ALLIANT ENERGY
Interstate Power and Light Company
Burlington Generating Station

CCR SURFACE IMPOUNDMENT

STRUCTURAL STABILITY ASSESSMENT

Report Issued: June 21, 2021
Revision 1

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EXECUTIVE SUMMARY

This Structural Stability Assessment (Report) is prepared in accordance with the requirements of the United States Environmental Protection Agency (USEPA) published Final Rule for Hazardous and Solid Waste Management System – Disposal of Coal Combustion Residual (CCR) from Electric Utilities (40 CFR Parts 257 and 261, also known as the CCR Rule) published on April 17, 2015 (effective October 19, 2015) and subsequent amendments.

This Report assesses the structural stability of each CCR unit at Burlington Generating Station in Burlington, Iowa in accordance with §257.73(b) and §257.73(d) of the CCR Rule. For purposes of this Report, "CCR unit" refers to an existing CCR surface impoundment.

Primarily, this Report documents whether the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded within each CCR unit.

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1 Introduction

The owner or operator of the Coal Combustion Residual (CCR) unit must conduct an initial and periodic structural stability assessments and document whether the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein. Revision 1 of this Report has been prepared in accordance with the requirements of §257.73(b) and §257.73(d) of the CCR Rule.

1.1 CCR Rule Applicability

The CCR Rule requires a periodic structural stability assessment by a qualified professional engineer (PE) for existing CCR surface impoundments with a height of 5 feet or more and a storage volume of 20 acre-feet or more; or the existing CCR surface impoundment has a height of 20 feet or more (§257.73(b)).

1.2 Structural Stability Assessment Applicability

The Burlington Generating Station (BGS) in Burlington, Iowa (Figure 1) has four existing CCR surface impoundments that meet the requirements of §257.73(b)(1) or §257.73(b)(2) of the CCR Rule, which are identified as follows:

- BGS Ash Seal Pond
- BGS Main Ash Pond
- BGS Economizer Pond
- BGS Upper Ash Pond

2 FACILITY DESCRIPTION

The following sub-section provides a summary description of the facility and existing CCR surface impoundments located at BGS.

BGS is located southeast of the City of Burlington, Iowa on the western shore of the Mississippi River in Des Moines County, at 4282 Sullivan Slough Road, Burlington, Iowa (Figure 1). BGS is a fossil-fueled electric generating station consisting of one steam electric generating unit and four combustion turbine units. Sub-bituminous coal is the primary fuel for producing steam, and natural gas is used for the combustion turbines. The burning of coal in the steam electric unit produces CCR. The CCR at BGS is categorized into three types, bottom ash, economizer ash, and precipitator fly ash.

General Facility Information:

Date of Initial Facility Operations: 1968
NPDES Permit Number: IA29-00-1-01
Facility Title V Operating Permit: 98-TV-023R1-M004
Latitude / Longitude: 40°44’29”N 91°07’04”W
Site Coordinates: Section 29, Township 69 North, Range 02 West
Unit Nameplate Ratings: Unit 1: 212 MW

2.1 BGS Ash Seal Pond

The BGS Ash Seal Pond is located south of the generating plant and east of the BGS Main Ash Pond. The CCR, in 1968, was originally managed by discharging into the BGS Ash Seal Pond for settling. Presently, the BGS Ash Seal Pond only receives storm water runoff from the surrounding area associated with the fly ash storage silo. The BGS Ash Seal Pond also may receive facility process water, such as ash seal water, but only if there is an issue with the ash seal water pumps. At the time of the last annual inspection on June 3, 2020 the CCR surface impoundment did not contain standing water.

The surface area of the BGS Ash Seal Pond is approximately 5.7 acres and has an embankment height of approximately 12 feet from the crest to the toe of the downstream slope. The embankment crest is at elevation 534 the same as the adjacent plant site grade and equivalent to the 100-year flood water elevation of the Mississippi River. The interior storage depth of the BGS Ash Seal Pond is approximately 12 feet. As stated in the 2020 Annual Inspection, the total volume of impounded CCR and water within the BGS Ash Seal Pond is approximately 106,000 cubic yards, which would include general fill that has been added in the northeast corner of the impoundment. The original outfall for the impoundment is sealed to prevent discharge to the Mississippi River and the impoundment normally contains no water. Rainfall that accumulates exfiltrates through the bottom of the impoundment. A manually operated pump is available to lift storm water to the adjacent BGS Main Ash Pond, if necessary.

2.2 BGS Main Ash Pond

The BGS Main Ash Pond is located southwest of the generating plant and west of the BGS Ash Seal Pond. The CCR, prior to being sluiced to the BGS Main Ash Pond, was originally managed in the BGS Ash Seal Pond in 1968. In 1971, BGS managed CCR in the BGS Upper Ash Pond. In 1980, the BGS Main Ash Pond became the primary receiver of CCR, with the BGS Upper Ash Pond becoming a downstream receiver.

Presently, the BGS Main Ash Pond receives bottom ash that is sluiced from the generating plant to the northeast corner of the BGS Main Ash Pond. The sluiced bottom ash discharges into the northeast corner where most of the bottom ash settles out. This bottom ash is recovered for beneficial reuse. Hydrated fly ash is also stored within the BGS Main Ash Pond area prior to being sold as aggregate material for beneficial reuse. Fly ash from the on-site storage silo is no longer added to the pile within impoundment.

The water that is used to sluice the bottom ash into the BGS Main Ash Pond is routed towards the west end of the BGS Main Ash Pond. The water is discharged in batch quantities as bottom ash accumulates in the boiler and averages 1 cubic foot per second (cfs) daily. From that point, the water flows to the west along the north side of a road constructed out of bottom ash through the center of the BGS Main Ash Pond, Figure 2. Then flows along the north side of the road until it reaches the west end where it transitions into a ponded area in the northwest corner of the BGS Main Ash Pond. The water in the northwest corner of the BGS Main Ash Pond leaves through two 15-inch diameter corrugated metal culverts with identical invert elevation under the generating plant entrance road where it discharges into a small channel in the southwest corner of the BGS Upper Ash Pond located north of the generating plant entrance road.

The surface area of the BGS Main Ash Pond is approximately 18.7 acres and has an embankment height of approximately 12 feet from the crest to the toe of the downstream slope. The embankment crest is at elevation 534 the same as the plant site grade and equivalent to the 100-year flood water elevation in the Mississippi River. The interior storage depth of the BGS Main Ash Pond is approximately 8 feet. As stated in the 2020 Annual Inspection, the total volume of impounded CCR and water within the BGS Main Ash Pond at normal water operation elevation is approximately 443,000 cubic yards.

2.3 BGS Economizer Pond

The BGS Economizer Pond is located west of the generating plant and north of the BGS Main Ash Pond. In 1986, BGS constructed the BGS Economizer Pond in the southern and eastern portion of the original footprint of the BGS Upper Ash Pond. The impoundment has resulted from economizer ash that has been deposited since 1986, which created the economizer embankment which is higher than the embankments of the BGS Upper Ash Pond at approximately elevation 548.

Presently, the BGS Economizer Pond receives economizer ash. The economizer ash is sluiced from the generating plant to the east end of the BGS Economizer Pond via a 10-inch diameter polyvinyl chloride pipe at a flow rate of 1.5 cfs (including approximately 10% plant process water). The economizer ash settles out through the water column of the 0.4-acre BGS Economizer Pond while the water flows to the west. The water discharges from the BGS Economizer Pond through an 18-inch diameter high-density polyethylene pipe into a storm water and process water treatment channel located along the south side of the economizer embankment.

The storm water and process water treatment channel receives runoff from 8 acres surrounding the generating plant. The collected storm water drains into a pump vault located at the toe of the downstream slope of the east embankment of the BGS Economizer Pond. Plant process water flows through an oil/water separator and receives influent flows from the plant floor drains and water treatment process water. After the oil/water separator, the process water discharges into the pump vault. The storm water and process water are then pumped from the vault up to the storm water treatment channel. The storm water treatment channel flows to the west along the south side of the economizer embankment until it discharges through an 18-inch diameter high-density polyethylene pipe located in the southwest corner of the economizer embankment. The water from the storm water treatment channel discharges into a small channel in the southwest corner of the BGS Upper Ash Pond located north of the generating plant entrance road.

The total surface area of the BGS Economizer Pond and economizer embankment is approximately 11 acres and has an embankment height of approximately 13 feet from the crest to the toe of slope on the CCR in the BGS Upper Ash Pond. The interior storage depth of the top of the economizer embankment to the bottom of the original footprint of the BGS Upper Ash Pond is approximately 27 feet. As stated in the 2020 Annual Inspection, the total volume of impounded CCR and water within the BGS Economizer Pond is approximately 478,500 cubic yards.

2.4 BGS Upper Ash Pond

The BGS Upper Ash Pond is located northwest of the generating plant and north of the BGS Main Ash Pond. In 1971, BGS began managing CCR in the BGS Upper Ash Pond.

In 1980, the BGS Main Ash Pond became the primary receiver of CCR and the BGS Upper Ash Pond became a downstream receiver of the BGS Main Ash Pond.

Presently, the BGS Upper Ash Pond receives influent flows from the BGS Main Ash Pond, BGS Economizer Pond, and storm water and process water flow from the generating plant. The influent flows all discharge into a small channel located in the southwest corner of the BGS Upper Ash Pond. The water in the channel routed along the south side of the gravel dike of the BGS Upper Ash Pond until it discharges into the southwest corner of the BGS Upper Ash Pond water body.

The water flows through the BGS Upper Ash Pond water body to the northeast towards a 24-inch wide precast concrete Parshall flume that discharges into a concrete catch basin. The water in the catch basin flows through a 15-inch diameter polyvinyl chloride pipe and discharges into the BGS Lower Pond. Instrumentation associated with the BGS Upper Ash Pond includes a flow meter that monitors the discharges. The discharge from the concrete catch basin enters the Lower Pond. The Lower Pond contains the facility's National Pollutant Discharge Elimination System (NPDES) Outfall 001. The water flows through the NPDES Outfall 001 hydraulic structure, which consists of cast in place weir box.

The total surface area of the BGS Upper Ash Pond is approximately 13.3 acres and has an embankment height of approximately 10 feet from the crest to the toe of the downstream slope. The elevation of the embankments is 531 feet, 3 feet lower than the 100-year flood elevation of the Mississippi River. The embankment is armored with cobble size stone on the crest and both outer and inner embankment slopes to prevent erosion of the embankment during overtopping from extreme flood stage of the Mississippi River. The interior storage depth of the BGS Upper Ash Pond is approximately 7 feet. As stated in the 2020 Annual Inspection, the volume of impounded CCR and water within the BGS Upper Ash Pond is approximately 156,400 cubic yards.

3 STRUCTURAL STABILITY ASSESSMENT- §257.73(d)

This Report documents the design, construction, operation, and maintenance of the BGS CCR units are consistent with recognized and generally accepted good engineering practices for maximum volume of CCR and CCR wastewater which can be impounded.

3.1 BGS Ash Seal Pond

The BGS Ash Seal Pond receives surface water runoff from an approximate area of 2 acres south of the main generating station complex including the dry fly ash handling silo and truck loading area. The northeast corner of the impoundment (approximately 25% of its original footprint) is filled to plant grade of 534 feet. Rainfall that directly enters the impoundment or enters as surface water is stored in the impoundment without discharge. Because the subsoil below the base of the impoundment is sandy due to its location on the natural river levee deposits, the accumulated rain water exfiltrates into the subsurface.

Soil borings and testing taken for plant construction activities and for determination of embankment properties as illustrated on Figure 3 and presented in Appendices A, B, C and D. The results indicate the embankments are constructed of clay compacted over naturally occurring sand and clay. Strength properties of the soils were measured by Standard Split Spoon Penetration (ASTM D 1586) or Cone Penetrometer testing (ASTM D 5778).

3.1.1 CCR Unit Foundation and Abutments - §257.73(d)(1)(i)

The partial excavation and construction of embankments for the BGS Ash Seal Pond occurred during the original construction of the plant. The south and west sides of the impoundment were constructed embankments and the east and north sides were incised below plant design grade. The embankments consist of a mixture of on-site soils from excavation in the sandy levee deposits and off-site clay imported from higher land west of the site. Deep borings taken for construction in the plant area show that the subsurface soils below elevation 510 feet is medium dense sand. Medium dense sand is a strong subbase for the impoundment embankments. Soil between elevation 510 and the bottom of the impoundment at elevation 520 is generally loose sand and silty sand that remained in place and is partially below the normal water elevation of the Mississippi River elevation 518. The foundations and abutments for the BGS Ash Seal Pond are adequate to support the impoundment infrastructure and contents as demonstrated in the Safety Factor Assessment Report – Revision 1.

3.1.2 Slope Protection - §257.73(d)(1)(ii)

The BGS Ash Seal Pond is incised on the east, north and west sides. The south side faces the condenser discharge channel for the generating station where non-contact cooling water is released in a channel back to the Mississippi River. The crest of the south embankment is approximately 12 feet wide and the downstream slope of the exposed embankment is a 2:1 vegetated slope. Well established and managed vegetation will minimize erosion on both the upstream and downstream slopes. Additionally, storm water runoff is limited to the crest and downstream slope of the embankment, which limits the erosive force. Therefore the impoundment configuration protects against surface erosion.

Wave erosion potential is reduced because the downstream slope is protected within the condenser discharge channel. Wave action is unlikely to produce erosive forces that would affect the BGS Ash Seal Pond embankment.

Sudden drawdown is addressed in Section 3.1.7.

3.1.3 CCR Embankment Density- §257.73(d)(1)(iii)

In 2011, soil borings and penetration tests were taken in the south embankment of the BGS Ash Seal Pond. The results indicate the embankment is low plasticity silty clay (CL) with some layers of loose to medium dense sand. The in-place embankment densities identified within the Safety Factor Assessment Report – Revision 1 are sufficient to withstand the range of loading conditions that were analyzed.

3.1.4 Vegetation Management - §257.73(d)(1)(iv)

Historically vegetation management has been conducted on a periodic basis. At the time of the 2020 Annual Inspection, the exterior embankment was armored with revetment stone along the southern slope, which is the only non-incised section of the embankment. The revetment stone was installed in 2016 to protect against erosion from fluctuations of the Mississippi River.

3.1.5 Spillway Management - §257.73(d)(1)(v)

The BGS Ash Seal Pond is currently a zero discharge impoundment. The former spillway, which consisted of a 18-inch PVC pipe, is permanently sealed with hydraulic cement. If rainwater accumulates faster than it exfiltrates, a pump is used to send water to the BGS Main Ash Pond adjacent to the west side of the BGS Ash Seal Pond, Figure 2.

This impoundment currently has a hazard potential classification of "Significant," which in turn requires an evaluation of the impacts of a 1,000 year rainfall event. The Inflow Flood Control Plan – Revision 2, which is a separate document developed to comply with 40 CFR §257.82, shows that the precipitation from this event will be contained within the limits of the impoundment without overtopping the embankments. The freeboard at peak flow will be approximately 7-inches.

3.1.6 Hydraulic Structures - §257.73(d)(1)(vi)

No active hydraulic structures are associated with this BGS Ash Seal Pond. The abandoned discharge pipe is filled with concrete and was visually inspected on April 22, 2021 and showed no signs of deterioration, deformation, or distortion.

3.1.7 Sudden Drawdown - §257.73(d)(1)(vii)

A Mississippi River flood of 100 year elevation will rise to the crest elevation of the south embankment. Rise of the flood on the Mississippi River is often rapid, but drawdown is slower. In the event of drawdown, drainage would occur through the sandy base of the dam, but not through the dam embankment that is mainly clay. Some sand intervals in the embankment shown on the borings in Appendix B were sealed in 2007 by the construction of a soil bentonite wall through the embankment to prevent seepage through the sand seams. Additionally, geotextile and revetment stone were added in 2016 on the southern embankment and at the toe-of-slope.

There are no factors that would result in slumping of the embankment toe as the flood recedes and the embankment has been exposed to multiple cycles of drawdown since construction that have not impacted the downstream slope.

3.2 BGS Main Ash Pond

The BGS Main Ash Pond was constructed in 1972 to replace the BGS Upper Ash Pond as the main receiver of CCR at the BGS. The impoundment was constructed on soft clay deposits in the backwater areas between the plant site and high ground to the west. The embankments are constructed of imported clay from a borrow site just west of the BGS. Borings and penetration tests taken in 2011 and presented in Appendices B, C, and D indicate that the embankment is low plasticity silty clay (CL). The underlying foundation of the embankment is a soft clay deposited in backwater flooding of the Mississippi. Beneath the soft clay is a medium dense sand layer common to the Mississippi River valley.

3.2.1 CCR Unit Foundation and Abutments - §257.73(d)(1)(i)

The foundation soils for the embankments are soft clay that is surcharged by the weight of the embankment soil. Below the clay is a medium dense sand layer that is typical of the Mississippi River valley. The embankment foundation is adequate to support the embankment and the contents of the CCR impoundment. The test results in Appendix D indicate that the foundation soils are low plasticity clay that is not subject to liquefaction during earthquake events. The foundation soils are adequate to support the embankments and the CCR as indicated in the Safety Factor Assessment Report – Revision 1.

3.2.2 Slope Protection - §257.73(d)(1)(ii)

The impoundment is incised on the north and east sides. The toe of the west embankment drains south and into the wetland area. The south embankment faces a large wetland classified by the U.S. Fish and Wildlife Service National Wetlands Inventory as a "Freshwater Forested/Shrub Wetland" with Classification Codes: PF01A (135 acres) and PF01C (559 acres). Additionally, IPL has performed a wetland delineation which indicates that no wetlands meeting the definition of 40 CFR 232.2 are in close proximity to the impoundment. The wetland area is nearly flat, where drainage flows east and ultimately ends up in the discharge channel for the facility where non-contact cooling water is released in a channel back to the Mississippi River. The crest of the embankments is approximately 12 feet wide and the downstream slope of the embankment varies between a 3:1 and 2:1 vegetated slope. Well established and managed vegetation will minimize surface erosion on both the upstream and downstream slopes. Additionally, storm water runoff is limited to the crest and downstream slope of the embankment, which limits the erosive force. Therefore the impoundment configuration protects against surface erosion.

Erosion due to wave action will have minimal impacts to the embankments as the 25 year flood event or greater of the Mississippi River will cause backwater to approach the embankments.

Sudden drawdown is addressed in Section 3.2.7.

3.2.3 CCR Embankment Density- §257.73(d)(1)(iii)

The embankment soil is silty clay typical of the surrounding uplands and as shown by the data in Appendix C and has adequate density to support the pressures from the CCR contents of the impoundments.

3.2.4 Vegetation Management - §257.73(d)(1)(iv)

Historically vegetation management has been conducted on a periodic basis. At the time of the Annual Inspection on May 18, 2021, the upstream and downstream slopes of were properly inspected and consisted of managed grass vegetation. The facility plans to continue properly manage the grassy vegetation on the embankments.

3.2.5 Spillway Management - §257.73(d)(1)(v)

The BGS Main Ash Pond is equipped with two 15 inch diameter corrugated steel culverts to drain process water and storm water under the plant access road at the northwest corner of the impoundment, Figure 2. The culverts are constructed of non-erodible material and designed to carry sustained flows.

The culverts are checked for malfunction (e.g., blockages, deformations) during the weekly inspections by the facility personnel.

This impoundment currently has a hazard potential classification of "Significant," which in turn requires an evaluation of the impacts of a 1,000 year rainfall event. The Inflow Flood Control Plan – Revision 2, which is a separate document developed to comply with §257.82, shows that the precipitation from this event will drain through the culverts without overtopping the embankments of the impoundment. The freeboard at peak flow will be approximately 8 inches.

3.2.6 Hydraulic Structures - §257.73(d)(1)(vi)

The discharge structures from the BGS Main Ash Pond are comprised of two 15-inch diameter corrugated metal culverts with identical invert elevation under the generating plant entrance road. On April 22, 2021, the pipes were inspected using remote camera video inspection. The inspection showed that there was minimal deterioration, deformation, distortion, sedimentation, debris, and no bedding deficiencies were observed.

3.2.7 Sudden Drawdown - §257.73(d)(1)(vii)

The south embankment of the BGS Main Ash Pond is subject to the rise and fall of flood water from the Mississippi River as high as the crest of the embankment. These water elevations have occurred during major floods of the Mississippi River at least four times since construction of the impoundment[1] and many smaller river floods have created sudden drawdown conditions on the embankment.

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[1] Records of the United States Army Corps of Engineers for Pool 19 of Mississippi River.

The embankments and the subsurface are both soft to medium stiff low plasticity clay and there no rapid drawdown impacts to the embankment outer slopes.

3.3 BGS Economizer Pond

The BGS Economizer Pond is constructed on top of the southern part of the BGS Upper Ash Pond. It was constructed by raising the clay embankment of the BGS Upper Ash Pond on the south and east sides of the impoundment and by building a clay embankment on top of the CCR in the BGS Upper Ash Pond on the west side and the western end of the north side of the impoundment. On the eastern end of the north side of the impoundment, the embankment on top of the CCR in the BGS Upper Ash Pond is constructed entirely of CCR.

The BGS Economizer Pond has received both economizer ash and fly ash, but is presently used only for settling and recovery of economizer ash. The impoundment is actually a piled CCR embankment with surface water only on the southern edge of the impoundment where there is a clay embankment. The northern slope of the embankment has a toe that sits on CCR in the BGS Upper Ash Pond and was regraded in 2011 to have a lessor slope of 5 horizontal to 1 vertical to limit the effects of poor embankment foundation soils.

Soil borings, penetration tests and laboratory tests on the impoundment embankments or slopes are shown in Appendices B, C and D. The boring locations are shown on Figure 3. The results indicate clay embankments and native clays that are classified as soft to medium stiff low plasticity clay (CL) and CCR with friction angles from 30 to 34 degrees. The CCR is very loose to medium dense cohesionless soil. The layer density varies in the unsaturated parts of the embankment (likely from cementation). The bottom ten feet of the CCR is saturated by the water in the BGS Upper Ash Pond and is very loose to loose.

3.3.1 CCR Unit Foundation and Abutments - §257.73(d)(1)(i)

The saturated very loose CCR in the north embankment of the BGS Upper Ash Pond is potentially an unstable foundation under earthquake loading conditions. The native clay soils are a stable foundation where present. The analysis completed in the Safety Factor Assessment Report – Revision 1, §257.73(b), indicates that the foundation soils would likely liquefy during the design earthquake with a 2,500-year return period.

In the event of liquefaction, the foundation soils would allow the embankment to slump and spread north into the BGS Upper Ash Pond during the strong motion part of the earthquake that would last approximately 30 seconds. At the end of the shaking, the residual strength of the foundation would be adequate to arrest further movement. Since the only water in the impoundment is far south of the slope, the release of water across the slope to the north instead of through the designed discharge at the west end of the impoundment is unlikely.

3.3.2 Slope Protection - §257.73(d)(1)(ii)

The economizer embankment is approximately 13 feet above the surrounding grade. The side slopes are vegetated and vary from 2:1 to 5:1. Well established and managed vegetation will minimize erosion on both the upstream and downstream slopes. Additionally, the storm water runoff is limited to the crest and downstream slope of the embankment, which limits the erosive force. Therefore the impoundment configuration protects against surface erosion.

The economizer embankment is located where the embankments will likely not be inundated by water which eliminates the potential for wave erosion.

Sudden drawdown is addressed in Section 3.3.7.

3.3.3 CCR Embankment Density- §257.73(d)(1)(iii)

The constructed clay embankments are soft to medium stiff low plasticity clay and have adequate strength to contain the CCR contents. The dry parts of the embankment constructed of CCR is loose to medium dense and cemented in certain layers. It will not move unless the foundation layers below the water table displace as described in 3.3.1. The strength of the embankments is acceptable as shown in the Safety Factor Assessment Report – Revision 1.

3.3.4 Vegetation Management - §257.73(d)(1)(iv)

Historically vegetation management has been conducted on a periodic basis. At the time of the Annual Inspection on May 18, 2021, the upstream and downstream slopes of were properly inspected and consisted of managed grass vegetation. The facility plans to continue properly manage the grassy vegetation on the embankments.

3.3.5 Spillway Management - §257.73(d)(1)(v)

The impoundment receives approximately 1.5 cfs of process water flow from the BGS and storm water from the BGS plant site. Both sources of water are pumped to the top of the embankment. The pumped storm water is limited by the capacity of the pumps and if the water is not lifted to the embankment it will accumulate on the plant site and under emergency conditions will surface drain to the east end of the BGS Upper Ash Pond.

The process water that is pumped to the top of the embankment passes through a small settling impoundment to remove the economizer ash and then by an open channel to an 18 -inch diameter HDPE discharge pipe at the west end of the embankment. Storm water is discharged directly to the open channel and passes through the same discharge pipe. During storms where both storm water pumps are running, the primary discharge pipe flows full and a 12-foot-wide, rock filled, emergency spillway transports the remaining discharge. The HDPE pipe and emergency spillway are constructed of non-erodible materials and designed to carry sustained flows.

This impoundment currently has a hazard potential classification of "Significant," which in turn requires an evaluation of the impacts of a 1,000-year rainfall event of 10.3 inches. The Inflow Flood Control Plan – Revision 2, which is a separate document developed to comply with §257.82, shows that the 1,000-year event would cause both the HDPE pipe and emergency spillway to flow for a duration of approximately 1 hour.

The pipes are checked for malfunction (e.g., blockages, deformations) during the weekly inspections by the facility personnel.

3.3.6 Hydraulic Structures - §257.73(d)(1)(vi)

The discharge structures from the BGS Economizer Pond are comprised of two 18-inch HDPE pipes and one 12-inch steel pipe. On April 22, 2021, the pipes were inspected using remote camera video inspection. The inspection showed that there was minimal deterioration, deformation, distortion, sedimentation, debris, and no bedding deficiencies were observed.

3.3.7 Sudden Drawdown - §257.73(d)(1)(vii)

The BGS Economizer Pond is not subject to flood rise and fall on the toe of the embankment. The only variation is the change in ground water elevation in the embankment as the BGS Upper Ash Pond rises from its normal operation elevation of 528 to 530.5 feet during flood flow conditions. Therefore the outer embankments slopes are not subject to rapid drawdown conditions.

3.4 BGS Upper Ash Pond

The BGS Upper Ash Pond was constructed of imported clay embankment placed over natural clay and sand deposited by the Mississippi River. Test borings locations on the BGS Upper Ash Pond are shown on Figure 3. The boring results and laboratory test results are presented in Appendices B, C, and D.

The embankment soil is a low plasticity clay (CL) of medium stiff consistency. The native clay under the embankment is soft and the sand below the clay is medium dense.

Water enters the impoundment in the southwest corner and exits at an overflow flume at the northeast corner. The flume discharges into a manhole with a 15-inch diameter PVC discharge pipe which carries the water to the Lower Pond. The impoundment also contains a 14-inch diameter steel secondary overflow pipe that has a manual valve at the discharge end of the pipe.

3.4.1 CCR Unit Foundation and Abutments - §257.73(d)(1)(i)

The foundation soils are clays and sands deposited by the Mississippi River. The clay and sand strength are adequate to support the embankment, as discussed in the Safety Factor Assessment – Revision 1.

3.4.2 Slope Protection - §257.73(d)(1)(ii)

Both the upstream and downstream slopes of the embankment and the crest are covered with gravel and rip-rap to allow overtopping of the embankment by flood waters of the Mississippi River. The crest elevation of 531 feet on the embankment creates overtopping whenever the Mississippi River flood elevation exceeds the 25 year return event. Additionally, storm water runoff is limited to the crest and downstream slope of the embankment, which limits the erosive force. Therefore, the impoundment configuration protects against surface erosion, while the riprap on either slope protects against erosion from wave action.

Sudden drawdown is addressed in Section 3.4.7.

3.4.3 CCR Embankment Density- §257.73(d)(1)(iii)

The clay embankment is medium stiff clay and is stronger than the foundation soils. The strength of the embankments is acceptable as shown in the Safety Factor Assessment Report – Revision 1.

3.4.4 Vegetation Management - §257.73(d)(1)(iv)

Vegetation management is not required on the north embankment of the impoundment as the upstream and downstream slopes of the embankment are covered with gravel and riprap. At the time of the Annual Inspection on May 18, 2021, the upstream and downstream slopes of the south end of the west embankment were properly inspected and consisted of managed grass vegetation. The facility plans to continue properly manage the grassy vegetation on the embankments.

3.4.5 Spillway Management - §257.73(d)(1)(v)

The BGS Upper Pond discharge structure is equipped with a 24-inch wide precast concrete Parshall flume that discharges into a concrete catch basin. The water in the catch basin flows through a 15-inch diameter polyvinyl chloride pipe and discharges into the BGS Lower Pond. The pipes are constructed of non-erodible materials and designed to carry sustained flows.

The pipes are checked for malfunction (e.g., blockages, deformations) during the weekly inspections by the facility personnel.

This impoundment currently has a hazard potential classification of "Significant," which in turn requires an evaluation of the impacts of a 1,000 year rainfall event. The Inflow Flood Control Plan – Revision 2, which is a separate document developed to comply with §257.82, shows that the precipitation from this event will drain through the Parshall flume without overtopping the embankments of the impoundment. The freeboard at peak flow will be approximately 9 inches. The Inflow Flood Control Plan – Revision 2 indicates a peak flow of 9.2 cfs with a storage of 30-acre feet during the flood.

3.4.6 Hydraulic Structures - §257.73(d)(1)(vi)

The discharge structure from the BGS Upper Ash Pond is comprised of one 15-inch PVC pipes and one 14-inch emergency overflow pipe. On April 22, 2021, the pipes were inspected using remote camera video inspection. The inspection showed that there was minimal deterioration, deformation, distortion, sedimentation, debris, and no bedding deficiencies were observed.

3.4.7 Sudden Drawdown - §257.73(d)(1)(vii)

The embankment and its foundation is constructed of clay and is not subject to rapid drawdown impacts on the outside toe. The embankment is flooded at the toe on numerous occasions each year without detrimental effect.

4 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

To meet the requirements of 40 CFR 257.73(d)(3), I Mark W. Loerop hereby certify that I am a licensed professional engineer in the State of Iowa; and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in 40 CFR 257.73(b) and 40 CFR 257.73(d).

MARK W. LOEROP
22197

By:

Name: MARK LOEROP

Date: JUNE 21, 2021

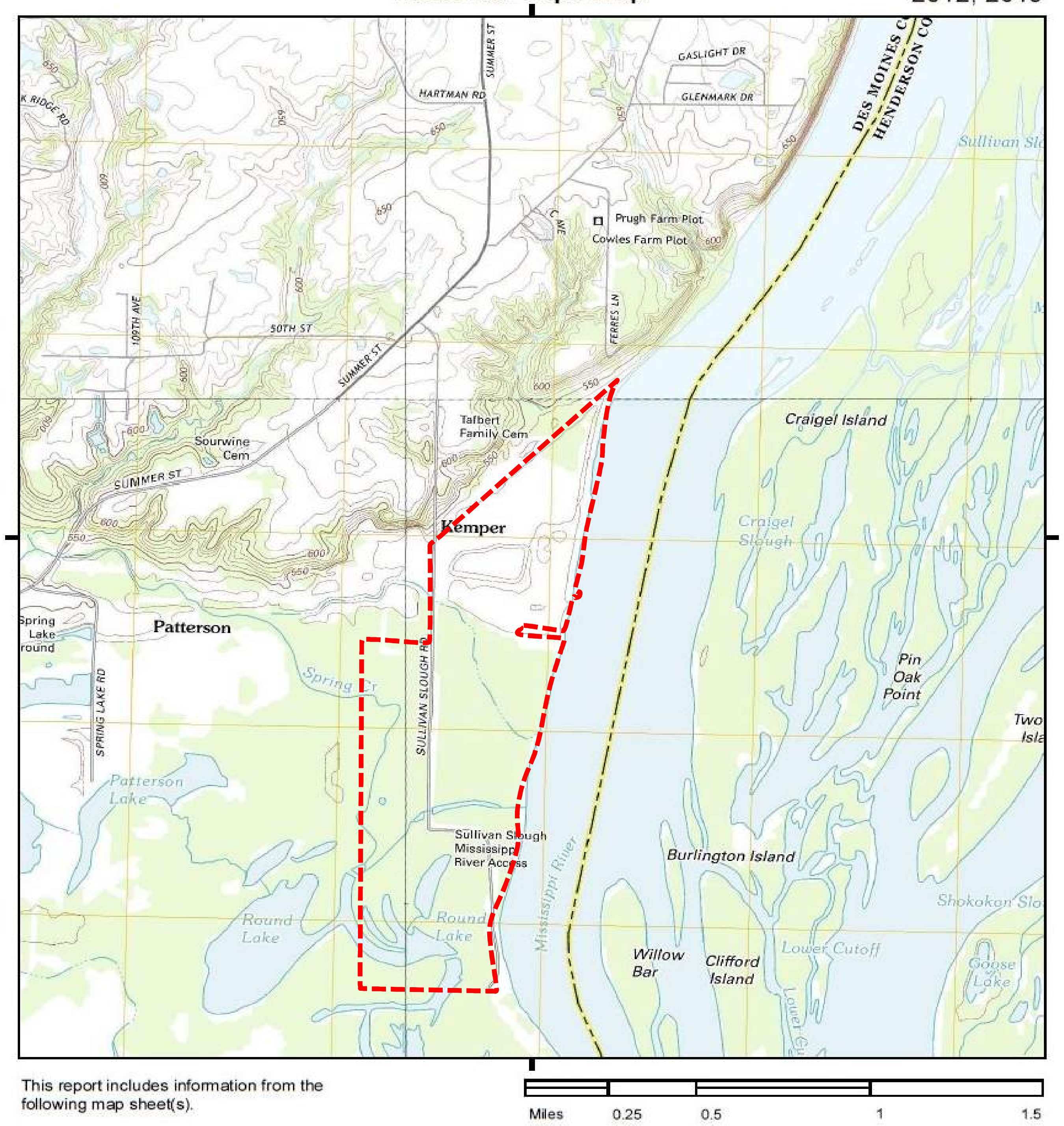
FIGURES

Alliant Energy
Interstate Power and Light Company
Burlington Generating Station
Burlington, Iowa

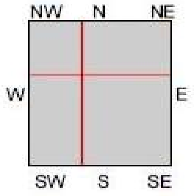
Structural Stability Assessment

Historical Topo Map

2012, 2013



This report includes information from the following map sheet(s).



TP, Lomax, 2012, 7.5-minute

NE, Burlington, 2013, 7.5-minute

SW, Dallas City, 2012, 7.5-minute

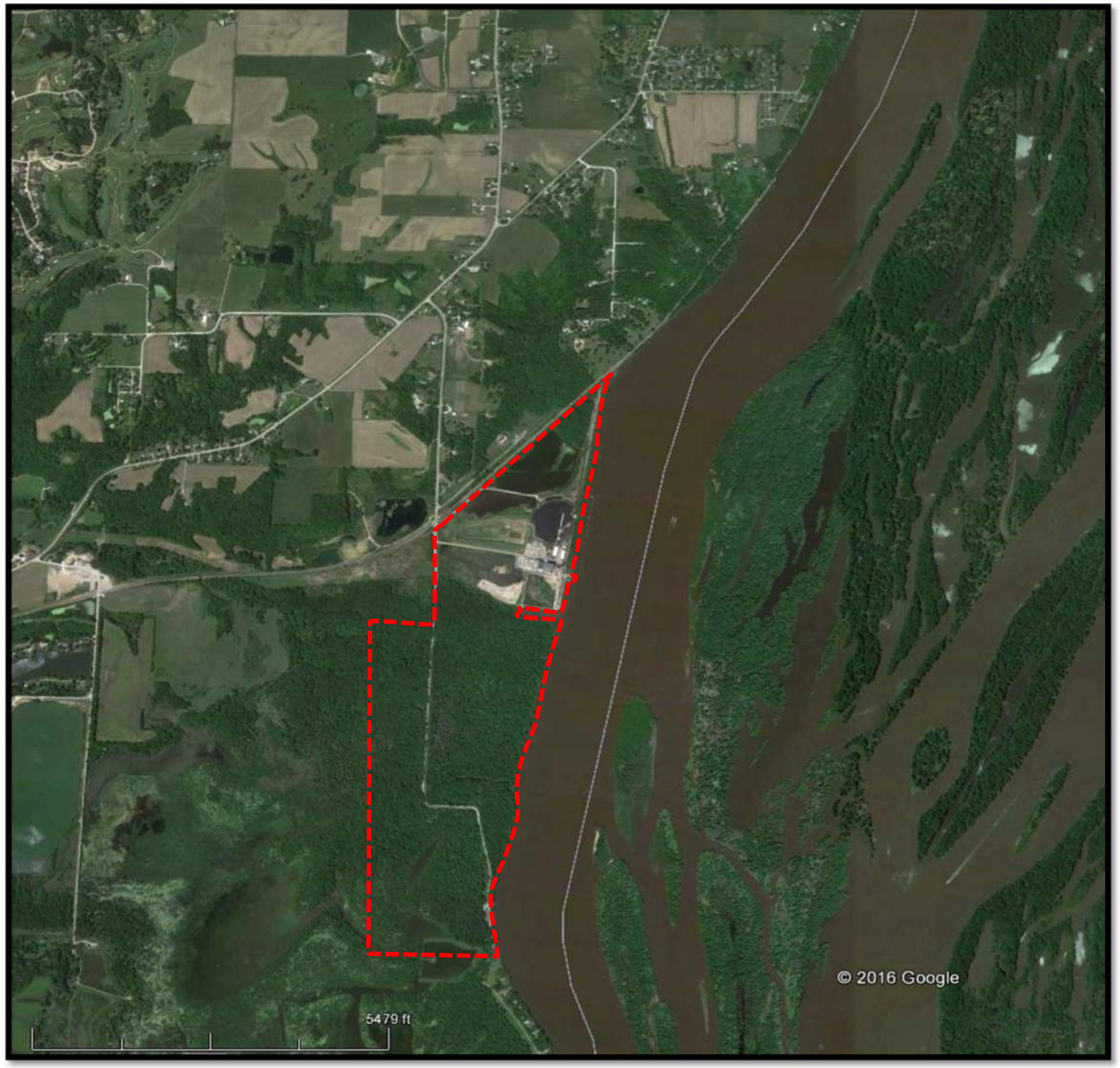
NW, West Burlington, 2013, 7.5-minute

SITE NAME: Burlington Generating Station
ADDRESS: 4282 Sullivan Slough Road
Burlington, IA 52601
CLIENT: Environmental Site Assessors

N

4555570 - 3 page 4

Historical Aerial Photo 6/12/2014

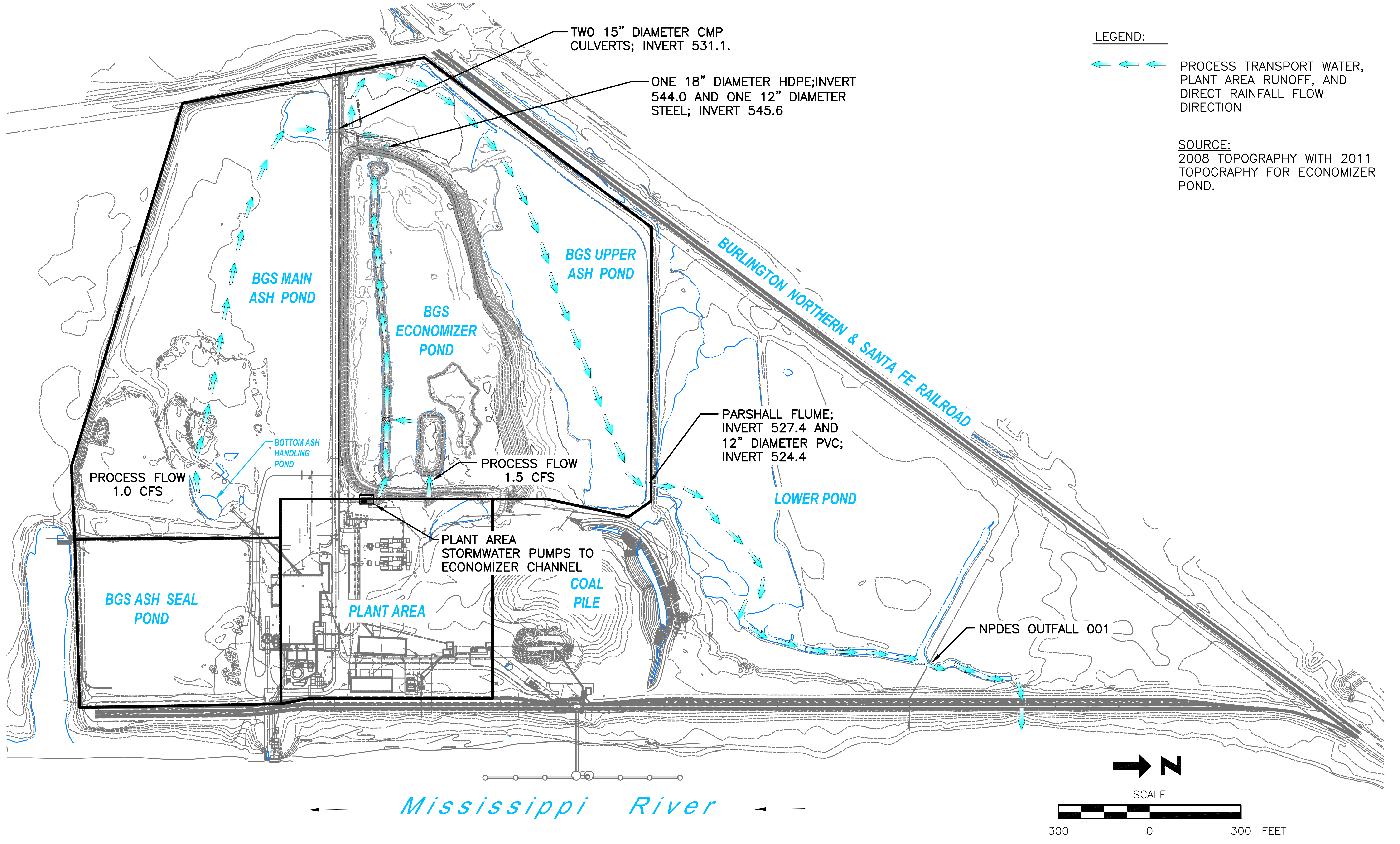


Approximate Property Boundary

HARD HAT SERVICES™
Engineering, Construction and Management Solutions

Site Location
Burlington Generating Station
Intersate Power and Light Company

Drawing
Figure 1
Date
5/25/2016



LEGEND:

⇦ ⇦ ⇦ PROCESS TRANSPORT WATER, PLANT AREA RUNOFF, AND DIRECT RAINFALL FLOW DIRECTION

SOURCE:
2008 TOPOGRAPHY WITH 2011 TOPOGRAPHY FOR ECONOMIZER POND.

NOTICE
THIS DRAWING IS THE PROPERTY OF HARD HAT SERVICES AND IS NOT TO BE REPRODUCED, CHANGED, OR COPIED IN ANY FORM OR MANNER WITHOUT PRIOR WRITTEN PERMISSION. ALL RIGHTS RESERVED.

REV	DATE	BY	DESCRIPTION
5			
4			
3			
2			
1			

SCALE: AS SHOWN
DATE: 5-13-16
DRAWN BY: JFD
CHECKED BY: TJH
APPROVED BY: MWL

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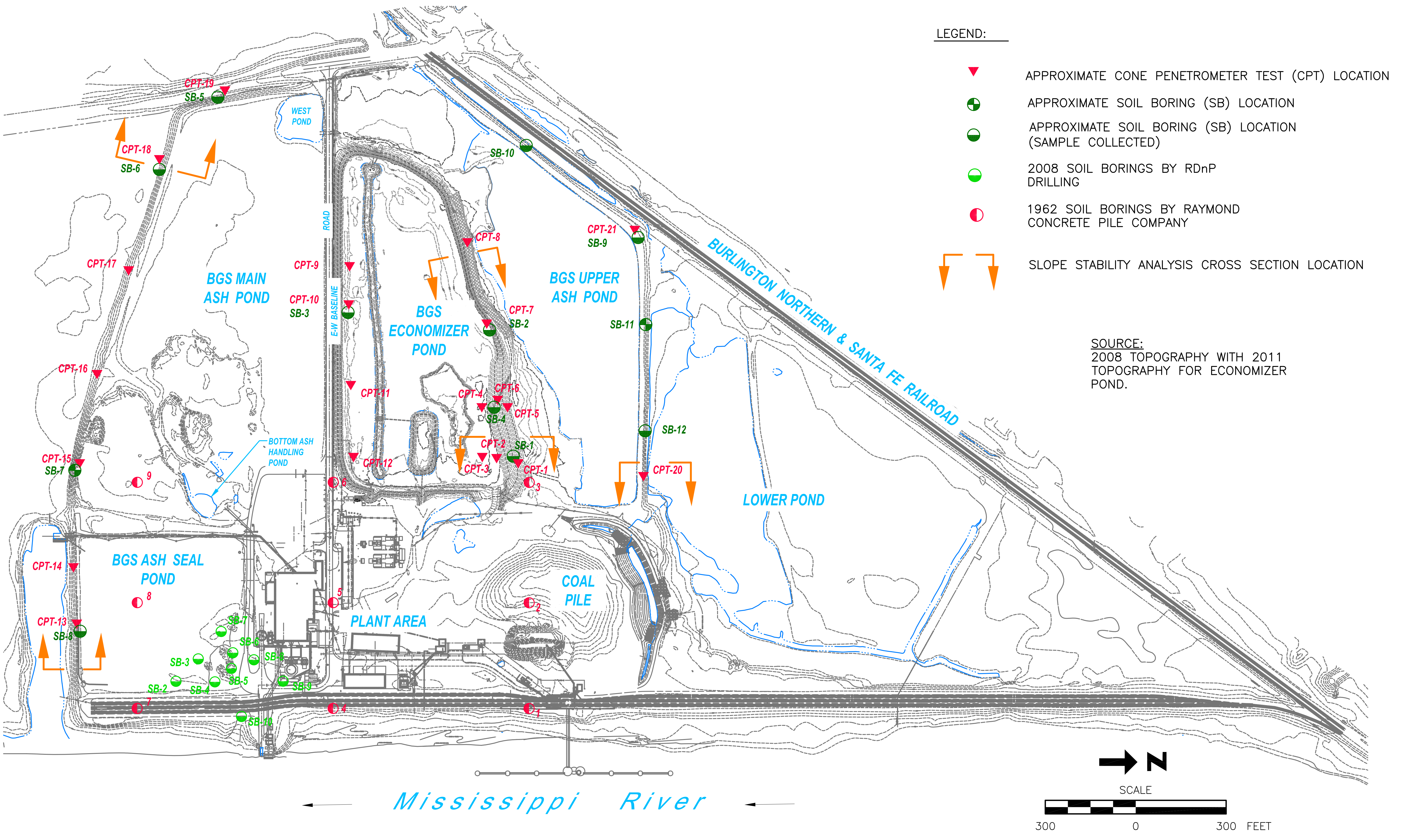
Engineering, Construction and Management Solutions

CLIENT / LOCATION
ALLIANT ENERGY
BURLINGTON GENERATING STATION
BURLINGTON, IOWA

DRAWING DESCRIPTION
Structural Stability Analysis
SITE PLAN

JOB 154.018.012.001
SHT. FIGURE 1
DWG. 154.018.012.001-D1



LEGEND:

- ▼ APPROXIMATE CONE PENETROMETER TEST (CPT) LOCATION
- ⊕ APPROXIMATE SOIL BORING (SB) LOCATION
- ◒ APPROXIMATE SOIL BORING (SB) LOCATION (SAMPLE COLLECTED)
- ◒ 2008 SOIL BORINGS BY RDnP DRILLING
- ◐ 1962 SOIL BORINGS BY RAYMOND CONCRETE PILE COMPANY
- ⌐ ¬ SLOPE STABILITY ANALYSIS CROSS SECTION LOCATION

SOURCE:
2008 TOPOGRAPHY WITH 2011 TOPOGRAPHY FOR ECONOMIZER POND.

NOTICE
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REV	DATE	BY	DESCRIPTION
5			
4			
3			
2			
1			

SCALE: AS SHOWN
DATE: 5-13-16
DRAWN BY: JFD
CHECKED BY: TJH
APPROVED BY: MWL

HARD HAT SERVICES™
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CLIENT / LOCATION
ALLIANT ENERGY
BURLINGTON GENERATING STATION
BURLINGTON, IOWA

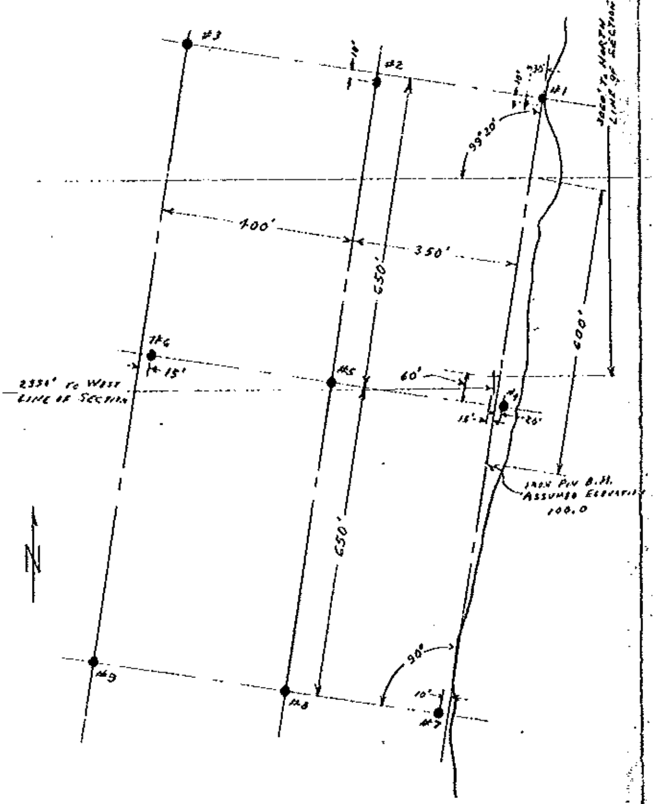
DRAWING DESCRIPTION
SOIL BORINGS, CPT, AND
SLOPE STABILITY CROSS SECTION LOCATIONS

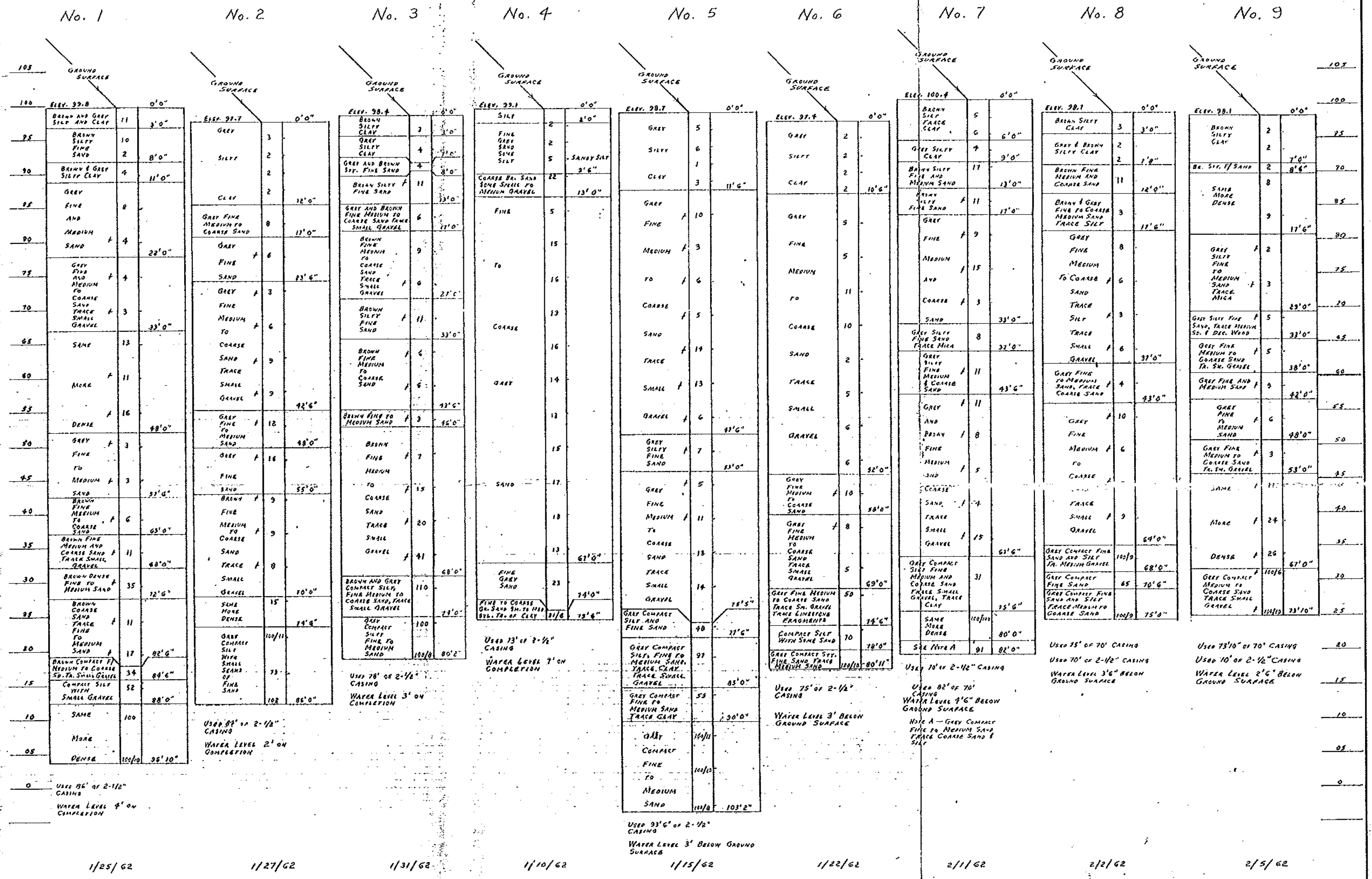
JOB 154.018.012.001
SHT. FIGURE 2
DWG. 154.018.012.001-D2

APPENDIX A – Deep Soil Borings

Alliant Energy
Interstate Power and Light Company
Burlington Generating Station
Burlington, Iowa

Structural Stability Assessment





Figures in Right Hand Column Shown as Fractions — Numerator = No. of Blows / Denominator = Penetration in Inches

ƒ Indicates Wash Sample Recovered

Classifications are made by visual inspection. Figures in right hand column indicate number of blows required to drive 2" O.D. sampling pipe one foot, using 140-lb. weight falling 30 inches.

References:
See D-467 For Boring Locations.
Test Boring Report - February 13, 1962, By Raymond Concrete Pile Company, Gow Division, Job No. CB-948-KC Sheets 1 through 4

IOWA SOUTHERN UTILITIES CO.
CENTERVILLE, IOWA

Proposed Burlington Plant Site
Test Boring Reports

SCALE 1"=8' Vertical	DATE 3-15-62
SKETCH OHN DWN	TRCD LLA CHKD
D-484	APPROVED

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BORING LOG

PROJECT No. 154.002.008.001
BORING No. **BH-2**
LOGGED BY LES
PAGE No. 1 of 2

PROJECT NAME Alliant Energy - December 2008 Baghouse Geotechnical Investigation
BORING LOCATION Burlington, Iowa
SURFACE ELEVATION 534.13
DRILLER RDnP Drilling - Kris Norwick
DATE: START 12/11/2008 FINISH 12/12/2008

DEPTH	SAMPLE			BLOW COUNT				REC	WC	qu	CONTACT DEPTH	ELEV. (MSL)	USCS SOIL TYPE	SOIL DESCRIPTION
		INTERVAL (ft)		0"	6"	12"	18"	(in)	(%)	(TSF)				
	No.	FROM	TO	6"	12"	18"	24"							
														Frozen ground
	SS-1	2.0	4.0	2	3	4	4	14.0		0.75			CL	Black and brown mottled SILTY CLAY, little fine to medium sand, medium plasticity, medium stiff, wet
5	SS-2	4.0	6.0	1	6	5	3	17.0			4'3"	529.88		Grey SILT, trace fine sand, medium dense, moist
	SS-3	6.0	8.0	1	8	15	7	17.5						medium dense
	SS-4	8.0	10.0	1	6	50/5		18.0					ML	very dense
10														
	SS-5	13.0	15.0	1	1	1	1	13.0	49	0.75	13'5"	520.71		
15														Dark brown and black mottled CLAY, trace silt, high plasticity, medium stiff, wet
	SS-6	18.0	20.0	2	2	3	3	15.0	48	0.25 0.50			CH	soft (LL=52, PI=27)
20														
	SS-7	23.0	25.0	4	5	7	12	20.0			23'6"	510.63		Brown fine to medium SAND, medium dense, wet
25														
	SS-8	28.0	30.0	3	12	17	18	9.0						brownish-grey
30														
	SS-9	33.0	35.0	8	10	11	12	11.5					SP	
35														
	SS-10	38.0	40.0	7	7	10	12	10.0						some coarse sand and wood pieces
40														

Drilled with Dietrich-120
Method: auger and mud rotary
Hole was backfilled with bentonite slurry

BH-2.XLS

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BORING LOG

PROJECT No. 154.002.008.001
BORING No. **BH-2**
LOGGED BY LES
PAGE No. 2 of 2

PROJECT NAME Alliant Energy - December 2008 Baghouse Geotechnical Investigation
BORING LOCATION Burlington, Iowa
SURFACE ELEVATION 534.13
DRILLER RDnP Drilling - Kris Norwick
DATE: START 12/11/2008 FINISH 12/12/2008

DEPTH	SAMPLE No.	INTERVAL (ft) FROM	INTERVAL (ft) TO	BLOW COUNT 0" 6"	BLOW COUNT 6" 12"	BLOW COUNT 12" 18"	BLOW COUNT 18" 24"	REC (in)	WC (%)	qu (TSF)	CONTACT DEPTH	ELEV. (MSL)	USCS SOIL TYPE	SOIL DESCRIPTION
														Brownish-grey fine to medium sand, some coarse sand, medium dense, wet (cont.)
	SS-11	43.0	45.0	3	6	12	14	15.5					SP	2" of black silt at 44'1"
45														
											46'6"	487.63		Brownish-grey fine to coarse SAND, medium dense, wet
	SS-12	48.0	50.0	6	7	8	12	16.0						
50														
	SS-13	53.0	55.0	10	11	12	19	21.0					SW	
55														
	SS-14	58.0	60.0	15	22	32	42	24.0						medium to coarse sand, trace fine sand and fine gravel, very dense
60											60'	474.13		EOB 60' - Sand was causing hole to collapse and would have needed to be cased to 60' to continue.
65														
70														
75														
80														

Drilled with Dietrich-120
Method: auger and mud rotary
Hole was backfilled with bentonite slurry

BH-2.XLS

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BORING LOG

PROJECT No. 154.002.008.001
BORING No. BH-B-1 **(BH-3)**
LOGGED BY LES
PAGE No. 1 of 2

PROJECT NAME Alliant Energy - Baghouse Geotechnical Investigation
BORING LOCATION Burlington, Iowa
DRILLER RDnP Drilling - Chris
DATE: START 7/15/2008 FINISH 7/21/2008

DEPTH	SAMPLE No.	INTERVAL FROM	INTERVAL TO	BLOW COUNT 0"-6"	BLOW COUNT 6"-12"	BLOW COUNT 12"-18"	BLOW COUNT 18"-24"	REC (in)	WC (%)	qu (TSF)	CONTACT DEPTH	USCS SOIL TYPE	SOIL DESCRIPTION
	SS-1	0.0	2.0	5	10	10	12	12	23				Brown and black silty clay FILL, medium dense, dry
	SS-2	2.0	4.0	10	11	11	15	9.5		2.0			Coarse sand and fine gravel FILL, trace grey fines, medium dense, dry
5	SS-3	4.0	6.0	5	10	2	2	10	14	4.0		FILL	some silt
	SS-4	6.0	8.0	1	10	16	12	22		6.0			Grey-black sand and gravel FILL with silt, medium dense wet.
	SS-5	8.0	10.0	6	10	22	32	24	24		10.0		
10	SS-6	10.0	12.0	3	8	3	2	14					Grey sandy SILT, trace coarse sand, loose, saturated
	SS-7	12.0	14.0	1	0	1	0	18	50				Grey SILT, little fine sand, very loose, saturated
15	SS-8	14.0	16.0	Rod Weight				17				ML	
20	SS-9	18.0	20.0	1	1	1	1	16	33				trace low plasticity clay, trace fine sand
											22'6"		
													Dark grey SILTY CLAY, trace fine sand, medium to high plasticity, soft, wet
25	SS-10	23.0	25.0	1	2	2	1	18				CL	
											26.5		
													Grey fine to medium grained SAND, trace coarse sand, very loose, saturated
30	SS-11	28.0	30.0	1	0	0	0	3	18				
35	SS-12	33.0	35.0	5	8	12	14	11				SP	medium dense
40	SS-13	38.0	40.0	8	10	11	12	11	13				

Drilled with Dietrich-120
Method: auger and mud rotary
Hole was backfilled with bentonite slurry

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BORING LOG

PROJECT No. 154.002.008.001
BORING No. BH-B-1 **(BH-3)**
LOGGED BY LES
PAGE No. 2 of 2

PROJECT NAME Alliant Energy - Baghouse Geotechnical Investigation
BORING LOCATION Burlington, Iowa
DRILLER RDnP Drilling - Chris
DATE: START 7/15/2008 FINISH 7/21/2008

DEPTH	SAMPLE No.	INTERVAL FROM	INTERVAL TO	BLOW COUNT 0"-6"	BLOW COUNT 6"-12"	BLOW COUNT 12"-18"	BLOW COUNT 18"-24"	REC (in)	WC (%)	qu (TSF)	CONTACT DEPTH	USCS SOIL TYPE	SOIL DESCRIPTION
												SP	Grey fine to medium SAND, trace coarse sand, medium dense, saturated
45	SS-14	43.0	45.0	5	10	14	22	11					
50	SS-15	48.0	50.0	9	14	16	16	12	15				
55	SS-16	53.0	55.0	8	12	14	15	11					
60	SS-17	58.0	60.0	10	11	18	24	10	13				several pieces of coarse grained gravel at 58.5'
65	SS-18	63.0	65.0	15	24	26	36	10					dense
											66.5	SW	Grey fine to coarse SAND and fine grained gravel, very dense, saturated
70	SS-19	68.0	70.0	32	32	38		12	9				
75	SS-20	73.0	75.0	32	75/3			4					
											76.5	GP	Fine GRAVEL with fine to coarse sand, very dense, saturated
80	SS-21	78.0	80.0	50	100/3			4	8		79.5		Spoon bounced at 79.5'
													EOB at 80'

Drilled with Dietrich-120
Method: auger and mud rotary
Hole was backfilled with bentonite slurry

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BORING LOG

PROJECT No. 154.002.008.001
BORING No. **BH-4**
LOGGED BY LES
PAGE No. 1 of 2

PROJECT NAME Alliant Energy - December 2008 Baghouse Geotechnical Investigation
BORING LOCATION Burlington, Iowa
SURFACE ELEVATION 534.43
DRILLER RDnP Drilling - Kris Norwick
DATE: START 12/2/2008 FINISH 12/3/2008

DEPTH	SAMPLE			BLOW COUNTS				REC	WC	qu	CONTACT DEPTH	ELEV. (MSL)	USCS SOIL TYPE	SOIL DESCRIPTION
	No.	INTERVAL (ft) FROM	TO	0" 6"	6" 12"	12" 18"	18" 24"	(in)	(%)	(TSF)				
														Frozen ground
	SS-1	2.0	4.0	3	4	5	15	16.0					FILL	Black and brown silty clay FILL, some fine sand, dry
5	SS-2	4.0	6.0	9	8	11	12	17.0						Black and brown fine to coarse sand and fine gravel FILL, trace fines, wet
	SS-3	6.0	8.0	10	5	12	15	20.0			6'6"	527.93		Grey SILT, little fine sand, medium dense, saturated
	SS-4	8.0	10.0	2	2	3	20	24.0					ML	loose 4" fine sand seam at 9'6"
10											11'6"	522.93		Grey SILTY-CLAY, trace fine sand, medium plasticity, soft, moist to wet
	SS-5	13.0	15.0	2	2	3	4	14.0	50	2.00				
15													CL	
	SS-6	18.0	20.0	7	9	8	11	15.0			18'4"	516.10		Grey-brown fine to coarse SAND, medium dense, wet
20														
	SS-7	23.0	25.0	10	11	15	15	12.0	18					
25													SP	
	SS-8	28.0	30.0	6	10	12	14	11.0						
30														trace fine gravel
	SS-9	33.0	35.0	6	7	9	11	11.0	19					
35											36'6"	497.93	SW	Brown fine to coarse SAND, little fine gravel, trace silt, medium dense, wet
	SS-10	38.0	40.0	7	9	7	10	10.0						
40														

Drilled with Dietrich-120
Method: auger and mud rotary
Hole was backfilled with bentonite slurry

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BORING LOG

PROJECT No. 154.002.008.001
BORING No. **BH-4**
LOGGED BY LES
PAGE No. 2 of 2

PROJECT NAME Alliant Energy - December 2008 Baghouse Geotechnical Investigation
BORING LOCATION Burlington, Iowa
SURFACE ELEVATION 534.43
DRILLER RDnP Drilling - Kris Norwick
DATE: START 12/2/2008 FINISH 12/3/2008

DEPTH	SAMPLE No.	INTERVAL (ft) FROM	INTERVAL (ft) TO	BLOW COUNT 0"-6"	BLOW COUNT 6"-12"	BLOW COUNT 12"-18"	BLOW COUNT 18"-24"	REC (in)	WC (%)	qu (TSF)	CONTACT DEPTH	ELEV. (MSL)	USCS SOIL TYPE	SOIL DESCRIPTION
														(cont.) Brown fine to coarse SAND, little fine gravel, medium dense, wet
	SS-11	43.0	45.0	5	6	6	8	11.0	14					
45														
	SS-12	48.0	50.0	12	12	16	19	10.0						
50														
	SS-13	53.0	55.0	8	9	11	14	12.0	13				SW	
55														
	SS-14	58.0	60.0	10	8	10	13	12.0						
60														
	SS-15	63.0	65.0	18	21	32	50/5	16.0	11					very dense
65														
											64'6"	469.93		Grey silty CLAY, trace fine sand, medium plasticity, hard, wet
	SS-16	68.0	70.0	21	32	42	44	24.0		+4.5			CL	
70														
	SS-17	73.0	75.0	10	17	22	23	20.0	25					
75											75'	459.43		EOB 75'
80														

Drilled with Dietrich-120
Method: auger and mud rotary
Hole was backfilled with bentonite slurry

BH-4.XLS

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BORING LOG

PROJECT No. 154.002.008.001
BORING No. **BH-5**
LOGGED BY LES
PAGE No. 1 of 2

PROJECT NAME Alliant Energy - December 2008 Baghouse Geotechnical Investigation
BORING LOCATION Burlington, Iowa
SURFACE ELEVATION 534.71
DRILLER RDnP Drilling - Kris Norwick
DATE: START 12/4/2008 FINISH 12/5/2008

DEPTH	SAMPLE			BLOW COUNT				REC	WC	qu	CONTACT DEPTH	ELEV. (MSL)	USCS SOIL TYPE	SOIL DESCRIPTION
		INTERVAL (ft)		0"	6"	12"	18"	(in)	(%)	(TSF)				
	No.	FROM	TO	6"	12"	18"	24"							
														Frozen ground
	SS-1	2.0	4.0	15	19	22	23	12.0						Black and brown sand and gravel FILL, some fines, wet
5	SS-2	4.0	6.0	10	19	34	50/3	16.0					FILL	
	SS-3	6.0	8.0	32	32	22	8	18.0						Brown-grey silt with sand FILL
	SS-4	8.0	10.0	9	12	23	14	20.0						6" brown-red fine to coarse sand FILL
10	SS-5	10.0	12.0	1	2	4	1	24.0			10'	524.71	ML	Grey SILT, little fine sand, loose, wet
	SS-6	13.0	15.0	1	1	2	3	21.0	36		13'	521.71		Mottled green, black, and light grey SILTY CLAY, little fine sand, trace silt and wood pieces, medium stiff, wet
15														
	SS-7	18.0	20.0	2	2	3	3	13.0	34	1.00			CL	
20														
	SS-8	23.0	25.0	5	7	7	9	14.5			23'2"	511.54		Black and brown fine to medium SAND, trace coarse sand, medium dense, wet 23'7" grey
25														
	SS-9	28.0	30.0	3	4	6	7	13.0	19					
30														
	SS-10	33.0	35.0	7	7	9	11	12.0					SP	
35														
	SS-11	38.0	40.0	7	10	11	14	14.0	22					5" fine sand seam 2" coarse sand and fine gravel seam
40														

Drilled with Dietrich -120
Method: auger and mud rotary
Hole was backfilled with bentonite slurry

BH-5.XLS

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BORING LOG

PROJECT No. 154.002.008.001
BORING No. **BH-5**
LOGGED BY LES
PAGE No. 2 of 2

PROJECT NAME Alliant Energy - December 2008 Baghouse Geotechnical Investigation
BORING LOCATION Burlington, Iowa
SURFACE ELEVATION 534.71
DRILLER RDnP Drilling - Kris Norwick
DATE: START 12/4/2008 FINISH 12/5/2008

DEPTH	SAMPLE			BLOW COUNT				REC	WC	qu	CONTACT	ELEV.	USCS SOIL TYPE	SOIL DESCRIPTION
		INTERVAL (ft)		0"	6"	12"	18"	(in)	(%)	(TSF)	DEPTH	(MSL)		
	No.	FROM	TO	6"	12"	18"	24"							
														(cont.) Grey fine to medium SAND, trace coarse sand, wet
	SS-12	43.0	45.0	12	15	22	26	13.5						dense
45														
	SS-13	48.0	50.0	10	12	12	15	12	17				SP	medium dense
50														
	SS-14	53.0	55.0	5	15	21	15	13						dense, 53'6" - 1" gravel piece
55														
														medium dense
	SS-15	58.0	60.0	6	8	11	15	10	12		58'7"	476.13		Grey fine to coarse SAND, some fine gravel, very dense
60														
	SS-16	63.0	65.0	50/0				0					SW	
65														(rig was grinding heavily to get from 65' to 68')
	SS-17	68.0	70.0	50/4				4						
70											70'	464.71		EOB 70'
75														
80														

Drilled with Dietrich -120
Method: auger and mud rotary
Hole was backfilled with bentonite slurry

BH-5.XLS

HARD HAT SERVICES™
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BORING LOG

PROJECT No. 154.002.008.001
BORING No. **BH-6**
LOGGED BY LES
PAGE No. 1 of 2

PROJECT NAME Alliant Energy - December 2008 Baghouse Geotechnical Investigation
BORING LOCATION Burlington, Iowa
SURFACE ELEVATION 534.33
DRILLER RDnP Drilling - Kris Norwick
DATE: START 12/4/2008 FINISH 12/5/2008

DEPTH	SAMPLE			BLOW COUNT				REC	WC	qu	CONTACT DEPTH	ELEV. (MSL)	USCS SOIL TYPE	SOIL DESCRIPTION
		INTERVAL (ft)		0"	6"	12"	18"	(in)	(%)	(TSF)				
	No.	FROM	TO	6"	12"	18"	24"							
														Frozen ground
	SS-1	2.0	4.0	10	11	15	17	17.0						Brown silty sand FILL, trace medium sand, medium dense
5	SS-2	4.0	6.0	1	3	5	11	13.0					FILL	
	SS-3	6.0	8.0	50/5				7.5						(possibly gravel inhibiting sampling)
	SS-4	8.0	10.0	41	50/3			5.5						
10	SS-5	10.0	12.0	3	2	1	4	20.0	49		10'	524.33		Brownish-grey SILT, trace fine sand, very loose, saturated
	SS-6	13.0	15.0	3	4	4	5	24.0	53				ML	loose
15														
											16'6"	517.83		Brownish-grey SILTY CLAY, trace fine sand, soft, wet
	SS-7	18.0	20.0	1	1	1	2	17.0	49	0.50				
20													CL	
	SS-8	23.0	25.0	1	3	4	5	16.0			24'	510.33		Brown fine to medium SAND, trace coarse sand, medium dense, wet
25														
	SS-9	28.0	30.0	6	7	9	11	15.5	18					
30													SP	
	SS-10	33.0	35.0	10	11	14	14	12.0						
35														
											36'6"	497.83		Brown fine to coarse SAND, little fine gravel, medium dense, wet
	SS-11	38.0	40.0	6	8	9	12	12.5	9				SW	
40														

Drilled with Dietrich-120
Method: auger and mud rotary
Hole was backfilled with bentonite slurry

BH-6.XLS

HARD HAT SERVICES™
Engineering, Construction and Management Solutions

BORING LOG

PROJECT No. 154.002.008.001
BORING No. **BH-6**
LOGGED BY LES
PAGE No. 2 of 2

PROJECT NAME Alliant Energy - December 2008 Baghouse Geotechnical Investigation
BORING LOCATION Burlington, Iowa
SURFACE ELEVATION 534.33
DRILLER RDnP Drilling - Kris Norwick
DATE: START 12/4/2008 FINISH 12/5/2008

DEPTH	SAMPLE			BLOW COUNT				REC	WC	qu	CONTACT DEPTH	ELEV. (MSL)	USCS SOIL TYPE	SOIL DESCRIPTION
		INTERVAL (ft)		0"	6"	12"	18"	(in)	(%)	(TSF)				
	No.	FROM	TO	6"	12"	18"	24"							
													SW	Brown fine to coarse SAND, little fine gravel, medium dense, wet (cont.)
											42'6"	491.83		Brown fine to medium sand, trace fine sand, medium dense to dense, wet (cont.)
	SS-12	43.0	45.0	8	10	14	17	12.0						
45														
	SS-13	48.0	50.0	8	9	12	14	12.0	14					little coarse sand
50														
													SP	
	SS-14	53.0	55.0	10	17	17	15	12.5						
55														
	SS-15	58.0	60.0	10	12	14	14	10.0	14					
60														
											62' 6"	472.00		Grey SILTY CLAY, little fine to medium sand, medium plasticity, hard, wet 1" fine to medium sand seam at 63'6" 1" gravel piece at 6'8"
	SS-16	63.0	65.0	17	31	36	42	22.0	14	4.5+ 4.5+				
65													CL	
	SS-17	68.0	70.0	21	50/3			9.0		4.5+				
70											70'	464.33		EOB 70'
75														
80														

Drilled with Dietrich-120
Method: auger and mud rotary
Hole was backfilled with bentonite slurry

BH-6.XLS

HARD HAT SERVICES™
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BORING LOG

PROJECT No. 154.002.008.001
BORING No. **BH-7**
LOGGED BY LES
PAGE No. 1 of 2

PROJECT NAME Alliant Energy - December 2008 Baghouse Geotechnical Investigation
BORING LOCATION Burlington, Iowa
SURFACE ELEVATION 536.51
DRILLER RDnP Drilling - Kris Norwick
DATE: START 12/5/2008 FINISH 12/8/2008

DEPTH	SAMPLE No.	INTERVAL (ft) FROM	INTERVAL (ft) TO	BLOW COUNT 0" 6"	BLOW COUNT 6" 12"	BLOW COUNT 12" 18"	BLOW COUNT 18" 24"	REC (in)	WC (%)	qu (TSF)	CONTACT DEPTH	ELEV. (MSL)	USCS SOIL TYPE	SOIL DESCRIPTION
														Frozen ground
	SS-1	2.0	4.0	6	7	10	12	22.5		1.00			FILL	Black sand, gravel, and silt FILL 6" alternating brown and black fine sand and silt at 3'
5	SS-2	4.0	6.0	1	3	10	14	15.0		0.75				6"grey clay, medium stiff, moist at 4'
	SS-3	6.0	8.0	10	31	21	33	18.0			6'	530.51		Dark grey SILT, some fine sand, very dense, wet
	SS-4	8.0	10.0	15	21	18	15	17.0						
10	SS-5	10.0	12.0	10	22	32	44	21.0					ML	trace fine sand
	SS-6	13.0	15.0	3	4	1	5	23.0	67					loose
15														
											16'6"	520.01		Grey SILTY CLAY, trace fine sand, very soft, wet
	SS-7	18.0	20.0	1	2	1	2	24.0					CL	
20														
											23'6"	513.01		Grey fine to medium SAND with clay, loose, wet
	SS-8	23.0	25.0	1	2	4	12	16.0	19				SP-SC	
25														
											26'6"	510.01		Grey fine to medium SAND, medium dense, wet
	SS-9	28.0	30.0	2	5	8	8	18.0						
30														
	SS-10	33.0	35.0	8	14	16	15	12.0	17				SP	trace coarse sand
35														
	SS-11	38.0	40.0	8	14	10	8	12.0						medium dense
40														

Drilled with Dietrich-120
Method: auger and mud rotary
Hole was backfilled with bentonite slurry

BH-7.XLS

HARD HAT SERVICES™
Engineering, Construction and Management Solutions

BORING LOG

PROJECT No. 154.002.008.001
BORING No. **BH-7**
LOGGED BY LES
PAGE No. 2 of 2

PROJECT NAME Alliant Energy - December 2008 Baghouse Geotechnical Investigation
BORING LOCATION Burlington, Iowa
SURFACE ELEVATION 536.51
DRILLER RDnP Drilling - Kris Norwick
DATE: START 12/5/2008 FINISH 12/8/2008

DEPTH	SAMPLE			BLOW COUNT				REC	WC	qu	CONTACT DEPTH	ELEV. (MSL)	USCS SOIL TYPE	SOIL DESCRIPTION
		INTERVAL (ft)		0"	6"	12"	18"	(in)	(%)	(TSF)				
	No.	FROM	TO	6"	12"	18"	24"							
														Grey fine to medium SAND, trace coarse sand medium dense, wet
	SS-12	43.0	45.0	5	8	10	11	12.0	15					
45														
	SS-13	48.0	50.0	8	10	15	18	14.0					SP	
50														
	SS-14	53.0	55.0	10	12	15	16	10.0	15					
55														
											56'6"	480.01		Brown fine to coarse SAND, trace fine gravel, medium dense, wet
	SS-15	58.0	60.0	8	11	15	17	24.0						
60													SW	
														very dense
	SS-16	63.0	65.0	18	23	50/4		10.0	7					
65											65'	471.51		EOB 65'
70														
75														
80														

Drilled with Dietrich-120
Method: auger and mud rotary
Hole was backfilled with bentonite slurry

BH-7.XLS

HARD HAT SERVICES™
Engineering, Construction and Management Solutions

BORING LOG

PROJECT No. 154.002.008.001
BORING No. **BH-8**
LOGGED BY LES
PAGE No. 1 of 2

PROJECT NAME Alliant Energy - December 2008 Baghouse Geotechnical Investigation
BORING LOCATION Burlington, Iowa
SURFACE ELEVATION 534.72
DRILLER RDnP Drilling - Kris Norwick
DATE: START 12/15/2008 FINISH 12/17/2008

DEPTH	SAMPLE No.	INTERVAL (ft) FROM	TO	BLOW COUNT 0"-6"	6"-12"	12"-18"	18"-24"	REC (in)	WC (%)	qu (TSF)	CONTACT DEPTH	ELEV. (MSL)	USCS SOIL TYPE	SOIL DESCRIPTION
														Frozen ground
	SS-1	2.0	4.0	8	12	10	12	18.0						Brown and grey mottled silty clay FILL, little fine to coarse sand, medium dense, frozen
5	SS-2	4.0	6.0	3	4	6	6	16.0		1.75			FILL	
	SS-3	6.0	8.0	3	5	7	10	10.0						fine gravel pieces mixed in clay
	SS-4	8.0	10.0	3	4	6	9	15.0	17	2.50				
10	SS-5	10.0	12.0	4	5	7	4	14.0	23	3.00	10'6"	524.22		Grey SILT, trace fine sand, medium dense to loose, wet
	SS-6	13.0	15.0	2	3	3	3	8.0	26				ML	alternating silt and brown silty clay, stiff
15														
											16'6	518.22		Grey SILTY CLAY, medium plasticity, medium stiff, mois to wet
	SS-7	18.0	20.0	1	2	3	2	10.0	34	1.25				(LL=46, PI=24)
20													CL	
											23'3"	511.47		Brown fine to medium SAND, loose, wet
	SS-8	23.0	25.0	5	6	7	7	12.0						
25														
	SS-9	28.0	30.0	2	5	4	5	24.0	20					
30														
													SP	
	SS-10	33.0	35.0	2	3	4	5	12.0						trace coarse sand
35														
	SS-11	38.0	40.0	4	5	5	7	11.5	12					
40														

Drilled with Dietrich-120
Method: auger and mud rotary
Hole was backfilled with bentonite slurry

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BORING LOG

PROJECT No. 154.002.008.001
BORING No. **BH-8**
LOGGED BY LES
PAGE No. 2 of 2

PROJECT NAME Alliant Energy - December 2008 Baghouse Geotechnical Investigation
BORING LOCATION Burlington, Iowa
SURFACE ELEVATION 534.72
DRILLER RDnP Drilling - Kris Norwick
DATE: START 12/15/2008 FINISH 12/17/2008

DEPTH	SAMPLE No.	INTERVAL (ft) FROM	INTERVAL (ft) TO	BLOW COUNT 0"-6"	BLOW COUNT 6"-12"	BLOW COUNT 12"-18"	BLOW COUNT 18"-24"	REC (in)	WC (%)	qu (TSF)	CONTACT DEPTH	ELEV. (MSL)	USCS SOIL TYPE	SOIL DESCRIPTION
														Brown fine to medium SAND, trace coarse sand, medium dense, wet (cont.)
	SS-12	43.0	45.0	9	10	11	15	11.0						
45													SP	
	SS-13	48.0	50.0	14	17	9	7	13.0	16					
50														
											49'6"	485.22		Brown fine to coarse SAND, trace fine gravel, medium dense, wet
	SS-14	53.0	55.0	4	8	7	6	13.0						
55														
	SS-15	58.0	60.0	8	15	19	22	15.0	8				SW	dense
60														
	SS-16	63.0	65.0	5	15	24	26	17.0						little fine gravel
65														
											66'6"	468.22		Grey sandy SILTY CLAY, hard, moist to wet
	SS-17	68.0	70.0	48	50/4			13.0	14				CL	
70											70'	464.72		EOB 70'
75														
80														

Drilled with Dietrich-120
Method: auger and mud rotary
Hole was backfilled with bentonite slurry

BH-8.XLS

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BORING LOG

PROJECT No. 154.002.008.001
BORING No. **BH-9**
LOGGED BY LES
PAGE No. 1 of 2

PROJECT NAME Alliant Energy - December 2008 Baghouse Geotechnical Investigation
BORING LOCATION Burlington, Iowa
SURFACE ELEVATION 534.67
DRILLER RDnP Drilling - Kris Norwick
DATE: START 12/17/2008 FINISH 12/18/2008

DEPTH	SAMPLE No.	INTERVAL (ft) FROM	INTERVAL (ft) TO	BLOW COUNT 0"-6"	BLOW COUNT 6"-12"	BLOW COUNT 12"-18"	BLOW COUNT 18"-24"	REC (in)	WC (%)	qu (TSF)	CONTACT DEPTH	ELEV. (MSL)	USCS SOIL TYPE	SOIL DESCRIPTION
														Frozen ground
	SS-1	2.0	4.0	3	4	2	2	14.0		2.50				Grey and brown mottled silty clay FILL, some fine to medium sand, very stiff, moist
5	SS-2	4.0	6.0	3	4	6	5	17.0		4.00			FILL	
	SS-3	6.0	8.0	4	5	5	8	17.0		2.50				Alternating grey, brown, and orange clay and silt
	SS-4	8.0	10.0	4	5	10	10	17.0		2.00	8'11"	525.75		
10	SS-5	10.0	12.0	5	7	9	12	16.0		4.00			CL	Grey SILTY CLAY, trace fine sand, medium plasticity, very stiff, moist
											13'	521.67		
	SS-6	13.0	15.0	3	4	6	6	21.0						Dark grey CLAY, high plasticity, stiff, wet
15														
	SS-7	18.0	20.0	3	3	4	5	21.0	51	1.00				(LL=64, PI=34)
20													CH	
	SS-8	23.0	25.0	5	6	8	9	0.0						
25														(hole is taking a lot of water)
											24'6"	510.17		Grey fine to medium SAND, medium dense, wet
	SS-9	28.0	30.0	8	10	12	14	10.0	25					
30														
														trace coarse sand, dense
	SS-10	33.0	35.0	8	15	19	22	16.0					SP	
35														
	SS-11	38.0	40.0	10	16	17	19	11.0	18					
40														

Drilled with Dietrich-120
Method: auger and mud rotary
Hole was backfilled with bentonite slurry

BH-9.XLS

BORING LOG

PROJECT No. 154.002.008.001
BORING No. **BH-9**
LOGGED BY LES
PAGE No. 2 of 2

PROJECT NAME Alliant Energy - December 2008 Baghouse Geotechnical Investigation
BORING LOCATION Burlington, Iowa
SURFACE ELEVATION
DRILLER RDnP Drilling - Kris Norwick
DATE: START 12/17/2008 FINISH 12/18/2008

DEPTH	SAMPLE			BLOW COUNT				REC	WC	qu	CONTACT DEPTH	ELEV. (MSL)	USCS SOIL TYPE	SOIL DESCRIPTION
		INTERVAL (ft)		0"	6"	12"	18"	(in)	(%)	(TSF)				
	No.	FROM	TO	6"	12"	18"	24"							
														Grey fine to medium SAND, trace coarse sand, dense, wet
	SS-12	43.0	45.0	10	17	24	29	8.0						trace fine gravel
45														
	SS-13	48.0	50.0	8	16	20	21	12.0	17				SP	
50														
	SS-14	53.0	55.0	9	11	15	19	13.0						
55														
											56'6"	478.17		Grey-brown fine to coarse SAND, trace fine gravel, dense, wet
	SS-15	58.0	60.0	10	12	18	17	16.0	17					
60													SW	
	SS-16	63.0	65.0	12	15	24	26	15.0						dense
65														
											66'6"	468.17	CL	Grey CLAY, little fine to medium sand, medium plasticity, hard, moist to wet
	SS-17	68.0	70.0	37	50/4			10.0						
70											70'	464.67		EOB 70'
75														
80														

Drilled with Dietrich-120
Method: auger and mud rotary
Hole was backfilled with bentonite slurry

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Engineering, Construction and Management Solutions

BORING LOG

PROJECT No. 154.002.008.001
BORING No. **BH-10**
LOGGED BY LES
PAGE No. 1 of 2

PROJECT NAME Alliant Energy - December 2008 Baghouse Geotechnical Investigation
BORING LOCATION Burlington, Iowa
SURFACE ELEVATION 531.92
DRILLER RDnP Drilling - Kris Norwick
DATE: START 12/12/2008 FINISH 12/15/2008

DEPTH	SAMPLE			BLOW COUNT				REC	WC	qu	CONTACT DEPTH	ELEV. (MSL)	USCS SOIL TYPE	SOIL DESCRIPTION
	No.	INTERVAL (ft) FROM	TO	0" 6"	6" 12"	12" 18"	18" 24"	(in)	(%)	(TSF)				
														Frozen ground
	SS-1	2.0	4.0	4	5	5	4	13.0	17	2.00				Grey and brown mottled SILTY CLAY, trace fine sand, medium plasticity, stiff, moist
5	SS-2	4.0	6.0	3	4	5	6	15.0	15	2.50				little fine to coarse sand, very stiff
	SS-3	6.0	8.0	4	4	5	6	15.0	13	2.50			CL	
	SS-4	8.0	10.0	3	6	8	8	15.0	24	2.50 1.50				Brown, silt content increasing, thin brown silt seams
10														
	SS-5	13.0	15.0	1	2	3	4	15.0		0.75 1.00	13'	518.92		Dark grey CLAY, high plasticity, medium stiff, wet
15														
	SS-6	18.0	20.0	4	6	5	7	13.5		1.25				stiff
20													CH	
	SS-7	23.0	25.0	3	4	5	5	6.0		1.00				
25														
	SS-8	28.0	30.0	8	9	11	12	0.0			29'	502.92		Grey-brown fine to medium SAND, medium dense, wet
30														
	SS-9	33.0	35.0	6	8	5	5	10.0						
35														
	SS-10	38.0	40.0	8	9	11	12	11.0						trace coarse sand
40														

Drilled with Dietrich-120
Method: auger and mud rotary
Hole was backfilled with bentonite slurry

HARD HAT SERVICES™
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BORING LOG

PROJECT No. 154.002.008.001
BORING No. **BH-10**
LOGGED BY LES
PAGE No. 2 of 2

PROJECT NAME Alliant Energy - December 2008 Baghouse Geotechnical Investigation
BORING LOCATION Burlington, Iowa
SURFACE ELEVATION 531.92
DRILLER RDnP Drilling - Kris Norwick
DATE: START 12/12/2008 FINISH 12/15/2008

DEPTH	SAMPLE No.	INTERVAL (ft) FROM	INTERVAL (ft) TO	BLOW COUNT 0"-6"	BLOW COUNT 6"-12"	BLOW COUNT 12"-18"	BLOW COUNT 18"-24"	REC (in)	WC (%)	qu (TSF)	CONTACT DEPTH	ELEV. (MSL)	USCS SOIL TYPE	SOIL DESCRIPTION
														Grey-brown fine to medium SAND, trace coarse sand, medium dense, wet (cont.)
	SS-11	43.0	45.0	3	6	9	15	15.0						
45														
														dense
	SS-12	48.0	50.0	8	15	21	30	15.0						
50														
													SP	
	SS-13	53.0	55.0	50/0				0.0						(spoon bouncing, possibly on a cobble or boulder)
55														
	SS-14	58.0	60.0	14	17	17	15	16.0						trace fine gravel
60														
	SS-15	63.0	65.0	50/1				0.0			64'	467.92		Grey CLAY, little fine sand, hard, moist to wet
65														
													CL	
	SS-16	68.0	70.0	32	50/3			10.0		4.5+				(spoon bouncing)
70											70'	461.92		EOB 70'
75														
80														

Drilled with Dietrich-120
Method: auger and mud rotary
Hole was backfilled with bentonite slurry

BH-10.XLS

APPENDIX B – Geoprobe Soil Borings on CCR Embankments

Alliant Energy
Interstate Power and Light Company
Burlington Generating Station
Burlington, Iowa

Structural Stability Assessment

Boring Log
Legend

Sample
No: (Number) Soil samples are numbered consecutively from the ground surface. Core samples are numbered consecutively from the first core run.

Type: A= Auger Cuttings   CR= Core Run   MS= Modified Spoon   PB= Pitcher Barrel
PT= Piston Tube   ST= Shelby Tube   SS= Split Spoon (2" O.D.)   WC= Wash Cuttings

Interval: The depth of sampling interval in feet below ground surface

Blow Count
The number of blows required to drive a 2-inch O.D. split-spoon sampler with a 140 pound hammer falling 30-inches. When appropriate, the sampler is driven 18 inches and blow counts are reported for each 6-inch interval. The sum of blow counts for the last two 6-inch intervals is designated as the standard penetration resistance (N) expressed as blows per foot.

Recovery in Inches
The length of sample recovered by the sampling device.

U.S.C.S. Soil Type
The Unified Soil Classification System symbol for recovered soil samples determined by visual examination or laboratory tests. Refer to ASTM D2487-69 for a detailed description of procedure and symbols. Underlined symbols denote classifications based on laboratory tests (i.e. ML), all others are based on visual classification only.

Percent Moisture
Natural moisture content of sample expressed as percent of dry weight.

q_u TSF
Unconfined compressive strength in tons per square foot obtained by hand penetrometer. Laboratory compression test values are indicated by underlining.

Contact Depth
The contact depth between soil layers is interpreted from significant changes in recovered samples and observations during drilling. Actual changes between soil layers often occur gradually and the contact depths shown on the boring logs should be considered as approximate.

Soil Description and Remarks
Soil descriptions include consistency or density, color, predominant soil types and modifying constituents.

Cohesive Soils			Cohesionless Soils	
Consistency	q_u (TSF)	Blows/ft.	Density	Blows/ft.
Very Soft	less than 0.25	0-1	Very Loose	4 or less
Soft	0.25 to 0.50	2-4	Loose	5 to 10
Medium Stiff	0.50 to 1.00	5-8	Medium Dense	11 to 30
Stiff	1.00 to 2.00	9-15	Dense	30 to 50
Very Stiff	2.00 to 4.00	15-30	Very Dense	Over 50
Hard	more than 4.00	Over 30		

Particle Size Description

Boulder = Larger than 12 inches
Cobble = 3 to 12 inches
Gravel = 0.187 to 3 inches
Sand = 0.074 to 4.76 mm
Silt and Clay = smaller than 0.074 mm

Definition of Terms

Trace = 5 to 12 percent by weight
Some = 12 to 30 percent by weight
And = Approximately equal fractions
( ) = Driller's observation

Piezo.
(Piezometer) Screened interval of the piezometer installation is denoted by cross-hatching.

General Note
The boring log and related information depicted subsurface conditions only at the specified locations and date indicated. Soil conditions and water levels at other locations may differ from conditions occurring at these boring locations. Also the passage of time may result in a change in the conditions at these boring locations.

Soil Test Boring Refusal
Defined as any material causing a blow count greater that 50 blows/6 inches.   Such material may include bedrock, "floating" rock slabs, boulders, dense gravel seams, hard pan clay, or cemented soils. Refusal is usually indicated in fractional notation showing number of blows as the numerator and inches of penetration as the denominator.

CABENO

Environmental Field Services, LLC

BORING LOG

CLIENT: Aether dbs

PROJECT: Burlington, IA

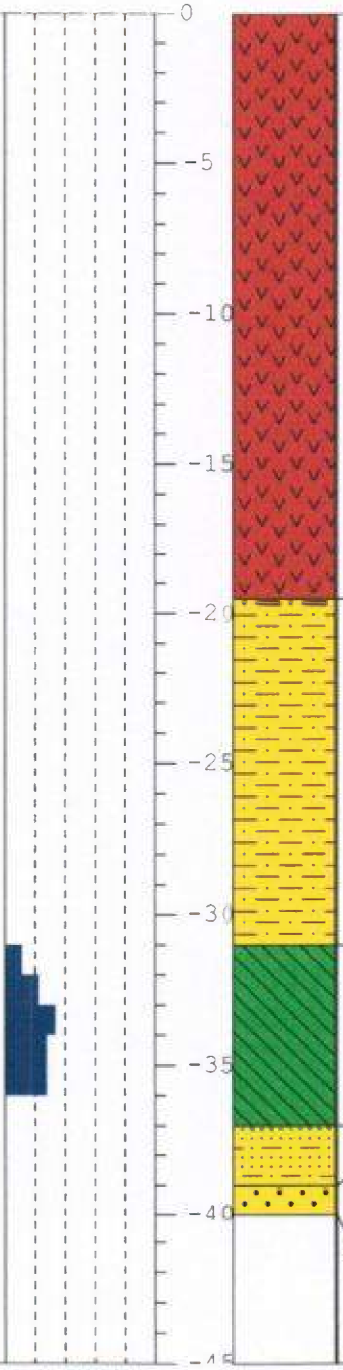
COORDINATES: *N NOT SURVEYED* *E NOT SURVEYED*

BORING NO.: *SB1 (CPT1)*

page 1 of 1

LOGGED BY: *John Noyes*
EDITED BY: *John Noyes*
CHECKED BY: *Chris Sullivan*
DATE BEGAN: *05-11-11*
DATE FINISHED: *05-11-11*
GROUND SURFACE ELEVATION:

DEPTH TO WATER WHILE DRILLING	SAMPLE NO. AND TYPE	SAMPLE RECOVERY	SAMPLE INFROMATION	POCKET PENETROMETER (TONS/FT2)
	SP1	2.5'/5'		
	SP2	5'/5'		
	SP3	5'/5'		
▽	SP4	5'/5'		
	SP5	0'/5'		
	SP6	5'/5'		
	SP7	1.5'/5'		2.75 2.75 3.25 3.75 1.5
	SP8	5'/5'		



DESCRIPTION

ASH; brown; poorly graded; fine grained; moist. (Fill)

@ 14' grades dark gray to black.

Clayey SILT; black to gray; non-plastic to low plasticity; moist to wet; some organic matter. (OL)

@ too soft for pocket penn from 19.5' to 31', no hammer required to push sampler.

CLAY; gray to black; high plasticity; soft to firm; moist; trace organic. (OH)

Sandy SILT; gray; non-plastic; wet. (ML)

SAND; gray; well graded; fine to coarse grained; rounded to sub-rounded; wet. (SW)

Bottom of boring @ 40'

Boring advanced W/ Geoprobe Model 6610DT using 60-inch Macrocore sampling system. Boring backfilled to groundsurface w/ bentonite chips on 05-11-11.

CABENO

Environmental Field Services, LLC

BORING LOG

CLIENT: Aether dbs

PROJECT: Burlington, IA

COORDINATES: *N NOT SURVEYED*
 E NOT SURVEYED

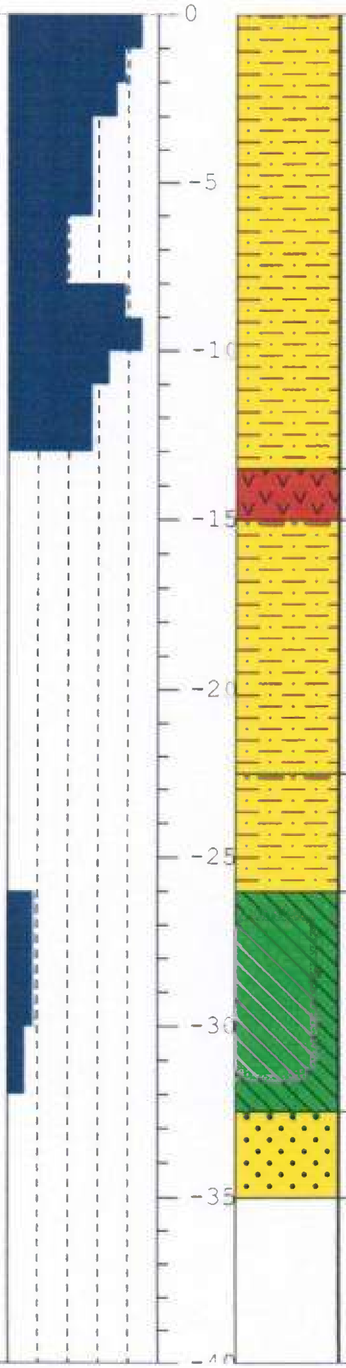
BORING NO.: *SB2 (CPT7)*

page 1 of 1

LOGGED BY: *John Noyes*
EDITED BY: *John Noyes*
CHECKED BY: *Chris Sullivan*
DATE BEGAN: *05-11-11*
DATE FINISHED: *05-11-11*
GROUND SURFACE ELEVATION:

DEPTH TO WATER WHILE DRILLING	SAMPLE NO. AND TYPE	SAMPLE RECOVERY	SAMPLE INFROMATION
	SP1	5'/5'	
	SP2	5'/5'	
	SP3	5'/5'	
	SP4	4'/5'	
▽	SP5	4'/5'	
	SP6	5'/5'	
	SP7	4'/5'	

POCKET PENETROMETER (TONS/FT2)
4.0
3.5
3.25
2.5
2.5
2.5
1.75
1.75
3.5
4.0
3.0
2.5
2.5
0.75
0.75
0.75
0.75
0.5
0.5



DESCRIPTION

Clayey SILT; brown to gray; non-plastic; firm to stiff; dry to moist; trace roots/organic matter. (Fill)

ASH; black; non-plastic; moist. (FILL)

Clayey SILT; gray to black; non-plastic; trace organic matter/shells. (OL)

SILT; gray; non-plastic; wet. (ML)

CLAY; gray to black; soft; high plasticity; moist; trace to some organic matter. (OH)

SAND; gray; poorly graded; medium grained; wet. (SP)

Bottom of boring @ 35'

Boring advanced W/ Geoprobe Model 6610DT using 60-inch Macrocore sampling system. Boring backfilled to groundsurface w/ bentonite chips on 05-11-11.

CABENO

Environmental Field Services, LLC

BORING LOG

CLIENT: Aether dbs

PROJECT: Burlington, IA

COORDINATES: *N NOT SURVEYED*
E NOT SURVEYED

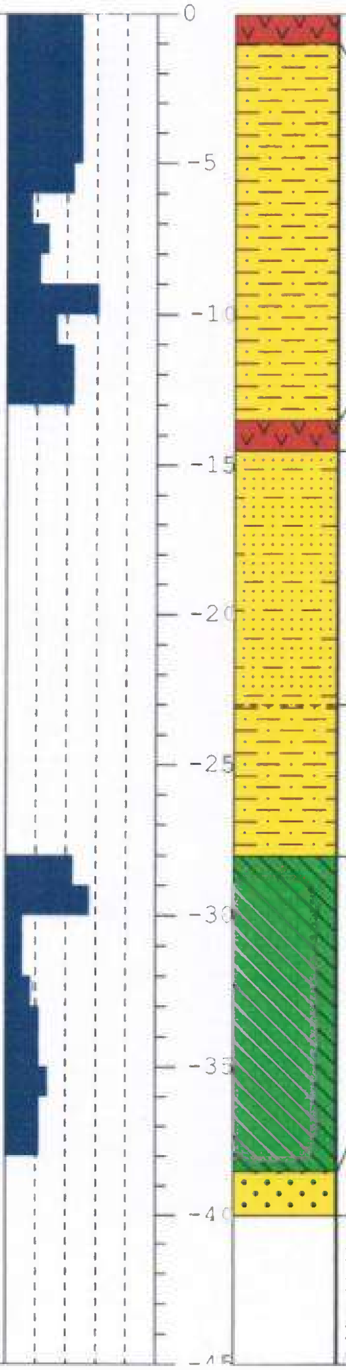
BORING NO.: *SB3 (CPT10)*

page 1 of 1

LOGGED BY: *John Noyes*
EDITED BY: *John Noyes*
CHECKED BY: *Chris Sullivan*
DATE BEGAN: *05-11-11*
DATE FINISHED: *05-11-11*
GROUND SURFACE ELEVATION:

DEPTH TO WATER WHILE DRILLING	SAMPLE NO. AND TYPE	SAMPLE RECOVERY	SAMPLE INFROMATION
	SP1	3.5'/5'	
	SP2	5'/5'	
	SP3	5'/5'	
▽			
	SP4	5'/5'	
	SP5	5'/5'	
	SP6	5'/5'	
	SP7	5'/5'	
	SP8	5'/5'	

POCKET PENETROMETER (TONS/FT2)
2.25
2.25
2.25
2.25
2.25
2.0
0.75
1.25
1.0
2.75
1.5
2.0
2.0
2.0
2.5
0.5
0.5
0.75
1.0
1.0
1.25
1.0
1.0
1.0



DESCRIPTION

ASH; brown; non-plastic; moist. (FILL)

Clayey SILT; brown to gray; non-plastic; firm to stiff; dry to moist; trace roots/organic matter. (Fill)

ASH; gray; non-plastic; moist. (FILL)

Silty SAND; dark gray to light gray; poorly graded; fine grained; wet. (SP)

SILT; gray; non-plastic; wet. (ML)

Silty CLAY; gray to black; soft; low plasticity; moist; trace to some organic matter. (OH)

SAND; gray; poorly graded; fine grained; wet. (SP)

Bottom of boring @ 40'

Boring advanced W/ Geoprobe Model 6610DT using 60-inch Macrocore sampling system. Boring backfilled to groundsurface w/ bentonite chips on 05-11-11.

CABENO

Environmental Field Services, LLC

BORING LOG

CLIENT: Aether dbs

PROJECT: Burlington, IA

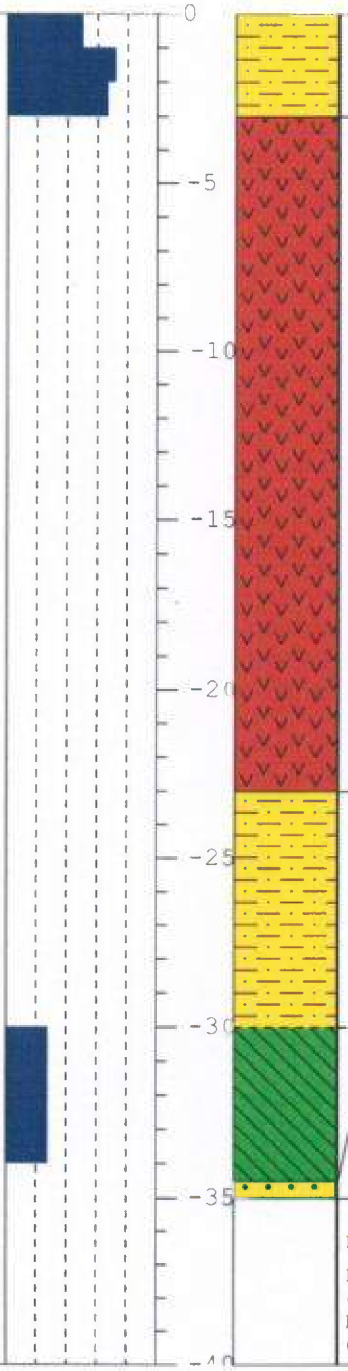
COORDINATES: *N NOT SURVEYED*
E NOT SURVEYED

BORING NO.: *SB4 (CPT6)*

page 1 of 1

LOGGED BY: *John Noyes*
EDITED BY: *John Noyes*
CHECKED BY: *Chris Sullivan*
DATE BEGAN: *05-11-11*
DATE FINISHED: *05-11-11*
GROUND SURFACE ELEVATION:

DEPTH TO WATER WHILE DRILLING	SAMPLE NO. AND TYPE	SAMPLE RECOVERY	SAMPLE INFROMATION	POCKET PENETROMETER (TONS/FT2)
	SP1	4.5'/5'		2.25 3.25 3.0
	SP2	5'/5'		
	SP3	5'/5'		
	SP4	5'/5'		
▽	SP5	3.5'/5'		
	SP6	4'/5'		
	SP7	5'/5'		1.25 1.25 1.25 1.25



DESCRIPTION

Clayey SILT; brown to gray; non-plastic; firm to stiff; dry to moist; trace roots/organic matter. (Fill)

ASH; gray; non-plastic; moist. (FILL)

SILT; gray; non-plastic; wet. (ML)

CLAY; gray to black; low to high plasticity; wet; some organic matter. (OL/OH)

SAND; gray; poorly graded; fine grained; wet. (SP)

Bottom of boring @ 35'

Boring advanced W/ Geoprobe Model 6610DT using 60-inch Macrocore sampling system. Boring backfilled to groundsurface w/ bentonite chips on 05-11-11.

CABENO

Environmental Field Services, LLC

BORING LOG

CLIENT: Aether dbs

PROJECT: Burlington, IA

COORDINATES: *N NOT SURVEYED* *E NOT SURVEYED*

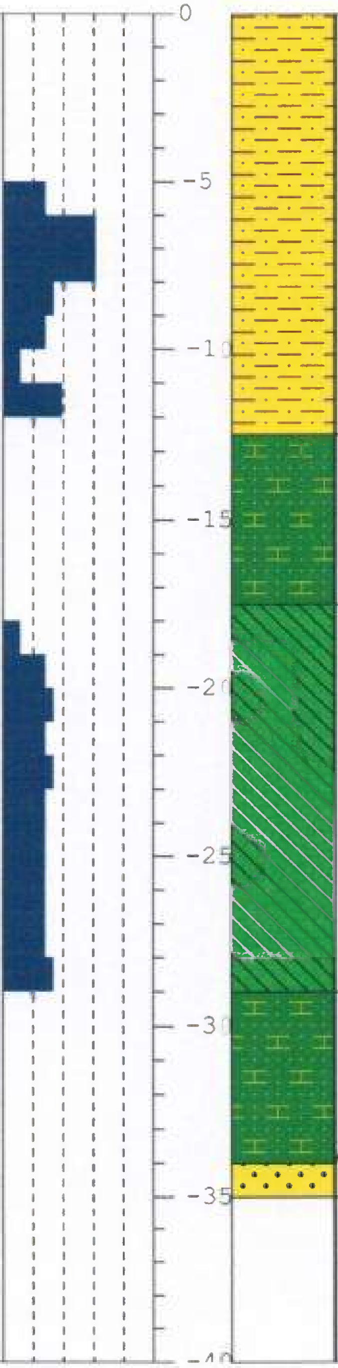
BORING NO.: *SB5 (cpt19)*

page 1 of 1

LOGGED BY: *John Noyes*
EDITED BY: *John Noyes*
CHECKED BY: *Chris Sullivan*
DATE BEGAN: *05-16-11*
DATE FINISHED: *05-16-11*
GROUND SURFACE ELEVATION:

DEPTH TO WATER WHILE DRILLING	SAMPLE NO. AND TYPE	SAMPLE RECOVERY	SAMPLE INFROMATION	POCKET PENETROMETER (TONS/FT2)
	SP1	5'/5'		
				1.25
				2.75
	SP2	5'/5'		2.75
				1.5
				1.25
				0.5
				1.75
	SP3	4'/5'		2.0
	SP4	4'/5'		
				0.5
				1.25
				1.5
				1.25
	SP5	3.5'/5'		1.5
				1.25
				1.25
				1.25
				1.25
	SP6	3.5'/5'		1.25
▽				1.5
				1.25
	SP7	3'/5'		

CONSISTENCY vs. DEPTH | **DEPTH IN FEET** | **PROFILE**



DESCRIPTION

SILT; brown; non-plastic; dry to moist; trace organic matter. (Fill)

@ 5' grades Clayey SILT; low plasticity; firm to stiff.

Sandy CLAY; black to dark gray; non-plastic to low plasticity; moist. (CL)

CLAY; black to dark gray; low to high plasticity; moist; trace organic matter. (CL)

Sandy CLAY; dark gray; low to high plasticity; wet; trace silt. (CL)

@ 33' grades several thin sand seams.

SAND; gray; poorly graded; coarse grained; wet. (SP)

Bottom of boring @ 35'

Boring advanced W/ Geoprobe Model 6610DT using 60-inch Macrocore sampling system. Boring backfilled to groundsurface w/ bentonite chips on 05-16-11.

BORING LOG

CLIENT: Aether dbs

PROJECT: Burlington, IA

COORDINATES: *N NOT SURVEYED*
E NOT SURVEYED

BORING NO.: *SB6 (cpt18)*

page 1 of 1

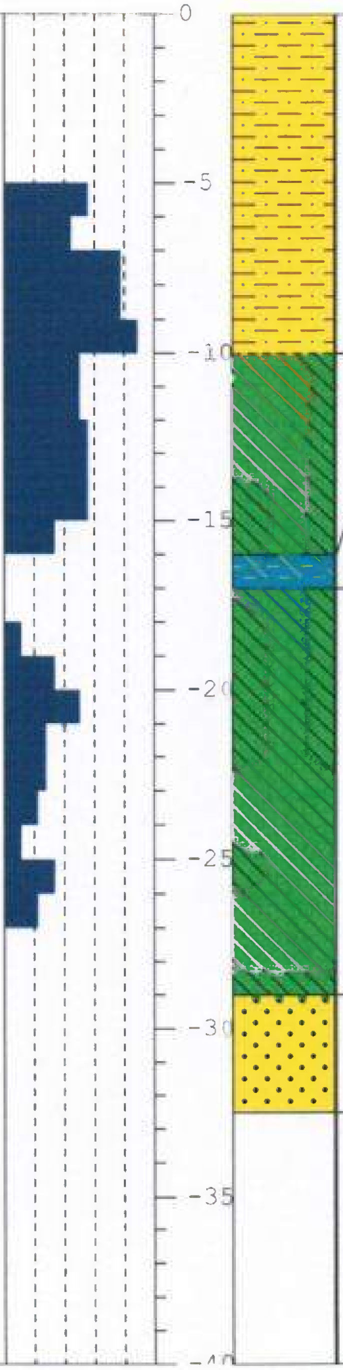
LOGGED BY: *John Noyes*
EDITED BY: *John Noyes*
CHECKED BY: *Chris Sullivan*
DATE BEGAN: *05-16-11*
DATE FINISHED: *05-16-11*
GROUND SURFACE ELEVATION:

DEPTH TO WATER WHILE DRILLING	SAMPLE NO. AND TYPE	SAMPLE RECOVERY	SAMPLE INFROMATION
	SP1	5'/5'	
	SP2	5'/5'	
	SP3	5'/5'	
▽			
	SP4	4.5'/5'	
	SP5	2.5'/5'	
	SP6	3.8'/5'	
	SP7	2.5'/2.5'	

POCKET PENETROMETER (TONS/FT2)

2.5
2.0
3.5
3.5
4.0
2.25
2.25
2.5
2.5
2.5
2.5
1.5
0.5
1.5
2.25
1.25
1.25
1.0
0.5
1.5
1.0
0
0
0

CONSISTENCY vs. DEPTH | **DEPTH IN FEET** | **PROFILE**



DESCRIPTION

SILT; brown; non-plastic; dry to moist; trace organic matter (FILL)

@ 5' grades Clayey SILT; low plasticity; very stiff.

CLAY; gray to olive; low to high plasticity; stiff to very stiff; moist; trace organic matter (Fill)

Clayey SAND; gray; poorly graded; medium grained; wet. (SP)

CLAY; gray to olive; high plasticity; very soft to firm; moist to wet. (CL)

@ 19' is a thin 1" sand seam, wet.

SAND; gray; well graded; fine to coarse grained; wet. (SW)

Bottom of boring @ 32.5'

Boring advanced W/ Geoprobe Model 6610DT using 60-inch Macrocore sampling system. Boring backfilled to groundsurface w/ bentonite chips on 05-16-11.

CABENO

Environmental Field Services, LLC

BORING LOG

CLIENT: Aether dbs

PROJECT: Burlington, IA

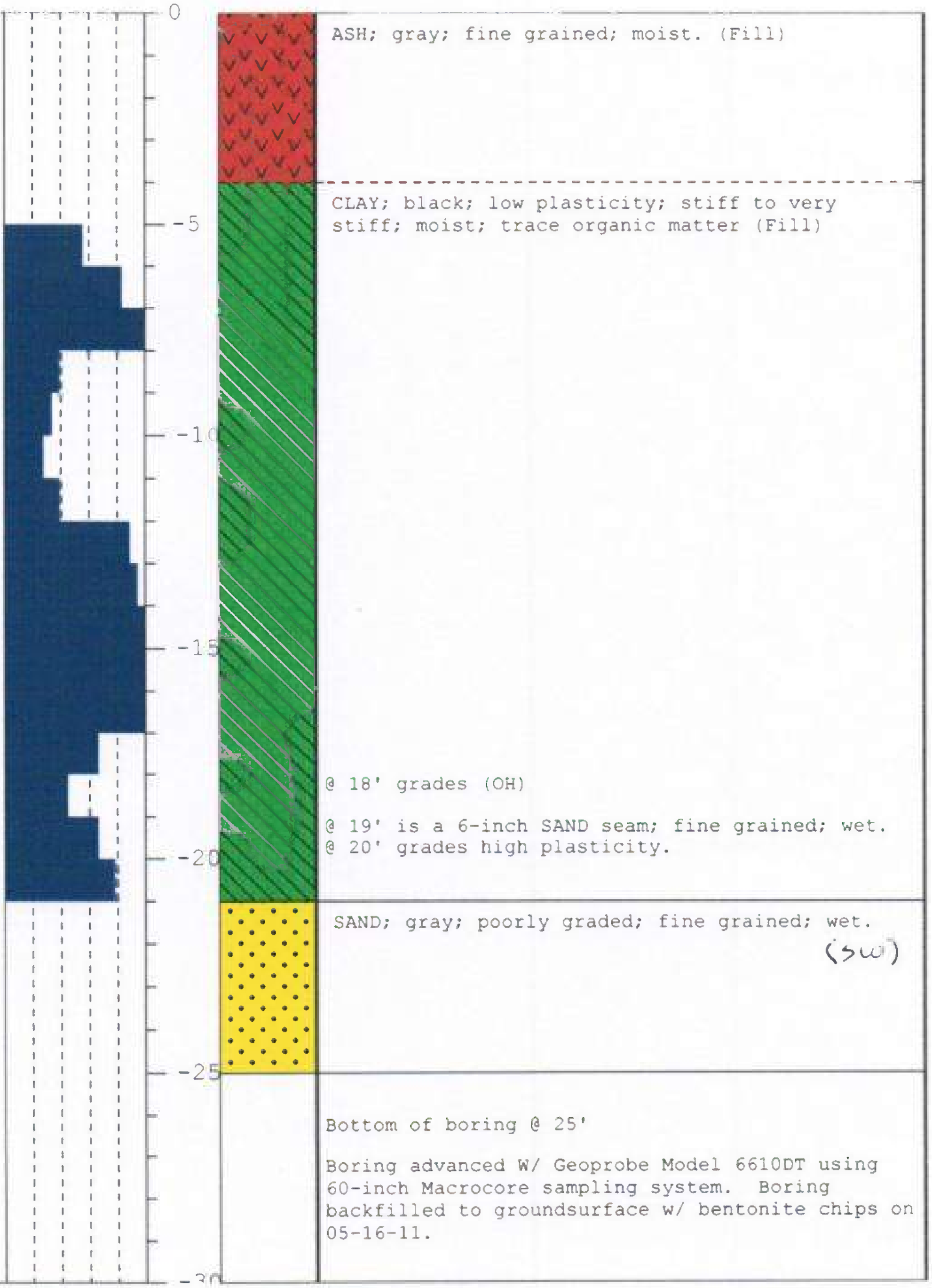
COORDINATES: *N NOT SURVEYED*
E NOT SURVEYED

BORING NO.: *SB7 (cpt15)*

page 1 of 1

LOGGED BY: *John Noyes*
EDITED BY: *John Noyes*
CHECKED BY: *Chris Sullivan*
DATE BEGAN: *05-16-11*
DATE FINISHED: *05-16-11*
GROUND SURFACE ELEVATION:

DEPTH TO WATER WHILE DRILLING	SAMPLE NO. AND TYPE	SAMPLE RECOVERY	SAMPLE INFROMATION	POCKET PENETROMETER (TONS/FT2)
	SP1	3.8'/5'		
				2.5
				3.75
				>4.5
	SP2	5'/5'		
				1.75
				1.5
				1.25
				1.75
				4.0
	SP3	5'/5'		
				4.25
				4.5
				4.5
				>4.5
				3.0
	SP4	5'/5'		
				2.0
▽				
				3.0
				3.5
	SP5	3'/5'		



DESCRIPTION

ASH; gray; fine grained; moist. (Fill)

CLAY; black; low plasticity; stiff to very stiff; moist; trace organic matter (Fill)

@ 18' grades (OH)

@ 19' is a 6-inch SAND seam; fine grained; wet.
@ 20' grades high plasticity.

SAND; gray; poorly graded; fine grained; wet.
(sw)

Bottom of boring @ 25'

Boring advanced W/ Geoprobe Model 6610DT using 60-inch Macrocore sampling system. Boring backfilled to groundsurface w/ bentonite chips on 05-16-11.

CABENO
Environmental Field Services, LLC

BORING LOG

CLIENT: Aether dbs

PROJECT: Burlington, IA

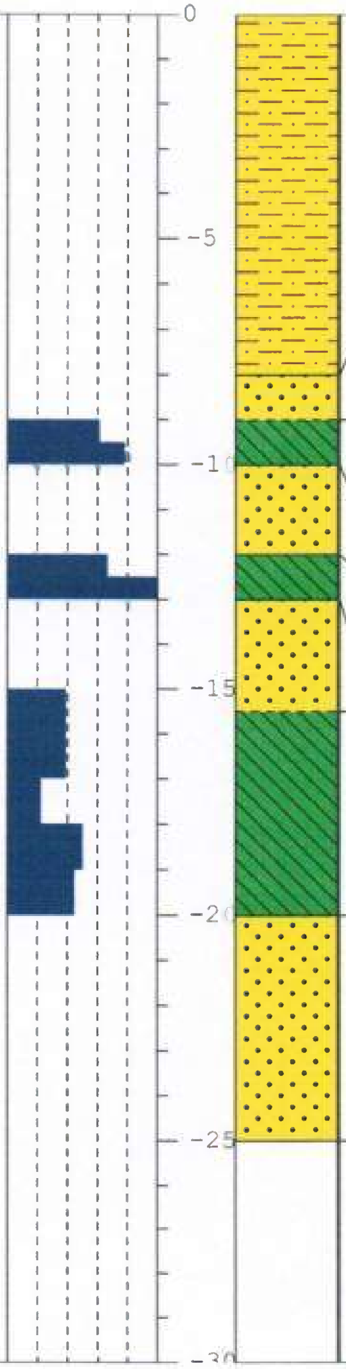
COORDINATES: *N NOT SURVEYED*
E NOT SURVEYED

BORING NO.: ***SB8 (cpt13)***

page 1 of 1

LOGGED BY: *John Noyes*
EDITED BY: *John Noyes*
CHECKED BY: *Chris Sullivan*
DATE BEGAN: *05-16-11*
DATE FINISHED: *05-16-11*
GROUND SURFACE ELEVATION:

DEPTH TO WATER WHILE DRILLING	SAMPLE NO. AND TYPE	SAMPLE RECOVERY	SAMPLE INFROMATION	POCKET PENETROMETER (TONS/FT2)
	SP1	4'/5'		
▽	SP2	4'/5'		
				2.75 3.5
	SP3	5'/5'		3.0 4.5
				1.75 1.75 1.0
	SP4	4'/5'		2.25 2.0
	SP5	4.5'/5'		



DESCRIPTION

SILT; brown; non-plastic; dry to moist; trace to some gravel, sand & ash. (Fill)

SAND; gray; fine grained; poorly graded; wet.(SP)

CLAY; gray; low to high plasticity; stiff; moist. (CL)

SAND; gray to black; fine grained; poorly graded; wet. (SP)

CLAY; gray; low to high plasticity; stiff; moist. (CL)

SAND; gray; well graded; fine to coarse grained; wet. (SW)

CLAY; dark gray; high plasticity; firm to stiff; moist; trace organic matter. (OH)

SAND; gray to black; poorly graded; fine grained; wet. (SP)

Bottom of boring @ 25'

Boring advanced W/ Geoprobe Model 6610DT using 60-inch Macrocore sampling system. Boring backfilled to groundsurface w/ bentonite chips on 05-16-11.

CABENO

Environmental Field Services, LLC

BORING LOG

CLIENT: Aether dbs

PROJECT: Burlington, IA

COORDINATES: *N NOT SURVEYED*
E NOT SURVEYED

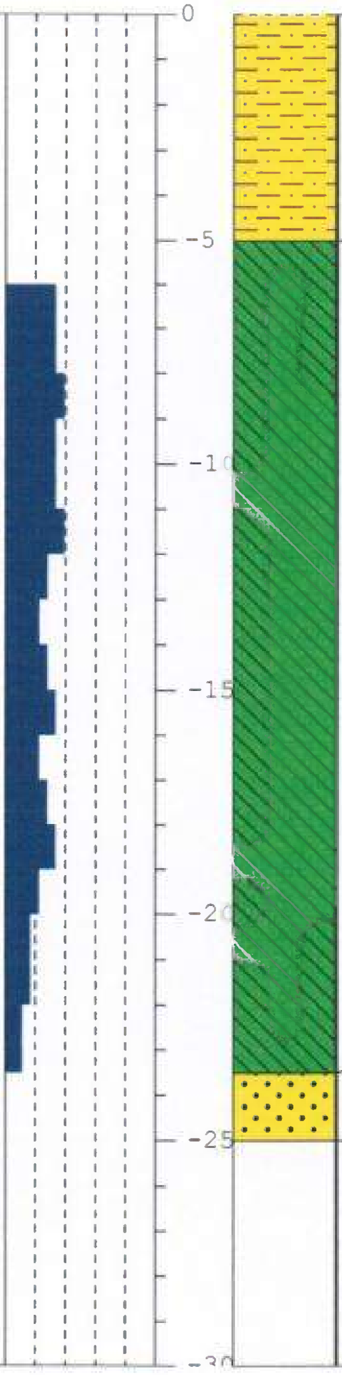
BORING NO.: *SB9 (cpt21)*

page 1 of 1

LOGGED BY: *John Noyes*
EDITED BY: *John Noyes*
CHECKED BY: *Chris Sullivan*
DATE BEGAN: *05-16-11*
DATE FINISHED: *05-16-11*
GROUND SURFACE ELEVATION:

DEPTH TO WATER WHILE DRILLING	SAMPLE NO. AND TYPE	SAMPLE RECOVERY	SAMPLE INFROMATION	POCKET PENETROMETER (TONS/FT2)
	SP1	2.5'/5'		
				1.5
				1.5
	SP2	4'/5'		
				1.75
				1.5
				1.5
				1.75
				1.25
	SP3	4.5'/5'		
				1.0
				1.25
				1.5
				1.0
				1.25
	SP4	5'/5'		
				1.5
				1.0
				0.75
				0.75
				0.5
	SP5	3.5'/5'		
▽				0.5

CONSISTENCY vs. DEPTH | **DEPTH IN FEET** | **PROFILE**



DESCRIPTION

SILT; brown; non-plastic; dry to moist; trace organic matter. (Fill)

CLAY:gray to olive; low to high plasticity; moist; trace organics. (OH)

SAND; gray; fine grained; poorly graded; wet. (SP)

Bottom of boring @ 25'

Boring advanced W/ Geoprobe Model 6610DT using 60-inch Macrocore sampling system. Boring backfilled to groundsurface w/ bentonite chips on 05-16-11.

CABENO

Environmental Field Services, LLC

BORING LOG

CLIENT: Aether dbs

PROJECT: Burlington, IA

COORDINATES: *N NOT SURVEYED*
E NOT SURVEYED

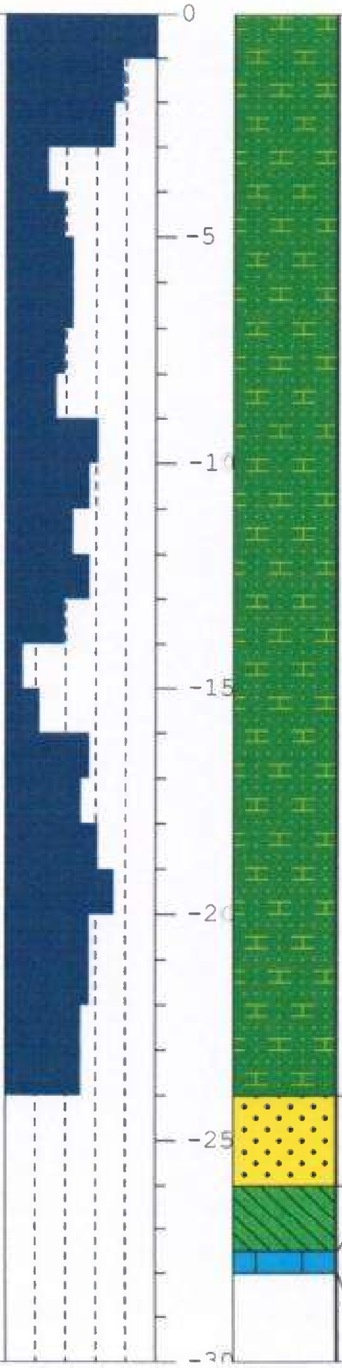
BORING NO.: *SB10*

page 1 of 1

LOGGED BY: *John Noyes*
EDITED BY: *John Noyes*
CHECKED BY: *Chris Sullivan*
DATE BEGAN: *05-16-11*
DATE FINISHED: *05-16-11*
GROUND SURFACE ELEVATION:

DEPTH TO WATER WHILE DRILLING	SAMPLE NO. AND TYPE	SAMPLE RECOVERY	SAMPLE INFROMATION	POCKET PENETROMETER (TONS/FT2)
				>4.5
				3.5
	SP1	2.5'/5'		
				3.25
				1.25
				1.75
				2.0
				2.0
	SP2	4'/5'		
				1.75
				1.5
				2.75
				2.5
				2.0
	SP3	4.5'/5'		
				2.5
				1.75
				0.5
				1.0
				2.5
	SP4	5'/5'		
				2.25
				2.75
				3.25
				2.5
				2.5
	SP5	3.5'/5'		
				2.25
▽				
	SP6	2'/3'		

CONSISTENCY vs. DEPTH | **DEPTH IN FEET** | **PROFILE**



DESCRIPTION

Silty CLAY; brown; low plasticity; firm to very stiff; moist; trace organics and gravels. (CL - OH)

SAND; gray to brown; well graded; fine to coarse grained; wet. (SW)

CLAY; gray; high plasticity; moist. (CL)

LIMESTONE; gray; thinly bedded; highly weathered. (Bedrock)

Bottom of boring @ 25'
Boring advanced W/ Geoprobe Model 6610DT using

CABENO

Environmental Field Services, LLC

BORING LOG

CLIENT: Aether dbs

PROJECT: Burlington, IA

COORDINATES: *N NOT SURVEYED* *E NOT SURVEYED*

BORING NO.: *SB11*

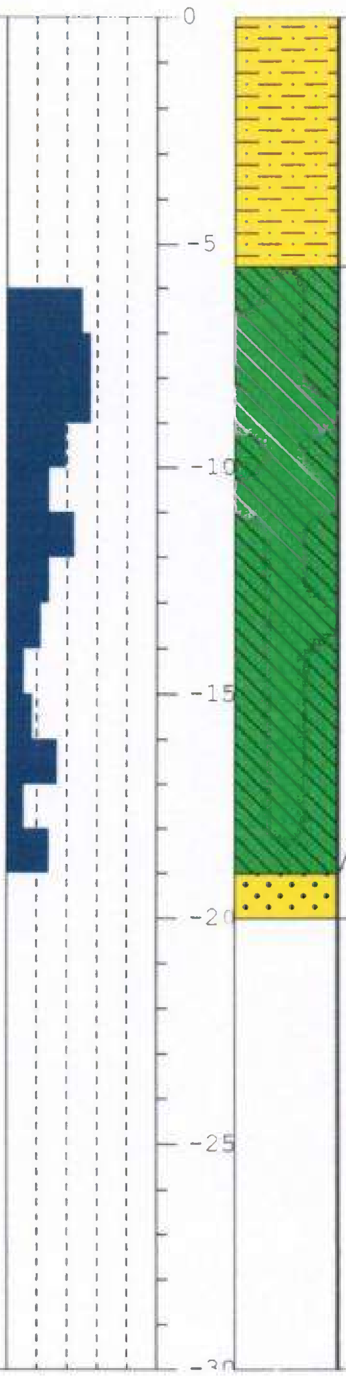
page 1 of 1

LOGGED BY: *John Noyes*
EDITED BY: *John Noyes*
CHECKED BY: *Chris Sullivan*
DATE BEGAN: *05-16-11*
DATE FINISHED: *05-16-11*
GROUND SURFACE ELEVATION:

DEPTH TO WATER WHILE DRILLING	SAMPLE NO. AND TYPE	SAMPLE RECOVERY	SAMPLE INFROMATION
	SP1	2.5'/5'	
	SP2	4'/5'	
	SP3	4.5'/5'	
▽			
	SP4	5'/5'	

POCKET PENETROMETER (TONS/FT2)
2.25
2.5
2.5
1.75
1.25
2.0
1.25
1.0
0.5
0.75
1.5
0.5
1.25
1.0

CONSISTENCY vs. DEPTH — DEPTH IN FEET — PROFILE



DESCRIPTION

Gravely SILT; brown; non-plastic; dry to moist. (Fill)

CLAY; brown; high plasticity; moist; stiff to soft; trace sand & gravel. (CL)

@ 11.5' grades black to gray, trace organics. (OH)

@ 14.5' are several thin, 1-inch, fine grained sand seams; wet.

SAND; gray; poorly graded; fine grained; wet. (SP)

Bottom of boring @ 20'

Boring advanced W/ Geoprobe Model 6610DT using 60-inch Macrocore sampling system. Boring backfilled to groundsurface w/ bentonite chips on 05-16-11.

CABENO

Environmental Field Services, LLC

BORING LOG

CLIENT: Aether dbs

PROJECT: Burlington, IA

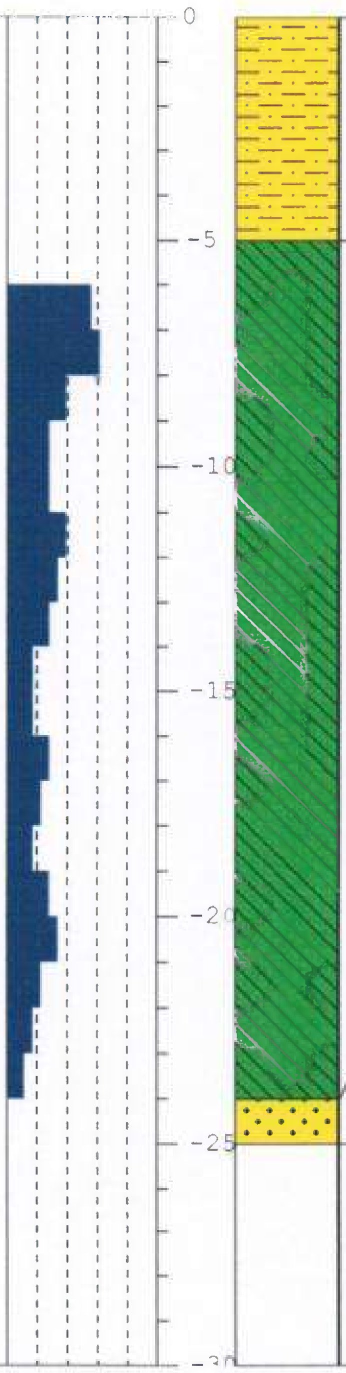
COORDINATES: *N NOT SURVEYED*
E NOT SURVEYED

BORING NO.: *SB12*

page 1 of 1

LOGGED BY: *John Noyes*
EDITED BY: *John Noyes*
CHECKED BY: *Chris Sullivan*
DATE BEGAN: *05-16-11*
DATE FINISHED: *05-16-11*
GROUND SURFACE ELEVATION:

DEPTH TO WATER WHILE DRILLING	SAMPLE NO. AND TYPE	SAMPLE RECOVERY	SAMPLE INFROMATION	POCKET PENETROMETER (TONS/FT2)
	SP1	2.5'/5'		
				2.5
				2.75
	SP2	5'/5'		
				1.75
				1.25
				1.25
				1.75
				1.5
	SP3	5'/5'		
				1.25
				0.75
				0.75
				1.25
				1.0
	SP4	4.5'/5'		
				0.75
				1.25
				1.5
				1.0
				0.75
	SP5	5'/5'		
				0.5
▽				



DESCRIPTION

Gravely SILT; brown; non-plastic; dry to moist. (Fill)

CLAY; brown; high plasticity; moist; stiff to soft; trace sand & gravel. (CL)

@ 14' grades dark gray to black; trace organics. (OH)

SAND; black to dark gray; poorly graded; fine grained; wet. (SP)

Bottom of boring @ 25'

Boring advanced W/ Geoprobe Model 6610DT using 60-inch Macrocore sampling system. Boring backfilled to groundsurface w/ bentonite chips on 05-16-11.

APPENDIX C – CPT Soil Probes on CCR Embankments

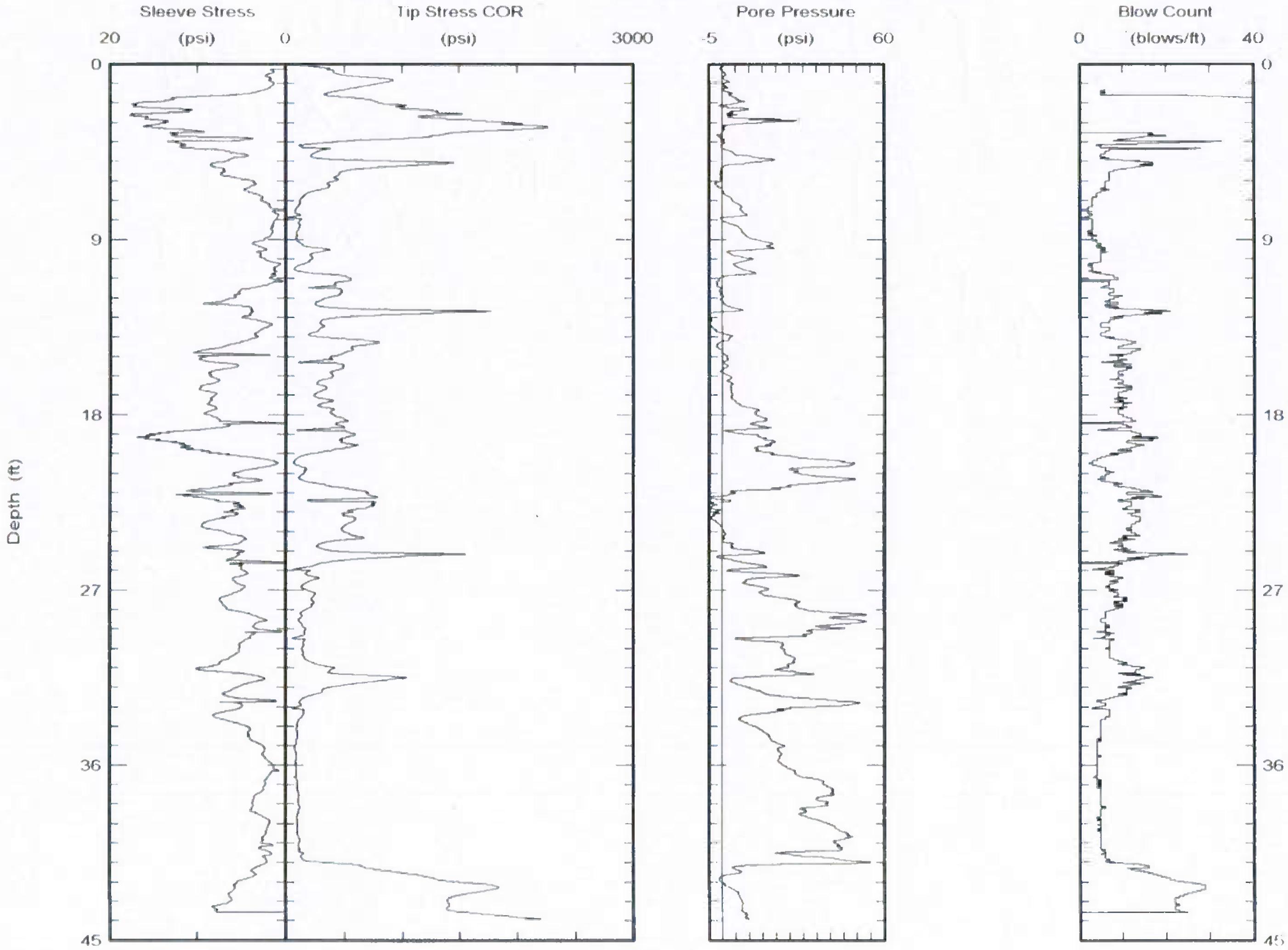
Alliant Energy
Interstate Power and Light Company
Burlington Generating Station
Burlington, Iowa

Safety Factor Assessment

CONE PENETROMETER TEST (CPT)

CPT I.D.	LOCATION	GROUND ELEVATION (FT)
CPT-1	Economizer Ash Pond	548.78
CPT-2	Economizer Ash Pond	550.34
CPT-3	Economizer Ash Pond	549.91
CPT-4	Economizer Ash Pond	549.65
CPT-5	Economizer Ash Pond	549.74
CPT-6	Economizer Ash Pond	550.57
CPT-7	Economizer Ash Pond	545.78
CPT-8	Economizer Ash Pond	546.26
CPT-9	Economizer Ash Pond	549.48
CPT-10	Economizer Ash Pond	549.42
CPT-11	Economizer Ash Pond	547.86
CPT-12	Economizer Ash Pond	548.25
CPT-13	Ash Seal Water Pond	534.22
CPT-14	Ash Seal Water Pond	533.67
CPT-15	Main Ash Pond	536.75
CPT-16	Main Ash Pond	534.84
CPT-17	Main Ash Pond	534.52
CPT-18	Main Ash Pond	533.89
CPT-19	Main Ash Pond	535.32
CPT-20	Upper Ash Pond	530.47
CPT-21	Upper Ash Pond	530.42

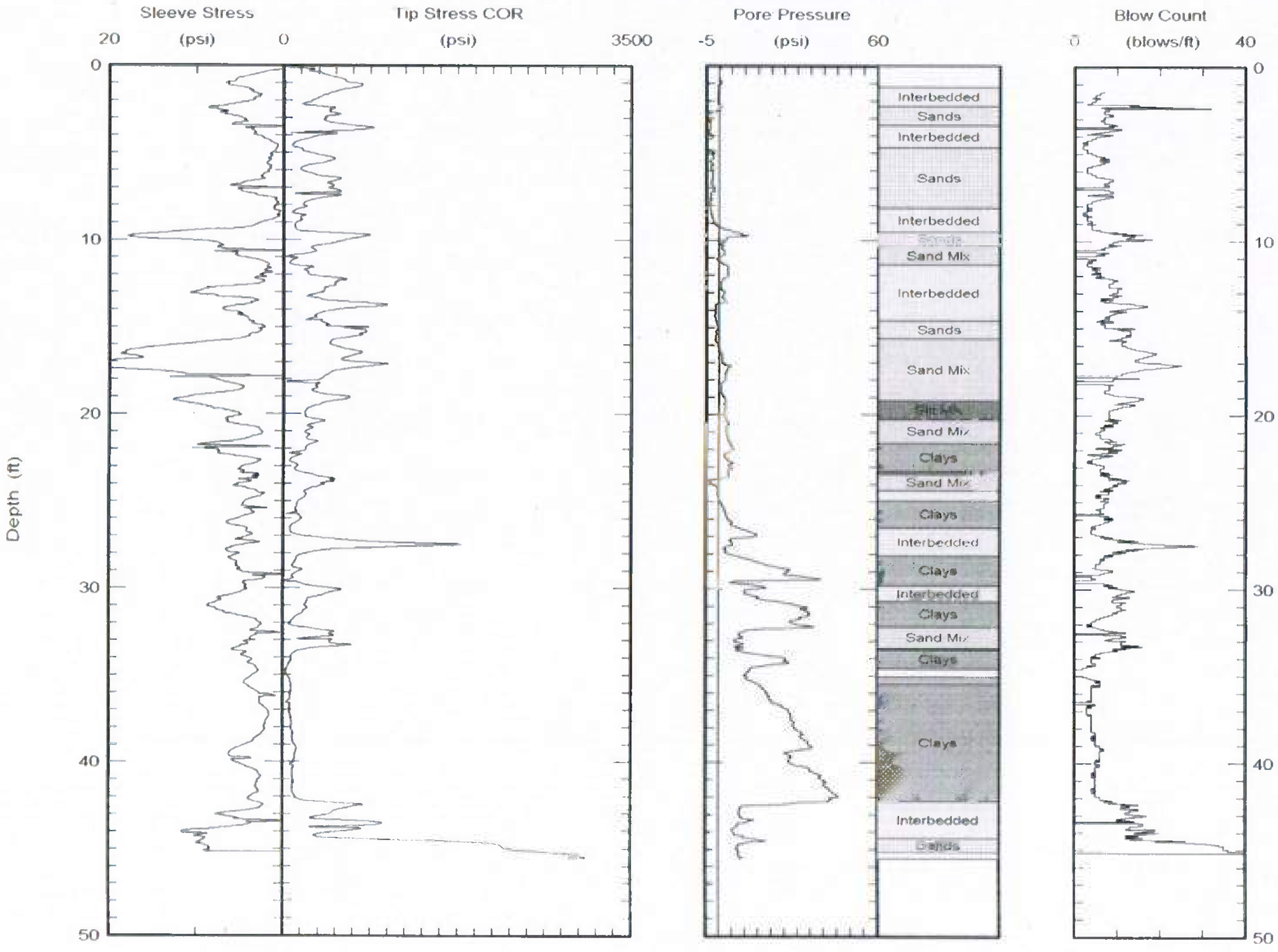
Applied Research Associates, Inc. South Royalton, VT 05068 802-763-8348 cpt@ned.ara.com www.ara.com	Northing: Easting: Elevation:	Date: 09/May/2011 Test ID: cpt1 Project: Alliant
	Client: Aetherdbs Job Site: Burlington	



Maximum depth: 43.92 (ft)

Test ID: cpt1
File: A09Y1101C.ECP

Applied Research Associates, Inc. South Royalton, VT 05068 802-763-8348 cpt@ned.ara.com www.ara.com	Northing: Easting: Elevation:	Date: 09/May/2011 Test ID: cpt2 Project: Alliant
	Client: Aetherdbs Job Site: Burlington	



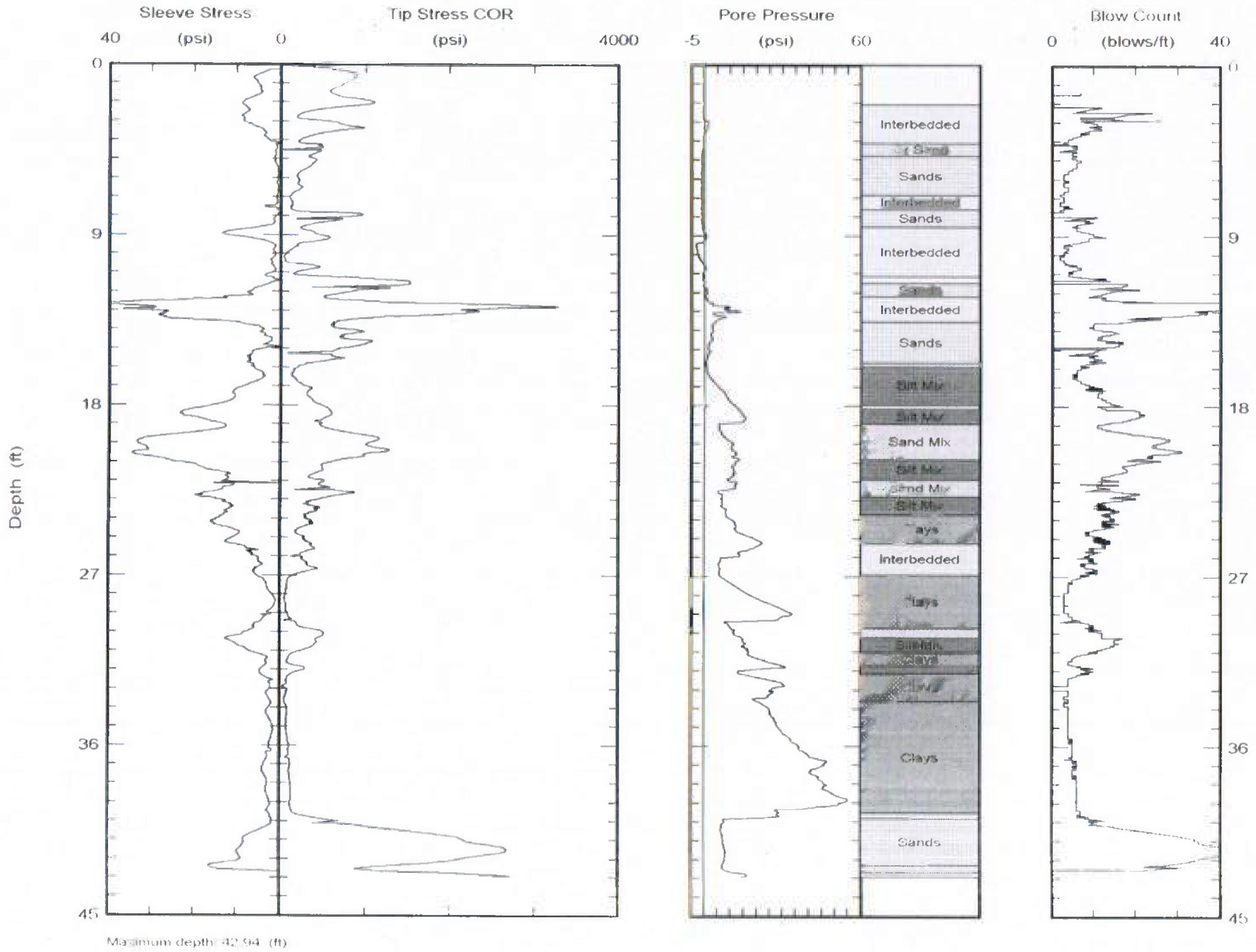
Maximum depth: 45.54 (ft)

Applied Research Associates, Inc.
South Royalton, VT 05068
802-763-8348
cpt@ned.ara.com
www.ara.com

Northing:
Easting:
Elevation:

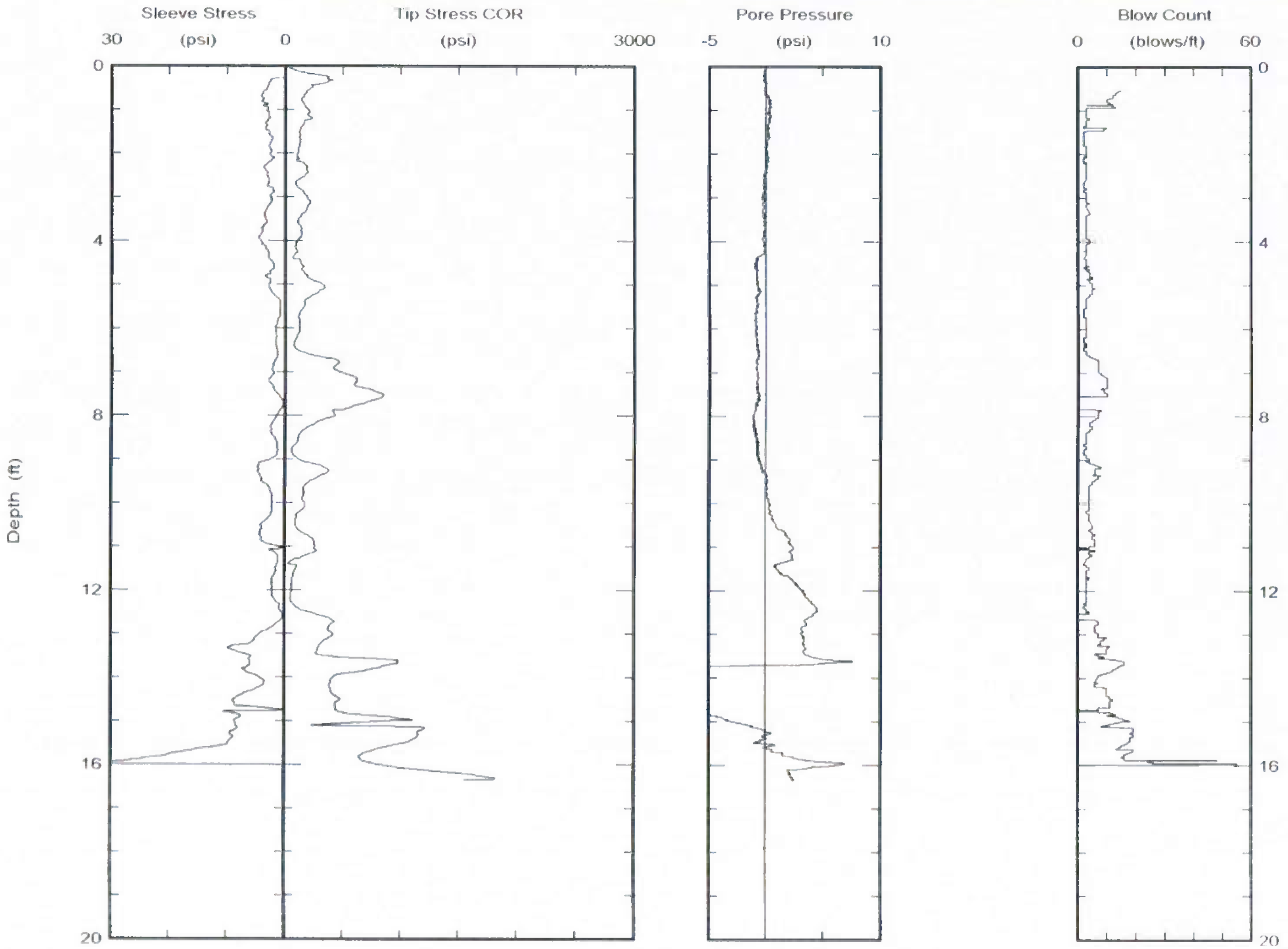
Date: 09/May/2011
Test ID: cpt3
Project: Alliant

Client: Aetherdbs
Job Site: Burlington



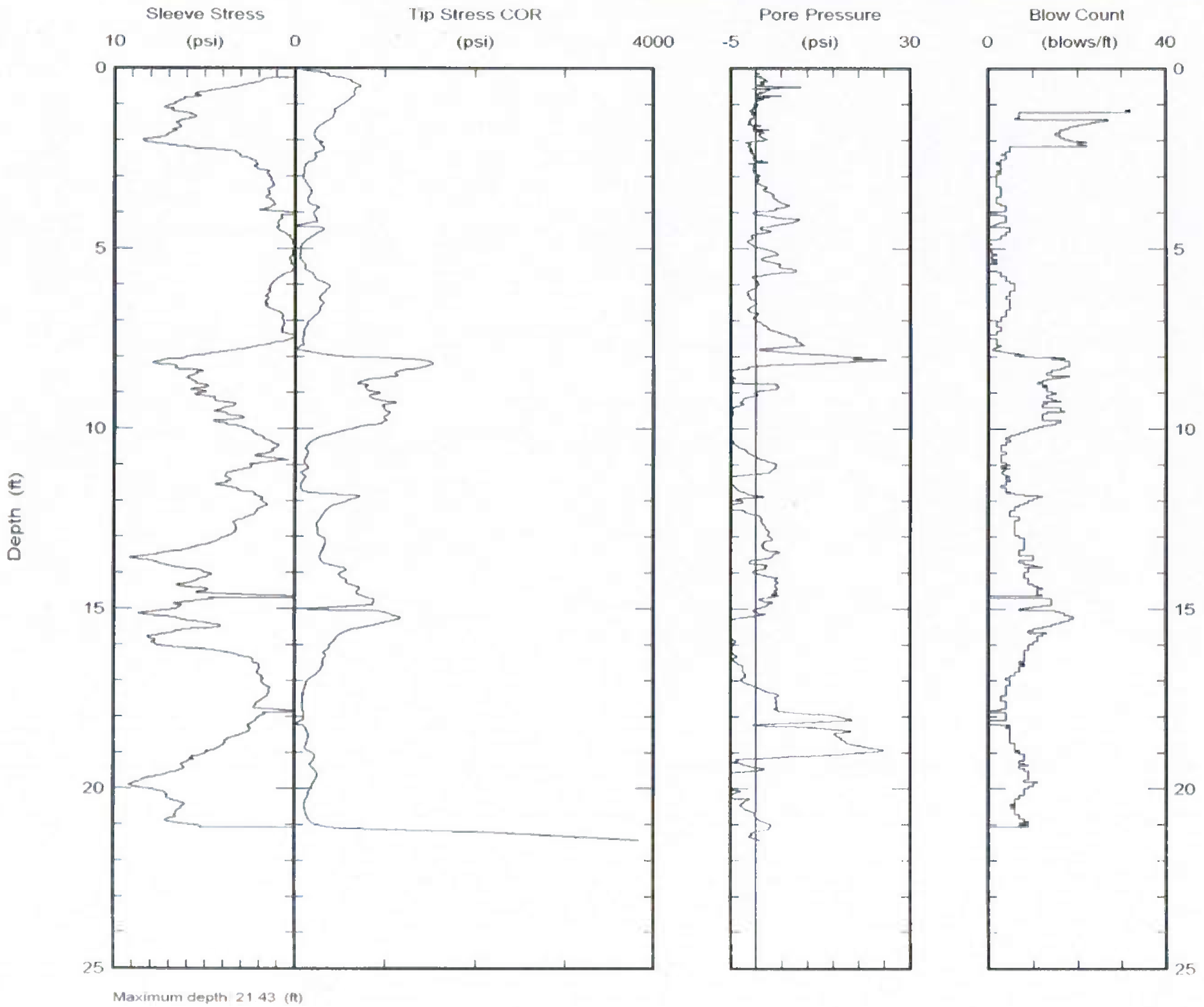
Maximum depth: 42.94 (ft)

Applied Research Associates, Inc. South Royalton, VT 05068 802-763-8348 cpt@ned.ara.com www.ara.com	Northing: Easting: Elevation:	Date: 09/May/2011 Test ID: cpt4 Project: Alliant
	Client: Aetherdbs Job Site: Burlington	



Maximum depth: 16.35 (ft)

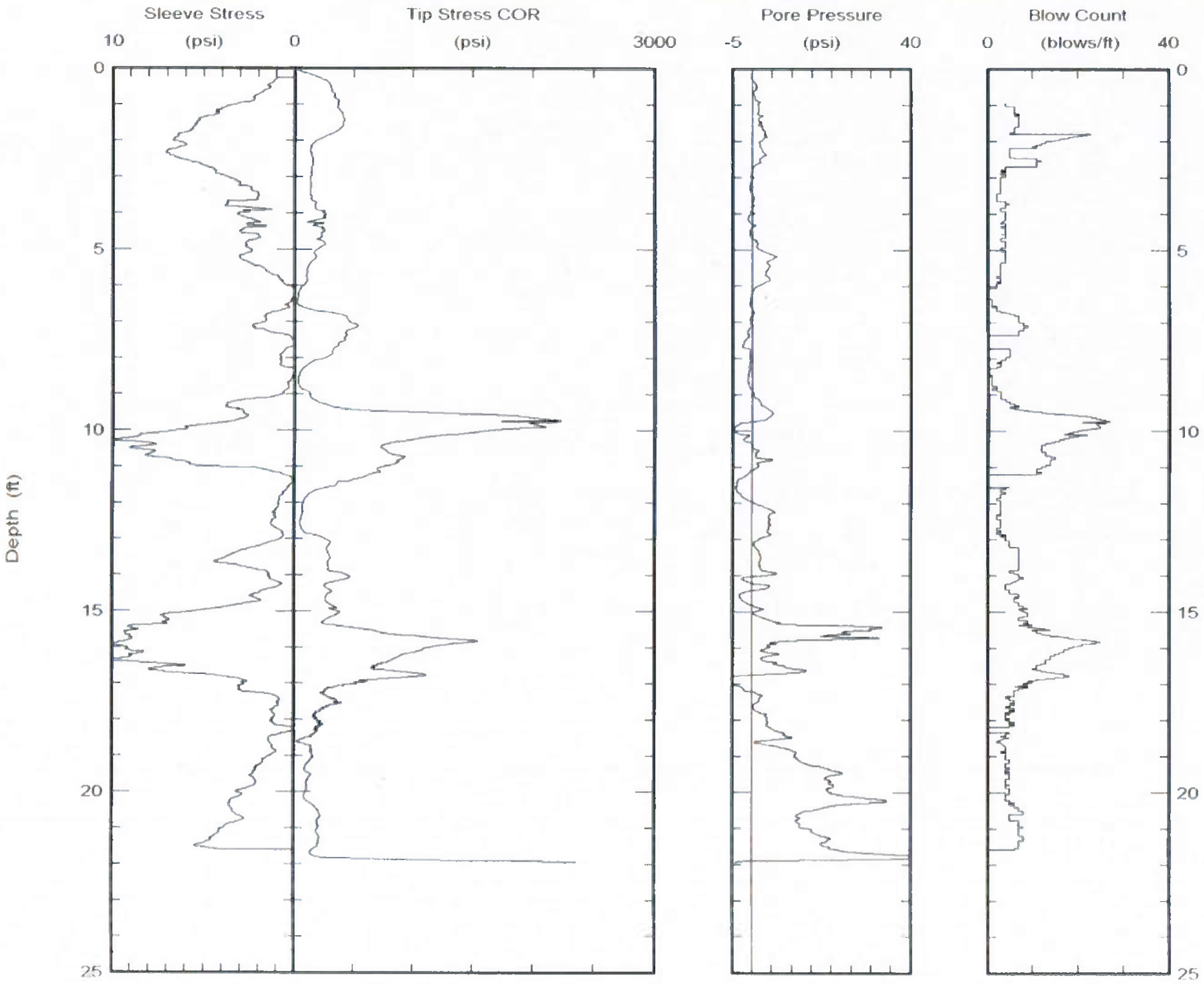
Applied Research Associates, Inc. South Royalton, VT 05068 802-763-8348 cpt@ned.ara.com www.ara.com	Northing: Easting: Elevation:	Date: 10/May/2011 Test ID: cpt5 Project: Alliant
	Client: Aetherdbs Job Site: Burlington	



Applied Research Associates, Inc.
South Royalton, VT 05068
802-763-8348
cpt@ned.ara.com
www.ara.com

Northing:
Easting:
Elevation:
Client: Aetherdbs
Job Site: Burlington

Date: 10/May/2011
Test ID: cpt6
Project: Alliant



Maximum depth: 21.96 (ft)

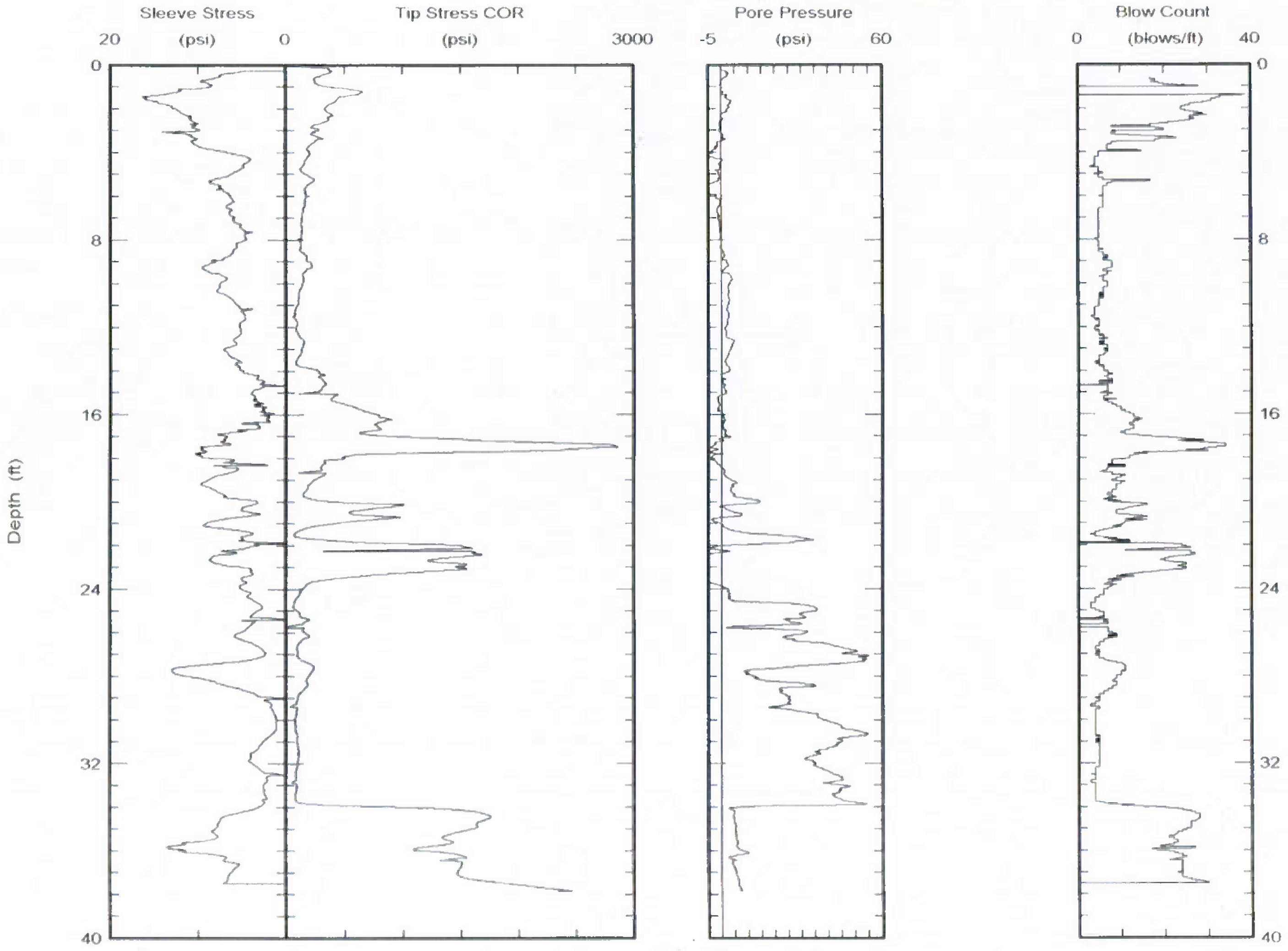
Test ID: cpt6
File: A10Y1102C.ECP

Applied Research Associates, Inc.
South Royalton, VT 05068
802-763-8348
cpt@ned.ara.com
www.ara.com

Northing:
Easting:
Elevation:

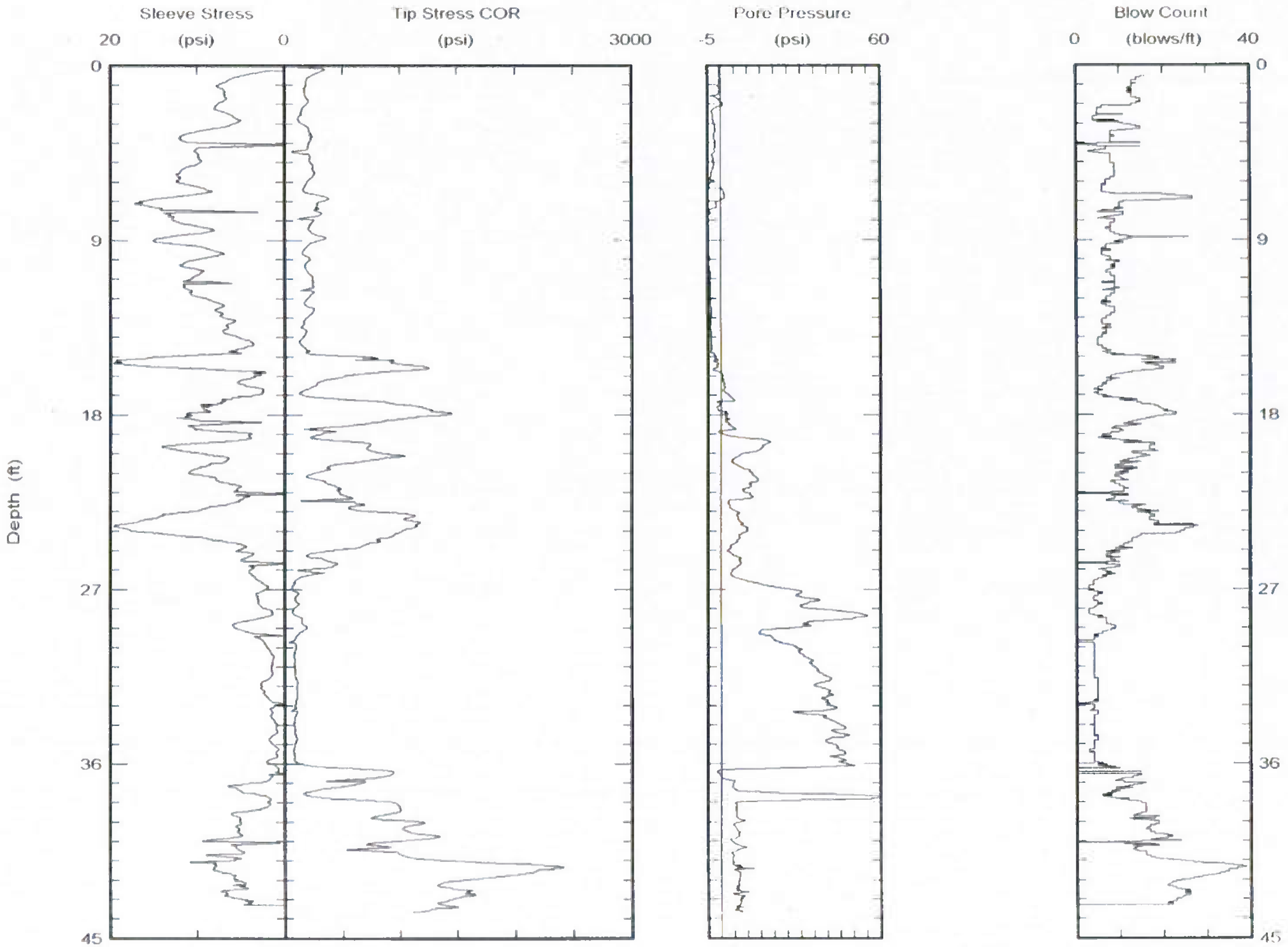
Date: 10/May/2011
Test ID: cpt7
Project: Alliant

Client: Aetherdbs
Job Site: Burlington



Maximum depth: 37.86 (ft)

Applied Research Associates, Inc. South Royalton, VT 05068 802-763-8348 cpt@ned.ara.com www.ara.com	Northing: Easting: Elevation:	Date: 10/May/2011 Test ID: cpt8 Project: Alliant
	Client: Aetherdbs Job Site: Burlington	



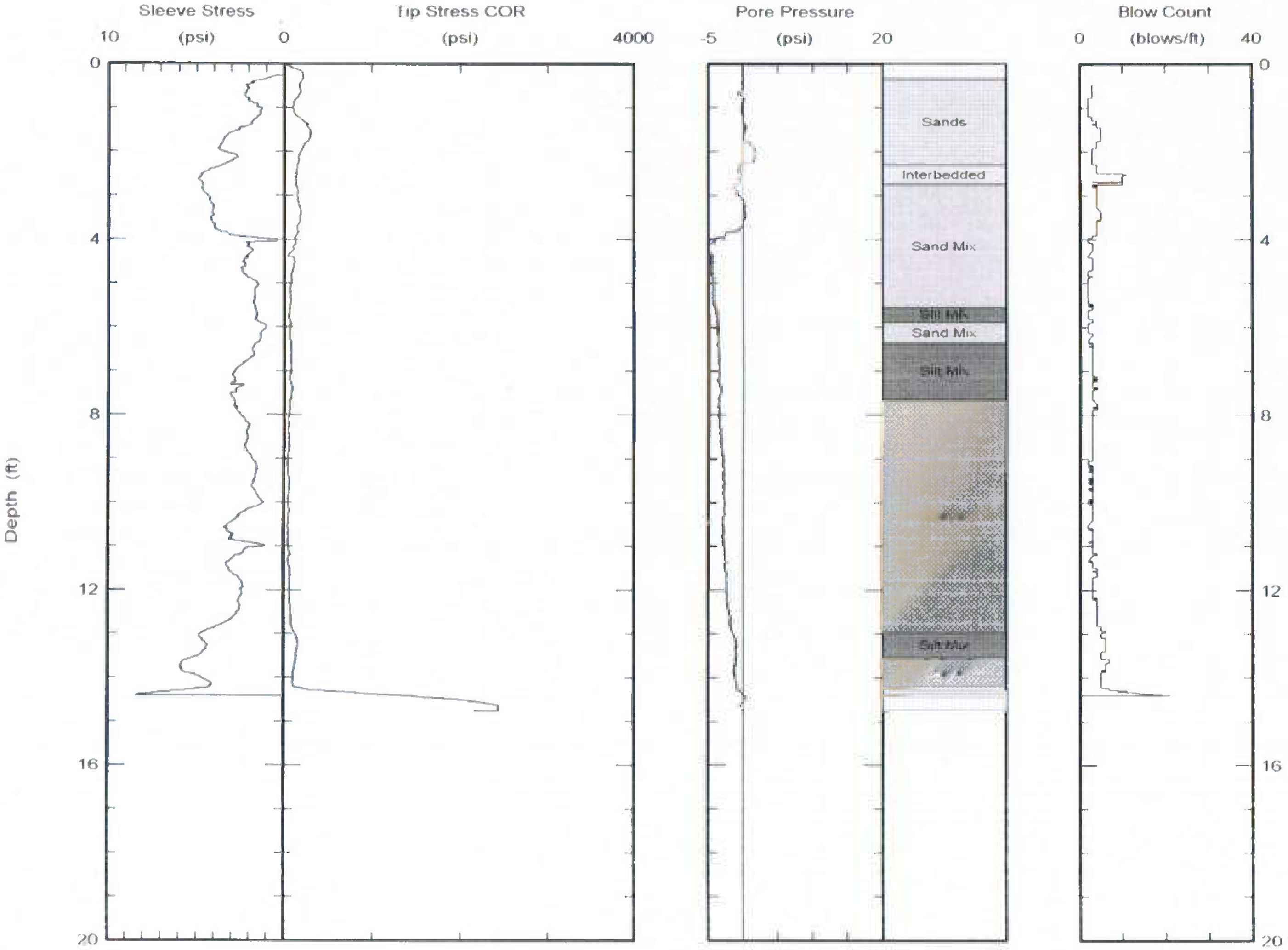
Maximum depth: 43.65 (ft)

Applied Research Associates, Inc.
South Royalton, VT 05068
802-763-8348
cpt@ned.ara.com
www.ara.com

Northing:
Easting:
Elevation:

Date: 10/May/2011
Test ID: cpt9
Project: Alliant

Client: Aetherdbs
Job Site: Burlington



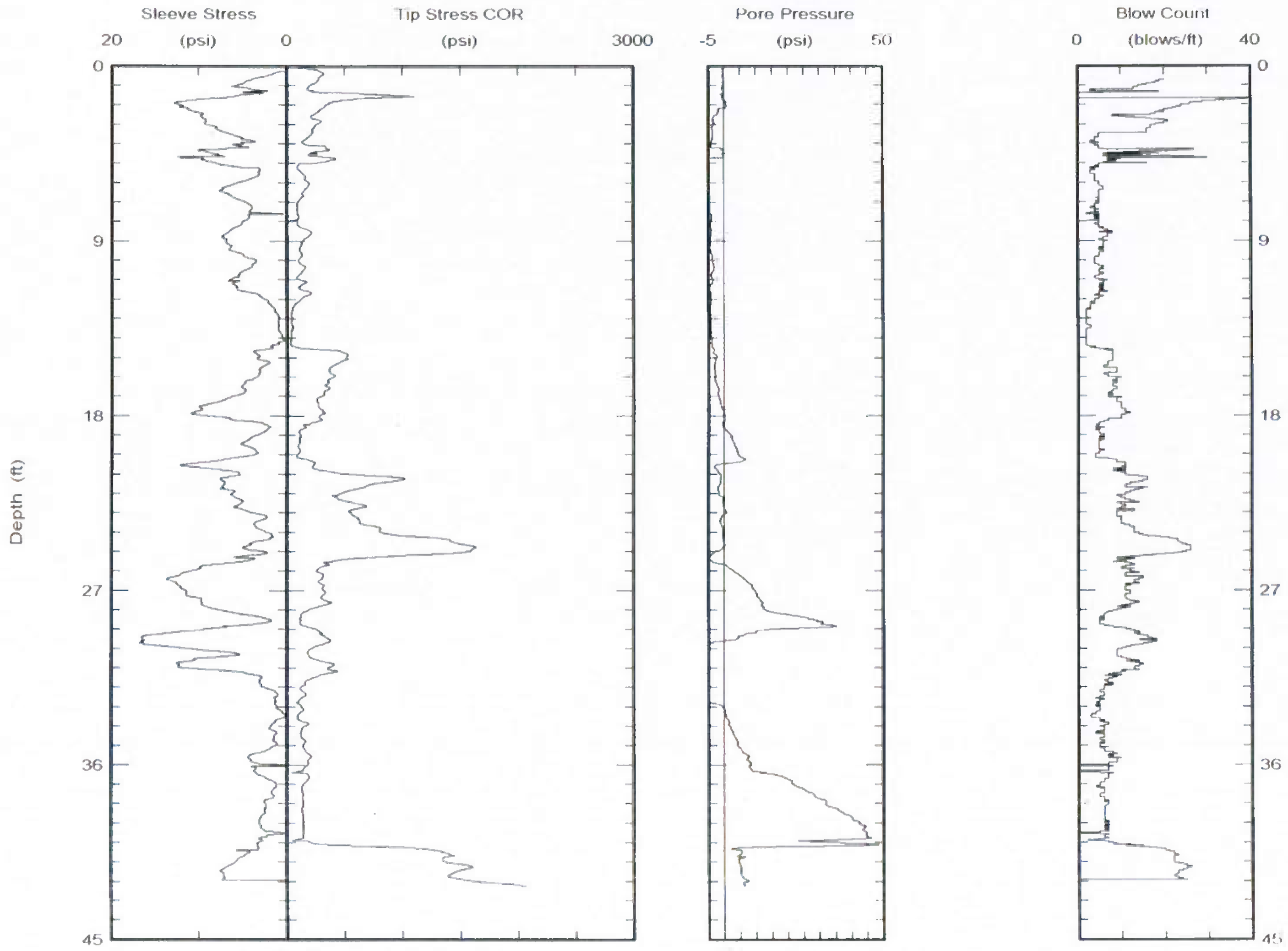
Maximum depth: 14.76 (ft)

Applied Research Associates, Inc.
South Royalton, VT 05068
802-763-8348
cpt@ned.ara.com
www.ara.com

Northing:
Easting:
Elevation:

Date: 10/May/2011
Test ID: cpt10
Project: Alliant

Client: Aetherdbs
Job Site: Burlington



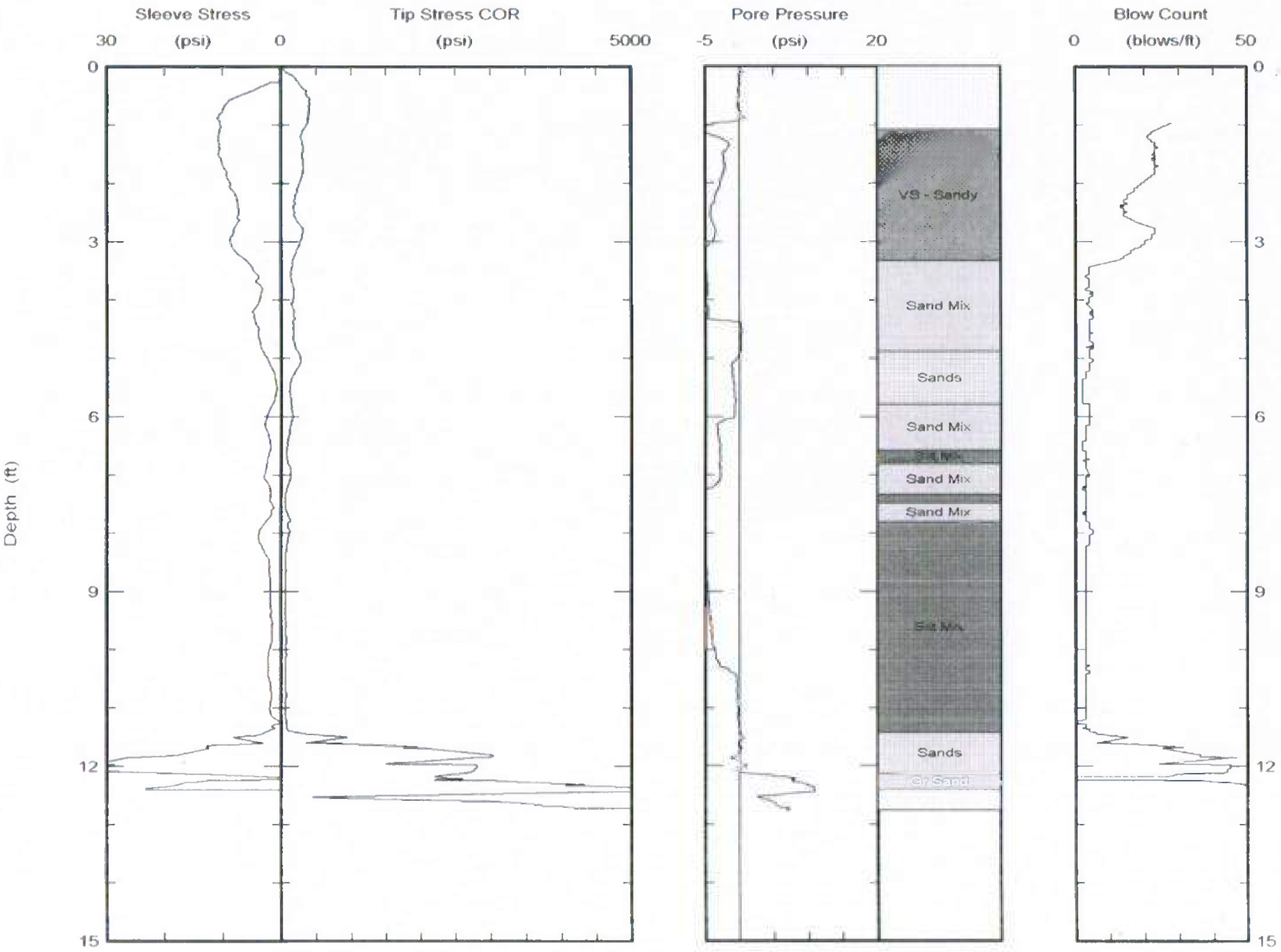
Maximum depth: 42.27 (ft)

Applied Research Associates, Inc.
South Royalton, VT 05068
802-763-8348
cpt@ned.ara.com
www.ara.com

Northing:
Easting:
Elevation:

Date: 10/May/2011
Test ID: cpt11
Project: Alliant

Client: Aetherdbs
Job Site: Burlington



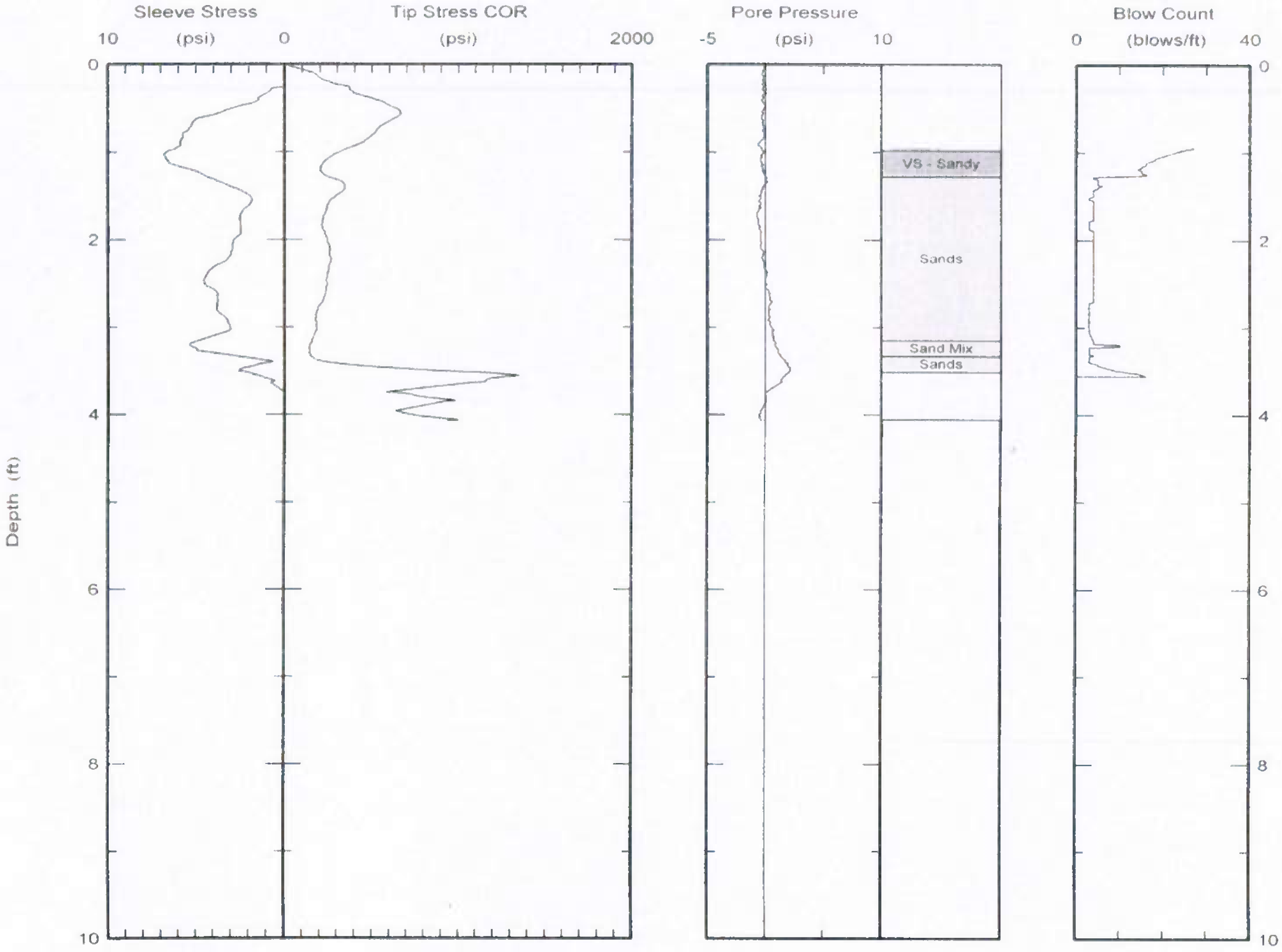
Maximum depth: 12.76 (ft)

Applied Research Associates, Inc.
South Royalton, VT 05068
802-763-8348
cpt@ned.ara.com
www.ara.com

Northing:
Easting:
Elevation:

Date: 10/May/2011
Test ID: cpt12
Project: Alliant

Client: Aetherdbs
Job Site: Burlington



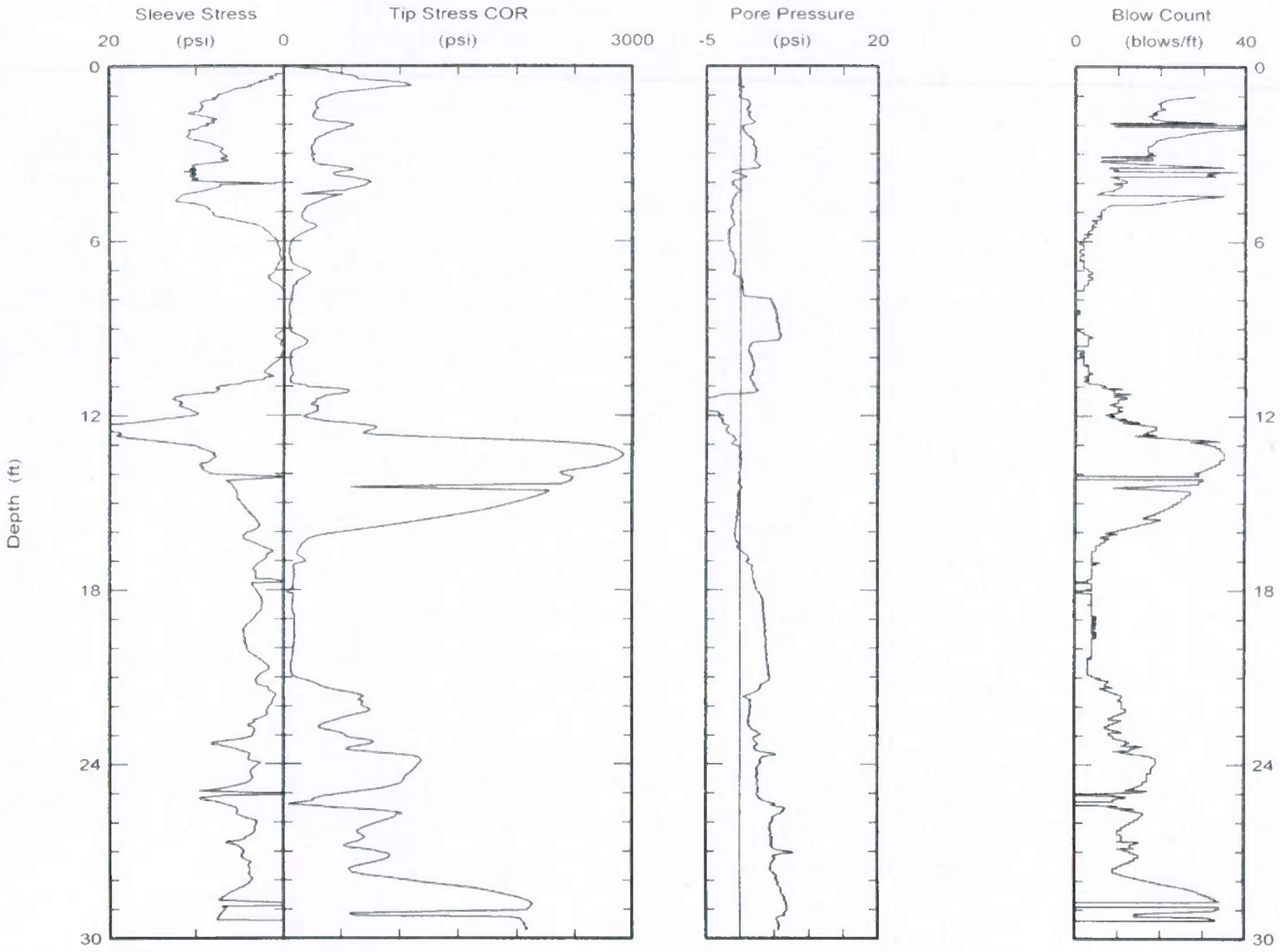
Maximum depth: 4.06 (ft)

Applied Research Associates, Inc.
South Royalton, VT 05068
802-763-8348
cpt@ned.ara.com
www.ara.com

Northing:
Easting:
Elevation:

Date: 10/May/2011
Test ID: cpt13
Project: Alliant

Client: Aetherdbs
Job Site: Burlington



Maximum depth: 29.72 (ft)

Test ID: cpt13
File: A10Y1109C.ECP

Applied Research Associates, Inc.
South Royalton, VT 05068
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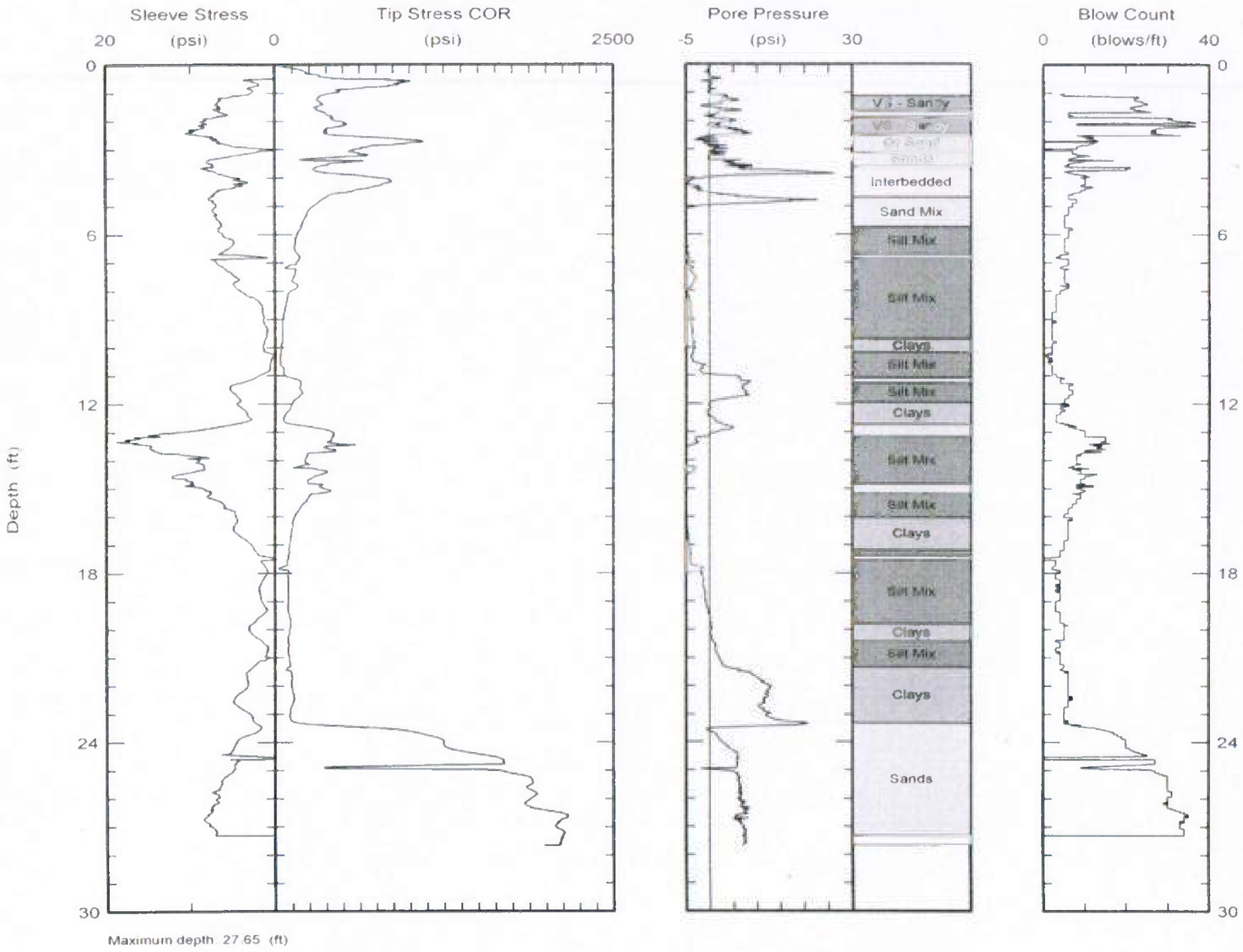
www.ara.com

Northing:
Easting:
Elevation:

Date: 15/May/2011
Test ID: cpt14
Project: Alliant

Client: Aetherdbs
Job Site: Burlington



Maximum depth: 27.65 (ft)

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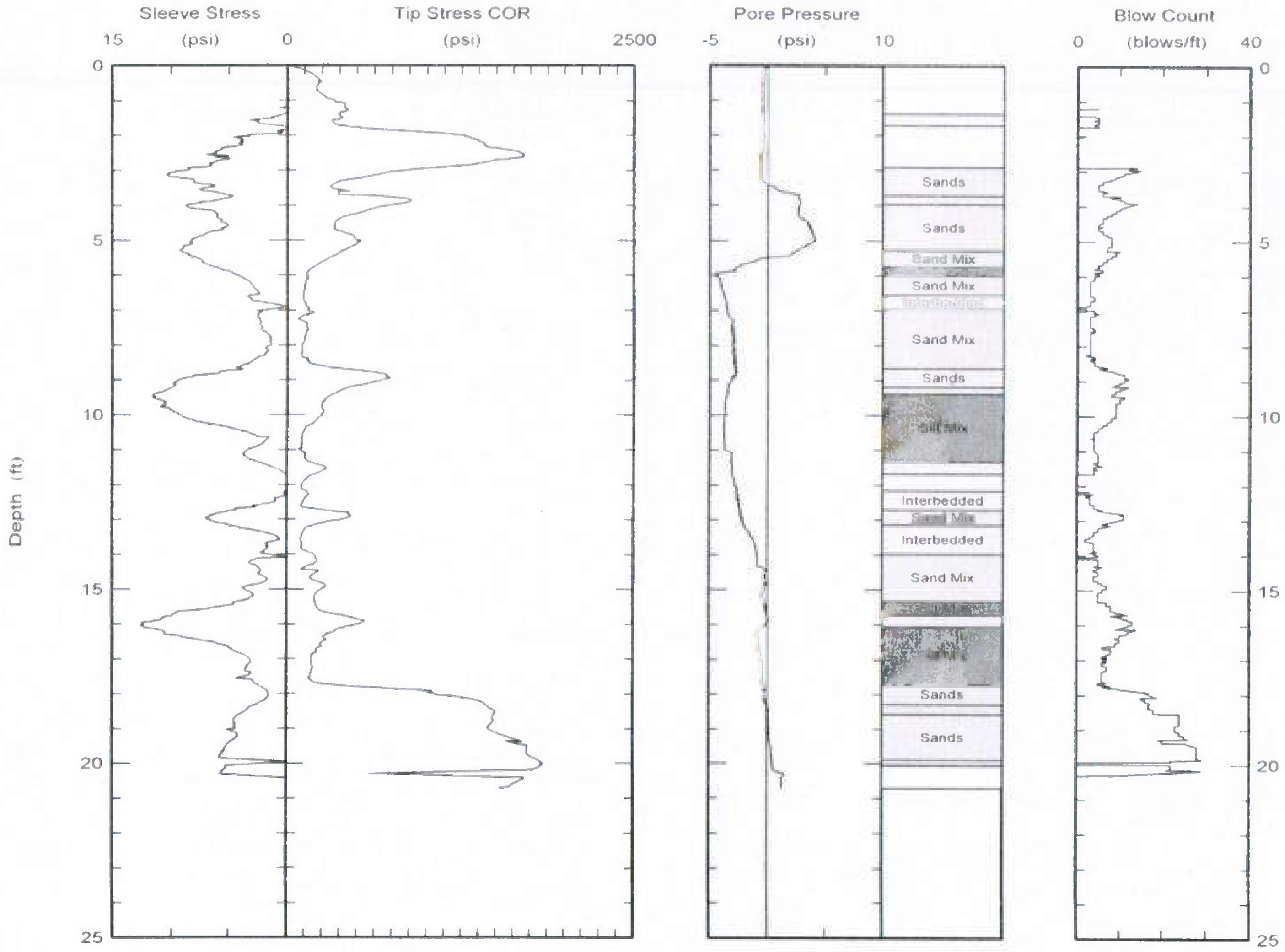
www.ara.com

Northing:
Easting:
Elevation:
Client: Aetherdbs
Job Site: Burlington

Date: 15/May/2011
Test ID: cpt15
Project: Alliant



Maximum depth: 20.70 (ft)

Test ID: cpt15
File: A15Y1102C.ECP

Applied Research Associates, Inc.
South Royalton, VT 05068
802-763-8348
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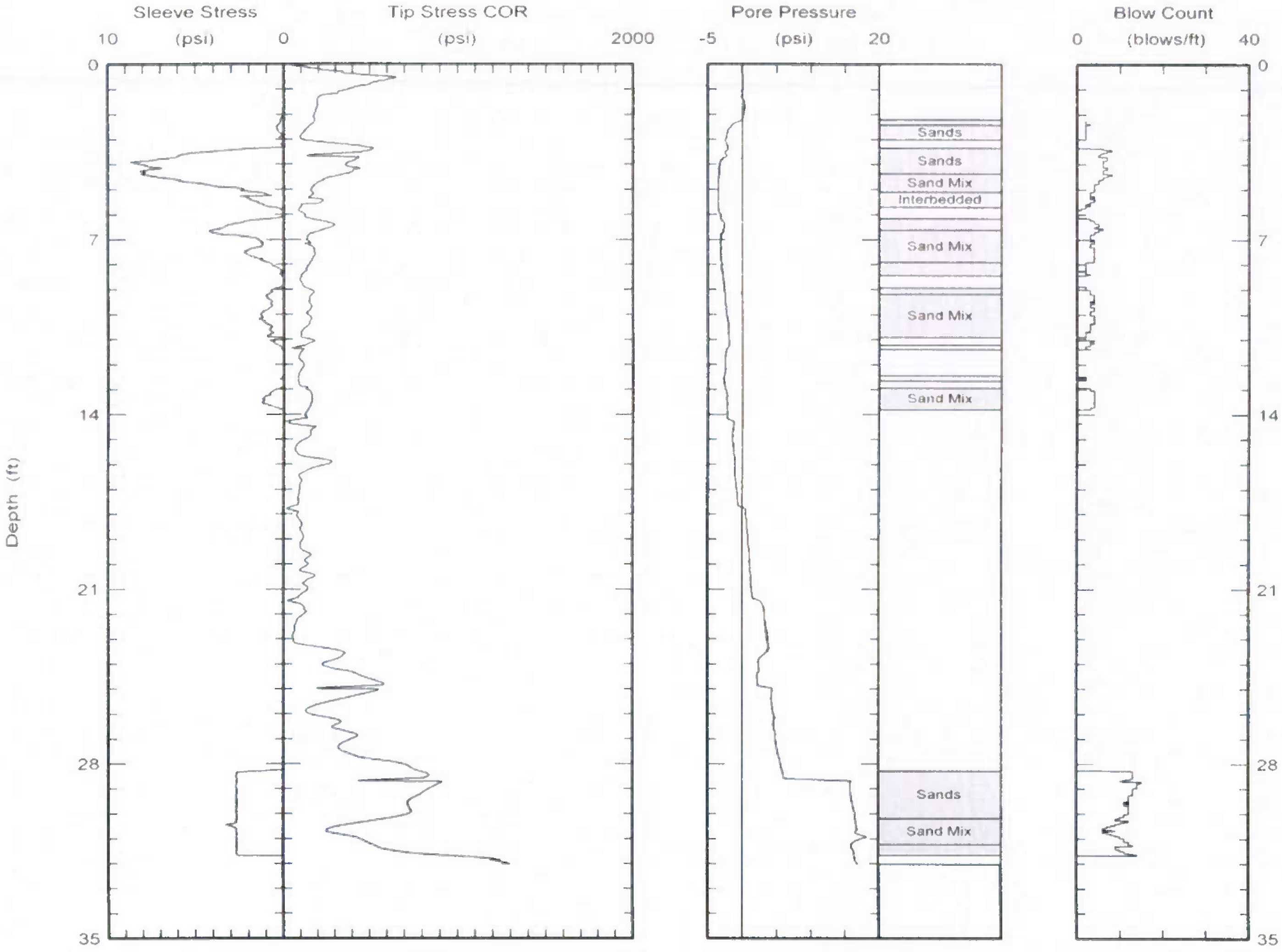
www.ara.com

Northing:
Easting:
Elevation:

Date: 15/May/2011
Test ID: cpt16
Project: Alliant

Client: Aetherdbs
Job Site: Burlington



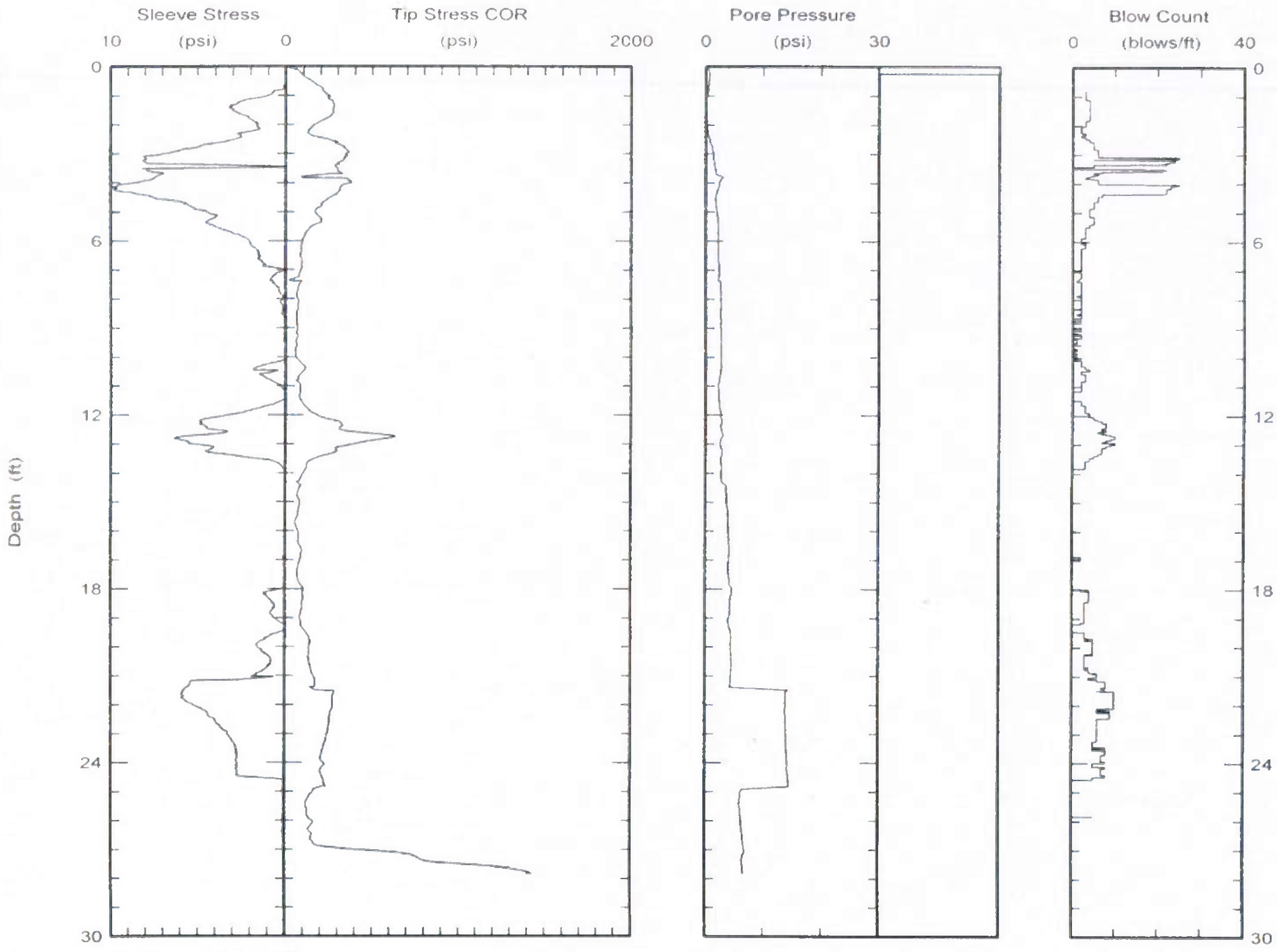
Maximum depth: 32.02 (ft)

Applied Research Associates, Inc.
South Royalton, VT 05068
802-763-8348
cpt@ned.ara.com
www.ara.com

Northing:
Easting:
Elevation:

Date: 15/May/2011
Test ID: cpt17
Project: Alliant

Client: Aetherdbs
Job Site: Burlington



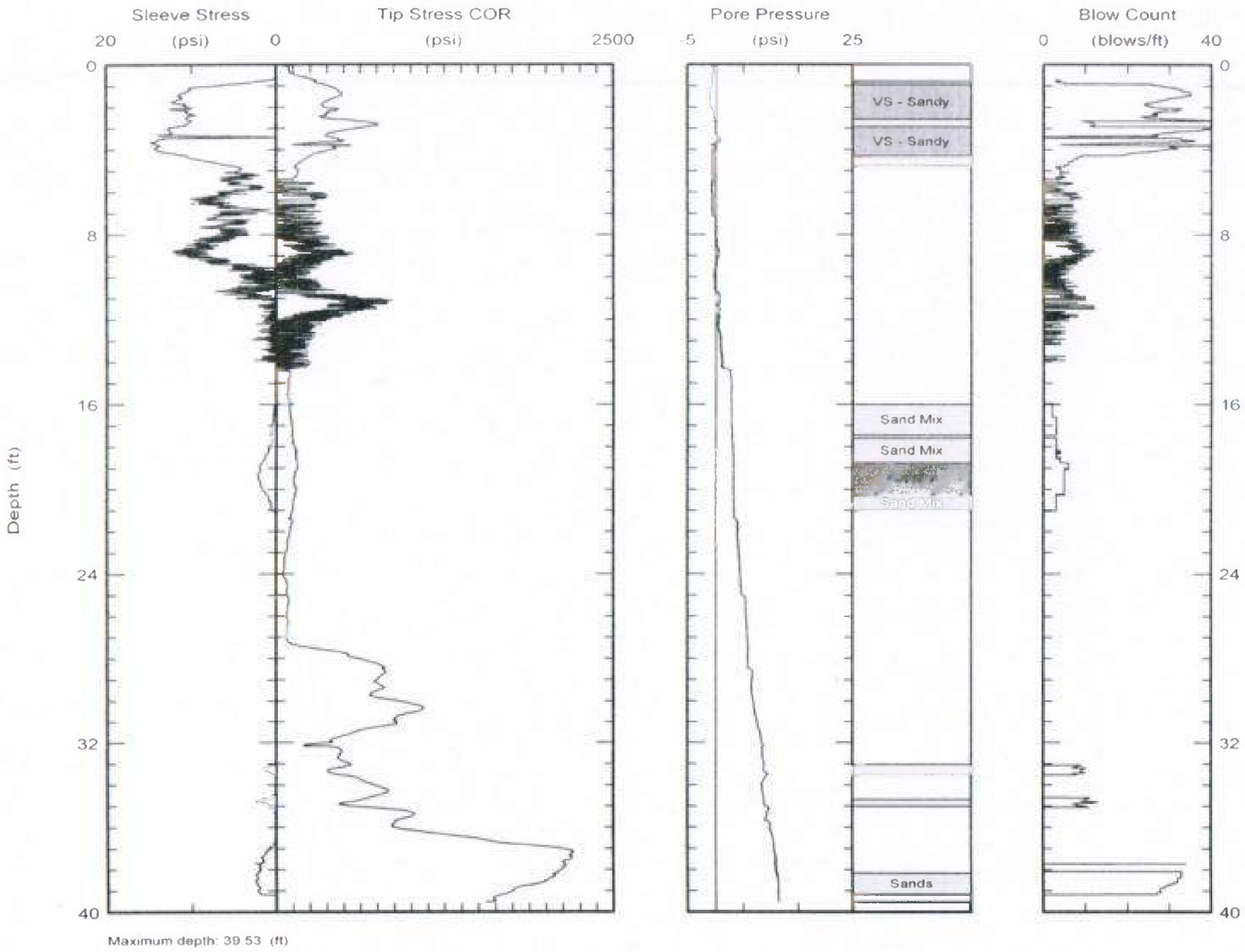
Maximum depth: 27.84 (ft)

Test ID: cpt17
File: A15Y1104C.ECP

Applied Research Associates, Inc.
South Royalton, VT 05068
802-763-8348
cpt@ned.ara.com
www.ara.com

Northing:
Easting:
Elevation:
Client: Aetherdbs
Job Site: Burlington

Date: 15/May/2011
Test ID: cpt18
Project: Alliant



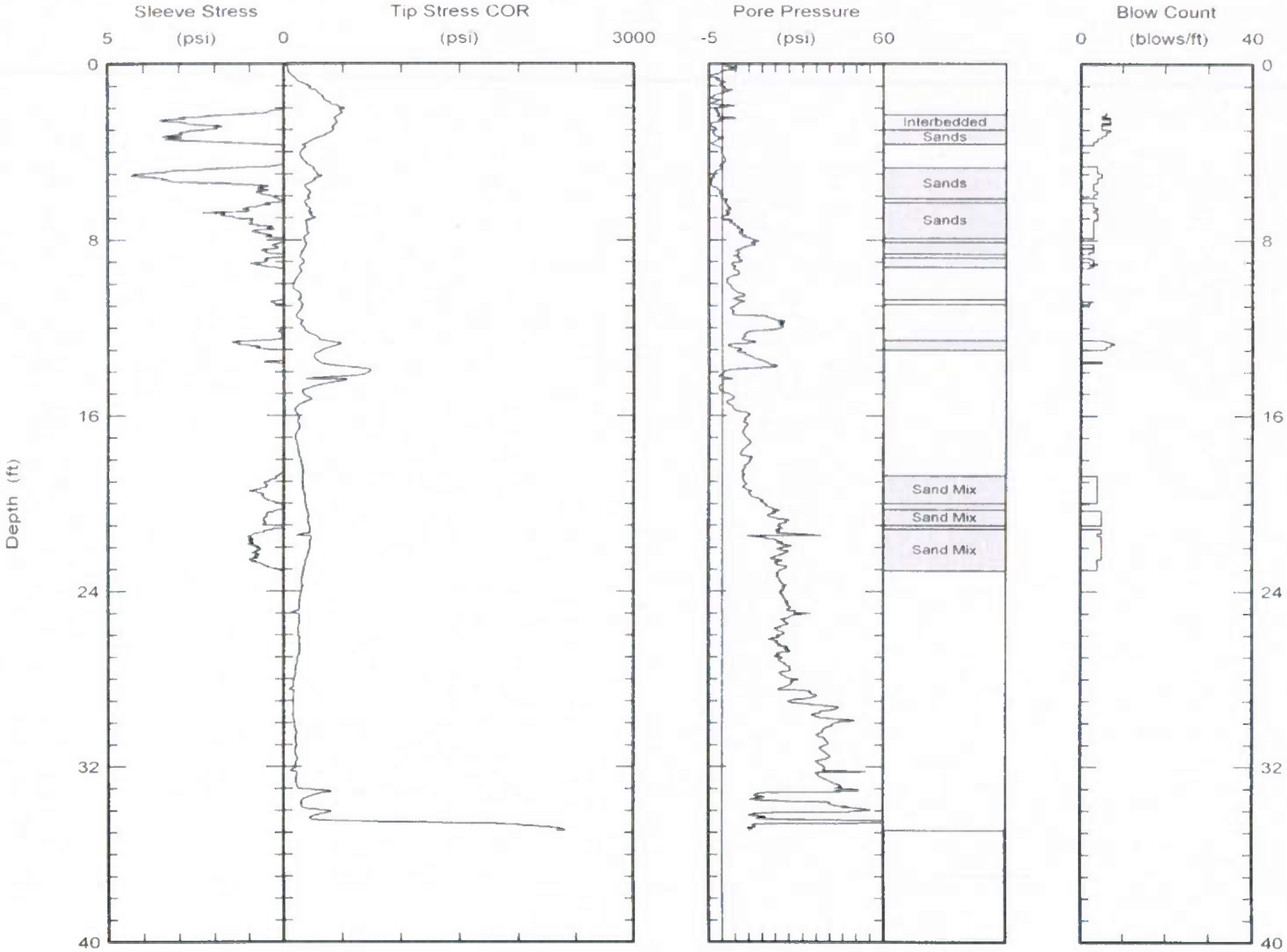
Maximum depth: 39.53 (ft)

Applied Research Associates, Inc.
South Royalton, VT 05068
802-763-8348
cpt@ned.ara.com
www.ara.com

Northing:
Easting:
Elevation:

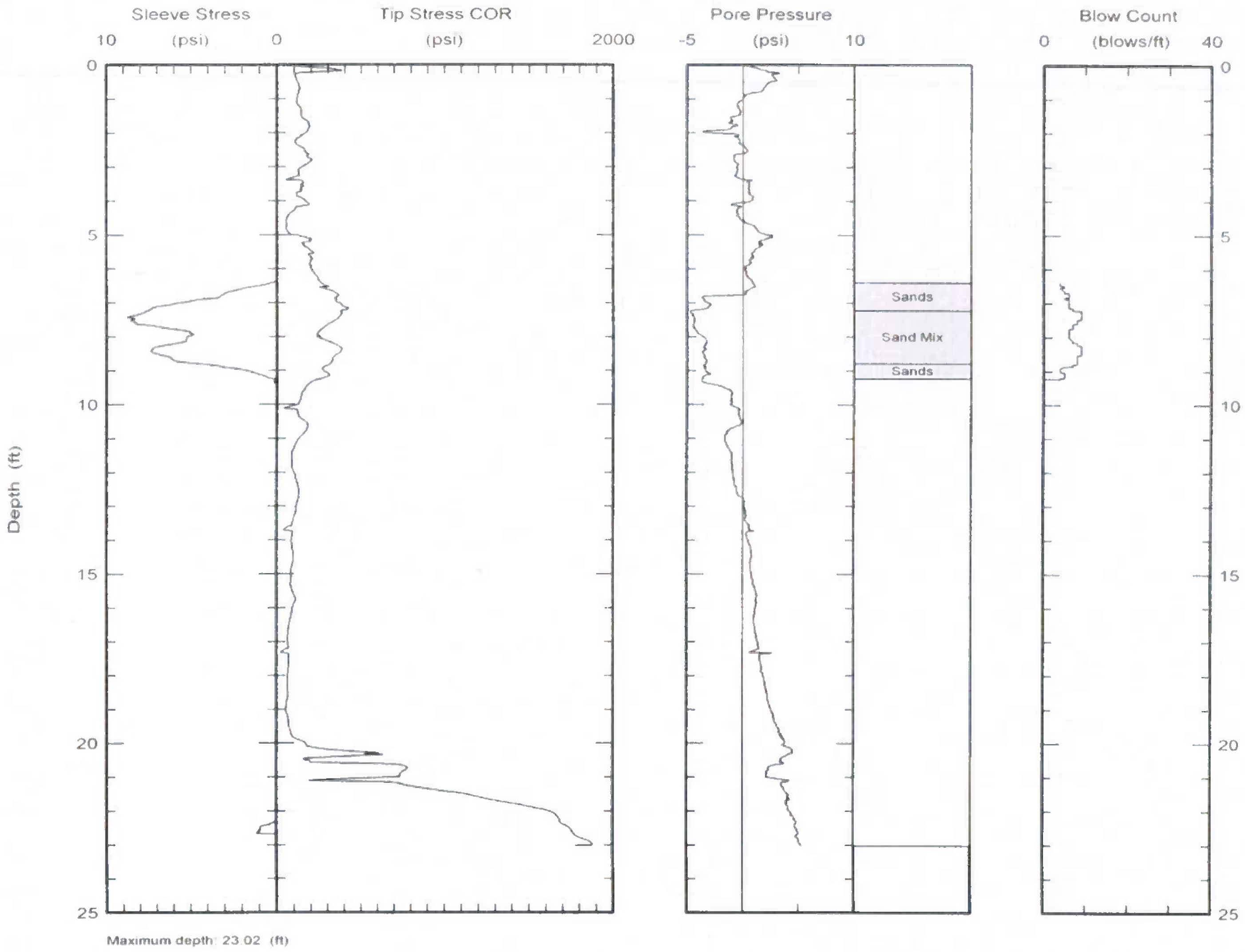
Date: 16/May/2011
Test ID: cpt19
Project: Alliant

Client: Aetherdbs
Job Site: Burlington



Maximum depth: 34.90 (ft)

Applied Research Associates, Inc. South Royalton, VT 05068 802-763-8348 cpt@ned.ara.com www.ara.com	Northing: Easting: Elevation:	Date: 16/May/2011 Test ID: cpt20 Project: Alliant
	Client: Aetherdbs Job Site: Burlington	



Maximum depth: 23.02 (ft)

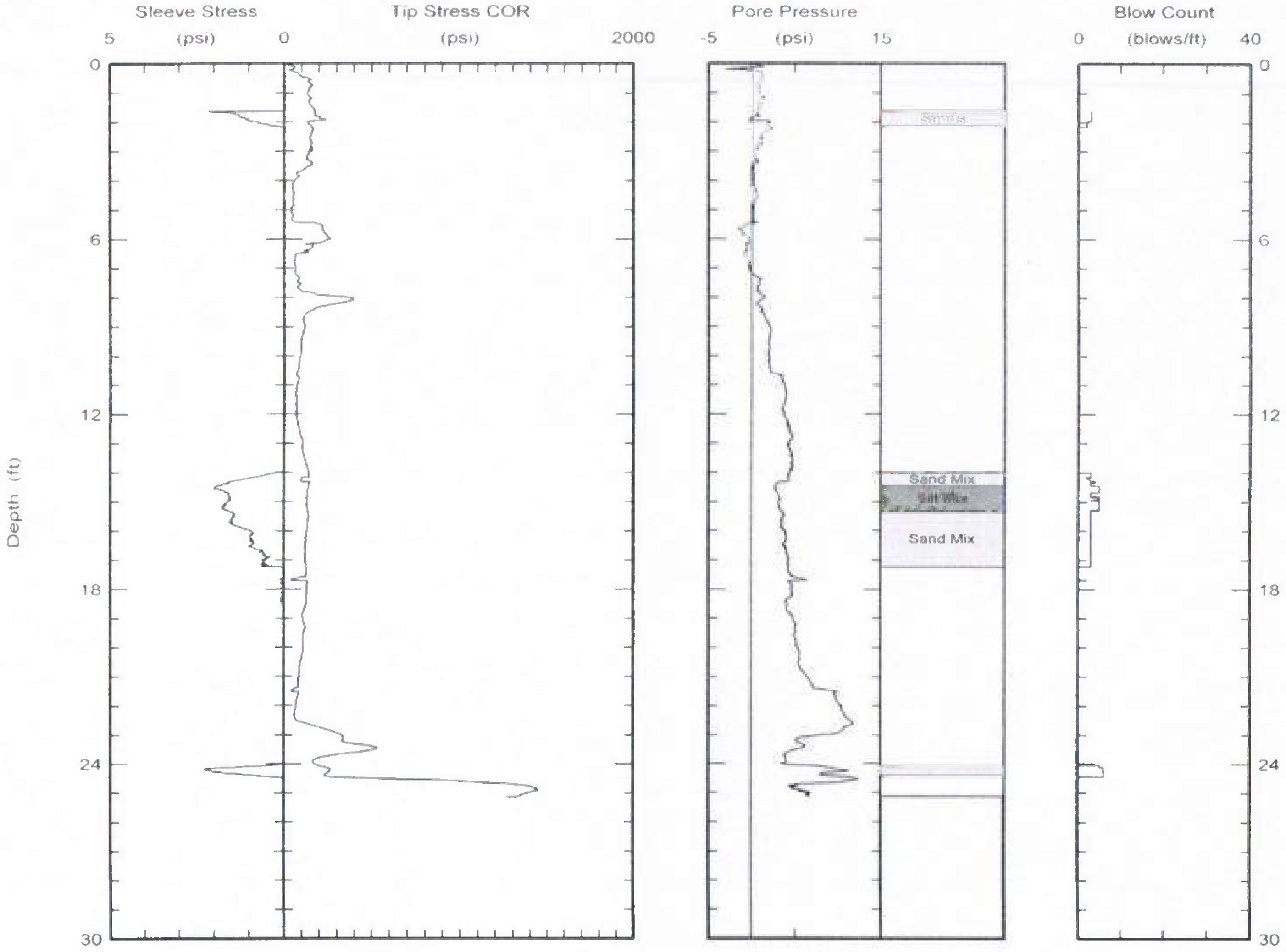
Test ID: cpt20
File: A16Y1102C.ECP

Applied Research Associates, Inc.
South Royalton, VT 05068
802-763-8348
cpt@ned.ara.com
www.ara.com

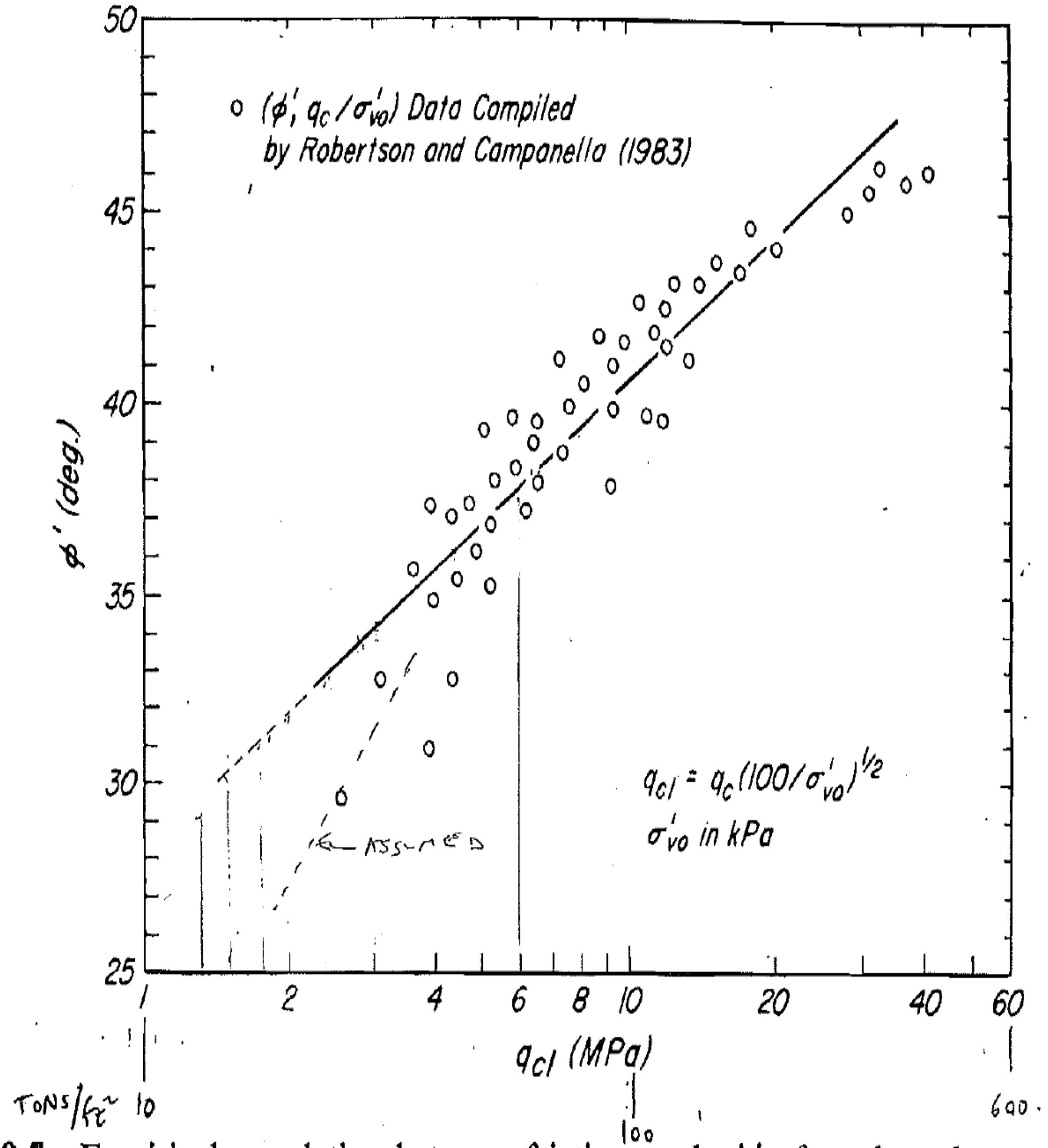
Northing:
Easting:
Elevation:

Date: 16/May/2011
Test ID: cpt21
Project: Alliant

Client: Aetherdbs
Job Site: Burlington



Maximum depth: 25.13 (ft)



19.5 Empirical correlation between friction angle ϕ′ of sands and norma penetration resistance.

Re: TERZAGHI PECK & MESRI (1996), SOIL MECHANICS IN ENG. PRACTICE, 3RD ED., JOHN WILEY & SONS, INC

APPENDIX D – Laboratory Testing on CCR Embankment Soils

Alliant Energy
Interstate Power and Light Company
Burlington Generating Station
Burlington, Iowa

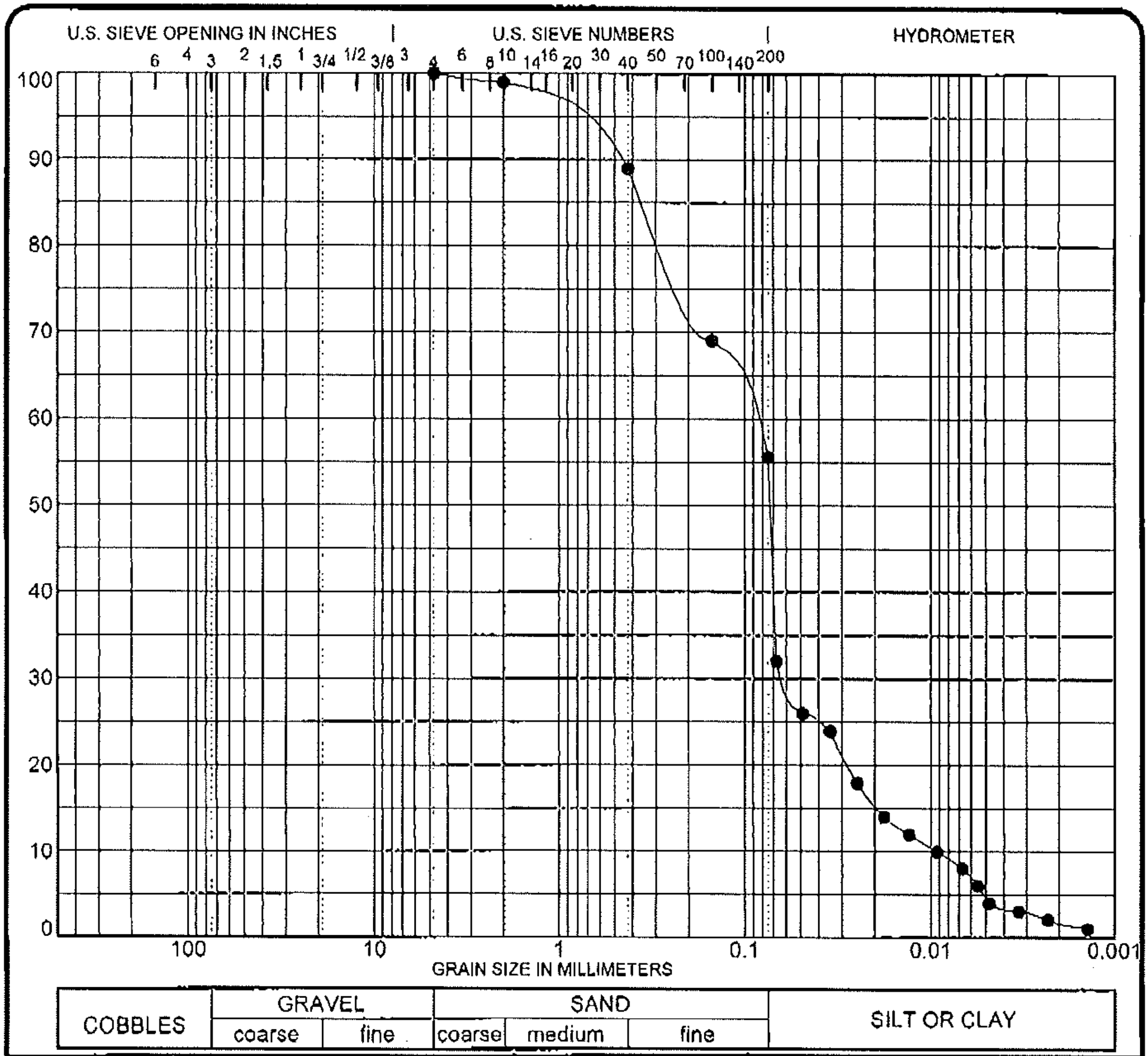
Safety Factor Assessment

Attachment C

Soil Laboratory Results

Burlington Generating Station

Source: Testing Service Corporation, May 2011



SPECIMEN IDENTIFICATION

Broing: SB-1

Sample: Ash

NOTES:

SIEVE	% PASS
3 inch	100
2	100
1 1/2	100
1	100
3/4	100
3/8	100
# 4	100
# 10	99
# 40	89
# 100	69
# 200	56

SOIL CLASSIFICATION

Brown ASH

%GRAVEL	%SAND	%SILT	%CLAY
0	44	54	2

MC%		LL	PL	PI
44.0		NP	NP	NP

PROJECT Geotechnical Testing
LOCATION ,

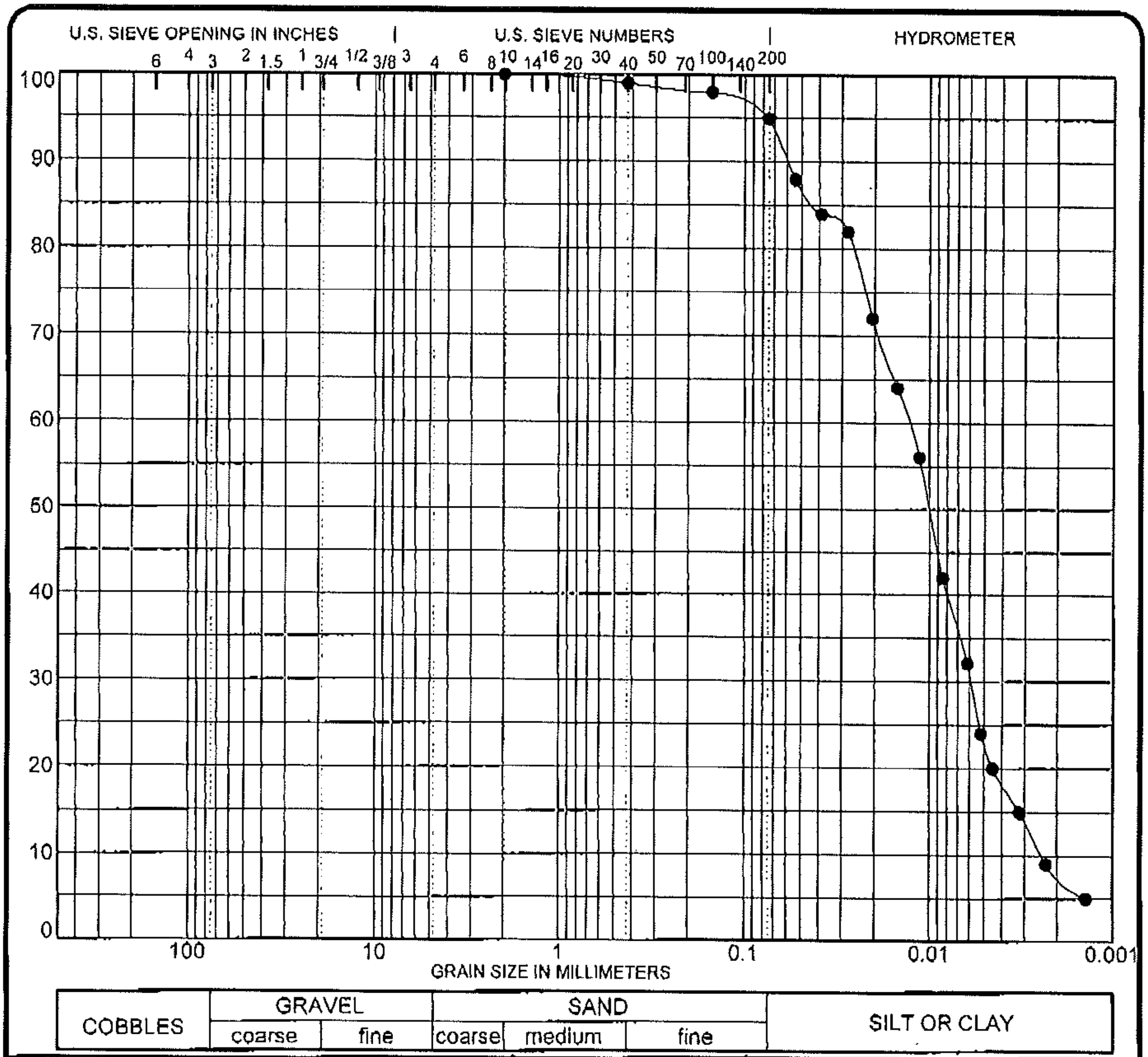
JOB NO. L - 76,757
DATE May 20, 2011

SB1

SOILGENR 76757.GPJ TSC_ALL.GDT 5/20/11

SOIL DATA SHEET

Testing Service Corporation
Carol Stream, IL 60188



SPECIMEN IDENTIFICATION	SIEVE	% PASS
Boring: SB-1	3 inch	100
Sample: A	2	100
Depth: 25.0'-26.0'	1 1/2	100
	1	100
NOTES:	3/4	100
	3/8	100
	# 4	100
	# 10	100
	# 40	99
	# 100	98
	# 200	95

SOIL CLASSIFICATION

Gray clayey SILT, trace sand (ML)

%GRAVEL	%SAND	%SILT	%CLAY
0	5	87	8

MC%		LL	PL	PI
69.4		36	31	5

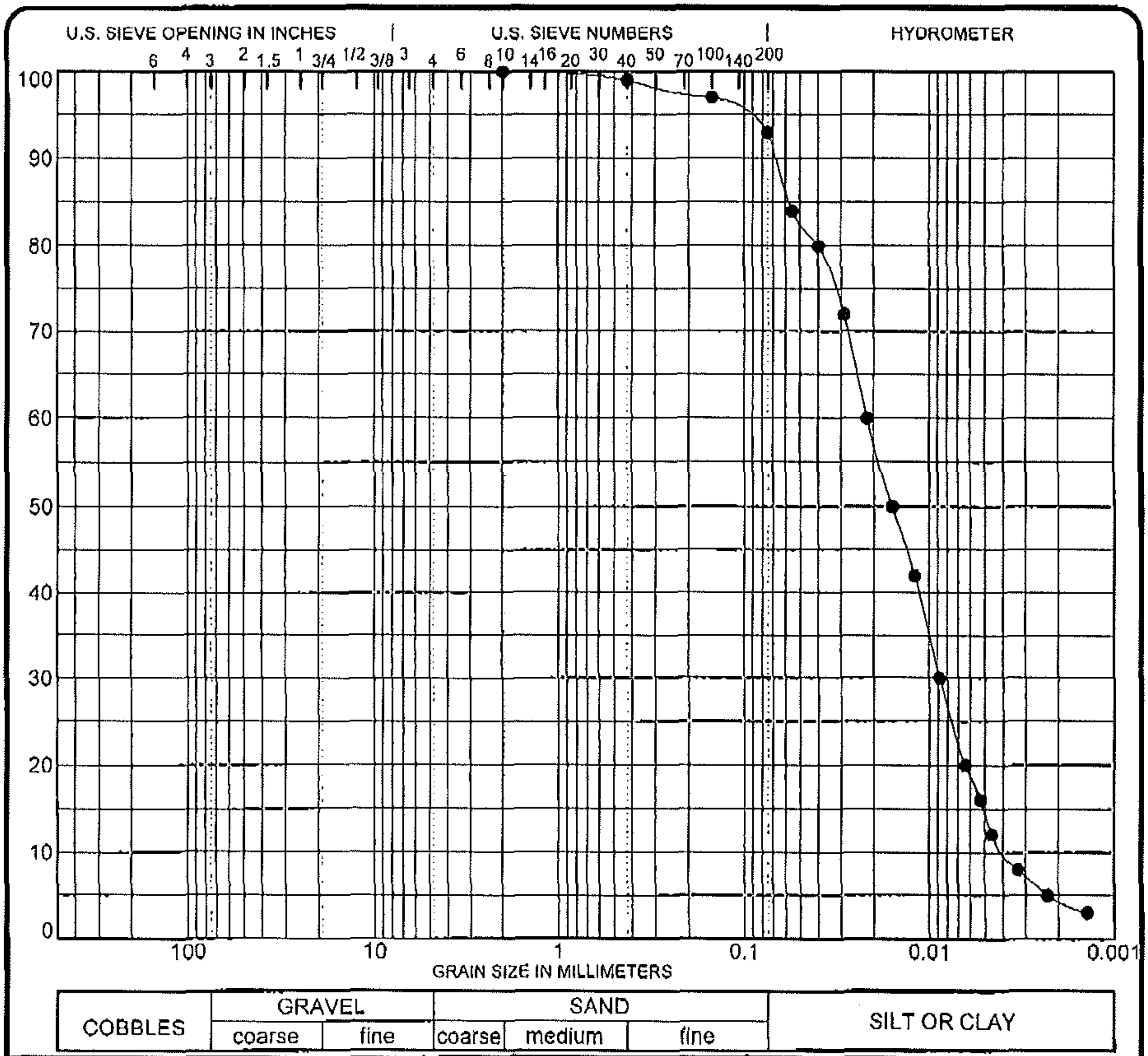
PROJECT Geotechnical Testing
LOCATION ,

JOB NO. L - 76,757
DATE May 20, 2011

SB1

SOIL DATA SHEET
Testing Service Corporation
Carol Stream, IL 60188

SOILGENR 76757.GPJ TSC_ALL.GDT 5/20/11



SPECIMEN IDENTIFICATION
Boring: SB-1
Sample: 8
Depth: 29.0'-30.0'

NOTES:

SIEVE	% PASS
3 inch	100
2	100
1 1/2	100
1	100
3/4	100
3/8	100
# 4	100
# 10	100
# 40	99
# 100	97
# 200	93

SOIL CLASSIFICATION

Gray clayey SILT, trace sand (ML)

%GRAVEL	%SAND	%SILT	%CLAY
0	7	89	4

MC%		LL	PL	PI
58.6		40	37	3

PROJECT Geotechnical Testing
LOCATION ,

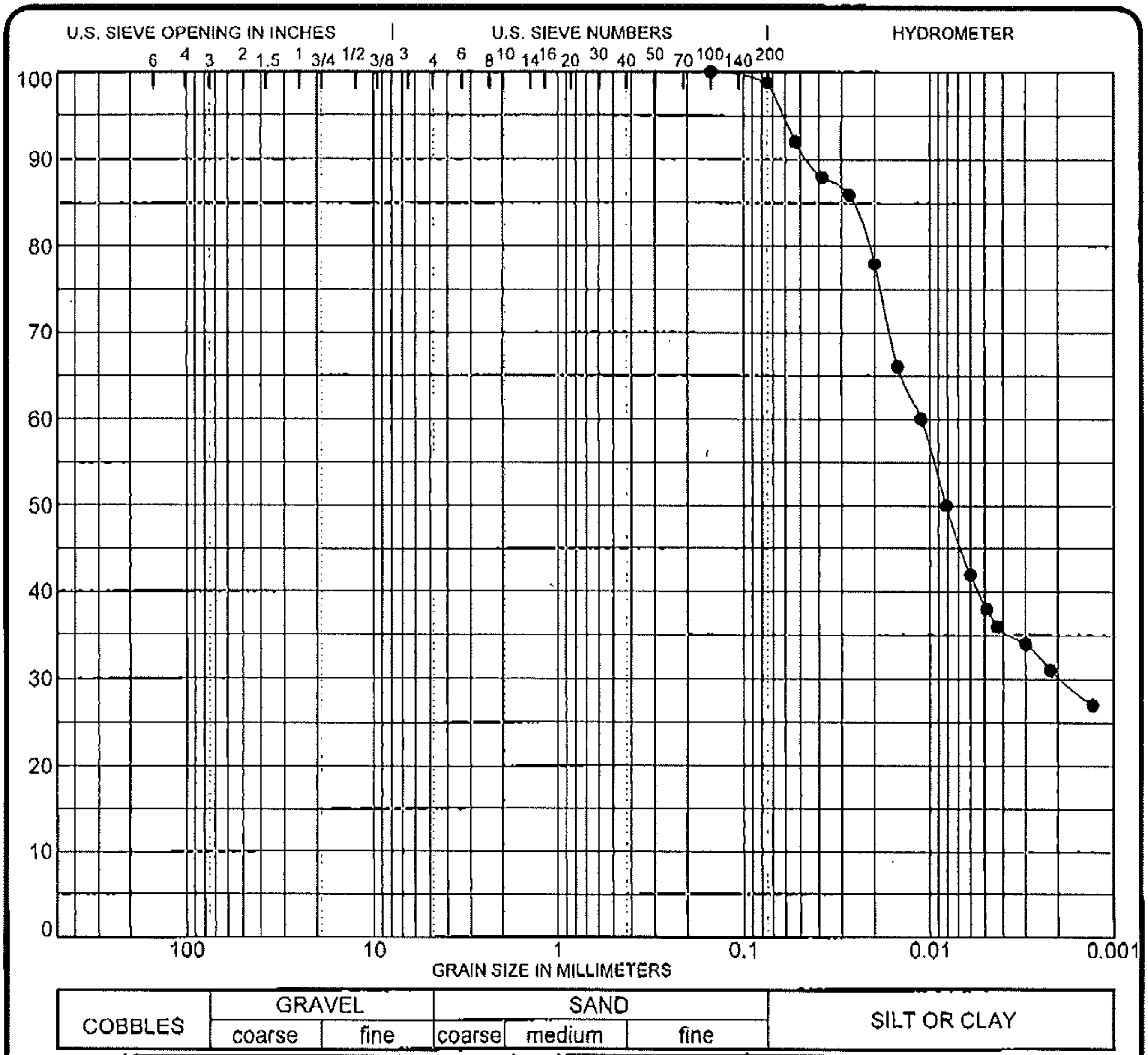
JOB NO. L - 76,757
DATE May 20, 2011

SB1

SOIL DATA SHEET

Testing Service Corporation
Carol Stream, IL 60188

SOILGENR 76757.GPJ TSC ALL.GDT 5/20/11



SPECIMEN IDENTIFICATION	SIEVE	% PASS
Boring: SB-1	3 inch	100
Sample: C	2	100
Depth: 34.0'-35.0'	1 1/2	100
	1	100
NOTES:	3/4	100
	3/8	100
	# 4	100
	# 10	100
	# 40	100
	# 100	100
	# 200	99

SOIL CLASSIFICATION

Gray silty CLAY, trace sand (CH)

%GRAVEL	%SAND	%SILT	%CLAY
0	1	69	30

MC%		LL	PL	PI
31.3		52	17	35

PROJECT Geotechnical Testing
LOCATION ,

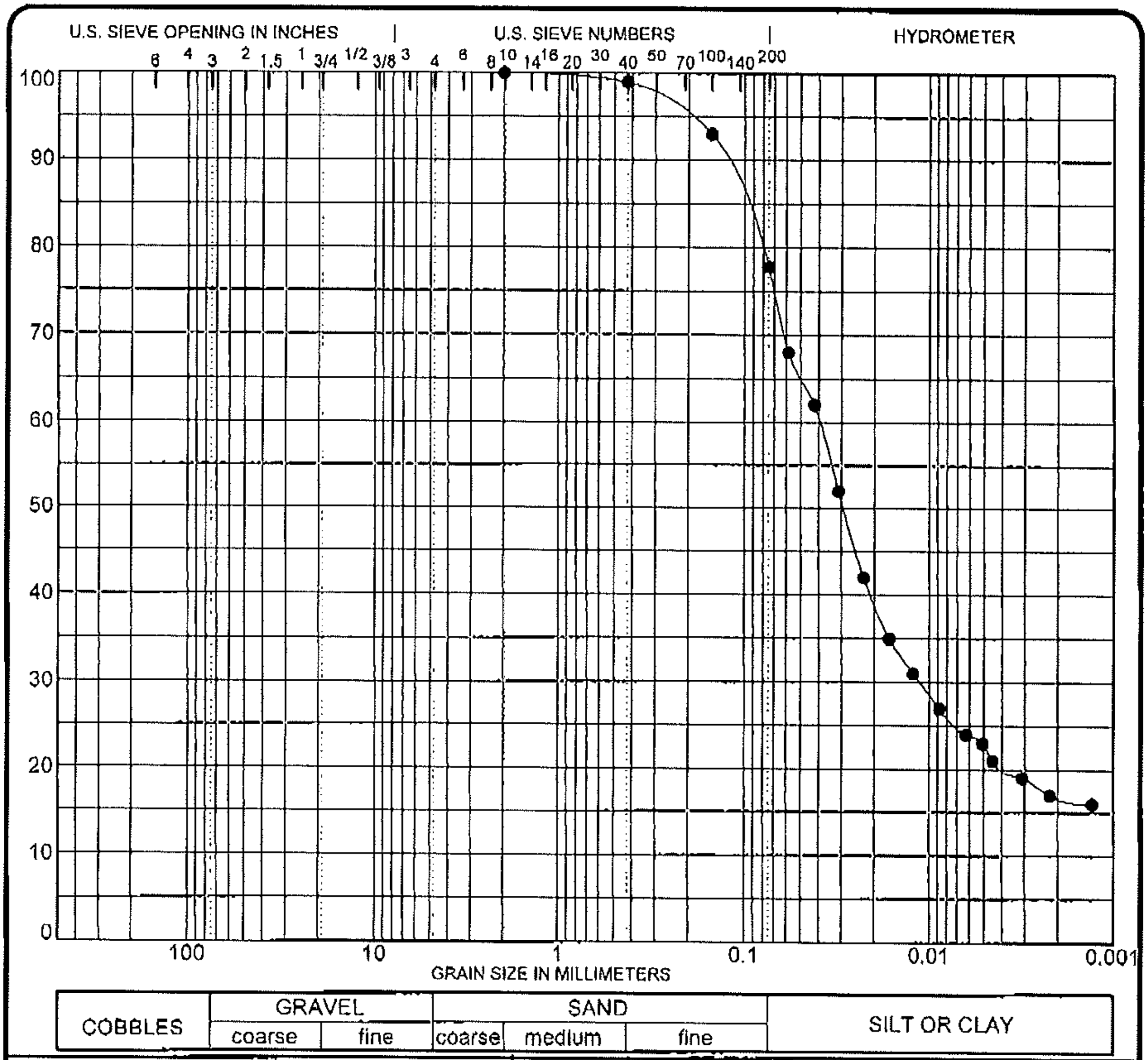
JOB NO. L - 76,757
DATE May 20, 2011

SB1

SOIL DATA SHEET

Testing Service Corporation
Carol Stream, IL 60188

SOILGENR 76757.GPJ TSC_ALL.GDT 5/20/11



SPECIMEN IDENTIFICATION	SIEVE	% PASS
Boring: SB-1	3 inch	100
Sample: D	2	100
Depth: 36.0'-37.0'	1 1/2	100
	1	100
NOTES:	3/4	100
	3/8	100
	# 4	100
	# 10	100
	# 40	99
	# 100	93
	# 200	78

SOIL CLASSIFICATION

Gray very silty CLAY, some sand (CL)

%GRAVEL	%SAND	%SILT	%CLAY
0	22	61	17

MC%		LL	PL	PI
29.1		36	16	20

PROJECT **Geotechnical Testing**
LOCATION ,

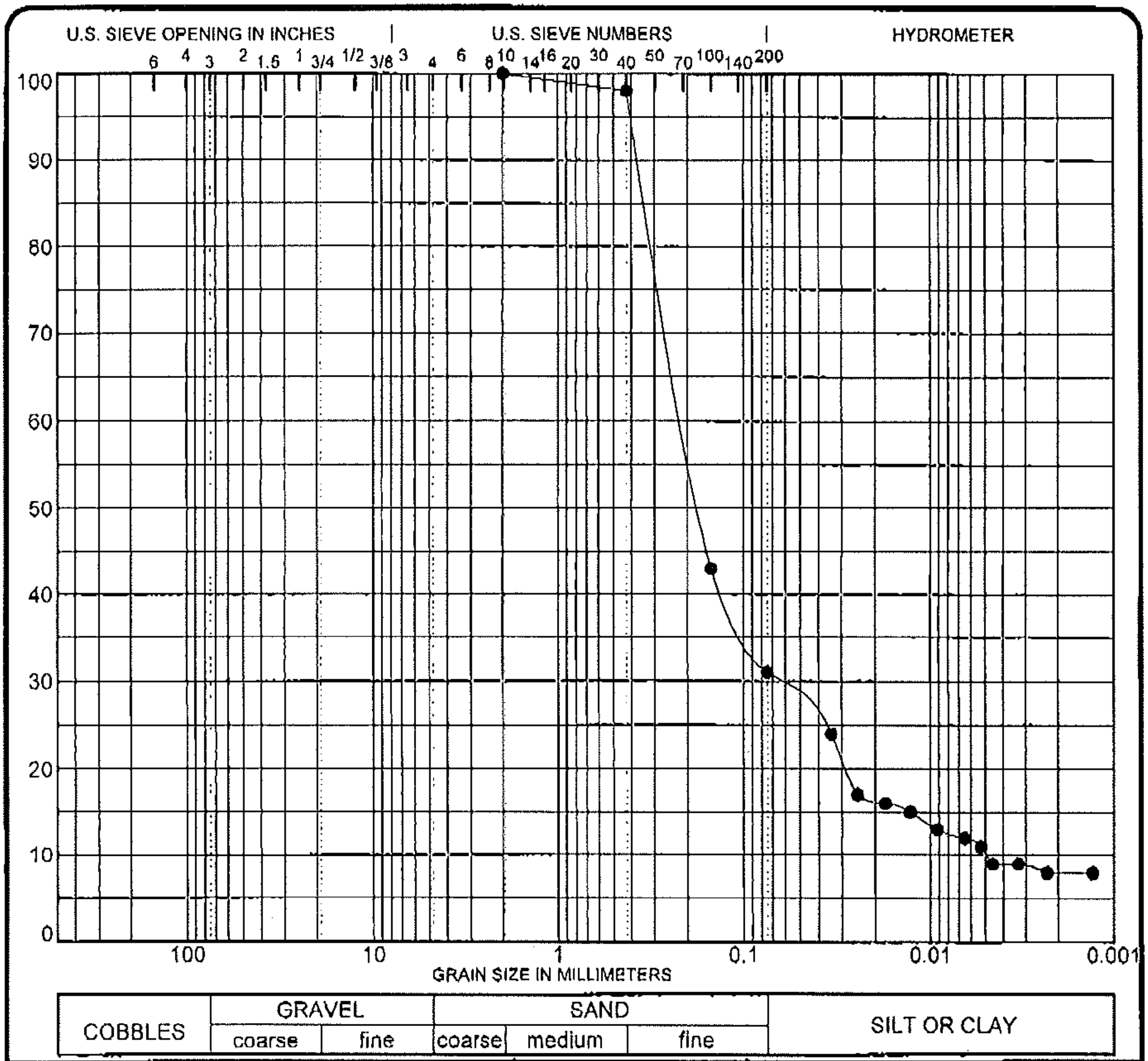
JOB NO. **L - 76,757**
DATE **May 20, 2011**

SB1

SOILGENR 76757.GPJ TSC_ALL.GDT 5/20/11

SOIL DATA SHEET

Testing Service Corporation
Carol Stream, IL 60188



SPECIMEN IDENTIFICATION	SIEVE	% PASS
Boring: SB-1	3 inch	100
Sample: E	2	100
Depth: 37.0'-38.0'	1 1/2	100
	1	100
NOTES:	3/4	100
	3/8	100
	# 4	100
	# 10	100
	# 40	98
	# 100	43
	# 200	31

SOIL CLASSIFICATION

Gray clayey SAND (SC)

%GRAVEL	%SAND	%SILT	%CLAY
0	69	23	8

MC%		LL	PL	PI
30.4		22	14	8

PROJECT Geotechnical Testing
LOCATION ,

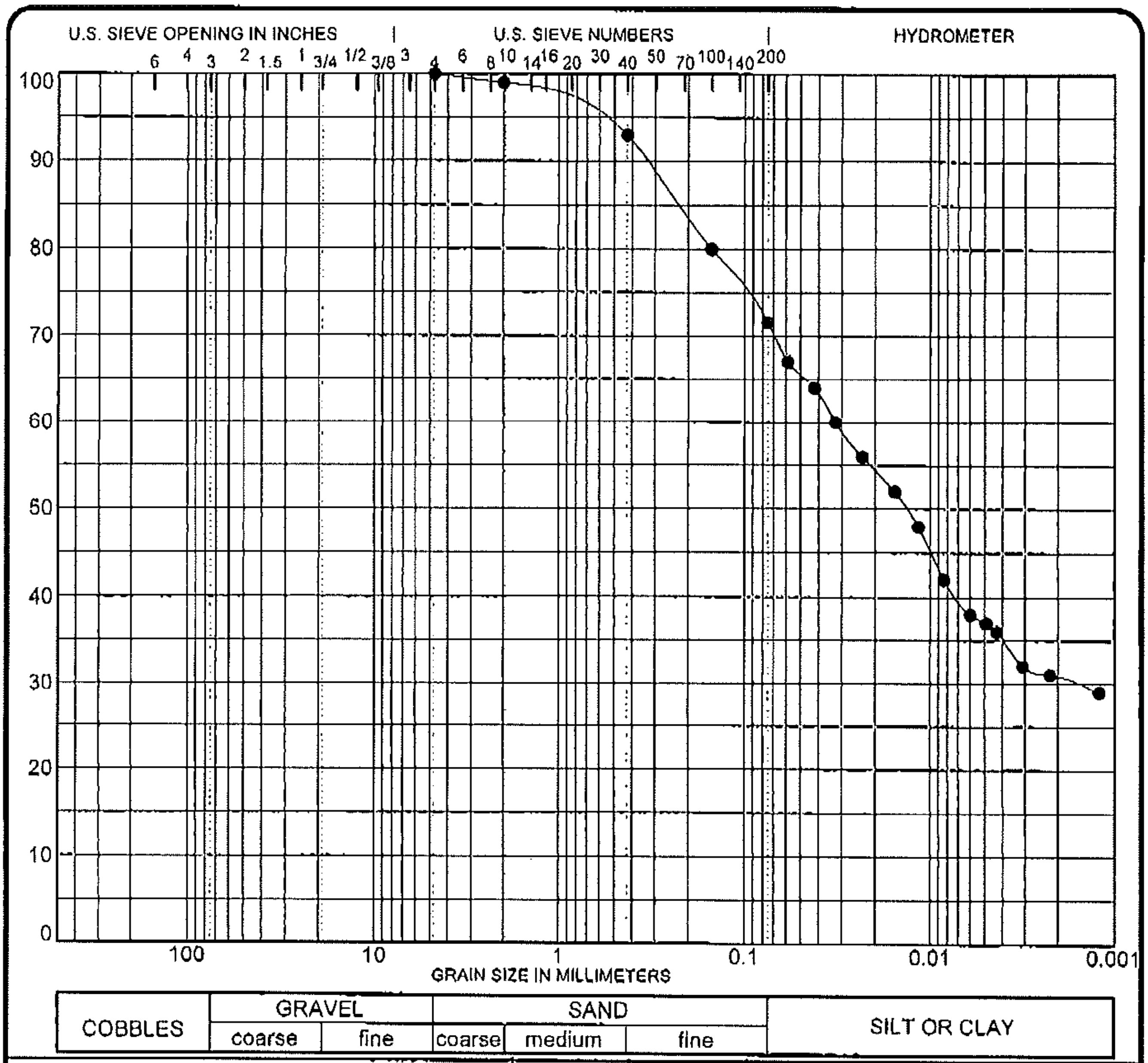
JOB NO. L - 76,757
DATE May 20, 2011

SB1

SOILGENR 76757.GPJ TSC ALL.GDT 5/20/11

SOIL DATA SHEET

Testing Service Corporation
Carol Stream, IL 60188



SPECIMEN IDENTIFICATION	SIEVE	% PASS
Boring: SB-2	3 inch	100
Sample: A	2	100
Depth: 8.0'-9.0'	1 1/2	100
	1	100
NOTES:	3/4	100
	3/8	100
	# 4	100
	# 10	99
	# 40	93
	# 100	80
	# 200	72

SOIL CLASSIFICATION

Brownish gray silty CLAY, some sand

(CL)

%GRAVEL	%SAND	%SILT	%CLAY
0	28	41	31

MC%		LL	PL	PI
15.7		46	12	34

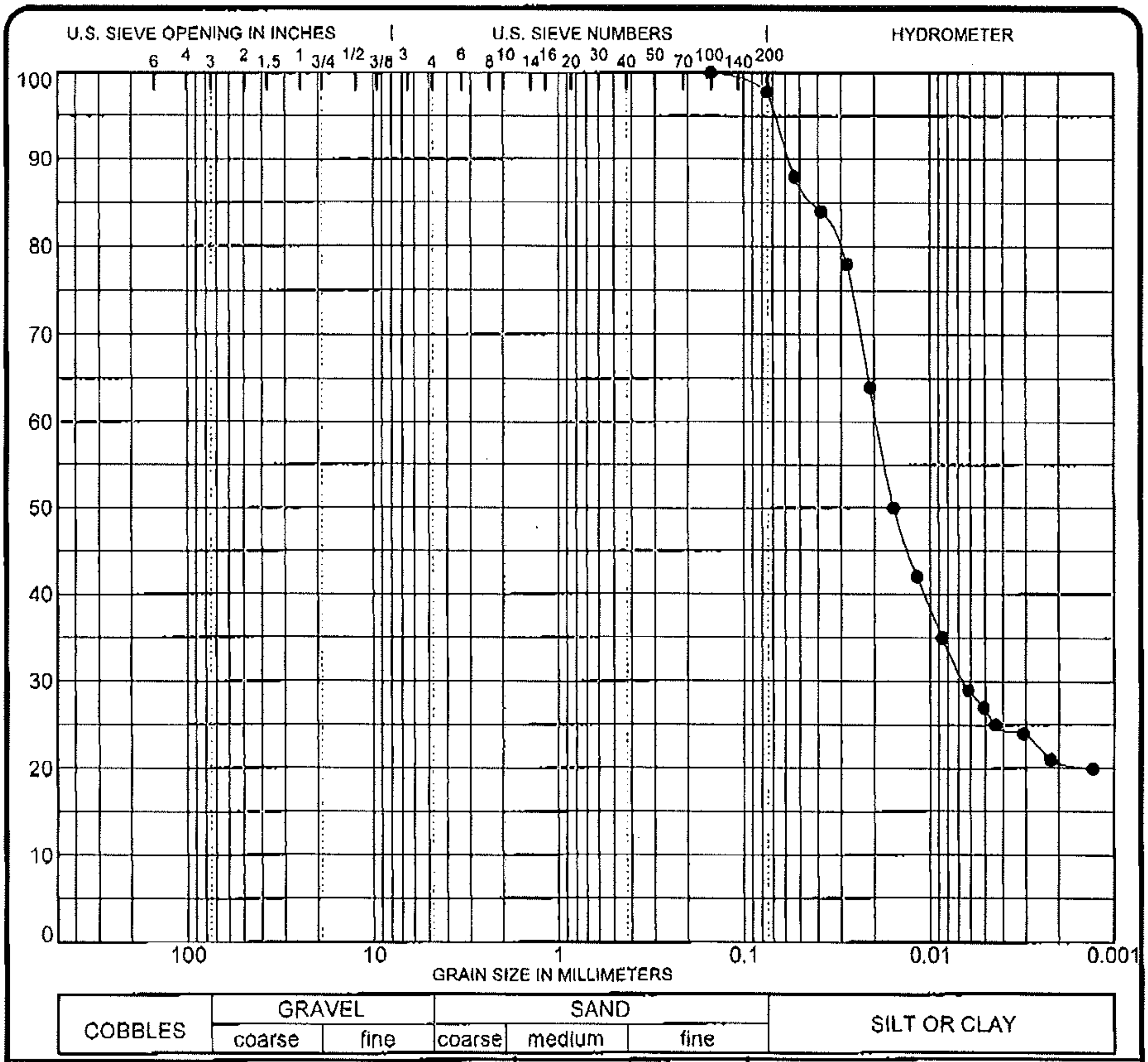
PROJECT Geotechnical Testing
LOCATION ,
SB2

JOB NO. L - 76,757
DATE May 20, 2011

SOIL DATA SHEET

Testing Service Corporation
Carol Stream, IL 60188

SOILGENR 76757.GPJ TSC_ALL.GDT 5/20/11



SPECIMEN IDENTIFICATION
Boring: SB-2
Sample: B
Depth: 28.0'-29.0
NOTES:

SIEVE	% PASS
3 inch	100
2	100
1 1/2	100
1	100
3/4	100
3/8	100
# 4	100
# 10	100
# 40	100
# 100	100
# 200	98

SOIL CLASSIFICATION

Dark gray very silty CLAY, trace sand

(CL)

%GRAVEL	%SAND	%SILT	%CLAY
0	2	77	21

MC%		LL	PL	PI
35.1		42	18	24

PROJECT Geotechnical Testing

LOCATION ,

JOB NO. L - 76,757

DATE May 20, 2011

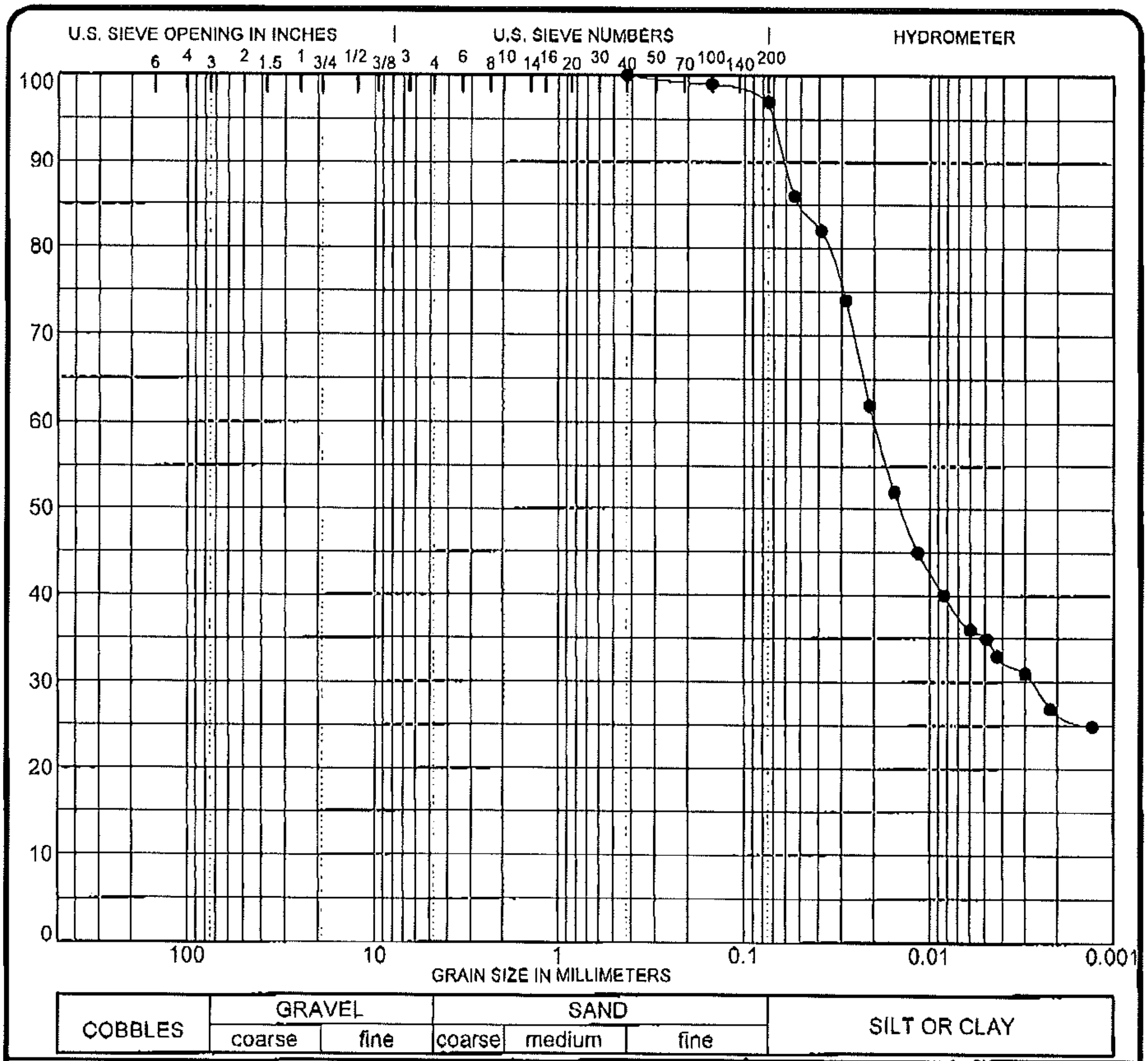
SB2

SOILGENR 76757.GPJ TSC_ALL.GDT 5/20/11

SOIL DATA SHEET

Testing Service Corporation

Carol Stream, IL 60188



SPECIMEN IDENTIFICATION	SIEVE	% PASS
Boring: SB-2	3 inch	100
Sample: C	2	100
Depth: 32.0'	1 1/2	100
	1	100
NOTES:	3/4	100
	3/8	100
	# 4	100
	# 10	100
	# 40	100
	# 100	99
	# 200	97

SOIL CLASSIFICATION

Dark gray silty CLAY, trace sand (CH)

%GRAVEL	%SAND	%SILT	%CLAY
0	3	70	27

MC%		LL	PL	PI
32.9		51	16	35

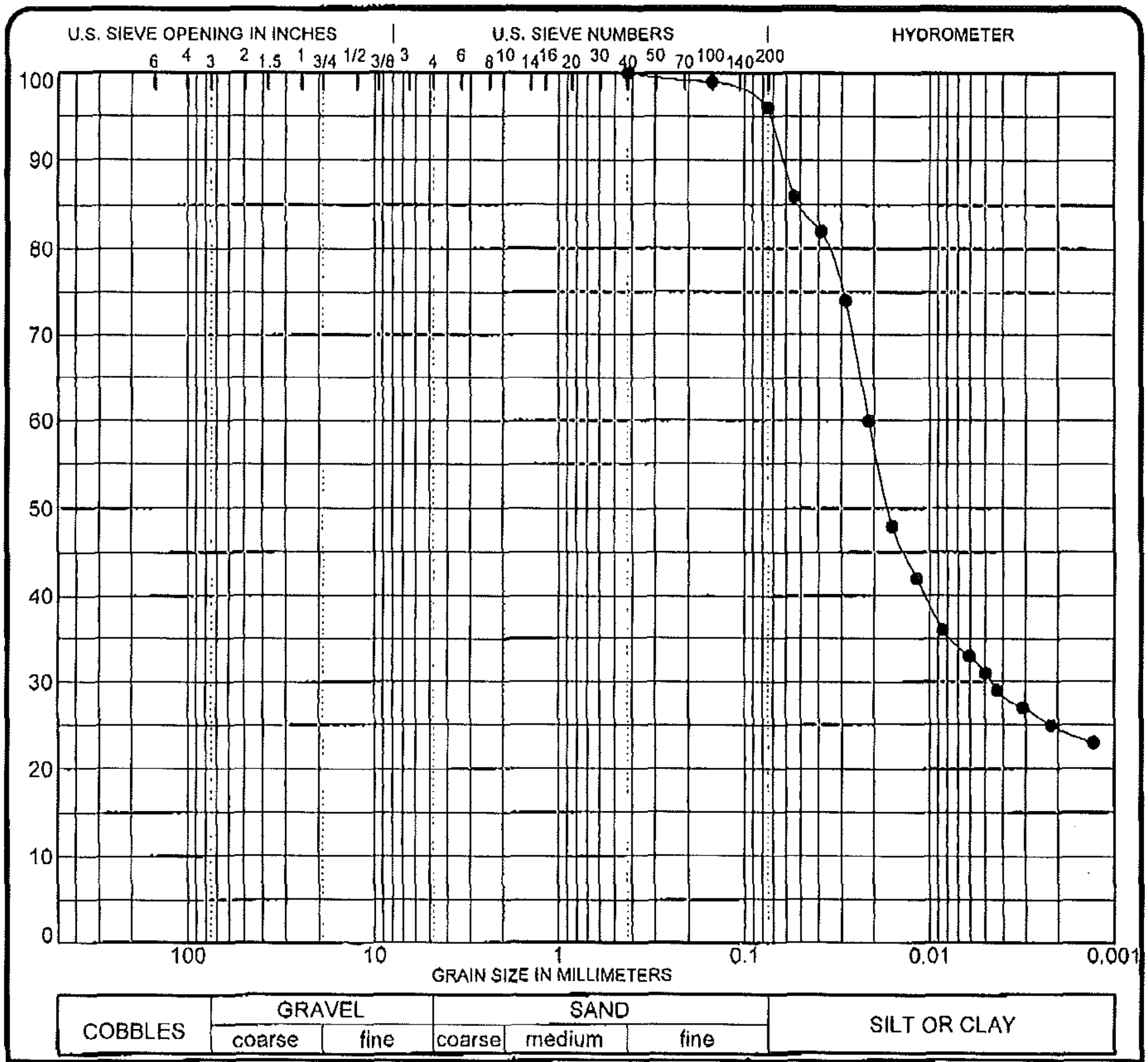
PROJECT Geotechnical Testing
LOCATION ,
JOB NO. L - 76,757
DATE May 20, 2011

SB2

SOILGENR 76757.GPJ TSC_ALL.GDT 5/20/11

SOIL DATA SHEET

Testing Service Corporation
Carol Stream, IL 60188



SPECIMEN IDENTIFICATION

Boring: SB-3

Sample: A

Depth: 38.0'

NOTES:

SIEVE	% PASS
3 inch	100
2	100
1 1/2	100
1	100
3/4	100
3/8	100
# 4	100
# 10	100
# 40	100
# 100	99
# 200	96

SOIL CLASSIFICATION

Dark gray very silty CLAY, trace sand

(CL)

%GRAVEL	%SAND	%SILT	%CLAY
0	4	71	25

MC%		LL	PL	PI
34.4		46	15	31

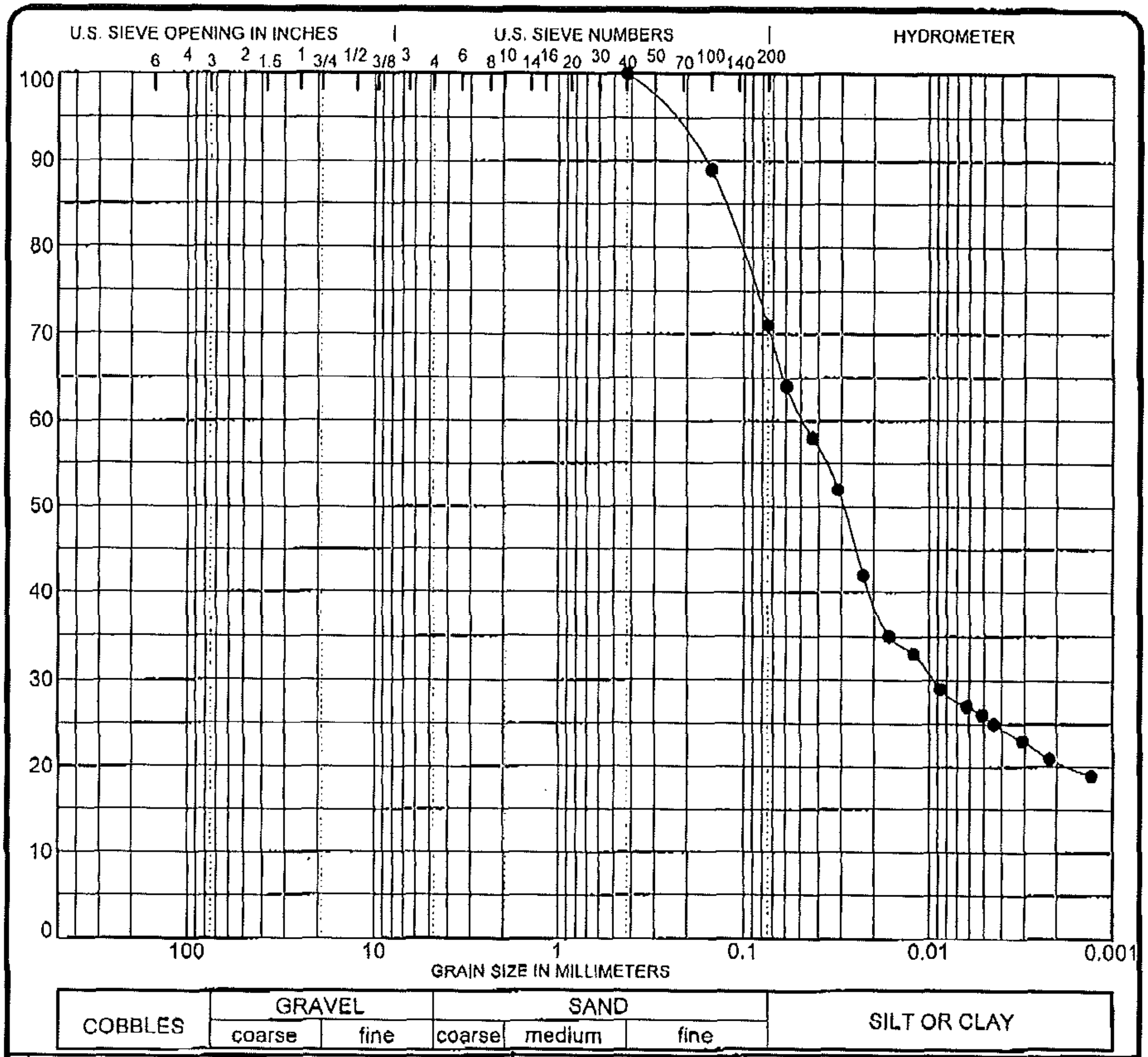
PROJECT Geotechnical Testing
LOCATION ,
JOB NO. L - 76,757
DATE May 20, 2011

SB3

SOILGENR 76757.GPJ TSC_ALL.GDT 5/20/11

SOIL DATA SHEET

Testing Service Corporation
Carol Stream, IL 60188



SPECIMEN IDENTIFICATION
Boring: SB-4
Sample: A
Depth: 34.0'
NOTES:

SIEVE	% PASS
3 inch	100
2	100
1 1/2	100
1	100
3/4	100
3/8	100
# 4	100
# 10	100
# 40	100
# 100	89
# 200	71

SOIL CLASSIFICATION

Dark gray silty CLAY, some sand (CL)

%GRAVEL	%SAND	%SILT	%CLAY
0	29	50	21

MC%		LL	PL	PI
24.1		41	12	29

PROJECT Geotechnical Testing
LOCATION ,

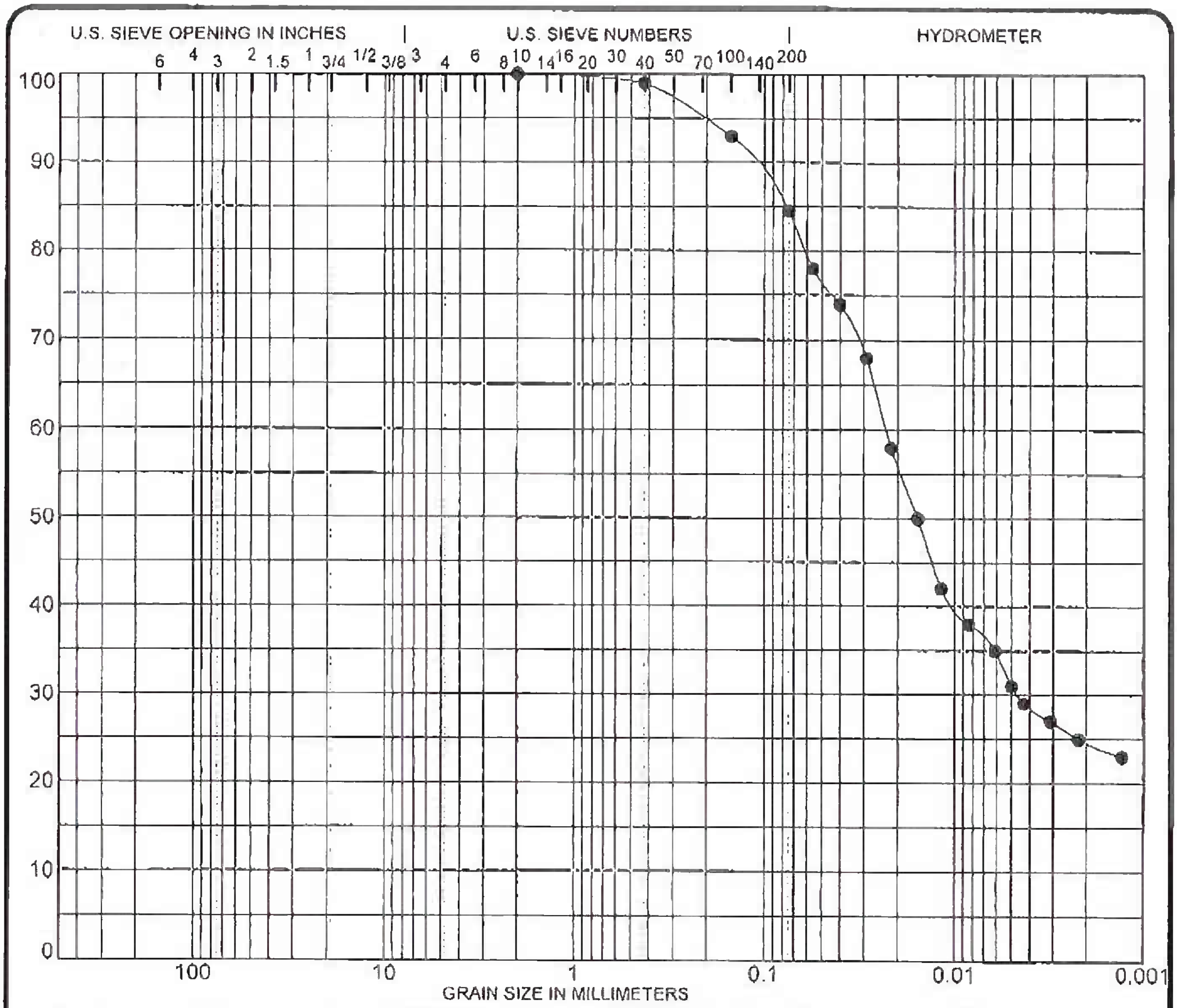
JOB NO. L - 76,757
DATE May 20, 2011

SB4

SOILGENR 76757.GPJ TSC ALL.GDT 5/20/11

SOIL DATA SHEET

Testing Service Corporation
Carol Stream, IL 60188



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SPECIMEN IDENTIFICATION

Boring: SB-5

Sample: A

Depth: 34.0'

NOTES:

SIEVE	% PASS
3 inch	100
2	100
1 1/2	100
1	100
3/4	100
3/8	100
# 4	100
# 10	100
# 40	99
# 100	93
# 200	85

SOIL CLASSIFICATION

Gray very silty CLAY, little sand (CL)

%GRAVEL	%SAND	%SILT	%CLAY
0	15	60	25

MC%		LL	PL	PI
23.3		43	16	27

PROJECT Geotechnical Testing
LOCATION ,

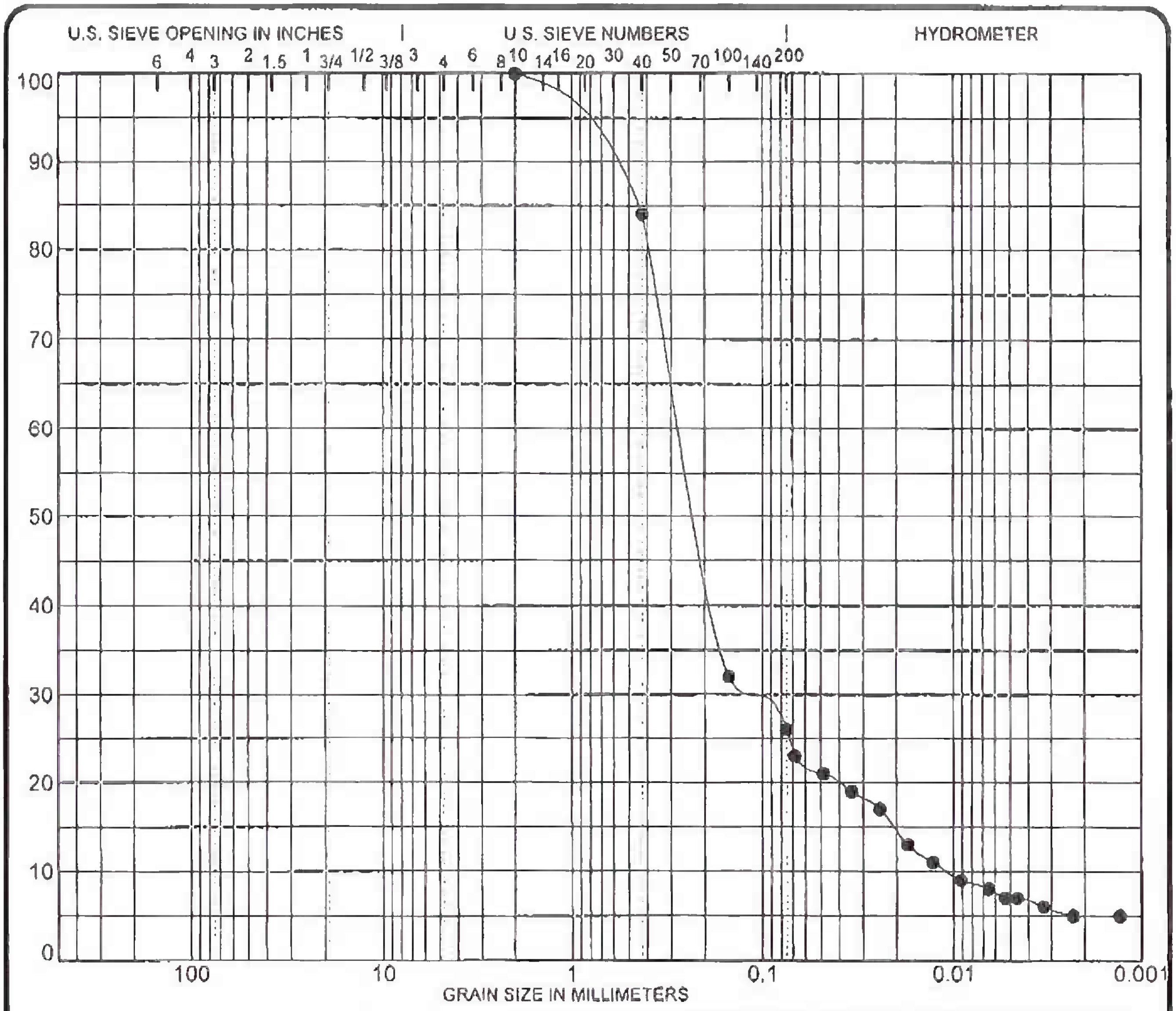
JOB NO. L - 76,757
DATE May 23, 2011

SB5

SOIL DATA SHEET

Testing Service Corporation
Carol Stream, IL 60188

SOILGENR 76757.GPJ TSC AL1.GDT 5/23/11



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<tr><td rowspan="2">COBBLES</td><td colspan="2">GRAVEL</td><td colspan="3">SAND</td><td rowspan="2">SILT OR CLAY</td></tr>
<tr><td>coarse</td><td>fine</td><td>coarse</td><td>medium</td><td>fine</td></tr>
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SPECIMEN IDENTIFICATION

Boring: SB-6

Sample: A

Depth: 16.0'-17.0'

NOTES:

SIEVE	% PASS
3 inch	100
2	100
1 1/2	100
1	100
3/4	100
3/8	100
# 4	100
# 10	100
# 40	84
# 100	32
# 200	26

SOIL CLASSIFICATION

Gray clayey SAND (SC)

%GRAVEL	%SAND	%SILT	%CLAY
0	74	21	5

MC%		LL	PL	PI
24.6		16	13	3

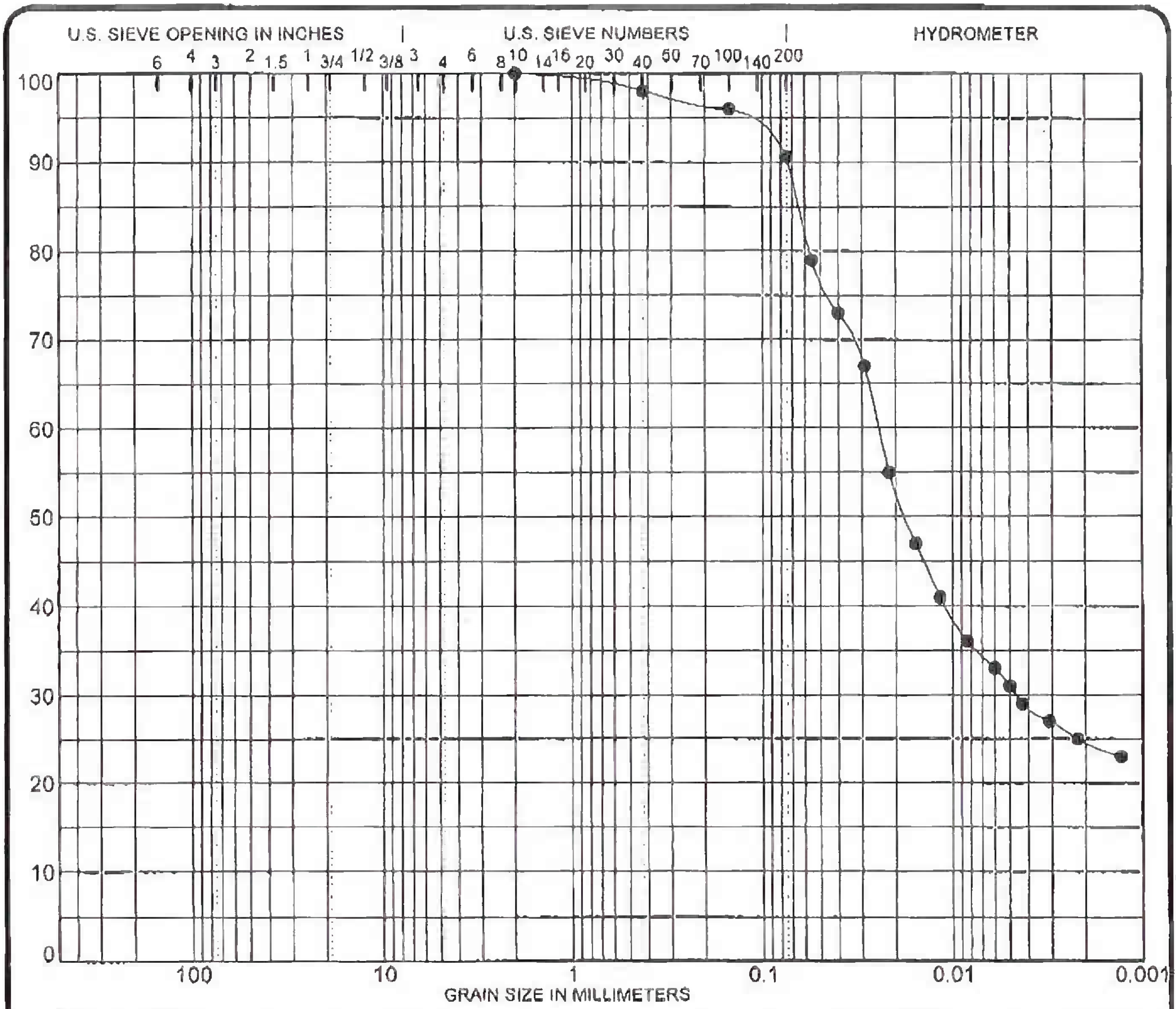
PROJECT Geotechnical Testing
LOCATION ,

JOB NO. L - 76,757
DATE May 23, 2011

SB6

SOIL DATA SHEET

Testing Service Corporation
Carol Stream, IL 60188



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SPECIMEN IDENTIFICATION	SIEVE	% PASS
Boring: SB-6	3 inch	100
Sample: B	2	100
Depth: 28.0'-29.0'	1 1/2	100
	1	100
NOTES:	3/4	100
	3/8	100
	# 4	100
	# 10	100
	# 40	98
	# 100	96
	# 200	91

SOIL CLASSIFICATION

Brownish gray very silty CLAY, trace sand

(CL)

%GRAVEL	%SAND	%SILT	%CLAY
0	9	66	25

MC%		LL	PL	PI
28.3		43	13	30

PROJECT Geotechnical Testing
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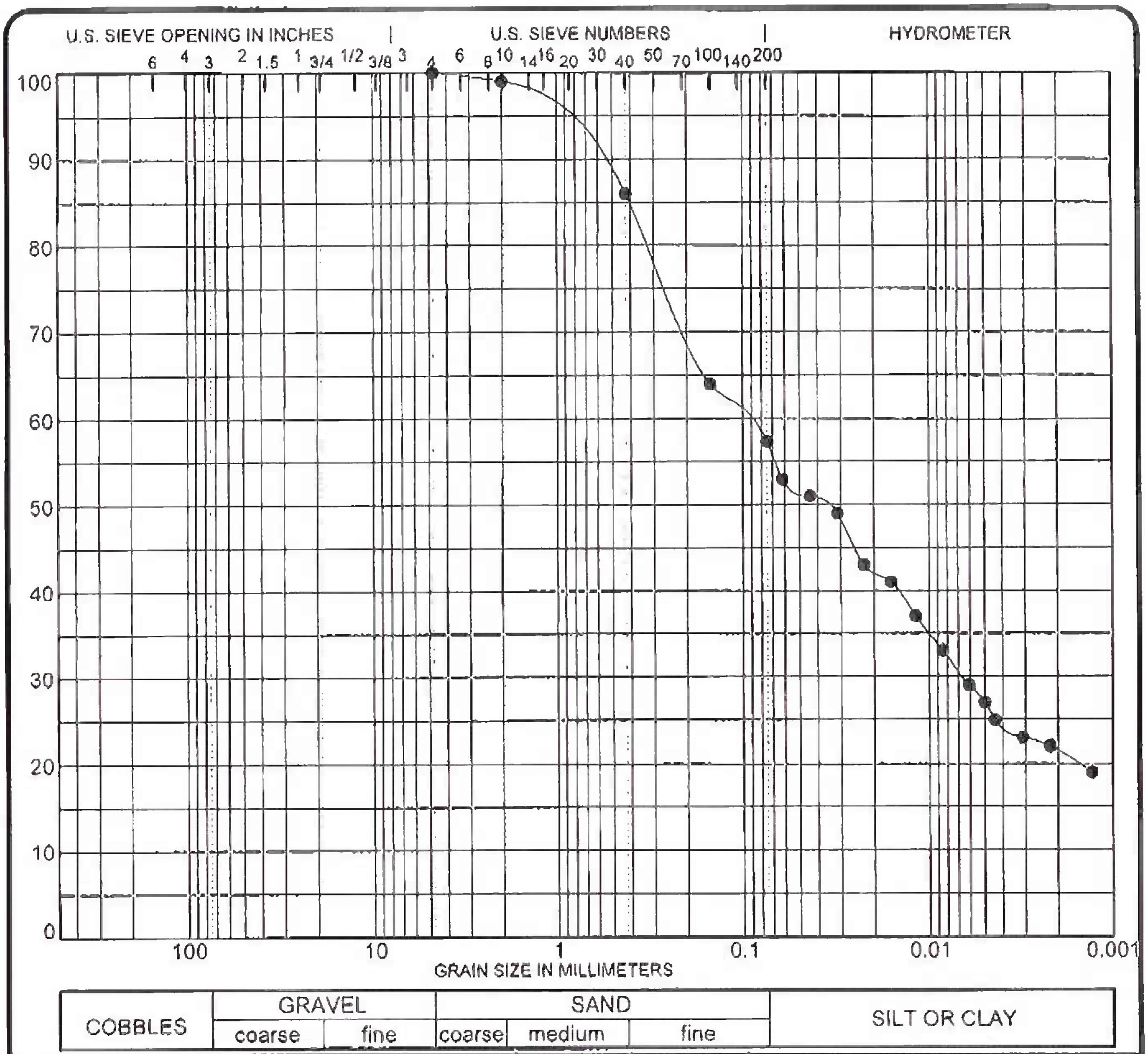
DATE May 23, 2011

SB6

SOIL DATA SHEET

Testing Service Corporation
Carol Stream, IL 60188

SOILGENR 76757.GPJ TSC_ALL.GDT 5/23/11



SPECIMEN IDENTIFICATION	SIEVE	% PASS
Boring: SB-8	3 inch	100
Sample: A	2	100
Depth: 10.0'	1 1/2	100
	1	100
NOTES:	3/4	100
	3/8	100
	# 4	100
	# 10	99
	# 40	86
	# 100	64
	# 200	57

SOIL CLASSIFICATION

Gray sandy CLAY (CL)

%GRAVEL	%SAND	%SILT	%CLAY
0	43	36	21

MC%		LL	PL	PI
21.6		36	12	24

PROJECT Geotechnical Testing
LOCATION ,
SB8

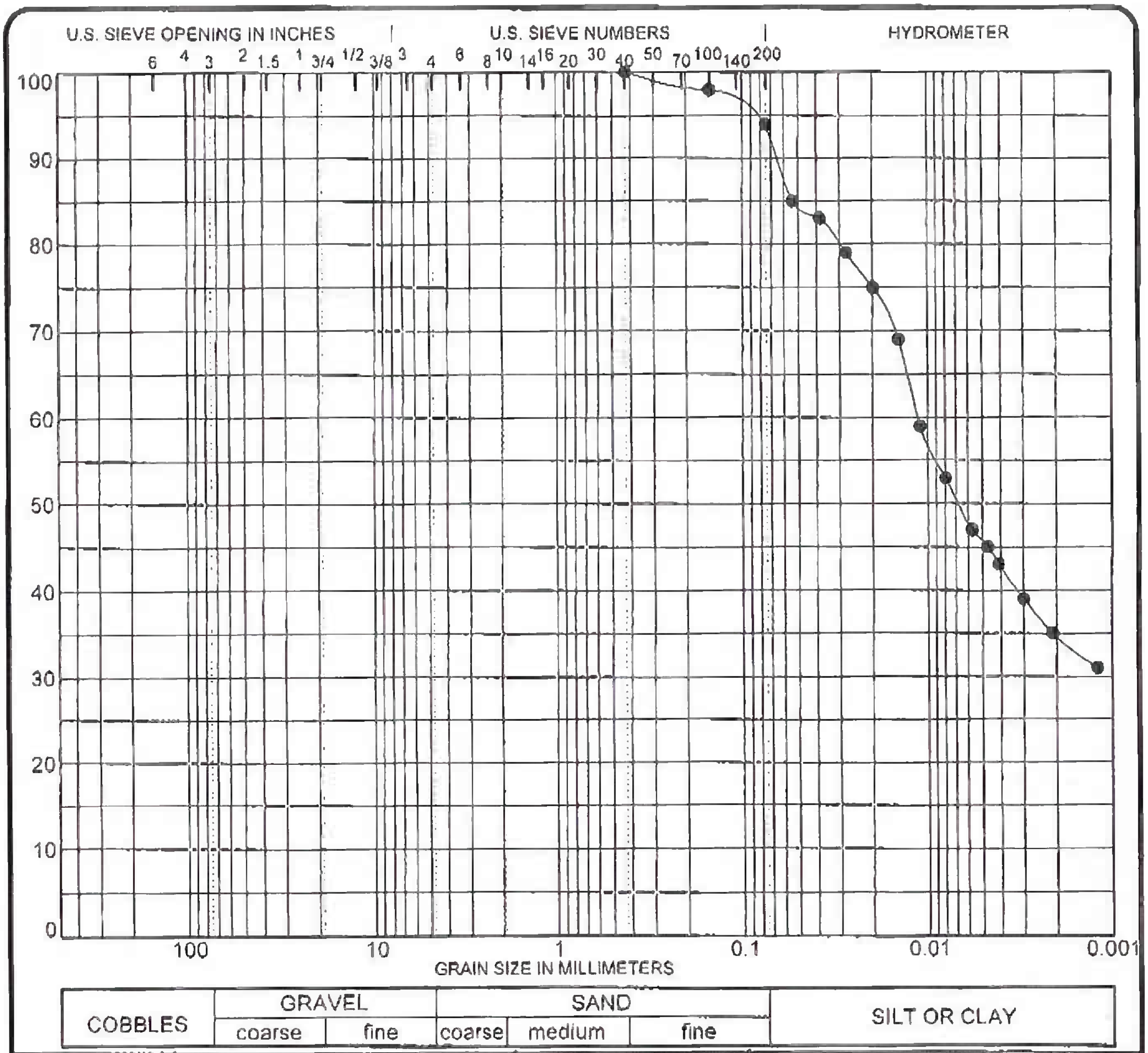
JOB NO. L - 76,757
DATE May 23, 2011

SOIL DATA SHEET

Testing Service Corporation
Carol Stream, IL 60188

SOILGENR 76757.GPJ TSC_ALL.GDT 5/23/11

07/16/2021 - Classification: Internal - ECRM12625229



SPECIMEN IDENTIFICATION

Boring: SB-8

Sample: B

Depth: 20.0'

NOTES:

SIEVE	% PASS
3 inch	100
2	100
1 1/2	100
1	100
3/4	100
3/8	100
# 4	100
# 10	100
# 40	100
# 100	98
# 200	94

SOIL CLASSIFICATION

Gray very silty CLAY, trace sand (CL)

%GRAVEL	%SAND	%SILT	%CLAY
0	6	59	35

MC%		LL	PL	PI
31.1		56	19	37

PROJECT Geotechnical Testing
LOCATION ,

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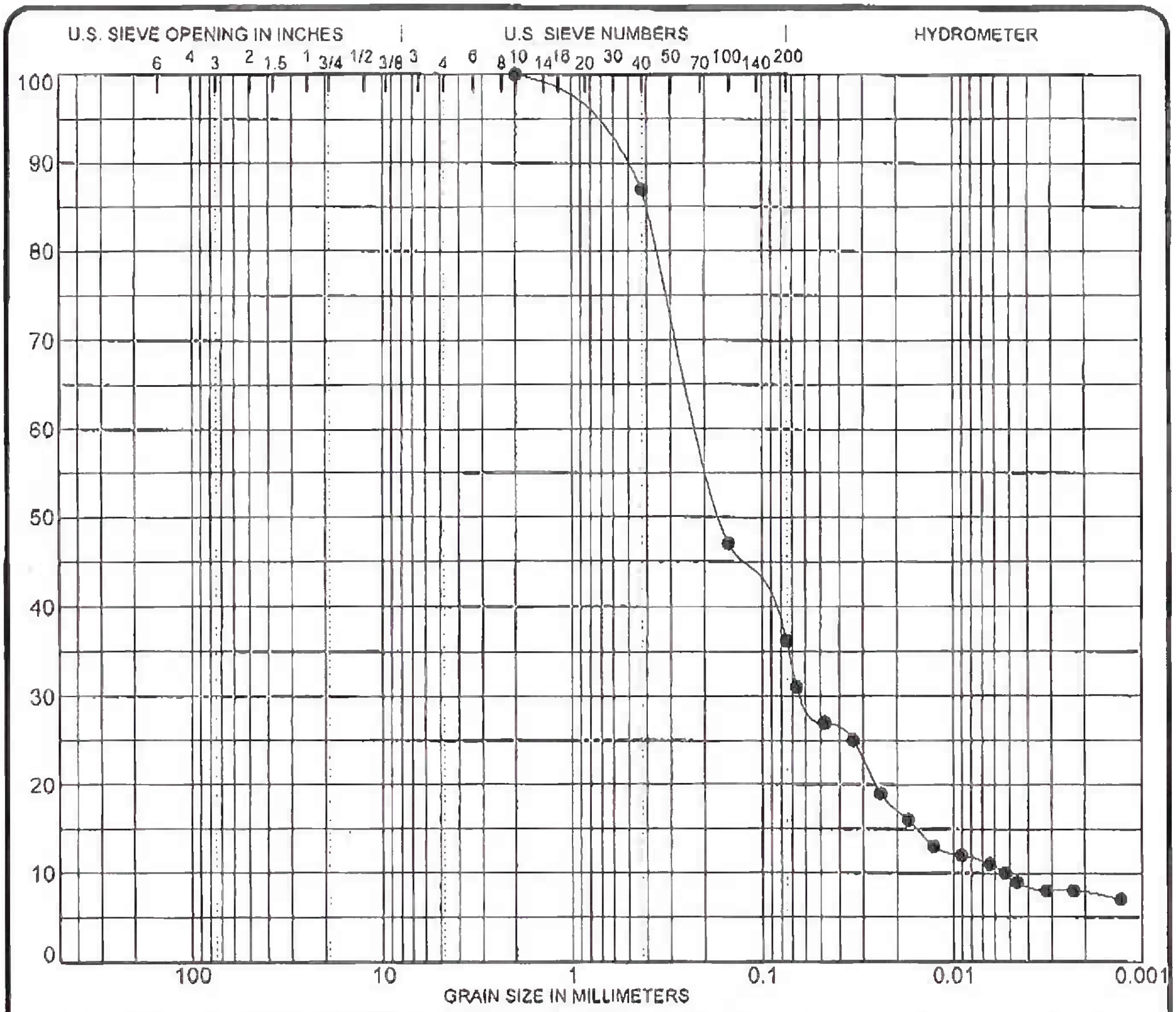
SOILGENR 76757.GPJ TSC ALL.GDT 5/23/11

SOIL DATA SHEET

Testing Service Corporation
Carol Stream, IL 60188



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SPECIMEN IDENTIFICATION	SIEVE	% PASS
Boring: SB-8	3 inch	100
Sample: C	2	100
Depth: 22.0'	1 1/2"	100
	1	100
NOTES:	3/4	100
	3/8	100
	# 4	100
	# 10	100
	# 40	87
	# 100	47
	# 200	36

SOIL CLASSIFICATION

Gray clayey SAND (SC)

%GRAVEL	%SAND	%SILT	%CLAY
0	64	28	8

MC%		LL	PL	PI
26.9		21	13	8

PROJECT Geotechnical Testing
LOCATION ,
SB8

JOB NO. L - 76,757
DATE May 23, 2011

SOIL DATA SHEET

Testing Service Corporation
Carol Stream, IL 60188

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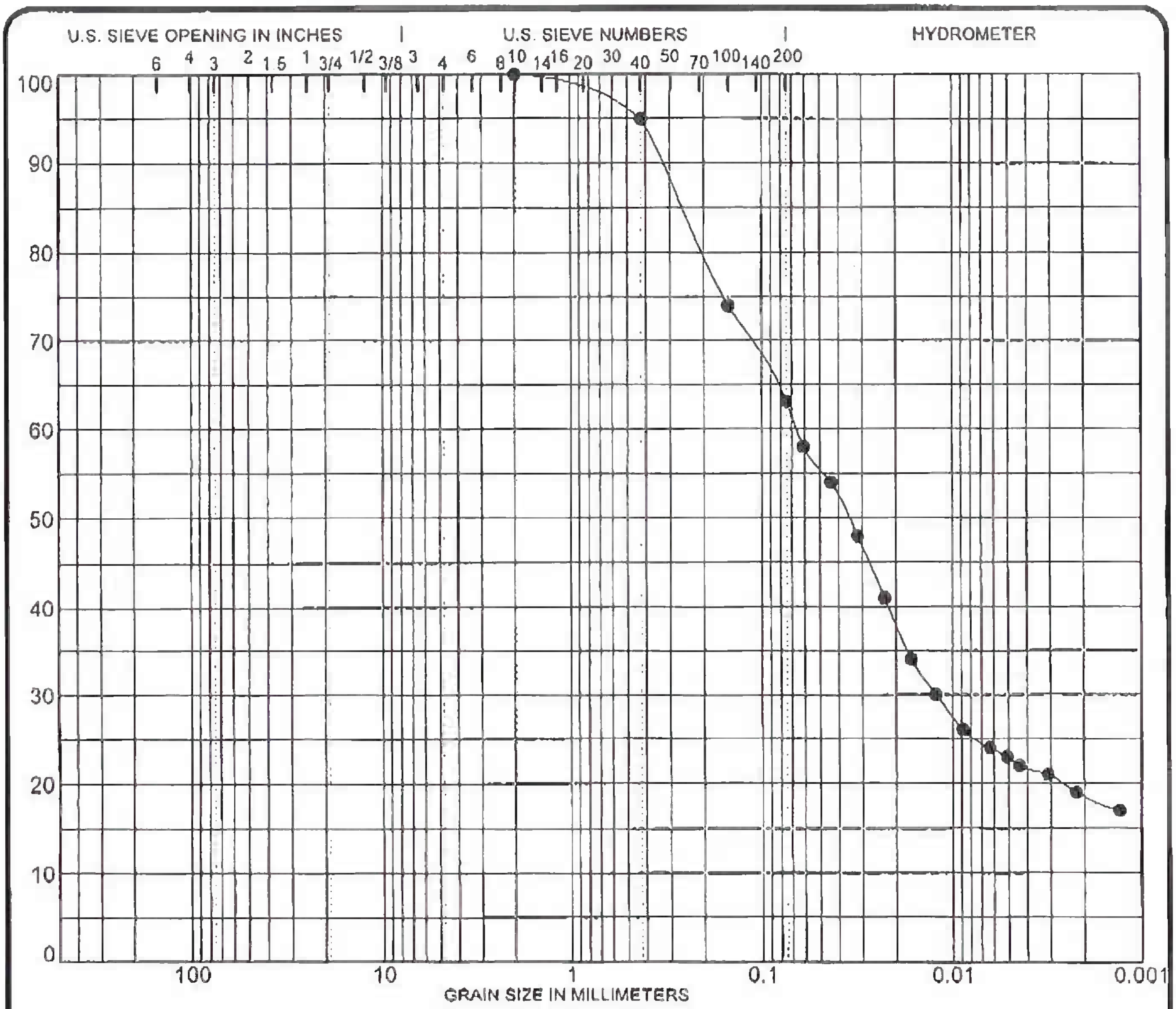

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<tr><td>coarse</td><td>fine</td><td>coarse</td><td>medium</td><td>fine</td></tr>
</table>

SPECIMEN IDENTIFICATION
Boring: SB-9
Sample: A
Depth: 18.0'
NOTES:

SIEVE	% PASS
3 inch	100
2	100
1 1/2	100
1	100
3/4	100
3/8	100
# 4	100
# 10	100
# 40	95
# 100	74
# 200	63

SOIL CLASSIFICATION

Brownish gray sandy CLAY (CL)

%GRAVEL	%SAND	%SILT	%CLAY
0	37	44	19

MC%		LL	PL	PI
34.0		35	13	22

PROJECT Geotechnical Testing
LOCATION ,

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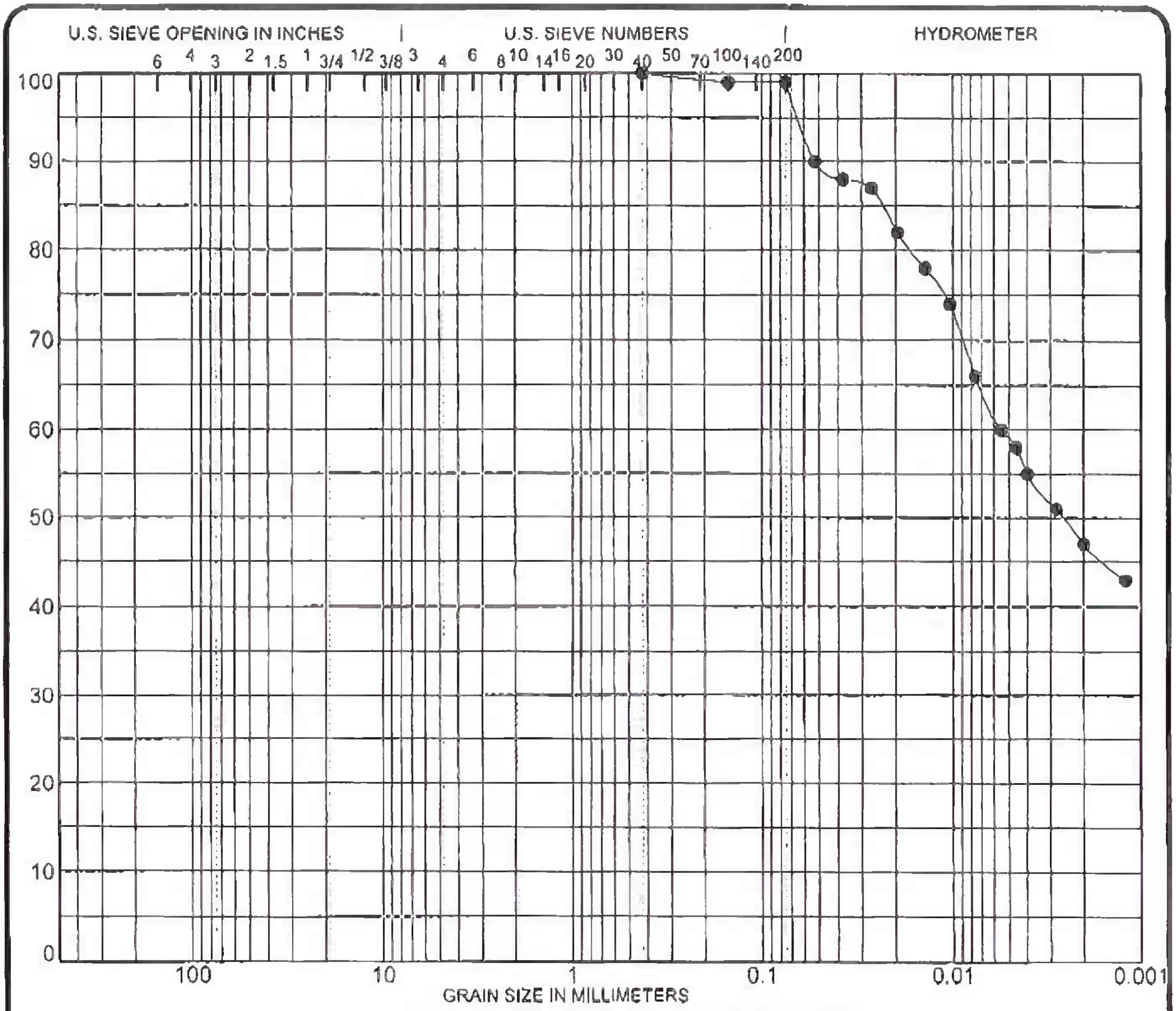
SB9

SOIL DATA SHEET

Testing Service Corporation
Carol Stream, IL 60188

SOILGENR 76757.GPJ TSC_ALL.GDT 5/23/11



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SPECIMEN IDENTIFICATION	SIEVE	% PASS
Boring: SB-10	3 inch	100
Sample: A	2	100
Depth: 20.0'	1 1/2	100
	1	100
NOTES:	3/4	100
	3/8	100
	# 4	100
	# 10	100
	# 40	100
	# 100	99
	# 200	99

SOIL CLASSIFICATION

Brownish gray silty CLAY, trace sand

(CH)

%GRAVEL	%SAND	%SILT	%CLAY
0	1	52	47

MC%		LL	PL	PI
26.9		74	15	59

PROJECT Geotechnical Testing
LOCATION ,

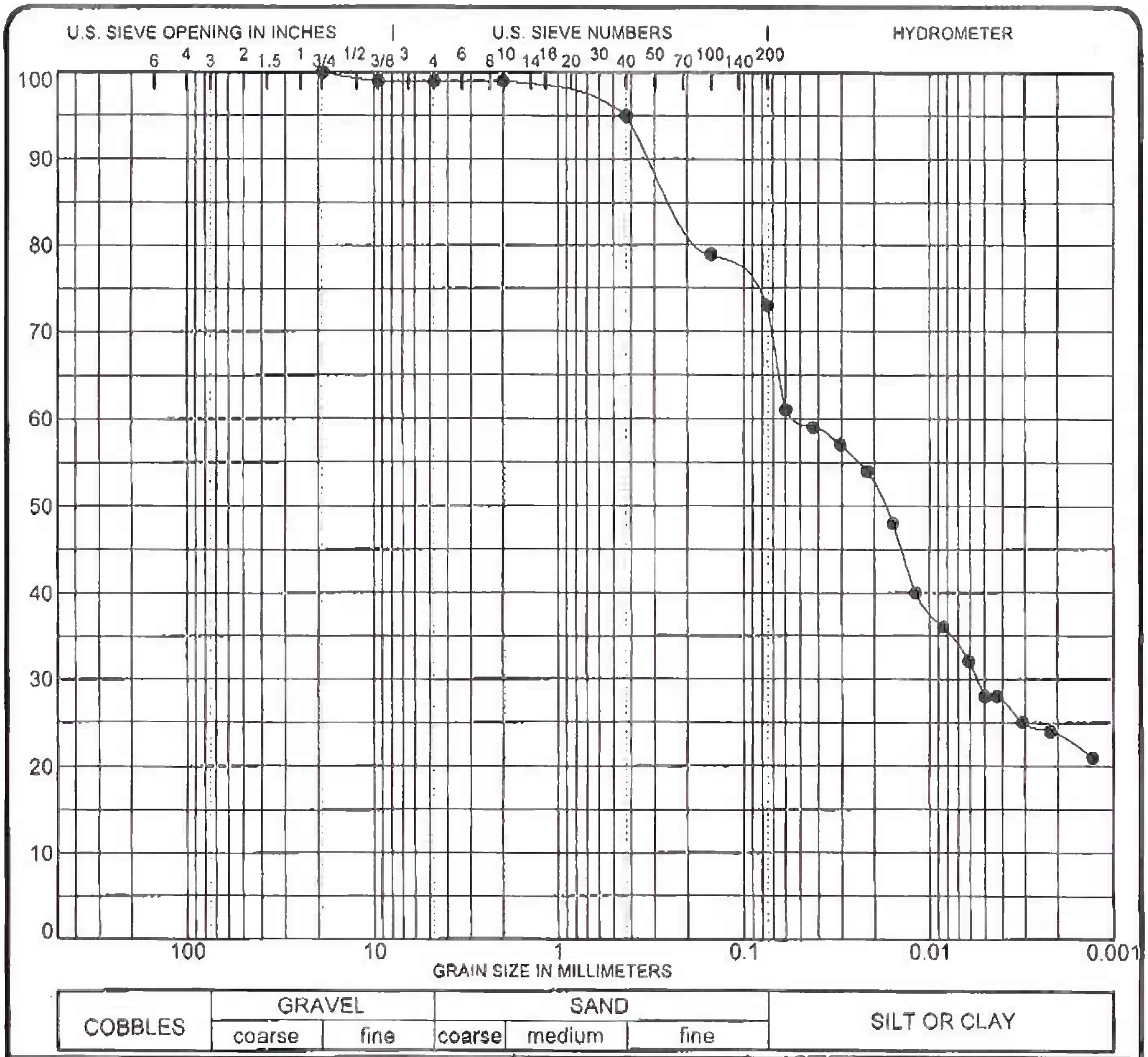
JOB NO. L - 76,757
DATE May 23, 2011

SB10

SOIL DATA SHEET

Testing Service Corporation
Carol Stream, IL 60188

SOILGENR 76757.GPJ TSC_ALL.GDT 5/23/11



SPECIMEN IDENTIFICATION
Boring: SB-12
Sample: A
Depth: 23.0'-24.0'
NOTES:

SIEVE	% PASS
3 inch	100
2	100
1 1/2	100
1	100
3/4	100
3/8	99
# 4	99
# 10	99
# 40	95
# 100	79
# 200	73

SOIL CLASSIFICATION

Gray silty CLAY, some sand, trace gravel

(CL)

%GRAVEL	%SAND	%SILT	%CLAY
1	26	50	23

MC%		LL	PL	PI
35.9		42	16	26

PROJECT Geotechnical Testing
LOCATION ,
JOB NO. L - 76,757
DATE May 23, 2011

SB12

SOIL DATA SHEET

Testing Service Corporation
Carol Stream, IL 60188

SOILGENR 76757.GPJ TSC ALL.GDT 5/23/11