NOTE

Subject: EPA Comments on "Draft Coal Combustion Residue Impoundment: Round 12 – Dam Assessment Report – Wisconsin Public Service Corp – Weston, Rothschild, WI"

To: File

Date: February 27, 2014

No Comments.

Wisconsin Public Service Corporation
700 North Adams Street
P.O. Box 19001
Green Bay, WI 54307-9001
www.wisconsinpublicservice.com

April 21, 2014

Mr. Stephen Hoffman
US Environmental Protection Agency (5304P)
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Dear Mr. Hoffman:

Draft Coal Combustion Residue Impoundment
Round 12 - Dam Assessment Report, Weston Generating Station

Reference: 1) Email to Mr. H Giesler from Ms. J Englander dated February 27, 2014

This letter and attachment hereto provides the Wisconsin Public Service Corporation (WPSC) comments on the draft Coal Combustion Residue Impoundment Round 12 - Dam Assessment Report prepared by Dewberry Consultants, LLC. This report documents the results of the August 21, 2012 inspection of the waste water treatment basins (management units) at the Weston Generating Station (Weston). After reviewing the draft report we question the appropriateness of assessing the Weston plant wastewater treatment basins against the 2004 Federal Guidelines for Dam Safety. We acknowledge that these plant management units may not meet all the dam inspection criteria used by the EPA for conducting the inspection but also recognize that these management units are not dams. WPSC believes that a clear distinction exists between a dam and the onsite management units and applying Federal Guidelines for Dam Safety is inappropriate due to the significant differences. The following provides a discussion of the Weston management units against how a dam is defined along with additional enhancements in design and operating characteristics that should be taken into consideration in their performance safety rating.

FEMA Definition of a Dam

WPSC believes the assessment of the management units at the Weston plant against dam safety requirements is inappropriate based upon the Federal Guidelines cited within the report. According to the 2004 Federal Guidelines for Dam Safety published by the Federal Emergency Management Agency (FEMA), a dam is defined as the following:

> *Any artificial barrier, including appurtenant works, which impounds or diverts water, and which (1) is twenty-five feet or more in height from the natural bed of the stream or watercourse measured at the downstream toe of the barrier or from the lowest elevation of the outside limit of the barrier if it is not across a stream channel or watercourse, to the maximum water storage elevation or (2) has an impounding capacity at maximum water*

> *storage elevation of fifty acre-feet or more. These guidelines do not apply to any such barrier which is not in excess of six feet in height regardless of storage capacity, or which has a storage capacity at maximum water storage elevation not in excess of fifteen acre-feet regardless of height (*emphasis added*). This lower size limitation should be waived if there is a potentially significant downstream hazard.*

As described in report Section 2.4, the impoundments evaluated have storage capacities of less than fifteen acre-feet. Further, the design documentation contained in Appendix A, Document 4, shows that the elevation between the maximum water storage elevation and lowest barrier elevation (i.e., toe of the embankment) is less than 25 feet. Lastly, with regards to potentially significant downstream hazards, the report acknowledges that "critical infrastructure within five miles downstream is nearly non-existent". Therefore, the impoundments at the Weston plant do not meet the criteria to be considered a dam.

Additional Enhancements in Design and Operating Characteristics

These management units were designed and constructed in 1981 as wastewater treatment settling basins that receive minor amounts of coal combustion residuals (CCR) fines that carry over from the primary bottom ash settling basins. These basins were design and are operated significantly different from the impoundments that have recently failed since they do not provide long term storage and/or disposal of CCR slurry. There are numerous design and operating characteristics that must be taken into account when evaluating these management units prior to determining a safety rating. They include;

1) The structural soundness and hydrologic/hydraulic safety standards identified in the report do not apply to the wastewater treatment system basins under State of Wisconsin regulations or other Federal regulations. They were not designed to nor do they serve as CCR storage or disposal impoundments, but instead only receive incidental amounts of CCRs.
2) These management units were constructed in 1981, and were designed by Sargent and Lundy, a reputable engineering firm that would have followed the industry standards in effect for this type of structure at the time of construction.
3) There are multiple water level sensors that alarm in the Weston control room should the management unit approach an overfill situation.
4) The management units are more than seven hundred feet away from the river.
5) The "toe" of the embankment is approximately 20 feet above both the 100 and the 500 year Wisconsin River flood stage.
6) Given the topography and soil conditions of the site, it is extremely unlikely that any discharge due to a failure of the management units would reach the Wisconsin River. The soil type in the area of the embankment is primarily sand. Thus most water would infiltrate the ground. If not, the water would travel towards the perimeter ditch where it would be contained. Furthermore, there is a natural low area adjacent to the river which would prevent a release to the river (unless flooding is occurring). Monthly inspections are conducted of each embankment and dike to observe conditions of the downstream slopes and toes, animal burrows, excess vegetation and other issues.

7) In addition, after extreme rainfall events the facility performs an additional visual inspection of the embankments and water levels.
8) The design of the management units was approved by the Wisconsin Department of Natural Resources (WDNR) since it met the applicable regulatory requirements.
9) An extensive geotechnical investigation was completed in 2003 for the Weston Unit 4 Project consisting of 50 soil borings, 4 test pits, and other test locations within the general area of new construction at Unit 4. As part of this investigation, a soil boring was completed on either side of the existing bottom ash management units (BV-3 and BV-4), with several other borings. The investigation verified subsurface soil conditions are suitable for construction of the management units and that no critical hydrogeologic conditions are present at the site.
10) At the time of the inspection by Dewberry, the facility had an informal inspection program for monitoring of the management units. The monitoring program in place was deemed "adequate" for small, low hazard impoundments. The facility continues to monitor the management units on a monthly basis.

Management Unit Rating

As previously stated, WPSC does not believe that the State and Federal criteria for dam safety apply to the wastewater basins at the Weston plant. Since these management units do not meet the regulatory definition of a dam and would otherwise not be regulated as such by a state or federal agency, we believe that these basins should be unrated. However, if they must be rated, WPSC strongly believes the rating should be modified from a "Poor" rating to a "Fair" rating. WPSC believes a "fair" rating is warranted for the embankments because of their proven historical performance, current physical condition, low embankment height, shallow side slopes, pond level instrumentation/alarms, and monthly visual inspections.

After reviewing the draft report we conclude that the four CCR management units are each rated Poor for continued safe and reliable operation due to the lack of sufficient engineering and structural stability analysis documentation. In light of recent failures of coal combustion residual (CCR) impoundment WPSC understands and supports the need for diligence in ensuring the integrity of coal combustion surface management units. WPSC is committed to the proper operation of management units at our generating facilities to prevent accidental releases of wastewater that could impact the environment. To show our commitment to resolving this issue, we believe that a structural stability analysis under static conditions is an appropriate analysis to demonstrate stability and safety of the management units. Since the original design data documentation could not be found, WPSC is willing to conduct a static stability analysis of the embankments around the basins in 2014. WPSC would be willing to share this analysis with USEPA when it becomes final and believe this analysis will warrant a "satisfactory" rating for the management units.

We appreciate the opportunity to review and provide comment on the content and technical conclusions of the draft report. If you have any questions regarding this submission, please contact Mr. Mark Metcalf at (920) 433-1833.

Sincerely,

Howard Giesler

Howard R. Giesler
General Manager - Weston

MWM

Enc: Comments on Draft Coal Combustion Residue Impoundment Assessment Report

ATTACHMENT 1

Comments on the Draft Coal Combustion Residue Impoundment

Round 12 - Dam Assessment Report

Weston Generating Station (Site 26)

Comments on the Draft Assessment

General Comment:

WPSC believes the assessment of the wastewater treatment basins at the Weston plant against dam safety requirements is inappropriate based upon the Federal Guidelines cited within the report. As described in the draft report, the management units at the Weston plant are being evaluated, in part, against the 2004 Federal Guidelines for Dam Safety published by the Federal Emergency Management Agency (FEMA). Within this document, a dam is defined as the following:

> *Any artificial barrier, including appurtenant works, which impounds or diverts water, and which (1) is twenty-five feet or more in height from the natural bed of the stream or watercourse measured at the downstream toe of the barrier or from the lowest elevation of the outside limit of the barrier if it is not across a stream channel or watercourse, to the maximum water storage elevation or (2) has an impounding capacity at maximum water storage elevation of fifty acre-feet or more. These guidelines do not apply to any such barrier which is not in excess of six feet in height regardless of storage capacity, or which has a storage capacity at maximum water storage elevation not in excess of fifteen acre-feet regardless of height (*emphasis added*). This lower size limitation should be waived if there is a potentially significant downstream hazard.*

The management units evaluated have storage capacities of less than fifteen acre-feet. The design documentation contained in Appendix A, Document 4, shows that the elevation between the maximum water storage elevation and lowest barrier elevation (i.e., toe of the embankment) is much less than 25 feet. Further, the management units are classified as low hazard. Therefore, the management units at the Weston plant do not meet the criteria to be considered a dam.

Introduction, Summary Conclusion and Recommendations

1. Page ii, first paragraph. While the impoundment release at the TVA Kingston plant was a devastating event, reference to this event without properly describing the Weston plant results in conjecture to the reader. WPSC recommends replacing the first paragraph with the following language:

   > "On August 21, 2011, Dewberry Consultants LLC conducted an on-site assessment of the wastewater treatment basins at the Wisconsin Public Service Corporation - Weston Generating Station. The assessment was conducted as part of a national effort to assess the stability and functionality of the ash impoundments and other units and then take needed corrective measures."

2. Page ii, impoundment ratings. The ratings used to assess the management units at the Weston plant have been adopted from the New Jersey Department of Environmental Protection *Dam Safety Guidelines for the Inspection of Existing Dams, January 2008.* WPSC believes it is inappropriate to rate the management units against standards for dam safety that would otherwise not apply under any other State or Federal Program. The management units have been given a "Poor" rating, which is defined as the following:

A management unit safety deficiency is recognized for a required loading condition (static, hydrologic, seismic) in accordance with the applicable dam safety regulatory criteria. Remedial action is necessary. "Poor" also applies when further critical studies or investigations are needed to identify any potential dam safety deficiencies.

A management unit rated as "Fair" rating is defined as:

Acceptable performance is expected under all required loading conditions (static, hydrologic, seismic) in accordance with the applicable safety regulatory criteria. Minor deficiencies may exist that require remedial action and/or secondary studies or investigations."

The draft report indicates a "Poor" rating is being assessed due to a lack of documentation or previous studies to assess the stability of the embankments. WPSC believes the management unit ratings for the four management units should be revised from "Poor" to "Fair" for several reasons:

a. In Wisconsin, dams are regulated pursuant to NR 333, Wisconsin Administrative Code. These basins do not meet the applicability requirements in NR 333.02 (1)(a) since their combined storage volume is less than 50 acre-feet. The management units do not meet the regulatory definition of a dam found in the 2004 Federal Guidelines for Dam Safety given their size and location. Therefore, there are no applicable dam safety regulatory criteria to evaluate the structures against.

b. The management units are permitted wastewater treatment basins designed by a qualified engineering firm and constructed in accordance with the Industrial Lagoon requirements found in NR 213, Wisconsin Administrative Code. The units are not CCR storage or disposal management units.

c. Given that the management units are not immediately adjacent to a river or stream and the ring dikes receive no surface water drainage and are not affected by river flows, hydrologic/hydraulic analyses are not required pursuant to State or Federal guidelines. The base flood elevation for the Wisconsin River near the plant for events with a 0.2 percent annual chance (500 year) flood hazard is 1153' (NAVD 1988)[1], while the lowest elevation of the toe of the embankment around the basins is approximately 1174'. The toe of the embankments is at least 500 feet from the base flood elevation mark. WPSC provided Figure 1 of this attachment as part of the August 2012 inspection depicting the location of the flood plain relative to the management units. The map shows the 100 year flood and 500 year flood plain areas near the facility.

d. Seismic stability is not a concern at the site. As described in Section 7.1.5, soils at the site have low susceptibility to liquefaction and EPA's consultant stated that liquefaction is not a concern at the site. State regulations do not require seismic stability analyses,

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1 – Wisconsin Department of Natural Resources, Surface Water Data Viewer. http://dnrmaps.wi.gov/SL/Viewer.html?Viewer=SWDV

and WPSC's experience with the Federal Energy Regulatory Commission (FERC) has been that FERC also has recognized seismic loading at hydroelectric dams in Wisconsin is not a primary concern since the probability of earthquakes is so low. As additional guidance, the FERC Engineering Guidelines, Chapter IV, Section 4-6.6.5 specifically exempts Low Hazard embankments from seismic investigations.

e. Field observations concluded "The overall assessment of the dam, based on a site visit, was that it was in satisfactory condition and no significant findings were noted" (Section 5.1).

Purpose and Scope

1. Page *iii*, first sentence. WPSC suggests changing "Coal Combustion Surface Impoundments" to "Coal Combustion Residue Surface Management units."
2. Page *iii*, first sentence. Replace the word "dam" with "management unit."
3. Page *iii*, first paragraph, last sentence. The report states that the initiative will address management units that are classified as having one of four hazard potential rankings. Section 2.3 only describes 3 hazard classifications. WPSC recommends revising Section 2.3 to include all hazard potential rankings to be consistent with this paragraph and the information provided in the inspection check lists.
4. Page *iii*, last paragraph, first sentence. We suggest the first sentence read as follows: "The purpose of this report is to evaluate the condition and potential for CCR release from the management units at the Weston Plant and rate the units for hazard potential classification."
5. Page *iv*, limitations paragraph. Replace the word "dam" in the first and last sentences with "management unit."

Conclusions

1. Page 1-1, section 1.1.1. WPSC suggests adding the following statement to the beginning of the paragraph:

   "The sizes of the management units at the Weston Plant are less than the thresholds which would require State or Federal regulation under dam safety standards."

2. Page 1-1, section 1.1.1, last sentence. As stated above, WPSC suggests changing the ratings of the management units from "Poor" to "Fair".
3. Page 1-1, sections 1.1.2. WPSC suggests adding the following statement after the second sentence of the paragraph:

   "Given that the impoundments are not immediately adjacent to a river or stream and the ring dikes receive no surface water drainage, hydrologic/hydraulic analyses are not required pursuant to State or Federal guidelines."

4. Page 1-1, section 1.2.2. WPSC suggests adding the following statement after the third sentence of the paragraph:

   "In response to the overtopping events, WPSC raised the grade in low areas along the embankment and installed level meters to monitor the management units. The level meters are calibrated on an annual basis."

5. Page 1-1, sections 1.1.2, last sentence. As stated above, WPSC suggests changing the ratings of the management units from "Poor" to "Fair".

6. Page 1-1, section 1.1.3. WPSC suggests modifying this paragraph as follows:

   "The supporting technical documentation is not adequate to evaluate the structural stability of the management units against current standards for dam safety. The utility has not been able to provide a design report for the original management units (constructed in 1981, designed by Sargent and Lundy, Chicago, IL), nor did Dewberry receive any relevant analysis information on these units. At the time of construction and modification of the management units, the embankments were constructed to the design requirements found in the Wisconsin Administrative Code. Construction specifications and liner permeability related to the original design was provided by the utility. An engineering report related to embankments constructed in 2005 when a railroad loop was constructed was provided by WPSC. At the time of construction, the management units were not required to meet the design standards which they are being evaluated against in this document."

7. Page 1-2, section 1.1.8. WPSC believes the management units should be rated as "Fair" as discussed above.

<u>Recommendations</u>

1. Page 1-3, section 1.2.1. WPSC disagrees with the recommendation of a need to perform structural stability calculations under seismic conditions to show the dikes have sufficient factors of safety to prevent failure and release to the environment. The management units meet the applicable design requirements found in NR 213, Wisconsin Administrative Code. The management units are not subject to the State requirements for water retaining structures (i.e., dams) found in NR 333, Wis. Admin. Code as the combined storage volume is less than 50 acre-feet. NR 333 only requires a stability analysis of the dam during base flow conditions and at maximum load (static) conditions. Further, Federal guidelines for dam safety do not apply to these management units as described above. WPSC agrees it is a good practice to perform a stability analysis under static conditions.

2. Page 1-3, section 1.2.2. WPSC disagrees with the recommendation to perform hydrologic and hydraulic analyses of management unit performance under flood conditions. The management units are not subject to river flows. The base flood elevation for the Wisconsin River near the plant is 1153', while the lowest elevation of the toe of the embankment around the basins is

approximately 1174'. Consequently, the only hydrologic effect that could potentially impact the basin is a rain event. Inflow of water to the basins is managed by the facility. The management units are not collection basins for control of stormwater runoff. The 100 year, 24-hour rainfall event for Marathon County, WI is approximately 5.83"[2]. The basins are operated with a freeboard of 19"; therefore there is adequate capacity to handle a significant precipitation event without overtopping.

3. Page 1-1, Section 1.1.3. WPSC believes the management units should be rated as "Fair" as discussed above.

Participants and Acknowledgements

1. There is a typo in the name of a participant. Please revise the spelling for Dave Molzahn.

Description of the Coal Combustion Residue Management Unit(s)

1. Note there are two pages labeled 2-2.
2. Please revise the labels for Tables 2.1a through 2.1d from "dam" to "management unit".
3. The management unit identifiers in Tables 2.1a and 2.1b need to be switched. The data in 2.1a is for the Northeastern management unit, and the data in Table 2.1b is for the Northwestern management unit.
4. Table 2.1b. The length of the Northwestern Secondary Ash Pond is listed as 405 feet. Based on an interpretation of drawing S3002 in Drawing 13, the length of the basin (distance between embankment crest in the middle of the management unit) is approximately 275 feet.
5. Table 2.1d. The length of the Southwestern Secondary Ash Pond is listed as 325 feet. Based on an interpretation of drawing S3002 in Drawing 13, the length of the basin (distance between embankment crest in the middle of the management unit) is approximately 150 feet.
6. Page 2-5, Section 2.3. It should be noted that the management units at the Weston Generating Station, while classified as small for the purpose of the evaluation, are well below the minimum size classification listed in Table 2.2a.
7. Page 2-6, Tables 2.3a and 2.3b. The names of the ponds need to be corrected. The capacities listed in Table 2.3a are the capacities for the Northwest Secondary Pond, while the capacities listed in Table 2.3b are for the Northeastern Secondary Pond.
8. Page 2-7, section 2.5.1. To clarify, please revise the beginning of the fourth paragraph to the following:

   "The facility was originally designed with two secondary storage basins. In 2005, the railroad loop was constructed which essentially split the existing basins into four secondary basins.

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2 - NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES.
http://hdsc.nws.noaa.gov/hdsc/pfds/

New Embankments were constructed with an underground conduit to allow the north and south secondary basins to operate as one hydraulically connected pond."

Summary of Relevant Reports, Permits, and Incidents

1. Page 3-2, last sentence. WPSC suggest modifying the sentence as follows:

   "In response to these events in 2008, WPSC raised the grade of the area on the embankment where the overtopping occurred and installed level meters on the basins to monitor water elevation to prevent any future overflow of the secondary or tertiary basins."

Summary of History of Construction and Operation

1. Page 4-1, section 4.1.1, last paragraph. This sentence should state "Next, a protective sand and rock layer was installed."
2. Page 4-1, section 4.1.2. We suggest the following language to clarify the modification:

   "In 2005, the secondary treatment basins were modified for the installation of a railroad loop track at the site. As a result, new embankments were constructed, effectively separating the existing secondary basins. New embankments were constructed parallel to the railroad track using the same materials and configuration as the existing embankments. The eastern and western basins are connected via a culvert underneath the railroad track, oriented perpendicular to the track. There is one culvert connecting the northern basins and one culvert connecting the southern basins."

Field Observations

1. Page 5-1, Section 5.1, third paragraph. Please replace "dam" with "management unit".
2. Page 5-12, Photo 5.5.4a. Note the pump in the photo is used to transfer water to the truck washing station on the temporary CCR storage pad adjacent to the management units.

Hydrologic/Hydraulic Safety

1. Page 6-1, section 6.1.1, Flood of Record. WPSC provided Figure 1 of this attachment as part of the August 2012 inspection depicting the location of the flood plain relative to the management units. The map shows the 100 year flood and 500 year flood plain areas near the facility[3].
2. Page 6-1, section 6.1.2 Inflow Design Flood. This is not applicable as the management units are not subject to river flows and inflow to the management units is controlled by the facility. Consequently, the only hydrologic effect that could potentially impact the basin is a rain event. As provided above, the basins are operated with sufficient freeboard to contain rainfall from a 100 year rain event.

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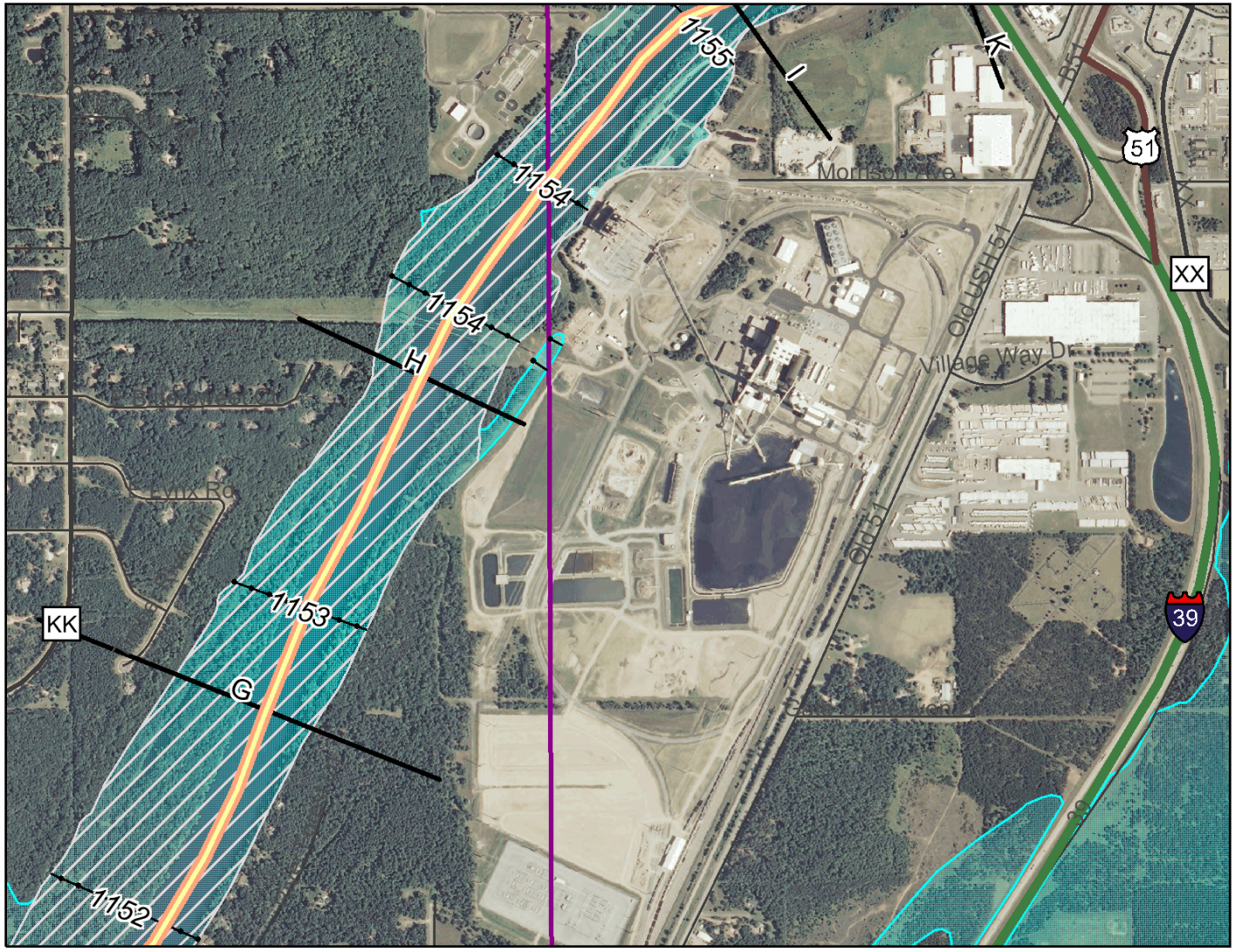
3 – Wisconsin Department of Natural Resources, Surface Water Data Viewer. http://dnrmaps.wi.gov/SL/Viewer.html?Viewer=SWDV

Structural Stability

1. Page 7-1, Section 7.1.1. As described in Section 7.1.5, liquefaction is not considered to be a concern at the site given the very low probability of a seismic event and the soil types present beneath the units are not susceptible to liquefaction. Therefore a seismic stability analysis is not warranted. WPSC recommends revising section 7.1.1 to the following:

   "Structural stability cannot be assessed without the design report and a static stability analysis. Seismic stability is not considered a concern for this site as described in 7.1.5."

Flood Zone / Inundation Map - Weston Generating Station



0 1500 3000 4500 ft.

Map created on Aug 28, 2012

Legend

Analysis Points
- Flood Insurance Study
- Letter of Map Revision
- Case By Case Analysis
- Bridge
- OTHER

Analysis Lines
- Flood Insurance Study
- Letter of Map Revision
- Case By Case Analysis
- Bridge
- OTHER
- Base Flood Elevations
- Digital Cross Sections
- FEMA Map Panel Index

Major Highways
- Interstate
- State Highway
- U.S. Highways
- County Roads
- Local Roads

Digital Flood Boundaries
- 100 Year Floodplain
- 500 Year Floodplain
- Floodway

N

Scale: 1:15,094

Wisconsin Wetland Inventory (WWI) maps show graphic representations of the type, size and location of wetlands in Wisconsin. These maps have been prepared from the analysis of high altitude imagery in conjunction with soil surveys, topographic maps, previous wetland inventories and field work. State statutes define a wetland as "an area where water is at, near or above the land surface long enough to be capable of supporting aquatic or hydrophytic vegetation and which has soils indicative of wet conditions." The principal focus of the WWI is to produce wetland maps that are graphic representations of the type, size and location of wetlands in Wisconsin. Within this context, the objective of the WWI is to produce reconnaissance level information on the location, type, size of these habitats such that they are accurate at the nominal scale of the 1:24,000 (1 inch = 2000 feet) base map. The DNR recognizes the limitations of using remotely sensed information as the primary data source. They are to be used as a guide for planning purposes. There is no attempt, in either the design or products of this inventory, to define the limits of jurisdiction of any Federal, State, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, State, or local agencies concerning specified agency regulatory programs and jurisdictions that may affect such activities. The most accurate method of determining the legal extent of a wetland for federal or state regulations is a field delineation of the wetland boundary by a professional trained in wetland delineation techniques.

Tue 5/27/2014 1:55 PM

From: Metcalf, Mark W MWMetcalf@integrysgroup.com

RE: Follow Up to Phone Call

To: Englander, Jana Englander.Jana@epa.gov


20140527 Stability Analysis Rpt Respon


R1404880_Weston Generating Station_

Good afternoon Jana,

As discussed, attached please find a stability analysis report for the CCR impoundments at the WPSC Weston Generating Station. WPSC appreciates the opportunity to provide this data to support the final assessment. Please let us know if there are any questions.

Regards,

Mark

Mark Metcalf

Environmental Consultant - Air & Water | Integrys Business Support, LLC

920-433-1833

920-606-8432 cell

mwmetcalf@integrysgroup.com

From: Englander, Jana [mailto:Englander.Jana@epa.gov]
Sent: Tuesday, May 20, 2014 9:35 AM
To: Metcalf, Mark W
Subject: Follow Up to Phone Call

Hello Mark,

I wanted to follow up on our phone conversation from yesterday. We look forward to receiving your final report that will provide the results of your recent stability analyses on the CCW

impoundments at the WPS Weston facility. Upon receipt, this document and its contents will be considered in the final assessment report for the Weston facility.

Thank you for contacting me.

Regards,

Jana

Jana Englander

Office of Resource Conservation and Recovery,

Materials Recovery Waste Management Division

Energy Recovery and Waste Disposal Branch

U.S. Environmental Protection Agency

703-308-8711

Wisconsin Public Service Corporation
700 North Adams Street
P.O. Box 19001
Green Bay, WI 54307-9001
www.wisconsinpublicservice.com

May 27, 2014

Ms. Jana Englander
US Environmental Protection Agency (5304P)
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Dear Ms. Englander:

Weston Generating Station Impoundment Structural Stability Analysis Report

Reference: 1) Letter to Mr. S Hoffman from Mr. H Giesler dated April 21, 2014

In Reference 1, Wisconsin Public Service Corporation (WPSC) provided comments on the draft Coal Combustion Residue Impoundment Round 12 - Dam Assessment Report prepared by Dewberry Consultants, LLC. This draft report documented the results of the August 21, 2012 inspection of the wastewater treatment basins (management units) at the Weston Generating Station (Weston).

Within the draft report, the structural soundness of the management units were identified as an issue due to a lack of relevant engineering analyses and/or reports on the stability of the management unit embankments. Although we questioned the appropriateness of assessing the management units in question against the 2004 Federal Guideline for Dam Safety, since they do not meet the definition of a dam, WPSC committed to resolving the issue by completing a structural stability analysis under static conditions. In April 2014, WPSC engaged a qualified engineering firm to determine the stability of the management unit embankments. A copy of the report is enclosed.

Please note that although WPSC committed to completing a structural stability analysis under static conditions, to further demonstrate the safety of the management units, an analysis under seismic conditions was also conducted. The results of the geotechnical stability analysis (Page 11, Table 5) indicate the management units have factor of safety values that exceed generally accepted minimum factors of safety for dams. WPSC believes that this information, along with the comments and reasons previously provided, supports a management unit rating modification from “Poor” to “Satisfactory”.

We appreciate the opportunity to review and provide comment on the content and technical conclusions of the draft report. If you have any questions regarding this submission, please contact Mr. Mark Metcalf at (920) 433-1833.

Sincerely,

Howard R. Giesler
General Manager - Weston

mwm

Enc: Geotechnical Stability Analysis, Secondary Bottom Ash Basins, Weston Generating Station

GEI Consultants

Geotechnical
Environmental
Water Resources
Ecological

Geotechnical Stability Analysis

Secondary Bottom Ash Basins

Weston Generating Station, Rothschild, Wisconsin

Submitted to:
Integrys Business Support LLC
700 North Adams Street
Green Bay, Wisconsin 54301

Submitted by:
GEI Consultants, Inc.
3159 Voyager Drive
Green Bay, Wisconsin 54311
920-455-8200

May 22, 2014

Project 1404880

John M. Trast, P.E.
Senior Consultant

Table of Contents

Tables

Figures

Appendix

Executive Summary

The Wisconsin Public Service Corporation (WPSC) owns and operates the Weston Generating Station located at 2501 Morrison Avenue in Rothschild, Wisconsin. The facility is a base load, coal fired, electrical power station having four coal fired boilers used for the production of electricity. Units 1-4 have capacities of 60, 75, 325, and 595 MW. The units were commissioned in 1954, 1960, 1981, and 2008, respectively. WPSC burns sub-bituminous coal from the Powder River Basin as the primary fuel source in the boilers. As a result, coal combustion residual products (fly ash, bottom ash, and FGD ash) are generated.

The United States Environmental Protection Agency (US EPA) retained Dewberry Consultants LLC, (Dewberry) from Fairfax, Virginia as their contract engineer to perform an assessment of the Weston Generating Station bottom ash treatment basins for Weston Unit 3. These basins are referred to as "management units" in EPA's draft assessment. Based on their site visit conducted on Tuesday, August 21, 2012, and information provided by WPSC to support the assessment, the basins have been given an initial rating of POOR due to a lack of sufficient engineering and structural stability data. WPSC has retained GEI to assist in providing technical documentation regarding the geotechnical structural stability of the basins.

After reviewing construction documentation and subsurface exploration data from the permanent operating record of the site, GEI performed a very conservative geotechnical stability analysis of the secondary bottom ash basins. The result of the geotechnical stability analysis shows that the secondary bottom ash basins have adequate factor of safety under the normal pool, maximum pool, rapid draw down, and seismic conditions modeled. The calculated factor of safety values exceed generally accepted minimum factor of safety criteria and no further exploration or investigation is necessary at this time.

1. Introduction

The Wisconsin Public Service Corporation (WPSC) owns and operates the Weston Generating Station located at 2501 Morrison Avenue in Rothschild, Wisconsin. The facility is a base load, coal fired, electrical power station having four coal fired boilers used for the production of electricity. Units 1-4 have capacities of 60, 75, 325, and 595 MW. The units were commissioned in 1954, 1960, 1981, and 2008, respectively. WPSC burns sub-bituminous coal from the Powder River Basin as the primary fuel source in the boilers. As a result, coal combustion residual (CCR) products (fly ash, bottom ash, and FGD ash) are generated.

Fly ash is dry handled from Units 1-3. Fly ash is removed from the flue gas stream of Units 1&2 using electrostatic precipitators. Fly ash is removed from the flue gas of Unit 3 using a bag house. The fly ash is collected in hoppers and transferred to dry storage silos. The fly ash is transferred to vendors for beneficial use as a cement replacement in concrete or the fly ash is moisture conditioned using a rotary mixer, then transported to a temporary ash storage pad where it is stockpiled for beneficial reuse projects as structural fill.

Unit 4 has a dry flue gas desulfurization (FGD) air emission control system to remove sulfur dioxide. The FGD waste is removed by a bag house, collected in hoppers, and is eventually transferred to a dry storage building. FGD waste from Unit 4 is moisture conditioned using a rotary mixer and transported to a temporary ash storage pad where it is stockpiled for beneficial reuse projects as structural fill.

Bottom ash from Unit 3 is collected from the boiler and sluiced to a series of redundant treatment basins (i.e., the management units). The coal combustion residuals are sluiced to one of two primary settling basins where the CCR quickly settles out and the sluice water quickly flows to the secondary basin. Dewatered bottom ash is removed from the primary basins on a weekly basis using a front-end loader and transported via dump truck to the ash storage pad for future beneficial use. Weston produces about 80,000 to 85,000 tons per year of bottom ash.

Bottom ash from Weston Unit 4, along with pulverizer rejects and economizer ash, is conveyed via the submerged flight conveyor and mostly de-watered prior to being dumped into a dump truck and taken to a temporary ash storage pad.

The secondary bottom ash basins are designed to provide residence time for the CCR fines to settle out from the sluice water. To improve residence time and assist in settling the fines, silt curtains are used in the secondary bottom ash basins. In 2005, to increase the rail car capacity of the plant, the secondary bottom ash basins were bisected to facilitate the

construction of a rail line. So rather than having north and south secondary bottom ash basins, Weston has Northeastern, Northwestern, Southeastern, and Southwestern secondary bottom ash basins. Equalizing underground conduits were installed beneath the rail lines to maintain the water levels of the Northeastern and Northwestern bottom ash basins and the Southeastern and Southwestern bottom ash basins. Water from the secondary bottom ash basins is treated for pH and suspended solids, as needed, and pumped to a Tertiary Basin where the water is either reused as carriage water for sluicing bottom ash in a close-loop system or discharged to the Wisconsin River under WPDES Permit No. WI-0042756-07-0. Figure 1: Site Location Diagram, shows the site and the location of the basins.

The United States Environmental Protection Agency (US EPA) retained Dewberry Consultants LLC, (Dewberry) from Fairfax, Virginia as their engineer contractor to perform the assessment of the Weston Generating Station bottom ash basins. The purpose of the assessment was to evaluate the condition of and potential for residue release from management units and determine a hazard potential classification rating for the units. Based on their site visit conducted on August 21, 2012, Dewberry considered the Unit 3 secondary bottom ash basins as being management units with a potential hazard. The Primary basins were not considered a hazard because of the berm height and size. WPSC submitted information indicating it does not consider the Tertiary basin to be a basin that contains CCR. Based on plant operations and visual assessment Dewberry concurred and did not assess the Tertiary basin.

According to the United States Army Corp of Engineers ER-1110-2-106 Guidelines for Safety Inspections of Dams the secondary bottom ash basin size classification is SMALL (all height are less than 25 feet and less than 1,000 acre-feet of water storage) and according to Federal Emergency Management Administration FEMA 93 – Federal Guidelines for Dam Safety the hazard classification is LOW in the event of failure (no loss of life expected and low economic loss and generally limited to the owner). However, Dewberry and the US EPA concluded that the secondary bottom ash basins should be rated as POOR due to a lack of sufficient engineering and structural stability data.

WPSC has retained GEI to assist in providing technical documentation regarding the geotechnical structural stability of the basins and to provide the additional engineering and structural stability documentation to support a SATIFACTORY rating of the basins.

Our work was performed in accordance with GEI proposal dated April 16, 2014. Integrys issued Purchase Order No. 1200139229 dated April 18, 2014 as authorization to proceed. Our scope of work included the following:

- Site visit and project meeting with basin operation staff,

- Review of existing documentation regarding the design and construction of the secondary bottom ash basins including historic soil boring information, operating records, and groundwater monitoring data from nearby wells,

- Geotechnical stability analysis of a critical cross-section of the secondary bottom ash basins, and

- Preparation of a report to present results of our geotechnical stability analysis.

This report presents the results of the above scope of work and includes the following sections:

2. Documents Reviewed and Relied Upon

GEI reviewed and relied upon the following documents in evaluating the structural stability of the Secondary Bottom Ash Basins:

Design and Documentation Drawings

Black & Veatch, (2004) Drawing S3001, Grading & Drainage, Site Area 1 Plan. Weston Generating Station, Unit 4. Wisconsin Public Service Corporation. September 15, 2004

Black & Veatch, (2004) Drawing S3002, Grading & Drainage, Site Area 2 Plan. Weston Generating Station, Unit 4. Wisconsin Public Service Corporation. September 15, 2004

Black & Veatch, (2004) Drawing S3007, Grading & Drainage, Site Area 7 Plan. Weston Generating Station, Unit 4. Wisconsin Public Service Corporation. September 15, 2004

Black & Veatch, (2004) Drawing S3050, Grading & Drainage, Site Typical Sections. Weston Generating Station, Unit 4. Wisconsin Public Service Corporation. September 15, 2004

Black & Veatch, (2004) Drawing S3051, Grading & Drainage, Site Typical Sections & Details. Weston Generating Station, Unit 4. Wisconsin Public Service Corporation. September 15, 2004

Black & Veatch, (2004) Drawing S3000, Grading & Drainage, Site Key Plan, General Notes & Legend. Weston Generating Station, Unit 4. Wisconsin Public Service Corporation. September 15, 2004

Sargent & Lundy, (1978) Drawing No. C-20, Grading, Roadwork, and Drainage Plan, Sheet 10. Weston Generating Station, Unit 3. Wisconsin Public Service Corporation, Wausau, WI. 1978.

Sargent & Lundy, (1978) Drawing No. C-21, Grading, Roadwork, and Drainage Plan, Sheet 11. Weston Generating Station, Unit 3. Wisconsin Public Service Corporation, Wausau, WI. 1978.

Sargent & Lundy, (1978) Drawing No. C-42, Miscellaneous Sections and Details, Sheet 1. Weston Generating Station, Unit 3. Wisconsin Public Service Corporation, Wausau, WI. 1978.

Sargent & Lundy, (1978) Drawing No. C-43, Miscellaneous Sections and Details, Sheet 1. Weston Generating Station, Unit 3. Wisconsin Public Service Corporation, Wausau, WI. 1978.

Sargent & Lundy, (1978) Drawing No. C-44, Miscellaneous Sections and Details, Sheet 3. Weston Generating Station, Unit 3. Wisconsin Public Service Corporation, Wausau, WI. 1978.

Engineering Reports

Black & Veatch Corporation (2004). Wisconsin Public Service Corporation Weston North Unit 4 Rothschild, WI. Geotechnical Report Revision 0. January 14, 2004.

Dewberry Consultants LLC (2014). Coal Combustion Residue Impoundment Round12 – Dam Assessment Report. Weston Generating Station (Site 26) Northeastern, Northwestern, Southeastern and Southwestern Secondary Bottom Ash Treatment Ponds. Wisconsin Public Service Rothschild, WI. February 2014.

STS Consultants, Inc. (1980). Merrill Gravel & Construction Company Laboratory Test Results. Proposed Soil-Bentonite Liner. Wisconsin Public Service, Weston Unit 3 Plant Expansion Weston, WI. July 16, 1980.

Groundwater Monitoring Well Data

Wisconsin Department of Natural Resources, Groundwater and Environmental Monitoring System (GEMS) Database, http://dnr.wi.gov/topic/Landfills/gems.html, Wisconsin Public Service Corporation, Weston #3 Landfill, WDNR License No. 2879.

References

Gueddouda, M.K., Lamara, MD, Aboubaker, N., Taibi, S. (2008), "Hydraulic Conductivity and Shear Strength of Dune Sand-Bentonite Mixtures," International Conference on Construction and Building Technology, ICCBT 2008-E-(12), June 2008, Kuala Lumpur, Malaysia, pp 139-150.

U.S. Army Corp of Engineers, (1979), "Recommended Guidelines for Safety Inspection of Dams," *ER 1110-2-106*. Washington D.C., September 1979.

U.S. Army Corp of Engineers, (2003), "Slope Stability," *EM 1110-2-1902*. Washington D.C., October 2003.

U.S. Department of Homeland Security, Federal Emergency Management Agency, (2004) Federal Guidelines for Dam Safety, *FEMA 93*, Denver: Bureau of Reclamation, U.S. Department of Interior.

3. Site Conditions

3.1 Secondary Bottom Ash Basins

The secondary bottom ash basins are designed to provide residence time for settling bottom ash fines from the sluice water. The basins were designed as two parallel basins where one basin could be taken off line for cleaning while the other remained in service. The basins were designed and constructed with 3 horizontal to 1 vertical (3H:1V) interior and exterior slopes and a minimum crest width of the exteriors berms of 10 feet. An interior dike bisects the secondary basins. The interior dike was constructed with 3H:1V slopes and a minimum crest width of 6 feet. The crest elevation of the secondary basins was designed by Sargent & Lundy to be constructed at elevation +1,182.5 feet. The interior of each basin is lined with a 1-foot thick compacted sand-bentonite liner system, 1-foot soil protection layer, and 2 feet of crushed stone.

In 2005, as part of the Weston Unit 4 construction project, the secondary basins were bisected by a loop railroad line to serve the needs of the plant. Underground conduits installed below the rail lines equalize water elevation in each basin and connect the Northeastern and Northwestern Basins and the Southeastern and Southwestern Basins, respectively. The design and construction of the rail line and secondary basin modifications were completed by Black & Veatch. Figure 2: Plan View, is a topographic map showing the basins, boring locations, and adjacent groundwater monitoring wells.

The dikes were constructed from on-site soil that was placed and compacted. GEI conservatively estimated the dike soils to be fine to medium sand based on borings BV-03, BV-04, BV-07, BV-08, and BV-09 and the soil recommendations from the WPSC Weston North Unit 4 Geotechnical Report by Black & Veatch Corporation dated January 14, 2004. The moist unit weight recommendation for on-site fine to medium sand (SW) is 120 pcf with a conservative friction angle of 28 degrees.

The sand-bentonite liner properties are estimated based on the Maximum Technologies Report of Soil Analysis dated March 24, 2005 and Gueddouda et, al, (2008). For our analyses we modeled the sand-bentonite layer with a saturated unit weight of 130 pcf, drained friction angle of 22 degrees, and undrained shear strength of 1,000 psf.

3.2 Subsurface Soil Conditions

Geotechnical Report – Wisconsin Public Service Corporation Weston North Unit 4, Rothschild, Wisconsin dated January 14, 2004 contains soil borings advanced near the secondary bottom ash basin. Black & Veatch advanced the soil borings using hollow stem

augers to the water level, and then switched to rotary wash drilling below the water table. Soil samples were reportedly obtained using a split barrel sampler while performing standard penetration tests (SPT). Soil borings BV-03, BV-04, BV-07, BV-08, and BV-09 were advanced near the secondary basins in support of the basin modifications and were used by GEI to define the subsurface soil conditions. In general these borings encountered fill near the surface, underlain by natural granular sandy soils. Based on the geotechnical borings near the secondary bottom ash basins GEI estimated a moist unit weight of 120 pcf with a conservative friction angle of 30 degrees for the medium dense natural sands (SP-SW).

3.3 Groundwater Conditions

The Wisconsin River is located west of the secondary bottom ash basins and flows north-south. Based on FEMA Map Number 55073C0631F dated July 22, 2010, the 100-year flood elevation of the Wisconsin River near the secondary ash basins is elevation +1,153.5 feet (NAVD88). The normal pool elevation is estimated to be +1,140.0 feet.

GEI obtained groundwater monitoring well data from the Wisconsin Department of Natural Resources (WDNR), Groundwater and Environmental Monitoring System (GEMS) Database for the WPSC Weston Landfill #3. Groundwater monitoring wells adjacent to the secondary ash basins are OW-38, OW-43A, OW 43B. Monitoring wells located north of the basins include OW28AR, OW28BR, OW-30A, OW30B, OW 40A, and OW 40B. The location of these wells is shown on Figure 2: Plan View.

To estimate groundwater conditions around the basin we selected the second quarter monitoring date of June 10, 2013. Table 1 – Groundwater Monitoring Well Data presents the monitoring data from adjacent wells from the second quarter of 2013.

Table 1 – Weston Groundwater Monitoring Well Data 2Q 2013

Monitoring Well	Groundwater Elevation (ft)
OW-28AR	+1,145.26
OW-28BR	+1,145.30
OW-30A	+1,144.87
OW-30B	+1,144.84
OW-38	+1,144.73
OW-40A	+1,145.99
OW-40B	+1,147.03
OW-43A	+1,145.08
OW-43B	+1,145.09

Figure 3: Weston Generating Station Secondary Ash Basin Ground and Surface Water Conditions shows the Normal Pool and 100 year Flood Elevation of the Wisconsin River, the normal operating level and maximum pool elevation of the Secondary Bottom Ash Basins, and the recorded groundwater elevations for the adjacent groundwater monitoring wells. For purposes of our analyses, we used a phreatic surface elevation of +1,145 feet in the natural sand soils underlying the basins.

4. Analyses

Based on the geometry and design of the secondary basin, GEI selected one cross-section for analysis - Section A-A'. This section corresponds to detail Section 43 from Drawing C-42, Miscellaneous Sections & Details, Sheet 1, as shown on Drawing C-20 Grading Roadwork, & Drainage Plan – Sheet 10, Weston Generating Station Unit 3, Wisconsin Public Service Corporation. Figure 2: Plan View, shows the location of Section A-A'.

The perimeter dike is a controlled compacted fill embankment with 3 horizontal to 1 vertical (3H:1V) side slopes and a 10-foot-wide crest width. The dike was constructed to elevation +1182.5 feet and has a vertical height ranging from 4 to 11 feet.

The basin dike was evaluated using two sets of time-dependent soil strength parameters. Both effective stress analysis and total stress analysis were conducted to evaluate the basin dikes. Effective stress analysis parameters were used to model drained, long-term, steady-state loading conditions where excess pore water pressures have had time to dissipate. Total stress analysis parameters were used to model undrained, short-term loading conditions such as drawdown and seismic events, where excess pore water pressures could develop in fine-grained soils and have not had time to dissipate. Table 2 summarizes the effective and total stress soil strength parameters for each of the soil layers used in the analysis.

Table 2: Soil Parameters Used For the Geotechnical Stability Analysis

Soil Description	Unit Weight (pcf)	Effective Stress Strength Parameters		Total Stress Strength Parameters	
		c' (psf)	ϕ'	c' (psf)	ϕ
Compacted Dike Fill Soils (SW)	120	0	28	0	28
Natural Sands Medium Dense (SP-SW)	120	0	30	0	30
Bentonite-Sand Liner	130	0	22	1,000	0
Soil Cover (SW)	120	0	28	0	28
Crushed Stone (GP)	110	0	32	0	32

The basins were not designed for CCR storage, disposal, or operating levels above the perimeter dike. Therefore, the CCR within the basin was assigned no strength parameters as a conservative approach to the analysis. The ash was modeled as water so that it applied weight and pressure but did not contribute any stabilizing resistance.

Four loading scenarios were evaluated for the secondary basins. The loading conditions modeled are referred to as the normal pool condition (water level at +1,180.75 feet), the

maximum pool condition (water level at +1,182.5 feet), a drawdown condition, and the seismic condition. Groundwater levels modeled are based on the design pond levels and the groundwater levels in the adjacent monitoring wells. The cross-section was analyzed for the effective stress and total stress conditions. Total stress conditions would be representative of the expected undrained soil strengths immediately after filling of the basin is completed, under a drawdown where the basin would be dewatered for cleaning, and under seismic conditions. The effective stress condition is a representation of the drained, long-term strengths that can be expected over time. This would be the normal steady-state operating condition of the basin. The drawdown case is representative of the condition when the basin is drained and the sand-bentonite liner could remain saturated. Based on the basin design and ground and surface water conditions it is not a typical "rapid drawdown condition" where water pressures can be difficult to predict due to the rapid nature of the loading and drainage that occurs. In our drawdown case we assumed total stress conditions with the sand bentonite liner saturated and the basin empty. An analysis was performed to determine what effect an earthquake would have on the stability of the basin. GEI chose a maximum probable earthquake for Weston Generating Station based on the 2008 United States Geological Survey National Seismic Hazard Maps, Peterson et.al (2008). The maximum probable earthquake has a peak ground acceleration of 0.02 g with a 2 percent Probability of Exceedance in 50 years.

Appropriate factors of safety are required to ensure adequate performance of slopes throughout their design lives. Two of the most important considerations that determine appropriate magnitudes for factor of safety are uncertainties in the conditions being analyzed, including shear strengths and consequences of failure or unacceptable performance.

What is considered an acceptable factor of safety should reflect the differences between new slopes, where stability must be forecast, and existing slopes, where information regarding past slope performance is available. In the case of secondary basins at Weston, there is a 33-year history of satisfactory performance and no instability issues. A history which is free of signs of slope movements provides solid evidence that a slope has been stable under the conditions it has experienced. Therefore, values of factors of safety lower than those required for new slopes can be justified for the existing slopes, if necessary.

Geotechnical engineers have relied upon judgment, precedent, experience, and regulations to select suitable factors of safety for slopes. For design and construction of earth and rock-fill dams, required factors of safety continue to be based on experience and guidance from the United States Army Corp of Engineers. Factors of safety recommended by the United States Army Corp of Engineers for various types of slopes and analysis conditions are summarized in Table 4. These are the minimum required factors of safety for new embankments at dams. They are advisory for existing dams and other types of slopes.

Table 4 - Minimum Required Factor of Safety for New Earth and Rock Filled Dams from USCOE EM1110-2-1902 Slope Stability

Analysis Condition[1]	Required Factor of Safety	Slope
End of Construction[2]	1.3	Upstream and Downstream
Long-Term (Steady-state seepage, maximum surcharge pool, spill way crest or top of gates)	1.5	Downstream
Maximum surcharge pool[3]	1.4	Downstream
Rapid drawdown	1.1-1.3 [4,5]	Upstream

[1] For earthquake loading, see ER 1110-2-1806 for guidance. An Engineer Circular, "Dynamic Analysis of Embankment Dams," is still in preparation.
[2] For embankments over 50 feet high on soft foundations and for embankments that will be subjected to pool loading during construction, a higher minimum end-of-construction factor of safety may be appropriate.
[3] Pool thrust from maximum surcharge level. Pore pressures are usually taken as those developed under steady-state seepage at maximum storage pool. However, for pervious foundations with no positive cutoff steady-state seepage may develop under maximum surcharge pool.
[4] Factor of safety (FS) to be used with improved method of analysis described in Appendix G of EM 1110-2-1902 Slope Stability
[5] FS = 1.1 applies to drawdown from maximum surcharge pool; FS = 1.3 applies to drawdown from maximum storage pool.
For dams used in pump storage schemes or similar applications where rapid drawdown is a routine operating condition, higher factors of safety, e.g., 1.4-1.5, are appropriate. If consequences of an upstream failure are great, such as blockage of the outlet works resulting in a potential catastrophic failure, higher factors of safety should be considered.

The desired factors of safety are based on the loading condition and normal engineering practice. For the steady-state loading condition (Scenarios I and II), a safety factor of 1.5 or greater would generally be considered acceptable; for the rapid drawdown condition (Scenario III), a factor of safety of 1.1 or greater would generally be considered acceptable; and for the seismic event (Scenario IV), a safety factor of 1.2 or greater is generally considered acceptable. However, after any significant seismic or flooding event, a comprehensive inspection should be performed to evaluate the dikes and any necessary repairs implemented. Table 5 – Slope Stability Analysis Results summarizes the analyses that were completed and the resulting computed factors of safety. The computer outputs for each case analyzed are included in the Appendix.

Table 5 - Slope Stability Analyses Results

Design Scenario, Pond and Loading Condition			Effective Stress Analysis		Total Stress Analysis	
			Block	Circular	Block	Circular
Scenario I	Normal Pool/Static	Downstream	1.9	1.8	1.9	1.8
Scenario II	Maximum Pool/Static	Downstream	1.9	1.8	1.9	1.8
Scenario III	Drawdown/ Static	Upstream	1.5	1.4	2.0	1.8
Scenario IV	Normal Pool/Seismic	Downstream	1.7	1.7	1.7	1.7

5. Conclusions and Recommendations

The WPSC Weston Generating Station Secondary Bottom Ash Basins were constructed in 1981 in conjunction with Unit 3 of the generating station. The basins were constructed by excavating and compacting on-site alluvial soils, lining the basin with a soil-bentonite liner, placing and compacting a protective soil layer, and installing a protective crushed stone. The basins were modified as part of the Unit 4 construction in 2005 to accommodate a loop railroad track. The modifications resulted in the dual secondary basins being bisected by the track, resulting in four secondary bottom ash basins. An underground conduit connects the Northeast and Northwest secondary bottom ash basins and a similar conduit connects the Southeast and Southwest secondary bottom ash basins. The basins were designed by a qualified engineering firm and constructed in accordance with the Industrial Lagoon requirements found in NR 213, Wisconsin Administrative Code. The basins are permitted by the WDNR under the authority of Chapter 283 of the Wisconsin Statutes and are operated under WPDES Permit No. WI-0042765-07-0. The US EPA performed an assessment on the status of the ash basin at the Weston Generating Station and recommended that a geotechnical stability analysis of the secondary bottom ash basins be performed to address short-term and long-term stability of the basins.

After reviewing construction documentation and subsurface exploration data from the permanent operating record of the site, GEI performed a very conservative geotechnical stability analysis of the secondary bottom ash basins. The result of the geotechnical stability analysis shows that the basins have an adequate factor of safety under the normal pool, maximum pool, rapid draw down, and seismic conditions modeled. The calculated factor of safety values exceed generally accepted minimum factor of safety and no further exploration or investigation is necessary at this time.

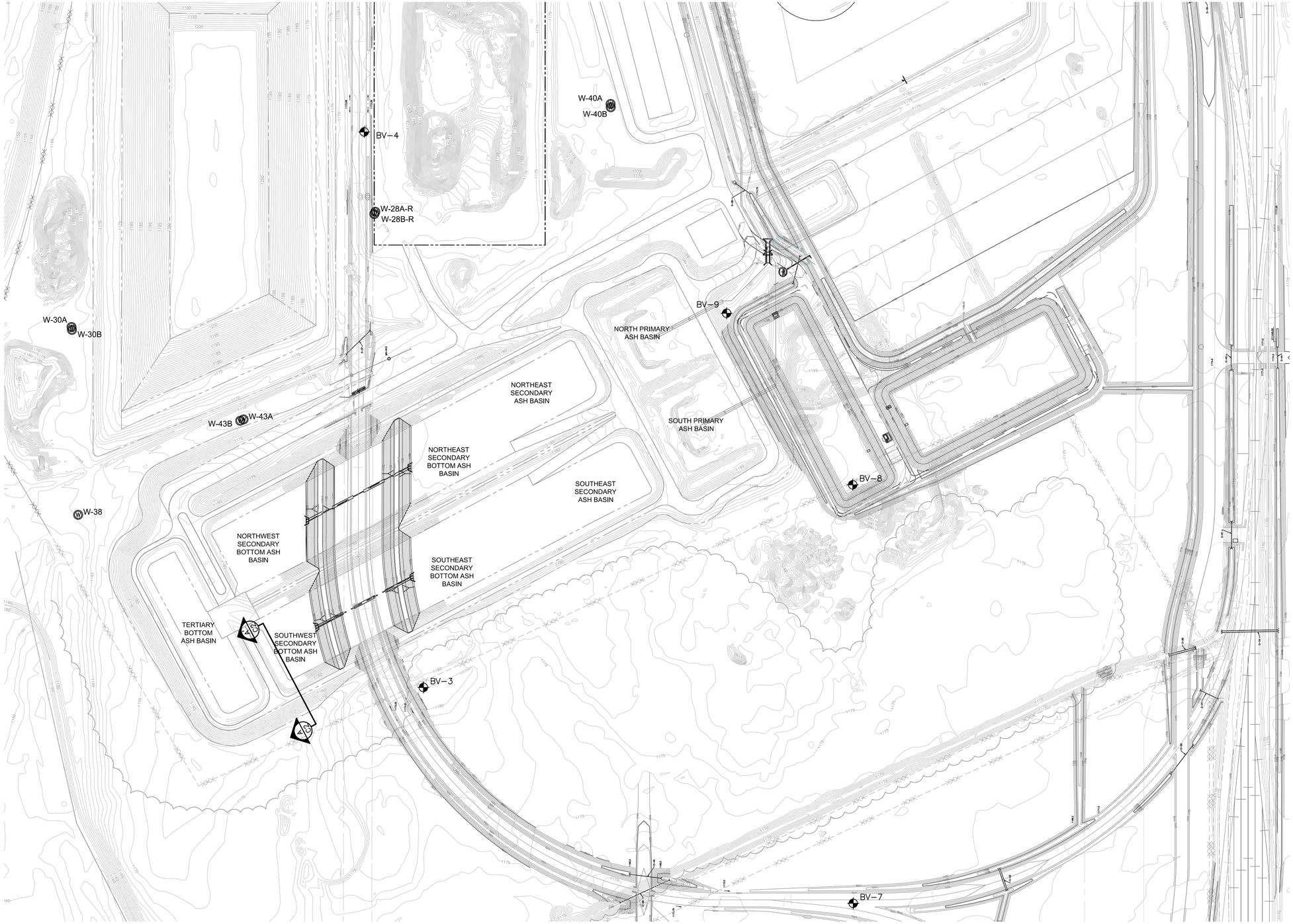
6. General Qualifications

This report has been prepared in accordance with normally accepted geotechnical engineering practices to aid in the evaluation of this site for our Client. We have prepared this report for the purpose intended by our Client, and reliance on its contents by anyone other than our Client is done at the sole risk of the user. No other warranty, either expressed or implied, is made. The scope is limited to the specific project and location described herein, and our description of the project represents our understanding of the significant aspects relevant to the geotechnical characteristics. In the event that any changes in the design or location of the facilities as outlined in the report are planned, we should be informed so that the changes can be reviewed and the conclusions of this report modified, as necessary, in writing by the professional engineer of GEI that sign this report.

The analysis and recommendations submitted in this report are based on the data obtained from the available soil borings provided by our client. In a subsurface exploration, specific information is obtained at specific locations at a specific time. This report does not reflect any variations which may occur between the boring obtained from the Client. It is a well-known fact that variation in soil and rock conditions exist on most sites between boring locations and that seasonal and annual fluctuations in groundwater levels will occur.

Figures

Units 3 and 4 Ash Basins Weston Generating Station	GEI Consultants	SITE LOCATION DIAGRAM
Wisconsin Public Service Corporation Rothschild, Wisconsin	Project 1404880	Figure 1



LEGEND

W-40B — GROUNDWATER WELL (APPROXIMATE LOCATION)

BV–4 — BLACK & VEACH CORP. SOIL BORING ADVANCED IN 2003 (APPROXIMATE LOCATION)

A / A' — GEI CROSS-SECTION

NOTE:

BASE MAP FROM "GRADING & DRAINAGE-SITE", DRAWING NO. 4SD-S3001, REV 2, BY BLACK & VEACH CORPORATION, DATED 9/15/2004.

Attention:

0 1"

If this scale bar does not measure 1" then drawing is not original scale.

NO.	DATE	ISSUE/REVISION	APP
0	X	X	X

Designed: JXT
Checked: JXT
Drawn: JLC
Submittal Date: 5/14/2014

GEI Consultants
3159 Voyager Drive
Green Bay, Wisconsin 54311
920-455-8200

WISCONSIN PUBLIC SERVICE CORP.
WESTON GENERATING STATION

GEI Project 1404880

WESTON ASH POND
GEOTECHNICAL EVALUATION

PLAN VIEW

FIGURE 2

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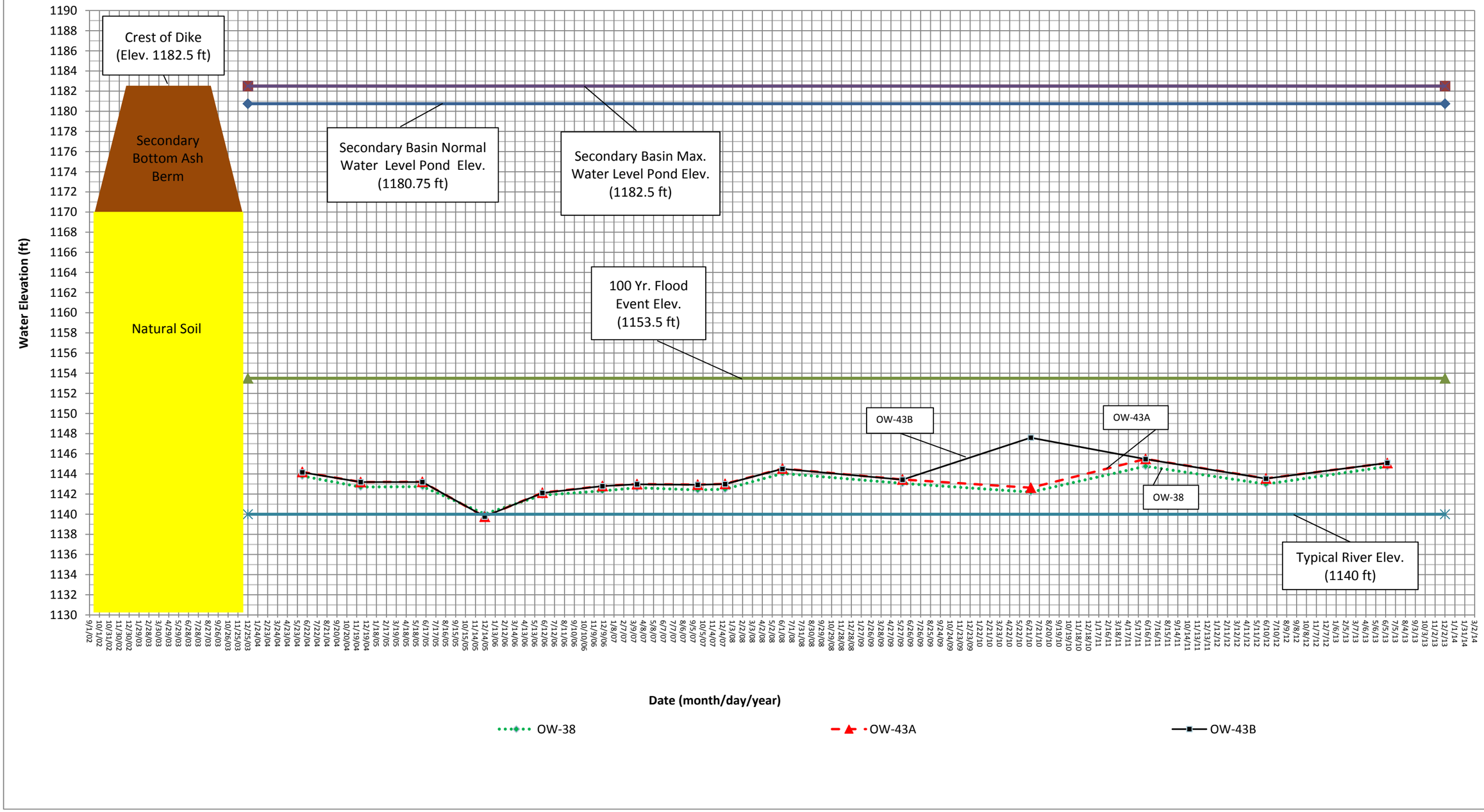
FIGURE 3: Weston Generating Station Secondary Ash Basin
Ground and Surface Water Conditions



K:\Integrys\1404880_Weston PP Coal Ash Storage Ponds\well information\Weston well elevations 2004_2014_BKB_R1

Appendix

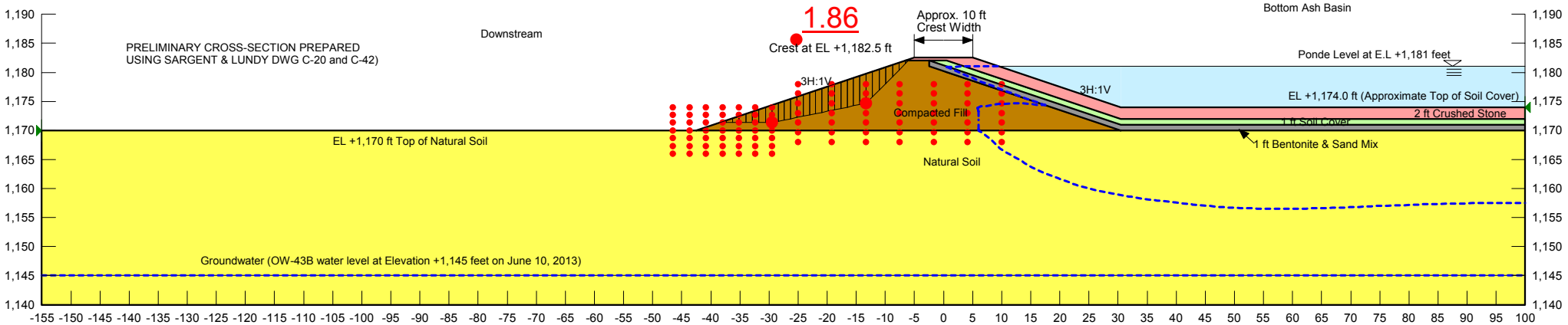
Stability Analyses

Wisconsin Public Service Corp
Weston Generating Station Unit 4

Slope Stability Analysis : Normal Operating Conditions

ESA

Name: Natural Soil Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 30 ° Phi-B: 0 °
Name: Compacted Fill Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 ° Phi-B: 0 °
Name: Bentonite and Sand Mix Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 22 ° Phi-B: 0 °
Name: Soil Cover Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 ° Phi-B: 0 °
Name: Crushed Stone Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 0 psf Phi': 32 ° Phi-B: 0 °



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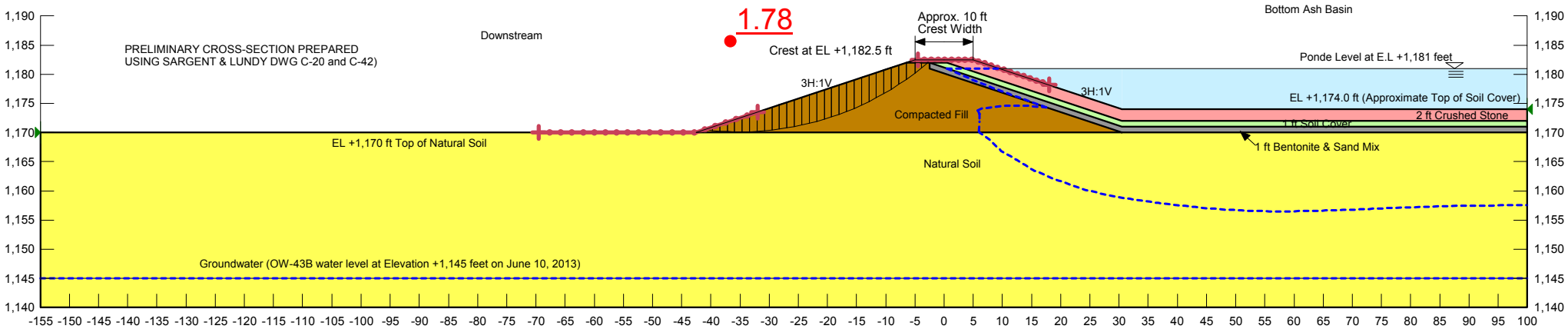
Directory: C:\Users\kkrueger\Desktop\Weston Ponds Geostudio\
Date: 5/14/2014

Wisconsin Public Service Corp
Weston Generating Station Unit 4

Slope Stability Analysis : Normal Operating Conditions

ESA

Name: Natural Soil Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 30 ° Phi-B: 0 °
Name: Compacted Fill Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 ° Phi-B: 0 °
Name: Bentonite and Sand Mix Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 22 ° Phi-B: 0 °
Name: Soil Cover Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 ° Phi-B: 0 °
Name: Crushed Stone Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 0 psf Phi': 32 ° Phi-B: 0 °



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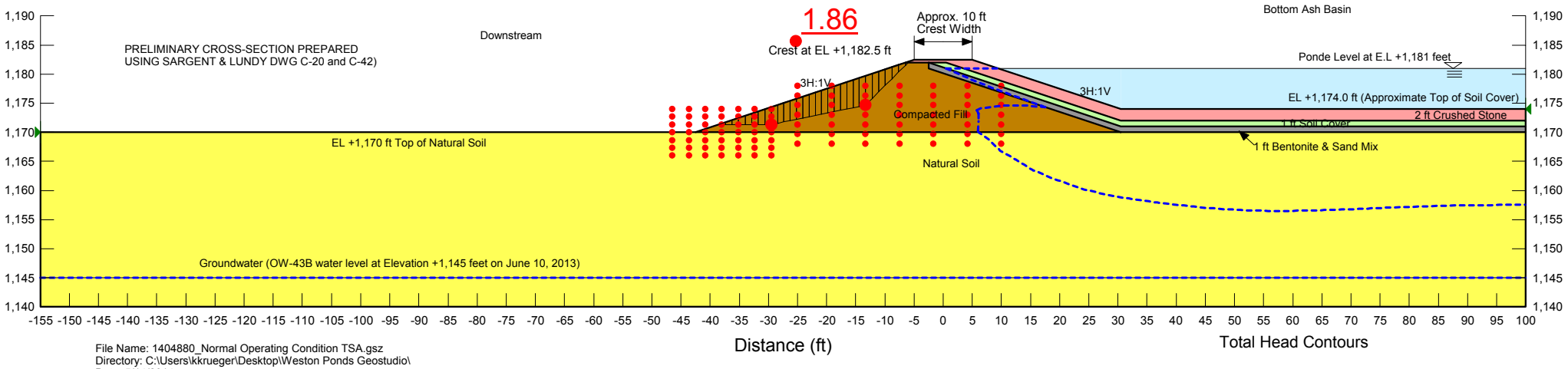
Date: 5/14/2014

Wisconsin Public Service Corp
Weston Generating Station Unit 4

Slope Stability Analysis : Normal Operating Conditions

TSA

Name: Natural Soil Unit Weight: 120 pcf Cohesion': 0 psf Phi': 30 °
Name: Compacted Fill Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 °
Name: Bentonite and Sand Mix Unit Weight: 130 pcf Cohesion': 1,000 psf Phi': 0 °
Name: Soil Cover Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 °
Name: Crushed Stone Unit Weight: 110 pcf Cohesion': 0 psf Phi': 32 °



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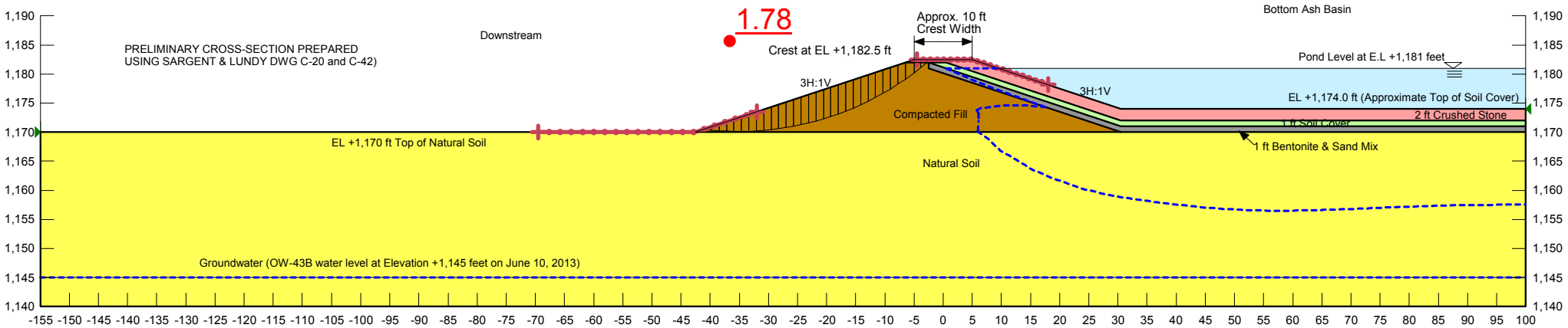
Date: 5/14/2014

Wisconsin Public Service Corp
Weston Generating Station Unit 4

Slope Stability Analysis : Normal Operating Conditions

TSA

Name: Natural Soil Unit Weight: 120 pcf Cohesion': 0 psf Phi': 30 °
Name: Compacted Fill Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 °
Name: Bentonite and Sand Mix Unit Weight: 130 pcf Cohesion': 1,000 psf Phi': 0 °
Name: Soil Cover Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 °
Name: Crushed Stone Unit Weight: 110 pcf Cohesion': 0 psf Phi': 32 °



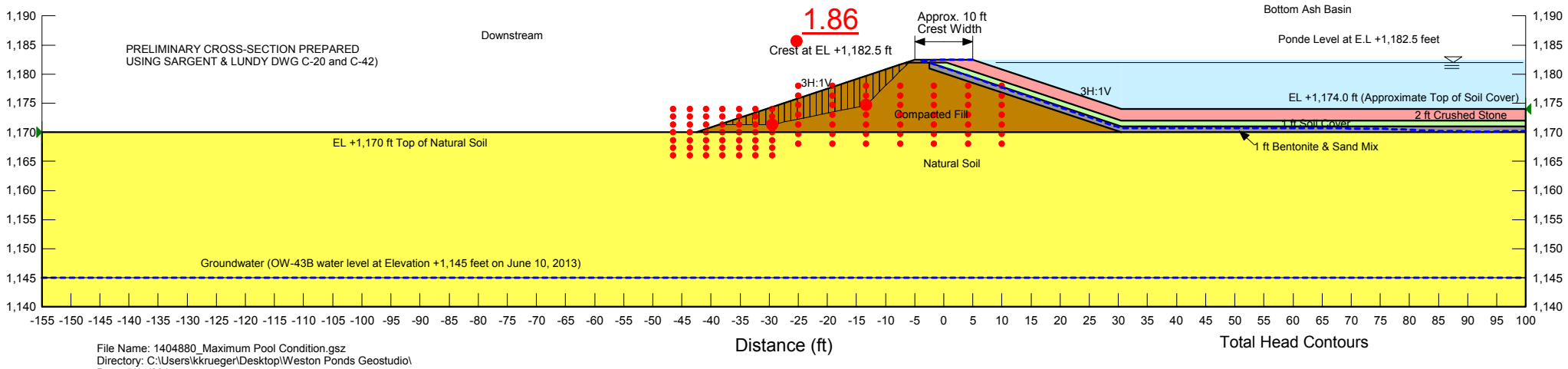
File Name: 1404880_Normal Operating Condition TSA.gsz
Directory: C:\Users\kkrueger\Desktop\Weston Ponds Geostudio\
Date: 5/14/2014

Wisconsin Public Service Corp
Weston Generating Station Unit 4

Slope Stability Analysis : Maximum Pool Operating Conditions

ESA

Name: Natural Soil Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 30 ° Phi-B: 0 °
Name: Compacted Fill Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 ° Phi-B: 0 °
Name: Bentonite and Sand Mix Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 22 ° Phi-B: 0 °
Name: Soil Cover Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 ° Phi-B: 0 °
Name: Crushed Stone Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 0 psf Phi': 32 ° Phi-B: 0 °



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Wisconsin Public Service Corp
Weston Generating Station Unit 4

Slope Stability Analysis : Maximum Pool Operating Conditions

ESA

Name: Natural Soil Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 30 ° Phi-B: 0 °
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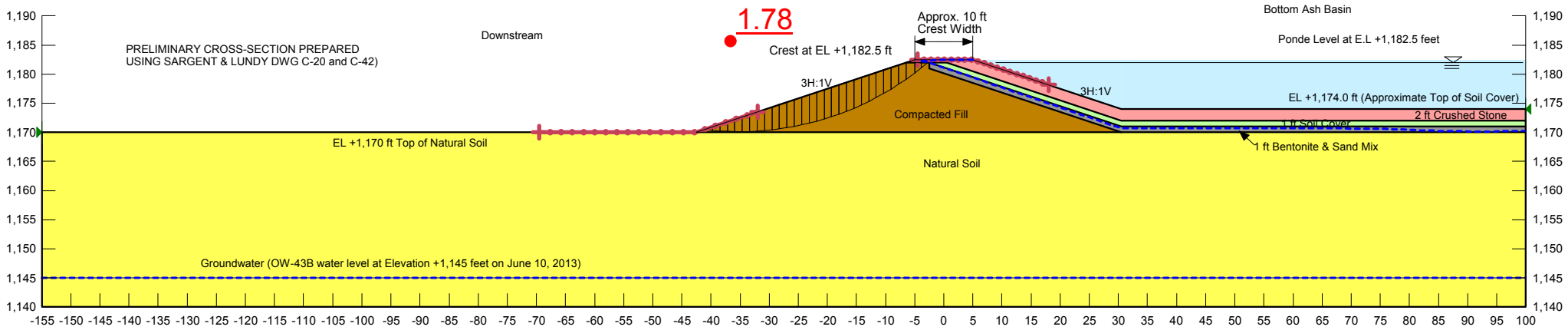
Name: Bentonite and Sand Mix Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 22 ° Phi-B: 0 °
Name: Soil Cover Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 ° Phi-B: 0 °
Name: Crushed Stone Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 0 psf Phi': 32 ° Phi-B: 0 °



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Wisconsin Public Service Corp
Weston Generating Station Unit 4

Slope Stability Analysis : Maximum Pool Operating Conditions

TSA

Name: Natural Soil Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 30 ° Phi-B: 0 °
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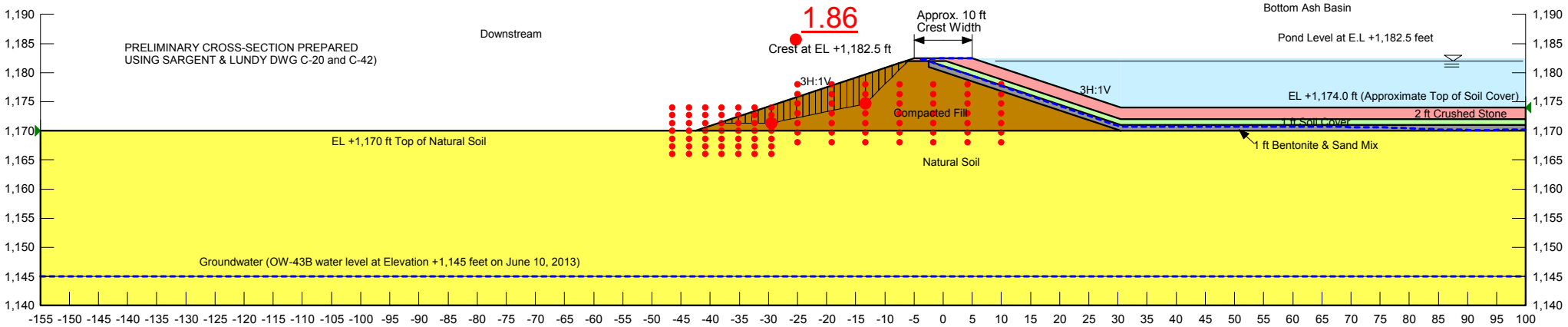
Name: Bentonite and Sand Mix Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 1,000 psf Phi': 0 ° Phi-B: 0 °
Name: Soil Cover Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 ° Phi-B: 0 °
Name: Crushed Stone Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 0 psf Phi': 32 ° Phi-B: 0 °



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Wisconsin Public Service Corp
Weston Generating Station Unit 4

Slope Stability Analysis : Maximum Pool Operating Conditions

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Name: Natural Soil Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 30 ° Phi-B: 0 °
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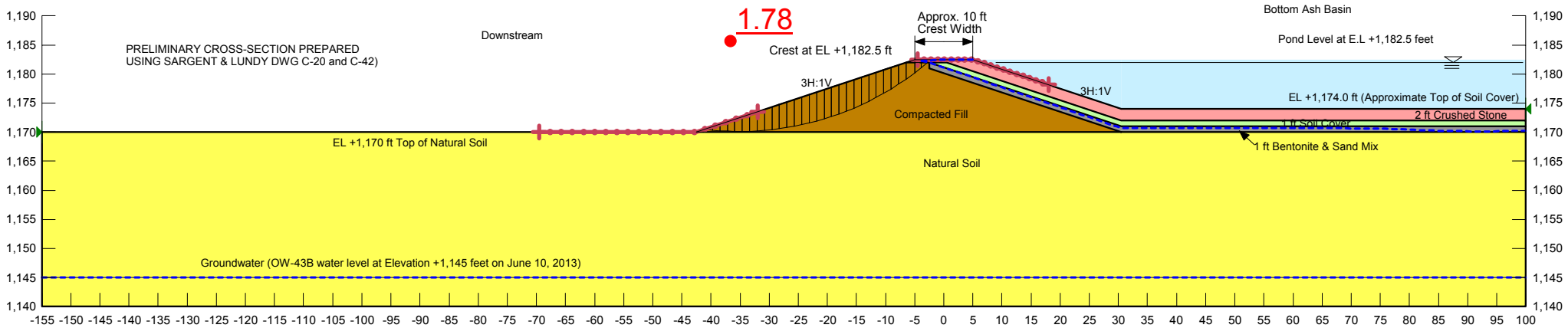
Name: Bentonite and Sand Mix Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 1,000 psf Phi': 0 ° Phi-B: 0 °
Name: Soil Cover Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 ° Phi-B: 0 °
Name: Crushed Stone Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 0 psf Phi': 32 ° Phi-B: 0 °



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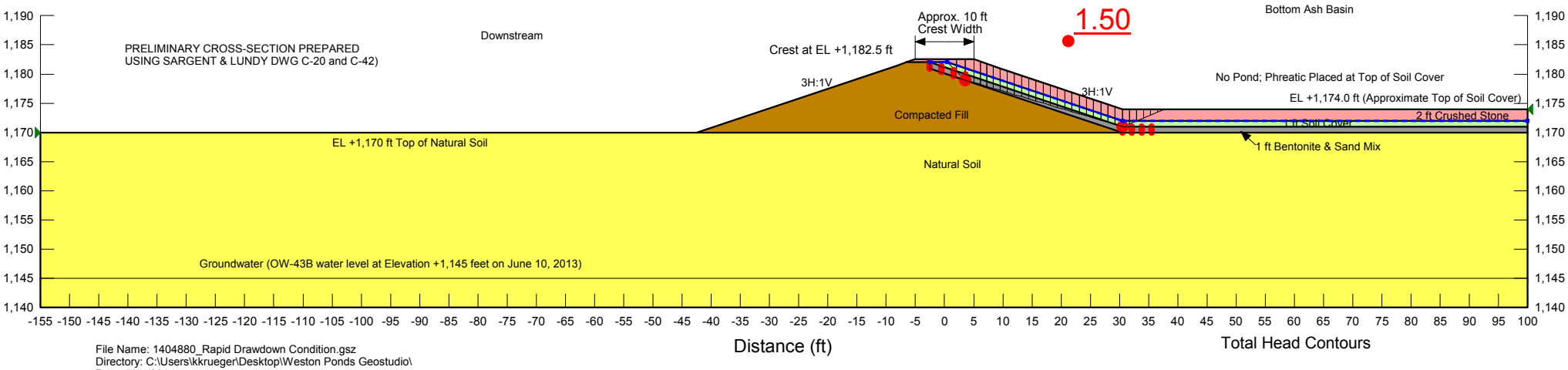
Wisconsin Public Service Corp
Weston Generating Station Unit 4

Slope Stability Analysis : Drawdown

ESA

Name: Natural Soil Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 30 ° Phi-B: 0 ° Piezometric Line: 1
Name: Compacted Fill Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 ° Phi-B: 0 ° Piezometric Line: 1
Name: Bentonite and Sand Mix Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 22 ° Phi-B: 0 ° Piezometric Line: 1
Name: Soil Cover Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 ° Phi-B: 0 ° Piezometric Line: 1
Name: Crushed Stone Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 0 psf Phi': 32 ° Phi-B: 0 ° Piezometric Line: 1



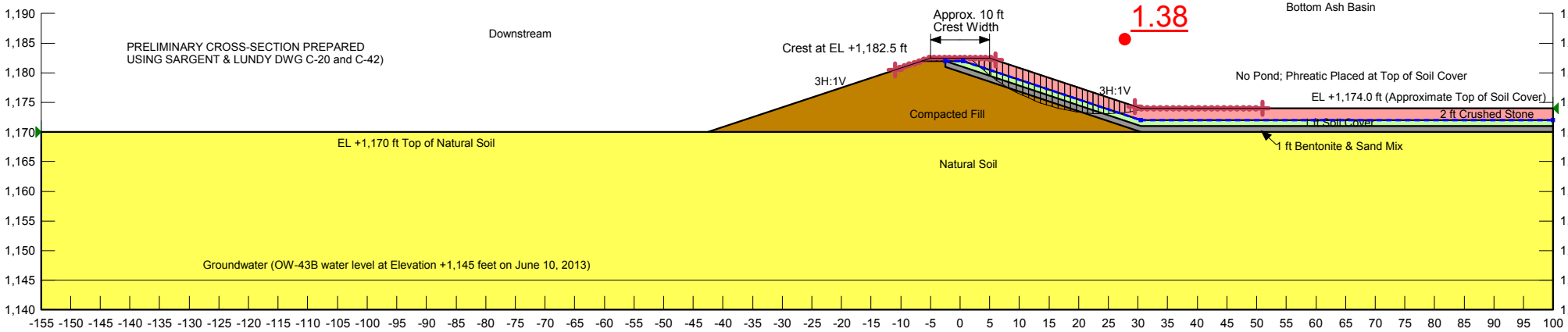
File Name: 1404880_Rapid Drawdown Condition.gsz
Directory: C:\Users\kkrueger\Desktop\Weston Ponds Geostudio\
Date: 5/14/2014

Wisconsin Public Service Corp
Weston Generating Station Unit 4

Slope Stability Analysis : Drawdown

ESA

Name: Natural Soil Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 30 ° Phi-B: 0 ° Piezometric Line: 1
Name: Compacted Fill Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 ° Phi-B: 0 ° Piezometric Line: 1
Name: Bentonite and Sand Mix Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 22 ° Phi-B: 0 ° Piezometric Line: 1
Name: Soil Cover Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 ° Phi-B: 0 ° Piezometric Line: 1
Name: Crushed Stone Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 0 psf Phi': 32 ° Phi-B: 0 ° Piezometric Line: 1



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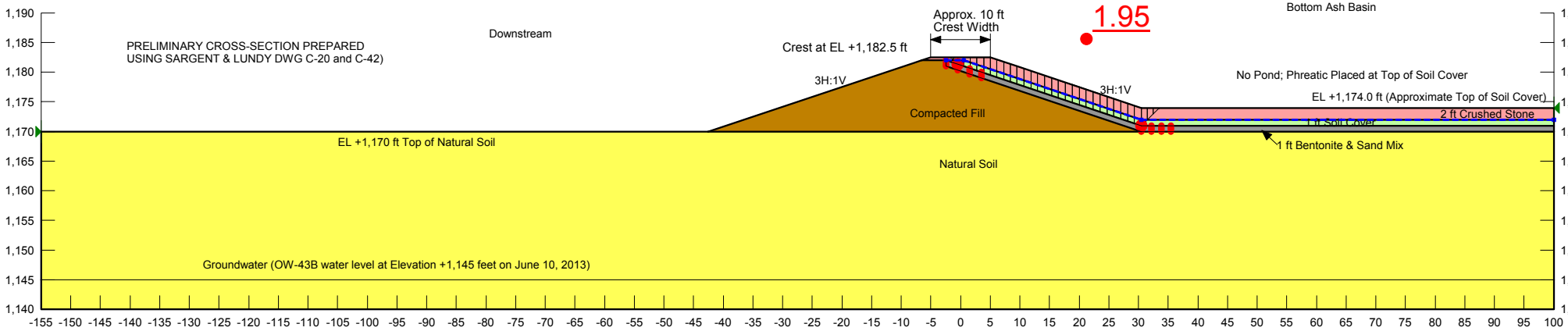
Wisconsin Public Service Corp
Weston Generating Station Unit 4

Slope Stability Analysis : Drawdown

TSA

Name: Natural Soil Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 30 ° Phi-B: 0 ° Piezometric Line: 1
Name: Compacted Fill Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 ° Phi-B: 0 ° Piezometric Line: 1
Name: Bentonite and Sand Mix Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 1,000 psf Phi': 0 ° Phi-B: 0 ° Piezometric Line: 1
Name: Soil Cover Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 ° Phi-B: 0 ° Piezometric Line: 1
Name: Crushed Stone Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 0 psf Phi': 32 ° Phi-B: 0 ° Piezometric Line: 1



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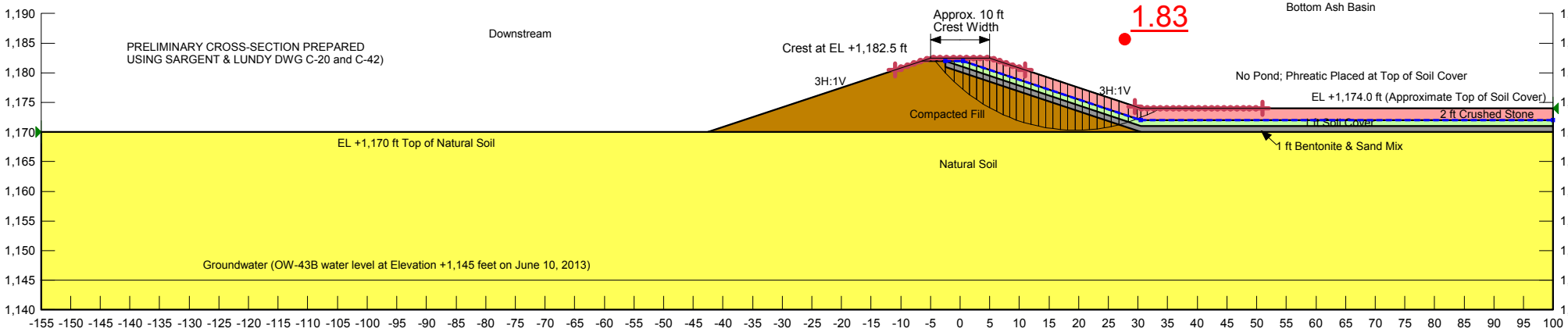
Wisconsin Public Service Corp
Weston Generating Station Unit 4

Slope Stability Analysis : Drawdown

TSA

Name: Natural Soil Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 30 ° Phi-B: 0 ° Piezometric Line: 1
Name: Compacted Fill Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 ° Phi-B: 0 ° Piezometric Line: 1
Name: Bentonite and Sand Mix Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 1,000 psf Phi': 0 ° Phi-B: 0 ° Piezometric Line: 1
Name: Soil Cover Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 ° Phi-B: 0 ° Piezometric Line: 1
Name: Crushed Stone Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 0 psf Phi': 32 ° Phi-B: 0 ° Piezometric Line: 1



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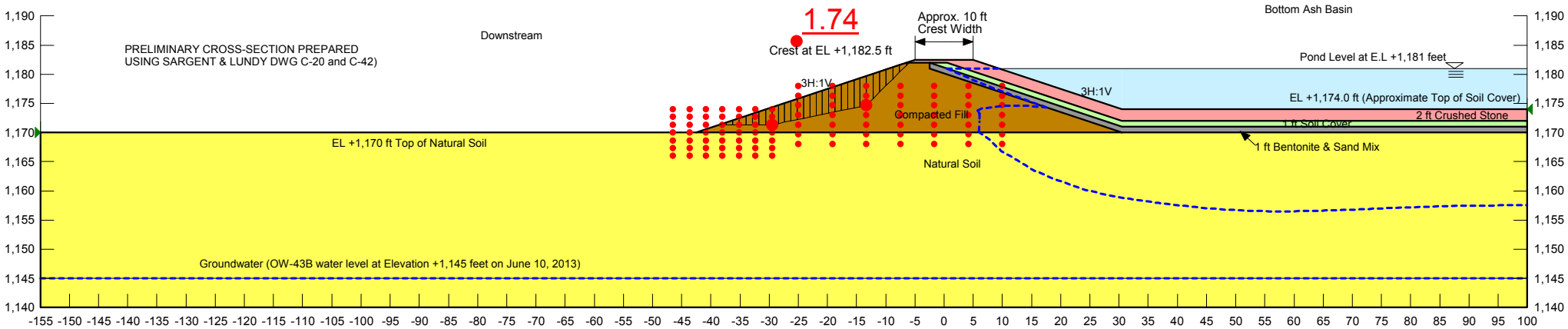
Wisconsin Public Service Corp
Weston Generating Station Unit 4

Slope Stability Analysis : Normal Operating Conditions - Seismic Loading 0.02g

ESA

Name: Natural Soil Unit Weight: 120 pcf Cohesion': 0 psf Phi': 30 °
Name: Compacted Fill Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 °
Name: Bentonite and Sand Mix Unit Weight: 130 pcf Cohesion': 0 psf Phi': 22 °
Name: Soil Cover Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 °
Name: Crushed Stone Unit Weight: 110 pcf Cohesion': 0 psf Phi': 32 °



File Name: 1404880_Normal Operating Condition_seismic condition.gsz
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Wisconsin Public Service Corp
Weston Generating Station Unit 4

Slope Stability Analysis : Normal Operating Conditions - Seismic Loading 0.02g

ESA

Name: Natural Soil Unit Weight: 120 pcf Cohesion': 0 psf Phi': 30 °
Name: Compacted Fill Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 °
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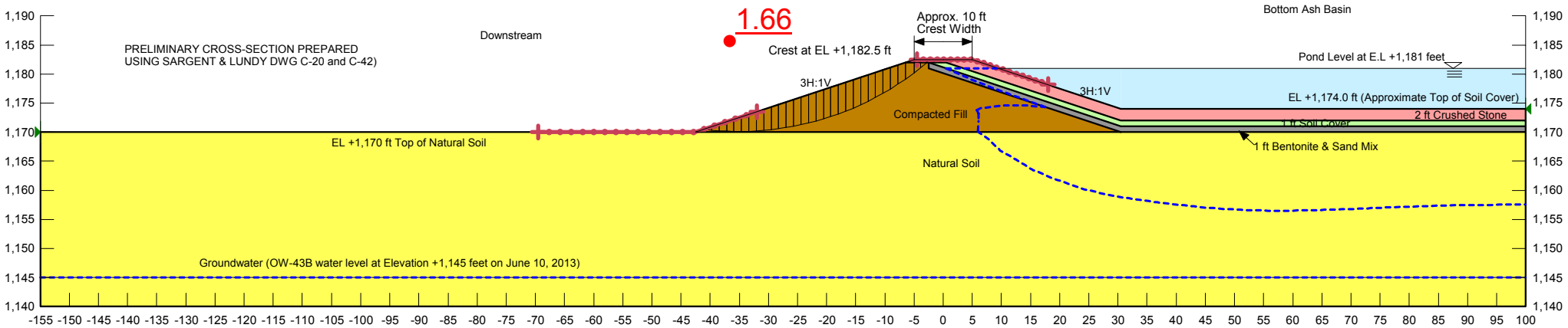
Name: Crushed Stone Unit Weight: 110 pcf Cohesion': 0 psf Phi': 32 °



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Wisconsin Public Service Corp
Weston Generating Station Unit 4

Slope Stability Analysis : Normal Operating Conditions - Seismic Loading 0.02g

TSA

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Name: Soil Cover Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 °
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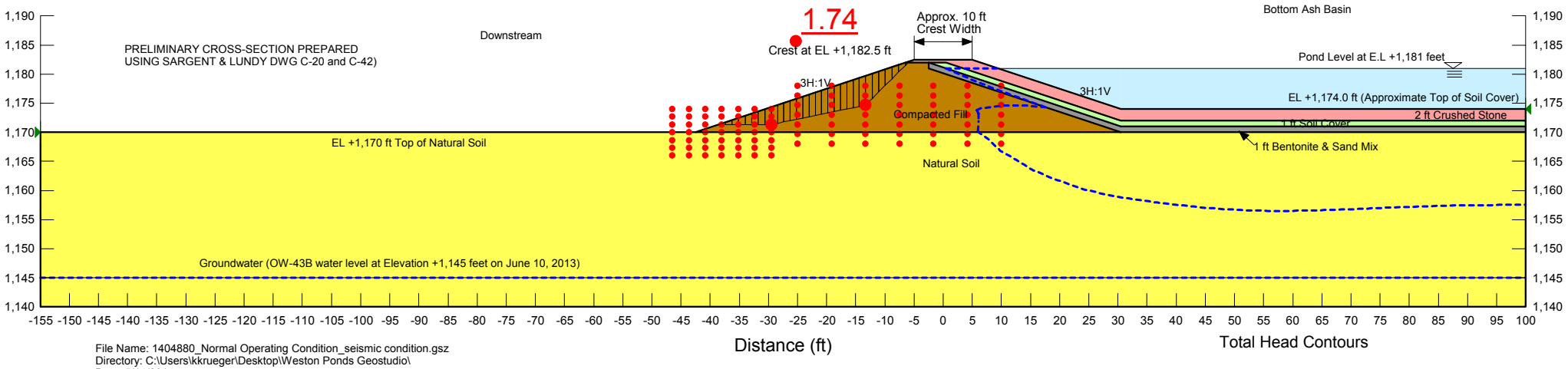

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Wisconsin Public Service Corp
Weston Generating Station Unit 4

Slope Stability Analysis : Normal Operating Conditions - Seismic Loading 0.02g

TSA

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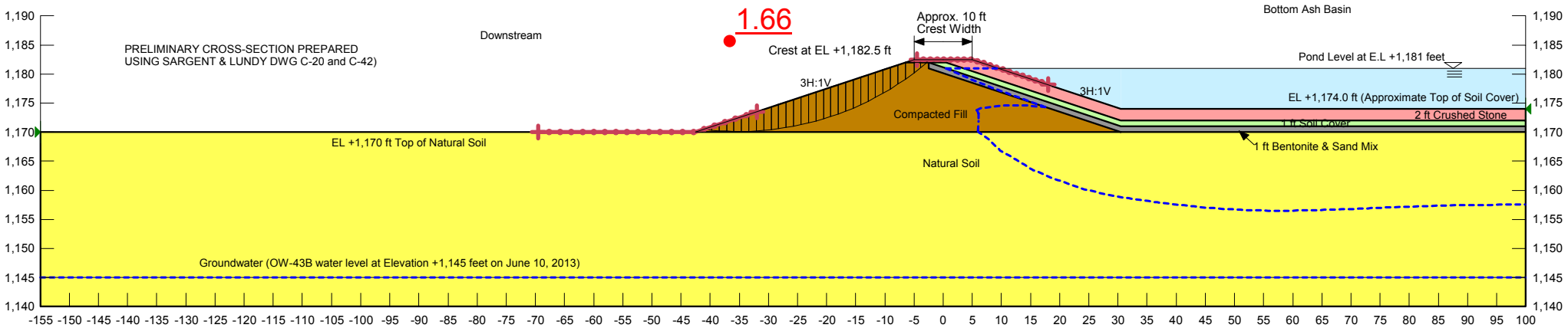

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