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October 11, 2021

Dynegy Midwest Generation, LLC
13498 E. 800th Street
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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

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Collinsville, Illinois 62234

Submitted by

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October 11, 2021

[1] Except for §257.73(d)(1)(vi).

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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		2021 Periodic Certification	
			Requirement Met?	Comments	Requirement Met?	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**.

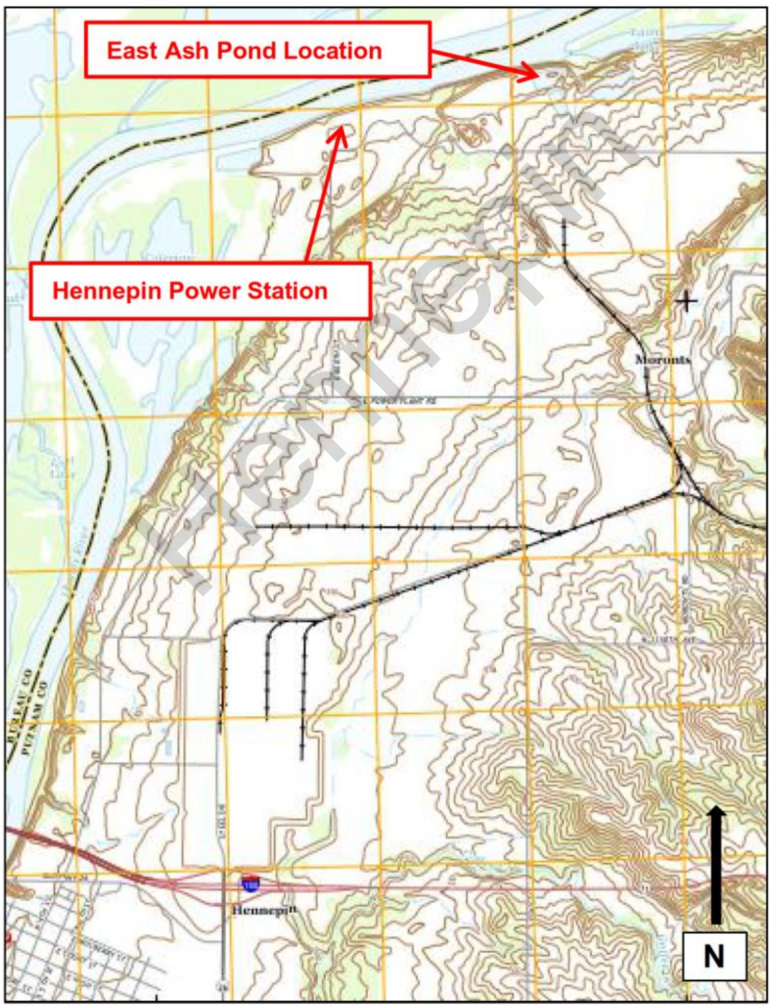

Figure 1 – Site Location Map (from AECOM, 2016)

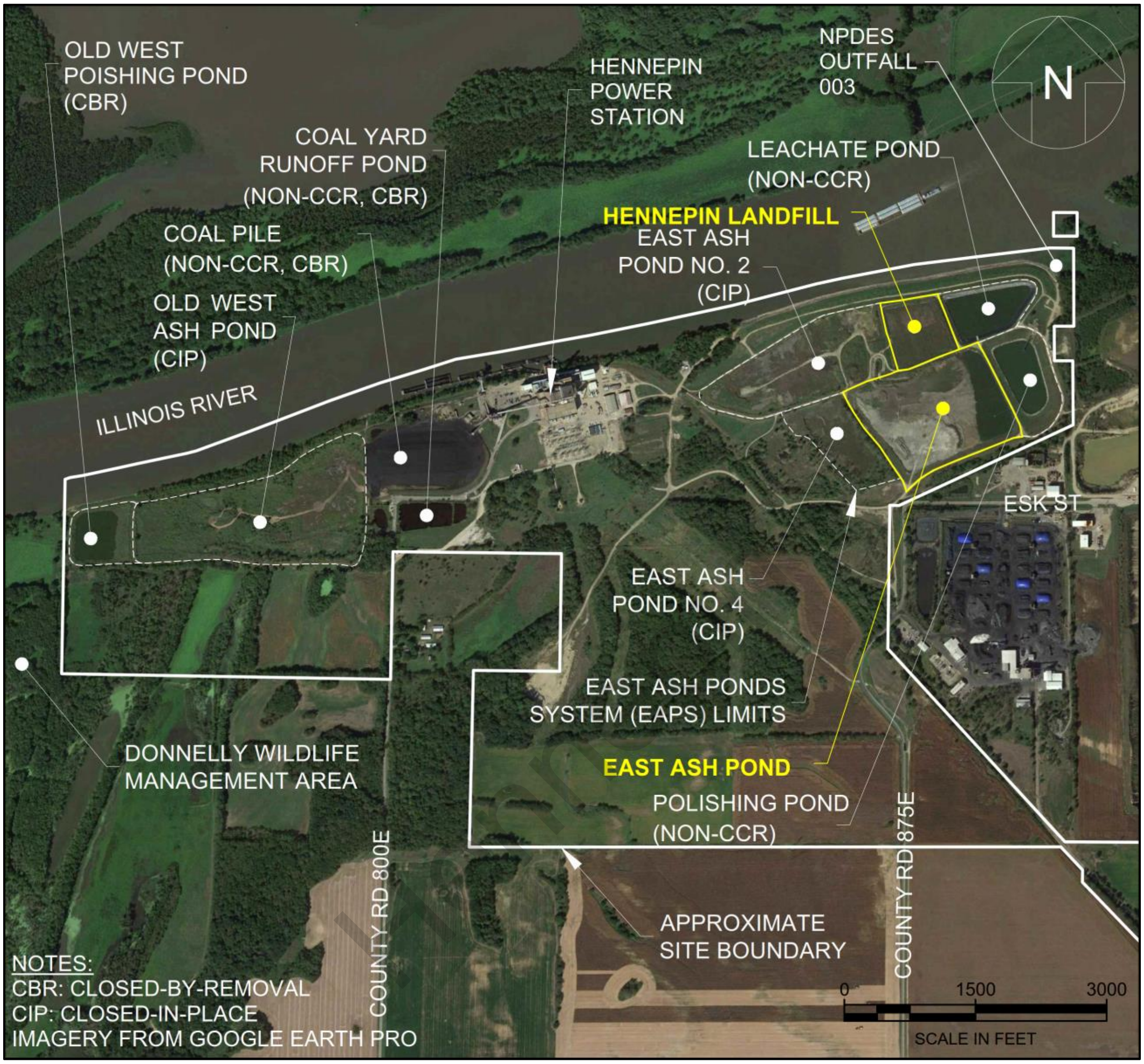

Figure 2 – Site Plan

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 1×10^{-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

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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

LICENSED PROFESSIONAL ENGINEER
LUCAS PHILIP
CARR
062066694
STATE OF ILLINOIS

Exp. 11/30/2021

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.

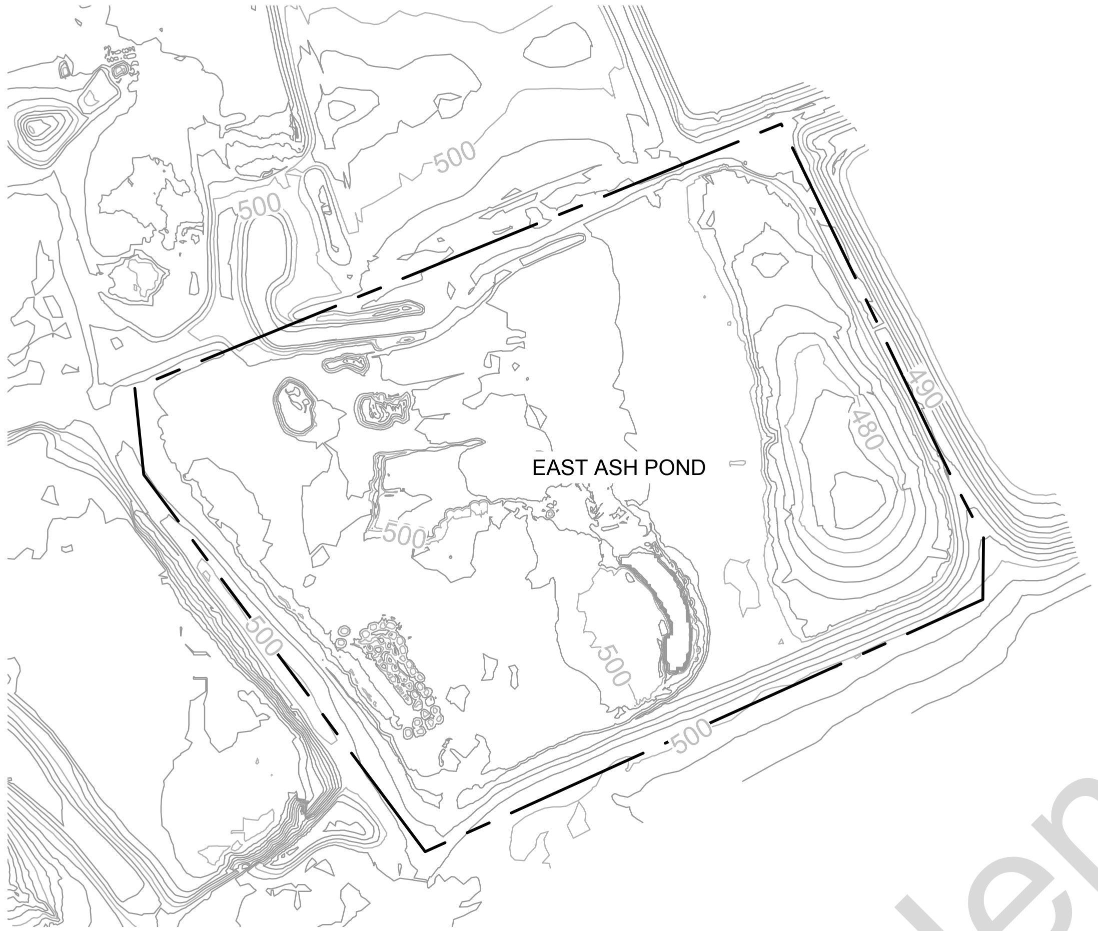
[22] F. A. Huff, "Time Distributions of Heavy Rainstorms in Illinois," State Water Survey, Department of Energy and Natural Resoruces, State of Illinois, Champaign, Illinois, 1990.

[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 Commerce, 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

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SCALE IN FEET

NOTES:

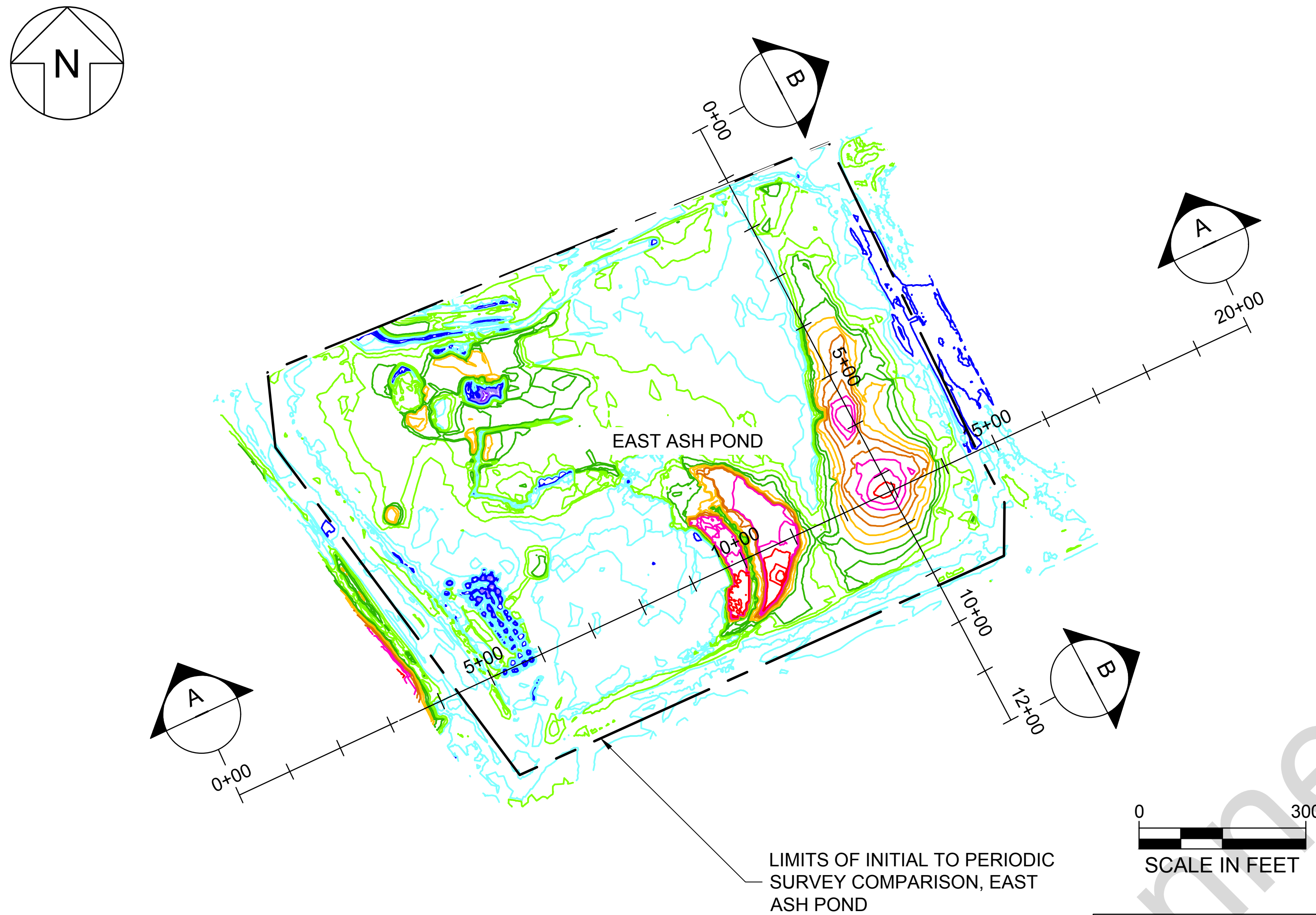
1. THE INITIAL SURVEY WAS TAKEN FROM THE DRAWING PACKAGE TITLED "DYNEGY, COLLINSVILLE, ILLINOIS, 2015 - HENNEPIN TOPOGRAPHY", PREPARED BY WEAVER CONSULTANTS GROUP, DATED DECEMBER 1, 2015.
2. THE PERIODIC SURVEY WAS TAKEN FROM THE DRAWING PACKAGE TITLED "LUMINANT, DYNEGY MIDWEST GENERATION, LLC, HENNEPIN 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.

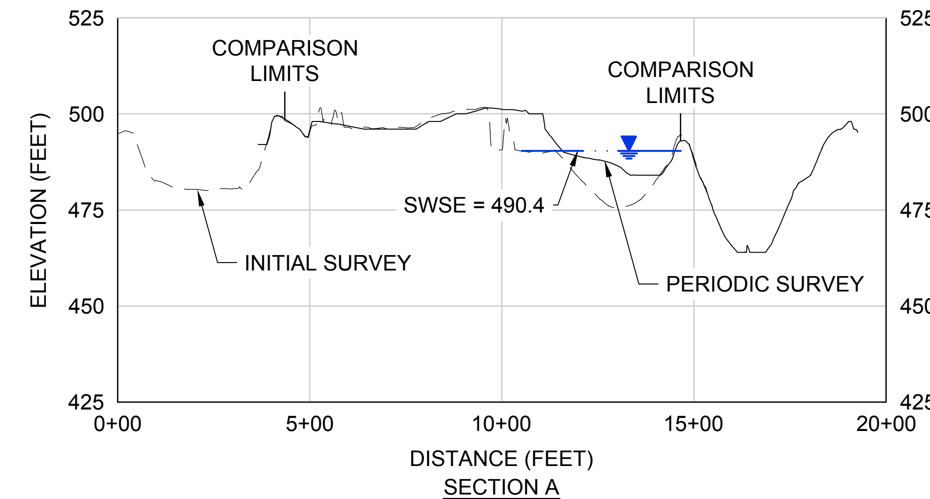
INITIAL TO PERIODIC SURVEY COMPARISON
EAST ASH POND
HENNEPIN POWER STATION
HENNEPIN, ILLINOIS

Geosyntec consultants

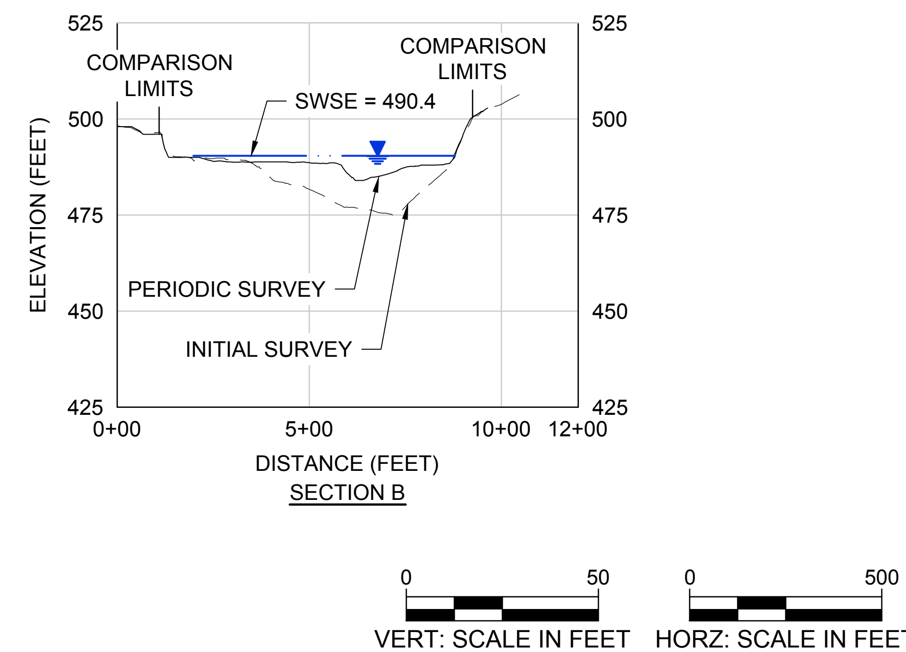
DRAWING 1

GLP8027.05 | MAY 2021





SECTION A



ISOPACH CONTOUR KEY		
COLOR	MIN ELEV	MAX ELEV
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	-6	-4
	-4	-2
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	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

N

INITIAL AERIAL
12-01-2015 IMAGERY

PERIODIC AERIAL
03-10-2021 IMAGERY

0 300
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

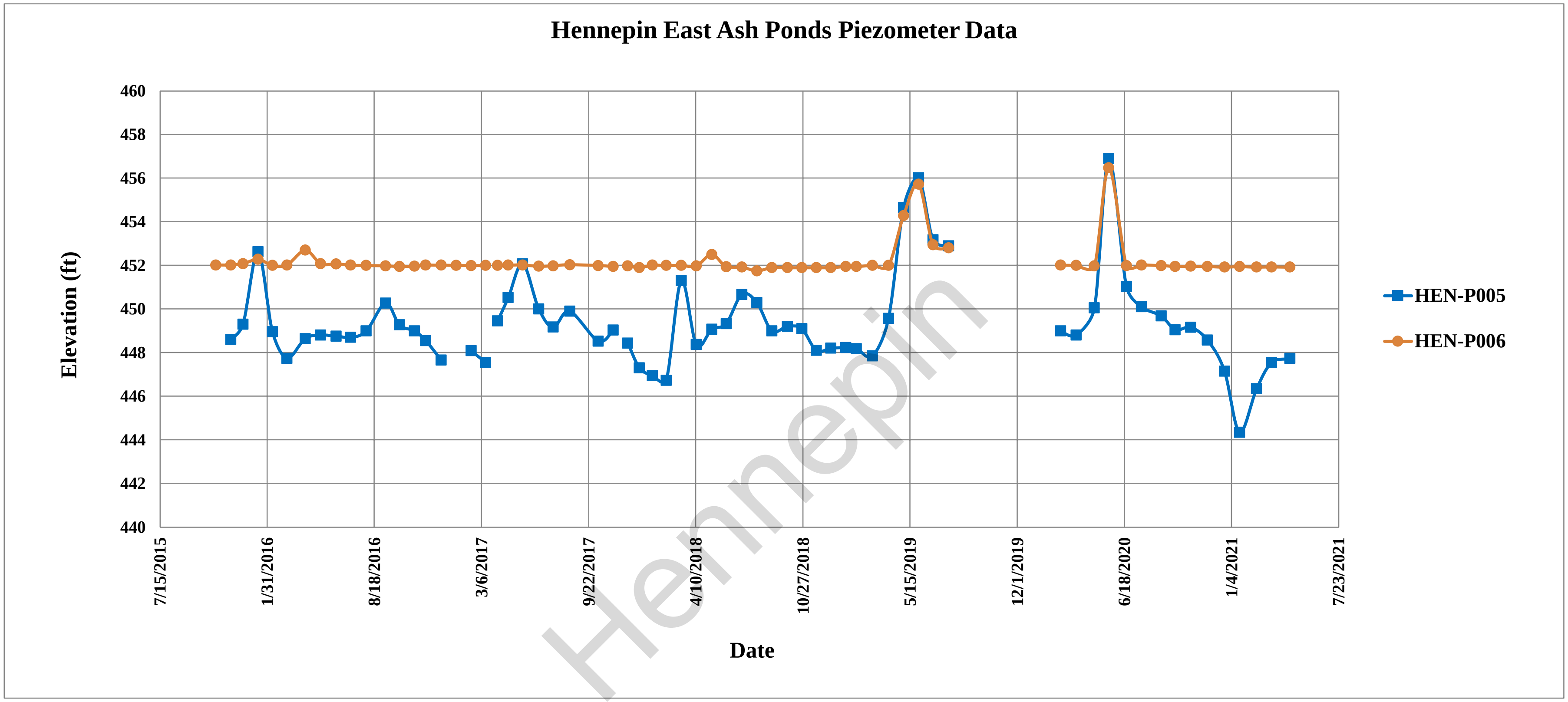
GLP8027.05

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 PERIODIC CERTIFICATION, EAST ASH POND HENNEPIN POWER STATION HENNEPIN, ILLINOIS		
Geosyntec consultants		Figure A-1
GLP8027	5/19/2021	

Attachment B

EAP Site Visit Photolog

GEOSYNTEC CONSULTANTS
Photographic Record

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

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.

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
Photographic Record

Site Owner: Dynegy Midwest Generation, LLC	**Project Number:** GLP8027
CCR Unit: East Ash Pond (EAP)	**Site:** Hennepin Power Plant

Photo: 07

Date: 05/27/2021

Direction Facing: SE

Comments: Overview of vegetation on the downstream slope of the EAP dike.

Photo: 08

Date: 05/27/2021

Direction Facing: SW

Comments: EAP upstream dike geomembrane slope covering overview

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.

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

GEOSYNTEC CONSULTANTS	
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

Site Owner: Dynegy Midwest Generation, LLC	**Project Number:** GLP8027
CCR Unit: East Ash Pond (EAP)	**Site:** Hennepin Power Plant

Photo: 15

Date: 05/27/2021

Direction Facing: NE

Comments: EAP pool overview

Photo: 16

Date: 05/27/2021

Direction Facing: NW

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

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**.

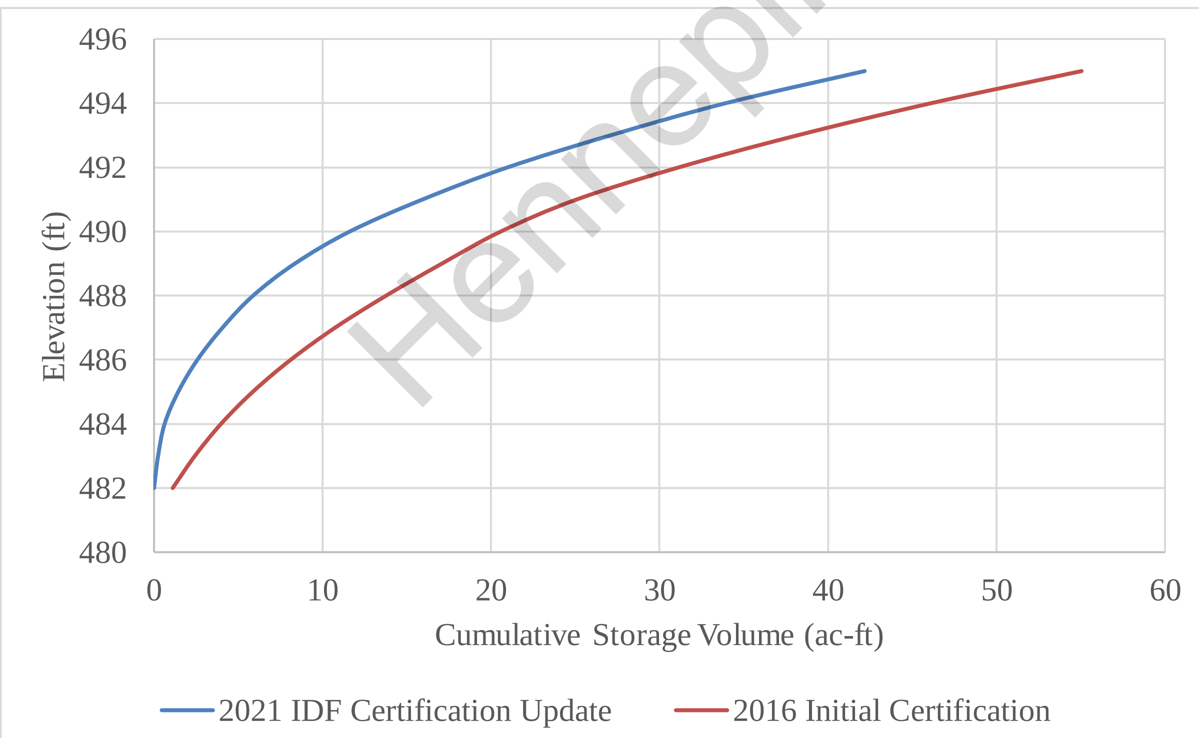


Figure 1 – Area-Capacity Curve for East Ash Pond

§ 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

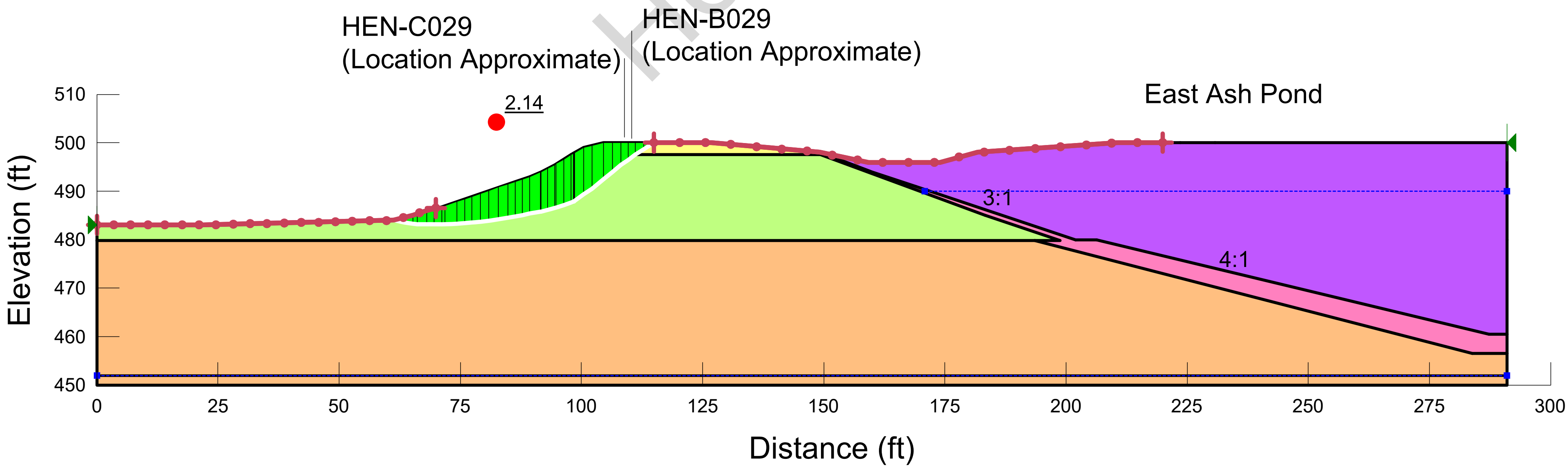
Periodic Structural Stability and Safety Factor Assessment Analyses

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	Unit Weight	Cohesion'	Phi'	Piezometric Line
Road Fill	130 pcf	0 psf	38 °	1
Alluvial Foundation	135 pcf	0 psf	38 °	1
Liner System (Drained)	120 pcf	60 psf	30 °	2
Fly Ash (Drained)	105 pcf	100 psf	27 °	2
Embankment Fill (Drained)	105 pcf	30 psf	32 °	1

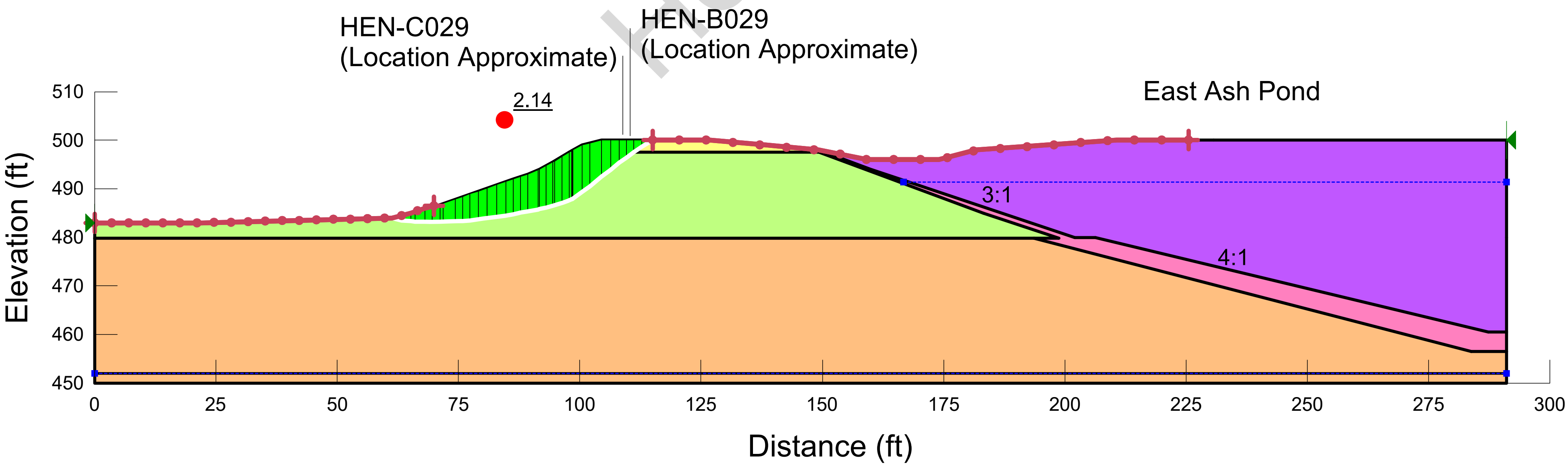


Hennepin East Ash Pond
Cross Section SL-10
Effective (Drained) - Static Max Pool

Calculated By: ZJF Date:9-21-2016
Modified By: PK Date: 8-31-2021
Checked By: PB Date:9-01-2021

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



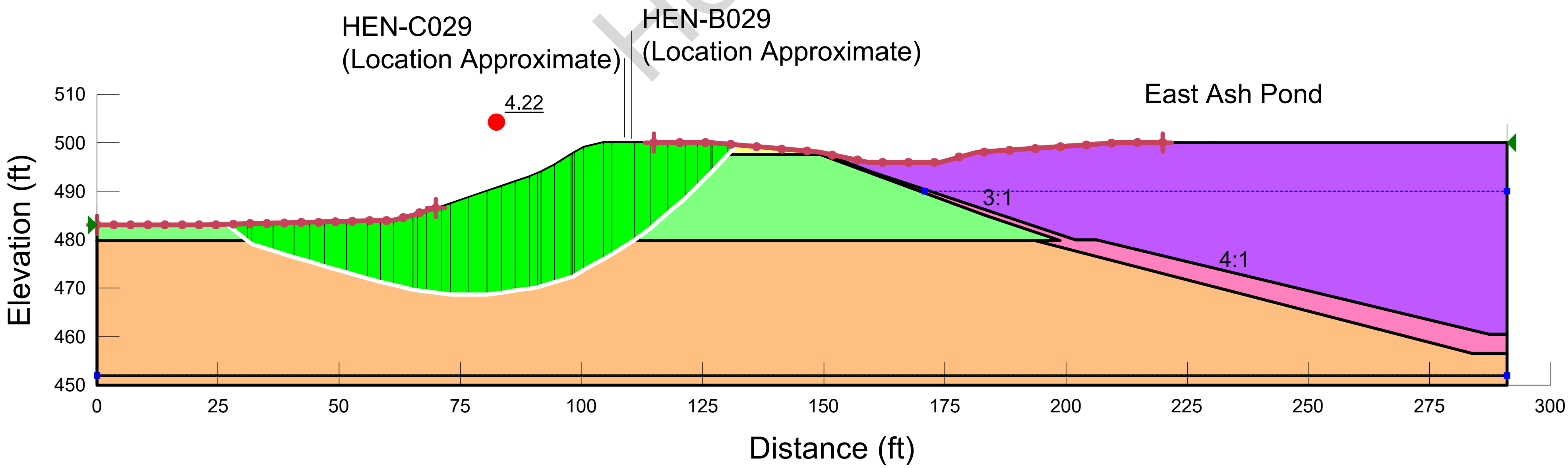
Calculated By: ZJF Date:9-21-2016
Modified By: PK Date: 8-31-2021
Checked By: PB Date:9-01-2021

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

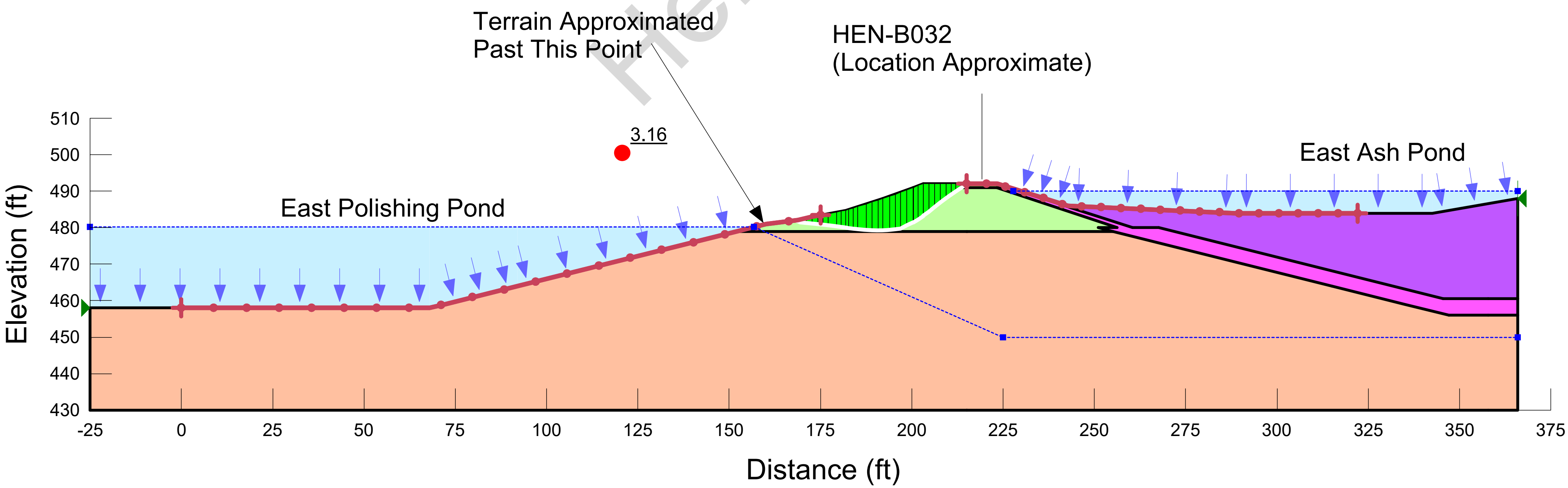


East Ash Pond
Cross Section SL-12
Effective (Drained) - Static Normal Pool

Calculated By: ZJF Date: 9/21/16
Modfied By: PK Date: 8/31/21
Checked By: PB Date: 9/01/21

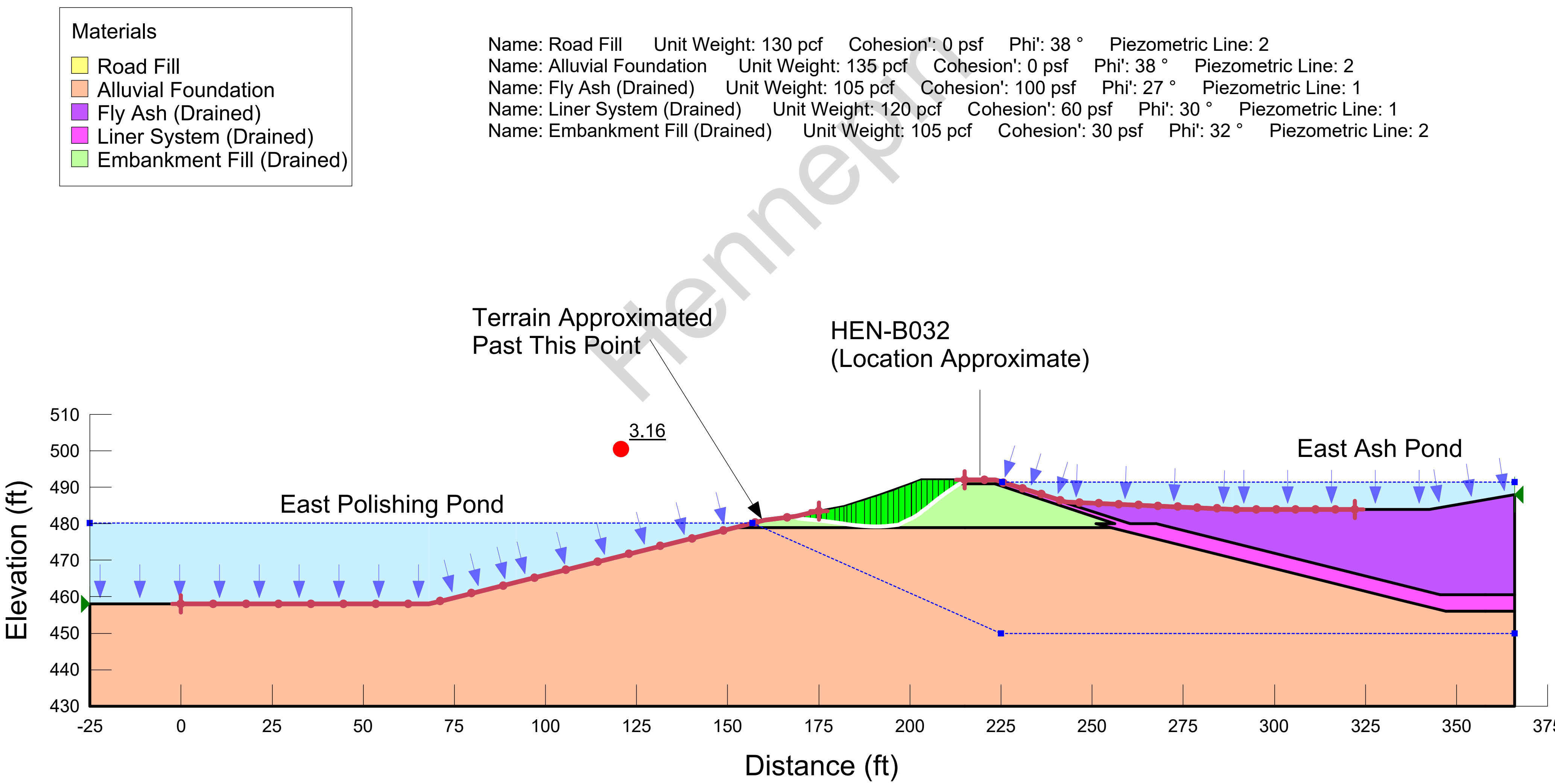
Materials
- Road Fill
- Alluvial Foundation
- Fly Ash (Drained)
- Liner System (Drained)
- Embankment Fill (Drained)

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



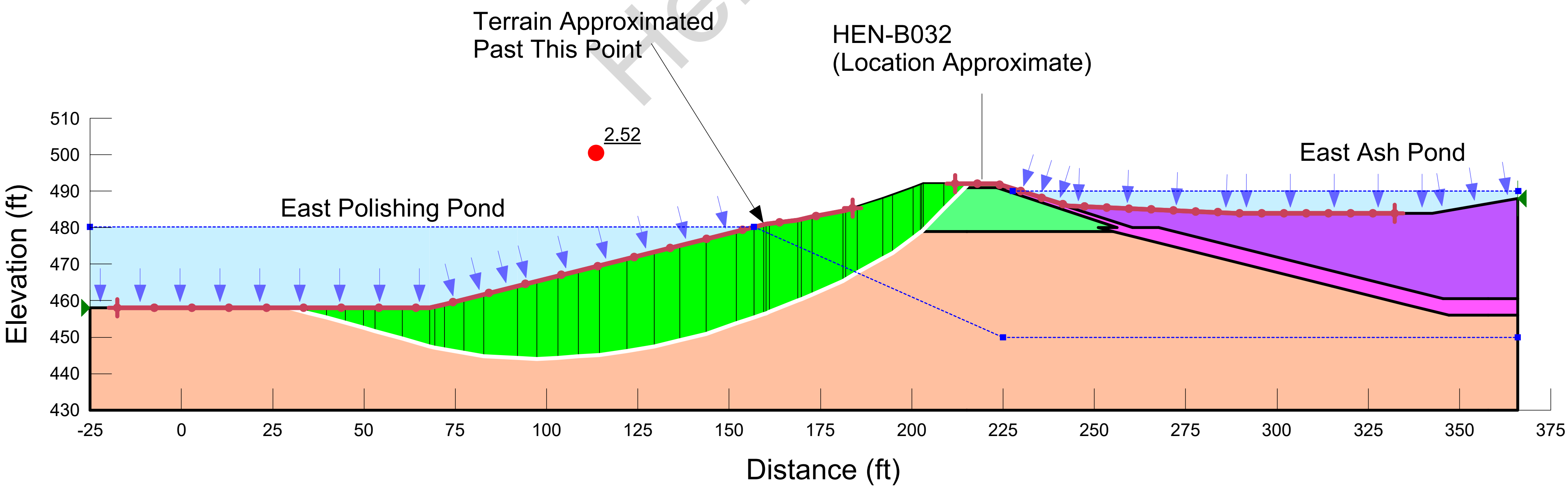
East Ash Pond
Cross Section SL-12
Total (Undrained) - Pseudostatic

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

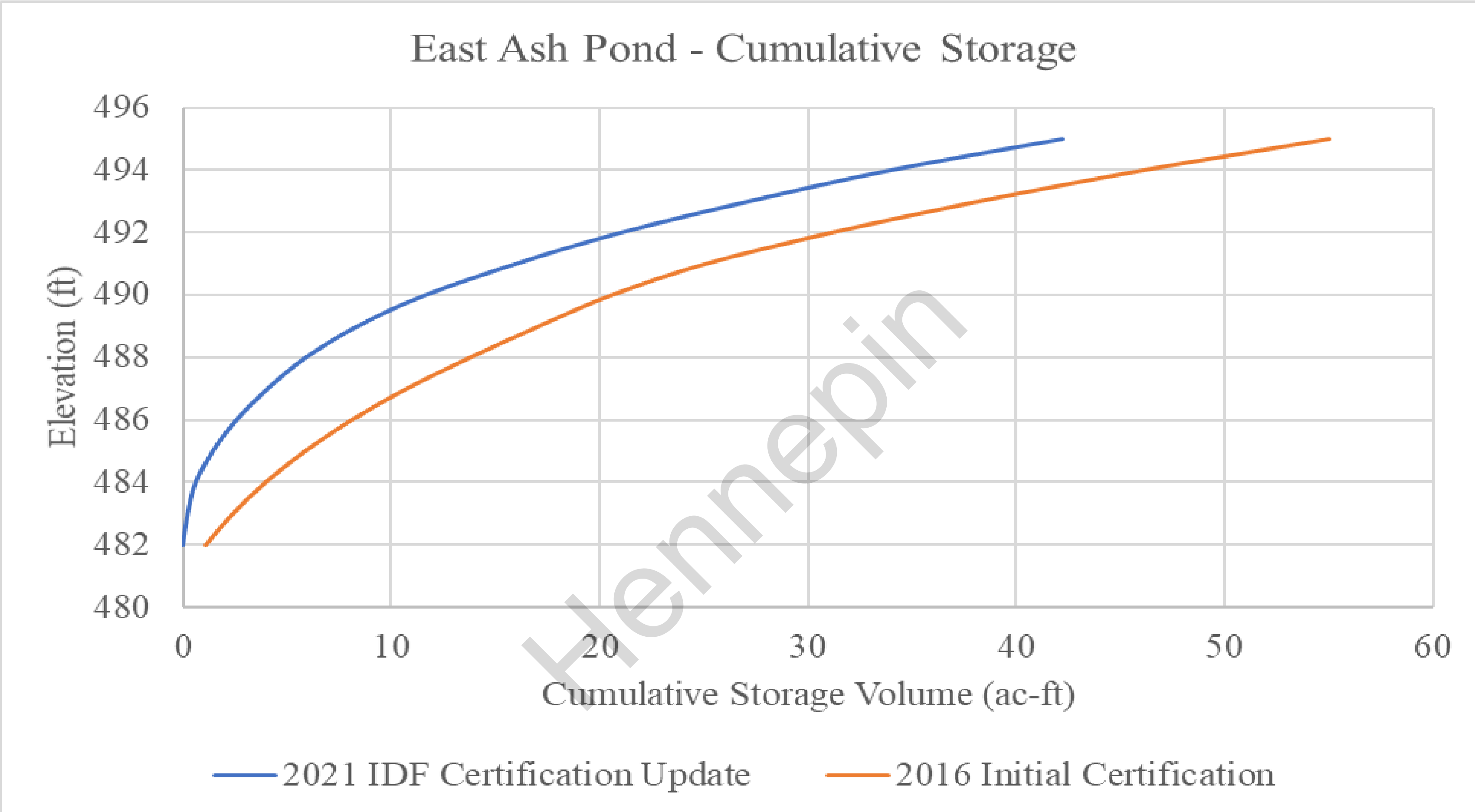
Materials
- Road Fill
- Alluvial Foundation
- Liner System (Undrained)
- Fly Ash (Undrained)
- Embankment Fill (Undrained)

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



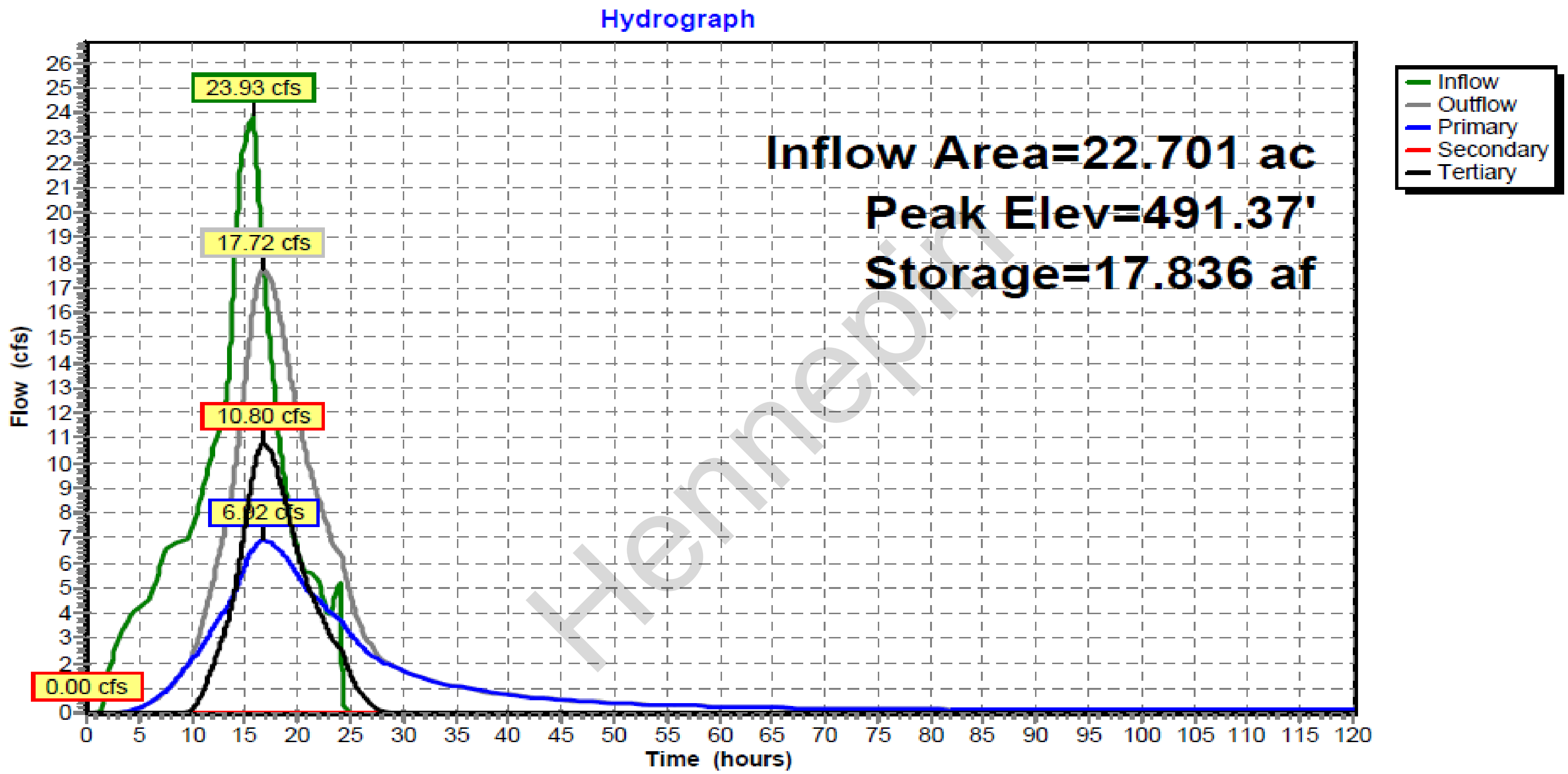
Attachment E

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	

Pond EAP: East Ash Pond



EAST ASH POND IDF HYDROGRAPH
PERIODIC CERTIFICATION
HENNEPIN POWER PLANT
HENNEPIN, ILLINOIS

Geosyntec consultants

GLP8027 | 8/30/2021

Figure E-2

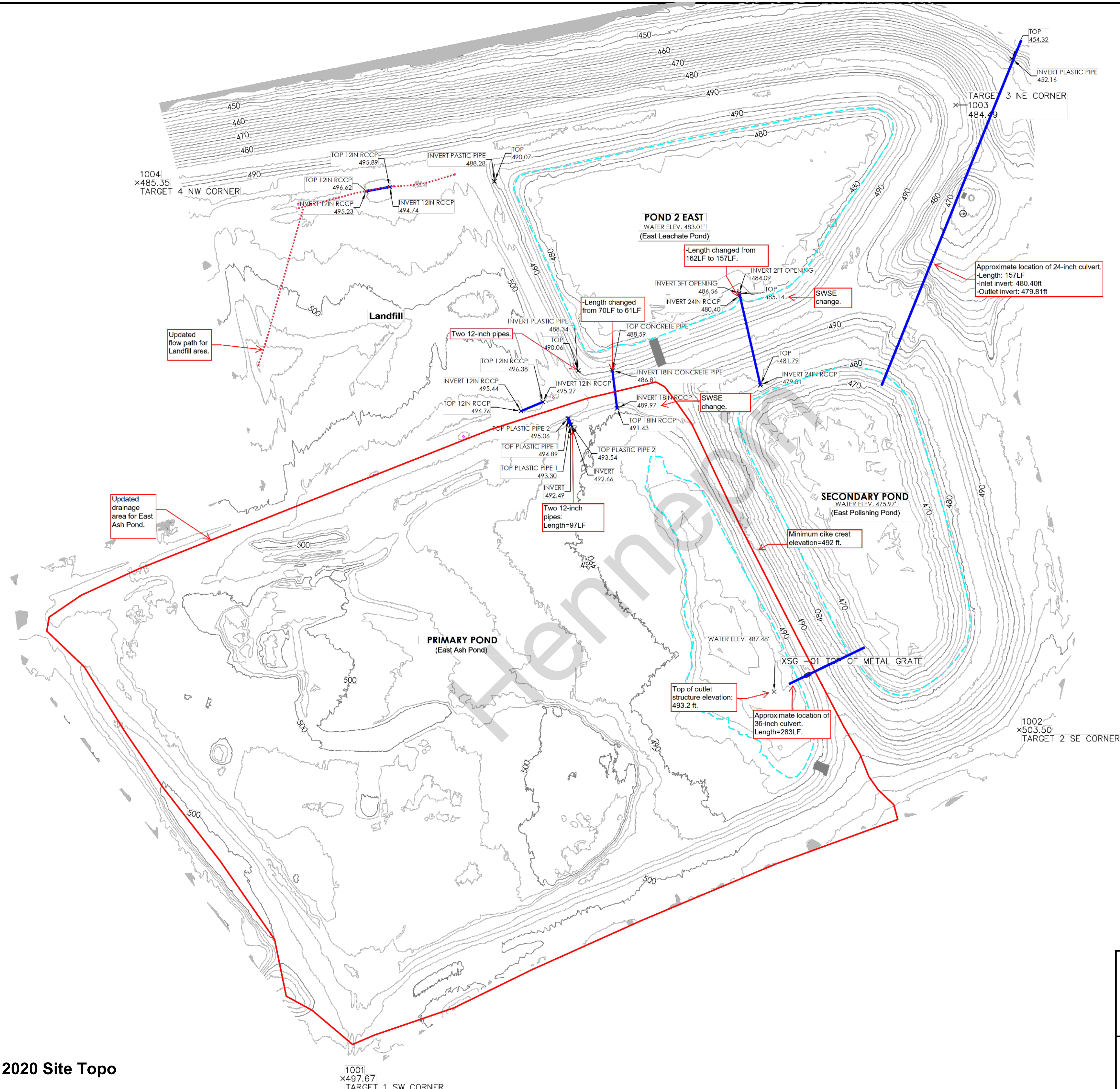
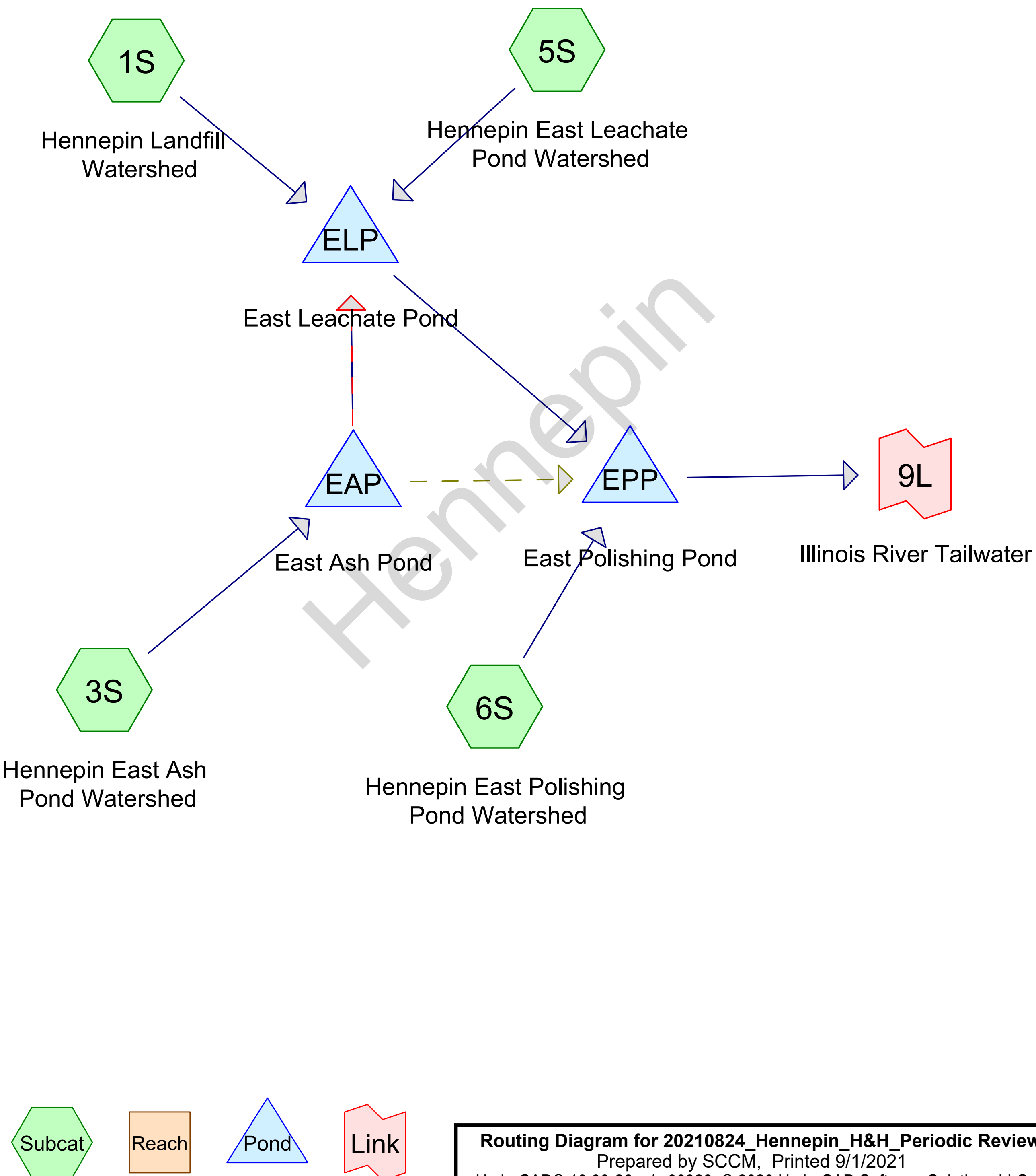


Figure based on IngenAE 2020 Site Topo

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

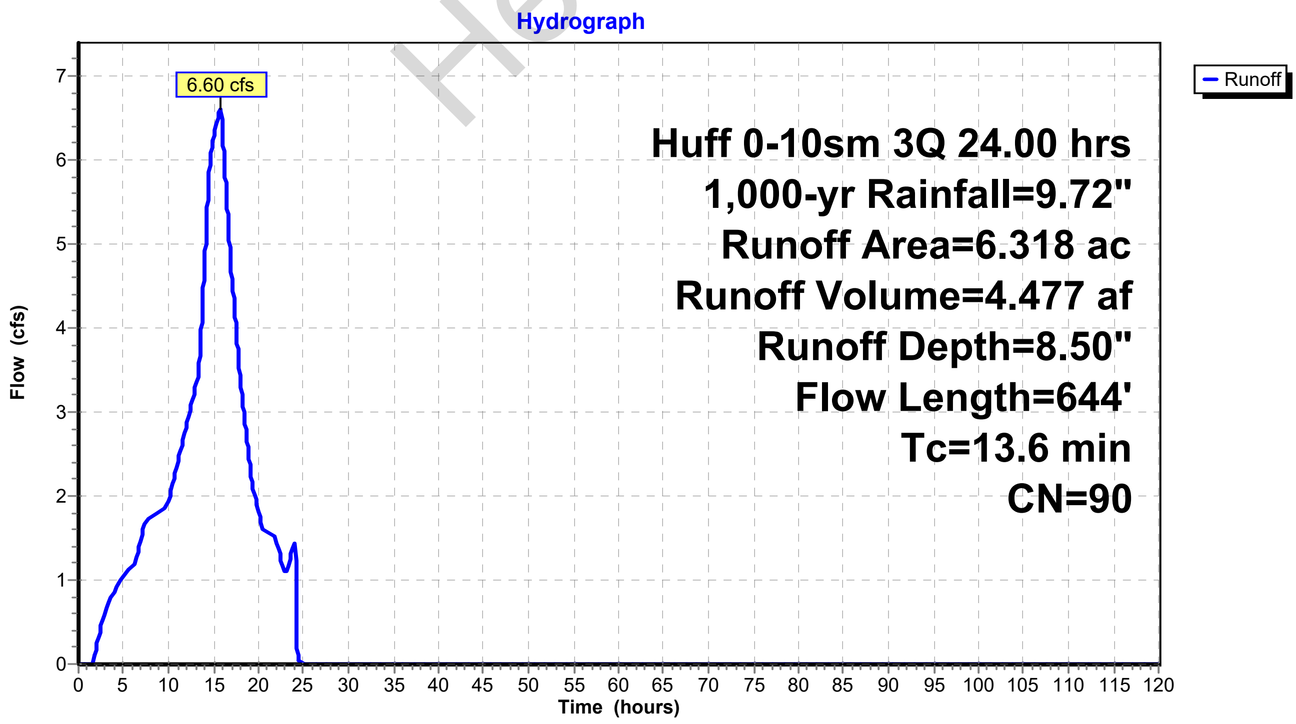
Runoff = 6.60 cfs @ 15.73 hrs, Volume= 4.477 af, Depth= 8.50"

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

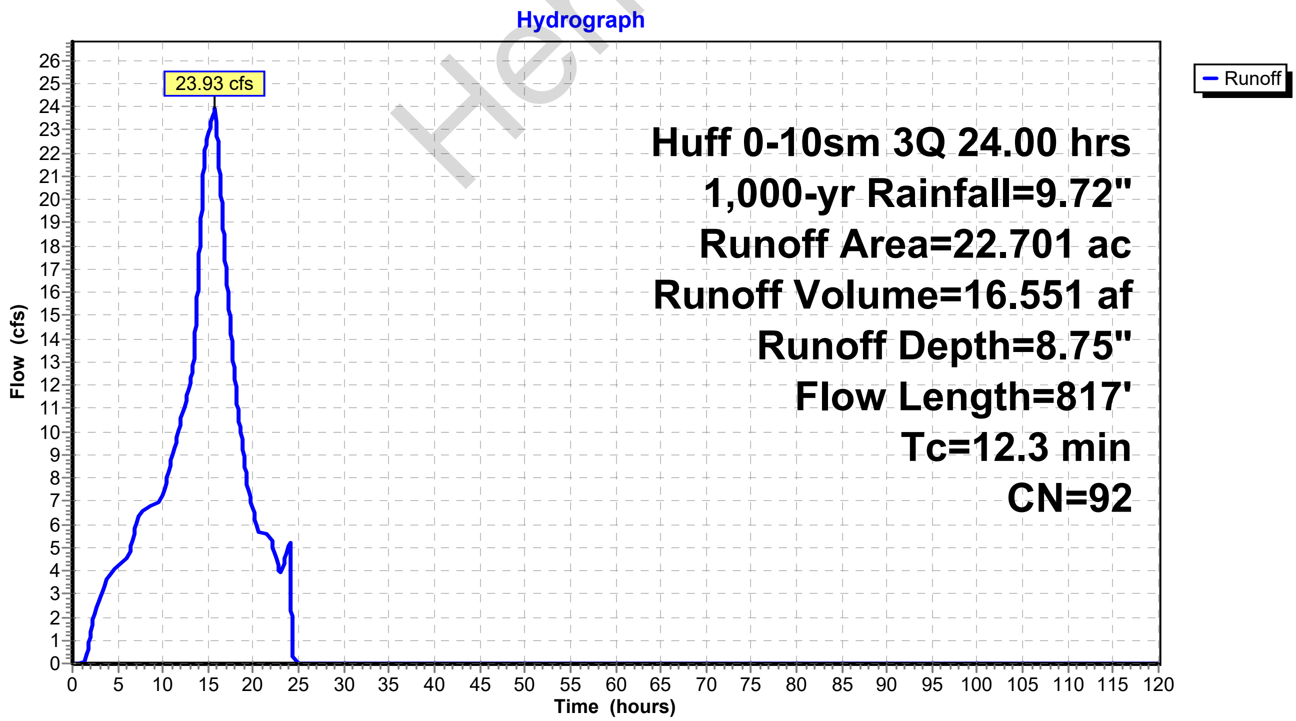
Runoff = 23.93 cfs @ 15.73 hrs, Volume= 16.551 af, Depth= 8.75"

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

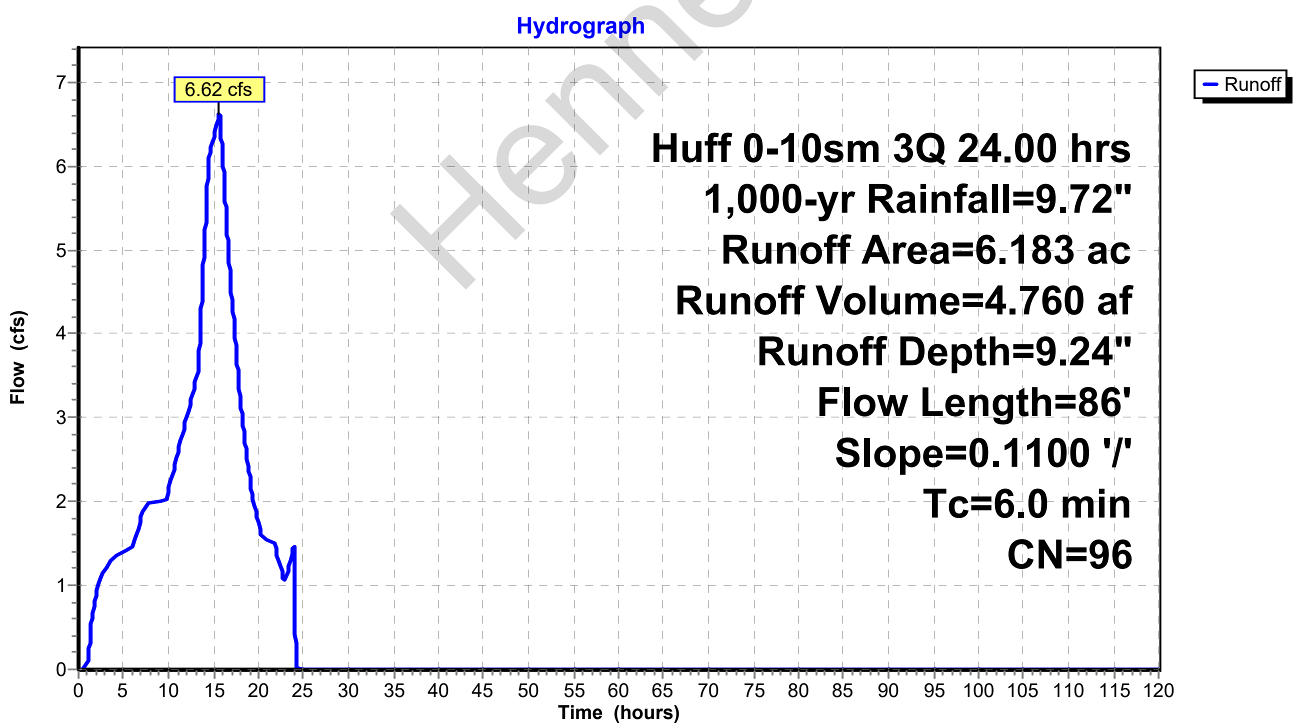
Runoff = 6.62 cfs @ 15.66 hrs, Volume= 4.760 af, Depth= 9.24"

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

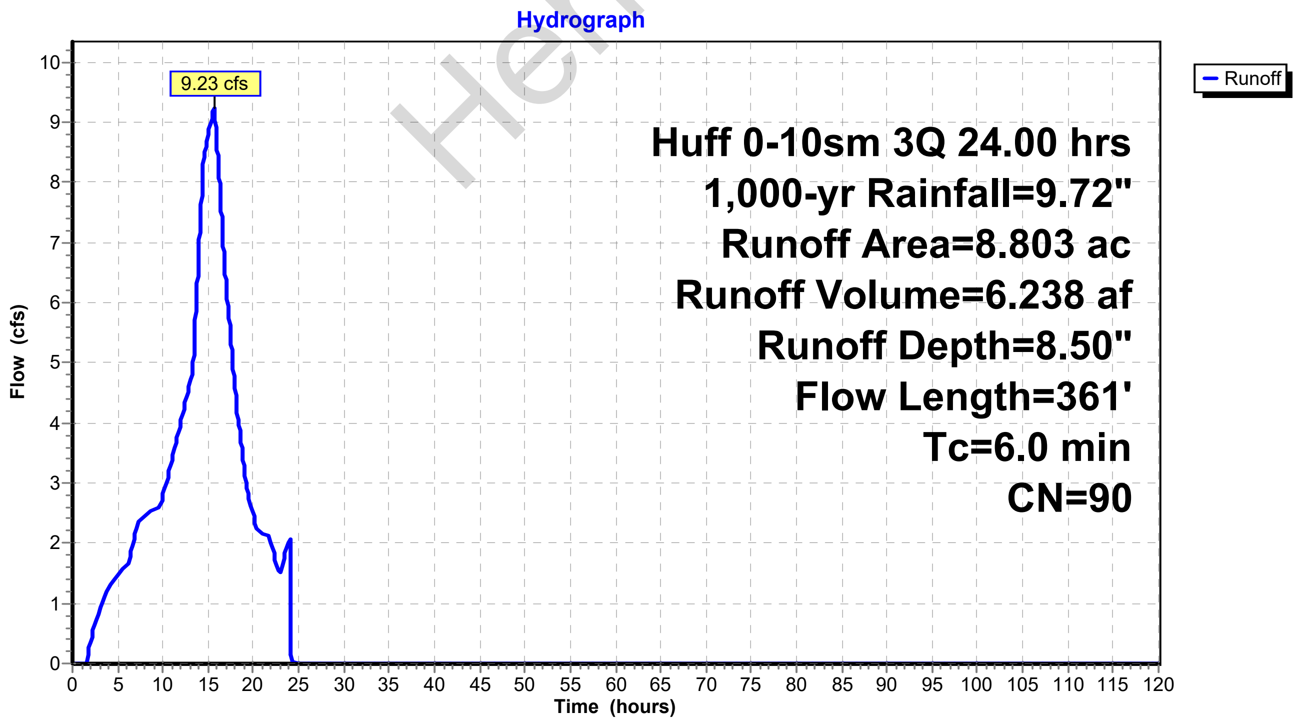
Runoff = 9.23 cfs @ 15.66 hrs, Volume= 6.238 af, Depth= 8.50"

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

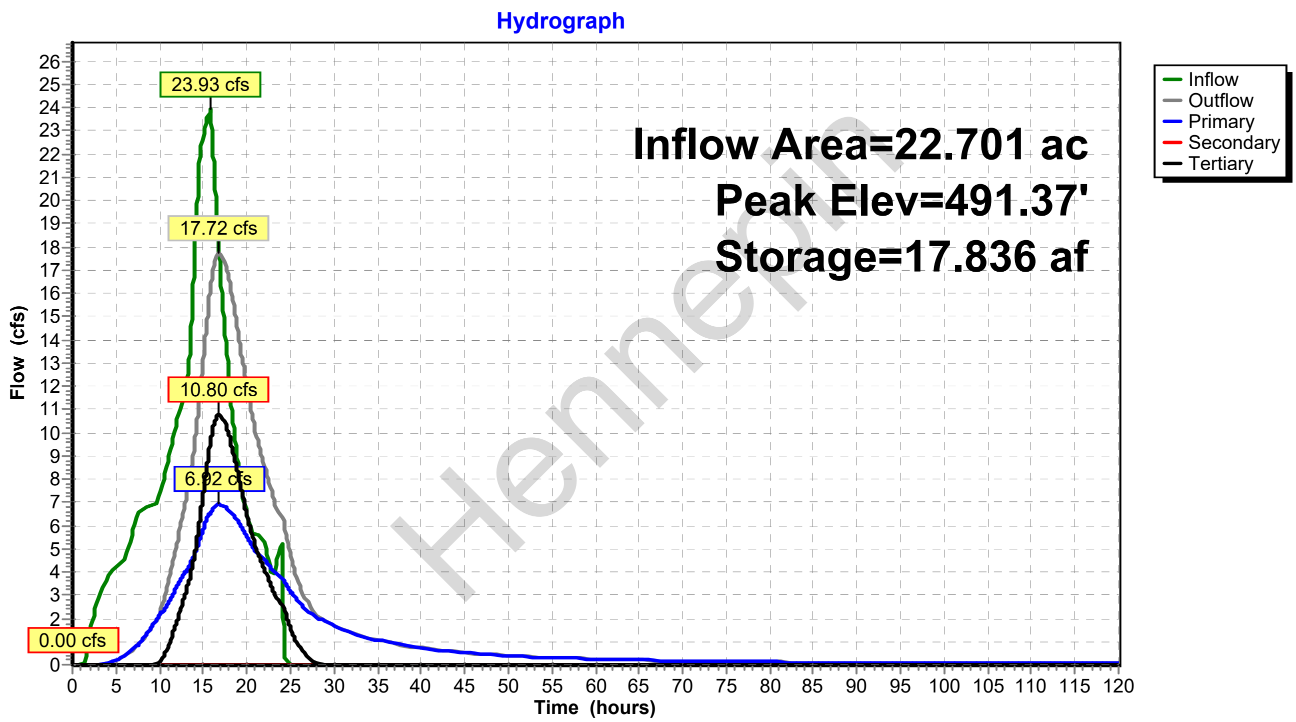
Device	Routing	Invert	Outlet Devices
#1	Primary	489.97'	**18.0" Round Culvert** L= 61.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 489.97' / 486.81' S= 0.0518 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Tertiary	458.00'	**36.0" Round Culvert** L= 283.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 458.00' / 457.50' S= 0.0018 '/' Cc= 0.900 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 Limited to weir flow at low heads
#5	Secondary	492.66'	**12.0" Round Culvert X 2.00** L= 97.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 492.66' / 488.34' S= 0.0445 '/' Cc= 0.900 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)

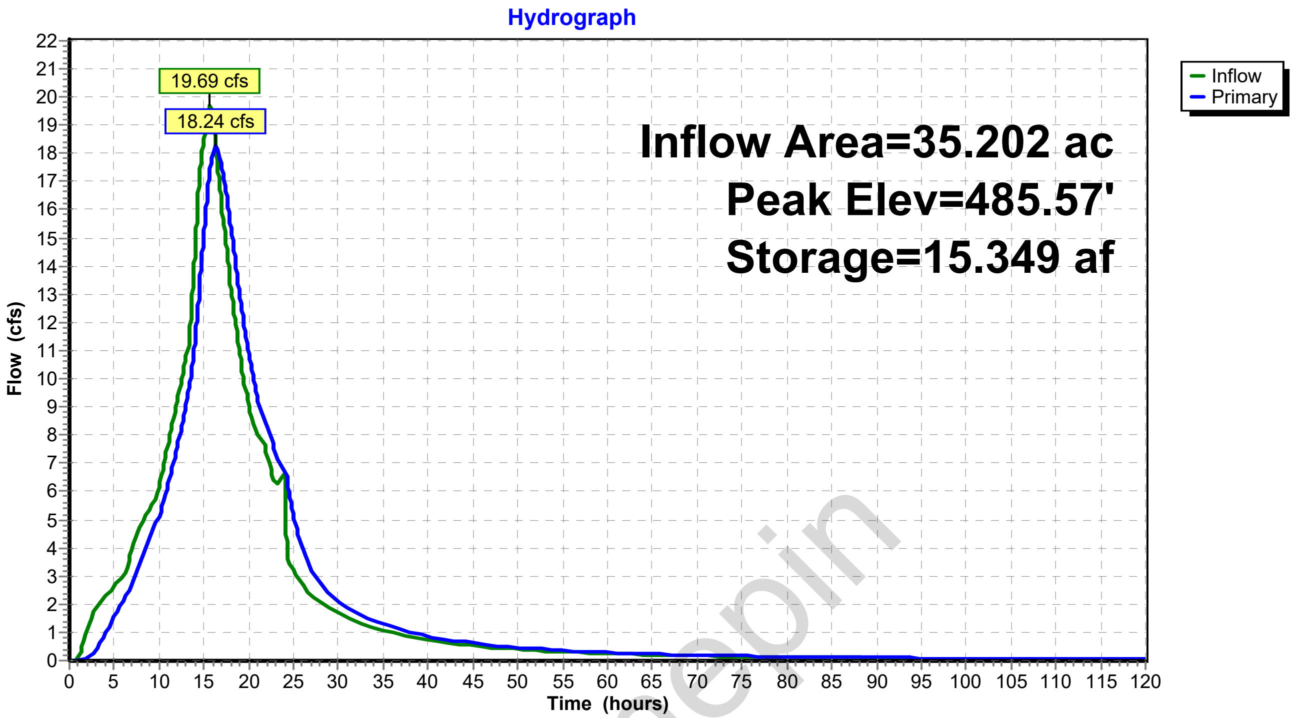
Volume	Invert	Avail.Storage	Storage Description
#1	479.00'	64.034 af	**Custom Stage Data (Conic)** Listed below (Recalc)

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** L= 157.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 480.40' / 479.81' S= 0.0038 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	485.14'	**48.0" x 72.0" Horiz. Orifice/Grate** C= 0.600 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)

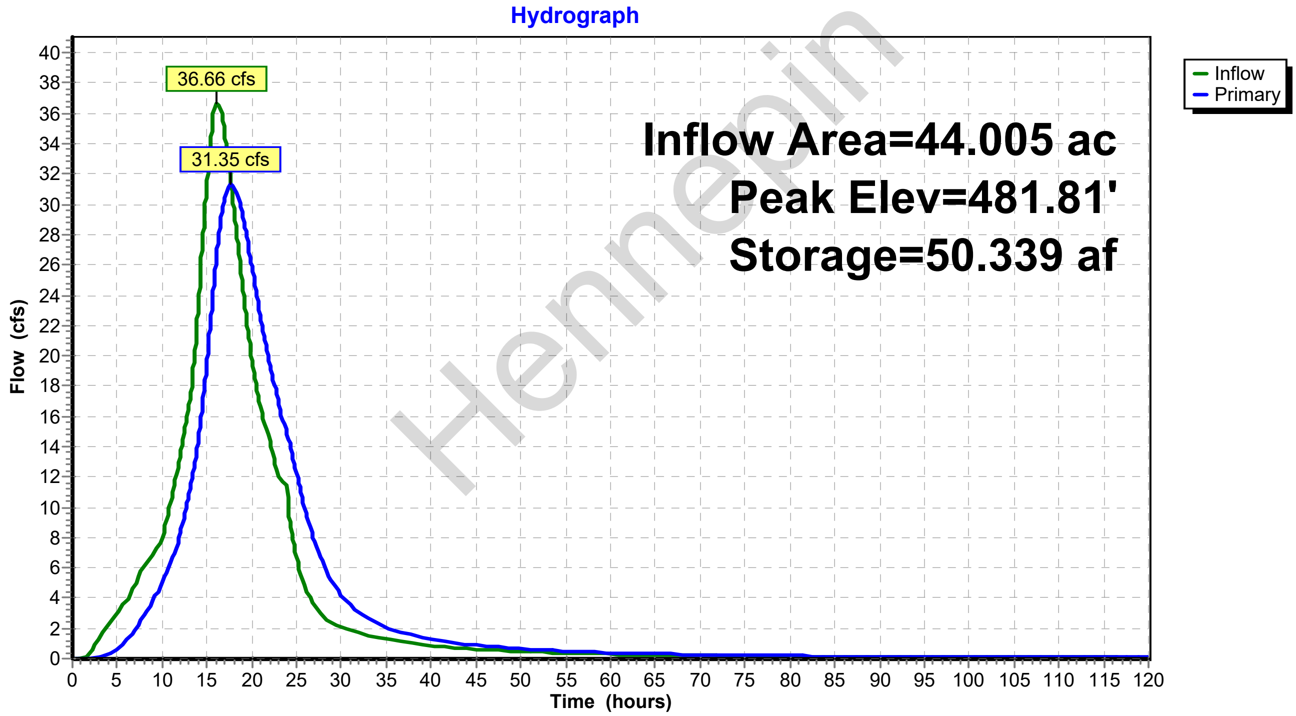
Volume	Invert	Avail.Storage	Storage Description
#1	463.00'	122.821 af	**Custom Stage Data (Conic)** Listed below (Recalc)

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** L= 655.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 458.00' / 452.16' S= 0.0089 '/' Cc= 0.900 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 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'