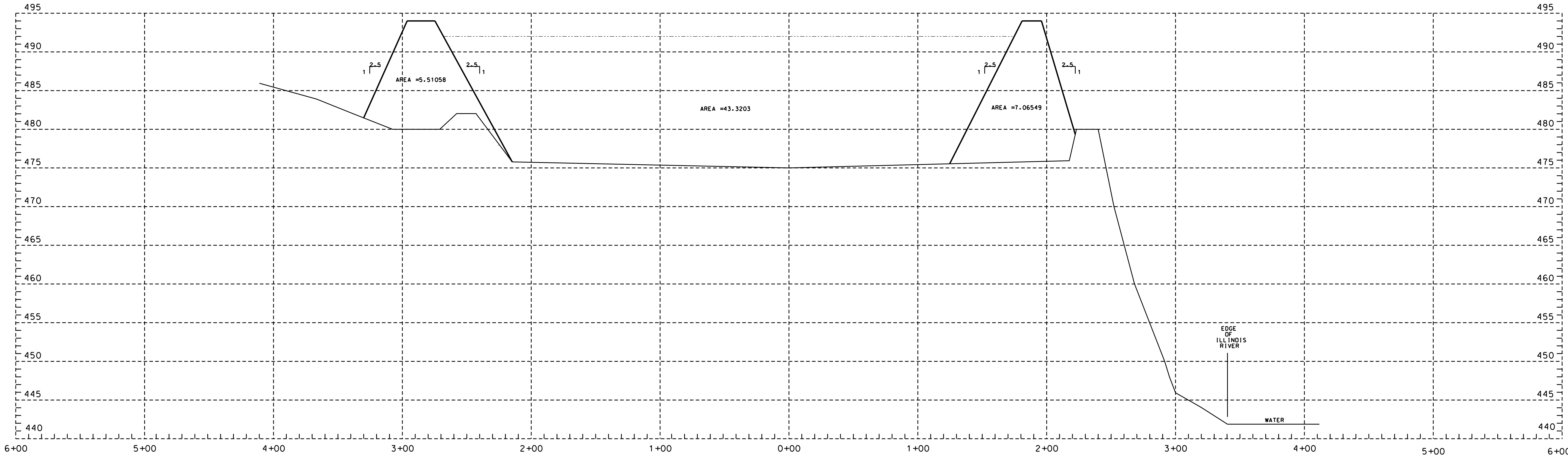
REFERENCES

REVISION STATUS
□ -CONSTRUCTION
○ -RECORD
0

ILLINOIS POWER COMPANY
DECATUR

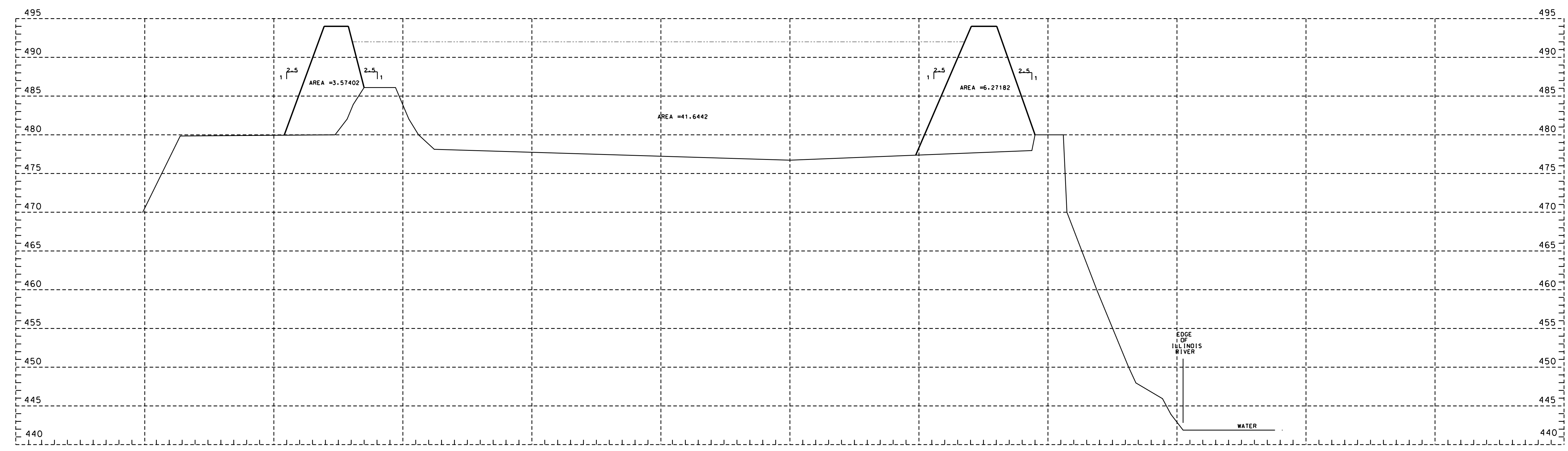
**CROSS SECTIONS**
**EAST ASH POND EXTENSION**
**HENNEPIN POWER STATION**

| | | |
|---|---|---|
| DR WJM | CAD WJM | DATE 1-11-89 |
| OK | CKD | SCALE 1"=5' V. 1"=30' H. |
| APP | PLOTTED 03-08-90 | CE-HEN1-B458-1 |
| APP | | |




BASE LINE N. 11,000

SECTION E. 53,692




BASE LINE N. 11,000

SECTION E. 53,492

| NO | DATE | DRF | DESCRIPTION | E | C | A | NO | DATE | DRF | DESCRIPTION | E | C | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | | |

NOTES

1. DATA COLLECTED FROM TOPO ON DWG. CE-HEN1-B-450 DATED NOV. 4, 1987, REV. 0
2. COORDINATES WERE SUPPLIED BY G. DECKARD FIELD INFORMATION TIEING TO J.L. FISHER'S PANELS.

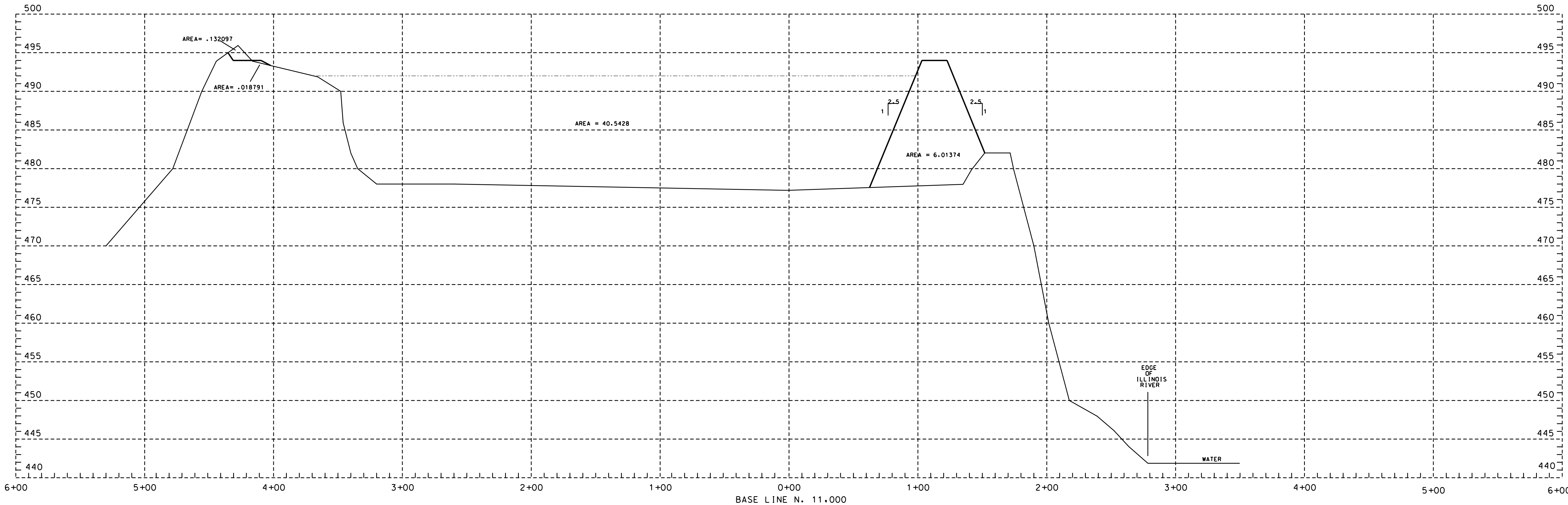
REFERENCES

REVISION STATUS
□ -CONSTRUCTION
○ -RECORD
0

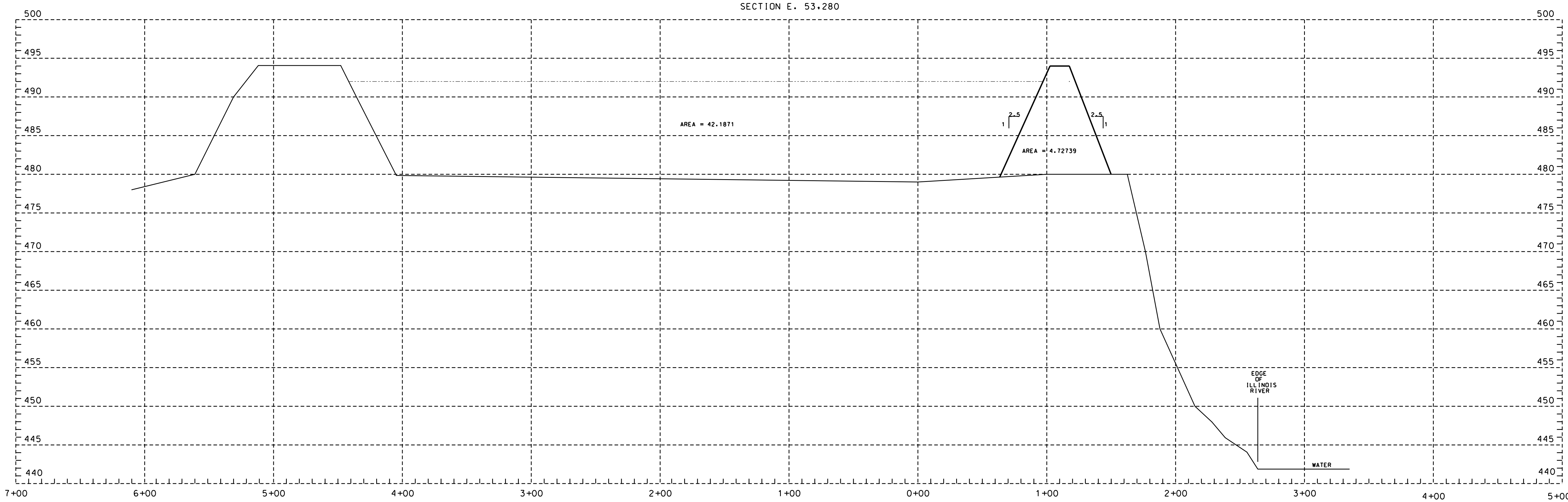
ILLINOIS POWER COMPANY
DECATUR

CROSS SECTIONS
EAST ASH POND EXTENSION
HENNEPIN POWER STATION

| | | |
|---|---|---|
| DR WJM | CAD WJM | DATE 1-12-89 |
| OK | CKD | SCALE 1"=5' V. 1"=30' H. |
| APP | PLOTTED 03-08-90 | CE-HEN1-B458-2 |
| APP | | |




SECTION E. 53,280




SECTION E. 53,080

| NO | DATE | DRF | DESCRIPTION | E | C | A | NO | DATE | DRF | DESCRIPTION | E | C | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | | |

NOTES

1. DATA COLLECTED FROM TOPO ON DWG. CE-HEN1-B-450 DATED NOV. 4, 1987, REV. 0
2. COORDINATES WERE SUPPLIED BY G. DECKARD FIELD INFORMATION TIEING TO J.L. FISHER'S PANELS.

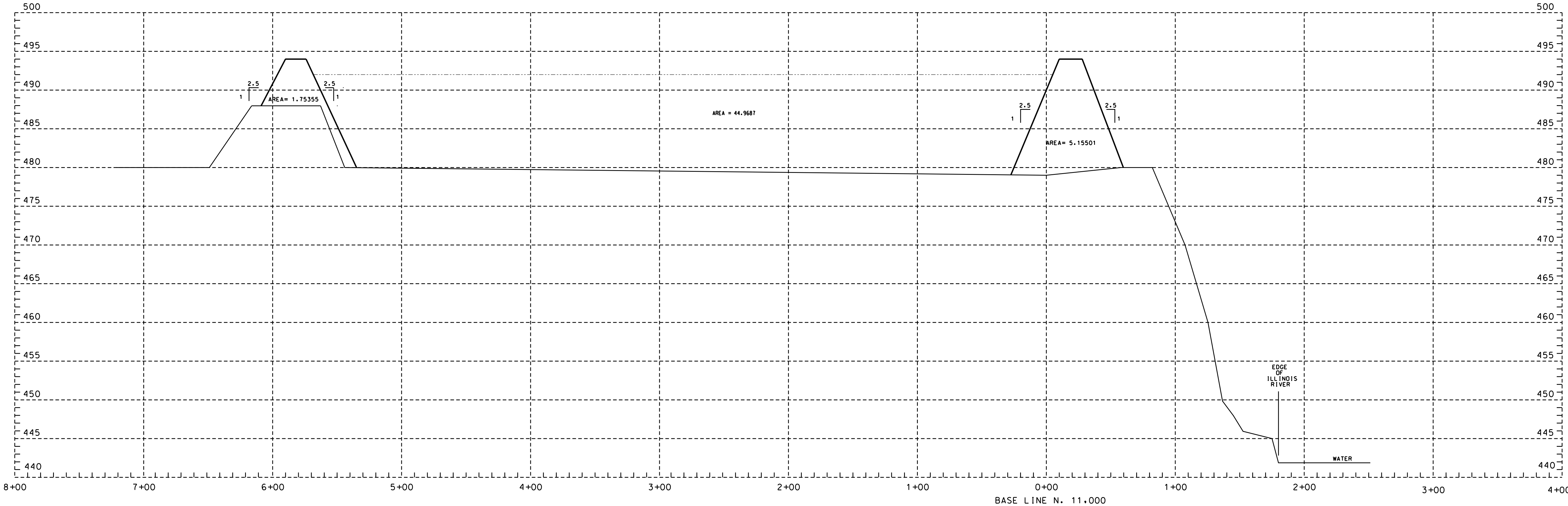
REFERENCES

REVISION STATUS
□ -CONSTRUCTION
○ -RECORD
0

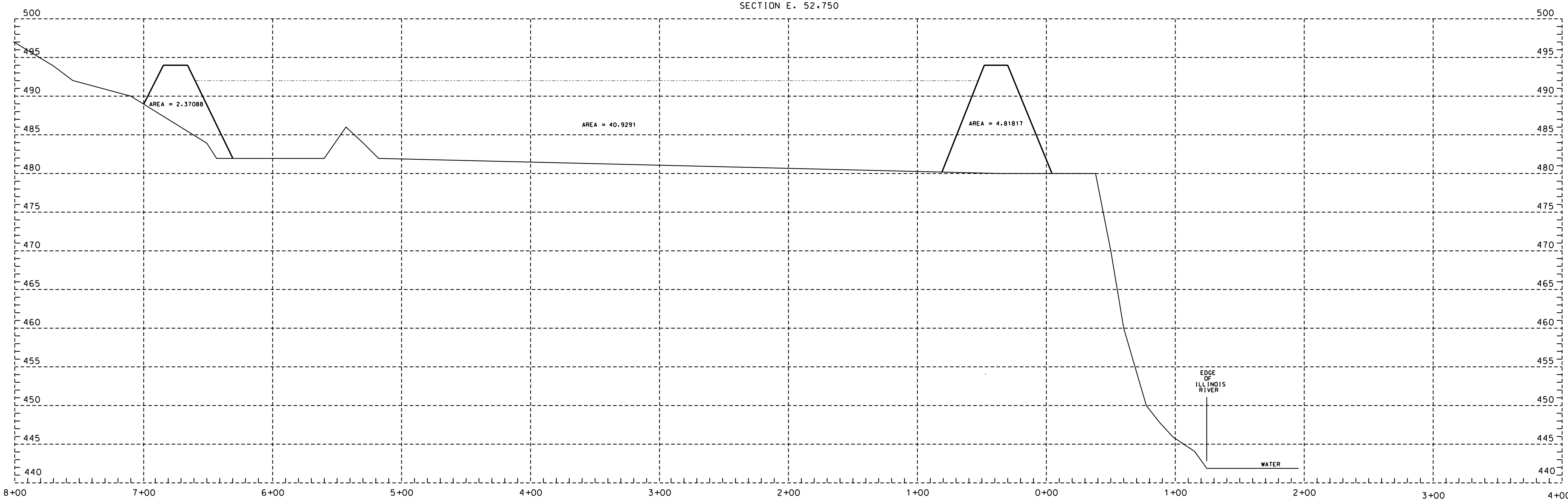
ILLINOIS POWER COMPANY
DECATUR

**CROSS SECTIONS**
**EAST ASH POND EXTENSION**
**HENNEPIN POWER STATION**

| | | |
|---|---|---|
| DR WJM | CAD WJM | DATE 1-12-89 |
| OK | CKD | SCALE 1"=5' V. 1"=30' H. |
| APP | PLOTTED 03-08-90 | CE-HEN1-B458-3 |
| APP | | |




SECTION E. 52.750




SECTION E. 52.448

| NO | DATE | DRF | DESCRIPTION | E | C | A | NO | DATE | DRF | DESCRIPTION | E | C | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | | |

NOTES

1. DATA COLLECTED FROM TOPO ON DWG. CE-HEN1-B-450 DATED NOV. 4, 1987, REV. 0
2. COORDINATES WERE SUPPLIED BY G. DECKARD FIELD INFORMATION TIEING TO J.L. FISHER'S PANELS.

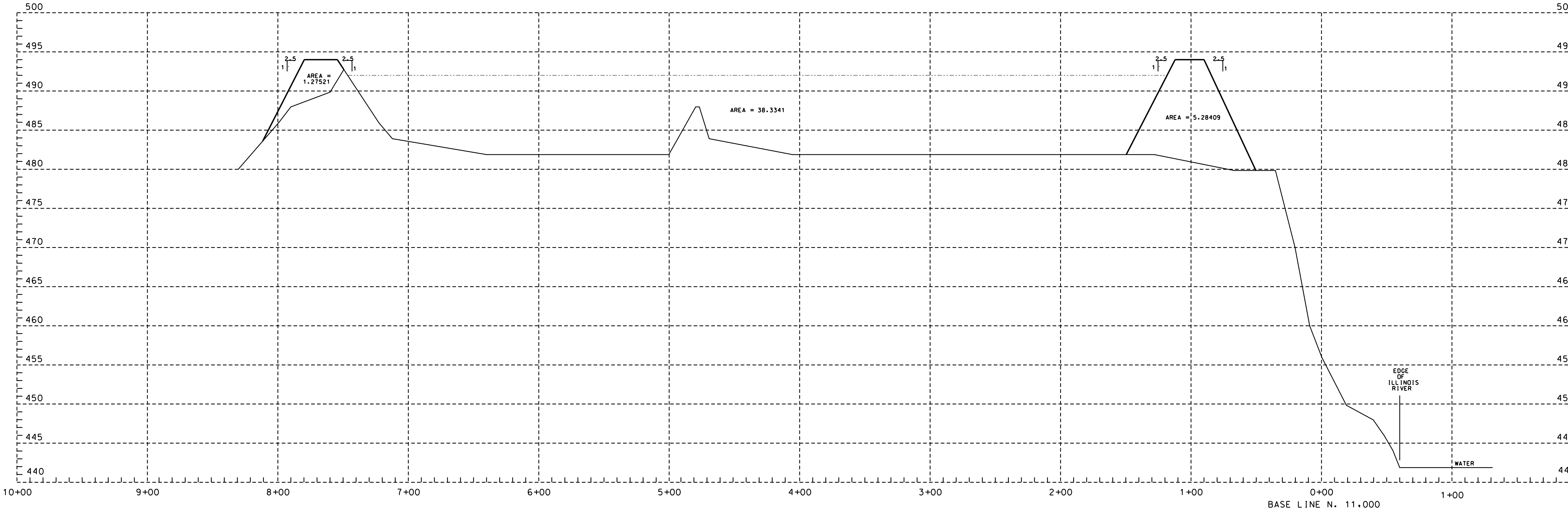
REFERENCES

REVISION STATUS
□ -CONSTRUCTION
○ -RECORD
0

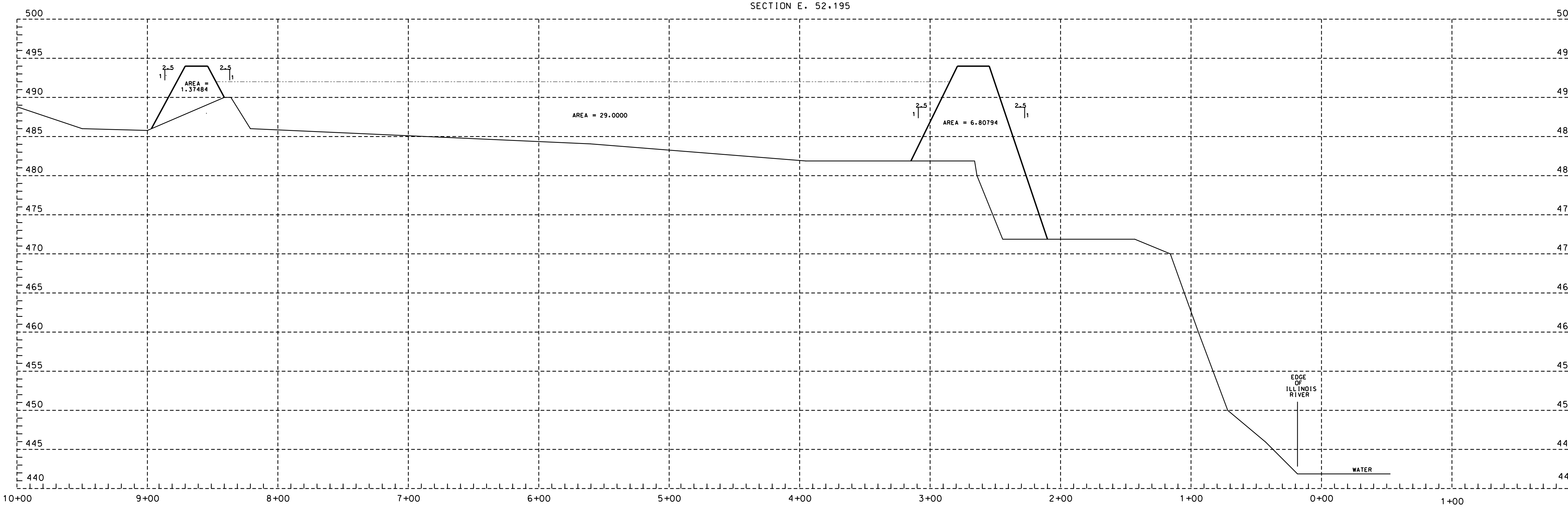
ILLINOIS POWER COMPANY
DECATUR

CROSS SECTIONS
EAST ASH POND EXTENSION
HENNEPIN POWER STATION

| | | |
|---|---|---|
| DR WJM | CAD WJM | DATE 1-12-89 |
| OK | CKD | SCALE 1"=5' V. 1"=30' H. |
| APP | PLOTTED 03-08-90 | CE-HEN1-B458-4 |
| APP | | |




SECTION E. 52.195




SECTION E. 51.920

| NO | DATE | DRF | DESCRIPTION | E | C | A | NO | DATE | DRF | DESCRIPTION | E | C | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | | |

NOTES

1. DATA COLLECTED FROM TOPO ON DWG. CE-HEN1-B-450 DATED NOV. 4, 1987, REV. 0
2. COORDINATES WERE SUPPLIED BY G. DECKARD FIELD INFORMATION TIEING TO J.L. FISHER'S PANELS.

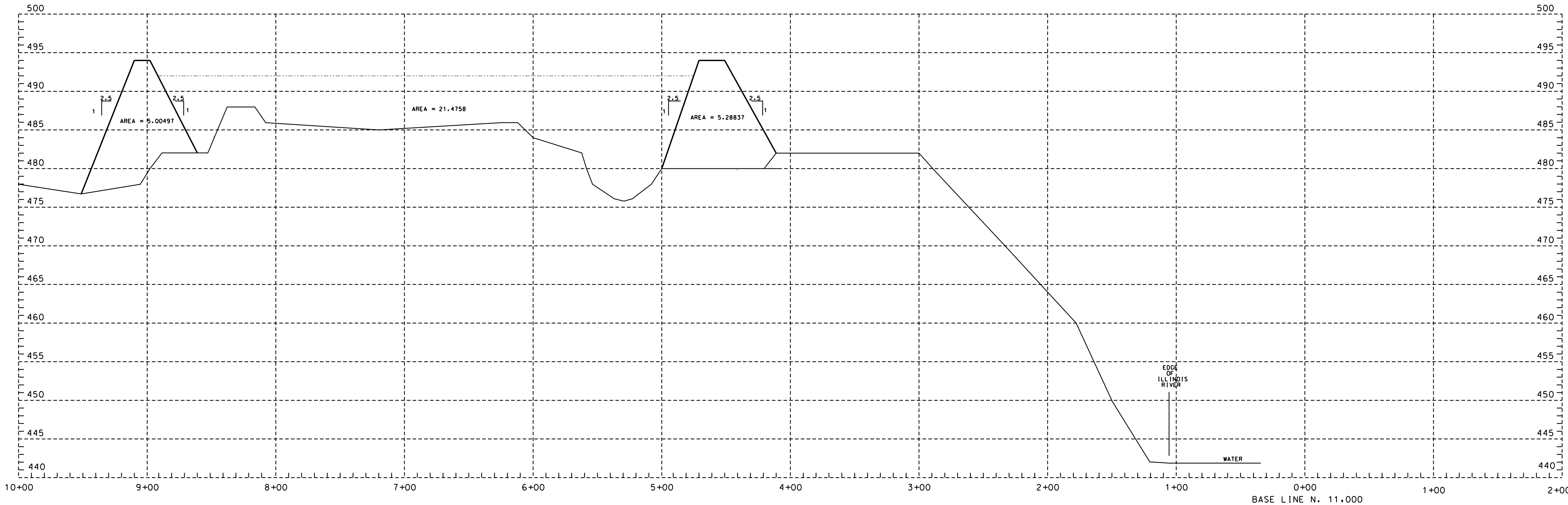
REFERENCES

REVISION STATUS
□ -CONSTRUCTION
○ -RECORD
0

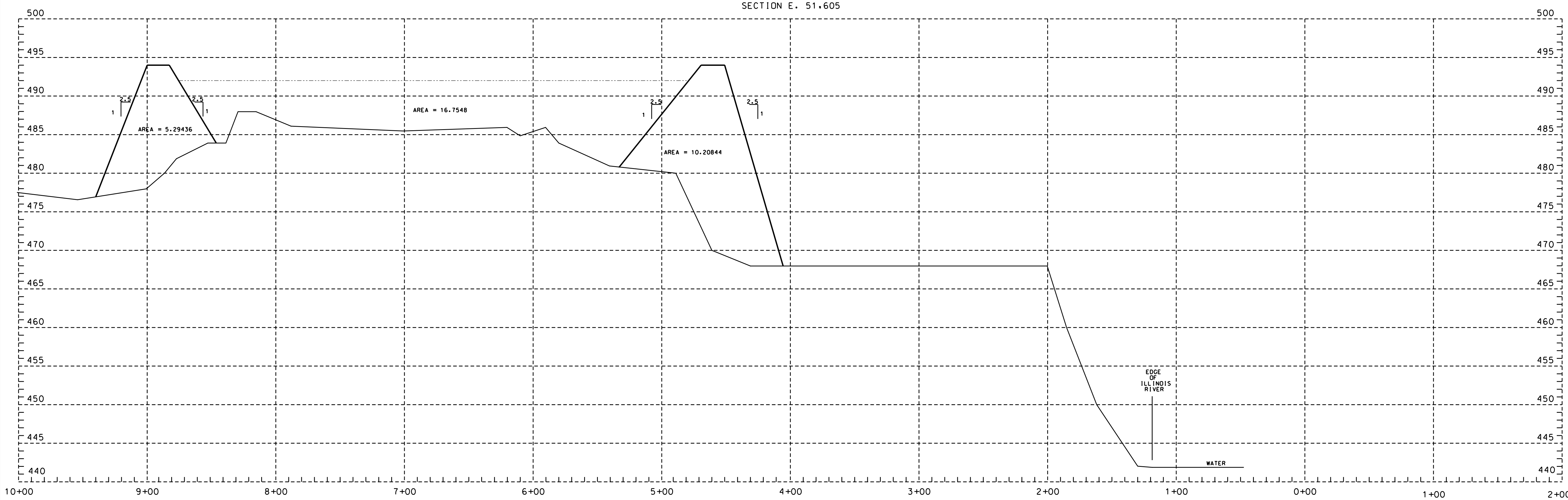
ILLINOIS POWER COMPANY
DECATUR

CROSS SECTIONS
EAST ASH POND EXTENSION
HENNEPIN POWER STATION

| | | |
|---|---|---|
| DR WJM | CAD WJM | DATE 1-12-89 |
| OK | CKD | SCALE 1"=5' V. 1"=30' H. |
| APP | PLOTTED 03-08-90 | CE-HEN1-B458-5 |
| APP | | |




SECTION E. 51,605




SECTION E. 51,552

| NO | DATE | DRF | DESCRIPTION | E | C | A | NO | DATE | DRF | DESCRIPTION | E | C | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | | |

NOTES

1. DATA COLLECTED FROM TOPO ON DWG. CE-HEN1-B-450 DATED NOV. 4, 1987, REV. 0
2. COORDINATES WERE SUPPLIED BY G. DECKARD FIELD INFORMATION TIEING TO J.L. FISHER'S PANELS.

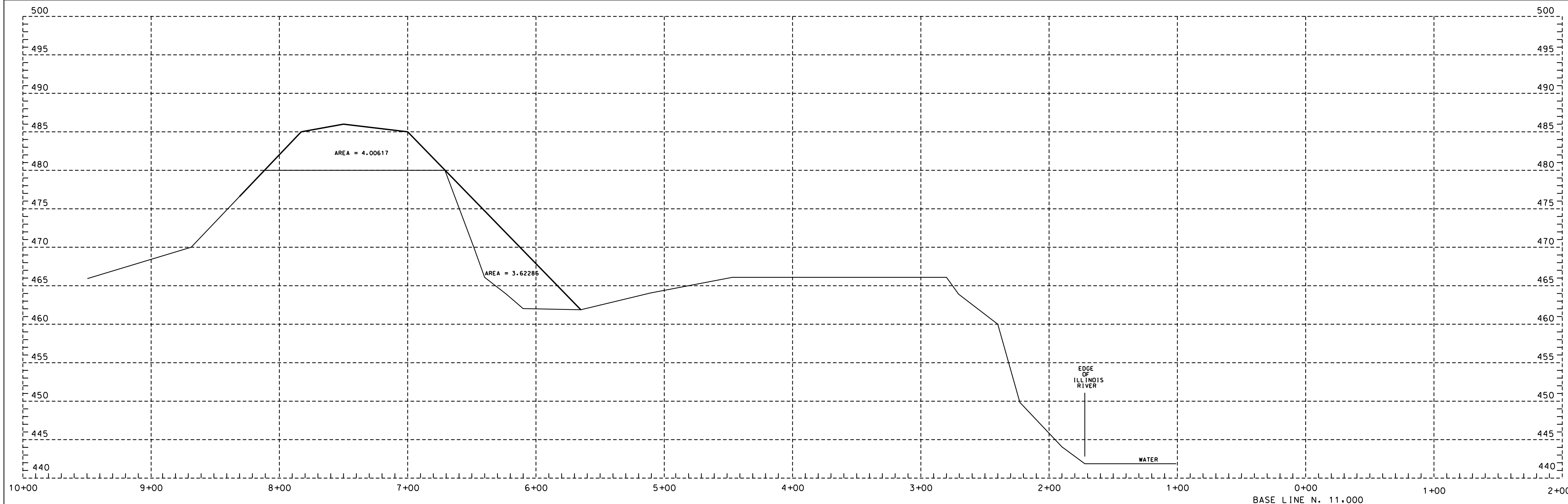
REFERENCES

REVISION STATUS
□ -CONSTRUCTION
○ -RECORD
0

ILLINOIS POWER COMPANY
DECATUR

**CROSS SECTIONS**
**EAST ASH POND EXTENSION**
**HENNEPIN POWER STATION**

| | | |
|---|---|---|
| DR WJM | CAD WJM | DATE 1-12-89 |
| OK | CKD | SCALE 1"=5' V. 1"=30' H. |
| APP | PLOTTED 03-08-90 | CE-HEN1-B458-6 |
| APP | | |




SECTION E. 51,285

| NO | DATE | DRF | DESCRIPTION | E | C | A | NO | DATE | DRF | DESCRIPTION | E | C | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | | |

NOTES

1. DATA COLLECTED FROM TOPO ON DWG. CE-HEN1-B-450 DATED NOV. 4, 1987, REV. 0
2. COORDINATES WERE SUPPLIED BY G. DECKARD FIELD INFORMATION TIEING TO J.L. FISHER'S PANELS.

REFERENCES

REVISION STATUS
□ -CONSTRUCTION
○ -RECORD
0

ILLINOIS POWER COMPANY
DECATUR

CROSS SECTIONS
EAST ASH POND EXTENSION
HENNEPIN POWER STATION

| | | |
|---|---|---|
| DR WJM | CAD WJM | DATE 1-12-89 |
| OK | CKD | SCALE 1"=5' V. 1"=30' H. |
| APP | PLOTTED 03-08-90 | CE-HEN1-B458-7 |
| APP | | |

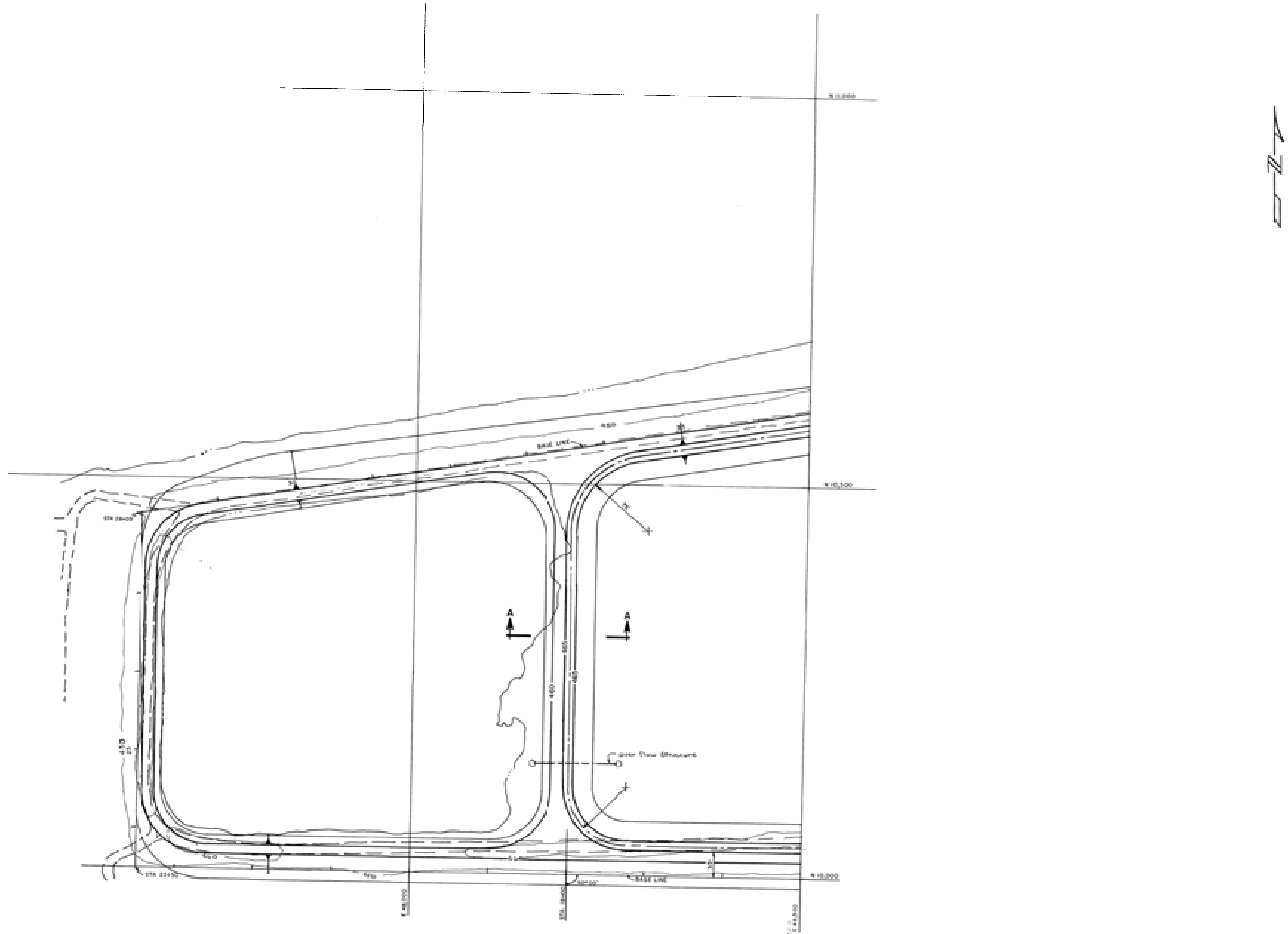

ILLINOIS POWER COMPANY

DECATUR

PLAN-UNIT #1 ASH POND EXTENSION
HENNEPIN POWER STATION
SHEET # 1

E-HEN1-B460-1

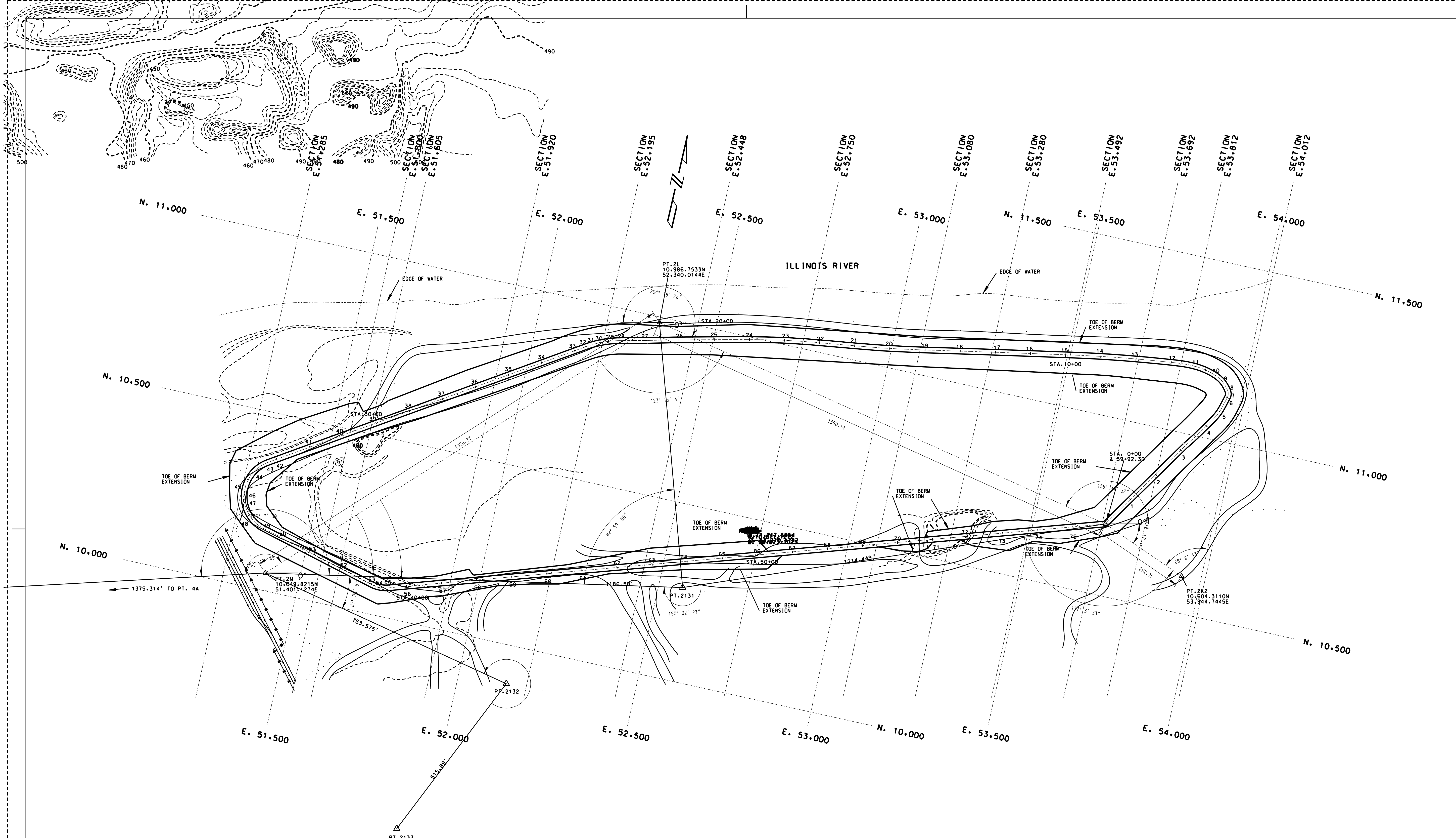
PLATE NO. 1




ILLINOIS POWER COMPANY
DECATUR

PLAN - UNIT#1 ASH POND EXTENSION
HENNEPIN POWER STATION
SHEET #2

E-HEN1-B460-2




| NO | DATE | DRF | DESCRIPTION | E | C | A | NO | DATE | DRF | DESCRIPTION | E | C | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | | |

NOTES

REFERENCES

NOTE: TOPO WAS DIDGITIZED FROM DWG. CE-HEN1-B-450 DATED 11-4-87

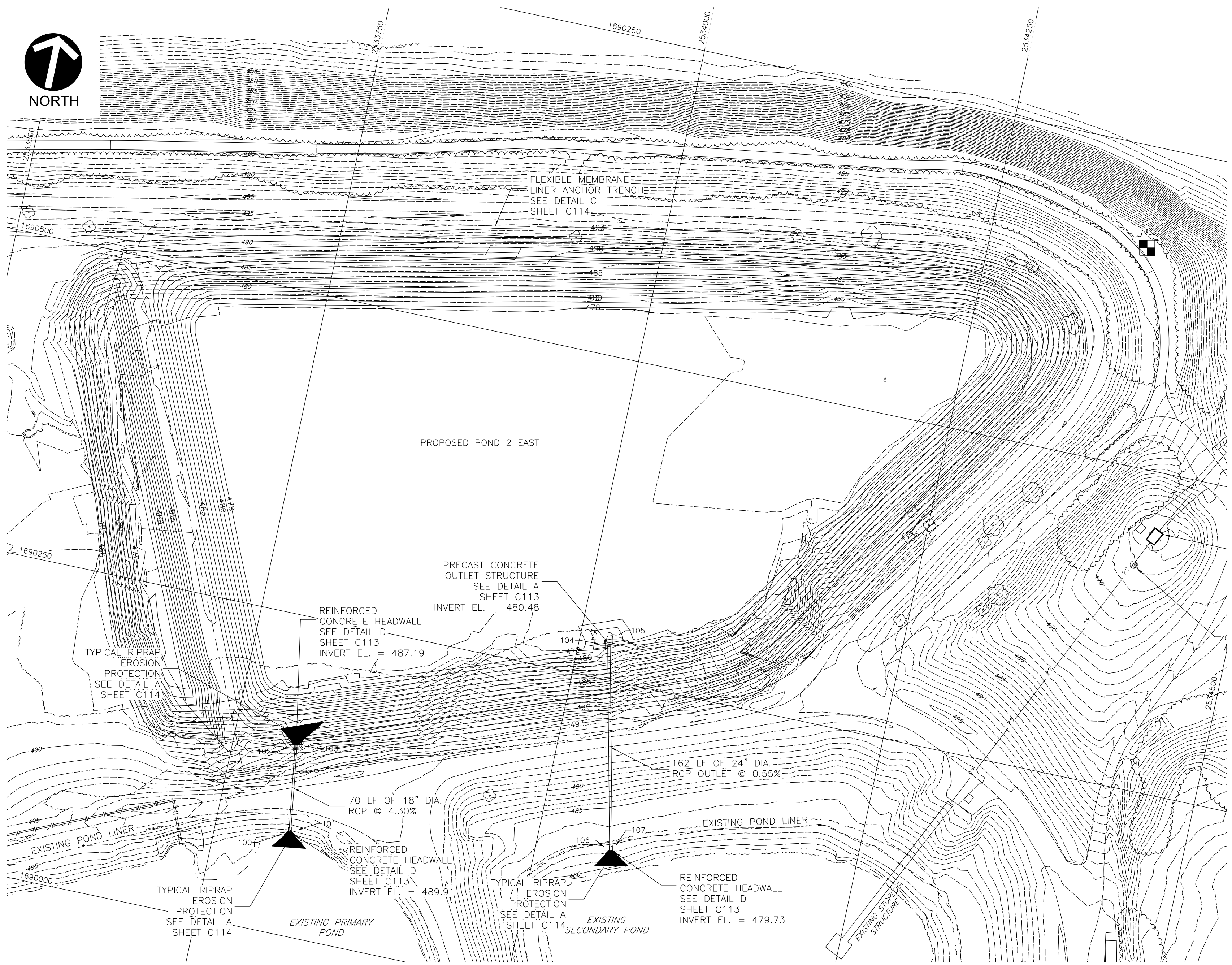
REVISION STATUS
□ -CONSTRUCTION
○ -RECORD
0

ILLINOIS POWER COMPANY
DECATUR

CONTOUR AND GRADING PLAN
UNIT #2 ASH POND EXTENSION
HENNEPIN POWER STATION

| | | |
|---|---|---|
| DR WJM | CAD WJM | DATE 1-11-89 |
| OK | CKD | SCALE 1"=100" |
| APP | PLOTTED 03-08-90 | CE-HEN1-B461 |
| APP | | |

0V0.1.2.3.4.5




| STRUCTURE TABLE | | |
|---|---|---|
| Point # | Northing | Easting |
| 100 | 1690080.864 | 2533807.450 |
| 101 | 1690081.207 | 2533809.928 |
| 102 | 1690149.246 | 2533797.977 |
| 103 | 1690149.589 | 2533800.456 |
| 104 | 1690276.331 | 2534020.790 |
| 105 | 1690282.205 | 2534024.973 |
| 106 | 1690118.909 | 2534057.560 |
| 107 | 1690119.451 | 2534060.003 |

**NOTE**

THE LOCATION OF THE ABOVE AND BELOW GRADE STRUCTURES SHOWN ON THESE DRAWINGS ARE APPROXIMATE. PRIOR TO PERFORMING EXCAVATIONS, THE CONTRACTOR SHALL FIELD LOCATE STRUCTURES THAT MAY BE WITHIN THE LIMITS OF WORK AND PROTECT THEM ACCORDINGLY.

**LEGEND**

- 495 PROPOSED INDEX CONTOURS
- 495 PROPOSED INTERMEDIATE CONTOURS
- 495 EXISTING INDEX CONTOURS
- 495 EXISTING INTERMEDIATE CONTOURS
- ?? EXISTING STORM WATER DRAINS
- EXISTING ACCESS ROAD

SCALE IN FEET

0 40 80

DRAWING NOT TO SCALE IF SCALE BAR DOES NOT MEASURE 2 INCHES

**REFERENCE**

1. TOPOGRAPHIC INFORMATION BASED UPON AERIAL SURVEY CONDUCTED BY SURDEX CORPORATION FLOWN ON OCTOBER 26, 2008.

**Civil & Environmental Consultants, Inc.**
5910 Haper Road, Suite 106 - Solon, OH 44139
Ph: 330.310.6800 - 866.507.2324
www.cecinc.com



REFERENCE DRAWINGS

| NO. | DATE | REVISION | BY | APPROVED |
|---|---|---|---|---|
| 0 | 7/28/10 | RECORD REVISION - 082-255 | DFB | SFP |

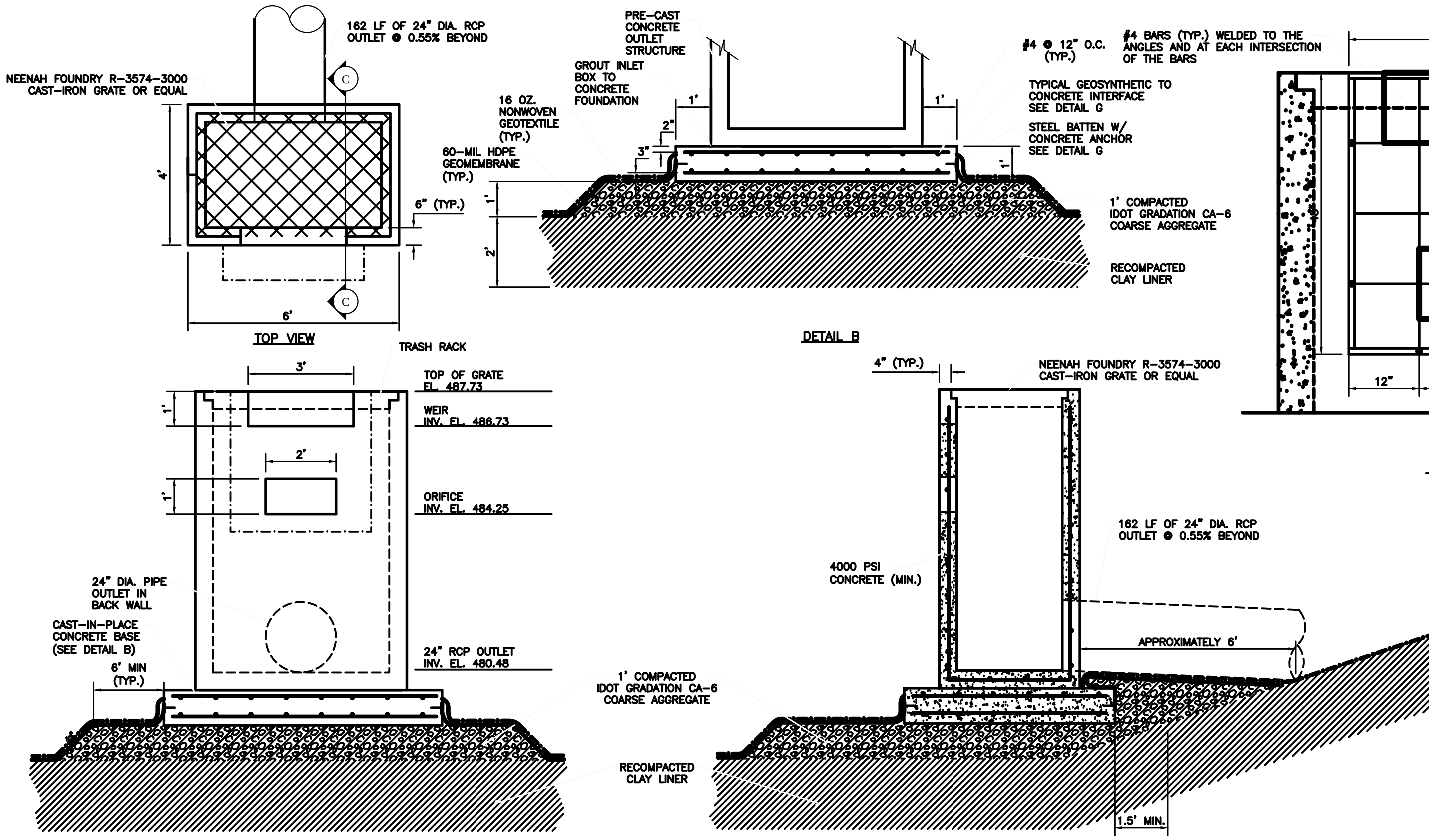
SCALE: AS_NOTED
DWN. DFB DATE 07/05/2010
CHK. RTM DATE 07/12/2010
APPV. SFP DATE 07/12/2010

DYNEGY

DYNEGY MIDWEST GENERATION, INC.
HENNEPIN POWER STATION
POND 2 EAST
FLEXIBLE MEMBRANE LINER AND STRUCTURES

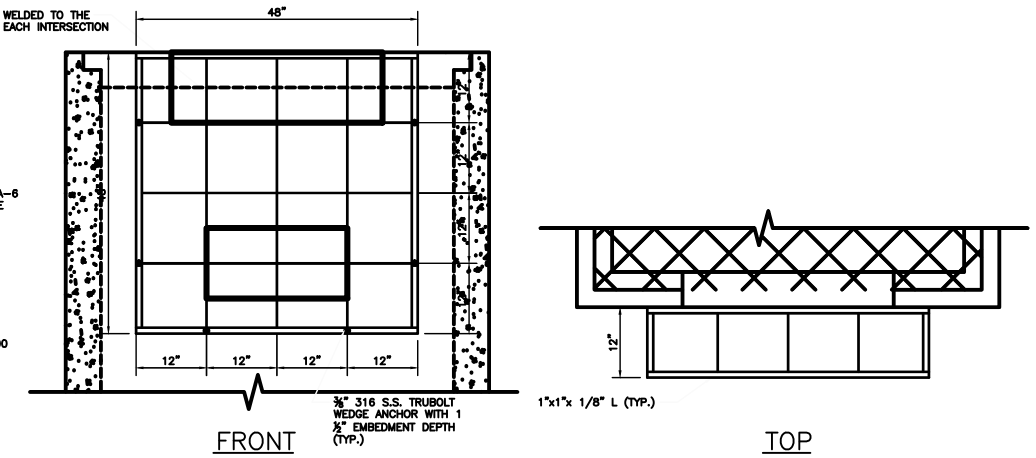
PROJECT NO: 082-255
CLIENT: DYNEGY
DWG. NO: HEN1-C109
REV. 0

HEN1-C109 HENNEPIN DFB 07/05/2010

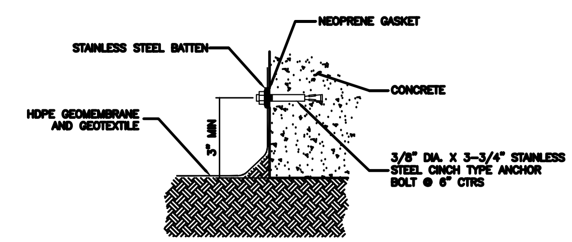



DETAIL A
PRECAST CONCRETE OUTLET STRUCTURE
N.T.S.

NOTES
1. REFER TO ILLINOIS DEPARTMENT OF TRANSPORTATION (IDOT) STANDARD FOR OUTLET REINFORCING.



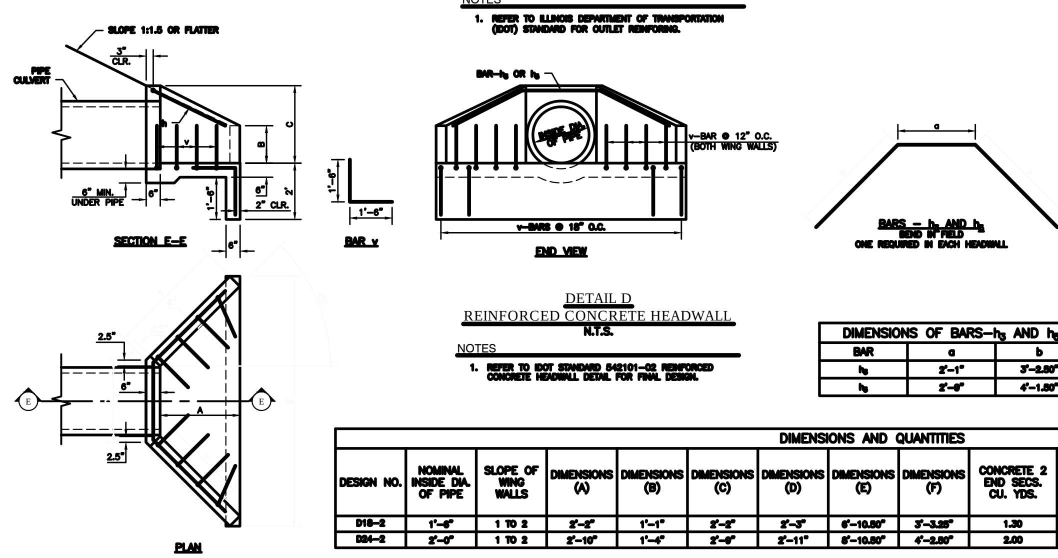

DETAIL E
TRASH RACK
N.T.S.




STEEL BATTEN W/ CONCRETE ANCHOR

DETAIL G
TYPICAL GEOSYNTHETIC TO CONCRETE INTERFACE
N.T.S.

NOTES
1. EARTH ADJACENT TO CONCRETE TO BE WELL COMPACTED TO PREVENT FUTURE DIFFERENTIAL SETTLEMENT.
2. ALL CONCRETE COLLARS TO BE CHAMFERED A MINIMUM OF 1" (TYP.) @ ALL CORNERS IN CONTACT WITH LINER




DETAIL D
REINFORCED CONCRETE HEADWALL
N.T.S.

NOTES
1. REFER TO IDOT STANDARD 542101-02 REINFORCED CONCRETE HEADWALL DETAIL FOR FINAL DESIGN.

DIMENSIONS OF BARS-$h_3$ AND $h_5$

| BAR | a | b |
|---|---|---|
| $h_3$ | 2'-1" | 3'-2.50" |
| $h_5$ | 2'-9" | 4'-1.50" |

DIMENSIONS AND QUANTITIES

| DESIGN NO. | NOMINAL INSIDE DIA. OF PIPE | SLOPE OF WING WALLS | DIMENSIONS (A) | DIMENSIONS (B) | DIMENSIONS (C) | DIMENSIONS (D) | DIMENSIONS (E) | DIMENSIONS (F) | CONCRETE 2 END SECS. CU. YDS. | NO.4 REBAR h-BARS (BAR) | NO.4 REBAR h-BARS (LENGTH) | NO.4 REBAR v-BARS NO. | NO.4 REBAR TOTAL WT. 2 END SECS. LBS. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D18-2 | 1'-6" | 1 TO 2 | 2'-2" | 1'-1" | 2'-2" | 2'-3" | 6'-10.50" | 3'-3.25" | 1.30 | $h_3$ | 8'-6" | 22 | 60 |
| D24-2 | 2'-0" | 1 TO 2 | 2'-10" | 1'-4" | 2'-9" | 2'-11" | 8'-10.50" | 4'-2.50" | 2.00 | $h_5$ | 11'-0" | 28 | 70 |

Civil & Environmental Consultants, Inc.
5910 Haper Road, Suite 106 - Solon, OH 44139
Ph: 330.310.6800 · 866.507.2324
www.cecinc.com



REFERENCE DRAWINGS

| NO. | DATE | REVISION | BY | APPROVED |
|---|---|---|---|---|
| 0 | 7/28/10 | RECORD REVISION - 082-255 | DFB | SFP |

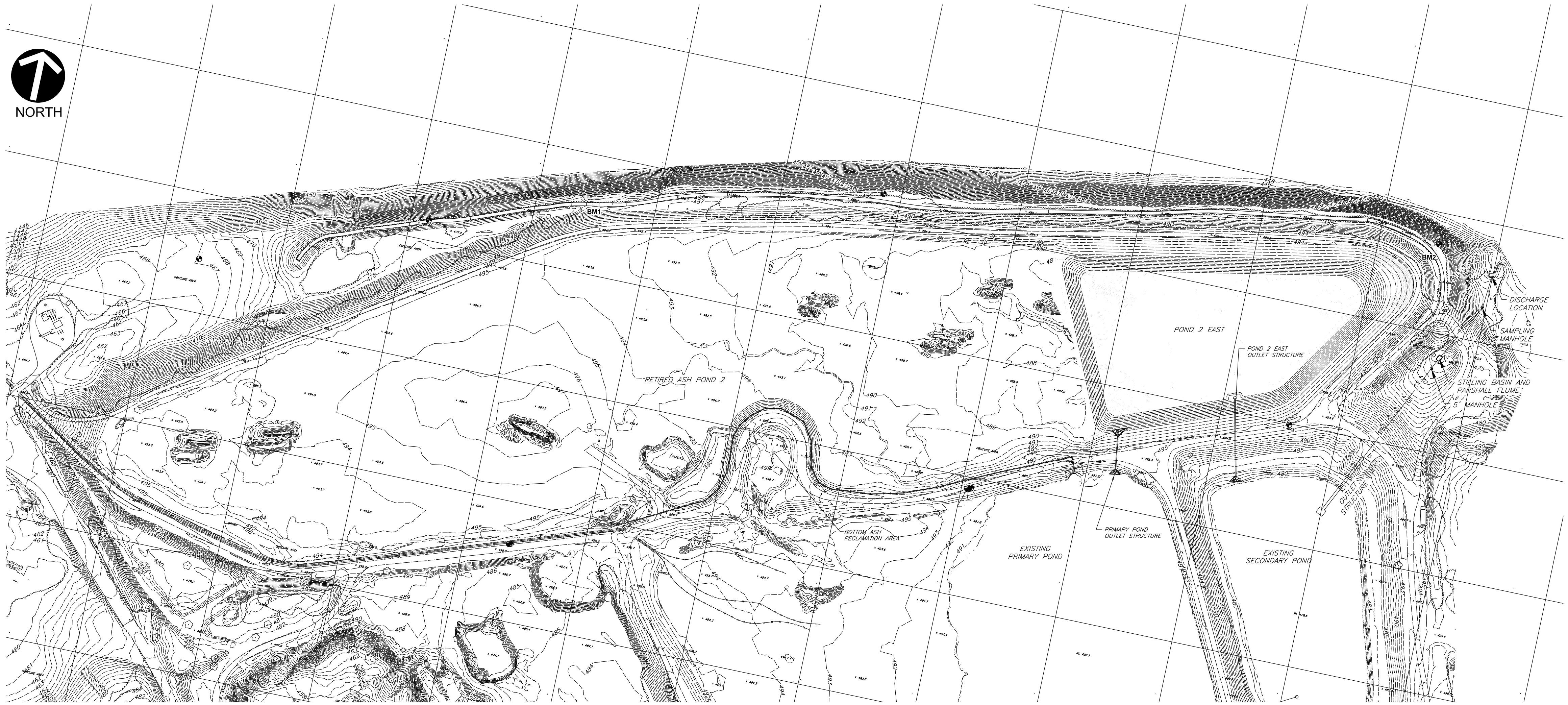
SCALE: AS_NOTED
DWN. DFB DATE 07/05/2010
CHK. RTM DATE 07/12/2010
APPV. SFP DATE 07/12/2010

DYNEGY

DYNEGY MIDWEST GENERATION, INC.
HENNEPIN POWER STATION
POND 2 EAST
DETAILS

PROJECT NO. 082-255
CLIENT: DYNEGY
DWG. NO. HEN1-C113
REV. 0

HENNEPIN HEN1-C113 DFB 07/05/2010




| BENCHMARK LOCATIONS | | | |
|---|---|---|---|
| NUMBER | NORTHING | EASTING | ELEVATION |
| 1 | 1690395.43 | 2532618.60 | 482.19 |
| 2 | 1690670.86 | 2534372.87 | 484.00 |
| 3* | 1689478.87 | 2534643.99 | 506.80 |
| 4* | 1688458.82 | 2533256.76 | 499.45 |
| 5* | 1688781.84 | 2531352.15 | 468.27 |
| 6* | 1689875.08 | 2531310.12 | 463.75 |

* BENCHMARKS BEYOND DRAWING BOUNDARY.

SCALE IN FEET

0 100 200

DRAWING NOT TO SCALE IF SCALE BAR DOES NOT MEASURE 2 INCHES

REFERENCE:

1. TOPOGRAPHIC INFORMATION BASED UPON AERIAL SURVEY CONDUCTED BY SURDEX CORPORATION FLOWN ON SEPTEMBER 10, 2008.

   DUE TO CONSTRUCTION ACTIVITIES, ACTUAL FIELD TOPOGRAPHY MAY VARY.

2. POND 2 EAST CONTOURS FROM CONSTRUCTION DRAWINGS SUBMITTED AUGUST 2009.

**LEGEND**

- MISCELLANEOUS FLOW PIPING
- EXISTING STORMWATER DRAINS
- EXISTING TREELINE
- EXISTING PIPING
- EXISTING ACCESS ROAD
- EXISTING PONDS/STREAMS
- EXISTING FENCE
- EXISTING BENCHMARK
- 500 EXISTING INDEX CONTOUR
- 499 EXISTING INTERMEDIATE CONTOUR
- EXISTING ROCK CHANNEL PROTECTION
- EXISTING MONITORING WELL

Civil & Environmental Consultants, Inc.
5910 Haper Road, Suite 106 - Solon, OH 44139
Ph: 330.310.6800 · 866.507.2324
www.cecinc.com



REFERENCE DRAWINGS

| NO. | DATE | REVISION | BY | APPROVED |
|---|---|---|---|---|
| 0 | 11/28/10 | RECORD REVISION - 082-255 | DFB | SFP |

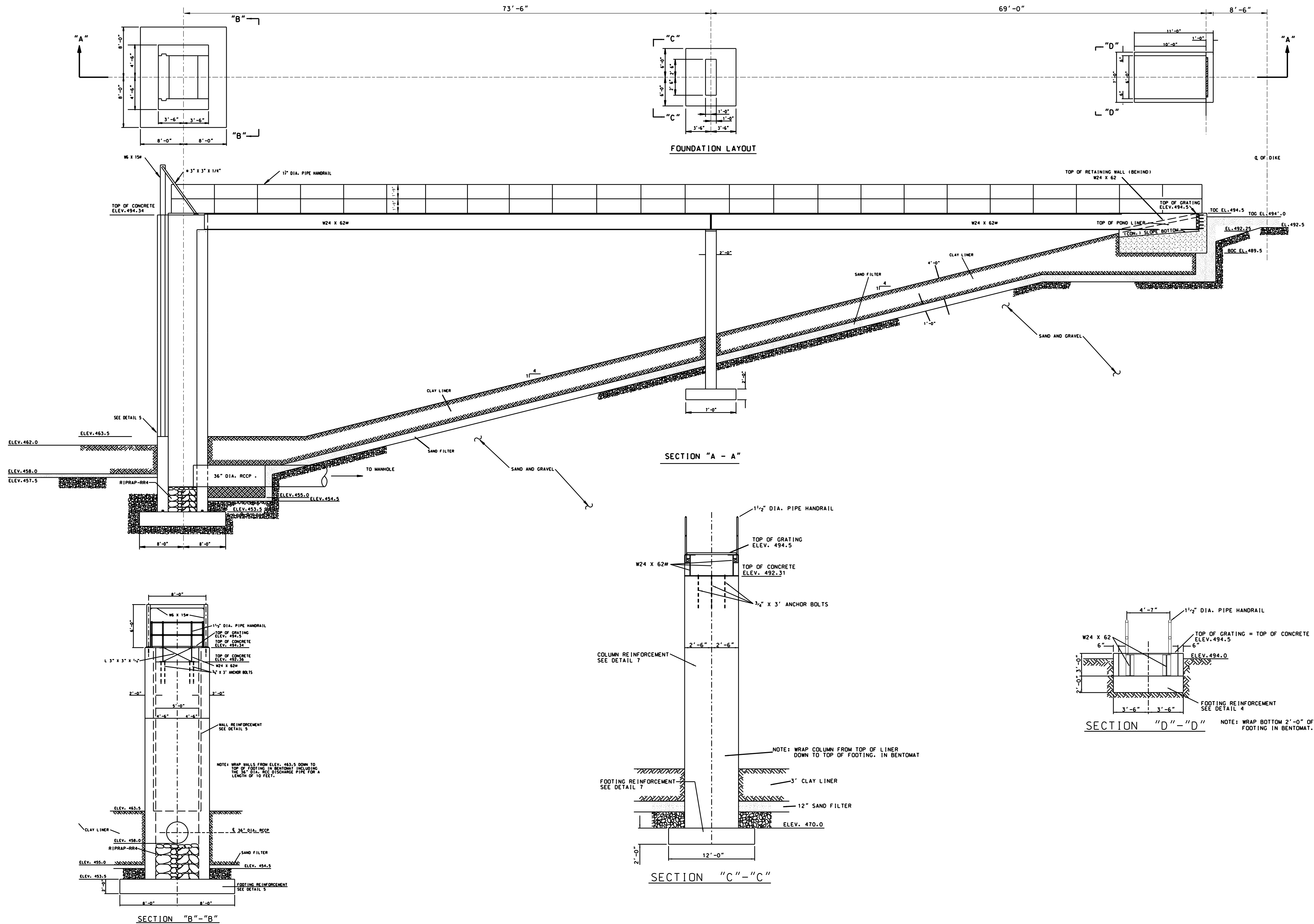
SCALE: AS_NOTED
DWN. DFB DATE 11/05/2010
CHK. RTM DATE 11/12/2010
APPV. SFP DATE 11/12/2010
EAPP_BY EABD
FEAPP_BY FEABD

DYNEGY

DYNEGY MIDWEST GENERATION, INC.
HENNEPIN POWER STATION
LANDFILL PHASE 1 CONSTRUCTION
EXISTING CONDITIONS

PROJECT NO.: 082-255
CLIENT: DYNEGY
DWG. NO.: HEN1-C117
REV. 0

HENNEPIN HEN1-C117 DFB 07/05/2010




| NO | DATE | DRF | DESCRIPTION | E | C | A | NO | DATE | DRF | DESCRIPTION | E | C | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | | |

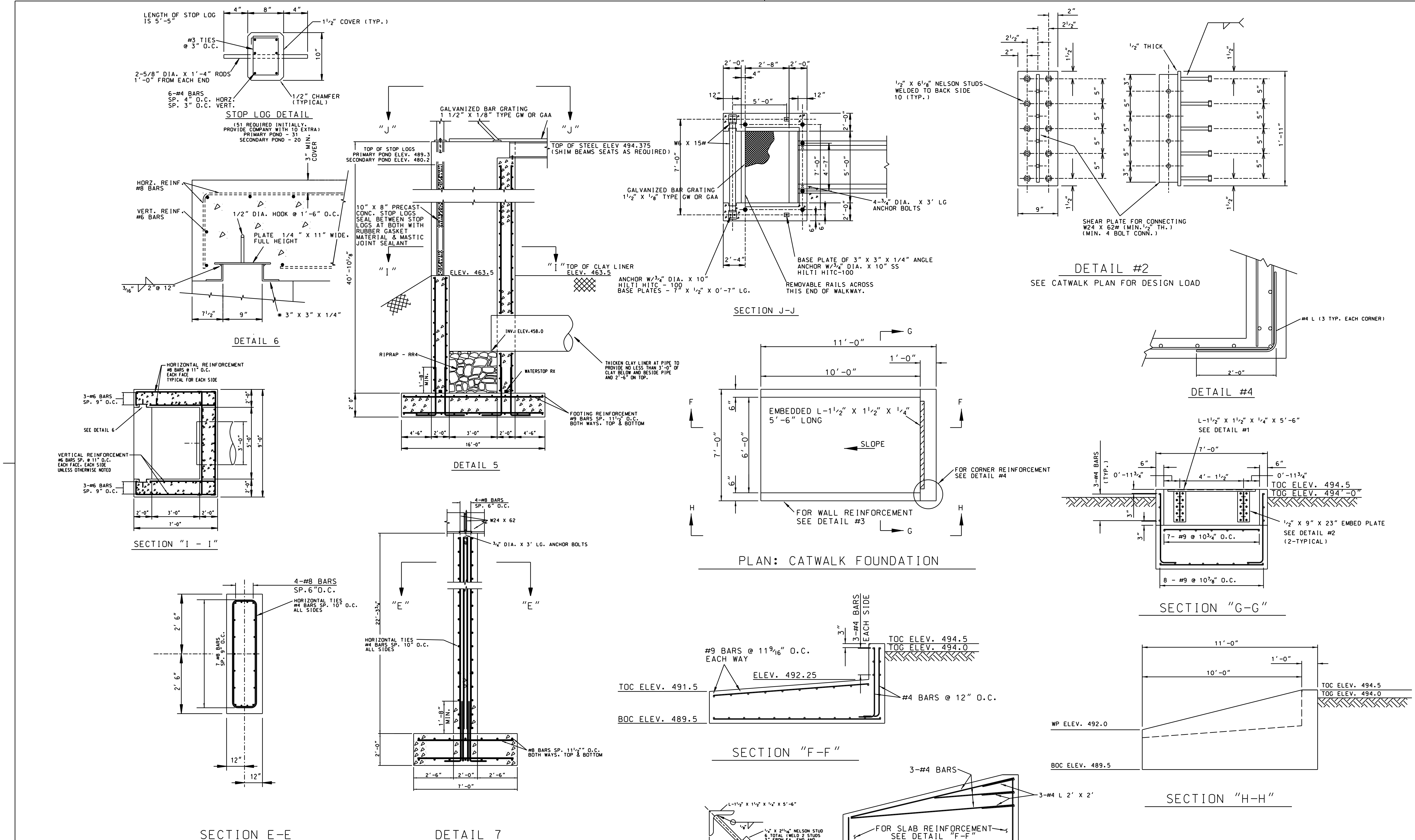
REVISION STATUS
□ -CONSTRUCTION
○ -RECORD
(0)

ILLINOIS POWER COMPANY
DECATUR

LAYOUT-POND DISCHARGE STRUCTURES
1995 ASH FACILITY
HENNEPIN POWER STATION

| | | |
|---|---|---|
| DR G.R.H. | CAD G.R.H. | DATE 1/5/94 |
| OK | CKD | SCALE NO SCALE |
| APP | PLOTTED 9/17/96 | CE-HEN1-C8 |
| APP | | |

p0019275.dgn




REVISION STATUS
- CONSTRUCTION
- RECORD

ILLINOIS POWER COMPANY
DECATUR

DETAILS: POND DISCHARGE STRUCTURE
1995 ASH FACILITY
HENNEPIN POWER STATION

| | | |
|---|---|---|
| DR G.R.H. | CAD G.R.H. | DATE 1/5/94 |
| CK | CKD | SCALE AS NOTED |
| APP | PLOTTED 9/17/96 | CE-HEN1-C9 |
| APP | | |

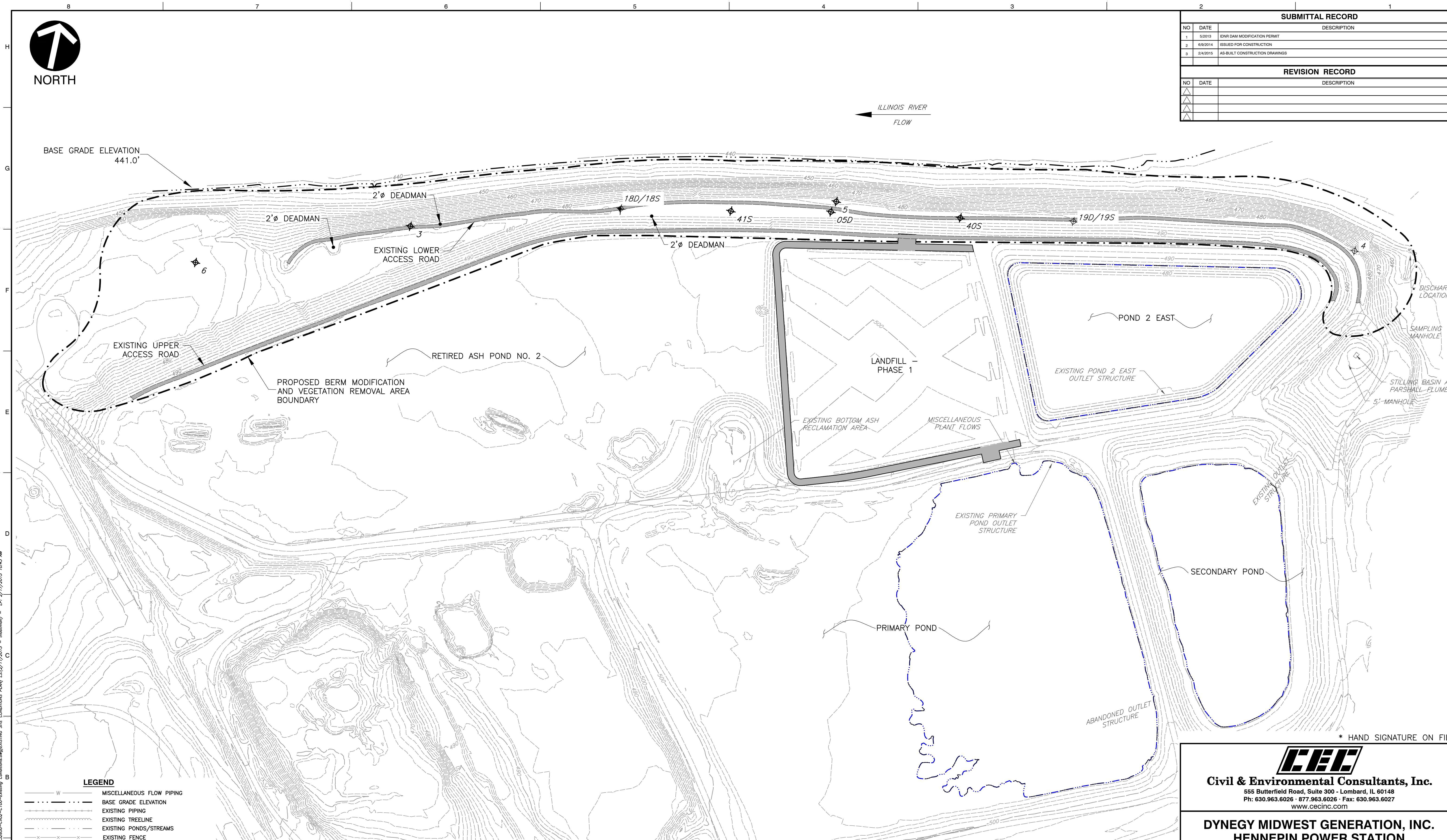
p0019276.dgn

## SUBMITTAL RECORD

| NO | DATE | DESCRIPTION |
|---|---|---|
| 1 | 5/2013 | IDNR DAM MODIFICATION PERMIT |
| 2 | 6/9/2014 | ISSUED FOR CONSTRUCTION |
| 3 | 2/4/2015 | AS-BUILT CONSTRUCTION DRAWINGS |
| | | |

## REVISION RECORD

| NO | DATE | DESCRIPTION |
|---|---|---|
| △ | | |
| △ | | |
| △ | | |
| △ | | |




**LEGEND**

- W — MISCELLANEOUS FLOW PIPING
- BASE GRADE ELEVATION
- EXISTING PIPING
- EXISTING TREELINE
- EXISTING PONDS/STREAMS
- EXISTING FENCE
- EXISTING ACCESS ROAD
- ST — EXISTING STORM WATER PIPING
- P — EXISTING UNDERGROUND PLANT FLOW PIPING
- EXISTING PLANT FLOW PIPING
- 495 — EXISTING INDEX CONTOURS
- EXISTING INTERMEDIATE CONTOURS
- 18D — EXISTING MONITORING WELL LOCATIONS
- EXISTING ACCESS ROAD
- PROPOSED EAST BERM MODIFICATIONS AREA BOUNDARY

**REFERENCE:**

1. TOPOGRAPHIC INFORMATION BASED UPON AERIAL SURVEY CONDUCTED BY SURDEX CORPORATION FLOWN ON SEPTEMBER 10, 2008.
2. EMBANKMENT AREA SURVEY RECEIVED BY CEC FROM DLZ ON MARCH 4, 2013 AND JANUARY 10, 2014.
3. IL DNR PERMIT NO. DS2014017–DAM I.D. NO. 50663
4. AS–BUILT SURVEY RECEIVED BY CEC FROM DLZ, DECEMBER 12, 2014.

# AS-BUILT CONSTRUCTION PLANS

SCALE IN FEET
0 100 200

* HAND SIGNATURE ON FILE


CEC
Civil & Environmental Consultants, Inc.
555 Butterfield Road, Suite 300 - Lombard, IL 60148
Ph: 630.963.6026 · 877.963.6026 · Fax: 630.963.6027
www.cecinc.com


**DYNEGY MIDWEST GENERATION, INC.**
**HENNEPIN POWER STATION**
**EAST BERM MODIFICATION**
**HENNEPIN, ILLINOIS**

| | | | | | |
|---|---|---|---|---|---|
| DRAWN BY: | DFB | CHECKED BY: | MDJ | APPROVED BY: | *MDJ |
| DATE: | FEBRUARY 2015 | DWG SCALE: | AS NOTED | PROJECT NO: | 132-650 |

**EXISTING SITE CONDITIONS PLAN**

DRAWING NO.: 3

SHEET 3 OF 9

## SUBMITTAL RECORD

| NO | DATE | DESCRIPTION |
|---|---|---|
| 1 | 5/2013 | IDNR DAM MODIFICATION PERMIT |
| 2 | 2/2014 | ISSUED FOR CONSTRUCTION |
| 3 | 2/4/2015 | AS-BUILT CONSTRUCTION DRAWINGS |
| | | |

## REVISION RECORD

| NO | DATE | DESCRIPTION |
|---|---|---|
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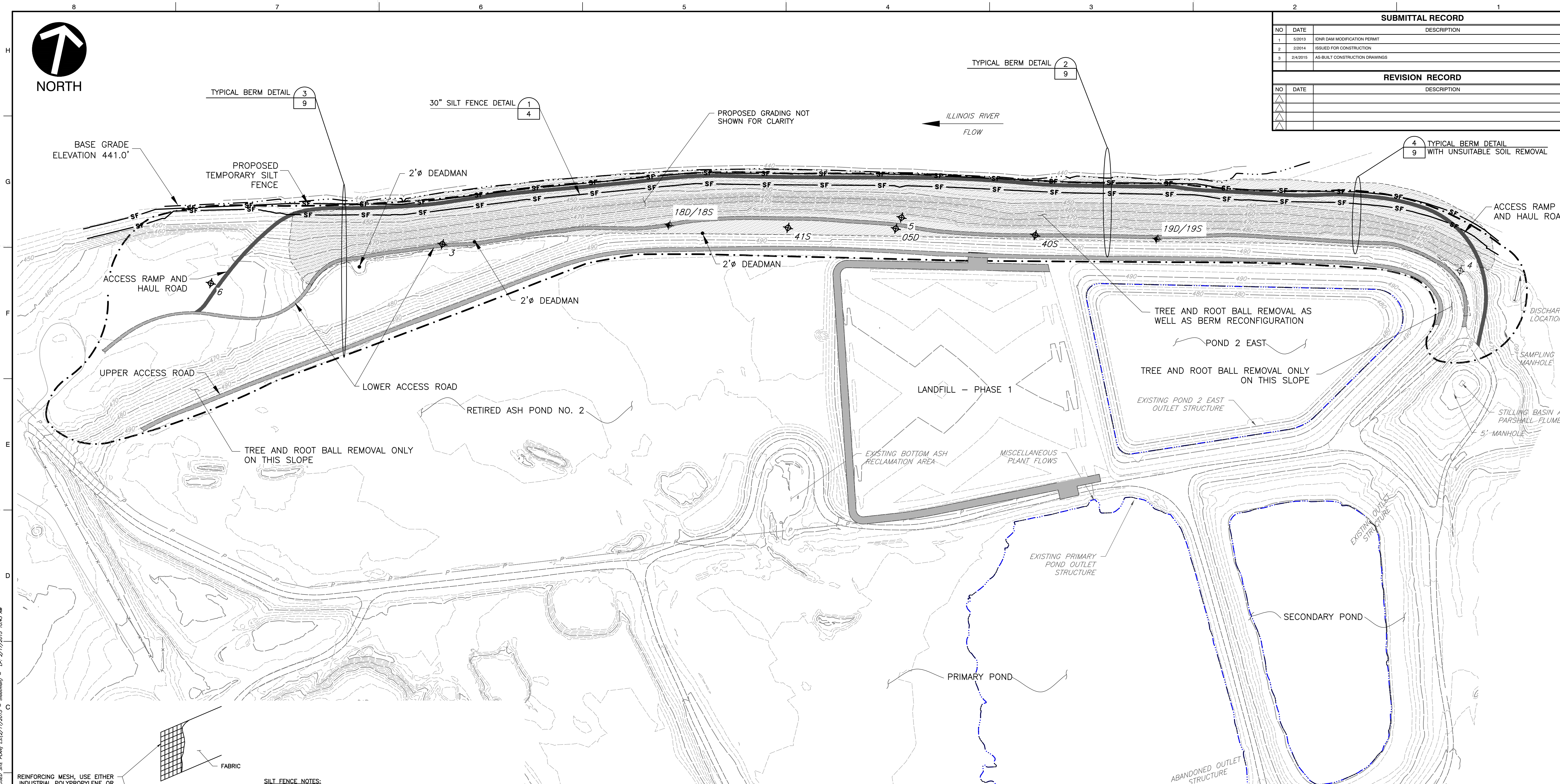
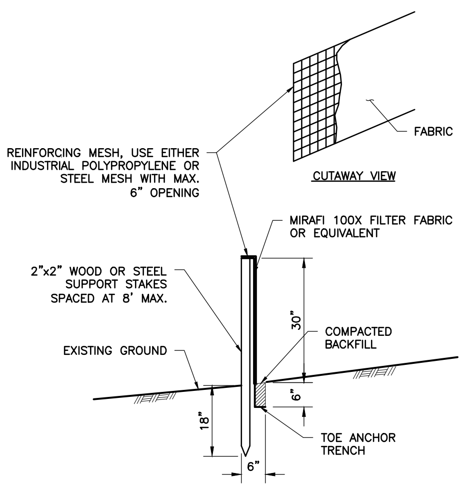



SITE PLAN
SCALE: 1" = 100'

* HAND SIGNATURE ON FILE




**DETAIL 1**
**30" SILT FENCE DETAIL**
N.T.S.

SILT FENCE NOTES:

1. SILT FENCE SHALL BE PLACED ON LEVEL GRADE, WHERE POSSIBLE, AND BOTH ENDS OF THE SILT FENCE SHALL BE EXTENDED UP THE SLOPE.
2. SILT FENCE SHALL NOT BE PLACED IN ANY AREA OF CONCENTRATED FLOW NOR IN AREAS WHERE ROCK OR ROCKY SOILS PREVENT THE FULL AND UNIFORM ANCHORING OF THE FENCE TOE.
3. THE CONTRACTOR SHALL INSPECT THE SILT FENCE AFTER EVERY PRECIPITATION EVENT AND IMMEDIATELY REPAIR ANY DEFICIENCIES.
4. THE CONTRACTOR SHALL REMOVE ACCUMULATED SEDIMENTS AS REQUIRED TO KEEP THE FENCE FUNCTIONAL. IN ALL CASES, THE CONTRACTOR SHALL REMOVE DEPOSITS WHERE ACCUMULATIONS REACH ONE-HALF THE ABOVE GROUND HEIGHT OF THE FENCE.
5. THE CONTRACTOR SHALL IMMEDIATELY REPAIR ALL UNDERCUTTING OR EROSION OF THE ANCHOR TOE WITH A ROCK FILTER OUTLET.
6. THE CONTRACTOR SHALL CONFORM TO ANY RECOMMENDATIONS BY THE MANUFACTURER FOR REPLACING FILTER FABRIC FENCE DUE TO WEATHERING.

LEGEND

- MISCELLANEOUS FLOW PIPING
- BASE GRADE ELEVATION
- EXISTING PIPING
- EXISTING TREELINE
- EXISTING PONDS/STREAMS
- EXISTING FENCE
- EXISTING ACCESS ROAD
- EXISTING STORM WATER PIPING
- EXISTING UNDERGROUND PLANT FLOW PIPING
- EXISTING PLANT FLOW PIPING
- 495 EXISTING INDEX CONTOURS
- EXISTING INTERMEDIATE CONTOURS
- 18D EXISTING MONITORING WELL LOCATIONS
- PROPOSED CONSTRUCTION ACCESS ROAD
- PROPOSED EAST BERM MODIFICATIONS AREA BOUNDARY
- SF PROPOSED SILT FENCE
- PROPOSED GRADING LIMITS

# AS-BUILT CONSTRUCTION PLANS

NOTE:
MONITORING WELLS EXIST WITHIN THE PROPOSED BERM MODIFICATION AREA. CONTRACTOR SHALL PROTECT EXISTING MONITORING WELLS WHILE PERFORMING BERM MODIFICATION ACTIVITIES.

REFERENCE:

1. TOPOGRAPHIC INFORMATION BASED UPON AERIAL SURVEY CONDUCTED BY SURDEX CORPORATION FLOWN ON SEPTEMBER 10, 2008.
2. EMBANKMENT AREA SURVEY RECEIVED BY CEC FROM DLZ ON MARCH 4, 2013 AND JANUARY 10, 2014.
3. IL DNR PERMIT NO. DS2014017–DAM I.D. NO. 50663
4. AS-BUILT SURVEY RECEIVED BY CEC FROM DLZ, DECEMBER 12, 2014.

SCALE IN FEET
0 100 200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**DYNEGY MIDWEST GENERATION, INC.**
**HENNEPIN POWER STATION**
**EAST BERM MODIFICATION**
**HENNEPIN, ILLINOIS**

| | | | | | |
|---|---|---|---|---|---|
| DRAWN BY: | DFB | CHECKED BY: | MDJ | APPROVED BY: | *MDJ |
| DATE: | FEBRUARY 2015 | DWG SCALE: | AS NOTED | PROJECT NO: | 132-650 |

PROPOSED SITE PLAN

DRAWING NO.: 4
SHEET 4 OF 9

## SUBMITTAL RECORD

| NO | DATE | DESCRIPTION |
|---|---|---|
| 1 | 5/2013 | IDNR DAM MODIFICATION PERMIT |
| 2 | 6/9/2014 | ISSUED FOR CONSTRUCTION |
| 3 | 2/4/2015 | AS-BUILT CONSTRUCTION DRAWINGS |
| | | |

## REVISION RECORD

| NO | DATE | DESCRIPTION |
|---|---|---|
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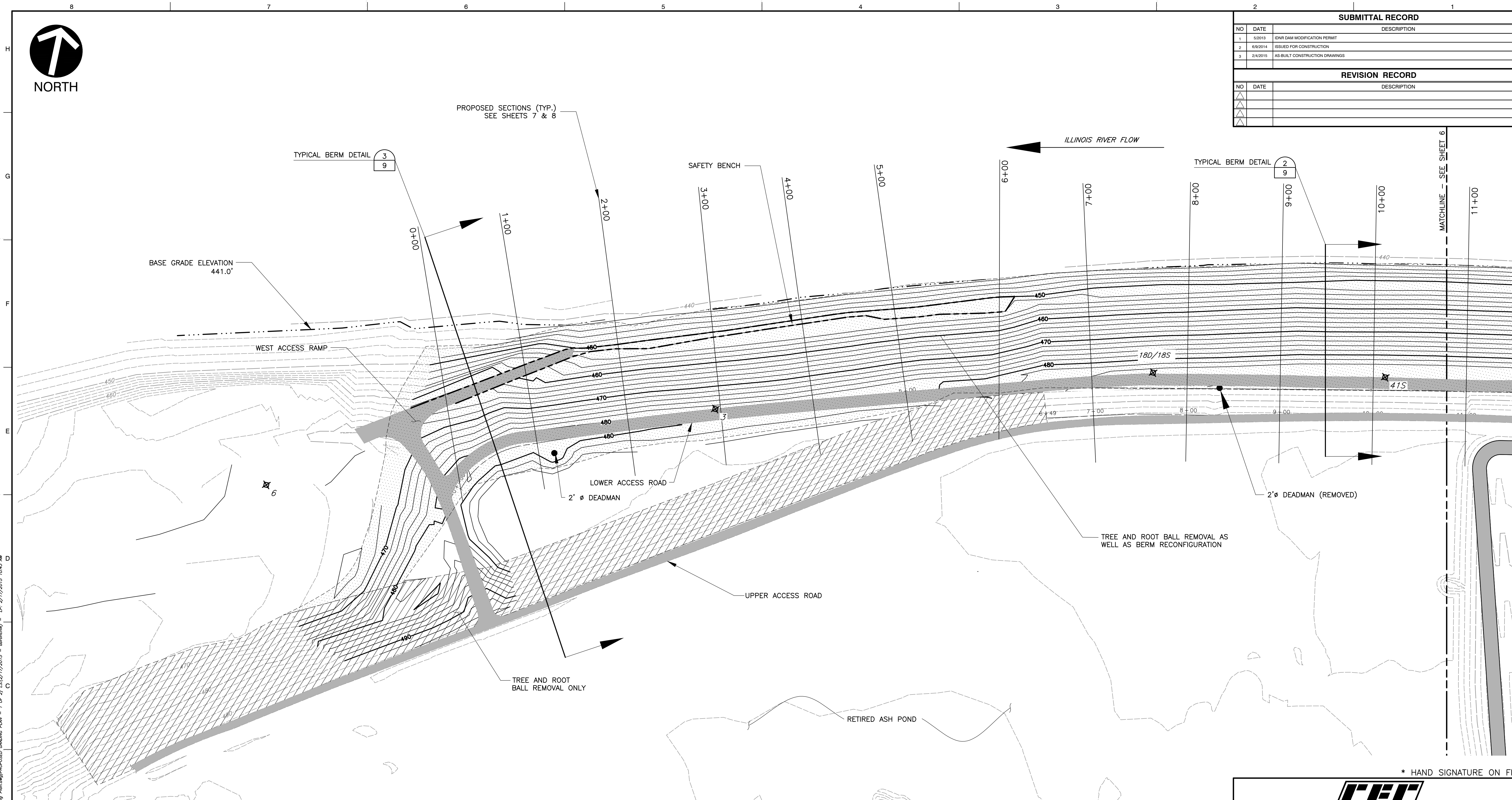


* HAND SIGNATURE ON FILE

**LEGEND**

- MISCELLANEOUS FLOW PIPING
- BASE GRADE ELEVATION
- EXISTING TREELINE
- EXISTING PONDS/STREAMS
- EXISTING FENCE
- EXISTING ACCESS ROAD
- EXISTING STORM WATER PIPING
- EXISTING UNDERGROUND PLANT FLOW PIPING
- EXISTING PLANT FLOW PIPING
- EXISTING INDEX CONTOURS
- EXISTING INTERMEDIATE CONTOURS
- 18D EXISTING MONITORING WELL LOCATIONS
- EXISTING ACCESS ROAD
- PROPOSED EAST BERM MODIFICATIONS AREA BOUNDARY
- PROPOSED INDEX CONTOUR
- PROPOSED INTERMEDIATE CONTOUR
- PROPOSED SAFETY BENCH

TREE/ROOT BALL REMOVAL ONLY

TREE/ROOT BALL REMOVAL WITH BERM RECONFIGURATION

**AS-BUILT CONSTRUCTION PLANS**

REFERENCE:

1. TOPOGRAPHIC INFORMATION BASED UPON AERIAL SURVEY CONDUCTED BY SURDEX CORPORATION FLOWN ON SEPTEMBER 10, 2008.
2. EMBANKMENT AREA SURVEY RECEIVED BY CEC FROM DLZ ON MARCH 4, 2013 AND JANUARY 10, 2014.
3. IL DNR PERMIT NO. DS2014017–DAM I.D. NO. 50663
4. AS–BUILT SURVEY RECEIVED BY CEC FROM DLZ, DECEMBER 12, 2014.

SCALE IN FEET 0 50 100


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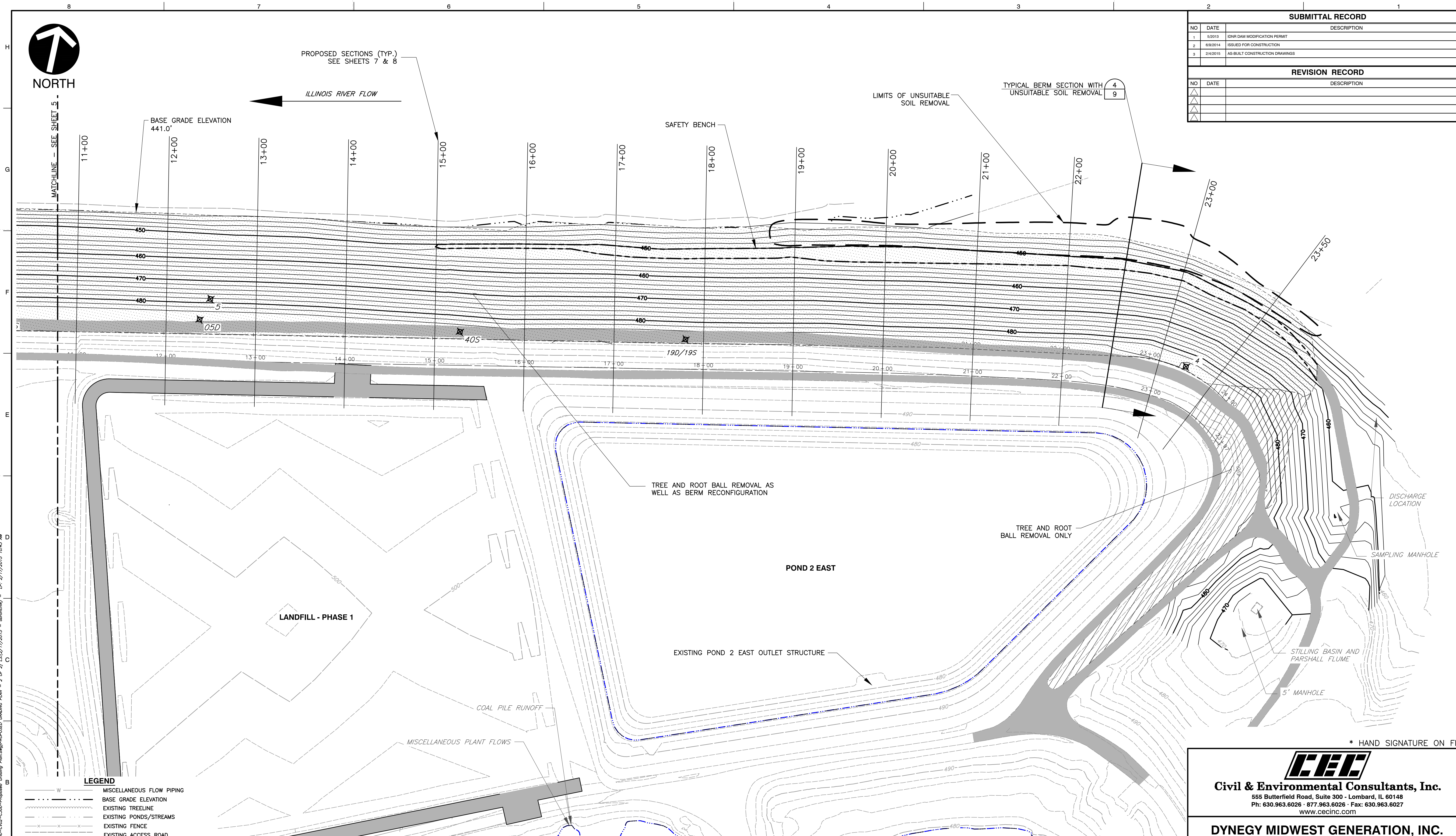
**DYNEGY MIDWEST GENERATION, INC.**
**HENNEPIN POWER STATION**
**EAST BERM MODIFICATION**
**HENNEPIN, ILLINOIS**

| | | | | | |
|---|---|---|---|---|---|
| DRAWN BY: | DFB | CHECKED BY: | MDJ | APPROVED BY: | *MDJ |
| DATE: | FEBRUARY 2015 | DWG SCALE: | AS NOTED | PROJECT NO: | 132-650 |

PROPOSED GRADING PLAN
1 OF 2

DRAWING NO.: 5

SHEET 5 OF 9




## SUBMITTAL RECORD

| NO | DATE | DESCRIPTION |
|---|---|---|
| 1 | 5/2013 | IDNR DAM MODIFICATION PERMIT |
| 2 | 6/9/2014 | ISSUED FOR CONSTRUCTION |
| 3 | 2/4/2015 | AS-BUILT CONSTRUCTION DRAWINGS |
| | | |

## REVISION RECORD

| NO | DATE | DESCRIPTION |
|---|---|---|
| △ | | |
| △ | | |
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**LEGEND**

- MISCELLANEOUS FLOW PIPING
- BASE GRADE ELEVATION
- EXISTING TREELINE
- EXISTING PONDS/STREAMS
- EXISTING FENCE
- EXISTING ACCESS ROAD
- EXISTING STORM WATER PIPING
- EXISTING UNDERGROUND PLANT FLOW PIPING
- EXISTING PLANT FLOW PIPING
- 495 EXISTING INDEX CONTOURS
- EXISTING INTERMEDIATE CONTOURS
- 18D EXISTING MONITORING WELL LOCATIONS
- EXISTING ACCESS ROAD
- PROPOSED EAST BERM MODIFICATIONS AREA BOUNDARY
- PROPOSED INDEX CONTOUR
- PROPOSED INTERMEDIATE CONTOUR
- PROPOSED SAFETY BENCH

TREE/ROOT BALL REMOVAL ONLY

TREE/ROOT BALL REMOVAL WITH BERM RECONFIGURATION

# AS-BUILT CONSTRUCTION PLANS

REFERENCE:

1. TOPOGRAPHIC INFORMATION BASED UPON AERIAL SURVEY CONDUCTED BY SURDEX CORPORATION FLOWN ON SEPTEMBER 10, 2008.
2. EMBANKMENT AREA SURVEY RECEIVED BY CEC FROM DLZ ON MARCH 4, 2013 AND JANUARY 10, 2014.
3. IL DNR PERMIT NO. DS2014017–DAM I.D. NO. 50663
4. AS–BUILT SURVEY RECEIVED BY CEC FROM DLZ, DECEMBER 12, 2014.

SCALE IN FEET

0 50 100

* HAND SIGNATURE ON FILE


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**DYNEGY MIDWEST GENERATION, INC.**
**HENNEPIN POWER STATION**
**EAST BERM MODIFICATION**
**HENNEPIN, ILLINOIS**

| DRAWN BY: DFB | CHECKED BY: MDJ | APPROVED BY: *MDJ |
|---|---|---|
| DATE: FEBRUARY 2015 | DWG SCALE: AS NOTED | PROJECT NO: 132-650 |

**PROPOSED GRADING PLAN**
**2 OF 2**

DRAWING NO.: 6

SHEET 6 OF 9

| SUBMITTAL RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
| 1 | 5/2013 | IDNR DAM MODIFICATION PERMIT |
| 2 | 6/9/2014 | ISSUED FOR CONSTRUCTION |
| 3 | 2/4/2015 | AS-BUILT CONSTRUCTION DRAWINGS |
| | | |

| REVISION RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
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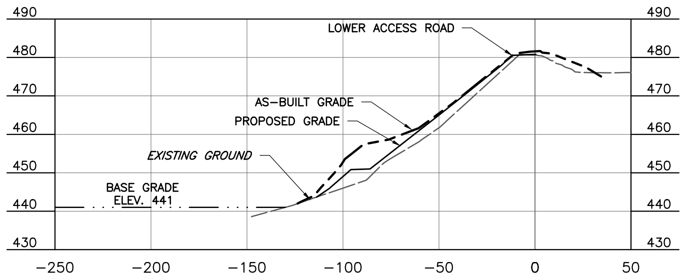

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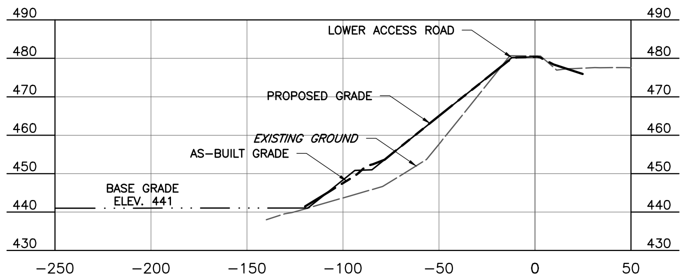

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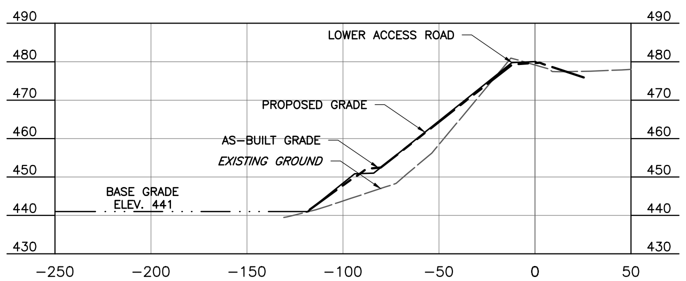

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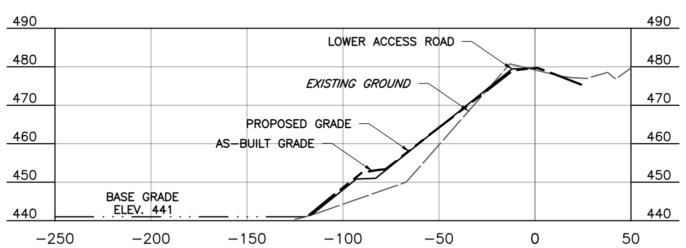

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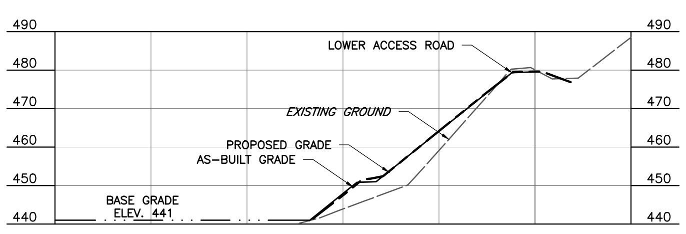

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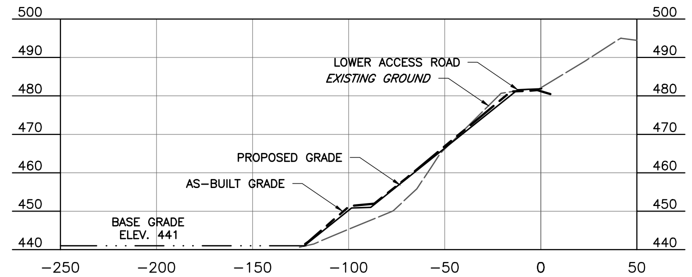
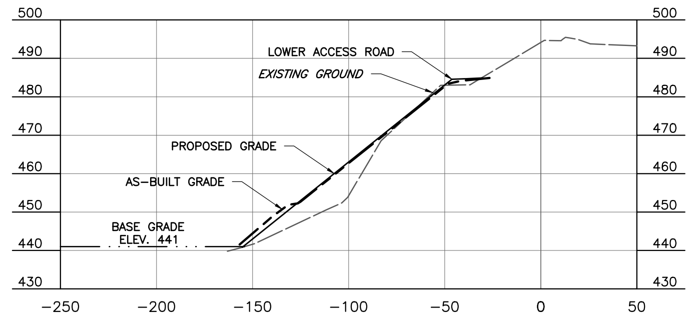
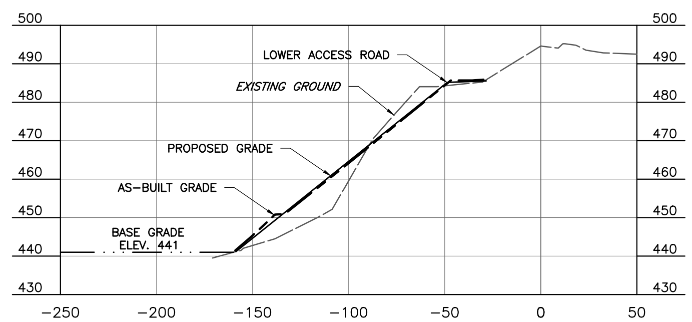


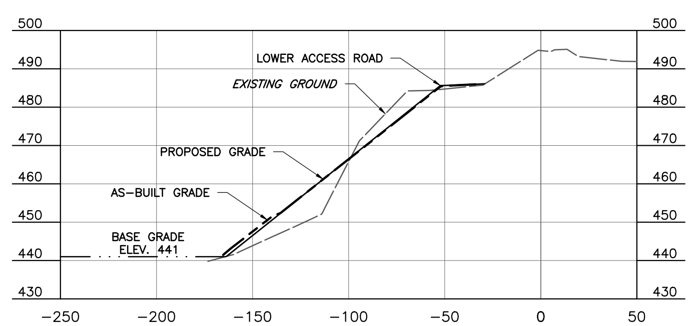
STA 6+00



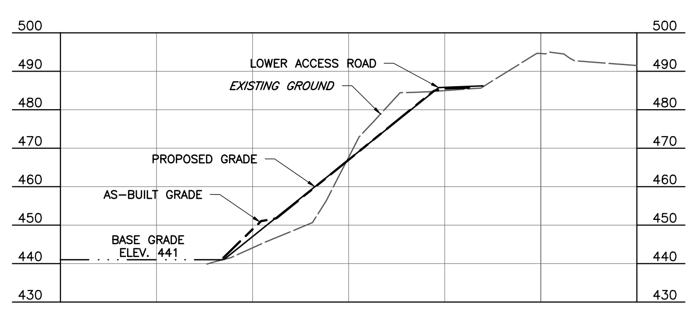
STA 7+00



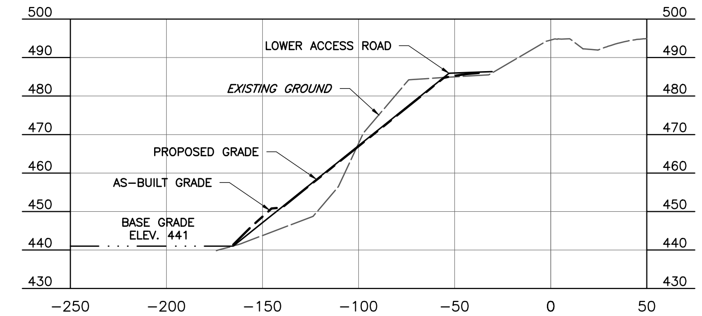
STA 8+00



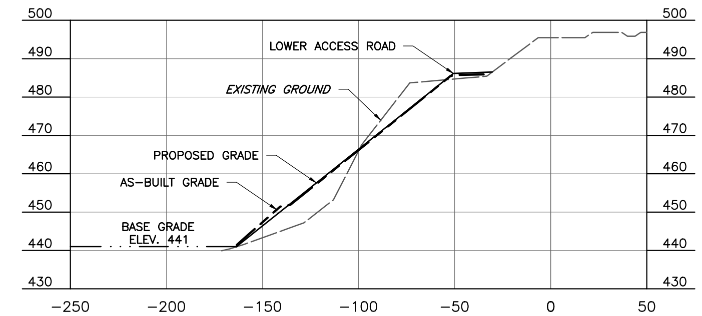
STA 9+00



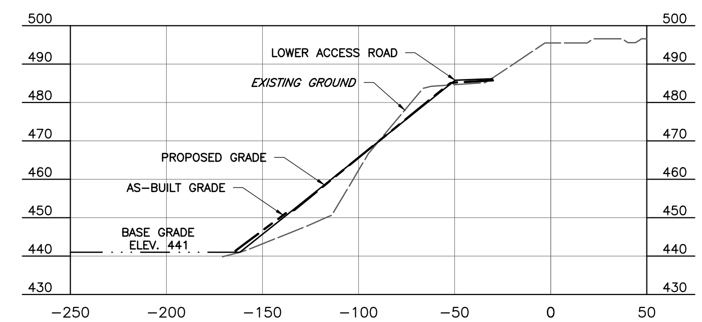
STA 10+00



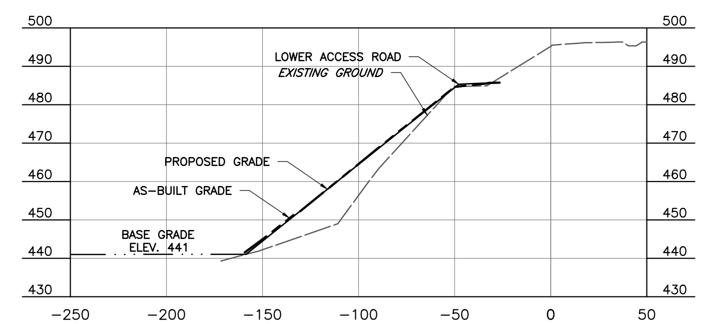
STA 11+00



STA 12+00



STA 13+00



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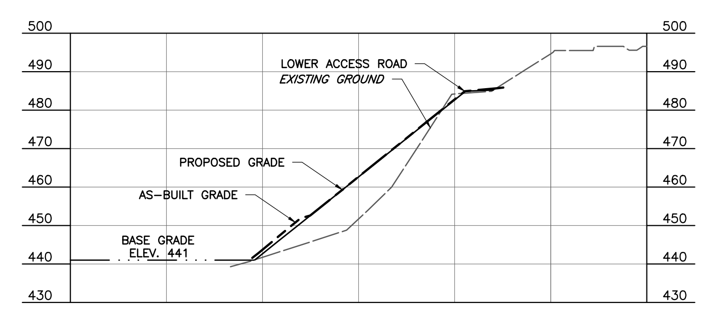

STA 15+00

REFERENCE:

1. TOPOGRAPHIC INFORMATION BASED UPON AERIAL SURVEY CONDUCTED BY SURDEX CORPORATION FLOWN ON SEPTEMBER 10, 2008.
2. EMBANKMENT AREA SURVEY RECEIVED BY CEC FROM DLZ ON MARCH 4, 2013 AND JANUARY 10, 2014.
3. IL DNR PERMIT NO. DS2014017–DAM I.D. NO. 50663
4. AS–BUILT SURVEY RECEIVED BY CEC FROM DLZ, DECEMBER 12, 2014.

## AS-BUILT CONSTRUCTION PLANS

HORIZONTAL
SCALE IN FEET
0 50 100

VERTICAL
SCALE IN FEET
0 25 50

* HAND SIGNATURE ON FILE


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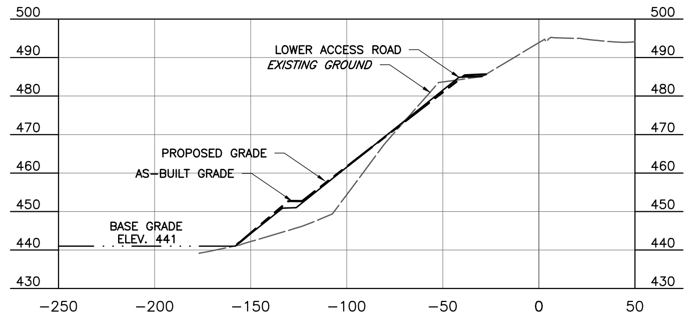
www.cecinc.com


**DYNEGY MIDWEST GENERATION, INC.**
**HENNEPIN POWER STATION**
**EAST BERM MODIFICATION**
**HENNEPIN, ILLINOIS**

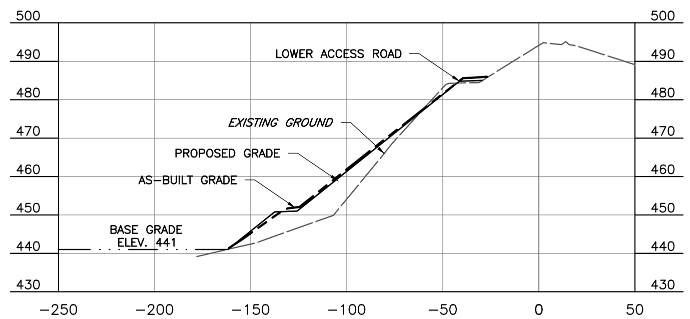
| DRAWN BY: DFB | CHECKED BY: MDJ | APPROVED BY: *MDJ |
|---|---|---|
| DATE: FEBRUARY 2015 | DWG SCALE: AS NOTED | PROJECT NO: 132-650 |

PROPOSED SECTIONS
STA 1+00 TO 15+00

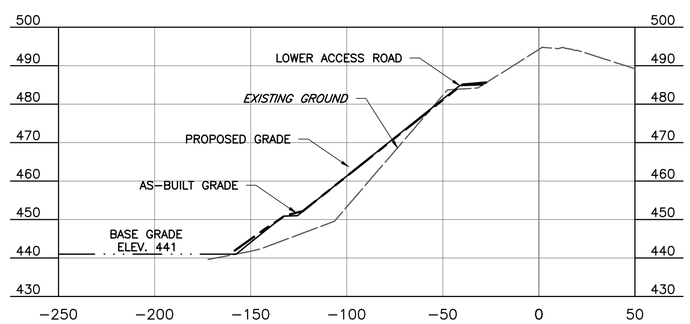
DRAWING NO.: 7
SHEET 7 OF 9



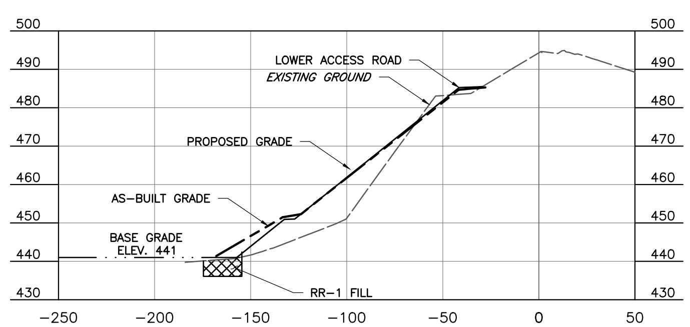

STA 16+00




STA 17+00




STA 18+00

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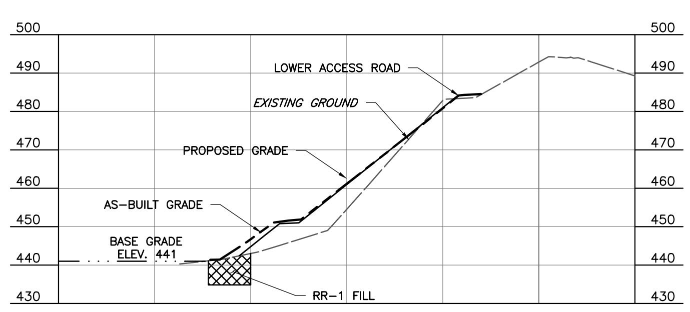


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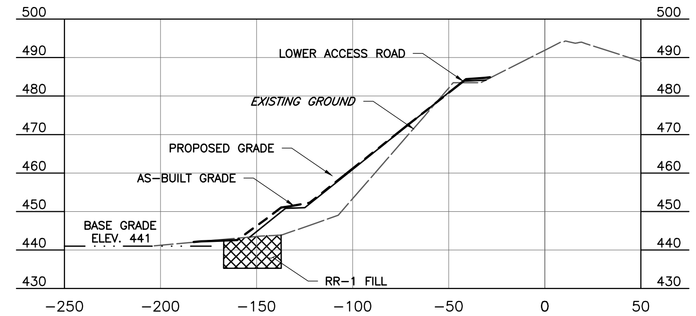


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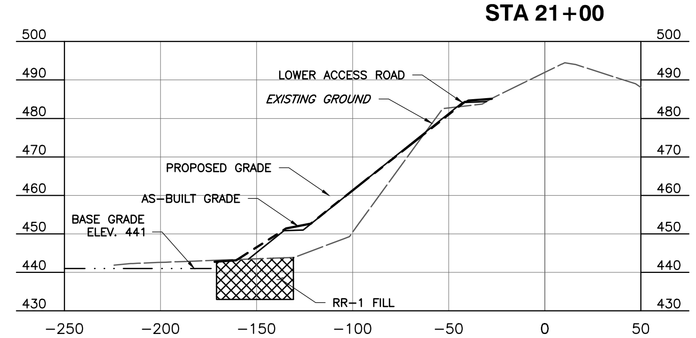


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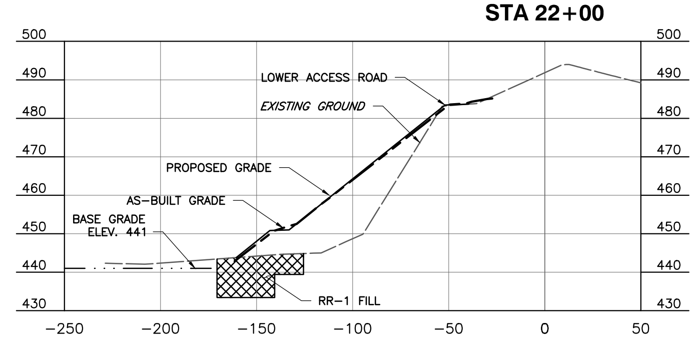


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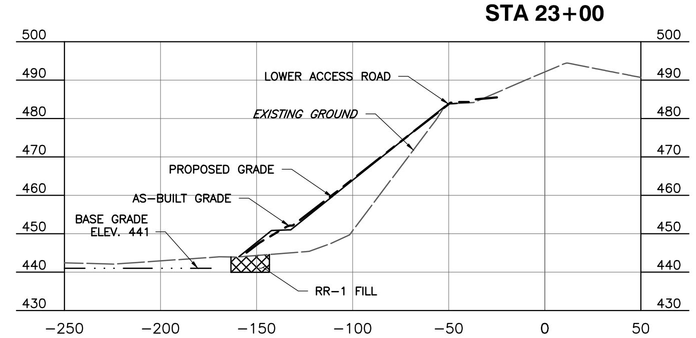



STA 23+50

**SUBMITTAL RECORD**

| NO | DATE | DESCRIPTION |
|---|---|---|
| 1 | 5/2013 | IDNR DAM MODIFICATION PERMIT |
| 2 | 6/9/2014 | ISSUED FOR CONSTRUCTION |
| 3 | 2/4/2015 | AS-BUILT CONSTRUCTION DRAWINGS |
| | | |

**REVISION RECORD**

| NO | DATE | DESCRIPTION |
|---|---|---|
| △ | | |
| △ | | |
| △ | | |
| △ | | |

REFERENCE:

1. TOPOGRAPHIC INFORMATION BASED UPON AERIAL SURVEY CONDUCTED BY SURDEX CORPORATION FLOWN ON SEPTEMBER 10, 2008.
2. EMBANKMENT AREA SURVEY RECEIVED BY CEC FROM DLZ ON MARCH 4, 2013 AND JANUARY 10, 2014.
3. IL DNR PERMIT NO. DS2014017–DAM I.D. NO. 50663
4. AS–BUILT SURVEY RECEIVED BY CEC FROM DLZ, DECEMBER 12, 2014.

## AS-BUILT CONSTRUCTION PLANS

HORIZONTAL
SCALE IN FEET
0 50 100

VERTICAL
SCALE IN FEET
0 25 50

* HAND SIGNATURE ON FILE

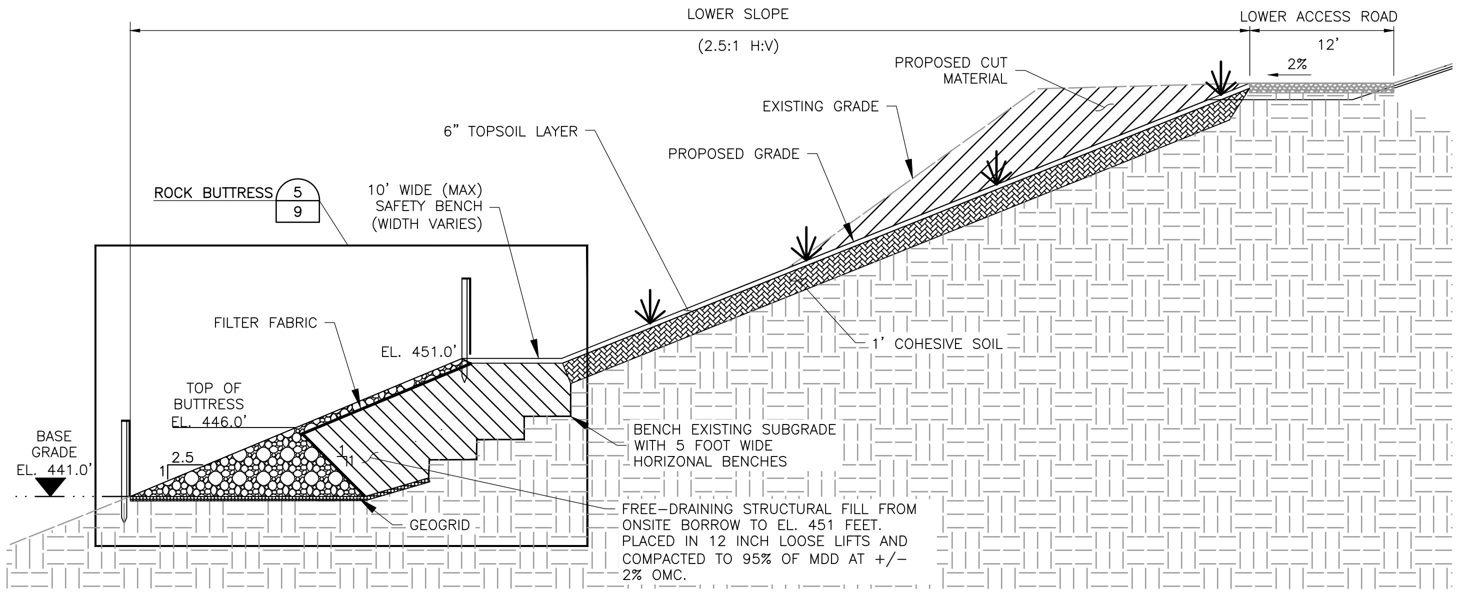
CEC
**Civil & Environmental Consultants, Inc.**
555 Butterfield Road, Suite 300 - Lombard, IL 60148
Ph: 630.963.6026 · 877.963.6026 · Fax: 630.963.6027
www.cecinc.com

**DYNEGY MIDWEST GENERATION, INC.**
**HENNEPIN POWER STATION**
**EAST BERM MODIFICATION**
**HENNEPIN, ILLINOIS**

| DRAWN BY: DFB | CHECKED BY: MDJ | APPROVED BY: *MDJ |
|---|---|---|
| DATE: FEBRUARY 2015 | DWG SCALE: AS NOTED | PROJECT NO: 132-650 |

**PROPOSED SECTIONS**
**STA 16+00 TO 23+50**

DRAWING NO.: 8
SHEET 8 OF 9




**DETAIL 2**
**TYPICAL BERM DETAIL**
SCALE: NTS

**LEGEND**

- PROPOSED CUT MATERIAL
- PROPOSED STRUCTURAL FILL
- UNSUITABLES/RR1 FILL
- RIPRAP
- DRAINAGE LAYER
- PROPOSED GRADELINE
- EXISTING GRADELINE
- WATER SURFACE ELEVATION
- VEGETATION

| SUBMITTAL RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
| 1 | 5/2013 | IDNR DAM MODIFICATION PERMIT |
| 2 | 6/9/2014 | ISSUED FOR CONSTRUCTION |
| 3 | 2/4/2015 | AS-BUILT CONSTRUCTION DRAWINGS |
| | | |

| REVISION RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
| △ | | |
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| △ | | |
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REFERENCE:

1. TOPOGRAPHIC INFORMATION BASED UPON AERIAL SURVEY CONDUCTED BY SURDEX CORPORATION FLOWN ON SEPTEMBER 10, 2008.
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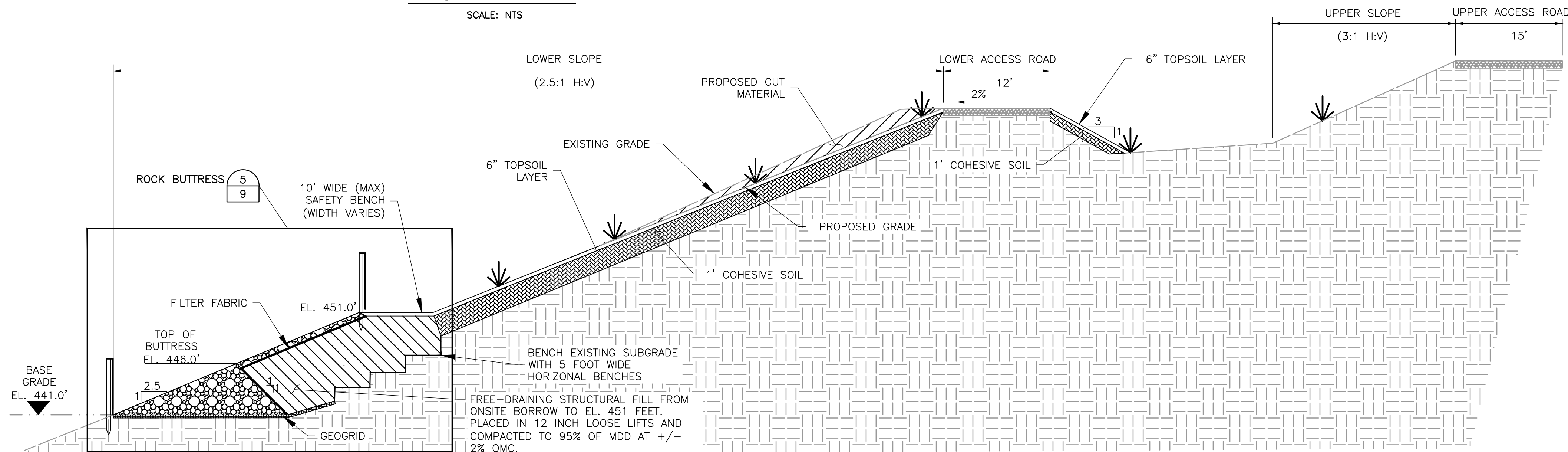
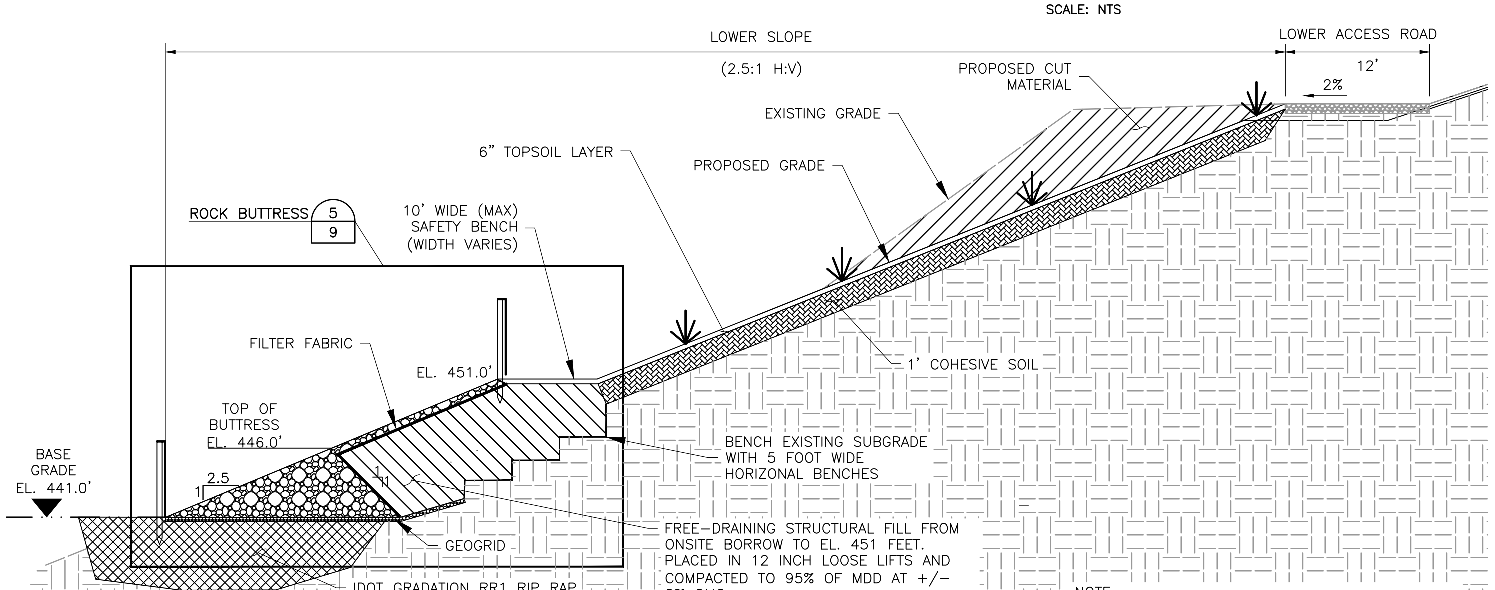
3. IL DNR PERMIT NO. DS2014017-DAM I.D. NO. 50663
4. AS-BUILT SURVEY RECEIVED BY CEC FROM DLZ, DECEMBER 12, 2014.




**DETAIL 3**
**TYPICAL BERM DETAIL**
SCALE: NTS

NOTE:

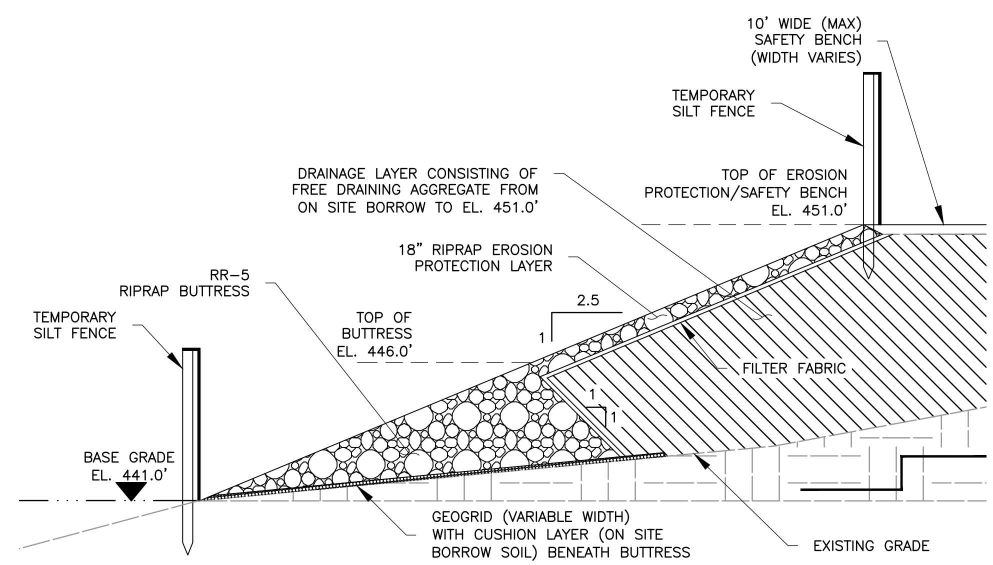
1. TEMPORARY SILT FENCE WAS INSTALLED PRIOR TO ROCK BUTTRESS INSTALLATION. UPON COMPLETION OF ROCK BUTTRESS. SILT FENCE WAS INSTALLED UP SLOPE OF ROCK BUTTRESS AND TEMPORARY SILT FENCE REMOVED.
2. AFTER PLACING TOPSOIL AND SEEDING, EROSION CONTROL BLANKETS WERE INSTALLED ON ALL SLOPES STEEPER THAN 3:1 FOR EROSION PROTECTION AND SEED ESTABLISHMENT. STRAW WATTLES WERE PLACED AT MID-HEIGHT OF BERM FOR ADDITIONAL EROSION PROTECTION.




**DETAIL 4**
**TYPICAL BERM WITH UNSUTABLE SOIL REMOVAL DETAIL**
SCALE: NTS

NOTE:

1. EXCAVATION FOR REMOVAL OF UNSUITABLE SOIL EXTENDED A DISTANCE OUT FROM THE TOE OF BERM EQUAL TO THE DEPTH OF EXCAVATION.




**DETAIL 5**
**ROCK BUTRESS AND**
**EROSION PROTECTION LAYER DETAIL**
SCALE: NTS

**AS-BUILT CONSTRUCTION PLANS**

* HAND SIGNATURE ON FILE

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**EAST BERM MODIFICATION**
**HENNEPIN, ILLINOIS**

| DRAWN BY: DFB | CHECKED BY: MDJ | APPROVED BY: *MDJ |
|---|---|---|
| DATE: FEBRUARY 2015 | DWG SCALE: AS NOTED | PROJECT NO: 132-650 |

BERM AND EROSION CONTROL DETAILS

DRAWING NO.: 9

SHEET 9 OF 9

p:\2013\132-650\2000\-CADD\Dwg\CIVIL\132650-CV02-C900-Erosion Control Details.dwg{DETAILS 22x34} LS:(2/17/2015 - dbrandvik) - LP: 2/17/2015 10:43 AM

AECOM

## Appendix C: Hennepin Power Station Piezometer Locations


EXPLORATION METHOD (B=BORING, C=CPT, P=PIEZOMETER)

XXX–X###

ID NUMBER

STATION ABBREVIATION

SOURCE:
MAP PROVIDED BY GOOGLE EARTH PRO 2015

LEGEND

PIEZOMETER LOCATION

CCR UNIT BERM ALIGNMENT

0 200

APPROXIMATE SCALE FEET

| DYNEGY MIDWEST GENERATION, LLC | PROJECT NO. 60439752 |
|---|---|
| AECOM | |
| DRN. BY: djd October 2015<br>DSGN. BY: eg<br>CHKD. BY: eg | Hennepin Ash Pond No. 2<br>Piezometer Locations |
| FIG. NO. | 2A |

File: P:\PROJECTS\GEOTECH\60428794_DYNEGYCCR\04TASKS\00 PROGRAM TASKS\1.0 TASK 1 INITIAL UNIT ASSESSMENT\CCR FACT SHEETS\SITE MAPS\FIGURE 2A-2D PIEZOMETER LOCATION PLAN (HENNEPIN).DWG Last edited: NOV. 03, 15 @ 3:11 p.m. by: david_deguire


EXPLORATION METHOD (B=BORING, C=CPT, P=PIEZOMETER)

XXX-X###

ID NUMBER

STATION ABBREVIATION

SOURCE:
MAP PROVIDED BY GOOGLE EARTH PRO 2015

LEGEND

PIEZOMETER LOCATION

CCR UNIT BERM ALIGNMENT

0 200

APPROXIMATE SCALE FEET

| DYNEGY MIDWEST GENERATION, LLC | | PROJECT NO. 60439752 |
|---|---|---|
| AECOM | | |
| DRN. BY: djd October 2015<br>DSGN. BY: eg<br>CHKD. BY: eg | Hennepin East Ash Pond Piezometer Locations | FIG. NO. 2B |

File: P:\PROJECTS\GEOTECH\60428794_DYNEGYCCR\04TASKS\00 PROGRAM TASKS\1.0 TASK 1 INITIAL UNIT ASSESSMENT\CCR FACT SHEETS\SITE MAPS\FIGURE 2A-2D PIEZOMETER LOCATION PLAN (HENNEPIN).DWG Last edited: NOV. 03, 15 @ 3:11 p.m. by: david_deguire


XXX-X###
EXPLORATION METHOD (B=BORING, C=CPT, P=PIEZOMETER)
ID NUMBER
STATION ABBREVIATION

SOURCE:
MAP PROVIDED BY GOOGLE EARTH PRO 2015

LEGEND

PIEZOMETER LOCATION

CCR UNIT BERM ALIGNMENT

0 200

APPROXIMATE SCALE FEET

| | |
|---|---|
| DYNEGY MIDWEST GENERATION, LLC | PROJECT NO. 60439752 |
| AECOM | |
| DRN. BY: djd October 2015<br>DSGN. BY: eg<br>CHKD. BY: eg | Hennepin Old West Ash Pond (Pond No. 1 and Pond No. 3) Piezometer Locations — FIG. NO. 2C |

File: P:\PROJECTS\GEOTECH\60428794_DYNEGYCCR\04TASKS\00 PROGRAM TASKS\1.0 TASK 1 INITIAL UNIT ASSESSMENT\CCR FACT SHEETS\SITE MAPS\FIGURE 2A-2D PIEZOMETER LOCATION PLAN (HENNEPIN).DWG Last edited: NOV. 03, 15 @ 3:11 p.m. by: david_deguire


EXPLORATION METHOD (B=BORING, C=CPT, P=PIEZOMETER)
XXX-X###
ID NUMBER
STATION ABBREVIATION

SOURCE:
MAP PROVIDED BY GOOGLE EARTH PRO 2015

LEGEND

PIEZOMETER LOCATION

CCR UNIT BERM ALIGNMENT

0 100
APPROXIMATE SCALE FEET

| | |
|---|---|
| DYNEGY MIDWEST GENERATION, LLC | PROJECT NO. 60439752 |
| AECOM | |
| DRN. BY: djd October 2015<br>DSGN. BY: eg<br>CHKD. BY: eg | Hennepin Old West Polishing Pond Piezometer Locations |
| FIG. NO. 2D | |

File: P:\PROJECTS\GEOTECH\60428794_DYNEGYCCR\04TASKS\00 PROGRAM TASKS\1.0 TASK 1 INITIAL UNIT ASSESSMENT\CCR FACT SHEETS\SITE MAPS\FIGURE 2A-2D PIEZOMETER LOCATION PLAN (HENNEPIN).DWG Last edited: NOV. 03, 15 @ 3:11 p.m. by: david_deguire

**Appendix D: Specification J-2616, Rev. A, Primary Ash Pond Modifications**

3

Sargent & Lundy LLC

# DYNEGY MIDWEST GENERATION
# HENNEPIN POWER STATION

# SPECIFICATION J-2616, REV. A
# PERMIT APPLICATION

# PRIMARY ASH POND MODIFICATIONS

Prepared By:
Sargent & Lundy, LLC
55 East Monroe Street
Chicago, Illinois 60603

# PRIMARY ASH POND MODIFICATIONS

## ISSUE SUMMARY

| Rev. | Purpose of Issue | Date | Sections Affected |
|---|---|---|---|
| A | Spec No. J-2616 Released for Permit Application | 02/14/03 | All |

# CERTIFICATION OF SPECIFICATION

# FOR

# PRIMARY ASH POND MODIFICATION

I certify that this Specification was prepared by me or under my supervision and that I am a registered professional engineer under the laws of the State of Illinois.

Sargent & Lundy LLC's Illinois Department of Professional Regulation registration number is 184-000106.

Certified By: Ronald Cook

Date: Feb 14, 2003

RONALD H. COOK
062 - 048602
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

EXP. 11-30-03

Seal

| Revision: | Certified By: | Date: |
|---|---|---|
| | | |
| | | |

# PRIMARY ASH POND MODIFICATIONS

## TABLE OF CONTENTS

Notes:

(1) Where Division and/or Sections are not included, work under the unlisted headings is not part of the Work.

(2) This Table of Contents will indicate the date of issue for the latest complete issue or revision issue of each section and any subsequent revision issue thereto.

(3) The numbering and subsequent Revisions to the Specification are in sequence with the previously issued Revision mark number.

# FABRIC FORMED CONCRETE MATS

## ISSUE SUMMARY

| Rev. | Purpose of Issue | Date | Sections Affected | Prepared By | Reviewed By | Approved By |
|---|---|---|---|---|---|---|
| A | Permit Application | 02/14/03 | ALL | Ronald Cook | Daniel C. Konik | Ronald Cook |
| | | | | | | |

# FABRIC FORMED CONCRETE MATS

## TABLE OF CONTENTS

Notes:

(1) This Table of Contents will indicate the date of issue for the latest complete issue or revision issue of each section and any subsequent revision issue thereto.

(2) The numbering and subsequent Revisions to the Specification are in sequence with the previously issued Revision mark number.

# Fabric Formed Concrete Mats - Technical Specification and Optional Features/Accessories

## 1.0 Scope of Work

The intent of this specification is to define the material and installation requirements for fabric formed concrete mats installed in accordance with the Design Drawings, technical data and as specified herein.

### 1.1 Work Included

The work shall include, but not be limited to, the following items as indicated:

A. Preparation and grading of surfaces to receive fabric mats.

B. Placing fabric mats and filling them with a pumpable sand/cement slurry to form a stable erosion protection system.

C. Offsite disposal of excess or unsuitable materials and debris.

## 2.0 Codes and Standards

A. Standards, specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein. Methods, equipment and materials specified herein shall comply with the specified and applicable portions of the referenced documents, in addition to federal, state or local codes having jurisdiction.

B. References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the latest additions, addenda, amendments, supplements, etc., thereto, in effect as of the date of contract for the work.

C. Abbreviations listed indicate the form used to identify the reference documents in the specification text.

### 2.1 ASTM – American Society for Testing and Materials

A. ASTM C 31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field.

B. ASTM C 39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

C. ASTM C 143 – Standard Test Method for Slump of Hydraulic Cement Concrete.

D. ASTM C 172 – Standard Practice for Sampling Freshly Mixed Concrete.

E. ASTM C 173 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

F. ASTM C 231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

G. ASTM C1064 – Standard Test Method for Temperature of Freshly Mixed Portland-Cement Concrete.

H. ASTM D 543 – Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.

I. ASTM D 751 – Standard Test Methods for Coated Fabrics.

J. ASTM D 792 – Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

K. ASTM D1777 – Standard Test Method for Thickness of Textile Materials.

L. ASTM D2101 – Standard Test Method for Tensile Properties of Single Man-Made Textile Fibers Taken From Yarns and Tows.

M. ASTM D3776 – Standard Test Methods for Mass Per Unit Area (Weight) of Fabric.

N. ASTM D3786 – Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics (Mullen Burst).

O. ASTM D3787 – Standard Test Method for Bursting Strength of Knitted Goods: Constant-Rate-of Traverse (CRT) Ball Burst Test.

P. ASTM D3885 – Standard Test Method for Abrasion Resistance of Textile Fabrics.

Q. ASTM D4355 – Standard Test Methods for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.

R. ASTM D4491 – Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

S. ASTM D4533 – Standard Test Method for Trapezoid Tearing Strength of Geotextiles.

T. ASTM D4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

U. ASTM D5034 – Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test).

V. ASTM D5035 – Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Strip Method).

## 3.0
## Supplier's Drawings and Data Submittals

A. Supplier shall submit drawings and data as specified. Supplier's drawings and data shall be submitted via electronic medium in a format compatible for importing into the Buyer's information systems specified by the Buyer.

## 3.1
## Submittals Prior to Installation

The Supplier shall submit the following items at least 30 days prior to scheduled delivery of materials:

A. Manufacturer's literature providing specifications on the fabric mats that will be supplied.

B. Manufacturer's certification that the fabric mats to be supplied comply with the requirements of this Technical Specification.

C. Manufacturer's Quality Control and Construction Quality Control Plans. The MQC Plan shall state the frequency that index tests are performed on the fabric mat during manufacturing.

D. If requested by the Buyer, four samples of each fabric mat suitable for testing.

E. Required concrete grout slurry mix design, including requirements for compressive strength, slump, air content and maximum temperature.

### 3.2 Submittals During and After Installation

The Supplier shall submit the following items on a daily basis during installation and a complete set of data within 30 days of the completion of the work:

A. Results of tests performed on the concrete grout fill.

## 4.0 Construction Quality Assurance

A. The Supplier shall examine the areas and conditions under which the work is to be installed and notify Buyer in writing of conditions detrimental to the proper and timely completion of the work that have changed from the time of the bidder's walkdown.

B. Material and installation procedures are subject to inspection and tests conducted by an Independent Testing Service employed by the Buyer. Such inspections and tests will not relieve the Supplier of responsibility for providing material and installation procedures in compliance with specified requirements. The Buyer reserves the right, at any time before final acceptance, to reject material not complying with the specified requirements.

C. The Supplier shall correct deficiencies in the work which inspections and laboratory test reports have indicated to be not in compliance with requirements. The Supplier shall perform additional tests, at his expense, as may be necessary to reconfirm any noncompliance of the original work, and as may be necessary to show compliance of corrected work.

D. The Supplier shall promptly correct errors or flaws in material or placement of the protection mats identified during construction. The Supplier shall make immediate substitution of non-complying component or make field changes to make the non-complying component acceptable. Whether the correction is made by substitution or field correction, it shall be performed without cost to the Buyer.

## 4.1 Testing

### 4.1.1 Independent Testing Service

An Independent Testing Service shall perform the following:

A. Test material for the concrete slurry fill and prepare initial test cylinders in accordance with the requirements specified herein.

B. Prepare test cylinders and determine the compressive strength of job concrete fill test cylinders.

### 4.1.2 Concrete Grout Testing

A. Obtaining and testing concrete grout shall be by the Independent Testing Service in accordance with the following specifications:

- Sampling freshly mixed grout shall be done in accordance with ASTM C172.
- Making and curing concrete test specimens shall be in accordance with ASTM C31.
- Slump test shall be in accordance with ASTM C143.
- Air Content tests shall be in accordance with ASTM C173 or ASTM C231.
- Tests for the temperature of the freshly mixed grout shall be in accordance with ASTM C1064.
- Compressive strength test shall be in accordance with ASTM C39.

B. The frequency of testing shall be as directed by Buyer as follows:

- At least one test shall be made for each day's placement of grout, but not less than once for each 100 cubic yards or part thereof placed.
- A test shall consist of a minimum of four cylinders taken from the same truck. One 7-day and two 28-day tests shall be performed by the laboratory with results submitted to the Buyer as soon as possible. One spare cylinder shall be made and used as directed by the Buyer.
- A slump test and air content test shall be performed on every 100 cubic yards of concrete grout.
- The temperature of each 100 cubic yards shall be recorded in the field prior to placement. If the concrete grout temperature is in excess of 100°F, the concrete shall be rejected.

# 5.0 Materials

## 5.1 Fabric Design

A. Fabric-forming material shall consist of double-layer, open-selvage fabric joined in a mat configuration. The fabric shall be woven of 100% continuous multi-filament nylon fiber of which 50% by weight shall be bulk textured fiber. The use of staple yarns will not be permitted.

B. The fabric shall be woven in such a manner as to provide interwoven points of attachment on spaced centers. These points of attachment shall serve to control the thickness of the finished product and to also act as a filter point to provide relief of hydrostatic uplift pressure beneath the completed revetment. The fabric shall be woven in a basket or other open pattern to provide permeability at the filter points and the main fabric field.

C. The spacing of the filter points is indicated on the Design Drawings. This spacing will result in an average revetment thickness that is consistent with the average thickness published by the manufacturer for the designated style specified.

## 5.2 Fiber and Fabric Material

A. The warp fiber shall be 1260 Denier Nylon, 18.5 ends/inch per single layer and the fill fiber shall be 1900 Denier Nylon, 14 picks/inch per single layer. The fiber and fabric material shall meet the minimum requirements listed in Table 1.

**TABLE 1**
**MATERIAL PROPERTIES**

| PROPERTY | ASTM TEST METHOD | MINIMUM TEST VALUE |
|---|---|---|
| Fiber count | - | 0.164 g/m |
| Trapezoidal tear breaking force on the warp fiber at 70% elongation | D 4533 | 80 lbs/in |
| Trapezoidal tear breaking force on the fill fiber at 70% elongation | D 4533 | 40 lbs/in |
| Density | D 792 | 1.00 g/cm$^3$ |
| Fiber dry breaking strength at 48% elongation | D 2101 | 20 lbs |
| Fiber wet breaking strength at 53% elongation (soaked in water for 2 hours) | D 2101 | 19 lbs |
| Tensile strength in the warp direction after exposure to 300 hours of Ca (OH) at a pH of 10 | D 543 | 180 lbs/in |
| Tensile strength in the warp direction after exposure to 300 hours of $H_2SO_4$ | D 543 | 170 lbs/in |
| Tensile breaking strength in the warp direction on a strip of the fabric at 39% elongation (1) | D 5034, D 5035 | 160 lbs/in |
| Tensile breaking strength in the fill direction on a strip of the fabric at 34% elongation (1) | D 5034, D 5035 | 190 lbs/in |
| Mass/unit area for a single layer of fabric | D 3776 | 7.8 oz/sq yd |
| Thickness of a single layer of fabric | D 1777 | 31 mils |
| Falling head permittivity of two layers of fabric woven together | D 4491 | 0.28 s$^{-1}$<br>0.04 cm/s (3) |
| Falling head permittivity of a single layer of fabric | D 4491 | 1.3 s$^{-1}$<br>0.12 cm/s |
| Seam strength (2) | D 751 | 35 lbs/in |
| Abrasion resistance in the warp direction | D 3885 | 160 lbs/in |
| Grab strength in the warp direction at 31% elongation | D 4632 | 350 lbs |
| Grab strength in the fill direction at 41% elongation | D 4632 | 275 lbs |
| Breaking strength in the warp direction after exposure to 500 hours of UV light | D 4355 | 190 lbs/in |
| Mullen burst test | D 3786 | 750 psi |
| Puncture test | D 3787 | 80 lbs |

Notes for Table 1:

(1) 3" x 8" sample gripped along full width of the specimen with 3" of separation between grips. Strip test to be performed on single layer of fabric at cross-head speed of 5 inches per minute.

(2) Seam centered between grips 3" apart and gripped the full width of the specimen.

(3) Applies to Filter Points only

## 5.3
## Fabric Assembly

A. Adjacent fabric panels shall be connected by sewing or by means of zipper.

B. The two top layers of fabric and the two bottom layers of fabric shall be joined separately permitting full mat thickness between the two parallel seams. A single seam in which all four layers of the fabric are joined at one point will not be permitted.

C. If required, grout stops may be installed parallel to and in between individual mill widths at predetermined intervals to regulate the flow of the concrete fill. Grout stops shall be so designed as to produce full mat thickness along the full length of the grout stop.

## 5.4
## Concrete Grout

A. The concrete grout shall consist of a mixture of Portland cement, fine aggregate and water so proportioned and mixed as to provide a readily pumpable slurry.

B. Admixtures and/or a pozzolan may be used with the approval of the Buyer. The use of superplasticizers and/or silica fume require special precautions and the approval of the Buyer.

C. The hardened concrete shall exhibit a minimum compressive strength of 2,500 psi at 28 days when specimens are made and tested in accordance with the provisions of ASTM C 31 and ASTM C 39.

## 5.5
## Acceptable Materials

The following companies manufacture products that meet the requirements of the specification:

A. Fabriform Filter Point Fabric as manufactured by Construction Techniques, Inc., Cleveland, Ohio, 440-572-8300.

B. Other approved by Buyer.

# 6.0
# Execution

## 6.1
## Acceptance and Storage at the Project Site

### 6.1.1
### Handling of Rolls

A. The method of off-loading the fabric at the project site shall not cause any damage to the fabric, its core, nor its protective covering.

B. Any protective covering that is accidentally damaged or stripped off of a pallet or roll shall be immediately repaired or the pallet or roll shall be moved to an enclosed facility until the repair can be made.

### 6.1.2
### Storage at the Field Site

A. The Buyer shall provide on-site storage space in a location near where the fabric will be placed such that on-site transportation and handling are minimized. The Supplier shall be responsible for protecting the stored material from theft and vandalism.

B. Rolls or pallets of fabric shall be stored in such a manner that cores are not crushed, the fabric damaged, and as required to provide protection from exposure to ultraviolet light, inundation, mud, dirt, dust, puncture, cutting or any other damaging or deleterious condition.

C. Outdoor storage of rolls or pallets shall not exceed the manufacturer's recommendations or longer than six months, whichever is less.

### 6.2
### Inspection upon Delivery

A. Upon delivery of the materials to the site, the Supplier shall conduct a visual inspection of all rolls of fabric for damage or defects. This inspection shall be done without unrolling any rolls unless damage to the inside of a roll is found or suspected.

B. Any damage or defects shall be noted and immediately reported to the Buyer, the manufacturer and the carrier that transported the material. Any roll, or portion thereof, which, in the judgement of the Buyer, is seriously damaged, shall be removed from the project site and replaced with complying material at no additional cost to the Buyer.

### 6.3
### Fabric Placement

A. Prior to concrete injection, the fabric shall be positioned over a geotextile on the grade as indicated on the Design Drawings making appropriate allowances for contraction of the fabric mats as a result of injecting the concrete grout.

B. Anchoring of fabric shall be as shown on the Design Drawings.

C. Fabric panels may be factory assembled in predetermined sizes and joined together side-by-side at the project site by field sewing or by means of zipper closures attached to the upper and lower layers of the fabric. In no case will simple unattached butt joints between panels be allowed. Overlapping shall be allowed only if approved by the Buyer.

### 6.4
### Concrete Injection

A. Following placement of the fabric mats the specified concrete grout shall be injected between the top and bottom layers of the fabric through small slits cut in the upper layer of the fabric. The injection pipe shall be wrapped tightly at the point of injection with a strip of burlap, or similar material, during pumping to seal the joint between the injection pipe and the slit. After pumping, the burlap shall be pushed into the slit as the injection pipe is withdrawn in order to minimize spillage of the concrete slurry onto the surface of the revetment.

B. The sequence of concrete slurry injection shall be such as to insure complete filling of the revetment-forming fabric to average thickness indicated by the manufacturer for the designated style specified on the Design Drawings.

C. Foot traffic will not be permitted on the freshly pumped mat since such traffic will cause permanent indentations in the mat surface. Walk boards shall be used where necessary.

D. Excess concrete slurry which has been inadvertently spilled on the mat surface shall be cleaned up with a broom and shovel. The use of a water hose to remove spillage from the surface of a freshly pumped mat will not be permitted.

E. During concrete slurry injection, the mat thickness shall be measured by inserting a short piece of stiff wire through the crowns of the mats midway between the filter points at several locations from the crest to the toe of the slope. Any mat measurements less than 90% of the average of all thickness measurements shall be re-injected until the average thickness indicated for the style specified has been attained.

# TEMPORARY AND PERMANENT SEEDING (ILLINOIS)

## ISSUE SUMMARY

| Rev. | Purpose of Issue | Date | Sections Affected | Prepared By | Reviewed By | Approved By |
|---|---|---|---|---|---|---|
| A | Permit Application | 02/14/03 | ALL | Ronald Cook | Daniel Konik | Ronald Cook |
| | | | | | | |

TEMPORARY AND PERMANENT SEEDING (ILLINOIS)

TABLE OF CONTENTS

Notes:

(1) This Table of Contents will indicate the date of issue for the latest complete issue or revision issue of each section and any subsequent revision issue thereto.

(2) The numbering and subsequent Revisions to the Specification are in sequence with the previously issued Revision mark number.

# Temporary and Permanent Seeding (Illinois) – Technical Specification and Optional Features/Accessories

## 1.0 Scope of Work

The intent of this specification is to define the minimum requirements for material and work for establishing a vegetative cover by planting grass seed.

## 1.1 Purpose and Use

A. All graded areas, slopes, and ditches which will not be paved or otherwise surfaced shall be provided with permanent seeding.

B. Graded areas subject to erosion shall not remain unprotected for longer than 30 days. Temporary seeding shall be provided by the Supplier to protect graded areas from erosion where permanent protection is not scheduled to be installed for 2 to 12 months after grading is completed.

## 1.2 Method of Seed and Mulch Application

Seed may be spread by a conventional method of application such as broadcasting, grass drill, or cultipacker followed by an application of mulch or by a hydro seeding procedure consisting of spraying a slurry mixture of water, seed, mulch, fertilizer, and tackifier onto the prepared seedbed.

## 1.3 Work Included

A. Furnish all materials.

B. Subgrade preparation.

C. Seedbed preparation, including placing topsoil and the addition of lime and fertilizer.

D. Seeding using broadcast, grass drill, or the cultipacker method and mulching, or hydro seeding with a mixture that contains seed, mulch and a tackifier.

E. Installation of matting where specified for erosion control.

F. Protection.

G. Maintenance.

H. Repairing and reseeding.

## 2.0
## Codes and Standards

A. Standards, specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein. Methods, equipment and materials specified herein shall comply with the specified and applicable portions of the referenced documents, in addition to federal, state or local codes having jurisdiction.

B. References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the latest additions, addenda, amendments, supplements, etc., thereto, in effect as of the date of Contract for the Work.

C. Abbreviations listed indicate the form used to identify the reference documents in the Specification text.

### 2.1
### USDA - United States Department of Agriculture, Soil Conservation Service

A. USDA-SCS Soil Classification. Supplement to Soil Classification System (7th Approximation), SCS, USDA, Second Printing, March 1967.

### 2.2
### ASTM - American Society for Testing and Materials

A. C602 - Specification for Agricultural Liming Materials.

B. D977 - Specification for Emulsified Asphalt.

C. D2026 - Specification for Cutback Asphalt (Slow-Curing Type).

D. D2027 - Specification for Cutback Asphalt (Medium-Curing Type).

E. D2028 - Specification for Cutback Asphalt (Rapid-Curing Type).

F. D2397 - Specification for Cationic Emulsified Asphalt.

G. D5268 - Specification for Topsoil Used for Landscaping Purposes.

## 3.0
## Supplier's Drawings and Data Submittals

Supplier shall submit drawings and data not less than 30 days before material is to be delivered. Supplier's drawings and data shall be submitted via electronic medium in a format compatible for importing into the Buyer's information systems specified by the Buyer.

### 3.1
### Topsoil

A. Topsoil Material:

- A copy of laboratory reports on two representative samples of topsoil. Laboratory tests shall be performed for:
- Percent deleterious material.
- Total organic content.

- Silt and clay contents.
- Sand content.
- pH.

B. If it is anticipated that topsoil stripped from either the present site or the borrow area will be used for permanent seeding, if requested by the Buyer, the Supplier shall provide two 50-pound samples to the Buyer's Testing Service for analyses.

## 3.2 Seed

A. A certified copy of a statement signed by the seed supplier that each lot of seed has been tested by a recognized seed-testing laboratory within six months before the date of delivery to the plant site.

B. A certified statement signed by the seed supplier that the maximum percentage of noxious weeds in the seed mixture complies with state law.

## 3.3 Data on Materials as Applied

As applied data on the following items:

A. Seed mixture and seed application rate.

B. Limestone application rate.

C. Fertilizer type, trademark name (if any), chemical composition, and application rate.

D. Mulch.

E. Tackifier.

## 3.4 Binder Spray

Data on the binder spray (tackifier) to be used on straw mulch or with hydro seeding. If a synthetic binder (tackifier) will be used, the Supplier shall provide a complete set of Manufacturer's specifications at least 30 days prior to anticipated use. Manufacturer's specifications shall contain a description of the binder material, the recommended method of application, and the recommended application rate.

## 3.5 Matting

Catalog data on the proposed erosion control matting and Manufacturer's literature on the recommended method of installation.

## 3.6 Samples

If requested by the Buyer, submit a sample of each material designated by the Buyer for laboratory testing.

# 4.0 Products

## 4.1 Topsoil

A. Topsoil shall consist of sandy clay loam, sandy loam, loam, clay loam, silty clay loam or silt loam as defined by the SCS Soil Classification System.

B. Topsoil shall be relatively free from large roots, sticks, weeds, brush or stones larger than 1 inch in diameter or other litter and waste products. It shall have at least 90 percent passing the No. 10 sieve.

C. The topsoil shall meet requirements of ASTM D5268 as follows:

- It shall contain not less than 2 percent nor more than 20 percent total organic matter.
- It shall contain not less than 35 percent nor more than 70 percent silt and clay.
- It shall contain not less than 20 percent nor more than 60 percent sand.
- The pH of the sample shall not be lower than 5.0 nor higher than 7.5.
- The percent deleterious material (rock, gravel, slag, cinder, roots, sod) shall not exceed 5 percent.

## 4.2 Seed

### 4.2.1 General Requirements

A. Grasses, legumes, or cover crop seed of the type specified herein shall conform to the standards of the United States Department of Agriculture for seed certification.

B. Seed or seeding mixtures shall be furnished in sealed bags or containers in accordance with standard commercial practice.

C. Each bag or container shall be tagged or labeled in accordance with state law. As a minimum, the tag or label shall provide the following information:

- Name and address of the supplier.
- Common name of seed.
- Lot number.
- Net weight.
- Guaranteed percentage of germination.
- Percentage of weed seed and inert material content.

D. Seed which has become wet, moldy, or otherwise damaged in transit or storage will not be accepted.

E. All seed furnished shall be free of primary noxious weed seed such as Russian or Canadian Thistle, European Birdweed, Johnson Grass and Leafy Spurge. The maximum allowable percentage of noxious weed seed in the seed mixture shall comply with state law.

### 4.2.2
### Seed Storage

If it is necessary to store seeds after their arrival on the site, they shall be stored in an approved weatherproof building in such a manner as to protect the seeds from deterioration and to permit easy access for inspection. The Buyer's approval for the storage building and the method of storage shall not relieve the Supplier of responsibility for the quality and fitness of the seeds at the time of their use.

### 4.2.3
### Seed Mixture

A. Seed species, rate per acre, and other data relevant to permanent seeding are given in Table 1.

B. Seed species, rate per acre, and other data relevant to temporary seeding are given in Table 2.

## TABLE 1
## ACCEPTABLE MIXTURES FOR PERMANENT SEEDING

| Mixture | Seed Species (1) | Seeding Rate, Pure Live Seed for Conventional Seed Application (2) | | Suitable pH | Site Suitability | | | Acceptable Dates for Seeding |
|---|---|---|---|---|---|---|---|---|
| | | Lbs. per acre | Lbs. per 1,000 sq. ft. | | Sunny, Dry | Well Drained | Wet | |
| 1 | Smooth Bromegrass or Tall Fescue | 30 | 0.75 | 6.0-7.5 | X | X | X | 4-1 to 6-1<br>8-1 to 9-1 |
| | Alfalfa or Birdsfoot Trefoil | 10 | 0.25 | | | | | |
| 2 | Smooth Bromegrass or Tall Fescue | 30 | 0.75 | 6.0-8.0 | X | X | | 4-1 to 6-1<br>8-1 to 9-1 |
| | Crown Vetch | 20 | 0.50 | | | | | |
| 3 | Tall Fescue | 15 | 0.35 | 5.5-7.5 | | X | X | 4-1 to 6-1<br>8-1 to 9-1 |
| | Timothy or Redtop | 3 | 0.07 | | | | | |
| | Birdsfoot Trefoil | 15 | 0.35 | | | | | |
| 4 | Reed Canary Grass | 15 | 0.35 | 5.5-7.5 | X | X | | 4-1 to 6-1<br>8-1 to 9-1 |
| | Smooth Bromegrass or Tall Fescue | 15 | 0.35 | | | | | |
| | Ladino (optional) | 3 | 0.07 | | | | | |

Notes: (1) Mixtures as defined by SCS for Illinois.

(2) Triple the seeding rate shown in the table when hydro seeding.

**TABLE 2**
**ACCEPTABLE MIXTURES FOR TEMPORARY SEEDING**

| MIXTURE | SEED SPECIES | MAXIMUM WEED SEED (percentage) | SEEDING RATE PER ACRE | SUITABLE pH | PLANTING DEPTH | ACCEPTABLE DATES FOR SEEDING |
|---|---|---|---|---|---|---|
| 1 | Wheat | 0.50 | 150 lbs | 5.5 to 7.0 | 1" to 1 ½" | 3-1 to 5-15<br>7-1 to 10-15 |
| 2 | Cereal Rye | 0.50 | 150 lbs | 5.5 to7.0 | 1" to 1 ½" | 3-1 to 5-15<br>7-1 to 10-15 |
| 3 | Spring Oats | 0.50 | 100 lbs | 5.5 to 7.0 | 1" | 3-1 to 7-1 |
| 4 | Perennial Ryegrass | 0.50 | 40 lbs | 5.0 to 7.5 | 1/4" | 4-1 to 6-1<br>8-1 to 9-15 |

## 4.3
## Lime (Agricultural Ground Limestone)

Agricultural lime shall be flour grade meeting the requirements of ASTM C602.

## 4.4
## Fertilizer

A. Fertilizer shall be a standard brand commercial grade of inorganic fertilizer furnished in unopened containers. The material may be separate or in a mixture containing the percentage of total nitrogen, available phosphoric acid and water-soluble potash in the amounts specified. If materials are separate, the Buyer shall be present when the separate fertilizers are mixed in the field. The fertilizer shall be odor free.

B. Fertilizer shall be supplied in one of the following forms:
- A dry free-flowing granular fertilizer suitable for application by an agricultural fertilizer spreader.
- A soluble form that will permit complete suspension of insoluble particles in water, suitable for application by power sprayer.

C. The following information shall be shown on the fertilizer container or on a tag attached thereto:
- Name and address of manufacturer.
- Name, brand or trademark.
- Number of net pounds of ready-mixed material in the package.
- Chemical composition or analysis.
- Guarantee of analysis.

## 4.5
## Mulch

### 4.5.1
### Straw Mulch

A. Straw shall be stalks of small grain straw of wheat, rye, oats, barley or other approved grain. Straw shall be air dried and free of grain and noxious weed seed, other materials detrimental to plant life, and mold.

B. Straw shall be seasoned before bailing or loading. Straw mulch shall be suitable for spreading with mulch blower equipment.

C. Old dry straw which breaks up in the crimping process instead of bending, or straw in such advanced stages of decomposition that it will smother or retard the normal growth of grass, is not acceptable.

### 4.5.2
### Wood Cellulose Fiber Mulch

A. Wood cellulose fiber shall be partly digested wood fibers.

B. The material shall be dyed green.

C. The material shall not contain growth or organism inhibiting agents.

D. The material shall be air-dried with a minimum of 30 percent of the fibers 3.7 mm (0.145 inch) or longer.

### 4.5.3
### Binder Sprays

A. Cutback Asphalt shall be in accordance with ASTM D2026 (Slow-Curing Type), ASTM D2027 (Medium-Curing Type) or ASTM D2028 (Rapid-Curing Type).

B. Emulsified Asphalt shall be in accordance with D977 (Emulsified Asphalt) or D2397 (Cationic Emulsified Asphalt).

## 4.6
## Tackifier (Synthetic Binder)

A. Tackifier material shall be an acrylic copolymer or a polyvinyl acetate emulsion in a liquid form. The material may contain additives to enhance its ability to penetrate the soil.

B. The material shall be non-toxic, non-flammable, and biodegradable.

C. Approved Materials:

- Soil Seal Concentrate manufactured by Soil Seal Corp., 1111 W. Sixth St., Los Angeles, California 90017, telephone number 213-481-7185.
- Reinco Mulch Binder and Terra Tac manufactured by Rienco Mulch Binder Corp., 520 North Avenue, Plainfield, New Jersey 07060, telephone number 1-800-526-7687.
- Aerospray 70 Binder manufactured by American Cyanamid Company, Mobile, Alabama 36601, telephone number 205-476-5800.

## 4.7
## Inoculant

A. The inoculant for treating legume seeds shall be a pure culture of nitrogen fixing bacteria prepared specifically for the species and shall not be used later than the date indicated on the container. A mixing medium, as recommended by the manufacturer, shall be used to bond the inoculant to the seed.

B. All legumes not pre-inoculated shall be inoculated within 12 hours of seeding. If the seed was pre-inoculated more than 60 days prior to seeding then it must be reinoculated.

## 4.8
## Matting for Erosion Control

A. Matting for erosion control may be one of the following unless a specific matting is specified on the Design Drawings.

- Jute mat shall be cloth of a uniform plain weave of undyed and unbleached single jute yarn, 48 inches in width, plus or minus 1 inch and weighing an average of 1.2 pounds per linear yard of cloth with a tolerance of plus or minus 5 percent, with approximately 78 warp ends per width of cloth and 41 weft ends per linear yard of cloth. The yarn shall be of a loosely twisted construction having an average twist of not less than 1.6 turns per inch and shall not vary in thickness by more than one-half its nominal diameter.

- Excelsior mat shall be wood excelsior, 48 inches in width plus or minus 1 inch and weighing 0.8 pounds per square yard plus or minus 10 percent. The excelsior material shall be covered with a netting to facilitate handling and to increase strength.
- Glass fiber matting of bonded textile glass fibers with an average fiber diameter of 8 to 12 microns, 2 to 4 inch strands of fiber bonded with phenol formaldehyde resin. Mat shall be roll type, water permeable, minimum thickness 1/4 inch, maximum thickness 1/2 inch, density not less than 3 pounds per cubic foot.

B. Staples for anchoring soil stabilizing materials shall be No. 11 gauge wire or heavier. Their length shall be 6 to 10 inches. Ten inch long staples shall be used on loose, unstable soils.

## 5.0 Execution

### 5.1 Site Preparation

A. Prior to seeding, install all erosion control facilities specified on the Design Drawings. These include: diversions, berms, sediment control traps, silt fences and straw bale dikes.

B. Grade areas as specified on the Design Drawings. Gullied and uneven areas shall be smoothed before starting seedbed preparation.

### 5.2 Limestone for pH Adjustment

A. The Supplier shall apply limestone as required to raise the pH of the subsoil. Apply a minimum of 4 tons of limestone per acre for clayey soils, 3 tons of limestone per acre for sandy loam, and 2 tons of limestone per acre for loamy sand or silty soils.

B. Thoroughly work the limestone into the subsoil to a depth of 2 to 3 inches with a harrow or disk. The limestone may be applied prior to or concurrently with the fertilizer described.

### 5.3 Fertilizer

A. The Supplier shall apply a 12-12-12 fertilizer to the subsoil at a rate of 300 pounds per acre.

B. Work the fertilizer into the soil to a depth of 2 to 3 inches with a harrow, disk, or rake. On slopes, operate the disk or rake across the slope.

C. If hydro seeding is used, the fertilizer may be added to the hydroseed mixture.

### 5.4 Tilling of Subsoil

Prior to placing the topsoil, scarify the subsoil to a depth of 3 inches immediately prior to spreading topsoil to ensure bonding of the topsoil and the subsoil. Repeat scarification in areas where equipment used for hauling and spreading topsoil has compacted the subsoil.

## 5.5 Placing Topsoil

Note: topsoil does not have to be placed for temporary seeding. Topsoil must be placed prior to permanent seeding.

A. Place topsoil during dry weather on a dry, unfrozen subgrade. Topsoil shall not be spread if it is frozen or muddy.

B. Remove large pieces of organic matter and foreign non-organic material from topsoil while spreading. There shall be no large roots, branches or trash of any kind in the topsoil.

C. Spread the topsoil to provide a compacted thickness of not less than 4 inches.

D. Compact the topsoil with a roller not exerting more than 100 pounds per square inch. The topsoil must be loose enough for water infiltration and root penetration. The soil surface on slopes shall be roughened to catch seeds if they are to be broadcast.

## 5.6 Seeding (Conventional Method)

A. Tables 1 and 2 list acceptable seed mixtures that may be used for seeding. The Supplier shall select a mixture from the appropriate table and plant within the dates shown in that table for that mixture.

B. Apply seed uniformly at the rate shown in the appropriate table with a rangeland grass drill or cultipacker type seeder, or broadcast seed uniformly. The seeding methods and equipment shall be submitted to the Buyer for approval prior to beginning work.

C. All seeders shall be calibrated and adjusted to sow seeds at the proper rate. Equipment shall be operated to ensure a complete and even coverage. Do not seed areas greater than that which can be mulched on the same day.

D. Do not sow immediately following a rain, where the ground is too dry, during windy periods, or otherwise when conditions are not proper for seeding.

E. No seeds shall be sown until the purity test has been completed for the seeds to be used and the tests show that the seed meets the noxious weed seed requirements.

F. Within 12 hours, all seeded areas shall be rolled at right angles to the runoff with a cultipacker or approved roller to compact the seedbed and place the seed in contact with the soil. The optimum depth for planting shall be 1/4 inch. Rolling is not required if the seeding equipment is equipped with a roller that achieves the desired compaction or a grass drill has been used. Note: For temporary seeding planted without topsoil, the optimum planting depth is shown in Table 2.

## 5.7 Mulching (Conventional Method)

### 5.7.1 Straw Mulching

A. All seeded areas shall be mulched with straw mulch within 24 hours after seeding. The mulch may be hand or machine applied. The mulch shall be uniformly applied in a loose enough condition to permit air to circulate, but compact enough to reduce erosion. About 25 percent of the solid surface should show through the mulch. If baled mulch material is used, care shall be taken that the material is in a loosened condition and contains no lumps or knots of compacted material.

B. Straw mulch shall be applied at the rate of 2 tons per acre, or 75 to 100 (two bales) pounds per 1,000 square feet.

C. Straw mulch shall be anchored immediately after placement to minimize loss by wind or water. Straw mulch shall be anchored using a mulch anchoring tool or by spraying with a liquid binder.

### 5.7.2 Anchoring Mulch Using a Mulch Anchoring Tool

A. The mulch anchoring tool shall be designed to punch and anchor the mulch into the top 2 to 3 inches of soil at 6 inch intervals. As an alternative, a smooth disk set in a straight position may be used.

B. On slopes flatter than 3 horizontal to 1 vertical, mulch anchoring shall cross the contour of the land (across slopes). On slopes steeper than 3 horizontal to 1 vertical, the mulch shall be anchored by tracking a bulldozer with 1-1/2 inch track cleats up and down slope making grooves running across the slope.

### 5.7.3 Anchoring Using a Sprayed Liquid Binder

A. A sprayed liquid binder may be used in lieu of crimping to anchor the mulch. The binder may be sprayed into the mulch as it leaves the blower pipe or it may be applied as an over spray. If over sprayed, the binder spray should be heavier at the edges where wind catches the mulch, in valleys and at crests of banks. Binder shall be applied uniformly over the remainder of the area. Caution shall be used when spraying binder near areas occupied by construction personnel.

B. Binder Spray shall be applied at the following rates:

- Cutback asphalt - Rapid curing (RC-70, RC-250, and RC-800) or medium curing (MC-250 or MC-800). Apply 5 gallons per 1,000 square feet or 218 gallons per acre.
- Emulsified asphalt - (SS-1, CSS-l, CMS-2, MS, RS-l, RS-2, CRS-l, and CRS-2). Apply 5 gallons per 1,000 square feet or 218 gallons per acre.
- Synthetic binders - Synthetic binders such as Acrylic Dir (Agri-Tac), DCA-70, Petroset or Terra Tack may be used at rates recommended by the manufacturer to anchor mulch material.

### 5.7.4 Repairing and Reseeding

A. Areas not mulched and anchored within 24 hours after seeding shall be reseeded and mulched.

B. Areas not properly mulched, or damaged due to construction activities, shall be repaired, reseeded, and remulched.

## 5.8 Hydro Seeding

A. Hydro seeding consists of spraying a slurry mixture of water, seed, fertilizer, mulch, and a tackifier on a prepared seed bed.

B. The slurry mixture shall be mixed and applied using a hydraulic seeder. Hydraulic seeding equipment shall include a pump rated and operated at not less than 100 gallons per minute and 100 psi pressure. The tank shall have a mechanical agitator powerful enough to keep the slurry mixture in a uniform suspension in water.

C. Hydrated lime **shall not** be added to the slurry mixture.

D. The slurry mixture shall contain a maximum of 55 percent solids (125 pounds of solids per 100 gallons of water).

E. The seed mixture shall be as specified in Table 1 or Table 2 except that the weight of seed in the slurry mixture shall be a minimum of three times the weight of pure live seed per acre specified in the appropriate table for conventional seed application.

F. The slurry mixture shall contain a minimum of 1500 pounds of wood cellulose fiber mulch per acre or 2000 pounds of straw mulch per acre.

G. The amount of tackifier provided per acre shall be in accordance with Manufacturer's recommendations.

H. The slurry-mixture shall contain a minimum of 1000 pounds of grade 12-12-12 fertilizer per acre or the equivalent weight of chemicals if another grade is used.

I. The soil surface shall be moist when the slurry mixture is applied.

## 5.9 Laying and Securing Matting

### 5.9.1 Laying and Securing Jute Matting

A. Prepare the seed bed as specified and lime, fertilize, and seed, except that when using jute matting, apply approximately one-half of the seed after laying the mat.

B. Most drainage channels will require multiple widths of jute matting. The total width shall be as specified on the Design Drawings. Unroll matting starting at the upper end of the channel allowing a 4 inch overlap of mattings along center of channel.

C. Bury the top ends of jute matting in a narrow trench. Backfill the trench and tamp firmly to conform to channel cross-section. Secure the matting with a row of staples about 4 inches down slope from the trench. Spacing between staples shall be a maximum of 6 inches.

D. Staple the 4 inch overlap in the center of the channel using an 18 inch spacing between staples. Before stapling the outer edges of the matting, make sure the matting is smooth and in firm contact with the soil. Staples shall be placed 2 feet apart along the outer edge of matting.

E. Where one roll of jute matting ends and another begins, the end of the top strip shall overlap the upper end of the lower strip by 4 inches, shiplap fashion.

F. Where matting crosses erosion stops, reinforce with a double row of staples placed six (6) inches apart in a staggered pattern on either side of erosion stop. Likewise, overlaps joining the length of matting together and the discharge end of the matting liner should be similarly secured with 2 double rows of staples.

### 5.9.2 Laying and Securing Excelsior Matting

A. Provide the same seedbed preparation as specified for jute matting with the exception that all seeding must be completed before laying excelsior matting.

B. Bury the top ends of excelsior matting in a trench as described for jute matting. As the blankets are unrolled down slope, the matting must be on top with the wood fibers in contact with the soils. Butt snugly at the ends and sides before stapling.

C. Using two (2) foot spacing between staples, excelsior matting shall be secured with four rows for each strip, with one row along each edge and alternating parallel rows down the center. The stapling over erosion stops, entrance and discharge ends of matting and butted end joints shall be the same as described for jute matting.

### 5.10 Construction Completed after Acceptable Seeding Dates

When construction is completed between October 15 and March 1 prepare the seedbed, fertilize and mulch as specified. Apply seed for permanent seed sometime between December 1 and March 1 increasing the seeding rates shown in Table 1 by 50 percent.

## 6.0 Protection

Planted areas shall be protected from damage and erosion. The Supplier shall provide and erect temporary barriers and signs as necessary to prevent vehicles, equipment and foot traffic from damaging seeded areas.

## 7.0 Maintenance

The Supplier shall perform the following maintenance tasks:

A. Keep seedbed continually moist with light, frequent sprinklings several times a day to prevent seedlings from drying out.

B. Inspect periodically after planting to see that vegetative stands are adequately established. Immediately reseed areas which show bare spots larger than 2 feet by 2 feet after germination.

C. Check for erosion damage after storm events and repair damage. Reseed and mulch, if necessary.

D. Fertilize newly permanent seeded areas one year after seeding with 300 pounds per acre of a complete (N-P-K) 10-10-10 or equivalent turf type slow release fertilizer.

- Application rate per acre shall be:

  Nitrogen (N) - 120 pounds of actual nitrogen.

Phosphorus (P) - 120 pounds of $P_20_5$.

Potassium (K) - 120 pounds of $K_20$.

**Appendix E: Hennepin Power Station; West Ash Disposal Pond Maintenance Plan (2013)**

**DYNEGY MIDWEST GENERATION, LLC**

**Hennepin Power Station**
Hennepin, Illinois

Putnam County

**West Ash Disposal Pond**

**IDNR Permit No. (not permitted)**

**Dam ID No. (not permitted)**

# Maintenance Plan

September 2013

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## 1.0 GENERAL

The following operations and maintenance procedures are provided to maintain the structural integrity of the west ash storage surface impoundment at the Hennepin Power Station, which is unclassified and unpermitted, by the Illinois Department of Natural Resources, Office of Water Resources.

## 2.0 EMERGENCY OPERATIONS

### 2.1 Unusual Conditions

Any unusual condition discovered during major storm events or routine inspection, which may constitute an emergency, shall be handled as follows. Notice of any type of emergency involving the dikes or outfall shall be made to the Shift Leader on duty [(815) 339-9211]. The Shift Leader on duty shall notify the Station Manager, Ted Lindenbusch [home: (815) 875-2381], or, in his absence, the Environmental Coordinator, John P. Augspols [home: (815) 925-7488]. One of the above designated personnel shall notify the following city, county, state and federal regulatory authorities of the emergency condition.

- Division of Water Resources, Dam Safety Section, Dam Safety Engineers (217) 782-3862
- Illinois Emergency Management Agency, 24-hour service 1-(800) 782-7860
- Putnam County Sheriff/Hennepin Police Department (815) 925-7015
- Senior Director – Environmental Compliance, Dynegy Operating Company (618) 206-5912

### 2.2 Dewatering

The Station Manager or the Environmental Coordinator shall have the responsibility of determining how repairs shall be accomplished and whether dewatering of the disposal facility is necessary. Emergency dewatering shall be accomplished by portable pumps.

# 3.0 MAINTENANCE

## 3.1 Vegetation

Dikes shall be maintained to protect the structural integrity of the disposal facility. Damaged and barren areas shall be repaired as soon as appropriate after being discovered. Damaged areas shall be filled with topsoil. Limed, fertilized, and seeded with appropriate vegetation. Trees and shrubs observed during semiannual inspections shall be cut and removed from the dikes and discharge channel. This shall be done as frequently as is necessary to insure that no tree reaches a size where the root structure would require removal and filling. Woody vegetation, shrubs, and trees shall be removed during the early stages of growth before reaching a three-inch diameter.

Low growing vegetation, a prairie grass mixture that grows to a height of no more than six inches, shall be planted and maintained to facilitate inspections.

## 3.2 Discharge Structure

The discharge structure shall be inspected periodically for significant corrosion and deterioriation. Any defects discovered shall be promptly repaired.

## 3.3 Animal Damage and Repairs

Animal burrows discovered during inspections shall be promptly repaired by filling with grout.

## 3.4 Restriction of Unauthorized Vehicles

Facility approaches shall be posted with signs restricting unauthorized travel on the roadways and slopes.

## 3.5 Inspections/Remedial Measures

### 3.5.1 Weekly Inspections

Weekly inspections of the perimeter berms shall be conducted, looking for seepage and slumping, and unusual seepage at and/or blockage of the outfall structures in each cell. All findings shall be entered into the weekly inspection checklist, discussed in Section 4.0. Maintenance activities shall be initiated, if required. Refer to Section 4.0 for the recommended inspection checklist to be used for the weekly inspections.

### 3.5.2 Quarterly Inspections

Inspections shall be made quarterly by Station personnel to determine the general condition of the dam and embankments. During these inspections, embankment erosion, tree growth, and embankment seepage shall be monitored. Seepage shall be observed for change in quantity and coloration. Refer to Section 4.0, for the recommended inspection checklist to be used for documenting the quarterly inspections.

### 3.5.3 Annual Inspections

An annual inspection shall be made by a licensed professional engineer. This inspection shall follow the Illinois Department of natural Resources (IDNR) *Guidelines and Forms for Inspection of Illinois Dams*, and shall be followed by verbal and written reports by the consulting engineer. Based on the findings of the inspection, the Station Manager shall implement corrective action as required to promote dam safety. Procedures and methods for corrective action shall be performed in accordance with recommendations of the consulting engineer and as outlined above. Because the dam is not permitted by the IDNR, copies of the engineer's report, along with corrective action taken, will not be reported to the IDNR.

## 4.0 INSPECTION CHECKLISTS

The following Inspection checklists should be used during the weekly and quarterly inspections.

## WEEKLY DAM INSPECTION FORM

**Dam Location: Hennepin Power Station – West Ash Pond**
**Owner: Dynegy Midwest Generation, LLC, Havana Power Station**
**Permit No.: Not permitted** **Class of Dam: Not classified**
**Type of Dam: Homogeneous earth dam**
**Type of Spillway: Drop structure**

**Date Inspected:** ________________________
**Weather Conditions:** ____________________________________________________
**Pool Elevation:** _________________________

**Inspection Personnel:**

_______________________________________ __________________________
**Name / Title** **Signature**

| Inspection Item | Conditions | Location of Problem and Recommended Remedial Measures and Implementation Schedule |
|---|---|---|
| Vertical and Horizontal Alignment of Crest | | |
| Unusual Movement or Cracking at or Beyond Toe | | |
| Seepage | | |
| Vegetative Cover | | |
| Embankment Erosion | | |
| Structural Cracking | | |
| Outfall Structures | | |
| Other | | |

## QUARTERLY DAM INSPECTION FORM

**Dam Location: Hennepin Power Station – West Ash Pond**

**Owner: Dynegy Midwest Generation, LLC, Hennepin Power Station**

**Permit No.: Not permitted** **Class of Dam: Not classified**

**Type of Dam: Homogeneous earth dam**

**Type of Spillway: Drop structure**

**Date Inspected: __________________**

**Weather Conditions: __________________________________________________**

**Pool Elevation: __________________________**

**Inspection Personnel:**

________________________________________

**Name / Title** **Signature**

| Inspection Item | Conditions | Location of Problem and Recommended Remedial Measures and Implementation Schedule |
|---|---|---|
| Vertical and Horizontal Alignment of Crest | Good condition, with no significant issues | |
| Downstream Fill Slopes | Good condition, with no significant issues | |
| Upstream Fill Slopes | Good condition, with no significant issues | |
| Unusual Movement or Cracking at or Beyond Toe | Good condition, with no significant issues | |
| Seepage (Condition/Color) | Good condition, with no significant issues | |
| Vegetative Cover (Tree growth) | Good condition, with no significant issues | |
| Animal Damage | Good condition, with no significant issues | |
| Embankment Erosion | Good condition, with no significant issues | |
| Water Passages | Good condition, with no significant issues | |
| Structural Cracking | Good condition, with no significant issues | |
| Outfall Structures | Good condition | |
| Other | | |

AECOM

## Appendix F: Hennepin Power Station; Old East Ash Disposal Pond Maintenance Plan (2013)

**DYNEGY MIDWEST GENERATION, LLC**

**Hennepin Power Station**
Hennepin, Illinois

Putnam County

**Old East Ash Disposal Pond**

**IDNR Permit No. (not permitted)**

**Dam ID No. (not permitted)**

# Maintenance Plan

September 2013

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# 1.0 GENERAL

The following operations and maintenance procedures are provided to maintain the structural integrity of the old east ash storage surface impoundment at the Hennepin Power Station, which is unclassified and unpermitted, by the Illinois Department of Natural Resources, Office of Water Resources.

This is primarily the @ 0.5 mile significant berm system that extends along the Illinois River. The old east ash pond system consists of the inactive cells # 2 and # 4. As a result of the May 2011 USEPA dam assessment, a dam safety permit was submitted to IDNR in May 2013, to address major modifications to this significant berm. These major modifications include extensive tree removal and resloping. Resloping is required to improve slope stability and allow safe access to slope, for long-term mowing and maintenance.

# 2.0 EMERGENCY OPERATIONS

## 2.1 Unusual Conditions

Any unusual condition discovered during major storm events or routine inspection, which may constitute an emergency, shall be handled as follows. Notice of any type of emergency involving the dikes or outfall shall be made to the Shift Leader on duty [(815) 339-9211]. The Shift Leader on duty shall notify the Station Manager, Ted Lindenbusch [home: (815) 875-2381], or, in his absence, the Environmental Coordinator, John P. Augspols [home: (815) 925-7488]. One of the above designated personnel shall notify the following city, county, state and federal regulatory authorities of the emergency condition.

- Division of Water Resources, Dam Safety Section, Dam Safety Engineers (217) 782-3862
- Illinois Emergency Management Agency, 24-hour service 1-(800) 782-7860
- Putnam County Sheriff/Hennepin Police Department (815) 925-7015
- Senior Director – Environmental Compliance, Dynegy Operating Company (618) 206-5912

## 2.2 Dewatering

Not applicable.

# 3.0 MAINTENANCE

## 3.1 Vegetation

Dikes shall be maintained to protect the structural integrity of the disposal facility. Damaged and barren areas shall be repaired as soon as appropriate after being discovered. Damaged areas shall be filled with topsoil. Limed, fertilized, and seeded with appropriate vegetation. Trees and shrubs observed during semiannual inspections shall be cut and removed from the dikes and discharge channel. This shall be done as frequently as is necessary to insure that no tree reaches a size where the root structure would require removal and filling. Woody vegetation, shrubs, and trees shall be removed during the early stages of growth before reaching a three-inch diameter.

Low growing vegetation, a prairie grass mixture that grows to a height of no more than six inches, shall be planted and maintained to facilitate inspections.

## 3.2 Discharge Structure

Not applicable.

## 3.3 Animal Damage and Repairs

Animal burrows discovered during inspections shall be promptly repaired by filling with grout.

## 3.4 Restriction of Unauthorized Vehicles

Facility approaches shall be posted with signs restricting unauthorized travel on the roadways and slopes.

## 3.5 Inspections/Remedial Measures

### 3.5.1 Weekly Inspections

Weekly inspections of the perimeter berms shall be conducted, looking for seepage and slumping. All findings shall be entered into the weekly inspection checklist, discussed in Section 4.0. Maintenance activities shall be initiated, if required. Refer to Section 4.0 for the recommended inspection checklist to be used for the weekly inspections.

### 3.5.2 Quarterly Inspections

Inspections shall be made quarterly by Station personnel to determine the general condition of the dam and embankments. During these inspections, embankment erosion, tree growth, and embankment seepage shall be monitored. Seepage shall be observed for change in quantity and coloration. Refer to Section 4.0, for the recommended inspection checklist to be used for documenting the quarterly inspections.

### 3.5.3 Annual Inspections

An annual inspection shall be made by a licensed professional engineer. This inspection shall follow the Illinois Department of natural Resources (IDNR) *Guidelines and Forms for Inspection of Illinois Dams*, and shall be followed by verbal and written reports by the consulting engineer. Based on the findings of the inspection, the Station Manager shall implement corrective action as required to promote dam safety. Procedures and methods for corrective action shall be performed in accordance with recommendations of the consulting engineer and as outlined above. Because the dam is not permitted by the IDNR, copies of the engineer's report, along with corrective action taken, will not be reported to the IDNR.

## 4.0 INSPECTION CHECKLISTS

The following Inspection checklists should be used during the weekly and quarterly inspections.

## WEEKLY DAM INSPECTION FORM

**Dam Location: Hennepin Power Station – Old East Ash Pond**
**Owner: Dynegy Midwest Generation, LLC, Havana Power Station**
**Permit No.: Not permitted** **Class of Dam: Not classified**
**Type of Dam: Homogeneous earth dam**
**Type of Spillway: N/A**

**Date Inspected:** ______________________
**Weather Conditions:** ______________________________________________
**Pool Elevation:** ______________________

**Inspection Personnel:**

__________________________________ __________________________
**Name / Title** **Signature**

| Inspection Item | Conditions | Location of Problem and Recommended Remedial Measures and Implementation Schedule |
|---|---|---|
| Vertical and Horizontal Alignment of Crest | | |
| Unusual Movement or Cracking at or Beyond Toe | | |
| Seepage | | |
| Vegetative Cover | | |
| Embankment Erosion | | |
| Structural Cracking | | |
| Outfall Structures | | |
| Other | | |

## QUARTERLY DAM INSPECTION FORM

**Dam Location: Hennepin Power Station – Old East Ash Pond**

**Owner: Dynegy Midwest Generation, LLC, Hennepin Power Station**

**Permit No.: Not permitted** **Class of Dam: Not classified**

**Type of Dam: Homogeneous earth dam**

**Type of Spillway: Not applicable**

**Date Inspected: ________________**
**Weather Conditions: ________________________________________________**
**Pool Elevation: ______________________**

**Inspection Personnel:**

**_________________________________**
**Name / Title** **Signature**

| Inspection Item | Conditions | Location of Problem and Recommended Remedial Measures and Implementation Schedule |
|---|---|---|
| Vertical and Horizontal Alignment of Crest | Good condition, with no significant issues | |
| Downstream Fill Slopes | Good condition, with no significant issues | |
| Upstream Fill Slopes | Good condition, with no significant issues | |
| Unusual Movement or Cracking at or Beyond Toe | Good condition, with no significant issues | |
| Seepage (Condition/Color) | Good condition, with no significant issues | |
| Vegetative Cover (Tree growth) | Good condition, with no significant issues | |
| Animal Damage | Good condition, with no significant issues | |
| Embankment Erosion | Good condition, with no significant issues | |
| Water Passages | Good condition, with no significant issues | |
| Structural Cracking | Good condition, with no significant issues | |
| Outfall Structures | Good condition | |
| Other | | |

**Appendix G: Hennepin Power Station; East Ash Disposal Pond Maintenance Plan (2014)**

**DYNEGY MIDWEST GENERATION, LLC**

**Hennepin Power Station**
Hennepin, Illinois

Putnam County

**East Ash Disposal Pond**

**Small Class III Dam**

**IDNR Permit No. DS2011079**

**Dam ID No. IL50363**

# Maintenance Plan

Revised – August 2014

# TABLE OF CONTENTS

## 1.0 GENERAL

The following operations and maintenance procedures are provided to maintain the structural integrity of the east ash storage surface impoundment at the Hennepin Power Station, which is classified as a small Class III dam by the Illinois Department of Natural Resources, Office of Water Resources. The primary pond's maximum normal poll elevation will be 489.5 msl with a dam crest at elevation 494.0 msl. The secondary pond's maximum normal pool elevation will be 480.5 with a dam crest at 494.0 msl.

## 2.0 EMERGENCY OPERATIONS

### 2.1 Unusual Conditions

Any unusual condition discovered during major storm events or routine inspection, which may constitute an emergency, shall be handled as follows. Notice of any type of emergency involving the dikes or outfall shall be made to the Shift Leader on duty [(815) 339-9211]. The Shift Leader on duty shall notify the Managing Director, Byron Veech [cell: (309) 543-8714], or, in his absence, the Environmental Coordinator, John P. Augspols [home: (815) 925-7488]. One of the above designated personnel shall notify the following city, county, state and federal regulatory authorities of the emergency condition.

- Division of Water Resources, Dam Safety Section, Dam Safety Engineers (217) 782-3862
- Illinois Emergency Management Agency, 24-hour service 1-(800) 782-7860
- Putnam County Sheriff/Hennepin Police Department (815) 925-7015
- Senior Director – Environmental Compliance, Dynegy Operating Company (618) 343-7761

### 2.2 Dewatering

The Station Manager or the Environmental Coordinator shall have the responsibility of determining how repairs shall be accomplished and whether dewatering of the disposal facility is necessary. Dewatering shall be accomplished by manually removing the concrete beams from the primary and/or secondary pond structures until the desired water level is reached.

# 3.0 MAINTENANCE

## 3.1 Vegetation

Dikes shall be maintained to protect the structural integrity of the disposal facility. Damaged and barren areas shall be repaired as soon as appropriate after being discovered. Damaged areas shall be filled with topsoil. Limed, fertilized, and seeded with appropriate vegetation. Trees and shrubs observed during periodic inspections shall be cut and removed from the dikes and discharge channel. This shall be done as frequently as is necessary to insure that no tree reaches a size where the root structure would require removal and filling. Woody vegetation, shrubs, and trees shall be removed during the early stages of growth before reaching a three-inch diameter.

Low growing vegetation shall be planted and maintained to facilitate inspections.

## 3.2 Discharge Structure

The discharge structure shall be inspected periodically for significant corrosion, spalling, and cracking. Any defects discovered shall be promptly repaired.

## 3.3 Animal Damage and Repairs

Animal burrows discovered during inspections shall be promptly repaired by filling with grout.

## 3.4 Restriction of Unauthorized Vehicles

Facility approaches shall be posted with signs restricting unauthorized travel on the roadways and slopes.

## 3.5 Inspections/Remedial Measures

### 3.5.1 Weekly Inspections

Weekly inspections of the perimeter berms shall be conducted, looking for seepage and slumping, and unusual seepage at and/or blockage of the outfall structures in each cell. All findings shall be entered into the weekly inspection checklist, discussed in Section 4.0. Maintenance activities shall be initiated, if required. Refer to Section 4.0 for the recommended inspection checklist to be used for the weekly inspections.

3.5.2 Quarterly Inspections

Inspections shall be made quarterly by Station personnel to determine the general condition of the dam and embankments. During these inspections, embankment erosion, tree growth, and embankment seepage shall be monitored. Seepage shall be observed for change in quantity and coloration. Refer to Section 4.0, for the recommended inspection checklist to be used for documenting the quarterly inspections.

3.5.3 Five-Year Inspections

Every five years, an inspection shall be made by a licensed professional engineer. This inspection shall follow the Illinois Department of natural Resources (IDNR) *Guidelines and Forms for Inspection of Illinois Dams*, and shall be followed by verbal and written reports by the consulting engineer. Based on the findings of the inspection, the Station Manager shall implement corrective action as required to promote dam safety. Procedures and methods for corrective action shall be performed in accordance with recommendations of the consulting engineer and as outlined above. Copies of the engineer's report, along with corrective actin taken, shall be reported to the IDNR.

3.6 Annual Statement

An annual statement on forms furnished by IDNR, certifying compliance with this maintenance plan, shall be submitted to IDNR.

## 4.0 INSPECTION CHECKLISTS

The following Inspection checklists should be used during the weekly and quarterly inspections.

**WEEKLY DAM INSPECTION FORM**

**Dam Location: Hennepin Power Station – East Ash Pond**
**Owner: Dynegy Midwest Generation, LLC, Havana Power Station**
**Permit No.:DS2011079** **Class of Dam: III**
**Type of Dam: Homogeneous earth dam, with clay and geosynthetic / clay liner**
**Type of Spillway: Drop structure and stop logs**

**Date Inspected: ____________________**
**Weather Conditions: ____________________________________________**
**Pool Elevation: ____________________**

**Inspection Personnel:**

______________________________ ____________________
**Name / Title** **Signature**

| Inspection Item | Conditions | Location of Problem and Recommended Remedial Measures and Implementation Schedule |
|---|---|---|
| Vertical and Horizontal Alignment of Crest | | |
| Unusual Movement or Cracking at or Beyond Toe | | |
| Seepage | | |
| Vegetative Cover | | |
| Embankment Erosion | | |
| Structural Cracking | | |
| Outfall Structures | | |
| Other | | |

## QUARTERLY DAM INSPECTION FORM

**Dam Location:** **Hennepin Power Station – East Ash Pond**
**Owner:** **Dynegy Midwest Generation, LLC, Hennepin Power Station**
**Permit No.:DS2011079** **Class of Dam: III**
**Type of Dam:** **Homogeneous earth dam, with clay and geosynthetic / clay liner**
**Type of Spillway:** **Drop structure and stop logs**

**Date Inspected:** ________________
**Weather Conditions:** ______________________________________________
**Pool Elevation:** ______________________

**Inspection Personnel:**

______________________________
**Name / Title** **Signature**

| Inspection Item | Conditions | Location of Problem and Recommended Remedial Measures and Implementation Schedule |
|---|---|---|
| Vertical and Horizontal Alignment of Crest | Good condition, with no significant issues | |
| Downstream Fill Slopes | Good condition, with no significant issues | |
| Upstream Fill Slopes | Good condition, with no significant issues | |
| Unusual Movement or Cracking at or Beyond Toe | Good condition, with no significant issues | |
| Seepage (Condition/Color) | Good condition, with no significant issues | |
| Vegetative Cover (Tree growth) | Good condition, with no significant issues | |
| Animal Damage | Good condition, with no significant issues | |
| Embankment Erosion | Good condition, with no significant issues | |
| Water Passages | Good condition, with no significant issues | |
| Structural Cracking | Good condition, with no significant issues | |
| Outfall Structures | Good condition | |
| Other | | |

# ATTACHMENT C

**Hennepin Power Plant East Ash Pond's Chemical Constituents**

In accordance with 35 I.A.C. 845.230(d)(2)(C), DMG is submitting available/existing analyses of "the chemical constituents of all waste streams, chemical additives and sorbent materials entering or contained in" the CCR impoundment, East Ash Pond.

A list of the chemical constituents' analyses contained in the CCR surface impoundment can be found in Appendix A. As determined through antidegradation studies, this list contains chemical constituents found in the surface free liquid and the subsurface free liquids. DMG is also including a list of chemical additives, sorbent materials and waste streams that were submitted in the facility's NPDES permit applications to IEPA within the past ten years at a minimum and/or listed in the current NPDES permit (IL0001554) in Appendix B.

## Appendix A: Chemical Constituents Contained in the East Ash Pond

| Pollutant | Units | Surface Free Liquids Average Concentration | Subsurface Free Liquids Average Concentration |
|---|---|---|---|
| Ammonia | mg/L | 0.200 | 1.495 |
| Arsenic | mg/L | 0.002 | 0.002 |
| Arsenic, Dissolved | mg/L | 0.002 | 0.002 |
| Barium | mg/L | 0.145 | 0.540 |
| Boron | mg/L | 0.675 | 2.275 |
| Cadmium | mg/L | 0.001 | 0.000 |
| Cadmium, Dissolved | mg/L | 0.001 | 0.000 |
| Chloride | mg/L | 95.500 | 76.000 |
| Chromium | mg/L | 0.005 | 0.037 |
| Chromium (hexavalent) | mg/L | 0.006 | 0.036 |
| Chromium, Dissolved | mg/L | 0.005 | 0.040 |
| Chromium, Hexavalent, Dissolved | mg/L | 0.005 | 0.038 |
| Chromium, Trivalent, Dissolved | mg/L | 0.010 | 0.010 |
| Copper | mg/L | 0.004 | 0.003 |
| Copper, Dissolved | mg/L | 0.003 | 0.002 |
| Cyanide | mg/L | 0.004 | 0.005 |
| Fluoride | mg/L | 0.180 | 0.890 |
| Fluoride, Dissolved | mg/L | 0.185 | 0.903 |
| Iron | mg/L | 0.097 | 0.234 |
| Iron, Dissolved | mg/L | 0.065 | 0.078 |
| Lead | mg/L | 0.000 | 0.000 |
| Lead, Dissolved | mg/L | 0.000 | 0.000 |
| Magnesium | mg/L | 29.500 | 0.280 |
| Manganese | mg/L | 0.020 | 0.002 |
| Mercury | mg/L | 0.000 | 0.000 |
| Mercury, Dissolved Total | mg/L | 0.000 | 0.000 |
| Nickel | mg/L | 0.007 | 0.003 |
| Nickel, Dissolved | mg/L | 0.007 | 0.003 |
| Nitrate - Nitrite | mg/L | 4.050 | 1.880 |
| Nitrogen, Kjeldahl | mg/L | 0.950 | 1.378 |
| Nitrogen, Total | mg/L | 5.000 | 3.250 |
| Oil and Grease | mg/L | 4.800 | 4.800 |
| pH | SU | 8.985 | 12.110 |
| Phenols | mg/L | 0.005 | 0.005 |
| Selenium | mg/L | 0.004 | 0.056 |
| Silver | mg/L | 0.001 | 0.001 |
| Sulfate | mg/L | 122.500 | 195.000 |
| TDS | mg/L | 510.000 | 917.500 |
| TSS | mg/L | 15.500 | 6.875 |
| Zinc | mg/L | 0.007 | 0.020 |
| Zinc, Dissolved | mg/L | 0.012 | 0.020 |

**Appendix B: List of Chemical Additives, Waste Streams and Sorbent Materials**

| Chemical Additives |
|---|
| Caustic (sodium hydroxide) |
| Sulfur Pellets |
| KLARAID IC1173 |
| SPECTRUS NX1106 |
| Active Carbon |
| Calcium Bromide |
| Carbon Dioxide |
| Cement Kiln Dust |
| Copper Sulfate |
| Nalco 8187 |
| Fluorescent Dye |
| Barley Straw |
| Nalco Dust Foam Plus |

| Waste Streams and Sorbent Materials |
|---|
| Units 1&2 Bottom and Fly Ash |
| Units 1&2 Ash Hopper Overflows |
| Bldg. Floor Drains & Sump Discharges |
| Reverse Osmosis Unit Concentrate and Reject Wastewater |
| U1&2 Nonchemical Metal Cleaning |
| U1&2 Fly Ash Air Separator Overflows |
| U1&2 Ash Hopper Tank Overflows |
| U1&2 Boiler Drum Tank Drainage |
| U1&2 Ash Line Low Pt. Drainage |
| Coal Breaker Building Drain Sump |
| Crib House Sump |
| Crib House Station Sump |
| Deep Well Acid Cleaning Rinse water |
| Coal Pile Runoff |
| Illinois River Dredge Spoils |
| Mercury Sorbent Residues |
| Boiler Chemical Cleaning Waste |
| Fly ash grit blasting material |
| Units 1 and 2 Non-Chemical Metal Cleaning Wash water |
| Power Block Building Floor Drains and Sump Discharges |
| Boiler Drum Chemical Tank Drainage |
| Bag House Diatomaceous Earth Solids |
| Landfill Leachate and Stormwater |
| Stormwater Runoff |
| Truck Wash Water and Pug Mill Mixer Wash Water |
| Coal-Pile Runoff and Mechanical and Wet Dredge Spoils |

DYNEGY

# Safety Data Sheet

## Section 1
## Identification of the Substance and of the Supplier

### 1.1 Product Identifier

| | |
|---|---|
| **Product Name/Identification:** | ASTM Class C Fly Ash |
| **Synonyms:** | Coal Fly Ash, Pozzolan |
| **Formula:** | UVCB Substance |

### 1.2 Relevant Identified Uses of the Substance or Mixture and Uses Advices Against

| | |
|---|---|
| **Relevant Identified Uses:** | Component of wallboard, concrete, roofing material, bricks, cement kiln feed. |
| **Uses Advised Against:** | None known. |

### 1.3 Details of the Supplier of the SDS

| | |
|---|---|
| **Manufacturer/Supplier:** | Dynegy, Inc. |
| **Street Address:** | 601 Travis Street, Suite 1400 |
| **City, State and Zip Code:** | Houston, TX 77002 |
| **Customer Service Telephone:** | 800-633-4704 |

## Section 2
## Hazards Identification

### 2.1 Classification of the Substance

**GHS Classification(s) according to OSHA Hazard Communication Standard (29 CFR 1910.1200):**

- Eye Irritant, Category 2A
- STOT-SE, Category 3 (Respiratory Irritation)
- Carcinogen, Category 1A
- STOT-RE, Category 1 (Lungs)
- Toxic to Reproduction, Category 2

### 2.2 Label Elements

| ***Labelling according to 29 CFR 1910.1200 Appendices A, B and C**** | |
|---|---|
| ***Hazard Pictogram(s):*** |  |
| ***Signal word:*** | **DANGER** |
| ***Hazard Statement(s):*** | *Causes serious eye irritation.*<br>*May cause damage to lungs after repeated/prolonged exposure via inhalation.*<br>*May cause respiratory irritation.*<br>*May cause cancer of the lung.*<br>*Suspected of damaging fertility or the unborn child.* |
| ***Precautionary Statement(s):*** | *Obtain special instructions before use.*<br>*Do not handle until all safety precautions have been read and understood.*<br>*Avoid breathing dust.*<br>*Wear protective gloves/protective clothing/eye protection/face protection.*<br>*Wash thoroughly after handling.*<br>*Do not eat drink or smoke when using this product.*<br>*Use outdoors or in a well-ventilated area.*<br>*If exposed or concerned: Get medical advice/attention.*<br>*Store in a secure area.*<br>*Dispose of product in accordance with local/national regulations.* |

** Fly ash and other coal combustion products (CCPs) are UVCB substances (unknown or variable composition or biological). Various CCPs, noted as ashes/ash residuals; Ashes, residues, bottom; Bottom ash; Bottom ash residues; Waste solids, ashes under TSCA are defined as: "The residuum from the burning of a combination of carbonaceous materials. The following elements may be present as oxides: aluminum, calcium, iron, magnesium, nickel, phosphorus, potassium, silicon, sulfur, titanium, and vanadium." Ashes including fly ash and fluidized bed combustion ash are identified by CAS number 68131-74-8. The exact composition of the ash is dependent on the fuel source and flue additives composed of many constituents. The* *classification of the final substance is dependent on the presence of specific identified oxides as well as other trace elements.*

## 2.3 Other Hazards

**Listed Carcinogens:**

**-Respirable Crystalline Silica**

**IARC:** [Yes] **NTP:** [Yes] **OSHA:** [Yes] **Other:** **(ACGIH)** [Yes]

# Section 3
# Composition/Information on Ingredients

| ***Substance*** | ***CAS No.*** | ***Percentage (%)*** | ***GHS Classification*** |
|---|---|---|---|
| *Crystalline Silica* | *14808-60-7* | *30 - 60%* | *Repeat Dose STOT, Category 1*<br>*Carcinogen, Category 1A* |
| *Silica, crystalline respirable (RCS)* | *14808-60-7* | ***See Footnote 1*** | *Repeat Dose STOT, Category 1*<br>*Carcinogen, Category 1A* |
| *Aluminosilicates* | *71243-67-9*<br>*1327-36-2* | *30 - 60%* | *Single Exposure STOT, Category 3* |
| *Iron oxide* | *1309-37-1* | *1 - 10%* | *Not Classified* |
| *Calcium oxide (CaO)* | *1305-78-8* | *20 - 30%* | *Skin Irritant, Category 2*<br>*Eye Irritant, Category 1*<br>*Single Exposure STOT, Category 3* |
| *Magnesium oxide* | *1309-48-4* | *2 - 10%* | *Not Classified* |
| *Phosphorus pentoxide ($P_2O_5$)* | *1314-56-3* | *≤2%* | *Skin Irritant, Category 2*<br>*Eye Irritant, Category 2B* |
| *Sodium oxide* | *1313-59-3* | *1-8%* | *Not Classified* |
| *Potassium oxide ($K_2O$)* | *12136-45-7* | *≤1%* | *Skin Irritant, Category 2*<br>*Eye Irritant, Category 2B* |
| *Titanium dioxide ($TiO_2$)* | *13463-67-7* | *<3%* | *Not Classified* |
| *Bromide salt (calcium)* | *7789-41-5* | *See Footnote 2* | *Toxic to Reproduction, Category 2* |

***Footnote 1:*** *The percentage of respirable crystalline silica has not been determined. Therefore, a GHS classification of Carcinogen, Category 1A has been assigned.*

***Footnote 2:*** *Analytical data are not available to demonstrate that the concentration of bromide salt is <0.1%; therefore, a GHS classification of Toxic to Reproduction, Category 2 has been assigned.*

# Section 4
# First Aid Measures

## 4.1 Description of First Aid Measures

| | |
|---|---|
| **Inhalation:** | If product is inhaled and irritation of the nose or coughing occurs, remove person to fresh air. Get medical advice/attention if respiratory symptoms persist. |
| **Skin Contact:** | If skin exposure occurs, wash with soap and water. |
| **Eye Contact:** | If product gets into the eye, rinse copiously with water for several minutes. Remove contact lenses, if present and easy to do. Seek medical attention/advice if irritation occurs or persists. |
| **Ingestion:** | No specific first aid measures are required. |

## 4.2 Most Important Health Effects, Both Acute and Delayed

**Acute Effects:** Direct exposure may cause respiratory irritation, eye irritation and skin irritation. The product dust can dry and irritate the skin and cause dermatitis and can irritate eyes and skin through mechanical abrasion.

**Chronic Effects:** Chronic exposure may cause lung damage from repeated exposure. Prolonged inhalation of respirable crystalline silica above certain concentrations may cause lung diseases, including silicosis and lung cancer. Repeated exposure to dusts containing inorganic bromide salts may affect fertility and/or result in effects to the unborn child.

## 4.3 Indication of Any Immediate Medical Attention and Special Treatment Needed

Seek first aid or call a doctor or Poison Control Center if contact with eyes occurs and irritation remains after rinsing. Get medical advice if inhalation occurs and respiratory symptoms persist.

# Section 5
# Firefighting Measures

## 5.1 Extinguishing Media

| | |
|---|---|
| **Suitable Extinguishing Media:** | Product is not flammable. Use extinguishing media appropriate for surrounding fire. |
| **Unsuitable Extinguishing Media:** | Not applicable, the product is not flammable. |

## 5.2 Special Hazards Arising from the Substance or Mixture

| | |
|---|---|
| **Hazardous Combustion Products:** | None known. |

## 5.3 Advice for Firefighters

| | |
|---|---|
| **Special Protective Equipment and Precautions for Firefighters:** | As with any fire, wear self-contained breathing apparatus (NIOSH approved or equivalent) and full protective gear. |

# Section 6
# Accidental Release Measures

## 6.1 Personal Precautions, Protective Equipment and Emergency Procedures

| | |
|---|---|
| **Personal precautions/Protective Equipment:** | See Section 8.2.2 Individual Protective Measures. For concentrations exceeding Occupational Exposure Levels (OELs), use a self-contained breathing apparatus (SCBA). |
| **Emergency procedures:** | Use scooping, water spraying/flushing/misting or ventilated vacuum cleaning systems to clean up spills. Do not use pressurized air. |

## 6.2 Environmental Precautions

| | |
|---|---|
| **Environmental precautions:** | Prevent contamination of drains or waterways and dispose according to local and national regulations. |

## 6.3 Methods and Material for Containment and Cleaning Up

| | |
|---|---|
| **Methods and materials for containment and cleaning up:** | Do not use brooms or compressed air to clean surfaces. Use dust collection vacuum and extraction systems.<br>Large spills of dry product should be removed by a vacuum system. Dampened material should be removed by mechanical means and recycled or disposed of according to local and national regulations. |

See Sections 8 and 13 for additional information on exposure controls and disposal.

# Section 7
# Handling and Storage

## 7.1 Precautions for Safe Handling

Practice good housekeeping. Use adequate exhaust ventilation, dust collection and/or water mist to maintain airborne dust concentrations below permissible exposure limits (note: respirable crystalline silica dust may be in the air without a visible dust cloud).

Do not permit dust to collect on walls, floors, sills, ledges, machinery, or equipment. Maintain and test ventilation and dust collection equipment. In cases of insufficient ventilation, wear a NIOSH approved respirator for silica dust when handling or disposing dust from this product. Avoid contact with skin and eyes. Wash or vacuum clothing that has become dusty. Avoid eating, smoking, or drinking while handling the material.

## 7.2 Conditions for Safe Storage, Including any Incompatibilities

Minimize dust produced during loading and unloading.

# Section 8
# Exposure Controls/Personal Protection

## 8.1 Control Parameters

| OCCUPATIONAL EXPOSURE LIMITS | | | | | |
|---|---|---|---|---|---|
| **SUBSTANCE** | | **OSHA PEL TWA (mg/m$^3$)** | **NIOSH REL TWA (mg/m$^3$)** | **ACGIH TLV TWA (mg/m$^3$)** | **CA - OSHA PEL (mg/m$^3$)** |
| **Calcium oxide** | | 5 | 2 | 2 | 2 |
| **Particulates Not Otherwise Regulated** | Total | 15 | 15 | 10 | 10 |
| | Respirable | 5 | 5 | 3 | 5 |
| **Respirable Crystalline Silica** | Respirable Crystalline Silica | 0.05 | 0.05 | 0.025 | 0.05 |
| **Titanium dioxide** | Total | 15 | 2.4 (fine)<br>0.3 (ultrafine) | 10 | 10 |
| **Manganese dioxide (as manganese compounds)** | Total | 5 (Ceiling) | 1<br>3 (STEL) | 0.1 | 0.2 |
| | Respirable | - | - | 0.02 | - |

## 8.2 Exposure Controls

### 8.2.1 Engineering Controls

Provide ventilation to maintain the ambient workplace atmosphere below the occupational exposure limit(s). Use general and local exhaust ventilation and dust collection systems as necessary to minimize exposure.

### 8.2.2 Personal Protective Equipment (PPE)

| | |
|---|---|
| **Respiratory protection:** | Wear a NIOSH approved particulate respirator if exposure to airborne particulates is unavoidable and where occupational exposure limits may be exceeded. If airborne exposures are anticipated to exceed applicable PELs or TLVs, a self-contained breathing apparatus or airline respirator is recommended. |
| **Eye and face protection:** | If eye contact is possible, wear protective glasses with side shields. Avoid contact lenses. |
| **Hand and skin protection:** | Wear gloves and protective clothing. Wash hands with soap and water after contact with material. |

# Section 9
# Physical and Chemical Properties

## 9.1 Information on Basic Physical and Chemical Properties

| Property: Value | Property: Value |
|---|---|
| **Appearance (physical state, color, etc.):** Fine tan/ gray particulate | **Upper/lower flammability or explosive limits:** Not applicable |
| **Odor:** Odorless[1] | **Vapor Pressure (Pa):** Not applicable |
| **Odor threshold:** Not applicable | **Vapor Density:** Not applicable |
| **pH (25 °C) (in water):** Not Determined | **Specific gravity or relative density:** 2.2 – 2.9 |
| **Melting point/freezing point (°C):** Not applicable | **Water Solubility:** Slight |
| **Initial boiling point/boiling range (°C):** NA | **Partition coefficient: n-octane/water:** NA |
| **Flash point (°C):** Not determined | **Auto ignition temperature (°C):** Not applicable |
| **Evaporation rate:** Not applicable | **Decomposition temperature (°C):** Not determined |
| **Flammability (solid, gas):** Not combustible | **Viscosity:** Not applicable |

[1] The use of urea or aqueous ammonia injected into the flue gas to reduce nitrogen oxides (NOx) emissions may result in the presence of ammonium sulfate or ammonium bisulfate in the ash at less than 0.1%. When ash containing these substances becomes wet under high pH (>9), free ammonia gas may be released resulting in objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces.

## Section 10
## Stability and Reactivity

| | |
|---|---|
| **10.1 Reactivity:** | The material is an inert, inorganic material primarily composed of elemental oxides. |
| **10.2 Chemical stability:** | The material is stable under normal use conditions. |
| **10.3 Possibility of hazardous reactions:** | The material is a relatively stable, inert material; however, when ash containing ammonia becomes wet under high pH (>9), free ammonia gas may be released resulting in an objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces. Polymerization will not occur. |
| **10.4 Conditions to avoid:** | Product can become airborne in moderate winds. Dry material should be stored in silos. Materials stored out of doors should be covered or maintained in a damp condition. |
| **10.5 Incompatible materials:** | None known. |
| **10. 6 Hazardous decomposition products:** | None known. |

# Section 11
# Toxicological Information

## 11.1 Information on Toxicological Effects

| Endpoint | Data |
|---|---|
| **Acute oral toxicity** | LD50 > 2000 mg/kg |
| **Acute dermal toxicity** | LD50 > 2000 mg/kg |
| **Acute inhalation toxicity** | LD50 > 5.0 mg/L |
| **Skin corrosion/irritation** | Does not meet the classification criteria but may cause slight skin irritation. Product dust can dry the skin which can result in irritation. |
| **Eye damage/irritation** | Causes serious eye irritation. Positive scores for conjunctiva irritation and chemosis in 2/3 animals based on average of 24, 48 and 72-hour scores with irritation clearing within 21 days; No corneal or iritis effects observed. |
| **Respiratory/skin sensitization** | Not a respiratory or dermal sensitizer. |
| **Germ cell mutagenicity** | Not mutagenic in in-vitro and in-vivo assays with or without metabolic activation. |
| **Carcinogenicity** | Not available. Respirable crystalline silica has been identified as a carcinogen by OSHA, NTP, ACGIH and IARC. |
| **Reproductive toxicity** | No developmental toxicity was observed in available animal studies. Reproductive studies on CCPs showed either no reproductive effects, or some effects on male and female reproductive organs and parameters but without a clear dose response.<br><br>Inorganic bromide salts have been shown to have adverse effects on reproductive parameters in some animal studies. |
| **STOT-SE** | CCPs when present as a nuisance dust may result in respiratory irritation. |
| **STOT-RE** | In a 180-day inhalation study with fly ash dust, no effects were observed at the highest dose tested. NOEC = 4.2 mg/m$^3$; it is not possible to assess the level at which toxicologically significant effects may occur.<br><br>Repeated inhalation exposures to high levels of respirable crystalline silica may result in lung damage (i.e., silicosis). |
| **Aspiration Hazard** | Not applicable based product form. |

## Section 12
## Ecological Information

### 12.1 Toxicity

| **Fly Ash C (CAS# 68131-74-8)** | |
|---|---|
| **Toxicity to Fish** | LC50 > 100 mg/L |
| **Toxicity to Aquatic Invertebrates** | Data indicates that the test substance is not toxic to *Daphnia magna* (EC50 undetermined). |
| **Toxicity to Aquatic Algae and Plants** | EC50 = 10 mg/L |

| **Calcium oxide CAS# 1305-78-8** | |
|---|---|
| **Toxicity to Fish** | LC50 = 50.6 mg/L<br>The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects. |
| **Toxicity to Aquatic Invertebrates** | EC50 = 49.1 mg/L<br>The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects. |
| **Toxicity to Aquatic Algae and Plants** | NOEC =48 mg/L @ 72 hours based on $Ca(OH)_2$<br>The initial pH of the test medium was not directly related to the biologically relevant effects. The formation of precipitates is likely the result of the reaction between $CO_2$ dissolved in the medium. |

### 12.2 Persistence and Degradability

Not relevant for inorganic materials.

### 12.3 Bioaccumulative Potential

This material does not contain any compounds that would bioaccumulate up the food chain.

### 12.4 Mobility in Soil

No data available.

### 12.5 Results of PBT and vPvB Assessment

This material does not contain any compounds classified as “persistent, bioaccumulative or toxic” nor as “very persistent/very bioaccumulative”.

### 12.6 Other Adverse Effects

None known.

## Section 13

## Disposal Considerations

See Sections 7 and 8 above for safe handling and use, including appropriate industrial hygiene practices.

Dispose of all waste product and containers in accordance with federal, state and local regulations.

## Section 14
## Transport Information

| | | |
|---|---|---|
| **Regulatory entity:** U.S. DOT | Shipping Name: | Not Regulated |
| | Hazard Class: | Not Regulated |
| | ID Number: | Not Regulated |
| | Packing Group: | Not Regulated |

# Section 15
# Regulatory Information

## 15.1 Safety, Health and Environmental Regulations/Legislation Specific for the Mixture

- TSCA Inventory Status

  All components are listed on the TSCA Inventory.

- California Proposition 65.

  The following substances are known to the State of California to be carcinogens and/or reproductive toxicants:

  - Respirable crystalline silica

- State Right-to-Know (RTK)

| Component | CAS | MA[1,2] | NJ[3,4] | PA[5] | RI[6] |
|---|---|---|---|---|---|
| Ammonium bisulfate | 7803-63-6 | No | Yes | No | No |
| Ammonium sulfate | 7783-20-2 | Yes | No | Yes | No |
| Calcium oxide | 1305-78-8 | Yes | Yes | Yes | No |
| Iron oxide | 1309-37-1 | Yes | Yes | Yes | No |
| Magnesium oxide | 1309-48-4 | No | Yes | No | No |
| Manganese oxide-as manganese compounds | 1313-13-9; Various | No | No | Yes | Yes |
| Phosphorus pentoxide (or phosphorus oxide) | 1314-56-3 | Yes | Yes | Yes | No |
| Potassium oxide | 12136-45-7 | No | Yes | No | No |
| Silica-crystalline (SiO2), quartz | 14808-60-7 | Yes | Yes | Yes | No |
| Sodium oxide | 1313-59-3 | No | Yes | No | No |
| Titanium dioxide | 13463-67-7 | Yes | Yes | Yes | Yes |

[1] Massachusetts Department of Public Health, no date
[2] 189th General Court of The Commonwealth of Massachusetts, no date
[3] New Jersey Department of Health and Senior Services, 2010a
[4] New Jersey Department of Health, 2010b
[5] Pennsylvania Code, 1986
[6] Rhode Island Department of Labor and Training, no date

# Section 16
# Other Information, Including Date of Preparation or Last Revision

## 16.1 Indication of Changes

Date of preparation or last revision: February 23, 2018

## 16.2 Abbreviations and Acronyms

- ACGIH: American Conference of Industrial Hygienists
- CA: California
- CAS: Chemical Abstract Services
- CCP: Coal Combustion Product
- CFR: Code of Federal Regulations
- EPA: Environmental Protection Agency

- GHS: Globally Harmonized System of Classification and Labelling
- IARC: International Agency for Research on Cancer
- LC50: Concentration resulting in the mortality of 50 % of an animal population
- LD50: Dose resulting in the mortality of 50 % of an animal population
- MA: Massachusetts
- NA: Not Applicable
- NJ: New Jersey
- NOEC: No observed effect concentration
- NIOSH: National Institute of Occupational Safety and Health
- NOx: Nitrogen oxides
- NTP: US National Toxicology Program
- OEL: Occupational Exposure Limit
- OSHA: Occupational Safety and Health Administration
- PA: Pennsylvania
- PBT: Persistent, Toxic and Bioaccumulative
- PEL: Permissible exposure limit
- PPE: Personal Protective Equipment
- REL: Recommended exposure limit
- RI: Rhode Island
- RCS: Respirable Crystalline Silica
- RTK: Right-to-Know
- SCBA: Self-contained breathing apparatus
- SDS: Safety Data Sheet
- STEL: Short-term exposure limit
- STOT-RE: Specific target organ toxicity-repeated exposure
- STOT-SE: Specific target organ toxicity-single exposure
- TLV: Threshold limit value
- TSCA: Toxic Substances Control Act
- TWA: Time-weighted average
- UEL: Upper explosive limit
- UVCB: Unknown or Variable Composition/Biological
- U.S.: United States
- U.S. DOT: United States of Department of Transportation

## 16.3 Other Hazards

| **Hazardous Materials Identification System (HMIS)**<br><br>Degree of hazard (0= low, 4 = extreme) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Health:** | 2* | **Flammability:** | 0 | **Physical Hazards:** | 0 | **Personal protection:**** | | |

** Chronic Health Effects*
*** Appropriate personal protection is defined by the activity to be performed.*
*See Section 8 for additional information.*

**DISCLAIMER:**

*This SDS has been prepared in accordance with the Hazard Communication Rule 29 CFR 1910.1200. Information herein is based on data considered to be accurate as of date prepared. No warranty or representation, express or implied, is made as to the accuracy or completeness of this data and safety information. No responsibility can be assumed for any damage or injury resulting from abnormal use, failure to adhere to recommended practices, or from any hazards inherent in the nature of the product.*

# Safety Data Sheet

## Section 1
## Identification of the Substance and of the Supplier

### 1.1 Product Identifier

| | |
|---|---|
| **Product Name/Identification:** | ASTM Bottom Ash |
| **Synonyms:** | Ash; Ashes; Ash residues; Ashes, residues, bottom; Bottom ash; Bottom ash residues; Coal Fly Ash; Pozzolan; Waste solids. |
| **Formula:** | UVCB Substance |

### 1.2 Relevant Identified Uses of the Substance or Mixture and Uses Advices Against

| | |
|---|---|
| **Relevant Identified Uses:** | Component of wallboard, concrete, roofing material, bricks, cement kiln feed. |
| **Uses Advised Against:** | None known. |

### 1.3 Details of the Supplier of the SDS

| | |
|---|---|
| **Manufacturer/Supplier:** | Dynegy, Inc. |
| **Street Address:** | 601 Travis Street, Suite 1400 |
| **City, State and Zip Code:** | Houston, TX 77002 |
| **Customer Service Telephone:** | 800-633-4704 |

## Section 2
## Hazards Identification

### 2.1 Classification of the Substance

**GHS Classification(s) according to OSHA Hazard Communication Standard (29 CFR 1910.1200):**

- Eye Irritant, Category 2A
- STOT-SE, Category 3 (Respiratory Irritation)
- Carcinogen, Category 1A
- STOT-RE, Category 1 (Lungs)
- Toxic to Reproduction, Category 2

### 2.2 Label Elements

| ***Labelling according to 29 CFR 1910.1200 Appendices A, B and C**** | |
|---|---|
| ***Hazard Pictogram(s):*** |  |
| ***Signal word:*** | **DANGER** |
| ***Hazard Statement(s):*** | *Causes serious eye irritation.*<br>*May cause respiratory irritation.*<br>*May cause damage to lungs after repeated/prolonged exposure via inhalation.*<br>*May cause cancer of the lung.*<br>*Suspected of damaging fertility or the unborn child.* |
| ***Precautionary Statement(s):*** | *Obtain special instructions before use.*<br>*Do not handle until all safety precautions have been read and understood.*<br>*Avoid breathing dust.*<br>*Wash thoroughly after handling.*<br>*Do not eat drink or smoke when using this product.*<br>*Wear protective gloves/protective clothing/eye protection/face protection.*<br>*Use outdoors or in a well-ventilated area.*<br>*If exposed or concerned: Get medical advice/attention.*<br>*Store in a secure area.*<br>*Dispose of product in accordance with local/national regulations.* |

** Fly ash and other coal combustion products (CCPs) are UVCB substances (unknown or variable composition or biological). Various CCPs, noted as ashes/ash residuals; Ashes, residues, bottom; Bottom ash; Bottom ash residues; Waste solids, ashes under TSCA are defined as: "The residuum from the burning of a combination of carbonaceous materials. The following elements may be present as oxides: aluminum, calcium, iron, magnesium, nickel, phosphorus, potassium, silicon, sulfur, titanium, and vanadium." Ashes including fly ash and fluidized bed combustion ash are identified by CAS number 68131-74-8. The exact composition of the ash is dependent on the fuel source and flue additives composed of many constituents. The classification of the final substance is dependent on the presence of specific identified oxides as well as other trace elements.*

## 2.3 Other Hazards

**Listed Carcinogens:**

**-Respirable Crystalline Silica**

**IARC:** [Yes] **NTP:** [Yes] **OSHA:** [Yes] **Other:** **(ACGIH)** [Yes]

## Section 3
## Composition/Information on Ingredients

| *Substance* | *CAS No.* | *Percentage (%)* | *GHS Classification* |
|---|---|---|---|
| *Crystalline Silica* | *14808-60-7* | *20 - 40%* | *Repeat Dose STOT, Category 1*<br>*Carcinogen, Category 1A* |
| *Silica, crystalline respirable (RCS)* | *14808-60-7* | *See Footnote 1* | *Repeat Dose STOT, Category 1*<br>*Carcinogen. Category 1A* |
| *Aluminosilicates*[2] | *Various, see Footnote 2* | *10 - 60%* | *Single Exposure STOT, Category 3* |
| *Calcium oxide (CaO)* | *1305-78-8* | *10 - 30%* | *Skin Irritant, Category 2*<br>*Eye Irritant, Category 1*<br>*Single Exposure STOT, Category 3* |
| *Iron oxide* | *1309-37-1* | *1 - 10%* | *Not Classified* |
| *Manganese dioxide ($MnO_2$)* | *1313-13-9* | *<2%* | *Skin Irritant, Category 2*<br>*Eye Irritant, Category 2B* |
| *Magnesium oxide* | *1309-48-4* | *2 - 10%* | *Not Classified* |
| *Phosphorus pentoxide ($P_2O_5$)* | *1314-56-3* | *≤2%* | *Skin Irritant, Category 2*<br>*Eye Irritant, Category 2B* |
| *Sodium oxide* | *1313-59-3* | *1 - 10%* | *Not Classified* |
| *Potassium oxide ($K_2O$)* | *12136-45-7* | *≤1%* | *Skin Irritant Category 2*<br>*Eye Irritant Category 2B* |
| *Titanium dioxide ($TiO_2$)* | *13463-67-7* | *<3%* | *Not Classified* |

*[1]The percentage of respirable crystalline silica has not been determined. Therefore, a GHS classification of Carcinogen 1A has been assigned.*
*[2]Aluminosilicates (CAS# 1327-36-2) may be in the form of mullite (CAS# 1302-93-8); aluminosilicate glass; pozzolans (CAS# 71243-67-9); or calcium aluminosilicates such as tricalcium aluminate (C3A), or calcium sulfoaluminate (C4A3S). The form is dependent on the source of the coal and or the process used to create the CCP. Pulverized coal combustion would be more likely to create high levels of pozzolans. Aluminosilicates may have inclusions of calcium, titanium, iron, potassium, phosphorus, magnesium and other metal oxides.*

# Section 4
# First Aid Measures

## 4.1 Description of First Aid Measures

| | |
|---|---|
| **Inhalation:** | If product is inhaled and irritation of the nose or coughing occurs, remove person to fresh air. Get medical advice/attention if respiratory symptoms persist. |
| **Skin Contact:** | If skin exposure occurs, wash with soap and water. |
| **Eye Contact:** | If product gets into the eye, rinse copiously with water for several minutes. Remove contact lenses, if present and easy to do. Seek medical attention/advice if irritation occurs or persists. |
| **Ingestion:** | No specific first aid measures are required. |

## 4.2 Most Important Health Effects, Both Acute and Delayed

**Acute Effects:** Direct exposure may cause respiratory irritation, eye irritation and skin irritation. The product dust can dry and irritate the skin and cause dermatitis and can irritate eyes and skin through mechanical abrasion.

**Chronic Effects:** Chronic exposure may cause lung damage from repeated exposure. Prolonged inhalation of respirable crystalline silica above certain concentrations may cause lung diseases, including silicosis and lung cancer.

## 4.3 Indication of Any Immediate Medical Attention and Special Treatment Needed

Seek first aid or call a doctor or Poison Control Center if contact with eyes occurs and irritation remains after rinsing. Get medical advice if inhalation occurs and respiratory symptoms persist.

## Section 5
## Firefighting Measures

### 5.1 Extinguishing Media

| | |
|---|---|
| **Suitable Extinguishing Media:** | Product is not flammable. Use extinguishing media appropriate for surrounding fire. |
| **Unsuitable Extinguishing Media:** | Not applicable, the product is not flammable. |

### 5.2 Special Hazards Arising from the Substance or Mixture

| | |
|---|---|
| **Hazardous Combustion Products:** | None known. |

### 5.3 Advice for Firefighters

| | |
|---|---|
| **Special Protective Equipment and Precautions for Firefighters:** | As with any fire, wear self-contained breathing apparatus (NIOSH approved or equivalent) and full protective gear. |

## Section 6
## Accidental Release Measures

### 6.1 Personal Precautions, Protective Equipment and Emergency Procedures

| | |
|---|---|
| **Personal precautions/Protective Equipment:** | See Section 8.2.2 Individual Protective Measures. For concentrations exceeding Occupational Exposure Levels (OELs), use a self-contained breathing apparatus (SCBA). |
| **Emergency procedures:** | Use scooping, water spraying/flushing/misting or ventilated vacuum cleaning systems to clean up spills. Do not use pressurized air. |

### 6.2 Environmental Precautions

| | |
|---|---|
| **Environmental precautions:** | Prevent contamination of drains or waterways and dispose according to local and national regulations. |

### 6.3 Methods and Material for Containment and Cleaning Up

| | |
|---|---|
| **Methods and materials for containment and cleaning up:** | Do not use brooms or compressed air to clean surfaces. Use dust collection vacuum and extraction systems.<br>Large spills of dry product should be removed by a vacuum system. Dampened material should be removed by mechanical means and recycled or disposed of according to local and national regulations. |

See Sections 8 and 13 for additional information on exposure controls and disposal.

## Section 7
## Handling and Storage

### 7.1 Precautions for Safe Handling

Practice good housekeeping. Use adequate exhaust ventilation, dust collection and/or water mist to maintain airborne dust concentrations below permissible exposure limits (note: respirable crystalline silica dust may be in the air without a visible dust cloud).

Do not permit dust to collect on walls, floors, sills, ledges, machinery, or equipment. Maintain and test ventilation and dust collection equipment. In cases of insufficient ventilation, wear a NIOSH approved respirator for silica dust when handling or disposing dust from this product. Avoid contact with skin and eyes. Wash or vacuum clothing that has become dusty. Avoid eating, smoking, or drinking while handling the material.

### 7.2 Conditions for Safe Storage, Including any Incompatibilities

Minimize dust produced during loading and unloading.

## Section 8
## Exposure Controls/Personal Protection

### 8.1 Control Parameters

| OCCUPATIONAL EXPOSURE LIMITS | | | | | |
|---|---|---|---|---|---|
| **SUBSTANCE** | | **OSHA PEL TWA ($mg/m^3$)** | **NIOSH REL TWA ($mg/m^3$)** | **ACGIH TLV TWA ($mg/m^3$)** | **CA - OSHA PEL ($mg/m^3$)** |
| **Calcium oxide** | | 5 | 2 | 2 | 2 |
| **Particulates Not Otherwise Regulated** | Total | 15 | 15 | 10 | 10 |
| | Respirable | 5 | 5 | 3 | 5 |
| **Respirable Crystalline Silica** | Respirable | 0.05 | 0.05 | 0.025 | 0.05 |
| **Manganese dioxide (as manganese compounds)** | Total | 5 (Ceiling) | 1<br>3 (STEL) | 0.1 | 0.2 |
| | Respirable | - | - | 0.02 | - |

### 8.2 Exposure Controls

### 8.2.1 Engineering Controls

Provide ventilation to maintain the ambient workplace atmosphere below the occupational exposure limit(s). Use general and local exhaust ventilation and dust collection systems as necessary to minimize exposure.

### 8.2.2 Personal Protective Equipment (PPE)

| | |
|---|---|
| **Respiratory protection:** | Wear a NIOSH approved particulate respirator if exposure to airborne particulates is unavoidable and where occupational exposure limits may be exceeded. If airborne exposures are anticipated to exceed applicable PELs or TLVs, a self-contained breathing apparatus or airline respirator is recommended. |
| **Eye and face protection:** | If eye contact is possible, wear protective glasses with side shields. Avoid contact lenses. |
| **Hand and skin protection:** | Wear gloves and protective clothing. Wash hands with soap and water after contact with material. |

# Section 9
# Physical and Chemical Properties

## 9.1 Information on Basic Physical and Chemical Properties

| Property: Value | Property: Value |
|---|---|
| **Appearance (physical state, color, etc.):** Fine tan/ gray particulate | **Upper/lower flammability or explosive limits:** Not applicable |
| **Odor:** Odorless[1] | **Vapor Pressure (Pa):** Not applicable |
| **Odor threshold:** Not applicable | **Vapor Density:** Not applicable |
| **pH (25 °C) (in water):** 8 - 11 | **Specific gravity or relative density:** 2.2 – 2.9 |
| **Melting point/freezing point (°C):** Not applicable | **Water Solubility:** Slight |
| **Initial boiling point and boiling range (°C):** Not applicable | **Partition coefficient: n-octane/water:** Not determined |
| **Flash point (°C):** Not determined | **Auto ignition temperature (°C):** Not applicable |
| **Evaporation rate:** Not applicable | **Decomposition temperature (°C):** Not determined |
| **Flammability (solid, gas):** Not combustible | **Viscosity:** Not applicable |

[1] The use of urea or aqueous ammonia injected into the flue gas to reduce nitrogen oxides (NOx) emissions may result in the presence of ammonium sulfate or ammonium bisulfate in the ash at less than 0.1%. When ash containing these substances becomes wet under high pH (>9), free ammonia gas may be released resulting in objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces.

## Section 10
## Stability and Reactivity

| | |
|---|---|
| **10.1 Reactivity:** | The material is an inert, inorganic material primarily composed of elemental oxides. |
| **10.2 Chemical stability:** | The material is stable under normal use conditions. |
| **10.3 Possibility of hazardous reactions:** | The material is a relatively stable, inert material; however, when ash containing ammonia becomes wet under high pH (>9), free ammonia gas may be released resulting in an objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces. Polymerization will not occur. |
| **10.4 Conditions to avoid:** | Product can become airborne in moderate winds. Dry material should be stored in silos. Materials stored out of doors should be covered or maintained in a damp condition. |
| **10.5 Incompatible materials:** | None known. |
| **10. 6 Hazardous decomposition products:** | None known. |

## Section 11
## Toxicological Information

### 11.1 Information on Toxicological Effects

| Endpoint | Data |
|---|---|
| **Acute oral toxicity** | LD50 > 2000 mg/kg |
| **Acute dermal toxicity** | LD50 > 2000 mg/kg |
| **Acute inhalation toxicity** | LD50 > 5.0 mg/L |
| **Skin corrosion/irritation** | Does not meet the classification criteria but may cause slight skin irritation. Product dust can dry the skin which can result in irritation. |
| **Eye damage/irritation** | Causes serious eye irritation. Positive scores for conjunctiva irritation and chemosis in 2/3 animals based on average of 24, 48 and 72-hour scores with irritation clearing within 21 days; no corneal or iritis effects observed. |
| **Respiratory/skin sensitization** | Not a respiratory or dermal sensitizer. |
| **Germ cell mutagenicity** | Not mutagenic in in-vitro and in-vivo assays with or without metabolic activation. |
| **Carcinogenicity** | Not available. Respirable crystalline silica has been identified as a carcinogen by OSHA, NTP, ACGIH and IARC. |
| **Reproductive toxicity** | No developmental toxicity was observed in available animal studies. Reproductive studies on CCPs showed either no reproductive effects, or some effects on male and female reproductive organs and parameters but without a clear dose response. |
| **STOT-SE** | CCPs when present as a nuisance dust may result in respiratory irritation. |
| **STOT-RE** | In a 180-day inhalation study with fly ash dust, no effects were observed at the highest dose tested. NOEC = 4.2 $mg/m^3$; it is not possible to assess the level at which toxicologically significant effects may occur.<br><br>Repeated inhalation exposures to high levels of respirable crystalline silica may result in lung damage (i.e., silicosis). |
| **Aspiration Hazard** | Not applicable based product form. |

## Section 12
## Ecological Information

### 12.1 Toxicity

| Fly Ash (CAS# 68131-74-8) | |
|---|---|
| **Toxicity to Fish** | LC50 > 100 mg/L |
| **Toxicity to Aquatic Invertebrates** | Data indicates that the test substance is not toxic to *Daphnia magna* (EC50 undetermined) |
| **Toxicity to Aquatic Algae and Plants** | EC50 = 10 mg/L |
| **Calcium oxide CAS# 1305-78-8** | |
| **Toxicity to Fish** | LC50 = 50.6 mg/L<br>The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects. |
| **Toxicity to Aquatic Invertebrates** | EC50 = 49.1 mg/L<br>The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects. |
| **Toxicity to Aquatic Algae and Plants** | NOEC =48 mg/L @ 72 hours based on $Ca(OH)_2$<br>The initial pH of the test medium was not directly related to the biologically relevant effects. The formation of precipitates is likely the result of the reaction between $CO_2$ dissolved in the medium. |

### 12.2 Persistence and Degradability

Not relevant for inorganic materials.

### 12.3 Bioaccumulative Potential

This material does not contain any compounds that would bioaccumulate up the food chain.

### 12.4 Mobility in Soil

No data available.

### 12.5 Results of PBT and vPvB Assessment

This material does not contain any compounds classified as “persistent, bioaccumulative or toxic” nor as “very persistent/very bioaccumulative”.

### 12.6 Other Adverse Effects

None known.

## Section 13
## Disposal Considerations

See Sections 7 and 8 above for safe handling and use, including appropriate industrial hygiene practices.

Dispose of all waste product and containers in accordance with federal, state and local regulations.

## Section 14
## Transport Information

| | | |
|---|---|---|
| **Regulatory entity:** U.S. DOT | Shipping Name: | Not Regulated |
| | Hazard Class: | Not Regulated |
| | ID Number: | Not Regulated |
| | Packing Group: | Not Regulated |

# Section 15
# Regulatory Information

## 15.1 Safety, Health and Environmental Regulations/Legislation Specific for the Mixture

- TSCA Inventory Status

  All components are listed on the TSCA Inventory.

- California Proposition 65

  The following substances are known to the State of California to be carcinogens and/or reproductive toxicants:

  - Respirable crystalline silica
  - Titanium dioxide

- State Right-to-Know (RTK)

| **Component** | **CAS** | **MA**[1,2] | **NJ**[3,4] | **PA**[5] | **RI**[6] |
|---|---|---|---|---|---|
| Ammonium bisulfate | 7803-63-6 | No | Yes | No | No |
| Ammonium sulfate | 7783-20-2 | Yes | No | Yes | No |
| Calcium oxide | 1305-78-8 | Yes | Yes | Yes | No |
| Iron oxide | 1309-37-1 | Yes | Yes | Yes | No |
| Magnesium oxide | 1309-48-4 | No | Yes | No | No |
| Phosphorus pentoxide (or phosphorus oxide) | 1314-56-3 | Yes | Yes | Yes | No |
| Potassium oxide | 12136-45-7 | No | Yes | No | No |
| Silica-crystalline ($SiO_2$), quartz | 14808-60-7 | Yes | Yes | Yes | No |
| Sodium oxide | 1313-59-3 | No | Yes | No | No |
| Titanium dioxide | 13463-67-7 | Yes | Yes | Yes | Yes |

[1] Massachusetts Department of Public Health, no date
[2] 189th General Court of The Commonwealth of Massachusetts, no date
[3] New Jersey Department of Health and Senior Services, 2010a
[4] New Jersey Department of Health, 2010b
[5] Pennsylvania Code, 1986
[6] Rhode Island Department of Labor and Training, no date

## Section 16
## Other Information, Including Date of Preparation or Last Revision

### 16.1 Indication of Changes

Date of preparation or last revision: February 23, 2018

### 16.2 Abbreviations and Acronyms

- ACGIH: American Conference of Industrial Hygienists
- CA: California
- CAS: Chemical Abstract Services
- CCP: Coal Combustion Product
- CFR: Code of Federal Regulations
- EPA: Environmental Protection Agency
- GHS: Globally Harmonized System of Classification and Labelling
- IARC: International Agency for Research on Cancer
- LC50: Concentration resulting in the mortality of 50 % of an animal population
- LD50: Dose resulting in the mortality of 50 % of an animal population
- MA: Massachusetts
- NA: Not Applicable
- NJ: New Jersey
- NOEC: No observed effect concentration
- NIOSH: National Institute of Occupational Safety and Health
- NOx: Nitrogen oxides
- NTP: US National Toxicology Program
- OEL: Occupational Exposure Limit
- OSHA: Occupational Safety and Health Administration
- PA: Pennsylvania
- PBT: Persistent, Toxic and Bioaccumulative
- PEL: Permissible exposure limit
- PPE: Personal Protective Equipment
- REL: Recommended exposure limit
- RI: Rhode Island
- RCS: Respirable Crystalline Silica
- RTK: Right-to-Know
- SCBA: Self-contained breathing apparatus
- SDS: Safety Data Sheet
- STEL: Short-term exposure limit
- STOT-RE: Specific target organ toxicity-repeated exposure
- STOT-SE: Specific target organ toxicity-single exposure
- TLV: Threshold limit value
- TSCA: Toxic Substances Control Act
- TWA: Time-weighted average
- UEL: Upper explosive limit
- UVCB: Unknown or Variable Composition/Biological
- U.S.: United States
- U.S. DOT: United States of Department of Transportation

## 16.3 Other Hazards

| **Hazardous Materials Identification System (HMIS)**<br><br>Degree of hazard (0= low, 4 = extreme) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Health:** | 2* | **Flammability:** | 0 | **Physical Hazards:** | 0 | **Personal protection:*** | |

** Chronic Health Effects*
****** *Appropriate personal protection is defined by the activity to be performed.*
*See Section 8 for additional information.*

**DISCLAIMER:**

*This SDS has been prepared in accordance with the Hazard Communication Rule 29 CFR 1910.1200. Information herein is based on data considered to be accurate as of date prepared. No warranty or representation, express or implied, is made as to the accuracy or completeness of this data and safety information. No responsibility can be assumed for any damage or injury resulting from abnormal use, failure to adhere to recommended practices, or from any hazards inherent in the nature of the product.*

# ATTACHMENT D

# Memorandum

BURNS McDONNELL

Date: 25 October 2021

Subject: 35 Ill. Admin. Code Part 845 - Fault Area Location Demonstration for East Ash Pond at the Hennepin Power Plant

Dynegy Midwest Generation, LLC (DMG) operates the coal-fired Hennepin Power Plant located in Putnam County, Illinois. The East Ash Pond is an existing surface impoundment storing coal combustion residuals (CCR). The requirements for the East Ash Pond are found in 35 Ill. Admin. Code (I.A.C.) 845 (Part 845).

This memorandum addresses the requirements of Section 845.320 Fault Areas, which states:

*Section 845.320 Fault Areas*

a) *Existing and new CCR surface impoundments, and all lateral expansions of CCR surface impoundments must not be located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene time unless the owner or operator demonstrates that an alternative setback distance of less than 60 meters (200 feet) will prevent damage to the structural integrity of the CCR surface impoundment.*

b) *The owner or operator of the CCR surface impoundment must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of subsection (a).*

Pursuant to Section 845.210(d)(2), for existing CCR surface impoundments, the owner or operator of the CCR surface impoundment may use a previously completed location restriction demonstration required by Section 845.300 (Placement Above the Uppermost Aquifer), Section 845.310 (Wetlands), Section 845.320 (Fault Areas), Section 845.330 (Seismic Impact Zones), and Section 845.340 (Unstable Areas), provided that the previously completed assessments meet the applicable requirements of those Sections.

The previous fault area demonstration was certified by a qualified professional engineer stating that the demonstration meets the requirements of 40 C.F.R. § 257.62. The requirements described in 40 C.F.R. § 257.62 are nearly identical to the requirements contained in I.A.C. Section 845.320. Pursuant to Section 845.210(d)(2), a certification is not required for this demonstration. The previously completed fault area demonstration is included in Attachment D.

HALEY & ALDRICH, INC.
6500 Rockside Road
Suite 200
Cleveland, OH 44131
216.739.0555

**MEMORANDUM**

16 October 2018
File No. 129788

SUBJECT: Location Restriction Demonstration - Fault Areas
Hennepin Power Station
East Ash Pond
Hennepin, Illinois

Dynegy Midwest Generation, LLC operates the coal-fired Hennepin Power Station (Plant) located near Hennepin, Illinois. The East Ash Pond (Unit) is an existing coal combustion residuals (CCR) surface impoundment. This demonstration addresses the requirements of 40 CFR §257.62 *(Fault Areas)* of the U.S. Environmental Protection Agency's (EPA) rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities.* 80 Fed. Reg. 21,302 (Apr. 17, 2015) (promulgating 40 CFR §257.62); 83 Fed. Reg. 36,435 (July 30, 2018) (amending 40 CFR §257.62).

*§257.62(a): New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene time unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that an alternative setback distance of less than 60 meters (200 feet) will prevent damage to the structural integrity of the CCR unit.*

A review of available data from the U.S. Geologic Survey, the Illinois State Geological Survey, and other available information was completed for this demonstration. The nearest known mapped faults area a series of four unnamed faults associated with the Troy Grove Dome, which is located approximately 11 miles northeast and the timeframe of the most recent activity on these faults is not known. Based on the available published geologic data and information reviewed, there are no active faults or fault damage zones that have had displacement in Holocene time reported or indicated within 200 feet of the Unit.

*§257.62(b): The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority stating that the demonstration meets the requirements of paragraph (a) of this section.*

I, Steven F. Putrich, 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 demonstration that the CCR Unit is not located within 60 meters (200 feet) of the outermost damage zone of a fault that has had a displacement in Holocene time as included in the CCR Rule Location Restrictions Evaluation memorandum dated 12 October 2018 meets the requirements of 40 CFR §257.62(a).

Signed: ______________________
Consulting Engineer

| | |
|---|---|
| Print Name: | Steven F. Putrich |
| Illinois License No.: | 62048779 |
| Title: | Vice President |
| Company: | Haley & Aldrich, Inc. |

Professional Engineer's Seal:

STEVEN F. PUTRICH
062-048-779
REGISTERED
PROFESSIONAL
ENGINEER
10/16/18
STATE OF ILLINOIS

# Memorandum

BURNS McDONNELL

Date: 25 October 2021

Subject: 35 Ill. Admin. Code Part 845 - Placement Above the Uppermost Aquifer Location Demonstration for East Ash Pond at the Hennepin Power Plant

Dynegy Midwest Generation, LLC (DMG) operates the coal-fired Hennepin Power Plant located in Putnam County, Illinois. The East Ash Pond is an existing surface impoundment storing coal combustion residuals (CCR). The requirements for the East Ash Pond are found in 35 Ill. Admin. Code (I.A.C.) 845 (Part 845).

This memorandum addresses the requirements of Section 845.300 Placement Above the Uppermost Aquifer, which states:

*Section 845.300 Placement Above the Uppermost Aquifer*

a) *Existing and new CCR surface impoundments, and all lateral expansions of CCR surface impoundments must, be constructed with a base that is located at least 1.52 meters (five feet) above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR surface impoundment and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table).*

b) *The owner or operator of the CCR surface impoundment must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of subsection (a).*

Pursuant to Section 845.210(d)(2), for existing CCR surface impoundments, the owner or operator of the CCR surface impoundment may use a previously completed location restriction demonstration required by Section 845.300 (Placement Above the Uppermost Aquifer), Section 845.310 (Wetlands), Section 845.320 (Fault Areas), Section 845.330 (Seismic Impact Zones), and Section 845.340 (Unstable Areas), provided that the previously completed assessments meet the applicable requirements of those Sections.

The previous upper aquifer demonstration was certified by a qualified professional engineer stating that the demonstration meets the requirements of 40 C.F.R. § 257.60. The requirements described in 40 C.F.R. § 257.60 are nearly identical to the requirements contained in I.A.C. Section 845.300. Pursuant to Section 845.210(d)(2), a certification is not required for this demonstration. The previously completed upper aquifer demonstration is included in Attachment D.

HALEY & ALDRICH, INC.
6500 Rockside Road
Suite 200
Cleveland, OH 44131
216.739.0555

**MEMORANDUM**

16 October 2018
File No. 129788

SUBJECT: Location Restriction Demonstration – Placement Above Uppermost Aquifer
East Ash Pond
Hennepin Power Station
Hennepin, Illinois

Dynegy Midwest Generating, LLC operates the coal-fired Hennepin Power Station (Plant) located near Hennepin, Illinois. The East Ash Pond (Unit) is an existing coal combustion residuals (CCR) surface impoundment. This demonstration addresses the requirements of 40 CFR §257.60 *(Placement above the uppermost aquifer)* of the U.S. Environmental Protection Agency's (EPA) rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities*. 80 Fed. Reg. 21,302 (Apr. 17, 2015) (promulgating 40 CFR §257.60); 83 Fed. Reg. 36,435 (July 30, 2018) (amending 40 CFR §257.60).



*§257.60(a): New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must be constructed with a base that is located no less than 1.52 meters (five feet) above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table). The owner or operator must demonstrate by the dates specified in paragraph (c) of this section that the CCR unit meets the minimum requirements for placement above the uppermost aquifer.*

Haley & Aldrich reviewed available information provided by Vistra including historic record drawings and design drawings and based on review and evaluation of the information provided, the results do not demonstrate compliance with the requirements of 40 CFR §257.60(a).

*<u>§257.60(b):</u> The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority stating that the demonstration meets the requirements of paragraph (a) of this section.*

I, Steven F. Putrich, 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 that the above-referenced CCR Unit does not meet the requirements of 40 CFR §257.60(a).

Signed: ______________________
Consulting Engineer

| | |
|---|---|
| Print Name: | Steven F. Putrich |
| Illinois License No.: | 62048779 |
| Title: | Vice President |
| Company: | Haley & Aldrich, Inc. |

Professional Engineer's Seal:

STEVEN F. PUTRICH
062-048-779
REGISTERED
PROFESSIONAL
ENGINEER
STATE OF ILLINOIS
10/16/18



HALEY ALDRICH

# Memorandum

BURNS McDONNELL

Date: 25 October 2021

Subject: 35 Ill. Admin. Code Part 845 – Seismic Impact Zone Location Demonstration for East Ash Pond at the Hennepin Power Plant

Dynegy Midwest Generation, LLC (DMG) operates the coal-fired Hennepin Power Plant located in Putnam County, Illinois. The East Ash Pond is an existing surface impoundment storing coal combustion residuals (CCR). The requirements for the East Ash Pond are found in 35 Ill. Admin. Code Part (I.A.C.) 845 (Part 845).

This memorandum addresses the requirements of Section 845.330 Seismic Impact Zones, which states:

*Section 845.330 Seismic Impact Zones*

a) *Existing and new CCR surface impoundments, and all lateral expansions of CCR surface impoundments must not be located in seismic impact zones unless the owner or operator demonstrates that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.*

b) *The owner or operator of the CCR surface impoundment must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of subsection (a).*

Pursuant to Section 845.210(d)(2), for existing CCR surface impoundments, the owner or operator of the CCR surface impoundment may use a previously completed location restriction demonstration required by Section 845.300 (Placement Above the Uppermost Aquifer), Section 845.310 (Wetlands), Section 845.320 (Fault Areas), Section 845.330 (Seismic Impact Zones), and Section 845.340 (Unstable Areas), provided that the previously completed assessments meet the applicable requirements of those Sections.

The previous seismic impact zone demonstration was certified by a qualified professional engineer stating that the demonstration meets the requirements of 40 C.F.R. § 257.63. The requirements described in 40 C.F.R. § 257.63 are nearly identical to the requirements contained in I.A.C. Section 845.330. Pursuant to Section 845.210(d)(2), a certification is not required for this demonstration. The previously completed seismic impact zone demonstration is included in Attachment D.

HALEY & ALDRICH, INC.
6500 Rockside Road
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216.739.0555

**MEMORANDUM**

16 October 2018
File No. 129788

SUBJECT: Location Restriction Demonstration – Seismic Impact Zone
Hennepin Power Station
East Ash Pond
Hennepin, Illinois



Dynegy Midwest Generation, LLC operates the coal-fired Hennepin Power Station (Plant) located near Hennepin, Illinois. The East Ash Pond (Unit) is an existing coal combustion residuals (CCR) surface impoundment This demonstration addresses the requirements of 40 CFR §257.63 *(Seismic Impact zones)* of the U.S. Environmental Protection Agency's (EPA) rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities.* 80 Fed. Reg. 21,302 (Apr. 17, 2015) (promulgating 40 CFR §257.63); 83 Fed. Reg. 36,435 (July 30, 2018) (amending 40 CFR §257.63).

*§257.63(a): New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in seismic impact zones unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.*

A Seismic Impact Zone is defined in the CCR Rule (40 CFR §257.63) as "an area having a 2% or greater probability that the maximum expected horizontal acceleration, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10 g in 50 years." The 2014 US Geological Survey Hazard Map raw data for the Hennepin Power Station East Ash Pond indicates that the maximum expected horizontal acceleration for 2 percent probability of exceedance in 50 years is 0.07g. Accordingly, the Unit is not located in a seismic impact zone and a demonstration that the structural components have been designed to resist the maximum horizontal acceleration in lithified earth material for the site is not required.

*§257.63(b): The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority stating that the demonstration meets the requirements of paragraph (a) of this section.*

I, Steven F. Putrich, 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, that the CCR Unit is not located in a seismic impact zone as included in the CCR Rule Location Restrictions Evaluation memorandum dated 12 October 2018 and, therefore, satisfies all requirements of 40 CFR §257.63(a).

Signed: ______________________
Consulting Engineer

| | |
|---|---|
| Print Name: | Steven F. Putrich |
| Illinois License No.: | 62048779 |
| Title: | Vice President |
| Company: | Haley & Aldrich, Inc. |

Professional Engineer's Seal:

# Memorandum

BURNS McDONNELL

Date: 25 October 2021

Subject: 35 Ill. Admin. Code Part 845 – Unstable Areas Location Standard Demonstration for East Ash Pond at the Hennepin Power Plant

Dynegy Midwest Generation, LLC (DMG) operates the coal-fired Hennepin Power Plant located in Putnam County, Illinois. The East Ash Pond is an existing surface impoundment storing coal combustion residuals (CCR). The requirements for the East Ash Pond are found in 35 Ill. Admin. Code Part (I.A.C.) 845 (Part 845).

This memorandum addresses the requirements of Section 845.340 Unstable Areas which states:

*Section 845.340 Unstable Areas*

a) *An existing or new CCR surface impoundment, or any lateral expansion of a CCR surface impoundment must not be located in an unstable area unless the owner or operator demonstrates that recognized and generally accepted engineering practices have been incorporated into the design of the CCR surface impoundment to ensure that the integrity of the structural components of the CCR surface impoundment will not be disrupted.*

b) *The owner or operator must consider all the following factors, at a minimum, when determining whether an area is unstable:*

   1) *On-site or local soil conditions, including liquefaction, that may result in significant differential settling;*

   2) *On-site or local geologic or geomorphologic features; and*

   3) *On-site or local human-made features or events (both surface and subsurface)*

d) *The owner or operator of the CCR surface impoundment must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of subsections (a).*

*Demonstration of compliance with Section 845.340(a) and (b) – Unstable Areas*:

Pursuant to Section 845.210(d)(2), for existing CCR surface impoundments, the owner or operator of the CCR surface impoundment may use a previously completed location restriction demonstration required by Section 845.300 (Placement Above the Uppermost Aquifer), Section 845.310 (Wetlands), Section 845.320 (Fault Areas), Section 845.330 (Seismic Impact Zones), and Section 845.340 (Unstable Areas), provided that the previously completed assessments meet the applicable requirements of those Sections.

The previous unstable area demonstration was certified by a qualified professional engineer stating that the demonstration meets the requirements of 40 C.F.R. § 257.64. The requirements described in 40 C.F.R. § 257.64 are nearly identical to the requirements contained in I.A.C. Section 845.340. Pursuant to Section 845.210(d)(2), a certification is not required for the unstable area demonstration. The previously completed unstable area demonstration is included in Attachment D.

HALEY & ALDRICH, INC.
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216.739.0555

**MEMORANDUM**

16 October 2018
File No. 129788

SUBJECT: Location Restriction Demonstration – Unstable Areas
Hennepin Power Station
East Ash Pond
Hennepin, Illinois



Dynegy Midwest Generation, LLC operates the coal-fired Hennepin Power Station (Plant) located near Hennepin, Illinois. The East Ash Pond (Unit) is an existing coal combustion residuals (CCR) surface impoundment. This demonstration addresses the requirements of 40 CFR §257.64 *(Unstable Areas)* of the U.S. Environmental Protection Agency's (EPA) rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities*. 80 Fed. Reg. 21,302 (Apr. 17, 2015) (promulgating 40 CFR §257.64); 83 Fed. Reg. 36,435 (July 30, 2018) (amending 40 CFR §257.64).

*§257.64(a): An existing or new CCR landfill, existing or new CCR surface impoundment, or any lateral expansion of a CCR unit must not be located in an unstable area unless the owner or operator demonstrates by the dates specified in paragraph (d) of this section that recognized and generally accepted good engineering practices have been incorporated into the design of the CCR unit to ensure that the integrity of the structural components of the CCR unit will not be disrupted.*

*§257.64(b): The owner or operator must consider all of the following factors, at a minimum, when determining whether an area is unstable:*

*(1) On-site or local soil conditions that may result in significant differential settling;*
*(2) On-site or local geologic or geomorphologic features; and*
*(3) On-site or local human-made features or events (both surface and subsurface).*

*Determination of compliance with §257.64(b)(1)* - Conditions associated with the potential for significant differential settlement due to liquefaction were not identified in the area where the Plant is located. A separate report completed by AECOM entitled "CCR Certification Report: Initial Structural Stability Assessment, Initial Safety Factor Assessment, and Initial Inflow Design Flood Control System Plan for the East Ash Pond at Hennepin Power Station" dated October 2016 concluded that the soils beneath the Unit are not susceptible to liquefaction.

*Determination of compliance with §257.64(b)(2)* - Based on available United States Geological Survey (USGS), Illinois State Geological Survey (ISGS) information, and communication with Vistra representatives familiar with the Plant's history, karst topography or physiographic features such as sinkholes, vertical shafts, sinking streams, caves, large springs, or blind valleys do not exist at the Plant. To evaluate the susceptibility of landslides, we reviewed readily available USGS and ISGS data. The USGS data indicates that the Plant is in an area of high landslide susceptibility and low landslide incidence, however more detailed ISGS data indicates that there has not been a documented landslide occurrence at the Unit. The closest ISGS documented landslide occurrences are approximately 3.5 to 5 miles away from the site and appear to be roadway landslides associated with Illinois Route 26 and Illinois Route 89. Accordingly, it is our opinion that the Unit is not located in an area that has high susceptibility to landslides.

*Determination of compliance with §257.64(b)(3)* - There are no documented surface or subsurface anthropogenic activities that would be indicative of creating unstable foundation conditions.

*§257.64(c): The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority stating that the demonstration meets the requirements of paragraph (a) of this section.*

I, Steven F. Putrich, 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 demonstration indicating the CCR Unit is not located in an unstable area as included in the CCR Rule Location Restrictions Evaluation memorandum dated 12 October 2018 meets the requirements of 40 CFR §257.64(a).



Signed: ______________________
Consulting Engineer

| | |
|---|---|
| Print Name: | Steven F. Putrich |
| Illinois License No.: | 62048779 |
| Title: | Vice President |
| Company: | Haley & Aldrich, Inc. |

Professional Engineer's Seal:

# Hennepin Power Plant Operating Permit Application: Floodplain Compliance for 35 I.A.C. 845.340(c)

**Dynegy Midwest Generation, LLC**

**Revision 1**
**10/20/2021**

# Hennepin Power Plant Operating Permit Application: Floodplain Compliance for 35 I.A.C. 845.340(c)

**prepared for**

**Dynegy Midwest Generation, LLC**
**Village of Hennepin, Illinois**

**Revision 1**
**10/20/2021**

**prepared by**

**Burns & McDonnell**
**Kansas City, Missouri**

## INDEX AND CERTIFICATION

## Dynegy Midwest Generation, LLC
## Hennepin Power Plant
## Operating Permit Application: Floodplain Compliance for 35 I.A.C. 845.340(c)

### Report Index



### Certification

I hereby certify, as a Professional Engineer in the state of Illinois, that the information in this document was assembled under my direct personal charge. This report is not intended or represented to be suitable for reuse by the Dynegy Midwest Generation, LLC or others without specific verification or adaptation by the Engineer. I hereby certify, for East Ash Pond CCR impoundment discussed herein, that demonstration regarding floodplains meets requirements of 35 I.A.C. 845.340(c).

Madison R. Gibler, P.E., IL, 062.070771

Signature: Madison R Gibler

Date of Signing: October 20, 2021

Date of License Expiration: November 30, 2021

LICENSED PROFESSIONAL ENGINEER
MADISON R. GIBLER
062.070771
OF ILLINOIS

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## LIST OF TABLES

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# 1.0 INTRODUCTION

Burns & McDonnell was hired by Dynegy Midwest Generation, LLC to evaluate compliance with *35 I.A.C. 845.340(c)* (2021) for the existing coal combustion residual (CCR) surface impoundment at the Hennepin Power Plant in the Village of Hennepin, Putnam County, Illinois. The Hennepin Power Plant (plant) currently has one CCR impoundment in operation, the East Ash Pond. The plant also had three additional CCR impoundments that have since been closed: the West Ash Pond, Ash Pond 2, and Ash Pond 4. The East Ash Pond was constructed and went into operation in 1996. The Hennepin Power Plant and CCR surface impoundments are located south of the Illinois River, as shown in Figure 1-1.

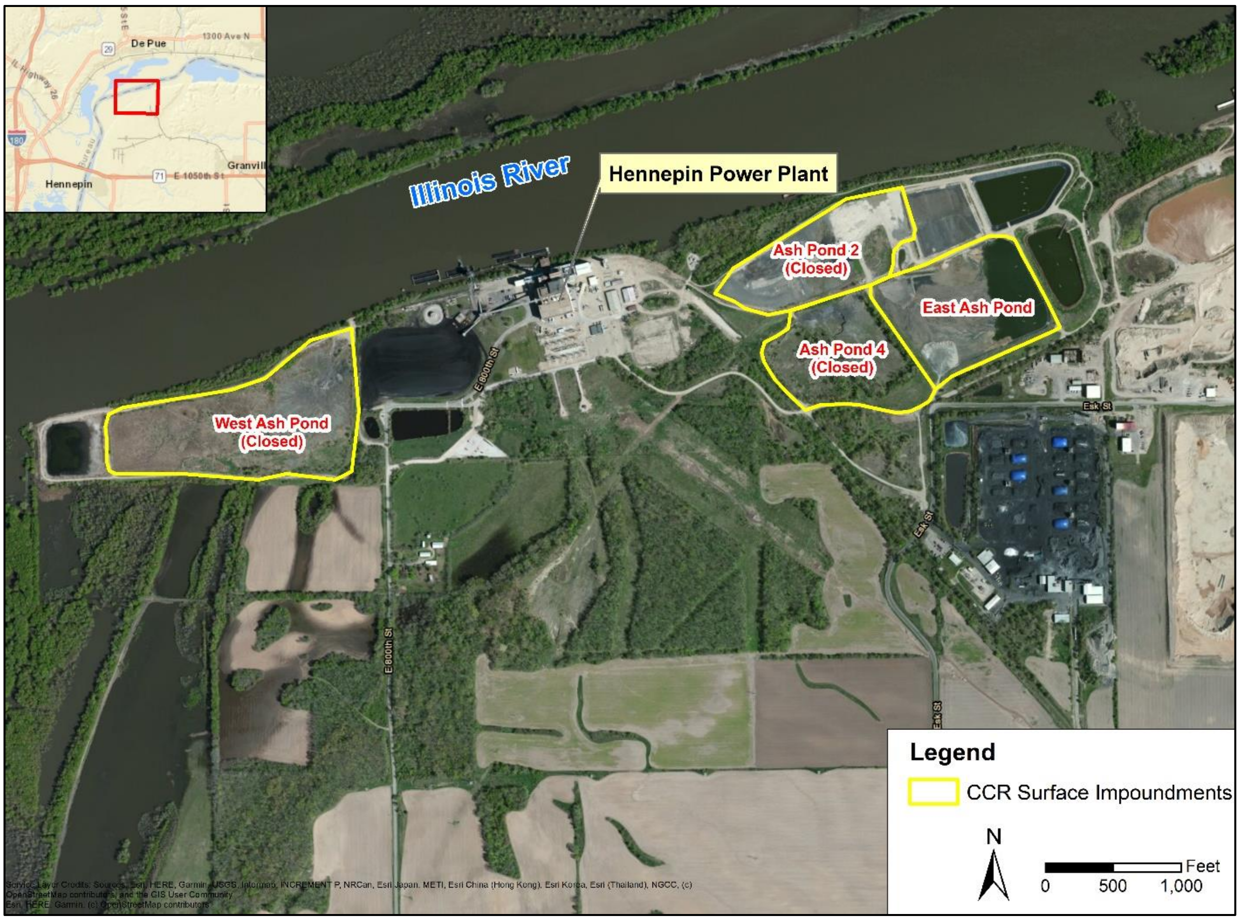


**Figure 1-1: Hennepin Power Plant CCR Surface Impoundments**

This report summarizes the evaluation of the existing East Ash Pond CCR impoundment for compliance with *35 I.A.C. 845.340(c)* (2021), herein referred to as "floodplain compliance." See Appendix A – Excerpt from 35 I.A.C. 845.340(c) for compliance requirements.

# 2.0 DATA AVAILABILITY AND ANALYSIS

## 2.1 Flood Insurance Rate Maps

The Hennepin Power Plant is split between two current Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs), 17155C0015E and 17155C0025E, both with an effective date of February 4, 2011. The currently operating East Ash Pond and the closed Ash Pond 2 and Ash Pond 4 are included in map number 17155C0025E, while the closed West Ash Pond is depicted on map number 17155C0015E. Copies of the FIRMS are provided in Appendix B – FEMA Flood Insurance Rate Maps. The East Ash Pond is located between river mile 212.4 and 212.9 and is delineated in "red" on Figure 2-1.

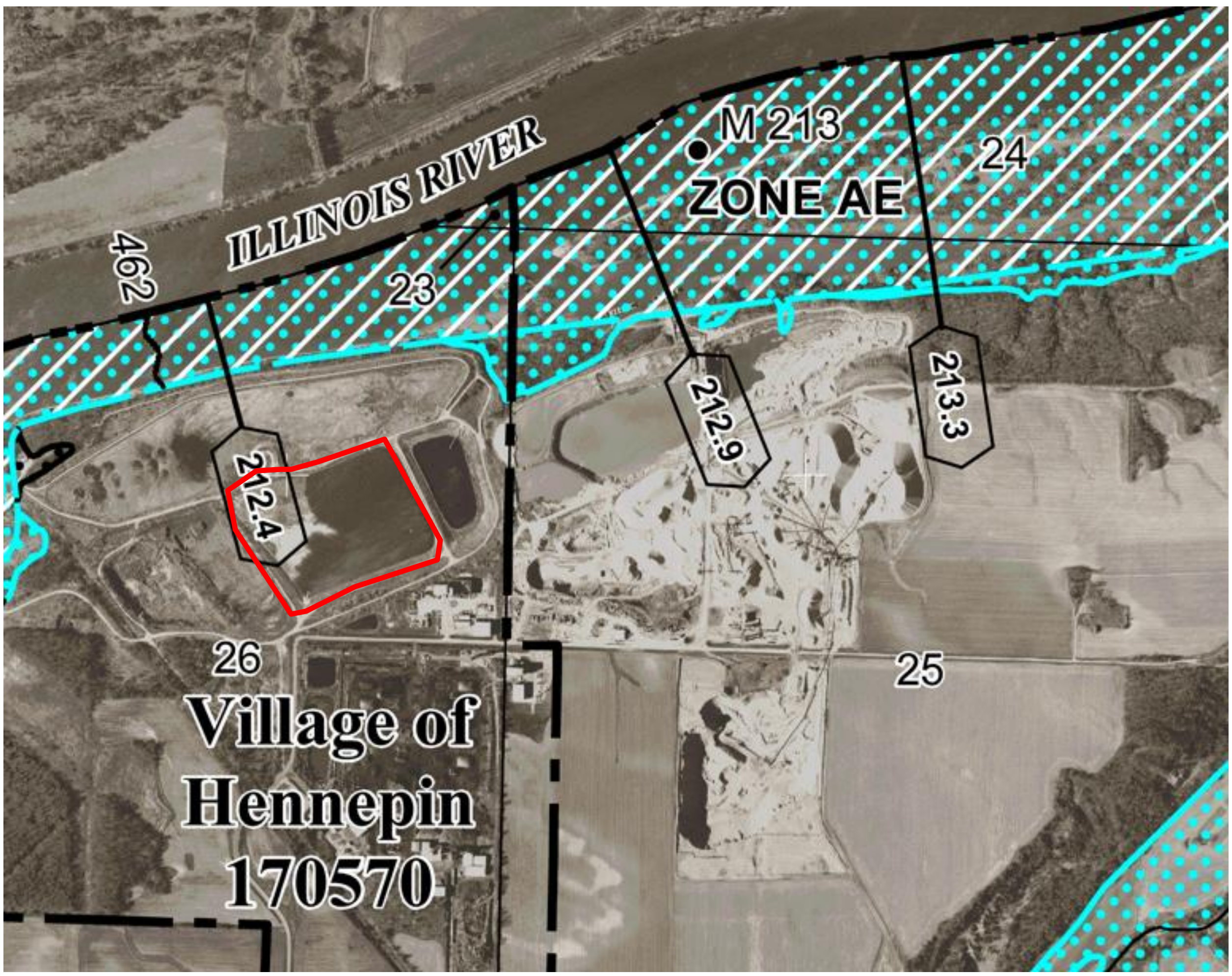


**Figure 2-1: East Ash Pond on FIRM 17155C0025E**

After review of the effective FIRM number 17155C0025E, the East Ash Pond appears to be located outside of the regulatory floodway and the area inundated by the base flood (the 1% annual chance flood), Zone AE in Figure 2-1.

## 2.2 Flood Insurance Study

The effective FEMA Flood Insurance Study (FIS) for Putnam County, study number 17155CV000A, has an effective date of February 4, 2011. According to the FIS, the hydrologic and hydraulic analysis was based on the *Upper Mississippi River System Flow Frequency Study* published in January 2004 (FEMA, 2011c). Cross sections for the Illinois River between river mile 80.2 and 286, which includes the area near the Hennepin Power Plant, were created using data from 1998 aerial photography and photogrammetry as well as digital hydrographic surveys collected from 1997 or later and supplemented with United States Geological Survey (USGS) National Elevation Dataset 1/3 arc second coverage (FEMA, 2011c). Because the East Ash Pond CCR impoundment was constructed in 1996, its impacts would have been accounted for in the 2011 FIS.

According to the FIS floodway data table, the base flood elevation for the cross sections at river miles 212.9 and 212.4, upstream and downstream of East Ash Pond, is 462.0 and 461.9 feet North American Vertical Datum of 1988 (NAVD88), respectively. Therefore, the base flood elevation of the East Ash Pond is estimated to be 462.0 feet. Unless otherwise noted, all elevations referenced in this report refer to NAVD88.

## 2.3 Effective Hydraulic Model

A copy of the effective hydraulic model for the Illinois River between river mile 157.75 and 230.91 was obtained from the FEMA Engineering Library on August 19, 2021, (USACE Rock Island District, 2005). The model was developed in 2005 using HEC-RAS version 3.1.3. The 100-year water surface elevations were calibrated to the results developed from the January 2004 *Upper Mississippi River System Flow Frequency Study*. The model files were converted to HEC-RAS version 6.0, and results were compared to the regulatory base flood elevations. Review of the model files confirmed that the CCR impoundment was represented in the ground elevations for the cross section at river mile 212.4.

Geospatial locations of the cross sections and the river centerline were obtained from the FEMA's National Flood Hazard Layer (NFHL) geographic information system (GIS) data (FEMA, 2011d). Figure 2-2 provides the locations of these cross sections.

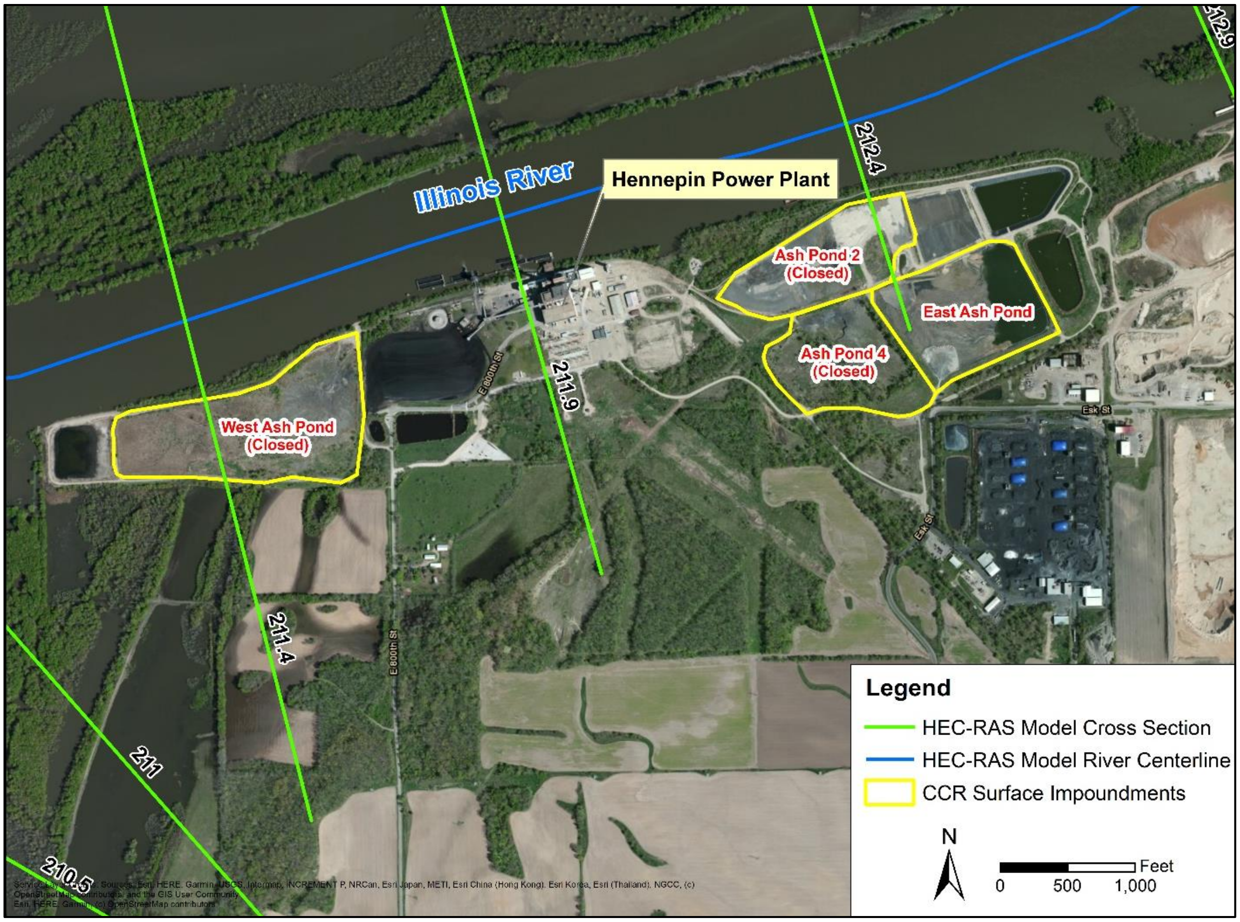


**Figure 2-2: Illinois River Cross Sections Near Hennepin Power Plant**

Modeling results were within 0.1-feet of the base flood elevations published in the FIS. Table 2-1 provides a comparison of the FIS base flood elevation and model results.

**Table 2-1: Base Flood Elevations (BFEs)**

| Cross Section (River Mile) | FIS BFE (feet) | Model BFE (feet) |
|---|---|---|
| 211.4 | 461.9 | 462.0 |
| 211.9 | 461.9 | 462.0 |
| 212.4 | 461.9 | 462.0 |
| 212.9 | 462.0 | 462.1 |

## 2.4 Closure of West Ash Pond

Closure of West Ash Pond was documented in *Technical Assessment of River and Dam Safety Impacts for the Closure of CCR Ponds* (Hanson Professional Services, Inc., 2020). The report states that the closure of the West Ash Pond was approved by the Illinois Environmental Protection Agency on June 19, 2018, with construction anticipated to be completed by November 17, 2020. The report also references a hydraulic analysis for the "worst-case", stating that the "[post-closure] grading creates a maximum water surface elevation over [pre-closure] of 0.00-ft and increase in channel velocity of 0.01-ft/s for all flows modeled." However, Appendix G of the report, which contains the model output summary, was not included. Model files developed for the report by Hanson Professional Services were not evaluated as part of this analysis. Therefore, it is assumed that the base flood was included in the "worst-case" analysis, which resulted in no increase in water surface elevation. No Letter of Map Amendment (LOMA) was available on FEMA's Map Service Center related to the West Ash Pond closure project.

# 3.0 CONCLUSION

Topographic/contour data at the Hennepin Power Plant and CCR impoundments was obtained from the Illinois Geospatial Data Clearinghouse (Illinois Geospatial Data Clearinghouse, 2012). Based on the topographic data, the top of embankment elevation for East Ash Pond is 493 feet. The effective regulatory floodway, areas inundated by the 1% and 0.2% annual chance floods, base flood elevations, and the contour line of the top of embankment elevation for East Ash Pond is provided in Figure 3-1.

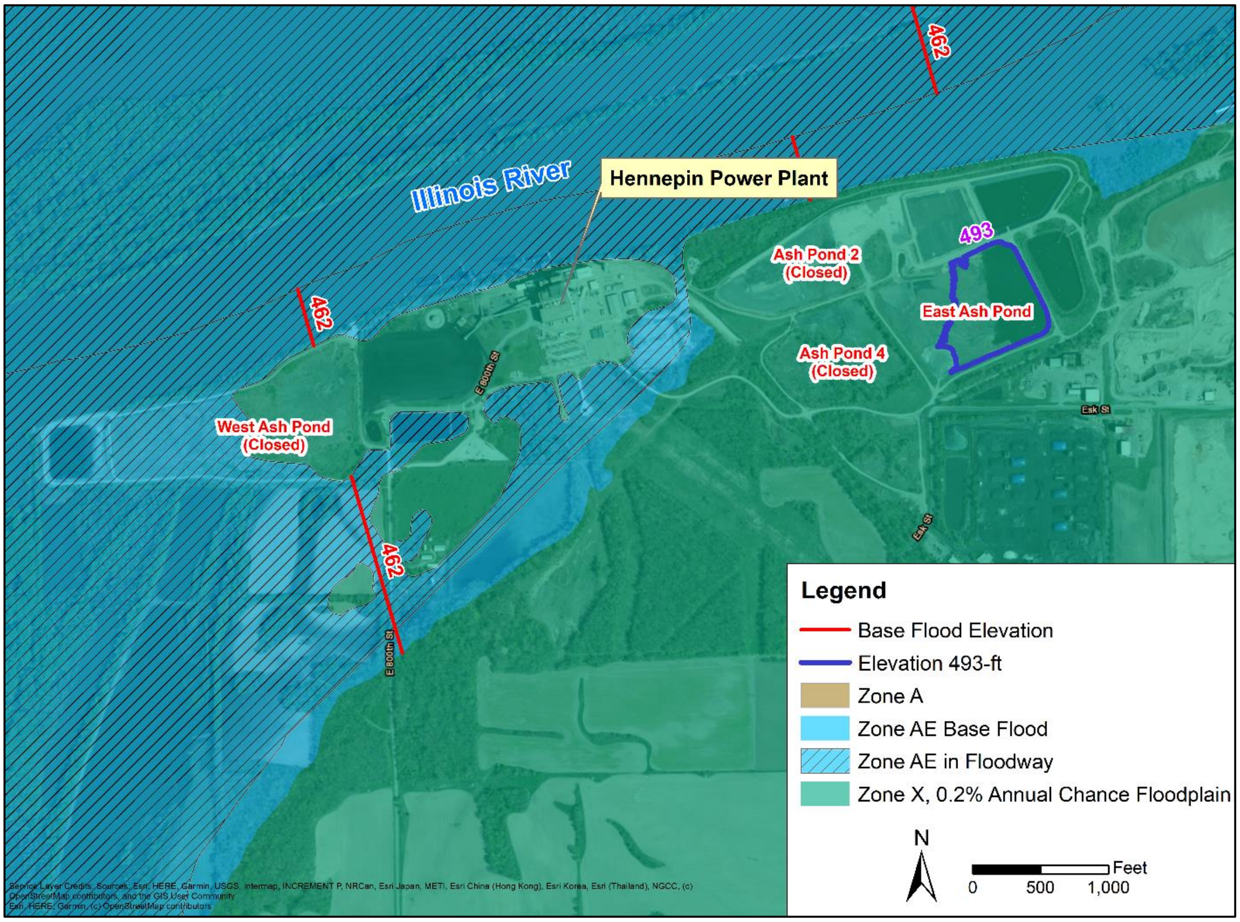


**Figure 3-1: Inundation Extents and Significant Elevations**

As seen in Figure 3-1, the top of embankment for East Ash Pond is located outside of the area subject to inundation by the 1% annual chance flood and has a top of embankment elevation of 493 feet. This is above the base flood elevation of 462.0 feet. Therefore, East Ash Pond is not subject to inundation by the base flood.

Since the construction of the East Ash Pond was completed in 1996 and the topographic information used to develop the hydraulic model (from which the regulatory floodway and the area inundated by the based flood was defined) was collected in 1997, the East Ash Pond does not restrict the flow of the base flood and does not reduce the temporary water storage capacity of the floodplain. The regulatory floodway is defined as the area that “must be reserved in order to discharge the base flood” (FEMA, 2020). Therefore, since the topography of the East Ash Pond was already included in the hydraulic model that determined the regulatory floodway, the East Ash Pond does not restrict this base flood discharge. Likewise, the topography of the East Ash Pond was included in the hydraulic model that determined the extents of the area inundated by the base flood. Therefore, the East Ash Pond does not reduce the compensatory storage of the base flood.

Based on the analysis included herein the existing Hennepin Power Plant East Ash Pond CCR surface impoundment complies with the requirements included in *35 I.A.C. 845.340(c)* (2021).

- The East Ash Pond does not restrict the flow of the base flood because it was included in the hydraulic modeling that defined the regulatory floodway, the area reserved to discharge the base flood.
- The East Ash Pond does not reduce the temporary water storage capacity of the 100-year floodplain because it was included in the hydraulic modeling that defined the special flood hazard area subject to inundation by the based flood or 1% annual chance flood.
- The East Ash Pond is not subject to carrying away of CCR by waters of the base flood because the top of embankment elevation for the CCR impoundment greater than the base flood elevation.

# 4.0 REFERENCES


FEMA. (2011a, February 4). Flood Insurance Rate Map (FIRM) 17155C0015E. *Map Service Center Effective Products*. Retrieved from https://msc.fema.gov/portal/advanceSearch

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Title 35 of the Illinois Administrative Code Part 845 Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (April 15, 2021).

USACE. (n.d.). Hydrologic Engineering Center. *Hydrologic Engineering Center's River Analysis System (HEC-RAS), Version 6.0*. Davis, California, United States. Retrieved from https://www.hec.usace.army.mil/software/hec-ras/download.aspx

USACE. (n.d.). Hydrologic Engineering Center. *Hydrologic Engineering Center's River Analysis System (HEC-RAS), Version 3.1.3*. Davis, California, United States. Retrieved from https://www.hec.usace.army.mil/software/hec-ras/download.aspx

USACE Rock Island District. (2005, September 30). FEMA Engineering Library. *Illinois River Mile 80 - 286 Flood Computation*.

# APPENDIX A – EXCERPT FROM 35 I.A.C. 845.340(C)

b) The owner or operator of the CCR surface impoundment must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of subsection (a).

c) The owner or operator of an existing CCR surface impoundment must complete the demonstration required by subsection (a) and submit the completed demonstration, along with the qualified professional engineer's certification to the Agency with the facility's initial operating permit application.

d) The owner or operator of a new CCR surface impoundment or a lateral expansion of a CCR surface impoundment must submit plans and specifications in a construction permit application that demonstrate the CCR surface impoundment will be constructed under subsection (a). Upon completion of construction, the owner or operator must obtain a certification from a qualified professional engineer that the CCR surface impoundment or lateral expansion was constructed in accordance with the requirements of subsection (a) and submit the certification to the Agency in the facility's initial operating permit application.

**Section 845.340 Unstable Areas and Floodplains**

a) An existing or new CCR surface impoundment, or any lateral expansion of a CCR surface impoundment, must not be located in an unstable area unless the owner or operator demonstrates that recognized and generally accepted engineering practices have been incorporated into the design of the CCR surface impoundment to ensure that the integrity of the structural components of the CCR surface impoundment will not be disrupted.

b) The owner or operator must consider all the following factors, at a minimum, when determining whether an area is unstable:

1) On-site or local soil conditions, including ~~but not limited to~~ liquefaction, that may result in significant differential settling;

2) On-site or local geologic or geomorphologic features; and

3) On-site or local human-made features or events (both surface and subsurface).

c) An existing or new CCR surface impoundment, or any lateral expansion of a CCR surface impoundment, must not be located in a floodplain unless the owner or operator demonstrates that recognized and generally accepted engineering practices have been incorporated into the design of the CCR surface impoundment to ensure that the CCR surface impoundment will not restrict the flow of the base flood, reduce the temporary water storage capacity of a floodplain, or result in washout of CCR, so as to pose a hazard to human life, wildlife, or land or water resources. For this subsection (c):

1) Base flood means a flood that has a 1 percent or greater chance of recurring in any year or a flood of a magnitude equaled or exceeded once in 100 years on average within the time of historical river level records.

2) Floodplain means the lowland and relatively flat areas adjoining inland and coastal waters, including flood-prone areas of offshore islands, which are inundated by the base flood.

3) Washout means the carrying away of CCR by waters of the base flood.

d~~c~~) The owner or operator of the CCR surface impoundment must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of subsections (a) and (c).

e~~d~~) The owner or operator of an existing CCR surface impoundment must complete the demonstration required by subsections (a) and (c) of this Section and submit the completed demonstration, along with a qualified professional engineer's certification, to the Agency with the facility's initial operating permit application.

f~~e~~) The owner or operator of a new CCR surface impoundment, or a lateral expansion of a CCR surface impoundment, must submit plans and specifications in a construction permit application that demonstrate the CCR surface impoundment will be constructed under subsections (a)and (c). Upon completion of construction, the owner or operator must obtain a certification from a qualified professional engineer that the CCR surface impoundment or lateral expansion was constructed in accordance with the requirements in subsections (a) and (c) and submit the certification to the Agency in the facility's initial operating permit application.

**Section 845.350 Failure to Meet Location Standards**

a) An owner or operator of an existing CCR surface impoundment who fails to demonstrate compliance with the requirements of this Subpart is subject to the requirements of Section 845.700.

b) An owner or operator of a new CCR surface impoundment, or any lateral expansion of a CCR surface impoundment, who fails to make the demonstration showing compliance with the requirements of this Subpart is prohibited from placing CCR in the CCR surface impoundment.

SUBPART D: DESIGN CRITERIA

**Section 845.400 Liner Design Criteria for Existing CCR Surface Impoundments**

# APPENDIX B – FEMA FLOOD INSURANCE RATE MAPS

# NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or flood plain management.

**Coastal Base Flood Elevations** shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or flood plain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

In the State of Illinois, any portion of a stream or watercourse that lies within the **floodway fringe** of a studied (AE) stream may have a state regulated floodway. The FIRM may not depict these state regulated floodways.

**Floodways** restricted by anthropogenic features such as bridges and culverts are drawn to reflect natural conditions and may not agree with the model computed widths listed in the Floodway Data table in the Flood Insurance Study report.

Multiple **topographic sources** may have been used in the delineation of Special Flood Hazard Areas. See Flood Insurance Study report for details on source resolution and geographic extent.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 16. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services, NOAA, N/NGS12
National Geodetic Survey SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit its website at www.ngs.noaa.gov.

**Base map** information shown on this FIRM was provided in digital format by the United States Geological Survey. Digital orthoimagery with a spatial resolution of 0.5 meter ground sample distance were photogrammetrically compiled from aerial photography acquired during the leaf-off period of spring 2005.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The Special Flood Hazard Areas and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

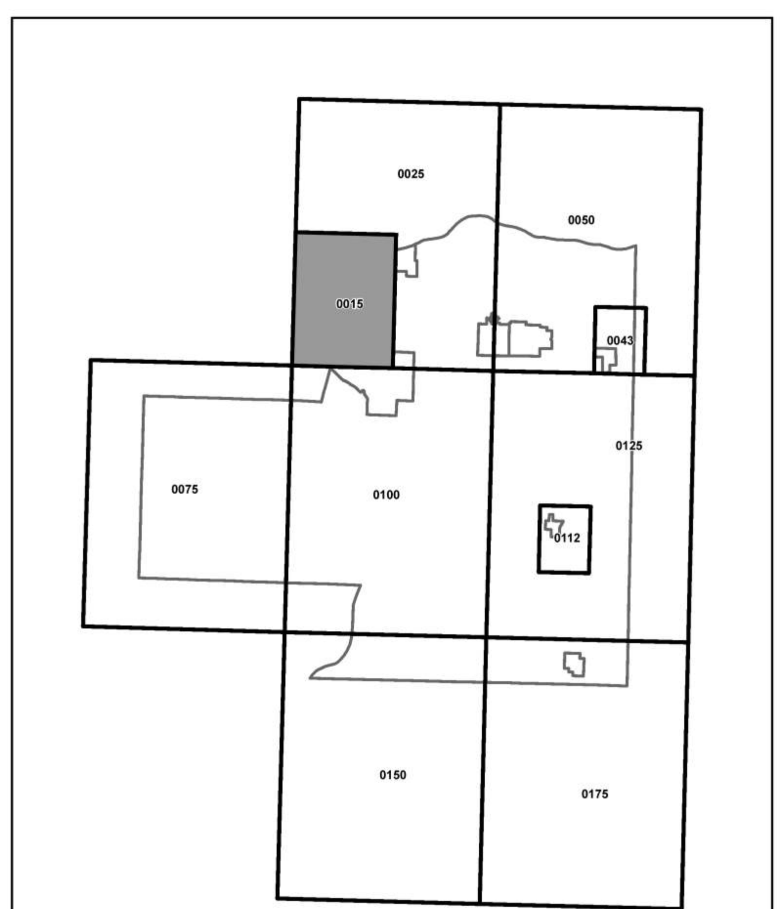
**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

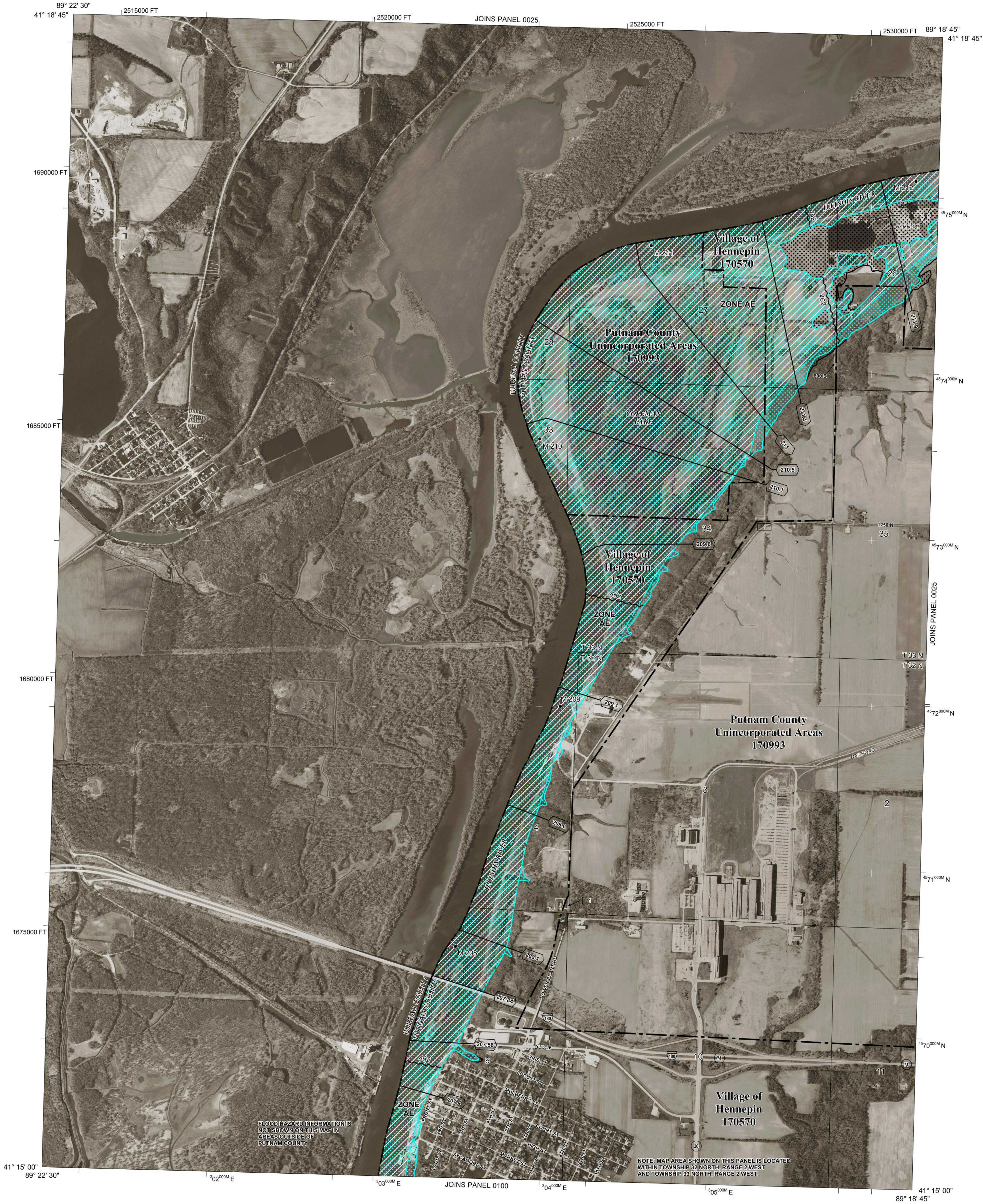
For information on available products associated with this FIRM visit the Map Service Center (MSC) website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map**, how to order products or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

# PANEL INDEX




Panel Not Printed




# LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

| | |
|---|---|
| **ZONE A** | No Base Flood Elevations determined. |
| **ZONE AE** | Base Flood Elevations determined. |
| **ZONE AH** | Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined. |
| **ZONE AO** | Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined. |
| **ZONE AR** | Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood. |
| **ZONE A99** | Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined. |
| **ZONE V** | Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined. |
| **ZONE VE** | Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined. |

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

**ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

**ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.
**ZONE D** Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

| | |
|---|---|
| | 1% annual chance floodplain boundary |
| | 0.2% annual chance floodplain boundary |
| | Floodway boundary |
| | Zone D boundary |
| | CBRS and OPA boundary |
| | Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities. |
| 513 | Base Flood Elevation line and value; elevation in feet* |
| (EL 987) | Base Flood Elevation value where uniform within zone; elevation in feet* |

*Referenced to the North American Vertical Datum of 1988

| | |
|---|---|
| A — A | Cross section line |
| 23 - - - 23 | Transect line |
| 45° 02' 08", 93° 02' 12" | Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) |
| $^{49}89^{000M}$ N | 1000-meter Universal Transverse Mercator grid values, zone 16 |
| 1565000 FT | 5000-foot grid tick: Illinois State Plane West Coordinate System, 3801 zone (FIPSZONE 1202) Transverse Mercator |
| DX5510× | Bench mark (see explanation in Notes to Users section of this FIRM panel) |
| • M1.5 | River Mile |

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
FEBRUARY 4, 2011

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

**MAP SCALE 1" = 1000'**

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

**PANEL 0015E**

# FIRM
## FLOOD INSURANCE RATE MAP
## PUTNAM COUNTY, ILLINOIS
### AND INCORPORATED AREAS

**PANEL 15 OF 175**

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| HENNEPIN, VILLAGE OF | 170570 | 0015 | E |
| PUTNAM COUNTY | 170993 | 0015 | E |

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

**MAP NUMBER**
**17155C0015E**

**EFFECTIVE DATE**
**FEBRUARY 4, 2011**

Federal Emergency Management Agency

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**Coastal Base Flood Elevations** shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or flood plain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

In the State of Illinois, any portion of a stream or watercourse that lies within the **floodway fringe** of a studied (AE) stream may have a state regulated floodway. The FIRM may not depict these state regulated floodways.

**Floodways** restricted by anthropogenic features such as bridges and culverts are drawn to reflect natural conditions and may not agree with the model computed widths listed in the Floodway Data table in the Flood Insurance Study report.

Multiple **topographic sources** may have been used in the delineation of Special Flood Hazard Areas. See Flood Insurance Study report for details on source resolution and geographic extent.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 16. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services, NOAA, N/NGS12
National Geodetic Survey SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit its website at www.ngs.noaa.gov.

**Base map** information shown on this FIRM was provided in digital format by the United States Geological Survey. Digital orthoimagery with a spatial resolution of 0.5 meter ground sample distance were photogrammetrically compiled from aerial photography acquired during the leaf-off period of spring 2005.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The Special Flood Hazard Areas and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

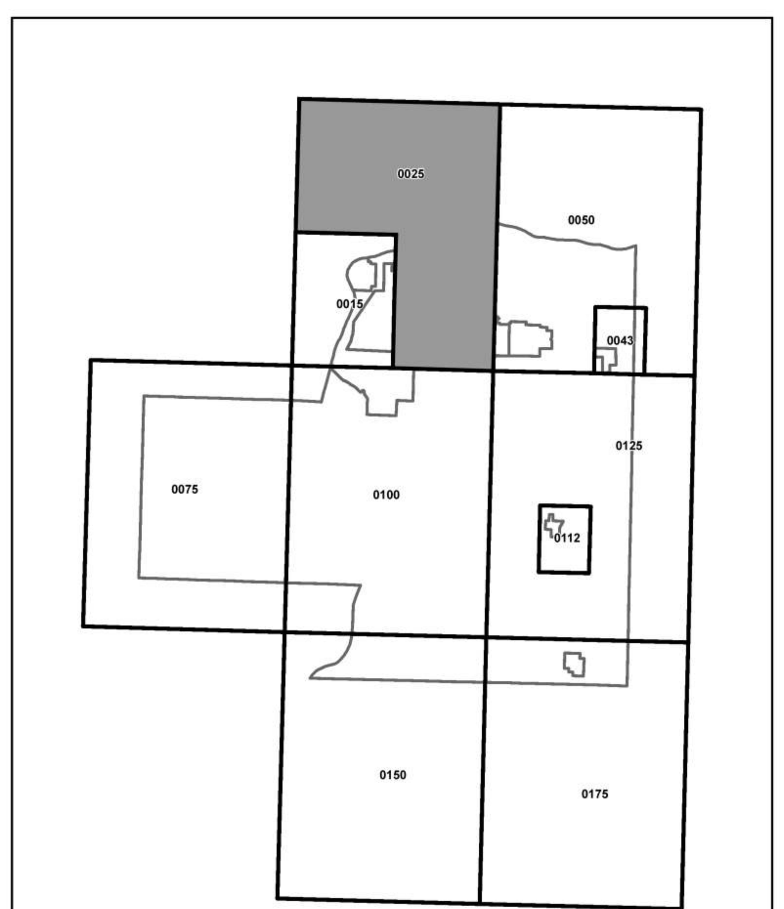
**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the Map Service Center (MSC) website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map**, how to order products or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

## PANEL INDEX




Panel Not Printed


# LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

| | |
|---|---|
| **ZONE A** | No Base Flood Elevations determined. |
| **ZONE AE** | Base Flood Elevations determined. |
| **ZONE AH** | Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined. |
| **ZONE AO** | Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined. |
| **ZONE AR** | Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood. |
| **ZONE A99** | Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined. |
| **ZONE V** | Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined. |
| **ZONE VE** | Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined. |

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

**ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

**ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.

**ZONE D** Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

| | |
|---|---|
| | 1% annual chance floodplain boundary |
| | 0.2% annual chance floodplain boundary |
| | Floodway boundary |
| | Zone D boundary |
| | CBRS and OPA boundary |
| | Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities. |
| 513 | Base Flood Elevation line and value; elevation in feet* |
| (EL 987) | Base Flood Elevation value where uniform within zone; elevation in feet* |

*Referenced to the North American Vertical Datum of 1988

| | |
|---|---|
| (A)——(A) | Cross section line |
| (23)------(23) | Transect line |
| 45° 02' 08", 93° 02' 12" | Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) |
| $^{49}89^{000M}$ N | 1000-meter Universal Transverse Mercator grid values, zone 16 |
| 1565000 FT | 5000-foot grid tick: Illinois State Plane West Coordinate System, 3801 zone (FIPSZONE 1202) Transverse Mercator |
| DX5510 × | Bench mark (see explanation in Notes to Users section of this FIRM panel) |
| • M1.5 | River Mile |

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
FEBRUARY 4, 2011

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

**MAP SCALE 1" = 2000'**

1000 0 2000 4000 FEET

600 0 600 1200 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

**PANEL 0025E**

# FIRM
## FLOOD INSURANCE RATE MAP
## PUTNAM COUNTY, ILLINOIS
## AND INCORPORATED AREAS

**PANEL 25 OF 175**

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| HENNEPIN, VILLAGE OF | 170570 | 0025 | E |
| MARK, VILLAGE OF | 170572 | 0025 | E |
| PUTNAM COUNTY | 170993 | 0025 | E |

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

**MAP NUMBER**
**17155C0025E**

**EFFECTIVE DATE**
**FEBRUARY 4, 2011**

Federal Emergency Management Agency

# APPENDIX C – TECHNICAL ASSESSMENT OF RIVER AND DAM SAFETY IMPACTS FOR THE CLOSURE OF CCR PONDS

Hanson Professional Services Inc.
1525 South Sixth Street
Springfield, Illinois 62703
ph (217) 788-2450
fax (217) 788-2503
www.hanson-inc.com

Additional Documentation

Riverine Structures Form

- Section D.4 – Closure of the Old West Ash Pond (OWAP) has been approved by the Illinois Department of Natural Resources Office of Water Resources under permit No. DS2021007 (see attached). The dam has been assigned a hazard classification of Class III (Low Hazard). The OWAP was closed through the installation of geomembrane in addition to fill within the pond. Ponded surface water was removed from the OWAP. The geomembrane cover consists of a 40-mil textured LLDPE and soil cover system. The cover system was constructed above the pre-closure top of dam eliminating the pre-closure impounding capacity of the structure. The post-closure cover system freely drains to the Illinois river and the structure will no longer be intended to impound water. The attached permit No. DS2021007 includes the related drawings, specifications and supporting design information for the OWAP closure.

- Section D.7 – Old West Ash Pond is a Class III: Low Hazard Dam. Per IDNR Part 3702 Rule 3702.40 the dam does not require a formal Operation & Maintenance Plan.

Pertinent excerpts from the Technical Assessment in support of permit No. DS2021007 are attached.

Draft Notice:

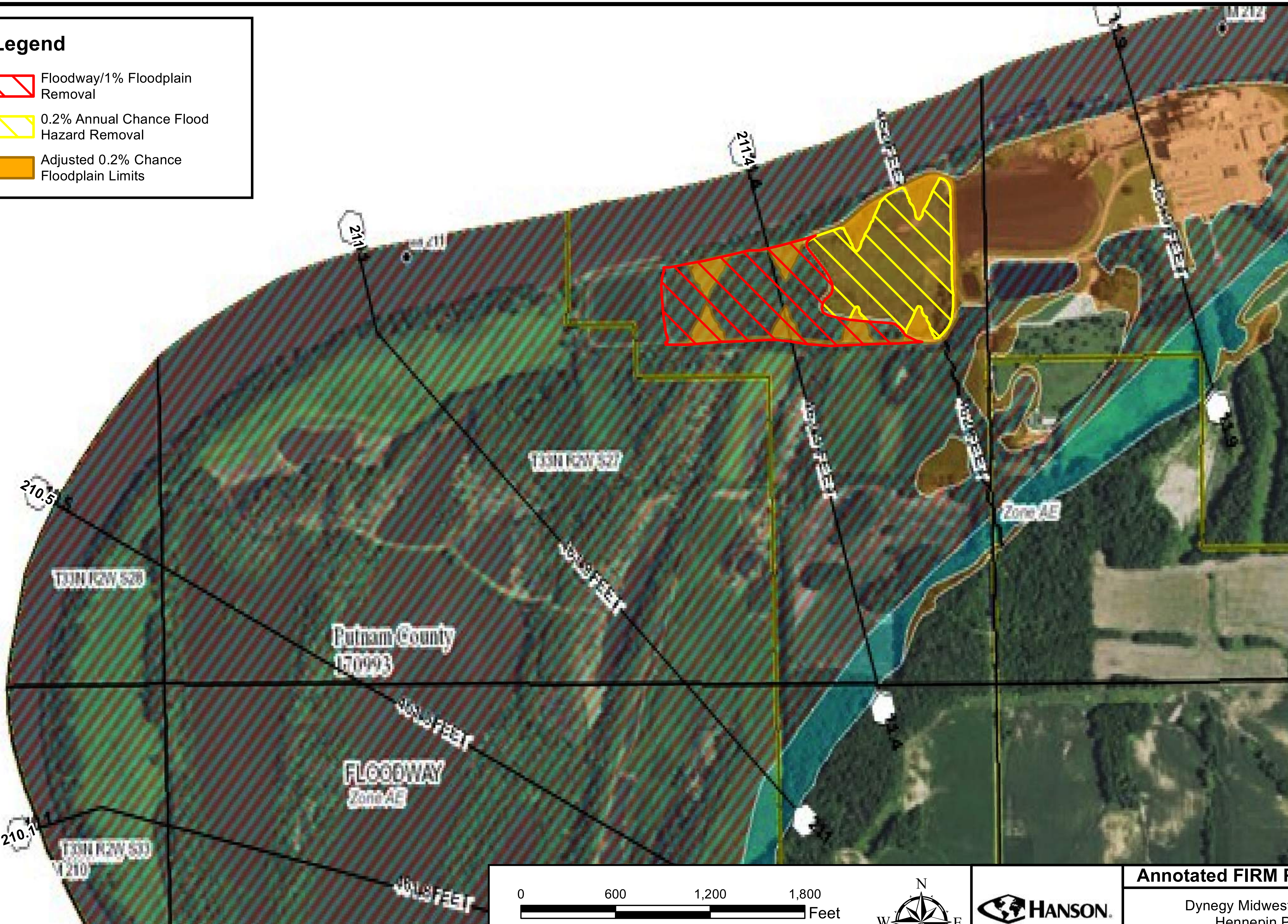
The Putnam County Zoning and Floodplain Office, in accordance with National Flood Insurance Program regulation 65.7(b)(1), hereby gives notice of Putnam County's intent to revise the flood hazard information, generally located on the south bank of the Illinois River along the Hennepin Power Station Old West Ash Pond (OWAP). Specifically, the flood hazard information will be revised over the Old West Ash Pond (OWAP). The flood hazard revisions are being proposed as part of a Letter of Map Revision (LOMR) Case No. xx-xx-xxxxx to incorporate the closure of the Hennepin Power Station OWAP.

1. The floodway and floodplain over OWAP will be revised to remove an area about 1800-ft by 1000-ft.
2. Base Flood Elevations (BFEs) will not change.

Maps and detailed analysis of the revision can be reviewed at the Putnam County Clerk Office at 120 N. Fourth Street, Hennepin IL. Interested persons may call Jim Burger, Zoning and Floodplain Office - Enforcement Officer at (972) 624-3109 or pczoning@co.putnam.il. for additional information from Monday – Friday : 9:00 am - 4:00pm.

**Figure TBD.**
**SAMPLE PUBLIC NOTIFICATION FOR PROPOSED FLOOD HAZARD REVISIONS**
(to be used by community when placing a notice in a newspaper)

Please note that a newspaper notice may not be used to fulfill the notification requirement of NFIP Regulation 65.12.




**Legend**

- Floodway/1% Floodplain Removal
- 0.2% Annual Chance Flood Hazard Removal
- Adjusted 0.2% Chance Floodplain Limits

Vertical Datum: NAVD88
Coordinate System: NAD 1983 NSRS2007 StatePlane Illinois West FIPS 1202 Ft US

0 600 1,200 1,800 Feet

1 inch = 600 feet

N E S W

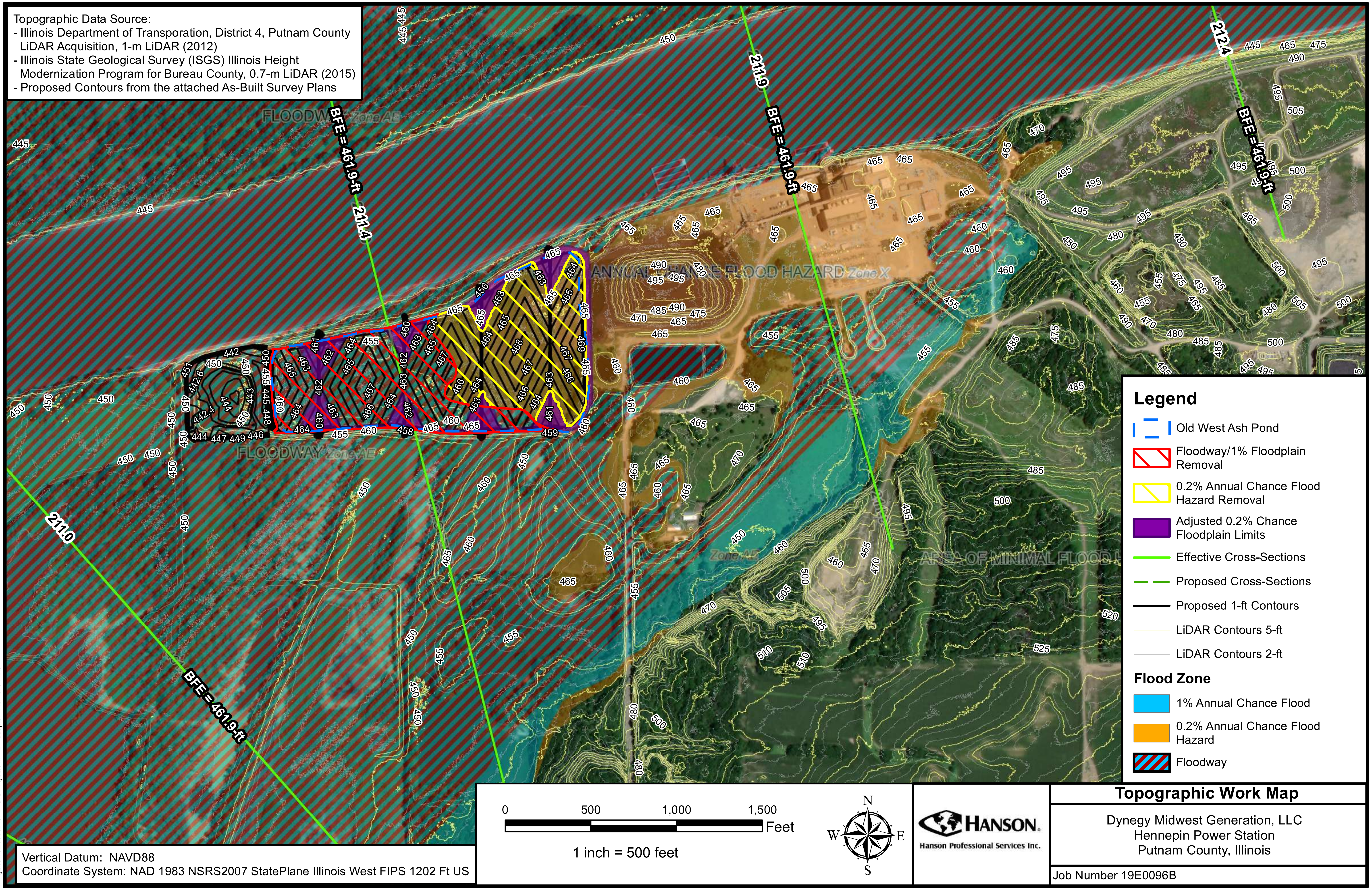
HANSON
Hanson Professional Services Inc.

**Annotated FIRM Panel 17155C0015E**

Dynegy Midwest Generation, LLC
Hennepin Power Station
Putnam County, Illinois

Job Number 19E0096B

I:\19jobs\19E0096B\CADD\GIS\Projects\MT-2 FIRM_0015.mxd




Vertical Datum: NAVD88
Coordinate System: NAD 1983 NSRS2007 StatePlane Illinois West FIPS 1202 Ft US

HANSON
Hanson Professional Services Inc.

## Topographic Work Map

Dynegy Midwest Generation, LLC
Hennepin Power Station
Putnam County, Illinois

Job Number 19E0096B

I:\19jobs\19E0096B\CAD\GIS\Projects\MT-2 Floodplain Removal.mxd

**PERMIT NO. DS2021007**
**DATE: February 11, 2021**

# State of Illinois

## Department of Natural Resources, Office of Water Resources

**Permission is hereby granted to:**

**Dynegy Midwest Generation, LLC**
**1500 Eastport Plaza Drive**
**Collinsville, Illinois 62234**

**To modify, operate and maintain the West Ash Pond Dam, an intermediate size Class II dam located in Section 27, Township 33 North, Range 2 West of the 3rd Principal Meridian in Putnam County, in accordance with an application dated October 30, 2020. The plans and specifications are entitled:**

**HENNIPEN POWER STATION**
**PERMIT DRAWINGS FOR THE CLOSURE OF THE**
**OLD WEST ASH POND AND OLD WEST POLISHING POND**
**Sheets G100, G110, C100, C200, C210, C220, C300, C310, C320, C330, C400, C410 and C420**
**Dated May 1, 2020**
**Technical Specifications**
**Sections 01 11 01, 01 42 13, 01 43 00, 01 57 19 01 78 00: Division 02 and Division 31**
**Dated January 28, 2019**

**The construction authorization covers removal of the surface impounding capacity, shaping of the embankment slopes and general site drainage work. The construction activities were previously completed.**

**Examined and Recommended:**

____________________________________

**Paul Mauer, Jr., P.E.**
**State Dam Safety Engineer**

**Approval Recommended:**

____________________________________

**Loren A. Wobig, Director**
**Office of Water Resources**

**Approved:**

____________________________________

**Colleen Callahan, Director**
**Department of Natural Resources**

This PERMIT is subject to the terms and special conditions contained herein.

**PERMIT NO. DS2021007**

# THIS PERMIT IS SUBJECT TO THE FOLLOWING CONDITIONS:

1) This permit is granted in accordance with the Rivers, Lakes and Streams Act [615 ILCS 5].

2) This permit does not convey title to the permittee or recognize title of the permittee to any submerged or other lands, and furthermore, does not convey, lease or provide any right or rights of occupancy or use of the public or private property on which the activity or any part thereof will be located, or otherwise grant to the permittee any right or interest in or to the property, whether the property is owned or possessed by the State of Illinois or by any private or public party or parties.

3) This permit does not release the permittee from liability for damage to persons or property resulting from the work covered by this permit, and does not authorize any injury to private property or invasion of private rights.

4) This permit does not relieve the permittee of the responsibility to obtain other federal, state or local authorizations required for the construction of the permitted activity; and if the permittee is required by law to obtain approval from any federal or other state agency to do the work, this permit is not effective until the federal and state approvals are obtained.

5) The permittee shall, at the permittee's own expense, remove all temporary piling, cofferdams, false work, and material incidental to the construction of the project, from the floodway, river, stream or lake in which the work is done. If the permittee fails to remove such structures or materials, the State may have removal made at the expense of the permittee. If the construction is on a public body of water and if future need for public navigation or other public interest of any character, by the State or federal government, necessitates changes in any part of the structure or structures, such changes shall be made by and at the expense of the permittee or the permittee's successors as required by the Department of Natural Resources or other properly constituted agency, within sixty (60) days from receipt of written notice of the necessity from the Department or other agency, unless a longer period of time is specifically authorized.

6) The execution and details of the work authorized shall be subject to the supervision and approval of the Department. Department personnel shall have the right of access to accomplish this purpose.

7) The permittee shall file with the Department a properly executed acceptance of all terms and conditions of the permit within sixty (60) days of receipt of the permit; however, starting work on the construction authorized will be considered full acceptance by the permittee of the terms and conditions of the permit.

8) The Department in issuing this permit has relied upon the statements and representations made by the permittee; if any substantive statement or representation made by the permittee is found to be false, the permit may be revoked at the option of the Department; and when a permit is revoked all rights of the permittee under the permit are voided.

9) If the project authorized by this permit is located in or along Lake Michigan or a meandered Lake, the permittee and the permittee's successors shall make no claim whatsoever to any interest in any accretions caused by the project.

10) In issuing this permit, the Department does not ensure the adequacy of the design or structural strength of the structure or improvement.

11) Noncompliance with the conditions of this permit will be considered grounds for revocation.

12) If the construction activity permitted is not completed on or before ______n/a_____, this permit shall cease and be null and void.

## THIS PERMIT IS SUBJECT TO THE FOLLOWING SPECIAL CONDITIONS:

**PERMIT NO. DS2021007**

# PERMIT ACCEPTANCE

This Acceptance must be signed and returned to the address below to validate this permit.

**ILLINOIS DEPARTMENT OF NATURAL RESOURCES**
**OFFICE OF WATER RESOURCES**
**One Natural Resources Way**
**Springfield, Illinois 62702-1271**

The undersigned permittee, personally, or if a corporation by its duly authorized officers, hereby accepts the permit bearing the above permit number subject to all conditions named therein, on this ____________day of _______________________, 20__.

_____________________________

By__________________________

By__________________________

If a corporation
affix seal here.

Date

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

Illinois Department of
**Natural Resources**

One Natural Resources Way Springfield, Illinois 62702-1271
www.dnr.illinois.gov

JB Pritzker, Governor
Colleen Callahan, Director

February 11, 2021

SUBJECT: Permit No. DS2021007
Modification, Operation and Maintenance
West Ash Pond Dam – IL00698
Putnam County

Dynegy Midwest Generation, LLC
Attn: Ms. Dianna Tickner
1500 Eastport Plaza Drive
Collinsville, IL 62234

Dear Ms. Tickner:

Enclosed is Illinois Department of Natural Resources, Office of Water Resources Permit No. DS2021007, authorizing the modification, operation and maintenance of the West Ash Pond Dam at Hennepin Power Station. This permit authorizes the removal of the surface impounding capacity, work on the embankment slopes and work on the drainage of the adjacent coal yard area. These items were previously completed and are approved on an after-the-fact basis. It also authorizes the future operation and maintenance of the structure.

The application included information related to several other aspects of the work. The result of our consideration of those items is as follows:

- Floodway delineation – the current FEMA maps indicate that the surface of the ash pond was in the floodway. The topographic information indicates that the top of the embankments has been above the BFE. This prevents the area which includes the top of the embankment and the interior of the impoundment from conveying flood flows of the BFE event. By definition, this area cannot be part of the floodway. The previous delineation appears to be in error. The Department supports the correction of the map by removing the areas above the BFE from the floodplain.

- Application of the Part 3704 rules – The application documents show that the work occurred above the 50% duration elevation of the Illinois River. The construction requirements in the Part 3704 rules do not apply. The permittee is reminded that the public's rights related to the public waters follow the water. Public use of the public waters shall not be impacted without authorization from the Department.

- Application of Part 3702 Rules – The application includes a partial analysis of the potential for the material within the structure to meet the criteria for deregulation of the structure. The investigation did not consider all parts of the impoundment and indicated that during the design seismic event some material may be subject to liquefaction. The result is that the structure still meets the definition of a dam and remains a regulated dam. Based on the analysis, the classification of the dam is reduced to Class III. The periodic inspection requirement is modified to require inspections only once every 5 years.

- Operation and Maintenance Plan – this authorization incorporates the Operation and Maintenance Plan for the East Ash Pond Dam, as applicable to the West Ash Pond Dam.

This permit does not supersede any other federal, state or local authorizations that may be required for the project.

If any changes of the permitted work are found necessary, revised plans should be submitted promptly to this office for review and approval.

Please feel free to contact me at 217/782-4427 if you have any questions concerning this authorization.

Sincerely,

Paul Mauer, Jr., P.E.
State Dam Safety Engineer

PM:cjp

Enclosure

cc: Mr. Tony Comerio, Hanson Professional Services (e-mail)

**SPECIAL CONDITIONS**
**DYNEGY MIDWEST GENERATION**
**HENNEPIN WEST ASH POND DAM – IL00698**
**DS2021007**

**a.** **There shall be no change from the plans submitted and hereby approved unless the proposed change in plans shall first have been submitted to and approved, in writing, by the State of Illinois acting by and through its Department of Natural Resources, Office of Water Resources.**

**b.** **The Permittee shall operate, inspect, and maintain the dam and appurtenances in accordance with the approved plans and in accordance with the latest edition of the "Rules for Construction and Maintenance of Dams" adopted by the Department of Natural Resources. If the approved operation, inspection and maintenance plans are not complied with by the Permittee, this permit shall cease and be null and void.**

**c.** **The Permittee grants the Department of Natural Resources, Office of Water Resources, the right of access to inspect the dam site and immediate vicinity beginning from the date of this permit, for the life of the dam and appurtenances.**

**d.** **The Permittee authorizes the Department of Natural Resources, Office of Water Resources, in the event that the dam is found to be in immediate danger of failure, to enter upon the dam property, if necessary, to prevent or alleviate any dam breach damage. The Permittee agrees to compensate the Office of Water Resources for costs reasonably incurred by such emergency action.**

**e.** **The Permittee shall have the dam and appurtenances inspected once every 5 years and shall have the engineer prepare and submit an inspection report on forms provided by the Department of Natural Resources to the Department of Natural Resources, Office of Water Resources. In the intervening years the Permittee shall complete and submit the Owner's Maintenance Statement. The first inspection report will be due in 2021 and shall serve as the baseline condition for the modified structure for future inspections.**

HANSON

TELEPHONE MEMORANDUM

| Date: 2/22/2021 | Time: 8:30am |
|---|---|
| Person Called: Chris Hanstad (ISWS) | |
| Person Calling: Garrett Litteken (Hanson) | |
| Project No.: 19E0096B | |
| Project Name: Closure of Old West Ash Pond at Hennepin Power Station, Hennepin, Illinois | |
| Subject: FEMA MT-2 Submittal Coordination | |
| Copy to File, Others: File | |

*The following expresses our understanding of the items discussed. Please respond in writing within five (5) days of receipt if any changes are required.*

On Monday, February 22, 2021, Garrett Litteken (Hanson) called Chris Hanstad (ISWS) to discuss submittal requirements for a MT-2 application in support of a Letter of Map Revision (LOMR) for the removal of the Hennepin Power Station Old West Ash Pond (OWAP) from the 1% annual chance flood hazard based on fill and a floodway mapping error. The primary topic of discussion was the requisite MT-2 forms required for approval of the map change.

Chris Hanstad (ISWS) requested the following information for the MT-2 application:

- The Riverine Structures form should be provided in support of removing the OWAP based on fill.
- Based on preliminary information provided during the call and IDNR OWR permit DS2021007, Chris concurred that the area within the OWAP is improperly mapped as floodway.
    - The Riverine Hydrology and Hydraulics form should be included to document the request to modify the floodway based on a mapping error.
    - Two hydraulic models were used to develop flood hazard information in the subject reach.
        - A UNET model was used to develop the BFE
        - The USACE HEC-RAS Unsteady model was used to develop floodway limits.
        - The unsteady HEC-RAS model does not produce water surface elevations identical to the UNET model.
    - The USACE floodway model should be provided with the conveyance and storage to the OWAP blocked.
        - Effective Cross-Section 211.4 crosses the OWAP. Additional Cross-Sections are not required
    - Garrett noted that changes in water surface resulting from removal of the area within the OWAP are negligible.
    - Chris will make an internal determination if the model should be provided to FEMA
        - Inclusion of the hydraulic model is primarily for administrative purposes and should not impact receipt of a Letter of Map Revision for the OWAP.

# JOINT APPLICATION FORM FOR ILLINOIS

ITEMS 1 AND 2 FOR AGENCY USE

| 1. Application Number | 2. Date Received |
|---|---|
| | |

3. and 4. (SEE SPECIAL INSTRUCTIONS) NAME, MAILING ADDRESS AND TELEPHONE NUMBERS

| 3a. Applicant's Name: | 3b. Co-Applicant/Property Owner Name (if needed or if different from applicant): | 4. Authorized Agent (an agent is not required): |
|---|---|---|
| Dynegy Midwest Generation, LLC<br>Company Name (if any) : Dynegy Midwest Generation, LLC<br>Address: 1500 Eastport Plaza Drive<br>Collinsville, IL 62234<br>Email Address: dianna.tickner@vistracorp.com | Company Name (if any):<br>Address:<br>Email Address: | Company Name (if any):<br>Address:<br>Email Address: |
| Applicant's Phone Nos. w/area code<br>Business: 618-381-3124<br>Residence:<br>Cell:<br>Fax: | Applicant's Phone Nos. w/area code<br>Business:<br>Residence:<br>Cell:<br>Fax: | Agent's Phone Nos. w/area code<br>Business:<br>Residence:<br>Cell:<br>Fax: |

***STATEMENT OF AUTHORIZATION***

I hereby authorize, ______________________________ to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

______________________________ Applicant's Signature

______________________________ Date

5. ADJOINING PROPERTY OWNERS (Upstream and Downstream of the water body and within Visual Reach of Project)

| Name | Mailing Address | Phone No. w/area code |
|---|---|---|
| a. IDNR | 1 Natural Resources Way, Springfield, IL 62702 | |
| b. David Urnikis ET AL | 11183 E Power Plant Rd., Granville, IL 61326 | |
| c. | | |
| d. | | |

6. PROJECT TITLE:
Closure of the Old West Ash Pond and the Old West Polishing Pond

7. PROJECT LOCATION:
Hennepin Power Station

| LATITUDE: 41.30057 °N<br>LONGITUDE: 89.32116 °W | UTMs<br>Northing: 4574722.62<br>Easting: 305669.53 | | | | |
|---|---|---|---|---|---|
| STREET, ROAD, OR OTHER DESCRIPTIVE LOCATION | LEGAL DESCRIPT | QUARTER | SECTION | TOWNSHIP NO. | RANGE |
| 13498 E 800th St. | | NE | 27 | 33N | 2W |

| ☐ IN OR ☒ NEAR CITY OF TOWN (check appropriate box)<br>Municipality Name<br>Hennepin | | | WATERWAY | RIVER MILE (if applicable) |
|---|---|---|---|---|
| COUNTY | STATE | ZIP CODE | Illinois River | 211.4 |
| Putnam County | IL | 61327 | | |

Revised 2010

☐ Corps of Engineers ☒ IL Dep't of Natural Resources ☐ IL Environmental Protection Agency ☐ Applicant's Copy

8. PROJECT DESCRIPTION (Include all features):

Hanson Professional Services Inc. (Hanson) was retained by Dynegy Midwest Generation, LLC to perform a hydraulic study for closure of the Old West Ash Pond (OWAP) and Old West Polishing Pond (OWPP) resulting in floodplain fill above the left bank of the Illinois River near Hennepin, Illinois. Closure of the OWAP includes construction of a 40-mil textured LLDPE geomembrane cover above the existing grade which will result in fill within the Illinois River effective floodway. Permits are being applied for the Title 17 Illinois Administrative Code (IAC), Illinois Department of Natural Resources (IDNR) Part 3700 Construction in Floodways of Rivers, Lakes, and Streams, Part 3702 Construction and Maintenance of Dams, and Part 3704 Regulation of Public Waters, and Part 3708 Floodway Construction in support of the pond closures.

9. PURPOSE AND NEED OF PROJECT:

Dynegy Midwest Generation, LLC submitted Notices of Intent to close the OWAP and OWPP to the Illinois Environmental Protection Agency (IEPA) in accordance with 40 Code of Federal Regulations (CFR) Part 257, Subpart D, which is known as the United States Environmental Protection Agency (USEPA) Coal Combustion Residuals (CCR) Final Rule, or the CCR Rule.

**COMPLETE THE FOLLOWING FOUR BLOCKS IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED**

10. REASON(S) FOR DISCHARGE:

11. TYPE(S) OF MATERIAL BEING DISCHARGED AND THE AMOUNT OF EACH TYPE IN CUBIC YARDS FOR WATERWAYS:

TYPE:

AMOUNT IN CUBIC YARDS:

12. SURFACE AREA IN ACRES OF WETLANDS OR OTHER WATERS FILLED (See Instructions)

13. DESCRIPTION OF AVOIDANCE, MINIMIZATION AND COMPENSATION (See instructions)

14. Date activity is proposed to commence: August 6, 2019

Date activity is expected to be completed: November 17, 2020

15. Is any portion of the activity for which authorization is sought now complete? Yes [X] No [ ]

NOTE: If answer is "YES" give reasons in the Project Description and Remarks section. Indicate the existing work on drawings.

Month and Year the activity was completed: October 26, 2020

16. List all approvals or certification and denials received from other Federal, interstate, state, or local agencies for structures, construction, discharges or other activities described in this application.

| Issuing Agency | Type of Approval | Identification No. | Date of Application | Date of Approval | Date of Denial |
|---|---|---|---|---|---|
| IEPA | CCR Closure | | Dec 20, 2017 | June 19, 2018 | |

17. CONSENT TO ENTER PROPERTY LISTED IN PART 7 ABOVE IS HEREBY GRANTED. Yes X No

18. APPLICATION VERIFICATION (SEE SPECIAL INSTRUCTIONS)

Application is hereby made for the activities described herein. I certify that I am familiar with the information contained in the application, and that to the best of my knowledge and belief, such information is true, complete, and accurate. I further certify that I possess the authority to undertake the proposed activities.

Dianna L Tickner

Signature of Applicant or Authorized Agent

10/30/2020

Date

Signature of Applicant or Authorized Agent

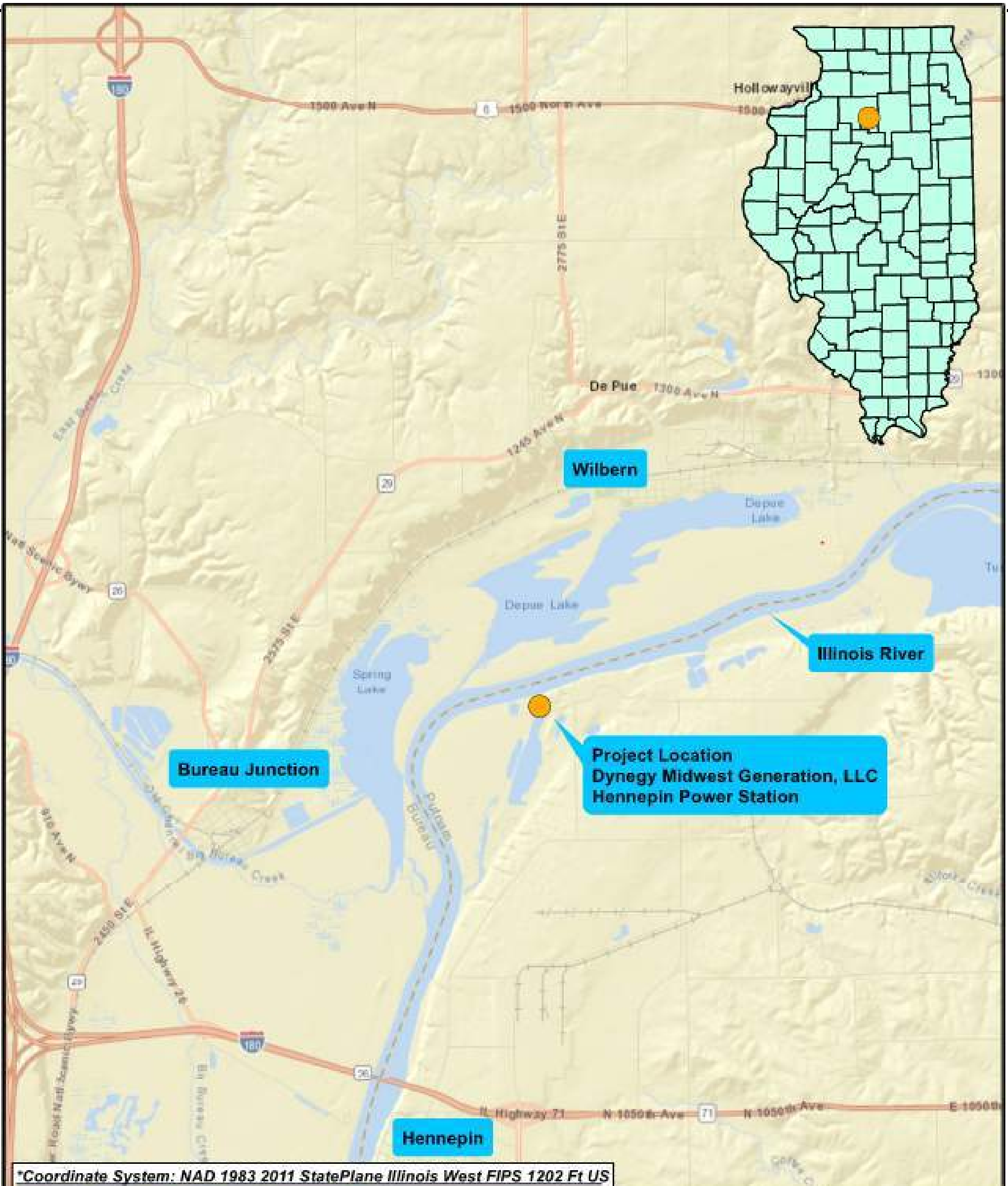
Date

Signature of Applicant or Authorized Agent

Date

☐ Corps of Engineers Revised 2010 ☒ IL Dep't of Natural Resources ☐ IL Environmental Protection Agency ☐ Applicant's Copy

SEE INSTRUCTIONS FOR ADDRESS




1 inch = 5,000 feet

0 2,500 5,000 Feet

N W E S

HANSON Hanson Professional Services Inc.

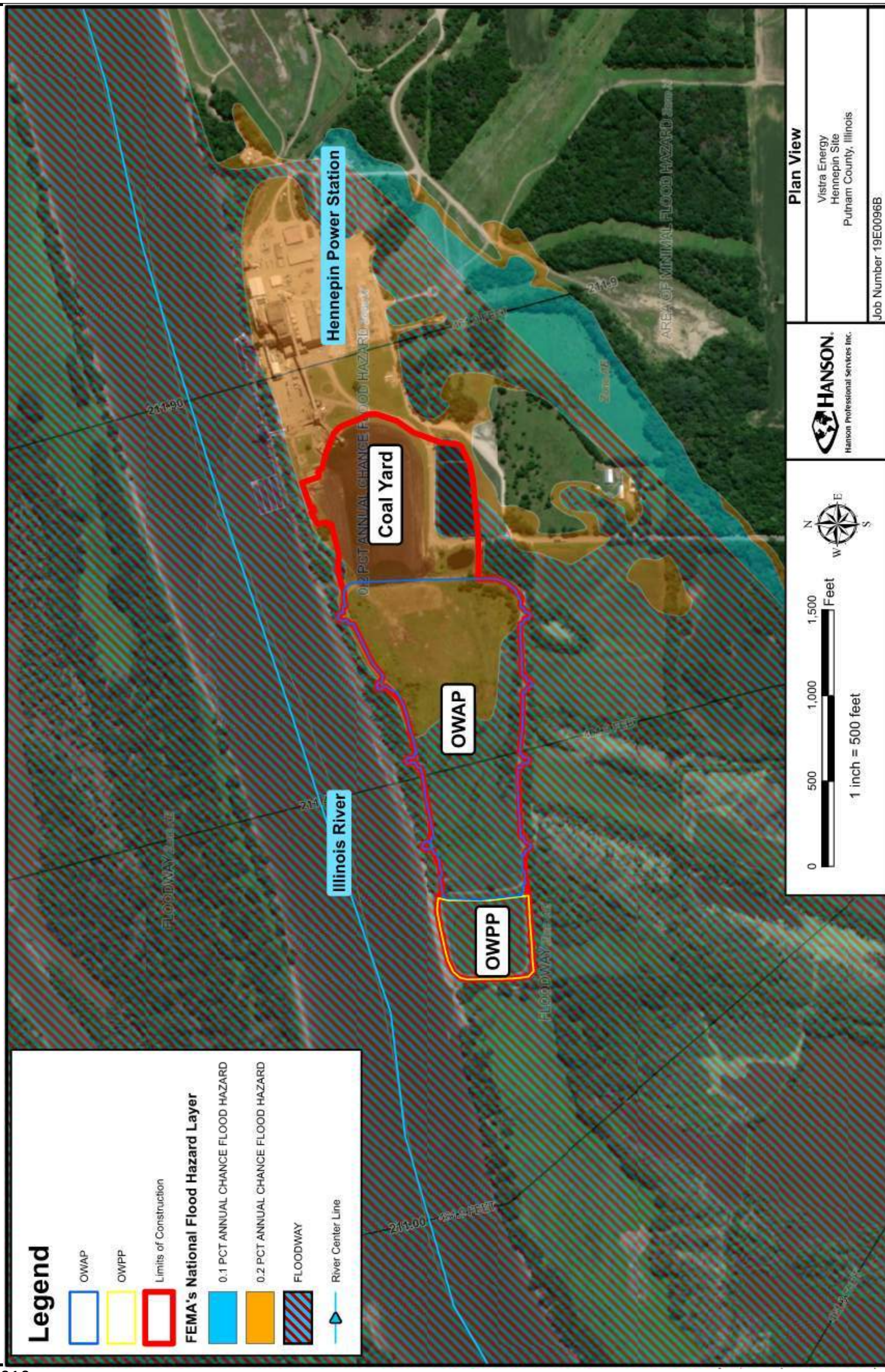
Project Location Map

Dynegy Midwest Generation, LLC
Hennepin Power Station
Putnam County, Illinois

Job Number: 19E0096B

Revised 2010

☐ Corps of Engineers ☒ IL Dep't of Natural Resources ☐ IL Environmental Protection Agency ☐ Applicant's Copy




Revised 2010

☐ Corps of Engineers ☒ IL Dep't of Natural Resources ☐ IL Environmental Protection Agency ☐ Applicant's Copy

# Technical Assessment of River and Dam Safety Impacts for the Closure of CCR Ponds

**Hennepin Power Station**
**Putnam County, Illinois**

Prepared For: Dynegy Midwest Generation, LLC

Prepared By: Hanson Professional Services Inc.
October 28, 2020

Engineering | Planning | Allied Services

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## Figures and Tables

### Figures



### Tables



## List of Appendices ........ 8

## 1. Introduction

Hanson Professional Services Inc. (Hanson) was retained by Dynegy Midwest Generation, LLC (Dynegy). to perform a technical assessment of the potential river and dam safety impacts from the closure of the Old West Ash Pond (OWAP) and Old West Polishing Pond (OWPP) at Hennepin Power Station, near Hennepin, Illinois. The impoundments are located 3 miles north of Hennepin, latitude 41°18'0.62"N and longitude 89°19'28.52"W, in the NE ¼ of Section 27, Township 33 North, Range 2 West of the 3rd Principal Meridian. A site location map is included in Appendix A. Hennepin Power Station is a retired coal fired power plant owned and operated by Dynegy who has pursued closure of the OWAP and OWPP ponds. Closure of the OWAP includes construction of a 40-mil textured LLDPE geomembrane and soil cover system above the coal combustion residuals (CCR) reservoir elevation and will result in fill within the Illinois River effective floodway. The OWPP was closed by removal of CCR residuals and the perimeter embankments degraded to allow free flow to the Illinois River. Closure of the OWPP and capping of the OWAP began on August 6, 2019 and will be substantially completed on November 17, 2020.

The results of this assessment, which included the development of a detailed Illinois River hydraulics model comparing pre-closure and post-closure conditions, show that the activities are permittable under Title 17 Illinois Administrative Code (IAC), Illinois Department of Natural Resources -Office of Water Resources (IDNR-OWR) Part 3700 Construction in Floodways of Rivers, Lakes, and Streams, Part 3702 Construction and Maintenance of Dams, and Part 3704 Regulation of Public Waters.

## 2. Data Collection

### *FEMA Data*

The FEMA Flood Insurance Rate Maps (FIRM) for unincorporated areas of Putnam County, effective February 2011, indicate that the Dynegy Hennepin Site is located in a Zone AE with portions of the site in the defined regulatory floodway. This means the floodplain has been delineated based on detailed methods, which include Base Flood Elevations (BFE's) for the 100-yr event. The entirety of the OWPP and a portion of the OWAP are located within the defined regulatory floodway, as shown in Figure 1. A copy of the FEMA map is provided in Appendix B. A 2005 US Army Corp of Engineers (USACE) unsteady HEC-RAS model of the Illinois River is the effective FEMA model at the project location. This model was obtained from FEMA and was supplemented with site specific information associated with the pond closures to determine the hydraulic impacts of the post-closure fill in the Illinois River floodplain.

### *LiDAR Data*

Light detection and ranging (LiDAR) data representing ground elevation for Putnam and Bureau Counties are available from the Illinois Height Modernization Program through IDOT via the Illinois Geospatial Data Clearinghouse. The data was recorded in 2012 and 2015, respectively, and was used in combination with the effective FEMA model to develop full floodplain cross-sections of Illinois River in the hydraulic model. All survey and elevation data, which was used to create the hydraulic models, was collected using the North American Vertical Datum of 1988 (NAVD88). All elevations listed in this report are NAVD88 unless otherwise noted.

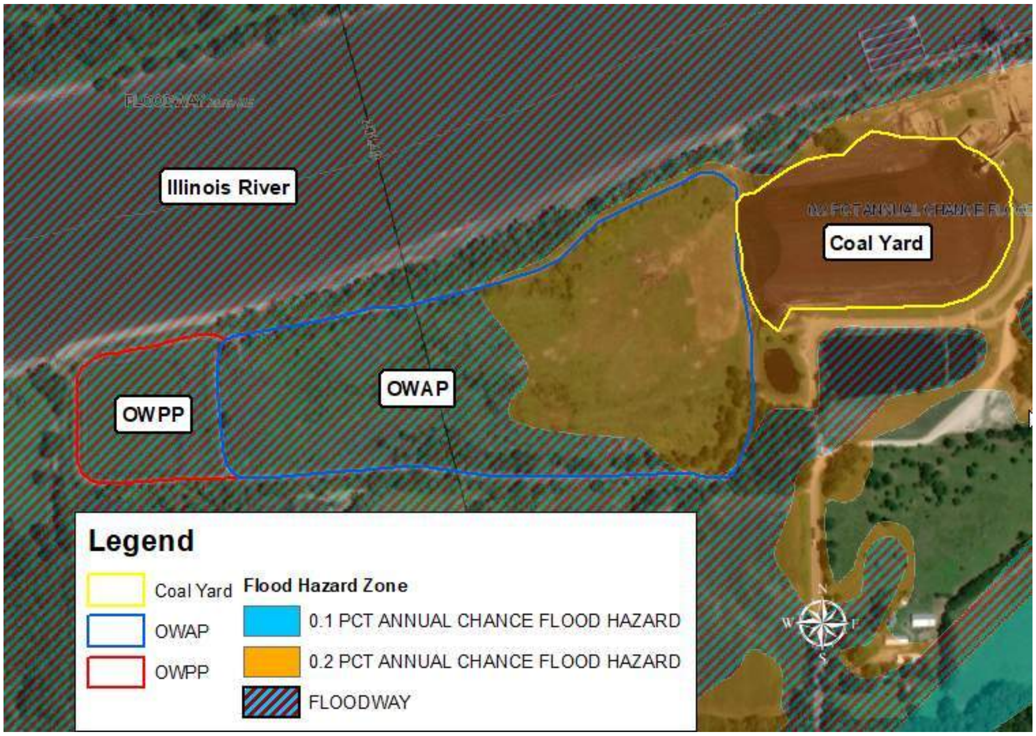



***Figure 1: Pre-Construction Pond and Coal Yard Locations***

### *Geosyntec Data*

In June 2020, Hanson received data from Geosyntec including survey, As-Built plans and CAD files for the project site. This data was used to generate pre-closure and post-closure topographic surfaces for use with the hydraulic modeling effort. In September 2020, Hanson received Geosyntec's Stormwater Pollution Prevention Plan (SWPPP) and the closure plan for the site which was submitted to and approved by the Illinois Environmental Protection Agency (IEPA). The pre-construction plans are provided along with the IEPA closure plan and SWPPP in Appendixes H and I, respectively. Also provided by Geosyntec is a Construction Quality Assurance (CQA) plan and Geotechnical Calculations for Closure Design included in Appendix J and K, respectively.

## 3. Pre-Closure Site Description

This site prior to closure includes two ponds, OWAP and OWPP, which have a surface area of approximately 29 acres and 5 acres, respectively. The ponds are located on the Illinois River's left (South) bank and are shown in Figure 1. The OWPP perimeter berm and interior elevations are below the 100-yr BFE of 461.9-ft. The interior elevations of the OWAP are below the BFE. However, the perimeter berm is above the BFE and preventing the OWAP from actively conveying flow or providing floodplain storage. The pre-closure berms are not FEMA accredited levees. Therefore, per FEMA criteria, the area within the OWAP is mapped as floodplain. However, since the pre-closure OWAP berm is above the 100-yr floodplain, the area within OWAP does not have access to the Illinois River floodplain and would not provide conveyance for a river flooding event within the bermed area. While the area within the OWAP containment berm cannot convey flow, the area within OWAP was modeled as effective flow for pre-closure site conditions to provide a conservative estimate of potential project impacts. Effective flow areas are locations where the flow velocity is greater than zero. The pre-closure site plan with the certified pre-construction survey contours is provided in Appendix C.

## 4. Hydrology

The Illinois River has an approximate drainage area of 13,000-mi² to the project location. Discharge estimates for the Illinois River were based on the 2005 USACE Upper Mississippi River System Flow Frequency Study (UMRSFFS). These discharges were acquired from USACE Flow Frequency Query (FFQ) website and are included in Appendix D. The FEMA Flood Insurance Study (FIS) provides flow estimates at river miles 157.7 and 231.1 and were interpolated to river mile 211.4. The UMRSFFS was the basis for the effective 2005 USACE unsteady HEC-RAS model. The effective model captures detail within the Peoria Pool that is not taken into consideration by the FFQ and FIS. As shown in Table 1, the HEC-RAS unsteady regulatory model discharges used in determination of the BFE are significantly lower than those documented in the FFQ and the FIS. The discharges provided by the FFQ include a flow range that encompasses both the FEMA FIS and regulatory model discharges. As a result, the flows from the FFQ were used as the basis for a worst-case hydraulic analysis of the impacts to the Illinois River to determine compliance with IDNR-OWR floodway construction regulations. This analysis meets the worst-case analysis criteria outlined by 17 IAC 3700.20. Documentation of all discharges used in this assessment are provided in Appendix D. Table 1 shows a discharge comparison of the UMRSFFS and FEMA FIS interpolated values.

***Table 1: Published Steady Discharges for Illinois River***

| Source | Frequency (yr) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 |
| USACE Flow Frequency Study (FFQ website) | 67,000 | 95,000 | 114,000 | 136,000 | 153,000 | 169,000 | 185,000 | 201,000 |
| FEMA FIS (Interpolated) | - | - | 86,485 | - | 113,459 | 124,386 | - | 149,775 |
| 2005 Effective USACE Unsteady HEC-RAS Model | - | - | - | - | - | 114,000 | - | - |

## 5. Hydraulics

To determine compliance with IDNR-OWR regulations regarding construction activities in a floodway, a worst-case hydraulic analysis of potential impacts to the Illinois River was prepared. The FEMA effective model from the USACE is an unsteady model using the Hydrologic Engineering Center's River Analysis System program version 3.1.3 (HEC-RAS). A duplicate effective model was run in HEC-RAS version 3.1.3 and served as the baseline for the study. Three (3) models were developed as part of this assessment which included a duplicate effective, corrected effective (existing/pre-closure conditions), and a proposed conditions (post-closure).

### *Duplicate Effective Model*

The effective USACE HEC-RAS unsteady model v. 3.1.3 was run in v. 3.1.3 to ensure that the model ran successfully. Results showed that there was no change in computed water surface between the effective and duplicate effective hydraulic models.

### *Corrected Effective (Existing/Pre-Closure Conditions) Model*

The duplicate effective model serves as the baseline for the corrected effective model. The duplicate effective model was imported into the current version of HEC-RAS, version 5.0.7 and was modified as follows to develop the corrected effective condition. To prepare the worst-case assessment of the proposed (post-closure) project, all cross-sections outside of river mile 213.66 to 208.60 were removed from the corrected effective model. Several cross-sections between the FEMA cross-sections 211.9 and 211.0 were added to the corrected effective model geometry to capture more detail for the project site geometry and proposed flow area changes. The corrected effective model was also converted to a steady state model to simplify the worst-case assessment. The downstream boundary condition was set as the water surface elevation of the downstream cross-section in the effective model. Hydraulic cross-section location maps are provided in Appendix E.

The corrected effective model serves as the existing model (pre-closure) on the basis that the pre-closure survey information does not contain man-made changes at the project site constructed since the effective date of the effective hydraulic modeling of the Illinois River.

Geometry for the added cross-sections was developed from a combination of interpolated channel geometry and LiDAR topography for the overbanks. The OWAP, OWPP and coal yard were further refined for the corrected effective model from pre-construction survey data provided by Geosyntec and incorporated into all relevant sections. A plan of the pre-construction site is included in Appendix C. Manning's n-values were assigned to the additional cross-sections using aerial imagery and corresponding to values in the effective model. A Manning's n-value of 0.025 was used for the natural channel. In the overbanks, values range from 0.045 in areas of moderate vegetation to 0.12 for areas of heavy vegetation and ineffective ponded water, including OWAP and OWPP, with a value of 0.03 for wetland areas.

Figure 2 includes FEMA FIRM data and shows divided flow around the project site. This appears to be a mapping error based on 2012 LiDAR topographic data. This area is not hydraulically connected at the upstream and downstream extent of this split in the floodplain. The topo data shows that areas upstream and downstream of the project site are above the BFE. However, for modeling purposes, these areas were modeled as effective flow through the project site as a conservative estimate of the potential project impacts to water surface elevations on the river.

### *Proposed Conditions (Post-Closure) Model*

The proposed (post-closure) grading plan includes a soil cap on the OWAP and closure by removal through excavation of CCR in the OWPP. The existing (pre-closure) coal pile and coal yard has been regraded to provide additional storage and positive drainage to the Illinois River. The ponds and coal yards are shown in Figure 1. A plan of the proposed grading with the certified As-Built survey contours is provided in Appendix F. Utilizing the site grading plans from Geosyntec, a proposed conditions HEC-RAS model was created based upon the existing conditions HEC-RAS model where the proposed grading replaced the existing grading at the project site.

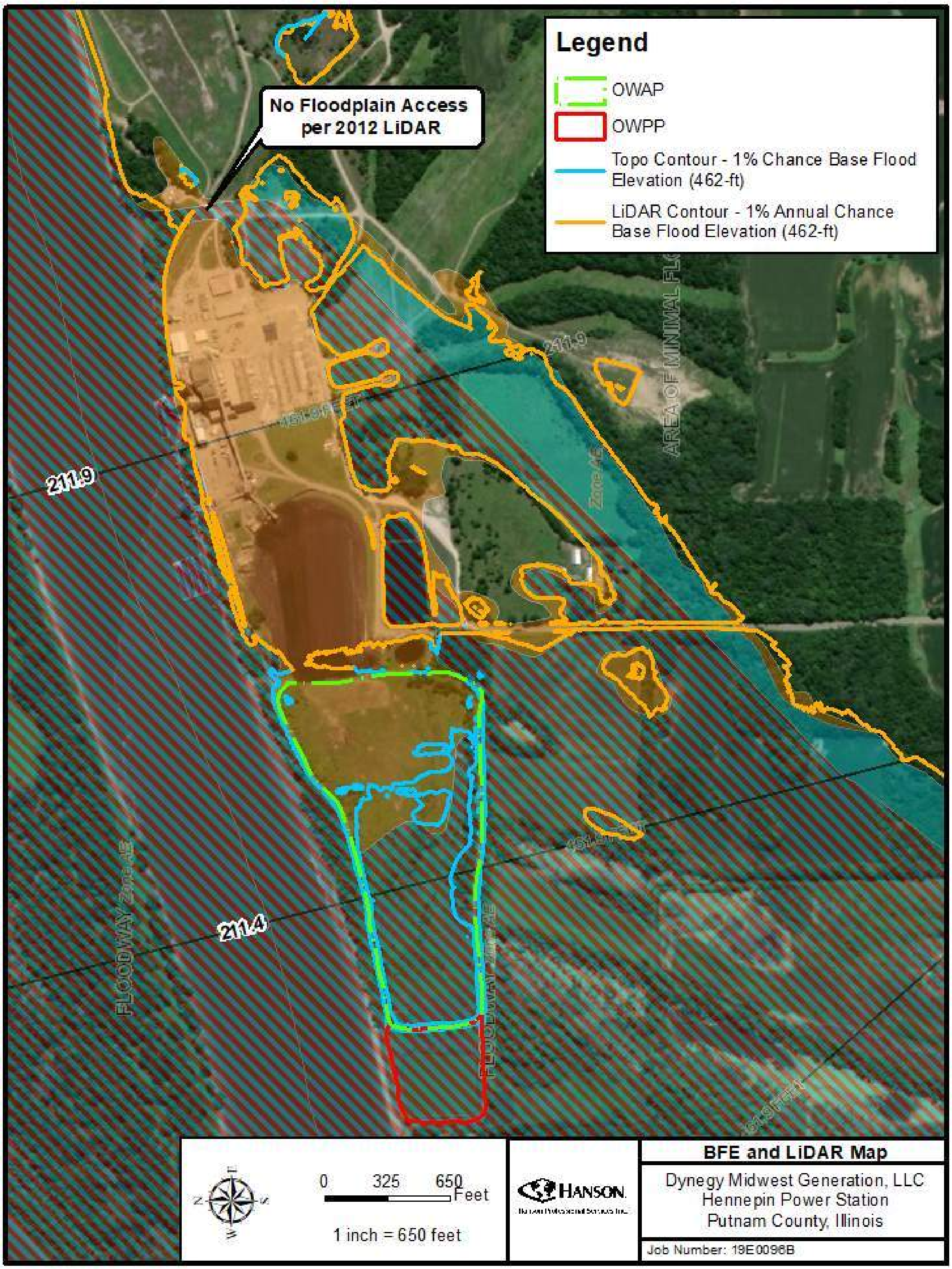



*Figure 2: Topo and LiDAR Contours at Project Site*

### *Worst-Case Analysis Results*

Results from this model show the proposed (post-closure) grading creates a maximum increase in water surface elevation over existing conditions (pre-closure) of 0.00-ft for all flows modeled. In addition, the maximum increase in channel velocity from existing to proposed is 0.01-ft/s. Existing conditions channel velocities do not exceed 3-ft/s, which, together, demonstrate that there is not an increase in scour potential in the river channel. The model results, including water surfaces elevations and velocity comparison tables, are provided in Appendix G.

## 6. Dam Safety

The OWAP and OWPP surface impoundment dams are earthen embankment structures separating the ponds from the Illinois River. The primary purpose of the dams was impoundment of coal combustion residuals (CCR). The OWAP dam has a length of approximately 5,100-ft at the crest, with a height of 16-ft and a crest at elevation 464.0-ft. The OWAP pond has a surface area of 28.9 acres at the dam crest with a maximum pre-construction impounding volume of 78.6 acre-feet. The OWPP pond shares its east dam embankment with the OWAP pond. The OWPP dam has a length of approximately 1,900-ft at the crest, with a height of 11-ft and a crest at elevation 459.0-ft (NAVD 88). The OWPP pond has a surface area of 5.2 acres at the dam crest with a maximum pre-construction impounding volume of 43.4 acre-feet. The OWAP and OWPP dams are located on the southern bank of the Illinois River and failure of the dams could potentially discharge directly to the Illinois River to the north and to the Illinois River floodplain to the south. According to 40 CFR 257.73, the OWAP and OWPP ponds are significant hazard potential classification CCR surface impoundments.

### *Pond Closure Methods*

The closure plan for the ponds, submitted by Geosyntec on behalf of Dynegy, was approved by IEPA on June 19, 2018. The IEPA approval letter and closure plans are included in Appendix H. According to these plans, Dynegy has completed the closure of the OWPP and OWAP as follows:

- The OWPP was closed-by-removal. CCR was removed from the impoundment and the perimeter dikes will be degraded to elevation 450-ft, equal to the Illinois River flood stage of 450.0-ft. The perimeter dike was breached to allow the area to freely drain to the Illinois River. A sheet pile wall provided temporary support between the OWPP and OWAP during construction, and a compacted clay buttress will serve as long-term support. Completion of construction on the OWPP allows for free surface drainage and the structure will no longer be intended to impound water.
- The OWAP was closed through the installation of a geomembrane in addition to fill within the pond. Ponded surface water was removed from the OWAP. The OWAP impoundment was regraded to support the final cover system. The geomembrane cover consists of a 40-mil textured LLDPE and soil cover system. Vegetation will be established on the soil cover layer using native grasses. The cover system was constructed above the pre-closure top of dam eliminating the pre-closure impounding capacity of the structure. The post-closure cover system freely drains to the Illinois River and the structure will no longer be intended to impound water.

Detail on construction activities and related documentation are provided in the Stormwater Pollution Prevention Plan (SWPPP) and Construction Quality Assurance (CQA) plan included in Appendix I and Appendix J, respectively.

### *Regulatory Criteria*

The OWAP and OWPP ponds are regulated in accordance with 17 Illinois Administrative Code (IAC), IDNR-OWR Part 3702 Rules for the Construction and Maintenance of Dams. A failure of the OWAP and OWPP dams under any circumstances would discharge to the Illinois River and have a low probability for causing loss of life. No permanent structures for human habitation are located in the breach inundation area. Under pre-closure operation, the dams are considered small-size Class II (significant hazard potential) dams due to the environmental risk associated with the impounded CCR material. In accordance with CCR design requirements for the pre-closure condition of the OWAP and OWPP ponds act as a closed loop system and the normal operating water surface is maintained by portable pumps.

Removal of CCR material from the OWPP and capping the OWAP began on August 6, 2019 and will be substantially completed on November 17, 2020. Closure of the OWPP and OWAP ponds met IEPA criteria for Closure and Post-Closure Care of CCR surface impoundments under Title 35 Illinois Administrative Code 620.250 per the IEPA approval letter of the closure plan included in Appendix H.

A supporting geotechnical evaluation for closure by capping of the OWAP was provided by Geosyntec. The geotechnical analysis was developed in accordance with 40 CFR Part 257.73 Subpart D. The geotechnical calculations received from Geosyntec, provided in Appendix K, indicate that the OWAP closure will meet the requirements for dam abandonment based on the following special conditions:

1. The pre-closure impounded material is of a non-flowable nature;
2. The material is not susceptible to liquefaction under seismic loading. The containing dam embankment provides a sufficient factor of safety under static conditions;
3. The OWAP cap is graded to freely drain. The OWAP cover consists of a 40-mm textured LLDPE geomembrane and does not permit resaturation of the CCR material; and
4. A final inspection report will be completed and submitted within 1 year of abandonment.

## 7. Compensatory Storage

17 IAC, IDNR-OWR Part 3708 outlines the rules for floodway construction in specific northeastern Illinois counties. This project is not located in one of the northeastern counties listed under Part 3708. However, IDNR-OWR made a special request that compensatory storage be provided for the floodplain fill associated with the closure of the OWAP and OWPP. The compensatory storage must be placed between the post-closure normal water elevation and the post-closure 100-yr flood elevation at a 1-to-1 ratio. The site has been graded to meet this special request and has been documented in the post-closure grading plans by Geosyntec shown in Appendix F. Table 2 shows the net compensatory storage calculation.

Hanson believes that the completed closure of the OWPP and OWAP ponds meet this special request. The basis of this determination is that the site work meets the following special conditions:

- Floodplain access to the OWPP and Coal Yard compensatory storage are provided within the property limits of Dynegy.
- Compensatory storage provided in the OWPP, Coal Yard, Coal Yard Pond East and Coal Yard Pond West will be free draining.

- The post-closure OWAP cover system produces 78,868 cu. yd. of fill below the Effective BFE of 461.9-ft. The regrading of the coal pile, Coal Yard Pond East and Coal Yard Pond West adds an additional 1,232 cu. yd of fill for a total of 80,100 cu. yd of fill below the Effective BFE. Removal of CCR material from the OWPP in addition to the regrading of OWAP, Coal Pile, Coal Yard Pond East and Coal Yard Pond West result in 77,857 cu. yd. of cut below the Effective BFE. This produces a net fill of 2,243 of cu. yd. However, the total volume of water in the ponds below the Effective BFE prior to construction was 23,217 cu. yd., while the total volume of water in the ponds was reduced to 15,999 cu. yd. after construction through the replacement or regrading of the pond outlet structures to drop the normal pool elevation. This provides an additional 7,218 cu. yd. of cut to provide storage below the Effective BFE. The resulting net volume below the Effective BFE is 4,975 cu. yd of cut.
- All post-closure material removed is between the normal water elevation and the post-closure 100-yr flood elevation.

***Table 2: Cut and Fill Volumes***

| Location | Cut Below EL 461.9-ft (Cu. Yards) | Pre-Construction Impounded Water Volume (Cu. Yards) | Fill Below EL 461.9-ft (Cu. Yards) | Post-Construction Impounded Water Volume (Cu. Yards) |
|---|---|---|---|---|
| OWAP | 2,099 | 0 | 78,868 | 0 |
| OWPP | 51,359 | 10,047 | 0 | 9 |
| Coal Pile | 11,992 | 0 | 679 | 0 |
| Coal Yard Pond East | 9,041 | 12,815 | 163 | 14,077 |
| Coal Yard Pond West | 3,366 | 355 | 390 | 1,913 |
| Total | 77,857 | 23,217 | 80,100 | 15,999 |
| Total Cut & Fill | 101,074 | | 96,099 | |
| **Cut - Fill** | **4,975** | | | |

## 8. Public Waters

All construction associated with the pond closure will be outside the banks of the Illinois River or any public water, indicating that the requirements of 17 IAC, IDNR Part 3704 would not be applicable to this assessment.

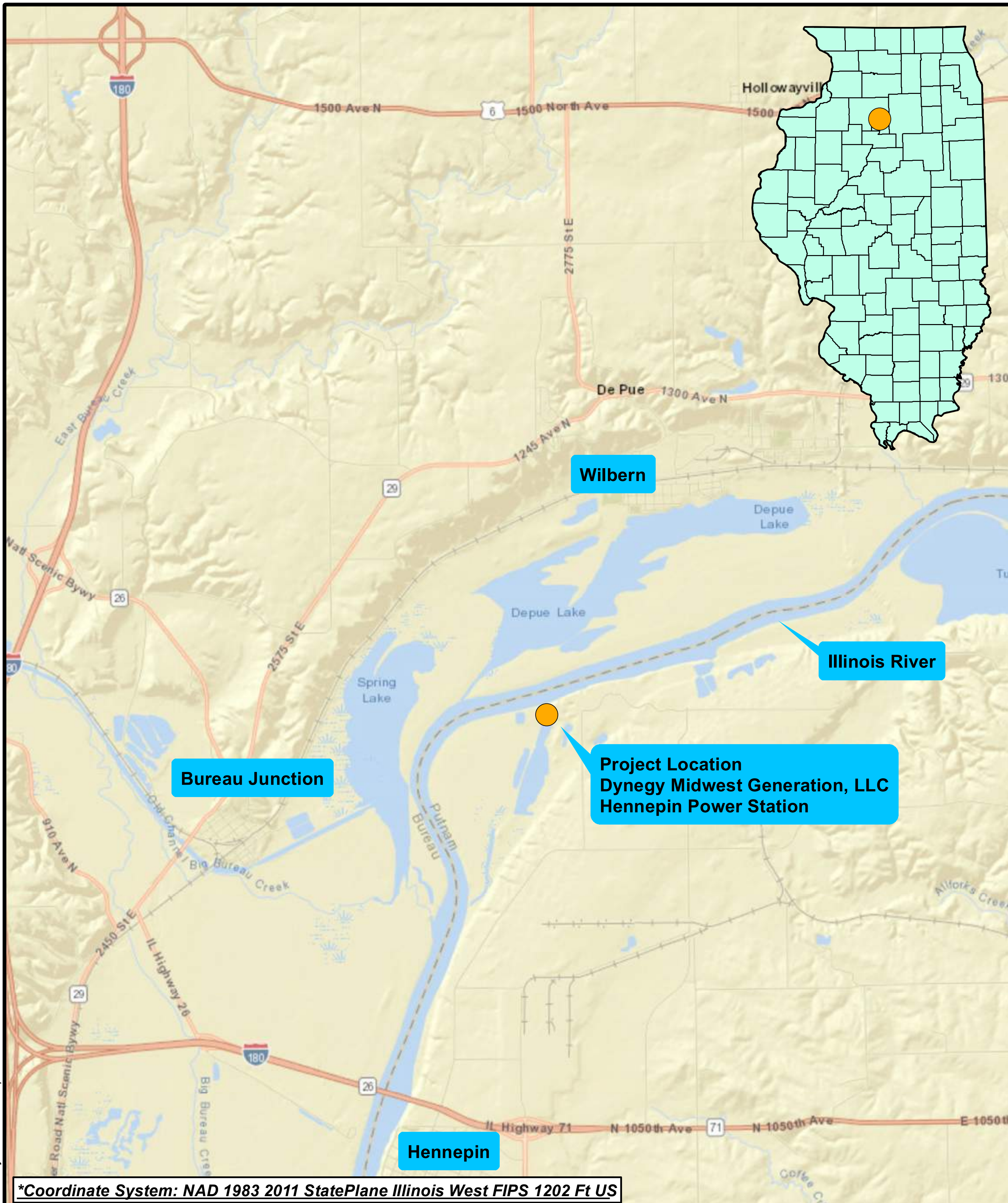
## 9. Conclusion

Based on the information presented in this technical assessment, the post-closure plans meets 17 IAC, IDNR Part 3700, 3702, and 3704. Sections 7 and 8 outline how the conditions for Parts 3702 and 3704 are met, while the post-closure grading meets Parts 3700 and 3704 through the following conditions:

1. The post-closure construction associated with the closure of the OWAP and OWPP will not have an adverse impact on Illinois River water surfaces profiles.
2. The post-closure construction does not increase in average channel velocity beyond the scour velocity.
3. No construction is within the banks of the Illinois River.

Appendix A

# Site Location Map




1 inch = 5,000 feet

0 2,500 5,000 Feet

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HANSON
Hanson Professional Services Inc.

# Project Location Map

Dynegy Midwest Generation, LLC
Hennepin Power Station
Putnam County, Illinois

Job Number: 19E0096B

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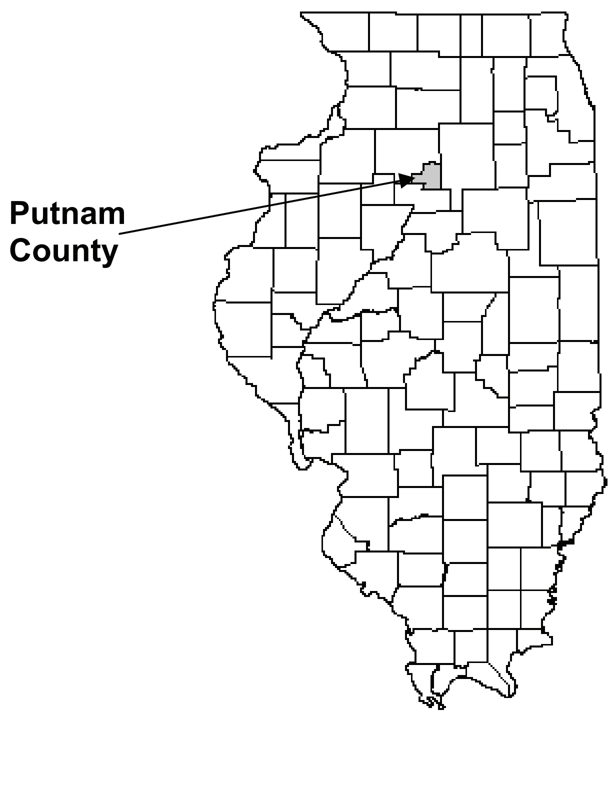
Appendix B

# FEMA Data

# FLOOD INSURANCE STUDY

# PUTNAM COUNTY, ILLINOIS
## AND INCORPORATED AREAS




| COMMUNITY NAME | COMMUNITY NUMBER |
|---|---|
| *GRANVILLE, VILLAGE OF | 171308 |
| HENNEPIN, VILLAGE OF | 170570 |
| *MAGNOLIA, VILLAGE OF | 170571 |
| MARK, VILLAGE OF | 170572 |
| MC NABB, VILLAGE OF | 170573 |
| PUTNAM COUNTY (UNINCORPORATED AREAS) | 170993 |
| STANDARD, VILLAGE OF | 171012 |

*NO SPECIAL FLOOD HAZARD AREAS IDENTIFIED


FEBRUARY 4, 2011

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER

17155CV000A

flooding of the Illinois River from Lockport to the mouth, the Missouri River below the Gavins Point Dam to the mouth, and the Mississippi River from St. Paul to the confluence with the Ohio River. The St. Louis District conducted the study of the Illinois River from the confluence with the Mississippi River to the La Grange Lock and Dam tailwater (river mile 80.2). The Rock Island District conducted the study of the Illinois River from river mile 80.2 to Lockport, IL.

Technical aspects of the study include impacts of levees, land use change, and climate variation The Illinois River flows were determined using data from the period 1940 to 1998. In situations where historic records were not adequate to develop discharge frequency relationships or to verify the results, hydrologic modeling was used to create synthetic flows based on rainfall.

A summary of the drainage area-peak discharge relationships for all the streams studied by detailed methods is shown in Table 4, "Summary of Discharges."

**Table 4- Summary of Discharges**

| | | *Peak Discharges (cubic feet per second)* | | | |
|---|---|---|---|---|---|
| *Flooding Source and Location* | *Drainage Area (square miles)* | *10-Percent-Annual-Chance* | *2-Percent-Annual-Chance* | *1-Percent-Annual-Chance* | *0.2-Percent-Annual-Chance* |
| **Illinois River** | | | | | |
| At Peoria Lock & Dam RM (157.7) | 14,550 | 66,000 | 82,000 | 90,000 | 111,000 |
| At Starved Rock Lock and Dam RM (231.1) | 11,060 | 94,000 | 125,000 | 137,000 | 164,000 |

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data tables in the FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are encouraged to use the flood elevation data presented in this FIS in conjunction with the data shown on the FIRM.

**Pre-Countywide FIS**

New detailed study data on the Illinois River supersedes the pre-countywide hydraulic analyses. No other detailed studies were included previously.

| FLOODING SOURCE | | FLOODWAY | | | 1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88) | | | |
|---|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE[1] | WIDTH (FEET) | SECTION AREA (SQUARE FEET) | MEAN VELOCITY (FEET PER SECOND) | REGULATORY FROM UNET MODEL | WITHOUT FLOODWAY FROM UNET MODEL | WITH FLOODWAY | INCREASE |
| **Illinois River** (continued) | | | | | | | | |
| 206.5 | 206.5 | 16,023/4,715[2] | * | * | 461.6 | 461.6 | * | * |
| 207 | 207 | 12,276/685[2] | * | * | 461.6 | 461.6 | * | * |
| 207.4 | 207.4 | 12,069/579[2] | * | * | 461.6 | 461.6 | * | * |
| 207.58 | 207.58 | 11,992/954[2] | * | * | 461.6 | 461.6 | * | * |
| 207.84 | 207.84 | 12,098/1,040[2] | * | * | 461.6 | 461.6 | * | * |
| 208.1 | 208.1 | 12,210/992[2] | * | * | 461.7 | 461.7 | * | * |
| 208.6 | 208.6 | 12,065/601[2] | * | * | 461.7 | 461.7 | * | * |
| 209.1 | 209.1 | 11,675/556[2] | * | * | 461.7 | 461.7 | * | * |
| 209.6 | 209.6 | 11,507/1,952[2] | * | * | 461.8 | 461.8 | * | * |
| 210.1 | 210.1 | 9,331/4,286[2] | * | * | 461.8 | 461.8 | * | * |
| 210.5 | 210.5 | 9,120/4,971[2] | * | * | 461.8 | 461.8 | * | * |
| 211 | 211 | 9,652/4,268[2] | * | * | 461.9 | 461.9 | * | * |
| 211.4 | 211.4 | 9,102/3,066[2] | * | * | 461.9 | 461.9 | * | * |
| 211.9 | 211.9 | 6,932/1,101[2,3] | * | * | 461.9 | 461.9 | * | * |
| 212.4 | 212.4 | 6,531/485[2] | * | * | 461.9 | 461.9 | * | * |
| 212.9 | 212.9 | 6,194/1,121[2] | * | * | 462.0 | 462.0 | * | * |
| 213.3 | 213.3 | 6,547/1,445[2] | * | * | 462.0 | 462.0 | * | * |
| 213.66 | 213.66 | 6,904/1,735[2] | * | * | 462.0 | 462.0 | * | * |
| 213.88 | 213.88 | 5,445/1,907[2] | * | * | 461.9 | 461.9 | * | * |
| 214.2 | 214.2 | 6,597/3,857[2] | * | * | 462.1 | 462.1 | * | * |
| 214.58 | 214.58 | 6,102/4,296[2] | * | * | 462.1 | 462.1 | * | * |
| 214.96 | 214.96 | 5,052/4,524[2] | * | * | 462.2 | 462.2 | * | * |

[1] Miles above confluence with the Mississippi River
[2] Total width / width within county
[3] Widths include areas not inundated by the 1-percent-annual-chance flood
* Data not available.

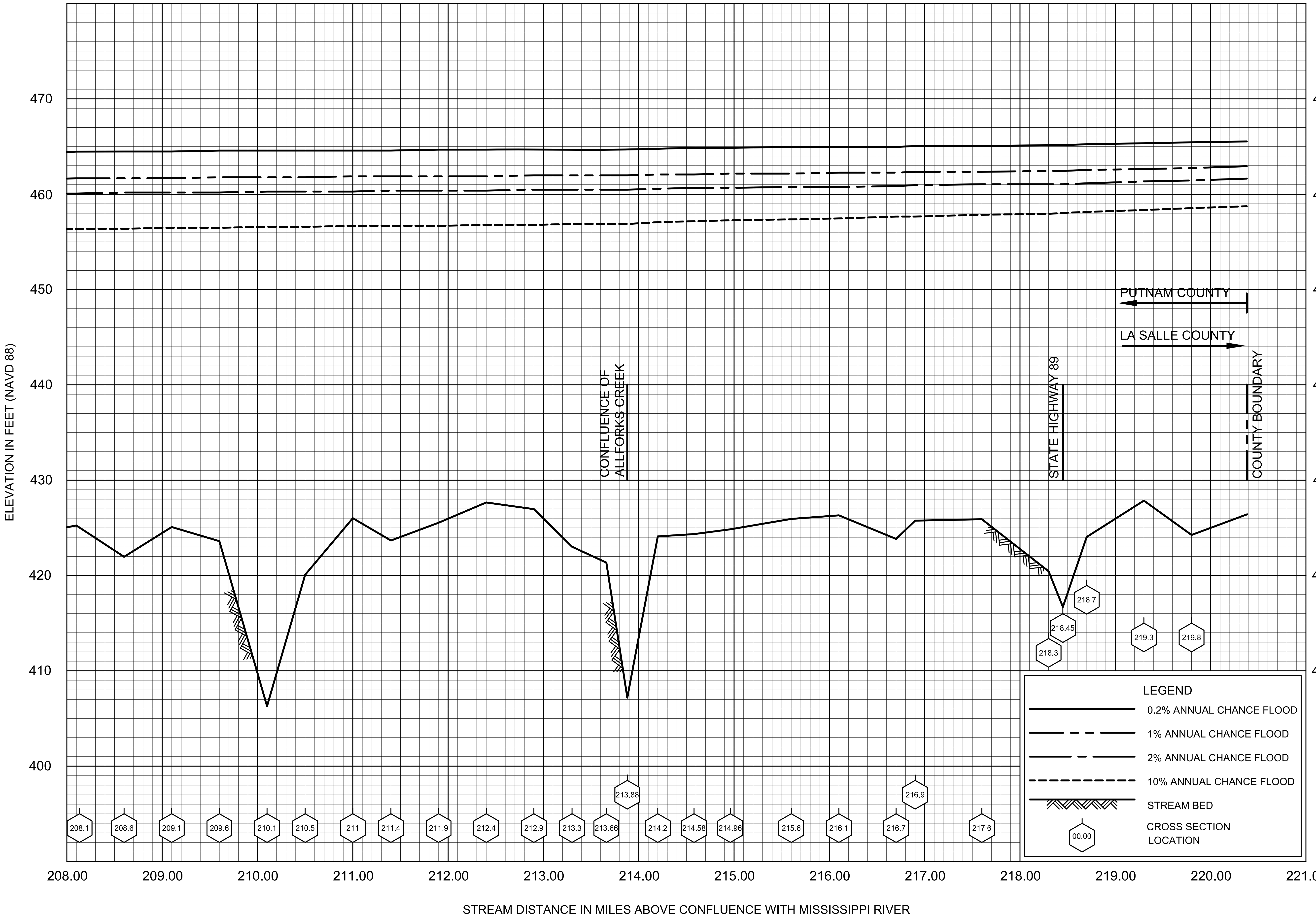
TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

**PUTNAM COUNTY, IL AND INCORPORATED AREAS**

**FLOODWAY DATA**

**ILLINOIS RIVER**




FLOOD PROFILES

ILLINOIS RIVER

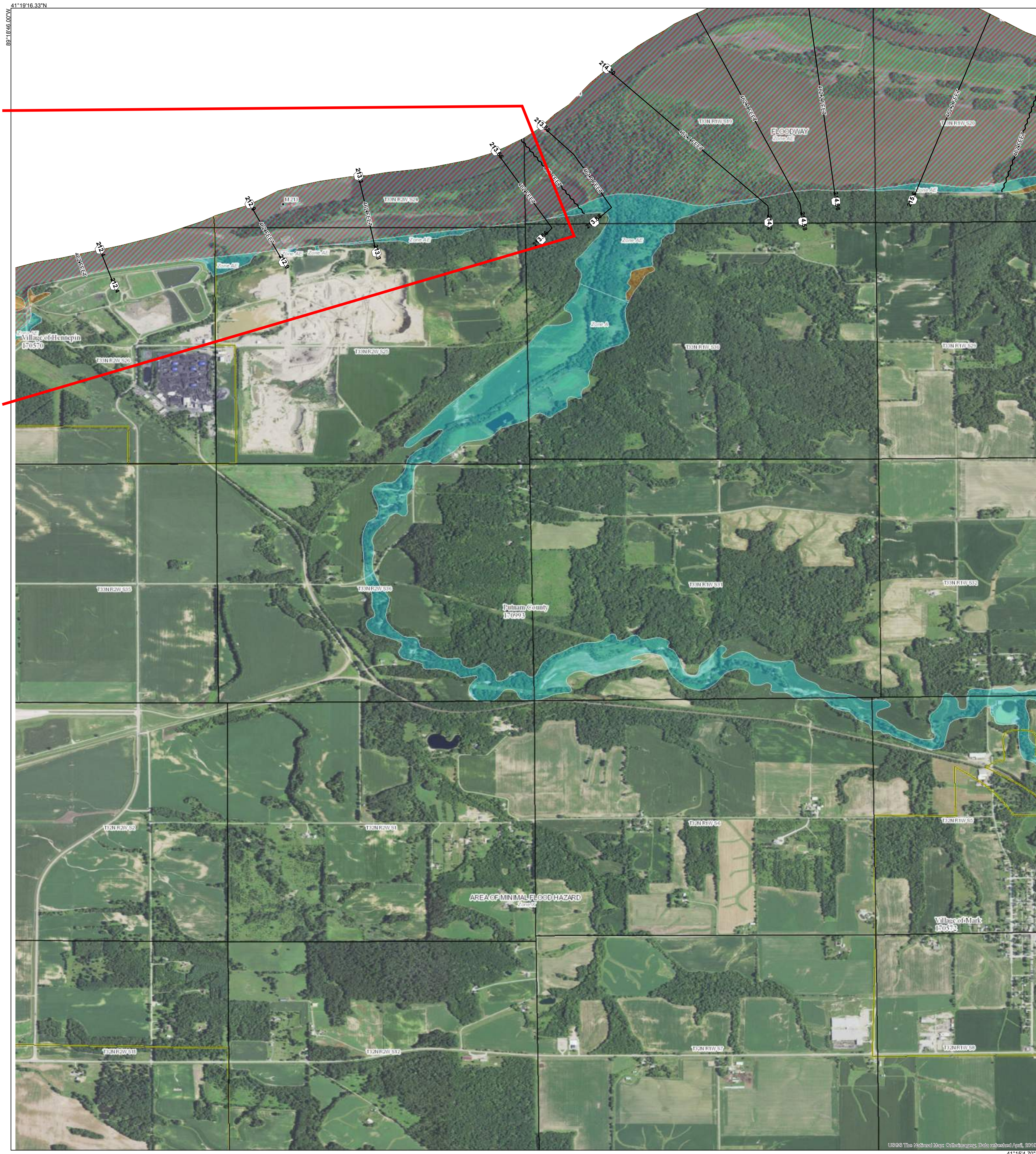
FEDERAL EMERGENCY MANAGEMENT AGENCY

PUTNAM COUNTY, IL

AND INCORPORATED AREAS

02P

41°19'16.33"N
89°18'46.00"W




89°14'59.04"W
41°15'4.70"N

## FLOOD HAZARD INFORMATION

**SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT**

| | |
|---|---|
| SPECIAL FLOOD HAZARD AREAS | Without Base Flood Elevation (BFE) *Zone A, V, A99*<br>With BFE or Depth *Zone AE, AO, AH, VE, AR* |
| | Regulatory Floodway |
| OTHER AREAS OF FLOOD HAZARD | 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X* |
| | Future Conditions 1% Annual Chance Flood Hazard *Zone X* |
| | Area with Reduced Flood Risk due to Levee See Notes. *Zone X* |
| | Area with Flood Risk due to Levee *Zone D* |
| OTHER AREAS | NO SCREEN Area of Minimal Flood Hazard *Zone X* |
| | Effective LOMRs |
| | Area of Undetermined Flood Hazard *Zone D* |
| GENERAL STRUCTURES | Channel, Culvert, or Storm Sewer |
| | Levee, Dike, or Floodwall |
| OTHER FEATURES | (B) 20.2 Cross Sections with 1% Annual Chance |
| | 17.5 Water Surface Elevation |
| | (8) Coastal Transect |
| | Coastal Transect Baseline |
| | Profile Baseline |
| | Hydrographic Feature |
| | 513 Base Flood Elevation Line (BFE) |
| | Limit of Study |
| | Jurisdiction Boundary |

## NOTES TO USERS

For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM, including historic versions, the current map date for each FIRM panel, how to order products, or the National Flood Insurance Program (NFIP) in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can beordered or obtained directly from the website.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study Report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Basemap information shown on this FIRM was provided in digital format by USDA, Farm Service Agency (FSA). This information was derived from NAIP, dated April 11, 2018.

This map was exported from FEMA's National Flood Hazard Layer (NFHL) on **9/24/2019 10:21:04 AM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time. For additional information, please see the Flood Hazard Mapping Updates Overview Fact Sheet at https://www.fema.gov/media-library/assets/documents/118418

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date.

## SCALE

N

Map Projection:
GCS, Geodetic Reference System 1980;
Vertical Datum: NAVD88
For information about the specific vertical datum for elevation features, datum conversions, or vertical monuments used to create this map please see the Flood Insurance Study(FIS) Report for your community at https://msc.fema.gov

**1 inch = 1,000 feet 1:12,000**

Feet: 0 500 1,000 2,000 3,000 4,000
Meters: 0 105 210 420 630 840

FEMA
National Flood Insurance Program

**NATIONAL FLOOD INSURANCE PROGRAM**
**FLOOD INSURANCE RATE MAP**

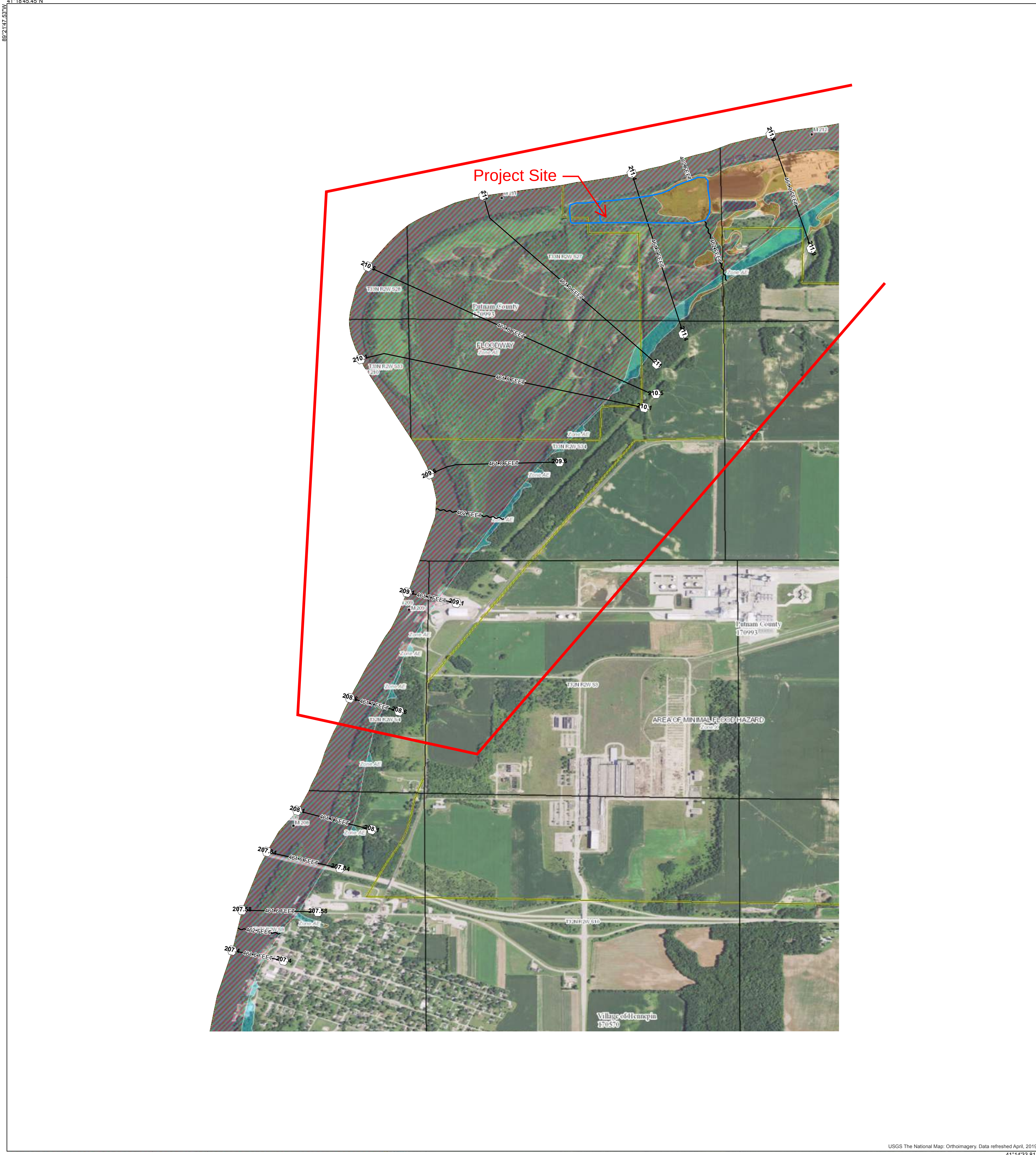
**PUTNAM COUNTY, ILLINOIS AND INCORPORATED AREAS**

PANEL 25 OF 175

Panel Contains:

| COMMUNITY | NUMBER | PANEL |
|---|---|---|
| VILLAGE OF HENNEPIN ILLINOIS | 170570 | 0025 |
| BUREAU COUNTY ILLINOIS | 170729 | 0025 |
| PUTNAM COUNTY ILLINOIS | 170993 | 0025 |
| VILLAGE OF MARK ILLINOIS | 170572 | 0025 |
| VILLAGE OF DEPUE ILLINOIS | 170012 | 0025 |

MAP NUMBER
17155C0025E
EFFECTIVE DATE
02/04/2011




## FLOOD HAZARD INFORMATION

**SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT**

**SPECIAL FLOOD HAZARD AREAS**
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

**OTHER AREAS OF FLOOD HAZARD**
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

**OTHER AREAS**
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

**GENERAL STRUCTURES**
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

**OTHER FEATURES**
- B 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- 8 Coastal Transect
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary

## NOTES TO USERS

For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM, including historic versions, the current map date for each FIRM panel, how to order products, or the National Flood Insurance Program (NFIP) in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can beordered or obtained directly from the website.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study Report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Basemap information shown on this FIRM was provided in digital format by USDA, Farm Service Agency (FSA). This information was derived from NAIP, dated April 11, 2018.

This map was exported from FEMA's National Flood Hazard Layer (NFHL) on **9/24/2019 10:15:20 AM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time. For additional information, please see the Flood Hazard Mapping Updates Overview Fact Sheet at https://www.fema.gov/media-library/assets/documents/118418

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date.

## SCALE

N

**Map Projection:**
**GCS, Geodetic Reference System 1980;**
**Vertical Datum: NAVD88**
**For information about the specific vertical datum for elevation features, datum conversions, or vertical monuments used to create this map please see the Flood Insurance Study(FIS) Report for your community at https://msc.fema.gov**

**1 inch = 1,000 feet** **1:12,000**

0 500 1,000 2,000 3,000 4,000 Feet

Meters 0 105 210 420 630 840

FEMA
National Flood Insurance Program

**NATIONAL FLOOD INSURANCE PROGRAM**
FLOOD INSURANCE RATE MAP

**PUTNAM COUNTY, ILLINOIS AND INCORPORATED AREAS**

PANEL **15** OF **175**

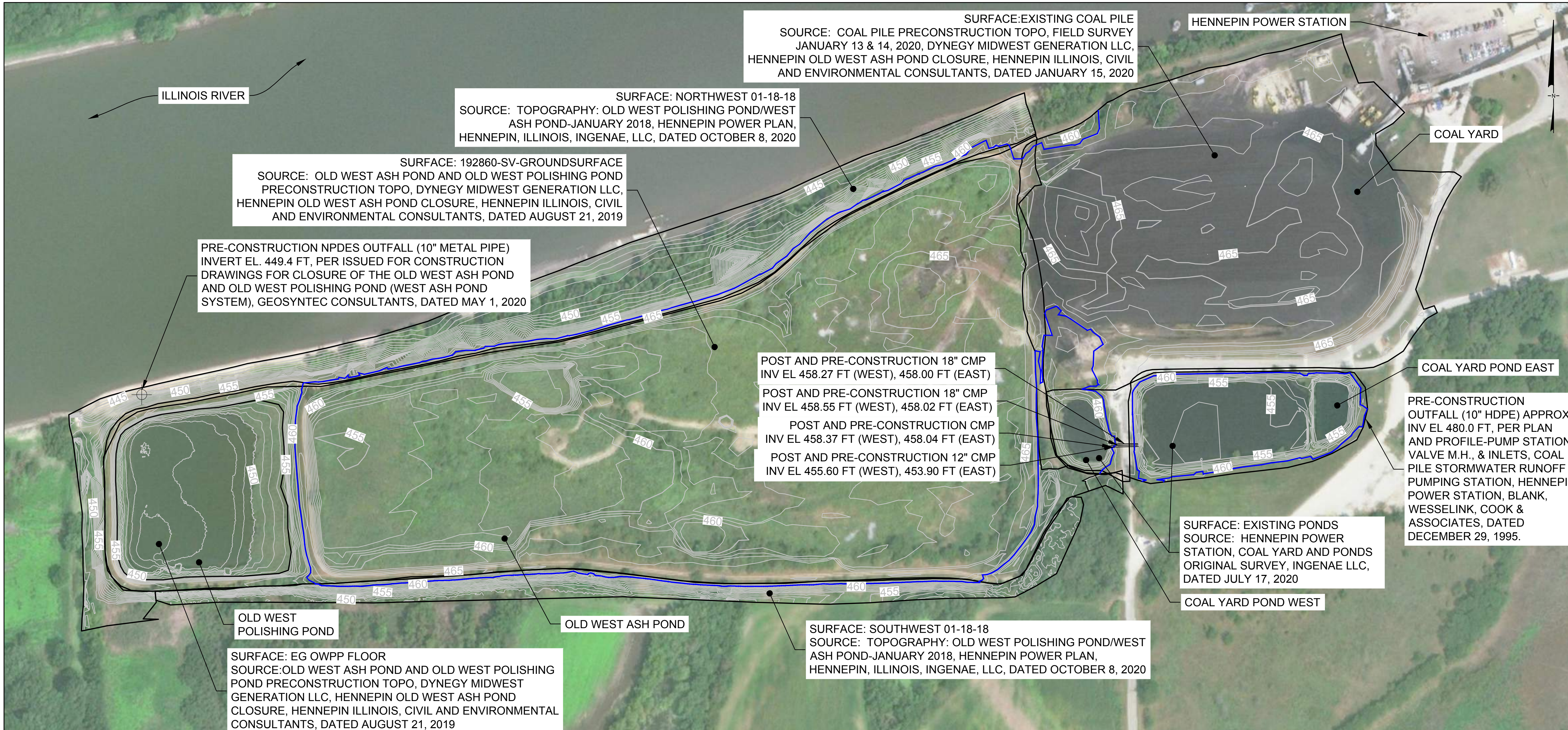
Panel Contains:

| COMMUNITY | NUMBER | PANEL |
|---|---|---|
| VILLAGE OF HENNEPIN ILLINOIS | 170570 | 0015 |
| BUREAU COUNTY ILLINOIS | 170729 | 0015 |
| PUTNAM COUNTY ILLINOIS | 170993 | 0015 |

MAP NUMBER
**17155C0015E**
EFFECTIVE DATE
**02/04/2011**

Appendix C

# Existing Site Plan




L:\CADD\D\DYNEGY\HENNEPIN\CLOSURE DESIGN - CHE8356B\VOLUMES\CHE8356B-X001 - COMBINED EG TOPO SURFACES - Last Saved by: SNichols on 10/11/20

0 250
SCALE IN FEET

NOTES:

1. TOPOGRAPHIC SURVEY DATA WAS COLLECTED BY MULTIPLE SURVEYORS ON MULTIPLE DATES AND MERGED INTO A COMPOSITE PRE-CONSTRUCTION TOPOGRAPHIC SURFACE FOR THE AREAS INDICATED ON THIS DRAWING.
2. SURVEY DATA USED TO CREATE THIS FIGURE WAS COLLECTED IN THE NAD83 HORIZONTAL DATUM AND THE NAVD88 VERTICAL DATUM.
3. THE BACKGROUND AERIAL IMAGE WAS OBTAINED FROM GOOGLE EARTH AND WAS COLLECTED ON SEPTEMBER 20, 2015.

## LEGEND

| | |
|---|---|
| 465 | SURFACE ELEVATIONS |
| | SURVEY BOUNDARY |
| | LIMITS OF BASE FLOOD ELEVATION 461.9 FT |

DRAFT

COMPOSITE PRE-CONSTRUCTION GRADES
HENNEPIN POWER STATION
WEST ASH POND SYSTEM CLOSURE

Geosyntec consultants

FIGURE 4

PROJECT NO: CHE8400 | OCTOBER 2020

| NO | DATE | DESCRIPTION |
|---|---|---|
| **REVISION RECORD** | | |
| 1 | 09/26/2019 | ADDED POLISHING POND CONTOURS TO EXISTING TOPOGRAPHIC CONDITIONS |
| 2 | 10/07/2020 | ADD CONTROL DATUM & SURVEYOR'S CERTIFICATE |
| | | |
| | | |

**SUBMITTAL RECORD**

| NO | DATE | DESCRIPTION |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

NORTH


SCALE IN FEET
0 80 160

**SURVEYOR'S CERTIFICATE**

*STATE OF ILLINOIS* }
*COUNTY OF DUPAGE* } *SS*

*I HEREBY CERTIFY THAT THIS PLAT, AND THE SURVEY UPON WHICH IT IS BASED, HAS BEEN PREPARED UNDER MY DIRECT SUPERVISION. ALL DISTANCES ARE GIVEN IN FEET AND DECIMALS THEREOF.*

*THIS PLAT HAS BEEN PREPARED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. ILLINOIS LICENSED PROFESSIONAL DESIGN FIRM NO. 184.004002, LICENSE EXPIRES APRIL 30, 2021. FOR THE EXCLUSIVE USE OF THE CLIENT NOTED HEREON. REPRODUCTION OF USE BY THIRD PARTIES IS STRICTLY PROHIBITED WITHOUT THE WRITTEN PERMISSION OF THE UNDERSIGNED. THIS PROFESSIONAL SERVICE CONFORMS TO THE CURRENT ILLINOIS MINIMUM STANDARDS FOR A BOUNDARY SURVEY.*

*FIELDWORK WAS COMPLETED ON AUGUST 29, 2019.*

*GIVEN UNDER MY HAND AND SEAL THIS 7TH DAY OF OCTOBER, 2020.*

Douglas R. McClintic

*ILLINOIS LICENSED PROFESSIONAL LAND SURVEYOR NO. 035-002992*
*LICENSED VALID THROUGH NOVEMBER 30, 2020*

DOUGLAS R. McCLINTIC
035-002992
PROFESSIONAL LAND SURVEYOR
NAPERVILLE, IL
STATE OF ILLINOIS

## REFERENCE

1. TOPOGRAPHIC INFORMATION BASE ON ILLINOIS WEST ZONE STATE PLANE NAD 83 (2011) NAVD 88 (VRS) GEOID 18. SURVEY CONDUCTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. ON JANUARY 15, 2020.
2. CONTROL POINTS 50, 51, 52, 53, 54 AND 55 COORDINATES AND ELEVATION ARE SHOWN, WERE USED TO OBTAIN THIS SURVEY. IT IS RECOMMENDED TO VERIFY A MINIMUM OF TWO CONTROL POINTS PRIOR TO ANY WAY WORK BEING DONE.


**CEC**
**Civil & Environmental Consultants, Inc.**
1230 East Diehl Road, Suite 200 - Naperville, IL 60563
Ph: 630.963.6026 · 877.963.6026 · Fax: 630.963.6027
www.cecinc.com


**DYNEGY MIDWEST GENERATION LLC**
**HENNEPIN OLD WEST ASH POND CLOSURE**
**HENNEPIN, ILLINOIS**

| | | | | | |
|---|---|---|---|---|---|
| DRAWN BY: | MSK | CHECKED BY: | DRM | APPROVED BY: | DRM* |
| DATE: | 08/21/2019 | DWG SCALE: | 1"=80' | PROJECT NO: | 192-860.AW00 |

**OLD WEST ASH POND AND OLD WEST POLISHING POND PRECONSTRUCTION TOPO**

DRAWING NO.: **1**

SHEET 1 OF 1


IngenAE
514 Earth City Plaza
Earth City, MO 63045
www.ingenae.com

STATE OF ILLINOIS MICHAEL J. GRAMINSKI 35-2901 REGISTERED LAND SURVEYOR
10/8/2020

| Submissions / Revisions: | Date: |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| 10 | |
| 11 | |
| 12 | |
| 13 | |

VISTRA ENERGY

Project Name & Location:

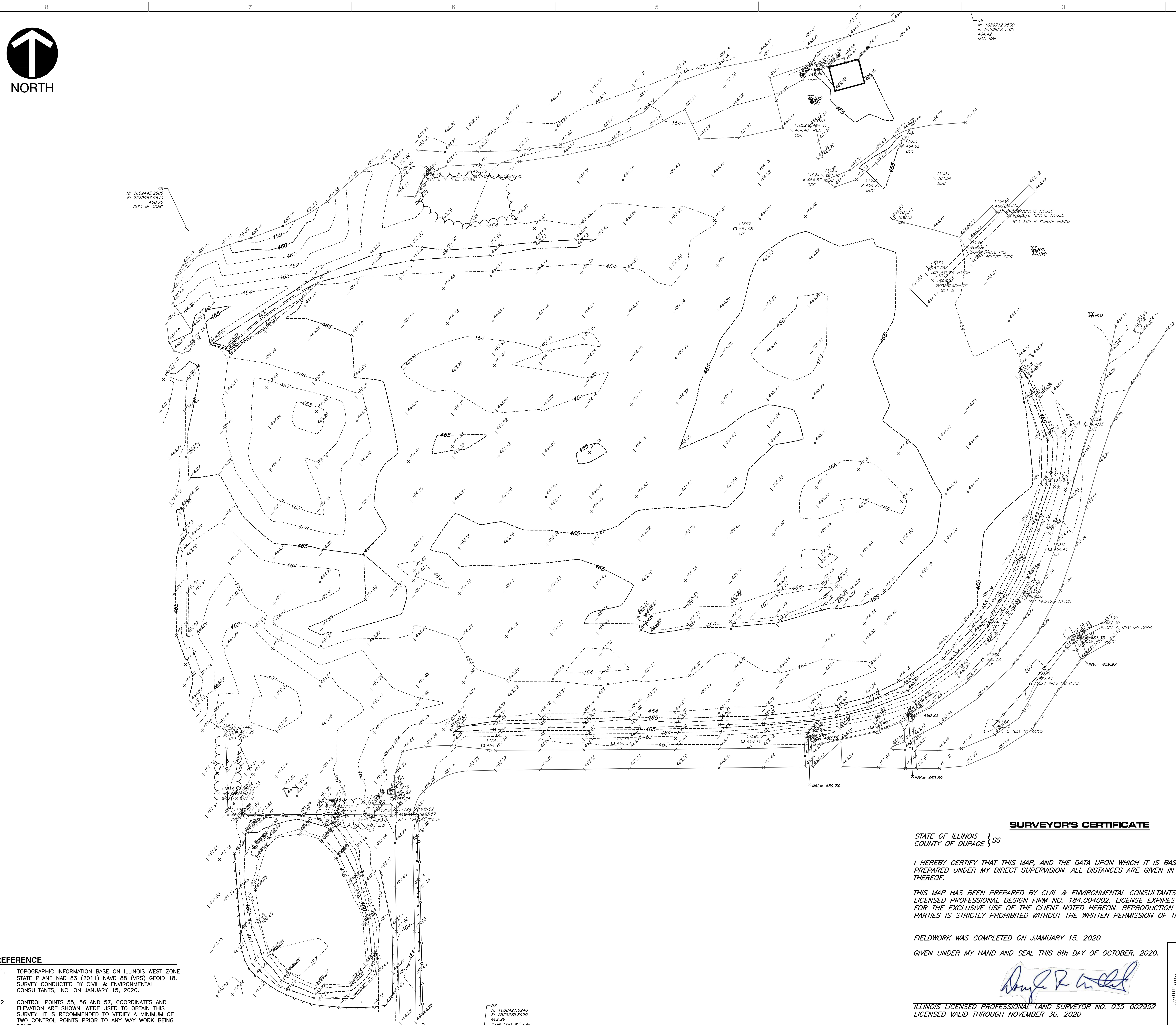
HENNEPIN
POWER PLANT
HENNEPIN, IL



DO NOT SCALE PLANS
Copying, Printing, Software and other processes required to produce these prints can stretch or shrink the actual paper or layout. Therefore, scaling of this drawing may be inaccurate. Contact IngenAE with any need for additional dimensions or clarifications.

Drawing Name:
TOPOGRAPHY: OLD WEST POLISHING POND/WEST ASH POND-JANUARY 2018

Date: 10/8/2020
Project No.:
Type: SITE
Drawing No.: 1
Drawn By: CB
Approved By: MG
Scale: AS NOTED




## REVISION RECORD

| NO | DATE | DESCRIPTION |
|---|---|---|
| 1 | 10/06/2020 | ADD CONTROL DATUM & SURVEYOR'S CERTIFICATE |
| | | |
| | | |
| | | |

## SUBMITTAL RECORD

| NO | DATE | DESCRIPTION |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

## REFERENCE

1. TOPOGRAPHIC INFORMATION BASE ON ILLINOIS WEST ZONE STATE PLANE NAD 83 (2011) NAVD 88 (VRS) GEOID 18. SURVEY CONDUCTED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. ON JANUARY 15, 2020.

2. CONTROL POINTS 55, 56 AND 57, COORDINATES AND ELEVATION ARE SHOWN, WERE USED TO OBTAIN THIS SURVEY. IT IS RECOMMENDED TO VERIFY A MINIMUM OF TWO CONTROL POINTS PRIOR TO ANY WAY WORK BEING DONE.

## SURVEYOR'S CERTIFICATE

*STATE OF ILLINOIS*
*COUNTY OF DUPAGE* } *SS*

*I HEREBY CERTIFY THAT THIS MAP, AND THE DATA UPON WHICH IT IS BASED, HAS BEEN PREPARED UNDER MY DIRECT SUPERVISION. ALL DISTANCES ARE GIVEN IN FEET AND DECIMALS THEREOF.*

*THIS MAP HAS BEEN PREPARED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. ILLINOIS LICENSED PROFESSIONAL DESIGN FIRM NO. 184.004002, LICENSE EXPIRES APRIL 30, 2021. FOR THE EXCLUSIVE USE OF THE CLIENT NOTED HEREON. REPRODUCTION OF USE BY THIRD PARTIES IS STRICTLY PROHIBITED WITHOUT THE WRITTEN PERMISSION OF THE UNDERSIGNED.*

*FIELDWORK WAS COMPLETED ON JJAMUARY 15, 2020.*

*GIVEN UNDER MY HAND AND SEAL THIS 6th DAY OF OCTOBER, 2020.*

Douglas R. McClintic

*ILLINOIS LICENSED PROFESSIONAL LAND SURVEYOR NO. 035-002992*
*LICENSED VALID THROUGH NOVEMBER 30, 2020*

DOUGLAS R. McCLINTIC
035-002992
PROFESSIONAL LAND SURVEYOR
NAPERVILLE, IL
STATE OF ILLINOIS

**Civil & Environmental Consultants, Inc.**
333 Baldwin Road · Pittsburgh, PA 15205
Ph: 412.429.2324 · 800.365.2324 · Fax: 412.429.2114
www.cecinc.com

# DYNEGY MIDWEST GENERATION LLC
# HENNEPIN OLD WEST ASH POND CLOSURE
# HENNEPIN, ILLINOIS

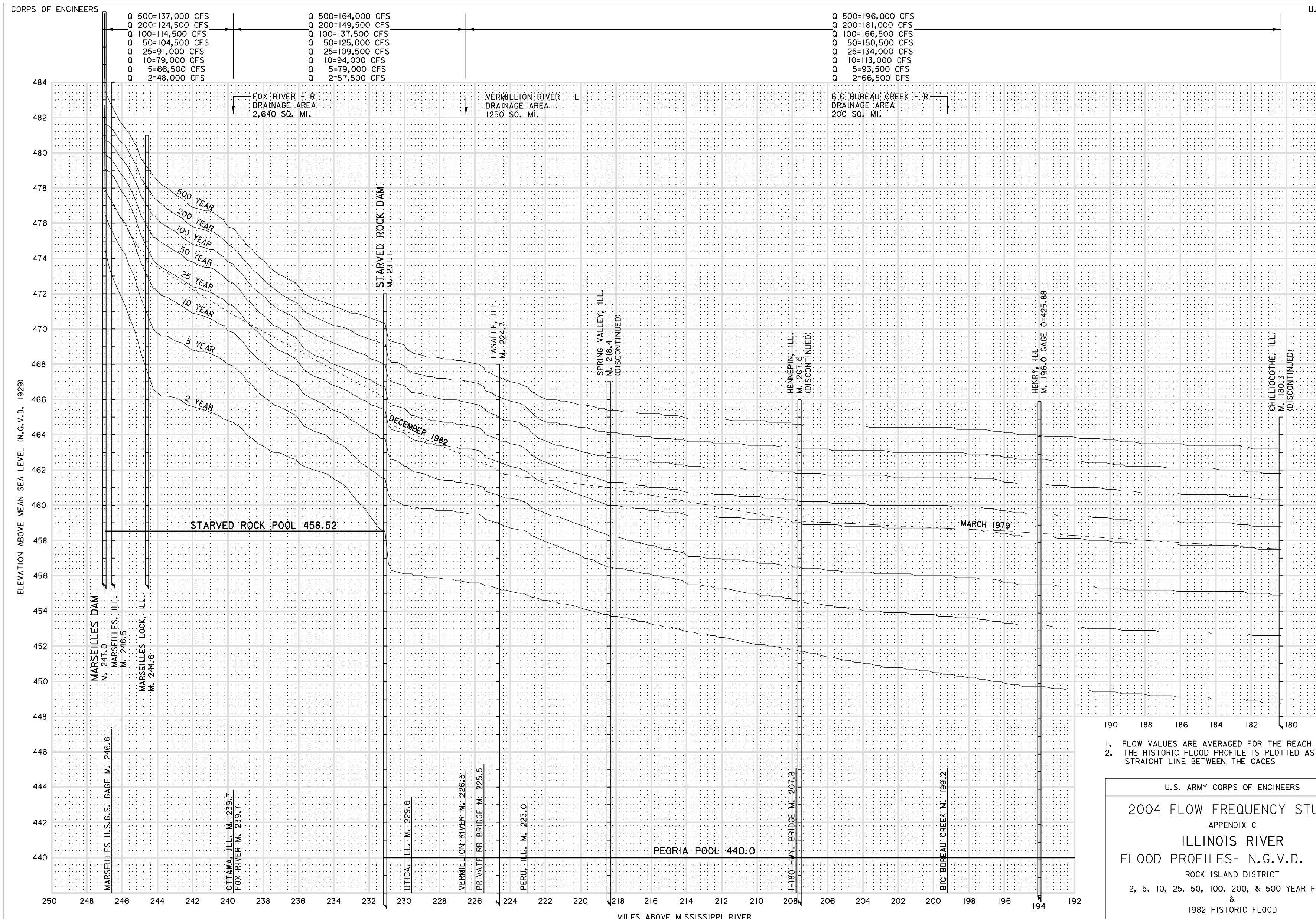
| DRAWN BY: MSK | CHECKED BY: DRAFT | APPROVED BY: DRAFT |
|---|---|---|
| DATE: 01/15/2020 | DWG SCALE: 1"=50' | PROJECT NO: 192-860.0001 |

**COAL PILE PRECONSTRUCTION TOPO**
**FIELD SURVEY JANUARY 13 &14, 2020**

DRAWING NO.: **1**
SHEET 1 OF 1

Appendix D

# Hydrology




1. FLOW VALUES ARE AVERAGED FOR THE REACH
2. THE HISTORIC FLOOD PROFILE IS PLOTTED AS A STRAIGHT LINE BETWEEN THE GAGES

U.S. ARMY CORPS OF ENGINEERS

2004 FLOW FREQUENCY STUDY

APPENDIX C

ILLINOIS RIVER

FLOOD PROFILES- N.G.V.D. 1929

ROCK ISLAND DISTRICT

2, 5, 10, 25, 50, 100, 200, & 500 YEAR FLOOD

&

1982 HISTORIC FLOOD

**RIVER MILES 247.0 TO 180.3**

PLATE # 2

# Flow Frequency Query

## *Upper Mississippi River*

### *United States Army Corps of Engineers*

### *Mississippi Valley Division*

***Developed by Rock Island District***

**[Disclaimers]|[Help]**

**River:**
Illinois River

**Datum:**
1929

**Return Period:**
2-year

**River Mile:**
211.4 Submit

Flow: 67,000 CFS

Surface Elevation: 452.4 Ft

Located in the pool of Peoria Lock and Dam

*Download PDF for a profile plot in the vicinity of the River Mile selection.*

**Or Select a Pool Reach***

Select a PDF Plate of Pool

**Pool Reach PDF's are only available for the pools for the Mississippi and Illinois Rivers. All downloadable PDF Plates are about 600 kb.*

[Datasources]

**River Locations of Interest**

Illinois River

| Location | River Mile |
|---|---|
| Brandon Road L&D | 285.9 |
| Dresden Island L&D | 271.5 |
| Morris, IL | 263.1 |
| Marseilles, IL | 246.5 |
| Marseilles L&D | 244.5 |
| Starved Rock L&D | 231.1 |
| La Salle, IL | 224.7 |
| Henry, IL | 196.0 |
| Peoria, IL | 164.6 |
| Peoria L&D | 157.9 |
| Kingston Mines, IL | 145.4 |
| Copperas Creek, IL | 136.8 |
| Beardstown, IL | 88.6 |
| New LaGrange L&D | 80.2 |
| Meredosia, IL | 70.8 |
| Valley City, IL | 61.3 |
| Florence, IL | 56.0 |
| Hardin, IL | 21.5 |

# Flow Frequency Query

## *Upper Mississippi River*

### *United States Army Corps of Engineers*
### *Mississippi Valley Division*
***Developed by Rock Island District***

[Disclaimers][Help]

**River:**
Illinois River

**Datum:**
1929

**Return Period:**
5-year

**River Mile:**
211.4 Submit

Flow: 95,000 CFS

Surface Elevation: 455.2 Ft

Located in the pool of Peoria Lock and Dam

*Download PDF for a profile plot in the vicinity of the River Mile selection.*

**Or Select a Pool Reach***
Select a PDF Plate of Pool

**Pool Reach PDF's are only available for the pools for the Mississippi and Illinois Rivers. All downloadable PDF Plates are about 600 kb.*

[Datasources]

**River Locations of Interest**

Illinois River

| Location | River Mile |
|---|---|
| Brandon Road L&D | 285.9 |
| Dresden Island L&D | 271.5 |
| Morris, IL | 263.1 |
| Marseilles, IL | 246.5 |
| Marseilles L&D | 244.5 |
| Starved Rock L&D | 231.1 |
| La Salle, IL | 224.7 |
| Henry, IL | 196.0 |
| Peoria, IL | 164.6 |
| Peoria L&D | 157.9 |
| Kingston Mines, IL | 145.4 |
| Copperas Creek, IL | 136.8 |
| Beardstown, IL | 88.6 |
| New LaGrange L&D | 80.2 |
| Meredosia, IL | 70.8 |
| Valley City, IL | 61.3 |
| Florence, IL | 56.0 |
| Hardin, IL | 21.5 |

# Flow Frequency Query

## *Upper Mississippi River*

### *United States Army Corps of Engineers*

### *Mississippi Valley Division*

***Developed by Rock Island District***

**[Disclaimers][Help]**

**River:**

Illinois River

**Datum:**

1929

**Return Period:**

10-year

**River Mile:**

211.4 Submit

Flow: 114,000 CFS

Surface Elevation: 456.9 Ft

Located in the pool of Peoria Lock and Dam

*Download PDF for a profile plot in the vicinity of the River Mile selection.*

**Or Select a Pool Reach***

Select a PDF Plate of Pool

**Pool Reach PDF's are only available for the pools for the Mississippi and Illinois Rivers. All downloadable PDF Plates are about 600 kb.*

[Datasources]

**River Locations of Interest**

Illinois River

| Location | River Mile |
|---|---|
| Brandon Road L&D | 285.9 |
| Dresden Island L&D | 271.5 |
| Morris, IL | 263.1 |
| Marseilles, IL | 246.5 |
| Marseilles L&D | 244.5 |
| Starved Rock L&D | 231.1 |
| La Salle, IL | 224.7 |
| Henry, IL | 196.0 |
| Peoria, IL | 164.6 |
| Peoria L&D | 157.9 |
| Kingston Mines, IL | 145.4 |
| Copperas Creek, IL | 136.8 |
| Beardstown, IL | 88.6 |
| New LaGrange L&D | 80.2 |
| Meredosia, IL | 70.8 |
| Valley City, IL | 61.3 |
| Florence, IL | 56.0 |
| Hardin, IL | 21.5 |

# Flow Frequency Query

## *Upper Mississippi River*

### *United States Army Corps of Engineers*

### *Mississippi Valley Division*

***Developed by Rock Island District***

[Disclaimers][Help]

**River:**
Illinois River

**Datum:**
1929

**Return Period:**
25-year

**River Mile:**
211.4 Submit

Flow: 136,000 CFS

Surface Elevation: 459.3 Ft

Located in the pool of Peoria Lock and Dam

*Download PDF for a profile plot in the vicinity of the River Mile selection.*

**Or Select a Pool Reach***
Select a PDF Plate of Pool

**Pool Reach PDF's are only available for the pools for the Mississippi and Illinois Rivers. All downloadable PDF Plates are about 600 kb.*

[Datasources]

**River Locations of Interest**

Illinois River

| Location | River Mile |
|---|---|
| Brandon Road L&D | 285.9 |
| Dresden Island L&D | 271.5 |
| Morris, IL | 263.1 |
| Marseilles, IL | 246.5 |
| Marseilles L&D | 244.5 |
| Starved Rock L&D | 231.1 |
| La Salle, IL | 224.7 |
| Henry, IL | 196.0 |
| Peoria, IL | 164.6 |
| Peoria L&D | 157.9 |
| Kingston Mines, IL | 145.4 |
| Copperas Creek, IL | 136.8 |
| Beardstown, IL | 88.6 |
| New LaGrange L&D | 80.2 |
| Meredosia, IL | 70.8 |
| Valley City, IL | 61.3 |
| Florence, IL | 56.0 |
| Hardin, IL | 21.5 |

# Flow Frequency Query

## *Upper Mississippi River*

### *United States Army Corps of Engineers*

### *Mississippi Valley Division*

***Developed by Rock Island District***

**[Disclaimers][Help]**

**River:**

Illinois River

**Datum:**

1929

**Return Period:**

50-year

**River Mile:**

211.4 Submit

Flow: 153,000 CFS

Surface Elevation: 460.6 Ft

Located in the pool of Peoria Lock and Dam

*Download PDF for a profile plot in the vicinity of the River Mile selection.*

**Or Select a Pool Reach***

Select a PDF Plate of Pool

**Pool Reach PDF's are only available for the pools for the Mississippi and Illinois Rivers. All downloadable PDF Plates are about 600 kb.*

[Datasources]

**River Locations of Interest**

Illinois River

| Location | River Mile |
|---|---|
| Brandon Road L&D | 285.9 |
| Dresden Island L&D | 271.5 |
| Morris, IL | 263.1 |
| Marseilles, IL | 246.5 |
| Marseilles L&D | 244.5 |
| Starved Rock L&D | 231.1 |
| La Salle, IL | 224.7 |
| Henry, IL | 196.0 |
| Peoria, IL | 164.6 |
| Peoria L&D | 157.9 |
| Kingston Mines, IL | 145.4 |
| Copperas Creek, IL | 136.8 |
| Beardstown, IL | 88.6 |
| New LaGrange L&D | 80.2 |
| Meredosia, IL | 70.8 |
| Valley City, IL | 61.3 |
| Florence, IL | 56.0 |
| Hardin, IL | 21.5 |

# Flow Frequency Query

## *Upper Mississippi River*

### *United States Army Corps of Engineers*
### *Mississippi Valley Division*

***Developed by Rock Island District***

[Disclaimers][Help]

**River:**
Illinois River

**Datum:**
1929

**Return Period:**
100-year

**River Mile:**
211.4 Submit

Flow: 169,000 CFS

Surface Elevation: 462.1 Ft

Located in the pool of Peoria Lock and Dam

*Download PDF for a profile plot in the vicinity of the River Mile selection.*

**Or Select a Pool Reach***
Select a PDF Plate of Pool

**Pool Reach PDF's are only available for the pools for the Mississippi and Illinois Rivers. All downloadable PDF Plates are about 600 kb.*

[Datasources]

**River Locations of Interest**

Illinois River

| Location | River Mile |
|---|---|
| Brandon Road L&D | 285.9 |
| Dresden Island L&D | 271.5 |
| Morris, IL | 263.1 |
| Marseilles, IL | 246.5 |
| Marseilles L&D | 244.5 |
| Starved Rock L&D | 231.1 |
| La Salle, IL | 224.7 |
| Henry, IL | 196.0 |
| Peoria, IL | 164.6 |
| Peoria L&D | 157.9 |
| Kingston Mines, IL | 145.4 |
| Copperas Creek, IL | 136.8 |
| Beardstown, IL | 88.6 |
| New LaGrange L&D | 80.2 |
| Meredosia, IL | 70.8 |
| Valley City, IL | 61.3 |
| Florence, IL | 56.0 |
| Hardin, IL | 21.5 |

# Flow Frequency Query

## *Upper Mississippi River*

### *United States Army Corps of Engineers*
### *Mississippi Valley Division*
***Developed by Rock Island District***

[Disclaimers][Help]

**River:**
Illinois River

**Datum:**
1929

**Return Period:**
200-year

**River Mile:**
211.4 Submit

Flow: 185,000 CFS

Surface Elevation: 463.5 Ft

Located in the pool of Peoria Lock and Dam

*Download PDF for a profile plot in the vicinity of the River Mile selection.*

**Or Select a Pool Reach***
Select a PDF Plate of Pool

**Pool Reach PDF's are only available for the pools for the Mississippi and Illinois Rivers. All downloadable PDF Plates are about 600 kb.*

[Datasources]

**River Locations of Interest**

Illinois River

| Location | River Mile |
|---|---|
| Brandon Road L&D | 285.9 |
| Dresden Island L&D | 271.5 |
| Morris, IL | 263.1 |
| Marseilles, IL | 246.5 |
| Marseilles L&D | 244.5 |
| Starved Rock L&D | 231.1 |
| La Salle, IL | 224.7 |
| Henry, IL | 196.0 |
| Peoria, IL | 164.6 |
| Peoria L&D | 157.9 |
| Kingston Mines, IL | 145.4 |
| Copperas Creek, IL | 136.8 |
| Beardstown, IL | 88.6 |
| New LaGrange L&D | 80.2 |
| Meredosia, IL | 70.8 |
| Valley City, IL | 61.3 |
| Florence, IL | 56.0 |
| Hardin, IL | 21.5 |

# Flow Frequency Query

## *Upper Mississippi River*

### *United States Army Corps of Engineers*

### *Mississippi Valley Division*

***Developed by Rock Island District***

[Disclaimers][Help]

**River:**

Illinois River

**Datum:**

1929

**Return Period:**

500-year

**River Mile:**

211.4 Submit

Flow: 201,000 CFS

Surface Elevation: 464.8 Ft

Located in the pool of Peoria Lock and Dam

*Download PDF for a profile plot in the vicinity of the River Mile selection.*

**Or Select a Pool Reach***

Select a PDF Plate of Pool

**Pool Reach PDF's are only available for the pools for the Mississippi and Illinois Rivers. All downloadable PDF Plates are about 600 kb.*

[Datasources]

**River Locations of Interest**

Illinois River

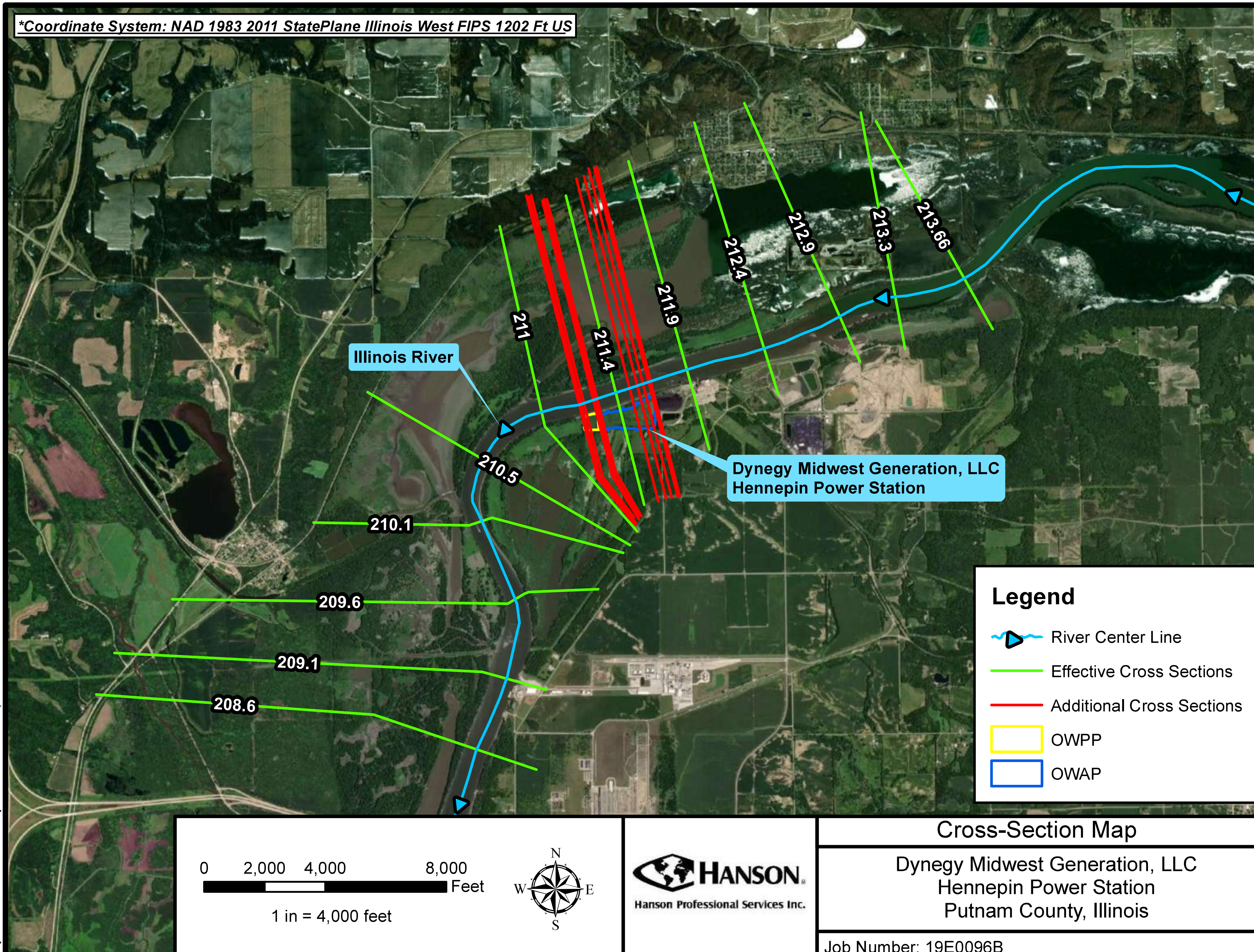
| Location | River Mile |
|---|---|
| Brandon Road L&D | 285.9 |
| Dresden Island L&D | 271.5 |
| Morris, IL | 263.1 |
| Marseilles, IL | 246.5 |
| Marseilles L&D | 244.5 |
| Starved Rock L&D | 231.1 |
| La Salle, IL | 224.7 |
| Henry, IL | 196.0 |
| Peoria, IL | 164.6 |
| Peoria L&D | 157.9 |
| Kingston Mines, IL | 145.4 |
| Copperas Creek, IL | 136.8 |
| Beardstown, IL | 88.6 |
| New LaGrange L&D | 80.2 |
| Meredosia, IL | 70.8 |
| Valley City, IL | 61.3 |
| Florence, IL | 56.0 |
| Hardin, IL | 21.5 |

**FEMA FIS Interpolated Flows (cfs)**

| River Mile | Flood Frequency (yr) | | | |
|---|---|---|---|---|
| | 10 | 50 | 100 | 500 |
| 157.7 | 66,000 | 82,000 | 90,000 | 111,000 |
| 231.1 | 94,000 | 125,000 | 137,000 | 164,000 |
| Interpolated Flows | | | | |
| **211.4** | **86,485** | **113,459** | **124,386** | **149,775** |

Appendix E

# Hydraulic Cross-Section Maps



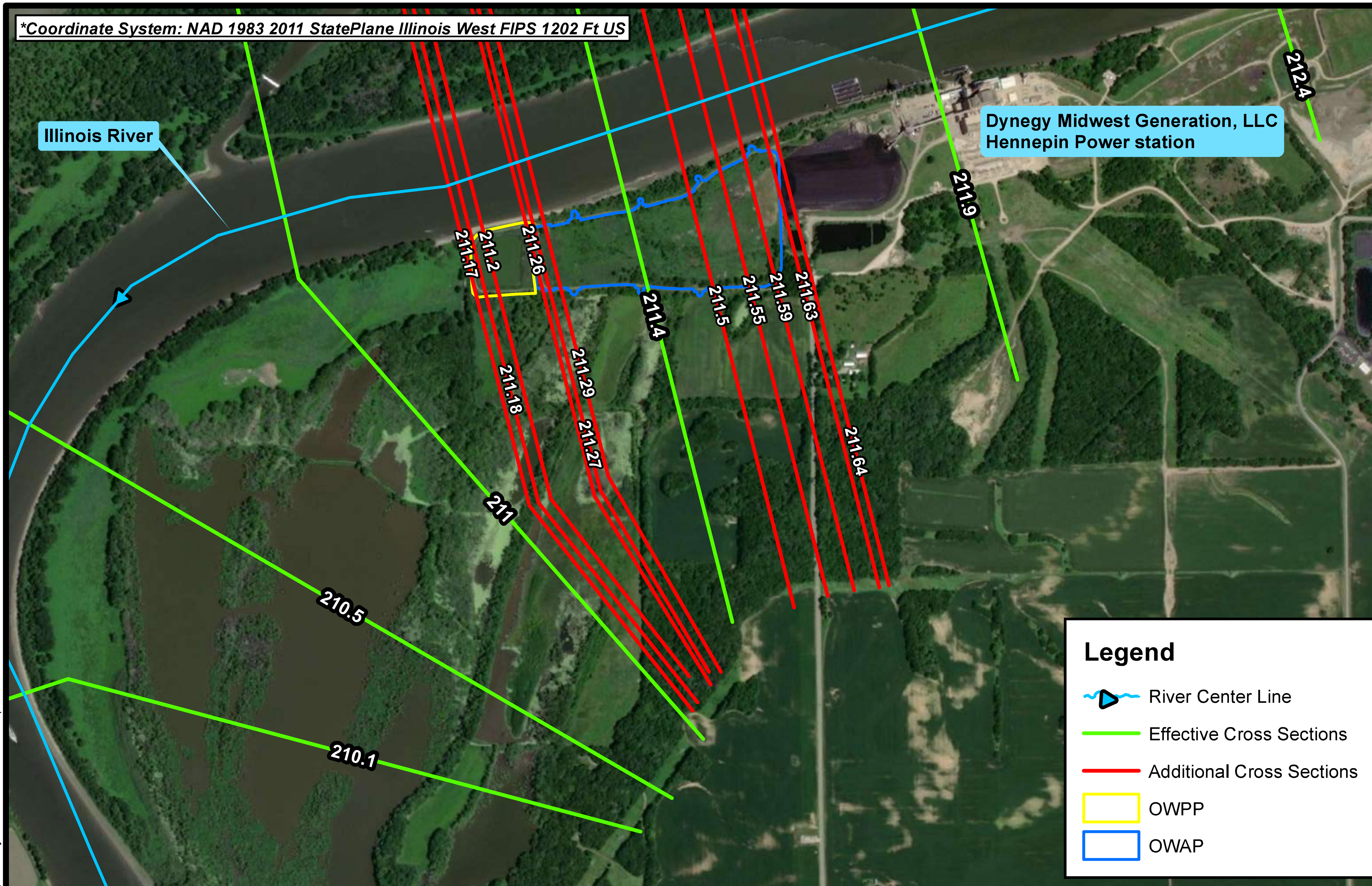

HANSON
Hanson Professional Services Inc.

# Cross-Section Map

Dynegy Midwest Generation, LLC
Hennepin Power Station
Putnam County, Illinois

Job Number: 19E0096B

I:\19jobs\19E0096B\CAD\GIS\Projects\Cross-Section Map.mxd




0 500 1,000 2,000 Feet

1 in = 1,000 feet

N W E S

HANSON
Hanson Professional Services Inc.

## Project Site Cross-Section Map

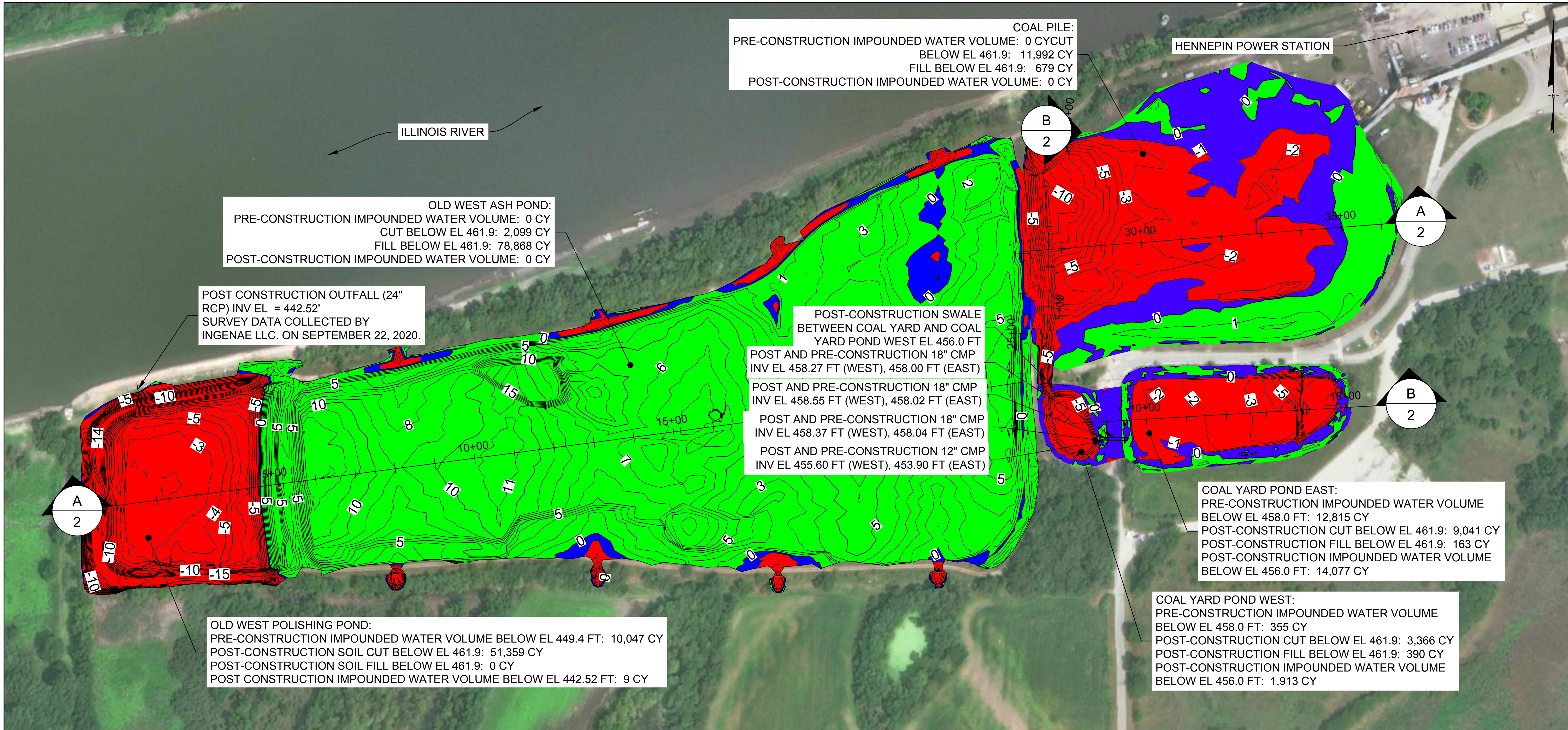
Dynegy Midwest Generation, LLC
Hennepin Power Station
Putnam County, Illinois

Job Number: 19E0096B

I:\19jobs\19E0096B\CAD\GIS\Projects\Project Site Cross-Section Map.mxd

Appendix F

# Proposed Site Plans




0 250
SCALE IN FEET

NOTES:

1. THE 100-YEAR FLOOD ELEVATION FOR THE SITE IS EL. 461.9 FT, PER THE FEMA FLOOD INSURANCE STUDY FOR PUTNAM COUNTY, ILLINOIS (17155CV000A, DATED FEBRUARY 2011).
2. CUT CONTOURS, ZERO CONTOURS, AND FILL CONTOURS REFER TO THE DIFFERENCE BETWEEN PRE-CONSTRUCTION GRADES AND FINAL AS-BUILT GRADES.
3. COMPOSITE PRE-CONSTRUCTION AND POST-CONSTRUCTION SURVEY GRADES ARE SHOWN ON FIGURES 2 AND 3.
4. SURVEY DATA USED TO CREATE THIS FIGURE WAS COLLECTED IN THE NAD83 HORIZONTAL DATUM AND THE NAVD88 VERTICAL DATUM.
5. THE BACKGROUND AERIAL IMAGE WAS OBTAINED FROM GOOGLE EARTH AND WAS COLLECTED ON SEPTEMBER 20, 2015.

LEGEND

| | |
|---|---|
| -1 | CUT CONTOURS |
| 0 | ZERO CONTOURS |
| 1 | FILL CONTOURS |

DRAFT

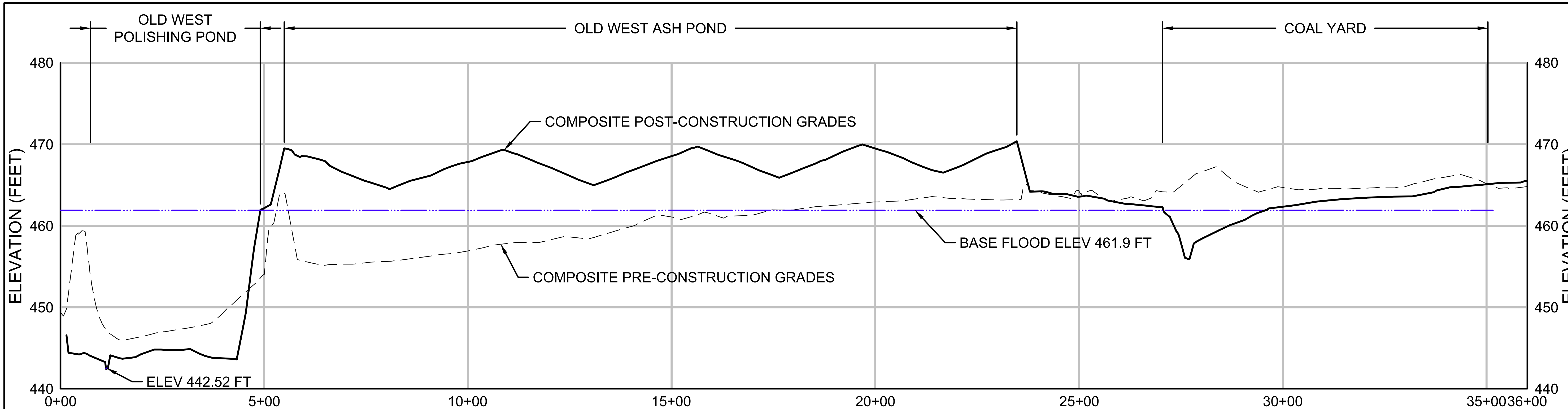
SUMMARY OF CUT AND FILL VOLUMES
BELOW ELEVATION 461.9 FT
HENNEPIN POWER STATION
WEST ASH POND SYSTEM CLOSURE

Geosyntec consultants

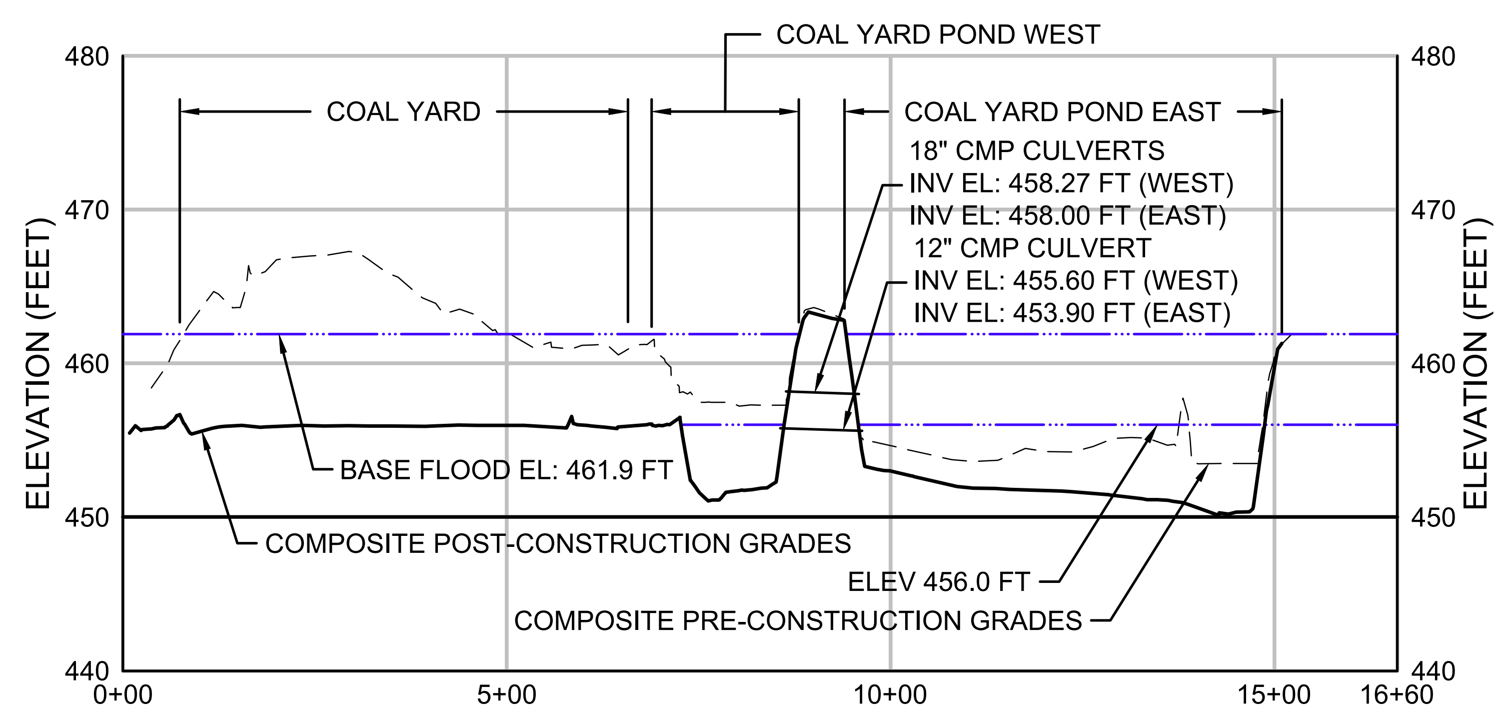
FIGURE 1

PROJECT NO: CHE8400 | OCTOBER 2020

L:\CADD\DYNEGY\HENNEPIN\CLOSURE DESIGN - CHE8356B\VOLUMES\CHE8356B-V002 - Last Saved by: SNichols on 10/14/20




A
1
SECTION
WEST TO EAST
SCALE: 1" = 250' (HORIZONTAL)




B
1
SECTION
NORTH TO SOUTH
SCALE: 1" = 250' (HORIZONTAL)

0 250
HORIZONTAL SCALE IN FEET

DRAFT

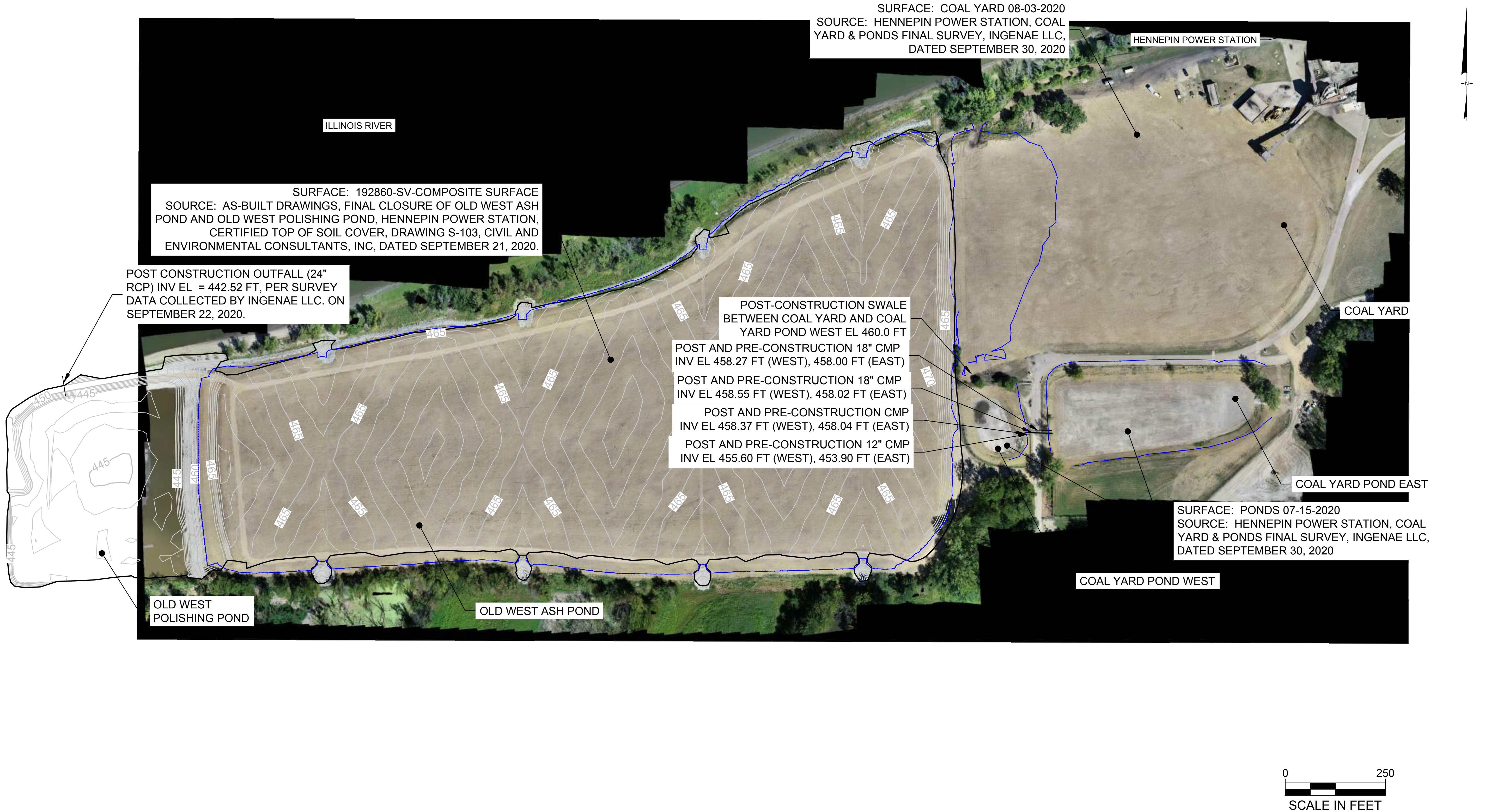
CROSS SECTIONS
HENNEPIN POWER STATION
WEST ASH POND SYSTEM CLOSURE

Geosyntec consultants

FIGURE 2

PROJECT NO: CHE8400 | OCTOBER 2020

L:\CADD\D\DYNEGY\HENNEPIN\CLOSURE DESIGN - CHE8356B\VOLUMES\CHE8356B-V002 - Last Saved by: SNichols on 10/14/20




NOTES:

1. TOPOGRAPHIC SURVEY DATA WAS COLLECTED BY MULTIPLE SURVEYORS ON MULTIPLE DATES AND MERGED INTO A COMPOSITE POST-CONSTRUCTION TOPOGRAPHIC SURFACE FOR THE AREAS INDICATED ON THIS DRAWING.
2. SURVEY DATA USED TO CREATE THIS FIGURE WAS COLLECTED IN THE NAD83 HORIZONTAL DATUM AND THE NAVD88 VERTICAL DATUM.
3. THE BACKGROUND AERIAL IMAGE WAS PROVIDED BY RYAN CENTRAL, INCORPORATED, AND COLLECTED ON JULY 23, 2020.

LEGEND

| | |
|---|---|
| 465 | SURFACE ELEVATIONS |
| | SURVEY BOUNDARY |
| | LIMITS OF BASE FLOOD ELEVATION 461.9 FT |

DRAFT

COMPOSITE POST-CONSTRUCTION GRADES
HENEPIN POWER STATION
WEST ASH POND SYSTEM CLOSURE

Geosyntec consultants

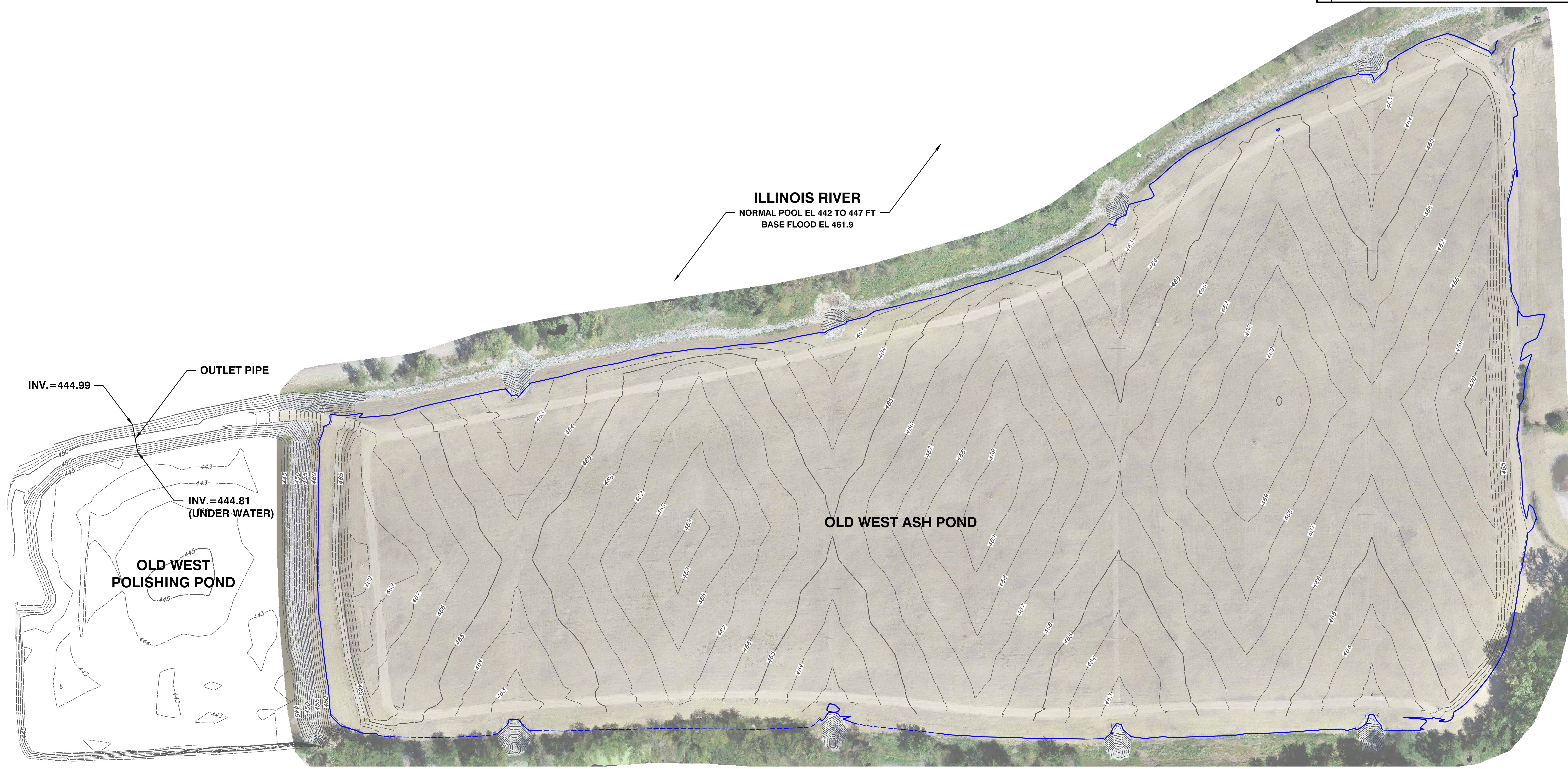
FIGURE 3

PROJECT NO: CHE8400 | OCTOBER 2020

| REVISION RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
| 1 | 10/08/2020 | REVISE PER GEOSYNTEC REVIEW |
| | | |
| | | |
| | | |

| SUBMITTAL RECORD | | |
|---|---|---|
| NO | DATE | DESCRIPTION |
| | | |
| | | |
| | | |
| | | |

NORTH




SCALE IN FEET
0 80 160

## SURVEYOR'S CERTIFICATE

*STATE OF ILLINOIS*
*COUNTY OF DUPAGE* } *SS*

*I HEREBY CERTIFY THAT THIS PLAT, AND THE SURVEY UPON WHICH IT IS BASED, HAS BEEN PREPARED UNDER MY DIRECT SUPERVISION. ALL DISTANCES ARE GIVEN IN FEET AND DECIMALS THEREOF.*

*THIS PLAT HAS BEEN PREPARED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. ILLINOIS LICENSED PROFESSIONAL DESIGN FIRM NO. 184.004002, LICENSE EXPIRES APRIL 30, 2021. FOR THE EXCLUSIVE USE OF THE CLIENT NOTED HEREON. REPRODUCTION OF USE BY THIRD PARTIES IS STRICTLY PROHIBITED WITHOUT THE WRITTEN PERMISSION OF THE UNDERSIGNED. THIS PROFESSIONAL SERVICE CONFORMS TO THE CURRENT ILLINOIS MINIMUM STANDARDS FOR A BOUNDARY SURVEY.*

*FIELDWORK WAS COMPLETED ON MAY 29, 2020.*

*GIVEN UNDER MY HAND AND SEAL THIS 9TH DAY OF OCTOBER, 2020.*

*ILLINOIS LICENSED PROFESSIONAL LAND SURVEYOR NO. 035-002992*
*LICENSED VALID THROUGH NOVEMBER 30, 2020*

DOUGLAS R. McCLINTIC
035-002992
PROFESSIONAL
LAND
SURVEYOR
NAPERVILLE, IL
STATE OF ILLINOIS

## LEGEND

- 462 — CERTIFIED 1 FOOT SOIL COVER CONTOUR
- 465 — CERTIFIED 5 FOOT SOIL COVER CONTOUR
- LIMITS OF BASE FLOOD ELEVATION 461.9
- APPROXIMATE LOCATION OF BASE FLOOD ELEVATION 461.9

## GENERAL NOTES

1. BASE FLOOD ELEVATION BASED ON COMPOSITE SURFACE OF MAY 29, 2020 MONTHLY FIELD DATA TOPOGRAPHY TIED INTO AUGUST 4, 2020 TOP OF SOL COVER TOPOGRAPHY.
2. MAP IS BASED ON ILLINOIS STATE PLANE WEST ZONE.
3. ALL ELEVATIONS ARE REFERENCED TO THE VRS NETWORK NAVD 88 VERTICAL DATUM.

## REFERENCE

1. AERIAL IMAGE PROVIDED COURTESY OF RYAN INCORPORATED CENTRAL, JANESVILLE, WISCONSIN.


Civil & Environmental Consultants, Inc.
1230 East Diehl Road, Suite 200 - Naperville, IL 60563
Ph: 630.963.6026 · 877.963.6026 · Fax: 630.963.6027
www.cecinc.com


# AS-BUILT DRAWINGS
# FINAL CLOSURE OF OLD WEST ASH POND AND OLD WEST POLISHING POND
# HENNEPIN POWER STATION

| DRAWN BY: MSK | CHECKED BY: DRM | APPROVED BY: DRAFT |
|---|---|---|
| DATE: 09/25/2020 | DWG SCALE: 1"=80' | PROJECT NO: 192-860.0001 |

CERTIFIED FINAL GRADES

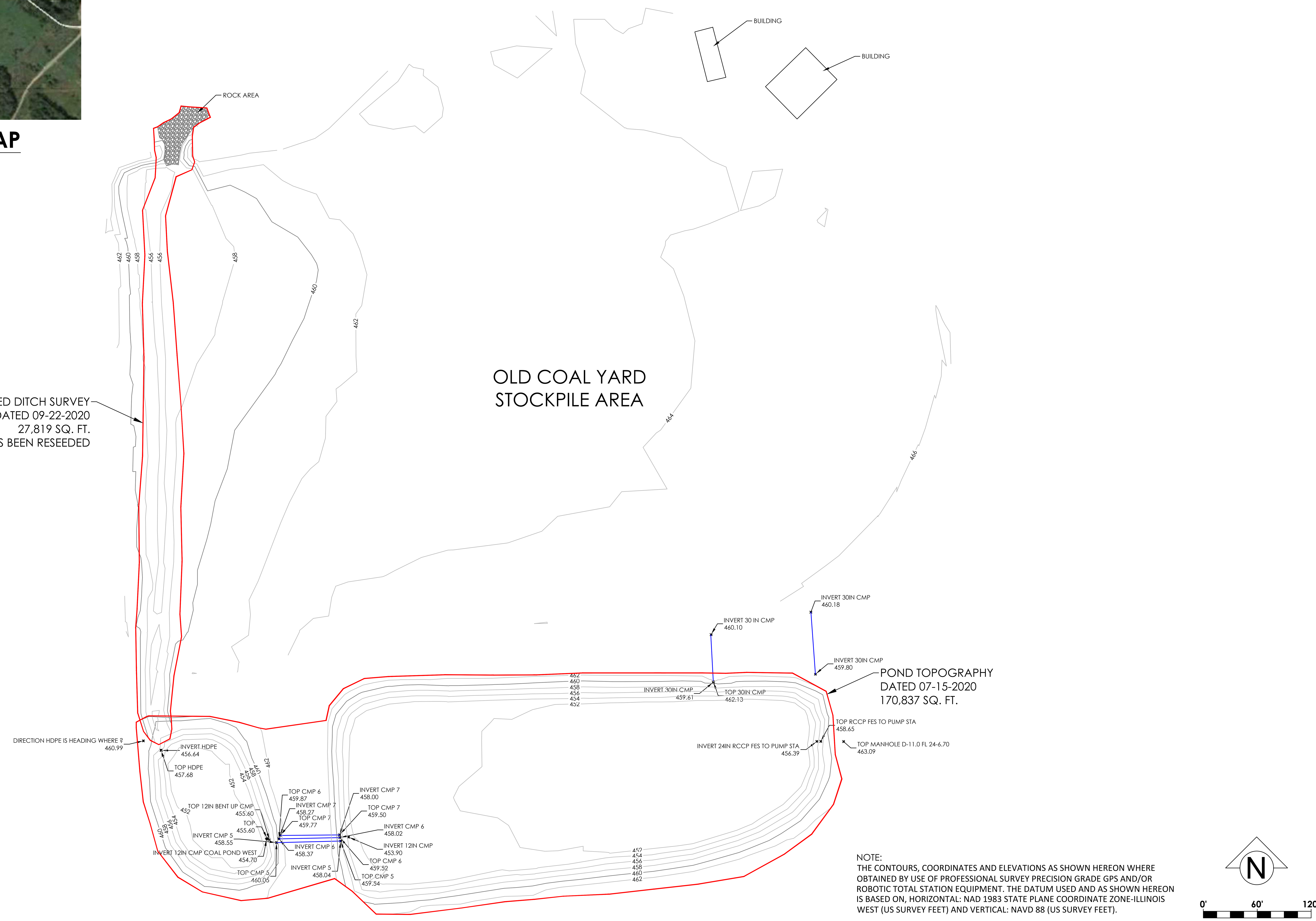
DRAWING NO.: S-103

# HENNEPIN POWER STATION

## OLD COAL YARD STOCK AREA 08-03-2020
## COAL YARD SETTLEMENT POND AREA 07-15-2020
## DITCH SURVEY 09-22-2020


**SITE LOCATION MAP**

N.T.S.




SEE SURVEY POINT FILE FOR ADDTIONAL PIPE SURVEY POINTS 7201-7203 & 7206-7207

NOTE:
THE CONTOURS, COORDINATES AND ELEVATIONS AS SHOWN HEREON WHERE OBTAINED BY USE OF PROFESSIONAL SURVEY PRECISION GRADE GPS AND/OR ROBOTIC TOTAL STATION EQUIPMENT. THE DATUM USED AND AS SHOWN HEREON IS BASED ON, HORIZONTAL: NAD 1983 STATE PLANE COORDINATE ZONE-ILLINOIS WEST (US SURVEY FEET) AND VERTICAL: NAVD 88 (US SURVEY FEET).


IngenAE
502 Earth City Plaza, Suite 120
Earth City, MO 63045
www.ingenae.com


STATE OF ILLINOIS
MICHAEL J. GRAMINSKI
35-2901
REGISTERED LAND SURVEYOR
10/8/2020

| Submissions / Revisions: | Date: |
|---|---|
| 1 REVISED | 9/25/20 |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| 10 | |
| 11 | |
| 12 | |
| 13 | |

VISTRA ENERGY

Project Name & Location:

HENNEPIN
POWER STATION



DO NOT SCALE PLANS
Copying, Printing, Software and other processes required to produce these prints can stretch or shrink the actual paper or layout. Therefore, scaling of this drawing may be inaccurate. Contact IngenAE with any need for additional dimensions or clarifications.

Drawing Name:
COAL YARD & PONDS FINAL SURVEY

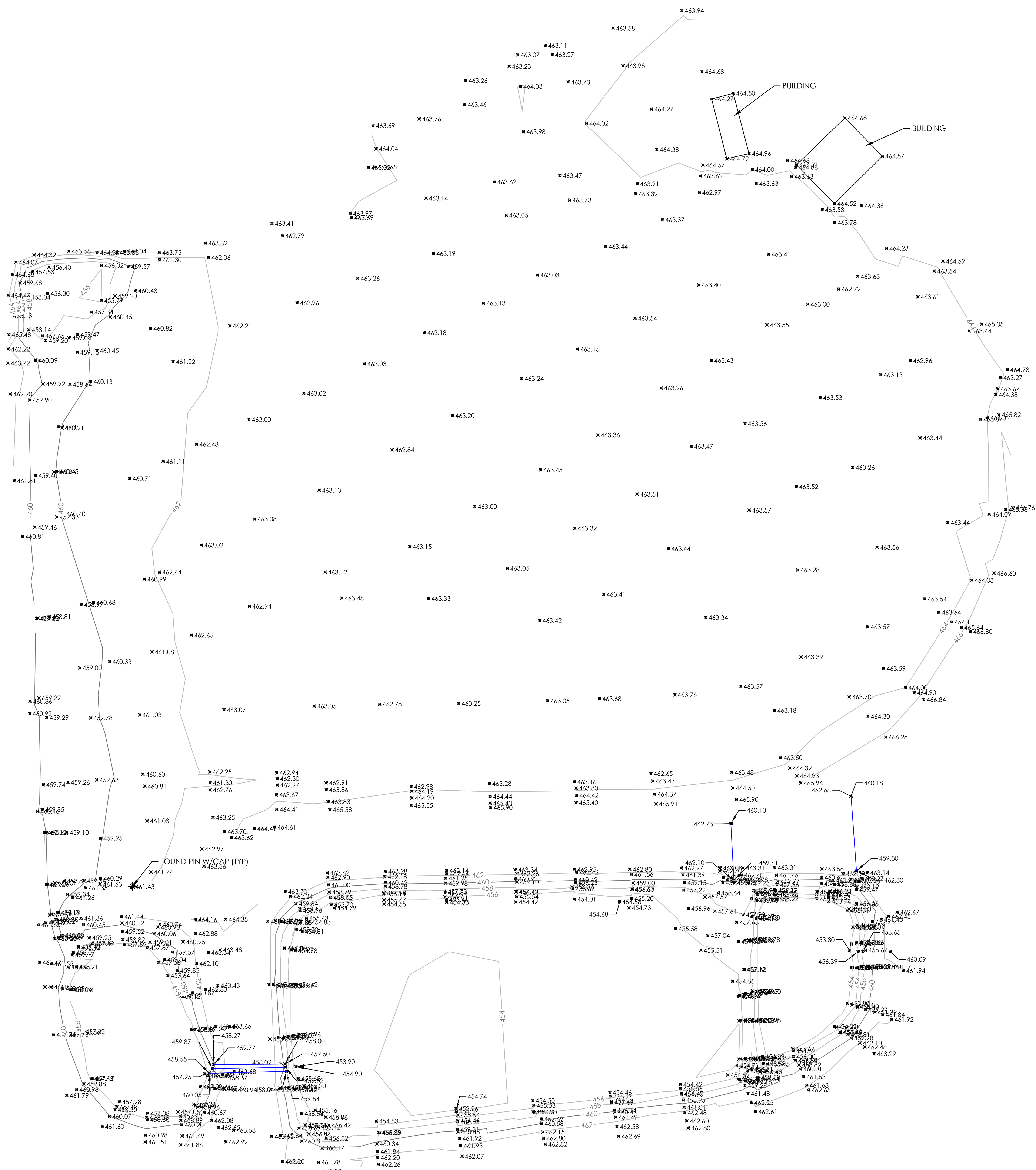
| | |
|---|---|
| Date: 10/13/2020 | Project No. |
| Type: SITE | Drawing No. 1 |
| Drawn By: CB | |
| Approved By: MG | |
| Scale: AS NOTED | |

# HENNEPIN POWER STATION

## OLD COAL YARD STOCK AREA AND STORM WATER RUN-OFF COLLECTION POND SURVEY


**SITE LOCATION MAP**

N.T.S.




NOTES:

1. ORIGINAL SURVEY COMPLETED ON OR AROUND JUNE 24, 2020.
2. THE SURVEYS AS SHOWN HERE ON WERE MADE BY USE OF DATA COLLECTED BY TRIMBLE G-8 GPS EQUIPMENT. THAT DATA IS BASED ON THE ILLINOIS STATE PLANE WEST COORDINATE SYSTEM. NAD1983 U.S. SURVEY FEET, NAVD 88 U.S. SURVEY FEET.

STATE OF ILLINOIS MICHAEL J. GRAMINSKI 35-2901 REGISTERED LAND SURVEYOR

MICHAEL J. GRAMINSKI DATE
IPLS NO. 035-2901

N

0' 60' 120'

IngenAE
502 Earth City Plaza, Suite 120
Earth City, MO 63045
www.ingenae.com

| Submissions / Revisions: | Date: |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| 10 | |
| 11 | |
| 12 | |
| 13 | |

Project Name & Location:

HENNEPIN
POWER STATION



Drawing Name:

COAL YARD AND PONDS ORIGINAL SURVEY

| Date: 7/17/2020 | Project No. |
|---|---|
| Type: SITE | Drawing No. 1 |
| Drawn By: CB | |
| Approved By: MG | |
| Scale: AS NOTED | |

CREATE AMAZING.

Burns & McDonnell World Headquarters
9400 Ward Parkway
Kansas City, MO 64114
**O** 816-333-9400
**F** 816-333-3690
www.burnsmcd.com

# Memorandum

BURNS McDONNELL

Date: 25 October 2021

Subject: 35 I.A.C. Admin. Code Part 845 - Wetland Location Demonstration for East Ash Pond at Hennepin Power Plant

Dynegy Midwest Generation, LLC (DMG) operates the coal-fired Hennepin Power Plant located in Putnam County, Illinois. The East Ash Pond is an existing surface impoundment storing coal combustion residuals (CCR). The requirements for the East Ash Pond are found in 35 Ill. Admin. Code (I.A.C.) 845 (Part 845).

This memorandum addresses the requirements of Section 845.310 Wetlands, which states:

*Section 845.310 Wetlands*

a) *Existing and new CCR surface impoundments, and all lateral expansions of CCR surface impoundments must not be located in wetlands unless the owner or operator demonstrates* [that the requirements listed in 845.310(a)(1) through (5) are met.]

b) *The owner or operator of the CCR surface impoundment must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of subsection (a).*

Pursuant to Section 845.210(d)(2), for existing CCR surface impoundments, the owner or operator of the CCR surface impoundment may use a previously completed location restriction demonstration required by Section 845.300 (Placement Above the Uppermost Aquifer), Section 845.310 (Wetlands), Section 845.320 (Fault Areas), Section 845.330 (Seismic Impact Zones), and Section 845.340 (Unstable Areas), provided that the previously completed assessments meet the applicable requirements of those Sections.

The previous wetlands demonstration was certified by a qualified professional engineer stating that the demonstration meets the requirements of 40 C.F.R. § 257.61. The requirements described in 40 C.F.R. § 257.61 are nearly identical to the requirements contained in I.A.C. Section 845.310. Pursuant to Section 845.210(d)(2), a certification is not required for this demonstration. The previously completed wetlands demonstration is included in Attachment D.

HALEY & ALDRICH, INC.
6500 Rockside Road
Suite 200
Cleveland, OH 44131
216.739.0555

**MEMORANDUM**

16 October 2018
File No. 129788

SUBJECT: Location Restriction Demonstration - Wetland Areas
Hennepin Power Station
East Ash Pond
Hennepin, Illinois

Dynegy Midwest Generation, LLC operates the coal-fired Hennepin Power Station (Plant) located near Hennepin, Illinois. The East Ash Pond (Unit) is an existing coal combustion residuals (CCR) surface impoundment. This demonstration addresses the requirements of 40 CFR §257.61 *(Wetlands)* of the U.S. Environmental Protection Agency's (EPA) rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities*. 80 Fed. Reg. 21,302 (Apr. 17, 2015) (promulgating 40 CFR §257.61); 83 Fed. Reg. 36,435 (July 30, 2018) (amending 40 CFR §257.61.

*§257.61(a)*: *New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in wetlands, as defined in §232.2 of this chapter, unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that the CCR unit meets the requirements of paragraphs (a)(1) through (5) of this section.*



Based on a review of the U.S. Fish and Wildlife Service's National Wetland Inventory mapping, 0.5-meter resolution aerial imagery (2016) and the results of on-site field assessments, the Unit is not located in wetlands as defined by 40 CFR §232.2.

*§257.61(b): The owner or operator of the CCR unit must obtain a certification from a qualified professional engineers or approval from the Participating State Director or approval from EPA where EPA is the permitting authority stating that the demonstration meets the requirements of paragraph (a) of this section.*

I, Steven F. Putrich, 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 CCR Unit is not located in wetlands as included in the CCR Rule Location Restrictions Evaluation memorandum dated 12 October 2018 and, therefore, meets the requirements of 40 CFR §257.61(a).

Signed: ____________________
Consulting Engineer

| | |
|---|---|
| Print Name: | Steven F. Putrich |
| Illinois License No.: | 62048779 |
| Title: | Vice President |
| Company: | Haley & Aldrich, Inc. |

Professional Engineer's Seal:

STEVEN F. PUTRICH
062-048-779
REGISTERED
PROFESSIONAL
ENGINEER
STATE OF ILLINOIS

# ATTACHMENT E


HENNEPIN
EAST NEW PRIMARY POND
ID #: W1550100002-05
DYNEGY MIDWEST
GENERATION, LLC

# ATTACHMENT F

# Dynegy Midwest Generation, LLC

## HENNEPIN POWER PLANT

*VILLAGE OF HENNEPIN, PUTNAM COUNTY, IL*

# <u>Emergency Action Plan (EAP)</u>

**40 C.F.R. § 257.73(a)(3), Ill. Adm. Code 845.520**
**Coal Combustion Residual (CCR) Impoundment**
**& Related Facilities**

- East Ash Pond (NID # IL50363) (IEPA # W1550100002-05)
- West Ash Pond System (IEPA #W1550100002-01)
- Ash Ponds 2/4 (IEPA #W1550100002-04, #W1550100002-07)

**Revision Date: September 23, 2021**

**Qualified Professional Engineer Certification; Emergency Action Plan for the Hennepin Power Plant East Ash Pond**

In accordance with 40 C.F.R. § 257.73(a)(3)(iv) and 35 Ill. Adm. Code 845.520(e), the owner or operator of a CCR unit that is required to prepare a written Emergency Action Plan under 40 C.F.R. § 257.73(a)(3) and 35 Ill. Adm. Code 845.520(a) must obtain a certification from a qualified professional engineer stating that the written Emergency Action Plan meets the requirements of 40 C.F.R. § 257.73(a)(3) and 35 Ill. Adm. Code 845.520.

I, Phil Morris, being a Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief that:

1. the information contained in this Emergency Action Plan was prepared in accordance with the accepted practice of engineering; and

2. this Emergency Action Plan meets the requirements of 40 C.F.R. § 257.73(a)(3) and 35 Ill. Adm. Code 845.520.

Phil Morris
Senior Director, Corporate Environmental

9/27/21
*Date*

PHIL L. MORRIS
062-058763
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

9/27/21

**HENNEPIN POWER PLANT**
**EMERGENCY ACTION PLAN**
**CCR IMPOUNDMENT & RELATED FACILITIES**

## TABLE OF CONTENTS



## List of Tables



## List of Figures

# HENNEPIN POWER PLANT
# EMERGENCY ACTION PLAN
# CCR IMPOUNDMENT & RELATED FACILITIES

## PART I – EAP NARRATIVE AND EXHIBITS

## 1 STATEMENT OF PURPOSE

The Hennepin Power Plant (Power Plant) is located near the Village of Hennepin in Putnam County, Illinois. The location is shown in Figure 1-1. The Power Plant is a retired coal-fired electricity producing power plant owned and operated by Dynegy Midwest Generation, LLC (DMG). This Emergency Action Plan (EAP) was prepared in accordance with 40 CFR § 257.73(a)(3) and covers the following Coal Combustion Residual (CCR) surface impoundment located at the site:

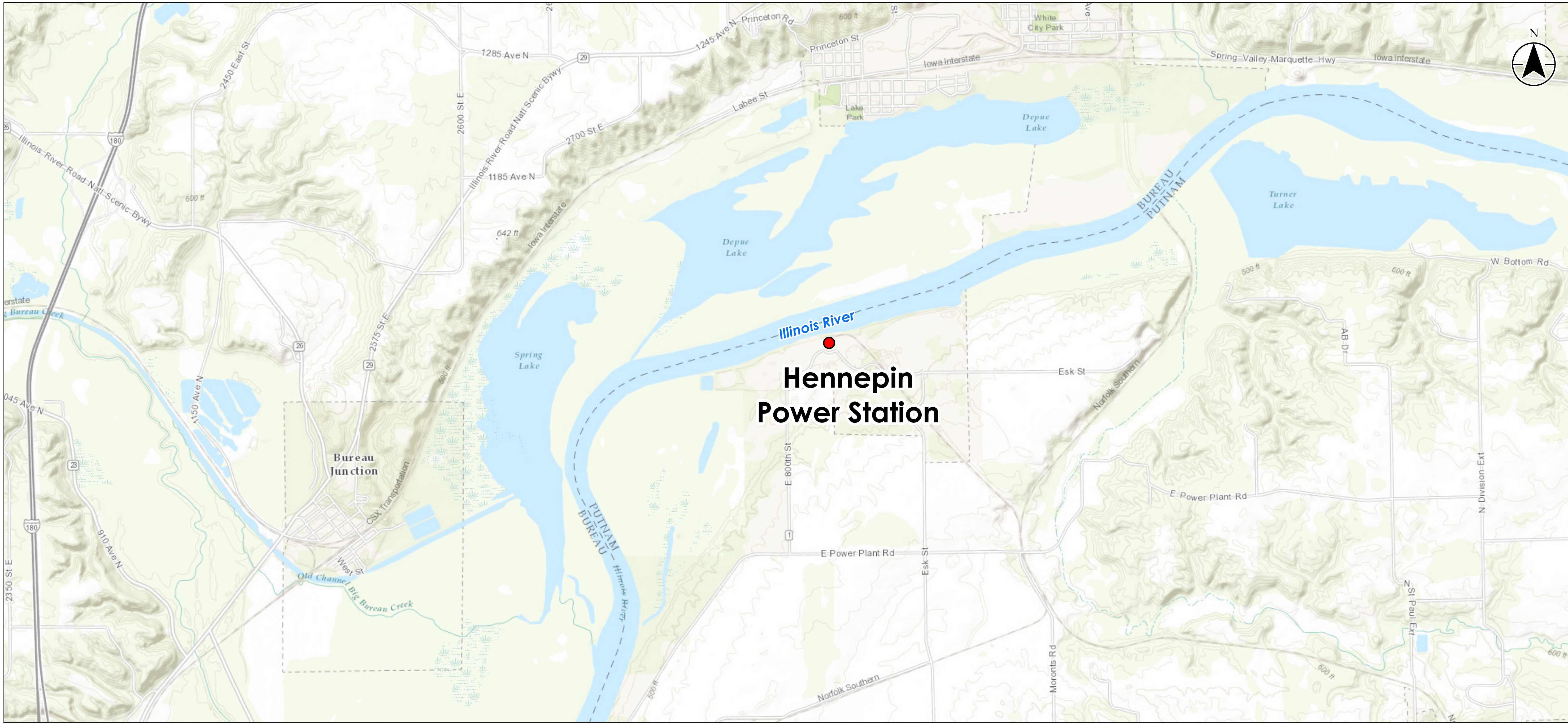
- East Ash Pond (NID # IL50363) (IEPA # W1550100002-05)

The location of the impoundment is shown in Figure 1-2. Section 6 of this EAP includes a description of the impoundment.

The purpose of this Emergency Action Plan (EAP) is to:

1. Safeguard the lives, as well as to reduce property damage, of citizens living within potential downstream flood inundation areas of the CCR impoundment and related facilities at the Hennepin Power Plant.
2. Define the events or circumstances involving the CCR impoundment and related facilities at the Hennepin Power Plant that represent atypical operating conditions that pose a safety hazard or emergency and how to identify those conditions.
3. Define responsible persons, their responsibilities, and notification procedures in the event of a safety emergency.
4. Provide contact information of emergency responders.
5. Identify emergency actions in the event of a potential or imminent failure of the impoundment.
6. Identify the downstream area that would be affected by failure of the impoundment.
7. Provide for effective facility surveillance, prompt notification to local Emergency Management Agencies, citizen warning and notification responses, and preparation should an emergency occur.

Information provided by DMG was utilized and relied upon in preparation of this report.





0 6,000 Feet

1:36,000 (At original document size of 11x17)

Stantec DYNEGY

**Notes**

1. Coordinate System: NAD 1983 StatePlane Illinois West FIPS 1202 Feet
2. Aerial Source: 2015 NAIP Imagery
3. Impoundment Boundaries Provided by Client (Dated 9/9/2015)

Project Location
Latitude: 41.302685
Longitude: -89.303883
Putnam County, Illinois

175605019
Prepared by CI on 2017-04-12
Technical Review by CI on 2017-04-12
Independent Review by MT on 2017-04-12

Client/Project

Hennepin Power Station
Emergency Action Plan

Figure No.

**1-1**

Title

**Location Map**



## Legend

CCR Surface Impoundment Boundary

0 1,000 Feet

1:12,000 (At original document size of 11x17)

Stantec

Project Location
Latitude: 41.302975
Longitude: -89.315035
Putnam County, Illinois

175605019
Prepared by CI on 2017-04-12
Technical Review by CI on 2017-04-12
Independent Review by MT on 2017-04-12

Client/Project
Hennepin Power Station
Emergency Action Plan

Figure No.
**1-2**

Title
**CCR Impoundment**

**Notes**
1. Coordinate System: NAD 1983 StatePlane Illinois West FIPS 1202 Feet
2. Aerial Source: 2015 NAIP Imagery
3. Impoundment Boundaries Provided by Client (Dated 9/9/2015)

# 2 COMMUNICATION

To facilitate understanding among everyone involved in implementing this EAP, four response levels are used to identify the condition of an impoundment. These are:

**Response Levels:**

- **Level 0:** Normal conditions and routine operations, including surveillance and initial investigation of unusual conditions and effects of storm events.
- **Level 1:** Potentially hazardous condition exists, requiring investigation and possible corrective action.
- **Level 2:** Potential failure situation is developing; possible mode of failure is being assessed; corrective measures are underway.
- **Level 3:** Failure is occurring or is imminent, public protective actions are required.

The 4-Step Incident Response Process is outlined in Figure 2-1 and described in detail in Appendix D. This should be used in conjunction with the Notification Flowchart (Figure 2-2) and EAP Decision Tree (Figure 2-3). Section 4 provides guidance tables for determining Response Levels and a table providing emergency actions to be taken given various situations. Table 2-1 lists contact information for the emergency responders.

**Figure 2-1. Summary/Sequence of Tasks 4-Step Incident Response Process**

**Step 1: Detection, Evaluation, and Response Level Determination**

Sequence of Tasks:

- Notify EAP Coordinator, Asset Closure Manager, and Dam Safety Manager of unusual condition detected and confer on next steps needed.
- Conduct technical evaluation of conditions as needed.
- Determine Response Level based on evaluation. **(Table 4-1)**
- Reset Response Level as revised evaluations warrant.

**Step 2: Notification**

Sequence of Tasks:

- Notify authorities, designated personnel, and external response partners of change in Response Level, using the Notification Flowchart. **(Figure 2-2)**
- *Re-notify authorities, designated personnel, and external response partners as Response Level is changed.*

**Step 3: Emergency Actions**

Sequence of Tasks:

- Perform emergency actions with goal of saving the impoundment and minimizing impacts to life, property, and environment. **(Table 4-3)**
- Take continuous actions to include situation assessment, information sharing, remediation, and public safety advisories or warnings, as warranted.
- *Revise action plan as changes in conditions warrant.*

**Step 4: Follow-up**

Sequence of Tasks:

- Document conditions and decisions in the Emergency Incident Log.
- Notify authorities, designated personnel, and external response partners that condition is stabilized; limit incident termination declarations to conditions at the site.
- Conduct and document after-action review of incident and response.

**Figure 2-2. Notification Flowchart**

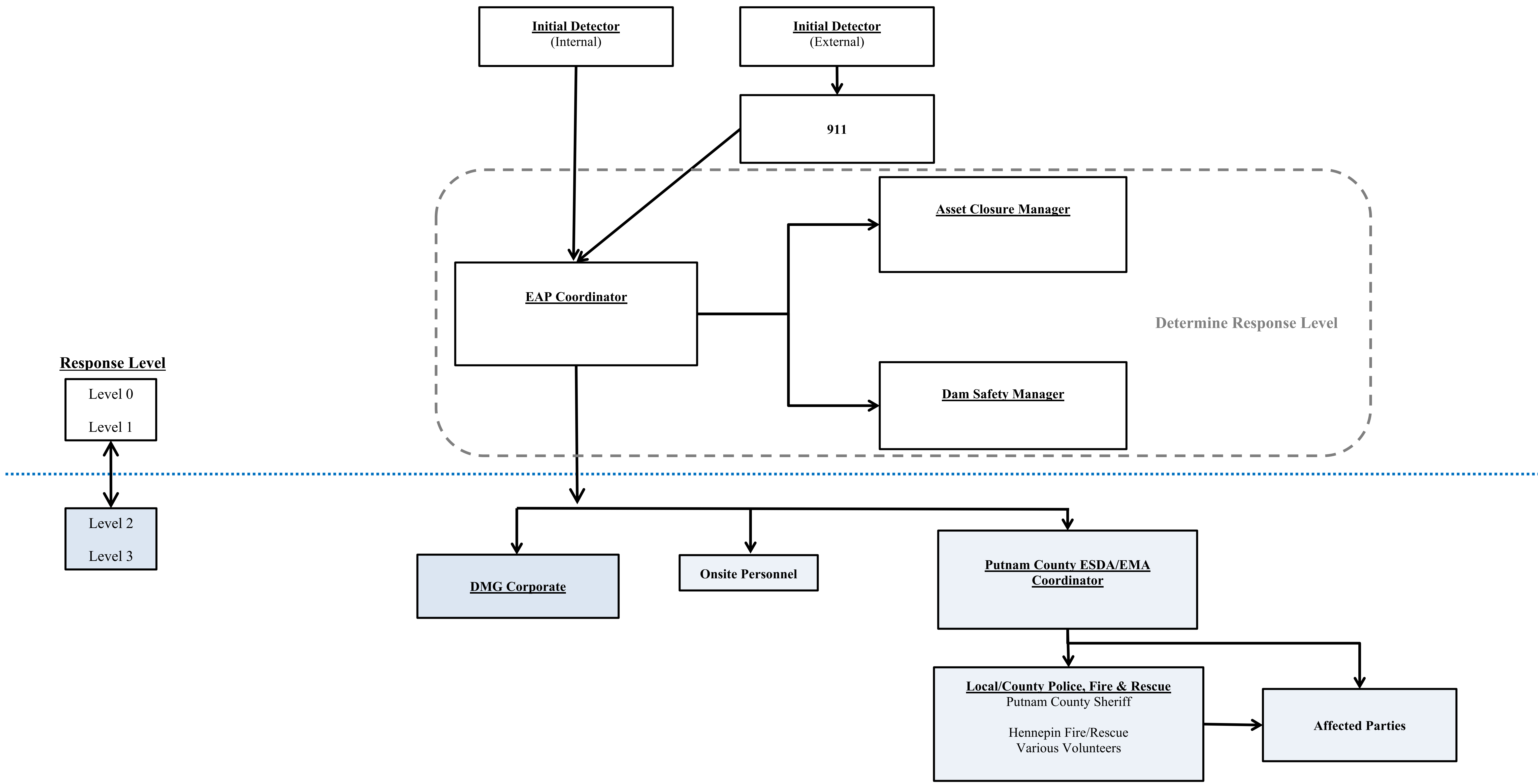


**Figure 2-3. EAP Response Process Decision Tree**

**Note:** At any given below, if failure is imminent or actively occurring **CALL 911 IMMEDIATELY** to notify emergency responders and then continue with process afterwards.

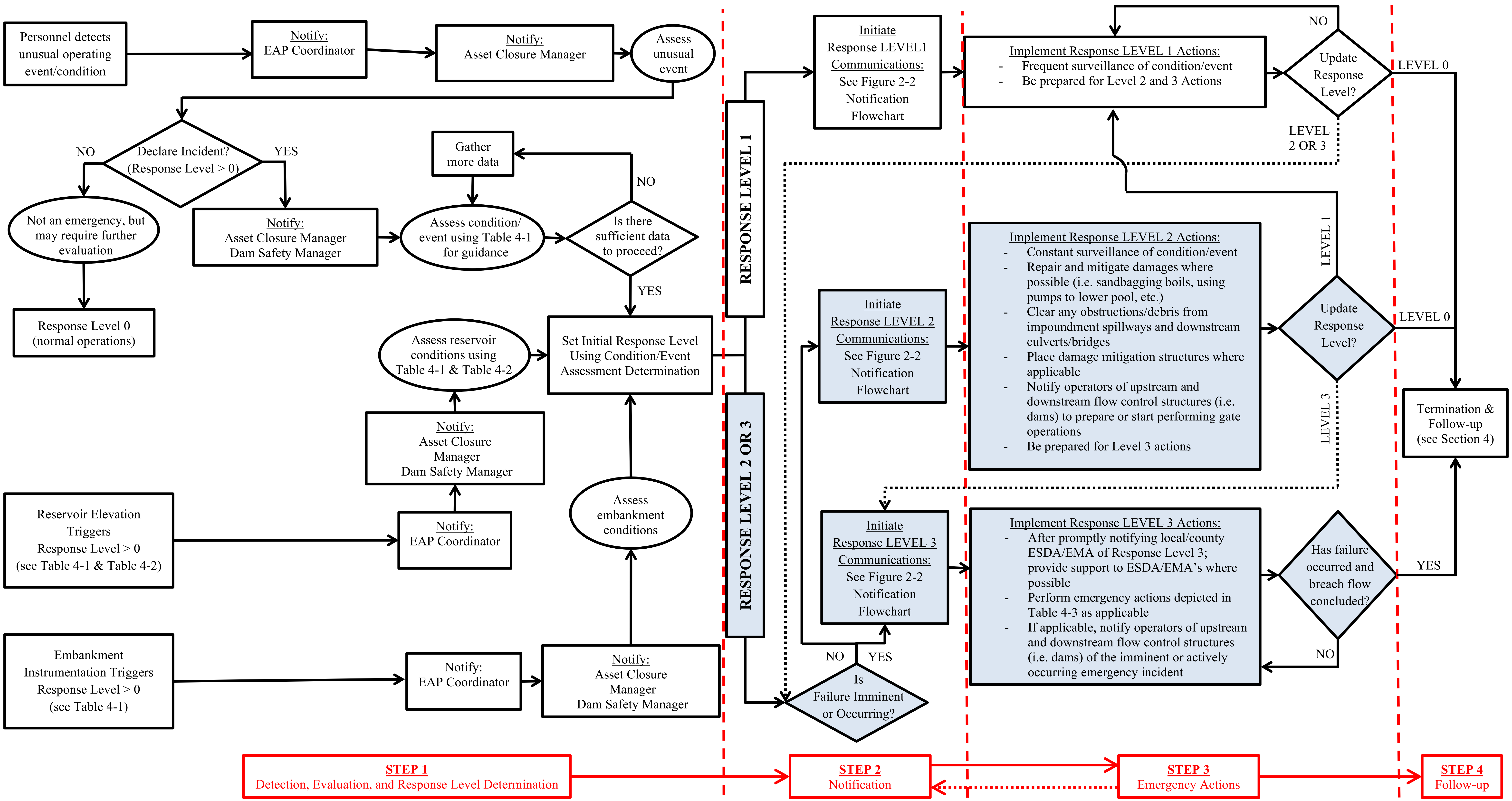


**Table 2-1. EAP Emergency Responders**

| Position / Entity | Contact Information | |
|---|---|---|
| **Internal Contacts** | | |
| **Hennepin Power Plant** | **Contact** | |
| Asset Closure Manager | | |
| EAP Coordinator | | |
| **DMG Corporate Operations** | **Contact** | |
| Dam Safety Manager | (618) 792-8488 | |
| **External Contacts** | | |
| **Local/County ESDA/EMA, Police, & Fire** | **Phone #** | **Alternate Phone #** |
| Putnam County 911 Emergency Communication Center | 911 | (815) 882-2635 |
| Putnam County – ESDA/EMA | (815) 925-3073 | (815) 252-2873 |
| Putnam County –Sheriff Dept. | (815) 925-7015 | |
| Village of Hennepin – Fire Dept. | (815) 925-7225 | |
| **State Emergency Management Agencies & Organizations** | **Phone #** | **Alternate Phone #** |
| Illinois Conservation Police | (815) 587-5136 | |
| Donnelley State Fish and Wildlife Area | (815) 447-2353 | |

# 3 EAP ROLES AND RESPONSIBILITIES

Table 3-1 provides a summary of the EAP roles during an emergency event.

**Table 3-1. Summary of EAP Roles**

| Entity | Role Description |
|---|---|
| **DMG Emergency Response Team (ERT)** | **ERT:** DMG personnel responsible for EAP implementation, distribution, updates/maintenance, and training activities. The *ERT* is comprised of the following roles;<br>1. **DMG Corporate:** DMG corporate entity, committee, team, or position with relevant responsibility for a given generating power plant.<br>2. **Asset Closure Management:** Personnel responsible for day-to-day operation and management of the Power Plant.<br>3. **Dam Safety Manager:** Personnel that is most knowledgeable about the design and technical operation of facilities at a given power plant.<br>4. **EAP Coordinator:** Personnel responsible for implementing the EAP and associated activities<br>**Emergency Event – EAP Responsibilities**<br>1. Respond to emergencies at the Power Plant.<br>2. Verify and assess emergency conditions.<br>3. Notify and coordinate as appropriate with participating emergency services disaster agencies or emergency management agencies (ESDA/EMA's), emergency responders, regulatory agencies, and all other entities involved or affected by this EAP.<br>4. Take corrective action at the Power Plant.<br>5. Declare termination of emergencies at the Power Plant. |
| **Putnam County ESDA/EMA** | 1. Receive Response Level reports from *DMG Corporate* through *EAP Coordinator*.<br>2. Coordinate emergency response activities with local authorities: police, fire and rescue, etc.<br>3. Coordinate notification of public as necessary through established channels, which may include door-to-door contact.<br>4. Coordinate notification activities to affected parties within inundation areas.<br>5. Evaluate risk to areas beyond the inundation areas, communicate needs to the *DMG Corporate* and/or *EAP Coordinator*, and coordinate aid as appropriate.<br>6. Responsible for declaring termination of an emergency condition off-site upon receiving notification of an emergency status termination from the *DMG Corporate*.<br>7. If necessary, coordinate with *State ESDA/EMA*. |
| **Village of Hennepin Police, Fire, and Rescue** | 1. Receive alert status reports from the *ERT* or the *County ESDA/EMA*.<br>2. If necessary, notify affected parties and general public within inundation areas (see Section 7).<br>3. Render assistance to Putnam County ESDA/EMA, as necessary.<br>4. Render assistance to *DMG Corporate* and *Power Plant Management*, as necessary. |
| **Putnam County Police, Fire and Rescue, and Emergency Services** | 1. Receive alert status reports from the *ERT* or the *County ESDA/EMA*.<br>2. If necessary, notify affected parties within the inundation area.<br>3. Provide mutual aid to other affected areas, if requested and able. |

# 4 EAP RESPONSE

The 4-Step Incident Response Process is shown in Figure 2-1. The Decision Tree shown in Figure 2-3 provides a flowchart for the various elements of the response process. Upon reaching Step 4 of the response process (termination and follow-up), the EAP Coordinator is responsible for notifying the ESDA/EMA's that the condition of the dam/impoundment has been stabilized. Additional details about the EAP response process can be found in Appendix D. The purpose of this section is to provide specific information that can be used during a response. This information is provided in the following tables:

- Table 4-1 provides guidance for determining the response level.
- Table 4-2 provides impoundment pool level trigger elevations.
- Table 4-3 lists emergency actions to be taken depending on the situation.

**Table 4-1. Guidance for Determining the Response Level**

| Event | Situation | Response Level |
|---|---|---|
| Spillway flow (See Table 4-2 for relevant elevations) | Primary spillway flow is not causing active erosion. | Level 0 |
| | Impoundment water surface elevation is at or above auxiliary spillway crest elevation (if equipped). No active erosion caused by spillway flow. | Level 1 |
| | Spillway flow actively causing minor erosion that is not threatening the control section or dam/impoundment stability. | Level 2 |
| | Spillway flow that could result in flooding of people downstream if the reservoir level continues to rise. | Level 2 |
| | Abnormal operation of the spillway system due to blockage or damage that could lead to flooding. | Level 2 |
| | Spillway flow actively eroding the soil around the spillway that is threatening the control section (e.g., undermining) or dam/impoundment stability. | Level 3 |
| | Spillway flow that is flooding people downstream. | Level 3 |
| Embankment overtopping (See Table 4-2 for relevant elevations) | Impoundment water surface elevation at or below typical normal pool fluctuation elevation. | Level 0 |
| | Impoundment water surface elevation above typical normal pool fluctuation elevation. | Level 1 |
| | Impoundment water surface elevation above high normal pool fluctuation elevation. | Level 2 |
| | Impoundment water surface elevation at or above embankment crest elevation. | Level 3 |
| Seepage | New seepage areas in or near the dam/impoundment with clear flow. | Level 1 |
| | New seepage areas with cloudy discharge or increasing flow rate. | Level 2 |
| | Heavy seepage with active erosion, muddy flow, and/or sand boils. | Level 3 |
| Sinkholes | Observation of new sinkhole in impoundment area or on embankment. | Level 2 |
| | Rapidly enlarging sinkhole and/or whirlpool in the impoundment. | Level 3 |
| | New cracks in the embankment greater than ¼ inch wide without seepage. | Level 1 |

**Table 4-1. Guidance for Determining the Response Level**

| Event | Situation | Response Level |
|---|---|---|
| Embankment cracking | Any crack in the embankment with seepage. | Level 2 |
| | Enlarging cracks with muddy seepage. | Level 3 |
| Embankment movement | Visual signs of movement/slippage of the embankment slope. | Level 1 |
| | Detectable active movement/slippage of the embankment slope or other related effects (tension cracking, bulges/heaves, etc.) that could threaten the integrity of the embankment. | Level 2 |
| | Sudden or rapidly proceeding slides of the embankment slopes. | Level 3 |
| Embankment Monitoring Equipment (piezometers, inclinometers, surface displacement mounts, etc.) | Instrumentation readings beyond historic normal. | Level 1 |
| | Instrumentation readings indicate the embankment is susceptible to failure. | Level 2 |
| | Instrumentation readings indicate embankment is at threshold of failure or is currently failing. | Level 3 |
| Earthquake or another event | Measurable earthquake felt or reported on or within 100 miles of the impoundment. | Level 1 |
| | Earthquake or other event resulting in visible damage to the impoundment or appurtenances. | Level 2 |
| | Earthquake or other event resulting in uncontrolled release of water or materials from the impoundment. | Level 3 |
| Security threat | Verified bomb threat or other physical threat that, if carried out, could result in damage to the impoundment. | Level 2 |
| | Detonated bomb or other physical damage that has resulted in damage to the impoundment or appurtenances. | Level 3 |
| Sabotage/ vandalism | Damage to impoundment or appurtenance with no impact to the functioning of the impoundment. | Level 1 |
| | Modification to the impoundment or appurtenances that could adversely impact the functioning of the impoundment. This would include unauthorized operation of spillway facilities. | Level 2 |
| | Damage to impoundment or appurtenances that has resulted in seepage flow. | Level 2 |
| | Damage to impoundment or appurtenances that has resulted in uncontrolled water release. | Level 3 |

**Table 4-2. Impoundment Trigger Elevations**

| Impoundment | Embankment Crest Elevation [1] | Auxiliary Spillway Crest Elevation | Normal Pool Fluctuation | |
|---|---|---|---|---|
| | | | Typical | High |
| East Ash Pond | 494.0 ft. | Not Applicable | 490.4 ft. | 492.2 |

Notes:
1 2015 Hennepin Topography, prepared by Weaver Consultants Group, December 2015

**Table 4-3. Step 3: Emergency Actions**

| Condition | Description of Condition | Action to be Taken |
|---|---|---|
| High Water Level/ Large Spillway Release | See Table 4-1 and Table 4-2 for elevations and triggering water levels associated with the impoundments and spillways covered by this EAP. | 1. Assess cause of increased reservoir stage, especially during fair weather conditions.<br>2. Determine Response Level.<br>3. Make proper notifications as outlined in the Figure 2-2 Notification Flowchart.<br>4. Perform additional tasks as determined through consultation with the ERT.<br>5. Make notifications if condition worsens such that downstream flooding is imminent.<br>**Response Level 0**: require enhanced surveillance 3 times per day<br>**Response Level 1**: contact internal chain of command and external response partners as necessary; inspect impoundment minimum 1 time per hour<br>**Response Level 2**: contact internal chain of command; notify ESDA/EMA's and notify external response partners. ESDA/EMA's notify affected parties.<br>**Response Level 3**: contact internal chain of command; notify ESDA/EMA's and notify external response partners. ESDA/EMA's notify affected parties of emergency incident. |
| Seepage | Localized new seepage or boil(s) observed along downstream face / toe of earthen embankment with muddy discharge and increasing but controllable discharge of water. | 1. Measure and record feature dimensions, approximate flow rate, and relative location to existing surface features. Take photos. Document location on a site plan and in inspection notes.<br>2. Determine Response Level.<br>3. Make proper notifications as outlined in the Figure 2-2 Notification Flowchart<br>4. ERT (with Dam Safety Engineer as lead) to determine mitigation actions. The following actions may apply:<br>a) Place a ring of sandbags with a weir at the top towards the natural drainage path to monitor flow rate. If boil becomes too large to sandbag, place a blanket filter over the area using non-woven filter fabric and pea gravel. Attempt to contain flow in such a manner (without performing any excavations) that flow rates can be measured. Stockpile gravel and sand fill for later use, if necessary.<br>b) Inspect the embankment and collect piezometer, water level and seepage flow data daily unless otherwise instructed by the Engineer. Record any changes of conditions. Carefully observe embankment for signs of depressions, seepage, sinkholes, cracking or movement.<br>c) Maintain continuous monitoring of feature. Record measured flow rate and any changes of condition, including presence or absence of muddy discharge. |

**Table 4-3. Step 3: Emergency Actions**

| Condition | Description of Condition | Action to be Taken |
|---|---|---|
| | | 5. Make notifications as outlined in the lower portion of the Notification Flowchart (Figure 2-2) if condition worsens such that failure is imminent. |
| Sabotage and Miscellaneous Other Issues | Criminal action with significant damage to embankment or structures where significant repairs are required and the integrity of the facility is compromised—condition appears stable with time. | 1. Contact law enforcement authorities and restrict all access (except emergency responders) to impoundment. Restrict traffic on embankment crest to essential emergency operations only.<br>2. Determine Response Level.<br>3. Make internal notifications as outlined in the upper portion of the Notification Flowchart (Figure 2-2).<br>4. In conjunction with the Dam Safety Manager, assess extent of damage and visually inspect entire embankment and ancillary structures for additional less obvious damage. Based on inspection results, confirm if extent of damage to various components of the impoundment warrants a revised Response Level and additional notifications.<br>5. Perform additional tasks as directed by the ERT.<br>6. Make notifications if conditions worsen. |
| Embankment Deformation | **Cracks:**<br>New longitudinal (along the embankment) or transverse (across the embankment) cracks more than 6 inches deep or more than 3 inches wide or increasing with time. New concave cracks on or near the embankment crest associated with slope movement. | 1. Measure and record feature dimensions, approximate flow rate, and relative location to existing surface features. Take photos. Document location on a site plan and in inspection notes.<br>2. Restrict traffic on embankment crest to essential emergency operations only.<br>3. Determine Response Level.<br>4. Make notifications as outlined in the Figure 2-2 Notification Flowchart.<br>5. ERT (with Dam Safety Manager as lead) to determine mitigation actions. The following actions may apply:<br>a) Place buttress fill against base of slope immediately below surface feature. Stockpile additional fill.<br>b) Place sandbags as necessary around crack area to divert any storm water runoff from flowing into crack(s).<br>6. As directed by the Dam Safety Manager, additional inspection and monitoring of the dam may be required. Items may include inspect the dam on a schedule determined by the engineers; collect piezometer and water level data; and record any changes of condition. Carefully observe dam for signs of depressions, seepage, sinkholes, cracking or movement.<br>7. Make notifications as outlined in the Figure 2-2 Notification Flowchart if conditions worsen such that failure is imminent. |
| Embankment Deformation (cont.) | **Slides / Erosion:**<br>Deep slide / erosion (greater than 2 feet deep) on the embankment that may also extend beyond the embankment toe but does not encroach onto the embankment crest and appears stable with time. | 1. Measure and record feature dimensions, approximate flow rate, and relative location to existing surface features. Take photos. Document location on a site plan and in inspection report.<br>2. Restrict traffic on embankment crest to essential emergency operations only.<br>3. Determine the Response Level.<br>4. Make notifications as outlined in the Figure 2-2 Notification Flowchart.<br>5. ERT (with Dam Safety Manager as lead) to determine mitigation actions. Additional actions may include the following items.<br>a) Place sandbags as necessary around slide area to divert any storm water runoff from flowing into slide(s).<br>b) Increase inspections of the dam; collect piezometer and water level data; and record any changes of condition. During inspections, carefully observe dam for signs of depressions, seepage, sinkholes, cracking or movement. |

**Table 4-3. Step 3: Emergency Actions**

| Condition | Description of Condition | Action to be Taken |
|---|---|---|
| | | 6. Make notifications as outlined in the Figure 2-2 Notification Flowchart if conditions worsen such that failure is imminent. |
| | **Sinkholes:**<br>Small depression observed on the embankment or within 50 feet of the embankment toe that is less than 5 feet deep and 30 feet wide or which is increasing with time. | 1. Slowly open drain gates to lower pool elevation.<br>2. Measure and record feature dimensions, approximate flow rate, and relative location to existing surface features. Take photos. Document location on a site plan and in inspection notes.<br>3. Restrict traffic on embankment crest to essential emergency operations only.<br>4. Determine Response Level.<br>5. Make notifications as outlined in the Figure 2-2 Notification Flowchart.<br>6. ERT (with Dam Safety Engineer as lead) to determine mitigation actions. Additional actions may include the following items:<br>a) Backfill the depression with relatively clean earth fill (free of organic materials) generally even with surrounding grade and slightly mounded (6 to 12 inches higher) in the center to shed storm water away from the depression. Stockpile additional fill.<br>b) Increase inspections of the dam; collect piezometer and water level data daily unless otherwise instructed by engineer; and record any changes of condition. Carefully observe dam for signs of depressions, seepage, sinkholes, cracking or movement.<br>7. Make notifications as outlined in the Figure 2-2 Notification Flowchart if conditions worsen such that failure is imminent. |
| Gate Malfunction or Failure | Sluice gate damaged structurally (sabotage, debris, etc.) with uncontrolled release of water at a constant volume. Condition appears stable. | 1. Close any other gates, if open.<br>2. Determine Response Level.<br>3. Make notifications as outlined in the Figure 2-2 Notification Flowchart.<br>4. Obtain instructions from the Engineer to determine if there are other methods to stop or slow down the flow of water.<br>5. If conditions worsen such that failure is imminent, make notifications as outlined in the lower portion of the Figure 2-2 Notification Flowchart. |

# 5 PREPAREDNESS

The intent of this section is to provide information that will be utilized during a response. Established emergency supplies and locations, suppliers, and equipment are provided in Table 5-1. Suppliers contact information is listed in Table 5-2.

A coordination meeting shall be conducted annually between representatives of DMG Midwest Generation, LLC, and local emergency responders. This meeting may be in the form of a face-to-face meeting, tabletop exercise, or additional training regarding the EAP.

**Table 5-1. Emergency Supplies and Equipment**

| Item | On-site (Yes/No/Occasionally) | Remarks |
|---|---|---|
| Flashlights<br>Generator<br>Extension Cords<br>Fire extinguishers<br>Floodlights | Yes | Typically, at Hennepin Power Plant maintenance facility, contact shift supervisor location(s). |
| Backhoe | Yes | Contact shift supervisor for location(s).<br>For rental equipment contact:<br>• Gensini Excavating, Inc. (815) 925-7050<br>• Central Illinois Equipment Sales, Inc. (815) 687-7022 |
| Dozer | No | Old one may be available on site, contact shift supervisor for location(s).<br>For rental equipment contact:<br>• Gensini Excavating, Inc. (815) 925-7050<br>• Central Illinois Equipment Sales, Inc. (815) 687-7022 |
| Large Equipment (Rental – including excavating equipment, pumps, lighting) | Occasionally | Portable lighting, backhoe and bobcat available on-site. Contact shift supervisor for availability and location(s).<br>For rental equipment contact:<br>• Gensini Excavating, Inc. (815) 925-7050<br>• Central Illinois Equipment Sales, Inc. (815) 687-7022 |
| Dump Truck | No | Old one may be available on site, contact shift supervisor for location(s).<br>For rental equipment contact:<br>• Gensini Excavating, Inc. (815) 925-7050<br>• Illinois Truck & Equipment (815) 941-1900 |
| Pump and Hoses | Yes | 3” and 2” trash pumps available. Contact shift supervisor for location(s).<br>For additional pumps/hoses contact:<br>• United Rentals (815) 223-7962 |
| Sandbags and Sand | Occasionally | Contact shift supervisor for location(s).<br>For additional materials contact:<br>• Home Depot (815) 224-2968<br>• Menards (815) 224-5621<br>• Tri-Con Material (815) 872-3206 |
| Fill (Stone, aggregate, sand) | Yes | Quarry next door and some fill on-site. Contact shift supervisor for location(s).<br>For additional materials contact:<br>• Tri-Con Material (815) 872-3206<br>• Western Sand & Gravel Co. (815) 664-2341 |
| Concrete/grout | No | To obtain materials contact:<br>• Western Sand & Gravel Co. (815) 664-2341 |
| Geotextile Filter Fabric | No | To obtain materials contact:<br>• Home Depot (815) 224-2968<br>• Menards (815) 224-5621 |
| Plastic Sheeting | No | To obtain materials contact:<br>• Home Depot (815) 224-2968<br>• Menards (815) 224-5621 |
| Rope | Yes | Contact shift supervisor for location(s). |
| Personal Flotation Devices | Yes | Contact shift supervisor for location(s). |

**Table 5-2. Supplier Addresses**

| Supplier | Distance from Site (miles) | Address |
|---|---|---|
| Gensini Excavating, Inc. | 7 | 8100 Deer Drive, Hennepin IL |
| Grassers True Value | 15 | 404 W Main Street, McNabb, IL |
| R.P Lumber Company | 18 | 1315 N Main Street, Princeton, IL |
| Menards | 17 | 5353 Mahoney Drive, Peru, IL |
| Home Depot | 17 | 4242 Venture Drive, Peru, IL |
| Tri-Con Material | 3 | 13559 Prairie Industrial Pkwy, Hennepin, IL |
| Western Sand & Gravel Company | 11 | 400 Old N Road, Spring Valley, IL |
| Central Illinois Equipment Sales, Inc | 5 | 1254 Old Hwy 26, Hennepin, IL |
| United Rentals | 15 | 2901 Peoria Street, Peru, IL |
| Illinois Truck and Equipment | 60 | 320 Briscoe Drive, Morris, IL |

# 6 FACILITY/IMPOUNDMENT DESCRIPTION

The impoundment included in this EAP is described as follows and illustrated in Figure 1-2. Table 6-1 contains additional geometric details for the impoundment.

Hennepin Power Plant is located in Hennepin, Illinois along the east bank of the Illinois River in Putnam County approximately 100 miles southwest of Chicago.

The East Ash Pond is located east of the Hennepin Power Plant. As described in a dam assessment report prepared for the Environmental Protection Agency in 2011, East Ash Pond was originally constructed by reshaping an area that was an existing gravel pit to form the current surface impoundment. The gravel pit at the time of construction was described to be equal to or greater than the maximum elevation proposed for the impoundment. The pond functions as a sedimentation basin for coal combustion wastes, including bottom ash, fly ash, miscellaneous power plant low volume waste, and coal pile runoff streams which are piped from the plant and discharged into the impoundment. Flow through East Ash Pond is discharged into the Leachate Pond to the northeast through an 18-inch diameter reinforced concrete pipe outlet structure.

**Table 6-1. Power Plant Impoundment Characteristics**

| Feature/Parameter | East Ash Pond |
|---|---|
| Maximum Embankment Height[2] | 32 ft. |
| Length of Dam[1] | 950 ft. |
| Crest Width[1] | 25 ft. |
| Crest Elevation[1] | 494.0 ft. |
| Reservoir Area at Top of Dam[1] | 9.9 acres |
| Storage Capacity at Top of Dam[1] | 49.7 acre-ft. |
| Primary Spillway Type[2] | 18 in. dia. RCP |
| Primary Spillway Crest Elevation[1] | 489.9 ft. |
| Storage Capacity at Primary Spillway Elevation[1] | 23.4 acre-ft. |
| Reservoir Area at Normal Water Surface Elevation[1] | 3.9 acres |
| Auxiliary Spillway Type | N/A |
| Auxiliary Spillway Crest Elevation | N/A |

Notes:
1 2015 Hennepin Topography, prepared by Weaver Consultants Group, December 2015
2 USEPA Round 10 Dam Assessment Report, Hennepin Power Station, December 2012

# 7 BREACH INUNDATION MAP AND POTENTIAL IMPACTS

An inundation map for East Ash Pond potential breach scenarios is provided in this section. It is the Putnam County ESDA/EMA's responsibility to keep a current list of affected parties/properties to contact in the case of emergencies that result in Response Level 2 or 3. This list should encompass all properties within and adjacent to the probable inundation extents shown in the provided maps.

The methodology used to identify probable inundation extents for potential breach scenarios varied as a function of the impoundment size, location, surrounding topography, and surrounding structures/facilities/waterbodies.

The inundation extents for East Ash Pond were determined by visual inspection using available topography and the failure description outlined in the Illinois DNR Dam Safety Emergency Response Procedure report, dated November 2005. This methodology was chosen as failure of the East Ash Pond would only result in water transfer to a secondary cell to the east, as all other sides are landlocked and essentially constructed at grade. If failure of this secondary cell also occurred, water would flow into the Illinois River. Although no structures would be impacted by such a failure, significant environmental impacts to the River and areas outside of utility owned property could occur.

The approximate inundation area is illustrated in Figure 7-1.



**Legend**

- Expected Breach Inundation Area
- CCR Surface Impoundment Boundary

0 500 Feet

1:5,000 (At original document size of 11x17)

Project Location
Latitude: 41.302685
Longitude: -89.303883
Putnam County, Illinois

175605019
Prepared by CI on 2017-04-03
Technical Review by CI on 2017-04-03
Independent Review by MT on 2017-04-03

Client/Project
Hennepin Power Station
Emergency Action Plan

Figure No.
**7-1**

Title
**Inundation Map**
**East Ash Pond**

**Notes**
1. Coordinate System: NAD 1983 StatePlane Illinois West FIPS 1202 Feet
2. Aerial Source: 2015 NAIP Imagery
3. Impoundment Boundaries Provided by Client (Dated 9/9/2015)

# ATTACHMENT G

# CCR Fugitive Dust Control Plan

## for

## Hennepin Power Plant

***Prepared for:***

Dynegy Midwest Generation, LLC

**Hennepin Power Plant**
**13498 East 800th Street**
**Hennepin, IL 61327**

***Prepared by:***

**Burns & McDonnell**
**Kansas City, Missouri**

Amendment 1
October 2021

# Table of Contents



# List of Tables

# 1 Introduction

This Coal Combustion Residuals (CCR) fugitive dust control plan has been prepared for the Hennepin Power Plant, located in Putnam County, Illinois. This plan addresses the air criteria in 40 C.F.R. § 257.80 of the United States Environmental Protection Agency's CCR rule, which requires the owner or operator of a CCR unit to "adopt measures that will effectively minimize CCR from becoming airborne at the facility" and to "prepare and operate in accordance with a CCR fugitive dust control plan." The plan also addresses the air criteria in 35 I.A.C. 845.500 of the Illinois Environmental Protection Agency's CCR rule, which contains similar requirements to the federal CCR rule.

## 1.1 Facility Information

- Facility Name: Hennepin Power Plant
- Facility Address: 13498 East 800th Street, Hennepin, IL 61327
- Owner/Operator: Dynegy Midwest Generation, LLC (DMG)

## 1.2 Certification

The owner or operator must obtain a certification from a qualified professional engineer that the initial CCR fugitive dust control plan, or any subsequent amendment of it, meets the requirements of 40 C.F.R. § 257.80 and 35 I.A.C. 845.500. See 40 C.F.R. § 257.80(b)(7); 35 I.A.C. 845.500(b)(7).

I certify under penalty of law that, to the best of my knowledge, this plan meets the requirements of 40 C.F.R. § 257.80 and 35 I.A.C. 845.500. This certification is based on my review of the document and conditions at the site and on my inquiry of the person or persons who managed the preparation of this document.

John R. Hesemann
Printed Name of Qualified Professional Engineer

John R. Hesemann 9/09/2021
Signature of Qualified Professional Engineer and Date

062.058523 – Illinois – Expires 11/30/2021
Registration Number and State

JOHN ROBERT HESEMANN
062-058523
LICENSED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

# 2 CCR Fugitive Dust Control Measures and Appropriateness

CCR fugitive dust has the potential to become airborne at the facility during periods of CCR management in the CCR units, CCR handling and CCR transport. Areas at the facility that have the potential for airborne CCR fugitive dust are CCR surface impoundments, an existing CCR landfill, CCR handling equipment and CCR transport in trucks. This section identifies and describes the control measures selected and adopted by the facility to minimize CCR from becoming airborne at the facility and explains how the selected measures are applicable and appropriate for site conditions. The control measures may be adjusted or modified based on observed effectiveness of minimizing CCR from becoming airborne and weather conditions.

## 2.1 Management of CCR in the CCR Units

The facility currently manages CCR in surface impoundments but will also manage CCR at the facility landfill once it begins receiving CCR. Table 2-1 below identifies CCR fugitive dust control measures that have been selected for use by the facility during CCR management in the CCR units, including placement of CCR into the CCR units, and explains how the selected measures are applicable and appropriate for site conditions. The facility will use the identified measures during CCR management in the CCR units to minimize CCR from becoming airborne at the facility.

| CCR Activity | CCR Fugitive Dust Control Measure | Applicability and Appropriateness of Control Measure |
|---|---|---|
| Management of CCR in the facility's CCR units | Condition CCR to be emplaced in the landfill before loading into vehicles for transport to the landfill. | Conditioning CCR to be placed in the landfill allows CCR to bind together and thus minimizes the potential for CCR fugitive dust generation when CCR is managed in the landfill. The added moisture content will prevent wind dispersal of the CCR but will not result in free liquids. Use of conditioned CCR also achieves at least equivalent performance to conventional daily cover in terms of preventing wind entrainment. |
| | Water dry CCR material generated from periodic cleanout/maintenance of CCR handling or CCR dust control systems as it is added into the CCR surface impoundments, as necessary. | Wetting CCR reduces the potential for CCR fugitive dust generation during addition to surface impoundments. |
| | Wet management of CCR bottom ash in CCR surface impoundments. | Wet management of CCR minimizes the potential for CCR fugitive dust generation. |
| | Water areas of exposed CCR in CCR units, as necessary. | Water will be applied to areas of exposed CCR to maintain moisture content to minimize the potential for CCR fugitive dust generation in excessively dry or windy conditions. Wetting activities will not generate "free liquids" within the landfill. |
| | Naturally occurring grass vegetation in areas of exposed CCR in CCR surface impoundments. | Vegetation provides a wind screen and/or cover to reduce wind entrainment of CCR. |
| | Apply chemical dust suppressant on areas of exposed CCR in CCR units, as necessary. | Mixing an appropriate chemical dust suppressant with water and applying to areas of exposed CCR will minimize the potential for CCR fugitive dust generation in excessively dry or windy conditions. |
| | Reduce or halt operations during high wind events, as necessary. | Reducing or halting operations during high wind events minimizes the potential for CCR fugitive dust generation. |

**Table 2-1. Control Measures for CCR Management in CCR Units**

## 2.2 Handling of CCR

CCR is regularly removed from the boiler system and conveyed to the CCR handling system, which includes silos and truck loading areas. CCR fly ash and flue gas desulfurization (FGD) ash is pneumatically conveyed in an enclosed system from the boiler system to storage silos. A pug mill can be used to condition FGD ash as it is loaded into trucks for transport to the surface impoundment. CCR bottom ash is wet sluiced into CCR surface impoundments. At times, CCR fly ash is also wet sluiced into CCR surface impoundments. CCR fly ash can be loaded into trucks for transport to either onsite surface impoundments or offsite. When unloading the CCR fly ash silos for transport to and emplacement in the CCR landfill, a pug mill will be used to condition the CCR fly ash as it is loaded into trucks. Table 2-2 below identifies CCR fugitive dust control measures that have been selected for use by the facility during handling of CCR and explains how the selected measures are applicable and appropriate for site conditions. The facility will use the identified measures when handling CCR to minimize CCR from becoming airborne at the facility.

| CCR Activity | CCR Fugitive Dust Control Measure | Applicability and Appropriateness of Control Measure |
|---|---|---|
| Handling of CCR at the facility | Wet sluice CCR fly ash and CCR bottom ash to CCR surface impoundments. | Wet sluicing CCR minimizes the potential for CCR fugitive dust generation. |
| | Pneumatically convey dry CCR fly ash and FGD ash to storage silos in an enclosed system. | Conveying CCR fly ash in an enclosed system minimizes the potential for CCR fugitive dust generation. |
| | Condition CCR to be emplaced in the landfill before loading into trucks for transport to the landfill, as needed. | Conditioning allows CCR to bind together and thus minimizes the potential for CCR fugitive dust generation while loading CCR into trucks (and during transport and emplacement in the landfill). |
| | Load CCR transport trucks from the CCR fly ash silos in a partially enclosed area. | Partial enclosure of the CCR transport truck loading area reduces the potential for wind to cause CCR fugitive dust to become airborne. |
| | Load CCR transport trucks from the CCR fly ash silos using vented spouts. | Use of engineered equipment, such as a vented spout, minimizes the potential for CCR fugitive dust to become airborne. |
| | Load FGD ash transport trucks from the FGD ash silo using a pug mill or vented spouts, as necessary. | The pug mill on the wet FDG loadout wets the FDG. Wetting allows CCR to bind together and thus minimizes the potential for CCR fugitive dust generation. Wetting will not result in the generation of free liquids.<br><br>Use of engineered equipment, such as a vented spout, minimizes the potential for CCR fugitive dust to become airborne. |
| | Perform housekeeping, as necessary, in the fly ash loading area. | Good housekeeping measures, such as sweeping or wetting the loading area, minimize the potential for CCR fugitive dust generation during handling activities. |
| | Operate fly ash handling system in accordance with good operating practices. | Operation in accordance with good operating practices minimizes the potential for CCR fugitive dust generation. |
| | Maintain and repair as necessary dust controls on the fly ash handling and truck load-out systems. | Perform maintenance and repairs as needed to maintain dust controls in good operating condition minimizes the potential for CCR fugitive dust generation. |
| | Reduce or halt operations during high wind events, as necessary. | Reducing or halting operations during high wind events minimizes the potential for CCR fugitive dust generation. |

**Table 2-2. Control Measures for Handling CCR**

### 2.2.1 Conditioning of CCR Prior to Emplacement in CCR Landfill

Conditioned CCR is CCR that has been wetted with water or an appropriate chemical dust suppressant. Water or a chemical dust suppressant is added to raise the moisture content of the CCR to prevent wind dispersal but will not result in free liquids. Conditioning allows for the CCR to bind together, which minimizes the potential for CCR fugitive dust.

All CCR generated on site that is placed into the facility's landfill will be conditioned in a pug mill or otherwise conditioned prior to emplacement. Therefore, all CCR that is added to the facility's landfill will be emplaced in the landfill as conditioned CCR.

## 2.3 Transportation of CCR

CCR is transported via truck at the facility using unpaved facility roads. Table 2-3 below identifies CCR fugitive dust control measures that have been selected for use by the facility during transport of CCR. The facility will use the identified measures when transporting CCR to minimize CCR from becoming airborne at the facility.

| CCR Activity | CCR Fugitive Dust Control Measure | Applicability and Appropriateness of Control Measure |
|---|---|---|
| Transportation of CCR at the facility | Condition CCR to be emplaced in the landfill before it is loaded into vehicles for transport to the landfill. | Conditioning CCR increases moisture content of the CCR and minimizes the potential for CCR fugitive dust generation. |
| | Cover or enclose trucks used to transport CCR, as necessary. | Covering or enclosing trucks transporting CCR minimizes the potential for CCR fugitive dust generation from the CCR transport trucks. |
| | Condition CCR materials to be transported offsite before they are loaded into trucks, as necessary. | Conditioning CCR increases moisture content of the CCR and minimizes the potential for CCR fugitive dust generation during CCR transport. |
| | Limit the speed of vehicles to no more than 15 mph on facility roads. | Limiting the speed of vehicles traveling on facility roads minimizes the potential for CCR fugitive dust generation from the CCR transport trucks. |
| | Condition CCR haul roads with water or dust suppressant, as necessary. | Watering CCR haul roads will minimize the potential for CCR fugitive dust generation in excessively dry or windy conditions. |
| | Sweep or rinse CCR off of the outside of the trucks transporting CCR, as necessary. | Removing CCR present on the outside of the truck minimizes the potential for movement of the truck or wind to cause CCR fugitive dust to become airborne. |
| | Remove CCR, as necessary, deposited on facility road surfaces during transport. | Removing CCR deposited on facility road surfaces as a result of transport minimizes the potential for CCR fugitive dust generation from vehicle traffic. |
| | Reduce or halt operations during high wind events, as necessary. | Reducing or halting operations during high wind events minimizes the potential for CCR fugitive dust generation. |

**Table 2-3. Control Measures for Transportation of CCR**

# 3 Procedures for Periodic Assessment of Effectiveness of the Plan

The facility conducts inspections associated with CCR fugitive dust control. The facility also uses the procedures identified in Section 5 of this plan to log every citizen complaint involving CCR fugitive dust events at the facility. These inspections and the investigations of citizen complaints will be used to periodically assess the effectiveness of the CCR fugitive dust control plan per per 40 C.F.R. § 257.80(b)(4) and 35 I.A.C. 845.500(b)(3).

The facility routinely performs inspections to verify the effectiveness of the CCR fugitive dust control measures used at the facility. Inspections are conducted during daylight working hours and include observing for the presence of CCR fugitive dust emissions from vehicles transporting CCR on facility roads, CCR handling and CCR management activities, including CCR placement in CCR units. Inspection records include the name of the person conducting the inspection, the date and time of the inspection, the results of the inspection, and any corrective action taken.

When a CCR fugitive dust event is observed or a citizen complaint involving a CCR fugitive dust event at the facility is received, current CCR management practices will be reviewed to see that the selected control measures are being properly implemented. If the control measures are not being properly implemented, relevant operating personnel will be notified and, as warranted, re-trained in the proper implementation of CCR fugitive dust control measures. If appropriate, use of revised and/or additional control measures will be evaluated. As warranted, revised and/or additional control measures found to be applicable and appropriate to control CCR fugitive dust emissions will be incorporated into an amended CCR fugitive dust control plan.

The plan also will be reassessed in the event of material changes in site conditions potentially resulting in CCR fugitive dust becoming airborne at the facility.

# 4 Recordkeeping, Notification, Internet Site

The written CCR fugitive dust control plan, any amendment of the written plan, and the annual CCR fugitive dust control report required by 40 C.F.R. § 257.80(c) and 35 I.A.C. 845.500(c) will be placed in the facility's written operating record and posted to the company's CCR website in accordance with 40 C.F.R. § 257.105(g), § 257.107(g), and 845.800(d)(7), (14) and 845.810(e). Notification of the availability of the CCR fugitive dust control plan, any amendment of the plan, and the annual CCR fugitive dust control report will be provided to IEPA in accordance with 40 C.F.R. § 257.106(g). Any amendment of the fugitive dust control plan will be submitted to IEPA in accordance with 845.500(b)(5).

Additionally, pursuant to 845.500(b)(6), this fugitive dust control plan is being placed in facility's operating record and posted to the company's CCR website prior to the submission of any permits for the Hennepin Power Plant.

# 5 Procedures to Log Citizen Complaints

In the event the owner or operator of the facility receives a citizen complaint involving a CCR fugitive dust event at the facility, relevant information about the complaint will be logged. Information that will be recorded includes, as applicable:

– Date/Time the complaint is received
– Date/Time and duration of the CCR fugitive dust event
– Description of the nature of the CCR fugitive dust event
– Name of the citizen entering the complaint
– Address & phone number of citizen entering the complaint
– Name of the personnel who took the complaint
– All actions taken to assess and resolve the complaint

All citizen complaints involving CCR fugitive dust events at the facility will be investigated promptly. As deemed appropriate or necessary, corrective measures will be taken and a follow-up response will be provided to the complainant.

Pursuant to 35 I.A.C. 845.500(b)(2), quarterly reports will be submitted to IEPA no later than 14 days from the end of the quarter for all complaints received in that quarter. At a minimum, the quarterly report will include the date of the complaint, the date of the incident, the name and contact information of the complainant (if given), and all actions taken to assess and resolve the complaints.

# 6 Amendments

The written CCR fugitive dust control plan may be amended at any time provided the revised plan is placed in the facility's operating record as required by 40 C.F.R. § 257.105(g)(1) and 845.500(b)(6). Any amendment of the fugitive dust control plan will be submitted to IEPA in accordance with 845.500(b)(5). The written CCR fugitive dust control plan must be amended whenever there is a change in conditions that would substantially affect the written plan in effect.

| Amendment Number and Date | Pages or Section | Description of Amendment | Professional Engineer Certifying Plan |
|---|---|---|---|
| Version 0<br>October 2015 | -- | Initial Plan | Wendy M. Pennington |
| Amendment 1<br>October, 2021 | Various | Administrative changes and adjustments to site condition controls as appropriate | John R. Hesemann |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

**Table 6-1. CCR Fugitive Dust Control Plan Amendments**

# ATTACHMENT H

Intended for
**Dynegy Midwest Generation, LLC**

Date
**October 25, 2021**

Project No.
**1940100806-005**

# HYDROGEOLOGIC SITE CHARACTERIZATION REPORT

## EAST ASH POND
## HENNEPIN POWER PLANT
## HENNEPIN, ILLINOIS

# HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
# HENNEPIN POWER PLANT EAST ASH POND

| | |
|---|---|
| Project Name | **Hennepin Power Plant East Ash Pond** |
| Project No. | **1940100806-005** |
| Recipient | **Dynegy Midwest Generation, LLC** |
| Document Type | **Hydrogeologic Site Characterization Report** |
| Revision | **FINAL** |
| Date | **October 25, 2021** |

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# CONTENTS

## TABLES (IN TEXT)



## TABLES (ATTACHED)



## FIGURES (IN TEXT)

## FIGURES (ATTACHED)



## APPENDICES

# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| °F | degree Fahrenheit |
| § | Section |
| 35 I.A.C. | Title 35 of the Illinois Administrative Code |
| 40 C.F.R. | Title 40 of the Code of Federal Regulations |
| AP2 | Ash Pond No. 2 |
| AP4 | Ash Pond No. 4 |
| bgs | below ground surface |
| CCR | coal combustion residuals |
| CCW | coal combustion waste |
| CCWL | Coal Combustion Waste Landfill |
| CEC | Civil & Environmental Consultants, Inc. |
| cm/s | centimeters per second |
| CSM | conceptual site model |
| DMG | Dynegy Midwest Generation, LLC |
| DWW | Illinois Drinking Water Watch |
| EAP | East Ash Pond |
| EAPS | East Ash Pond System, includes CCWL, EAP, AP2, and AP4 |
| FEMA | Federal Emergency Management Agency |
| ft/day | feet/day |
| ft/ft | feet per foot |
| g | horizontal acceleration |
| GMP | Groundwater Monitoring Plan |
| gpm | gallons per minute |
| GWPS | groundwater protection standard |
| GZA | GZA GeoEnvironmental, Inc. |
| Haley & Aldrich | Haley & Aldrich, Inc. |
| HCR | Hydrogeologic Site Characterization Report |
| HMP | Hydrogeologic Monitoring Plan |
| HPP | Hennepin Power Plant |
| HUC | Hydrologic Unit Code |
| ID | identification |
| IDNR | Illinois Department of Natural Resources |
| IEPA | Illinois Environmental Protection Agency |
| IFR | Initial Facility Report |
| ILWATER | Illinois Water and Related Wells |
| ISGS | Illinois State Geological Survey |
| ISWS | Illinois State Water Survey |
| Kelron | Kelron Environmental |
| Mathes | John Mathes & Associates |
| mg/L | milligrams per liter |
| MSL | above mean sea level |
| MW | megawatts |

| | |
|---|---|
| NAVD88 | North American Vertical Datum of 1988 |
| NGWMN | National Groundwater Monitoring Network |
| NGVD29 | National Geodetic Vertical Datum of 1929 |
| NID | National Inventory of Dams |
| No. | number |
| NPDES | National Pollutant Discharge Elimination System |
| NRT | Natural Resource Technology, Inc. |
| NRT/OBG | Natural Resource Technology, an OBG Company |
| OWAP | Old West Ash Pond |
| OWPP | Old West Polishing Pond |
| Part 845 | Residuals in Surface Impoundments: Title 35 of the Illinois Administrative Code § 845 |
| pcf | pounds per cubic foot |
| PWS | public water system |
| Ramboll | Ramboll Americas Engineering Solutions, Inc. |
| SCS | Soil Conservation Service |
| SDWIS | Safe Drinking Water Information System |
| SI | surface impoundment |
| Site | East Ash Pond |
| STMI | Science & Technology Management, Inc. |
| SU | standard units |
| TDS | total dissolved solids |
| USCS | Unified Soil Classification System |
| USEPA | United States Environmental Protection Agency |
| USFWS | United States Fish and Wildlife Services |
| USGS | United States Geological Survey |

# EXECUTIVE SUMMARY

This Hydrogeologic Site Characterization Report (HCR) for the East Ash Pond (EAP) expands upon the hydrogeology, groundwater quality data, and conceptual site model (CSM) presented in previous hydrogeologic investigation reports prepared for the EAP and also the East Ash Pond System (EAPS) which were most recently submitted and approved by the Illinois Environmental Protection Agency (IEPA) as part of the February 2018 *Closure and Post-Closure Care Plan for the Hennepin East Ash Pond No. 2* (*Closure Plan*) (Civil & Environmental Consultants, Inc. [CEC], 2018). This report has been assembled to satisfy the information and analysis requirements of Title 35 of the Illinois Administrative Code (35 I.A.C.) Section (§) 845.620 as summarized in **Table ES-1**. The CSM includes hydrogeologic and groundwater quality data specific to the EAP, which has been collected from 1983 to 2021.

The Hennepin Power Plant (HPP) property is bordered on the north by the Illinois River, on the south and east by industrial property, and on the west by agricultural land (**Figure 1-1**). The EAP (Vistra identification [ID] number [No.] 803, IEPA ID No. W1550100002-05, and National Inventory of Dams [NID] No. IL50363), is a lined unit constructed in 1995 and 1996 to replace the Ash Pond No. 2 (AP2) which was removed from service. Four coal combustion residuals (CCR) surface impoundments (SIs) are present on the HPP property and two of them are adjacent to the EAP, including: AP2 (Vistra ID No. 802, IEPA ID No. W1550100002-04, and NID No. IL50663) and Ash Pond No. 4 (AP4; Vistra ID No. 805, IEPA ID No. W1550100002-07) (closed with IEPA approval). The Coal Combustion Waste Landfill (CCWL; Vistra ID No. 801) is also located adjacent to the EAP (**Figure 1-2**). IEPA approved the *Closure Plan* for AP2 and AP4 on February 26, 2020. Closure construction began in May 2020 and was completed in November 2020.

In addition to the CCR, there are two principal types of unlithified material present above the bedrock near the EAP. Underlying the constructed CCR SIs at the EAP are the Henry Formation sand and gravels and the clayey sands and sandy clays of the Cahokia Alluvium, which comprise the uppermost aquifer at the EAP and extend from the water table to the bedrock. Bedrock at the EAP is comprised of shales with thin limestone, sandstone, and coal beds of the Pennsylvanian-aged Carbondale Formation. Discharge of groundwater from the EAP into the Illinois River through the uppermost aquifer is the primary pathway for contaminant migration. Temporary flow reversals of groundwater may occur during periods of high river elevations or flooding.

Groundwater flow direction and gradients have not changed significantly since the first hydrogeologic study of the EAP was completed in 1983, and recent data support the established conceptual site model. The Hennepin EAP overlies high permeability sands and gravels of the uppermost aquifer that flow generally to the north under normal river conditions and reverse during periods of high river stage.

Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: 35 I.A.C. § 845 (Part 845) parameters were monitored in the uppermost aquifer monitoring wells at the EAP as part of the groundwater quality investigations performed from 2015 to 2018. These data were supplemented with sampling of additional locations in 2021. The results indicate that the following parameters were greater than the applicable 35 I.A.C. § 845.600 groundwater protection standards (GWPSs) and are considered potential exceedances:

- Chloride – at background uppermost aquifer wells 08 and 08D;
- Cobalt – at background uppermost aquifer wells 07, 08, and 08D; at uppermost aquifer compliance well 53; and at bedrock confining unit compliance well 55;
- Lithium – at bedrock confining unit compliance well 55 in April 2021;
- pH – at background uppermost aquifer wells 07, 08, and 08D;
- Thallium – at background uppermost aquifer well 08; and at compliance uppermost aquifer well 52; and
- Total Dissolved Solids (TDS) – at background uppermost aquifer wells 08 and 08D.

Concentration results for the above parameters were compared directly to 35 I.A.C. § 845.600 GWPSs to determine potential exceedances. Potential exceedances include results reported during the background groundwater monitoring or prior period that are greater than the GWPS. The results are considered potential exceedances because the results were compared directly to the standard and did not include an evaluation of background groundwater quality or the statistical methodologies proposed in the Groundwater Monitoring Plan (GMP) provided in the Operating Permit application. Exceedances will be determined following IEPA approval of the GMP.

**TABLE ES-1. PART 845 REQUIREMENTS CHECKLIST**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Part 845 Reference | Individual Part 845 Components Reviewed for Completeness | Location of Information in HCR |
|---|---|---|
| **845.620(b)** | **The hydrogeologic site characterization shall include but not be limited to the following:** | - - |
| 845.620(b)(1) | Geologic well logs/boring logs; | Table 3-1<br>Figure 3-1<br>Appendix A |
| 845.620(b)(2) | Climatic aspects of the site, including seasonal and temporal fluctuations in groundwater flow; | Sections 3.2.5 & 3.3.1<br>Figures 3-3 to 3-5 |
| 845.620(b)(3) | Identification of nearby surface water bodies and drinking water intakes; | Sections 3.3.2 & 5.2<br>Appendix E |
| 845.620(b)(4) | Identification of nearby pumping wells and associated uses of the groundwater; | Section 5.1<br>Appendix E |
| 845.620(b)(5) | Identification of nearby dedicated nature preserves; | Section 5.3<br>Appendix E |
| 845.620(b)(6) | Geologic setting; | Sections 2.4 & 2.5<br>Figures 2-3 & 2-4 |
| 845.620(b)(7) | Structural characteristics; | Section 2.4.3<br>Figure 2-5 |
| 845.620(b)(8) | Geologic cross-sections; | Figure 2-8 & 2-9 |
| 845.620(b)(9) | Soil characteristics; | Section 2.3<br>Figure 2-2<br>Tables 2-1 & 2-4 |
| 845.620(b)(10) | Identification of confining layers; | Sections 2.5.2 & 3.2.1 |

**TABLE ES-1. PART 845 REQUIREMENTS CHECKLIST**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Part 845 Reference | Individual Part 845 Components Reviewed for Completeness | Location of Information in HCR |
|---|---|---|
| 845.620(b)(11) | Identification of potential migration pathways; | Section 3.2.4 |
| 845.620(b)(12) | Groundwater quality data; | Section 4.2<br>Tables 4-1 & 4.2 |
| 845.620(b)(13) | Vertical and horizontal extent of the geologic layers to a minimum depth of 100 feet below land surface, including lithology and stratigraphy; | Section 2.5<br>Figures 2-8 & 2-9<br>Appendix A |
| 845.620(b)(14) | A map displaying any known underground mines beneath a CCR surface impoundment; | Section 2.4.5; No map provided as there are no underground mines within 1000 meters |
| 845.620(b)(15) | Chemical and physical properties of the geologic layers to a minimum depth of 100 feet below land surface; | Section 2.5<br>Tables 2-1, 2-2, & 2-4<br>Appendix B |
| 845.620(b)(16) | Hydraulic characteristics of the geologic layers identified as migration pathways and geologic layers that limit migration, including: | Sections 3.2.4, 3.2.5, & 3.2.6<br>Tables 3-2 and 3-4<br>Appendices B & D |
| 845.620(b)(16)(A) | water table depth; | Section 3.2.5<br>Figures 3-3 through 3-5<br>Appendix C |
| 845.620(b)(16)(B) | hydraulic conductivities; | Section 3.2.6<br>Tables 2-1 & 3-3<br>Appendices B & D |
| 845.620(b)(16)(C) | effective and total porosities; | Section 2.5.1<br>Table 2-1 |
| 845.620(b)(16)(D) | direction and velocity of groundwater flow; and | Sections 3.2.5 & 3.2.6<br>Tables 3-2 through 3-5<br>Figures 3-3 through 3-5<br>Appendix C |

**TABLE ES-1. PART 845 REQUIREMENTS CHECKLIST**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Part 845 Reference | Individual Part 845 Components Reviewed for Completeness | Location of Information in HCR |
|---|---|---|
| 845.620(b)(16)(E) | map of the potentiometric surface; | Figures 3-3 through 3-5 |
| 845.620(b)(17) | Groundwater classification pursuant to 35 I.A.C. § 620; and | Section 3.2.8 |

[O: CJC 07/02/21, U: CJC 09/08/21, C: LDC 09/20/21]

**Notes:**
-- = reference to main regulation
35 I.A.C. § 620 = Title 35 of the Illinois Administrative Code, Part 620
HCR = Hydrogeologic Characterization Report

# 1. INTRODUCTION

## 1.1 Overview

In accordance with requirements of the Part 845 (IEPA, April 15, 2021), Ramboll Americas Engineering Solutions, Inc. (Ramboll) has prepared this HCR on behalf of HPP (**Figure 1-1**), operated by Dynegy Midwest Generation, LLC (DMG). This report will apply specifically to the CCR Unit referred to as the EAP. However, information gathered to evaluate other CCR units on site regarding geology, hydrogeology, and groundwater quality is included, where appropriate. The EAP is an existing 21-acre lined CCR SI used to manage CCR and non-CCR waste streams and to clarify process water prior to discharge in accordance with the plants National Pollutant Discharge Elimination System (NPDES) permit at the HPP. This HCR includes Part 845 content requirements specific to 35 I.A.C. § 845.620(b) (Hydrogeologic Site Characterization) for the EAP at HPP.

## 1.2 Part 845 Description

Part 845 contains comprehensive rules for the design, construction, operation, corrective action, closure, and post closure care of these SIs. CCR is commonly referred to as coal ash, and CCR SIs are commonly referred to as coal ash ponds. This rule includes GWPSs applicable at the waste boundary at each CCR SI and requires each owner or operator to monitor groundwater. IEPA's rule includes a permitting program as well as all federal standards for CCR SIs promulgated by the United States Environmental Protection Agency (USEPA). In addition, the rules include procedures for public participation, closure alternatives analyses, closure prioritization, and provides access to records via public website. The rule also includes financial assurance requirements for CCR SIs.

A checklist summarizing the specific requirements of 35 I.A.C. § 845.620 is included in **Table ES-1**. The table provides references to sections, tables, and figures included in this document to locate the information that meets specific requirements of 35 I.A.C. § 845.620.

## 1.3 Previous Investigations and Reports

Numerous hydrogeologic investigations have been performed concerning the CCR Units or Multi-Units located at the HPP. The information presented in this HCR includes data collected in support of the monitoring well network established for development of the GMP and supplements comprehensive data collection and evaluations from prior hydrogeologic investigation reports (recent to oldest), including, but not limited to, the following:

- ***Ramboll, March 19, 2020. Hennepin Power Plant – State Permit for Closure Plan – Log No. 2020-65026- Review Letter.***

  Ramboll compiled and provided a copy of the Closure Plan (CEC, 2018) and any subsequent documents and updates with drawing sets and annotated pages which had been superseded by a later submittal.

- ***Natural Resource Technology, an OBG Company (NRT/OBG), December 20, 2017. Hydrogeologic Site Characterization Report– Hennepin East Ash Pond No. 2.***

  A Hydrogeologic Site Characterization report prepared in support of a Closure Plan for CCR SIs associated with AP2 within the EAPS.

- ***NRT/OBG, October 17, 2017. Hydrogeologic Monitoring Plan – Hennepin East Ash Pond System.***

  A Hydrogeologic Monitoring Plan (HMP) prepared to provide background information in support of the groundwater monitoring system established to comply with Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257.91 of the USEPA Final Rule to regulate the disposal of CCR as solid waste.

- ***Natural Resource Technology, Inc. (NRT) and Kelron Environmental (Kelron), December 19, 2010. New Coal Combustion Waste (CCW) Landfill, Initial Facility Report, Hydrogeologic Studies and Evaluations, Section 25 Hydrogeological Investigations.***

  Provided the foundation on which the monitoring system, groundwater impact assessment, and groundwater quality standards are to be developed for inclusion with the Initial Facility Report (IFR) for the new CCWL. Forty-one borings (B-1 through B-41) were advanced near and within the footprint of the Site during February and March 2009 for Site engineering studies. Four new monitoring wells (18S, 18D, 19S and 19D) were installed along the north perimeter, downgradient of the Site. One new upgradient well (08D) was located to the south adjacent to existing well 08.

- ***NRT and Kelron, December 19, 2010. New Coal Combustion Waste (CCW) Landfill, Initial Facility Report, Hydrogeologic Studies and Evaluations, Section 27 Groundwater Impact Assessment.***

  Three-dimensional numerical flow and transport modeling was used to estimate the effect of leachate seepage from the CCWL on groundwater concentrations at the downgradient edge of the zone of attenuation.

- ***NRT and Kelron, December 19, 2010. New Coal Combustion Waste (CCW) Landfill, Initial Facility Report, Hydrogeologic Studies and Evaluations, Section 28 Groundwater Monitoring Program.***

  Describes the groundwater monitoring program to identify discharges from all waste disposal units (Phases) within AP2 and the leachate collection system associated with the new CCWL.

- ***NRT and Kelron, June 3, 2009. Water Well Survey, Dynegy Midwest Generation, Hennepin Power Station.***

  A water well survey was performed in accordance with the "Right to Know" Potable Water Well Survey procedures of 35 I.A.C. § 1600.210(b)(1) and 35 I.A.C. § 1600.210(b)(2). The purpose of this survey was to identify water wells located within 2,500 feet of HPP property boundary.

- ***NRT and Kelron, February 2, 2009. Field Implementation Plan, New East Ash Landfill, Hennepin Power Station.***

  Described the data collection and analysis to be performed to satisfy the requirements of the hydrogeologic investigation as well as complete the groundwater impact assessment and GMP.

- ***Science & Technology Management, Inc. (STMI), June 1996. Investigation of Site Closure Options at Illinois Power Company's Hennepin East Ash Impoundment. Report No. STMI/135/96-02.***

  A supplemental hydrogeologic characterization was conducted to further characterize the Hennepin EAPS, develop a groundwater flow and transport model, and evaluate four alternative closure options using the model. Eight new monitoring wells (10 through 17) were installed around the EAPS to augment the existing network. Six new wells were located along the intermediate berm that separates AP2 from the EAP, and two wells were located upgradient of the EAP. Field permeability tests were conducted on eight wells.

- ***John Mathes & Associates (Mathes), April 19, 1983. Hydrogeologic Study, Existing Ash Ponds, Hennepin Power Plant.***

  Six monitoring wells were installed, currently designated as wells 02 through 06. Well 01 was abandoned during construction of the EAP. Monitoring wells 03 through 06 are downgradient of AP2, and well 02 is an upgradient well located south of the impoundment. Grain size analyses were performed on soil samples.

A GMP is being prepared for the EAP in conjunction with this report.

## 1.4 Site Location and Background

The EAP is located in northcentral Illinois in Putnam County, approximately four miles northeast of the Village of Hennepin, located within the northeast quarter of Section 26, Township 33 North, Range 2 West (**Figure 1-1**). The HPP is an approximately 504-acre property consisting of 19 parcels, including a retired coal-fired power plant, CCWL and SIs, and farmland. The HPP ceased operations in 2019 when the power plant was retired.

The HPP construction history includes construction of Unit 1 in 1953 and Unit 2 in 1959 with capacities of 70 megawatts (MW) and 210 MW, respectively. The plant initially burned high-sulfur Illinois coal and switched to sub-bituminous Powder River Basin coal in 1999 (STMI, 1996).

The CCR Units located adjacent, or near, to each other in the eastern portion of the HPP are AP2, AP4, and the EAP (referred to as the Primary East Ash Pond in previous documents), and non-CCR units including the Leachate Pond (formerly Pond 2E) and the Polishing Pond (formerly Secondary Pond); all of which comprise the EAPS. The CCWL was constructed on a portion of AP2 and is included in the extent of the EAPS. The CCR Units associated with the EAPS are situated south and adjacent to the Illinois River. The area is also bounded on the east and south by industrial properties owned by Tri-Con Materials and Washington Mills, respectively (**Figure 1-2**). The HPP provides the western boundary for the CCR Units with agricultural land to the southwest. Additionally, a 9-acre parcel between the HPP property and Washington Mills (south of the CCR Units) was previously occupied by Advanced Asphalt but operations are no longer active, and the property contains several buildings. The current owner of this parcel is listed as Tri-Con Materials.

**Figure 1-2** depicts the location of the CCR Units and non-CCR Units within the EAPS. The four Hennepin EAPS CCR units consist of the following: one existing landfill (CCWL), one existing SI (EAP), and two IEPA-approved, closed SIs (AP2 and AP4). Information regarding the CCWL, AP2, and AP4 CCR Units is solely for background information, as this report applies specifically to the EAP CCR Unit, which will hereinafter be referred to as the Site.

## 1.5 Site History and Unit Description

The EAP also referred to as the Primary EAP in previous documents, is classified as an existing lined SI. The first phase of the EAP construction occurred in 1995 when the pond bottom and sidewalls were constructed to a depth of 32 feet with a variable but lowermost bottom elevation of 458 feet above mean sea level (MSL). The bottom and sidewall liners were constructed with 48 inches of compacted clay with a hydraulic conductivity of $1 \times 10^{-7}$ centimeters per second (cm/s). The sidewall liners constructed during the first phase extended 20 feet above the bottom liner and water level within the pond was limited to 15 feet above the bottom liner. The second phase of construction occurred in 2003 when the sidewall liners were raised an additional 12 feet and the total water depth was raised to approximately 30 feet. The raised sidewalls were lined with 12 inches of compacted clay having a hydraulic conductivity of $1 \times 10^{-6}$ cm/s, a 45-millimeter polypropylene geomembrane, and a polypropylene geotextile fabric.

Prior to the plant closure in 2019, this 21-acre SI was used to store and dispose bottom ash, fly ash, and other non-CCR waste, and to clarify process water prior to discharge in accordance with the plant's NPDES permit (AECOM, 2017). The EAP is surrounded by a perimeter road and is bounded to the northeast by the Leachate Pond (formerly Pond 2E), to the northcentral by the CCWL, to the northwest by AP2, to the east by the Polishing Pond (formerly Secondary Pond), to the south by Washington Mills, and to the west by AP4.

The approximate dates of construction of HPP CCR Units, as identified in **Section 1.4**, are summarized in **Table A** below (AECOM, 2017).

**Table A. History of Construction**

| Date | Event |
|---|---|
| 1951 to 1952 | Construction of historical Ash Pond No. 1. |
| 1958 | Construction of AP2. |
| Late 1960's | Construction of historical Ash Pond No. 3. |
| 1978 | Embankment raise of AP2. |
| 1985 | Embankment raise of AP2 to elevation 484 feet and Ash Pond No. 3 (Old West Ash Pond [OWAP]) to elevation 460 feet. |
| 1988 to 1989 | Embankment raise of OWAP to elevation 465 feet that merged historical Ash Pond No. 1 and Ash Pond No. 3 into one single pond and created the Old West Polishing Pond (OWPP). |
| 1989 | Embankment raise of AP2 to elevation 494 feet. |
| 1995 to 1996 | Construction of EAP. |
| 1996 | AP2 was removed from service and completely dewatered. |
| 2003 | Embankment liner raise of EAP. |
| 2009 to 2010 | Eastern portion of AP2 was removed to facilitate construction of the Leachate Pond. |
| 2010 / 2011 | Landfill Phase I cell was constructed in 2010 over placed CCR in AP2 adjacent to the Leachate Pond. In February 2011, 7,500 cubic yards of bottom ash was placed into the Phase I cell as a post-construction freeze-protection measure to protect the leachate collection system and geomembrane liner. No other material (fly ash or bottom ash) has been placed in the landfill since then. |
| 2014 | North embankment tree removal, grading, and vegetation re-establishment adjacent to AP2 and CCWL. |
| 2020 | Completed closure in-place of AP2 and AP4. |

# 2. REGIONAL AND SITE GEOLOGY

A detailed hydrogeological investigation of the regional and local geology was completed and reported as part of the IFR (NRT and Kelron, 2010a). Significant portions of the results of the hydrogeological investigation are included in this HCR, along with supplemental information (including information sourced from previous investigations and reports identified in **Section 1.3** of this HCR) and updated as needed to satisfy the content requirements specific to 35 I.A.C. § 845.620(b).

## 2.1 Topography

Topography in the vicinity of the Site (**Figure 2-1**) ranges from approximately 445 feet North American Vertical Datum of 1988 (NAVD88) along the Illinois River north of the Site to 500 feet NAVD88 towards the south. There are three geomorphic features dominant in the immediate vicinity of the HPP: an upper river terrace at an elevation of about 500 to 550 feet NAVD88, a lower river terrace at an elevation of about 450 to 460 feet NAVD88, and the current river valley filled with alluvium to an elevation of about 445 feet NAVD88.

The HPP and AP2 were constructed on the original narrow lower terrace between the Illinois River and the uplands. The original lower terrace is approximately 10 to 20 feet above normal river level, or 441 feet (National Geodetic Vertical Datum of 1929 [NGVD29]) at the HPP. The EAP, Polishing Pond and AP4 were constructed on the upper terrace at an elevation of approximately 500 to 505 feet NAVD88, or 60 to 65 feet above normal river level. The EAP having been originally constructed by reshaping an existing gravel pit to form the current Unit. The elevation surrounding the gravel pit at the time of construction was described to be equal to or greater than the maximum elevation proposed for the impoundments (GZA GeoEnvironmental, Inc. [GZA], 2011). The lower road on the north side of the EAPS lies at an elevation of 480 to 485 feet NAVD88. The upper road along the top of the east berm for EAP is at an elevation of approximately 494 feet NAVD88.

The overall change in topography from pre-construction to current land surface ranges from approximately 5 to 40 feet, with the greatest elevation changes, ranging from 20 to 40 feet, occurring at the AP4 and the smallest elevation changes, ranging from 5 to 15 feet, occurring in the area now occupied by the EAP. The current drainage pattern at the Site is similar to pre-construction conditions.

## 2.2 Regional Geomorphology

The Site is located within Putnam County, which has an area of about 110,080 acres or 172 square miles. The county has about 25,000 acres of woodland, much of it along the Illinois River. Approximately three-fourths of the county is on the east side of the Illinois River, and one-fourth is on the west side (Soil Conservation Service [SCS], 1992).

The physiographic division in the region of the Site the Bloomington Ridged Plain section of the Central Lowland Province. The Bloomington Ridged Plain includes most of the Wisconsinan Stage moraines and is characterized by low, broad morainic ridges with intervening stretches of relatively flat or gently rolling ground moraine. Drainage is generally in the initial stages of development, and most streams follow, and are eroding, in constructional depressions, many of which cross morainic ridges. The valleys of principal streams are large and have floodplains bordered by valley-train terraces. The Illinois River has a broad, flat-bottomed valley with steep walls and is bordered by numerous steep-walled valleys with steep gradients (NRT, 2017).

## 2.3 Soils

Surficial soils at the Site and vicinity are shown on **Figure 2-2**, based on the soil survey performed in Putnam County in 1986 (SCS, 1992). Former soils underlying the Site are identified as Moundprairie Silty Clay Loam, Wet (No. 1480). The Moundprairie series soils consist of poorly drained, moderately permeable soils on floodplains. These soils formed in alluvium, and the soil association is well suited for and used as habitat for wetland wildlife. These soils are unsuitable for dwellings and only moderately suitable for cultivated crops, due to shallow water table and flooding.

Areas surrounding the EAP that are not designated Urban Land (No. 533) or Gravel Pits (No. 865) are predominantly classified as Wea Silt Loam (No. 398A and 398B). The Wea series consists of well drained soils on stream terraces. These soils formed in glacial outwash. Permeability is moderate in the upper part of the profile and very rapid in the lower part. Most areas of this association are well suited for and used in cultivating crops (SCS, 1992). Some areas are used as a source of sand and gravel, such as the property to the east.

## 2.4 Regional Geology

### 2.4.1 Regional Unlithified Geology

The unlithified geologic deposits covering bedrock in the region surrounding the EAP are derived from recent river deposition (alluvium), glacial outwash, and glacial till deposits. Total unlithified (drift) thickness ranges from 50 to 200 feet, generally becoming thicker with distance from the Illinois River southward from the impoundment. The geologic history of the Illinois River Valley was described in detail by Willman (1973), Hansel and Johnson (1996), and Frankie (2002).

The Illinoian and Wisconsinan glaciers repeatedly moved over the area. The Illinois River established its present position during the Woodfordian substage of Wisconsinan glaciation, which covered the area as far south as Peoria. Wisconsinan drift lies directly on bedrock as a result of repeated Woodfordian glacial episodes eroding earlier deposits of loess and glacial drift.

During the glacial retreats from the Hennepin area, numerous moraines were deposited across the Illinois Valley. Large areas between these moraines and/or the glaciers subsequently flooded from meltwaters. One such lake was glacial Lake Illinois, which formed behind the Bloomington Moraine, crossing the Illinois River valley near Peoria. Rapid melting and drainage from this area (Kankakee Flood) deepened and widened the valley, cutting an extensive terrace at an elevation of 500 to 550 feet about 14,500 years ago. These deposits (Henry Formation) are mostly fine gravel and pebbly sand and may be as much as 150 to 200 feet thick in the large terrace on which the city of Hennepin is located (areas shown as 'Mackinaw Member' on **Figure 2-3**), along with the eastern (*i.e.,* EAPS) and southeastern portion of the HPP property.

Another major flooded area formed behind the Tinley Moraine creating Lake Chicago. During downcutting of the Lake Chicago outlet about 3,000 years ago, the Chicago Outlet River deposited coarse gravel in bars on the eroded surfaces. The lower river terrace that underlies the AP2 includes deposits of the Chicago Outlet River. These deposits commonly occur about 20 to 40 feet above the Illinois River and may be up to about 50 feet in thickness. They are generally coarser and more uniformly sorted than the higher terrace deposits that occur immediately south of the Site.

The Illinois River is currently shallowly entrenched in glacial outwash and the Chicago Outlet River deposits. Lateral erosion by the river has developed a floodplain and deposited alluvium (Cahokia Alluvium) in abandoned channels. Alluvial deposits of the modern Illinois River consist largely of clayey silt and sandy silt with lenses of sand and gravel. The alluvium, where present, is 20 to 40 feet thick, overlying thick deposits of sand and gravel of the Henry Formation. These areas (**Figure 2-3**) occur between the northernmost portion of the EAPS and the river.

### 2.4.2 Regional Bedrock Geology

The uppermost bedrock in the region consists of the shale with thin limestone, sandstone, and coal beds of the Pennsylvanian-age Carbondale Formation. The thickness of the Pennsylvanian rock ranges from 150 feet in the western part of Putnam County to more than 525 feet along the eastern margin of the county (Woller and Sanderson, 1976). In the vicinity of the HPP, the Pennsylvanian rocks have an estimated thickness of approximately 300 to 400 feet. Beneath the Pennsylvanian rocks are Mississippian and Devonian-age interbedded layers of limestone and shale over Silurian-age dolomite. The dolomite generally ranges in thickness from 410 to 505 feet in the immediate region (Willman, 1970; Frankie, 2002). Crevassing in the unit varies widely and well yields are inconsistent. Deeper bedrock units beneath the Silurian-age dolomite consist of the following in descending order (Woller and Sanderson, 1976; Frankie, 2002):

- Maquoketa Shale Group of Ordovician age, composed primarily of blue to green shales with some limestone and dolomite layers, occurs at depths of less than 1,000 feet in the northwest part of Putnam County to 1,200 feet in southern Putnam County, with a thickness generally ranging from 155 to 240 feet. This shale is an aquitard between the Silurian dolomite and deeper dolomite and sandstone aquifers.
- Ordovician age dolomite and sandstone aquifers, including the following:
  - Galena-Platteville Dolomite Group at depths of about 1,150 feet in northwest Putnam County to about 1,400 feet in the southeast, ranging in thickness from 320 to 380 feet.
  - Glenwood-St. Peter Sandstone at depths of about 1,450 feet in west Putnam County near the Site to 1,750 feet in the southeast part of the county, ranging in thickness from about 120 to 170 feet.
  - Dolomite with some shale and sandstone beds below depths of 1,750 to 1,800 feet near the Site, principally consisting of the Shakopee (130 to 150 feet thick), New Richmond (approximately 165 feet thick), and the Oneota (approximately 215 feet thick) formations.
- Cambrian age dolomite and sandstone aquifers, including the Ironton-Galesville and Elmhurst-Mt. Simon formations.
- Precambrian age igneous and metamorphic.

A generalized stratigraphic column for the Hennepin region is provided in **Figure 2-4**.

### 2.4.3 Structure

The major geologic structural features around Illinois are shown on **Figure 2-5**. The HPP is located within a relatively stable region of the continent within the north-central portion of the Illinois Basin. Rock units to the northeast of the Site form the La Salle Anticlinorium where folds are expressed in synclines, anticlines, arches, and monoclines present in the area (Nelson 1993;

Nelson 1995). The Paleozoic bedrock strata, consisting of Pennsylvanian and older rocks, have a southwestern regional dip of approximately 15 to 30 feet per mile due to the effects of the anticlinorium. Variations to the bedrock dip occur in areas where there are local structures. The anticlinorium has subparallel anticlines, domes, monoclines, and synclines, which can change local dip and strike of bedrock units (Nelson, 1995).

### 2.4.4 Seismic Setting

A review of the available data from the United States Geological Survey (USGS), Illinois State Geological Survey (ISGS) and other available structural information was completed by Haley & Aldrich, Inc. (Haley & Aldrich) (2018) for the Location Restriction Demonstration to address the requirements of 40 C.F.R. § 257.62 (Fault Areas) of the USEPA rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities*. The review found that a series of four unnamed faults associated with the Troy Grove Dome are located approximately 11 miles northeast of the HPP, near the La Salle Anticline Belt (**Figure 2-5**).

Additionally, the Sandwich Fault Zone is located approximately 35 miles northeast of the Site. Vertical displacement on the Sandwich Fault Zone ranges from 150 to 800 feet. The fault zone is downthrown to the northeast. Due to the depth of burial by Quaternary sediments and the lack of well or seismic data, detailed information about the fault zone is unavailable. Although depicted as a single fault on this map, evidence from surrounding counties indicates that the Sandwich Fault Zone is a complex configuration of many faults of varying direction and amount of displacement (Kolata et al., 1976).

The Plum River Fault Zone is a 112-mile long, east-west trending zone of high-angle faulting in east-central Iowa and northwest Illinois, roughly 60 miles northwest of the Site. The north side of the fault zone is downthrown, with documented net vertical displacements of Silurian strata up to 270 feet. The physical relationships of Pennsylvanian deposits to the Plum River Fault Zone are not known with sufficient precision to preclude up to 33 feet of post-Pennsylvanian displacement. Historic data are inadequate to evaluate the potential for seismic hazard associated with the Plum River Fault Zone (Bunker et al., 1985). USGS seismic hazard maps show no enhanced ground acceleration in the Plum River Fault Zone vicinity.

The Haley and Aldrich review found that the timeframe of the most recent activity for the four unnamed faults near the La Salle Anticline Belt is not known. Available geologic data and information indicate that there have been no active faults or fault damage zones that have had displacement in the current Holocene time reported within 200 feet of the EAP (Haley & Aldrich, 2018).

As required in 35 I.A.C. § 845.330, existing and new CCR SIs and lateral expansions of existing landfills must not be located in seismic impact areas, unless owners or operators demonstrate that the unit is designed to resist the maximum horizontal acceleration (g) in lithified earth material. The definition of a seismic impact zone, per 40 C.F.R. § 257.53 is "areas having a 2 percent or greater probability that the maximum expected horizontal acceleration in hard rock, expressed as a percentage of the earth's gravitational acceleration, will exceed 0.10 g in 50 years." The Haley and Aldrich review utilized raw data from the 2014 USGS Hazard Map to calculate that the maximum expected horizontal acceleration for 2 percent probability of exceedance in 50 years at the EAP is 0.07 g (Haley & Aldrich, 2018). The Site is therefore not within a seismic impact area, as currently defined in 35 I.A.C. § 845.330 and a demonstration that the structural components have been designed to resist the maximum horizontal acceleration for the EAP is not required.

#### 2.4.5 Mining Activities

Based on the directory of coal mines for Putnam County (ISGS, 2006), the nearest coal mines in the vicinity of the HPP are located approximately three miles to the northeast and four miles to the southeast. These mines, identified as the Lacey Mine (ISGS Index No. 8) and the St. Paul Mine (ISGS Index No. 298), are both abandoned underground shaft mines that used the longwall method of mining, essentially removing all of the coal. The Lacey Mine was active from 1883 to 1890, and the coal seam at this mine ranged from 28 to 42 inches in thickness. The St. Paul Mine, and later the Prairie State Mine, operated from 1905 to 1925 and from 1930 to 1939. The coal seam at this location ranged from 42 to 66 inches in thickness.

The coal mined is the Colchester Seam, also known as the No. 2 and LaSalle Seam. The Colchester Seam is located within the lower portion of the Carbondale Formation, which is the shallowest coal mined in the region. In the vicinity of the Site, the Colchester Coal occurs at a depth of approximately 200 to 300 feet.

#### 2.4.6 Industrial Activities

As indicated in **Section 1.4**, the surrounding areas include industrial properties to the east and south of the impoundments with agricultural land to the southwest and the HPP to the west (**Figure 1-2**). The industrial properties are:

- Tricon Materials is located immediately east of the Site at 13559 Esk Street. Tricon Materials is an aggregate business providing various fill and washed sand, gravel, crushed rock, rock and boulder products.
- Washington Mills is located south of the impoundment at 13230 Esk Street. They are the largest producer and distributor of abrasive grains and specialty electro-fused minerals in North America.
- Between the HPP property and Washington Mills north of Esk Street is a 9-acre parcel that was previously occupied by Advanced Asphalt. Operations are no longer active and the property includes several abandoned buildings. The current owner of this parcel is listed as Tri-Con Materials.

### 2.5 Site Geology

A field investigation was performed in 2021 to collect additional data for the discussion of vertical and horizontal lithology, stratigraphy, chemical properties, and physical properties of geologic layers to a minimum of 100 feet below ground surface (bgs) as specified in 35 I.A.C. § 845.620(b). Field investigation locations are shown on **Figure 2-6**.

#### 2.5.1 Site Specific Unlithified Geology

The stratigraphy within and immediately surrounding the EAP consists of the following in descending order; fill material and CCRs, unlithified river alluvium (Cahokia Alluvium), and Pleistocene-age glacial outwash deposits (Henry Formation) overlying Pennsylvanian-age shale bedrock (Carbondale Formation). Boring logs, monitoring well and piezometer construction forms obtained from investigations at the EAP are provided in **Appendix A**.

#### 2.5.1.1 Fill and CCRs

Surficial soils encountered at most boring locations at the Site are coal ash fill and man-made berms constructed of a variety of locally available materials, primarily sand, gravel, and coal ash. Where undisturbed or partially excavated, the surficial soils at the Site (**Figure 2-2**) are poorly drained, moderately permeable Moundprairie Silty Clay Loam, Wet (No. 1480) formed in alluvium on floodplains.

CCR within the EAP is comprised predominantly of fly ash and bottom ash. Soil borings performed within the EAP (XPW01, XPW02, and XPW03) and the EAP Construction Documents indicate the base grade elevation of ash is as low as 464 feet NAVD88 and generally flat (**Figure 2-7**). Ash is present within the EAP at a thickness of up to 37.6 feet, as measured in XPW03 (**Appendix A**). Groundwater elevations measured in February through August 2021 showed typical water elevations in wells within the EAP (XPW01, XPW02, and XPW03) to be near 490.8 feet NAVD88. A maximum thickness of saturated fill and CCRs was observed at 32.2 feet in July 2021. The amount of saturated fill and CCRs in the EAP is generally consistent, ranging from 24.9 feet to 32.2 feet between February and August 2021.

Seven samples were obtained from the ash within borings XPW01, XPW02, and XPW03 (**Figure 2-6**). Geotechnical analysis of four of the ash samples yielded Unified Soil Classification System (USCS) soil classifications of silt. Previous geotechnical analyses of samples within the fill material along the embankments of the EAP yielded a USCS soil classification of lean clay (AECOM, 2016). The results of the geotechnical analysis performed in 2021 are summarized below and in **Table 2-1** and the geotechnical laboratory report is provided in **Appendix B**.

- The moisture content ranged from 31.0 to 177.0 percent, with an average moisture content of 111.8 percent.
- The total porosity (calculated) ranged from 51.7 to 82.7 percent with an average total porosity (calculated) of 70.3 percent.
- The dry density ranged from 28.0 to 79.0 pounds per cubic foot (pcf), with an average dry density of 49.6 pcf.
- The specific gravity ranged from 2.59 to 2.86, with an average specific gravity of 2.65.
- The distribution of particle sizes was 0 to 14.1 percent gravel, 13.7 to 83.1 percent sand, and 6.8 to 86.3 percent fines (silt and clay). The material is on average 4.1 percent gravel, 36.0 percent sand, and 59.9 percent fines (silt and clay).
- The vertical hydraulic conductivity ranged from $1.7 \times 10^{-4}$ to $2.9 \times 10^{-4}$ cm/s, with a geometric mean vertical hydraulic conductivity of $2.1 \times 10^{-4}$ cm/s.

Solids samples were collected from XPW01, XPW02, and XPW03 for chemical analysis. The results of solid samples collected from within the EAP are summarized in **Table 2-2**.

Leachate wells were installed in XPW01, XPW02, and XPW03 and porewater samples were collected for chemical analysis. The results of porewater samples collected from the EAP are summarized in **Table 2-3**.

#### 2.5.1.2 Cahokia Alluvium

These are the alluvial sediments deposited in abandoned channels from relatively recent lateral erosion by the Illinois River. Cahokia Alluvium was observed at boring locations MW52, MW53, and MW55 in 2021 (**Appendix A**). The Cahokia Alluvium at the EAP consist predominantly of sandy and silty lean clay to lean clay with sand with interbedded sands and gravels. These deposits extend to elevations near 477 feet NAVD88 at the EAP and thicknesses range from approximately 9.5 feet at well 52 to 14.5 feet at well 54.

Three samples were collected from the Cahokia Alluvium for geotechnical testing within borings MW52, MW53, and MW55. Geotechnical analysis of the three Cahokia Alluvium samples yielded USCS soil classifications of lean clay and clayey sand. Boring locations are depicted on **Figure 2-6**. The results of the geotechnical analysis are summarized below and in **Table 2-1** and the geotechnical laboratory report is provided in **Appendix B**.

- The moisture content ranged from 13.7 to 21.4 percent, with an average moisture content of 16.5 percent.
- The total porosity (calculated) ranged from 28.3 to 43.1 percent with an average total porosity (calculated) of 35.7 percent.
- The dry density ranged from 95.0 to 120.0 pcf, with an average dry density of 108.0 pcf.
- The specific gravity ranged from 2.68 and 2.72, with an average specific gravity of 2.69.
- The distribution of particle sizes was 0.7 to 12.4 percent gravel, 21 to 39.6 percent sand, and 48 to 78.3 percent fines (silt and clay). The material is on average 7.6 percent gravel, 33.3 percent sand, and 59.1 percent fines (silt and clay).
- The vertical hydraulic conductivity ranged from $2.4 \times 10^{-8}$ to $1.5 \times 10^{-7}$ cm/s, with a geometric mean vertical hydraulic conductivity of $6.3 \times 10^{-8}$ cm/s.

Soil samples from the Cahokia Alluvium were also submitted to an analytical laboratory for chemical analysis. The results of the chemical analysis are summarized in **Table 2-4**.

#### 2.5.1.3 Henry Formation

The Henry Formation consists of the glacial outwash deposits comprising the low-level terraces, up to about 40 feet above the Illinois River. Thicknesses of Henry Formation deposits within the EAP ranged from approximately 21 feet at well 52 to approximately 45 feet at well 55. These materials extend to the top of bedrock and are dominated by gravelly soils. Beneath the pond berms and surficial veneer of clay, granular deposits were encountered for nearly the full depth of all boring logs on the Site. These granular deposits are primarily gravel containing sand and lesser amounts of boulders, cobbles, and fines.

Two samples were collected from the Henry Formation within borings MW53 and MW55. Geotechnical analysis of one of the Henry Formation samples yielded a USCS soil classification of clayey to silty gravel. Boring locations are depicted on **Figure 2-6**. The results of the geotechnical analysis are summarized below and in **Table 2-1** and the geotechnical laboratory report is provided in **Appendix B**.

- The moisture content ranged from 8.2 to 9.9 percent, with an average moisture content of 9.1 percent.
- The total porosity was not calculated for the two samples from the Henry Formation.
- The dry density was not calculated for the two samples from the Henry Formation.
- The specific gravity analysis from the boring at MW55 (50 to 52 feet bgs) resulted in a specific gravity of 2.72.

- The distribution of particle sizes was 48.9 to 60 percent gravel, 23.2 to 42.8 percent sand, and 8.3 to 16.8 percent fines (silt and clay). The material is on average 54.5 percent gravel, 33 percent sand, and 12.6 percent fines (silt and clay).
- The vertical hydraulic conductivity was not calculated for the two samples from the Henry Formation.

Soil samples from the Henry Formation were also submitted to an analytical laboratory for chemical analysis. The results of the chemical analysis are summarized in **Table 2-4**.

Four continuously sampled borings (08D, 18D, 19D, and 55) were drilled to confirm the local stratigraphy and hydrogeologic setting information. These borings fully penetrated the Cahokia Alluvium and Henry Formation into the shale bedrock underlying the unconsolidated sediments in the EAP. Boring 08D extended 30 feet below the bottom of the Henry Formation and boring 55 extended approximately 15 feet below the bottom of the Henry Formation, which comprises the uppermost aquifer.

Geologic cross-sections across of the study area (**Figure 2-8**) includes one southwest-northeast line and one northwest-southeast line. AP2 is located over the original narrow lower terrace between the Illinois River and the uplands. The original lower terrace is approximately 10 to 20 feet above normal river level of 441 feet NGVD29 (**Figure 2-8** cross-section B-B’). The EAP, Polishing Pond and AP4 were constructed on the upper terrace at an elevation of approximately 500 to 505 feet NGVD29, or 60 to 65 feet above normal river level (**Figure 2-8** cross-section B-B’).

### 2.5.2 Site Specific Bedrock Geology

The uppermost bedrock at the HPP, including the EAPS, is the Pennsylvanian Carbondale Formation (Kolata, 2005), which consists of shale with thin limestone, sandstone, and coal beds (**Figure 2-4**). The bedrock surface elevation ranges from 400 and 450 feet above mean sea level (Herzog et al., 1994). Three deeper borings (08D, 18D, and 55) around the perimeter of the EAPS confirm the presence of shale bedrock at elevations from 400 and 410 feet NAVD88. The top of bedrock at well 55 was described as grayish green silty shale. The elevation of the top of bedrock (**Figure 2-8**) is highest at well 55 (410.2 feet NAVD88) and drops to the north toward well 18D (399.2 feet NAVD88). Well logs for former production wells at the power plant indicate shale bedrock at an elevation of roughly 350 feet (NRT/OBG, 2017a).

Details on the occurrence and characteristics of regional bedrock are provided **Section 2.4.2**. A brief description of bedrock in the area near the EAP is as follows:

Bedrock below the Site is composed of the Pennsylvanian-age Carbondale Formation, which defines the base of the unlithified deposits (and uppermost aquifer) underlying both the Site and the entire EAPS and is regarded as the first confining unit beneath the uppermost aquifer. Water-bearing openings are extremely variable from place to place and are best developed near the surface in thin limestones and sandstones, when present within the predominantly shale formation. Near the HPP, the Pennsylvanian rock has an estimated thickness of approximately 300 to 400 feet.

Bedrock samples from the Carbondale Formation were submitted to an analytical laboratory for chemical analysis. The results of the chemical analysis are summarized in **Table 2-4**.

# 3. REGIONAL AND LOCAL HYDROGEOLOGY

## 3.1 Regional Hydrogeology

### 3.1.1 Unlithified Deposits Hydrogeology

Regional groundwater flow in the unlithified deposits above the shale bedrock discharges into the Illinois River. Depth to the water table is typically greater than 20 feet bgs around the Site. The water table elevation can vary significantly, depending on the river stage. During flood stages, exfiltration from the river may temporarily recharge groundwater close to the river and the water table beneath the Site may rise to levels similar to river elevations.

The Henry Formation outwash deposits have high hydraulic conductivity compared to the underlying bedrock. Pump test and specific capacity data were obtained for five high capacity industrial and municipal wells screened in the unlithified deposits along the Illinois River within several miles of the HPP (Illinois State Water Survey [ISWS], 1989). Hydraulic conductivity of the Henry Formation sand and gravel ranged from $5 \times 10^{-2}$ to $3 \times 10^{-1}$ cm/s with a median of $1 \times 10^{-1}$ cm/s. Pumping rates ranged from 125 to 1,570 gallons per minute (gpm) and the tests were conducted over periods ranging from 30 minutes to 24 hours. Effective porosity typically ranges from 20 to 35 percent for poorly sorted sand and gravel alluvial deposits (Walton, 1988; Fetter, 1980).

Hydraulic conductivity of the alluvial deposits, generally consisting of lower permeability materials (*i.e.,* silt, silty sand, and clay), will typically be several orders of magnitude lower than the more permeable outwash sand and gravel deposits of the Henry Formation. However, no published regional data is available specifically for the shallow alluvial deposits. Silt, clay, and mixtures of sand, silt, and clay typically have horizontal hydraulic conductivity ranging from $10^{-4}$ to $10^{-7}$ cm/s (United States Department of Interior [DOI], 1981; Fetter, 1980).

### 3.1.2 Bedrock Hydrogeology

The Pennsylvanian rocks in the region are not considered a municipal or subdivision water supply source. (Gibb et al., 1977). Water-bearing openings are extremely variable from place to place and are best developed near the surface in thin limestones and sandstones, when present within the predominantly shale formation. In the bedrock upland areas away from the Illinois River, farm and domestic water supplies are obtained locally from sandstone and creviced limestone in the upper 250 feet of these rocks (Woller and Sanderson, 1976). When present, the limestone and sandstone units yield less than 10 gpm (Visocky, et al., 1985). Water quality within the bedrock varies considerably and it becomes highly mineralized with increasing depth. As a result, the Pennsylvanian bedrock is not a reliable source of groundwater.

The Pennsylvanian rocks generally have low porosity and hydraulic conductivity. The porosity of shale typically ranges from 1 to 20 percent (Walton, 1988). Representative horizontal hydraulic conductivity for shale typically ranges from $5 \times 10^{-6}$ to $5 \times 10^{-10}$ cm/s. Representative vertical hydraulic conductivity ranges for shale are $5 \times 10^{-8}$ to $5 \times 10^{-12}$ cm/s (Walton, 1988). Recharge to the Pennsylvanian rocks is derived locally from vertical leakage through the glacial drift and other unlithified materials that are in turn recharged from precipitation. Deeper bedrock units beneath the Pennsylvanian rocks and their water-bearing properties (Woller and Sanderson, 1976) are as follows:

- Silurian dolomite, which may provide water to wells in moderate quantities from cracks and crevices, but is too mineralized for most uses;
- Maquoketa Group of Ordovician age composed of non-water-bearing shales and acts as an aquitard between the Silurian dolomite and deeper water-bearing units; and
- Cambrian-Ordovician Aquifer (also known as Midwest Bedrock Aquigroup), composed of the Ironton-Galesville aquifer at the base of this group up through the Glenwood-St. Peter Sandstones. These formations are the major bedrock aquifer and principal water producing zones in the region capable of yielding moderate quantities of groundwater (Visocky, et al., 1985).

In the region surrounding the Site, these bedrock aquifers provide municipal water supply sources.

## 3.2 Site Hydrogeology

Prior to 2015, there were 21 monitoring wells located around the EAPS for monitoring groundwater. Wells 46 and 47 were installed in 2015 to further evaluate groundwater surrounding the EAP and meet the requirements of 40 C.F.R. § 257. Four new monitoring wells (52, 53, 54, and 55) were installed in 2021 around the perimeter of the EAP to meet requirements of Part 845. Construction details for monitoring wells and piezometers within the HPP are provided in **Table 3-1** and depicted in **Figure 3-1**. Boring logs, monitoring well and piezometer construction forms are provided in **Appendix A**.

### 3.2.1 Hydrostratigraphic Units

Two distinct water-bearing units have been identified at the Site based on stratigraphic relationships and common hydrogeologic characteristics, which are summarized below in descending order:

- **Uppermost Aquifer:** The Illinois River is immediately adjacent to the lower terrace, east of the Site, and there is minimal Cahokia Alluvium between the Site and the river. The Cahokia Alluvium, also described in detail in **Section 2.5.1.2**, consists of river deposits of fine-grained silts and clays. The estimated thickness of the alluvium at the EAP is 20 to 40 feet.

  The highly permeable Henry Formation sands and gravels make up the upper and lower terraces and fill the valley beneath the alluvium. The sand and gravels of the two terraces are indistinguishable, consisting of a heterogeneous mixture of silty-sandy gravel, with cobble zones and with boulders up to several feet in diameter. The Henry Formation is more than 100 feet thick in the river valley and at least 130 feet thick on the upper terrace.
- **Bedrock Confining Unit**: The thick and low permeability shales with thin limestone, sandstone, and coal beds of the Carbondale Formation underlie the uppermost aquifer at the EAP.

### 3.2.2 Uppermost Aquifer

The uppermost aquifer is comprised of the silty-sandy gravel with boulders, classified as Henry Formation, and the overlying river-laid fine-grained silts and clays of the Cahokia Alluvium. These deposits combined are slightly more than 80 feet thick directly beneath the Site. The lower 45 feet are saturated. Observed groundwater elevations seasonally fluctuate by about 3 to 7 feet. The top of the uppermost aquifer is presented in **Figure 3-2**.

This uppermost aquifer extends laterally about 7,000 feet upgradient of the EAP to the south where clay-rich glacial till is encountered. Glacial tills in the region typically yield little water.

### 3.2.3 Bedrock Confining Unit

The base of the uppermost aquifer is the top of the uppermost bedrock, the shale of the Pennsylvanian-age Carbondale Formation. This shale unit is estimated to have a thickness of approximately 300 to 400 feet. Borings for monitoring wells 08D and 55 extend into the bedrock as far as 30 feet. As described in **Section 3.1.2**, the horizontal hydraulic conductivity of the shale bedrock generally ranges from 5 x $10^{-6}$ cm/s to 5 x $10^{-10}$ cm/s with low porosities (ranging from 1 to 20 percent) and low vertical hydraulic conductivities (ranging from 5 x $10^{-8}$ to 5 x $10^{-12}$ cm/s). However, the one slug test result obtained for the uppermost (*i.e.,* weathered) shale at the Site yielded a higher horizontal hydraulic conductivity value of 3.6 x $10^{-5}$ cm/s.

### 3.2.4 Potential Migration Pathways

The potential pathways for contaminant migration at the Site have been fully characterized and defined in **Section 3.2**. The glacial outwash sand and gravel (Henry Formation) and Cahokia Alluvium comprise the uppermost aquifer at the Site. The hydrogeology of the Site has been fully characterized spatially and temporally under recharge/discharge conditions of the Illinois River. Groundwater from the vicinity of the CCR unit flows toward the Illinois River through the uppermost aquifer as the primary pathway for potential groundwater contaminant migration. Due to the unlithified, granular nature of this aquifer, macro-pore flow through fractures or other conduits does not occur and evidence of such flow was not observed. Vertical migration is limited by the underlying Pennsylvanian-age shale bedrock unit, which acts as a confining layer. No potential migration pathways have been identified other than the uppermost aquifer.

### 3.2.5 Water Table Elevation and Groundwater Flow Direction

Groundwater flow has been monitored since the 1980s. Groundwater flow is represented using groundwater elevation contour maps for sampling events conducted in 2021 (**Figures 3-3** through **3-5**). The EAP is upgradient of the CCWL and AP2 and the groundwater elevation in wells surrounding the EAP averaged 448.9 feet NAVD88 from February to August 2021.

Groundwater elevations are primarily controlled by river stage of the Illinois River near the Site. Typically, groundwater from the Site flows from south to north and discharges to the Illinois River (**Figure 3-3**). Under high river stage events or flooding, flow direction can be reversed (*i.e.,* groundwater flows in a south to southwest direction) near the river for limited durations (**Figures 3-4** and **3-5**). Flow reversals have not been observed to extend south beyond the EAP (**Appendix C** and **Figures 3-3** through **3-5**). Seasonal variation of groundwater levels and flow direction near the CCR Units are depicted in the series of 2015 through 2020 groundwater elevation contour maps (**Appendix C**). Flow reversals and the impact of river stage are further discussed in **Section 3.2.5.3**.

#### 3.2.5.1 Vertical Hydraulic Gradients

Vertical hydraulic gradients were calculated using available groundwater elevation data from February to August 2021 at nested well locations within the uppermost aquifer. Vertical hydraulic gradients for the EAP are presented in **Table 3-2** and summarized below:

- Vertical hydraulic gradients between upgradient wells 08 and 08D averaged slightly downward at 0.0045 feet per foot (ft/ft) and ranged from -0.0017 to 0.0086 ft/ft.
- Vertical hydraulic gradients between well nests downgradient and adjacent to the north edge of the EAP (12, 13, and 55) were variable and averaged slightly downward at 0.0059 ft/ft.

- Vertical hydraulic gradients between downgradient wells 12 and 13 were generally flat, with an average vertical gradient at -0.0013 ft/ft and ranged from -0.0068 ft/ft to 0.0015 ft/ft.
- Vertical hydraulic gradients between downgradient wells 12 and 55 averaged slightly downward at 0.0081 ft/ft and ranged from -0.0138 to 0.0495 ft/ft.
- Vertical hydraulic gradients between downgradient wells 13 and 55 averaged downward at 0.0104 ft/ft and ranged from -0.0223 to 0.0764 ft/ft.

The slightly downward vertical hydraulic gradients observed between wells 08 and 08Dand the generally flat-to-upward vertical gradients observed between wells 12 and 13 are consistent with gradients reported in NRT/OBG's *Hydrogeologic Site Characterization Report* (NRT/OBG, 2017a). Based on these observations and the physical characteristics of the uppermost aquifer, vertical groundwater gradients do not appreciably affect the horizontal migration of dissolved constituents.

#### 3.2.5.2 Impact of Existing Ponds and Ash Saturation

The phreatic surface measured from February through August 2021 in the EAP ranges from approximately 477.7 to 492.2 feet NAVD88 while groundwater elevations measured in monitoring wells surrounding the EAP and screened within the uppermost aquifer range from approximately 446.1 to 457.1 feet NAVD88. Groundwater elevation contours of the uppermost aquifer (**Figure 3-3**) illustrate flow towards the north and discharging at the Illinois River. The absence of a radial component of flow outward indicates that the EAP does not significantly impact flow direction. The EAP is lined as described in **Section 1.5**. The flat horizontal groundwater gradient beneath this area (**Section 3.2.7**) and the small and inconsistent upward/downward vertical gradients between wells 13 and 55 (**Table 3-2**) suggests the EAP and neighboring ponds are not areas of increased recharge or infiltration.

#### 3.2.5.3 Impact of River Stage on Groundwater Flow

The river basin experiences annual spring flooding during the months of March, April, May, and sometimes June, while lesser flooding occasionally occurs during autumn. River stage during high precipitation and/or flood events seasonally rises above adjacent groundwater elevations and groundwater gradients will temporarily reverse in response to the river temporarily recharging the aquifer. Groundwater gradient reversals are observed on the quarterly groundwater elevation contour maps for March and April 2021 (**Figures 3-4** and **3-5**). During these events, the groundwater flow direction reverses, moving south to southeasterly across a portion of the Site. A moderate horizontal gradient reversal of about 0.003 ft/ft was observed in April 2021. The groundwater flow reversals are typically limited in duration and extent.

**Figure A** below compares the groundwater hydrograph recorded at former well 14 with the river hydrograph recorded at the HPP (STMI, 1996). Well 14 was located adjacent to wells 12 and 13 between the CCWL and EAP (**Figure 3-1**). This graph shows that groundwater elevations respond rapidly to major flood events where river elevations rise above adjacent groundwater levels. It also indicates that groundwater levels, at least as far as the south side of AP2, can be expected to rise temporarily in response to river flooding to elevations similar to those observed at the river.

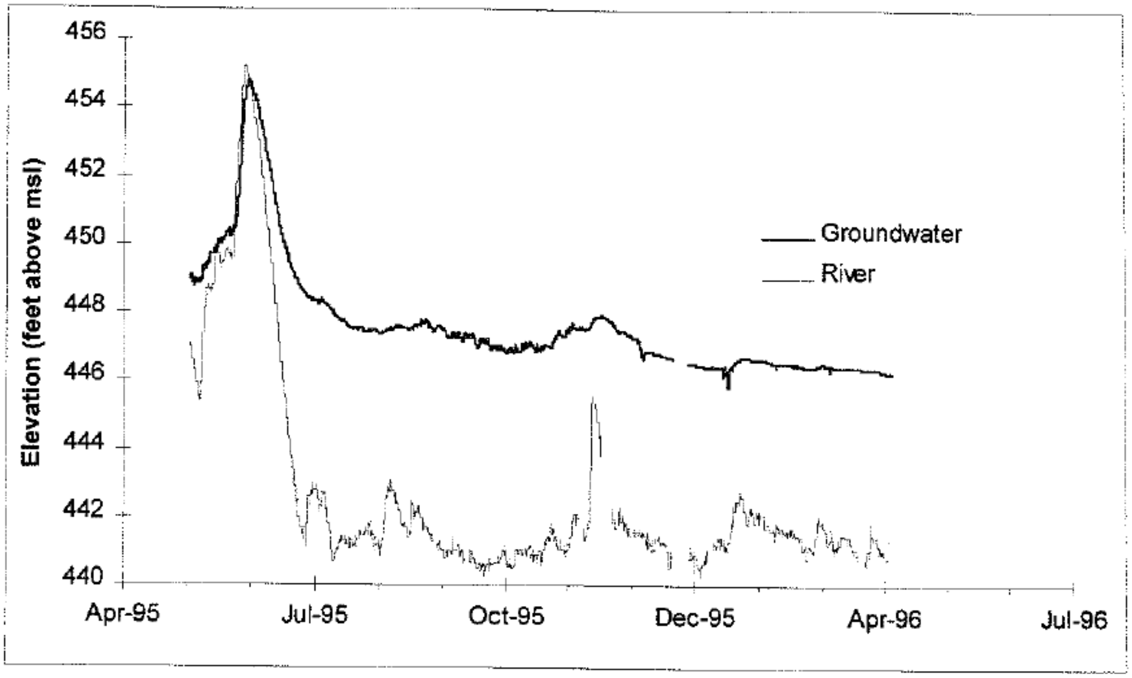


**Figure A. Hydrograph Comparison for Well 14 and the Illinois River (STMI, 1996).**

The relationship between the Illinois River and the EAPS was further discussed in the River Flood Evaluation Report (Ramboll, 2020) included as Addendum 3 to the Closure Plan. Explicit simulation of flood events indicates that potential increases in simulated concentration from flooding of the Illinois River are small and transient, such that long-term concentrations will not be affected (*i.e.,* flooding events are not sufficiently impactful to require incorporation in the prediction model for AP2 and AP4). The EAP is located within the same geologic and hydrogeologic system as AP2 and AP4; therefore, flow reversals are not expected to have a significant impact on long-term concentration trends at the EAP.

### 3.2.6 Hydraulic Conductivity

#### 3.2.6.1 Field Hydraulic Conductivity

Field hydraulic conductivity tests performed at wells in the uppermost aquifer at the EAP were completed as part of the 2021 field investigation and these data were supplemented with results from field hydraulic conductivity tests performed in 2017 as part of NRT/OBG's *Hydrogeologic Site Characterization Report* (NRT/OBG, 2017a). Hydraulic conductivity tests and results from 2017 and 2021 are summarized in **Table 3-3** and 2021 analyses are provided in **Appendix D**.

Results of field hydraulic conductivity tests conducted in 2021 in the leachate monitoring wells (XPW01, XPW02, and XPW03) ranged from 7.7 x $10^{-3}$ to 5.2 x $10^{-2}$ cm/s with a geometric mean of 1.9 x $10^{-2}$ cm/s (**Table 3-3**).

The Henry Formation sands and gravels at the Site are highly permeable with measured hydraulic conductivity ranging from 1.6 x $10^{-3}$ to 3.2 x $10^{-0}$ cm/s and a geometric mean of 8.4 x $10^{-2}$ cm/s (**Table 3-3**). At several monitoring well locations, water levels recovered as fast as the slug was removed and no drawdown recovery measurements could be made by the transducer. These values are consistent with pump test data from area high-capacity wells screened in the unlithified deposits which ranged from 5 x $10^{-2}$ to 3 x $10^{-1}$ cm/s. Hydraulic conductivity within the shale bedrock lower confining unit, as measured at well 55, is 3.6 x $10^{-5}$ cm/s (**Table 3-3**).

Pump test data from the fire well installed at the power plant in 1968 was also available to estimate the permeability of the Henry Formation. This fire well is located at the southwest corner of the plant and was drilled to a depth of 112 feet, terminating on shale. The lower 30 feet of the well is screened within unlithified deposits. The well log is contained in NRT and Kelron's *Water Well Survey* (2009a). The pump test hydraulic conductivity result reported by Mathes (1983) was 1.3 x $10^{-1}$ cm/s. No vertical hydraulic conductivity pattern was discerned from the slug test data. Horizontal hydraulic conductivity appears consistently higher, on the order of $10^{0}$ to $10^{-1}$ cm/s in an east-west trending line under the EAP and Polishing Pond. These high hydraulic conductivities coincide with a very flat hydraulic gradient.

A moderately steep horizontal gradient (average of 0.0028 ft/ft) between wells 07 and 08 (**Table 3-4**) suggests that the hydraulic conductivity upgradient of the Site in the upper terrace deposits may be locally somewhat lower, based on the occurrence of finer-grained materials noted in the boring log for well 07.

#### 3.2.6.2 Laboratory Hydraulic Conductivity

Falling head permeability tests (ASTM D5084 Method F) were performed in the laboratory on samples collected during the 2021 investigations. Sample locations are shown on **Figure 2-6**. The geotechnical laboratory report is provided in **Appendix B** and the results are summarized in **Table 2-1**. Laboratory measurements indicated vertical hydraulic conductivity for the uppermost aquifer ranged from 1.5 x $10^{-7}$ cm/s to 7.1 x $10^{-8}$ cm/s, with a geometric mean for all three samples of 6.4 x $10^{-8}$ cm/s.

### 3.2.7 Horizontal Hydraulic Gradients and Groundwater Flow Velocities

Groundwater elevations have been measured quarterly since 2008. The Illinois River is the regional groundwater discharge area. Under normal conditions at the Site, groundwater flows from south to north toward the river as shown on **Figure 3-3**. Additional water table contour maps for 2015 through 2020 are available in **Appendix C**.

Horizontal hydraulic gradients are typically moderate (0.0013 to 0.0062 ft/ft) as groundwater approaches the Site south of the EAP (**Table 3-4**). The horizontal gradient becomes nearly flat beneath the EAP (no gradient to 0.0012 ft/ft) before steepening slightly between the Site and the Illinois River (**Table 3-4**). The flattening of the horizontal gradient is attributed to the highly permeable sand and gravel that runs continuously along the south perimeter of the EAPS, as illustrated in cross sections A-A' and B-B' (**Figure 2-8**).

Horizontal groundwater flow at the base of the uppermost aquifer also moves from south to north towards the Illinois River, based on hydraulic head measurements in monitoring wells 08D and 18D. Horizontal gradients at depth are similar to those beneath the EAP, averaging 0.0003 ft/ft from February to August 2021 (**Table 3-4**).

Groundwater flow in the uppermost aquifer under normal flow conditions generally from south to north across the Site (**Figure 3-3**) towards the Illinois River. Groundwater flow velocity calculations are provided in **Table 3-4**, and a summary of velocities at the EAP from February to August 2021 under normal flow conditions is provided below:

- East of the EAP (between wells 17 and 19S): groundwater flow velocities ranged from approximately 0.5 feet per day (ft/day) in March 2021 to 3.0 ft/day in May 2021, with an average groundwater velocity of 2.0 ft/day. Groundwater velocities, as measured between wells 17 and 12, to the east of the EAP were from approximately 0.5 ft/day to 0.7 ft/day (NRT/OBG, 2017a).
- West of the EAP (between wells 53 and 52): groundwater flow velocities ranged from 0.03 ft/day in May 2021 to 0.1 ft/day in February 2021.
- Below the EAP (between wells 16 and 54): groundwater flow velocities ranged from 0.3 ft/day in February 2021 to 10.6 ft/day in April 2021, with an average groundwater velocity of 3.6 ft/day.
- Base of the uppermost aquifer (between wells 08D and 18D): groundwater flow velocities ranged from 0.2 ft/day in March 2021 to 1.0 ft/day in August 2021, with an average groundwater velocity of 0.6 ft/day.

Flow reversals were observed in the velocity calculations in the areas west (between wells 53 and 52) and north (between wells 54 and 18S) of the EAP during monitoring events occurring in March, April, June, July, and August 2021 (**Table 3-4**).

### 3.2.8 Groundwater Classification

Per 35 I.A.C. § 620.210, groundwater within the uppermost aquifer at the EAP meets the definition of a Class I – Potable Resource Groundwater based on the following criteria:

- Groundwater in the uppermost aquifer extends 10 feet or more below the land surface, and;
- Hydraulic conductivity exceeds the $1 \times 10^{-4}$ cm/s criterion (**Table 3-3**).

## 3.3 Surface Water Hydrology

### 3.3.1 Climate

The climate in Hennepin is humid and annual precipitation generally exceeds evapotranspiration. ISWS records from 1981 through 2010 at the Hennepin water treatment plant in Hennepin, Illinois, which is located approximately four miles southwest of the Site, indicates precipitation averages 36.2 inches per year. Monthly precipitation averages near three inches from April through November, and one to three inches in December through March. On average 15.5 inches of precipitation occur yearly as snowfall.

As shown below in **Table B**, ISWS temperature records show average maximum daily temperatures for 1981 to 2010 ranging from above 70 degrees Fahrenheit (°F) May through September and minimum average daily temperatures that are less than freezing November through March (ISWS, 2021).

**Table B. Average Monthly Temperature Extremes and Precipitation for Hennepin Water Treatment Plant, Hennepin, Illinois (1981-2010).**

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Max Temp ºF | 32.4 | 37.0 | 49.5 | 63.0 | 73.7 | 83.0 | 86.4 | 84.6 | 78.4 | 65.6 | 50.6 | 36.4 | 61.8 |
| Min Temp ºF | 13.7 | 17.8 | 28.0 | 38.5 | 49.1 | 58.8 | 62.7 | 60.9 | 51.9 | 40.3 | 30.2 | 18.1 | 39.3 |
| Precipitation (inches) | 1.74 | 1.71 | 2.55 | 3.02 | 3.93 | 3.87 | 4.02 | 4.18 | 3.36 | 2.97 | 3.04 | 1.79 | 36.2 |
| https://www.isws.illinois.edu/statecli/newnormals/normals.USC00114013.txt | | | | | | | | | | | | | |

### 3.3.2 Surface Waters

The predominant surface water body in the region is the Illinois River and associated lowland backwater lakes. The Illinois River is located directly adjacent to and downgradient from the EAP. A USGS stream gage (No. 05558300) for the Illinois River at Henry, Illinois is located 15 river miles south (downstream) of the HPP. The gage datum elevation is 425.88 feet NGVD29. Daily gage heights for the periods of January 1, 2016 to August 31, 2021 are shown in the following graph (USGS, 2021).

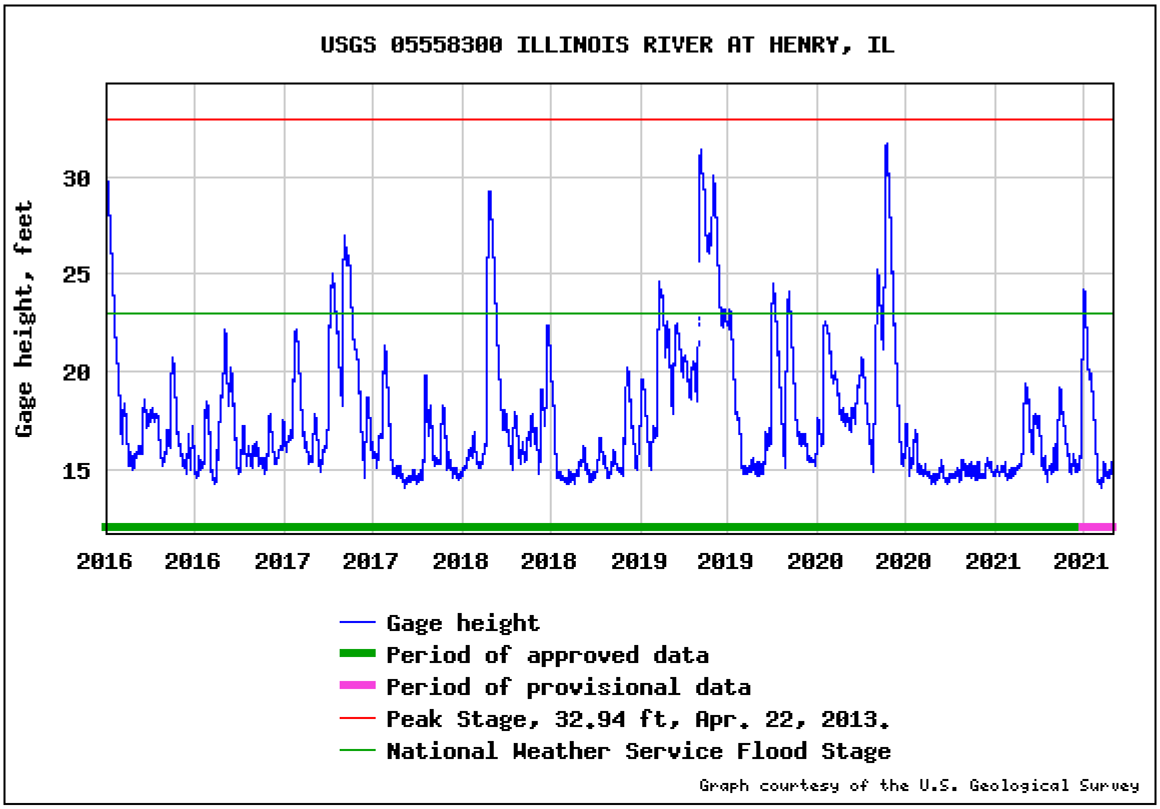


**Figure B. Daily Gage Height (feet) January 1, 2016 to August 31, 2021 for USGS Gaging Station 05558300 at the Illinois River near Henry, Illinois.**

The gage height of 15 feet, representing approximate base flow, occurs at elevation of about 441 feet NGVD29.

Other surface waters in the vicinity include various ponds on property to the east created by sand and gravel extraction as well as the EAP, Leachate Pond, and Polishing Pond associated with the HPP. A map of wetlands and surface waters in the vicinity of the EAP is presented in **Appendix E**. A Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map for Putnam County (Map No. 17155C0015E; Effective Date: February 4, 2011) is attached in **Appendix F** and can also be viewed online at: https://www.illinoisfloodmaps.org/dfirm.aspx?county=putnam.

None of the impoundment berms within the EAPS occur below the base flood elevation value of 462 feet identified on the 2011 FEMA map. The flood hazard areas shown on the map are defined as those areas subject to inundation by the 1 percent annual chance flood (*i.e.,* 100-year flood), also known as the base flood, that has a 1 percent chance of being equaled or exceeded in any given year.

# 4. GROUNDWATER QUALITY

## 4.1 Summary of Groundwater Monitoring Activities

Several monitoring programs are being conducted as required by IEPA and USEPA to evaluate the CCR Units associated with the HPP EAPS and CCWL. The networks have changed over time and many of the wells and parameters overlap as a result of previously approved GMPs and permits which were developed to focus on specific (and separate) Units at the EAPS. The monitoring networks for each of the CCR and non-CCR Units at the EAPS include:

- CCWL
  - IFR (Section 28)
  - 40 C.F.R. § 257
- AP2 and AP4
  - 40 C.F.R. § 257 for AP2 (AP4 was classified as capped or otherwise maintained and not subject to 40 C.F.R § 257)
  - IEPA Closure Plan (2019 GMP included in Closure Plan) and proposed network for Part 845
- EAPS (also includes Leachate Pond and Polishing Pond)
  - IEPA Water Pollution Control Permit 2019-EO-64097 – Special Condition No. 4
- EAP (subject of this HCR)
  - 40 C.F.R. § 257
  - Proposed network for Part 845

Initial monitoring at the HPP, began with the installation of monitoring wells around AP2 in 1983. Since then, additional monitoring wells have been added and modifications to the existing well networks were completed as additional units were proposed and constructed (*i.e.,* 1995/1996 with the construction of the EAP and 2008-2010 for construction of the CCWL). The current monitoring networks are summarized above.

In 2015, additional well installation and groundwater sampling was performed to meet the requirements of 40 C.F.R. § 257. Groundwater samples were collected, and totals analyses were completed for Appendix III and Appendix IV parameters of 40 C.F.R. § 257. In 2021, additional wells were installed to comply with 35 I.A.C. § 845 requirements, specifically to reduce the lateral spacing between monitoring points and to characterize the bedrock confining unit. These wells were sampled for the parameters listed in 35 I.A.C. § 845.600. A review and summary of data from both the 40 C.F.R. § 257 and 35 I.A.C. § 845 monitoring programs is included in the evaluation of groundwater quality at the EAP.

### 4.1.1 40 C.F.R. § 257 Program Monitoring and Well Network

The 40 C.F.R. § 257 monitoring well network for the EAP consists of seven monitoring wells installed nearby and adjacent to the EAP within the unlithified uppermost aquifer. The 40 C.F.R. § 257 well network consists of three background monitoring wells (07, 08, and 08D) and four compliance monitoring wells (12, 13, 46, and 47). Monitoring wells 16 and 17 are being considered as additional background wells to represent groundwater quality impacts from off-site, upgradient sources.

The boring logs, well construction forms, and other related monitoring well forms for the EAP 40 C.F.R. § 257 well network included in **Appendix A** of this HCR.

Assessment monitoring of these wells was established on April 9, 2018. The 40 C.F.R. § 257 well network locations are shown on **Figure 3-1**. Details on the procedures and techniques used to fulfill the groundwater sampling and analysis program requirements are found in the Sampling and Analysis Plan for the EAP (NRT, 2017).

Groundwater samples are collected and analyzed semiannually for the following laboratory parameters from Appendix III and Appendix IV of 40 C.F.R. § 257, summarized in **Table C** below.

**Table C. 40 C.F.R. § 257 Groundwater Monitoring Program Parameters**

| **Field Parameters[1]** | | | |
|---|---|---|---|
| Groundwater Elevation | pH | | |
| **Appendix III Parameters (Total, except TDS)** | | | |
| Boron | Chloride | Sulfate | |
| Calcium | Fluoride | TDS | |
| **Appendix IV Parameters (Total)** | | | |
| Antimony | Cadmium | Lead | Selenium |
| Arsenic | Chromium | Lithium | Thallium |
| Barium | Cobalt | Mercury | Radium 226/228 |
| Beryllium | Fluoride | Molybdenum | |

[1]Dissolved oxygen, temperature, specific conductance, oxidation/reduction potential, and turbidity are recorded during sample collection.

### 4.1.2 Part 845 Well Installation and Groundwater Monitoring

In 2021, four additional monitoring wells (52, 53, 54, and 55) were installed along the perimeter of the EAP to assess the vertical and horizontal lithology, stratigraphy, chemical properties, and physical properties of geologic layers to a minimum of 100 feet bgs as specified in 35 I.A.C. § 845.620(b). Additionally, three leachate monitoring wells (XPW01, XPW02, and XPW03) were installed within the EAP unit to characterize the CCR materials.

Prospective Part 845 monitoring wells were sampled for eight rounds from February to August 2021 and the results were assessed for selection of the EAP Part 845 monitoring well network presented in the GMP. Groundwater samples were collected and analyzed for 35 I.A.C. § 845.600 parameters summarized in **Table D** below. Part 845 groundwater monitoring results are included below in **Section 4.2** and a summary of groundwater analytical data is presented in **Table 4-1**.

**Table D. Part 845 Groundwater Monitoring Program Parameters**

| | | | |
|---|---|---|---|
| **Field Parameters[1]** | | | |
| Groundwater Elevation | pH | Turbidity | |
| **Metals (Total)** | | | |
| Antimony | Boron | Cobalt | Molybdenum |
| Arsenic | Cadmium | Lead | Selenium |
| Barium | Calcium | Lithium | Thallium |
| Beryllium | Chromium | Mercury | |
| **Inorganics (Total, except TDS)** | | | |
| Fluoride | Sulfate | Chloride | TDS |
| **Other (Total)** | | | |
| Radium 226 and 228 combined | | | |

[1] Dissolved oxygen, temperature, specific conductivity, and oxidation/reduction potential were recorded during sample collection.

## 4.2 Groundwater Monitoring Results and Analysis

Groundwater data collected from the 40 C.F.R. § 257 network monitoring wells from 2015 to 2021 were supplemented with sampling of additional locations in 2021 and evaluated with respect to standards included in 35 I.A.C. § 845.600(a)(1). This data set was selected because it includes parameters (total metals) consistent with the parameter list in 35 I.A.C. § 845.600(a)(1). Based on this data set there were no concentrations of antimony, arsenic, barium, beryllium, boron, cadmium, chromium, fluoride, lead, mercury, molybdenum, radium 226 and 228 combined, selenium, or sulfate greater than the GWPSs. Discussion of primary indicator parameters for CCR leachate impacts on groundwater quality (boron, chloride, sulfate, TDS, and pH) as well as recent potential exceedances[1] (chloride, TDS, pH, cobalt, lithium, and thallium) observed in the proposed Part 845 network (although limited in occurrence) are provided in the following sections. A summary of groundwater analytical data is provided in **Table 4-1** and groundwater field parameters are included in **Table 4-2**.

### 4.2.1 Boron

Boron is a primary indicator parameter for CCR leachate impacts on groundwater quality. Boron was not detected at concentrations greater than the GWPS (2 milligrams per liter [mg/L]) during monitoring events from 2015 to 2021 (**Table 4-1**). Boron concentrations at background wells (07, 08, 08D, 16, and 17) ranged from 0.054 to 0.181 mg/L with a median concentration of 0.110 mg/L. Boron concentrations at compliance wells (12, 13, 46, 47, 52, 53, 54, and 55) ranged from 0.104 to 1.41 mg/L with a median concentration of 0.388 mg/L. Except for well 13, concentrations of boron detected in background and compliance wells were all less than 1 mg/L.

[1] Potential exceedances include results reported during the eight rounds of baseline groundwater monitoring that are greater than the applicable 35 I.A.C. § 845.600(a)(1) standards. The results are considered potential exceedances because they were compared directly to the standard and did not include an evaluation of background groundwater quality or apply the statistical methodologies proposed in the Groundwater Monitoring Plan (GMP). For simplicity, "GWPS" will be used hereafter in discussing potential exceedances. Exceedances will be determined following IEPA approval of the GMP.

#### 4.2.2 Chloride

Chloride was detected at concentrations greater than the GWPS (200 mg/L) in background well 08 during 25 monitoring events and at upgradient (background) well 08D during 26 sampling events from 2015 to 2021 (**Table 4-1**). Chloride concentrations at background well 08 ranged from 127 to 312 mg/L with a median concentration of 253 mg/L. Chloride concentrations at background well 08D ranged from 184 to 366 mg/L with a median concentration of 245 mg/L.

#### 4.2.3 Sulfate

Sulfate is also a primary indicator of CCR leachate impacts on groundwater quality. Sulfate was not detected at concentrations greater than the GWPS (400 mg/L) during monitoring events from 2015 to 2021 (**Table 4-1**). Sulfate concentrations at background wells (07, 08, 08D, 16, and 17) ranged from 48 to 278 mg/L with a median concentration of 120 mg/L. Sulfate concentrations at compliance wells (12, 13, 46, 47, 52, 53, 54, and 55) ranged from 22 to 112 mg/L with a median concentration of 69.0 mg/L.

#### 4.2.4 Total Dissolved Solids

TDS was detected at concentrations greater than the GWPS (1,200 mg/L) at background monitoring well 08 during ten monitoring events and at background monitoring well 08D during 15 monitoring events from 2015 to 2021 (**Table 4-1**). TDS concentrations at monitoring well 08 ranged from 918 to 1,520 mg/L with a median concentration of 1,200 mg/L. TDS concentrations at monitoring well 08D ranged from 954 to 1,340 mg/L with a median concentration of 1,230 mg/L.

#### 4.2.5 pH

Recorded field pH measurements were less than the lower limit GWPS for pH (6.5 standard units [SU]) at background well 07 during one monitoring event in November 2019, at background well 08 during one monitoring event in July 2021, and at background well 08D during three monitoring events occurring from May to July 2021 (**Table 4-1**). Recorded field pH measurements at monitoring well 07 ranged from 6.3 to 7.5 SU with a median pH measurement of 6.9 SU. Recorded field pH measurements at monitoring well 08 ranged from 6.4 to 7.2 SU with a median pH measurement of 6.7 SU. Recorded field pH measurements at monitoring well 08D ranged from 6.32 to 7.1 SU with a median pH measurement of 6.7 SU. No pH measurements were greater than the upper limit GWPS of 9.0 SU.

#### 4.2.6 Cobalt

Cobalt was detected at concentrations greater than the GWPS (0.006 mg/L) at background wells 07, 08, and 08D, and at compliance wells 53 and 55, multiple times during monitoring events from 2015 to 2021 (**Table 4-1**). Cobalt concentrations at background wells (07, 08, 08D, 16, and 17) ranged from non-detect (at a reporting limit of 0.001 mg/L) to 0.147 mg/L with a median concentration of 0.003 mg/L. Cobalt concentrations at compliance wells (12, 13, 46, 47, 52, 53, 54, and 55) ranged from non-detect (at a reporting limit of 0.001 mg/L) to 0.011 mg/L with a median concentration of 0.001 mg/L. Cobalt concentrations in compliance well 55, which is screened in the bedrock confining unit, ranged from non-detect (at a reporting limit of 0.001 mg/L) to 0.007 mg/L with a median concentration of 0.002 mg/L.

### 4.2.7 Lithium

Lithium was detected at concentrations greater than the GWPS (0.04 mg/L) at compliance well 55 during one monitoring event occurring in April 2021 (**Table 4-1**). Lithium concentrations at compliance well 55, which is screened in the bedrock confining unit, ranged from 0.026 to 0.041 mg/L with a median concentration of 0.031 mg/L.

### 4.2.8 Thallium

Thallium was detected at concentrations greater than the GWPS (0.002 mg/L) at background well 08 and compliance well 52 during one monitoring event occurring in August 2021. Thallium concentrations at background well 08 ranged from non-detect (at a reporting limit of 0.001 mg/L) to 0.003 mg/L with a median concentration of 0.002 mg/L. Thallium concentrations at compliance well 52 ranged from non-detect (at a reporting limit of 0.001 mg/L) to 0.0025 mg/L with a median concentration of 0.002 mg/L.

# 5. EVALUATION OF POTENTIAL RECEPTORS

## 5.1 Water Well Survey

A potable water well inventory was completed in 2021 utilizing federal and state databases to assess nearby pumping wells, drinking water receptors, and other uses of water in the vicinity of the EAP. The following sources of information were queried to identify well locations, drinking water receptors, and other uses of water within 1,000 meters of the EAP boundary:

- USGS National Groundwater Monitoring Network (NGWMN)[1]
- ISGS Illinois Water and Related Wells (ILWATER) Map[2]
- USEPA Safe Drinking Water Information System (SDWIS)[3]
- IEPA Illinois Drinking Water Watch (DWW)[4]

As indicated in the USGS NGWMN, the EAP is situated above one or more water bearing units (**Appendix E**) of alluvial and glacial origins. However, the aquifer is not designated as a principal aquifer, which is defined as a regionally extensive aquifer or aquifer system that has the potential to be used as a source of potable water.

A review of the USEPA SDWIS and IEPA DWW databases for drinking water intakes in the vicinity of the EAP yielded no results for public water systems (PWSs) within 1,000 meters of the Site. The PWSs in Putnam County and Bureau County (north of the Site) obtain drinking water from groundwater. Based on approximated locations obtained from SWDIS, the PWS wells are not within 1,000 meters of the EAP.

A comprehensive search of the ILWATER Map identified ten wells, including three co-located wells) within 1,000 meters of the EAP (**Appendix E**). Under normal conditions, three of these wells are located downgradient (Well IDs 121552059800, 121552043500, and 121550012800) from the EAP, two are located side gradient (Well IDs 121552045800 and 121552059900), and the remaining five are located upgradient (Well IDs 121552029200, 121552049700, 121552025800, 121552051800, and 121552068500). The three downgradient wells (Well IDs 121552059800, 121552043500, and 121550012800) and one of the side gradient wells (Well ID 121552059900) are attributed to Illinois Power, now HPP (**Appendix E**).

## 5.2 Surface Water

A comprehensive search was performed utilizing the United States Fish and Wildlife Service (USFWS) Wetlands Mapper[5] and the USGS National Map[6] for surface water bodies within 1,000 meters of the EAP. The predominant surface water bodies near the EAP are the Illinois River, located to the north of the Site, and Lyons Lake, located to the northeast of the Site. Bordering the north perimeter of the EAPS, the river has a normal pool elevation of about 441 feet. A USGS stream gage (No. 05558300) for the Illinois River at Henry, Illinois is located 15 river miles south (downstream) of the HPP. The gage datum elevation is 425.88 feet NGVD29. Daily gage heights

[1] USGS NGWMN: https://cida.usgs.gov/ngwmn/index.jsp
[2] ISGS ILWATER Map: https://prairieresearch.maps.arcgis.com/apps/webappviewer/index.html?id=e06b64ae0c814ef3a4e43a191cb57f87
[3] USEPA SDWIS: https://www.epa.gov/enviro/sdwis-search
[4] IEPA Illinois DWW: http://water.epa.state.il.us/dww/index.jsp
[5] USFWS Wetlands Mapper: https://www.fws.gov/wetlands/data/mapper.html
[6] USGS National Map: https://apps.nationalmap.gov/viewer/

for the periods of January 1, 2016 to August 31, 2021 are shown on the **Figure B** in **Section 3.3.2**. The gage height of 15 feet, representing approximate base flow, occurs at elevation of about 441 NGVD29.

Additional surface water features indicated in the USFWS Wetlands Mapper and USGS National Map include several freshwater emergent wetlands and freshwater forested/shrub wetlands located to the north, northeast and southwest of the EAP and an unnamed stream located to the east of the EAP. A map of wetlands and surface waters in the vicinity of the EAP is presented in **Appendix E**.

The USGS National Map places the EAP within the Depue Lake-Illinois River Watershed (Hydrologic Unit Code [HUC] 071300010804), which is part of the Alforques Creek Illinois River Watershed (HUC 0713000108) and located within the larger Lower Illinois-Senachwine Lake Watershed (HUC 07130001). The HUC watershed location is presented in **Appendix E**.

Based on groundwater elevation contours (**Figure 3-3**), under normal conditions groundwater predominantly flows to the north and northwest, towards the Illinois River. Due to the downgradient location and proximity of the Illinois River to the EAP, the Illinois River is likely to be hydraulically connected to the uppermost aquifer beneath the Hennepin EAP.

## 5.3 Nature Preserves, Historic Sites, Endangered/Threatened Species

A comprehensive search of the Illinois Department of Natural Resources (IDNR) Natural Heritage Database[7] for natural areas and protected areas within 1,000 meters of the Site was performed. No natural or protected areas were identified within 1,000 meters of the EAP.

The IDNR Natural Heritage Database Threatened and Endangered Species by County[8] lists 23 threatened and endangered species as located within Putnam County, including 14 endangered and 9 threatened species. Habitats for endangered or threatened species are identified at the county level only.

Additionally, a search of the IDNR Historic Preservation Division[9] database for historic sites in the vicinity of the Site yielded no results within 1,000 meters of the EAP.

[7] IDNR Natural Heritage Database:
https://www2.illinois.gov/dnr/conservation/NaturalHeritage/Pages/NaturalHeritageDatabase.aspx
[8] Illinois Threatened and Endangered Species by County:
https://www2.illinois.gov/dnr/ESPB/Documents/ET_by_County.pdf
[9] IDNR Historic Preservation Division: https://www2.illinois.gov/dnrhistoric/Pages/default.aspx

# 6. CONCLUSIONS

Hydrogeologic characterization of the HPP was originally developed as part of the *Hydrogeologic Study, Existing Ash Ponds, Hennepin Power Plant* (Mathes, 1983) and most recently updated for the *Hydrogeologic Site Characterization Report* (NRT/OBG, 2017a). Results of these hydrogeologic studies were reintroduced in this HCR and updated to include geologic, hydrogeologic, and groundwater quality data collected with a focus on the EAP (Part 845 regulated) CCR Unit and subject of this HCR.

The data were summarized and evaluated for changes in groundwater conditions since the previous investigations; available groundwater quality data for the EAP was compared to the GWPSs.

The results of the hydrogeologic and groundwater quality evaluation are:

- There are three principal types of unlithified materials above the bedrock in the vicinity of the EAP, these include the following in descending order: fill – predominantly as bottom ash and fly ash; Cahokia Alluvium (alluvial clay, sandy clay, and clayey sand ranging in thickness at the EAP from 9.5 to 14.5 feet); and the Henry Formation (glacial outwash consisting of sands and gravels ranging in thickness at the EAP from 21 to 45 feet). Depth to bedrock at the Site ranges from 399.2 feet NAVD88 at well 18D to 410.2 feet NAVD88 at well 55.
- Two distinct water bearing layers have been identified at the EAP based on stratigraphic relationships and common hydrogeologic characteristics, these include the following in descending order: the uppermost aquifer (unlithified natural geologic materials of the Cahokia Alluvium and Henry Formation extending from the upper saturated zone to the bedrock, predominantly sand and gravels with some sandy clay and clayey sand with a geometric mean horizontal hydraulic conductivity of $8.4 \times 10^{-2}$ cm/s); and the bedrock confining unit (composed of shales with thin limestone, sandstone, and coal beds with a horizontal hydraulic conductivity of $3.7 \times 10^{-5}$ cm/s).
- Groundwater flows from beneath the EAP toward the Illinois River through the uppermost aquifer as the primary pathway for contaminant migration, although temporary flow reversals are observed during periods of high river elevations or flooding. Vertical migration is limited by the underlying Pennsylvanian-age shale bedrock unit which acts as a confining layer. No potential migration pathways have been identified outside of the uppermost aquifer.
- Based on water level elevation measurements, lateral groundwater flow in the shallow unlithified materials is generally from south to north toward the Illinois River. Under high river stage events or flooding, flow direction can be reversed (*i.e.,* groundwater flows in a south to southwest direction) near the river for limited durations. Estimated groundwater velocities in the shallow unlithified materials at the EAP ranged from approximately 0.03 to 10.6 ft/day with an average velocity of 1.7 ft/day. Groundwater flow reversals were observed to the north and west of the EAP most recently in August 2021. Groundwater velocity at the base of the aquifer, as measured in wells 08D and 18D, was on average approximately 0.6 ft/day.
- The flat horizontal groundwater gradient beneath the EAP and the small and inconsistent upward/downward vertical gradients between wells 13 and 55 suggests the EAP and neighboring ponds are not areas of increased recharge or infiltration.
- Groundwater within the uppermost aquifer at the EAP is classified as Class I – Potable Resource Groundwater.
- Potential exceedances of 35 I.A.C. § 845.600 GWPSs were detected in monitoring wells at the EAP are summarized as follows:
  - Chloride – at background uppermost aquifer wells 08 and 08D;

- Cobalt – at background uppermost aquifer wells 07, 08, and 08D; at uppermost aquifer compliance well 53; and at bedrock confining unit compliance well 55;
- Lithium – at bedrock confining unit compliance well 55 in April 2021;
- pH – at background uppermost aquifer wells 07, 08, and 08D;
- Thallium – at background uppermost aquifer well 08; and at compliance uppermost aquifer well 52; and
- TDS – at background uppermost aquifer wells 08 and 08D.

Groundwater results are considered potential exceedances because they were compared directly to the 35 I.A.C. § 845.600 GWPSs and did not include an evaluation of background groundwater quality or apply the statistical methodologies proposed in the GMP.

This HCR satisfies Part 845 content requirements specific to 35 I.A.C. § 845.620(b) (Hydrogeologic Site Characterization) for the EAP at the HPP.

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# TABLES

**TABLE 2-1. GEOTECHNICAL RESULTS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample ID | Field Location ID | Top of Sample (ft bgs) | Bottom of Sample (ft bgs) | Moisture Content (%) | Dry Density (pcf) | Specific Gravity | Calculated Porosity [1] (%) | Vertical Hydraulic Conductivity (cm/s) | LL | PL | PI | Laboratory USCS | Gravel (%) | Sand (%) | Fines (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cahokia Alluvium** | | | | | | | | | | | | | | | |
| MW52-(4-8)-20210211 | 52 | 4 | 8 | 21.4 | 95.0 | 2.675 | 43.1 | 7.1E-08 | 32 | 17 | 15 | CL | 0.7 | 21.0 | 78.3 |
| MW53-(2-6)-20210112 | 53 | 2 | 6 | 13.7 | 120.0 | 2.680 | 28.2 | 2.4E-08 | 29 | 16 | 13 | CL | 9.6 | 39.3 | 51.1 |
| MW55-(15-17.5)-20210210 | 55 | 15 | 17.5 | 14.4 | 109.0 | 2.720 | 35.8 | 1.5E-07 | 32 | 19 | 13 | SC | 12.4 | 39.6 | 48.0 |
| **Henry Formation** | | | | | | | | | | | | | | | |
| MW53-(54-58)-20210112 | 53 | 54 | 58 | 9.9 | -- | -- | -- | -- | -- | -- | -- | -- | 48.9 | 42.8 | 8.3 |
| MW55-(50-52)-20210210 | 55 | 50 | 52 | 8.2 | -- | 2.823 | -- | -- | 21 | 15 | 6 | GC-GM | 60.0 | 23.2 | 16.8 |
| **CCR** | | | | | | | | | | | | | | | |
| XPW01-(10-12)-20210114 | XPW01 | 10 | 12 | 157.0 | -- | 2.635 | -- | -- | -- | -- | -- | -- | 4.0 | 22.2 | 73.8 |
| XPW01-(12-14)-20210114 | XPW01 | 12 | 14 | 42.3 | 71.0 | 2.859 | 60.2 | -- | -- | -- | -- | -- | 14.1 | 71.8 | 14.1 |
| XPW01-(15-17)-20210114 | XPW01 | 15 | 17 | 31.0 | 79.0 | 2.622 | 51.7 | -- | -- | -- | -- | -- | 10.1 | 83.1 | 6.8 |
| XPW02-(14-16)-20210115 | XPW02 | 14 | 16 | 123.3 | 36.0 | 2.615 | 77.9 | 2.9E-04 | NP | NP | NP | ML | 0.0 | 20.8 | 79.2 |
| XPW02-(16-18)-20210115 | XPW02 | 16 | 18 | 113.2 | -- | 2.622 | -- | -- | NP | NP | NP | ML | 0.5 | 22.1 | 77.4 |
| XPW03-(14-16)-20210114 | XPW03 | 14 | 16 | 177.0 | 28.0 | 2.595 | 82.7 | 1.7E-04 | NP | NP | NP | ML | 0.0 | 13.7 | 86.3 |
| XPW03-(18-20)-20210114 | XPW03 | 18 | 20 | 138.8 | 34.0 | 2.585 | 78.9 | 2.0E-04 | NP | NP | NP | ML | 0.0 | 18.6 | 81.4 |

[O: CJC 07/02/21; U: CJC 09/08/21; C: KLT 9/9/21]

**Notes:**
[1] Porosity calculated as relationship of bulk density ($p_b$) to particle density ($p_d$) ($n = 100[1- (p_b/p_d)]$)
bgs = below ground surface
CCR = coal combustion residuals
cm/s = centimeters per second
ft = foot/feet
LL = Liquid Limit
NP = Non-Plastic
pcf = pounds per cubic foot
PI = Plasticity Index
PL = Plastic Limit
-- = data not available
% = percent

**USCS = Unified Soil Classification System**
CL = Lean Clay
GC-GM = Clayey to Silty Gravel
ML = Silt
SC = Clayey Sand

**TABLE 2-2. ASH ANALYTICAL RESULTS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Depth (ft BGS) | Sample Date | Antimony (mg/kg) | Arsenic (mg/kg) | Barium (mg/kg) | Beryllium (mg/kg) | Boron (mg/kg) | Cadmium (mg/kg) | Calcium (mg/kg) | Chromium (mg/kg) | Cobalt (mg/kg) | Lead (mg/kg) | Lithium (mg/kg) | Mercury (mg/kg) | Molybdenum (mg/kg) | Selenium (mg/kg) | Thallium (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| XPW01 | 8-10 | 01/14/2021 | 0.96 | 7.53 | 4150 | 2.12 | 299 | 0.68 | 100000 | 32.7 | 15.4 | 22.5 | 21.6 | 0.129 | 2.86 | 1.17 | <0.2 |
| XPW01 | 14-15 | 01/14/2021 | <0.38 | 2.7 | 2580 | 1.85 | 117 | 0.25 | 71000 | 20.3 | 9.19 | 4.76 | 23.5 | <0.015 | 2.08 | <0.96 | <0.19 |
| XPW02 | 6-8 | 01/15/2021 | <0.75 | 20.9 | 4120 | 2.68 | 600 | 1.28 | 97600 | 49.6 | 18.7 | 32.5 | 26.9 | 2.92 | 9.87 | 11 | 1.43 |
| XPW02 | 16-18 | 01/15/2021 | 0.52 | 6.19 | 4660 | 2.31 | 398 | 0.68 | 124000 | 41 | 19.2 | 22.2 | 22.1 | 0.274 | 3.94 | 1.66 | 0.41 |
| XPW03 | 4-6 | 01/14/2021 | 1.28 | 15.6 | 4200 | 2.38 | 379 | 0.85 | 105000 | 46.8 | 18.6 | 25 | 25 | 0.363 | 6.1 | 4.45 | 0.59 |
| XPW03 | 16-18 | 01/14/2021 | 1.46 | 9.08 | 4140 | 2.2 | 341 | 0.69 | 102000 | 43.6 | 18.5 | 22.7 | 22.2 | 0.094 | 4.43 | 1.45 | 0.48 |

**Notes:**
< = concentration is less than the concentration shown, which corresponds to the reporting limit for the method.
BGS = below ground surface
ft = feet
mg/kg = milligrams per kilogram
generated 10/05/2021, 4:11:24 PM CDT


RAMBOLL

**TABLE 2-3. POREWATER ANALYTICAL RESULTS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Antimony, total (mg/L) | Arsenic, total (mg/L) | Barium, total (mg/L) | Beryllium, total (mg/L) | Boron, total (mg/L) | Cadmium, total (mg/L) | Calcium, total (mg/L) | Chloride, 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) | pH (field) (SU) | Radium 226 and 228 combined (pCi/L) | Selenium, total (mg/L) | Sulfate, total (mg/L) | Thallium, total (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| XPW01 | 02/26/2021 | <0.001 | 0.0067 | 0.148 | <0.001 | 2.56 | <0.001 | 15.3 | 80 | 0.0025 | <0.001 | 0.51 | <0.001 | 0.0208 | <0.0002 | 0.0517 | 11.9 | 0.794 | 0.0033 | 128 | <0.002 |
| XPW01 | 03/22/2021 | <0.001 | 0.0069 | 0.142 | <0.001 | 2.3 | <0.001 | 18.6 | 91 | 0.0021 | <0.001 | 0.45 | <0.001 | 0.0319 | <0.0002 | 0.0506 | 11.3 | 1.09 | 0.0034 | 127 | <0.002 |
| XPW01 | 04/08/2021 | <0.001 | 0.0057 | 0.128 | <0.001 | 2.68 | <0.001 | 30.9 | 93 | <0.0015 | <0.001 | 0.38 | <0.001 | 0.0662 | <0.0002 | 0.0447 | 11.2 | 0.116 | 0.0043 | 159 | <0.002 |
| XPW01 | 05/06/2021 | <0.002 | 0.00436 | 0.132 | <0.001 | 2.15 | <0.001 | 31.1 | 89 | 0.001 | <0.001 | 0.42 | <0.001 | 0.0408 | <0.0002 | 0.0399 | 11.3 | 0.0443 | 0.00375 | 146 | <0.001 |
| XPW01 | 08/03/2021 | <0.001 | 0.0033 | 0.152 | <0.001 | 2.39 | <0.001 | 49.2 | 87 | <0.0015 | <0.001 | 0.32 | <0.001 | 0.087 | <0.0002 | 0.0614 | 11.2 | 1.4 | 0.0057 | 189 | <0.002 |
| XPW02 | 02/25/2021 | <0.001 | 0.0193 | 0.116 | <0.001 | 3.35 | <0.001 | 27.7 | 99 | 0.0042 | <0.001 | 1.85 | <0.001 | 0.0153 | <0.0002 | 0.61 | 12.8 | 0.528 | 0.08 | 632 | <0.002 |
| XPW02 | 03/22/2021 | <0.001 | 0.0063 | 0.561 | <0.001 | 2.87 | <0.001 | 45.9 | 56 | 0.119 | 0.0037 | 1.58 | 0.0051 | 0.0076 | <0.0002 | 0.483 | 12.1 | 0.627 | 0.143 | 306 | <0.002 |
| XPW02 | 04/08/2021 | <0.001 | 0.0102 | 0.132 | <0.001 | 4.21 | <0.001 | 25.4 | 67 | 0.0079 | <0.001 | 1.75 | <0.001 | 0.01 | <0.0002 | 0.532 | 12.2 | 0.687 | 0.152 | 315 | <0.002 |
| XPW02 | 05/06/2021 | <0.002 | 0.0107 | 0.284 | <0.001 | 3.02 | <0.001 | 34.1 | 76 | 0.00464 | 0.00184 | 2.19 | 0.00245 | 0.00947 | 0.00026 | 0.536 | 11.9 | 0.251 | 0.127 | 318 | <0.001 |
| XPW02 | 08/03/2021 | <0.001 | 0.0038 | 0.334 | <0.001 | 3.4 | <0.001 | 38.8 | 54 | 0.0415 | <0.001 | 1.46 | 0.0015 | 0.0057 | <0.0002 | 0.514 | 12.0 | 0.881 | 0.158 | 331 | <0.002 |
| XPW03 | 02/26/2021 | <0.001 | 0.0023 | 0.357 | <0.001 | 2.78 | <0.001 | 125 | 75 | <0.0015 | <0.001 | 0.2 | <0.001 | 0.0396 | <0.0002 | 0.0565 | 12.5 | 0.256 | 0.0061 | 186 | <0.002 |
| XPW03 | 03/22/2021 | <0.001 | 0.0028 | 0.528 | <0.001 | 2.63 | <0.001 | 107 | 69 | 0.0034 | 0.0013 | 0.16 | 0.0016 | 0.0497 | <0.0002 | 0.0571 | 11.6 | 0.519 | 0.0065 | 194 | <0.002 |
| XPW03 | 04/07/2021 | <0.001 | 0.0025 | 0.313 | <0.001 | 3.07 | <0.001 | 97.2 | 71 | <0.0015 | <0.001 | 0.16 | <0.001 | 0.0634 | <0.0002 | 0.0536 | 11.6 | 0.105 | 0.0057 | 192 | <0.002 |
| XPW03 | 05/05/2021 | <0.002 | 0.00228 | 0.358 | <0.001 | 2.77 | <0.001 | 119 | 76 | 0.00155 | <0.001 | 0.16 | <0.001 | 0.049 | <0.0002 | 0.0571 | 11.6 | 0.151 | 0.00706 | 219 | <0.001 |
| XPW03 | 08/03/2021 | <0.001 | 0.0017 | 0.301 | <0.001 | 2.73 | <0.001 | 105 | 74 | <0.0015 | <0.001 | 0.15 | <0.001 | 0.0591 | <0.0002 | 0.057 | 11.4 | 1.3 | 0.0056 | 241 | <0.002 |

**Notes:**
Field readings are reported with as many significant figures as provided by analytical laboratory.
< = concentration is less than the concentration shown, which corresponds to the reporting limit for the method.
mg/L = milligrams per liter
pCi/L = picocuries per liter
SU = standard units

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**TABLE 2-4. SOIL ANALYTICAL RESULTS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Geologic Unit | Sample Depth (ft BGS) | Sample Date | Antimony (mg/kg) | Arsenic (mg/kg) | Barium (mg/kg) | Beryllium (mg/kg) | Boron (mg/kg) | Cadmium (mg/kg) | Calcium (mg/kg) | Chromium (mg/kg) | Cobalt (mg/kg) | Lead (mg/kg) | Lithium (mg/kg) | Mercury (mg/kg) | Molybdenum (mg/kg) | Selenium (mg/kg) | Thallium (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 52 | Cahokia Alluvium | 8-12 | 01/13/2021 | 0.42 | 9.49 | 145 | 0.67 | 6.06 | 1.34 | 24000 | 19.7 | 12.4 | 19.7 | 8.81 | 0.035 | 1.81 | <0.96 | 0.26 |
| 52 | Henry Formation | 49-50 | 02/22/2021 | 0.71 | 4.59 | 52.9 | 0.37 | 7.2 | 1.13 | 247000 | 9.9 | 5.06 | 6.27 | 6.35 | 0.013 | 1.66 | <0.94 | <0.19 |
| 53 | Cahokia Alluvium | 8-10 | 01/12/2021 | 0.39 | 10 | 293 | 1.11 | 5.51 | 0.83 | 6230 | 26.7 | 14.1 | 19.9 | 12.4 | 0.02 | 1.27 | <0.91 | 0.29 |
| 53 | Henry Formation | 50-54 | 01/12/2021 | 1.12 | 21 | 53.1 | 0.87 | 12.9 | 1.33 | 277000 | 10.5 | 14.5 | 14.4 | 7.92 | 0.026 | 8.23 | <0.96 | 0.53 |
| 54 | Cahokia Alluvium | 10-12 | 02/09/2021 | 0.63 | 11.9 | 153 | 0.66 | 17.9 | 1.15 | 55800 | 18.4 | 10.1 | 16.6 | 9.82 | 0.025 | 1.86 | <0.93 | <4.63 |
| 54 | Henry Formation | 53.5-54.5 | 02/09/2021 | 0.87 | 10.9 | 92.8 | 0.56 | 17.6 | 1.65 | 126000 | 18.9 | 9.7 | 19.5 | 8.86 | 0.02 | 5.27 | <0.94 | <4.72 |
| 55 | Cahokia Alluvium | 8-10 | 02/09/2021 | 0.44 | 8.74 | 150 | 0.58 | 18 | 0.57 | 19900 | 17 | 10.2 | 15 | 8.95 | 0.024 | 1.35 | <0.94 | <4.72 |
| 55 | Henry Formation | 55-56 | 02/10/2021 | <0.38 | 5.02 | 98.1 | 0.35 | 8.96 | 1.33 | 254000 | 9.74 | 5.8 | 9.27 | 6.68 | <0.01 | 3.44 | <0.93 | <4.63 |
| 55 | Bedrock | 85-89 | 02/10/2021 | 1.77 | 8.48 | 36.3 | 0.82 | 3.93 | 0.75 | 70400 | 21.5 | 20.5 | 17.9 | 29.9 | 0.018 | 1.59 | <3.92 | <4.9 |

**Notes:**
< = concentration is less than the concentration shown, which corresponds to the reporting limit for the method.
BGS = below ground surface
ft = foot or feet
mg/kg = milligrams per kilogram

generated 10/05/2021, 4:26:43 PM CDT



RAMBOLL

**TABLE 3-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Well Number | HSU | Date Constructed | Top of PVC Elevation (ft) | Measuring Point Elevation (ft) | Measuring Point Description | Ground Elevation (ft) | Screen Top Depth (ft BGS) | Screen Bottom Depth (ft BGS) | Screen Top Elevation (ft) | Screen Bottom Elevation (ft) | Well Depth (ft BGS) | Bottom of Boring Elevation (ft) | Screen Length (ft) | Screen Diameter (inches) | Latitude (Decimal Degrees) | Longitude (Decimal Degrees) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 02 | UA | 11/29/1982 | 492.01 | 492.01 | Top of PVC | 488.50 | 45.00 | 55.00 | 443.54 | 433.54 | 57.00 | 431.50 | 10 | 2 | 41.301321 | -89.309151 |
| 03R | UA | 01/16/2015 | 481.92 | 481.92 | Top of PVC | 479.40 | 42.00 | 52.00 | 437.38 | 427.38 | 52.00 | 427.40 | 10 | 2 | 41.304578 | -89.308691 |
| 04R | UA | 01/13/2015 | 486.60 | 486.60 | Top of PVC | 484.13 | 41.00 | 51.00 | 443.13 | 433.13 | 51.00 | 433.10 | 10 | 2 | 41.305564 | -89.301177 |
| 05R | UA | 01/14/2015 | 488.43 | 488.43 | Top of PVC | 485.60 | 44.00 | 54.00 | 441.60 | 431.60 | 54.00 | 431.60 | 10 | 2 | 41.305163 | -89.305449 |
| 05DR | UA | 01/14/2015 | 488.37 | 488.37 | Top of PVC | 485.70 | 70.00 | 75.00 | 415.70 | 410.70 | 75.00 | 410.70 | 5 | 2 | 41.30516 | -89.305471 |
| 06 | UA | 12/08/1982 | 469.75 | 469.75 | Top of PVC | 467.60 | 28.70 | 38.70 | 438.86 | 428.86 | 40.00 | 427.60 | 10 | 2 | 41.304178 | -89.310285 |
| 07 | UA | 11/15/1984 | 518.27 | 518.27 | Top of PVC | 515.10 | 67.50 | 77.50 | 447.61 | 437.61 | 78.00 | 437.10 | 10 | 2 | 41.297986 | -89.305712 |
| 08 | UA | 11/17/1984 | 501.38 | 501.38 | Top of PVC | 498.70 | 51.50 | 61.50 | 447.24 | 437.24 | 62.00 | 436.70 | 10 | 2 | 41.300698 | -89.3044 |
| 08D | UA | 04/17/2009 | 501.34 | 501.34 | Top of PVC | 498.80 | 83.00 | 88.00 | 415.79 | 410.79 | 90.00 | 408.80 | 5 | 2 | 41.300799 | -89.304522 |
| 10 | UA | 03/28/1995 | 498.03 | 498.03 | Top of PVC | 495.19 | 48.80 | 58.80 | 446.39 | 436.39 | 57.00 | 438.20 | 10 | 2 | 41.302824 | -89.307656 |
| 11 | UA | 03/27/1995 | 498.25 | 498.25 | Top of PVC | 495.35 | 65.30 | 67.30 | 430.05 | 428.05 | 68.00 | 427.30 | 2 | 2 | 41.30282 | -89.307668 |
| 12 | UA | 03/28/1995 | 498.44 | 498.44 | Top of PVC | 495.16 | 49.45 | 59.50 | 445.71 | 435.71 | 60.00 | 435.20 | 10 | 2 | 41.303663 | -89.304304 |
| 13 | UA | 03/01/1995 | 498.47 | 498.47 | Top of PVC | 495.38 | 67.00 | 69.00 | 428.38 | 426.38 | 75.00 | 420.40 | 2 | 2 | 41.303658 | -89.304315 |
| 15 | UA | 03/29/1995 | 496.80 | 496.80 | Top of PVC | 494.23 | 50.65 | 60.70 | 443.58 | 433.58 | 60.00 | 434.20 | 10 | 2 | 41.304388 | -89.301997 |
| 16 | UA | 03/30/1995 | 501.74 | 501.74 | Top of PVC | 500.30 | 56.00 | 66.00 | 444.28 | 434.28 | 68.00 | 432.30 | 10 | 2 | 41.30168 | -89.302861 |
| 17 | UA | 03/30/1995 | 507.13 | 507.13 | Top of PVC | 504.80 | 58.06 | 68.10 | 446.77 | 436.77 | 68.00 | 436.80 | 10 | 2 | 41.3022 | -89.3006 |
| 18S | UA | 04/14/2009 | 487.70 | 487.70 | Top of PVC | 485.59 | 40.00 | 50.00 | 445.59 | 435.59 | 52.00 | 433.60 | 10 | 2 | 41.304939 | -89.3071 |
| 18D | UA | 04/14/2009 | 487.60 | 487.60 | Top of PVC | 485.51 | 71.00 | 76.00 | 414.51 | 409.51 | 78.00 | 407.50 | 5 | 2 | 41.30492 | -89.307093 |
| 19S | UA | 04/16/2009 | 487.26 | 487.26 | Top of PVC | 484.12 | 40.00 | 50.00 | 444.12 | 434.12 | 52.00 | 432.10 | 10 | 2 | 41.30546 | -89.303203 |
| 19D | UA | 04/15/2009 | 487.19 | 487.19 | Top of PVC | 484.09 | 67.00 | 72.00 | 417.09 | 412.09 | 74.00 | 410.10 | 5 | 2 | 41.30546 | -89.303196 |
| 40S | UA | 10/26/2010 | 487.67 | 487.67 | Top of PVC | 484.76 | 40.00 | 50.00 | 444.76 | 434.76 | 50.50 | 434.30 | 10 | 2 | 41.305292 | -89.304363 |
| 45S | UA | 06/29/2015 | 467.48 | 467.48 | Top of PVC | 465.70 | 35.00 | 45.00 | 430.70 | 420.70 | 45.00 | 420.70 | 10 | 2 | 41.303751 | -89.310195 |
| 46 | UA | 08/11/2015 | 498.75 | 498.75 | Top of PVC | 496.44 | 50.00 | 60.00 | 446.44 | 436.44 | 60.00 | 436.40 | 10 | 2 | 41.303953 | -89.303472 |


RAMBOLL

**TABLE 3-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Well Number | HSU | Date Constructed | Top of PVC Elevation (ft) | Measuring Point Elevation (ft) | Measuring Point Description | Ground Elevation (ft) | Screen Top Depth (ft BGS) | Screen Bottom Depth (ft BGS) | Screen Top Elevation (ft) | Screen Bottom Elevation (ft) | Well Depth (ft BGS) | Bottom of Boring Elevation (ft) | Screen Length (ft) | Screen Diameter (inches) | Latitude (Decimal Degrees) | Longitude (Decimal Degrees) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 47 | UA | 08/11/2015 | 502.65 | 502.65 | Top of PVC | 499.07 | 50.00 | 60.00 | 452.13 | 442.13 | 60.00 | 442.10 | 10 | 2 | 41.303301 | -89.305994 |
| 48 | UA | 08/11/2015 | 487.46 | 487.46 | Top of PVC | 485.19 | 44.00 | 54.00 | 441.19 | 431.19 | 54.00 | 431.20 | 10 | 2 | 41.305227 | -89.304931 |
| 52 | UA | 02/11/2021 | 500.93 | 500.93 | Top of PVC | 497.70 | 51.00 | 61.00 | 446.74 | 436.74 | 60.90 | 436.80 | 10 | 2 | 41.302466 | -89.306369 |
| 53 | UA | 01/13/2021 | 502.68 | 502.68 | Top of PVC | 500.00 | 53.80 | 63.80 | 446.21 | 436.21 | 64.11 | 435.90 | 10 | 2 | 41.301693 | -89.305583 |
| 54 | UA | 02/09/2021 | 500.30 | 500.30 | Top of PVC | 497.10 | 65.00 | 75.00 | 432.14 | 422.14 | 74.06 | 423.10 | 10 | 2 | 41.303439 | -89.30522 |
| 55 | BR | 02/10/2021 | 498.46 | 498.46 | Top of PVC | 495.70 | 90.00 | 95.00 | 405.65 | 400.65 | 94.69 | 401.00 | 5 | 2 | 41.303659 | -89.304353 |
| XPW01 | CCR | 01/13/2021 | 500.97 | 500.97 | Top of PVC | 498.19 | 12.30 | 17.30 | 485.89 | 480.89 | 17.30 | 480.90 | 5 | 2 | 41.302603 | -89.305842 |
| XPW02 | CCR | 01/14/2021 | 504.56 | 504.56 | Top of PVC | 501.60 | 13.60 | 18.60 | 488.00 | 483.00 | 18.63 | 483.00 | 5 | 2 | 41.301877 | -89.303723 |
| XPW03 | CCR | 02/08/2021 | 495.17 | 495.17 | Top of PVC | 492.00 | 14.40 | 19.40 | 477.60 | 472.60 | 19.29 | 472.70 | 5 | 2 | 41.303278 | -89.30379 |
| XSG01 | CCR | -- | -- | 493.49 | Staff gauge | -- | -- | -- | -- | -- | -- | -- | -- | -- | 41.302583 | -89.302249 |
| SG02 | SW | -- | -- | -- | Staff gauge | -- | -- | -- | -- | -- | -- | -- | -- | -- | 41.303678 | -89.31531 |

**Notes:**
All elevation data are presented relative to the North American Vertical Datum 1988 (NAVD88), GEOID 12A
-- = data not available
BGS = below ground surface
BR = bedrock
CCR = Coal Combustion Residual
ft = foot or feet
HSU = Hydrostratigraphic Unit
PVC = polyvinyl chloride
SW = surface water
UA = uppermost aquifer

generated 10/05/2021, 4:19:30 PM CDT



RAMBOLL

**TABLE 3-2. VERTICAL HYDRAULIC GRADIENTS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Date | 08 Groundwater Elevation (ft NAVD88) | 08D Groundwater Elevation (ft NAVD88) | Head Change (ft) | Distance Change [1] (ft) | Vertical Hydraulic Gradient [2] (dh/dl) | |
|---|---|---|---|---|---|---|
| | UA | UA | | | | |
| 2/24/2021 | 446.41 | 446.21 | 0.20 | 33.12 | 0.0060 | down |
| 3/18/2021 | 447.50 | 447.34 | 0.16 | 28.95 | 0.0055 | down |
| 4/7/2021 | 447.77 | 447.56 | 0.21 | 28.95 | 0.0073 | down |
| 5/6/2021 | 449.09 | 449.06 | 0.03 | 28.95 | 0.0010 | flat |
| 6/8/2021 | 448.98 | 448.75 | 0.23 | 28.95 | 0.0079 | down |
| 6/24/2021 | 449.26 | 449.31 | -0.05 | 28.95 | -0.0017 | up |
| 7/13/2021 | 451.48 | 451.44 | 0.04 | 28.95 | 0.0014 | flat |
| 8/3/2021 | 449.67 | 449.42 | 0.25 | 28.95 | 0.0086 | down |
| | | | Middle of screen elevation 08 | | | 442.24 |
| | | | Middle of screen elevation 08D | | | 413.29 |

| Date | 12 Groundwater Elevation (ft NAVD88) | 13 Groundwater Elevation (ft NAVD88) | Head Change (ft) | Distance Change [1] (ft) | Vertical Hydraulic Gradient [2] (dh/dl) | |
|---|---|---|---|---|---|---|
| | UA | UA | | | | |
| 2/24/2021 | -- | 446.28 | -- | 13.33 | -- | -- |
| 3/22/2021 | 447.38 | 447.47 | -0.09 | 13.33 | -0.0068 | up |
| 4/7/2021 | 447.60 | 447.61 | -0.01 | 13.33 | -0.0008 | flat |
| 5/5/2021 | 448.78 | 448.77 | 0.01 | 13.33 | 0.0008 | flat |
| 6/8/2021 | 448.68 | 448.69 | -0.01 | 13.33 | -0.0008 | flat |
| 6/23/2021 | 449.15 | 449.18 | -0.03 | 13.33 | -0.0023 | up |
| 7/13/2021 | 451.34 | 451.35 | -0.01 | 13.33 | -0.0008 | flat |
| 8/3/2021 | 449.35 | 449.33 | 0.02 | 13.33 | 0.0015 | down |
| | | | Middle of screen elevation 12 | | | 440.71 |
| | | | Middle of screen elevation 13 | | | 427.38 |

**TABLE 3-2. VERTICAL HYDRAULIC GRADIENTS**

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT

HENNEPIN POWER PLANT

EAST ASH POND

HENNEPIN, ILLINOIS

| Date | 12 Groundwater Elevation (ft NAVD88) | 55 Groundwater Elevation (ft NAVD88) | Head Change (ft) | Distance Change [1] (ft) | Vertical Hydraulic Gradient [2] (dh/dl) | |
|---|---|---|---|---|---|---|
| | UA | UA | | | | |
| 2/24/2021 | -- | 446.52 | -- | 37.56 | -- | -- |
| 3/22/2021 | 447.38 | 447.41 | -0.03 | 37.56 | -0.0008 | flat |
| 4/7/2021 | 447.60 | 447.61 | -0.01 | 37.56 | -0.0003 | flat |
| 5/5/2021 | 448.78 | 446.92 | 1.86 | 37.56 | 0.0495 | down |
| 6/8/2021 | 448.68 | 448.87 | -0.19 | 37.56 | -0.0051 | up |
| 6/23/2021 | 449.15 | 448.91 | 0.24 | 37.56 | 0.0064 | down |
| 7/13/2021 | 451.34 | 450.56 | 0.78 | 37.56 | 0.0208 | down |
| 8/3/2021 | 449.35 | 449.87 | -0.52 | 37.56 | -0.0138 | up |
| | | | Middle of screen elevation 12 | | | 440.71 |
| | | | Middle of screen elevation 55 | | | 403.15 |

| Date | 13 Groundwater Elevation (ft NAVD88) | 55 Groundwater Elevation (ft NAVD88) | Head Change (ft) | Distance Change [1] (ft) | Vertical Hydraulic Gradient [2] (dh/dl) | |
|---|---|---|---|---|---|---|
| | UA | UA | | | | |
| 2/24/2021 | 446.28 | 446.52 | -0.24 | 24.23 | -0.0099 | up |
| 3/22/2021 | 447.47 | 447.41 | 0.06 | 24.23 | 0.0025 | down |
| 4/7/2021 | 447.61 | 447.61 | 0.00 | 24.23 | 0.0000 | flat |
| 5/5/2021 | 448.77 | 446.92 | 1.85 | 24.23 | 0.0764 | down |
| 6/8/2021 | 448.69 | 448.87 | -0.18 | 24.23 | -0.0074 | up |
| 6/23/2021 | 449.18 | 448.91 | 0.27 | 24.23 | 0.0111 | down |
| 7/13/2021 | 451.35 | 450.56 | 0.79 | 24.23 | 0.0326 | down |
| 8/3/2021 | 449.33 | 449.87 | -0.54 | 24.23 | -0.0223 | up |
| | | | Middle of screen elevation 13 | | | 427.38 |
| | | | Middle of screen elevation 55 | | | 403.15 |

[O: CJC 07/02/21; U: CJC 09/08/21; C: KLT 9/9/21]

**Notes:**

[1] Distance change was calculated using the midpoint of the piezometer screen and water table surface. If the water table surface was above the top of the monitoring well screen, then distance change was calculated using the midpoint of both screens.

[2] Vertical gradients between ±0.0015 are considered flat, and typically have less than 0.02 foot difference in groundwater elevation between wells.

-- = data not available

dh = head change

dl = distance change

ft = foot/feet

NAVD88 = North American Vertical Datum of 1988

UA = uppermost aquifer

**TABLE 3-3. FIELD HYDRAULIC CONDUCTIVITIES**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Well ID | Gradient Position | Bottom of Screen Elevation (ft NAVD88) | Screen Length [1] (ft) | Field Identified Screened Material (USCS) | Slug Type | Analysis Method | Falling Head (Slug In) Hydraulic Conductivity (cm/s) | | | Rising Head (Slug Out) Hydraulic Conductivity (cm/s) | | | | Average Hydraulic Conductivity (cm/s) | Minimum Hydraulic Conductivity (cm/s) | Maximum Hydraulic Conductivity (cm/s) | Hydraulic Conductivity Geometric Mean (cm/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | | | | |
| **Uppermost Aquifer** | | | | | | | | | | | | | | | | | |
| 02 [2] | VAR | 433.54 | 10.0 | GP, SP | Solid | Bouwer Rice | 3.2E+00 | -- | -- | 3.1E+00 | -- | -- | -- | 3.2E+00 | 1.6E-03 | 3.2E+00 | 8.4E-02 |
| 07 [2] | U | 437.61 | 10.0 | SP | Solid | Bouwer Rice | 3.5E-02 | -- | -- | 4.0E-02 | -- | -- | -- | 3.8E-02 | | | |
| 08 [2] | U | 437.24 | 10.0 | GP-GM, GP-GC | Pneumatic/Solid | Bouwer Rice | 7.4E-03 | -- | -- | 1.0E-02 | 1.2E-02 | 1.0E-02 | 9.2E-03 | 9.7E-03 | | | |
| 08D [2] | U | 410.79 | 5.0 | CL, GW-GC, SC | Solid | Bouwer Rice | 1.4E-01 | -- | -- | 1.7E-01 | -- | -- | -- | 1.6E-01 | | | |
| 10 [2] | VAR | 436.39 | 10.0 | GW | -- | Estimated | 3.7E-01 | -- | -- | -- | -- | -- | -- | 3.7E-01 | | | |
| 12 [2] | D | 435.71 | 10.0 | GW | Solid | Bouwer Rice | 1.2E-02 | -- | -- | -- | -- | -- | -- | 1.2E-02 | | | |
| 13 [2] | D | 426.38 | 2.0 | GW | Solid | Bouwer Rice | 2.9E-01 | -- | -- | -- | -- | -- | -- | 2.9E-01 | | | |
| 15 [2] | VAR | 433.58 | 10.0 | GW-GM | -- | Estimated | 3.7E-01 | -- | -- | -- | -- | -- | -- | 3.7E-01 | | | |
| 16 [2] | U | 434.28 | 10.0 | GW-GM | Pneumatic/Solid | Bouwer Rice [3] | 1.5E+00 | -- | -- | 6.9E-01 | 4.7E-01 | 1.5E+00 | -- | 1.0E+00 | | | |
| 17 [2] | U | 436.77 | 10.0 | SP | Pneumatic | Bouwer Rice | -- | -- | -- | 2.8E-02 | 2.2E-02 | -- | -- | 2.5E-02 | | | |
| 53 | VAR | 436.21 | 10.0 | GW, SW | Pneumatic | Bouwer-Rice | -- | -- | -- | 2.0E-03 | 1.6E-03 | -- | -- | 1.8E-03 | | | |
| 54 | D | 422.14 | 10.0 | GW-GC | Pneumatic | Springer-Gelhar | -- | -- | -- | 3.4E-01 | 1.8E-01 | -- | -- | 2.6E-01 | | | |
| **Bedrock Confining Unit** | | | | | | | | | | | | | | | | | |
| 55 | D | 400.65 | 5.0 | BR | Solid | Bouwer-Rice | -- | -- | -- | 3.6E-05 | -- | -- | -- | -- | -- | -- | -- |
| **CCR** | | | | | | | | | | | | | | | | | |
| XPW01 | NA | 480.89 | 5.0 | SW | Pneumatic | Bouwer-Rice | -- | -- | -- | 5.1E-02 | 5.2E-02 | -- | -- | 5.2E-02 | 7.7E-03 | 5.2E-02 | 1.9E-02 |
| XPW02 | NA | 483.00 | 5.0 | ML | Pneumatic | Bouwer-Rice | -- | -- | -- | 2.1E-02 | 1.2E-02 | -- | -- | 1.7E-02 | | | |
| XPW03 | NA | 472.60 | 5.0 | ML | Pneumatic | Bouwer-Rice | -- | -- | -- | 8.0E-03 | 7.7E-03 | -- | -- | 7.9E-03 | | | |

[O: CJC 07/02/21; U: CJC 09/08/21; C: KLT 9/9/21]

**Notes:**
[1] All wells are constructed from 2 inch polyvinyl chloride (PVC) with 0.01 inch slotted screens.
[2] Hydraulic conductivities were reported in the *Hydrogeologic Site Characterization Report* (Natural Resource Technology, an OBG Company [NRT/OBG], 2017).
[3] Estimated hydraulic conductivity value reported in NRT/OBG 2017 at well 16 not presented as complete test results are available.
-- = data not available
CCR = coal combustion residuals
cm/s = centimeters per second
D = downgradient
ft = foot/feet
NAVD88 = North American Vertical Datum of 1988
U = upgradient
VAR = variable

**USCS = Unified Soil Classification System**
BR = Bedrock
CL = Lean Clay
GP-GC = Poorly Graded Gravel with Clay and Sand
GP-GM = Poorly Graded Gravel with Silt and Sand
GW = Well Graded Gravel
GW-GC = Well Graded Gravel with Clay and Sand
GW-GM = Well Graded Gravel with Silt and Sand
ML = Silt
SC = Clayey Sand
SP = Poorly Graded Sand
SW = Well Graded Sand

**TABLE 3-4. HORIZONTAL HYDRAULIC GRADIENTS AND GROUNDWATER FLOW VELOCITIES**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

$\mathbf{V = K\,i \;/\; n_e}$

V = Groundwater Velocity [1]
K = Hydraulic Conductivity [2]
i = hydraulic gradient
$n_e$ = Effective Porosity [3]

**West of CCR Unit (53 to 52): Uppermost Aquifer**

Distance between Wells (ft): 355
Hydraulic Conductivity (ft/day): 132
Effective Porosity (%): 27.4 Assumes: gravel and sand

| Date | 53 Groundwater Elevation (ft NAVD88) | 52 Groundwater Elevation (ft NAVD88) | Change in Elevation (ft) | Horizontal Gradient (ft/ft) | Velocity (ft/day) |
|---|---|---|---|---|---|
| 2/24/2021-2/25/2021 | 446.24 | 446.17 | 0.07 | 0.0002 | 0.1 |
| 3/19/2021-3/22/2021 | 447.08 | 447.23 | -0.15 | -0.0004 | -0.2 |
| 4/7/2021 | 446.45 | 447.45 | -1.00 | -0.0028 | -1.4 |
| 5/6/2021 | 448.97 | 448.95 | 0.02 | 0.0001 | 0.03 |
| 6/8/2021 | -- | 448.62 | -- | -- | -- |
| 6/23/2021-6/24/2021 | 449.09 | 449.23 | -0.14 | -0.0004 | -0.2 |
| 7/13/2021 | 451.27 | 451.28 | -0.01 | 0.0000 | 0.0 |
| 8/3/2021 | 449.29 | 449.37 | -0.08 | -0.0002 | -0.1 |
| | | | **Average** | -0.0005 | -0.3 |

**East of CCR Unit (17 to 19S): Uppermost Aquifer**

Distance between Wells (ft): 1386
Hydraulic Conductivity (ft/day): 165
Effective Porosity (%): 20.6 Assumes: gravel, sand, and clay

| Date | 17 Groundwater Elevation (ft NAVD88) | 19S Groundwater Elevation (ft NAVD88) | Change in Elevation (ft) | Horizontal Gradient (ft/ft) | Velocity (ft/day) |
|---|---|---|---|---|---|
| 2/24/2021 | 447.95 | 446.42 | 1.53 | 0.0011 | 0.9 |
| 3/18/2021-3/22/2021 | 448.04 | 447.16 | 0.88 | 0.0006 | 0.5 |
| 4/7/2021 | 450.39 | 447.37 | 3.02 | 0.0022 | 1.8 |
| 5/5/2021-5/6/2021 | 453.68 | 448.44 | 5.24 | 0.0038 | 3.0 |
| 6/8/2021 | 452.59 | 448.37 | 4.22 | 0.0030 | 2.4 |
| 6/23/2021-6/24/2021 | 453.57 | 448.55 | 5.02 | 0.0036 | 2.9 |
| 7/13/2021 | 454.14 | 450.96 | 3.18 | 0.0023 | 1.8 |
| 8/3/2021 | 453.33 | 449.01 | 4.32 | 0.0031 | 2.5 |
| | | | **Average** | 0.0025 | 2.0 |

**TABLE 3-4. HORIZONTAL HYDRAULIC GRADIENTS AND GROUNDWATER FLOW VELOCITIES**

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT

HENNEPIN POWER PLANT

EAST ASH POND

HENNEPIN, ILLINOIS

**North of CCR Unit (54 to 18S): Uppermost Aquifer**

Distance between Wells (ft): 746

Hydraulic Conductivity (ft/day): 498

Effective Porosity (%): 20.4 Assumes: gravel, sand, silt, and clay

| Date | 54 Groundwater Elevation (ft NAVD88) | 18S Groundwater Elevation (ft NAVD88) | Change in Elevation (ft) | Horizontal Gradient (ft/ft) | Velocity (ft/day) |
|---|---|---|---|---|---|
| 2/24/2021 | 446.15 | 446.12 | 0.03 | 0.0000 | 0.1 |
| 3/22/2021 | 447.15 | 447.27 | -0.12 | -0.0002 | -0.4 |
| 4/7/2021 | 446.40 | 447.30 | -0.90 | -0.0012 | -2.9 |
| 5/5/2021 | 448.66 | 448.31 | 0.35 | 0.0005 | 1.1 |
| 6/8/2021 | 448.50 | 448.26 | 0.24 | 0.0003 | 0.8 |
| 6/23/2021-6/25/2021 | 448.99 | 448.90 | 0.09 | 0.0001 | 0.3 |
| 7/13/2021 | -- | 451.05 | -- | -- | -- |
| 8/3/2021 | 449.18 | 448.80 | 0.38 | 0.0005 | 1.2 |
| | | | **Average** | 0.0000 | 0.0 |

**South of CCR Unit (07 to 08): Uppermost Aquifer**

Distance between Wells (ft): 1053

Hydraulic Conductivity (ft/day): 67

Effective Porosity (%): 24.9 Assumes: gravel, sand, and silt

| Date | 07 Groundwater Elevation (ft NAVD88) | 08 Groundwater Elevation (ft NAVD88) | Change in Elevation (ft) | Horizontal Gradient (ft/ft) | Velocity (ft/day) |
|---|---|---|---|---|---|
| 2/24/2021 | 449.54 | 446.41 | 3.13 | 0.0030 | 0.8 |
| 3/18/2021 | 450.09 | 447.50 | 2.59 | 0.0025 | 0.7 |
| 4/7/2021 | 450.15 | 447.77 | 2.38 | 0.0023 | 0.6 |
| 5/5/2021-5/6/2021 | 455.60 | 449.09 | 6.51 | 0.0062 | 1.7 |
| 6/8/2021 | 451.55 | 448.98 | 2.57 | 0.0024 | 0.7 |
| 6/24/2021 | 451.49 | 449.26 | 2.23 | 0.0021 | 0.6 |
| 7/13/2021 | 452.82 | 451.48 | 1.34 | 0.0013 | 0.3 |
| 8/3/2021 | 452.61 | 449.67 | 2.94 | 0.0028 | 0.8 |
| | | | **Average** | 0.0028 | 0.8 |

**TABLE 3-4. HORIZONTAL HYDRAULIC GRADIENTS AND GROUNDWATER FLOW VELOCITIES**

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT

HENNEPIN POWER PLANT

EAST ASH POND

HENNEPIN, ILLINOIS

**Below CCR Unit (16 to 54): Uppermost Aquifer**

Distance between Wells (ft): 910

Hydraulic Conductivity (ft/day): 1843

Effective Porosity (%): 20.6 Assumes: gravel, sand, and clay

| Date | 16 Groundwater Elevation (ft NAVD88) | 54 Groundwater Elevation (ft NAVD88) | Change in Elevation (ft) | Horizontal Gradient (ft/ft) | Velocity (ft/day) |
|---|---|---|---|---|---|
| 2/24/2021 | 446.18 | 446.15 | 0.03 | 0.0000 | 0.3 |
| 3/18/2021-03/22/2021 | 447.24 | 447.15 | 0.09 | 0.0001 | 0.9 |
| 4/7/2021 | 447.48 | 446.40 | 1.08 | 0.0012 | 10.6 |
| 5/5/2021-5/6/2021 | 449.14 | 448.66 | 0.48 | 0.0005 | 4.7 |
| 6/8/2021 | 448.76 | 448.50 | 0.26 | 0.0003 | 2.6 |
| 6/23/2021 | 449.29 | 448.99 | 0.30 | 0.0003 | 3.0 |
| 7/13/2021 | 452.53 | -- | -- | -- | -- |
| 8/3/2021 | 449.47 | 449.18 | 0.29 | 0.0003 | 2.9 |
| | | | **Average** | 0.0004 | 3.6 |

**Base of Aquifer (08D to 18D): Uppermost Aquifer**

Distance between Wells (ft): 1670

Hydraulic Conductivity (ft/day): 350

Effective Porosity (%): 20.6 Assumes: gravel, sand, and clay

| Date | 08D Groundwater Elevation (ft NAVD88) | 18D Groundwater Elevation (ft NAVD88) | Change in Elevation (ft) | Horizontal Gradient (ft/ft) | Velocity (ft/day) |
|---|---|---|---|---|---|
| 2/24/2021 | 446.21 | 446.02 | 0.19 | 0.0001 | 0.2 |
| 03/18/2021-03/22/2021 | 447.34 | 447.18 | 0.16 | 0.0001 | 0.2 |
| 4/7/2021 | 447.56 | 447.11 | 0.45 | 0.0003 | 0.5 |
| 5/5/2021-5/6/2021 | 449.06 | 448.09 | 0.97 | 0.0006 | 1.0 |
| 6/8/2021 | 448.75 | 447.99 | 0.76 | 0.0005 | 0.8 |
| 6/24/2021-6/25/2021 | 449.31 | 448.69 | 0.62 | 0.0004 | 0.6 |
| 7/13/2021 | 451.44 | 450.96 | 0.48 | 0.0003 | 0.5 |
| 8/3/2021 | 449.42 | 448.43 | 0.99 | 0.0006 | 1.0 |
| | | | **Average** | 0.0003 | 0.6 |

[O: CJC 07/02/21; U: CJC 09/08/21; C: KLT 9/10/21]

**TABLE 3-4. HORIZONTAL HYDRAULIC GRADIENTS AND GROUNDWATER FLOW VELOCITIES**

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT

HENNEPIN POWER PLANT

EAST ASH POND

HENNEPIN, ILLINOIS

**Notes:**

[1] A negative groundwater velocity indicates a reversal of groundwater flow from normal conditions.

[2] Hydraulic conductivity values used above are average of the individual wells used in each velocity calculation as reported in the *Hydrogeologic Monitoring Plan* (Natural Resource Technology, an OBG Company [NRT/OBG], 2017) or derived from slug tests completed in February and March 2021 by Geosyntec Consultants, Inc.

[3] Effective porosity used in these calculations was derived from an average between estimated values of 0.20 for silt material, 0.267 for gravel, 0.07 for clay, and 0.28 for sand from Morris, D.A. and A.I. Johnson, 1967. *Summary of hydrologic and physical properties of rock and soil materials as analyzed by the Hydrologic Laboratory of the U.S. Geological Survey,* U.S. Geological Survey Water-Supply Paper 1839-D, 42p. and Heath, R.C., 1983. *Basic ground-water hydrology,* U.S. Geological Survey Water-Supply Paper 2220, 86p. Effective porosity may be as high as maximum total porosity (43.1%) calculated in Table 2-1.

-- = data not available

% = percent

ft= foot/feet

ft/day = feet per day

ft/ft = feet per foot

NAVD88 = North American Vertical Datum of 1988

**TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Location | Sample Date | Antimony, total (mg/L) | Arsenic, total (mg/L) | Barium, total (mg/L) | Beryllium, total (mg/L) | Boron, total (mg/L) | Cadmium, total (mg/L) | Calcium, total (mg/L) | Chloride, 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) | pH (field) (SU) | Radium 226 and 228 combined (pCi/L) | Selenium, total (mg/L) | Sulfate, total (mg/L) | Thallium, total (mg/L) | Total Dissolved Solids (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 35 I.A.C. 845.600 | Lower | 0 | 0 | 0 | 0 | 0 | 0 | -- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6.5 | 0 | 0 | 0 | 0 | 0 |
| | Upper | 0.006 | 0.010 | 2.0 | 0.004 | 2 | 0.005 | -- | 200 | 0.1 | 0.006 | 4.0 | 0.0075 | 0.04 | 0.002 | 0.1 | 9.0 | 5 | 0.05 | 400 | 0.002 | 1200 |
| 07 | 03/19/2015 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.1 | -- | -- | -- | -- | -- |
| 07 | 06/23/2015 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 6.8 | -- | -- | -- | -- | -- |
| 07 | 09/17/2015 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.1 | -- | -- | -- | -- | -- |
| 07 | 12/09/2015 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.0 | -- | -- | -- | -- | -- |
| 07 | 03/10/2016 | <0.001 | <0.001 | 0.104 | <0.001 | 0.0629 | <0.001 | 126 | 51 | <0.001 | <0.001 | 0.1 | <0.001 | 0.0079 | <0.0002 | <0.001 | 6.9 | 0.12 | <0.001 | 70 | <0.001 | 536 |
| 07 | 06/07/2016 | <0.001 | <0.001 | 0.13 | <0.001 | 0.0673 | <0.001 | 154 | 55 | <0.001 | <0.001 | <0.1 | <0.001 | 0.0085 | <0.0002 | <0.001 | 6.6 | 1.09 | 0.0011 | 82 | <0.001 | 758 |
| 07 | 06/08/2016 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 6.6 | -- | -- | -- | -- | -- |
| 07 | 07/29/2016 | <0.001 | <0.001 | 0.111 | <0.001 | 0.0745 | <0.001 | 131 | 48 | <0.001 | <0.001 | <0.1 | <0.001 | 0.009 | <0.0002 | <0.001 | 7.5 | 1.1 | <0.001 | 71 | <0.001 | 632 |
| 07 | 09/01/2016 | <0.001 | <0.001 | 0.13 | <0.001 | 0.0697 | <0.001 | 150 | 49 | <0.001 | <0.001 | 0.1 | <0.001 | 0.0091 | <0.0002 | <0.001 | 6.9 | 0.36 | 0.0014 | 75 | <0.001 | 574 |
| 07 | 12/09/2016 | <0.001 | <0.001 | 0.168 | <0.001 | 0.0939 | <0.001 | 158 | 63 | 0.001 | <0.001 | 0.1 | <0.001 | 0.0084 | <0.0002 | 0.001 | 6.8 | 1.21 | 0.0011 | 82 | <0.001 | 718 |
| 07 | 02/22/2017 | <0.001 | <0.001 | 0.115 | <0.001 | 0.0544 | <0.001 | 137 | 46 | <0.001 | <0.001 | <0.1 | <0.001 | 0.0084 | <0.0002 | <0.001 | 7.0 | 0.67 | <0.001 | 66 | <0.001 | 660 |
| 07 | 04/27/2017 | <0.001 | <0.001 | 0.104 | <0.001 | 0.0588 | <0.001 | 125 | 48 | <0.001 | <0.001 | <0.1 | <0.001 | 0.0088 | <0.0002 | <0.001 | 6.7 | 0.81 | 0.001 | 69 | <0.001 | 630 |
| 07 | 06/08/2017 | <0.001 | <0.001 | 0.101 | <0.001 | 0.0701 | <0.001 | 118 | 56 | <0.001 | <0.001 | 0.1 | <0.001 | 0.0081 | <0.0002 | <0.001 | 6.9 | 0.79 | 0.001 | 75 | <0.001 | 572 |
| 07 | 09/07/2017 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 6.9 | -- | -- | -- | -- | -- |
| 07 | 11/16/2017 | -- | -- | -- | -- | 0.0702 | -- | 136 | 48 | -- | -- | 0.12 | -- | -- | -- | -- | 7.2 | -- | -- | 68 | -- | 658 |
| 07 | 03/27/2018 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 6.8 | -- | -- | -- | -- | -- |
| 07 | 06/14/2018 | <0.001 | <0.001 | 0.106 | <0.001 | 0.0865 | <0.001 | 133 | 50 | <0.0015 | <0.001 | <0.1 | <0.001 | 0.0086 | <0.0002 | <0.0015 | 6.8 | 0.23 | <0.001 | 67 | <0.002 | 644 |
| 07 | 09/13/2018 | -- | -- | 0.136 | -- | 0.0731 | <0.001 | 168 | 44 | <0.0015 | <0.001 | <0.1 | -- | 0.0113 | <0.0002 | <0.0015 | 6.8 | 0.86 | 0.001 | 67 | -- | 684 |
| 07 | 12/13/2018 | -- | -- | -- | -- | 0.079 | -- | 155 | 39 | -- | -- | <0.1 | -- | -- | -- | -- | 7.0 | -- | -- | 60 | -- | 656 |
| 07 | 03/14/2019 | <0.001 | 0.0016 | 0.109 | <0.001 | 0.0869 | <0.001 | 140 | 44 | <0.0015 | <0.001 | <0.1 | <0.001 | 0.0094 | <0.0002 | <0.0015 | 6.9 | 0.59 | <0.001 | 59 | <0.002 | 590 |
| 07 | 06/18/2019 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.0 | -- | -- | -- | -- | -- |
| 07 | 09/18/2019 | -- | <0.001 | 0.114 | -- | 0.0797 | <0.001 | 147 | 33 | -- | <0.001 | 0.11 | <0.001 | 0.0088 | -- | <0.0015 | 6.3 | 0.85 | <0.001 | 55 | -- | 666 |



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**TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Location | Sample Date | Antimony, total (mg/L) | Arsenic, total (mg/L) | Barium, total (mg/L) | Beryllium, total (mg/L) | Boron, total (mg/L) | Cadmium, total (mg/L) | Calcium, total (mg/L) | Chloride, 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) | pH (field) (SU) | Radium 226 and 228 combined (pCi/L) | Selenium, total (mg/L) | Sulfate, total (mg/L) | Thallium, total (mg/L) | Total Dissolved Solids (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 35 I.A.C. 845.600 | Lower | 0 | 0 | 0 | 0 | 0 | 0 | -- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6.5 | 0 | 0 | 0 | 0 | 0 |
| | Upper | 0.006 | 0.010 | 2.0 | 0.004 | 2 | 0.005 | -- | 200 | 0.1 | 0.006 | 4.0 | 0.0075 | 0.04 | 0.002 | 0.1 | 9.0 | 5 | 0.05 | 400 | 0.002 | 1200 |
| 07 | 12/12/2019 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 6.8 | -- | -- | -- | -- | -- |
| 07 | 03/12/2020 | <0.001 | <0.001 | 0.114 | <0.001 | 0.0788 | <0.001 | 148 | 60 | <0.0015 | <0.001 | 0.11 | <0.001 | 0.0081 | <0.0002 | <0.0015 | 6.7 | 1.36 | <0.001 | 53 | <0.002 | 638 |
| 07 | 06/04/2020 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 6.9 | -- | -- | -- | -- | -- |
| 07 | 09/03/2020 | <0.001 | <0.001 | 0.117 | <0.001 | 0.0811 | <0.001 | 146 | 38 | <0.0015 | <0.001 | 0.1 | <0.001 | 0.0086 | <0.0002 | <0.0015 | 6.8 | 0.49 | <0.001 | 67 | <0.002 | 606 |
| 07 | 12/10/2020 | <0.001 | <0.001 | 0.105 | <0.001 | 0.107 | <0.001 | 142 | 83 | <0.0015 | <0.001 | <0.1 | <0.001 | 0.0087 | <0.0002 | <0.0015 | 6.9 | -- | <0.001 | 82 | <0.002 | 612 |
| 07 | 02/24/2021 | <0.001 | <0.001 | 0.139 | <0.001 | 0.0837 | <0.001 | 161 | 57 | <0.0015 | 0.147 | 0.12 | <0.001 | 0.0105 | <0.0002 | <0.0015 | 7.3 | 0.88 | <0.001 | 105 | <0.002 | 764 |
| 07 | 03/18/2021 | <0.001 | <0.001 | 0.133 | <0.001 | 0.0714 | <0.001 | 135 | 58 | <0.0015 | 0.129 | 0.11 | <0.001 | 0.0107 | <0.0002 | <0.0015 | 6.9 | 1.21 | <0.001 | 78 | <0.002 | 712 |
| 07 | 04/07/2021 | <0.001 | <0.001 | 0.123 | <0.001 | 0.0762 | <0.001 | 102 | 42 | <0.0015 | 0.0962 | 0.13 | <0.001 | 0.0096 | <0.0002 | <0.0015 | 6.8 | 0.895 | <0.001 | 72 | <0.002 | 614 |
| 07 | 05/05/2021 | <0.002 | <0.001 | 0.131 | <0.001 | 0.0723 | <0.001 | 118 | 54 | <0.001 | 0.105 | 0.12 | <0.001 | 0.0103 | <0.0002 | 0.00117 | 6.7 | 0.202 | <0.001 | 58 | <0.001 | -- |
| 07 | 06/08/2021 | <0.001 | <0.001 | 0.127 | <0.001 | 0.162 | <0.001 | 121 | 78 | <0.0015 | 0.0542 | 0.12 | <0.001 | 0.0097 | <0.0002 | <0.0015 | 6.7 | 1.73 | <0.001 | 53 | <0.002 | 680 |
| 07 | 06/24/2021 | <0.001 | <0.001 | 0.109 | <0.001 | 0.0728 | <0.001 | 109 | 49 | <0.0015 | 0.0479 | 0.13 | <0.001 | 0.01 | <0.0002 | <0.0015 | 6.8 | 1.72 | <0.001 | 51 | <0.002 | 582 |
| 07 | 07/13/2021 | <0.001 | <0.001 | 0.124 | <0.001 | 0.0617 | <0.001 | 124 | 69 | <0.0015 | 0.0307 | 0.13 | <0.001 | 0.0087 | <0.0002 | <0.0015 | 6.5 | 1.27 | <0.001 | 55 | <0.002 | 652 |
| 07 | 08/03/2021 | <0.001 | <0.001 | 0.11 | <0.001 | 0.069 | <0.001 | 115 | 48 | <0.0015 | 0.0257 | 0.13 | <0.001 | 0.0091 | <0.0002 | <0.0015 | 6.9 | 0.661 | <0.001 | 55 | <0.002 | 608 |
| 08 | 03/19/2015 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 6.9 | -- | -- | -- | -- | -- |
| 08 | 06/22/2015 | -- | <0.001 | 0.136 | -- | 0.141 | <0.002 | 198 | 269 | <0.005 | -- | <0.1 | <0.001 | -- | <0.0002 | <0.01 | 6.7 | -- | 0.0011 | 108 | -- | -- |
| 08 | 09/16/2015 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 6.8 | -- | -- | -- | -- | -- |
| 08 | 12/08/2015 | <0.001 | <0.001 | 0.118 | <0.001 | 0.0972 | <0.001 | 198 | 216 | <0.001 | 0.0029 | <0.1 | <0.001 | 0.01 | <0.0002 | 0.0015 | 6.8 | 0.89 | <0.001 | 164 | <0.001 | 1170 |
| 08 | 03/10/2016 | <0.001 | <0.001 | 0.148 | <0.001 | 0.0878 | <0.001 | 213 | 145 | <0.001 | 0.0017 | <0.1 | <0.001 | 0.0091 | <0.0002 | 0.0016 | 6.7 | 0.72 | <0.001 | 133 | <0.001 | 918 |
| 08 | 06/07/2016 | <0.001 | <0.001 | 0.127 | <0.001 | 0.075 | <0.002 | 191 | 202 | <0.001 | 0.0034 | <0.1 | <0.001 | 0.0092 | <0.0002 | 0.0013 | 6.6 | 0.74 | <0.001 | 129 | <0.001 | 1060 |
| 08 | 09/01/2016 | <0.001 | <0.001 | 0.146 | <0.001 | 0.142 | <0.001 | 299 | 312 | <0.001 | 0.0285 | <0.1 | <0.001 | 0.0127 | <0.0002 | 0.0014 | 6.7 | 0.33 | <0.001 | 209 | <0.001 | 1370 |
| 08 | 12/09/2016 | <0.001 | <0.001 | 0.107 | <0.001 | 0.103 | <0.001 | 244 | 241 | <0.001 | 0.0216 | <0.1 | <0.001 | 0.0095 | <0.0002 | 0.0014 | 6.6 | 0.63 | <0.001 | 198 | <0.001 | 1200 |
| 08 | 02/22/2017 | <0.001 | <0.001 | 0.111 | <0.001 | 0.0873 | <0.001 | 208 | 223 | <0.001 | 0.0139 | <0.1 | <0.001 | 0.0093 | <0.0002 | 0.0014 | 6.9 | 0.85 | <0.001 | 140 | <0.001 | 1160 |



RAMBOLL

**TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Location | Sample Date | Antimony, total (mg/L) | Arsenic, total (mg/L) | Barium, total (mg/L) | Beryllium, total (mg/L) | Boron, total (mg/L) | Cadmium, total (mg/L) | Calcium, total (mg/L) | Chloride, 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) | pH (field) (SU) | Radium 226 and 228 combined (pCi/L) | Selenium, total (mg/L) | Sulfate, total (mg/L) | Thallium, total (mg/L) | Total Dissolved Solids (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 35 I.A.C. 845.600 | Lower | 0 | 0 | 0 | 0 | 0 | 0 | -- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6.5 | 0 | 0 | 0 | 0 | 0 |
| | Upper | 0.006 | 0.010 | 2.0 | 0.004 | 2 | 0.005 | -- | 200 | 0.1 | 0.006 | 4.0 | 0.0075 | 0.04 | 0.002 | 0.1 | 9.0 | 5 | 0.05 | 400 | 0.002 | 1200 |
| 08 | 04/27/2017 | <0.001 | <0.001 | 0.119 | <0.001 | 0.121 | <0.002 | 182 | 300 | <0.001 | 0.0158 | <0.1 | <0.001 | 0.0118 | <0.0002 | 0.0013 | 6.7 | 1.01 | <0.001 | 139 | <0.001 | 1310 |
| 08 | 06/09/2017 | <0.001 | <0.001 | 0.0992 | <0.001 | 0.133 | <0.001 | 152 | 127 | <0.001 | 0.0083 | <0.1 | <0.001 | 0.0094 | <0.0002 | 0.0015 | 6.9 | 0.85 | <0.001 | 134 | <0.001 | 972 |
| 08 | 09/07/2017 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 6.7 | -- | -- | -- | -- | -- |
| 08 | 11/16/2017 | -- | -- | -- | -- | 0.135 | -- | 243 | 277 | -- | -- | 0.1 | -- | -- | -- | -- | 7.0 | -- | -- | 167 | -- | 1370 |
| 08 | 03/27/2018 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 6.7 | -- | -- | -- | -- | -- |
| 08 | 06/14/2018 | <0.001 | <0.001 | 0.119 | <0.001 | 0.168 | <0.002 | 211 | 290 | <0.0015 | 0.0073 | <0.1 | <0.001 | 0.0122 | <0.0002 | <0.0015 | 6.7 | 0.45 | <0.001 | 128 | <0.002 | 1280 |
| 08 | 09/13/2018 | -- | -- | 0.135 | -- | 0.114 | <0.001 | 235 | 241 | <0.0015 | 0.005 | <0.1 | -- | 0.0132 | <0.0002 | <0.0015 | 6.7 | 0.14 | <0.001 | 184 | -- | 1200 |
| 08 | 12/13/2018 | -- | -- | -- | -- | 0.151 | -- | 273 | 288 | -- | -- | 0.11 | -- | -- | -- | -- | 6.8 | -- | -- | 264 | -- | 1520 |
| 08 | 03/14/2019 | <0.001 | 0.0012 | 0.105 | <0.001 | 0.172 | <0.001 | 239 | 272 | <0.0015 | 0.0319 | <0.1 | <0.001 | 0.0158 | <0.0002 | 0.0017 | 6.8 | 0.66 | <0.001 | 193 | <0.002 | 1370 |
| 08 | 06/18/2019 | -- | <0.001 | 0.103 | -- | 0.149 | <0.002 | 225 | 274 | <0.005 | -- | 0.1 | <0.001 | -- | <0.0002 | <0.01 | 6.6 | -- | <0.001 | 167 | -- | -- |
| 08 | 09/18/2019 | -- | <0.001 | 0.0943 | -- | 0.151 | <0.001 | 242 | 220 | -- | 0.0099 | <0.1 | <0.001 | 0.0123 | -- | <0.0015 | 6.6 | 1.39 | <0.001 | 195 | -- | 1360 |
| 08 | 12/12/2019 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 6.6 | -- | -- | -- | -- | -- |
| 08 | 03/12/2020 | <0.001 | <0.001 | 0.0707 | <0.001 | 0.106 | <0.001 | 203 | 209 | <0.0015 | 0.0131 | 0.11 | <0.001 | 0.0098 | <0.0002 | 0.0016 | 6.7 | 1.13 | <0.001 | 197 | <0.002 | 1210 |
| 08 | 06/04/2020 | -- | <0.001 | 0.0795 | -- | 0.13 | <0.002 | 197 | 265 | <0.005 | -- | 0.11 | <0.001 | -- | <0.0002 | <0.01 | 6.7 | -- | <0.001 | 158 | -- | -- |
| 08 | 09/03/2020 | <0.001 | <0.001 | 0.0918 | <0.001 | 0.119 | <0.001 | 202 | 168 | <0.0015 | 0.0047 | <0.1 | <0.001 | 0.0116 | <0.0002 | <0.0015 | 6.7 | 0.88 | <0.001 | 154 | <0.002 | 1010 |
| 08 | 12/10/2020 | <0.001 | <0.001 | 0.0765 | <0.001 | 0.137 | <0.001 | 228 | 209 | <0.0015 | 0.0085 | <0.1 | <0.001 | 0.0112 | <0.0002 | <0.0015 | 6.7 | -- | <0.001 | 278 | <0.002 | 1250 |
| 08 | 02/24/2021 | <0.001 | <0.001 | 0.0773 | <0.001 | 0.132 | <0.001 | 190 | 231 | <0.0015 | 0.0034 | 0.11 | <0.001 | 0.0119 | <0.0002 | <0.0015 | 7.2 | 0.432 | <0.001 | 121 | <0.002 | 1110 |
| 08 | 03/18/2021 | <0.001 | <0.001 | 0.0969 | <0.001 | 0.124 | <0.001 | 215 | 273 | <0.0015 | 0.0045 | <0.1 | <0.001 | 0.013 | <0.0002 | <0.0015 | 6.7 | 0.54 | <0.001 | 128 | <0.002 | 1200 |
| 08 | 04/08/2021 | <0.001 | <0.001 | 0.104 | <0.001 | 0.133 | <0.001 | 221 | 284 | <0.0015 | 0.0063 | 0.1 | <0.001 | 0.0121 | <0.0002 | <0.0015 | 6.6 | 0.0906 | <0.001 | 138 | <0.002 | 1250 |
| 08 | 05/06/2021 | <0.002 | <0.001 | 0.0963 | <0.001 | 0.133 | <0.001 | 206 | 253 | <0.001 | 0.00916 | 0.11 | <0.001 | 0.0112 | <0.0002 | 0.00143 | 6.6 | 0.289 | <0.001 | 137 | <0.001 | 1200 |
| 08 | 06/08/2021 | <0.001 | <0.001 | 0.0905 | <0.001 | 0.181 | <0.001 | 209 | 259 | <0.0015 | 0.0087 | 0.1 | <0.001 | 0.0125 | <0.0002 | <0.0015 | 6.5 | 0.475 | <0.001 | 134 | <0.002 | 1170 |
| 08 | 06/24/2021 | <0.001 | <0.001 | 0.0879 | <0.001 | 0.141 | <0.001 | 204 | 259 | <0.0015 | 0.0106 | 0.11 | <0.001 | 0.015 | <0.0002 | <0.0015 | 6.6 | 0.983 | <0.001 | 120 | <0.002 | 1110 |



RAMBOLL

**TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Location | Sample Date | Antimony, total (mg/L) | Arsenic, total (mg/L) | Barium, total (mg/L) | Beryllium, total (mg/L) | Boron, total (mg/L) | Cadmium, total (mg/L) | Calcium, total (mg/L) | Chloride, 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) | pH (field) (SU) | Radium 226 and 228 combined (pCi/L) | Selenium, total (mg/L) | Sulfate, total (mg/L) | Thallium, total (mg/L) | Total Dissolved Solids (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 35 I.A.C. 845.600 | Lower | 0 | 0 | 0 | 0 | 0 | 0 | -- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6.5 | 0 | 0 | 0 | 0 | 0 |
| | Upper | 0.006 | 0.010 | 2.0 | 0.004 | 2 | 0.005 | -- | 200 | 0.1 | 0.006 | 4.0 | 0.0075 | 0.04 | 0.002 | 0.1 | 9.0 | 5 | 0.05 | 400 | 0.002 | 1200 |
| 08 | 07/13/2021 | <0.001 | <0.001 | 0.0909 | <0.001 | 0.126 | <0.001 | 208 | 253 | <0.0015 | 0.0104 | 0.11 | <0.001 | 0.013 | <0.0002 | <0.0015 | 6.4 | 0.192 | <0.001 | 131 | <0.002 | 1130 |
| 08 | 08/03/2021 | <0.001 | <0.001 | 0.0856 | <0.001 | 0.129 | <0.001 | 195 | 230 | <0.0015 | 0.0072 | <0.1 | <0.001 | 0.0138 | <0.0002 | 0.0015 | 6.6 | 0.179 | <0.001 | 114 | 0.0034 | 1050 |
| 08D | 03/19/2015 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 6.9 | -- | -- | -- | -- | -- |
| 08D | 06/22/2015 | -- | <0.001 | 0.144 | -- | 0.13 | <0.002 | 198 | 236 | <0.005 | -- | 0.11 | <0.001 | -- | <0.0002 | <0.01 | 6.7 | -- | <0.001 | 142 | -- | -- |
| 08D | 09/16/2015 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 6.8 | -- | -- | -- | -- | -- |
| 08D | 12/08/2015 | <0.001 | <0.001 | 0.133 | <0.001 | 0.109 | <0.001 | 174 | 184 | <0.001 | 0.0122 | 0.12 | <0.001 | 0.0121 | <0.0002 | 0.0014 | 6.9 | 0.94 | <0.001 | 119 | <0.001 | 1050 |
| 08D | 03/10/2016 | <0.001 | <0.001 | 0.155 | <0.001 | 0.122 | <0.001 | 187 | 209 | <0.001 | 0.0036 | 0.1 | <0.001 | 0.0143 | <0.0002 | 0.0013 | 6.7 | 0.12 | <0.001 | 130 | <0.001 | 1060 |
| 08D | 06/07/2016 | <0.001 | <0.001 | 0.138 | <0.001 | 0.111 | <0.002 | 177 | 217 | <0.001 | 0.0028 | 0.1 | <0.001 | 0.0108 | <0.0002 | 0.0011 | 6.6 | 0.35 | <0.001 | 113 | <0.001 | 1090 |
| 08D | 09/01/2016 | <0.001 | <0.001 | 0.23 | <0.001 | 0.139 | 0.0011 | 287 | 325 | <0.001 | 0.013 | 0.12 | <0.001 | 0.0164 | <0.0002 | 0.0014 | 6.6 | 0.55 | <0.001 | 161 | <0.001 | 1340 |
| 08D | 12/09/2016 | <0.001 | <0.001 | 0.181 | <0.001 | 0.125 | <0.001 | 233 | 313 | <0.001 | 0.0152 | 0.1 | <0.001 | 0.0131 | <0.0002 | 0.0012 | 6.6 | 0.35 | <0.001 | 164 | <0.001 | 954 |
| 08D | 02/22/2017 | <0.001 | <0.001 | 0.167 | <0.001 | 0.115 | <0.001 | 220 | 262 | <0.001 | 0.0078 | <0.1 | <0.001 | 0.0136 | <0.0002 | 0.0011 | 6.8 | 0.38 | <0.001 | 124 | <0.001 | 1220 |
| 08D | 04/27/2017 | <0.001 | <0.001 | 0.158 | <0.001 | 0.118 | 0.0024 | 175 | 315 | <0.001 | 0.0385 | 0.1 | 0.0015 | 0.0171 | <0.0002 | 0.001 | 6.6 | 1.41 | <0.001 | 119 | <0.001 | 1250 |
| 08D | 06/09/2017 | <0.001 | <0.001 | 0.184 | <0.001 | 0.139 | 0.0011 | 208 | 366 | <0.001 | 0.0162 | <0.1 | <0.001 | 0.0166 | <0.0002 | 0.0017 | 6.8 | 0.94 | <0.001 | 123 | <0.001 | 1320 |
| 08D | 09/07/2017 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 6.8 | -- | -- | -- | -- | -- |
| 08D | 11/16/2017 | -- | -- | -- | -- | 0.122 | -- | 189 | 200 | -- | -- | 0.12 | -- | -- | -- | -- | 7.0 | -- | -- | 157 | -- | 1200 |
| 08D | 03/27/2018 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 6.7 | -- | -- | -- | -- | -- |
| 08D | 06/14/2018 | <0.001 | <0.001 | 0.171 | <0.001 | 0.133 | <0.002 | 204 | 315 | <0.0015 | 0.0136 | 0.12 | <0.001 | 0.0163 | <0.0002 | <0.0015 | 6.8 | 0.22 | <0.001 | 114 | <0.002 | 1310 |
| 08D | 09/13/2018 | -- | -- | 0.22 | -- | 0.0941 | <0.001 | 252 | 269 | 0.0087 | 0.0112 | <0.1 | -- | 0.02 | <0.0002 | 0.0021 | 6.7 | 0.41 | <0.001 | 161 | -- | 1330 |
| 08D | 12/13/2018 | -- | -- | -- | -- | 0.116 | -- | 205 | 251 | -- | -- | 0.11 | -- | -- | -- | -- | 6.8 | -- | -- | 182 | -- | 1320 |
| 08D | 03/14/2019 | <0.001 | 0.0012 | 0.145 | <0.001 | 0.17 | 0.0023 | 184 | 246 | <0.0015 | 0.0157 | 0.12 | 0.0016 | 0.0199 | <0.0002 | 0.0015 | 6.8 | 0.48 | <0.001 | 143 | <0.002 | 1220 |
| 08D | 06/18/2019 | -- | <0.001 | 0.148 | -- | 0.136 | <0.002 | 180 | 232 | <0.005 | -- | 0.13 | 0.0012 | -- | <0.0002 | <0.01 | 6.6 | -- | <0.001 | 134 | -- | -- |
| 08D | 09/18/2019 | -- | <0.001 | 0.143 | -- | 0.117 | <0.001 | 187 | 226 | -- | 0.0057 | 0.12 | <0.001 | 0.0142 | -- | 0.0016 | 6.7 | 0.42 | <0.001 | 121 | -- | 1230 |



RAMBOLL

**TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Location | Sample Date | Antimony, total (mg/L) | Arsenic, total (mg/L) | Barium, total (mg/L) | Beryllium, total (mg/L) | Boron, total (mg/L) | Cadmium, total (mg/L) | Calcium, total (mg/L) | Chloride, 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) | pH (field) (SU) | Radium 226 and 228 combined (pCi/L) | Selenium, total (mg/L) | Sulfate, total (mg/L) | Thallium, total (mg/L) | Total Dissolved Solids (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 35 I.A.C. 845.600 | Lower | 0 | 0 | 0 | 0 | 0 | 0 | -- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6.5 | 0 | 0 | 0 | 0 | 0 |
| | Upper | 0.006 | 0.010 | 2.0 | 0.004 | 2 | 0.005 | -- | 200 | 0.1 | 0.006 | 4.0 | 0.0075 | 0.04 | 0.002 | 0.1 | 9.0 | 5 | 0.05 | 400 | 0.002 | 1200 |
| 08D | 12/12/2019 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 6.7 | -- | -- | -- | -- | -- |
| 08D | 03/12/2020 | <0.001 | <0.001 | 0.127 | <0.001 | 0.115 | <0.001 | 182 | 217 | <0.0015 | 0.0023 | 0.12 | <0.001 | 0.0132 | <0.0002 | <0.0015 | 6.7 | 1.35 | <0.001 | 142 | <0.002 | 1110 |
| 08D | 06/04/2020 | -- | <0.001 | 0.13 | -- | 0.126 | <0.002 | 187 | 246 | <0.005 | -- | 0.13 | 0.0011 | -- | <0.0002 | <0.01 | 6.7 | -- | <0.001 | 179 | -- | -- |
| 08D | 09/03/2020 | <0.001 | <0.001 | 0.131 | <0.001 | 0.0942 | <0.001 | 226 | 222 | <0.0015 | 0.0042 | 0.11 | <0.001 | 0.013 | <0.0002 | <0.0015 | 6.7 | 0.55 | <0.001 | 213 | <0.002 | 1200 |
| 08D | 12/10/2020 | <0.001 | <0.001 | 0.148 | <0.001 | 0.106 | <0.001 | 264 | 260 | <0.0015 | 0.0024 | <0.1 | <0.001 | 0.0137 | <0.0002 | <0.0015 | 6.7 | -- | <0.001 | 183 | <0.002 | 1280 |
| 08D | 02/24/2021 | <0.001 | <0.001 | 0.122 | <0.001 | 0.109 | <0.001 | 227 | 219 | <0.0015 | 0.0025 | 0.11 | <0.001 | 0.0141 | <0.0002 | <0.0015 | 7.1 | 0.0758 | <0.001 | 189 | <0.002 | 1250 |
| 08D | 03/18/2021 | <0.001 | <0.001 | 0.128 | <0.001 | 0.106 | <0.001 | 224 | 243 | <0.0015 | 0.0028 | 0.1 | <0.001 | 0.0141 | <0.0002 | <0.0015 | 6.7 | 1.67 | <0.001 | 199 | <0.002 | 1250 |
| 08D | 04/08/2021 | <0.001 | <0.001 | 0.128 | <0.001 | 0.0979 | <0.001 | 222 | 232 | <0.0015 | 0.0028 | 0.1 | <0.001 | 0.0133 | <0.0002 | <0.0015 | 6.6 | 0.518 | <0.001 | 184 | <0.002 | 1260 |
| 08D | 05/06/2021 | <0.002 | <0.001 | 0.13 | <0.001 | 0.102 | <0.001 | 231 | 291 | <0.001 | 0.00303 | 0.12 | <0.001 | 0.0121 | <0.0002 | 0.00132 | 6.5 | 0.023 | <0.001 | 171 | <0.001 | 1270 |
| 08D | 06/08/2021 | <0.001 | <0.001 | 0.116 | <0.001 | 0.122 | <0.001 | 216 | 238 | <0.0015 | 0.0029 | 0.1 | <0.001 | 0.0127 | <0.0002 | <0.0015 | 6.5 | 0.56 | <0.001 | 173 | <0.002 | 1240 |
| 08D | 06/24/2021 | <0.001 | <0.001 | 0.12 | <0.001 | 0.108 | <0.001 | 219 | 250 | <0.0015 | 0.0037 | 0.12 | <0.001 | 0.0137 | <0.0002 | <0.0015 | 6.5 | 1.11 | <0.001 | 149 | <0.002 | 1130 |
| 08D | 07/13/2021 | <0.001 | <0.001 | 0.11 | <0.001 | 0.0865 | <0.001 | 191 | 252 | <0.0015 | 0.0066 | 0.12 | <0.001 | 0.014 | <0.0002 | <0.0015 | 6.3 | 0.766 | <0.001 | 134 | <0.002 | 1070 |
| 08D | 08/03/2021 | <0.001 | <0.001 | 0.113 | <0.001 | 0.103 | <0.001 | 190 | 244 | <0.0015 | 0.004 | 0.11 | <0.001 | 0.0141 | <0.0002 | <0.0015 | 6.7 | 0.22 | <0.001 | 146 | <0.002 | 1110 |
| 12 | 03/19/2015 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.4 | -- | -- | -- | -- | -- |
| 12 | 06/22/2015 | -- | <0.001 | 0.0731 | -- | 0.715 | <0.002 | 101 | 78 | <0.005 | -- | 0.24 | <0.001 | -- | <0.0002 | 0.0369 | 7.3 | -- | 0.0028 | 99 | -- | -- |
| 12 | 09/17/2015 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.4 | -- | -- | -- | -- | -- |
| 12 | 12/09/2015 | <0.001 | <0.001 | 0.0424 | <0.001 | 0.41 | <0.001 | 71.4 | 73 | <0.001 | <0.001 | 0.24 | <0.001 | 0.0148 | <0.0002 | 0.0401 | 7.7 | 1 | 0.0016 | 71 | <0.001 | 474 |
| 12 | 03/10/2016 | <0.001 | <0.001 | 0.0805 | <0.001 | 0.423 | <0.001 | 95.4 | 80 | <0.001 | <0.001 | 0.23 | <0.001 | 0.0159 | <0.0002 | 0.0324 | 7.1 | 0.266 | 0.0013 | 76 | <0.001 | 568 |
| 12 | 06/08/2016 | <0.001 | <0.001 | 0.0385 | <0.001 | 0.401 | <0.002 | 69.5 | 89 | <0.001 | <0.001 | 0.24 | <0.001 | 0.0129 | <0.0002 | 0.0351 | 7.7 | 1.21 | 0.0011 | 72 | <0.001 | 454 |
| 12 | 08/31/2016 | <0.001 | <0.001 | 0.0407 | <0.001 | 0.247 | <0.001 | 68.1 | 77 | <0.001 | <0.001 | 0.24 | <0.001 | 0.011 | <0.0002 | 0.0329 | 7.6 | 0.6 | 0.0013 | 68 | <0.001 | 450 |
| 12 | 12/09/2016 | <0.001 | <0.001 | 0.047 | <0.001 | 0.274 | <0.001 | 69 | 63 | <0.001 | <0.001 | 0.27 | <0.001 | 0.012 | <0.0002 | 0.0374 | 7.2 | 0.85 | 0.0013 | 58 | <0.001 | 436 |
| 12 | 02/22/2017 | <0.001 | <0.001 | 0.0393 | <0.001 | 0.833 | <0.001 | 67.4 | 68 | <0.001 | <0.001 | 0.19 | <0.001 | 0.018 | <0.0002 | 0.0171 | 7.5 | 0.07 | 0.0024 | 91 | <0.001 | 444 |

**TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Location | Sample Date | Antimony, total (mg/L) | Arsenic, total (mg/L) | Barium, total (mg/L) | Beryllium, total (mg/L) | Boron, total (mg/L) | Cadmium, total (mg/L) | Calcium, total (mg/L) | Chloride, 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) | pH (field) (SU) | Radium 226 and 228 combined (pCi/L) | Selenium, total (mg/L) | Sulfate, total (mg/L) | Thallium, total (mg/L) | Total Dissolved Solids (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 35 I.A.C. 845.600 | Lower | 0 | 0 | 0 | 0 | 0 | 0 | -- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6.5 | 0 | 0 | 0 | 0 | 0 |
| | Upper | 0.006 | 0.010 | 2.0 | 0.004 | 2 | 0.005 | -- | 200 | 0.1 | 0.006 | 4.0 | 0.0075 | 0.04 | 0.002 | 0.1 | 9.0 | 5 | 0.05 | 400 | 0.002 | 1200 |
| 12 | 04/26/2017 | <0.001 | <0.001 | 0.0482 | <0.001 | 0.476 | <0.002 | 64.4 | 73 | <0.001 | <0.001 | 0.27 | <0.001 | 0.0122 | <0.0002 | 0.0374 | 7.3 | 0.46 | 0.0025 | 69 | <0.001 | 430 |
| 12 | 06/09/2017 | <0.001 | <0.001 | 0.0509 | <0.001 | 0.605 | <0.001 | 74.1 | 68 | <0.001 | <0.001 | 0.25 | <0.001 | 0.013 | <0.0002 | 0.0318 | 7.5 | 0.56 | 0.0028 | 76 | <0.001 | 414 |
| 12 | 09/07/2017 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.5 | -- | -- | -- | -- | -- |
| 12 | 11/16/2017 | -- | -- | -- | -- | 0.344 | -- | 69 | 64 | -- | -- | 0.3 | -- | -- | -- | -- | 7.6 | -- | -- | 53 | -- | 460 |
| 12 | 03/26/2018 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.4 | -- | -- | -- | -- | -- |
| 12 | 06/13/2018 | <0.001 | <0.001 | 0.0406 | <0.001 | 0.388 | <0.002 | 66.2 | 78 | <0.0015 | <0.001 | 0.28 | <0.001 | 0.0145 | <0.0002 | 0.0387 | 7.3 | 1.66 | 0.0013 | 65 | <0.002 | 436 |
| 12 | 09/12/2018 | -- | -- | 0.0514 | -- | 0.286 | <0.001 | 79.3 | 89 | 0.0023 | <0.001 | 0.25 | -- | 0.0151 | -- | 0.0408 | 7.4 | 0.62 | 0.0011 | 61 | -- | 474 |
| 12 | 12/13/2018 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.3 | -- | -- | -- | -- | -- |
| 12 | 03/13/2019 | <0.001 | <0.001 | 0.0783 | <0.001 | 0.404 | <0.001 | 105 | 83 | <0.0015 | <0.001 | 0.21 | <0.001 | 0.0165 | <0.0002 | 0.0193 | 7.3 | 0.05 | 0.0021 | 66 | <0.002 | 548 |
| 12 | 06/18/2019 | -- | <0.001 | 0.0763 | -- | 0.93 | <0.002 | 94.3 | 79 | <0.005 | -- | 0.26 | <0.001 | -- | <0.0002 | 0.0206 | 7.2 | -- | 0.0093 | 88 | -- | -- |
| 12 | 09/17/2019 | -- | <0.001 | 0.064 | -- | 0.345 | <0.001 | 83.4 | 66 | -- | <0.001 | 0.28 | <0.001 | 0.0148 | -- | 0.0285 | 7.1 | 0.58 | <0.001 | 58 | -- | 510 |
| 12 | 12/11/2019 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.1 | -- | -- | -- | -- | -- |
| 12 | 03/11/2020 | <0.001 | <0.001 | 0.0774 | <0.001 | 0.493 | <0.001 | 89.6 | 62 | <0.0015 | <0.001 | 0.33 | <0.001 | 0.0141 | <0.0002 | 0.0232 | 7.2 | 0.66 | 0.0013 | 64 | <0.002 | 496 |
| 12 | 06/04/2020 | -- | <0.001 | 0.0767 | -- | 0.858 | <0.002 | 97.2 | 66 | <0.005 | -- | 0.26 | <0.001 | -- | <0.0002 | 0.0237 | 7.2 | -- | 0.0084 | 95 | -- | -- |
| 12 | 09/02/2020 | -- | -- | 0.0609 | -- | 0.402 | -- | 76.2 | 57 | -- | -- | 0.3 | -- | 0.0126 | -- | 0.0322 | 7.4 | 0.63 | <0.001 | 61 | -- | 432 |
| 12 | 12/10/2020 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.3 | -- | -- | -- | -- | -- |
| 12 | 03/18/2021 | <0.001 | <0.001 | 0.0806 | <0.001 | 0.454 | <0.001 | 91.9 | 77 | <0.0015 | <0.001 | 0.25 | <0.001 | 0.0124 | <0.0002 | 0.0254 | 7.2 | 0.231 | 0.0011 | 74 | <0.002 | 540 |
| 12 | 06/23/2021 | <0.001 | <0.001 | 0.0547 | <0.001 | 0.204 | <0.001 | 79.4 | 79 | <0.0015 | <0.001 | 0.28 | <0.001 | 0.0102 | <0.0002 | 0.0288 | 7.2 | -- | <0.001 | 61 | <0.002 | -- |
| 13 | 03/19/2015 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.5 | -- | -- | -- | -- | -- |
| 13 | 06/22/2015 | -- | <0.001 | 0.0457 | -- | 1.14 | <0.002 | 73.4 | 82 | <0.005 | -- | 0.17 | <0.001 | -- | <0.0002 | 0.012 | 7.4 | -- | 0.0019 | 99 | -- | -- |
| 13 | 09/17/2015 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.4 | -- | -- | -- | -- | -- |
| 13 | 12/09/2015 | <0.001 | <0.001 | 0.0431 | <0.001 | 0.86 | <0.001 | 71 | 72 | <0.001 | <0.001 | 0.19 | <0.001 | 0.023 | <0.0002 | 0.0134 | 7.6 | 1 | 0.0014 | 81 | <0.001 | 490 |



RAMBOLL

**TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Location | Sample Date | Antimony, total (mg/L) | Arsenic, total (mg/L) | Barium, total (mg/L) | Beryllium, total (mg/L) | Boron, total (mg/L) | Cadmium, total (mg/L) | Calcium, total (mg/L) | Chloride, 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) | pH (field) (SU) | Radium 226 and 228 combined (pCi/L) | Selenium, total (mg/L) | Sulfate, total (mg/L) | Thallium, total (mg/L) | Total Dissolved Solids (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 35 I.A.C. 845.600 | Lower | 0 | 0 | 0 | 0 | 0 | 0 | -- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6.5 | 0 | 0 | 0 | 0 | 0 |
| | Upper | 0.006 | 0.010 | 2.0 | 0.004 | 2 | 0.005 | -- | 200 | 0.1 | 0.006 | 4.0 | 0.0075 | 0.04 | 0.002 | 0.1 | 9.0 | 5 | 0.05 | 400 | 0.002 | 1200 |
| 13 | 03/10/2016 | <0.001 | <0.001 | 0.0504 | <0.001 | 1.18 | <0.001 | 82.9 | 80 | <0.001 | <0.001 | 0.18 | <0.001 | 0.0238 | <0.0002 | 0.0114 | 7.2 | 0.396 | 0.0028 | 98 | <0.001 | 606 |
| 13 | 06/08/2016 | <0.001 | <0.001 | 0.0429 | <0.001 | 0.997 | <0.002 | 71.5 | 91 | <0.001 | <0.001 | 0.18 | <0.001 | 0.0222 | <0.0002 | 0.014 | 7.6 | 0.73 | 0.0021 | 101 | <0.001 | 508 |
| 13 | 08/31/2016 | <0.001 | <0.001 | 0.0509 | <0.001 | 0.383 | <0.001 | 85.5 | 84 | <0.001 | <0.001 | 0.18 | <0.001 | 0.0157 | <0.0002 | 0.0196 | 7.6 | 0.58 | 0.0014 | 69 | <0.001 | 452 |
| 13 | 12/09/2016 | <0.001 | <0.001 | 0.0351 | <0.001 | 0.634 | <0.001 | 66.7 | 85 | 0.0012 | <0.001 | 0.2 | <0.001 | 0.0165 | <0.0002 | 0.0185 | 7.3 | 0.98 | 0.0011 | 84 | <0.001 | 490 |
| 13 | 02/22/2017 | <0.001 | <0.001 | 0.0556 | <0.001 | 0.303 | <0.001 | 74.5 | 60 | <0.001 | <0.001 | 0.25 | <0.001 | 0.0118 | <0.0002 | 0.0348 | 7.3 | 0.67 | 0.0032 | 59 | <0.001 | 432 |
| 13 | 04/27/2017 | <0.001 | <0.001 | 0.0394 | <0.001 | 1.06 | <0.002 | 63.9 | 72 | <0.001 | <0.001 | 0.2 | <0.001 | 0.0199 | <0.0002 | 0.0165 | 7.3 | 1.24 | 0.0029 | 107 | <0.001 | 528 |
| 13 | 06/09/2017 | <0.001 | <0.001 | 0.0439 | <0.001 | 1.26 | <0.001 | 72.2 | 80 | 0.001 | <0.001 | 0.2 | <0.001 | 0.0201 | <0.0002 | 0.0165 | 7.6 | 0.27 | 0.0038 | 112 | <0.001 | 536 |
| 13 | 09/07/2017 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.5 | -- | -- | -- | -- | -- |
| 13 | 11/16/2017 | -- | -- | -- | -- | 0.758 | -- | 67 | 63 | -- | -- | 0.21 | -- | -- | -- | -- | 7.6 | -- | -- | 69 | -- | 468 |
| 13 | 03/26/2018 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.6 | -- | -- | -- | -- | -- |
| 13 | 06/13/2018 | <0.001 | <0.001 | 0.0401 | <0.001 | 1.32 | <0.002 | 70.7 | 71 | <0.0015 | <0.001 | 0.22 | <0.001 | 0.0232 | <0.0002 | 0.0214 | 7.3 | 0.94 | 0.0024 | 88 | <0.002 | 516 |
| 13 | 09/12/2018 | -- | -- | 0.0466 | -- | 0.484 | <0.001 | 80.9 | 88 | <0.0015 | <0.001 | 0.19 | -- | 0.0244 | -- | 0.024 | 7.4 | 0.2 | 0.0014 | 73 | -- | 482 |
| 13 | 12/13/2018 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.3 | -- | -- | -- | -- | -- |
| 13 | 03/13/2019 | <0.001 | 0.0011 | 0.0529 | <0.001 | 1.41 | <0.001 | 78.4 | 82 | <0.0015 | <0.001 | 0.23 | <0.001 | 0.0281 | <0.0002 | 0.019 | 7.6 | 0.81 | 0.0034 | 95 | <0.002 | 548 |
| 13 | 06/18/2019 | -- | <0.001 | 0.0511 | -- | 1.15 | <0.002 | 86.7 | 77 | <0.005 | -- | 0.25 | <0.001 | -- | <0.0002 | 0.0165 | 7.4 | -- | 0.005 | 99 | -- | -- |
| 13 | 09/17/2019 | -- | <0.001 | 0.0428 | -- | 1.14 | <0.001 | 75.7 | 77 | -- | <0.001 | 0.26 | <0.001 | 0.0207 | -- | 0.0187 | 7.4 | 0 | 0.0022 | 92 | -- | 552 |
| 13 | 12/11/2019 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.3 | -- | -- | -- | -- | -- |
| 13 | 03/11/2020 | <0.001 | <0.001 | 0.0469 | <0.001 | 1.34 | <0.001 | 79.9 | 72 | <0.0015 | <0.001 | 0.3 | <0.001 | 0.025 | <0.0002 | 0.0177 | 7.4 | 0.43 | 0.0033 | 98 | <0.002 | 552 |
| 13 | 06/04/2020 | -- | <0.001 | 0.0478 | -- | 1.07 | <0.002 | 83 | 69 | <0.005 | -- | 0.24 | <0.001 | -- | <0.0002 | 0.0172 | 7.5 | -- | 0.0037 | 105 | -- | -- |
| 13 | 09/02/2020 | -- | -- | 0.0422 | -- | 1 | -- | 71.4 | 64 | -- | -- | 0.24 | -- | 0.0207 | -- | 0.0198 | 7.5 | 0.94 | 0.0019 | 81 | -- | 456 |
| 13 | 12/10/2020 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.4 | -- | -- | -- | -- | -- |
| 13 | 03/18/2021 | <0.001 | <0.001 | 0.0476 | <0.001 | 1.12 | <0.001 | 85 | 79 | <0.0015 | <0.001 | 0.24 | <0.001 | 0.0244 | <0.0002 | 0.0209 | 7.4 | 0.238 | 0.0024 | 96 | <0.002 | 552 |


RAMBOLL

**TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Location | Sample Date | Antimony, total (mg/L) | Arsenic, total (mg/L) | Barium, total (mg/L) | Beryllium, total (mg/L) | Boron, total (mg/L) | Cadmium, total (mg/L) | Calcium, total (mg/L) | Chloride, 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) | pH (field) (SU) | Radium 226 and 228 combined (pCi/L) | Selenium, total (mg/L) | Sulfate, total (mg/L) | Thallium, total (mg/L) | Total Dissolved Solids (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 35 I.A.C. 845.600 | Lower | 0 | 0 | 0 | 0 | 0 | 0 | -- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6.5 | 0 | 0 | 0 | 0 | 0 |
| | Upper | 0.006 | 0.010 | 2.0 | 0.004 | 2 | 0.005 | -- | 200 | 0.1 | 0.006 | 4.0 | 0.0075 | 0.04 | 0.002 | 0.1 | 9.0 | 5 | 0.05 | 400 | 0.002 | 1200 |
| 13 | 06/23/2021 | <0.001 | <0.001 | 0.0435 | <0.001 | 0.3 | <0.001 | 81.9 | 85 | <0.0015 | <0.001 | 0.22 | <0.001 | 0.0149 | <0.0002 | 0.0194 | 7.2 | -- | <0.001 | 66 | <0.002 | -- |
| 16 | 03/19/2015 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.6 | -- | -- | -- | -- | -- |
| 16 | 06/22/2015 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.4 | -- | -- | -- | -- | -- |
| 16 | 09/17/2015 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.4 | -- | -- | -- | -- | -- |
| 16 | 03/14/2019 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.3 | -- | -- | -- | -- | -- |
| 16 | 06/18/2019 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.3 | -- | -- | -- | -- | -- |
| 16 | 09/18/2019 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.1 | -- | -- | -- | -- | -- |
| 16 | 12/12/2019 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.2 | -- | -- | -- | -- | -- |
| 16 | 03/12/2020 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.3 | -- | -- | -- | -- | -- |
| 16 | 06/04/2020 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.6 | -- | -- | -- | -- | -- |
| 16 | 09/03/2020 | <0.001 | <0.001 | 0.084 | <0.001 | 0.116 | <0.001 | 72.9 | 80 | <0.0015 | <0.001 | 0.27 | <0.001 | 0.0072 | <0.0002 | 0.0075 | 7.3 | 1.13 | <0.001 | 66 | <0.002 | 404 |
| 16 | 12/10/2020 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.4 | -- | -- | -- | -- | -- |
| 16 | 02/24/2021 | <0.001 | <0.001 | 0.0779 | <0.001 | 0.125 | <0.001 | 80.9 | 68 | <0.0015 | <0.001 | 0.27 | <0.001 | 0.00695 | <0.0002 | 0.0062 | 7.7 | 0.798 | <0.001 | 58 | <0.002 | 470 |
| 16 | 03/18/2021 | <0.001 | <0.001 | 0.0857 | <0.001 | 0.116 | <0.001 | 88.5 | 68 | <0.0015 | <0.001 | 0.24 | <0.001 | 0.0083 | <0.0002 | 0.0059 | 7.4 | 0.376 | <0.001 | 59 | <0.002 | 532 |
| 16 | 04/08/2021 | <0.001 | <0.001 | 0.0769 | <0.001 | 0.11 | <0.001 | 80.8 | 73 | <0.0015 | <0.001 | 0.24 | <0.001 | 0.0078 | <0.0002 | 0.0064 | 7.2 | 1.73 | <0.001 | 59 | <0.002 | 488 |
| 16 | 05/06/2021 | <0.002 | <0.001 | 0.0646 | <0.001 | 0.112 | <0.001 | 68.4 | 101 | <0.001 | <0.001 | 0.29 | <0.001 | 0.00651 | <0.0002 | 0.0108 | 7.4 | 0.216 | <0.001 | 68 | <0.001 | 446 |
| 16 | 06/08/2021 | <0.001 | <0.001 | 0.0642 | <0.001 | 0.129 | <0.001 | 69.4 | 82 | <0.0015 | <0.001 | 0.28 | <0.001 | 0.0067 | <0.0002 | 0.0106 | 7.1 | 0.00746 | <0.001 | 62 | <0.002 | 442 |
| 16 | 06/23/2021 | <0.001 | <0.001 | 0.069 | <0.001 | 0.109 | <0.001 | 69.6 | 83 | <0.0015 | <0.001 | 0.27 | <0.001 | 0.0069 | <0.0002 | 0.0095 | 7.2 | 0.643 | <0.001 | 60 | <0.002 | -- |
| 16 | 07/13/2021 | <0.001 | <0.001 | 0.0636 | <0.001 | 0.0968 | <0.001 | 65.4 | 62 | <0.0015 | <0.001 | 0.28 | <0.001 | 0.0064 | <0.0002 | 0.0098 | 7.2 | 0.628 | <0.001 | 48 | <0.002 | 360 |
| 16 | 08/03/2021 | <0.001 | <0.001 | 0.0713 | <0.001 | 0.133 | <0.001 | 77.5 | 70 | <0.0015 | <0.001 | 0.24 | <0.001 | 0.0071 | <0.0002 | 0.0075 | 7.1 | 0.167 | <0.001 | 58 | <0.002 | 418 |
| 17 | 03/19/2015 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.8 | -- | -- | -- | -- | -- |
| 17 | 06/22/2015 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.7 | -- | -- | -- | -- | -- |

**TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Location | Sample Date | Antimony, total (mg/L) | Arsenic, total (mg/L) | Barium, total (mg/L) | Beryllium, total (mg/L) | Boron, total (mg/L) | Cadmium, total (mg/L) | Calcium, total (mg/L) | Chloride, 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) | pH (field) (SU) | Radium 226 and 228 combined (pCi/L) | Selenium, total (mg/L) | Sulfate, total (mg/L) | Thallium, total (mg/L) | Total Dissolved Solids (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 35 I.A.C. 845.600 | Lower | 0 | 0 | 0 | 0 | 0 | 0 | -- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6.5 | 0 | 0 | 0 | 0 | 0 |
| | Upper | 0.006 | 0.010 | 2.0 | 0.004 | 2 | 0.005 | -- | 200 | 0.1 | 0.006 | 4.0 | 0.0075 | 0.04 | 0.002 | 0.1 | 9.0 | 5 | 0.05 | 400 | 0.002 | 1200 |
| 17 | 09/17/2015 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.5 | -- | -- | -- | -- | -- |
| 17 | 03/14/2019 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.4 | -- | -- | -- | -- | -- |
| 17 | 06/18/2019 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.2 | -- | -- | -- | -- | -- |
| 17 | 09/18/2019 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.1 | -- | -- | -- | -- | -- |
| 17 | 12/12/2019 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.3 | -- | -- | -- | -- | -- |
| 17 | 03/12/2020 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.4 | -- | -- | -- | -- | -- |
| 17 | 06/04/2020 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.7 | -- | -- | -- | -- | -- |
| 17 | 09/03/2020 | <0.001 | <0.001 | 0.0624 | <0.001 | 0.123 | <0.001 | 56 | 93 | <0.0015 | <0.001 | 0.3 | <0.001 | 0.0066 | <0.0002 | 0.0076 | 7.2 | 0.99 | <0.001 | 70 | <0.002 | 396 |
| 17 | 12/10/2020 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.4 | -- | -- | -- | -- | -- |
| 17 | 02/24/2021 | <0.001 | <0.001 | 0.0931 | <0.001 | 0.137 | <0.001 | 121 | 81 | <0.0015 | <0.001 | 0.22 | <0.001 | 0.00699 | <0.0002 | 0.0056 | 7.6 | 0.382 | <0.001 | 67 | <0.002 | 646 |
| 17 | 03/18/2021 | <0.001 | <0.001 | 0.0896 | <0.001 | 0.121 | <0.001 | 109 | 81 | <0.0015 | <0.001 | 0.18 | <0.001 | 0.0083 | <0.0002 | 0.004 | 7.0 | 0.116 | <0.001 | 63 | <0.002 | 596 |
| 17 | 04/08/2021 | <0.001 | <0.001 | 0.0572 | <0.001 | 0.0688 | <0.001 | 65.2 | 77 | <0.0015 | <0.001 | 0.23 | <0.001 | 0.0052 | <0.0002 | 0.0053 | 7.3 | 0.103 | <0.001 | 56 | <0.002 | 410 |
| 17 | 05/06/2021 | <0.002 | <0.001 | 0.0629 | <0.001 | 0.103 | <0.001 | 65.5 | 116 | <0.001 | <0.001 | 0.32 | <0.001 | <0.005 | <0.0002 | 0.00761 | 7.2 | 0.257 | <0.001 | 65 | <0.001 | 466 |
| 17 | 06/08/2021 | <0.001 | <0.001 | 0.0533 | <0.001 | 0.105 | <0.001 | 63.4 | 78 | <0.0015 | <0.001 | 0.29 | <0.001 | 0.0058 | <0.0002 | 0.0077 | 7.2 | 0.408 | <0.001 | 56 | <0.002 | 416 |
| 17 | 06/23/2021 | <0.001 | <0.001 | 0.0556 | <0.001 | 0.0873 | <0.001 | 65.4 | 80 | <0.0015 | <0.001 | 0.29 | <0.001 | 0.0061 | <0.0002 | 0.0076 | 7.1 | 0.511 | <0.001 | 58 | <0.002 | -- |
| 17 | 07/13/2021 | <0.001 | <0.001 | 0.0531 | <0.001 | 0.0822 | <0.001 | 64.9 | 80 | <0.0015 | <0.001 | 0.29 | <0.001 | 0.0066 | <0.0002 | 0.0075 | 6.9 | 0.0926 | <0.001 | 56 | <0.002 | 388 |
| 17 | 08/03/2021 | <0.001 | <0.001 | 0.0504 | <0.001 | 0.103 | <0.001 | 65 | 79 | <0.0015 | <0.001 | 0.25 | <0.001 | 0.0062 | <0.0002 | 0.0065 | 7.2 | 0.0882 | <0.001 | 57 | <0.002 | 402 |
| 46 | 12/09/2015 | <0.001 | <0.001 | 0.0507 | <0.001 | 0.205 | <0.001 | 73.2 | 72 | <0.001 | <0.001 | 0.24 | <0.001 | 0.0108 | <0.0002 | 0.0389 | 7.6 | 0.16 | <0.001 | 63 | <0.001 | 434 |
| 46 | 03/10/2016 | <0.001 | <0.001 | 0.0562 | <0.001 | 0.312 | <0.001 | 84.5 | 81 | 0.0011 | <0.001 | 0.23 | <0.001 | 0.0119 | <0.0002 | 0.039 | 7.3 | 0.753 | 0.0018 | 76 | <0.001 | 524 |
| 46 | 06/08/2016 | <0.001 | <0.001 | 0.0483 | <0.001 | 0.182 | <0.001 | 71.7 | 91 | <0.001 | <0.001 | 0.23 | <0.001 | 0.0088 | <0.0002 | 0.0314 | 7.6 | 1.05 | <0.001 | 74 | <0.001 | 454 |
| 46 | 08/31/2016 | <0.001 | <0.001 | 0.0642 | <0.001 | 0.264 | <0.001 | 91 | 74 | <0.001 | <0.001 | 0.26 | <0.001 | 0.009 | <0.0002 | 0.0448 | 7.6 | 0.81 | <0.001 | 62 | <0.001 | 450 |
| 46 | 12/08/2016 | <0.001 | <0.001 | 0.0702 | <0.001 | 0.278 | <0.001 | 69 | 63 | 0.0012 | <0.001 | 0.29 | <0.001 | 0.0086 | <0.0002 | 0.0574 | 7.4 | 0.96 | 0.0011 | 59 | <0.001 | 424 |

**TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Location | Sample Date | Antimony, total (mg/L) | Arsenic, total (mg/L) | Barium, total (mg/L) | Beryllium, total (mg/L) | Boron, total (mg/L) | Cadmium, total (mg/L) | Calcium, total (mg/L) | Chloride, 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) | pH (field) (SU) | Radium 226 and 228 combined (pCi/L) | Selenium, total (mg/L) | Sulfate, total (mg/L) | Thallium, total (mg/L) | Total Dissolved Solids (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 35 I.A.C. 845.600 | Lower | 0 | 0 | 0 | 0 | 0 | 0 | -- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6.5 | 0 | 0 | 0 | 0 | 0 |
| | Upper | 0.006 | 0.010 | 2.0 | 0.004 | 2 | 0.005 | -- | 200 | 0.1 | 0.006 | 4.0 | 0.0075 | 0.04 | 0.002 | 0.1 | 9.0 | 5 | 0.05 | 400 | 0.002 | 1200 |
| 46 | 02/22/2017 | <0.001 | <0.001 | 0.0534 | <0.001 | 0.209 | <0.001 | 71.4 | 60 | <0.001 | <0.001 | 0.26 | <0.001 | 0.0102 | <0.0002 | 0.0375 | 7.5 | 0.32 | 0.0014 | 57 | <0.001 | 424 |
| 46 | 04/26/2017 | <0.001 | <0.001 | 0.0499 | <0.001 | 0.203 | <0.001 | 63.2 | 65 | <0.001 | <0.001 | 0.26 | <0.001 | 0.01 | <0.0002 | 0.0334 | 7.1 | 3.21 | 0.0011 | 67 | <0.001 | 398 |
| 46 | 06/09/2017 | <0.001 | <0.001 | 0.0507 | <0.001 | 0.208 | <0.001 | 70 | 69 | <0.001 | <0.001 | 0.25 | <0.001 | 0.0092 | <0.0002 | 0.0315 | 7.6 | 0.15 | 0.0011 | 69 | <0.001 | 426 |
| 46 | 11/16/2017 | -- | -- | -- | -- | 0.191 | -- | 73.3 | 72 | -- | -- | 0.29 | -- | -- | -- | -- | 7.6 | -- | -- | 60 | -- | 420 |
| 46 | 06/13/2018 | <0.001 | <0.001 | 0.0543 | <0.001 | 0.181 | <0.001 | 69.8 | 85 | <0.0015 | <0.001 | 0.26 | <0.001 | 0.0096 | <0.0002 | 0.0299 | 7.4 | 0.04 | <0.001 | 61 | <0.002 | 452 |
| 46 | 09/13/2018 | -- | -- | 0.0566 | -- | 0.247 | <0.001 | 68.9 | 95 | <0.0015 | <0.001 | 0.26 | -- | 0.0115 | -- | 0.0356 | 7.4 | 0.4 | <0.001 | 70 | -- | 466 |
| 46 | 03/14/2019 | <0.001 | <0.001 | 0.0712 | <0.001 | 0.277 | <0.001 | 78.7 | 85 | <0.0015 | <0.001 | 0.25 | <0.001 | 0.0112 | <0.0002 | 0.0302 | 7.3 | 0.31 | 0.0012 | 63 | <0.002 | 472 |
| 46 | 09/17/2019 | -- | <0.001 | 0.0621 | -- | 0.298 | <0.001 | 76.1 | 64 | -- | <0.001 | 0.28 | <0.001 | 0.0113 | -- | 0.0272 | 7.3 | 1.01 | 0.001 | 57 | -- | 468 |
| 46 | 03/11/2020 | <0.001 | <0.001 | 0.0644 | <0.001 | 0.407 | <0.001 | 74.6 | 67 | <0.0015 | <0.001 | 0.32 | <0.001 | 0.0117 | <0.0002 | 0.0271 | 7.4 | 2.51 | 0.001 | 63 | <0.002 | 468 |
| 46 | 09/03/2020 | -- | -- | 0.0653 | -- | 0.289 | -- | 77.7 | 58 | -- | -- | 0.27 | -- | 0.0117 | -- | 0.0254 | 7.0 | 0.72 | <0.001 | 58 | -- | 436 |
| 46 | 03/18/2021 | <0.001 | <0.001 | 0.0728 | <0.001 | 0.254 | <0.001 | 80.7 | 69 | <0.0015 | <0.001 | 0.26 | <0.001 | 0.0112 | <0.0002 | 0.0258 | 7.3 | 0.48 | 0.0011 | 63 | <0.002 | 486 |
| 47 | 12/09/2015 | <0.001 | <0.001 | 0.0736 | <0.001 | 0.219 | <0.001 | 89.2 | 70 | <0.001 | <0.001 | 0.4 | <0.001 | 0.0085 | <0.0002 | 0.0617 | 7.2 | 1 | <0.001 | 63 | <0.001 | 394 |
| 47 | 03/10/2016 | <0.001 | <0.001 | 0.0714 | <0.001 | 0.208 | <0.001 | 92.3 | 89 | <0.001 | <0.001 | 0.35 | <0.001 | 0.0069 | <0.0002 | 0.0618 | 7.2 | 0.465 | <0.001 | 71 | <0.001 | 544 |
| 47 | 06/08/2016 | <0.001 | <0.001 | 0.0904 | <0.001 | 0.539 | <0.001 | 112 | 88 | <0.001 | 0.0023 | 0.4 | <0.001 | 0.0132 | <0.0002 | 0.0681 | 6.9 | 1.34 | <0.001 | 96 | <0.001 | 520 |
| 47 | 09/01/2016 | <0.001 | <0.001 | 0.0877 | <0.001 | 0.459 | <0.001 | 114 | 86 | <0.001 | <0.001 | 0.38 | <0.001 | 0.0101 | <0.0002 | 0.0557 | 7.3 | 0.63 | <0.001 | 86 | <0.001 | 546 |
| 47 | 12/09/2016 | <0.001 | <0.001 | 0.0635 | <0.001 | 0.167 | <0.001 | 85.3 | 63 | <0.001 | <0.001 | 0.38 | <0.001 | 0.0081 | <0.0002 | 0.0491 | 7.1 | 0.13 | <0.001 | 59 | <0.001 | 440 |
| 47 | 02/22/2017 | <0.001 | <0.001 | 0.0707 | <0.001 | 0.163 | <0.001 | 81.4 | 61 | <0.001 | <0.001 | 0.33 | <0.001 | 0.0066 | <0.0002 | 0.0449 | 7.2 | 0.35 | <0.001 | 58 | <0.001 | 406 |
| 47 | 04/26/2017 | <0.001 | <0.001 | 0.073 | <0.001 | 0.491 | <0.001 | 76.7 | 73 | <0.001 | 0.0013 | 0.37 | <0.001 | 0.0089 | <0.0002 | 0.0471 | 6.9 | 0.69 | <0.001 | 83 | <0.001 | 492 |
| 47 | 06/09/2017 | <0.001 | <0.001 | 0.0717 | <0.001 | 0.335 | <0.001 | 84.3 | 79 | <0.001 | 0.0047 | 0.4 | <0.001 | 0.0093 | <0.0002 | 0.0512 | 7.4 | 0.37 | <0.001 | 64 | <0.001 | 462 |
| 47 | 11/16/2017 | -- | -- | -- | -- | 0.183 | -- | 96.5 | 73 | -- | -- | 0.34 | -- | -- | -- | -- | 7.1 | -- | -- | 65 | -- | 442 |
| 47 | 06/13/2018 | <0.001 | <0.001 | 0.0811 | <0.001 | 0.714 | <0.001 | 90.8 | 76 | <0.0015 | 0.002 | 0.35 | <0.001 | 0.0116 | <0.0002 | 0.0406 | 6.7 | 0.23 | <0.001 | 81 | <0.002 | 552 |
| 47 | 09/12/2018 | -- | -- | 0.107 | -- | 0.174 | <0.001 | 111 | 87 | <0.0015 | <0.001 | 0.29 | -- | 0.0146 | -- | 0.0436 | 7.0 | 0.11 | <0.001 | 73 | -- | 530 |

**TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Location | Sample Date | Antimony, total (mg/L) | Arsenic, total (mg/L) | Barium, total (mg/L) | Beryllium, total (mg/L) | Boron, total (mg/L) | Cadmium, total (mg/L) | Calcium, total (mg/L) | Chloride, 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) | pH (field) (SU) | Radium 226 and 228 combined (pCi/L) | Selenium, total (mg/L) | Sulfate, total (mg/L) | Thallium, total (mg/L) | Total Dissolved Solids (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 35 I.A.C. 845.600 | Lower | 0 | 0 | 0 | 0 | 0 | 0 | -- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6.5 | 0 | 0 | 0 | 0 | 0 |
| | Upper | 0.006 | 0.010 | 2.0 | 0.004 | 2 | 0.005 | -- | 200 | 0.1 | 0.006 | 4.0 | 0.0075 | 0.04 | 0.002 | 0.1 | 9.0 | 5 | 0.05 | 400 | 0.002 | 1200 |
| 47 | 03/14/2019 | <0.001 | 0.001 | 0.087 | <0.001 | 0.309 | <0.001 | 96.6 | 78 | <0.0015 | <0.001 | 0.31 | <0.001 | 0.0101 | <0.0002 | 0.0387 | 7.1 | 0.18 | <0.001 | 63 | <0.002 | 502 |
| 47 | 09/17/2019 | -- | <0.001 | 0.0871 | -- | 0.156 | <0.001 | 99 | 71 | -- | <0.001 | 0.31 | <0.001 | 0.0095 | -- | 0.0287 | 7.0 | 0.33 | <0.001 | 54 | -- | 520 |
| 47 | 03/11/2020 | <0.001 | <0.001 | 0.0821 | <0.001 | 0.19 | <0.001 | 90.5 | 63 | <0.0015 | <0.001 | 0.37 | <0.001 | 0.0089 | <0.0002 | 0.0308 | 7.2 | 1.11 | <0.001 | 53 | <0.002 | 462 |
| 47 | 09/02/2020 | -- | -- | 0.0932 | -- | 0.158 | -- | 94.1 | 69 | -- | -- | 0.29 | -- | 0.0083 | -- | 0.0245 | 7.1 | 0.39 | -- | 51 | -- | 478 |
| 47 | 03/18/2021 | <0.001 | <0.001 | 0.0939 | <0.001 | 0.15 | <0.001 | 98.1 | 85 | <0.0015 | <0.001 | 0.27 | <0.001 | 0.0091 | <0.0002 | 0.0271 | 7.2 | 0.418 | <0.001 | 66 | <0.002 | 548 |
| 52 | 02/24/2021 | <0.001 | <0.001 | 0.0845 | <0.001 | 0.155 | <0.001 | 85.9 | 77 | <0.0015 | 0.001 | 0.31 | <0.001 | 0.00787 | <0.0002 | 0.0095 | 7.7 | 1.02 | <0.001 | 75 | <0.002 | 500 |
| 52 | 03/22/2021 | <0.001 | <0.001 | 0.093 | <0.001 | 0.211 | <0.001 | 88.1 | 75 | <0.0015 | <0.001 | 0.29 | <0.001 | 0.0085 | <0.0002 | 0.009 | 7.2 | 0.596 | <0.001 | 63 | <0.002 | 518 |
| 52 | 04/07/2021 | <0.001 | <0.001 | 0.0873 | <0.001 | 0.226 | <0.001 | 88.7 | 69 | <0.0015 | <0.001 | 0.3 | <0.001 | 0.0097 | <0.0002 | 0.0087 | 7.2 | 0.499 | <0.001 | 63 | <0.002 | 506 |
| 52 | 05/06/2021 | <0.002 | <0.001 | 0.0719 | <0.001 | 0.153 | <0.001 | 76.5 | 109 | <0.001 | <0.001 | 0.29 | <0.001 | 0.0051 | <0.0002 | 0.011 | 7.2 | 0.115 | <0.001 | 64 | <0.001 | 472 |
| 52 | 06/08/2021 | <0.001 | <0.001 | 0.0649 | <0.001 | 0.119 | <0.001 | 71 | 82 | <0.0015 | <0.001 | 0.32 | <0.001 | 0.0063 | <0.0002 | 0.0139 | 7.1 | 0.682 | <0.001 | 65 | <0.002 | 416 |
| 52 | 06/24/2021 | <0.001 | <0.001 | 0.0709 | <0.001 | 0.118 | <0.001 | 72 | 77 | <0.0015 | <0.001 | 0.34 | <0.001 | 0.0078 | <0.0002 | 0.0153 | 7.3 | 1.77 | <0.001 | 58 | <0.002 | -- |
| 52 | 07/13/2021 | <0.001 | <0.001 | 0.0666 | <0.001 | 0.121 | <0.001 | 67.7 | 73 | <0.0015 | <0.001 | 0.34 | <0.001 | 0.0061 | <0.0002 | 0.0143 | 6.8 | 0.732 | <0.001 | 57 | <0.002 | 372 |
| 52 | 08/03/2021 | <0.001 | <0.001 | 0.081 | <0.001 | 0.133 | <0.001 | 84.5 | 66 | <0.0015 | <0.001 | 0.28 | <0.001 | 0.0078 | <0.0002 | 0.0114 | 7.0 | 0.661 | <0.001 | 54 | 0.0025 | 442 |
| 53 | 02/25/2021 | <0.001 | <0.001 | 0.106 | <0.001 | 0.142 | 0.0019 | 109 | 114 | <0.0015 | 0.011 | 0.28 | 0.0036 | 0.0234 | <0.0002 | 0.006 | 7.1 | 0.338 | <0.001 | 76 | <0.002 | 640 |
| 53 | 03/19/2021 | <0.001 | <0.001 | 0.102 | <0.001 | 0.135 | 0.0016 | 105 | 102 | <0.0015 | 0.0074 | 0.26 | 0.0029 | 0.0193 | <0.0002 | 0.0059 | 7.0 | 0.484 | <0.001 | 70 | <0.002 | 622 |
| 53 | 04/08/2021 | <0.001 | <0.001 | 0.104 | <0.001 | 0.173 | 0.0017 | 105 | 99 | <0.0015 | 0.0113 | 0.25 | 0.0029 | 0.0256 | <0.0002 | 0.0052 | 6.9 | 0.132 | <0.001 | 72 | <0.002 | 644 |
| 53 | 05/06/2021 | <0.002 | <0.001 | 0.0547 | <0.001 | 0.104 | <0.001 | 78.6 | 112 | <0.001 | <0.001 | 0.3 | <0.001 | 0.0057 | <0.0002 | 0.00708 | 7.2 | 0 | <0.001 | 64 | <0.001 | 490 |
| 54 | 02/24/2021 | <0.001 | <0.001 | 0.0766 | <0.001 | 0.893 | <0.001 | 97.3 | 84 | <0.0015 | 0.0018 | 0.41 | <0.001 | 0.017 | <0.0002 | 0.0309 | 7.9 | 0.222 | <0.001 | 83 | <0.002 | 542 |
| 54 | 03/22/2021 | <0.001 | <0.001 | 0.0708 | <0.001 | 0.682 | <0.001 | 91.8 | 88 | <0.0015 | <0.001 | 0.37 | <0.001 | 0.0154 | <0.0002 | 0.03 | 7.2 | 0.333 | <0.001 | 70 | <0.002 | 544 |
| 54 | 04/07/2021 | <0.001 | <0.001 | 0.0672 | <0.001 | 0.753 | <0.001 | 91.3 | 88 | <0.0015 | 0.0011 | 0.37 | <0.001 | 0.0193 | <0.0002 | 0.0284 | 7.2 | 0.135 | <0.001 | 70 | <0.002 | 510 |
| 54 | 05/05/2021 | <0.002 | <0.001 | 0.0694 | <0.001 | 1.09 | <0.001 | 94.6 | 77 | <0.001 | <0.001 | 0.34 | <0.001 | 0.0151 | <0.0002 | 0.0235 | 7.0 | 0.173 | <0.001 | 104 | <0.001 | -- |
| 54 | 06/08/2021 | <0.001 | <0.001 | 0.0619 | <0.001 | 1.03 | <0.001 | 92.3 | 84 | <0.0015 | <0.001 | 0.32 | <0.001 | 0.0172 | <0.0002 | 0.0178 | 6.8 | 0.447 | 0.0017 | 107 | <0.002 | 528 |

**TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Location | Sample Date | Antimony, total (mg/L) | Arsenic, total (mg/L) | Barium, total (mg/L) | Beryllium, total (mg/L) | Boron, total (mg/L) | Cadmium, total (mg/L) | Calcium, total (mg/L) | Chloride, 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) | pH (field) (SU) | Radium 226 and 228 combined (pCi/L) | Selenium, total (mg/L) | Sulfate, total (mg/L) | Thallium, total (mg/L) | Total Dissolved Solids (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 35 I.A.C. 845.600 | Lower | 0 | 0 | 0 | 0 | 0 | 0 | -- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6.5 | 0 | 0 | 0 | 0 | 0 |
| | Upper | 0.006 | 0.010 | 2.0 | 0.004 | 2 | 0.005 | -- | 200 | 0.1 | 0.006 | 4.0 | 0.0075 | 0.04 | 0.002 | 0.1 | 9.0 | 5 | 0.05 | 400 | 0.002 | 1200 |
| 54 | 06/23/2021 | <0.001 | <0.001 | 0.0578 | <0.001 | 0.859 | <0.001 | 86.4 | 76 | <0.0015 | <0.001 | 0.33 | <0.001 | 0.0163 | <0.0002 | 0.0196 | 7.2 | 1.35 | 0.0016 | 90 | <0.002 | -- |
| 54 | 07/13/2021 | <0.001 | <0.001 | 0.0578 | <0.001 | 0.678 | <0.001 | 87.2 | 85 | <0.0015 | <0.001 | 0.34 | <0.001 | 0.0138 | <0.0002 | 0.0189 | 7.0 | 0.204 | 0.0017 | 78 | <0.002 | 484 |
| 54 | 08/03/2021 | <0.001 | <0.001 | 0.0513 | <0.001 | 0.595 | <0.001 | 86.7 | 84 | <0.0015 | <0.001 | 0.32 | <0.001 | 0.0133 | <0.0002 | 0.0189 | 7.1 | 0.353 | 0.0012 | 89 | <0.002 | 482 |
| 55 | 02/25/2021 | <0.001 | 0.0025 | 0.101 | <0.001 | 0.49 | <0.001 | 90 | 133 | 0.019 | 0.0071 | 0.26 | 0.003 | 0.0369 | <0.0002 | 0.0035 | 7.5 | 0.488 | <0.001 | 33 | <0.002 | 596 |
| 55 | 03/22/2021 | <0.001 | 0.0016 | 0.107 | <0.001 | 0.469 | <0.001 | 82.9 | 143 | 0.007 | 0.0028 | 0.26 | 0.0013 | 0.0304 | <0.0002 | 0.0071 | 7.2 | 1.67 | <0.001 | 32 | <0.002 | 602 |
| 55 | 04/07/2021 | <0.001 | 0.0013 | 0.101 | <0.001 | 0.729 | <0.001 | 81.6 | 142 | 0.0037 | 0.0016 | 0.25 | <0.001 | 0.0414 | <0.0002 | 0.0058 | 7.1 | 0.17 | <0.001 | 32 | <0.002 | 598 |
| 55 | 05/05/2021 | <0.002 | <0.001 | 0.178 | <0.001 | 0.559 | <0.001 | 79.4 | 139 | 0.00253 | <0.001 | 0.27 | <0.001 | 0.026 | <0.0002 | 0.0074 | 7.2 | 1.04 | <0.001 | 29 | <0.001 | -- |
| 55 | 08/03/2021 | <0.001 | <0.001 | 0.19 | <0.001 | 0.455 | <0.001 | 75.1 | 146 | 0.0018 | <0.001 | 0.29 | <0.001 | 0.0313 | <0.0002 | 0.0115 | 7.2 | 1.74 | <0.001 | 22 | <0.002 | 558 |

**Notes:**
Detected at concentration greater than the GWPS
-- = data not available
GWPS = Groundwater Protection Standard
mg/L = milligrams per liter
pCi/L = picocuries per liter
SU = 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 they are not utilized in statistics to determine exceedances above Part 845 standards.
35 I.A.C. 845.600 = Residuals in Surface Impoundments: Title 35 of the Illinois Administrative Code § 845

**TABLE 4-2. GROUNDWATER FIELD PARAMETERS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Dissolved Oxygen (mg/L) | Oxidation Reduction Potential (mV) | pH (field) (SU) | Specific Conductance (micromhos/cm) | Temperature (deg. C) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|
| 07 | 03/19/2015 | -- | -- | 7.1 | 769 | 11.3 | -- |
| 07 | 06/23/2015 | -- | -- | 6.8 | 959 | 12.1 | -- |
| 07 | 09/17/2015 | -- | -- | 7.1 | 710 | 13.0 | -- |
| 07 | 12/09/2015 | -- | -- | 7.0 | 1160 | 12.3 | -- |
| 07 | 03/10/2016 | 1.18 | 201 | 6.9 | 668 | 10.9 | <1 |
| 07 | 06/07/2016 | 3.48 | 191 | 6.6 | 785 | 11.3 | <1 |
| 07 | 06/08/2016 | -- | -- | 6.6 | 785 | 11.3 | -- |
| 07 | 07/29/2016 | 3.10 | 124 | 7.5 | 778 | 13.0 | <1 |
| 07 | 09/01/2016 | 3.90 | 258 | 6.9 | 805 | 12.6 | <1 |
| 07 | 12/09/2016 | 6.01 | 291 | 6.8 | 1050 | 9.9 | 3 |
| 07 | 02/22/2017 | 1.81 | 142 | 7.0 | 809 | 12.3 | <1 |
| 07 | 04/27/2017 | <1 | 173 | 6.7 | 841 | 10.6 | <1 |
| 07 | 06/08/2017 | 9.07 | 172 | 6.9 | 815 | 13.7 | <1 |
| 07 | 09/07/2017 | -- | -- | 6.9 | 1085 | 12.0 | -- |
| 07 | 11/16/2017 | 4.35 | 166 | 7.2 | 892 | 11.2 | <1 |
| 07 | 03/27/2018 | <1 | 180 | 6.8 | 966 | 12.2 | <1 |
| 07 | 06/14/2018 | 3.93 | 134 | 6.8 | 990 | 12.6 | <1 |
| 07 | 09/13/2018 | 4.05 | 178 | 6.8 | 914 | 17.1 | <1 |
| 07 | 12/13/2018 | 3.60 | 164 | 7.0 | 1140 | 10.6 | <1 |
| 07 | 03/14/2019 | 5.79 | 140 | 6.9 | 1110 | 13.7 | <1 |
| 07 | 06/18/2019 | -- | -- | 7.0 | 1030 | 11.5 | -- |
| 07 | 09/18/2019 | 5.76 | 179 | 6.3 | 1160 | 11.5 | <1 |
| 07 | 12/12/2019 | -- | -- | 6.8 | 1020 | 10.1 | -- |
| 07 | 03/12/2020 | 5.30 | 165 | 6.7 | 1080 | 10.7 | 3 |
| 07 | 06/04/2020 | -- | -- | 6.9 | 886 | 12.7 | -- |
| 07 | 09/03/2020 | 5.66 | 163 | 6.8 | 1100 | 12.6 | 1.4 |
| 07 | 12/10/2020 | 5.05 | 114 | 6.9 | 880 | 11.0 | 1.9 |
| 07 | 02/24/2021 | 1.99 | 121 | 7.3 | 1030 | 10.7 | 1.1 |
| 07 | 03/18/2021 | 3.00 | 358 | 6.9 | 1220 | 11.0 | 2.6 |
| 07 | 04/07/2021 | 1.02 | 108 | 6.8 | 1110 | 11.4 | <1 |
| 07 | 05/05/2021 | 2.14 | 163 | 6.7 | 1540 | 11.2 | <1 |
| 07 | 06/08/2021 | 2.50 | 171 | 6.7 | 1250 | 12.1 | 1 |
| 07 | 06/24/2021 | 1.26 | 69 | 6.8 | 1200 | 11.4 | <1 |
| 07 | 07/13/2021 | 3.00 | 156 | 6.5 | 1300 | 11.5 | 2.2 |
| 07 | 08/03/2021 | 1.77 | 14 | 6.9 | 1050 | 11.6 | <1 |
| 08 | 03/19/2015 | -- | -- | 6.9 | 1270 | 12.9 | -- |
| 08 | 06/22/2015 | -- | -- | 6.7 | 1720 | 14.0 | -- |
| 08 | 09/16/2015 | -- | -- | 6.8 | 1110 | 13.8 | -- |
| 08 | 12/08/2015 | <1 | 153 | 6.8 | 1990 | 13.5 | <1 |
| 08 | 03/10/2016 | <1 | 191 | 6.7 | 1060 | 12.8 | <1 |
| 08 | 06/07/2016 | 2.03 | 174 | 6.6 | 1120 | 12.9 | <1 |
| 08 | 09/01/2016 | <1 | 247 | 6.7 | 1550 | 18.8 | 1.8 |
| 08 | 12/09/2016 | 2.70 | 275 | 6.6 | 1960 | 12.0 | <1 |
| 08 | 02/22/2017 | <1 | 148 | 6.9 | 1710 | 14.7 | <1 |

**TABLE 4-2. GROUNDWATER FIELD PARAMETERS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Dissolved Oxygen (mg/L) | Oxidation Reduction Potential (mV) | pH (field) (SU) | Specific Conductance (micromhos/cm) | Temperature (deg. C) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|
| 08 | 04/27/2017 | <1 | 172 | 6.7 | 2130 | 12.4 | <1 |
| 08 | 06/09/2017 | 3.99 | 156 | 6.9 | 1570 | 15.7 | <1 |
| 08 | 09/07/2017 | -- | -- | 6.7 | 1760 | 14.7 | -- |
| 08 | 11/16/2017 | 1.01 | 175 | 7.0 | 2040 | 13.5 | <1 |
| 08 | 03/27/2018 | <1 | 186 | 6.7 | 2230 | 14.8 | <1 |
| 08 | 06/14/2018 | <1 | 87 | 6.7 | 2260 | 15.2 | <1 |
| 08 | 09/13/2018 | 2.42 | 172 | 6.7 | 2170 | 15.0 | <1 |
| 08 | 12/13/2018 | 1.07 | 178 | 6.8 | 2420 | 13.5 | 1.5 |
| 08 | 03/14/2019 | 1.00 | 136 | 6.8 | 2900 | 16.1 | <1 |
| 08 | 06/18/2019 | -- | -- | 6.6 | 2210 | 14.3 | -- |
| 08 | 09/18/2019 | 2.30 | 160 | 6.6 | 2230 | 14.3 | <1 |
| 08 | 12/12/2019 | -- | -- | 6.6 | 2540 | 13.6 | -- |
| 08 | 03/12/2020 | 2.80 | 157 | 6.7 | 1950 | 13.4 | 3.7 |
| 08 | 06/04/2020 | -- | -- | 6.7 | 1770 | 14.1 | -- |
| 08 | 09/03/2020 | 3.27 | 197 | 6.7 | 1710 | 14.1 | 2.4 |
| 08 | 12/10/2020 | 2.71 | 105 | 6.7 | 1570 | 13.1 | 2.2 |
| 08 | 02/24/2021 | 0.98 | 96 | 7.2 | 1560 | 13.0 | 2.5 |
| 08 | 03/18/2021 | 1.05 | 147 | 6.7 | 1720 | 13.1 | <1 |
| 08 | 04/08/2021 | 0.84 | 58 | 6.6 | 2140 | 13.2 | <1 |
| 08 | 05/06/2021 | 0.65 | 106 | 6.6 | 2180 | 13.3 | <1 |
| 08 | 06/08/2021 | 1.17 | 158 | 6.5 | 2130 | 13.5 | <1 |
| 08 | 06/24/2021 | 0.65 | 110 | 6.6 | 2230 | 13.4 | <1 |
| 08 | 07/13/2021 | 0.98 | 123 | 6.4 | 2180 | 13.5 | 2.5 |
| 08 | 08/03/2021 | 1.36 | 66 | 6.6 | 1820 | 13.5 | <1 |
| 08D | 03/19/2015 | -- | -- | 6.9 | 1310 | 12.9 | -- |
| 08D | 06/22/2015 | -- | -- | 6.7 | 1690 | 15.1 | -- |
| 08D | 09/16/2015 | -- | -- | 6.8 | 1170 | 15.2 | -- |
| 08D | 12/08/2015 | <1 | 143 | 6.9 | 1870 | 14.2 | <1 |
| 08D | 03/10/2016 | <1 | 175 | 6.7 | 1280 | 12.7 | <1 |
| 08D | 06/07/2016 | <1 | 146 | 6.6 | 1210 | 13.4 | <1 |
| 08D | 09/01/2016 | 6.00 | 247 | 6.6 | 2090 | 14.9 | <1 |
| 08D | 12/09/2016 | <1 | 288 | 6.6 | 2210 | 12.1 | 1.9 |
| 08D | 02/22/2017 | <1 | 146 | 6.8 | 1850 | 14.6 | <1 |
| 08D | 04/27/2017 | <1 | 174 | 6.6 | 2130 | 13.0 | <1 |
| 08D | 06/09/2017 | 3.65 | 160 | 6.8 | 2220 | 18.3 | <1 |
| 08D | 09/07/2017 | -- | -- | 6.8 | 2120 | 14.7 | -- |
| 08D | 11/16/2017 | 1.57 | 177 | 7.0 | 1880 | 14.2 | <1 |
| 08D | 03/27/2018 | <1 | 187 | 6.7 | 2120 | 14.7 | <1 |
| 08D | 06/14/2018 | <1 | 75 | 6.8 | 2450 | 15.5 | <1 |
| 08D | 09/13/2018 | <1 | 160 | 6.7 | 2530 | 15.6 | <1 |
| 08D | 12/13/2018 | <1 | 151 | 6.8 | 2220 | 13.8 | 3.4 |
| 08D | 03/14/2019 | <1 | 134 | 6.8 | 2646 | 14.9 | 1 |
| 08D | 06/18/2019 | -- | -- | 6.6 | 2010 | 15.1 | -- |
| 08D | 09/18/2019 | <1 | 167 | 6.7 | 2180 | 14.4 | <1 |

**TABLE 4-2. GROUNDWATER FIELD PARAMETERS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Dissolved Oxygen (mg/L) | Oxidation Reduction Potential (mV) | pH (field) (SU) | Specific Conductance (micromhos/cm) | Temperature (deg. C) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|
| 08D | 12/12/2019 | -- | -- | 6.7 | 1950 | 13.7 | -- |
| 08D | 03/12/2020 | <1 | 149 | 6.7 | 1920 | 13.1 | 2.2 |
| 08D | 06/04/2020 | -- | -- | 6.7 | 1660 | 14.5 | -- |
| 08D | 09/03/2020 | 1.00 | 185 | 6.7 | 2050 | 14.5 | 1.6 |
| 08D | 12/10/2020 | 1.00 | 48 | 6.7 | 1610 | 13.0 | 2.1 |
| 08D | 02/24/2021 | 0.28 | 133 | 7.1 | 1720 | 13.1 | 4.4 |
| 08D | 03/18/2021 | 0.28 | 352 | 6.7 | 2100 | 13.2 | 4.4 |
| 08D | 04/08/2021 | 0.19 | -7 | 6.6 | 2070 | 13.4 | <1 |
| 08D | 05/06/2021 | 0.65 | 84 | 6.5 | 2170 | 13.3 | <1 |
| 08D | 06/08/2021 | 0.39 | 160 | 6.5 | 2040 | 13.9 | <1 |
| 08D | 06/24/2021 | 0.95 | 89 | 6.5 | 2180 | 14.0 | <1 |
| 08D | 07/13/2021 | 0.44 | 108 | 6.3 | 2080 | 14.0 | 1 |
| 08D | 08/03/2021 | 0.42 | 15 | 6.7 | 1840 | 14.0 | <1 |
| 12 | 03/19/2015 | -- | -- | 7.4 | 645 | 14.5 | -- |
| 12 | 06/22/2015 | -- | -- | 7.3 | 963 | 18.4 | -- |
| 12 | 09/17/2015 | -- | -- | 7.4 | 450 | 17.5 | -- |
| 12 | 12/09/2015 | <1 | 92 | 7.7 | 556 | 18.2 | <1 |
| 12 | 03/10/2016 | <1 | 174 | 7.1 | 605 | 15.4 | 1.2 |
| 12 | 06/08/2016 | 3.20 | 177 | 7.7 | 488 | 17.0 | <1 |
| 12 | 08/31/2016 | 6.03 | 224 | 7.6 | 610 | 19.5 | <1 |
| 12 | 12/09/2016 | 2.59 | 237 | 7.2 | 566 | 16.4 | <1 |
| 12 | 02/22/2017 | 2.90 | 111 | 7.5 | 558 | 19.4 | <1 |
| 12 | 04/26/2017 | <1 | 109 | 7.3 | 624 | 17.5 | <1 |
| 12 | 06/09/2017 | 4.82 | 141 | 7.5 | 680 | 21.0 | <1 |
| 12 | 09/07/2017 | -- | -- | 7.5 | 716 | 16.8 | -- |
| 12 | 11/16/2017 | <1 | 162 | 7.6 | 622 | 17.6 | <1 |
| 12 | 03/26/2018 | <1 | 80 | 7.4 | 926 | 18.6 | <1 |
| 12 | 06/13/2018 | 7.59 | 111 | 7.3 | 688 | 20.6 | <1 |
| 12 | 09/12/2018 | 2.17 | 153 | 7.4 | 671 | 21.1 | <1 |
| 12 | 12/13/2018 | -- | -- | 7.3 | 884 | 17.4 | -- |
| 12 | 03/13/2019 | 2.71 | 108 | 7.3 | 1090 | 15.8 | <1 |
| 12 | 06/18/2019 | -- | -- | 7.2 | 951 | 17.9 | -- |
| 12 | 09/17/2019 | 1.25 | 118 | 7.1 | 833 | 18.5 | <1 |
| 12 | 12/11/2019 | -- | -- | 7.1 | 807 | 17.6 | -- |
| 12 | 03/11/2020 | 1.60 | 123 | 7.2 | 840 | 17.9 | 2.6 |
| 12 | 06/04/2020 | -- | -- | 7.2 | 792 | 17.9 | -- |
| 12 | 09/02/2020 | 1.07 | 99 | 7.4 | 721 | 18.1 | 1.1 |
| 12 | 12/10/2020 | -- | -- | 7.3 | 728 | 17.7 | -- |
| 12 | 03/18/2021 | 3.07 | 356 | 7.2 | 911 | 16.9 | 1.5 |
| 12 | 06/23/2021 | 4.58 | 57 | 7.2 | 955 | 16.4 | <1 |
| 13 | 03/19/2015 | -- | -- | 7.5 | 664 | 15.3 | -- |
| 13 | 06/22/2015 | -- | -- | 7.4 | 867 | 17.8 | -- |
| 13 | 09/17/2015 | -- | -- | 7.4 | 701 | 16.7 | -- |
| 13 | 12/09/2015 | <1 | 95 | 7.6 | 593 | 17.0 | <1 |


RAMBOLL

**TABLE 4-2. GROUNDWATER FIELD PARAMETERS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Dissolved Oxygen (mg/L) | Oxidation Reduction Potential (mV) | pH (field) (SU) | Specific Conductance (micromhos/cm) | Temperature (deg. C) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|
| 13 | 03/10/2016 | 3.11 | 175 | 7.2 | 596 | 15.6 | 2.3 |
| 13 | 06/08/2016 | <1 | 138 | 7.6 | 522 | 16.1 | <1 |
| 13 | 08/31/2016 | 3.65 | 241 | 7.6 | 620 | 17.8 | <1 |
| 13 | 12/09/2016 | 7.71 | 258 | 7.3 | 635 | 14.6 | 2.3 |
| 13 | 02/22/2017 | <1 | 136 | 7.3 | 616 | 18.1 | <1 |
| 13 | 04/27/2017 | <1 | 148 | 7.3 | 723 | 15.5 | <1 |
| 13 | 06/09/2017 | 5.29 | 141 | 7.6 | 766 | 18.6 | <1 |
| 13 | 09/07/2017 | -- | -- | 7.5 | 773 | 16.5 | -- |
| 13 | 11/16/2017 | 6.63 | 165 | 7.6 | 625 | 16.2 | <1 |
| 13 | 03/26/2018 | <1 | 62 | 7.6 | 857 | 17.9 | <1 |
| 13 | 06/13/2018 | 5.48 | 102 | 7.3 | 755 | 19.2 | <1 |
| 13 | 09/12/2018 | 9.99 | 124 | 7.4 | 695 | 18.6 | <1 |
| 13 | 12/13/2018 | -- | -- | 7.3 | 885 | 16.5 | -- |
| 13 | 03/13/2019 | <1 | 98 | 7.6 | 1010 | 16.6 | <1 |
| 13 | 06/18/2019 | -- | -- | 7.4 | 986 | 17.7 | -- |
| 13 | 09/17/2019 | <1 | 96 | 7.4 | 912 | 17.7 | <1 |
| 13 | 12/11/2019 | -- | -- | 7.3 | 863 | 16.4 | -- |
| 13 | 03/11/2020 | <1 | 119 | 7.4 | 891 | 16.9 | 2.4 |
| 13 | 06/04/2020 | -- | -- | 7.5 | 807 | 17.3 | -- |
| 13 | 09/02/2020 | 1.00 | 118 | 7.5 | 768 | 17.5 | 1.2 |
| 13 | 12/10/2020 | -- | -- | 7.4 | 696 | 17.1 | -- |
| 13 | 03/18/2021 | 0.30 | 344 | 7.4 | 918 | 16.4 | <1 |
| 13 | 06/23/2021 | 4.09 | 70 | 7.2 | 964 | 16.4 | <1 |
| 16 | 03/19/2015 | -- | -- | 7.6 | 548 | 17.0 | -- |
| 16 | 06/22/2015 | -- | -- | 7.4 | 771 | 15.8 | -- |
| 16 | 09/17/2015 | -- | -- | 7.4 | 562 | 21.3 | -- |
| 16 | 12/08/2015 | -- | -- | 7.4 | 800 | 19.2 | -- |
| 16 | 03/10/2016 | -- | -- | 7.4 | 520 | 16.0 | -- |
| 16 | 06/08/2016 | -- | -- | 7.6 | 492 | 13.9 | -- |
| 16 | 09/01/2016 | -- | -- | 7.7 | 580 | 22.2 | -- |
| 16 | 12/09/2016 | -- | -- | 7.3 | 588 | 16.9 | -- |
| 16 | 02/22/2017 | -- | -- | 7.1 | 525 | 19.0 | -- |
| 16 | 04/27/2017 | -- | -- | 7.2 | 589 | 14.8 | -- |
| 16 | 09/07/2017 | -- | -- | 7.4 | 711 | 22.6 | -- |
| 16 | 11/16/2017 | -- | -- | 7.6 | 608 | 17.1 | -- |
| 16 | 03/27/2018 | 1.97 | 170 | 7.4 | 648 | 18.2 | <1 |
| 16 | 06/14/2018 | 3.56 | 132 | 7.0 | 741 | 19.4 | <1 |
| 16 | 09/13/2018 | 2.20 | 116 | 7.3 | 755 | 24.2 | 2.8 |
| 16 | 12/13/2018 | -- | -- | 7.4 | 844 | 15.6 | -- |
| 16 | 03/14/2019 | -- | -- | 7.3 | 873 | 17.9 | -- |
| 16 | 06/18/2019 | -- | -- | 7.3 | 754 | 19.6 | -- |
| 16 | 09/18/2019 | -- | -- | 7.1 | 866 | 23.3 | -- |
| 16 | 12/12/2019 | -- | -- | 7.2 | 782 | 16.3 | -- |
| 16 | 03/12/2020 | -- | -- | 7.3 | 713 | 17.0 | -- |

**TABLE 4-2. GROUNDWATER FIELD PARAMETERS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Dissolved Oxygen (mg/L) | Oxidation Reduction Potential (mV) | pH (field) (SU) | Specific Conductance (micromhos/cm) | Temperature (deg. C) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|
| 16 | 06/04/2020 | -- | -- | 7.6 | 537 | 18.8 | -- |
| 16 | 09/03/2020 | 2.02 | 144 | 7.3 | 807 | 24.9 | 1.3 |
| 16 | 12/10/2020 | -- | -- | 7.4 | 673 | 13.9 | -- |
| 16 | 02/24/2021 | 5.66 | 163 | 7.7 | 671 | 13.1 | 2.2 |
| 16 | 03/18/2021 | 6.55 | 122 | 7.4 | 740 | 14.4 | <1 |
| 16 | 04/08/2021 | 3.80 | 106 | 7.2 | 861 | 15.6 | <1 |
| 16 | 05/06/2021 | 6.65 | 185 | 7.4 | 901 | 16.8 | <1 |
| 16 | 06/08/2021 | 3.24 | 153 | 7.1 | 841 | 20.0 | <1 |
| 16 | 06/23/2021 | 4.30 | 80 | 7.2 | 915 | 22.9 | <1 |
| 16 | 07/13/2021 | 0.86 | 98 | 7.2 | 771 | 23.3 | 2 |
| 16 | 08/03/2021 | 0.39 | 61 | 7.1 | 796 | 23.4 | <1 |
| 17 | 03/19/2015 | -- | -- | 7.8 | 551 | 13.0 | -- |
| 17 | 06/22/2015 | -- | -- | 7.7 | 699 | 17.5 | -- |
| 17 | 09/17/2015 | -- | -- | 7.5 | 567 | 22.8 | -- |
| 17 | 12/08/2015 | -- | -- | 7.6 | 818 | 18.1 | -- |
| 17 | 03/10/2016 | -- | -- | 7.4 | 508 | 13.0 | -- |
| 17 | 06/08/2016 | -- | -- | 7.7 | 485 | 15.0 | -- |
| 17 | 09/01/2016 | -- | -- | 7.7 | 570 | 21.0 | -- |
| 17 | 12/09/2016 | -- | -- | 7.5 | 596 | 13.1 | -- |
| 17 | 02/22/2017 | -- | -- | 7.6 | 546 | 17.3 | -- |
| 17 | 04/27/2017 | -- | -- | 7.0 | 577 | 13.2 | -- |
| 17 | 09/07/2017 | -- | -- | 7.2 | 802 | 22.2 | -- |
| 17 | 11/16/2017 | -- | -- | 7.6 | 604 | 9.8 | -- |
| 17 | 03/27/2018 | <1 | 175 | 7.3 | 657 | 16.9 | 1.1 |
| 17 | 06/14/2018 | 5.25 | 97 | 7.5 | 642 | 23.3 | <1 |
| 17 | 09/13/2018 | 3.43 | 144 | 7.2 | 694 | 24.8 | <1 |
| 17 | 12/13/2018 | -- | -- | 7.5 | 835 | 12.3 | -- |
| 17 | 03/14/2019 | -- | -- | 7.4 | 866 | 16.2 | -- |
| 17 | 06/18/2019 | -- | -- | 7.2 | 691 | 20.6 | -- |
| 17 | 09/18/2019 | -- | -- | 7.1 | 797 | 24.0 | -- |
| 17 | 12/12/2019 | -- | -- | 7.3 | 678 | 15.4 | -- |
| 17 | 03/12/2020 | -- | -- | 7.4 | 747 | 16.0 | -- |
| 17 | 06/04/2020 | -- | -- | 7.7 | 519 | 23.0 | -- |
| 17 | 09/03/2020 | 1.52 | 144 | 7.2 | 762 | 25.3 | 1.8 |
| 17 | 12/10/2020 | -- | -- | 7.4 | 655 | 15.3 | -- |
| 17 | 02/24/2021 | 0.73 | 118 | 7.6 | 936 | 15.3 | 9 |
| 17 | 03/18/2021 | 2.50 | 339 | 7.0 | 1030 | 18.0 | <1 |
| 17 | 04/08/2021 | 9.25 | 108 | 7.3 | 756 | 14.4 | <1 |
| 17 | 05/06/2021 | 8.67 | 175 | 7.2 | 940 | 15.7 | <1 |
| 17 | 06/08/2021 | 7.50 | 153 | 7.2 | 803 | 19.0 | <1 |
| 17 | 06/23/2021 | 7.10 | 87 | 7.1 | 874 | 20.9 | <1 |
| 17 | 07/13/2021 | 6.35 | 114 | 6.9 | 803 | 21.6 | 1 |
| 17 | 08/03/2021 | 4.47 | 73 | 7.2 | 744 | 20.2 | <1 |
| 46 | 12/09/2015 | 1.32 | 88 | 7.6 | 558 | 19.0 | <1 |

**TABLE 4-2. GROUNDWATER FIELD PARAMETERS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Dissolved Oxygen (mg/L) | Oxidation Reduction Potential (mV) | pH (field) (SU) | Specific Conductance (micromhos/cm) | Temperature (deg. C) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|
| 46 | 03/10/2016 | <1 | 170 | 7.3 | 560 | 16.3 | <1 |
| 46 | 06/08/2016 | 4.82 | 182 | 7.6 | 481 | 16.6 | <1 |
| 46 | 08/31/2016 | 1.55 | 248 | 7.6 | 629 | 17.5 | <1 |
| 46 | 12/08/2016 | 2.96 | 235 | 7.4 | 599 | 16.4 | <1 |
| 46 | 02/22/2017 | <1 | 33 | 7.5 | 550 | 20.2 | <1 |
| 46 | 04/26/2017 | <1 | 127 | 7.1 | 606 | 18.0 | <1 |
| 46 | 06/09/2017 | 6.28 | 120 | 7.6 | 649 | 19.8 | <1 |
| 46 | 11/16/2017 | 1.13 | 165 | 7.6 | 637 | 17.2 | <1 |
| 46 | 06/13/2018 | 6.27 | 124 | 7.4 | 713 | 19.9 | <1 |
| 46 | 09/13/2018 | 2.63 | 244 | 7.4 | 742 | 18.4 | <1 |
| 46 | 03/14/2019 | <1 | 97 | 7.3 | 937 | 17.7 | <1 |
| 46 | 09/17/2019 | 1.38 | 112 | 7.3 | 804 | 19.0 | <1 |
| 46 | 03/11/2020 | <1 | 120 | 7.4 | 768 | 16.6 | 2.4 |
| 46 | 09/03/2020 | 1.30 | 149 | 7.0 | 778 | 18.6 | 1.2 |
| 46 | 03/18/2021 | 1.38 | 347 | 7.3 | 840 | 16.0 | 1.6 |
| 47 | 12/09/2015 | <1 | 111 | 7.2 | 619 | 19.9 | <1 |
| 47 | 03/10/2016 | <1 | 174 | 7.2 | 584 | 16.6 | <1 |
| 47 | 06/08/2016 | <1 | 134 | 6.9 | 565 | 17.7 | <1 |
| 47 | 09/01/2016 | <1 | 243 | 7.3 | 728 | 18.4 | <1 |
| 47 | 12/09/2016 | 1.07 | 229 | 7.1 | 628 | 17.7 | 1.1 |
| 47 | 02/22/2017 | 7.30 | 124 | 7.2 | 585 | 20.2 | 1.2 |
| 47 | 04/26/2017 | <1 | 112 | 6.9 | 834 | 18.0 | <1 |
| 47 | 06/09/2017 | 6.01 | 131 | 7.4 | 736 | 21.4 | 0 |
| 47 | 11/16/2017 | <1 | 166 | 7.1 | 737 | 17.9 | <1 |
| 47 | 06/13/2018 | <1 | 114 | 6.7 | 836 | 19.8 | <1 |
| 47 | 09/12/2018 | <1 | 123 | 7.0 | 818 | 22.2 | <1 |
| 47 | 03/14/2019 | 1.00 | 107 | 7.1 | 1020 | 18.5 | <1 |
| 47 | 09/17/2019 | <1 | 85 | 7.0 | 904 | 22.6 | <1 |
| 47 | 03/11/2020 | 1.60 | 108 | 7.2 | 791 | 17.7 | 2.3 |
| 47 | 09/02/2020 | 1.00 | 103 | 7.1 | 648 | 22.5 | 1.4 |
| 47 | 03/18/2021 | 3.01 | 118 | 7.2 | 789 | 15.6 | <1 |
| 52 | 02/24/2021 | 0.66 | 23 | 7.7 | 741 | 12.0 | 9.8 |
| 52 | 03/22/2021 | 0.31 | 137 | 7.2 | 729 | 16.7 | <1 |
| 52 | 04/07/2021 | 0.64 | 46 | 7.2 | 890 | 16.8 | <1 |
| 52 | 05/06/2021 | 5.01 | 167 | 7.2 | 954 | 15.2 | <1 |
| 52 | 06/08/2021 | 4.13 | 137 | 7.1 | 822 | 19.0 | 1 |
| 52 | 06/24/2021 | 2.36 | 89 | 7.3 | 884 | 22.0 | <1 |
| 52 | 07/13/2021 | 1.86 | 103 | 6.8 | 807 | 22.4 | 1 |
| 52 | 08/03/2021 | 0.67 | -34 | 7.0 | 800 | 23.3 | 1.2 |
| 53 | 02/25/2021 | 0.38 | 30 | 7.1 | 960 | 16.9 | 9.9 |
| 53 | 03/19/2021 | 0.53 | 189 | 7.0 | 1240 | 16.2 | 8.6 |
| 53 | 04/08/2021 | 0.39 | 50 | 6.9 | 1220 | 16.4 | 9.6 |
| 53 | 05/06/2021 | 0.63 | 90 | 7.2 | 1090 | 16.0 | <1 |
| 54 | 02/24/2021 | 0.86 | -22 | 7.9 | 765 | 16.0 | 9.5 |



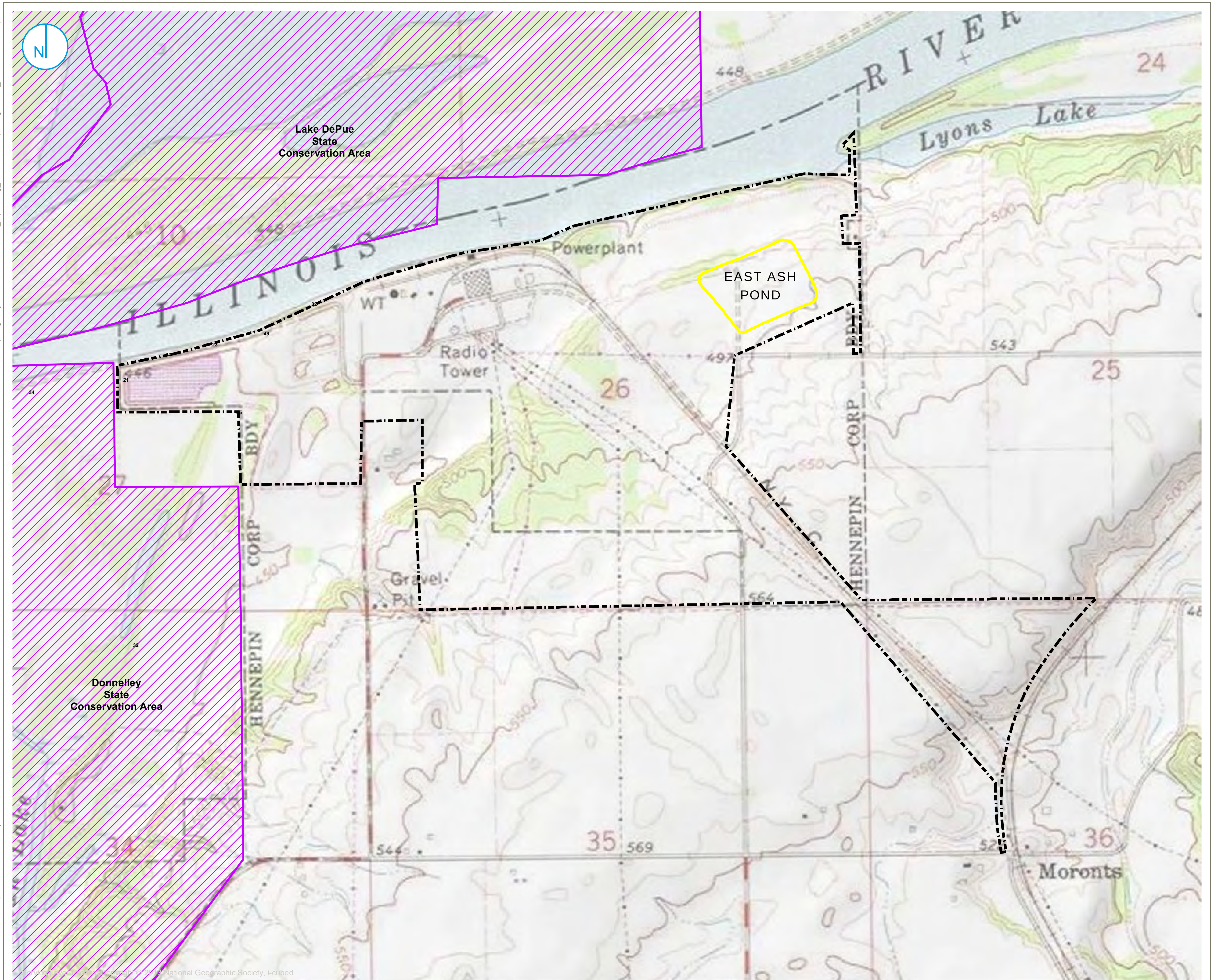
RAMBOLL

**TABLE 4-2. GROUNDWATER FIELD PARAMETERS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Dissolved Oxygen (mg/L) | Oxidation Reduction Potential (mV) | pH (field) (SU) | Specific Conductance (micromhos/cm) | Temperature (deg. C) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|
| 54 | 03/22/2021 | 0.78 | 102 | 7.2 | 919 | 17.7 | 3.7 |
| 54 | 04/07/2021 | 1.37 | 7 | 7.2 | 912 | 17.7 | <1 |
| 54 | 05/05/2021 | 2.22 | 199 | 7.0 | 1240 | 17.4 | <1 |
| 54 | 06/08/2021 | 0.53 | 121 | 6.8 | 997 | 18.0 | <1 |
| 54 | 06/23/2021 | 0.93 | 5 | 7.2 | 1030 | 18.0 | <1 |
| 54 | 07/13/2021 | 2.06 | 108 | 7.0 | 969 | 17.4 | 2.8 |
| 54 | 08/03/2021 | 2.40 | 28 | 7.1 | 864 | 17.4 | <1 |
| 55 | 02/25/2021 | 0.40 | -125 | 7.5 | 785 | 13.0 | 280 |
| 55 | 03/22/2021 | 0.66 | -97 | 7.2 | 1080 | 16.0 | 5800 |
| 55 | 04/07/2021 | 0.35 | -132 | 7.1 | 1080 | 16.7 | 35 |
| 55 | 05/05/2021 | 5.78 | -67 | 7.2 | 1430 | 18.0 | <1 |
| 55 | 08/03/2021 | 3.55 | 40 | 7.2 | 1070 | 23.5 | 110 |

**Notes:**
Field readings are reported with as many significant figures as provided by analytical laboratory.
-- = data not available
cm = centimeter
deg. C = degrees Celsius
mg/L = milligrams per liter
mV = millivolts
NTU = nephelometric turbidity units
SU = standard units
generated 10/05/2021, 3:57:58 PM CDT

# FIGURES




PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY
PROTECTED AREA

0 500 1,000
Feet

## SITE LOCATION MAP

**HYDROGEOLOGIC SITE CHARACTERIZATION REPORT**
**EAST ASH POND**
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

## FIGURE 1-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Hennepin\Figure 1-1_Site Location Map.mxd

PROJECT: 169000XXXX | DATED: 9/28/2021 | DESIGNER: STOLZSD


Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Hennepin\Figure 1-2_Site Map.mxd

PROJECT: 169000XXXX | DATED: 9/28/2021 | DESIGNER: STOLZSD

## SITE MAP

**HYDROGEOLOGIC SITE CHARACTERIZATION REPORT**
**EAST ASH POND**
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

## FIGURE 1-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL


10 FOOT ELEVATION CONTOUR
2 FOOT ELEVATION CONTOUR
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

NOTE:
ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88). TOPOGRAPHIC CONTOURS PROVIDED FROM AERIAL SURVEY COMPLETED BY DRAGONFLY AEROSOLUTIONS DATED 11/15/2020 AND TOPOGRAPHIC/BATHYMETRIC SURVEYS COMPLETED BY INGENAE DATED 11/2/2020 AND 11/16/2020.

0 175 350 Feet

## SITE TOPOGRAPHIC MAP

**HYDROGEOLOGIC SITE CHARACTERIZATION REPORT**
**EAST ASH POND**
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

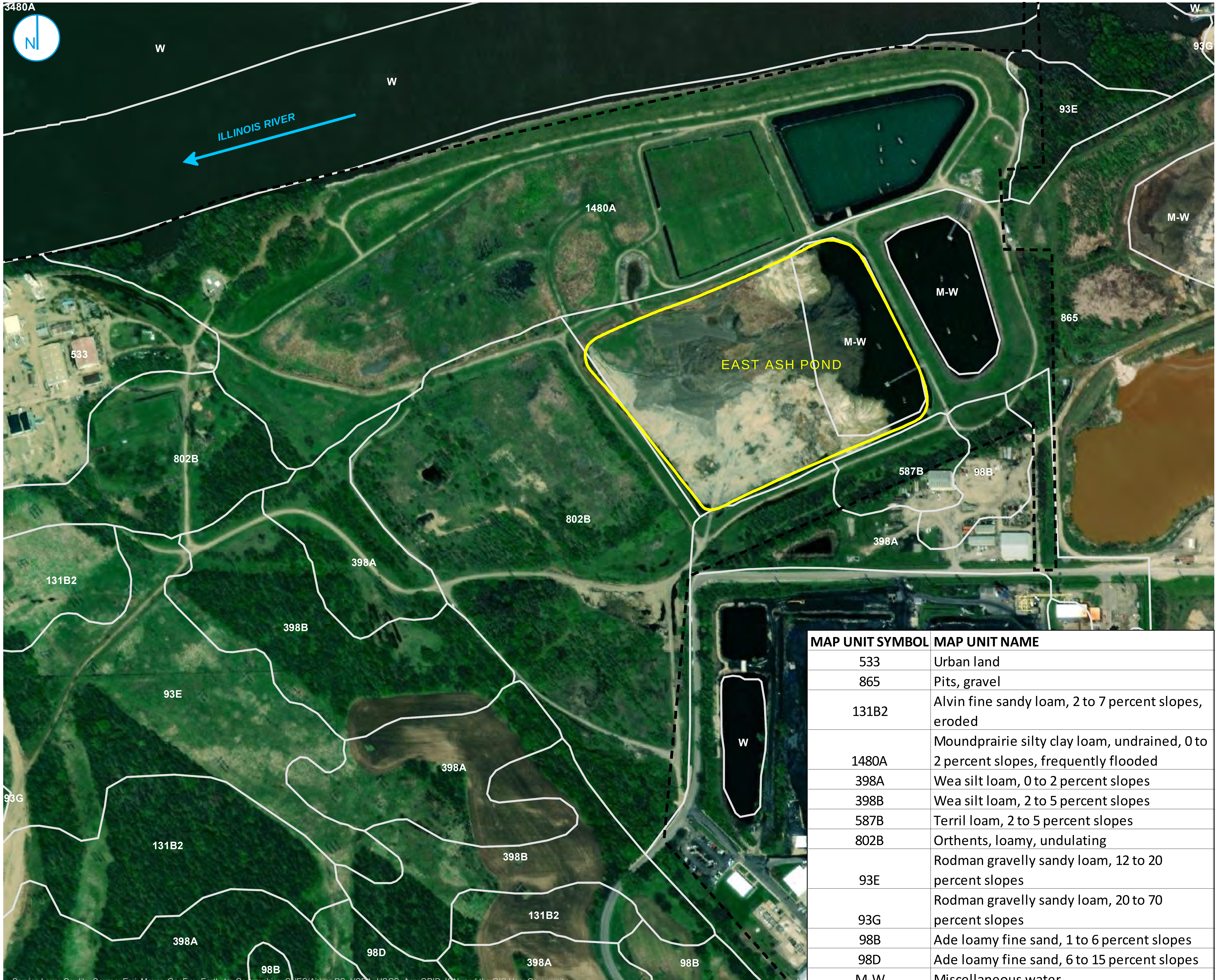
## FIGURE 2-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 169000XXXX | DATED: 10/5/2021 | DESIGNER: STOLZSD

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Hennepin\Figure 2-1_Site Topographic Map.mxd




| MAP UNIT SYMBOL | MAP UNIT NAME |
|---|---|
| 533 | Urban land |
| 865 | Pits, gravel |
| 131B2 | Alvin fine sandy loam, 2 to 7 percent slopes, eroded |
| 1480A | Moundprairie silty clay loam, undrained, 0 to 2 percent slopes, frequently flooded |
| 398A | Wea silt loam, 0 to 2 percent slopes |
| 398B | Wea silt loam, 2 to 5 percent slopes |
| 587B | Terril loam, 2 to 5 percent slopes |
| 802B | Orthents, loamy, undulating |
| 93E | Rodman gravelly sandy loam, 12 to 20 percent slopes |
| 93G | Rodman gravelly sandy loam, 20 to 70 percent slopes |
| 98B | Ade loamy fine sand, 1 to 6 percent slopes |
| 98D | Ade loamy fine sand, 6 to 15 percent slopes |
| M-W | Miscellaneous water |

PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY
NRCS SOIL SURVEY MAP UNIT BOUNDARY

SOURCE:
NATURAL RESOURCES CONSERVATION SERVICE (NRCS)

0 175 350 Feet

## SOIL SURVEY MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EAST ASH POND
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

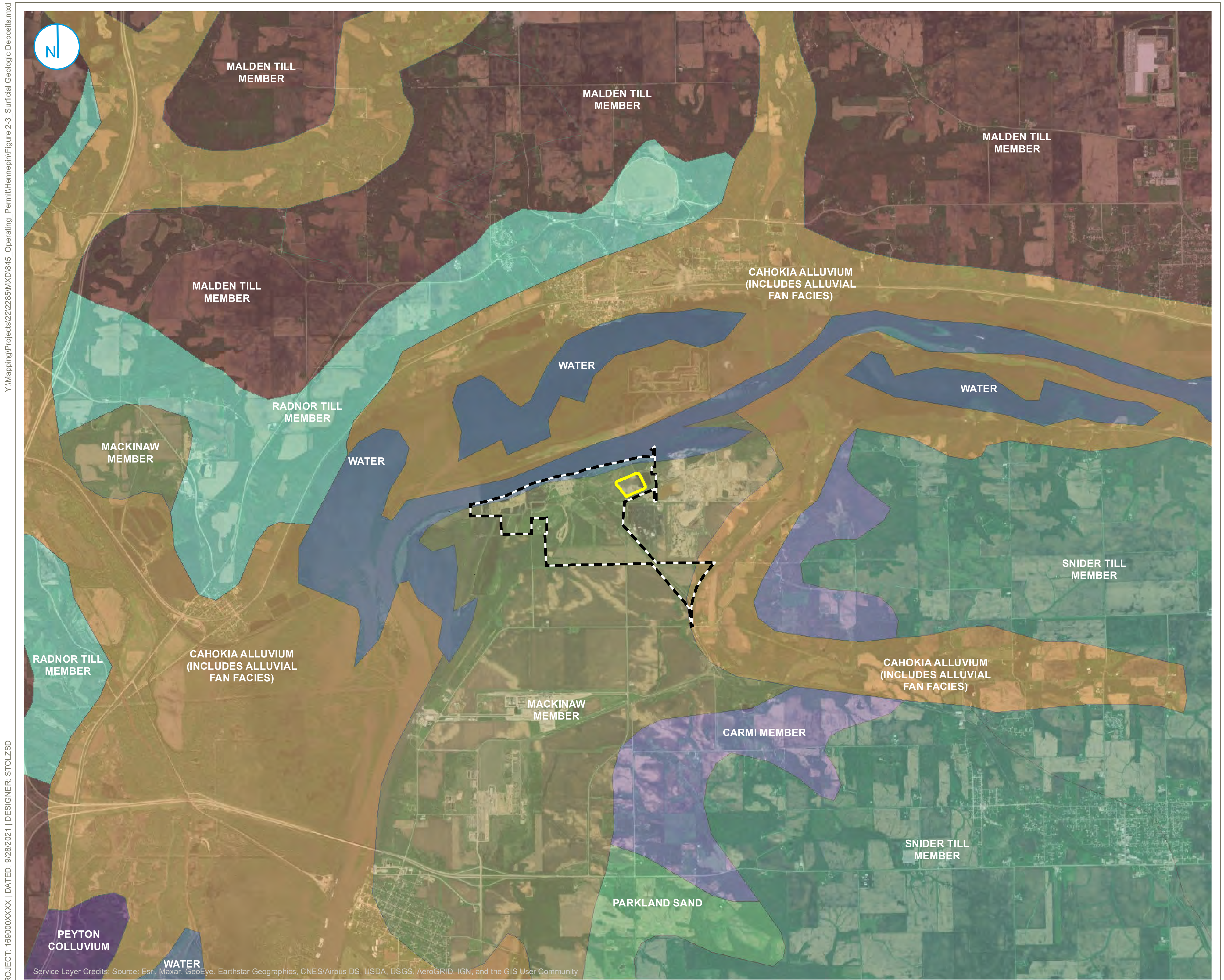
## FIGURE 2-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Hennepin\Figure 2-2_Soil Survey.mxd

PROJECT: 169000XXXX | DATED: 9/28/2021 | DESIGNER: STOLZSD




PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY
CAHOKIA ALLUVIUM (INCLUDES ALLUVIAL FAN FACIES)
CARMI MEMBER
MACKINAW MEMBER
MALDEN TILL MEMBER
PARKLAND SAND
PEYTON COLLUVIUM
RADNOR TILL MEMBER
SNIDER TILL MEMBER
WATER

SOURCE
ILLINOIS STATE GEOLOGICAL SURVEY (ISGS)

0 2,000 4,000 Feet

## SURFICIAL GEOLOGIC DEPOSITS

**HYDROGEOLOGIC SITE CHARACTERIZATION REPORT**
**EAST ASH POND**
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

## FIGURE 2-3

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL

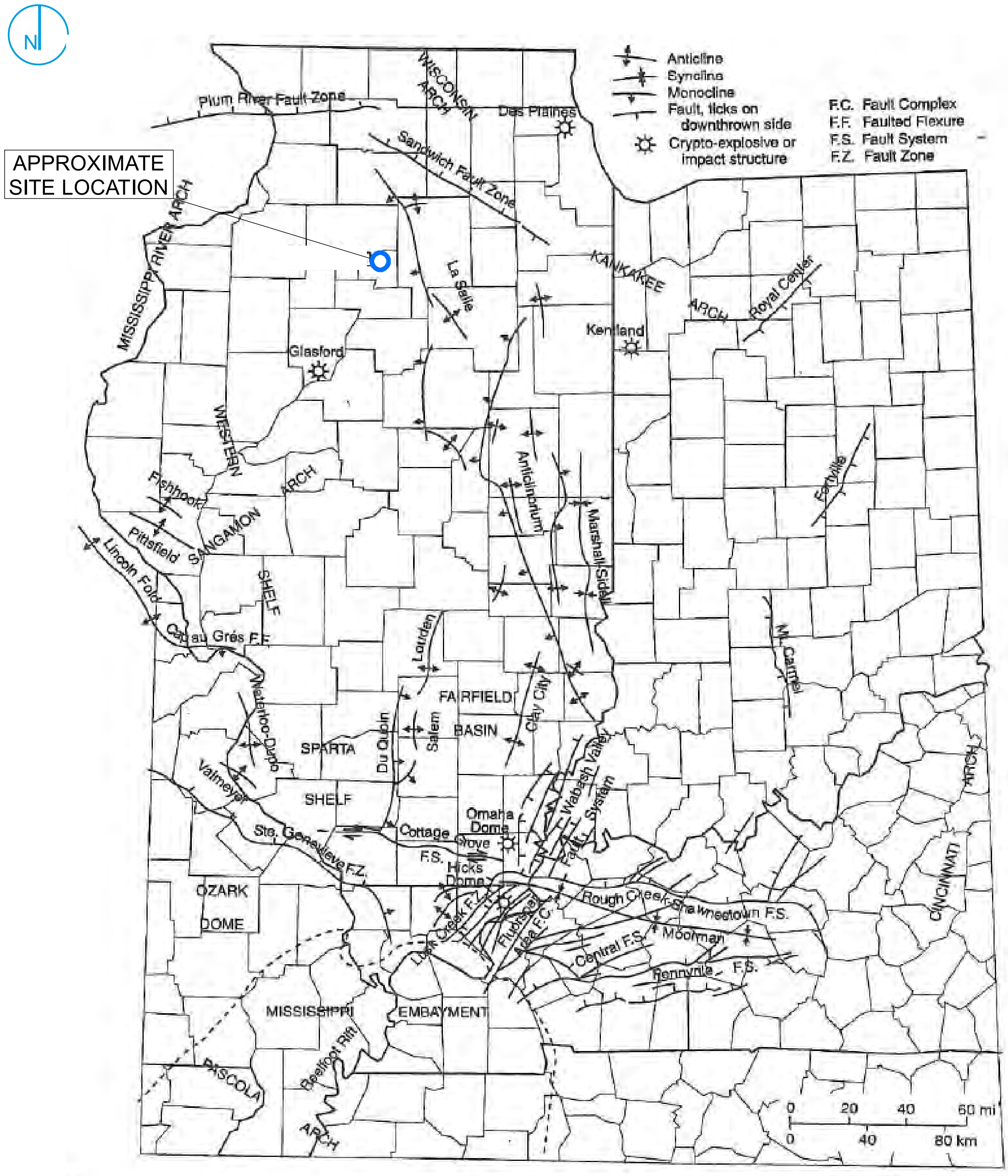
| SYSTEM or SERIES | HYDROGEOLOGIC UNITS | GRAPHIC LOG | ROCK TYPE | WATER-YIELDING CHARACTERISTICS |
|---|---|---|---|---|
| PLEIS-TOCENE | Drift (0–300 feet) | | Unconsolidated glacial deposits, loess and alluvium (drift). | Water yields variable, largest from thick basal sand and gravel deposits (Sankoty Sand) in bedrock valleys. |
| PENNSYLVANIAN | (280–475 feet) | | Mainly shale with thin sandstone, limestone, and coal beds. | Generally unfavorable as an aquifer. Locally, domestic and farm supplies obtained from thin limestone and sandstone beds. Casing usually required. |
| SILURIAN | Niagaran-Alexandrian (410–505 feet) | | Dolomite; argillaceous near base, lower part cherty. | Generally yields poor quality water. |
| ORDOVICIAN | Maquoketa (155–240 feet) | | Green to blue shale with limestone and dolomite beds. | Not water yielding at most places. Casing required. |
| | Galena-Platteville (320–380 feet) | | Dolomite, with shaly zone near the middle; some limestone in the lower part. | Not important as an aquifer, Creviced dolomite probably yields some water. Water quality good. |
| | Glenwood-St. Peter (115–135 feet) | | Sandstone, white, clean. | Dependable source of groundwater. Water quality good. |
| | Shakopee (130–150 feet) | | Dolomite, with some shale and sandstone. | Not important as aquifer. |
| | New Richmond (165 feet ±) | | Sandstone, with some dolomite. | May yield some water. |
| | Oneota (215 feet ±) | | Dolomite, with some sandstone beds. | Not important as aquifer. |

SOURCE NOTE: MODIFIED FROM "MCCOMAS, M.R. (1968), GEOLOGY RELATED TO LAND USE IN THE HENNEPIN REGION FIGURE 2, ILLINOIS STATE GEOLOGICAL SURVEY, CIRCULAR 422, CHAMPAIGN, ILLINOIS.

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Hennepin\Figure 2-4_Generalized Stratigraphic Column.mxd
PROJECT: 169000XXXX | DATED: 9/28/2021 | DESIGNER: STOLZSD

GENERALIZED STRATIGRAPHIC COLUMN FOR THE HENNEPIN AREA

FIGURE 2-4




SOURCE NOTE: MODIFIED FROM "NELSON, W.J. 1995, STRUCTURAL FEATURES IN ILLINOIS, ILLINOIS STATE GEOLOGICAL SURVEY, BULLETIN 100, CHAMPAIGN, ILLINOIS."

Service Layer Credits:

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Hennepin\Figure 2-5_Major Structural Features of Illinois.mxd

PROJECT: 169000XXXX | DATED: 9/28/2021 | DESIGNER: STOLZSD

## MAJOR STRUCTURAL FEATURES OF ILLINOIS

## FIGURE 2-5

**HYDROGEOLOGIC SITE CHARACTERIZATION REPORT**
**EAST ASH POND**
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.






MONITORING WELL
SOURCE SAMPLE LOCATION
STAFF GAGE
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

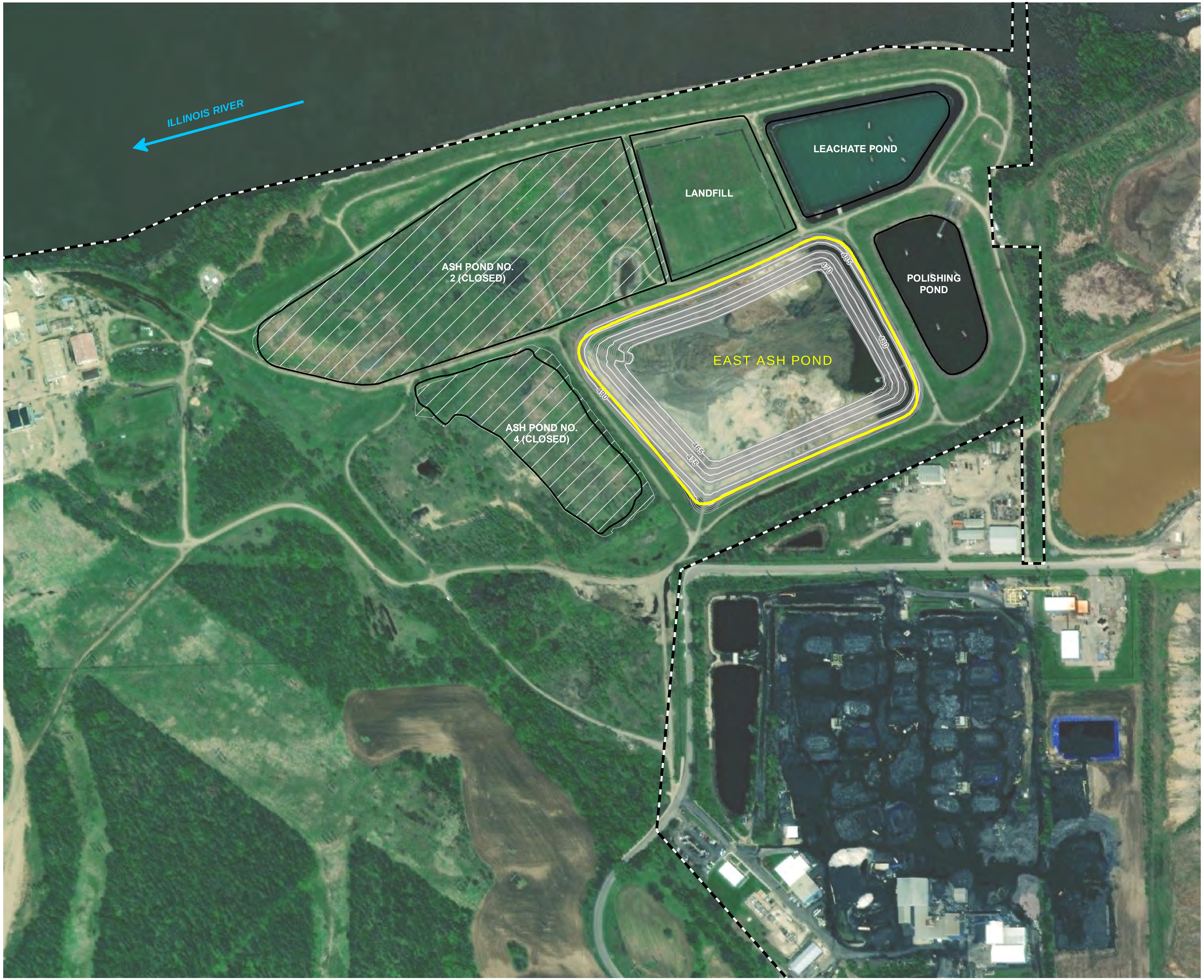
0 175 350 Feet

## FIELD INVESTIGATION LOCATION MAP

**HYDROGEOLOGIC SITE CHARACTERIZATION REPORT**
**EAST ASH POND**
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

## FIGURE 2-6

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.




5 FOOT CONSTRUCTION ELEVATION CONTOUR
1 FOOT CONSTRUCTION ELEVATION CONTOUR
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

**NOTE:**
ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

0 175 350 Feet

## BOTTOM OF ASH

**HYDROGEOLOGIC SITE CHARACTERIZATION REPORT**
**EAST ASH POND**
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

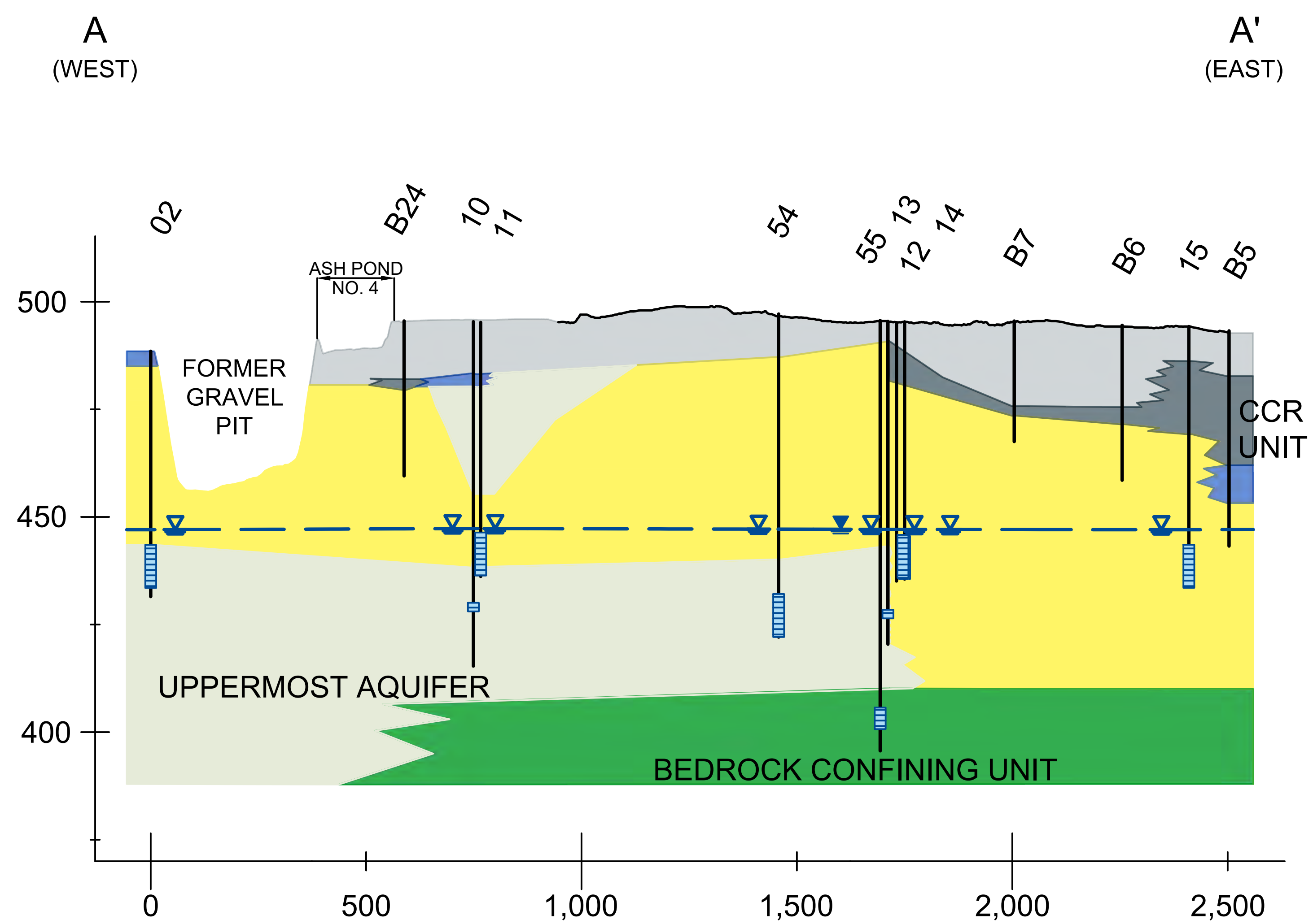
## FIGURE 2-7

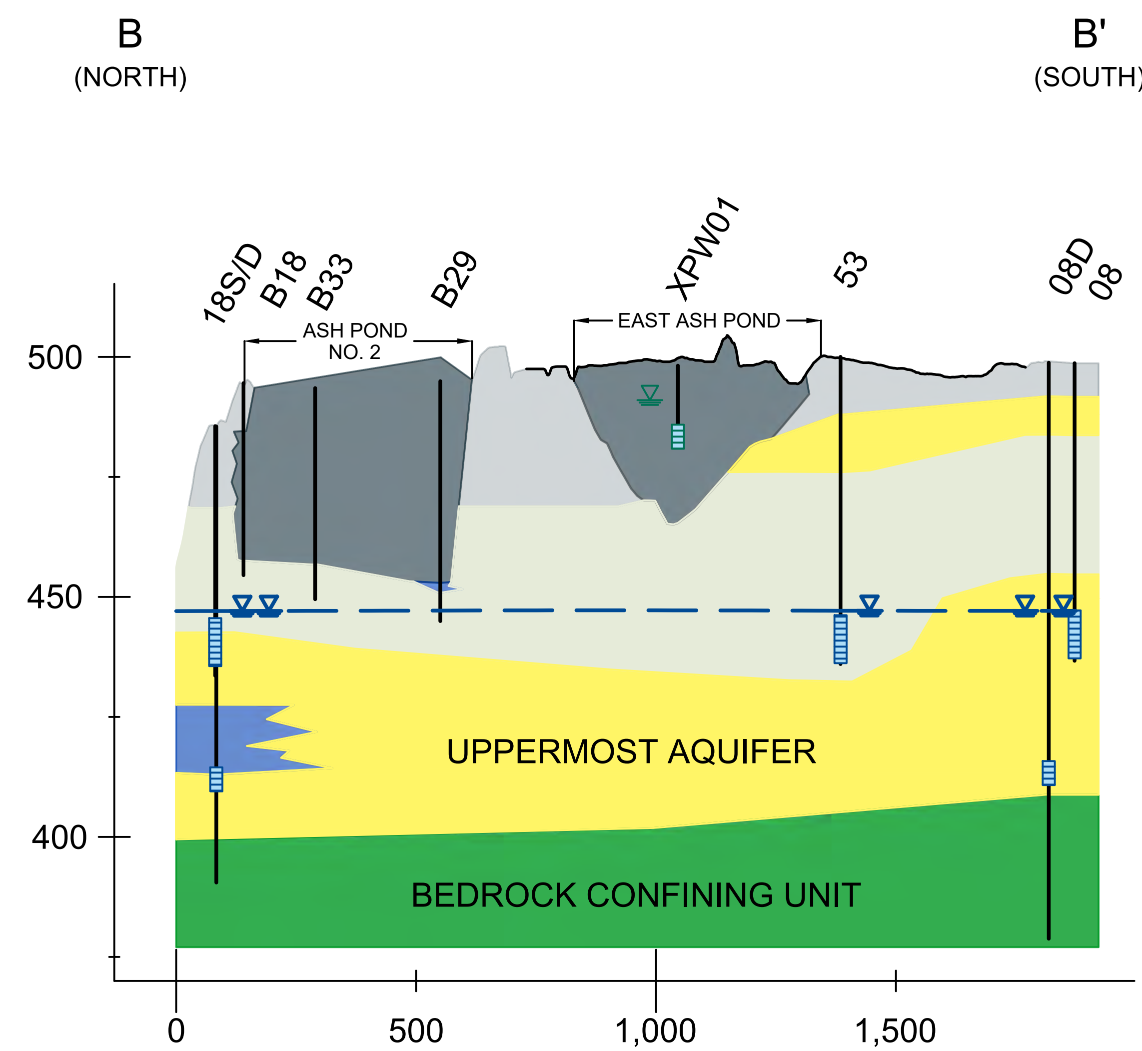
RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Hennepin\Figure 2-7_Bottom of Ash.mxd

PROJECT: 169000XXXX | DATED: 9/28/2021 | DESIGNER: STOLZSD

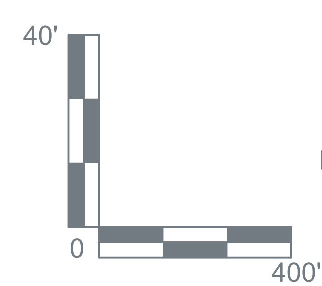

NOTES
1. This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.
2. Scale is approximate.
3. Vertical scale is exaggerated 10X.
4. Vertical Datum: NAVD88
5. Groundwater elevations measured March, 2021.




LEGEND

- COAL COMBUSTION RESIDUALS, CCRs
- FILL
- SILT (ML)
- SAND AND GRAVEL WITH FINES
- SAND AND GRAVEL
- BEDROCK / WEATHERED BEDROCK (SHALE)
- WELL SCREEN INTERVAL
- UPPERMOST AQUIFER POTENTIOMETRIC SURFACE
- UPPERMOST AQUIFER GROUNDWATER ELEVATION
- POREWATER ELEVATION
- BEDROCK GROUNDWATER / OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)




## GEOLOGIC CROSS SECTIONS
A-A' and B-B'

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EAST ASH POND
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

FIGURE 2-8

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY


BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
STAFF GAGE
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

0 175 350 Feet

## MONITORING WELL LOCATION MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EAST ASH POND
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

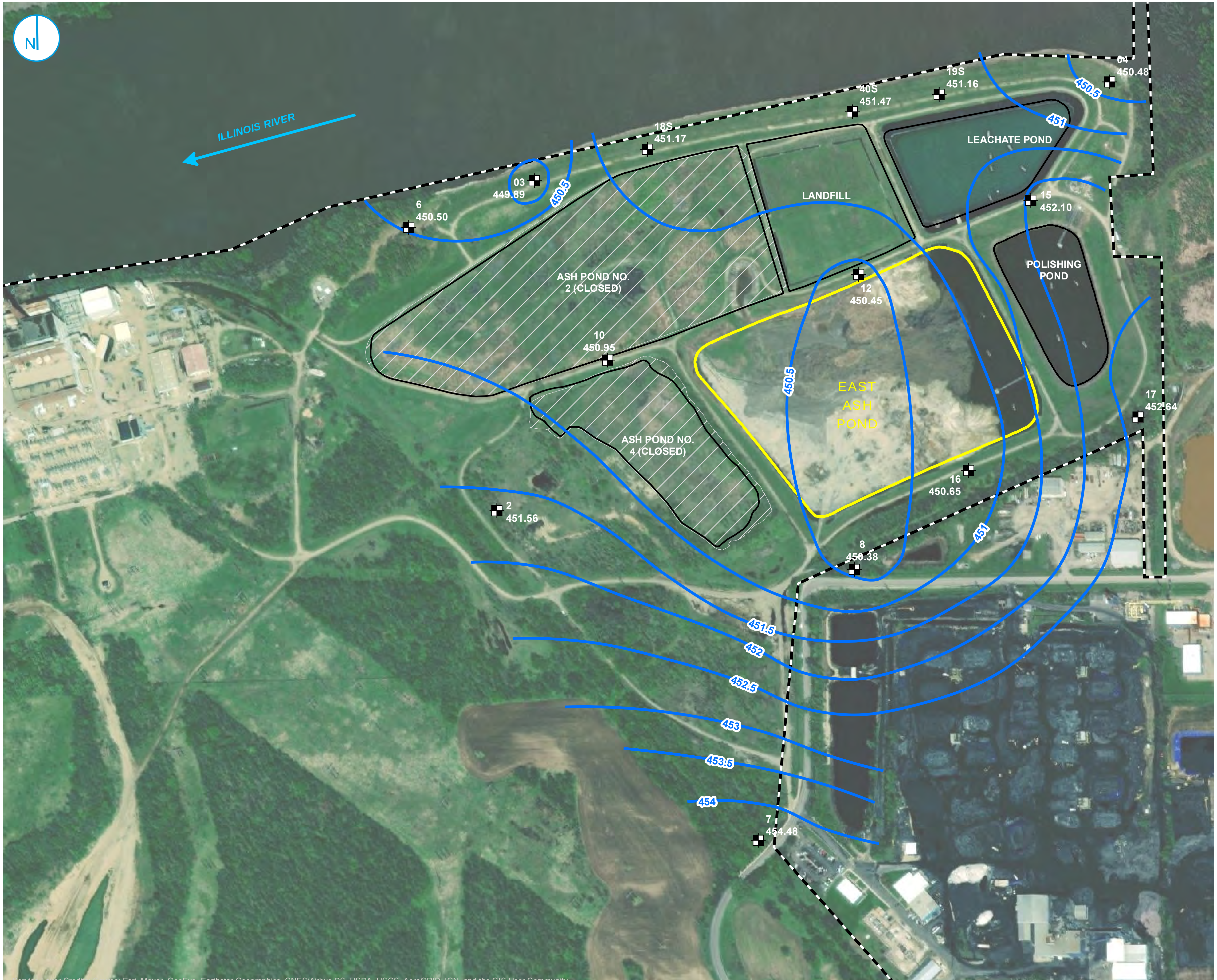
FIGURE 3-1

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Hennepin\Figure 3-1_EAP_Monitoring Well Location Map.mxd

PROJECT: 169000XXXX | DATED: 9/28/2021 | DESIGNER: STOLZSD




MONITORING WELL

INTERPRETED TOP OF UPPERMOST AQUIFER (95TH PERCENTILE GROUNDWATER ELEVATION CONTOURS, 0.5 FT INTERVAL, NAVD88)

PART 845 REGULATED UNIT (SUBJECT UNIT)

SITE FEATURE

LIMITS OF FINAL COVER

PROPERTY BOUNDARY

**NOTE**

TOP OF UPPERMOST AQUIFER CONTOURS GENERATED IN 2018 FOR 40 C.F.R. § 257 AQUIFER SEPARATION DETERMINATION (HALEY & ALDRICH, 2018). CONTOURS HAVE NOT BEEN MODIFIED USING GROUNDWATER ELEVATION DATA COLLECTED IN 2021, BUT THE SEPARATION BETWEEN THE TOP OF AQUIFER AND BASE OF CCR IS CONSISTENT.

0 175 350
Feet

## TOP OF UPPERMOST AQUIFER

**HYDROGEOLOGIC SITE CHARACTERIZATION REPORT**
**EAST ASH POND**
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

## FIGURE 3-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Hennepin\Figure 3-2_Top of Uppermost Aquifer.mxd

PROJECT: 169000XXXX | DATED: 9/30/2021 | DESIGNER: STOLZSD


BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
STAFF GAGE
GROUNDWATER ELEVATION CONTOUR (1-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

NOTE:
ELEVATIONS IN PARENTHESIS WERE NOT USED FOR CONTOURING.

0 175 350 Feet

## UPPERMOST AQUIFER GROUNDWATER ELEVATION CONTOURS FEBRUARY 24-26, 2021

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EAST ASH POND
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

## FIGURE 3-3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.


Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Hennepin\Figure 3-4_GWE Contours 20210317.mxd

PROJECT: 169000XXXX | DATED: 9/30/2021 | DESIGNER: STOLZSD

BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
STAFF GAGE
GROUNDWATER ELEVATION CONTOUR (0.5 FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW ARROW
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

NOTE:
ELEVATIONS IN PARENTHESIS WERE NOT USED FOR CONTOURING.

0 175 350
Feet

# UPPERMOST AQUIFER GROUNDWATER ELEVATION CONTOURS MARCH 17-19 AND 22, 2021

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EAST ASH POND
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

FIGURE 3-4

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL


BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
STAFF GAGE
GROUNDWATER ELEVATION CONTOUR (1-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

NOTE:
ELEVATIONS IN PARENTHESIS WERE NOT USED FOR CONTOURING.

0 175 350 Feet

## UPPERMOST AQUIFER GROUNDWATER ELEVATION CONTOURS APRIL 7, 2021

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EAST ASH POND
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

FIGURE 3-5

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Hennepin\Figure 3-5_GWE Contours 20210407.mxd

PROJECT: 169000XXXX | DATED: 9/28/2021 | DESIGNER: STOLZSD

# APPENDICES

# APPENDIX A
# BORING LOGS AND WELL CONSTRUCTION LOGS

# APPENDIX A
# BORING LOGS AND WELL CONSTRUCTION LOGS
# GEOSYNTEC BORING LOGS

Geosyntec consultants
engineers | scientists | innovators

Client: Dynegy
Project: GLP8020, Hennepin East Ash Pond
Address: 13498 E 800th, Hennepin, IL

# BORING LOG

Boring No. MW52



| | | | |
|---|---|---|---|
| Drilling Start Date: | 02/11/2021 | Boring Depth (ft): | 61 |
| Drilling End Date: | 02/11/2021 | Boring Diameter (in): | 6 |
| Drilling Company: | Cascade Drilling | Sampling Method(s): | Direct Push |
| Drilling Method: | Sonic | DTW During Drilling (ft): | |
| Drilling Equipment: | | DTW After Drilling (ft): | |
| Driller: | Jason Green | Ground Surface Elev. (ft): | 497.74 |
| Logged By: | Will Blocher | Location (Lat, Long): | 41.3024578, -89.3063692 |

| DEPTH (ft) | LITHOLOGY | WATER LEVEL | BORING COMPLETION | COLLECT: Sample Type | COLLECT: Recovery (in) | COLLECT: Blow Counts | COLLECT: N Value RQD (%) | SOIL/ROCK VISUAL DESCRIPTION | MEASURE: Lab Sample | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | DP | 48/60 | | | (0') GRAVELLY LEAN CLAY WITH SAND (CL); dense, somewhat cohesive, dark brown (10YR 4/3). | | 0 |
| | | | | | | | | (3.25') SANDY LEAN CLAY (CL); dark brown (10YR 4/3), medium consistency, medium plasticity, moist. | | |
| | | | | | | | | (3.75') Same as above: except darker (10YR 3/2). | 4-8 Geotech Sample 1 | |
| 5 | | | | DP | 42/60 | | | (5') LEAN CLAY WITH SAND (CL); trace gravel, stiff, medium plasticity, very dark (10YR 2/1). | | 5 |
| | | | | | | | | (8.5') 1" Sandy interbed. | | |
| 10 | | | | DP | 102/120 | | | (10') Same as above: some gravel, lighter (10YR 3/2). | | 10 |
| 15 | | | | | | | | (15') SANDY SILT (ML); with some gravel, loose, dry, pale yellowish tan (10YR 6/2), color lightens downward to (10YR 7/2). | | 15 |
| 20 | | | | | | | | | | 20 |

NOTES: Sample 1: 21.4% moisture content, 8080 mg/kg total organic carbon, 95.0 pcf dry unit weight, 2.675 specific gravity, $7.1x10^{-8}$ cm/s vertical hydraulic conductivity, 32 LL, 17 PL, 15 PI, 0.7% gravel, 21.0% sand, 78.3% fines.

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| Client: | Dynegy |
|---|---|
| Project: | GLP8020, Hennepin East Ash Pond |
| Address: | 13498 E 800th, Hennepin, IL |

**BORING LOG**
**Boring No.** MW52


| | | | |
|---|---|---|---|
| Drilling Start Date: | 02/11/2021 | Boring Depth (ft): | 61 |
| Drilling End Date: | 02/11/2021 | Boring Diameter (in): | 6 |
| Drilling Company: | Cascade Drilling | Sampling Method(s): | Direct Push |
| Drilling Method: | Sonic | DTW During Drilling (ft): | |
| Drilling Equipment: | | DTW After Drilling (ft): | |
| Driller: | Jason Green | Ground Surface Elev. (ft): | 497.74 |
| Logged By: | Will Blocher | Location (Lat, Long): | 41.3024578, -89.3063692 |

| DEPTH (ft) | LITHOLOGY | WATER LEVEL | BORING COMPLETION | COLLECT: Sample Type | COLLECT: Recovery (in) | COLLECT: Blow Counts | COLLECT: N Value RQD (%) | SOIL/ROCK VISUAL DESCRIPTION | MEASURE: Lab Sample | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 20 | | | | DP | 66/120 | | | | | 20 |
| 24.5 | | | | | | | | (24.5') LEAN CLAY WITH SAND (CL); moist, medium consistency, medium plasticity, dark (10YR 2/2). | | |
| 25 | | | | | | | | (25') SILTY SAND WITH GRAVEL (SM); loose, dry, dull red (10YR 4/4). | | 25 |
| 27.5 | | | | | | | | (27.5') WELL-GRADED SAND WITH SILT AND GRAVEL (SM); loose, dry, grayish tan (10YR 6/3). | | |
| 30 | | | | DP | 96/120 | | | | | 30 |
| 32 | | | | | | | | (32') LEAN CLAY WITH SAND AND GRAVEL (CL); stiff, medium plasticity, dark brown (10YR 5/2). | | |
| 33 | | | | | | | | (33') SANDY SILT WITH GRAVEL (ML); loose, dry, light dull red (10YR 5/4). | | |
| 35 | | | | | | | | | | 35 |
| 38.5 | | | | | | | | (38.5') <1" clay interbed. | | |
| 39.5 | | | | | | | | Begin drilling with water. | | |
| 40 | | | | | | | | | | 40 |

NOTES:

| | | | |
|---|---|---|---|
| Drilling Start Date: | **02/11/2021** | Boring Depth (ft): | **61** |
| Drilling End Date: | **02/11/2021** | Boring Diameter (in): | **6** |
| Drilling Company: | **Cascade Drilling** | Sampling Method(s): | **Direct Push** |
| Drilling Method: | **Sonic** | DTW During Drilling (ft): | |
| Drilling Equipment: | | DTW After Drilling (ft): | |
| Driller: | **Jason Green** | Ground Surface Elev. (ft): | **497.74** |
| Logged By: | **Will Blocher** | Location (Lat, Long): | **41.3024578, -89.3063692** |

| DEPTH (ft) | LITHOLOGY | WATER LEVEL | BORING COMPLETION | COLLECT: Sample Type | COLLECT: Recovery (in) | COLLECT: Blow Counts | COLLECT: N Value RQD (%) | SOIL/ROCK VISUAL DESCRIPTION | MEASURE: Lab Sample | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 40 | | | | DP | 96/ 120 | | | (40') WELL-GRADED SILTY GRAVEL WITH SAND (GM); pebble to cobble, loose, moist, light dull red (10YR 5/4). | | 40 |
| 45 | | | | | | | | | | 45 |
| | | | | | | | | (48.5-49.5') Lighter colored interval (10YR 7/3). | 49-50 Geotech (not tested) | |
| 50 | | | | DP | 24/ 132 | 5 5 4 5 | | | | 50 |
| 55 | | | | | | | | | | 55 |
| | | | | | | | | (59') WELL-GRADED GRAVEL (GW); wet, fines likely removed in drilling. | | |
| 60 | | | | | | | | | | 60 |

NOTES:

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|---|---|---|
| Client: Dynegy | | **BORING LOG** |
| Project: GLP8020, Hennepin East Ash Pond | | Boring No. MW52 |
| Address: 13498 E 800th, Hennepin, IL | |  |

| | | | |
|---|---|---|---|
| Drilling Start Date: | 02/11/2021 | Boring Depth (ft): | 61 |
| Drilling End Date: | 02/11/2021 | Boring Diameter (in): | 6 |
| Drilling Company: | Cascade Drilling | Sampling Method(s): | Direct Push |
| Drilling Method: | Sonic | DTW During Drilling (ft): | |
| Drilling Equipment: | | DTW After Drilling (ft): | |
| Driller: | Jason Green | Ground Surface Elev. (ft): | 497.74 |
| Logged By: | Will Blocher | Location (Lat, Long): | 41.3024578, -89.3063692 |

| DEPTH (ft) | LITHOLOGY | WATER LEVEL | BORING COMPLETION | COLLECT: Sample Type | COLLECT: Recovery (in) | COLLECT: Blow Counts | COLLECT: N Value RQD (%) | SOIL/ROCK VISUAL DESCRIPTION | MEASURE: Lab Sample | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 60 | | | | | | | | | | 60 |
| | | | | | | | | (61') End of Boring. | | |
| 65 | | | | | | | | | | 65 |

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Client: Dynegy
Project: GLP8020, Hennepin East Ash Pond
Address: 13498 E 800th, Hennepin, IL

# BORING LOG

Boring No. SB53



| | | | |
|---|---|---|---|
| Drilling Start Date: | **01/12/2021** | Boring Depth (ft): | **64** |
| Drilling End Date: | **01/12/2021** | Boring Diameter (in): | **10** |
| Drilling Company: | **Geotechnology** | Sampling Method(s): | **Split Spoon & Shelby Tube** |
| Drilling Method: | **Hollow Stem Auger** | DTW During Drilling (ft): | |
| Drilling Equipment: | **CME 55** | DTW After Drilling (ft): | |
| Driller: | | Ground Surface Elev. (ft): | **500.01** |
| Logged By: | **D. Mateas** | Location (Lat, Long): | **41.3016855, -89.3055835** |

| DEPTH (ft) | Sample Type | Recovery (in) | Blow Counts | N Value RQD (%) | SOIL/ROCK VISUAL DESCRIPTION | Lab Sample |
|---|---|---|---|---|---|---|
| 0 | SS | 19/24 | 1, 5, 11, 12 | 16 | (0.0') CLAYEY SILT (ML); dark yellowish brown (10YR 3/4), low plasticity, some clay, trace roots, trace sand, very stiff, dry. (1') As above: some large angular gravel. | |
| 2 | SH | 8/8 | | | (2') GRAVELLY SILT (ML); dark yellowish brown (10YR 3/4), non-plastic, cohesive, some coarse subangular gravel, few clay, few sand, very stiff, dry. | 2-4 ST |
| 2.5 | SS | 7/16 | 7, 16, 10 | 26 | | |
| 4 | SS | 11/24 | 15, 8, 8, 8 | 16 | (4') SILTY LEAN CLAY (CL); dark yellowish brown (10YR 3/4), low plasticity, cohesive, little to some silt, trace sand, very stiff, moist. | 2-6 Geotech Sample 1 |
| 6 | SS | 0/24 | 4, 8, 6, 5 | 14 | (6') No Recovery. | |
| 8 | SS | 22/24 | 2, 5, 7, 10 | 12 | (8') SILTY LEAN CLAY (CL); very dark brown (10YR 2/2); low plasticity, cohesive, little to some silt, trace fine gravel, stiff, moist. | 8-10 Chem |
| 10 | SS | 14/24 | 2, 5, 9, 10 | 14 | (10.9') As above: few to little sand. | |
| 12 | SS | 14/24 | 3, 5, 6, 9 | 11 | (12') CLAYEY SAND (SC); very dark brown (10YR 2/2), non-plastic, cohesive, fine grained, poorly-graded, few silt, little clay, medium dense, moist. | |
| 14 | SS | 22/24 | 2, 5, 6, 7 | 11 | (14') POORLY-GRADED SAND (SP); very dark brown (10YR 2/2), slightly cohesive, fine grained, few to little silt, trace fine angular gravel, medium dense, moist. | |
| 16 | SS | 17/24 | 2, 4, 5, 6 | 9 | (16') CLAYEY SILT (ML); very dark brown (10YR 2/2), cohesive, little to some clay, few sand, non-plastic, stiff, moist. | |
| 18 | SS | 16/24 | 2, 4, 6, 8 | 10 | (18') As above: dark yellowish brown (10YR 3/6) | |
| 20 | | | | | | |

NOTES: Berm fill to 24 ft bgs. Sand/gravel from 24 to 65 ft bgs. Split spoon sampler advanced to 64 ft bgs. Auger advanced to 63.78 ft bgs Sample 1: 13.7% moisture content, 11600 mg/kg total organic carbon, 120.0 pcf dry unit weight, 2.680 specific gravity, $2.4 \times 10^{-8}$ cm/s vertical hydraulic conductivity, 29 LL, 16 PL, 13 PI, 9.6% gravel, 39.3% sand, 51.1% fines.

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|---|---|---|

| | | | |
|---|---|---|---|
| Drilling Start Date: | **01/12/2021** | Boring Depth (ft): | **64** |
| Drilling End Date: | **01/12/2021** | Boring Diameter (in): | **10** |
| Drilling Company: | **Geotechnology** | Sampling Method(s): | **Split Spoon & Shelby Tube** |
| Drilling Method: | **Hollow Stem Auger** | DTW During Drilling (ft): | |
| Drilling Equipment: | **CME 55** | DTW After Drilling (ft): | |
| Driller: | | Ground Surface Elev. (ft): | **500.01** |
| Logged By: | **D. Mateas** | Location (Lat, Long): | **41.3016855, -89.3055835** |

| DEPTH (ft) | LITHOLOGY | WATER LEVEL | BORING COMPLETION | Sample Type (COLLECT) | Recovery (in) (COLLECT) | Blow Counts (COLLECT) | N Value RQD (%) (COLLECT) | SOIL/ROCK VISUAL DESCRIPTION | Lab Sample (MEASURE) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 20 | | | | SS | 16/24 | 3<br>5<br>8<br>13 | 13 | (20') SANDY LEAN CLAY (CL); dark yellowish brown (10YR 3/6), low plasticity, cohesive, little fine to medium sand, few silt, trace coarse rounded gravel, stiff, moist. | | 20 |
| | | | | SS | 0/24 | 16<br>16<br>12<br>23 | 28 | (22') No Recovery. | | |
| 25 | | | | SS | 14/24 | 16<br>38<br>28<br>22 | 66 | (24') WELL-GRADED GRAVEL (GW); very pale brown (10YR 8/2) with some dark yellowish brown (10YR 4/6), well-graded sand, very dense, moist. | | 25 |
| | | | | SS | 16/24 | 17<br>22<br>21<br>19 | 43 | (26') GRAVELLY WELL-GRADED SAND (SW); yellowish brown (10YR 5/8); fine to coarse grained, some fine to coarse subangular to subrounded gravel (10YR 8/2), dense, moist. | | |
| | | | | SS | 17/24 | 15<br>19<br>29<br>35 | 48 | (28') As above. | | |
| 30 | | | | SS | 17/24 | 14<br>19<br>25<br>20 | 44 | (30') As above. | | 30 |
| | | | | SS | 16/24 | 27<br>10<br>12<br>16 | 22 | (32') As above: medium dense.<br>(32.3-33') As above: little clay. | | |
| 35 | | | | SS | 16/24 | 12<br>12<br>10<br>14 | 22 | (34.9-35.0') As above: trace clay. | | 35 |
| | | | | SS | 16/24 | 24<br>21<br>20<br>23 | 41 | (36') As above: dense. | | |
| 40 | | | | SS | 13/24 | 8<br>7<br>6<br>6 | 13 | (38') As above: medium dense, some light greenish gray (GLEY 7/1) gravel. | | 40 |

NOTES: Berm fill to 24 ft bgs.
Sand/gravel from 24 to 65 ft bgs.
Split spoon sampler advanced to 64 ft bgs. Auger advanced to 63.78 ft bgs.

| Geosyntec consultants | Client: Dynegy<br>Project: GLP8020, Hennepin East Ash Pond<br>Address: 13498 E 800th, Hennepin, IL | **BORING LOG**<br>Boring No. SB53<br>Page: 3 of 4 |
|---|---|---|

| | | | |
|---|---|---|---|
| Drilling Start Date: | **01/12/2021** | Boring Depth (ft): | **64** |
| Drilling End Date: | **01/12/2021** | Boring Diameter (in): | **10** |
| Drilling Company: | **Geotechnology** | Sampling Method(s): | **Split Spoon & Shelby Tube** |
| Drilling Method: | **Hollow Stem Auger** | DTW During Drilling (ft): | |
| Drilling Equipment: | **CME 55** | DTW After Drilling (ft): | |
| Driller: | | Ground Surface Elev. (ft): | **500.01** |
| Logged By: | **D. Mateas** | Location (Lat, Long): | **41.3016855, -89.3055835** |

| DEPTH (ft) | Sample Type | Recovery (in) | Blow Counts | N Value RQD (%) | SOIL/ROCK VISUAL DESCRIPTION | Lab Sample |
|---|---|---|---|---|---|---|
| 40 | SS | 13/24 | 4, 4, 8, 7 | 12 | (40') GRAVELLY WELL-GRADED SAND (SW); strong brown (7.5YR 5/6), fine to coarse grained, some fine to coarse subangular to subrounded gravel, trace clay, medium dense, wet. | |
| 42 | SS | 10/24 | 6, 7, 8, 6 | 15 | (42') SANDY WELL-GRADED GRAVEL (GW); yellowish brown (10YR 5/8) and light greenish gray (GLEY 7/1), fine to coarse (up to 2" diameter), some sand, trace clay, medium dense, moist. | |
| 44 | SS | 6/24 | 4, 4, 7, 14 | 11 | (44') As above. | |
| 46 | SS | 12/24 | 21, 20, 8, 7 | 28 | (46') GRAVELLY WELL-GRADED SAND (SW); yellowish brown (10YR 5/8), fine to coarse grained, some fine to coarse subangular to subrounded gravel, trace to few clay, medium dense, moist. | |
| 48 | SS | 10/24 | 4, 5, 7, 10 | 12 | (48') As above: wet. | |
| 50 | SS | 8/24 | 7, 6, 5, 8 | 11 | (50') SANDY WELL-GRADED GRAVEL (GW); yellowish brown (10YR 5/8), fine to coarse (up to 2" diameter), some sand, trace clay, medium dense, wet. | 50-54 Chem |
| 52 | SS | 11/24 | 5, 6, 6, 7 | 12 | (52') As above: no clay. | |
| 54 | SH | 8/13 | | | | 54-56 ST |
| 56 | SS | 9/24 | 4, 5, 6, 7 | 11 | (56') WELL-GRADED SAND (SW); yellowish brown (10YR 5/8); medium to coarse grained, little coarse subrounded gravel (up to 1" diameter), medium dense, wet. | 56-58 Geotech Sample 2 |
| 58 | SS | 4/24 | 3, 3, 6, 4 | 9 | (58') WELL-GRADED GRAVEL (GW); yellowish brown (10YR 5/8), coarse grained, subrounded, some very coarse grained sand, loose, wet. | |
| 60 | | | | | | |

NOTES: Berm fill to 24 ft bgs. Sand/gravel from 24 to 65 ft bgs. Split spoon sampler advanced to 64 ft bgs. Auger advanced to 63.78 ft bgs.
Sample 2: 9.9% moisture content, 8580 mg/kg total organic carbon, 48.9% gravel, 42.8% sand, 8.3% fines.

# BORING LOG

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**Client:** Dynegy
**Project:** GLP8020, Hennepin East Ash Pond
**Address:** 13498 E 800th, Hennepin, IL

**Boring No.** SB53


| | | | |
|---|---|---|---|
| Drilling Start Date: | **01/12/2021** | Boring Depth (ft): | **64** |
| Drilling End Date: | **01/12/2021** | Boring Diameter (in): | **10** |
| Drilling Company: | **Geotechnology** | Sampling Method(s): | **Split Spoon & Shelby Tube** |
| Drilling Method: | **Hollow Stem Auger** | DTW During Drilling (ft): | |
| Drilling Equipment: | **CME 55** | DTW After Drilling (ft): | |
| Driller: | | Ground Surface Elev. (ft): | **500.01** |
| Logged By: | **D. Mateas** | Location (Lat, Long): | **41.3016855, -89.3055835** |

| DEPTH (ft) | LITHOLOGY | WATER LEVEL | BORING COMPLETION | COLLECT: Sample Type | COLLECT: Recovery (in) | COLLECT: Blow Counts | COLLECT: N Value RQD (%) | SOIL/ROCK VISUAL DESCRIPTION | MEASURE: Lab Sample | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 60 | | | | SS | 6/24 | 4 6 6 8 | 12 | (60') As above. | | 60 |
| | | | | SS | 4/24 | 5 9 5 3 | 14 | | | |
| | | | | | | | | (64') End of Boring. | | |
| 65 | | | | | | | | | | 65 |

NOTES: Berm fill to 24 ft bgs.
Sand/gravel from 24 to 65 ft bgs.
Split spoon sampler advanced to 64 ft bgs. Auger advanced to 63.78 ft bgs.

| Geosyntec consultants<br>engineers \| scientists \| innovators | Client: Dynegy<br>Project: GLP8020, Hennepin East Ash Pond<br>Address: 13498 E 800th, Hennepin, IL | **BORING LOG**<br>**Boring No. MW54**<br>**Page: 1 of 4** |
|---|---|---|

| | | | |
|---|---|---|---|
| Drilling Start Date: | **02/08/2021** | Boring Depth (ft): | **75** |
| Drilling End Date: | **02/09/2021** | Boring Diameter (in): | **6** |
| Drilling Company: | **Cascade Drilling** | Sampling Method(s): | **Direct Push** |
| Drilling Method: | **Sonic** | DTW During Drilling (ft): | |
| Drilling Equipment: | | DTW After Drilling (ft): | |
| Driller: | **Jason Green** | Ground Surface Elev. (ft): | **497.14** |
| Logged By: | **SWB** | Location (Lat, Long): | **41.3034315, -89.3052197** |

| DEPTH (ft) | LITHOLOGY | WATER LEVEL | BORING COMPLETION | COLLECT: Sample Type | COLLECT: Recovery (in) | COLLECT: Blow Counts | COLLECT: N Value RQD (%) | SOIL/ROCK VISUAL DESCRIPTION | MEASURE: Lab Sample | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | DP | 60/60 | | | (0') SANDY LEAN CLAY (CL); little gravel, stiff, dark brown (10YR 3/2), low plasticity, non-cohesive, moist. | | 0 |
| 5 | | | | DP | 60/60 | | | (5') SILTY SAND WITH GRAVEL (SM); medium dense, reddish brown (5Y 4/6), moist, non-plastic, non-cohesive. | | 5 |
| | | | | | | | | (7.9') SANDY LEAN CLAY (CL); trace gravel, stiff, mottled reddish brown (5Y 4/6), gray (2.5Y 4/1). | | |
| 10 | | | | SH | 20/24 | 6<br>4<br>5<br>5 | | (10') FAT CLAY WITH SAND (CH); trace gravel, medium dark brown (5Y 3/1), moist, high plasticity. | 10-12 Geotech (not tested) & Chem | 10 |
| | | | | DP | 60/96 | | | (12') As above: few gravel (large). | | |
| 15 | | | | | | | | | | 15 |
| | | | | | | | | (17') As above: gradational color change to darker brown (10YR 2/1). | | |
| 20 | | | | | | | | | | 20 |

NOTES:

# BORING LOG

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| | | | |
|---|---|---|---|
| Client: | Dynegy | Boring No. | MW54 |
| Project: | GLP8020, Hennepin East Ash Pond | Page: | 2 of 4 |
| Address: | 13498 E 800th, Hennepin, IL | | |

| | | | |
|---|---|---|---|
| Drilling Start Date: | 02/08/2021 | Boring Depth (ft): | 75 |
| Drilling End Date: | 02/09/2021 | Boring Diameter (in): | 6 |
| Drilling Company: | Cascade Drilling | Sampling Method(s): | Direct Push |
| Drilling Method: | Sonic | DTW During Drilling (ft): | |
| Drilling Equipment: | | DTW After Drilling (ft): | |
| Driller: | Jason Green | Ground Surface Elev. (ft): | 497.14 |
| Logged By: | SWB | Location (Lat, Long): | 41.3034315, -89.3052197 |

| DEPTH (ft) | LITHOLOGY | WATER LEVEL | BORING COMPLETION | COLLECT: Sample Type | COLLECT: Recovery (in) | COLLECT: Blow Counts | COLLECT: N Value RQD (%) | SOIL/ROCK VISUAL DESCRIPTION | MEASURE: Lab Sample | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 20 | | | | DP | 90/ 120 | | | (20') As above: trace gravel. | | 20 |
| 25 | | | | | | | | (24.5') SILTY SAND WITH GRAVEL (SM); very loose, pale yellow tan (10YR 6/3), dry, non-cohesive.<br>(25.5') As above: color change to white (10YR 7/1).<br>(25.8') As above: color change to yellow (10YR 6/4), color is mottled, few to some gravel. | | 25 |
| 30 | | | | DP | 91/ 120 | | | (30') No Recovery. | | 30 |
| | | | | | | | | (32.5') FAT CLAY WITH SAND (CH); medium stiff, very dark brown (10YR 3/1), trace gravel, cohesive, moist, medium plasticity. (possible slough) | | |
| 35 | | | | | | | | (35') WELL-GRADED SILTY SAND (SM); few gravel, non-cohesive, very loose, light tan (10YR 7/2), dry. | | 35 |
| | | | | | | | | (37.6') GRAVELLY FAT CLAY WITH SAND (CH); medium stiff, dark brown (10YR 3/2), dry to moist, medium plasticity. | | |
| | | | | | | | | (38.6') SILTY SAND WITH GRAVEL (SM); loose, tan (10YR 6/3), dry. | | |
| 40 | | | | | | | | | | 40 |

NOTES:

| Geosyntec consultants | Client: Dynegy<br>Project: GLP8020, Hennepin East Ash Pond<br>Address: 13498 E 800th, Hennepin, IL | **BORING LOG**<br>Boring No. MW54<br>Page: 3 of 4 |
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| | | | |
|---|---|---|---|
| Drilling Start Date: | **02/08/2021** | Boring Depth (ft): | **75** |
| Drilling End Date: | **02/09/2021** | Boring Diameter (in): | **6** |
| Drilling Company: | **Cascade Drilling** | Sampling Method(s): | **Direct Push** |
| Drilling Method: | **Sonic** | DTW During Drilling (ft): | |
| Drilling Equipment: | | DTW After Drilling (ft): | |
| Driller: | **Jason Green** | Ground Surface Elev. (ft): | **497.14** |
| Logged By: | **SWB** | Location (Lat, Long): | **41.3034315, -89.3052197** |

| DEPTH (ft) | Sample Type (COLLECT) | Recovery (in) (COLLECT) | Blow Counts (COLLECT) | N Value RQD (%) (COLLECT) | SOIL/ROCK VISUAL DESCRIPTION | Lab Sample (MEASURE) |
|---|---|---|---|---|---|---|
| 40 | DP | 108/ 120 | | | (40') No Recovery. | |
| 41 | | | | | (41') LEAN CLAY WITH GRAVEL (CL); medium stiff, dark gray (10YR 3/1), dry to moist, medium plasticity, cohesive. (possible slough) | |
| 42.25 | | | | | (42.25') SILTY GRAVEL WITH SAND (GM); loose, dark yellowish tan (10YR 5/3), dry. | |
| 48 | | | | | (48') As above: wet. | |
| 49.3 | | | | | (49.3') As above: dry, with siltstone (compacted silt). | |
| 50 | SH | 12/24 | 10<br>8<br>9<br>9 | | (50') As above: wet, no silt rock. | |
| 52 | DP | 78/ 120 | | | (52') No Recovery. | |
| 53.5 | | | | | (53.5') CLAYEY GRAVEL WITH SAND (GC); medium dense, yellowish brown (10YR 4/3), moist, cohesive, clay matrix. | 53.5-54.5 Chem<br>54.5-56 Geotech (not tested) |
| 57 | | | | | (57') WELL-GRADED GRAVEL WITH CLAY AND SAND (GW-GC); gradational contact (1ft), increased sand and decreased clay content, still moist to dry, no color change. | |
| 60 | | | | | | |

NOTES:

| Geosyntec consultants | Client: Dynegy<br>Project: GLP8020, Hennepin East Ash Pond<br>Address: 13498 E 800th, Hennepin, IL | **BORING LOG**<br>Boring No. MW54<br>Page: 4 of 4 |
|---|---|---|

| | | | |
|---|---|---|---|
| Drilling Start Date: | **02/08/2021** | Boring Depth (ft): | **75** |
| Drilling End Date: | **02/09/2021** | Boring Diameter (in): | **6** |
| Drilling Company: | **Cascade Drilling** | Sampling Method(s): | **Direct Push** |
| Drilling Method: | **Sonic** | DTW During Drilling (ft): | |
| Drilling Equipment: | | DTW After Drilling (ft): | |
| Driller: | **Jason Green** | Ground Surface Elev. (ft): | **497.14** |
| Logged By: | **SWB** | Location (Lat, Long): | **41.3034315, -89.3052197** |

| DEPTH (ft) | LITHOLOGY | WATER LEVEL | BORING COMPLETION | COLLECT: Sample Type | COLLECT: Recovery (in) | COLLECT: Blow Counts | COLLECT: N Value RQD (%) | SOIL/ROCK VISUAL DESCRIPTION | MEASURE: Lab Sample | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 60 | | | | DP | 108/ 120 | | | (61') WELL-GRADED GRAVEL WITH SAND AND CLAY (GW-GC); loose, pale yellowish brown (10Y 5/4), wet. | | 60 |
| 65 | | | | | | | | | | 65 |
| 70 | | | | | | | | | | 70 |
| 75 | | | | | | | | (75') End of Boring. | | 75 |
| 80 | | | | | | | | | | 80 |

NOTES:

Geosyntec consultants
engineers | scientists | innovators

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PrGlecty W8P0121, He: : epi: Eost Ash PG d
Addressy 63490 E 011th, He: : epi: , I8

j ORINW8OW
j Gri: J NG MB 55
PoJey 6 Gf 5

| | | | |
|---|---|---|---|
| Drilling Start Date: | 12/61/2126 | Boring Depth (ft): | 611 |
| Drilling End Date: | 12/61/2126 | Boring Diameter (in): | C |
| Drilling Company: | I oscode Drimi: J | Sampling Method(s): | Direct Push |
| Drilling Method: | SG ic | DTW During Drilling (ft): | |
| Drilling Equipment: | | DTW After Drilling (ft): | |
| Driller: | aosG Wree: | Ground Surface Elev. (ft): | 495.65 |
| Logged By: | B imj rGcher | Location (Lat, Long): | 41.303651, -89.3043529 |

| DEPTH (ft) | LITHOLOGY | WATER LEVEL | BORING COMPLETION | COLLECT: Sample Type | COLLECT: Recovery (in) | COLLECT: Blow Counts | COLLECT: N Value RQD (%) | SOIL/ROCK VISUAL DESCRIPTION | MEASURE: Lab Sample | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | DP | 60/60 | | | (0') CLAYEY SAND WITH GRAVEL (SC); yellowish brown (10YR 4/4), medium dense, clay matrix, cohesive, medium plasticity, moist. | | 0 |
| 5 | | | | DP | 78/ 120 | | | (5') SANDY LEAN CLAY WITH GRAVEL (CL); yellowish brown (10YR 4/4), medium consistency, medium plasticity, cohesive, moist. | 8-10 Chem | 5 |
| 10 | | | | | | | | (10') As above: darker color (10YR 2/2). | | 10 |
| 15 | | | | DP | 56/60 | 17 11 7 4 | | (18.3') Thin (<1") interval of grayish green silt. | 15-17.5 ST Sample 1 | 15 |
| | | | | | | | | (19') WELL-GRADED GRAVEL WITH CLAY AND SAND (GW); yellowish tan (10YR 4/2), dry, loose, non-cohesive. | | |
| 20 | | | | | | | | | | 20 |

NOTES: Sample 1: 14.4% moisture content, 9800 mg/kg total organic carbon, 109.0 pcf dry unit weight, 2.720 specific gravity, $1.5x10^{-7}$ cm/s vertical hydraulic conductivity, 32 LL, 19 PL, 13 PI, 12.4% gravel, 39.6% sand, 48.0% fines.

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j ORINW8OW

j Gri: J NG MB 55



| | | | |
|---|---|---|---|
| Drilling Start Date: | 12/61/2126 | Boring Depth (ft): | 611 |
| Drilling End Date: | 12/61/2126 | Boring Diameter (in): | C |
| Drilling Company: | I oscode Drimi: J | Sampling Method(s): | Direct Push |
| Drilling Method: | SG ic | DTW During Drilling (ft): | |
| Drilling Equipment: | | DTW After Drilling (ft): | |
| Driller: | aosG Wree: | Ground Surface Elev. (ft): | 495.65 |
| Logged By: | B imj rGcher | Location (Lat, Long): | 41.303651, -89.3043529 |

| DEPTH (ft) | LITHOLOGY | WATER LEVEL | BORING COMPLETION | COLLECT: Sample Type | COLLECT: Recovery (in) | COLLECT: Blow Counts | COLLECT: N Value RQD (%) | SOIL/ROCK VISUAL DESCRIPTION | MEASURE: Lab Sample | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 20 | | | | DP | 94/ 120 | | | | | 20 |
| 25 | | | | | | | | (24.5') As above: with more clay, red (2.5YR 3/6).<br>(25.5') As above: less clay, yellowish tan (10YR 4/2). | | 25 |
| | | | | | | | | (28.75') As above: little clay, pale yellow (5YR 10/2). | | |
| 30 | | | | DP | 100/ 120 | | | (30') SANDY LEAN CLAY WITH GRAVEL (CL); moist, dark yellowish brown (10YR 2/2), medium consistency, medium plasticity. | | 30 |
| | | | | | | | | (32.5') WELL-GRADED GRAVEL WITH CLAY AND SAND (GW); reddish yellowish brown (7.5YR 3/3), dry, loose, non-cohesive. | | |
| 35 | | | | | | | | | | 35 |
| | | | | | | | | (37') LEAN CLAY WITH SAND AND GRAVEL (CL); clay-rich interval, low plasticity, stiff. | | |
| 40 | | | | | | | | | | 40 |

NOTES:

| Geosyntec consultants | I rie: ty Dg: eJg<br>PrGlecty W8P0121, He: : epi: East Ash PG d<br>Addressy 63490 E 011th, He: : epi: , I8 | j ORINW8OW<br>j Gri: J NG. MB 55<br>PoJey 3 Gf 5 |
|---|---|---|

| | | | |
|---|---|---|---|
| Drilling Start Date: | 12/61/2126 | Boring Depth (ft): | 611 |
| Drilling End Date: | 12/61/2126 | Boring Diameter (in): | C |
| Drilling Company: | I oscode Drimi: J | Sampling Method(s): | Direct Push |
| Drilling Method: | SG ic | DTW During Drilling (ft): | |
| Drilling Equipment: | | DTW After Drilling (ft): | |
| Driller: | aosG Wree: | Ground Surface Elev. (ft): | 495.65 |
| Logged By: | B imj rGcher | Location (Lat, Long): | 41.303651, -89.3043529 |

| DEPTH (ft) | LITHOLOGY | WATER LEVEL | BORING COMPLETION | COLLECT: Sample Type | COLLECT: Recovery (in) | COLLECT: Blow Counts | COLLECT: N Value RQD (%) | SOIL/ROCK VISUAL DESCRIPTION | MEASURE: Lab Sample | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 40 | | | | DP | 96/ 120 | | | (40') WELL-GRADED GRAVEL WITH CLAY AND SAND (GW); reddish yellowish brown (7.5YR 3/3), dry, loose, non-cohesive. Short, clay-rich interval at top of recovered core. | | 40 |
| 45 | | | | | | | | | | 45 |
| 50 | | | | DP | 102/ 120 | 2 8 5 8 | | | 50-52 ST Sample 2 | 50 |
| | | | | | | | | (51') LEAN CLAY WITH SAND AND GRAVEL (CL); dark yellowish brown (10YR 3/2), dry, medium plasticity, stiff. | | |
| | | | | | | | | (52.5') WELL-GRADED GRAVEL WITH SAND (GW); yellowish brown (10YR 4/3), dry, loose, non-cohesive. | | |
| 55 | | | | | | | | | | 55 |
| | | | | | | | | (57') Gradually wetter beginning at 57 ft. | | |
| | | | | | | | | (59') Wet. | | |
| 60 | | | | | | | | | | 60 |

NOTES: Sample 2: 8.2% moisture content, 50,000 mg/kg total organic carbon, 2.823 specific gravity, 21 LL, 15 PL, 6 PI, 60.0% gravel, 23.2% sand, 16.8% fines.

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j Gri: J NG. MB 55
PoJey 4 Gf 5

| | | | |
|---|---|---|---|
| Drilling Start Date: | 12/61/2126 | Boring Depth (ft): | 611 |
| Drilling End Date: | 12/61/2126 | Boring Diameter (in): | C |
| Drilling Company: | I oscode Drimi: J | Sampling Method(s): | Direct Push |
| Drilling Method: | SG: ic | DTW During Drilling (ft): | |
| Drilling Equipment: | | DTW After Drilling (ft): | |
| Driller: | aosG: Wree: | Ground Surface Elev. (ft): | 495.65 |
| Logged By: | B imj rGcher | Location (Lat, Long): | 41.303651, -89.3043529 |

| DEPTH (ft) | LITHOLOGY | WATER LEVEL | BORING COMPLETION | COLLECT: Sample Type | COLLECT: Recovery (in) | COLLECT: Blow Counts | COLLECT: N Value RQD (%) | SOIL/ROCK VISUAL DESCRIPTION | MEASURE: Lab Sample | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 60 | | | | DP | 100/120 | | | | | 60 |
| | | | | | | | | (61') No clay at top of core. | | |
| 65 | | | | | | | | (65') Interval consistently wet. | | 65 |
| | | | | | | | | (68.5') Thin interval dark clay (10YR 2/2).<br>(69') Trace pebble sized gravel. | | |
| 70 | | | | DP | 100/120 | | | | | 70 |
| | | | | | | | | (71') No clay. | | |
| | | | | | | | | (73') Gravel fines downward in last 1' to pebble size, poorly graded. | | |
| | | | | | | | | (73.5') POORLY GRADED SAND (SP); trace pebbles, dark yellowish brown (10YR 3/4), very clean, dense, wet. | | |
| 75 | | | | | | | | | | 75 |
| | | | | | | | | (77.5') Quartz & feldspar black grains, sharp upper contact.<br>(78') As above: with more pebbles, darker (10Y 4/4). | | |
| 80 | | | | | | | | | | 80 |

NOTES:

| Geosyntec consultants (engineers \| scientists \| innovators) | I rie: ty Dg: eJg<br>PrGlecty W8P0121, He: : epi: Eost Ash PG d<br>Addressy 63490 E 011th, He: : epi: , I8 | j ORINW8OW<br>j Gri: J NG MB 55<br>PoJey 5 Gf 5 |
|---|---|---|

| | | | |
|---|---|---|---|
| Drilling Start Date: | **12/61/2126** | Boring Depth (ft): | **611** |
| Drilling End Date: | **12/61/2126** | Boring Diameter (in): | **C** |
| Drilling Company: | **I oscode Drimi: J** | Sampling Method(s): | **Direct Push** |
| Drilling Method: | **SG ic** | DTW During Drilling (ft): | |
| Drilling Equipment: | | DTW After Drilling (ft): | |
| Driller: | **aosG Wree:** | Ground Surface Elev. (ft): | **495.65** |
| Logged By: | **B imj rGcher** | Location (Lat, Long): | **41.303651, -89.3043529** |

| DEPTH (ft) | LITHOLOGY | WATER LEVEL | BORING COMPLETION | COLLECT: Sample Type | COLLECT: Recovery (in) | COLLECT: Blow Counts | COLLECT: N Value RQD (%) | SOIL/ROCK VISUAL DESCRIPTION | MEASURE: Lab Sample | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 80 | | | | DP | 96/ 108 | | | (80') As above. | | 80 |
| | | | | | | | | (83.25') PEBBLY CLAY (CL); trace pebbles. | | |
| | | | | | | | | (84') POORLY GRADED SAND WITH CLAY AND GRAVEL (SP); medium dense, non-cohesive, moist. | | |
| 85 | | | | | | | | | 85-89 Chem | 85 |
| | | | | | | | | (85.5') SILTY SHALE; grayish green (GLEY1 10Y 5/2), cohesive rock chips, reacts weakly with 5% acetic acid. | | |
| | | | | DP | 84/ 132 | | | | | |
| 90 | | | | | | | | | | 90 |
| 95 | | | | | | | | | | 95 |
| 100 | | | | | | | | (100') End of Boring. | | 100 |

NOTES:

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**Client:** Dynegy
**Project:** GLP8020, Hennepin East Ash Pond
**Address:** 13498 E 800th, Hennepin, IL

# WELL LOG

**Well No.** XPW01
**Page:** 1 of 1

| | | | | | |
|---|---|---|---|---|---|
| Drilling Start Date: | 01/14/2021 | Boring Depth (ft): | 17 | Well Depth (ft): | |
| Drilling End Date: | 01/14/2021 | Boring Diameter (in): | 10 | Well Diameter (in): | |
| Drilling Company: | Geotechnology | DTW During Drilling (ft): | | Screen Slot (in): | |
| Drilling Method: | Hollow Stem Auger | DTW After Drilling (ft): | | Riser Material: | |
| Drilling Equipment: | CME 55 | Top of Casing Elev. (ft) | | Screen Material: | |
| Driller: | | Ground Elev. (ft): | 498.19 | Seal Material(s): | |
| Logged By: | D. Mateas | Location (Lat/Long): | 41.30259, -89.30584 | Filter Pack: | |

COLLECT

| DEPTH (ft) | Sample Type | Recovery (in) | Blow Counts | N Value RQD (%) |
|---|---|---|---|---|
| 0 | SS | 15/24 | 4, 6, 5, 4 | 11 |
| 2 | SS | 21/24 | 2, 4, 4, 5 | 8 |
| 4 | SS | 15/24 | 2, 2, 2, 1 | 4 |
| 6 | SS | 20/24 | 2, 2, 0, 1 | 2 |
| 8 | SS | 24/24 | 0, 1, 2, 4 | 3 |
| 10 | SH | 16/24 | | |
| 12 | SH | 24/24 | | |
| 14 | SS | 5/12 | 0, 2 | |
| 15 | SH | 24/24 | | |

SOIL/ROCK VISUAL DESCRIPTION

(0.0') WELL-GRADED SAND (SW); light brown (2.5Y 5/4), fine to medium grained, some slag and coal fragments, 2-inch piece of slag at surface, medium dense, dry, brick fragments at 0.3 to 0.4 ft. [BOT ASH]

(2.0') SILT (ML); dark gray (10YR 4/1), non-plastic, trace fine grained sand, medium stiff, moist. [FLY ASH]

(2.5') As above: light gray (7.5YR 7/1), trace slag and coal fragments.

(3.3') WELL-GRADED SAND (SW); light brown (2.5Y 5/4), fine to medium grained, some slag and coal fragments, 2-inch piece of slag at surface, medium dense, dry, brick fragments at 0.3 to 0.4 ft. [BOT ASH]

(4.0') As above.

(4.5') SILT (ML); gray (2.5Y 5/1), non-plastic, trace fine grained sand, soft, moist. [FLY ASH]

(6.0') WELL-GRADED SAND (SW); olive brown (2.5Y 4/4), fine to medium grained, little slag and coal fragments, very loose, moist. [BOTTOM ASH]

(6.75') SILT (ML); brownish gray (2.5Y 6/2), non-plastic, little medium grained sand, soft, wet. [FLY ASH]

(8.0') As above.

(10') As above. Failed Shelby Tube from 10-12' bgs.

(12') WELL-GRADED SAND (SW); light olive brown (2.5Y 3/3), fine to medium grained, some slag and coal fragments, loose, wet.

(17') End of Boring.

MEASURE

| Lab Sample |
|---|
| 8-10 Chem |
| 10-12 Geotech Sample 1 |
| 12-14 ST Sample 2 |
| 14-15 Chem |
| 15-17 ST Sample 3 |

NOTES: Split Fly ash and bottom ash from 0 to 17 ft bgs. Split spoon sampler advanced to 17 ft bgs. Augers advanced to 17.25 ft bgs.
Sample 1: 157.0% moisture content, 2.635 specific gravity, 4.0% gravel, 22.2% sand, 73.8% fines.
Sample 2: 42.3% moisture content, 71.0 pcf dry unit weight, 2.859 specific gravity, 14.1% gravel, 71.8% sand, 14.1% fines.
Sample 3: 31.0% moisture content, 79.0 pcf dry unit weight, 2.622 specific gravity, 10.1% gravel, 83.1% sand, 6.8% fines.

| Geosyntec consultants | Client: Dynegy<br>Project: GLP8020, Hennepin East Ash Pond<br>Address: 13498 E 800th, Hennepin, IL | **WELL LOG**<br>**Well No. XPW02**<br>**Page: 1 of 1** |
|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| Drilling Start Date: | **01/15/2021** | Boring Depth (ft): | **18.5** | Well Depth (ft): | |
| Drilling End Date: | **01/15/2021** | Boring Diameter (in): | **10** | Well Diameter (in): | |
| Drilling Company: | **Geotechnology** | DTW During Drilling (ft): | | Screen Slot (in): | |
| Drilling Method: | **Hollow Stem Auger** | DTW After Drilling (ft): | | Riser Material: | |
| Drilling Equipment: | **CME 55** | Top of Casing Elev. (ft) | | Screen Material: | |
| Driller: | | Ground Elev. (ft): | **501.60** | Seal Material(s): | |
| Logged By: | **D. Mateas** | Location (Lat/Long): | **41.30186, -89.30372** | Filter Pack: | |

| DEPTH (ft) | Sample Type | Recovery (in) | Blow Counts | N Value RQD (%) | SOIL/ROCK VISUAL DESCRIPTION | Lab Sample |
|---|---|---|---|---|---|---|
| 0 | SS | 24/24 | 3, 9, 10, 11 | 19 | (0.0') SILT (ML); light yellowish brown (2.5Y 6/3), non-plastic, cohesive, few medium to coarse grained sand, few fine gravel, few clay, very stiff, wet. [FLY ASH] | |
| | SS | 7/24 | 1, 2, 1, 2 | 3 | (2.0') WELL-GRADED GRAVEL (GW); light yellowish brown (2.5Y 6/3), fine to coarse grained, little sand, trace silt, very loose, wet. [BOTTOM ASH]<br>(2.3') FAT CLAY (CH); black (2.5Y 2.5/1), medium plasticity, soft, wet. [FILL] | |
| 5 | SS | 13/24 | 2, 5, 34, 50/2 | 39 | (4') As above.<br>(4.3') WELL-GRADED GRAVEL (GW); light yellowish brown (2.5Y 6/3), fine to coarse grained, little sand, trace silt, very loose, wet. [BOTTOM ASH] | |
| | SS | 18/24 | 5, 5, 3, 4 | 3 | (4.9') As above: gray (2.5Y 5/1)<br>(6.0') WELL-GRADED SAND (SW); light gray (5Y 4/1), fine to coarse grained sand, fine gravel, few silt, trace slag, loose, wet. [BOTTOM ASH] | 6-8 Chem |
| | SS | 17/24 | 2, 3, 3, 2 | 6 | (8') As above. | |
| 10 | SS | 22/24 | 2, 2, 1, 1 | 3 | (10') As above: olive gray (5Y 5/2), very loose.<br>(11') SILT (ML); light gray (5Y 4/1), non-plastic, trace fine grained sand, soft, saturated. [FLY ASH] | |
| | SH | 24/24 | | | (12') As above: no sand. Failed Shelby Tube from 12-14' bgs.<br>(13') Grades to partially lithified structures. | |
| 15 | SH | 26/26 | | | (14') As above. | 14-16 ST |
| | SH | 24/24 | | | (16') As above. Failed Shelby Tube from 16-18' bgs. | 16-18 Geotech |
| | SH | 6/6 | | | (18') As above.<br>(18.5') End of Boring. | |
| 20 | | | | | | |

NOTES: Fly ash, bottom ash and fill material from 0 to 18.5 ft bgs. Split spoon sampler advanced to 18.5 ft bgs. Augers advanced to 18.6 ft bgs. Sample 1: 123.3% moisture content, 36.0 pcf dry unit weight, 2.615 specific gravity, $2.9 \times 10^{-4}$ cm/s vertical hydraulic conductivity, NP, 0.0% gravel, 20.8% sand, 79.2% fines. Sample 2: 113.2% moisture content, 2.622 specific gravity, NP, 0.5% gravel, 22.1% sand, 77.4% fines.

| Geosyntec consultants (engineers \| scientists \| innovators) | Client: Dynegy<br>Project: GLP8020, Hennepin East Ash Pond<br>Address: 13498 E 800th, Hennepin, IL | **WELL LOG**<br>**Well No.** **XPW03**<br>**Page:** **1 of 1** |
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| | | | | | |
|---|---|---|---|---|---|
| u Trsyy L 2 rMTr u M] C | **01/14/2021** | VeTryL u ] wE 4 6H C | **20** | f ] ssu ] wE 4 6H C | |
| u TrsyyL myF u M] C | **01/14/2021** | VeTryL u M, ] r] T4ryH C | **10** | f ] ssu M, ] r] T4ryH C | |
| u TrsyyL 8 e, wMy; C | **Geotechnology** | u ' f u RTryL u TrsyyL 4 6H C | | 2 YT] ] y 2 ser 4ryH C | |
| u TrsyyL ) ] rEeF C | **Hollow Stem Auger** | u ' f a 6] Tu TrsyyL 4 6H C | | i rb] T) M] TrMs C | |
| u TrsyyL mqRw, ] yr C | **C5 E MM** | ' ew e68 MbryL ms] D' 4 6H | | 2 YT] ] y ) M] TrMs C | |
| u Trs] T C | | d TeRyF ms] D' 4 6H C | **492.03** | 2 ] Ms) M] TrMs4 bH C | |
| . eLL] F V; C | **D. 5 ateas** | . eYMrey 4 Mth eyLH C | **41.30326, -89.30378** | prs] TPMYA C | |

| u mP' 5 4 6H | . (' 5 B. Bd I | f a' mi . mKm. | f m. 8 B ) P. m' (B[ | 2 M, ws] ' ; w] | i ] YeD] T; 4ryH | Vse W 8 eRyrb | [ KMR] i Qu 4%H | 2 B (. hi B 8 7 K(2 Ua. u m2 8 i (P' (B[ | . MG 2 M, ws] | u mP' 5 4 6H |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | 22 | 90/8v | 3 3 3 9 | v | 41/1$H2 (. ' 4) . HI LTM, 4 9 1 I i gh9H yeyowsMbmYt brm6t , erbr/ -p. l a 2 5 c<br>41/v$Hf m . odi aumu 2 a[ u 42 f HI FMTA; ] sseWbE GTeWy 4 9 1 I i vh vHt 6y] re , ] FnR, LTMy] F bMyFt smrs] bsML MyF YeMs6TML, ] yrbt D] T, seeb] t , erbr/ -VB' ' B) a 2 5 c | | |
| | | | | 22 | 9O/8v | 9 1 0 3 | 0 | 41/O$Ha b MGeD] CbMRTM] Ft 6] Wbrs/<br>43/1$Ha b MGeD] C, erbrt ye brst 6y] re YeMTb] LTMy] F bMyF/<br>43/k$H2 (. ' 4) . HI wMs] ; ] sseW 43/gl : h0H yeyowsMbmYt D] T, be6t bMRTM] F/ | | |
| | | | | 22 | 33/8v | 1 1 1 9 | 1 | 4v/1$Ha b MGeD] / | vck 8 E] , | |
| g | | | | | | | | | | |
| | | | | 25 | 3v/8v | | | 4k/1$Ha b MGeD] / pMs] F 2 E] sG, ' RG] 6Te, kdNSGLb/ | | |
| | | | | 22 | 3v/8v | 9 1 9 1 | 9 | 4N/1$Ha b MGeD] / | | |
| 91 | | | | 22 | 3v/8v | 1 1 1 9 | 1 | 4 9 1/: gc99/: g$Ha b MGeD] CsLEr GTeWyrbE LTM, 43/gl k/8H | | |
| | | | | 25 | 30/8v | | | 4 9 3$Ha b MGeD] / pMs] F 2 E] sG, ' RG] 6Te, 93c9vSGLb/ | | |
| 9g | | | | 25 | 9N/8v | | | 4 9v$Ha b MGeD] / | 9vc9k 2'<br>Sample 1 | |
| | | | | 22 | 3v/8v | 1 1 1 1 | 1 | 4 9: /3gc9: /: g$Ha b MGeD] CLTM, rbE GTeWy 43/gl g/8H | 9kc9N 8 E] , | |
| | | | | 25 | 99/8v | | | 4 9: /: gc9N$Ha b MGeD] CsLEr esD] GTeWy 43/gl g/0H | 9Nc31 2'<br>Sample 2 | |
| 31 | | | | | | | | 4 3 1$HmyF e6VeTryL/ | | |

[ B' m2 C ps, MbE 6Te, 1 re 31 6 GLb/ Split spoon sampler advanced to 20 ft bgs. Augers advanced to 19.43 ft bgs. Sample 1: 177.0% moisture content, 28.0 pcf dry unit weight, 2.595 specific gravity, 1.7x10$^{-4}$ cm/s vertical hydraulic conductivity, NP, 0.0% gravel, 13.7% sand, 86.3% fines. Sample 2: 138.8% moisture content, 34.0 pcf dry unit weight, 2.585 specific gravity, 2.0x10$^{-4}$ cm/s vertical hydraulic conductivity, NP, 0.0% gravel, 18.6% sand, 81.4% fines.

# APPENDIX A
# BORING LOGS AND WELL CONSTRUCTION LOGS
# GEOSYNTEC WELL CONSTRUCTION LOGS

Geosyntec consultants

1420 Kensington Rd., Suite 103
Oak Brook, Illinois 60523
(630) 203-3340

# MONITORING WELL CONSTRUCTION DETAIL

- Well ID: MW52
- Project Name: Vistra - Hennepin East Ash Pond
- Project Number: GLP8020
- Site Location: Hennepin, IL
- Field Personnel: Will Blocher, Sam Baushke
- Recorded By: Will Blocher

- Permit Number: 
- Installation Date(s): 2/11/21
- Drilling Method: Sonic
- Borehole Diameter: 6"
- Drilling Contractor: Cascade
- Driller: Jason Green
- Drilling Fluid: water
- Fluid Loss During Drilling: 150 Gallons

## Materials Used

**Riser Pipe:**
- Diameter 2 inches
- Construction
  - ☑ PVC schedule ______
  - ☐ Stainless Steel
  - ☐ Other ______

**Slotted Area:**
- Length 10 feet
- Diameter 2 inches
- Slot Size 0.010 inches
- Construction
  - ☑ PVC schedule ______
  - ☐ Stainless Steel
  - ☐ Other ______
- Silt Trap Used ☐ Yes ☑ No

**Bottom End Cap:** ☑ Male ☐ Female ☐ Slip
- ☑ PVC
- ☐ Stainless Steel
- ☐ Other ______

**Top Cap:** ☐ Male ☐ Female ☐ Slip ☑ J Plug
- ☐ PVC
- ☐ Stainless Steel
- ☐ Other ______

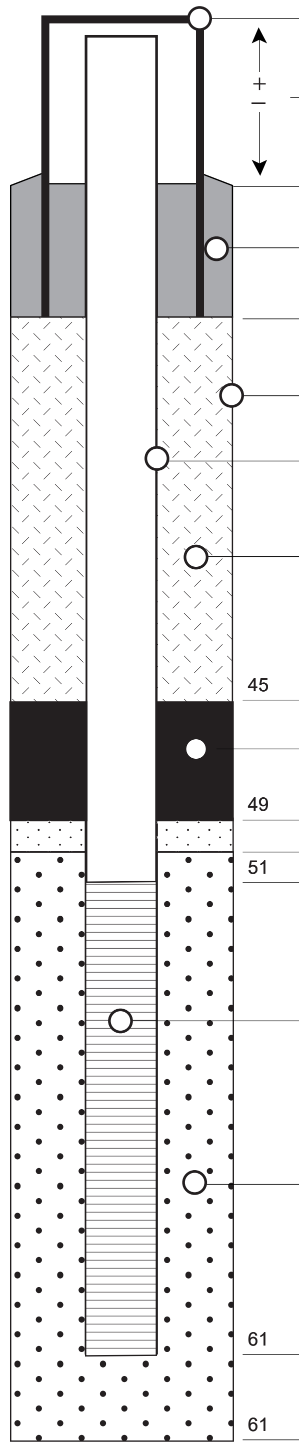
**Protective Casing:**
- Length ______ feet
- Diameter ______ inches
- Construction ☐ Cast Aluminum ☐ Cast Steel ☐ Other ______

**Casing Installation:**
- Length ______ feet
- Diameter ______ inches
- Material ______

**Sandpack:**
- Coarse Sand: 4 bags of 50 lb per bag — Graded Sand — Size #5
- Fine Sand: ____ bags of ____ lb per bag — Size ______

**Seal:**
- Bentonite Pellets: 1 bags of 50 — Type ______
- Bentonite Slurry: ____ bags of ____ lb per bag — Type ______

**Grout:**
- Cement: 2 bags of 50 lb per bag — Type Quick-grout
- Bentonite: ____ bags of ____ lb per bag — Type ______



- ☑ above ground protective casing
- ☐ flush mount protective casing
- ☐ other ______
- +/– ______ feet
- ground surface elevation ______ ☐ surveyed ☐ estimated
- ☐ surface seal backfill
- ☑ surface seal grout
- ______ feet*
- drilled hole 6 inches diameter
- well casing 2 inches diameter
- ☐ backfill
- ☑ grout Quick-grout
- ☐ density of grout ______
- 45 feet*
- ☐ bentonite slurry
- ☑ bentonite pellets
- 49 feet*
- ______ feet*
- 51 feet*
- well screen 2 inches diameter, 0.01 slot
- ☐ gravel pack
- ☑ sand pack
- ☐ formation collapse
- 61 feet*
- 61 feet*

Measuring Point is Top of Well Casing Unless Otherwise Noted

* Depth Below Ground Surface

Geosyntec consultants

1420 Kensington Rd., Suite 103
Oak Brook, Illinois 60523
(630) 203-3340

# MONITORING WELL CONSTRUCTION DETAIL

| | | | |
|---|---|---|---|
| Well ID | MW53 | Site Location | Hennepin, IL |
| Project Name | Vistra - Hennepin East Ash Pond | Field Personnel | D. Mateas + A. Toye |
| Project Number | GLP8020 | Recorded By | D. Mateas |

Permit Number ______
Installation Date(s) 01/12/21 - 01/13/21
Drilling Method Hollow Stem Auger
Borehole Diameter 10"
Drilling Contractor Geotechnology
Driller Pat Hart
Drilling Fluid n/a
Fluid Loss During Drilling n/a Gallons

## Materials Used

**Riser Pipe:** Diameter 2 inches
Construction
☑ PVC schedule 40
☐ Stainless Steel
☐ Other ______

**Slotted Area:** Length 10 feet
Diameter 2 inches
Slot Size 0.010 inches
Construction
☑ PVC schedule 40
☐ Stainless Steel
☐ Other ______
Silt Trap Used ☐ Yes ☑ No

**Bottom End Cap:** ☐ Male ☐ Female ☐ Slip
☑ PVC
☐ Stainless Steel
☐ Other ______

**Top Cap:** ☐ Male ☐ Female ☑ Slip ☐ J Plug
☑ PVC
☐ Stainless Steel
☐ Other ______

**Protective Casing:** Length 5 feet
Diameter 4 x 4 inches
Construction ☐ Cast Aluminum
☑ Cast Steel
☐ Other ______

**Casing Installation:** Length n/a feet
Diameter n/a inches
Material n/a

FilterSil

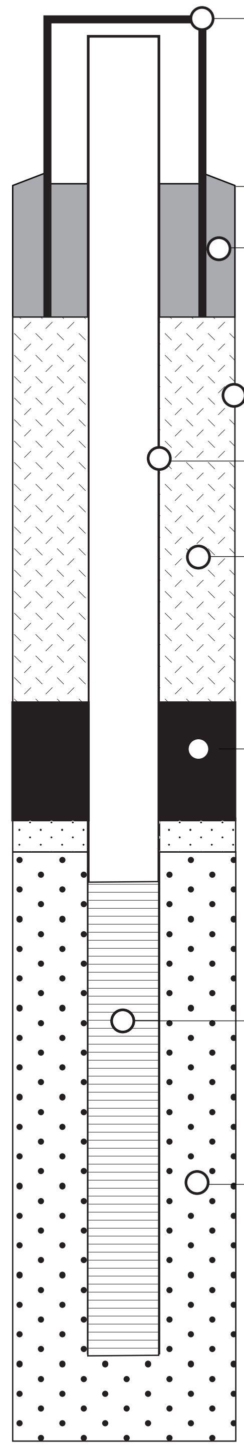
**Sandpack:**
Coarse Sand: 3.5 bags of 50 lb per bag Graded Sand Size ______
~~Fine Sand: ____ bags of ____ lb per bag Size ______~~

3/8" Halliburton Holeplug

**Seal:**
Bentonite Pellets: 1 bags of 50 Type Bent. chips
~~Bentonite Slurry: ___ bags of ___ lb per bag Type ______~~

20% Solids Halliburton Quick-Grout

**Grout:**
~~Cement: ____ bags of ____ lb per bag Type ______~~
Bentonite: 8.5 bags of 50 lb per bag Type Bent. grout
+ Used 180 Gallons of grout



☑ above ground protective casing
☐ flush mount protective casing
☐ other ______

\+ ― 36 feet

ground surface elevation TBD
☐ surveyed ☐ estimated

☐ surface seal backfill
☑ surface seal grout

n/a feet*

drilled hole 10 inches diameter

well casing 2 inches diameter

☐ backfill
☑ grout Bentonite
☐ density of grout ______

40.0 feet*

☐ bentonite slurry
☑ bentonite pellets

44.0 feet* (top of form. collapse)
52.0 feet* (top of sand pack)
53.78 feet*

well screen 2 inches diameter
0.01 slot

☐ gravel pack
☑ sand pack (52.0'-63.78')
☑ formation collapse (44.0'-52.0')

63.78 feet*

63.78 feet*

Measuring Point is Top of Well Casing
Unless Otherwise Noted

* Depth Below Ground Surface

# MONITORING WELL CONSTRUCTION DETAIL

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Oak Brook, Illinois 60523
(630) 203-3340

Well ID: MW54
Site Location: Hennepin, IL
Project Name: Vistra - Hennepin East Ash Pond
Field Personnel:
Project Number: GLP8020
Recorded By:

Permit Number: n/a
Installation Date(s): 2/8/21 - 2/9/21
Drilling Method: Sonic
Borehole Diameter: 6"
Drilling Contractor: Cascade
Driller: Jason Green
Drilling Fluid: water
Fluid Loss During Drilling: 400 Gallons

## Materials Used

**Riser Pipe:** Diameter 2 inches
Construction
☑ PVC schedule 40
☐ Stainless Steel
☐ Other

**Slotted Area:** Length 10 feet
Diameter 2 inches
Slot Size 0.010 inches
Construction
☑ PVC schedule 40
☐ Stainless Steel
☐ Other
Silt Trap Used ☐ Yes ☑ No

**Bottom End Cap:** ☐ Male ☑ Female ☐ Slip
☑ PVC
☐ Stainless Steel
☐ Other

**Top Cap:** ☐ Male ☐ Female ☐ Slip ☑ J Plug
☐ PVC
☐ Stainless Steel
☐ Other

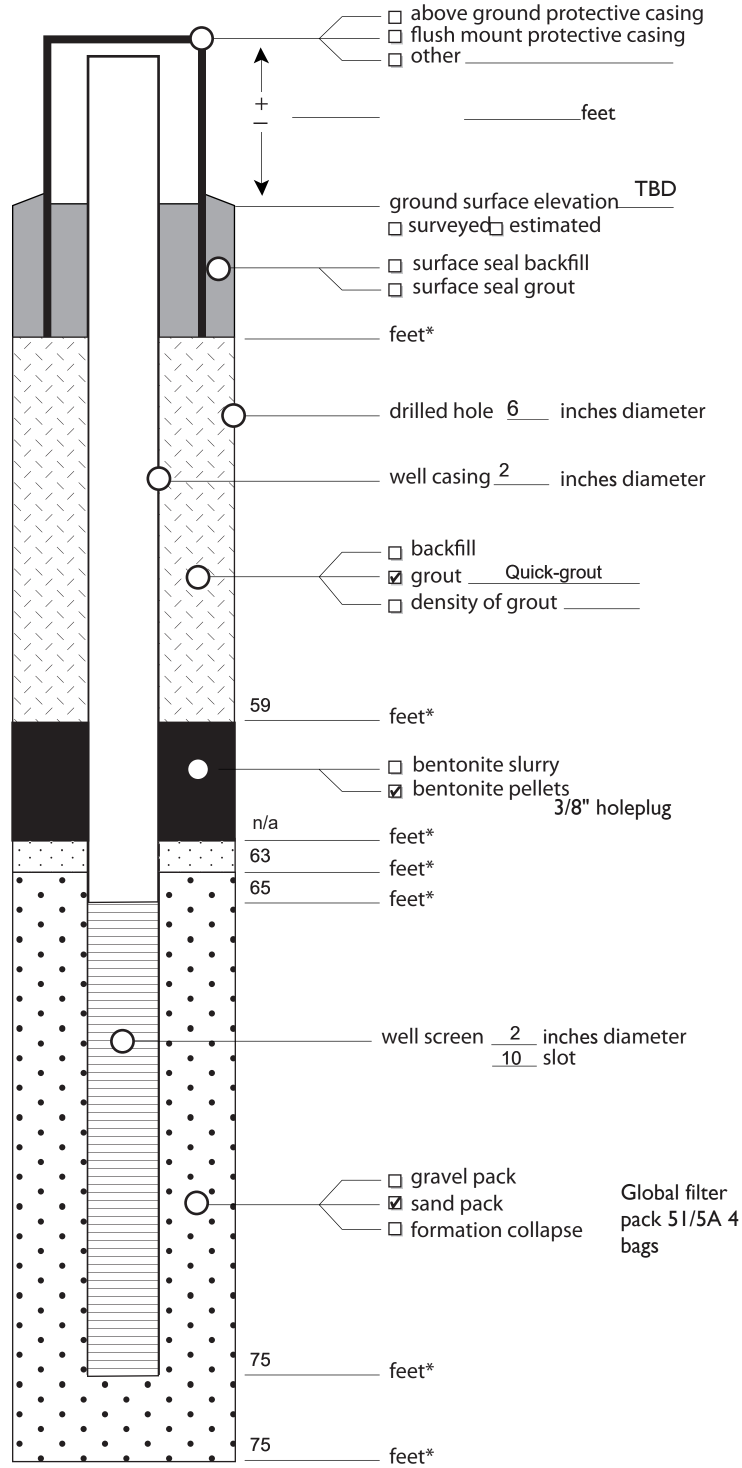
**Protective Casing:** Length ___ feet
Diameter ___ inches
Construction ☐ Cast Aluminum ☐ Cast Steel ☐ Other

**Casing Installation:** Length ___ feet
Diameter 2 inches
Material PVC

**Sandpack:**
Coarse Sand: 4 bags of 51/5A 50 lb per bag Size #5
Fine Sand: - bags of - lb per bag - Size

**Seal:**
Bentonite Pellets: 1 bags of 50 Type 3/8"
Bentonite Slurry: - bags of - lb per bag Type -

**Grout:**
Cement: - bags of - lb per bag Type -
Bentonite: 3 bags of 50 lb per bag Type Quick-grout




Measuring Point is Top of Well Casing Unless Otherwise Noted

* Depth Below Ground Surface

Geosyntec consultants

1420 Kensington Rd., Suite 103
Oak Brook, Illinois 60523
(630) 203-3340

# MONITORING WELL CONSTRUCTION DETAIL

Well ID: MW55
Site Location: Hennepin, IL
Project Name: Vistra - Hennepin East Ash Pond
Field Personnel: Will Blocher, Sam Baushke
Project Number: GLP8020
Recorded By: Will Blocher

Permit Number: ____
Installation Date(s): 2/10/21
Drilling Method: Sonic
Borehole Diameter: 6"
Drilling Contractor: Cascade
Driller: Jason Green
Drilling Fluid: water
Fluid Loss During Drilling: 250 Gallons

## Materials Used

Riser Pipe: Diameter 2 inches
Construction
- ☑ PVC schedule ____
- ☐ Stainless Steel
- ☐ Other ____

Slotted Area: Length 5 feet
Diameter 2 inches
Slot Size 0.010 inches
Construction
- ☑ PVC schedule ____
- ☐ Stainless Steel
- ☐ Other ____

Silt Trap Used ☐ Yes ☐ No

Bottom End Cap: ☐ Male ☑ Female ☐ Slip
- ☐ PVC
- ☐ Stainless Steel
- ☐ Other ____

Top Cap: ☐ Male ☐ Female ☐ Slip ☑ J Plug
- ☐ PVC
- ☐ Stainless Steel
- ☐ Other ____

Protective Casing: Length ____ feet
Diameter ____ inches
Construction ☐ Cast Aluminum ☐ Cast Steel ☐ Other ____

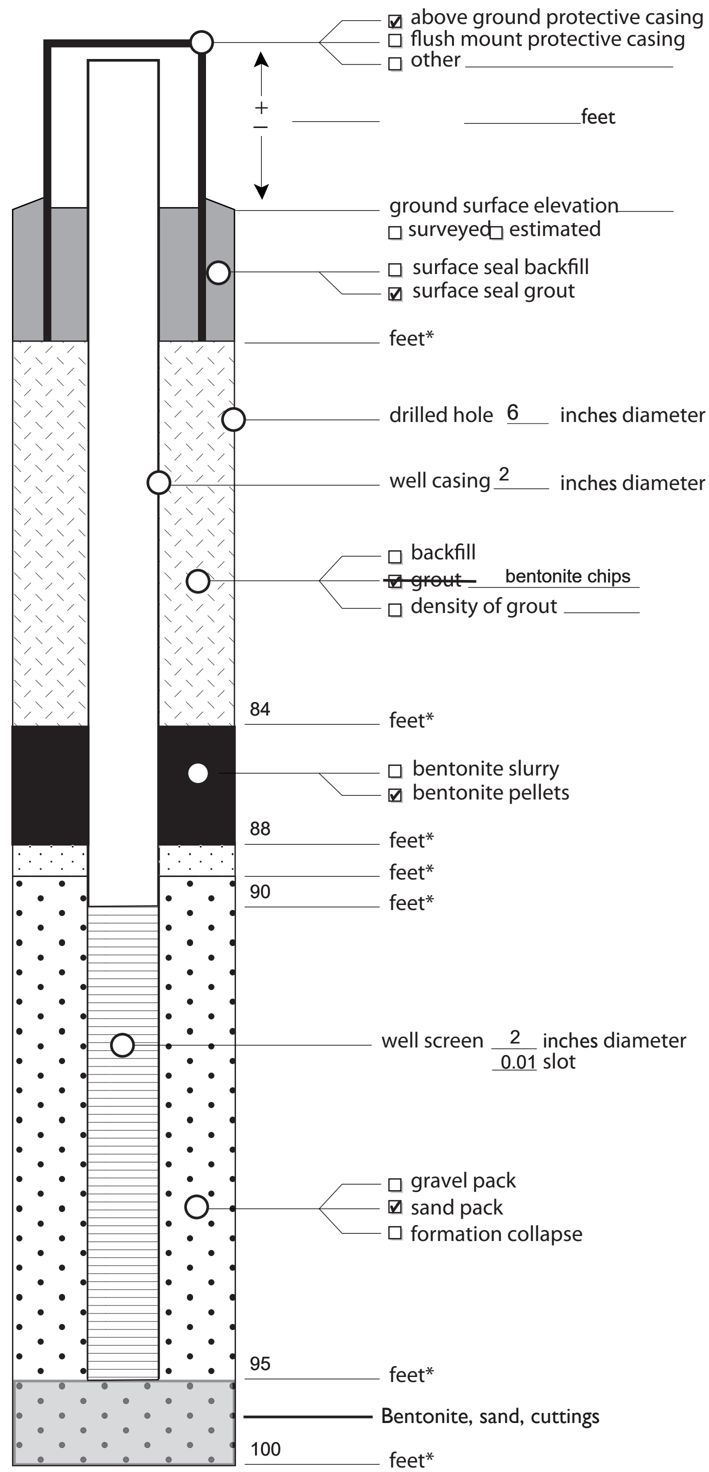
Casing Installation: Length ____ feet
Diameter ____ inches
Material ____

Sandpack:
Coarse Sand: 2.5 bags of 50 lb per bag — Graded Sand Size #5
Fine Sand: ____ bags of ____ lb per bag Size ____

Seal:
Bentonite Pellets: 1 bags of 50 Type ____
Bentonite Slurry: ____ bags of ____ lb per bag Type ____

Grout:
Cement: 5.8 bags of 50 lb per bag Type Quick-grout
Bentonite: >15 bags of 50 lb per bag Type ____

cement largely lost into aquifer




Measuring Point is Top of Well Casing Unless Otherwise Noted

* Depth Below Ground Surface

Geosyntec consultants
1420 Kensington Rd., Suite 103
Oak Brook, Illinois 60523
(630) 203-3340

# MONITORING WELL CONSTRUCTION DETAIL

| | | | |
|---|---|---|---|
| Well ID | XPW01 | Site Location | Hennepin, IL |
| Project Name | Vistra - Hennepin East Ash Pond | Field Personnel | D.Mateas |
| Project Number | GLP8020 | Recorded By | D. Mateas |

Permit Number ____
Installation Date(s) 01/14/21
Drilling Method Hollow Stem Auger
Borehole Diameter 10"
Drilling Contractor Geotechnology
Driller Pat Hart
Drilling Fluid n/a
Fluid Loss During Drilling n/a Gallons

## Materials Used

Riser Pipe: Diameter 2 inches
Construction
☑ PVC schedule 40
☐ Stainless Steel
☐ Other ____

Slotted Area: Length 5 feet
Diameter 2 inches
Slot Size 0.010 inches
Construction
☑ PVC schedule 40
☐ Stainless Steel
☐ Other ____
Silt Trap Used ☐ Yes ☑ No

Bottom End Cap: ☐ Male ☑ Female ☐ Slip
☑ PVC
☐ Stainless Steel
☐ Other ____

Top Cap: ☐ Male ☐ Female ☑ Slip ☐ J Plug
☑ PVC
☐ Stainless Steel
☐ Other ____

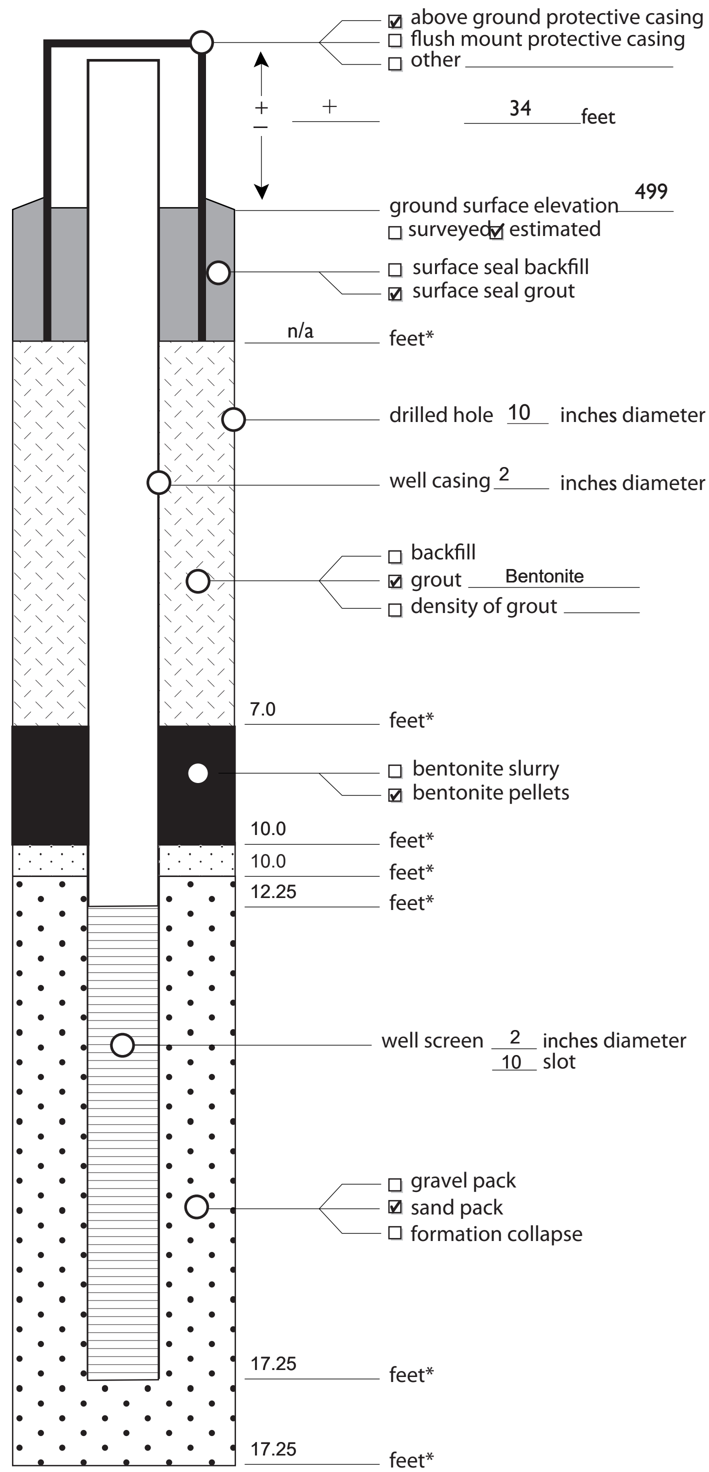
Protective Casing: Length 5 feet
Diameter 4 x 4 inches
Construction ☐ Cast Aluminum
☑ Cast Steel
☐ Other ____

Casing Installation: Length n/a feet
Diameter n/a inches
Material n/a

FilterSil
Sandpack:
Coarse Sand: 3 bags of 50 lb per bag Graded Sand Size ____
~~Fine Sand: ____ bags of ____ lb per bag Size ____~~

3/8" Halliburton Holeplug
Seal:
Bentonite Pellets: 1 bags of 50 Type Bent. chips
~~Bentonite Slurry: ____ bags of ____ lb per bag Type ____~~

20% Solids Halliburton Quick-Grout
Grout:
~~Cement: ____ bags of ____ lb per bag Type ____~~
Bentonite: 2 bags of 50 lb per bag Type bent. grout
+ Used 25 Gallons of grout




Measuring Point is Top of Well Casing Unless Otherwise Noted

* Depth Below Ground Surface

# MONITORING WELL CONSTRUCTION DETAIL

Geosyntec consultants
1420 Kensington Rd., Suite 103
Oak Brook, Illinois 60523
(630) 203-3340

Well ID XPW02
Project Name Vistra - Hennepin East Ash Pond
Project Number GLP8020
Site Location Hennepin, IL
Field Personnel D.Mateas
Recorded By D. Mateas

Permit Number
Installation Date(s) 01/15/21
Drilling Method Hollow Stem Auger
Borehole Diameter 10"
Drilling Contractor Geotechnology
Driller Pat Hart
Drilling Fluid n/a
Fluid Loss During Drilling n/a Gallons

Materials Used

Riser Pipe: Diameter 2 inches
Construction
☑ PVC schedule 40
☐ Stainless Steel
☐ Other

Slotted Area: Length 5 feet
Diameter 2 inches
Slot Size 0.010 inches
Construction
☑ PVC schedule 40
☐ Stainless Steel
☐ Other

Silt Trap Used ☐ Yes ☑ No

Bottom End Cap: ☐ Male ☑ Female ☐ Slip
☑ PVC
☐ Stainless Steel
☐ Other

Top Cap: ☐ Male ☐ Female ☑ Slip ☐ J Plug
☑ PVC
☐ Stainless Steel
☐ Other

Protective Casing: Length 5 feet
Diameter 4 x 4 inches
Construction ☐ Cast Aluminum
☑ Cast Steel
☐ Other

Casing Installation: Length n/a feet
Diameter n/a inches
Material n/a

FilterSil

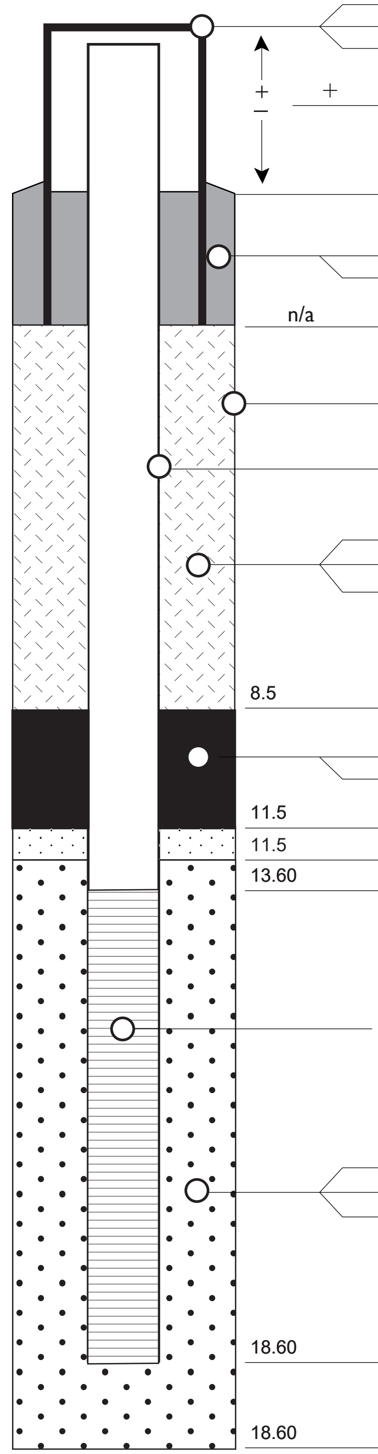
Sandpack:
Coarse Sand: 3 bags of 50 lb per bag Graded Sand Size
~~Fine Sand: ___ bags of ___ lb per bag Size~~

3/8" Halliburton Holeplug

Seal:
Bentonite Pellets: 1 bags of 50 Type Bent. chips
~~Bentonite Slurry: ___ bags of ___ lb per bag Type~~

20% Solids Halliburton Quick-Grout

Grout:
~~Cement: ___ bags of ___ lb per bag Type~~
Bentonite: 2 bags of 50 lb per bag Type bent. grout
+ Used 30 Gallons of grout




☑ above ground protective casing
☐ flush mount protective casing
☐ other

ground surface elevation 499.5
☐ surveyed ☑ estimated

☐ surface seal backfill
☑ surface seal grout

n/a feet*

drilled hole 10 inches diameter

well casing 2 inches diameter

☐ backfill
☑ grout Bentonite
☐ density of grout

8.5 feet*

☐ bentonite slurry
☑ bentonite pellets

11.5 feet*
11.5 feet*
13.60 feet*

well screen 2 inches diameter
10 slot

☐ gravel pack
☑ sand pack
☐ formation collapse

18.60 feet*
18.60 feet*

Measuring Point is Top of Well Casing Unless Otherwise Noted

* Depth Below Ground Surface

Geosyntec consultants

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Oak Brook, Illinois 60523
(630) 203-3340

# MONITORING WELL CONSTRUCTION DETAIL

| | | | |
|---|---|---|---|
| Well ID | XPW03 | Site Location | Hennepin, IL |
| Project Name | Vistra - Hennepin East Ash Pond | Field Personnel | D.Mateas / A. Toye / C. Luttrell |
| Project Number | GLP8020 | Recorded By | D. Mateas |

Permit Number ____________

Installation Date(s) 01/14/21

Drilling Method Hollow Stem Auger

Borehole Diameter 10"

Drilling Contractor Geotechnology

Driller Pat Hart

Drilling Fluid n/a

Fluid Loss During Drilling n/a Gallons

## Materials Used

**Riser Pipe:**
Diameter 2 inches
Construction
- ☑ PVC schedule 40
- ☐ Stainless Steel
- ☐ Other ____________

**Slotted Area:**
Length 5 feet
Diameter 2 inches
Slot Size 0.010 inches
Construction
- ☑ PVC schedule 40
- ☐ Stainless Steel
- ☐ Other ____________

Silt Trap Used ☐ Yes ☑ No

**Bottom End Cap:** ☐ Male ☑ Female ☐ Slip
- ☑ PVC
- ☐ Stainless Steel
- ☐ Other ____________

**Top Cap:** ☐ Male ☐ Female ☑ Slip ☐ J Plug
- ☑ PVC
- ☐ Stainless Steel
- ☐ Other ____________

**Protective Casing:**
Length 5 feet
Diameter 4 x 4 inches
Construction ☐ Cast Aluminum ☑ Cast Steel ☐ Other ____________

**Casing Installation:**
Length n/a feet
Diameter n/a inches
Material n/a

FilterSil

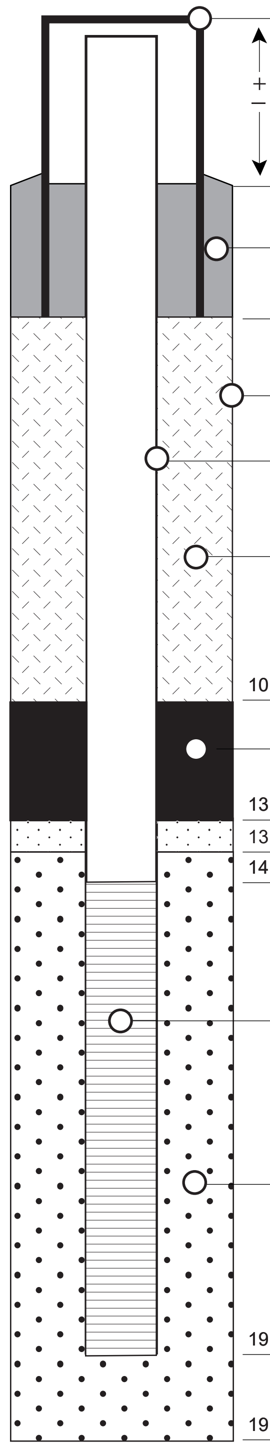
**Sandpack:** Graded Sand
Coarse Sand: 3 bags of 50 lb per bag Size ______
~~Fine Sand: ____ bags of ___ lb per bag Size ______~~

3/8" Halliburton Holeplug

**Seal:**
Bentonite Pellets: 1 bags of 50 Type Bent. chips
~~Bentonite Slurry: ___ bags of ___ lb per bag Type ______~~

20% Solids Halliburton Quick-Grout

**Grout:**
~~Cement: ____ bags of ____ lb per bag Type ______~~
Bentonite: 2 bags of 50 lb per bag Type bent. grout
+ Used 30 Gallons of grout



- ☑ above ground protective casing
- ☐ flush mount protective casing
- ☐ other ____________

+/− ______ 36 feet

ground surface elevation 494
☐ surveyed ☑ estimated

- ☐ surface seal backfill
- ☑ surface seal grout

n/a feet*

drilled hole 10 inches diameter

well casing 2 inches diameter

- ☐ backfill
- ☑ grout Bentonite
- ☐ density of grout ______

10.0 feet*

- ☐ bentonite slurry
- ☑ bentonite pellets

13.0 feet*

13.0 feet*

14.43 feet*

well screen 2 inches diameter
10 slot

- ☐ gravel pack
- ☑ sand pack
- ☐ formation collapse

19.43 feet*

19.43 feet*

Measuring Point is Top of Well Casing
Unless Otherwise Noted

* Depth Below Ground Surface

# APPENDIX A
# BORING LOGS AND WELL CONSTRUCTION LOGS
# MATHES BORING LOGS

# RECORD OF SUBSURFACE EXPLORATION

PROJECT: Hydrogeologic Study, Hennepin Power Plant
JOB NO. 82-1293

BORING: E-2 — Renamed 02
SHEET 1 OF 2

Soil Classification System: Unified
Surface Elevation: 488.8'

(Color Modifier MATERIAL. Classification)

Shear Strength, tsf: SV△ QP/2□ QU/2○ (0, ½, 1, 1½, 2, 2½)
PL + NMC • LL x (0, 50, 100)
Rock Quality Designation (0, 50, 100)

| DEPTH (ft) | SAMPLE NUMBER | INTERVAL AND TYPE | ADVANCED / RECOVERED (in) | SEE REMARK # | DESCRIPTION OF MATERIALS | BLOWS (per 6 in) | DRY UNIT WEIGHT (pcf) |
|---|---|---|---|---|---|---|---|
| | | | | | Brown Silty CLAY, CL | | |
| | | | | | Brown GRAVEL w/ Sand, Clay, GC | | |
| 5 | 1 | SS | 18/4 | | | 5-2-22 | |
| 10 | 2 | SS | 18/12 | | Brown Medium-Coarse SAND w/ Gravel, Clay, SC | 10-23-19 | |
| 15 | 3 | SS | 18/8 | | | 15-14-11 | |
| 20 | 4 | SS | 18/10 | | | 8-17-12 | |
| 25 | 5 | SS | 18/5 | | Gray-Brown GRAVEL w/Sand, GP | 49-27-25 | |
| 30 | 6 | SS | 18/8 | | Gray-Brown Fine SAND Trace Silt, SP-SM | 15-12-9 | |
| 35 | 7 | SS | 18/14 | | | 7-10-13 | |

DRILLING METHOD: NW Casing Advancer
DATE DRILLED: 11/24, 29/82
DRILLED BY: Roberts
LOGGED BY: Maxeiner
PIEZOMETER: Yes

## GROUNDWATER LEVELS

Encountered at ____ Feet
15 Hours after completion 42.1 Feet
17 Days after completion 34.3 Feet
____ after completion ____ Feet

**NOTE:** Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

John Mathes & Associates, Inc.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study
Hennepin Power Plant

JOB NO. 82-1293

BORING E-2 Renamed 02
SHEET 2 OF 2

| DEPTH (ft) | SAMPLE NUMBER | INTERVAL AND TYPE | ADVANCED / RECOVERED (in) | SEE REMARK # | DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 488.8' | BLOWS (per 6 in) | DRY UNIT WEIGHT (pcf) | Shear Strength, tsf (SV, QP/2, OU/2); PL NMC LL; Rock Quality Designation |
|---|---|---|---|---|---|---|---|---|
| | 7 | SS | 18/14 | | Gray-Brown Fine SAND Trace Silt, SP-SM | 7-10-13 | | |
| 40 | 8 | SS | 18/18 | | -Clay Seam 40.2-41.1' | 5-8-10 | | |
| | | | | | Brown Silty Fine SAND, SM | | | |
| | | | | | -Black Peat @ 45.3' | | | |
| 45 | 9 | SS | 18/10 | | Gray-Brown Sandy GRAVEL Trace Clay, GP | 8-9-10 | | |
| 50 | 10 | SS | 18/8 | | | 34-29-32 | | |
| | | | | | Brown Medium SAND Trace Coarse, SP | | | |
| 55 | 11 | SS | 18/6 | | TOB ~ 433.0' | 5-18-16 | | |
| 60 | | | | | | | | |

DRILLING METHOD NW Casing Advancer
DATE DRILLED 11/24, 29/82
DRILLED BY Roberts
LOGGED BY Maxeiner
PIEZOMETER Yes

GROUNDWATER LEVELS
Encountered at — Feet
15 Hours after completion 42.1 Feet
17 Days after completion 34.3 Feet
after completion Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

mathes

John Mathes & Associates, Inc.

# RECORD OF SUBSURFACE EXPLORATION

PROJECT: Hydrogeologic Study, Hennepin Power Plant
JOB NO. 82-1293

BORING E-6 Renamed 06
SHEET 1 OF 2

| DEPTH (ft) | SAMPLE NUMBER | INTERVAL AND TYPE | ADVANCED / RECOVERED (in) | SEE REMARK # | DESCRIPTION OF MATERIALS (Color Modifier MATERIAL, Classification) Soil Classification System: Unified; Surface Elevation: 466.4' | BLOWS (per 6 in) | DRY UNIT WEIGHT (pcf) | Shear Strength, tsf (SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½); PL + NMC • LL x 0 50 100; Rock Quality Designation 0 50 100 |
|---|---|---|---|---|---|---|---|---|
| | 1 | AS | | | Dark Brown Silty CLAY w/Sand, CL | | | |
| 5 | 2 | SS | 18/8 | | Brown Sandy CLAY w/Gravel, CL | 3-3-2 | | |
| | | | | | Gray-Brown Sandy GRAVEL, GP | | | |
| 10 | 3 | SS | 18/9 | | | 12-12-13 | | |
| 15 | 4 | SS | 18/10 | | Gray-Brown GRAVEL w/Sand Trace Clay, GP | 9-30-35 | | |
| 20 | 5 | SS | 4/4 | | | 50/4" | | |
| 25 | 6 | SS | 18/6 | | | 6-10-14 | | |
| 30 | 7 | SS | 18/4 | | | 3-5-7 | | |
| 35 | 8 | SS | 18/7 | | | 5-7-12 | | |

DRILLING METHOD: Hollow Auger
DATE DRILLED: 12/8/82
DRILLED BY: Roberts
LOGGED BY: Maxeiner
PIEZOMETER: Yes

## GROUNDWATER LEVELS

Encountered at 18.0 Feet
___ Hours after completion ___ Feet
8 Days after completion 12.4 Feet
___ after completion ___ Feet

**NOTE:** Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

John Mathes & Associates, Inc.

# RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study
Hennepin Power Plant
JOB NO. 82-1293

BORING E-6 Renamed 06
SHEET 2 OF 2

| DEPTH (ft) | SAMPLE NUMBER | SAMPLE INTERVAL AND TYPE | ADVANCED / RECOVERED (in) | SEE REMARK # | DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 466.4' | BLOWS (per 6 in) | DRY UNIT WEIGHT (pcf) | Shear Strength, tsf SV△ QP/₂□ QU/₂○ 0 ½ 1 1½ 2 2½; PL + NMC • LL x 0 50 100; Rock Quality Designation 0 50 100 |
|---|---|---|---|---|---|---|---|---|
| | 8 | SS | | | Gray-Brown GRAVEL w/Sand Trace Clay, GP | | | |
| 40 | 9 | SS | 18/6 | | TOB ~ 426.0' | 5-6-6 | | |

DRILLING METHOD Hollow Auger
DATE DRILLED 12/8/82
DRILLED BY Roberts
LOGGED BY Maxeiner
PIEZOMETER Yes

**GROUNDWATER LEVELS**
Encountered at 18.0 Feet
____ Hours after completion ____ Feet
8 Days after completion 12.4 Feet
____ after completion ____ Feet

**NOTE:** Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

mathes
John Mathes & Associates, Inc.

# RECORD OF SUBSURFACE EXPLORATION

PROJECT I.P. Hennepin, Hydrogeologic Investigation
JOB NO. 04-1934

BORING E-7 Renamed 07
SHEET 1 OF 3

| DEPTH (ft) | SAMPLE NUMBER | INTERVAL AND TYPE | ADVANCED / RECOVERED (in) | SEE REMARK # | DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 515.2' | BLOWS (per 6 in) | DRY UNIT WEIGHT (pcf) | Shear Strength, tsf (SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½); PL + NMC • LL x 0 50 100; Rock Quality Designation 0 50 100 |
|---|---|---|---|---|---|---|---|---|
| | | | | | Brown Fine SAND w/Silt, SM | | | |
| 5 | 1 | SS | 18/18 | | | 4-6-6 | | |
| | | | | | Brown Fine SAND w/Coarse Trace Gravel, Silt, SP | | | |
| 10 | 2 | SS | 18/14 | | | 7-7-8 | | |
| | | | | | Brown Gravelly Medium-Coarse SAND w/Fine, Silt, SM | | | |
| 15 | 3 | SS | 18/16 | | | 18-35-33 | | |
| 20 | 4 | SS | 18/12 | | | 18-34-31 | | |
| 25 | 5 | SS | 18/6 | | | 36-48-51 | | |
| | | | | | Brown Gravelly Fine SAND w/Medium Trace Silt, SP-SM | | | |
| 30 | 6 | SS | 18/- | | | 17-31-44 | | |
| | | | | | Brown Gravelly Medium-Coarse SAND w/Silt, SM | | | |
| 35 | 7 | SS | 18/- | | | 19-29-37 | | |

DRILLING METHOD Casing Advancer & NW
DATE DRILLED 11/13-15/84
DRILLED BY Maniaci
LOGGED BY Hebel/Maxeiner
PIEZOMETER Yes

## GROUNDWATER LEVELS

Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

**NOTE:** Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

mathes

John Mathes & Associates, Inc.

# RECORD OF SUBSURFACE EXPLORATION

PROJECT I.P. Hennepin, Hydrogeologic Investigation
JOB NO. 04-1934

BORING E-7 Renamed 07
SHEET 2 OF 3

Soil Classification System: Unified
Surface Elevation: 515.2'

| DEPTH (ft) | SAMPLE NUMBER | INTERVAL AND TYPE | ADVANCED / RECOVERED (in) | SEE REMARK # | DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) | BLOWS (per 6 in) | DRY UNIT WEIGHT (pcf) | Shear Strength, tsf / PL NMC LL / Rock Quality Designation |
|---|---|---|---|---|---|---|---|---|
| | | | | | Brown Gravelly Medium-Coarse SAND w/Silt, SM | | | |
| 40 | 8 | SS | 18/12 | | | 10-23-27 | | |
| 45 | 9 | SS | 18/14 | | | 12-20-25 | | |
| 50 | 10 | SS | 18/11 | | | 14-31-36 | | |
| 55 | 11 | SS | 18/14 | | - Boulders 55.0-57.0' | 16-46-52 | | |
| | | | | | Gray Fine-Medium SAND Trace Coarse, SP | | | |
| 60 | 12 | SS | 18/3 | | | 12-22-30 | | |
| 65 | 13 | SS | 18/12 | | | 18-27-43 | | |
| 70 | 14 | SS | 18/12 | | | 20-22-34 | | |

DRILLING METHOD Casing Advancer & NW
DATE DRILLED 11/13-15/84
DRILLED BY Maniaci
LOGGED BY Hebel/Maxeiner
PIEZOMETER Yes

## GROUNDWATER LEVELS

Encountered at ______ Feet
____ Hours after completion ____ Feet
____ after completion ____ Feet
____ after completion ____ Feet

**NOTE:** Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

John Mathes & Associates, Inc.

# RECORD OF SUBSURFACE EXPLORATION

PROJECT I. P. Hennepin, Hydrogeologic Investigation

JOB NO. 04-1934

BORING E-7 Renamed 07

SHEET 3 OF 3

| DEPTH (ft) | SAMPLE NUMBER | INTERVAL AND TYPE | ADVANCED / RECOVERED (in) | SEE REMARK # | DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 515.2' | BLOWS (per 6 in) | DRY UNIT WEIGHT (pcf) | Shear Strength, tsf (SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½); PL + NMC • LL x (0 50 100); Rock Quality Designation (0 50 100) |
|---|---|---|---|---|---|---|---|---|
| | | | | | Gr Fi-Med SAND Tr Co, SP | | | |
| | 15 | SS | 18/10 | | Gray Medium SAND w/Fine Trace Gravel, SP | 15-15-22 | | |
| 75 | | | | | | | | |
| | | | | | TOB | | | |
| 80 | | | | | | | | |
| 85 | | | | | | | | |
| 90 | | | | | | | | |
| 95 | | | | | | | | |
| 100 | | | | | | | | |
| 105 | | | | | | | | |

DRILLING METHOD Casing Advancer & NW

DATE DRILLED 11/13-15/84

DRILLED BY Maniaci

LOGGED BY Hebel/Maxeiner

PIEZOMETER Yes

## GROUNDWATER LEVELS

Encountered at - Feet

___ Hours after completion ___ Feet

___ after completion ___ Feet

___ after completion ___ Feet

**NOTE:** Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

John Mathes & Associates, Inc.

# RECORD OF SUBSURFACE EXPLORATION

PROJECT I. P. Hennepin, Hydrogeologic Investigation

BORING E-8B Renamed 08

SHEET 1 OF 2

JOB NO. 04-1934

| DEPTH (ft) | SAMPLE NUMBER | INTERVAL AND TYPE | ADVANCED / RECOVERED (in) | SEE REMARK # | DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 498.7' | BLOWS (per 6 in) | DRY UNIT WEIGHT (pcf) | Shear Strength, tsf SVΔ QP/2□ QU/2○ (0 ½ 1 1½ 2 2½); PL + NMC • LL x (0 50 100); Rock Quality Designation (0 50 100) |
|---|---|---|---|---|---|---|---|---|
| | | | | | Dark Brown Silty CLAY w/Sand Trace Gravel, CL | | | |
| 5 | 1 | SS | 18/14 | | | 6-11-13 | | |
| | | | | | Brown Sandy GRAVEL Trace Clay, Silt, GC-GP | | | |
| | 2 | SS | 18/12 | | | 11-9-7 | | |
| 10 | | | | | | | | |
| | 3 | SS | 18/12 | | | 5-7-8 | | |
| 15 | | | | | | | | |
| | 4 | SS | 18/12 | | | 5-5-10 | | |
| 20 | | | | | | | | |
| | | | | | Gray Medium-Coarse SAND w/Fine, SP | | | |
| | 5 | SS | 18/14 | | | 5-6-9 | | |
| 25 | | | | | | | | |
| | 6 | SS | 18/0 | | | 11-15-18 | | |
| 30 | | | | | | | | |
| | | | | | Brown Fine SAND w/Silt Trace Clay, SM | | | |
| | 7 | SS | 18/12 | | | 3-10-10 | | |
| 35 | | | | | | | | |

DRILLING METHOD Casing Advancer & NW

DATE DRILLED 11/16-17/84

DRILLED BY Maniaci

LOGGED BY Hebel/Maxeiner

PIEZOMETER Yes

**GROUNDWATER LEVELS**

Encountered at - Feet

___ Hours after completion ___ Feet

___ after completion ___ Feet

___ after completion ___ Feet

**NOTE:** Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

mathes

John Mathes & Associates, Inc.

# RECORD OF SUBSURFACE EXPLORATION

PROJECT I. P. Hennepin, Hydrogeologic Investigation

JOB NO. 04-1934

BORING E-8B Renamed 08

SHEET 2 OF 2

| DEPTH (ft) | SAMPLE NUMBER | INTERVAL AND TYPE | ADVANCED / RECOVERED (in) | SEE REMARK # | DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System: Unified; Surface Elevation: 498.7' | BLOWS (per 6 in) | DRY UNIT WEIGHT (pcf) | Shear Strength, tsf (SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½); PL + NMC • LL x 0 50 100; Rock Quality Designation 0 50 100 |
|---|---|---|---|---|---|---|---|---|
| | | | | | Brown Fine SAND w/Silt Trace Clay, SM | | | |
| | 8 | SS | 18/14 | | | 3-7-9 | | |
| 40 | | | | | | | | |
| | 9 | SS | 18/16 | | -w/Gravel @ 43.0' | 4-7-10 | | |
| 45 | | | | | | | | |
| | 10 | SS | 13/14 | | | 12-10-12 | | |
| 50 | | | | | | | | |
| | 11 | SS | 18/10 | | -Trace Gravel @ 53.0' | 5-8-11 | | |
| 55 | | | | | | | | |
| | | | | | Brown Sandy GRAVEL w/Silt, Clay, GC-GM | | | |
| | 12 | SS | 18/10 | | | 25-30-33 | | |
| 60 | | | | | | | | |
| | | | | | TOB | | | |
| 65 | | | | | | | | |
| 70 | | | | | | | | |

DRILLING METHOD Casing Advancer & NW

DATE DRILLED 11/16-17/84

DRILLED BY Maniaci

LOGGED BY Hebel/Maxeiner

PIEZOMETER Yes

**GROUNDWATER LEVELS**

Encountered at - Feet

___ Hours after completion ___ Feet

___ after completion ___ Feet

___ after completion ___ Feet

**NOTE:** Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

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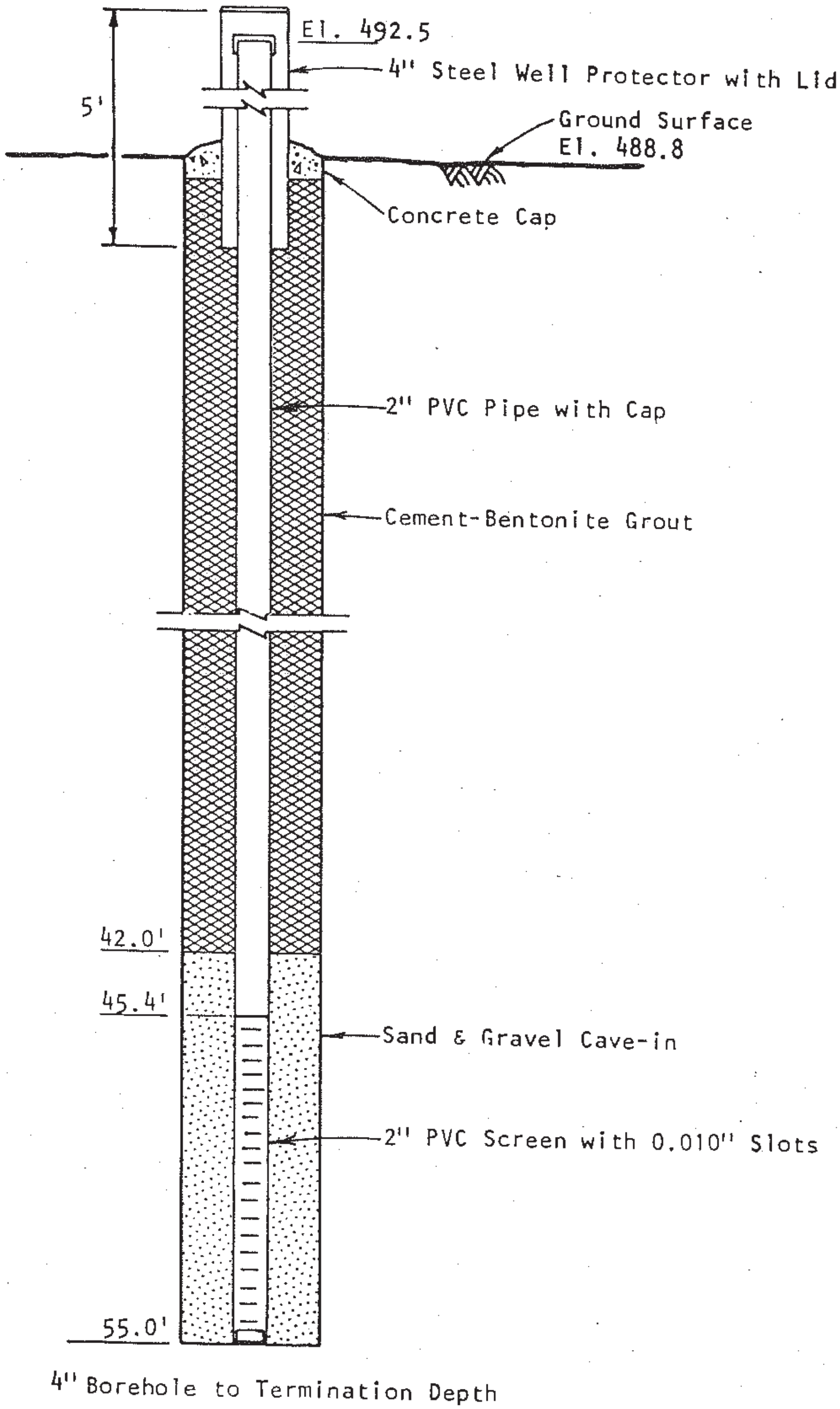
John Mathes & Associates, Inc.

# APPENDIX A
# BORING LOGS AND WELL CONSTRUCTION LOGS
# MATHES WELL CONSTRUCTION LOGS



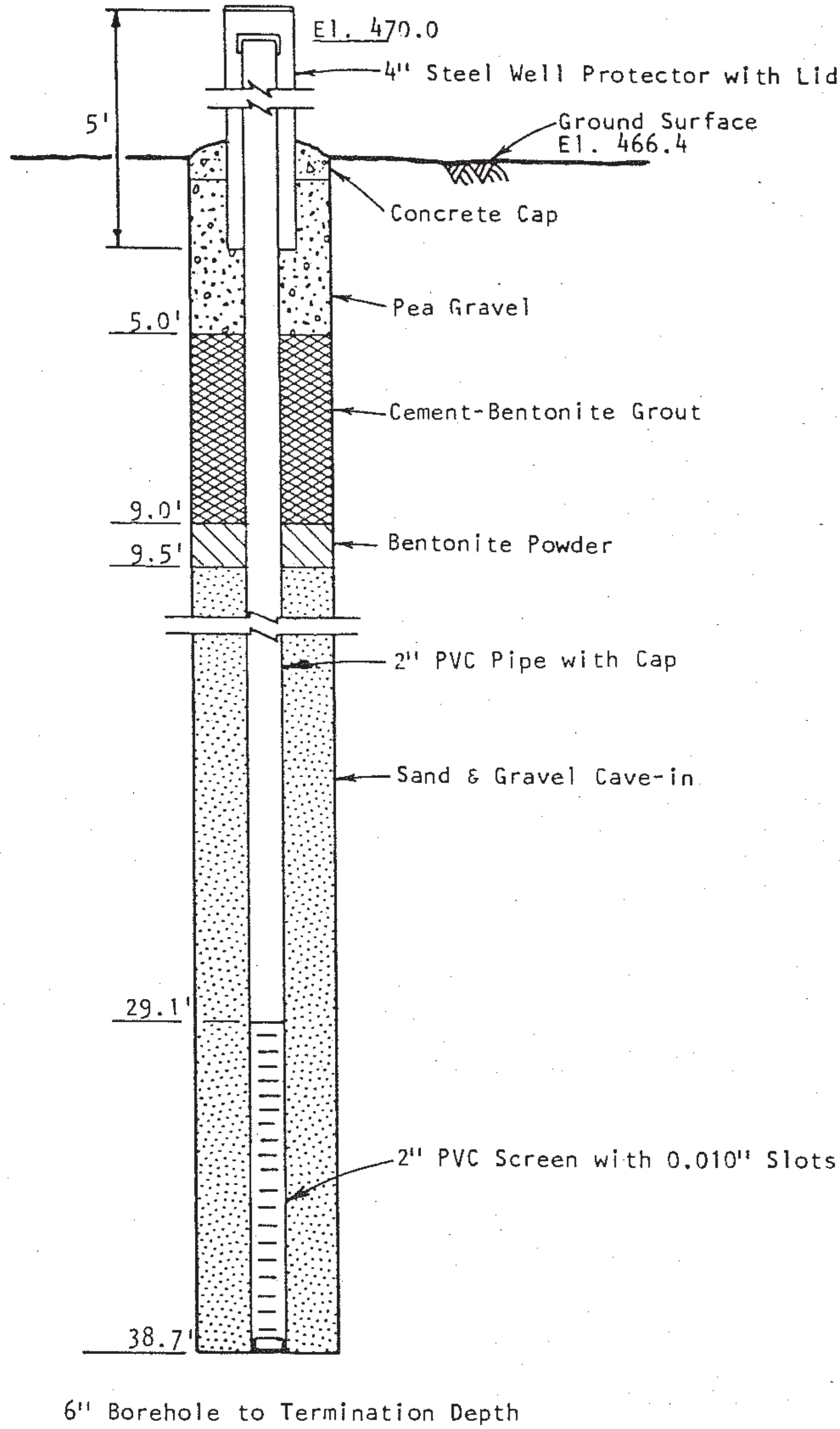

Not to Scale

John Mathes & Associates, Inc.

PIEZOMETER E-2

Renamed 02

PLATE 10




Not to Scale

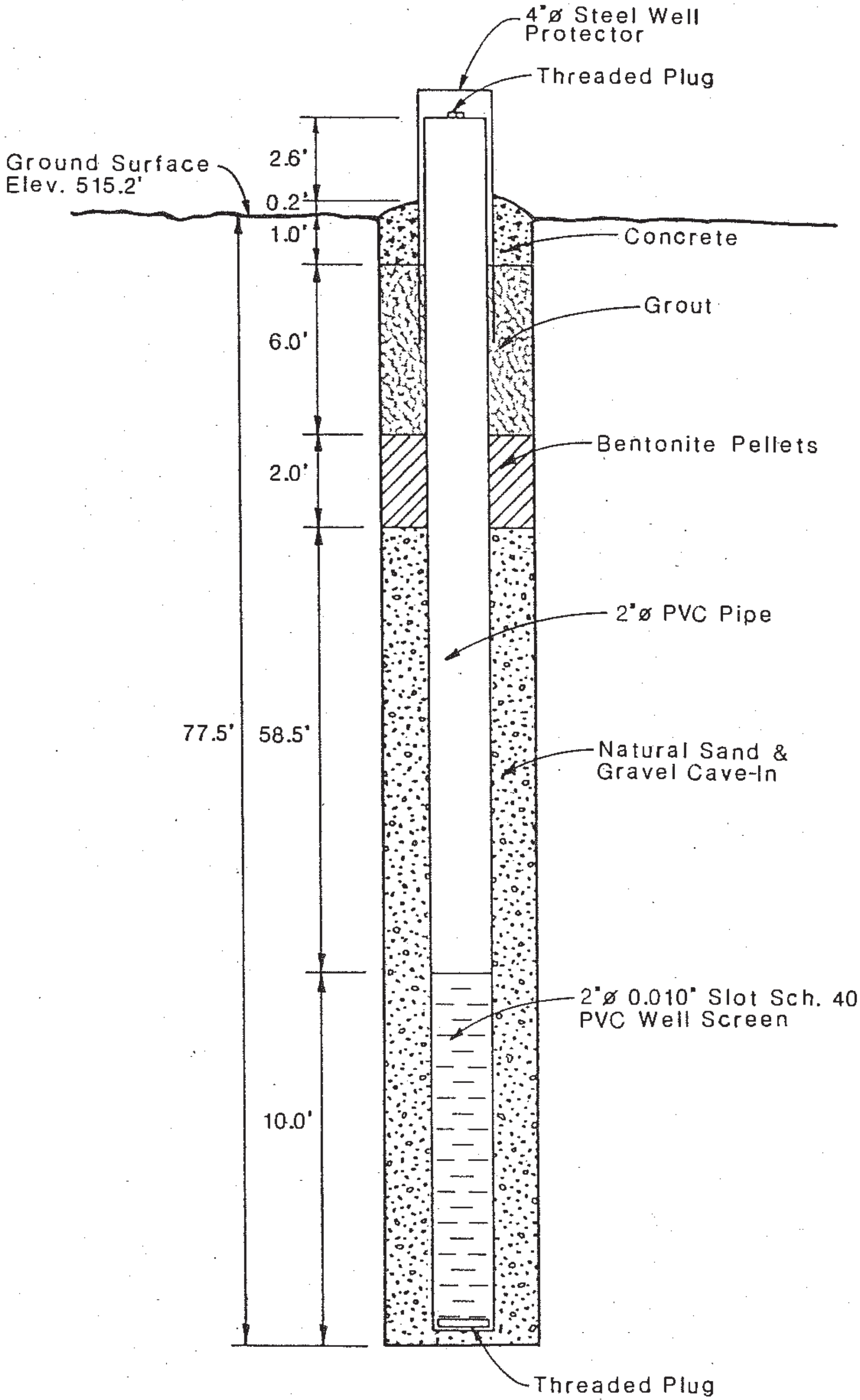
mathes

John Mathes & Associates, Inc.

PIEZOMETER E-6

Renamed 06

PLATE 14

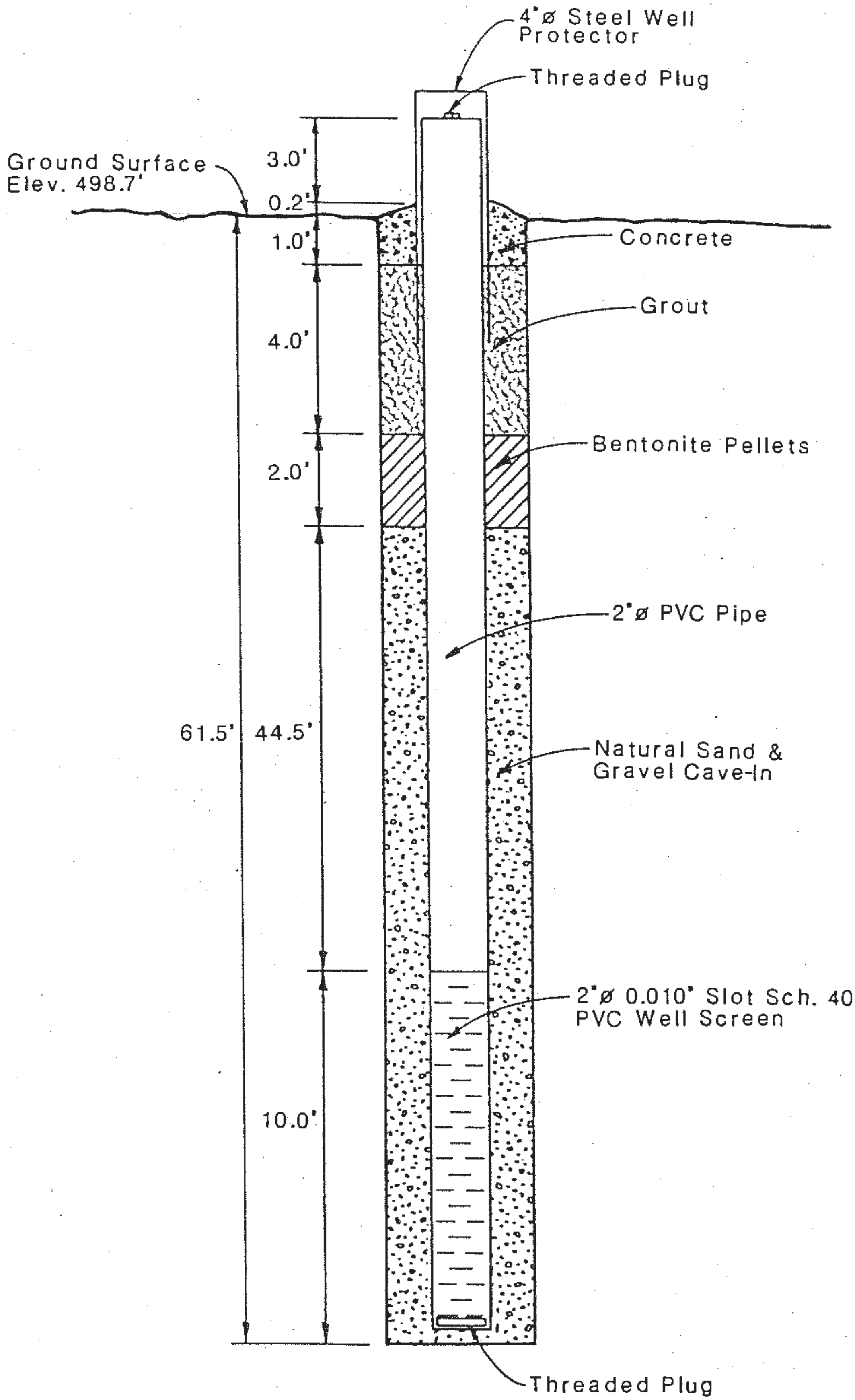



Not To Scale

Renamed 07

PIEZOMETER E-7

John Mathes & Associates, Inc.




Not To Scale

Renamed 08

PIEZOMETER E-8B

John Mathes & Associates, Inc.

# APPENDIX A
# BORING LOGS AND WELL CONSTRUCTION LOGS
# NRT BORING LOGS

# SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Hennepin Power Station - New East Ash Landfill | | 03R |

| Boring Drilled By: Name of crew chief (first, last) and Firm | Date Drilling Started | Date Drilling Completed | Drilling Method |
|---|---|---|---|
| Randy Redke<br>Cascade | 1/15/2015 | 1/15/2015 | Sonic |

| Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|
| 03R | 447.8 Feet (NAVD88) | 479.4 Feet (NAVD88) | 6.0 inches |

Local Grid Origin ☐ (estimated: ☒ ) or Boring Location ☒
State Plane 1,690,297 N, 2,532,308 E S / C / N
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location
☐ N ☐ E
Feet ☐ S Feet ☐ W

| Facility ID | County | State | Civil Town/City/ or Village |
|---|---|---|---|
| | Putnam | IL | Hennepin |

| Sample Number and Type | 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 | | Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 30<br>30 | | 0 | 0 - 5.8' **FILL, SILTY CLAY** CL/ML, with gravel and some sand. | (FILL) CL/ML | | | | | | | | | |
| 2 | 30<br>26 | | 2.5 | | | | | | | | | | | |
| 3 | 120<br>93 | | 5 | | | | | | | | | | | |
| | | | 5.8 | 5.8 - 23.9' **FILL, ASH (Coal):** ASH (Coal), trace silt and gravel, dark gray, medium dense. | (FILL) ASH (Coal) | | | | | | | | | |

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

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

Signature

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number 03R



| Sample Number and Type | 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 | | Soil Properties: Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 5.8 - 23.9' **FILL, ASH (Coal):** ASH (Coal), trace silt and gravel, dark gray, medium dense. *(continued)* | (FILL) ASH (Coal) | | | | | | | | | |
| 4 | 120<br>96 | | 15 | | | | | | | | | | | |
| | | | | 23.9 - 52' **POORLY-GRADED SAND WITH GRAVEL:** (SP)g, fine grained sized gravel, trace silt, light brown, loose, dry. | (SP)g | | | | | | | | | |
| 5 | 60<br>44 | | 25 | | | | | | | | | | | |
| 6 | 60<br>54 | | 30 | | | | | | | | | | | |
| | | | 31.6 | 31.6' Wet. | | | | | | | | | | |

Depth scale: 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32

NATURAL RESOURCE TECHNOLOGY

Boring Number 03R



| 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 | Soil Properties: Compressive Strength (tsf) | Soil Properties: Moisture Content | Soil Properties: Liquid Limit | Soil Properties: Plasticity Index | Soil Properties: P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 23.9 - 52' **POORLY-GRADED SAND WITH GRAVEL:** (SP)g, fine grained sized gravel, trace silt, light brown, loose, dry. *(continued)* | | | | | | | | | |
| | | | 33 | | | | | | | | | | |
| | | | 34 | | | | | | | | | | |
| 7 | 120<br>69 | | 35 | | | | | | | | | | |
| | | | 36 | | | | | | | | | | |
| | | | 37 | | | | | | | | | | |
| | | | 38 | | | | | | | | | | |
| | | | 39 | | | | | | | | | | |
| | | | 40 | | | | | | | | | | |
| | | | 41 | | | | | | | | | | |
| | | | 42 | | (SP)g | | | | | | | | |
| | | | 43 | | | | | | | | | | |
| | | | 44 | | | | | | | | | | |
| 8 | 84<br>36 | | 45 | | | | | | | | | | |
| | | | 46 | | | | | | | | | | |
| | | | 47 | | | | | | | | | | |
| | | | 48 | | | | | | | | | | |
| | | | 49 | | | | | | | | | | |
| | | | 50 | | | | | | | | | | |
| | | | 51 | | | | | | | | | | |
| | | | 52 | | | | | | | | | | |

NATURAL RESOURCE TECHNOLOGY

Boring Number 03R



| 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 | | Soil Properties: Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 52 - 53' Blind drilled to 53' for well installation. | | | | | | | | | | |
| | | | 53 | 53' End of Boring. | | | | | | | | | | |

**SOIL BORING LOG INFORMATION**

NATURAL RESOURCE TECHNOLOGY



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Hennepin Power Station - New East Ash Landfill | | 04R |

| Boring Drilled By: Name of crew chief (first, last) and Firm | Date Drilling Started | Date Drilling Completed | Drilling Method |
|---|---|---|---|
| Randy Redke<br>Cascade | 1/13/2015 | 1/13/2015 | Sonic |

| Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|
| 04R | 453.8 Feet (NAVD88) | 483.8 Feet (NAVD88) | 6.0 inches |

Local Grid Origin ☐ (estimated: ☒ ) or Boring Location ☒
State Plane 1,690,677 N, 2,534,367 E S / C / Ⓝ
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

| Facility ID | County | State | Civil Town/City/ or Village |
|---|---|---|---|
| | Putnam | IL | Hennepin |

| Sample Number and Type | 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 | Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 60<br>42 | | 0 | 0 - 15' **FILL, SILTY CLAY** CL/ML, with small to large gravel, dark brown, low plasticity, loose, dry. | | | | | | | | | |
| 2 | 60<br>40 | | 5 | | (FILL) CL/ML | | | | | | | | |
| 3 | 60<br>32 | | 10 | 10.5' Ash begins to grade in, more rounded gravel. | | | | | | | | | |

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

| Signature | Firm | |
|---|---|---|
| | Natural Resource Technology<br>234 W. Florida St., Fifth Floor, Milwaukee, WI 53204 | Tel: (414) 837-3607<br>Fax: (414) 837-3608 |

# SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number 04R



| 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 | Soil Properties: Compressive Strength (tsf) | Soil Properties: Moisture Content | Soil Properties: Liquid Limit | Soil Properties: Plasticity Index | Soil Properties: P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 12–15 | 0 - 15' **FILL, SILTY CLAY** CL/ML, with small to large gravel, dark brown, low plasticity, loose, dry. *(continued)* | (FILL) CL/ML | | | | | | | | |
| 4 | 120<br>72 | | 15 | 15 - 25.6' **SILTY CLAY** CL/ML, little gravel and fine grained sand, dark brown, low plasticity, dry. | CL/ML | | | | | | | | |
| 5 | 60<br>48 | | 25 | | | | | | | | | | |
| | | | 25.6 | 25.6 - 30' **POORLY-GRADED SAND:** SP, fine grained sand, little rounded gravel, trace silt, brown, loose, dry. | SP | | | | | | | | |
| 6 | 120<br>48 | | 30 | 30 - 31.5' **SILT WITH SAND:** (ML)s, fine grained sand, little rounded gravel, brown, wet. | (ML)s | | | | | | | | |
| | | | 31.5–32 | | SP | | | | | | | | |

NATURAL RESOURCE TECHNOLOGY

Boring Number 04R



| 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 | | Soil Properties: Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 33, 34 | 31.5 - 35' **POORLY-GRADED SAND:** SP, fine grained sand, some rounded gravel, little silt. *(continued)* | SP | | | | | | | | | |
| | | | 35, 36, 37, 38, 39 | 35 - 40' No recovery, a large granitic cobble stuck in sampler and pushed soil sample to 40'. | | | | | | | | | | |
| 7 | 132<br>80 | | 40, 41, 42, 43, 44, 45, 46, 47, 48, 49 | 40 - 49.9' **WELL-GRADED GRAVEL:** GW, subrounded gravel, some silt, some fine to medium grained sand, brown, loose. | GW | | | | | | | | | |
| | | | 50 | 49.9 - 51' **SILT:** ML, gray, hard, dry. | ML | | | | | | | | | |
| | | | 51 | 51 - 52' Blind drilled to 52' for well installation. | | | | | | | | | | |

NATURAL RESOURCE TECHNOLOGY

# SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number 04R



| Sample | | | | | | | | | Soil Properties | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number and Type | 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 | | Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
| | | | | 52' End of Boring. | | | | | | | | | | |

# SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Hennepin Power Station - New East Ash Landfill | | 05R |

| Boring Drilled By: Name of crew chief (first, last) and Firm | Date Drilling Started | Date Drilling Completed | Drilling Method |
|---|---|---|---|
| Randy Redke<br>Cascade | 1/15/2015 | 1/15/2015 | Sonic |

| Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|
| 05R | Feet (NAVD88) | 485.6 Feet (NAVD88) | 6.0 inches |

Local Grid Origin ☐ (estimated: ☒ ) or Boring Location ☒
State Plane 1,690,518 N, 2,533,196 E S / C / Ⓝ
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location ☐ N ☐ E
Feet ☐ S Feet ☐ W

| Facility ID | County | State | Civil Town/City/ or Village |
|---|---|---|---|
| | Putnam | IL | Hennepin |

| 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 | | Soil Properties: Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0–12 | 0 - 55' See boring 05DR for details. | | | | | | | | | | |

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

| Signature | Firm |
|---|---|
| | Natural Resource Technology<br>234 W. Florida St., Fifth Floor, Milwaukee, WI 53204<br>Tel: (414) 837-3607<br>Fax: (414) 837-3608 |

NATURAL RESOURCE TECHNOLOGY

# SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number 05R

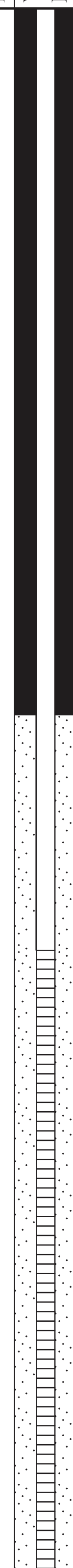


| Sample | | Blow Counts | Depth In Feet | Soil/Rock Description And Geologic Origin For Each Major Unit | U S C S | Graphic Log | Well Diagram | | Soil Properties | | | | | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number and Type | Length Att. & Recovered (in) | | | | | | | | Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | |
| | | | | 0 - 55' See boring 05DR for details. *(continued)* | | | | | | | | | | |
| | | | 13 | | | | | | | | | | | |
| | | | 14 | | | | | | | | | | | |
| | | | 15 | | | | | | | | | | | |
| | | | 16 | | | | | | | | | | | |
| | | | 17 | | | | | | | | | | | |
| | | | 18 | | | | | | | | | | | |
| | | | 19 | | | | | | | | | | | |
| | | | 20 | | | | | | | | | | | |
| | | | 21 | | | | | | | | | | | |
| | | | 22 | | | | | | | | | | | |
| | | | 23 | | | | | | | | | | | |
| | | | 24 | | | | | | | | | | | |
| | | | 25 | | | | | | | | | | | |
| | | | 26 | | | | | | | | | | | |
| | | | 27 | | | | | | | | | | | |
| | | | 28 | | | | | | | | | | | |
| | | | 29 | | | | | | | | | | | |
| | | | 30 | | | | | | | | | | | |
| | | | 31 | | | | | | | | | | | |
| | | | 32 | | | | | | | | | | | |

NATURAL RESOURCE TECHNOLOGY

Boring Number 05R



| 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 | | Soil Properties: Compressive Strength (tsf) | Soil Properties: Moisture Content | Soil Properties: Liquid Limit | Soil Properties: Plasticity Index | Soil Properties: P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 33<br>34<br>35<br>36<br>37<br>38<br>39<br>40<br>41<br>42<br>43<br>44<br>45<br>46<br>47<br>48<br>49<br>50<br>51<br>52 | 0 - 55' See boring 05DR for details. *(continued)* | | |  | | | | | | | |

NATURAL RESOURCE TECHNOLOGY

Boring Number 05R



| 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 | | Soil Properties: Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 53<br>54 | 0 - 55' See boring 05DR for details. *(continued)* | | | | | | | | | | |
| | | | | 55. | | | | | | | | | | |

# SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Hennepin Power Station - New East Ash Landfill | | 05DR |

| Boring Drilled By: Name of crew chief (first, last) and Firm | Date Drilling Started | Date Drilling Completed | Drilling Method |
|---|---|---|---|
| Randy Redke<br>Cascade | 1/14/2015 | 1/14/2015 | Sonic |

| Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|
| 05DR | 454.5 Feet (NAVD88) | 485.7 Feet (NAVD88) | 6.0 inches |

| Local Grid Origin ☐ (estimated: ☒ ) or Boring Location ☒ | | Local Grid Location |
|---|---|---|
| State Plane 1,690,517 N, 2,533,190 E S / C / Ⓝ | Lat ° ' " | ☐ N ☐ E |
| 1/4 of 1/4 of Section , T N, R | Long ° ' " | Feet ☐ S Feet ☐ W |

| Facility ID | County | State | Civil Town/City/ or Village |
|---|---|---|---|
| | Putnam | IL | Hennepin |

| Sample Number and Type | 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 | | Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 60<br>40 | | 0 | 0 - 10' **FILL, LEAN CLAY:** CL, with some sand, rounded to subrounded gravel, light brown to dark brown. | (FILL) CL | | | | | | | | | |
| 2 | 60<br>24 | | 5 | | | | | | | | | | | |
| 3 | 120<br>40 | | 10 | 10 - 22' **FILL, ASH (Coal):** ASH (Coal), fine grained sand sized particles, dark gray, loose, wet. | (FILL) ASH (Coal) | | | | | | | | | |
| | | | 12 | | | | | | | | | | | |

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

| Signature | Firm | |
|---|---|---|
| [signature] | Natural Resource Technology<br>234 W. Florida St., Fifth Floor, Milwaukee, WI 53204 | Tel: (414) 837-3607<br>Fax: (414) 837-3608 |

NATURAL RESOURCE TECHNOLOGY

Boring Number 05DR



| 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 | | Soil Properties: Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 13–22 | 10 - 22' **FILL, ASH (Coal):** ASH (Coal), fine grained sand sized particles, dark gray, loose, wet. *(continued)* | (FILL) ASH (Coal) | | | | | | | | | |
| 4 | 120<br>84 | | 20 | | | | | | | | | | | |
| | | | 22–28 | 22 - 28.2' **SANDY SILT:** s(ML), with little fine grained gravel and coal, dark brown, dense, dry. | s(ML) | | | | | | | | | |
| | | | 28–32 | 28.2 - 72.7' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, coarse grained sand, little silt, light brown, loose, dry. | (GW)s | | | | | | | | | |
| 5 | 72<br>60 | | 30 | | | | | | | | | | | |
| | | | 31 | 31.2' Wet. | | | | | | | | | | |

NATURAL RESOURCE TECHNOLOGY

Boring Number 05DR



| 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 | | Soil Properties: Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 33–35 | 28.2 - 72.7' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, coarse grained sand, little silt, light brown, loose, dry. *(continued)* | | | | | | | | | | |
| 6 | 108<br>96 | | 36 | | | | | | | | | | | |
| | | | 37–41 | | | | | | | | | | | |
| | | | 42 | | (GW)s | | | | | | | | | |
| | | | 43–44 | | | | | | | | | | | |
| 7 | 120<br>86 | | 45 | | | | | | | | | | | |
| | | | 46–52 | | | | | | | | | | | |

| 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 | | Soil Properties Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 28.2 - 72.7' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, coarse grained sand, little silt, light brown, loose, dry. *(continued)* | | | | | | | | | | |
| | | | 53 | | | | | | | | | | | |
| | | | 54 | | | | | | | | | | | |
| 8 | 60<br>40 | | 55 | | | | | | | | | | | |
| | | | 56 | | | | | | | | | | | |
| | | | 57 | | | | | | | | | | | |
| | | | 58 | | | | | | | | | | | |
| | | | 59 | | | | | | | | | | | |
| 9 | 180<br>144 | | 60 | | | | | | | | | | | |
| | | | 61 | | | | | | | | | | | |
| | | | 62 | | (GW)s | | | | | | | | | |
| | | | 63 | | | | | | | | | | | |
| | | | 64 | | | | | | | | | | | |
| | | | 65 | | | | | | | | | | | |
| | | | 66 | | | | | | | | | | | |
| | | | 67 | | | | | | | | | | | |
| | | | 68 | | | | | | | | | | | |
| | | | 69 | | | | | | | | | | | |
| | | | 70 | | | | | | | | | | | |
| | | | 71 | | | | | | | | | | | |
| | | | 72 | | | | | | | | | | | |

NATURAL RESOURCE TECHNOLOGY

# SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number 05DR



| 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 | | Soil Properties: Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | (GW)s | | | | | | | | | |
| | | | 73<br>74 | 72.7 - 75' **SILT:** ML, little clay and gravel, gray, dense, dry. | ML | | | | | | | | | |
| | | | 75 | 75 - 76' Blind drilled to 76' for well installation. | | | | | | | | | | |
| | | | | 76' End of Boring. | | | | | | | | | | |

NATURAL RESOURCE TECHNOLOGY

# SOIL BORING LOG INFORMATION



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Hennepin Power Station - New East Ash Landfill | | 08D |

| Boring Drilled By: Name of crew chief (first, last) and Firm | Date Drilling Started | Date Drilling Completed | Drilling Method |
|---|---|---|---|
| Mike Hansen<br>Boart Longyear Company | 4/16/2009 | 4/17/2009 | sonic |

| Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|
| 08D | 448.4 Feet (Site) | 499.2 Feet (Site) | 6.0 inches |

Local Grid Origin ☐ (estimated: ☐ ) or Boring Location ☐
State Plane 1,688,932 N, 2,533,463 E S/C/N
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location ☐ N ☐ E
Feet ☐ S Feet ☐ W

| Facility ID | County | State | Civil Town/City/ or Village |
|---|---|---|---|
| | | IL | Hennepin |

| 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 | | Soil Properties: Compressive Strength | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CS | 60<br>60 | | 0 – 2.5 | 0 - 7' **FILL, SILTY SAND:** SM, very dark brown (7.5YR 2.5/3), well graded, mostly sand [mostly fine, little coarse], few gravel [mostly fine], some silt, moist. | (FILL) SM | | | | | | | | | Relative Density by visual inspection, not SPT |
| CS | 120<br>120 | | 5.0 | | | | | | | | | | | |
| | | | 7.5 – 12.5 | 7 - 15' **FILL, WELL-GRADED SAND WITH GRAVEL:** (SW)g, brown (7.5YR 4/4), well graded, mostly sand [mostly medium, few coarse], some gravel [mostly fine], moist, trace brick pieces. | (FILL) (SW)g | | | | | | | | | |
| CS | 120<br>120 | | 15.0 – 22.5 | 15 - 40' **FILL, POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/4), poorly graded, mostly sand [mostly medium, trace coarse], few subangular gravel [mostly coarse], moist, loose. | (FILL) SP | | | | | | | | | |
| CS | 120<br>120 | | 25.0 – 30.0 | | | | | | | | | | | |

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

| Signature | Firm | |
|---|---|---|
| Rachel Wilberding | Natural Resource Technology, Inc.<br>23713 W. Paul Road, St D. Pewaukee, WI 53072 | Tel: 262.523.9000<br>Fax: 262.532.9001 |

NATURAL RESOURCE TECHNOLOGY

Boring Number 08D



| 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 | Soil Properties: Compressive Strength | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 32.5 | 15 - 40' **FILL, POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/4), poorly graded, mostly sand [mostly medium, trace coarse], few subangular gravel [mostly coarse], moist, loose. *(continued)* | | | | | | | | | |
| CS | 120<br>120 | | 35.0 | | (FILL) SP | | | | | | | | |
| | | | 37.5 | | | | | | | | | | |
| | | | 40.0 | 40 - 52' **FILL, POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/4), poorly graded, mostly sand [mostly medium], few silt, moist, trace bottom ash, loose. | | | | | | | | | |
| | | | 42.5 | | | | | | | | | | |
| CS | 120<br>120 | | 45.0 | 46' wet. | (FILL) SP | | | | | | | | |
| | | | 47.5 | | | | | | | | | | |
| | | | 50.0 | | | | | | | | | | |
| | | | 52.5 | 52 - 55' **CLAYEY SAND:** SC, yellowish brown (10YR 5/4), well graded, mostly sand [mostly medium, little coarse], few gravel [mostly coarse], some clay. | SC | | | | | | | | |
| CS | 120<br>0 | | 55.0 | 55 - 65' No Recovery. Some black fine sand on outside of core barrel, possible peat. | | | | | | | | | |
| | | | 57.5 | | | | | | | | | | |
| | | | 60.0 | | | | | | | | | | |
| | | | 62.5 | | | | | | | | | | |
| CS | 120<br>120 | | 65.0 | 65 - 66' **CLAYEY GRAVEL:** GC, dark yellowish brown (10YR 4/6), high plasticity, mostly gravel [mostly fine, few coarse], some clay. | GC | | | | | | | | |
| | | | 67.5 | 66 - 67' **WELL-GRADED SAND:** SW, dark brown (10YR 3/3), well graded, mostly sand [mostly medium]. | SW | | | | | | | | |
| | | | 70.0 | 67 - 83' **WELL-GRADED GRAVEL WITH CLAY AND SAND:** (GW-GC)s, yellowish brown (10YR 5/6), well graded, some sand [mostly medium], mostly gravel [mostly fine, few coarse], little clay. | | | | | | | | | |
| | | | 72.5 | | (GW-GC)s | | | | | | | | |
| CS | 120<br>120 | | 75.0 | 75' 12-inch medium sand seam. | | | | | | | | | |
| | | | 77.5 | | | | | | | | | | |
| | | | 80.0 | | | | | | | | | | |

Natural Resource Technology

Boring Number 08D



| 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 | | Soil Properties: Compressive Strength | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 82.5 | | (GW-GC) | | | | | | | | | |
| | | | | 83 - 84' **LEAN CLAY:** CL, gray), hard, dry. | CL | | | | | | | | | |
| CS | 120<br>120 | | 85.0 | 84 - 87' **WELL-GRADED GRAVEL WITH CLAY AND SAND:** (GW-GC)s, brownish yellow (10YR 5/8), well graded, some sand [mostly medium], mostly gravel [mostly fine, few coarse], little clay. | (GW-GC) | | | | | | | | | |
| | | | 87.5 | 87 - 90' **CLAYEY SAND:** SC, yellowish brown), well graded, mostly sand [mostly medium], some clay, medium dense. | SC | | | | | | | | | |
| | | | 90.0 | 90 - 104' **WEATHERED BEDROCK** BDX (SH), gray (7/5B), Weathered Shale. Samples expanded in core sleeve with addition of water. | | | | | | | | | | |
| | | | 92.5 | | | | | | | | | | | |
| CS | 120<br>120 | | 95.0 | | | | | | | | | | | |
| | | | 97.5 | | BDX (SH) | | | | | | | | | |
| | | | 100.0 | | | | | | | | | | | |
| | | | 102.5 | | | | | | | | | | | |
| CORE | 60<br>60 | | 105.0 | 104 - 120' **SHALE:** BDX (SH), gray (7/5B), drilling more difficult. | | | | | | | | | | RQD = 66% |
| | | | 107.5 | | | | | | | | | | | |
| CORE | 120<br>120 | | 110.0 | | | | | | | | | | | RQD = 63% |
| | | | 112.5 | | BDX (SH) | | | | | | | | | |
| | | | 115.0 | | | | | | | | | | | |
| | | | 117.5 | | | | | | | | | | | |
| | | | 120.0 | 120' EOB. | | | | | | | | | | |

**SOIL BORING LOG INFORMATION**

NATURAL RESOURCE TECHNOLOGY



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number | |
|---|---|---|---|
| Hennepin Power Station - New East Ash Landfill | | 18D | |
| **Boring Drilled By:** Name of crew chief (first, last) and Firm | **Date Drilling Started** | **Date Drilling Completed** | **Drilling Method** |
| Mike Hansen<br>Boart Longyear Company | 4/14/2009 | 4/14/2009 | sonic |
| Common Well Name: 18D | **Final Static Water Level**: 451.3 Feet (Site) | **Surface Elevation**: 485.2 Feet (Site) | **Borehole Diameter**: 6.0 inches |

Local Grid Origin ☐ (estimated: ☐ ) or Boring Location ☐
State Plane 1,690,429 N, 2,532,742 E S/C/N
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location: Feet ☐ N ☐ S; Feet ☐ E ☐ W

| Facility ID | County | State | Civil Town/City/ or Village |
|---|---|---|---|
| | | IL | Hennepin |

| Sample Number and Type | Length Att. & Recovered (in) | Blow Counts | Depth In Feet | Soil/Rock Description And Geologic Origin For Each Major Unit | USCS | Graphic Log | Well Diagram | Compressive Strength | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CS | 60 / 60 | | 0 - 1.5 | 0 - 2' FILL, WELL-GRADED SAND WITH SILT: SW-SM, strong brown (7.5YR 4/6), well graded, mostly sand [mostly medium, few coarse], trace subrounded gravel [mostly medium], some silt, moist. | (FILL) SW-SM | | | | | | | | Relative Density by visual inspection, not SPT |
| | | | 3.0 - 4.5 | 2 - 4.5' FILL, WELL-GRADED SAND: SW, dark gray (2.5Y 4/1), well graded, mostly sand [trace fine, little medium, mostly coarse], some gravel [mostly medium], very dense. | (FILL) SW | | | | | | | | |
| CS | 120 / 120 | | 6.0 - 9.0 | 4.5 - 10' FILL, WELL-GRADED GRAVEL WITH SAND: (GW)s, strong brown (7.5YR 4/6), well graded, some sand [some medium, few coarse], mostly gravel [mostly medium, little coarse], trace clay, dry, medium dense. | (FILL) (GW)s | | | | | | | | |
| | | | 10.5 - 13.5 | 10 - 15' FILL, WELL-GRADED SAND WITH SILT: SW-SM, very dark brown (2.5Y 2.5/1), 50% dark olive brown (2.5Y 3/3) mottling, well graded, mostly sand [mostly fine, little coarse], few gravel [mostly medium], some silt, trace bottom ash. | (FILL) SW-SM | | | | | | | | |
| CS | 120 / 120 | | 15.0 - 16.5 | 15 - 17' POORLY-GRADED GRAVEL: GP, poorly graded, mostly gravel [mostly coarse], with limestone cobbles (2 - 4 inches diameter). | GP | | | | | | | | |
| | | | 18.0 - 19.5 | 17 - 22' WELL-GRADED SAND WITH GRAVEL: (SW)g, very dark grayish brown (2.5Y 3/2), well graded, mostly sand [mostly fine, few coarse], little gravel [mostly medium], moist, medium dense. | (SW)g | | | | | | | | |

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

Signature: [signature]

Firm: Natural Resource Technology, Inc.
23713 W. Paul Road, St D. Pewaukee, WI 53072
Tel: 262.523.9000
Fax: 262.532.9001

NATURAL RESOURCE TECHNOLOGY

Boring Number 18D



| 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 | Soil Properties: Compressive Strength | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 21.0 | | (SW)g | | | | | | | | |
| CS | 120 120 | | 22.5, 24.0, 25.5, 27.0, 28.5, 30.0, 31.5 | 22 - 32' **WELL-GRADED SAND:** SW, strong brown (7.5YR 5/6), well graded, mostly sand [mostly fine, some medium, trace coarse]. | SW | | | | | | | | grain size @ 25' |
| | | | 33.0, 34.5 | 32 - 35' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, strong brown (7.5YR 5/6), well graded, some sand [mostly coarse], mostly gravel [mostly fine, few coarse]. | (GW)s | | | | | | | | |
| CS | 120 120 | | 36.0, 37.5, 39.0, 40.5, 42.0 | 35 - 43' **WELL-GRADED SAND WITH GRAVEL:** (SW)g, strong brown (7.5YR 5/6), well graded, mostly sand [mostly fine], little gravel [little fine, few medium], medium dense, trace cobbles. | (SW)g | | | | | | | | |
| | | | 43.5 | 43 - 45' **SILT:** ML, very pale brown (10YR 8/2), dry, very loose. | ML | | | | | | | | |
| CS | 120 120 | | 45.0, 46.5, 48.0, 49.5, 51.0, 52.5 | 45 - 58' **WELL-GRADED GRAVEL WITH CLAY:** GW-GC, yellowish brown (10YR 5/4), very soft, well graded, mostly subrounded gravel [mostly fine, few coarse], little clay, wet, trace cobbles. | GW-GC | | | | | | | | grain size @ 45' |

NATURAL RESOURCE TECHNOLOGY

Boring Number 18D



| 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 | Soil Properties: Compressive Strength | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CS | 120 120 | | 54.0–57.0 | 45 - 58' **WELL-GRADED GRAVEL WITH CLAY:** GW-GC, yellowish brown (10YR 5/4), very soft, well graded, mostly subrounded gravel [mostly fine, few coarse], little clay, wet, trace cobbles. *(continued)* | GW-GC | | | | | | | | grain size @ 55' |
| | | | 58.5–61.5 | 58 - 62' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), medium toughness, medium plasticity, firm, laminated, PP = 1.5. | CL | | | | | | | | PP = Pocket Pen |
| | | | 63.0–64.5 | 62 - 65' **WELL-GRADED GRAVEL WITH CLAY:** GW-GC, yellowish brown (10YR 5/4), very soft, well graded, mostly subrounded gravel [mostly fine, few coarse], little clay, wet, trace cobbles. | GW-GC | | | | | | | | |
| CS | 120 120 | | 66.0–69.0 | 65 - 70' **LEAN CLAY:** CL, dark gray (2.5Y 4/1), medium toughness, medium to high plasticity, soft, PP = 0.5. | CL | | | | | | | | |
| | | | 70.5–72.0 | 70 - 72.5' **POORLY-GRADED SAND:** SP, dark gray (2.5Y 4/1), poorly graded, mostly sand [mostly fine], wet. | SP | | | | | | | | |
| | | | 73.5 | 72.5 - 75' **POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/4), poorly graded, mostly sand [mostly medium]. | SP | | | | | | | | |
| CS | 120 120 | | 75.0–81.0 | 75 - 82' **CLAYEY GRAVEL:** GC, dark yellowish brown (10YR 3/4), well graded, little sand [mostly coarse], mostly subrounded gravel [mostly medium], some clay, dense.<br>80' gray (N 5/), Dolomite Boulder. | GC | | | | | | | | grain size @ 77' |
| | | | 82.5 | 82 - 84' **SILT:** ML, gray (N 5/), dry, medium dense. | ML | | | | | | | | |
| CS | 120 120 | | 84.0–85.5 | 84 - 86' **LEAN CLAY WITH GRAVEL:** (CL)g, gray (N 5/), some gravel [mostly coarse], dense, Till. | (CL)g | | | | | | | | |

NATURAL RESOURCE TECHNOLOGY

Boring Number 18D



| 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 | | Soil Properties: Compressive Strength | Soil Properties: Moisture Content | Soil Properties: Liquid Limit | Soil Properties: Plasticity Index | Soil Properties: P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 87.0<br>88.5<br>90.0<br>91.5<br>93.0<br>94.5 | 86 - 95' **WEATHERED BEDROCK** BDX (SH), gray (N 5/), very hard, dry, Weathered Shale. *(continued)* | BDX (SH) | | | | | | | | | |
| | | | | 95' EOB. | | | | | | | | | | |

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number | |
|---|---|---|---|
| Hennepin Power Station - New East Ash Landfill | | 18S | |
| **Boring Drilled By:** Name of crew chief (first, last) and Firm | **Date Drilling Started** | **Date Drilling Completed** | **Drilling Method** |
| Mike Hansen<br>Boart Longyear Company | 4/14/2009 | 4/15/2009 | sonic |
| **Common Well Name** | **Final Static Water Level** | **Surface Elevation** | **Borehole Diameter** |
| 18S | 450.7 Feet (Site) | 485.2 Feet (Site) | 6.0 inches |

Local Grid Origin ☐ (estimated: ☐ ) or Boring Location ☐
State Plane 1,690,428 N, 2,532,740 E S/C/N
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location ☐ N ☐ E
Feet ☐ S Feet ☐ W

| Facility ID | County | State | Civil Town/City/ or Village |
|---|---|---|---|
| | | IL | Hennepin |

| 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 | Soil Properties: Compressive Strength | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 | 0 - 2' SW-SM, Blind Drilled to 52'. See log for 18D. | (FILL) SW-SM | | | | | | | | |
| | | | 2 | 2 - 4.5' SW. | (FILL) SW | | | | | | | | |
| | | | 4.5 | 4.5 - 10' (GW)s. | (FILL) (GW)s | | | | | | | | |
| | | | 10 | 10 - 15' SW-SM. | (FILL) SW-SM | | | | | | | | |
| | | | 15 | 15 - 17' GP. | GP | | | | | | | | |
| | | | 17 | 17 - 22' (SW)g. | (SW)g | | | | | | | | |
| | | | 22 | 22 - 32' SW. | SW | | | | | | | | |

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

Signature Rachel Wilberding

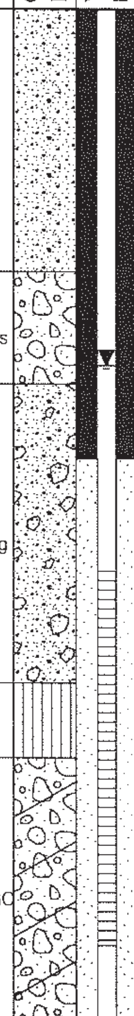
Firm Natural Resource Technology, Inc.
23713 W. Paul Road, St D. Pewaukee, WI 53072
Tel: 262.523.9000
Fax: 262.532.9001

NATURAL RESOURCE TECHNOLOGY

Boring Number 18S



| 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 | Soil Properties: Compressive Strength | Soil Properties: Moisture Content | Soil Properties: Liquid Limit | Soil Properties: Plasticity Index | Soil Properties: P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 26, 28, 30, 32 | 22 - 32' SW. *(continued)* | SW | | | | | | | | |
| | | | 34 | 32 - 35' (GW)s. | (GW)s | | | | | | | | |
| | | | 36, 38, 40, 42 | 35 - 43' (SW)g. | (SW)g | | | | | | | | |
| | | | 44 | 43 - 45' ML. | ML | | | | | | | | |
| | | | 46, 48, 50, 52 | 45 - 52' GW-GC. | GW-GC | | | | | | | | |
| | | | | 52' EOB. | | | | | | | | | |



NATURAL RESOURCE TECHNOLOGY

# SOIL BORING LOG INFORMATION



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number | |
|---|---|---|---|
| Hennepin Power Station - New East Ash Landfill | | 19D | |
| **Boring Drilled By:** Name of crew chief (first, last) and Firm | **Date Drilling Started** | **Date Drilling Completed** | **Drilling Method** |
| Mike Hansen<br>Boart Longyear Company | 4/15/2009 | 4/15/2009 | sonic |
| **Common Well Name** | **Final Static Water Level** | **Surface Elevation** | **Borehole Diameter** |
| 19D | 450.8 Feet (Site) | 483.9 Feet (Site) | 6.0 inches |

Local Grid Origin ☐ (estimated: ☐ ) or Boring Location ☐
State Plane 1,690,632 N, 2,533,812 E S/C/N
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location: Feet ☐ N ☐ S; Feet ☐ E ☐ W

| Facility ID | County | State | Civil Town/City/ or Village |
|---|---|---|---|
| | | IL | Hennepin |

| 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 | Soil Properties: Compressive Strength | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CS | 60<br>60 | | | 0 - 10' **FILL, WELL-GRADED GRAVEL WITH CLAY AND SAND:** (GP-GC)s, dark yellowish brown (10YR 4/4), well graded, some sand [few medium, mostly coarse], mostly gravel [mostly fine, trace coarse], little clay. | | | | | | | | | Relative Density by visual inspection, not SPT |
| | | | 4 | 4' 5 - 10% bottom ash to 5'. | (FILL)<br>(GP-GC)s | | | | | | | | |
| CS | 120<br>120 | | 5 | | | | | | | | | | |
| | | | 10 | 10 - 14' **FILL, WELL-GRADED SAND:** SW, dark yellowish brown (10YR 3/6), 35% black) mottling, well graded, mostly sand [mostly fine], some bottom ash. | (FILL)<br>SW | | | | | | | | |
| | | | 14 | 14 - 17' **FILL, ASH (Coal):** ASH (Coal), fine grained, gray. | (FILL)<br>ASH<br>(Coal) | | | | | | | | |
| CS | 120<br>120 | | 15 | | | | | | | | | | |
| | | | 17 | 17 - 30' **FILL, POORLY-GRADED SAND:** SP, dark yellowish brown (10YR 3/6), poorly graded, mostly sand [mostly fine, few coarse], moist, trace bottom ash, cohesive. | (FILL)<br>SP | | | | | | | | |

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

Signature: Rachel Wilberding

Firm: Natural Resource Technology, Inc.
23713 W. Paul Road, St D. Pewaukee, WI 53072
Tel: 262.523.9000
Fax: 262.532.9001

NATURAL RESOURCE TECHNOLOGY

Boring Number 19D



| 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 | | Soil Properties: Compressive Strength | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CS | 120<br>120 | | 26<br>28 | 17 - 30' **FILL, POORLY-GRADED SAND:** SP, dark yellowish brown (10YR 3/6), poorly graded, mostly sand [mostly fine, few coarse], moist, trace bottom ash, cohesive. *(continued)* | (FILL) SP | | | | | | | | | |
| | | | 30<br>32<br>34 | 30 - 35' **WELL-GRADED SAND WITH SILT:** SW-SM, yellowish brown ( 2.5Y 6/3), well graded, mostly sand [mostly coarse], little angular to subangular gravel [mostly fine, few coarse], some silt, dry, loose. | SW-SM | | ▼ | | | | | | | |
| CS | 120<br>120 | | 36 | 35 - 37' **WELL-GRADED GRAVEL WITH CLAY AND SAND:** (GW-GC)s, yellowish brown (10YR 5/6), well graded, some sand [mostly coarse], mostly subrounded to rounded gravel [mostly fine, few coarse], little clay, wet, loose. | (GW-GC)s | | | | | | | | | |
| | | | 38<br>40<br>42<br>44 | 37 - 73' **CLAYEY SAND WITH GRAVEL:** (SC)g, yellowish brown (10YR 5/6), soft, well graded, mostly sand [few fine, mostly coarse], little gravel [mostly coarse], some clay, wet. | (SC)g | | | | | | | | | |
| CS | 120<br>60 | | 46<br>48<br>50<br>52<br>54 | 45' - 55' Poor Recovery. | | | | | | | | | | |
| CS | 120<br>120 | | 56<br>58<br>60<br>62<br>64 | | | | | | | | | | | |
| CS | 120<br>120 | | 66 | | | | | | | | | | | |

NATURAL RESOURCE TECHNOLOGY

Boring Number 19D



| 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 | | Soil Properties: Compressive Strength | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CS | 120 120 | | 68–73 | 37 - 73' **CLAYEY SAND WITH GRAVEL:** (SC)g, yellowish brown (10YR 5/6), soft, well graded, mostly sand [few fine, mostly coarse], little gravel [mostly coarse], some clay, wet. *(continued)* | (SC)g | | | | | | | | | |
| | | | 73–83 | 73 - 83' **WEATHERED BEDROCK** BDX (SH), dark gray (N 4/), dry, Weathered Shale. | BDX (SH) | | | | | | | | | |
| | | | 83–85 | 83 - 85' **SHALE:** BDX (SH), dark gray (N 4/), dry, samples were pulverized, drilling more difficult. | BDX (SH) | | | | | | | | | |
| | | | 85 | 85' EOB. | | | | | | | | | | |

NATURAL RESOURCE TECHNOLOGY

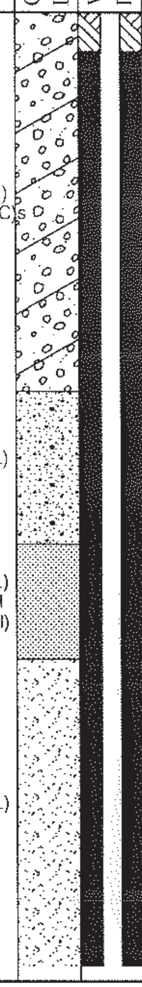


| Facility/Project Name | License/Permit/Monitoring Number | Boring Number | |
|---|---|---|---|
| Hennepin Power Station - New East Ash Landfill | | 19S | |
| **Boring Drilled By: Name of crew chief (first, last) and Firm** | **Date Drilling Started** | **Date Drilling Completed** | **Drilling Method** |
| Mike Hansen<br>Boart Longyear Company | 4/16/2009 | 4/16/2009 | sonic |
| **Common Well Name** | **Final Static Water Level** | **Surface Elevation** | **Borehole Diameter** |
| 19S | 450.6 Feet (Site) | 483.9 Feet (Site) | 6.0 inches |

Local Grid Origin ☐ (estimated: ☐ ) or Boring Location ☐
State Plane 1,690,631 N, 2,533,810 E S/C/N
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

| Facility ID | County | State | Civil Town/City/ or Village |
|---|---|---|---|
| | | IL | Hennepin |

| 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 | Soil Properties: Compressive Strength | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 | 0 - 10' (GW-GC)s, Blind drilled to 52'. See log for 19D. | (FILL) (GW-GC)s | | | | | | | | |
| | | | 10 | 10 - 14' SW. | (FILL) SW | | | | | | | | |
| | | | 14 | 14 - 17' ASH (Coal). | (FILL) ASH (Coal) | | | | | | | | |
| | | | 17 | 17 - 30' SP. | (FILL) SP | | | | | | | | |



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

Signature Kaahl Wilberding

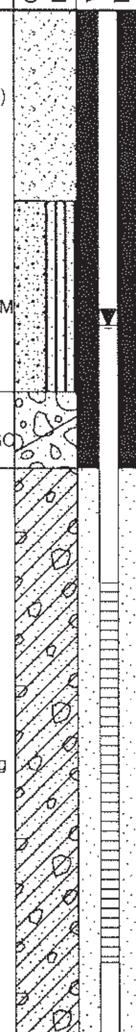
Firm Natural Resource Technology, Inc.
23713 W. Paul Road, St D. Pewaukee, WI 53072
Tel: 262.523.9000
Fax: 262.532.9001

NATURAL RESOURCE TECHNOLOGY

Boring Number 19S



| 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 | | Soil Properties: Compressive Strength | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 26, 28 | 17 - 30' SP. *(continued)* | (FILL) SP | | | | | | | | | |
| | | | 30, 32, 34 | 30 - 35' SW-SM. | SW-SM | | | | | | | | | |
| | | | 36 | 35 - 37' GW-GC. | GW-GC | | | | | | | | | |
| | | | 38, 40, 42, 44, 46, 48, 50, 52 | 37 - 52' (SC)g. | (SC)g | | | | | | | | | |
| | | | | 52' EOB. | | | | | | | | | | |



**NATURAL RESOURCE TECHNOLOGY**

# SOIL BORING LOG INFORMATION



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Hennepin Power Station - New East Ash Landfill | | 40S |

| Boring Drilled By: Name of crew chief (first, last) and Firm | Date Drilling Started | Date Drilling Completed | Drilling Method |
|---|---|---|---|
| Jerry Hancock<br>PSC Drilling | 10/25/2010 | 10/26/2010 | hollow stem auger |

| Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|
| 40S | 473.8 Feet (Site) | 485.8 Feet (Site) | 8.3 inches |

Local Grid Origin ☐ (estimated: ☒ ) or Boring Location ☒
State Plane 1,690,567 N, 2,533,492 E S/C/N
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

| Facility ID | County | State | Civil Town/City/ or Village |
|---|---|---|---|
| | | IL | Hennepin |

| Sample Number and Type | 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 | Compressive Strength | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 CS | 60 42 | | 0 | 0 - 10.5' FILL, WELL-GRADED GRAVEL WITH SAND: (GW)s, brown (7.5YR 5/4), well graded, dry, Gravel is composed of lithics (granite and dolomite). 16-30% lean clay. | | | | | | | | | | |
| 2 CS | 60 42 | | 5 | | (FILL) (GW)s | | | | | | | | | 10-15 ft. dense. A lot of hammer blows |
| 3 CS | 60 60 | | 10 | | | | | | | | | | | 15-20 ft. softer. Few hammer blows |
| | | | 10.5 | 10.5 - 28' FILL, ASH (Coal): ASH (Coal), black (5YR 2.5/1), dry, Coarse like bottom ash to 15 ft. | (FILL) ASH (Coal) | | | | | | | | | |

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

| Signature | Firm | |
|---|---|---|
| | Natural Resource Technology | Tel:<br>Fax: |

Template: SOIL BORING - Project: 1940 GINT.GPJ

# SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number 40S



| Sample Number and Type | 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 | Compressive Strength | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 10.5 - 28' FILL, ASH (Coal): ASH (Coal), black (5YR 2.5/1), dry, Coarse like bottom ash to 15 ft. *(continued)* | | | | | | | | | | |
| | | | 13 | | | | | | | | | | | |
| | | | 14 | | | | | | | | | | | |
| 4 CS | 60 60 | | 15 | 15' very dark grayish brown (10YR 3/2), Fine like fly ash. Horizontally laminated in alternating layers of fine and coarse ash. | | | | | | | | | | |
| | | | 16 | | | | | | | | | | | |
| | | | 17 | 17' moist. | | | | | | | | | | |
| | | | 18 | | | | | | | | | | | |
| | | | 19 | | | | | | | | | | | |
| 5 CS | 60 60 | | 20 | | (FILL) ASH (Coal) | | | | | | | | | |
| | | | 21 | 21' wet, Very soft to 24 ft. | | | | | | | | | | |
| | | | 22 | | | | | | | | | | | |
| | | | 23 | | | | | | | | | | | |
| | | | 24 | 24' moist. | | | | | | | | | | |
| 6 CS | 60 52 | | 25 | 25 - 28' wet, Soft. Very fine ash. | | | | | | | | | | |
| | | | 26 | | | | | | | | | | | |
| | | | 27 | | | | | | | | | | | |
| | | | 28 | 28 - 30' WELL-GRADED SAND: SW, dark yellowish brown (10YR 4/4), moist to wet, Native, buried terrace. Well graded fine to medium sand. 5-10% silt. Trace fine gravel (rounded) and root fibers. | SW | | | | | | | | | |
| | | | 29 | | | | | | | | | | | |
| 7 CS | 60 48 | | 30 | 30 - 33.5' LEAN CLAY WITH SAND: (CL)s, dark grayish brown (2.5Y 4/2), slow dilatency, medium toughness, medium plasticity, moist to wet, 5-10% fine sand. Trace organics (black, woody). | (CL)s | | | | | | | | | |
| | | | 31 | | | | | | | | | | | |
| | | | 32 | | | | | | | | | | | |

# SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number 40S



| 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 | Soil Properties: Moisture Content | Soil Properties: Liquid Limit | Soil Properties: Plasticity Index | Soil Properties: P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 33 | 30 - 33.5' LEAN CLAY WITH SAND: (CL)s, dark grayish brown (2.5Y 4/2), slow dilatency, medium toughness, medium plasticity, moist to wet, 5-10% fine sand. Trace organics (black, woody). *(continued)* | (CL)s | | | | | | | | | |
| 8 CS | 60 27 | | 34, 35, 36 | 33.5 - 37' WELL-GRADED GRAVEL WITH SAND: (GW)s, strong brown (7.5YR 5/6), well graded, wet, Fine to coarse gravel. | (GW)s | | | | | | | | | Poor recovery |
| | | | 37, 38, 39 | 37 - 40' WELL-GRADED GRAVEL: GW, very pale brown (10YR 7/3), well graded, Fine to coarse angular gravel. 5-10% medium sand. | GW | | | | | | | | | |
| 9 CS | 60 27 | | 40, 41, 42, 43, 44 | 40 - 45' WELL-GRADED GRAVEL WITH CLAY: GW-GC, light yellowish brown (10YR 6/4), wet, Fine sand to coarse gravel. 15-25% lean clay. 5-10% sand (well graded). 20% lean clay. Occasionally gravelly layers ~3 in. thick. | GW-GC | | | | | | | | | |
| 10 CS | 60 18 | | 45, 46, 47, 48, 49, 50 | 45 - 50.5' WELL-GRADED GRAVEL WITH SAND: (GW)s, light yellowish brown (10YR 6/4), wet, Fine to coarse gravel. 15-25% well graded sand (fine to coarse). <5% silt. | (GW)s | | | | | | | | | Poor recovery |
| | | | | 50.5' EOB. | | | | | | | | | | |

# SOIL BORING LOG INFORMATION



| | | |
|---|---|---|
| Facility/Project Name: Hennepin Power Station | License/Permit/Monitoring Number: | Boring Number: 45S |

| | | | |
|---|---|---|---|
| Boring Drilled By: Name of crew chief (first, last) and Firm: Chad Dutton, Bulldog Drilling | Date Drilling Started: 6/23/2015 | Date Drilling Completed: 6/24/2015 | Drilling Method: hollow stem auger |
| Common Well Name: 45S | Final Static Water Level: Feet (NAVD88) | Surface Elevation: 465.70 Feet (NAVD88) | Borehole Diameter: 8.3 inches |

Local Grid Origin ☐ (estimated: ☐ ) or Boring Location ☒
State Plane 1,689,993.67 N, 2,531,896.69 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 41° 18' 13.503"
Long -89° 18' 36.702"

Local Grid Location ☐ N ☐ E
Feet ☐ S Feet ☐ W

| Facility ID | County | State | Civil Town/City/ or Village |
|---|---|---|---|
| | Putnam | Illinois | Hennepin |

| Sample Number and Type | Length Att. & Recovered (in) | Blow Counts | Depth In Feet | Soil/Rock Description And Geologic Origin For Each Major Unit | USCS | Graphic Log | Well Diagram | Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 SS | 24 20 | 2 5 4 3 | 0.5, 1.0, 1.5, 2.0 | 0 - 2.5' **SILT:** ML, very dark grayish brown (10YR 3/2), mostly silt, some very fine sand, trace roots and gravel, cohesive, nonplastic, dry to moist. | ML | | | | | | | | |
| 2 SS | 24 6 | 2 10 6 4 | 2.5, 3.0, 3.5, 4.0, 4.5 | 2.5 - 5' **SILT WITH SAND:** (ML)s, very dark grayish brown (10YR 3/2) to dark reddish gray (5YR 4/2), trace clay. | (ML)s | | | | | | | | |
| 3 ST | 18 17.5 | | 5.0, 5.5, 6.0 | 5 - 6.5' Shelby Tube. | | | | | | | | | ST3: 18" at 550 lbs of pressure. |
| | | | 6.5, 7.0 | 6.5 - 7.5' **SILT WITH SAND:** (ML)s, very dark grayish brown (10YR 3/2) to dark reddish gray (5YR 4/2), trace clay. | (ML)s | | | | | | | | |
| 4 SS | 24 18 | 6 12 20 18 | 7.5, 8.0, 8.5, 9.0, 9.5 | 7.5 - 10.5' **WELL-GRADED SAND WITH GRAVEL:** (SW)g, brown (7.5YR 4/3), subangular gravel, trace clay, moist, top 2" of unit is fine poorly-graded sand. 8.2' thin layer of black material. | (SW)g | | | | | | | | |
| 5 SS | 24 16 | 7 3 3 | 10.0, 10.5 | | | | | | | | | | |

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

Signature *Patrick M Hafla*

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

| Sample Number and Type | 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 | Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 10.5 – 13.4 | 10.5 - 13.4' **POORLY-GRADED SAND:** SP, brown (7.5YR 5/4), fine sand, trace to little clay, trace silt, cohesive, decreasing cohesiveness and clay content with depth, moist to wet. | SP | | | | | | | | |
| 6 SS | 24 / 24 | 8, 19, 22, 9 | 12.5 | | | | | | | | | | |
| | | | 13.4 – 15 | 13.4 - 15' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, brown (7.5YR 5/3), subangular to rounded gravel, fine sand, trace clay and silt, wet. | (GW)s | | | | | | | | |
| 7 SS | 24 / 19 | 8, 23, 40, 25 | 15 – 15.4 | 15 - 15.4' **POORLY-GRADED SAND:** SP, brown (7.5YR 5/4), fine sand, trace clay and silt, wet. | SP | | | | | | | | |
| | | | 15.4 – 32.5 | 15.4 - 32.5' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, yellowish brown (10YR 5/4), rounded to subangular gravel, fine sand, trace clay and silt, wet. | (GW)s | | | | | | | | |
| 8 SS | 24 / 12 | 2, 10, 17, 15 | 17.5 | | | | | | | | | | |
| 9 SS | 24 / 10 | 10, 31, 25, 3 | 20.0 | | | | | | | | | | |
| 10 SS | 24 / 8 | 9, 14, 12, 13 | 22.5 | 22.7' brown (7.4YR 4/2), thin layer of poorly-graded fine sand. | | | | | | | | | |
| 11 SS | 24 / 11 | 5, 8, 10, 9 | 25.0 | | | | | | | | | | |
| 12 SS | 24 / 8 | 10, 11, 11 | 27.5 | 27.5' increase in clay content. | | | | | | | | | |

# SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number 45S



| 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 | Soil Properties: Compressive Strength (tsf) | Soil Properties: Moisture Content | Soil Properties: Liquid Limit | Soil Properties: Plasticity Index | Soil Properties: P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 10 | 28.5<br>29.0<br>29.5 | 15.4 - 32.5' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, yellowish brown (10YR 5/4), rounded to subangular gravel, fine sand, trace clay and silt, wet. *(continued)* | | | | | | | | | |
| 13<br>SS | 24<br>19 | 7<br>8<br>6<br>6 | 30.0<br>30.5<br>31.0<br>31.5<br>32.0 | | (GW)s | | | | | | | | |
| 14<br>SS | 24<br>8 | 5<br>6<br>11<br>12 | 32.5<br>33.0<br>33.5<br>34.0<br>34.5 | 32.5 - 37.5' **WELL-GRADED SAND WITH GRAVEL:** (SW)g, yellowish brown (10YR 5.4), medium to coarse sand, fine subangular to rounded gravel, fine gravel, trace silt and clay, wet. | | | | | | | | | |
| 15<br>SS | 24<br>9 | 4<br>5<br>9<br>11 | 35.0<br>35.5<br>36.0<br>36.5<br>37.0 | | (SW)g | | | | | | | | |
| 16<br>SS | 24<br>14 | 7<br>10<br>9<br>9 | 37.5<br>38.0<br>38.5<br>39.0<br>39.5 | 37.5 - 40.5' **WELL-GRADED SAND:** SW, yellowish brown (10YR 5/4), fine to coarse sand, few to little subangular to subrounded gravel, trace clay, wet, layer of fine sand at top 1" of unit. | SW | | | | | | | | |
| 17<br>SS | 24<br>19 | 9<br>6<br>7<br>8 | 40.0<br>40.5<br>41.0<br>41.5<br>42.0 | 40.5 - 42.5' **SILT:** ML, yellowish brown (10YR 5/4), little to some clay, trace medium sand, cohesive, nonplastic, moist. | ML | | | | | | | | |
| 18<br>SS | 24<br>16 | 3<br>13<br>11<br>13 | 42.5<br>43.0<br>43.5<br>44.0<br>44.5 | 42.5 - 45' **WELL-GRADED SAND WITH GRAVEL:** to **POORLY-GRADED SAND WITH GRAVEL:** (SW)g, yellowish brown (10YR 5/4), mostly fine sand, subangular to rounded gravel, little to some medium to coarse sand, trace clay and silt, wet. | (SW)g | | | | | | | | |
| | | | 45.0 | 45' End of Boring. | | | | | | | | | |

**SOIL BORING LOG INFORMATION**

NATURAL RESOURCE TECHNOLOGY



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Hennepin Power Station | | 46 |

| Boring Drilled By: Name of crew chief (first, last) and Firm | Date Drilling Started | Date Drilling Completed | Drilling Method |
|---|---|---|---|
| Jason Drabek<br>Cascade Drilling | 8/11/2015 | 8/11/2015 | Sonic |

| Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|
| 46 | Feet (NAVD88) | 496.44 Feet (NAVD88) | 6.0 inches |

Local Grid Origin ☐ (estimated: ☐ ) or Boring Location ☒
State Plane 1,690,085.24 N, 2,533,743.42 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 41° 18' 14.23"
Long -89° 18' 12.5"

Local Grid Location ☐N ☐S Feet ☐E ☐W Feet

| Facility ID | County | State | Civil Town/City/ or Village |
|---|---|---|---|
| | Putnam | Illinois | Hennepin |

| Sample Number and Type | 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 | | Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 CS | 60 41.5 | | 0–5 | 0 - 5' **FILL, TOPSOIL:** GM, dark yellowish brown (10YR 4/4), mostly fine to coarse gravel, silt (<50%), roots (<10%).<br>2' ash (30-50%).<br>3' - 3.5' fine to coarse gravel layer. | (FILL) GM | | | | | | | | | |
| 2 CS | 60 42 | | 5–11 | 5 - 11' **FILL, SILT:** ML, yellowish brown (10YR 5/8) mottling, fine to coarse gravel (<40%), clay (<20%), ash (5-15%), ash content increases with depth, dry. | (FILL) ML | | | | | | | | | |
| 3 CS | 30 30 | | 10 | 10' decrease in fine gravel content (<10%), decrease in ash content (<10%), increase in clay content with depth, low plasticity, moist. | | | | | | | | | | |
| | | | 11–12.5 | 11 - 12.5' **FILL, ASH (Coal):** very dark brown (10YR 2/2), clay (30-50%), fine gravel (5-15%), low plasticity, moist. | (FILL) | | | | | | | | | |

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

Signature Andrea Salus

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NATURAL RESOURCE TECHNOLOGY

Boring Number 46



| 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 | | Soil Properties: Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 CS | 30 30 | | 13, 14 | 12.5 - 15' **FILL, LEAN CLAY:** CL, very dark grayish brown (10YR 3/2), silt-sized ash (30-50%), cobbles (15-30%), fine subrounded gravel (10-15%), very fine sand (10-15%), trace silt-sized ash, medium plasticity, cohesive, wet.<br>14.8' wood fragments (5-15%). | (FILL) CL | | | | | | | | | |
| 5 CS | 60 58 | | 15, 16, 17 | 15 - 18' **FILL, SILTY CLAY** CL/ML, very dark gray (10YR 3/1), fine gravel (5-10%), very fine sand (10-15%), cohesive, medium plasticity, soft, wet.<br>16' - 16.5' dark brown (10YR 3/3).<br>16.5' - 17.0' mostly silt [very soft, wet]. | (FILL) CL/ML | | | | | | | | | |
| | | | 18, 19 | 18 - 19.9' **FILL, CLAYEY SILT** ML/CL, pale brown (10YR 6/3), fine to coarse angular gravel (>15%), fine sand (10-20%), dry. | (FILL) ML/CL | | | | | | | | | |
| 6 CS | 60 60 | | 20, 21, 22 | 20 - 23' **FILL, ASH (Coal):** very dark brown (10YR 2/2), clay to silt-sized ash, wood fragments (5-10%), seams of very dark gray (10YR 3/1) material. | (FILL) | | | | | | | | | |
| 7 CS | 60 60 | | 23, 24, 25, 26, 27, 28, 29 | 23 - 30' **CLAYEY SILT** ML/CL, very dark grayish brown (10YR 3/2), fine to medium sand (30-50%), subangular to subrounded gravel (>15%), dry.<br>24' grayish brown (10YR 5/2).<br>25' cobbles (15-30%). | ML/CL | | | | | | | | | |
| 8 CS | 60 58 | | 30, 31, 32, 33 | 30 - 50' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, grayish brown (10YR 5/2), dark yellowish brown (10YR 4/6), and yellowish brown (10YR 5/8), subangular to subrounded gravel, coarse sand, clay (5-15%), dry. | (GW)s | | | | | | | | | |

NATURAL RESOURCE TECHNOLOGY

Boring Number 46



| 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 | | Soil Properties: Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 34 | 30 - 50' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, grayish brown (10YR 5/2), dark yellowish brown (10YR 4/6), and yellowish brown (10YR 5/8), subangular to subrounded gravel, coarse sand, clay (5-15%), dry. *(continued)* | | | | | | | | | | |
| 9 CS | 60 23 | | 35 | | | | | | | | | | | |
| | | | 36 | | | | | | | | | | | |
| | | | 37 | | | | | | | | | | | |
| | | | 38 | | | | | | | | | | | |
| | | | 39 | | | | | | | | | | | |
| 10 CS | 60 54 | | 40 | 40' clay (5-10%) , clay content increasing with depth, trace silt and very fine sand, moist. | | | | | | | | | | |
| | | | 41 | | | | | | | | | | | |
| | | | 42 | | (GW)s | | | | | | | | | |
| | | | 43 | | | | | | | | | | | |
| | | | 44 | | | | | | | | | | | |
| 11 CS | 60 54 | | 45 | 45' increase in clay content (10-15%), trace fine sand. | | | | | | | | | | |
| | | | 46 | | | | | | | | | | | |
| | | | 47 | | | | | | | | | | | |
| | | | 48 | 47.5' - 49.0' pulverized cobble (white, rock flour and gravel-sized fragments). | | | | | | | | | | |
| | | | 49 | | | | | | | | | | | |
| 12 CS | 120 72 | | 50 | 50 - 60' **WELL-GRADED GRAVEL:** GW, subrounded to rounded gravel, clay (15-20%), trace fine sand and silt, wet. | | | | | | | | | | |
| | | | 51 | | | | | | | | | | | |
| | | | 52 | | GW | | | | | | | | | |
| | | | 53 | | | | | | | | | | | |
| | | | 54 | | | | | | | | | | | |

NATURAL RESOURCE TECHNOLOGY

Boring Number 46



| 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 | | Soil Properties: Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 55 | 50 - 60' **WELL-GRADED GRAVEL:** GW, subrounded to rounded gravel, clay (15-20%), trace fine sand and silt, wet. *(continued)*<br>55' - 56' yellowish brown (10YR 5/5). | | | | | | | | | | |
| | | | 56 | | | | | | | | | | | |
| | | | 57 | | GW | | | | | | | | | |
| | | | 58 | | | | | | | | | | | |
| | | | 59 | | | | | | | | | | | |
| | | | 60 | 60' End of Boring. | | | | | | | | | | |

NATURAL RESOURCE TECHNOLOGY

# SOIL BORING LOG INFORMATION



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number | |
|---|---|---|---|
| Hennepin Power Station | | 47 | |
| **Boring Drilled By:** Name of crew chief (first, last) and Firm | **Date Drilling Started** | **Date Drilling Completed** | **Drilling Method** |
| Jason Drabek<br>Cascade Drilling | 8/10/2015 | 8/10/2015 | Sonic |
| **Common Well Name** | **Final Static Water Level** | **Surface Elevation** | **Borehole Diameter** |
| 47 | Feet (NAVD88) | 502.13 Feet (NAVD88) | 6.0 inches |

Local Grid Origin ☐ (estimated: ☐ ) or Boring Location ☒
State Plane 1,689,837.69 N, 2,533,052.86 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 41° 18' 11.85"
Long -89° 18' 21.579"

Local Grid Location: Feet ☐ N ☐ S; Feet ☐ E ☐ W

| Facility ID | County | State | Civil Town/City/ or Village |
|---|---|---|---|
| | Putnam | Illinois | Hennepin |

| Sample Number and Type | 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 | Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 CS | 60 26 | | 0 – 5.0 | 0 - 5' **FILL, TOPSOIL:** ML, brown (7.5YR 4/2), silt, trace roots, trace angular to subangular gravel dry.<br>0.7' grayish brown (10YR 5/2), subangular gravel (5-10%).<br>1' very dark gray (5YR 3/1), trace rounded to subrounded gravel, trace sand-sized ash, dry. | (FILL) ML | | | | | | | | |
| 2 CS | 60 43 | | 5.0 – 10.0 | 5 - 11.5' **FILL, ASH (Coal):** black (5YR 2.5/1), clay (5-15%), trace subrounded to subangular gravel, moist.<br>7' very dark brown (7.5YR 2.5/2), cohesive, dry to moist.<br>8.6' increased clay content. | (FILL) | | | | | | | | |
| 3 CS | 60 32 | | 10.0 – 10.5 | 10' increase in clay content (15-25%). | | | | | | | | | |

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

| Signature | Firm |
|---|---|
| | Natural Resource Technology<br>234 W. Florida St., Fifth Floor, Milwaukee, WI 53204<br>Tel: (414) 837-3607<br>Fax: (414) 837-3608 |

NATURAL RESOURCE TECHNOLOGY

Boring Number 47



| 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 | | Soil Properties: Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 11.0 | 5 - 11.5' **FILL, ASH (Coal):** black (5YR 2.5/1), clay (5-15%), trace subrounded to subangular gravel, moist. *(continued)* | (FILL) | | | | | | | | | |
| 4 CS | 60 60 | | 11.5–16.0 | 11.5 - 16.3' **FILL, CLAYEY SILT** ML/CL, dark reddish gray (5YR 4/2), gravel (>5%), dry. | (FILL) ML/CL | | | | | | | | | |
| | | | 16.5–19.5 | 16.3 - 20' **FILL, ASH (Coal):** dark gray (10YR 4/1), mostly silt-sized ash, clay (0-10%), dry to moist. | (FILL) | | | | | | | | | |
| 5 CS | 60 60 | | 20.0–21.5 | 20 - 21.8' **FILL, CLAYEY SILT** ML/CL, dark reddish gray (5YR 4/2), strong brown mottling, gravel (>5%), moist to wet. | (FILL) ML/CL | | | | | | | | | |
| | | | 22.0–24.5 | 21.8 - 30' **FILL, SILT:** ML, dark gray (10YR 4/1) to very dark brown (7.5YR 2.5/2), clay, trace sand and gravel-sized bottom ash, moist to wet.<br>22.7' wood chips (<1" layer). | (FILL) ML | | | | | | | | | |
| 6 CS | 60 60 | | 25.0–28.0 | 25' - 26.6' very dark brown (7.5YR 2.5/2), moist to wet. | | | | | | | | | | |

NATURAL RESOURCE TECHNOLOGY

Boring Number 47



| 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 | | Soil Properties: Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 28.5–30.0 | 21.8 - 30' **FILL, SILT:** ML, dark gray (10YR 4/1) to very dark brown (7.5YR 2.5/2), clay, trace sand and gravel-sized bottom ash, moist to wet. *(continued)* | (FILL) ML | | | | | | | | | |
| 7 CS | 60 60 | | 30.0–33.5 | 30 - 33.5' **POORLY-GRADED SAND:** SP, light brown (10YR 5/4), clay (5-15%), subrounded gravel (5-10%), dry.<br><br>31.2' - 33.5' white cobble pulverized by drilling method into angular to subangular gravel-sized pieces, dry. | SP | | | | | | | | | |
| | | | 33.5–35.0 | 33.5 - 35' **SILT WITH GRAVEL:** (ML)g, light brown (10YR 7/3), subangular to subrounded gravel, noncohesive, dry. | (ML)g | | | | | | | | | |
| 8 CS | 60 18 | | 35.0–40.9 | 35 - 40.9' **WELL-GRADED GRAVEL:** GW, very pale brown (10YR 7/3), gravel and cobbles (50%), sand (10-20%), trace clay.<br><br>36.5' cobble (>6" diameter) pulverized by drilling method into gravel-sized, sand-sized, and silt-sized pieces. | GW | | | | | | | | | |
| 9 CS | 60 60 | | 40.0 | 40' piece of cobble. | | | | | | | | | | |
| | | | 40.9–45.0 | 40.9 - 45' **POORLY-GRADED SAND WITH CLAY AND GRAVEL:** (SC)g, sand (20-40%), subangular gravel (25-30%), clay (15-25%).<br><br>43.7' - 45' increased clay content. | (SC)g | | | | | | | | | |
| 10 CS | 60 42 | | 45.0–45.5 | 45 - 55' **CLAYEY SILT** ML/CL, light brown (10YR 5/4), moist. | ML/CL | | | | | | | | | |

**SOIL BORING LOG INFORMATION SUPPLEMENT**

NATURAL RESOURCE TECHNOLOGY

Boring Number 47



| 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 | | Soil Properties: Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 45.5–50.0 | 45 - 55' **CLAYEY SILT** ML/CL, light brown (10YR 5/4), moist. *(continued)*<br>45.6' - 45.7 ' trace black silt-sized material.<br>45.8' - 46.7' wet. | | | | | | | | | | |
| 11 CS | 60 34 | | 50.0–51.0 | | ML/CL | | | | | | | | | |
| | | | 51.5 | 51.4' wet. | | | | | | | | | | |
| 12 CS | 60 33 | | 55.0 | 55 - 60' **CLAYEY GRAVEL:** GC, subrounded gravel, clay (5-15%), trace silt and sand, decreasing silt and sand content with depth, wet. | GC | | | | | | | | | |
| | | | 60.0 | 60' End of Boring. | | | | | | | | | | |

# SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY



| Facility/Project Name | License/Permit/Monitoring Number | Boring Number |
|---|---|---|
| Hennepin Power Station | | 48 |

| Boring Drilled By: Name of crew chief (first, last) and Firm | Date Drilling Started | Date Drilling Completed | Drilling Method |
|---|---|---|---|
| Jason Drabek<br>Cascade Drilling | 8/11/2015 | 8/11/2015 | Sonic |

| Common Well Name | Final Static Water Level | Surface Elevation | Borehole Diameter |
|---|---|---|---|
| 48 | Feet (NAVD88) | 485.19 Feet (NAVD88) | 6.0 inches |

Local Grid Origin ☐ (estimated: ☐ ) or Boring Location ☒
State Plane 1,690,545.64 N, 2,533,337.84 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 41° 18' 18.816"
Long -89° 18' 17.753"

Local Grid Location ☐ N ☐ S Feet ☐ E ☐ W Feet

| Facility ID | County | State | Civil Town/City/ or Village |
|---|---|---|---|
| | Putnam | Illinois | Hennepin |

| Sample Number and Type | 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 | Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 CS | 60 60 | | 0 – 1.9 | 0 - 1.9' **FILL, TOPSOIL:** ML, brown (7.5YR 4/2), gravel (5-10%), trace roots, clay, and sand, dry. | (FILL) ML | | | | | | | | |
| | | | 1.9 – 3.4 | 1.9 - 3.4' **FILL, SILTY SAND WITH GRAVEL:** (SM)g, very pale brown (10YR 7/3), very fine sand, dry. | (FILL) (SM)g | | | | | | | | |
| | | | 3.4 – 7.9 | 3.4 - 7.9' **FILL, CLAYEY SILT** ML/CL, very dark brown (7YR 2/2), gravel (>15%), cohesive, dry. | (FILL) ML/CL | | | | | | | | |
| | | | 4.2 | 4.2' cobbles. | | | | | | | | | |
| 2 CS | 60 42 | | 5.0 | 5' - 7.9' decreased cobble content. | | | | | | | | | |
| | | | 6.6 | 6.6' ash seam (2" layer, color changes from gray to reddish brown with depth). | | | | | | | | | |

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

Signature

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Tel: (414) 837-3607
Fax: (414) 837-3608

# SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number 48



| 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 | | Soil Properties: Compressive Strength (tsf) | Soil Properties: Moisture Content | Soil Properties: Liquid Limit | Soil Properties: Plasticity Index | Soil Properties: P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 8.0 | 7.9 - 11.4' **FILL, SANDY SILT WITH GRAVEL:** s(ML)g, silt (>50%), cobbles (20-40%), sand (10-20%), trace clay, noncohesive, dry. | | | | | | | | | | |
| | | | 8.5 | | | | | | | | | | | |
| | | | 9.0 | | | | | | | | | | | |
| | | | 9.5 | | (FILL) s(ML)g | | | | | | | | | |
| 3 CS | 60 56 | | 10.0 | | | | | | | | | | | |
| | | | 10.5 | | | | | | | | | | | |
| | | | 11.0 | | | | | | | | | | | |
| | | | 11.5 | 11.4 - 23.4' **FILL, ASH (Coal):** dark gray, (10YR 4/1), cohesive, dry. | | | | | | | | | | |
| | | | 12.0 | | | | | | | | | | | |
| | | | 12.5 | | | | | | | | | | | |
| | | | 13.0 | 13' - 13.4' very dark brown (7.5YR 2.5/2). | | | | | | | | | | |
| | | | 13.5 | | | | | | | | | | | |
| | | | 14.0 | | | | | | | | | | | |
| | | | 14.5 | | | | | | | | | | | |
| 4 CS | 60 55 | | 15.0 | 15' - 20' trace gravel-sized ash. | | | | | | | | | | |
| | | | 15.5 | | | | | | | | | | | |
| | | | 16.0 | | (FILL) | | | | | | | | | |
| | | | 16.5 | | | | | | | | | | | |
| | | | 17.0 | 16.9' moist. | | | | | | | | | | |
| | | | 17.5 | | | | | | | | | | | |
| | | | 18.0 | | | | | | | | | | | |
| | | | 18.5 | | | | | | | | | | | |
| | | | 19.0 | | | | | | | | | | | |
| | | | 19.5 | | | | | | | | | | | |
| 5 CS | 60 60 | | 20.0 | 20' - 23.4' trace white particles, wet. | | | | | | | | | | |
| | | | 20.5 | | | | | | | | | | | |
| | | | 21.0 | | | | | | | | | | | |

| 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 | | Soil Properties: Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 21.5 | 11.4 - 23.4' **FILL, ASH (Coal):** dark gray, (10YR 4/1), cohesive, dry. *(continued)* | (FILL) | | | | | | | | | |
| | | | 23.2 | 23.2' white particles (0.2" layer). | | | | | | | | | | |
| | | | 23.5 | 23.4 - 24.5' **FILL, SILT:** ML, trace subangular to subrounded gravel, cohesive, dry. | (FILL) ML | | | | | | | | | |
| | | | 24.5 | 24.5 - 25' **FILL, SANDY SILT WITH GRAVEL:** s(ML)g, silt (>50%), gravel (30-40%), very fine sand (5-10%), dry. | (FILL) s(ML)g | | | | | | | | | |
| 6 CS | 60 52 | | 25.0 | 25 - 40.4' **FILL, SILTY SAND WITH GRAVEL:** (SM)g, very fine sand (30-40%), gravel (20-40%), silt (20-30%), dry. | (FILL) (SM)g | | | | | | | | | |
| 7 CS | 60 36 | | 30.0 | 30' - 33' decrease in silt content (0-10%), trace clay, dry. | | | | | | | | | | |
| | | | 32.0 | 31.9' brown (10YR 4/3), trace ash. | | | | | | | | | | |
| | | | 34.0 | | | | | | | | | | | |

NATURAL RESOURCE TECHNOLOGY

Boring Number 48



| 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 | | Soil Properties: Compressive Strength (tsf) | Moisture Content | Liquid Limit | Plasticity Index | P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 34.5 | 25 - 40.4' **FILL, SILTY SAND WITH GRAVEL:** (SM)g, very fine sand (30-40%), gravel (20-40%), silt (20-30%), dry. *(continued)* | | | | | | | | | | |
| 8 CS | 60 36 | | 35.0 | 35' - 40' clay content increases with depth, iron oxidation. | | | | | | | | | | |
| | | | 35.5 | | | | | | | | | | | |
| | | | 36.0 | | | | | | | | | | | |
| | | | 36.5 | | | | | | | | | | | |
| | | | 37.0 | | | | | | | | | | | |
| | | | 37.5 | 37.3' wet. | (FILL) (SM)g | | | | | | | | | |
| | | | 38.0 | | | | | | | | | | | |
| | | | 38.5 | | | | | | | | | | | |
| | | | 39.0 | | | | | | | | | | | |
| | | | 39.5 | | | | | | | | | | | |
| 9 CS | 120 78 | | 40.0 | | | | | | | | | | | |
| | | | 40.5 | 40.4 - 54' **WELL-GRADED GRAVEL:** GW, brown (10YR 4/3), gravel (>50%), clay (10-30%), increase in clay content (20-40%) with depth, sand (10-20%). | | | | | | | | | | |
| | | | 41.0 | | | | | | | | | | | |
| | | | 41.5 | | | | | | | | | | | |
| | | | 42.0 | | | | | | | | | | | |
| | | | 42.5 | | | | | | | | | | | |
| | | | 43.0 | | | | | | | | | | | |
| | | | 43.5 | | | | | | | | | | | |
| | | | 44.0 | | GW | | | | | | | | | |
| | | | 44.5 | | | | | | | | | | | |
| | | | 45.0 | | | | | | | | | | | |
| | | | 45.5 | | | | | | | | | | | |
| | | | 46.0 | | | | | | | | | | | |
| | | | 46.5 | | | | | | | | | | | |
| | | | 47.0 | | | | | | | | | | | |

NATURAL RESOURCE TECHNOLOGY

Boring Number 48



| 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 | | Soil Properties: Compressive Strength (tsf) | Soil Properties: Moisture Content | Soil Properties: Liquid Limit | Soil Properties: Plasticity Index | Soil Properties: P 200 | RQD/ Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 CS | 48 28 | | 47.5–54.0 | 40.4 - 54' **WELL-GRADED GRAVEL:** GW, brown (10YR 4/3), gravel (>50%), clay (10-30%), increase in clay content (20-40%) with depth, sand (10-20%). *(continued)* | GW | | | | | | | | | |
| | | | 54.0 | 54' End of Boring. | | | | | | | | | | |

# APPENDIX A
# BORING LOGS AND WELL CONSTRUCTION LOGS
# NRT WELL CONSTRUCTION LOGS

# Illinois Environmental Protection Agency Well Completion Report

SITE #: ____________ COUNTY: Putnam WELL #: 03R

SITE NAME: Hennepin Power Station - Dynegy Midwest Generation BOREHOLE #: ____________

STATE PLANE COORDINATE: X 1690299 Y 2532307 (or) LATITUDE: ____________ LONGITUDE: ____________

SURVEYED BY: Homer L. Chastain & Associates ILL REGISTRATION #: ____________

DRILLING CONTRACTOR: Cascade Drilling DRILLER: Randy Radke

CONSULTING FIRM: Natural Resource Technology GEOLOGIST: E. Kazonovitz

DRILLING METHOD: Sonic DRILLING FLUIDS (TYPE): Water

LOGGED BY: E. Kazonovitz DATE STARTED: 01/15/15 DATE FINISHED: 01/16/15

REPORT FORM COMPLETED BY: E. Kazonovitz DATE : 03/26/15

## ANNULAR SPACE DETAILS

TYPE OF SURFACE SEAL: Concrete

TYPE OF ANNULAR SEALANT: Grout

INSTALLATION METHOD: Pumped

SETTING TIME: + 24 hours

TYPE OF BENTONITE SEAL- GRANULAR, PELLET, SLURRY, CHIPS (CIRCLE ONE)

INSTALLATION METHOD: Poured

SETTING TIME: ~ 15 minutes

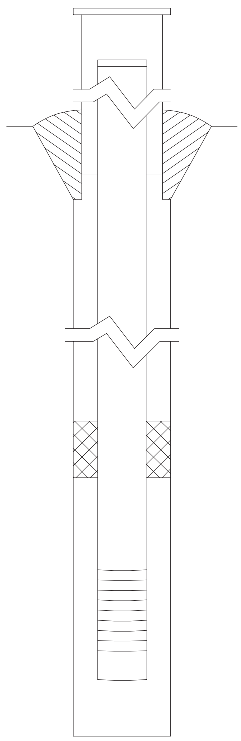
TYPE OF SAND PACK: Quartz

GRAIN SIZE: 40-60 U.S. Standard Series Sieve

INSTALLATION METHOD: Poured

TYPE OF BACKFILL MATERIAL: ____________ (IF APPLICABLE)

INSTALLATION METHOD: ____________



| ELEVATIONS (MSL) * | DEPTHS (BGS) | (.01 ft) |
|---|---|---|
| 501.78 | -2.6 | TOP OF PROTECTIVE CASING |
| 481.92 | -2.5 | TOP OF RISER PIPE |
| 479.4 | 0 | GROUND SURFACE |
| 478.4 | 1.0 | TOP OF ANNULAR SEALANT |
| 448.4 | 35.42 | STATIC WATER LEVEL (AFTER COMPLETION) |
| 442.4 | 37.0 | TOP OF SEAL |
| 440.4 | 39.0 | TOP OF SANDPACK |
| 437.4 | 42.0 | TOP OF SCREEN |
| 427.4 | 52 | BOTTOM OF SCREEN |
| 427.4 | 52.0 | BOTTOM OF WELL |
| 426.4 | 53.0 | BOTTOM OF BOREHOLE |

* REFERENCED TO A NATIONAL GEODETIC VERTICAL DATUM

## WELL CONSTRUCTION MATERIALS

(CIRCLE ONE)

| | |
|---|---|
| PROTECTIVE CASING | SS304, SS316, PTFE, PVC OR OTHER: Steel |
| RISER PIPE ABOVE W.T. | SS304, SS316, PTFE, PVC OR OTHER: |
| RISER PIPE BELOW W.T. | SS304, SS316, PTFE, PVC OR OTHER: |
| SCREEN | SS304, SS316, PTFE, PVC OR OTHER: |

## CASING MEASUREMENTS

| | |
|---|---|
| DIAMETER OF BOREHOLE (in.) | 6 |
| ID OF RISER PIPE (in) | 2 |
| PROTECTIVE CASING LENGTH (ft) | 5 |
| RISER PIPE LENGTH (ft) | 44.5 |
| BOTTOM OF SCREEN TO END CAP (ft) | 0.5 |
| SCREEN LENGTH (1st SLOT TO LAST SLOT) (ft) | 10.0 |
| TOTAL LENGTH OF CASING (ft) | NA |
| SCREEN SLOT SIZE ** | 0.1 |

** HAND-SLOTTED WELL SCREENS ARE UNACCEPTABLE

# Illinois Environmental Protection Agency Well Completion Report

SITE #: ______ COUNTY: Putnam WELL #: 05R

SITE NAME: Hennepin Power Station - Dynegy Midwest Generation BOREHOLE #: ______

STATE PLANE COORDINATE: X 1690521 Y 2533196 (or) LATITUDE: ______ LONGITUDE: ______

SURVEYED BY: Homer L. Chastain & Associates ILL REGISTRATION #: ______

DRILLING CONTRACTOR: Cascade Drilling DRILLER: Randy Radke

CONSULTING FIRM: Natural Resource Technology GEOLOGIST: E. Kazonovitz

DRILLING METHOD: Sonic DRILLING FLUIDS (TYPE): Water

LOGGED BY: E. Kazonovitz DATE STARTED: 01/14/15 DATE FINISHED: 01/14/15

REPORT FORM COMPLETED BY: E. Kazonovitz DATE : 03/26/15

## ANNULAR SPACE DETAILS

TYPE OF SURFACE SEAL: Concrete

TYPE OF ANNULAR SEALANT: Grout

INSTALLATION METHOD: Pumped

SETTING TIME: + 24 hours

TYPE OF BENTONITE SEAL-

GRANULAR, PELLET, SLURRY, CHIPS

(CIRCLE ONE)

INSTALLATION METHOD: Poured

SETTING TIME: ~ 15 minutes

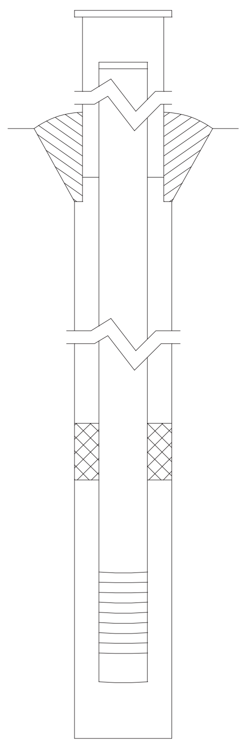
TYPE OF SAND PACK: Quartz

GRAIN SIZE: 40-60 U.S. Standard Series Sieve

INSTALLATION METHOD: Poured

TYPE OF BACKFILL MATERIAL: ______ (IF APPLICABLE)

INSTALLATION METHOD: ______



| ELEVATIONS (MSL) * | DEPTHS (BGS) | (.01 ft) |
|---|---|---|
| 488.5 | -2.9 | TOP OF PROTECTIVE CASING |
| 488.43 | -2.8 | TOP OF RISER PIPE |
| 485.6 | 0 | GROUND SURFACE |
| 484.6 | 1.0 | TOP OF ANNULAR SEALANT |
| 448.4 | 41.86 | STATIC WATER LEVEL (AFTER COMPLETION) |
| 446.6 | 39.0 | TOP OF SEAL |
| 444.6 | 41.0 | TOP OF SANDPACK |
| 441.6 | 44.0 | TOP OF SCREEN |
| 431.6 | 54 | BOTTOM OF SCREEN |
| 431.6 | 54.0 | BOTTOM OF WELL |
| 430.6 | 55.0 | BOTTOM OF BOREHOLE |

* REFERENCED TO A NATIONAL GEODETIC VERTICAL DATUM

## WELL CONSTRUCTION MATERIALS

(CIRCLE ONE)

| | |
|---|---|
| PROTECTIVE CASING | SS304, SS316, PTFE, PVC OR OTHER: Steel |
| RISER PIPE ABOVE W.T. | SS304, SS316, PTFE, PVC OR OTHER: |
| RISER PIPE BELOW W.T. | SS304, SS316, PTFE, PVC OR OTHER: |
| SCREEN | SS304, SS316, PTFE, PVC OR OTHER: |

## CASING MEASUREMENTS

| | |
|---|---|
| DIAMETER OF BOREHOLE (in.) | 6 |
| ID OF RISER PIPE (in) | 2 |
| PROTECTIVE CASING LENGTH (ft) | 5 |
| RISER PIPE LENGTH (ft) | 46.8 |
| BOTTOM OF SCREEN TO END CAP (ft) | 0.5 |
| SCREEN LENGTH (1st SLOT TO LAST SLOT) (ft) | 10.0 |
| TOTAL LENGTH OF CASING (ft) | NA |
| SCREEN SLOT SIZE ** | 0.1 |

** HAND-SLOTTED WELL SCREENS ARE UNACCEPTABLE

# Illinois Environmental Protection Agency Well Completion Report

SITE #: 
COUNTY: Putnam
WELL #: 05DR

SITE NAME: Hennepin Power Station - Dynegy Midwest Generation
BOREHOLE #: 

STATE PLANE COORDINATE: X 1690520 Y 2533190 (or) LATITUDE: LONGITUDE:

SURVEYED BY: Homer L. Chastain & Associates
ILL REGISTRATION #: 

DRILLING CONTRACTOR: Cascade Drilling
DRILLER: Randy Radke

CONSULTING FIRM: Natural Resource Technology
GEOLOGIST: E. Kazonovitz

DRILLING METHOD: Sonic
DRILLING FLUIDS (TYPE): Water

LOGGED BY: E. Kazonovitz
DATE STARTED: 01/14/15
DATE FINISHED: 01/14/15

REPORT FORM COMPLETED BY: E. Kazonovitz
DATE : 03/26/15

## ANNULAR SPACE DETAILS

TYPE OF SURFACE SEAL: Concrete

TYPE OF ANNULAR SEALANT: Grout

INSTALLATION METHOD: Pumped

SETTING TIME: + 24 hours

TYPE OF BENTONITE SEAL- GRANULAR, PELLET, SLURRY, CHIPS
(CIRCLE ONE)

INSTALLATION METHOD: Poured

SETTING TIME: ~ 15 minutes

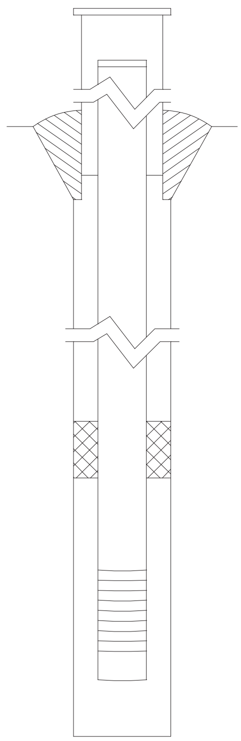
TYPE OF SAND PACK: Quartz

GRAIN SIZE: 40-60 U.S. Standard Series Sieve

INSTALLATION METHOD: Poured

TYPE OF BACKFILL MATERIAL: 
(IF APPLICABLE)

INSTALLATION METHOD: 



| ELEVATIONS (MSL) * | DEPTHS (BGS) | (.01 ft) |
|---|---|---|
| 488.5 | -2.8 | TOP OF PROTECTIVE CASING |
| 488.4 | -2.7 | TOP OF RISER PIPE |
| 485.7 | 0 | GROUND SURFACE |
| 484.7 | 1.0 | TOP OF ANNULAR SEALANT |
| 448.4 | 41.86 | STATIC WATER LEVEL (AFTER COMPLETION) |
| 420.7 | 65.0 | TOP OF SEAL |
| 418.7 | 67.0 | TOP OF SANDPACK |
| 415.7 | 70.0 | TOP OF SCREEN |
| 410.7 | 75 | BOTTOM OF SCREEN |
| 410.7 | 75.0 | BOTTOM OF WELL |
| 409.7 | 76.0 | BOTTOM OF BOREHOLE |

* REFERENCED TO A NATIONAL GEODETIC VERTICAL DATUM

## WELL CONSTRUCTION MATERIALS

(CIRCLE ONE)

| | |
|---|---|
| PROTECTIVE CASING | SS304, SS316, PTFE, PVC OR OTHER: Steel |
| RISER PIPE ABOVE W.T. | SS304, SS316, PTFE, PVC OR OTHER: |
| RISER PIPE BELOW W.T. | SS304, SS316, PTFE, PVC OR OTHER: |
| SCREEN | SS304, SS316, PTFE, PVC OR OTHER: |

## CASING MEASUREMENTS

| | |
|---|---|
| DIAMETER OF BOREHOLE (in.) | 6 |
| ID OF RISER PIPE (in) | 2 |
| PROTECTIVE CASING LENGTH (ft) | 5 |
| RISER PIPE LENGTH (ft) | 72.7 |
| BOTTOM OF SCREEN TO END CAP (ft) | 0.5 |
| SCREEN LENGTH (1st SLOT TO LAST SLOT) (ft) | 5.0 |
| TOTAL LENGTH OF CASING (ft) | NA |
| SCREEN SLOT SIZE ** | 0.1 |

** HAND-SLOTTED WELL SCREENS ARE UNACCEPTABLE

# Illinois Environmental Protection Agency Well Completion Report

SITE #: ______ COUNTY: Putnam WELL #: 08D

SITE NAME: Hennepin Power Station - Dynegy Midwest Generation BOREHOLE #: ______

STATE PLANE COORDINATE: X 1688932 Y 2533463 (or) LATITUDE: ______ LONGITUDE: ______

SURVEYED BY: Homer L. Chastain & Associates ILL REGISTRATION #: ______

DRILLING CONTRACTOR: Boart Longyear Company DRILLER: Mike Hansen

CONSULTING FIRM: Natural Resource Technology/Kelron Env. GEOLOGIST: R. Wilberding

DRILLING METHOD: Sonic DRILLING FLUIDS (TYPE): water

LOGGED BY: R. Wilberding DATE STARTED: 04/16/09 DATE FINISHED: 04/17/09

REPORT FORM COMPLETED BY: R. Wilberding DATE : 05/26/09

## ANNULAR SPACE DETAILS

TYPE OF SURFACE SEAL: Concrete

TYPE OF ANNULAR SEALANT: Bentonite grout

INSTALLATION METHOD: pumped

SETTING TIME: + 24 hours

TYPE OF BENTONITE SEAL- GRANULAR, PELLET, SLURRY, CHIPS (CIRCLE ONE)

INSTALLATION METHOD: pured and hydrated

SETTING TIME: ~ 15 minutes

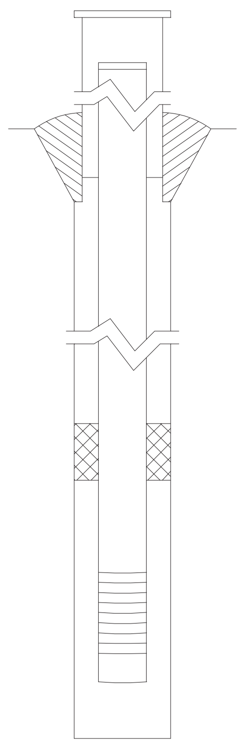
TYPE OF SAND PACK: Quartz

GRAIN SIZE: 40-60 U.S. Standard Series Sieve

INSTALLATION METHOD: Poured

TYPE OF BACKFILL MATERIAL: Bentonite chips (IF APPLICABLE)

INSTALLATION METHOD: Poured



| ELEVATIONS (MSL) * | DEPTHS (BGS) | (.01 ft) |
|---|---|---|
| 501.78 | -2.6 | TOP OF PROTECTIVE CASING |
| 501.45 | -2.3 | TOP OF RISER PIPE |
| 499.2 | 0 | GROUND SURFACE |
| 498.2 | 1.0 | TOP OF ANNULAR SEALANT |
| 448.4 | 50.8 | STATIC WATER LEVEL (AFTER COMPLETION) |
| 424.2 | 75.0 | TOP OF SEAL |
| 419.2 | 80.0 | TOP OF SANDPACK |
| 416.2 | 83.0 | TOP OF SCREEN |
| 411.2 | 88 | BOTTOM OF SCREEN |
| 409.2 | 90.0 | BOTTOM OF WELL |
| 379.2 | 120.0 | BOTTOM OF BOREHOLE |

* REFERENCED TO A NATIONAL GEODETIC VERTICAL DATUM

### WELL CONSTRUCTION MATERIALS

(CIRCLE ONE)

| | |
|---|---|
| PROTECTIVE CASING | SS304, SS316, PTFE, PVC OR OTHER: Steel |
| RISER PIPE ABOVE W.T. | SS304, SS316, PTFE, PVC OR OTHER: |
| RISER PIPE BELOW W.T. | SS304, SS316, PTFE, PVC OR OTHER: |
| SCREEN | SS304, SS316, PTFE, PVC OR OTHER: |

### CASING MEASUREMENTS

| | |
|---|---|
| DIAMETER OF BOREHOLE (in.) | 6 |
| ID OF RISER PIPE (in) | 2 |
| PROTECTIVE CASING LENGTH (ft) | 5 |
| RISER PIPE LENGTH (ft) | 85.3 |
| BOTTOM OF SCREEN TO END CAP (ft) | 2 |
| SCREEN LENGTH (1st SLOT TO LAST SLOT) (ft) | 5.0 |
| TOTAL LENGTH OF CASING (ft) | 92.3 |
| SCREEN SLOT SIZE ** | 0.1 |

** HAND-SLOTTED WELL SCREENS ARE UNACCEPTABLE

# Illinois Environmental Protection Agency Well Completion Report

SITE #: 

COUNTY: Putnam

WELL #: 18D

SITE NAME: Hennepin Power Station - Dynegy Midwest Generation

BOREHOLE #: 

STATE PLANE COORDINATE: X 1688932 Y 2533463 (or) LATITUDE: LONGITUDE:

SURVEYED BY: Homer L. Chastain & Associates

ILL REGISTRATION #: 

DRILLING CONTRACTOR: Boart Longyear Company

DRILLER: Mike Hansen

CONSULTING FIRM: Natural Resource Technology/Kelron Env.

GEOLOGIST: R. Wilberding

DRILLING METHOD: Sonic

DRILLING FLUIDS (TYPE): water

LOGGED BY: R. Wilberding

DATE STARTED: 04/14/09 DATE FINISHED: 04/14/09

REPORT FORM COMPLETED BY: R. Wilberding

DATE : 05/26/09

## ANNULAR SPACE DETAILS

TYPE OF SURFACE SEAL: Concrete

TYPE OF ANNULAR SEALANT: Bentonite grout

INSTALLATION METHOD: pumped

SETTING TIME: + 24 hours

TYPE OF BENTONITE SEAL-

GRANULAR, PELLET, SLURRY, CHIPS

(CIRCLE ONE)

INSTALLATION METHOD: poured and hydrated

SETTING TIME: ~ 15 minutes

TYPE OF SAND PACK: Quartz

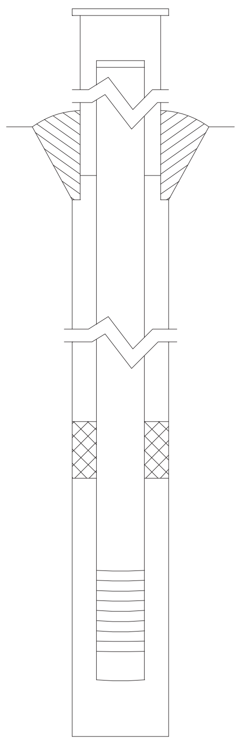
GRAIN SIZE: 40-60 U.S. Standard Series Sieve

INSTALLATION METHOD: Poured

TYPE OF BACKFILL MATERIAL: Bentonite chips

(IF APPLICABLE)

INSTALLATION METHOD: Poured



| ELEVATIONS (MSL) * | DEPTHS (BGS) | (.01 ft) |
|---|---|---|
| 485.18 | 0 | TOP OF PROTECTIVE CASING |
| 484.43 | 0.8 | TOP OF RISER PIPE |
| 485.22 | 0 | GROUND SURFACE |
| 483.2 | 2.0 | TOP OF ANNULAR SEALANT |
| 451.2 | 34 | STATIC WATER LEVEL (AFTER COMPLETION) |
| 422.2 | 63.0 | TOP OF SEAL |
| 417.2 | 68.0 | TOP OF SANDPACK |
| 414.2 | 71.0 | TOP OF SCREEN |
| 409.2 | 76 | BOTTOM OF SCREEN |
| 407.2 | 78.0 | BOTTOM OF WELL |
| 390.2 | 95.0 | BOTTOM OF BOREHOLE |

* REFERENCED TO A NATIONAL GEODETIC VERTICAL DATUM

## WELL CONSTRUCTION MATERIALS

(CIRCLE ONE)

| | |
|---|---|
| PROTECTIVE CASING | SS304, SS316, PTFE, PVC OR OTHER: Steel |
| RISER PIPE ABOVE W.T. | SS304, SS316, PTFE, PVC OR OTHER: |
| RISER PIPE BELOW W.T. | SS304, SS316, PTFE, PVC OR OTHER: |
| SCREEN | SS304, SS316, PTFE, PVC OR OTHER: |

## CASING MEASUREMENTS

| | |
|---|---|
| DIAMETER OF BOREHOLE (in.) | 6 |
| ID OF RISER PIPE (in) | 2 |
| PROTECTIVE CASING LENGTH (ft) | 5 |
| RISER PIPE LENGTH (ft) | 70.2 |
| BOTTOM OF SCREEN TO END CAP (ft) | 2 |
| SCREEN LENGTH (1st SLOT TO LAST SLOT) (ft) | 5.0 |
| TOTAL LENGTH OF CASING (ft) | 77.2 |
| SCREEN SLOT SIZE ** | 0.1 |

** HAND-SLOTTED WELL SCREENS ARE UNACCEPTABLE

# Illinois Environmental Protection Agency Well Completion Report

SITE #: ______ COUNTY: Putnam WELL #: 18S

SITE NAME: Hennepin Power Station - Dynegy Midwest Generation BOREHOLE #: ______

STATE PLANE COORDINATE: X 1688932 Y 2533463 (or) LATITUDE: ______ LONGITUDE: ______

SURVEYED BY: Homer L. Chastain & Associates ILL REGISTRATION #: ______

DRILLING CONTRACTOR: Boart Longyear Company DRILLER: Mike Hansen

CONSULTING FIRM: Natural Resource Technology/Kelron Env. GEOLOGIST: R. Wilberding

DRILLING METHOD: Sonic DRILLING FLUIDS (TYPE): water

LOGGED BY: R. Wilberding DATE STARTED: 04/14/09 DATE FINISHED: 04/14/09

REPORT FORM COMPLETED BY: R. Wilberding DATE : 05/26/09

## ANNULAR SPACE DETAILS

TYPE OF SURFACE SEAL: Concrete

TYPE OF ANNULAR SEALANT: Bentonite grout

INSTALLATION METHOD: pumped

SETTING TIME: + 24 hours

TYPE OF BENTONITE SEAL-

GRANULAR, PELLET, SLURRY, CHIPS
(CIRCLE ONE)

INSTALLATION METHOD: poured and hydrated

SETTING TIME: ~ 15 minutes

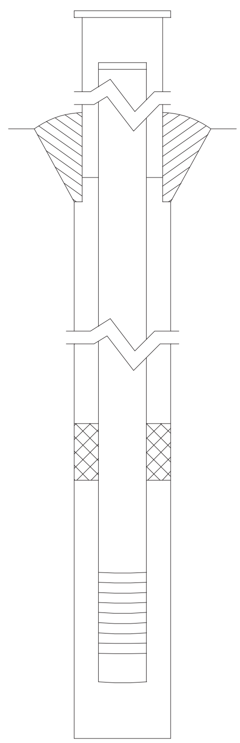
TYPE OF SAND PACK: Quartz

GRAIN SIZE: 40-60 U.S. Standard Series Sieve

INSTALLATION METHOD: Poured

TYPE OF BACKFILL MATERIAL: Bentonite chips
(IF APPLICABLE)

INSTALLATION METHOD: Poured



| ELEVATIONS (MSL) * | DEPTHS (BGS) | (.01 ft) |
|---|---|---|
| 485.23 | 0 | TOP OF PROTECTIVE CASING |
| 484.64 | 0.6 | TOP OF RISER PIPE |
| 485.22 | 0 | GROUND SURFACE |
| 484.2 | 1.0 | TOP OF ANNULAR SEALANT |
| 451.2 | 34 | STATIC WATER LEVEL (AFTER COMPLETION) |
| 453.2 | 32.0 | TOP OF SEAL |
| 448.2 | 37.0 | TOP OF SANDPACK |
| 445.2 | 40.0 | TOP OF SCREEN |
| 435.2 | 50 | BOTTOM OF SCREEN |
| 433.2 | 52.0 | BOTTOM OF WELL |
| 433.2 | 52.0 | BOTTOM OF BOREHOLE |

* REFERENCED TO A NATIONAL GEODETIC VERTICAL DATUM

## WELL CONSTRUCTION MATERIALS

(CIRCLE ONE)

| | |
|---|---|
| PROTECTIVE CASING | SS304, SS316, PTFE, PVC OR OTHER: Steel |
| RISER PIPE ABOVE W.T. | SS304, SS316, PTFE, PVC OR OTHER: |
| RISER PIPE BELOW W.T. | SS304, SS316, PTFE, PVC OR OTHER: |
| SCREEN | SS304, SS316, PTFE, PVC OR OTHER: |

## CASING MEASUREMENTS

| | |
|---|---|
| DIAMETER OF BOREHOLE (in.) | 6 |
| ID OF RISER PIPE (in) | 2 |
| PROTECTIVE CASING LENGTH (ft) | 5 |
| RISER PIPE LENGTH (ft) | 38.4 |
| BOTTOM OF SCREEN TO END CAP (ft) | 2 |
| SCREEN LENGTH (1st SLOT TO LAST SLOT) (ft) | 10.0 |
| TOTAL LENGTH OF CASING (ft) | 51.4 |
| SCREEN SLOT SIZE ** | 0.1 |

** HAND-SLOTTED WELL SCREENS ARE UNACCEPTABLE

# Illinois Environmental Protection Agency Well Completion Report

SITE #: 　　COUNTY: Putnam　　WELL #: 19D

SITE NAME: Hennepin Power Station - Dynegy Midwest Generation　　BOREHOLE #:

STATE PLANE COORDINATE: X 1688932　Y 2533463　(or) LATITUDE: 　LONGITUDE:

SURVEYED BY: Homer L. Chastain & Associates　　ILL REGISTRATION #:

DRILLING CONTRACTOR: Boart Longyear Company　　DRILLER: Mike Hansen

CONSULTING FIRM: Natural Resource Technology/Kelron Env.　　GEOLOGIST: R. Wilberding

DRILLING METHOD: Sonic　　DRILLING FLUIDS (TYPE): water

LOGGED BY: R. Wilberding　　DATE STARTED: 04/15/09　　DATE FINISHED: 04/15/09

REPORT FORM COMPLETED BY: R. Wilberding　　DATE : 05/26/09

## ANNULAR SPACE DETAILS

TYPE OF SURFACE SEAL: Concrete

TYPE OF ANNULAR SEALANT: Bentonite grout

INSTALLATION METHOD: pumped

SETTING TIME: + 24 hours

TYPE OF BENTONITE SEAL-

GRANULAR, PELLET, SLURRY, CHIPS

(CIRCLE ONE)

INSTALLATION METHOD: poured and hydrated

SETTING TIME: ~ 15 minutes

TYPE OF SAND PACK: Quartz

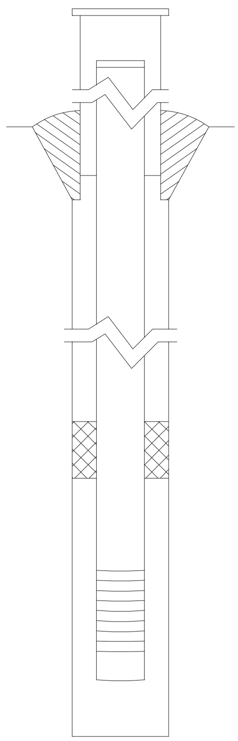
GRAIN SIZE: 40-60 U.S. Standard Series Sieve

INSTALLATION METHOD: Poured

TYPE OF BACKFILL MATERIAL: Bentonite chips

(IF APPLICABLE)

INSTALLATION METHOD: Poured



| ELEVATIONS (MSL) * | DEPTHS (BGS) | (.01 ft) |
|---|---|---|
| 483.8 | 0.1 | TOP OF PROTECTIVE CASING |
| 483.3 | 0.6 | TOP OF RISER PIPE |
| 483.9 | 0 | GROUND SURFACE |
| 482.9 | 1.0 | TOP OF ANNULAR SEALANT |
| 450.9 | 33 | STATIC WATER LEVEL (AFTER COMPLETION) |
| 424.9 | 59.0 | TOP OF SEAL |
| 419.9 | 64.0 | TOP OF SANDPACK |
| 416.9 | 67.0 | TOP OF SCREEN |
| 410.9 | 73 | BOTTOM OF SCREEN |
| 408.9 | 75.0 | BOTTOM OF WELL |
| 398.9 | 85.0 | BOTTOM OF BOREHOLE |

* REFERENCED TO A NATIONAL GEODETIC VERTICAL DATUM

## WELL CONSTRUCTION MATERIALS

(CIRCLE ONE)

| | |
|---|---|
| PROTECTIVE CASING | SS304, SS316, PTFE, PVC OR OTHER: Steel |
| RISER PIPE ABOVE W.T. | SS304, SS316, PTFE, PVC OR OTHER: |
| RISER PIPE BELOW W.T. | SS304, SS316, PTFE, PVC OR OTHER: |
| SCREEN | SS304, SS316, PTFE, PVC OR OTHER: |

## CASING MEASUREMENTS

| | |
|---|---|
| DIAMETER OF BOREHOLE (in.) | 6 |
| ID OF RISER PIPE (in) | 2 |
| PROTECTIVE CASING LENGTH (ft) | 5 |
| RISER PIPE LENGTH (ft) | 67.6 |
| BOTTOM OF SCREEN TO END CAP (ft) | 2 |
| SCREEN LENGTH (1st SLOT TO LAST SLOT) (ft) | 5.0 |
| TOTAL LENGTH OF CASING (ft) | 75.6 |
| SCREEN SLOT SIZE ** | 0.1 |

** HAND-SLOTTED WELL SCREENS ARE UNACCEPTABLE

# Illinois Environmental Protection Agency Well Completion Report

SITE #: ______ COUNTY: Putnam WELL #: 19S

SITE NAME: Hennepin Power Station - Dynegy Midwest Generation BOREHOLE #: ______

STATE PLANE COORDINATE: X 1688932 Y 2533463 (or) LATITUDE: ______ LONGITUDE: ______

SURVEYED BY: Homer L. Chastain & Associates ILL REGISTRATION #: ______

DRILLING CONTRACTOR: Boart Longyear Company DRILLER: Mike Hansen

CONSULTING FIRM: Natural Resource Technology/Kelron Env. GEOLOGIST: R. Wilberding

DRILLING METHOD: Sonic DRILLING FLUIDS (TYPE): water

LOGGED BY: R. Wilberding DATE STARTED: 04/16/09 DATE FINISHED: 04/16/09

REPORT FORM COMPLETED BY: R. Wilberding DATE : 05/26/09

## ANNULAR SPACE DETAILS

TYPE OF SURFACE SEAL: Concrete

TYPE OF ANNULAR SEALANT: Bentonite grout

INSTALLATION METHOD: pumped

SETTING TIME: + 24 hours

TYPE OF BENTONITE SEAL-
GRANULAR, PELLET, SLURRY, CHIPS
(CIRCLE ONE)

INSTALLATION METHOD: poured and hydrated

SETTING TIME: ~ 15 minutes

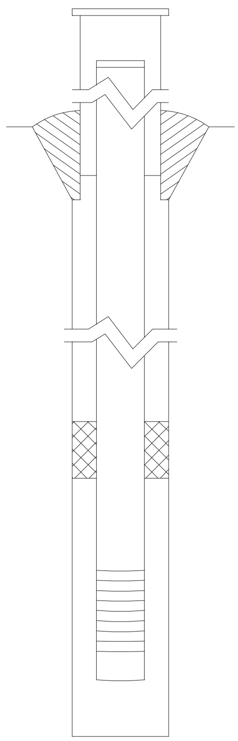
TYPE OF SAND PACK: Quartz

GRAIN SIZE: 40-60 U.S. Standard Series Sieve

INSTALLATION METHOD: Poured

TYPE OF BACKFILL MATERIAL: Bentonite chips
(IF APPLICABLE)

INSTALLATION METHOD: Poured



| ELEVATIONS (MSL) * | DEPTHS (BGS) | (.01 ft) |
|---|---|---|
| 483.88 | 0 | TOP OF PROTECTIVE CASING |
| 483.34 | 0.6 | TOP OF RISER PIPE |
| 483.86 | 0 | GROUND SURFACE |
| 482.9 | 1.0 | TOP OF ANNULAR SEALANT |
| 450.9 | 33 | STATIC WATER LEVEL (AFTER COMPLETION) |
| 451.9 | 32.0 | TOP OF SEAL |
| 446.9 | 37.0 | TOP OF SANDPACK |
| 443.9 | 40.0 | TOP OF SCREEN |
| 433.9 | 50 | BOTTOM OF SCREEN |
| 431.9 | 52.0 | BOTTOM OF WELL |
| 431.9 | 52.0 | BOTTOM OF BOREHOLE |

* REFERENCED TO A NATIONAL GEODETIC VERTICAL DATUM

## WELL CONSTRUCTION MATERIALS

(CIRCLE ONE)

| | |
|---|---|
| PROTECTIVE CASING | SS304, SS316, PTFE, PVC OR OTHER: Steel |
| RISER PIPE ABOVE W.T. | SS304, SS316, PTFE, PVC OR OTHER: |
| RISER PIPE BELOW W.T. | SS304, SS316, PTFE, PVC OR OTHER: |
| SCREEN | SS304, SS316, PTFE, PVC OR OTHER: |

## CASING MEASUREMENTS

| | |
|---|---|
| DIAMETER OF BOREHOLE (in.) | 6 |
| ID OF RISER PIPE (in) | 2 |
| PROTECTIVE CASING LENGTH (ft) | 5 |
| RISER PIPE LENGTH (ft) | 39.4 |
| BOTTOM OF SCREEN TO END CAP (ft) | 2 |
| SCREEN LENGTH (1st SLOT TO LAST SLOT) (ft) | 10.0 |
| TOTAL LENGTH OF CASING (ft) | 51.4 |
| SCREEN SLOT SIZE ** | 0.1 |

** HAND-SLOTTED WELL SCREENS ARE UNACCEPTABLE

# Illinois Environmental Protection Agency Well Completion Report

SITE #: ______ COUNTY: Putnam WELL #: 40S

SITE NAME: Hennepin Power Station - Dynegy Midwest Generation BOREHOLE #: ______

STATE PLANE COORDINATE: X 1690566.812 Y 2533491.9 (or) LATITUDE: ______ LONGITUDE: ______

SURVEYED BY: Illinois Valley Surveying and Consultants, Inc ILL REGISTRATION #: ______

DRILLING CONTRACTOR: PSC Environmental DRILLER: Jerry Hancock

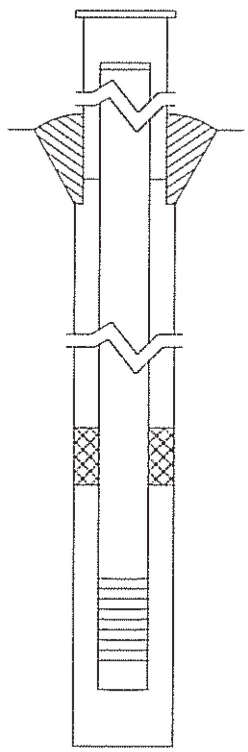
CONSULTING FIRM: Natural Resource Technology/Kelron Env. GEOLOGIST: B. Hennings

DRILLING METHOD: Hollow Stem Auger DRILLING FLUIDS (TYPE): water

LOGGED BY: B. Hennings DATE STARTED: 10/25/10 DATE FINISHED: 10/26/10

REPORT FORM COMPLETED BY: B. Hennings DATE : 12/06/10

## ANNULAR SPACE DETAILS



TYPE OF SURFACE SEAL: Concrete

TYPE OF ANNULAR SEALANT: Bentonite

INSTALLATION METHOD: Poured

SETTING TIME: + 24 hours

TYPE OF BENTONITE SEAL- GRANULAR, PELLET, SLURRY, CHIPS (CIRCLE ONE)

INSTALLATION METHOD: pumped

SETTING TIME: ~ 15 minutes

TYPE OF SAND PACK: Quartz

GRAIN SIZE: 40-60 U.S. Standard Series Sieve

INSTALLATION METHOD: Poured

TYPE OF BACKFILL MATERIAL: Quartz sand (IF APPLICABLE)

INSTALLATION METHOD: Poured

| ELEVATIONS (MSL) * | DEPTHS (BGS) | (.01 ft) |
|---|---|---|
| 484.8 | 0 | TOP OF PROTECTIVE CASING |
| 484.42 | 0.3 | TOP OF RISER PIPE |
| 484.75 | 0 | GROUND SURFACE |
| 483.8 | 1.0 | TOP OF ANNULAR SEALANT |
| 472.8 | 12 | STATIC WATER LEVEL (AFTER COMPLETION) |
| 450.8 | 34.0 | TOP OF SEAL |
| 447.8 | 37.0 | TOP OF SANDPACK |
| 444.8 | 40.0 | TOP OF SCREEN |
| 434.8 | 50 | BOTTOM OF SCREEN |
| 434.5 | 50.3 | BOTTOM OF WELL |
| 434.3 | 50.5 | BOTTOM OF BOREHOLE |

* REFERENCED TO A NATIONAL GEODETIC VERTICAL DATUM

## WELL CONSTRUCTION MATERIALS

(CIRCLE ONE)

| | | |
|---|---|---|
| PROTECTIVE CASING | | SS304, SS316, PTFE, PVC OR OTHER: Steel |
| RISER PIPE ABOVE W.T. | | SS304, SS316, PTFE, PVC OR OTHER: |
| RISER PIPE BELOW W.T. | | SS304, SS316, PTFE, PVC OR OTHER: |
| SCREEN | | SS304, SS316, PTFE, PVC OR OTHER: |

## CASING MEASUREMENTS

| | |
|---|---|
| DIAMETER OF BOREHOLE (in.) | 8 |
| ID OF RISER PIPE (in) | 2 |
| PROTECTIVE CASING LENGTH (ft) | 1 |
| RISER PIPE LENGTH (ft) | 39.7 |
| BOTTOM OF SCREEN TO END CAP (ft) | 0.3 |
| SCREEN LENGTH (1st SLOT TO LAST SLOT) (ft) | 10.0 |
| TOTAL LENGTH OF CASING (ft) | 50.0 |
| SCREEN SLOT SIZE ** | 0.1 |

** HAND-SLOTTED WELL SCREENS ARE UNACCEPTABLE

NATURAL RESOURCE TECHNOLOGY

# MONITORING WELL CONSTRUCTION

| Facility/Project Name | Local Grid Location of Well | Well Name |
|---|---|---|
| Hennepin Power Station | ______ ft. ☐ N. ☐ S. ______ ft. ☐ E. ☐ W. | 45S |
| Facility License, Permit or Monitoring No. | Local Grid Origin ☐ (estimated: ☐ ) or Well Location ☒ Lat. 41° 18' 13.503" Long. -89° 18' 36.702" or | |
| Facility ID | St. Plane 1,689,993.67 ft. N, 2,531,896.69 ft. E. E / (W) | Date Well Installed 06/29/2015 |
| Type of Well mw | Section Location of Waste/Source ____ 1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W | Well Installed By: (Person's Name and Firm) Chad Dutton, Bulldog Drilling |
| Distance from Waste/Source ft. — State: Illinois | Location of Well Relative to Waste/Source: u ☐ Upgradient; s ☐ Sidegradient; d ☒ Downgradient; n ☐ Not Known — Gov. Lot Number | |

A. Protective pipe, top elevation ______ ft. (NAVD88)

B. Well casing, top elevation 467.48 ft. (NAVD88)

C. Land surface elevation 465.70 ft. (NAVD88)

D. Surface seal, bottom 464.7 ft. (NAVD88) or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☒ SW ☒ SP ☐
SM ☐ SC ☐ ML ☒ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐
Hollow Stem Auger ☒
______ Other ☐

15. Drilling fluid used: Water ☒ 0 2 Air ☐
Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ______

17. Source of water (attach analysis, if required):
Onsite Potable Well

E. Bentonite seal, top 434.7 ft. (NAVD88) or 31.0 ft.

F. Fine sand, top ______ ft. (NAVD88) or ______ ft.

G. Filter pack, top 432.7 ft. (NAVD88) or 33.0 ft.

H. Screen joint, top 430.7 ft. (NAVD88) or 35.0 ft.

I. Well bottom 420.7 ft. (NAVD88) or 45.0 ft.

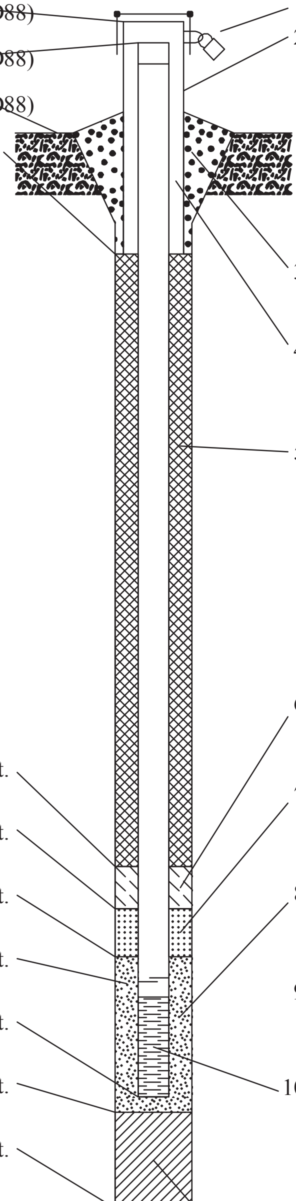
J. Filter pack, bottom 420.7 ft. (NAVD88) or 45.0 ft.

K. Borehole, bottom 420.7 ft. (NAVD88) or 45.0 ft.

L. Borehole, diameter 8.3 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 5.0 ft.
c. Material: Steel ☒
______ Other ☐
d. Additional protection? ☒ Yes ☐ No
If yes, describe: Three steel bollards
3. Surface seal: Bentonite ☐
Concrete ☒
______ Other ☐
4. Material between well casing and protective pipe:
Bentonite ☒
Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
d. 30 % Bentonite . . . Bentonite-cement grout ☒
e. ______ $Ft^3$ volume added for any of the above
f. How installed: Tremie ☐
Tremie pumped ☒
Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ______ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
a. ______
b. Volume added ______ $ft^3$
8. Filter pack material: Manufacturer, product name & mesh size
a. 33-35 ft formation sand backfill above prepacked screen.
b. Volume added ______ $ft^3$
9. Well casing: Flush threaded PVC schedule 40 ☒
Flush threaded PVC schedule 80 ☐
______ Other ☐
10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☐
Continuous slot ☐
Sand prepacked screen Other ☒
b. Manufacturer ______
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☒
______ Other ☐

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

Date Modified: 11/4/2015

Signature Patrick M Hafe

Firm Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

# MONITORING WELL CONSTRUCTION

| Facility/Project Name | Local Grid Location of Well | Well Name |
|---|---|---|
| Hennepin Power Station | ____ft. ☐ N. ☐ S. ____ft. ☐ E. ☐ W. | 46 |
| Facility License, Permit or Monitoring No. | Local Grid Origin ☐ (estimated: ☐ ) or Well Location ☒ Lat. 41° 18' 14.230" Long. -89° 18' 12.500" or | |
| Facility ID | St. Plane 1,690,085.24 ft. N, 2,533,743.42 ft. E. E / W (W circled) | Date Well Installed 08/11/2015 |
| Type of Well mw | Section Location of Waste/Source ____1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W | Well Installed By: (Person's Name and Firm) Jason Drabek, Cascade Drilling |
| Distance from Waste/Source ft. / State Illinois | Location of Well Relative to Waste/Source: u ☐ Upgradient; s ☐ Sidegradient; d ☒ Downgradient; n ☐ Not Known / Gov. Lot Number | |

A. Protective pipe, top elevation ____ ft. (NAVD88)

B. Well casing, top elevation 498.75 ft. (NAVD88)

C. Land surface elevation 496.44 ft. (NAVD88)

D. Surface seal, bottom 495.4 ft. (NAVD88) or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☒ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐
Hollow Stem Auger ☐
Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐
Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Onsite Potable Well

E. Bentonite seal, top 495.4 ft. (NAVD88) or 1.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 449.4 ft. (NAVD88) or 47.0 ft.

H. Screen joint, top 446.4 ft. (NAVD88) or 50.0 ft.

I. Well bottom 436.4 ft. (NAVD88) or 60.0 ft.

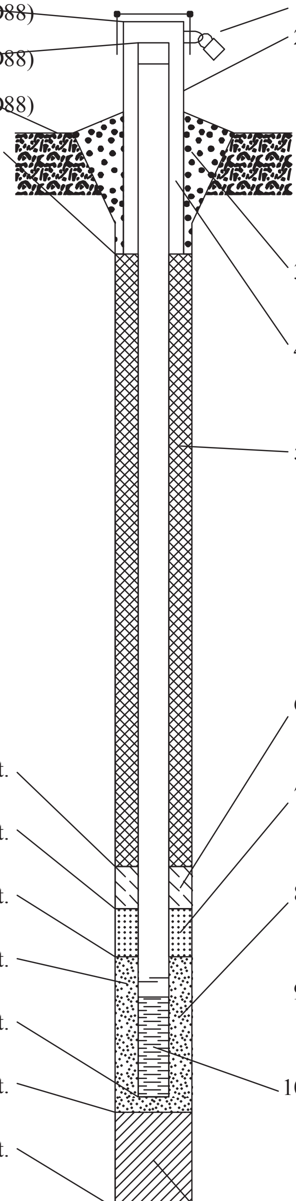
J. Filter pack, bottom 436.4 ft. (NAVD88) or 60.0 ft.

K. Borehole, bottom 436.4 ft. (NAVD88) or 60.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 5.0 ft.
c. Material: Steel ☒
Other ☐
d. Additional protection? ☒ Yes ☐ No
If yes, describe: Three steel bollards

3. Surface seal: Bentonite ☐
Concrete ☒
Other ☐

4. Material between well casing and protective pipe:
Bentonite ☒
Sand Other ☒

5. Annular space seal: a. Granular/Chipped Bentonite ☒
b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. ____Lbs/gal mud weight . . . Bentonite slurry ☐
d. 30 % Bentonite . . . Bentonite-cement grout ☒
e. ____$Ft^3$ volume added for any of the above
f. How installed: Tremie ☐
Tremie pumped ☒
Gravity ☐

6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
a. ____
b. Volume added ____ $ft^3$

8. Filter pack material: Manufacturer, product name & mesh size
a. Red Flint Sand and Gravel, Well Pack
b. Volume added ____ $ft^3$

9. Well casing: Flush threaded PVC schedule 40 ☒
Flush threaded PVC schedule 80 ☐
Other ☐

10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒
Continuous slot ☐
Other ☐
b. Manufacturer ____
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.

11. Backfill material (below filter pack): None ☒
Other ☐

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

Date Modified: 11/4/2015

Signature Andrea Salus

Firm Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

# MONITORING WELL CONSTRUCTION

| Facility/Project Name | Local Grid Location of Well | Well Name |
|---|---|---|
| Hennepin Power Station | ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W. | 47 |
| Facility License, Permit or Monitoring No. | Local Grid Origin ☐ (estimated: ☐ ) or Well Location ☒<br>Lat. 41° 18' 11.850" Long. -89° 18' 21.579" or | |
| Facility ID | St. Plane 1,689,837.69 ft. N, 2,533,052.86 ft. E. E /Ⓦ | Date Well Installed<br>08/11/2015 |
| Type of Well<br>mw | Section Location of Waste/Source<br>____ 1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W | Well Installed By: (Person's Name and Firm)<br>Jason Drabek<br>Cascade Drilling |
| Distance from Waste/Source ft. — State: Illinois | Location of Well Relative to Waste/Source: u ☐ Upgradient; s ☐ Sidegradient; d ☒ Downgradient; n ☐ Not Known — Gov. Lot Number: | |

A. Protective pipe, top elevation ________ ft. (NAVD88)

B. Well casing, top elevation 504.32 ft. (NAVD88)

C. Land surface elevation 502.13 ft. (NAVD88)

D. Surface seal, bottom 501.1 ft. (NAVD88) or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☒ SW ☐ SP ☐
SM ☐ SC ☐ ML ☒ MH ☐ CL ☒ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☐ Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____________

17. Source of water (attach analysis, if required):
Onsite Potable Well

E. Bentonite seal, top 501.1 ft. (NAVD88) or 1.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 454.1 ft. (NAVD88) or 48.0 ft.

H. Screen joint, top 452.1 ft. (NAVD88) or 50.0 ft.

I. Well bottom 442.1 ft. (NAVD88) or 60.0 ft.

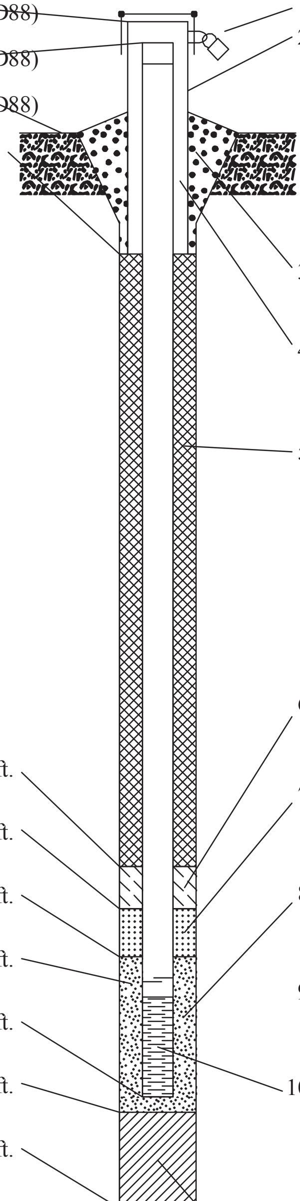
J. Filter pack, bottom 442.1 ft. (NAVD88) or 60.0 ft.

K. Borehole, bottom 442.1 ft. (NAVD88) or 60.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Three steel bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☒ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. 30 % Bentonite . . . Bentonite-cement grout ☒
   e. ____ Ft³ volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft³
8. Filter pack material: Manufacturer, product name & mesh size
   a. Red Flint Sand and Gravel, Well Pack
   b. Volume added ____ ft³
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer ____
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☒ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 11/4/2015

Signature [signature]

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

**MONITORING WELL CONSTRUCTION**

| | | |
|---|---|---|
| Facility/Project Name: Hennepin Power Station | Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W. | Well Name |
| Facility License, Permit or Monitoring No. | Local Grid Origin ☐ (estimated: ☐ ) or Well Location ☒<br>Lat. 41° 18' 18.816" Long. -89° 18' 17.753" or | 48 |
| Facility ID | St. Plane 1,690,545.64 ft. N, 2,533,337.84 ft. E. E/Ⓦ | Date Well Installed: 08/11/2015 |
| Type of Well: mw | Section Location of Waste/Source<br>____1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W | Well Installed By: (Person's Name and Firm)<br>Jason Drabek<br>Cascade Drilling |
| Distance from Waste/Source ft. \| State: Illinois | Location of Well Relative to Waste/Source<br>u ☐ Upgradient s ☐ Sidegradient<br>d ☒ Downgradient n ☐ Not Known \| Gov. Lot Number | |

A. Protective pipe, top elevation ____ ft. (NAVD88)

B. Well casing, top elevation 487.46 ft. (NAVD88)

C. Land surface elevation 485.19 ft. (NAVD88)

D. Surface seal, bottom 484.2 ft. (NAVD88) or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☒ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☐ Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Onsite Potable Well

E. Bentonite seal, top 484.2 ft. (NAVD88) or 1.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 444.2 ft. (NAVD88) or 41.0 ft.

H. Screen joint, top 441.2 ft. (NAVD88) or 44.0 ft.

I. Well bottom 431.2 ft. (NAVD88) or 54.0 ft.

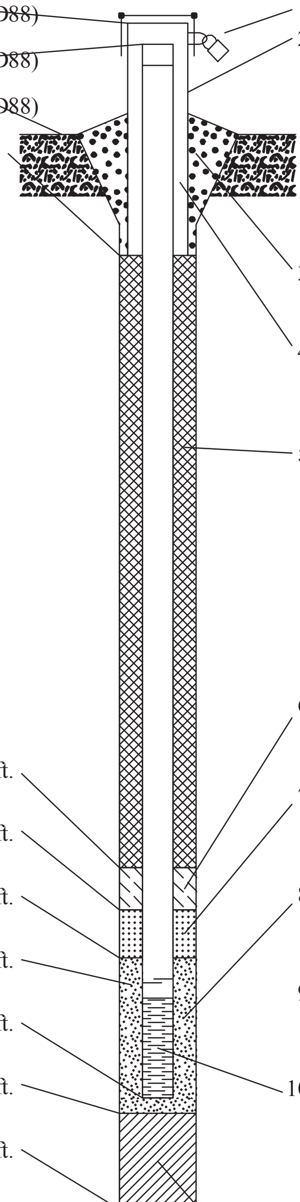
J. Filter pack, bottom 431.2 ft. (NAVD88) or 54.0 ft.

K. Borehole, bottom 431.2 ft. (NAVD88) or 54.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Three steel bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☒ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ____% Bentonite . . . Bentonite-cement grout ☐
   e. ____$Ft^3$ volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ $ft^3$
8. Filter pack material: Manufacturer, product name & mesh size
   a. Red Flint Sand and Gravel, Well Pack
   b. Volume added ____ $ft^3$
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
   a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
   b. Manufacturer ____
   c. Slot size: 0.010 in.
   d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☒ Other ☐

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

Date Modified: 11/4/2015

Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

# APPENDIX A
# BORING LOGS AND WELL CONSTRUCTION LOGS
# STMI BORING LOGS AND WELL CONSTRUCTION LOGS

# Monitoring Well No. 10

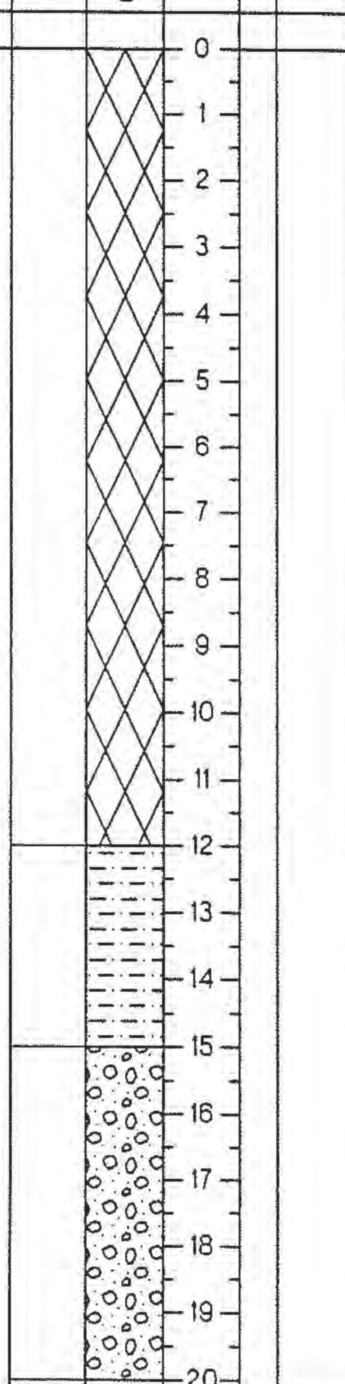
**PROJECT:** Hennepin East Ash Impoundment
**DRILL RIG:** Rotosonic Drill
**DRILLER:** Boart Longyear

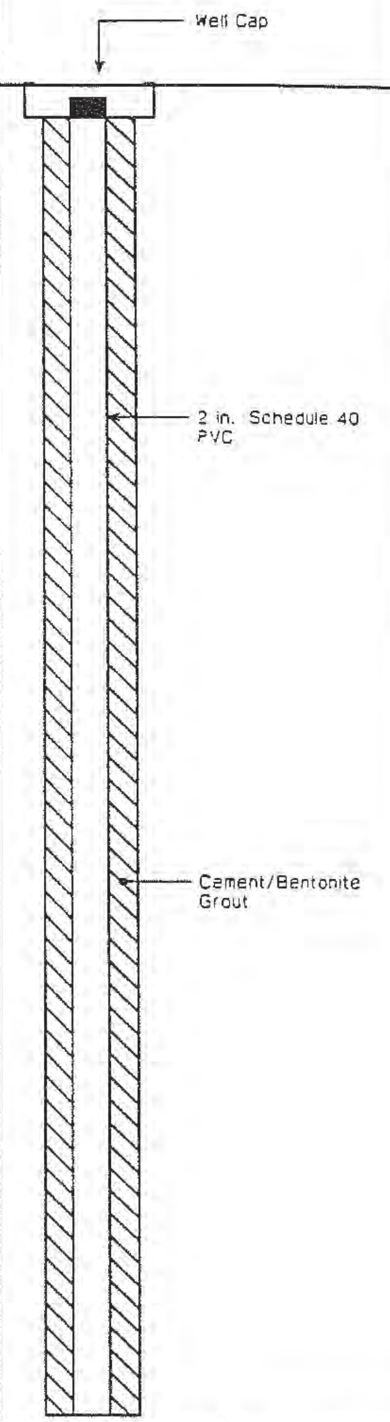
**DATE:** 03-28-95
**HOLE DIA.:** 6 in.
**GW DEPTH:** Not Measured ft.

**LOGGED BY:** Hensel/Tu
**SAMPLER:** Core Barrel
**HOLE ELEV.:** 495.10 ft. MSL

| DESCRIPTION | USCS CLASS | GRAPHIC LOG | DEPTH | SAMPLE | | WELL CONSTRUCTION DETAIL |
|---|---|---|---|---|---|---|

Blind Drilling (Refer to boring log for MW 11 for lithologic descriptions)





STMI
2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208


*Notes:*
*Sample 10-1 was collected between 45-55 feet*

Project No.
135-1.21

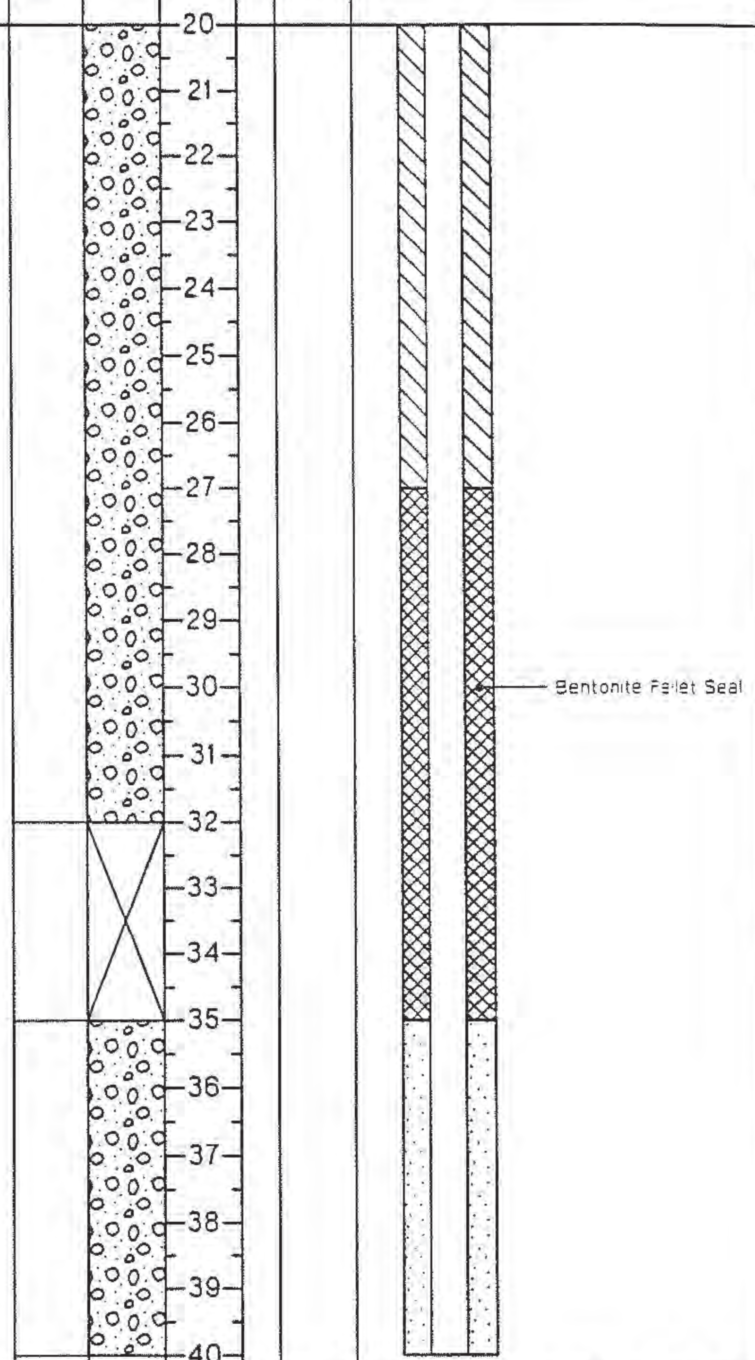
# Monitoring Well No. 10

**PROJECT:** Hennepin East Ash Impoundment  
**DRILL RIG:** Rotosonic Drill  
**DRILLER:** Boart Longyear

**DATE:** 03-28-95  
**HOLE DIA.:** 6 in.  
**GW DEPTH:** Not Measured ft.

**LOGGED BY:** Hensel/Tu  
**SAMPLER:** Core Barrel  
**HOLE ELEV.:** 495.10 ft. MSL

| DESCRIPTION | USCS CLASS | GRAPHIC LOG | DEPTH | SAMPLE | | WELL CONSTRUCTION DETAIL |
|---|---|---|---|---|---|---|
| Blind Drilling (Refer to boring log for MW 11 for lithologic descriptions) | | | 20–40 | | | |

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*Notes:*

*Sample 10-1 was collected between 45-55 feet*

Project No.  
135-1.21

# Monitoring Well No. 10

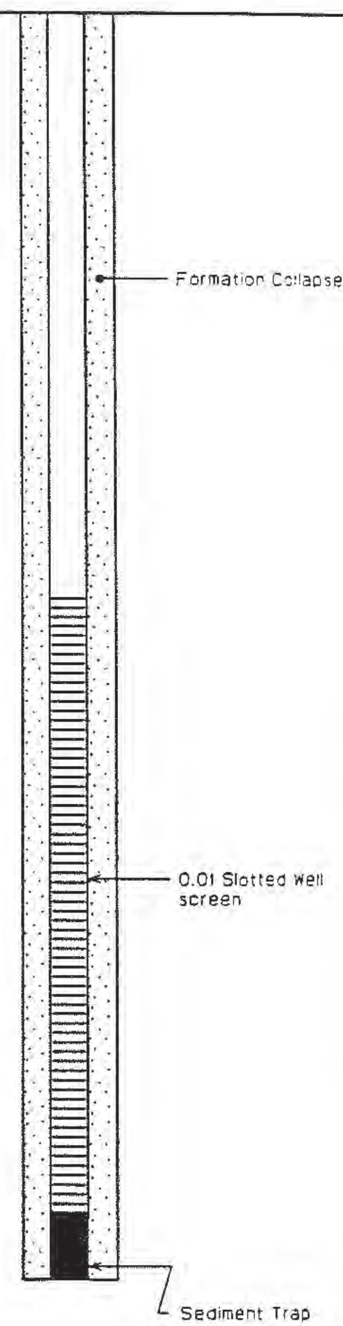
**PROJECT:** Hennepin East Ash Impoundment
**DRILL RIG:** Rotosonic Drill
**DRILLER:** Boart Longyear

**DATE:** 03-28-95
**HOLE DIA.:** 6 in.
**GW DEPTH:** Not Measured ft.

**LOGGED BY:** Hensel/Tu
**SAMPLER:** Core Barrel
**HOLE ELEV.:** 495.10 ft. MSL

| DESCRIPTION | USCS CLASS | GRAPHIC LOG | DEPTH | SAMPLE | WELL CONSTRUCTION DETAIL |
|---|---|---|---|---|---|
| | | | 40 – 45 | | |
| Clean, fine to coarse gravels w/ cobbles up to 4" in diameter, well rounded to subangular | | | 45 – 55 | 10-1 | |
| Blind Drilling (Refer to boring log for MW 11 for lithologic descriptions) | | | 55 – 59 | | |

Depth scale: 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60





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*Notes:*
*Sample 10-1 was collected between 45-55 feet*

Project No.
135-1.21

# Monitoring Well No. 11

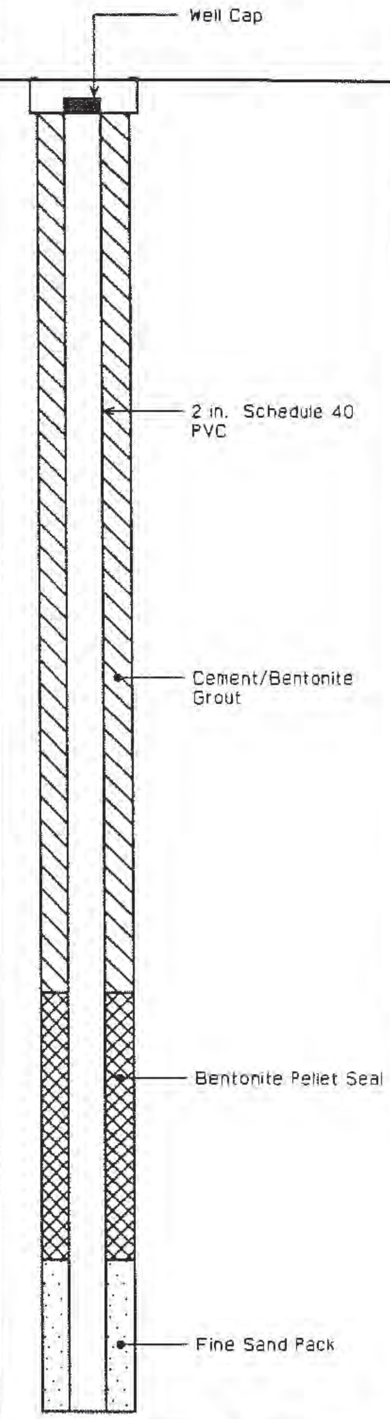
**PROJECT:** Hennepin East Ash Impoundment
**DRILL RIG:** Rotosonic Drill
**DRILLER:** Boart Longyear

**DATE:** 03-27-95
**HOLE DIA.:** 6 in.
**GW DEPTH:** 50 ft.

**LOGGED BY:** Hensel/Tu
**SAMPLER:** Core barrel
**HOLE ELEV.:** 494.84 ft. MSL

| DESCRIPTION | USCS CLASS | GRAPHIC LOG | DEPTH | SAMPLE |
|---|---|---|---|---|
| Fill, consisting of poorly sorted sand, gravels (gravels up to 3") and crushed limestone | | | 0–12 | |
| Olive, silty clay w/ gravels up to 2", and some fine sand | | | 12–15 | 11-1 |
| Dry, brown, med sand to coarse gravel, cobbles up to 4" | | | 15–20 | |

WELL CONSTRUCTION DETAIL

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*Notes:*
*Continuously sampled bore-hole. Sample numbers refer to saved samples*

Project No.
135-1.21

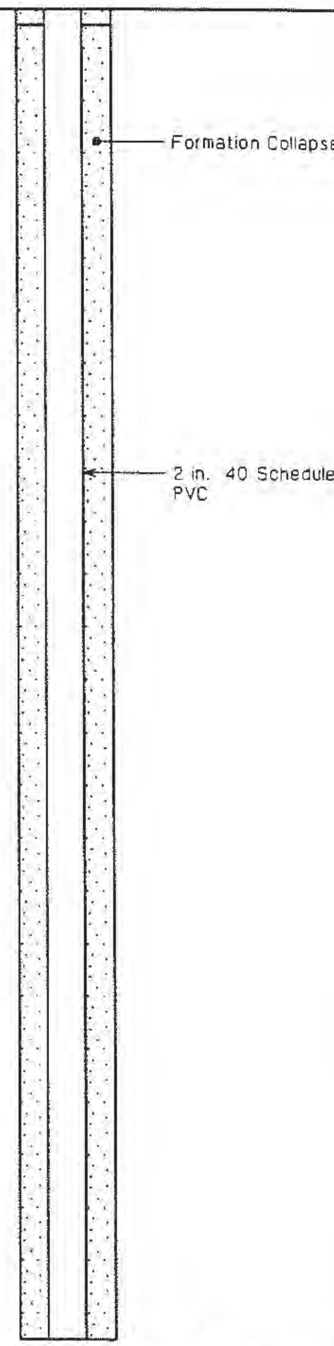
# Monitoring Well No. 11

**PROJECT:** Hennepin East Ash Impoundment
**DRILL RIG:** Rotosonic Drill
**DRILLER:** Boart Longyear

**DATE:** 03-27-95
**HOLE DIA.:** 6 in.
**GW DEPTH:** 50 ft.

**LOGGED BY:** Hensel/Tu
**SAMPLER:** Core barrel
**HOLE ELEV.:** 494.84 ft. MSL

| DESCRIPTION | USCS CLASS | GRAPHIC LOG | DEPTH | SAMPLE | WELL CONSTRUCTION DETAIL |
|---|---|---|---|---|---|
| Dry, brown, med. sand to coarse gravel, gravels up to 2" in diameter, subrounded to subangular | | | 20–32 | 11-2 (22–23.5) | Formation Collapse (22); 2 in. 40 Schedule PVC (27) |
| No sample | | | 32–35 | | |
| Brown, dry coarse sand and gravel, some silt, some clay, cobbles up to 4", subangular to rounded | | | 35–40 | 11-3 (35–36.5) | |

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*Notes:*
*Continuously sampled bore-hole. Sample numbers refer to saved samples*

Project No.
135-1.21

# Monitoring Well No. 11

**PROJECT:** Hennepin East Ash Impoundment
**DRILL RIG:** Rotosonic Drill
**DRILLER:** Boart Longyear

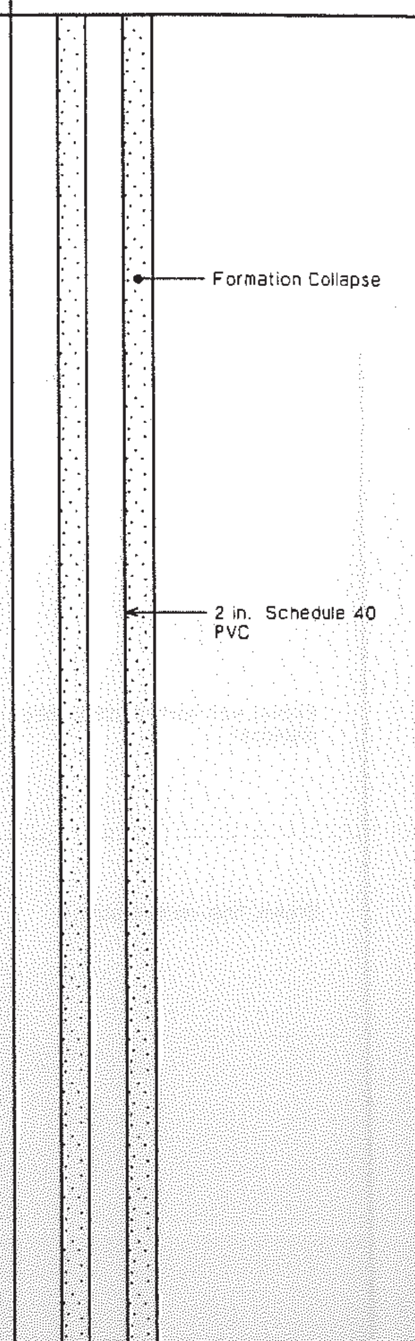
**DATE:** 03-27-95
**HOLE DIA.:** 6 in.
**GW DEPTH:** 50 ft.

**LOGGED BY:** Hensel/Tu
**SAMPLER:** Core barrel
**HOLE ELEV.:** 494.84 ft. MSL

| DESCRIPTION | USCS CLASS | GRAPHIC LOG | DEPTH | SAMPLE |
|---|---|---|---|---|
| Grading from fine to coarse sand w/ some gravels and fines | | | 40–46 | |
| 2' Dark brown, sandy clay w/ gravels | | | 46–48 | 11-4 |
| Coarse sand and gravel, some silt, gravels to 2", subrounded to subangular, fines may have been washed out during drilling | | | 48–55 | |
| Coarse sand and gravel, some silt; well rounded, gravels up to 2" | | | 55–57 | |
| Clean fine to coarse gravel, gravels up to 3" | | | 57–60 | |

Depth: 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60

WELL CONSTRUCTION DETAIL

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*Notes:*
*Continuously sampled bore-hole. Sample numbers refer to saved samples*

Project No.
135-1.21

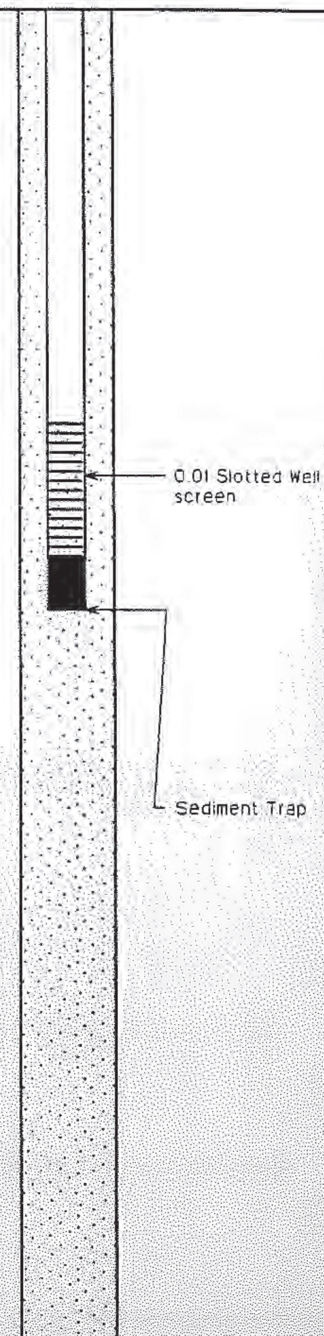
# Monitoring Well No. 11

**PROJECT:** Hennepin East Ash Impoundment
**DRILL RIG:** Rotosonic Drill
**DRILLER:** Boart Longyear

**DATE:** 03-27-95
**HOLE DIA.:** 6 in.
**GW DEPTH:** 50 ft.

**LOGGED BY:** Hensel/Tu
**SAMPLER:** Core barrel
**HOLE ELEV.:** 494.84 ft. MSL

| DESCRIPTION | USCS CLASS | GRAPHIC LOG | DEPTH | SAMPLE | | WELL CONSTRUCTION DETAIL |
|---|---|---|---|---|---|---|
| | | | 60 | | | |
| | | | 61 | | | |
| | | | 62 | | | |
| | | | 63 | 11-5 | | |
| | | | 64 | | | |
| | | | 65 | | | |
| | | | 66 | | | |
| | | | 67 | 11-6 | | |
| | | | 68 | | | |
| | | | 69 | | | |
| Brown, well sorted, clean med. sand w/ small gravels 1" in diameter | | | 70 | | | |
| | | | 71 | | | |
| | | | 72 | | | |
| Brown, fine uniform sand | | | 73 | | | |
| | | | 74 | | | |
| | | | 75 | 11-7 | | |
| | | | 76 | | | |
| | | | 77 | | | |
| | | | 78 | | | |
| | | | 79 | | | |
| | | | 80 | | | |





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*Notes:*
*Continuously sampled bore-hole. Sample numbers refer to saved samples*

Project No.
135-1.21

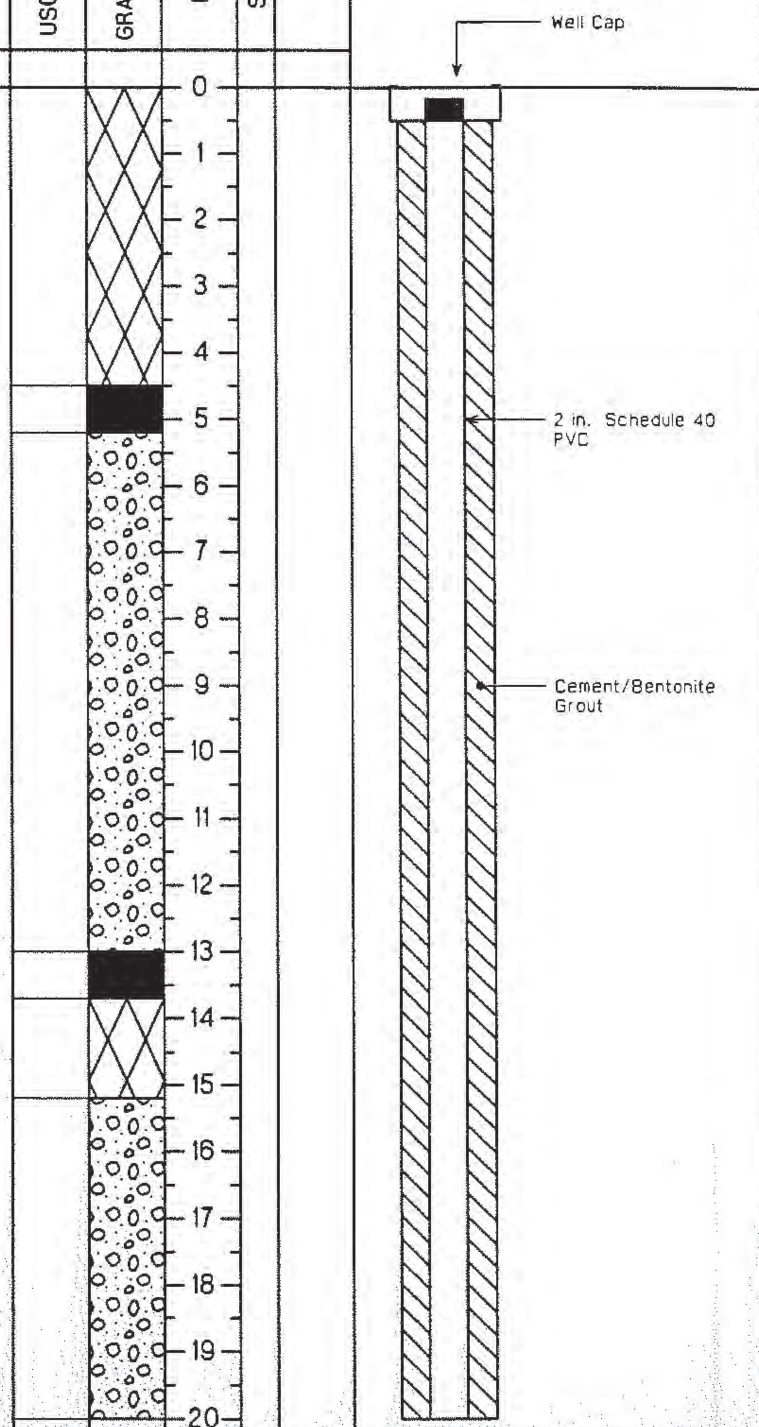
# Monitoring Well No. 12

**PROJECT:** Hennepin East Ash Impoundment
**DRILL RIG:** Rotosonic Drill
**DRILLER:** Boart Longyear

**DATE:** 03-28-95
**HOLE DIA.:** 6 in.
**GW DEPTH:** 48.5 ft.

**LOGGED BY:** Hensel/Tu
**SAMPLER:** Core Barrel
**HOLE ELEV.:** 494.84 ft. MSL

| DESCRIPTION | USCS CLASS | GRAPHIC LOG | DEPTH | SAMPLE | | WELL CONSTRUCTION DETAIL |
|---|---|---|---|---|---|---|
| Blind Drilling (Refer to boring log for MW 13 for lithologic descriptions) | | | 0–20 | | | |

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Brookfield, Wisconsin 53005-8208

*Notes:*
*No samples were collected from MW 12*

**Project No.**
135-1.21

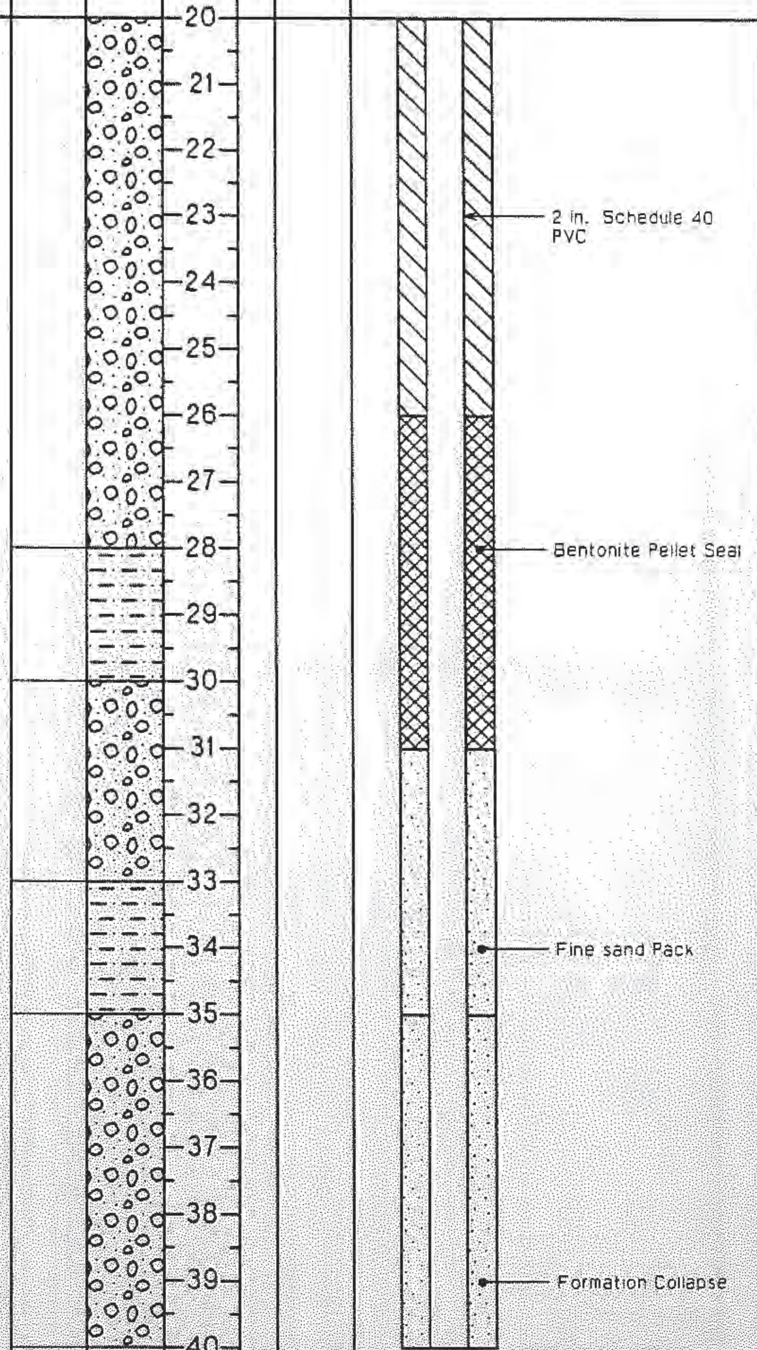
# Monitoring Well No. 12

**PROJECT:** Hennepin East Ash Impoundment
**DRILL RIG:** Rotosonic Drill
**DRILLER:** Boart Longyear

**DATE:** 03-28-95
**HOLE DIA.:** 6 in.
**GW DEPTH:** 48.5 ft.

**LOGGED BY:** Hensel/Tu
**SAMPLER:** Core Barrel
**HOLE ELEV.:** 494.84 ft. MSL

| DESCRIPTION | USCS CLASS | GRAPHIC LOG | DEPTH | SAMPLE | | WELL CONSTRUCTION DETAIL |
|---|---|---|---|---|---|---|
| Blind Drilling (Refer to boring log for MW 13 for lithologic descriptions) | | | 20–40 | | | |





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Brookfield, Wisconsin 53005-8208


*Notes:*
*No samples were collected from MW 12*

**Project No.** 135-1.21

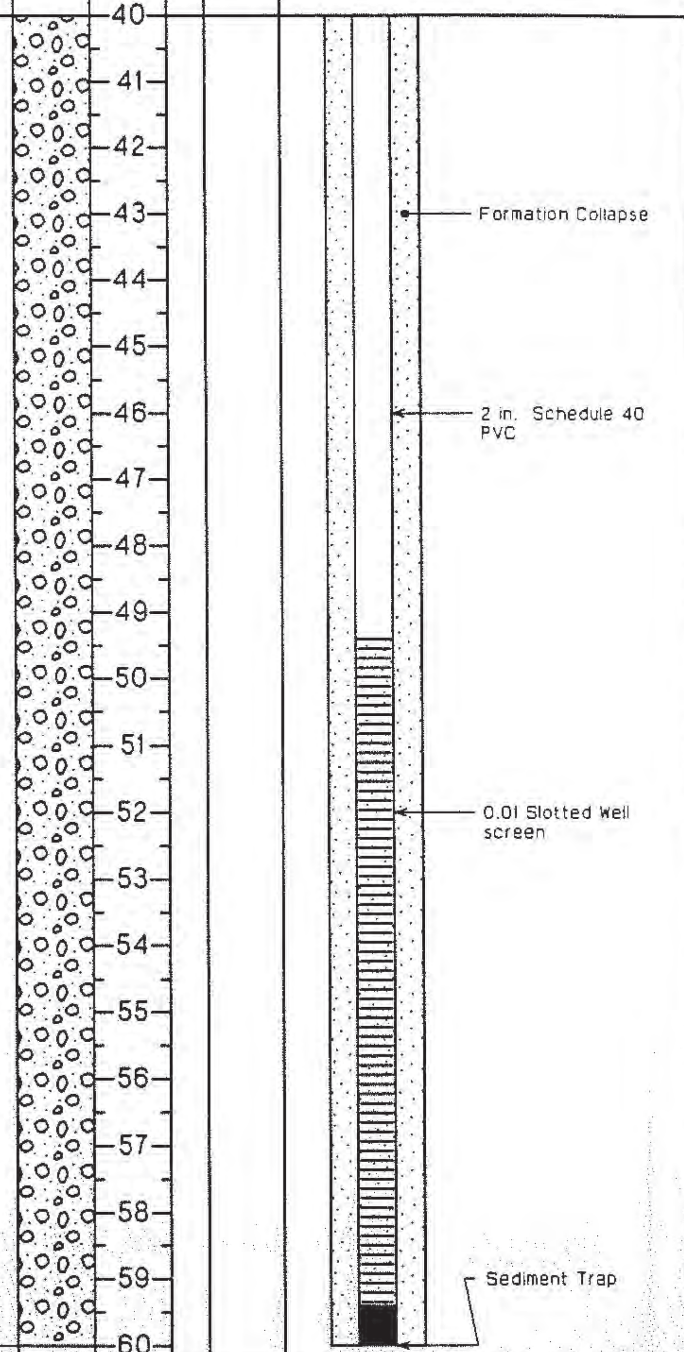
# Monitoring Well No. 12

**PROJECT:** Hennepin East Ash Impoundment
**DRILL RIG:** Rotosonic Drill
**DRILLER:** Boart Longyear

**DATE:** 03-28-95
**HOLE DIA.:** 6 in.
**GW DEPTH:** 48.5 ft.

**LOGGED BY:** Hensel/Tu
**SAMPLER:** Core Barrel
**HOLE ELEV.:** 494.84 ft. MSL

| DESCRIPTION | USCS CLASS | GRAPHIC LOG | DEPTH | SAMPLE | | WELL CONSTRUCTION DETAIL |
|---|---|---|---|---|---|---|
| Blind Drilling (Refer to boring log for MW 13 for lithologic descriptions) | | | 40–60 | | | |

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Brookfield, Wisconsin 53005-8208

*Notes:*
*No samples were collected from MW 12*

**Project No.** 135-1.21

# Monitoring Well No. 13

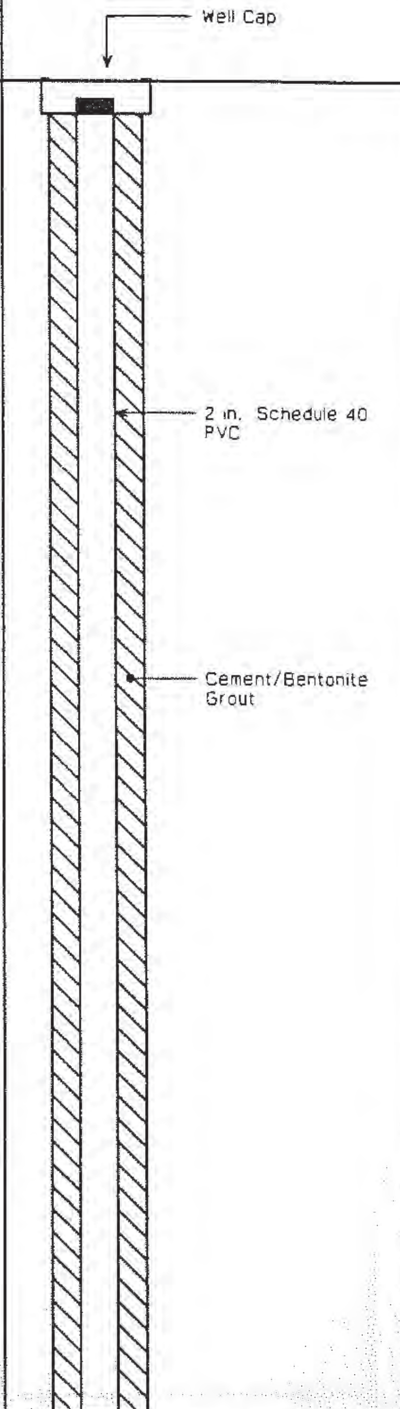
**PROJECT:** Hennepin East Ash Impoundment
**DRILL RIG:** Rotosonic Drill
**DRILLER:** Boart Longyear

**DATE:** 03-28-95
**HOLE DIA.:** 6 in.
**GW DEPTH:** 49.5 ft.

**LOGGED BY:** Hensel/Tu
**SAMPLER:** Core Barrel
**HOLE ELEV.:** 494.82 ft. MSL

| DESCRIPTION | USCS CLASS | GRAPHIC LOG | DEPTH | SAMPLE | |
|---|---|---|---|---|---|
| Fill, consisting of olive, silty clay loam, with gravels up 3 in in diameter | | | 0–4 | | |
| Fly ash | | | 5 | | |
| Brown gravel w/ sand and silt, gravels up to 3", poorly sorted, subrounded to subangular | | | 6–12 | | |
| Fly ash | | | 13 | | |
| Fill, consisting of fine silty sand, wood chips, gravels up to 1". | | | 14–15 | | |
| Tan sand and gravel, some silt, gravels up to 3", poorly sorted, rounded | | | 16–20 | | |

WELL CONSTRUCTION DETAIL





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2511 N. 124th St. Suite 205
Brookfield, Wisconsin 53005-8208


*Notes:*

*Continuously sampled bore-hole. Sample numbers refer to saved samples*

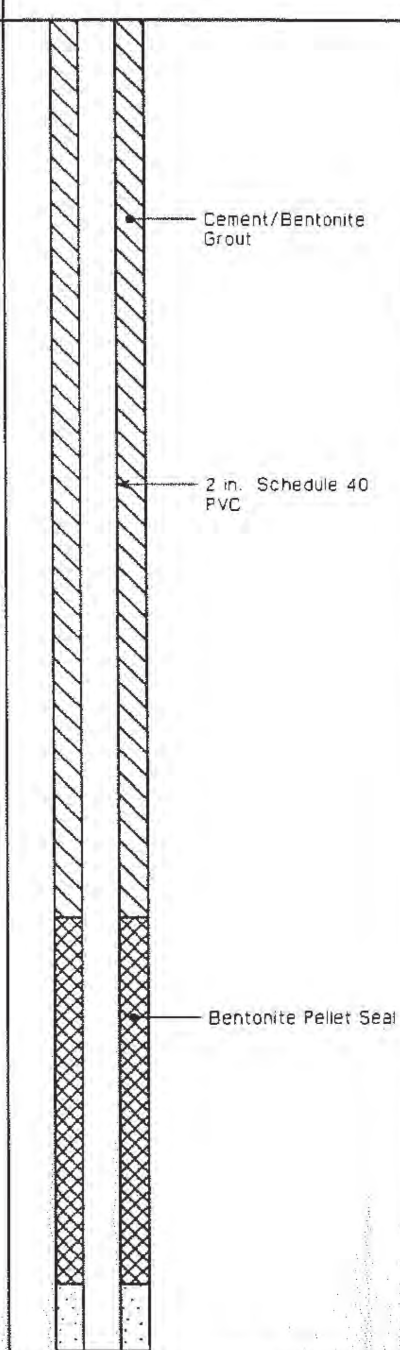
Project No.
135-1.21

# Monitoring Well No. 13

| | | |
|---|---|---|
| **PROJECT:** Hennepin East Ash Impoundment | **DATE:** 03-28-95 | **LOGGED BY:** Hensel/Tu |
| **DRILL RIG:** Rotosonic Drill | **HOLE DIA.:** 6 in. | **SAMPLER:** Core Barrel |
| **DRILLER:** Boart Longyear | **GW DEPTH:** 49.5 ft. | **HOLE ELEV.:** 494.82 ft. MSL |

| DESCRIPTION | USCS CLASS | GRAPHIC LOG | DEPTH | SAMPLE |
|---|---|---|---|---|
| | | | 20 | |
| | | | 21 | |
| | | | 22 | 13-1 |
| | | | 23 | |
| | | | 24 | |
| | | | 25 | |
| | | | 26 | |
| | | | 27 | |
| | | | 28 | |
| Brown, fine silty, sandy clay w/ gravels (well-rounded) | | | 29 | |
| | | | 30 | |
| Gray, fine to coarse sand and gravel, well-rounded | | | 31 | 13-2 |
| | | | 32 | |
| Red, silty, sandy clay w/ gravels up to 2" in diameter | | | 33 | |
| | | | 34 | |
| White, fine sand w/ gravels up to 3" | | | 35 | |
| | | | 36 | |
| | | | 37 | |
| Brown, coarse sand and gravel with silt, cobbles up to 4" | | | 38 | |
| | | | 39 | |
| | | | 40 | |

WELL CONSTRUCTION DETAIL




| | | |
|---|---|---|
| **STMI**<br>2511 N. 124th St. Suite 205<br>Brookfield, Wisconsin 53005-8208 | *Notes:*<br>*Continuously sampled bore-hole. Sample numbers refer to saved samples* | **Project No.**<br>135-1.21<br>***Page 2 of 4*** |

# Monitoring Well No. 13

**PROJECT:** Hennepin East Ash Impoundment
**DRILL RIG:** Rotosonic Drill
**DRILLER:** Boart Longyear

**DATE:** 03-28-95
**HOLE DIA.:** 6 in.
**GW DEPTH:** 49.5 ft.

**LOGGED BY:** Hensel/Tu
**SAMPLER:** Core Barrel
**HOLE ELEV.:** 494.82 ft. MSL

| DESCRIPTION | USCS CLASS | GRAPHIC LOG | DEPTH | SAMPLE | | WELL CONSTRUCTION DETAIL |
|---|---|---|---|---|---|---|
| | | | 40 | | | |
| | | | 41 | | | |
| | | | 42 | 13-3 | | |
| | | | 43 | | | |
| | | | 44 | | | Formation Collapse |
| | | | 45 | | | |
| | | | 46 | | | |
| | | | 47 | | | |
| Brown gravel w/ some sand and silt. cobbles up to 4" | | | 48 | | | |
| | | | 49 | | | 2 in. Schedule 40 PVC |
| | | | 50 | | | |
| | | | 51 | | | |
| | | | 52 | 13-4 | | |
| | | | 53 | | | |
| | | | 54 | | | |
| | | | 55 | | | |
| | | | 56 | | | |
| | | | 57 | | | |
| | | | 58 | | | |
| | | | 59 | | | |
| | | | 60 | | | |

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Brookfield, Wisconsin 53005-8208

*Notes:*
*Continuously sampled bore-hole. Sample numbers refer to saved samples*

Project No.
135-1.21

# Monitoring Well No. 13

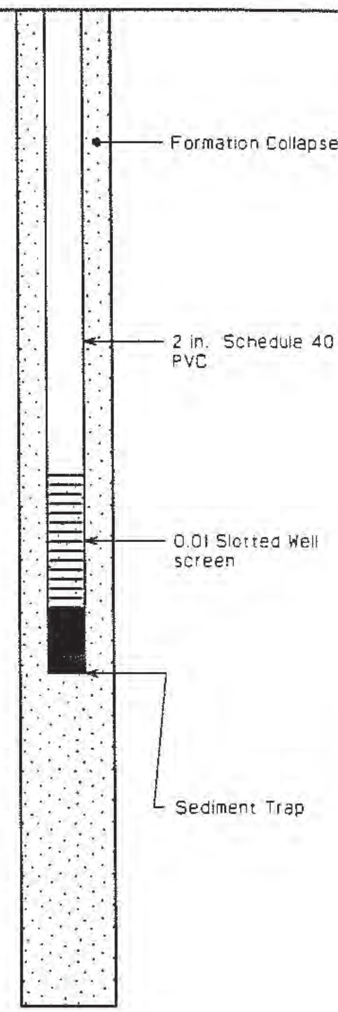
**PROJECT:** Hennepin East Ash Impoundment
**DRILL RIG:** Rotosonic Drill
**DRILLER:** Boart Longyear

**DATE:** 03-28-95
**HOLE DIA.:** 6 in.
**GW DEPTH:** 49.5 ft.

**LOGGED BY:** Hensel/Tu
**SAMPLER:** Core Barrel
**HOLE ELEV.:** 494.82 ft. MSL

| DESCRIPTION | USCS CLASS | GRAPHIC LOG | DEPTH | SAMPLE |
|---|---|---|---|---|
| | | | 60 | |
| | | | 61 | |
| | | | 62 | |
| Gravel becomes finer | | | 63 | 13-5 |
| | | | 64 | |
| | | | 65 | |
| Brown, fine gravel w/ little silt and sand, well rounded, well sorted | | | 66 | 13-6 |
| | | | 67 | |
| | | | 68 | 13-7 |
| | | | 69 | |
| | | | 70 | |
| | | | 71 | |
| Fine, uniform silty sand w/ cobbles up to 3" | | | 72 | |
| Brown, uniform fine to med. sand with some gravel | | | 73 | |
| | | | 74 | |
| | | | 75 | |
| | | | 76 | |
| | | | 77 | |
| | | | 78 | |
| | | | 79 | |
| | | | 80 | |

WELL CONSTRUCTION DETAIL

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Brookfield, Wisconsin 53005-8208

*Notes:*
*Continuously sampled bore-hole. Sample numbers refer to saved samples*

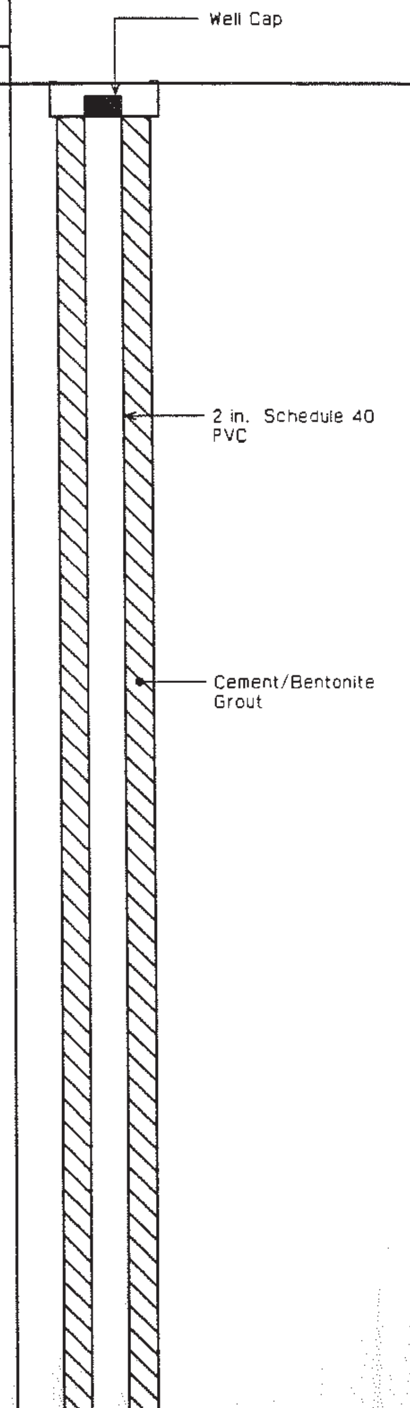
Project No.
135-1.21

# Monitoring Well No. 15

**PROJECT:** Hennepin East Ash Impoundment
**DATE:** 03-29-95
**LOGGED BY:** Hensel/Tu
**DRILL RIG:** Rotosonic Drill
**HOLE DIA.:** 6 in.
**SAMPLER:** Core barrel
**DRILLER:** Boart Longyear
**GW DEPTH:** Not Measured ft.
**HOLE ELEV.:** 494.41 ft. MSL

| DESCRIPTION | USCS CLASS | GRAPHIC LOG | DEPTH | SAMPLE |
|---|---|---|---|---|
| Fill, consisting of poorly sorted sand, gravels | | | 0–4 | |
| Fly ash | | | 4 | |
| Fill, consisting of poorly sorted sand, gravels up to 3" | | | 5–8 | |
| Bottom ash | | | 8–15 | 15-1 |
| Fly ash | | | 15–20 | 15-2 |

WELL CONSTRUCTION DETAIL

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*Notes:*
*Continuously sampled bore-hole. Sample numbers refer to saved samples*

Project No.
135-1.21

# Monitoring Well No. 15

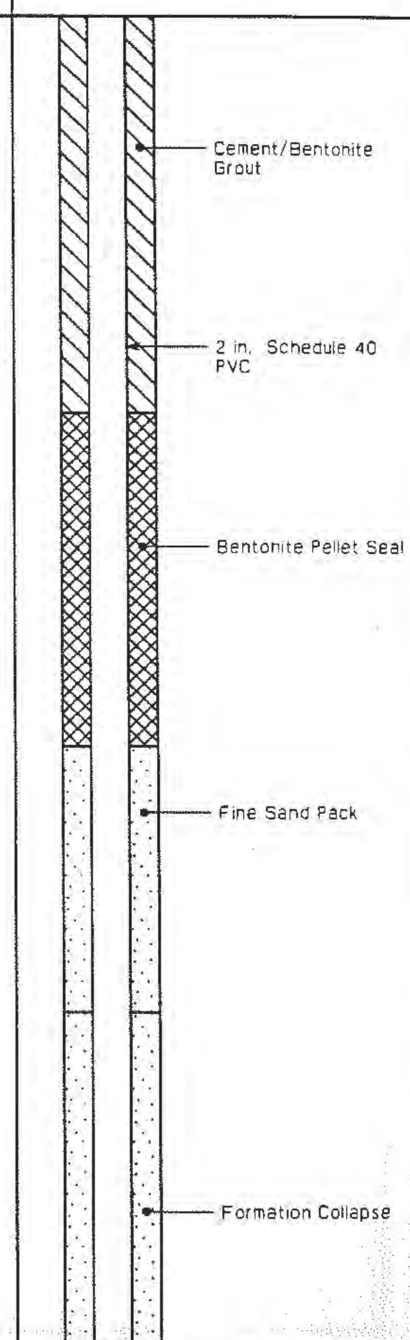
**PROJECT:** Hennepin East Ash Impoundment
**DRILL RIG:** Rotosonic Drill
**DRILLER:** Boart Longyear

**DATE:** 03-29-95
**HOLE DIA.:** 6 in.
**GW DEPTH:** Not Measured ft.

**LOGGED BY:** Hensel/Tu
**SAMPLER:** Core barrel
**HOLE ELEV.:** 494.41 ft. MSL

| DESCRIPTION | USCS CLASS | GRAPHIC LOG | DEPTH | SAMPLE |
|---|---|---|---|---|
| Same as above | | | 20–25 | 15-2 |
| Brown uniform silt w/ organic matter | | | 25–26 | 15-3 |
| White gravel w/ sand and gravels up to 1.5" | | | 26– | 15-4 |
| Brown gravel w/ silty, fine-med. sand, rounded to subrounded | | | –40 | 15-5, 15-6 |

WELL CONSTRUCTION DETAIL





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*Notes:*
*Continuously sampled bore-hole. Sample numbers refer to saved samples*

**Project No.** 135-1.21

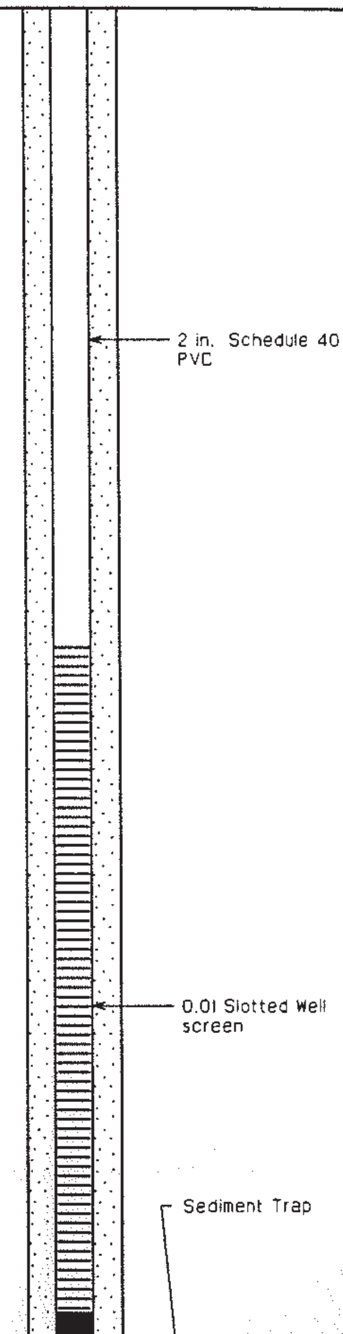
# Monitoring Well No. 15

**PROJECT:** Hennepin East Ash Impoundment
**DRILL RIG:** Rotosonic Drill
**DRILLER:** Boart Longyear
**DATE:** 03-29-95
**HOLE DIA.:** 6 in.
**GW DEPTH:** Not Measured ft.
**LOGGED BY:** Hensel/Tu
**SAMPLER:** Core barrel
**HOLE ELEV.:** 494.41 ft. MSL

| DESCRIPTION | USCS CLASS | GRAPHIC LOG | DEPTH | SAMPLE |
|---|---|---|---|---|
| Same as above | | | 40–50 | 15-6 |
| Olive fine sand and silt, platy structure, well sorted | | | 50–51 | 15-7 |
| Gravel w/ some sand, some silt, generally finer gravel than above | | | 51–60 | 15-8 |

Depth scale: 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60

WELL CONSTRUCTION DETAIL

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Brookfield, Wisconsin 53005-8208

*Notes:*
*Continuously sampled bore-hole. Sample numbers refer to saved samples*

**Project No.** 135-1.21

# Monitoring Well No. 16

**PROJECT:** Hennepin East Ash Impoundment
**DRILL RIG:** Rotosonic Drill
**DRILLER:** Boart Longyear

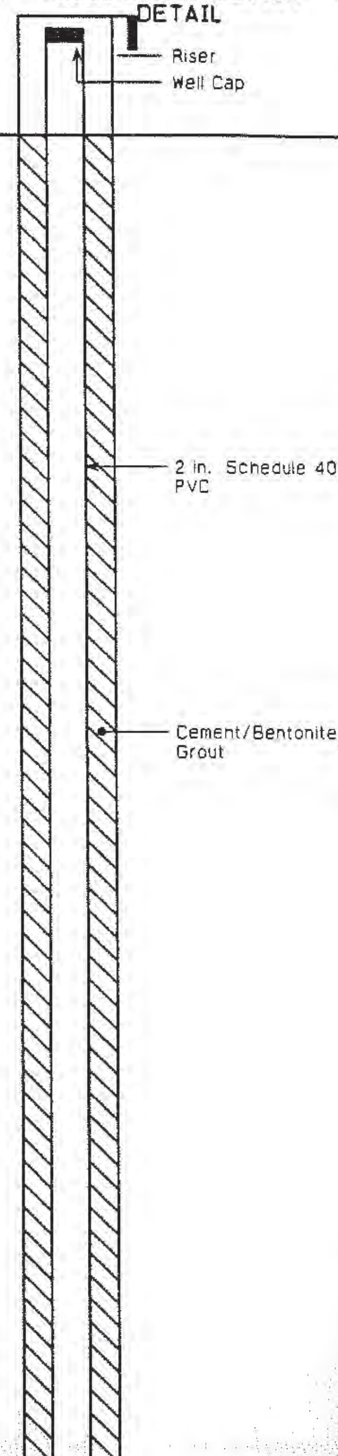
**DATE:** 03-30-95
**HOLE DIA.:** 6 in.
**GW DEPTH:** 53 ft.

**LOGGED BY:** Hensel/Tu
**SAMPLER:** Core barrel
**HOLE ELEV.:** 502.09 ft. MSL

| DESCRIPTION | USCS CLASS | GRAPHIC LOG | DEPTH | SAMPLE |
|---|---|---|---|---|
| Possible fill, consisting of brown, well-sorted, fine-med. sand | | | 0–3 | |
| Brown, dry gravel w/ fine-coarse sands, gravels up to 2", well-rounded, poorly sorted | | | 3– | |
| | | | 5–10 | 16-1 |
| | | | 15–20 | 16-2 |
| Same as above, cobbles up to 4", rust stain at 22 ft. | | | | |

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20

WELL CONSTRUCTION DETAIL

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*Notes:*
*Continuously sampled bore-hole. Sample numbers refer to saved samples*

**Project No.**
135-1.21

# Monitoring Well No. 16

**PROJECT:** Hennepin East Ash Impoundment
**DRILL RIG:** Rotosonic Drill
**DRILLER:** Boart Longyear

**DATE:** 03-30-95
**HOLE DIA.:** 6 in.
**GW DEPTH:** 53 ft.

**LOGGED BY:** Hensel/Tu
**SAMPLER:** Core barrel
**HOLE ELEV.:** 502.09 ft. MSL

| DESCRIPTION | USCS CLASS | GRAPHIC LOG | DEPTH | SAMPLE | WELL CONSTRUCTION DETAIL |
|---|---|---|---|---|---|
| | | | 20 | | |
| | | | 21 | | |
| | | | 22 | | Cement/Bentonite Grout |
| | | | 23 | | |
| | | | 24 | | |
| | | | 25 | | |
| Same as above | | | 26 | | |
| | | | 27 | 16-3 | |
| | | | 28 | | Bentonite Pellet Seal |
| | | | 29 | | |
| | | | 30 | | 2 in. Schedule 40 PVC |
| | | | 31 | | |
| | | | 32 | | |
| | | | 33 | | |
| | | | 34 | | |
| | | | 35 | | |
| | | | 36 | | |
| Gravel becomes finer at 35' | | | 37 | 16-4 | Fine Sand Pack |
| | | | 38 | | |
| | | | 39 | | |
| | | | 40 | | |

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Brookfield, Wisconsin 53005-8208

*Notes:*

*Continuously sampled bore-hole. Sample numbers refer to saved samples*

**Project No.**
135-1.21

# Monitoring Well No. 16

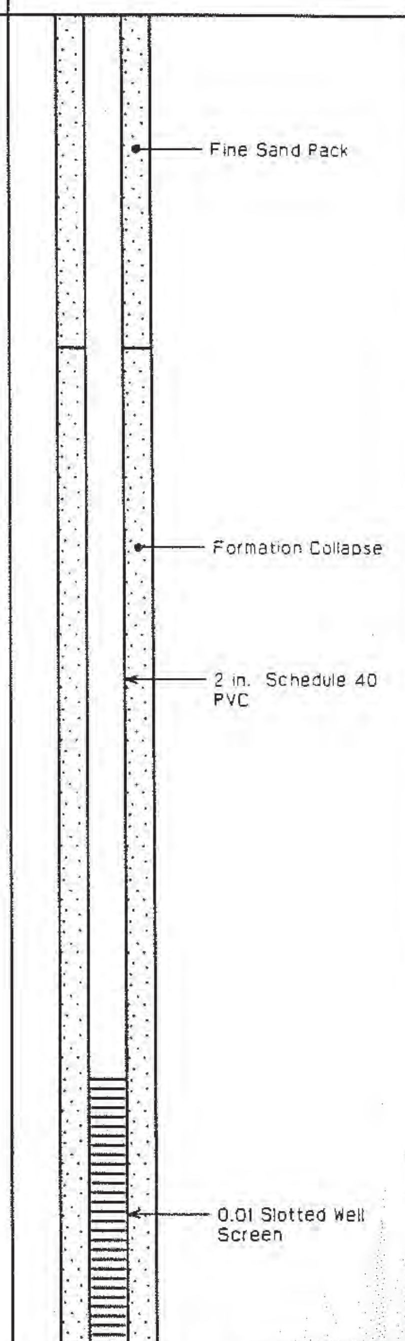
**PROJECT:** Hennepin East Ash Impoundment
**DRILL RIG:** Rotosonic Drill
**DRILLER:** Boart Longyear

**DATE:** 03-30-95
**HOLE DIA.:** 6 in.
**GW DEPTH:** 53 ft.

**LOGGED BY:** Hensel/Tu
**SAMPLER:** Core barrel
**HOLE ELEV.:** 502.09 ft. MSL

| DESCRIPTION | USCS CLASS | GRAPHIC LOG | DEPTH | SAMPLE | | WELL CONSTRUCTION DETAIL |
|---|---|---|---|---|---|---|
| Brown gravel w/ fine to med. sand and silt (more sand than above), poorly sorted | | | 40–60 | 16-5 (40–45); 16-6 (50–55) | | |

Depth scale: 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60

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*Notes:*
*Continuously sampled bore-hole. Sample numbers refer to saved samples*

**Project No.** 135-1.21

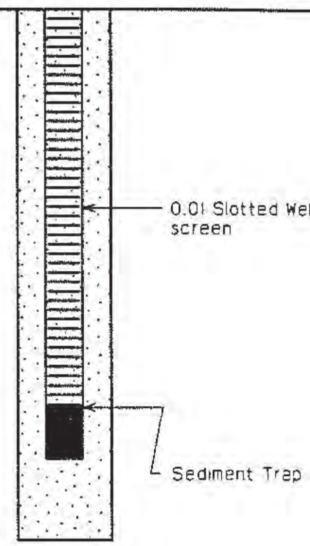
# Monitoring Well No. 16

**PROJECT:** Hennepin East Ash Impoundment
**DRILL RIG:** Rotosonic Drill
**DRILLER:** Boart Longyear

**DATE:** 03-30-95
**HOLE DIA.:** 6 in.
**GW DEPTH:** 53 ft.

**LOGGED BY:** Hensel/Tu
**SAMPLER:** Core barrel
**HOLE ELEV.:** 502.09 ft. MSL

| DESCRIPTION | USCS CLASS | GRAPHIC LOG | DEPTH | SAMPLE | | WELL CONSTRUCTION DETAIL |
|---|---|---|---|---|---|---|
| | | | 60 | | | |
| | | | 61 | | | |
| | | | 62 | | | |
| Same as above w/ more silt | | | 63 | 16-7 | | |
| | | | 64 | | | |
| | | | 65 | | | |
| | | | 66 | | | |
| | | | 67 | 16-8 | | |
| | | | 68 | | | |
| | | | 69 | | | |
| | | | 70 | | | |
| | | | 71 | | | |
| | | | 72 | | | |
| | | | 73 | | | |
| | | | 74 | | | |
| | | | 75 | | | |
| | | | 76 | | | |
| | | | 77 | | | |
| | | | 78 | | | |
| | | | 79 | | | |
| | | | 80 | | | |





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*Notes:*
*Continuously sampled bore-hole. Sample numbers refer to saved samples*

**Project No.**
135-1.21

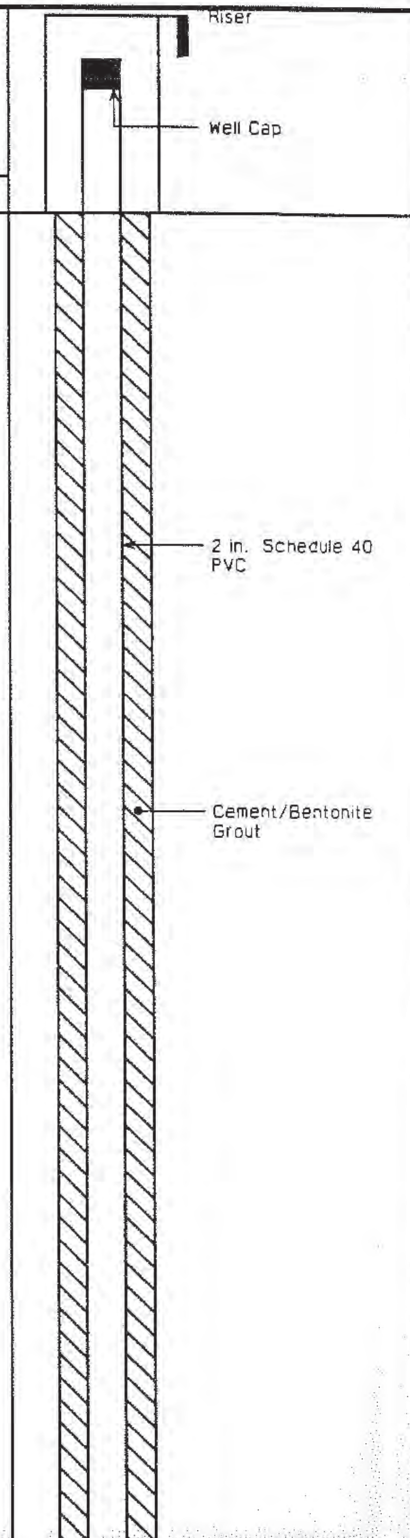
# Monitoring Well No. 17

**PROJECT:** Hennepin East Ash Impoundment
**DRILL RIG:** Rotosonic Drill
**DRILLER:** Boart Longyear

**DATE:** 03-30-95
**HOLE DIA.:** 6 in.
**GW DEPTH:** 56 ft.

**LOGGED BY:** Hensel/Tu
**SAMPLER:** Core barrel
**HOLE ELEV.:** 507.34 ft. MSL

| DESCRIPTION | USCS CLASS | GRAPHIC LOG | DEPTH | SAMPLE |
|---|---|---|---|---|
| Silt, dark brown, no structure or pebbles, organic material to 2 ft. | | | 0–3 | 17-1 |
| Light brown, gravel w/ sand and silt, gravels up to 3", subrounded to angular, poorly sorted | | | 3–5 | 17-1 |
| White gravel w/ sand, angular to subangular | | | 5–20 | 17-2 |

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*Notes:*
*Continuously sampled bore-hole. Sample numbers refer to saved samples*

**Project No.** 135-1.21

# Monitoring Well No. 17

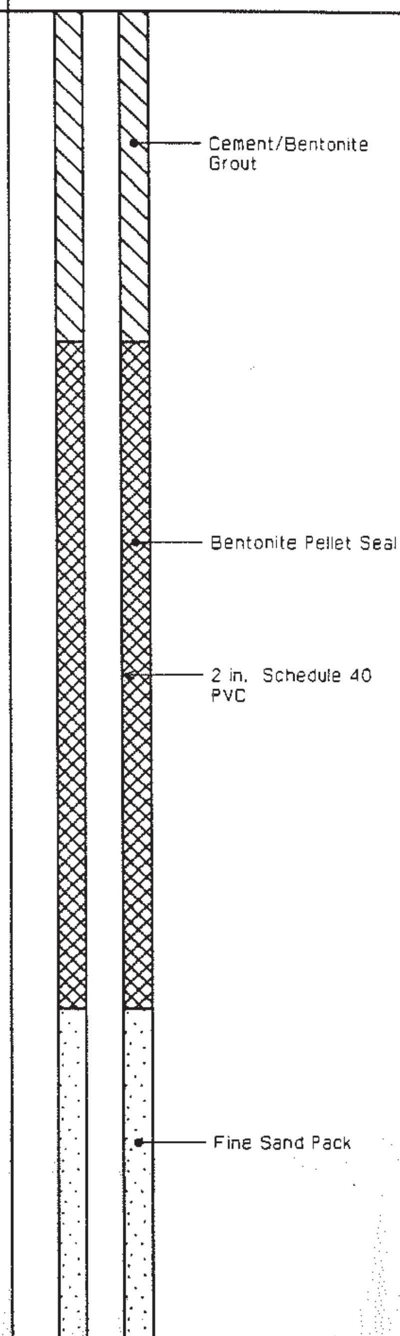
**PROJECT:** Hennepin East Ash Impoundment
**DRILL RIG:** Rotosonic Drill
**DRILLER:** Boart Longyear

**DATE:** 03-30-95
**HOLE DIA.:** 6 in.
**GW DEPTH:** 56 ft.

**LOGGED BY:** Hensel/Tu
**SAMPLER:** Core barrel
**HOLE ELEV.:** 507.34 ft. MSL

| DESCRIPTION | USCS CLASS | GRAPHIC LOG | DEPTH | SAMPLE |
|---|---|---|---|---|
| | | | 20 | |
| | | | 21 | |
| Brown gravel w/ sand, some silt, poorly sorted, subangular to rounded | | | 22 | 17-3 |
| | | | 23 | |
| | | | 24 | |
| | | | 25 | |
| | | | 26 | |
| | | | 27 | |
| | | | 28 | |
| | | | 29 | |
| | | | 30 | |
| | | | 31 | |
| Same as above w/ more silt | | | 32 | 17-4 |
| | | | 33 | |
| | | | 34 | |
| | | | 35 | |
| 2" lens of gray sand and gravel at 36 ft. | | | 36 | 17-51 |
| | | | 37 | |
| Brownish-red gravel w/ sand and silt, poorly sorted, gravels up 1.5", rounded | | | 38 | 17-6 |
| | | | 39 | |
| | | | 40 | |

WELL CONSTRUCTION DETAIL





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*Notes:*
*Continuously sampled bore-hole. Sample numbers refer to saved samples*

Project No.
135-1.21

# Monitoring Well No. 17

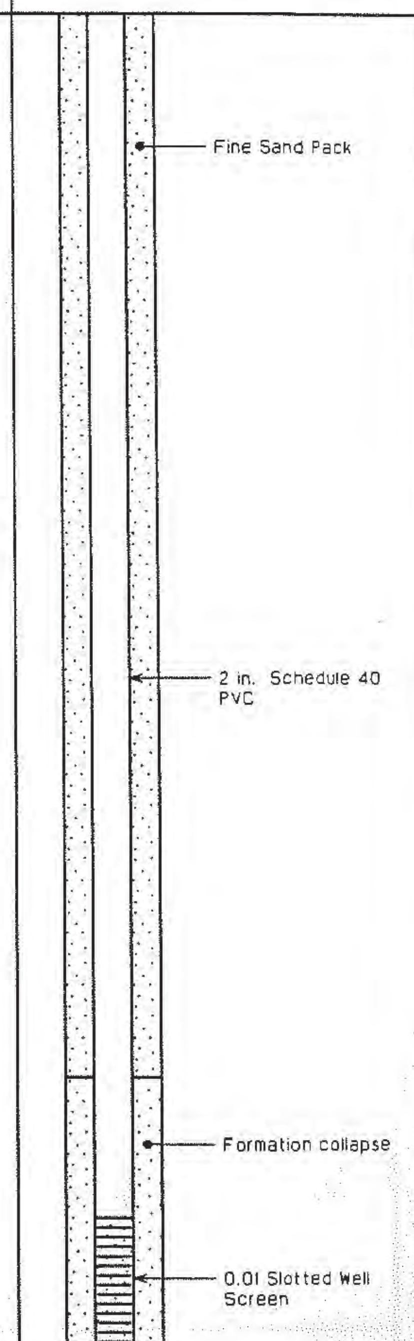
**PROJECT:** Hennepin East Ash Impoundment
**DRILL RIG:** Rotosonic Drill
**DRILLER:** Boart Longyear

**DATE:** 03-30-95
**HOLE DIA.:** 6 in.
**GW DEPTH:** 56 ft.

**LOGGED BY:** Hensel/Tu
**SAMPLER:** Core barrel
**HOLE ELEV.:** 507.34 ft. MSL

| DESCRIPTION | USCS CLASS | GRAPHIC LOG | DEPTH | SAMPLE |
|---|---|---|---|---|
| | | | 40 | |
| | | | 41 | 17-7 |
| Sequence of black and yellow sand and gravel | | | 42 | |
| | | | 43 | 17-8 |
| | | | 44 | |
| Brown gravel w/ sand and silt, poorly sorted, gravels up to 1.5" | | | 45 | |
| | | | 46 | 17-9 |
| | | | 47 | |
| | | | 48 | |
| Brown, med. sand, well-sorted, dry | | | 49 | |
| | | | 50 | |
| | | | 51 | |
| | | | 52 | 17-10 |
| | | | 53 | |
| | | | 54 | |
| | | | 55 | |
| | | | 56 | |
| Becomes wet at 56 ft. Same as above w/ few gravels | | | 57 | |
| | | | 58 | 17-11 |
| | | | 59 | |
| | | | 60 | |

WELL CONSTRUCTION DETAIL





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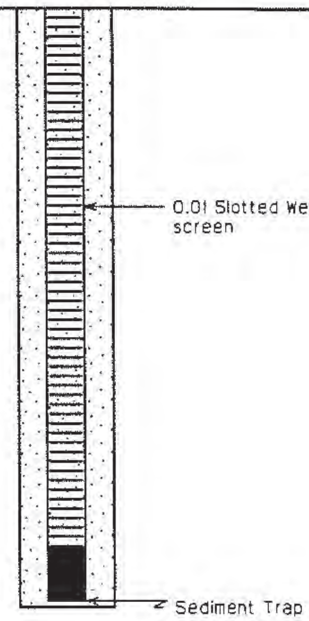
*Notes:*
*Continuously sampled bore-hole. Sample numbers refer to saved samples*

**Project No.** 135-1.21

# Monitoring Well No. 17

**PROJECT:** Hennepin East Ash Impoundment
**DATE:** 03-30-95
**LOGGED BY:** Hensel/Tu
**DRILL RIG:** Rotosonic Drill
**HOLE DIA.:** 6 in.
**SAMPLER:** Core barrel
**DRILLER:** Boart Longyear
**GW DEPTH:** 56 ft.
**HOLE ELEV.:** 507.34 ft. MSL

| DESCRIPTION | USCS CLASS | GRAPHIC LOG | DEPTH | SAMPLE | | WELL CONSTRUCTION DETAIL |
|---|---|---|---|---|---|---|
| Same as above | | | 60–69 | 17-12 | |  |
| | | | 69–80 | | | |



Depth scale: 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80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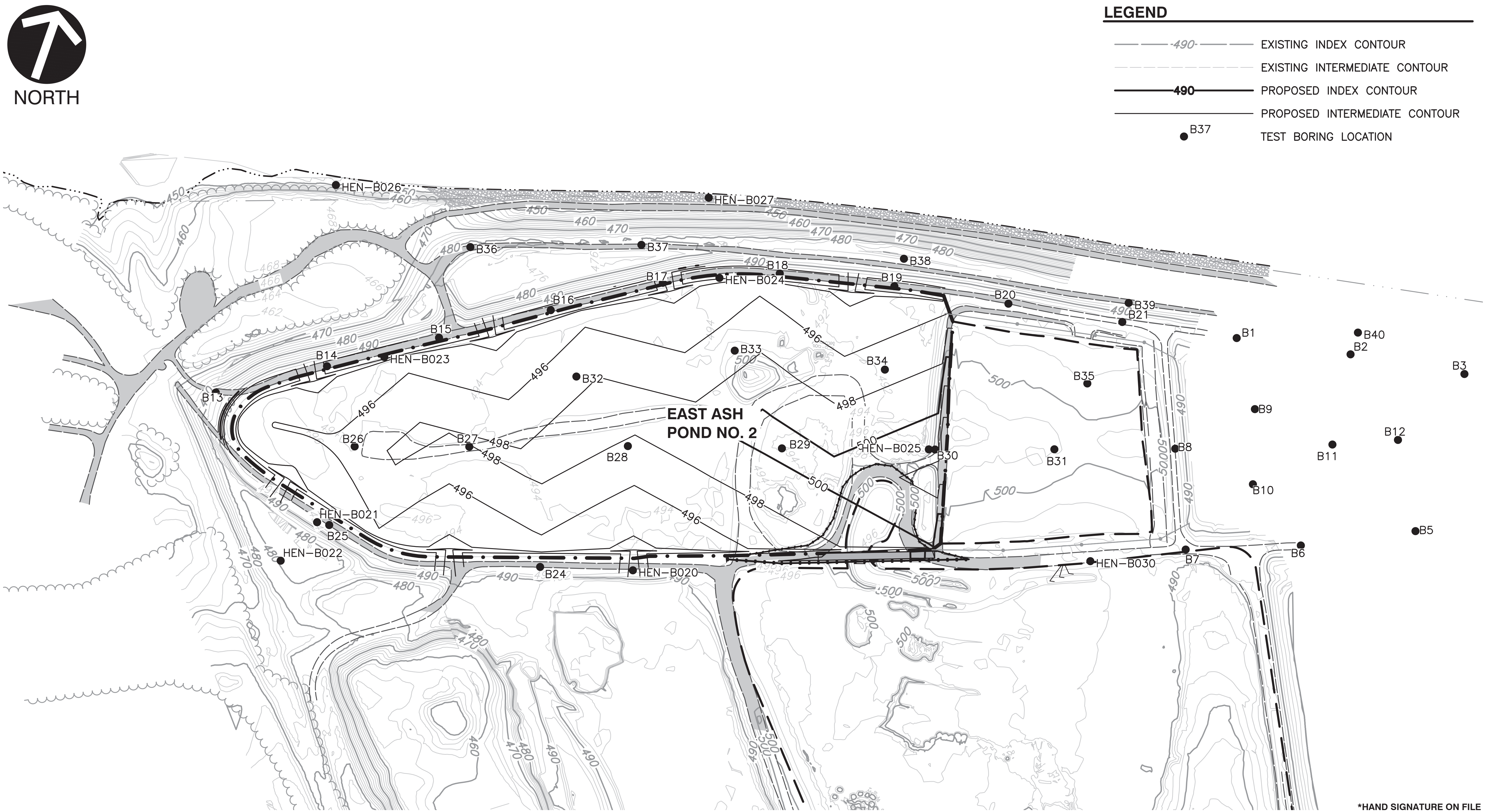
*Notes:*
*Continuously sampled bore-hole. Sample numbers refer to saved samples*

Project No.
135-1.21

# APPENDIX A
# BORING LOGS AND WELL CONSTRUCTION LOGS
# CEC BORING LOGS




## LEGEND

| | |
|---|---|
| 490 | EXISTING INDEX CONTOUR |
| | EXISTING INTERMEDIATE CONTOUR |
| 490 | PROPOSED INDEX CONTOUR |
| | PROPOSED INTERMEDIATE CONTOUR |
| ● B37 | TEST BORING LOCATION |

*HAND SIGNATURE ON FILE

## REFERENCE

1. TOPOGRAPHIC CONTOURS SHOWN ARE FROM AERIAL SURVEY COMPLETED BY SURDEX ON AUGUST 17, 2015 AND TOPOGRAPHIC/BATHYMETRIC SURVEY COMPLETED BY WEAVER CONSULTANTS GROUP ON SEPTEMBER 22, 2015.
2. TOPOGRAPHIC CONTOURS SHOWN OUTSIDE THE LIMIT OF 2015 TOPOGRAPHIC SURVEY WERE DERIVED FROM USGS NATIONAL ELEVATION DATASET (NED) 1/9 ARC-SECOND DIGITAL ELEVATION MODEL, DATED 2012.

SCALE IN FEET
0 200 400

CEC
Civil & Environmental Consultants, Inc.
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www.cecinc.com

DYNEGY MIDWEST GENERATION, LLC.
HENNEPIN STATION
EAST ASH POND NO. 2

TEST BORING LOCATION PLAN

| | | | | | | |
|---|---|---|---|---|---|---|
| DRAWN BY: JAH | CHECKED BY: JMN | APPROVED BY: *DMC | FIGURE NO.: |
| DATE: 09/21/17 | DWG SCALE: 1"=200' | PROJECT NO: 171-101.0400 | 1 |

P:\2017\171-101\-CADD\Dwg\GT01\171101-GT01-Boring Location Plan.dwg{1} LS:(10/9/2017 - jleidy) - LP: 10/16/2017 9:20 AM

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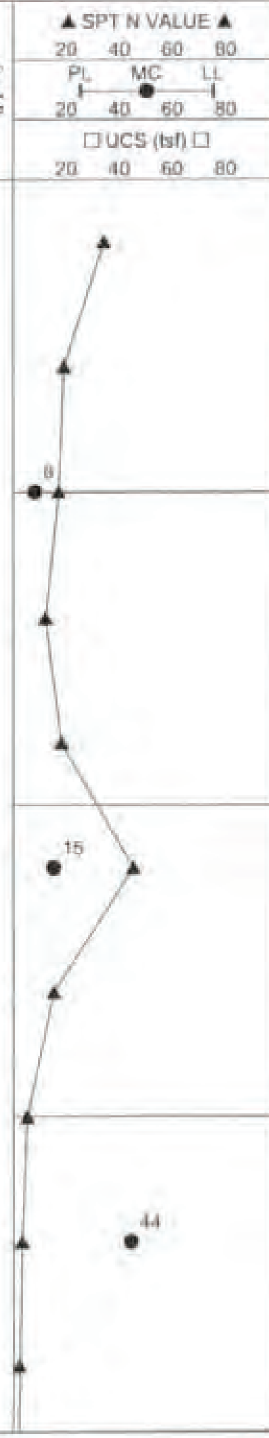
Downers Grove, IL 60510

# BORING NUMBER B-5



| | |
|---|---|
| **CLIENT** Dynegy - Hennepin Power Station | **PROJECT NAME** Dry Ash Landfill Feasability Study |
| **PROJECT NUMBER** 082-255 | **PROJECT LOCATION** Hennepin, Illinois |
| **DATE STARTED** 2/17/09 **COMPLETED** 2/17/09 | **GROUND ELEVATION** 492.9 ft **BACKFILL** Cement Grout |
| **DRILLING CONTRACTOR** Groff Testing | **GROUND WATER LEVELS:** |
| **DRILLING METHOD** Hollow Stem Auger | **WHILE DRILLING** 45.1 ft / Elev 447.8 ft |
| **CEC REP** D. KORTH **CHECKED BY** MDJ | **AT END OF DRILLING** NA |
| **NOTES** Southeast Corner of Ash Pond on Berm | **AFTER DRILLING** NA |

| ELEVATION (ft) | MATERIAL DESCRIPTION | DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (%) | BLOW COUNTS | Pocket Pen. (tsf) | PID (ppm) |
|---|---|---|---|---|---|---|---|
| | Brown poorly graded SAND AND GRAVEL FILL, moist, medium dense to dense. **(BERM FILL)** | 0 | SS 1 | 50 | 13 8 26 20 | NP | |
| 490 | | | SS 2 | 55 | 8 10 9 25 | NP | |
| | Dark yellowish brown clayey SAND AND GRAVEL, to sandy CLAY, trace gravel, moist, medium dense, poorly graded. **(BERM FILL)** | 5 | SS 3 | 75 | 8 8 9 10 | NP | |
| | Very dark brown silty CLAY, moist, hard. **(BERM FILL)** | | SS 4 | 85 | 4 4 8 7 | 4.5 | |
| 485 | | | SS 5 | 75 | 4 8 10 10 | 4.5 | |
| | Very dark gray sandy SILT, moist, medium dense to dense. **(ASH)** | 10 | SS 6 | 80 | 8 15 30 25 | NP | |
| 480 | | | SS 7 | 65 | 8 9 6 6 | NP | |
| | | 15 | SS 8 | 60 | 3 3 2 3 | NP | |
| | Gray SILT, moist to wet, loose. **(ASH)** Wet between 17.0 and 18.0 feet | | SS 9 | 85 | 2 2 1 1 | NP | |
| 475 | | | SS 10 | 50 | 2 1 1 1 | NP | |
| | | 20 | | | | | |




(Continued Next Page)

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Downers Grove, IL 60510

# BORING NUMBER B-5



**CLIENT** Dynegy - Hennepin Power Station
**PROJECT NAME** Dry Ash Landfill Feasability Study
**PROJECT NUMBER** 082-255
**PROJECT LOCATION** Hennepin, Illinois

| ELEVATION (ft) | MATERIAL DESCRIPTION | DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (%) | BLOW COUNTS | Pocket Pen (tsf) | PID (ppm) | ▲ SPT N VALUE ▲ / PL MC LL / ☐ UCS (tsf) ☐ |
|---|---|---|---|---|---|---|---|---|
| | Gray SILT, moist to wet, loose, **(ASH)** *(continued)* | 20 | SS 11 | 90 | 1 1 1 1 | NP | | |
| 470 | Grades to wet below 23.0 feet | | SS 12 | 75 | 1 1 1 1 | NP | | 47 |
| | Dark grayish brown SILT, wet, very loose, laminated **(ASH)** | 25 | SS 13 | 95 | 1 1 1 1 | NP | | |
| 465 | | | SS 14 | 100 | 0 0 1 1 | NP | | |
| | | 30 | SS 15 | 100 | 0 1 1 1 | NP | | 43 |
| | | | SS 16 | 90 | 1 1 2 8 | NP | | |
| 460 | Dark reddish brown SILT, trace sand and gravel, trace plant matter, moist, stiff, **(STREAM TERRACE DEPOSIT)** | | SS 17 | 35 | 5 5 7 6 | NP | | |
| | | 35 | SS 18 | 65 | 3 4 4 6 | 1.75 | | 17 |
| 455 | Dusky red silty CLAY, trace sand and gravel, moist, very stiff, **(STREAM TERRACE DEPOSIT)** | | SS 19 | 100 | 2 5 12 10 | 2.25 | | |
| | | 40 | SS 20 | 100 | 2 5 12 10 | 2.25 | | |
| | Dark yellowish brown SAND AND GRAVEL, moist, medium dense, poorly graded, **(GLACIAL OUTWASH)** | | SS 21 | 50 | 5 8 13 10 | NP | | |
| | | | | | 10 | | | |

*(Continued Next Page)*

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# BORING NUMBER B-5



**CLIENT** Dynegy - Hennepin Power Station
**PROJECT NAME** Dry Ash Landfill Feasability Study
**PROJECT NUMBER** 082-255
**PROJECT LOCATION** Hennepin, Illinois

| ELEVATION (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (%) | BLOW COUNTS | Pocket Pen. (tsf) | PID (ppm) | ▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ UCS (tsf) ☐ 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|---|
| 450 | | Dark yellowish brown SAND AND GRAVEL, moist, medium dense, poorly graded, **(GLACIAL OUTWASH)** *(continued)* | | SS 22 | 60 | 12 13 14 | NP | | |
| | | Grades to wet at 45.1 feet | 45 | SS 23 | 75 | 9 10 11 12 | NP | | |
| 445 | | | | SS 24 | 0 | 4 6 9 16 | NP | | |
| | | | 50 | SS 25 | 45 | 3 7 7 10 | NP | | 13 |

End of Borehole at 50.0 feet

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# BORING NUMBER B-6



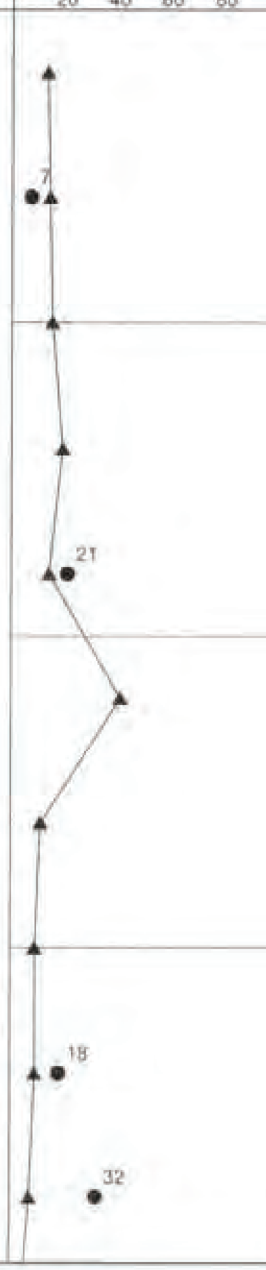
| | |
|---|---|
| CLIENT: Dynegy - Hennepin Power Station | PROJECT NAME: Dry Ash Landfill Feasability Study |
| PROJECT NUMBER: 082-255 | PROJECT LOCATION: Hennepin, Illinois |
| DATE STARTED: 2/26/09 COMPLETED: 2/26/09 | GROUND ELEVATION: 494.5 ft BACKFILL: Cement Grout |
| DRILLING CONTRACTOR: Groff Testing | GROUND WATER LEVELS: |
| DRILLING METHOD: Hollow Stem Auger | WHILE DRILLING: Dry |
| CEC REP: CAC CHECKED BY: MDJ | AT END OF DRILLING: --- |
| NOTES: | AFTER DRILLING: --- |

| ELEVATION (ft) | MATERIAL DESCRIPTION |
|---|---|
| | Brown sandy GRAVEL, trace clay, medium sand, moist, medium dense, poorly graded. **(BERM FILL)** |
| | Brown gray gravelly CLAY, some sand, moist, stiff, low to no plasticity. **(BERM FILL)** |
| 490 | Coarse gravel |
| | Dark gray to black silty CLAY, trace coarse gravel, to cobbles, moist, very stiff, low plasticity. **(BERM FILL)** |
| 485 | Dark gray sandy SILT, trace coal pieces, coarse sand, dry to moist, dense, non-plastic. **(BERM FILL)** |
| 480 | Dark gray to black silty CLAY, trace coarse gravel, with cobbles, moist, low plasticity. **(BERM FILL)** |
| 475 | Gray sandy SILT, moist to wet. **(ASH)** |

| SAMPLE TYPE NUMBER | RECOVERY (%) | BLOW COUNTS | Pocket Pen. (tsf) | PID (ppm) | MC |
|---|---|---|---|---|---|
| SS 1 | 75 | 7-4-9-11 | NP | | |
| SS 2 | 80 | 6-6-8-10 | 2.0 | | 7 |
| SS 3 | 70 | 5-8-7-6 | 1.3 | | |
| SS 4 | 100 | 11-13-6-13 | 3.75 | | |
| SS 5 | 100 | 4-6-8-10 | 3.5 | | 21 |
| SS 6 | 100 | 8-15-26-18 | 2.5 | | |
| SS 7 | 0 | 5-5-6-6 | | | |
| SS 8 | 70 | 7-4-5-4 | - | | |
| SS 9 | 50 | 5-4-5-10 | - | | 18 |
| SS 10 | 100 | 5-4-3-2 | NP | | 32 |

DEPTH (ft): 0, 5, 10, 15, 20

▲ SPT N VALUE ▲ 20 40 60 80
PL MC LL 20 40 60 80
☐ UCS (tsf) ☐ 20 40 60 80



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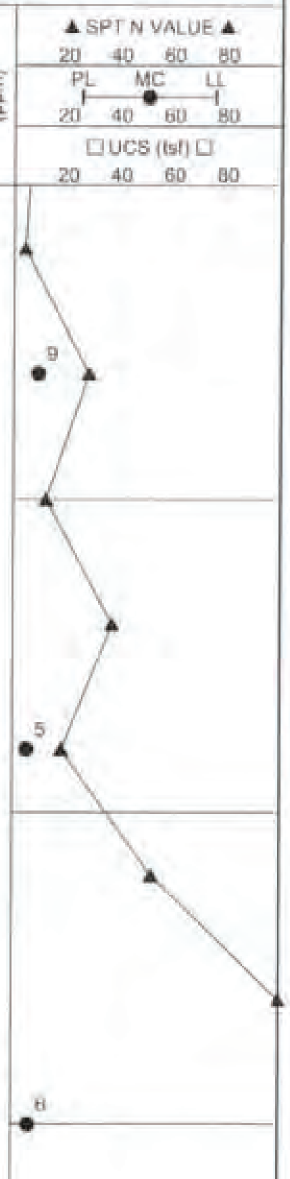
Civil & Environmental Consultants, Inc
3041 Woodcreek Dr Suite 210
Downers Grove, IL 60510

# BORING NUMBER B-6



**CLIENT** Dynegy - Hennepin Power Station
**PROJECT NAME** Dry Ash Landfill Feasability Study
**PROJECT NUMBER** 082-255
**PROJECT LOCATION** Hennepin, Illinois

| ELEVATION (ft) | MATERIAL DESCRIPTION | DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (%) | BLOW COUNTS | Pocket Pen. (tsf) | PID (ppm) |
|---|---|---|---|---|---|---|---|
| | Gray sandy SILT, moist to wet, **(ASH)** *(continued)* | 20 | SS 11 | 0 | 2 2 2 3 | NP | |
| | Brown gravelly CLAY, moist, medium dense, low plasticity, poorly graded, **(STREAM TERRACE DEPOSIT)** | | SS 12 | 70 | 8 9 19 10 | NP | |
| 470 | Tan medium SAND, trace fine gravel, dry to moist, medium dense, poorly graded, **(STREAM TERRACE DEPOSIT)** | 25 | SS 13 | 60 | 6 6 6 6 | NP | |
| | Brown gravelly SAND, dry to moist, medium dense, non-plastic, poorly graded, **(STREAM TERRACE DEPOSIT)** | | | | | | |
| | Sandy GRAVEL, dry, poorly graded, **(GLACIAL OUTWASH)** | | SS 14 | 25 | 20 22 15 10 | NP | |
| 465 | | 30 | SS 15 | 50 | 11 7 11 10 | NP | |
| | | | SS 16 | 50 | 11 12 40 40 | NP | |
| | | | SS 17 | 75 | 18 30 70 | NP | |
| 460 | | 35 | SS 18 | 50 | 100 | NP | |
| | End of Borehole at 36.0 feet | | | | | | |



# BORING NUMBER B-7



Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60515

**CLIENT** Dynegy - Hennepin Power Station
**PROJECT NAME** Dry Ash Landfill Feasability Study
**PROJECT NUMBER** 082-255
**PROJECT LOCATION** Hennepin, Illinois
**DATE STARTED** 2/27/09 **COMPLETED** 2/27/09
**GROUND ELEVATION** 475 ft **BACKFILL** Cement Grout
**DRILLING CONTRACTOR** Groff Testing
**GROUND WATER LEVELS:**
**DRILLING METHOD** Hollow Stem Auger
**WHILE DRILLING** ---
**CEC REP** CAC **CHECKED BY** MDJ
**AT END OF DRILLING** ---
**NOTES**
**AFTER DRILLING** ---

| ELEVATION (ft) | MATERIAL DESCRIPTION | DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (%) | BLOW COUNTS | Pocket Pen (tsf) | PID (ppm) | ▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / □ UCS (tsf) □ 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|
| 475 | Brown - gray clayey GRAVEL, with sand, roots, coarse gravel, moist, low plasticity, poorly graded. **(BERM FILL)** | 0 | SS 1 | 100 | 5 8 12 14 | NP | | |
| | Gr = 33.8%, Sa = 25.7%, Si = 19.8%, Cl = 20.6% | | SS 2 | 85 | 9 11 6 11 | NP | | 6 16 39 |
| 470 | Brown silty CLAY, with cobbles, some sand, moist, stiff, low plasticity. **(BERM FILL)** | 5 | SS 3 | 80 | 7 8 10 12 | 1.75 | | |
| | | | SS 4 | 0 | 12 9 8 10 | -- | | |
| | Dark brown silty CLAY, trace coarse gravel, trace sand, soft, low plasticity. **(BERM FILL)** | | SS 5 | 50 | 3 5 8 10 | 0.5 | | 12 |
| 465 | | 10 | | | | | | |
| | Trace coarse gravel, crushed limestone, trace sand, stiff | | SS 6 | 100 | 4 7 9 11 | 2.5 | | |
| | | | SS 7 | 17 | 5 6 9 14 | NP | | |
| 460 | Brown silty CLAY, with silt layers, trace coarse gravel, dry to moist, very stiff, low plasticity. **(BERM FILL)** | 15 | SS 8 | 75 | 9 14 38 12 | 2.5 / 3.0 | | 14 |
| | Crushed limestone GRAVEL, dry, dense, non-plastic, poorly graded. **(BERM FILL)** | | | | | | | |
| | Dark brown silty CLAY, with gravel, trace wood chips, sand, cobbles to coarse gravel. **(BERM FILL)** | | SS 9 | 60 | 6 6 12 15 | -- | | |
| | | | SS 10 | 75 | 10 8 5 3 | -- | | |
| 455 | | 20 | | | | | | |

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**CLIENT** Dynegy - Hennepin Power Station
**PROJECT NAME** Dry Ash Landfill Feasability Study
**PROJECT NUMBER** 082-255
**PROJECT LOCATION** Hennepin, Illinois

| ELEVATION (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (%) | BLOW COUNTS | Pocket Pen (tsf) | PID (ppm) | ▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ UCS (tsf) ☐ 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|---|
| 455 | | | 20 | | | | | | |
| | | Gray SILT, trace fine sand, moist to wet, loose, **(ASH)** *(continued)* | | SS 11 | 90 | 2 1 1 5 | NP | | 35 |
| | | SAND AND GRAVEL, limestone fragments, dry, medium dense to dense, non-plastic, **(GLACIAL OUTWASH)** | | SS 12 | 70 | 14 14 14 12 | NP | | |
| 450 | | | 25 | SS 13 | 50 | 50 30 20 | NP | | |
| | | | | SS 14 | 50 | 65 35 | NP | | 9 |
| | | End of Borehole at 28.0 feet. | | | | | | | |

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Downers Grove, IL 60510

# BORING NUMBER B-18



**CLIENT** Dynegy - Hennepin Power Station
**PROJECT NAME** Dry Ash Landfill Feasability Study
**PROJECT NUMBER** 082-255
**PROJECT LOCATION** Hennepin, Illinois
**DATE STARTED** 3/6/09 **COMPLETED** 3/6/09
**GROUND ELEVATION** 493.9 ft **BACKFILL** Cement Grout
**DRILLING CONTRACTOR** Groff Testing
**GROUND WATER LEVELS:**
**DRILLING METHOD** Hollow Stem Auger
**WHILE DRILLING** ---
**CEC REP** CAC **CHECKED BY** MDJ
**AT END OF DRILLING** ---
**NOTES**
**AFTER DRILLING** ---

| ELEVATION (ft) | MATERIAL DESCRIPTION | DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (%) | BLOW COUNTS (N VALUE) | Pocket Pen. (tsf) | PID (ppm) | MC (%) |
|---|---|---|---|---|---|---|---|---|
| | Brown and gray SAND AND GRAVEL, moist, medium dense to dense, poorly graded, **(BERM FILL)** | 0 | SS 1 | 50 | 3 6 15 20 | NP | | 5 |
| 490 | | | SS 2 | 70 | 17 18 18 10 | NP | | |
| | Brown sandy CLAY, trace gravel, moist, medium stiff, **(BERM FILL)** | | | | | | | |
| | Brown and gray clayey SAND AND GRAVEL, moist, dense, poorly graded, **(BERM FILL)** | 5 | SS 3 | 90 | 4 17 16 10 | NP | | |
| | | | SS 4 | 100 | 5 12 20 15 | NP | | 14 |
| 485 | Three inch sand seam at 8.5 feet. | | SS 5 | 65 | 10 17 15 20 | NP | | |
| | Dark brown to gray SILTY SAND, trace coal pieces, dry to moist, poorly graded, **(ASH)** | 10 | SS 6 | 90 | 5 20 35 25 | NP | | |
| 480 | Dark gray SILT, with fine sand laminations, moist to wet, loose, **(ASH/ML)** | | SS 7 | 95 | 2 2 2 4 | NP | | 31 |
| | | 15 | SS 8 | 100 | 4 3 2 2 | NP | | |
| | Grades moist to wet. | | SS 9 | 90 | 2 1 1 2 | NP | | |
| 475 | | 20 | SS 10 | 100 | 2 2 3 3 | NP | | 46 |

▲ SPT N VALUE ▲ (20 40 60 80); PL MC LL (20 40 60 80); ☐ FINES CONTENT (%) ☐ (20 40 60 80)

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# BORING NUMBER B-18



**CLIENT** Dynegy - Hennepin Power Station

**PROJECT NAME** Dry Ash Landfill Feasability Study

**PROJECT NUMBER** 082-255

**PROJECT LOCATION** Hennepin, Illinois

| ELEVATION (ft) | MATERIAL DESCRIPTION | DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (%) | BLOW COUNTS (N VALUE) | Pocket Pen. (tsf) | PID (ppm) | SPT N VALUE / PL MC LL (20 40 60 80) / FINES CONTENT (%) |
|---|---|---|---|---|---|---|---|---|
| | Dark gray SILT, with fine sand laminations, moist to wet, loose, **(ASH/ML)** *(continued)* | 20 | SS 11 | 100 | 3-3-2-2 | NP | | |
| 470 | | | SS 12 | 100 | 3-3-3-2 | NP | | |
| | Grades moist to wet. | 25 | SS 13 | 90 | 3-2-2-1 | NP | | MC 47 |
| | | | SS 14 | 90 | 2-1-1-2 | NP | | |
| 465 | | | SS 15 | 90 | 2-1-1-1 | NP | | |
| | Grades to moist.<br>Gravel ~ 0%<br>Sand ~ 13.4%<br>Silt ~ 73.5%<br>Clay ~ 13.1% | 30 | ST 16 | 100 | | NP | | MC 46 |
| 460 | | | SS 17 | 100 | 3-6-5-9 | NP | | |
| | Grades to wet. | 35 | SS 18 | 100 | 2-1-3-6 | NP | | |
| | Brown and gray SILTY SAND, dry to moist, very dense, poorly graded, **(GLACIAL OUTWASH/SM)**<br>Gravel ~ 4.0%<br>Sand ~ 79.1%<br>Silt ~10.9%<br>Clay ~ 6.1% | | ST 19 | 50 | | NP | | MC 11 |
| 455 | | 40 | SS 20 | 85 | 16-20-35-25 | NP | | |

End of Borehole at 40.0 feet.

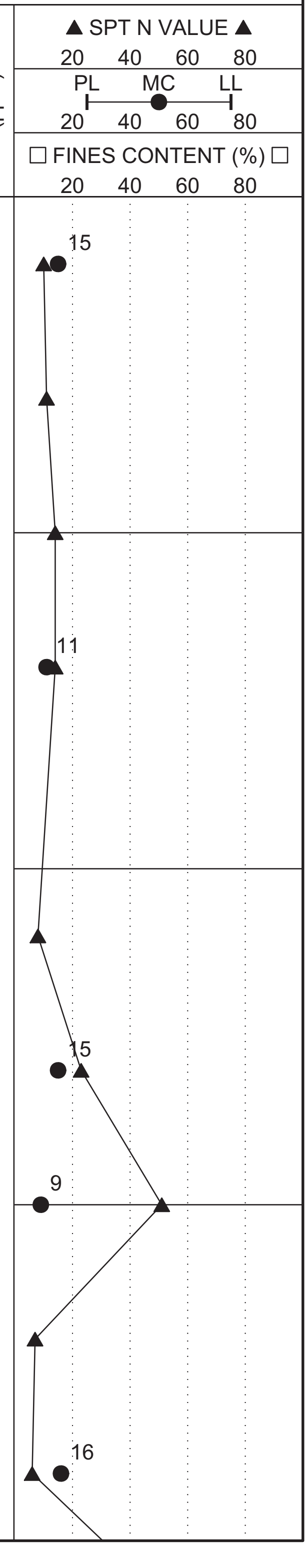
# BORING NUMBER B-24



Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

**CLIENT** Dynegy - Hennepin Power Station
**PROJECT NAME** Dry Ash Landfill Feasability Study
**PROJECT NUMBER** 082-255
**PROJECT LOCATION** Hennepin, Illinois
**DATE STARTED** 3/20/09 **COMPLETED** 3/20/09
**GROUND ELEVATION** 494.9 ft **BACKFILL** Cement Grout
**DRILLING CONTRACTOR** Groff Testing
**GROUND WATER LEVELS:**
**DRILLING METHOD** Hollow Stem Auger
**WHILE DRILLING** Dry
**CEC REP** D. KORTH **CHECKED BY** MDJ
**AT END OF DRILLING** ---
**NOTES**
**AFTER DRILLING** ---

| ELEVATION (ft) | MATERIAL DESCRIPTION | DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (%) | BLOW COUNTS (N VALUE) | Pocket Pen. (tsf) | PID (ppm) |
|---|---|---|---|---|---|---|---|
| | Dark brown LEAN CLAY WITH SAND, trace fine to coarse gravel, moist, hard, **(BERM FILL)** | 0 | SS 1 | 70 | 3 4 6 12 | >4.5 | |
| | Dark yellowish brown SAND AND GRAVEL, moist, medium dense, **(BERM FILL)** | | SS 2 | 55 | 7 6 5 4 | NP | |
| 490 | | 5 | SS 3 | 70 | 7 8 6 5 | NP | |
| | | | SS 4 | 80 | 8 8 6 12 | NP | |
| | | | SS 5 | 100 | 65 | NP | |
| 485 | Black LEAN CLAY, trace medium to coarse sand, moist, stiff, **(BERM FILL)** | 10 | SS 6 | 55 | 6 4 4 3 | 1.5 | |
| | | | SS 7 | 100 | 6 12 11 25 | 4.0 | |
| 480 | Dark yellowish brown with very dark brown SILTY SAND WITH GRAVEL, moist, very dense, **(ASH/SM)**<br>Gravel ~ 22.3%<br>Sand ~ 59.4%<br>Silt ~ 16.0%<br>Clay ~ 2.2% | 15 | SS 8 | 80 | 20 25 26 20 | NP | |
| | Yellowish brown SILTY SAND, trace fine gravel, moist, loose, **(STREAM TERRACE DEPOSIT)** | | SS 9 | 80 | 3 4 3 3 | NP | |
| 475 | Dark yellowish brown SILTY GRAVEL WITH SAND, with cobbles, moist, dense, **(GLACIAL OUTWASH/GM)** | 20 | SS 10 | 40 | 2 5 1 30 | NP | |

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Civil & Environmental Consultants, Inc.
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Downers Grove, IL 60510

**CLIENT** Dynegy - Hennepin Power Station
**PROJECT NAME** Dry Ash Landfill Feasability Study
**PROJECT NUMBER** 082-255
**PROJECT LOCATION** Hennepin, Illinois

| ELEVATION (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (%) | BLOW COUNTS (N VALUE) | Pocket Pen. (tsf) | PID (ppm) | ▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|---|
| | | Dark yellowish brown SILTY GRAVEL WITH SAND, with cobbles, moist, dense, **(GLACIAL OUTWASH/GM)** *(continued)* | 20 | SS 11 | 50 | 20 25 30 28 | NP | | |
| | | | | SS 12 | 100 | 50 50 | NP | | |
| 470 | | | 25 | SS 13 | 33 | 20 50 30 | NP | | 7 |
| | | | | SS 14 | 25 | 25 18 16 21 | NP | | 9 |
| | | Grades medium dense to dense<br>Gravel ~ 45.5%<br>Sand ~ 37.6%<br>Silt ~ 11.8%<br>Clay ~ 5.1% | | SS 15 | 50 | 12 13 30 35 | NP | | |
| 465 | | | 30 | SS 16 | 30 | 25 16 16 10 | NP | | 4 |
| | | | | SS 17 | 30 | 15 13 12 12 | NP | | |
| 460 | | | 35 | SS 18 | 35 | 10 8 8 11 | NP | | 7 |
| | | End of Borehole at 36.0 feet. | | | | | | | |

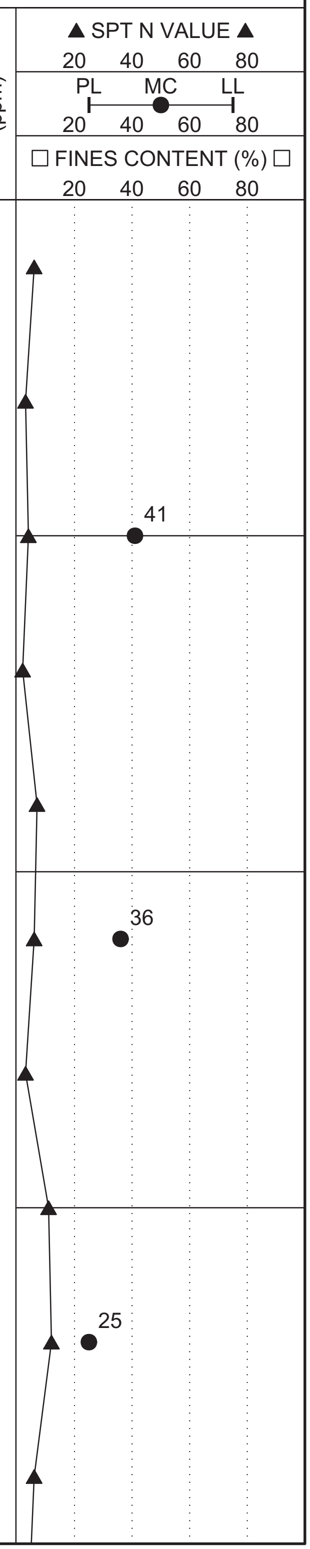
# BORING NUMBER B-29



Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

**CLIENT** Dynegy - Hennepin Power Station
**PROJECT NAME** Dry Ash Landfill Feasability Study
**PROJECT NUMBER** 082-255
**PROJECT LOCATION** Hennepin, Illinois
**DATE STARTED** 3/12/09 **COMPLETED** 3/12/09
**GROUND ELEVATION** 494.4 ft **BACKFILL** Monitoring Well
**DRILLING CONTRACTOR** Groff Testing
**GROUND WATER LEVELS:**
**DRILLING METHOD** Hollow Stem Auger
**WHILE DRILLING** 46.0 ft / Elev 448.4 ft
**CEC REP** CAC **CHECKED BY** MDJ
**AT END OF DRILLING** ---
**NOTES**
**AFTER DRILLING** ---

| ELEVATION (ft) | MATERIAL DESCRIPTION | DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (%) | BLOW COUNTS (N VALUE) | Pocket Pen. (tsf) | PID (ppm) | MC (%) |
|---|---|---|---|---|---|---|---|---|
| | Dark brown silty SAND, trace gravel , roots, and coal, moist, poorly graded, **(ASH)** | 0 | SS 1 | 80 | 2 2 4 2 | NP | | |
| | Gray SILT, with fine sand laminantions, wet to moist, very loose, low to no plasticity, **(ASH)** | | SS 2 | 75 | 1 1 2 2 | NP | | |
| 490 | | 5 | SS 3 | 90 | 1 2 2 1 | NP | | 41 |
| | | | SS 4 | 85 | 2 1 1 1 | NP | | |
| 485 | | 10 | SS 5 | 90 | 2 3 4 4 | NP | | |
| | | | SS 6 | 100 | 2 4 2 2 | NP | | 36 |
| | | | SS 7 | 85 | 2 1 2 5 | NP | | |
| 480 | | 15 | SS 8 | 100 | 1 5 6 9 | NP | | |
| | Grades to silty SAND, **(ASH)** | | SS 9 | 95 | 2 2 10 13 | NP | | 25 |
| 475 | | 20 | SS 10 | 95 | 2 4 2 2 | NP | | |

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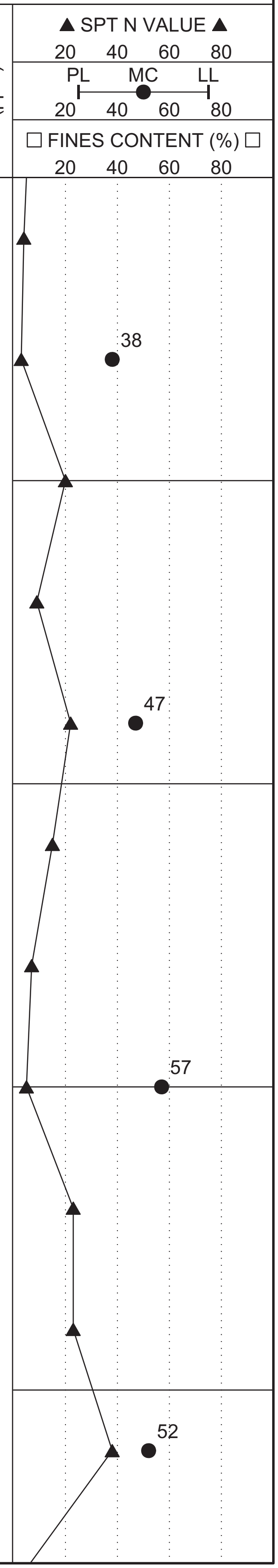
Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

# BORING NUMBER B-29



**CLIENT** Dynegy - Hennepin Power Station
**PROJECT NAME** Dry Ash Landfill Feasability Study
**PROJECT NUMBER** 082-255
**PROJECT LOCATION** Hennepin, Illinois

| ELEVATION (ft) | MATERIAL DESCRIPTION | DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (%) | BLOW COUNTS (N VALUE) | Pocket Pen. (tsf) | PID (ppm) |
|---|---|---|---|---|---|---|---|
| | Grades to silty SAND, **(ASH)** *(continued)* | 20 | SS 11 | 85 | 2 2 2 2 | NP | |
| | | | SS 12 | 95 | 2 2 1 4 | NP | |
| 470 | Dark gray to black coarse SAND, some silt, trace fine gravel and coal, dry to moist, medium dense, non plastic, **(ASH)** | 25 | SS 13 | 90 | 6 10 10 7 | NP | |
| | Gray SILT, some sand lenses, moist to wet, loose to medium dense, **(ASH)** | | SS 14 | 100 | 2 3 6 14 | NP | |
| 465 | Dark brown-dark gray silty SANDY SILT, trace coal pieces, dry to moist, medium dense, poorly graded, **(ASH/ML)**<br>Gravel ~ 2.9%<br>Sand ~ 39.7%<br>Silt ~ 61.9%<br>Clay ~ 5.5% | 30 | SS 15 | 100 | 5 8 14 10 | NP | |
| | Grades moist to wet. | | SS 16 | 100 | 8 8 7 3 | NP | |
| | Gray SILT, with fine sand laminantions, moist to wet, loose, **(ASH)** | | SS 17 | 95 | 4 2 5 4 | NP | |
| 460 | | 35 | SS 18 | 75 | 3 3 2 5 | NP | |
| | Grades to very dense | | SS 19 | 100 | 12 13 10 22 | NP | |
| 455 | | 40 | SS 20 | 100 | 18 13 10 8 | NP | |
| | Wet between 40.0 to 40.25 feet. | | SS 21 | 100 | 13 13 25 30 | NP | |
| | Dark brown to black silty CLAY, trace sand, trace roots, moist, stiff, **(LOESS DEPOSIT)** | | | | 1 | | |

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# BORING NUMBER B-29



Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

**CLIENT** Dynegy - Hennepin Power Station
**PROJECT NAME** Dry Ash Landfill Feasability Study
**PROJECT NUMBER** 082-255
**PROJECT LOCATION** Hennepin, Illinois

| ELEVATION (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (%) | BLOW COUNTS (N VALUE) | Pocket Pen. (tsf) | PID (ppm) | SPT N VALUE (20 40 60 80) / PL MC LL (20 40 60 80) / FINES CONTENT (%) (20 40 60 80) |
|---|---|---|---|---|---|---|---|---|---|
| | | Dark brown to black silty CLAY, trace sand, trace roots, moist, stiff, **(LOESS DEPOSIT)** *(continued)* | | SS 22 | 90 | 1 3 6 | 2.5 | | |
| 450 | | Dark brown to black sandy CLAY, trace silt, moist, stiff, **(STREAM TERRACE DEPOSIT)** | 45 | SS 23 | 85 | 3 3 3 4 | 2.5 | | |
| | ▽ | Dark brown coarse SAND, trace gravel, wet, loose to medium stiff, poorly graded, **(STREAM TERRACE DEPOSIT)** | | SS 24 | 90 | 2 2 2 4 | 1.0 | | MC 20 |
| 445 | | Gray-black-brown clayey GRAVEL, some sand, wet, loose, poorly graded, **(GLACIAL OUTWASH)** | 50 | SS 25 | 75 | 3 4 5 5 | NP | | |

End of Borehole at 50.0 feet.

# BORING NUMBER B-33



Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

**CLIENT** Dynegy - Hennepin Power Station
**PROJECT NAME** Dry Ash Landfill Feasability Study
**PROJECT NUMBER** 082-255
**PROJECT LOCATION** Hennepin, Illinois
**DATE STARTED** 3/2/09 **COMPLETED** 3/2/09
**GROUND ELEVATION** 493.1 ft **BACKFILL** Bentonite Chips
**DRILLING CONTRACTOR** Groff Testing
**GROUND WATER LEVELS:**
**DRILLING METHOD** Hollow Stem Auger
**WHILE DRILLING** ---
**CEC REP** CAC **CHECKED BY** MDJ
**AT END OF DRILLING** ---
**NOTES**
**AFTER DRILLING** ---

| ELEVATION (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (%) | BLOW COUNTS (N VALUE) | Pocket Pen. (tsf) | PID (ppm) | SPT N VALUE (20 40 60 80) / PL MC LL (20 40 60 80) / FINES CONTENT (%) (20 40 60 80) |
|---|---|---|---|---|---|---|---|---|---|
| | | Gray SILT WITH SAND, moist to wet, loose, non plastic, **(ASH/ML)** | 0 | SS 1 | 100 | 4 3 3 3 | NP | | |
| 490 | | | | SS 2 | 100 | 2 3 3 4 | NP | | |
| | | With fine sand laminantions | 5 | SS 3 | 85 | 2 2 3 2 | NP | | 31 |
| | | | | SS 4 | 90 | 2 2 1 2 | NP | | |
| 485 | | Gravel ~ 0.0%<br>Sand ~ 18.7%<br>Silt ~ 65.8%<br>Clay ~ 15.5% | 10 | SS 5 | 90 | 3 2 2 2 | NP | | 33 |
| | | | | SS 6 | 95 | 2 2 2 1 | NP | | 43 |
| 480 | | | | SS 7 | 100 | 4 2 3 5 | NP | | |
| | | | 15 | SS 8 | 100 | 2 3 2 2 | NP | | |
| 475 | | Grades dry to moist | | SS 9 | 100 | 2 2 2 4 | NP | | 48 |
| | | | 20 | SS 10 | 100 | 2 2 2 2 | NP | | |

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3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

# BORING NUMBER B-33



**CLIENT** Dynegy - Hennepin Power Station
**PROJECT NAME** Dry Ash Landfill Feasability Study
**PROJECT NUMBER** 082-255
**PROJECT LOCATION** Hennepin, Illinois

| ELEVATION (ft) | MATERIAL DESCRIPTION | DEPTH (ft) |
|---|---|---|
| | Gray SILT WITH SAND, moist to wet, loose, non plastic, **(ASH/ML)** *(continued)* | 20 |
| 470 | Dark gray SILT, trace sand, dry to moist, loose, **(ASH)** | |
| | | 25 |
| 465 | Grades moist to wet | |
| | Gray SILT, trace sand, wet, loose, poorly graded, **(ASH)** | 30 |
| 460 | | |
| | | 35 |
| | Dark brown fine to medium SAND, trace fine gravel, organics, moist, dense to very dense, poorly graded, **(STREAM TERRACE DEPOSIT)** | |
| 455 | Brown and gray SAND AND GRAVEL, dry to moist, non plastic; poorly graded, **(GLACIAL OUTWASH)** | |
| | | 40 |

| SAMPLE TYPE NUMBER | RECOVERY (%) | BLOW COUNTS (N VALUE) | Pocket Pen. (tsf) | PID (ppm) | MC (%) |
|---|---|---|---|---|---|
| SS 11 | 100 | 2-1-3-6 | NP | | |
| SS 12 | 95 | 5-2-2-3 | NP | | 33 |
| SS 13 | 100 | 3-2-2-2 | NP | | |
| SS 14 | 100 | 5-4-2-2 | NP | | |
| SS 15 | 100 | 3-2-2-2 | NP | | 50 |
| SS 16 | 100 | 3-11-15-15 | NP | | |
| SS 17 | 100 | 4-5-6-10 | NP | | 42 |
| SS 18 | 80 | 7-11-10-28 | NP | | 38 |
| SS 19 | 100 | 12-25-25-30 | NP | | |
| SS 20 | 100 | 35-60 | NP | | |
| SS 21 | 100 | 20-20-30 | NP | | 7 |

▲ SPT N VALUE ▲ 20 40 60 80
PL MC LL 20 40 60 80
☐ FINES CONTENT (%) ☐ 20 40 60 80

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Civil & Environmental Consultants, Inc.
3041 Woodcreek Dr. Suite 210
Downers Grove, IL 60510

# BORING NUMBER B-33



**CLIENT** Dynegy - Hennepin Power Station

**PROJECT NAME** Dry Ash Landfill Feasability Study

**PROJECT NUMBER** 082-255

**PROJECT LOCATION** Hennepin, Illinois

| ELEVATION (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (%) | BLOW COUNTS (N VALUE) | Pocket Pen. (tsf) | PID (ppm) | ▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|---|
| 450 | | Brown and gray SAND AND GRAVEL, dry to moist, non plastic; poorly graded, **(GLACIAL OUTWASH)** *(continued)* | | SS 22 | 100 | 25 75 | NP | | |
| | | End of Borehole at 44.0 feet. | | | | | | | |

# APPENDIX B
# GEOTECHNICAL LABORATORY REPORT

GEOTECHNOLOGY INC
FROM THE GROUND UP

**Via email: akreinberg@geosyntec.com**

March 29, 2021

Ms. Allison Kreinberg
Geosyntec Consultants, Inc.
941 Chatham Lane Suite 103
Columbus, Ohio 43221

Re: Laboratory Testing Services
Vistra Energy
Hennepin, Illinois
Geotechnology Project No. J037936.01

Dear Ms. Kreinberg:

Provided herein are the laboratory test results for the referenced project. Our services were performed in accordance with ASTM procedures.

This report has been prepared for the exclusive use of Geosyntec Consultants, Inc. Our scope of services was limited to performing specific tests on the provided samples and did not include engineering or interpretation of the test results.

Our services shall not be construed to constitute an expressed or implied warranty, including, but not limited to, any warranty for merchantability or fitness for a particular use. We do not accept responsibility for the manner in which the test results are used.

It has been our pleasure to provide laboratory testing services to you, and we would welcome the opportunity to provide other services during the course of the project. Please contact us if you need further information or clarification about this document.

* * * * *

Yours very truly,
**GEOTECHNOLOGY, INC.**

Erin Grimes

Erin Grimes
Laboratory Manager

EKG/CKK:ekg

Attachments: Appendix A – Summary of Laboratory Results
Appendix B – Atterberg Limits Results
Appendix C – Grain Size Distribution
Appendix D – Test Report

Copies submitted: PDF

# APPENDIX A

## Summary of Laboratory Results

| Borehole | Depth | Liquid Limit | Plastic Limit | Plasticity Index | Maximum Size (mm) | %<#200 Sieve | Class-ification | Moisture Content (%) | Dry Unit Weight (pcf) | Qu/2 (tsf) | Specific Gravity (20°C) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MW55 | 15.0 | 32 | 19 | 13 | 19 | 48.0 | SC | 14.4 | 109.0 | | 2.720 |
| SB52 | 4.0 | 32 | 17 | 15 | 9.5 | 78.3 | CL | 21.4 | 95.0 | | 2.675 |
| SB53 | 2.0 | 29 | 16 | 13 | 25 | 51.1 | CL | 13.7 | 120.0 | | 2.680 |
| SB53 | 56.0 | | | | 37.5 | 8.3 | | 9.9 | | | |
| SB55 | 50.0 | 21 | 15 | 6 | 50 | 16.8 | GC-GM | 8.2 | | | 2.823 |
| XPW01 | 10.0 | | | | 19 | 73.8 | | 157.0 | | | 2.635 |
| XPW01 | 12.0 | | | | 19 | 14.1 | | 42.3 | 71.0 | | 2.859 |
| XPW01 | 15.0 | | | | 9.5 | 6.8 | | 31.0 | 79.0 | | 2.622 |
| XPW02 | 14.0 | NP | NP | NP | 0.84 | 79.2 | ML | 123.3 | 36.0 | | 2.615 |
| XPW02 | 16.0 | NP | NP | NP | 9.5 | 77.4 | ML | 113.2 | | | 2.622 |
| XPW03 | 14.0 | NP | NP | NP | 2 | 86.3 | ML | 177.0 | 28.0 | | 2.595 |
| XPW03 | 18.0 | NP | NP | NP | 2 | 81.4 | ML | 138.8 | 34.0 | | 2.585 |

US LAB SUMMARY J037936.01 - VISTRA HENNEPIN.GPJ 00 CLONE ME.GPJ 3/29/21

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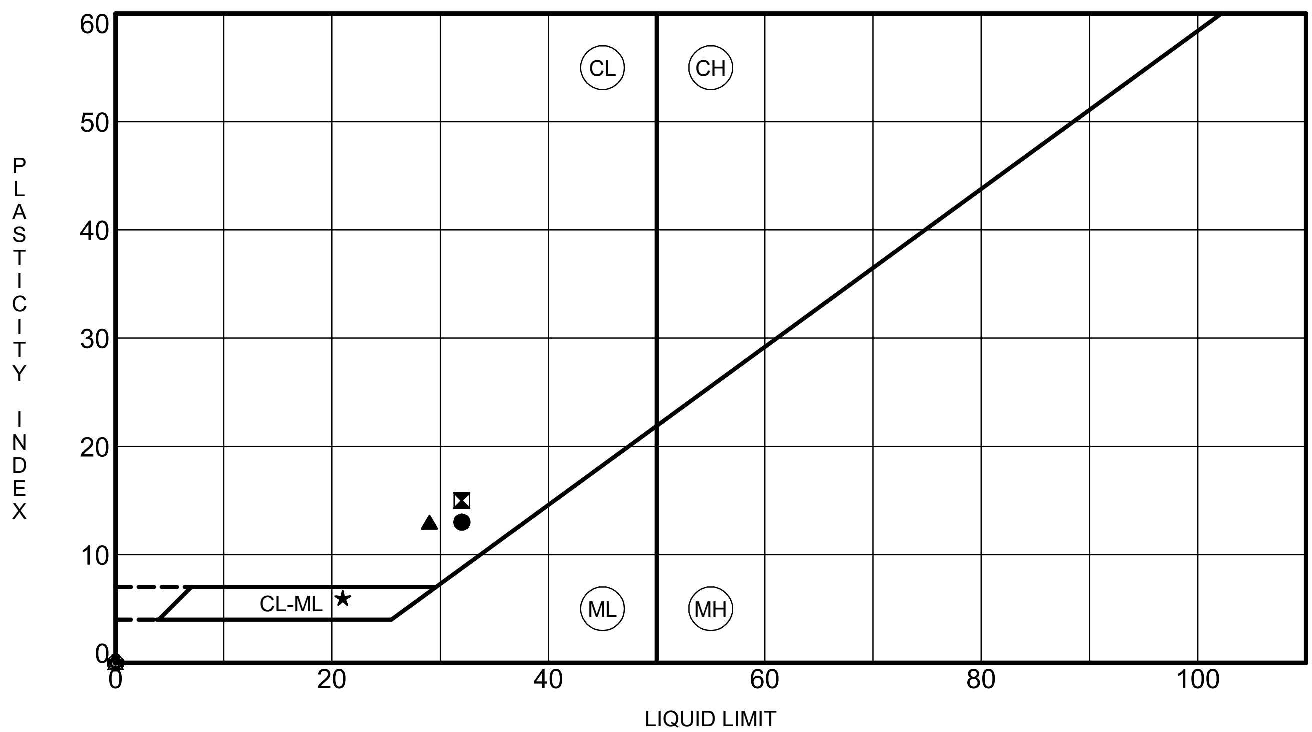
## Summary of Laboratory Results

**Vistra Energy**
**Hennepin, Illinois**
**J037936.01**

# APPENDIX B

## Atterberg Limits Results




| | Boring | Depth (ft.) | LL | PL | PI | Fines | Sample Description |
|---|---|---|---|---|---|---|---|
| ● | **MW55** | **15.0** | **32** | **19** | **13** | **48** | **CLAYEY SAND(SC)** |
| ⧗ | **SB52** | **4.0** | **32** | **17** | **15** | **78** | **LEAN CLAY with SAND(CL)** |
| ▲ | **SB53** | **2.0** | **29** | **16** | **13** | **51** | **SANDY LEAN CLAY(CL)** |
| ★ | **SB55** | **50.0** | **21** | **15** | **6** | **17** | **SILTY, CLAYEY GRAVEL with SAND(GC-GM)** |
| ⊙ | **XPW02** | **14.0** | **NP** | **NP** | **NP** | **79** | **SILT with SAND(ML)** |
| ✿ | **XPW02** | **16.0** | **NP** | **NP** | **NP** | **77** | **SILT with SAND(ML)** |
| ○ | **XPW03** | **14.0** | **NP** | **NP** | **NP** | **86** | **SILT(ML)** |
| △ | **XPW03** | **18.0** | **NP** | **NP** | **NP** | **81** | **SILT with SAND(ML)** |

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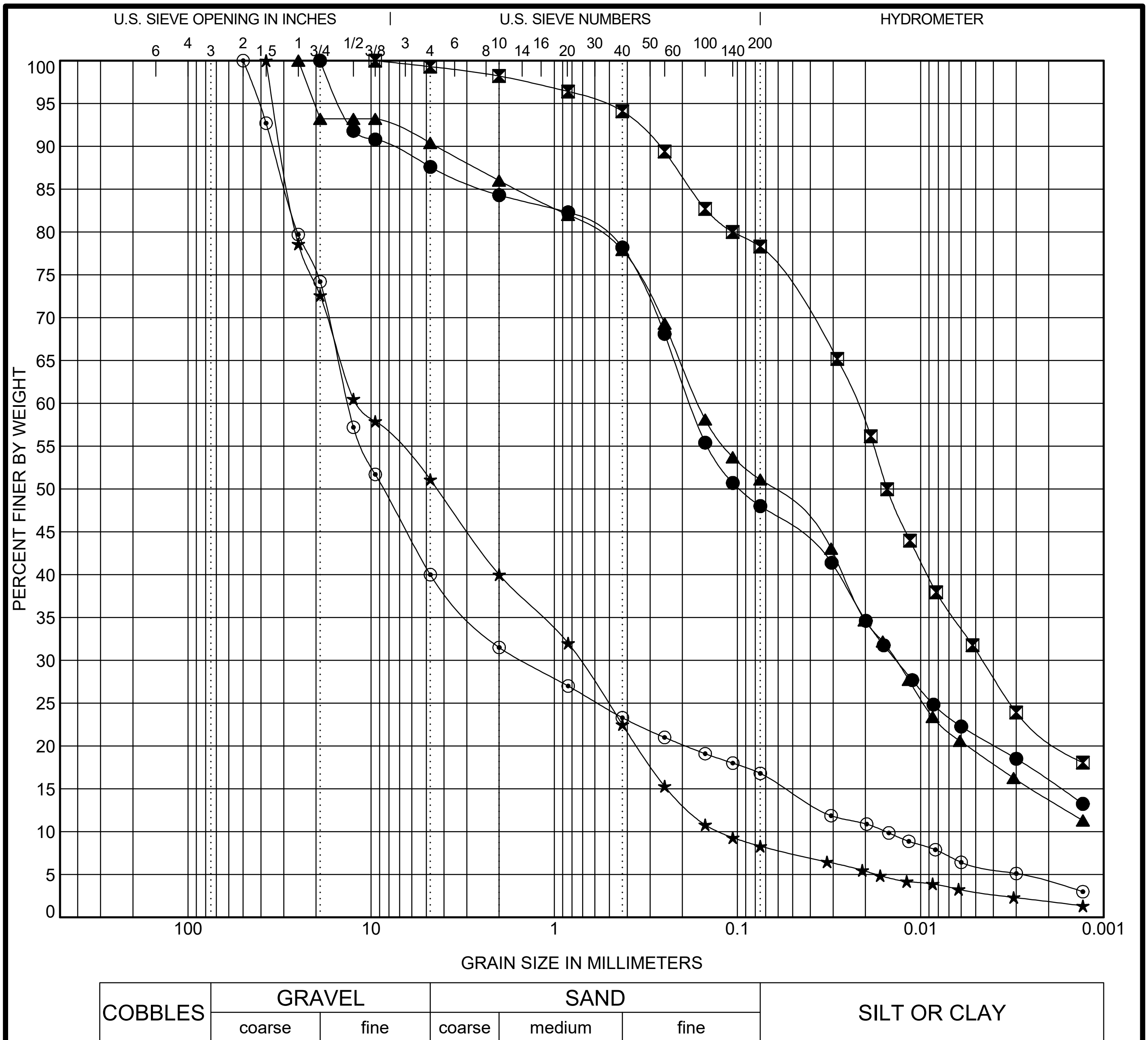
# ATTERBERG LIMITS RESULTS

**Vistra Energy**
**Hennepin, Illinois**
**J037936.01**

# APPENDIX C

## Grain Size Distribution




| | Boring | Depth (ft.) | Sample Description | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | **MW55** | **15.0** | **CLAYEY SAND(SC)** | **32** | **19** | **13** | | |
| ⧗ | **SB52** | **4.0** | **LEAN CLAY with SAND(CL)** | **32** | **17** | **15** | | |
| ▲ | **SB53** | **2.0** | **SANDY LEAN CLAY(CL)** | **29** | **16** | **13** | | |
| ★ | **SB53** | **56.0** | | | | | **0.36** | **95.13** |
| ⊙ | **SB55** | **50.0** | **SILTY, CLAYEY GRAVEL with SAND(GC-GM)** | **21** | **15** | **6** | **10.79** | **862.67** |

| | Boring | Depth (ft.) | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | **MW55** | **15.0** | **19** | **0.18** | **0.01** | | **12.4** | **39.6** | **26.7** | **21.3** |
| ⧗ | **SB52** | **4.0** | **9.5** | **0.02** | **0** | | **0.7** | **21.0** | **47.1** | **31.2** |
| ▲ | **SB53** | **2.0** | **25** | **0.16** | **0.01** | | **9.6** | **39.3** | **31.8** | **19.3** |
| ★ | **SB53** | **56.0** | **37.5** | **11.86** | **0.73** | **0.125** | **48.9** | **42.8** | **5.3** | **3.0** |
| ⊙ | **SB55** | **50.0** | **50** | **13.39** | **1.5** | **0.016** | **60.0** | **23.2** | **10.7** | **6.1** |

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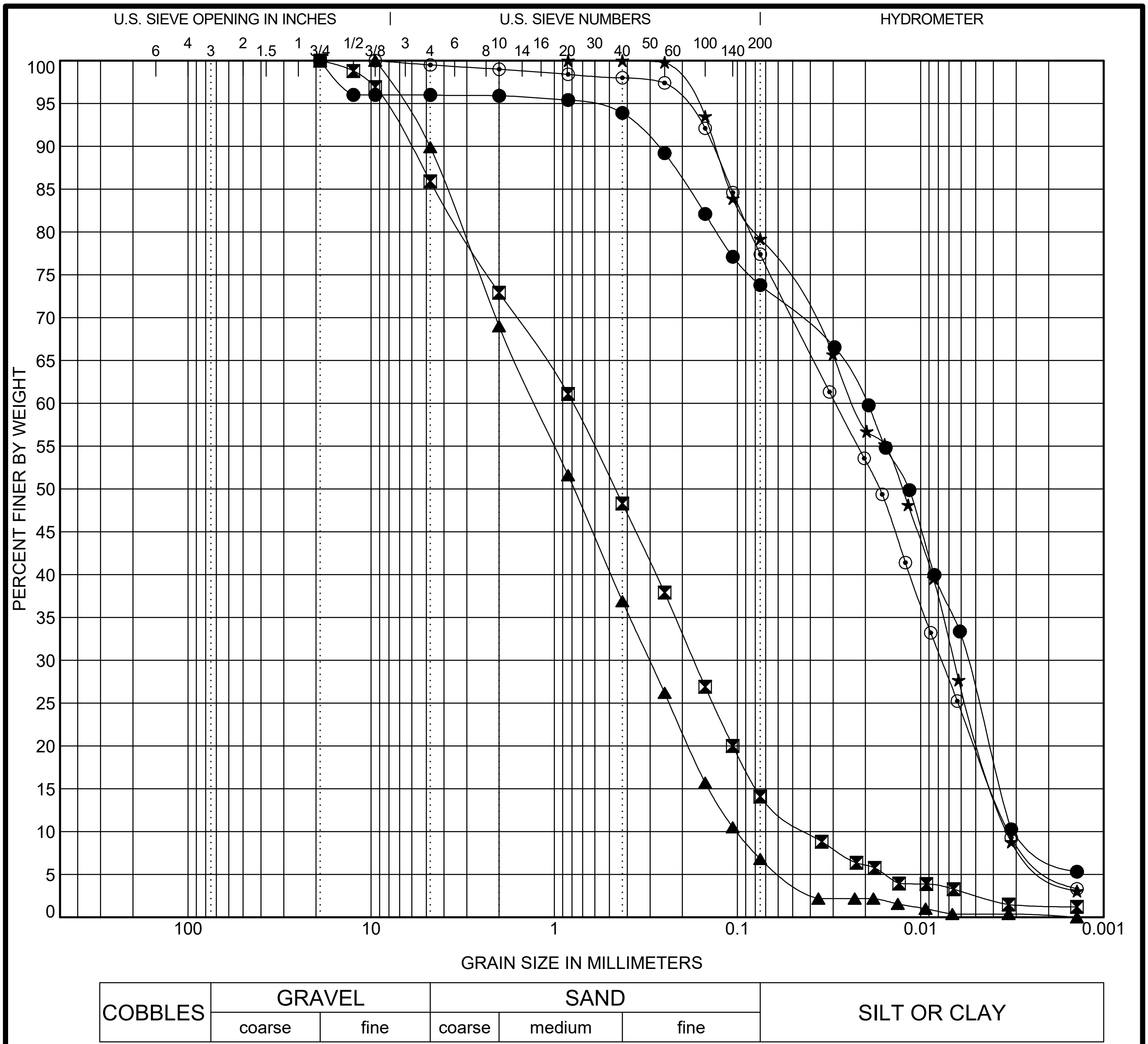
# GRAIN SIZE DISTRIBUTION

**Vistra Energy**
**Hennepin, Illinois**
**J037936.01**

GRAIN SIZE 2018 J037936.01 - VISTRA HENNEPIN.GPJ 00 CLONE ME.GPJ 3/26/21




| | Boring | Depth (ft.) | Sample Description | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | **XPW01** | **10.0** | | | | | **0.52** | **6.37** |
| ⊠ | **XPW01** | **12.0** | | | | | **0.92** | **19.28** |
| ▲ | **XPW01** | **15.0** | | | | | **0.71** | **12.62** |
| ★ | **XPW02** | **14.0** | **SILT with SAND(ML)** | **NP** | **NP** | **NP** | **0.57** | **6.89** |
| ⊙ | **XPW02** | **16.0** | **SILT with SAND(ML)** | **NP** | **NP** | **NP** | **0.62** | **8.84** |

| | Boring | Depth (ft.) | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | **XPW01** | **10.0** | **19** | **0.02** | **0.01** | **0.003** | **4.0** | **22.2** | **47.6** | **26.2** |
| ⊠ | **XPW01** | **12.0** | **19** | **0.79** | **0.17** | **0.041** | **14.1** | **71.8** | **11.5** | **2.6** |
| ▲ | **XPW01** | **15.0** | **9.5** | **1.28** | **0.3** | **0.101** | **10.1** | **83.1** | **6.4** | **0.4** |
| ★ | **XPW02** | **14.0** | **0.84** | **0.02** | **0.01** | **0.003** | **0.0** | **20.8** | **57.7** | **21.5** |
| ⊙ | **XPW02** | **16.0** | **9.5** | **0.03** | **0.01** | **0.003** | **0.5** | **22.1** | **57.6** | **19.8** |

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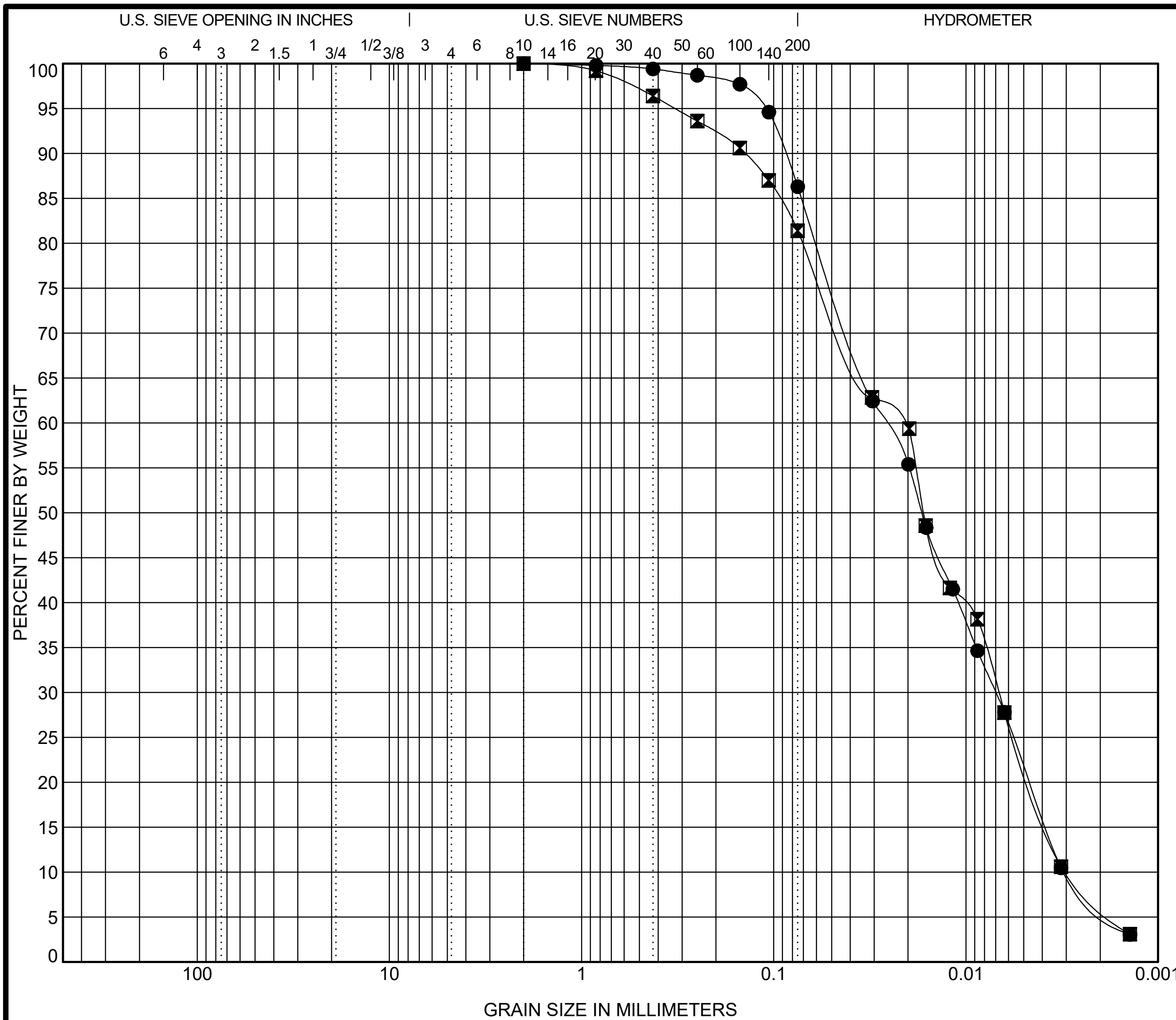
# GRAIN SIZE DISTRIBUTION

**Vistra Energy**
**Hennepin, Illinois**
**J037936.01**

GRAIN SIZE 2018 J037936.01 - VISTRA HENNEPIN.GPJ 00 CLONE ME.GPJ 3/26/21




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| | Boring | Depth (ft.) | Sample Description | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | **XPW03** | **14.0** | **SILT(ML)** | **NP** | **NP** | **NP** | **0.61** | **8.69** |
| ⊠ | **XPW03** | **18.0** | **SILT with SAND(ML)** | **NP** | **NP** | **NP** | **0.71** | **7.14** |

| | Boring | Depth (ft.) | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | **XPW03** | **14.0** | **2** | **0.03** | **0.01** | **0.003** | **0.0** | **13.7** | **64.4** | **21.9** |
| ⊠ | **XPW03** | **18.0** | **2** | **0.02** | **0.01** | **0.003** | **0.0** | **18.6** | **59.5** | **21.9** |

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## GRAIN SIZE DISTRIBUTION

**Vistra Energy**
**Hennepin, Illinois**
**J037936.01**

# APPENDIX D

## Test Report

# TEST REPORT

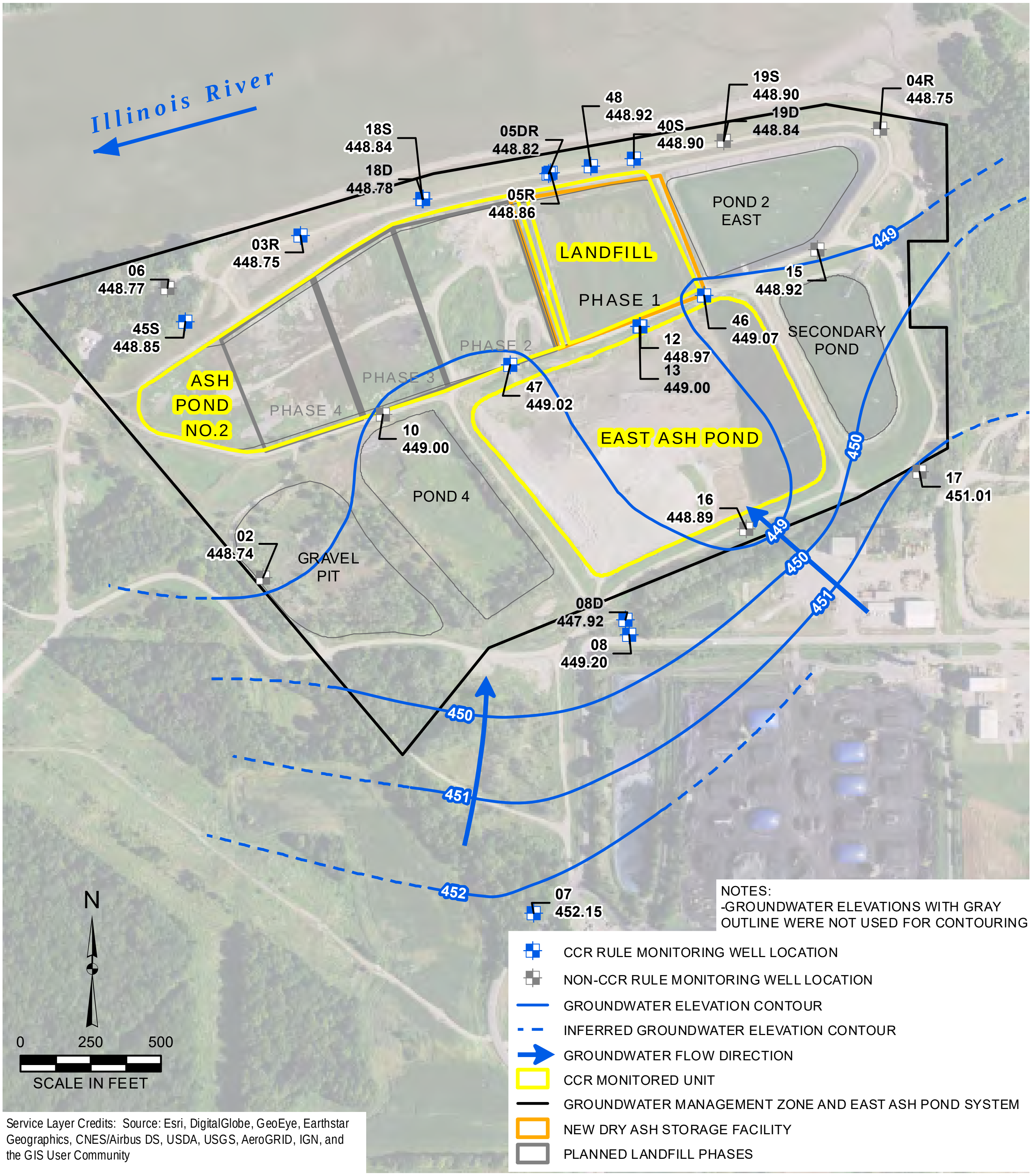
**Prepared For:**
**Geosyntec Consultants, Inc.**
**941 Chatham Lane Suite 103**
**Columbus, Ohio 43221**

| | | |
|---|---|---|
| **Project No.:** | **J037936.01** | **March 29, 2021** |
| **Project Name:** | **Vistra Energy - Hennepin** |  |
| **Sampled By:** | **Geotechnology, Inc.** | |
| **Attention:** | **Ms. Allison Kreinberg** | |

## HYDRAULIC CONDUCTIVITY (PERMEABILITY) TEST & DENSITY DETERMINATION (UNIT WEIGHT) ASTM D5084 & D7263

| Sample ID | Moisture Content (%) | Initial Wet Density (pcf) | Initial Dry Density (pcf) | Hydraulic Conductivity (cm/s) |
|---|---|---|---|---|
| MW55-(15-17.5) | 14.4 | 124.5 | 108.8 | $1.5 \times 10^{-7}$ |
| SB52-(6-8) | 24.8 | 118.8 | 95.2 | $7.1 \times 10^{-8}$ |
| SB53-(2-4) | 13.6 | 136.4 | 120.1 | $2.4 \times 10^{-8}$ |
| XPW02-(14-16) | 123.3 | 79.9 | 35.8 | $2.9 \times 10^{-4}$ |
| XPW03-(14-16) | 177.0 | 76.9 | 27.8 | $1.7 \times 10^{-4}$ |
| XPW03-(18-20) | 138.8 | 80.4 | 33.7 | $2.0 \times 10^{-4}$ |

# APPENDIX C
# GROUNDWATER CONTOUR MAPS AND ELEVATIONS




DRAWN BY/DATE:
SDS 1/25/17
REVIEWED BY/DATE:
TBN 1/26/17
APPROVED BY/DATE:
JJW 2/9/17

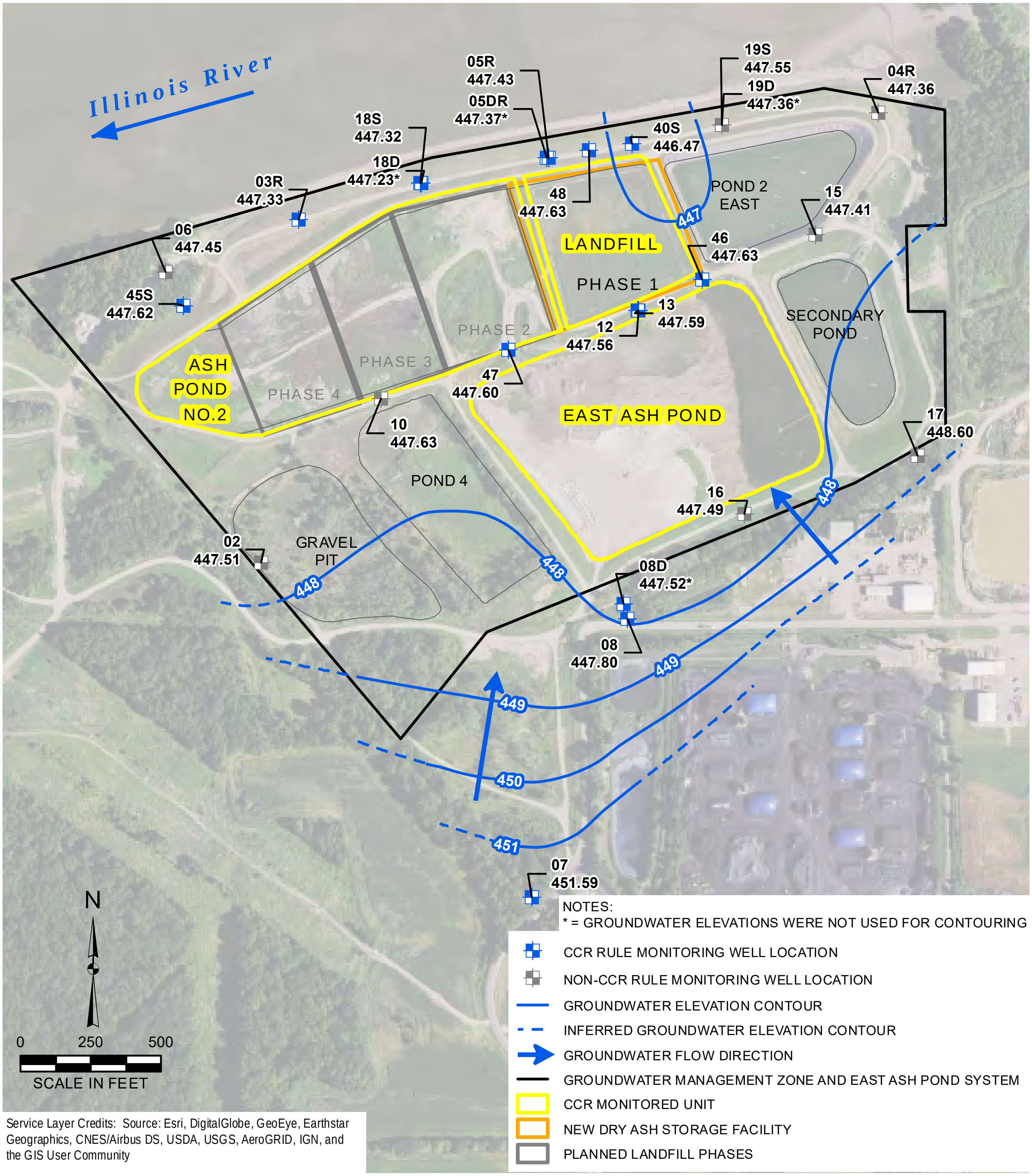
**HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)**
**UPPERMOST AQUIFER UNIT**
**GROUNDWATER ELEVATION CONTOUR MAP**
**ROUND 1: DECEMBER 8, 2015**

DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY




DRAWN BY/DATE:
SDS 1/25/17
REVIEWED BY/DATE:
TBN 1/26/17
APPROVED BY/DATE:
JJW 2/9/17

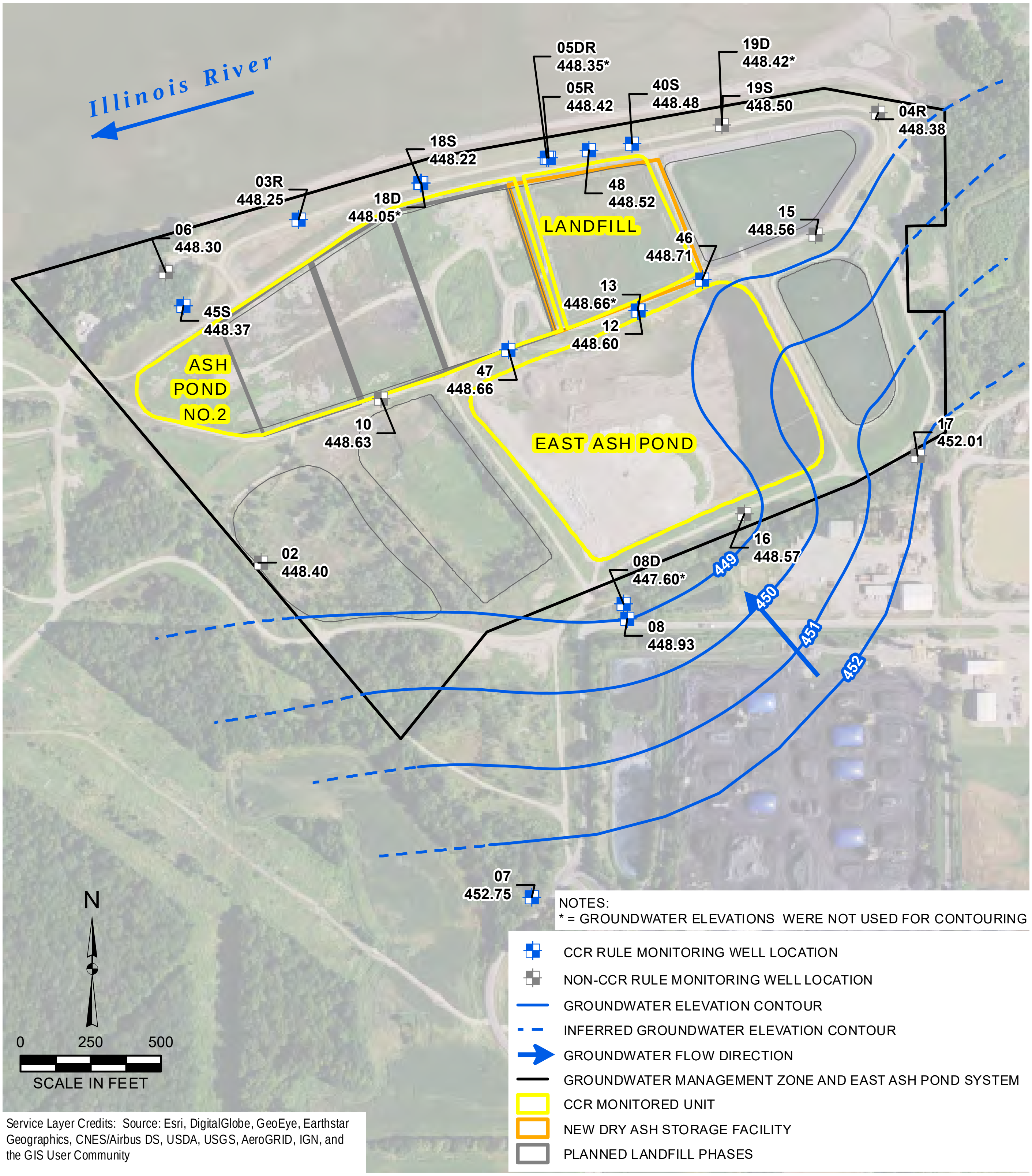
**HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)**
**UPPERMOST AQUIFER UNIT**
**GROUNDWATER ELEVATION CONTOUR MAP**
**ROUND 2: MARCH 8, 2016**

DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



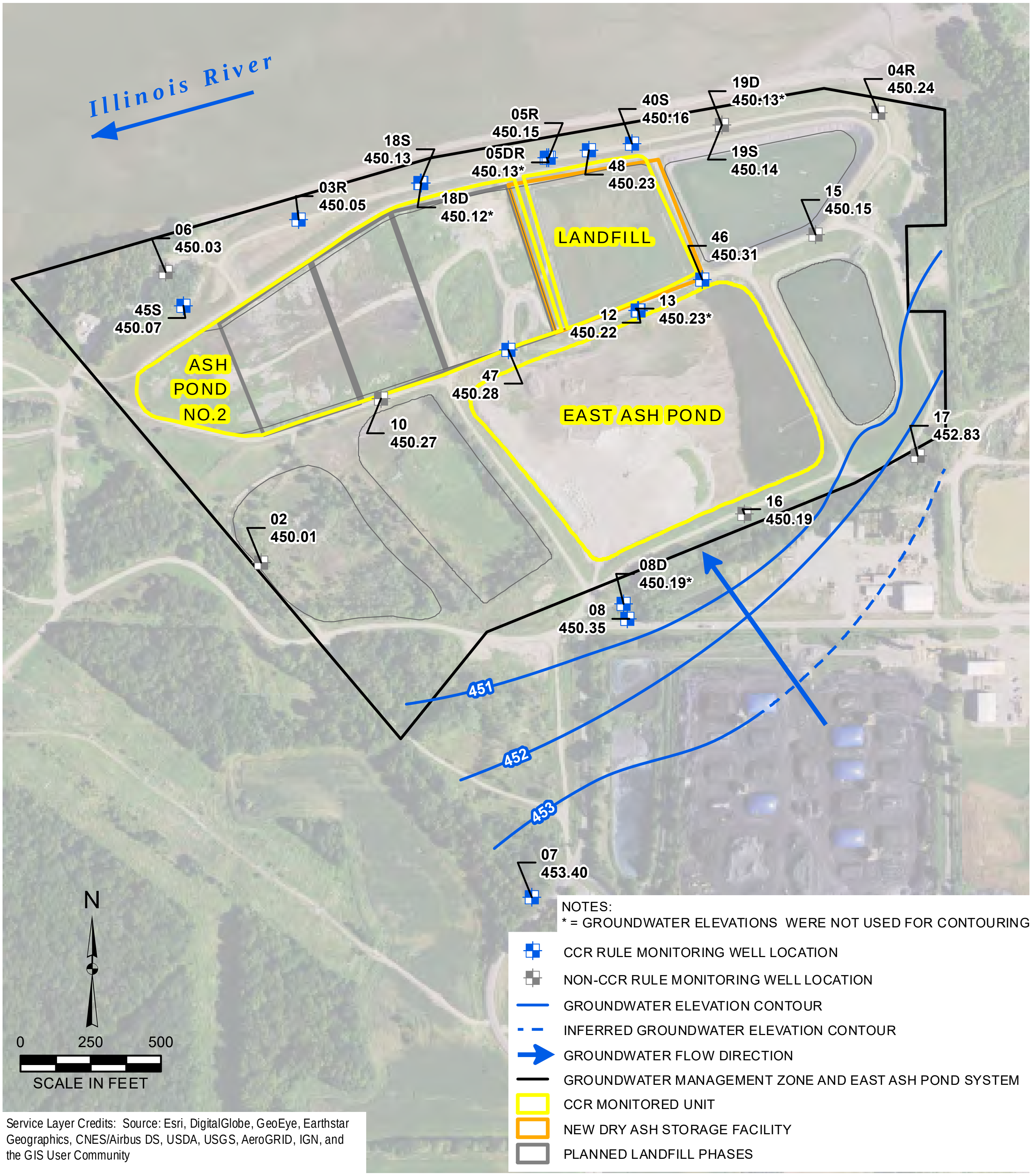

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

NOTES:
* = GROUNDWATER ELEVATIONS WERE NOT USED FOR CONTOURING

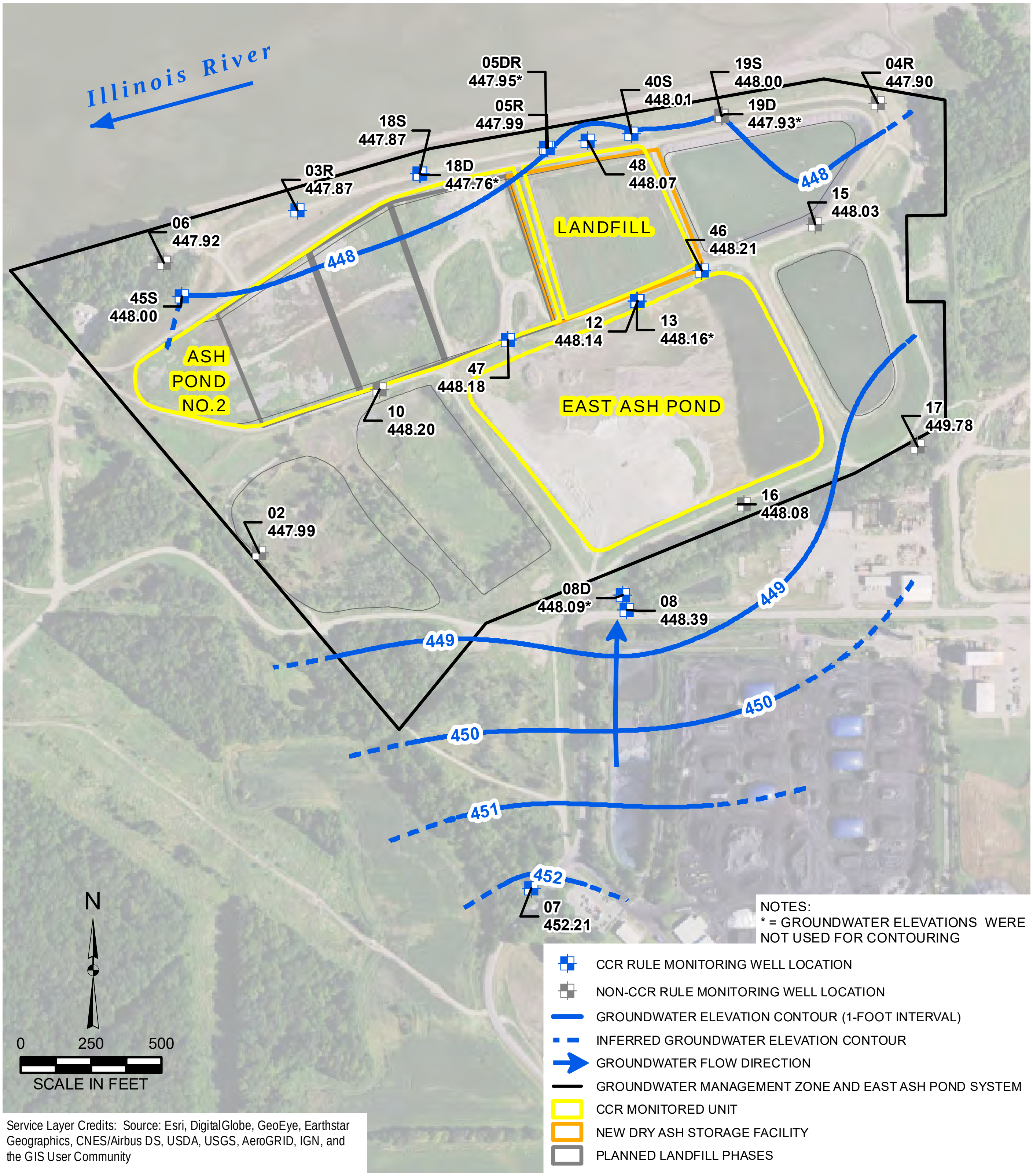
CCR RULE MONITORING WELL LOCATION
NON-CCR RULE MONITORING WELL LOCATION
GROUNDWATER ELEVATION CONTOUR
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
GROUNDWATER MANAGEMENT ZONE AND EAST ASH POND SYSTEM
CCR MONITORED UNIT
NEW DRY ASH STORAGE FACILITY
PLANNED LANDFILL PHASES

| DRAWN BY/DATE: SDS 1/25/17<br>REVIEWED BY/DATE: TBN 1/26/17<br>APPROVED BY/DATE: JJW 2/9/17 | **HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)<br>UPPERMOST AQUIFER UNIT<br>GROUNDWATER ELEVATION CONTOUR MAP<br>ROUND 3: JUNE 7, 2016**<br><br>DYNEGY CCR RULE GROUNDWATER MONITORING<br>HENNEPIN POWER STATION<br>HENNEPIN, ILLINOIS | PROJECT NO: 2285<br>FIGURE NO: 1<br>Natural Resource Technology<br>AN OBG COMPANY |
|---|---|---|

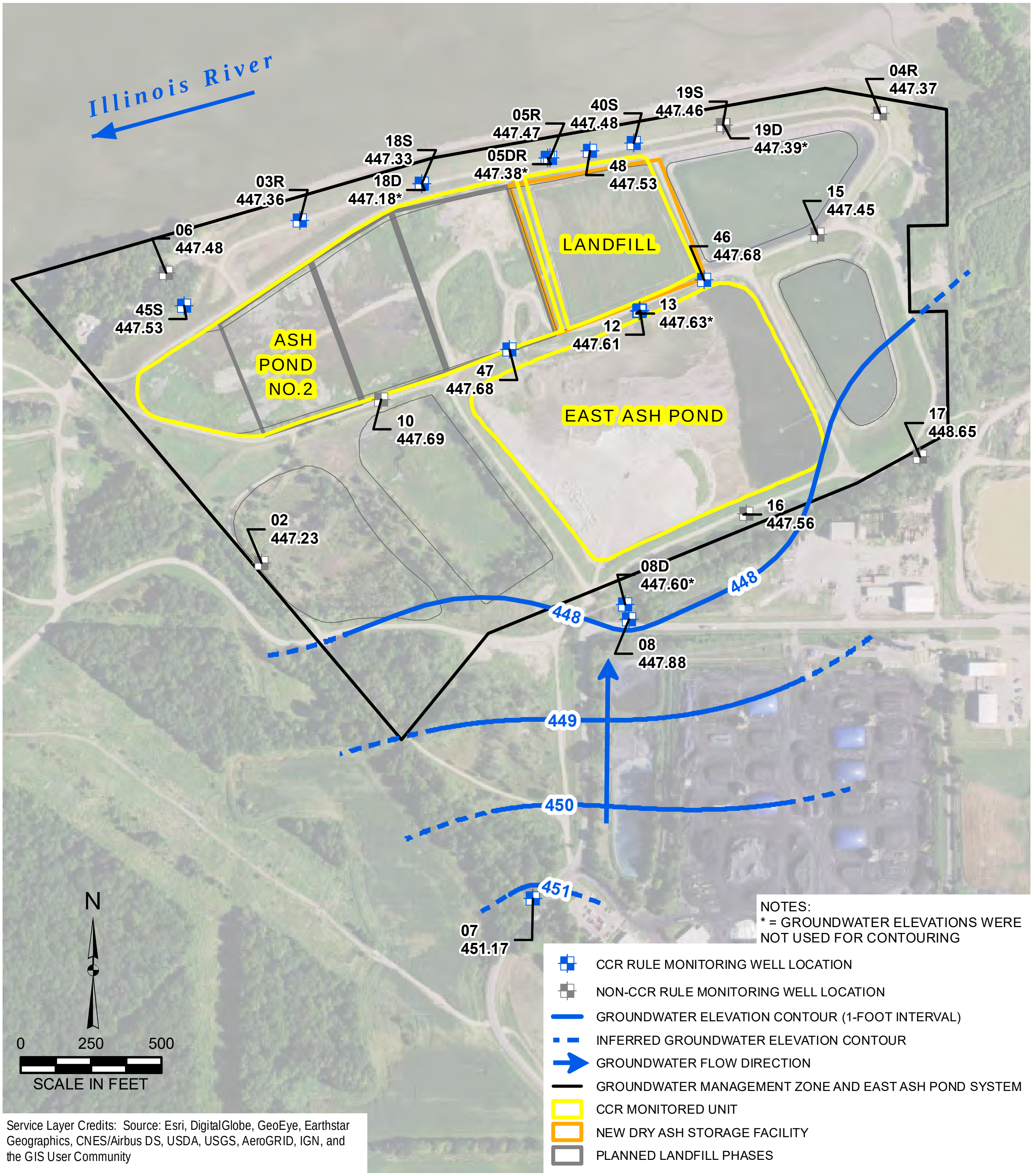
Y:\Mapping\Projects\22\2285\MXD\GW_Contours\Round_03\R3_HennepinEast_GW_Contours.mxd Author: stolzsd; Date/Time: 4/11/2017, 6:08:24 PM



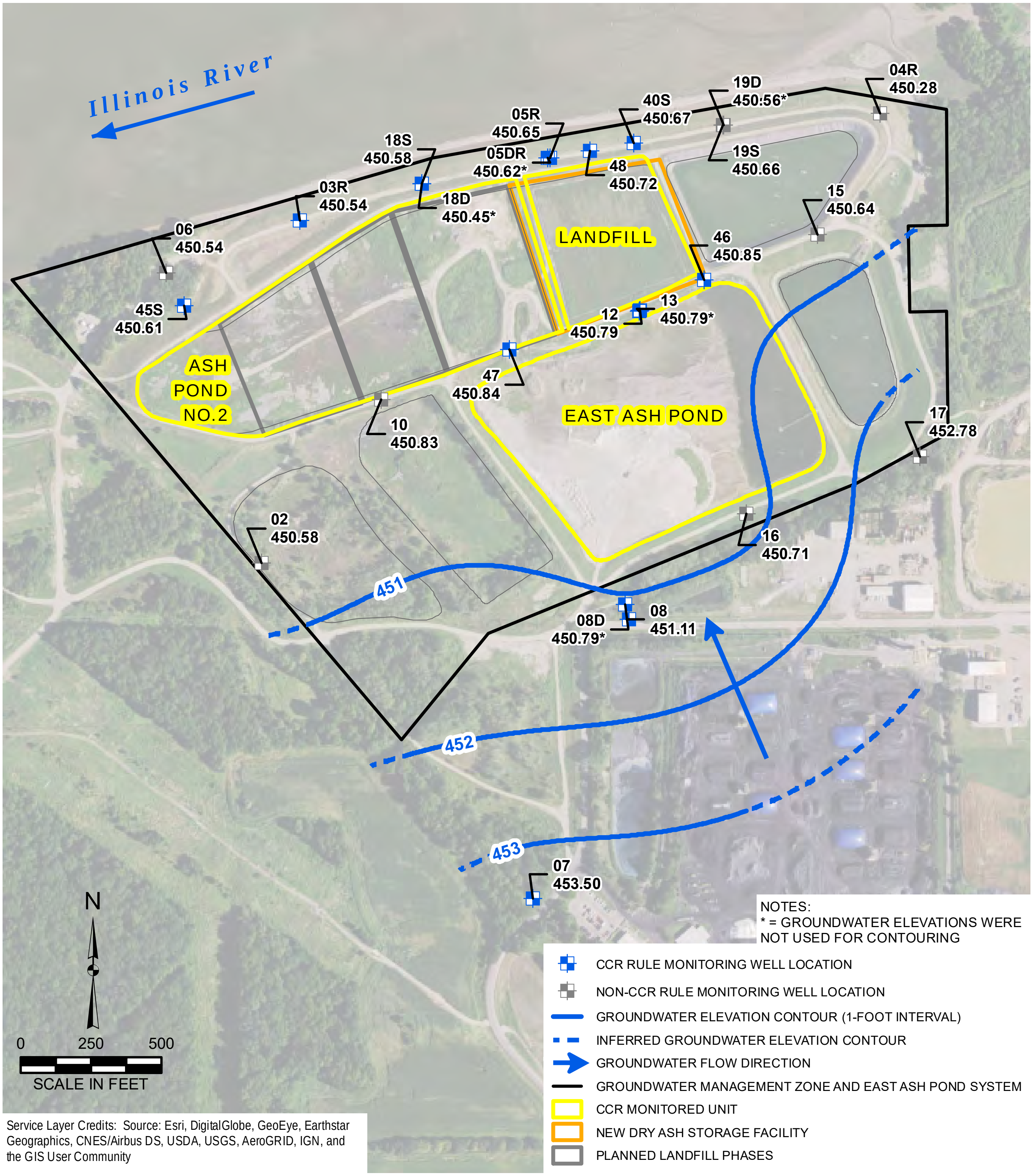

| DRAWN BY/DATE: SDS 1/25/17<br>REVIEWED BY/DATE: TBN 1/27/17<br>APPROVED BY/DATE: JJW 2/7/17 | **HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)<br>UPPERMOST AQUIFER UNIT<br>GROUNDWATER ELEVATION CONTOUR MAP<br>ROUND 4: SEPTEMBER 9, 2016**<br><br>DYNEGY CCR RULE GROUNDWATER MONITORING<br>HENNEPIN POWER STATION<br>HENNEPIN, ILLINOIS | PROJECT NO: 2285<br><br>FIGURE NO: 1<br><br>Natural Resource Technology<br>AN OBG COMPANY |
|---|---|---|




| DRAWN BY/DATE: SDS 3/6/17<br>REVIEWED BY/DATE: TBN 3/6/17<br>APPROVED BY/DATE: JJW 9/1/17 | **HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)<br>UPPERMOST AQUIFER UNIT<br>GROUNDWATER ELEVATION CONTOUR MAP<br>ROUND 5: DECEMBER 7, 2016**<br><br>DYNEGY CCR RULE GROUNDWATER MONITORING<br>HENNEPIN POWER STATION<br>HENNEPIN, ILLINOIS | PROJECT NO: 2285<br><br>FIGURE NO: 1<br><br>Natural Resource Technology<br>AN OBG COMPANY |
|---|---|---|




| DRAWN BY/DATE: SDS 3/6/17<br>REVIEWED BY/DATE: TBN 3/6/17<br>APPROVED BY/DATE: JJW 9/1/17 | **HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)**<br>**UPPERMOST AQUIFER UNIT**<br>**GROUNDWATER ELEVATION CONTOUR MAP**<br>**ROUND 6: FEBRUARY 20, 2017**<br><br>DYNEGY CCR RULE GROUNDWATER MONITORING<br>HENNEPIN POWER STATION<br>HENNEPIN, ILLINOIS | PROJECT NO: 2285<br>FIGURE NO: 1<br>Natural Resource Technology<br>AN OBG COMPANY |
|---|---|---|




DRAWN BY/DATE:
SDS 5/25/17
REVIEWED BY/DATE:
TBN 5/25/17
APPROVED BY/DATE:
JJW 9/1/17

**HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)**
**UPPERMOST AQUIFER UNIT**
**GROUNDWATER ELEVATION CONTOUR MAP**
**ROUND 7: APRIL 25, 2017**

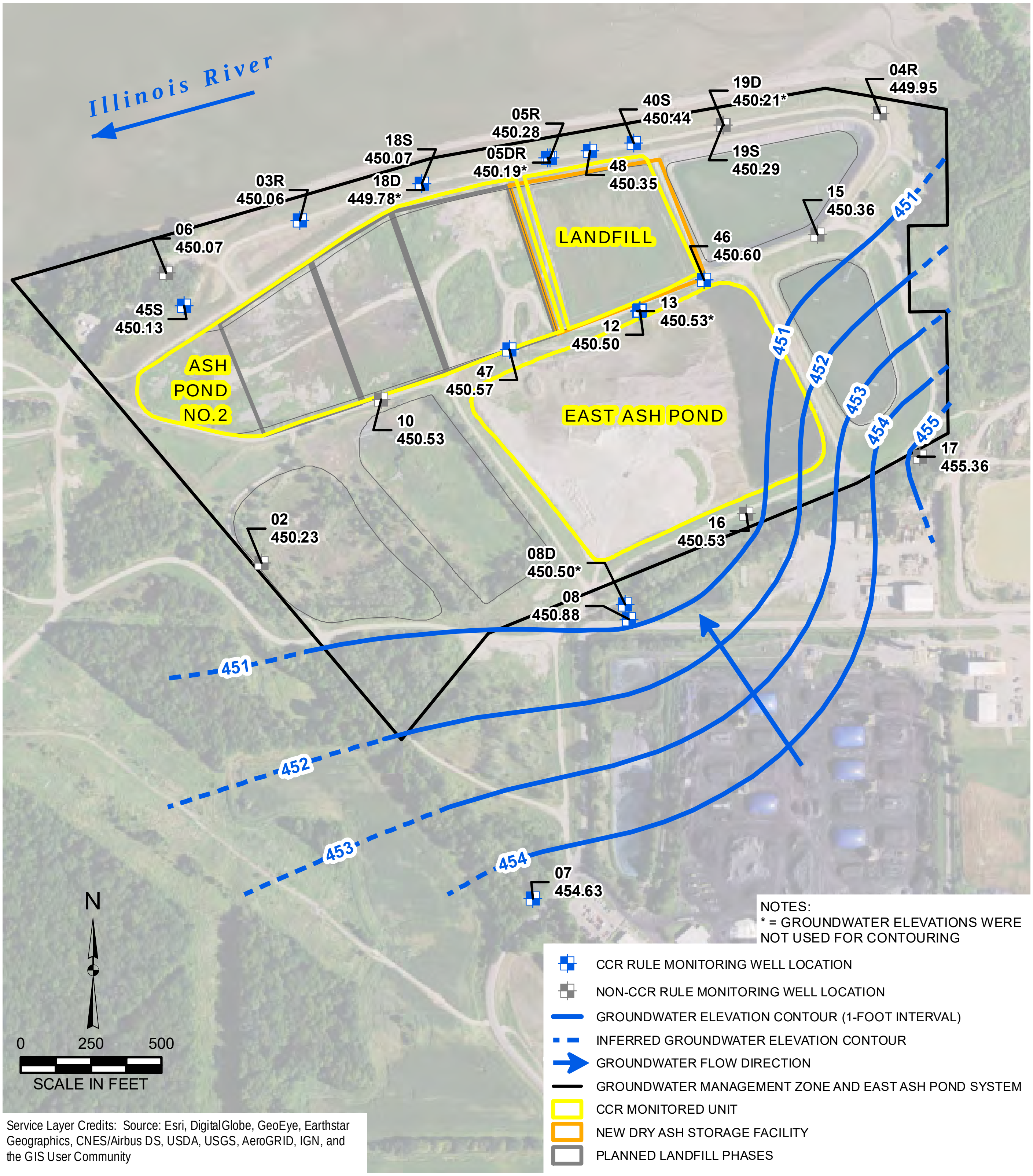
DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

Y:\Mapping\Projects\22\2285\MXD\GW_Contours\Round_07\R7_HennepinEast_GW_Contours.mxd Author: stolzsd; Date/Time: 9/8/2017, 4:33:47 PM




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

Y:\Mapping\Projects\22\2285\MXD\GW_Contours\Round_08\R8_HennepinEast_GW_Contours.mxd Author: stolzsd; Date/Time: 9/8/2017, 4:31:23 PM

DRAWN BY/DATE: SDS 7/20/17
REVIEWED BY/DATE: TBN 7/20/17
APPROVED BY/DATE: JJW 9/1/17

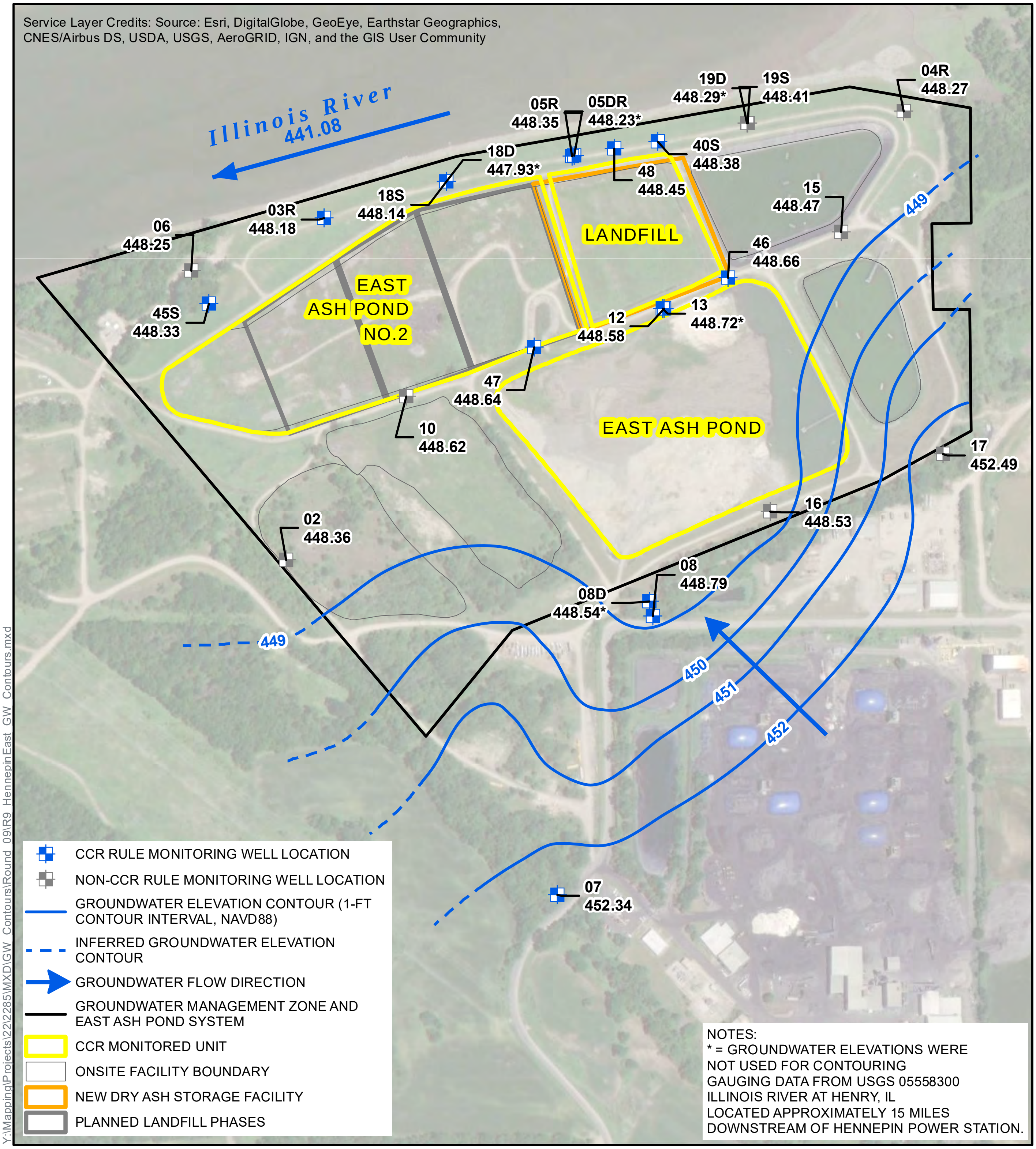
**HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)**
**UPPERMOST AQUIFER UNIT**
**GROUNDWATER ELEVATION CONTOUR MAP**
**ROUND 8: JUNE 8, 2017**

DYNEGY CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



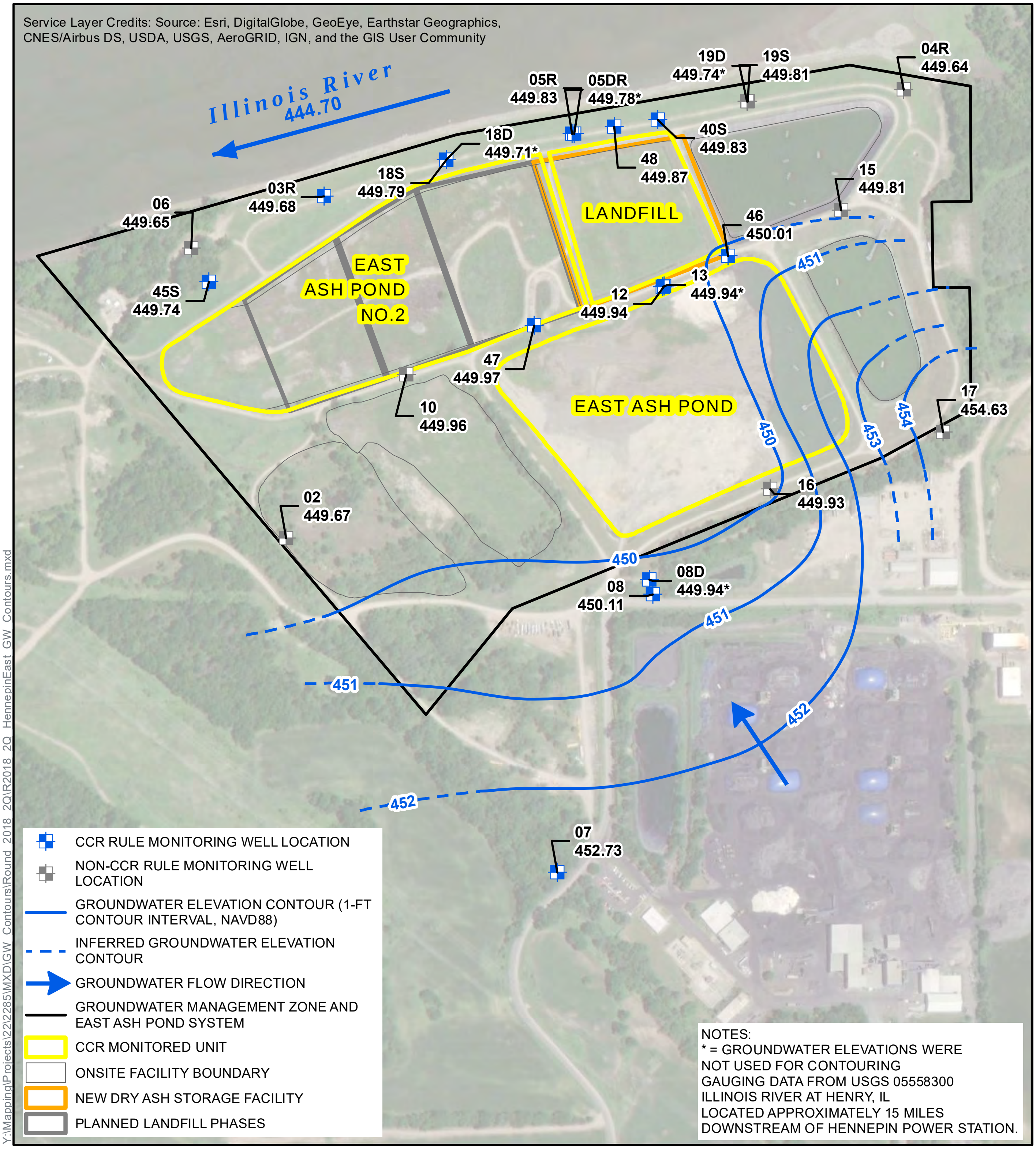

**HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)**
**GROUNDWATER ELEVATION CONTOUR MAP**
**NOVEMBER 15, 2017**

CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

0 125 250 500
Feet

N

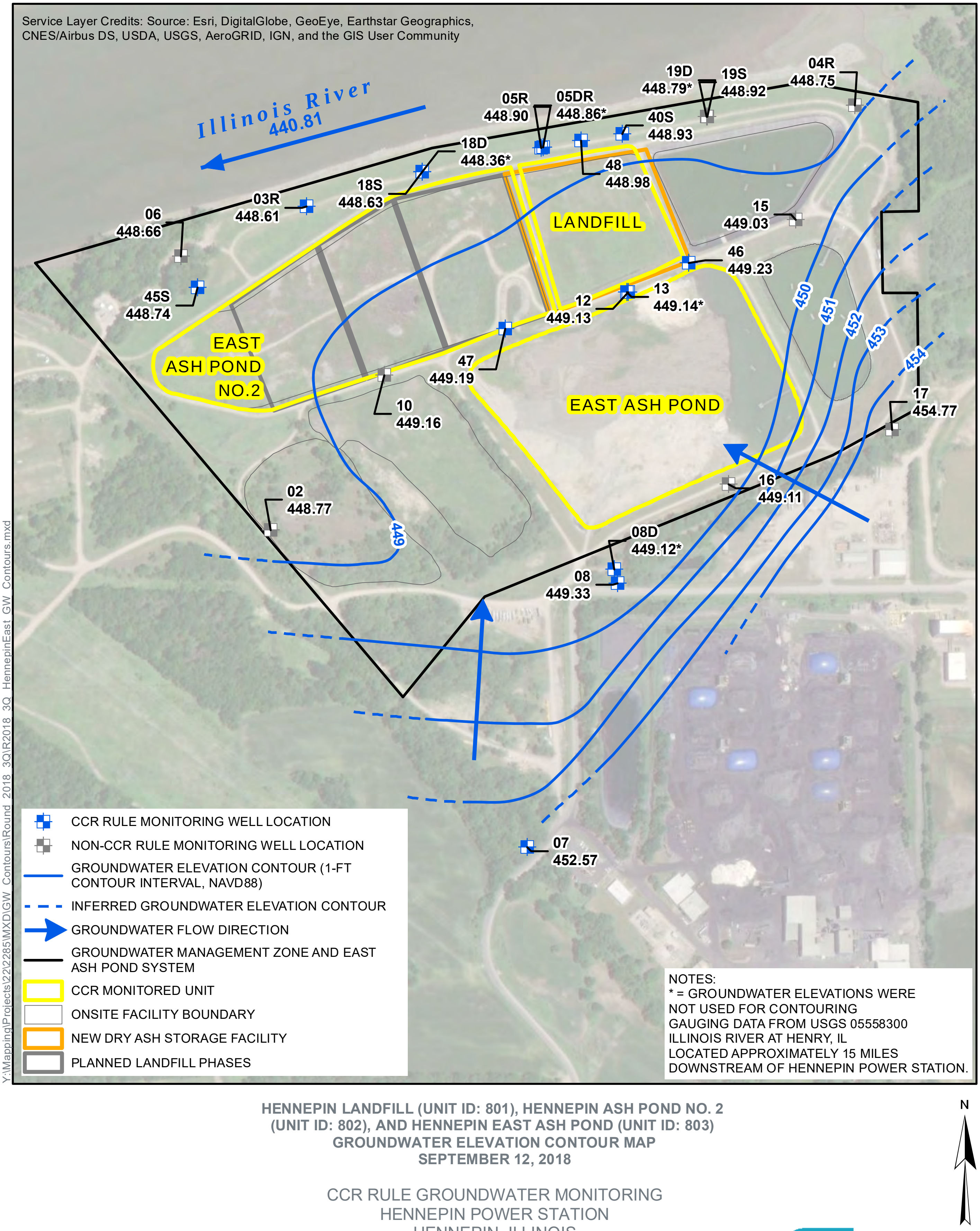
O'BRIEN & GERE ENGINEERS, INC.




**HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803) GROUNDWATER ELEVATION CONTOUR MAP**
**JUNE 13, 2018**

CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

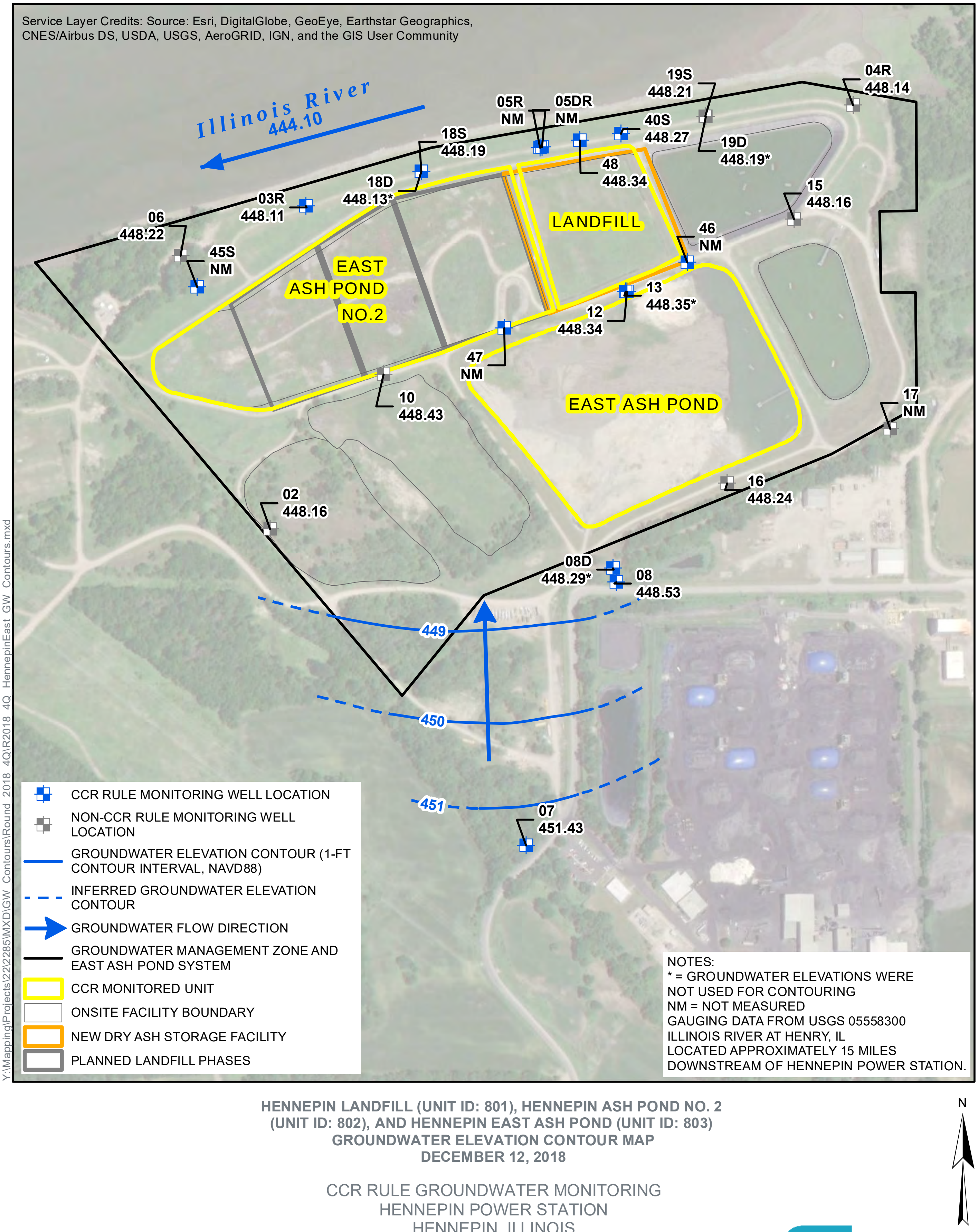
O'BRIEN & GERE ENGINEERS, INC.




**HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803) GROUNDWATER ELEVATION CONTOUR MAP SEPTEMBER 12, 2018**

CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

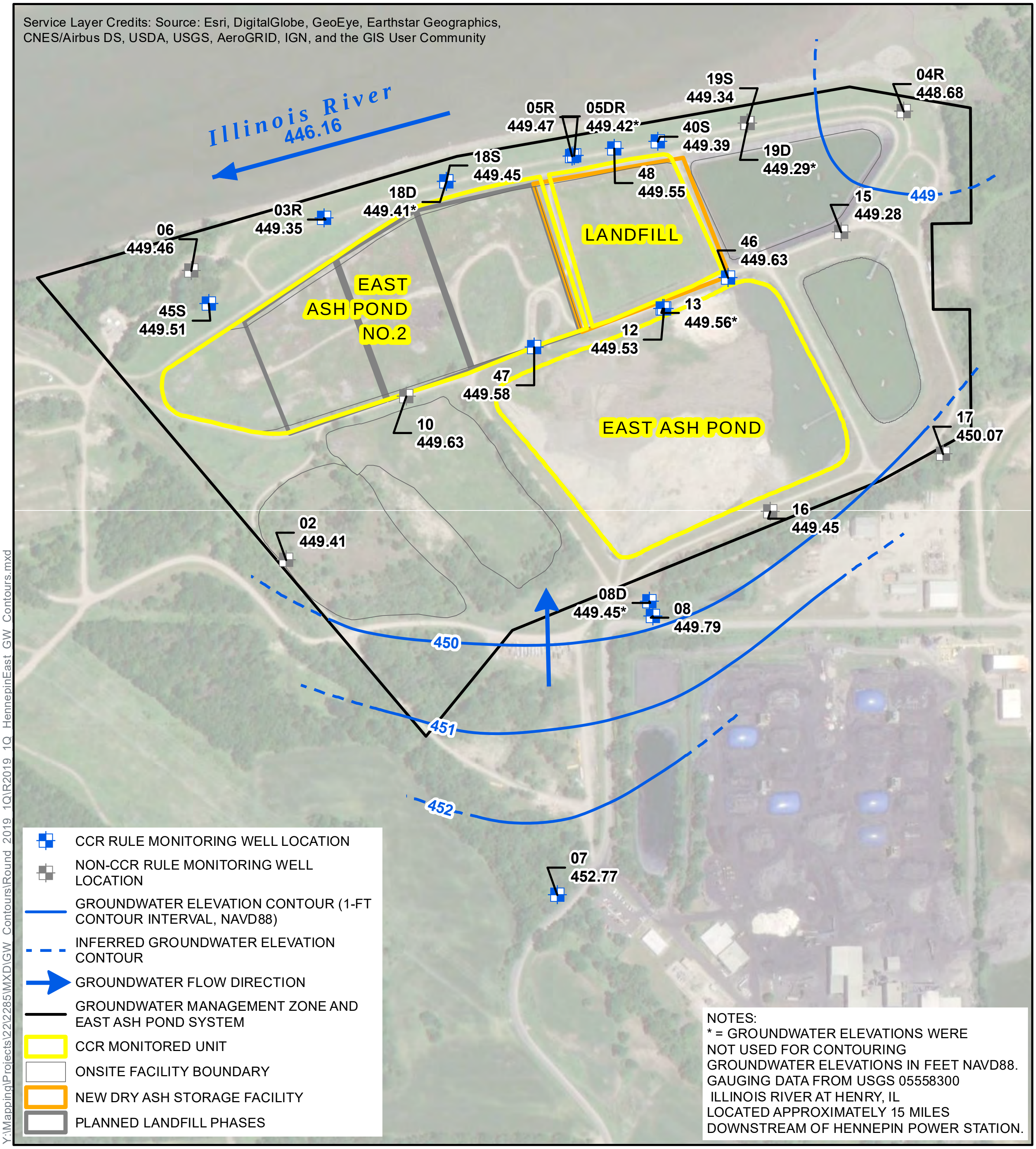
O'BRIEN & GERE ENGINEERS, INC.




**HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803) GROUNDWATER ELEVATION CONTOUR MAP DECEMBER 12, 2018**

CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

O'BRIEN & GERE ENGINEERS, INC.




Y:\Mapping\Projects\22\2285\MXD\GW_Contours\Round_2019_1Q\R2019_1Q_HennepinEast_GW_Contours.mxd

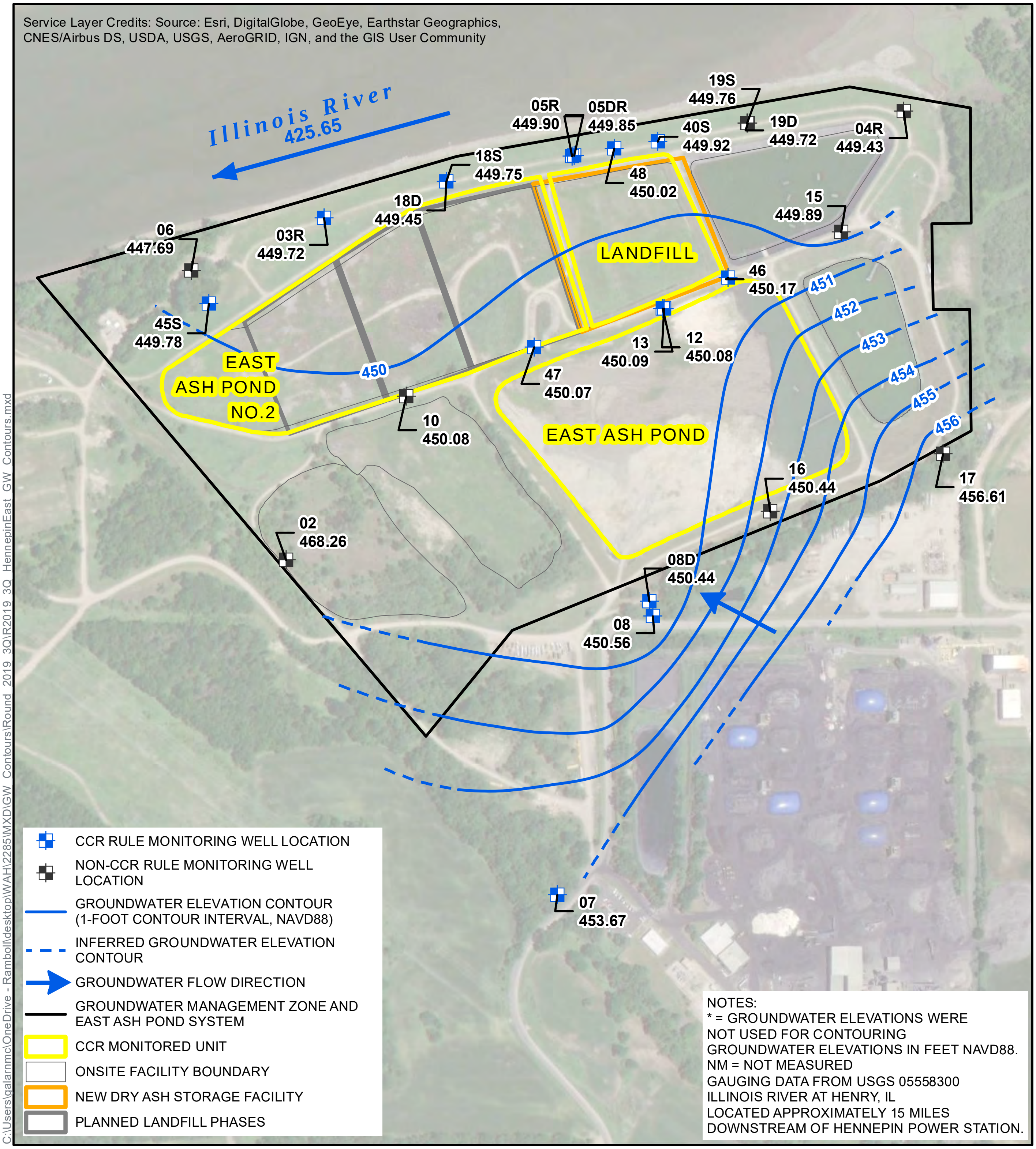
**HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803) GROUNDWATER ELEVATION CONTOUR MAP MARCH 13, 2019**

CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

0 125 250 500
Feet

N

O'BRIEN & GERE ENGINEERS, INC.



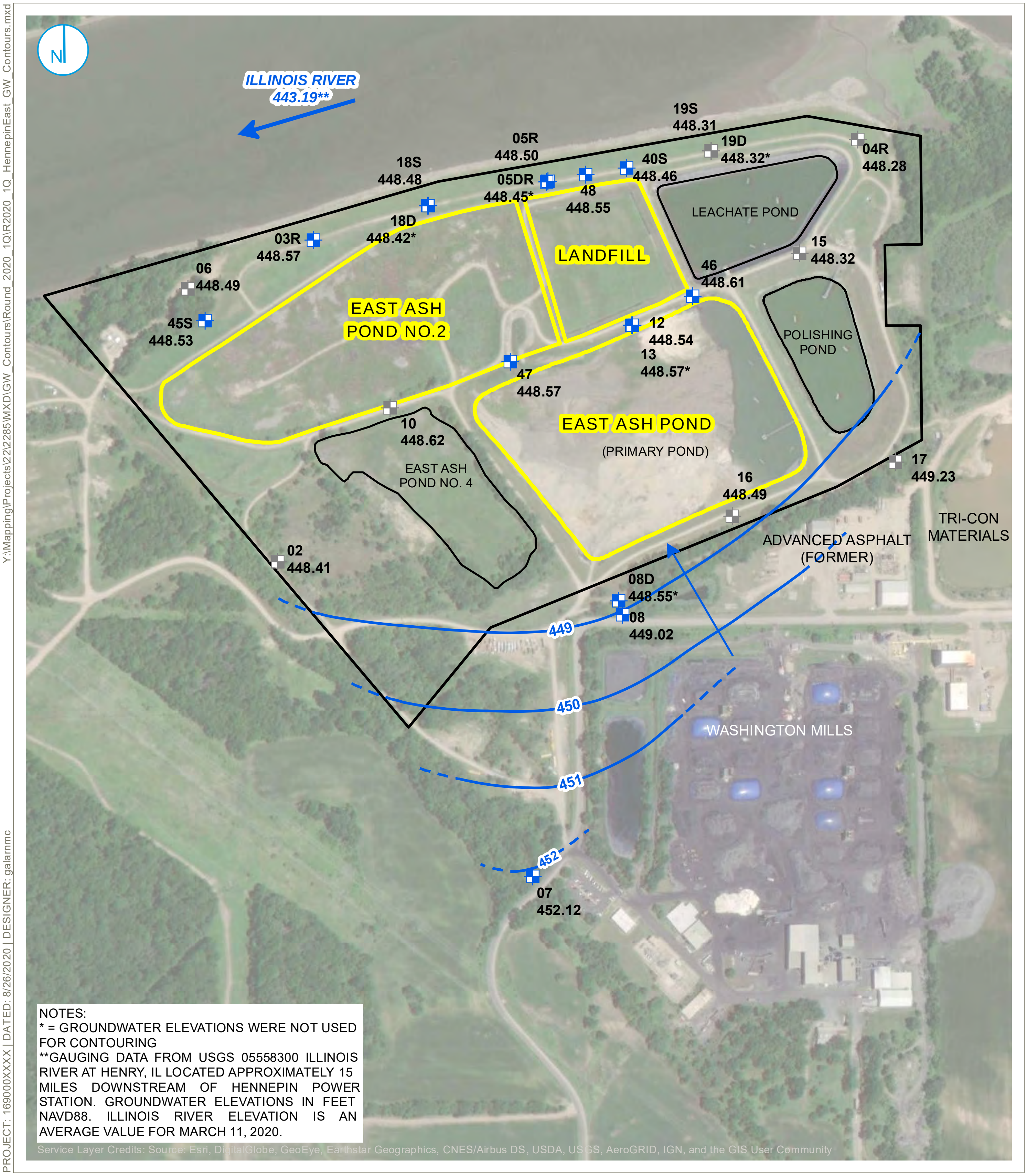

**HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)**
**GROUNDWATER ELEVATION CONTOUR MAP**
**SEPTEMBER 17, 2019**

CCR RULE GROUNDWATER MONITORING
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

0 125 250 500
Feet

N

O'BRIEN & GERE ENGINEERS, INC.




CCR MONITORING WELL
NON-CCR MONITORING WELL
GROUNDWATER ELEVATION CONTOUR (1-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
GROUNDWATER MANAGEMENT ZONE AND EAST ASH POND SYSTEM
CCR MONITORED UNIT
NON-CCR UNIT

0 250 500 Feet

## GROUNDWATER ELEVATION CONTOUR MAP
## MARCH 11, 2020

**HENNEPIN LANDFILL (UNIT ID: 801), HENNEPIN ASH POND NO. 2 (UNIT ID: 802), AND HENNEPIN EAST ASH POND (UNIT ID: 803)**
VISTRA ENERGY
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

# APPENDIX C
# GROUNDWATER CONTOUR MAPS AND ELEVATIONS
# TABLE C-1. GROUNDWATER ELEVATION RESULTS (2015-2021)

**TABLE C-1. GROUNDWATER ELEVATIONS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Groundwater Elevation (ft NAVD88) |
|---|---|---|
| 02 | 03/19/2015 | 446.28 |
| 02 | 06/22/2015 | 455.43 |
| 02 | 09/17/2015 | 448.06 |
| 02 | 12/09/2015 | 448.74 |
| 02 | 03/08/2016 | 447.51 |
| 02 | 03/10/2016 | 447.51 |
| 02 | 06/07/2016 | 448.40 |
| 02 | 06/08/2016 | 448.40 |
| 02 | 08/31/2016 | 450.01 |
| 02 | 09/01/2016 | 450.01 |
| 02 | 12/07/2016 | 447.99 |
| 02 | 12/09/2016 | 447.99 |
| 02 | 02/20/2017 | 447.23 |
| 02 | 02/22/2017 | 447.23 |
| 02 | 04/25/2017 | 450.58 |
| 02 | 04/27/2017 | 450.58 |
| 02 | 06/08/2017 | 450.23 |
| 02 | 09/07/2017 | 448.69 |
| 02 | 11/15/2017 | 448.36 |
| 02 | 11/16/2017 | 448.36 |
| 02 | 03/27/2018 | 449.04 |
| 02 | 06/13/2018 | 449.67 |
| 02 | 09/12/2018 | 448.77 |
| 02 | 12/12/2018 | 448.16 |
| 02 | 03/13/2019 | 449.41 |
| 02 | 03/14/2019 | 449.41 |
| 02 | 06/18/2019 | 452.88 |
| 02 | 09/17/2019 | 468.26 |
| 02 | 09/18/2019 | 468.26 |
| 02 | 12/11/2019 | 448.61 |
| 02 | 12/12/2019 | 448.61 |
| 02 | 03/11/2020 | 448.41 |
| 02 | 03/12/2020 | 448.41 |
| 02 | 06/03/2020 | 454.04 |
| 02 | 06/04/2020 | 454.04 |
| 02 | 09/02/2020 | 449.59 |
| 02 | 12/09/2020 | 447.06 |
| 02 | 12/10/2020 | 447.06 |
| 02 | 02/24/2021 | 446.17 |
| 02 | 03/17/2021 | 447.04 |
| 02 | 03/18/2021 | 447.09 |
| 02 | 03/22/2021 | 447.23 |
| 02 | 04/07/2021 | 447.22 |
| 02 | 05/06/2021 | 448.67 |
| 02 | 06/08/2021 | 448.45 |

**TABLE C-1. GROUNDWATER ELEVATIONS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Groundwater Elevation (ft NAVD88) |
|---|---|---|
| 02 | 06/24/2021 | 448.80 |
| 02 | 07/13/2021 | 451.11 |
| 02 | 08/03/2021 | 449.07 |
| 03R | 03/18/2015 | 446.98 |
| 03R | 06/23/2015 | 455.64 |
| 03R | 09/16/2015 | 447.92 |
| 03R | 12/08/2015 | 448.75 |
| 03R | 12/09/2015 | 448.75 |
| 03R | 03/08/2016 | 447.33 |
| 03R | 03/09/2016 | 447.33 |
| 03R | 06/07/2016 | 448.25 |
| 03R | 06/08/2016 | 448.25 |
| 03R | 08/31/2016 | 450.05 |
| 03R | 12/07/2016 | 447.87 |
| 03R | 12/08/2016 | 447.87 |
| 03R | 02/20/2017 | 447.36 |
| 03R | 02/22/2017 | 447.36 |
| 03R | 04/25/2017 | 450.54 |
| 03R | 04/26/2017 | 450.54 |
| 03R | 06/08/2017 | 450.06 |
| 03R | 06/09/2017 | 450.06 |
| 03R | 09/07/2017 | 448.45 |
| 03R | 11/15/2017 | 448.18 |
| 03R | 11/16/2017 | 448.18 |
| 03R | 03/26/2018 | 448.97 |
| 03R | 06/13/2018 | 449.68 |
| 03R | 09/12/2018 | 448.61 |
| 03R | 12/12/2018 | 448.11 |
| 03R | 03/13/2019 | 449.35 |
| 03R | 06/18/2019 | 452.79 |
| 03R | 09/17/2019 | 449.72 |
| 03R | 12/11/2019 | 448.50 |
| 03R | 12/12/2019 | 448.50 |
| 03R | 03/11/2020 | 448.57 |
| 03R | 03/12/2020 | 448.42 |
| 03R | 06/03/2020 | 454.11 |
| 03R | 09/02/2020 | 448.90 |
| 03R | 09/03/2020 | 448.90 |
| 03R | 12/09/2020 | 446.94 |
| 03R | 02/24/2021 | 446.11 |
| 03R | 03/18/2021 | 447.08 |
| 03R | 03/22/2021 | 447.22 |
| 03R | 04/07/2021 | 447.30 |
| 03R | 05/05/2021 | 448.32 |
| 03R | 06/08/2021 | 448.23 |

**TABLE C-1. GROUNDWATER ELEVATIONS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Groundwater Elevation (ft NAVD88) |
|---|---|---|
| 03R | 06/25/2021 | 448.87 |
| 03R | 07/13/2021 | 450.92 |
| 03R | 08/03/2021 | 448.79 |
| 04R | 03/18/2015 | 450.93 |
| 04R | 06/23/2015 | 455.70 |
| 04R | 09/16/2015 | 448.05 |
| 04R | 12/09/2015 | 448.75 |
| 04R | 03/08/2016 | 447.36 |
| 04R | 03/10/2016 | 447.36 |
| 04R | 06/07/2016 | 448.38 |
| 04R | 06/08/2016 | 448.38 |
| 04R | 08/31/2016 | 450.24 |
| 04R | 12/07/2016 | 447.90 |
| 04R | 12/08/2016 | 447.90 |
| 04R | 02/20/2017 | 447.37 |
| 04R | 02/22/2017 | 447.37 |
| 04R | 04/25/2017 | 450.28 |
| 04R | 04/26/2017 | 450.28 |
| 04R | 06/08/2017 | 449.95 |
| 04R | 09/07/2017 | 448.58 |
| 04R | 11/15/2017 | 448.27 |
| 04R | 11/16/2017 | 448.27 |
| 04R | 03/26/2018 | 448.84 |
| 04R | 06/13/2018 | 449.64 |
| 04R | 09/12/2018 | 448.75 |
| 04R | 12/12/2018 | 448.14 |
| 04R | 03/13/2019 | 448.68 |
| 04R | 06/18/2019 | 452.31 |
| 04R | 09/17/2019 | 449.43 |
| 04R | 12/11/2019 | 448.45 |
| 04R | 03/11/2020 | 448.28 |
| 04R | 06/03/2020 | 453.75 |
| 04R | 09/02/2020 | 448.92 |
| 04R | 09/03/2020 | 448.92 |
| 04R | 12/09/2020 | 447.04 |
| 04R | 02/24/2021 | 446.18 |
| 04R | 03/17/2021 | 447.02 |
| 04R | 03/18/2021 | 447.02 |
| 04R | 03/22/2021 | 447.21 |
| 04R | 04/07/2021 | 447.38 |
| 04R | 05/06/2021 | 448.66 |
| 04R | 06/08/2021 | 448.30 |
| 04R | 06/24/2021 | 448.89 |
| 04R | 07/13/2021 | 450.50 |
| 04R | 08/03/2021 | 448.89 |

**TABLE C-1. GROUNDWATER ELEVATIONS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Groundwater Elevation (ft NAVD88) |
|---|---|---|
| 05R | 03/18/2015 | 447.02 |
| 05R | 06/23/2015 | 455.70 |
| 05R | 09/16/2015 | 448.13 |
| 05R | 12/08/2015 | 448.86 |
| 05R | 12/09/2015 | 448.86 |
| 05R | 03/08/2016 | 447.43 |
| 05R | 03/09/2016 | 447.43 |
| 05R | 06/07/2016 | 448.42 |
| 05R | 06/08/2016 | 448.42 |
| 05R | 08/31/2016 | 450.15 |
| 05R | 12/07/2016 | 447.99 |
| 05R | 12/08/2016 | 447.99 |
| 05R | 02/20/2017 | 447.47 |
| 05R | 02/22/2017 | 447.47 |
| 05R | 04/25/2017 | 450.65 |
| 05R | 04/26/2017 | 450.65 |
| 05R | 06/08/2017 | 450.28 |
| 05R | 09/07/2017 | 448.73 |
| 05R | 11/15/2017 | 448.35 |
| 05R | 11/16/2017 | 448.35 |
| 05R | 03/26/2018 | 449.09 |
| 05R | 06/13/2018 | 449.83 |
| 05R | 09/12/2018 | 448.90 |
| 05R | 12/13/2018 | 448.24 |
| 05R | 03/13/2019 | 449.47 |
| 05R | 06/18/2019 | 452.98 |
| 05R | 09/17/2019 | 449.90 |
| 05R | 12/11/2019 | 448.63 |
| 05R | 12/12/2019 | 448.63 |
| 05R | 03/11/2020 | 448.50 |
| 05R | 03/12/2020 | 448.50 |
| 05R | 06/03/2020 | 454.28 |
| 05R | 09/02/2020 | 449.13 |
| 05R | 09/03/2020 | 449.13 |
| 05R | 12/09/2020 | 447.08 |
| 05R | 02/24/2021 | 446.16 |
| 05R | 03/18/2021 | 447.13 |
| 05R | 03/22/2021 | 447.32 |
| 05R | 04/07/2021 | 448.02 |
| 05R | 05/05/2021 | 448.53 |
| 05R | 06/08/2021 | 448.48 |
| 05R | 06/24/2021 | 449.05 |
| 05R | 07/13/2021 | 451.16 |
| 05R | 08/03/2021 | 449.12 |
| 05DR | 03/18/2015 | 447.00 |

**TABLE C-1. GROUNDWATER ELEVATIONS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Groundwater Elevation (ft NAVD88) |
|---|---|---|
| 05DR | 06/23/2015 | 455.68 |
| 05DR | 09/16/2015 | 448.03 |
| 05DR | 12/08/2015 | 448.82 |
| 05DR | 12/09/2015 | 448.82 |
| 05DR | 03/08/2016 | 447.37 |
| 05DR | 03/09/2016 | 447.37 |
| 05DR | 06/07/2016 | 448.35 |
| 05DR | 06/08/2016 | 448.35 |
| 05DR | 08/31/2016 | 450.13 |
| 05DR | 12/07/2016 | 447.95 |
| 05DR | 12/08/2016 | 447.95 |
| 05DR | 02/20/2017 | 447.38 |
| 05DR | 02/22/2017 | 447.38 |
| 05DR | 04/25/2017 | 450.62 |
| 05DR | 04/26/2017 | 450.62 |
| 05DR | 06/08/2017 | 450.19 |
| 05DR | 09/07/2017 | 448.57 |
| 05DR | 11/15/2017 | 448.23 |
| 05DR | 11/16/2017 | 448.23 |
| 05DR | 03/26/2018 | 448.97 |
| 05DR | 06/13/2018 | 449.78 |
| 05DR | 09/12/2018 | 448.86 |
| 05DR | 12/13/2018 | 448.16 |
| 05DR | 03/13/2019 | 449.42 |
| 05DR | 06/18/2019 | 452.95 |
| 05DR | 09/17/2019 | 449.85 |
| 05DR | 12/11/2019 | 448.47 |
| 05DR | 12/12/2019 | 448.47 |
| 05DR | 03/11/2020 | 448.45 |
| 05DR | 03/12/2020 | 448.45 |
| 05DR | 06/03/2020 | 454.32 |
| 05DR | 09/02/2020 | 449.06 |
| 05DR | 09/03/2020 | 449.06 |
| 05DR | 12/09/2020 | 446.92 |
| 05DR | 02/24/2021 | 446.13 |
| 05DR | 03/18/2021 | 447.02 |
| 05DR | 03/22/2021 | 447.24 |
| 05DR | 04/07/2021 | 447.46 |
| 05DR | 05/05/2021 | 448.42 |
| 05DR | 06/08/2021 | 448.32 |
| 05DR | 06/24/2021 | 448.89 |
| 05DR | 07/13/2021 | 451.02 |
| 05DR | 08/03/2021 | 448.98 |
| 06 | 03/18/2015 | 447.04 |
| 06 | 03/19/2015 | 446.28 |

**TABLE C-1. GROUNDWATER ELEVATIONS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Groundwater Elevation (ft NAVD88) |
|---|---|---|
| 06 | 06/22/2015 | 455.75 |
| 06 | 09/16/2015 | 448.00 |
| 06 | 12/09/2015 | 448.77 |
| 06 | 03/08/2016 | 447.45 |
| 06 | 03/09/2016 | 447.45 |
| 06 | 06/07/2016 | 448.30 |
| 06 | 06/08/2016 | 448.30 |
| 06 | 08/31/2016 | 450.03 |
| 06 | 12/07/2016 | 447.92 |
| 06 | 12/08/2016 | 447.92 |
| 06 | 02/20/2017 | 447.48 |
| 06 | 02/22/2017 | 447.48 |
| 06 | 04/25/2017 | 450.54 |
| 06 | 04/26/2017 | 450.54 |
| 06 | 06/08/2017 | 450.07 |
| 06 | 09/07/2017 | 448.50 |
| 06 | 11/15/2017 | 448.25 |
| 06 | 11/16/2017 | 448.25 |
| 06 | 03/26/2018 | 449.04 |
| 06 | 06/13/2018 | 449.65 |
| 06 | 09/12/2018 | 448.66 |
| 06 | 12/12/2018 | 448.22 |
| 06 | 03/13/2019 | 449.46 |
| 06 | 03/14/2019 | 449.46 |
| 06 | 06/18/2019 | 452.74 |
| 06 | 09/17/2019 | 447.69 |
| 06 | 12/11/2019 | 448.55 |
| 06 | 12/12/2019 | 448.55 |
| 06 | 03/11/2020 | 448.49 |
| 06 | 03/12/2020 | 448.49 |
| 06 | 06/03/2020 | 453.99 |
| 06 | 09/02/2020 | 441.55 |
| 06 | 09/03/2020 | 441.55 |
| 06 | 12/09/2020 | 447.06 |
| 06 | 03/17/2021 | 447.07 |
| 06 | 03/18/2021 | 447.07 |
| 06 | 06/25/2021 | 447.84 |
| 07 | 03/19/2015 | 449.10 |
| 07 | 06/23/2015 | 454.07 |
| 07 | 09/17/2015 | 452.72 |
| 07 | 12/09/2015 | 452.15 |
| 07 | 03/08/2016 | 451.59 |
| 07 | 03/10/2016 | 451.59 |
| 07 | 06/07/2016 | 452.75 |
| 07 | 06/08/2016 | 452.75 |

**TABLE C-1. GROUNDWATER ELEVATIONS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Groundwater Elevation (ft NAVD88) |
|---|---|---|
| 07 | 07/29/2016 | 453.12 |
| 07 | 08/31/2016 | 453.40 |
| 07 | 09/01/2016 | 453.40 |
| 07 | 12/07/2016 | 452.21 |
| 07 | 12/09/2016 | 452.21 |
| 07 | 02/20/2017 | 451.17 |
| 07 | 02/22/2017 | 451.17 |
| 07 | 04/25/2017 | 453.50 |
| 07 | 04/27/2017 | 435.50 |
| 07 | 06/08/2017 | 454.63 |
| 07 | 09/07/2017 | 453.06 |
| 07 | 11/15/2017 | 452.34 |
| 07 | 11/16/2017 | 452.34 |
| 07 | 03/27/2018 | 452.77 |
| 07 | 06/13/2018 | 452.73 |
| 07 | 09/12/2018 | 452.57 |
| 07 | 12/12/2018 | 451.43 |
| 07 | 03/13/2019 | 452.77 |
| 07 | 03/14/2019 | 452.77 |
| 07 | 06/18/2019 | 457.11 |
| 07 | 09/17/2019 | 453.67 |
| 07 | 09/18/2019 | 453.67 |
| 07 | 12/11/2019 | 452.93 |
| 07 | 12/12/2019 | 452.93 |
| 07 | 03/11/2020 | 452.12 |
| 07 | 03/12/2020 | 452.12 |
| 07 | 06/03/2020 | 457.05 |
| 07 | 06/04/2020 | 457.05 |
| 07 | 09/02/2020 | 453.37 |
| 07 | 09/03/2020 | 453.37 |
| 07 | 12/09/2020 | 451.07 |
| 07 | 12/10/2020 | 451.07 |
| 07 | 02/24/2021 | 449.54 |
| 07 | 03/18/2021 | 450.09 |
| 07 | 04/07/2021 | 450.15 |
| 07 | 05/05/2021 | 455.60 |
| 07 | 06/08/2021 | 451.55 |
| 07 | 06/24/2021 | 451.49 |
| 07 | 07/13/2021 | 452.82 |
| 07 | 08/03/2021 | 452.61 |
| 08 | 03/19/2015 | 447.18 |
| 08 | 06/22/2015 | 455.41 |
| 08 | 09/16/2015 | 448.60 |
| 08 | 12/08/2015 | 449.20 |
| 08 | 03/08/2016 | 447.80 |

**TABLE C-1. GROUNDWATER ELEVATIONS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Groundwater Elevation (ft NAVD88) |
|---|---|---|
| 08 | 03/10/2016 | 447.80 |
| 08 | 06/07/2016 | 448.93 |
| 08 | 08/31/2016 | 450.35 |
| 08 | 09/01/2016 | 450.35 |
| 08 | 12/07/2016 | 448.39 |
| 08 | 12/09/2016 | 448.39 |
| 08 | 02/20/2017 | 447.88 |
| 08 | 02/22/2017 | 447.88 |
| 08 | 04/25/2017 | 451.11 |
| 08 | 04/27/2017 | 451.11 |
| 08 | 06/08/2017 | 450.88 |
| 08 | 06/09/2017 | 450.88 |
| 08 | 09/07/2017 | 449.29 |
| 08 | 11/15/2017 | 448.79 |
| 08 | 11/16/2017 | 448.79 |
| 08 | 03/27/2018 | 449.45 |
| 08 | 06/13/2018 | 450.11 |
| 08 | 09/12/2018 | 449.33 |
| 08 | 12/12/2018 | 448.53 |
| 08 | 03/13/2019 | 449.79 |
| 08 | 03/14/2019 | 449.79 |
| 08 | 06/18/2019 | 453.61 |
| 08 | 09/17/2019 | 450.56 |
| 08 | 09/18/2019 | 450.56 |
| 08 | 12/11/2019 | 449.06 |
| 08 | 12/12/2019 | 449.06 |
| 08 | 03/11/2020 | 449.02 |
| 08 | 03/12/2020 | 448.82 |
| 08 | 06/03/2020 | 454.94 |
| 08 | 06/04/2020 | 454.94 |
| 08 | 09/02/2020 | 449.69 |
| 08 | 09/03/2020 | 449.93 |
| 08 | 12/09/2020 | 447.52 |
| 08 | 12/10/2020 | 447.52 |
| 08 | 02/24/2021 | 446.41 |
| 08 | 03/18/2021 | 447.50 |
| 08 | 04/07/2021 | 447.77 |
| 08 | 04/08/2021 | 447.77 |
| 08 | 05/06/2021 | 449.09 |
| 08 | 06/08/2021 | 448.98 |
| 08 | 06/24/2021 | 449.26 |
| 08 | 07/13/2021 | 451.48 |
| 08 | 08/03/2021 | 449.67 |
| 08D | 03/19/2015 | 447.06 |
| 08D | 06/22/2015 | 455.57 |

**TABLE C-1. GROUNDWATER ELEVATIONS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Groundwater Elevation (ft NAVD88) |
|---|---|---|
| 08D | 09/16/2015 | 448.24 |
| 08D | 12/08/2015 | 447.92 |
| 08D | 03/08/2016 | 447.52 |
| 08D | 03/10/2016 | 447.52 |
| 08D | 06/07/2016 | 447.60 |
| 08D | 08/31/2016 | 450.19 |
| 08D | 09/01/2016 | 450.19 |
| 08D | 12/07/2016 | 448.09 |
| 08D | 12/09/2016 | 448.09 |
| 08D | 02/20/2017 | 447.60 |
| 08D | 02/22/2017 | 447.60 |
| 08D | 04/25/2017 | 450.79 |
| 08D | 04/27/2017 | 450.79 |
| 08D | 06/08/2017 | 450.50 |
| 08D | 06/09/2017 | 450.50 |
| 08D | 09/07/2017 | 448.99 |
| 08D | 11/15/2017 | 448.54 |
| 08D | 11/16/2017 | 448.54 |
| 08D | 03/27/2018 | 449.16 |
| 08D | 06/13/2018 | 449.94 |
| 08D | 09/12/2018 | 449.12 |
| 08D | 12/12/2018 | 448.29 |
| 08D | 03/13/2019 | 449.45 |
| 08D | 03/14/2019 | 449.45 |
| 08D | 06/18/2019 | 453.14 |
| 08D | 09/17/2019 | 450.44 |
| 08D | 09/18/2019 | 450.44 |
| 08D | 12/11/2019 | 448.76 |
| 08D | 12/12/2019 | 448.76 |
| 08D | 03/11/2020 | 448.55 |
| 08D | 03/12/2020 | 448.55 |
| 08D | 06/03/2020 | 454.55 |
| 08D | 06/04/2020 | 454.55 |
| 08D | 09/02/2020 | 449.72 |
| 08D | 09/03/2020 | 449.72 |
| 08D | 12/09/2020 | 447.22 |
| 08D | 12/10/2020 | 447.22 |
| 08D | 02/24/2021 | 446.21 |
| 08D | 03/18/2021 | 447.34 |
| 08D | 04/07/2021 | 447.56 |
| 08D | 04/08/2021 | 447.56 |
| 08D | 05/06/2021 | 449.06 |
| 08D | 06/08/2021 | 448.75 |
| 08D | 06/24/2021 | 449.31 |
| 08D | 07/13/2021 | 451.44 |

**TABLE C-1. GROUNDWATER ELEVATIONS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Groundwater Elevation (ft NAVD88) |
|---|---|---|
| 08D | 08/03/2021 | 449.42 |
| 10 | 03/19/2015 | 447.01 |
| 10 | 06/22/2015 | 455.52 |
| 10 | 09/17/2015 | 448.32 |
| 10 | 12/09/2015 | 449.01 |
| 10 | 03/10/2016 | 447.63 |
| 10 | 03/11/2016 | 447.63 |
| 10 | 06/07/2016 | 448.63 |
| 10 | 06/08/2016 | 448.63 |
| 10 | 08/31/2016 | 450.27 |
| 10 | 09/01/2016 | 450.27 |
| 10 | 12/07/2016 | 448.20 |
| 10 | 12/09/2016 | 448.20 |
| 10 | 02/20/2017 | 447.69 |
| 10 | 02/22/2017 | 447.69 |
| 10 | 04/25/2017 | 450.83 |
| 10 | 04/27/2017 | 450.83 |
| 10 | 06/08/2017 | 450.53 |
| 10 | 09/07/2017 | 448.98 |
| 10 | 11/15/2017 | 448.62 |
| 10 | 11/16/2017 | 448.62 |
| 10 | 03/27/2018 | 449.22 |
| 10 | 06/13/2018 | 449.96 |
| 10 | 09/12/2018 | 449.16 |
| 10 | 12/12/2018 | 448.43 |
| 10 | 03/13/2019 | 449.63 |
| 10 | 03/14/2019 | 449.63 |
| 10 | 06/18/2019 | 453.18 |
| 10 | 09/17/2019 | 450.08 |
| 10 | 12/11/2019 | 449.02 |
| 10 | 12/12/2019 | 449.02 |
| 10 | 03/11/2020 | 448.62 |
| 10 | 06/03/2020 | 454.46 |
| 10 | 06/04/2020 | 454.46 |
| 10 | 09/02/2020 | 449.43 |
| 10 | 12/09/2020 | 447.30 |
| 10 | 12/10/2020 | 447.30 |
| 10 | 03/17/2021 | 447.31 |
| 10 | 03/18/2021 | 447.45 |
| 10 | 03/22/2021 | 447.45 |
| 10 | 04/07/2021 | 447.62 |
| 10 | 05/05/2021 | 448.73 |
| 10 | 06/08/2021 | 448.74 |
| 10 | 06/24/2021 | 448.24 |
| 10 | 07/13/2021 | 451.33 |

**TABLE C-1. GROUNDWATER ELEVATIONS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Groundwater Elevation (ft NAVD88) |
|---|---|---|
| 10 | 08/03/2021 | 449.41 |
| 11 | 07/13/2021 | 451.38 |
| 12 | 03/19/2015 | 447.09 |
| 12 | 06/22/2015 | 455.60 |
| 12 | 09/17/2015 | 448.29 |
| 12 | 12/08/2015 | 448.97 |
| 12 | 12/09/2015 | 448.97 |
| 12 | 03/08/2016 | 447.56 |
| 12 | 03/10/2016 | 447.56 |
| 12 | 06/07/2016 | 448.60 |
| 12 | 06/08/2016 | 448.60 |
| 12 | 08/31/2016 | 450.22 |
| 12 | 12/07/2016 | 448.14 |
| 12 | 12/09/2016 | 448.14 |
| 12 | 02/20/2017 | 447.61 |
| 12 | 02/22/2017 | 447.61 |
| 12 | 04/25/2017 | 450.79 |
| 12 | 04/26/2017 | 450.79 |
| 12 | 06/08/2017 | 450.50 |
| 12 | 06/09/2017 | 450.50 |
| 12 | 09/07/2017 | 448.96 |
| 12 | 11/15/2017 | 448.58 |
| 12 | 11/16/2017 | 448.58 |
| 12 | 03/26/2018 | 449.24 |
| 12 | 06/13/2018 | 449.94 |
| 12 | 09/12/2018 | 449.13 |
| 12 | 12/12/2018 | 448.34 |
| 12 | 03/13/2019 | 449.53 |
| 12 | 06/18/2019 | 453.18 |
| 12 | 09/17/2019 | 450.08 |
| 12 | 12/11/2019 | 457.48 |
| 12 | 03/11/2020 | 448.54 |
| 12 | 06/03/2020 | 454.49 |
| 12 | 06/04/2020 | 454.49 |
| 12 | 09/02/2020 | 449.42 |
| 12 | 12/09/2020 | 447.24 |
| 12 | 12/10/2020 | 447.24 |
| 12 | 03/18/2021 | 447.12 |
| 12 | 03/22/2021 | 447.38 |
| 12 | 04/07/2021 | 447.60 |
| 12 | 05/05/2021 | 448.78 |
| 12 | 06/08/2021 | 448.68 |
| 12 | 06/23/2021 | 449.15 |
| 12 | 07/13/2021 | 451.34 |
| 12 | 08/03/2021 | 449.35 |

**TABLE C-1. GROUNDWATER ELEVATIONS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Groundwater Elevation (ft NAVD88) |
|---|---|---|
| 13 | 03/19/2015 | 447.07 |
| 13 | 06/22/2015 | 455.58 |
| 13 | 09/17/2015 | 448.30 |
| 13 | 12/08/2015 | 449.00 |
| 13 | 12/09/2015 | 449.00 |
| 13 | 03/08/2016 | 447.59 |
| 13 | 03/10/2016 | 447.59 |
| 13 | 06/07/2016 | 448.66 |
| 13 | 06/08/2016 | 448.66 |
| 13 | 08/31/2016 | 450.23 |
| 13 | 12/07/2016 | 448.16 |
| 13 | 12/09/2016 | 448.16 |
| 13 | 02/20/2017 | 447.63 |
| 13 | 02/22/2017 | 447.63 |
| 13 | 04/25/2017 | 450.79 |
| 13 | 04/27/2017 | 450.79 |
| 13 | 06/08/2017 | 450.53 |
| 13 | 06/09/2017 | 450.53 |
| 13 | 09/07/2017 | 448.98 |
| 13 | 11/15/2017 | 448.72 |
| 13 | 11/16/2017 | 448.72 |
| 13 | 03/26/2018 | 449.26 |
| 13 | 06/13/2018 | 449.94 |
| 13 | 09/12/2018 | 449.14 |
| 13 | 12/12/2018 | 448.35 |
| 13 | 03/13/2019 | 449.56 |
| 13 | 06/18/2019 | 453.18 |
| 13 | 09/17/2019 | 450.09 |
| 13 | 12/11/2019 | 448.82 |
| 13 | 03/11/2020 | 448.57 |
| 13 | 06/03/2020 | 454.51 |
| 13 | 06/04/2020 | 454.51 |
| 13 | 09/02/2020 | 449.47 |
| 13 | 12/09/2020 | 447.28 |
| 13 | 12/10/2020 | 447.28 |
| 13 | 02/24/2021 | 446.28 |
| 13 | 03/18/2021 | 447.15 |
| 13 | 03/22/2021 | 447.47 |
| 13 | 04/07/2021 | 447.61 |
| 13 | 05/05/2021 | 448.77 |
| 13 | 06/08/2021 | 448.69 |
| 13 | 06/23/2021 | 449.18 |
| 13 | 07/13/2021 | 451.35 |
| 13 | 08/03/2021 | 449.33 |
| 15 | 03/19/2015 | 447.12 |

**TABLE C-1. GROUNDWATER ELEVATIONS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Groundwater Elevation (ft NAVD88) |
|---|---|---|
| 15 | 06/22/2015 | 455.65 |
| 15 | 09/17/2015 | 448.25 |
| 15 | 12/09/2015 | 448.92 |
| 15 | 03/08/2016 | 447.41 |
| 15 | 03/10/2016 | 447.41 |
| 15 | 06/07/2016 | 448.56 |
| 15 | 06/08/2016 | 448.56 |
| 15 | 08/31/2016 | 450.15 |
| 15 | 12/07/2016 | 448.03 |
| 15 | 12/08/2016 | 448.03 |
| 15 | 02/20/2017 | 447.45 |
| 15 | 02/22/2017 | 447.45 |
| 15 | 04/25/2017 | 450.64 |
| 15 | 04/26/2017 | 450.64 |
| 15 | 06/08/2017 | 450.36 |
| 15 | 09/07/2017 | 448.85 |
| 15 | 11/15/2017 | 448.47 |
| 15 | 11/16/2017 | 448.47 |
| 15 | 03/26/2018 | 449.04 |
| 15 | 06/13/2018 | 449.81 |
| 15 | 09/12/2018 | 449.03 |
| 15 | 12/12/2018 | 448.16 |
| 15 | 03/13/2019 | 449.28 |
| 15 | 06/18/2019 | 452.93 |
| 15 | 09/17/2019 | 449.89 |
| 15 | 12/11/2019 | 448.60 |
| 15 | 03/11/2020 | 448.32 |
| 15 | 06/03/2020 | 454.25 |
| 15 | 06/04/2020 | 454.25 |
| 15 | 09/02/2020 | 449.69 |
| 15 | 09/03/2020 | 449.69 |
| 15 | 12/09/2020 | 447.10 |
| 15 | 12/10/2020 | 447.10 |
| 15 | 02/24/2021 | 446.09 |
| 15 | 03/17/2021 | 447.02 |
| 15 | 03/18/2021 | 447.02 |
| 15 | 03/22/2021 | 456.18 |
| 15 | 04/07/2021 | 447.46 |
| 15 | 05/05/2021 | 448.63 |
| 15 | 06/08/2021 | 448.55 |
| 15 | 06/24/2021 | 449.25 |
| 15 | 07/13/2021 | 450.35 |
| 15 | 08/03/2021 | 449.35 |
| 16 | 03/19/2015 | 447.00 |
| 16 | 06/22/2015 | 455.54 |

**TABLE C-1. GROUNDWATER ELEVATIONS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Groundwater Elevation (ft NAVD88) |
|---|---|---|
| 16 | 09/17/2015 | 448.26 |
| 16 | 12/08/2015 | 448.89 |
| 16 | 03/08/2016 | 447.49 |
| 16 | 03/10/2016 | 447.49 |
| 16 | 06/07/2016 | 448.57 |
| 16 | 06/08/2016 | 448.57 |
| 16 | 08/31/2016 | 450.19 |
| 16 | 09/01/2016 | 450.19 |
| 16 | 12/07/2016 | 448.08 |
| 16 | 12/09/2016 | 448.08 |
| 16 | 02/20/2017 | 447.56 |
| 16 | 02/22/2017 | 447.56 |
| 16 | 04/25/2017 | 450.71 |
| 16 | 04/27/2017 | 450.71 |
| 16 | 06/08/2017 | 450.53 |
| 16 | 09/07/2017 | 448.97 |
| 16 | 11/15/2017 | 448.53 |
| 16 | 11/16/2017 | 448.53 |
| 16 | 03/27/2018 | 449.08 |
| 16 | 06/13/2018 | 449.93 |
| 16 | 09/12/2018 | 449.11 |
| 16 | 12/12/2018 | 448.24 |
| 16 | 03/13/2019 | 449.45 |
| 16 | 03/14/2019 | 483.83 |
| 16 | 06/18/2019 | 453.22 |
| 16 | 09/17/2019 | 450.44 |
| 16 | 09/18/2019 | 450.44 |
| 16 | 12/11/2019 | 448.74 |
| 16 | 12/12/2019 | 448.74 |
| 16 | 03/11/2020 | 448.49 |
| 16 | 03/12/2020 | 448.49 |
| 16 | 06/03/2020 | 454.57 |
| 16 | 06/04/2020 | 454.57 |
| 16 | 09/02/2020 | 449.52 |
| 16 | 09/03/2020 | 449.52 |
| 16 | 12/09/2020 | 447.16 |
| 16 | 12/10/2020 | 447.16 |
| 16 | 02/24/2021 | 446.18 |
| 16 | 03/17/2021 | 447.12 |
| 16 | 03/18/2021 | 447.24 |
| 16 | 04/07/2021 | 447.48 |
| 16 | 04/08/2021 | 447.48 |
| 16 | 05/06/2021 | 449.14 |
| 16 | 06/08/2021 | 448.76 |
| 16 | 06/23/2021 | 449.29 |

**TABLE C-1. GROUNDWATER ELEVATIONS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Groundwater Elevation (ft NAVD88) |
|---|---|---|
| 16 | 07/13/2021 | 452.53 |
| 16 | 08/03/2021 | 449.47 |
| 17 | 03/19/2015 | 447.77 |
| 17 | 06/22/2015 | 456.28 |
| 17 | 09/17/2015 | 451.54 |
| 17 | 12/08/2015 | 451.01 |
| 17 | 03/08/2016 | 448.60 |
| 17 | 03/10/2016 | 448.60 |
| 17 | 06/07/2016 | 452.01 |
| 17 | 06/08/2016 | 452.01 |
| 17 | 08/31/2016 | 452.83 |
| 17 | 09/01/2016 | 452.83 |
| 17 | 12/07/2016 | 449.78 |
| 17 | 12/09/2016 | 449.78 |
| 17 | 02/20/2017 | 448.65 |
| 17 | 02/22/2017 | 448.65 |
| 17 | 04/25/2017 | 452.78 |
| 17 | 04/27/2017 | 452.78 |
| 17 | 06/08/2017 | 455.36 |
| 17 | 09/07/2017 | 454.56 |
| 17 | 11/15/2017 | 452.49 |
| 17 | 11/16/2017 | 452.49 |
| 17 | 03/27/2018 | 449.86 |
| 17 | 06/13/2018 | 454.63 |
| 17 | 09/12/2018 | 454.77 |
| 17 | 03/13/2019 | 450.07 |
| 17 | 03/14/2019 | 450.07 |
| 17 | 06/18/2019 | 457.12 |
| 17 | 09/17/2019 | 456.61 |
| 17 | 09/18/2019 | 456.61 |
| 17 | 12/11/2019 | 449.66 |
| 17 | 12/12/2019 | 449.66 |
| 17 | 03/11/2020 | 449.23 |
| 17 | 03/12/2020 | 449.23 |
| 17 | 06/03/2020 | 457.92 |
| 17 | 06/04/2020 | 457.92 |
| 17 | 09/02/2020 | 454.51 |
| 17 | 09/03/2020 | 454.51 |
| 17 | 12/09/2020 | 448.45 |
| 17 | 12/10/2020 | 448.45 |
| 17 | 02/24/2021 | 447.45 |
| 17 | 03/17/2021 | 447.93 |
| 17 | 03/18/2021 | 448.04 |
| 17 | 04/07/2021 | 450.39 |
| 17 | 04/08/2021 | 450.39 |



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**TABLE C-1. GROUNDWATER ELEVATIONS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Groundwater Elevation (ft NAVD88) |
|---|---|---|
| 17 | 05/06/2021 | 453.68 |
| 17 | 06/08/2021 | 452.59 |
| 17 | 06/23/2021 | 453.57 |
| 17 | 07/13/2021 | 454.14 |
| 17 | 08/03/2021 | 453.33 |
| 18S | 03/18/2015 | 447.02 |
| 18S | 06/23/2015 | 455.73 |
| 18S | 09/16/2015 | 447.90 |
| 18S | 12/08/2015 | 448.84 |
| 18S | 12/09/2015 | 448.84 |
| 18S | 03/08/2016 | 447.32 |
| 18S | 03/09/2016 | 447.32 |
| 18S | 06/07/2016 | 448.22 |
| 18S | 06/08/2016 | 448.22 |
| 18S | 08/31/2016 | 450.13 |
| 18S | 12/07/2016 | 447.87 |
| 18S | 12/08/2016 | 447.87 |
| 18S | 02/20/2017 | 447.33 |
| 18S | 02/22/2017 | 447.33 |
| 18S | 04/25/2017 | 450.58 |
| 18S | 04/26/2017 | 450.58 |
| 18S | 06/08/2017 | 450.07 |
| 18S | 06/09/2017 | 450.07 |
| 18S | 09/07/2017 | 448.40 |
| 18S | 11/15/2017 | 448.14 |
| 18S | 11/16/2017 | 448.14 |
| 18S | 03/26/2018 | 448.96 |
| 18S | 06/13/2018 | 449.79 |
| 18S | 09/12/2018 | 448.63 |
| 18S | 12/12/2018 | 448.19 |
| 18S | 03/13/2019 | 449.45 |
| 18S | 06/18/2019 | 452.94 |
| 18S | 09/17/2019 | 449.75 |
| 18S | 12/11/2019 | 448.46 |
| 18S | 12/12/2019 | 448.46 |
| 18S | 03/11/2020 | 448.48 |
| 18S | 03/12/2020 | 448.48 |
| 18S | 06/03/2020 | 454.35 |
| 18S | 09/02/2020 | 447.86 |
| 18S | 09/03/2020 | 447.86 |
| 18S | 12/09/2020 | 446.88 |
| 18S | 02/24/2021 | 446.12 |
| 18S | 03/18/2021 | 447.12 |
| 18S | 03/22/2021 | 447.27 |
| 18S | 04/07/2021 | 447.30 |

**TABLE C-1. GROUNDWATER ELEVATIONS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Groundwater Elevation (ft NAVD88) |
|---|---|---|
| 18S | 05/05/2021 | 448.31 |
| 18S | 06/08/2021 | 448.26 |
| 18S | 06/25/2021 | 448.90 |
| 18S | 07/13/2021 | 451.05 |
| 18S | 08/03/2021 | 448.80 |
| 18D | 03/18/2015 | 447.00 |
| 18D | 06/23/2015 | 455.75 |
| 18D | 09/16/2015 | 447.65 |
| 18D | 12/08/2015 | 448.78 |
| 18D | 12/09/2015 | 448.78 |
| 18D | 03/08/2016 | 447.23 |
| 18D | 03/09/2016 | 447.23 |
| 18D | 06/07/2016 | 448.05 |
| 18D | 06/08/2016 | 448.05 |
| 18D | 08/31/2016 | 450.12 |
| 18D | 12/07/2016 | 447.76 |
| 18D | 12/08/2016 | 447.76 |
| 18D | 02/20/2017 | 447.18 |
| 18D | 02/22/2017 | 447.18 |
| 18D | 04/25/2017 | 450.45 |
| 18D | 04/26/2017 | 450.45 |
| 18D | 06/08/2017 | 449.78 |
| 18D | 06/09/2017 | 449.78 |
| 18D | 09/07/2017 | 448.04 |
| 18D | 11/15/2017 | 447.93 |
| 18D | 11/16/2017 | 448.70 |
| 18D | 03/26/2018 | 448.80 |
| 18D | 06/13/2018 | 449.71 |
| 18D | 09/12/2018 | 448.36 |
| 18D | 12/12/2018 | 448.13 |
| 18D | 03/13/2019 | 449.41 |
| 18D | 06/18/2019 | 452.85 |
| 18D | 09/17/2019 | 449.45 |
| 18D | 12/11/2019 | 448.24 |
| 18D | 12/12/2019 | 448.24 |
| 18D | 03/11/2020 | 448.42 |
| 18D | 03/12/2020 | 448.42 |
| 18D | 06/03/2020 | 454.26 |
| 18D | 09/02/2020 | 448.51 |
| 18D | 09/03/2020 | 448.51 |
| 18D | 12/09/2020 | 446.66 |
| 18D | 02/24/2021 | 446.02 |
| 18D | 03/18/2021 | 446.90 |
| 18D | 03/22/2021 | 447.18 |
| 18D | 04/07/2021 | 447.11 |

**TABLE C-1. GROUNDWATER ELEVATIONS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Groundwater Elevation (ft NAVD88) |
|---|---|---|
| 18D | 05/05/2021 | 448.09 |
| 18D | 06/08/2021 | 447.99 |
| 18D | 06/25/2021 | 448.69 |
| 18D | 07/13/2021 | 450.96 |
| 18D | 08/03/2021 | 448.43 |
| 19S | 03/18/2015 | 447.03 |
| 19S | 06/23/2015 | 455.65 |
| 19S | 09/16/2015 | 448.19 |
| 19S | 12/09/2015 | 448.90 |
| 19S | 03/08/2016 | 447.55 |
| 19S | 03/09/2016 | 447.55 |
| 19S | 06/07/2016 | 448.50 |
| 19S | 06/08/2016 | 448.50 |
| 19S | 08/31/2016 | 450.14 |
| 19S | 12/07/2016 | 448.00 |
| 19S | 12/08/2016 | 448.00 |
| 19S | 02/20/2017 | 447.46 |
| 19S | 02/22/2017 | 447.46 |
| 19S | 04/25/2017 | 450.66 |
| 19S | 04/26/2017 | 450.66 |
| 19S | 06/08/2017 | 450.29 |
| 19S | 09/07/2017 | 448.76 |
| 19S | 11/15/2017 | 448.41 |
| 19S | 11/16/2017 | 448.41 |
| 19S | 03/26/2018 | 448.44 |
| 19S | 06/13/2018 | 449.81 |
| 19S | 09/12/2018 | 448.92 |
| 19S | 12/12/2018 | 448.21 |
| 19S | 03/13/2019 | 449.34 |
| 19S | 06/18/2019 | 452.86 |
| 19S | 09/17/2019 | 449.76 |
| 19S | 12/11/2019 | 448.57 |
| 19S | 03/11/2020 | 448.31 |
| 19S | 06/03/2020 | 454.24 |
| 19S | 09/02/2020 | 449.08 |
| 19S | 09/03/2020 | 447.46 |
| 19S | 12/09/2020 | 447.02 |
| 19S | 02/24/2021 | 446.42 |
| 19S | 03/17/2021 | 446.97 |
| 19S | 03/18/2021 | 446.97 |
| 19S | 03/22/2021 | 447.16 |
| 19S | 04/07/2021 | 447.37 |
| 19S | 05/05/2021 | 448.44 |
| 19S | 06/08/2021 | 448.37 |
| 19S | 06/24/2021 | 448.55 |

**TABLE C-1. GROUNDWATER ELEVATIONS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Groundwater Elevation (ft NAVD88) |
|---|---|---|
| 19S | 07/13/2021 | 450.96 |
| 19S | 08/03/2021 | 449.01 |
| 19D | 03/18/2015 | 447.00 |
| 19D | 06/23/2015 | 455.61 |
| 19D | 09/16/2015 | 448.07 |
| 19D | 12/09/2015 | 448.84 |
| 19D | 03/08/2016 | 447.36 |
| 19D | 03/09/2016 | 447.36 |
| 19D | 06/07/2016 | 448.42 |
| 19D | 06/08/2016 | 448.42 |
| 19D | 08/31/2016 | 450.13 |
| 19D | 12/07/2016 | 447.93 |
| 19D | 12/08/2016 | 447.93 |
| 19D | 02/20/2017 | 447.39 |
| 19D | 02/22/2017 | 447.39 |
| 19D | 04/25/2017 | 450.56 |
| 19D | 04/26/2017 | 450.56 |
| 19D | 06/08/2017 | 450.21 |
| 19D | 09/07/2017 | 448.62 |
| 19D | 11/15/2017 | 448.29 |
| 19D | 11/16/2017 | 448.29 |
| 19D | 03/26/2018 | 449.99 |
| 19D | 06/13/2018 | 449.74 |
| 19D | 09/12/2018 | 448.79 |
| 19D | 12/12/2018 | 448.19 |
| 19D | 03/13/2019 | 449.29 |
| 19D | 06/18/2019 | 452.87 |
| 19D | 09/17/2019 | 449.72 |
| 19D | 12/11/2019 | 448.49 |
| 19D | 03/11/2020 | 448.32 |
| 19D | 06/03/2020 | 454.28 |
| 19D | 09/02/2020 | 449.04 |
| 19D | 09/03/2020 | 448.69 |
| 19D | 12/09/2020 | 447.00 |
| 19D | 02/24/2021 | 446.08 |
| 19D | 03/17/2021 | 446.91 |
| 19D | 03/18/2021 | 446.91 |
| 19D | 03/22/2021 | 447.15 |
| 19D | 04/07/2021 | 447.36 |
| 19D | 05/05/2021 | 448.44 |
| 19D | 06/08/2021 | 448.37 |
| 19D | 06/24/2021 | 449.01 |
| 19D | 07/13/2021 | 451.03 |
| 19D | 08/03/2021 | 449.00 |
| 40S | 03/18/2015 | 447.03 |

**TABLE C-1. GROUNDWATER ELEVATIONS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Groundwater Elevation (ft NAVD88) |
|---|---|---|
| 40S | 06/23/2015 | 455.70 |
| 40S | 09/16/2015 | 448.14 |
| 40S | 12/08/2015 | 448.90 |
| 40S | 12/09/2015 | 448.90 |
| 40S | 03/08/2016 | 446.47 |
| 40S | 03/09/2016 | 446.47 |
| 40S | 06/07/2016 | 448.48 |
| 40S | 06/08/2016 | 448.48 |
| 40S | 08/31/2016 | 450.16 |
| 40S | 12/07/2016 | 448.01 |
| 40S | 12/08/2016 | 448.01 |
| 40S | 02/20/2017 | 447.48 |
| 40S | 02/22/2017 | 447.48 |
| 40S | 04/25/2017 | 450.67 |
| 40S | 04/26/2017 | 450.67 |
| 40S | 06/08/2017 | 450.44 |
| 40S | 09/07/2017 | 448.75 |
| 40S | 11/15/2017 | 448.38 |
| 40S | 11/16/2017 | 448.38 |
| 40S | 03/26/2018 | 449.08 |
| 40S | 06/13/2018 | 449.83 |
| 40S | 09/12/2018 | 448.93 |
| 40S | 12/12/2018 | 448.27 |
| 40S | 03/13/2019 | 449.39 |
| 40S | 06/18/2019 | 453.02 |
| 40S | 09/17/2019 | 449.92 |
| 40S | 12/11/2019 | 448.63 |
| 40S | 12/12/2019 | 448.63 |
| 40S | 03/11/2020 | 448.46 |
| 40S | 06/03/2020 | 454.39 |
| 40S | 09/02/2020 | 449.22 |
| 40S | 09/03/2020 | 449.22 |
| 40S | 12/09/2020 | 447.08 |
| 40S | 03/18/2021 | 447.02 |
| 40S | 06/24/2021 | 449.12 |
| 45S | 12/08/2015 | 448.85 |
| 45S | 03/08/2016 | 447.62 |
| 45S | 06/07/2016 | 448.37 |
| 45S | 08/31/2016 | 450.07 |
| 45S | 12/07/2016 | 448.00 |
| 45S | 02/20/2017 | 447.53 |
| 45S | 04/25/2017 | 450.61 |
| 45S | 06/08/2017 | 450.13 |
| 45S | 06/09/2017 | 450.13 |
| 45S | 11/15/2017 | 448.33 |

**TABLE C-1. GROUNDWATER ELEVATIONS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Groundwater Elevation (ft NAVD88) |
|---|---|---|
| 45S | 06/13/2018 | 449.74 |
| 45S | 09/12/2018 | 448.74 |
| 45S | 03/13/2019 | 449.51 |
| 45S | 09/17/2019 | 449.78 |
| 45S | 03/11/2020 | 448.53 |
| 45S | 06/03/2020 | 454.13 |
| 45S | 09/02/2020 | 449.03 |
| 45S | 12/09/2020 | 447.14 |
| 45S | 02/24/2021 | 415.09 |
| 45S | 03/18/2021 | 447.10 |
| 45S | 04/07/2021 | 447.39 |
| 45S | 05/05/2021 | 448.38 |
| 45S | 06/08/2021 | 448.32 |
| 45S | 06/25/2021 | 448.97 |
| 45S | 07/13/2021 | 450.98 |
| 45S | 08/03/2021 | 448.93 |
| 46 | 12/08/2015 | 449.07 |
| 46 | 03/08/2016 | 447.63 |
| 46 | 06/07/2016 | 448.71 |
| 46 | 08/31/2016 | 450.31 |
| 46 | 12/07/2016 | 448.21 |
| 46 | 02/20/2017 | 447.68 |
| 46 | 04/25/2017 | 450.85 |
| 46 | 06/08/2017 | 450.60 |
| 46 | 06/09/2017 | 450.60 |
| 46 | 11/15/2017 | 448.66 |
| 46 | 06/13/2018 | 450.01 |
| 46 | 09/12/2018 | 449.23 |
| 46 | 03/13/2019 | 449.63 |
| 46 | 09/17/2019 | 450.17 |
| 46 | 03/11/2020 | 448.61 |
| 46 | 06/03/2020 | 454.56 |
| 46 | 09/02/2020 | 449.53 |
| 46 | 12/09/2020 | 446.81 |
| 46 | 03/18/2021 | 447.23 |
| 46 | 03/22/2021 | 447.41 |
| 46 | 04/07/2021 | 447.65 |
| 46 | 05/05/2021 | 448.89 |
| 46 | 06/08/2021 | 448.79 |
| 46 | 06/23/2021 | 449.20 |
| 46 | 07/13/2021 | 451.45 |
| 46 | 08/03/2021 | 449.52 |
| 47 | 12/08/2015 | 449.02 |
| 47 | 03/08/2016 | 447.60 |
| 47 | 06/07/2016 | 448.66 |

**TABLE C-1. GROUNDWATER ELEVATIONS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Groundwater Elevation (ft NAVD88) |
|---|---|---|
| 47 | 08/31/2016 | 450.28 |
| 47 | 09/01/2016 | 450.28 |
| 47 | 12/07/2016 | 448.18 |
| 47 | 02/20/2017 | 447.68 |
| 47 | 04/25/2017 | 450.84 |
| 47 | 06/08/2017 | 450.57 |
| 47 | 06/09/2017 | 450.57 |
| 47 | 11/15/2017 | 448.64 |
| 47 | 06/13/2018 | 449.97 |
| 47 | 09/12/2018 | 449.19 |
| 47 | 03/13/2019 | 449.58 |
| 47 | 09/17/2019 | 450.07 |
| 47 | 03/11/2020 | 448.57 |
| 47 | 06/03/2020 | 454.52 |
| 47 | 09/02/2020 | 449.15 |
| 47 | 12/09/2020 | 446.82 |
| 47 | 02/24/2021 | 446.07 |
| 47 | 03/18/2021 | 446.97 |
| 47 | 04/07/2021 | 447.35 |
| 47 | 05/05/2021 | 448.53 |
| 47 | 06/08/2021 | 448.47 |
| 47 | 06/23/2021 | 450.42 |
| 47 | 07/13/2021 | 451.10 |
| 47 | 08/03/2021 | 449.10 |
| 48 | 12/08/2015 | 448.92 |
| 48 | 03/08/2016 | 447.63 |
| 48 | 06/07/2016 | 448.52 |
| 48 | 06/08/2016 | 448.52 |
| 48 | 08/31/2016 | 450.23 |
| 48 | 12/07/2016 | 448.07 |
| 48 | 02/20/2017 | 447.53 |
| 48 | 04/25/2017 | 450.72 |
| 48 | 06/08/2017 | 450.35 |
| 48 | 11/15/2017 | 448.45 |
| 48 | 06/13/2018 | 449.87 |
| 48 | 09/12/2018 | 448.98 |
| 48 | 12/12/2018 | 448.34 |
| 48 | 03/13/2019 | 449.55 |
| 48 | 09/17/2019 | 450.02 |
| 48 | 03/11/2020 | 448.55 |
| 48 | 06/03/2020 | 454.41 |
| 48 | 09/02/2020 | 449.24 |
| 48 | 12/09/2020 | 447.16 |
| 48 | 03/18/2021 | 447.11 |
| 52 | 02/24/2021 | 446.17 |


RAMBOLL

**TABLE C-1. GROUNDWATER ELEVATIONS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

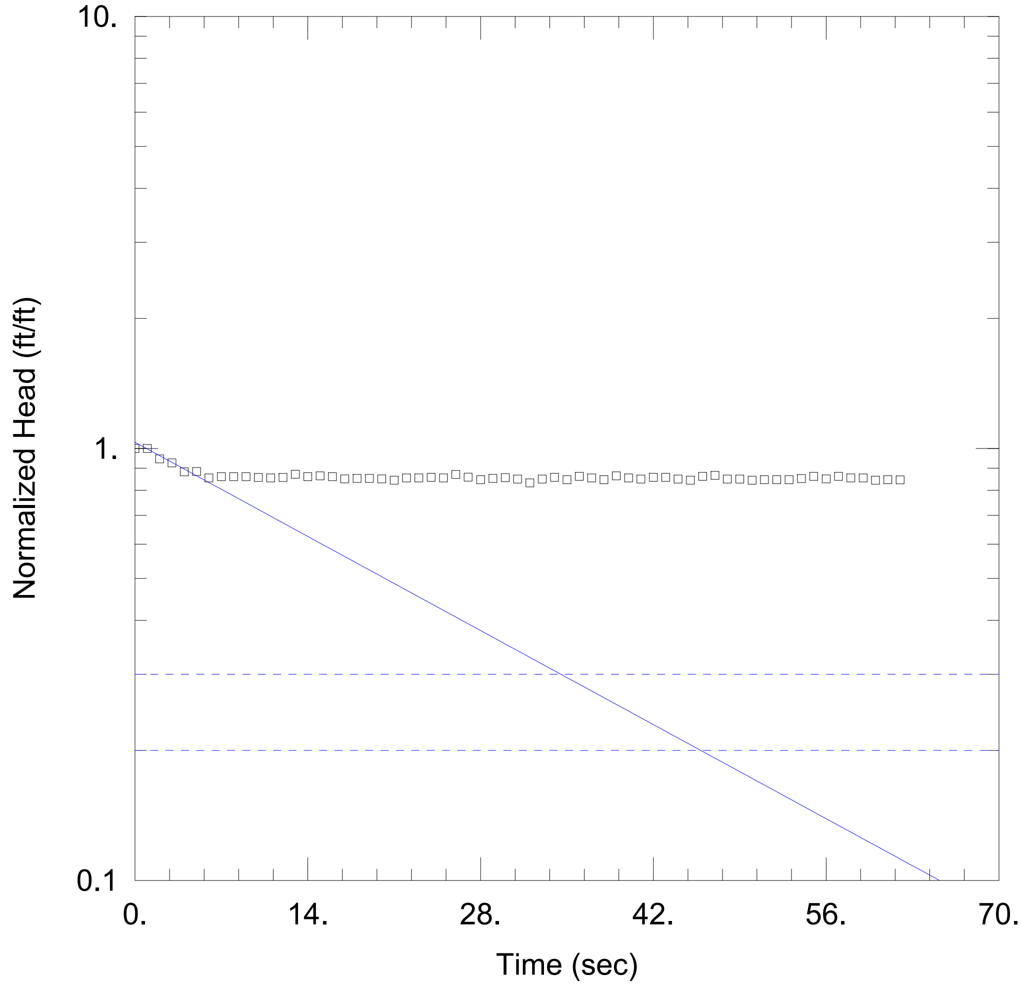
| Sample Location | Sample Date | Groundwater Elevation (ft NAVD88) |
|---|---|---|
| 52 | 03/22/2021 | 447.23 |
| 52 | 04/07/2021 | 447.45 |
| 52 | 05/06/2021 | 448.95 |
| 52 | 06/08/2021 | 448.62 |
| 52 | 06/24/2021 | 449.23 |
| 52 | 07/13/2021 | 451.28 |
| 52 | 08/03/2021 | 449.37 |
| 53 | 02/25/2021 | 446.24 |
| 53 | 03/19/2021 | 447.08 |
| 53 | 04/07/2021 | 446.45 |
| 53 | 04/08/2021 | 446.45 |
| 53 | 05/06/2021 | 448.97 |
| 53 | 06/08/2021 | 502.68 |
| 53 | 06/23/2021 | 449.09 |
| 53 | 07/13/2021 | 451.27 |
| 53 | 08/03/2021 | 449.29 |
| 54 | 02/24/2021 | 446.15 |
| 54 | 03/22/2021 | 447.15 |
| 54 | 04/07/2021 | 446.40 |
| 54 | 05/05/2021 | 448.66 |
| 54 | 06/08/2021 | 448.50 |
| 54 | 06/23/2021 | 448.99 |
| 54 | 07/13/2021 | 451.13 |
| 54 | 08/03/2021 | 449.18 |
| 55 | 02/25/2021 | 446.52 |
| 55 | 03/22/2021 | 447.41 |
| 55 | 04/07/2021 | 447.61 |
| 55 | 05/05/2021 | 446.92 |
| 55 | 06/08/2021 | 448.87 |
| 55 | 06/23/2021 | 448.91 |
| 55 | 07/13/2021 | 450.56 |
| 55 | 08/03/2021 | 449.87 |
| XPW01 | 02/26/2021 | 490.18 |
| XPW01 | 03/22/2021 | 491.22 |
| XPW01 | 04/07/2021 | 491.37 |
| XPW01 | 04/08/2021 | 491.37 |
| XPW01 | 05/06/2021 | 490.94 |
| XPW01 | 06/08/2021 | 491.84 |
| XPW01 | 06/23/2021 | 493.18 |
| XPW01 | 07/13/2021 | 488.47 |
| XPW01 | 08/03/2021 | 492.27 |
| XPW02 | 02/25/2021 | 491.70 |
| XPW02 | 03/22/2021 | 491.26 |
| XPW02 | 04/07/2021 | 490.38 |
| XPW02 | 04/08/2021 | 491.97 |

**TABLE C-1. GROUNDWATER ELEVATIONS**
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | Sample Date | Groundwater Elevation (ft NAVD88) |
|---|---|---|
| XPW02 | 05/06/2021 | 489.60 |
| XPW02 | 06/08/2021 | 490.71 |
| XPW02 | 06/23/2021 | 489.75 |
| XPW02 | 07/13/2021 | 496.18 |
| XPW02 | 08/03/2021 | 490.99 |
| XPW03 | 02/26/2021 | 488.94 |
| XPW03 | 03/22/2021 | 489.79 |
| XPW03 | 04/07/2021 | 489.55 |
| XPW03 | 05/05/2021 | 489.26 |
| XPW03 | 06/08/2021 | 489.88 |
| XPW03 | 06/23/2021 | 489.46 |
| XPW03 | 07/13/2021 | 490.82 |
| XPW03 | 08/03/2021 | 490.32 |
| XSG01 | 02/26/2021 | 487.44 |
| XSG01 | 03/22/2021 | 487.61 |
| XSG01 | 04/07/2021 | 487.88 |
| XSG01 | 05/05/2021 | 477.71 |
| XSG01 | 06/08/2021 | 487.72 |
| XSG01 | 06/23/2021 | 474.06 |
| XSG01 | 07/13/2021 | 488.19 |
| XSG01 | 08/03/2021 | 488.29 |
| SG02 | 02/25/2021 | 443.75 |
| SG02 | 03/22/2021 | 445.50 |
| SG02 | 04/07/2021 | 442.25 |
| SG02 | 04/08/2021 | 442.25 |
| SG02 | 05/06/2021 | 442.00 |
| SG02 | 06/08/2021 | 442.00 |
| SG02 | 06/23/2021 | 442.25 |
| SG02 | 07/13/2021 | 447.00 |
| SG02 | 08/03/2021 | 441.00 |

**Notes:**
ft NAVD88 = feet relative to the North American Vertical Datum 1988, GEOID 12A
generated 10/05/2021, 4:08:36 PM CDT

# APPENDIX D
# HYDRAULIC CONDUCTIVITY TEST DATA




## SLUG TEST MW-53

Data Set: P:\Projects\Hennepin\AqtSolv Reports\MW-53\MW-53 Trial 1.aqt
Date: 04/02/21 Time: 13:17:59

## PROJECT INFORMATION

Company: Geosyntec
Client: Vistra
Project: GLP8020
Location: Hennepin, IL
Test Well: MW-53
Test Date: 2/12/2021

## AQUIFER DATA

Saturated Thickness: 10.35 ft
Anisotropy Ratio (Kz/Kr): 0.3

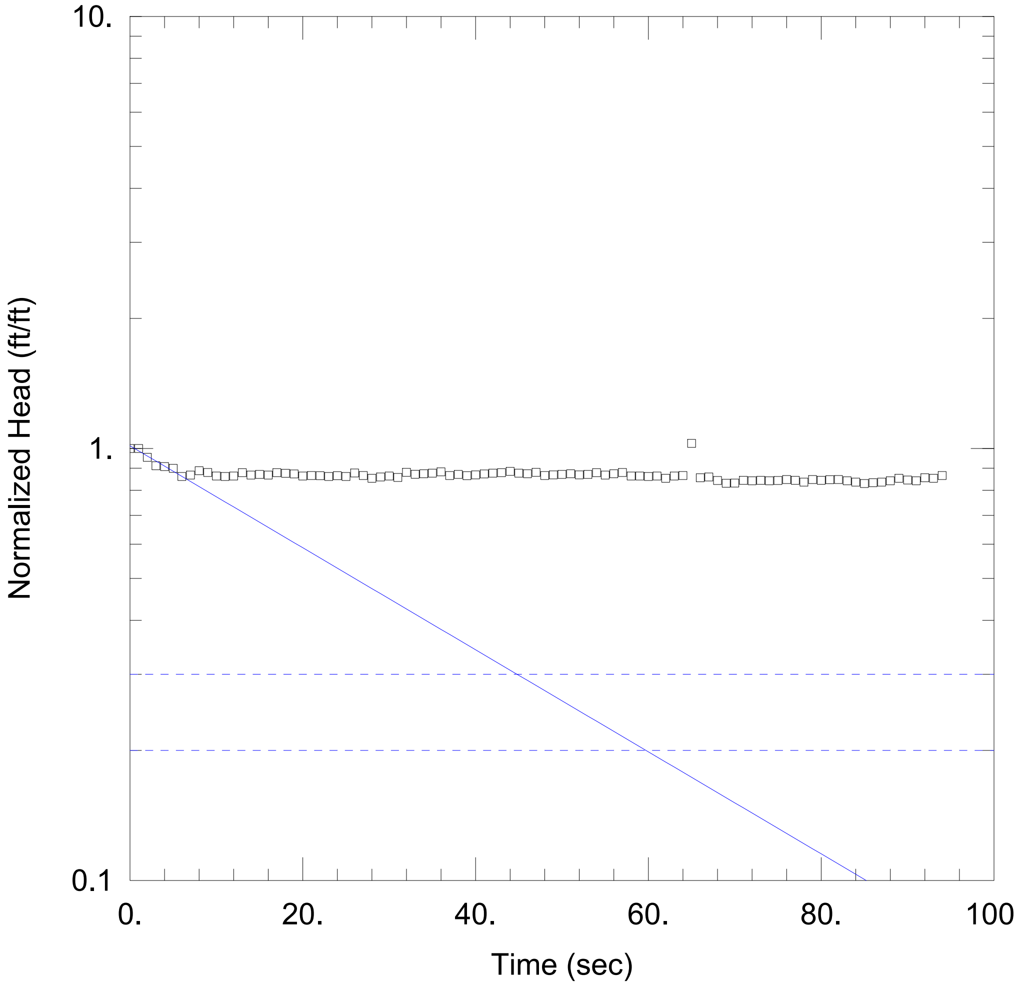
## WELL DATA (MW-53)

Initial Displacement: 0.755 ft
Total Well Penetration Depth: 67. ft
Casing Radius: 0.083 ft
Static Water Column Height: 10.35 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

## SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.002045 cm/sec
y0 = 0.7803 ft




SLUG TEST MW-53

Data Set: P:\Projects\Hennepin\AqtSolv Reports\MW-53\MW-53 Trial 2.aqt
Date: 03/31/21 Time: 17:51:54

PROJECT INFORMATION

Company: Geosyntec
Client: Vistra
Project: GLP8020
Location: Hennepin, IL
Test Well: MW-53
Test Date: 2/12/2021

AQUIFER DATA

Saturated Thickness: 10.35 ft Anisotropy Ratio (Kz/Kr): 0.3

WELL DATA (MW-53)

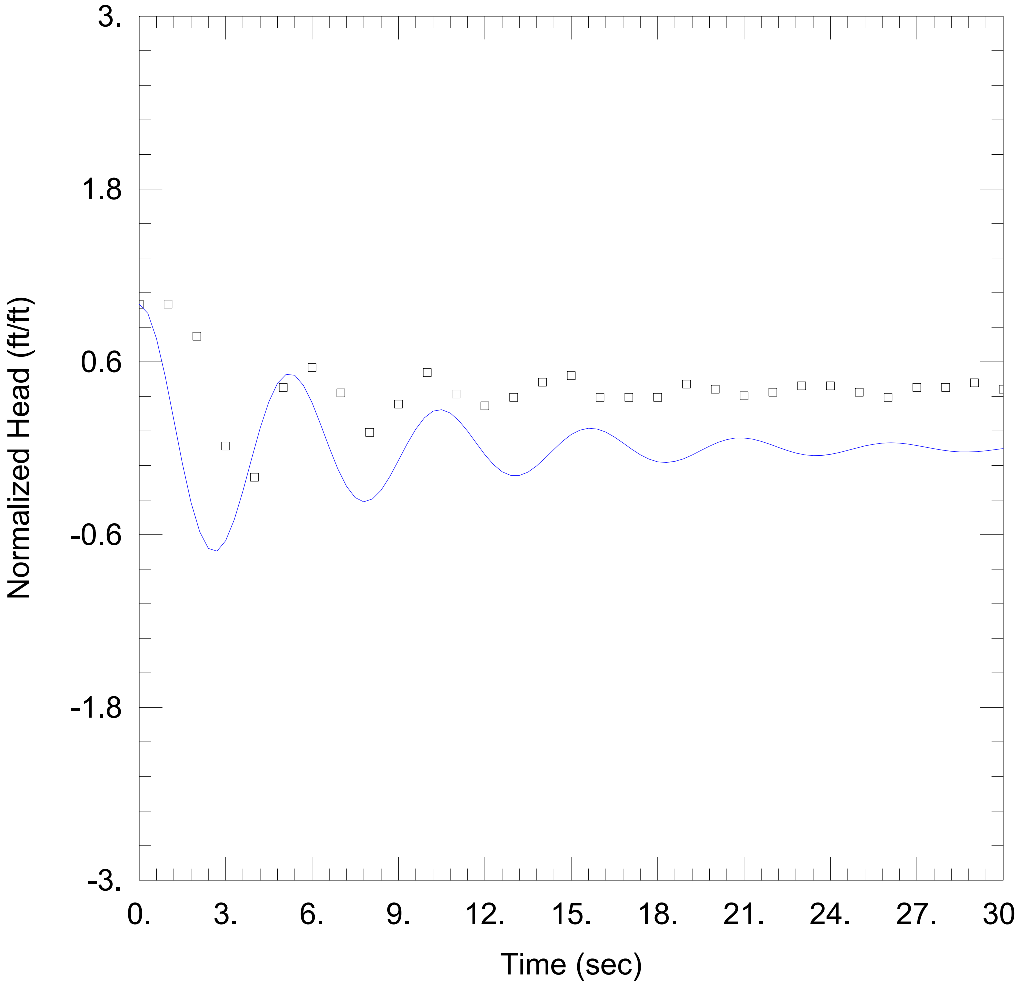
Initial Displacement: 0.7489 ft
Total Well Penetration Depth: 67. ft
Casing Radius: 0.083 ft

Static Water Column Height: 10.35 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.001552 cm/sec y0 = 0.7596 ft




SLUG TEST MW-54

Data Set: C:\Users\alamore\Documents\Hennepin\MW-54 Trial 1.aqt
Date: 03/31/21 Time: 16:46:16

PROJECT INFORMATION

Company: Geosyntec
Client: Vistra
Project: GLP8020
Location: Hennepin, IL
Test Well: MW-54
Test Date: 2/17/2021

AQUIFER DATA

Saturated Thickness: 22.6 ft
Anisotropy Ratio (Kz/Kr): 0.3

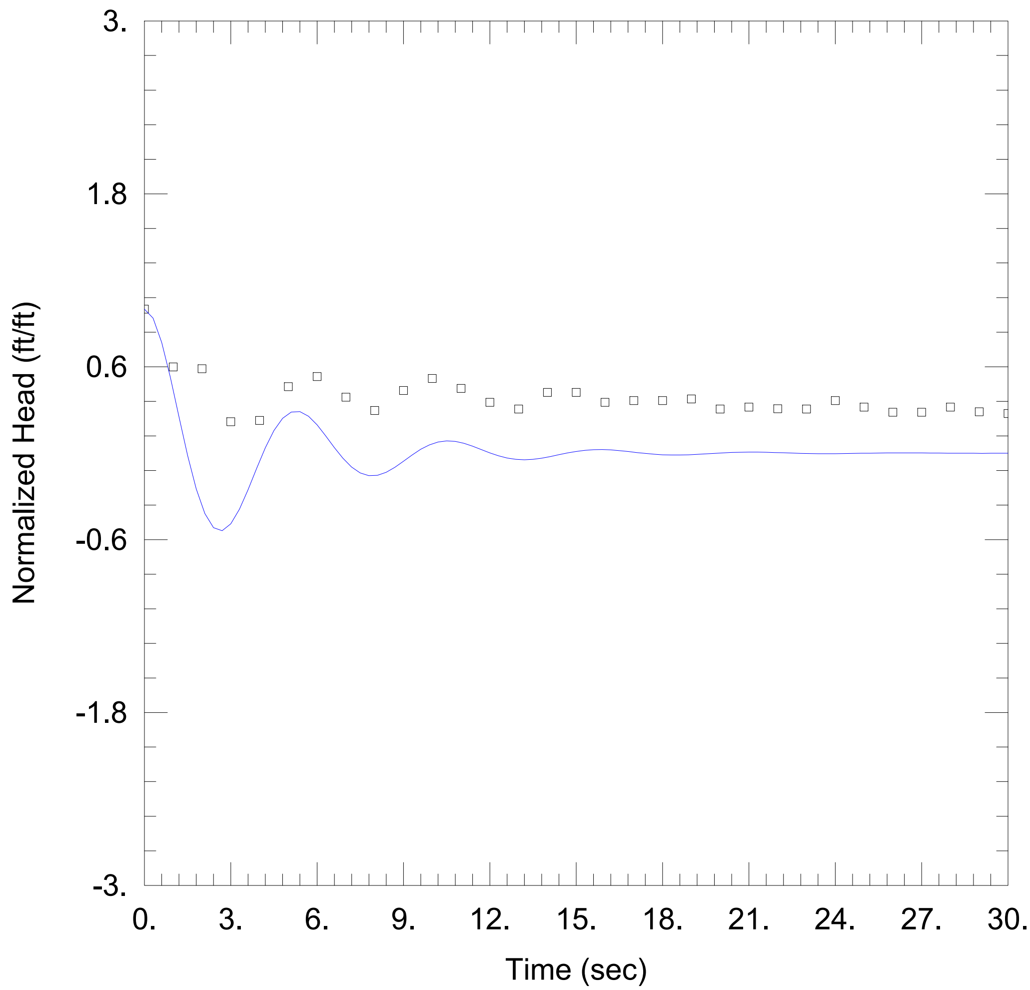
WELL DATA (MW-54)

Initial Displacement: 0.1301 ft
Total Well Penetration Depth: 77. ft
Casing Radius: 0.083 ft
Static Water Column Height: 22.6 ft
Screen Length: 10. ft
Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Springer-Gelhar

K = 0.3367 cm/sec
Le = 21.96 ft




SLUG TEST MW-54

Data Set: C:\Users\alamore\Documents\Hennepin\MW-54 Trial 2.aqt
Date: 03/31/21 Time: 16:51:09

PROJECT INFORMATION

Company: Geosyntec
Client: Vistra
Project: GLP8020
Location: Hennepin, IL
Test Well: MW-54
Test Date: 2/17/2021

AQUIFER DATA

Saturated Thickness: 22.6 ft
Anisotropy Ratio (Kz/Kr): 0.3

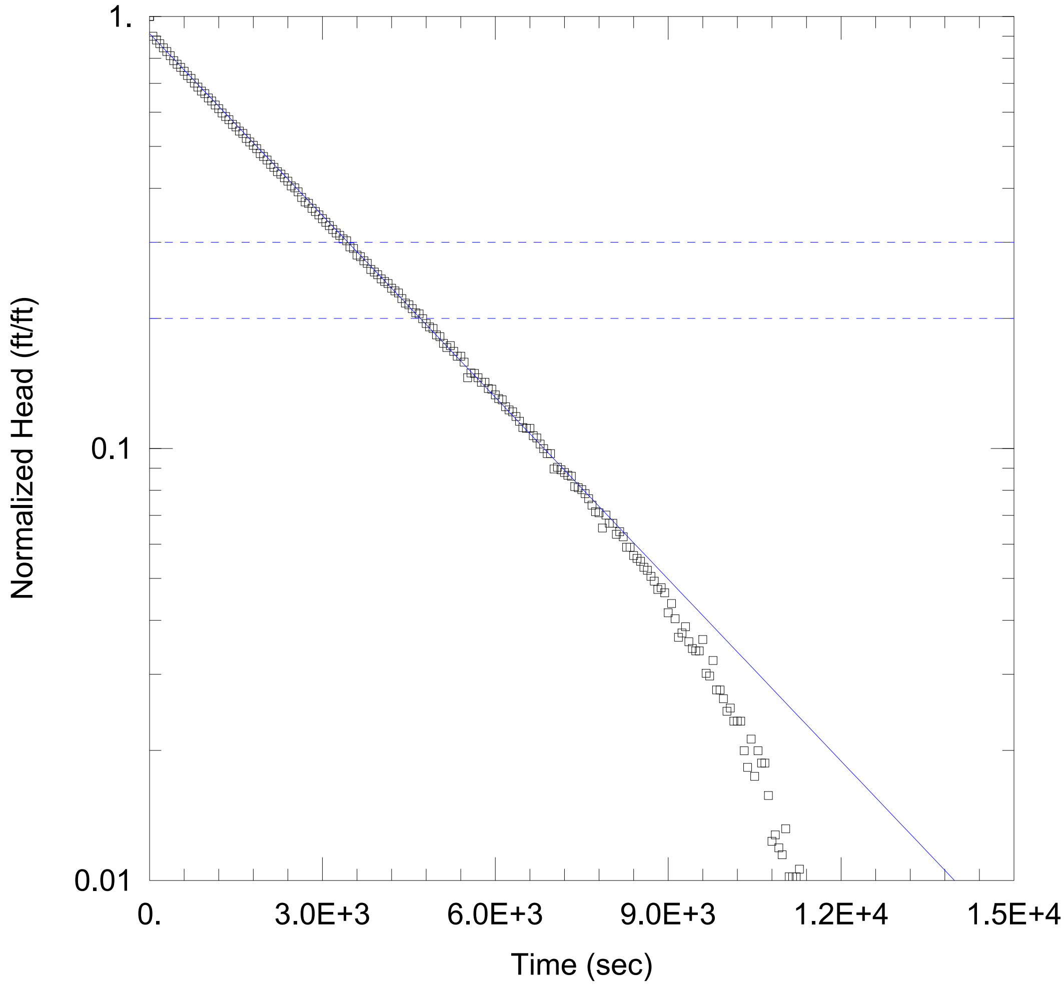
WELL DATA (MW-54)

Initial Displacement: 0.1301 ft
Total Well Penetration Depth: 77. ft
Casing Radius: 0.083 ft
Static Water Column Height: 22.6 ft
Screen Length: 10. ft
Well Radius: 0.083 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Springer-Gelhar

K = 0.1828 cm/sec
Le = 21.82 ft




## SLUG TEST MW-55

Data Set: P:\Projects\Hennepin\AqtSolv Reports\MW-55\MW-55BR.aqt
Date: 03/31/21 Time: 17:54:45

## PROJECT INFORMATION

Company: Geosyntec
Client: Vistra
Project: GLP8020
Location: Hennepin, IL
Test Well: MW-55
Test Date: 3/9/2021

## AQUIFER DATA

Saturated Thickness: 10. ft Anisotropy Ratio (Kz/Kr): 0.3

## WELL DATA (MW-55)

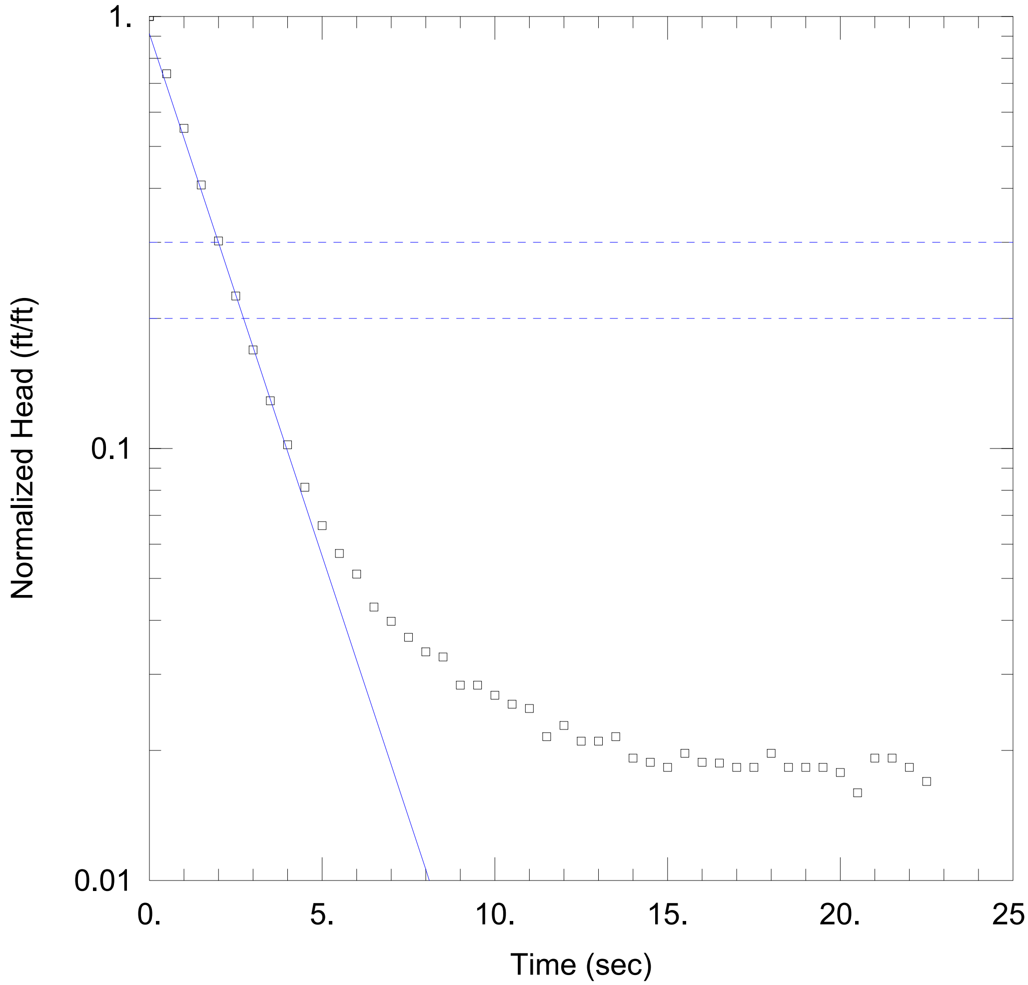
Initial Displacement: 2.354 ft
Total Well Penetration Depth: 95. ft
Casing Radius: 0.083 ft

Static Water Column Height: 10. ft
Screen Length: 5. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

## SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 3.647E-5 cm/sec y0 = 2.149 ft




SLUG TEST XPW-1

Data Set: Q:\...\XPW-1 Trial 1.aqt
Date: 04/02/21 Time: 15:30:16

PROJECT INFORMATION

Company: Geosyntec
Client: Vistra
Project: GLP8020
Location: Hennepin, IL
Test Well: XPW-1
Test Date: 2/17/2021

AQUIFER DATA

Saturated Thickness: 5.87 ft Anisotropy Ratio (Kz/Kr): 0.3

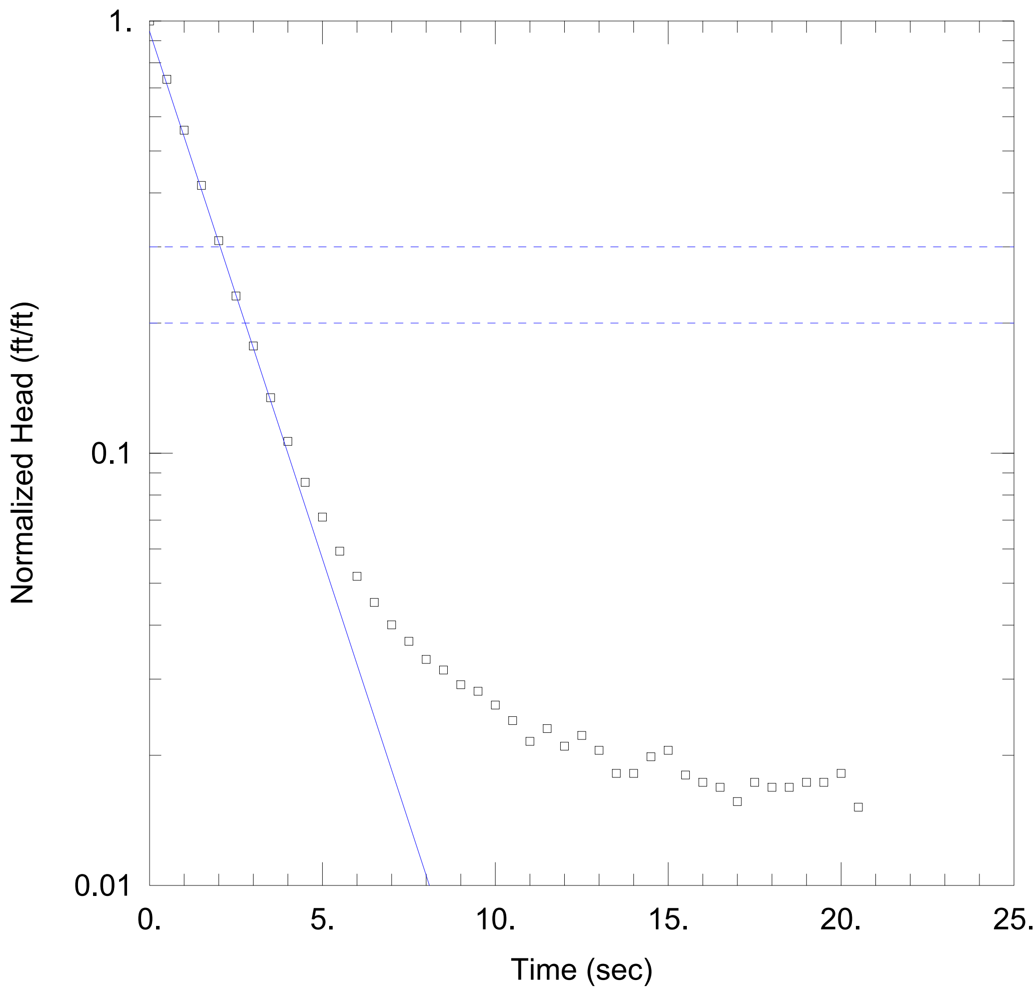
WELL DATA (XPW-1)

Initial Displacement: 3.292 ft
Total Well Penetration Depth: 17.3 ft
Casing Radius: 0.083 ft
Static Water Column Height: 5.87 ft
Screen Length: 5. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.05143 cm/sec y0 = 3.001 ft




SLUG TEST XPW-1

Data Set: Q:\...\XPW-1 Trial 2.aqt
Date: 04/02/21 Time: 15:31:15

PROJECT INFORMATION

Company: Geosyntec
Client: Vistra
Project: GLP8020
Location: Hennepin, IL
Test Well: XPW-1
Test Date: 2/17/2021

AQUIFER DATA

Saturated Thickness: 5.87 ft Anisotropy Ratio (Kz/Kr): 0.3

WELL DATA (XPW-1)

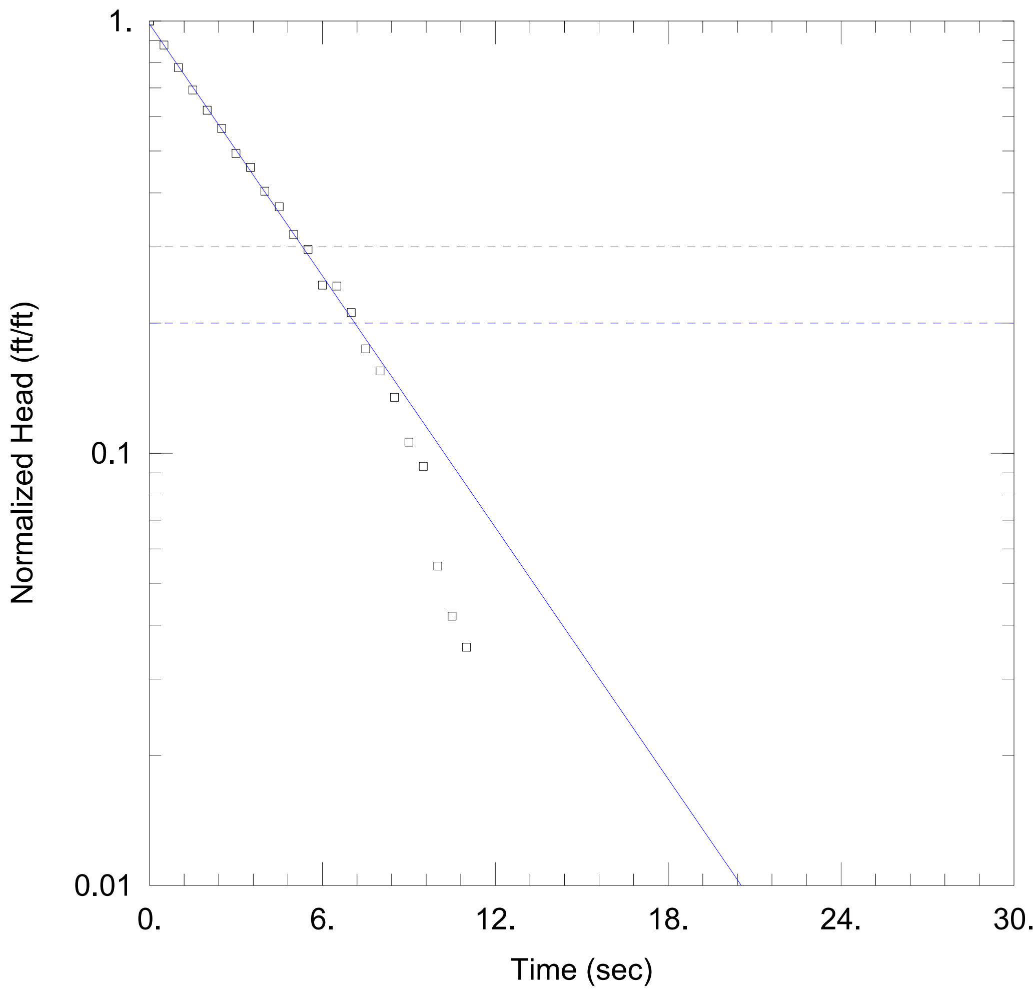
Initial Displacement: 3.568 ft
Total Well Penetration Depth: 17.3 ft
Casing Radius: 0.083 ft

Static Water Column Height: 5.87 ft
Screen Length: 5. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.05191 cm/sec y0 = 3.373 ft




## SLUG TEST XPW-2

Data Set: P:\Projects\Hennepin\AqtSolv Reports\XPW-2\XPW-2 Trial 1.aqt
Date: 04/09/21 Time: 15:18:38

## PROJECT INFORMATION

Company: Geosyntec
Client: Vistra
Project: GLP8020
Location: Hennepin, IL
Test Well: XPW-2
Test Date: 2/17/2021

## AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.3

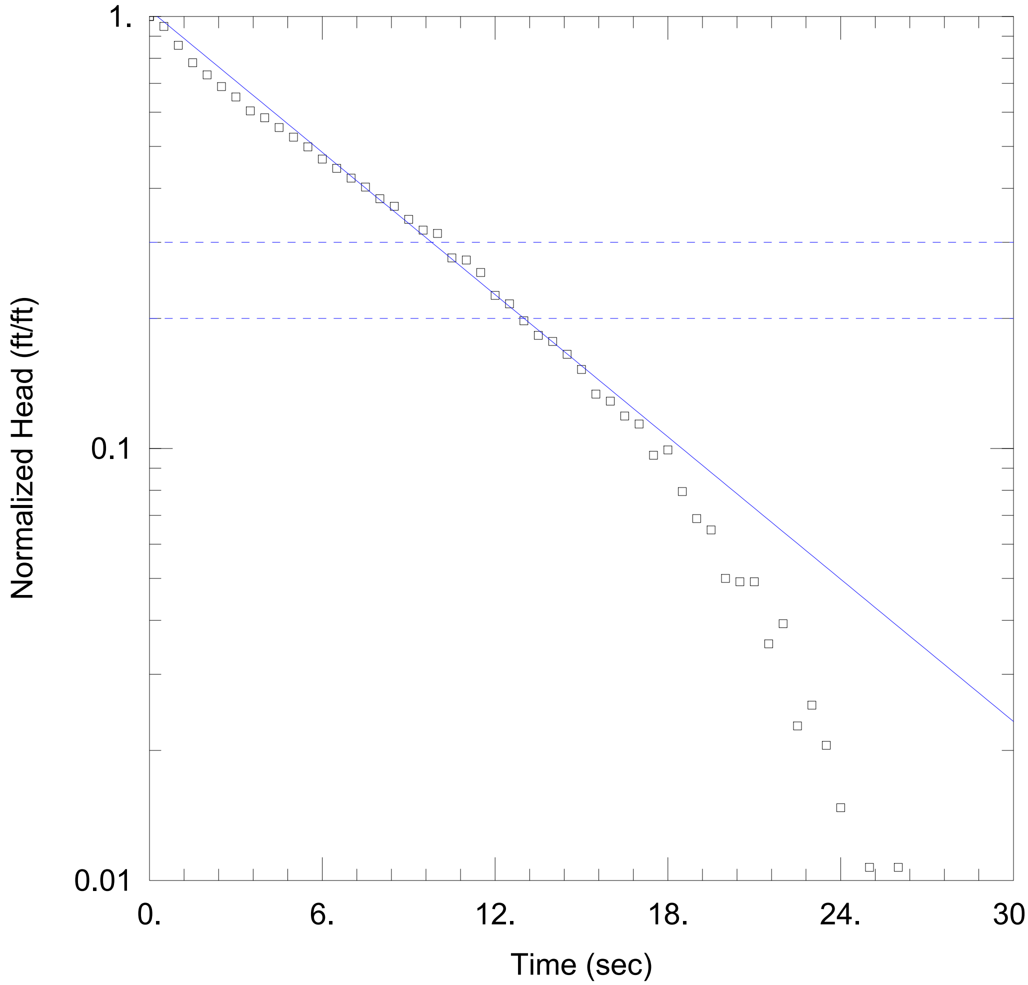
## WELL DATA (XPW-2)

Initial Displacement: 0.4692 ft
Total Well Penetration Depth: 21.8 ft
Casing Radius: 0.083 ft
Static Water Column Height: 6. ft
Screen Length: 5. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

## SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.02129 cm/sec
y0 = 0.4611 ft




## SLUG TEST XPW-2

Data Set: P:\Projects\Hennepin\AqtSolv Reports\XPW-2\XPW-2 Trial 2.aqt
Date: 04/09/21 Time: 15:20:01

## PROJECT INFORMATION

Company: Geosyntec
Client: Vistra
Project: GLP8020
Location: Hennepin, IL
Test Well: XPW-2
Test Date: 2/17/2021

## AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.3

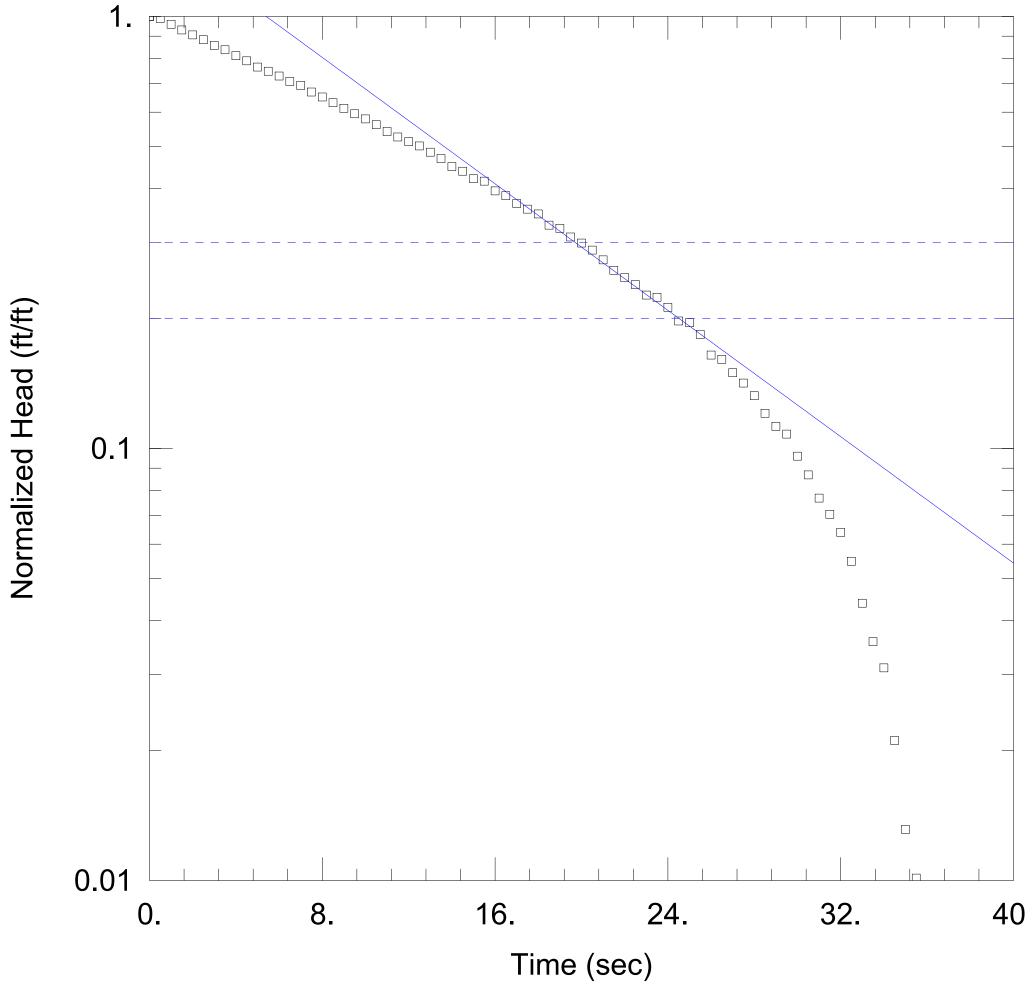
## WELL DATA (XPW-2)

Initial Displacement: 0.6122 ft
Total Well Penetration Depth: 21.8 ft
Casing Radius: 0.083 ft
Static Water Column Height: 6. ft
Screen Length: 5. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

## SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.01205 cm/sec
y0 = 0.6335 ft




## SLUG TEST XPW-3

Data Set: P:\Projects\Hennepin\AqtSolv Reports\XPW-3\XPW-3 Trial 1.aqt
Date: 04/09/21 Time: 15:35:04

## PROJECT INFORMATION

Company: Geosyntec
Client: Vistra
Project: GLP8020
Location: Hennepin, IL
Test Well: XPW-3
Test Date: 2/17/2021

## AQUIFER DATA

Saturated Thickness: 15.41 ft
Anisotropy Ratio (Kz/Kr): 0.3

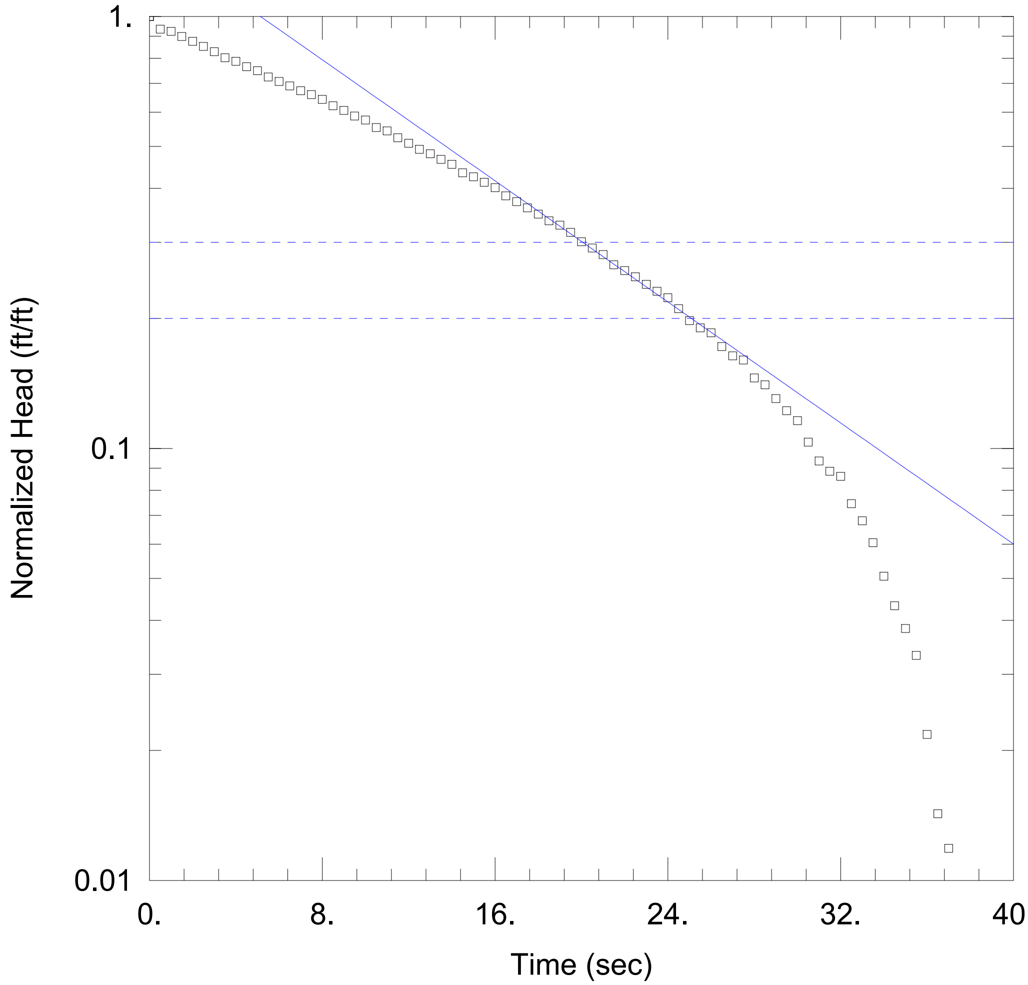
## WELL DATA (XPW-3)

Initial Displacement: 1.647 ft
Total Well Penetration Depth: 22.32 ft
Casing Radius: 0.083 ft
Static Water Column Height: 15.41 ft
Screen Length: 5. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

## SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.008048 cm/sec
y0 = 2.595 ft




SLUG TEST XPW-3

Data Set: P:\Projects\Hennepin\AqtSolv Reports\XPW-3\XPW-3 Trial 2.aqt
Date: 04/09/21 Time: 15:36:55

PROJECT INFORMATION

Company: Geosyntec
Client: Vistra
Project: GLP8020
Location: Hennepin, IL
Test Well: XPW-3
Test Date: 2/17/2021

AQUIFER DATA

Saturated Thickness: 15.41 ft
Anisotropy Ratio (Kz/Kr): 0.3

WELL DATA (XPW-3)

Initial Displacement: 1.821 ft
Total Well Penetration Depth: 22.32 ft
Casing Radius: 0.083 ft
Static Water Column Height: 15.41 ft
Screen Length: 5. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.007708 cm/sec
y0 = 2.755 ft

# APPENDIX E
# INFORMATION PERTIENT TO 35 I.A.C. § 845.220(a)(3)

# TABLES

**Table A-1. Surrounding Surface Water Bodies**

Part 845
Hennepin East Ash Pond (Unit ID: 803)
Hennepin Power Station
Hennepin, Illinois

| HUC | Surface Water ID | Distance from Unit (m) | Physical Orientation to Unit | Hydraulic Orientation to Unit | Classification Code | Size (acres) | Notes |
|---|---|---|---|---|---|---|---|
| 07130001 | Freshwater Pond 1 | 41 | WSW | Sidegradient | PUBGx | 0.48 | |
| 07130001 | Freshwater Pond 2 | 121 | S | Upgradient | PUBGx | 0.59 | |
| 07130001 | Riverine 1 | 127 | E | Sidegradient | R4SBC | 1.22 | |
| 07130001 | Lake 1 | 171 | SSW | Upgradient | L1UBHh | 16872.11 | |
| 07130001 | Freshwater Pond 3 | 196 | S | Upgradient | PUBGx | 2.14 | |
| 07130001 | Freshwater Emergent Wetland 1 | 239 | NE | Sidegradient | PEM1Fh | 3.62 | |
| 07130001 | Freshwater Forested/Shrub Wetland 1 | 294 | NE | Sidegradient | PFO1Ch | 1.37 | |
| 07130001 | Freshwater Forested/Shrub Wetland 2 | 342 | NE | Sidegradient | PFO1Ah | 30.15 | |
| 07130001 | Freshwater Emergent Wetland 2 | 639 | N | Downgradient | PEM1Ch | 31.96 | |
| 07130001 | Freshwater Forested/Shrub Wetland 3 | 652 | ENE | Sidegradient | PFO1Ch | 11.24 | |
| 07130001 | Freshwater Forested/Shrub Wetland 4 | 668 | ENE | Sidegradient | PFO1Ch | 22.48 | |
| 07130001 | Freshwater Forested/Shrub Wetland 5 | 711 | NW | Downgradient | PFO1Ch | 270.10 | |
| 07130001 | Freshwater Forested/Shrub Wetland 6 | 757 | NE | Sidegradient | PFO1A | 8.49 | |

**Notes:**

List of wetlands and water bodies obtained from the US Fish and Wildlife Service. Distance and direction were calculated by Geosyntec.
Based on groundwater elevation contour maps in the vicinity of the EAP from 2015 to 2020, groundwater predominantly flows to the north-northeast, towards the Illinois River (Ramboll, 2020).
Distance and direction from EAP were calculated by Geosyntec.
Wetlands and surface water features located within 1,000 meters of the Hennepin Power Station are included in this table.
Watershed codes are provided as HUC8.
m = meter/meters
EAP = East Ash Pond
HUC = Hydrologic Unit Code
E = east
ENE = east-northeast
N = north
NE = northeast
NW = northwest
S = south
SSW = south-southwest
WSW = west-southwest

**Table A-2. Surrounding Wells**

Part 845
Hennepin East Ash Pond (Unit ID: 803)
Hennepin Power Station
Hennepin, Illinois

| Well Number | Date Constructed | Ground Elevation (ft NAVD88/ GEOID 12A) | Screen Top Depth (ft BGS) | Screen Bottom Depth (ft BGS) | Screen Top Elevation (ft NAVD88/ GEOID 12A) | Screen Bottom Elevation (ft NAVD88/ GEOID 12A) | Bottom of Boring Elevation (ft NAVD88/ GEOID 12A) | Screen Length (ft) | Screen Diameter (inches) | Well Depth from Ground Surface (ft bgs) |
|---|---|---|---|---|---|---|---|---|---|---|
| 121552029200 | 8/31/1978 | -- | -- | -- | -- | -- | -- | -- | -- | 109 |
| 121552045800 | 6/11/1995 | -- | 109 | 113 | -- | -- | -- | 4 | -- | 114 |
| 121552049700 | 10/16/1996 | -- | 102 | 117 | -- | -- | -- | 15 | -- | 124 |
| 121552025800 | 6/30/1978 | -- | -- | -- | -- | -- | -- | -- | -- | 128 |
| 121552043500 | 9/29/1993 | -- | 90 | 115 | -- | -- | -- | 25 | -- | 120 |
| 121550012800 | 8/31/1968 | -- | -- | -- | -- | -- | -- | -- | -- | 113 |
| 121552059800 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 114 |
| 121552059900 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 115 |
| 121552051800 | 8/24/1999 | -- | 0 | 0 | -- | -- | -- | -- | -- | 72 |
| 121552068500 | 11/14/2002 | -- | 28 | 64 | -- | -- | -- | 36 | -- | 64 |

**Notes:**

Water well information obtained from the Illinois Geological Survey (ISGS) Illinois Water Wells (ILWATER) database.
Based on groundwater elevation contour maps in the vicinity of the EAP from 2015 to 2020, groundwater predominantly flows to the north-northeast, towards the Illinois River (Ramboll, 2020).
Distance and direction from EAP were calculated by Geosyntec.
Wells located within 3,280 ft. of the Site are included in this table.
bgs = below ground surface
D = downgradient
DD = decimal degrees
m = meter/meters
S = Source water (Porewater or Pond water)
Sd = Sidegradient
U = upgradient
-- = information not available

**Table A-2. Surrounding Wells**

Part 845
Hennepin East Ash Pond (Unit ID: 803)
Hennepin Power Station
Hennepin, Illinois

| Well Number | Total Boring Depth (ft BGS) | State Planar Northing - Y (NAD83/ East Zone) | State Planar Easting - X (NAD 83/ East Zone) | Latitude (DD) | Longitude (DD) | X, Y Survey Date | Hydraulic Position Designation (B/Sd/U/D/P) | Distance from Unit (m) |
|---|---|---|---|---|---|---|---|---|
| 121552029200 | 109 | 1688035.517 | 2533586.945 | 41.298332 | -89.304115 | -- | U | 331 |
| 121552045800 | 114 | 1690497.038 | 2534947.337 | 41.30505 | -89.299075 | -- | Sd | 346 |
| 121552049700 | 124 | 1687987.525 | 2534110.643 | 41.298186 | -89.302211 | -- | U | 400 |
| 121552025800 | 128 | 1687796.866 | 2533772.61 | 41.297672 | -89.303448 | -- | U | 415 |
| 121552043500 | 120 | 1690402.706 | 2531611.164 | 41.304882 | -89.31122 | -- | D | 454 |
| 121550012800 | 113 | 1690402.706 | 2531611.164 | 41.304882 | -89.31122 | -- | D | 454 |
| 121552059800 | 114 | 1690402.706 | 2531611.164 | 41.304882 | -89.31122 | -- | D | 454 |
| 121552059900 | 115 | 1689354.194 | 2530630.626 | 41.302031 | -89.314826 | -- | Sd | 699 |
| 121552051800 | 72 | 1687206.835 | 2535662.026 | 41.296001 | -89.296594 | -- | U | 822 |
| 121552068500 | 64 | 1687206.835 | 2535662.026 | 41.296001 | -89.296594 | -- | U | 822 |

**Notes:**

Water well information obtained from the Illinois Geological Survey (ISGS) Illinois Water Wells (ILWATER) database.
Based on groundwater elevation contour maps in the vicinity of the EAP from 2015 to 2020, groundwater predominantly flows to the north-northeast, towards the Illinois River (Ramboll, 2020).
Distance and direction from EAP were calculated by Geosyntec.
Wells located within 3,280 ft. of the EAP are included in this table.
bgs = below ground surface
D = downgradient
DD = decimal degrees
m = meter/meters
S= Source water (Porewater or Pond water)
Sd= Sidegradient
U = upgradient
-- = information not available

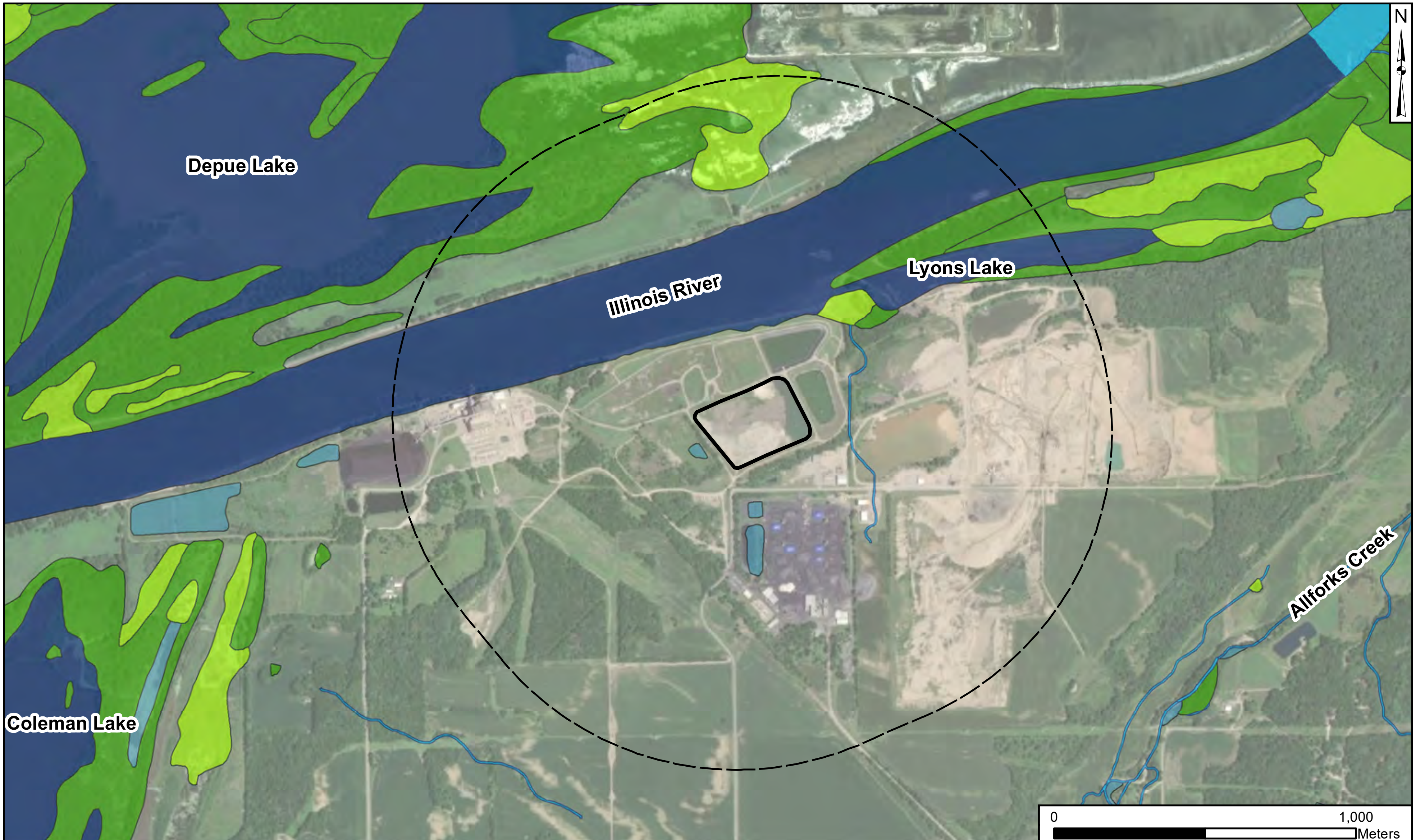
**Table A-3 Threatened and Endangered Species**

Part 845
Hennepin East Ash Pond (Unit ID: 803)
Hennepin Power Station
Hennepin, Illinois

| Scientific Name | Common Name | Status | Distance from Unit (m) | Physical Orientation to Unit | Hydraulic Orientation to Unit | Occurences | Last Observed | Notes |
|---|---|---|---|---|---|---|---|---|
| Asio flammeus | Short-eared Owl | LE | -- | -- | -- | 1 | January 2012 | Habitat identified at the county level only |
| Boltonia decurrens | Decurrent False Aster | LT | -- | -- | -- | 4 | August 2018 | Habitat identified at the county level only |
| Bombus affinis | Rusty Patched Bumble Bee | LE | -- | -- | -- | 1 | August 2018 | Habitat identified at the county level only |
| Chlidonias niger | Black Tern | LE | -- | -- | -- | 1 | June 2004 | Habitat identified at the county level only |
| Circus hudsonius | Northern Harrier | LE | -- | -- | -- | 1 | December 2015 | Habitat identified at the county level only |
| Coregonus artedi | Cisco | LE | -- | -- | -- | 1 | October 1935 | Habitat identified at the county level only |
| Filipendula rubra | Queen-of-the-prairie | LT | -- | -- | -- | 2 | July 2014 | Habitat identified at the county level only |
| Fundulus dispar | Starhead Topminnow | LT | -- | -- | -- | 1 | August 2015 | Habitat identified at the county level only |
| Gallinula galeata | Common Gallinule | LE | -- | -- | -- | 1 | June 2017 | Habitat identified at the county level only |
| Heterodon nasicus | Plains Hog-nosed Snake | LT | -- | -- | -- | 1 | May 1905 | Habitat identified at the county level only |
| Ichthyomyzon fossor | Northern Brook Lamprey | LE | -- | -- | -- | 1 | April 2015 | Habitat identified at the county level only |
| Ixobrychus exilis | Least Bittern | LT | -- | -- | -- | 1 | June 2017 | Habitat identified at the county level only |
| Lanius ludovicianus | Loggerhead Shrike | LE | -- | -- | -- | 1 | June 1905 | Habitat identified at the county level only |
| Lepomis miniatus | Redspotted Sunfish | LT | -- | -- | -- | 1 | June 2015 | Habitat identified at the county level only |
| Mimulus glabratus | Yellow Monkey Flower | LE | -- | -- | -- | 1 | March 2012 | Habitat identified at the county level only |
| Myotis septentrionalis | Northern Long-eared Myotis | LT | -- | -- | -- | 1 | May 2002 | Habitat identified at the county level only |
| Myotis sodalis | Indiana Bat | LE | -- | -- | -- | 4 | May 2011 | Habitat identified at the county level only |
| Notropis chalybaeus | Ironcolor Shiner | LT | -- | -- | -- | 1 | August 2016 | Habitat identified at the county level only |
| Phalaropus tricolor | Wilson's Phalarope | LE | -- | -- | -- | 1 | June 2005 | Habitat identified at the county level only |
| Rallus elegans | King Rail | LE | -- | -- | -- | 1 | June 1905 | Habitat identified at the county level only |
| Sparganium americanum | American Bur-reed | LE | -- | -- | -- | 1 | August 1977 | Habitat identified at the county level only |
| Trifolium reflexum | Buffalo Clover | LT | -- | -- | -- | 1 | June 2017 | Habitat identified at the county level only |
| Xanthocephalus xanthocephalus | Yellow-headed Blackbird | LE | -- | -- | -- | 1 | June 2015 | Habitat identified at the county level only |

**Notes:**
List of endangered species obtained from the Illinois Department of Natural Resources (IDNR)
**--** = not provided/cannot be determined
m = meter/meters
LE = listed endangered
LT = listed threatened

# FIGURES




**Legend**

- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Riverine
- Hennepin East Ash Pond (EAP)
- Hennepin EAP 1000-meter Buffer

**Notes:**
- Wetlands and Surface data were provided by the United States Fish and Wildlife Service (USFWS) Data Mapper and the United States Geologic Survey (USGS) National Hydrography Dataset (NHD).

**Surface Water and Wetlands within 1,000 meters of the Hennepin East Ash Pond**

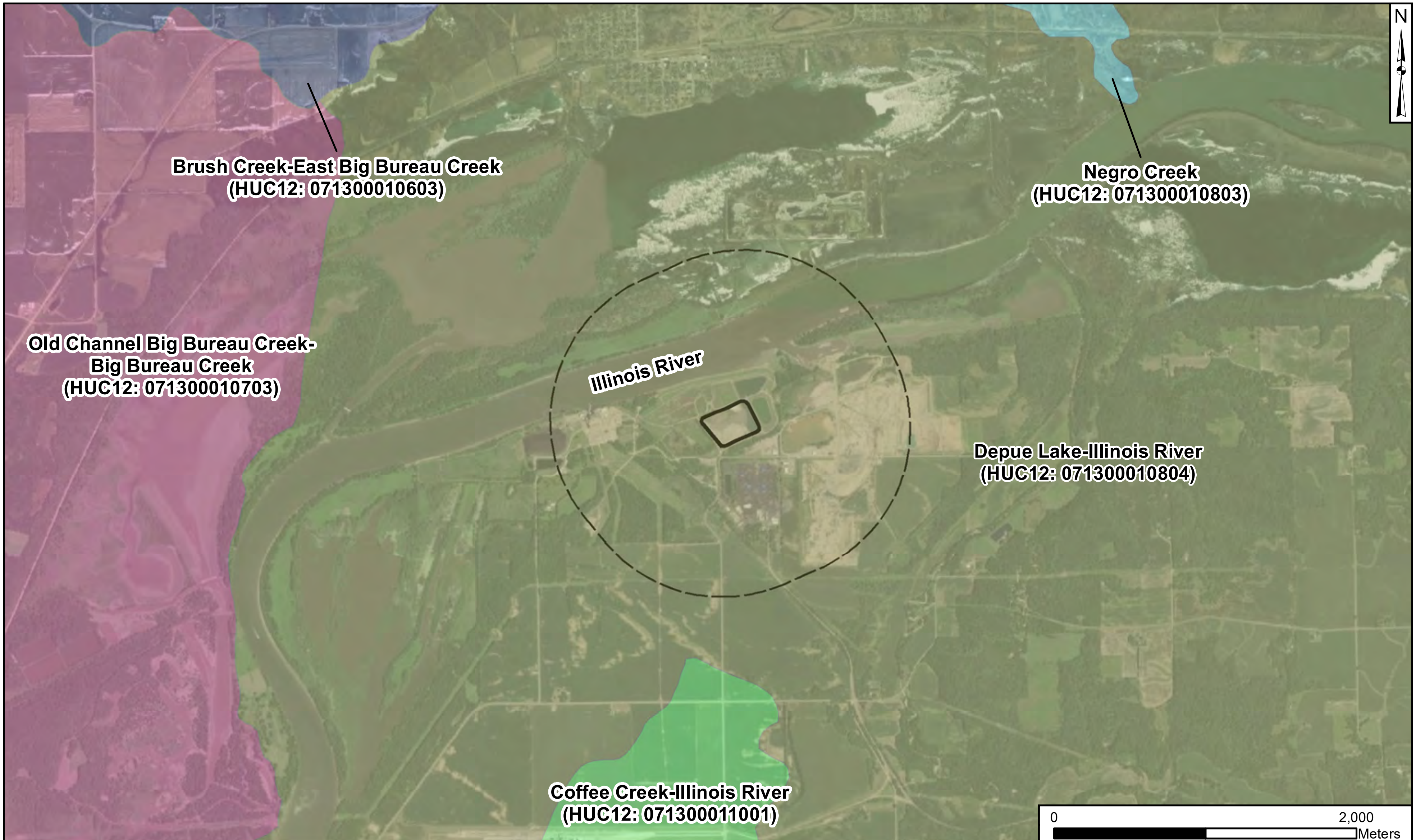
Hennepin Power Station
Hennepin, Illinois

Geosyntec consultants

GLP8020 | March 2021

**Figure A-1**

C:\Users\CCua\Desktop\Projects\Vistra\GIS\MXD Hennepin\Fig A-1 - Wetlands Hennepin.mxd 3/29/2021 10:58:04 AM




**Legend**

- Brush Creek-East Big Bureau Creek
- Coffee Creek-Illinois River
- Depue Lake-Illinois River
- Negro Creek
- Old Channel Big Bureau Creek-Big Bureau Creek
- Hennepin East Ash Pond
- Hennepin EAP 1000-meter Buffer

**Notes:**
- Watershed boundary data was obtained from the United States Geologic Survey (USGS) Watershed Boundary Dataset.
- HUC 12 = Hydrologic Unit Code 12

**Watersheds within 1,000 meters of the Hennepin East Ash Pond**

Hennepin Power Station
Hennepin, Illinois

Geosyntec consultants

**Figure**

**A-2**

GLP8020 | March 2021

C:\Users\CCua\Desktop\Projects\Vistra\GIS\MXD Hennepin\Fig A-2 - Watersheds Hennepin.mxd 3/31/2021 11:26:00 AM


**Legend**

- Aquifers of Alluvial and Glacial Origin
- Illinois Major Sand and Gravel Aquifer
- Hennepin East Ash Pond (EAP)
- Hennepin EAP 1000-meter Buffer

**Notes:**
- Aquifers of Alluvial and Glacial Origin dataset was obtained from the United States Geologic Survey (USGS).
- Illinois Major Sand and Gravel Aquifer dataset was obtained from the Illinois Geological Survey (ISGS) .

**Aquifers within 1,000 meters of the Hennepin East Ash Pond**

Hennepin Power Station
Hennepin, Illinois

Geosyntec consultants

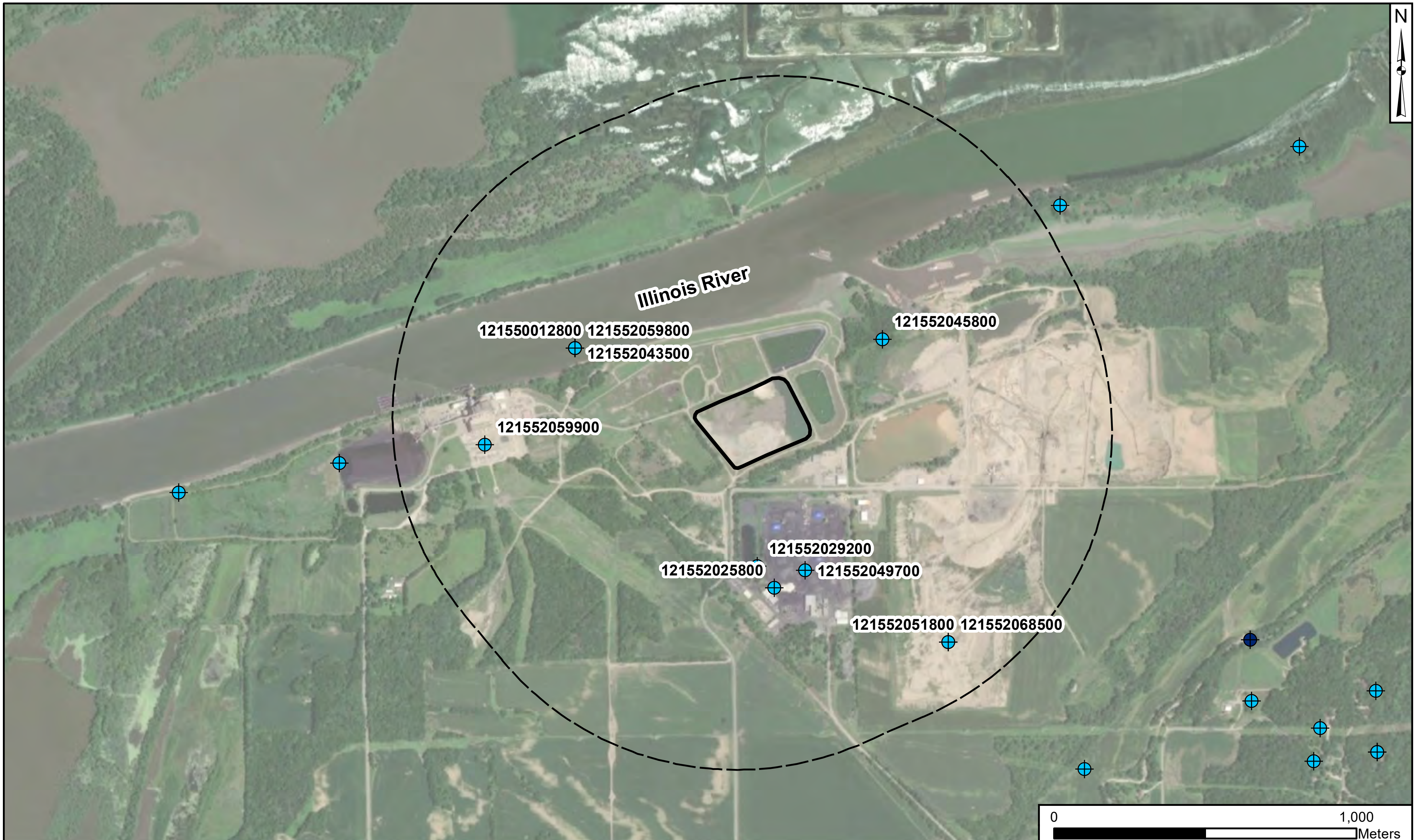
GLP8020

March 2021

**Figure**

**A-3**

C:\Users\CCua\Desktop\Projects\Vistra\GIS\MXD Hennepin\Fig A-3 - Aquifers Hennepin.mxd 3/29/2021 10:57:57 AM




**Legend**

- Water Well
- Water Well, Plugged
- Hennepin East Ash Pond (EAP)
- Hennepin EAP 1000-meter Buffer

**Notes:**

- One group of three wells (121552043500, 121550012800, 121552059800) and one group of two wells (121552051800, 121552068500) are indicated to have the same location coordinates.
- Wells resulting in significant findings are called out.
- Water well data obtained from Illinois Geological Survey (ISGS) Illinois Water and Related Wells (ILWATER) database.
- No Public Water Supply Wells were found within 1,000-meter of the Site.

**Water Wells within 1,000 meters of the Hennepin East Ash Pond**

Hennepin Power Station
Hennepin, Illinois

Geosyntec consultants

**Figure A-4**

GLP8020

March 2021

C:\Users\CCua\Desktop\Projects\Vistra\GIS\MXD Hennepin\Fig A-4 - Surrounding Wells Hennepin.mxd 3/30/2021 9:46:50 AM

# ISGS BORING LOGS

# ILLINOIS STATE GEOLOGICAL SURVEY

| Water Well | Top | Bottom |
|---|---|---|
| **Total Depth** | | **113** |
| Driller's Log filed | | |

**Permit Date:** **Permit #:**

**COMPANY** Layne Western Co., Inc.

**FARM** Illinois Power

**DATE DRILLED** September 1, 1968 **NO.** 5

**ELEVATION** 0 **COUNTY NO.** 00128

**LOCATION** NE NE NW

**LATITUDE** 41.304882 **LONGITUDE** -89.31122

**COUNTY** Putnam **API** 121550012800 26 - 33N - 2W

# ILLINOIS STATE GEOLOGICAL SURVEY

| Water Well | Top | Bottom |
|---|---|---|
| **Total Depth** | | **128** |
| Driller's Log filed | | |
| Sample set # 61999 (0' - 130') Received: June 15, 1979 | | |

**Permit Date:** **Permit #:**

**COMPANY** Layne Western Co., Inc.

**FARM** Esk Corporation

**DATE DRILLED** July 1, 1978 **NO.** 2

**ELEVATION** 0 **COUNTY NO.** 20258

**LOCATION** 1590'S line, 890'E line of SE

**LATITUDE** 41.297672 **LONGITUDE** -89.303448

**COUNTY Putnam** **API 121552025800** **26 - 33N - 2W**

# ILLINOIS STATE GEOLOGICAL SURVEY

| Water Well | Top | Bottom |
|---|---|---|
| **Total Depth** | | **109** |
| Driller's Log filed | | |
| Sample set # 61998 (0' - 105') Received: June 15, 1979 | | |

**Permit Date:** **Permit #:**

**COMPANY** Layne Western Co., Inc.
**FARM** Esk Corporation
**DATE DRILLED** September 1, 1978 **NO.** 1
**ELEVATION** 0 **COUNTY NO.** 20292
**LOCATION** 1830'S line, 1070'E line of SE
**LATITUDE** 41.298332 **LONGITUDE** -89.304115
**COUNTY** Putnam **API** 121552029200 **26 - 33N - 2W**

# ILLINOIS STATE GEOLOGICAL SURVEY

| Noncommunity - Public Water Well | Top | Bottom |
|---|---|---|
| SS #68242 (0'-120') | 0 | 0 |
| black topsoil | 0 | 2 |
| brown clay, a little clayey | 2 | 7 |
| yellow-brown coarse gravel & boulders | 7 | 27 |
| brown coarse sand to coarse gravel | 27 | 41 |
| gray & brown soft silty clay | 41 | 43 |
| brn med sand to coarse gravel & boulders | 43 | 50 |
| reddish brown coarse gravel & boulders | 50 | 67 |
| multi-colored boulders | 67 | 73 |
| conglomerate clay & boulders /trace lime | 73 | 82 |
| light gray silty clay | 82 | 84 |
| hard tight coarse gravel | 84 | 86 |
| brn med sand to coarse gravel & boulders | 86 | 96 |
| boulder | 96 | 98 |
| fn brn snd; coarse gravel w/finer layers | 98 | 112 |
| brown fine sand to medium gravel | 112 | 118 |
| firm gray shale | 118 | 125 |
| **Total Depth** | | **120** |

Casing: 36" STEEL from 12' to 62'
18" STEEL 70.59#/FT. from -2' to 90'

Screen: 25' of 18" diameter .1 slot

Grout: CONCRETE from 0 to 20.

Water from sand & gravel at 90' to 115'.
Static level 17' below casing top which is 3' above GL
Pumping level 31' when pumping at 1086 gpm for 8 hours

Permanent pump installed at 50'

**Permit Date:** August 31, 1993 **Permit #:**

**COMPANY** Buffington, G.
**FARM** Illinois Power Co.
**DATE DRILLED** September 30, 1993 **NO.** 1A/5
**ELEVATION** 0 **COUNTY NO.** 20435
**LOCATION** NE NE NW
**LATITUDE** 41.304882 **LONGITUDE** -89.31122
**COUNTY Putnam** **API 121552043500** **26 - 33N - 2W**

on October 31, 1993, with a capacity of 500 gpm
Sample set # 68242 (10' - 120') Received: July 14, 1994

Owner Address: P.O. Box #188 Hennepin, IL
Location source: Location from permit

# ILLINOIS STATE GEOLOGICAL SURVEY

| Semi-Private Water Well | Top | Bottom |
|---|---|---|
| yellow rocky sand & gravel | 0 | 75 |
| very fine Sankoty sand | 75 | 114 |
| blue shale at | 114 | 114 |
| **Total Depth** | | **114** |

Casing: 6" BLACK STEEL from 3' to 109'

Screen: 4' of 6" diameter 10 slot

Grout: BENTONITE from 0 to 90.

Size hole below casing: 6"

Water from Sankoty at 109' to 113'.
Static level 75' below casing top which is 1' above GL
Pumping level 105' when pumping at 10 gpm for 2 hours

Permanent pump installed at 112'
on June 29, 1995, with a capacity of 10 gpm

Owner Address: W. Railroad Ave. Princeton, IL

Address of well: R.R. #1
Hennepin, IL

Location source: Location from permit

**Permit Date:** May 31, 1995 **Permit #:**

**COMPANY** Lutes, George W.

**FARM** Advanced Asphalt Co.

**DATE DRILLED** June 12, 1995 **NO.**

**ELEVATION** 0 **COUNTY NO.** 20458

**LOCATION** SW NW NW

**LATITUDE** 41.30505 **LONGITUDE** -89.299075

**COUNTY Putnam** **API 121552045800** **25 - 33N - 2W**

# ILLINOIS STATE GEOLOGICAL SURVEY

| Noncommunity - Public Water Well | Top | Bottom |
|---|---|---|
| SS #68792 (0-120') | 0 | 0 |
| fine brown sand | 0 | 4 |
| gray clay | 4 | 5 |
| coarse sand & gravel with boulders | 5 | 79 |
| brown clay with gravel | 79 | 81 |
| fine sand with gravel | 81 | 117 |
| gray shale | 117 | 124 |
| **Total Depth** | | **124** |

Casing: 12" STEEL .375" from 0' to 102'
Screen: 15' of 12" diameter .13 slot
Grout: CEMENT from 0 to 20.

Size hole below casing: 38"

Water from sand & gravel at 102' to 117'.

Remarks: for factory

Sample set # 68792 (0' - 120') Received: March 6, 2000

Owner Address: Box #200 A Hennepin, IL
Location source: Location from permit

**Permit Date:** September 5, 1996 **Permit #:** 155-011

**COMPANY** Buffington, G.
**FARM** Exolon - ESK Company
**DATE DRILLED** October 17, 1996 **NO.** 3
**ELEVATION** 0 **COUNTY NO.** 20497
**LOCATION** 1775'N 550'W SE/c
**LATITUDE** 41.298186 **LONGITUDE** -89.302211
**COUNTY Putnam** **API 121552049700** **26 - 33N - 2W**

# ILLINOIS STATE GEOLOGICAL SURVEY

| Private Water Well | Top | Bottom |
|---|---|---|
| dirty sand | 0 | 8 |
| gravel | 8 | 18 |
| clay | 18 | 36 |
| yellow gravel (a lot of water loss) | 36 | 50 |
| gray gravel (a lot of water loss) | 50 | 72 |
| shale at | 72 | 72 |
| **Total Depth** | | **72** |

Casing: 4" PVC SCH 40 from -1' to 51'
Screen: 4' of 4" diameter 15 slot
Grout: BENT GROUT MIX from 0 to 46.

Water from sand & gravel at 0' to 0'.
Static level 18' below casing top which is 1' above GL
Pumping level 0' when pumping at 50 gpm for 3 hours

Owner Address: 27W 161 80th St. Naperville, IL
Address of well: R.R. #1
Hennepin, IL
Location source: Location from permit

**Permit Date:** August 3, 1999 **Permit #:**

**COMPANY** Jet Hall
**FARM** Brown, Kenneth
**DATE DRILLED** August 25, 1999 **NO.**
**ELEVATION** 0 **COUNTY NO.** 20518
**LOCATION** NE SW SW
**LATITUDE** 41.296001 **LONGITUDE** -89.296594
**COUNTY** Putnam **API** 121552051800 **25 - 33N - 2W**

# ILLINOIS STATE GEOLOGICAL SURVEY

| Water Well | Top | Bottom |
|---|---|---|
| **Total Depth** | | **114** |
| Sample set # 56227 (65' - 114') Received: May 16, 1969 | | |

**Permit Date:** **Permit #:**

**COMPANY** Layne-Western Drlg

**FARM** Il. Power Co.

**DATE DRILLED** **NO.** 4

**ELEVATION** 0GL **COUNTY NO.** 20598

**LOCATION** NE NE NW

**LATITUDE** 41.304882 **LONGITUDE** -89.31122

**COUNTY** Putnam **API** 121552059800 **26 - 33N - 2W**

# ILLINOIS STATE GEOLOGICAL SURVEY

| Water Well | Top | Bottom |
|---|---|---|
| **Total Depth** | | **115** |
| Sample set # 20941 (0' - 115') Received: January 1, 1950 | | |

**Permit Date:** **Permit #:**

**COMPANY** Layne-Western Drlg
**FARM** Il. Power Co. Test
**DATE DRILLED** **NO.** 9
**ELEVATION** 0GL **COUNTY NO.** 20599
**LOCATION** NW
**LATITUDE** 41.302031 **LONGITUDE** -89.314826
**COUNTY** Putnam **API** 121552059900 26 - 33N - 2W

# ILLINOIS STATE GEOLOGICAL SURVEY

| Private Water Well | Top | Bottom |
|---|---|---|
| sandy brown clay | 0 | 12 |
| gravel | 12 | 20 |
| pinkish gray clay | 20 | 28 |
| yellow gravel (lots of water loss) | 28 | 50 |
| fine sand | 50 | 64 |
| **Total Depth** | | **64** |

Casing: 6" PVC from 0' to 42'
6" SS SCREEN 18/20 SLOT from 42' to 50'
Screen: 8' of 6" diameter slot
Grout: BENT CLAY SLRY from 0 to 40.
Grout: MUSCATINE #1 from 40 to 50.

Water from sand & gravel at 28' to 64'.
Static level 5' below casing top which is 1' above GL
Pumping level 7' when pumping at 12 gpm for 2 hours

Remarks: pond fill

Owner Address: R.R. 1 Box 204 Hennepin, IL
Address of well: same as above
Location source: Location from permit

**Permit Date:** October 4, 2002 **Permit #:**

**COMPANY** Jet Hall/Lutes H2o Well Drlg.
**FARM** Brown, Kenneth
**DATE DRILLED** November 15, 2002 **NO.**
**ELEVATION** 0 **COUNTY NO.** 20685
**LOCATION** NE SW SW
**LATITUDE** 41.296001 **LONGITUDE** -89.296594
**COUNTY Putnam** **API 121552068500** **25 - 33N - 2W**

# APPENDIX F
# FEMA FLOOD HAZARD MAP

## NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or flood plain management.

**Coastal Base Flood Elevations** shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or flood plain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

In the State of Illinois, any portion of a stream or watercourse that lies within the **floodway fringe** of a studied (AE) stream may have a state regulated floodway. The FIRM may not depict these state regulated floodways.

**Floodways** restricted by anthropogenic features such as bridges and culverts are drawn to reflect natural conditions and may not agree with the model computed widths listed in the Floodway Data table in the Flood Insurance Study report.

Multiple **topographic sources** may have been used in the delineation of Special Flood Hazard Areas. See Flood Insurance Study report for details on source resolution and geographic extent.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 16. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services, NOAA, N/NGS12
National Geodetic Survey SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit its website at www.ngs.noaa.gov.

**Base map** information shown on this FIRM was provided in digital format by the United States Geological Survey. Digital orthoimagery with a spatial resolution of 0.5 meter ground sample distance were photogrammetrically compiled from aerial photography acquired during the leaf-off period of spring 2005.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The Special Flood Hazard Areas and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

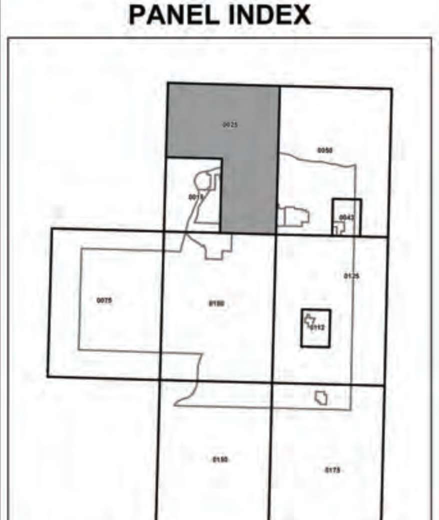
**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the Map Service Center (MSC) website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map**, how to order products or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

## PANEL INDEX



Panel Not Printed


## LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

| | |
|---|---|
| **ZONE A** | No Base Flood Elevations determined. |
| **ZONE AE** | Base Flood Elevations determined. |
| **ZONE AH** | Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined. |
| **ZONE AO** | Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined. |
| **ZONE AR** | Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood. |
| **ZONE A99** | Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined. |
| **ZONE V** | Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined. |
| **ZONE VE** | Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined. |

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

| | |
|---|---|
| **ZONE X** | Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood. |

OTHER AREAS

| | |
|---|---|
| **ZONE X** | Areas determined to be outside the 0.2% annual chance floodplain. |
| **ZONE D** | Areas in which flood hazards are undetermined, but possible. |

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary
0.2% annual chance floodplain boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

| | |
|---|---|
| ~~513~~ | Base Flood Elevation line and value; elevation in feet* |
| (EL 987) | Base Flood Elevation value where uniform within zone; elevation in feet* |

*Referenced to the North American Vertical Datum of 1988

| | |
|---|---|
| (A)———(A) | Cross section line |
| (23)- - - - -(23) | Transect line |
| 45° 02' 08", 93° 02' 12" | Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) |
| $^{45}89^{000M}$ N | 1000-meter Universal Transverse Mercator grid values, zone 16 |
| 1565000 FT | 5000-foot grid tick: Illinois State Plane West Coordinate System, 3801 zone (FIPSZONE 1202) Transverse Mercator |
| DX5510× | Bench mark (see explanation in Notes to Users section of this FIRM panel) |
| • M1.5 | River Mile |

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
FEBRUARY 4, 2011

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

**MAP SCALE 1" = 2000'**

1000 0 2000 4000 FEET
600 0 600 1200 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

**PANEL 0025E**

# FIRM
## FLOOD INSURANCE RATE MAP
## PUTNAM COUNTY, ILLINOIS
### AND INCORPORATED AREAS

**PANEL 25 OF 175**

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| HENNEPIN, VILLAGE OF | 170570 | 0025 | E |
| MARK, VILLAGE OF | 170572 | 0025 | E |
| PUTNAM COUNTY | 170993 | 0025 | E |

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

**MAP NUMBER**
**17155C0025E**

**EFFECTIVE DATE**
**FEBRUARY 4, 2011**

Federal Emergency Management Agency

# ATTACHMENT I

Intended for
**Dynegy Midwest Generation, LLC**

Date
**October 25, 2021**

Project No.
**1940100806-005**

# GROUNDWATER MONITORING PLAN

## EAST ASH POND
## HENNEPIN POWER PLANT
## HENNEPIN, ILLINOIS

RAMBOLL Bright ideas. Sustainable change.

# GROUNDWATER MONITORING PLAN
# EAST ASH POND

| | |
|---|---|
| Project Name | **Hennepin Power Plant East Ash Pond** |
| Project No. | **1940100806-005** |
| Recipient | **Dynegy Midwest Generation, LLC** |
| Document Type | **Groundwater Monitoring Plan** |
| Revision | **FINAL** |
| Date | **October 25, 2021** |

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**Senior Managing Hydrogeologist**

**Eric J. Tlachac, PE**
**Senior Managing Engineer**

**Nathaniel R. Keller**
**Senior Hydrogeologist**

**Chase J. Christenson, PG**
**Hydrogeologist**

# LICENSED PROFESSIONAL CERTIFICATIONS

## 35 I.A.C. § 845.630 Groundwater Monitoring Systems (PE)

*I, Eric J. Tlachac, a qualified professional engineer in good standing in the State of Illinois, certify that the groundwater monitoring system described in this document (Groundwater Monitoring Plan, Hennepin Power Plant East Ash Pond), has been designed and constructed to meet the requirements of 35 I.A.C. § 845.630. The monitoring system was developed based on information included in the Hydrogeologic Site Characterization Report (Ramboll 2021; included in the Operating Permit to which this Groundwater Monitoring Plan is attached).*

Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
Date: October 25, 2021

## 35 I.A.C. § 845.630 Groundwater Monitoring Systems (PG)

*I, Brian G. Hennings, a qualified professional geologist in good standing in the State of Illinois, certify that the groundwater monitoring system described in this document (Groundwater Monitoring Plan, Hennepin Power Plant East Ash Pond), has been designed and constructed to meet the requirements of 35 I.A.C. § 845.630. The monitoring system was developed based on information included in the Hydrogeologic Site Characterization Report (Ramboll 2021; included in the Operating Permit to which this Groundwater Monitoring Plan is attached).*

Brian G. Hennings
Professional Geologist
196.001482
Illinois
Date: October 25, 2021

# CONTENTS

## TABLES (IN TEXT)



## TABLES (ATTACHED)



## FIGURES (ATTACHED)



## APPENDICES

# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| § | Section |
| 35 I.A.C. | Title 35 of the Illinois Administrative Code |
| 40 C.F.R. | Title 40 of the Code of Federal Regulations |
| AP2 | Ash Pond No. 2 |
| AP4 | Ash Pond No. 4 |
| ASD | Alternate Source Demonstration |
| bgs | below ground surface |
| CCR | coal combustion residuals |
| CCWL | Coal Combustion Waste Landfill |
| cm/s | centimeters per second |
| CSM | conceptual site model |
| DMG | Dynegy Midwest Generation, LLC |
| EAP | East Ash Pond |
| EAPS | East Ash Pond System, includes CCWL, EAP, AP2, and AP4 |
| GMP | Groundwater Monitoring Plan |
| GWPS | groundwater protection standard |
| HCR | Hydrogeologic Site Characterization Report |
| HPP | Hennepin Power Plant |
| ID | identification |
| IEPA | Illinois Environmental Protection Agency |
| IFR | Initial Facility Report |
| MW | megawatts |
| NAVD88 | North American Vertical Datum of 1988 |
| NID | National Inventory of Dams |
| No. | number |
| NRT | Natural Resource Technology, Inc. |
| Part 845 | Residuals in Surface Impoundments: Title 35 of the Illinois Administrative Code § 845 |
| PMP | potential migration pathway |
| QA/QC | quality assurance/quality control |
| Ramboll | Ramboll Americas Engineering Solutions, Inc. |
| RL | reporting limit |
| SI | surface impoundment |
| Site | Hennepin EAP |
| STMI | Science & Technology Management, Inc. |
| TDS | total dissolved solids |
| USEPA | United States Environmental Protection Agency |

# 1. INTRODUCTION

## 1.1 Overview

In accordance with requirements of the Standards for the Disposal of Coal Combustion Residuals (CCR) in Surface Impoundments (SIs): Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845 (Part 845) (Illinois Environmental Protection Agency [IEPA], April 15, 2021), Ramboll Americas Engineering Solutions, Inc. (Ramboll) has prepared this Groundwater Monitoring Plan (GMP) on behalf of Hennepin Power Plant (HPP) (**Figure 1-1**), operated by Dynegy Midwest Generation, LLC (DMG). This report will apply specifically to the CCR Unit referred to as the East Ash Pond (EAP) (Vistra identification [ID] Number [No.] 803, IEPA ID No. W1550100002-05, and National Inventory of Dams [NID] No. IL50363). The EAP is a lined 21-acre CCR SI used to manage CCR and non-CCR waste streams at the HPP. This GMP includes Part 845 content requirements specific to 35 I.A.C. § 845.630 (Groundwater Monitoring System), 35 I.A.C. § 845.640 (Groundwater Sampling and Analysis), and 35 I.A.C. § 845.650 (Groundwater Monitoring Program) for the EAP at HPP.

A checklist which identifies the specific requirements of 35 I.A.C. § 845.630, 35 I.A.C. § 845.640, and 35 I.A.C. § 845.650 is included in **Table 1-1**. The table provides references to sections, tables, and figures included in this document to locate the information that meets specific requirements of 35 I.A.C. § 845.630, 35 I.A.C. § 845.640, and 35 I.A.C. § 845.650.

## 1.2 Site Location and Background

The EAP is located in northcentral Illinois in Putnam County, approximately four miles northeast of the Village of Hennepin, located within the northeast quarter of Section 26, Township 33 North, Range 2 West (**Figure 1-1**). The HPP is an approximately 504-acre property consisting of 19 parcels, including a retired coal-fired power plant, CCR landfill and SIs, and farmland. The HPP ceased operations in 2019 when the power plant was retired.

The HPP construction history includes construction of Unit 1 in 1953 and Unit 2 in 1959 with capacities of 70 megawatts (MW) and 210 MW, respectively. The plant initially burned high-sulfur Illinois coal and switched to sub-bituminous Powder River Basin coal in 1999 (Science and Technology Management, Inc. [STMI], 1996).

The three CCR Units located adjacent to, or in the vicinity of, each other in the eastern portion of the HPP are referred to as the East Ash Pond System (EAPS). The CCR Units associated with the EAPS are situated south and adjacent to the Illinois River. The area is also bounded to the east and south by industrial properties owned by Tri-Con Materials and Washington Mills, respectively (**Figure 1-2**). The HPP provides the western boundary for the CCR Units with agricultural land to the southwest. Additionally, a 9-acre parcel between the HPP property and Washington Mills (south of the CCR Units) was previously occupied by American Asphalt but operations are no longer active, and the property contains several abandoned buildings. The current owner of this parcel is listed as Tri-Con Materials.

**Figure 1-2** depicts the location of the CCR Units and non-CCR Units within the EAPS. The four Hennepin EAPS CCR units consist of the following: one existing landfill (Coal Combustion Waste Landfill [CCWL; Vistra ID No. 801]), one existing SI (EAP), and two IEPA-approved, closed SIs (Ash Pond No. 2 [AP2; Vistra ID No. 802, IEPA ID No. W1550100002-04, and NID No. IL50663] and Ash Pond No. 4 [AP4; Vistra ID No. 805 and IEPA ID No. W1550100002-07]). Information regarding the CCWL, AP2, and AP4 CCR Units is solely for background information, as this report applies specifically to the EAP CCR Unit, which will hereinafter be referred to as the Site.

## 1.3 Conceptual Model

Significant site investigation has been completed at the HPP to characterize the geology, hydrogeology, and groundwater quality. Based on extensive investigation and monitoring, the EAP has been well characterized and detailed in the Hydrogeologic Site Characterization Report (HCR; included in the Operating Permit to which this Plan is attached). A conceptual site model (CSM) has been developed and is discussed below.

The Site is characterized by two hydrostratigraphic units:

- **Uppermost Aquifer**: Includes the unlithified natural geologic materials of the Cahokia Alluvium and Henry Formation extending from the upper saturated zone to the bedrock. This unit was encountered in all borings advanced at the EAP in 2021 and is identified as the potential migration pathway (PMP).
- **Bedrock Confining Unit**: Comprised of shales with thin limestone, sandstone, and coal beds. This bedrock confining unit is encountered at the EAP at elevations ranging from 399.2 to 410.2 feet North American Vertical Datum of 1988 (NAVD88).

In the vicinity of the EAP groundwater generally flows from the south beneath the EAP toward the Illinois River (**Figure 1-3**) through the uppermost aquifer which is the primary pathway for contaminant migration. Periodic and temporary flow reversals are possible during periods of high river elevations or flooding (**Figure 1-4**). Vertical migration is limited by the underlying Pennsylvanian-age shale bedrock unit which acts as a confining layer. No PMPs have been identified outside of the uppermost aquifer.

Part 845 parameters were monitored in the uppermost aquifer monitoring wells at the EAP as part of the Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257 monitoring program beginning in 2015. These data were supplemented with sampling of additional locations in 2021. The results indicate that the following parameters were detected at concentrations greater than the applicable 35 I.A.C. § 845.600 groundwater protection standards (GWPSs) and are considered potential exceedances:

- Chloride – at background uppermost aquifer wells 08 and 08D;
- Cobalt – at background uppermost aquifer wells 07, 08, and 08D; at uppermost aquifer compliance well 53; and at bedrock confining unit compliance well 55;
- Lithium – at bedrock confining unit compliance well 55 in April 2021;
- pH – at background uppermost aquifer wells 07, 08, and 08D;
- Thallium – at background uppermost aquifer well 08; and at compliance uppermost aquifer well 52; and
- Total Dissolved Solids (TDS) – at background uppermost aquifer wells 08 and 08D.

Concentration results for the above parameters were compared directly to the GWPS, without an evaluation of background concentrations. Evaluation of background groundwater quality has been completed as part of this GMP, and compliance with Part 845 will be determined following the first round of groundwater sampling. The first round of groundwater sampling for compliance will be completed the quarter following issuance of the Operating Permit and in accordance with this GMP.

# 2. GROUNDWATER MONITORING SYSTEMS

## 2.1 Existing Monitoring Well Network and Analysis

Several monitoring programs are being conducted as required by the IEPA and the United States Environmental Protection Agency (USEPA) to evaluate the CCR Units associated with the HPP EAPS and the CCWL. The networks have changed over time and many of the wells and parameters overlap as a result of previously approved GMPs and permits which were developed to focus on specific (and separate) units at the EAPS. The monitoring networks for each of the CCR and non-CCR Units at the EAPS include:

- CCWL
  - Initial Facility Report (IFR) (Section 28)
  - 40 C.F.R. § 257
- AP2 and AP4
  - 40 C.F.R. § 257 for AP2 (AP4 was classified as capped or otherwise maintained and not subject to 40 C.F.R. § 257)
  - IEPA Closure Plan (2019 GMP included in Closure and Post-Closure Care Plan for the Hennepin AP2) and proposed network for Part 845
- EAPS (also includes Leachate Pond and Polishing Pond)
  - IEPA Water Pollution Control Permit 2019-EO-64097 – Special Condition No. 4
- EAP (subject of this GMP)
  - 40 C.F.R. § 257
  - Proposed network for Part 845

This GMP is being provided to propose a groundwater monitoring network and monitoring program specific to the EAP that will comply with Part 845. Monitoring networks and programs that apply to other units are not discussed in this GMP. Those programs will continue to be performed as specified in IEPA approvals. Upon approval of the Operating Permit applications (and by extension the GMPs) for AP2 and AP4 and the EAP, the IEPA Water Pollution Control Permit 2019-EO-64097 Special Condition No. 4 will be discontinued following approval of a future permit modification submittal and will be replaced by the proposed Part 845 monitoring program. The remaining discussion in this document will include only the networks and monitoring programs that are applicable and specific to the EAP, specifically the 40 C.F.R. § 257 network and the proposed Part 845 monitoring network.

### 2.1.1 40 C.F.R. § 257 Monitoring Program

The 40 C.F.R. § 257 well network for the EAP consists of seven monitoring wells installed nearby or adjacent to the EAP within the uppermost aquifer. The EAP 40 C.F.R. § 257 well network consists of three background monitoring wells (07, 08, and 08D) and four compliance monitoring wells (12, 13, 46, and 47). Monitoring wells 16 and 17 are being considered as additional background wells to represent groundwater quality impacts from off-site, upgradient sources. The boring logs, well construction forms, and other related monitoring well forms are available in the Operating Records as required by 40 C.F.R. § 257.91 for each monitored CCR Unit or CCR

Multi-Unit, and are included in Appendix A of the HCR (included in the Operating Permit to which this Plan is attached).

Assessment monitoring in accordance with 40 C.F.R. § 257.95 was initiated on April 9, 2018. Details on the procedures and techniques used to fulfill the groundwater sampling and analysis program requirements are found in the Sampling and Analysis Plan for the EAP (Natural Resource Technology, Inc. [NRT], 2017).

Groundwater samples are collected semiannually and analyzed for the following laboratory and field parameters from Appendix III and Appendix IV of 40 C.F.R. § 257, summarized in **Table A** below.

**Table A. 40 C.F.R. § 257 Groundwater Monitoring Program Parameters**

| | | | |
|---|---|---|---|
| **Field Parameters[1]** | | | |
| Groundwater Elevation | pH | | |
| **Appendix III Parameters (Total, except TDS)** | | | |
| Boron | Chloride | Sulfate | |
| Calcium | Fluoride | TDS | |
| **Appendix IV Parameters (Total)** | | | |
| Antimony | Cadmium | Lead | Selenium |
| Arsenic | Chromium | Lithium | Thallium |
| Barium | Cobalt | Mercury | Radium 226 and 228 combined |
| Beryllium | Fluoride | Molybdenum | |

[1]Dissolved oxygen, temperature, specific conductance, oxidation/reduction potential, and turbidity are recorded during sample collection.

Results and analysis of groundwater sampling are reported annually by January 31 of the following year and made available on the CCR public website as required by 40 C.F.R. § 257.

### 2.1.2 Part 845 Well Installation and Monitoring

In 2021, four additional monitoring wells (52, 53, 54, and 55) were installed along the perimeter of the EAP to assess the vertical and horizontal lithology, stratigraphy, chemical properties, and physical properties of geologic layers to a minimum of 100 feet below ground surface (bgs) as specified in 35 I.A.C. § 845.620(b). Additionally, three leachate monitoring wells (XPW01, XPW02, and XPW03) were installed within the EAP to characterize the CCR materials.

Prospective Part 845 monitoring wells were sampled for eight rounds from February to August 2021 and the results were assessed for selection of the EAP Part 845 monitoring well network. Groundwater samples were collected and analyzed for 35 I.A.C. § 845.600 parameters as summarized in **Table B** below.

**Table B. Part 845 Groundwater Monitoring Program Parameters**

| | | | |
|---|---|---|---|
| **Field Parameters**[1] | | | |
| Groundwater Elevation | pH | Turbidity | |
| **Metals (Total)** | | | |
| Antimony | Boron | Cobalt | Molybdenum |
| Arsenic | Cadmium | Lead | Selenium |
| Barium | Calcium | Lithium | Thallium |
| Beryllium | Chromium | Mercury | |
| **Inorganics (Total)** | | | |
| Fluoride | Sulfate | Chloride | TDS |
| **Other (Total)** | | | |
| Radium 226 and 228 combined | | | |

[1] Dissolved oxygen, temperature, specific conductance, and oxidation/reduction potential were recorded during sample collection.

Data and results from the Part 845 background monitoring were included in the water quality discussion included in the HCR (included in the Operating Permit to which this Plan is attached). The data collected from background locations during the Part 845 monitoring were used to evaluate and calculate background concentrations for the EAP. The evaluation and discussion are included in **Section 3.2** of this report.

Data collected from the 40 C.F.R. § 257 monitoring network from 2015 to 2021, and from the Part 845 background monitoring were used for selection of the Part 845 monitoring well network proposed in **Section 2.2**.

## 2.2 Proposed Part 845 Monitoring Well Network

The groundwater monitoring network proposed in this plan will include 11 monitoring wells screened in the uppermost aquifer (07, 08, 08D, 12, 13, 16, 17, 46, 47, 52, and 54) and two temporary water level only surface water staff gages (XSG01 and SG02). The proposed network is summarized in **Table C** below and displayed on **Figure 2-1**. Eleven wells (five background and six compliance) will be used to monitor groundwater concentrations within the uppermost aquifer.

The groundwater samples collected from the 11 wells will be used to monitor and evaluate groundwater quality and demonstrate compliance with the groundwater quality standards listed in 35 I.A.C. § 845.600(a). The proposed monitoring wells will yield groundwater samples that represent the quality of downgradient groundwater at the CCR boundary (as required in 35 I.A.C. § 845.630(a)(2)). Monitoring well depths and construction details are listed in **Table 2-1** and summarized in **Table C** below.

**Table C. Proposed Part 845 Monitoring Well Network**

| Well ID | Monitored Unit | Well Screen Interval (feet bgs) | Well Type[1] |
|---|---|---|---|
| **07** | UA | 67.5 – 77.5 | Background |
| **08** | UA | 51.5 – 61.5 | Background |
| **08D** | UA | 83.0 – 88.0 | Background |
| **12** | UA | 49.5 – 59.5 | Compliance |
| **13** | UA | 67.0 – 69.0 | Compliance |
| **16** | UA | 56.0 – 66.0 | Background |
| **17** | UA | 58.1 – 68.1 | Background |
| **46** | UA | 50.0 – 60.0 | Compliance |
| **47** | UA | 50.0 – 60.0 | Compliance |
| **52** | UA | 51.0 – 61.0 | Compliance |
| **54** | UA | 65.0 – 75.0 | Compliance |
| **XSG01**[2,3] | CCR | NA | WLO |
| **SG02**[2,3] | Surface Water | NA | WLO |

[1] Well type refers to the role of the well in the monitoring network.
[2] Surface water level measuring points
[3] Location is temporary pending implementation of impoundment closure per an approved Construction Permit Application.
NA = not applicable
UA = uppermost aquifer
WLO = water level only

## 2.3 Well Abandonment

No wells are currently proposed for abandonment.

# 3. APPLICABLE GROUNDWATER QUALITY STANDARDS

## 3.1 Groundwater Classification

Groundwater at the EAP meets the definition of Class I – Potable Resource Groundwater (35 I.A.C. § 620.210), based on the following criteria:

- Groundwater in the uppermost aquifer extends ten feet or more below the land surface; and
- Field hydraulic conductivity tests from wells screened within the uppermost aquifer resulted in an overall (geometric mean) horizontal hydraulic conductivity of $8.4 \times 10^{-2}$ centimeters per second (cm/s), which exceeds the $1 \times 10^{-4}$ cm/s criterion.

## 3.2 Statistical Evaluation of Background Groundwater Data

A Statistical Analysis Plan (**Appendix A**) has been developed to describe procedures that will be used to establish background conditions and implement compliance monitoring as necessary and required by 35 I.A.C. § 845.640 and 35 I.A.C. § 845.650. The Statistical Analysis Plan was prepared in accordance with the requirements of 35 I.A.C. § 845.640(f), with reference to the acceptable statistical procedures provided in USEPA's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (*Unified Guidance,* March 2009), and is intended to provide a logical process and framework for conducting the statistical analysis of the data obtained during groundwater monitoring.

In accordance with 35 I.A.C. § 845.640(f)(1), the statistical method chosen for analysis of background groundwater quality was either the tolerance interval or the prediction interval procedure for each constituent listed in 35 I.A.C. § 845.600(a)(1) at this CCR unit per 35 I.A.C. § 845.640(f)(1)(C). A comparison of the statistical background concentrations and groundwater quality standards listed in 35 I.A.C. § 845.600(a)(1) and the resulting GWPSs are summarized in **Table 3-1**.

## 3.3 Applicable Groundwater Protection Standards

The applicable GWPSs will be established in accordance with 35 I.A.C. § 845.600(a) (greater of the background concentration or numerical limit specified in 35 I.A.C. § 845.600(a)(1)). The results of the statistical analysis of background groundwater data (**Table 3-1**) indicate that most background concentrations in the uppermost aquifer are less than the groundwater quality standards listed in 35 I.A.C. § 845.600(a)(1). Therefore, for these parameters, the groundwater quality standards listed in 35 I.A.C. § 845.600(a)(1) will be applied to the results from the proposed groundwater monitoring network. The exceptions include chloride, cobalt, and TDS, where the background concentration is greater than the 35 I.A.C. § 845.600(a)(1) standard. In these instances, the GWPS will be the background concentration.

Under most circumstances, the GWPS will be compared to the lower confidence limit for the observed concentrations for each constituent in each compliance well. Exceptions are when there are high percentages (greater than 50 percent) of non-detects in compliance well data, for which a future mean (for 50 to 70 percent non-detects) or median (for greater than 70 percent non-detects) will be compared to the GWPS. Consistent with the *Unified Guidance*, the same general statistical method of confidence interval testing against a fixed GWPS is recommended in compliance and corrective action programs. Confidence intervals provide a flexible and statistically accurate method to test how a parameter estimated from a single sample compares to a fixed numerical limit. Confidence intervals explicitly account for variation and uncertainty in the sample data used to construct them.

Evaluation of the applicable standards will occur in conjunction with the analysis of groundwater quality results. Background calculations and the resulting concentrations may be updated as appropriate, in accordance with the Statistical Analysis Plan included in **Appendix A.**

# 4. GROUNDWATER MONITORING PLAN

The GMP will monitor and evaluate groundwater quality to demonstrate compliance with the groundwater quality standards included in 40 C.F.R. § 257.94(e), 40 C.F.R. § 257.95(h), and 35 I.A.C. § 845.600(a). The groundwater monitoring program will include sampling and analysis procedures that are consistent and that provide an accurate representation of groundwater quality at the background and downgradient wells as required by 35 I.A.C. § 845.630. As discussed in **Section 2**, two monitoring programs specific to the EAP exist, the 40 C.F.R. § 257 monitoring program and the proposed Part 845 monitoring program. These networks will continue to be monitored until USEPA approves Part 845. It is expected that upon USEPA approval of Part 845, the 40 C.F.R. § 257 monitoring program and reporting will be eliminated, and the proposed Part 845 monitoring and reporting included in this Plan will continue until requirements of Part 845 have been achieved. Upon approval of the Operating Permit applications (and by extension the GMPs) for AP2 and AP4 and the EAP, the IEPA Water Pollution Control Permit 2019-EO-64097 Special Condition No. 4 will be discontinued following approval of a future permit modification submittal and will be replaced by the proposed Part 845 monitoring program.

## 4.1 Monitoring Networks and Parameters

### 4.1.1 40 C.F.R. § 257 Groundwater Monitoring

The existing 40 C.F.R. § 257 monitoring program was discussed in detail in **Section 2.1.1**. Seven wells (three background and four compliance) are sampled for Appendix III and Appendix IV parameters on a semi-annual frequency. Monitoring wells 16 and 17 are being considered as additional background wells to represent groundwater quality impacts from off-site, upgradient sources. Well locations and parameters will continue to be monitored and reported as required by 40 C.F.R. § 257 until USEPA approves Part 845.

### 4.1.2 Part 845 Groundwater Monitoring

The proposed Part 845 Monitoring Network will consist of five background monitoring wells (07, 08, 08D, 16, and 17), six compliance monitoring wells (12, 13, 46, 47, 52, and 54), and two temporary water level only staff gages (XSG01 and SG02) to monitor potential impacts from the EAP (**Figure 2-1**). These monitoring wells are screened within the uppermost aquifer along the perimeter of the EAP. Groundwater samples will be collected and analyzed for the following laboratory and field parameters in **Table D** below.

**Table D. Part 845 Groundwater Monitoring Program Parameters**

| | | | |
|---|---|---|---|
| **Field Parameters[1]** | | | |
| Groundwater Elevation | pH | Turbidity | |
| **Metals (Total)** | | | |
| Antimony | Boron | Cobalt | Molybdenum |
| Arsenic | Cadmium | Lead | Selenium |
| Barium | Calcium | Lithium | Thallium |
| Beryllium | Chromium | Mercury | |
| **Inorganics (Total)** | | | |
| Fluoride | Sulfate | Chloride | TDS |
| **Other (Total)** | | | |
| Radium 226 and 228 combined | | | |

[1] Dissolved oxygen, temperature, specific conductance, and oxidation/reduction potential will be recorded during sample collection.

All parameters listed above were sampled a minimum of eight times by October 18, 2021 to establish background groundwater quality in accordance with 35 I.A.C. § 845.650 (b)(1)(A). Discussion of background groundwater quality is included in **Section 3.2**.

## 4.2 Sampling Schedule

Groundwater sampling for the Part 845 monitoring well network will initially be performed quarterly according to the following schedule:

**Table E. Part 845 Sampling Schedule**

| Frequency | Duration |
|---|---|
| Monthly (groundwater elevations only) | Begins: the quarter following approval of this plan and issuance of the Operating Permit. |
| | Ends: Following the 30-year post closure care period and following IEPA approval of documentation that groundwater concentrations are below standards in 35 I.A.C. § 845.600 and concentrations exceeding background are not increasing and meet requirements in 35 I.A.C. § 845.780 (c)(2)(B)(i) and (ii). |
| Quarterly (groundwater quality) | Begins: the quarter following approval of this plan and issuance of the Operating Permit. |
| | Ends: Following the 30-year post closure care period and following IEPA approval of documentation that groundwater concentrations are below standards in 35 I.A.C. § 845.600 and concentrations exceeding background are not increasing and meet requirements in 35 I.A.C. § 845.780 (c)(2)(B)(i) and (ii), or upon IEPA approval of an alternate schedule as allowed by 35 I.A.C. § 845.650(b)(4). |
| Semi-annual (groundwater quality) | Begins: Following 5 years of quarterly groundwater monitoring and IEPA approval of a demonstration that groundwater concentrations are below standards in 35 I.A.C. § 845.600 and not exhibiting statistically-significant increasing trends, monitoring effectiveness is not compromised by a semi-annual schedule, and sufficient data has been collected to characterize groundwater. |
| | Ends: Following detection of a statistically-significant increasing trend in groundwater concentrations or an exceedance of the standards in 35 I.A.C. § 845.600 (quarterly monitoring shall be resumed in these circumstances), or following the 30-year post closure care period and following IEPA approval of documentation that groundwater concentrations |

| | |
|---|---|
| | are below standards in 35 I.A.C. § 845.600 and concentrations exceeding background are not increasing and meet requirements in 35 I.A.C. § 845.780 (c)(2)(B)(i) and (ii). |

## 4.3 Groundwater Sample Collection

Groundwater sampling procedures have been developed and the collection of groundwater samples is being implemented to meet the requirements of 35 I.A.C. § 845.640. In addition to groundwater well samples, quality assurance samples will be collected as described in **Section 4.5** (**Table 4-1**).

## 4.4 Laboratory Analysis

Laboratory analysis will be performed consistent with the requirements of 35 I.A.C. § 845.640(j) by a state-certified laboratory using methods approved by IEPA and USEPA. Laboratory methods may be modified based on laboratory equipment availability or procedures, but the Reporting Limit (RL) for all parameters analyzed, regardless of method, will be lower than the applicable groundwater quality standard. RLs for the applicable parameters are summarized in **Table 4-2**. Concentrations lower than the RL will be reported as less than the RL.

## 4.5 Quality Assurance Program

Consistent with the requirements of 35 I.A.C. § 845.640(a)(5), the sampling and analysis program includes procedures and techniques for quality assurance/quality control (QA/QC). Additional quality assurance samples to be collected will include the following:

- Field duplicates will be collected at a frequency of one per group of ten or fewer investigative water samples.
- One equipment blank sample will be collected and analyzed for each day of sampling. If dedicated sampling equipment is used, then equipment blank samples will not be collected.

The duplicate and equipment blank quality assurance samples will be supplemented by the laboratory QA/QC program, which typically includes:

- Regular generation of instrument calibration curves to assure instrument reliability
- Laboratory control samples and/or quality control check standards that have been spiked, and analyses to monitor the performance of the analytical method
- Matrix spike/matrix spike duplicate analyses to determine percent recoveries and relative percent differences for each of the parameters detected
- Analysis of replicate samples to check the precision of the instrumentation and/or methodology employed for all analytical methods
- Analysis of method blanks to assure that the system is free of contamination

Water quality meters used to measure pH and turbidity will be calibrated according to manufacturer's specifications. At a minimum, it is recommended that calibration of pH occur daily prior to sampling and checked for accuracy at the end of each day. Unusual or suspect pH measurements during sampling events will be flagged, evaluated, and additional calibration may be performed throughout the sampling events. Turbidity meters will be checked daily, prior to and following sampling. Unusual measurements or erratic meter performance will be flagged and evaluated for overall effects on the data prior to reporting.

## 4.6 Groundwater Monitoring System Maintenance Plan

Consistent with the requirements of 35 I.A.C. § 845.630(e)(2), maintenance will be performed as needed to assure that the monitoring wells provide representative groundwater samples. Monitoring wells will be inspected during each groundwater sampling event; inspections will consist of the following:

- Visual inspection, clearing of vegetation, replacement of markers, and painting of protective casings as needed to assure that monitoring wells are clearly marked and accessible
- Visual inspection and repair or replacement of well aprons as needed to assure that they are intact, drain water away from the well, and have not heaved
- Visual inspection and repair or replacement of protective casings as needed to assure that they are undamaged, and that locks are present and functional
- Checks to assure that well caps are intact and vented, unless in flood-prone areas in which case caps will not be vented
- Annual measurement of monitoring well depths to determine the degree of siltation within the wells. Wells will be redeveloped as needed to remove siltation from the screened interval if it impedes flow of water into the well
- Checks to assure that wells are clear of internal obstructions, and flow freely

If maintenance of a monitoring well cannot address an identified deficiency, a replacement well will be installed.

## 4.7 Statistical Analysis

Statistical analysis will be consistent with procedures listed in 35 I.A.C. § 845.640(f). A Statistical Analysis Plan, provided in **Appendix A**, has been developed to summarize the statistical procedures that will be used to evaluate the groundwater results.

## 4.8 Data Reporting

Data reporting for the 40 C.F.R. § 257 monitoring well network will be consistent with recordkeeping, notification, and internet posting requirements described in 40 C.F.R. § 257.105 through 257.107.

Groundwater monitoring and analysis completed in accordance with the Part 845 monitoring under an approved monitoring program will be reported to IEPA within 60 days after completion of sampling and the data placed in the facility's operating record as required by 35 I.A.C. § 845.610(b)(3)(D). Within 14 days of posting to the operating record, information will be posted to the publicly accessible internet site "Illinois CCR Rule Compliance Data and Information" as required by 35 I.A.C. § 845.810(d). Information will also be submitted to IEPA annually by January 31 as required by 35 I.A.C. § 845.550, for data collected the preceding year. The report will include the status of the groundwater monitoring and any required corrective action plan for the EAP in addition to other requirements detailed in 35 I.A.C. § 845.610(e).

## 4.9 Compliance with Applicable On-site Groundwater Protection Standards

In accordance with 35 I.A.C. § 845.600(a)(1), the groundwater protection standard at the waste boundary will be the higher of either the 35 I.A.C. § 845.600 standard or the concentration determined by background groundwater monitoring.

As provided in 35 I.A.C. § 845.780(c)(2), at the end of the 30-year post-closure care period, groundwater monitoring will continue to be conducted in post-closure care until the groundwater results show the concentrations are:

- Below the GWPS in 35 I.A.C. § 845.600; and
- Not increasing for those constituents over background, using the statistical procedures and performance standards in 35 I.A.C. § 845.640(f) and (g), provided that:
  - Concentrations have been reduced to the maximum extent feasible; and
  - Concentrations are protective of human health and the environment.

If one or more constituents are detected and confirmed by an immediate resample, to be greater than the GWPS in any sampling event, an Alternate Source Demonstration (ASD) will be evaluated as described in **Section 4.10**.

## 4.10 Alternate Source Demonstrations

As allowed in 35 I.A.C. § 845.650(e), following detection of an exceedance of the GWPS, an ASD will be evaluated and, if completed, submitted to IEPA within 60 days. The ASD will provide lines of evidence that a source other than the EAP caused the contamination and the EAP did not contribute to the contamination, or that the exceedance of the GWPS resulted from error in sampling, analysis, statistical evaluation, natural variation in groundwater quality, or a change in the potentiometric surface and groundwater flow direction.

The ASD will include information and analysis that supports the conclusions and a certification of accuracy by a qualified professional engineer. Once the ASD is approved by IEPA, the Part 845 groundwater monitoring will continue as defined in **Section 4.1.2**.

If an ASD is not completed and submitted, or IEPA does not approve the ASD, a notification of the exceedance will be provided to IEPA and placed in the operating record. Additional actions will also be completed as required by 35 I.A.C § 845.650(d)(1) through (3), including initiation of an assessment of corrective measures under 35 I.A.C § 845.660. As allowed in 35 I.A.C § 845.650(e)(7) a petition for review of IEPA's non-concurrence under 35 I.A.C. § 105 may also be filed

## 4.11 Assessment of Corrective Measures and Corrective Action

As described in 35 I.A.C. § 845.660, if the ASD summarized in **Section 4.10** has not been approved by IEPA, an assessment of corrective measures will be initiated within 90 days of the detection of a result exceeding 35 I.A.C. § 845.600 standards (*i.e.,* receipt of laboratory data). The assessment of corrective measures will include at least the following (35 I.A.C. § 845.660(c)):

- The performance, reliability, ease of implementation, and potential impacts of appropriate potential remedies, including safety impacts, cross-media impacts, and control of exposure to any residual contamination;

- The time required to begin and complete the corrective action plan; and
- The institutional requirements, such as State or local permit requirements or other environmental or public health requirements that may substantially affect implementation of the corrective action plan.

Within one year of completing the assessment of corrective measures, a corrective action plan will be developed to identify the selected remedy in accordance with 35 I.A.C. § 845.670. If closure of the CCR Unit is required, a closure alternatives analysis will be completed as specified in 35 I.A.C. § 845.710. The analysis and selected alternative will be submitted to IEPA in a Closure Plan as specified by 35 I.A.C. § 845.720. Groundwater monitoring proposed in this Addendum will continue as specified until the post closure care period has expired and IEPA has approved termination of post-closure care.

# 5. REFERENCES

Illinois Environmental Protection Agency, 2021. *Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Title 35 of the Illinois Administrative Code § 845.* April 15, 2021.

Natural Resource Technology, Inc. (NRT), 2017. *Sampling and Analysis Plan. Hennepin East Ash Pond Hennepin Power Station. Hennepin, IL*. October 17, 2017.

Ramboll Americas Engineering Solutions, Inc. (Ramboll), 2021. *Hydrogeologic Site Characterization Report. Hennepin East Ash Pond. Hennepin Power Plant. Hennepin, Illinois*.

Science and Technology Management, Inc. (STMI), 1996. *Investigation of Site Closure Options at Illinois Power Company's Hennepin East Ash Impoundment. Report No. STMI/135/96-02*. Brookfield, Wisconsin. June 1996.

United States Environmental Protection Agency (USEPA), March 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance*. Office of Resource Conservation and Recovery, Program Implementation and Information Division, United States Environmental Protection Agency, Washington D.C. EPA/530/R-09/007.

United States Environmental Protection Agency (USEPA), 2015. *Title 40 of the Code of Federal Regulations, Part 257*.

# TABLES

**TABLE 1-1. PART 845 REQUIREMENTS CHECKLIST**
GROUNDWATER MONITORING PLAN
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Part 845 Reference | Part 845 Components | Location of Information in GMP |
|---|---|---|
| **845.630** | **Groundwater Monitoring Systems** | |
| 845.630(a)(2) | Potential contaminant pathways must be monitored. | Sections 2.1.2, 2.2, & 4.1.2<br>Table 2-1<br>Figure 2-1 |
| 845.630(a)<br>845.630(b)<br>845.630(c) | At least two upgradient wells and four downgradient wells (min. 1 and 3, but requires additional documentation) | Sections 2.1.2, 2.2, & 4.1.2<br>Table 2-1<br>Figure 2-1 |
| 845.630(a)<br>845.630(b)<br>845.630(c) | Downgradient Well Density | Figure 2-1 |
| 845.630(a)(2) | Downgradient wells at waste boundary | Figure 2-1 |
| **845.640** | **Groundwater Sampling and Analysis Requirements** | |
| 845.640(a) | Consistent sampling and analysis procedures | Section 4<br>Tables 4-1 & 4-2 |
| 845.640(b) | Methods are appropriate | Section 4<br>Tables 4-1 & 4-2 |
| 845.640(c) | Groundwater elevations must be measured in each well prior to purging, each time groundwater is sampled. | Section 4.3 |
| 845.640 (d)(e)(f)(g)(h) | Establishment of background and application of statistical methods | Sections 3 & 4.7<br>Appendix A |
| 845.640(i) | Analyze total recoverable metals | Section 4.1.2 |
| 845.640(j) | Analyze groundwater samples using a certified laboratory | Section 4.4 |

**TABLE 1-1. PART 845 REQUIREMENTS CHECKLIST**
GROUNDWATER MONITORING PLAN
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Part 845 Reference | Part 845 Components | Location of Information in GMP |
|---|---|---|
| **845.650** | **Groundwater Monitoring Program** | |
| 845.650(a) | Must include monitoring for all constituents with a groundwater protection standard in Section 845.600(a), calcium, and turbidity | Section 4.1.2 |
| 845.650(b)(c) | Groundwater Monitoring Frequency | Sections 4.1.2 & 4.2 |
| 845.650(d)(e) | Exceedances of the groundwater protection standard | Sections 4.9, 4.10, & 4.11 |
| 845.650(b)(2) and (3) | Staff gauge/ piezometer to monitor head in impoundment | Sections 2.2 & 4.1.2<br>Figure 2-1 (XSG01) |
| NA | Staff gauge/ piezometer to monitor head of neighboring surface water body | Sections 2.2 & 4.1.2<br>Figure 2-1 (SG02) |

[O: NRK 08/17/21; U: CJC 09/16/21; C: LDC 09/20/21]

**Notes:**
GMP = Groundwater Monitoring Plan
NA = Not Applicable



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**TABLE 2-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS**
GROUNDWATER MONITORING PLAN
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Well Number | Type | HSU | Date Constructed | Top of PVC Elevation (ft) | Measuring Point Elevation (ft) | Measuring Point Description | Ground Elevation (ft) | Screen Top Depth (ft BGS) | Screen Bottom Depth (ft BGS) | Screen Top Elevation (ft) | Screen Bottom Elevation (ft) | Well Depth (ft BGS) | Bottom of Boring Elevation (ft) | Screen Length (ft) | Screen Diameter (inches) | Latitude (Decimal Degrees) | Longitude (Decimal Degrees) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 07 | B | UA | 11/15/1984 | 518.27 | 518.27 | Top of PVC | 515.10 | 67.50 | 77.50 | 447.61 | 437.61 | 78.00 | 437.10 | 10 | 2 | 41.297986 | -89.305712 |
| 08 | B | UA | 11/17/1984 | 501.38 | 501.38 | Top of PVC | 498.70 | 51.50 | 61.50 | 447.24 | 437.24 | 62.00 | 436.70 | 10 | 2 | 41.300698 | -89.3044 |
| 08D | B | UA | 04/17/2009 | 501.34 | 501.34 | Top of PVC | 498.80 | 83.00 | 88.00 | 415.79 | 410.79 | 90.00 | 408.80 | 5 | 2 | 41.300799 | -89.304522 |
| 12 | C | UA | 03/28/1995 | 498.44 | 498.44 | Top of PVC | 495.16 | 49.45 | 59.50 | 445.71 | 435.71 | 60.00 | 435.20 | 10 | 2 | 41.303663 | -89.304304 |
| 13 | C | UA | 03/01/1995 | 498.47 | 498.47 | Top of PVC | 495.38 | 67.00 | 69.00 | 428.38 | 426.38 | 75.00 | 420.40 | 2 | 2 | 41.303658 | -89.304315 |
| 16 | B | UA | 03/30/1995 | 501.74 | 501.74 | Top of PVC | 500.30 | 56.00 | 66.00 | 444.28 | 434.28 | 68.00 | 432.30 | 10 | 2 | 41.30168 | -89.302861 |
| 17 | B | UA | 03/30/1995 | 507.13 | 507.13 | Top of PVC | 504.80 | 58.06 | 68.10 | 446.77 | 436.77 | 68.00 | 436.80 | 10 | 2 | 41.3022 | -89.3006 |
| 46 | C | UA | 08/11/2015 | 498.75 | 498.75 | Top of PVC | 496.44 | 50.00 | 60.00 | 446.44 | 436.44 | 60.00 | 436.40 | 10 | 2 | 41.303953 | -89.303472 |
| 47 | C | UA | 08/11/2015 | 502.65 | 502.65 | Top of PVC | 499.07 | 50.00 | 60.00 | 452.13 | 442.13 | 60.00 | 442.10 | 10 | 2 | 41.303301 | -89.305994 |
| 52 | C | UA | 02/11/2021 | 500.93 | 500.93 | Top of PVC | 497.70 | 51.00 | 61.00 | 446.74 | 436.74 | 60.90 | 436.80 | 10 | 2 | 41.302466 | -89.306369 |
| 54 | C | UA | 02/09/2021 | 500.30 | 500.30 | Top of PVC | 497.10 | 65.00 | 75.00 | 432.14 | 422.14 | 74.06 | 423.10 | 10 | 2 | 41.303439 | -89.30522 |
| XSG01 | WLO | CCR | -- | -- | 493.49 | Staff gauge | -- | -- | -- | -- | -- | -- | -- | -- | -- | 41.302583 | -89.302249 |
| SG02 | WLO | SW | -- | -- | -- | Staff gauge | -- | -- | -- | -- | -- | -- | -- | -- | -- | 41.303678 | -89.31531 |

**Notes:**
All elevation data are presented relative to the North American Vertical Datum 1988 (NAVD88), GEOID 12A
Type refers to the role of the well in the monitoring network: background (B), compliance (C), or water level measurements only (WLO)
WLO wells are temporary pending implementation of impoundment closure per an approved Construction Permit application
-- = data not available
BGS = below ground surface
CCR = Coal Combustion Residual
ft = foot or feet
HSU = Hydrostratigraphic Unit
PVC = polyvinyl chloride
SW = surface water
UA = uppermost aquifer

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**TABLE 3-1. BACKGROUND GROUNDWATER QUALITY AND STANDARDS**
GROUNDWATER MONITORING PLAN
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Parameter | Background Concentration | 845 Limit | Groundwater Protection Standard | Unit |
|---|---|---|---|---|
| Antimony, total | 0.001 | 0.006 | 0.006 | mg/L |
| Arsenic, total | 0.001 | 0.010 | 0.010 | mg/L |
| Barium, total | 0.212 | 2.0 | 2.0 | mg/L |
| Beryllium, total | 0.001 | 0.004 | 0.004 | mg/L |
| Boron, total | 0.163 | 2 | 2 | mg/L |
| Cadmium, total | 0.0023 | 0.005 | 0.005 | mg/L |
| Chloride, total | 435 | 200 | 435 | mg/L |
| Chromium, total | 0.001 | 0.1 | 0.1 | mg/L |
| Cobalt, total | 0.038 | 0.006 | 0.038 | mg/L |
| Fluoride, total | 0.12 | 4.0 | 4.0 | mg/L |
| Lead, total | 0.0015 | 0.0075 | 0.0075 | mg/L |
| Lithium, total | 0.019 | 0.04 | 0.04 | mg/L |
| Mercury, total | 0.0002 | 0.002 | 0.002 | mg/L |
| Molybdenum, total | 0.0017 | 0.1 | 0.1 | mg/L |
| pH (field) | 7.5 / 6.6 | 9.0 / 6.5 | 9.0 / 6.5 | SU |
| Radium 226 and 228 combined | 2 | 5 | 5 | pCi/L |
| Selenium, total | 0.0014 | 0.05 | 0.05 | mg/L |
| Sulfate, total | 215 | 400 | 400 | mg/L |
| Thallium, total | 0.001 | 0.002 | 0.002 | mg/L |
| Total Dissolved Solids | 1620 | 1200 | 1620 | mg/L |

**Notes:**
For pH, the values presented are the upper / lower limits
Groundwater protection standards for calcium and turbidity do not apply per 35 I.A.C. § 845.600(b)
mg/L = milligrams per liter
SU = standard units
pCi/L = picocuries per liter

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**TABLE 4-1. SAMPLING AND ANALYSIS SUMMARY**
GROUNDWATER MONITORING PLAN
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Parameter | Analytical Method [1] | Number of Samples | Field Duplicates [2] | Field Blanks [3] | Equipment Blanks [3] | MS/MSD [4] | Total | Container Type | Minimum Volume [5] | Preservation (Cool to 4 °C for all samples) | Sample Hold Time from Collection Date |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Metals** | | | | | | | | | | | |
| Metals [6] | 6020, Li - EPA 200.7 | 11 | 2 | 0 | 0 | 1 | 14 | plastic | 600 mL | $HNO_3$ to pH<2 | 6 months |
| Mercury | 7470A or 6020 | 11 | 2 | 0 | 0 | 1 | 14 | plastic | 400 mL | $HNO_3$ to pH<2 | 28 days |
| **Inorganic Parameters** | | | | | | | | | | | |
| Fluoride | 9214 or EPA 300 | 11 | 2 | 0 | 0 | 1 | 14 | plastic | 300 mL | Cool to 4 °C | 28 days |
| Chloride | 9251 or EPA 300 | 11 | 2 | 0 | 0 | 1 | 14 | plastic | 100 mL | Cool to 4 °C | 28 days |
| Sulfate | 9036 or EPA 300 | 11 | 2 | 0 | 0 | 1 | 14 | plastic | 50 mL | Cool to 4 °C | 28 days |
| Total Dissolved Solids | SM 2540 C | 11 | 2 | 0 | 0 | 1 | 14 | plastic | 200 mL | Cool to 4 °C | 7 days |
| **Radium** | | | | | | | | | | | |
| Radium 226 | 9315 or EPA 903 | 11 | 0 | 0 | 0 | 0 | 11 | plastic | 1000 mL | $HNO_3$ to pH<2 | 6 months |
| Radium 228 | 9320 or EPA 904 | 11 | 0 | 0 | 0 | 0 | 11 | plastic | 1000 mL | $HNO_3$ to pH<2 | 6 months |
| **Field Parameters** | | | | | | | | | | | |
| pH | SM 4500-H+ B | 11 | NA | NA | NA | NA | 11 | flow-through cell | NA | none | immediately |
| Dissolved Oxygen [8] | SM 4500-O/405.1 | 11 | NA | NA | NA | NA | 11 | flow-through cell | NA | none | immediately |
| Temperature [8] | SM 2550 | 11 | NA | NA | NA | NA | 11 | flow-through cell | NA | none | immediately |
| Oxidation/Reduction Potential [8] | SM 2580 B | 11 | NA | NA | NA | NA | 11 | flow-through cell | NA | none | immediately |
| Specific Conductance [8] | SM 2510 B | 11 | NA | NA | NA | NA | 11 | flow-through cell | NA | none | immediately |
| Turbidity [7] | SM 2130 B | 11 | NA | NA | NA | NA | 11 | flow-through cell or hand-held turbidity meter | NA | none | immediately |

[O: NRK 08/17/21; C: CJC 09/16/21]

**Notes:**
[1] Analytical method numbers are from SW-846 unless otherwise indicated. Analytical methods may be updated with more recent versions as appropriate.
[2] Field duplicates will be collected at a frequency of one per group of 10 or fewer investigative water samples. Field duplicates will not be collected for radium analysis.
[3] Field blanks will be collected at the discretion of the project manager; Equipment blanks will be collected at a rate of 1 per sampling event if non-dedicated equipment is used.
[4] Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples will be collected at a frequency of one per group of 20 or fewer investigative water samples per CCR unit/multi-unit. Additional volume to be determined by laboratory.
[5] Sample volume is estimated and will be determined by the laboratory.
[6] Metals = antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chromium, cobalt, lead, lithium, molybdenum, selenium, thallium. Metals may be analyzed via ICP/ ICP-MS USEPA methods 6010 or 6020 depending on laboratory instrument availability
[7] If turbidity exceeds 10 NTUs, a duplicate sample filtered through a .45 micron filter may be collected for metals analysis in addition to the unfiltered sample. Both samples would be submitted for analysis.
[8] Parameter collected for quality assurance and quality control for field sampling purposes only; not required to be collected or reported under Part 845; collection of parameter may be discontinued without notification.
< = less than
°C = degrees Celsius
$HNO_3$ = nitric acid
mL = milliliter
NA = not applicable
NTU = nephelometric turbidity unit



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**TABLE 4-2. DETECTION AND REPORTING LIMITS FOR PART 845 PARAMETERS**

GROUNDWATER MONITORING PLAN

HENNEPIN POWER PLANT

EAST ASH POND

HENNEPIN, ILLINOIS

| Constituent | CAS | Unit | Analytical Methods [1] | USEPA MCL [2] | 35 I.A.C. § 845.600 | RL [4, 5] | MDL [5] |
|---|---|---|---|---|---|---|---|
| **Metals** | | | | | | | |
| Antimony | 7440-36-0 | mg/L | 6020 | 0.006 | 0.006 | 0.003 | 0.00036 |
| Arsenic | 7440-38-2 | mg/L | 6020 | 0.01 | 0.01 | 0.001 | 0.00013 |
| Barium | 7440-39-3 | mg/L | 6020 | 2 | 2 | 0.001 | 0.00028 |
| Beryllium | 7440-41-7 | mg/L | 6020 | 0.004 | 0.004 | 0.001 | 0.000017 |
| Boron | 7440-42-8 | mg/L | 6020 | NS | 2 | 0.01 | 0.0023 |
| Cadmium | 7440-43-9 | mg/L | 6020 | 0.005 | 0.005 | 0.001 | 0.000042 |
| Calcium | 7440-70-2 | mg/L | 6020 | NS | NS | 0.15 | 0.15 |
| Chromium | 7440-47-3 | mg/L | 6020 | 0.1 | 0.1 | 0.004 | 0.00027 |
| Cobalt | 7440-48-4 | mg/L | 6020 | 0.006 | 0.006 | 0.002 | 0.000017 |
| Lead | 7439-92-1 | mg/L | 6020 | 0.015 | 0.0075 | 0.001 | 0.000025 |
| Lithium | 7439-93-2 | mg/L | 6020 or EPA 200.7 | 0.04 | 0.04 | 0.02 | 0.0001 |
| Mercury | 7439-97-6 | mg/L | 6020 or 7470A | 0.002 | 0.002 | 0.0002 | 0.000078 |
| Molybdenum | 7439-98-7 | mg/L | 6020 | 0.1 | 0.1 | 0.001 | 0.000063 |
| Selenium | 7782-49-2 | mg/L | 6020 | 0.05 | 0.05 | 0.001 | 0.00032 |
| Thallium | 7440-28-0 | mg/L | 6020 | 0.002 | 0.002 | 0.001 | 0.000062 |
| **Inorganics** | | | | | | | |
| Fluoride | 7681 | mg/L | 9214 or EPA 300 | 4 | 4 | 0.25 | 0.065 |
| Chloride | 16887-00-6 | mg/L | 9251 or EPA 300 | 250 [3] | 200 | 1 | 0.15 |
| Sulfate | 18785-72-3 | mg/L | 9036 or EPA 300 | 250 [3] | 400 | 1 | 0.24 |
| Total Dissolved Solids | 10052 | mg/L | SM 2540C | 500 [3] | 1200 | 17 | -- |
| **Other** | | | | | | | |
| Radium 226 and 228 combined | 7440-14-4 | pCi/L | 9315/9320 or EPA 903/904 | 5 | 5 | -- [6] | -- [7] |
| **Field** | | | | | | | |
| pH | NA | SU | SM 4500-H+ B | NS | 6.5-9.0 | NA | NA |
| Oxidation/Reduction Potential | NA | mV | SM 2580 B | NS | NS | NA | NA |
| Dissolved Oxygen | NA | mg/L | SM 4500-O/405.1 | NS | NS | NA | NA |
| Temperature | NA | °C | SM 2550 | NS | NS | NA | NA |
| Specific Conductance | NA | µS/cm | SM 2510 B | NS | NS | NA | NA |

**TABLE 4-2. DETECTION AND REPORTING LIMITS FOR PART 845 PARAMETERS**

GROUNDWATER MONITORING PLAN

HENNEPIN POWER PLANT

EAST ASH POND

HENNEPIN, ILLINOIS

| Constituent | CAS | Unit | Analytical Methods [1] | USEPA MCL [2] | 35 I.A.C. § 845.600 | RL [4, 5] | MDL [5] |
|---|---|---|---|---|---|---|---|
| Turbidity | NA | NTU | SM 2130 B | NS | NS | NA | NA |

[O: NRK 08/17/21; C: CJC 09/16/21]

**Notes:**

[1] Analytical method numbers are from SW-846 unless otherwise indicated. Metals will be analyzed via Method 6020 or 6010 depending on laboratory equipment availability. Selected method will ensure reporting limits (RL) are below Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845.600 groundwater protection standards.

[2] USEPA MCL = United States Environmental Protection Agency Maximum Contaminant Level.

[3] USEPA SMCL = United States Environmental Protection Agency Secondary Maximum Contaminant Level.

[4] RLs will be less than the 35 I.A.C. § 845.600 groundwater protection standards.

[5] RLs and method detection limits (MDL) will vary depending on the laboratory performing the work.

[6] All radium results will be reported (values may be positive or negative) and will include uncertainty and the calculated MDC.

[7] Laboratories calculate a minimum detectable concentration (MDC) based on the sample.

°C = degrees Celsius

µS/cm = microsiemens per centimeter

CAS = Chemical Abstract Number

MDL = Method detection limit as established by the laboratory

mg/L = milligrams per liter

mV = millivolts

NS = No standard

NTU = nephelometric turbidity unit

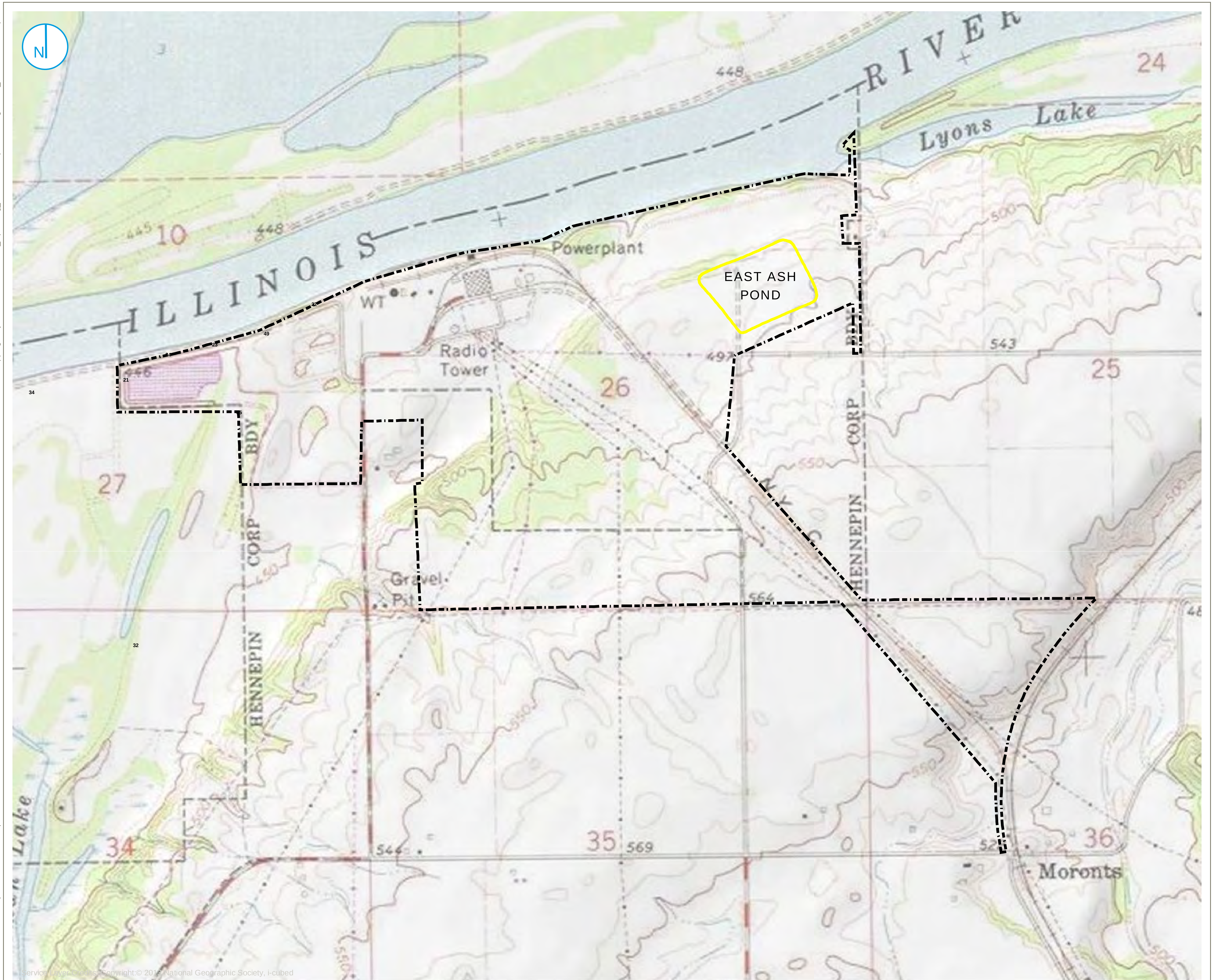
pCi/L = picocuries per liter

RL = Reporting limit as established by the laboratory

SM = Standard Methods for the Examination of Water and Wastewater

SU = Standard Units

# FIGURES




PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 500 1,000 Feet

## SITE LOCATION MAP

**GROUNDWATER MONITORING PLAN**
**EAST ASH POND**
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

## FIGURE 1-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL


Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Hennepin\GMP\Figure 1-2_Site Map.mxd

PROJECT: 169000XXXX | DATED: 9/29/2021 | DESIGNER: STOLZSD

## SITE MAP

**GROUNDWATER MONITORING PLAN**
**EAST ASH POND**
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

## FIGURE 1-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL


Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Hennepin\GMP\Figure 1-3_GWE Contours 20210224_26.mxd

PROJECT: 169000XXXX | DATED: 9/29/2021 | DESIGNER: STOLZSD

BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
STAFF GAGE
GROUNDWATER ELEVATION CONTOUR (1-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

NOTE:
ELEVATIONS IN PARENTHESIS WERE NOT USED FOR CONTOURING.

0 175 350 Feet

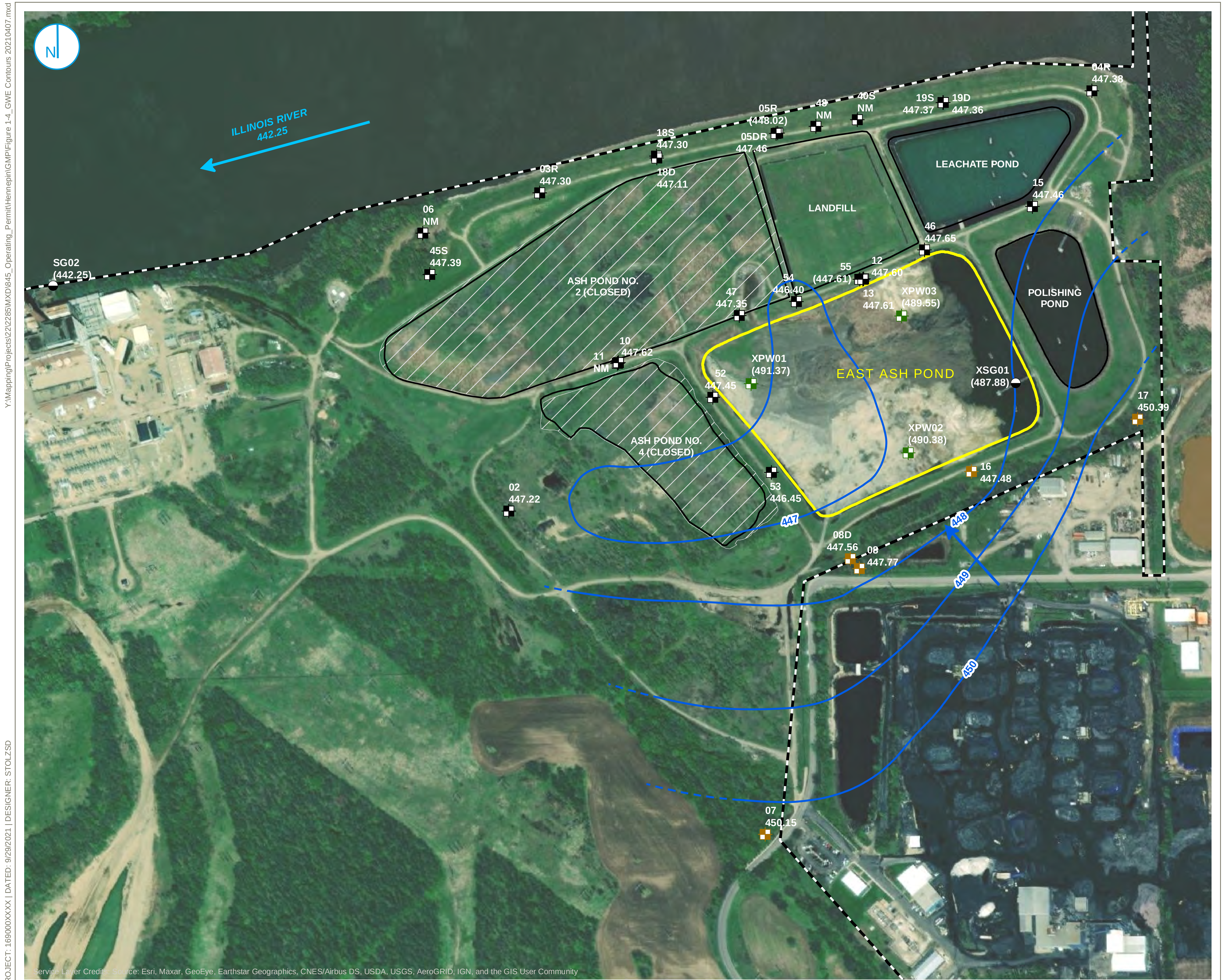
## UPPERMOST AQUIFER GROUNDWATER ELEVATION CONTOURS FEBRUARY 24-26, 2021

GROUNDWATER MONITORING PLAN
EAST ASH POND
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

## FIGURE 1-3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL




BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
STAFF GAGE
GROUNDWATER ELEVATION CONTOUR (1-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

NOTE:
ELEVATIONS IN PARENTHESIS WERE NOT USED FOR CONTOURING.

0 175 350 Feet

## UPPERMOST AQUIFER GROUNDWATER ELEVATION CONTOURS APRIL 7, 2021

GROUNDWATER MONITORING PLAN
EAST ASH POND
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

## FIGURE 1-4

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.


BACKGROUND WELL
COMPLIANCE WELL
STAFF GAGE
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

0 175 350 Feet

**PROPOSED PART 845 GROUNDWATER MONITORING WELL NETWORK**

**GROUNDWATER MONITORING PLAN**
**EAST ASH POND**
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

**FIGURE 2-1**

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Hennepin\GMP\Figure 2-1_Proposed Monitoring Well Network.mxd

PROJECT: 169000XXXX | DATED: 10/13/2021 | DESIGNER: HOTCALD

# APPENDIX A
# STATISTICAL ANALYSIS PLAN

Prepared for
**Dynegy Midwest Generation, LLC**

Date
**October 25, 2021**

Project No.
**1940100806-005**

# STATISTICAL ANALYSIS PLAN

## EAST ASH POND
## HENNEPIN POWER PLANT
## HENNEPIN, ILLINOIS

RAMBOLL Bright ideas. Sustainable change.

# STATISTICAL ANALYSIS PLAN
# HENNEPIN POWER PLANT EAST ASH POND

| | |
|---|---|
| Project Name | **Hennepin Power Plant East Ash Pond** |
| Project No. | **1940100806-005** |
| Recipient | **Dynegy Midwest Generation, LLC** |
| Document Type | **Statistical Analysis Plan** |
| Version | **FINAL** |
| Date | **October 25, 2021** |

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**Brian G. Hennings, PG**
**Senior Managing Hydrogeologist**

**Eric J. Tlachac, PE**
**Senior Managing Engineer**

**Rachel A. Banoff, EIT**
**Project Statistician**

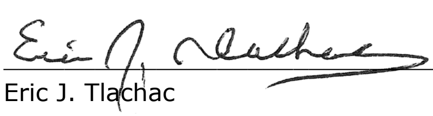
# LICENSED PROFESSIONAL CERTIFICATIONS

This certification is based on the description of the statistical methods selected to evaluate groundwater as presented in the following Statistical Analysis Plan; Hennepin Power Plant East Ash Pond. The procedures described in the plan will be used to establish background conditions and implement compliance monitoring as necessary and required by 35 I.A.C. § 845.640 and 35 I.A.C. § 845.650. The Statistical Analysis Plan was prepared in accordance with the requirements of 35 I.A.C. § 845.640(f), with reference to the acceptable statistical procedures provided in the United States Environmental Protection Agency (USEPA)'s *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (*Unified Guidance,* March 2009), and is intended to provide a logical process and framework for conducting the statistical analysis of the data obtained during groundwater monitoring. In accordance with 35 I.A.C. § 845.640(f)(1), the statistical method chosen for analysis of background groundwater quality will be either the tolerance interval or the prediction interval procedure for each constituent listed in 35 I.A.C. § 845.600(a)(1) at this CCR unit per 35 I.A.C. § 845.640(f)(1)(C). Groundwater Protection Standards (GWPS) will be established in accordance with 35 I.A.C. § 845.600(a) (greater of the background concentration or numerical limit specified in 35 I.A.C. § 845.600(a)(1)). The GWPS will be compared to the lower confidence limit for the observed concentrations for each constituent in each compliance well. Consistent with the *Unified Guidance*, the same general statistical method of confidence interval testing against a fixed GWPS is recommended in compliance and corrective action programs. Confidence intervals provide a flexible and statistically accurate method to test how a parameter estimated from a single sample compares to a fixed numerical limit. Confidence intervals explicitly account for variation and uncertainty in the sample data used to construct them.

Description of the statistical methods chosen for analysis of groundwater monitoring data and application of these methods for determining exceedances of the GWPS identified in 35 I.A.C. § 845.600(a) is provided in this Statistical Analysis Plan.

### 35 I.A.C. § 845.640 Statistical Analysis (PE)

*I, Eric J. Tlachac, a qualified professional engineer in good standing in the State of Illinois, certify that the statistical methods summarized above and described in this document (Statistical Analysis Plan; Hennepin Power Plant East Ash Pond) are appropriate for evaluating the groundwater monitoring data collected as described in the attached document and are in substantial compliance with 35 I.A.C. § 845.640.*




Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
Date: October 25, 2021

## 35 I.A.C. § 845.640 Statistical Analysis (PG)

*I, Brian G. Hennings, a qualified professional geologist in good standing in the State of Illinois, certify that the statistical methods described in this document (Statistical Analysis Plan; Hennepin Power Plant East Ash Pond) are appropriate for evaluating the groundwater monitoring data collected as described in the attached document and are in substantial compliance with 35 I.A.C. § 845.640.*

____________________________________
Brian G. Hennings
Professional Geologist
196.001482
Illinois
Date: October 25, 2021

LICENSED PROFESSIONAL GEOLOGIST
BRIAN G. HENNINGS
196.001482
ILLINOIS

## 35 I.A.C. § 845.640 Statistical Analysis

*I, Rachel A. Banoff, a qualified professional, certify that the statistical methods described in this document (Statistical Analysis Plan; Hennepin Power Plant East Ash Pond), are appropriate for evaluating the groundwater monitoring data collected as described in the attached document and are in substantial compliance with 35 I.A.C. § 845.640.*

____________________________________
Rachel A. Banoff, EIT
Project Statistician
Date: October 25, 2021

# CONTENTS



## TABLES (IN TEXT)

# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| § | Section |
| 35 I.A.C. | Title 35 of the Illinois Administrative Code |
| ANOVA | analysis of variance |
| CCR | coal combustion residuals |
| COC | constituents of concern |
| GWPS | groundwater protection standard |
| IEPA | Illinois Environmental Protection Agency |
| LCL | lower confidence limit |
| LTL | lower tolerance limit |
| MSE | mean squared error |
| *P* | probability |
| Part 845 | Residuals in Surface Impoundments: Title 35 of the Illinois Administrative Code § 845 |
| RCRA | Resource Conservation and Recovery Act |
| RL | reporting limit |
| ROS | regression on order statistics |
| SI | surface impoundment |
| SSI | statistically significant increase |
| SWFPR | site-wide false positive rate |
| *Unified Guidance* | *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (USEPA, 2009) |
| UPL | upper prediction limit |
| USEPA | United States Environmental Protection Agency |
| UTL | upper tolerance limit |

# 1. INTRODUCTION

In April 2021, the Illinois Environmental Protection Agency (IEPA) issued a final rule for the regulation and management of Coal Combustion Residuals (CCR) in surface impoundments (SIs) under the Standards for the Disposal of CCR in Surface Impoundments: Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845 (Part 845). Facilities regulated under Part 845 are required to develop and sample a groundwater monitoring well network to evaluate whether impounded CCR materials are impacting downgradient groundwater quality. The groundwater quality evaluation must include selection and certification by a qualified professional engineer of the statistical procedures to be used. The procedures described in the evaluation will be used to establish background conditions and implement compliance and corrective action monitoring as necessary and required by 35 I.A.C. § 845.640 and 35 I.A.C. § 845.650. This Statistical Analysis Plan was prepared in accordance with the requirements of 35 I.A.C. § 845.640(f), with reference to the acceptable statistical procedures provided in United States Environmental Protection Agency's (USEPA's) *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (*Unified Guidance*) (March 2009).

This Statistical Analysis Plan does not include procedures for groundwater sample collection and analysis, as these activities are conducted in accordance with the Sampling and Analysis Plan prepared for each CCR unit in accordance with 35 I.A.C. § 845.640. This Statistical Analysis Plan will be used as the primary reference for evaluating groundwater quality during operation and post-closure care.

## 1.1 Statistical Analysis Objectives

This Statistical Analysis Plan is intended to provide a logical process and framework for conducting the statistical analyses of data obtained during groundwater monitoring conducted in accordance with the Sampling and Analysis Plan for each CCR unit. The Statistical Analysis Plan will enable a qualified professional engineer to certify that the selected statistical methods are appropriate for evaluating the groundwater monitoring data for the applicable CCR unit(s).

## 1.2 Statistical Analysis Plan Approach

The main sections of this Statistical Analysis Plan should be viewed as a "generic" outline of statistical methods utilized for each CCR unit and constituent required to be monitored. The statistical analysis of the groundwater monitoring data, however, will be conducted on an individual-constituent or well basis, and may involve the use of appropriate statistical procedures depending on multiple factors such as detection frequency and normality distributions.

The CCR Rule outlines two phases of groundwater monitoring:

- Background Monitoring in accordance with 35 I.A.C. § 845.650(b)(1)
- Compliance Monitoring in accordance with 35 I.A.C. § 845.650

Each phase of the groundwater monitoring program requires specific statistical procedures to accomplish the intended purpose. During the background monitoring phase, background groundwater quality will be established utilizing upgradient and background wells and downgradient groundwater quality data will be collected to facilitate statistics in subsequent phases. Compliance Monitoring is then initiated through the evaluation of the downgradient groundwater monitoring data for exceedances of the groundwater protection standard (GWPS) established by Part 845 (concentration specified in 35 I.A.C. § 845.600 or an IEPA-approved background concentration). The developed statistical analysis plan will be implemented for each monitoring phase and in accordance with the statistical procedures.

# 2. BACKGROUND MONITORING AND DATA PREPARATION

The background and compliance monitoring wells were sampled and analyzed for constituents, as listed in Part 845 (antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chloride, chromium, cobalt, fluoride, lead, lithium, mercury, molybdenum, pH, radium 226 and 228 combined, selenium, sulfate, thallium, total dissolved solids, and turbidity), during the baseline phase of the groundwater monitoring program.

The background monitoring well(s) were placed upgradient of the CCR unit, or at an alternative background location, where they are not affected by potential leakage from the CCR unit. Compliance monitoring wells were placed at the waste boundary of the CCR unit, along the same groundwater flow path. As 35 I.A.C. § 845.630(a) specifies, the location of these wells ensures that background accurately represents the quality of unaffected groundwater, while compliance wells accurately represent groundwater quality at the waste boundary and monitor all potential contaminant pathways.

As required by 35 I.A.C. § 845.650(a)(1), eight sampling events were completed within 180 days of April 21, 2021. As outlined, groundwater sampling procedures included sampling of the background and compliance wells using low-flow sampling methods, collection of one field quality control sample per event, and groundwater samples were not field filtered before laboratory analysis of total recoverable metals.

Following completion of the eight sampling events, background groundwater quality was established for Part 845 constituents. Groundwater monitoring will be conducted quarterly for at least the first five years. In accordance with 35 I.A.C. § 845.650(b)(4), after the first five years, a request to reduce the monitoring frequency to semiannual may be submitted to IEPA if all of the following can be demonstrated:

- Groundwater monitoring effectiveness will not be compromised by the reduced frequency
- Sufficient data has been collected to characterize groundwater
- Monitoring to date does not show any statistically significant increasing trends
- The concentrations of monitored constituents at the compliance monitoring wells are below the applicable GWPSs established in 35 I.A.C. § 845.600

The following subsections outline the statistical tests and procedures (methods) that will be utilized to evaluate data collected for each constituent in both background and compliance wells for Background and Compliance Monitoring. When necessary and contingent upon equivalent statistical power, an alternative test not included in this Statistical Analysis Plan may be chosen due to site-specific data requirements.

## 2.1 Sample Independence

Independence of sample results is a major assumption for most statistical analyses. To ensure physical independence of groundwater sampling results, the minimum time between sampling events must be longer than the time required for groundwater to move through the monitoring well. The sampling schedules for both the baseline and compliance monitoring periods are specified in 35 I.A.C. § 845.650(b) and may conflict with the statistical assumption of independence of sample results.

### 2.2 Non-Detect Data Processing

The reporting limit (RL) will be used as the lower level for the reporting of non-detected groundwater quality data. For all summary statistics (box plots, timeseries, etc.), the RL will be substituted for concentrations reported below the RL, including non-detects. With professional judgement, analytical results between the RL and the method detection limit, *i.e.,* estimated values, typically identified with a "J" flag, may be utilized if provided by the laboratory.

For all statistical test procedures:

- If the frequency of non-detect data are less than or equal to 15 percent, half of the RL will be substituted for these data
- If the non-detect frequency is between 15 percent and 50 percent, either the Kaplan-Meier or robust regression on order statistics (ROS) will be used to estimate the mean and standard deviation adjusted for the presence of left-censored values
- If the non-detect frequency is greater than 50 percent, a non-parametric test will be used
- If only one background result is detected that value will be used as the non-parametric upper prediction limit (UPL)

### 2.3 Testing for Normality

Many statistical analyses assume that sample data are normally distributed (parametric). However, environmental data are frequently not normally distributed (nonparametric). 35 I.A.C. § 845.640(g) requires the knowledge of the background data distribution for comparison to compliance results. The *Unified Guidance* document recommends the Shapiro-Wilk normality test for sample sizes of 50 or less, and the Shapiro-Francia normality test for sample sizes greater than 50.

When possible, transformation of datasets to achieve normal distributions is preferred.

### 2.4 Testing for Outliers

Part 845 constituents will be screened for the existence of outliers using a method described by the *Unified Guidance*. Outliers are extreme data points that may represent an anomaly or erroneous data point. To test for outliers, one or more of the following outlier tests will be utilized:

- Dixon's test, for well-constituent pairs with less than 25 samples, assumes normally distributed data.
- Rosner's test, for well-constituent pairs with more than 20 samples, assumes normally distributed data.
- Grubb's test for well-constituent pairs with seven or more samples, assumes normally distributed data.
- Time series, box-whisker plots, and probability plots provide visual tools to identify potential outliers, and evaluation of seasonal, spatial, or temporal variability for both normally and non-normally distributed data.

Data quality control, groundwater geochemistry, and sampling procedures will be evaluated as potential sources of error leading to an outlier result. The outlier tests cannot be used alone to determine whether a value is a true outlier that should be excluded from future statistical analysis. Corroborating evidence needed to exclude values includes a discrete data reporting or analytical error, or potential laboratory bias. Absent corroborating evidence, the flagged values are considered true, but extreme, values in the data set. Professional judgement will be used to exclude extreme outliers from further statistical analyses. Outliers will be retained in the database.

With professional judgement, a confirmatory sample may be collected to allow for the distinction between an outlier and a true representation of groundwater quality at the monitoring point. If re-sampling is conducted, this sample will be collected within 90 days following outlier identification. If the confirmatory sample indicates the original result as an outlier, it will be reported as such.

## 2.5 Trend Analysis

Statistical analyses supporting the lack of trend are a fundamental step to confirm the assumption that groundwater quality values are stationary or constant over time at a CCR unit. These analyses allow for evaluation of variation in the background and compliance data for each constituent over time. A statistically significant increasing trend in background data could indicate an existing release from the CCR unit or alternate source, requiring further investigation. In addition, statistically significant trending background data can result in increased standard deviation and, therefore, greater prediction or control limits. Consequently, the increased prediction or control limit will have less power or ability to identify a release from the CCR unit.

A linear regression, coupled with a t-test for slope significance at a 95 percent confidence level (0.05 significance level), may be used on datasets for each constituent with few non-detects and a normally distributed variance of the mean to evaluate time trends. The Theil-Sen trend line, coupled with the Mann-Kendall test for slope significance at a 95 percent confidence level (0.05 significance level), will be used for datasets with frequent non-detects or non-normal variance. Similarly, trend analyses could also be used on compliance data to evaluate a possible release from the CCR unit.

## 2.6 Spatial Variation

Spatial trends and/or variation between background wells could indicate an existing release from a CCR unit. If the spatial variability is not due to an existing release, intrawell comparisons in compliance wells may be used to account for spatial variability and monitor for a future release. However, the CCR unit being monitored was placed into service prior to the start of groundwater monitoring and it is unknown whether a previous release has occurred. Accordingly, intrawell comparisons in compliance wells cannot be used to determine the occurrence of a future release. Interwell comparisons between compliance wells and background wells will be used.

## 2.7 Temporal Variation

Time series plots can be used to identify temporal dependence. Potentially significant temporal components of variability can be identified by graphing single constituent data from multiple wells together on a time series plot. With temporal dependence, the time series plot as a pattern of parallel traces, in which the individual wells will tend to rise and fall together across the sequence of sampling dates. Time series plots can be helpful by plotting multiple constituents over time for the same well, or averaging values for each constituent across wells on each sampling event and then plotting the averages over time. In either case, the plots can signify whether the general concentration pattern over time is simultaneously observed for different constituents. If so, it may indicate that a group of constituents is highly correlated in groundwater or that the same artifacts of sampling and/or lab analysis impacted the results of several monitoring parameters.

Hydrologic factors such as drought, recharge patterns or regular (*e.g.,* seasonal) water table fluctuations may be responsible for the temporal variation. In these cases, it may be useful to test for the presence of a significant temporal effect by first constructing a parallel time series plot and then running a formal one-way analysis of variance (ANOVA) ($\alpha = 0.05$) for temporal effects. A one-way ANOVA for temporal effects considers multiple well data sets for individual sampling events or seasons as the relevant statistical factor. If event-specific analytical differences or seasonality appear to be an important temporal factor, the one-way ANOVA for temporal effects can be used to formally identify seasonality, parallel trends, or changes in lab performance that affect other temporal effects. The one-way ANOVA for temporal effects assumes that the data groups are normally distributed with constant variance. It is also assumed that for each of a series of background wells, measurements are collected at each well on sampling events or dates common to all the wells. Results of the ANOVA can also be used to create temporally stationary residuals, where the temporal effect has been 'subtracted from' the original measurements. These stationary residuals may be used to replace the original data in subsequent statistical testing.

If the data cannot be normalized, a similar test for a temporal or seasonal effect can be performed using the Kruskal-Wallis test ($\alpha = 0.05$). Each sampling event should be treated as a separate 'well,' while each well is treated as a separate 'sampling event.' In this case, no residuals can be computed since the Kruskal-Wallis test employs ranks of the data rather than the measurements themselves.

Where both spatial and temporal variation occur, two-way ANOVA can be considered where both well location and sampling event/season are treated as statistical factors. This procedure is described in Davis (1994).

### 2.8 Updating Background

Updating the background dataset periodically by adding recent results to an existing background dataset can improve the statistical power and accuracy of the statistical analysis, especially for non-parametric prediction intervals. The *Unified Guidance* recommends updating statistical limits (background) when at least four to eight new measurements (every 1 to 2 years under a quarterly monitoring program), are available for comparison to historical data. Professional judgement will be used to evaluate whether any background data appear to be affected by a release and need to be excluded from a background update. A t-test for equal means (if normal data distribution) or appropriate non-parametric test (if non-normal data distribution) such as a Mann-Whitney (or Wilcoxon) rank-sum or box-whisker plots, will be conducted to evaluate whether the two groups of background sample populations are statistically different prior to updating any background datasets. A 0.05 significance level will be utilized when evaluating the two populations, with the null hypothesis that they are equivalent. In addition, time series graphs or other trend evaluation statistics will be conducted on the new background dataset to verify the absence of a release or changing groundwater quality. If the tests indicate that there are no statistical differences between the two background populations, the new data will be combined with the existing dataset. If the two populations are found to be different, the data will be reviewed to evaluate the cause of the difference. If the differences appear to be caused by a release (if the new data are significantly higher, or lower for pH), then the previous background dataset may continue to be used. Furthermore, verified outliers will not be added to an existing background dataset. In accordance with the *Unified Guidance*, continual background updates will not be conducted due to the lack of sufficient samples for a statistical comparison.

# 3. COMPLIANCE MONITORING

Compliance monitoring is designed to monitor groundwater for evidence of a release by comparing Part 845 constituents in compliance wells to both background concentrations and the GWPS. Compliance Monitoring will begin the 1st quarter following approval of this Groundwater Monitoring Plan and issuance of the Operating Permit. The selected Compliance Monitoring statistical method used to compare compliance groundwater quality data for each constituent to the GWPS will provide for adequate statistical power, error levels and individual test false positive rates, and be appropriate for the distribution and detection frequency of the background dataset. Statistical power is the ability of a statistical test to detect a true exceedance.

In accordance with 35 I.A.C. § 845.610(b)(3)(D), compliance monitoring statistical analyses will be completed and submitted to IEPA within 60 days after completion of sampling.

## 3.1 GWPS Establishment and Exceedance Determination

In accordance with 35 I.A.C. § 845.600(a), the GWPS will be the constituent concentrations specified in 35 I.A.C. § 845.600(a)(1) except for when the background concentration is greater, or no concentration is specified (*i.e.,* for calcium and turbidity), in which case the GWPS will be the background concentration. The GWPS based on background concentration will be calculated using a parametric upper tolerance limit (UTL), a parametric UPL for a future mean, or a non-parametric UPL for a future median.

Statistical calculations that will be utilized in Compliance Monitoring procedures are summarized in **Table A** below and listed in **Sections 3.1.1** through **3.1.7**. Depending on the distribution of the data and the percentage of non-detects, it may be more appropriate to use a parametric model over a non-parametric model. As necessary, other techniques as mentioned in the *Unified Guidance* and/or new methods will be implemented.

**Table A. Statistical Calculations Used in Compliance Monitoring Procedures**

| Compliance Monitoring | | | | | | |
|---|---|---|---|---|---|---|
| Significant Trend? | Background Data | | | Compliance Data | | |
| | Percent Non-Detects | Distribution | GWPS Determination | Percent Non-Detects | Distribution | Method to Determine Exceedance |
| No | 0 ≤ 50 | Normal | 35 I.A.C § 845.600(a)(1) constituent concentration or The Upper Tolerance Limit | ≤75 | Normal | Parametric Lower Confidence Limit around a Normal Mean |
| | | | | ≤75 | Log-Normal | Parametric Lower Confidence Limit around a Lognormal Geometric Mean |
| | | | | NA | Non-Normal | Non-Parametric Lower Confidence Limit around a Median |
| | | | | >75 | Unknown/ Cannot be determined | |
| | 50 ≤ 70 | Normal | The Upper Prediction Limit for a Future Mean | NA | NA | Future mean |
| | >70 | Non-Normal | Upper Prediction Limit for a Future Median | NA | NA | Future median |
| | 100 | Non-Normal | Double Quantification Rule | NA | NA | Individual Retesting Values |
| Yes | 0 ≤ 50 | Normal | UCL of Confidence Band around Linear Regression | ≤75 | Residuals after subtracting trend are normal, equal variance | Lower Limit from Confidence Band around Linear Regression |
| | 50 ≤ 100 | Non-Normal | UCL of Confidence Band around Thiel-Sen trend line | ≤75 | Residuals not normal | Lower Limit from Confidence Band around Thiel-Sen |

### 3.1.1 The Upper Tolerance Limit

The UTL will be used to calculate the GWPS when pooled background data are normally distributed, with a non-detect frequency of 50 percent or less. When non-detect frequency is 15 percent or less, half the RL will be substituted for non-detects. The *Unified Guidance* recommends 95 percent confidence level and 95 percent coverage (95/95 tolerance interval).

- When non-detect frequency is 15 percent or less, half the RL will be substituted for non-detects (simple substitution), and the normal mean and standard deviation will be calculated.

- The Kaplan-Meier or the ROS method will be used when the detection frequency is between 15 percent and 50 percent. The Kaplan-Meier method assesses the linearity of a censored probability plot to determine whether the background sample can be approximately normalized. If so, then the Kaplan-Meier method will be used to compute estimates of the mean and standard deviation adjusted for the presence of left-censored values. The Kaplan-Meier or ROS estimate of the mean and standard deviation will be substituted for the sample mean and standard deviation.
- If background normality cannot be achieved, non-parametric UTLs will not be calculated until a minimum of 60 background samples have been collected (to achieve 95 percent coverage).

The parametric UTL on a future mean will be calculated from the background dataset as follows:

$$UTL = \overline{x} + \kappa\,(n, \gamma, \alpha - 1) \cdot s$$

$\overline{x}$ = background sample mean

$s$ = background sample standard deviation

$\kappa\,(n, \gamma, \alpha - 1)$ = one-sided normal tolerance factor based on the chosen coverage (γ) and confidence level (α -1) and the size of the background dataset (n). Values are tabulated in Table 17-3 in Appendix D of the *Unified Guidance*. If exact values are not provided, then κ values can be estimated by linear interpolation.

If the UTL is constructed on the logarithms of original observations to achieve normality, where $\overline{y}$ and $s_y$ are the log-mean and log-standard deviation, the limit will be exponentiated for back-transformation to the concentration scale as follows:

$$UTL = \exp\left[\overline{y} + \kappa\,(n, \gamma, \alpha - 1) \cdot s_y\right]$$

$\overline{y}$ = background sample log-mean

$s_y$ = background sample log-standard deviation

When the GWPS is based on the 35 I.A.C. § 845.600(a)(1) constituent concentrations or a UTL derived from the background dataset, an exceedance in compliance wells relative to the GWPS will be evaluated using confidence intervals. A confidence interval defines the upper and lower bound of the true mean of a constituent concentration in groundwater within a specified confidence range.

- Non-detects in compliance data will be handled similarly to upgradient analyses, with half the RL substituted for non-detects when the frequency is 15 percent or less.
- The Kaplan-Meier, or the ROS method, will be used when the detection frequency is between 15 percent and 50 percent to compute estimates of the mean and standard deviation adjusted for the presence of left-censored values. These estimates will then be substituted for the sample mean and standard deviation.

Once the GWPS is established for background data using the UTL, either parametric or non-parametric confidence intervals will be computed for each constituent in compliance wells to identify GWPS exceedances.

### 3.1.2 Parametric Confidence Intervals around a Mean

If compliance data are approximately normal, one-sided parametric confidence intervals around a sample mean will be constructed for each constituent and well pair. The lower confidence limit (LCL) will be calculated as:

$$LCL_{1-\alpha} = \overline{x} - t_{1-\alpha,n-1} \cdot \frac{s}{\sqrt{n}}$$

$\overline{x}$ = compliance sample mean

*s* = compliance sample standard deviation

*n* = compliance sample size

$t_{1-\alpha,n-1}$ = obtained from a Student's t-table with (n–1) degrees of freedom (Table 16-1 in Appendix D of the *Unified Guidance*)

The chosen t value will aim to achieve both a low false-positive rate, and high statistical power. Minimum ɑ values are tabulated in Table 22-2 of Appendix D of the *Unified Guidance*. The selected minimum ɑ value, from which the t value will be derived, will have at least 80 percent power (1-β = 0.8) when the underlying mean concentration is twice the GWPS.

If compliance data are distributed lognormally, the LCL will be computed around the lognormal geometric mean as:

$$LCL_{1-\alpha} = \exp\left(\overline{y} - t_{1-\alpha,n-1} \cdot \frac{s_y}{\sqrt{n}}\right)$$

$\overline{y}$ = compliance sample log-mean

$s_y$ = compliance sample log-standard deviation

### 3.1.3 Non-Parametric Confidence Intervals around a Median

Non-parametric confidence intervals around the median will be computed if the compliance data contain greater than 50 percent non-detects or are not normally distributed. The mathematical algorithm used to construct non-parametric confidence intervals is based on the probability (*P*) that any randomly selected measurement in a sample of n concentration measurements will be less than an unknown *P* x 100th percentile of interest (where *P* is between 0 and 1). Then the probability that the measurement will exceed the *P* x 100$^{th}$ percentile is (1–*P*). The number of sample values falling below the *P* x 100$^{th}$ percentile out of a set of n should follow a binomial distribution with parameters n and success probability *P*, where 'success' is defined as the event that a sample measurement is below the *P* x 100$^{th}$ percentile. The probability that the interval formed by a given pair of order statistics will contain the percentile of interest will then be determined by a cumulative binomial distribution *Bin(x;n,p)*, representing the probability of *x* or fewer successes occurring in *n* trials with success probability p. *P* will be set to 0.50 for an interval around the median.

The sample size n will be ordered from least to greatest. Given *P* = 0.50, candidate interval endpoints will be chosen by ordered data values with ranks close to the product of (n+1) x 0.50. If the result of (n+1) x 0.50 is a fraction (for even-numbered sample sizes), the rank values immediately above and below will be selected as possible candidate endpoints. If the result of (n+1) x 0.50 is an integer (for odd-numbered sample sizes), one will be added to and subtracted from the result to get the upper and lower candidate endpoints. The ranks of the endpoints will be denoted L* and U*. For a one-sided LCL, the confidence level associated with endpoint L* will be computed as:

$$1 - \alpha = Bin(L^{*} - 1; n, 0.50) = \sum_{x=L^{*}}^{n} \binom{n}{x} \left(\frac{1}{2}\right)^{n}$$

If the candidate endpoint(s) do not achieve the desired confidence level, new candidate endpoints (L*−1) and (U*+1) and achieved confidence levels will be calculated. If one candidate endpoint equals the data minimum or maximum, only the rank of the other endpoint will be changed. Achievable confidence levels are tabulated using these equations in Table 21-11 in Appendix D of the *Unified Guidance*.

Both parametric and non-parametric confidence limits will then be compared to the GWPS. The CCR unit is considered to be in compliance if the LCL is equal to or lower than the GWPS for all detected constituents at all compliance monitoring wells. A GWPS exceedance is determined if the LCL exceeds the GWPS.

### 3.1.4 The Upper Prediction Limit for a Future Mean

The parametric UPL for a future mean will be used to calculate the GWPS if the pooled background data contain 50 to 70 percent non-detects and normality can be achieved. The Kaplan-Meier or ROS methods will be used to estimate the mean and standard deviation. The non-parametric UPL for a future median will be calculated as the GWPS if background samples cannot be normalized or contain greater than 70 percent non-detects. The parametric UPL for a future mean will be calculated from the background dataset at follows:

$$UPL_{1-\alpha} = \overline{x} + \kappa s$$

$\overline{x}$ = background sample mean

$s$ = background standard deviation

$\kappa$ = multiplier based on the order (p) of the future mean to be predicted, the number of compliance wells to be tested (w), the background sample size (n) the number (c) of constituents of concern (COCs), the "1-of-m" retesting scheme, and the evaluation schedule (annual, semi-annual, quarterly). Values are tabulated in 19-5 to 19-9 in Appendix D of the *Unified Guidance*.

The mean of order p will be computed for each well and compared against the UPL. For any compliance point mean that exceeds the limit, p additional resamples may be collected at that well for a 1-of-2 retesting scheme. Resample means will then be compared to the UPL. A GWPS exceedance has been deemed to occur at a compliance well when the initial mean and all resample means exceed the UPL.

### 3.1.5 The Non-Parametric Upper Prediction Limit for a Future Median

The non-parametric UPL for a future median will be used to calculate the GWPS if the pooled background data contain greater than 70 percent non-detects and normality cannot be achieved. Non-parametric methods assume that the data does not have an underlying distribution. To calculate the non-parametric UPL on a future value, the target per-constituent false positive rate ($\alpha_{const}$) will be determined as follows:

$$\alpha_{const} = 1 - (1 - \alpha)^{1/c}$$

α = the site-wide false positive rate (SWFPR) of 0.10 recommended by the *Unified Guidance*

*c* = the number of monitoring constituents

The number of yearly statistical evaluation (nE) will be multiplied by the number of compliance wells (w) to determine the look-up table entry, w*. The background sample size (n) and w* will be used to select an achievable per-constituent false positive rate value in Table 19-24 of Appendix D in the *Unified Guidance*. The chosen achievable per-constituent false positive rate value will determine the type of non-parametric prediction limit (maximum or 2nd highest value in background) and a retesting scheme for a future median. The background data will be sorted in ascending order, and the upper prediction limit will be set to the appropriate order statistic previously determined by the achievable per-constituent false positive rate value in Table 19-24. If all constituent measurements in a background sample are non-detect, the Double Quantification rule will be used. The use of the Double Quantification rule in Compliance Monitoring will only be applicable if the RL is above the 35 I.A.C. § 845.600(a)(1) constituent concentration or a constituent concentration is not specified in § 845.600(a)(1). This scenario is highly unlikely. The constituent will also be removed from calculations identifying the target false positive rate.

Two initial measurements per compliance well will be collected. If both do not exceed the upper prediction limit, a third initial measurement will not be collected since the median of order 3 will also not exceed the limit. If both exceed the prediction limit, a third initial measurement will not be collected since the median will also exceed the limit. If one initial measurement is above and one below the limit, a third initial observation may be collected to determine the position of the median relative to the UPL. Up to three resamples will be collected in order to assess the resample median. In all cases, if two or more of the compliance point observations are non-detect, the median will be set equal to the RL. The median value for each compliance well will be compared to the UPL. For the 1-of-2 retesting scheme, if any compliance point median exceeds the limit, up to three additional resamples will may be collected from that well. The resample median will be computed and compared to the UPL. A GWPS exceedance has been deemed to occur at a compliance well when either the initial median, or both the initial median and resample median exceed the UPL.

If the concentrations of detected constituents are below the established GWPS, Compliance Monitoring will continue.

### 3.1.6 Parametric Linear Regression and Confidence Band

If the t-test detects a significant trend in the parametric linear regression line using either background or compliance data for a particular constituent, confidence bands accounting for trends will be constructed to account for the trend-induced variation. If this is not accounted for, a wider confidence interval will inevitably be calculated for a given confidence level and sample size (n). A wider confidence interval will result in less statistical power, or ability to demonstrate an exceedance or return to compliance. When a linear trend line has been estimated, a series of confidence intervals is estimated at each point along the trend. This creates a simultaneous confidence band that follows the trend line. As the underlying population mean increases or decreases, the confidence band does also to reflect this change at that point in time.

Linear regression will be used when background or compliance data are approximately normally distributed, with a constant sample variance around the mean, and the frequency of non-detects is low. The linear regression of concentration against sampling date (time) will be computed as follows:

$$\hat{b} = \sum_{i=1}^{n} (t_i - \bar{t}) \cdot x_i / (n-1) \cdot s_t^2$$

$x_i$ = $i^{th}$ concentration value and

$t_i$ = $i^{th}$ sampling date

$\bar{t}$ = sampling mean date

$s_t^2$ = variance of the sampling dates

This estimate leads to the following regression equation:

$$\hat{x} = \bar{x} + \hat{b} \cdot (\mathrm{t} - \bar{t})$$

$\bar{x}$ = mean concentration level

$\hat{x}$ = estimated mean concentration at time t

The regression residuals will also be computed at each sampling event to ensure uniformity and lack of significant skewness. Regression residuals will be computed at each sampling event as follows:

$$r_i = x_i - \hat{x}_i$$

The estimated variance around the regression line, or mean squared error (MSE) will be computed as follows:

$$s_e^2 = \frac{1}{n-2} \sum_{i=1}^{n} r_i^2$$

The confidence intervals around a linear regression trend line given confidence level (1-ɑ) and a point in time ($t_0$), will be computed as follows:

$$LCL_{1-\alpha} = \hat{x}_0 - \sqrt{2 s_e^2 \cdot F_{1-2\alpha,2,\mathrm{n}-1} \cdot \left[ \frac{1}{n} + \frac{\left(t_0 - \bar{t}\right)^2}{(n-1) \cdot s_t^2} \right]}$$

$$UCL_{1-\alpha} = \hat{x}_0 - \sqrt{2 s_e^2 \cdot F_{1-2\alpha,2,\mathrm{n}-2} \cdot \left[ \frac{1}{n} + \frac{\left(t_0 - \bar{t}\right)^2}{(n-1) \cdot s_t^2} \right]}$$

$\hat{x}_0$ = estimated mean concentration from the regression equation at time $t_0$

$F_{1-2\alpha,2,\mathrm{n}-2}$ = upper $(1\text{-}2\alpha)^{th}$ percentage point from an F-distribution with 2 and (n-2) degrees of freedom

For background data, the UCL around the linear regression line will be used as the GWPS for the trending constituent. For compliance data, confidence bands around the linear regression line will be compared to the GWPS. The CCR unit is considered to be in compliance if the LCL is equal to or lower than the GWPS for all detected constituents at all compliance wells. A GWPS exceedance is determined when the LCL based on the trend line first exceeds the GWPS.

### 3.1.7 Non-Parametric Thiel-Sen Trend Line and Confidence Band

If the Mann-Kendall test detects a significant trend in the non-parametric Thiel-Sen line using either background or compliance data for a particular constituent, confidence bands accounting for trends will be constructed to account for the trend-induced variation. The Thiel-Sen trend line will be used as a non-parametric alternative to linear regression when trend residuals cannot be normalized or if there are a higher percentage of non-detects in either background or compliance data. The Thiel-Sen trend line estimates the median concentration over time by combining the median pairwise slope with the median concentration value and the median sample date. To compute the Thiel-Sen line, the data will first be ordered by sampling event x1, x2, xn. All possible distinct pairs of measurements ($x_i$, $x_j$) for j > i will be considered and the simple pairwise slope estimate will be computed for each pair as follows:

$$m_{ij} = (x_j - x_i)/(j - i)$$

With a sample size of n, there will be a total of N = n(n-1)/2 pairwise estimates ($m_{ij}$). If a given observation is a non-detect, half the RL will be substituted. The N pairwise slope estimates ($m_{ij}$) will be ordered from least to greatest (renamed m(1), m(2),..m(N)). The Thiel-Sen estimate of slope (Q) will be calculated as the median value of the list depending on whether N is even or odd as follows:

$$Q = \begin{cases} m_{([N+1]/2)} \; if \; N \; is \; odd \\ (m_{(N/2)} + m_{([N+2]/2)})/2 \; if \; N \; is \; even \end{cases}$$

The sample concentration magnitude will be ordered from least to greatest, x(1), x(2), to x(n) and the median concentration will be calculated as follows:

$$\tilde{x} = \begin{cases} x_{([n+1]/2)} \; if \; n \; is \; odd \\ (x_{(n/2)} + x_{([n+2]/2)})/2 \; if \; n \; is \; even \end{cases}$$

The median sampling date ($\tilde{t}$) with ordered times (t(1), t(2), to t(n)) will also be determined in this way. The Thiel-Sen trend line will then be computed for an estimate at any time (t) of the expected median concentration (x) as follows:

$$x = \tilde{x} + Q \cdot (\mathrm{t} - \tilde{t}) = (\tilde{x} - Q \cdot \tilde{t}) + Q \cdot \mathrm{t}$$

To construct a confidence band around the Thiel-Sen line, sample pairs (ti, xi) will be formed with a sample date (ti) and the concentration measurement from that date (xi). Bootstrap samples (B) will be formed by repeatedly sampling n pairs at random with replacement from the original sample pairs. This will be repeated 500 times. For each bootstrap sample, a Thiel-Sen trend line will be constructed using the equation above. A series of equally spaced time points (tj) will be identified along the range of sampling dates represented in the original sample, j =1 to m. The Thiel-Sen trend line associated with each bootstrap replicate will be used to compute an estimated concentration ($\hat{x}_j^B$). An LCL will be constructed for the lower $\alpha^{th}$ percentile $\hat{x}_j^{[\alpha]}$ from the distribution of estimated concentrations at each time point (tj). For a UCL, compute the upper $(1-\alpha)^{th}$ percentile, $\hat{x}_j^{[1-\alpha]}$ at each time point (tj).

For background data, the UCL around the Thiel-Sen trend line will be used as the GWPS for the trending constituent. For compliance data, confidence bands around the Thiel-Sen trend line will be compared to the GWPS. The CCR unit is considered to be in compliance if the LCL is equal to or lower than the GWPS for all detected constituents at all compliance wells. A GWPS exceedance is confirmed when the LCL based on the trend line first exceeds the GWPS.

## 3.2 Determination of Statistically Significant Increases over Background

In accordance with 35 I.A.C. §§ 845.610(b)(3)(B) and 845.640(h), individual monitoring event concentrations for each constituent detected in the compliance monitoring wells during compliance monitoring sampling events will be compared to the background concentration as determined by the methods described above. An exceedance of the background concentration for any constituent measured at any compliance monitoring well, or constituent detection if not detected in the background samples, constitutes a Statistically Significant Increase (SSI). An exception to this method is pH, where two-sided (upper and lower) tolerance limits are established from the distribution of the background groundwater quality data. An exceedance of either the UTL or lower tolerance limit (LTL) would constitute an SSI for pH.

# 4. REFERENCES

Davis, C.B., 1994. *Environmental Regulatory Statistics.* In GP Patil & CR Rao (Eds.) *Handbook of Statistics, Volume 12: Environmental Statistics*, Chapter 26. New York: Elsevier Science B.V.

United States Environmental Protection Agency (USEPA), 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Unified Guidance*. EPA 530-R-09-007. March 2009.

# ATTACHMENT J

# Memorandum

BURNS McDONNELL

Date: 25 October 2021

Subject: 35 I.A.C. Section 845.430 – Slope Maintenance Documentation for East Ash Pond at Hennepin Power Plant

Dynegy Midwest Generation, LLC (DMG) operates the coal-fired Hennepin Power Plant located in Putnam County, Illinois. The East Ash Pond is an inactive surface impoundment storing coal combustion residuals (CCR). The requirements for the East Ash Pond are found in 35 Ill. Admin. Code Part 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Part 845).

Pursuant to Part 845, Section 845.230(d)(2)(F), the initial operating permit application for existing or inactive CCR surface impoundments that have not completed an Agency approved closure before prior to July 30, 2021, must contain documentation that the CCR surface impoundment, if not incised, will be operated, and maintained with one of the forms of slope protection specified in Section 845.430. This statement addresses the requirements of Part 845, Section 845.430 Slope Maintenance, which states:

> <u>*Section 845.430:*</u> *The slopes and pertinent surrounding areas of the CCR surface impoundment must be designed, constructed, operated, and maintained with one of the forms of slope protection specified in subsection (a) that meets all the performance standards of subsection (b).*
>
> <u>*Section 845.430(a):*</u> *Slope protection must consist of one of the following: 1) A vegetative cover consisting of grassy vegetation; 2) An engineered cover consisting of a single form or combination of forms of engineered slope protection measures; or 3) A combination of the forms of cover specified in subsections (a)(1) or (a)(2).*
>
> <u>*Section 845.430(b):*</u> *Any form of cover for slope protection must meet the following performance standards: 1) The cover must be installed and maintained on the slopes and pertinent surrounding areas of the CCR surface impoundment; 2) The cover must provide protection against surface erosion, wave action, and adverse effects of rapid drawdown; 3) The cover must be maintained to allow for the observation of, and access to, the slopes and pertinent surrounding areas during routine and emergency events; 4) Woody vegetation must be removed from the slopes or pertinent surrounding areas. Any removal of woody vegetation with a diameter greater than 1/2 inch must be directed by a person familiar with the design and operation of the CCR surface impoundment and in consideration of the complexities of removal of a tree or a shrubbery, who must ensure the removal does not create a risk of destabilizing the CCR surface impoundment or*

> *otherwise adversely affect the stability and safety of the CCR surface impoundment or personnel undertaking the removal; and 5) The height of vegetation must not exceed 12 inches.*

Slope protection, consisting of vegetative cover, was installed on the slopes and pertinent surrounding areas of the Hennepin East Ash CCR impoundment, and is inspected, maintained and repaired as needed. Based on observations from weekly inspections conducted in accordance with Section 845.540(a), and the 2020 annual inspections conducted by Hanson Professional Services Inc., the vegetative cover is described to be in good working condition with a maximum vegetation height of 12 inches. The owner's Operations and Maintenance Plan (O&M Plan) provides details for maintaining grass and removing woody vegetation and addressing erosion features on the slopes. Based on a review of the documentation described above, the owner is implementing the O&M Plan, including the completion of repairs and maintenance as needed and when issues are identified during weekly and/or annual inspections. The slope maintenance portion of the O&M Plan and the Annual Inspection performed by Hanson in 2020 are included in Attachment J. The surface impoundment slope protection (vegetative cover) installed and maintained on the slopes and pertinent areas around the slopes is depicted in the aerial photograph provided below.

Source: Imagery ©2021 Maxar Technologies, USDA Farm Service Agency,
Map data ©2021 (accessed via Google® on 10/20/21)

## Excerpt from the Hennepin EAP Operations and Maintenance Manual

# 1.0 MAINTENANCE

## 1.1 Vegetation

Dikes shall be maintained to protect the structural integrity of the disposal facility. Damaged and barren areas shall be repaired as soon as appropriate after being discovered. Damaged areas shall be filled with topsoil. Limed, fertilized, and seeded with appropriate vegetation. Trees and shrubs observed during periodic inspections shall be cut and removed from the dikes and discharge channel. This shall be done as frequently as is necessary to ensure that no tree reaches a size where the root structure would require removal and filling. Woody vegetation, shrubs, and trees shall be removed during the early stages of growth before reaching a three-inch diameter.

Low growing vegetation shall be planted and maintained to facilitate inspections.

## 1.2 Discharge Structure

The discharge structure shall be inspected periodically for significant corrosion, spalling, and cracking. Any defects discovered shall be promptly repaired.

## 1.3 Animal Damage and Repairs

Animal burrows discovered during inspections shall be promptly repaired by filling with grout.

## 1.4 Restriction of Unauthorized Vehicles

Facility approaches shall be posted with signs restricting unauthorized travel on the roadways and slopes.

## 1.5 Inspections/Remedial Measures

### 1.5.1 Weekly Inspections

Weekly inspections of the perimeter berms shall be conducted, looking for seepage and slumping, and unusual seepage at and/or blockage of the outfall structures in each cell. All findings shall be entered into the weekly inspection checklist, discussed in Section 4.0. Maintenance activities shall be initiated, if required. Refer to Section 4.0 for the recommended inspection checklist to be used for the weekly inspections.

### 1.5.2 Quarterly Inspections

Inspections shall be made quarterly by Station personnel to determine the general condition of the dam and embankments. During these inspections, embankment erosion, tree growth, and embankment seepage shall be monitored. Seepage shall be observed for change in quantity and coloration. Refer to Section 4.0, for the recommended inspection checklist to be used for documenting the quarterly inspections.

### 1.5.3 Five-Year Inspections

Every five years, an inspection shall be made by a licensed professional engineer. This inspection shall follow the Illinois Department of natural Resources (IDNR) *Guidelines and Forms for Inspection of Illinois Dams* and shall be followed by verbal and written reports by the consulting engineer. Based on the findings of the inspection, the Station Manager shall implement corrective action as required to promote dam safety. Procedures and methods for corrective action shall be performed in accordance with recommendations of the consulting engineer and as outlined above. Copies of the engineer's report, along with corrective action taken, shall be reported to the IDNR.

## 1.6 Annual Statement

An annual statement on forms furnished by IDNR, certifying compliance with this maintenance plan, shall be submitted to IDNR.

# Dam Inspection Report

Name of Dam: Hennepin East Ash Pond — Dam ID No. IL 50363

Permit Number: DS2004119 — Class of Dam: III

Location: NE 1/4 Section 26 Township 33N Range 2W

Owner: Dynegy Midwest Generation (Name) — 815-339-9210 (Telephone Number (Day))

RR1, Box 200AA (Street) — 815-339-9215 (Telephone Number (Night))

Hennepin (City) — 61327 (Zip Code) — County: Putnam

Type of Dam: Earth embankment with geosynthetic-clay liner

Type of Spillway: Drop structure and stop logs

Date(s) Inspected: 11-Nov-20

Weather When Inspected: Pt. Cloudy

Temperature When Inspected: 38 F

Pool Elevation When Inspected: Primary 481.4, Secondary 479.5

Tailwater Elevation When Inspected: N.A.

LICENSED PROFESSIONAL ENGINEER
JAMES P. KNUTELSKI
062-054206
OF ILLINOIS

12/30/2020

Professional Engineer's Seal

EYP 11/30/21

Inspection Personnel:

| Name | Title |
|---|---|
| James P. Knutelski, P.E. | Geotechnical Engineer |
| Jason Campbell, P.E. | Dynegy Dam Safety |
| Paul Mauer | IDNR-OWR |
| | |

The Department of Nautural Resources is requesting information that is necessary to accomplish the statutory purpose as outlined under the River, Lakes and Streams Act, 615 ILCS 5. Submittal of this information is REQUIRED. Failure to provide the required information could result in the initiation of non-compliance procedures as outlined in Section 3702.160 of the "Rules for Construction and Maintenance of Dams".

## CONDITION CODES

| | |
|---|---|
| NE - | No evidence of a problem |
| GC - | Good condition |
| MM - | Item needing minor maintenance and/or repairs within the year, the safety or integrity of the item is not yet imperiled |
| IM - | Item needing immediate maintenance to restore or ensure its safety or integrity |
| EC - | Emergency condition which if not immediately repaired or other appropriate measures taken could lead to failure of the dam |
| OB - | Condition requires regular observation to ensure that the condition does not become worse |
| NA - | Not applicable to this dam |
| NI - | Not inspected - list the reason for non-inspection under deficiencies |

## EARTH EMBANKMENT

| ITEM | CONDITION CODE | DEFICIENCIES | RECOMMENDED REMEDIAL MEASURES AND IMPLEMENTATION SCHEDULE |
|---|---|---|---|
| Surface Cracks | NE | | |
| Vertical and Horizontal Alignment of Crest | GC | | |
| Unusual Movement or Cracking At or Beyond Toe | NE | | |
| Sloughing or Erosion of Embankment and Abutment Slopes | MM | Minor erosion bench on west end adjacent to river.<br>Minor erosion feature near crest adjacent to river. | Add riprap to this area and other areas where flood on river was above riprap.<br>Fill erosion feature, seed areas and monitor. |
| Upstream Face Slope Protection | NE | | |
| Seepage | NE | | |
| Filter and Filter Drains | NA | | |

## EARTH EMBANKMENT

(Continued)

| ITEM | CONDITION CODE | DEFICIENCIES | RECOMMENDED REMEDIAL MEASURES AND IMPLEMENTATION SCHEDULE |
|---|---|---|---|
| Animal Damage | MM | North side animal burrow. | Fill and reseed animal damage. |
| Embankment Drainage Ditches | GC | | |
| Vegetative Cover | GC | Woody vegetation in riprap at outlet structure in secondary pond. | Remove woody vegetation in riprap in secondary pond. |
| Riprap | NE | | |
| Articulated blocks | MM | Loss of aggregate between articulated concrete blocks | Replace aggregate between blocks. |
| Other | | | |
| Other | | | |

## PRINCIPAL SPILLWAY

X Drop Inlet Spillway ☐ Overflow Spillway Structure ☐ Gated

| ITEM | CONDITION CODE | DEFICIENCIES | RECOMMENDED REMEDIAL MEASURES AND IMPLEMENTATION SCHEDULE |
|---|---|---|---|
| Erosion, Spalling, Cavitation | OB | Spalling at pedestrian bridge seat on Polishing Pond Riser | Condition has not deteriorated - observe this area and repair if condition deteriorates. |
| Structure to Embankment Junction | NI | Underwater | |
| Drains | NA | | |
| Seepage Around or Into Structure | NI | Underwater | |
| Surface Cracks | NI | Underwater | |
| Structural Cracks | NI | Underwater | |

IF THE SPILLWAY IS GATED FILL OUT THE GATES SECTION

## PRINCIPAL SPILLWAY

(Continued)

[x] Drop Inlet Spillway    [ ] Overflow Spillway Structure    [ ] Gated

| ITEM | CONDITION CODE | DEFICIENCIES | RECOMMENDED REMEDIAL MEASURES AND IMPLEMENTATION SCHEDULE |
|---|---|---|---|
| Alignment of Abutment Walls | NA | | |
| Construction Joints | NA | | |
| Filter and Filter Drains | NA | | |
| Trash Racks | NA | | |
| Bridge and Piers | NE | | |
| Differential Settlement | NE | | |
| Other (Name) | | | |

IF THE SPILLWAY IS GATED FILL OUT THE GATES SECTION

# PRINCIPAL SPILLWAY

(Continued)

X Conduit ☐ Gated

| ITEM | CONDITION CODE | DEFICIENCIES | RECOMMENDED REMEDIAL MEASURES AND IMPLEMENTATION SCHEDULE |
|---|---|---|---|
| Erosion, Spalling, Cavitation | NE | | |
| Joint Separation | NI | Underwater | |
| Seepage Around of Into Conduit | NI | Underwater | |
| Surface Cracks | NI | Underwater | |
| Structural Cracks | NI | Underwater | |
| Trash Racks | NA | | |
| Differential Settlement | NI | Underwater | |
| Alignment | NI | Underwater | |
| Other (Name) | | | |

IF THE SPILLWAY IS GATED FILL OUT THE GATES SECTION

## PRINCIPAL SPILLWAY

X Principal Spillway ☐ Dewatering ☐ Other: ____________

| ITEM | CONDITION CODE | DEFICIENCIES | RECOMMENDED REMEDIAL MEASURES AND IMPLEMENTATION SCHEDULE |
|---|---|---|---|
| Gate Sill | NI | Underwater | |
| Gate Seals | NI | Underwater | |
| Gate and Frame (Stoplogs) | GC | | |
| Operating Machinery | NA | | |
| Emergency Operating Machinery | NA | | |
| Outlet Flume | GC | | |
| Outlet Discharge | GC | | Note: Outlets to river backwater area. |

SUMMARY OF MAINTENANCE DONE AND/OR

REPAIRS MADE SINCE THE LAST INSPECTION

DATE OF PRESENT INSPECTION: 11-Nov-20

DATE OF LAST INSPECTION: 6-Nov-19

1. EARTH EMBANKMENT DAMS
   Slopes and interior of closed pond regraded and reseeded.

2. CONCRETE MASONRY DAMS
   NA

3. PRINCIPAL SPILLWAY
   None

4. OUTLET WORKS
   None.

5. EMERGENCY SPILLWAY
   NA

North side exterior

North side exterior

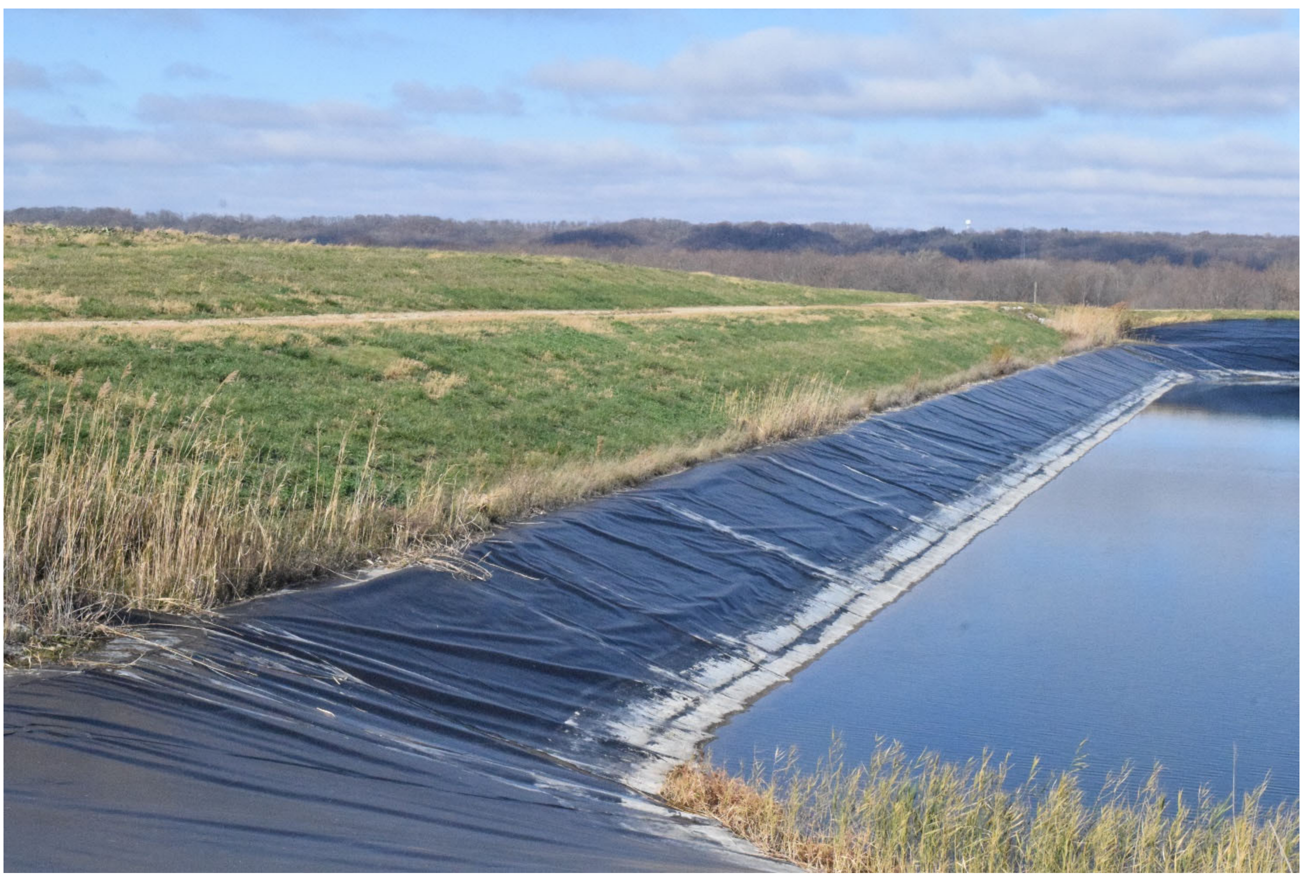
North side adjacent to river – repair erosion

North side adjacent to river

North side erosion feature – repair and reseed

North side let down structure - typical

East exterior slope



Old pond – new pond separator berm

New pond interior

Primary pond – secondary pond separator berm

Primary pond – secondary pond separator berm

South side new pond – aggregate missing – fill voids between blocks

Secondary pond outlet structure and bridge

Secondary pond and outlet structure to river – spray/remove vegetation in riprap

West side crest – west interior filled

West downstream slope – filled area

# ATTACHMENT K

**POST-CLOSURE PLAN FOR EXISTING CCR SURFACE IMPOUNDMENT**
**40 C.F.R. § 257.104 and 35 I.A.C. 845.780**
**REV 0 – 10/30/2021**

| SITE INFORMATION | | | |
|---|---|---|---|
| Site Name / Address | Hennepin Power Plant / 13498 East 800th Street, Hennepin, IL 61327 | | |
| Owner Name / Address | Dynegy Midwest Generation, LLC / 6555 Sierra Drive Irving, Texas 75039 | | |
| CCR Unit | East Ash Pond | Closure Method and Final Cover Type | Close In-Place Geomembrane with Soil and Vegetation Cover |

| POST-CLOSURE PLAN DESCRIPTION | |
|---|---|
| 40 C.F.R. § 257.104(c)(1) and 35 I.A.C. 845.780(c)(1) – Length of post-closure care period. | Post-closure care will be conducted for a period of 30 years as required by 40 C.F.R. § 257.104(c)(1) and 35 I.A.C. 845.780(c)(1), except as provided by 40 C.F.R. § 257.104(c)(2) and 35 I.A.C. 845.780(c)(2). |
| 40 C.F.R. § 257.104(c)(2) and 35 I.A.C. 845.780(c)(2) – Circumstances extending the post closure care period. | If at the end of the post-closure care period the CCR unit is operating under assessment monitoring in accordance with §257.95, the post-closure care as described in this plan will continue until returning to detection monitoring in accordance with §257.95.<br><br>Under 35 I.A.C. 845.780(c)(2), the post-closure care period will be extended until groundwater monitoring data demonstrate that concentrations are below the groundwater protection standards in Section 845.600 and are not increasing for those constituents over background, using the statistical procedures and performance standards in Section 845.640(f) and (g), provided that concentrations have been reduced to the maximum extent feasible and concentrations are protective of human health and the environment. |
| 40 C.F.R. § 257.104(d)(1)(i) and 35 I.A.C. 845.780(d)(1)(A) – A description of the monitoring and maintenance activities required in 40 C.F.R. § 257.104(b) and 35 I.A.C. 845.780(b), and the frequency at which these activities will be performed, to maintain the integrity and effectiveness of the final cover system, maintain the groundwater monitoring system and monitor the groundwater. | Pursuant to § 257.104(b)(1) and 35 I.A.C. 845.780(b)(1), throughout the post-closure care period, periodic visual observations of the final cover system and stormwater management system will be performed at least annually for evidence of settlement, subsidence, erosion, or other damage that may adversely affect the integrity and effectiveness of the final cover system. When practical, visual observations of the final cover will be made concurrent with groundwater monitoring activities.<br><br>Noted evidence of damage, such as rills, surface cracks and settlement, will be repaired to maintain the integrity and effectiveness of the final cover system. Vegetation will be established and maintained on the final cover system, including storm drainage areas, where appropriate, to provide long-term erosion control. Established vegetation and the slope design of the final cover system will prevent potential erosion and damage that may be caused by run-on and run-off.<br><br>Repair activities may include, but are not limited to, replacing and |

| | |
|---|---|
| | compacting soil cover, repairing drainage channels that have been eroded, filling in depressions with soil, regrading, and reseeding areas of failed vegetation, as necessary.<br><br>Pursuant to § 257.104(b)(3) and 35 I.A.C. 845.780(b)(3), the groundwater monitoring system will be maintained, and groundwater will be monitored as required by 40 C.F.R. § 257.90 through 40 C.F.R. § 257.98 and 35 I.A.C. 845.600 through 845.680. Monitoring wells will be inspected during each groundwater sampling event. Monitoring wells and associated instrumentation will be maintained so that they perform to the design specifications throughout the life of the monitoring program. Groundwater monitoring frequency will be at least quarterly, except as provided in 40 C.F.R. § 257.94(d) and 35 I.A.C. 845.650(b)(4). |
| 40 C.F.R. § 257.104(d)(1)(ii) and 35 I.A.C. 845.780(d)(1)(B) – The name, address, telephone number and email address of the person or office to contact about the facility during the post-closure care period. | Dynegy Midwest Generation, LLC<br>6555 Sierra Drive<br>Irving, Texas 75039<br>800.633.4704<br>ccr@dynegy.com |
| 40 C.F.R. § 257.104(d)(1)(iii) and 35 I.A.C. 845.780(d)(1)(C) – A description of the planned uses of the property during the post-closure period. | The CCR unit is located at a retired electric generation facility. Planned uses of the property during the post-closure period are currently unknown, except for post-closure care of the CCR unit.<br><br>Post-closure use of the property will not disturb the integrity of the final cover system or other components of the containment system, or the function of the monitoring systems unless necessary to comply with the requirements of 40 C.F.R. Part § 257, Subpart D and 35 I.A.C. Part 845. Any other disturbance will be conducted following a demonstration that it will not increase the potential threat to human health or the environment, as required by 40 C.F.R. § 257.104(d)(1)(iii) and 35 I.A.C. 845.780 (d)(1)(C). The demonstration will be certified by a qualified professional engineer and submitted to the Illinois Environmental Protection Agency (IEPA). Per 40 C.F.R. § 257.104(d)(1)(iii) notification shall be provided to the State Director that the demonstration has been placed in the operating record and on the owners or operator's publicly accessible internet site.<br><br>Following closure of the CCR unit, a notation on the deed to the property, or some other instrument that is normally examined during title search, will be recorded in accordance with 40 C.F.R. § 257.102(i) and 35 I.A.C. 845.760(h). The notation will notify potential purchasers of the property that the land has been used as a CCR unit and its use is restricted under the post-closure care requirements in 40 C.F.R. § 257.104(d)(1)(iii) and 35 I.A.C. 845.780(d)(1)(C) or groundwater monitoring requirements per 35 I.A.C. 845.740(b). Within 30 days of recording the deed notation, a notification stating that the notation has been recorded will be submitted to the IEPA and placed in the facility's operating record per 35 I.A.C. 845.760(h)(3). The notification will be placed on the owner or operator's publicly accessible CCR Web site in accordance with 40 C.F.R. § 257.107(i)(9) and 35 I.A.C. 845.810(e) and placed in the facility's operating record as required by 35 I.A.C. 845.800(d)(26) and §257.105(i)(9). |

| | |
|---|---|
| 40 C.F.R. § 257.104(d)(3) and 35 I.A.C. 845.780(d)(3)- Amendments to the initial or subsequent written post-closure plan. | Pursuant to 40 C.F.R. § 257.104(d), the initial post closure care plan for the Hennepin East Ash Pond was prepared on October 17, 2016. That plan is being amended pursuant to 40 C.F.R. § 257.104(d)(3)(i). This plan also serves as the initial post-closure care plan, prepared in accordance with 35 I.A.C. 845.780(d).<br><br>Pursuant to § 257.104(d)(3) and 35 I.A.C. 845.780(d)(3), an operating permit modification application to amend the initial or any subsequent written post-closure care plan developed under 35 I.A.C. 845.780 (d)(1) and § 257.104(d)(1) will be submitted to IEPA. The written post-closure care plan will be amended whenever there is a change in the operation of the CCR surface impoundment that would substantially affect the written post-closure care plan in effect; or unanticipated events necessitate a revision of the written post-closure care plan, after post-closure activities have started.<br><br>The written post-closure care plan will be amended at least 60 days before a planned change in the operation of the facility or CCR surface impoundment, or within 60 days after an unanticipated event requires the need to revise the existing plan. If the plan is revised after post-closure activities have started, a request to modify the operating permit, including an amended written post-closure care plan, will be submitted to the IEPA within 30 days following the triggering event. |
| 40 C.F.R. § 257.104(d)(4) and 35 I.A.C. 845.780(d)(4) – Qualified professional engineering certification. | Certification by a qualified professional engineer will be appended to this plan and any amendment of this plan. |
| 35 I.A.C. 845.780(e) – Termination of post-closure care. | Upon completion of the post-closure period, a request to terminate post-closure care will be submitted to the IEPA. The request will include a certification by a qualified professional engineer verifying that post-closure care has been completed in accordance with the post-closure care plan specified in 35 I.A.C. 845.780(d) and the requirements of 35 I.A.C. 845.780. |
| 40 C.F.R. § 257.104(e) and 35 I.A.C. 845.780(f) – Notification of completion of the post-closure care period. | A notification of completion of post-closure care will be prepared and placed in the facility's operating record within 30 days after IEPA approval of the request to terminate post-closure care. The notification will be placed in the facility's operating record in accordance with 35 I.A.C. 845.800(d)(31) and § 257.105(i)(13).<br><br>The notification will be placed on the owner or operator's publicly accessible CCR Internet site in accordance with the requirements of § 257.107(i)(13) and 35 I.A.C. 845.810(e). The IEPA will be notified when the notification has been placed in the operating record and on the owner or operator's publicly accessible Internet site in accordance with the requirements of § 257.106(i)(13). |

**Certification Statement 40 C.F.R. § 257.104 (d)(4) and 35 I.A.C. 845.780(d)(4) – Amended/Initial Written Post Closure Plan for a CCR Surface Impoundment**

**CCR Unit: Dynegy Midwest Generation, LLC; Hennepin Power Plant; East Ash Pond**

I, John R. Hesemann, 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 amended/initial written post closure plan, dated October 30, 2021, meets the requirements of 40 C.F.R. § 257.104 and 35 I.A.C. 845.780.

John R. Hesemann

*Printed Name*

9/28/2021

*Date*

JOHN ROBERT HESEMANN
062-058523
LICENSED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

John R. Hesemann
Exp.: 11/30/2021

# ATTACHMENT M

RAMBOLL

## HISTORY OF POTENTIAL EXCEEDANCES

This presentation of the History of Potential Exceedances, and any corrective action taken to remediate groundwater, is provided to meet the requirements of Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845.230(d)(2)(M) for the Hennepin Power Plant East Ash Pond, Illinois Environmental Protection Agency (IEPA) ID No. W1550100002-05.

***Note***

*Groundwater concentrations from 2015 to 2021 presented in the Hydrogeologic Site Characterization Report (HCR) Table 4-1, and evaluated and summarized in the following tables, are considered potential exceedances because the methodology used to determine them is proposed in the Statistical Analysis Plan (Appendix A to Groundwater Monitoring Plan [GMP]), which has not been reviewed or approved by IEPA at the time of submittal of the 35 I.A.C. § 845 Operating Permit application.*

*Alternate sources for potential exceedances as allowed by 35 I.A.C. § 845.650(e) have not yet been evaluated. These will be evaluated and presented in future submittals to IEPA as appropriate.*

*Table 1 summarizes how the potential exceedances were determined.*

*Background Concentrations*

*Background monitoring wells identified in the GMP include 07, 08, 08D, 16, and 17.*

*For monitoring wells that have been historically monitored in accordance with Title 40, Code of Federal Regulations, Part 257, Subpart D (Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments), background concentrations calculated from sampling events in 2015-2017 were compared to the standards identified in 35 I.A.C. § 845.600(a)(1). For constituents with calculated background concentrations in 2015-2017 greater than the standards in 35 I.A.C. § 845.600(a)(1), those calculated background concentrations were used as Groundwater Protection Standards (GWPSs) for comparing to statistical calculation results for each compliance well to determine potential exceedances. Compliance well statistical calculations consider concentrations from all sampling events in 2015-2021.*

*For all other monitoring wells, either newly constructed in 2021 or existing wells not monitored under Title 40, Code of Federal Regulations, Part 257, Subpart D, background concentrations calculated from the eight sampling events required by 35 I.A.C. § 845.650(b)(1)(A), to be collected within 180 days from April 21, 2021, were compared to the standards identified in 35 I.A.C. § 845.600(a)(1). For constituents with calculated background concentrations greater than the standards in 35 I.A.C. § 845.600(a)(1), those calculated background concentrations were used as GWPSs. Compliance well statistical calculations from that same time period were compared to the GWPSs to determine potential exceedances.*

*Corrective Action*

*No corrective actions are required to remediate the groundwater.*

**TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES**
HISTORY OF POTENTIAL EXCEEDANCES
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | HSU | Program | Constituent | Result Unit | Sample Date Range | Statistical Calculation | Statistical Result | GWPS | Background | Part 845 Standard | GWPS Source |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 | UA | 257 | Antimony, total | mg/L | 12/09/2015 - 06/23/2021 | All ND - Last | 0.001 | 0.006 | 0.001 | 0.006 | Standard |
| 12 | UA | 257 | Arsenic, total | mg/L | 06/22/2015 - 06/23/2021 | All ND - Last | 0.001 | 0.010 | 0.001 | 0.01 | Standard |
| 12 | UA | 257 | Barium, total | mg/L | 06/22/2015 - 06/23/2021 | CI around mean | 0.050 | 2.0 | 0.21 | 2 | Standard |
| 12 | UA | 257 | Beryllium, total | mg/L | 12/09/2015 - 06/23/2021 | All ND - Last | 0.001 | 0.004 | 0.001 | 0.004 | Standard |
| 12 | UA | 257 | Boron, total | mg/L | 06/22/2015 - 06/23/2021 | CI around mean | 0.36 | 2.0 | 0.15 | 2 | Standard |
| 12 | UA | 257 | Cadmium,total | mg/L | 06/22/2015 - 06/23/2021 | All ND - Last | 0.001 | 0.005 | 0.0023 | 0.005 | Standard |
| 12 | UA | 257 | Chloride, total | mg/L | 06/22/2015 - 06/23/2021 | CI around mean | 68 | 396 | 396 | 200 | Background |
| 12 | UA | 257 | Chromium, total | mg/L | 06/22/2015 - 06/23/2021 | CI around median | 0.001 | 0.10 | 0.001 | 0.1 | Standard |
| 12 | UA | 257 | Cobalt, total | mg/L | 12/09/2015 - 06/23/2021 | All ND - Last | 0.001 | 0.038 | 0.038 | 0.006 | Background |
| 12 | UA | 257 | Fluoride, total | mg/L | 06/22/2015 - 06/23/2021 | CB around linear reg | 0.25 | 4.0 | 0.12 | 4 | Standard |
| 12 | UA | 257 | Lead, total | mg/L | 06/22/2015 - 06/23/2021 | All ND - Last | 0.001 | 0.0075 | 0.0015 | 0.0075 | Standard |
| 12 | UA | 257 | Lithium, total | mg/L | 12/09/2015 - 06/23/2021 | CI around mean | 0.012 | 0.040 | 0.019 | 0.04 | Standard |
| 12 | UA | 257 | Mercury, total | mg/L | 06/22/2015 - 06/23/2021 | All ND - Last | 0.0002 | 0.002 | 0.0002 | 0.002 | Standard |
| 12 | UA | 257 | Molybdenum, total | mg/L | 06/22/2015 - 06/23/2021 | CI around mean | 0.026 | 0.10 | 0.0017 | 0.1 | Standard |
| 12 | UA | 257 | pH (field) | SU | 03/19/2015 - 06/23/2021 | CB around linear reg | 7.0 | 6.5/9.0 | 6.6/7.5 | 6.5/9 | Standard/Standard |
| 12 | UA | 257 | Radium-226 + Radium 228, tot | pCi/L | 12/09/2015 - 03/18/2021 | CI around mean | 0.34 | 5.0 | 1.5 | 5 | Standard |
| 12 | UA | 257 | Selenium, total | mg/L | 06/22/2015 - 06/23/2021 | CI around median | 0.0011 | 0.050 | 0.0014 | 0.05 | Standard |
| 12 | UA | 257 | Sulfate, total | mg/L | 06/22/2015 - 06/23/2021 | CI around mean | 64 | 400 | 200 | 400 | Standard |
| 12 | UA | 257 | Thallium, total | mg/L | 12/09/2015 - 06/23/2021 | All ND - Last | 0.002 | 0.002 | 0.001 | 0.002 | Standard |
| 12 | UA | 257 | Total Dissolved Solids | mg/L | 12/09/2015 - 03/18/2021 | CI around mean | 443 | 1520 | 1520 | 1200 | Background |
| 13 | UA | 257 | Antimony, total | mg/L | 12/09/2015 - 06/23/2021 | All ND - Last | 0.001 | 0.006 | 0.001 | 0.006 | Standard |
| 13 | UA | 257 | Arsenic, total | mg/L | 06/22/2015 - 06/23/2021 | CI around median | 0.001 | 0.010 | 0.001 | 0.01 | Standard |
| 13 | UA | 257 | Barium, total | mg/L | 06/22/2015 - 06/23/2021 | CI around mean | 0.043 | 2.0 | 0.21 | 2 | Standard |
| 13 | UA | 257 | Beryllium, total | mg/L | 12/09/2015 - 06/23/2021 | All ND - Last | 0.001 | 0.004 | 0.001 | 0.004 | Standard |
| 13 | UA | 257 | Boron, total | mg/L | 06/22/2015 - 06/23/2021 | CI around mean | 0.75 | 2.0 | 0.15 | 2 | Standard |
| 13 | UA | 257 | Cadmium,total | mg/L | 06/22/2015 - 06/23/2021 | All ND - Last | 0.001 | 0.005 | 0.0023 | 0.005 | Standard |



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**TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES**
HISTORY OF POTENTIAL EXCEEDANCES
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | HSU | Program | Constituent | Result Unit | Sample Date Range | Statistical Calculation | Statistical Result | GWPS | Background | Part 845 Standard | GWPS Source |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 | UA | 257 | Chloride, total | mg/L | 06/22/2015 - 06/23/2021 | CI around mean | 72 | 396 | 396 | 200 | Background |
| 13 | UA | 257 | Chromium, total | mg/L | 06/22/2015 - 06/23/2021 | CI around median | 0.001 | 0.10 | 0.001 | 0.1 | Standard |
| 13 | UA | 257 | Cobalt, total | mg/L | 12/09/2015 - 06/23/2021 | All ND - Last | 0.001 | 0.038 | 0.038 | 0.006 | Background |
| 13 | UA | 257 | Fluoride, total | mg/L | 06/22/2015 - 06/23/2021 | CB around linear reg | 0.23 | 4.0 | 0.12 | 4 | Standard |
| 13 | UA | 257 | Lead, total | mg/L | 06/22/2015 - 06/23/2021 | All ND - Last | 0.001 | 0.0075 | 0.0015 | 0.0075 | Standard |
| 13 | UA | 257 | Lithium, total | mg/L | 12/09/2015 - 06/23/2021 | CI around mean | 0.018 | 0.040 | 0.019 | 0.04 | Standard |
| 13 | UA | 257 | Mercury, total | mg/L | 06/22/2015 - 06/23/2021 | All ND - Last | 0.0002 | 0.002 | 0.0002 | 0.002 | Standard |
| 13 | UA | 257 | Molybdenum, total | mg/L | 06/22/2015 - 06/23/2021 | CI around geomean | 0.015 | 0.10 | 0.0017 | 0.1 | Standard |
| 13 | UA | 257 | pH (field) | SU | 03/19/2015 - 06/23/2021 | CI around mean | 7.4 | 6.5/9.0 | 6.6/7.5 | 6.5/9 | Standard/Standard |
| 13 | UA | 257 | Radium-226 + Radium 228, tot | pCi/L | 12/09/2015 - 03/18/2021 | CI around mean | 0.38 | 5.0 | 1.5 | 5 | Standard |
| 13 | UA | 257 | Selenium, total | mg/L | 06/22/2015 - 06/23/2021 | CI around mean | 0.00181 | 0.050 | 0.0014 | 0.05 | Standard |
| 13 | UA | 257 | Sulfate, total | mg/L | 06/22/2015 - 06/23/2021 | CI around mean | 80 | 400 | 200 | 400 | Standard |
| 13 | UA | 257 | Thallium, total | mg/L | 12/09/2015 - 06/23/2021 | All ND - Last | 0.002 | 0.002 | 0.001 | 0.002 | Standard |
| 13 | UA | 257 | Total Dissolved Solids | mg/L | 12/09/2015 - 03/18/2021 | CI around mean | 480 | 1520 | 1520 | 1200 | Background |
| 46 | UA | 257 | Antimony, total | mg/L | 12/09/2015 - 03/18/2021 | All ND - Last | 0.001 | 0.006 | 0.001 | 0.006 | Standard |
| 46 | UA | 257 | Arsenic, total | mg/L | 12/09/2015 - 03/18/2021 | All ND - Last | 0.001 | 0.010 | 0.001 | 0.01 | Standard |
| 46 | UA | 257 | Barium, total | mg/L | 12/09/2015 - 03/18/2021 | CB around linear reg | 0.058 | 2.0 | 0.21 | 2 | Standard |
| 46 | UA | 257 | Beryllium, total | mg/L | 12/09/2015 - 03/18/2021 | All ND - Last | 0.001 | 0.004 | 0.001 | 0.004 | Standard |
| 46 | UA | 257 | Boron, total | mg/L | 12/09/2015 - 03/18/2021 | CI around mean | 0.21 | 2.0 | 0.15 | 2 | Standard |
| 46 | UA | 257 | Cadmium,total | mg/L | 12/09/2015 - 03/18/2021 | All ND - Last | 0.001 | 0.005 | 0.0023 | 0.005 | Standard |
| 46 | UA | 257 | Chloride, total | mg/L | 12/09/2015 - 03/18/2021 | CI around mean | 66 | 396 | 396 | 200 | Background |
| 46 | UA | 257 | Chromium, total | mg/L | 12/09/2015 - 03/18/2021 | CB around linear reg | 0.00137 | 0.10 | 0.001 | 0.1 | Standard |
| 46 | UA | 257 | Cobalt, total | mg/L | 12/09/2015 - 03/18/2021 | All ND - Last | 0.001 | 0.038 | 0.038 | 0.006 | Background |
| 46 | UA | 257 | Fluoride, total | mg/L | 12/09/2015 - 03/18/2021 | CI around mean | 0.25 | 4.0 | 0.12 | 4 | Standard |
| 46 | UA | 257 | Lead, total | mg/L | 12/09/2015 - 03/18/2021 | All ND - Last | 0.001 | 0.0075 | 0.0015 | 0.0075 | Standard |
| 46 | UA | 257 | Lithium, total | mg/L | 12/09/2015 - 03/18/2021 | CI around mean | 0.00966 | 0.040 | 0.019 | 0.04 | Standard |


RAMBOLL

**TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES**
HISTORY OF POTENTIAL EXCEEDANCES
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | HSU | Program | Constituent | Result Unit | Sample Date Range | Statistical Calculation | Statistical Result | GWPS | Background | Part 845 Standard | GWPS Source |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 46 | UA | 257 | Mercury, total | mg/L | 12/09/2015 - 03/18/2021 | All ND - Last | 0.0002 | 0.002 | 0.0002 | 0.002 | Standard |
| 46 | UA | 257 | Molybdenum, total | mg/L | 12/09/2015 - 03/18/2021 | CB around T-S line | 0.014 | 0.10 | 0.0017 | 0.1 | Standard |
| 46 | UA | 257 | pH (field) | SU | 12/09/2015 - 03/18/2021 | CI around mean | 7.3 | 6.5/9.0 | 6.6/7.5 | 6.5/9 | Standard/Standard |
| 46 | UA | 257 | Radium-226 + Radium 228, tot | pCi/L | 12/09/2015 - 03/18/2021 | CI around geomean | 0.25 | 5.0 | 1.5 | 5 | Standard |
| 46 | UA | 257 | Selenium, total | mg/L | 12/09/2015 - 03/18/2021 | CI around median | 0.001 | 0.050 | 0.0014 | 0.05 | Standard |
| 46 | UA | 257 | Sulfate, total | mg/L | 12/09/2015 - 03/18/2021 | CI around mean | 60 | 400 | 200 | 400 | Standard |
| 46 | UA | 257 | Thallium, total | mg/L | 12/09/2015 - 03/18/2021 | All ND - Last | 0.002 | 0.002 | 0.001 | 0.002 | Standard |
| 46 | UA | 257 | Total Dissolved Solids | mg/L | 12/09/2015 - 03/18/2021 | CI around mean | 430 | 1520 | 1520 | 1200 | Background |
| 47 | UA | 257 | Antimony, total | mg/L | 12/09/2015 - 03/18/2021 | All ND - Last | 0.001 | 0.006 | 0.001 | 0.006 | Standard |
| 47 | UA | 257 | Arsenic, total | mg/L | 12/09/2015 - 03/18/2021 | Most recent sample | 0.001 | 0.010 | 0.001 | 0.01 | Standard |
| 47 | UA | 257 | Barium, total | mg/L | 12/09/2015 - 03/18/2021 | CI around mean | 0.074 | 2.0 | 0.21 | 2 | Standard |
| 47 | UA | 257 | Beryllium, total | mg/L | 12/09/2015 - 03/18/2021 | All ND - Last | 0.001 | 0.004 | 0.001 | 0.004 | Standard |
| 47 | UA | 257 | Boron, total | mg/L | 12/09/2015 - 03/18/2021 | CI around geomean | 0.18 | 2.0 | 0.15 | 2 | Standard |
| 47 | UA | 257 | Cadmium,total | mg/L | 12/09/2015 - 03/18/2021 | All ND - Last | 0.001 | 0.005 | 0.0023 | 0.005 | Standard |
| 47 | UA | 257 | Chloride, total | mg/L | 12/09/2015 - 03/18/2021 | CI around mean | 70 | 396 | 396 | 200 | Background |
| 47 | UA | 257 | Chromium, total | mg/L | 12/09/2015 - 03/18/2021 | All ND - Last | 0.0015 | 0.10 | 0.001 | 0.1 | Standard |
| 47 | UA | 257 | Cobalt, total | mg/L | 12/09/2015 - 03/18/2021 | Future median | 0.001 | 0.038 | 0.038 | 0.006 | Background |
| 47 | UA | 257 | Fluoride, total | mg/L | 12/09/2015 - 03/18/2021 | CB around linear reg | 0.24 | 4.0 | 0.12 | 4 | Standard |
| 47 | UA | 257 | Lead, total | mg/L | 12/09/2015 - 03/18/2021 | All ND - Last | 0.001 | 0.0075 | 0.0015 | 0.0075 | Standard |
| 47 | UA | 257 | Lithium, total | mg/L | 12/09/2015 - 03/18/2021 | CI around mean | 0.00812 | 0.040 | 0.019 | 0.04 | Standard |
| 47 | UA | 257 | Mercury, total | mg/L | 12/09/2015 - 03/18/2021 | All ND - Last | 0.0002 | 0.002 | 0.0002 | 0.002 | Standard |
| 47 | UA | 257 | Molybdenum, total | mg/L | 12/09/2015 - 03/18/2021 | CB around linear reg | 0.015 | 0.10 | 0.0017 | 0.1 | Standard |
| 47 | UA | 257 | pH (field) | SU | 12/09/2015 - 03/18/2021 | CI around mean | 7.0 | 6.5/9.0 | 6.6/7.5 | 6.5/9 | Standard/Standard |
| 47 | UA | 257 | Radium-226 + Radium 228, tot | pCi/L | 12/09/2015 - 03/18/2021 | CI around mean | 0.26 | 5.0 | 1.5 | 5 | Standard |
| 47 | UA | 257 | Selenium, total | mg/L | 12/09/2015 - 03/18/2021 | All ND - Last | 0.001 | 0.050 | 0.0014 | 0.05 | Standard |
| 47 | UA | 257 | Sulfate, total | mg/L | 12/09/2015 - 03/18/2021 | CI around mean | 60 | 400 | 200 | 400 | Standard |

**TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES**
HISTORY OF POTENTIAL EXCEEDANCES
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | HSU | Program | Constituent | Result Unit | Sample Date Range | Statistical Calculation | Statistical Result | GWPS | Background | Part 845 Standard | GWPS Source |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 47 | UA | 257 | Thallium, total | mg/L | 12/09/2015 - 03/18/2021 | All ND - Last | 0.002 | 0.002 | 0.001 | 0.002 | Standard |
| 47 | UA | 257 | Total Dissolved Solids | mg/L | 12/09/2015 - 03/18/2021 | CI around mean | 456 | 1520 | 1520 | 1200 | Background |
| 52 | UA | 845 | Antimony, total | mg/L | 02/24/2021 - 08/03/2021 | All ND - Last | 0.001 | 0.006 | 0.001 | 0.006 | Standard |
| 52 | UA | 845 | Arsenic, total | mg/L | 02/24/2021 - 08/03/2021 | All ND - Last | 0.001 | 0.010 | 0.001 | 0.01 | Standard |
| 52 | UA | 845 | Barium, total | mg/L | 02/24/2021 - 08/03/2021 | CI around mean | 0.066 | 2.0 | 0.21 | 2 | Standard |
| 52 | UA | 845 | Beryllium, total | mg/L | 02/24/2021 - 08/03/2021 | All ND - Last | 0.001 | 0.004 | 0.001 | 0.004 | Standard |
| 52 | UA | 845 | Boron, total | mg/L | 02/24/2021 - 08/03/2021 | CI around mean | 0.11 | 2.0 | 0.16 | 2 | Standard |
| 52 | UA | 845 | Cadmium,total | mg/L | 02/24/2021 - 08/03/2021 | All ND - Last | 0.001 | 0.005 | 0.0023 | 0.005 | Standard |
| 52 | UA | 845 | Chloride, total | mg/L | 02/24/2021 - 08/03/2021 | CI around mean | 64 | 435 | 435 | 200 | Background |
| 52 | UA | 845 | Chromium, total | mg/L | 02/24/2021 - 08/03/2021 | All ND - Last | 0.0015 | 0.10 | 0.001 | 0.1 | Standard |
| 52 | UA | 845 | Cobalt, total | mg/L | 02/24/2021 - 08/03/2021 | Most recent sample | 0.001 | 0.038 | 0.038 | 0.006 | Background |
| 52 | UA | 845 | Fluoride, total | mg/L | 02/24/2021 - 08/03/2021 | CI around mean | 0.28 | 4.0 | 0.12 | 4 | Standard |
| 52 | UA | 845 | Lead, total | mg/L | 02/24/2021 - 08/03/2021 | All ND - Last | 0.001 | 0.0075 | 0.0015 | 0.0075 | Standard |
| 52 | UA | 845 | Lithium, total | mg/L | 02/24/2021 - 08/03/2021 | CI around mean | 0.00583 | 0.040 | 0.019 | 0.04 | Standard |
| 52 | UA | 845 | Mercury, total | mg/L | 02/24/2021 - 08/03/2021 | All ND - Last | 0.0002 | 0.002 | 0.0002 | 0.002 | Standard |
| 52 | UA | 845 | Molybdenum, total | mg/L | 02/24/2021 - 08/03/2021 | CI around mean | 0.00891 | 0.10 | 0.0017 | 0.1 | Standard |
| 52 | UA | 845 | pH (field) | SU | 02/24/2021 - 08/03/2021 | CI around mean | 6.9 | 6.5/9.0 | 6.6/7.5 | 6.5/9 | Standard/Standard |
| 52 | UA | 845 | Radium-226 + Radium 228, tot | pCi/L | 02/24/2021 - 08/03/2021 | CI around mean | 0.25 | 5.0 | 2.0 | 5 | Standard |
| 52 | UA | 845 | Selenium, total | mg/L | 02/24/2021 - 08/03/2021 | All ND - Last | 0.001 | 0.050 | 0.0014 | 0.05 | Standard |
| 52 | UA | 845 | Sulfate, total | mg/L | 02/24/2021 - 08/03/2021 | CI around mean | 56 | 400 | 215 | 400 | Standard |
| 52 | UA | 845 | Thallium, total | mg/L | 02/24/2021 - 08/03/2021 | CI around median | 0.001 | 0.002 | 0.001 | 0.002 | Standard |
| 52 | UA | 845 | Total Dissolved Solids | mg/L | 02/24/2021 - 08/03/2021 | CI around mean | 397 | 1620 | 1620 | 1200 | Background |
| 53 | UA | 845 | Antimony, total | mg/L | 02/25/2021 - 05/06/2021 | All ND - Last | 0.002 | 0.006 | 0.001 | 0.006 | Standard |
| 53 | UA | 845 | Arsenic, total | mg/L | 02/25/2021 - 05/06/2021 | All ND - Last | 0.001 | 0.010 | 0.001 | 0.01 | Standard |
| 53 | UA | 845 | Barium, total | mg/L | 02/25/2021 - 05/06/2021 | CI around median | 0 | 2.0 | 0.21 | 2 | Standard |
| 53 | UA | 845 | Beryllium, total | mg/L | 02/25/2021 - 05/06/2021 | All ND - Last | 0.001 | 0.004 | 0.001 | 0.004 | Standard |

**TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES**
HISTORY OF POTENTIAL EXCEEDANCES
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | HSU | Program | Constituent | Result Unit | Sample Date Range | Statistical Calculation | Statistical Result | GWPS | Background | Part 845 Standard | GWPS Source |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 53 | UA | 845 | Boron, total | mg/L | 02/25/2021 - 05/06/2021 | CI around mean | 0.074 | 2.0 | 0.16 | 2 | Standard |
| 53 | UA | 845 | Cadmium,total | mg/L | 02/25/2021 - 05/06/2021 | CI around mean | 0.000671 | 0.005 | 0.0023 | 0.005 | Standard |
| 53 | UA | 845 | Chloride, total | mg/L | 02/25/2021 - 05/06/2021 | CI around mean | 90 | 435 | 435 | 200 | Background |
| 53 | UA | 845 | Chromium, total | mg/L | 02/25/2021 - 05/06/2021 | All ND - Last | 0.001 | 0.10 | 0.001 | 0.1 | Standard |
| 53 | UA | 845 | Cobalt, total | mg/L | 02/25/2021 - 05/06/2021 | Future median | 0.0074 | 0.038 | 0.038 | 0.006 | Background |
| 53 | UA | 845 | Fluoride, total | mg/L | 02/25/2021 - 05/06/2021 | CI around mean | 0.22 | 4.0 | 0.12 | 4 | Standard |
| 53 | UA | 845 | Lead, total | mg/L | 02/25/2021 - 05/06/2021 | CI around mean | 0.0000651 | 0.0075 | 0.0015 | 0.0075 | Standard |
| 53 | UA | 845 | Lithium, total | mg/L | 02/25/2021 - 05/06/2021 | CI around mean | -0.00176 | 0.040 | 0.019 | 0.04 | Standard |
| 53 | UA | 845 | Mercury, total | mg/L | 02/25/2021 - 05/06/2021 | All ND - Last | 0.0002 | 0.002 | 0.0002 | 0.002 | Standard |
| 53 | UA | 845 | Molybdenum, total | mg/L | 02/25/2021 - 05/06/2021 | CI around mean | 0.00428 | 0.10 | 0.0017 | 0.1 | Standard |
| 53 | UA | 845 | pH (field) | SU | 02/25/2021 - 05/06/2021 | CI around mean | 6.7 | 6.5/9.0 | 6.6/7.5 | 6.5/9 | Standard/Standard |
| 53 | UA | 845 | Radium-226 + Radium 228, tot | pCi/L | 02/25/2021 - 05/06/2021 | CI around mean | -0.249 | 5.0 | 2.0 | 5 | Standard |
| 53 | UA | 845 | Selenium, total | mg/L | 02/25/2021 - 05/06/2021 | All ND - Last | 0.001 | 0.050 | 0.0014 | 0.05 | Standard |
| 53 | UA | 845 | Sulfate, total | mg/L | 02/25/2021 - 05/06/2021 | CI around mean | 59 | 400 | 215 | 400 | Standard |
| 53 | UA | 845 | Thallium, total | mg/L | 02/25/2021 - 05/06/2021 | All ND - Last | 0.001 | 0.002 | 0.001 | 0.002 | Standard |
| 53 | UA | 845 | Total Dissolved Solids | mg/L | 02/25/2021 - 05/06/2021 | CI around mean | 433 | 1620 | 1620 | 1200 | Background |
| 54 | UA | 845 | Antimony, total | mg/L | 02/24/2021 - 08/03/2021 | All ND - Last | 0.001 | 0.006 | 0.001 | 0.006 | Standard |
| 54 | UA | 845 | Arsenic, total | mg/L | 02/24/2021 - 08/03/2021 | All ND - Last | 0.001 | 0.010 | 0.001 | 0.01 | Standard |
| 54 | UA | 845 | Barium, total | mg/L | 02/24/2021 - 08/03/2021 | CB around linear reg | 0.048 | 2.0 | 0.21 | 2 | Standard |
| 54 | UA | 845 | Beryllium, total | mg/L | 02/24/2021 - 08/03/2021 | All ND - Last | 0.001 | 0.004 | 0.001 | 0.004 | Standard |
| 54 | UA | 845 | Boron, total | mg/L | 02/24/2021 - 08/03/2021 | CI around mean | 0.64 | 2.0 | 0.16 | 2 | Standard |
| 54 | UA | 845 | Cadmium,total | mg/L | 02/24/2021 - 08/03/2021 | All ND - Last | 0.001 | 0.005 | 0.0023 | 0.005 | Standard |
| 54 | UA | 845 | Chloride, total | mg/L | 02/24/2021 - 08/03/2021 | CI around mean | 78 | 435 | 435 | 200 | Background |
| 54 | UA | 845 | Chromium, total | mg/L | 02/24/2021 - 08/03/2021 | All ND - Last | 0.0015 | 0.10 | 0.001 | 0.1 | Standard |
| 54 | UA | 845 | Cobalt, total | mg/L | 02/24/2021 - 08/03/2021 | Future median | 0.001 | 0.038 | 0.038 | 0.006 | Background |
| 54 | UA | 845 | Fluoride, total | mg/L | 02/24/2021 - 08/03/2021 | CI around mean | 0.32 | 4.0 | 0.12 | 4 | Standard |

**TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES**
HISTORY OF POTENTIAL EXCEEDANCES
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | HSU | Program | Constituent | Result Unit | Sample Date Range | Statistical Calculation | Statistical Result | GWPS | Background | Part 845 Standard | GWPS Source |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 54 | UA | 845 | Lead, total | mg/L | 02/24/2021 - 08/03/2021 | All ND - Last | 0.001 | 0.0075 | 0.0015 | 0.0075 | Standard |
| 54 | UA | 845 | Lithium, total | mg/L | 02/24/2021 - 08/03/2021 | CI around mean | 0.014 | 0.040 | 0.019 | 0.04 | Standard |
| 54 | UA | 845 | Mercury, total | mg/L | 02/24/2021 - 08/03/2021 | All ND - Last | 0.0002 | 0.002 | 0.0002 | 0.002 | Standard |
| 54 | UA | 845 | Molybdenum, total | mg/L | 02/24/2021 - 08/03/2021 | CB around linear reg | 0.012 | 0.10 | 0.0017 | 0.1 | Standard |
| 54 | UA | 845 | pH (field) | SU | 02/24/2021 - 08/03/2021 | CI around mean | 6.8 | 6.5/9.0 | 6.6/7.5 | 6.5/9 | Standard/Standard |
| 54 | UA | 845 | Radium-226 + Radium 228, tot | pCi/L | 02/24/2021 - 08/03/2021 | CI around geomean | 0.14 | 5.0 | 2.0 | 5 | Standard |
| 54 | UA | 845 | Selenium, total | mg/L | 02/24/2021 - 08/03/2021 | CI around median | 0.001 | 0.050 | 0.0014 | 0.05 | Standard |
| 54 | UA | 845 | Sulfate, total | mg/L | 02/24/2021 - 08/03/2021 | CI around mean | 72 | 400 | 215 | 400 | Standard |
| 54 | UA | 845 | Thallium, total | mg/L | 02/24/2021 - 08/03/2021 | All ND - Last | 0.002 | 0.002 | 0.001 | 0.002 | Standard |
| 54 | UA | 845 | Total Dissolved Solids | mg/L | 02/24/2021 - 08/03/2021 | CI around mean | 477 | 1620 | 1620 | 1200 | Background |
| 55 | BR | 845 | Antimony, total | mg/L | 02/25/2021 - 08/03/2021 | All ND - Last | 0.001 | 0.006 | 0.001 | 0.006 | Standard |
| 55 | BR | 845 | Arsenic, total | mg/L | 02/25/2021 - 08/03/2021 | CI around mean | 0.000438 | 0.010 | 0.001 | 0.01 | Standard |
| 55 | BR | 845 | Barium, total | mg/L | 02/25/2021 - 08/03/2021 | CI around mean | 0.061 | 2.0 | 0.21 | 2 | Standard |
| 55 | BR | 845 | Beryllium, total | mg/L | 02/25/2021 - 08/03/2021 | All ND - Last | 0.001 | 0.004 | 0.001 | 0.004 | Standard |
| 55 | BR | 845 | Boron, total | mg/L | 02/25/2021 - 08/03/2021 | CI around mean | 0.35 | 2.0 | 0.16 | 2 | Standard |
| 55 | BR | 845 | Cadmium,total | mg/L | 02/25/2021 - 08/03/2021 | All ND - Last | 0.001 | 0.005 | 0.0023 | 0.005 | Standard |
| 55 | BR | 845 | Chloride, total | mg/L | 02/25/2021 - 08/03/2021 | CI around mean | 132 | 435 | 435 | 200 | Background |
| 55 | BR | 845 | Chromium, total | mg/L | 02/25/2021 - 08/03/2021 | CI around mean | -0.00509 | 0.10 | 0.001 | 0.1 | Standard |
| 55 | BR | 845 | Cobalt, total | mg/L | 02/25/2021 - 08/03/2021 | Future median | 0.001 | 0.038 | 0.038 | 0.006 | Background |
| 55 | BR | 845 | Fluoride, total | mg/L | 02/25/2021 - 08/03/2021 | CI around mean | 0.24 | 4.0 | 0.12 | 4 | Standard |
| 55 | BR | 845 | Lead, total | mg/L | 02/25/2021 - 08/03/2021 | CI around median | 0 | 0.0075 | 0.0015 | 0.0075 | Standard |
| 55 | BR | 845 | Lithium, total | mg/L | 02/25/2021 - 08/03/2021 | CI around mean | 0.023 | 0.040 | 0.019 | 0.04 | Standard |
| 55 | BR | 845 | Mercury, total | mg/L | 02/25/2021 - 08/03/2021 | All ND - Last | 0.0002 | 0.002 | 0.0002 | 0.002 | Standard |
| 55 | BR | 845 | Molybdenum, total | mg/L | 02/25/2021 - 08/03/2021 | CI around mean | 0.00217 | 0.10 | 0.0017 | 0.1 | Standard |
| 55 | BR | 845 | pH (field) | SU | 02/25/2021 - 08/03/2021 | CI around mean | 7.0 | 6.5/9.0 | 6.6/7.5 | 6.5/9 | Standard/Standard |
| 55 | BR | 845 | Radium-226 + Radium 228, tot | pCi/L | 02/25/2021 - 08/03/2021 | CI around mean | -0.147 | 5.0 | 2.0 | 5 | Standard |

**TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES**
HISTORY OF POTENTIAL EXCEEDANCES
HENNEPIN POWER PLANT
EAST ASH POND
HENNEPIN, ILLINOIS

| Sample Location | HSU | Program | Constituent | Result Unit | Sample Date Range | Statistical Calculation | Statistical Result | GWPS | Background | Part 845 Standard | GWPS Source |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 55 | BR | 845 | Selenium, total | mg/L | 02/25/2021 - 08/03/2021 | All ND - Last | 0.001 | 0.050 | 0.0014 | 0.05 | Standard |
| 55 | BR | 845 | Sulfate, total | mg/L | 02/25/2021 - 08/03/2021 | CI around mean | 22 | 400 | 215 | 400 | Standard |
| 55 | BR | 845 | Thallium, total | mg/L | 02/25/2021 - 08/03/2021 | All ND - Last | 0.002 | 0.002 | 0.001 | 0.002 | Standard |
| 55 | BR | 845 | Total Dissolved Solids | mg/L | 02/25/2021 - 08/03/2021 | CI around mean | 542 | 1620 | 1620 | 1200 | Background |

**Notes:**
Potential exceedance of GWPS (note: No potential exceedances were determined based on data collected from 2015 through 2021)
HSU = hydrostratigraphic unit:
BR = bedrock
UA = uppermost aquifer
Program = regulatory program data were collected under:
257 = 40 C.F.R. Part 257 Subpart D (Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments)
845 = 35 I.A.C. Part 845 (Sampling events completed to assess well locations for inclusion in the Part 845 monitoring well network)
mg/L = milligrams per liter
pCi/L = picocuries per liter
SU = standard units
Statistical Calculation = method used to calculate the statistical result:
All ND - Last = All results were below the reporting limit, and the last determined reporting limit is shown
CB around linear reg = Confidence band around linear regression
CB around T-S line = Confidence band around Thiel-Sen line
CI around geomean = Confidence interval around the geometric mean
CI around mean = Confidence interval around the mean
CI around median = Confidence interval around the median
Future median = Median of the three most recent samples
Most recent sample = Result for the most recently collected sample used due to insufficient data
Statistical Result = calculated in accordance with Statistical Analysis Plan using constituent concentrations observed at monitoring well during all sampling events within the specified date range
For pH, the values presented are the lower / upper limits
GWPS = Groundwater Protection Standard
GWPS Source:
Standard = standard specified in 35 I.A.C. § 845.600(a)(1)
Background = background concentration (see cover page for additional information)

# ATTACHMENT N

Certification of Financial Assurance Requirements

On June 17, 2021, Dynegy Midwest Generation, LLC provided financial assurance in the form of performance bonds to the Illinois Environmental Protection Agency in the amount of $ 9,382,670 for the West Ash Pond System, East Ash Pond 2, East New Primary Pond, and East Pond 4 at the Hennepin Power Plant.[1]

I, Matthew A. Goering, Senior Vice President of Dynegy Midwest Generation, LLC, do hereby certify to the best of my knowledge for the above referenced CCR Units that the financial assurance instruments satisfy the requirements of 35 I.A.C. Part 845, Subpart I.

Matthew A. Goering
Senior Vice President
Dynegy Midwest Generation, LLC

[1] In the operating permit applications, the West Ash Pond System is referred to as the Old West Ash Pond (Pond No. 1 and No. 3) and Old West Polishing Pond, the East Ash Pond 2 and East Pond 4 are referred to as Ash Ponds 2 & 4, and the East New Primary Pond is referred to as the East Ash Pond.

# ATTACHMENT O

Stantec

Stantec Consulting Services Inc.
1859 Bowles Avenue Suite 250, Fenton MO 63026-1944

October 12, 2016
File: let_017_175666013_certification
Revision 0

**Initial Hazard Potential Classification Assessment**
**EPA Final CCR Rule**
**East Ash Pond**
**Hennepin Power Station**
**Putnam County, Illinois**

---

## 1.0 PURPOSE

This report documents Stantec's certification of the initial hazard potential classification assessment for the Hennepin Power Station East Ash Pond.

40 CFR 257.73(a)(2) requires the owner or operator of an existing CCR surface impoundment to conduct an initial hazard potential classification assessment and document the hazard potential classification, and the basis for the classification, of the CCR unit as either a high hazard potential CCR surface impoundment, a significant hazard potential CCR surface impoundment, or a low hazard potential CCR surface impoundment.

## 2.0 FINDINGS

A visual analysis was performed to evaluate potential hazards associated with a failure of the East Ash Pond perimeter containment dike. Failure scenarios were considered along the perimeter dike and specifically at two locations. These two locations are located at the east and northeast embankments of the perimeter dike. The remainder of the impoundment is bordered by higher ground, so it is unlikely that a breach would occur in this direction. A breach failure of the dike at the two locations was evaluated for potential downstream impacts to structures, infrastructure, frequently occupied facilities/areas, and waterways. Potential for impacts was evaluated by determining probable breach flow paths using available elevation data and imagery of the impoundment and nearby area.

The analysis indicated that none of the breach scenarios appear to impact structures. A breach of the east embankment could impact an intermittently-used access road to the power station and East Polishing Pond, and a breach to the northeast could impact Leachate Pond. Both receiving ponds are on-site. A breach failure of the containment dike would not likely result in in probable loss of human life. However, breach of the impoundment could cause stored CCR materials to be released into the Illinois River, which can cause environmental damage to downstream areas.

40 CFR 257.53 defines a "significant hazard potential CCR surface impoundment" as a diked surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.

Based on the results of the analysis summarized above, East Ash Pond was assigned a Significant hazard potential classification per 40 CFR 257.53.

## 3.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

I, Matthew Hoy, being a Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief that;

1. the information contained in this report and the underlying data in the operating record was prepared in accordance with the accepted practice of engineering and is accurate as of the date of my signature below; and

2. the initial hazard potential classification assessment for the Hennepin Power Station East Ash Pond was conducted in accordance with the requirements specified in 40 CFR 257.73.

SIGNATURE ______________________ DATE 10/12/2016

ADDRESS: Stantec Consulting Services Inc.
1859 Bowles Avenue Suite 250
Fenton MO 63026-1944

TELEPHONE: (636) 343-3880

LICENSED PROFESSIONAL ENGINEER
MATTHEW A. HOY
062-063141
STATE OF ILLINOIS

# Documentation of Initial Hazard Potential Classification Assessment

East Ash Pond
Hennepin Power Station
Hennepin, Illinois

Prepared for:
Dynegy

October 12, 2016

**Stantec Consulting Services Inc.**
Design with community in mind
www.stantec.com

# Table of Contents

**Section** **Page No.**



# List of Appendixes

## Executive Summary

This report documents the hazard potential classification assessment for the East Ash Pont at the Hennepin Power Station as required per the Coal Combustion Residuals (CCR) Rule in 40 C.F.R. § 257.73(a)(2). The applicable hazard potential classifications are defined in 40 C.F.R. § 257.53 as follows:

> (1) <u>High hazard potential CCR surface impoundment</u> means a diked surface impoundment where failure or mis-operation will probably cause loss of human life.
>
> (2) <u>Significant hazard potential CCR surface impoundment</u> means a diked surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.
>
> (3) <u>Low hazard potential CCR surface impoundment</u> means a diked surface impoundment where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the surface impoundment owner's property.

Based on these definitions and the analysis herein, the East Ash Pond is classified as a <u>Significant hazard potential</u> CCR surface impoundment.

This report contains supporting documentation for the hazard potential classification assessment. The hazard potential classification for this CCR unit was determined by a visual assessment conducted by Stantec in August, 2016.

# 1. Introduction

## 1.1. Background

The CCR Rule was published in the Federal Register on April 17, 2015. The Rule requires that a hazard potential classification assessment be performed for existing CCR surface impoundments that are not incised. A previously completed assessment may be used in lieu of the initial assessment provided the previous hazard assessment was completed no earlier than April 17, 2013. The applicable hazard potential classifications are defined in the CCR Rule 40 C.F.R. § 257.53 as follows:

*<u>High Hazard Potential CCR surface impoundment</u> means a diked surface impoundment where failure or mis-operation will probably cause loss of human life.*

*<u>Significant Hazard Potential CCR surface impoundment</u> means a diked surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.*

*<u>Low Hazard Potential CCR surface impoundment</u> means a diked surface impoundment where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the surface impoundment owner's property.*

Dynegy has contracted Stantec Consulting Services Inc. (Stantec) to prepare hazard potential classification assessments for selected impoundments[1].

It was determined that there was no existing available hazard potential classification assessment documentation for the East Ash Pond.

## 1.2. Location

Hennepin Power Station is located in Hennepin, Illinois along the east bank of the Illinois River in Putnam County approximately 100 miles southwest of Chicago. East Ash Pond is located to the east of the power station. A site overview figure is included in Appendix A.

# 2. Source Data

The following information was used to perform the hazard assessment of East Ash Pond:

---

[1] Dynegy Administrative Services Company (Dynegy) contracted Stantec on behalf of the Hennepin Power Station owner, Dynegy Midwest Generation, LLC. Thus, Dynegy is referenced in this report.

- Aerial Imagery (dated August 17, 2015)
- Topographic and Bathymetric Survey Information (from Weaver Consultants Group dated September 22, 2016)
- Digital Surface Model (from Illinois State Geological Survey dated December, 2011)

# 3. Potential Failure Scenarios

## 3.1. Unit Description

East Ash Pond has a 3.5 acre surface area, and according to available topographic and bathymetric information, the impoundment measures approximately 18 feet from the bottom to the overflow elevation. East Ash Pond discharges to East Polishing Pond through a 36-inch diameter culvert and to Leachate Pond through a 18-inch diameter culvert. East Ash Pond could also overtop east into East Polishing Pond. East Ash Pond has an overtopping elevation of approximately 494 feet.

## 3.2. Failure Scenarios

East Ash Pond is adjacent to a landfill to the north and an off-site area to the south. Due to these areas being higher ground, a breach in these directions was not evaluated. The west half of East Ash Pond is 3 to 4 feet higher than the overtopping length of the pond; therefore, a breach in this direction was also not evaluated. The impoundment could potentially fail towards Leachate Pond to the northeast and East Polishing Pond to the east. Two failure scenarios were evaluated as summarized below.

### 3.2.1. East

A failure of the impoundment to the east would discharge flow over an access road into East Polishing Pond. The access road is typically intermittently used by Hennepin Power Station personnel and the at-risk populations are considered transient. In accordance with Federal guidelines, loss of life is not considered probable for scenarios where persons are only temporarily in the potential inundation area (Reference 2). This receiving pond is on-site and would discharge to the Illinois River if overtopped. Given the relative size of the river in comparison to East Polishing Pond, overtopping in this direction would likely be contained to the river and not impact adjacent land.

### 3.2.2. Northeast

A failure of the impoundment to the northeast would discharge into Leachate Pond. This receiving pond is on-site and flow could potentially overtop into the Illinois River. Given the relative size of the river, overtopping in this direction would likely be contained to the river and not impact adjacent land.

# 4. Hazard Classification

Due to the limited potential impacts to Dynegy property and/or transient nature of potential at-risk populations, it is Stantec's opinion that a breach of East Ash Pond does not represent a probable threat to human life. However, a breach failure of the containment dike could result in the release of the stored CCR materials into the Illinois River, which can cause environmental damage. Therefore, the impoundment fits the definition for a Significant hazard potential CCR surface impoundment (as defined in the CCR Rule §257.53).

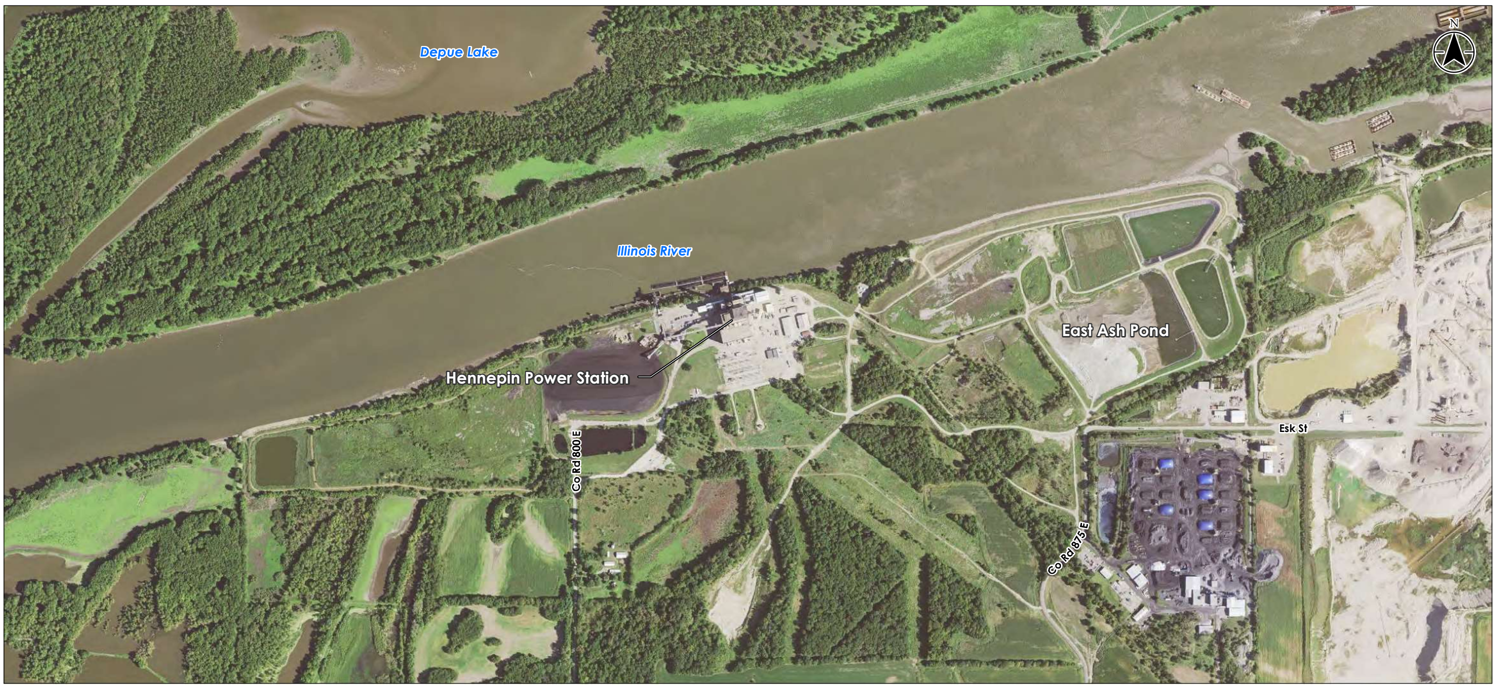
# 5. References

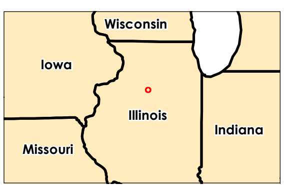

1. EPA Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, 40 CFR § 257 and § 261 (effective April 17, 2015).

2. Federal Emergency Management Agency (FEMA). (2004). Hazard Potential Classification System for Dams.

# Appendix A

# Site Overview Figure




0 1,000 Feet

1:12,000 (At original document size of 11x17)

Project Location
Latitude: 41.302975
Longitude: -89.315035
Putnam County, Illinois

175605019
Prepared by WSW on 2016-10-05
Technical Review by NS on 2016-10-05
Independent Review by MH on 2016-10-05

Client/Project
Dynegy
Hennepin Power Station
Hazard Potential Classification Assessment

Figure No.
1

Title
**Site Overview Figure**
**East Ash Pond**
**Hennepin Power Station**

**Notes**
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
2. Aerial Source: 2015 NAIP Imagery
3. Impoundment Boundaries Provided by Client (Dated 9/9/2015)

# ATTACHMENT P

Submitted to
Dynegy Midwest Generation, LLC
1500 Eastport Plaza Drive
Collinsville, IL 62234

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

October 2016

# CCR Rule Report: Initial Structural Stability Assessment

# For

# East Ash Pond

# At Hennepin Power Station

# 1 Introduction

This Coal Combustion Residual (CCR) Rule Report documents that the East Ash Pond at the Dynegy Midwest Generation, LLC Hennepin 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 Hennepin, Illinois in Putnam County, approximately 0.4 miles east of the Hennepin Power Station. The East Ash Pond serves as the wet impoundment basin for CCR material produced by the Hennepin 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 East Ash Pond were found to be consistent with recognized and generally accepted good engineering practices, and meets 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 and abutments 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 foundation consists of medium dense to very dense soil, which indicates stable foundations. 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 Hennepin Power Station* (October 2016). A review of operational and maintenance procedures 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. Operational and maintenance procedures are in place to address any issues related to the stability of foundations. 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, operational and maintenance procedures, 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 interior slopes are protected with a geomembrane liner. The exterior slopes are adjacent to the pool level of the downstream East Leachate Pond and East Polishing Pond non-CCR units and either a geomembrane liner (East Leachate Pond) or riprap (East Polishing Pond) is present as slope protection. Vegetation is present on the exterior slopes above the liner and riprap. The geomembrane liner on the interior and exterior slopes isolates the embankment soils from surface erosion or wave action. Operational and maintenance procedures to repair the vegetation, liner, and riprap as needed are appropriate to protect against surface erosion or wave action. Given the presence of a liner that serves to prevent saturation of the dike's soils below the normal pool, sudden drawdown, as well as the corresponding adverse effects, is not applicable to the interior slopes East Ash Pond and the exterior slopes adjacent to the East Leachate Pond. Sudden drawdown of the exterior slopes adjacent to the East Polishing Pond is not expected to occur due to operational controls associated with the East Polishing Pond, and therefore slope protection to protect against sudden drawdown is not required for the slopes adjacent to the East Polishing Pond. Therefore, the East Ash Pond meets the requirements in §257.73(d)(1)(ii).

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

*CCR 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 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 dike over the range of expected loading conditions as defined within §257.73(e)(1).

Based on this evaluation, the dike consists of stiff to hard material, which is indicative of 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 Hennepin Power Station* (October 2016); therefore, the original design and construction of the East Ash Pond included sufficient density and dike compaction. Operational and maintenance procedures are in place to identify and mitigate deficiencies in order to maintain sufficient compaction 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, operational and maintenance procedures, 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. Exposed geomembrane liners on the interior and exterior slopes, and riprap on the exterior slopes are used as an alternate form of slope protection, which is adequate as significant tears, defects, or areas of erosion were not observed. Therefore, the original design and construction of the East Ash Pond included adequate vegetation of the dikes and surrounding areas. Adequate operational and maintenance procedures 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, operational and maintenance procedures, and conditions observed in the field by AECOM. Additionally, hydrologic and hydraulic analyses were completed to evaluate the capacity of the spillways relative to inflow estimated for the 1,000-year flood event for the significant hazard potential East Ash Pond. The hazard potential classification assessment was performed by Stantec in 2016 in accordance with §257.73(a)(2).

The spillways are comprised of a reinforced concrete pipe primary spillway and a secondary spillway consisting of a concrete riser and reinforced concrete outlet pipe, which 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 1,000-year storm 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 Hennepin Power Station* (October 2016). Operational and maintenance procedures are in place to repair any issues with the spillways and remove debris or other obstructions from the spillway, as evidenced by the conditions observed by AECOM. As a result, these procedures are appropriate for maintaining the spillways. 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 at the East Ash Pond: the reinforced concrete pipe primary spillway and reinforced concrete pipe secondary spillway. The stability and structural integrity of the pipes was evaluated using design drawings, operational and maintenance procedures, 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.

A closed-circuit television (CCTV) pipe inspection of the primary spillway was performed and covered the complete length of the pipe and found the pipe to be free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris that may negatively affect the operation of the hydraulic structure. Evaluation of design drawings and operational and maintenance procedures for this pipe also did not identify any issues.

The evaluation of design drawings and operational and maintenance procedures and conditions observed in the field did not identify any issues with the secondary spillway pipe. However, the evaluation of the stability and structural integrity of the secondary spillway has not been fully completed because the pipe is full of water, which is required for operation of the Hennepin Power Station and precluded CCTV inspection.

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 CCTV inspection of the secondary spillway 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 secondary spillway 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 slopes of the East Ash Pond was evaluated by comparing the location of the East Ash Pond relative to adjacent water bodies using published Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs), aerial imagery, and conditions observed in the field by AECOM.

Based on this evaluation, the nearest downstream water body is the Illinois River. However, the East Ash Pond is outside of the 100-year flood boundary for the Illinois River, as shown on the FEMA FIRM for the area. The East Ash Pond is adjacent to the downstream East Polishing Pond and East Leachate Pond non-CCR units, however these are not rivers, streams, or lakes, and drawdown of these non-CCR units is discussed in **Section 2.2** of this report, pursuant to §257.73(d)(1)(ii).

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 by a river, stream, or lake is not expected to occur.

# 3 Certification Statement

**CCR Unit:** Dynegy Midwest Generation, LLC; Hennepin 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 13, 2016 was conducted in accordance with the requirements of 40 CFR § 257.73(d).

VICTOR A MODEER JR.
*Printed Name*

10/13/16
*Date*

VICTOR ALBERT MODEER JR.
062-043112
REGISTERED PROFESSIONAL ENGINEER OF ILLINOIS

11/30/17

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# ATTACHMENT Q

AECOM

Submitted to
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1500 Eastport Plaza Drive
Collinsville, IL 62234

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 Hennepin Power Station

# 1 Introduction

This Coal Combustion Residual (CCR) Rule Report documents that the East Ash Pond at the Dynegy Midwest Generation, LLC Hennepin 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 Hennepin, Illinois in Putnam County, approximately 0.4 miles east of the Hennepin Power Station. The East Ash Pond serves as the primary wet impoundment basin for CCR produced by the Hennepin 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 auger borings, installation of piezometers, and laboratory program including strength, consolidation 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.

In general, the subsurface conditions at the East Ash Pond consist of stiff to hard embankment fill (clay) overlying medium dense to very dense alluvial gravel with trace amounts of silt and clay. The phreatic surface is within the foundation of the East Ash Pond.

Two (2) 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 site. 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 or foundation. As a result, this loading condition is not applicable to the East Ash Pond at the Hennepin 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 | 2.14 |
| Maximum Surcharge Pool Loading | (ii) | 1.40 | 2.14 |
| Seismic | (iii) | 1.00 | 2.53 |
| 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:** Dynegy Midwest Generation, LLC; Hennepin 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 13, 2016 meets the requirements of 40 CFR §257.73(e).

VICTOR A MODEER JR.

*Printed Name*

10/13/16

*Date*

VICTOR ALBERT MODEER JR.
062-043112
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

11/30/17

About AECOM

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# ATTACHMENT R

AECOM

Submitted to
Dynegy Midwest Generation, LLC
1500 Eastport Plaza Drive
Collinsville, IL 62234

Submitted by
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St. Louis, MO 63110

October 2016

# CCR Rule Report: Initial Inflow Design Flood Control System Plan

For

East Ash Pond

At Hennepin Power Station

# 1 Introduction

This Coal Combustion Residual (CCR) Rule Report documents that the initial inflow design flood control system plan for the East Ash Pond at the Dynegy Midwest Generation, LLC Hennepin Power Station meets the requirements specified in 40 Code of Federal Regulations (CFR) §257.82. The East Ash Pond is located near Hennepin, Illinois in Putnam County, approximately 0.4 miles east of the Hennepin Power Station. The East Ash Pond serves as the primary wet impoundment basin for CCR produced by the Hennepin 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 inflow design flood control system plan for an existing CCR surface impoundment be prepared by October 17, 2016. The plan must document how the inflow design flood control system has been designed and constructed to meet the requirements of 40 CFR §257.82 and be supported by appropriate engineering calculations.

The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the inflow design flood control system meets the requirements of 40 CFR §257.82. The owner or operator must prepare an inflow design flood control system plan every five years.

# 2 Initial Inflow Design Flood Control System Plan

*40 CFR §257.82*
*(a) The owner or operator of an existing … CCR surface impoundment … must design, construct, operate, and maintain an inflow design flood control system as specified in paragraphs (a)(1) and (2) of this section.*
*(1) The inflow design flood control system must adequately manage flow into the CCR unit during and following the peak discharge of the inflow design flood specified in paragraph (a)(3) of this section.*
*(2) The inflow design flood control system must adequately manage flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood specified in paragraph (a)(3) of this section.*
*(3) The inflow design flood is:*
*(i) For a high hazard potential CCR surface impoundment, …, the probable maximum flood;*
*(ii) For a significant hazard potential CCR surface impoundment, …, the 1,000-year flood;*
*(iii) For a low hazard potential CCR surface impoundment, …, the 100-year flood; or*
*(iv) For an incised CCR surface impoundment, the 25-year flood.*
*(b) Discharge from the CCR unit must be handled in accordance with the surface water requirements under §257.3-3.*

Analyses completed for the initial inflow design flood control system plan of the East Ash Pond are described in the following subsections. Data and analysis results in the following subsections are based on spillway design information shown on design drawings, construction information, topographic surveys, information about operational and maintenance procedures provided by Dynegy Midwest Generation, LLC, and field measurements collected by AECOM. The analysis approach and results of the hydrologic and hydraulic analyses are presented in the following subsections.

The East Ash Pond has a significant hazard potential based on the initial hazard potential classification assessment performed by Stantec in 2016 in accordance with §257.73(a)(2).

## 2.1 Initial Inflow Design Flood Control Systems (§257.82(a))

An initial inflow design flood control system plan, supported by a hydraulic and hydrologic analysis, was developed for the East Ash Pond by evaluating the effects of a 24-hour duration design storm for the 1,000-year Inflow Design Flood (IDF) using a hydrologic HydroCAD (Version 10) computer model and a starting water surface elevation of 490.4 feet. The computer model evaluated the East Ash Pond's ability to collect and control the 1,000-year IDF under existing operational and maintenance procedures. Rainfall data for the 1,000-year IDF was obtained from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14. The NOAA Atlas 14 rainfall depth is 9.70 inches.

The HydroCAD model results for the East Ash Pond indicate that the CCR unit has sufficient storage capacity and spillway structures to adequately manage (1) flow into the CCR unit during and following the peak discharge of the 1,000-year IDF and (2) flow from the CCR unit to collect and control the peak discharge resulting from the 1,000-year IDF. The peak water surcharge elevation is 492.2 feet during the IDF, and the minimum crest elevation of the East Ash Pond dike is 493.0 feet. Therefore, overtopping is not expected.

Based on this evaluation, the East Ash Pond meets the requirements in §257.82(a).

## 2.2 Discharge from the CCR Unit (§257.82(b))

40 CFR §257.82(b) provides that the discharge from the CCR unit must be handled in accordance with the surface water requirements under 40 CFR §257.3-3, which states the following:

*(a) For purposes of section 4004(a) of the Act, a facility shall not cause a discharge of pollutants into waters of the United States that is in violation of the requirements of the National Pollutant Discharge Elimination System (NPDES) under section 402 of the Clean Water Act, as amended.*
*(b) For purposes of section 4004(a) of the Act, a facility shall not cause a discharge of dredged material or fill material to waters of the United States that is in violation of the requirements under section 404 of the Clean Water Act, as amended.*
*(c) A facility or practice shall not cause non-point source pollution of waters of the United States that violates applicable legal requirements implementing an areawide or Statewide water quality management plan that has been approved by the Administrator under section 208 of the Clean Water Act, as amended.*
*(d) Definitions of the terms Discharge of dredged material, Point source, Pollutant, Waters of the United States, and Wetlands can be found in the Clean Water Act, as amended, 33 U.S.C. 1251 et seq., and implementing regulations, specifically 33 CFR part 323 (42 FR 37122, July 19, 1977).*

The handling of discharge was evaluated by reviewing design drawings, operational and maintenance procedures, conditions observed in the field by AECOM, and the inflow design flood control system plan developed per §257.82(a).

Based on this evaluation, outflow from the East Ash Pond is ultimately routed through a NPDES-permitted discharge into the Illinois River via the East Polishing Pond and East Leachate Pond non-CCR surface impoundments. Hydraulic and hydrologic analyses performed as part of the initial inflow design flood control system plan found that the East Ash Pond adequately manages outflow during the 1,000-year IDF, as overtopping of the East Ash Pond embankments is not expected.

Therefore, discharge of pollutants in violation of the NPDES permit is not expected as all discharge is routed and controlled through the existing spillway system and NPDES-permitted outfall during both normal and IDF conditions. Based on this evaluation, the East Ash Pond meets the requirements in §257.82(b).

# 3 Certification Statement

**CCR Unit:** Dynegy Midwest Generation, LLC; Hennepin 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 inflow design flood control system plan dated October 13, 2016 meets the requirements of 40 CFR §257.82.

VICTOR A MODEER JR.

*Printed Name*

10/13/16

*Date*

VICTOR ALBERT MODEER JR.
062-043112
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

11/30/17

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# ATTACHMENT S

# PART 845 SAFETY AND HEALTH PLAN

# HENNEPIN POWER PLANT
# EAST ASH POND

# CONTENTS

## APPENDICES



## ACRONYMS & ABBREVIATIONS

| | |
|---|---|
| % | Percent |
| § | Section |
| 35 I.A.C. | Title 35 of the Illinois Administrative Code |
| 29 C.F.R. | Title 29 of the Code of Federal Regulations |
| ACGIH | American Conference of Governmental Industrial Hygienists |
| CCR | Coal Combustion Residual |
| DMG | Dynegy Midwest Generation, LLC |
| EAP | East Ash Pond |
| HAZWOPER | Hazardous Waste Operations and Emergency Response |
| HPP | Hennepin Power Plant |
| ID | identification |
| IDLH | Immediately Dangerous to Life and Health |
| IEPA | Illinois Environmental Protection Agency |
| kV | kilovolt |
| NID | National Inventory of Dams |
| NIOSH | National Institute for Occupational Safety and Health |
| No. | number |
| OSHA | Occupational Safety and Health Administration |
| Part 845 | 35 I.A.C. Part 845: Residuals in Surface Impoundments |
| PEL | Permissible Exposure Level |
| PFAS | Per- and polyfluoroalkyl substances |
| PFD | Personal Flotation Device |
| PNOR | particulates not otherwise recognized |
| POC | Point of Contact |
| PPE | personal protective equipment |
| ppm | parts per million |
| SDS | Safety Data Sheet |
| STEL | Short Term Exposure Limit |
| TLV | Threshold Limit Value |
| TWA | time-weighted averages |
| USCG | United States Coast Guard |

# REVISION SUMMARY

| **Revision Date** | **Description of Changes**<br>(Section title or number – description) | **Responsible Party**<br>(individual name or title, company / agency name, document reference and date) |
|---|---|---|
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# PREFACE

Dynegy Midwest Generation, LLC (DMG) has prepared this Safety and Health Plan in accordance with requirements set forth in Title 35 of the Illinois Administrative Code (35 I.A.C.) Part 845: Residuals in Surface Impoundments (Part 845), Section (§) 845.530. DMG assessed health and safety hazards of its coal combustion residual (CCR) surface impoundments to develop and update this Safety and Health Plan.

This document describes the minimum anticipated protective measures necessary for worker health and safety at Hennepin Power Plant (HPP) East Ash Pond (EAP; Vistra identification [ID] number [No.] 803, Illinois Environmental Protection Agency [IEPA] ID No. W1550100002-05, National Inventory of Dams [NID] No. IL50363). Employees of DMG, contract workers, and third-party contractors must read and comply with the contents of this document. The contents of this document are not intended to cover all situations that may arise nor to waive any provisions specified in Federal, State, and local regulations or site owner / contractor health and safety requirements.

Third-party contractors are accountable for the health and safety of their employees. Third-party contractors are required to prepare a Safety and Health Plan that meets the minimum requirements herein. However, no requirements or provisions within this plan shall be construed as an assumption of DMG of their legal responsibilities as an employer.

This Safety and Health Plan will be reviewed and updated annually, at a minimum. The Safety and Health Plan will also be updated if facility operations change, or a new hazard is identified.

# 1. INTRODUCTION

This Safety and Health Plan has been developed to outline the requirements to be met by employees of DMG, contract workers, and third-party contractors while performing any activity to construct, operate, or close the EAP. This Safety and Health Plan has been developed to meet the requirements of 35 I.A.C. § 845.530 and describes the responsibilities, training requirements, protective equipment, and safety procedures necessary to minimize the risk of injury, fires, explosion, chemical spills, material damage incidents, and near misses related to CCR activities. This Safety and Health Plan incorporates by reference the Occupational Safety and Health Administration (OSHA) regulations contained in Title 29 of the Code of Federal Regulations (29 C.F.R.) § 1910 and 29 C.F.R. § 1926.

The requirements and guidelines in this Safety and Health Plan are based on a review of available information and data, and an evaluation of identified on-site hazards. This Safety and Health Plan will be reviewed with persons assigned to work in the EAP and will be available on-site.

## 1.1 Site Description/History

The HPP is a retired coal-fired power plant located in northcentral Illinois in Putnam County, approximately four miles northeast of the Village of Hennepin, located within the northeast quarter of Section 26, Township 33 North, Range 2 West. The HPP is an approximately 504-acre property consisting of 19 parcels, including the former power plant, CCR landfill and surface impoundments, and farmland. The HPP ceased operations in 2019 when the power plant was retired.

The EAP is situated south and adjacent to the Illinois River. The area is also bounded on the east and south by industrial properties owned by Tri-Con Materials and Washington Mills, respectively. The power plant provides the western boundary of the EAP, with agricultural land to the southwest (Appendix A).

## 1.2 Facility Personnel

The following table outlines key personnel with respect to facility operations and health and safety.

| Name | Position | Phone Number |
|---|---|---|
| Jason Stuckey | Plant Manager / Point-of-Contact | 815-719-0540 (mobile) |
| Security (24/7) | Site Security / Emergency Contact | 309-660-7153 |
| Mike Olle | Environmental Manager | 815-875-7022 (mobile) |
| Matt Ballance | Engineering Manager | 618-343-7739 (office)<br>618-792-7274 (mobile) |
| Jason Campbell | Dam Safety Manager | 271-753-8904 (Springfield)<br>217-622-3491 (mobile) |
| Stu Cravens | Senior Technical Expert | 217-390-1503 (mobile) |
| Vic Modeer | Engineering Manager | 618-541-0878 |
| Charles Koudelka | Plant Closure Director | 903-235-8633 |

## 1.3 Responsibilities

The following persons have responsibilities associated with communicating and implementing the Safety and Health Plan for the EAP.

### 1.3.1 DMG Point of Contact

The DMG Point of Contact (POC) is a management-level person who is requiring employees, contract workers, or third-party contractors to enter the EAP. The DMG POC is responsible to communicate Safety and Health Plan information and requirements to employees, contract workers, and third-party contractors, and oversee work performed in the EAP to the extent necessary to confirm implementation of Safety and Health Plan requirements.

### 1.3.2 DMG Employees

DMG employees are directly hired by DMG. They are required to implement and/or follow Safety and Health Plan requirements as applicable to their work and exercise their "stop work authority" if safety requirements are unclear or unanticipated site conditions or hazards are observed.

### 1.3.3 Contract Workers

Contract workers are those hired by DMG through an agency firm. Similar to DMG employees, contract workers are required to implement and/or follow Safety and Health Plan requirements as applicable to their work and exercise their "stop work authority" if safety requirements are unclear or unanticipated site conditions or hazards are observed.

### 1.3.4 Third-Party Contractor Employees

Third-party contractor employees work for firms under contract to DMG. Third-party contractors include prime contractors and all of their lower tier subcontractors. Similar to DMG employees, third-party contractors are required to implement Safety and Health Plan requirements as applicable to their work and exercise their "stop work authority" if safety requirements are unclear or unanticipated site conditions or hazards are observed.

### 1.3.5 Third-Party Contractor Safety Competent Person

Third-party contractors will be required to designate a Safety Competent Person. The Safety Competent Person must be in a management position (*e.g.,* superintendent, foreman, etc.) with OSHA 30-hour construction safety certification who may perform other duties, unless DMG requires a dedicated Safety Competent Person. A Safety Competent Person must be on site at all times when the subcontractor has employees performing work for DMG and must possess a sound working knowledge of pertinent OSHA regulations, this Safety and Health Plan, and other applicable safety requirements related to the scope of work. Third-party contractors must also designate a backup Safety Competent Person that possesses the same authority and training. The competent person will ensure timely correction of safety deficiencies identified by DMG. The Safety Competent Person is responsible to ensure Safety and Health Plan requirements have been communicated to lower-tier subcontractors and enforce Safety and Health Plan requirements.

# 2. SITE ACCESS & CONTROL

This section outlines requirements for ensuring that only authorized personnel and visitors are permitted in the EAP.

## 2.1 Facility Security

Elements of site control include restricting access to the EAP to persons until they have met the training requirements outlined in this Safety and Health Plan and have been authorized to do so by HPP POC or their representative.

Upon arriving to the facility, all DMG employees, contract workers, and third-party contractors must sign in at the main gate. All personnel must also sign out upon leaving the EAP.

Upon arrival to the Site, all DMG employees, contract workers, and third-party contractors must check in/out at Security. A COVID-19 screening must also be completed per Section 3.8.

## 2.2 Third-Party Contractor Management

Prior to working at the EAP, all third-party prime contractors must maintain an active registration with ISNetworld and maintain a grade of A or B. Lower tier subcontractors are currently not required to be registered in ISNetworld, but this requirement may change at the discretion of DMG.

## 2.3 Third-Party Contractor Safety and Health Plan

Prior to being authorized to conduct work at the EAP, third-party contractors must develop and submit a Safety and Health Plan. The third-party contractor's Safety and Health Plan must be specific to the scope of work that they will be performing at the EAP. The third-party contractor's Safety and Health Plan must meet or exceed all the requirements in this Safety and Health Plan, other DMG requirements, and applicable regulations. All lower tier subcontractors of third-party contractors must meet the requirements in this Safety and Health Plan as well as the requirements outlined in the Safety and Health Plan of the third-party with whom they are contracted.

## 2.4 Authorized Personnel

At a minimum, authorized personnel who will be granted unescorted access to the project include DMG employees, contract workers, and third-party contractors that meet the following:

- Reviewed this Safety and Health Plan and other applicable safety planning documentation
- Have completed all the training, medical surveillance, and drug screen and background investigation requirements as outlined in Section 3 of this Safety and Health Plan.
- Received a Pre-Job Brief/Site Orientation Training

## 2.5 Visitors

Visitors must be escorted by Authorized Personnel through the EAP if they have not reviewed this Safety and Health Plan or completed the training requirements outlined in Section 3 of this Safety and Health Plan. Visitors may not undertake any activity to construct, operate, or close a CCR surface impoundment.

## 2.6 Communication

Communication between workers and emergency services must be maintained at all times. Cellular service is not consistently available and cannot be relied upon to summon emergency services.

In lieu of using mobile phones, handheld radios must be used to communicate with Security. Third-party contractors are responsible for providing their radios and must leave one at Security upon arrival to the site.

# 3. TRAINING & MEDICAL REQUIREMENTS

Project personnel must be properly trained for the type of work being performed and in accordance with 35 I.A.C. § 845.530, 29 C.F.R. § 1926 and 29 C.F.R. § 1910, and DMG policies. Additionally, personnel working in areas regulated by the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) standards (29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65) must have current medical surveillance. All employees, contractors, and third-party contractors must complete the following prior to beginning any activity to construct, operate, or close the EAP.

## 3.1 HAZWOPER Training

35 I.A.C. § 845.530(c)(2)(E) requires that all employees, contract workers, and third-party contractors be trained in accordance with 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65. The following training will be completed as required by job function:

- **OSHA 40-Hour Training** per 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65, for those personnel who are expected to have extensive contact with contaminated materials and/or may be required to wear a respirator.
- **OSHA 24-Hour Training** per 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65, for those personnel who are expected to have minimal contact with contaminated materials and will NOT be required to wear a respirator.
- **OSHA 8-hour Supervisor Training** per 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65, for Site Supervisors, Foremen, Superintendents, and others who will be directing and managing site activities.
- **OSHA 8-hour Refresher** per 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65, completed within 12 months of initial 40-hour or 24-hour training and annually thereafter.

The following matrix outlines HAZWOPER training requirements based on typical job functions at the EAP. It is not intended to be all inclusive, new job functions must be evaluated per 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65.

| Training | Job Function |
|---|---|
| OSHA 40-hour | Ash handlers |
| OSHA 24-hour | Personnel not required to handle CCR materials |
| OSHA 8-hour Supervisor Training | Third-Party Contractor Safety Competent Persons |
| OSHA 8-hour refresher | All personnel |

## 3.2 OSHA Construction Outreach Training

35 I.A.C. § 845.530(c)(2)(E) requires that all employees, contract workers, and third-party contractors complete an OSHA 10-hour or 30-hour construction safety training. These trainings will be completed as follows:

- All employees, contract workers, and third-party contract employees: OSHA 10-hour or 30-hour construction outreach training.
- Supervisors, superintendents, foreman and safety professionals: OSHA 30-hour construction outreach training.

## 3.3 EAP Safety and Health Plan Review

Pursuant to 35 I.A.C. § 845.530(d)(e), before beginning any activity at the EAP, and annually thereafter, all DMG employees, contract workers, and third-party contractors must review the content of this HASP. After reviewing this Safety and Health Plan all personnel will understand the following:

- Procedures for using, inspecting, repairing, and replacing facility emergency and monitoring equipment
- Communications or alarm systems outlined in Section 6
- Response to fires and explosions outlined in Section 6
- Response to a spill or release of CCR
- Information about chemical hazards and hazardous materials outlined in Section 5
- The use of engineering controls, administrative controls, and personal protective equipment (PPE) outlined in Section 4

All personnel will acknowledge this HASP by signing the *Safety and Health Plan Acknowledgment Form (Appendix B).*

## 3.4 Emergency and Monitoring Equipment Training

All DMG employees, contract workers, and third-party contractors must be aware of how to respond to alarms and other emergencies as outlined in Section 6 of this plan. Individuals may only use facility emergency and monitoring equipment if they have been trained in their use and authorized to do so by the designated POC. Additionally, a written release may need to be completed as required by Vistra Corporate Procedure FFA-POL-0006.

Individual DMG employees and contract workers may be responsible for using, inspecting, repairing and replacing facility emergency monitoring equipment. These individuals will be trained in accordance with procedures identified by DMG. These individuals will review and adhere to the manufacturer's instructions, where applicable.

Third-party contractors are responsible for inspecting, repairing, and replacing any owned emergency (*i.e.*, fire extinguishers) and monitoring equipment (*i.e.*, air monitoring equipment). Third-party contractors will maintain procedures for using inspecting, repairing, and replacing owned emergency and monitoring equipment that is consistent with the manufacturer's requirements. Third-party contractor employees who are responsible for this equipment will be trained in procedures for using, inspecting, and repairing owned equipment by their employer.

## 3.5 Hazard Communication

All employees, contract workers, and third-party contractors must be trained in chemical hazards (if any) associated with their work in accordance with 29 C.F.R. § 1910.1200. Work tasks performed on the EAP may include exposure to compounds identified in the Hazard Communication section of this Safety and Health Plan and is included as part of the Safety and Health Plan Review outlined in Section 3.3.

## 3.6 Medical Surveillance

All employees, contract workers, and third-party contractors engaged in operations specified in 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65 and meet one of the criteria outlined in 29 C.F.R. § 1910.120(f)(2) and 29 C.F.R. § 1926.65(f)(2) must participate in a medical surveillance program that is administered by their employer. The criteria for participating in a medical surveillance program are:

- All employees who are or may be exposed to hazardous substances at or above the established permissible exposure limit, without regard to the use of respirators, for 30 days or more a year;
- All employees who wear a respirator for 30 days or more a year; or
- All employees who are injured, become ill or develop signs or symptoms due to possible overexposure involving hazardous substances or health hazards from an emergency response or hazardous waste operation.

The medical surveillance program must result in documentation that an individual is cleared to work on sites covered by 29 C.F.R. § 1910.120 and 20 C.F.R. § 1926.65 and is medically fit to wear a respirator when applicable.

## 3.7 Drug Screen and Background Investigations

DMG requires that contract worker agencies and third-party contractors are responsible for ensuring that all personnel have completed and passed a drug and alcohol test and background investigation prior to on-site work as described in Appendix C.

## 3.8 COVID-19 Site Entry Guidelines

All personnel entering Vistra work sites shall review and adhere to the site entry guidelines provided in Appendix D.

## 3.9 Document Management

DMG will maintain employee and contract employee training and medical surveillance records at corporate headquarters. Third-party contractors are responsible for maintaining training and medical surveillance documentation for their employees. Third-party contractors will produce documentation upon DMG request.

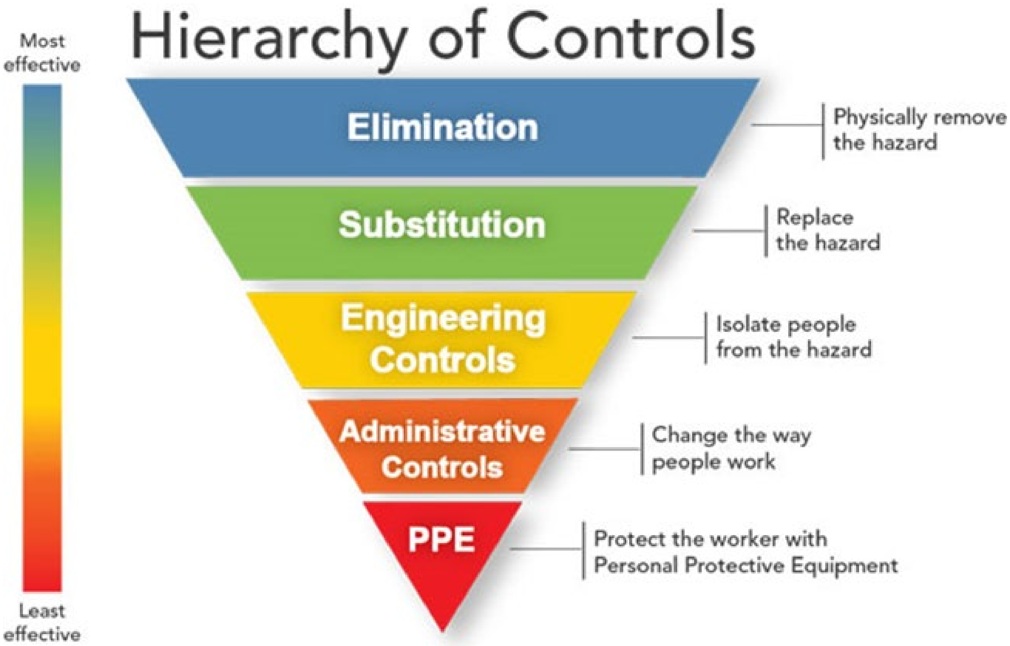
## 3.10 Industrial Hygiene Sampling Records

Upon receipt of exposure sampling results DMG and third-party contractors must distribute exposure sampling results to employees within 15 business days unless otherwise required by applicable regulation. All personnel exposure sampling results and records must be maintained by the employee’s company for at least 30 years following termination of employment.

# 4. HAZARD & CONTROLS

The following section outlines general controls for the hazards and controls. Third-party contractors are still responsible for developing a Safety and Health Plan that incorporates requirements of this Safety and Health Plan, other safety requirements for the HPP, as well as the third-party contractor's safety policies and procedures. Safety and Health Plans developed by third-party contractors must be specific to the site and the anticipated work means and methods. Safety and Health Plans that consist of only standard operating procedures or are not otherwise specific to the work performed at the EAP will not be accepted by DMG.

DMG requires that a hierarchy of controls be considered when performing work at the EAP. Implement controls that favor elimination, substitution, and engineering over the use of administrative controls and PPE when feasible. See the figure below for additional guidance (courtesy of the National Institute for Occupational Safety and Health [NIOSH]).




## 4.1 Ash/Unstable Surfaces

Prior to working in or on an ash pond, third-party contractors must notify the POC. Work in or on an ash pond may not begin until the facility POC has approved the work. Upon completion of the work third-party contractors must notify the POC that they have left the ash pond.

All individuals must check in with the POC upon arrival and departure of the EAP.

When working on ash ponds or unstable surfaces the following requirements must be implemented where applicable and feasible. The following table summarizes safety controls for work performed in ash ponds and on unstable surfaces and are aligned to the hierarchy of controls:

| Elimination | Substitution | Engineering | Administrative | PPE |
|---|---|---|---|---|
| Change the work task or work methods so that work on ash ponds is no longer required | Use the lightest available tracked equipment to reduce ground pressure | Use crane mats or other cribbing to support heavy equipment on ash ponds | Traverse compacted paths that have previously been used by heavy equipment | Use a restraint (tethering) system to prevent falls or slips into unstable ash pond surfaces or surface water that represents a drowning hazard |

| Elimination | Substitution | Engineering | Administrative | PPE |
|---|---|---|---|---|
| | | | If an unstable condition exists, complete a Next Level Up Pre-Job Brief prior to accessing the ash pond. | |
| | | | Approach the ash pond from the most stable direction | |
| | | | Inspect travel paths for recent terrain shifts, particularly following heavy rains or rapid dewatering | |
| | | | Working alone on ash ponds is prohibited without pre-approval from the POC. | |
| | | | When a drowning hazard exists, implement requirements for working on/near water as outlined in Section 4.4. | |
| | | | Implement an emergency response plan with trained responders for falls into (or engulfment by) ash | |

## 4.2 Ash Inhalation/Airborne Exposure

Ash that becomes airborne due to site activities or environmental conditions may result in an exposure to its components as outlined in Section 5.1. DMG and third-party contractors are responsible for ensuring their respective employees' and contract workers' exposures are below occupational exposure limits. Upon request, third-party contractors must demonstrate to DMG that exposure control methods are adequate. The following table summarizes airborne exposure controls and is aligned to the hierarchy of controls:

| Elimination | Substitution | Engineering | Administrative | PPE |
|---|---|---|---|---|
| Change the work task or work methods so that work on ash ponds is no longer required | Substitute manual work methods for those that can be completed from the cab of a vehicle | Continually wet work areas to reduce the amount of ash that becomes airborne<br><br>Equip vehicles and heavy equipment cabs with filters. Clean and change filters as required | Conduct air monitoring or exposure sampling to confirm that airborne exposure is below regulatory limits | If exposure levels are above the PEL, equip employees with respirators appropriate to the level of exposure |

## 4.3 Stuck Vehicles/Equipment

If a vehicle or piece of equipment becomes stuck, a third-party towing or wrecking company who is trained in vehicle extraction must be retained and the DMG will be notified. Third-party contractors may extract their own vehicle if they have an approved extraction plan, and a competent person is on site to implement the extraction. The extraction plan shall be included as part of the third-party contractor's reviewed and approved Safety and Health Plan. The above notifications are still required.

The hazards presented by stuck vehicles/equipment must not be underestimated. While the weight of the stuck equipment can be calculated, it's impossible to precisely calculate the other forces that are pulling against the towing vehicle which requires special training and experience to properly size towing equipment and select towing techniques. This is especially true for "complex" or high-hazard extractions involving equipment stuck at axle depth (or beyond) or sloped surfaces or any area where extraction activities could trigger shifts in the ground surface. No chains shall be used to remove stuck vehicles/equipment.

The following table summarizes safety controls related to stuck vehicles and equipment and are aligned to the hierarchy of controls:

| Elimination | Substitution | Engineering | Administrative | PPE |
|---|---|---|---|---|
| Change the work task or work methods so that work on ash ponds is no longer required | Use the lightest available tracked equipment to reduce ground pressure<br><br>Substitute tracked equipment for wheeled equipment | Use crane mats or other cribbing to support heavy equipment on ash ponds<br><br>Lighten the load – Remove materials from stuck vehicles or equipment prior to extraction if possible | Only persons trained in vehicle extraction are permitted to remove stuck vehicles/equipment<br><br>A professional towing/wrecking service is required<br><br>Prepare for spills (damage to fuel or hydraulic systems) | All persons involved in removing stuck equipment must wear PPE that includes hard hat, safety boots, safety glasses, high visibility vests, and cut resistant gloves |

## 4.4 Working Near/Over Water

All employees, contract workers, and third-party contractors must wear a United States Coast Guard (USCG) approved personal floatation device (PFD), when within 6 feet of water, over water, and/or wading in water where the danger of drowning exists. The PFD must be properly secured to the wearer, free of all defects including rips, tears, stress, and fading, and be kept clean and free of excessive dirt and oil.

If the possibility of falling into water has been eliminated through the use of guardrails, fall restraint, or other method, the use of a PFD is no longer required.

When performing work on water from a vessel, at least one lifesaving rescue vessel (*e.g.,* a skiff) shall be immediately available at locations where employees are working over, in, on, or adjacent to water where the danger of drowning exists. However, if the water is so shallow that rescuers could simply walk/run into the water body without endangering themselves and/or others or the work was being conducted very close to shore (*e.g.,* the length of the skiff from shore would be greater than the working distance from shore and/or the skiff would foul on the bottom), a skiff would not be required.

The following table summarizes the requirements for working over/near water where a drowning hazard exists and are aligned to the hierarchy of controls:

| Elimination | Substitution | Engineering | Administrative | PPE |
|---|---|---|---|---|
| Change the work task or work methods so that work near a drowning hazard is no longer required | | Install guardrails that separate work areas from the drowning hazard | All work to be performed by at least two people where each is equipped with proper safety gear and capable of summoning emergency rescue | All personnel are required to wear suitable PFDs |
| | | Utilize equipment (crowd-control barricades, safety fence, etc.) that will keep personnel at least 6 feet from a drowning hazard | When working on water use of a rescue skiff as outlined above | |
| | | | Use of a ring buoy with 90 feet of braided polycarbonate (or equivalent) line | |
| | | | Ring buoys must be positioned within 100 feet of work (maximum of 200 feet spacing) | |

## 4.5 Heavy Equipment

All heavy equipment operators must be competent and authorized to operate each piece of heavy equipment. Forklift and telehandler (*e.g.,* Lull, JLG) operators must have a license or certificate that indicates they have passed a written test and "road" test for the equipment they will be operating within the last 3 years. Third-party contractors will provide proof of qualification upon request of DMG.

Persons working around heavy equipment must implement the “25 Foot Rule.” The 25 Foot Rule requires that persons get the operator’s attention and permission prior to approaching closer than 25 feet to heavy equipment. Persons must walk quickly through blind spots. Loitering in heavy equipment blind spots (especially to the rear) must be avoided.

Temporary fuel storage tanks will be labelled as to their content and be protected from collision by Site vehicles using solid barricades including balusters, chain link fence, or equivalent. Spill kit (55-gallon sorbent capacity contained in an overpack) and one 20-pound Type ABC fire extinguisher will be located within 45 feet of fueling areas. Tanks will be rated for above ground use and provided with secondary containment. Tanks will be rated for above ground use and will be double walled or have secondary containment in case of a leak. Tanks and dispensing hose will be bonded and grounded. On-site filling of fuel storage tanks will be completed with trucks that have automatic over-flow shutoffs. These trucks will be properly bonded to the storage tank and meet all of the other storage tank requirements. Temporary secondary containment must be provided in the refueling area that includes the storage tank and dispensing hoses.

| Elimination | Substitution | Engineering | Administrative | PPE |
|---|---|---|---|---|
| | | Heavy equipment (and vehicles) must be equipped with backup alarms, horns, roll-over protection (when feasible) | Operators must be competent and authorized | Operators must use seatbelts when equipped |
| | | Vehicles and heavy equipment operated at night must have headlights, tail lamps, and reflectors | Forklift operators must have a current license or certificate (within 3 years) | High visibility vests are required when working around heavy equipment |
| | | | All vehicles and equipment must be turned off when not in use | |
| | | | Operators must inspect equipment daily prior to use | |
| | | | Persons working near heavy equipment must follow the “25 Foot Rule” and avoid lingering in blind spots as outlined above | |
| | | | Always obey site speed limits – 15 mph unless otherwise posted | |

## 4.6 Overhead Powerlines

All overhead powerlines must be assumed to be energized until confirmed otherwise. The minimum clearance distance for equipment working near energized power lines must be in accordance with the table found in 29 C.F.R. § 1926.1408(h).

The following table summarizes safety controls for work near energized power lines:

| Elimination | Substitution | Engineering | Administrative | PPE |
|---|---|---|---|---|
| Plan to work away from powerlines | Use heavy equipment with shorter booms/attachments to avoid coming close to power lines | Contact the utility owner to deenergize the line | Install signs to warn personnel of overhead powerlines | |

| Elimination | Substitution | Engineering | Administrative | PPE |
|---|---|---|---|---|
| | | Contact the utility owner to install insulated sleeves over energized lines | Install a non-conductive distance marker to delineate minimum clearance | |
| | | | Use a dedicated spotter to ensure equipment does not enter minimum clearance distances | |

## 4.7 Severe Weather

Severe weather conditions include but are not limited to high winds, electrical storms, heavy rain, and tornados can cause hazardous conditions at CCR surface impoundments. The primary control for severe weather is monitoring weather reports prior to beginning work and as work occurs throughout the day.

Monitor lightning using a commercially available mobile application if cellular service is available. When lightning is observed within 10 miles of the CCR surface impoundment, or a storm is imminent, take shelter in the nearest solid structure or fully enclosed vehicle. If possible secure all tools, materials, and equipment prior to the storm arriving. Work may resume 30 minutes after the last lightning strike is observed within 10 miles. The following locations are acceptable shelter locations near the EAP:

- The stairwell inside the front door of the Main Plant
- The breakroom on the 2nd floor of the Main Plant

Do not conduct work on a CCR surface impoundment when there is a risk for tornados in the area. If on a CCR surface impoundment and a tornado forms, seek the nearest substantial shelter. The closest tornado shelters are the locations listed above; shelter locations will be reviewed during the Site Orientation Training. If no shelter is available, attempt to evacuate to a shelter using a vehicle. If a tornado forms and you are not in a shelter, take one of the following actions:

- Stay in a vehicle with the seat belt on, keep your head below the windows and cover it with your hands
- If there is an area which is noticeably lower than the work area, lie in that area and cover your head with your hands.

The following table summarizes safety controls related to severe weather:

| Elimination | Substitution | Engineering | Administrative | PPE |
|---|---|---|---|---|
| Plan outdoor tasks on days with low potential for severe weather. | | | Prior to beginning outdoor work monitor the day's weather. | |

| Elimination | Substitution | Engineering | Administrative | PPE |
|---|---|---|---|---|
| | | | Periodically monitor weather throughout the day. Use a weather app which issues alerts for severe weather and lightning, assuming cell service is available | |
| | | | Utilize a weather radio if cellular service is inconsistent | |
| | | | Stop all outdoor work and seek shelter when lightning is observed | |

## 4.8 Heat Stress

Heat stress can be a significant hazard, especially for workers wearing protective clothing. Depending on the ambient conditions and the work being performed, heat stress can occur very rapidly, within as little as 15 minutes. Employees, contract workers, and third-party contractors will be instructed in the identification of a heat stress victim, the first-aid treatment procedures for the victim, and in the prevention of heat stress incidents.

Workers will be encouraged to immediately report any heat-related problems that they experience or observe in fellow workers. Any worker exhibiting signs of heat stress and exhaustion should be made to rest in a cool location and drink plenty of water. Emergency help by a medical professional is required immediately for anyone exhibiting symptoms of heat stroke, such as red, dry skin, confusion, delirium, or unconsciousness. Heat stroke is a life-threatening condition that must be treated immediately by competent medical authority.

### 4.8.1 Heat Stress Prevention

To prevent heat stress, DMG employees, contract workers, and third-party contractors will implement heat stress prevention measures as outlined in OSHA's Heat Index (below). A summary of these precautions is described below.

| Heat Index | Risk Level | Protective Measures |
|---|---|---|
| Less than 91°F | Lower (Caution) | Basic heat safety and planning |
| 91°F to 103°F | Moderate | Implement precautions and heighten awareness |
| 103°F to 115°F | High | Additional precautions to protect workers |
| Greater than 115°F | Very High to Extreme | Triggers even more aggressive protective measures |

**Know the Symptoms:** Some symptoms associated with heat stress are: Employees should be aware of these symptoms with themselves and with their co-workers:

- Elevated heart rate, lack of concentration, difficulty focusing on a task, fatigue
- Irritability and/or sickness
- Cramps, rash, headache
- Loss of desire to drink water
- Fainting
- Skin clammy, moist, and pale (severe heat exhaustion)
- Skin extremely dry and red (heat stroke)

**Acclimatize:** When high heat stress conditions arise, employees should be exposed to the heat for short work periods followed by longer periods of work. Acclimatization usually takes five (5) days and should be provided for all new employees and employees returning from an absence of two (2) weeks or more. Contact Corporate Health and Safety for proper procedures.

**Hydration & Pace of Work:** Make sure all employees intake plenty of water throughout the work day (sometimes as much as a quart per worker per hour) and let employees know where the drinking water is located. Adjust your work pace and expectations on how much work can be done during periods of high heat stress. Workers cannot do as much during periods of high heat stress compared with similar periods of low heat stress. After acclimatization, workers may be able to resume a more "normal" work pace as long as fluid intake is adequate.

**Work/Rest Periods:** If possible, heavy work should be scheduled during the cooler parts of the day (*i.e.,* early morning) and rest periods should be taken in cool areas for longer periods.

**Personal Protective Equipment (PPE):** Employees using PPE (*i.e.*, Tyvek® suits or other equipment which may retain heat) can be more susceptible to heat stress due to the fact that heat/sweat often cannot escape the suits and/or the equipment. Persons wearing PPE that contributes to heat stress require more hydration, longer rest periods, or a reduced pace of work. Also, more careful monitoring of each person's health status is required by co-workers and management.

The following table summarizes safety controls for heat related illnesses:

| Elimination | Substitution | Engineering | Administrative | PPE |
|---|---|---|---|---|
| Perform outdoor, strenuous, tasks at cooler times of day/year | Use mechanized equipment in place of manual labor | Install fans or air conditioning units in the work area | Train all personnel to know the signs of heat stress/stroke and how to prevent it | Implement the use of cooling vests or other similar PPE |
| | | Install a canopy to provide shade to work areas | Allow workers to acclimatize to the work environment | |
| | | Provide cool, shaded break areas | Adjust work pace to allow for the effects of heat | |
| | | | Implement work/rest periods | |

## 4.9 Cold Stress

The four environmental conditions that cause cold-related stress are low temperatures, high/cool winds (wind chill), dampness, and cold water. One, or any combination of these factors, can cause cold-related hazards. Cold stress, including frostbite and hypothermia, can result in severe health effects. Employees, contract employees, and third-party contractors will be instructed in the identification of a cold stress victim, the first-aid treatment procedures for the victim and in the prevention of heat stress incidents.

A dangerous situation of rapid heat loss may arise for any individual exposed to high winds and cold temperatures. Major risk factors for cold-related stresses include:

- Wearing inadequate or wet clothing thus increasing the effects of cold on the body.
- Taking certain drugs or medications such as alcohol, nicotine, caffeine, and medication thus inhibiting the body's response to the cold and/or impairing judgment.
- Having a cold or certain disease, such as diabetes, heart, vascular and thyroid problems, and thereby increasing susceptibility to the winter elements.
- Lower body-fat composition or other physiological differences. Statistics show that men experience far greater death rates due to cold exposure than women, potentially attributable to participation in risk-taking activities, lower body-fat composition and/or other physiological differences.
- Becoming exhausted or immobilized, especially due to injury or entrapment, thus speeding up the effects of cold weather.

The following table provides the resulting equivalent chill temperature to exposed skin because of increasing wind speeds at decreasing actual temperatures. Personnel shall be aware of predicted weather conditions before beginning site work and stay apprised of changes.

**TABLE 2. Cooling Power or Wind on Exposed Flesh Expressed as Equivalent Temperature (under calm conditions)***

| Estimated Wind Speed (in mph) | Actual Temperature Reading (°F) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 50 | 40 | 30 | 20 | 10 | 0 | −10 | −20 | −30 | −40 | −50 | −60 |
| | Equivalent Chill Temperature (°F) | | | | | | | | | | | |
| calm | 50 | 40 | 30 | 20 | 10 | 0 | −10 | −20 | −30 | −40 | −50 | −60 |
| 5 | 48 | 37 | 27 | 16 | 6 | −5 | −15 | −26 | −36 | −47 | −57 | −68 |
| 10 | 40 | 28 | 16 | 4 | −9 | −24 | −33 | −46 | −58 | −70 | −83 | −95 |
| 15 | 36 | 22 | 9 | −5 | −18 | −32 | −45 | −58 | −72 | −85 | −99 | −112 |
| 20 | 32 | 18 | 4 | −10 | −25 | −39 | −53 | −67 | −82 | −96 | −110 | −121 |
| 25 | 30 | 16 | 0 | −15 | −29 | −44 | −59 | −74 | −88 | −104 | −118 | −133 |
| 30 | 28 | 13 | −2 | −18 | −33 | −48 | −63 | −79 | −94 | −109 | −125 | −140 |
| 35 | 27 | 11 | −4 | −20 | −35 | −51 | −67 | −82 | −98 | −113 | −129 | −145 |
| 40 | 26 | 10 | −6 | −21 | −37 | −53 | −69 | −85 | −100 | −116 | −132 | −148 |
| (Wind speeds greater than 40 mph have little additional effect.) | LITTLE DANGER<br>In < hr with dry skin. Maximum danger of false sense of security | | | | INCREASING DANGER<br>Danger from freezing of exposed flesh within one minute. | | | | GREAT DANGER<br>Flesh may freeze within 30 seconds. | | | |
| | Trenchfoot and immersion foot may occur at any point on this chart. | | | | | | | | | | | |

*Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA.

Equivalent chilll temperature requiring dry clothing to maintain core body tempearture above 36°C (96.8°F) per cold stress TLV

The following table summarizes safety controls for preventing cold stress:

| Elimination | Substitution | Engineering | Administrative | PPE |
|---|---|---|---|---|
| Perform work during warm parts of the day or warmer parts of the year | | Install heaters in enclosed work areas | Train all personnel on the symptoms of cold stress and how to prevent it | All personnel must wear multiple layers of clothing |
| | | Provide a warm break area | Implement work/rest schedule | Utilize hand/foot warmers when required |

An additional hazard in cold weather conditions is the increased risk for slips from the accumulation of ice and snow in general work areas, ruts where water is accumulated, and heavy equipment. The following table outlines controls that may be used for preventing slips:

| Elimination | Substitution | Engineering | Administrative | PPE |
|---|---|---|---|---|
| Perform work during warm parts of the day or in areas free of accumulated areas | | Clear snow in work areas | | Use traction control devices (*i.e.,* YakTrax) on work boots to provide additional traction. |
| | | Apply salt/sand to icy areas | | |
| | | Use equipment to access work areas | | |

## 4.10 Biological Hazards

The following are biological hazards that may be present at the EAP.

### 4.10.1 Ticks (Lyme Disease) & Mites

Although Lyme disease has been detected throughout the continental United States, it is prevalent primarily in certain areas in New England, the Mid-Atlantic and the northern Midwest states. Although Lyme disease is the most common tickborne illness, other tickborne illnesses include southern tick-associated rash illness, Rocky Mountain spotted fever, ehrlichiosis, and tularemia. More information on Lyme disease and other tickborne illnesses can be found from the CDC.

**Prevention**

- Standard field gear (work boots, socks, and light-colored coveralls) provides good protection against tick bites, particularly if the joints are taped. However, even when wearing field gear, the following precautions shall be taken when working in areas that might be infested with ticks:
  - Wear long pants and long-sleeved shirts that fit tightly at the ankles and wrists, tape cuffs if necessary
  - Wear light colored clothing so ticks can be easily spotted
  - Per- and polyfluoroalkyl substances (PFAS)-free tick repellents (DEET and Permethrin) must be used when walking in all overgrown areas. DEET (≥25 percent [%]) must be applied to skin while permethrin must be applied to clothes and allowed to dry. Spray outer clothing, particularly your pant legs and socks, BUT NOT YOUR SKIN, with an insect repellent that contains permethrin. For heavily infested tick areas, wear spun polypropylene coveralls that have been sprayed with permethrin.
  - Inspect clothing frequently
  - Inspect head and body thoroughly when you return from the field, particularly on your lower legs and areas covered with hair
  - When walking in wooded areas, wear a hard hat, and avoid contact with bushes, tall grass, or brush as much as possible

**Removal**

- Remove any ticks by tugging with tweezers or special tick removal tools
- Do not squeeze or crush the tick
- DO NOT use matches, a lit cigarette, nail polish, or any other type of chemical to "coax" the tick out

**Treatment**

- Disinfect the area with alcohol or a similar antiseptic after removal
- Notify the Safety Competent Person of the embedded tick
- For several days to several weeks after removal of the tick, look for the signs of the onset of Lyme disease, such as a rash.
- No further treatment is necessary for ticks embedded <48 hours.
- If other signs or symptoms of Lyme are observed (fever/chills, aches, and pains), then notify the Safety Competent Person and seek medical attention

The following table summarizes safety controls to reduce the hazards associated with ticks and mites.

| Elimination | Substitution | Engineering | Administrative | PPE |
|---|---|---|---|---|
| Use mechanical equipment to remove overgrown vegetation | | Remove overgrowth and excessive vegetation from walkways and work areas (provide safe access) | Train personnel on tick and mite prevention. Areas of vegetation overgrowth and/or debris piles should be considered “high risk” areas | Wear light-colored long sleeved shirt tucked into pants. Tuck pant legs into socks |
| | | | Perform frequent tick checks in the field and a thorough tick check after completing work activities | Apply Permethrin to clothes and DEET (20% or more) to exposed skin |
| | | | Call licensed pesticide contractors to remove infestations of bees, wasps, fire ants, etc. | |

### 4.10.2 Insect Bites/Stings

Stinging/biting insects at the EAP include spiders, wasps, and bees. Contact with these insects may result in project personnel experiencing adverse health effects that range from being mildly uncomfortable to being life-threatening. Therefore, insects present a serious hazard to project personnel, and extreme caution must be exercised whenever Site and weather conditions increase the risk of encountering stinging insects. Some of the factors related to stinging insects that increase the degree of risk associated with accidental contact are as follows:

- The nests for these insects are frequently found in remote wooded or grassy areas or equipment staging areas where equipment has not been moved recently.
- Some people are hypersensitive to the toxins injected by a sting, and when stung, experience a violent and immediate allergic reaction resulting in a life-threatening condition known as anaphylactic shock. Anaphylactic shock manifests itself very rapidly and is characterized by extreme swelling of the body, eyes, face, mouth, and respiratory passages.
- The hypersensitivity needed to cause anaphylactic shock, can in some people accumulate over time and exposure, therefore even if someone has been stung previously and not experienced an allergic reaction, there is no guarantee that they will not have an allergic reaction if they are stung again
- Spider bites generally only cause localized reactions such as swelling, pain, and redness. However, bites from a Black Widow or Brown Recluse, or if you are allergic to spiders, can cause symptoms that are more serious.
- ***If a worker knows that they are hypersensitive to bee, wasp, or hornet stings, or other insects, they must inform the Safety Competent Person prior to site work. Persons who have been prescribed epi-pens by their physician must have an epi-pen on the Site.***
- Inspect any clothing or PPE that has been left for a period of time prior to putting it on. Shake out the clothing and inspect the inside of safety shoes/boots prior to putting them on
- Nests in active work areas must be eradicated. Small nests may be handled by Site personnel using consumer-type insecticide. A pest control contractor should be hired to handle large or difficult to reach nests.

The following table outlines safety controls to reduce the risk of hazards associated with stinging/biting insects.

| Elimination | Substitution | Engineering | Administrative | PPE |
|---|---|---|---|---|
| Use mechanical equipment to remove overgrown vegetation | | Remove overgrowth and excessive vegetation from walkways and work areas (provide safe access) | Train personnel on stinging/biting insect prevention. Areas of vegetation overgrowth and/or debris piles should be considered “high risk” areas | Wear light-colored long sleeved shirt tucked into pants. Tuck pant legs into socks |
| | | Eradicate nests in the work area as outlined above. | Instruct personnel to inspect/shake out clothing and work boots that have been left for a period of time. | Apply Permethrin to clothes and DEET (20% or more) to exposed skin – NOTE this will not repel bees/wasps |
| | | | Instruct employees who are hypersensitive to insect bites/stings to carry their epi-pen while on site | |

### 4.10.3 Venomous Snakes

There are four species of venomous snakes in Illinois, they are:

- Copperhead
- Cottonmouth Water Moccasin
- Timber rattlesnake
- Eastern Massasauga

Generally, these snakes are found in the southern one-third of the state, with the Cottonmouth Water Moccasin found mostly in the southernmost portions of Illinois. Snakes are generally found in tall grass, wood piles, or other covered areas. Snakes are generally not aggressive towards humans, but if they are encountered avoid the snake and do not provoke it. If bitten by a snake that may be venomous seek medical treatment.

The following table outlines safety controls to reduce the hazard associated with venomous snakes.

| Elimination | Substitution | Engineering | Administrative | PPE |
|---|---|---|---|---|
| Use mechanical equipment to remove overgrown vegetation | | Remove debris piles, overgrowth and excessive vegetation from walkways and work areas (provide safe access) | Train personnel on the identification of venomous snakes. Areas of vegetation overgrowth and/or debris piles should be considered “high risk” areas | If working in area with snakes cannot be avoided, wear snake chaps |
| | | | Instruct personnel to not disturb snakes if they identify one in their work area | |

| Elimination | Substitution | Engineering | Administrative | PPE |
|---|---|---|---|---|
| | | | Use caution when moving staged tools or materials into which snakes may have moved | |

#### 4.10.4 Poisonous Plants and Plant Hazards

Poison ivy and poison oak may be present at the Site. Poison ivy thrives in all types of light and usually grows in the form of a trailing vine; however, it can also grow as a bush and can attain heights of 10 feet or more. Poison ivy has pointed leaves that grow in clusters of three. Poison oak resembles poison ivy except that the poison oak leaves are more rounded rather than jagged like poison ivy, and the underside of poison oak leaves are covered with hair.

The skin reaction associated with contacting these plants is caused by the body's allergic reaction to toxins contained in oils produced by the plant. Becoming contaminated with the oils does not require contact with just the leaves. Contamination can be achieved through contact with other parts of the plant such as the branches, stems or berries, or contact with contaminated items such as tools and clothing. The allergic reaction associated with exposure to these plants will generally cause the following signs and symptoms:

**Symptoms**

- Blistering at the site of contact, usually occurring within 12 to 48 hours after contact and in many cases, persons experience almost immediate irritation.
- Reddening, swelling, itching, and burning at the site of contact.
- Pain, if the reaction is severe.
- Conjunctivitis, asthma, and other allergic reactions if the person is extremely sensitive to the poisonous plant toxin.

**Prevention**

- The best treatment appears to be removal of the irritating oil before it has had time to cause inflammation by wiping exposed skin with rubbing alcohol followed by washing with soap and water.
- A visual Site inspection and identification of the plants should be completed prior to starting work so that all individuals are aware of the potential exposure. Avoid contact with any poisonous plants on the Site, and keep a steady watch to identify, report, and mark poisonous plants found on the Site.
- Avoid contact with, and wash daily, contaminated tools, equipment, and clothing.
- Barrier creams (Ivy Block®) and orally administered desensitization may prove effective and should be tried to find the best preventive solution.
- Keeping the skin covered as much as possible (*i.e.*, long pants and long-sleeved shirts) in areas where these plants are known to exist will limit much of the potential exposure. PFAS-free spun polypropylene coveralls or Tyvek® may be worn to prevent contact of skin and clothes with poison ivy.

The following table outlines safety controls to mitigate the hazards associated with poisonous plants.

| Elimination | Substitution | Engineering | Administrative | PPE |
|---|---|---|---|---|
| Use mechanical equipment to remove overgrown vegetation | | Remove overgrowth and excessive vegetation from walkways and work areas (provide safe access) | Train personnel on the identification of poisonous plants | Wear pants and long sleeves when working in overgrown areas |
| | | | Instruct personnel to avoid areas where poisonous plants have been identified | Consider the use of a coverall when working in areas where these plants are present, especially for hypersensitive employees. |
| | | | Provide isopropyl alcohol along with soap and water to remove oils from skin, tools, and equipment. | |

## 4.11 Working Alone

As outlined in Section 4.1, working alone while on the EAP must be pre-approved by the POC. Working alone is prohibited for tasks deemed to be high risk by DMG including, but not limited to, handling highly hazardous chemicals (sulfuric acid), work over/near water, excavation and trenching, hot work (grinding, welding and torch cutting), and elevated work that requires personal fall arrest. Third-party contractors are responsible for identifying potential high-risk tasks in their Safety and Health Plan and requiring that a buddy system be implemented while high risk work is performed. The buddy must be located in a safe area but may perform other tasks that do not prevent observing the person performing high risk work. Working alone may occur on and around other parts of the EAP when there is no drowning hazard or risk of severe injury due to high-risk work.

| Elimination | Substitution | Engineering | Administrative | PPE |
|---|---|---|---|---|
| | Modify work methods by substituting lower hazard methods for high hazard methods | Varies depending on the hazard, but for example, could include installing guardrails (temporary or permanent) which mitigates a fall hazard reducing the risk to levels where working alone may be permitted | Prohibit working alone on ash ponds and for other high hazard tasks without prior approval form the POC | |
| | | | Implement a buddy system whenever feasible (required for high hazard work) | |

| Elimination | Substitution | Engineering | Administrative | PPE |
|---|---|---|---|---|
| | | | Implement a worker check-in, emergency alerting, and monitoring system | |

# 5. HAZARD COMMUNICATION

As required by 35 I.A.C. § 845.530, the OSHA HAZWOPER standards (29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65) and OSHA Hazard Communication Standard, site personnel, subcontractors, and visitors must be informed of chemical hazards associated with their work area. The information in this section is based on:

- Recommendations in the most recent "NIOSH Pocket Guide to Chemical Hazards" by the Department of Health and Human Services, Centers for Disease Control and Prevention, and the NIOSH Pocket Guide.
- Requirements set forth in the OSHA regulations from as defined in Chapter 17 of 29 C.F.R. § 1910.1200(c) for all hazards not otherwise classified.

## 5.1 Coal Combustion Residuals

Primary exposure to CCR is through inhalation and skin contact. CCR is typically a fine, black, grey, or tan particulate. CCR is comprised of several components. The following table outlines the components of the CCR. The exact percentage of each component will vary based on the type of ash and location at the surface impoundment.

| Chemical | Percentage | PEL | IDLH | ACGIH TLV | Symptoms of Exposure & Health Effects |
|---|---|---|---|---|---|
| Crystalline Silica | 20-60% (total) | 0.05 mg/m³ (respirable) | 25 mg/m³ (respirable) | 0.025 mg/m³ (respirable) | Cough, dyspnoea (breathing difficulty), wheezing; decreased pulmonary function, progressive respiratory symptoms (silicosis); irritation eyes; [potential occupational carcinogen] |
| Iron oxide | 1-10% | 5 mg/m³ | 2500 mg/m³ | 5 mg/m³ | Benign pneumoconiosis with X-ray shadows indistinguishable from fibrotic pneumoconiosis (siderosis) |
| Calcium oxide | 10-30% | 5 mg/m³ | 25 mg/m³ | 2 mg/m³ | irritation eyes, skin, upper respiratory tract; ulcer, perforation nasal septum; pneumonitis; dermatitis |
| Titanium dioxide | <3% | 15 mg/m³ | ND | 10 mg/m³ | Lung fibrosis; [potential occupational carcinogen] |
| Aluminosilicates | 10-60% | 15 mg/m³ (PNOR) | ND | 10 mg/m³ (PNOR) | irritation eyes, skin, throat, upper respiratory system |
| Magnesium oxide | 2-10% | | | | |
| Magnesium dioxide | <2% | | | | |
| Phosphorous pentoxide | ≤2% | | | | |
| Sodium oxide | 1-10% | | | | |
| Potassium oxide | ≤1% | | | | |
| Bromide salt | <0.1% | | | | |

**Footnotes:**

All values are 8-hour time-weighted averages (TWAs) unless otherwise indicated.

- PEL: Permissible Exposure Limit, the concentration an employee may be exposed to for an 8-hour work day for a 40-hour work week for which nearly all employees may be repeatedly exposed without adverse health effects.
- IDLH: IMMEDIATELY Dangerous to Life and Health, contaminant concentration which present the possibility for severe health consequences if exposed to the IDLH concentration without the appropriate personal protective equipment (PPE).
- ACGIH TLV: American Conference of Governmental Industrial Hygienists Threshold Limit Value
- mg/m³ = milligrams per cubic meter of air
- PNOR: Particulates Not Otherwise Regulated
- ND: Not Determined

## 5.2 Safety Data Sheets

Pursuant to 35 I.A.C. § 845.530(b)(3), DMG will provide Safety Data Sheets (SDSs) to all employees, contract workers, and third-party contractors for the CCR located in the plant closure office trailer. Third-party contractors will provide SDSs to the POC prior to bringing a material on site. SDSs are provided in Appendix E.

## 5.3 Signage

The absence of any of the following signage does not mean that a potential hazard does not exist. Signage will be posted by DMG, but employees, contract workers, and third-party contractors must remain vigilant for changing site conditions.

To aid in hazard communication and pursuant to 35 I.A.C. § 845.530(f), DMG will post the following signs at the EAP:

- Signs identifying the hazards of CCR, including dust inhalation when handling CCR.
- Signs identifying unstable CCR areas that make the operation of heavy equipment hazardous.
- Signs identifying the necessary safety measures and necessary precautions, including the proper use of PPE.

The following signs may also be posted at the CCR units to aid in hazard communication:

- Overhead electrical lines that may be struck by heavy equipment of vehicles will have signs warning drivers of their presence.

# 6. EMERGENCY RESPONSE PLAN

This emergency response section details actions to be taken in the event of site emergencies. This section is consistent with the EAP Emergency Action Plan. All personnel on site must be familiar with emergency signals and the content of this section.

## 6.1 Emergency Phone Numbers & Notifications

| Emergency Number | |
|---|---|
| **Site Address** | **Emergency Phone Number** |
| 13498 E 800th St<br>Hennepin, IL 61327 | 911 |
| | Security (24/7): 309-660-7153 (m) |

| Medical Treatment | |
|---|---|
| **Local Hospital** | **Phone Number** |
| St. Margaret's Hospital<br>600 East 1st Street<br>Spring Valley, IL 61362 | 815-664-5311 |

| Incident Notifications | | |
|---|---|---|
| **Title** | **Name** | **Contact Number** |
| POC | Jason Stuckey | 815-719-0540 |

## 6.2 Evacuation Signal

Upon hearing verbal notification to evacuate all personnel will leave the work area and proceed to the muster point.

## 6.3 Muster Point

The muster point for the EAP is the flagpole in front of the Main Plant. The following locations are acceptable severe weather shelter locations near the EAP:

- The stairwell inside the front door of the Main Plant
- The breakroom on the 2$^{nd}$ floor of the Main Plant

The muster point and severe weather shelter locations will be communicated during the Site Orientation Training.

## 6.4 Calls for Emergency Support

In the case of an emergency, site personnel will call 911. Security will coordinate the arrival of on-site emergency personnel. The individual calling for emergency support will briefly explain the nature of the emergency and site conditions as follows:

- Indicate his/her name
- Location of emergency
- Description of emergency conditions that may require special rescue equipment, such as confined spaces, excavations, and elevated work platforms
- Potential chemical hazards and recommended PPE

## 6.5 Fire & Explosion Response Plan

Trained site personnel may respond to incipient stage fires using a 20-pound Type ABC dry chemical fire extinguisher or hose. An incipient stage fire is a fire which is in the initial or beginning stage and which can be controlled or extinguished by portable fire extinguishers, Class

II standpipe or small hose systems without the need for protective clothing or breathing apparatus. Personnel shall only attempt to extinguish the fire if it is safe to do so.

A fire that CANNOT be readily extinguished with a fire extinguisher will require evacuation of the work area personnel to Muster Point areas per this Safety and Health Plan. If personal injuries result from any fire or explosion, the procedures outlined in the Personal Injury Response Plan will also be followed.

All fires or explosions must be reported to the contacts outlined in Section 6.1 of this Safety and Health Plan.

## 6.6 Injury Response Plan

Treatment for minor injuries will be provided on site using available first aid supplies and personnel trained in first aid. All third-party contractors must have at least one individual on site who is trained in first aid, CPR, and AED use. Third-party contractors must provide their own first aid kits and AED. For minor injuries that are not life-threatening but require further medical attention, employees should be treated by occupational physicians at occupational clinics whenever possible. Treatment of minor injuries by emergency room or personal physicians should be avoided. When injured workers are released back to work with restrictions, all subcontractors are expected to accommodate those restrictions.

Emergency medical incidents include puncture wounds to the head, chest, and abdomen, serious head and spinal cord injuries, and loss of consciousness must be treated at the hospital emergency room listed in Section 6.1 of this Safety and Health Plan.

All injuries must be reported to the contacts outlined in Section 6.1 of this Safety and Health Plan.

## 6.7 Spill Response Plan

In general, DMG employees, contract workers, and third-party contractors are trained and equipped to handle small spills associated with their work. Third-party contractors must include an approved spill response plan in their Safety and Health Plan. Site personnel will generally respond to spills as follows:

- Stop the leak immediately if it can be done without directly contacting the leaking material.
- Remove or stop all ignition sources (hot work, generators, etc.) that are within 25 feet of any part of the spill.
- On-site personnel should immediately secure the area to prevent unauthorized entry into the spill area.
- Although not likely given the anticipated types of spills, site personnel must immediately initiate evacuation if a spill may cause an explosion, death, or serious injury.
- Site personnel may only respond to incipient stage fires regardless if such fires are associated with a spill.
- PPE for spills to open areas generally requires Modified Level D PPE (poly-coat Tyvek®, nitrile gloves, and boot covers or boot decontamination). Over-boots or boot covers may also be used if persons cleaning the spill would have to walk on spilled materials. Latex gloves are not acceptable and will degrade with exposure to petroleum products.

## 6.8 CCR Spill or Release Response Plan

Response to minor or incidental spills of CCR will be managed as outlined in the General Spill Response Plan. An incidental release is a release of a hazardous substance which does not pose a significant safety or health hazard to employees in the immediate vicinity or to the employee cleaning it up, nor does it have the potential to become an emergency within a short time frame. Incidental releases are limited in quantity, exposure potential, or toxicity and present minor safety or health hazards to employees in the immediate work area or those assigned to clean them up. An incidental spill may be safely cleaned up by employees who are familiar with CCR. Response to major releases of CCR will be in accordance with the HPP Emergency Action Plan, which can be found on the Luminant CCR website at https://www.luminant.com/ccr/.

## 6.9 Ash Pond Rescue

Ash ponds may be unstable and represent an engulfment hazard if persons and equipment traverse the surface, berms, or other unstable areas. Special training is required on behalf of emergency responders to retrieve persons and equipment who become trapped in unstable ash. **Untrained persons must not enter unstable areas** in an attempt to conduct rescue because of the significant potential that they will also become victims. Call the HPP emergency number and state that an "ash pond rescue" is required. The HPP emergency contact will notify the designated service to perform the ash pond rescue. On-site personnel should remain on stand-by to support the ash pond rescue team as necessary.

## 6.10 Incident Reporting

All incidents must be reported to the contacts outlined in Section 6.1 of this Safety and Health Plan. An Incident Report must be completed for all injuries, illnesses, spills, fire, explosion, or property damage. The absence of an injury does not preclude the need to complete an Incident Report as such incidents will be classified as "near miss" or "other." It will include, but is not limited to, the nature of the problem, time, location, and corrective actions taken to prevent recurrence.

# APPENDIX A
# SITE MAP


Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Hennepin\Appendix A_HEN_Site Map_SnHP.mxd

PROJECT: 169000XXXX | DATED: 8/13/2021 | DESIGNER: COOKEDT

PART 845 REGULATED UNIT (SUBJECT UNIT)

SITE FEATURE

PROPERTY BOUNDARY

0 175 350 Feet

## SITE MAP

**PART 845 SAFETY AND HEALTH PLAN**
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

## APPENDIX A

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

# APPENDIX B
# SAFETY AND HEALTH PLAN ACKNOWLEDGMENT FORM

## *SAFETY AND HEALTH PLAN ACKNOWLEDGEMENT FORM*

*I HEREBY CERTIFY THAT I HAVE READ AND UNDERSTOOD ALL HEALTH AND SAFETY PROCEDURES AS STATED HEREIN:*

| **Name and Affiliation (printed)** | **Signature** | **Date** |
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## APPENDIX C
## DRUG SCREEN POLICIES AND SUPPLEMENTAL TERMS

Drug and Background Investigations

Contractor is solely responsible for ensuring that all members of Contractor Project Team have completed and passed all drug and alcohol tests and background investigations required under this Attachment and under Contractor's own programs before assigning such personnel to perform Work. Contractor is also solely responsible for ensuring that such testing and investigations are performed in accordance with all applicable laws.

1. Required Investigations. Except as otherwise required by applicable law, Required Investigations shall consist of all of the following:

   1.1 a 7-panel drug screening;

   1.2 a background investigation that includes a criminal records check in all counties where the applicable person has resided for at least the last seven (7) years;

   1.3 a third-party verification of previous employment and the highest education level completed by the applicable person;

   1.4 a check of the National Sex Offender Registry and Terrorist Watch List (Denied Parties); and

   1.5 a check of Motor Vehicles Record (if work to be performed by the applicable person requires driving as part of the defined duties).

2. Notices to Tested Persons Regarding Background Checks. All background checks will be conducted in compliance with applicable provisions of the Fair Credit Reporting Act.
3. Forms and Testing Organization for Drug Tests. Except for those positions subject to Department of Transportation ("DOT") drug and alcohol testing regulations, all drug testing shall be performed using the Universal Toxicology four part "Non-DOT" Chain of Custody and Request Form with white and blue top page, and shall be conducted by an independent third-party organization.

4. Pass/Fail Standards – Background Checks. A person shall be deemed to have failed the applicable background check if:

   4.1 information is reported through the background check process indicating that such person has failed to disclose or misrepresented information requested at any time about such a person's criminal background history; or

   4.2 such person has ever committed any felony constituting a violent crime, crime against a person, sexual offense or fraud; or

   4.3 such person has committed any other felony, or has been incarcerated for a felony, within ten (10) years prior to the date of such background check (i.e., for these felonies there must be a ten (10) year lapse in time from the later of the commission and the end of any period of incarceration); or

   4.4 such person has committed any misdemeanor that:

      4.4.1 involves violence that is sexually related; or

4.4.2 consists of a DUI that is the second (or more) DUI in the last two (2) years prior to the date of the background check; or

4.4.3 consists of a theft-related offense; provided that there can be no more than one theft by check and it must have been for an amount less that $100; or

4.4.4 consists of any drug-related misdemeanor committed at any time within forty-eight (48) months prior to the date of the background check.

4.4 For purposes of both felonies and misdemeanors, a person is deemed to have committed the applicable offense if he/she is convicted or enters a plea of guilty or nolo contendere for such offense (to include, without limitation, sentences of probation and deferred adjudication).

5. Pass/Fail Standards – Drug Tests. A person shall be deemed to have failed the applicable drug test if any of the following maximum cut-off levels are exceeded, unless there is a legitimate medical explanation for the presence of a tested substance at or above the applicable cut-off level:

5.1 Amphetamines 500ng/mL

5.2 Barbiturates 150ng/mL

5.3 Benzodiazepines 150ng/mL

5.4 Cocaine 150ng/mL

5.5 Marijuana 150ng/mL

5.6 Opiates 2000ng/mL

5.7 Phencyclidine 25ng/mL

For any positions subject to DOT drug and alcohol testing requirements, testing shall be conducted according to the applicable DOT panel and cutoff levels.

6. Other Requirements.

6.1 Background checks and drug tests will be paid for by Contractor without reimbursement by Company.

6.2 Contractor will keep background checks and drug test records while the applicable persons are working pursuant to this Agreement and for three (3) years thereafter.

6.3 Upon request, Contractor will provide a certification to Company that no person required hereunder to pass a background check or drug test has failed such investigation or test. Contractor will not provide the specific results of the background check or drug test of any individual to Company.

6.4 If any person required under this Agreement to pass a background check or drug test fails such check or test, Contractor will not report the specific results of such check or test to Company and will not allow such individual to perform any Work for Company. Although such person may not be assigned to perform any Work for Company, nothing in this Attachment requires Contractor to take any other action with respect to such person's employment with Contractor.

Supplemental Terms for Onsite Services

1. SAFETY

1.1 Contractor agrees that any safety-related assistance or initiatives undertaken by Company will not relieve Contractor while on Company Property from responsibility for the implementation of, and compliance with, safe working practices, as developed from their own experience, or as imposed by law or regulation, and will not in any way, affect the responsibilities resting with Contractor under the provisions of any agreement to which these policies are attached and to meet all safety requirements as specified by the Occupational Safety & Health Administration (OSHA), the Mine Safety Health Administration (MSHA), including the "Mining Contractor Safety Reference Handbook" located at http://www.vistraenergy.com/wp-content/uploads/2016/12/Contractors-Safety-Handbook_Final-MC-08262016.pdf, the Department of Transportation (DOT) and any other applicable state or federal safety and health laws or regulations.

1.2 In the event that a material safety data sheet, warning label, or other documentation concerning the use of hazardous chemicals at any property owned or controlled by Company or any of its affiliates (collectively, "Company Properties"), applies to any materials or equipment provided by Contractor as an aspect of the Work, such documentation will be provided by Contractor to Company prior to the commencement of any such Work.

1.3 Contractor will report to Company all accidents involving personal injuries (including death) and damage to property occurring directly or indirectly as a result of the Work performed by Contractor hereunder immediately, but in no event, no later than 24 hours after the occurrence of any such accident. Any accident or incident occurring directly or indirectly as a result of the Work which Contractor must report to a regulatory agency (e.g. OSHA, MSHA, TCEQ) must also be reported to Company immediately following notification to the regulatory agency.

2. SECURITY

2.1 It will be the affirmative duty of Contractor to ensure that Contractor Group assists in carrying out all security measures, to include reporting all information or knowledge of matters adversely affecting security to Company's designated security personnel.

2.2 Company reserves the right to exclude any of Contractor's employees from any Company Property by denial of access, suspension or revocation of access authorization, preemptory expulsion, or by any other means, without notice or cause. Former Company employees, and any of Contractor's employees who previously have been excluded from any Company Property, may be brought onto Company property or facilities only if prior approval from Company is obtained. If Contractor terminates a member of Contractor Group performing Work on Company's premises, Contractor shall inform Company immediately, but in no event, no later than twenty-four (24) hours after such employee is terminated in order for Company to remove access to Company Property for such employee.

2.3 Company measures may also include investigations, whether by Company or law enforcement officials. Contractor agrees to cooperate in such investigations and understands that Company reserves the right to require anyone in Contractor Group to authorize appropriate agencies to release his or her criminal records to Contractor as a condition of either initial or continued permission for access to any Company Property. Investigations may include searches of Contractor Group. Such searches may include searches of facilities assigned to Contractor Group, search of all Company Property areas and property at such Company Property areas, searches of including, but not limited to, offices, lockers, desks, lunch boxes, packages and motor vehicles (regardless of ownership). Without limiting the foregoing, Contractor acknowledges and agrees that all members of Contractor Group, to the extent that Company reasonably determines that such members require security badge access prior to entering onto any Company Property, shall be required to comply with Company's standard security badge requirements, including without limitation a background check to be performed by Company.

3. ISNETWORLD

3.1 Contractor agrees to maintain at Contractor's expense a subscription with ISNetworld (www.ISNetworld.com), Company's safety compliance program or any replacement program therefor, as directed by Company, for the Term of the Agreement. Contractor shall also furnish ISNetworld with any information requested by ISNetworld relating to ISNetworld's evaluation of the Contractor's safety program and practices. As a minimum, requested documents will be related to safety, health, and insurance (i.e., regulatory required training, certifications, safety plans, safe and secure workplace practices, insurance certificates, etc.), OSHA and MSHA injury rates and Experience Modification Rate (EMR).

3.2 Contractor has and during the performance of this Agreement shall continue to report full, complete and accurate information to ISNetworld concerning Contractor's employees.

4. MATERIALS, EQUIPMENT AND LABOR. Contractor will be solely responsible for the proper storage, transportation and disposal of any product or waste, other than sandblasting waste, used or generated in connection with the Work in accordance with all applicable Environmental Laws. Contractor will dispose of all waste materials, other than sandblasting waste, at an off-site disposal facility approved for such waste materials pursuant to applicable Environmental Laws and will complete and sign all waste manifests as the generator of such waste. Company will be responsible for the storage, transportation and disposal of any sandblasting waste generated during the performance of the Work.

5. CONDITIONS AFFECTING WORK

5.1 Contractor will investigate and acquaint itself with the conditions affecting the Work, including but not limited to those related to the transportation, disposal, handling and storage of materials and waste; availability of labor, water, electric power and roads; the uncertainties of weather, river stages or similar physical conditions at the site; the conformation and condition of the ground; and the character of equipment and facilities needed preliminary to and during prosecution of the Work. Contractor has satisfied itself as to the character, quality and quantity of surface and subsurface materials or obstacles to be encountered. Contractor's failure to acquaint itself with any conditions affecting the Work or any available related information will not relieve it from responsibility for properly estimating the difficulty or cost of successfully performing the Work.

5.2 Contractor assumes full responsibility for investigating conditions and determining the existence and magnitude of any hazards to the physical well-being of property of Contractor, the employees, agents, and servants of Contractor, or any other person or entity who is or may become involved in the performance of Work, and any and all other persons in the vicinity of the Work. Contractor will advise all of the above-specified persons or entities of any hazards relating to Work, and will ensure that those persons or entities are advised of and fully understand the nature of the hazards and safety precautions that can be taken to eliminate or minimize dangers relating to the hazards.

5.3 Contractor will provide information to Company regarding hazardous chemicals and/or consumable products that contain constituents listed in 40 CFR 372.65 used at any Company Property. Contractor will report the amount of such material carried on and off the site, the amount actually used and the manner of use. Contractor will provide the maximum quantity of the material stored on site at any one time and if a waste material was collected, where it was disposed of (location name and address). Contractor will provide information on the amount of material used for the previous calendar year by the first of February.

5.4 Contractor will use its best efforts to ensure that the Work is performed so as to minimize any adverse impact upon natural resources and the environment and will use best industry practices in this regard at all times.

5.5 Contractor acknowledges and agrees that all members of Contractor Group performing Work at any Company Generation or Mining Property are required to view Company's "Contractor/Visitor Safety Orientation" video (in the case of Company Generation property), when applicable, and to read and adhere to Company's "Contractor/Visitor Safety Booklet" (in the case of Company Mining property) prior to performing any Work at any Company Generation or Mining Property.

5.6 Contractor will immediately notify Company as soon as Contractor has reason to believe that Contactor, or any employee or other person performing the Work, is not or may not be performing the Work in compliance with applicable Environmental Laws. Contractor will provide Company with written notice to Company of such actual or potential non-compliance within three (3) days following the discovery thereof. Contractor will take immediate steps to ensure compliance with all applicable Environmental Laws and will, if directed by Company, cease all Work until authorized by Company to resume the Work.

5.7 Contractor will report to Company all accidents involving personal injuries (including death) and damage to property occurring directly or indirectly as a result of the Work performed by Contractor hereunder immediately, but in no event, no later than 24 hours after the occurrence of any such accident. Any accident or incident occurring directly or indirectly as a result of the Work which Contractor must report to a regulatory agency (e.g. OSHA, MSHA, TCEQ) must also be reported to Company immediately following notification to the regulatory agency.

## 6. WORK SITE PERMITS AND LICENSES

6.1 Subject to the following two paragraphs, Contractor will obtain, prior to the commencement of the Work, and provide to Company upon request, all permits, licenses and governmental authorizations, at its sole expense, required for the performance of the Work. Contractor will be solely responsible for maintaining compliance with such permits, licenses and governmental authorizations.

6.2 In the event that a storm water discharge permit is required for the performance of the Work, (i) Contractor will be responsible for filing a Notice of Intent with respect to the Work, in addition to any Notice of Intent that Company may be required to file, and (ii) Contractor will coordinate with

Company in the preparation and execution of a Storm Water Pollution Prevention Plan for the Work Site.

6.3 In the event that the performance of the Work involves the handling or abatement of asbestos-containing materials, Contractor will coordinate with Company in the preparation and filing of all required notification forms.

7. ACCESS. Should Contractor desire access to the Work Site over any land not controlled by Company, it will, at its sole expense, obtain all proper permits or written permission necessary for that access.

8. COMPANY FACILITIES. Contractor will not use Company's sanitary facilities, changehouses, shops, parks, storage buildings, tools, equipment or other facilities unless so directed by Company. Contractor will not discharge, without Company's prior written authorization, any product or waste used or generated in connection with the Work through any (i) Company-permitted outfall, (ii) Company-owned or operated pollution control equipment, or (iii) storm or sanitary sewer located at or in the vicinity of the Work Site. Any request for authorization to discharge will include, at a minimum, either a copy of the Material Safety Data Sheet for the product or a written description of the waste, including a list of the constituents of the waste and the relative concentrations thereof.

9. ENVIRONMENTAL

9.1 In the event that Contractor discovers during the performance of the Work any substance at the Work Site that is not the subject of the Work or has not otherwise been identified by Company for Contractor, which substance Contractor has reason to believe is or may be a Hazardous Substance that (i) has been or may be released or spilled into the soil, surface water, or groundwater or in a building or structure, or (ii) consists of asbestos-containing materials, lead-based paint, batteries, thermostats, lighting equipment, or equipment containing polychlorinated biphenyls, Contractor will immediately stop Work and notify Company of the discovery. Contractor will not resume the Work until receiving authorization from Company to do so.

9.2 The term "Hazardous Substance" means any product, waste, emission or substance defined, listed or designated as a hazardous or toxic substance, hazardous waste, hazardous material or pollutant by or pursuant to any Environmental Law and includes, but is not limited to, any petroleum-based product, substance or waste, including any additives associated therewith, pesticides, fertilizers, solvents, polychlorinated biphenyls, mercury, lead, lead-based paint, asbestos-containing material or explosives.

9.3 Contractor will immediately notify Company in the event of a spill or release of any material which Contractor knows or has reason to believe is a Hazardous Substance, whether onto the ground, into any body of water, a storm or sanitary sewer, or the air, or anywhere on property owned or controlled by Company, including within any building or structure. Contractor will be solely responsible, as may be required by applicable Environmental Laws, for, in consultation with Company, (i) notifying the appropriate governmental agencies of such spill or release caused or permitted by the acts or omissions of Contractor and (ii) for the cleanup and remediation of such spill or release.

10. PROTECTION OF HIGHWAYS AND RAILROADS. Contractor will make suitable arrangements with governmental authorities and railroads for the construction of all structures, whether underneath or over roads, railroads or rights-of-way to protect the public from accident or delay. Contractor will repair, at its

own expense, to the satisfaction of the governmental authorities or other owners, all roads, railroads and bridges that may be damaged by, or given undue wear due to the Work.

11. CLEANING UP

11.1 Contractor will at all times keep the Work Site free of waste materials or rubbish caused by the Work. After completing the Work, Contractor will remove all its waste materials, rubbish, tools, supplies, equipment and surplus materials from and about the Work Site.

11.2 If Contractor fails to keep the Work Site clean or to clean up after completing the Work, Company may do so and charge all costs of cleaning up to Contractor. Those costs may be deducted from the final payment to Contractor.

12. COLLATERAL WORK. Company and other contractors may be working at the Work Site. Company reserves the right to coordinate the performance of Contractor's Work with the work of others. Contractor will cooperate with and will not delay, impede or otherwise impair the work of others. Company does not guarantee Contractor continuous uninterrupted access to the Work Site, but will provide such access as good construction practices will allow, considering the other activities in the area.

13. ALCOHOLIC BEVERAGES, DRUGS AND WEAPONS. Contractor will inform all members of Contractor Group who may be involved in the performance of any Work of the following Company rules relating to alcoholic beverages, drugs and weapons, with which all personnel are expected to comply:

13.1 Bringing, attempting to bring, possessing, using or being under the influence of intoxicants, drugs, or narcotics while on any Company Property, including but not limited to parking areas, is prohibited. Possessing alcoholic beverages in sealed containers is permitted, however, in designated parking areas.

13.2 Prescription or over-the-counter medications that could affect the performance of safety-sensitive work are allowed on Company Property only if they have been previously cleared by Contractor. Contractor must confirm that the medication and dosage do not impair an individual's ability to perform safety-sensitive work before clearing the individual to perform such work while under the influence of the medication.

13.3 Bringing, attempting to bring, possessing or using firearms, whether classified as legal or illegal, while on any Company Property, including but not limited to buildings, parking areas, recreation facilities, equipment and vehicles, is prohibited, unless otherwise required by applicable law. Use or possession of firearms for specific situations is permitted if approved by function or higher level management of Company.

13.4 Off-the-job involvement with intoxicants, illegal drugs, or illegal narcotics that adversely affects Company's business, to include impairing the individual's ability to perform his job or the public trust in the safe operation of Company, is prohibited.

13.5 Any conduct on any Company Property which is in violation of any state or federal law or regulation is considered a violation of these rules and a breach of any agreement to which these policies are attached.

13.6 In order to enforce these rules, all individuals with access to any Company Property as well as the vehicles, offices, lockers and any personal belongings of such individuals on any Company Property are subject to search by Company and its agents, to include security representatives appointed or employed by Company. Individuals may be required to take a blood, urinalysis or Breathalyzer test, or submit to other recognized investigatory tests or procedures as are deemed appropriate or necessary by Company in the investigation of a violation of these rules.

14. TITLE AND RIGHT. Nothing in the Agreement will vest Contractor with any right of property in materials used after they have been attached to or incorporated into the Work, nor materials for which Contractor has received full or partial payment. All those materials, upon being so attached, incorporated or paid for, will become the property of Company. Any gravel, sand, stone, minerals, timber or other materials excavated, uncovered, developed or obtained in the Work, or on any land belonging to Company may be used, in the performance of the Work, provided such materials meet the requirements of this Agreement. Any objects or natural materials or animals excavated or exposed that may have historical significance or constitute a threatened or endangered species must be brought to the attention of Company.

15. PROTECTION AGAINST LIENS AND ENCUMBRANCES

15.1 Contractor will not at any time permit any lien, attachment or other encumbrance ("Encumbrance") by any person or persons whosoever or by reason of any claim or demand against Contractor to be placed or remain on the property of Company, including, but not limited to, the Work Site upon which Work is being performed or equipment and materials that are being furnished. To prevent an Encumbrance from being placed on the property of Company, Contractor will furnish during the progress of any Work, as requested from time to time, verified statements showing Contractor's total outstanding indebtedness in connection with the Work.

15.2 If Contractor allows any indebtedness to accrue to subcontractors or others and fails to pay or discharge that indebtedness within five (5) days after demand, then Company may withhold any money due Contractor until that indebtedness is paid or pay the indebtedness and apply that amount against the money due Contractor.

15.3 If Contractor allows any Encumbrances, whether valid or invalid to be placed on the property of Company, any and all claims or demands for payment to Contractor will be denied by Company until the Encumbrance is removed. If the Encumbrance is not removed immediately, Company may pay that claim or demand and deduct the amount paid, together with all related expenses, including attorneys' fees, from any further payment due Contractor, or at Company's election, Contractor will, upon demand, reimburse Company for the amount paid and all related expenses. Any payment made in good faith by Company will be binding on Contractor.

16. TERMINATION FOR DEFAULT

16.1 If a petition in bankruptcy should be filed by Contractor, or if Contractor should make a general assignment for the benefit of creditors, or if a receiver should be appointed due to the insolvency of Contractor, or if Contractor should refuse or fail to supply enough properly skilled workmen or proper equipment, materials or services or should fail to make prompt payment to subcontractors, or to pay promptly for materials or labor, or disregard laws, ordinances or the instruction of Company's Contract Coordinator, or if Contractor should refuse or fail to abide by the SOW Construction Schedule or otherwise violate any provisions of the Agreement or SOW, then Company, upon a determination by Company's Contract Coordinator that sufficient cause exists to justify such action, may, without prejudice to any other right or remedy available to it after giving Contractor seven (7) days' written notice, terminate the Agreement or the SOW and take possession of the Work Site. In the event of such a termination, Company may use all or part of Contractor's equipment and materials and may finish the Work by whatever method Company may deem expedient. In such event, Contractor will not be entitled to receive any further payment hereunder until the Work is finished. If the unpaid balance of the SOW fees will exceed the expense of finishing the Work, including compensation of Company's Contract Coordinator, other Company personnel, third party engineering companies, or other contractors for additional services, such excess will be paid to Contractor. If the expense of finishing the Work will exceed such unpaid balance, Contractor will pay the difference to Company within fifteen (15) days of receiving an invoice for same. The expenses incurred by Company herein, and the damage incurred through Contractor's default, will be determined by Company's Contract Coordinator, in its sole discretion, and such determination will be binding as between the parties.

16.2 In the event of a termination under the provisions of this Section 3, Contractor will transfer and assign to Company, in accordance with Company's instructions, all Work, all construction records, reports, permits, data and information, other materials (including all Company-supplied materials), supplies, Work in progress and other goods for which Contractor is entitled to receive reimbursement hereunder, and any and all plans, drawings, sketches, specifications, and information in connection with the Work, and will take such action as may be necessary to secure Company, at Company's sole election, the rights of Contractor under any or all orders and subcontracts made in connection with the Work.

16.3 In the event that Company so directs or authorizes, Contractor will sell at a price approved by Company, or retain at a mutually agreeable price, any such materials, supplies, Work in progress, or other goods as referred to in the preceding paragraph. In any event, Company will receive any and all records, plans, drawings, data, permits, specifications, sketches, reports, or other information relating to the Work. The proceeds of any such sale or the agreed price will be paid or credited to Company in such manner as Company may direct so as to reduce the amount payable by Company under this Section 3.

## APPENDIX D
## COVID-19 SITE ENTRY GUIDELINES

COVID-19 Vistra Site Entry Guidelines – *Effective: June 17, 2021*
These guidelines are applicable to ALL PERSONNEL entering Vistra work sites.

**To enter a Vistra work site, each person must answer the following three questions with a "no" answer *and* pass the required temperature testing *unless* they display their Vistra vaccination sticker on their employee badge or hardhat:**

Site Entry Questions:

1. In the past 10 days, have you tested positive for COVID-19 or are you currently waiting on test results?

2. In the past 10 days, have you been within six feet of someone, where masks were not worn, who:
    a. has tested positive for COVID-19,
    b. is known to be waiting on test results for COVID-19, or
    c. is under a quarantine order?

3. In the past 10 days, have you or someone who has been within six feet of you where masks were not worn had:
    a. flu-like symptoms,
    b. a deep, dry cough,
    c. recent shortness of breath or difficulty breathing,
    d. new loss of taste or smell, and/or
    e. fever of 100 degrees or above?

Temperature Testing:

You must register a temperature between 96- and 100-degrees Fahrenheit as described in the temperature procedures. (see next page for testing procedures)

- If your temperature is below 96 degrees, retest with a different device.
- If your temperature is 100-degrees Fahrenheit or above, retest on another device preferably an ear thermometer, if your temperature still registers 100-degrees Fahrenheit or above you may not enter the site.

## Clearance to enter the site:

- If you have answered **"no"** to all three questions ***and*** passed the temperature test, you may enter the site.
- ***If you have an approved Vistra vaccination sticker, you are cleared to enter the site without the temperature test or answering COVID screening questions.***
- If you passed the temperature test ***and*** answered "Yes" to any of the questions, but have been cleared through VistraTravelerSafety (HR clearance) to enter the Vistra work site for that instance of exposure, testing, or symptoms, you may enter the site.

Anyone *not* cleared to enter the work site must immediately leave the work site and notify their supervisor who will notify HR at VistraTravelerSafety@vistracorp.com for next steps.

**Any symptomatic employee, unvaccinated employee exposed to COVID-19 or any employee tested for COVID-19 as described above must be cleared through VistraTravelerSafety prior to returning to work.**

Required Temperature Testing Procedures:

All persons entering the site without a Vistra vaccination sticker, who have cleared all questions above, will also submit to temperature testing or self-administer a temperature test as required by the facility management. If a self-administered test is required, then a member of the management team or their designee will witness the testing; however, where that is not practicable, each person must attest that they are only entering the site premises because they have passed the screening questions and temperature test required for entry. Also:

a. Hats may cause false high temperatures and should not be worn for five minutes immediately preceding a forehead temperature test.
b. Each person is responsible for ensuring all self-testing materials and areas touched during testing are sanitized.
c. All personnel should maintain a **distance of at least six feet** from other people during this process or wear required masks.

Temperature Testing Requirements:

1. **All persons entering the site without a Vistra vaccination sticker must register a temperature between 96- and 100-degrees Fahrenheit. Any such person who has a temperature not within that range or who triggers an alarm on a thermal camera** must **retest with a different device**, preferably an **ear thermometer**, if available. If the second test registers a temperature of 100 degrees or above:
    a. That person **may not enter** the Vistra work site and must notify their supervisor, who will notify HR at VistraTravelerSafety@vistracorp.com for next steps.
    b. If there is significant inconsistency between the two tests, repeat another temperature test and use the two closest readings.
2. **Anyone who registers a temperature between 96- and 100-degrees Fahrenheit** may proceed to their work site.
    - **If temperature is below 96 degrees, wait a few minutes and retest with a different device.**

Control rooms and communal areas:

***All persons entering the site without a Vistra vaccination sticker should maintain at least six-feet distance from other people as much as possible and should wear face coverings when six-feet distance is not feasible. No one should gather in communal areas (including the temperature-testing area) without a Vistra vaccination sticker. Only operators are allowed in control rooms without plant manager approval.***

Vistra Vaccination Sticker protocols:

***All persons with a valid Vistra vaccination sticker do not have to socially distance or wear masks while at the site. They will also not be required to quarantine as a part of COVID-19 exposures unless exhibiting COVID-19 symptoms. To be eligible for these protocols, each person must have their approved Vistra vaccination sticker easily visible at all times while at work***. If someone who has applied for a Vistra vaccination sticker believes they have specific health conditions that may affect the ability to have a full immune response to the vaccination, please consult your health provider prior to working without a mask.

**Any symptomatic employee, unvaccinated employee exposed to COVID-19 or any employee tested for COVID-19 as described above must be cleared through VistraTravelerSafety prior to returning to work.**

# APPENDIX E
# SAFETY DATA SHEETS

DYNEGY

# Safety Data Sheet

## Section 1
## Identification of the Substance and of the Supplier

### 1.1 Product Identifier

| | |
|---|---|
| **Product Name/Identification:** | ASTM Bottom Ash |
| **Synonyms:** | Ash; Ashes; Ash residues; Ashes, residues, bottom; Bottom ash; Bottom ash residues; Coal Fly Ash; Pozzolan; Waste solids. |
| **Formula:** | UVCB Substance |

### 1.2 Relevant Identified Uses of the Substance or Mixture and Uses Advices Against

| | |
|---|---|
| **Relevant Identified Uses:** | Component of wallboard, concrete, roofing material, bricks, cement kiln feed. |
| **Uses Advised Against:** | None known. |

### 1.3 Details of the Supplier of the SDS

| | |
|---|---|
| **Manufacturer/Supplier:** | Dynegy, Inc. |
| **Street Address:** | 601 Travis Street, Suite 1400 |
| **City, State and Zip Code:** | Houston, TX 77002 |
| **Customer Service Telephone:** | 800-633-4704 |

**Section 2**
**Hazards Identification**

## 2.1 Classification of the Substance

**GHS Classification(s) according to OSHA Hazard Communication Standard (29 CFR 1910.1200):**

- Eye Irritant, Category 2A
- STOT-SE, Category 3 (Respiratory Irritation)
- Carcinogen, Category 1A
- STOT-RE, Category 1 (Lungs)
- Toxic to Reproduction, Category 2

## 2.2 Label Elements

| ***Labelling according to 29 CFR 1910.1200 Appendices A, B and C**** | |
|---|---|
| ***Hazard Pictogram(s):*** |  |
| ***Signal word:*** | **DANGER** |
| ***Hazard Statement(s):*** | *Causes serious eye irritation.*<br>*May cause respiratory irritation.*<br>*May cause damage to lungs after repeated/prolonged exposure via inhalation.*<br>*May cause cancer of the lung.*<br>*Suspected of damaging fertility or the unborn child.* |
| ***Precautionary Statement(s):*** | *Obtain special instructions before use.*<br>*Do not handle until all safety precautions have been read and understood.*<br>*Avoid breathing dust.*<br>*Wash thoroughly after handling.*<br>*Do not eat drink or smoke when using this product.*<br>*Wear protective gloves/protective clothing/eye protection/face protection.*<br>*Use outdoors or in a well-ventilated area.*<br>*If exposed or concerned: Get medical advice/attention.*<br>*Store in a secure area.*<br>*Dispose of product in accordance with local/national regulations.* |

** Fly ash and other coal combustion products (CCPs) are UVCB substances (unknown or variable composition or biological). Various CCPs, noted as ashes/ash residuals; Ashes, residues, bottom; Bottom ash; Bottom ash residues; Waste solids, ashes under TSCA are defined as: "The residuum from the burning of a combination of carbonaceous materials. The following elements may be present as oxides: aluminum, calcium, iron, magnesium, nickel, phosphorus, potassium, silicon, sulfur, titanium, and vanadium." Ashes including fly ash and fluidized bed combustion ash are identified by CAS number 68131-74-8. The exact composition of the ash is dependent on the fuel source and flue additives composed of many constituents. The classification of the final substance is dependent on the presence of specific identified oxides as well as other trace elements.*

## 2.3 Other Hazards

**Listed Carcinogens:**

**-Respirable Crystalline Silica**

**IARC:** [Yes] **NTP:** [Yes] **OSHA:** [Yes] **Other:** **(ACGIH)** [Yes]

## Section 3
## Composition/Information on Ingredients

| *Substance* | *CAS No.* | *Percentage (%)* | *GHS Classification* |
|---|---|---|---|
| *Crystalline Silica* | *14808-60-7* | *20 - 40%* | *Repeat Dose STOT, Category 1*<br>*Carcinogen, Category 1A* |
| *Silica, crystalline respirable (RCS)* | *14808-60-7* | *See Footnote 1* | *Repeat Dose STOT, Category 1*<br>*Carcinogen. Category 1A* |
| *Aluminosilicates*[2] | *Various, see Footnote 2* | *10 - 60%* | *Single Exposure STOT, Category 3* |
| *Calcium oxide (CaO)* | *1305-78-8* | *10 - 30%* | *Skin Irritant, Category 2*<br>*Eye Irritant, Category 1*<br>*Single Exposure STOT, Category 3* |
| *Iron oxide* | *1309-37-1* | *1 - 10%* | *Not Classified* |
| *Manganese dioxide ($MnO_2$)* | *1313-13-9* | *<2%* | *Skin Irritant, Category 2*<br>*Eye Irritant, Category 2B* |
| *Magnesium oxide* | *1309-48-4* | *2 - 10%* | *Not Classified* |
| *Phosphorus pentoxide ($P_2O_5$)* | *1314-56-3* | *≤2%* | *Skin Irritant, Category 2*<br>*Eye Irritant, Category 2B* |
| *Sodium oxide* | *1313-59-3* | *1 - 10%* | *Not Classified* |
| *Potassium oxide ($K_2O$)* | *12136-45-7* | *≤1%* | *Skin Irritant Category 2*<br>*Eye Irritant Category 2B* |
| *Titanium dioxide ($TiO_2$)* | *13463-67-7* | *<3%* | *Not Classified* |
| *Bromide salt (calcium)* | *7789-41-5* | *See Footnote 3* | *Toxic to Reproduction Category 2* |

*[1]The percentage of respirable crystalline silica has not been determined. Therefore, a GHS classification of Carcinogen 1A has been assigned.*

*[2]Aluminosilicates (CAS# 1327-36-2) may be in the form of mullite (CAS# 1302-93-8); aluminosilicate glass; pozzolans (CAS# 71243-67-9); or calcium aluminosilicates such as tricalcium aluminate (C3A), or calcium sulfoaluminate (C4A3S). The form is dependent on the source of the coal and or the process used to create the CCP. Pulverized coal combustion would be more likely to create high levels of pozzolans. Aluminosilicates may have inclusions of calcium, titanium, iron, potassium, phosphorus, magnesium and other metal oxides.*

*[3]Analytical data are not available to demonstrate that the concentration of bromide salt is <0.1%; therefore, a GHS classification of Toxic to Reproduction Category 2 has been assigned.*

## Section 4
## First Aid Measures

### 4.1 Description of First Aid Measures

| | |
|---|---|
| **Inhalation:** | If product is inhaled and irritation of the nose or coughing occurs, remove person to fresh air. Get medical advice/attention if respiratory symptoms persist. |
| **Skin Contact:** | If skin exposure occurs, wash with soap and water. |
| **Eye Contact:** | If product gets into the eye, rinse copiously with water for several minutes. Remove contact lenses, if present and easy to do. Seek medical attention/advice if irritation occurs or persists. |
| **Ingestion:** | No specific first aid measures are required. |

### 4.2 Most Important Health Effects, Both Acute and Delayed

**Acute Effects:** Direct exposure may cause respiratory irritation, eye irritation and skin irritation. The product dust can dry and irritate the skin and cause dermatitis and can irritate eyes and skin through mechanical abrasion.

**Chronic Effects:** Chronic exposure may cause lung damage from repeated exposure. Prolonged inhalation of respirable crystalline silica above certain concentrations may cause lung diseases, including silicosis and lung cancer. Repeated exposure to dusts containing inorganic bromide salts may affect fertility and/or result in effects to the unborn child.

### 4.3 Indication of Any Immediate Medical Attention and Special Treatment Needed

Seek first aid or call a doctor or Poison Control Center if contact with eyes occurs and irritation remains after rinsing. Get medical advice if inhalation occurs and respiratory symptoms persist.

## Section 5
## Firefighting Measures

### 5.1 Extinguishing Media

| | |
|---|---|
| **Suitable Extinguishing Media:** | Product is not flammable. Use extinguishing media appropriate for surrounding fire. |
| **Unsuitable Extinguishing Media:** | Not applicable, the product is not flammable. |

### 5.2 Special Hazards Arising from the Substance or Mixture

| | |
|---|---|
| **Hazardous Combustion Products:** | None known. |

### 5.3 Advice for Firefighters

| | |
|---|---|
| **Special Protective Equipment and Precautions for Firefighters:** | As with any fire, wear self-contained breathing apparatus (NIOSH approved or equivalent) and full protective gear. |

## Section 6
## Accidental Release Measures

### 6.1 Personal Precautions, Protective Equipment and Emergency Procedures

| | |
|---|---|
| **Personal precautions/Protective Equipment:** | See Section 8.2.2 Individual Protective Measures. For concentrations exceeding Occupational Exposure Levels (OELs), use a self-contained breathing apparatus (SCBA). |
| **Emergency procedures:** | Use scooping, water spraying/flushing/misting or ventilated vacuum cleaning systems to clean up spills. Do not use pressurized air. |

### 6.2 Environmental Precautions

| | |
|---|---|
| **Environmental precautions:** | Prevent contamination of drains or waterways and dispose according to local and national regulations. |

### 6.3 Methods and Material for Containment and Cleaning Up

| | |
|---|---|
| **Methods and materials for containment and cleaning up:** | Do not use brooms or compressed air to clean surfaces. Use dust collection vacuum and extraction systems.<br>Large spills of dry product should be removed by a vacuum system. Dampened material should be removed by mechanical means and recycled or disposed of according to local and national regulations. |

See Sections 8 and 13 for additional information on exposure controls and disposal.

## Section 7
## Handling and Storage

### 7.1 Precautions for Safe Handling

Practice good housekeeping. Use adequate exhaust ventilation, dust collection and/or water mist to maintain airborne dust concentrations below permissible exposure limits (note: respirable crystalline silica dust may be in the air without a visible dust cloud).

Do not permit dust to collect on walls, floors, sills, ledges, machinery, or equipment. Maintain and test ventilation and dust collection equipment. In cases of insufficient ventilation, wear a NIOSH approved respirator for silica dust when handling or disposing dust from this product. Avoid contact with skin and eyes. Wash or vacuum clothing that has become dusty. Avoid eating, smoking, or drinking while handling the material.

### 7.2 Conditions for Safe Storage, Including any Incompatibilities

Minimize dust produced during loading and unloading.

## Section 8
## Exposure Controls/Personal Protection

### 8.1 Control Parameters

| OCCUPATIONAL EXPOSURE LIMITS | | | | | |
|---|---|---|---|---|---|
| **SUBSTANCE** | | **OSHA PEL TWA ($mg/m^3$)** | **NIOSH REL TWA ($mg/m^3$)** | **ACGIH TLV TWA ($mg/m^3$)** | **CA - OSHA PEL ($mg/m^3$)** |
| **Calcium oxide** | | 5 | 2 | 2 | 2 |
| **Particulates Not Otherwise Regulated** | Total | 15 | 15 | 10 | 10 |
| | Respirable | 5 | 5 | 3 | 5 |
| **Respirable Crystalline Silica** | Respirable | 0.05 | 0.05 | 0.025 | 0.05 |
| **Manganese dioxide (as manganese compounds)** | Total | 5 (Ceiling) | 1<br>3 (STEL) | 0.1 | 0.2 |
| | Respirable | - | - | 0.02 | - |

### 8.2 Exposure Controls

#### 8.2.1 Engineering Controls

Provide ventilation to maintain the ambient workplace atmosphere below the occupational exposure limit(s). Use general and local exhaust ventilation and dust collection systems as necessary to minimize exposure.

#### 8.2.2 Personal Protective Equipment (PPE)

| | |
|---|---|
| **Respiratory protection:** | Wear a NIOSH approved particulate respirator if exposure to airborne particulates is unavoidable and where occupational exposure limits may be exceeded. If airborne exposures are anticipated to exceed applicable PELs or TLVs, a self-contained breathing apparatus or airline respirator is recommended. |
| **Eye and face protection:** | If eye contact is possible, wear protective glasses with side shields. Avoid contact lenses. |
| **Hand and skin protection:** | Wear gloves and protective clothing. Wash hands with soap and water after contact with material. |

## Section 9
## Physical and Chemical Properties

### 9.1 Information on Basic Physical and Chemical Properties

| Property: Value | Property: Value |
|---|---|
| **Appearance (physical state, color, etc.):** Fine tan/ gray particulate | **Upper/lower flammability or explosive limits:** Not applicable |
| **Odor:** Odorless[1] | **Vapor Pressure (Pa):** Not applicable |
| **Odor threshold:** Not applicable | **Vapor Density:** Not applicable |
| **pH (25 °C) (in water):** 8 - 11 | **Specific gravity or relative density:** 2.2 – 2.9 |
| **Melting point/freezing point (°C):** Not applicable | **Water Solubility:** Slight |
| **Initial boiling point and boiling range (°C):** Not applicable | **Partition coefficient: n-octane/water:** Not determined |
| **Flash point (°C):** Not determined | **Auto ignition temperature (°C):** Not applicable |
| **Evaporation rate:** Not applicable | **Decomposition temperature (°C):** Not determined |
| **Flammability (solid, gas):** Not combustible | **Viscosity:** Not applicable |

[1] The use of urea or aqueous ammonia injected into the flue gas to reduce nitrogen oxides (NOx) emissions may result in the presence of ammonium sulfate or ammonium bisulfate in the ash at less than 0.1%. When ash containing these substances becomes wet under high pH (>9), free ammonia gas may be released resulting in objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces.

## Section 10
## Stability and Reactivity

| | |
|---|---|
| **10.1 Reactivity:** | The material is an inert, inorganic material primarily composed of elemental oxides. |
| **10.2 Chemical stability:** | The material is stable under normal use conditions. |
| **10.3 Possibility of hazardous reactions:** | The material is a relatively stable, inert material; however, when ash containing ammonia becomes wet under high pH (>9), free ammonia gas may be released resulting in an objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces. Polymerization will not occur. |
| **10.4 Conditions to avoid:** | Product can become airborne in moderate winds.  Dry material should be stored in silos.  Materials stored out of doors should be covered or maintained in a damp condition. |
| **10.5 Incompatible materials:** | None known. |
| **10. 6 Hazardous decomposition products:** | None known. |

# Section 11
# Toxicological Information

## 11.1 Information on Toxicological Effects

| Endpoint | Data |
|---|---|
| **Acute oral toxicity** | LD50 > 2000 mg/kg |
| **Acute dermal toxicity** | LD50 > 2000 mg/kg |
| **Acute inhalation toxicity** | LD50 > 5.0 mg/L |
| **Skin corrosion/irritation** | Does not meet the classification criteria but may cause slight skin irritation. Product dust can dry the skin which can result in irritation. |
| **Eye damage/irritation** | Causes serious eye irritation. Positive scores for conjunctiva irritation and chemosis in 2/3 animals based on average of 24, 48 and 72-hour scores with irritation clearing within 21 days; no corneal or iritis effects observed. |
| **Respiratory/skin sensitization** | Not a respiratory or dermal sensitizer. |
| **Germ cell mutagenicity** | Not mutagenic in in-vitro and in-vivo assays with or without metabolic activation. |
| **Carcinogenicity** | Not available. Respirable crystalline silica has been identified as a carcinogen by OSHA, NTP, ACGIH and IARC. |
| **Reproductive toxicity** | No developmental toxicity was observed in available animal studies. Reproductive studies on CCPs showed either no reproductive effects, or some effects on male and female reproductive organs and parameters but without a clear dose response.<br><br>Inorganic bromide salts have been shown to have adverse effects on reproductive parameters in some animal studies. |
| **STOT-SE** | CCPs when present as a nuisance dust may result in respiratory irritation. |
| **STOT-RE** | In a 180-day inhalation study with fly ash dust, no effects were observed at the highest dose tested. NOEC = 4.2 mg/m$^3$; it is not possible to assess the level at which toxicologically significant effects may occur.<br><br>Repeated inhalation exposures to high levels of respirable crystalline silica may result in lung damage (i.e., silicosis). |
| **Aspiration Hazard** | Not applicable based product form. |

# Section 12
# Ecological Information

## 12.1 Toxicity

| | |
|---|---|
| **Fly Ash (CAS# 68131-74-8)** | |
| **Toxicity to Fish** | LC50 > 100 mg/L |
| **Toxicity to Aquatic Invertebrates** | Data indicates that the test substance is not toxic to *Daphnia magna* (EC50 undetermined) |
| **Toxicity to Aquatic Algae and Plants** | EC50 = 10 mg/L |
| **Calcium oxide CAS# 1305-78-8** | |
| **Toxicity to Fish** | LC50 = 50.6 mg/L<br>The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects. |
| **Toxicity to Aquatic Invertebrates** | EC50 = 49.1 mg/L<br>The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects. |
| **Toxicity to Aquatic Algae and Plants** | NOEC =48 mg/L @ 72 hours based on $Ca(OH)_2$<br>The initial pH of the test medium was not directly related to the biologically relevant effects. The formation of precipitates is likely the result of the reaction between $CO_2$ dissolved in the medium. |

## 12.2 Persistence and Degradability

Not relevant for inorganic materials.

## 12.3 Bioaccumulative Potential

This material does not contain any compounds that would bioaccumulate up the food chain.

## 12.4 Mobility in Soil

No data available.

## 12.5 Results of PBT and vPvB Assessment

This material does not contain any compounds classified as “persistent, bioaccumulative or toxic” nor as “very persistent/very bioaccumulative”.

## 12.6 Other Adverse Effects

None known.

## Section 13
## Disposal Considerations

See Sections 7 and 8 above for safe handling and use, including appropriate industrial hygiene practices.

Dispose of all waste product and containers in accordance with federal, state and local regulations.

## Section 14
## Transport Information

| | | |
|---|---|---|
| **Regulatory entity:** U.S. DOT | Shipping Name: | Not Regulated |
| | Hazard Class: | Not Regulated |
| | ID Number: | Not Regulated |
| | Packing Group: | Not Regulated |

# Section 15
# Regulatory Information

## 15.1 Safety, Health and Environmental Regulations/Legislation Specific for the Mixture

- TSCA Inventory Status

  All components are listed on the TSCA Inventory.

- California Proposition 65

  The following substances are known to the State of California to be carcinogens and/or reproductive toxicants:

  - Respirable crystalline silica
  - Titanium dioxide

- State Right-to-Know (RTK)

| Component | CAS | MA[1,2] | NJ[3,4] | PA[5] | RI[6] |
|---|---|---|---|---|---|
| Ammonium bisulfate | 7803-63-6 | No | Yes | No | No |
| Ammonium sulfate | 7783-20-2 | Yes | No | Yes | No |
| Calcium oxide | 1305-78-8 | Yes | Yes | Yes | No |
| Iron oxide | 1309-37-1 | Yes | Yes | Yes | No |
| Magnesium oxide | 1309-48-4 | No | Yes | No | No |
| Phosphorus pentoxide (or phosphorus oxide) | 1314-56-3 | Yes | Yes | Yes | No |
| Potassium oxide | 12136-45-7 | No | Yes | No | No |
| Silica-crystalline ($SiO_2$), quartz | 14808-60-7 | Yes | Yes | Yes | No |
| Sodium oxide | 1313-59-3 | No | Yes | No | No |
| Titanium dioxide | 13463-67-7 | Yes | Yes | Yes | Yes |

[1] Massachusetts Department of Public Health, no date
[2] 189th General Court of The Commonwealth of Massachusetts, no date
[3] New Jersey Department of Health and Senior Services, 2010a
[4] New Jersey Department of Health, 2010b
[5] Pennsylvania Code, 1986
[6] Rhode Island Department of Labor and Training, no date

**Section 16**

**Other Information, Including Date of Preparation or Last Revision**

## 16.1 Indication of Changes

Date of preparation or last revision: February 23, 2018

## 16.2 Abbreviations and Acronyms

- ACGIH: American Conference of Industrial Hygienists
- CA: California
- CAS: Chemical Abstract Services
- CCP: Coal Combustion Product
- CFR: Code of Federal Regulations
- EPA: Environmental Protection Agency
- GHS: Globally Harmonized System of Classification and Labelling
- IARC: International Agency for Research on Cancer
- LC50: Concentration resulting in the mortality of 50 % of an animal population
- LD50: Dose resulting in the mortality of 50 % of an animal population
- MA: Massachusetts
- NA: Not Applicable
- NJ: New Jersey
- NOEC: No observed effect concentration
- NIOSH: National Institute of Occupational Safety and Health
- NOx: Nitrogen oxides
- NTP: US National Toxicology Program
- OEL: Occupational Exposure Limit
- OSHA: Occupational Safety and Health Administration
- PA: Pennsylvania
- PBT: Persistent, Toxic and Bioaccumulative
- PEL: Permissible exposure limit
- PPE: Personal Protective Equipment
- REL: Recommended exposure limit
- RI: Rhode Island
- RCS: Respirable Crystalline Silica
- RTK: Right-to-Know
- SCBA: Self-contained breathing apparatus
- SDS: Safety Data Sheet
- STEL: Short-term exposure limit
- STOT-RE: Specific target organ toxicity-repeated exposure
- STOT-SE: Specific target organ toxicity-single exposure
- TLV: Threshold limit value
- TSCA: Toxic Substances Control Act
- TWA: Time-weighted average
- UEL: Upper explosive limit
- UVCB: Unknown or Variable Composition/Biological
- U.S.: United States
- U.S. DOT: United States of Department of Transportation

## 16.3 Other Hazards

| **Hazardous Materials Identification System (HMIS)**<br><br>Degree of hazard (0= low, 4 = extreme) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Health:** | 2* | **Flammability:** | 0 | **Physical Hazards:** | 0 | **Personal protection:**** | |

** Chronic Health Effects*
******** *Appropriate personal protection is defined by the activity to be performed.*
*See Section 8 for additional information.*

**DISCLAIMER:**

*This SDS has been prepared in accordance with the Hazard Communication Rule 29 CFR 1910.1200. Information herein is based on data considered to be accurate as of date prepared. No warranty or representation, express or implied, is made as to the accuracy or completeness of this data and safety information. No responsibility can be assumed for any damage or injury resulting from abnormal use, failure to adhere to recommended practices, or from any hazards inherent in the nature of the product.*

DYNEGY

# Safety Data Sheet

## Section 1
## Identification of the Substance and of the Supplier

### 1.1 Product Identifier

| | |
|---|---|
| **Product Name/Identification:** | ASTM Class C Fly Ash |
| **Synonyms:** | Coal Fly Ash, Pozzolan |
| **Formula:** | UVCB Substance |

### 1.2 Relevant Identified Uses of the Substance or Mixture and Uses Advices Against

| | |
|---|---|
| **Relevant Identified Uses:** | Component of wallboard, concrete, roofing material, bricks, cement kiln feed. |
| **Uses Advised Against:** | None known. |

### 1.3 Details of the Supplier of the SDS

| | |
|---|---|
| **Manufacturer/Supplier:** | Dynegy, Inc. |
| **Street Address:** | 601 Travis Street, Suite 1400 |
| **City, State and Zip Code:** | Houston, TX 77002 |
| **Customer Service Telephone:** | 800-633-4704 |

# Section 2
# Hazards Identification

## 2.1 Classification of the Substance

**GHS Classification(s) according to OSHA Hazard Communication Standard (29 CFR 1910.1200):**

- Eye Irritant, Category 2A
- STOT-SE, Category 3 (Respiratory Irritation)
- Carcinogen, Category 1A
- STOT-RE, Category 1 (Lungs)
- Toxic to Reproduction, Category 2

## 2.2 Label Elements

| ***Labelling according to 29 CFR 1910.1200 Appendices A, B and C**** | |
|---|---|
| ***Hazard Pictogram(s):*** |  |
| ***Signal word:*** | **DANGER** |
| ***Hazard Statement(s):*** | *Causes serious eye irritation.*<br>*May cause damage to lungs after repeated/prolonged exposure via inhalation.*<br>*May cause respiratory irritation.*<br>*May cause cancer of the lung.*<br>*Suspected of damaging fertility or the unborn child.* |
| ***Precautionary Statement(s):*** | *Obtain special instructions before use.*<br>*Do not handle until all safety precautions have been read and understood.*<br>*Avoid breathing dust.*<br>*Wear protective gloves/protective clothing/eye protection/face protection.*<br>*Wash thoroughly after handling.*<br>*Do not eat drink or smoke when using this product.*<br>*Use outdoors or in a well-ventilated area.*<br>*If exposed or concerned: Get medical advice/attention.*<br>*Store in a secure area.*<br>*Dispose of product in accordance with local/national regulations.* |

** Fly ash and other coal combustion products (CCPs) are UVCB substances (unknown or variable composition or biological). Various CCPs, noted as ashes/ash residuals; Ashes, residues, bottom; Bottom ash; Bottom ash residues; Waste solids, ashes under TSCA are defined as: "The residuum from the burning of a combination of carbonaceous materials. The following elements may be present as oxides: aluminum, calcium, iron, magnesium, nickel, phosphorus, potassium, silicon, sulfur, titanium, and vanadium." Ashes including fly ash and fluidized bed combustion ash are identified by CAS number 68131-74-8. The exact composition of the ash is dependent on the fuel source and flue additives composed of many constituents. The* *classification of the final substance is dependent on the presence of specific identified oxides as well as other trace elements.*

## 2.3 Other Hazards

**Listed Carcinogens:**

**-Respirable Crystalline Silica**

**IARC:** [Yes] **NTP:** [Yes] **OSHA:** [Yes] **Other:** **(ACGIH)** [Yes]

## Section 3
## Composition/Information on Ingredients

| Substance | CAS No. | Percentage (%) | GHS Classification |
|---|---|---|---|
| Crystalline Silica | 14808-60-7 | 30 - 60% | Repeat Dose STOT, Category 1<br>Carcinogen, Category 1A |
| Silica, crystalline respirable (RCS) | 14808-60-7 | See Footnote 1 | Repeat Dose STOT, Category 1<br>Carcinogen, Category 1A |
| Aluminosilicates | 71243-67-9<br>1327-36-2 | 30 - 60% | Single Exposure STOT, Category 3 |
| Iron oxide | 1309-37-1 | 1 - 10% | Not Classified |
| Calcium oxide (CaO) | 1305-78-8 | 20 - 30% | Skin Irritant, Category 2<br>Eye Irritant, Category 1<br>Single Exposure STOT, Category 3 |
| Magnesium oxide | 1309-48-4 | 2 - 10% | Not Classified |
| Phosphorus pentoxide ($P_2O_5$) | 1314-56-3 | ≤2% | Skin Irritant, Category 2<br>Eye Irritant, Category 2B |
| Sodium oxide | 1313-59-3 | 1-8% | Not Classified |
| Potassium oxide ($K_2O$) | 12136-45-7 | ≤1% | Skin Irritant, Category 2<br>Eye Irritant, Category 2B |
| Titanium dioxide ($TiO_2$) | 13463-67-7 | <3% | Not Classified |
| Bromide salt (calcium) | 7789-41-5 | See Footnote 2 | Toxic to Reproduction, Category 2 |

*Footnote 1: The percentage of respirable crystalline silica has not been determined. Therefore, a GHS classification of Carcinogen, Category 1A has been assigned.*

*Footnote 2: Analytical data are not available to demonstrate that the concentration of bromide salt is <0.1%; therefore, a GHS classification of Toxic to Reproduction, Category 2 has been assigned.*

## Section 4
## First Aid Measures

### 4.1 Description of First Aid Measures

| | |
|---|---|
| **Inhalation:** | If product is inhaled and irritation of the nose or coughing occurs, remove person to fresh air. Get medical advice/attention if respiratory symptoms persist. |
| **Skin Contact:** | If skin exposure occurs, wash with soap and water. |
| **Eye Contact:** | If product gets into the eye, rinse copiously with water for several minutes. Remove contact lenses, if present and easy to do. Seek medical attention/advice if irritation occurs or persists. |
| **Ingestion:** | No specific first aid measures are required. |

### 4.2 Most Important Health Effects, Both Acute and Delayed

**Acute Effects:** Direct exposure may cause respiratory irritation, eye irritation and skin irritation. The product dust can dry and irritate the skin and cause dermatitis and can irritate eyes and skin through mechanical abrasion.

**Chronic Effects:** Chronic exposure may cause lung damage from repeated exposure. Prolonged inhalation of respirable crystalline silica above certain concentrations may cause lung diseases, including silicosis and lung cancer. Repeated exposure to dusts containing inorganic bromide salts may affect fertility and/or result in effects to the unborn child.

### 4.3 Indication of Any Immediate Medical Attention and Special Treatment Needed

Seek first aid or call a doctor or Poison Control Center if contact with eyes occurs and irritation remains after rinsing. Get medical advice if inhalation occurs and respiratory symptoms persist.

# Section 5
# Firefighting Measures

## 5.1 Extinguishing Media

| | |
|---|---|
| **Suitable Extinguishing Media:** | Product is not flammable. Use extinguishing media appropriate for surrounding fire. |
| **Unsuitable Extinguishing Media:** | Not applicable, the product is not flammable. |

## 5.2 Special Hazards Arising from the Substance or Mixture

| | |
|---|---|
| **Hazardous Combustion Products:** | None known. |

## 5.3 Advice for Firefighters

| | |
|---|---|
| **Special Protective Equipment and Precautions for Firefighters:** | As with any fire, wear self-contained breathing apparatus (NIOSH approved or equivalent) and full protective gear. |

# Section 6
# Accidental Release Measures

## 6.1 Personal Precautions, Protective Equipment and Emergency Procedures

| | |
|---|---|
| **Personal precautions/Protective Equipment:** | See Section 8.2.2 Individual Protective Measures. For concentrations exceeding Occupational Exposure Levels (OELs), use a self-contained breathing apparatus (SCBA). |
| **Emergency procedures:** | Use scooping, water spraying/flushing/misting or ventilated vacuum cleaning systems to clean up spills. Do not use pressurized air. |

## 6.2 Environmental Precautions

| | |
|---|---|
| **Environmental precautions:** | Prevent contamination of drains or waterways and dispose according to local and national regulations. |

## 6.3 Methods and Material for Containment and Cleaning Up

| | |
|---|---|
| **Methods and materials for containment and cleaning up:** | Do not use brooms or compressed air to clean surfaces. Use dust collection vacuum and extraction systems.<br>Large spills of dry product should be removed by a vacuum system. Dampened material should be removed by mechanical means and recycled or disposed of according to local and national regulations. |

See Sections 8 and 13 for additional information on exposure controls and disposal.

# Section 7
# Handling and Storage

## 7.1 Precautions for Safe Handling

Practice good housekeeping. Use adequate exhaust ventilation, dust collection and/or water mist to maintain airborne dust concentrations below permissible exposure limits (note: respirable crystalline silica dust may be in the air without a visible dust cloud).

Do not permit dust to collect on walls, floors, sills, ledges, machinery, or equipment. Maintain and test ventilation and dust collection equipment. In cases of insufficient ventilation, wear a NIOSH approved respirator for silica dust when handling or disposing dust from this product. Avoid contact with skin and eyes. Wash or vacuum clothing that has become dusty. Avoid eating, smoking, or drinking while handling the material.

## 7.2 Conditions for Safe Storage, Including any Incompatibilities

Minimize dust produced during loading and unloading.

# Section 8
# Exposure Controls/Personal Protection

## 8.1 Control Parameters

| OCCUPATIONAL EXPOSURE LIMITS | | | | | |
|---|---|---|---|---|---|
| **SUBSTANCE** | | **OSHA PEL TWA (mg/m$^3$)** | **NIOSH REL TWA (mg/m$^3$)** | **ACGIH TLV TWA (mg/m$^3$)** | **CA - OSHA PEL (mg/m$^3$)** |
| **Calcium oxide** | | 5 | 2 | 2 | 2 |
| **Particulates Not Otherwise Regulated** | Total | 15 | 15 | 10 | 10 |
| | Respirable | 5 | 5 | 3 | 5 |
| **Respirable Crystalline Silica** | Respirable Crystalline Silica | 0.05 | 0.05 | 0.025 | 0.05 |
| **Titanium dioxide** | Total | 15 | 2.4 (fine)<br>0.3 (ultrafine) | 10 | 10 |
| **Manganese dioxide (as manganese compounds)** | Total | 5 (Ceiling) | 1<br>3 (STEL) | 0.1 | 0.2 |
| | Respirable | - | - | 0.02 | - |

## 8.2 Exposure Controls

### 8.2.1 Engineering Controls

Provide ventilation to maintain the ambient workplace atmosphere below the occupational exposure limit(s). Use general and local exhaust ventilation and dust collection systems as necessary to minimize exposure.

### 8.2.2 Personal Protective Equipment (PPE)

| | |
|---|---|
| **Respiratory protection:** | Wear a NIOSH approved particulate respirator if exposure to airborne particulates is unavoidable and where occupational exposure limits may be exceeded. If airborne exposures are anticipated to exceed applicable PELs or TLVs, a self-contained breathing apparatus or airline respirator is recommended. |
| **Eye and face protection:** | If eye contact is possible, wear protective glasses with side shields. Avoid contact lenses. |
| **Hand and skin protection:** | Wear gloves and protective clothing. Wash hands with soap and water after contact with material. |

## Section 9
## Physical and Chemical Properties

### 9.1 Information on Basic Physical and Chemical Properties

| Property: Value | Property: Value |
|---|---|
| **Appearance (physical state, color, etc.):** Fine tan/ gray particulate | **Upper/lower flammability or explosive limits:** Not applicable |
| **Odor:** Odorless[1] | **Vapor Pressure (Pa):** Not applicable |
| **Odor threshold:** Not applicable | **Vapor Density:** Not applicable |
| **pH (25 °C) (in water):** Not Determined | **Specific gravity or relative density:** 2.2 – 2.9 |
| **Melting point/freezing point (°C):** Not applicable | **Water Solubility:** Slight |
| **Initial boiling point/boiling range (°C):** NA | **Partition coefficient: n-octane/water:** NA |
| **Flash point (°C):** Not determined | **Auto ignition temperature (°C):** Not applicable |
| **Evaporation rate:** Not applicable | **Decomposition temperature (°C):** Not determined |
| **Flammability (solid, gas):** Not combustible | **Viscosity:** Not applicable |

[1] The use of urea or aqueous ammonia injected into the flue gas to reduce nitrogen oxides (NOx) emissions may result in the presence of ammonium sulfate or ammonium bisulfate in the ash at less than 0.1%. When ash containing these substances becomes wet under high pH (>9), free ammonia gas may be released resulting in objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces.

## Section 10
## Stability and Reactivity

| | |
|---|---|
| **10.1 Reactivity:** | The material is an inert, inorganic material primarily composed of elemental oxides. |
| **10.2 Chemical stability:** | The material is stable under normal use conditions. |
| **10.3 Possibility of hazardous reactions:** | The material is a relatively stable, inert material; however, when ash containing ammonia becomes wet under high pH (>9), free ammonia gas may be released resulting in an objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces. Polymerization will not occur. |
| **10.4 Conditions to avoid:** | Product can become airborne in moderate winds.  Dry material should be stored in silos.  Materials stored out of doors should be covered or maintained in a damp condition. |
| **10.5 Incompatible materials:** | None known. |
| **10. 6 Hazardous decomposition products:** | None known. |

# Section 11
# Toxicological Information

## 11.1 Information on Toxicological Effects

| Endpoint | Data |
|---|---|
| **Acute oral toxicity** | LD50 > 2000 mg/kg |
| **Acute dermal toxicity** | LD50 > 2000 mg/kg |
| **Acute inhalation toxicity** | LD50 > 5.0 mg/L |
| **Skin corrosion/irritation** | Does not meet the classification criteria but may cause slight skin irritation. Product dust can dry the skin which can result in irritation. |
| **Eye damage/irritation** | Causes serious eye irritation. Positive scores for conjunctiva irritation and chemosis in 2/3 animals based on average of 24, 48 and 72-hour scores with irritation clearing within 21 days; No corneal or iritis effects observed. |
| **Respiratory/skin sensitization** | Not a respiratory or dermal sensitizer. |
| **Germ cell mutagenicity** | Not mutagenic in in-vitro and in-vivo assays with or without metabolic activation. |
| **Carcinogenicity** | Not available. Respirable crystalline silica has been identified as a carcinogen by OSHA, NTP, ACGIH and IARC. |
| **Reproductive toxicity** | No developmental toxicity was observed in available animal studies. Reproductive studies on CCPs showed either no reproductive effects, or some effects on male and female reproductive organs and parameters but without a clear dose response.<br><br>Inorganic bromide salts have been shown to have adverse effects on reproductive parameters in some animal studies. |
| **STOT-SE** | CCPs when present as a nuisance dust may result in respiratory irritation. |
| **STOT-RE** | In a 180-day inhalation study with fly ash dust, no effects were observed at the highest dose tested. NOEC = 4.2 $mg/m^3$; it is not possible to assess the level at which toxicologically significant effects may occur.<br><br>Repeated inhalation exposures to high levels of respirable crystalline silica may result in lung damage (i.e., silicosis). |
| **Aspiration Hazard** | Not applicable based product form. |

# Section 12
# Ecological Information

## 12.1 Toxicity

| **Fly Ash C (CAS# 68131-74-8)** | |
|---|---|
| **Toxicity to Fish** | LC50 > 100 mg/L |
| **Toxicity to Aquatic Invertebrates** | Data indicates that the test substance is not toxic to *Daphnia magna* (EC50 undetermined). |
| **Toxicity to Aquatic Algae and Plants** | EC50 = 10 mg/L |

| **Calcium oxide CAS# 1305-78-8** | |
|---|---|
| **Toxicity to Fish** | LC50 = 50.6 mg/L<br>The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects. |
| **Toxicity to Aquatic Invertebrates** | EC50 = 49.1 mg/L<br>The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects. |
| **Toxicity to Aquatic Algae and Plants** | NOEC =48 mg/L @ 72 hours based on $Ca(OH)_2$<br>The initial pH of the test medium was not directly related to the biologically relevant effects. The formation of precipitates is likely the result of the reaction between $CO_2$ dissolved in the medium. |

## 12.2 Persistence and Degradability

Not relevant for inorganic materials.

## 12.3 Bioaccumulative Potential

This material does not contain any compounds that would bioaccumulate up the food chain.

## 12.4 Mobility in Soil

No data available.

## 12.5 Results of PBT and vPvB Assessment

This material does not contain any compounds classified as “persistent, bioaccumulative or toxic” nor as “very persistent/very bioaccumulative”.

## 12.6 Other Adverse Effects

None known.

# Section 13

## Disposal Considerations

See Sections 7 and 8 above for safe handling and use, including appropriate industrial hygiene practices.

Dispose of all waste product and containers in accordance with federal, state and local regulations.

## Section 14
## Transport Information

| | | |
|---|---|---|
| **Regulatory entity:** U.S. DOT | Shipping Name: | Not Regulated |
| | Hazard Class: | Not Regulated |
| | ID Number: | Not Regulated |
| | Packing Group: | Not Regulated |

# Section 15
# Regulatory Information

## 15.1 Safety, Health and Environmental Regulations/Legislation Specific for the Mixture

- TSCA Inventory Status

  All components are listed on the TSCA Inventory.

- California Proposition 65.

  The following substances are known to the State of California to be carcinogens and/or reproductive toxicants:

  - Respirable crystalline silica

- State Right-to-Know (RTK)

| Component | CAS | MA[1,2] | NJ[3,4] | PA[5] | RI[6] |
|---|---|---|---|---|---|
| Ammonium bisulfate | 7803-63-6 | No | Yes | No | No |
| Ammonium sulfate | 7783-20-2 | Yes | No | Yes | No |
| Calcium oxide | 1305-78-8 | Yes | Yes | Yes | No |
| Iron oxide | 1309-37-1 | Yes | Yes | Yes | No |
| Magnesium oxide | 1309-48-4 | No | Yes | No | No |
| Manganese oxide-as manganese compounds | 1313-13-9; Various | No | No | Yes | Yes |
| Phosphorus pentoxide (or phosphorus oxide) | 1314-56-3 | Yes | Yes | Yes | No |
| Potassium oxide | 12136-45-7 | No | Yes | No | No |
| Silica-crystalline (SiO2), quartz | 14808-60-7 | Yes | Yes | Yes | No |
| Sodium oxide | 1313-59-3 | No | Yes | No | No |
| Titanium dioxide | 13463-67-7 | Yes | Yes | Yes | Yes |

[1] Massachusetts Department of Public Health, no date
[2] 189th General Court of The Commonwealth of Massachusetts, no date
[3] New Jersey Department of Health and Senior Services, 2010a
[4] New Jersey Department of Health, 2010b
[5] Pennsylvania Code, 1986
[6] Rhode Island Department of Labor and Training, no date

# Section 16
# Other Information, Including Date of Preparation or Last Revision

## 16.1 Indication of Changes

Date of preparation or last revision: February 23, 2018

## 16.2 Abbreviations and Acronyms

- ACGIH: American Conference of Industrial Hygienists
- CA: California
- CAS: Chemical Abstract Services
- CCP: Coal Combustion Product
- CFR: Code of Federal Regulations
- EPA: Environmental Protection Agency

- GHS: Globally Harmonized System of Classification and Labelling
- IARC: International Agency for Research on Cancer
- LC50: Concentration resulting in the mortality of 50 % of an animal population
- LD50: Dose resulting in the mortality of 50 % of an animal population
- MA: Massachusetts
- NA: Not Applicable
- NJ: New Jersey
- NOEC: No observed effect concentration
- NIOSH: National Institute of Occupational Safety and Health
- NOx: Nitrogen oxides
- NTP: US National Toxicology Program
- OEL: Occupational Exposure Limit
- OSHA: Occupational Safety and Health Administration
- PA: Pennsylvania
- PBT: Persistent, Toxic and Bioaccumulative
- PEL: Permissible exposure limit
- PPE: Personal Protective Equipment
- REL: Recommended exposure limit
- RI: Rhode Island
- RCS: Respirable Crystalline Silica
- RTK: Right-to-Know
- SCBA: Self-contained breathing apparatus
- SDS: Safety Data Sheet
- STEL: Short-term exposure limit
- STOT-RE: Specific target organ toxicity-repeated exposure
- STOT-SE: Specific target organ toxicity-single exposure
- TLV: Threshold limit value
- TSCA: Toxic Substances Control Act
- TWA: Time-weighted average
- UEL: Upper explosive limit
- UVCB: Unknown or Variable Composition/Biological
- U.S.: United States
- U.S. DOT: United States of Department of Transportation

## 16.3 Other Hazards

| **Hazardous Materials Identification System (HMIS)**<br><br>Degree of hazard (0= low, 4 = extreme) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Health:** | 2* | **Flammability:** | 0 | **Physical Hazards:** | 0 | **Personal protection:**** | | |

** Chronic Health Effects*
****** *Appropriate personal protection is defined by the activity to be performed.*
*See Section 8 for additional information.*

**DISCLAIMER:**

*This SDS has been prepared in accordance with the Hazard Communication Rule 29 CFR 1910.1200. Information herein is based on data considered to be accurate as of date prepared. No warranty or representation, express or implied, is made as to the accuracy or completeness of this data and safety information. No responsibility can be assumed for any damage or injury resulting from abnormal use, failure to adhere to recommended practices, or from any hazards inherent in the nature of the product.*

# ATTACHMENT T

Phil Morris
Dynegy Midwest Generation, LLC
Luminant
1500 Eastport Plaza Drive
Collinsville, IL 62234

May 19, 2021

Mr. Darin LeCrone, P.E.
Manager, Industrial Unit
Bureau of Water, Division of Water Pollution Control, Permits Section
Illinois Environmental Protection Agency
1021 North Grand Avenue, East
Springfield, IL 62794-9276

Re: CCR Surface Impoundment Category Designation and Justification for Dynegy Midwest Generation, LLC

Dear Mr. LeCrone:

Pursuant to 35 I.A.C. 845.700(c), Dynegy Midwest Generation, LLC submits the information necessary to categorize the CCR surface impoundments located at the Baldwin Power Plant and the retired Hennepin and Vermilion Power Plants. The following parameters were used in assessing and justifying each assigned category.

- Category 1 – *Impacts to existing potable water supply well or impacts to groundwater quality within the setback of an existing potable water supply well.*
    - This review includes an assessment of potable water wells within 2,500 feet of CCR surface impoundments to determine whether any potential impacts are occurring within the setback zone of any community water supply well established under the Illinois Groundwater Protection Act.
    - This information was developed during the Part 845 rulemaking and is summarized in Attachment 1, Table 2: Impacts to Potable Water Supply.
- Category 2 – *Imminent threat to human health or the environment or have been designated by IEPA under (g)(5)*
    - The surface impoundments at Baldwin, Hennepin and Vermilion Power Plants do not pose an imminent threat to human health or the environment. There are no known conditions at or around the facility where someone or something may be exposed to contaminant concentrations reasonably expected to cause harm
- Category 3 – *Located in areas of environmental justice ("EJ") concern*
    - EJ areas were evaluated using the EJ mapping link from IEPA's webpage located at https://www2.illinois.gov/epa/topics/environmental-justice. Per the IEPA mapping tool, the EJ Status thresholds were determined as twice the state averages for Minority and Low Income consistent with 35 IAC 845.700(g)(6).
    - An EJ map denoting the facilities with impoundments is located in Attachment 3.

- Category 4-7
    - Category 4 - Inactive CCR surface impoundments that have an exceedance of the groundwater protection standards in Section 845.600
    - Category 5 - Existing CCR surface impoundments that have exceedances of the groundwater protection standards in Section 845.600
    - Category 6 - Inactive CCR surface impoundments that are in compliance with the groundwater protection standards in Section 845.600.
    - Category 7 – Existing CCR surface impoundments that are in compliance with the groundwater protection standards in Section 845.600

Based on the information above, category designations have been assigned. The category designations for each CCR impoundment are shown in Attachment 1, Table 1: Category Designations.

If you have any questions regarding this submittal, please contact Phil Morris at 618-343-7794 or phil.morris@vistracorp.com.

Sincerely,

Phil Morris
Senior Environmental Director

Attachments

Attachment 1

**Table 1: Category Designation**

| Facility | Pond Description | Classifications | Potable Water Supply Impacts (Category 1) | Human Health or Environment Threat (Category 2) | Located within Environmental Justice Areas[1] (Category 3) | Standards Exceedances[2] (Categories 4,5,6,7) | Impoundment Category 845.700(g) |
|---|---|---|---|---|---|---|---|
| Baldwin | Bottom Ash Pond | Existing | No | No | No | No | 7 |
| Hennepin | East New Primary Pond | Inactive | No | No | Yes | NA[3] | 3 |
| Vermilion | North Pond Cell 1 & 2 | Inactive | No | No | No | Yes | 4 |
| | Old East Pond | Inactive | No | No | No | Yes | 4 |
| | New East Pond Cell 1 & 2 | Inactive | No | No | No | Yes | 4 |

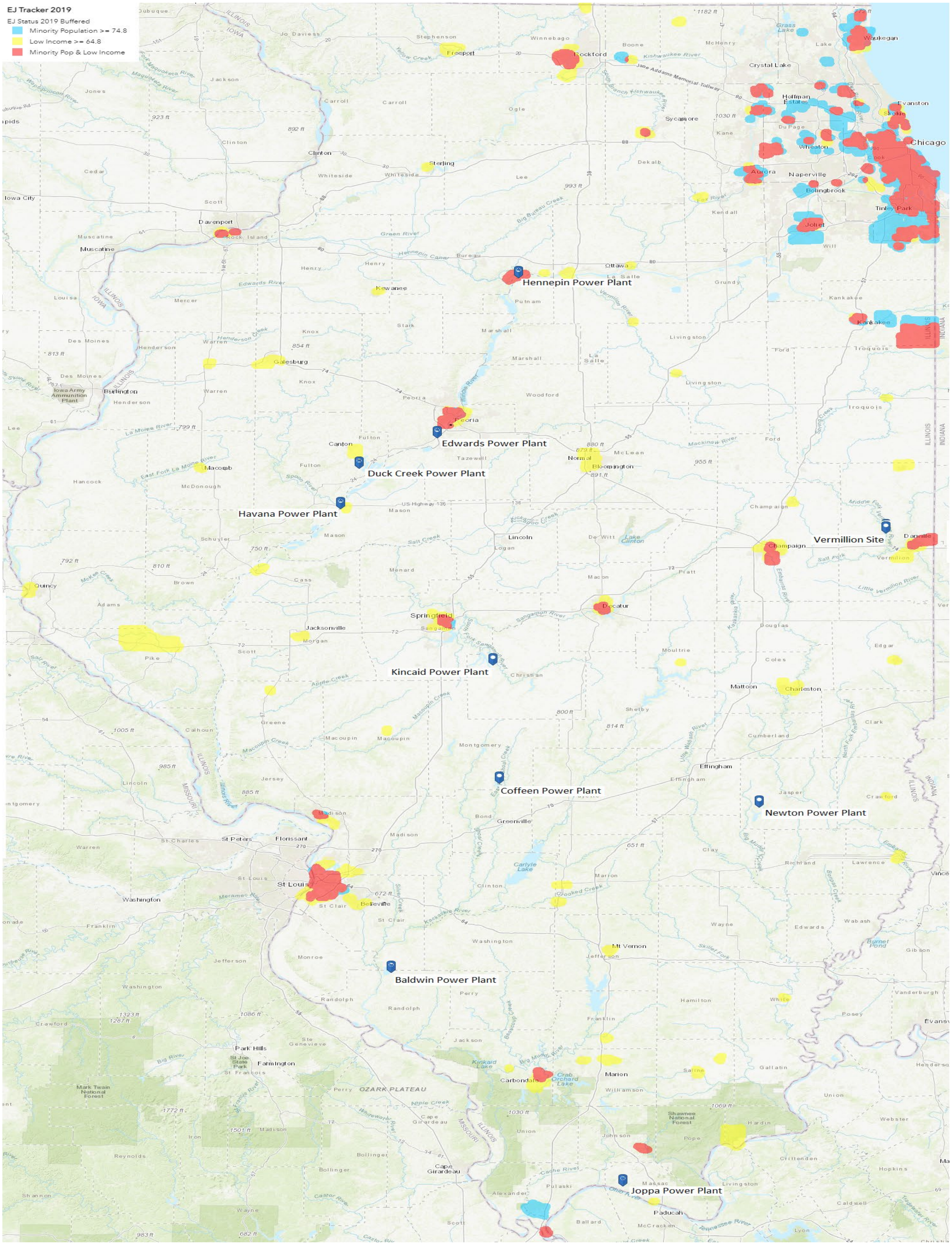
[1] See Attachment 3 Environmental Justice Area Map
[2] Ground water analyses for purposes of categories 4-7, assumptions have been made based on current groundwater data. However, since sampling and analysis is ongoing and subject to IEPA review and approval, IPGC reserves the right to update its category designations for Categories 4-7.
[3] NA for this determination since the CCR surface impoundment was assign a highest priority category

Attachment 2

**Table 2: Impacts to Potable Water Supply**

| Site Name | Private and Semi-Private Wells | Non-Community Water Supply (CWS) Wells | Non-CWS Surface Water Intakes | Community Water Supply Wells | CWS Surface Water Intakes |
|---|---|---|---|---|---|
| Baldwin | **Present, but not at risk** Twenty-two (22) water wells were identified and eight (8) are located potentially downgradient of the site. Based on Ramboll's review of groundwater data, these wells are unlikely to be impacted by releases from the site. | Absent | Absent | **Present, but not at risk** Two (2) active CWS wells were identified; however, they are unlikely to be at risk because of their hydrogeologic location relative to the power plant. | **Present, but not at risk** One (1) CWS surface water intake was identified potentially downgradient of the site. Based on Ramboll's review of available information, this CWS surface water intake is unlikely to be impacted by releases from the site. |
| Hennepin | **Present, but not at risk** Sixteen (16) water wells were identified and one (1) is located potentially downgradient of the site. However, this well is unlikely to be present/in use based on its remote floodplain location and installation date (1884). | **Present, but not at risk** Three (3) non-CWS wells were identified; however, they are unlikely to be at risk because of their relative hydrogeologic position or inactive status. | Absent | Absent | Absent |
| Vermilion | **Present, but not at risk** Seventy-nine (79) water wells were identified; however, they are unlikely to be at risk because of their hydrogeologic location relative to the power plant, they are abandoned, they do not appear to be used for potable purposes, and/or they are unlikely to be present based on the mapped location. None of the off-site wells are located in a downgradient direction. | **Present, but not at risk** Two CWS wells were identified; however, they are unlikely to be at risk because of their hydrogeologic location relative to the power plant and/or their inactive status. | **Present, but inactive** One non-CWS surface water intake was identified; however, it is unlikely to be at risk because it is listed with inactive status. | Absent | Absent |

Attachment 3: EJ Mapping Denoting Facilities with Impoundments



# ATTACHMENT U

October 2021

Geosyntec
consultants

1 McBride and Son Center Drive, Suite 202
Chesterfield, MO 63005
PH 636-812-0800
www.geosyntec.com

October 11, 2021

Dynegy Midwest Generation, LLC
13498 E. 800th Street
Hennepin, Illinois 61327

**Subject: USEPA CCR Rule and IEPA Part 845 Rule Applicability Cross-Reference**
**2021 USEPA CCR Rule Periodic Certification Report**
**East Ash Pond, Hennepin Power Plant, Hennepin, Illinois**

At the request of Dynegy Midwest Generation, LLC Geosyntec Consultants (Geosyntec) has prepared this letter to document how the attached 2021 United States Environmental Protection Agency (USEPA) CCR Rule Periodic Certification Report (Report) was prepared in accordance with both the Federal USEPA CCR Rule[1] and the state-specific Illinois Environmental Protection Agency (IEPA) Part 845 Rule[2]. Specific sections of the report and the applicable sections of the USEPA CCR Rule and Illinois Part 845 Rule are cross-referenced in **Table 1**. A certification from a Qualified Professional Engineer for each of the CCR Rule sections listed in **Table 1** is provided in Section 10 of the attached Report. This certification statement is also applicable to each section of the Part 845 Rule listed in **Table 1.**

**Table 1 – USEPA CCR Rule and Illinois Part 845 Rule Cross-Reference**

| Report Section | USEPA CCR Rule | | Illinois Part 845 Rule | |
|---|---|---|---|---|
| 3 | §257.73 (a)(2) | Hazard Potential Classification | 845.440 | Hazard Potential Classification Assessment[3] |
| 4 | §257.73 (c)(1) | History of Construction | 845.220(a) | Design and Construction Plans (Construction History) |
| 5 | §257.73 (d)(1) | Structural Stability Assessment | 845.450 (a) and (c) | Structural Stability Assessment |
| 6 | §257.73 (e)(1) | Safety Factor Assessment | 845.460 (a-b) | Safety Factor Assessment |
| 7 | §257.82 (a)(1-3) | Adequacy of Inflow Design Control System Plan | 845.510(a), (c)(1), (c)(3) | Hydrologic and Hydraulic Capacity Requirements / Inflow Design Flood Control System Plan |
| | §257.82 (b) | Discharge from CCR Unit | 845.510(b) | Discharge from CCR Surface Impoundment |

[1] United Stated Environmental Protection Agency, 2015. *40 CFR Parts 257 and 261, Hazardous and Solid Waste Management System, Disposal of Coal Combustion Residuals from Electric Utilities, Final Rule.*
[2] State of Illinois, Joint Committee on Administrative Rule, Administrative Code (2021). *Title 35: Environmental Protection, Subtitle G: Waste Disposal, Chapter I: Pollution Control Board, Subchapter j: Coal Combustion Waste Surface Impoundment, Part 845 Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments.*
[3] "Significant" and "High" hazard, per the CCR Rule[1], are equivalent to Class II and Class I hazard potential, respectively, per Part 845[2].

**CLOSING**

This letter has been prepared to demonstrate that the content and Qualified Professional Engineer Certification of the 2021 Periodic USEPA CCR Rule Certification Report fulfills the corresponding requirements of Part 845 of Illinois Administrative Code listed in **Table 1**.

Sincerely,

Lucas P. Carr, P.E.
Senior Engineer

John P. Seymour P.E.
Senior Principal

# 2021 USEPA CCR RULE PERIODIC CERTIFICATION REPORT
# §257.73(a)(2), (c), (d[1]), (e) and §257.82
# EAST ASH POND
# Hennepin Power Plant
# Hennepin, Illinois

*Submitted to*

**Dynegy Midwest Generation, LLC**

**1500 Eastport Plaza Drive**
**Collinsville, Illinois 62234**

*Submitted by*

Geosyntec consultants

engineers | scientists | innovators

1 McBride and Son Center Drive, Suite 202
Chesterfield, Missouri 63005

October 11, 2021

[1] Except for §257.73(d)(1)(vi).

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## LIST OF TABLES



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## LIST OF ATTACHMENTS

## EXECUTIVE SUMMARY

This Periodic United States Environmental Protection Agency (USEPA) Coal Combustion Residuals (CCR) Rule [1] certification report (Periodic Certification Report) for the East Ash Pond (EAP)[2] at the Hennepin Power Plant (HPP), also referred to as the Hennepin Power Station (HEN), has been prepared in accordance with Rule 40, Code of Federal Regulations (CFR) §257, herein referred to as the "CCR Rule" [1]. The CCR Rule requires that initial certifications for existing CCR surface impoundment, completed in 2016 and subsequently posted on Dynegy Midwest Generation, LLC (DMG) CCR Website ( [2], [3], [4], [5], [6]) be updated on a five-year basis.

The initial certification reports developed in 2016 and 2017 were independently reviewed by Geosyntec ( [2], [7], [3], [8], [4], [5], [6]). Additionally, field observations, interviews with plant staff, updated engineering analyses, and evaluations were performed to compare conditions in 2021 at the EAP relative to the 2016 and 2017 initial certifications. These tasks determined that updates are not required for the Initial Hazard Potential Classification. However, due to changes at the site, updates were performed for the:

- History of Construction Report,
- Initial Structural Stability Assessment,
- Initial Safety Factor Assessment, and
- Initial Inflow Design Flood System Control Plan.

Geosyntec's evaluations of the initial certification reports and updated analyses identified that the EAP meets all requirements for hazard potential classification, history of construction reporting, structural stability assessment, safety factor assessment, and hydrologic and hydraulic control, with the exception of the structural integrity of hydraulic structures (§257.73(d)(1)(vi)), which was independently certified by others. **Table 1** provides a summary of the initial 2016 certifications and the updated 2021 periodic certifications.

[2] The EAP is also referred to as ID Number W1550100002-05, East New Primary Pond by the Illinois Environmental Protection Agency (IEPA); CCR unit ID 803 by DMG; and IL50363 within the National Inventory of Dams (NID) maintained by the Illinois Department of Natural Resources (IDNR). Within this document it is referred to as the EAP.

## Table 1 – Periodic Certification Summary

| | CCR Rule Reference | Requirement Summary | 2016 Initial Certification: Requirement Met? | 2016 Initial Certification: Comments | 2021 Periodic Certification: Requirement Met? | 2021 Periodic Certification: Comments |
|---|---|---|---|---|---|---|
| **Hazard Potential Classification** | | | | | | |
| 3 | §257.73(a)(2) | Document hazard potential classification | Yes | Impoundment was determined to have Significant hazard potential classification [2]. | Yes | Updates were not determined to be necessary. Geosyntec recommends retaining the Significant hazard potential classifications. |
| **History of Construction** | | | | | | |
| 4 | §257.73(c)(1) | Compile a history of construction | Yes | A history of Construction report was prepared for the EAP, Old West Polishing Pond, Old West Ash Pond and Ash Pond No. 2 [3]. | Yes | A letter listing updates to the History of Construction report is provided in **Attachment C**. |
| **Structural Stability Assessment** | | | | | | |
| 5 | §257.73(d)(1)(i) | Stable foundations and abutments | Yes | Foundations and abutments were found to be stable [8]. | Yes | Foundations and abutments were found to be stable after performing updated slope stability analyses. |
| | §257.73(d)(1)(ii) | Adequate slope protection | Yes | Slope protection was adequate [8]. | Yes | No changes were identified that may affect this requirement. |
| | §257.73(d)(1)(iii) | Sufficiency of dike compaction | Yes | Dike compaction was sufficient for expected ranges in loading conditions [8]. | Yes | Dike compaction was found to be sufficient after performing updated slope stability analyses. |
| | §257.73(d)(1)(iv) | Presence and condition of slope vegetation | Yes | Vegetation was present on exterior slopes and is maintained. Interior slopes had alternate protection (geomembrane liner) [8]. | Yes | No changes were identified that may affect this requirement. |
| | §257.73(d)(1)(v)(A) and (B) | Adequacy of spillway design and management | Yes | Spillways were adequately designed and constructed and were expected to adequately manage flow during 1,000-year flood [8]. | Yes | Spillways were found to be adequately designed and constructed and are expected to adequately manager flow during the 1,000-year flood, after performing updated hydrologic and hydraulic analyses. |
| | §257.73(d)(1)(vi) | Structural integrity of hydraulic structures | No | Requirement could not be certified in 2016 due to inability to complete a CCTV inspection of the discharge pipe into the Polishing Pond due to submerged outfall conditions needed for plant operations. AECOM recommended inspected this pipe as soon as feasible to address the issue [8]. | Periodic certification of §257.73(d)(1)(vi) was performed independently by Luminant in 2021 [9]. | |
| | §257.73(d)(1)(vii) | Stability of downstream slopes inundated by water body. | Not Applicable | Inundation of exterior slopes was not expected; this requirement was not applicable [8]. | Yes | No changes were identified that may affect this requirement. |
| **Safety Factor Assessment** | | | | | | |
| 6 | §257.73(e)(1)(i) | Maximum storage pool safety factor must be at least 1.50 | Yes | Safety factors were calculated to be 2.14 and higher [5]. | Yes | Safety factors from updated slope stability analyses were calculated to be 2.14 and higher. |
| | §257.73(e)(1)(ii) | Maximum surcharge pool safety factor must be at least 1.40 | Yes | Safety factors were calculated to be 2.14 and higher [5]. | Yes | Safety factors from updated slope stability analyses were calculated to be 2.14 and higher. |
| | §257.73(e)(1)(iii) | Seismic safety factor must be at least 1.00 | Yes | Safety factors were calculated to be 2.53 and higher [5]. | Yes | Safety factors from updated slope stability analyses were calculated to be 2.52 and higher. |
| | §257.73(e)(1)(iv) | For dike construction of soils that have susceptible to liquefaction, safety factor must be at least 1.20 | Not Applicable | Dike soils were not susceptible to liquefaction [5]. | Not Applicable | No changes were identified that may affect this requirement. |
| **Inflow Design Flood Control System Plan** | | | | | | |
| 7 | §257.82(a)(1), (2), (3) | Adequacy of inflow design control system plan. | Yes | Flood control system adequately manages inflow and peak discharge during the 1,000-year, 24-hour, Inflow Design Flood [8]. | Yes | The inflow flood control system was found to adequately manage inflow and peak discharge during the 1,000-year, 24-hour Inflow Design Flood, after performing updated hydrologic and hydraulic analyses. |
| | §257.82(b) | Discharge from CCR Unit | Yes | Discharges from the CCR Unit is routed through a NPDES-Permitted outfall during both normal and 1,000-year, 24-hour Inflow Design Flood conditions [6]. | Yes | Discharge from the CCR Unit is routed through a NPDES-Permitted outfall during both normal and 1,000-year, 24-hour Inflow Design Flood conditions, after performing updated hydrologic and hydraulic analyses. |

# SECTION 1

## INTRODUCTION AND BACKGROUND

This Periodic United States Environmental Protection Agency (USPA) Coal Combustion Residual (CCR) Rule [1] Certification Report was prepared by Geosyntec Consultants (Geosyntec) for Dynegy Midwest Generation, LLC (Dynegy) to document the periodic certification of the East Ash Pond (EAP) at the Hennepin Power Plant (HPP), also known as the Hennepin Power Station (HEN), located at 13498 East 800th Street in Hennepin, Illinois, 61327. The location of HPP is provided in **Figure 1**, and a site plan showing the location of the EAP and LF, among other closed and open CCR units and non-CCR surface impoundments, is provided in **Figure 2**.

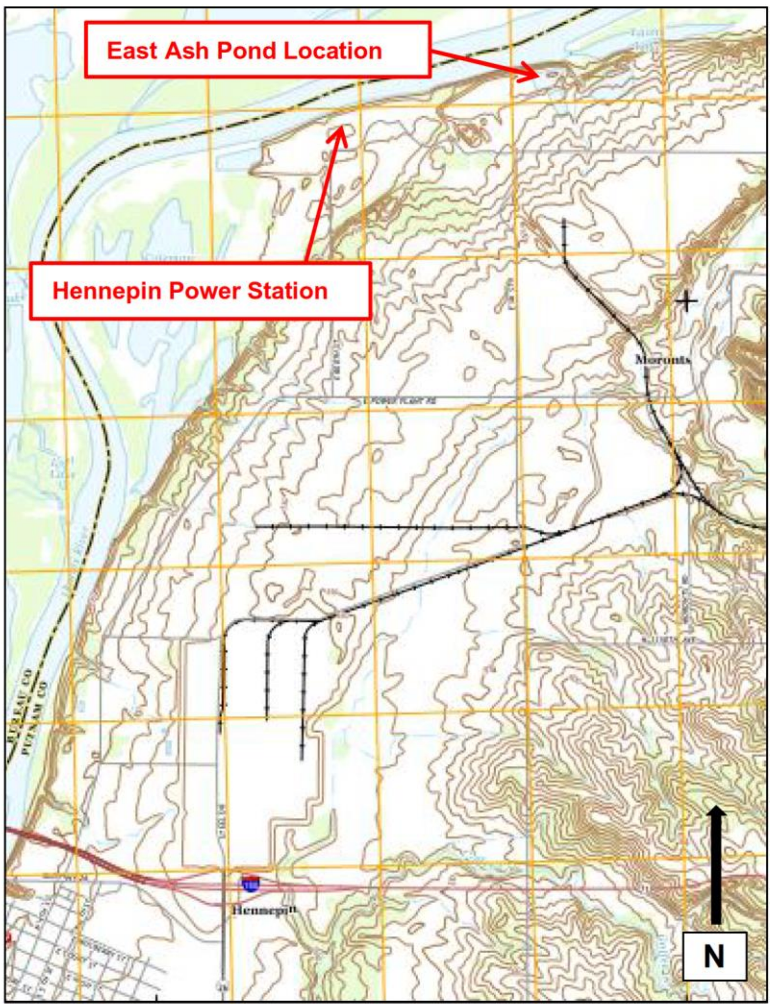



**Figure 1 – Site Location Map (from AECOM, 2016)**

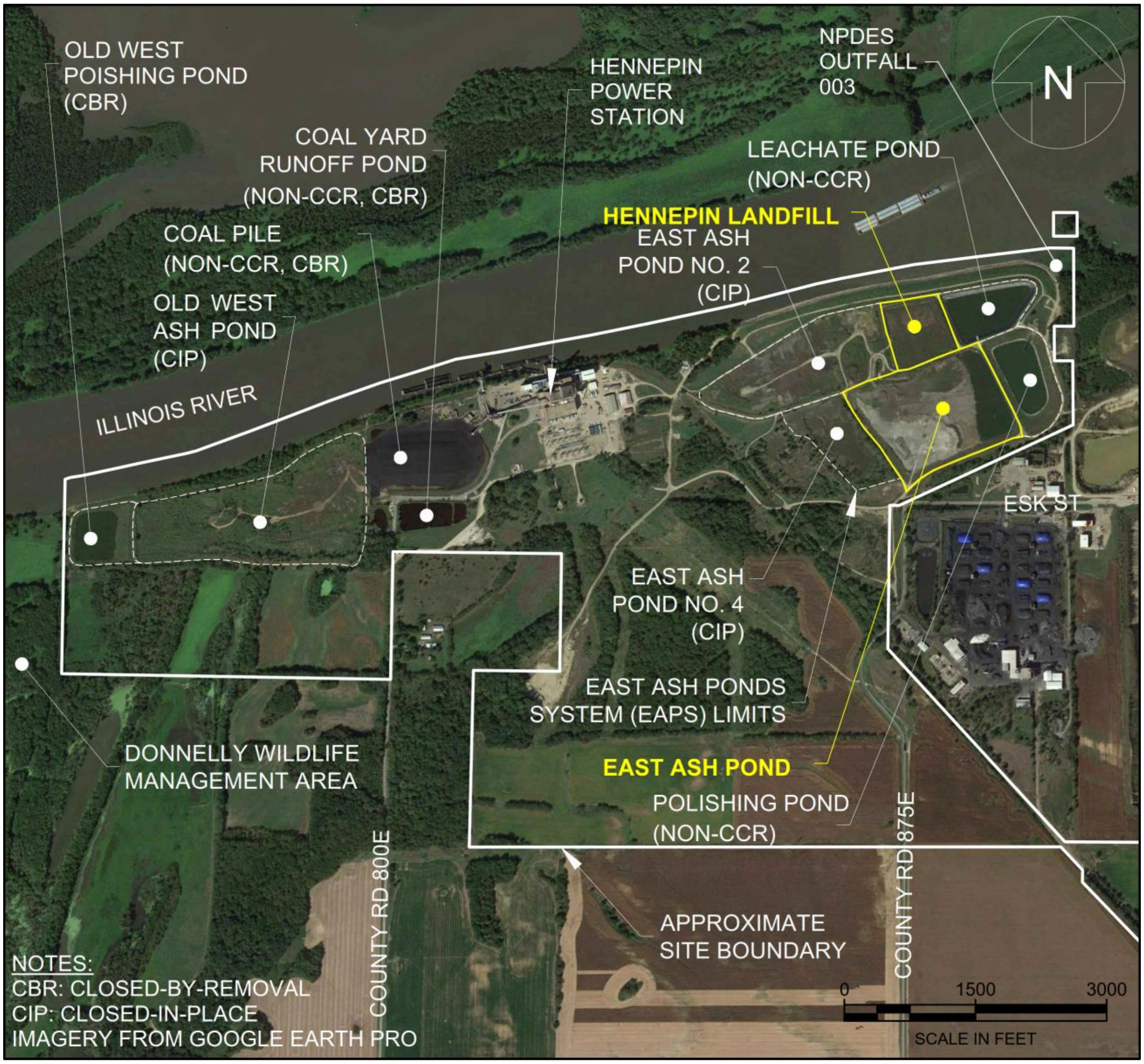



**Figure 2 – Site Plan**

## 1.1 EAP Description

The EAP formerly served as a wet impoundment basin for CCR that materials that were produced by HPP, prior to retirement of HPP in 2019. The EAP is approximately 21 acres in area, and the total length of the embankments is approximately 3,800 ft [8]. The EAP formerly received CCR and non-CCR discharge from a single high-density polyethylene (HDPE) sluice pipe that discharged until the northwestern corner of the EAP [8], prior to abandonment of the pipes in 2020 [10].

Outflow from the EAP is discharged downstream into the Leachate Pond, an adjacent non-CCR surface impoundment, via an 18-in diameter reinforced concrete pipe (RCP) culvert, with an invert elevation[3] of 489.9 ft that acts as the primary spillway. Additional outflow is discharged to the Polishing Pond, which is another adjacent non-CCR surface impoundment. Flow form the EAP into the polishing pond is transmitted via a 7- by 9-ft wide concrete riser structure (invert elevation of 490.6 ft) with a generally horizontal 36-in. diameter reinforced concrete pipe (RCP) secondary spillway pipe. Flow from the Leachate Pond is transmitted to the Polishing Pond, which then discharges into the Illinois River at a NPDES-permitted outfall [8].

The EAP is comprised of earthen embankments. Maximum embankment heights on the west and east sides are 16 and 36 feet, respectively, as referenced to the downstream toe. The downstream embankment slopes range from 3.5H:1V (horizontal to vertical) to 4H:1V and the interior slopes have an orientation of 3H:1V above El. 482 ft and 4H:1V below EL. 482 ft. An embankment is not present on the south side of the EAP, where the impoundment is adjacent to natural high ground that slopes upward to the south [3]. The dike on the north side of the EAP is adjacent to East Ash Pond No. 2 (EAP#2), which was closed-in-place in 2020 [10], and final cover grades are similar to the crest elevation of the EAP dike. The dike on the west side of the EAP is adjacent to EAP#4, which was also closed-in-place in 2020 [10]. Embankment crest widths are approximately 18 to 19 ft [8].

The perimeter embankment of the EAP was raised from elevation 483 ft to the current elevations of 493 to 500 ft in the early 2000s. As part of this construction, a double layer of 45-mil reinforced polypropylene geomembrane liner was installed over a 12-inch-thick clay layer on the slopes and keyed into the existing 4-ft thick clay bottom liner system (design permeability of $1\times10^{-7}$ cm/sec) at elevation 480 ft. The clay liner then extends at a 4H:1V slope with the top of liner at an elevation of approximately 460.5 ft. A layer of 8-oz polypropylene geotextile was placed under the 1-ft thick layer of clay and was then terminated at the existing liner. Under the existing 4-ft thick clay layer is a 6-inch-thick sand filter layer on the bottom of the pond and as 12-inch-thick sand layer on the side slopes of the pond [8].

The normal operating pool of the EAP is El. 490.4 ft, as controlled by the primary spillway pipe invert, although the normal pool may lower at times due to the cessation of process flows into the EAP associated with closure of HPP in 2019.

Initial certifications for the EAP for Hazard Potential Classification (§257.73(a)(2)), History of Construction (§257.73(c)), Structural Stability Assessment (§257.73(d)), Safety Factor Assessment (§257.73(e)(1)), and Inflow Design Flood Control System Plan (§257.82) were completed by Stantec and AECOM in 2016 and 2017 and subsequently posted to DMG's CCR Website ( [2], [11], [3], [4], [5], [6]). Additional documentation for the initial certifications included a detailed operating record reports containing calculations and other information prepared for the hazard potential classification by Stantec [7] and for the structural stability assessment,

[3] All elevations are in the North American Vertical Datum of 1988 (NAVD88), unless otherwise noted.

safety factor assessment, and inflow design flood control system plan by AECOM [8]. These operating record reports were not posted to DMG's CCR Website.

## 1.2 Report Objectives

These following objectives are associated with this report:

- Compare site conditions from 2015/2016, when the initial certifications were developed, to site conditions in 2020/2021, when data for the periodic certification was obtained, and evaluate if updates are required to the:
    - §257.73(a)(2) Hazard Potential Classification [2];
    - §257.73(c) History of Construction [3];
    - §257.73(d) Structural Stability Assessment [4];
    - §257.73(e) Safety Factor Assessment [5], and/or
    - §257.82 Inflow Design Flood Control System Plan [6].
- Independently review the Hazard Potential Classification ( [2], [7]), Structural Stability Assessment ( [4], [8]), Safety Factor Assessment ( [5], [8]), and Inflow Design Flood Control System Plan ( [6], [8]) reports to determine if updates may be required based on technical considerations.
    - The History of Construction report [3] was not independently reviewed for technical considerations, as this report contained historical information primarily developed prior to promulgation of the CCR Rule [1] for the CCR units at HPP, and did not include calculations or other information used to certify performance and/or integrity of the impoundments under §257.73(a)(2)-(3), §257.73(c)-(e), or §257.82.
- Confirm that the EAP meets all of the requirements associated with §257.73(a)(2), (c), (d), (e), and §257.82, or, if the EAP does not meet all requirements, provide recommendations for compliance with these sections of the CCR Rule [1].

# SECTION 2

# COMPARISON OF INITIAL AND PERIODIC SITE CONDITIONS

## 2.1 Overview

This section describes the comparison of conditions at the EAP between the start of the initial CCR certification program in 2015 and 2016 (initial conditions) and subsequent collection of periodic certification site data in 2020 and 2021 (periodic conditions).

## 2.2 Review of Annual Inspection Reports

Annual onsite inspections for the EAP were performed between 2016 and 2020 ( [12], [13], [14], [15], [16]) and were certified by a licensed professional engineer in accordance with §257.83(b). Each inspection report provided the following information relative to the previous inspection:

- A statement that no changes in geometry of the impounding structure were observed since the previous inspection.
- Information on maximum recorded instrumentation readings and water levels.
- Approximate volumes of impounded water and CCR at the time of inspection.
- A statement that no appearances of actual or potential structural weakness or other disruptive conditions were observed.
- A statement that no other changes which may have affected the stability or operation of the impounding structure were observed.

In summary, the reports did not indicate any significant changes to the EAP between 2015 and 2020. No signs of instability, structural weakness, or changes which may have affected the operation or stability of the EAP were noted in the inspection reports.

## 2.3 Review of Instrumentation Data

Two piezometers, P006 and P007, are present at the EAP and were monitored monthly by DMG between October 27, 2015 and April 23, 2021. The piezometers are screened in coarse-grained alluvial soils beneath the EAP. Monitoring is still ongoing. Geosyntec reviewed the piezometer data to evaluate if significant fluctuations, partially increases in phreatic levels, may have occurred between development of the initial structural stability and factor of safety certifications ( [8], [4], [5]) and April 23, 2021. Available piezometer readings are plotted in **Attachment A**.

In summary, the piezometer readings were consistent during this time period. Piezometer levels in P006 were consistently El. 452 ft, other than two spikes to approximately El. 456 ft that occurred in May of 2019 and May of 2020. Levels in P007 were somewhat variable, fluctuating between EL. 446 ft and El. 456 ft, with a typical level of around El. 449 ft. These water levels are similar to normal water levels in the adjacent Illinois River and the spikes are coincident with observed flooding events. Piezometer levels are similar to levels utilized for the initial structural stability and factor of safety certifications ( [8], [4], [5]).

## 2.4 Comparison of Initial to Periodic Surveys

The initial survey of the EAP, conducted by Weaver Consultants (Weaver) in 2015 [17], was compared to the periodic survey of the EAP, conducted by IngenAE, LLC (IngenAE) in 2020 [18], using AutoCAD Civil3D 2021 software. This comparison quantified changes in the volume of CCR placed within the EAP and considered volumetric changes above and below the starting water surface elevation (SWSE) used for the 2016 §257.82 inflow design flood control plan hydraulic analysis [8]. Potential changes to embankment geometry were also evaluated. This comparison is presented by showing both surveys side-by-side in **Drawing 1** and in a plan view isopach map denoting changes in ground surface elevation in **Drawing 2**. A summary of the water elevations and changes in CCR volumes is provided in **Table 1**.

**Table 2 – Initial to Periodic Survey Comparison**

| | |
|---|---|
| **Initial Surveyed Pool Elevation (ft)** | 490.4 |
| **Periodic Surveyed Pool Elevation (ft)** | 487.5 |
| **Initial §257.82 Starting Water Surface Elevation (SWSE) (ft)** | 490.4 |
| **Total Change in CCR Volume (CY)** | + 48,856 |
| **Change in CCR Volume Above SWSE (CY)** | +26,801 |
| **Change in CCR Volume Below SWSE (CY)** | +19,038 |

The comparison indicated that approximately 49,000 CY of CCR was placed in the EAP between the initial and periodic surveys, including approximately 27,000 CY placed above the SWSE thereby leading to a potential for the peak water surface elevation (PWSE) to increase during the inflow design 1,000-year flood event.

## 2.5 Comparison of Initial to Periodic Aerial Photography

Initial aerial photographs of the EAP collected by Weaver in 2015 [17] were compared to periodic aerial photographs collected by IngenAE in 2020 [18] to visually evaluate if potential site changes (i.e., changes to the embankment, outlet structures, limits of CCR, other appurtenances) may have occurred. A comparison of these aerial photographs is provided in **Drawing 3**, and the following changes were identified:

- Adjacent CCR surface impoundments (East Ash Pond No. 2 and East Ash Pond No. 4) were closed.

- The CCR sluice pipe discharge structure, consisting of a fabric-formed concrete-lined pool and channel that was constructed overlying East Ash Pond No. 2, was removed as part of the East Ash Pond No. 2 closure.

- Additional CCR was placed in the East Ash Pond and the free water pool area was reduced.

## 2.6 Comparison of Initial to Periodic Site Visits

An initial site visit to the EAP was conducted by AECOM in 2015 and documented with a Site Visit Summary and corresponding photographs [19]. A periodic site visit was conducted by Geosyntec on May 27, 2021, with Mr. Lucas P. Carr, P.E. conducting the site visit. The site visit was intended to evaluate potential changes at the site since the initial certifications were prepared (i.e., modification to the embankment, outlet structures or other appurtenances, limits of CCR, maintenance programs, repairs), in addition to performing visual observations of the EAP to evaluate if the structural stability requirements (§257.73(d)) were still met. The site visit included walking the perimeter access roads and slope crests of the EAP, visually observing conditions, recording filed notes, and collecting photographs. The site visit is documented in a photographic log provided in **Appendix A**. A summary of significant findings from the periodic site visit is provided below:

- Maintenance and operational conditions appeared similar between 2015 and 2021.

- No new development was observed in the EAP downstream breach area shown in the Initial EmAP inundation map [11].

- Modifications to the EAP were observed including altering the sluice discharge location as part of the East Ash Pond No. 2 closure and modifying the dike between East Ash Pond No. 4 and the EAP as part of the East Ash Pond No. 4 closure.

- No signs of structural instability were noted. Visual observations did not indicate insufficient slope vegetation and protection, compaction or instability at the dikes or abutments, sudden drawdown instability, or spillway erosion.

- The interior of the culverts connecting the EAP to the Leachate Pond and the EAP to the Polishing Pond could not be visually observed at the time of the site visit due to access and health and safety considerations.

## 2.7 Interview with Power Plant Staff

An interview with Mr. Jason Stuckey and Mr. Michael Olle of the HPP was conducted by Mr. Lucas P. Carr, P.E. of Geosyntec on May 27, 2021. Mr. Stuckey had been employed at HPP for 14 years and Mr. Olle had been employed at HPP for 13 years at the time of the interview. Mr. Stuckey has been responsible for performing weekly impoundment inspections, managing maintenance, and operating the EAP since the HPP closed in 2019. The interview included a discussion of potential changes that may have occurred at the EAP since development of the initial certifications ( [2], [11], [3], [4], [5], [6]).

- Were any construction projects completed for the EAP since 2015, and, if so, are design drawings and/or details available?
    - No construction projects were completed since 2015.
- Were there any changes to the purpose of the EAP since 2015?
    - CCR placement into the EAP ceased when the HPP was closed in November of 2019. The EAP also received unwatering flows from closure of the Old West Ash Pond and Old West Polishing Pond during 2019 and 2020, via the Coal Pile Runoff Pond, although these flows have since ceased.
- Were there any changes to the to the instrumentation program and/or physical instruments for the EAP since 2015?
    - No known changes have occurred.
- Have area-capacity curves for the EAP been prepared since 2015?
    - No known area-capacity curves have been developed.
- Were there any changes to spillways and/or diversion features for the EAP completed since 2015?
    - The sluice discharge area was partially removed and altered in 2020 as part of the East Ash Pond No. 2 closure.
- Were there any changes to construction specifications, surveillance, maintenance, and repair procedures for the EAP since 2015?
    - No changes have occurred.
- Were there any instances of dike and/or structural instability for the EAP since 2015?
    - No known instances of instability have occurred.

# SECTION 3

# HAZARD POTENTIAL CLASSIFICATION - §257.73(a)(2)

## 3.1 Overview of Initial HPC

The Initial Hazard Potential Classification (Initial HPC) was prepared by Stantec Consulting Services, Inc. (Stantec) in 2016 ( [2], [7]), following the requirements of §257.73(a)(2). The Initial HPC included the following information:

- Performing a visual analysis to evaluate potential hazards associated with a failure of the EAP perimeter dike, along the east and northeast embankments of the EAP, as the EAP is contained by natural high ground to the south and other CCR units to the west and north.
- Evaluation of potential breach flow paths were evaluated using elevation data and aerial imagery to evaluate potential impacts to downstream structures, infrastructure, frequently occupied facilities/areas, and waterways [2].
- While a breach map is not included within the Initial HPC, it included within the §257.73(a)(3) Initial Emergency Action Plan (Initial EmAP) [11].

The visual analysis indicated that none of the breach scenarios appeared to impact occupied structures, although a breach of the east embankment could impact an infrequently used gravel site access road and a breach to the north would inundate the leachate pond. The Initial HPC concluded that neither breach would be likely to result in a probable loss of human life, although the breach could cause CCR to be released into the Illinois River, thereby causing environmental damage. The Initial HPC therefore recommended a “Significant” hazard potential classification for the EAP [2].

## 3.2 Review of Initial HPC

Geosyntec performed a review of the Initial HPC ( [2], [7]), in terms of technical approach, input parameters, assessment of the results, and applicable requirements of the CCR Rule [1]. No significant technical issues were noted within the technical review, although a detailed review (e.g., check) of the calculations was not performed as the Initial HPC utilized a visual assessment.

## 3.3 Summary of Site Changes Affecting the Initial HPC

Geosyntec did not identify any changes at the site that may affect the HPC. No new structures, infrastructure, frequently occupied facilities/areas, or waterways were present in the probable breach area indicated in the Initial EmAP [11]. Additionally, no significant changes to the topography in the probable breach were identified.

## 3.4 Periodic HPC

Geosyntec recommends retaining the "Significant" hazard potential classification for the EAP, per §257.73(a)(2), based on the lack of site changes potentially affecting the Initial HPC occurring since the initial HPC was developed, as described in **Section 3.3**, and the lack of significant review comments, as described in **Section 3.2**. Updates to the Initial HPC reports ( [2], [7]) are not recommended at this time.

# SECTION 4

# HISTORY OF CONSTRUCTION REPORT - §257.73(c)

## 4.1 Overview of Initial HoC

The Initial History of Construction report (Initial HoC) was prepared by AECOM in 2016 [3], following the requirements of §257.73(c), and included information on all CCR surface impoundments at HPP, including the OWPP, OWAP, EAP#2, EAP#4, and the EAP. The Initial HoC included the following information for each CCR surface impoundment:

- The name and address of the owner/operator,
- Location maps,
- Statements of purpose,
- The names and size of the surrounding watershed,
- A description of the foundation and abutment materials,
- A description of the dike materials,
- Approximate dates and stages of construction,
- Available design and engineering drawings,
- A summary of instrumentation,
- A statement that area-capacity curves are not available,
- Information on spillway structures,
- Constructions specifications,
- Inspection and surveillance plans,
- Information on operational and maintenance procedures, and
- A statement that historical structural instability had not occurred at any of the CCR surface impoundments.

### 4.2 Summary of Site Changes Affecting the Initial HoC

Several changes at the site that occurred after development of the initial HoC report were identified. These changes required updates to the HoC report. Each change and the corresponding updates to the HoC report [3] are described below:

- A state identification number (ID) of W1550100002-05 was assigned to the EAP by the Illinois Environmental Protection Agency (IEPA).
- Electricity generation at the HPP ceased in 2019. The purpose of the EAP changed to only store CCR that was present at the time of HPP closure. The EAP no longer receives actively generated CCR or process water, as CCR is no longer generated at the HPP. However, the EAP has not yet been closed.
- Other inflows into the EAP including discharge water from the non-CCR Coal Yard Runoff Pond and water from Ash Pond No. 2 were ceased due to closure of those impoundments.
- Revised area-capacity curves and spillway design calculations for the EAP were prepared as part of the updated periodic Inflow Design Flood Control System Plan, as described in **Section 7.3**.

A letter documenting changes to the HoC report is provided in **Attachment C**.

# SECTION 5

# STRUCTURAL STABILITY ASSESSMENT - §257.73(d)

## 5.1 Overview of Initial SSA

The Initial Structural Stability Assessment (Initial SSA) was prepared by AECOM in 2016 ( [4], [8]), following the requirements of §257.73(d)(1), and included the following evaluations:

- Stability of dike foundations, dike abutments, slope protection, dike compaction, and slope vegetation,
- Spillway stability including capacity, structural stability and integrity; and
- Downstream slope stability under sudden drawdown conditions for a downstream water body.

The Initial SSA concluded that the EAP met all structural stability requirements for §257.73(d)(1)(i)-(v) and (vii). However, the EAP was not certified for the stability and structural integrity criteria for hydraulic outfall structures, per §257.73(d)(1)(vi), as an inspection of the 36-inch secondary spillway pipe between the EAP and Settling Pond was not performed due to the pipe being submerged during normal operating conditions, as required for plant operations. The 18-inch primary spillway pipe between the EAP and Leachate Pond was inspected and certified. The Initial SSA recommended inspection of the secondary spillway pipe.

The Initial SSA referenced the results of the Initial Structural Factor Assessment (Initial SFA) ( [5], [8]), to demonstrate stability of the stability of foundations and abutments (§257.73(d)(1)(i)) and sufficiency of dike compaction (§257.73(d)(1)(iii)) portions of the SSA criteria. This included stating that slope stability analyses for slip surfaces passing through the foundation met or exceeded the criteria listed in §257.73(e)(1), for the stability of foundations and abutments. For the sufficiency of dike compaction, this included stating that slope stability analyses for slip surfaces passing through the dike also met or exceeded the §257.73(e)(1) criteria.

## 5.2 Review of Initial SSA

Geosyntec performed a review of the Initial SSA ( [4], [8]) in terms of technical approach, calculation input parameters and methodology, recommendations, and completeness. The review included the following tasks:

- Reviewing photographs collected in 2015 and used to demonstrate compliance with §257.73(d)(1)(i)-(vii);

- Reviewing geotechnical calculations used to demonstrate the stability of foundations, per §257.73(d)(1)(i) and sufficiency of dike compaction, per §257.73(d)(1)(iii), in terms of supporting geotechnical investigation and testing data, input parameters, analysis methodology, selection of critical cross-sections, and loading conditions;

- Review of the methodology used to demonstrate that a downstream water body that could induce a sudden drawdown condition, per §257.73(d)(1)(vii), is not present;

- Completeness and technical approach used to evaluate the stability of hydraulic structures, per §257.73(d)(1)(vi); and

- Reviewing the contents vs. the applicable CCR Rule requirements [1].

No significant technical issues were noted within the technical review of the Initial SSA, although a detailed review (e.g., check) of the calculations was not performed.

## 5.3 Summary of Site Changes Affecting Initial SSA

Several changes at the site that occurred after development of the Initial SSA were identified. These changes required updates to the Initial SSA and are described below:

- The Initial SSA utilized the results of the Initial Inflow Design Flood Control System Plan (IDF) to demonstrate compliance with the adequacy of spillway design and management (§257.73(d)(1)(v)(A)-(B)). The Initial IDF was subsequently updated to develop a Periodic IDF, based on site changes, as discussed in **Section 7**.

- The Initial SSA utilized the slope stability analysis results of the Initial Safety Factor Assessment (SFA) as part of the compliance demonstration for the stability of foundations and abutments (§257.73(d)(1)(i)) and sufficiency of dike compaction (§257.73(d)(1)(iii)) as discussed in **Section** Error! Reference source not found.. The Initial SFA slope stability analyses were subsequently updated to develop a Periodic SFA, based on site changes, as discussed in **Section 6**.

## 5.4 Periodic SSA

The Periodic SFA (**Section 6**) indicates that foundations and abutments are stable and dike compaction is sufficient for expected ranges in loading conditions, as slope stability factors of safety were found to meet or exceed the requirements of §257.73(e)(1). Therefore, the requirements of §257.73(d)(1)(i) and §257.73(d)(1)(iii) are met for the Periodic SSA.

The Periodic IDF (**Section 7**) indicates that spillways are adequately designed and constructed to adequately manage flow during the 1,000-year flood, as the spillways can adequately manage flow during peak discharge from the 1,000-year storm event without overtopping of the embankments. Therefore, the requirements of §257.73(d)(1)(v)(A)-(B) are met for the Periodic SSA. Certification of §257.73(d)(1)(vi) was independently performed by Luminant [9].

# SECTION 6

# SAFETY FACTOR ASSESSMENT - §257.73(e)(1)

## 6.1 Overview of Initial SFA

The Initial Safety Factor Assessment (Initial SFA) was prepared by AECOM in 2016 ( [5], [8]), following the requirements of §257.73(e)(1). The Initial SFA included the following information:

- A geotechnical investigation program with in-situ and laboratory testing.
- An assessment of the potential for liquefaction in the dike and foundation soils.
- The development of two slope stability cross-sections for limit equilibrium stability analysis utilizing GeoStudio SLOPE/W software.
- The analysis of both cross-sections for maximum storage pool, maximum surcharge pool, and seismic loading conditions.
- Liquefaction loading conditions were not evaluated as liquefaction-susceptible soil layers were not identified in the either the embankments or foundation soils.

The Initial SFA concluded that the EAP met all safety factor requirements, per §257.73(e), as all calculated safety factors were equal to or higher than the minimum required values.

## 6.2 Review of Initial SFA

Geosyntec performed a review of the Initial SFA ( [5], [8]) in terms of technical approach, calculation input parameters and methodology, recommendations, and completeness. The review included the following tasks:

- Reviewing geotechnical calculations used to demonstrate the acceptable safety factors, per §257.73(e)(1), in terms of:
    - Completeness and adequacy of supporting geotechnical investigation and testing data.
    - Completeness and approach of liquefaction triggering assessments.
    - Analyzed loading conditions relative to the applicable CCR Rule [1] requirements and site-specific conditions.

  - o Input parameters, analysis methodology, selection of critical cross-sections, loading conditions, and piezometric/groundwater levels utilized for slope stability analyses.

- Reviewing the contents vs. the applicable CCR Rule requirements [1].

No significant technical issues were noted within the technical review, although a detailed review (e.g., check) of the calculations was not performed.

## 6.3 Summary of Site Changes Affecting the Initial SFA

Several changes at the site that occurred after development of the Initial SFA were identified. These changes required updates to the Initial SFA and are described below:

- Additional CCR was placed below the SWSE in the free water pool upstream of the dike between the EAP and the Polishing Pond, thereby potentially applying additional load to the EAP dike than was present at the time of the Initial SFA.

- The Periodic IDF (**Section 7)** found that the normal pool elevation within the EAP decreased from 490.4 to 490.0 ft, resulting in 0.4 ft less water loading on the embankment dikes than was considered in the Initial SFA for the maximum storage pool and seismic loading conditions (§257.73(e)(1)(i) and (iii)). Peak water surface elevations during the IDF also decreased from 492.9 to 491.4 ft, resulting in 1.5 ft less water loading on the embankment dikes than was considered in the Initial SFA for the maximum surcharge pool loading conditions (§257.73(e)(1)(i)).

## 6.4 Periodic SFA

Geosyntec revised existing slope stability analyses associated with the Initial SFA ( [5], [8]) for two cross-sections (SL-10 &SL-12) previously evaluated to account for site changes, as described in **Section 6.3**. The following approach and input data were used to revise the analyses:

- Ground surface geometry was revised for all the loading conditions in section SL-10 and SL-12 using the 2021 site survey [18] to account for the changes that occurred to CCR grades.

- Water levels in the EAP for the maximum storage pool, and seismic slope stability analysis loading conditions were decreased to El. 490.0 ft for section SL-10 and section SL-12, based on the Periodic IDF.

- Water levels in the EAP for the maximum surcharge pool slope stability analysis loading conditions were decreased to El. 491.4 ft for section SL-10 and section SL-12, based on the Periodic IDF.

Factors of safety from the Periodic SFA are summarized in **Table 3** and confirm that the EAP meets the requirements of §257.73(e)(1). Slope stability analysis output associated with the Initial SFA is provided in **Attachment D**.

**Table 3 – Factors of Safety from Periodic SFA**

| | Structural Stability Assessment (§257.73(d)) and Safety Factor Assessment (§257.73(e)) | | | |
|---|---|---|---|---|
| **Cross-Section** | **Maximum Storage Pool §257.73(e)(1)(i) Minimum Required = 1.50** | **Maximum Surcharge Pool[1] §257.73(e)(1)(ii) Minimum Required = 1.40** | **Seismic §257.73(e)(1)(iii) Minimum Required = 1.00** | **Dike Liquefaction §257.73(e)(1)(iv) Minimum Required = 1.20** |
| SL-10 | 2.14* | 2.14* | 4.22 | N/A |
| SL-12 | 3.16 | 3.16 | 2.52* | N/A |

Notes:
*Indicates critical cross-section (i.e., lowest calculated factor of safety out of the two cross-sections analyzed)
N/A – Loading condition is not applicable.

# SECTION 7

# INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN - §257.82

## 7.1 Overview of Initial IDF

The Initial Inflow Design Flood Control System Plan (Initial IDF) was prepared by AECOM in 2016 ( [6], [8]), following the requirements of §257.82. The Initial IDF included the following information:

- A hydraulic and hydrologic analysis, performed for the 1,000-year design flood event because of the hazard potential classification of "Significant", which corresponded to 9.70 inches of rainfall over a 24-hour period.
- The Initial IDF utilized a HydroCAD Version 10 model to evaluate spillway flows and pool level increases during the IDF, with an EAP SWSE of 490.4 ft and considered water flows between the EAP and the interconnected adjacent ponds.

The Initial IDF concluded that the EAP met the requirements of §257.82, as the peak water surface estimated by the HydroCAD model was El. 492.2 ft, relative to a minimum EAP dike crest elevation of 493.0 ft. Therefore, EAP embankment overtopping was not expected from the evaluated IDF. The Initial IDF also evaluated the potential for discharge from the CCR unit, and determined discharge from the EAP during both normal and inflow design flood conditions was expected to be routed through the existing spillway and NDPES-permitted outfall.

## 7.2 Review of Initial IDF

Geosyntec performed a review of the Initial IDF ( [6], [8]) in terms of technical approach, calculation input parameters and methodology, recommendations, and completeness. The review included the following tasks:

- Reviewing the return interval used vs. the hazard potential classification.
- Reviewing the rainfall depth and distribution for appropriateness.
- Performing a high-level review of the inputs to the hydrological modeling.
- Reviewing the hydrologic model parameters for spillway parameters, starting pool elevation, and storage vs. the reference data.
- Reviewing the overall Initial IDF vs. the applicable requirements of the CCR Rule [1].

Several comments were identified during review of the Initial IDF. The comments are described below:

- The Initial IDF utilized the National Resource Conservation Service (NRCS) Type II rainfall distribution type [20]. Geosyntec recommends utilizing the Huff 3rd Quartile distribution for areas less than 10 square miles [21] for the reasons listed below.
  - Huff 3rd Quartile distribution was identified to be a more appropriate representation of a 1,000-year, 24-hour storm event per the Illinois State Water Survey (ISWS) Circular 173 [22] which developed standardized rainfall distributions from compiled rainfall data at sites throughout Illinois.
  - Illinois Department of Natural Resources, Office of Water Resources (IDNR-OWR) [23] recommends use of the Huff Quartile distributions in Circular 173 when using frequency events to determine the spillway design flood inflow hydrograph, "*The suggested method to distribute this rainfall is described in the ISWS publication, Circular 173, "Time Distributions of Heavy Rainstorms in Illinois"*.
- The dimensions of hydraulic structures within the EAP and East Leachate Pond were reported to be larger than the dimensions included within the hydrologic and hydraulic analysis file.
- Hydrologic soil group types for some areas require updates based on conditions observed at HPP.

### 7.3 Summary of Site Changes Affecting the Initial IDF

Several changes at the site that occurred after development of the Initial IDF were identified. These changes required updates to the Initial IDF and are described below:

- Approximately 27,000 CY of CCR were placed above the SWSE utilized for the Initial IDF certification, thereby altering the stage-storage curve for the EAP relative to the Initial IDF. Process inflows to the EAP have ceased due to the cessation of operations at the HPP, thereby the process inflow conditions utilized in the Initial IDF were no longer consistent with conditions observed in 2020
- Minor differences in the surveyed elevations of pipe inverts and dike crest elevations were noted between the initial and periodic site surveys.
- Two 12-inch diameter culverts connecting the EAP to the Leachate Pond were noted in the 2020 site survey and had not been included in the Initial IDF hydrologic and hydraulic analysis.

- Several changes to the ground surface within the EAP occurred, including a reduction in the area of the EAP due to closure of adjacent East Ash Pond No. 2.

## 7.4 Periodic IDF

Geosyntec revised the HydroCAD model associated with the Initial IDF to account for the revised rainfall distribution type, cessation of process flows, and additional CCR placement, as described in **Sections7.3**. The following approach and input data were used for the revised analyses and are referenced in **Attachment E**:

- Stage-storage (i.e., area-capacity) curves for the EAP were updated based on the 2020 site survey [18].
  - A revised stage-volume curve for the EAP was prepared based on measuring the storage volume of the EAP at every one-foot increment of depth from the minimum depth (482 ft) to the typical crest elevation (495 ft). This analysis identified an overall decrease of 20,777 CY (13 ac-ft) of storage volume at the EAP from 2016 to 2021.
- The SWSE within the EAP was updated from 490.4 ft to 490.0 ft and Leachate Pond from 485.0 ft to 485.1 ft to reflect spillway invert updates detailed by the 2020 site survey [18].
  - The 2016 certification included an addition of 0.5 ft to the SWSE at the EAP to account for process flows. Plant operations, including process flow generation and unwatering of CCR units at the site have since ceased. Inflows in excess of stormwater are omitted from this model; however, the SWSE of each pond is set to the surveyed WSE or the discharge structure invert, whichever is greater, to provide conservatism in the updated model.
- The minimum dike crest elevation of EAP was updated from 493.0 ft to 492.0 ft to reflect the 2020 site survey [18].
- The precipitation depth for the 1,000-year, 24-hour design storm event was updated from 9.70 inches to 9.72 inches per NOAA Atlas 14 precipitation frequency estimates [24].
- The rainfall distribution type was updated to the "Huff 3rd Quartile" storm type provided by HydroCAD [25].
- The following hydrologic parameters for drainage areas were updated:
  - The time of concentration flow path for the Landfill drainage area, which drains into the Leachate Pond and therefore is part of the multi-pond hydraulic system including the EAP, was updated based on the 2020 site survey. The surface description of the shallow concentrated flow corresponding to the exposed geomembrane segment was changed to "unpaved" to account for the smooth surface.

- The curve numbers for the EAP and Polishing Pond drainage areas were updated to reflect hydrologic soil group (HSG) D soils. The Initial IDF considered these areas as HSG C; however, the NRCS soil survey referenced in the Initial IDF describes these areas as predominately "Pits, gravel" with no HSG rating. A HSG rating of D was selected for conservatism.

- The EAP drainage area was updated to reflect the 2020 site survey. Grading changes along the northern edge of the pond associated with closure of East Ash Pond No. 2 resulted in a decrease of 1.05 acres. CCR placement in the EAP resulted in an increase of exposed CCR material and decrease of water surface. CCR surface, identified as "Urban industrial, 72% imp" land use, increased from 810.0 ac to 16.7 ac and water surface decreased from 7.8 ac to 1.5 ac. Gravel surfaces were considered to account for 25% of the drainage area exterior to the exposed CCR and grass cover for the remainder of the area. Gravel land use was updated from 1.095 ac to 1.120 ac and grass land use was updated from 4.9 ac to 3.4 ac.

- The following pipe parameters were updated based on length measurements from pipe inspections performed as part of the Initial SSA ( [4], [8]) and invert elevations from the 2020 site survey [18]:
  - 18-inch diameter culvert conveying flow from EAP to the Leachate Pond:
    - Updated length from 70 linear feet (LF) to 61 LF, per the pipe inspections.
    - Updated inlet invert from 489.9 ft to 490.0 ft per the 2020 survey.
    - Updated outlet invert from 487.2 ft to 486.8 ft per the 2020 survey.
  - 36-inch diameter culvert conveying flow from EAP to Polishing Pond:
    - Updated length from 300 LF to 283 LF per design drawing CE-HEN1-C3 included in the History of Construction report [3], with the length calculated from northing and easting values.
  - Added two, 12-inch diameter pipes conveying flow from EAP to the Leachate Pond:
    - Diameters were calculated as the nearest typical pipe diameter calculated from difference between top of pipe and invert elevation.
    - Length of 97 LF estimated per the 2020 site survey.
    - Higher invert elevation of two pipes, 492.66 ft, used in model.
    - Outlet invert of 488.34 ft per the 2020 site survey.

        - Manning's n value of 0.010 corresponding to smooth plastic pipe per conditions observed during Geosyntec's stie visit.

    - 24-inch diameter culvert conveying flow from Leachate Pond to the Polishing Pond:

        - Updated length from 162 LF to 157 LF per the pipe inspections.

        - Updated inlet invert from 480.48 ft to 480.40 ft per the 2020 site survey.

        - Updated outlet invert from 479.73 ft to 479.81 ft per the 2020 site survey.

    - 36-inch diameter culvert conveying flow from Polishing Pond to the NPDES outfall at the Illinois River:

        - Updated length from 613 LF to 655 LF per design drawing CE-HEN1-C3 included in the History of Construction Report, with the length calculated from northing and easting values.

        - Updated outlet invert from 452.00 ft to 452.16 ft per the 2020 site survey.

- The following outlet structure parameters were updated:

    - EAP:

        - Top of outlet structure elevation updated from 493.2 ft to 493.5 ft per 2020 site survey.

        - Top opening dimensions updated from 60-in by 36-in to 84-in by 108-in to be consistent with the description of the structure in the Initial IDF.

    - Leachate Pond:

        - Top of outlet structure elevation updated from 485.0 ft to 485.1 ft per 2020 site survey.

    - Polishing Pond:

        - Top opening dimensions updated from 60-in by 36-in to 84-in by 108-in to be consistent with the description of the structure in the Initial IDF.

- All other input data and settings from the Initial IDF HydroCAD model were utilized, including, but not limited to software package and version, runoff method, analysis time span and analysis time step.

The results of the Updated IDF are summarized in **Table 4** and confirm that the EAP meets the requirements of §257.82(a)-(b), as the peak water surface elevation does not exceed the minimum perimeter dike crest elevations. Additionally, all discharge from the EAP is routed through the existing spillway system to the NPDES-permitted outfall, during both normal and IDF conditions. Updated area-capacity curves and HydroCAD model output is provided in **Attachment E**.

**Table 4- Water Levels from Periodic IDF**

| | East Ash Pond | | |
|---|---|---|---|
| **Analysis** | **Starting Water Surface Elevation (ft)** | **Peak Water Surface Elevation (ft)** | **Minimum Dike Crest Elevation (ft)** |
| Initial IDF | 490.4 | 492.9 | 493.0 |
| Updated Periodic IDF | 490.0 | 491.4 | 492.0 |
| Initial to Periodic Change[1] | -0.4 | -1.5 | |

Notes:
[1]Postive change indicates increase in the WSE relative to the Initial IDF, negative change indicates decrease in the WSE, relative to the Initial IDF

.

# SECTION 8

# CONCLUSIONS

The EAP at HPP was evaluated relative to the USEPA CCR Rule periodic assessment requirements for:

- Hazard potential classification (§257.73(a)(2)),
- History of Construction reporting (§257.73(d)),
- Structural stability assessment (§257.73(d)), with the exception of §257.73(d)(1)(vi) that was independently certified by Luminant [9],
- Safety factor assessment (§257.73(e)), and
- Inflow design flood control system planning (§257.82).

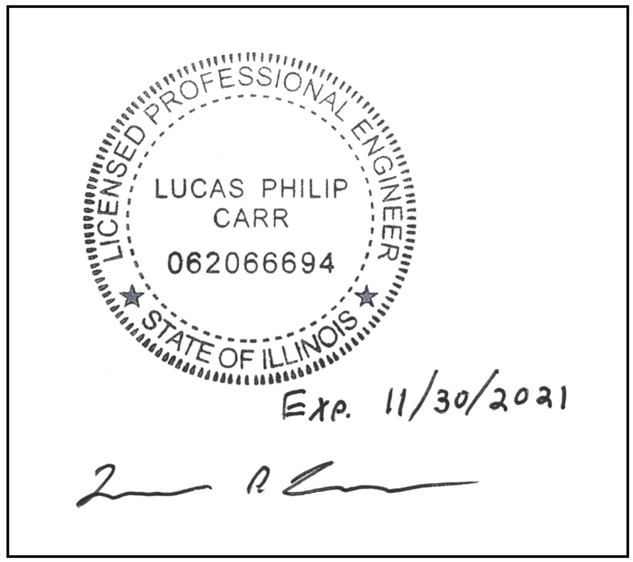
Based on the evaluations presented herein, the referenced requirements are satisfied.

## SECTION 9

## CERTIFICATION STATEMENT

CCR Unit: Dynegy Midwest Generation, LLC, Hennepin Power Plant, East Ash Pond

I, Lucas P. Carr, 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 2021 USEPA CCR Rule Periodic Certification Report, has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that the periodic assessment of the hazard potential classification, history of construction report, structural stability, safety factors, and inflow design flood control system planning, dated October 2021, were conducted in accordance with the requirements of 40 CFR §257.73(a)(2), (c), (d), (e), and §257.82, with the exception of §257.73(d)(1)(vi)) that was independently certified by others.




Lucas P. Carr

*Printed Name*

10/11/2021

*Date*

# SECTION 10

# REFERENCES

[1] United States Environmental Protection Agency, 40 CFR Parts 257 and 261; Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule, 2015.

[2] Stantec Consulting Services Inc., "Initial Hazard Potential Classification Assessment, EPA Final CCR Rule, East Ash Pond, Hennepin Power Station, Putnam County, Illinois," Fenton, MO, October 12, 2016.

[3] AECOM, "History of Construction, USEPA Final CCR Rule, Hennepin Power Station, Hennepin, Illinois," October 2016.

[4] AECOM, "CCR Rule Report: Initial Structural Stability Assessment For East Ash Pond At Hennepin Power Station," St. Louis, MO, October 2016.

[5] AECOM, "CCR Rule Report: Initial Safety Factor Assessment For East Ash Pond At Hennepin Power Station," St. Louis, MO, October 2016.

[6] AECOM, "CCR Rule Report: Initial Inflow Design Flood Control System Plan For East Ash Pond At Hennepin Power Station," St. Louis, MO, October 2016.

[7] Stantec Consulting Services, Inc., "Documentation of Initial Hazard Potential Classification Assessment, East Ash Pond, Hennepin Power Station, Hennepin, Illinois," October 12, 2016.

[8] AECOM, "CCR Certification Report: Initial Structural Stability Assessment, Initial Safety Factor Assessment, and Initial Inflow Design Flood Control System Plan for East Ash Pond at Hennepin Power Station," St. Louis, MO, October 2016.

[9] V. Modeer, "Dynegy Midwest Generation, LLC, Hennepin Power Station," 2021.

[10] Geosyntec Consultants, "DRAFT Construction Certification Report, Closure of Eash Ash Pond No. 2 & No. 4, Hennepin Power Station, Hennepin, Illinois," Chesterfield, MO, March 25, 2021.

[11] Stantec Consulting Services Inc, "Dynegy Midwest Generation, LLC, Hennepin Power Station, Village of Hennepin, Putnam County, IL, Emergency Action Plan, East Ash Pond (NID # IL50363)," Fenton, MO, April 13, 2017.

[12] J. Knutelski and J. Campbell, "Annual CCR Surface Impoundment Inspection Report (per 40 CFR 257.83(b)(2)), Hennepin Power Station, East Ash Pond," November 2, 2016.

[13] J. Knutelski and J. Campbell, "Annual CCR Surface Impoundment Inspection Report (per 40 CFR 257.83(b)(2)), Hennepin Power Station, East Ash Pond," August 10, 2017.

[14] S. Arends, "Annual Inspection by a Qualified Professional Engineer, 40 CFR §257.83(b), Hennepin Power Station, East Ash Pond," November 30, 2019.

[15] J. Knutelski, "Annual Inspection by a Qualified Professional Engineer, 40 CFR 257.83(b), Hennepin Power Station, East Ash Pond," January 10, 2020.

[16] Knutelski, James, "Annual Inspection by a Qualified Professional Engineer, 40 CFR §257.83(b), Hennepin Power Station, East Ash Pond," January 6, 2021.

[17] Weaver Consultants Group, "Dynegy, Collinsville, IL, 2015 - Hennepin Topography," Collinsville, IL, December 2015.

[18] IngenAE, "Luminant, Dynegy Midwest Generation, LLC, Hennepin Power Station, December 2020 Topography," Earth City, Missouri, March 10, 2021.

[19] AECOM, "Draft CCR Unit Initial Site Visit Summary, Dynegy CCR Compliance Program," June 15, 2015.

[20] Natural Resources Conservation Service, Conservation Engineering Division, "Urban Hydrology for Small Watersheds (TR-55)," United States Department of Agriculture, June 1985.

[21] F. A. Huff and J. R. Angel, "Frequency Distributions and Hydroclimatic Characteristics of Heavy Rainstorms in Illinois," State Water Survey Division, Department of Energy and Natural Resoruces, State of Illinois, Champaign, Illinois, 1989.

[22] F. A. Huff, "Time Distributions of Heavy Rainstorms in Illinois," State Water Survey, Department of Energy and Natural Resoruces, State of Illinois, Champaign, Illinois, 1990.

[23] Office of Natural Resources, "Procedural Guidelines for Preparation of Technical Data to be included in Applications for Permits for Construction and Maintenance of Dams," Department of Natural Resoruces, State of Illinois, Springfield, Illinois, Undated.

[24] National Oceanic and Atmospheric Administration, "NOAA Atlas 14: Precipitation-Frequency Atlas of the United States," U.S. Department of Commerence, Silver Spring, Maryland, 2006.

[25] HydroCADTM Software Solutions, LLC, "HydroCADTM Stormwater Modeling System, Version 10," Chocorua, New Hampshire, 2016.

# DRAWINGS


INITIAL SURVEY
12-01-2015 TOPOGRAPHY

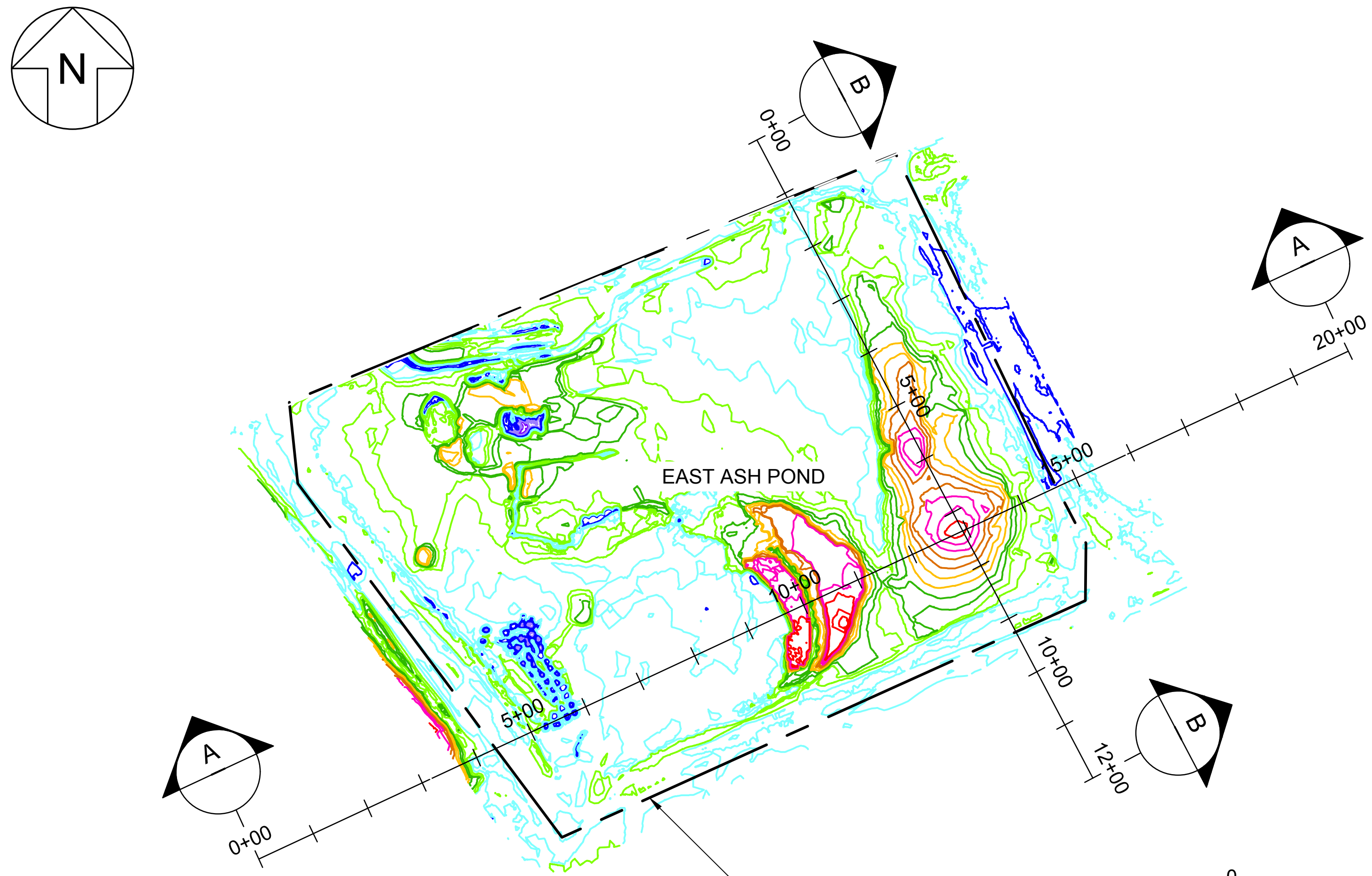

PERIODIC SURVEY
03-10-2021 TOPOGRAPHY

0 300
SCALE IN FEET

NOTES:

1. THE INITIAL SURVEY WAS TAKEN FROM THE DRAWING PACKAGE TITLED "DYNEGY, COLLINSVILLE, ILLINOIS, 2015 - HENNEPIN TOPOGRAPHY", PREPARED BY WEAVER CONSULTANTS GROUP, DATED DECEMBER 1, 2015.
2. THE PERIODIC SURVEY WAS TAKEN FROM THE DRAWING PACKAGE TITLED "LUMINANT, DYNEGY MIDWEST GENERATION, LLC, HENNEPIN POWER STATION, DECEMBER 2020 TOPOGRAPHY", PREPARED BY INGENAE, DATED MARCH 10, 2021.
3. ALL SURVEY DATA WAS COLLECTED IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) AND NORTH AMERICAN DATUM OF 1983 (NAD83) FOR VERTICAL AND HORIZONTAL COORDINATES, RESPECTIVELY.

| | | |
|---|---|---|
| INITIAL TO PERIODIC SURVEY COMPARISON<br>EAST ASH POND<br>HENNEPIN POWER STATION<br>HENNEPIN, ILLINOIS | | |
| Geosyntec consultants | | DRAWING<br>1 |
| GLP8027.05 | MAY 2021 | |

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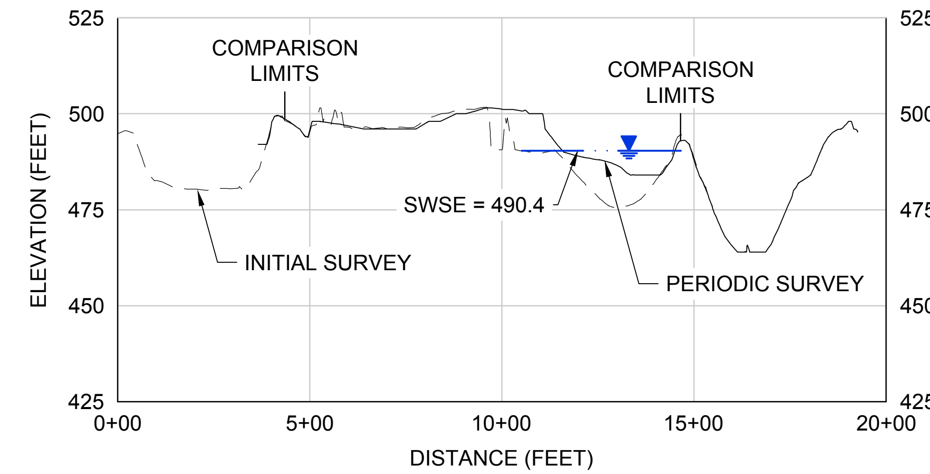
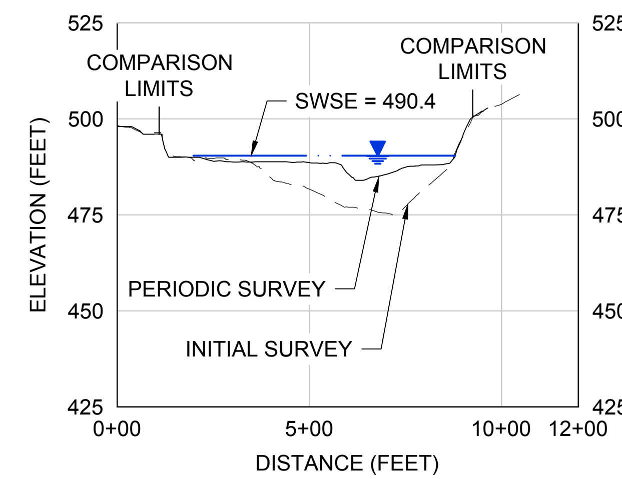
SCALE IN FEET




SECTION A




SECTION B

0 50
VERT: SCALE IN FEET

0 500
HORZ: SCALE IN FEET

| ISOPACH CONTOUR KEY | | |
|---|---|---|
| COLOR | MIN ELEV | MAX ELEV |
| | -8 | -6 |
| | -6 | -4 |
| | -4 | -2 |
| | -2 | 0 |
| | 0 | 2 |
| | 2 | 4 |
| | 4 | 6 |
| | 6 | 8 |
| | 8 | 10 |
| | 10 | 14 |

NOTES:

1. THE INITIAL SURVEY WAS TAKEN FROM THE DRAWING PACKAGE TITLED "DYNEGY, COLLINSVILLE, ILLINOIS, 2015 - HENNEPIN TOPOGRAPHY", PREPARED BY WEAVER CONSULTANTS GROUP, DATED DECEMBER 1, 2015.
2. THE PERIODIC SURVEY WAS TAKEN FROM THE DRAWING PACKAGE TITLED "LUMINANT, DYNEGY MIDWEST GENERATION, LLC, HENNEPIN POWER STATION, DECEMBER 2020 TOPOGRAPHY", PREPARED BY INGENAE, DATED MARCH 10, 2021.
3. ALL SURVEY DATA WAS COLLECTED IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) AND NORTH AMERICAN DATUM OF 1983 (NAD83) FOR VERTICAL AND HORIZONTAL COORDINATES, RESPECTIVELY.
4. THE STARTING WATER SURFACE ELEVATION (SWSE) OF THE BOTTOM ASH POND IS EL. 490.4 FT, AS NOTED IN THE REPORT TITLED "CCR CERTIFICATION REPORT: INITIAL STRUCTURAL STABILITY ASSESSMENT, INITIAL SAFETY FACTOR ASSESSMENT, AND INITIAL INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN FOR EAST ASH POND AT HENNEPIN POWER STATION", PREPARED BY AECOM, DATED OCTOBER, 2016.

| INITIAL TO PERIODIC SURVEY COMPARISON SUMMARY | | | |
|---|---|---|---|
| CCR SURFACE IMPOUNDMENT | CUT | FILL | NET (CU. YD.) |
| EAST ASH POND | 7,595 | 53,452 | 45,856 (FILL) |
| ABOVE SWSE | 6,469 | 33,270 | 26,801 (FILL) |
| BELOW SWSE | 1,156 | 20,194 | 19,038 (FILL) |

SURVEY COMPARISION ISOPACH
EAST ASH POND
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

Geosyntec consultants

DRAWING 2

GLP8027.05 MAY 2021

P:\CADD\PROJECTS\VISTRA PONDS\HENNEPIN\ISOPACH-2 - Last Saved by: KHanavec on 5/17/21


INITIAL AERIAL
12-01-2015 IMAGERY


PERIODIC AERIAL
03-10-2021 IMAGERY

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SCALE IN FEET

NOTES:

1. THE INITIAL IMAGERY WAS TAKEN FROM THE DRAWING PACKAGE TITLED "DYNEGY, COLLINSVILLE, ILLINOIS, 2015 - HENNEPIN TOPOGRAPHY", PREPARED BY WEAVER CONSULTANTS GROUP, DATED DECEMBER 1, 2015.
2. THE PERIODIC IMAGERY WAS TAKEN FROM THE DRAWING PACKAGE TITLED "LUMINANT, DYNEGY MIDWEST GENERATION, LLC, HENNEPIN POWER STATION, DECEMBER 2020 TOPOGRAPHY", PREPARED BY INGENAE, DATED MARCH 10, 2021.

INITIAL TO PERIODIC AERIAL IMAGERY COMPARISON
EAST ASH POND
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

Geosyntec consultants

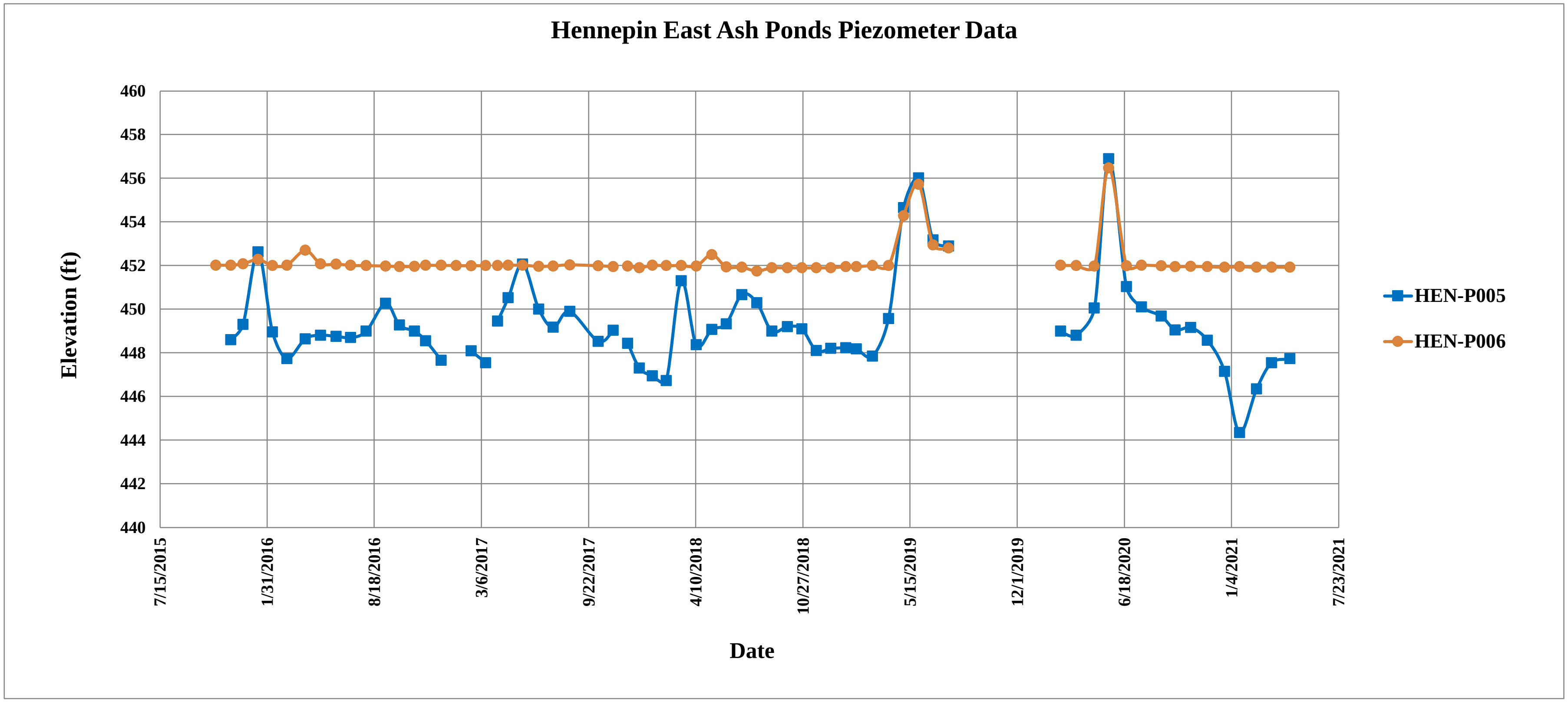
DRAWING 3

GLP8027.05 | MAY 2021

# ATTACHMENTS

# Attachment A

# EAP Piezometer Data Plots




NOTE:

1. Piezometer data was taken from the spreadsheet titled "Hennepin Piezo Measurements 2016 - 2021", extracted from the spreadsheets provided by the Hennepin Power Station.

| PIEZOMETER DATA<br>PERIODIC CERTIFICATION, EAST ASH POND<br>HENNEPIN POWER STATION<br>HENNEPIN, ILLINOIS | | |
|---|---|---|
| Geosyntec consultants | | Figure A-1 |
| GLP8027 | 5/19/2021 | |

# Attachment B

# EAP Site Visit Photolog

| | |
|---|---|
| **Site Owner:** Dynegy Midwest Generation, LLC | **Project Number:** GLP8027 |
| **CCR Unit:** East Ash Pond (EAP) | **Site:** Hennepin Power Plant |

**Photo:** 01

**Date:** 05/27/2021

**Direction Facing:** SE

**Comments:** Overview of EAP.

**Photo:** 02

**Date:** 05/27/2021

**Direction Facing:** SE

**Comments:** Interior slope vegetation of EAP.

# GEOSYNTEC CONSULTANTS
## Photographic Record

Geosyntec consultants

| | |
|---|---|
| **Site Owner:** Dynegy Midwest Generation, LLC | **Project Number:** GLP8027 |
| **CCR Unit:** East Ash Pond (EAP) | **Site:** Hennepin Power Plant |

**Photo:** 03

**Date:** 05/27/2021

**Direction Facing:** SE

**Comments:** Overview of EAP.

**Photo:** 04

**Date:** 05/27/2021

**Direction Facing:** NW

**Comments:** Gate valve at inlet of culvert between EAP and Leachate Pond. Note partial obstruction with vegetation. Geosyntec recommended clearing as part of routine site maintenance.

## GEOSYNTEC CONSULTANTS

| | |
|---|---|
| **Site Owner:** Dynegy Midwest Generation, LLC | **Project Number:** GLP8027 |
| **CCR Unit:** East Ash Pond (EAP) | **Site:** Hennepin Power Plant |

**Photo:** 05

**Date:** 05/27/2021

**Direction Facing:** W

**Comments:** Outlet of culvert between EAP and Leachate Pond, on the Leachate Pond sideslopes. Note heavy vegetation growth obstructing the culvert. Geosyntec recommended clearing as part of routine site maintenance.

**Photo:** 06

**Date:** 05/27/2021

**Direction Facing:** S

**Comments:** Overview of the EAP dike crest.

| **GEOSYNTEC CONSULTANTS**<br>**Photographic Record** | |
|---|---|
| **Site Owner:** Dynegy Midwest Generation, LLC | **Project Number:** GLP8027 |
| **CCR Unit:** East Ash Pond (EAP) | **Site:** Hennepin Power Plant |

| | |
|---|---|
| **Photo:** 07<br>**Date:** 05/27/2021<br>**Direction Facing:** SE<br>**Comments:** Overview of vegetation on the downstream slope of the EAP dike. |  |
| **Photo:** 08<br>**Date:** 05/27/2021<br>**Direction Facing:** SW<br>**Comments:** EAP upstream dike geomembrane slope covering overview |  |

## GEOSYNTEC CONSULTANTS

Geosyntec consultants

| | |
|---|---|
| **Site Owner:** Dynegy Midwest Generation, LLC | **Project Number:** GLP8027 |
| **CCR Unit:** East Ash Pond (EAP) | **Site:** Hennepin Power Plant |

**Photo:** 09

**Date:** 05/27/2021

**Direction Facing:** SE

**Comments:** EAP downstream dike vegetation overview.

**Photo:** 10

**Date:** 05/27/2021

**Direction Facing:** SW

**Comments:** EAP upstream dike geomembrane overview and outlet structure.

## GEOSYNTEC CONSULTANTS
### Photographic Record

Geosyntec consultants

| | |
|---|---|
| **Site Owner:** Dynegy Midwest Generation, LLC | **Project Number:** GLP8027 |
| **CCR Unit:** East Ash Pond (EAP) | **Site:** Hennepin Power Plant |

**Photo:** 11

**Date:** 05/27/2021

**Direction Facing:** W

**Comments:** EAP outfall structure catwalk

**Photo:** 12

**Date:** 05/27/2021

**Direction Facing:** Down

**Comments:** EAP outfall structure stoplogs from above

| | |
|---|---|
| **Site Owner:** Dynegy Midwest Generation, LLC | **Project Number:** GLP8027 |
| **CCR Unit:** East Ash Pond (EAP) | **Site:** Hennepin Power Plant |

**Photo:** 13

**Date:** 05/27/2021

**Direction Facing:** N

**Comments:** EAP dike overview

**Photo:** 14

**Date:** 05/27/2021

**Direction Facing:** W

**Comments:** EAP south side overview

**GEOSYNTEC CONSULTANTS**
**Photographic Record**

Geosyntec consultants

| | |
|---|---|
| **Site Owner:** Dynegy Midwest Generation, LLC | **Project Number:** GLP8027 |
| **CCR Unit:** East Ash Pond (EAP) | **Site:** Hennepin Power Plant |

| | |
|---|---|
| **Photo:** 15<br>**Date:** 05/27/2021<br>**Direction Facing:** NE<br>**Comments:** EAP pool overview |  |
| **Photo:** 16<br>**Date:** 05/27/2021<br>**Direction Facing:** NW<br>**Comments:** EAP interior overview |  |

| | |
|---|---|
| **Site Owner:** Dynegy Midwest Generation, LLC | **Project Number:** GLP8027 |
| **CCR Unit:** East Ash Pond (EAP) | **Site:** Hennepin Power Plant |

| | |
|---|---|
| **Photo:** 17 |  |
| **Date:** 05/27/2021 | |
| **Direction Facing:** N | |
| **Comments:** EAP interior overview | |

| | |
|---|---|
| **Photo:** 18 |  |
| **Date:** 05/27/2021 | |
| **Direction Facing:** N | |
| **Comments:** West side of EAP overview | |

# GEOSYNTEC CONSULTANTS
## Photographic Record

Geosyntec consultants

| | |
|---|---|
| **Site Owner:** Dynegy Midwest Generation, LLC | **Project Number:** GLP8027 |
| **CCR Unit:** East Ash Pond (EAP) | **Site:** Hennepin Power Plant |

**Photo:** 19

**Date:** 05/27/2021

**Direction Facing:** N

**Comments:** West side of EAP overview.

**Photo:** 20

**Date:** 05/27/2021

**Direction Facing:** E

**Comments:** EAP interior overview

# Attachment C

# Periodic History of Construction Report Update Letter

Geosyntec consultants

1 McBride and Son Center Drive, Suite 202
Chesterfield, MO 63005
PH 636-812-0800
www.geosyntec.com

October 11, 2021

Dynegy Midwest Generation, LLC
13498 E. 800th Street
Hennepin, Illinois 61327

**Subject: Periodic History of Construction Report Update Letter**
**USEPA Final CCR Rule, 40 CFR §257.73(c)**
**Hennepin Power Plant**
**Hennepin, Illinois**

At the request of Dynegy Midwest Generation, LLC (DMG), Geosyntec Consultants (Geosyntec) has prepared this Letter to documents updates to the Initial History of Construction (HoC) report for the Hennepin Power Plant (HPP), also known as the Hennepin Power Station (HEN). The Initial HoC report was prepared by AECOM in October of 2016 [1] in accordance with 40 Code of Federal Regulations (CFR) §257.73(c) of the United States Environmental Protection Agency (USEPA) Coal Combustion Residuals Rule, known as the CCR Rule [2]. This letter also includes information required by Section 845.220(a)(1)(B) (Design and Construction Plans) of the state-specific Illinois Environmental Protection Agency (IEPA) Part 845 CCR Rule [3] that is not expressly required by §257.73(c).

## BACKGROUND

The CCR Rule required that, by October 17, 2016, Initial HoC reports to be compiled for existing CCR surface impoundments with: (1) a height of five feet or more and a storage volume of 20 acre-feet or more, or (2) a height of 20 feet or more. The Initial HoC report was required to contain, to the extent feasible, the information specified in 40 CFR §257.73(c)(1)(i)-(xii). The Initial HoC report for HPP, which included four existing CCR surface impoundments, the Old West Polishing Pond (OWPP), Old West Ash Pond (Pond No. 1 and Pond No. 3, also known as the OWAP), Ash Pond No. 2 (AP2), and the East Ash Pond (EAP), was prepared and subsequently posted to DMG's CCR Website prior to October 17, 2016.

The CCR Rule requires that Initial HoC to be updated if there is a significant change to any information complied in the Initial HoC report, as listed below:

*§ 257.73(c)(2): If there is a significant change to any information complied under paragraph (c)(1) of this section, the owner or operator of the CCR unit must update the relevant information and place it in the facility's operating record as required by § 257.105(f)(9).*

DMG retained Geosyntec to review the Initial HoC report, review reasonably and readily available information for the OWPP, OWAP, AP2, EAP generated since the Initial HoC report was prepared, and perform a site visit to HPP to evaluate if significant changes may have occurred since the Initial HoC report was prepared. This Letter contains the results of Geosyntec's evaluation and documents significant changes that have occurred at the OWPP, OWAP, AP2, and EAP, as they pertain the requirements of §257.73(c)(1)(i)-(xii)

**UPDATES TO HISTORY OF CONSTRUCTION REPORT**

Geosyntec's evaluation for the HPP OWPP, OWAP, AP2, and EAP determined that no known significant changes requiring updates to the information in the Initial HoC report pertaining to §257.73(c)(1)(ii), (iv), (v), (vi), (vii), (xi), and (xii) of the CCR Rule had occurred since the Initial HoC report was developed.

However, Geosyntec's evaluation determined that significant changes at the HPP EAP pertaining to §257.73(c)(1)(i), (iii), (viii), (ix), and (x) of the CCR Rule had occurred since the Initial HoC report had been developed. Additionally, information how long the CCR EAP and been operating and the types of CCR in the impoundment, as required by Section 845.220(a)(1)(B) of the Part 845 Rule were not included in the Initial HoC report, as this information is not required by the CCR Rule. Each change and the subsequent updates to the Initial HoC report is described within this section.

*Section 845.220(a)(1)(B): A statement of … how long the CCR surface impoundment has been in operation, and the types of CCR that have been placed in the surface impoundment.*

<u>*East Ash Pond*</u>

The EAP was in operation from 1996 until the HPP was retired in December of 2019, for a total of approximately 23 years [1]. Since December of 2019 the EAP has not been actively receiving CCR but has not yet been closed. As of the date of this report, the EAP has been present for approximately 25 years.

CCR placed in the EAP has included bottom ash and fly ash, in addition to other non-CCR waste streams [1].

*Old West Polishing Pond and Old West Ash Pond*

The OWAP and OWPP were in operation from 1952 to approximately 1996, for a total of approximately 44 years. The OWAP and OWPP did not receive CCR after 1996 but was not closed until 2020. The OWAP and OWPP were present for a total of approximately 68 years prior to closure.

CCR placed in the OWAP and OWPP included fly ash and bottom ash.

*Ash Pond No. 2*

AP2 was in operation from 1958 until sometime between 2003 and 2009, for a total of approximately 45 to 51 years. AP2 did not receive CCR after sometime between 2003 and 2009, but was not closed until 2020. AP2 was present for a total of approximately 62 years.

CCR placed in AP2 included fly ash and bottom ash.

*§ 257.73(c)(1)(i): The name and address of the person(s) owning or operating the CCR unit; the name associated with the CCR unit; and the identification number of the CCR unit if one has been assigned by the state.*

State identification numbers (IDs) for the OWPP, OWAP, AP2, and EAP have been assigned by the Illinois Environmental Protection Agency (IEPA). Each ID is listed in **Table 1**.

**Table 1 – Results of Updated Discharge Capacity Calculations**

| CCR Surface Impoundment | State ID |
|---|---|
| Old West Polishing Pond (OWPP) | W1550100002-01 |
| Old West Ash Pond (OWAP) | W1550100002-03 |
| Ash Pond No. 2 (AP2) | W1550100002-04 |
| East Ash Pond (EAP) | W1550100002-05 |

*§ 257.73(c)(1)(iii): A statement of the purpose for which the CCR unit is being used.*

The OWPP, OWAP, and EAP2 were closed in 2020, in substantial compliance with the written closure plans posted to DMG's CCR Website ( [4], [5], [6] ), and as documented by certified Notification of Completion of Closures posted to DMG's CCR Website ( [7], [8]). Therefore, the OWAP and EAP2 are no longer capable of storing additional CCR or free liquids, and all CCR was removed from the OWPP as part of closure-by-removal.

The HPP was retired in December of 2019, with the generation of electricity ceased at that time. Therefore, the EAP is no longer being used to actively store and dispose of new CCR, as CCR is no longer being generated by the HPP. The EAP also received inflows from East

Ash Pond No. 2 and the Coal Pile Runoff Pond; these inflows have also ceased as part of plant closure.

*§ 257.73(c)(1)(viii): A description of the type, purpose, and location of existing instrumentation.*

Instrumentation monitoring at the OWPP, OWAP, and EAP is no longer required as these CCR surface impoundments were closed in accordance with §257.102 ( [7], [8]), and the instrumentation network was modified at that time. Therefore, the instrumentation locations shown in Appendix C of the Initial HoC report are no longer applicable to the OWPP, OWAP, and EAP.

*§ 257.73(c)(1)(ix): Area-capacity curves for the CCR unit.*

An updated area-capacity curve was prepared for the EAP in 2021 and is provided in **Figure 1**.

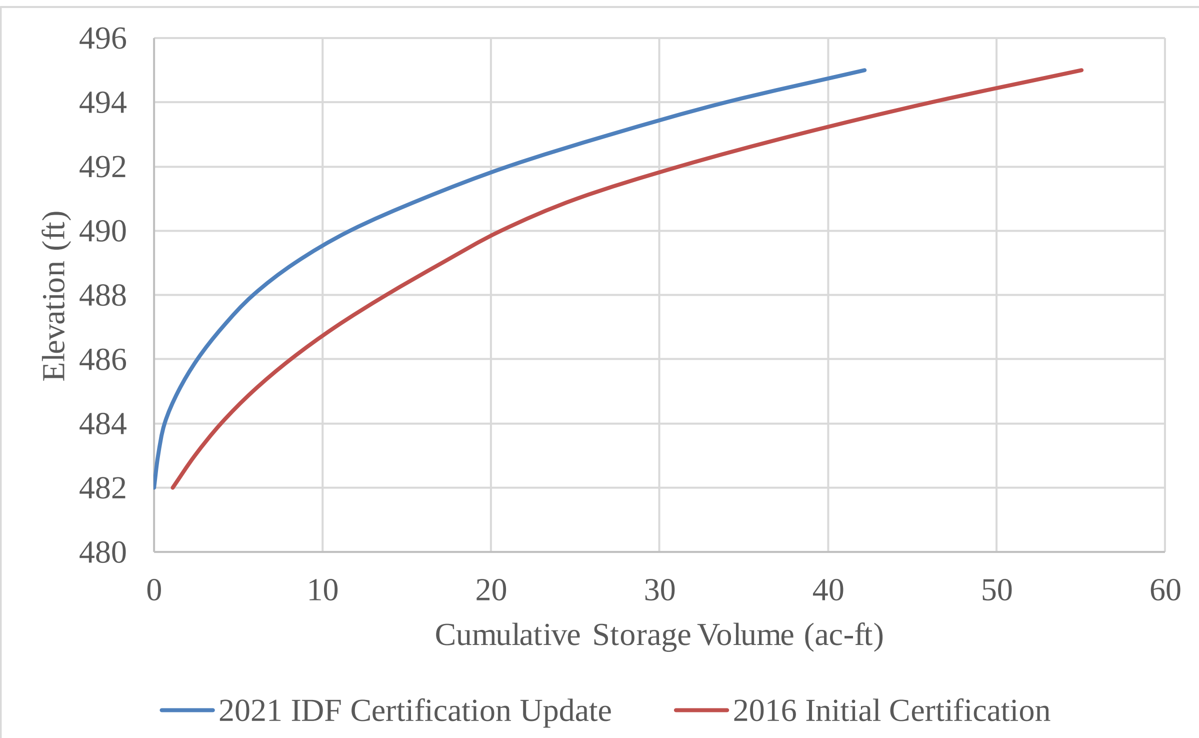



**Figure 1 – Area-Capacity Curve for East Ash Pond**

*§ 257.73(c)(1)(x): A description of each spillway and diversion design features and capacities and calculations used in their determination.*

Updated discharge capacity calculations for the existing spillways of the EAP were prepared in 2021 using HydroCAD 10 modeling software. The calculations indicate that the EAP has sufficient storage capacity and will not overtop the embankments during the 1,000-year, 24-hour, storm event. The results of the calculations are provided in **Table 2**.

**Table 2 – Results of Updated Discharge Capacity Calculations**

| | East Ash Pond |
|---|---|
| Approximate Berm Minimum Elevation[1], ft | 492.0 |
| Approximate Emergency Spillway Elevation[1], ft | Not Applicable |
| Starting Water Surface Elevation[1] (SWSE), ft | 490.0 |
| Peak Water Surface Elevation[1] (PWSE), ft | 491.4 |
| Time to Peak, hr | 16.8 |
| Surface Area[2], ac | 5.0 |
| Storage[3], ac-ft | 6.3 |

Notes:
[1]Elevations are based on the NAVD88 datum
[2]Surface area is defined as the water surface area at the PWSE
[3]Storage is defined as the volume between the SWSE and PWSE

The OWPP, OWAP, and EAP2 no longer retain free water as both CCR surface impoundments were closed in 2020 ( [7], [8]). Therefore, the spillways are no longer present and the information regarding the spillways of these structures, as presented in the Initial HoC report, is no longer applicable to the OWPP, OWAP, and EAP2.

## CLOSING

This letter has been prepared to document Geosyntec's evaluation of changes that have occurred at the OWPP, OWAP, AP2, and EAP at the HPP since the Initial HoC was developed, based on reasonably and readily available information provided by DMG, observed by Geosyntec during the site visit, or generated by Geosyntec as part of subsequent calculations.

Sincerely,

Lucas P. Carr, P.E.
Senior Engineer

John Seymour, P.E.
Senior Principal

**REFERENCES**

[1] AECOM, "History of Construction, USEPA Final CCR Rule, 40 CFR § 257.73(c), Hennepin Power Station, Hennepin, Illinois," October 2016.

[2] United Stated Environmental Protection Agency, "40 CFR Parts 257 and 261, Hazardous and Solid Waste Management System, Disposal of Coal Combustion Residuals from Electric Utilities, Final Rule, 2015," 2015.

[3] Illinois Environmental Protection Agency, "35 Ill. Adm. Code Part 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments," Springfield, IL, 2021.

[4] V. Modeer, "Closure Plan for Existing CCR Surface Impoundment, 40 CFR 257.102(b), Hennepin Power Station, Dynegy Midwest Generation, LLC, Old West Polishing Pond," October 17, 2016.

[5] V. Modeer, "Closure Plan for Existing CCR Surface Impoundment, 40 CFR 257.102(b), Hennepin Power Station, Dynegy Midwest Generation, LLC, Old West Ash Pond," December 17, 2020.

[6] V. Modeer, "Closure Plan for Existing CCR Surface Impoundment, 40 CFR 257.102(b), Hennepin Power Station, Dynegy Midwest Generation, LLC, East Ash Pond," October 17, 2016.

[7] D. Tickner, "Hennepin Power Station; Old West Polishing Pond, Notificaiton of Completion of Closure," Luminant, December 17, 2020.

[8] D. Tickner, "Hennepin Power Station; Old West Ash Pond, Ash Pond No. 2, Notificaiton of Completion of Closure," Luminant, December 17, 2020.

# Attachment D

# Periodic Structural Stability and Safety Factor Assessment Analyses

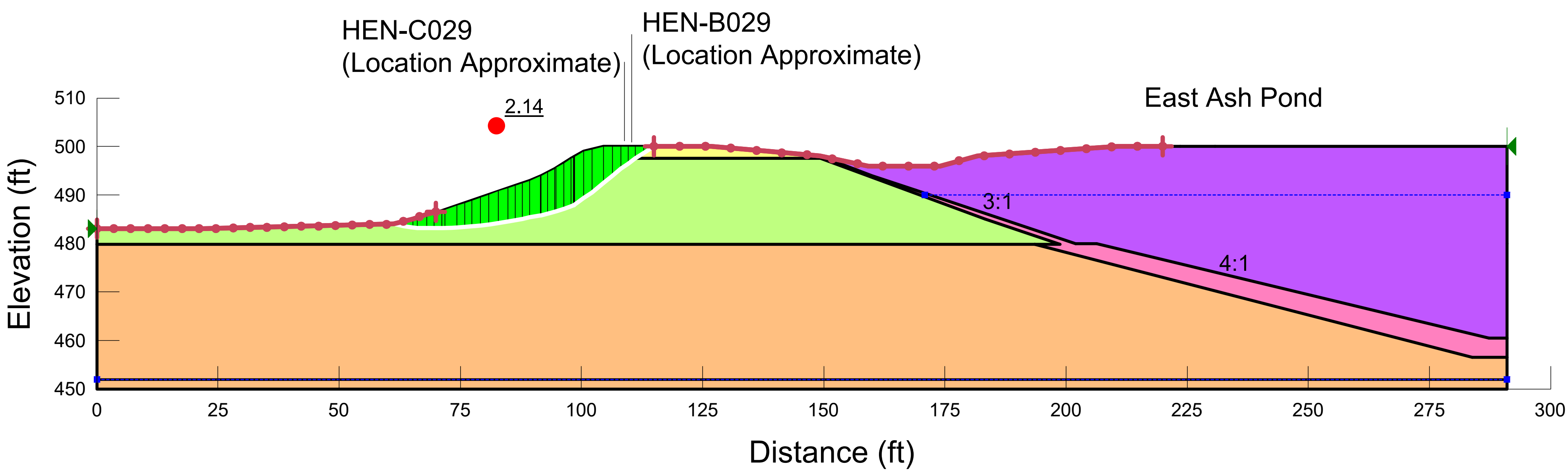
Calculated By: ZJF Date:9-21-2016
Modified By: PK Date: 8-31-2021
Checked By: PB Date:9-01-2021

Hennepin East Ash Pond
Cross Section SL-10
Effective (Drained)-Static Normal Pool

Materials

- Road Fill
- Alluvial Foundation
- Liner System (Drained)
- Fly Ash (Drained)
- Embankment Fill (Drained)

Name: Road Fill Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Piezometric Line: 1
Name: Alluvial Foundation Unit Weight: 135 pcf Cohesion': 0 psf Phi': 38 ° Piezometric Line: 1
Name: Liner System (Drained) Unit Weight: 120 pcf Cohesion': 60 psf Phi': 30 ° Piezometric Line: 2
Name: Fly Ash (Drained) Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 2
Name: Embankment Fill (Drained) Unit Weight: 105 pcf Cohesion': 30 psf Phi': 32 ° Piezometric Line: 1



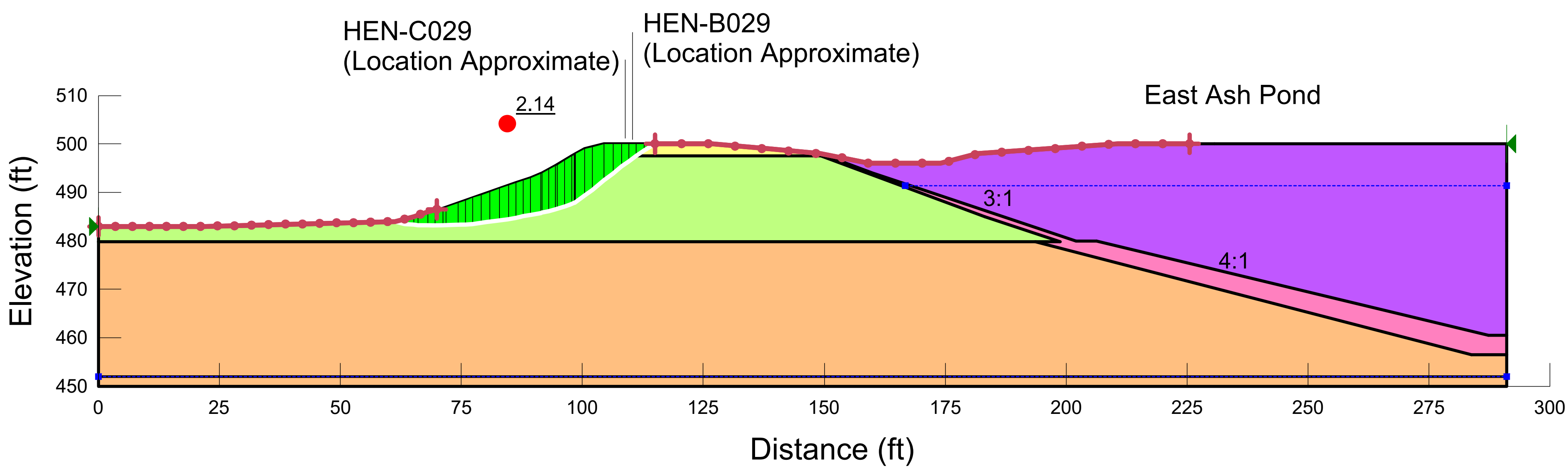
Calculated By: ZJF Date:9-21-2016
Modified By: PK Date: 8-31-2021
Checked By: PB Date:9-01-2021

Hennepin East Ash Pond
Cross Section SL-10
Effective (Drained) - Static Max Pool

Materials

- Road Fill
- Alluvial Foundation
- Liner System (Drained)
- Fly Ash (Drained)
- Embankment Fill (Drained)

Name: Road Fill Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Piezometric Line: 1
Name: Alluvial Foundation Unit Weight: 135 pcf Cohesion': 0 psf Phi': 38 ° Piezometric Line: 1
Name: Liner System (Drained) Unit Weight: 120 pcf Cohesion': 60 psf Phi': 30 ° Piezometric Line: 2
Name: Fly Ash (Drained) Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 2
Name: Embankment Fill (Drained) Unit Weight: 105 pcf Cohesion': 30 psf Phi': 32 ° Piezometric Line: 1



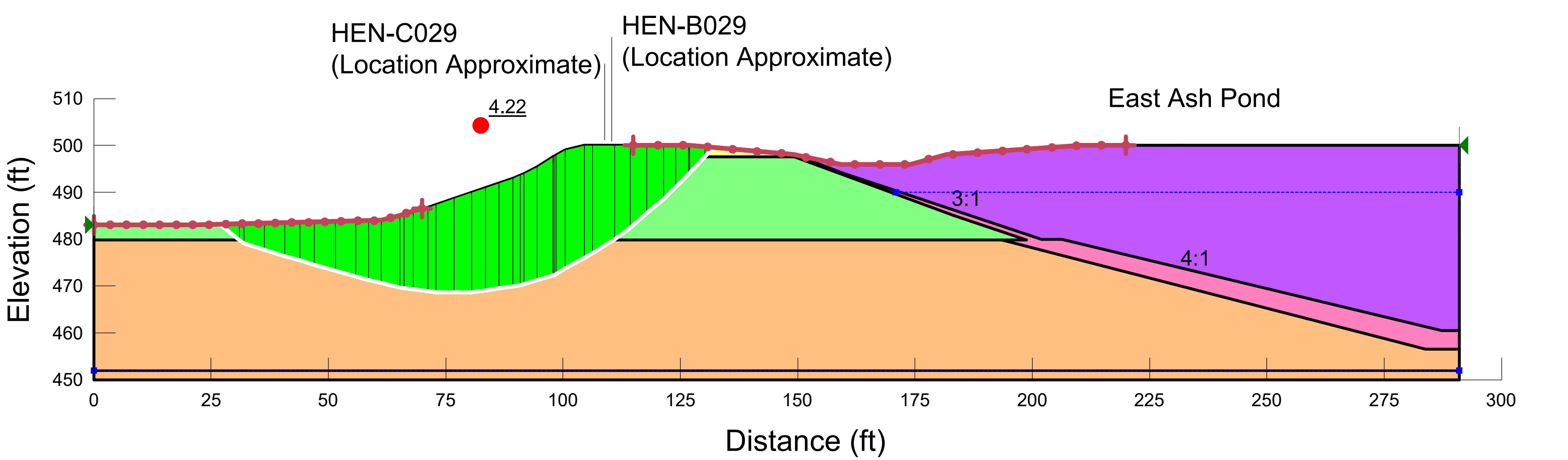
Calculated By: ZJF Date:9-21-2016
Modified By: PK Date: 8-31-2021
Checked By: PB Date:9-01-2021

Hennepin East Ash Pond
Cross Section SL-10
Total (Undrained) - Pseudostatic

Horz Seismic Coef.: 0.119

| Materials |
| --- |
| Road Fill |
| Alluvial Foundation |
| Liner System (Undrained) |
| Fly Ash (Undrained) |
| Embankment Fill (Undrained) |

Name: Road Fill Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Piezometric Line: 1
Name: Alluvial Foundation Unit Weight: 135 pcf Cohesion': 0 psf Phi': 38 ° Piezometric Line: 1
Name: Liner System (Undrained) Unit Weight: 120 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 2
Name: Fly Ash (Undrained) Unit Weight: 105 pcf Cohesion': 600 psf Phi': 0 ° Piezometric Line: 2
Name: Embankment Fill (Undrained) Unit Weight: 105 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1

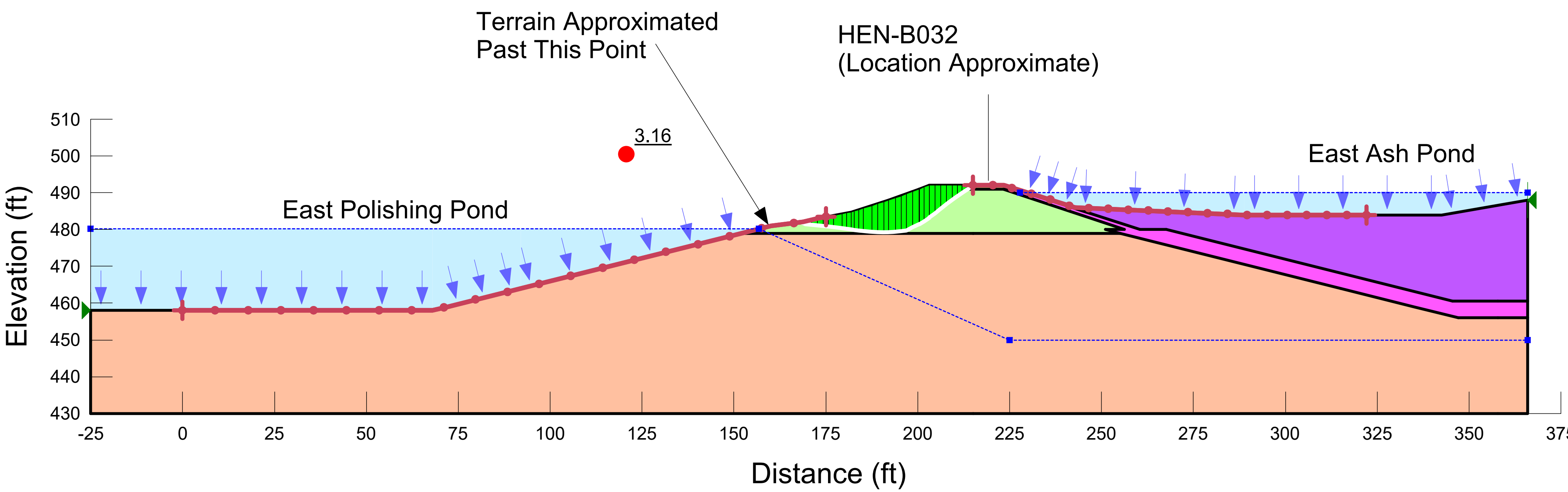


East Ash Pond
Cross Section SL-12
Effective (Drained) - Static Normal Pool

Calculated By: ZJF Date: 9/21/16
Modfied By: PK Date: 8/31/21
Checked By: PB Date: 9/01/21

Materials
- Road Fill
- Alluvial Foundation
- Fly Ash (Drained)
- Liner System (Drained)
- Embankment Fill (Drained)

Name: Road Fill Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Piezometric Line: 2
Name: Alluvial Foundation Unit Weight: 135 pcf Cohesion': 0 psf Phi': 38 ° Piezometric Line: 2
Name: Fly Ash (Drained) Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: Liner System (Drained) Unit Weight: 120 pcf Cohesion': 60 psf Phi': 30 ° Piezometric Line: 1
Name: Embankment Fill (Drained) Unit Weight: 105 pcf Cohesion': 30 psf Phi': 32 ° Piezometric Line: 2

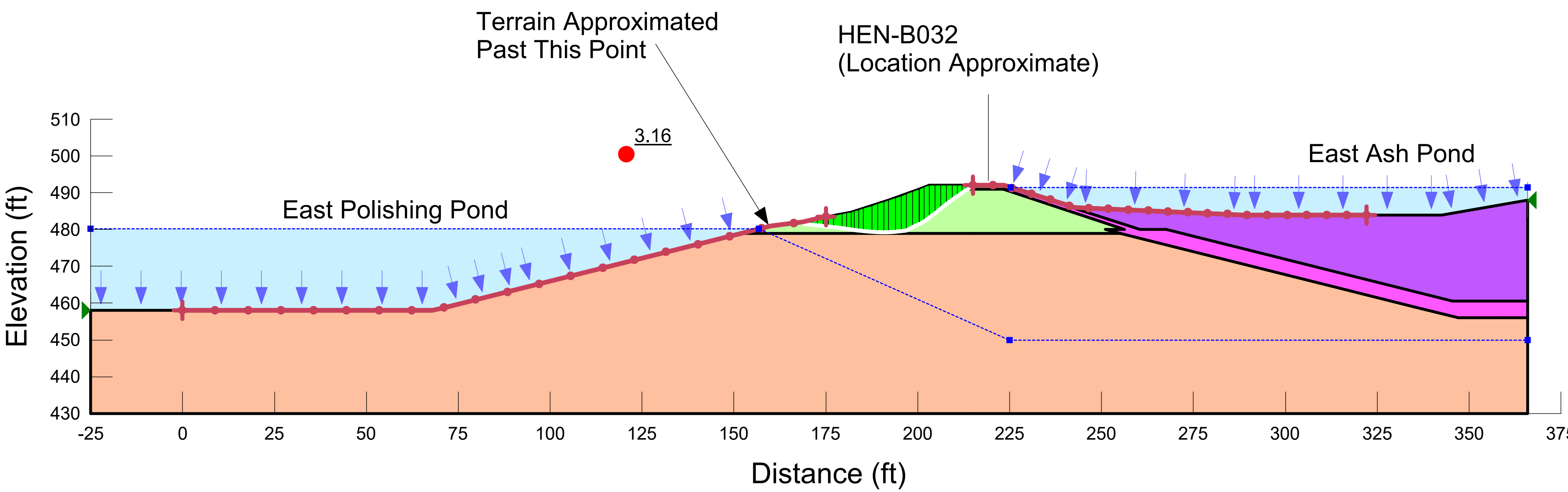


East Ash Pond
Cross Section SL-12
Effective (Drained) - Static Max Pool

Calculated By: ZJF Date: 9/21/16
Modfied By: PK Date: 8/31/21
Checked By: PB Date: 9/01/21

Materials
- Road Fill
- Alluvial Foundation
- Fly Ash (Drained)
- Liner System (Drained)
- Embankment Fill (Drained)

Name: Road Fill Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Piezometric Line: 2
Name: Alluvial Foundation Unit Weight: 135 pcf Cohesion': 0 psf Phi': 38 ° Piezometric Line: 2
Name: Fly Ash (Drained) Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: Liner System (Drained) Unit Weight: 120 pcf Cohesion': 60 psf Phi': 30 ° Piezometric Line: 1
Name: Embankment Fill (Drained) Unit Weight: 105 pcf Cohesion': 30 psf Phi': 32 ° Piezometric Line: 2



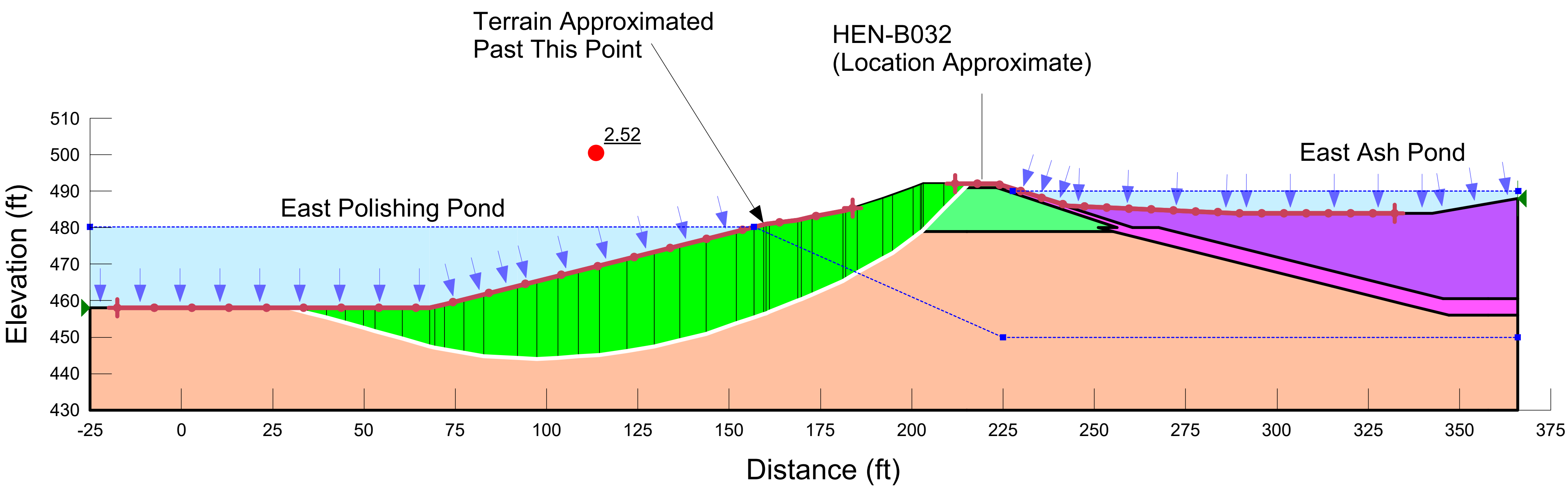
East Ash Pond
Cross Section SL-12
Total (Undrained) - Pseudostatic

Calculated By: ZJF Date: 9/21/16
Modfied By: PK Date: 8/31/21
Checked By: PB Date: 9/01/21

Horz Seismic Coef.: 0.119

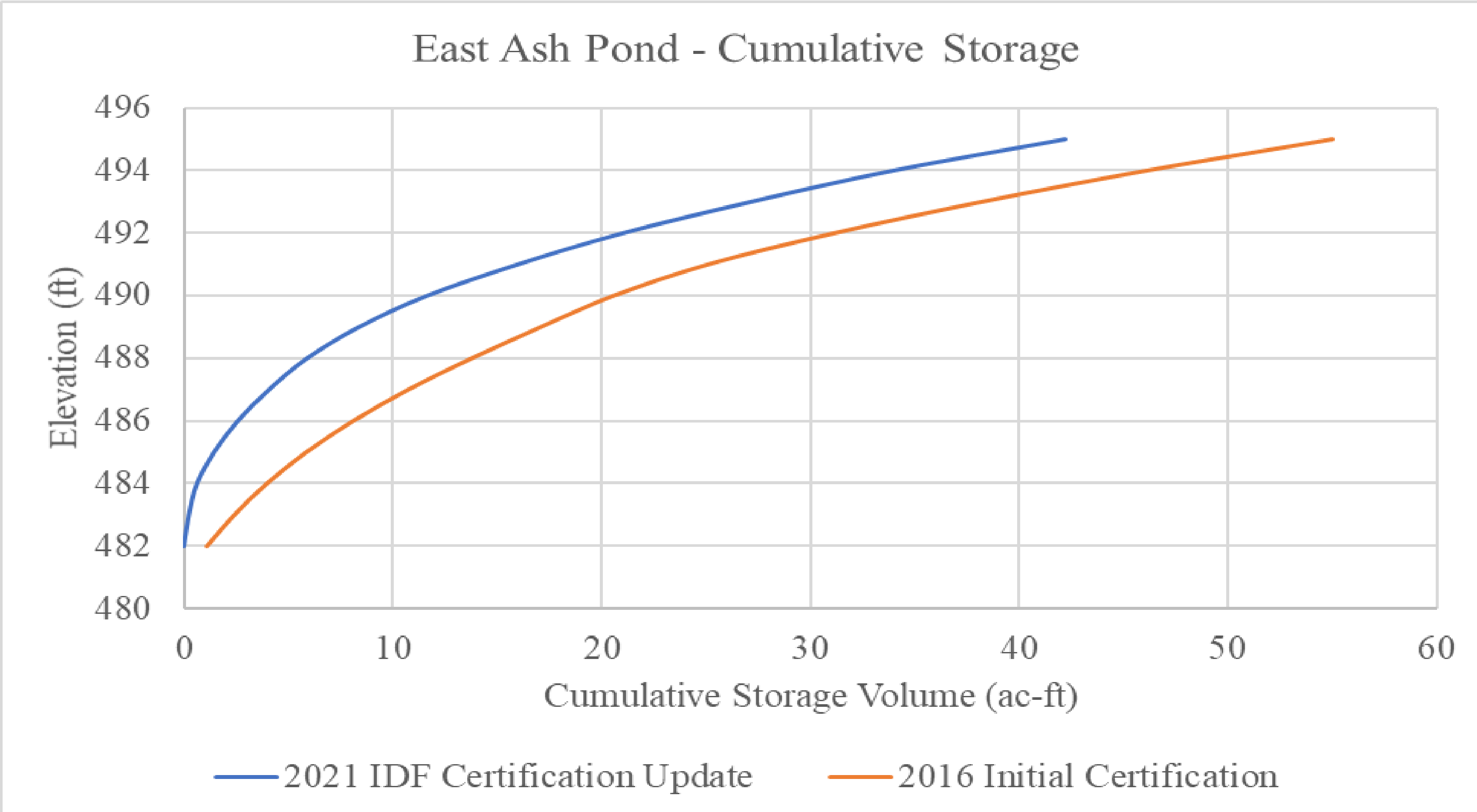
Materials
- Road Fill
- Alluvial Foundation
- Liner System (Undrained)
- Fly Ash (Undrained)
- Embankment Fill (Undrained)

Name: Road Fill Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Piezometric Line: 2
Name: Alluvial Foundation Unit Weight: 135 pcf Cohesion': 0 psf Phi': 38 ° Piezometric Line: 2
Name: Liner System (Undrained) Unit Weight: 120 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: Fly Ash (Undrained) Unit Weight: 105 pcf Cohesion': 600 psf Phi': 0 ° Piezometric Line: 1
Name: Embankment Fill (Undrained) Unit Weight: 105 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 2



# Attachment E

# Periodic Inflow Design Flood Control System Plan Analyses

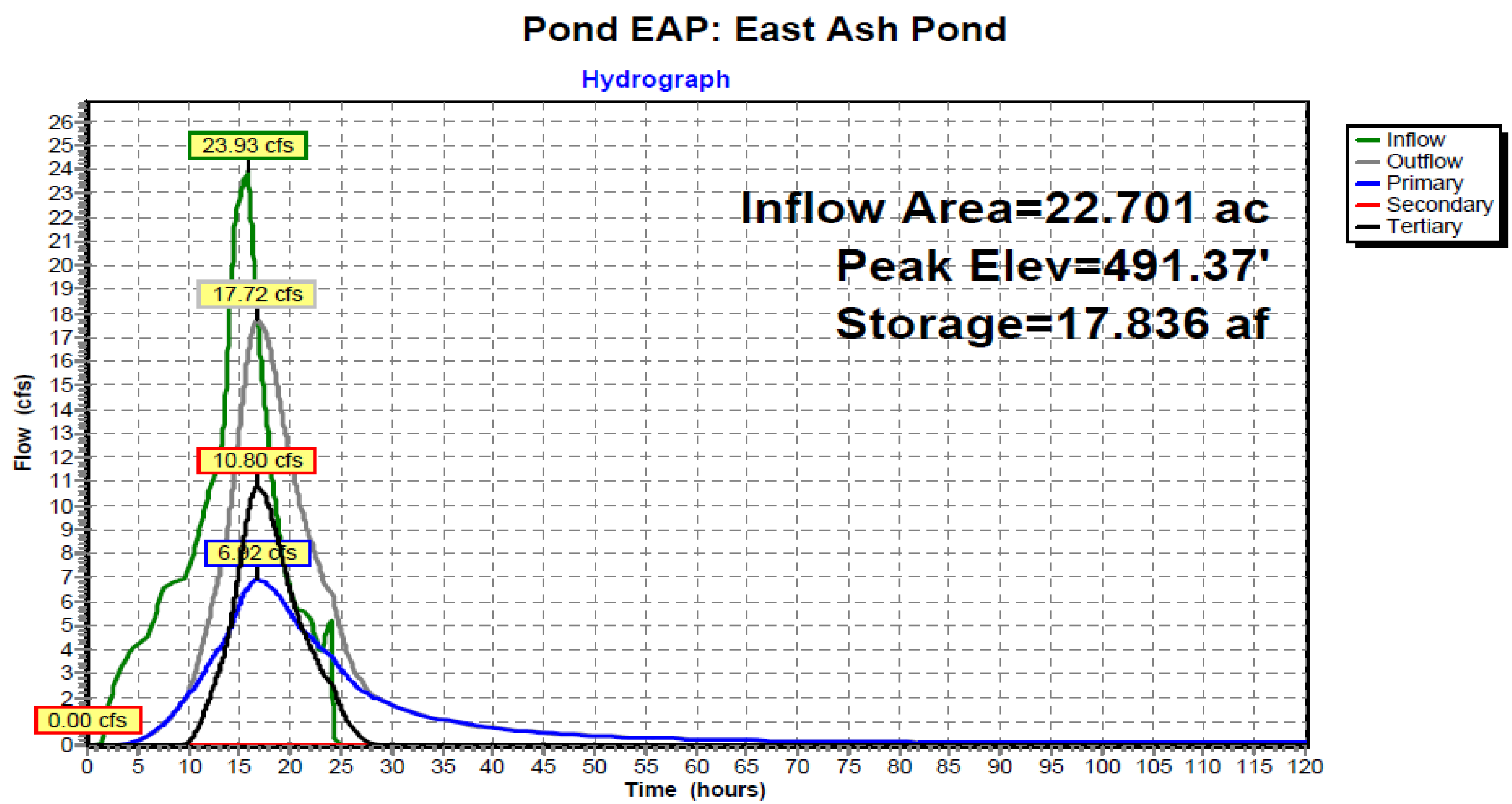



EAST ASH POND - CUMULATIVE STORAGE
PERIODIC CERTIFICATION
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

Geosyntec consultants

Figure E-1

GLP8027 | 8/30/2021




EAST ASH POND IDF HYDROGRAPH
PERIODIC CERTIFICATION
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

Geosyntec consultants

Figure E-2

GLP8027 | 8/30/2021

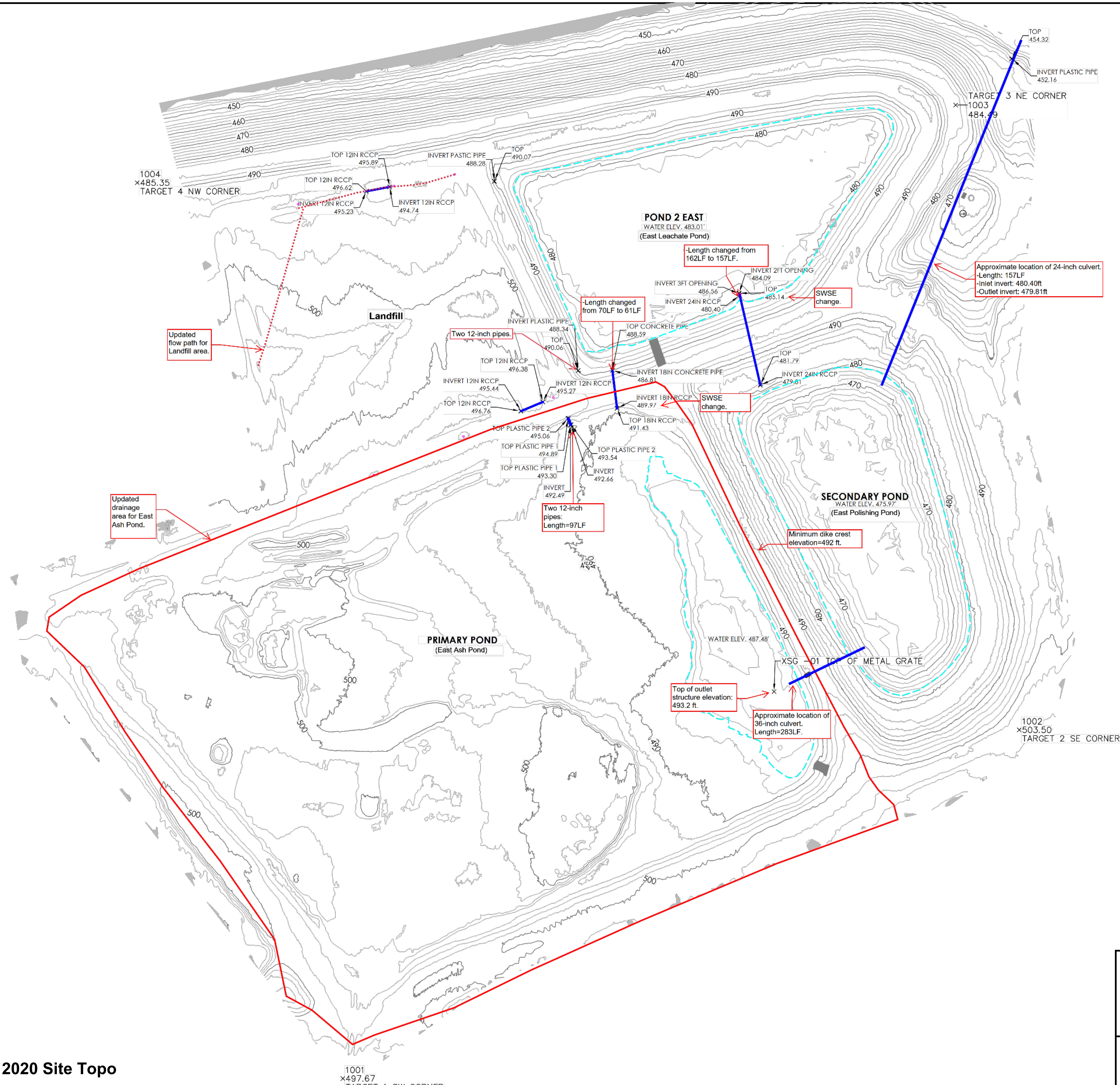



**Figure based on IngenAE 2020 Site Topo**

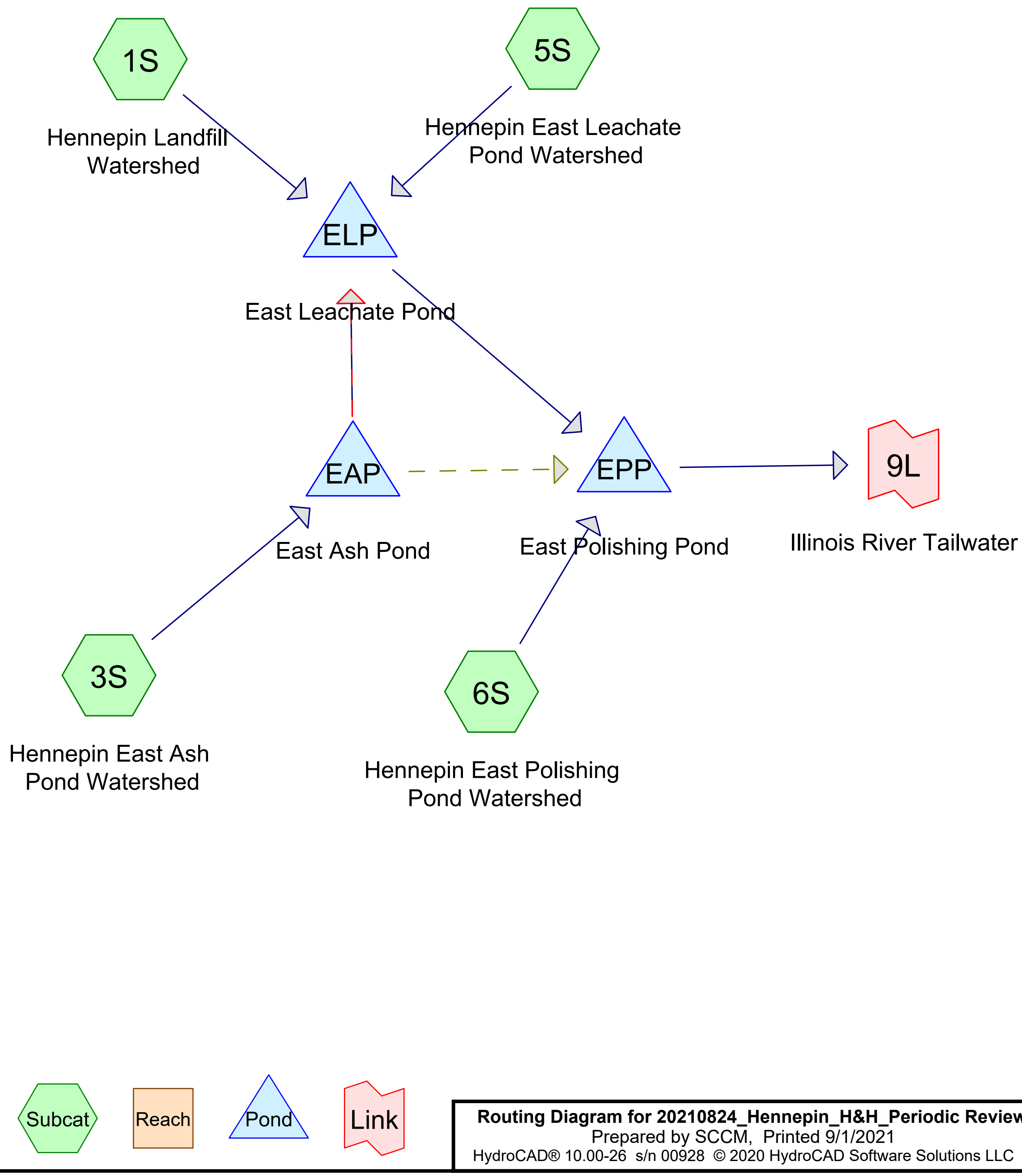
Hennepin Power Station East Ash Pond
Hydrologic Workmap

Geosyntec consultants

GLP8027 | August 2021

**Figure**

**E-3**




**Routing Diagram for 20210824_Hennepin_H&H_Periodic Review**
Prepared by SCCM, Printed 9/1/2021
HydroCAD® 10.00-26 s/n 00928 © 2020 HydroCAD Software Solutions LLC

## Area Listing (all nodes)

| Area (acres) | CN | Description (subcatchment-numbers) |
|---:|---:|---|
| 0.734 | 84 | 50-75% Grass cover, Fair, HSG D (5S) |
| 5.253 | 89 | <50% Grass cover, Poor, HSG D (1S) |
| 7.197 | 80 | >75% Grass cover, Good, HSG D (3S, 6S) |
| 2.159 | 96 | Gravel Surface, HSG D (3S, 5S, 6S) |
| 1.065 | 96 | Gravel surface, HSG D (1S) |
| 17.485 | 93 | Urban industrial, 72% imp, HSG D (3S, 6S) |
| 10.112 | 98 | Water Surface, HSG D (3S, 5S, 6S) |
| **44.005** | **92** | **TOTAL AREA** |

## Soil Listing (all nodes)

| Area (acres) | Soil Group | Subcatchment Numbers |
|---|---|---|
| 0.000 | HSG A | |
| 0.000 | HSG B | |
| 0.000 | HSG C | |
| 44.005 | HSG D | 1S, 3S, 5S, 6S |
| 0.000 | Other | |
| **44.005** | | **TOTAL AREA** |

## Ground Covers (all nodes)

| HSG-A (acres) | HSG-B (acres) | HSG-C (acres) | HSG-D (acres) | Other (acres) | Total (acres) | Ground Cover | Subcatchment Numbers |
|---|---|---|---|---|---|---|---|
| 0.000 | 0.000 | 0.000 | 0.734 | 0.000 | 0.734 | 50-75% Grass cover, Fair | 5S |
| 0.000 | 0.000 | 0.000 | 5.253 | 0.000 | 5.253 | <50% Grass cover, Poor | 1S |
| 0.000 | 0.000 | 0.000 | 7.197 | 0.000 | 7.197 | >75% Grass cover, Good | 3S, 6S |
| 0.000 | 0.000 | 0.000 | 2.159 | 0.000 | 2.159 | Gravel Surface | 3S, 5S, 6S |
| 0.000 | 0.000 | 0.000 | 1.065 | 0.000 | 1.065 | Gravel surface | 1S |
| 0.000 | 0.000 | 0.000 | 17.485 | 0.000 | 17.485 | Urban industrial, 72% imp | 3S, 6S |
| 0.000 | 0.000 | 0.000 | 10.112 | 0.000 | 10.112 | Water Surface | 3S, 5S, 6S |
| **0.000** | **0.000** | **0.000** | **44.005** | **0.000** | **44.005** | **TOTAL AREA** | |

## Pipe Listing (all nodes)

| Line# | Node Number | In-Invert (feet) | Out-Invert (feet) | Length (feet) | Slope (ft/ft) | n | Diam/Width (inches) | Height (inches) | Inside-Fill (inches) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1S | 0.00 | 0.00 | 71.0 | 0.0210 | 0.010 | 24.0 | 0.0 | 0.0 |
| 2 | EAP | 489.97 | 486.81 | 61.0 | 0.0518 | 0.012 | 18.0 | 0.0 | 0.0 |
| 3 | EAP | 458.00 | 457.50 | 283.0 | 0.0018 | 0.012 | 36.0 | 0.0 | 0.0 |
| 4 | EAP | 492.66 | 488.34 | 97.0 | 0.0445 | 0.010 | 12.0 | 0.0 | 0.0 |
| 5 | ELP | 480.40 | 479.81 | 157.0 | 0.0038 | 0.012 | 24.0 | 0.0 | 0.0 |
| 6 | EPP | 458.00 | 452.16 | 655.0 | 0.0089 | 0.015 | 36.0 | 0.0 | 0.0 |

Time span=0.00-120.00 hrs, dt=0.01 hrs, 12001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment 1S: Hennepin Landfill** Runoff Area=6.318 ac 0.00% Impervious Runoff Depth=8.50"
Flow Length=644' Tc=13.6 min CN=90 Runoff=6.60 cfs 4.477 af

**Subcatchment 3S: Hennepin East Ash** Runoff Area=22.701 ac 59.67% Impervious Runoff Depth=8.75"
Flow Length=817' Tc=12.3 min CN=92 Runoff=23.93 cfs 16.551 af

**Subcatchment 5S: Hennepin East Leachate** Runoff Area=6.183 ac 85.38% Impervious Runoff Depth=9.24"
Flow Length=86' Slope=0.1100 '/' Tc=6.0 min CN=96 Runoff=6.62 cfs 4.760 af

**Subcatchment 6S: Hennepin East Polishing** Runoff Area=8.803 ac 44.04% Impervious Runoff Depth=8.50"
Flow Length=361' Tc=6.0 min CN=90 Runoff=9.23 cfs 6.238 af

**Pond EAP: East Ash Pond** Peak Elev=491.37' Storage=17.836 af Inflow=23.93 cfs 16.551 af
Primary=6.92 cfs 9.491 af Secondary=0.00 cfs 0.000 af Tertiary=10.80 cfs 6.695 af Outflow=17.72 cfs 16.187 af

**Pond ELP: East Leachate Pond** Peak Elev=485.57' Storage=15.349 af Inflow=19.69 cfs 18.728 af
Outflow=18.24 cfs 18.690 af

**Pond EPP: East Polishing Pond** Peak Elev=481.81' Storage=50.339 af Inflow=36.66 cfs 31.623 af
Outflow=31.35 cfs 31.533 af

**Link 9L: Illinois River Tailwater** Inflow=31.35 cfs 31.533 af
Primary=31.35 cfs 31.533 af

**Total Runoff Area = 44.005 ac Runoff Volume = 32.025 af Average Runoff Depth = 8.73"**
**48.41% Pervious = 21.304 ac 51.59% Impervious = 22.701 ac**

## Summary for Subcatchment 1S: Hennepin Landfill Watershed

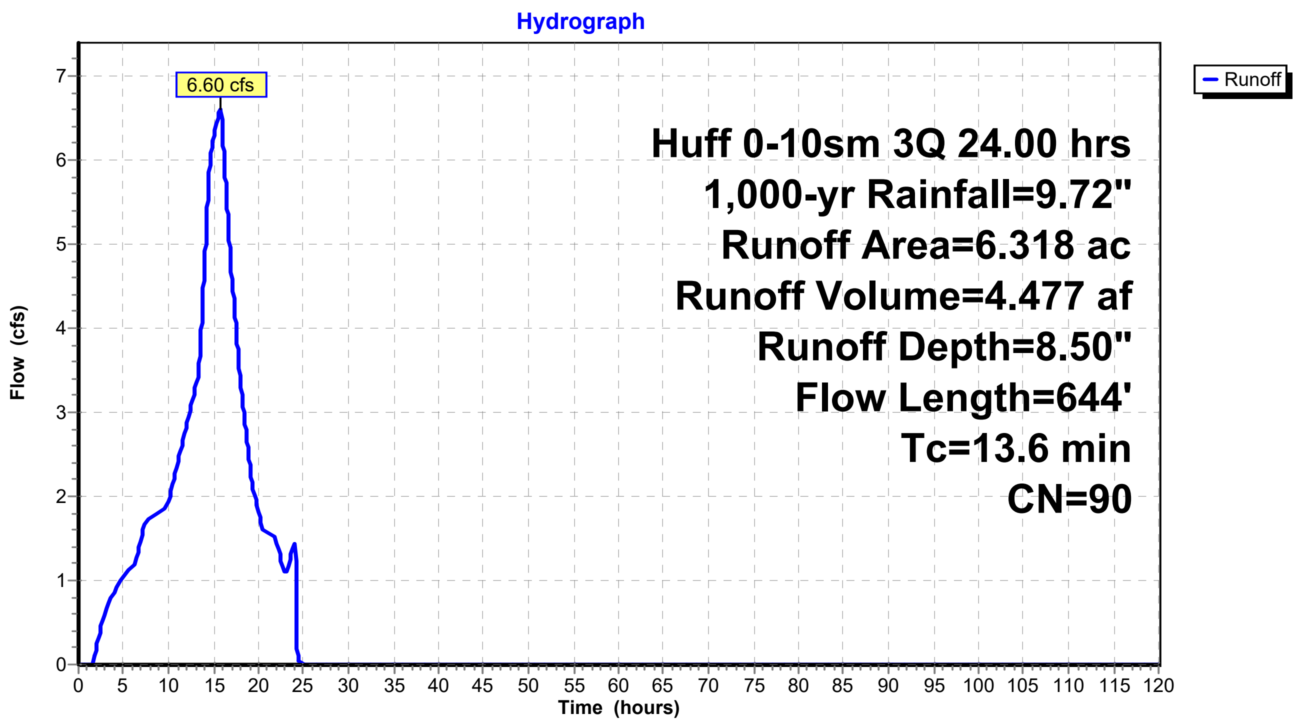
Runoff = 6.60 cfs @ 15.73 hrs, Volume= 4.477 af, Depth= 8.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.01 hrs
Huff 0-10sm 3Q 24.00 hrs 1,000-yr Rainfall=9.72"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 1.065 | 96 | Gravel surface, HSG D |
| | 5.253 | 89 | <50% Grass cover, Poor, HSG D |
| | 6.318 | 90 | Weighted Average |
| | 6.318 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 8.2 | 100 | 0.0350 | 0.20 | | **Sheet Flow,** Grass: Short n= 0.150 P2= 2.90" |
| 2.4 | 189 | 0.0350 | 1.31 | | **Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps |
| 2.9 | 284 | 0.0100 | 1.61 | | **Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps |
| 0.1 | 71 | 0.0210 | 13.57 | 42.62 | **Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.010 |
| 13.6 | 644 | Total | | | |

## Subcatchment 1S: Hennepin Landfill Watershed



## Summary for Subcatchment 3S: Hennepin East Ash Pond Watershed

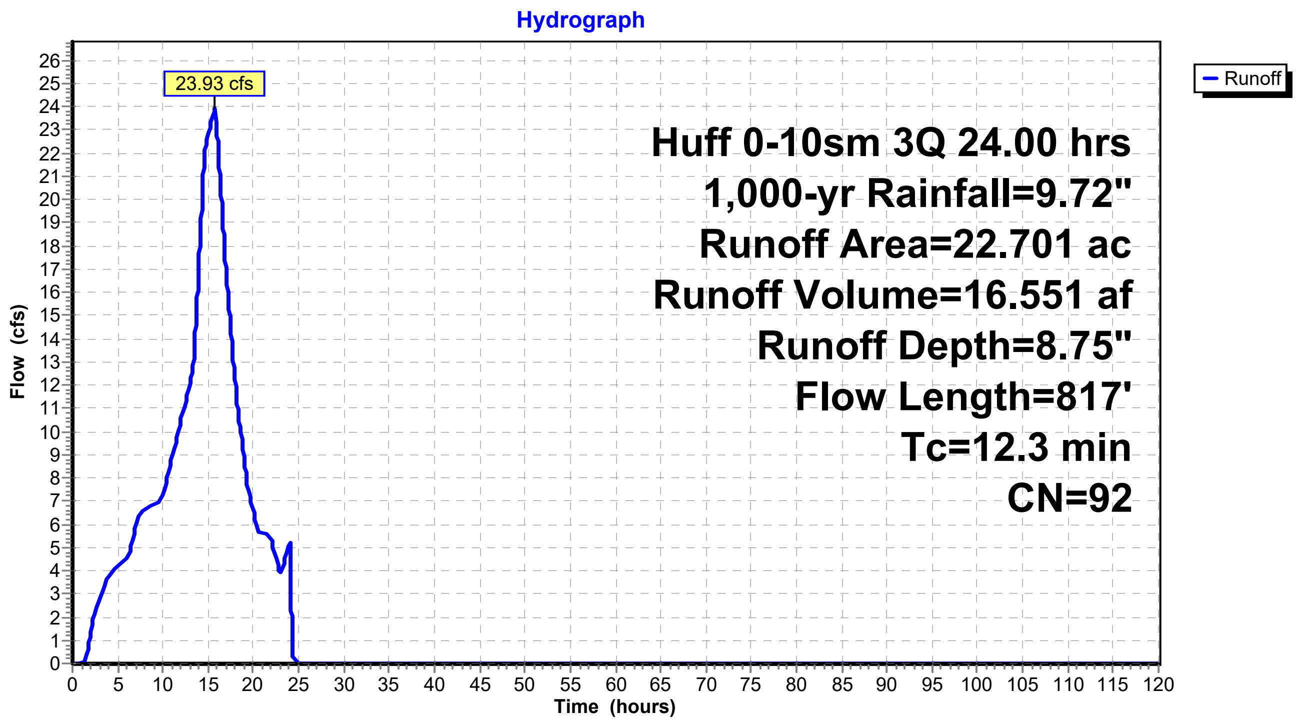
Runoff = 23.93 cfs @ 15.73 hrs, Volume= 16.551 af, Depth= 8.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.01 hrs
Huff 0-10sm 3Q 24.00 hrs 1,000-yr Rainfall=9.72"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 1.517 | 98 | Water Surface, HSG D |
| * | 1.120 | 96 | Gravel Surface, HSG D |
| | 3.358 | 80 | >75% Grass cover, Good, HSG D |
| | 16.706 | 93 | Urban industrial, 72% imp, HSG D |
| | 22.701 | 92 | Weighted Average |
| | 9.156 | | 40.33% Pervious Area |
| | 13.545 | | 59.67% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 3.4 | 100 | 0.0350 | 0.49 | | **Sheet Flow,** Fallow n= 0.050 P2= 2.90" |
| 8.9 | 717 | 0.0070 | 1.35 | | **Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps |
| 12.3 | 817 | Total | | | |

### Subcatchment 3S: Hennepin East Ash Pond Watershed



## Summary for Subcatchment 5S: Hennepin East Leachate Pond Watershed

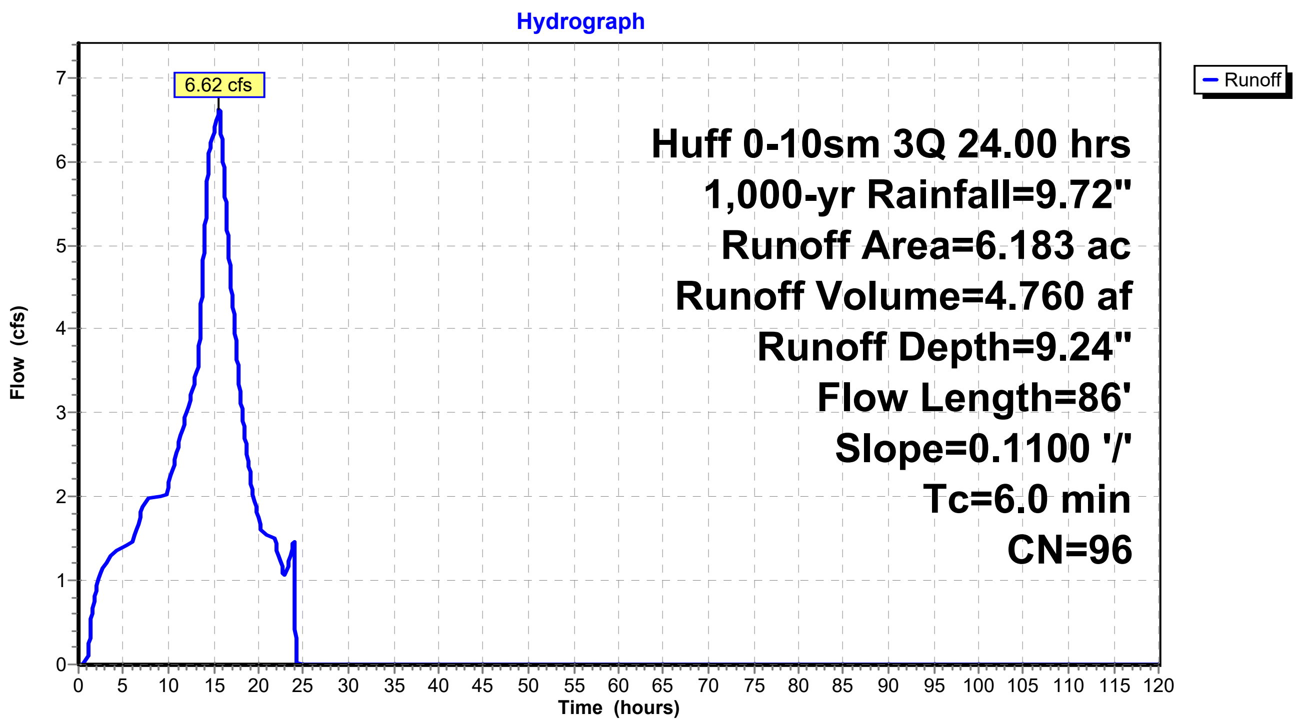
Runoff = 6.62 cfs @ 15.66 hrs, Volume= 4.760 af, Depth= 9.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.01 hrs
Huff 0-10sm 3Q 24.00 hrs 1,000-yr Rainfall=9.72"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 5.279 | 98 | Water Surface, HSG D |
| * | 0.170 | 96 | Gravel Surface, HSG D |
| | 0.734 | 84 | 50-75% Grass cover, Fair, HSG D |
| | 6.183 | 96 | Weighted Average |
| | 0.904 | | 14.62% Pervious Area |
| | 5.279 | | 85.38% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 4.6 | 86 | 0.1100 | 0.31 | | **Sheet Flow,** Grass: Short n= 0.150 P2= 2.90" |
| 4.6 | 86 | Total, Increased to minimum Tc = 6.0 min | | | |

### Subcatchment 5S: Hennepin East Leachate Pond Watershed



### Summary for Subcatchment 6S: Hennepin East Polishing Pond Watershed

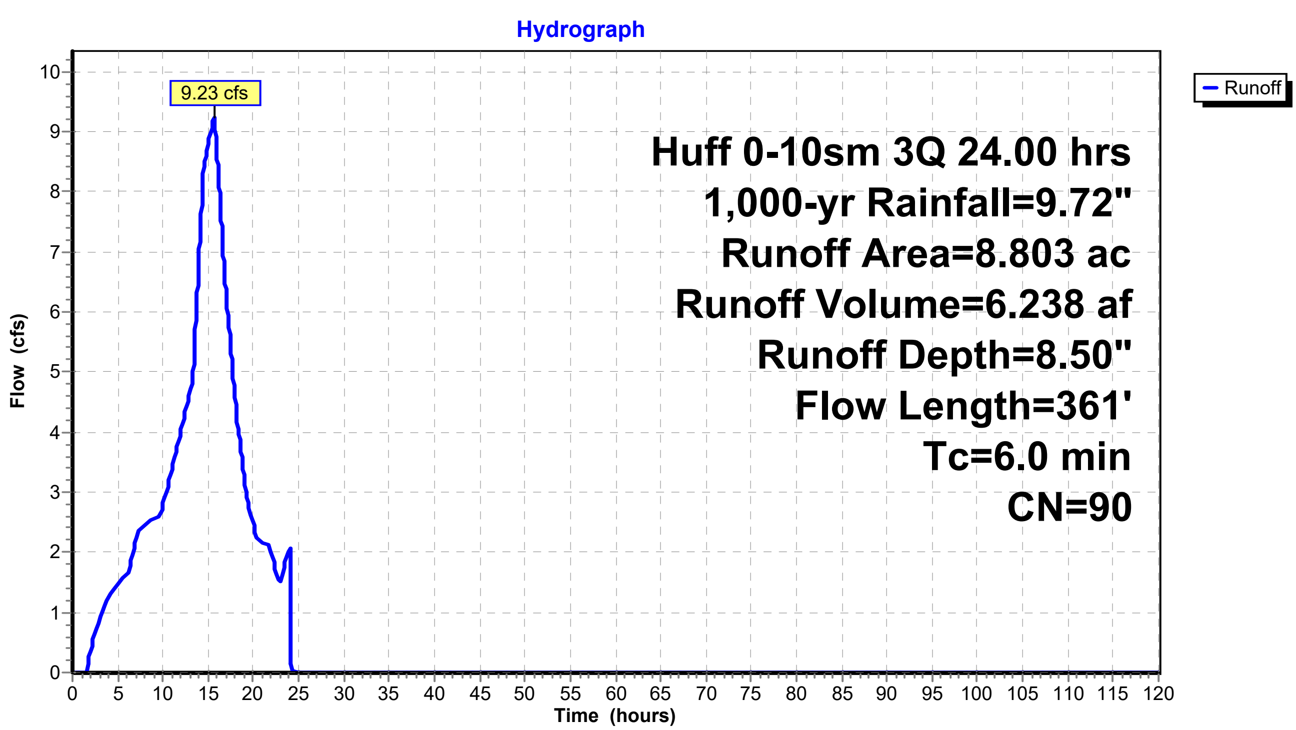
Runoff = 9.23 cfs @ 15.66 hrs, Volume= 6.238 af, Depth= 8.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.01 hrs
Huff 0-10sm 3Q 24.00 hrs 1,000-yr Rainfall=9.72"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 3.316 | 98 | Water Surface, HSG D |
| * | 0.869 | 96 | Gravel Surface, HSG D |
| | 3.839 | 80 | >75% Grass cover, Good, HSG D |
| | 0.779 | 93 | Urban industrial, 72% imp, HSG D |
| | 8.803 | 90 | Weighted Average |
| | 4.926 | | 55.96% Pervious Area |
| | 3.877 | | 44.04% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 3.2 | 100 | 0.0400 | 0.51 | | **Sheet Flow,** Fallow n= 0.050 P2= 2.90" |
| 2.1 | 261 | 0.0840 | 2.03 | | **Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps |
| 5.3 | 361 | Total, Increased to minimum Tc = 6.0 min | | | |

### Subcatchment 6S: Hennepin East Polishing Pond Watershed



## Summary for Pond EAP: East Ash Pond

| | | | | |
|---|---|---|---|---|
| Inflow Area = | 22.701 ac, 59.67% Impervious, | Inflow Depth = 8.75" | for 1,000-yr event | |
| Inflow = | 23.93 cfs @ | 15.73 hrs, Volume= | 16.551 af | |
| Outflow = | 17.72 cfs @ | 16.83 hrs, Volume= | 16.187 af, | Atten= 26%, Lag= 66.1 min |
| Primary = | 6.92 cfs @ | 16.83 hrs, Volume= | 9.491 af | |
| Secondary = | 0.00 cfs @ | 0.00 hrs, Volume= | 0.000 af | |
| Tertiary = | 10.80 cfs @ | 16.83 hrs, Volume= | 6.695 af | |

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.01 hrs
Starting Elev= 489.97' Surf.Area= 0.000 ac Storage= 11.526 af
Peak Elev= 491.37' @ 16.83 hrs Surf.Area= 0.000 ac Storage= 17.836 af (6.310 af above start)

Plug-Flow detention time= 1,731.2 min calculated for 4.660 af (28% of inflow)
Center-of-Mass det. time= 498.3 min ( 1,350.1 - 851.8 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 482.00' | 42.172 af | **Custom Stage Data** Listed below |

| Elevation (feet) | Inc.Store (acre-feet) | Cum.Store (acre-feet) |
|---|---|---|
| 482.00 | 0.000 | 0.000 |
| 483.00 | 0.239 | 0.239 |
| 484.00 | 0.387 | 0.626 |
| 485.00 | 0.808 | 1.434 |
| 486.00 | 1.140 | 2.574 |
| 487.00 | 1.489 | 4.063 |
| 488.00 | 1.819 | 5.882 |
| 489.00 | 2.482 | 8.364 |
| 490.00 | 3.260 | 11.624 |
| 491.00 | 4.327 | 15.951 |
| 492.00 | 5.041 | 20.992 |
| 493.00 | 6.121 | 27.113 |
| 494.00 | 6.826 | 33.939 |
| 495.00 | 8.233 | 42.172 |

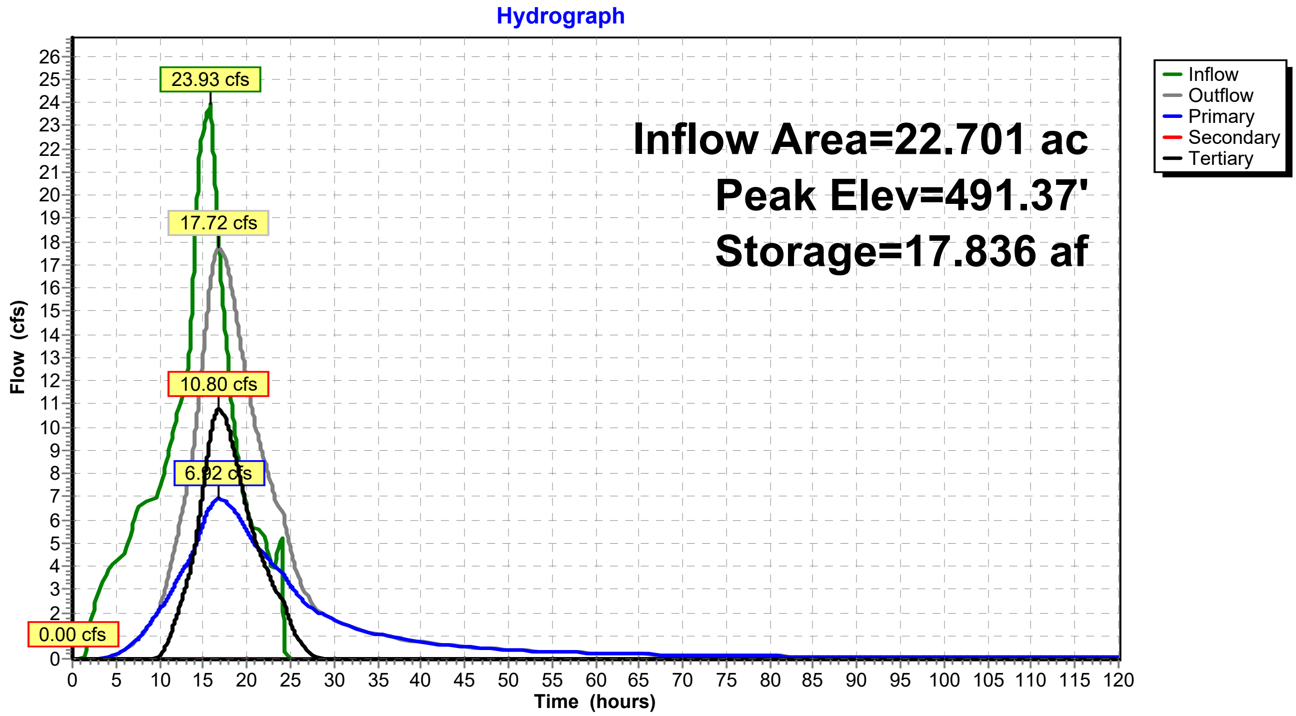
| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 489.97' | **18.0" Round Culvert**<br>L= 61.0' RCP, square edge headwall, Ke= 0.500<br>Inlet / Outlet Invert= 489.97' / 486.81' S= 0.0518 '/' Cc= 0.900<br>n= 0.012, Flow Area= 1.77 sf |
| #2 | Tertiary | 458.00' | **36.0" Round Culvert**<br>L= 283.0' RCP, square edge headwall, Ke= 0.500<br>Inlet / Outlet Invert= 458.00' / 457.50' S= 0.0018 '/' Cc= 0.900<br>n= 0.012, Flow Area= 7.07 sf |
| #3 | Device 2 | 490.60' | **5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) |
| #4 | Device 2 | 493.49' | **84.0" x 108.0" Horiz. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #5 | Secondary | 492.66' | **12.0" Round Culvert X 2.00**<br>L= 97.0' CPP, projecting, no headwall, Ke= 0.900<br>Inlet / Outlet Invert= 492.66' / 488.34' S= 0.0445 '/' Cc= 0.900<br>n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf |

**Primary OutFlow** Max=6.94 cfs @ 16.83 hrs HW=491.37' TW=485.56' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 6.94 cfs @ 4.03 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=489.97' TW=485.14' (Dynamic Tailwater)
└**5=Culvert** ( Controls 0.00 cfs)

**Tertiary OutFlow** Max=10.79 cfs @ 16.83 hrs HW=491.37' TW=481.77' (Dynamic Tailwater)
└**2=Culvert** (Passes 10.79 cfs of 97.52 cfs potential flow)
  ├**3=Sharp-Crested Rectangular Weir** (Weir Controls 10.79 cfs @ 2.88 fps)
  └**4=Orifice/Grate** ( Controls 0.00 cfs)

## Pond EAP: East Ash Pond



## Summary for Pond ELP: East Leachate Pond

Inflow Area = 35.202 ac, 53.48% Impervious, Inflow Depth > 6.38" for 1,000-yr event
Inflow = 19.69 cfs @ 15.70 hrs, Volume= 18.728 af
Outflow = 18.24 cfs @ 16.31 hrs, Volume= 18.690 af, Atten= 7%, Lag= 36.8 min
Primary = 18.24 cfs @ 16.31 hrs, Volume= 18.690 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.01 hrs
Starting Elev= 485.14' Surf.Area= 4.335 ac Storage= 13.482 af
Peak Elev= 485.57' @ 16.31 hrs Surf.Area= 4.412 ac Storage= 15.349 af (1.867 af above start)

Plug-Flow detention time= 1,662.8 min calculated for 5.208 af (28% of inflow)
Center-of-Mass det. time= 103.8 min ( 1,300.0 - 1,196.2 )

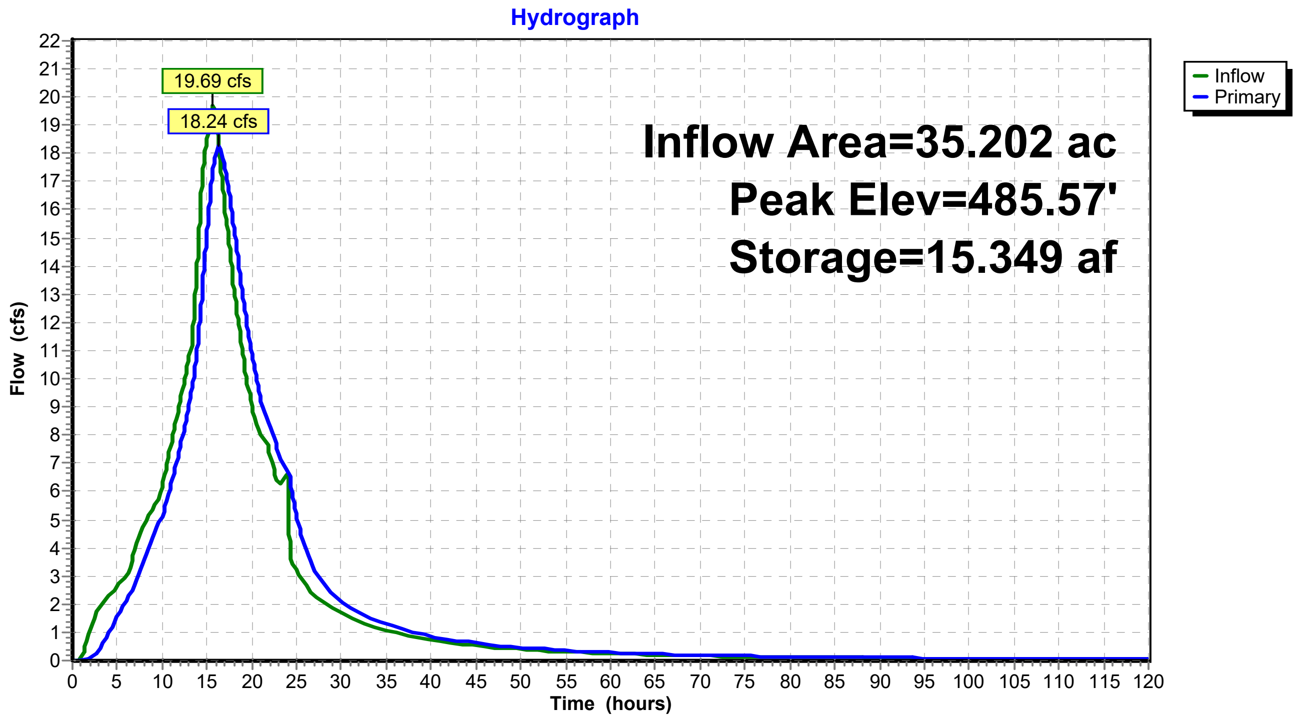
| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 479.00' | 64.034 af | **Custom Stage Data (Conic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (acres) | Inc.Store (acre-feet) | Cum.Store (acre-feet) | Wet.Area (acres) |
|---|---|---|---|---|
| 479.00 | 0.080 | 0.000 | 0.000 | 0.080 |
| 480.00 | 0.880 | 0.408 | 0.408 | 0.880 |
| 481.00 | 1.600 | 1.222 | 1.631 | 1.600 |
| 482.00 | 2.240 | 1.911 | 3.542 | 2.241 |
| 483.00 | 2.800 | 2.515 | 6.056 | 2.801 |
| 484.00 | 3.280 | 3.037 | 9.093 | 3.282 |
| 485.00 | 4.310 | 3.783 | 12.877 | 4.313 |
| 486.00 | 4.490 | 4.400 | 17.276 | 4.496 |
| 487.00 | 4.640 | 4.565 | 21.841 | 4.651 |
| 488.00 | 4.820 | 4.730 | 26.571 | 4.834 |
| 489.00 | 4.960 | 4.890 | 31.461 | 4.979 |
| 490.00 | 5.100 | 5.030 | 36.490 | 5.124 |
| 491.00 | 5.240 | 5.170 | 41.660 | 5.270 |
| 492.00 | 5.390 | 5.315 | 46.975 | 5.425 |
| 493.00 | 5.560 | 5.475 | 52.450 | 5.599 |
| 494.00 | 5.770 | 5.665 | 58.115 | 5.813 |
| 495.00 | 6.070 | 5.919 | 64.034 | 6.116 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 480.40' | **24.0" Round Culvert**<br>L= 157.0' RCP, square edge headwall, Ke= 0.500<br>Inlet / Outlet Invert= 480.40' / 479.81' S= 0.0038 '/' Cc= 0.900<br>n= 0.012, Flow Area= 3.14 sf |
| #2 | Device 1 | 485.14' | **48.0" x 72.0" Horiz. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |

**Primary OutFlow** Max=18.24 cfs @ 16.31 hrs HW=485.57' TW=481.69' (Dynamic Tailwater)
└─**1=Culvert** (Passes 18.24 cfs of 27.46 cfs potential flow)
  └─**2=Orifice/Grate** (Weir Controls 18.24 cfs @ 2.14 fps)

## Pond ELP: East Leachate Pond



## Summary for Pond EPP: East Polishing Pond

Inflow Area = 44.005 ac, 51.59% Impervious, Inflow Depth > 8.62" for 1,000-yr event
Inflow = 36.66 cfs @ 16.14 hrs, Volume= 31.623 af
Outflow = 31.35 cfs @ 17.70 hrs, Volume= 31.533 af, Atten= 14%, Lag= 93.6 min
Primary = 31.35 cfs @ 17.70 hrs, Volume= 31.533 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.01 hrs
Starting Elev= 480.20' Surf.Area= 3.481 ac Storage= 44.423 af
Peak Elev= 481.81' @ 17.70 hrs Surf.Area= 3.804 ac Storage= 50.339 af (5.916 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 181.1 min ( 1,346.9 - 1,165.9 )

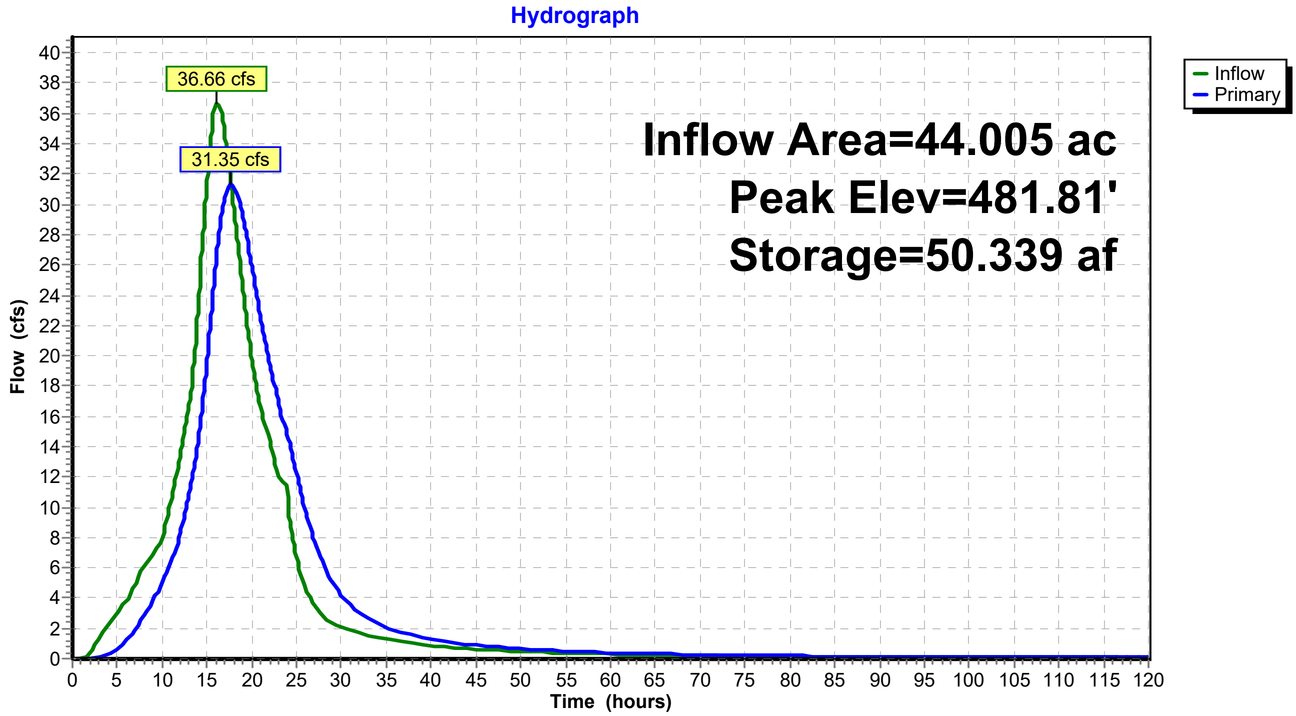
| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 463.00' | 122.821 af | **Custom Stage Data (Conic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (acres) | Inc.Store (acre-feet) | Cum.Store (acre-feet) | Wet.Area (acres) |
|---|---|---|---|---|
| 463.00 | 1.780 | 0.000 | 0.000 | 1.780 |
| 464.00 | 1.870 | 1.825 | 1.825 | 1.873 |
| 465.00 | 1.900 | 1.885 | 3.710 | 1.911 |
| 466.00 | 2.050 | 1.975 | 5.684 | 2.063 |
| 467.00 | 2.140 | 2.095 | 7.779 | 2.156 |
| 468.00 | 2.230 | 2.185 | 9.964 | 2.249 |
| 469.00 | 2.320 | 2.275 | 12.239 | 2.343 |
| 470.00 | 2.410 | 2.365 | 14.604 | 2.437 |
| 471.00 | 2.510 | 2.460 | 17.064 | 2.540 |
| 472.00 | 2.610 | 2.560 | 19.623 | 2.644 |
| 473.00 | 2.710 | 2.660 | 22.283 | 2.748 |
| 474.00 | 2.810 | 2.760 | 25.043 | 2.852 |
| 475.00 | 2.910 | 2.860 | 27.903 | 2.956 |
| 476.00 | 3.010 | 2.960 | 30.863 | 3.060 |
| 477.00 | 3.110 | 3.060 | 33.923 | 3.164 |
| 478.00 | 3.220 | 3.165 | 37.087 | 3.278 |
| 479.00 | 3.320 | 3.270 | 40.357 | 3.383 |
| 480.00 | 3.430 | 3.375 | 43.732 | 3.497 |
| 481.00 | 3.690 | 3.559 | 47.291 | 3.759 |
| 482.00 | 3.830 | 3.760 | 51.051 | 3.903 |
| 483.00 | 4.010 | 3.920 | 54.971 | 4.086 |
| 484.00 | 4.620 | 4.311 | 59.282 | 4.697 |
| 485.00 | 4.880 | 4.749 | 64.032 | 4.960 |
| 486.00 | 5.070 | 4.975 | 69.006 | 5.153 |
| 487.00 | 5.260 | 5.165 | 74.171 | 5.347 |
| 488.00 | 5.440 | 5.350 | 79.521 | 5.532 |
| 489.00 | 5.630 | 5.535 | 85.056 | 5.726 |
| 490.00 | 5.810 | 5.720 | 90.775 | 5.910 |
| 491.00 | 6.000 | 5.905 | 96.680 | 6.105 |
| 492.00 | 6.190 | 6.095 | 102.775 | 6.299 |
| 493.00 | 6.390 | 6.290 | 109.065 | 6.504 |
| 494.00 | 6.850 | 6.619 | 115.683 | 6.966 |
| 495.00 | 7.430 | 7.138 | 122.821 | 7.548 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 458.00' | **36.0" Round Outfall to Illinois River**<br>L= 655.0' RCP, square edge headwall, Ke= 0.500<br>Inlet / Outlet Invert= 458.00' / 452.16' S= 0.0089 '/' Cc= 0.900<br>n= 0.015, Flow Area= 7.07 sf |
| #2 | Device 1 | 480.20' | **5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) |
| #3 | Device 1 | 494.30' | **84.0" x 108.0" Horiz. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |

**Primary OutFlow** Max=31.35 cfs @ 17.70 hrs HW=481.81' TW=462.00' (Dynamic Tailwater)
**1=Outfall to Illinois River** (Passes 31.35 cfs of 90.23 cfs potential flow)
**2=Sharp-Crested Rectangular Weir** (Weir Controls 31.35 cfs @ 4.15 fps)
**3=Orifice/Grate** ( Controls 0.00 cfs)

## Pond EPP: East Polishing Pond



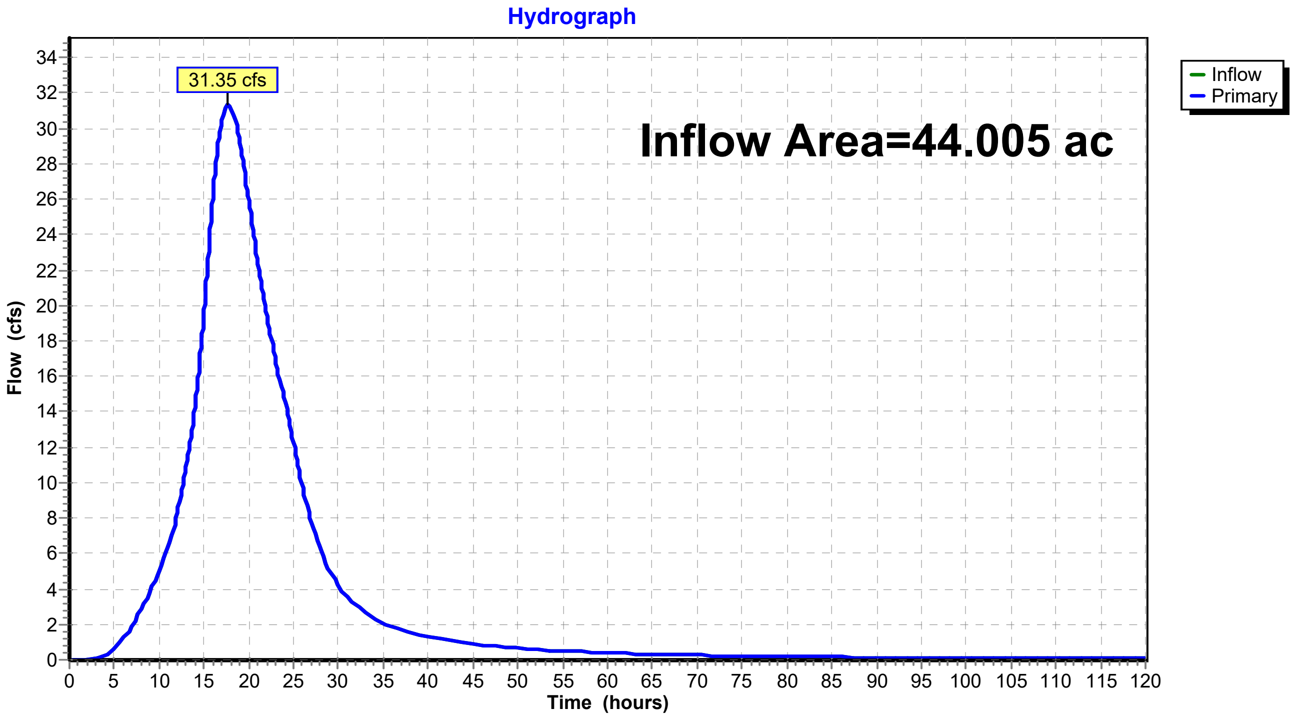
### Summary for Link 9L: Illinois River Tailwater

Inflow Area = 44.005 ac, 51.59% Impervious, Inflow Depth > 8.60" for 1,000-yr event
Inflow = 31.35 cfs @ 17.70 hrs, Volume= 31.533 af
Primary = 31.35 cfs @ 17.70 hrs, Volume= 31.533 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-120.00 hrs, dt= 0.01 hrs

Fixed water surface Elevation= 462.00'

### Link 9L: Illinois River Tailwater



Luminant

# Office Memorandum

**Date:** October 1, 2021

**To:** Cynthia Vodopivec

**cc:** Charles Koudelka

**From:** Vic Modeer

**Subject:** Dynegy Midwest Generation, LLC
Hennepin Power Station

**BACKGROUND**

The October 2016 certified "CCR Certification Report: Initial Structural Stability Assessment, Initial Safety Factor Assessment, and Initial Inflow Design Flood Control System Plan, Ash Pond at Hennepin Power Station" (CCR Certification Report)" prepared by AECOM describes the outlets of the East Ash Pond. The East Ash Pond utilizes a 7 ft wide x 9 ft wide concrete vertical drop structure as a secondary outflow to a 36-inch diameter reinforced concrete pipe (RCP) to the East Polishing Pond.

The CCR Certification Report states: *"An evaluation of the 36-inch spillway pipe design drawings, operational and maintenance procedures and conditions observed in the field did not identify any issues. However, the 36-inch spillway pipe has not yet been inspected using CCTV equipment because the outlet of the pipe is below the normal pool elevation in the downstream East Polishing Pond, causing the pipe to be completely full of water during normal conditions. The pool level in the East Polishing Pond must be maintained above the pipe elevation as part of station operations, and the condition precludes camera inspection. Because a thorough visual inspection of the 36-inch secondary spillway pipe has not yet been completed, AECOM cannot currently conclude that the §257.73(d)(1)(vi) requirements have been met for the secondary spillway pipe. As a corrective measure, AECOM recommends that the 36-inch secondary spillway pipe be inspected using CCTV equipment as soon as feasible and that this assessment be updated with documentation of the inspection at that time."*

The Hennepin Power Station boiler was shut down and ceased operation on November 1, 2019.

**EVALUATION**

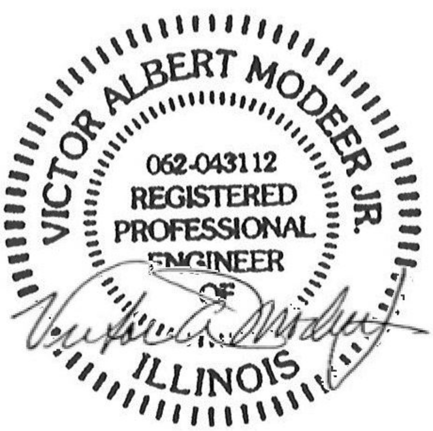
**2021 Pipe Inspection**.

The October 4, 2021 inspection was performed on the 36-inch spillway by Jason Stuckey. A visual inspection of the horizontal pipe was possible as water was not flowing at the time of the inspection. The inspection of the 7 ft wide x 9 ft wide concrete vertical drop structure as a secondary outflow to a 36-inch diameter reinforced concrete pipe (RCP) did not show any deficiencies in the concrete drop inlet structure or the pipe.

Based on these evaluations, the East Ash Pond meets the requirements in § 257.73(d)(1)(vi). Please let me know if you have any questions.

Sincerely,

Vic Modeer, PE, D.GE
(IL, MO, IN, KY, OH, LA)
Engineering Manager



October 2021