MidAmerican ENERGY
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4299 NW Urbandale Drive
Urbandale, Iowa 50322

August 23, 2011

Delivered via E-Mail to
hoffman.stephen@epa.gov

Mr. Stephen Hoffman
U.S. Environmental Protection Agency
Two Potomac Yard
2733 South Crystal Drive
5th Floor, N-5838
Arlington, Virginia 22202-2733

Re: Responses to Recommendations in Final Coal Combustion Waste Impoundment Round 7 - Dam Assessment Report for Walter Scott Junior Energy Center

Dear Mr. Hoffman:

MidAmerican Energy Company ("MidAmerican") appreciates the opportunity to provide responses to the recommendations outlined in the Final Coal Combustion Waste Impoundment Round 7 - Dam Assessment Report for Walter Scott Junior Energy Center. The specific recommendations were summarized in EPA's June 26, 2011 letter, Enclosure 2, submitted to MidAmerican's Ms. Cathy Woollums.

MidAmerican takes its environmental responsibilities very seriously. I therefore hope you find the responses complete and consistent with your expectations. However, if you have any questions or require any additional information, please don't hesitate to contact me.

Sincerely,

Kevin D. Dodson
Director – Environmental Programs,
Compliance and Permitting
Phone: 515-281-2692
kddodson@midamerican.com

Attachments

cc: Matt Finnegan
Dave Ulozas
Cathy Woollums
Dave Maystrick

Walter Scott Junior Energy Center Recommendations

1.2.1 Recommendations Regarding the Structural Stability

EPA Comment: No recommendations regarding structural stability appear to be warranted at this time.

MEC Response: MidAmerican agrees that no structural stability requirements are warranted at this time.

1.2.2 Recommendations Regarding the Hydrologic/Hydraulic Safety

EPA Comment: Perform hydrologic calculations to provide formal documentation of internal hydrologic safety of the ash basins and update the calculations as necessary to account for changes in internal drainage patterns and reduction in available flood surcharge storage as the basins fill with more ash.

MEC Response: Terracon and HGM completed the geotechnical report of global stability of the surface impoundments' embankments on October 22, 2010, and the results were provided to Dewberry on October 24, 2010. In addition, Terracon completed a seepage analysis April 12, 2011. Both reports are attached for convenience as Exhibit A and Exhibit B, respectively. The calculations will be updated as necessary to account for changes in internal drainage patterns and reduction in available flood surcharge storage as the basins fill with more ash.

1.2.3 Recommendations Regarding the Supporting Technical Documentation

EPA Comment: Maintain current documentation of all relevant appropriate stability analyses and hydrologic analyses in MidAmerican files, including copies of the current analyses conducted under the charge of the levee districts and/or the USACE. The utility should ask the levee districts and the USACE for updates of the analyses whenever they are made.

MEC Response: All documentation concerning stability analyses and hydrologic analyses, including those received by the levee district and/or the U.S. Army Corps of Engineers, will be maintained in the plant environmental files for a minimum of five years. Requests will be made to the levee district and the USACE to provide updates of analyses whenever they are conducted.

1.2.4 Recommendations Regarding the Description of the Management Unit(s)

EPA Comment: Update project documents to include or note current features of the ash basins and modify or supplement the documents as needed when changes are made in the future. For example, the recently completed crest elevation profiles around both ash ponds surveyed by HGM Associates, Inc. (Appendix D - Item 2 of the final report) serves to provide documentation of current crest elevations, which should be referenced on official project plans.

MEC Response: Project files have been updated showing the new levee crests and indicate the updated survey elevations from HGM Associates. The documents will be modified or supplemented as needed when changes are made in the future.

1.2.5 Recommendations Regarding the Field Observations

EPA Comment: A number of field observations relate to maintenance issues. Recommendations regarding maintenance issues are included in the following Subsection 1.2.6.

MEC Response: Please refer to MidAmerican's response in Subsection 1.2.6.

EPA Comment: The draft report identified issues concerning the slump on the levee (outside slope of dike on north side of South Ash Pond) and damaged end of outlet pipe from the North Ash Pond. Subsequent repairs have been made, so no action is required by MidAmerican, other than visual monitoring.

MEC Response: The USACE and M&P Levee District made repairs to the Pony Creek dike on the north side of the South Ash Pond and repaired the damaged outlet pipe in the first quarter of 2011. The following photo documents repairs to the scoured and sloughed areas.

USACE repaired scour on Pony Creek levee, north of WSEC south ash pond. Photo taken 8/16/2011.

MidAmerican conducts monthly visual evaluations of the North and South Ash Ponds. A checklist is completed during these inspections to note areas of concern. More frequent inspections will be conducted and documented as conditions may warrant.

EPA Comment: Raising the low section of the South Ash Pond dike does not appear to be necessary at this time, but may need to be considered if there is continuing settlement due to unusually large secondary compression effects or if more formal calculations of hydrologic safety show a need for more freeboard at the low dike section.

MEC Response: The low section of the east side of the South Ash Pond levee was raised uniformly to Elevation 978 along south-east side. See the following photos.

Photo shows construction to level top of levee of south ash pond. Levee has since been seeded.

WSEC completed construction of raising portion of levee on southeast side of WSEC south ash pond (see following photo).

Photo shows the completed top and level east side levee of WSEC south ash pond on 8/16/2011(looking south).

1.2.6 Recommendations Regarding the Maintenance and Methods of Operation

EPA Comment: It is recommended that MidAmerican develop and implement a written plan or operating procedure for removing water from the ponds or limiting water build-up in the ponds during times of unusually wet weather, in order to be assured of maintaining pond water surface elevations at or below elevations that provide seepage exit gradients at or below 0.5. No other recommendations regarding methods of operation appear to be warranted at this time.

MEC Response: Currently, MidAmerican has developed and is currently refining its comprehensive surface impoundment operating and maintenance plan. In the event of unusually wet weather, Walter Scott Jr. Energy Center has an NPDES permit to discharge water from the North Ash Pond to Pony Creek. The South Ash Pond does not discharge, so activities affecting the water elevation in this pond are monitored closely. The source, volume and duration of water sent to the south impoundment as well as reclaimed water back to Unit 3, are taken into consideration to limit the water surface elevation.

Maintenance recommendations are as follows:

- **EPA Comment:** Eradicate sunflowers and other tall, stalky vegetation on the dike embankment slopes or control this type of vegetation by cutting three times during the growing season. Continue to mow the crests and shoulder areas of the dike embankments, also three times during the growing season.

  MEC Response: Herbicide was applied during March and April 2011, and mowing occurred in June 2011. MidAmerican will continue to mow the crest and shoulder areas of dike embankments at least two to three times during the growing season and apply pre-emergent and broadleaf herbicides as needed. Depending on seasonal conditions, more frequent mowing and herbicide applications will be conducted. These activities will be documented and maintained in the plant files.

- **EPA Comment:** If possible through an agreement with the adjacent land owner, remove the small trees and bushes on the outside slope of the dike on the north side of the North Ash Pond before they become large.

  MEC Response: MidAmerican is currently working to obtain an estimate for the removal of the small trees and bushes on the north end of the North Ash Pond. Subsequently, a schedule will be developed to clean woody vegetation from the areas of concern, with a goal to complete the work by December 2011. Please note, however, that a bald eagle roosts in one of the larger trees in the northwest corner of the north ash pond, and the area around that tree will not be disturbed.

- **EPA Comment:** Subsequent to the draft report, MidAmerican has provided follow-up documentation showing that the riprap repairs at the South Ash Pond have been completed. MidAmerican has further indicated that the wave erosion at the northeast corner of the North Ash Pond is being monitored and an assessment on placement of riprap for wave erosion protection will be made in late spring 2011.

  MEC Response: The surface impoundments are being inspected for signs of soil movements and/or erosion. Improvements have been made on the north side of south ash pond with addition of rip rap to mitigate further wave erosion. See the following photo documenting the improvements.

Photo shows Rip rap added to north levee of south ash pond to mitigate wave erosion.

- **EPA Comment:** Clean sediment out of the overflow structure at the inlet end of the outlet structure in the North Ash Pond and maintain the structure clear of sediment in the future, to assure that the opening under the skimmer wall is not blocked, when (or if) discharge through the outlet structure is needed.

  MEC Response: The inlet end of the outlet structure will be inspected following the conclusion of the existing flooding conditions along the Missouri River. Sediment will be removed as necessary to ensure the opening under the skimmer is not blocked. Routine inspections will be made to monitor the condition of this structure.

1.2.7 Recommendations Regarding the Surveillance and Monitoring Program

EPA Comment: It is recommended that, at a minimum, an engineer experienced with dams accompany the inspection personnel at least once annually and prepare a separate report or checklist of his/her observations and include assessment of the impounding dikes along with recommendations, as needed. In addition, if the normal operating water level in the North Ash Pond is raised and discharges through the outlet structure become routine, it is recommended that conducting interior inspections every 5 years with a remote video camera or by personnel using

confined-space entry procedures begin soon after raising the water level or allowing discharge through outlet structure. The results should be documented with a written inspection report.

MEC Response: Annual inspections of the impoundments will be conducted and documented by an engineer experienced with dams. If discharges through the North Ash Pond outlet structure become routine, interior inspections at least every five years will be conducted via a remote video camera or visual observations. All inspection results will be documented in a written report and maintained in the plant files for a minimum of five years.

EPA Comment: During future inspections, it is recommended that inspectors closely observe the dike embankment on the north side of the North Ash Pond where the inside slope is particularly steep just above waterline, to check for tension cracks, slide scarps or other signs of mass soil movement.

MEC Response: Future inspections will include the dike embankment on the north side of the North Ash Pond. Any deficiencies, such as tension cracks, slide scarps or other signs of mass soil movement will be documented on the facility ash impoundment inspection checklist. Corrective actions will be promptly initiated as warranted.

EPA Comment: No recommendations for permanent performance monitoring instruments appear to be warranted at this time. However, frequent visual monitoring of the temporary steel pins behind the slough on the outside slope of the dike on the north side of the South Ash Pond should continue as planned and frequent visual monitoring of the damaged end of the outlet pipe should be done, until both are repaired by the USACE.

MEC Response: The outlet pipe and the sloughed area have been repaired. Please refer to the response to Subsection 1.2.5. These areas will continue to be monitored through the routine inspection process.

1.2.8 Recommendations Regarding Continued Safe and Reliable Operation

EPA Comment: No additional recommendations for continued safe and reliable operation appear warranted at this time.

MEC Response: MidAmerican agrees that no additional improvements are warranted at this time for the safe and reliable operation of the surface impoundments.

Geotechnical Engineering Report

Preliminary Opinions of Global Stability
Ash Containment Pond Embankments
Walter Scott Energy Center
Council Bluffs, Iowa

October 22, 2010

Terracon Project No. 05105087

Prepared for:
HGM Associates, Inc.
Council Bluffs, Iowa

Prepared by:
Terracon Consultants, Inc.
Omaha, Nebraska

LICENSED PROFESSIONAL ENGINEER
EDWARD D. PROST, JR.
12790
IOWA

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

Edward D. Prost Jr., P.E. 10-22-10 (date)

My license renewal date is December 31, 2010.

Pages or sheets covered by this seal:
Geotechnical Engineering Report

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October 22, 2010

HGM Associates, Inc
640 5th Avenue
Council Bluffs, Iowa 51502

Attention: Mr. Terry Smith, P.E.

Re: Geotechnical Engineering Report
Preliminary Opinions of Global Stability
Ash Containment Pond Embankments
Walter Scott Energy Center
Council Bluffs, Iowa
Terracon Project No. 05105087

Dear Mr. Smith:

Terracon Consultants, Inc. (Terracon) conducted a limited subsurface exploration to obtain data concerning subsurface conditions for our use in performing global stability analyses of selected Ash Containment Pond embankments as described in our Proposal P05090622. This report presents the findings of the subsurface exploration and provides the results of our slope stability analyses. The scope of exploration and analyses is considered limited and cursory and is not intended to meet any particular regulatory guidelines, but rather to provide preliminary opinions of global stability at selected locations.

We appreciate the opportunity to provide the geotechnical consulting services for this project and are prepared to provide more rigorous analyses as recommended in this report. Please contact us if you have any questions regarding this report.

Sincerely,

Terracon Consultants, Inc.

FOR Brett W. Larsen
Staff Geotechnical Engineer

Edward D. Prost, Jr., P.E.
Principal

BWL/EDP:bwl/leb

Report Distribution: Addressee (2, 1 via e-mail)
David Maystrick, MidAmerican Energy Company (1-via e-mail)

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EXECUTIVE SUMMARY

Consultants to the EPA are currently conducting an audit of the ash containment ponds located on the east side of the Walter Scott Energy Center (WSEC) in Council Bluffs, Iowa. MidAmerican Energy Company (MEC) requested Terracon Consultants, Inc. (Terracon) conduct cursory analyses of global stability of the earth embankments that surround the ash ponds. Terracon understands this report will be provided to the EPA consultants to assist with their audit. Terracon conducted a limited subsurface exploration to obtain data concerning subsurface conditions for our use in performing the requested cursory global stability analyses of selected Ash Containment Pond embankments located at WSEC. Five borings, designated B-1, B-2, B-4, B-5, and B-6, were completed to depths of approximately 50 feet below the existing ground surface. To supplement data obtained from these borings, three electronic cone soundings, designated EC-1, EC-3 and EC-4 were completed to depths of approximately 19 to 47 feet. Boring and cone sounding locations are shown on the Location Diagram in Appendix A. Laboratory tests were performed on selected samples recovered from the borings.

This report presents the findings of the subsurface exploration and provides the results of our slope stability analyses. An abbreviated summary of findings, results, and recommendations are presented below. This report must be read in its entirety for a comprehensive understanding of our analyses and the limitations of this report.

For this study, embankment geometry was taken from survey cross sections supplied by HGM. The slope stability models utilized cohesion and friction angle values determined from experience with similar soils, correlation with data from index tests performed the samples recovered from borings, and shear strength test data obtained from discrete samples collected at the site during this and previous explorations. Two consolidated undrained triaxial tests were performed on samples obtained during this site exploration; sample 4 from Boring B-2 and sample 5 from Boring B-5. Strength parameters determined from the laboratory tests are representative of peak strengths. The design shear strength parameters selected for the embankment fill and native clay soils are representative of post-peak strengths, which consider the effects of long-term strain softening. Subsurface stratigraphy was based on conditions encountered at borings conducted along the crest of embankments. Piezometric surfaces were inferred based on elevations of static water surface levels in the ponds provided by HGM and short term water levels recorded at borings.

- Stability analyses were performed using the computer program SLOPE/W, developed by Geo-Slope Inc. Analyses searched for circular failure arcs on the upstream and downstream slope for the Steady Stage Seepage condition at the maximum pool elevations, which were set at 971.3 feet and 970 feet for the south and north ponds, respectively and the phreatic lines within the levees were estimated for each model. We also evaluated the seismic (pseudo-static) stability for the each model. The computer

program utilized the Morgenstern-Price method to calculate the critical failure surfaces for each case. Four (4) cases were analyzed for each of six (6) models.

We did not analyze the selected models using undrained shear strength parameters. Undrained analyses are applicable to conditions that exist immediately following construction. Inasmuch as the embankments have been in place for some time and the embankments have not been recently altered, we did not consider undrained analyses would appropriately model current conditions. Also, since there is no mechanism to allow for rapid drawdown of the water levels within the ponds, we did not analyze the affect of rapid drawdown of pond water levels on the stability of slopes facing pond interiors.

- The stability analysis results were compared with US Army Corps of Engineers (USACE) minimum requirements for earthen levees contained in Table 6.1b from USACE EM 1110-2-1913. Models of the Embankment Sections A-A, C-C, E-E, F-F, L-L, M-M, and O-O were analyzed. Each of these models, representing sections in both the north and south pond, exhibit factors of safety greater than 1.4 for the steady state seepage conditions and greater than 1.0 for pseudo-static seismic conditions. The results are summarized in a table in Section 4.5 of this report.

- Since the time of our exploration, the owner reshaped portions of the pond side slope of the south levee to approximately 2 Horizontal: 1 Vertical by adding clay fill and surfacing with rip-rap at the water edge. This fill placement is anticipated to reduce further erosion action and in our opinion will not reduce the stability of the levee at these locations.

- Global stability of pond embankment slopes is sensitive to subsurface conditions, particularly at the base of the embankment slopes. Without boring data at the toes of the embankments, we extrapolated conditions encountered within the interior of the embankment to beyond the landward and pond side toe. Models do not reflect variations in stratigraphy or shear strength between or beyond the boring locations.

GEOTECHNICAL ENGINEERING REPORT
PRELIMINARY OPINIONS OF GLOBAL STABILITY
ASH CONTAINMENT POND EMBANKMENTS
WALTER SCOTT ENERGY CENTER
COUNCIL BLUFFS, IOWA

Terracon Project No. 05105087
October 22, 2010

1.0 INTRODUCTION

Consultants to the EPA are currently conducting an audit of the ash containment ponds located on the east side of the Walter Scott Energy Center (WSEC) in Council Bluffs, Iowa. MidAmerican Energy Company (MEC) requested Terracon Consultants, Inc. (Terracon) conduct cursory analyses of global stability of the earth embankments that surround the ash ponds. Terracon understands this report will be provided to the EPA consultants to assist with their audit. Terracon conducted a limited subsurface exploration to obtain data concerning subsurface conditions for our use in performing the requested cursory global stability analyses of selected Ash Containment Pond embankments located at WSEC. Five borings, designated B-1, B-2, B-4, B-5, and B-6, were completed to depths of approximately 50 feet below the existing ground surface. To supplement data obtained from these borings, three electronic cone soundings, designated EC-1, EC-3 and EC-4 were completed to depths of approximately 19 to 47 feet. Boring B-3 and cone sounding EC-2 were not completed due to the presence of overhead power lines along that portion of the embankment. Logs of the borings and cone penetrometer soundings along with a Location Diagram are included in Appendix A of this report.

This study was performed in general accordance with our proposal number P05100622 dated September 21, 2010.

2.0 PROJECT INFORMATION

2.1 Project Description

	Description
Background	Consultants to the EPA are currently conducting an audit of the ash containment ponds located on the east side of the Walter Scott Energy Center (WSEC) in Council Bluffs, Iowa. MidAmerican Energy Company (MEC) requested Terracon conduct cursory analyses of slope stability of the levees surrounding the ash ponds. MEC will provide our report to the EPA consultant.

	Description
Related Study	A study of the north levee of the south pond and analysis of the underseepage and slope stability was completed by Terracon and the results were presented to Olmsted and Perry Consulting Engineers (OPCE) in a report dated September 10, 2010 (Terracon Project No. 05095039). Additional borings were completed to install monitoring wells in the area of the containment ponds as part of a study conducted by MWH Consultants, Inc. The boring logs and location diagram for these borings is included in Appendix C and were utilized to supplement the subsurface information for the current study.
Limitations of this Study	Terracon performed a cursory evaluation of the slope stability of the existing levees surrounding the north and south ash containment ponds at the WSEC facility. Due to the limited scope of exploration and short time period allowed for these analyses, this study is not comprehensive, nor intended to meet any particular regulatory guidelines, but rather a preliminary study. No exploration or analysis was provided for the levees adjacent to Mosquito or Pony Creek, since these are in the USACE program. Opinions of global stability are based on simplified models developed as described in this report. Rigorous analyses of embankment stability would require performance of additional exploratory borings and laboratory tests, and analyses of underseepage.
Additional Information	Representatives of Terracon, HGM Associates, Inc. (HGM), and MEC selected and marked 13 locations along the pond levees on September 17, 2010 which appeared to include the more critical slope heights and grades for stability analysis. HGM provided survey cross-sections of the levees, extending into the pond area and beyond the toe on the opposite side from the pond. MEC indicated the following anticipated maximum water elevations for the ponds as follows: ▪ North Pond: 970 feet ▪ South Pond: 971.3 feet (current elevation assumed)

2.2 Site Location and Description

Item	Description
Location	The north and south ash containment ponds are located east of the WSEC in Council Bluffs, Iowa, between the WSEC and Interstate Highway 29.

Item	Description
Pond Descriptions	The north pond was utilized primarily for fly ash disposal and is currently being mined for hydrated fly ash and crushed to form a product marketed as "C-Stone". The north pond is currently contained within an area along the east levee, extending to the north and south levees, with a large mass of hydrated fly ash separating the pond from the western portion of the containment area. The south pond was primarily used for containment of bottom ash and some process water. Bottom ash is currently being mined from this pond. The west levee of this containment area is embedded within a general fill area for a substation and some operations buildings, and is not considered a stability concern due to the wide area of containment. The pond currently borders the north, east, and south levees and is currently about 94.5 acres in size. A survey completed by OPCE indicated the elevation of the bottom of the south ash pond ranges from about 959.6 to 969.9 feet within about 100 feet of the Pony Creek levee toe, with the deeper bottom elevations to the east of about Station 984+00. The survey cross-sections completed by HGM indicate that the bottom elevation of the south pond typically ranges from about 960 to 965 feet. The bottom elevation of the north pond extends to about 953 feet near Pony Creek and is generally between 955 and 960 along the east levee.
Pond Water Surface Elevations	Water levels were recorded by HGM on September 11, 2010 as follows: ▪ North Pond: 967.8 feet ▪ South Pond: 971.3 feet ▪ Pony Creek (location between ponds): 963.1 feet
Existing Levees	The ponds are surrounded by levees (earth embankments) on all sides. The north and south ponds are separated by an east-west flowing section of Pony Creek. The levees separating the ponds from Pony Creek are USACE designed levees, maintained by the M & P Levee Improvement District. The north pond area is bordered on the west side by a levee along Mosquito Creek, which is also a USACE levee, maintained by the City of Council Bluffs. The remainder of the surrounding levees are maintained by MEC and were reportedly designed by Black and Veatch. The levee crest along Pony Creek is about Elevation 982 to 983 feet along the ponds. The levee crest along Mosquito Creek is about Elevation 979 to 981 feet where it borders the ponds. The

Item	Description
	elevation of the ash pond levees not bordering the creeks varies. A low area of levee embankment is present along the east levee, near the southeast corner of the south pond and was recorded by HGM to be about Elevation 973.2 feet. The remainder of the levee crest generally ranges from about Elevation 979 to 981 feet. The following information was obtained from the plans for the levee system, prepared by the USACE dated March 1980. The levee sections bordering Pony Creek were designed with 3 horizontal to 1 vertical slopes and contain random fill material within the core of the levee with lower permeability soils along the faces of the levee (3 feet thick creek side, 1 foot thick land or ash pond side). Plans dated January 21, 1974, provided by MEC and prepared by Black and Veatch indicate that the other pond levees were also constructed with 3 horizontal to 1 vertical side slopes, and included the initial construction of the embankment along the south side of Pony Creek to a crest elevation of about 980 feet.

3.0 SUBSURFACE CONDITIONS

3.1 Mapped Soil Units

The project site is located in Pottawattamie County Iowa. The Soil Survey of Pottawattamie County, Iowa, indicates the primary soil type at the project site is the Albaton Silty Clay soil unit. The following table summarizes the major soil unit identified in the Soil Survey.

Soil Name	Parent Material	Drainage Class	Flooding Frequency	Depth to Seasonal High Water Table
Albaton Silty Clay	Clayey alluvium	Poorly drained	Occasional	About 0 to 12 inches

3.2 Typical Profile

Borings and cone penetrometer soundings were conducted from the levee crest. Subsurface conditions encountered at the borings are described as follows:

Description	Approximate Depth to Bottom of Stratum	Material Encountered	Consistency/Density
Surface:	N/A	Grass and a shallow root zone	N/A

Description	Approximate Depth to Bottom of Stratum	Material Encountered	Consistency/Density
Stratum 1 (Embankment Fill)	8 to 13 feet	Fat Clay with pockets of Lean Clay and Silty Fine Sand	N/A
Stratum 2 (Alluvium)	33.5 feet at Boring 1 >50 feet at Boring 2 17.5 to 19.5 feet at Borings 4, 5, and 6	Fat Clay	Stiff to Very Stiff
Stratum 3 (Alluvium)	Underlying Stratum 2 (except at Boring 2) to their completed depths	Fine Sand, Silty Fine Sand	Loose to Dense

Since samples are not recovered using the cone, stratigraphy is correlated to cone penetration data. These data inferred conditions similar to those encountered at nearby borings. We inferred primarily cohesive soils are present to depths of about 16 feet at EC-2 and EC-3, and to a depth of about 47 feet at EC-1. The cohesive soils were underlain by granular soils. Conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in situ, the transition between materials may be gradual. The boring logs and cone soundings are in Appendix A.

3.3 Groundwater Conditions

The boreholes were observed while drilling for the presence and level of groundwater. The water levels observed are noted on the attached boring logs, and are summarized below.

Boring Number	Depth to groundwater while drilling, ft.
B-1	N/R[1]
B-2	N/R[1]
B-4	N/R[1]
B-5	17.5
B-6	18

1. Water levels not recorded (N/R) below 10 feet because wash bore methods were used to advance borings.

The levels of naturally occurring groundwater could not be determined following drilling where water or drilling slurry had been used to advance the boreholes. We grouted the boreholes after drilling. A relatively long period of time is necessary for a groundwater level to develop and

stabilize in a borehole. Longer term monitoring in cased holes or piezometers would be required for a more accurate evaluation of the groundwater conditions.

Fluctuations of the water levels will occur due to fluctuations in the water level of the Missouri River, Mosquito and Pony Creeks, the ash ponds, seasonal variations in the amount of rainfall and runoff, and other factors not evident at the time the borings were performed. Subsurface water levels during construction or at other times in the life of the structure will be higher or lower than the levels indicated in the boring logs. Perched water conditions can also develop overlying clay layers. The possibility of groundwater level fluctuations and development of perched water conditions should be considered when developing the design and construction plans for the project.

4.0 GLOBAL STABILITY OF ASH POND EMBANKMENTS

4.1 Mechanics of Slope Stability

As used in slope stability analyses, *Factor of Safety* is considered to be the sum of resisting forces (those forces which resist movement) divided by the sum of driving forces (those forces which promote movement). Therefore, for a slope to be stable, the resisting forces must be greater than the driving forces and their ratio, or Factor of Safety, must be greater than 1. The acceptable factor of safety for any particular slope depends upon many factors. Consequences of slope failure are one factor. The extent to which subsurface material properties, piezometric pressures, and geometry are precisely known is another very important factor.

Analyses techniques are based on principles of mechanics. Input parameters include slope geometry, material strength, presence and orientation of discrete subsurface layers and water (piezometric) pressure.

For this study, slope geometry was taken from survey cross sections supplied by HGM, material strength properties were inferred from available laboratory test data obtained by testing samples obtained from the limited number of exploratory borings, correlations with index properties and our experience with similar soils in the area. The estimated strength parameters are effective stress parameters. Subsurface geometry was based on conditions encountered at borings conducted along the crest of embankments. Piezometric surfaces were inferred based on elevations of static water surface levels in the ponds provided by HGM and short term water levels recorded at borings.

4.2 Selection of Embankment Sections for Analysis

Survey cross sections of the existing embankments at distinct locations were provided by HGM. Terracon selected seven (7) of the provided cross sections for slope stability analyses of the levees of the north and south ponds. Four sections at the south pond (A-A, C-C, E-E, and F-F) and three sections at north pond (L-L, M-M, and O-O) were modeled. The maximum water

surface elevations were considered as 971.3 feet and 970 feet for the south and north ponds, respectively. These elevations were indicated by MEC to represent the highest anticipated water elevations which would be allowed to occur within these ponds. The effective stress shear strength parameters selected for the analyses are representative of post-peak strengths which consider the effects of long-term strain softening.

We did not analyze the selected models using undrained shear strength parameters. Undrained analyses are applicable to conditions that exist immediately following construction. Inasmuch as the embankments have been in place for some time and the embankments have not been recently altered, we did not consider undrained analyses would appropriately model current conditions. Also, since there is no mechanism to allow for rapid drawdown of the water levels within the ponds, we did not analyze the affect of rapid drawdown of pond water levels on the stability of slopes facing pond interiors.

4.3 Subsurface Profile and Shear Strength Parameters

Data obtained from our exploratory borings, cone soundings, the topographical survey of the site, and laboratory tests, were used to constitute the slope models for performing global stability analyses of the existing embankments.

Borings and cone soundings were performed at the crest of the levees. Explorations were not performed in the area of proposed Boring B-2 and Cone Sounding EC-2, which was not accessible to our drilling equipment due to overhead power lines. The subsurface profiles for the analysis models were interpreted and extrapolated from the nearest boring or cone sounding. Since borings were only performed at the crest of the existing levees and no information was available regarding the conditions at the toe of the embankments, we considered that stratum elevations encountered at the borings or cone soundings represented a relatively level contact between strata.

The slope stability analyses utilized cohesion and friction angle values determined from experience with similar soils, correlation with data from index tests performed the samples recovered from borings, and shear strength test data obtained from discrete samples collected at the site during this and previous explorations. Two consolidated undrained triaxial tests were performed on samples from this site exploration; one on Sample 4 of Boring B-2 and one on sample 5 of Boring B-5. Refer to appendix B. Strength parameters determined from the laboratory testing are representative of peak strengths. The design shear strength parameters selected for the embankment fill and native clay soils are representative of post-peak strengths, which consider the effects of long-term strain softening. The effective friction angle for the native sand deposits was taken as 29 degrees, based on the correlated value range of 28 to 30 degrees published in NAVFAC DM-7 for silty sand. The shear strength parameters used in our analyses are summarized below:

Material	Total Unit Weight (pcf)	Effective Stress Friction Angle (degrees)	Effective Stress Cohesion (psf)
Embankment Fill	120	26	50
Fat Clay Foundation Soils	120	26 [1]	50
Silty Sand	125	29	0

1. Effective stress friction angles as low as 20 degrees were used in models for soft and very soft clay layers encountered below approximate elevation 950 feet.

4.4 Earthquake Parameters for Seismic Analyses

Based on 2008 USGS Earthquake Hazard Maps, the peak ground acceleration with a 2% probability of exceedance in 50 years at the project site is 0.0455 g. The pseudo static analyses were performed at 2/3 of the design acceleration ground acceleration. A horizontal seismic coefficient of 0.0428 and a vertical seismic coefficient of zero were used in our analyses.

4.5 Results of Analyses

Stability analyses were performed using the computer program SLOPE/W, developed by Geo-Slope Inc. Analyses searched for circular failure arcs on the upstream and downstream slope for the Steady Stage Seepage condition at the maximum pool elevations, which were set at 971.3 feet and 970 feet for the south and north ponds, respectively and the phreatic lines within the levees were estimated for each model. We also evaluated the seismic (pseudo-static) stability for the each model. The computer program utilized the Morgenstern-Price method to calculate the failure surfaces for each case. Four (4) cases were analyzed for each of six (6) models. The following table summarizes factors of safety determined for each case.

Pond	Section[2]	Factor of Safety Obtained from Analysis [1]					
		Steady State Seepage			Seismic (pseudo-static)		
		Required Minimum Factor of Safety [3]	Upstream	Downstream	Required Minimum Factor of Safety [3]	Upstream	Downstream
South	A-A	1.4	1.73	1.79	1.0	1.52	1.57
	C-C	1.4	1.50	1.82	1.0	1.39	1.60
	E-E	1.4	4.05	2.20	1.0	2.42	1.82
	F-F	1.4	1.66	1.64	1.0	1.45	1.44
North	L-L	1.4	1.70	1.61	1.0	1.50	1.40
	M-M	1.4	1.74	1.87	1.0	1.49	1.60
	O-O	1.4	1.57	1.64	1.0	1.39	1.46

Pond	Section[2]	Factor of Safety Obtained from Analysis [1]					
		Steady State Seepage			Seismic (pseudo-static)		
		Required Minimum Factor of Safety [3]	Upstream	Downstream	Required Minimum Factor of Safety [3]	Upstream	Downstream

1. Reported factors of safety are for deep seated circular "failure" surfaces that emerge near the levee crest. Computed factors of safety for shallow circular "failure" surfaces near the toe of the levee may be smaller.
2. Refer to Ash Pond Plan in Exhibit D-1, for cross section locations.
3. Reference: Table 6.1b from EM 1110-2-1913

Based on these analyses, Models of the Embankment Sections (A-A, C-C, E-E, F-F, L-L, M-M, and O-O) exhibit factors of safety greater than 1.4 for the steady state seepage conditions and greater than 1.0 for pseudo-static seismic conditions. Graphical results of the slope stability analyses for all cases are in Appendix D.

Since the time of our exploration, the owner reshaped portions of the pond side slope of the south levee to approximately 2 Horizontal:1 Vertical by adding clay fill and surfacing with rip-rap at the water edge. This fill placement is anticipated to reduce further erosion action and in our opinion will not reduce the stability of the levee at these locations.

The global stability of pond embankment slopes is sensitive to subsurface conditions, particularly at the base of the embankment slopes. Without boring data at the toes of the embankments, we extrapolated conditions encountered within the interior of the embankment to beyond the landward and pond side toe. Our models do not reflect variations in stratigraphy or shear strength between or beyond the boring locations.

5.0 GENERAL COMMENTS

The limited, cursory global stability analyses presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. The models for global stability analysis were developed using survey data provided by others. Subsurface stratigraphy for each model was extrapolated from nearby borings; actual conditions may be different and such differences would affect the results of our analyses. More rigorous analyses would require more exploration and laboratory tests and analyses of underseepage. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that the actual embankment conditions are found to vary from the analyses models described in this report, the analyses and opinions expressed herein shall not be considered valid unless Terracon reviews the actual conditions and further verifies the analyses and opinions of this report in writing.

APPENDIX A

FIELD EXPLORATION

N

Project Manager: EDP	Project No. 05105087	Terracon Consulting Engineers & Scientists	VICINITY MAP
Drawn by: EDP	Scale: N.T.S.	15080 A Circle Omaha, Nebraska 68144	WSEC ASH CONTAINMENT PONDS
Checked by: CKD	File Name: 05105087 VMAP	PH. (402) 330-2202 FAX. (402) 330-7606	7215 NAVAJO STREET
Approved by: CKD	Date: 10/6/2010		COUNCIL BLUFFS, IOWA

Ex. No. A-1

Note: Boring 3 and Cone Sounding EC-2 were not completed due to overhead power line obstruction.

N

- Boring location

- Cone sounding location

Source: HGM Associates, Inc. Exhibit on Aerial

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: EDP	Project No. 05105087
Drawn by: EDP	Scale: As Shown
Checked by:	File Name: 05105087BLAN
Approved by: EDP	Date: 10/6/2010

Terracon
Consulting Engineers & Scientists
15080 A Circle Omaha, Nebraska 68144
PH. (402) 330-2202 FAX. (402) 330-7606

BORING LOCATION DIAGRAM

WSEC ASH CONTAINMENT PONDS
7215 NAVAJO STREET
COUNCIL BLUFFS, IOWA

FIG No.
A-2

LOG OF BORING NO. B-1

CLIENT **HGM Associates Inc.**

SITE **WSEC, 7215 Navajo Road Council Bluffs, IA**

PROJECT **WSEC Ash Containment Ponds**

Approx. Surface Elev.: 980 ft

DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	TYPE	RECOVERY, in.	SPT - N ** BLOWS / ft.	TESTS WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf	Atterberg Limits, %
			HS						
		1	ST	7		30	90	6000*	
		2	ST	11		29 13	89	6000*	LL = 62 PL = 22
5		3	ST	15				6000*	PI = 40
			HS						
	CH	4	ST	14		32	88	6500* 3060	
10			WB						
	CH	5	SS	15	10	37		4500*	
15			WB						
	CH	6	SS	18	4	36		2000*	
20			WB						
	CH	7	SS	18	WOH	46		2000*	LL = 70 PL = 23 PI = 47
25			WB						
	CH	8	SS	18	WOH	53		<500*	
30			WB						

GRAPHIC LOG: 8 (FILL) FAT CLAY; 972 FAT CLAY

(FILL) FAT CLAY
Dark gray

With clayey sand seam at about 4.5 feet

FAT CLAY
Dark gray and gray
Very stiff

Medium stiff below about 18.5 feet

Very soft at about 28.5 feet

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME Automatic Hammer

WATER LEVEL OBSERVATIONS, ft			
WL	N/E	WD	
WL			
WL			

Terracon

BORING STARTED	9-24-10		
BORING COMPLETED	9-24-10		
RIG	958	FOREMAN	MR
APPROVED	EDP	JOB #	05105087

LOG OF BORING NO. B-1

CLIENT
HGM Associates Inc.

SITE
WSEC, 7215 Navajo Road
Council Bluffs, IA

PROJECT
WSEC Ash Containment Ponds

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N ** BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf	Atterberg Limits, %
	33.5 946.5										
	SILTY FINE SAND Gray Medium dense		SM	9	SS	12	14	26			
		35			WB						
			SM	10	SS	10	10	20			
		40			WB						
	Dense at about 43.5 feet		SM	11	SS	12	33	24			
		45			WB						
	50 930		SM	12	SS	12	29	25			
	BOTTOM OF BORING	50									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME Automatic Hammer

WATER LEVEL OBSERVATIONS, ft			
WL	N/E	WD	
WL			
WL			

Terracon

BORING STARTED	9-24-10		
BORING COMPLETED	9-24-10		
RIG	958	FOREMAN	MR
APPROVED	EDP	JOB #	05105087

LOG OF BORING NO. B-2

CLIENT **HGM Associates Inc.**

SITE **WSEC, 7215 Navajo Road Council Bluffs, IA**

PROJECT **WSEC Ash Containment Ponds**

Approx. Surface Elev.: 974 ft

DEPTH, ft.	USCS SYMBOL	NUMBER	TYPE	RECOVERY, in.	SPT - N ** BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf	Atterberg Limits, %
			HS						
		1	ST	13		30	88	5000*	
		2	ST	9		30	92	7500*	
5		3	ST	14		30	90	5500*	
			HS						
		4	ST	18				4500*	
10			WB						
	CH	5	ST	20		35	84	3000* 1240 UU	LL = 58 PL = 24 PI = 34
15			WB						
	CH	6	ST	17		40	79	2500*	
20			WB						
	CH	7	SS	18	WOH	65		<500*	
25			WB						
	CH	8	SS	18	WOH	72		<500*	
30			WB						

(FILL) FAT CLAY
Dark gray and gray

10 — 964

FAT CLAY
Dark gray
Stiff

Very soft below about 23.5 feet

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME Automatic Hammer

WATER LEVEL OBSERVATIONS, ft			
WL	N/E	WD	
WL			
WL			

Terracon

BORING STARTED	9-24-10		
BORING COMPLETED	9-24-10		
RIG	958	FOREMAN	MR
APPROVED	EDP	JOB #	05105087

BOREHOLE 05105087 LOGS.GPJ TERRACON.GDT 10/4/10

LOG OF BORING NO. B-2

CLIENT
HGM Associates Inc.

SITE
WSEC, 7215 Navajo Road
Council Bluffs, IA

PROJECT
WSEC Ash Containment Ponds

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N ** BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf	Atterberg Limits, %
	FAT CLAY Dark gray Very soft		CH	9	SS	18	WOH	60		<500*	LL = 86 PL = 26 PI = 60
		35			WB						
			CH	10	SS	15	WOH	66		<500*	
		40			WB						
			CH	11	SS	18	WOH	66		<500*	LL = 80 PI = 26 Pi = 54
		45			WB						
	Soft at about 48.5 feet		CH	12	SS	12	2	61			
	50 924	50									
	BOTTOM OF BORING										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME Automatic Hammer

WATER LEVEL OBSERVATIONS, ft			
WL	N/E	WD	
WL			
WL			

Terracon

BORING STARTED	9-24-10		
BORING COMPLETED	9-24-10		
RIG	958	FOREMAN	MR
APPROVED	EDP	JOB #	05105087

BOREHOLE 05105087 LOGS.GPJ TERRACON.GDT 10/4/10

LOG OF BORING NO. B-4

CLIENT **HGM Associates Inc.**

SITE **WSEC, 7215 Navajo Road Council Bluffs, IA**

PROJECT **WSEC Ash Containment Ponds**

Approx. Surface Elev.: 980 ft

DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	TYPE	RECOVERY, in.	SPT - N ** BLOWS / ft.	TESTS WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf	Atterberg Limits, %
			HS						
		1	ST	19		25	87	9000+*	LL = 66 PL = 25 PI = 41
		2	ST	6		22	101	9000+*	
5		3	ST	15		26	93	8500*	
			HS						
		4	ST	20		16	105	2650 UU	LL = 30 PL = 13 PI = 17
10			WB						
	CH	5	SS	15	10	28			
15			WB						
	CH	6	SS	18	22	32			LL = 29 PL = 15 PI = 14
20			WB						
	SM	7	SS	12	21	24			
25			WB						
	SM	8	SS	10	15	24			
30			WB						

(FILL) FAT CLAY
Dark gray (blocky with trace roots)

13 967

FAT CLAY
Dark gray
Stiff to very stiff

19.5 960.5

SILTY FINE SAND
Gray
Medium dense

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME Automatic Hammer

WATER LEVEL OBSERVATIONS, ft			
WL	N/E	WD	
WL			
WL			

Terracon

BORING STARTED	9-24-10		
BORING COMPLETED	9-24-10		
RIG	958	FOREMAN	MR
APPROVED	EDP	JOB #	05105087

LOG OF BORING NO. B-4

CLIENT **HGM Associates Inc.**

SITE **WSEC, 7215 Navajo Road Council Bluffs, IA**

PROJECT **WSEC Ash Containment Ponds**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	TYPE	RECOVERY, in.	SPT - N ** BLOWS / ft.	TESTS WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf	Atterberg Limits, %
	SILTY FINE SAND Gray Medium dense		SM	9	SS	12	13	27			
		35			WB						
			SM	10	SS	12	16	22			
		40			WB						
	Dense at about 43.5 feet		SM	11	SS	15	31	24			
		45			WB						
			SM	12	SS	15	19	25			
	50 930	50									
	BOTTOM OF BORING										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME Automatic Hammer

WATER LEVEL OBSERVATIONS, ft			
WL	N/E	WD	
WL			
WL			

Terracon

BORING STARTED	9-24-10		
BORING COMPLETED	9-24-10		
RIG	958	FOREMAN	MR
APPROVED	EDP	JOB #	05105087

LOG OF BORING NO. B-5

CLIENT **HGM Associates Inc.**

SITE **WSEC, 7215 Navajo Road Council Bluffs, IA**

PROJECT **WSEC Ash Containment Ponds**

Approx. Surface Elev.: 980.5 ft

DEPTH, ft.	USCS SYMBOL	NUMBER	TYPE	RECOVERY, in.	SPT - N ** BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf	Atterberg Limits, %
			HS						
		1	ST	12		24	93	7000*	
		2	ST	10		19	106	6000*	
5		3	ST	9		26	94	5000*	LL = 49 PL = 18 PI = 31
			HS						
		4	ST	12		28	96	4130 UU	LL = 52 PL = 21 PI = 31
10			HS						
	CH	5	ST	18					
15			HS						
	SM	6	ST	21		25			
20			WB						
	SM	7	SS	18	26	25			
25			WB						
	SM	8	SS	12	25	25			
30			WB						

(FILL) FAT CLAY with sand seams
Dark grayish brown

13 967.5

FAT CLAY
Dark gray

17.5 963

SILTY FINE SAND
Gray

Medium dense below about 23.5 feet

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME Automatic Hammer

WATER LEVEL OBSERVATIONS, ft			
WL	17.5	WD	
WL			
WL			

Terracon

BORING STARTED	9-24-10		
BORING COMPLETED	9-24-10		
RIG	102	FOREMAN	SP
APPROVED	EDP	JOB #	05105087

LOG OF BORING NO. B-5

CLIENT
HGM Associates Inc.

SITE
WSEC, 7215 Navajo Road
Council Bluffs, IA

PROJECT
WSEC Ash Containment Ponds

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N ** BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf	Atterberg Limits, %
	SILTY FINE SAND Gray Loose		SM	9	SS	18	8	26			
		35			WB						
			SM	10	SS	12	11	24			
		40			WB						
	Dense at about 43.5 feet		SM	11	SS	18	34	23			
		45			WB						
	Medium dense at about 48.5 feet		SM	12	SS	12	27	8			
	50 930.5	50									
	BOTTOM OF BORING										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME Automatic Hammer

WATER LEVEL OBSERVATIONS, ft			
WL	17.5	WD	
WL			
WL			

Terracon

BORING STARTED	9-24-10		
BORING COMPLETED	9-24-10		
RIG	102	FOREMAN	SP
APPROVED	EDP	JOB #	05105087

LOG OF BORING NO. B-6

CLIENT **HGM Associates Inc.**

SITE **WSEC, 7215 Navajo Road Council Bluffs, IA**

PROJECT **WSEC Ash Containment Ponds**

Approx. Surface Elev.: 980.5 ft

DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	TYPE	RECOVERY, in.	SPT - N ** BLOWS / ft.	TESTS WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf	Atterberg Limits, %
			HS						
		1	ST	10		32	77	3500*	LL = 61 PL = 24 PI = 37
		2	ST	13		26	91	7000*	LL = 59 PL = 23 PI = 36
5		3	ST	NR					
			HS						
		4	ST	9		33	87	6000*	
10			HS						
	CH	5	ST	6		26			LL = 55 PI = 23 PI = 32
15			HS						
	SM	6	SS	18	7	23			
20			WB						
	SM	7	SS	12	27	22			
25			WB						
	SM	8	SS	12	14	28			
30			WB						

(FILL) FAT CLAY
Dark gray
With trace calcareous between 1 to 3 feet

13 — 967.5

SANDY FAT CLAY
Dark grayish brown

18.5 — 962

SILTY FINE SAND
Gray
Loose

Medium dense below about 23.5 feet

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME Automatic Hammer

WATER LEVEL OBSERVATIONS, ft			
WL	18	WD	
WL			
WL			

Terracon

BORING STARTED	9-24-10		
BORING COMPLETED	9-24-10		
RIG	102	FOREMAN	SP
APPROVED	EDP	JOB #	05105087

LOG OF BORING NO. B-6

CLIENT
HGM Associates Inc.

SITE
WSEC, 7215 Navajo Road
Council Bluffs, IA

PROJECT
WSEC Ash Containment Ponds

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N ** BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf	Atterberg Limits, %
	SILTY FINE SAND Gray Medium dense		SM	9	SS	12	11				
		35			WB						
	Loose, with decayed wood fragments at about 38.5 feet		SM	10	SS	12	6	36			
		40			WB						
			SM	11	SS	18	16	28			
		45			WB						
	Dense at about 48.5 feet		SM	12	SS	18	38	24			
	50 930.5	50									
	BOTTOM OF BORING										

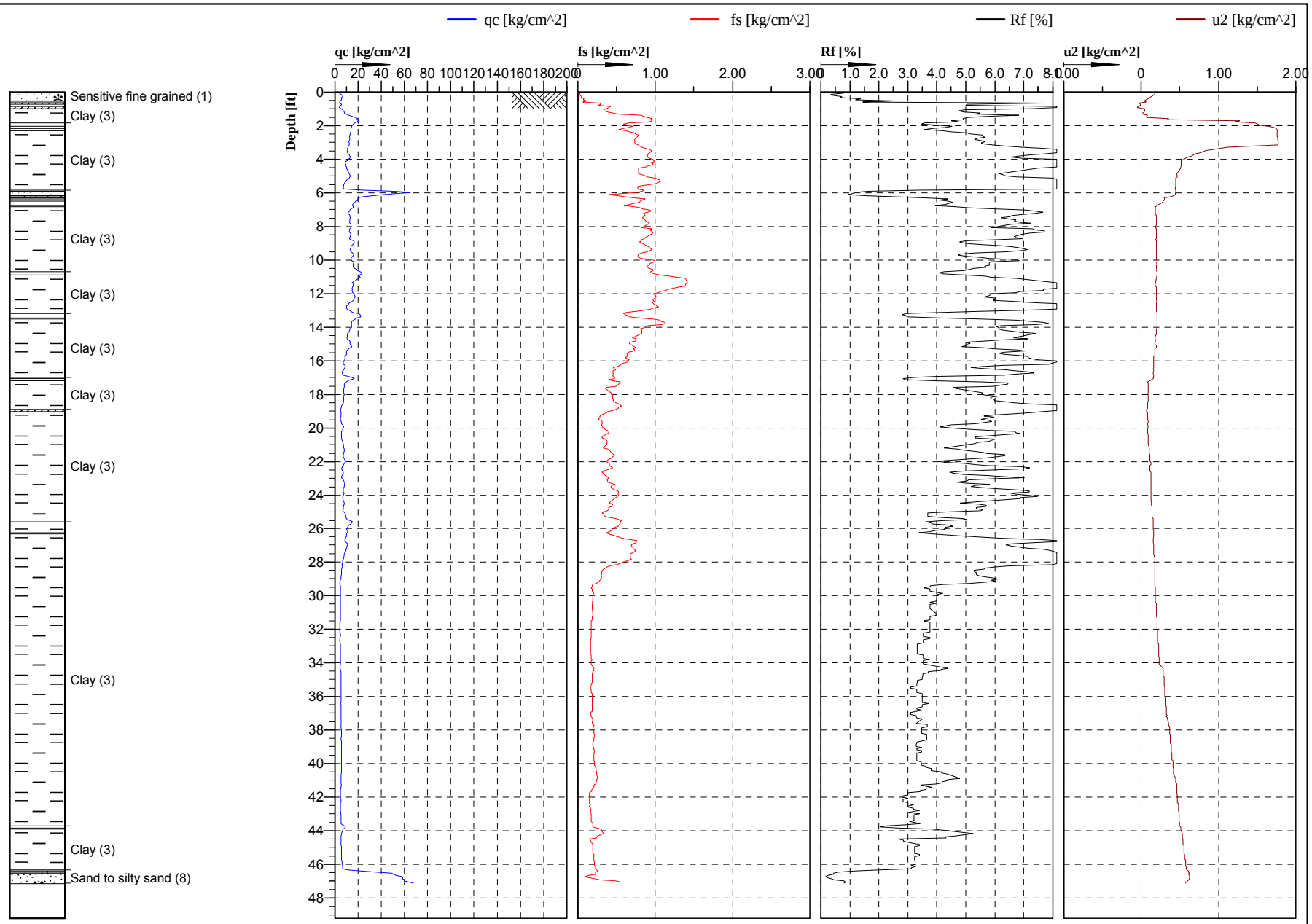
The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME Automatic Hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 18	WD	▼
WL	▼		▼
WL			

Terracon

BORING STARTED	9-24-10		
BORING COMPLETED	9-24-10		
RIG	102	FOREMAN	SP
APPROVED	EDP	JOB #	05105087

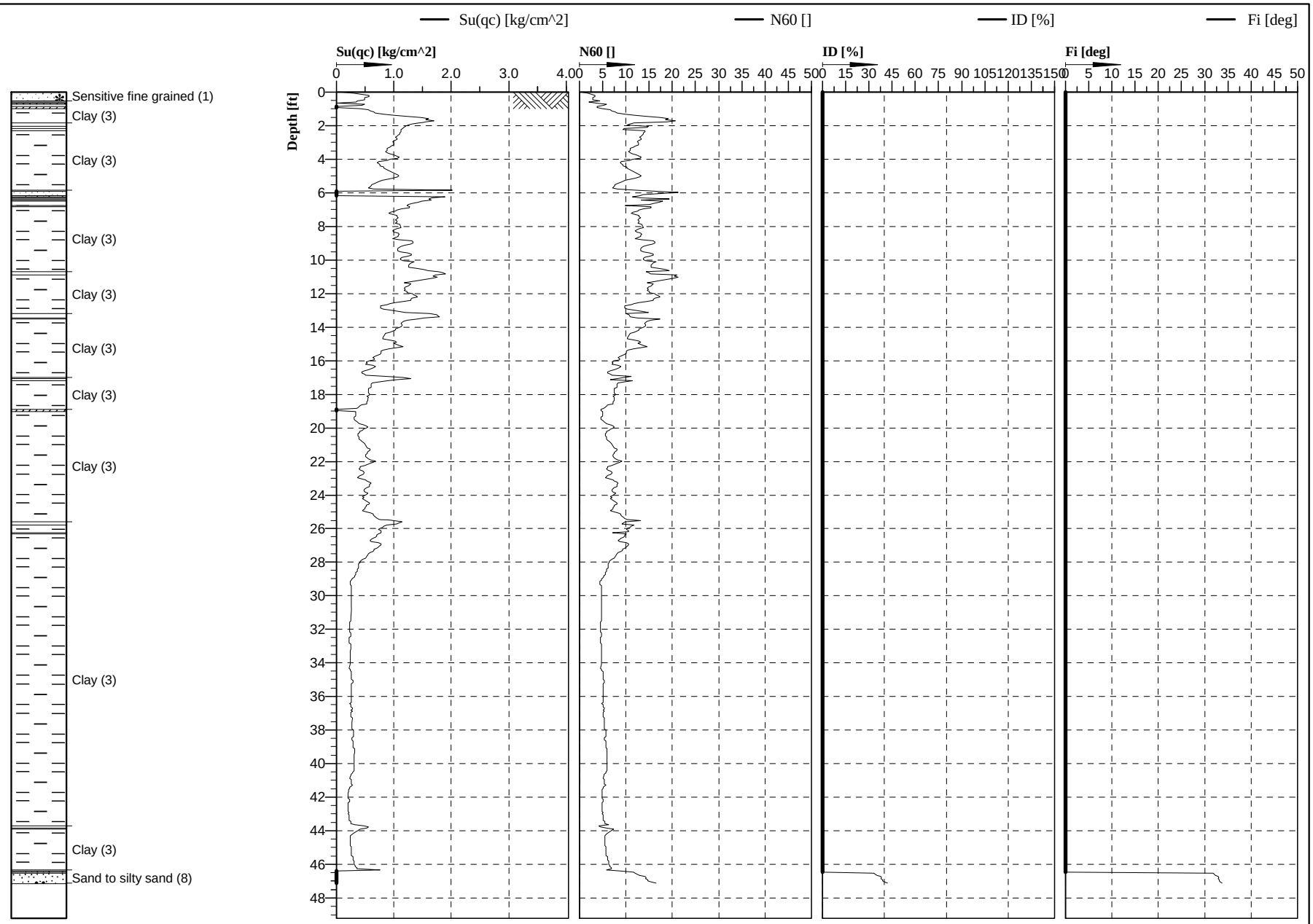


Location: Council Bluffs, Iowa	Position:	Ground level: 978.5	Test no: EC-1
Project ID: 05105087	Client: HGM Associates	Date: 9/24/2010	Scale: 1 : 100
Project: WSEC Ash Containment Ponds		Page: 1/2	Fig: EC-1
		File: 5087EC-1m.cpd	

Terracon

Cone No: 0
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Exhibit A-13



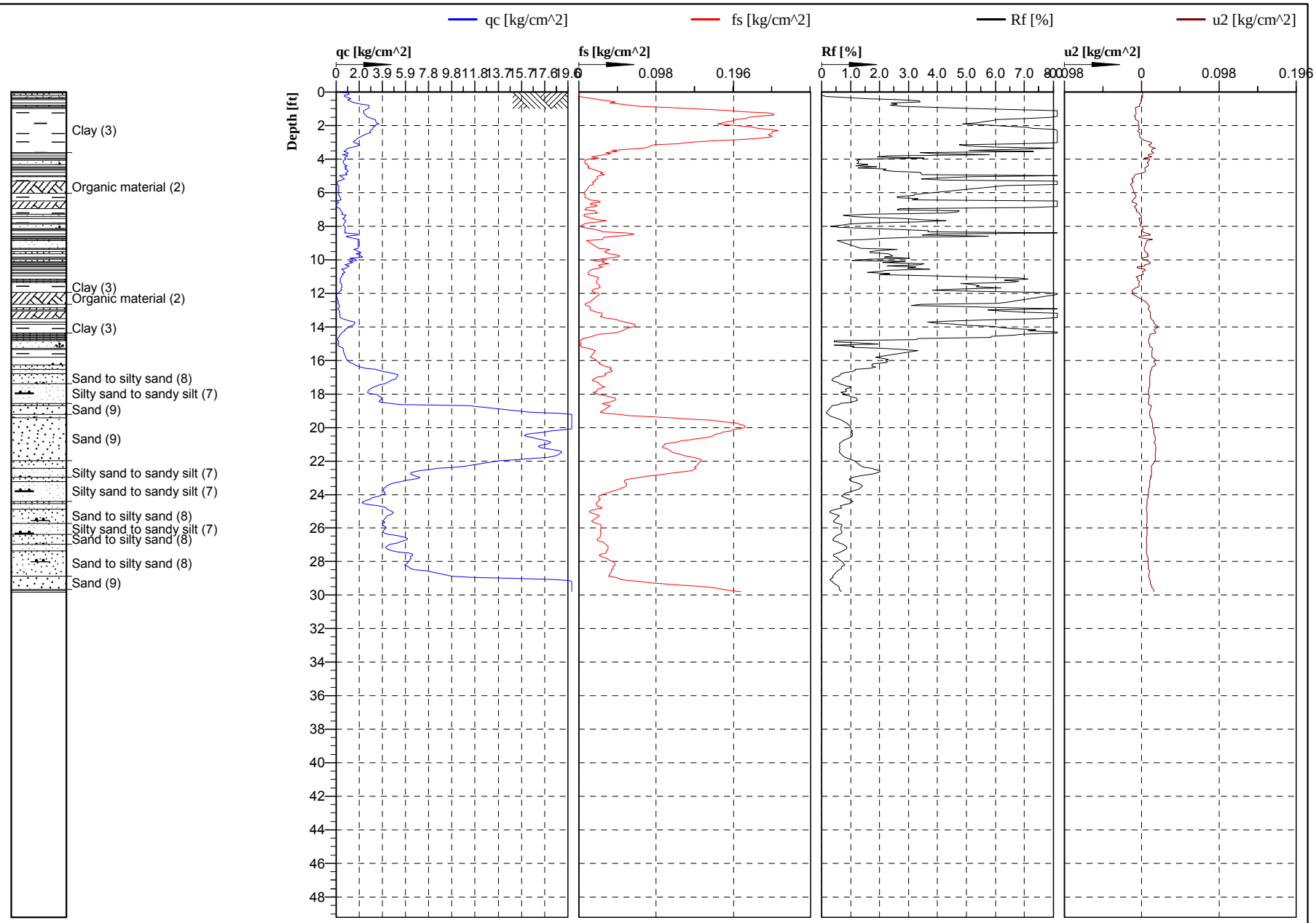
U2

Terracon

Cone No: 0
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Council Bluffs, Iowa	Position:	Ground level: 978.5	Test no: EC-1
Project ID: 05105087	Client: HGM Associates	Date: 9/24/2010	Scale: 1 : 100
Project: WSEC Ash Containment Ponds		Page: 2/2	Fig: EC-1
		File: 5087EC-1m.cpd	

Exhibit A-14



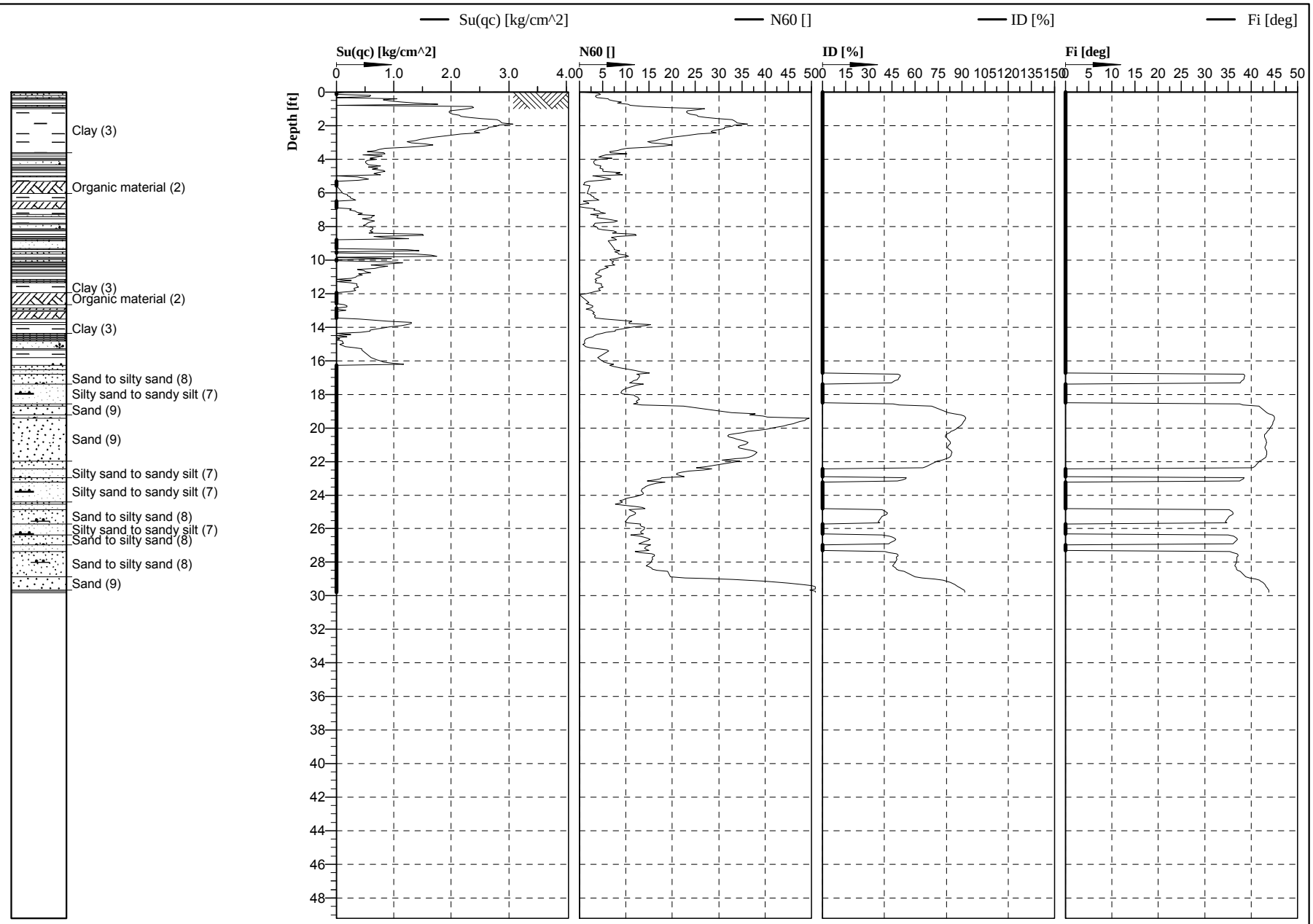
U2

Terracon

Cone No: 0
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Council Bluffs, Iowa	Position:	Ground level: 980	Test no: EC-3
Project ID: 05105087	Client: HGM Associates	Date: 9/24/2010	Scale: 1 : 100
Project: WSEC Ash Containment Ponds		Page: 1/2	Fig: EC-3
		File: 5087EC-3m.cpd	

Exhibit A-15



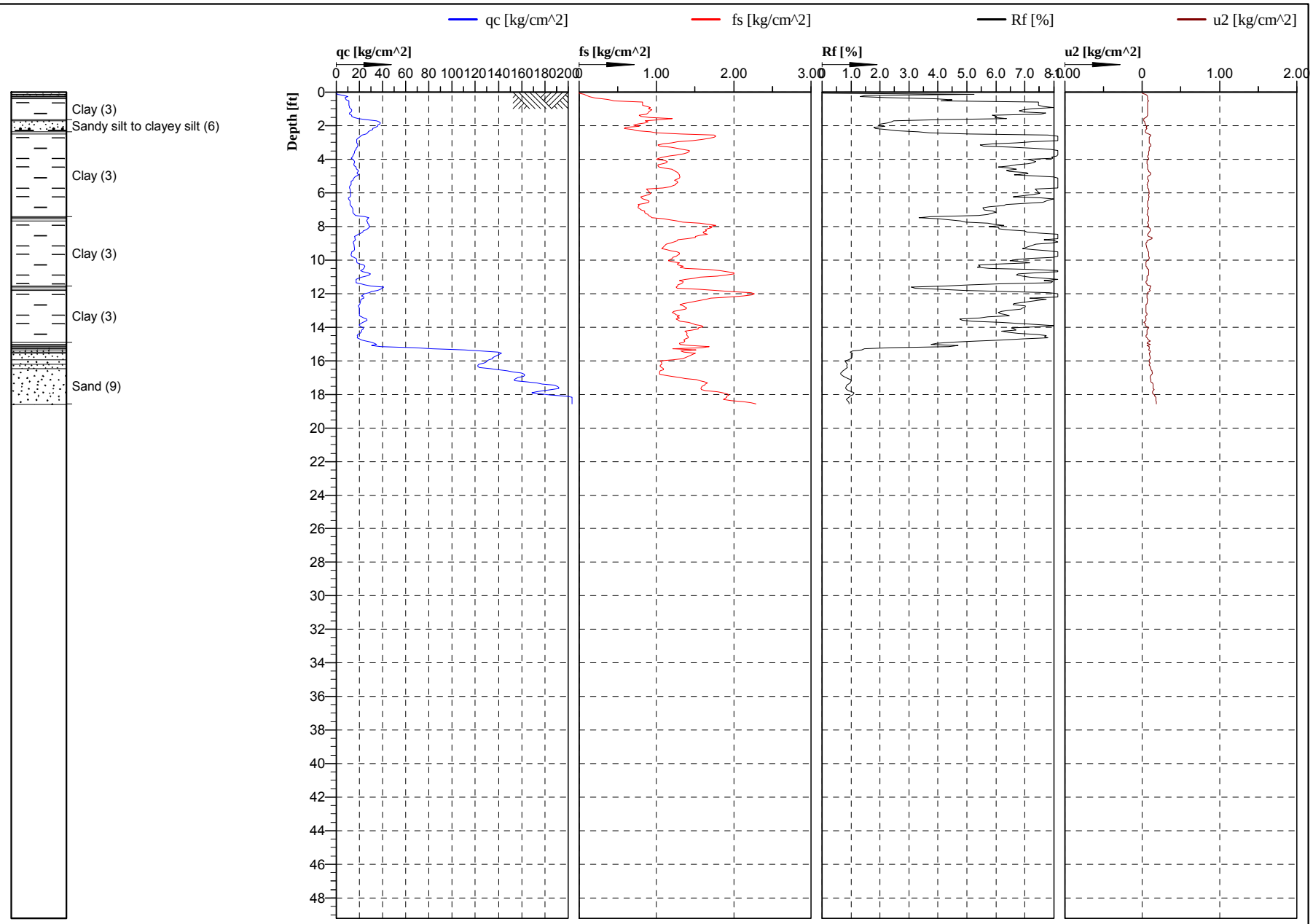
U2

Terracon

Cone No: 0
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Council Bluffs, Iowa	Position:	Ground level: 980	Test no: EC-3
Project ID: 05105087	Client: HGM Associates	Date: 9/24/2010	Scale: 1 : 100
Project: WSEC Ash Containment Ponds		Page: 2/2	Fig: EC-3
		File: 5087EC-3m.cpd	

Exhibit A-16



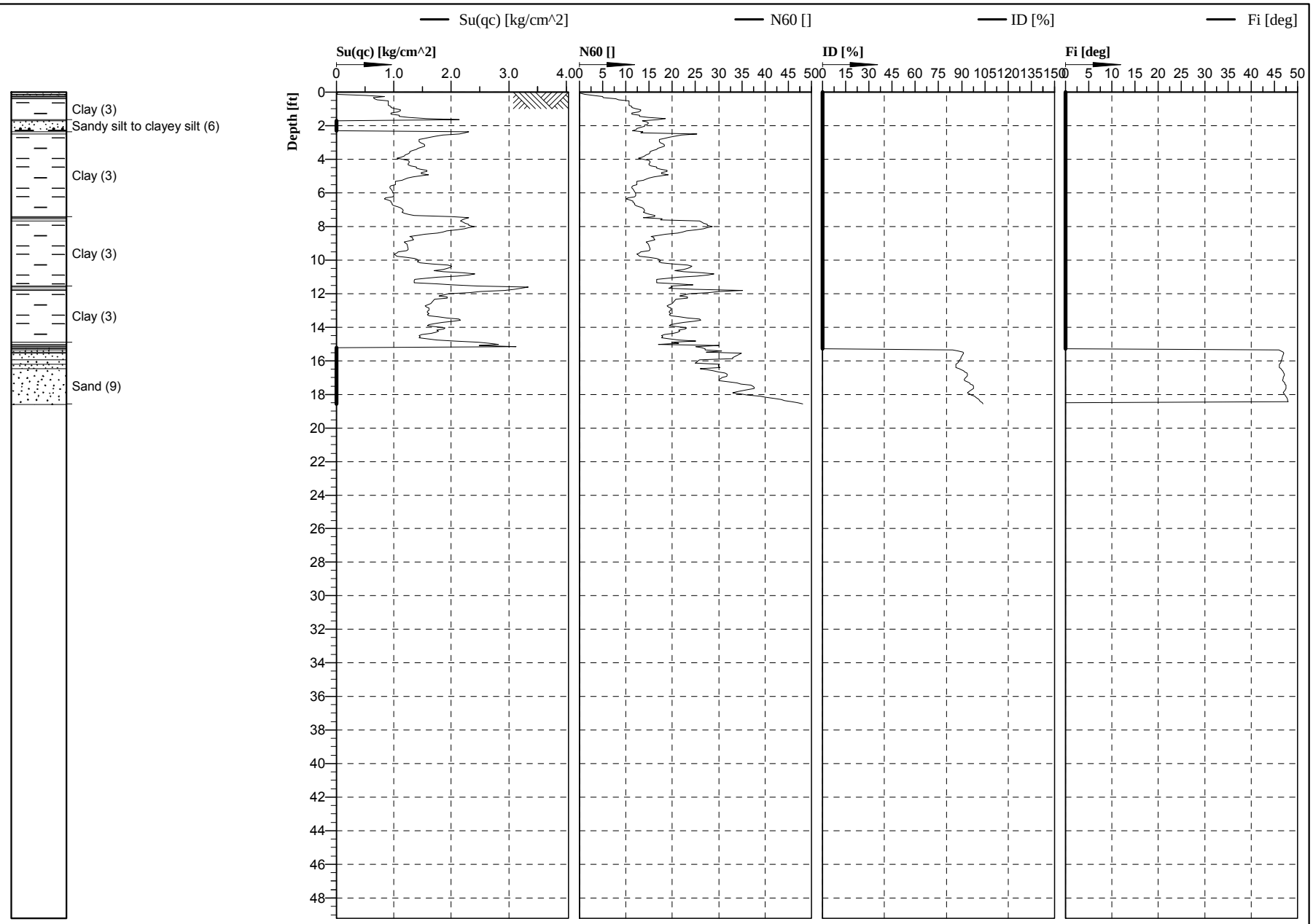
U2

Terracon

Cone No: 0
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Council Bluffs, Iowa	Position:	Ground level: 980	Test no: EC-4
Project ID: 05105087	Client: HGM Associates	Date: 9/24/2010	Scale: 1 : 100
Project: WSEC Ash Containtment Ponds		Page: 1/2	Fig: EC-4
		File: 5087EC-4m.cpd	

Exhibit A-17



U2

Terracon

Cone No: 0
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Council Bluffs, Iowa	Position:	Ground level: 980	Test no: EC-4
Project ID: 05105087	Client: HGM Associates	Date: 9/24/2010	Scale: 1 : 100
Project: WSEC Ash Containtment Ponds		Page: 2/2	Fig: EC-4
		File: 5087EC-4m.cpd	

Exhibit A-18

Field Exploration Description

The drill crew staked the boring and cone sounding locations relative to the cross-section locations which had been staked by HGM. The borings were completed near the center of the levee crest, or in the case of Boring 1 and Cone sounding EC-1, were completed near the roadway shoulder. Distances were measured with a mechanical wheel or nylon tape and right angles for these measurements were estimated. The approximate boring locations are shown on the Boring Location Diagram included in Appendix A. The locations of the borings should be considered accurate only to the degree implied by the means and methods used to define them.

Ground surface elevations indicated on the boring logs are approximate and have been rounded to the nearest ½-foot. The elevations were estimated from the levee cross sections provided by HGM Associates, Inc. The elevations of the soil borings should be considered accurate only to the degree implied by the means and methods used to define them.

The borings were advanced with a both track and truck-mounted drilling rigs utilizing continuous flight hollow-stem augers and rotary wash methods to advance the boreholes. Representative samples were obtained using thin-walled tube and split-barrel sampling procedures. In the thin-walled tube sampling procedure, a thin-walled, 3-inch OD, seamless steel tube with a sharp cutting edge is pushed hydraulically into the ground to obtain relatively undisturbed samples of cohesive or moderately cohesive soils. In the split-barrel sampling procedure, a standard 2-inch O.D. split-barrel sampling spoon is driven into the ground with an automated 140-pound hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the standard penetration resistance value. These values are indicated on the boring logs at the depths of occurrence. The samples were sealed and transported to the laboratory for testing and classification. The boreholes were grouted with a cement-bentonite slurry.

The drill crew prepared a field log for each boring. Each log included visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. The boring logs included with this report represent an interpretation of the field logs and include modifications based on laboratory observation and tests of the samples.

We also performed electronic piezo-cone penetrometer soundings for this project. This device includes a cone-tipped sounding unit attached to steel rods with flush joint couplings. The sounding unit has electronic strain gauges that measure point resistance and sleeve friction, a transducer that measures pore water pressure and an inclinometer that measures verticality of the sounding unit. The readings from the cone instruments are transmitted acoustically through the rods to a computer at the surface that stores the data and provides real-time display of the cone

results. A depth encoder device monitors penetration as the rods are pushed slowly into the ground. The cone unit records the measured values at 2-cm intervals. The resistance to penetration and pore water pressure can be correlated with soil strength and density properties, and soil type can be estimated. Results of the cone penetrometer testing provide valuable information on in-situ soil characteristics and stratigraphy for stability, bearing capacity and settlement analyses.

APPENDIX B

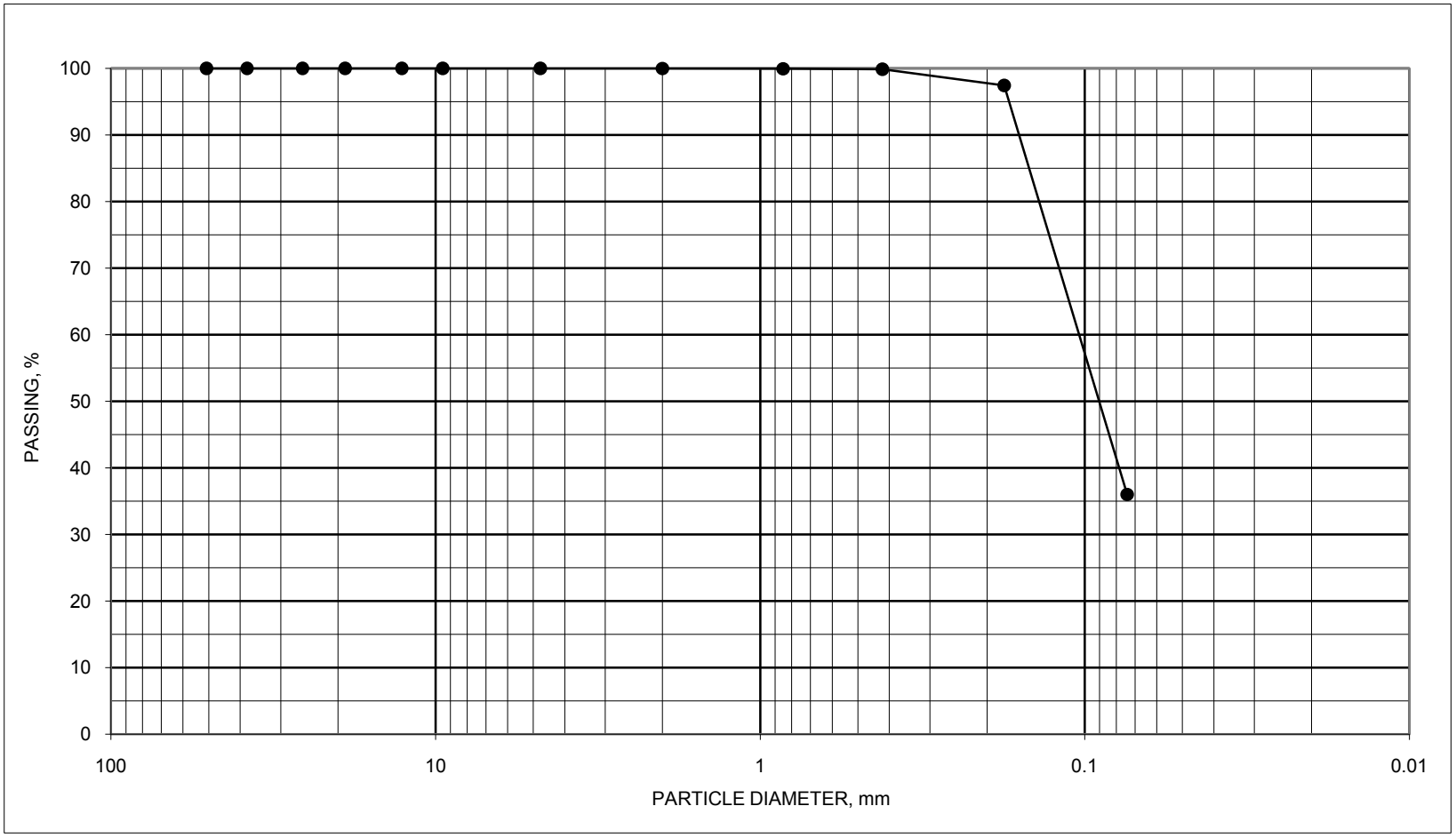
LABORATORY TESTING

Laboratory Testing

Moisture content tests were performed on the samples. Density determinations were made on most of the thin-walled tube samples. The unconfined compressive strength of most of the cohesive samples was estimated with a hand penetrometer. The results of these laboratory tests are provided on the boring logs. In addition, sixteen Atterberg limits, ten grain size analyses, one unconfined compression test, three unconsolidated, undrained triaxial tests, and two consolidated, undrained triaxial tests were completed for this project. The results of the Atterberg limits tests are provided on the boring logs. The results of the laboratory tests are provided in Appendix B.

The samples were classified in the laboratory based on visual observation, texture and plasticity. Additional laboratory testing could be performed to more accurately classify the samples. The soil descriptions presented on the boring logs for native soils are in accordance with our enclosed General Notes and Unified Soil Classification System (USCS). The estimated group symbol for the USCS is also shown on the boring logs for native soils, and a brief description of the Unified System is included with this report.

SIEVE SIZE	DIAMETER, mm	PASS, %
2"	50.8	100
1.5"	38.1	100
1"	25.7	100
3/4"	19.0	100
1/2"	12.7	100
3/8"	9.5	100
#4	4.76	100
#10	2.00	100
#20	0.85	100
#40	0.42	100
#80	0.177	97
#200	0.074	36



GRAIN SIZE DISTRIBUTION CURVE

BORING ID	SAMPLE ID	DEPTH, feet	SPECIMEN DESCRIPTION	UNIFIED SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
1	2	3 TO 5	GRAYISH BROWN CLAYEY SAND	SC	13.0			

*TESTED IN OMAHA

PROJECT WSEC ASH CONTAINMENT PONDS

COUNCIL BLUFFS, IA JOB NO. 05105087 DATE 9/30/10

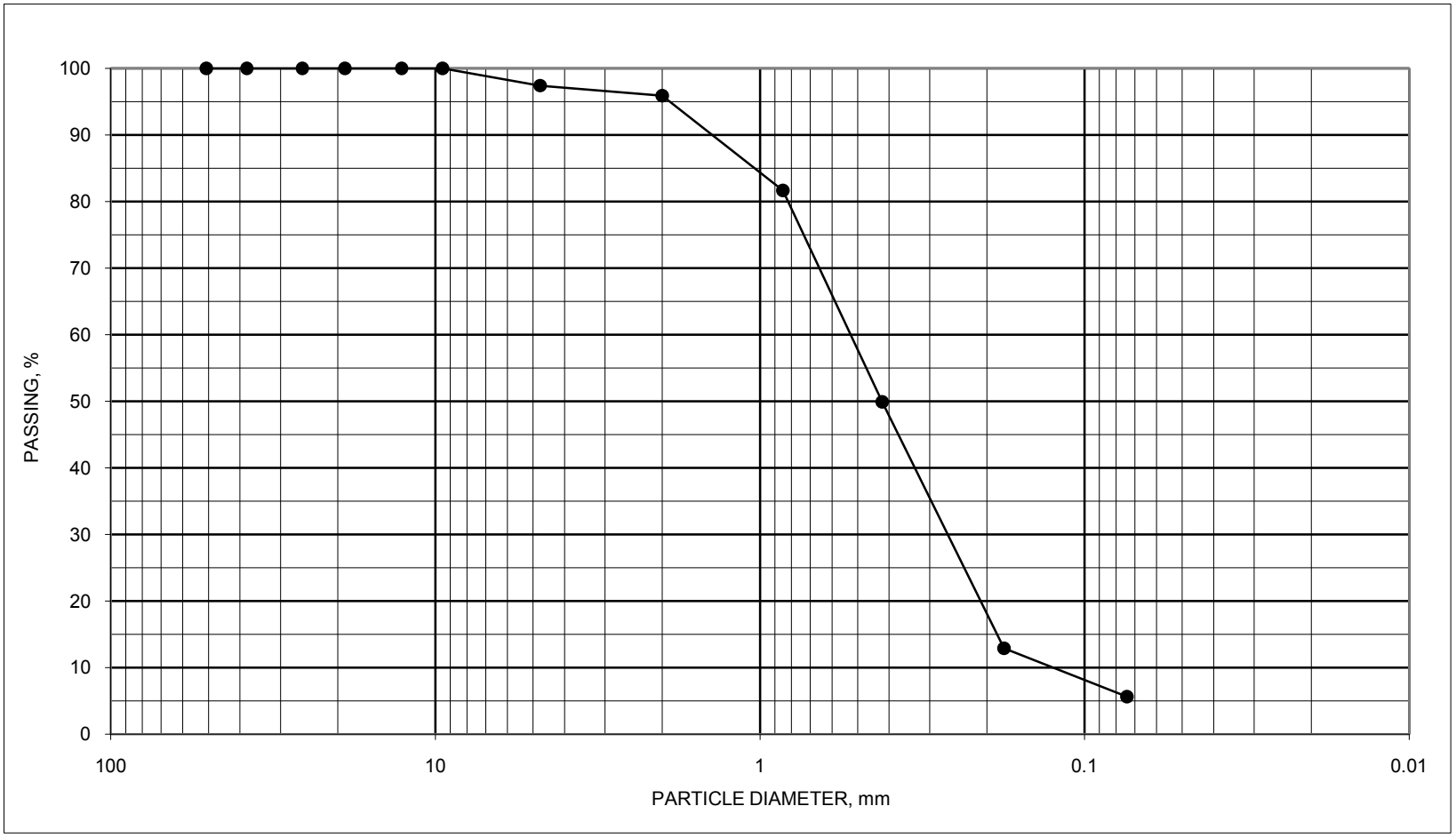
Terracon

N:\Projects\2010\05105087\Omaha Lab\Sieves\[05105087 Sieve B-1, S-2, 3-5' 9-30-10.xls]REPORT

Exhibit B-2

SIEVE SIZE	DIAMETER, mm	PASS, %
2"	50.8	100
1.5"	38.1	100
1"	25.7	100
3/4"	19.0	100
1/2"	12.7	100
3/8"	9.5	100
#4	4.76	97
#10	2.00	96
#20	0.85	82
#40	0.42	50
#80	0.177	13
#200	0.074	6

D10	0.1251
Cu	4.2
Cc	1.1



GRAIN SIZE DISTRIBUTION CURVE

BORING ID	SAMPLE ID	DEPTH, feet	SPECIMEN DESCRIPTION	UNIFIED SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
1	10	38.5 TO 40	GRAY POORLY GRADED SAND WITH SILT	SP-SM				

*TESTED IN OMAHA

PROJECT WSEC ASH CONTAINMENT PONDS

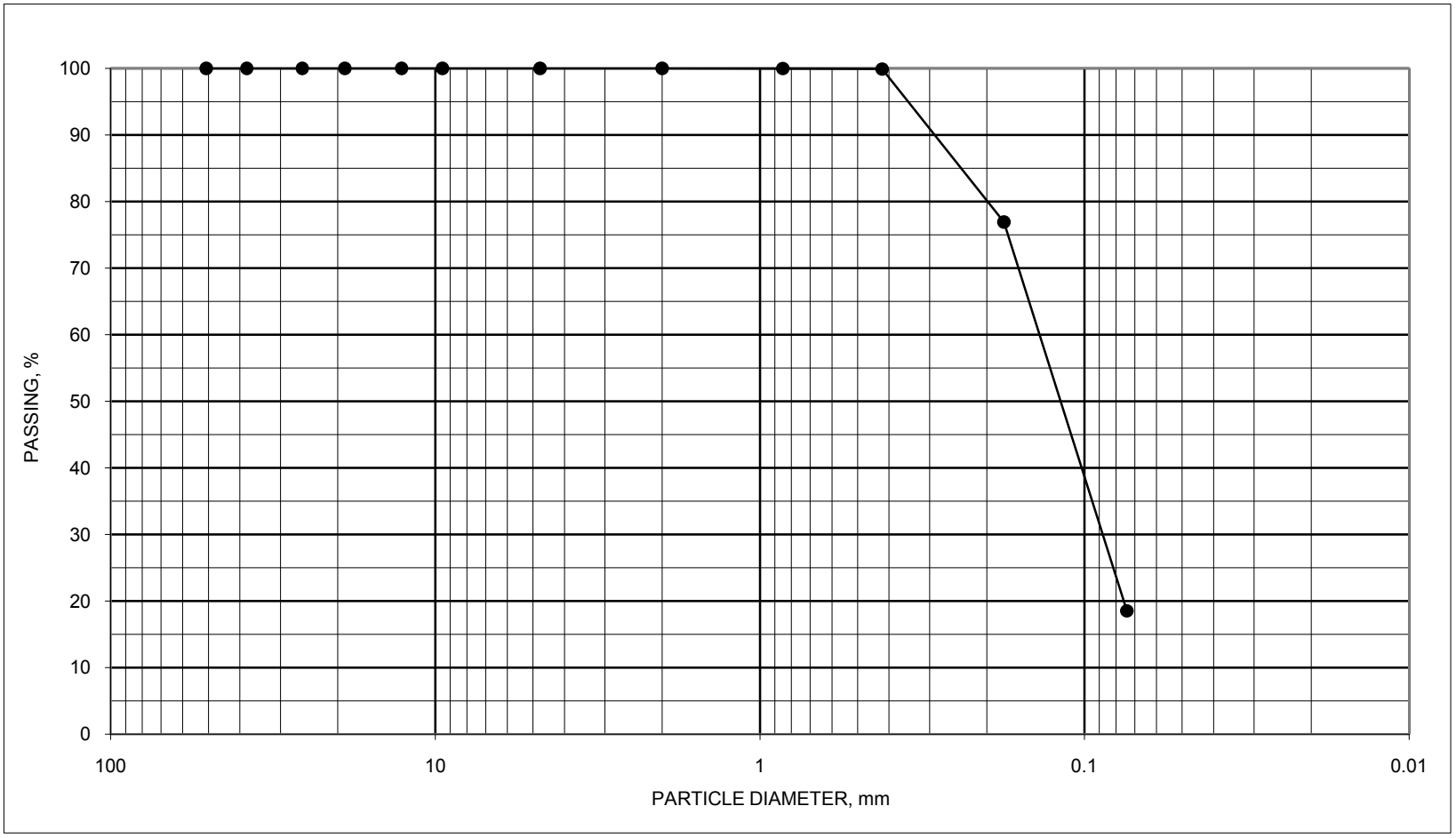
COUNCIL BLUFFS, IA JOB NO. 05105087 DATE 9/30/10

N:\Projects\2010\05105087\Omaha Lab\Sieves\[05105087 Sieve B-1, S-10, 38.5-40' 9-30-10.xls]REPORT

Terracon

Exhibit B-3

SIEVE SIZE	DIAMETER, mm	PASS, %
2"	50.8	100
1.5"	38.1	100
1"	25.7	100
3/4"	19.0	100
1/2"	12.7	100
3/8"	9.5	100
#4	4.76	100
#10	2.00	100
#20	0.85	100
#40	0.42	100
#80	0.177	77
#200	0.074	19



GRAIN SIZE DISTRIBUTION CURVE

BORING ID	SAMPLE ID	DEPTH, feet	SPECIMEN DESCRIPTION	UNIFIED SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
4	3	5 TO 7	GRAYISH BROWN SILTY SAND	SM				

*TESTED IN OMAHA

PROJECT WSEC ASH CONTAINMENT PONDS

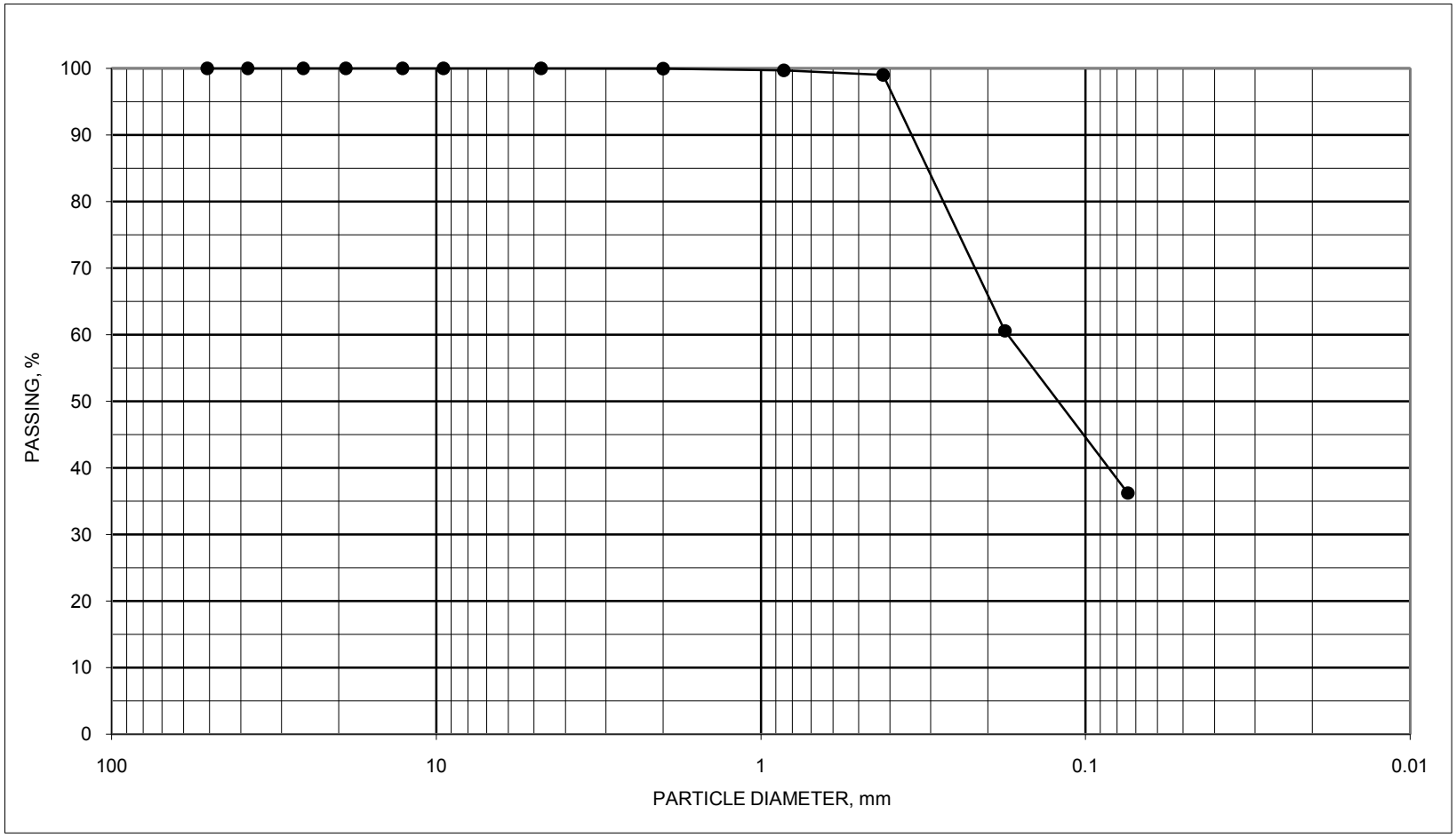
COUNCIL BLUFFS, IA JOB NO. 05105087 DATE 9/30/10

N:\Projects\2010\05105087\Omaha Lab\Sieves\[05105087 Sieve B-4, S-3, 5-7' 9-30-10.xls]REPORT

Terracon

Exhibit B-4

SIEVE SIZE	DIAMETER, mm	PASS, %
2"	50.8	100
1.5"	38.1	100
1"	25.7	100
3/4"	19.0	100
1/2"	12.7	100
3/8"	9.5	100
#4	4.76	100
#10	2.00	100
#20	0.85	100
#40	0.42	99
#80	0.177	61
#200	0.074	36



GRAIN SIZE DISTRIBUTION CURVE

BORING ID	SAMPLE ID	DEPTH, feet	SPECIMEN DESCRIPTION	UNIFIED SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
4	6	18.5 TO 20	GRAY & GRAYISH BROWN CLAYEY SAND	SC		29	15	14

*TESTED IN OMAHA

PROJECT WSEC ASH CONTAINMENT PONDS

COUNCIL BLUFFS, IA JOB NO. 05105087 DATE 9/30/10

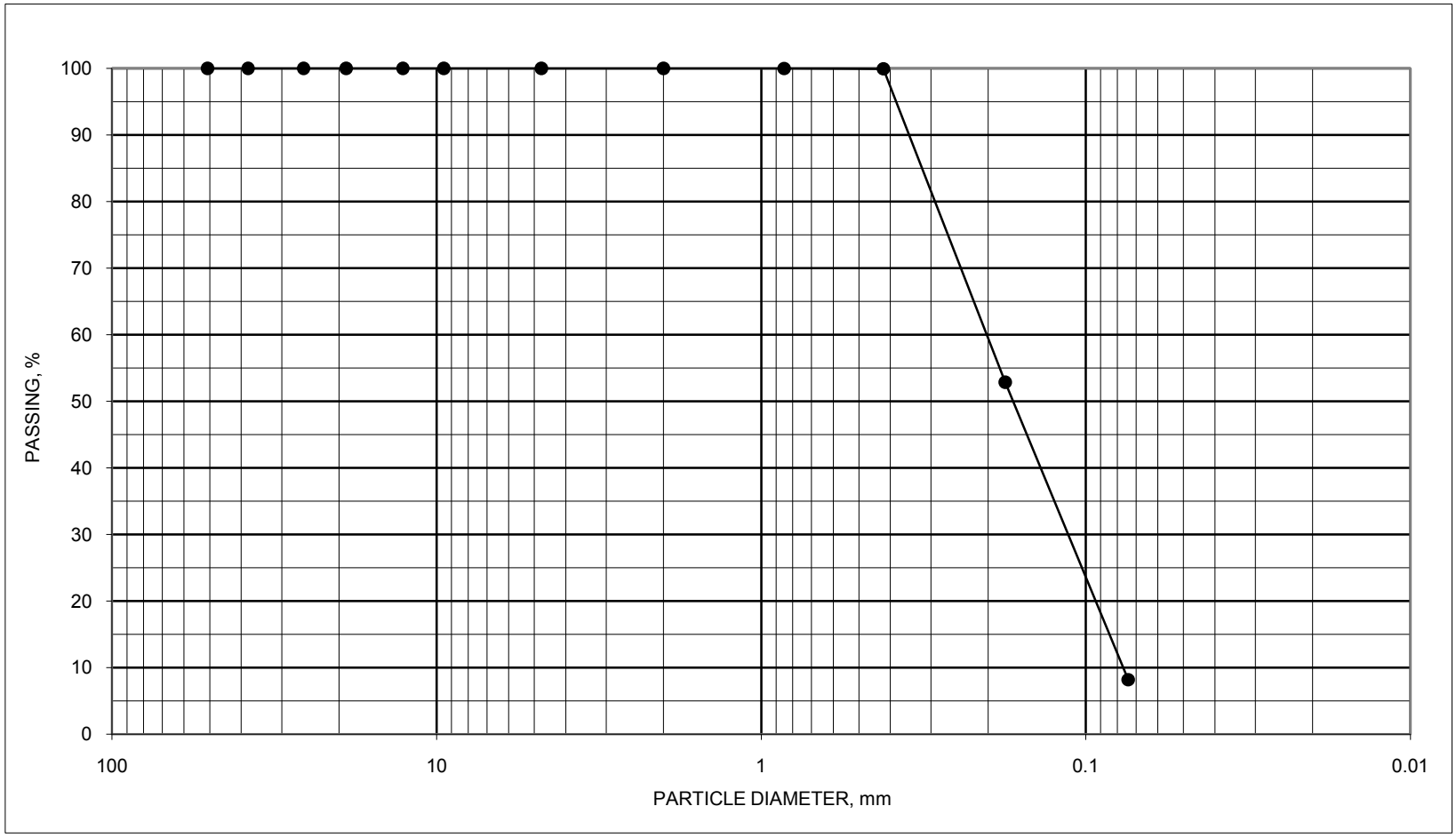
N:\Projects\2010\05105087\Omaha Lab\Sieves\[05105087 Sieve B-4, S-6, 18.5-20' 9-30-10.xls]REPORT

Terracon

Exhibit B-5

SIEVE SIZE	DIAMETER, mm	PASS, %
2"	50.8	100
1.5"	38.1	100
1"	25.7	100
3/4"	19.0	100
1/2"	12.7	100
3/8"	9.5	100
#4	4.76	100
#10	2.00	100
#20	0.85	100
#40	0.42	100
#80	0.177	53
#200	0.074	8

D10	0.0767
Cu	2.6
Cc	0.8



GRAIN SIZE DISTRIBUTION CURVE

BORING ID	SAMPLE ID	DEPTH, feet	SPECIMEN DESCRIPTION	UNIFIED SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
4	7	23.5 TO 25	GRAY POORLY GRADED SAND WITH SILT	SP-SM				

*TESTED IN OMAHA

PROJECT WSEC ASH CONTAINMENT PONDS

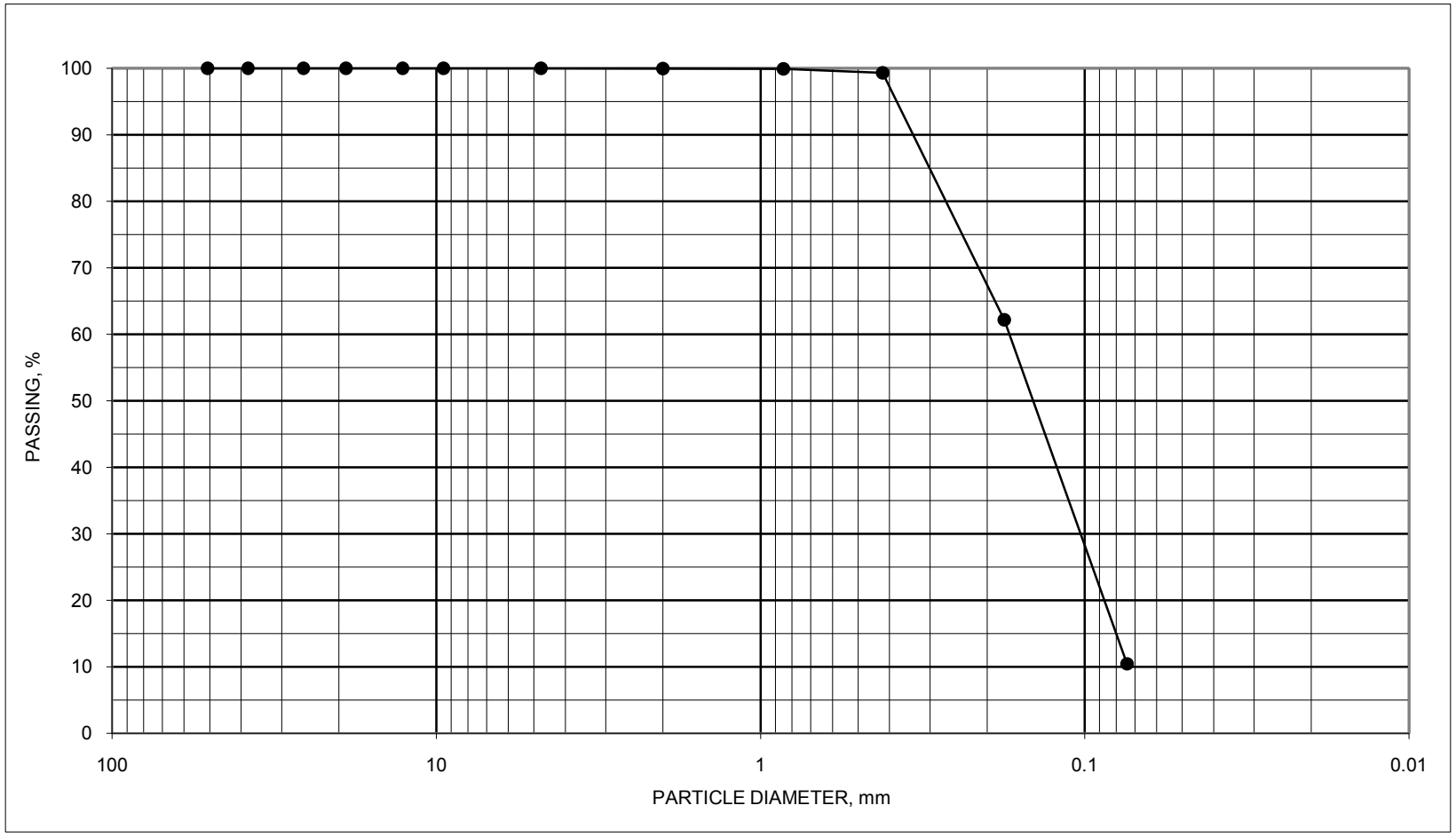
COUNCIL BLUFFS, IA JOB NO. 05105087 DATE 9/30/10

N:\Projects\2010\05105087\Omaha Lab\Sieves\[05105087 Sieve B-4, S-7, 23.5-25' 9-30-10.xls]REPORT

Terracon

Exhibit B-6

SIEVE SIZE	DIAMETER, mm	PASS, %
2"	50.8	100
1.5"	38.1	100
1"	25.7	100
3/4"	19.0	100
1/2"	12.7	100
3/8"	9.5	100
#4	4.76	100
#10	2.00	100
#20	0.85	100
#40	0.42	99
#80	0.177	62
#200	0.074	10



GRAIN SIZE DISTRIBUTION CURVE

BORING ID	SAMPLE ID	DEPTH, feet	SPECIMEN DESCRIPTION	UNIFIED SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
4	11	43.5 TO 45	GRAY POORLY GRADED SAND WITH SILT	SP-SM				

*TESTED IN OMAHA

PROJECT WSEC ASH CONTAINMENT PONDS

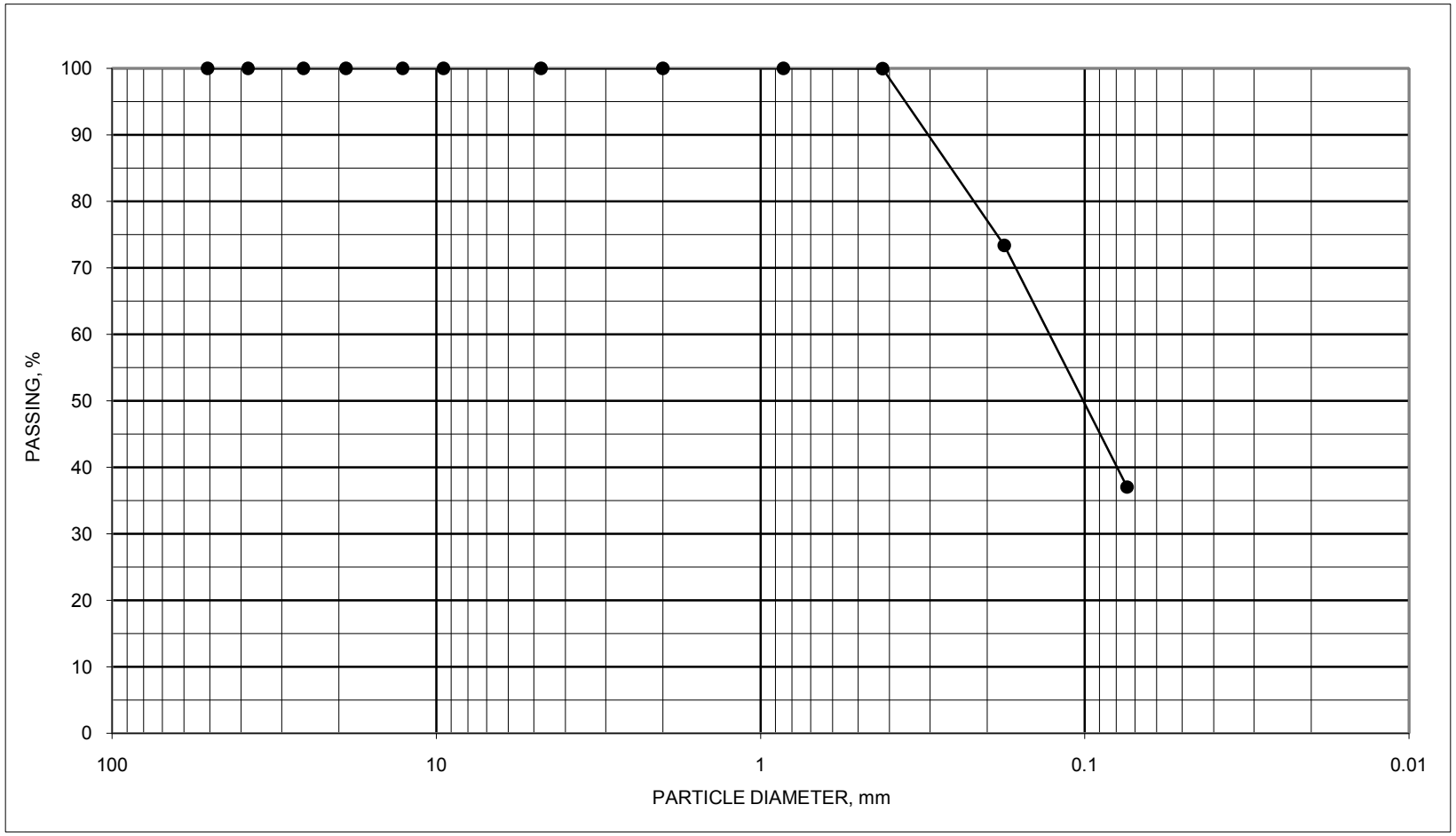
COUNCIL BLUFFS, IA JOB NO. 05105087 DATE 9/30/10

N:\Projects\2010\05105087\Omaha Lab\Sieves\[05105087 Sieve B-4, S-11, 43.5-45' 9-30-10.xls]REPORT

Terracon

Exhibit B-7

SIEVE SIZE	DIAMETER, mm	PASS, %
2"	50.8	100
1.5"	38.1	100
1"	25.7	100
3/4"	19.0	100
1/2"	12.7	100
3/8"	9.5	100
#4	4.76	100
#10	2.00	100
#20	0.85	100
#40	0.42	100
#80	0.177	73
#200	0.074	37



GRAIN SIZE DISTRIBUTION CURVE

BORING ID	SAMPLE ID	DEPTH, feet	SPECIMEN DESCRIPTION	UNIFIED SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
5	7	23 TO 25	GRAY SILTY SAND	SM				

*TESTED IN OMAHA

PROJECT WSEC ASH CONTAINMENT PONDS

COUNCIL BLUFFS, IA JOB NO. 05105087 DATE 9/30/10

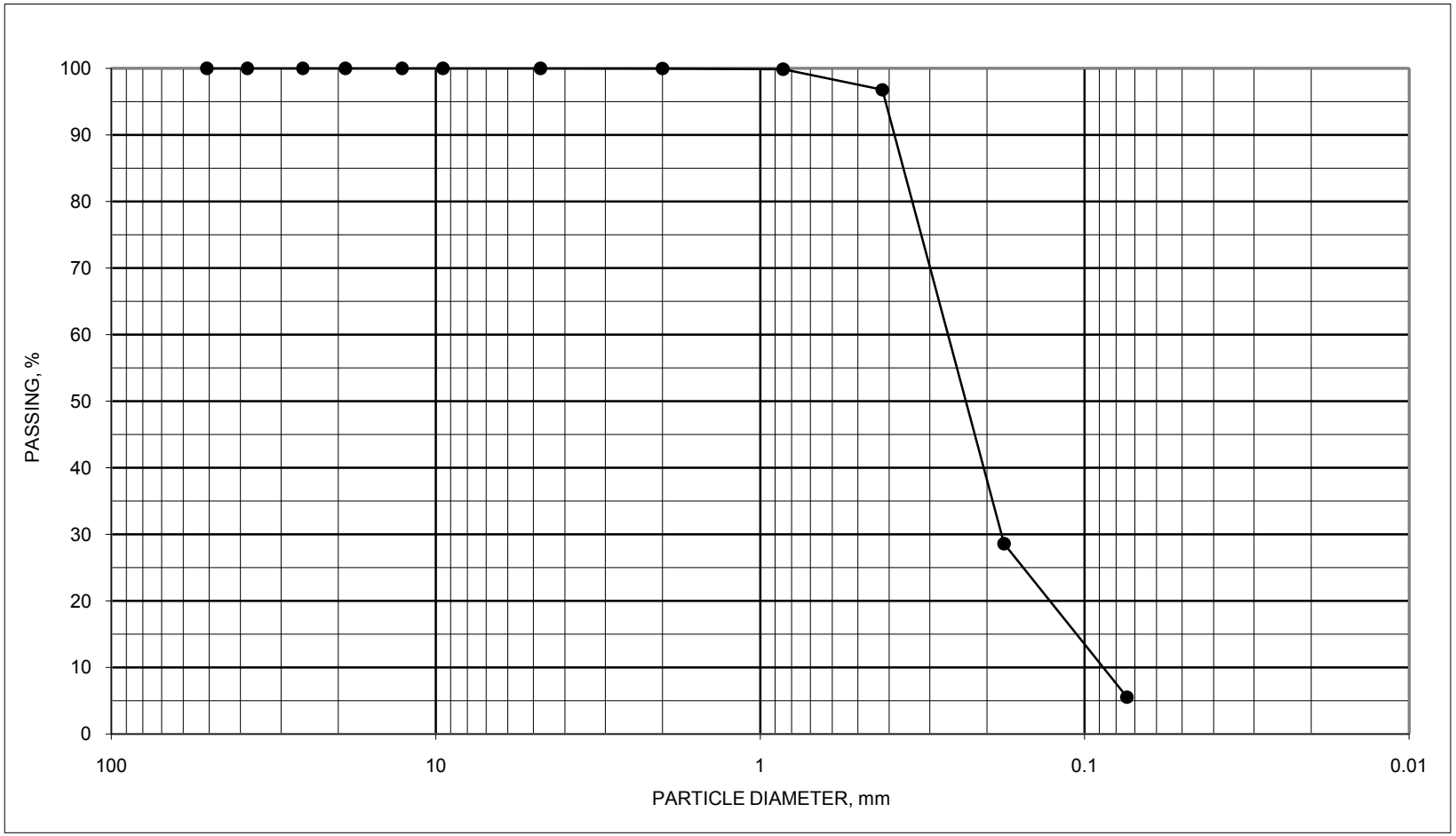
Terracon

N:\Projects\2010\05105087\Omaha Lab\Sieves\[05105087 Sieve B-5, S-7, 23-25' 9-30-10.xls]REPORT

Exhibit B-8

SIEVE SIZE	DIAMETER, mm	PASS, %
2"	50.8	100
1.5"	38.1	100
1"	25.7	100
3/4"	19.0	100
1/2"	12.7	100
3/8"	9.5	100
#4	4.76	100
#10	2.00	100
#20	0.85	100
#40	0.42	97
#80	0.177	29
#200	0.074	6

D10	0.0877
Cu	3.0
Cc	1.4



GRAIN SIZE DISTRIBUTION CURVE

BORING ID	SAMPLE ID	DEPTH, feet	SPECIMEN DESCRIPTION	UNIFIED SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
5	11	43 TO 45	GRAY POORLY GRADED SAND WITH SILT	SP-SM				

*TESTED IN OMAHA

PROJECT WSEC ASH CONTAINMENT PONDS

COUNCIL BLUFFS, IA JOB NO. 05105087 DATE 9/30/10

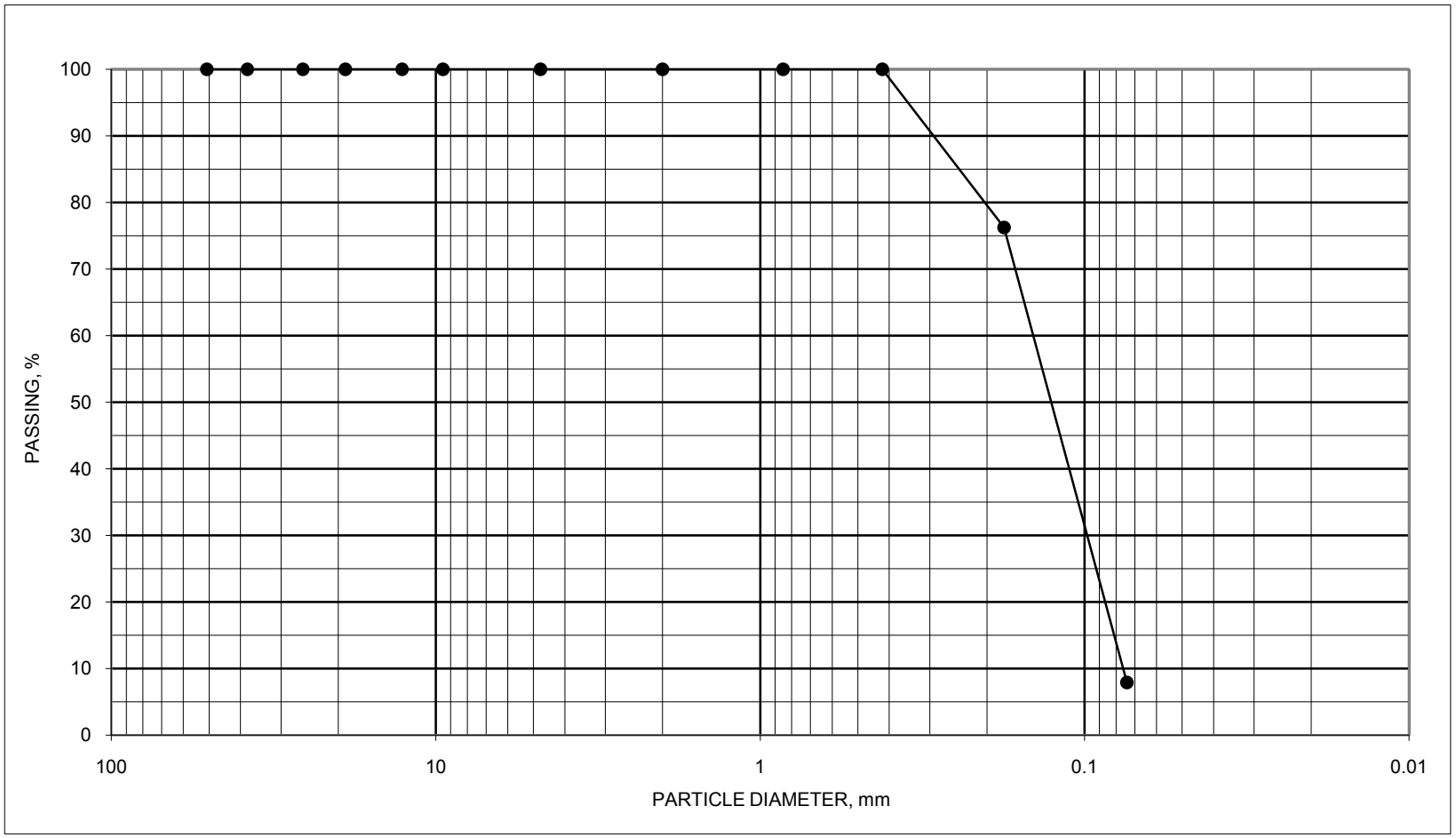
N:\Projects\2010\05105087\Omaha Lab\Sieves\[05105087 Sieve B-5, S-11, 43-45' 9-30-10.xls]REPORT

Terracon

Exhibit B-9

SIEVE SIZE	DIAMETER, mm	PASS, %
2"	50.8	100
1.5"	38.1	100
1"	25.7	100
3/4"	19.0	100
1/2"	12.7	100
3/8"	9.5	100
#4	4.76	100
#10	2.00	100
#20	0.85	100
#40	0.42	100
#80	0.177	76
#200	0.074	8

D10	0.0760
Cu	1.9
Cc	0.9



GRAIN SIZE DISTRIBUTION CURVE

BORING ID	SAMPLE ID	DEPTH, feet	SPECIMEN DESCRIPTION	UNIFIED SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
6	8	28 TO 30	LIGHT GRAY POORLY GRADED SAND WITH SILT	SP-SM				

*TESTED IN OMAHA

PROJECT WSEC ASH CONTAINMENT PONDS

COUNCIL BLUFFS, IA JOB NO. 05105087 DATE 9/30/10

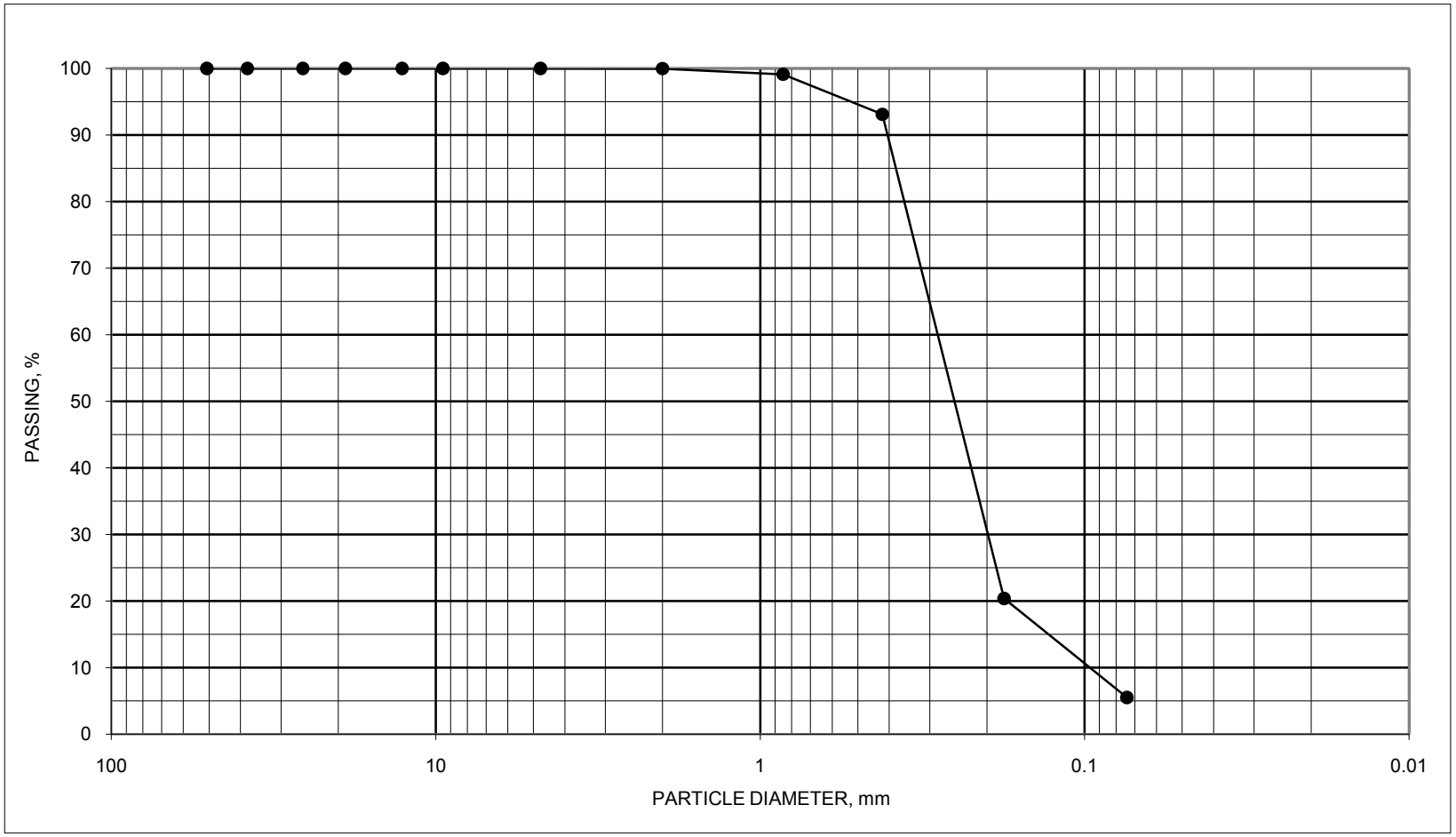
N:\Projects\2010\05105087\Omaha Lab\Sieves\[05105087 Sieve B-6, S-8, 28-30' 9-30-10.xls]REPORT

Terracon

Exhibit B-10

SIEVE SIZE	DIAMETER, mm	PASS, %
2"	50.8	100
1.5"	38.1	100
1"	25.7	100
3/4"	19.0	100
1/2"	12.7	100
3/8"	9.5	100
#4	4.76	100
#10	2.00	100
#20	0.85	99
#40	0.42	93
#80	0.177	20
#200	0.074	5

D10	0.0963
Cu	2.9
Cc	1.4



GRAIN SIZE DISTRIBUTION CURVE

BORING ID	SAMPLE ID	DEPTH, feet	SPECIMEN DESCRIPTION	UNIFIED SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
6	12	48 TO 50	GRAY POORLY GRADED SAND WITH SILT	SP-SM				

*TESTED IN OMAHA

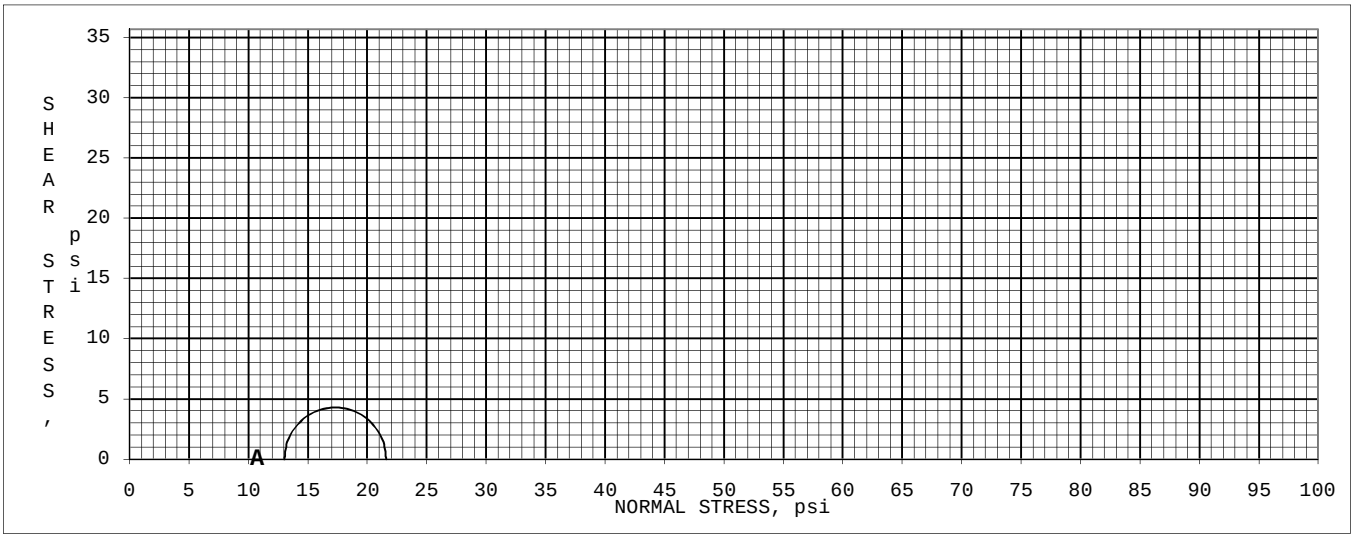
PROJECT WSEC ASH CONTAINMENT PONDS

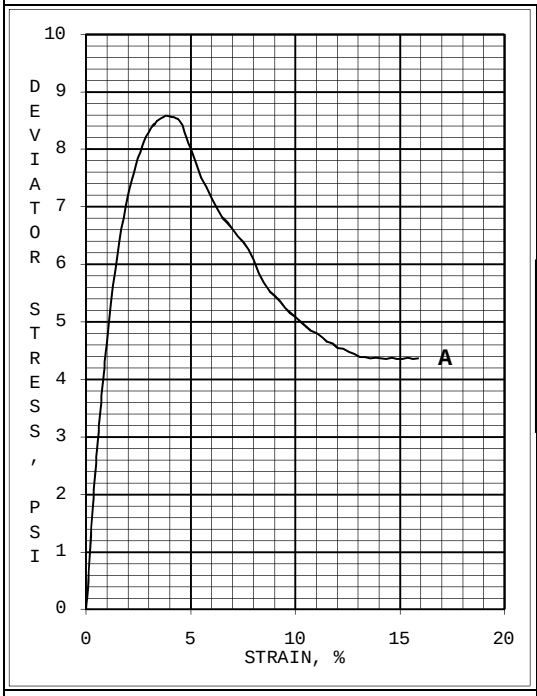
COUNCIL BLUFFS, IA JOB NO. 05105087 DATE 9/30/10

N:\Projects\2010\05105087\Omaha Lab\Sieves\[05105087 Sieve B-6, S-12, 48-50' 9-30-10.xls]REPORT

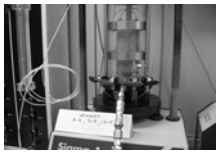
Terracon

Exhibit B-11





SPECIMEN #:		A		
INITIAL	WATER CONTENT, % FROM TRIMMINGS	34.9		
	DRY DENSITY, pcf	84.3		
	SATURATION, %	94		
	VOID RATIO	1.00		
WATER CONTENT, % AFTER SHEAR		35.9		



A	B	C

MINOR PRINCIPAL STRESS, psi	13.0		
MOHR'S CIRCLES DRAWN AT % STRAIN	3.9		
DEVIATOR STRESS AT % STRAIN, psi	8.6		
STRAIN AT PEAK DEVIATOR STRESS, %	3.9		
DEVIATOR STRESS AT 15% STRAIN, psi	4.4		
INITIAL DIAMETER, inch	2.885		
INITIAL HEIGHT, inch	6.340		
STRAIN RATE, %/minute	0.30		

CONTROLLED - STRAIN TEST

DESCRIPTION OF SPECIMENS: FAT CLAY (CH), MOTTLED BROWN, GRAYISH BROWN, & GRAY

LL	PL	PI	Gs
58	24	34	2.7 EST.

SAMPLE TYPE: 3" SHELBY TUBE

TEST TYPE: UU

REMARKS:

PROJECT: WSEC ASH CONTAINMENT PONDS
COUNCIL BLUFFS, IA 05105087

BORING #: 2

SAMPLE #: 5

DEPTH, feet: 13 - 15

LABORATORY: TERRACON - OMAHA

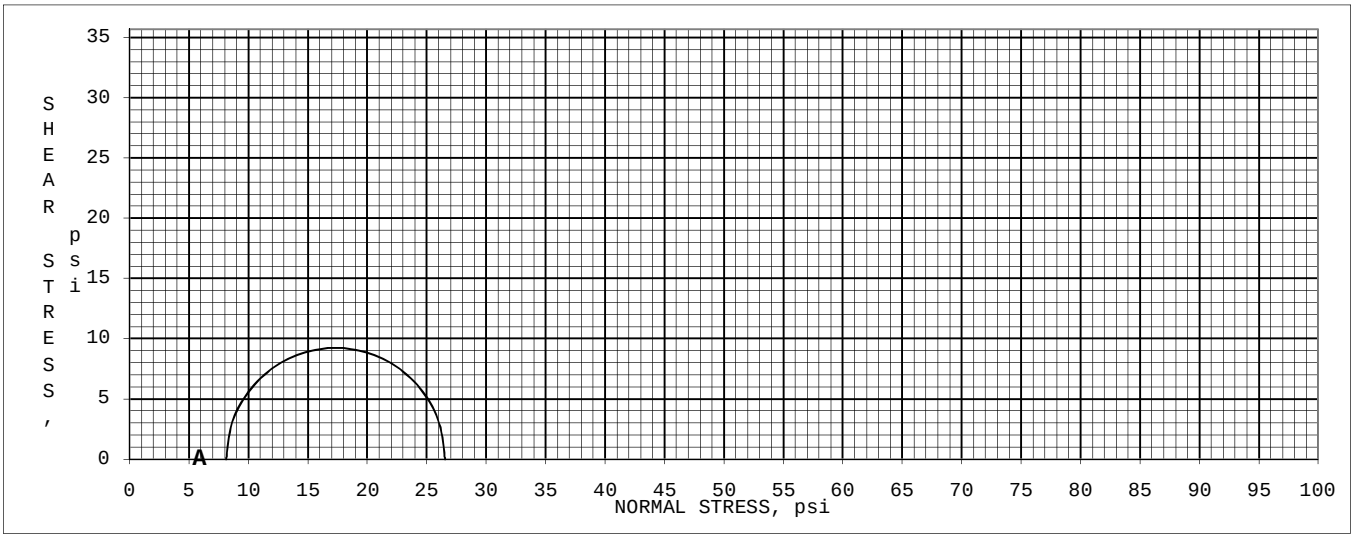
DATE: 9/30/2010

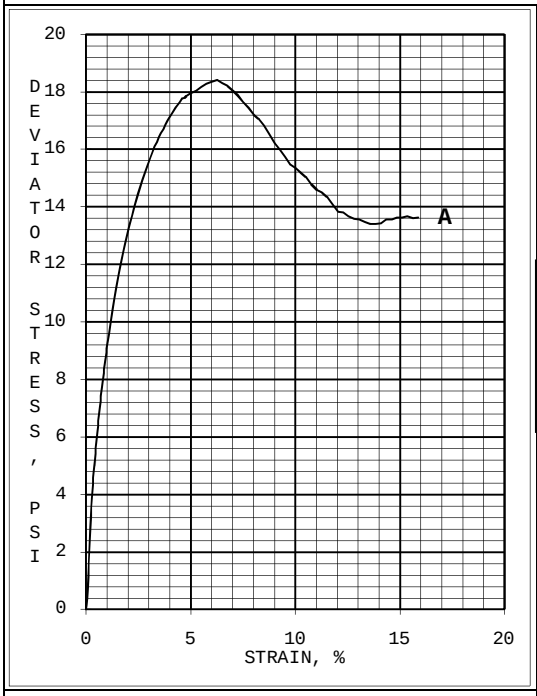
TRIAXIAL COMPRESSION TEST REPORT

PROCEDURE: ASTM D2850, UNCONSOLIDATED, UNDRAINED COMPRESSIVE STRENGTH OF COHESIVE SOILS IN TRIAXIAL COMPRESSION, MEMBRANE CORRECTION APPLIED. OTHER TESTS WERE CONDUCTED IN GENERAL ACCORDANCE WITH ASTMS D2216 AND D4318 IF APPLICABLE.

Terracon

N:\Projects\2010\05105087\Omaha Lab\UU\[05105087 UU B-2, S-5, 13-15' 9-30-10.xls]REPORT





SPECIMEN #:		A		
INITIAL	WATER CONTENT, % FROM TRIMMINGS	16.3		
	DRY DENSITY, pcf	104.7		
	SATURATION, %	72		
	VOID RATIO	0.61		
WATER CONTENT, % AFTER SHEAR		20.6		

A B C

MINOR PRINCIPAL STRESS, psi	8.1		
MOHR'S CIRCLES DRAWN AT % STRAIN	6.3		
DEVIATOR STRESS AT % STRAIN, psi	18.4		
STRAIN AT PEAK DEVIATOR STRESS, %	6.3		
DEVIATOR STRESS AT 15% STRAIN, psi	13.6		
INITIAL DIAMETER, inch	2.888		
INITIAL HEIGHT, inch	6.300		
STRAIN RATE, %/minute	0.30		

CONTROLLED - STRAIN TEST

DESCRIPTION OF SPECIMENS: LEAN CLAY (CL), MOTTLED VERY DARK GRAYISH BROWN & VERY DARK GRAY

LL	PL	PI	Gs
30	13	17	2.7 EST.

SAMPLE TYPE: 3" SHELBY TUBE

TEST TYPE: UU

REMARKS:

PROJECT: WSEC ASH CONTAINMENT PONDS
COUNCIL BLUFFS, IA 05105087

BORING #: 4

SAMPLE #: 4

DEPTH, feet: 8 - 10

LABORATORY: TERRACON - OMAHA

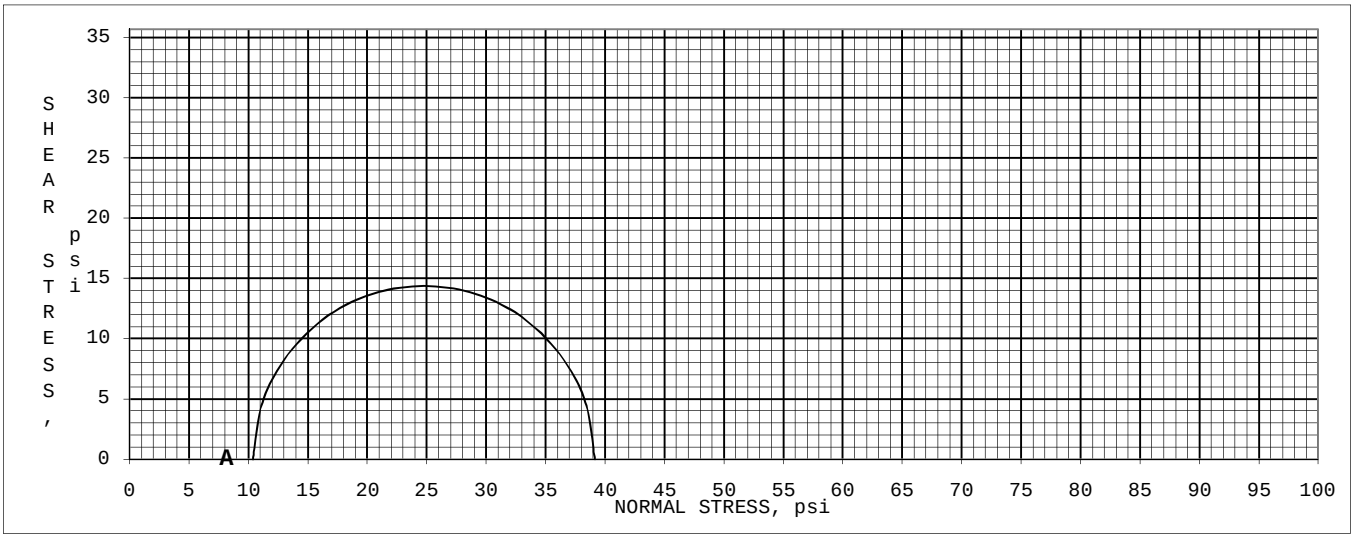
DATE: 9/30/2010

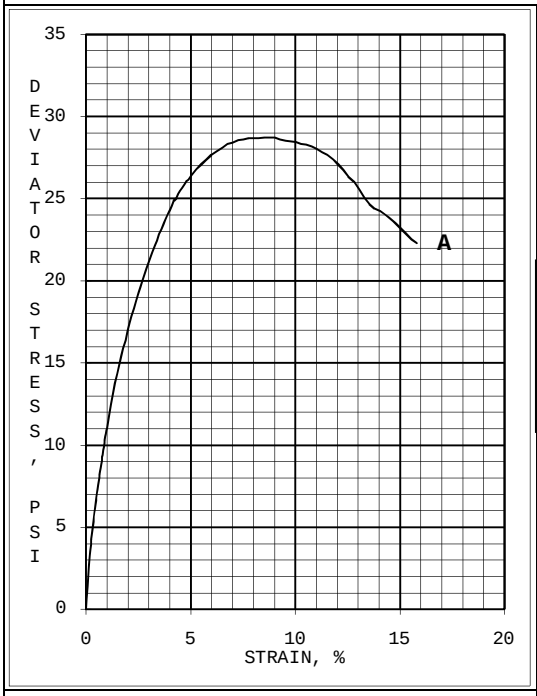
TRIAXIAL COMPRESSION TEST REPORT

PROCEDURE: ASTM D2850, UNCONSOLIDATED, UNDRAINED COMPRESSIVE STRENGTH OF COHESIVE SOILS IN TRIAXIAL COMPRESSION, MEMBRANE CORRECTION APPLIED. OTHER TESTS WERE CONDUCTED IN GENERAL ACCORDANCE WITH ASTMS D2216 AND D4318 IF APPLICABLE.

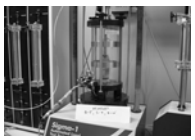
Terracon

N:\Projects\2010\05105087\Omaha Lab\UU\[05105087 UU B-4, S-4, 8-10' 9-30-10.xls]REPORT





SPECIMEN #:		A		
INITIAL	WATER CONTENT, % FROM TRIMMINGS	27.8		
	DRY DENSITY, pcf	95.6		
	SATURATION, %	98		
	VOID RATIO	0.76		
WATER CONTENT, % AFTER SHEAR		27.3		



A	B	C

MINOR PRINCIPAL STRESS, psi	10.4		
MOHR'S CIRCLES DRAWN AT % STRAIN	8.8		
DEVIATOR STRESS AT % STRAIN, psi	28.7		
STRAIN AT PEAK DEVIATOR STRESS, %	8.8		
DEVIATOR STRESS AT 15% STRAIN, psi	23.2		
INITIAL DIAMETER, inch	1.331		
INITIAL HEIGHT, inch	2.917		
STRAIN RATE, %/minute	0.30		

CONTROLLED - STRAIN TEST

DESCRIPTION OF SPECIMENS: FAT CLAY (CH), VERY DARK GRAYISH BROWN

LL	PL	PI	Gs
52	21	31	2.7 EST.

SAMPLE TYPE: 3" SHELBY TUBE

TEST TYPE: UU

REMARKS:

PROJECT: WSEC ASH CONTAINMENT PONDS
COUNCIL BLUFFS, IA 05105087

BORING #: 5

SAMPLE #: 4

DEPTH, feet: 8 - 10

LABORATORY: TERRACON - OMAHA

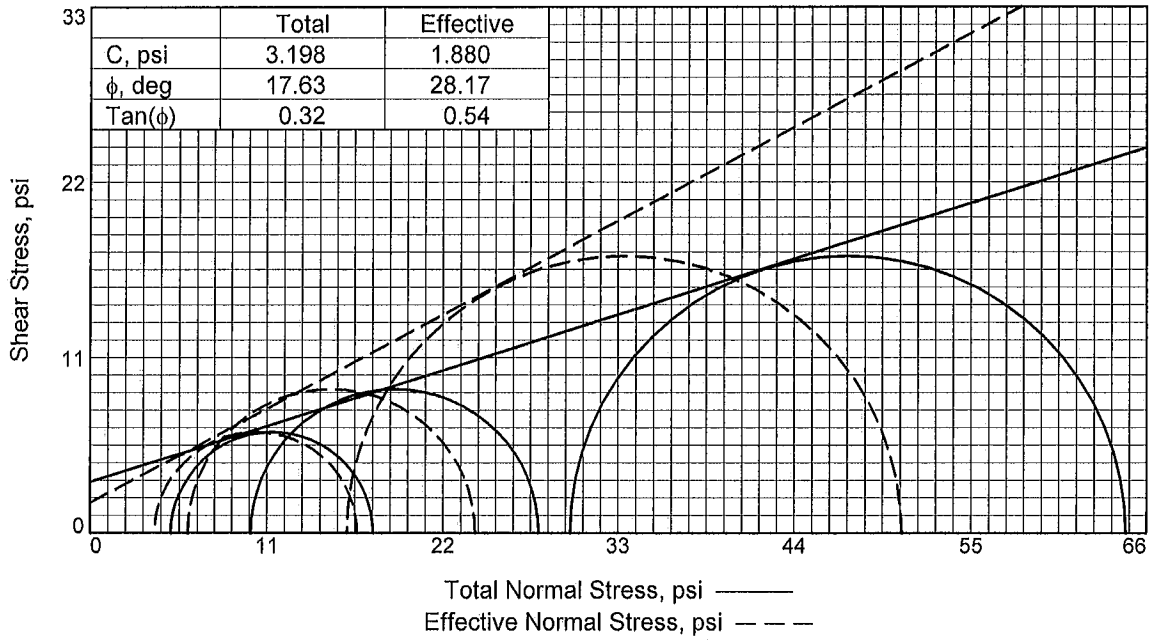
DATE: 9/30/2010

TRIAXIAL COMPRESSION TEST REPORT

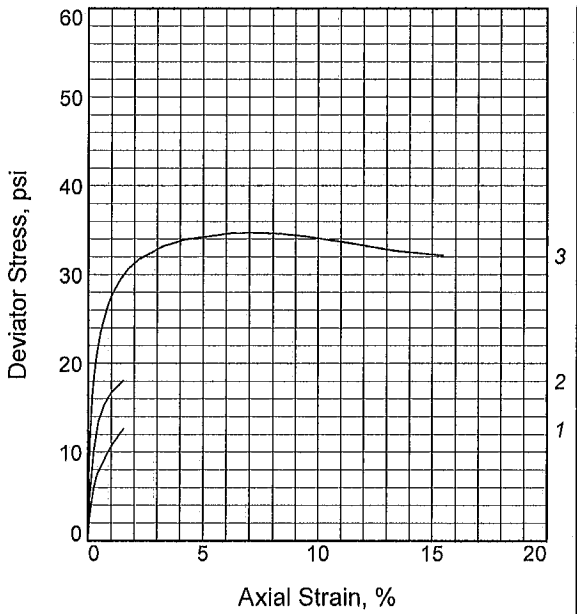
PROCEDURE: ASTM D2850, UNCONSOLIDATED, UNDRAINED COMPRESSIVE STRENGTH OF COHESIVE SOILS IN TRIAXIAL COMPRESSION, MEMBRANE CORRECTION APPLIED. OTHER TESTS WERE CONDUCTED IN GENERAL ACCORDANCE WITH ASTMS D2216 AND D4318 IF APPLICABLE.

Terracon

N:\Projects\2010\05105087\Omaha Lab\UU\[05105087 UU B-5, S-4, 8-10' 9-30-10.xls]REPORT



	Total	Effective
C, psi	3.198	1.880
ϕ, deg	17.63	28.17
Tan(ϕ)	0.32	0.54



Sample No.		1	2	3
Initial	Water Content, %	31.0	31.0	31.0
	Dry Density, pcf	91.8	91.8	91.8
	Saturation, %	98.7	98.7	98.7
	Void Ratio	0.8565	0.8565	0.8565
	Diameter, in.	2.875	2.875	2.875
	Height, in.	5.750	5.750	5.750
At Test	Water Content, %	31.0	30.9	30.8
	Dry Density, pcf	92.3	92.4	92.6
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.8468	0.8439	0.8409
	Diameter, in.	2.870	2.891	2.911
	Height, in.	5.740	5.649	5.561
Strain rate, in./min.		0.001	0.001	0.001
Back Pressure, psi		60.00	60.00	60.00
Cell Pressure, psi		65.00	70.00	90.00
Fail. Stress, psi		12.63	18.01	34.69
Total Pore Pr., psi		61.00	64.00	74.00
Ult. Stress, psi				
Total Pore Pr., psi				
$\bar{\sigma}_1$ Failure, psi		16.63	24.01	50.69
$\bar{\sigma}_3$ Failure, psi		4.00	6.00	16.00

Type of Test:
CU with Pore Pressures (Stage Loaded Sample)
Sample Type: ST
Description: DARK BROWN FAT CLAY

LL= 58 **PL=** 24 **PI=** 34
Assumed Specific Gravity= 2.73
Remarks: Lab No. 10131

Client: HGM ASSOCIATES INC

Project: WSEC ASH CONTAINMENT PONDS

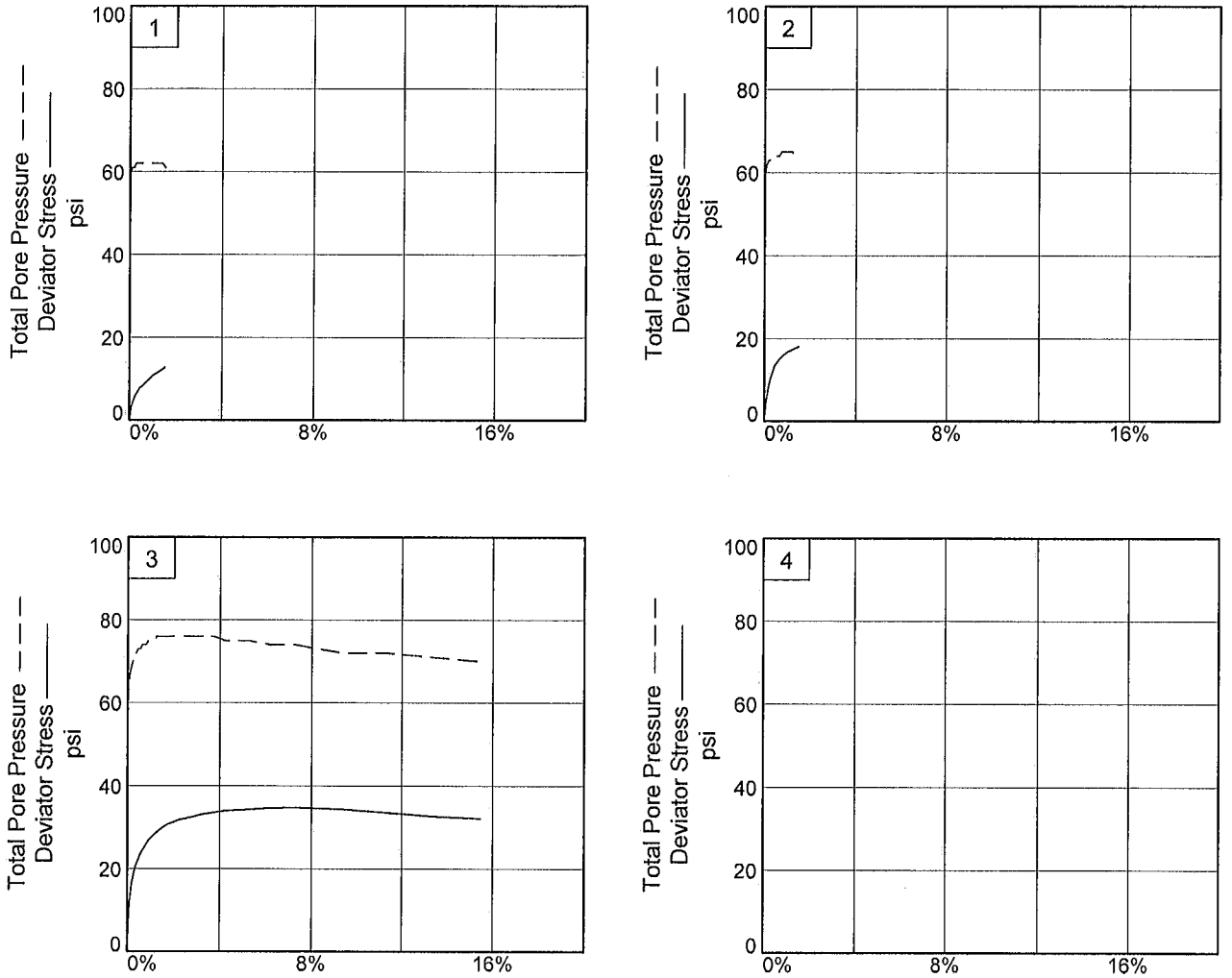
Source of Sample: B-2 **Depth:** 8-10'
Sample Number: ST/4
Proj. No.: 05105087 **Date Sampled:** 10-11-10

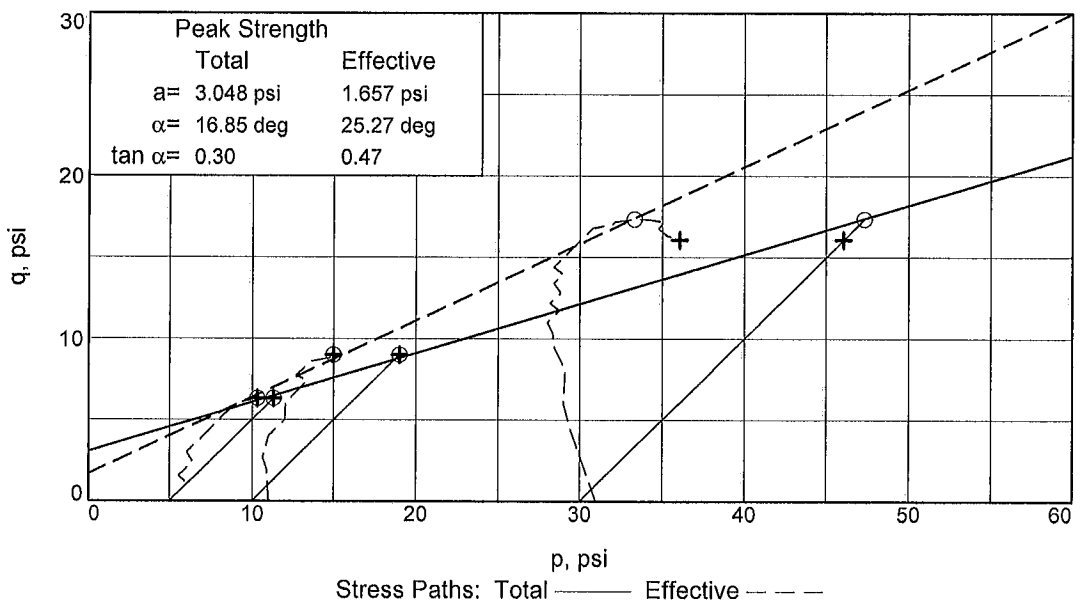
TRIAXIAL SHEAR TEST REPORT
H.C. Nutting
A Terracon Company

Figure 1 of 2

Tested By: FCE **Checked By:** GS

Exhibit B-15



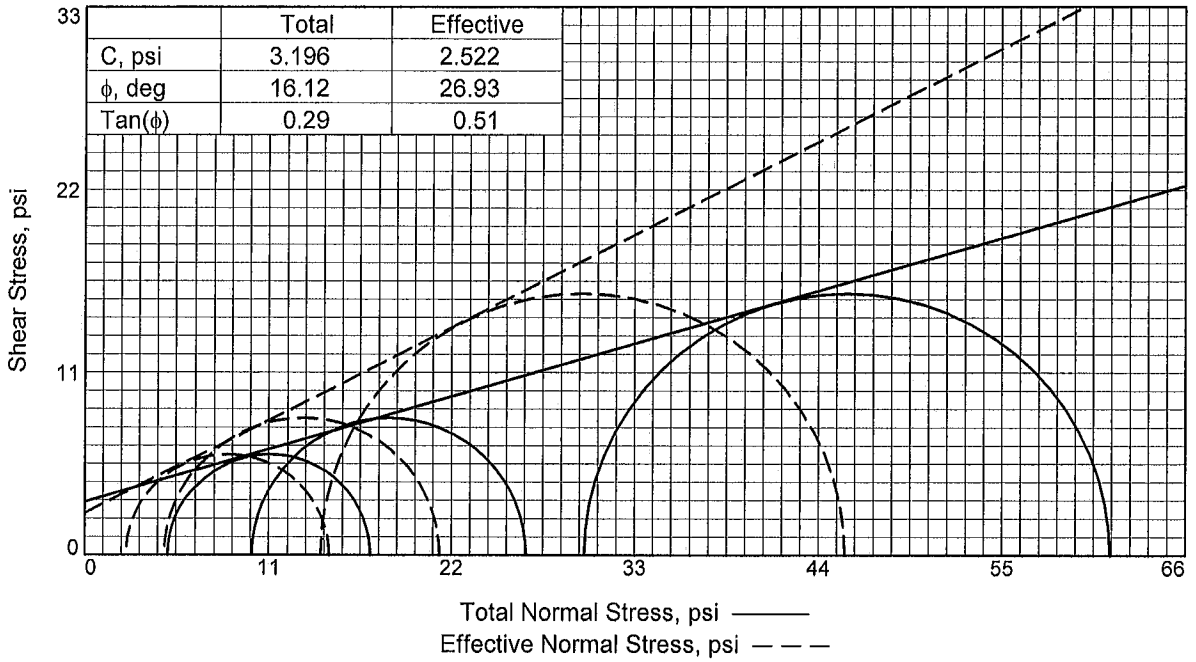


Client: HGM ASSOCIATES INC
Project: WSEC ASH CONTAINMENT PONDS
Source of Sample: B-2 **Depth:** 8-10' **Sample Number:** ST/4
Project No.: 05105087 **Figure** 2 of 2

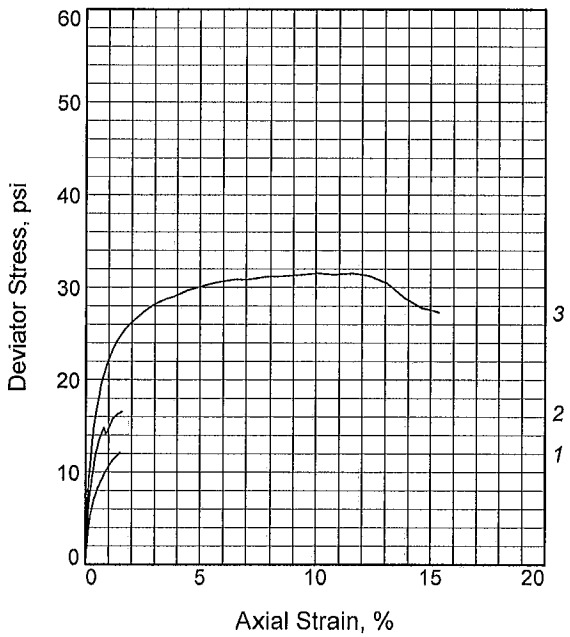
H.C. Nutting - A Terracon Company

Tested By: FCE **Checked By:** GS

Exhibit B-16



	Total	Effective
C, psi	3.196	2.522
ϕ, deg	16.12	26.93
Tan(ϕ)	0.29	0.51



Sample No.		1	2	3
Initial	Water Content, %	27.2	27.2	27.2
	Dry Density, pcf	93.8	93.8	93.8
	Saturation, %	91.2	91.2	91.2
	Void Ratio	0.8101	0.8101	0.8101
	Diameter, in.	2.850	2.850	2.850
	Height, in.	5.697	5.697	5.697
At Test	Water Content, %	29.3	29.3	28.8
	Dry Density, pcf	94.5	94.6	95.3
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.7978	0.7958	0.7822
	Diameter, in.	2.843	2.864	2.880
	Height, in.	5.684	5.597	5.494
Strain rate, in./min.		0.001	0.001	0.001
Back Pressure, psi		60.00	60.00	60.00
Cell Pressure, psi		65.00	70.00	90.00
Fail. Stress, psi		12.10	16.50	31.50
Total Pore Pr., psi		62.50	65.20	75.90
Ult. Stress, psi				
Total Pore Pr., psi				
$\bar{\sigma}_1$ Failure, psi		14.60	21.30	45.60
$\bar{\sigma}_3$ Failure, psi		2.50	4.80	14.10

Type of Test:
CU with Pore Pressures (Stage Loaded Sample)
Sample Type: ST
Description: DARK BROWN LEAN CLAY

LL= 47 **PL=** 19 **PI=** 28
Assumed Specific Gravity= 2.72
Remarks: Lab No. 10134

Client: HGM ASSOCIATES INC

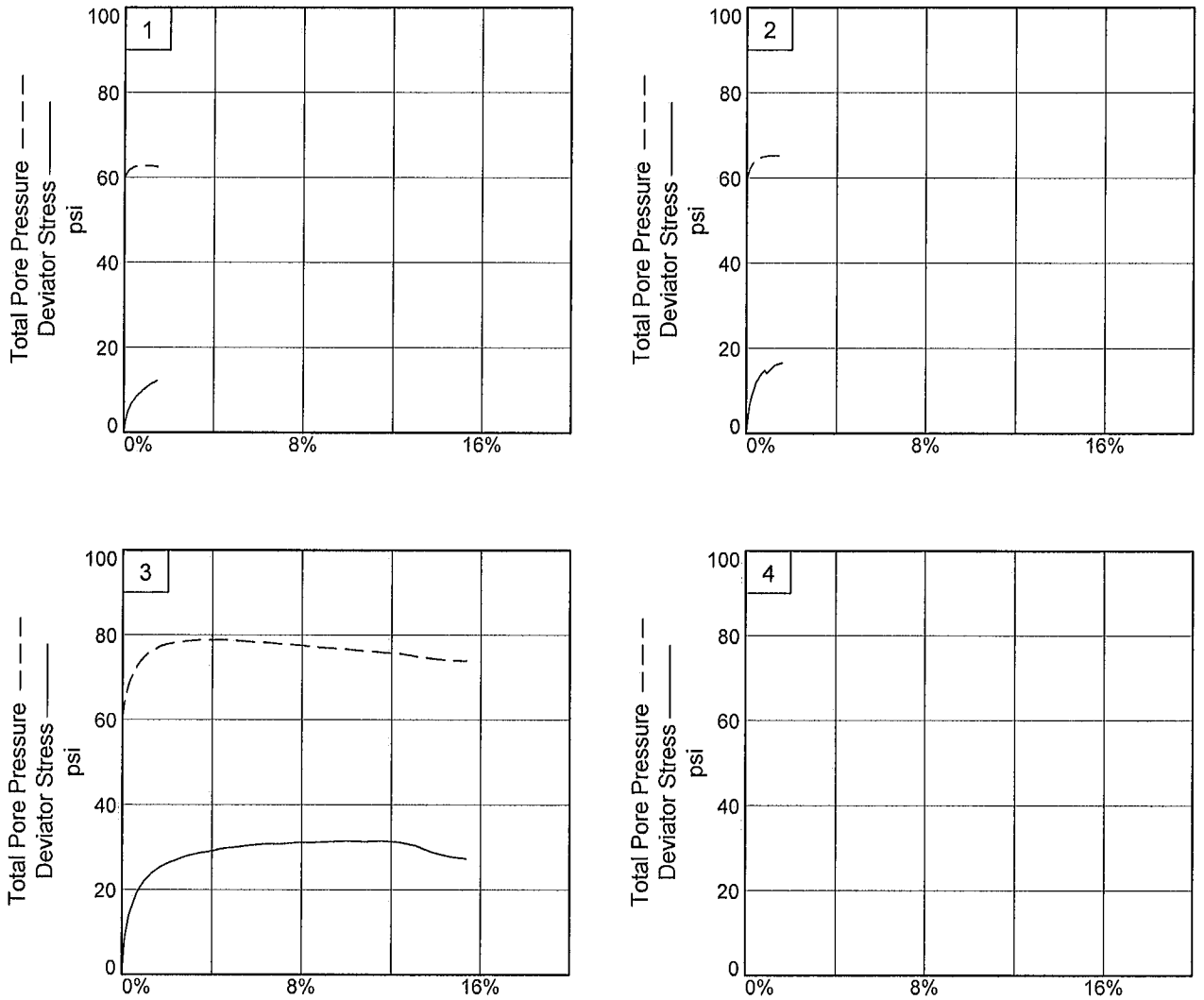
Project: WSEC ASH CONTAINMENT PONDS

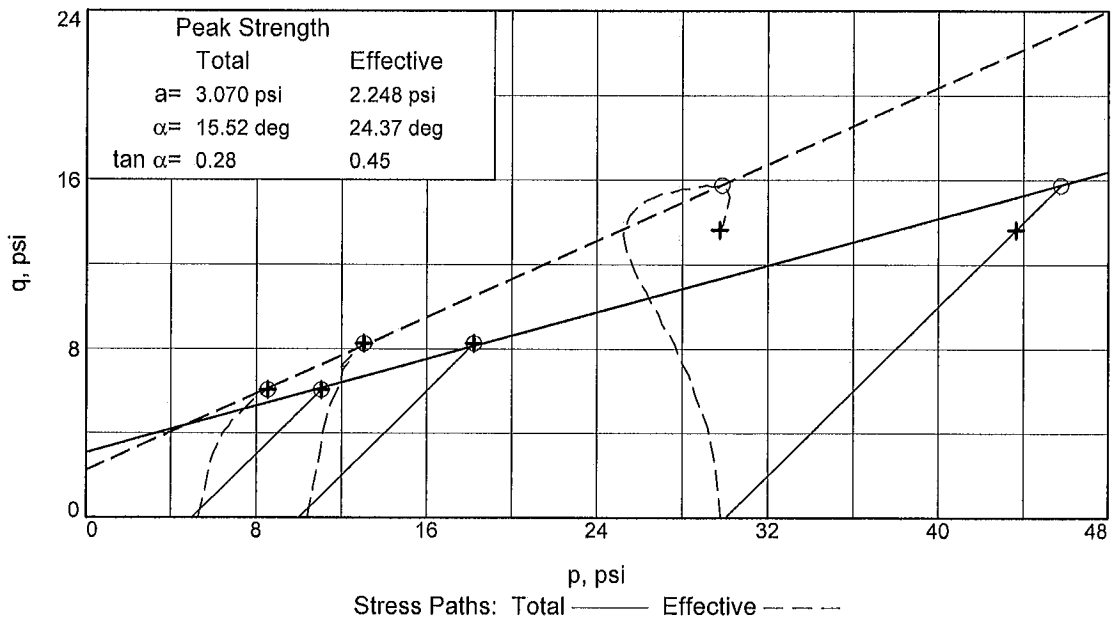
Source of Sample: B-5 **Depth:** 13-15'
Sample Number: ST/5
Proj. No.: 05105087 **Date Sampled:** 10-11-10

TRIAXIAL SHEAR TEST REPORT
H.C. Nutting
A Terracon Company

Figure 1 of 2

Exhibit B-17





Client: HGM ASSOCIATES INC

Project: WSEC ASH CONTAINMENT PONDS

Source of Sample: B-5 **Depth:** 13-15' **Sample Number:** ST/5

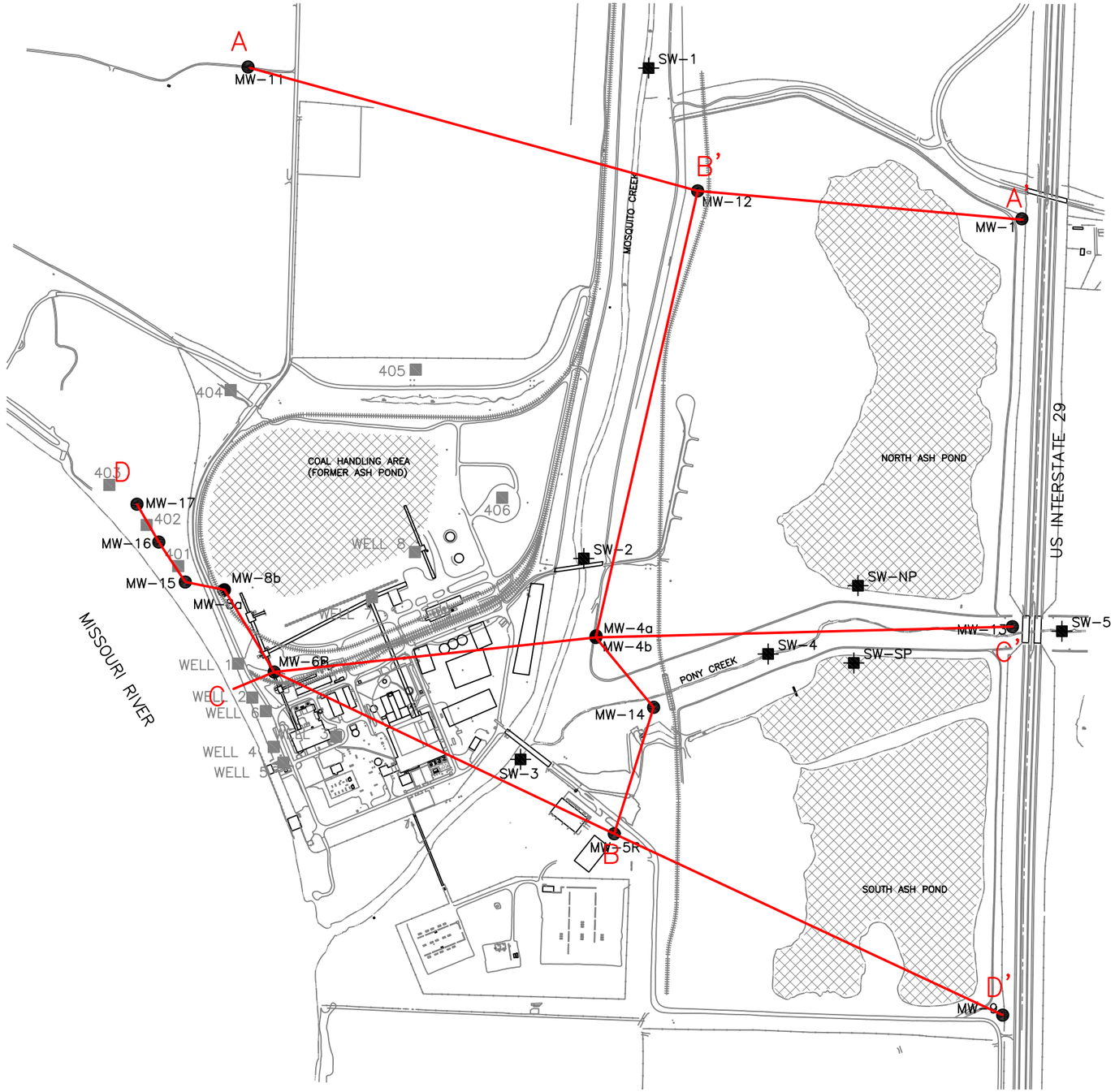
Project No.: 05105087 **Figure** 2 of 2

H.C. Nutting - A Terracon Company

Exhibit B-18

APPENDIX C

SUPPORTING DOCUMENTS



LEGEND:

- MONITORING WELL
- SURFACE WATER SAMPLE
- RAILROAD
- CROSS-SECTION LINE

DESIGNED BY	ANGEL SHAWDA	
DRAWN BY	NORA DAY	
CHECKED BY	ANGEL SHAWDA	
APPROVED BY	KEVIN ARMSTRONG	
PROJECT MANAGER	KEVIN ARMSTRONG	

0 400 800
SCALE IN FEET

MANAGING OFFICE: DES MOINES, IOWA

PROJECT: MIDAMERICAN ENERGY COMPANY
WALTER SCOTT JR. ENERGY CENTER
COUNCIL BLUFFS, IOWA

TITLE: **CROSS-SECTION MAP**

MWH

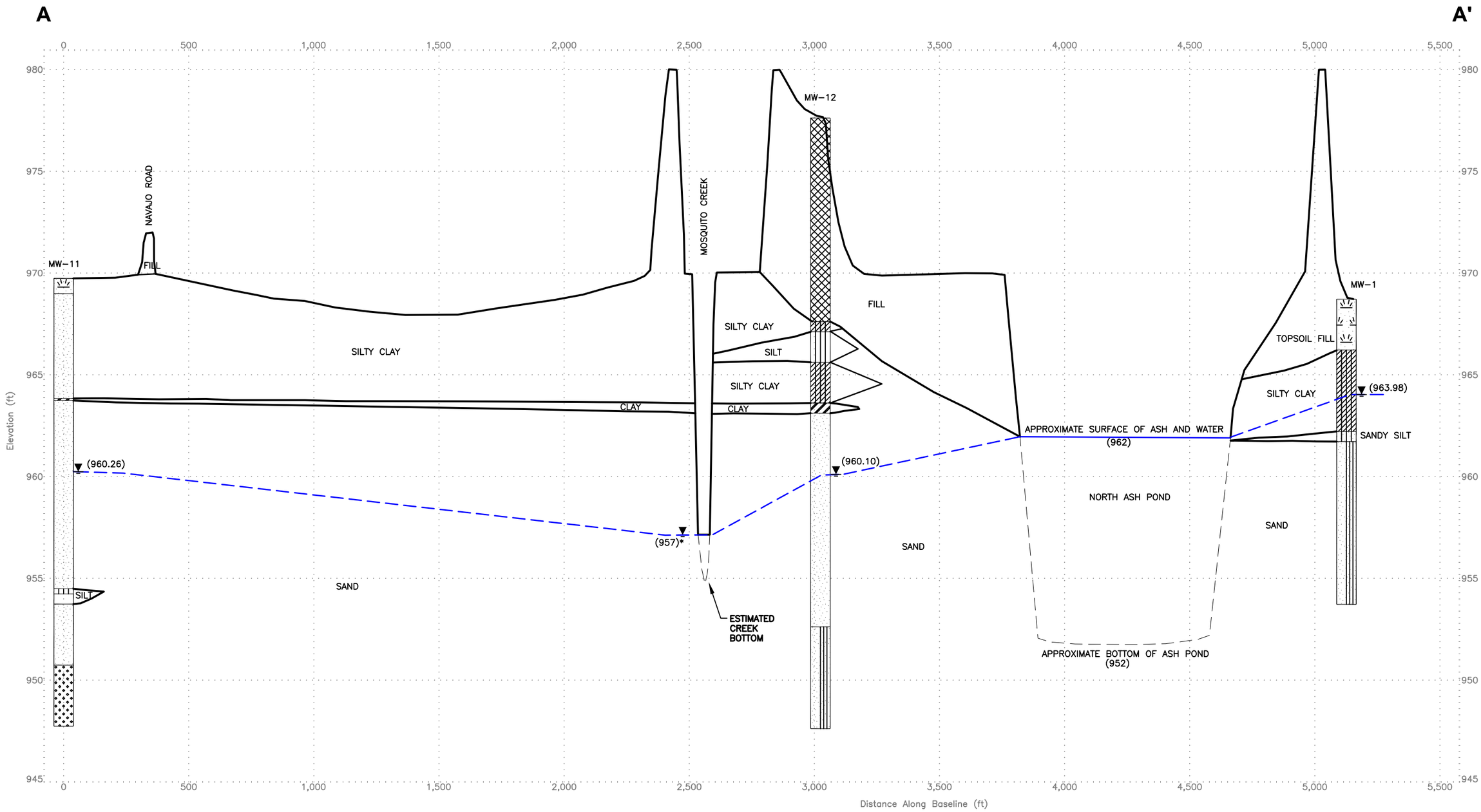
FIGURE: 5

REVISION: .

FILE NAME: .

P:\CAD\MidAmerican\Council Bluffs\WSEC\North\xsm.dwg Mar 06, 2009 - 9:11am

Exhibit C-4



ESTIMATED WATER TABLE (BASED ON SEASONAL HIGH CONDITIONS – AUGUST 4, 2008)

(957)* ESTIMATED CREEK LEVEL (BASED ON TOPOGRAPHIC SURVEY)

LITHOLOGY GRAPHICS

- Topsoil
- USCS High Plasticity Clay
- USCS Low Plasticity Silty Clay
- USCS Silt
- USCS Sandy Silt
- USCS Well-graded Sand
- USCS Poorly-graded Sand with Silt
- Fill (made ground)
- USCS Poorly-graded Sand

DESIGNED BY	ANGEL SHAWDA	
DRAWN BY	DAVID MIRANDA	
CHECKED BY	ANGEL SHAWDA	
APPROVED BY	KEVIN ARMSTRONG	
PROJECT MANAGER	KEVIN ARMSTRONG	

MANAGING OFFICE: DES MOINES, IOWA

PROJECT: MIDAMERICAN ENERGY COMPANY
WALTER SCOTT JR. ENERGY CENTER
COUNCIL BLUFFS, IOWA

TITLE: **HYDROGEOLOGIC CROSS SECTION A-A'**

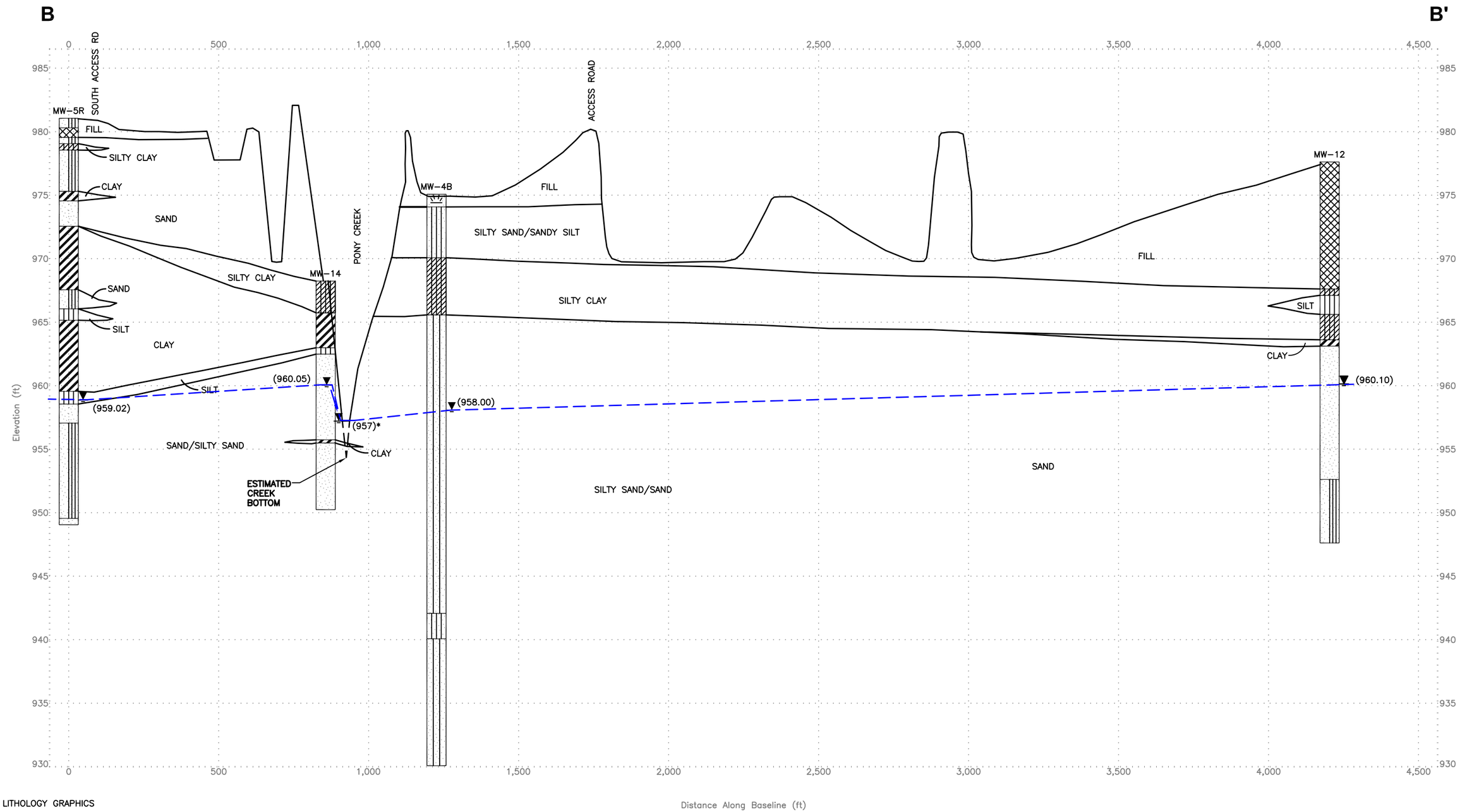
MWH

FIGURE 6 | REVISION .

FILE NAME .

Exhibit C-5

P:\CAD\MidAmerican\Council Bluffs\WSEC\North\19141580001-AA.dwg Mar 25, 2009 - 1:46pm



DESIGNED BY	ANGEL SHAWDA	
DRAWN BY	DAVID MIRANDA	
CHECKED BY	ANGEL SHAWDA	
APPROVED BY	KEVIN ARMSTRONG	
PROJECT MANAGER	KEVIN ARMSTRONG	

MANAGING OFFICE: DES MOINES, IOWA

PROJECT: MIDAMERICAN ENERGY COMPANY
WALTER SCOTT JR. ENERGY CENTER
COUNCIL BLUFFS, IOWA

TITLE: **HYDROGEOLOGIC CROSS SECTION B-B'**

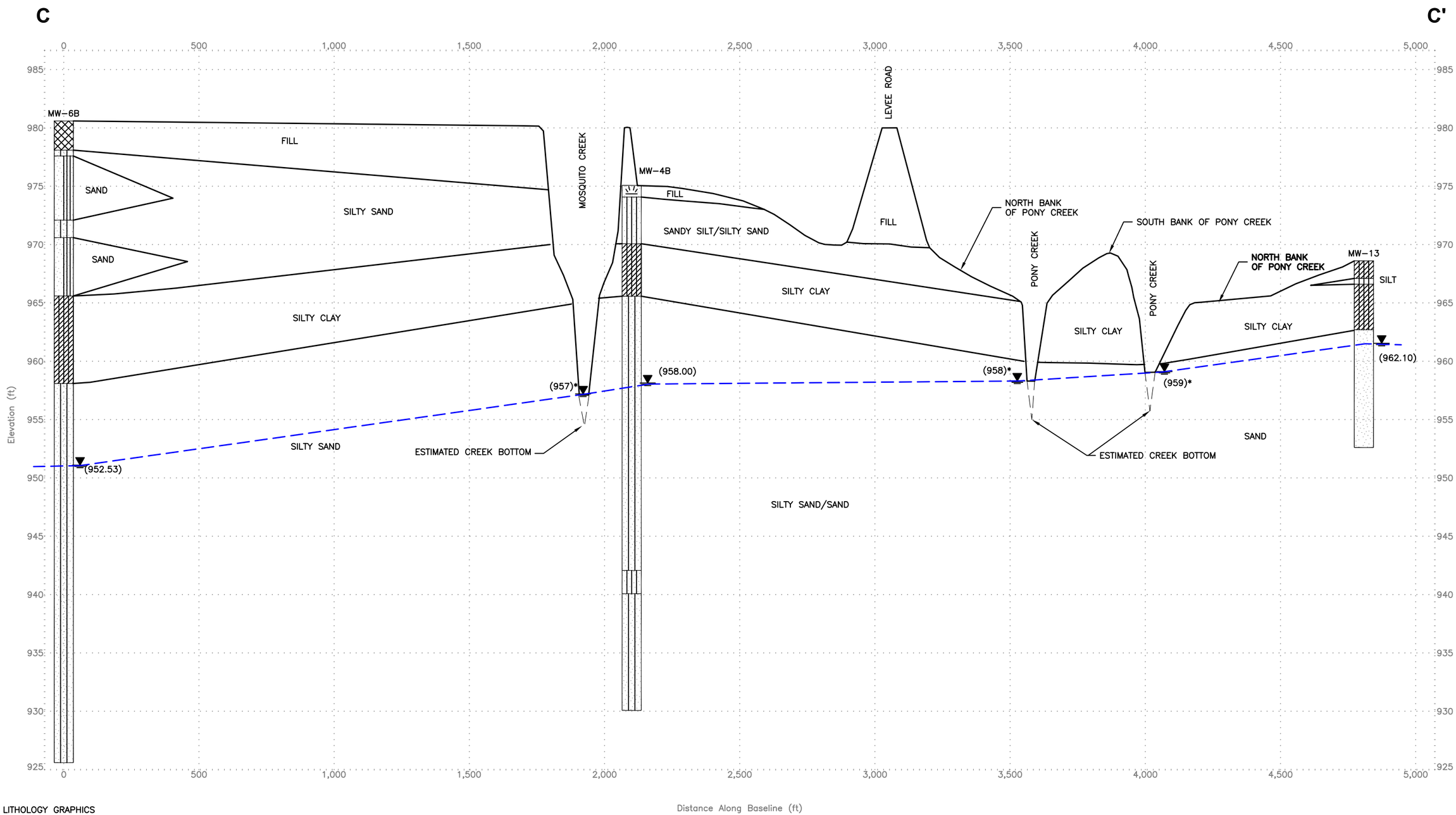
MWH

FIGURE 7

REVISION .

FILE NAME .

P:\CAD\MidAmerican\Council Bluffs\WSEC\North\19141580002-BB.dwg Mar 25, 2009 - 1:47pm



LITHOLOGY GRAPHICS

- USCS Low Plasticity Silty Clay
- USCS Silt
- USCS Poorly-graded Sand
- USCS Silty Sand
- Fill (made ground)
- USCS Poorly-graded Sand with Silt
- Topsoil
- USCS Sandy Silt

— — — ESTIMATED WATER TABLE (BASED ON SEASONAL HIGH CONDITIONS – AUGUST 4, 2008)

(957)* ESTIMATED CREEK LEVEL (BASED ON TOPOGRAPHIC SURVEY)

DESIGNED BY	ANGEL SHAWDA	
DRAWN BY	DAVID MIRANDA	
CHECKED BY	ANGEL SHAWDA	
APPROVED BY	KEVIN ARMSTRONG	
PROJECT MANAGER	KEVIN ARMSTRONG	

MANAGING OFFICE: DES MOINES, IOWA

PROJECT: MIDAMERICAN ENERGY COMPANY
WALTER SCOTT JR. ENERGY CENTER
COUNCIL BLUFFS, IOWA

TITLE: **HYDROGEOLOGIC CROSS SECTION C-C'**

MWH

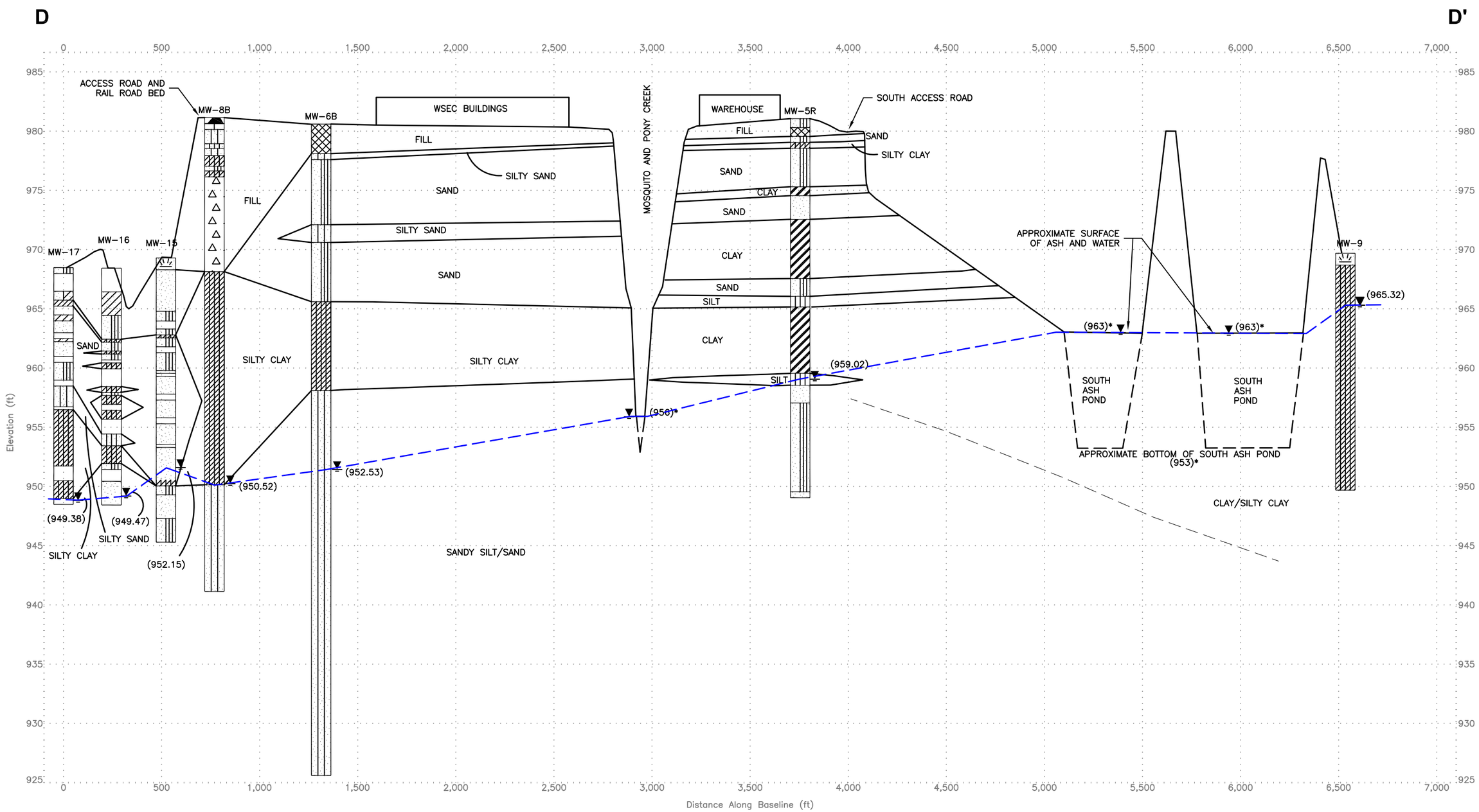
FIGURE 8

REVISION .

FILE NAME .

P:\CAD\MidAmerican\Council Bluffs\WSEC\North\1914158003-CC.dwg Mar 25, 2009 – 1:49pm

Exhibit C-7



LITHOLOGY GRAPHICS

- Topsoil
- USCS Poorly-graded Sand
- USCS Poorly-graded Sand with Silt
- USCS Low Plasticity Silty Clay
- USCS Clayey Sand
- USCS Sandy Silt
- USCS Poorly-graded Sand with Clay
- USCS Low Plasticity Clay
- USCS Silty Sand
- Fill (made ground)
- USCS High Plasticity Clay
- USCS Silt
- Coal
- Limestone
- Breccia

— — — ESTIMATED WATER TABLE (BASED ON SEASONAL HIGH CONDITIONS – AUGUST 4, 2008)

(957)* ESTIMATED CREEK LEVEL (BASED ON TOPOGRAPHIC SURVEY)

DESIGNED BY	ANGEL SHAWDA	
DRAWN BY	DAVID MIRANDA	
CHECKED BY	ANGEL SHAWDA	
APPROVED BY	KEVIN ARMSTRONG	
PROJECT MANAGER	KEVIN ARMSTRONG	

MANAGING OFFICE: DES MOINES, IOWA

PROJECT: MIDAMERICAN ENERGY COMPANY
WALTER SCOTT JR. ENERGY CENTER
COUNCIL BLUFFS, IOWA

TITLE: **HYDROGEOLOGIC CROSS SECTION D-D'**

MWH

FIGURE 9 | REVISION .

FILE NAME .

P:\CAD\MidAmerican\Council Bluffs\WSEC\North\1914158004-00.dwg Mar 25, 2009 - 1:50pm

Exhibit C-8

BORING AND WELL CONSTRUCTION LOG

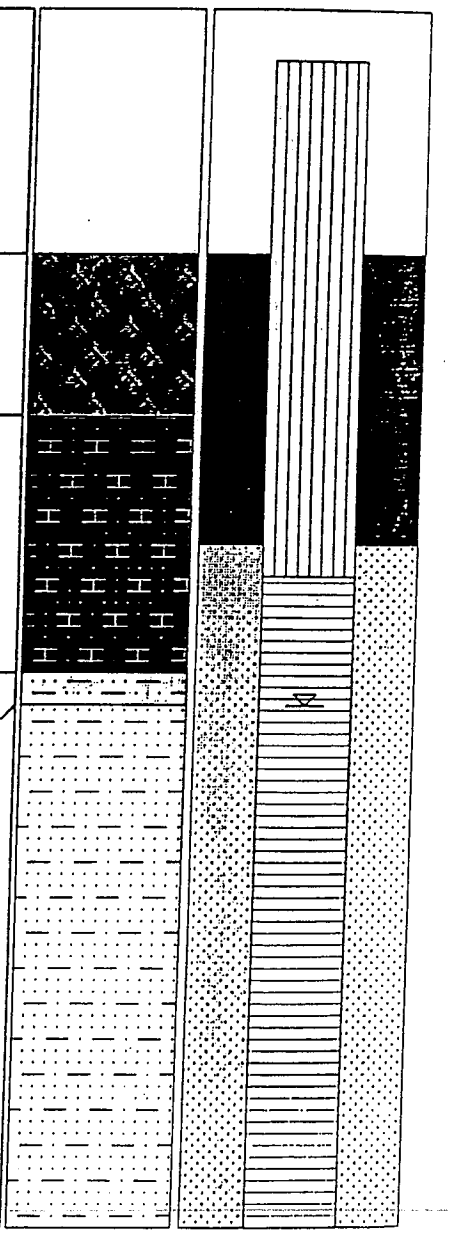
BOREHOLE NUMBER: MW-1

PROJECT NUMBER: **MEC - Council Bluffs**
PROJECT NAME: **Ash Ponds Investigation**
LOCATION: **Council Bluffs, IA**
DRILLING CO: **Aquadrill**
DRILLING METHOD: **Hollow Stem Auger**
FIELD PARTY: **Auld, Dennis**
GEOLOGIST: **Eisen, Kevin**
DATE BEGUN: **11/8/00** DATE COMPLETED: **11/8/00**

FIELD BOOK NO: **MEC - CB book 1**
TOTAL DEPTH: **15'**
GROUND SURFACE ELEVATION: **967.2'**

STATIC WATER LEVEL (BGS)		
Depth (ft)		
Time		
Date		

ELEVATION	SAMPLES	SAMPLE NUMBER	MOISTURE	CONSISTENCY	G/S/F (%)	ORGANIC VAPOR	DESCRIPTION	LITHOLOGY	WELL INSTALLATION
971.0									
970.0									
969.0									
968.0									
967.0							TOPSOIL: Brown silt/clay with roots and organics.		
966.0			M						
965.0									
964.0							CLAY AND SILT: Tan/gray silt and clay.		
963.0			M		-/-/100				
962.0									
961.0									
960.0			S		-/20/80		SANDY SILT: Tan/gray fine sandy silt.		
959.0							SAND WITH SILT: Tan/gray fine sand with silt.		
958.0					-/90/10				
957.0									
956.0									
955.0									
954.0					-/85/15		End of Boring at 15' bgs. Screened interval 5 - 15' bgs. Protective riser and expandable well cap installed.		
953.0									



BORING AND WELL CONSTRUCTION LOG

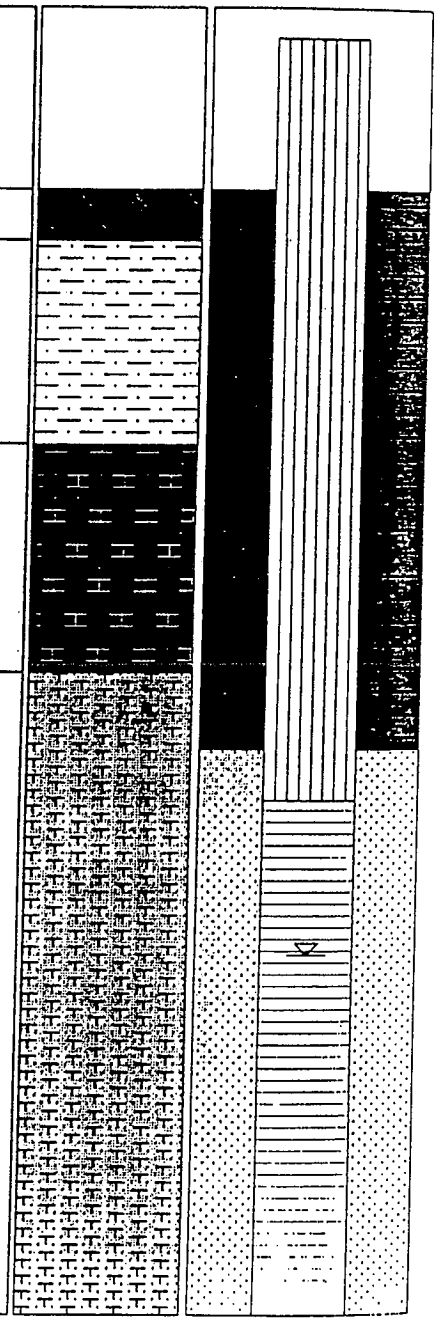
BOREHOLE NUMBER	MW-4A

PROJECT NUMBER: **MEC - Council Bluffs**
PROJECT NAME: **Ash Ponds Investigation**
LOCATION: **Council Bluffs, IA**
DRILLING CO: **Aquadrill**
DRILLING METHOD: **Hollow Stem Auger**
FIELD PARTY: **Auld, Dennis**
GEOLOGIST: **Eisen, Kevin**
DATE BEGUN: **11/9/00** DATE COMPLETED: **11/10/00**

FIELD BOOK NO: **MEC - CB book 1**
TOTAL DEPTH: **45'**
GROUND SURFACE ELEVATION: **974.4'**

STATIC WATER LEVEL (BGS)		
Depth (ft)		
Time		
Date		

ELEVATION	SAMPLES	SAMPLE NUMBER	MOISTURE	CONSISTENCY	G/S/F (%)	ORGANIC VAPOR	DESCRIPTION	LITHOLOGY	WELL INSTALLATION
978.0									
977.0									
976.0									
975.0									
974.0							TOPSOIL: Brown silt with organics.		
973.0			D/M				SILT WITH SAND: Tan/brown silt with 5-10% fine to coarse sand.		
972.0									
971.0					-/5/95				
970.0			D						
969.0							CLAY AND SILT: Brown/gray silt and clay.		
968.0									
967.0			M						
966.0							Low-medium plasticity.		
965.0									
964.0					-/70/30		SILTY SAND: Tan very fine to fine silty sand.		
963.0					-/40/60		6" sandy silt at 11' bgs.		
962.0									
961.0			M						
960.0					-/80/20				
959.0			S				Water table at 15'.		
958.0									
957.0									
956.0									
955.0							Pilot Boring advanced to 45' bgs. MW-4A is screened 12-22' bgs. MW-4A is 6' North of MW-4B. Protective riser and expandable well cap installed.		
954.0									
953.0									



BORING AND WELL CONSTRUCTION LOG

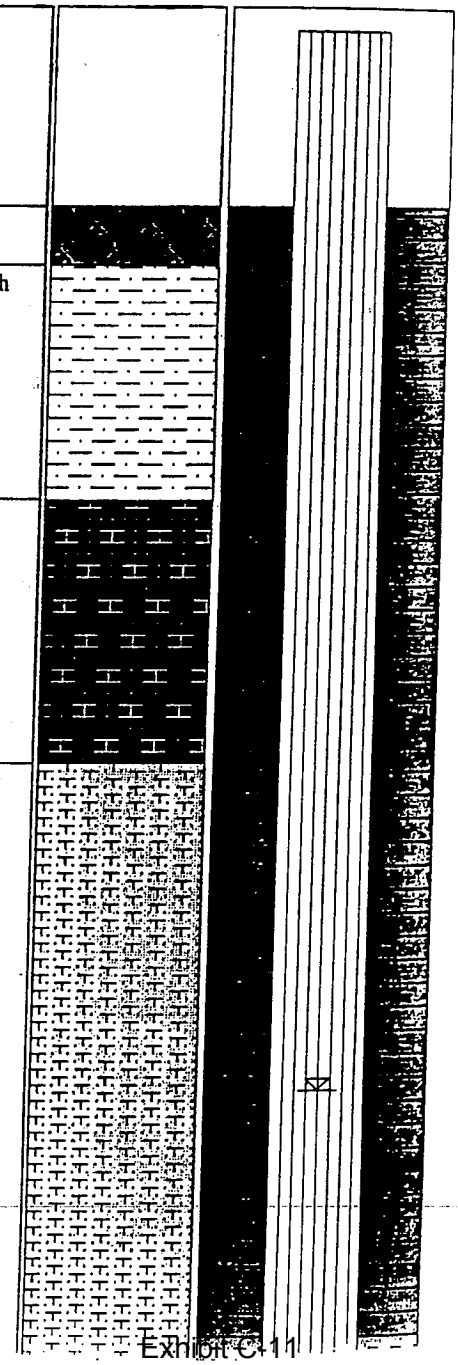
BOREHOLE NUMBER: MW-4B

PROJECT NUMBER: MEC - Council Bluffs
PROJECT NAME: Ash Ponds Investigation
LOCATION: Council Bluffs, IA
DRILLING CO: Aquadrill
DRILLING METHOD: Hollow Stem Auger
FIELD PARTY: Auld, Dennis
GEOLOGIST: Eisen, Kevin
DATE BEGUN: 11/9/00 DATE COMPLETED: 11/10/00

FIELD BOOK NO: MEC - CB book 1
TOTAL DEPTH: 45'
GROUND SURFACE ELEVATION: 974.6'

STATIC WATER LEVEL (BGS)		
Depth (ft)		
Time		
Date		

ELEVATION	SAMPLES	SAMPLE NUMBER	MOISTURE	CONSISTENCY	G/S/F (%)	ORGANIC VAPOR	DESCRIPTION	LITHOLOGY	WELL INSTALLATION
978.0									
977.0									
976.0									
975.0									
974.0							TOPSOIL: Brown silt with organics.		
973.0			D/M				SILT WITH SAND: Tan/brown silt with 5-10% fine to coarse sand.		
972.0									
971.0					-/5/95				
970.0			D						
969.0							CLAY AND SILT: Brown/gray silt and clay.		
968.0									
967.0			M						
966.0							Low-medium plasticity.		
965.0									
964.0					-/70/30		SILTY SAND: Tan very fine to fine silty sand.		
963.0					-/40/60		6" sandy silt at 11' bgs.		
962.0			M				MW-4A is screened 12-22' bgs.		
961.0									
960.0					-/80/20				
959.0			S				Water table at 15' bgs.		
958.0									
957.0									
956.0									



BORING AND WELL CONSTRUCTION LOG

BOREHOLE NUMBER MW-4B

ELEVATION	SAMPLES	SAMPLE NUMBER	MOISTURE	CONSISTENCY	G/S/F (%)	ORGANIC VAPOR	DESCRIPTION	LITHOLOGY	WELL CONSTRUCTION
955.0									
954.0			S						
953.0							As above. Tan silty fine sand.		
952.0					-/85/15				
951.0					-/80/20				
950.0									
949.0			S						
948.0									
947.0									
946.0					-/80/20				
945.0									
944.0			S						
943.0									
942.0					-/85/15				
941.0							SANDY SILT: Dark gray sandy silt with 5% gravel.		
940.0					5/15/80				
939.0			S				SILTY SAND: Tan/gray silty sand.		
938.0									
937.0							No recovery 35-40.		
936.0									
935.0									
934.0			S						
933.0									
932.0					-/80/20		2 silt lenses 1" thick each at 45' bgs.		
931.0							End of Pilot Boring at 45' bgs. MW-4B is screened 35-45' bgs. MW-4A is 6' North of MW-4B. Protective risers and expandable well caps installed on both.		
930.0									

Drilling Log

MWH

Monitoring Well **MW-5R**

Project *WSEC CCR Monofill* Owner *MidAmerican Energy Company*

Location *18236 Applewood Rd, Council Bluffs, IA* Project Number

Surface Elev. *981.05 ft* North *437777.012* East *998168.83*

Top of Casing *981.05 ft* Water Level Initial *952.574* 03/17/08 15:55 Static *952.644* 03/20/08 09:53

Hole Depth *32.0ft* Screen: Diameter *2 in* Length *10.0 ft* Type/Size *PVC/0.01 in*

Hole Diameter *8.0 in* Casing: Diameter *2 in* Length *22.0 ft* Type *PVC*

Drill Co. *Thiele Geotech* Drilling Method *Hollow Stem Auger/24-inch split spoon*

Driller *J. Carmen* Driller Reg. # *7801* Log By *A. Shawda*

Start Date *3/17/2008* Completion Date *3/17/2008* Checked By *K. Armstrong*

Bentonite Grout | Bentonite Granules | Grout | Portland Cement | Sand Pack | Sand Pack

COMMENTS
Filter pack is Unimin 20/40 Filter Sil sand.
added during soil boring and well completion activities due to heavying sands.

Depth (ft)	None (ppm)	% Recovery	Blow Count Recovery	Graphic Log	USCS	Description (Color, Moisture, Texture, Structure, Odor) Geologic Descriptions are Based on the USCS.	Well Completion	Elevation (ft)
0		100%	5 4 3		SP SM	Sandy silt/silty sand, light brown, loose, moist, 2.0 to 3.0 phi grain size, well sorted, subrounded, greater than 95% quartz.		981.054
						Fill, limestone gravel, gravel is angular with varying diameters.		980
			4		SP SM	Same as sandy silt/silty sand as 0 to 0.75 feet bgs.		
2			2		CL ML	Silty clay, olive gray, medium stiff, moist, medium plasticity.		
		100%	5 11 14		SP SM	Sandy silt/silty sand, light brown to light gray, loose, moist, same as 1.5 to 2.0 feet bgs.		978
4			3 6 7					976
6		100%	7 1		CH	Silty clay/clay, olive gray to dark gray, soft to crumbly, moist to dry, high plasticity.		
			9 16 25		SP	Sand with minor silt, olive gray to yellowish orange, loose to medium dense, moist to dry, 1.5 to 2.5 phi grain size, well sorted, subrounded, sand composed of 95% quartz and 5% other rock fragments-black flecks with minor lignite banding.		974
8		100%	4					
			4 5 11		CH	Clay, dark gray, very stiff, dry to moist, high plasticity, fine sand bands at approximately 9.5 ft to 9.9 ft bgs, sand bands are dark gray, 2.0 to 3.0 phi grain size, well sorted, and composed of greater than 95% quartz.		972
10		100%	2 3 6			Same as 8.5 to 10 feet bgs with 0.25 inch sand band at 11.25 feet bgs, very stiff to hard, dry to moist, with minor organic material composed of roots, wood, and etc.		970
12		100%	10 3 6 10			Same as 10 to 12 feet bgs, but medium stiff.		
						Same as 12 to 12.75 but hard to very stiff.		968
14		100%	14 2 9		SP SM	Sandy silt, dark gray, loose/crumbly, dry to moist, non-plastic, well sorted, 2.5 to 3.5 phi grain size, sand composed of greater than 95% quartz, straw inbedded.		
		100%						

Continued Next Page

Drilling Log CBEC HIR 08-2006 SOUTH.GPJ MWH IA.GDT 2/25/09

Drilling Log

MWH

Monitoring Well **MW-5R**

Project *WSEC CCR Monofill* Owner *MidAmerican Energy Company*

Location *18236 Applewood Rd, Council Bluffs, IA* Project Number

Depth (ft)	None (ppm)	% Recovery	Blow Count Recovery	Graphic Log	USCS	Description (Color, Moisture, Texture, Structure, Odor) Geologic Descriptions are Based on the USCS.	Well Completion	Elevation (ft)
						Continued		
		100%	13 9		ML	Silt, dark gray, loose/crumbly, dry, non-plastic.		966
16		100%	2 3 5 6		CH	Clay, dark gray, soft, moist, high plasticity, still has pieces of straw embedded. Clay, light gray with light brown veining grading to light brown color with light gray mottles, medium stiff to soft with depth, moist, high plasticity		964
18		100%	1 2 2 3			Same light brown clay, but no mottles, getting softer with depth, moist to wet at 20 ft with trace of 2.5 to 3.5 phi sand, sand composed of greater than 95% quartz.		962
20		100%	0 2 2			Clay, light gray with light brown mottles, soft, moist, high plasticity.		960
22		100%	3 1		ML	Silt with trace sand, light gray to olive gray, loose/crumbly, moist, no plasticity.		
			6 9 9		SP	Sand, yellowish orange, loose, moist to dry, 2.5 to 3.5 phi grain size, well sorted, subrounded, sand composed of greater than 95% quartz and 5% other rock fragments - black flecks.		958
24		100%	3 5 5		SP SM	Same as 22.5 to 24 but wet at approximately 25 ft bgs, minor silt matrix.		956
26		75%	8 2 5 5			Sand, light brown, wet, same as 25 to 26 ft bgs.		954
28		100%	7 1 2 3			Same as 26 to 28 ft bgs, sand with silt, wet, 1.5 to 2.5 phi grain size, well sorted, black flecks-lignite.		952
30		100%	5 1 3 7					950
32		100%	10		SP	Sand, olive gray to dark gray, loose, wet, 1.0 to 2.0 phi grain size, well sorted, subrounded, sand composed of 95% quartz and 5% rock fragments - black flecks.		948
34						End of boring = 32 feet bgs.		

Drilling Log CBEC HIR 08-2006 SOUTH.GPJ MWH IA.GDT 2/25/09

BORING AND WELL CONSTRUCTION LOG

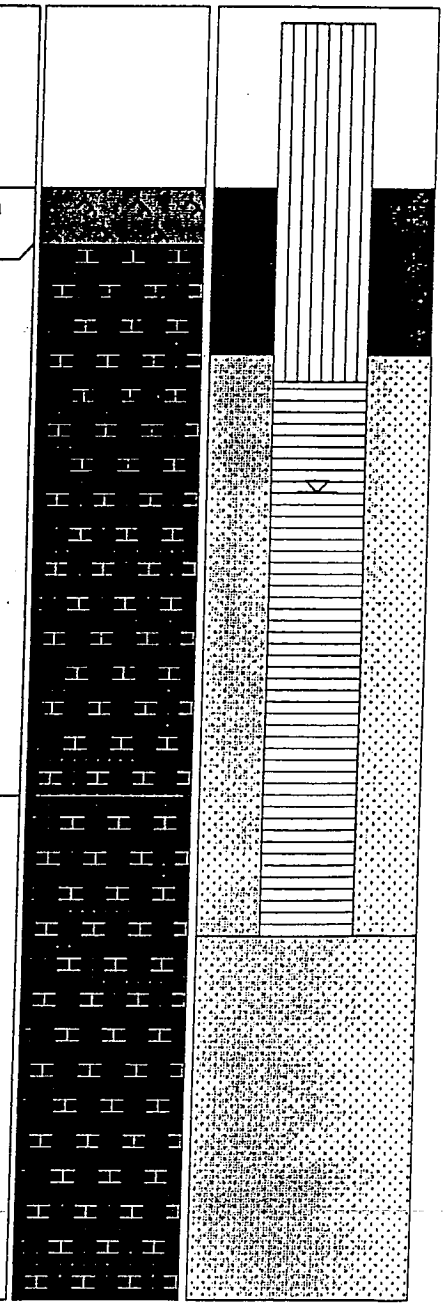
BOREHOLE NUMBER: MW-9

PROJECT NUMBER: MEC - Council Bluffs
PROJECT NAME: Ash Ponds Investigation
LOCATION: Council Bluffs, IA
DRILLING CO: Aquadrill
DRILLING METHOD: Hollow Stem Auger
FIELD PARTY: Auld, Dennis
GEOLOGIST: Eisen, Kevin
DATE BEGUN: 11/10/00 DATE COMPLETED: 11/10/00

FIELD BOOK NO: MEC - CB book 1
TOTAL DEPTH: 20'
GROUND SURFACE ELEVATION: 968.7'

STATIC WATER LEVEL (BGS)		
Depth (ft)		
Time		
Date		

ELEVATION	SAMPLES	SAMPLE NUMBER	MOISTURE	CONSISTENCY	G/S/F (%)	ORGANIC VAPOR	DESCRIPTION	LITHOLOGY	WELL INSTALLATION
972.0									
971.0									
970.0									
969.0									
968.0			M				TOPSOIL: Brown/gray silt and clay with organics.		
967.0							CLAY AND SILT: Gray clay/silt.		
966.0									
965.0			M		-/-/100		Minor organics in top 2' of unit (to 3' bgs).		
964.0									
963.0							Water table (stablized) at 5.5' bgs.		
962.0					-/-/100		Low plasticity.		
961.0									
960.0									
959.0					-/5/95		5% very fine sand in matrix.		
958.0			S		-/-/100 -/70/30		1/2" thick silty sand seam at 11' bgs.		
957.0					-/-/100		CLAY AND SILT: Tan/gray silt/clay.		
956.0									
955.0									
954.0									
953.0					-/-/100				
952.0			S		-/70/30		1/4" thick silty sand seam at 16.5' bgs.		
951.0									
950.0					-/-/100		End of Boring at 20' bgs. Screened interval 3.5 - 13.5' bgs. Protective riser and expandable well cap installed.		
949.0									



Drilling Log

MWH

Monitoring Well **MW-12**

Project *WSEC CCR Monofill* Owner *MidAmerican Energy Company*

Location *18236 Applewood Rd, Council Bluffs, IA* Project Number

Surface Elev. *977.62 ft* North *441957.079* East *998711.403*

Top of Casing *980.50 ft* Water Level Initial *957.612* 03/18/08 15:10 Static *957.612* 03/18/08 15:10

Hole Depth *30.0ft* Screen: Diameter *2 in* Length *10.0 ft* Type/Size *PVC/0.01 in*

Hole Diameter *8.0 in* Casing: Diameter *2 in* Length *20.0 ft* Type *PVC*

Drill Co. *Thiele Geotech* Drilling Method *Hollow Stem Auger/24-inch split spoon*

Driller *J. Carmen* Driller Reg. # *7801* Log By *A. Shawda*

Start Date *3/18/2008* Completion Date *3/18/2008* Checked By *K. Armstrong*

Bentonite Grout | Bentonite Granules | Grout | Portland Cement | Sand Pack | Sand Pack

COMMENTS
Filter pack is Unimin 20/40 Filter Sil sand.

Depth (ft)	None (ppm)	% Recovery	Blow Count Recovery	Graphic Log	USCS	Description (Color, Moisture, Texture, Structure, Odor) Geologic Descriptions are Based on the USCS.	Well Completion	Elevation (ft)
0		100%	13, 17, 8, 9			Fill, yellowish orange and light brown, hard, dry, crumbly, no plasticity.		977.617
2		100%	6, 43, 29, 13			Fill, dark gray to olive gray with greenish gray mottles, hard, dry, crumbly, no plasticity.		976
4		100%	16, 11, 10, 28			Fill/silt, yellowish orange to light brown, loose, dry, crumbly, no plasticity. Same as 3.75 to 4.5 but light brown.		974
6		100%	6, 7, 19, 4			Fill, dark gray to olive gray, hard crumbly, no plasticity. Fill, yellowish brown, loose, dry, no plasiticy.		972
8		100%	1, 3, 4, 3			Fill, dark gray, looe, dry, no plasticity. Silty clay/fill mix, greenish gray, moist, no plasticity.		970
10		100%	1, 4, 9, 4		CL ML, ML	Silty clay to silt, light gray, soft, moist, no plasticity. Silt, light gray, crumbly, moist to dry with depth, no plasticity.		968
12		100%	2, 3, 4, 5		CL ML	Silty clay, light brown, soft to medium stiff, moist, low plasticity. At 14ft bgs, clay to silty clay, light brown to dark gray, medium stiff to stiff, dry to moist, medium plasticity.		966
14		75%	1, 4, 7, 10		CH, SP	Clay, dark gray to light brown, soft, moist, high plasticity. Sand, yellowish orange, loose, dry, 2.0-3.0 phi grain size, well sorted, subrounded, sand composed of greater than 95% quartz and less than 5% other rock fragments - black flecks.		964
16		100%	3, 8, 9, 15		SP	Same sand as 14.5ft to 16.0 ft bgs, grading to yellowish orange to light brown with slight moisture at 17.75ft to 18 feet bgs.		962
18		100%	8, 11, 13, 18		SP	Same sand, increasing moisture with depth - moist to wet at 20 ft bgs, also increase in grain size to 1.5 to 2.5 phi.		960
20		100%						958

Continued Next Page

Drilling Log

MWH

Monitoring Well **MW-12**

Project *WSEC CCR Monofill* Owner *MidAmerican Energy Company*

Location *18236 Applewood Rd, Council Bluffs, IA* Project Number

Depth (ft)	None (ppm)	% Recovery	Blow Count Recovery	Graphic Log	USCS	Description (Color, Moisture, Texture, Structure, Odor) Geologic Descriptions are Based on the USCS.	Well Completion	Elevation (ft)
						Continued		
20			2 7 11 12			Same sand, moist to wet.		
22		100%	1 4 4 4		SP	Sand, light brown to olive gray, loose, wet, 1.5 to 2.5 phi grain size, well sorted, subrounded, sand composed of 95% quartz and 5% other rock fragments - black flecks.		956
24		100%	1 3 3 5			Sand, olive gray, loose to medium dense, wet, 1.5 to 2.5 phi grain size, well sorted, subrounded, sand composed of 95% quartz and 5% rock fragments - black flecks.		954
26		100%	2 2 5 6		SP SM	Silty sand/sand silt, olive gray to dark gray, loose to medium dense, wet, 2.0 to 3.0 phi grain size, well sorted, sand composed of 90% quartz and 10% rock fragments - black flecks, no plasticity.		952
28		100%	3 6 6 8					950
30		100%						948
						End of boring = 30 feet bgs.		
32								946
34								944
36								942
38								940
40								938
42								936
44								934
46								932

Drilling Log CBEC HIR 08-2006 SOUTH.GPJ MWH IA.GDT 2/25/09

Drilling Log

MWH

Monitoring Well **MW-13**

Project *WSEC CCR Monofill* Owner *MidAmerican Energy Company*

Location *18236 Applewood Rd, Council Bluffs, IA* Project Number

Surface Elev. *968.61 ft* North *439123.389* East *1000757.67*

Top of Casing *971.50 ft* Water Level Initial *961.154* 03/19/08 11:14 Static

Hole Depth *16.0ft* Screen: Diameter *2 in* Length *10.0 ft* Type/Size *PVC/0.01 in*

Hole Diameter *8.0 in* Casing: Diameter *2 in* Length *6.0 ft* Type *PVC*

Drill Co. *Thiele Geotech* Drilling Method *Hollow Stem Auger/24-inch split spoon*

Driller *J. Carmen* Driller Reg. # *7801* Log By *A. Shawda*

Start Date *3/19/2008* Completion Date *3/19/2008* Checked By *K. Armstrong*

Bentonite Grout | Bentonite Granules | Grout | Portland Cement | Sand Pack | Sand Pack

COMMENTS
Filter pack is Unimin 20/40 Filter Sil sand.

Depth (ft)	None (ppm)	% Recovery	Blow Count Recovery	Graphic Log	USCS	Description (Color, Moisture, Texture, Structure, Odor) Geologic Descriptions are Based on the USCS.	Well Completion	Elevation (ft)
0			5, 7, 13		CL ML	Silt to silty clay, light brown with organic material, loose to soft and crumbly, moist, low to no plasticity, roots and etc. Same as 0-0.5 feet but dry.		968.606
		100%	13		ML	Silt, light gray, crumbly, moist to dry, no plasticity, organic matter, roots and etc.		968
2			6, 8, 8		CL ML	Silty clay, light brown to olive gray, soft to crumbly, moist, low plasticity.		966
4		100%	10, 1, 1					964
		100%	2, 3					
6			2, 4, 5		SP	Sand, yellowish orange to light brown, loose, dry to moist, 1.5 to 2.5 phi grain size, well sorted, subrounded, sand composed of greater than 95% quartz and less than 5% rock fragments -black lignite flecks.		962
▽		100%	8, 3, 4			Same sand as 5.9-6.0 ft bgs, with 6 ft to 7 ft bgs moist, 7 ft to 7.5 ft bgs moist to wet, and 7.5 to 7.75 ft bgs wet.		▽
8			4, 3, 1			Same wet sand as 7.5 to 7.75 feet bgs with red rock fragments as well as black flecks, lignite layer/band at 14 ft bgs.		960
10		100%	2, 3, 4					958
12		100%	1, 3, 5					956
14		100%	6, 1, 4			Same wet sand as 8-14 feet but increase in lignite flecks - very few red flecks and color olive gray, sand composed of 90% quartz and 10% other rock fragments - lignite flecks.		954
16		100%	8, 16			End of boring = 16 feet bgs.		952
18								950

Drilling Log CBEC HIR 08-2006 SOUTH.GPJ MWH IA.GDT 2/25/09

Drilling Log

MWH

Monitoring Well **MW-14**

Project *WSEC CCR Monofill* Owner *MidAmerican Energy Company*

Location *18236 Applewood Rd, Council Bluffs, IA* Project Number

Surface Elev. *968.24 ft* North *438598.96* East *998425.105*

Top of Casing *971.18 ft* Water Level Initial *957.211* 03/19/08 17:00 Static

Hole Depth *18.0ft* Screen: Diameter *2 in* Length *10.0 ft* Type/Size *PVC/0.01 in*

Hole Diameter *8.0 in* Casing: Diameter *2 in* Length *7.5 ft* Type *PVC*

Drill Co. *Thiele Geotech* Drilling Method *Hollow Stem Auger/24-inch split spoon*

Driller *J. Carmen* Driller Reg. # *7801* Log By *A. Shawda*

Start Date *3/19/2008* Completion Date *3/19/2008* Checked By *K. Armstrong*

Bentonite Grout | Bentonite Granules | Grout | Portland Cement | Sand Pack | Sand Pack

COMMENTS
Filter pack is Unimin 20/40 Filter Sil sand.

Depth (ft)	None (ppm)	% Recovery	Blow Count Recovery	Graphic Log	USCS	Description (Color, Moisture, Texture, Structure, Odor) Geologic Descriptions are Based on the USCS.	Elevation (ft)
0			2 2 4		CL ML	Silt/silty clay, light brown, stiff to very stiff, moist to wet from 0.0 ft to 0.5 ft bgs and then moist, medium to low plasticity, organic materials - roots, grass, and etc.	968.239 / 968
2		75%	5 1			Silty clay, light brown, soft, moist, medium plasticity, few roots.	966
			3 6		CH	Clay, light gray, very stiff, moist, roots.	
4		75%	7 1 3 4				964
					ML	Silt with minor fine sand, light brown to yellowish orange, soft, wet, no plasticity.	
6		100%	7 5 7 7			Sand, yellowish orange, loose, dry to moist, 2.5 to 3.5 phi grain size, well sorted, subrounded, sand composed of greater than 95% quartz and less than 5% rock fragments - black flecks and reds.	962
8		100%	11 5 6 6			Sand, yellowish orange to light gray, loose, dry to slightly moist with increased moisture at 8 ft bgs, 2.5 to 3.5 phi grain size, sand composed of greater than 95% quartz and less than 5% rock fragments - black flecks and reds.	960
10		100%	5 1 2 3		SP	Sand, light brown to yellowish orange, loose, wet, 2.0 to 3.0 phi grain size, well sorted, subrounded, sand composed of 95% quartz and 5% rock fragments - black flecks.	958
12		100%	4 2 4		CH	Clay, light gray, stiff to medium stiff, wet, high plasticity.	956
14		100%	5 7 3 6		SP	Sand, light brown to yellowish orange, loose, wet, 2.0 to 3.0 phi grain size, well sorted, subrounded, sand composed of 95% quartz and 5% rock fragments - black flecks.	954
16		100%	8 11 3 6				952
18		100%	6 27			End of boring = 18 ft bgs.	950
20							

Well Completion

Drilling Log CBEC HIR 08-2006 SOUTH.GPJ MWH IA.GDT 2/25/09

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon – 1-$^{3}/_{8}$" I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube - 3" O.D., unless otherwise noted	PA:	Power Auger
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
DB:	Diamond Bit Coring - 4", N, B	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB:	Wash Boring or Mud Rotary

The number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the "Standard Penetration" or "N-value".

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling	N/E:	Not Encountered
WCI:	Wet Cave in	WD:	While Drilling		
DCI:	Dry Cave in	BCR:	Before Casing Removal		
AB:	After Boring	ACR:	After Casing Removal		

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

CONSISTENCY OF FINE-GRAINED SOILS

Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-value (SS) Blows/Ft.	Consistency
< 500	0-1	Very Soft
500 – 1,000	2-4	Soft
1,001 – 2,000	4-8	Medium Stiff
2,001 – 4,000	8-15	Stiff
4,001 – 8,000	15-30	Very Stiff
8,000+	> 30	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Standard Penetration or N-value (SS) Blows/Ft.	Ring Sampler (RS) Blows/Ft.	Relative Density
0 – 3	0-6	Very Loose
4 – 9	7-18	Loose
10 – 29	19-58	Medium Dense
30 – 49	59-98	Dense
> 50	> 99	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other Constituents	Percent of Dry Weight
Trace	< 15
With	15 – 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75 mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other Constituents	Percent of Dry Weight
Trace	< 5
With	5 – 12
Modifiers	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1-10
Medium	11-30
High	> 30

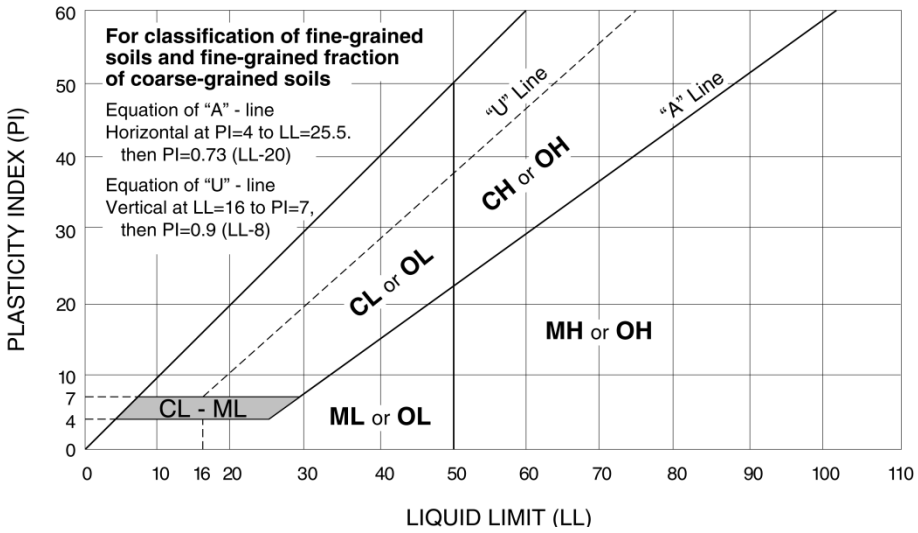
UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G,H,I]
			Fines Classify as CL or CH		SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	$PI > 7$ and plots on or above "A" line [J]		CL	Lean clay [K,L,M]
			$PI < 4$ or plots below "A" line [J]		ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K,L,M,N]
			Liquid limit - not dried			Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K,L,M]
			PI plots below "A" line		MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K,L,M,P]
			Liquid limit - not dried			Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] PI ≥ 4 and plots on or above "A" line.
[O] PI < 4 or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.



References

Soil Survey of Pottawattamie County, Iowa; United States Department of Agriculture; accessed via the NRCS web site at http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

Pottawattamie County GIS Mapping Website, accessed via http://gis3.pottcounty.com/giswebsite/

Engineering and Design – Design and Construction of Levees, Manual No. 1110-2-1913, U.S. Army Corps of Engineers, Washington, D.C., April, 2000

Engineering and Design – Slope Stability, Manual No. 1110-2-1902, U.S. Army Corps of Engineers, Washington, D.C., October, 2003

APPENDIX D

Slope Stability Analyses

fb: hgm: \\Srv13\data\WSEC\WSEC BERM STABILITY\dwg\EXHIBIT.dwg

project no.

sheet 1 OF 1

project WSEC IPOUNDMENT PONDS
BERM STABILITY

client MIDAMERICAN ENERGY COMPANY
7215 NAVAJO STREET, COUNCIL BLUFFS, IOWA 51501

sheet EXHIBIT

DEF	drawn
DEF	designed
TLS	approved
SEPT.'10	date

revision date

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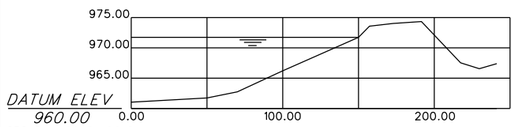

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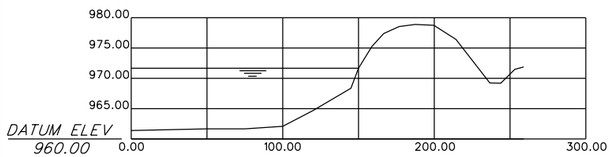

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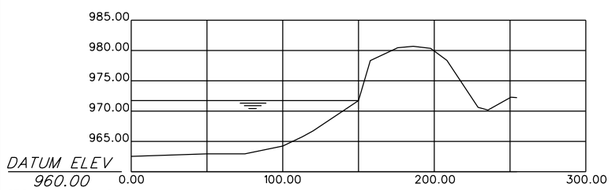

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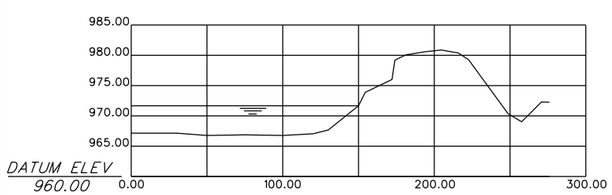

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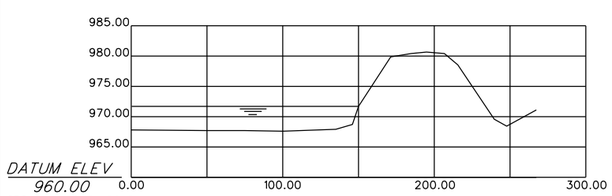

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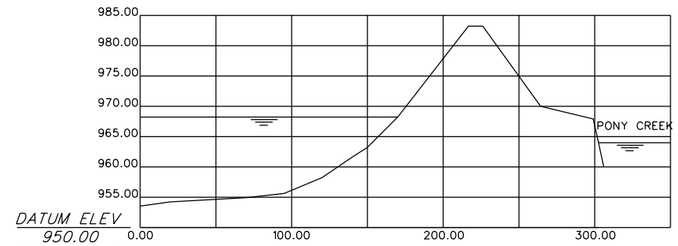

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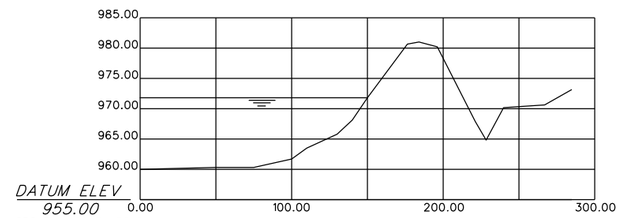

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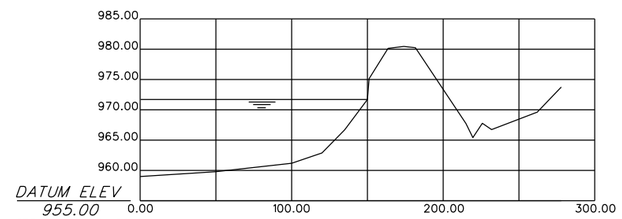
SECTION I-I



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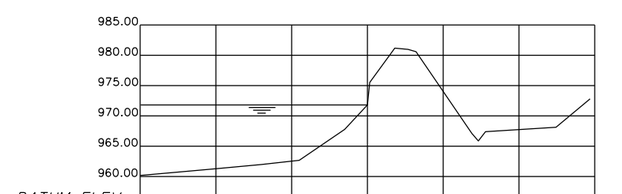

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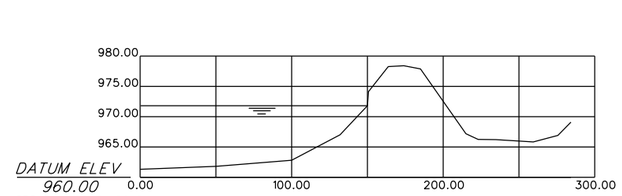

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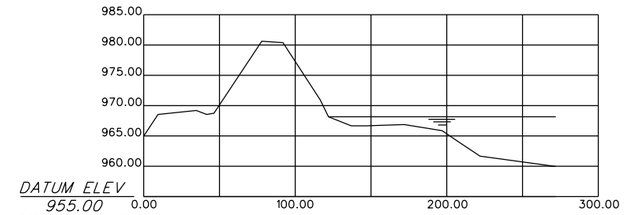
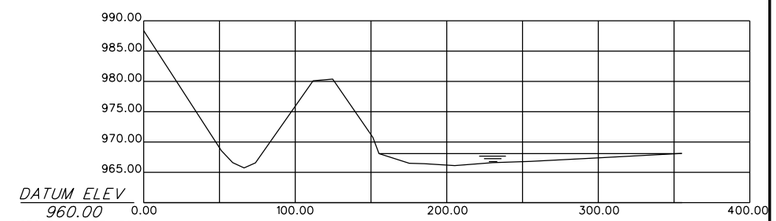


GROUP NORTH POND
SECTION O-O



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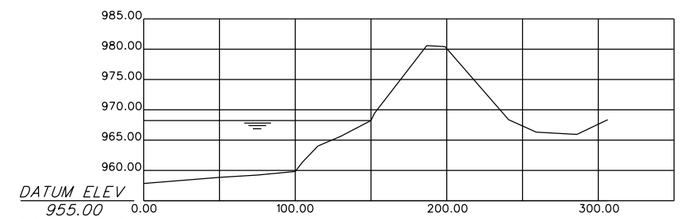

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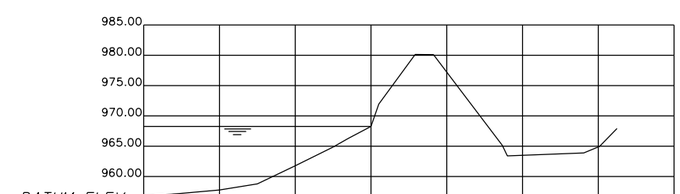

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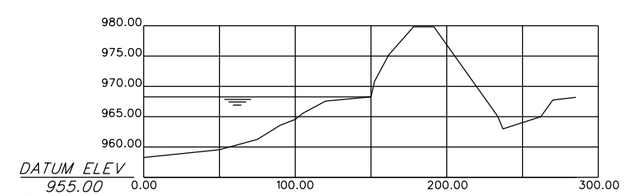

GROUP NORTH POND
SECTION K-K

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approved	
date	SEP. '10
revision	
date	

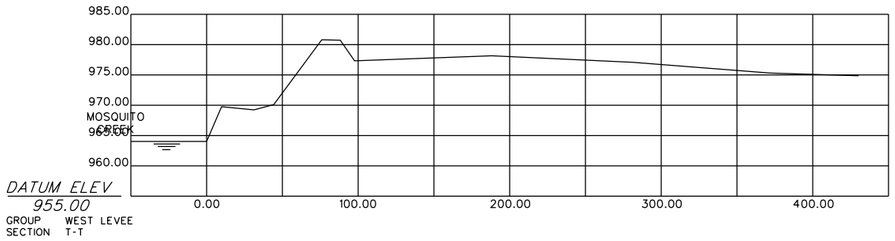
project WSEC IMPOUNDMENT PONDS
BERM STABILITY
client MID AMERICAN ENERGY COMPANY
sheet POND CROSS SECTIONS

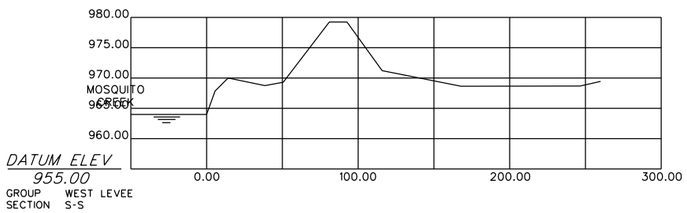
project no.

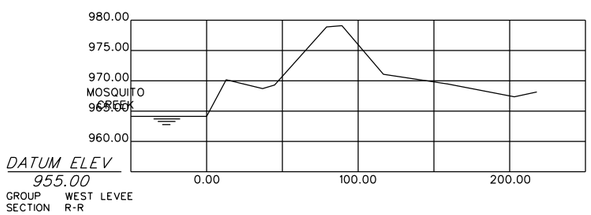
sheet
1 OF 1

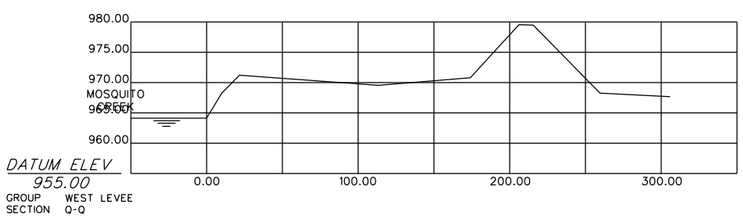
hgm:
fb:

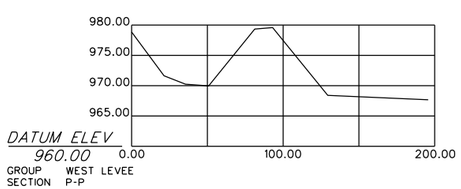
Exhibit D-2











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revision	date

project WSEC IMPOUNDMENT PONDS
BERM STABILITY
client MID AMERICAN ENERGY COMPANY
sheet WEST LEVEE CROSS SECTIONS

project no.

sheet
1 OF 1

File Name: Sect A-A.gsz
BWL Date: 10/13/2010

Name: Silty Sand Unit Weight: 125 pcf Cohesion: 0 psf Phi: 29 °
Name: Fill Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay (Stiff) Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay (Med) Unit Weight: 120 pcf Cohesion: 0 psf Phi: 24 °
Name: Fat Clay (V. Soft) Unit Weight: 120 pcf Cohesion: 0 psf Phi: 20 °

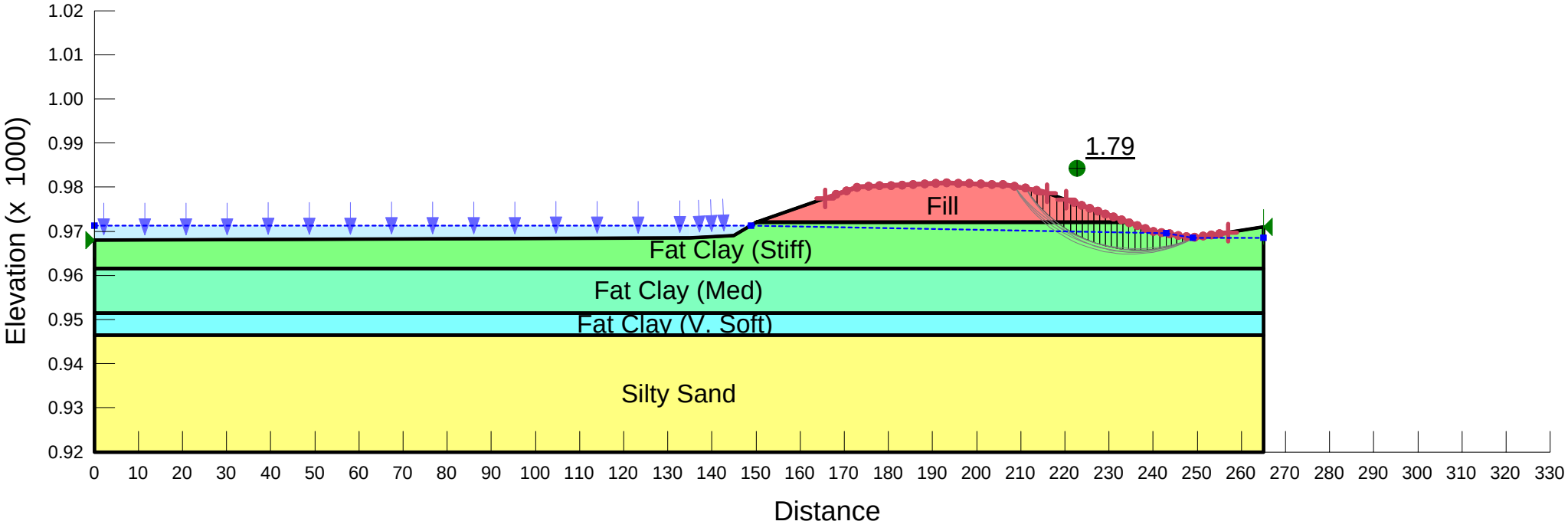

Exhibit D-4

File Name: Sect A-A (up).gsz
BWL Date: 10/13/2010

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Name: Fill Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay (Stiff) Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay (Med) Unit Weight: 120 pcf Cohesion: 0 psf Phi: 24 °
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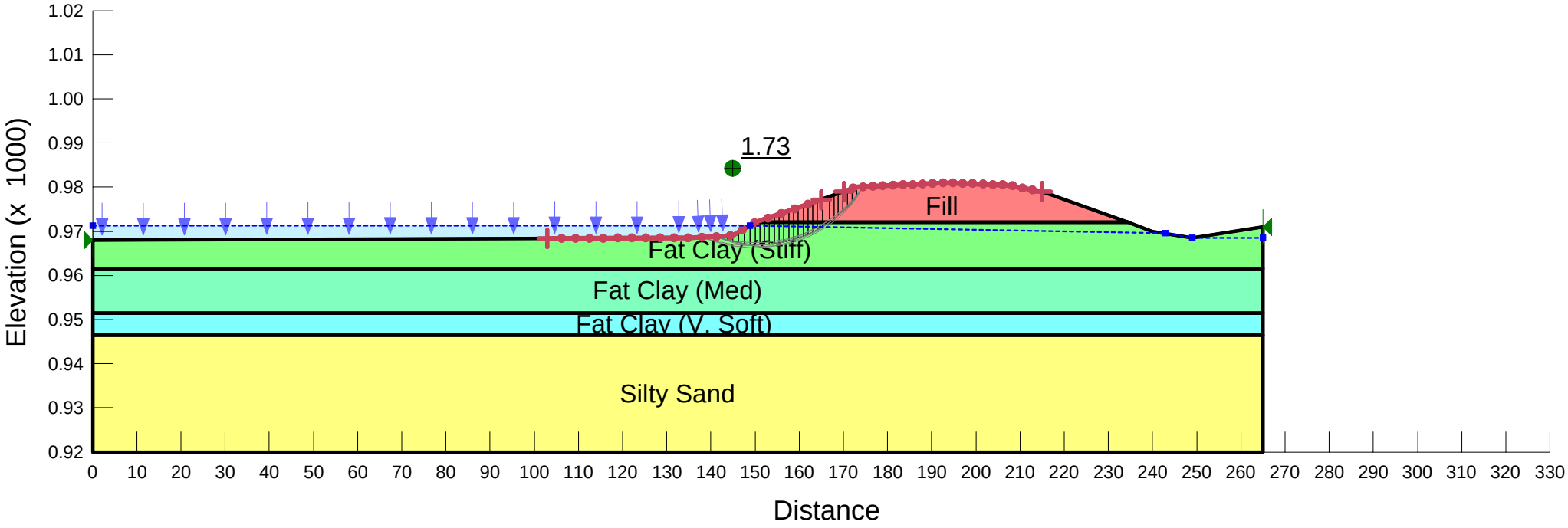

Exhibit D-5

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BWL Date: 10/13/2010

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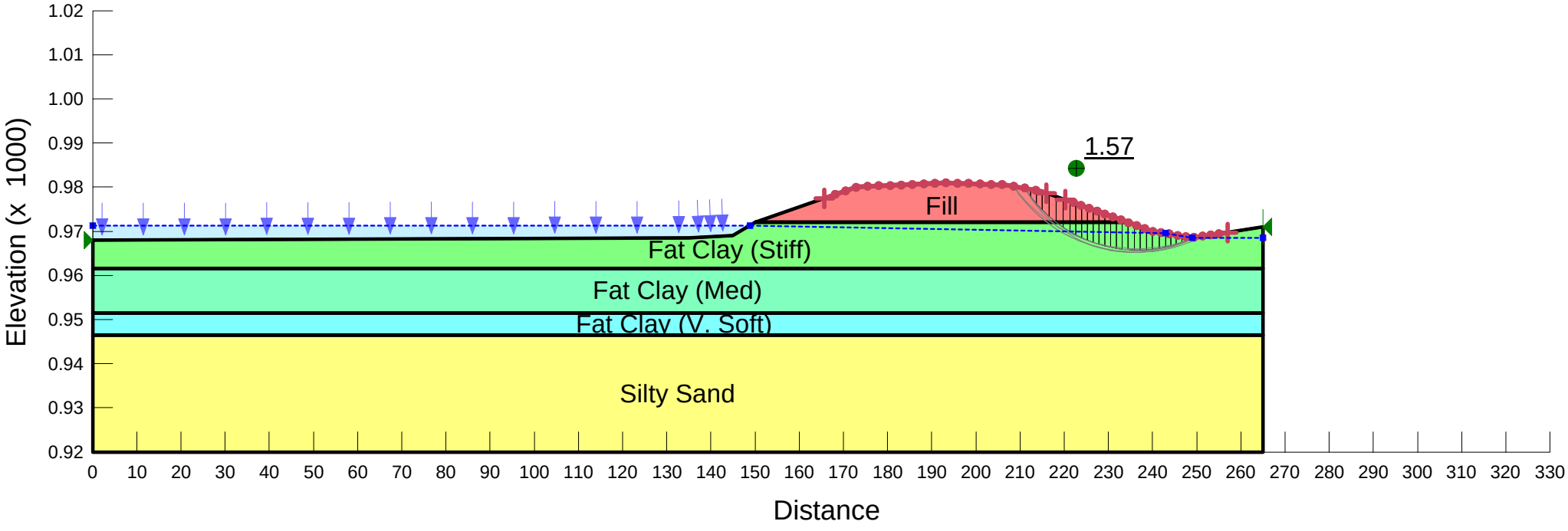
Name: Fill Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay (Stiff) Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay (Med) Unit Weight: 120 pcf Cohesion: 0 psf Phi: 24 °
Name: Fat Clay (V. Soft) Unit Weight: 120 pcf Cohesion: 0 psf Phi: 20 °



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File Name: Sect A-A siesmic (up).gsz
BWL Date: 10/13/2010

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Name: Fat Clay (Stiff) Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
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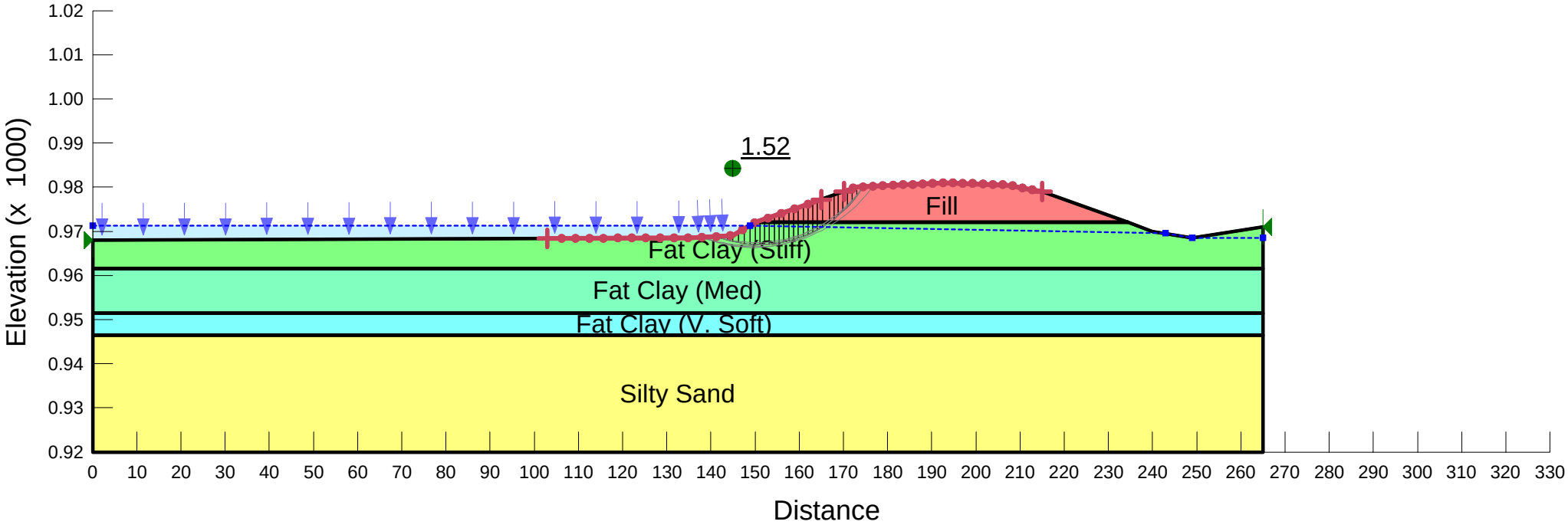

Exhibit D-7

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BWL Date: 10/13/2010

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Name: Fat Clay (Stiff) Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay (Med Stiff) Unit Weight: 120 pcf Cohesion: 0 psf Phi: 24 °
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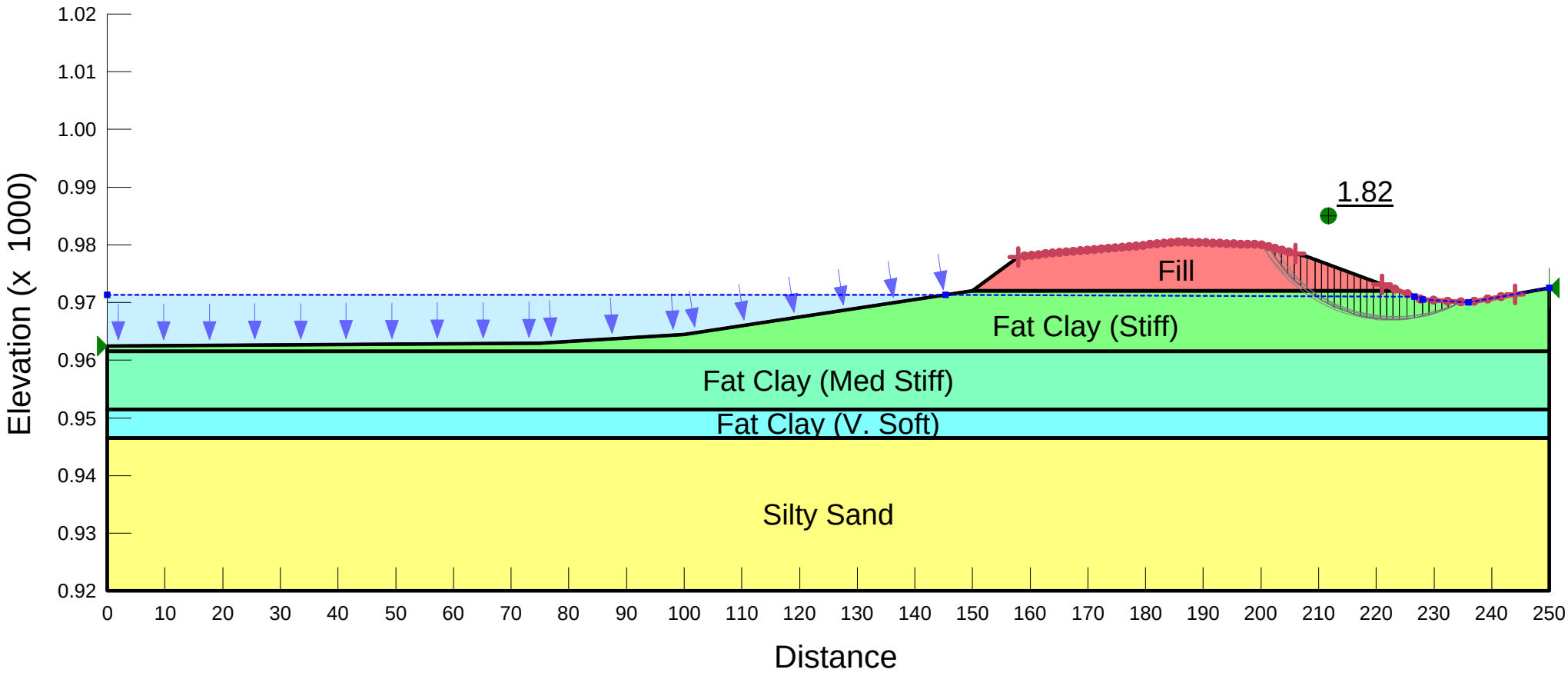

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File Name: Sect C-C (Up) phi 26.gsz
BWL Date: 10/13/2010

Name: Silty Sand Unit Weight: 125 pcf Cohesion: 0 psf Phi: 29 °
Name: Fill Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay (Stiff) Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay (Med Stiff) Unit Weight: 120 pcf Cohesion: 0 psf Phi: 24 °
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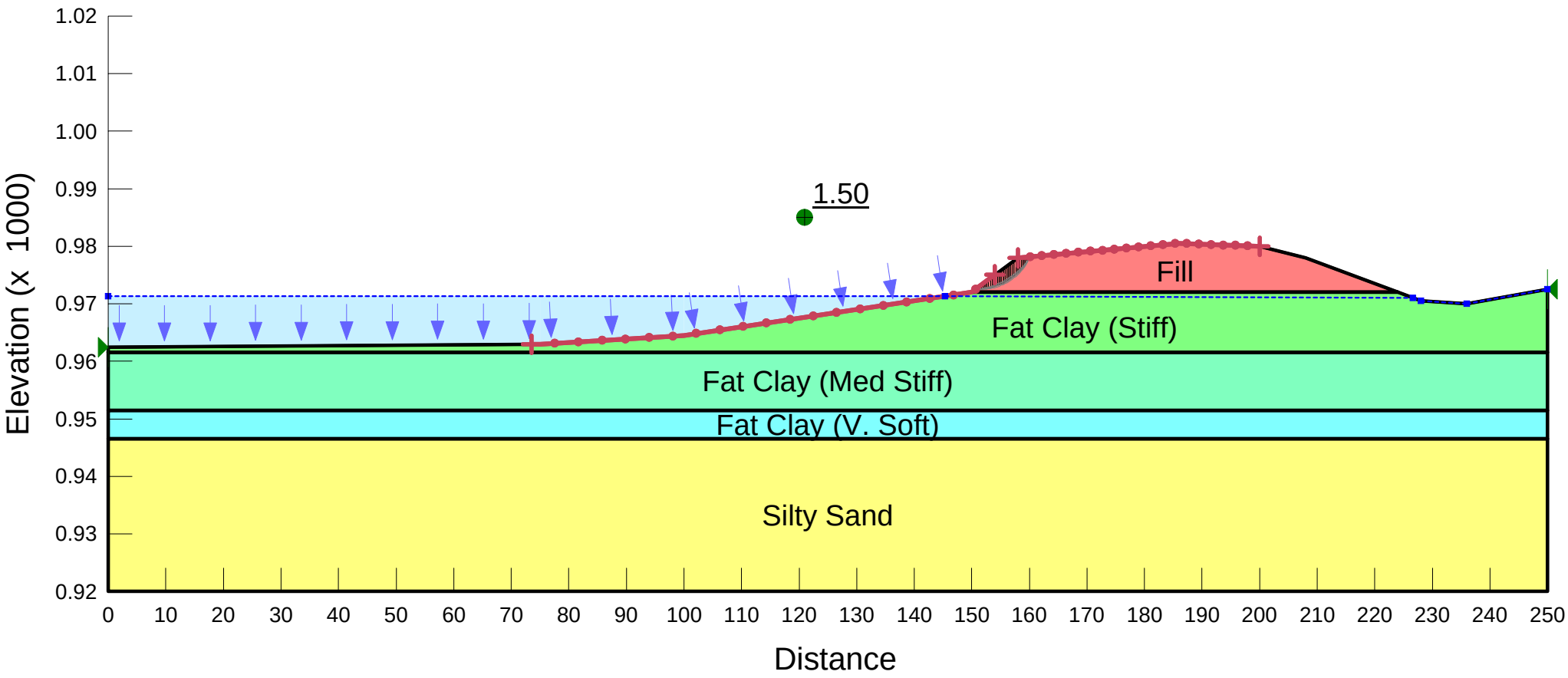

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File Name: Sect C-C (Seismic).gsz
BWL Date: 10/13/2010

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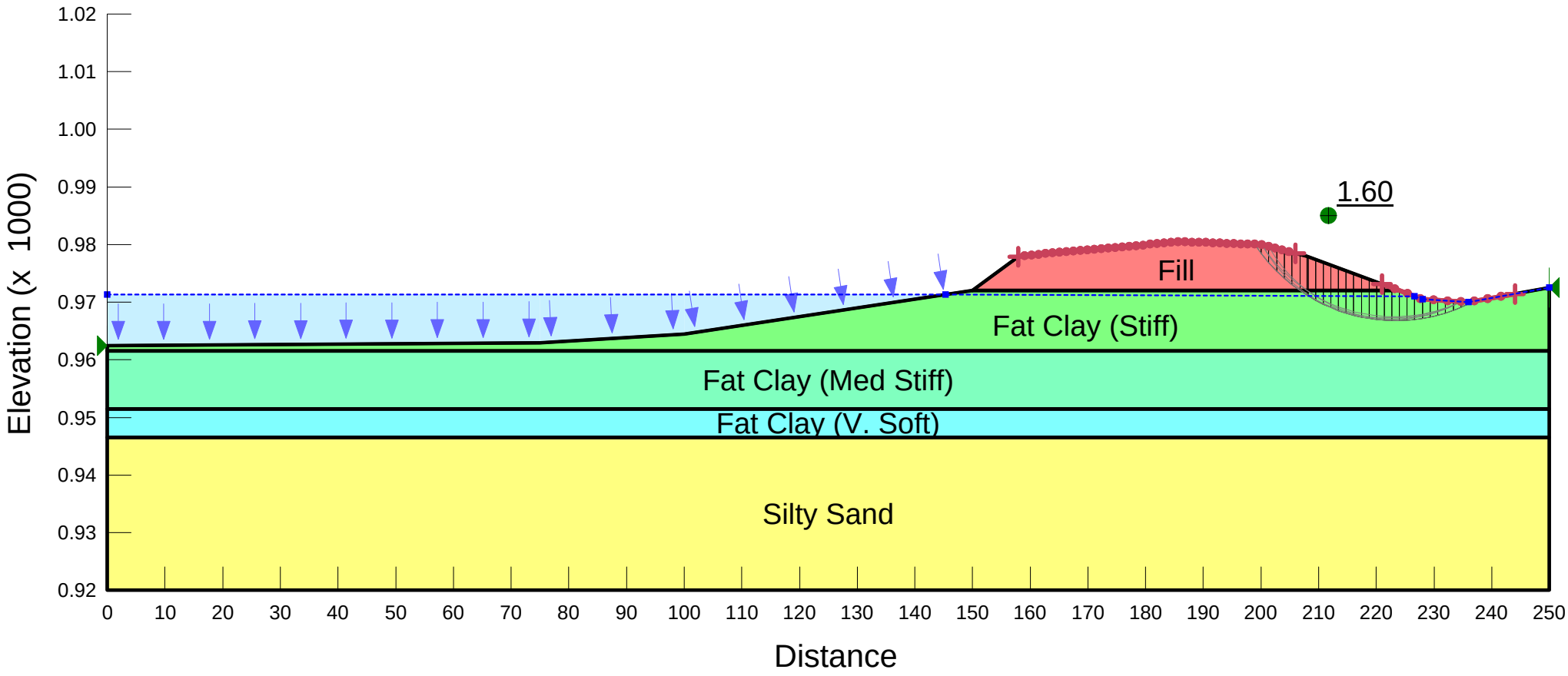
Name: Fill Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay (Stiff) Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay (Med Stiff) Unit Weight: 120 pcf Cohesion: 0 psf Phi: 24 °
Name: Fat Clay (V. Soft) Unit Weight: 120 pcf Cohesion: 0 psf Phi: 20 °



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File Name: Sect C-C (Up Seismic).gsz
BWL Date: 10/13/2010

Name: Silty Sand Unit Weight: 125 pcf Cohesion: 0 psf Phi: 29 °
Name: Fill Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay (Stiff) Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
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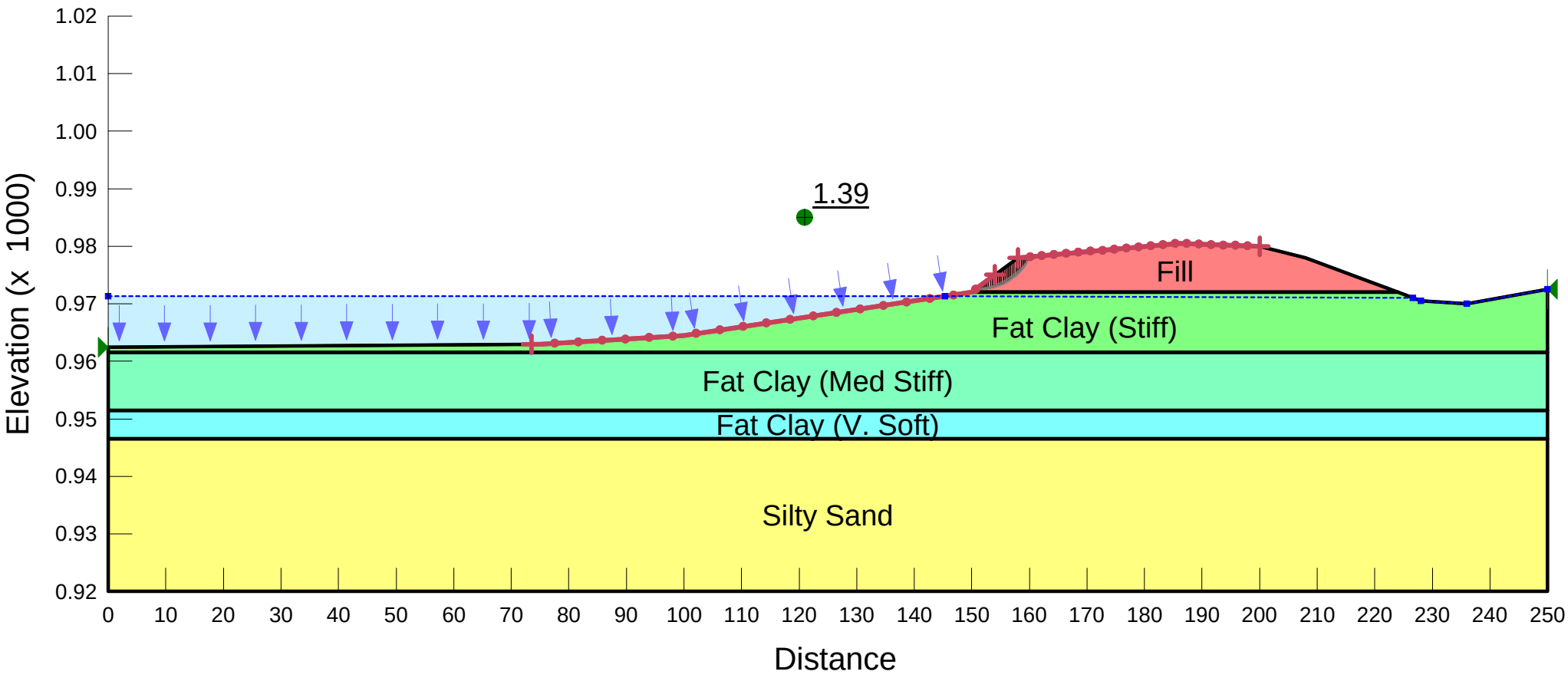


Exhibit D-11

File Name: Sect E-E (phi 26).gsz
BWL Date: 10/13/2010

Name: Fill Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Very Soft Clay Unit Weight: 120 pcf Cohesion: 0 psf Phi: 20 °

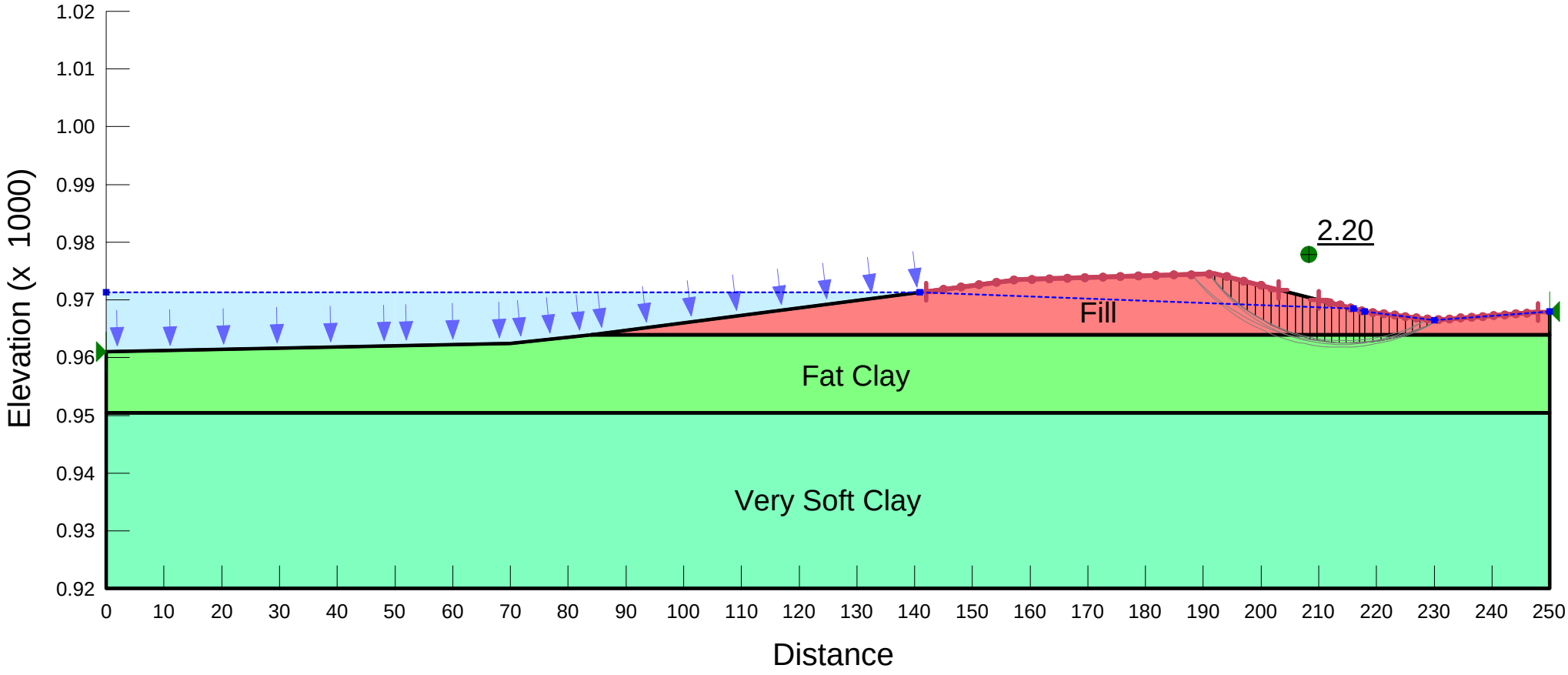


Exhibit D-12

File Name: Sect E-E (Up) phi 26.gsz
BWL Date: 10/13/2010

Name: Fill Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Very Soft Clay Unit Weight: 120 pcf Cohesion: 0 psf Phi: 20 °

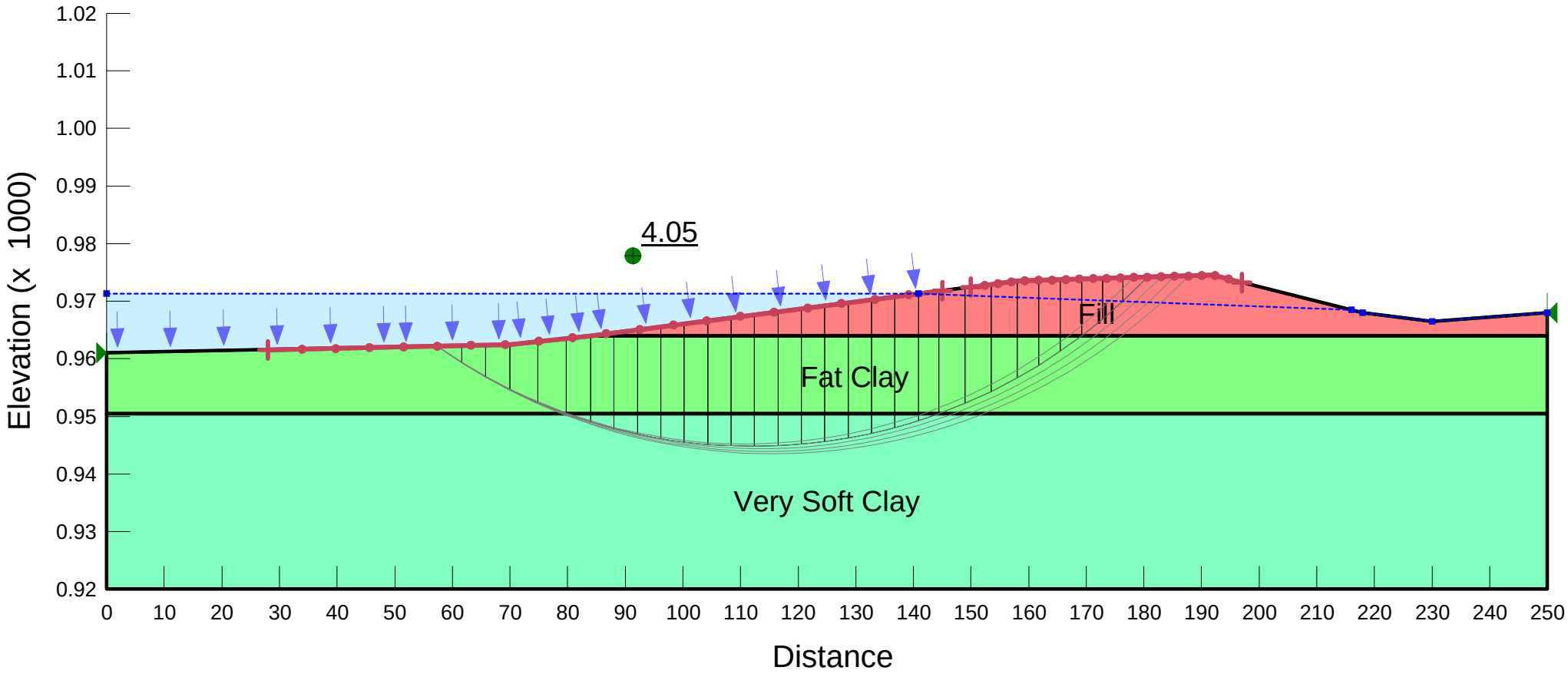


Exhibit D-13

File Name: Sect E-E (Seismic) phi 26.gsz
BWL Date: 10/13/2010

Name: Fill Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Very Soft Clay Unit Weight: 120 pcf Cohesion: 0 psf Phi: 20 °

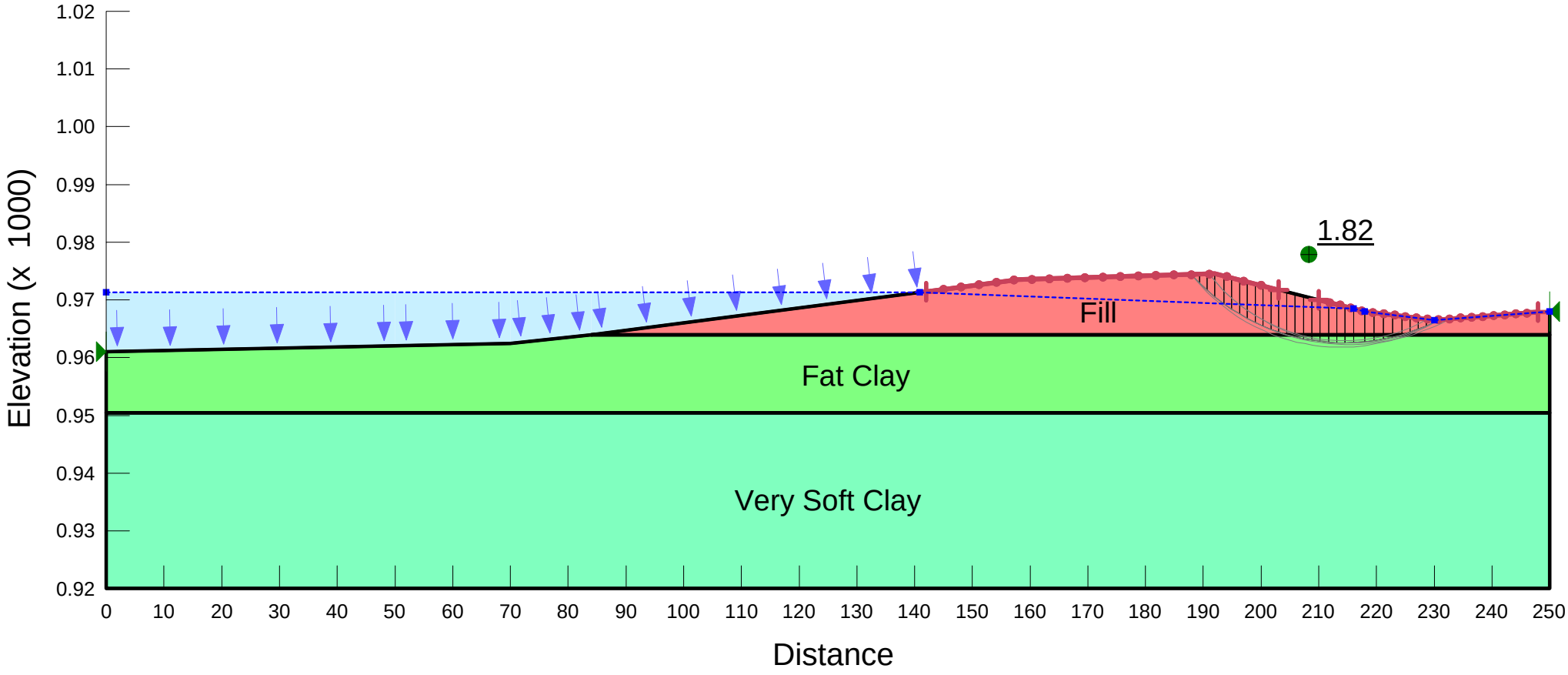


Exhibit D-14

File Name: Sect E-E (Up Seismic) phi 26.gsz
BWL Date: 10/13/2010

Name: Fill Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Very Soft Clay Unit Weight: 120 pcf Cohesion: 0 psf Phi: 20 °

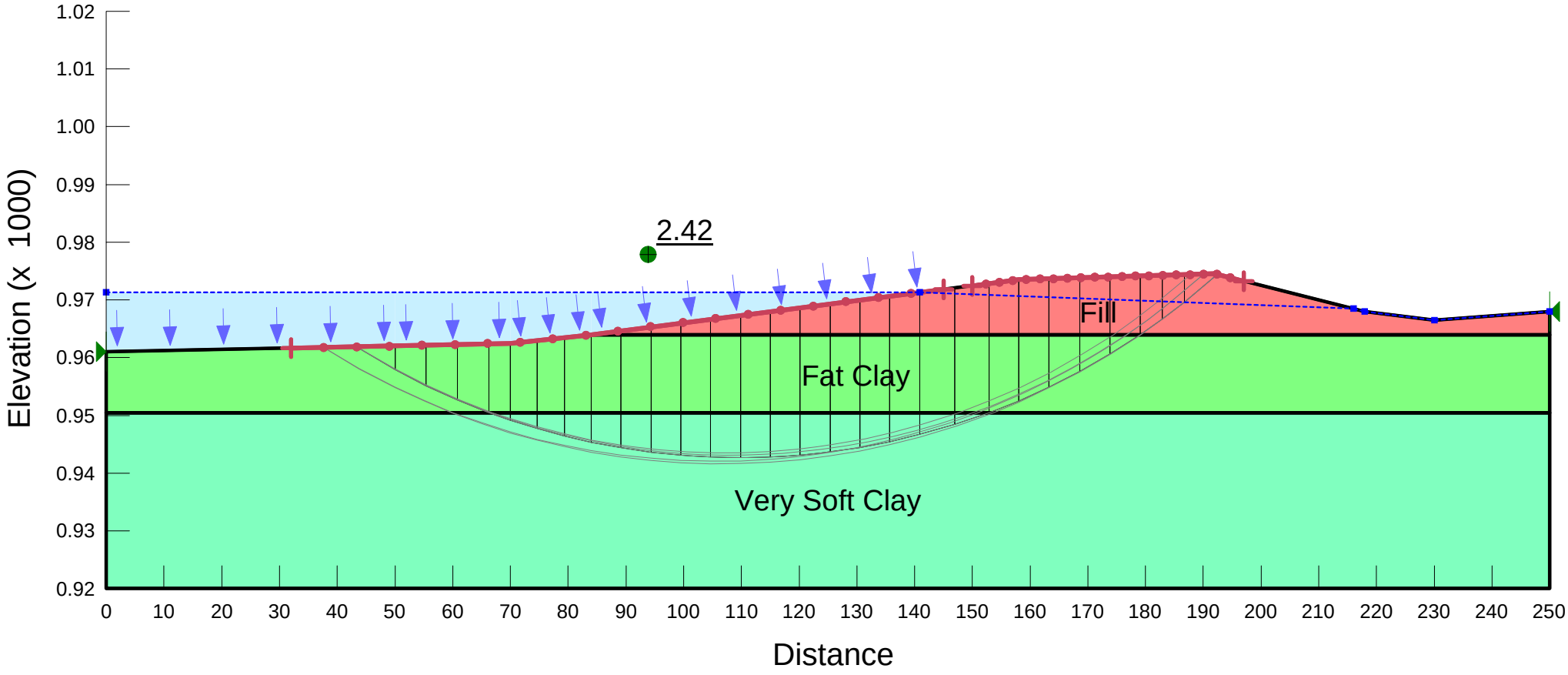
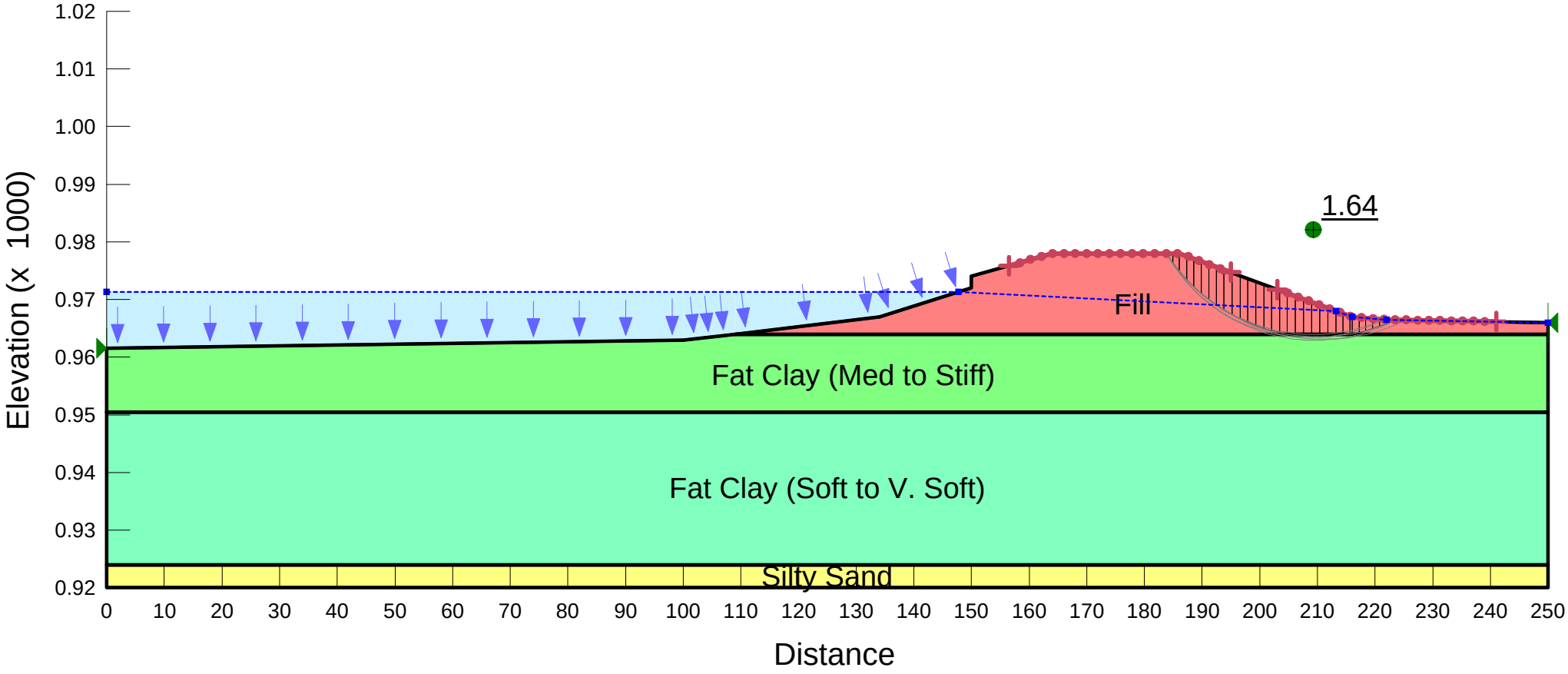


Exhibit D-15

File Name: Sect F-F phi 26.gsz
BWL Date: 10/13/2010

Name: Silty Sand Unit Weight: 125 pcf Cohesion: 0 psf Phi: 29 °
Name: Fill Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay (Med to Stiff) Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay (Soft to V. Soft) Unit Weight: 120 pcf Cohesion: 0 psf Phi: 20 °



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File Name: Sect F-F (Up) phi 26.gsz
BWL Date: 10/13/2010

Name: Silty Sand Unit Weight: 125 pcf Cohesion: 0 psf Phi: 29 °
Name: Fill Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay (Med to Stiff) Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay (Soft to V. Soft) Unit Weight: 120 pcf Cohesion: 0 psf Phi: 20 °

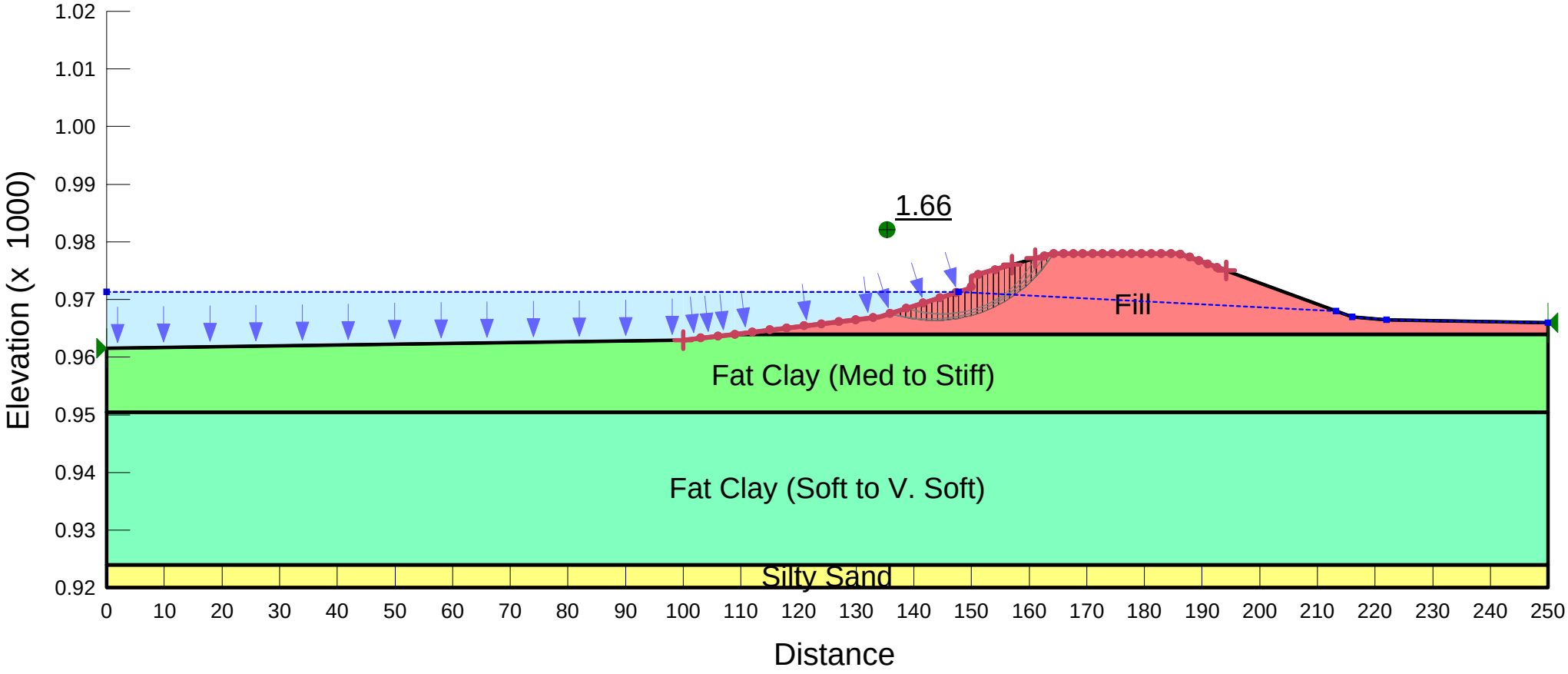


Exhibit D-17

File Name: Sect F-F (seismic) phi 26.gsz
BWL Date: 10/13/2010

Name: Silty Sand Unit Weight: 125 pcf Cohesion: 0 psf Phi: 29 °
Name: Fill Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay (Med to Stiff) Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay (Soft to V. Soft) Unit Weight: 120 pcf Cohesion: 0 psf Phi: 20 °

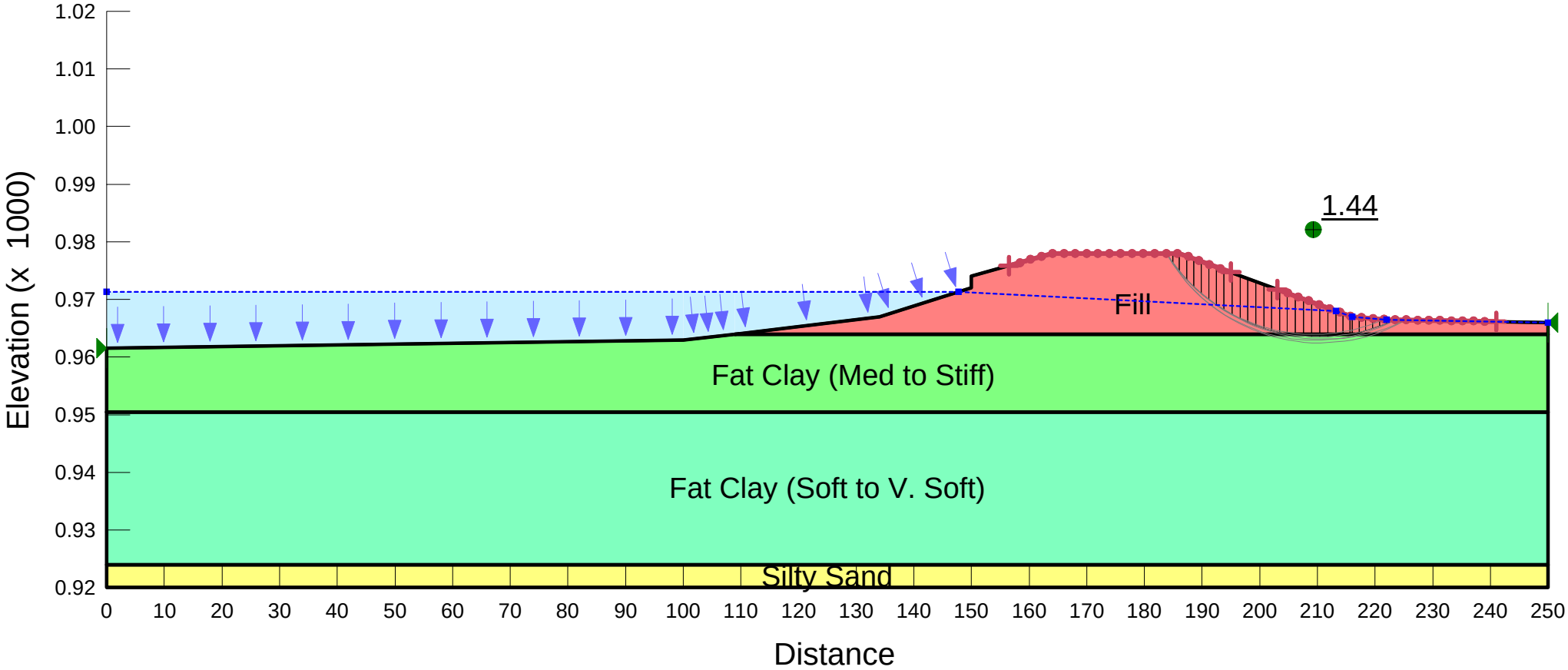


Exhibit D-18

File Name: Sect F-F (Up Seismic) phi 26.gsz
BWL Date: 10/13/2010

Name: Silty Sand Unit Weight: 125 pcf Cohesion: 0 psf Phi: 29 °
Name: Fill Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay (Med to Stiff) Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay (Soft to V. Soft) Unit Weight: 120 pcf Cohesion: 0 psf Phi: 20 °

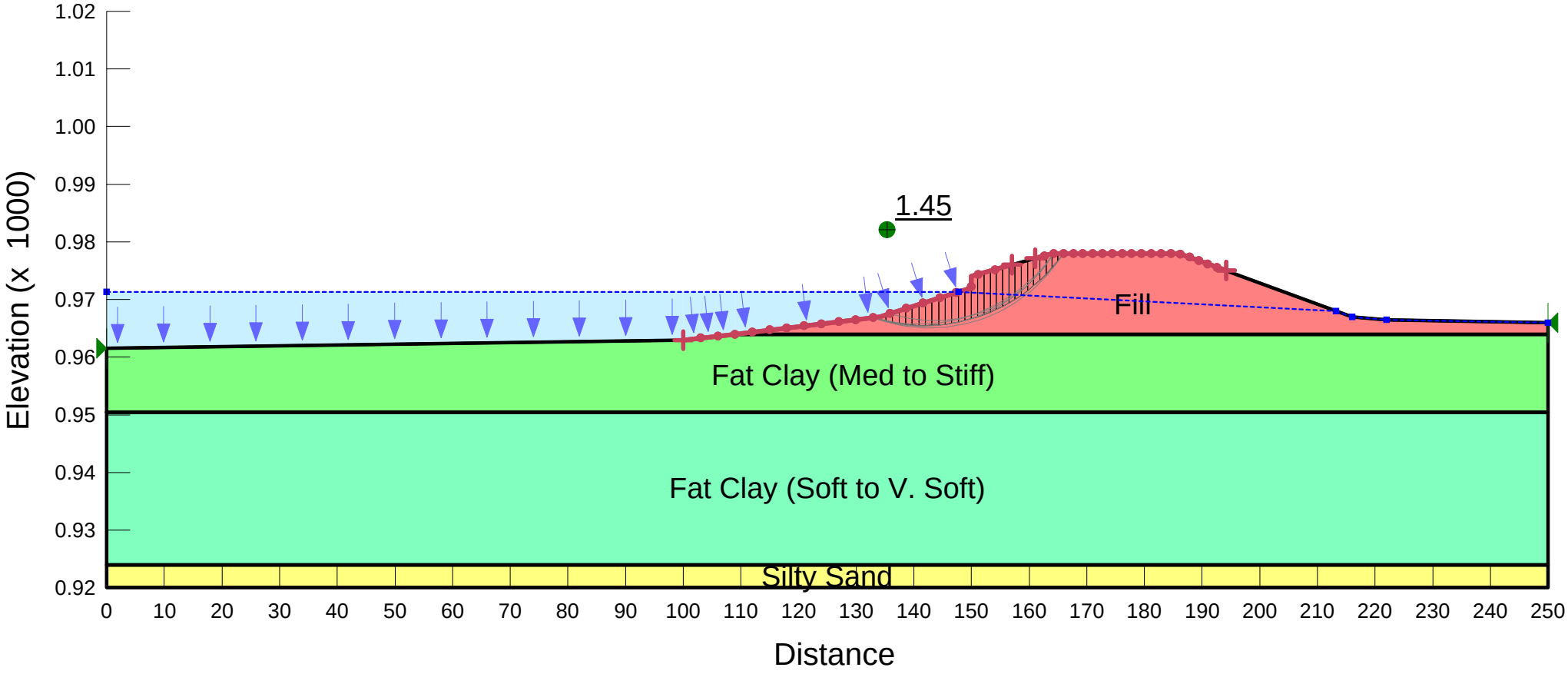


Exhibit D-19

File Name: Sect L-L (phi 26).gsz
BWL Date: 10/13/2010

Name: Silty Sand Unit Weight: 125 pcf Cohesion: 0 psf Phi: 29 °
Name: Fill Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °

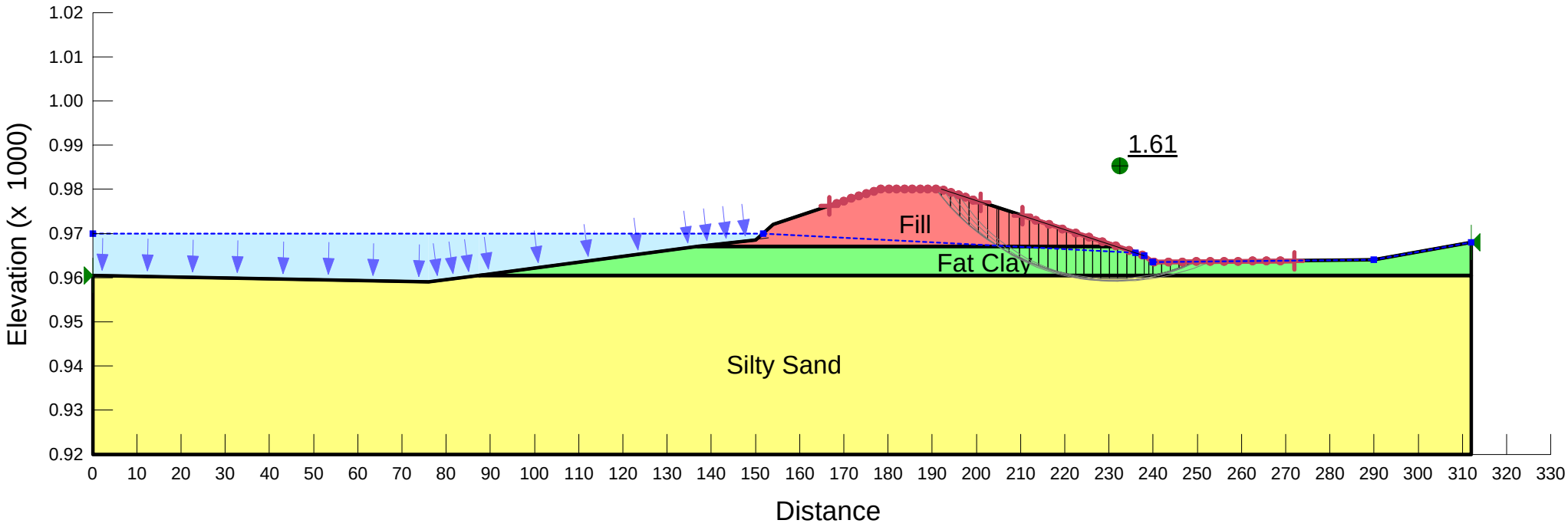


Exhibit D-20

File Name: Sect L-L (up) phi 26.gsz
BWL Date: 10/13/2010

Name: Silty Sand Unit Weight: 125 pcf Cohesion: 0 psf Phi: 29 °
Name: Fill Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °

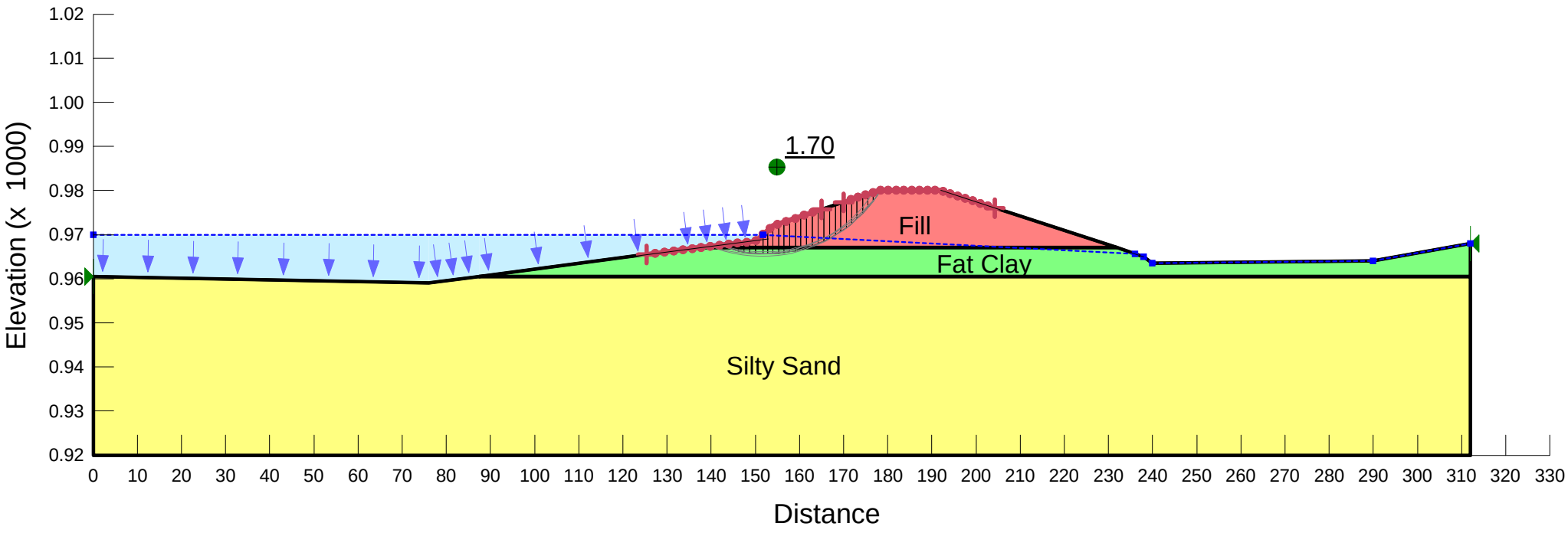


Exhibit D-21

File Name: Sect L-L (seismic) phi 26.gsz
BWL Date: 10/13/2010

Name: Silty Sand Unit Weight: 125 pcf Cohesion: 0 psf Phi: 29 °
Name: Fill Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °

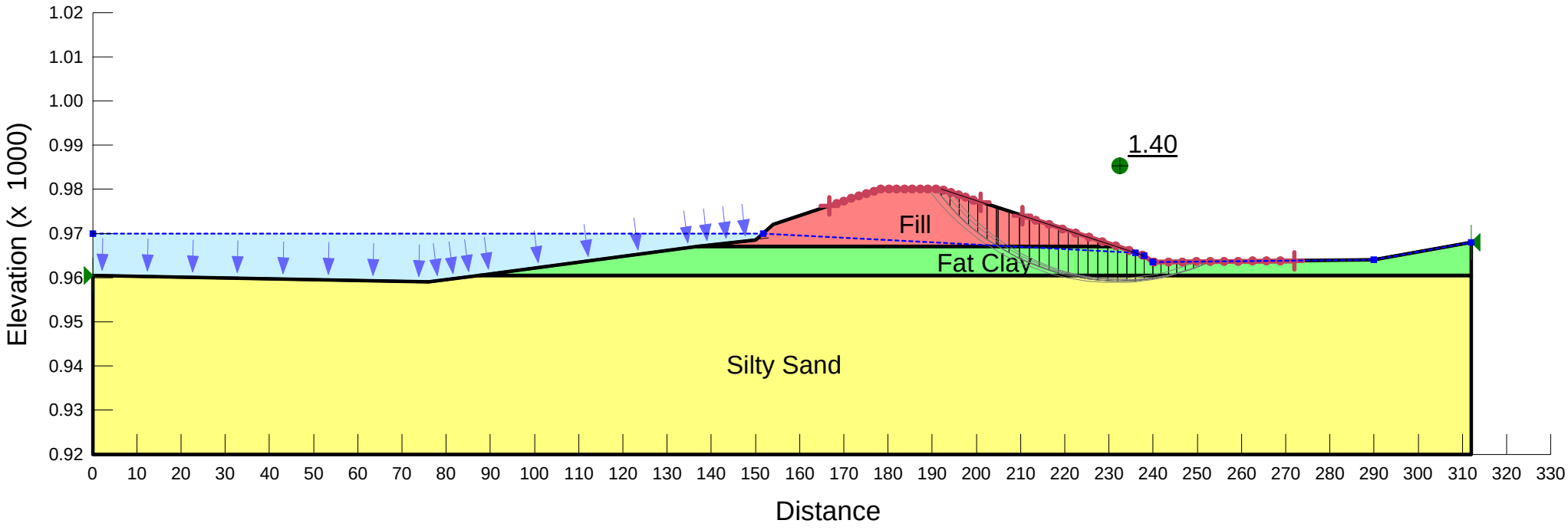


Exhibit D-22

File Name: Sect L-L (up seismic) phi 26.gsz
BWL Date: 10/13/2010

Name: Silty Sand Unit Weight: 125 pcf Cohesion: 0 psf Phi: 29 °
Name: Fill Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °

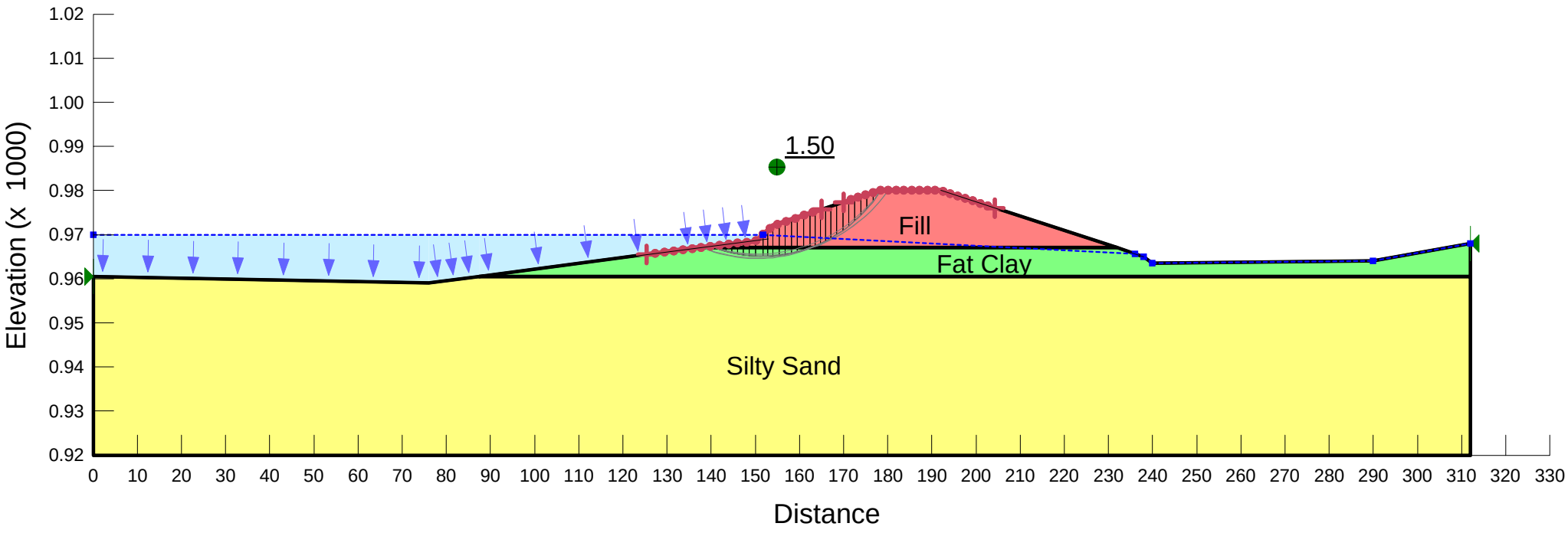


Exhibit D-23

File Name: Sect M-M phi 26.gsz
BWL Date: 10/13/2010

Name: Silty Sand Unit Weight: 125 pcf Cohesion: 0 psf Phi: 29 °
Name: Fill Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °

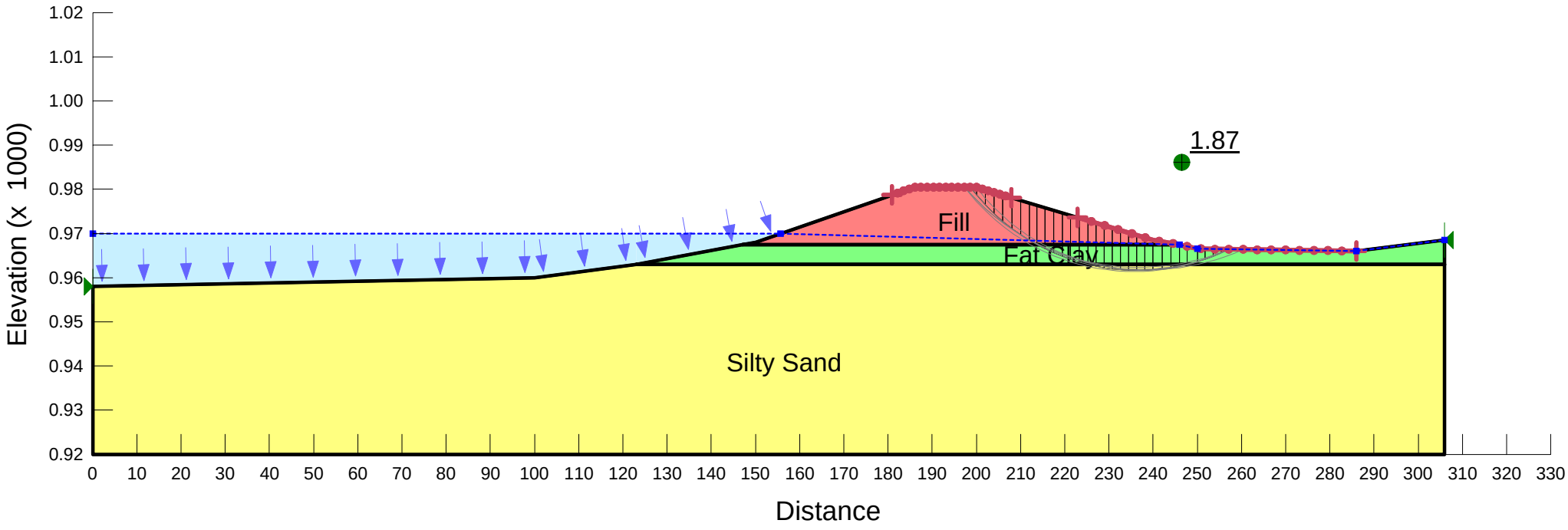


Exhibit D-24

File Name: Sect M-M (UP) phi 26.gsz
BWL Date: 10/13/2010

Name: Silty Sand Unit Weight: 125 pcf Cohesion: 0 psf Phi: 29 °
Name: Fill Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °

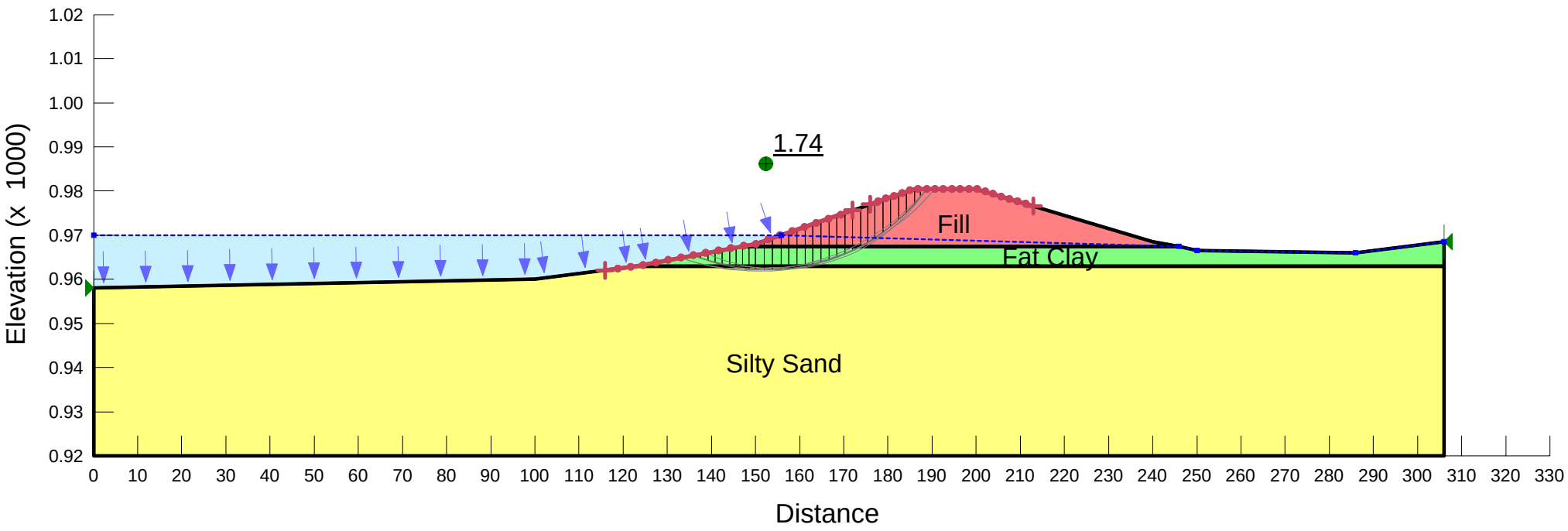


Exhibit D-25

File Name: Sect M-M (seismic) phi 26.gsz
BWL Date: 10/13/2010

Name: Silty Sand Unit Weight: 125 pcf Cohesion: 0 psf Phi: 29 °
Name: Fill Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °

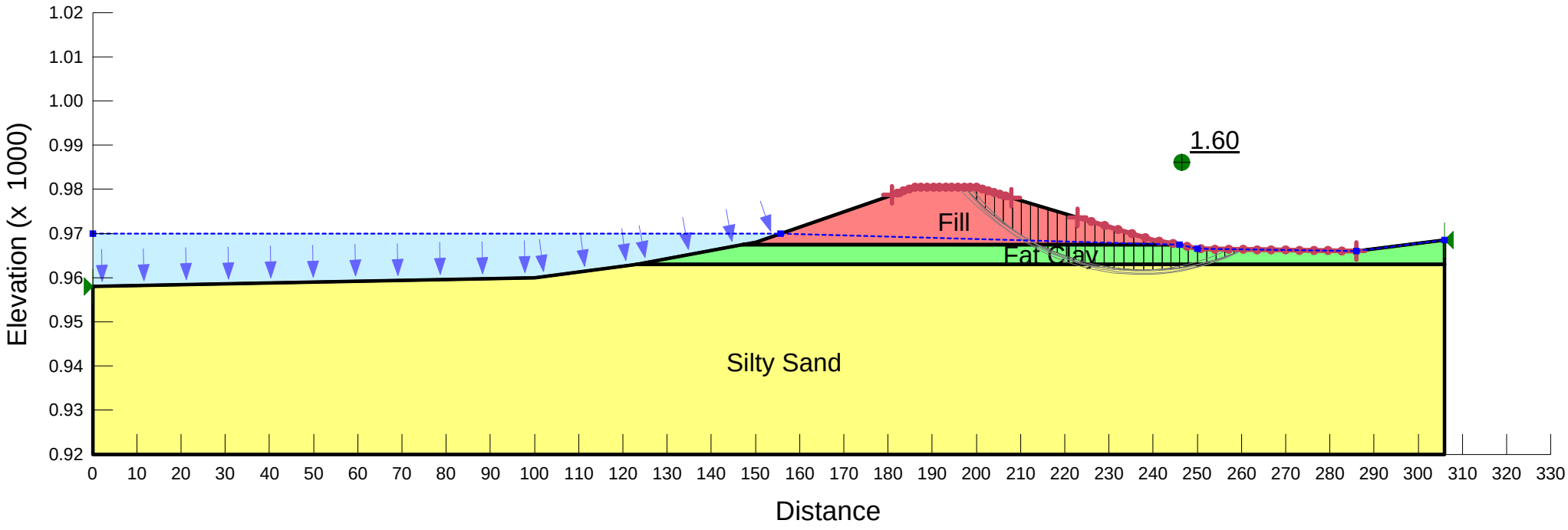


Exhibit D-26

File Name: Sect M-M (UP seismic) phi 26.gsz
BWL Date: 10/13/2010

Name: Silty Sand Unit Weight: 125 pcf Cohesion: 0 psf Phi: 29 °
Name: Fill Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °

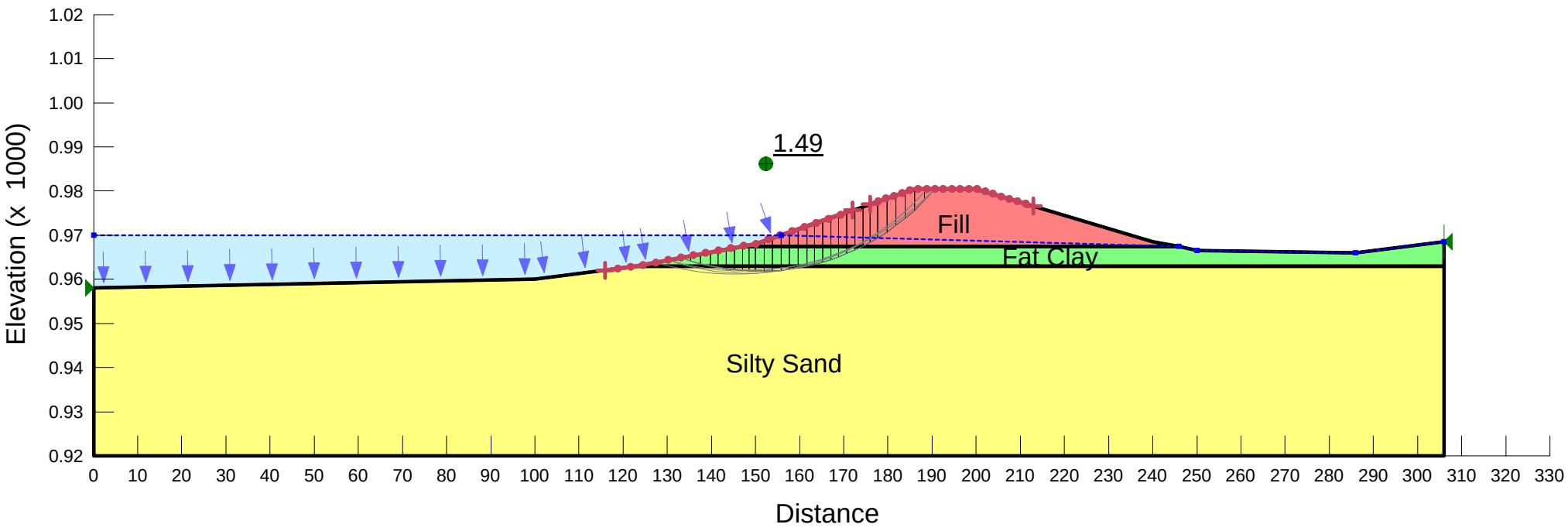


Exhibit D-27

File Name: Sect O-O (phi 26).gsz
BWL Date: 10/13/2010

Name: Silty Sand Unit Weight: 125 pcf Cohesion: 0 psf Phi: 29 °
Name: Fill Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °

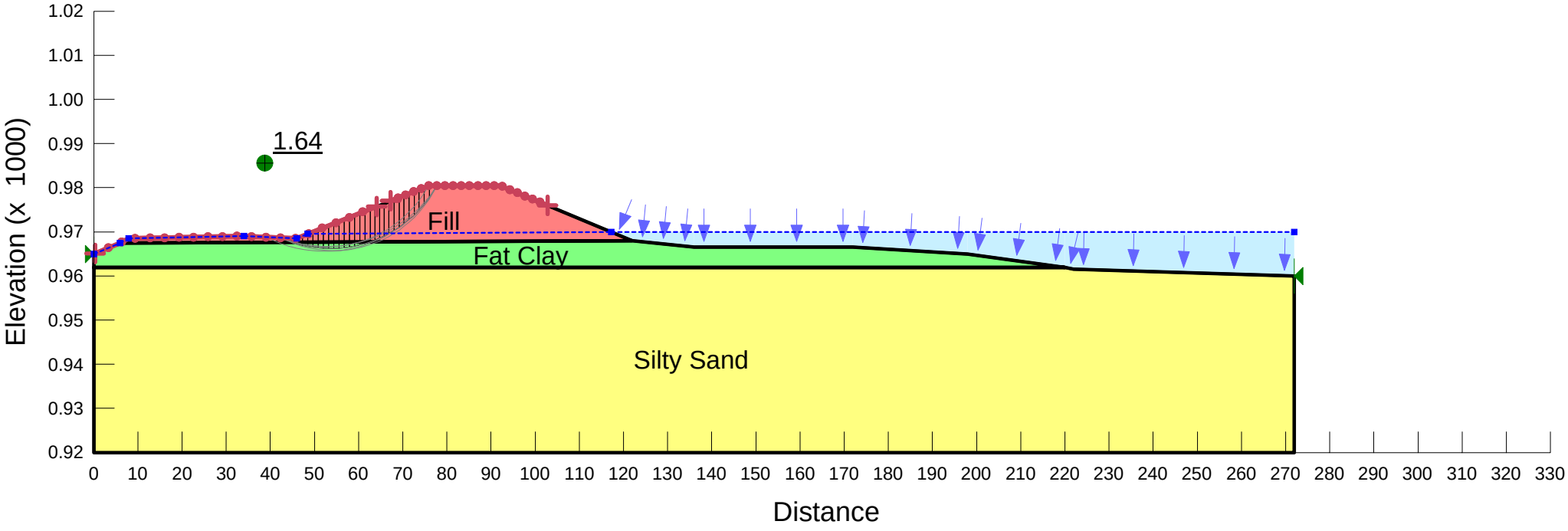


Exhibit D-28

File Name: Sect O-O (up) phi=26.gsz
BWL Date: 10/13/2010

Name: Silty Sand Unit Weight: 125 pcf Cohesion: 0 psf Phi: 29 °
Name: Fill Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °

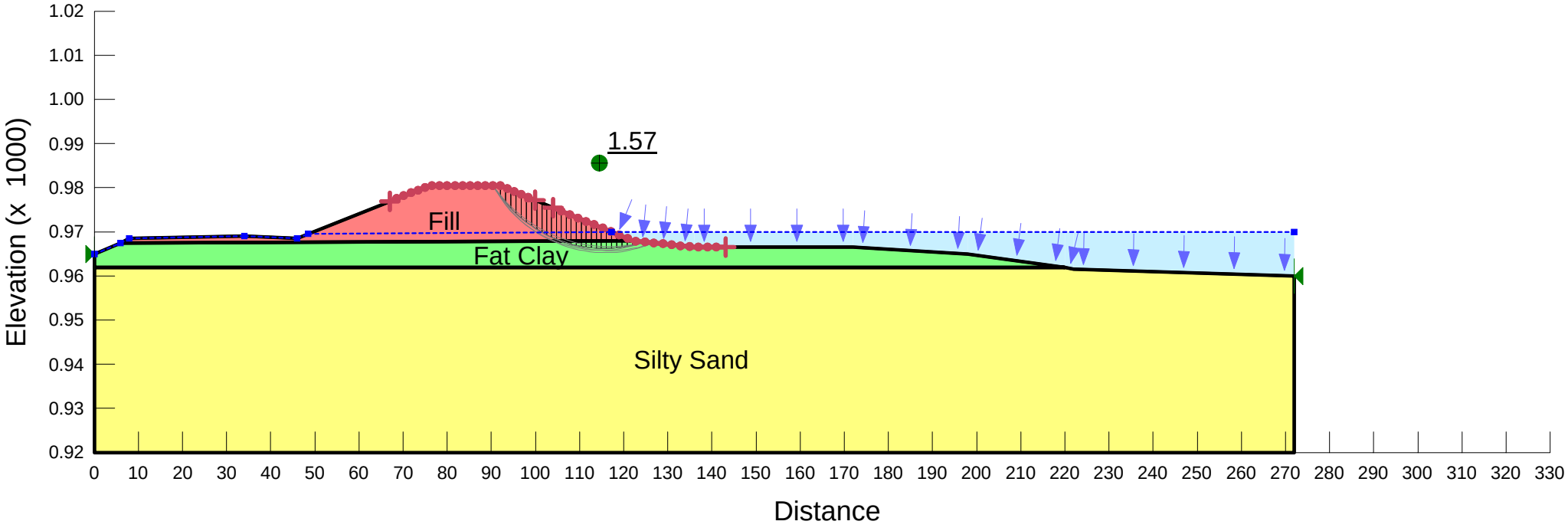


Exhibit D-29

File Name: Sect O-O (seismic) phi 26.gsz
BWL Date: 10/13/2010

Name: Silty Sand Unit Weight: 125 pcf Cohesion: 0 psf Phi: 29 °
Name: Fill Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °

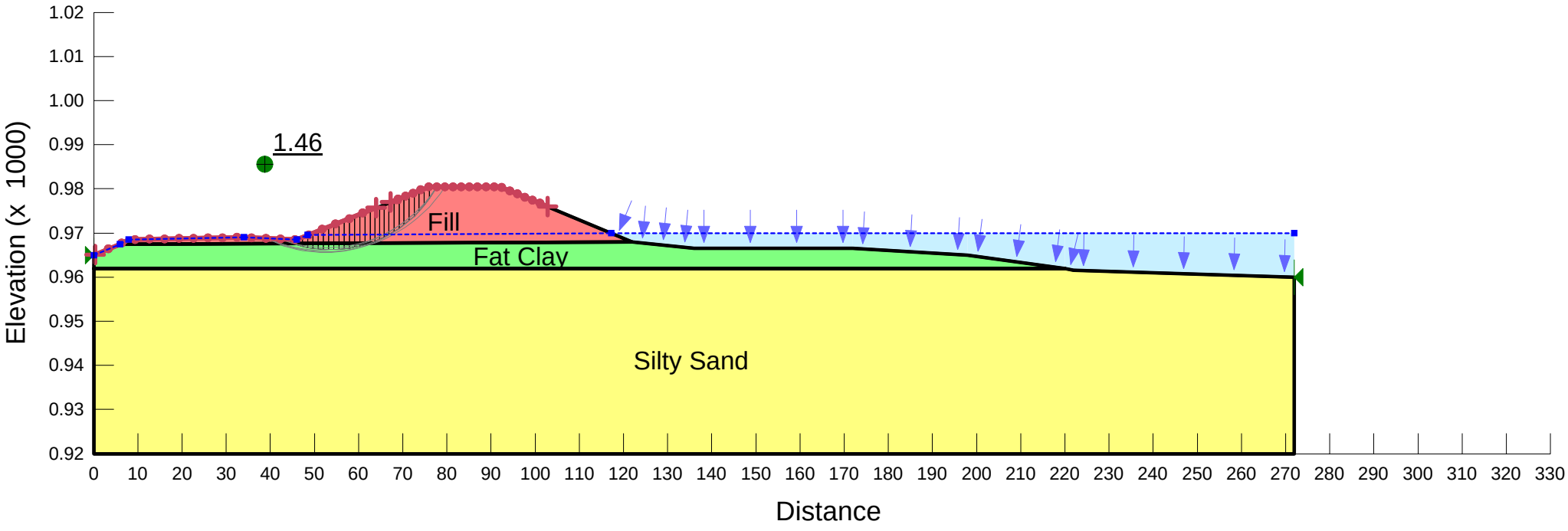


Exhibit D-30

File Name: Sect O-O (up seismic) phi 26.gsz
BWL Date: 10/13/2010

Name: Silty Sand Unit Weight: 125 pcf Cohesion: 0 psf Phi: 29 °
Name: Fill Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °
Name: Fat Clay Unit Weight: 120 pcf Cohesion: 50 psf Phi: 26 °

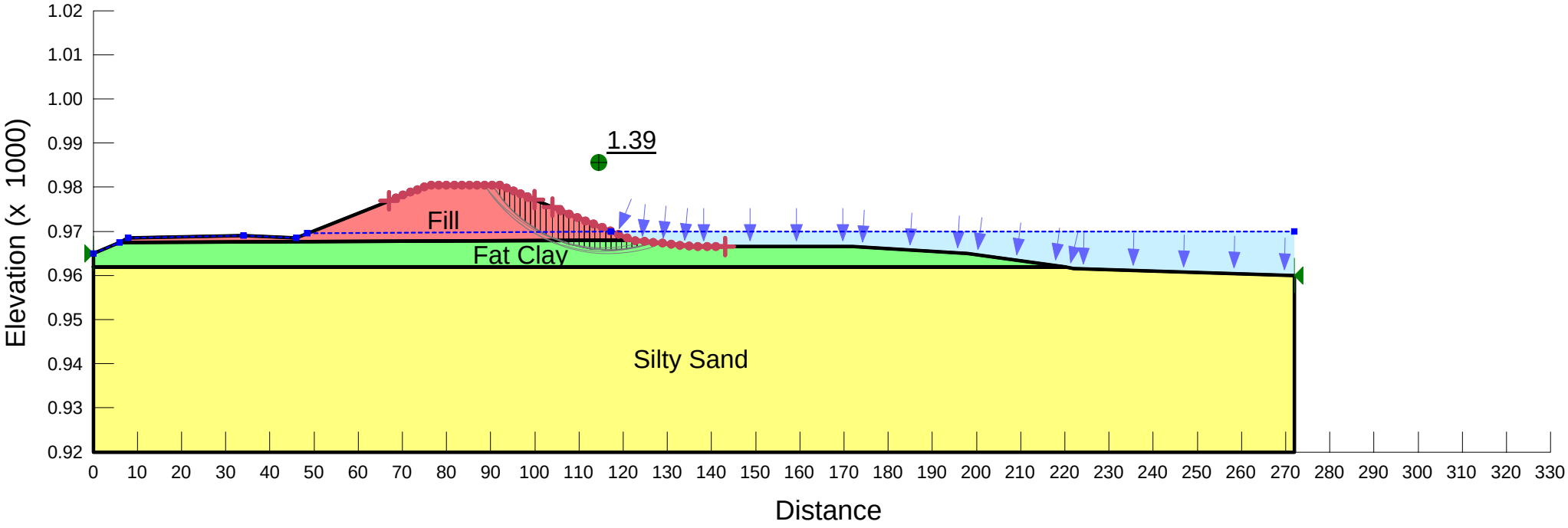


Exhibit D-31

April 12, 2011

HGM Associates, Inc
640 5th Avenue
Council Bluffs, Iowa 51502

Attention: Mr. Terry Smith, P.E.

Re: Preliminary Geotechnical Engineering Report
Seepage Analysis - Ash Containment Ponds
Walter Scott Energy Center
Council Bluffs, Iowa
Terracon Project No. 05105087

Dear Mr. Smith:

Terracon Consultants, Inc. (Terracon) has completed a seepage analysis of the levees of the north and south ash ponds at the Walter Scott Energy Center (WSEC) in Council Bluffs, Iowa, as described in our Proposal P05090622a. Five cross-sections were analyzed based on the existing topography and soil stratigraphy. These cross-sections were provided to us by HGM Associates. The subsurface profiles for the analysis models were interpreted and extrapolated from the nearest boring or cone sounding. The cross-sections, borings and cone sounding logs are presented in our report regarding global stability of the levees, dated October 22, 2010. Since borings were only performed at the crest of the existing levees and no information was available regarding the conditions at the toe of the embankments, we considered that stratum elevations encountered at the borings or cone soundings represented a relatively level contact between strata.

Terracon used the SEEP/W program to estimate the exit gradients for the underseepage study. The SEEP/W computer program uses finite element numerical analyses to analyze groundwater seepage. A finite element mesh is created by drawing regions, applying boundary conditions and assigning materials. A steady-state flow analysis was conducted. The recommended design guidance for flood protection levees from the USACOE Technical Letter 1110-2-569 states that the exit gradient should be less than 0.5.

The attached diagram summarizes the results of Terracon's analysis of seepage conditions at the WSEC Ash Ponds. Based on our analysis with the estimated parameters, geometry and stratigraphy, we anticipate the following:

- The computed south pond seepage exit gradients, including along Pony Creek, are approximately 0.5 or less if the water level does not exceed 970 feet.
- The computed south pond seepage exit gradients, excluding areas along Pony Creek, are less than 0.5 if the water level does not exceed 971.3 feet (indicated as highest

water level observed).

- The computed north pond seepage exit gradients are approximately 0.5 or less if the water level does not exceed 967 feet.

HGM surveyed the water elevations of WSEC ash ponds and Pony Creek on April 11, 2011 and have indicated the following recorded surface water elevations:

Location	Top of Water Elevation, feet
South Ash Pond	967.69
Pony Creek	962.47
North Ash Pond	966.71

MidAmerican Energy has indicated that it is the plant's intent is to keep pond levels at elevations that result in gradient of 0.5 or less.

This letter report has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, express or implied, are intended or made. Terracon plans to provide additional documentation of our analysis and results in a subsequent report in May, 2011. We appreciate the opportunity to be of service to you on this project. If you have any questions regarding this addendum report, please contact us.

Sincerely,

Terracon Consultants, Inc.

Edward D. Prost, Jr., P.E.
Principal

Gopala K. Allam, E.I.
Staff Geotechnical Engineer

Attachment: Diagram

Report Distribution: Addressee (1 via e-mail)

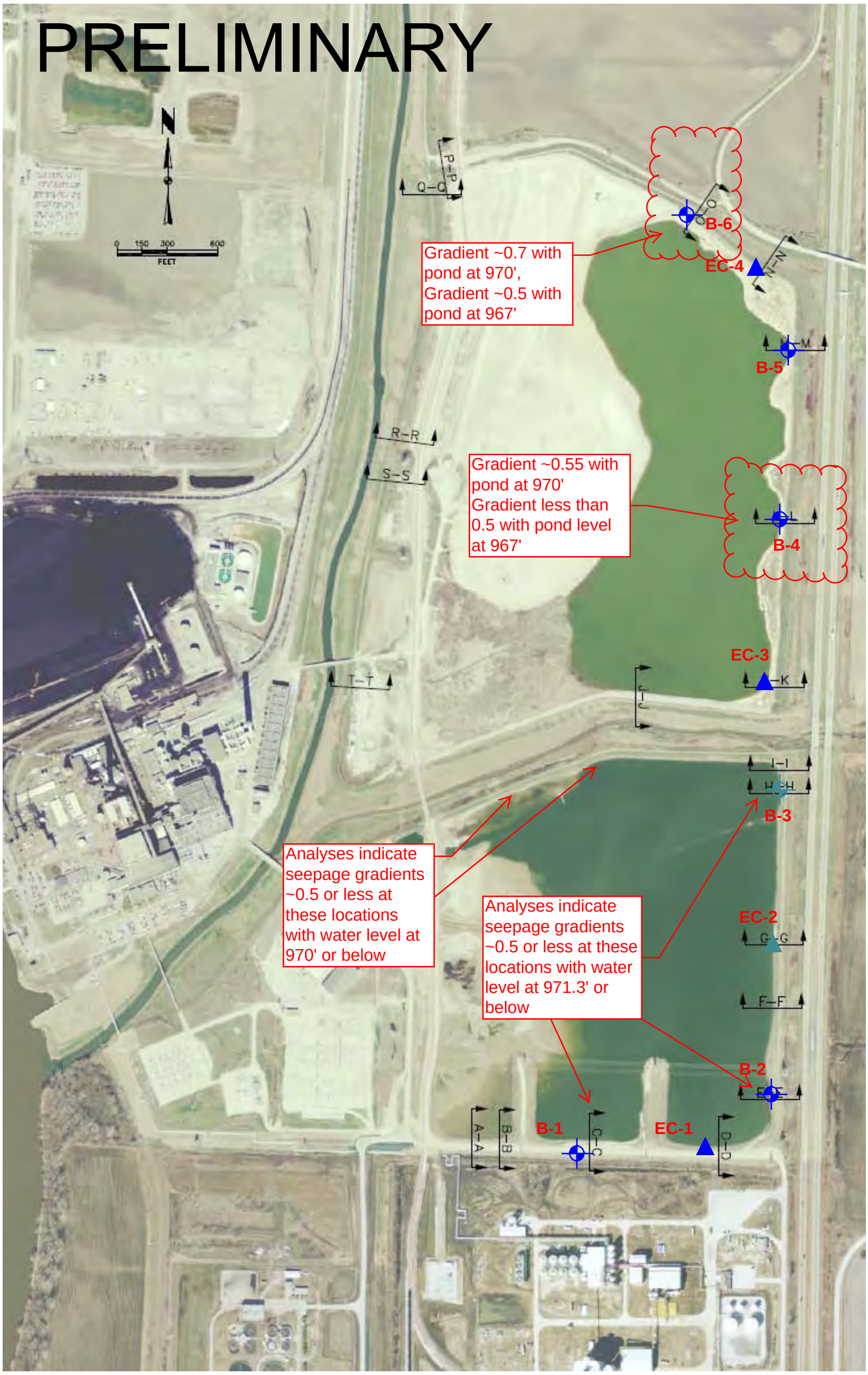
LICENSED PROFESSIONAL ENGINEER
EDWARD D. PROST, JR.
12790
IOWA

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

Edward D. Prost Jr., P.E. 4/12/2011 (date)

My license renewal date is December 31, 2012.

Pages or sheets covered by this seal:
Geotechnical Engineering Report



Note: Boring 3 and Cone Sounding EC-2 were not completed due to overhead power line obstruction.

N

- Boring location

- Cone sounding location

Source: HGM Associates, Inc. Exhibit on Aerial

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: EDP	Project No. 05105087	Terracon Consulting Engineers & Scientists	BORING LOCATION DIAGRAM
Drawn by: EDP	Scale: As Shown	15080 A Circle Omaha, Nebraska 68144	WSEC ASH CONTAINMENT PONDS
Checked by:	File Name: 05105087BLAN	PH. (402) 330-2202 FAX. (402) 330-7606	7215 NAVAJO STREET
Approved by: EDP	Date: 4/12/2010		COUNCIL BLUFFS, IOWA

FIG No. A-2