NOTE

Subject: EPA Comments on Dynegy Midwest Generation Inc. – Hennepin Power Station, Hennepin, IL
Round 10 Draft Assessment Report

To: File

Date: May 21, 2012

1. For both the **EAPS and the AEAP, the report states**: "*The stability analysis completed indicates that the 1979 embankments that support the underlying ash along the Illinois River have a calculated factor of safety less than the generally accepted value*." Section 2.6 does not make it clear that this issue applies to both ash pond systems. Please clarify with the following explanation: "The 1979 embankment is common to the AEAP and the EAP; the ponds were separated into different units in association with the construction of Pond 2E at a later date. Since the embankment is common to both impoundments, we would expect the wedge-type failure noted in the CEC analysis for the 1979 embankment for the EAP are to be applicable to the 1979 embankment for the AEAP. Therefore, it is our opinion that both the AEAP and the EAPS systems should be rated "POOR". In addition, on p. 13, Section 2.6 "Structural and Seepage Stability," it may be advantageous to provide a chart referencing calculated factors of safety for respective loading conditions along with acceptable minimum factors of safety used in reference.

2. Please make a global change of "inspection" to "assessment" in relation to the contractor's activities.

3. Please include H&H and stability analyses reports.

4. Appendix A, Limitations, is written for "Alliant" and "Wisconsin" not "Dynegy" and "Illinois" Please correct.

5. On p. 2, Section 1.2.1 "Location," it may be advantageous to include a latitude and longitude of the facility or of an impoundment (I found the facility to be 41°18'11"N, 89°18'55"W). I found this helpful in previous drafts from GZA.

6. It is requested that either in Appendix C- the checklist, or in section 1.2 there be a specific statement made to address the following question: "Is any part of the impoundment built over wet ash, slag, or other unsuitable materials (like TVA)?" Please correct for each impoundment.

7. On p. 2, Section 1.2.3 "Purpose of the Impoundments," it may be advantageous to denote, on Figure 2 in particular, the locations of "Active East Ash Pond System," "East Ash

Pond System," and "West Ash Pond System," as well as any intermediate Ash Ponds (e.g., East Ash Pond System Ponds 2 and 4). It may be confusing to the reader if the names used for units in the report do not track exactly with the names for units denoted on the Overall Ash Basin Plan.

Comments on Draft Report
Dynegy Midwest Generation – Hennepin Power Station
By Paul Mauer, Jr., P.E.
Senior Engineer
Illinois Dam Safety Program

In general, it is important that the report correctly reflect the regulation of structures in Illinois. All man-made structures intended to impound or divert water, or other fluids, are regulated by the Illinois Department of Natural Resources' Dam Safety Program. All the structures covered in the report are subject to those regulations. The NPDES permit program in Illinois is administered by the Illinois Environmental Protection Agency.

Executive Summary

Assessments

EAPS –

> 3. The stated assessment does not report the overall stability analysis for the 1979 northerly embankments. The reported deficient factor of safety is for the sliding wedge analysis. This office was not provided with the analysis of the 1979 embankments in the 2010 permit application package. It is thus difficult to comment, other than to note that the factor of safety computed implies that evidence of underdesign might have been expected in the 30+ years since construction. The lack of that observation indicates that the analysis may not be based upon proper assumptions.

Based upon the reported existence of mature trees on the embankment, the assessment of POOR is appropriate.

AEAPS –

> 3. The analysis of the 1979 embankment stability of the northerly embankment is only directly related to the embankment of Pond 2E. It is not clear if the reported factor of safety for the 1979 embankment includes the loading by construction of the Pond 2e embankment. As noted above, the lack of evidence of distress in the 1979 embankments indicates that the further analysis to be done would not be considered to be critical.

Based upon the reported existence of mature trees on the embankment, the assessment of POOR is appropriate.

WAPS –

The introductory discussion in this section is significantly different than that provided for the EAPS and AEAPS sections. The reader is led to conclude that a different standard is being applied here, but the visual observations are not significantly different and the conclusion should not be.

4. Seepage /stability analysis was not available. The observations fail to provide evidence that design was missing or inadequate. The availability of documents is not a determining factor in the condition assessment of the structure.

5. Hydraulic/hydrologic design information was not available. The observation of approximately 10 feet of freeboard approaches approval by observation of the physical condition. The design PMP event is approximately 28". The structure has minimal additional drainage area. Without physical evidence of deficiencies, the lack of availability of design information is not material to the condition assessment.

Based upon the reported existence of mature trees on the embankment, the assessment of POOR is appropriate.

Studies and Analyses

3. The recommendation to generate a remedial design ignores the physical assessment of the condition of the embankment. The correct recommendation is the reanalysis of the northerly embankment to verify the stability for wedge failure. The result of that analysis should be the basis for any redesign determined to be appropriate.

Recurrent Operation & Maintenance Recommendations

1. There is no evidence provided to justify the recommendation. The recommendation appears to be based upon the lack of coordination of the inspection date with the mowing schedule. Except the observation of the vegetation in an area of mature tree growth, the observations indicate that the current mowing program has resulted in a dense grass cover, the preferred condition.

Repair Recommendations

All 3 recommendations are premature.

Dynegy Operating Company
604 Pierce Boulevard
O'Fallon, IL 62269
618.206.5905

Via Overnight Delivery

July 2, 2012

DYNEGY

United States Environmental Protection Agency
Two Potomac Yard
2733 South Crystal Drive
5th Floor, N-5237
Arlington, Virginia 22202-2733

Attn: Mr. Stephen Hoffman

RE: DMG Comments on Draft Assessment of Dam Safety of Coal Combustion Surface Impoundments at the Hennepin Power Station, dated March 15, 2012

Mr. Hoffman:

Dynegy Midwest Generation, LLC (DMG), by its agent Dynegy Operating Company, appreciates the opportunity to review and comment upon the March 15, 2012 draft dam assessment report of the Hennepin Power Station ash pond systems, written by GZA GeoEnvironmental, Inc. (GZA). ***We are enclosing a marked-up copy of selected pages of the draft report, which includes our consolidated comments.*** These attached revisions are minor and are provided for clarification purposes.

With respect to the draft assessment report recommendations and while we have had initial consultations with our independent, 3rd party, geotechnical engineering consultant - URS Corporation (URS) - DMG and URS will review the recommendations in greater detail.

General Comments

DMG offers the following general comments:

1. The east ash pond (EAP) and eastern portion of the west ash pond (WAP) systems are essentially inactive and do not impound surface water. DMG also understands that the scope of the assessment, as stated by the USEPA, includes "the assessment of closed units that no longer receive coal combustion residues or by-products but still contain free liquids". GZA has apparently assumed that these inactive surface impoundments contain free liquids, without performing a paint filter (free liquid) test. DMG recommends that a paint filter (free liquid) test

be conducted, to determine the presence of free liquids, before the report is finalized.

2. For the secondary cell of the WAP, an alternative to the WAP recommendations would be to dewater and backfill/cap the secondary cell, rendering this cell unable to impound water. For the eastern cells of the WAPS (cells # 1 and # 3) and if these two eastern cells do indeed contain free liquids, an alternative to the WAP recommendations would be to backfill/cap these two cells, rendering these two cell unable to impound water.

3. With respect to the recommendation for tree clearing from the slopes and crests of the embankments, DMG is concerned that tree clearing could cause damage, as opposed to leaving the trees undisturbed. Also, the mature tree growth of approximately 45 years does provide erosion protection.

Specific Comments

DMG, after initial consultations with both URS and Civil and Environmental Consultants, Inc. (CEC), offers the following more-detailed comments on specific recommendations and statements in the draft assessment report. For ease of review, the USEPA/GZA recommendation/statement is italicized and the respective DMG/URS/CEC comment is provided immediately afterwards.

1. *"Pending the results of the complete seepage and stability analysis for the WAPS, modify the design or operation of the impoundments to provide conditions that result in embankments that meet generally-accepted factors of safety."* (Executive Summary, "Repair Recommendations", #2, page iv).

   The values for "generally accepted factors of safety" are dependent upon the reference used to identify the factors of safety. DMG/URS recommends using a modified version of the factors of safety utilized by the Illinois Department of Natural Resources (IDNR) for the permitting of new dams.

   Because the IDNR Guidelines address the permitting of new dams and the Hennepin Power Station impoundments are existing impoundment systems, the factors of safety proposed by the IDNR should not apply.

   As an alternative, DMG/URS recommends using the modified minimum factors of safety listed in Table 1 as criteria for the impoundments at the Hennepin Power Station.

Table 1 – Proposed Minimum Factor of Safety Criteria for DMG's Hennepin Impoundments

Loading Condition	Analysis Type	Minimum Factor of Safety without Seismic Forces	Minimum Factor of Safety with Seismic Forces
Normal Operating Level (Steady Seepage)	Drained (Steady-State Seepage)	1.5	1.0
100-yr, 24 Hour Storm Water Level	Drained and Undrained	1.4[1]	N/A
Rapid (Sudden) Drawdown	Drained/Undrained[2]	1.2	N/A

[1]Recommended factor of safety for this type of analysis by the US Army Corps of Engineers.
[2]Rapid drawdown analyses will use a multi-stage approach as recommended by the US Army Corps of Engineers.

DMG requests USEPA's concurrence on the use of these proposed minimum factor of safety criteria for the Hennepin Power Station impoundments.

2. *"Perform a complete structural and seepage stability analysis of the WAPS impoundment embankments including static, seismic and liquefaction loading."* (Executive Summary, "Studies and Analyses", #2, page iii).

   DMG/URS assume that the referenced "seismic loading" is a pseudostatic slope stability analysis. DMG/URS also assume that the "liquefaction loading" is an analysis of liquefaction potential and analysis with liquefied soil strengths if liquefaction occurs, rather than "liquefaction loading". Otherwise, please clarify.

   Seismic hazard maps by USGS predict a peak ground acceleration (PGA) of 0.08 g for the site, with a 2% probability of exceedance in 50 years (2500 year return period). Generally, sites with a PGA with a 2% probability of exceedance within 50 years of less than 0.10 g are not considered to be within a seismic impact zone. Therefore, seismic forces would be a secondary consideration. However, DMG/URS recognize that IDNR requires seismic activity to be considered in the design of all Illinois dams.

3. *"These results* [of the factors of safety calculated for the Active EAP System (AEAPS)] *are well within the range of acceptable factors of safety for the types of embankments and load conditions evaluated."* (Section 2.6, 1st paragraph, page 13).

"Similarly, the stability analysis completed [for the AEAPS] *indicates that the 1979 embankments that support the underlying ash along the Illinois River have a calculated factor of safety less than the generally minimum accepted value."* (Executive Summary, "Assessments", #3 under the AEAPS list of deficiencies, page ii).

These two statements contradict each other. Please clarify. DMG recommends removal of this second statement, from the final assessment report.

4. *"The previous stability analysis completed April 29, 2010* [for the EAPS] *indicates that the 1979 embankments that support the underlying ash along the Illinois River have a calculated factor of safety less than the generally accepted minimum value." (*Executive Summary, "Assessments", #3 under the EAPS list of deficiencies, page ii).

   CEC prepared permit drawings for a new dry ash landfill to be constructed over portions of the EAPS at the Hennepin Power Station. CEC's drawings included construction of a 5-stage, geosynthetic-lined landfill for disposal of fly ash and a surface and leachate drainage pond (Pond 2E). Initial construction of the landfill commenced in 2009 and included phased-closure of the EAPS, construction of Pond 2E, and construction of Phase 1 of the landfill.

   As part of the landfill design, CEC prepared a detailed slope stability analysis that evaluated eight cross sections across the site during multiple phases of the proposed construction. Two cross sections evaluated the final construction conditions along the Illinois River embankments that border the northern portion of the project. Those cross sections were:

   NB-2: located on the northern limit of the landfill and extends from the landfill's peak waste elevation along a north-south alignment to the base of the northern slope at the Illinois River. This section was selected because it represents the closest the landfill encroaches on the steep northern slope down to the Illinois River. NB-2 is considered the most critical section of the landfill due to its proximity to the Illinois River and proposed height of waste, which yields the lowest FS.

   P2-1: located on the northern limit of the currently constructed Pond 2E where it slopes towards the Illinois River. This section analyzes the stability of the northern berm/northern river bank if the pond 2E were to completely fill with water. The extent of the ash under the existing berm were conservatively assumed. This section is considered the critical profile of Pond 2E, based on the existing topography along the northern berm/northern river bank.

The analysis was performed specific to the proposed landfill design to verify that the proposed grades yield global/deep-seated slope stability FS of at least 1.5 for static conditions and 1.3 for seismic (pseudo-static) conditions in accordance with typical landfill design criteria. The static analysis also used a static water level equal to the flood level of Elevation 465 feet mean see level. These criteria were applied to "critical" failure surface that were identified as breaching the berm or liner of the landfill or Pond 2E. Each cross section was analyzed for rotational and translational failure conditions. The analysis determined that the minimum static FS of the critical failure surfaces were 1.76 and 1.53 for NB-2 and P2-1, respectively. The minimum seismic (pseudo-static) FS was 1.39 and 1.35 for NB-2 and P2-1, respectively. All of the critical failure surfaces for the identified cross sections were greater than the acceptable standards.

As part of the analysis, slope stability was also performed on the existing slope along the Illinois River in the vicinity of the proposed landfill and Pond 2E. As commented by GZA, the minimum static condition FS's calculated for these conditions were 1.19 and 1.01 for NB-2 and P2-1, respectively. The seismic (pseudo-static) analyses presented minimum FS's of 1.13 and 0.95 for NB-2 and P2-1, respectively. However, the intent of this analysis was not to provide a detailed analysis of the existing embankment, but to conservatively back-calculate the embankment material's soil parameters to use in the deep-seated analysis of the landfill.

CEC performed a revised stability analysis for Section P2-1 utilizing more realistic effective shear strength parameters for the existing berm fill (Φ' = 34°, c' = 300 psf). These parameters are more consistent with the conditions encountered in the test borings at the site. Utilizing these parameters yields a FS = 1.37 and 1.24 for static and seismic conditions, respectively (see attached stability analyses).

DMG/CEC conclude that the northern embankments along the Illinois River adjacent to the EAPS are adequately stable. This conclusion is based on the following:

A. The existing berm fill material shear strength values were based primarily on the assumption that the existing Illinois River sloped bank is at approximately equilibrium (FS~1.0). This assumption was very conservative (since there is no evidence of existing instability in the embankment) and was used only as a baseline to perform the long-term stability for the landfill design. The actual shear strength of the existing berm material is considered to be much stronger. The existing berm fill samples tested primarily consisted of clayey/silty gravel with sand and silty sand with gravel. Utilizing more realistic effective shear strength parameters for this material, CEC recalculated the FS = 1.37 and 1.24 for Section P2-1 under static and seismic conditions, respectively. Static FS > 1.3 are considered acceptable in most short-term

slope stability applications (such as the flood water levels used in the design) and when evaluating existing embankments that have a long-term history of adequate performance. Seismic FS > 1.2 are also considered acceptable in this application.

B. The minimum failure surfaces commented on by GZA were surficial and did not impact the landfill berms or liner system, and are not considered critical to the existing landfill or pond. No failure surface that would affect the proposed landfill has a FS below the minimum 1.5 for static conditions or 1.3 for seismic (pseudo-static) conditions, even when utilizing the more-conservative soil parameters for the existing berm fill.

* * * * *

In conclusion, as discussed above, DMG/URS/CEC raise numerous technical issues with the draft assessment report. DMG requests a phone conference with USEPA/GZA, to discuss and/or clarify these issues.

If you have any questions regarding our comments on the draft report, please contact Mr. Phil Morris, P.E., a member of my staff, directly at (618) 206-5934.

Sincerely,

Dynegy Midwest Generation, LLC
by its agent Dynegy Operating Company

Rick Diericx
Senior Director
Environmental Compliance
Tel. No. 618-206-5912
e-mail: rick.diericx@dynegy.com

Enclosures

EXECUTIVE SUMMARY

This Inspection Report presents the results of a visual inspection of the Dynegy Midwest Generation, ~~Inc. (Dynegy)~~ – Hennepin Power Station (HPS) Coal Combustion Waste (CCW) Impoundments located at 13498 E 800th Street, Hennepin, Illinois. These inspections were performed on May 23, 2011 by representatives of GZA GeoEnvironmental, Inc (GZA), accompanied by representatives of ~~Dynegy~~.

The HPS is a two-unit coal-fired power plant, with a maximum generating capacity of approximately 310 Megawatts. Commercial operation of the facility began in the 1950's. Earthen and fly ash embankment CCW Impoundments (Active East Ash Pond System, East Ash Pond System, and West Ash Pond System) were constructed in conjunction with the HPS facility for the purpose of storing and disposing non-recyclable CCW from the HPS facility and clarification of water prior to discharge.

The current HPS operations use the Active East Ash Pond (AEAPS) for disposal of CCW products. The AEAPS consists of three (3) pond units. The first two units, known as the Primary and Secondary Cells, were designed as two chambered wet ash ponds and placed in service in 1997. After several years of operation, the Primary Cell's settling efficiency was reduced due to ash deposition and a third pond, Pond 2 East (2E) was added to the system in 2010.

There are two impoundments areas at the HPS which have been decommissioned and include: 1) East Ash Pond System Ponds 2 and 4 (EAPS) which are located adjacent to AEAPS and have been out of service since 1995; and, 2) West Ash Pond System Ponds 1 and 3 (WAPS) which are located west of the HPS and have been out of service since 1997. Pond 2E was constructed within the eastern footprint of the decommissioned Pond 2 area of the EAPS. The remaining portion of the Pond 2 area of the EAPS has being permitted as a dry fly ash landfill facility.

Process water and sluiced CCW are currently discharged into the Primary Cell of the AEAPS, where the CCW is allowed to settle and water is discharged into Pond 2E. Solids are further settled in Pond 2E prior to water discharge to the adjoining Secondary Cell (refer to Figure 2). Water flows sequentially through the Primary Cell, Pond 2E, and the Secondary Cell prior to discharge through a 5 foot stoplog weir structure and into the system outlet works. The AEAPS final outlet works include a Parshall flume for flow measurement and a final sampling manhole. Flow is then discharged to the Illinois River through NPDES outfall 003.

For the purposes of this EPA-mandated inspection, the sizes of the impoundments were based on U. S. Army Corps of Engineers (COE) criteria. Based on the maximum crest height of 18 feet and a storage volume of approximately 36 acre-feet, the WAPS is classified as a **Small** sized structure. Based on the maximum crest height of 52 feet and a storage volume of approximately 1,560 acre-feet, the AEAPS is classified as an **Intermediate** sized structure.

1.0 DESCRIPTION OF PROJECT

1.1 General

1.1.1 Authority

The United States Environmental Protection Agency (EPA), has retained GZA GeoEnvironmental, Inc. (GZA) to perform a visual inspection and develop a report of conditions for the Dynegy Midwest Generation, ~~Inc., (Dynegy~~, Owner) Hennepin Power Station (HPS, Site) Coal Combustion Waste (CCW) Impoundments in Putnam County, Illinois. This inspection was authorized by the EPA under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 104(e). This inspection and report were performed in accordance with Request for Quote (RFQ) RFQ-DC-16, dated March 16, 2011 and EPA Contract No. EP10W001313, Order No. EP-B11S-00049. The inspection generally conformed to the requirements of the Federal Guidelines for Dam Safety[1], and this report is subject to the limitations contained in **Appendix A** and the Terms and Conditions of our Contract Agreement.

1.1.2 Purpose of Work

The purpose of this investigation was to visually inspect and evaluate the present condition of the impoundments and appurtenant structures (the management unit) to attempt to identify conditions that may adversely affect their structural stability and functionality, to note the extent of any deterioration that may be observed, review the status of maintenance and needed repairs, and to evaluate the conformity with current design and construction standards of care.

The investigation was divided into five parts: 1) obtain and review available reports, investigations, and data from the Owner pertaining to the impoundment and appurtenant structures; 2) perform a review with the Owner of available design, inspection, and maintenance data and procedures for the management unit; 3) perform a visual inspection of the site; 4) prepare and submit a field assessment checklist; and 5) prepare and submit a draft and a final report presenting the evaluation of the structure, including recommendations and proposed remedial actions.

1.1.3 Definitions

To provide the reader with a better understanding of the report, definitions of commonly used terms associated with dams are provided in **Appendix B**. Many of these terms may be included in this report. The terms are presented under common categories associated with dams which include: 1) orientation; 2) dam components; 3) size classification; 4) hazard classification; 5) general; and 6) condition rating.

[1] FEMA/ICODS, April 2004: http://www.ferc.gov/industries/hydropower/safety/guidelines/fema-93.pdf

1.2 Description of Project

1.2.1 Location

The HPS is located in Sections 26 and 27, Township 33 North, Range 2 West, in Putnam County, Illinois. The HPS is adjacent to the Illinois River at river mile 211.5, approximately four (4) miles north of Hennepin, Illinois. The HPS CCW impoundments are located to the east and west of the power plant. A Site locus of the impoundments and surrounding area is shown in **Figure 1**. An aerial photograph of the impoundments and surrounding area is provided as **Figure 2**. The impoundments can be accessed by vehicles from earthen access roads from the HPS.

1.2.2 Owner/Caretaker

The CCW impoundments are owned by Dynegy Midwest Generation, ~~Inc.~~ LLC and operated by the HPS.

	Dam Owner/Caretaker
Name	Dynegy Midwest Generation, ~~Inc.~~ Hennepin Power Station
Mailing Address	13498 E 800th St Hennepin, IL 61327
City, State, Zip	Hennepin, Illinois 62327
Contact	Ted Lindenbusch
Title	~~Operations Manager~~ MANAGING DIRECTOR
E-Mail	Ted.Lindenbusch@dynegy.com
Daytime Phone	815-339-9210
Emergency Phone	911

1.2.3 Purpose of the Impoundments

The HPS is a two-unit coal-fired power plant, with a maximum generating capacity of approximately 310 Megawatts. Commercial operation of the facility began in the 1950's. Earthen and fly ash embankment CCW Impoundments (Active East Ash Pond System, East Ash Pond System, and West Ash Pond System) were constructed in conjunction with the HPS facility for the purpose of storing and disposing non-recyclable CCW from the HPS facility and clarification of water prior to discharge.

The current HPS operations use the Active East Ash Pond (AEAPS) for disposal of CCW products. The AEAPS consists of three (3) pond units. The first two units, known as the Primary and Secondary Cells, were designed as two chambered wet ash ponds and placed in service in 1997. After several years of operation, the Primary Cell's settling efficiency was reduced due to ash deposition and a third pond, Pond 2 East (2E) was added to the system in 2010.

There are two impoundments areas at the HPS which have been decommissioned and include: 1) East Ash Pond System Ponds 2 and 4 (EAPS) which are located adjacent to AEAPS

AND DO NOT CURRENTLY IMPOUND WATER.

and have been out of service since 1995; and, 2) West Ash Pond System Ponds 1 and 3 (WAPS) which are located west of the HPS and have been out of service since 1997. Pond 2E was constructed within the eastern footprint of the decommissioned Pond 2 area of the EAPS. The remaining portion of the Pond 2 area of the EAPS ~~has being permitted~~ WILL BE OPERATED as a dry fly ash landfill facility.

BOTTOM ASH

Process water and sluiced ~~CCW~~ are currently discharged into the Primary Cell of the AEAPS, where the CCW is allowed to settle and water is discharged into Pond 2E. Solids are further settled in Pond 2E prior to water discharge to the adjoining Secondary Cell (refer to Figure 2). Water flows sequentially through the Primary Cell, Pond 2E, and the Secondary Cell prior to discharge through a 5 foot stoplog weir structure and into the system outlet works. The AEAPS final outlet works include a Parshall flume for flow measurement and a final sampling manhole. Flow is then discharged to the Illinois River through outfall 003.

1.2.4 Description of the EAPS Impoundment and Appurtenances

The EAPS was designed by Illinois Power Company. However, available information regarding the original design and/or construction of the EAPS was limited to drawings related to subsequent embankment modifications and references in various documents prepared by Civil & Environmental Consultants, Inc. (CEC) for the design and construction of Pond 2E. The following description of the EAPS is based on the limited available information and observations made by GZA during our Site visit.

Based on the available information, the embankments surrounding the EAPS were constructed in three phases. The original embankments were constructed in 1958, with subsequent modifications in 1978 and 1989. The original embankments were constructed to about elevation 474 feet (MSL) and the north, east and west sides of the EAPS were tied into the bluff on the south side which is also the northern embankment of the Primary and Secondary Cells. In 1978, the embankments were raised to elevation 484 feet (MLS), and to elevation 494 feet (MLS) in 1989. Typical sections of the 1989 embankment extensions are shown on **Figures 3 and 4**.

Borings were performed in 2009 by CEC in the area of the EAPS as part of the design for Pond 2E. Seven of the borings were drilled through the top of the 1989 embankment (at approximate elevation 494 (MLS)) and two borings through the 1978 embankment (at approximate elevation 484 (MLS)). The borings encountered gravelly clays and sands interbedded with layers of loose to medium dense sand, gravel and gravelly sands and clays; stiff to very stiff sandy and silty clays; and loose to very loose, moist to wet, laminated silt with zones of fly ash with a consistency of fine and/or silty sand. Several other borings drilled in the EAPS disposal area encountered CCW materials to depths ranging from about 24 to 35 feet below the existing surface grades or elevations ranging about 456 to 453 (MSL), respectively. The boring locations are provided on **Figure 5.**

The original embankment slopes of the EAPS were variable and appear to have been constructed with downstream and upstream slopes that range from approximately 2.5H:1V to about 1.5H:1V. The EAPS crest length is approximately 1 mile with a maximum height (from the lowest downstream toe elevation to the crest of the impoundment) of approximately 52 feet corresponding to a crest elevation of 494.0 (MSL). The upstream and downstream slopes of the raised embankments sections were constructed at approximately 2.5H:1V.

FOR FUTURE OPERATION

A dry ash landfill has been ~~permitted for construction~~ CONSTRUCTED on the western portion of the Pond 2 area of the EAPS. The landfill ~~permit included construction of~~ WAS CONSTRUCTED WITH a liner placed on the existing ash fill that was subsequently covered with several feet of ash during construction of Pond 2E. The landfill is permitted to extend to a height of 66 feet above the current embankment corresponding to an elevation of approximately 560 feet (MSL). Please note that the embankments of the EAPS are not regulated as a dam by the Illinois Department of Water Resources.

1.2.5 Description of the AEAPS Primary Cell, Secondary Cell and Appurtenances

The embankments of the Primary Cell and Secondary Cells were designed by Illinois Power Company. The following description of the impoundment is based on information provided in various Illinois Power Company Drawings and Documents, various Design Documents prepared by Civil & Environmental Consultants, Inc. (CEC), other information received from HPS, and observations made by GZA during our Site visit.

The AEAPS Primary and Secondary Cells are located east of the HPS and were originally constructed by reshaping an area that was an existing gravel pit to form the current surface impoundment. The ground elevation surrounding most of gravel pit at the time of construction was described to be equal to or greater than the maximum elevation proposed for the impoundments. The northeast corner of the impoundment however required the construction of an embankment with a portion of it being approximately 20 feet above the existing ground level. This area was described as having uneven natural terrain and was stabilized by leveling the existing ground surface and adding fill to the leveled elevation. The natural slopes in this area gave the northeast corner a height of about 32 feet.

FLY ASH IS CONDITIONED AND TRANSPORTED DRY, TO THE PRIMARY CELL

The AEAPS Primary and Secondary Cells function as sedimentation basins for coal combustion wastes (CCW) including bottom ash, fly ash, miscellaneous station low volume waste, and coal pile runoff streams which are piped from the plant and discharged into the impoundment. The CCW enters the Primary Cell through two 12 inch diameter HDPE pipes and two 10 inch diameter steel pipes which are located near the northeast corner of the Primary Cell. Miscellaneous station low volume waste streams and coal pile runoff also enter the Primary Cell to the west of the northeast corner. The CCW settles in the Primary Cell and flow through the pond is discharged into Pond 2E through an 18 inch diameter reinforced concrete pipe (RCP) outlet structure which is located near the northeast corner of the Primary Cell.

The Secondary Cell receives flow from Pond 2E through a 24 inch diameter RCP which is located near the northwest corner of the Secondary Cell. Flow from the Secondary Cell is discharged through a five foot stop log weir structure into a 36 inch diameter RCP which conveys the flows into the final outlet works and into the Illinois River through outfall structure 003. The locations of the discharge pipes and structures are shown in **Figure 6**. Details of the discharge pipes and structures are shown on **Figures 7 and 8**. Prior to the construction of Pond 2E, flow through the Primary Cell was discharged into the Secondary Cell through a five-foot stoplog decant structure. The decant structure was abandoned as part of the construction of Pond 2E.

The AEAPS Primary and Secondary Cells consist of sand and gravel earthen embankments with a crest length of approximately 0.6 miles and 0.4 miles, respectively and a

maximum height (from the lowest downstream toe elevation to the crest of the impoundment) of approximately 32 feet corresponding to a crest elevation of 494.0 Mean Sea Level (MSL). The bottom of the impoundments is at approximately Elevation 458.0 (MSL). The embankments of the cells were constructed in 1995 and 1996 and placed in service in 1997 with 4-foot horizontal to one-foot vertical (4H:1V) upstream and downstream slopes consisting of native sand and gravel materials. A 4-foot thick clay liner was constructed on the bottom of the cells and up the upstream side slopes of the cells to a height of approximately 20 feet above the base of the impoundments. The upper 12 feet of the upstream slopes were not lined at the time of the initial construction. After construction, operating water levels in the cells were maintained at or below the top elevation of the clay liner. Over the next several years, CCW filled the Primary Cell to levels that required that the upstream liner be raised to provide full depth operating levels for CCW transport, clarification and deposition. The liner in both cells was raised in 2003 by extending the existing liner up the upstream slopes from the original 20 foot level an additional 12 feet to the top of the crest. The construction of the extended liner consisted of 45-mil HDPE geomembrane over a 12-inch layer of compacted clay. A typical section for the liner extension is shown in **Figure 9.**

The intermediate embankment between the AEAPS Primary and Secondary Cells is regulated by the Illinois Department of Transportation, Division of Water Resources (IDOT/DWR) as a small-size, Class III dam under permit no. 21922, issued November 10, 1994. According to guidelines established by the DWR, dams with a storage volume less than 1,000 acre-feet and/or a height less than 40 feet are classified as Small sized structures. *Class III* structures are those for which failure has a low probability of causing loss of life or substantial environmental damage.

GROUNDWATER

Instrumentation near the AEAPS Primary and Secondary Cells include six monitoring wells, numbered 12 through 16, which are located as shown on **Figure 6**.

1.2.6 Description of the AEAPS Pond 2E and Appurtenances

Pond 2E was constructed within the footprint of the eastern portion of Pond 2 of the EAPS and follows the same history as the EAPS, as discussed in Section 1.2.4, until 2009. Construction of Pond 2E began in 2009 and was completed in 2010. CCW flows are discharged directly from the Primary Cell into Pond 2E along with surface water runoff from EAPS Pond 2. Flow is routed from the Primary Cell through Pond 2E and into the Secondary Pond before discharging to the Illinois River through the system outlet works. According to HPS personnel, Pond 2E was designed to increase the efficiency of the existing pond system by adding additional storage and settling capacity. ~~A permit application~~ for a dry ash landfill ~~has~~ been submitted ~~for approval~~ which would be located on the EAPS west of Pond 2E. Once the dry ash landfill has been constructed, Pond 2E will provide sediment control, storm flow storage, and leachate detention.

THE ASSOCIATED DESIGN PLANS AND CALCULATIONS

HAVE

IT SHOULD BE NOTED THAT A LANDFILL PERMIT APPROVAL IS NOT REQUIRED.

TO IEPA, BUREAU OF LAND,

Pond 2E is located on the eastern portion of the decommissioned EAPS Pond 2 and was constructed by excavating and removing a portion of the ash fill. Flow is routed from the AEAPS Primary Cell to Pond 2E through an 18 inch diameter reinforced concrete pressure pipe (RCPP) discharge culvert which was installed during the construction of Pond 2E. Operational flows exit Pond 2E through the principal spillway, a 2-foot wide by 1-foot tall orifice, of Pond 2E's concrete outlet structure. The concrete outlet structure includes an auxiliary spillway which is a 3-foot wide by 1-foot tall weir, and an emergency spillway which is a 6-foot by

4-foot drop inlet. The principal and auxiliary spillways were designed to pass the 100-year frequency storm without the emergency spillway functioning. Flows through all three spillways are discharged through a 24-inch diameter RCP into the Secondary Cell.

Pond 2E's earth embankment structure is approximately 11 feet to 52 feet high and 1300 feet long. It has a crest elevation of approximately 494 feet (MLS) and an upstream face with a 3H:1V (horizontal: vertical) slope. A 60-mil smooth HDPE geomembrane was installed on the bottom and upstream slopes of Pond 2E. The liner also caps the underlying ash along the eastern portion of the former ash impoundment. A concrete culvert and headwalls were installed on the southwest side of Pond 2E to allow inflow from the Primary Cell. A gate valve was installed on the Primary Cell headwall to provide flow control, if required, for repairs. A plan view and typical sections of the Pond 2E embankments and other details are provided on **Figures 7 and 8**.

Instrumentation near the AEAPS Pond 2E includes GROUNDWATER monitoring wells, numbered 12 through 16, which are located as shown on **Figure 6**.

1.2.7 Description of the WAPS Impoundment and Appurtenances

The WAPS is located to the west of the HPS and based on available records was designed by Illinois Power Company. The following description of the impoundment is based on information provided on various Illinois Power Company drawings, information received from Dynegy and observations made by GZA during our site visit. Information for the original design and construction of the WAPS was limited to drawings which were prepared for the 1989 raise of the original impoundment embankments.

The original WAPS was constructed in 1950's and designated as Ponds 1 and 3. The ponds appear to have been constructed as unlined earthen embankments which consist of sand and gravel materials. The north embankment of WAPS abuts the south bank of the Illinois River. The general height of the original embankments (from the lowest downstream toe elevation to the top of the impoundment) was about 10 feet, corresponding to a crest elevation of 460.0 (MSL). The WAPS embankments were raised in 1989 by adding an average of 5 feet of new fill to the existing embankments, increasing the crest elevation to 465.0 (MSL). The perimeter of the WAPS was also extended at that time to enclose Ponds 1 and 3 into a single pond. The crest length of the combined ponds is about 1.2 miles. The WAPS was decommissioned in 1995 and was not receiving or discharging flows at the time of GZA's site visit. The WAPS is not regulated as a dam by the ~~DWR~~. IDNR

Instrumentation near the WAPS includes GROUNDWATER monitoring wells numbered as follows; 21 through 27, 31 through 36 and, L1 and L4, which are located as shown on **Figure 10**. The wells are monitored quarterly and as a condition of the 1996 IEPA approved Closure Work Plan (CWP) for the WAPS.

1.2.8 Operations and Maintenance

The impoundments are operated and maintained by HPS personnel. Operation of the Primary Cell, Secondary Cell and Pond 2E includes periodic adjustment of the decant elevations and includes monitoring of groundwater and repair of the gravel access roads as needed.

, OF THE AEAPS,

DISCHARGES

~~Operation and maintenance~~ of the HPS facility, ~~including the impoundments~~, ~~is~~ ARE * regulated by the EPA under the National Pollutant Discharge Elimination System (NPDES) Permit No. IL0001554. A portion of outer embankments of Primary and Secondary Cell are * considered to be a dam that is regulated by the Illinois Department of Natural Resources, Office of Water Resources under permit number DS2004119. As part of the dam permit, there is an Operation and Maintenance Plan that was developed for the Primary and Secondary Cells. That plan includes regular mowing, vegetation management, semi-annual inspections, and inspections by a register professional engineer every 5 years.

An operation and maintenance plan was developed by CEC for Pond 2E. The plan included information about the frequency and scope of periodic inspections. The plan requires inspection of the impoundment on a quarterly basis by HPS staff and every 5 years by a registered professional engineer. The plan also requires maintenance of an emergency drawdown pump at the facility.

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1.2.9 Size Classification

For the purposes of this EPA-mandated inspection, the sizes of the impoundments were based on U. S. Army Corps of Engineers (COE) criteria. Based on the maximum crest height of 18 feet and a storage volume of approximately 36 acre-feet, the WAPS is classified as a **Small** * sized structure. Based on the maximum crest height of 52 feet and a storage volume of approximately 1,560 acre-feet, the AEAPS is classified as an **Intermediate** sized structure. Because there was no pool area associated with the EAPS, no size classification was estimated for the EAPS.

According to guidelines established by the COE, dams with a storage volume less than 1,000 acre-feet and/or a height less than 40 feet are classified as Small sized structures and dams with a storage volume between 1,000 acre-feet and 50,000 acre-feet and/or a height between 40 feet and 100 feet are classified as Intermediate sized structures.

1.2.10 Hazard Potential Classification

Under the EPA classification system, as presented on page 2 of the EPA check list (**Appendix C**) and Definitions section (**Appendix B**), it is GZA's opinion that the AEAPS, EAPS and the WAPS would be considered as having a **Significant** hazard potential. The hazard potential rating is based on no probable loss of human life due to failure and the potential environmental impacts outside of Utility owned property. The hazard rating for the ~~AEPS~~ AEAPS * differs from the hazard rating given to the Primary and Secondary Cells by the ~~DWR~~ due to the inclusion of Pond 2E in the ~~AEPS~~ since ~~DWR~~ rating. *

AEAPS IDNR

1.3 Pertinent Engineering Data

1.3.1 Drainage Area

The existing impoundments are surrounded by exterior dikes with crest elevations that are above the surrounding geographical features. This confines the rainfall sub-basin areas to the impoundment areas themselves resulting in no additional overland flow being introduced to the system.

SECONDARY CELL OF THE

1.3.2 Reservoir

Based on estimates made by GZA[2], the WAPS has a surface area of 2 acres and a storage volume of approximately 36 acre feet at a pool elevation of 455.6 feet MSL. The AEAPS has a surface area of approximately 30 acres and a storage volume of approximately 1,560 acre feet at a pool elevation of 489.5 feet MSL. The EAPS no longer actively impounds water and therefore a reservoir volume was not calculated. The pool areas observed on GZA's May 23, 2011 Site visit are consistent with the surfaces areas noted above.

1.3.3 Discharges at the Impoundment Sites

According to HPS personnel, under normal operating conditions, approximately 2.4 million gallons of water per day (MGD) are discharged from the Secondary Cell to the Illinois River.

1.3.4 General Elevations (feet – MSL)

Elevations were taken from design drawings, reports, and data provided by HPS. Elevations were based upon the USGS topographic map MSL vertical datum.

AEAPS Impoundment

Primary Cell

A. Top of Embankment (Minimum)	± 494 feet
B. Upstream Water at Time of Inspection	± 489.5 feet
C. Downstream Tail Water at Time of Inspection	485.2 feet (Pond 2E)
D. Maximum Pond Water Elevation	489.5 feet

Secondary Cell

A. Top of Embankment (Minimum)	± 494 feet
B. Upstream Water at Time of Inspection	479.5 feet
C. Downstream Tail Water at Time of Inspection	448 feet (Illinois River)
D. Maximum Pond Water Elevation	480.5 feet

Pond 2E

A. Top of Embankment (Minimum)	±494 feet
B. Upstream Water at Time of Inspection	485.2 feet
C. Downstream Tail Water at Time of Inspection	479.5 feet (Secondary Cell)
D. Maximum Pond Water Elevation	480 feet

EAPS Impoundment

A. Top of Embankment (Minimum)	494 feet
B. Upstream Water at Time of Inspection	N/A
C. Downstream Tail Water at Time of Inspection	442 feet
D. Maximum Pond Water Elevation	Unknown

[2] Surface area estimates generated using Google Earth Professional software and available aerial photographs.

OUT-OF-SERVICE PRIMARY CELL OF THE

With respect to our visual inspection, there was no evidence of prior releases, failures, or repairs observed by GZA for most of the impoundment areas. It appeared that the downstream slope of the northwestern embankment of the WAPS had been regraded within the last year.

2.1.1 EAPS Impoundment General Findings

In general, the HPS EAPS Impoundment was found to be in **POOR** condition. An overall Site plan showing the impoundments is provided as **Figure 2**. The location and orientation of photographs provided in **Appendix E** is shown on the Photo Plan in **Figure 6**.

2.1.2 EAPS Upstream Slope (Photos 18, 22, 24, and 74)

The northern portion of the EAPS has been ~~permitted for~~ DEVELOPED AS a dry ash landfill and the upstream slopes are covered with ash along that portion of the impoundment. The southern portion of the EAPS that includes the former Pond 4 is no longer active. The upstream embankments along that portion of the EAPS were generally vegetated with grass that had not been recently mowed. Trees up to 12 inches in diameter were present on the slope.

2.1.3 EAPS Crest of Impoundment (Photos 32 though 35, 45, 52, 71 through 73)

The crest of the EAPS Impoundment generally had a gravel access road along the northern portion of the impoundment. The crest of impoundment had occasional pot holes along its entire length. The alignment of the crest appeared generally level, with no large depressions or irregularities observed. Based on information provided by HPS personnel, the crest elevation is approximately elevation 494 feet MSL. No significant settlement was observed at the time of our inspection. There was no water present in the EAPS at the time of our inspection.

2.1.4 EAPS Downstream Slope (Photos 25 through 28, 55 through 57, 69, and 70)

The downstream slope of the impoundment was generally covered in thick grass vegetation making it difficult to observe during our inspections. In addition, the rough terrain and steep slopes along the northern portion of the impoundment created a personal safety risk to access the slope. Therefore, our observations along that portion of the impoundment were limited to that which could be observed from the crest of the 1979 embankment. Trees up to 24 inches in diameter generally characterized northern embankment along the Illinois River. No grass was present along that portion of the embankment. The western and southwestern embankment was generally covered with grass that had not been recently mowed. No unusual movement or displacement was observed on the slope.

2.1.5 EAPS Discharge Pipes (Photo 44)

The EAPS no longer functions as an active ash impoundment and no CCW sluice piping present. Storm water drains have been installed along portions of the perimeter of the permitted landfill as shown in Photo 44. The drains appeared to be in good condition at the time of our inspection.

2.1.6 AEAPS Impoundment General Findings

In general, the HPS AEAPS Impoundment was found to be in **POOR** condition. An overall Site plan showing the impoundments is provided as **Figure 2**. The location and orientation of photographs provided in **Appendix E** is shown on the Photo Plan in **Figure 6**.

2.1.7 AEAPS Upstream Slope (Photos 35 through 43, 45 through 53)

The water surface elevation at the time of inspection was approximately at elevation 489.5 feet, 489.0 feet, and 479.5 feet MSL in the Primary Cell, Pond 2E and Secondary Cell, respectively. Therefore, the lower portion of the upstream slope was below the water level and not visible. Where visible, the upstream slope of Pond 2E was covered with a HDPE liner that was in good condition. The upstream slopes of the Primary and Secondary Cells were generally covered with grass above the water level.

2.1.8 AEAPS Crest of Impoundment (Photos 35 through 43, 45 through 53)

The crest of the AEAPS Impoundment was generally covered by a gravel access road. The crest of impoundment had occasional pot holes along its entire length. The alignment of the crest appeared generally level, with no large depressions or irregularities observed. Based on information provided by HPS personnel, the crest elevation is approximately elevation 494 feet MSL. No significant settlement was observed at the time of our inspection. There was approximately 4 feet to 14 feet of free board at the time of our inspection.

2.1.9 AEAPS Downstream Slope (Photos 29 through 31)

The AEAPS Impoundment shares a common embankment with the EAPS along the western portion of the impoundment and is incised along the southern portion. Therefore, no downstream slope was visible or present along those portions of the impoundment. The northern embankment of the impoundment abuts the Illinois River and is characterized by trees up to 24-inches in diameter. The eastern embankment was covered with grass that had not been recently mowed.

2.1.10 AEAPS Discharge Structures (Photos 58 through 68)

GZA observed the outlet structures that transmit flow from the Primary Cell to Pond 2E and then to the Secondary Cell. Based on our observations, the structures appeared to be in good condition with no defects noted. GZA also observed the condition of the decant structure in the Secondary Cell and the partial flume. Both structures appeared to be in good condition based on our observations.

2.1.11 WAPS Impoundment General Findings

In general, the HPS WAPS Impoundment was found to be in **POOR** condition. An overall Site plan showing the impoundments is provided as **Figure 2**. The location and orientation of photographs provided in **Appendix E** is shown on the Photo Plan in **Figure 10**.

SECONDARY CELL OF THE

IN THE SECONDARY CELL

2.1.12 WAPS Upstream Slope (Photos 18, 22, and 24)

The eastern portion of the WAPS has been filled with ash and the upstream slopes along that portion were not visible. The water surface elevation at the time of inspection was approximately at elevation 455.6 feet MSL along the western portion of the impoundment. Therefore, the lower portion of the upstream slope was below the water level and not visible. Where visible, the upstream slope was generally vegetated with grass that had not been recently mowed. Trees and shrubs up to 4 inches in diameter were noted along several portions of the upstream slope.

2.1.13 WAPS Crest of Impoundment (Photos 14 through 20)

The crest of the WAPS Impoundment was generally covered by a gravel access road. The crest of impoundment had occasional pot holes along its entire length. The alignment of the crest appeared generally level, with no large depressions or irregularities observed. Based on information provided by HPS personnel, the crest elevation is approximately elevation 460 feet MSL. No significant settlement was observed at the time of our inspection. There was approximately 8 feet of free board at the time of our inspection.

2.1.14 WAPS Downstream Slope (Photos 1 through 13)

The downstream slope of the impoundment was generally wooded along the northern portion of the impoundment adjacent to the Illinois River. Trees up to 24-inches in diameter were present along the downstream slope of the northern embankment. The remaining embankments were generally covered with grass that had not been recently mowed. Trees up to 12 inches in diameter were noted along the southern embankment and smaller trees and shrubs were noted along the eastern embankment. There was erosion (likely due to wave action) of the downstream slope of the northern embankment.

2.1.15 WAPS Discharge Pipes (Photos 21 and 22)

The decant structure for the WAPS Impoundment consists of a 12-inch diameter steel pipe with a trash rack as shown in Photo 21. The pipe discharges into the Illinois River and the discharge pipe is shown in Photo 22. The decant and discharge portions of the pipe appeared to be in good condition at the time of our inspection.

2.2 Caretaker Interview

Maintenance of the impoundments is the responsibility of HPS personnel. GZA met with HPS personnel and discussed the operations and maintenance procedures, regulatory requirements, and the history of the impoundments since their construction. Information gathered during that discussion is reflected in this report.

2.3 Operation and Maintenance Procedures

As discussed in Section 1.2.7, HPS personnel are responsible for the regular operations and maintenance of the impoundments. No formal maintenance plan has been developed for the WAPS and EAPS impoundments. An operation and maintenance plan for the Primary and Secondary Cells has been developed along with a separate operation and maintenance plan for

Pond 2E. Based on our discussions with HPS personnel, the roadways and slopes are repaired as needed.

2.4 Emergency Action Plan

An Emergency Action Plan (EAP) has not been developed for the impoundments. An emergency action plan is not required for Class III structure per Illinois regulations. Note that the hazard potential classification for the dam is discussed in Section 1.2.11.

2.5 Hydrologic/Hydraulic Data

Illinois Power Company performed a hydrologic/hydraulic analysis in 1994 for the AEAP Primary and Secondary Cells as part of the original impoundment design. The results are provided in the "Hennepin Power Station Ash Surface Impoundment, Hydrologic/Hydraulic Analysis" report. The analysis was used to determine the maximum discharge rates and water elevations the facility would obtain and also to size the discharge piping and determine the required freeboard.

A hydrologic/hydraulic analysis was also conducted in 2009 by CEC for the AEAP Primary and Secondary Cells and for Pond 2E. The results are provided in the "Engineering Basis of Design, Application for a Permit to Construct a New Leachate and Storm Water Runoff Collection Pond, Dynegy – Hennepin Power Station, Hennepin, Illinois" report. In addition to the HPS operating flows and the future effects from the new landfill portion of the EAPS, the ponds were determined by CEC to have sufficient capacity to safely pass the 24-hour 25-year and the 24-hour 100-year frequency rainfall events with a minimum free-broad of more than 2 feet,

Based on the available information, a hydrologic/hydraulic analysis has not been performed for the WAPS.

GZA did not perform an independent assessment of the hydraulics and hydrology for the impoundments as this was beyond our scope of services.

2.6 Structural and Seepage Stability

Illinois Power Company performed a stability and seepage analysis for the AEAP Primary and Secondary Cells as part of the original impoundment design. The results are provided in the "Hennepin Power Station Ash Surface Impoundment, Geotechnical/Structural Design" report. Based on the results of the stability analysis, the factor of safety was calculated for several load conditions. The critical load conditions were determined to be the end of construction and rapid drawdown conditions. Both static and seismic conditions were evaluated. The results indicted minimum static and seismic factors of safety of 2.0 and 1.7, respectively for the upstream embankments and 2.3 and 2.0, respectively for the downstream embankments. These results are well within the range of acceptable factors of safety for the types of embankments and load conditions evaluated.

CEC performed a stability analysis for a section of the existing EAPS north embankment as part of the new landfill ~~permit application~~ DESIGN. Based on the results provided, the calculated factor of safety against wedge failure of the 1978 embankment without seismic loading was 1.009.

This result is less than generally acceptable factors of safety for the types of embankments and load conditions evaluated, in GZA's opinion.

No engineering evaluation is available for the WAPS embankments which were designed by Illinois Power Company.

GZA did not perform an independent assessment of the structural and seepage stability for the impoundments as this was beyond our scope of services.

3.0 ASSESSMENTS AND RECOMMENDATIONS

3.1 Assessments

In general, the overall condition of the EAPS impoundment was judged to be **POOR**. The EAPS impoundment was found to have the following deficiencies:

1. Trees were present along the upstream and downstream slopes;
2. Minor potholes and rutting along the crest gravel access road; and,
3. The stability analysis completed indicates that the 1979 embankments that support the underlying ash along the Illinois River have a calculated factor of safety less than the generally accepted value.

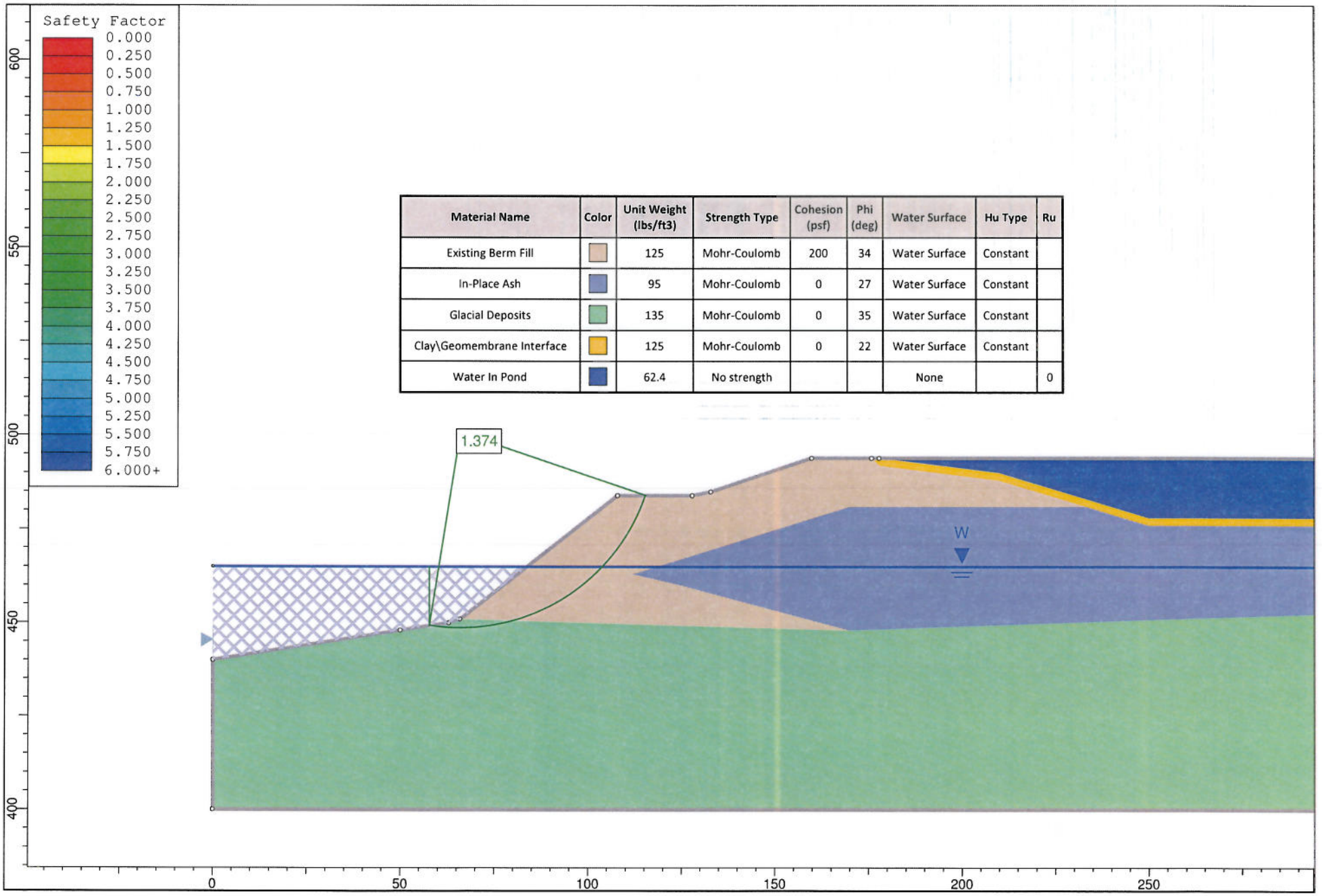
In general, the overall condition of the AEAPS impoundments was judged to be **POOR**. The AEAPS impoundment was found to have the following deficiencies:

1. Minor potholes and rutting along the crest gravel access road;
2. Trees were present along the downstream slope of the northern embankment; and,
3. The stability analysis completed indicates that the 1979 embankments that support the underlying ash along the Illinois River have a calculated factor of safety less than the generally accepted value.

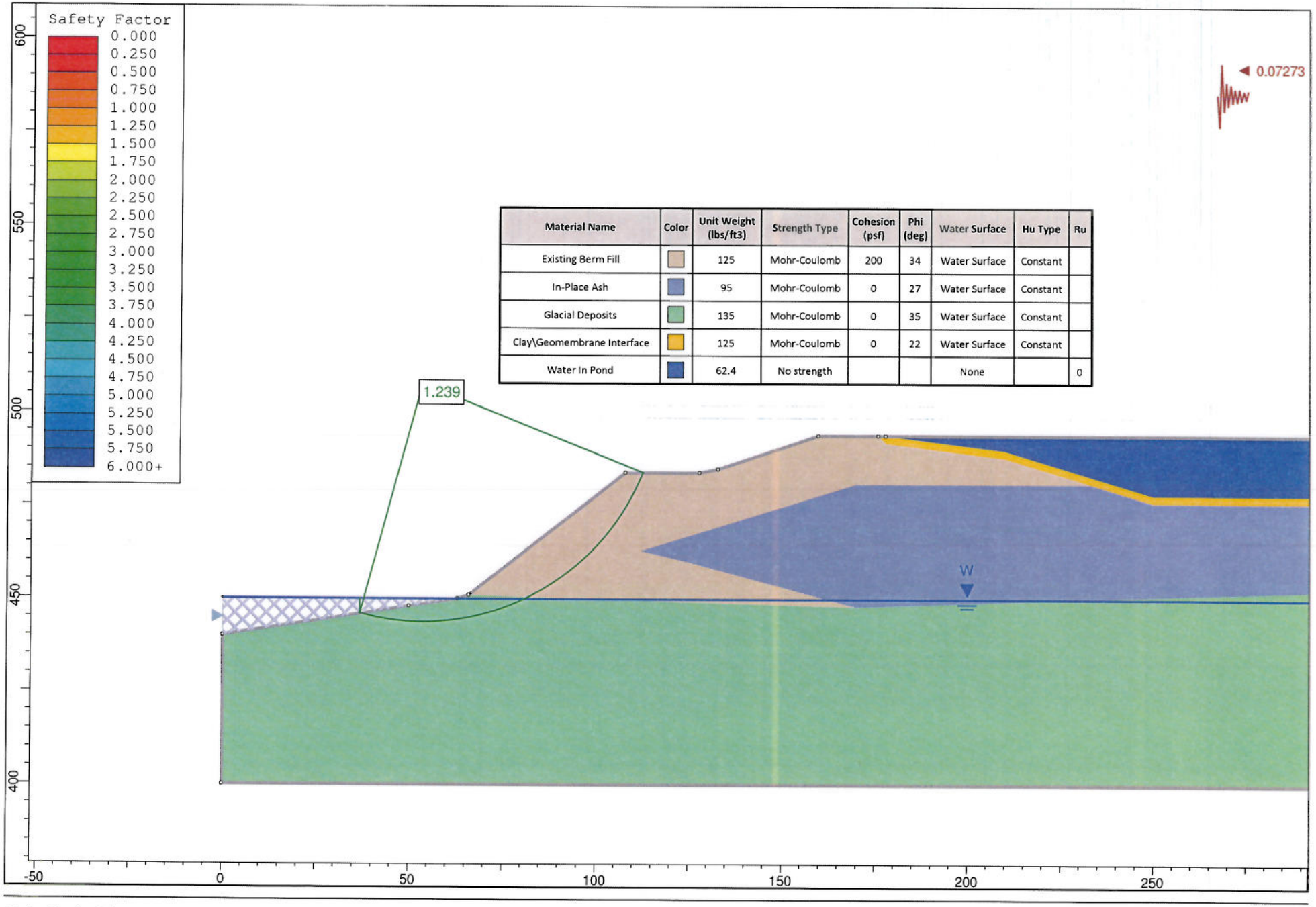
In general, the overall condition of the WAPS impoundment was judged to be **POOR**. In GZA's professional opinion, the embankment(s) visually appear to be sound and no immediate remedial action appears to be necessary. However, based on EPA's inspection criteria, the impoundment has been given a **POOR** Condition Rating, because complete hydrologic/hydraulic analysis and geotechnical computations were not provided/available for GZA's for review. Thus, the hydrologic/hydraulic adequacy of the impoundment(s) and the stability of the embankment(s) could not be independently verified. In summary the WAPS impoundment was found to have the following deficiencies:

SECONDARY CELL *

1. Thick vegetation and trees along the downstream slopes;
2. Minor potholes and rutting along the crest gravel access road;
3. Erosion along the downstream slope of the northern embankment;
4. No seepage and/or stability analysis has been performed for the WAPS; and



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Ru
Existing Berm Fill		125	Mohr-Coulomb	200	34	Water Surface	Constant	
In-Place Ash		95	Mohr-Coulomb	0	27	Water Surface	Constant	
Glacial Deposits		135	Mohr-Coulomb	0	35	Water Surface	Constant	
Clay\Geomembrane Interface		125	Mohr-Coulomb	0	22	Water Surface	Constant	
Water In Pond		62.4	No strength			None		0



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Ru
Existing Berm Fill		125	Mohr-Coulomb	200	34	Water Surface	Constant	
In-Place Ash		95	Mohr-Coulomb	0	27	Water Surface	Constant	
Glacial Deposits		135	Mohr-Coulomb	0	35	Water Surface	Constant	
Clay\Geomembrane Interface		125	Mohr-Coulomb	0	22	Water Surface	Constant	
Water In Pond		62.4	No strength			None		0

P2-1 - Circular Failure, Seismic.slim

Civil & Environmental Consultants, Inc.
333 Baldwin Road
Pittsburgh, PA 15205

CLIENT Dynegy - Hennepin Power Station

PROJECT NUMBER 082-255

PROJECT NAME Dry Ash Landfill Feasability Study

PROJECT LOCATION Hennepin, Illinois

CROSS-SECTION P2-1

Geologic Conditions

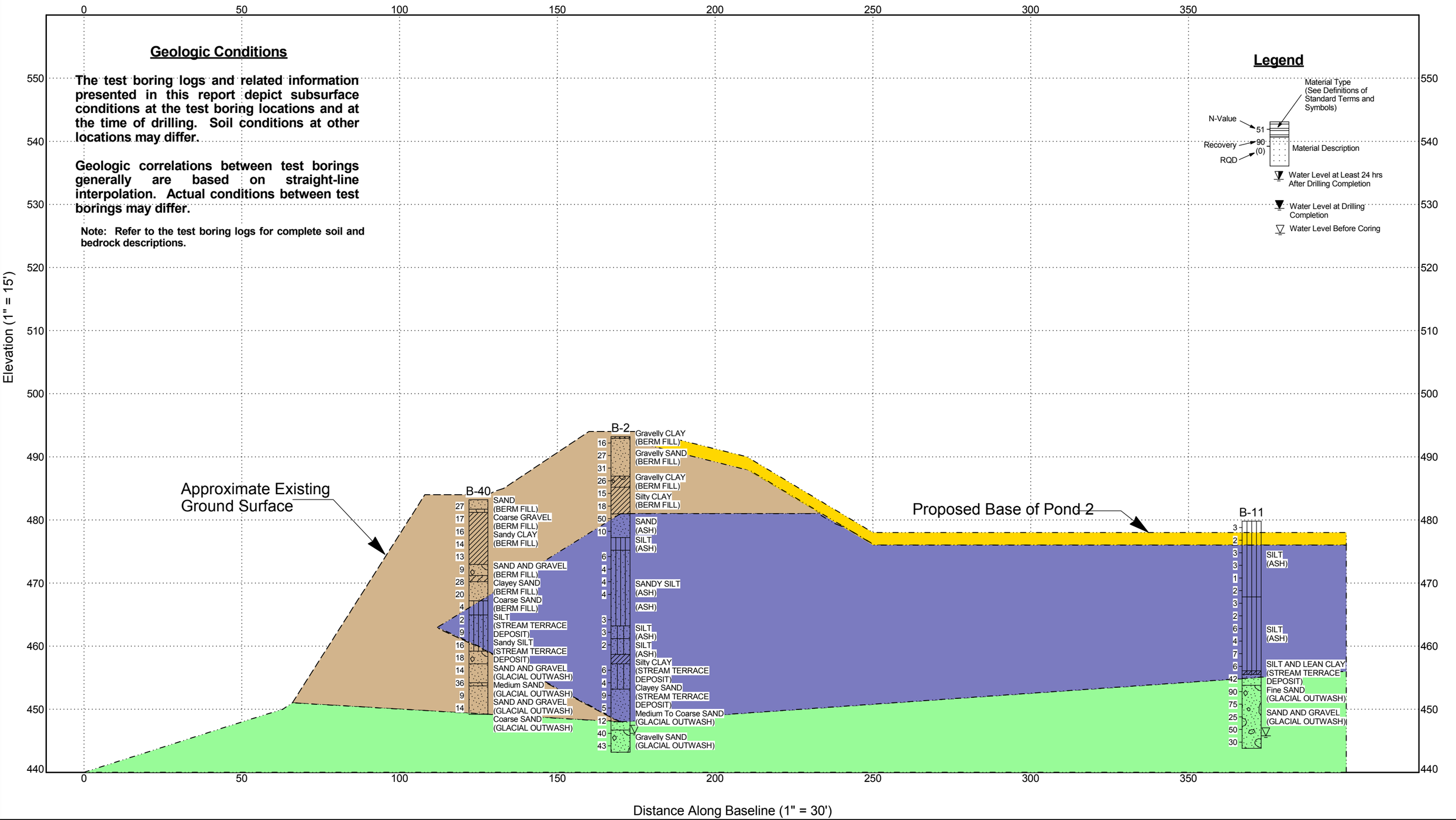
The test boring logs and related information presented in this report depict subsurface conditions at the test boring locations and at the time of drilling. Soil conditions at other locations may differ.

Geologic correlations between test borings generally are based on straight-line interpolation. Actual conditions between test borings may differ.

Note: Refer to the test boring logs for complete soil and bedrock descriptions.

Legend

Material Type (See Definitions of Standard Terms and Symbols)
N-Value
Recovery
RQD
Material Description
Water Level at Least 24 hrs After Drilling Completion
Water Level at Drilling Completion
Water Level Before Coring



STRATIGRAPHY & GW - B SIZE 082-255 BORING LOGS.GPJ CEC.GDT 4/19/10