CCR COMPLIANCE

FLY ASH BASIN AND BOTTOM ASH BASIN STRUCTURAL INTEGRITY ASSESSMENT REPORT

Prepared for:

Louisiana Generating LLC, a subsidiary of NRG
Big Cajun II
10431 Cajun II Road
New Roads, LA 70760

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List of Acronyms

CB&I	CB&I Environmental and Infrastructure, Inc.
BC II	Big Cajun II Plant
CCR	Coal Combustion Residuals
cm/sec	centimeters per second
EAP	Emergency Action Plan
EPA	U.S. Environmental Protection Agency
FOS	Factor of Safety
LAC	Louisiana Administrative Code
LaGen	Louisiana Generating, LLC
LDEQ	Louisiana Department of Environmental Quality
LPDES	Louisiana Pollutant Discharge Elimination System
MSL	Mean Sea Level
NRG	NRG Energy, Inc.
RCRA	Resource Conservation and Recovery Act
SWMU	Solid Waste Management Units
USGS	U.S. Geological Survey
yd^3	cubic yards

Structural Integrity Assessment Report/Amendment Log §257.73

Date of Review	Reviewer Name	Amendment Required (YES/NO)	Sections Amended and Reason

CCR Regulatory Requirements

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(a)(1) stipulates: *No later than, December 17, 2015, the owner or operator of the CCR unit must place on or immediately adjacent to the CCR unit a permanent identification marker, at least six feet high showing the identification number of the CCR unit, if one has been assigned by the state, the name associated with the CCR unit and the name of the owner or operator of the CCR unit.*	Section 4.1.1
§257.73(a)(2)(i)stipulates: *(i) The owner or operator of the CCR unit must conduct initial and periodic hazard potential classification assessments of the CCR unit according to the timeframes specified in paragraph (f) of this section. The owner or operator must document the hazard potential classification of each CCR unit as either a high hazard potential CCR surface impoundment, a significant hazard potential CCR surface impoundment, or a low hazard potential CCR surface impoundment. The owner or operator must also document the basis for each hazard potential classification.*	Section 4.1.2

USEPA CCR Criteria **40 CFR 257.73**	**NRG Big Cajun II Power Plant** **Structural Integrity Review**
§257.73(a)(2)(ii)stipulates: *(ii) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial hazard potential classification and each subsequent periodic classification specified in paragraph (a)(2)(i) of this section was conducted in accordance with the requirements of this section.*	Section 4.1.2

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(a)(2)(iii) & (iv) stipulates: *(iii) Changes in hazard potential classification.* *(A) If the owner or operator of a CCR unit determines during a periodic hazard potential assessment that the CCR unit is no longer classified as either a high hazard potential CCR surface impoundment or a significant hazard potential CCR surface impoundment, then the owner or operator of the CCR unit is no longer subject to the requirement to prepare and maintain a written Emergency Action Plan (EAP) beginning on the date the periodic hazard potential assessment documentation is placed in the facility's operating record as required by § 257.105(f)(5).* *(B) If the owner or operator of a CCR unit classified as a low hazard potential CCR surface impoundment subsequently determines that the CCR unit is properly re-classified as either a high hazard potential CCR surface impoundment or a significant hazard potential CCR surface impoundment, then the owner or operator of the CCR unit must prepare a written EAP for the CCR unit as required by paragraph (a)(3)(i) of this section within six months of completing such periodic hazard potential assessment.* *(iv) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the written EAP, and any subsequent amendment of the EAP, meets the requirements of paragraph (a)(3) of this section.*	Sections 4.1.2 and 4.1.3

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(a)(2)(v) stipulates: *(v) Activation of the EAP. The EAP must be implemented once events or circumstances involving the CCR unit that represent a safety emergency are detected, including conditions identified during periodic structural stability assessments, annual inspections, and inspections by a qualified person.*	Section 4.1.3

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(a)(4)(c) stipulates: *(4) The CCR unit and surrounding areas must be designed, constructed, operated, and maintained with vegetated slopes of dikes not to exceed a height of 6 inches above the slope of the dike, except for slopes which are protected with an alternate form(s) of slope protection.* *(c)(1) No later than October 17, 2016, the owner or operator of the CCR unit must compile a history of construction, which shall contain, to the extent feasible, the information specified in* *(i) The name and address of the person(s) owning or operating the CCR unit; the name associated with the CCR unit; and the identification number of the CCR unit if one has been assigned by the state.* *(ii) The location of the CCR unit identified on the most recent U.S. Geological Survey (USGS) 71⁄2 minute or 15 minute topographic quadrangle map, or a topographic map of equivalent scale if a USGS map is not available.* *(iii) A statement of the purpose for which the CCR unit is being used.* *(iv) The name and size in acres of the watershed within which the CCR unit is located.* *(v) A description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is constructed.*	Sections 4.1.4 and 4.1.5

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(a)(4)(c) stipulates: *(vi) A statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR unit; the method of site preparation and construction of each zone of the CCR unit; and the approximate dates of construction of each successive stage of construction of the CCR unit.* *(vii) At a scale that details engineering structures and appurtenances relevant to the design, construction, operation, and maintenance of the CCR unit, detailed dimensional drawings of the CCR unit, including a plan view and cross sections of the length and width of the CCR unit, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection, in addition to the normal operating pool surface elevation and the maximum pool surface elevation following peak discharge from the inflow design flood, the expected maximum depth of CCR within the CCR surface impoundment, and any identifiable natural or manmade features that could adversely affect operation of the CCR unit due to malfunction or mis-operation.* *(viii) A description of the type, purpose, and location of existing instrumentation.* *(ix) Area-capacity curves for the CCR unit.* *(x) A description of each spillway and diversion design features and capacities and calculations used in their determination.* *(xi) The construction specifications and provisions for surveillance, maintenance, and repair of the CCR unit.*	Section 4.1.5

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(a)(4)(c) stipulates: *(xii) Any record or knowledge of structural instability of the CCR unit.*	Section 4.1.5

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(d)(1) stipulates: *(d) Periodic structural stability assessments. (1) The owner or operator of the CCR unit must conduct initial and periodic structural stability assessments and document whether the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein. The assessment must, at a minimum, document whether the CCR unit has been designed, constructed, operated, and maintained with:* *(i) Stable foundations and abutments;* *(ii) Adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown;* *(iii) Dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit;* *(iv) Vegetated slopes of dikes and surrounding areas not to exceed a height of six inches above the slope of the dike, except for slopes which have an alternate form or forms of slope protection;* *(v) A single spillway or a combination of spillways configured as specified in paragraph (d)(1)(v)(A) of this section. The combined capacity of all spillways must be designed, constructed, operated, and maintained to adequately manage flow during and following the peak discharge from the event specified in paragraph (d)(1)(v)(B) of this section;*	Section 4.1.6

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(d)(1) stipulates: *(A) All spillways must be either:* *(1) Of non-erodible construction and designed to carry sustained flows; or* *(2) Earth- or grass-lined and designed to carry short-term, infrequent flows at non-erosive velocities where sustained flows are not expected.* *(B) The combined capacity of all spillways must adequately manage flow during and following the peak discharge from a:* *(1) Probable maximum flood (PMF) for a high hazard potential CCR surface impoundment; or* *(2) 1000-year flood for a significant hazard potential CCR surface impoundment; or* *(3) 100-year flood for a low hazard potential CCR surface impoundment.* §257.73(d) stipulates: *(vi) Hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit that maintain structural integrity and are free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure; and* *(vii) For CCR units with downstream slopes which can be inundated by the pool of an adjacent water body, such as a river, stream or lake, downstream slopes that maintain structural stability during low pool of the adjacent water body or sudden drawdown of the adjacent water body.*	Section 4.1.6

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(d)(2) & (3) stipulate: *(2) The periodic assessment described in paragraph (d)(1) of this section must identify any structural stability deficiencies associated with the CCR unit in addition to recommending corrective measures. If a deficiency or a release is identified during the periodic assessment, the owner or operator unit must remedy the deficiency or release as soon as feasible and prepare documentation detailing the corrective measures taken.* *(3) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial assessment and each subsequent periodic assessment was conducted in accordance with the requirements of this section.*	Section 4.1.6

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(e)(1) stipulates: *(e) Periodic safety factor assessments. (1) The owner or operator must conduct an initial and periodic safety factor assessments for each CCR unit and document whether the calculated factors of safety for each CCR unit achieve the minimum safety factors specified in paragraphs (e)(1)(i) through (iv) of this section for the critical cross section of the embankment. The critical cross section is the cross section anticipated to be the most susceptible of all cross sections to structural failure based on appropriate engineering considerations, including loading conditions. The safety factor assessments must be supported by appropriate engineering calculations* *(i) The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.* *(ii) The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.* *(iii) The calculated seismic factor of safety must equal or exceed 1.00.* *(iv) For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.*	Section 4.1.7

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(e)(2) stipulates: *(2) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial assessment and each subsequent periodic assessment specified in paragraph (e)(1) of this section meets the requirements of this section.*	Section 4.1.6
§257.73(f)(1) stipulates: *(f) Timeframes for periodic assessments—(1) Initial assessments. Except as provided by paragraph (f)(2) of this section, the owner or operator of the CCR unit must complete the initial assessments required by paragraphs (a)(2), (d), and (e) of this section no later than October 17, 2016. The owner or operator has completed an initial assessment when the owner or operator has placed the assessment required by paragraphs (a)(2), (d), and (e) of this section in the facility's operating record as required by § 257.105(f)(5), (10), and (12).* *(3) Frequency for conducting periodic assessments. The owner or operator of the CCR unit must conduct and complete the assessments required by paragraphs (a)(2), (d), and (e) of this section every five years. The date of completing the initial assessment is the basis for establishing the deadline to complete the first subsequent assessment. The owner or operator has completed an assessment when the relevant assessment(s) required by paragraphs (a)(2), (d), and (e) of this section has been placed in the facility's operating record as required by § 257.105(f)(5), (10), and (12).*	Sections 4.1.2, 4.1.6, 4.1.7, and 5.0

USEPA CCR Criteria **40 CFR 257.73**	**NRG Big Cajun II Power Plant** **Structural Integrity Review**
§257.73(f)(4) stipulates: *(4) Closure of the CCR unit. An owner or operator of a CCR unit who either fails to complete a timely safety factor assessment or fails to demonstrate minimum safety factors as required by paragraph (e) of this section is subject to the requirements of §257.101(b)(2).*	Section 4.1.7
§257.73(g) stipulates: *(g) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(f), the notification requirements specified in §257.106(f), and the internet requirements specified in § 257.107(f).*	Section 5.0

1.0 *INTRODUCTION*

CB&I Environmental and Infrastructure, Inc. (CB&I) has prepared the following Structural Integrity Assessment documentation at the request of Louisiana Generating, LLC (LaGen) (a subsidiary of NRG Energy, Inc. [NRG]) for the Fly Ash Basin and Bottom Ash Basin (Ash Basins) at the Big Cajun II Power Plant (BC II Plant) located near New Roads, Pointe Coupee Parish, Louisiana (**Figure 1**). The BC II Plant is a coal-fired and natural gas-fired power plant that has been in operation since 1980. The Fly Ash Basin and Bottom Ash Basin have been deemed to be regulated coal combustion residual (CCR) units by the U. S. Environmental Protection Agency (EPA), through the Disposal of Coal Combustion Residuals from Electric Utilities Final Rule (CCR Rule) 40 CFR §257 and §261.

There are five solid waste management units (SWMUs) at the BC II Plant that are operated as industrial surface impoundments in accordance with the Louisiana Department of Environmental Quality (LDEQ), Louisiana Solid Waste Regulations (Louisiana Administrative Code [LAC] Title 33: part VII) under Permit Number P-0108R1 for Facility Identification Number GD-077-0583. Two of the five WMUs are required to comply with the requirements of the CCR Rule, which include the Fly Ash Basin and Bottom Ash Basin. The other three LDEQ-permitted surface impoundments at the BC II Plant that are not subject to the CCR Rule requirements include the Primary Louisiana Pollutant Discharge Elimination System (LPDES) Treatment Pond, Secondary LPDES Treatment Pond, and Rainfall Surge Pond (**Figure 2**).

LaGen has completed an initial structural integrity assessment of the Fly Ash Basin and Bottom Ash Basin in line with the requirements outlined in §257.73 for Structural Integrity Criteria for Existing CCR Surface Impoundments. This assessment document is presented to provide supporting documentation of the evaluation of the structural stability for the Fly Ash Basin and Bottom Ash Basin at LaGen's BC II Plant. The following Plan meets all the structural integrity assessment requirements outlined in the Rule, which are further described in Section 2.0.

2.0 *REGULATORY OVERVIEW OF CCR STRUCTURAL INTEGRITY REQUIREMENTS*

On April 17, 2015, the EPA published the CCR Rule under Subtitle D of the Resource Conservation and Recovery Act (RCRA) as 40 CFR Parts 257 and 261. The purpose of the CCR Rule is to regulate the management of coal combustion residuals in regulated units for landfill and surface impoundments. Section 257.73 of the CCR Rule requires owners or operators of CCR units to meet and document specific requirements related to the structural integrity criteria for existing CCR surface impoundments, including providing the following:

- Permanent identification marker for each CCR unit
- A summary of the history of construction for each CCR unit
- Initial and periodic assessments to determine the CCR unit hazard potential classification
- Initial and periodic CCR Unit structural stability assessments
- Initial and periodic CCR unit safety factor assessments

The following citations from the Rule are applicable for the Ash Basins as discussed in this document:

§257.73(a)(1) stipulates:

(1) No later than December 17, 2015, the owner or operator of the CCR unit must place on or immediately adjacent to the CCR unit a permanent identification marker, at least six feet high showing the identification number of the CCR unit, if one has been assigned by the state, the name associated with the CCR unit and the name of the owner or operator of the CCR unit.

§257.73(a)(2)(i) through (v) stipulate:

(2) Periodic hazard potential classification assessments.

(i) The owner or operator of the CCR unit must conduct initial and periodic hazard potential classification assessments of the CCR unit according to the timeframes specified in paragraph (f) of this section. The owner or operator must document the hazard potential classification of each CCR unit as either a high hazard potential CCR surface impoundment, a significant hazard potential CCR surface impoundment, or a low hazard potential CCR surface impoundment. The owner or operator must also document the basis for each hazard potential classification.

(ii) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial hazard potential classification and each subsequent periodic classification specified in paragraph (a)(2)(i) of this section was conducted in accordance with the requirements of this section.

(iii) Changes in hazard potential classification.

(A) If the owner or operator of a CCR unit determines during a periodic hazard potential assessment that the CCR unit is no longer classified as either a high hazard potential CCR surface impoundment or a significant hazard potential CCR surface impoundment, then the owner or operator of the CCR unit is no longer subject to the requirement to prepare and maintain a written Emergency Action Plan (EAP) beginning on the date the periodic hazard potential assessment documentation is placed in the facility's operating record as required by §257.105(f)(5).

(B) If the owner or operator of a CCR unit classified as a low hazard potential CCR surface impoundment subsequently determines that the CCR unit is properly re-classified as either a high hazard potential CCR surface impoundment or a significant hazard potential CCR surface impoundment, then the owner or operator of the CCR unit must prepare a written EAP for the CCR unit as required by paragraph (a)(3)(i) of this section within six months of completing such periodic hazard potential assessment.

(iv) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the written EAP, and any subsequent amendment of the EAP, meets the requirements of paragraph (a)(3) of this section.

(v) Activation of the EAP. The EAP must be implemented once events or circumstances involving the CCR unit that represent a safety emergency are detected, including conditions identified during periodic structural stability assessments, annual inspections, and inspections by a qualified person.

§257.73(a)(4)(c)(i) through (xii) stipulates:

(4) The CCR unit and surrounding areas must be designed, constructed, operated, and maintained with vegetated slopes of dikes not to exceed a height of 6 inches above the slope of the dike, except for slopes which are protected with an alternate form(s) of slope protection.

(c)(1) No later than October 17, 2016, the owner or operator of the CCR unit must compile a history of construction, which shall contain, to the extent feasible, the information specified below:

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

(ii) The location of the CCR unit identified on the most recent U.S. Geological Survey (USGS) 7 1⁄2 minute or 15 minute topographic quadrangle map, or a topographic map of equivalent scale if a USGS map is not available.

(iii) A statement of the purpose for which the CCR unit is being used.

(iv) The name and size in acres of the watershed within which the CCR unit is located.

(v) A description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is constructed.

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

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

(viii) A description of the type, purpose, and location of existing instrumentation.

(ix) Area-capacity curves for the CCR unit.

(x) A description of each spillway and diversion design features and capacities and calculations used in their determination.

(xi) The construction specifications and provisions for surveillance, maintenance, and repair of the CCR unit.

(xii) Any record or knowledge of structural instability of the CCR unit.

§257.73(d)(1)(i) through (vii) stipulates:

(d) Periodic structural stability assessments.

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

(i) Stable foundations and abutments;

(ii) Adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown;

(iii) Dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit;

(iv) Vegetated slopes of dikes and surrounding areas not to exceed a height of six inches above the slope of the dike, except for slopes which have an alternate form or forms of slope protection;

(v) A single spillway or a combination of spillways configured as specified in paragraph (d)(1)(v)(A) of this section. The combined capacity of all spillways must be designed, constructed, operated, and maintained to adequately manage flow during and following the peak discharge from the event specified in paragraph (d)(1)(v)(B) of this section;

(A) All spillways must be either:

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

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

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

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

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

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

(vi) Hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit that maintain structural integrity and are free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure; and

(vii) For CCR units with downstream slopes which can be inundated by the pool of an adjacent water body, such as a river, stream or lake, downstream slopes that maintain structural stability during low pool of the adjacent water body or sudden drawdown of the adjacent water body.

§257.73(d)(2) & (3) stipulate:

(2) The periodic assessment described in paragraph (d)(1) of this section must identify any structural stability deficiencies associated with the CCR unit in addition to recommending corrective measures. If a deficiency or a release is identified during the periodic assessment, the owner or operator unit must remedy the deficiency or release as soon as feasible and prepare documentation detailing the corrective measures taken.

(3) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial assessment and each subsequent periodic assessment was conducted in accordance with the requirements of this section.

§257.73(e)(1)(i) through (iv) stipulates:

(e) Periodic safety factor assessments.

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

(i) The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.

(ii) The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.

(iii) The calculated seismic factor of safety must equal or exceed 1.00.

(iv) For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

§257.73(e)(2) stipulates:

(2) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial assessment and each subsequent periodic assessment specified in paragraph (e)(1) of this section meets the requirements of this section.

§257.73(f)(1) stipulates:

(f) Timeframes for periodic assessments

(1) Initial assessments. Except as provided by paragraph (f)(2) of this section, the owner or operator of the CCR unit must complete the initial assessments required by paragraphs (a)(2), (d), and (e) of this section no later than October 17, 2016. The owner or operator has completed an initial assessment when the owner or operator has placed the assessment required by paragraphs (a)(2), (d), and (e) of this section in the facility's operating record as required by § 257.105(f)(5), (10), and (12).

§257.73(f)(3) stipulates:

(3) Frequency for conducting periodic assessments. The owner or operator of the CCR unit must conduct and complete the assessments required by paragraphs (a)(2), (d), and (e) of this section every five years. The date of completing the initial assessment is the basis for establishing the deadline to complete the first subsequent assessment. The owner or operator has completed an assessment when the relevant assessment(s) required by paragraphs (a)(2), (d), and (e) of this section has been placed in the facility's operating record as required by § 257.105(f)(5), (10), and (12).

§257.73(f)(4) stipulates:

(4) Closure of the CCR unit. An owner or operator of a CCR unit who either fails to complete a timely safety factor assessment or fails to demonstrate minimum safety factors as required by paragraph (e) of this section is subject to the requirements of § 257.101(b)(2).

§257.73(g) stipulates:

(g) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(f), the notification requirements specified in § 257.106(f), and the internet requirements specified in § 257.107(f).

3.0 *ASH BASINS OVERVIEW*

Pertinent site information and history related to the installation and operation of the Ash Basins are presented below to address the requirement of the documentation of the history of the CCR units and to provide context for the CCR Rule structural integrity documentation that follows.

3.1 Location, Topography, and Character

The LaGen BC II Plant is located at 10431 Cajun II Road, New Roads, Pointe Coupee Parish, Louisiana. The BC II Plant is situated in Sections 4, 5, and 37 in Township 4 South and Range 11 East. The Fly Ash Basin is located on the southwest end of the surface impoundments west of the BC II Plant and is bordered on the east by the Bottom Ash Basin; on the west by wooded property, a drainage ditch, and agricultural land; on the north by wooded property and agricultural land; and on the south by wooded property and grassy fields. The Fly Ash Basin and surrounding area are shown on **Figures 1 and 2**. The Bottom Ash Basin is located west of the BC II Plant. The Bottom Ash Basin is bordered on the west by the Fly Ash Basin; on the north by wooded property and agricultural land; on the east by the Treatment Ponds; and on the south by wooded property and grassy fields (**Figures 1 and 2**).

The Fly Ash Basin currently being filled has an area of approximately 175 acres. It was constructed above natural grade with a base of approximately 30 feet Mean Sea Level (MSL) and a surrounding berm with a design crest of 40-foot MSL. The existing site topography adjacent to the Fly Ash Basin is depicted on **Figure 3**. The Fly Ash Basin has an approximate capacity of 1,750 acre-feet with a permitted total ash storage capacity of 3,905,000 cubic yards [yd^3]). The soils underlying the Fly Ash Basin consist of naturally occurring and/or recompacted clayey soil that is a minimum of 3 feet thick to over 10 feet thick in some areas.

The Bottom Ash Basin currently being filled has an area of approximately 66 acres. It was constructed above natural grade with a base of approximately 30 feet MSL and a surrounding berm with a design crest of 48-foot MSL. The existing site topography adjacent to the Bottom Ash Basin is depicted on **Figure 3**. The Bottom Ash Basin has an approximate capacity of 1,188 acre-feet with a permitted total ash storage capacity of 2,585,000 yd^3. Similar to the Fly Ash Basin, the soils underlying the Bottom Ash Basin consist of naturally occurring and/or recompacted clayey soil that is a minimum of 3 feet thick to over 10 feet thick in some areas.

3.2 Existing Regulatory Permits

The Ash Basins have been granted and are currently operating under a LDEQ Solid Waste Permit as an industrial surface impoundment in accordance with the Louisiana Solid Waste

Regulations (LAC 33:VII) under Permit Number P-0108R1 and Facility Identification Number GD-077-0583. The Solid Waste Permit renewal was issued by the LDEQ on February 24, 2011 and allows CCR materials generated on-site at the LaGen BC II Plant to be properly disposed of within the boundaries of the Ash Basins.

3.3 Ash Generation, Recycling, and Disposal

Fly ash and bottom ash have been generated at the BC II Plant since they were constructed and became operational in 1980. Fly ash is generated from the burning of finely pulverized coal in high efficiency boilers. The fly ash is composed primarily of oxides of silicon, aluminum, calcium, sulfur, and iron and is typically a fine, spherical particle ranging in diameter from 0.5 to 100 microns, which can be used as a soil or aggregate stabilization agent.

Fly ash that is generated at the BC II Plant has historically been recycled (sold for beneficial reuse as a cement additive, for road base, and/or for soil stabilization applications) and/or transported to the Fly Ash Basin for disposal. Recycled fly ash rates depend on the market demand and can affect the life of the basin due to the variability in the amount of recycled material. Disposal rates therefore vary based on recycling opportunities, which vary between years. When the demand for ash exceeds production, the fly ash in the basin can be removed and sold.

Bottom ash is generated concurrently with fly ash during the combustion of coal in the boilers when particles of ash fuse together. These fused particles become too large to remain entrained in the rising flue gas and fall to the bottom of the boiler. Particles of bottom ash vary in diameter but approximate the size of coarse sand. Due to their similar origins, bottom ash and fly ash have the same approximate chemical makeup. The Bottom Ash Basin receives bottom ash from Units 1 and 3, as well as sediment from the clarifier beds associated with the cooling towers and boilers. Unit 2 is currently a gas-fired unit; therefore, ash is no longer generated by this unit. The clarifier sediments are piped to the southeast corner of the Bottom Ash Basin. The clarifier sediments are produced when water from the Mississippi River is clarified and softened for use as cooling water or boiler water. These sediments consist primarily of Mississippi River water naturally occurring silts and clays. They also contain some lime, sodium aluminate, and trace amounts of a water treatment polymer. The filling of the basin started along the south levee and proceeded northward.

3.4 Ash Basin Operations

3.4.1 Fly Ash Basin

Fly ash that is placed in the Fly Ash Basin for disposal is collected, stored in a silo, and transported by truck in dry powdered form to the Fly Ash Basin. Currently transport trucks discharge their loads of fly ash in the Fly Ash Basin and dozer equipment then spreads the fill evenly. The fly ash is hydrated by rainfall and compacted so that it will harden as it dries. Straight hardened fly ash has a theoretical hydraulic conductivity range of 10^{-6} centimeters per second (cm/sec) to 10^{-7} cm/sec. Periodic dozing of the fly ash material occurs as needed, within the active area to maintain a relatively uniform height.

Daily cover is not applied in the active area of fly ash disposal due to the fly ash being wetted (by rainfall) and hardened, and thereby minimizing potential dust generation. Additionally, no intermediate cover is applied to the basin due to the rapid hardening of the fly ash. Weekly (7-day) inspections and annual reporting are undertaken for the Fly Ash Basin in line with site inspection requirements for CCR units (§257.83[b] Inspection Requirements for CCR Surface Impoundments) to identify any stability, operational, and/or safety issues which require attention.

During the 2015 annual inspection of the Fly Ash Basin, observations indicated the water level inside the basin was approximately 5 feet below the crest of the levee and approximately two-thirds of the Fly Ash Basin was covered with open water. Rainfall runoff is removed from the basin by a stormwater runoff collection system. Flood control is managed in accordance with the CCR Rule Inflow Design Flood Control System Plan for the site.

Under current operations, the Fly Ash Basin surface water runoff is directed by an interior drainage swale to a pipe connection into the Bottom Ash Basin. The Bottom Ash Basin process water and surface water, combined with storm water from the Fly Ash Basin, are directed by an interior swale to a weir located at the northeast corner of the Bottom Ash Basin. A 30-inch diameter pipe carries the combined water by gravity flow to the Rainfall Surge Pond. Water from the Rainfall Surge Pond is then pumped into the Primary Treatment Basin for further treatment. Water flows by gravity from the Primary Treatment Basin to the Secondary Treatment Basin. A pump station moves water from the Secondary Treatment Basin to the Mississippi River discharge point in accordance with the Plant's LPDES permit (Permit No. LA0054135).

3.4.2 Bottom Ash Basin

The bottom ash from Unit 1 is collected in hoppers at the base of the boiler of Unit 1 and then transported hydraulically (sluiced) through a pipe directly to the Bottom Ash Basin. Bottom ash from Unit 3 is collected in hoppers at the base of the boiler and trucked in a hydrated state to the southwest corner of the Bottom Ash Basin for disposal. The clarifier sediments are piped to the southeast corner of the Bottom Ash Basin. The filling of the basin started along the south levee and proceeded northward.

Periodic dozing of the bottom ash material occurs as needed, within the active area to maintain a relatively uniform height. Daily and/or interim cover is not applied in the active area of bottom ash disposal. The bottom ash is wet and/or transported in hydrated form that prevents potential dust generation. Weekly (7-day) inspections and annual reporting are undertaken for the Bottom Ash Basin in line with site inspection requirements for CCR units (§257.83[b]: Inspection Requirements for CCR Surface Impoundments) to identify any stability, operational, and/or safety issues which require attention.

During the 2015 annual inspection of the Bottom Ash Basin, observations indicated there was minimal open water in the Bottom Ash Unit and the bottom of the unit was covered with bottom ash. The north half of the Basin was covered to a level of about 15 feet below the crest of the levee, while the southern half was filled to about the level of the levee. The southern half also had a large stockpile of ash at the ash disposal location. The stockpile was approximately 15 to 20 feet tall, but was no closer than approximately 50 feet from the levee. Rainfall runoff is removed from the basin by a stormwater runoff collection system.

As previously described, the Bottom Ash Basin sluice water and surface water is combined with storm water from the Fly Ash Basin and is treated and discharged to the Mississippi River in accordance with the Plant's LPDES permit (Permit No. LA0054135).

4.0 *STUCTURAL SATABILITY DOCUMENTATION*

4.1 *Structural Stability Criteria and Requirements*

Supporting documentation for the structural integrity criteria for the Fly Ash Basin and Bottom Ash Basin are presented below in accordance with the CCR Rule requirements. The applicable structural stability criteria and certification/recordkeeping requirements are as follows:

4.1.1 *Ash Basin Identification Marker*

In December 2015, identification markers were installed at the Fly Ash and Bottom Ash Basins in accordance with the applicable CCR Rule requirements. The markers include the name associated with the CCR unit, the name of the facility, and the name of the owner/operator of the CCR unit. The location of each of the markers was surveyed and documentation/certification of the installation and survey is maintained at the BC II Plant, and placed in the facilities operating records in December 2015. A copy of the marker installation documentation is included in **Appendix A**.

4.1.2 *Periodic Hazard Potential Classification Assessments*

The initial hazard potential classification assessments of the Fly Ash Basin and Bottom Ash Basin were completed in accordance with the CCR Rule requirement. The basis for the criteria used to evaluate the hazard potential assessment was in accordance with the ‘‘Guidelines for Inspections of Existing Dams.’’ New Jersey Department of Environmental Protection—Dam Safety (January 2008). EPA modeled its impoundment condition rating criteria on those developed by the State of New Jersey. In developing the criteria that were used to conduct the assessments, a standard rating system was developed to classify the units’ suitability for continued safe and reliable operation.

The potential hazard classes defined in the CCR Rule are as follows:

- **High hazard potential** CCR surface impoundment means a diked surface impoundment where failure or mis-operation will probably cause loss of human life.
- **Significant hazard potential** CCR surface impoundment means a diked surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.
- **Low hazard potential** CCR surface impoundment means a diked surface impoundment where failure or mis-operation results in no probable loss of human life and low economic

and/or environmental losses. Losses are principally limited to the surface impoundment owner's property.

An evaluation of the possible adverse incremental consequences that could result from the release of water or stored contents due to failure of the diked CCR surface impoundments or mis-operation of the diked surface impoundments was performed. It was determined that failure or mis-operation of the diked surface impoundments was unlikely to cause: loss of human life, economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns. This determination was based on the materials stored in the impoundments and the impoundment's capacity and physical location relative to downgradient inhabitants/structures and environmental systems. Specifically, it was determined that:

- The fly ash stored in the Fly Ash Basin is a pozzolanic material, which forms a slow hardening cement in the presence of water. This produces a hard, structurally stable compound with very low permeability that has a low susceptibility to flow beyond the basin levees. The rainwater runoff that is also impounded in the Basin is more susceptible to flow from the basin if the basin levee were to fail.
- The bottom ash stored in the Bottom Ash Basin consists of particles that are the approximate size of coarse sand, which makes this material less susceptible to flow over long distances. The volume of rainwater stored in the Bottom Ash Basin is much less than in the Fly Ash Basin resulting in less potential for discharge from the basin if the basin levee were to fail.
- If failure or mis-operation of the diked surface impoundments occurred, topographic control would generally direct flow away from inhabitants and sensitive structures (**Figure 4**).
- Power plant structures are more than 1,500 feet away and are not downgradient from the impoundments.
- Flow would generally initially proceed in a southerly direction until reaching an unnamed drainage ditch located about 750 feet south of the impoundments.
- The nearest downgradient infrastructure is a railroad track that is located on the opposite side of the drainage ditch.
- Flow would then proceed southwesterly in the drainage ditch, flowing under Louisiana (La) Highway 10, which is located approximately 1,200 feet away along the shortest flow path from the nearest impoundment.
- Approximately 700 feet downgradient from La Highway 10, the flow would turn south and go under the railroad track.
- Flow would then proceed south through a 1.75-mile stretch of wooded area.
- The nearest water body is Lake Pattin, located over 2 miles away from the impoundments.

- The impoundment capacities are insufficient to cause physical damage to the railroad track, highway, or environmental damage to the nearest water body, even under complete and sudden failure conditions.
- Due to levees and topographic control, a release would not impact the Mississippi River.
- Losses would likely be principally limited to the facility property.
- Engineering analyses indicate the basin is designed to contain a 100-year storm event. Documentation of this analysis is provided under separate cover in the CCR Rule Fly Ash Basin and Bottom Ash Basin Inflow Design Flood Control System Plan.
- Slope stability engineering analyses indicate the basin design meets the applicable safety factor requirements as specified in the CCR Rule. Documentation of these engineering analyses is provided in Section 4.1.7.

Based on this information, the Fly Ash and Bottom Ash Basins were assigned a low hazard potential. The hazard potential classification assessment for the Ash Basins includes a certification from a qualified professional engineer stating that the initial hazard potential classification was conducted in accordance with the requirements of the applicable CCR Rule. The certification is provided in Section 6.0 of this document.

In accordance with the CCR Rule, the next hazard potential classification assessment will be completed 5 years from the date of the completion of the initial assessment.

4.1.3 Emergency Action Plan

Based on the low hazard potential assigned to the Fly Ash Basin and Bottom Ash Basin, it is not required to develop and implement an EAP for these CCR units at this time. If in the future the CCR unit is properly re-classified as either a high hazard potential or a significant hazard potential, a written EAP will be prepared for the CCR unit within 6 months of completing the subsequent hazard potential assessment. The EAP must be implemented once events or circumstances involving the CCR unit that represent a safety emergency are detected, including conditions identified during periodic structural stability assessments, annual inspections, and inspections by a qualified person.

Although the Fly Ash and Bottom Ash Basins are not required to have an EAP, LaGen has prepared emergency action procedures for the BC II Plant as part of the regulatory permitting of the surface impoundments under the Louisiana Solid Waste Rules and Regulations.

4.1.4 Vegetated Slope Protection

The Fly Ash Basin and Bottom Ash Basin levees and surrounding areas are designed, constructed, operated, and maintained with a protective vegetative cover on the slopes of the levees that is maintained such that it does not exceed a height of 6 inches above the slope of the levee.

4.1.5 History of Construction

A history of the Fly Ash Basin and Bottom Ash Basin construction, to the extent feasible, has been compiled in accordance with the CCR Rule requirements of §257.73(a)(4)(c)(i) through (xii) as follows:

- The name and address of the person(s) owning or operating the CCR unit: LaGen, a subsidiary of NRG Energy, Inc.
- The name associated with the CCR units: Fly Ash Basin and Bottom Ash Basin
- The identification number of the CCR unit (if one has been assigned by the state): Not applicable (numbers have not been assigned by the state).
- The locations of the Fly Ash Basin and Bottom Ash Basin: The locations of the Ash Basins are identified on the US Geological Survey (USGS) topographic map on **Figure 1**.
- The purposes for which the Fly Ash Basin and the Bottom Ash Basin are being used: The Fly Ash Basin is used to collect and store fly ash generated from the burning of finely pulverized coal in a high efficiency boiler. The Bottom Ash Basin is used to store bottom ash from Power Generating Units 1, 2, and 3, as well as sediment from the clarifier beds associated with the cooling towers and boilers.
- The name and size (in acres) of the watershed within which the Fly Ash Basin and the Bottom Ash Basin are located: The False River watershed (Hydrologic Unit Code 080703000101) with an area of 34,640 acres. A map showing the location of the watershed is included in **Appendix B**. However, due to the construction of the Ash Basins, the watershed for the Basins is limited to the Basins themselves.
- The physical and engineering properties of the foundation and abutment materials on which the Fly Ash and the Bottom Ash Basins were constructed: Between 1974 and 1977, prior to construction, an extensive geotechnical soil survey was conducted at the location of the Fly Ash Basin and Bottom Ash Basin to determine the properties of the soil foundation. Soil borings were laid out in a square pattern with a spacing of 250 feet. Classification tests such as the Atterberg Limits Determination, grain size analysis, and compression tests were conducted. Void ratios and permeabilities were also determined at that time. The results of the soil investigation indicated that both of the Ash Basins have a foundation of at least 3 feet of clayey soils, with permeabilities less than 1.0 $X10^{-7}$ cm/sec. In areas where naturally-occurring clayey soils were less than 3 feet thick, recompacted clay was added during construction of the impoundments to ensure a minimum clayey soil thickness of 3 feet below the impoundments.

  The levee system surrounding the Fly Ash and Bottom Ash basins were constructed of compacted earthen, clay material sloped to a ratio of 3:1 (horizontal:vertical) ratio, with a base of approximately 30 feet MSL. The levee system that surrounds the Fly Ash Basin has a design elevation of 40 feet MSL, which is approximately 10 feet above grade. The Fly Ash Basin has an approximate capacity of 1,750 acre-feet with a permitted total fly ash capacity of 3,905,000 yd^3. The levee system that surrounds the Bottom Ash Basin has a design elevation of 48 feet MSL, which is approximately 18 feet above grade. The Bottom Ash Basin has an approximate capacity of 1,188 acre-feet with a permitted total bottom ash capacity of 2,585,000 yd^3.

- The type, size, range, and physical and engineering properties of the materials used in constructing, the method of site preparation and construction, and the date of construction of the Fly Ash and the Bottom Ash Basins: After clearing and grubbing exposed the existing land surface, the Ash Basins were constructed by surrounding the naturally existing clay grade with compacted clay (lifts of approximately 10 to 12 inches) until the designed slope and crest height was reached. Construction of both Ash Basins was completed in 1980.

- Scaled drawings and cross sections that detail the engineering structures and appurtenances relevant to the design, construction, operation, and maintenance of the Fly Ash Bain and the Bottom Ash Basin: The applicable features are included on **Figures 2** through **8**. These drawings include detailed dimensions of the basins, including plan view and cross sections of the basin lengths and widths, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection, in addition to the normal operating pool surface elevation and the maximum pool surface elevation following peak discharge from the inflow design flood, plus the expected maximum depth of CCR within the basins, and any identifiable natural or manmade features that could adversely affect operation of the basins due to malfunction or mis-operation.

- The type, purpose, and location of existing instrumentation for the Fly Ash Basin and the Bottom Ash Basin are as follows: The only instrumentation installed in either of the ash basins is a weir and valve located on the downstream side of the Bottom Ash Basin to control gravity flow into the Rainfall Surge Pond.

- The area-capacity curves for the Fly Ash Basin and the Bottom Ash Basin: The area-capacity curves for the Ash Basins are included in **Appendix C**.

- The spillway and diversion design features and capacities and calculations used in area-capacity curves determinations: Water in the Fly Ash Basin is directed by an interior drainage swale to a 30-inch diameter gravity flow pipe connection into the Bottom Ash Basin. The water in the Bottom Ash Basin is directed by an interior swale to a weir located at the northeast corner of the Bottom Ash Basin. The combined water from the Fly Ash and Bottom Ash Basins is transported by a 30-inch diameter gravity flow pipe to the Rainfall Surge Pond. There is a flow control valve between the Bottom Ash Unit and the Rainfall Surge Pond.

  The design capacity of the 30-inch pipe to transfer water from the Fly Ash Basin to the Bottom Ash Basin was evaluated/calculated in conjunction with the transfer of water from the Bottom Ash Basin to the Rainwater Surge Pond to determine if the capacity is sufficient to prevent overtopping of the levee from a 100-year rain event. This evaluation was conducted using HydroCAD®. Based on the existing hydraulic storage capacity of the Basins and the design storm, it is calculated that the peak water level rises 1.3 feet in the Fly Ash Basin and 2 feet in the Bottom Ash Basin. The general operating procedure is to maintain a minimum freeboard in the Fly Ash Basin of 2 feet. The freeboard on the Bottom Ash Basin is much larger due to the higher berm elevation. Therefore, this minimum 2 feet of freeboard is sufficient to prevent overtopping of the Fly Ash Basin. The calculation indicated the existing storage capacity is sufficient to prevent overtopping of the levee from a 100-year rain event. Additional details on the spillway and diversion design features and capacities and calculations are provided under separate cover in the CCR Rule Fly Ash Basin and Bottom Ash Basin Inflow Design Flood Control System Plan.

- The construction specifications and provisions for surveillance, maintenance, and repair of the Fly Ash and the Bottom Ash Basins: The Facility Operational Plan indicates that daily inspections are performed to detect evidence of leaks, odors, or structural failure, and to verify that a minimum 2.0 feet of freeboard is maintained. If leaks are detected, the LDEQ Waste Permits Division will be notified immediately.

  A more involved weekly inspection looks for surface cracking, low areas, sliding/sloughing/bulging, soft/wet areas, vegetation, animal burrow holes, and erosion. The condition of the interior drainage swale and exit weir are also observed weekly.

  Historically, maintenance and repair has included, but was not limited to: frequent mowing of the crest and outside embankment face, limited areas of regrading/repair of the crest, repairing/rebuilding the inside embankment slope, erosion protection, and removing trees that have grown near the outside dike toe.

  In 2011, the facility implemented a program of regular inspections by dam safety engineers to identify changes in the performance of the embankments in a timely manner.

- Previous records or knowledge of any structural instability of the Fly Ash and the Bottom Ash Basins: Previous geotechnical reconnaissance and assessments/evaluations of the CCR units and other impoundments were conducted by GeoEngineers, Inc. (GeoEngineers) of Baton Rouge, Louisiana at the BC II Plant in 2011, 2012, 2014, and 2015. Summaries of the most recently completed GeoEngineers geotechnical evaluations of the Fly Ash and Bottom Ash Basins from 2014 and 2015 are presented below.

  The GeoEngineers report (GeoEngineers, 2014) titled "Embankment Dike Inspection Services", August 13, 2014 concluded that the dikes are generally stable, but several areas for consideration were identified, including:

  - Erosion along inside of levees
  - Excessive vegetation growth
  - Desiccation cracking
  - Animal burrows
  - Sloughing or slope instability areas and
  - Toe seepage areas.

The GeoEngineers report (GeoEngineers, 2015) titled "Dike Slope Failure Evaluation", July 1, 2015 identified three locations where the dikes were potentially unstable, if actions were not taken to address the current conditions.

- North dike of Bottom Ash Unit
- South dike of Fly Ash Unit near west end
- South dike of Fly Ash Unit near center of south dike.

As a result of recommendations detailed in the above 2015 GeoEngineers report, the following actions were undertaken and completed by LaGen in the 4th quarter 2015.

- Removal of the failure slip-plane through excavation of the dike soil to behind and below the failure
- Rebuilding of dike slope with geogrid-reinforced layers to resist the failure plane shear and increase slope stability
- Rebuilding of the outside half of the dike crest where it had settled

CB&I conducted a CCR Annual Inspection of the Fly Ash Basin and Bottom Ash Basin in October 2015. The inspection noted minor erosion, some animal burrows, and some small desiccation cracks, however, there were no signs of distress or malfunction that would indicate actual or potential structural weakness of either ash basin.

4.1.6 Periodic Structural Stability Assessment

The initial structural stability assessment of the Fly Ash and Bottom Ash Basins is included herein in accordance with the applicable CCR Rule requirements. The structural stability assessment for the Fly Ash and Bottom Ash Basins includes documentation that the Basins have been designed, constructed, operated, and maintained consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein. Applicable documentation of the stability assessment with respect to the CCR Rule follows.

During the most recent CCR Annual Inspection conducted in October 2015, the following CCR criteria were observed and found to be adequate, with respect to the design, construction, operation, and maintenance of the Ash Basins:

- Stable foundations
- Adequate slope protection to protect against surface erosion, wave action and adverse effects of sudden drawdown
- Dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit

- Vegetated slopes of dikes and surrounding areas that do not exceed a height of 6 inches above the slope of the dike
- A 30-inch diameter gravity flow pipe (used instead of a spillway) constructed of non-erodible material that is designed to carry sustained flows, with a capacity designed, constructed, operated, and maintained to adequately manage flow during and following the peak discharge from a 100-year flood (as required for the low hazard potential Fly Ash Basin and Bottom Ash Basin)
- A 30-inch gravity flow pipe (used in place of hydraulic structures underlying the base of the CCR unit) that passes through the dike of the Fly Ash Basin and Bottom Ash Basin is maintained with structural integrity and is free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure
- A location not adjacent to a water body, such as a river, stream or lake, such that the slopes are not inundated by water which could affect structural stability

In accordance with the CCR Rule, the periodic structural stability assessment must identify any structural stability deficiencies associated with the CCR unit in addition to recommending corrective measures. If a deficiency or a release is identified during the periodic assessment, the owner or operator must remedy the deficiency or release as soon as feasible and prepare documentation detailing the corrective measures taken. The previous and current structural stability assessments for the Fly Ash Basin and Bottom Ash Basin noted any observed structural stability deficiencies and recommended corrective measures. Corrective measures completed to date have been documented, the most recent of which were previously described in Section 4.1.5

In accordance with the CCR Rule, the next structural stability assessment will be completed 5 years from the date of the completion of the initial assessment.

The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial structural stability assessment and each subsequent periodic assessment was conducted in accordance with the requirements of this section. As required, the previous assessment has been, and future assessments will be, certified by a qualified professional engineer. The certification is provided in Section 6.0 of this document.

4.1.7 Periodic Safety Factor Assessment

In accordance with the CCR Rule, the owner or operator of the CCR unit must conduct initial and periodic safety factor assessments for each CCR unit and document whether the calculated factors of safety (FOS) for each CCR unit achieve the minimum safety factors specified in paragraphs (e)(1)(i) through (iv) of this section for the critical cross section of the embankment. The critical cross section is the cross section anticipated to be the most susceptible of all cross sections to structural failure based on appropriate engineering considerations, including loading conditions. The safety factor assessments must be supported by appropriate engineering calculations. A slope stability analysis was performed for the Fly Ash Basin and the Bottom Ash Basin, the details of which is presented in **Appendix D** and summarized below.

The critical cross-section of the embankment for the Fly Ash Basin is located on the southeast corner at the location of the fly ash disposal area. The critical section considered the current emplaced fly ash and the final designed section. Similarly, the location of the Bottom Ash Basin is located along the southern berm. The critical section considered the current stockpiled bottom ash and the final design section. The geometry of the ash piles, ash basin berms, soil strength profiles, and ash strength characteristics were obtained from the GeoEngineers (2011) geotechnical engineering report. The slope stability analyses were performed using the computer program SLOPE/W by GEO-SLOPE International Ltd. The search for the minimum FOS was performed using the automated search routine in SLOPE/W. The analyses also considered the effect of long-term basin water levels and the water level surcharge due to the 100-year design storm. For the purpose of the stability analysis, the elevations of the design elevation of the berms (40 feet for the Fly Ash Basin and 48 feet for the Bottom ash Basin), a freeboard of 2 feet in the Fly Ash Basin (elevation 38 feet), and storm surcharge of 1.3 feet and 1.93 feet in the Fly Ash Basin and Bottom Ash Basin, respectively, were used. Finally, these scenarios were evaluated for non-seismic and seismic effects. A horizontal seismic acceleration coefficient of 0.05 is used which relates to a 2% chance of experiencing peak acceleration in rock in a 50-year period (USGS Seismic Hazard Map, revised May, 2003). A total of 16 scenarios were evaluated and summarized in the tables below. Figures showing each slope stability section and the location of the minimum failure surface are presented in **Appendix D**.

Slope Stability Results Without Seismic Effects

Area	Slope Scenario	Storage pool elevation, feet	Calculated FOS	Required FOS
Fly Ash Basin	Existing Slope	38	2.31	1.5
		39.3	2.29	1.4
	Proposed Capped Slope	38	2.74	1.5
		39.3	2.71	1.4
Bottom Ash Basin	Existing Slope	38	1.50	1.5
		39.9	1.48	1.4
	Proposed Capped Slope	38	1.60	1.5
		39.9	1.58	1.4

The safety factor assessments for the critical cross-sections of the embankments for the Ash Basins have been completed as follows:

- The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.

  The results of the assessment for the Fly Ash Basin indicate minimum FOS for the current ash pile and the design stack for long term water pool are 2.31 and 2.74, respectively. Similarly, the results of the assessment for the Bottom Ash Basin indicate minimum FOS of 1.50 and 1.60, respectively. For these scenarios, the minimum FOS is greater than or equal to the required FOS.

- The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.

  The results of the assessment for the Fly Ash Basin indicate minimum FOS for the current ash pile and the design stack for short term surcharge water pool are 2.29 and 2.71, respectively. Similarly, the results of the assessment for the Bottom Ash Basin indicate minimum FOS of 1.48 and 1.58, respectively. For these scenarios, the minimum FOS is greater than the required FOS.

Slope Stability Results With Seismic Effects (Kh = 0.05

Area	Slope Scenario	Storage pool elevation, feet	Calculated FOS	Required FOS
Fly Ash Basin	Existing Slope	38	1.68	1.0
		39.3	1.66	
	Proposed Capped Slope	38	1.75	
		39.3	1.74	
Bottom Ash Basin	Existing Slope	38	1.12	
		39.9	1.11	
	Proposed Capped Slope	38	1.19	
		39.9	1.18	

- The calculated seismic factor of safety must equal or exceed 1.00.

  The results of the seismic assessment for the Fly Ash Basin indicate minimum FOS for the current ash pile and the design stack for long term water pool are 1.68 and 1.75, respectively. Similarly, the results of the assessment for the Bottom Ash Basin indicate minimum FOS of 1.12 and 1.19, respectively. For these scenarios, the minimum FOS is greater than the required FOS.

The results of the seismic assessment for the Fly Ash Basin indicate minimum FOS for the current ash pile and the design stack for short term surcharge water pool are 1.66 and 1.74, respectively. Similarly, the results of the assessment for the Bottom Ash Basin indicate minimum FOS of 1.11 and 1.18, respectively. For these scenarios, the minimum FOS is greater than the required FOS.

- For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

  The clayey soils used for construction of the Ash Basins and which comprise the foundation for the berms are not susceptible to liquefaction; therefore, no liquefaction safety factor was calculated.

The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial safety factor assessment and each subsequent periodic assessment specified in paragraph (e)(1) of this section meets the requirements of this section. As required, the previous assessment has been, and future assessments will be, certified by a qualified professional engineer. The certification is provided in Section 6.0 of this document.

An owner or operator of a CCR unit who either fails to complete a timely safety factor assessment or fails to demonstrate minimum safety factors as required by paragraph (e) of this section is subject to the CCR unit closure requirements of § 257.101(b)(2).

In accordance with the CCR Rule, the next safety factor assessment will be completed 5 years from the date of the completion of the initial assessment.

5.0 *RECORD KEEPING/NOTIFICATION REQUIREMENTS*

The BC II Plant will maintain files of all information related to the Stability Integrity Assessment of the Fly Ash Basin and Bottom Ash Basin in a written operating record at the BC II Plant as required by the CCR Rule. This will include documentation of the permanent CCR Unit identification marker, the initial and periodic hazard potential classification assessments, the history of construction and any revisions to it, the initial and periodic structural stability assessments, documentation detailing with corrective measures taken to remedy a deficiency or release, and the initial and periodic safety factor assessments. The files will be retained until closure of the units and/or for at least 5 years following the date of each occurrence, measurement, maintenance, corrective action, report, record, or study. The files for separate CCR units at the Plant will be maintained in one recordkeeping system with files separated by the name or identification number of each CCR unit. It is understood the files may be maintained on microfilm, on a computer, on computer disks, on a storage system accessible by a computer, on magnetic tape disks, or on microfiche.

The CCR Rule also requires that the owner or operator of a CCR unit maintain a publicly accessible Internet site (CCR Web site) that contains specific information related to the CCR unit initial and subsequent Structural Integrity Assessments.

In accordance with the CCR Rule, the BC II Plant will place the Structural Integrity Assessment documentation for the Fly Ash Basin and Bottom Ash Basin, as it becomes available, in the facility's operating record and post it to the CCR Web site (within 30 days of placing the pertinent information in the BC II Plant operating record).

6.0 *QUALIFIED PROFESSIOINAL ENGINEER CERTIFICATION*

The undersigned registered professional engineer is familiar with the requirements of §257.73 and has visited and examined the BC II Plant Fly Ash Basin and Bottom Ash Basin or has supervised examination of the Big Cajun II Fly Ash Basin and Bottom Ash Basin by appropriately qualified personnel. The undersigned registered professional engineer attests that:

- the initial hazard potential classification and each subsequent periodic hazard potential classification specified in paragraph (a)(2)(i) of section § 257.73 was conducted in accordance with the requirements of this section.
- the initial structural stability assessment and each subsequent periodic assessment in paragraph (d)(1) of section § 257.73 was conducted in accordance with the requirements of this section.
- the initial safety factor assessment and each subsequent periodic assessment specified in paragraph (e)(1) of section § 257.73 meets the requirements of this section.

The CCR Structural Integrity Assessment activities have been prepared in accordance with the requirements of §257.73 and that this assessment is adequate for the Big Cajun II Plant. This certification was prepared as required by §257.73(a)(2)(ii), §257.73(d)(3), and §257.73(e)(2).

Name of Professional Engineer: Glen R. Landry

Company: CB&I Environmental, Inc

Signature: Glen R. Landry

Date: 10/5/16

PE Registration State: Louisiana

PE Registration Number: 18931

Professional Engineer Seal:

STATE OF LOUISIANA
GLEN R. LANDRY
License No. 18931
PROFESSIONAL ENGINEER
IN
CIVIL ENGINEERING

10/5/16

7.0 *REFERENCES*

CB&I Environmental & Infrastructure, Inc.; 2016; Big Cajun II, Coal Combustion Residual (CCR), Annual Inspection Report, NRG Louisiana Generating, LLC; NRG Energy, Inc.; New Roads, Louisiana.

Environmental Protection Agency; 2015; 40 CFR Parts 257 and 261 Rules and Regulations, Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Volume 80, No. 74; Final Rule.

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GeoEngineers, Inc.; 2015; Dike Slope Failure Evaluations, Ash Basin Ponds, Big Cajun II Generating Site, New Roads, Pointe Coupee Parish, Louisiana.

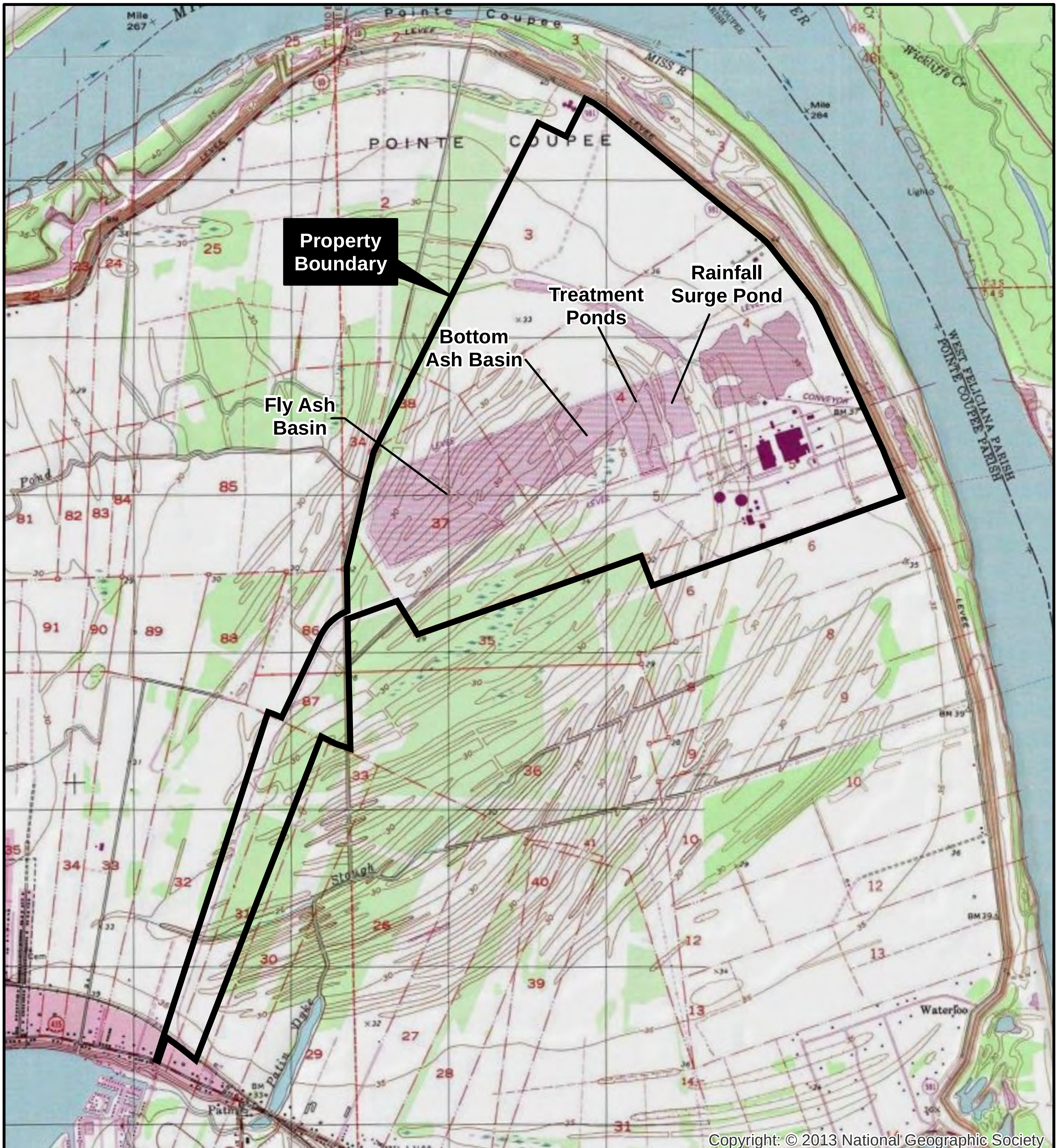
Louis J. Capozzoli and Associates, Inc.; 1974; Preliminary Subsoil Investigation and Foundation Design Data, Big Cajun No. 2, Site C-2, New Roads, Louisiana; File No. 74-30.

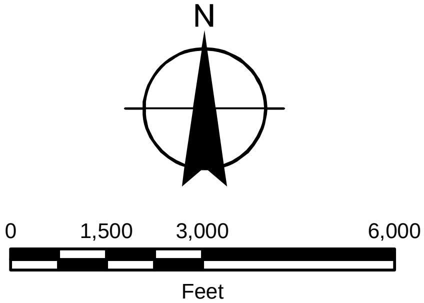
Louis J. Capozzoli and Associates, Inc.; 1977; Preliminary Subsurface Soil Investigation and Laboratory Testing, Ash Storage Area, CEPCO No. 2, Plant Site; New Roads, Louisiana.

Louis J. Capozzoli and Associates, Inc.; 2006; Geotechnical Investigation, Bottom Ash Storage Pond Expansion, Big Cajun No. 2, Pointe Coupee Parish Plant Site, Louisiana; LJC&A File: 0558.

Shaw Environmental & Infrastructure, Inc.; 2010; Type I Solid Waste Facility Permit, Renewal and Modification Application, Final Copies, Permit No. P-0108 (Volumes 1 of 2 and 2of 2), Louisiana Generating, LLC, Big Cajun II Power Plant, New Roads, Pointe Coupee Parish, Louisiana.

FIGURES



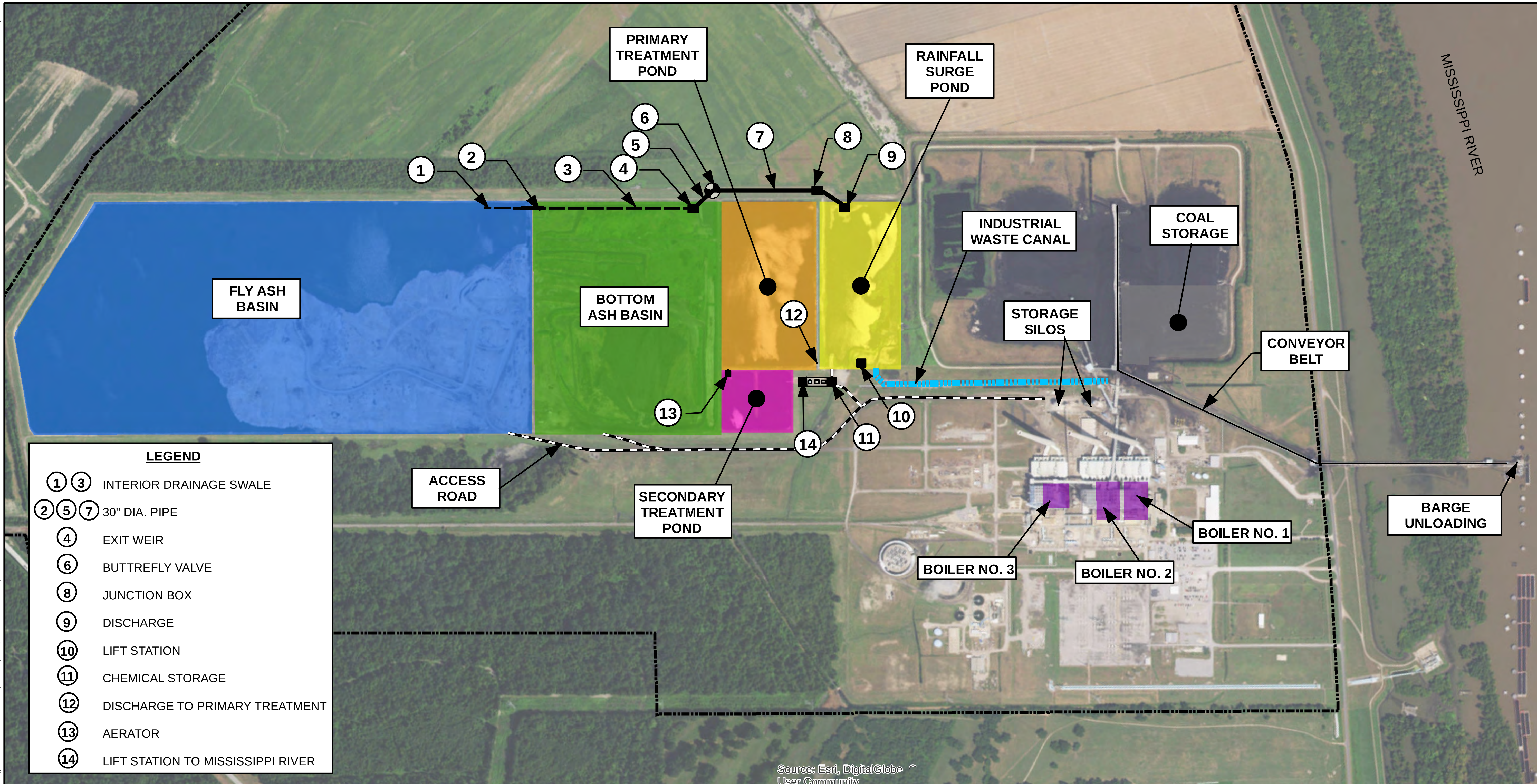


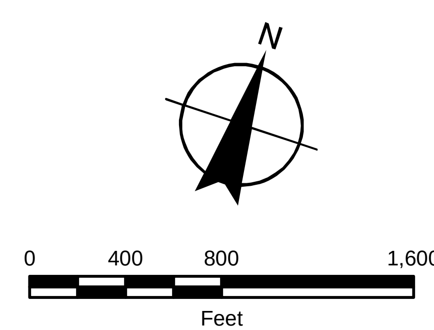
LOUISIANA GENERATING, LLC
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

BIG CAJUN II POWER PLANT
STRUCTURAL INTEGRITY ASSESSMENT

FIGURE NUMBER	
1	**SITE LOCATION**

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809





LOUISIANA GENERATING, LLC
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

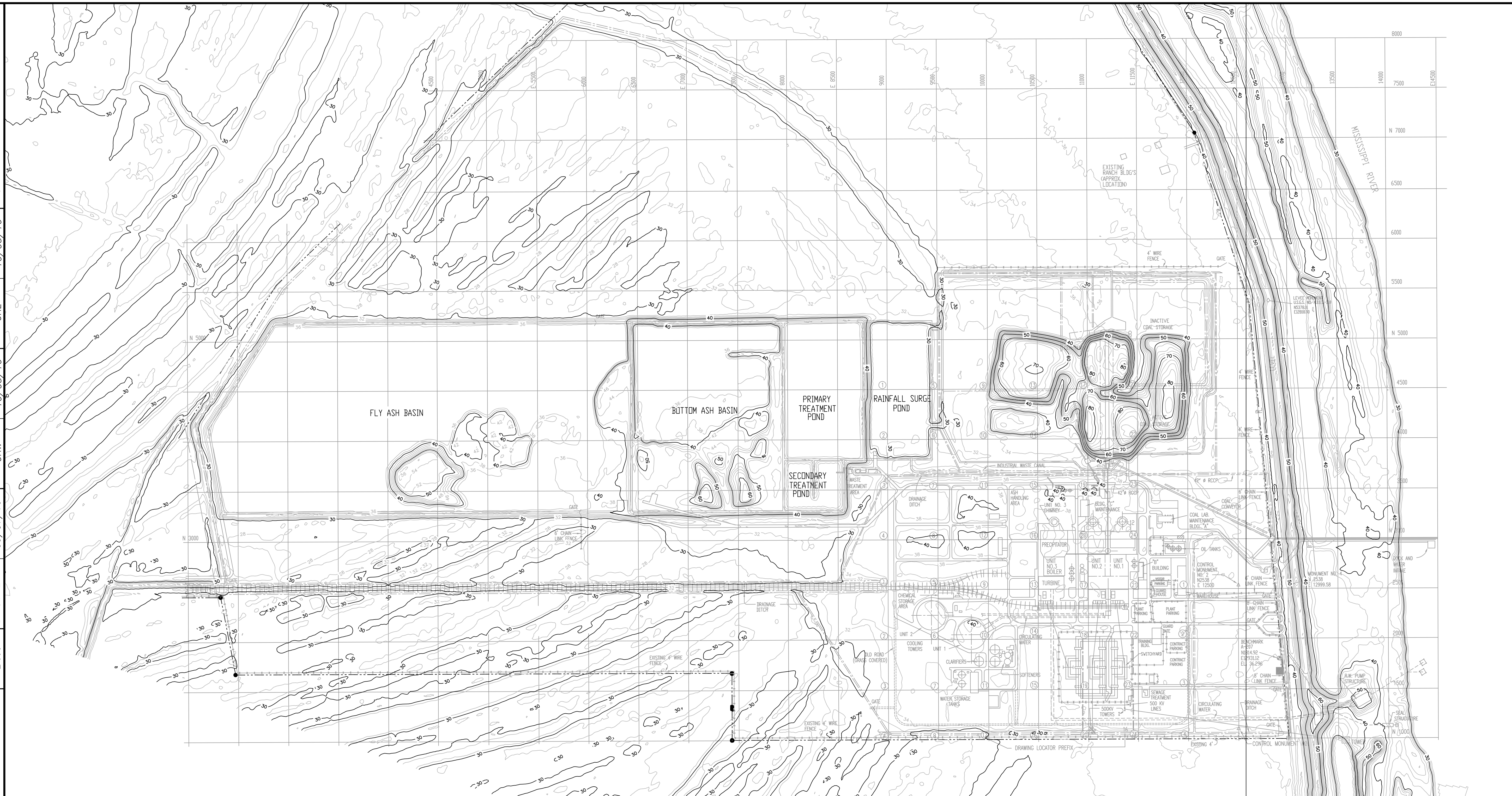
BIG CAJUN II POWER PLANT
STRUCTURAL INTEGRITY ASSESSMENT

FIGURE NUMBER 2

SITE LAYOUT

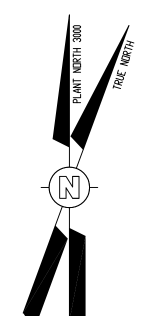
CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
BTR	D. COMEAUX 09/07/16	CRW 10/03/16	GRL 10/03/16	631215151_B10



LEGEND

—·—··—·—	PROPERTY LINE
⌒30⌒	TOPOGRAPHIC CONTOUR (FEET, NGVD 29) WITH 2-FOOT CONTOUR INTERVAL



SCALE

0 1000 2000 FEET

REFERENCE: Louisiana Oil Spill Coordinator's Office (LOSCO), LiDAR Digital Elevation Map (DEM) of Louisiana, 2009.

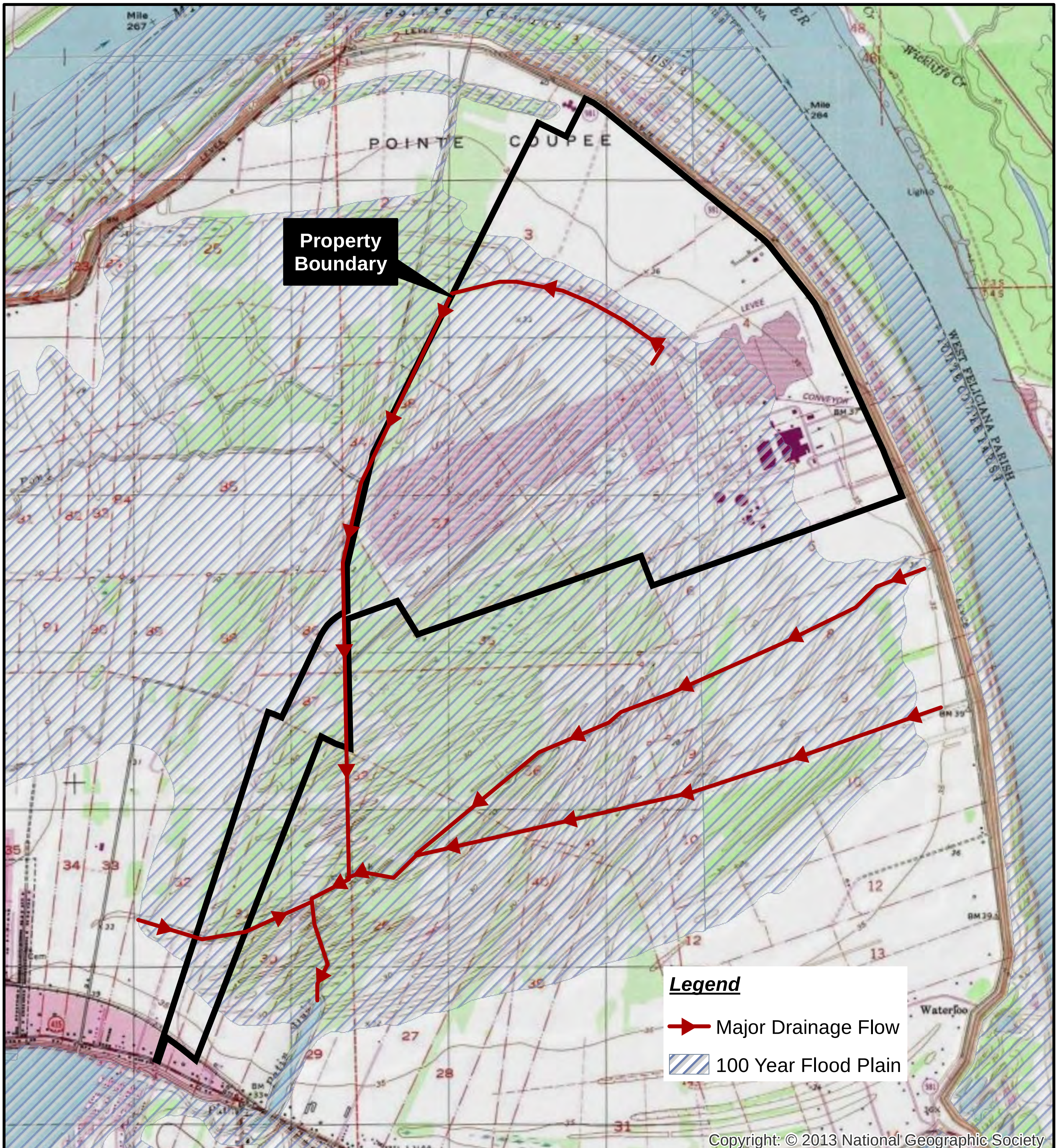
LOUISIANA GENERATING, L.L.C.
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

BIG CAJUN II POWER PLANT
STRUCTURAL INTEGRITY ASSESSMENT

FIGURE NUMBER 3

EXISTING SITE TOPOGRAPHY

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809



N

0 1,500 3,000 6,000
Feet

LOUISIANA GENERATING, LLC
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

BIG CAJUN II POWER PLANT
STRUCTURAL INTEGRITY ASSESSMENT

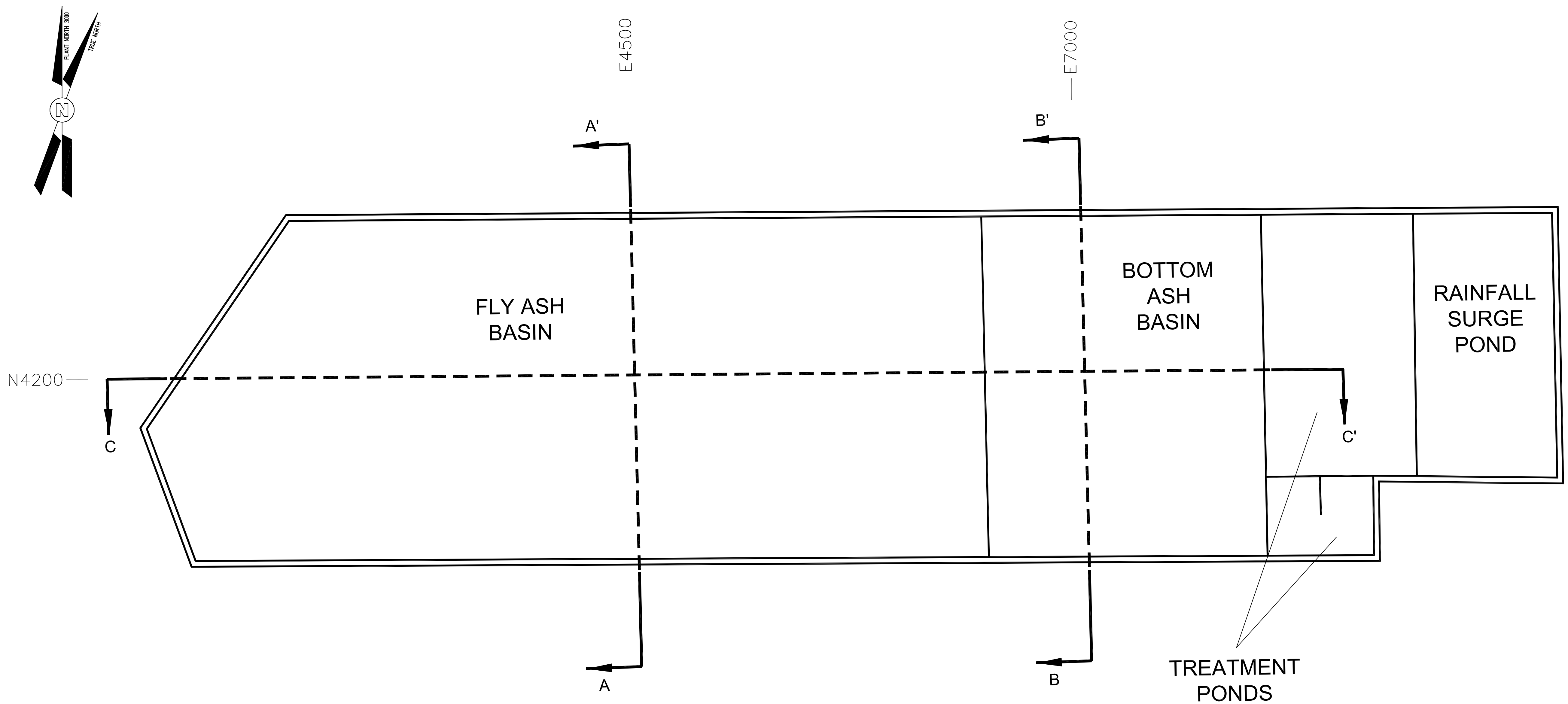
FIGURE NUMBER
4

DRAINAGE AND FLOOD PLAIN MAP

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809

J:\Drafting\NRG\631215151\ArcView\GIS_Documents\Project_Maps\ng_631215151_0009_flood_map.mxd; Analyst: ben.holt; Date: 9/19/2016 3:54:22 PM
iDocs Document No.; Issue Statement; Rev. 0; 19Sep2016

OFFICE BTR | DRAWN BY D. COMEAUX 09/14/16 | CHECKED BY CRW 10/03/16 | APPROVED BY GRL 10/03/16 | DRAWING NUMBER 631215151_B15



NOTES:

1. Cross-section lines are designated along approximate plant grid designated by North (N) or East (E) and coordinates in feet.

2. See Figures 6, 7, and 8 for Cross-Sections A-A', B-B', and C-C'.

SCALE

0 50 100 FEET

LOUISIANA GENERATING, L.L.C.
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

BIG CAJUN II POWER PLANT
STRUCTURAL INTEGRITY ASSESSMENT

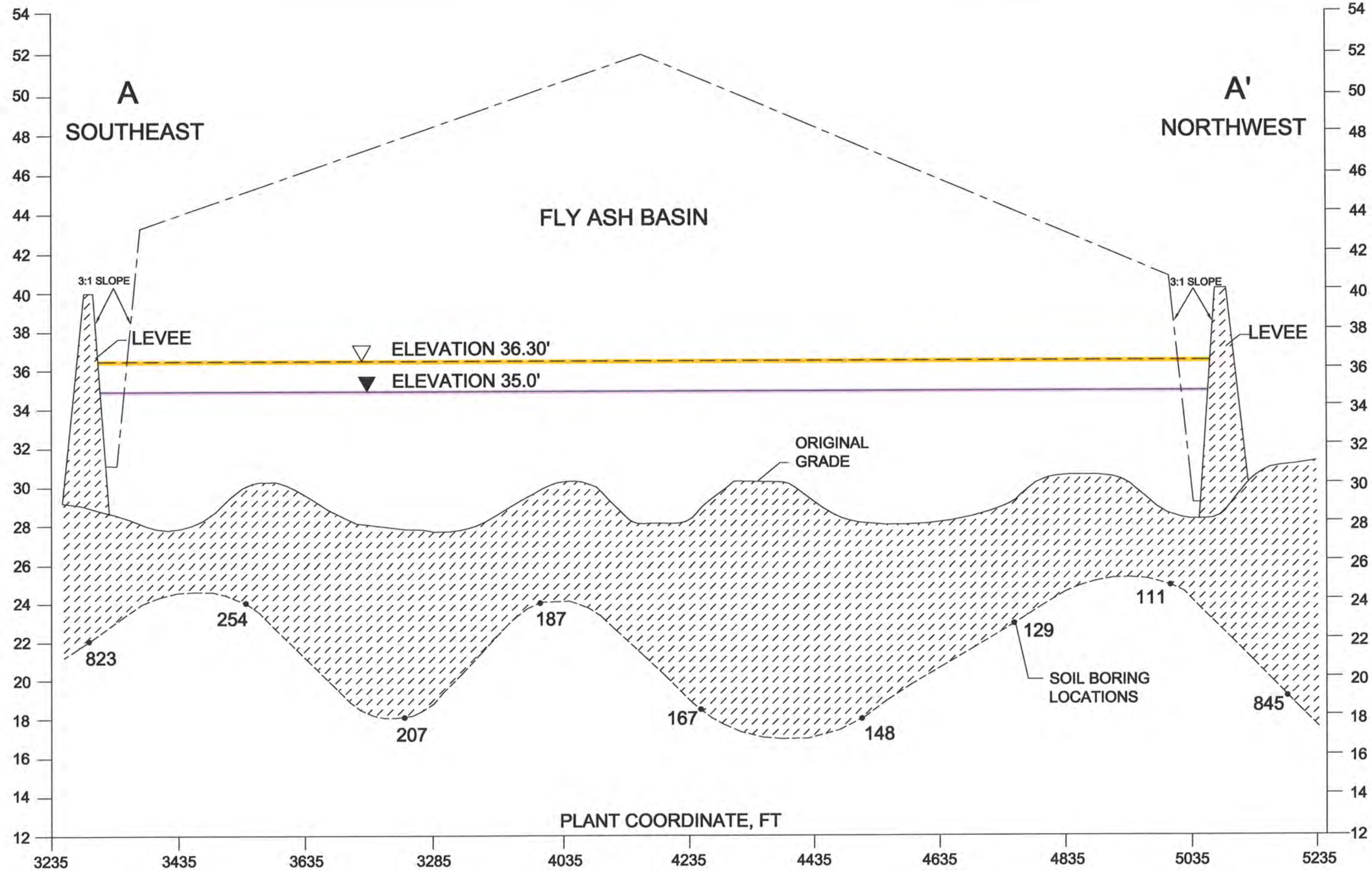
FIGURE NUMBER 5

CROSS-SECTIONS LOCATION MAP

CB&I

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809

RE: SOURCE DRAWING PROVIDED BY C-K ASSOCATES, INC., DWG. NO. A05-268-02, 1/20/1994.



LEGEND:

- Native clayey soils
- Maximum elevation of Coal Combustion Residual (CCR) materials stored in the Fly Ash Basin (based on potential maximum ash volume at time of basin closure)
- Fly Ash Basin maximum surface water elevation based on inflow design flood
- Fly Ash Basin normal operating surface water elevation

NOTES:

1. Base information taken from Big Cajun's original 1986 Solid Waste Permit Application.
2. See Figure 5 for location of Cross-Section A-A'.
3. Slopes of basin levees are vegetated to minimize/prevent potential erosion.

RE: SOURCE DRAWING PROVIDED BY C-K ASSOCATES, INC.

LOUISIANA GENERATING, L.L.C.
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

BIG CAJUN II POWER PLANT
STRUCTURAL INTEGRITY ASSESSMENT

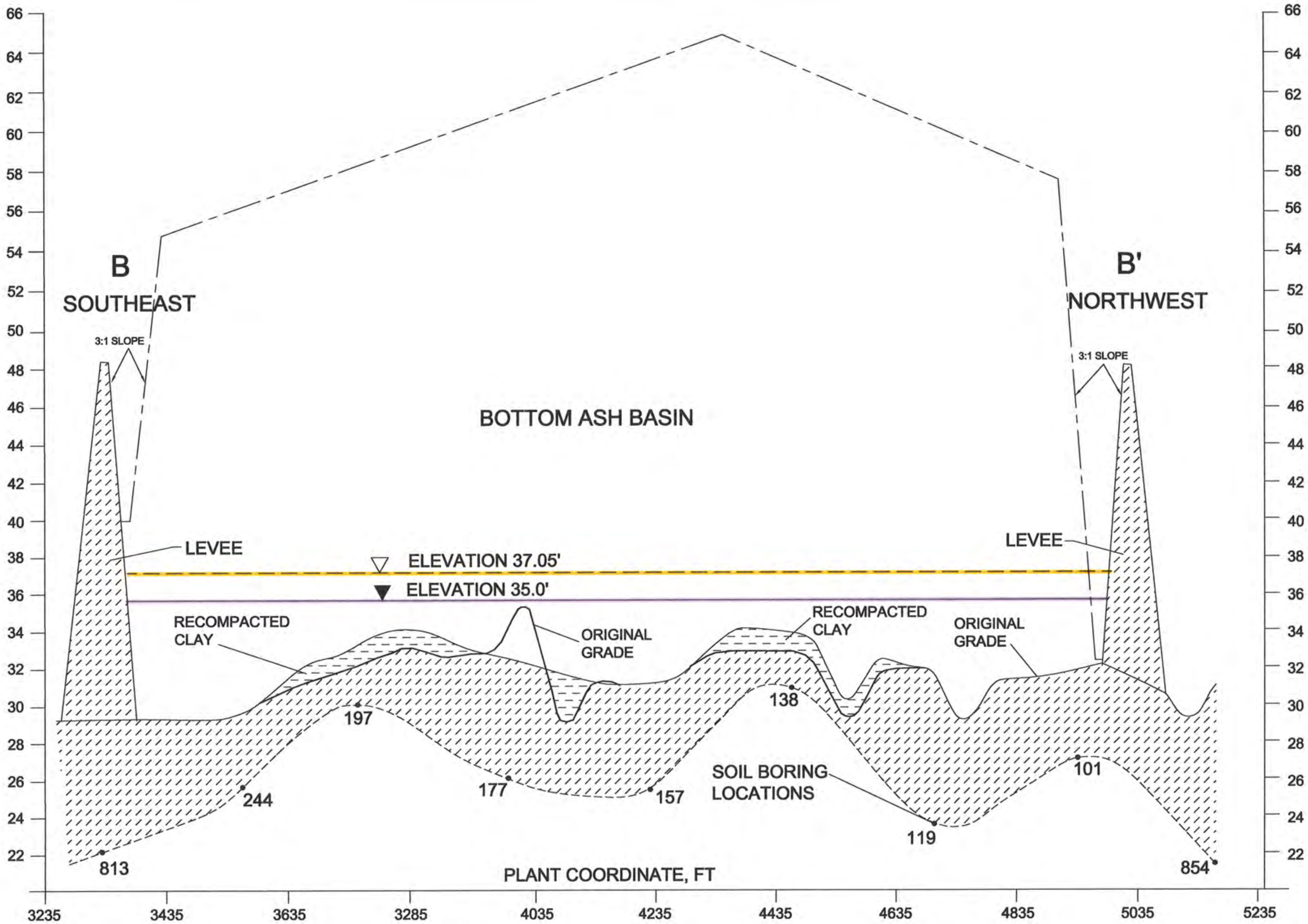
FIGURE NUMBER 6

FLY ASH BASIN CROSS-SECTION A-A'

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
BTR	D. COMEAUX 09/14/16	CRW 10/03/16	GRL 10/03/16	631215151_B16

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
BTR	D. COMEAUX 09/14/16	CRW 10/03/16	GRL 10/03/16	631215151_B17



LEGEND:

- Native clayey soils at bottom of Basin
- Recompacted clay
- Maximum elevation of Coal Combustion Residual (CCR) materials stored in the Bottom Ash Basin (based on potential maximum as volume at time of basin closure)
- Bottom Ash Basin maximum surface water elevation based on inflow design flood
- Bottom Ash Basin normal operating surface water elevation

RE: SOURCE DRAWING PROVIDED BY C-K ASSOCATES, INC.

NOTES:

1. Base information taken from Big Cajun's original 1986 Solid Waste Permit Application.
2. See Figure 5 for location of Cross-Section B-B'.
3. Slopes of basin levees are vegetated to minimize/prevent potential erosion.

LOUISIANA GENERATING, L.L.C.
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

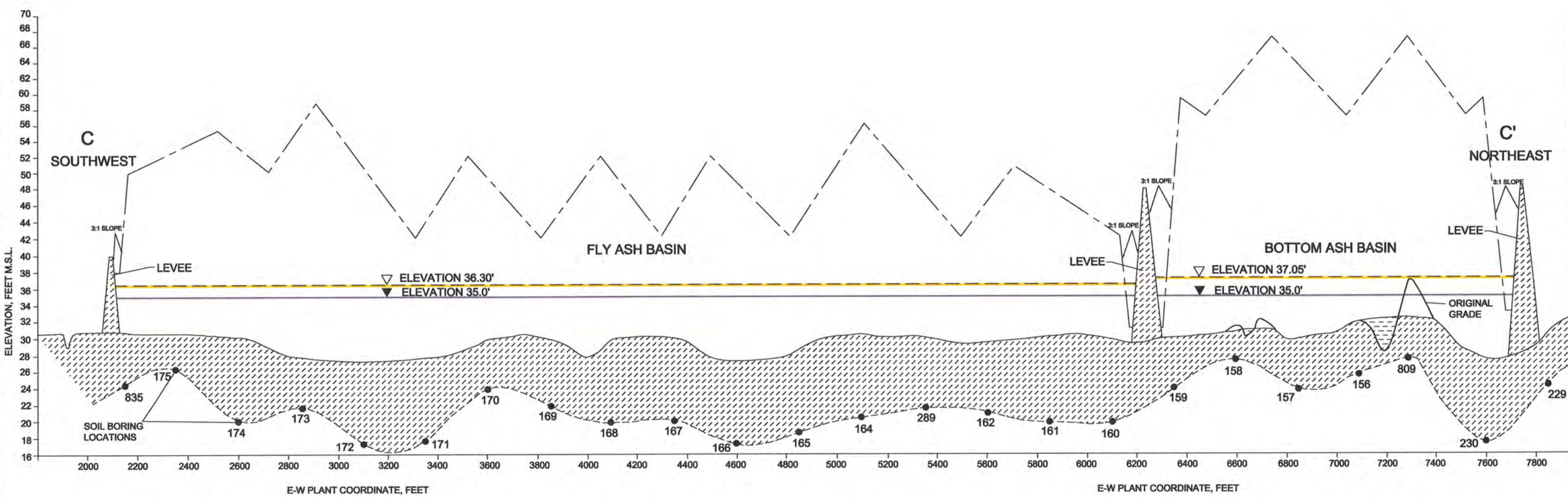
BIG CAJUN II POWER PLANT
STRUCTURAL INTEGRITY ASSESSMENT

FIGURE NUMBER 7

BOTTOM ASH BASIN CROSS-SECTION B-B'

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809

DRAWING NUMBER	APPROVED BY	CHECKED BY	DRAWN BY	OFFICE
631215151_B18	GRL 10/03/16	CRW 10/03/16	D. COMEAUX 09/14/16	BTR



LEGEND:

Native clayey soils at bottom of Basin

Recompacted clay

Maximum Depth of Coal Combustion Residual (CCR) materials stored in the Bottom Ash Basin (based on potential maximum ash volume at time of basin closure)

Bottom Ash Basin maximum surface water elevation based on inflow design flood

Bottom Ash Basin normal operating surface water elevation

NOTES:

1. Base information taken from Big Cajun's original 1986 Solid Waste Permit Application.
2. See Figure 5 for location of Cross-Section C-C'.
3. Slopes of basin levees are vegetated to minimize/prevent potential erosion.

10/4/2016

LOUISIANA GENERATING, L.L.C.
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

BIG CAJUN II POWER PLANT
STRUCTURAL INTEGRITY ASSESSMENT

FIGURE NUMBER 8

FLY ASH BASIN AND BOTTOM ASH BASIN CROSS-SECTION C-C'

CBI

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809

APPENDIX A

4171 Essen Lane
Baton Rouge, LA 70809
Tel: 412.372.7701
Fax: 412.373.7135
www.CBI.com

December 11, 2015

Mr. Gary Ellender
Regional Environmental Manager
Louisiana Generating, LLC (LaGen)

Subject: Installation of Permanent Identification Marker (40 CFR Part 257.73(a)(1))
Big Cajun II
10431 Cajun II Road
New Roads, LA 70760

Dear Mr. Ellender:

CB&I Environment & Infrastructure (CB&I) arranged for the acquisition and installation of permanent identification markers for the Bottom Ash and Fly Ash Units for compliance with the above referenced regulation. A photo log documenting the installation is attached. In conjunction with the installation, a location survey was conducted of the referenced markers resulting in the following data:

	NAD'83 – LA NORTH		NAD'83 – GEODETIC	
Marker ID	Northing	Easting	Latitude	Longitude
Bottom Ash Unit marker	809,135.84	3,265,630.61	30° 43' 29.652"	91° 22' 54.185"
Fly Ash Unit marker	808,875.71	3,264,794.97	30° 43' 27.090"	91° 23' 03.753"

NAD 83 Coordinate data is reported in Louisiana State Plane South Zone grid coordinate.

I hereby certify that on the 10th day of December, 2015, the hereon described survey was completed under my supervision, to the best of my knowledge and ability.

Date: December 11, 2015

Glen R. Landry, PLS #4445
Project Manager 3
CB&I Environmental & Infrastructure, Inc.

STATE OF LOUISIANA
GLEN R. LANDRY
REG. No. 4445
REGISTERED
LAND SURVEYOR

Photographic Record

Client:	NRG-Big Cajun II	**Photographer:**	Kevin Simoneaux
Location:	10431 Cajun II Rd. New Roads, LA. 70807	**Photograph Date:**	12/10/2015
Project No.	1005494026		

Photo No: 3125 **Picture Direction**: SW

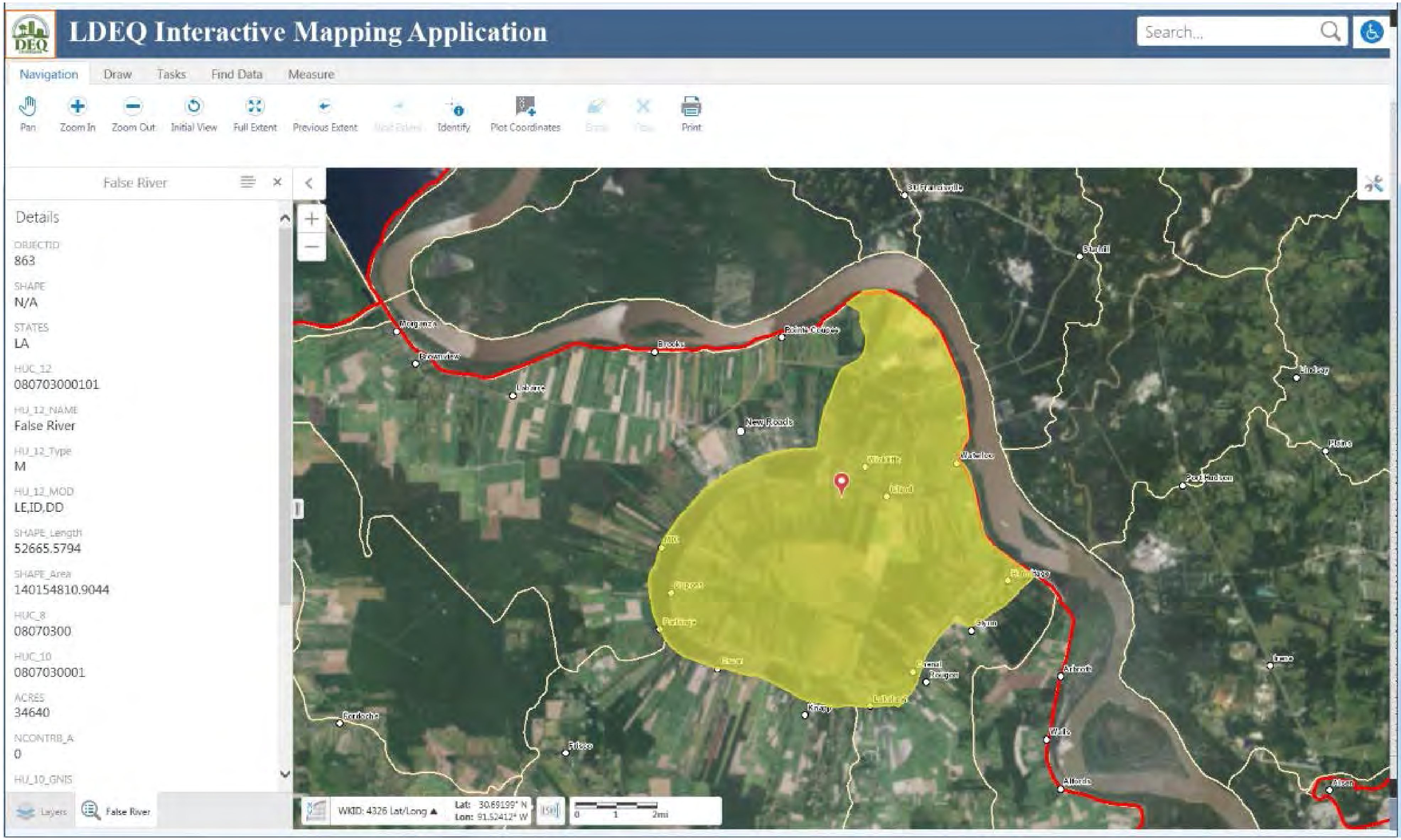
Description: Installed Bottom Ash Unit sign

Photo No: 3123 **Picture Direction**: SW

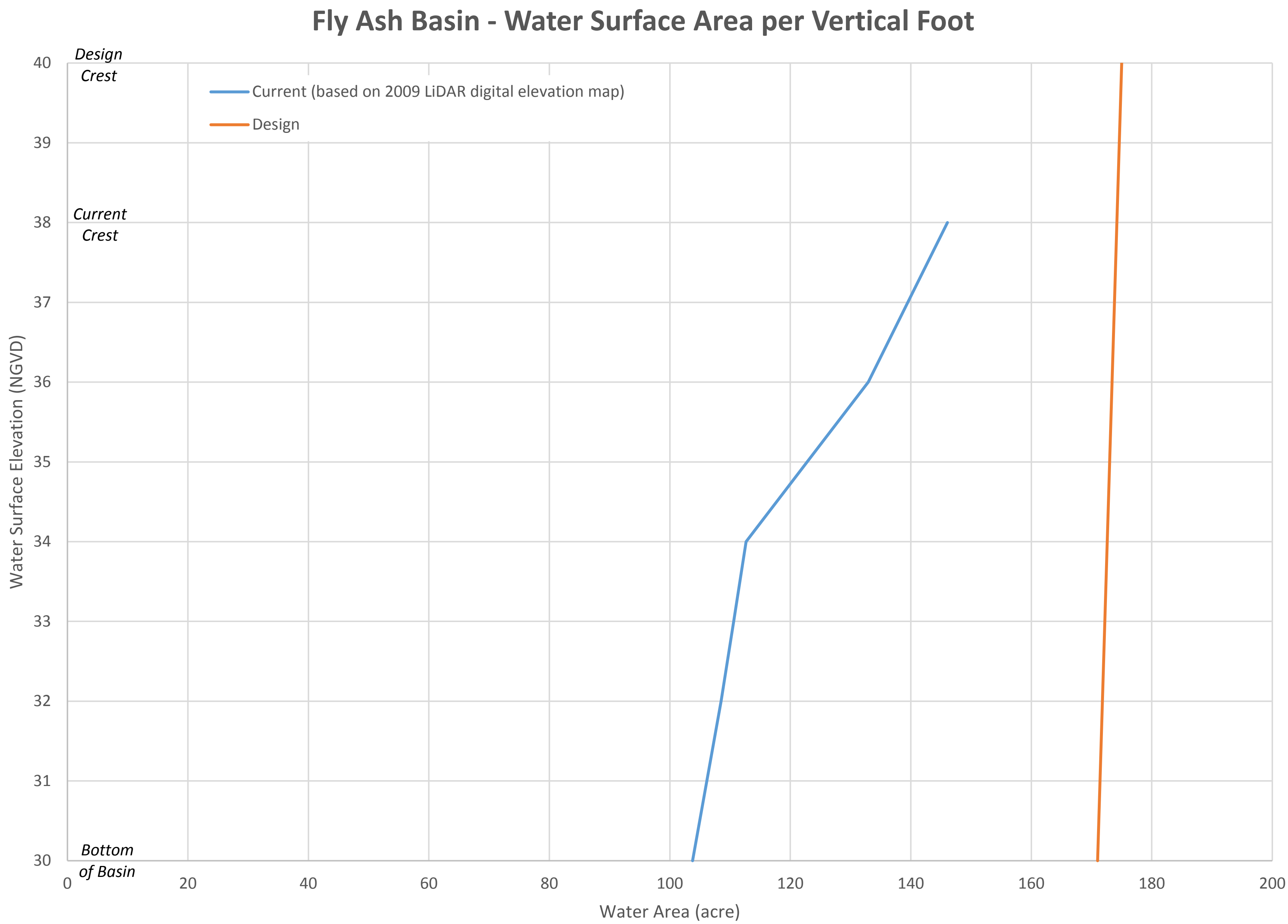
Description: Installed Fly Ash Unit sign

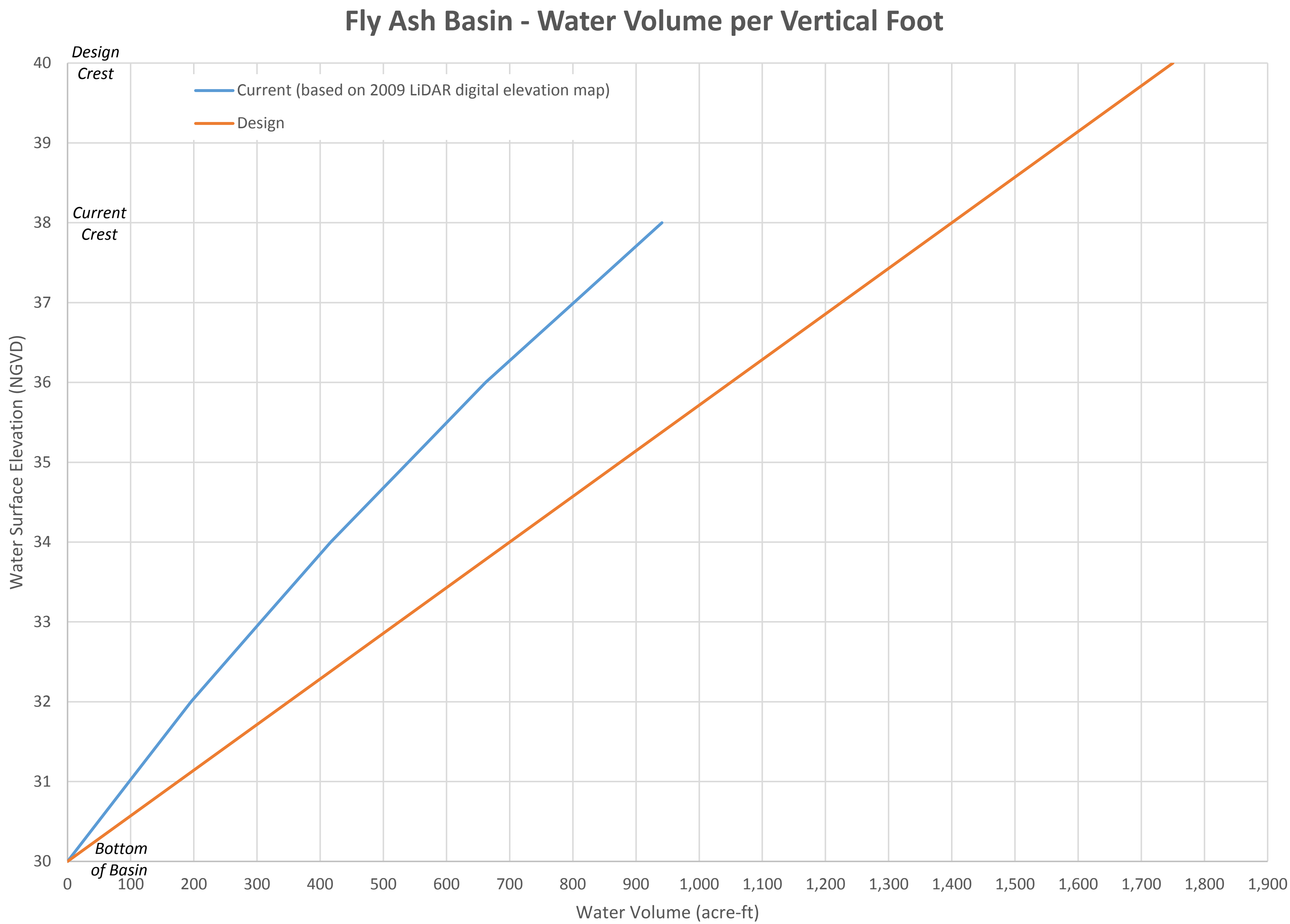
APPENDIX B

APPENDIX B
Watershed Map
NRG Big Cajun II Plant
New Roads, Louisiana

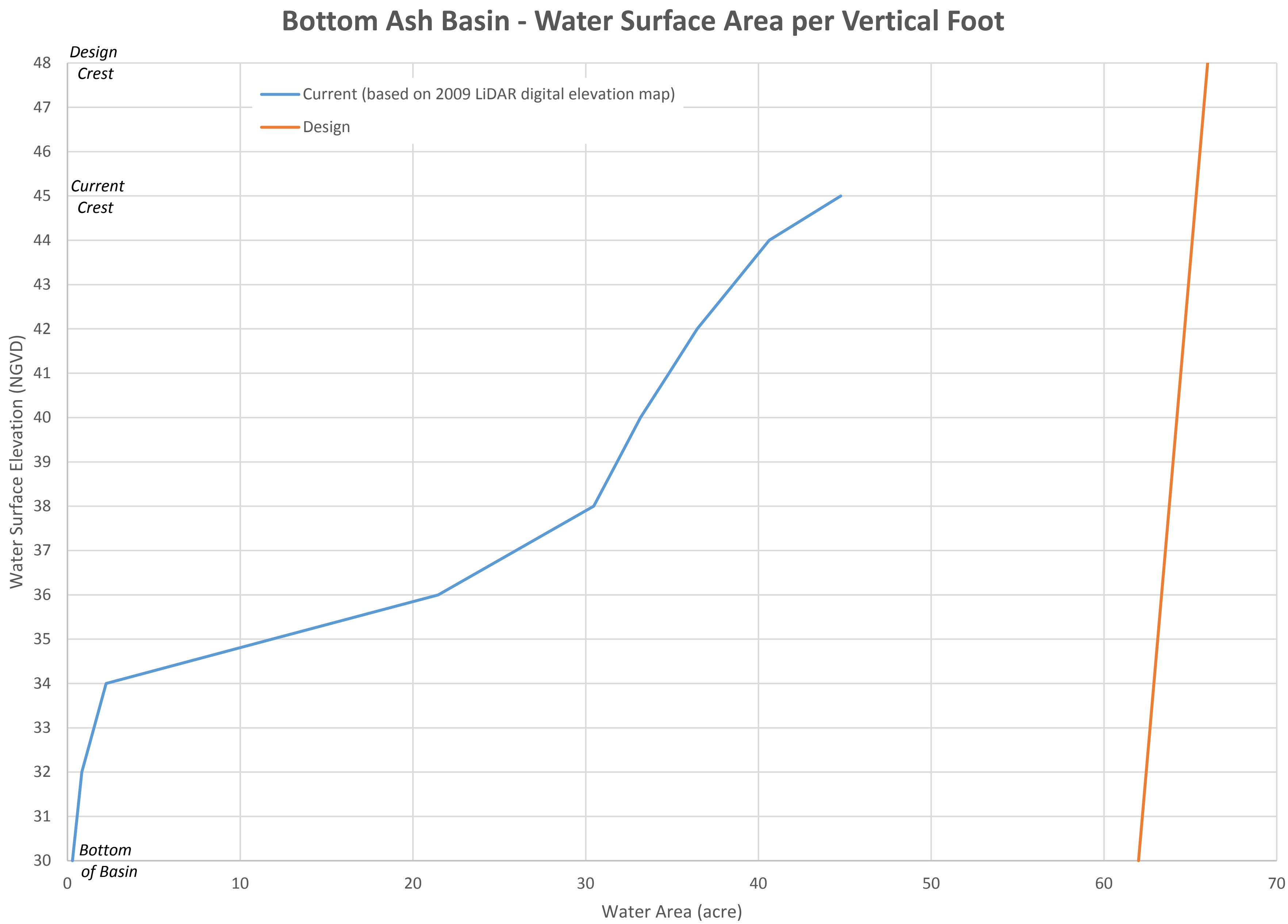


APPENDIX C

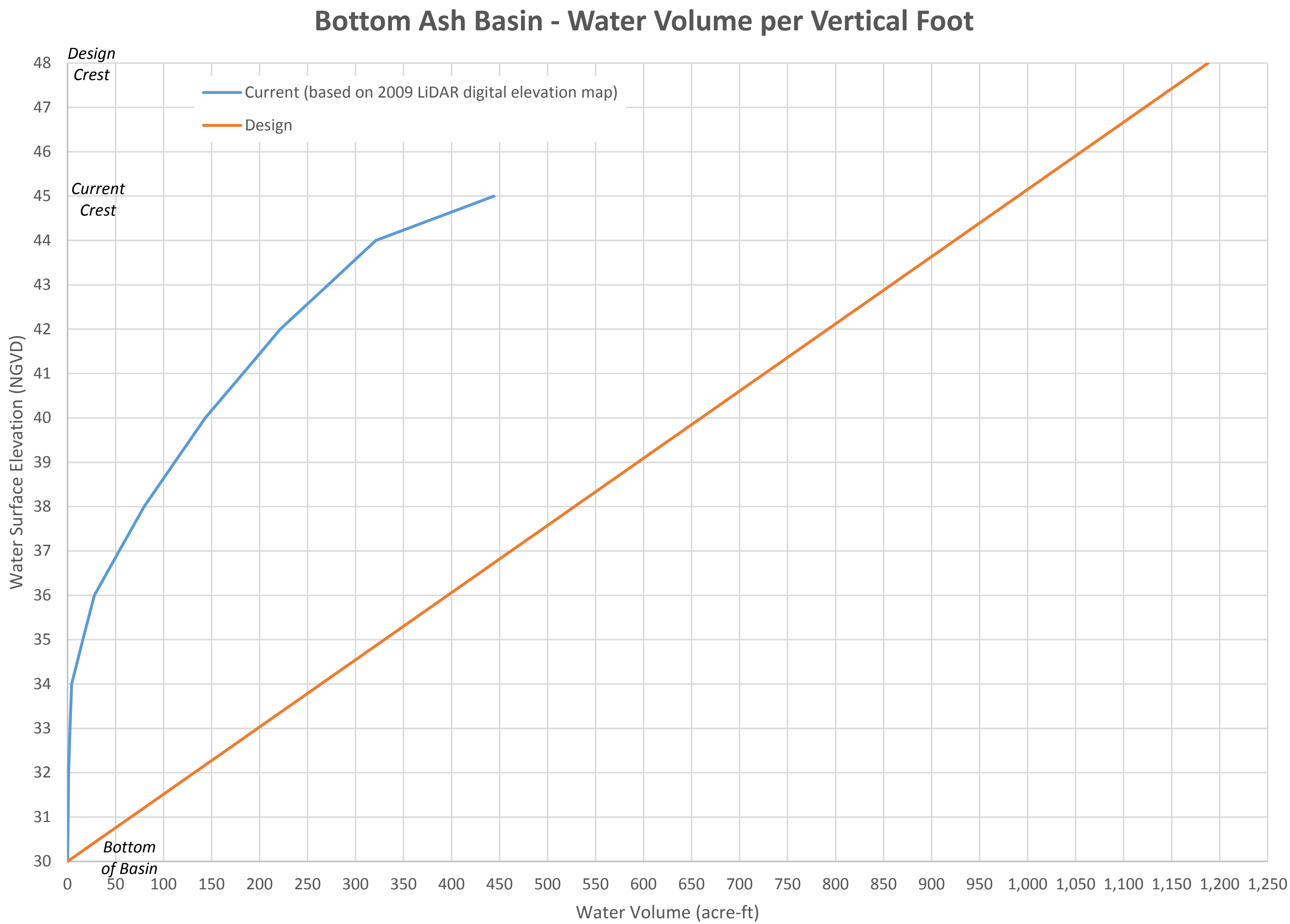

Fly Ash Basin - Water Surface Area per Vertical Foot
Current (based on 2009 LiDAR digital elevation map)
Design
Design Crest
Current Crest
Bottom of Basin
Water Surface Elevation (NGVD)
Water Area (acre)
40
39
38
37
36
35
34
33
32
31
30
0
20
40
60
80
100
120
140
160
180
200



Fly Ash Basin - Water Volume per Vertical Foot
Design Crest
Current Crest
Bottom of Basin
Current (based on 2009 LiDAR digital elevation map)
Design
Water Surface Elevation (NGVD)
40
39
38
37
36
35
34
33
32
31
30
0
100
200
300
400
500
600
700
800
900
1,000
1,100
1,200
1,300
1,400
1,500
1,600
1,700
1,800
1,900
Water Volume (acre-ft)



Bottom Ash Basin - Water Surface Area per Vertical Foot
Current (based on 2009 LiDAR digital elevation map)
Design
Design Crest
Current Crest
Bottom of Basin
Water Surface Elevation (NGVD)
Water Area (acre)
48
47
46
45
44
43
42
41
40
39
38
37
36
35
34
33
32
31
30
0
10
20
30
40
50
60
70



Bottom Ash Basin - Water Volume per Vertical Foot
Current (based on 2009 LiDAR digital elevation map)
Design
Design Crest
Current Crest
Bottom of Basin
Water Surface Elevation (NGVD)
Water Volume (acre-ft)
48
47
46
45
44
43
42
41
40
39
38
37
36
35
34
33
32
31
30
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
950
1,000
1,050
1,100
1,150
1,200
1,250

APPENDIX D

GEOTECHNICAL DESIGN MEMORANDUM

TO: BRAD C. BARRE

FROM: GLEN LANDRY, PE, AND FIROUZ ROSTI, PHD, EI

SUBJECT: SLOPE STABILIY ANALYSES FOR BIG CAJUN II GENERATION SITE

DATE: SEPTEMBER 2, 2016

ATTCHEMENTS: Attachment A (Stability Results)

---

1. PROJECT DESCRIPTION

The Big Cajun II Generating Station is located near the town of New Roads, Louisiana, approximately 35 miles northwest of Baton Rouge, Louisiana. The site is approximately 1500 feet from the west bank of the Mississippi River (Figure 1), with the closest ash basin being approximately 2750 feet from the river.

Figure 1: Project Site Plan

2. CALCULATION OBJECTIVE/PURPOSES

The objective of this analysis is to calculate factor of safety (FOS) for the existing and proposed final slopes for the Fly Ash (FA) and Bottom Ash (BA) basins at the site. This memorandum includes the results of our analyses of the requested slopes considering both static and seismic loads.

3. INPUTS

Data from the preliminary geotechnical Report (GeoEngineers, 2011) was used in our calculations, and includes the following:

1. Geometries of the existing and proposed slopes
2. The site stratigraphy and soil properties in the site area as described below

4. SOIL PROPERTIES

Soil properties were obtained from the provided report. A summary of soil properties is presented below in Table 1.

Table 1: General soil profile used in the evaluation

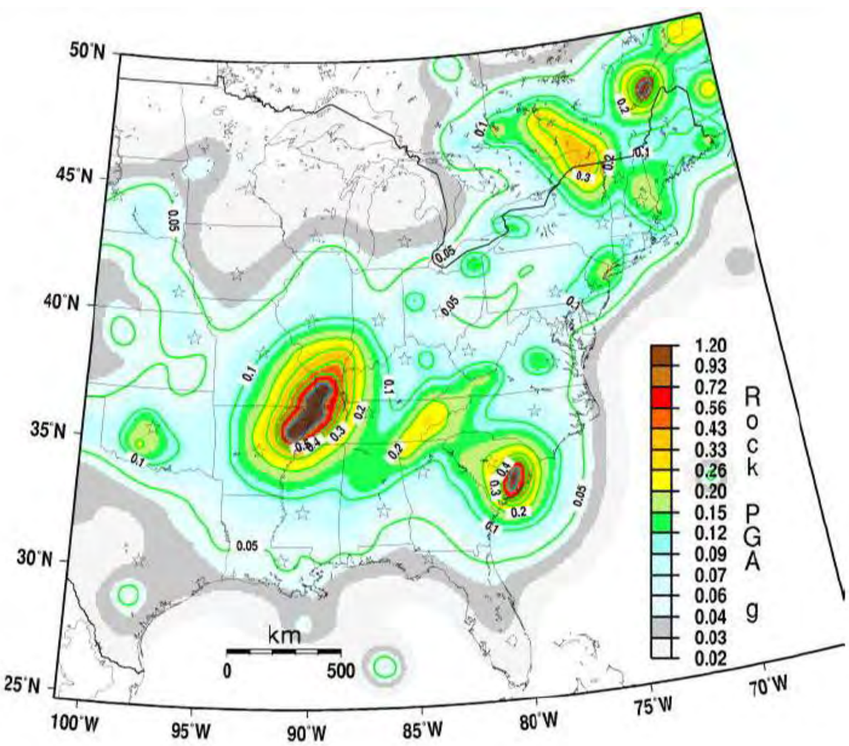
Layer	*Elevation, feet*	*Soil Type*	*Unit weight (pcf)*	*C (psf)*	*Friction Angle*
1	30 to 26	Stiff Clay	114	1000	0
2	26 to 20	Soft Clay	114	500	0
3	20 to 10	Soft Clay	114	400	0
4	10 to 0	Medium Sand	117	0	20
5	0 to -10	Medium to Dense Sand	117	0	25
6	-10 to -50	Dense Sand	117	0	30

5. GROUNDWATER:

The groundwater table was assumed to be at the ground level with an approximate elevation of 30 feet.

6. ASSUMPTIONS

1. It is assumed that there are no surcharge loads on the top of the slopes.
2. Evaluation of liquefaction of the underlying sandy layers is beyond the scope of this analysis.
3. A horizontal seismic acceleration was obtained from national survey of seismicity. A coefficient of 0.05 is used which relates to a 2% chance of experiencing peak acceleration in rock in a 50-years period (USGS Seismic Hazard Map, revised May, 2003) as shown below.



USGS prediction of Peak Ground acceleration in rock with a 2% chance of exceedance in 50 years

4. Natural groundwater level assumed to be at the ground level.
5. Only short-term response using undrained soil parameters was considered in this study.

7. ANALYSIS

Global slope stability analyses were conducted for slopes at four (4) cross-sections with and without consideration of seismic loads, including:

1. Slope stability analysis of the *existing slope* at the FA basin
2. Slope stability analysis of the *proposed final slope* at the FA basin
3. Slope stability analysis of the *existing slope* at the BA basin
4. Slope stability analysis of the *proposed final slo*pe at the BA basin

In each of the abovementioned cases, the slope was evaluated under two (2) different water elevations named as "static maximum storage pool" and "static maximum surcharge pool". According to the provided information, the former one was considered to be at elevation +38 feet for both FA and BA basins, while the latter one was considered to be at elevations +39.9 feet and 39.3 feet for BA and FA basins, respectively.

The analyses were performed using the computer program SLOPE/W, which analyzes the stability utilizing the limit equilibrium method. For this study, the Spencer method (Spencer 1967) was used for a rigorous analysis in order to calculate the minimum factor of safety (FOS) of the selected cross-sections for the existing conditions, as well for the proposed final design slope.

8. RESULTS & CONCLUSIONS

8.1. SLOPE STABILITY ANALYSIS WITHOUT SEISMIC EFFECTS

The stability analyses for both FA and BA basins were conducted under static loads, and the obtained results for the factor of safety (FOS) correspond to each slope are presented in Table 2. The calculated FOS values vary between 1.48 and 2.74 under static load conditions. Comparing the obtained FOS values with the minimum allowable values in Table 2 under static loads (FOS=1.4 & 1.5), indicates that slope for all cases are stable under static loads. Details of the slope geometry, soil layering and obtained results are presented in Attachment A.

Table 2: Slope stability results without seismic effects (Kh=0).

Area	Slope Scenario	Storage pool elevation, feet	Calculated FOS	Required FOS
Fly Ash Basin	Existing Slope	38	2.31	1.5
		39.3	2.29	1.4
	Proposed Capped Slope	38	2.74	1.5
		39.3	2.71	1.4
Bottom Ash Basin	Existing Slope	38	1.50	1.5
		39.9	1.48	1.4
	Proposed Capped Slope	38	1.60	1.5
		39.9	1.58	1.4

8.2. SLOPE STABILITY ANALYSIS WITH SEISMIC EFFECTS

The stability analyses for both FA and BA basins were conducted under additional seismic loads, and the results obtained for the factor of safety (FOS) correspond to each slope are presented in Table 3. The calculated FOS values vary between 1.1 and 1.75 under static load conditions. Comparing the obtained FOS values with the minimum allowable value under seismic loads (FOS=1.1), indicates that slope at the all cases are stable under seismic loads. Details of the slope geometry, soil layering and obtained results are also presented in Attachment A.

Table 3: Slope stability results with seismic effects (Kh=0.05).

Area	Slope Scenario	Storage pool elevation, feet	Calculated FOS	Required FOS
Fly Ash Basin	Existing Slope	38	1.68	1.0
		39.3	1.66	
	Proposed Capped Slope	38	1.75	
		39.3	1.74	
Bottom Ash Basin	Existing Slope	38	1.12	
		39.9	1.11	
	Proposed Capped Slope	38	1.19	
		39.9	1.18	

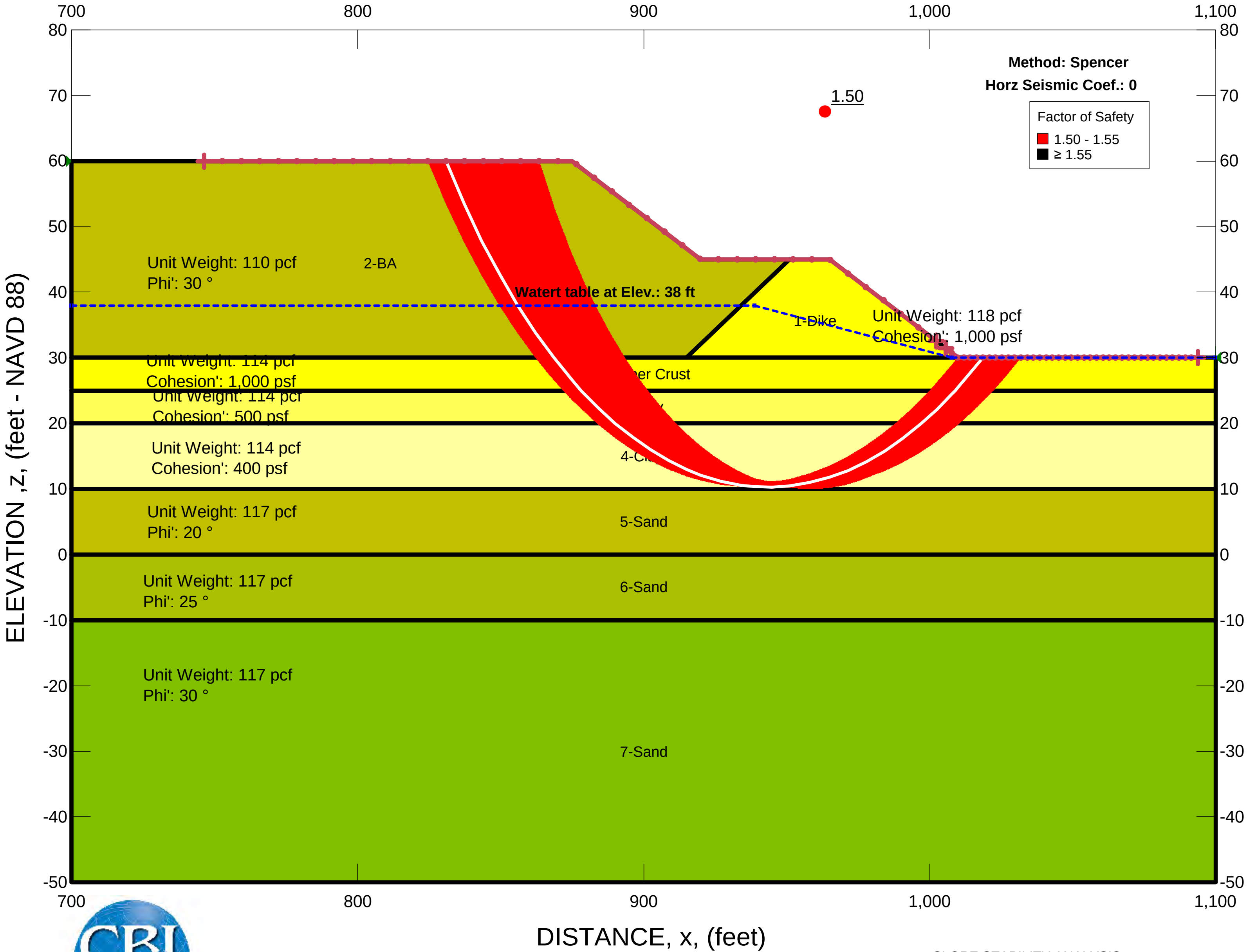
References:

1- GeoEngineers, 2011. "Ash Basins/Wastewater Treatment Ponds, Big Cajun II Generation Site." Preliminary geotechnical engineering service.

2- USGS Seismic Design Map, Revised May, 2003, http://earthquake.usgs.gov/hazards/designmaps/usdesign.php

Attachment A

Slope Stability Results



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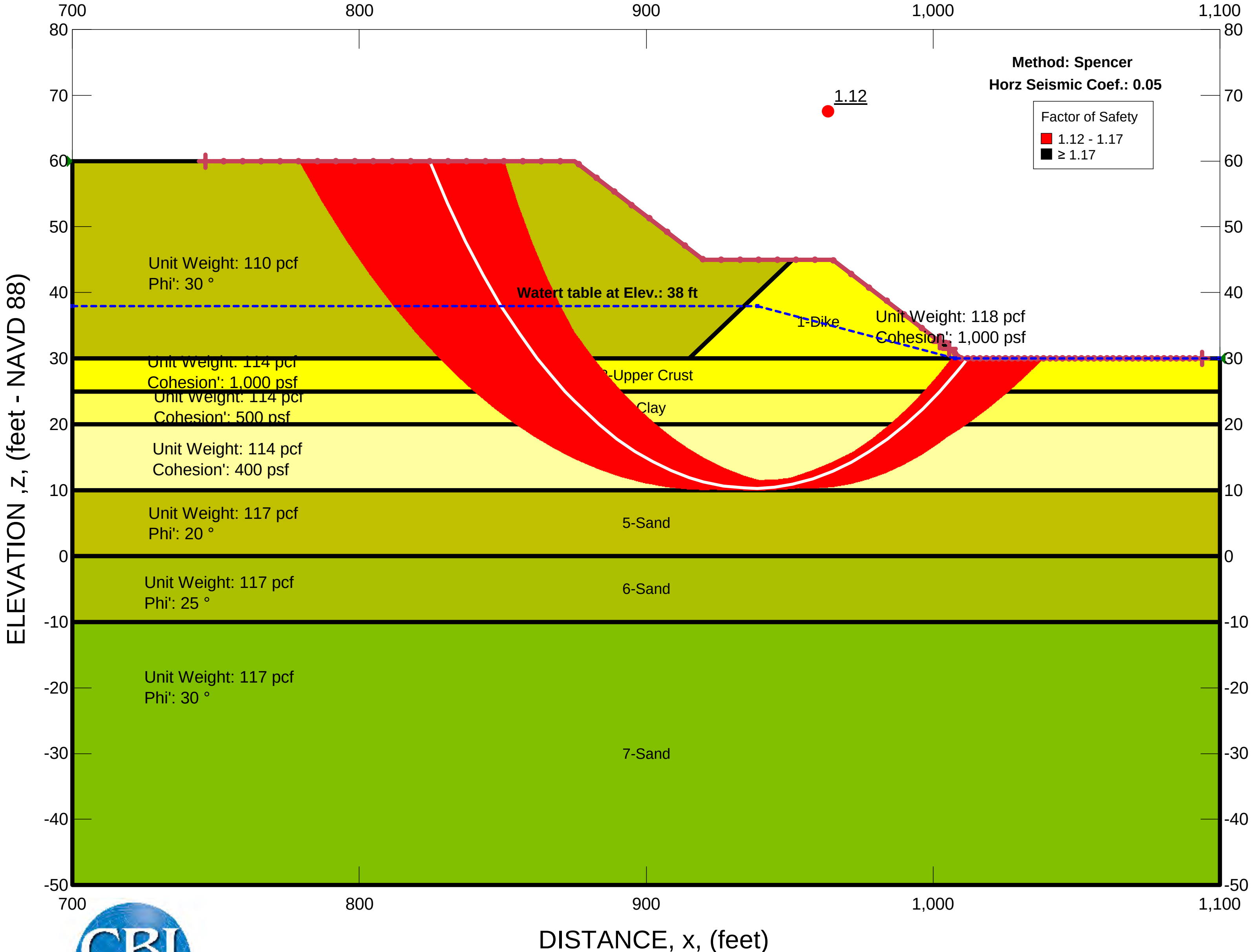
File Name: Cajun-BA-Existing.gsz
Directory: C:\Users\firouz.rosti\Desktop\Documents\PROJECTS\Cajun II\Calculations\
Last Edited By: Rosti, Firouz

SLOPE STABILITY ANALYSIS
GLOBAL STABILITY
GEOMETRY: Existing Slope w./ Bottom Ash (BA)

PROJECT NO. 631215151
Big Cajun II Pond
New Raods, Louisiana

FIGURE



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File Name: Cajun-BA-Existing.gsz
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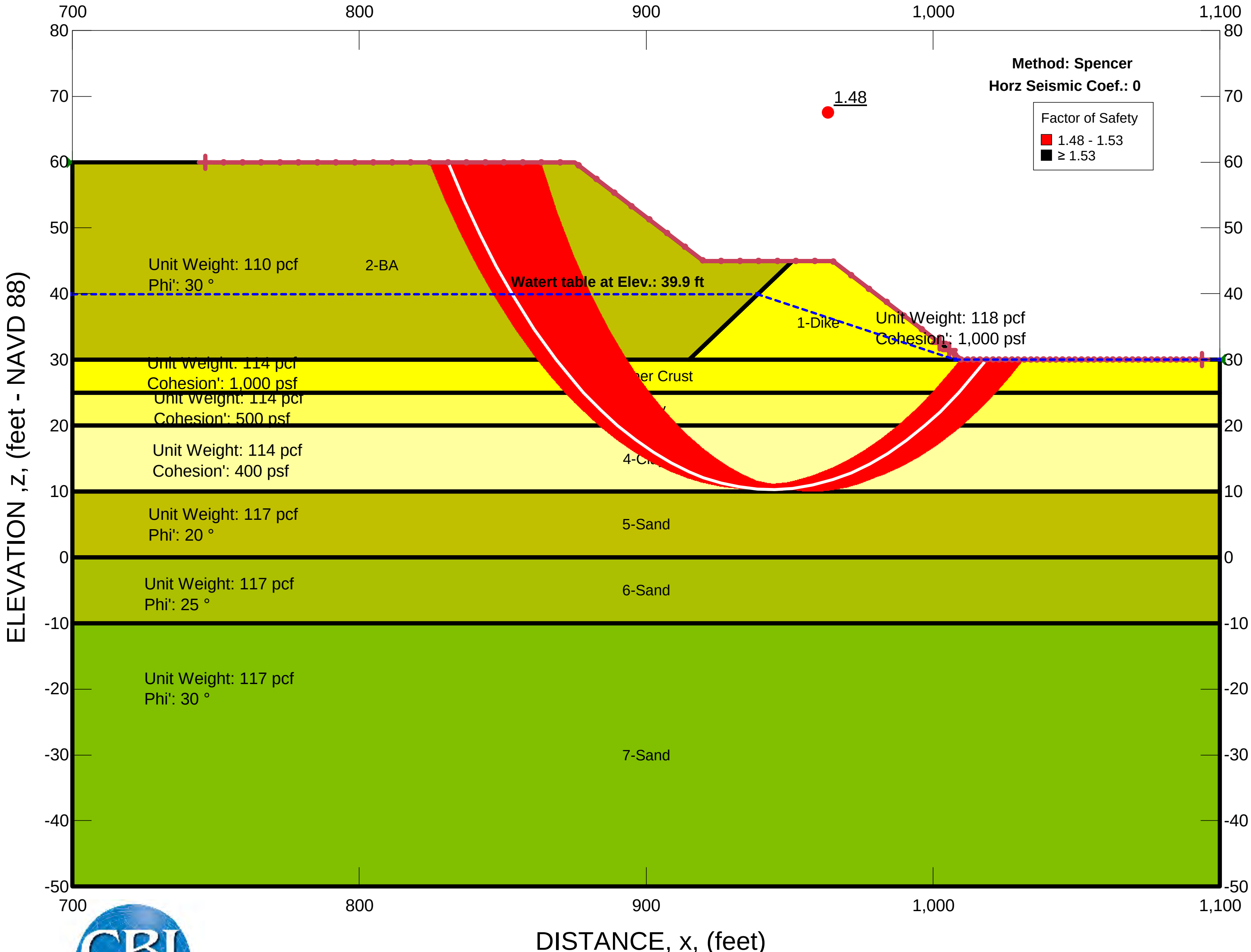
Last Edited By: Rosti, Firouz

SLOPE STABILITY ANALYSIS
GLOBAL STABILITY
GEOMETRY: Existing Slope w./ Bottom Ash (BA)

PROJECT NO. 631215151
Big Cajun II Pond
New Raods, Louisiana

FIGURE



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File Name: Cajun-BA-Existing.gsz
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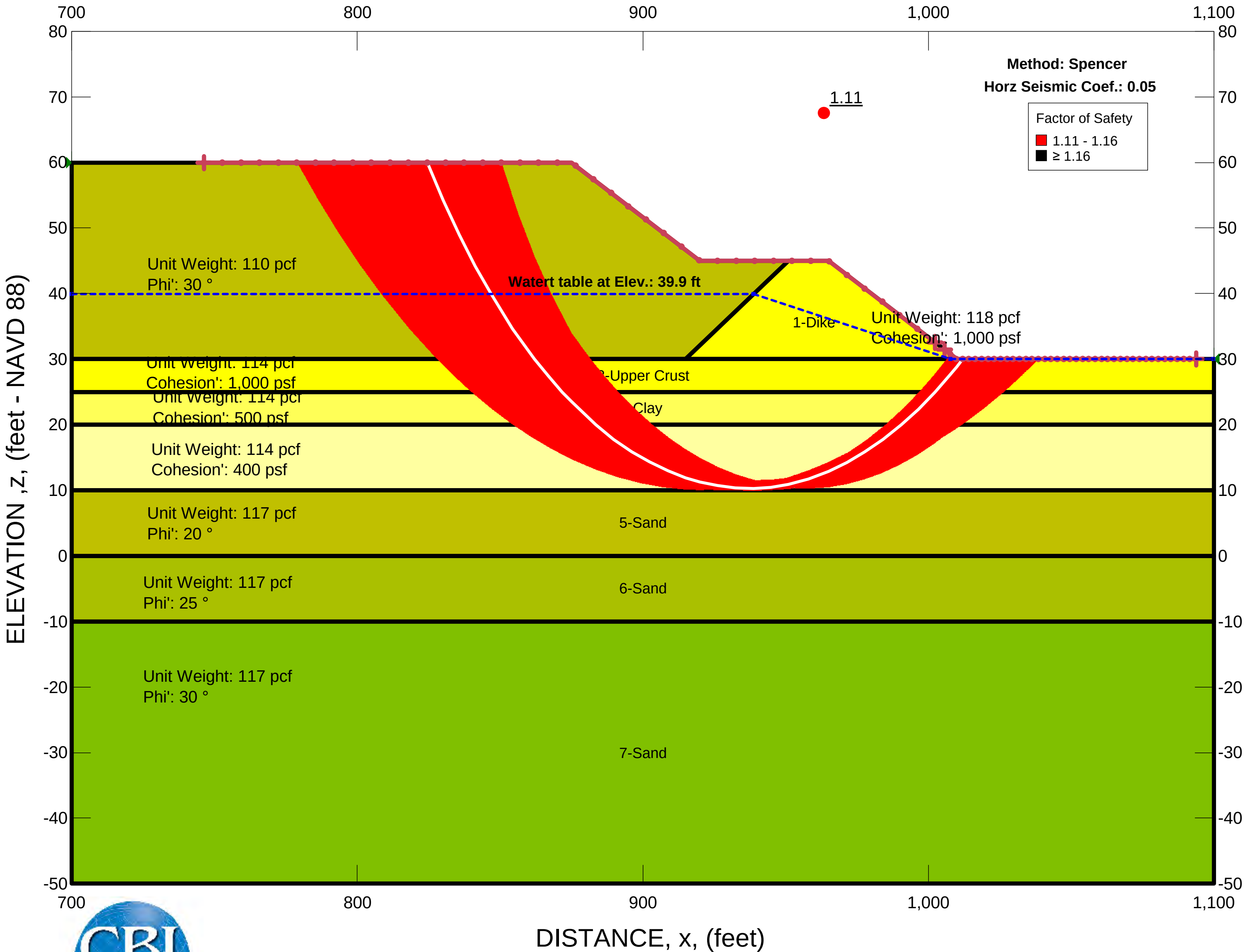
Last Edited By: Rosti, Firouz

SLOPE STABILITY ANALYSIS
GLOBAL STABILITY
GEOMETRY: Existing Slope w./ Bottom Ash (BA)

PROJECT NO. 631215151
Big Cajun II Pond
New Raods, Louisiana

FIGURE

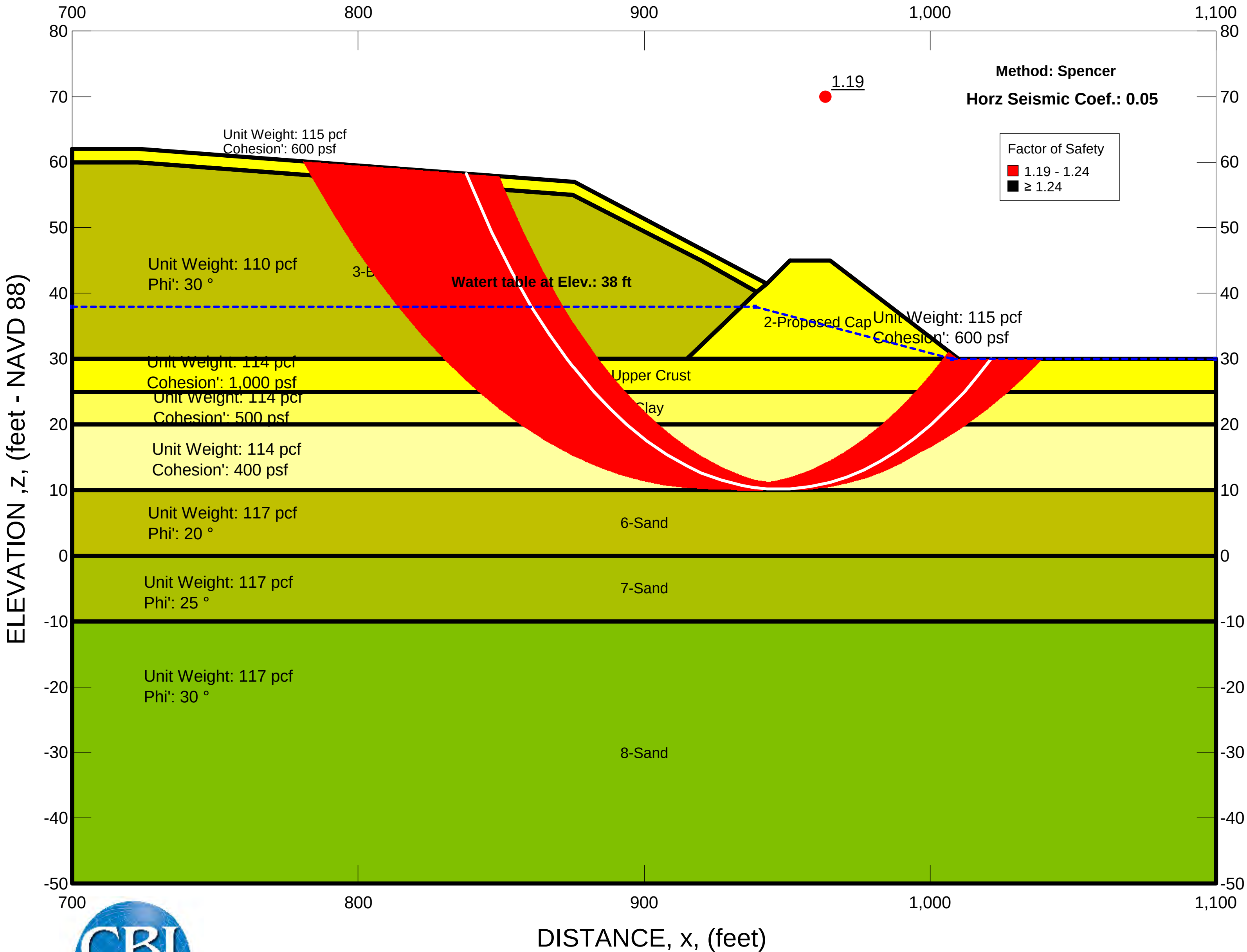


Name: BA-Existing Slope
File Name: Cajun-BA-Existing.gsz
Directory: C:\Users\firouz.rosti\Desktop\Documents\PROJECTS\Cajun II\Calculations\
Last Edited By: Rosti, Firouz

SLOPE STABILITY ANALYSIS
GLOBAL STABILITY
GEOMETRY: Existing Slope w./ Bottom Ash (BA)

PROJECT NO. 631215151
Big Cajun II Pond
New Raods, Louisiana

FIGURE

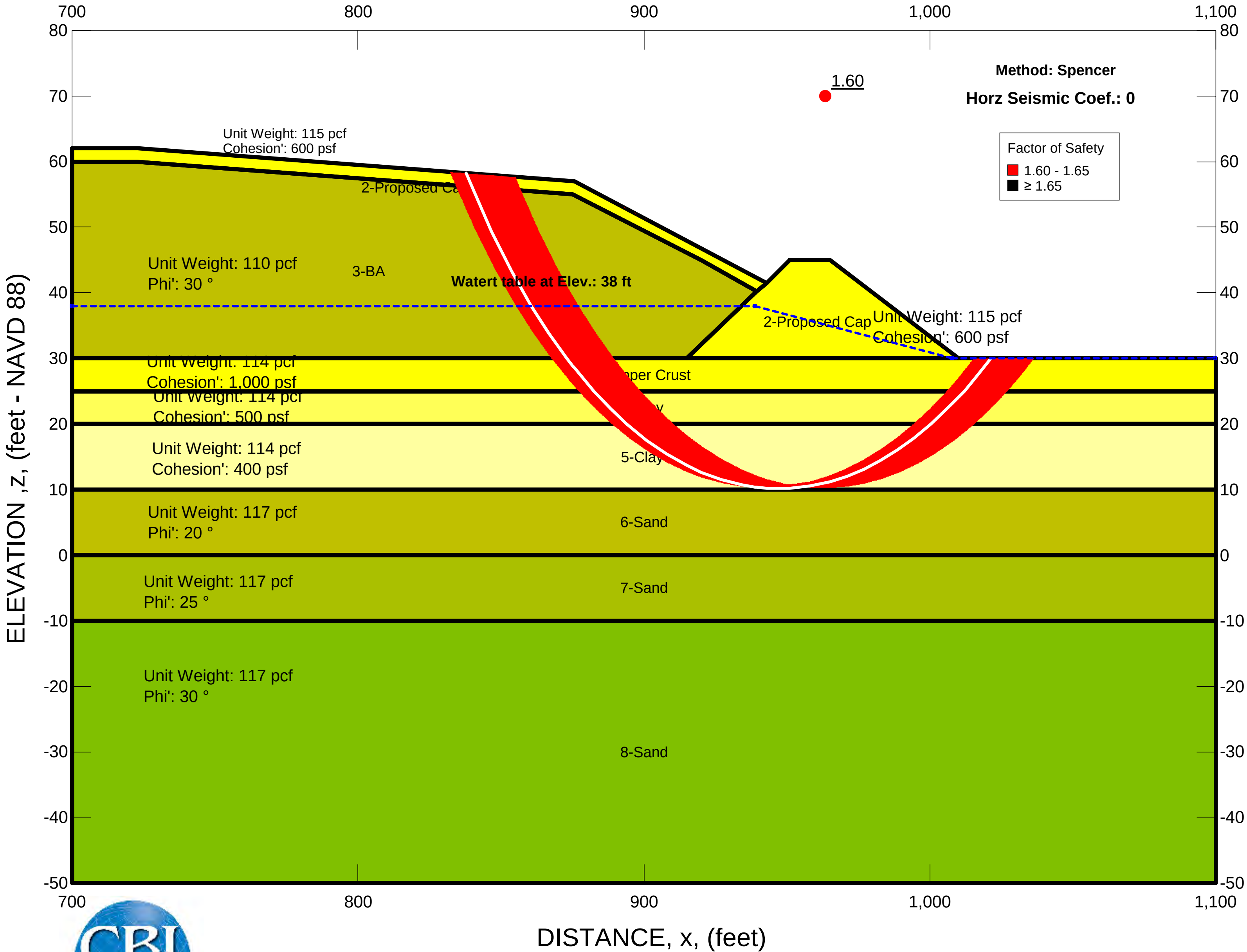


Name: BA-Proposed Slope
File Name: Cajun-BA-Proposed.gsz
Directory: C:\Users\firouz.rosti\Desktop\Documents\PROJECTS\Cajun II\Calculations\
Last Edited By: Rosti, Firouz

SLOPE STABILITY ANALYSIS
GLOBAL STABILITY
GEOMETRY:Proposed Slope w./ Bottom Ash (BA)

PROJECT NO. 631215151
Big Cajun II Pond
New Raods, Louisiana

FIGURE



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Last Edited By: Rosti, Firouz

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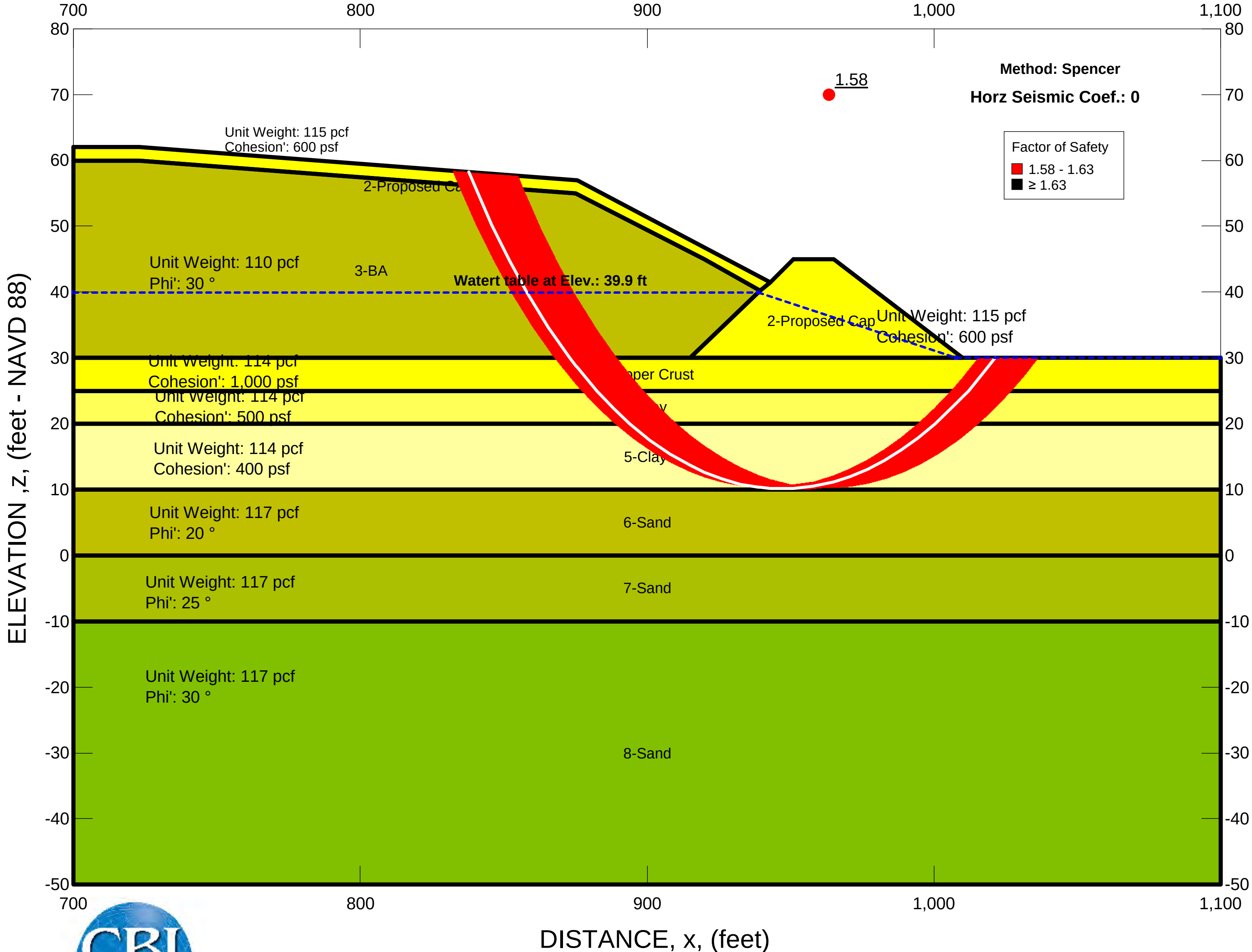

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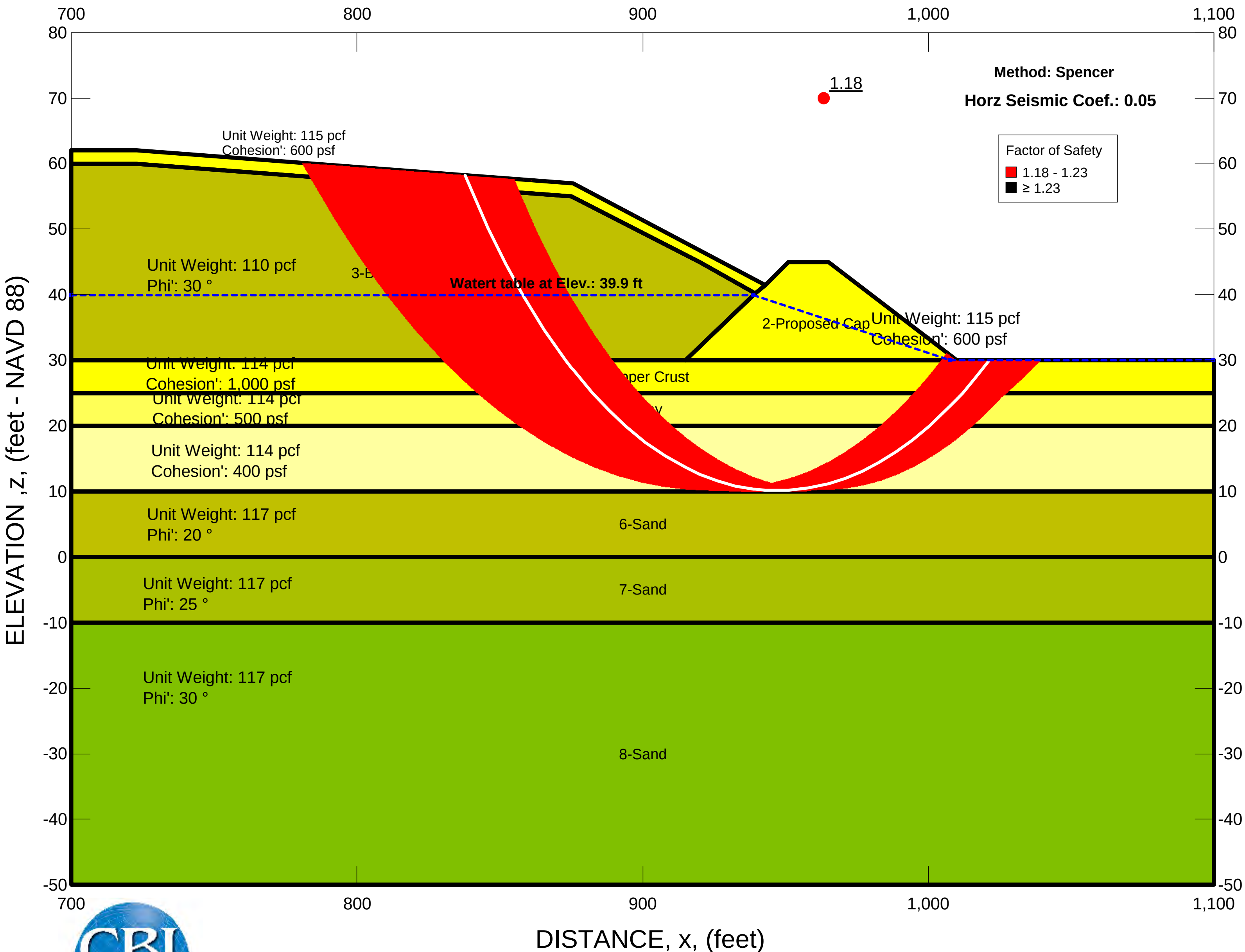

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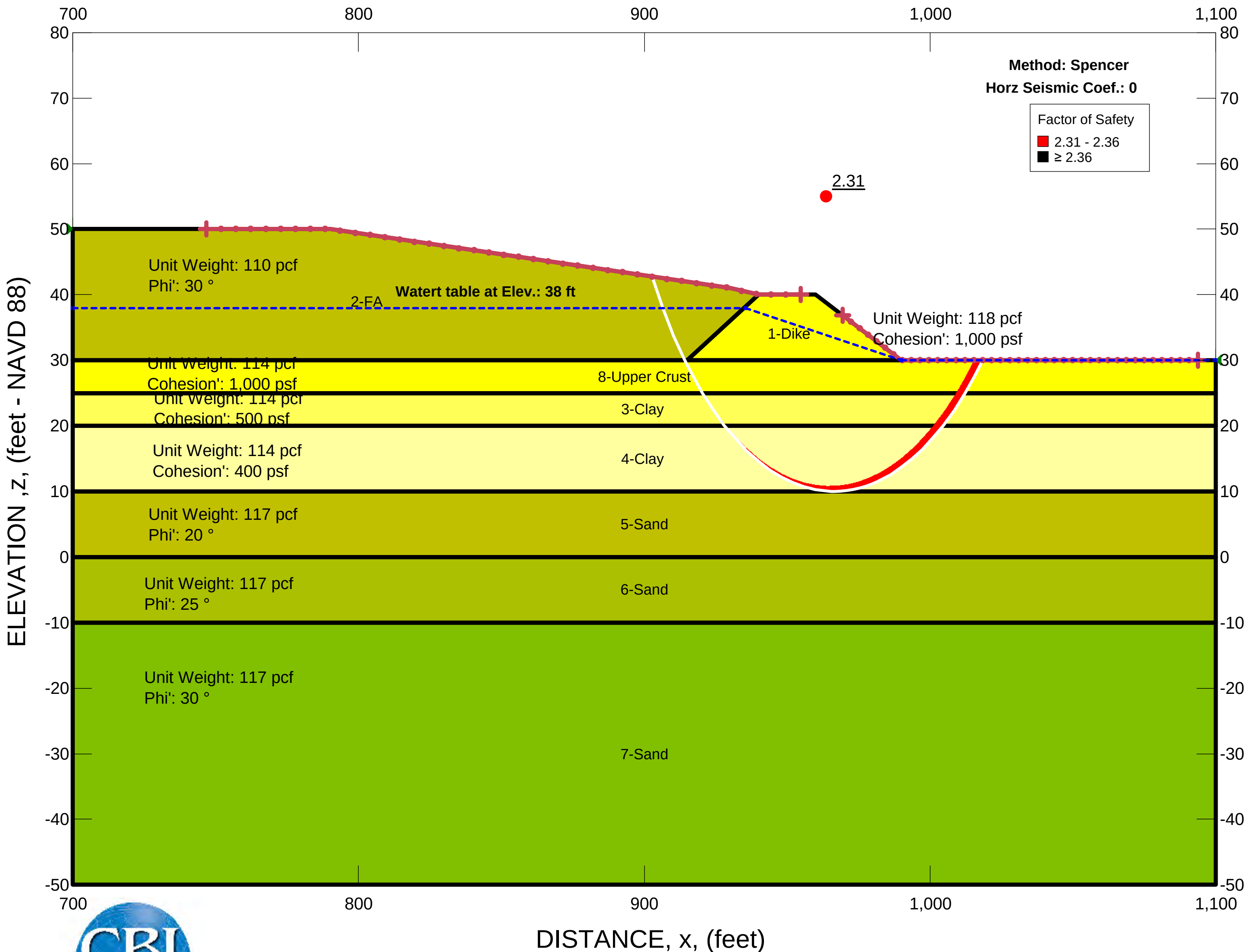

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SLOPE STABILITY ANALYSIS
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PROJECT NO. 631215151
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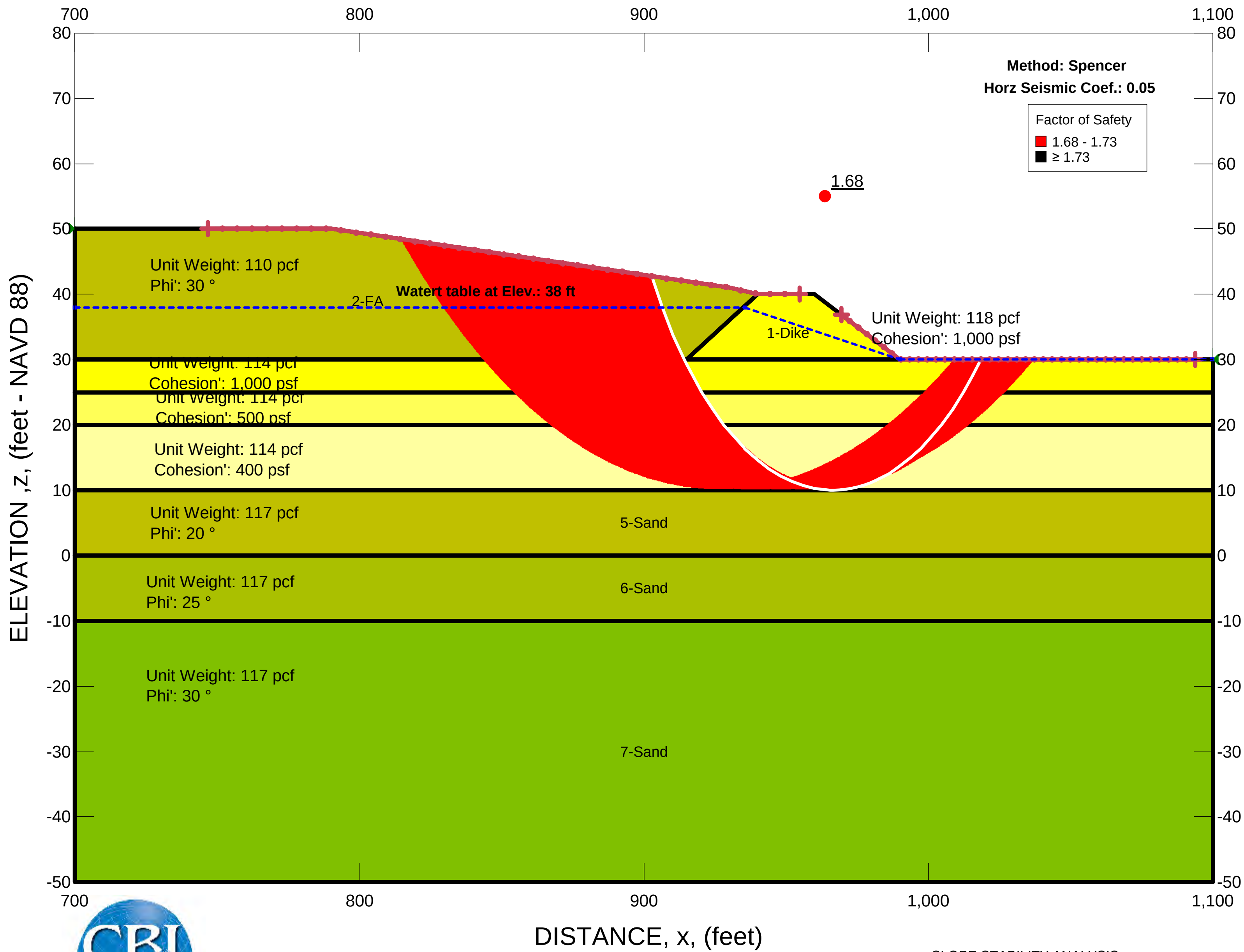

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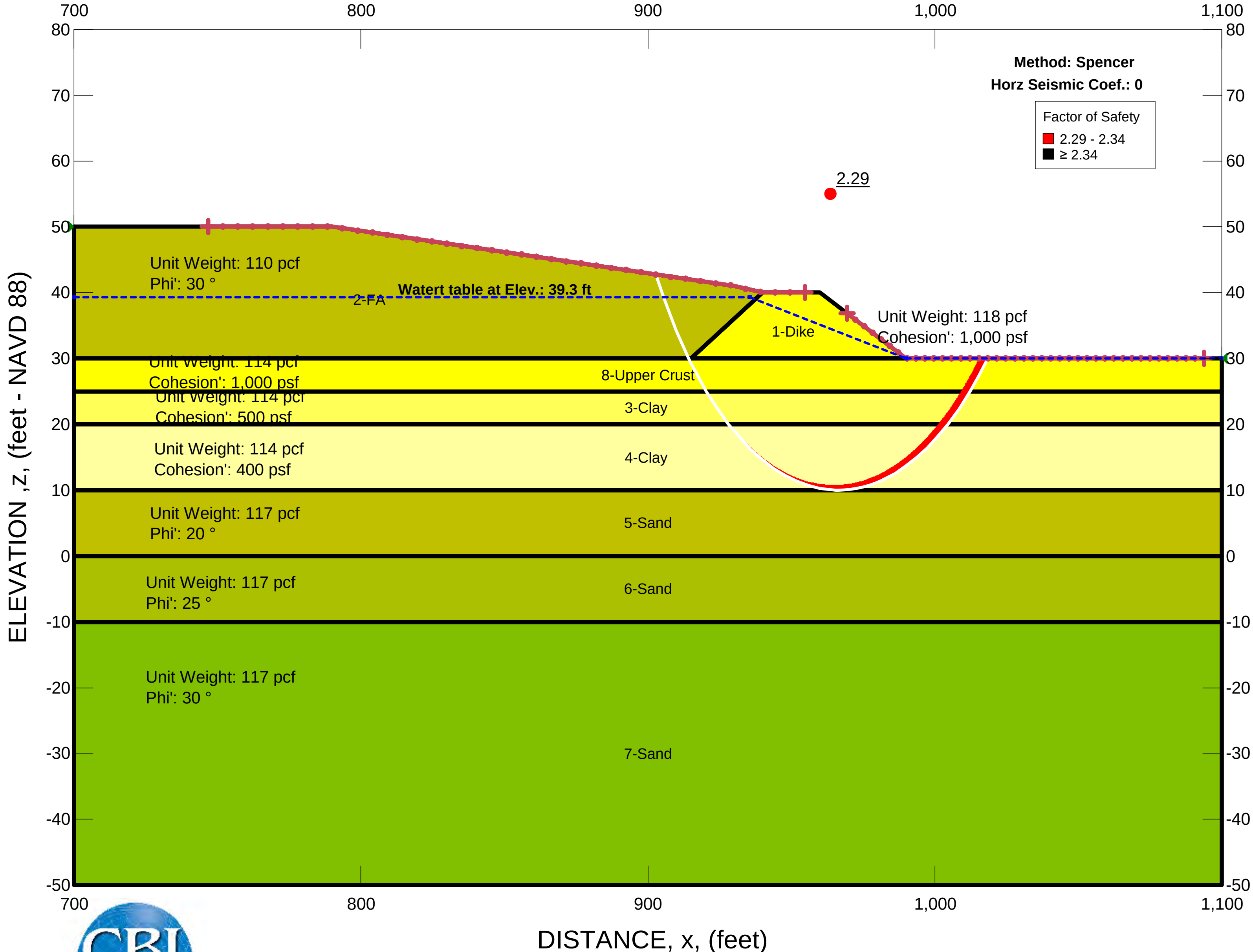

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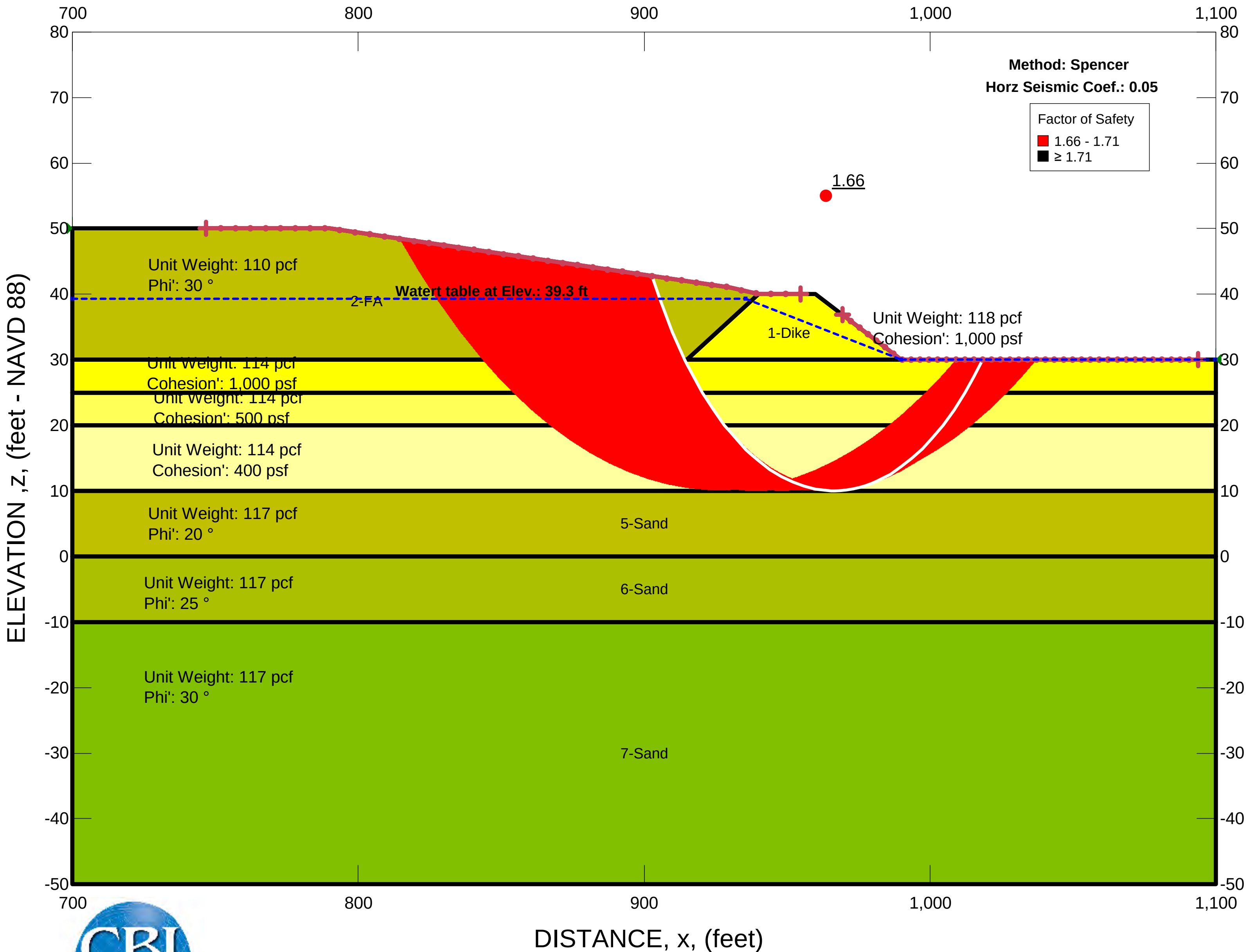

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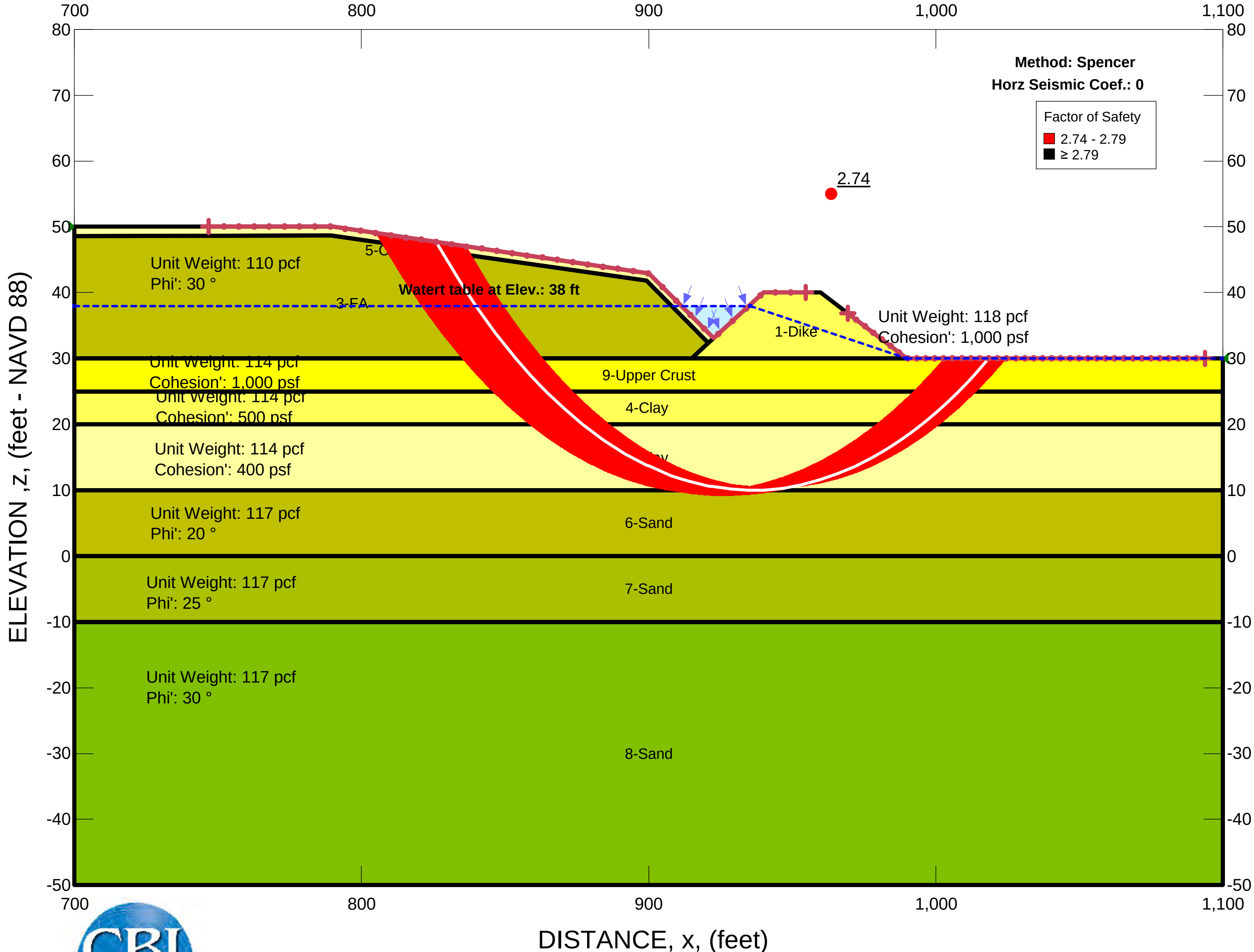

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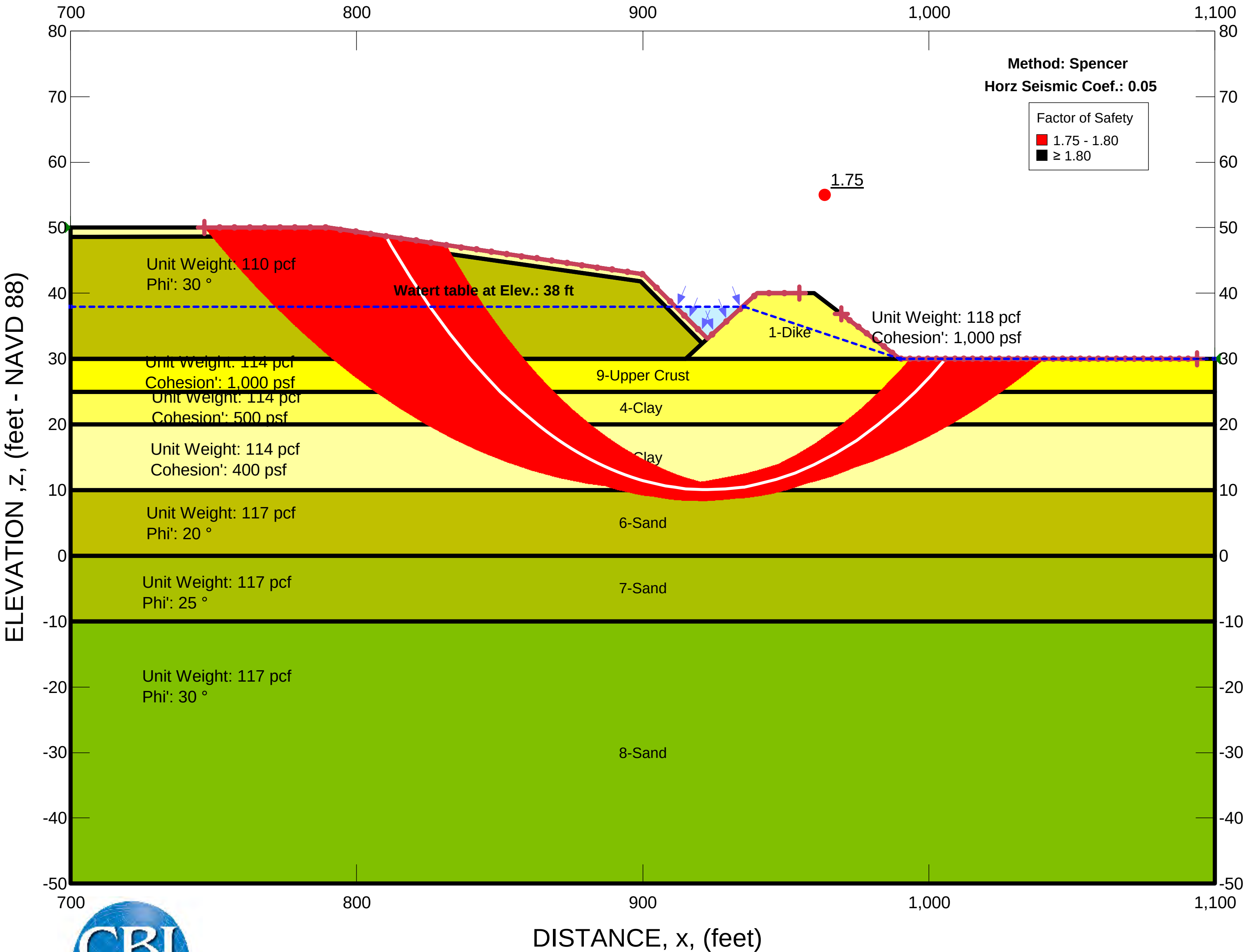

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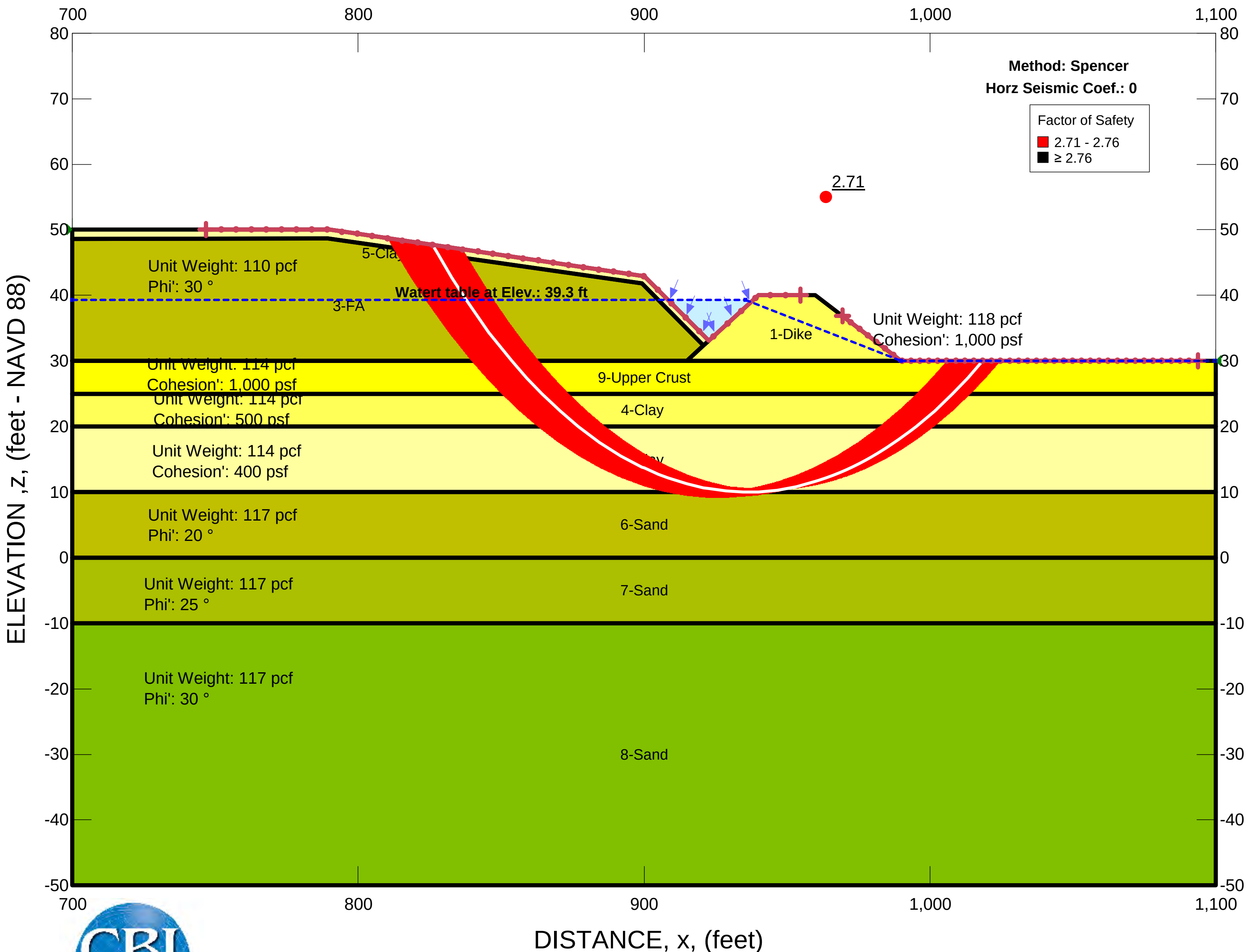

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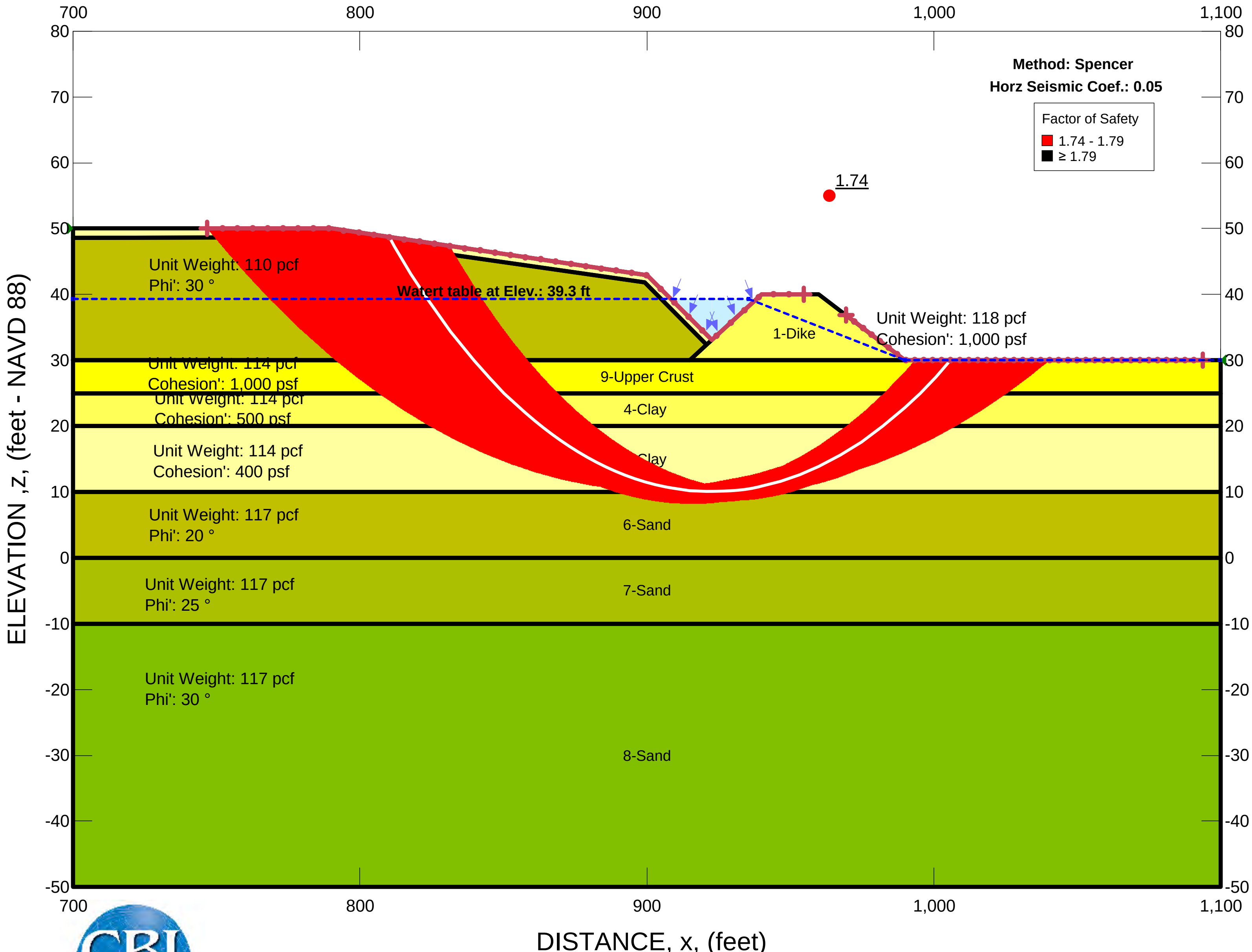

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