Addendum No. 1

DATE: May 8, 2015

Joliet Junior College
1215 Houbolt Road
Joliet, IL 60431

TO: Prospective Respondents
SUBJECT: Addendum No. 1
PROJECT NAME: Watermain Extension
JJC PROJECT NO.: B15008

This Addendum forms a part of the Bidding and Contract Documents and modifies the original bidding document as posted on the JJC website. Acknowledge receipt of this addendum in the space provided on the Bid Form. FAILURE TO DO SO MAY SUBJECT BIDDER TO DISQUALIFICATION.

Questions Submitted:

1. Since the contractor is responsible for obtaining the permit for the project, have the drawings been submitted to the City of Joliet for review?
   There will not be a permit for this project.
2. Is there a location for onsite storage and where will the location be?
   Onsite storage is limited to the area behind the construction fence as shown on the site logistics plan.
3. How long will it take to turn around shop drawings and submittals?
   Shop drawings and submittals will have a turnaround time of less than a week.
4. What is the purpose of the cost breakdown with the quantity breakdown?
   The cost breakdown is set up to ensure that all elements of the work are accounted for in the total bid. The quantity breakdown will be used for pricing if there is a need for additional work.
5. Is there an apprenticeship program and training form attached to the documents?
   No there is not.
6. Will the existing water main be able to be shut down where the proposed water main is running in order to remove the existing?
   The existing water main will be able to be shut down on Thursdays and Fridays each week as necessary.
7. Do you have a spec or detail on the temporary construction fence?
   A six foot high chain link construction fence on stands (not driven) is acceptable.
8. Is there a quantity for bidding purposes for the unit price on the asphalt saw cut and demo and the unit price for concrete saw cut and demo?
   There is no quantity for the unit pricing. Any additional work is anticipated to be very small.
9. Are there liquidated damages on the project and what are they?
   There are no liquidated damages.

DATE: May 8, 2015

Clarifications:

1. Soil boring logs have been added to the database (appendix A).
2. On site utilities will be mark by the JJC staff.
3. Final completion is anticipated to be August 26th, 2015.
4. Removal and disposal of excess material/spoils shall be the sole responsibility of the contractor.
5. Areas excavated within the existing running track do not need to be restored to asphalt. These areas can be backfilled with fill material as specified under paved areas.
6. On page 195 under Quantity Breakdown:, Delete the line "**Total Improvements**"

Drawing Revisions:

1. Sheet 2: Route new water main around existing sign as shown.
2. Sheet 5: Actual route of existing gas line- revised.
3. Sheet 6: Temporary construction fence detail- added.
4. Sheet 6: Pavement cross section- added.

End of Addendum #1

REPORT OF SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING SERVICES

JOLIET JUNIOR COLLEGE MAIN CAMPUS IMPROVEMENTS AND ADDITIONS
1215 HOUBOLT ROAD
JOLIET, ILLINOIS

ECS PROJECT NO. 16:10466

FOR

JOLIET JUNIOR COLLEGE
JOLIET, ILLINOIS

JANUARY 29, 2015

ECS MIDWEST, LLC
"Setting the Standard for Service"
Geotechnical • Construction Materials • Environmental • Facilities

January 29, 2015

Mr. Phil Thiele
Project Manager
Joliet Junior College
1215 Houbolt Road
Joliet, Illinois 60431
Email: philip.thiele@jjc.edu

ECS Project No. 16:10466

Reference: Report of Subsurface Exploration and Geotechnical Engineering Services, Joliet Junior College Main Campus Improvements and Additions, 1215 Houbolt Road, Joliet, Illinois

Dear Mr. Thiele:

As authorized by your acceptance of our Proposal No. 16:13397-GP dated December 15, 2014, ECS Midwest, LLC (ECS) has completed the subsurface exploration and geotechnical engineering analysis for the proposed campus improvements and additions to be constructed at 1215 Houbolt Road in Joliet, Illinois.

A report, including the results of the subsurface exploration, boring data, ReMi testing, laboratory testing, recommendations regarding the geotechnical engineering design and construction aspects of the project and a Boring Location Plan are enclosed herein. The recommendations presented are intended for use by your office and for use by other professionals involved in the design and construction stages of the project described herein.

We appreciate this opportunity to be of service to Joliet Junior College during the design phase of this project. If you have questions with regard to the information and recommendations contained in this report, or if we may be of further service to you during the planning and/or construction phase of this project, please do not hesitate to contact the undersigned.

Respectfully,

ECS MIDWEST, LLC

MICHAEL BRONSON
062-054164

Michael T. Bronson, P.E.
Geotechnical Group Leader
Renews 11/30/2015

Stephen J. Geiger, P.E.
Senior Principal Engineer

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1575 Barclay Boulevard, Buffalo Grove, IL 60089 • T: 847-279-0366 • F: 847-279-0369 • www.ecslimited.com
ECS Capitol Services, PLLC • ECS Carolinas, LLP • ECS Central, PLLC • ECS Florida, LLC • ECS Mid-Atlantic, LLC • ECS Midwest, LLC • ECS Southeast, LLC • ECS Texas, LLP

REPORT

PROJECT

Subsurface Exploration and
Geotechnical Engineering Services
Joliet Junior College Main Campus Improvements and Additions
1215 Houbolt Road
Joliet, Illinois

CLIENT

Mr. Phil Thiele
Project Manager
Joliet Junior College
1215 Houbolt Road
Joliet, Illinois 60431

SUBMITTED BY

ECS Midwest, LLC
1575 Barclay Boulevard
Buffalo Grove, Illinois 60089

Illinois Professional Design Firm
No. 184-004247

PROJECT NO. 16:10466

DATE January 29, 2015

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EXECUTIVE SUMMARY

The subsurface conditions encountered during our exploration and ECS Midwest, LLC.'s conclusions and recommendations are summarized below. This summary should not be considered apart from the entire text of the report with all the qualifications and considerations mentioned herein. Details of our conclusions and recommendations are discussed in the following sections and in the Appendix.

The project site is on the campus of Joliet Junior College at the address of 1215 Houbolt Road in Joliet, Illinois. The project site is currently developed by the existing Main Campus of Joliet Junior College. The proposed construction at the project site will consist of a two-story slab-on-grade addition, parking lots and on-site stormwater detention. To better understand the subsurface conditions at the project site twenty (20) soil borings were performed. The subsurface conditions encountered at the borings performed at the site can be summarized as follows.

The surficial materials were observed to consist of about 7 to 30 inches of topsoil (typically 10 to 12 inches) or 4 to 5 inches of rubber material (i.e, running track surface) underlain by 3 to 7 inches of gravel. The surficial materials were typically observed to be underlain by Silty Clay FILL to depths ranging from about 2½ to 5½ feet below existing site grades. The FILL was observed to be underlain by natural Silty CLAY, Clayey SILT or Silty SAND with Gravel to depths ranging from about 4 feet to 6 feet below existing site grades. The natural soils were typically observed to be underlain by Weathered Limestone which extended to the refusal depth of the soil borings on apparent competent bedrock (i.e., approximately 5 to 8½ feet below existing site grades).

The Silty Clay FILL soils exhibited unconfined compressive strength values ranging from 2¼ tsf to 4 tsf (very stiff to stiff) and moisture contents ranging from about 16 percent to 28 percent. The natural Silty CLAY soil encountered exhibited unconfined compressive strength values ranging from 2½ tsf to greater than 4½ tsf (very stiff to hard) and had moisture contents ranging from about 12 to 19 percent. The Silty SAND exhibited SPT N-values ranging from 3 to 49 blows per foot (bpf) which is indicative of a very loose to dense relative density for granular soils, but was typically observed to be loose. The Silty SAND exhibited SPT N-values ranging from 3 to 49 blows per foot (bpf) which is indicative of a very loose to dense relative density for granular soils, but was typically observed to be loose. The Clayey SILT exhibited SPT N-values ranging from 7 bpf to over 50 blows to advance the spoon a few inches which is indicative of a loose to very dense relative density for granular soils. The Weathered Limestone exhibited SPT N-values ranging from 28 bpf to over 80 blows to advance the spoon several inches which is indicative of a medium dense to very dense relative density.

A Reflection Microtremor (ReMi) survey was performed on the site to evaluate the seismic site class. Based on the results of the ReMi survey, the average shear wave velocity at the project site is estimated to be 3,366 ft/s. The average shear wave velocity profile along the performed array is contained on the ReMi Test Results that are included in the Appendix. Based on the average shear wave velocity data obtained to a depth of 100 feet below the existing ground surface from the refraction microtremor surveys, the soil profile type for the site falls into seismic site Class B in accordance with section 1613.5.2 of the 2009 International Building Code (IBC). According to the IBC, a Site Class B can only be utilized for design if there is less than 10 feet of soil between the bottom of the spread footing or mat foundation and the rock surface.

The proposed addition can be supported on a shallow foundation system (i.e., wall and spread footings) bearing in competent natural soils or new engineered fill/lean concrete overlying competent natural soils. Consequently, the foundations will need to be extended through existing fill or the existing fill will need to be removed in its entirety. A shallow foundation system bearing in the competent natural soils or new engineered fill/lean concrete overlying competent natural soils can be designed for a maximum net allowable soil bearing pressure of 4,000 psf. Competent soils can be identified on the boring log as natural Silty CLAY or Clayey SILT/Silty SAND exhibiting an unconfined compressive strength estimate of at least 1½ tsf or SPT N-values of at least 8 bpf, respectively.

For the design and construction of the slabs-on-grade for the building addition, the recommendations provided in the section entitled **Subgrade Preparation and Earthwork Operations** should be followed. The building floor slab thickness can be determined utilizing an assumed modulus of subgrade reaction of 100 pounds per cubic inch (pci) after passing a proofroll. We recommend the floor slab be designed with a minimum thickness of 5 inches.

More detailed recommendations with regard to foundations, subgrade preparation and earthwork operations, fill placement, slab and pavement design, underslab drainage and construction dewatering are included herein and must be fully reviewed and understood so that the intent of the recommendations are properly utilized during design and construction of the proposed development. We recommend that ECS be retained during construction of the proposed development to monitor all earthwork/subgrade preparation to verify that the exposed subgrade materials and the soil bearing pressures will be suitable for the proposed structure.

Report Prepared By:	Report Reviewed By:
Michael T. Bronson, P.E. Project Engineer	Stephen J. Geiger, P.E. Senior Principal Engineer

PROJECT OVERVIEW

Introduction

This report presents the results of our subsurface exploration and geotechnical engineering recommendations for the proposed campus improvements and additions to be constructed at the Main Campus of Joliet Junior College at the physical address of 1215 Houbolt Road in Joliet, Illinois. A General Location Map included in the Appendix of this report shows the approximate location of the project site.

This study was conducted in general accordance with ECS Proposal No. 16:13397-GP dated December 15, 2014 and authorized by you. In preparing this report, we have utilized information from our current subsurface exploration as well as information from nearby sites.

Existing Site Conditions

Joliet Junior College's main campus is located at 1215 Houbolt Road in Joliet, Illinois. The site is bound to the north by undeveloped fields, to the west by a stream/river and to the south by several industrial developments. Of specific interest to the scope outlined herein is the athletic field located on the southwest corner of the campus. Based on our review of online resources (i.e., Google Earth®), existing site grades will range from EL. +565 to EL. + 570 feet.

Proposed Construction

Based on our discussions with you we understand the proposed construction at the project site will consist of one two-story, slab-on-grade stand-alone addition to the existing main campus. The development will also include new parking areas and possibly some on-site stormwater detention. The proposed column loads are expected to range from 150 to 250 kips and the exterior wall loads are expected to be approximately 1½ to 3 kips per linear feet (klf).

ECS requests that the actual design loads are made available to us as the project moves forward. If our understanding of the proposed construction is inaccurate, or if the design changes, please notify ECS immediately so that we can review the proposed scope of work to verify it is applicable for the proposed construction.

Purposes of Exploration and Scope of Services

The purposes of this exploration were to explore the soil and groundwater conditions at the project site and to develop engineering recommendations to help guide in the design and construction of the geotechnical aspects of the project. We accomplished these purposes by performing the following scope of services:

1. Reviewing the geotechnical reports prepared for nearby sites by ECS;

2. Drilling twenty (20) SPT (standard penetration tests) soil borings at the project site using an auger drill rig.
3. Perform one (1) ReMi test at the project site to determine the seismic Site Classification.
4. Performing laboratory tests on selected representative samples from the borings to estimate pertinent engineering properties;
5. Analyzing the field and laboratory data to develop appropriate engineering recommendations; and,
6. Preparing this geotechnical report of our findings and recommendations.

The conclusions and recommendations contained in this report are based on twenty (20) soil borings. Four (4) soil borings (MC-1 through MC-4) were drilled in the footprint of the proposed stormwater pond to depths ranging from approximately 8 to 8½ feet below existing site grades. Three (3) soil borings (MC-5 through MC-7) were drilled in the footprint of the proposed parking expansion to a depths ranging from approximately 7½ to 8½ feet below existing site grades. The remaining thirteen (13) soil borings (MC-8 through MC-20) were drilled in the footprint of the proposed structure to a depths ranging from approximately 5 to 8½ feet below existing site grades. The borings were scheduled to be drilled to a depth of approximately 20 feet below existing site grades but were terminated due to auger refusal on apparent competent bedrock.

The subsurface exploration (for the soil borings) included split-spoon soil sampling, standard penetration tests (SPT) and groundwater level observations in the boreholes. The results of the completed soil borings, ReMi testing and a Boring Location Plan are included in the Appendix of this report.

The boring locations were selected by you based on the proposed construction. The borings were located in the field by an ECS representative. The approximate locations of the borings are shown on the Boring Location Plan. According to the available online resources (i.e., Google Earth®), existing site grades are anticipated to range from approximately EL. +565 to EL. + 570 feet +/-. The approximate boring elevations are shown on the Boring Logs attached in the Appendix of the report.

EXPLORATION PROCEDURES

Subsurface Exploration Procedures

The borings were located in the field by an ECS representative. The soils boring locations were selected by you based on the proposed layout of the proposed construction. An ECS subcontracted driller contacted the State of Illinois Utility One-Call Center, JULIE, to clear and mark underground utilities in the vicinity of the project site prior to drilling operations.

The soil borings were performed with a truck-mounted rotary-type auger drill rig which utilized hollow stem augers to advance the boreholes. Representative soil samples were obtained by means of conventional split-barrel sampling procedures. Samples were typically obtained at 2½-foot intervals in the upper 10 feet and at 5-foot intervals thereafter. In this procedure, a 2-inch O.D., split-barrel sampler is driven into the soil a distance of 18 inches by a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler through a 12-inch interval, after initial setting of 6 inches, is termed the Standard Penetration Test (SPT) or N-value and is indicated for each sample on the boring logs. The SPT value can be used as a qualitative indication of the in-place relative density of cohesionless soils. In a less reliable way, it also indicates the consistency of cohesive soils. This indication is qualitative, since many factors can significantly affect the standard penetration resistance value and prevent a direct correlation between drill crews, drill rigs, drilling procedures, and hammer-rod-sampler assemblies.

The drill rig utilized an automatic trip hammer to drive the sampler. Consideration of the effect of the automatic hammer's efficiency was included in the interpretation of subsurface information for the analyses prepared for this report.

A field log of the soils encountered in the borings was maintained by the drill crew. After recovery, each geotechnical soil sample was removed from the sampler and visually classified. Representative portions of each soil sample were then sealed in jars. The soil samples were then delivered to our laboratory in Buffalo Grove, Illinois for further visual examination and laboratory testing. After completion of the drilling operations, the boreholes were backfilled with auger cuttings to the existing ground surface.

Shear Wave Velocity Testing

A Reflection Microtremor (ReMi) survey was performed on the site. The data was processed using SeisOpt® ReMi™ software to reveal a one-dimensional average shear-wave (S-wave) velocity image for the line (array). In addition, the survey also provides the average shear wave velocity to a depth of 100 feet that was used to determine the seismic Site Class. The results of ReMi survey are included in the Appendix of this report.

The data gathering process in the field used standard refraction seismic equipment to measure site characteristics using ambient vibrations (micro tremors) as a seismic source. The equipment used for the survey included a SiesOpt ReMi recording unit capable of storing record lengths up to about 100 seconds and 12 10-Hz vertical P-wave geophones. The analysis presented here was developed from the 12 receivers (10 Hz. Geophones) set along relatively straight-line arrays with evenly spaced intervals between the receivers. Twelve unfiltered 30-

second records were recorded along each line. The vibration records collected above were processed using proprietary software and the refraction micro tremor method as explained in Louie, J, N, 2001, “Faster, Better: Shear-wave velocity to 100 meters depth from refraction micrometer arrays”, Bulletin of the Seismological Society of America, v. 91, p.347-364.

Laboratory Testing Program

Representative soil samples were selected and tested in our laboratory to check field classifications and to help estimate engineering properties. The laboratory testing program included visual classifications, calibrated hand penetrometer unconfined compressive strength testing and moisture content determinations of cohesive soil samples.

Each soil sample was classified on the basis of texture and plasticity in accordance with the Unified Soil Classification System. The group symbols for each soil type are indicated in parentheses following the soil descriptions on the boring logs. A brief explanation of the Unified System is included with this report. The various soil types were grouped into the major zones noted on the boring logs. The stratification lines designating the interfaces between earth materials on the boring logs and profiles are approximate; in situ, the transitions may be gradual.

The unconfined compressive strength (Qp) of relatively cohesive clay soil samples was estimated with the use of a calibrated hand penetrometer. In the hand penetrometer test, the unconfined compressive strength of a soil sample is estimated, to a maximum of 4½ tons per square foot (tsf) by measuring the resistance of a soil sample to penetration of a small, calibrated spring-loaded cylinder.

The soil samples will be retained in our laboratory for a period of 60 days, after which, they will be discarded unless other instructions are received as to their disposal.

EXPLORATION RESULTS

Soil Conditions

To understand the subsurface conditions at the project site, twenty (20) soil borings were performed. Four (4) soil borings (MC-1 through MC-4) were drilled in the footprint of the proposed pond to depths ranging from approximately 8 to 8½ feet below existing site grades. Three (3) soil borings (MC-5 through MC-7) were drilled in the footprint of the proposed parking expansion to a depths ranging from approximately 7½ to 8½ feet below existing site grades. The remaining thirteen (13) soil borings (MC-8 through MC-20) were drilled in the footprint of the proposed structure to a depths ranging from approximately 5 to 8½ feet below existing site grades. The borings were scheduled to be drilled to a depth of approximately 20 feet below existing site grades but were terminated due to auger refusal on apparent competent bedrock. No rock coring beyond the depth of auger refusal was performed. The subsurface conditions encountered at the borings performed at the site can be summarized as follows. The specific soil types observed at the boring locations are noted on the boring logs in the Appendix.

The surficial materials were observed to consist of about 7 to 30 inches of topsoil (typically 10 to 12 inches) or 4 to 5 inches of rubber material (i.e, running track surface) underlain by 3 to 7 inches of gravel. The surficial soils were typically observed to be underlain by Silty Clay FILL to depths ranging from about 2½ to 5½ feet below existing site grades. The existing FILL must be considered undocumented as ECS has not been provided with in-place density test results. The FILL was observed to be underlain by natural Silty CLAY, Clayey SILT or Silty SAND with Gravel to depths ranging from about 4 feet to 6 feet below existing site grades. The natural soils were typically observed to be underlain by Weathered Limestone which extended to the refusal depth of the soil borings on apparent competent bedrock (i.e., approximately 5 to 8½ feet below existing site grades).

The Silty Clay FILL soils exhibited unconfined compressive strength values ranging from 2¼ tsf to 4 tsf (very stiff to stiff) and moisture contents ranging from about 16 percent to 28 percent. The natural Silty CLAY soil encountered exhibited unconfined compressive strength values ranging from 2½ tsf to greater than 4½ tsf (very stiff to hard) and had moisture contents ranging from about 12 to 19 percent. The Silty SAND exhibited SPT N-values ranging from 3 to 49 blows per foot (bpf) which is indicative of a very loose to dense relative density for granular soils, but was typically observed to be loose. The Silty SAND exhibited SPT N-values ranging from 3 to 49 blows per foot (bpf) which is indicative of a very loose to dense relative density for granular soils, but was typically observed to be loose. The Clayey SILT exhibited SPT N-values ranging from 7 bpf to over 50 blows to advance the spoon a few inches which is indicative of a loose to very dense relative density for granular soils. The Weathered Limestone exhibited SPT N-values ranging from 28 bpf to over 80 blows to advance the spoon several inches which is indicative of a medium dense to very dense relative density.

It should be noted that bid quantity estimation by “averaging” depths and strata changes from boring logs may not be representative of the actual depths and strata changes during earthwork construction. Too many variations exist for such “averaging” to be valid, particularly in the pavement and base course thicknesses, soil types and condition, depth, and groundwater conditions. Additional scope of professional services may be required to obtain subsurface information needed for earthwork bid preparation. This additional scope could include test pit exploration to better understand the extent (vertical and horizontal) of the materials/soils of concern. Even with this additional information, contingencies should always be carried in construction budgets or land purchase agreements to cover variations in subsurface conditions. Soil borings cannot present the same full-scale view that is obtained during complete site grading, excavation or other aspects of earthwork construction.

Groundwater Observations

Observations for groundwater were made during sampling and upon completion of the drilling operations at the boring locations. In auger drilling operations, water is not introduced into the boreholes, and the groundwater position can often be obtained by observing water flowing into or out of the boreholes. Furthermore, visual observation of the soil samples retrieved during the auger drilling exploration can often be used in evaluating the groundwater conditions.

Groundwater was encountered at a depth of about 7 feet during drilling to 7½ feet after auger removal at boring location MC-10. The balance of the borings were observed to be dry at the time of our exploration. Glacial till soils in the Midwest frequently oxidize from gray to brown above the level at which the soil remains saturated. The long-term groundwater level is often interpreted to be near this zone of color change. Based on the results of this exploration and soil color change of the natural soils encountered, the static long-term groundwater level at the project site is estimated to be located deeper than the extent of our exploration.

The highest groundwater observations are normally encountered in late winter and early spring and our current groundwater observations are not expected to be at the seasonal maximum water table. It should be noted that the groundwater level can vary based on precipitation, evaporation, surface run-off and other factors not immediately apparent at the time of this exploration. Surface water runoff will be a factor during general construction, and steps should be taken during construction to control surface water runoff and to remove water that may accumulate in the proposed excavations as well as floor slab.

Seismic Site Class

A Reflection Microtremor (ReMi) survey was performed on the site to evaluate the seismic Site Class. Based on the results of the ReMi survey, the average shear wave velocity at the project site is estimated to be 3,366 ft/s. The average shear wave velocity profile along the performed array is contained on the ReMi Test Results that are included in the Appendix. Based on the average shear wave velocity data obtained to a depth of 100 feet below the existing ground surface from the refraction microtremor surveys, the soil profile type for the site falls into seismic Site Class B in accordance with section 1613.5.2 of the 2009 International Building Code (IBC). According to the IBC, a Site Class B can only be utilized for design if there is less than 10 feet of soil between the bottom of the spread footing or mat foundation and the rock surface.

ANALYSIS AND RECOMMENDATIONS

Overview

The conclusions and recommendations presented in this report should be incorporated in the design and construction of the project to help reduce possible soil and/or foundation related problems. The following recommendations have been developed on the basis of the previously described project characteristics and subsurface conditions encountered at the project site. If there are any changes to the project characteristics or if different subsurface conditions are encountered during construction, ECS Midwest, LLC should be consulted so that the recommendations of this report can be reviewed and modified, if necessary.

The presence of undocumented FILL, to depths as great as about 5½ feet in some portions of the site, will influence the design, construction and performance of the proposed construction. New construction supported on or over the undocumented FILL will likely experience some geotechnical relates distress. Consequently, the undocumented FILL should be completely removed and replaced with new engineered fill to eliminate the risk associated with these materials. Otherwise, the client must accept some risk of geotechnical related distress in the new construction if some lesser amount of remedial work is performed.

The following sections present specific recommendations with regard to the design of the proposed Campus Improvements and Additions. These include recommendations with regard to subgrade preparation and earthwork, fill placement, building foundations, floor slab design, pavement design and construction dewatering. Discussion of the factors affecting the building foundations for the proposed construction, as well as additional recommendations regarding design and construction at the project site are included below. We recommend that ECS review the final design and specifications to check that the earthwork and foundation recommendations presented in this report have been properly interpreted and implemented in the design and specifications.

Subgrade Preparation and Earthwork Operations

Considerations for Existing Fill

As previously discussed, the only way to eliminate the risk associated with the undocumented fill is to completely remove the fill and replace it with new engineered fill. However, within areas of proposed slabs-on-grade and/or pavements, other remedial strategies may be considered if the client is willing to accept some risk for premature subgrade related distress of slabs and pavements. The decision to leave existing fill in-place beneath new construction is a decision only the client can make based upon their level of risk tolerance.

The first alternative would involve removing a select depth of existing fill and replacing it with new engineered fill. For planning purposes, we suggest that the partial depth undercutting be no less than 2 feet below the planned final subgrade elevation. The undercut excavation should also extend at least 5 feet beyond the perimeter of the planned structure and/or pavements. The exposed subgrade should then be evaluated as described later in this section. The resulting excavation should then be backfilled as described in the Fill Placement and Compaction of this report. This approach will not eliminate the possibility for premature subgrade related distress of new grade supported construction and considered to be of low to moderate risk. However, it may delay the need and severity of future repairs.

The second alternative would be to evaluate existing fill present at the final subgrade elevations or prior to the placement of new engineered fill to achieve the design grades. With this option, the exposed subgrades should be proofrolled with heavy rubber tired equipment and unstable or yielding areas removed and replaced with new engineered fill on an a case by case basis. An ECS geotechnical engineer should observe the proofrolling and provide specific recommendations based on the conditions observed. This alternative is expected to carry moderate risk for pavement and lightly loaded floor slabs. The client should understand that this approach will likely result in the need for heightened maintenance and repair of new grade supported construction.

The following paragraphs discuss general site preparation and earthwork operations regardless of the client's approach to the existing fill.

General Earthwork Considerations

The subgrade preparation should generally consist of stripping/removal of all existing vegetation, topsoil, rubber track materials, subbase and any other soft or unsuitable material from the project areas. We recommend the earthwork clearing be extended a minimum of 10 feet beyond the limits of new structure and 5 feet beyond the limits of the proposed parking lot, where possible. ECS does not recommend the floor slab/pavement subgrades remain exposed to the elements or construction traffic for a prolonged period of time as the subgrade may be disturbed and/or softened. If the floor slab is not planned to be constructed within a few days after exposing the final design subgrade, consideration should be given to leaving the subgrade approximately 1 foot above the final design subgrade to help prevent softening of the design subgrade soils (if feasible).

Once the subgrade has been exposed, the subgrade should be proofrolled using a loaded dump truck having an axle weight of at least 10 tons. The intent of the proofroll is to aid in identifying localized soft or unsuitable material which may be required to be removed. In cut areas, if soft or yielding soils are observed during the proofroll of the subgrade, the soft or yielding soils should be undercut up to a maximum of 2 feet and replaced with compacted and engineered fill to the design subgrade in accordance with the **Fill Placement** section of this report. In fill areas, if soft or yielding soils are observed during the proofroll of the subgrade, the soft or yielding soils should be further evaluated by the Geotechnical Engineer of Record to determine what remedial action is required. Proofrolling of the subgrade should be performed under the observation of the Geotechnical Engineer of Record or his authorized representative.

To help limit the volume of soil removed as a result unstable conditions revealed by the proofrolling observations, we recommend that soft or yielding soils be evaluated in approximately 6-inch intervals. That is to say, if soft or yielding soils are identified, the contractor should remove 6 inches of material in the subject area and then proofroll/evaluate the undercut subgrade. This process can help reduce the potential for performing more undercutting than may otherwise be necessary.

Steps should be taken by the contractor to control surface water runoff and to remove water from precipitation that may accumulate in the subgrade areas, especially during the wet season. When wet and subjected to construction traffic, softening and disturbance of the exposed clayey subgrade may occur. Construction traffic should be especially limited when the subgrade is wet. During final preparation of the subgrade, a smooth drum roller is often used to provide a flat surface and provide for better drainage to reduce the negative impact of rain events. Due to the relative sensitivity of the lean clay soils, we recommend that these materials be static rolled (no vibrations) with a sheepsfoot roller to reduce the potential for subgrade soil disturbance. We also recommend sealing, crowning and sloping the subgrade to provide positive drainage off the subgrades.

Exposure to the environment may weaken the subgrade soils if the excavations remain open for too long a period. If the subgrade soils are softened by surface water intrusion or exposure, the softened soils must be removed from the subgrade excavation bottom immediately prior to placement of concrete and/or engineered fill.

Excavations should comply with the requirements of OSHA 29CFR, Part 1926, Subpart P, "Excavations" and its appendices, as well as other applicable codes. This document states that the contractor is solely responsible for the design and construction of stable, temporary excavations. The excavations should not only be in accordance with current OSHA excavation and trench safety standards but also with applicable Local, State and Federal regulations. The contractor should shore, slope or bench the excavation sides when appropriate.

If problems are encountered during the earthwork operations, or if site conditions deviate from those encountered during our subsurface exploration, ECS should be notified immediately. We recommend that the project geotechnical engineer or his representative be on site to monitor stripping and site preparation operations and observe that unsuitable soils have been satisfactorily removed and observe the proofrolling of the subgrades.

Fill Placement and Compaction

All fills should consist of an approved material, free of organic matter and debris, particles greater than 3-inches and have a Liquid Limit and Plasticity Index less than 40 and 15, respectively. Unacceptable fill materials include topsoil and organic materials (OH, OL), high plasticity silts and clays (CH, MH), fat clays and low-plasticity silts (ML). Under no circumstances should high plasticity soils be used as fill material in proposed structural areas or close to site slopes.

The Silty Clay can be utilized as engineered fill. However, the project team/contractor should be prepared to implement discing or other drying techniques (termed manipulation) prior to their (silty clay) use as compacted fill, and recognize and account for increased costs associated with manipulation of the on-site clay. The Clayey SILT and Silty SAND can be used as engineered fill but should not be utilized within 3½ feet of exterior site grades as these materials are frost susceptible. The use of the Clayey SILT and Silty SAND as fill at depths shallower than 3½ feet requires the client/owner to accept the risks of premature distress of pavements, sidewalks, etc. On-site and off-site soils to be considered for engineered fill at the project site should be further evaluated and approved by the project geotechnical engineer prior to placement at the time of construction. We do not recommend the use of pea gravel as engineered fill. Pea gravel has round/smooth characteristics, no fines and does not interlock when compacted which make more susceptible to future movement and instability resulting in excessive and variable settlement.

Fill materials should be placed in lifts not exceeding 8-inches in loose thickness and moisture conditioned to within ±2 percentage points of the optimum moisture content. Soil bridging lifts should not be used, since intolerable settlement of overlying structures will likely occur. Controlled fill soils should be compacted to a minimum of 95 percent of the maximum dry density obtained in accordance with ASTM D 1557, modified Proctor method. The zone of the engineered fill placed below the foundations should extend 1 foot beyond the outside edges of the footings and from that point, outward laterally 1 foot for every 2 feet of fill thickness below the footing.

The expanded footprint of the proposed building pad and fill areas should be well defined, including the limits of the fill zones at the time of fill placement. Grade control should be maintained throughout the fill placement operations. All fill operations should be observed on a full-time basis by a qualified soil technician to determine that the specified compaction requirements are being met. A minimum of one compaction test per 2,500 square foot area should be tested in each lift placed. Within trench or other localized excavations, one test for each 50 linear feet of each lift of fill shall be performed. The elevation and location of the tests should be clearly identified at the time of fill placement.

Compaction equipment suitable to the soil type used as fill should be used to compact the fill material. Theoretically, any equipment type can be used as long as the required density is achieved; however, the standard of practice typically dictates that a vibratory roller be utilized for compaction of granular soils and a sheepsfoot roller be utilized for compaction of cohesive soils. In addition, a steel drum roller is typically most efficient for compacting and sealing the surface soils. All areas receiving fill should be graded to facilitate positive drainage away from the building pad and pavement areas. Natural clayey silt soils are difficult to work with and compact and easily become disturbed, especially when wet. Construction traffic should be limited on clayey silt subgrade soils. Care should be taken with vibrating equipment near existing structures.

It should be noted that prior to the commencement of fill operations and/or utilization of off-site borrow materials, the Geotechnical Engineer of Record should be provided with representative samples to determine the material's suitability for use in a controlled compacted fill and to develop moisture-density relationships. In order to expedite the earthwork operations, if off-site borrow materials are required, it is recommended they consist of suitable fill materials in accordance with the recommendations previously outlined in this section.

Fill materials should not be placed on frozen soils or frost-heaved soils and/or soils that have been recently subjected to precipitation. All frozen soils should be removed prior to continuation of fill operations. Borrow fill materials, if required, should not contain frozen materials at the time of placement. All frost-heaved soils should be removed prior to placement of controlled, compacted fill, granular subbase materials, foundation or slab concrete, and asphalt pavement materials.

Foundation Recommendations

The proposed addition can be supported on a shallow foundation system (i.e., wall and spread footings) bearing in competent natural soils or new engineered fill/lean concrete overlying competent natural soils. If the existing fill is not completely removed from the expanded building footprint area and replaced with new engineered fill, the foundations must be extended through the fill to bear in competent natural soil. A shallow foundation system bearing in the competent natural soils or new engineered fill/lean concrete overlying competent natural soils can be designed for a maximum net allowable soil bearing pressure of 4,000 psf. The net allowable soil bearing pressure refers to that pressure which may be transmitted to the foundation bearing soils in excess of the final minimum surrounding overburden pressure. Competent soils can be identified on the boring log as natural Silty CLAY or Clayey SILT/Silty SAND exhibiting an unconfined compressive strength estimate of at least 1½ tsf or SPT N-values of at least 8 bpf, respectively.

If unsuitable/loose/soft soils or soils with elevated moisture contents (i.e., greater than 25 percent) are encountered at the proposed bearing elevation, consideration should be given to extending the footings until suitable bearing soils are encountered or the unsuitable soils should be removed beneath the base of the footing and replaced with compacted engineered fill or lean concrete. ECS recommends hand auger probes be performed to a depth of at least 3 feet below the footing bearing elevation supplemented with in-situ DCP testing to evaluate the bearing soils during construction and confirm the soils are suitable.

If engineered fill is utilized, the engineered fill should be compacted to a minimum of 95 percent of the maximum dry density in accordance with modified Proctor method, ASTM D 1557. The zone of the engineered fill placed below the foundations should extend 1 foot beyond the outside edges of the footings and from that point, outward laterally 1 foot for every 2 feet of fill thickness below the footing. If lean concrete is utilized to replace weaker/low bearing soils or unsuitable soils, no lateral over-excavation will be necessary, but the excavation should be 1 foot wider than the footing (6 inches on each side), and the lean concrete should be allowed to sufficiently harden prior to placement of the foundation concrete. We recommend that the excavation/backfill of foundations be monitored full-time by an ECS Geotechnical Engineer or his representative to verify that the available soil bearing pressure is consistent with the boring log information obtained during the geotechnical exploration and our design recommendations.

To help reduce the potential for foundation bearing failure and excessive settlement due to local shear or "punching" action, we recommend that continuous footings have a minimum width of 18 inches and that isolated column footings have a minimum lateral dimension of 30 inches. In addition, footings should be placed at a depth to provide adequate frost cover protection. For this region, we recommend the exterior footings and footings beneath unheated areas be placed at a minimum depth of 3½ feet below finished grade. Interior footings in heated areas can be placed at a minimum of 2 feet below grade provided that suitable soils are encountered and that the foundations will not be subjected to freezing weather either during or after construction.

Settlement of individual footings, designed in accordance with our recommendations presented in this report, is expected to be small and within tolerable limits for the proposed building. For footings placed on competent natural soils or properly compacted engineered fill overlying competent natural soils, maximum total and differential settlements are expected to be in the range of 1 inch or less and ½ inch, respectively. These settlement values are based on our engineering experience and the anticipated structural loading, and are to help guide the structural engineer with his design.

Floor Slab Design

For the design and construction of the slabs-on-grade for the building addition, the recommendations provided in the section entitled **Subgrade Preparation and Earthwork Operations** should be followed. Provided the recommendations of this report are strictly followed, the building floor slab thickness can be determined utilizing an assumed modulus of subgrade reaction of 100 pounds per cubic inch (pci). The final slab subgrade should be firm and unyielding during a final proofroll. We recommend the slab be designed with a minimum thickness of 5 inches.

We recommend consideration be given to the floor slab being underlain by a minimum of 6 inches of granular material having a maximum aggregate size of 1½ inches and no more than 2 percent soil passing the No. 200 sieve. This granular layer will facilitate the fine grading of the subgrade and help prevent the rise of water through the floor slab. Prior to placing the granular material, the floor subgrade should be free of standing water, mud, and frozen soil. Before the placement of concrete, a vapor barrier may be placed on top of the granular material to provide additional moisture protection. Welded-wire mesh reinforcement should be placed in the upper half of the floor slab and attention should be given to the surface curing of the slab to minimize uneven drying of the slab and associated cracking and/or slab curling. The use of a blotter or cushion layer above the vapor retarder can also be considered for project specific reasons. Please refer to ACI 302.1R04 *Guide for Concrete Floor and Slab Construction* and ASTM E 1643 *Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs* for additional guidance on this issue.

We recommend that the floor slab be isolated from the foundations so differential settlement of the structure will not induce shear stresses on the floor slab. For maximum effectiveness, temperature and shrinkage reinforcements in slabs on ground should be positioned in the upper third of the slab thickness. The Wire Reinforcement Institute recommends the mesh reinforcement be placed 2 inches below the slab surface or upper one-third of slab thickness, whichever is closer to the surface. Adequate construction joints, contraction joints and isolation joints should also be provided in the slab to reduce the impacts of cracking and shrinkage. Please refer to ACI 302.1R04 *Guide for Concrete Floor and Slab Construction* for additional information regarding concrete slab joint design.

If problems are encountered during the slab subgrade preparation, or if site conditions deviate from those encountered during our subsurface exploration, ECS should be notified immediately. We recommend that the project geotechnical engineer or his representative should be on site to monitor subgrade preparation and observe that unsuitable soils have been satisfactorily removed and the subgrade soils are suitable to support the slab.

Underslab Sub-Drainage Design

Based on the groundwater levels observed during the subsurface exploration, we do not anticipate a significant volume of water will persist at the slab subgrade elevation. It should be noted; however, that surface runoff and limited groundwater seepage may accumulate at the slab subgrade. As such, we recommend that positive drainage be implemented around the perimeter of the proposed structure to reduce the potential for water accumulation under the floor slab and foundation elements, which could potentially weaken the bearing soils.

Pavement Design

We recommend that the pavement subgrade be prepared in accordance with the **Subgrade Preparation and Earthwork Operations** section of this report. Once the subgrade has been properly prepared, we recommend the following minimum pavement sections for the proposed development. The minimum pavement sections were developed based on assumed traffic loads and a CBR of 3 for the subgrade soils.

Table 1: Pavement Section Recommendations

Pavement Material	Compacted Material Thicknesses (Inches)			
	Flexible Pavement (Light Duty)	Flexible Pavement (Heavy Duty)	Rigid Pavement (Light Duty)	Rigid Pavement (Heavy Duty)
Portland Cement Concrete	--	--	5	6
Bituminous Surface Course	1½	1½	--	--
Bituminous Base Course	2	3	--	--
Crushed Granular Subbase	8	12	6	6
Total Pavement Section Thickness	11½	16½	11	12

All pavement materials and construction should be in accordance with the Guidelines for AASHTO Pavement Design and IDOT Standards for Road and Bridge Construction.

The pavement sections specified in the table above are general pavement recommendations based on the anticipated usage at the project site and were not developed based on specific traffic patterns/loading and resiliency factors, as those parameters were not provided by the design team. We recommend the project team provide ECS with actual design traffic loads so that we can verify the recommendations detailed herein are appropriate for the anticipated traffic loads. The table above provides “Standard” and “Heavy Duty” flexible and rigid pavement recommendations. The light-duty pavement section assumes that typical traffic loading will be limited to standard automobiles and does not account for more heavily loaded vehicles (i.e., multiple axle trucks and buses) and should be used for parking lanes. The “Heavy-Duty” pavement section is recommended for pavements to be subjected with frequent traffic such as drive lanes, delivery areas, bus lanes and entrance/exit drive areas.

It should also be noted that the pavement sections specified in the table above were developed for the anticipated in-service traffic conditions only and do not provide an allowance for construction traffic conditions or traffic conditions in excess of typical residential/collector street traffic. Therefore, if pavements will be constructed early during site development to accommodate construction traffic, consideration should be given to the construction of designated haul roads, where thickened pavement sections can be provided to accommodate the construction traffic, as well as the future in-service traffic. ECS can provide additional design assistance with pavement sections for haul roads upon request. If the organic/peat soils are allowed to remain below the pavement, shortened service life and increase maintenance costs should be anticipated.

We recommend the crushed granular base course should be compacted to at least 95 percent of the maximum dry density obtained in accordance with ASTM D1557, Modified Proctor Method. During asphalt pavement construction, the wearing and leveling course should be compacted to a minimum of 93 percent of the theoretical density value. Prior to placing the granular material, the pavement subgrade soil should be properly compacted, observed to be stable during a final proofroll and free of standing water, mud, and frozen soil.

Adequate construction joints, contraction joints and isolation joints should be provided in the areas of rigid pavement to reduce the impacts of cracking and shrinkage. Please refer to ACI 330R-92 *Guide for Design of Concrete Parking Lots*. The Guide recommends an appropriate spacing strategy for the anticipated loads and pavement thickness. It has been our experience that joint spacing closer to the minimum values results in a pavement with less cracking and better long term performance.

The pavements should be designed and constructed with adequate surface and subsurface drainage. Where standing water develops, either on the pavement surface or within the base course layer, softening of the subgrade and other problems related to the premature deterioration of the pavement can be expected. Furthermore, good drainage should minimize the possibility of the subgrade materials beneath the pavement becoming saturated over a long period of time. Infiltration and subterranean water are the two sources of water that should be considered in the pavement design for the project. Infiltration is surface water that enters the pavement through the joints, pores, cracks in the pavement and through shoulders and adjacent areas pavements as a result of precipitation. Subterranean water is a source of water from a high water table on the site. The long term groundwater level on the site is estimated to be located deeper than the extent of our subsurface exploration. Therefore, infiltration is the most important source of water to be considered for this project.

Large, front loading trash dumpsters frequently impose concentrated front-wheel loads on pavements during loading. This type of loading typically results in rutting of the pavement and ultimately pavement failures. Therefore, we recommend that the pavement in trash pickup areas consist of the heavy duty rigid pavement section in Table 1. It should be noted that the pavement should be comprised of air-entrained Portland cement concrete with a minimum compressive strength of 4,000 psi and a minimum flexural strength of 650 psi.

Pavement Maintenance

Regular maintenance and occasional repairs should be implemented to keep pavements in a serviceable condition. In addition, to help minimize water infiltration to the pavement section and within the base course layer resulting in softening of the subgrade and deterioration of the pavement, we recommend the timely sealing of joints and cracks using elastomeric caulk or other compatible material. We recommend exterior pavements should be reviewed for distress/cracks twice a year, once in the spring and once in the fall. In areas where deep deposits of undocumented and variable fill soils are considered to be left in place, the Owner should anticipate increased in long term pavement maintenance due to compression of deep fill/organic peat over time.

Sound maintenance programs should help maintain and enhance the performance of pavements and attain the design service life. A preventative maintenance program should be implemented early in the pavement life to be effective. The “standard in the industry” supported by research indicates that preventative maintenance should typically begin within 2 to 5 years of the placement of pavement. Failure to perform preventative maintenance will reduce the service life of the pavement and increase the costs for both corrective maintenance and full pavement rehabilitation.

Stormwater Detention Pond

Based on our observations at the project site, we anticipate the soils in the vicinity of the proposed detention pond will likely consist of Silty CLAY or Clayey SILT (depending on final grading). Based on the subsurface soil in the vicinity of the detention pond, we are providing general recommendations for construction and design of the detention pond.

The natural Silty CLAY is considered suitable for the retention of water. If granular soils, such as SILT or Sand are encountered at the bottom or sides of the pond, an impermeable clay liner will be required. We recommend ECS and the project team evaluate the soils in the vicinity of the detention pond be evaluated at the time of construction. The exposed cut surfaces at the pond excavation sides and bottom may tend to become disturbed during the excavation process. We recommend a minimum 12 inches below the finish grade be scarified and recompacted to a minimum of 90 percent of modified Proctor maximum dry density value. If a clay liner is required, ECS recommends a 1 foot thick layer of Silty CLAY be placed at the pond bottom and sides to retain the stormwater runoff.

To help reduce erosion of the sides of the basin excavation and embankments, erosion protection should be provided. The placement of a granular rip-rap and/or establishment of uniform vegetation can be considered for erosion control within the pond and surrounding areas. A slope of 3:1 (Horizontal:Vertical) or flatter should be used to reduce the potential for slope stability related problems within side slopes of the pond. If side slope inclinations steeper than 3:1 will be utilized, a formal slope stability analysis should be performed.

PROJECT CONSTRUCTION RECOMMENDATIONS

General Construction Considerations

We recommend that the subgrade preparation, installation of the foundations, and construction of slabs-on-grade be monitored by an ECS geotechnical engineer or his representative. Methods of verification and identification such as proofrolling, hand auger probes with in-situ DCP testing will be necessary to further evaluate the subgrade soils and identify unsuitable soils. The contractor should be prepared to over-excavate slab-on-grade subgrades at isolated locations (as necessary). We recommend that excavations of new foundations be monitored on a full-time basis by an ECS geotechnical engineer or his representative to verify that the soil bearing pressure and the subgrade materials will be suitable for the proposed structure and are consistent with the boring log information obtained during this geotechnical exploration. We would be pleased to provide these services.

All unsuitable materials should be removed and legally disposed off site and replaced with environmentally clean, inorganic fill and free of debris or harmful matter. Unsuitable materials removed from the project site should be disposed of in accordance with all applicable Federal, State, and Local regulations.

The contractor should avoid stockpiling excavated materials immediately adjacent to excavation walls. We recommend that stockpile materials be kept back from the excavation a minimum distance equal to the excavation depth to avoid surcharging the excavation walls. If this is impractical due to space constraints, the excavation walls should be retained with bracing/shoring designed for the anticipated surcharge loading.

Excavations should comply with the requirements of OSHA 29CFR, Part 1926, Subpart P, "Excavations" and its appendices, as well as other applicable codes. This document states that the contractor is solely responsible for the design and construction of stable, temporary excavations. The excavations should not only be in accordance with current OSHA excavation and trench safety standards but also with applicable Local, State and Federal regulations. The contractor should shore, slope or bench the excavation sides when appropriate. Site safety is the sole responsibility of the contractor, who shall also be responsible for the means, methods and sequencing of construction operations.

Foundation Subgrades

If unsuitable/loose/soft soils or soils with elevated moisture contents (i.e., greater than 25 percent) are encountered at the proposed bearing elevation, consideration should be given to extending the footings until suitable bearing soils are encountered or the unsuitable soils should be removed beneath the base of the footing and replaced with compacted engineered fill or lean concrete. ECS recommends hand auger probes be performed to at least 3 feet below footing bearing elevation supplemented with in-situ DCP testing to evaluate the bearing soils during construction and confirm the soils are suitable. These evaluations are essential if the client does not elect to completely remove and replace the existing undocumented fill with new engineered fill. Foundations bearing on undocumented fill

If engineered fill is utilized, the engineered fill should be compacted to a minimum of 95 percent of the maximum dry density in accordance with modified Proctor method, ASTM D 1557. The zone of the engineered fill placed below the foundations should extend 1 foot beyond the outside edges of the footings and from that point, outward laterally 1 foot for every 2 feet of fill thickness below the footing. If lean concrete is utilized to replace weaker/low bearing soils or unsuitable soils, no lateral over-excavation will be necessary, but the excavation should be 1 foot wider than the footing (6 inches on each side), and the lean concrete should be allowed to sufficiently harden prior to placement of the foundation concrete. We recommend that the excavation/backfill of foundations be monitored full-time by an ECS Geotechnical Engineer or his representative to verify that the soil bearing pressure is consistent with the boring log information obtained during the geotechnical exploration.

Construction Dewatering

Based on the subsurface information obtained from the borings and our understanding of the proposed construction, dewatering efforts during construction should be minimal unless rainfall or perched water becomes an issue. We believe the use of sump pumps should be adequate to maintain a dry excavation during excavation and construction. The sump pits should be located around the perimeter of the excavations.

Exposure to the environment may weaken the soils within excavations if the excavations remain open for too long a period. If the subgrade soils are softened by surface water intrusion or exposure, the softened soils must be removed from the excavation bottom immediately prior to placement of concrete or engineered fill.

Closing

This report has been prepared to aid in the evaluation of this property and to assist the architect and/or engineer in the design of this project. The scope is limited to the specific project and locations described herein and our description of the project represents our understanding of the significant aspects relative to soil and foundation characteristics. In the event that any change in the nature or location of the proposed construction outlined in this report are planned, we should be informed so that the changes can be reviewed and the conclusions of this report modified or approved in writing by the geotechnical engineer. It is recommended that all construction operations dealing with earthwork and foundations be reviewed by an experienced geotechnical engineer to provide information on which to base a decision as to whether the design requirements are fulfilled in the actual construction. If you wish, we would welcome the opportunity to provide field construction services for you during construction.

The analysis and recommendations submitted in this report are based upon the data obtained from the soil borings and tests performed at the locations as indicated on the Boring Location Plan and other information referenced in this report. This report does not reflect variations, which may occur between the borings. In the performance of the subsurface exploration, specific information is obtained at specific locations at specific times. However, it is a well known fact that variations in soil conditions exist on most sites between boring locations and also such situations as groundwater levels vary from time to time. The nature and extent of variations may not become evident until the course of construction. If variations then appear evident, after performing on-site observations during the construction period and noting characteristics and variations, a reevaluation of the recommendations for this report will be necessary.

In addition to geotechnical engineering services, ECS Midwest, LLC has the in-house capability to perform multiple additional services as this project moves forward. These services include the following:

- Environmental Consulting;
- Project Drawing and Specification Review; and,
- Construction Material Testing / Special Inspections

We would be pleased to provide these services for you. If you have questions with regard to this information or need further assistance during the design and construction of the project please feel free to contact us.

APPENDIX

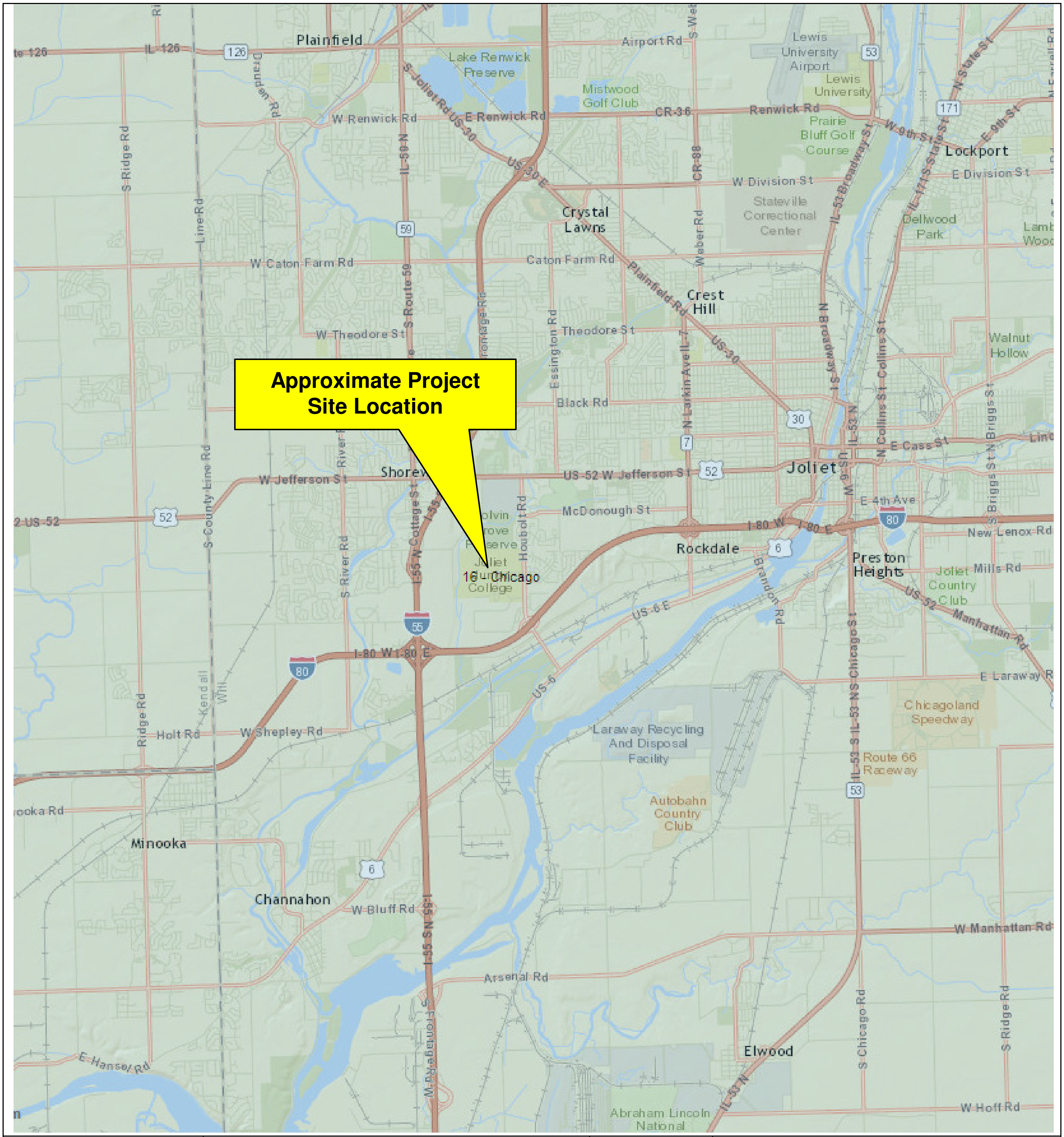
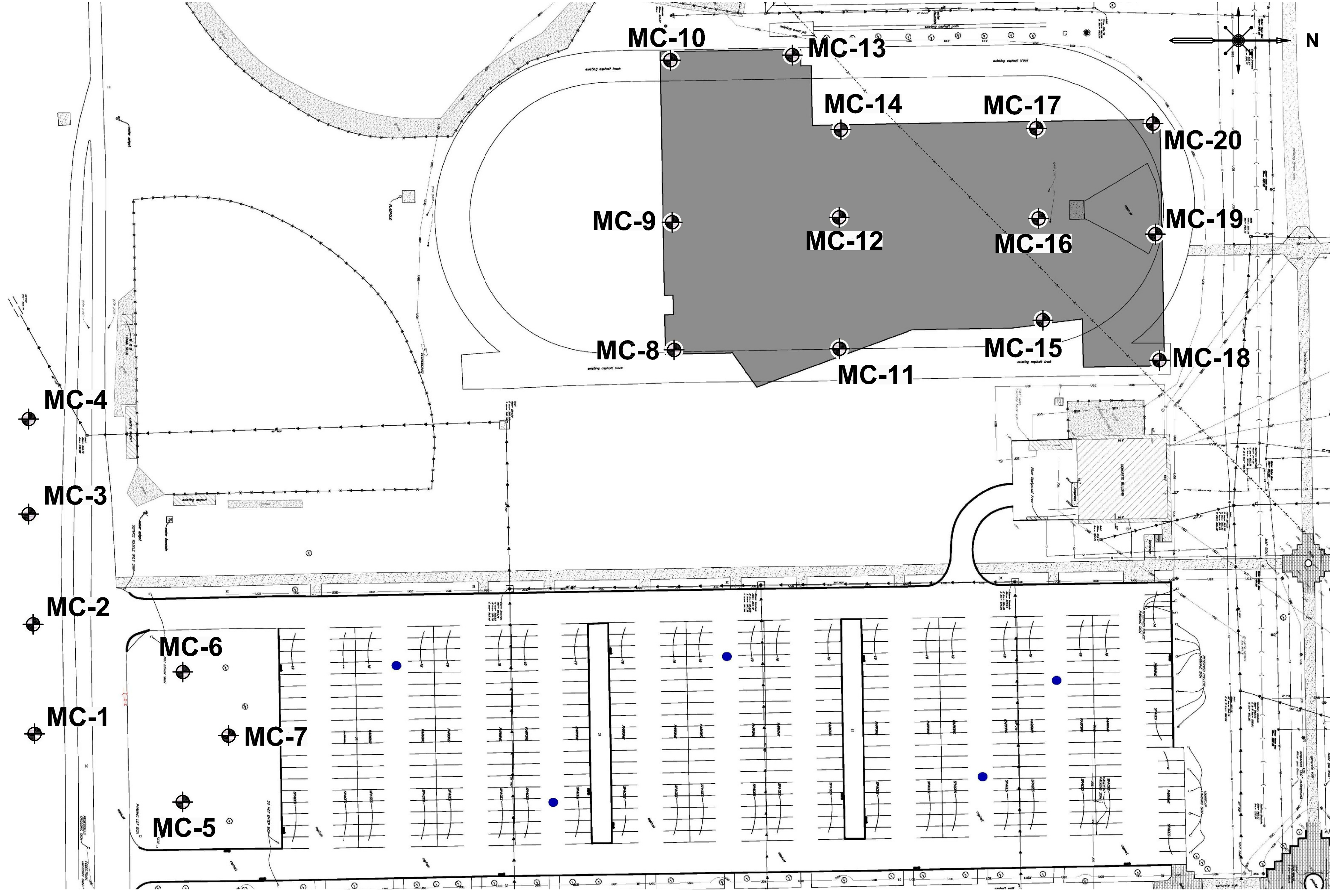


Figure 1

GENERAL LOCATION PLAN

ECS Project No. 16:10466
Joliet Junior College
Romeoville Campus
Improvements and Additions
1215 Houbolt Road
Joliet, Illinois



GRAPHIC SCALE

0' 100'

⊕ APPROXIMATE SOIL BORING LOCATION

BORING LOCATION PLAN

Joliet Junior College

Multipurpose Building

ENGINEER MTB	SCALE Approx. 1"=100'
DRAFTING LGM	PROJECT NO. 10466
REVISIONS	SHEET FIGURE 2
	DATE 01/28/15

CLIENT
Joliet Junior College

JOB # 10466

BORING # MC-1

SHEET 1 OF 1

PROJECT NAME
Joliet Junior College

ARCHITECT-ENGINEER

SITE LOCATION
1215 Houbolt Road, Joliet, Illinois

NORTHING

EASTING

STATION

-○- CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – – – REC% ———

PLASTIC LIMIT% × WATER CONTENT% ● LIQUID LIMIT% △

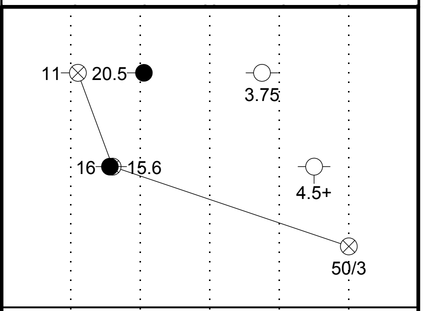
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL ENGLISH UNITS

BOTTOM OF CASING LOSS OF CIRCULATION

SURFACE ELEVATION 570

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [7"]	570	
	S-1	SS	18	12	(CL/ML FILL) SILTY CLAY, Trace Sand, Trace Gravel, Dark Brown and Black, Moist, Very Stiff		5 5 6
	S-2	SS	18	14	(CL/ML) SILTY CLAY, Trace Sand, Trace Gravel, Yellowish Brown, Moist, Hard		6 9 7
5						565	
	S-3	SS	9	6	(SP) PARTIALLY WEATHERED LIMESTONE SAMPLED AS FINE SAND WITH GRAVEL, Brown, Moist, Very Dense		8 50/3
					AUGER REFUSAL @ 8'		
10						560	
15						555	
20						550	
25						545	
30						540	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐

BORING STARTED 01/14/15

WL(BCR) WL(ACR)

BORING COMPLETED 01/14/15

CAVE IN DEPTH

WL

RIG CME-45 FOREMAN S. Euker

DRILLING METHOD CFA

CLIENT	JOB #	BORING #	SHEET
Joliet Junior College	10466	MC-2	1 OF 1

PROJECT NAME: Joliet Junior College

ARCHITECT-ENGINEER:

SITE LOCATION: 1215 Houbolt Road, Joliet, Illinois

NORTHING: EASTING: STATION:

-○- CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – – – REC% ———

PLASTIC LIMIT% ✕ WATER CONTENT% ● LIQUID LIMIT% △

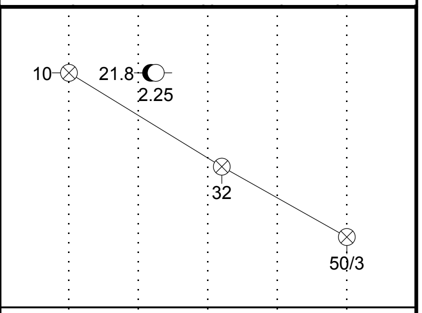
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING ➧ LOSS OF CIRCULATION

SURFACE ELEVATION 568

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [10"]			
	S-1	SS	18	14	(CL/ML FILL) SILTY CLAY, Trace Sand, Trace Gravel, Dark Brown, Moist, Very Stiff		565	3 4 6
	S-2	SS	18	14	(ML/CL) CLAYEY SILT, Orangish Brown, Moist, Dense			9 10 22
5	S-3	SS	3	2	(SP) PARTIALLY WEATHERED LIMESTONE SAMPLED AS FINE SAND WITH GRAVEL, Orangish Brown, Moist, Very Dense		560	50/3
					AUGER REFUSAL @ 8'			
10							555	
15							550	
20							545	
25							540	
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 01/14/15	
WL(BCR) WL(ACR)	BORING COMPLETED 01/14/15	CAVE IN DEPTH
WL	RIG CME-45 FOREMAN S. Euker	DRILLING METHOD CFA

CLIENT
Joliet Junior College

JOB #
10466

BORING #
MC-3

SHEET
1 OF 1

PROJECT NAME
Joliet Junior College

ARCHITECT-ENGINEER

SITE LOCATION
1215 Houbolt Road, Joliet, Illinois

NORTHING

EASTING

STATION

-○- CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% ✕ WATER CONTENT% ● LIQUID LIMIT% △

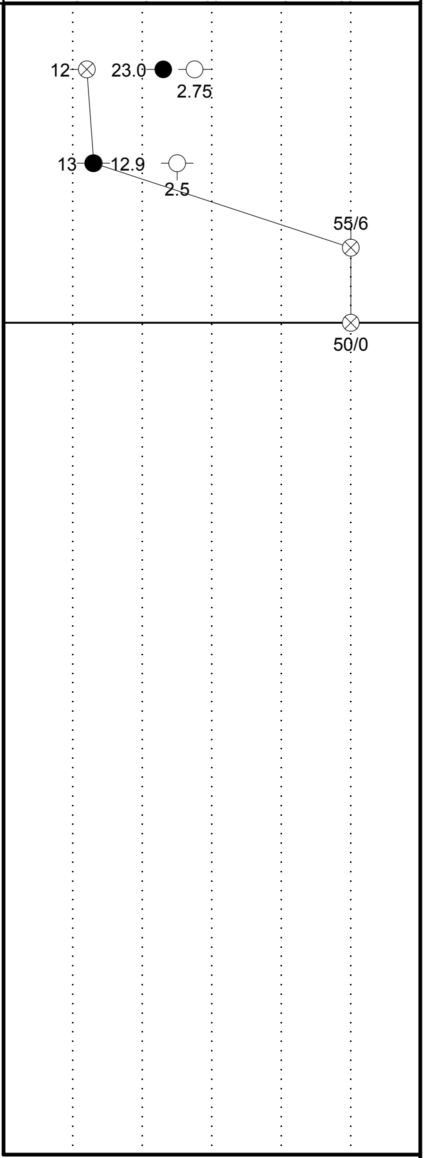
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL ENGLISH UNITS

BOTTOM OF CASING LOSS OF CIRCULATION

SURFACE ELEVATION 567

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [12"]			
	S-1	SS	18	8	(CL/ML FILL) SILTY CLAY, Trace Sand, Trace Gravel, Brown, Moist, Very Stiff		565	5 5 7
					(CL/ML) SANDY SILTY CLAY, Trace Gravel, Brown and Gray, Moist, Very Stiff			
	S-2	SS	18	14				4 6 7
5								
	S-3	SS	12	12			560	20 55/6
					(SP) PARTIALLY WEATHERED LIMESTONE SAMPLED AS FINE SAND WITH GRAVEL, Yellowish Brown, Moist, Very Dense			
	S-4	SS	0	0				50/0
					AUGER REFUSAL @ 8½'			
10								
							555	
15								
							550	
20								
							545	
25								
							540	
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐

BORING STARTED 01/14/15

WL(BCR) WL(ACR)

BORING COMPLETED 01/14/15

CAVE IN DEPTH

WL

RIG CME-45 FOREMAN S. Euker

DRILLING METHOD CFA

CLIENT
Joliet Junior College

JOB #
10466

BORING #
MC-4

SHEET
1 OF 1

PROJECT NAME
Joliet Junior College

ARCHITECT-ENGINEER

SITE LOCATION
1215 Houbolt Road, Joliet, Illinois

NORTHING

EASTING

STATION

-○- CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — –   REC% ———

PLASTIC LIMIT% ✕   WATER CONTENT% ●   LIQUID LIMIT% △

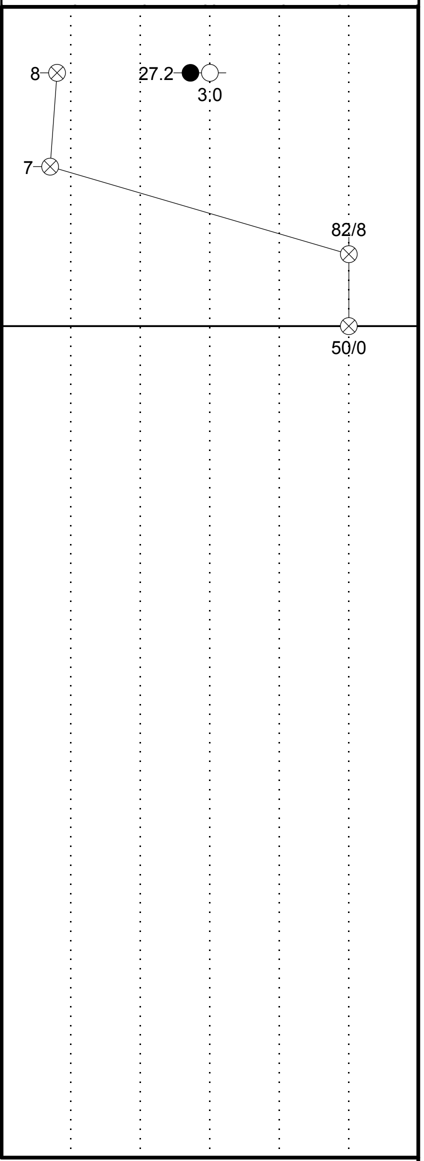
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL   ENGLISH UNITS

BOTTOM OF CASING   LOSS OF CIRCULATION

SURFACE ELEVATION 566

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [12"]		565	
	S-1	SS	18	10	(CL/ML FILL) SILTY CLAY, Trace Sand, Trace Gravel, Yellowish Brown and Black, Moist, Very Stiff			3 3 5
	S-2	SS	18	14	(SC/SM) CLAYEY/SILTY SAND WITH GRAVEL, Yellowish Brown, Moist, Loose			5 4 3
5								
	S-3	SS	14	14	(SP) PARTIALLY WEATHERED LIMESTONE SAMPLED AS FINE SAND WITH GRAVEL, Brown, Moist, Very Dense		560	15 32 50/2
	S-4	SS	0	0	AUGER REFUSAL @ 8½'			50/0
10								
							555	
15								
							550	
20								
							545	
25								
							540	
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 01/14/15	
WL(BCR) WL(ACR)	BORING COMPLETED 01/14/15	CAVE IN DEPTH
WL	RIG CME-45 FOREMAN S. Euker	DRILLING METHOD CFA

CLIENT	JOB #	BORING #	SHEET
Joliet Junior College	10466	MC-5	1 OF 1

PROJECT NAME: Joliet Junior College

ARCHITECT-ENGINEER:

SITE LOCATION: 1215 Houbolt Road, Joliet, Illinois

NORTHING:

EASTING:

STATION:

-○- CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% − − − REC% ———

PLASTIC LIMIT% × WATER CONTENT% ● LIQUID LIMIT% △

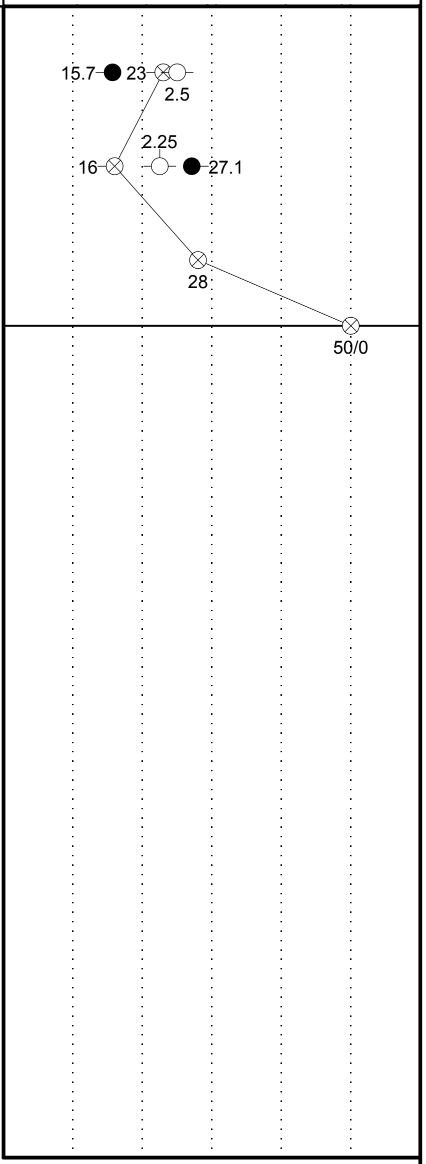
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION 571

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [12"]		570	
	S-1	SS	18	8	(CL/ML FILL) SILTY CLAY, Trace Sand, Trace Gravel, Black and Dark Brown, Moist, Very Stiff			11 13 10
	S-2	SS	18	16				6 7 9
5								
	S-3	SS	18	16	(ML/CL) CLAYEY SILT, Greenish Gray, Moist, Medium Dense to Very Dense		565	11 15 13
	S-4	SS	0	0	AUGER REFUSAL @ 8½'			50/0
10							560	
15							555	
20							550	
25							545	
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 01/14/15	
WL(BCR) WL(ACR)	BORING COMPLETED 01/14/15	CAVE IN DEPTH
WL	RIG CME-45 FOREMAN S. Euker	DRILLING METHOD CFA

CLIENT
Joliet Junior College

JOB #
10466

BORING #
MC-6

SHEET
1 OF 1

PROJECT NAME
Joliet Junior College

ARCHITECT-ENGINEER

SITE LOCATION
1215 Houbolt Road, Joliet, Illinois

NORTHING

EASTING

STATION

–○– CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% ✕ — WATER CONTENT% ● — LIQUID LIMIT% △

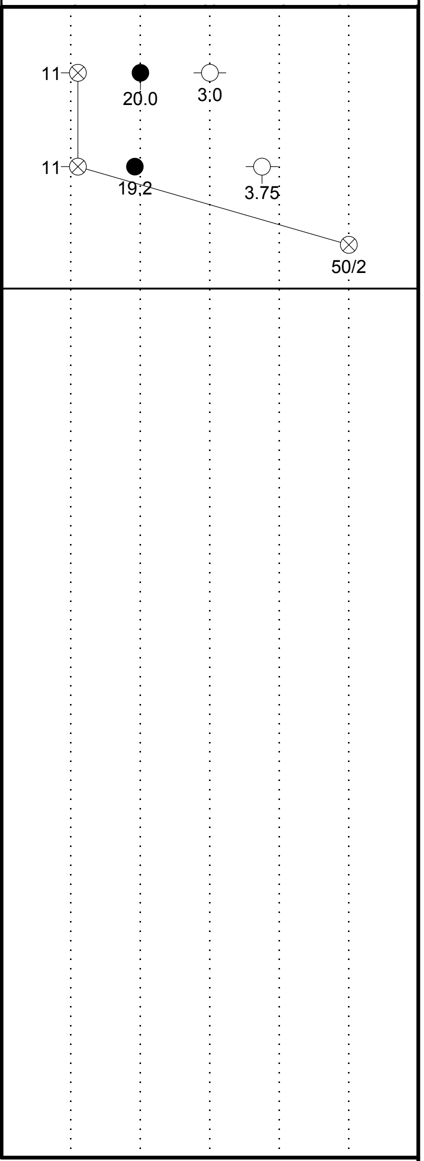
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION 570

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [14"]		570	
	S-1	SS	18	12	(CL/ML FILL) SILTY CLAY, Trace Sand, Trace Gravel, Black and Dark Brown, Moist, Very Stiff			3 5 6
	S-2	SS	18	12				3 5 6
5							565	
	S-3	SS	8	4	(GP) PARTIALLY WEATHERED LIMESTONE SAMPLED AS GRAVEL WITH SAND, Yellowish Brown, Moist, Very Dense			18 50/2
					AUGER REFUSAL @ 7½'			
10							560	
15							555	
20							550	
25							545	
30							540	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 01/14/15	
WL(BCR) WL(ACR)	BORING COMPLETED 01/14/15	CAVE IN DEPTH
WL	RIG CME-45 FOREMAN S. Euker	DRILLING METHOD CFA

CLIENT	JOB #	BORING #	SHEET
Joliet Junior College	10466	MC-7	1 OF 1

PROJECT NAME: Joliet Junior College

ARCHITECT-ENGINEER:

SITE LOCATION: 1215 Houbolt Road, Joliet, Illinois

NORTHING: EASTING: STATION:

-○- CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – – – REC% ———

PLASTIC LIMIT% × WATER CONTENT% ● LIQUID LIMIT% △

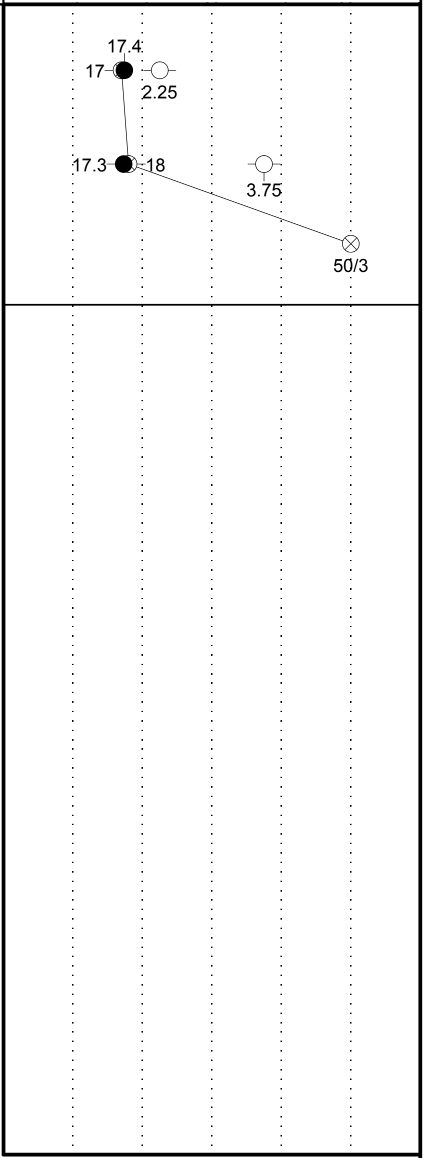
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION 570

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [12"]		570	
	S-1	SS	18	6	(CL/ML FILL) SILTY CLAY, Trace Sand, Trace Gravel, Dark Brown, Moist, Very Stiff			6 8 9
	S-2	SS	18	10				5 8 10
5							565	
	S-3	SS	9	9	(ML/CL) CLAYEY SILT, Yellowish Brown, Moist, Very Dense			22 50/3
					AUGER REFUSAL @ 8'			
10							560	
15							555	
20							550	
25							545	
30							540	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 01/14/15	
WL(BCR) WL(ACR)	BORING COMPLETED 01/14/15	CAVE IN DEPTH
WL	RIG CME-45 FOREMAN S. Euker	DRILLING METHOD CFA

CLIENT	JOB #	BORING #	SHEET
Joliet Junior College	10466	MC-8	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Joliet Junior College	

SITE LOCATION
1215 Houbolt Road, Joliet, Illinois

NORTHING	EASTING	STATION

-○- CALIBRATED PENETROMETER TONS/FT²

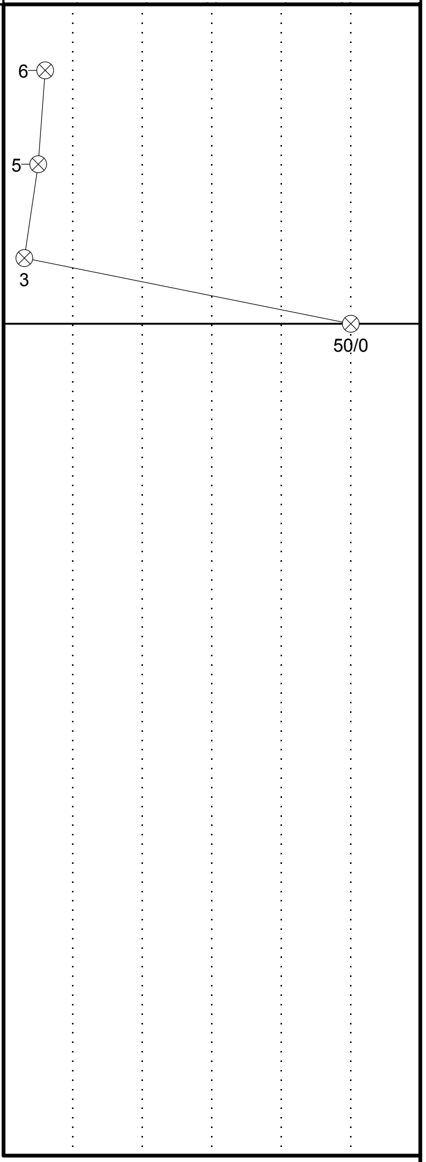
ROCK QUALITY DESIGNATION & RECOVERY
RQD% - — - REC% ———

PLASTIC LIMIT% ✕ WATER CONTENT% ● LIQUID LIMIT% △

⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL ENGLISH UNITS
BOTTOM OF CASING LOSS OF CIRCULATION
SURFACE ELEVATION 567

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [16"]			
	S-1	SS	18	10	(SM) SILTY SAND WITH GRAVEL, Brown, Moist, Loose to Very Loose		565	3 3 3
	S-2	SS	18	6				4 3 2
5								
	S-3	SS	18	10			560	1 1 2
	S-4	SS	0	0	AUGER REFUSAL @ 8½'			50/0
10								
							555	
15								
							550	
20								
							545	
25								
							540	
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 01/15/15	
WL(BCR) WL(ACR)	BORING COMPLETED 01/15/15	CAVE IN DEPTH
WL	RIG CME-45 FOREMAN S. Euker	DRILLING METHOD CFA

CLIENT: Joliet Junior College
JOB #: 10466
BORING #: MC-9
SHEET: 1 OF 1
PROJECT NAME: Joliet Junior College
ARCHITECT-ENGINEER:
SITE LOCATION: 1215 Houbolt Road, Joliet, Illinois
NORTHING: EASTING: STATION:

-○- CALIBRATED PENETROMETER TONS/FT^2

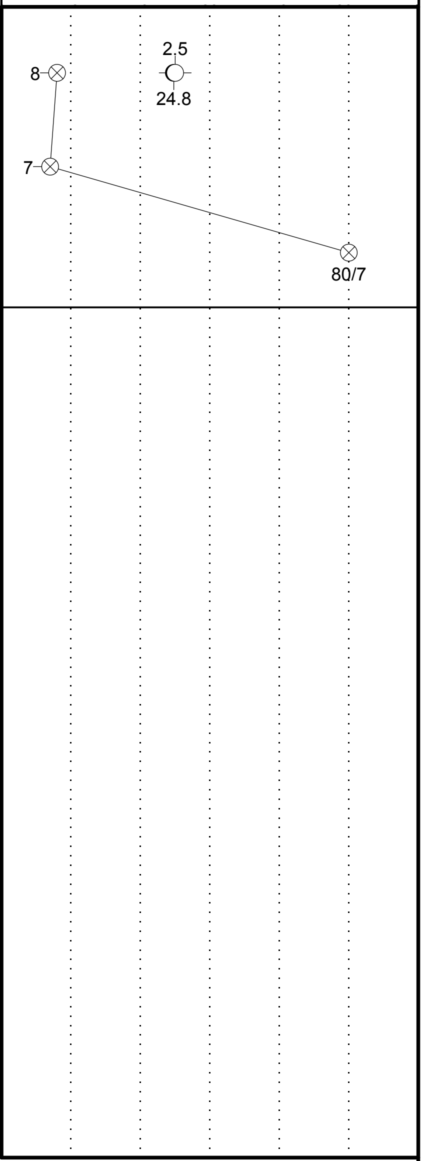
ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% ✕ WATER CONTENT% ● LIQUID LIMIT% △

⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS
BOTTOM OF CASING — LOSS OF CIRCULATION
SURFACE ELEVATION 567

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [12"]			
	S-1	SS	18	10	(CL/ML FILL) SILTY CLAY, Trace Sand, Trace Gravel, Brown and Black, Moist, Very Stiff		565	8 4 4
	S-2	SS	18	6	(SM) SILTY FINE SAND WITH GRAVEL, Yellowish Brown, Moist, Loose			4 3 4
5								
	S-3	SS	13	8	(SP) PARTIALLY WEATHERED LIMESTONE SAMPLED AS FINE SAND WITH GRAVEL, Brown, Moist, Very Dense		560	15 30 50/1
					AUGER REFUSAL @ 8'			
10								
							555	
15								
							550	
20								
							545	
25								
							540	
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 01/15/15	
WL(BCR) WL(ACR)	BORING COMPLETED 01/15/15	CAVE IN DEPTH
WL	RIG CME-45 FOREMAN S. Euker	DRILLING METHOD CFA

CLIENT	JOB #	BORING #	SHEET
Joliet Junior College	10466	MC-10	1 OF 1

PROJECT NAME: Joliet Junior College

ARCHITECT-ENGINEER:

SITE LOCATION: 1215 Houbolt Road, Joliet, Illinois

NORTHING	EASTING	STATION

-○- CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY

RQD% – – –   REC% ———

PLASTIC LIMIT% ✕ —— WATER CONTENT% ● —— LIQUID LIMIT% △

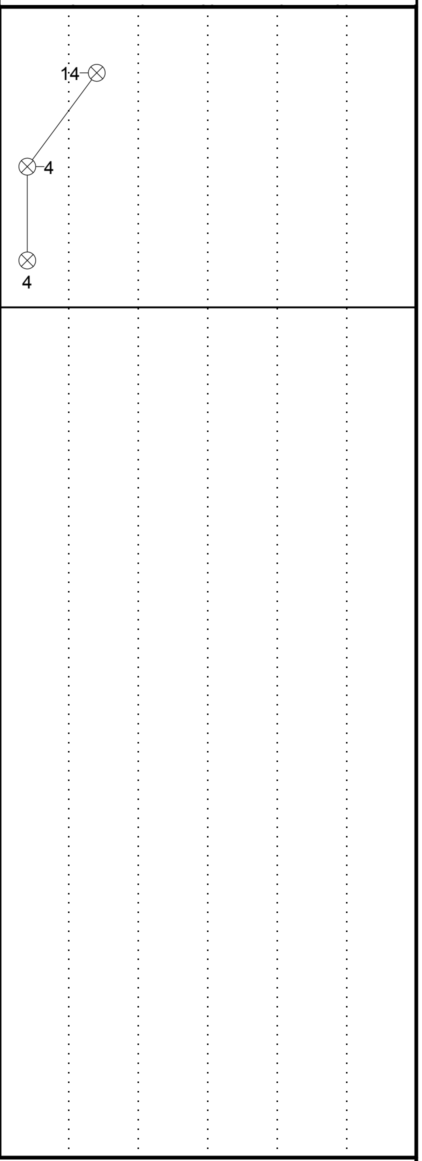
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL   ENGLISH UNITS

BOTTOM OF CASING   LOSS OF CIRCULATION

SURFACE ELEVATION 566

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Rubber Track Depth [5"], Gravel Depth [6"]			
	S-1	SS	18	14	(SM) SILTY SAND WITH GRAVEL, Trace Clay, Yellowish Brown, Moist to Wet, Medium Dense to Very Loose		565	38 9 5
	S-2	SS	18	6				3 2 2
5								
	S-3	SS	18	12		▼	560	1 1 3
					AUGER REFUSAL @ 8'			
10								
							555	
15								
							550	
20								
							545	
25								
							540	
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 7 WS ☐ WD ☐	BORING STARTED 01/15/15	
WL(BCR) WL(ACR) 7½	BORING COMPLETED 01/15/15	CAVE IN DEPTH
WL	RIG CME-45 FOREMAN S. Euker	DRILLING METHOD CFA

CLIENT	JOB #	BORING #	SHEET
Joliet Junior College	10466	MC-11	1 OF 1

PROJECT NAME: Joliet Junior College

ARCHITECT-ENGINEER:

SITE LOCATION: 1215 Houbolt Road, Joliet, Illinois

NORTHING: EASTING: STATION:

-○- CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY

RQD% – — – REC% ———

PLASTIC LIMIT% × WATER CONTENT% ● LIQUID LIMIT% △

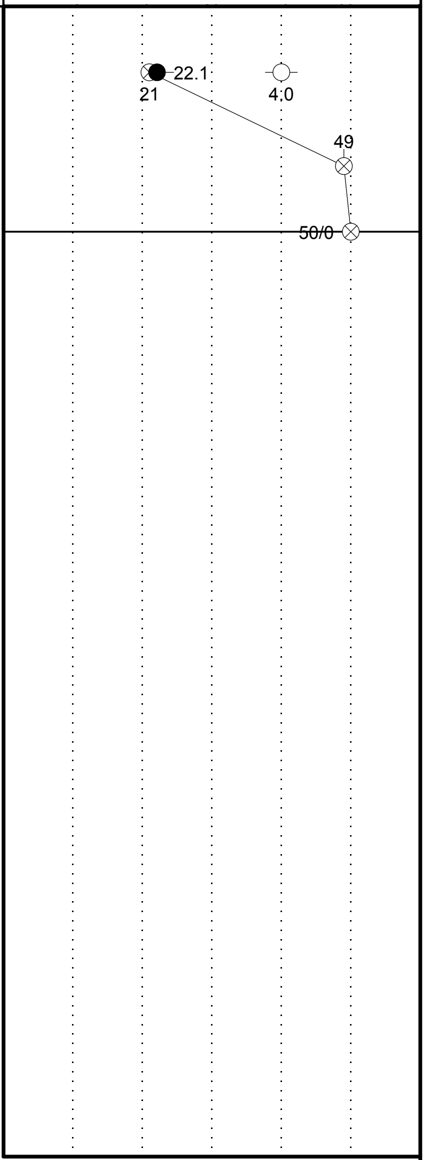
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION 567

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [18"]			
	S-1	SS	18	12	(CL/ML FILL) SILTY CLAY, Trace Sand, Trace Gravel, Dark Brown, Moist, Hard		565	4 11 10
	S-2	SS	18	14	(SP-SM) SAND WITH SILT AND GRAVEL, Brown, Moist, Dense			5 11 38
5	S-3	SS	0	0	(SP) PARTIALLY WEATHERED LIMESTONE SAMPLED AS FINE SAND WITH GRAVEL, Brown, Moist, Very Dense		560	50/0
					AUGER REFUSAL @ 6'			
10							555	
15							550	
20							545	
25							540	
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

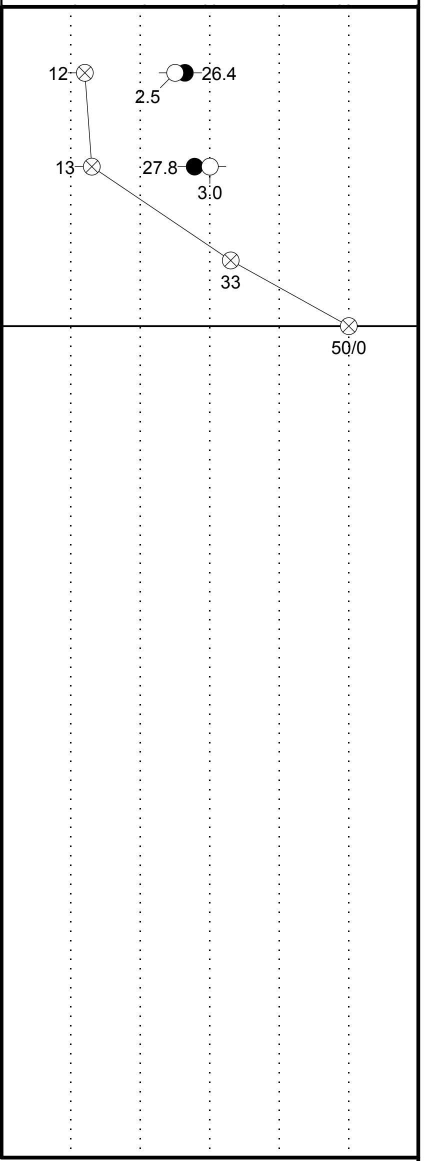
WL WS ☐ WD ☐	BORING STARTED 01/14/15	
WL(BCR) WL(ACR)	BORING COMPLETED 01/14/15	CAVE IN DEPTH
WL	RIG CME-45 FOREMAN S. Euker	DRILLING METHOD CFA

CLIENT: Joliet Junior College
JOB #: 10466
BORING #: MC-12
SHEET: 1 OF 1
PROJECT NAME: Joliet Junior College
ARCHITECT-ENGINEER:
SITE LOCATION: 1215 Houbolt Road, Joliet, Illinois
NORTHING:
EASTING:
STATION:

DESCRIPTION OF MATERIAL — ENGLISH UNITS
BOTTOM OF CASING ➤ LOSS OF CIRCULATION
SURFACE ELEVATION 568

-○- CALIBRATED PENETROMETER TONS/FT^2
ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———
PLASTIC LIMIT% × WATER CONTENT% ● LIQUID LIMIT% △
⊗ STANDARD PENETRATION BLOWS/FT

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [24"]			
	S-1	SS	18	12				3 5 7
					(CL/ML FILL) SILTY CLAY, Trace Sand, Trace Gravel, Black and Brown, Moist, Very Stiff		565	
	S-2	SS	18	14				3 5 8
5								
					(GP) PARTIALLY WEATHERED LIMESTONE SAMPLED AS GRAVEL WITH SAND, Yellowish Brown, Moist, Very Dense			
	S-3	SS	18	14				5 12 21
							560	
	S-4	SS	0	0	AUGER REFUSAL @ 8½'			50/0
10								
							555	
15								
							550	
20								
							545	
25								
							540	
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 01/14/15	
WL(BCR) WL(ACR)	BORING COMPLETED 01/14/15	CAVE IN DEPTH
WL	RIG CME-45 FOREMAN S. Euker	DRILLING METHOD CFA

CLIENT
Joliet Junior College

JOB #
10466

BORING #
MC-13

SHEET
1 OF 1

PROJECT NAME
Joliet Junior College

ARCHITECT-ENGINEER

SITE LOCATION
1215 Houbolt Road, Joliet, Illinois

NORTHING

EASTING

STATION

-○- CALIBRATED PENETROMETER TONS/FT^2

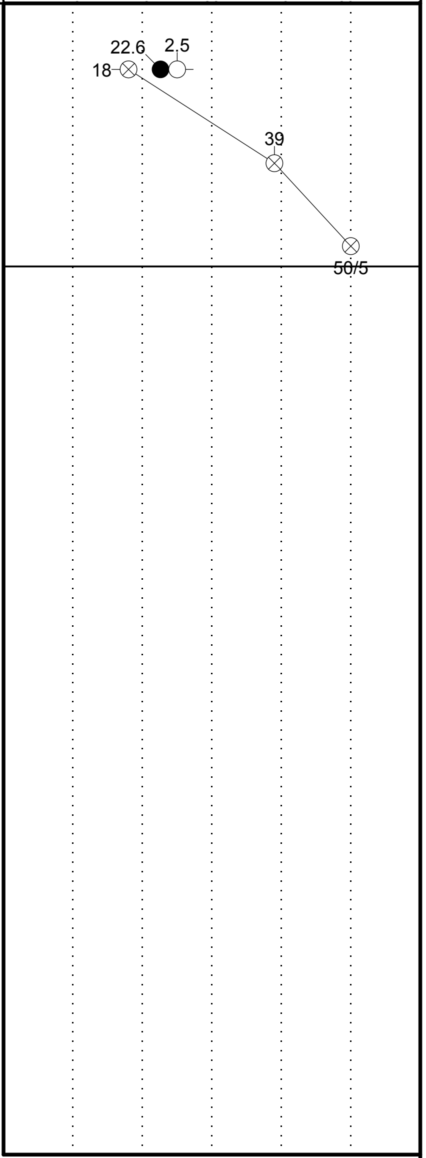
ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% × — WATER CONTENT% ● — LIQUID LIMIT% △

⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS
BOTTOM OF CASING — LOSS OF CIRCULATION
SURFACE ELEVATION 568

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Rubber Track Depth [5"], Gravel Depth [7"]			
	S-1	SS	18	16	(CL/ML FILL) SILTY CLAY, Trace Sand, Trace Gravel, Dark Brown, Moist, Very Stiff		565	10 8 10
5	S-2	SS	18	16	(ML/CL) CLAYEY SILT, Brown, Moist, Dense			7 26 13
	S-3	SS	11	0	(SP) PARTIALLY WEATHERED LIMESTONE SAMPLED AS SAND WITH GRAVEL, Yellowish Brown, Moist, Very Dense			12 50/5
					AUGER REFUSAL @ 7'		560	
10							555	
15							550	
20							545	
25							540	
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 01/14/15	
WL(BCR) WL(ACR)	BORING COMPLETED 01/14/15	CAVE IN DEPTH
WL	RIG CME-45 FOREMAN S. Euker	DRILLING METHOD CFA

CLIENT	JOB #	BORING #	SHEET
Joliet Junior College	10466	MC-14	1 OF 1

PROJECT NAME
Joliet Junior College

ARCHITECT-ENGINEER

SITE LOCATION
1215 Houbolt Road, Joliet, Illinois

NORTHING
EASTING
STATION

-○- CALIBRATED PENETROMETER TONS/FT²

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% ✕ — WATER CONTENT% ● — LIQUID LIMIT% △

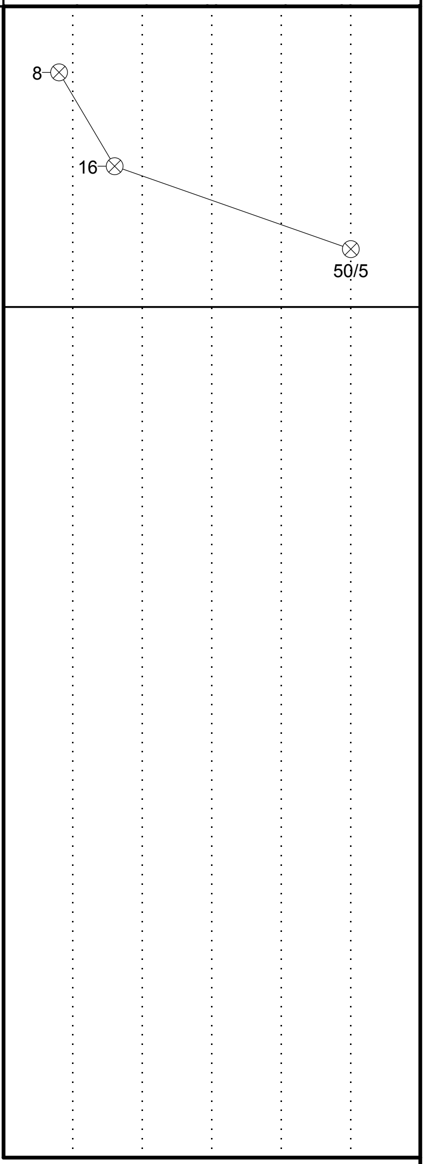
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION 567

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [30"]			
	S-1	SS	18	10			565	2 4 4
					(ML/SM) SANDY SILT/SILTY SAND WITH GRAVEL, Yellowish Brown, Moist, Medium Dense			
	S-2	SS	18	12				6 8 8
5								
	S-3	SS	11	10			560	15 50/5
					(GP) PARTIALLY WEATHERED LIMESTONE SAMPLED AS GRAVEL WITH SAND, Yellowish Brown, Moist, Very Dense			
					AUGER REFUSAL @ 8'			
10								
							555	
15								
							550	
20								
							545	
25								
							540	
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 01/14/15	
WL(BCR) WL(ACR)	BORING COMPLETED 01/14/15	CAVE IN DEPTH
WL	RIG CME-45 FOREMAN S. Euker	DRILLING METHOD CFA

CLIENT	JOB #	BORING #	SHEET
Joliet Junior College	10466	MC-15	1 OF 1

PROJECT NAME: Joliet Junior College

ARCHITECT-ENGINEER:

SITE LOCATION: 1215 Houbolt Road, Joliet, Illinois

NORTHING: EASTING: STATION:

-○- CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% ✕ WATER CONTENT% ● LIQUID LIMIT% △

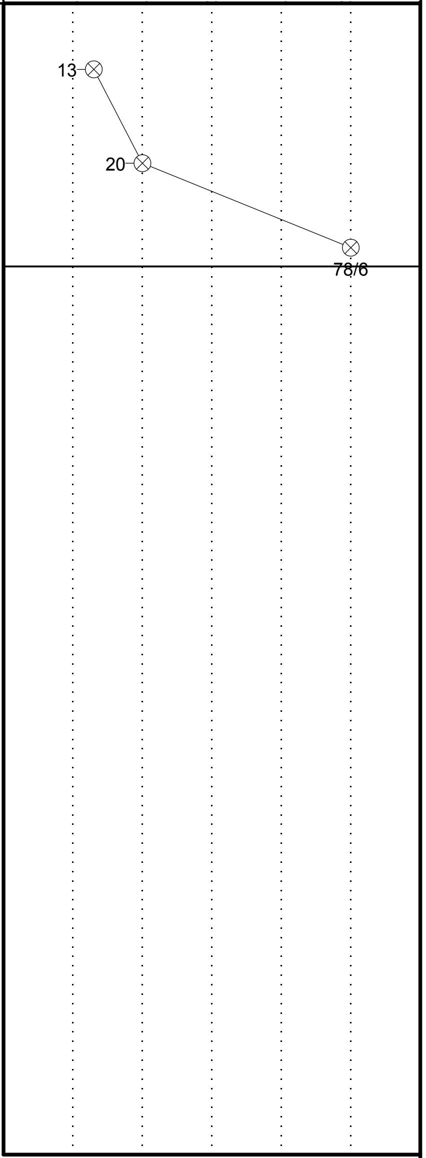
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING ➤ LOSS OF CIRCULATION

SURFACE ELEVATION 567

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [18"]			
	S-1	SS	18	12	(ML/CL) CLAYEY SILT, Trace Gravel, Trace Sand, Yellowish Brown, Moist, Medium Dense		565	3 6 7
5	S-2	SS	18	14				6 8 12
	S-3	SS	12	8	(GP) PARTIALLY WEATHERED LIMESTONE SAMPLED AS GRAVEL WITH SAND, Yellowish Brown, Moist, Very Dense		560	21 28 50/0
					AUGER REFUSAL @ 7'			
10								
							555	
15								
							550	
20								
							545	
25								
							540	
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 01/14/15	
WL(BCR) WL(ACR)	BORING COMPLETED 01/14/15	CAVE IN DEPTH
WL	RIG CME-45 FOREMAN S. Euker	DRILLING METHOD CFA

CLIENT	JOB #	BORING #	SHEET
Joliet Junior College	10466	MC-16	1 OF 1

PROJECT NAME: Joliet Junior College

ARCHITECT-ENGINEER:

SITE LOCATION: 1215 Houbolt Road, Joliet, Illinois

NORTHING:
EASTING:
STATION:

-○- CALIBRATED PENETROMETER TONS/FT²

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% ✕ WATER CONTENT% ● LIQUID LIMIT% △

⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

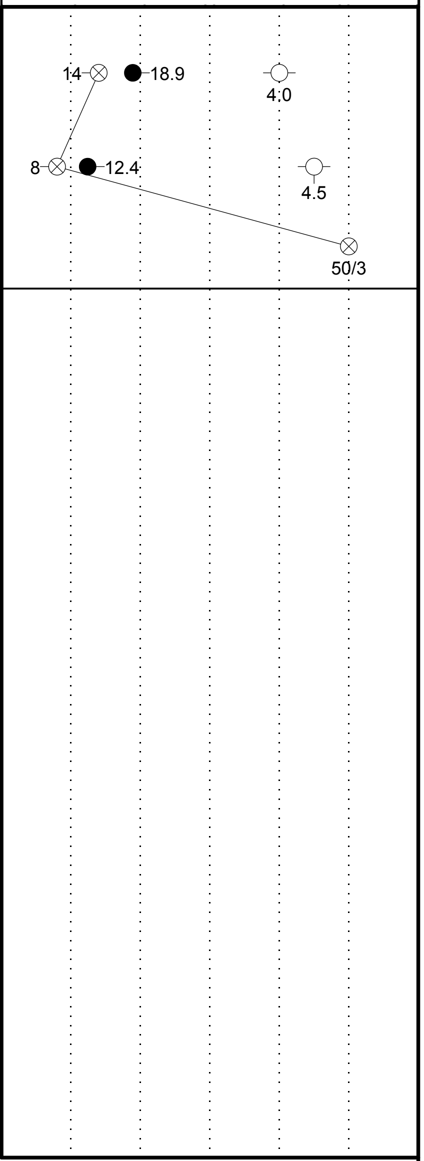
BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION 568

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0	S-1	SS	18	10	Topsoil Depth [24"]			5 7 7
	S-2	SS	18	16	(CL/ML) SILTY CLAY, Trace Sand, Trace Gravel, Brown, Moist, Hard		565	5 4 4
5	S-3	SS	9	8	(GP) PARTIALLY WEATHERED LIMESTONE SAMPLED AS GRAVEL WITH SAND, Yellowish Brown, Moist, Very Dense			26 50/3
					AUGER REFUSAL @ 7½'		560	

DEPTH (FT): 0, 5, 10, 15, 20, 25, 30

ELEVATION (FT): 565, 560, 555, 550, 545, 540



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 01/14/15	
WL(BCR) WL(ACR)	BORING COMPLETED 01/14/15	CAVE IN DEPTH
WL	RIG CME-45 FOREMAN S. Euker	DRILLING METHOD CFA

CLIENT Joliet Junior College

JOB # 10466

BORING # MC-17

SHEET 1 OF 1

PROJECT NAME Joliet Junior College

ARCHITECT-ENGINEER

SITE LOCATION 1215 Houbolt Road, Joliet, Illinois

NORTHING

EASTING

STATION

-○- CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% × WATER CONTENT% ● LIQUID LIMIT% △

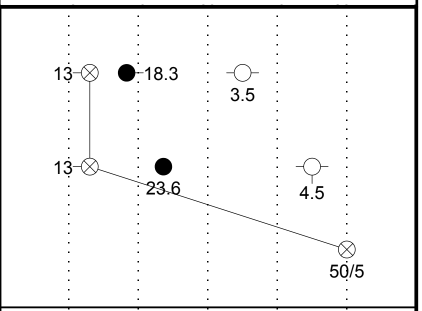
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL ENGLISH UNITS

BOTTOM OF CASING LOSS OF CIRCULATION

SURFACE ELEVATION 568

SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	BLOWS/6"
S-1	SS	18	14	Topsoil Depth [30"]	7 6 7
S-2	SS	18	12	(CL/ML) SILTY CLAY, Trace Sand, Trace Gravel, Yellowish Brown, Moist, Very Stiff to Hard	5 6 7
S-3	SS	11	6	(GP) PARTIALLY WEATHERED LIMESTONE SAMPLED AS GRAVEL WITH SAND, Yellowish Brown, Moist, Very Dense	26 50/5
				AUGER REFUSAL @ 8'	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐

BORING STARTED 01/14/15

WL(BCR) WL(ACR)

BORING COMPLETED 01/14/15

CAVE IN DEPTH

WL

RIG CME-45 FOREMAN S. Euker

DRILLING METHOD CFA

CLIENT	JOB #	BORING #	SHEET
Joliet Junior College	10466	MC-18	1 OF 1

PROJECT NAME: Joliet Junior College

ARCHITECT-ENGINEER:

SITE LOCATION: 1215 Houbolt Road, Joliet, Illinois

NORTHING: EASTING: STATION:

-○- CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% ✕ WATER CONTENT% ● LIQUID LIMIT% △

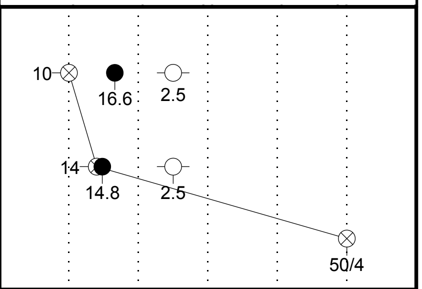
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION 567

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [12"]			
	S-1	SS	18	14	(CL/ML FILL) SILTY CLAY, Trace Sand, Trace Gravel, Black and Yellowish Brown, Moist, Very Stiff		565	5 5 5
5	S-2	SS	18	14	(CL/ML) SILTY CLAY, Trace Sand, Trace Gravel, Yellowish Brown and Gray, Moist, Very Stiff			4 5 9
	S-3	SS	4	4	(GP) PARTIALLY WEATHERED LIMESTONE SAMPLED AS GRAVEL WITH SAND, Yellowish Brown, Moist, Very Dense		560	50/4
					AUGER REFUSAL @ 7½'			
10							555	
15							550	
20							545	
25							540	
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 01/14/15	
WL(BCR) WL(ACR)	BORING COMPLETED 01/14/15	CAVE IN DEPTH
WL	RIG CME-45 FOREMAN S. Euker	DRILLING METHOD CFA

CLIENT	JOB #	BORING #	SHEET
Joliet Junior College	10466	MC-19	1 OF 1

PROJECT NAME: Joliet Junior College

ARCHITECT-ENGINEER:

SITE LOCATION: 1215 Houbolt Road, Joliet, Illinois

NORTHING: EASTING: STATION:

DESCRIPTION OF MATERIAL ENGLISH UNITS

BOTTOM OF CASING LOSS OF CIRCULATION

SURFACE ELEVATION 568

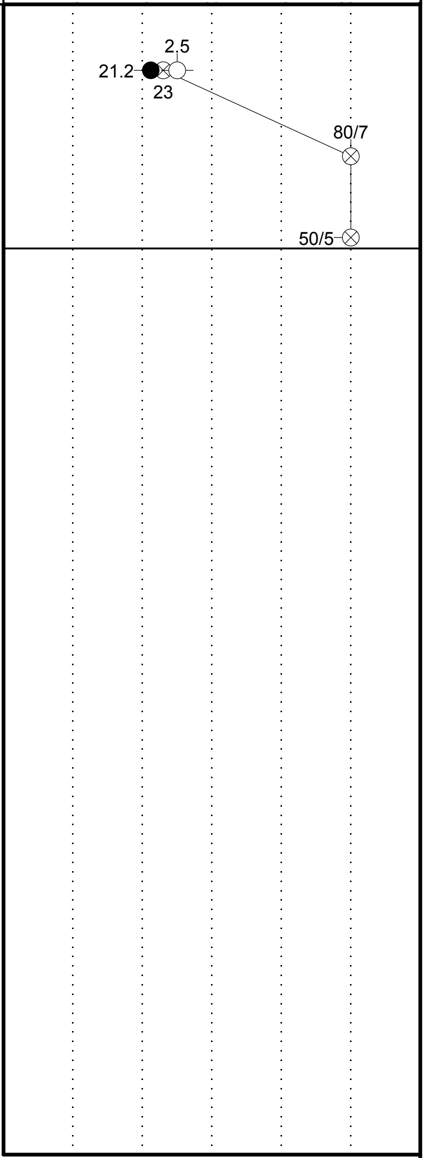
DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Rubber Track Depth [4"], Gravel Depth [2"]			
	S-1	SS	18	2	(CL/ML FILL) SILTY CLAY, Trace Sand, Trace Gravel, Dark Brown, Moist, Very Stiff			11 10 13
							565	
	S-2	SS	13	10	(ML/CL) CLAYEY SILT, Yellowish Brown, Moist, Very Stiff			8 30 50/1
5								
	S-3	SS	5	4				50/5
					END OF BORING @ 6½'			
							560	
10								
							555	
15								
							550	
20								
							545	
25								
							540	
30								

-○- CALIBRATED PENETROMETER TONS/FT²

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% ✕ WATER CONTENT% ● LIQUID LIMIT% △

⊗ STANDARD PENETRATION BLOWS/FT



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 01/14/15	
WL(BCR) WL(ACR)	BORING COMPLETED 01/14/15	CAVE IN DEPTH
WL	RIG CME-45 FOREMAN S. Euker	DRILLING METHOD CFA

CLIENT	JOB #	BORING #	SHEET
Joliet Junior College	10466	MC-20	1 OF 1

PROJECT NAME
Joliet Junior College

ARCHITECT-ENGINEER

SITE LOCATION
1215 Houbolt Road, Joliet, Illinois

NORTHING
EASTING
STATION

-○- CALIBRATED PENETROMETER TONS/FT^2

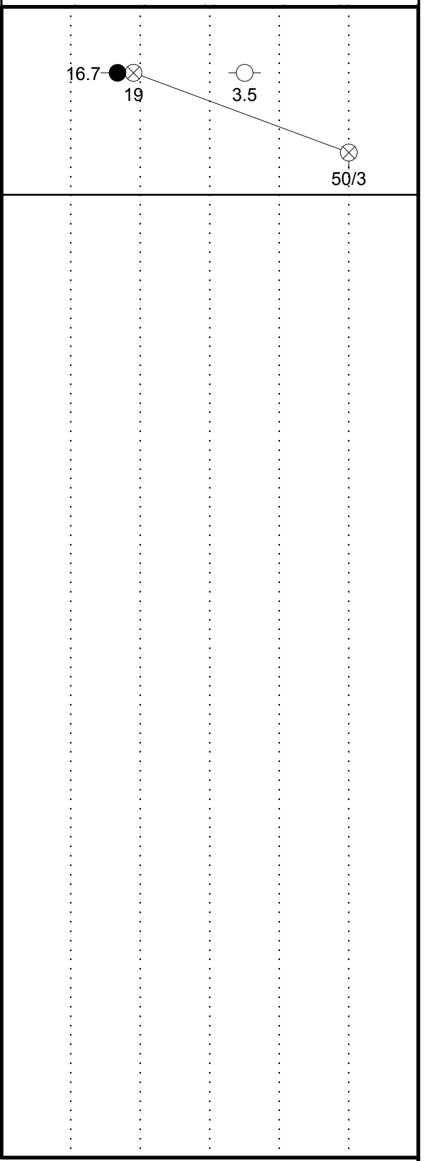
ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — –   REC% ———

PLASTIC LIMIT% ✕   WATER CONTENT% ●   LIQUID LIMIT% △

⊗ STANDARD PENETRATION BLOWS/FT

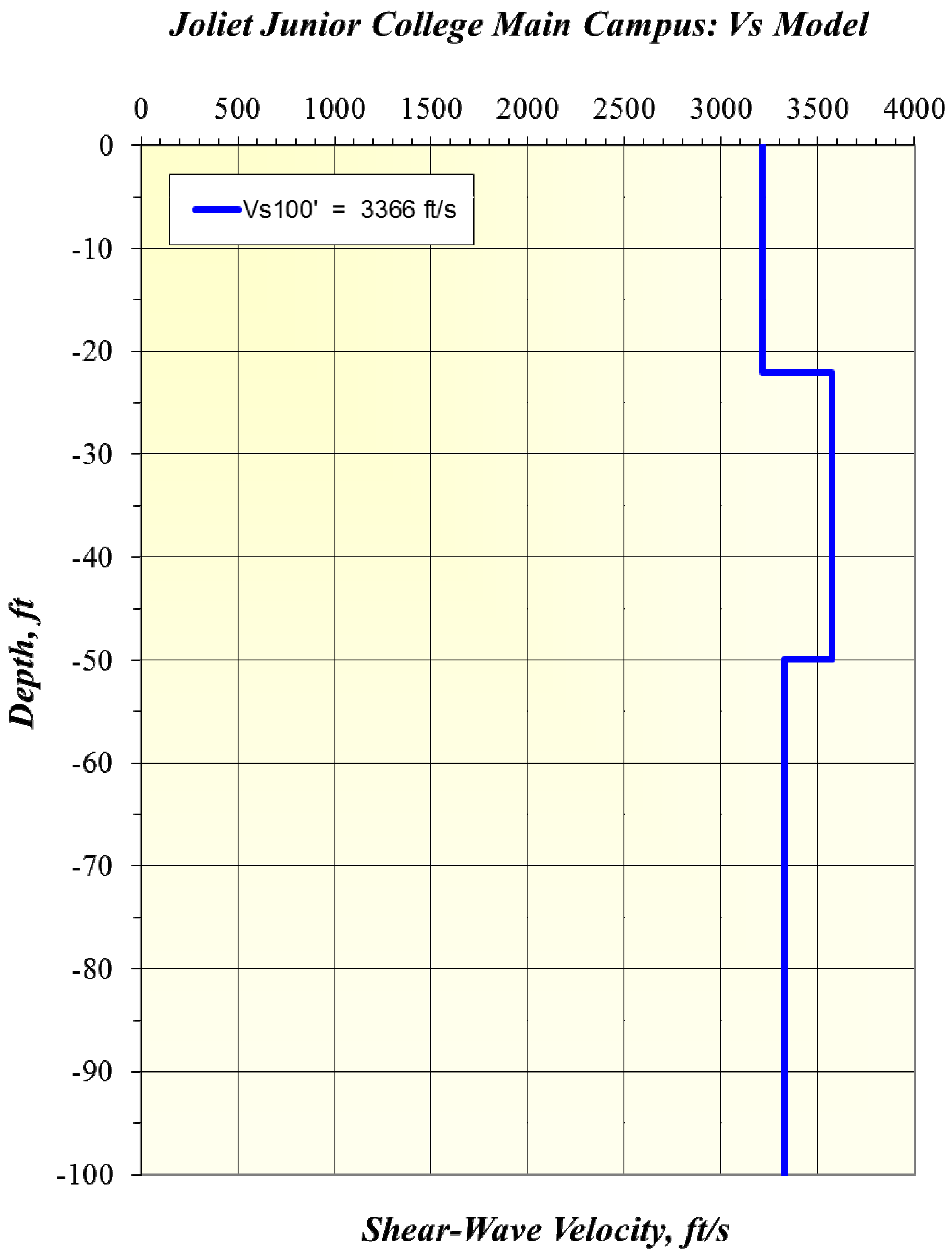
DESCRIPTION OF MATERIAL   ENGLISH UNITS
BOTTOM OF CASING   LOSS OF CIRCULATION
SURFACE ELEVATION 568

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Rubber Track Depth [4"], Gravel Depth [3"]			
	S-1	SS	18	18	(CL/ML FILL) SILTY CLAY, Trace Sand, Trace Gravel, Dark Gray and Dark Brown, Moist, Very Stiff		565	8 10 9
	S-2	SS	9	6	(GP) PARTIALLY WEATHERED LIMESTONE SAMPLED AS GRAVEL WITH SAND, Yellowish Brown, Moist, Very Dense			15 50/3
5					AUGER REFUSAL @ 5'			
							560	
10								
							555	
15								
							550	
20								
							545	
25								
							540	
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 01/14/15	
WL(BCR) WL(ACR)	BORING COMPLETED 01/14/15	CAVE IN DEPTH
WL	RIG CME-45 FOREMAN S. Euker	DRILLING METHOD CFA



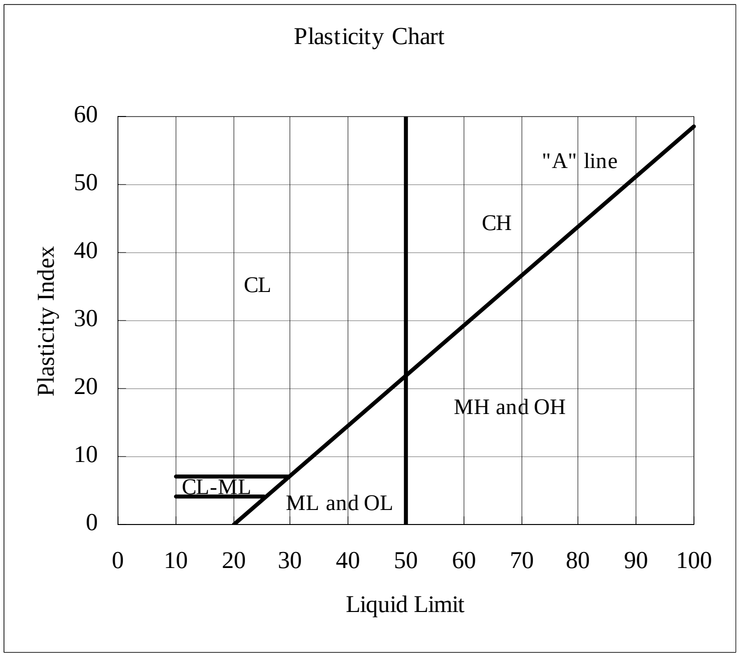
ARRAY 1
GEOPHONE SPACING = 25 Feet

FIGURE 1

SHEAR WAVE VELOCITY PROFILE
Joliet Junior College Main Campus
Joliet, Illinois

ECS Project 16:10466

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

Major Divisions			Group Symbols		Typical Names	Laboratory Classification Criteria		
Coarse-grained soils (More than half of material is larger than No. 200 Sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW		Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 percent GW, GP, SW, SP More than 12 percent GM, GC, SM, SC 5 to 12 percent Borderline cases requiring dual symbols [b]	$C_u = D_{60}/D_{10}$ greater than 4 $C_c = (D_{30})^2/(D_{10}\mathrm{x}D_{60})$ between 1 and 3	
			GP		Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	GM[a]	d	Silty gravels, gravel-sand mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
				u				
			GC		Clayey gravels, gravel-sand-clay mixtures		Atterberg limits below "A" line or P.I. less than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines		$C_u = D_{60}/D_{10}$ greater than 6 $C_c = (D_{30})^2/(D_{10}\mathrm{x}D_{60})$ between 1 and 3	
			SP		Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM[a]	d	Silty sands, sand-silt mixtures		Atterberg limits above "A" line or P.I. less than 4	Limits plotting in CL-ML zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
				u				
			SC		Clayey sands, sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
Fine-grained soils (More than half material is smaller than No. 200 Sieve)	Silts and clays (Liquid limit less than 50)		ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity			
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL		Organic silts and organic silty clays of low plasticity			
	Silts and clays (Liquid limit greater than 50)		MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH		Inorganic clays of high plasticity, fat clays			
			OH		Organic clays of medium to high plasticity, organic silts			
	Highly Organic soils		Pt		Peat and other highly organic soils			

[a] Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when L.L. is 28 or less and the P.I. is 6 or less; the suffix u used when L.L. is greater than 28.

[b] Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC,well-graded gravel-sand mixture with clay binder. (From Table 2.16 - Winterkorn and Fang, 1975)

REFERENCE NOTES FOR BORING LOGS

MATERIALS

■		**ASPHALT**
░		**CONCRETE**
☷		**SUBBASE STONE / GRAVEL**
▩		**TOPSOIL**
░	**FILL**	Man-placed or disturbed soils
▦	**GW**	**WELL-GRADED GRAVEL** gravel-sand mixtures, little or no fines
▦	**GP**	**POORLY-GRADED GRAVEL** gravel-sand mixtures, little or no fines
▦	**GM**	**SILTY GRAVEL** gravel-sand-silt mixtures
▩	**GC**	**CLAYEY GRAVEL** gravel-sand-clay mixtures
▒	**SW**	**WELL-GRADED SAND** gravelly sand, little or no fines
░	**SP**	**POORLY-GRADED SAND** gravelly sand, little or no fines
▥	**SM**	**SILTY SAND** sand-silt mixtures
▧	**SC**	**CLAYEY SAND** sand-clay mixtures
▥	**ML**	**SILT** non-plastic to medium plasticity
▥	**MH**	**ELASTIC SILT** high plasticity
▧	**CL**	**LEAN CLAY** low to medium plasticity
▧	**CH**	**FAT CLAY** high plasticity
▒	**OL**	**ORGANIC SILT or CLAY** non-plastic to low plasticity
⨯	**OH**	**ORGANIC SILT or CLAY** high plasticity
☰	**PT**	**PEAT** highly organic soils
▤		**WEATHERED ROCK**
+		**IGNEOUS ROCK**
≈		**METAMORPHIC ROCK**
▦		**SEDIMENTARY ROCK**

DRILLING SAMPLING SYMBOLS & ABBREVIATIONS

SS	Split Spoon Sampler	PM	Pressuremeter Test
ST	Shelby Tube Sampler	RD	Rock Bit Drilling
WS	Wash Sample	RC	Rock Core, NX, BX, AX
BS	Bulk Sample of Cuttings	REC	Rock Sample Recovery %
PA	Power Auger (no sample)	RQD	Rock Quality Designation
HSA	Hollow Stem Auger		

PARTICLE SIZE IDENTIFICATION

DESIGNATION		PARTICLE SIZES
Boulders		12-inches (300-mm) or larger
Cobbles		3-inches to 12- inches (75-mm to 300-mm)
Gravel:	Coarse	¾-inch to 3-inches (19-mm to 75-mm)
	Fine	4.75-mm to 19-mm (No. 4 sieve to ¾-inch)
Sand:	Coarse	2.00-mm to 4.75-mm (No. 10 to No. 4 sieve)
	Medium	0.425-mm to 2.00-mm (No. 40 to No. 10 sieve)
	Fine	0.074-mm to 0.425-mm (No. 200 to No. 40 sieve)
Silt & Clay ("Fines")		<0.074-mm (smaller than a No. 200 sieve)

WATER LEVELS[1]

▽	WL	Water Level (WS)(WD) (WS) While Sampling (WD) While Drilling
▽	BCR	Before Casing Removal
▼	ACR	After Casing Removal
▽	WL	Water Level as stated
	DCI	Dry Cave-In
	WCI	Wet Cave-In

RELATIVE PROPORTIONS

Trace	<5%
Little	5% - <15%
With	15% - <30%
Adjective *(ex: "Silty")*	30% - <50%

COHESIVE SILTS & CLAYS

UNCONFINED COMP. STRENGTH, Q_P[2] (TSF)	SPT[3] (BPF)	CONSISTENCY (COHESIVE ONLY)
<0.25	≤2	Very Soft
0.25 - 0.49	3 - 4	Soft
0.50 - 0.99	5 - 8	Medium Stiff
1.00 - 1.99	9 - 15	Stiff
2.00 - 3.99	16 - 30	Very Stiff
4.00 - 8.00	31 - 50	Hard
>8.00	>50	Very Hard

GRAVELS, SANDS & NON-COHESIVE SILTS

SPT[3] (BPF)	DENSITY
≤4	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
51 - 99	Very Dense
≥100	Partially Weathered Rock to Intact Rock

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[1] The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in granular soils. In clay and cohesive silts, the determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally taken.

[2] Typically estimated via pocket penetrometer or Torvane shear test and expressed in tons per square foot (tsf).

[3] Standard Penetration Test (SPT) refers to the number of hammer blows (blow count) of a 140 lb. hammer falling 30 inches on a 2-inch OD split-spoon sampler required to drive the sampler 12 inches (ASTM D 1586). "N-value" is another term for "blow count" and is expressed in blows per foot (bpf).