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Report of Soils Exploration

NIU West Boiler House Expansion

NEC Grant Drive East and Douglas Drive North

DeKalb, Illinois

Geotechnical & Environmental Engineering

Construction Materials Engineering & Testing

Laboratory Testing of Soils, Concrete & Asphalt

Geo-Environmental Drilling & Sampling

Middough, Inc.

700 Commerce Drive, Suite 200

Oak Brook, Illinois 60523

GEOTECHNICAL GROUP

August 27, 2019
L -89,788

REPORT OF SOILS EXPLORATION
NIU WEST BOILER HOUSE EXPANSION
NEC GRANT DRIVE EAST AND DOUGLAS DRIVE NORTH
DEKALB, ILLINOIS

PREPARED FOR:
MIDDOUGH, INC.
700 COMMERCE DRIVE, SUITE 200
OAK BROOK, ILLINOIS 60523

PREPARED BY:
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August 27, 2019
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REPORT OF SOILS EXPLORATION
NIU WEST BOILER HOUSE EXPANSION
NEC GRANT DRIVE EAST AND DOUGLAS DRIVE NORTH
DEKALB, ILLINOIS

1.0 INTRODUCTION

This report presents results of the Soils Exploration prepared for the proposed Northern Illinois University (NIU) West Boiler House Expansion in DeKalb, Illinois. These geotechnical engineering services are provided in accordance with the agreement between Middough and Testing Service Corporation (TSC) executed on May 16, 2019 incorporating TSC Proposal No 62,828 dated April 19, 2019.

The following is our understanding of the proposed project:

- A single-story, slab-on-grade addition will extend off of the south side of the existing West Boiler Plant at the NIU Campus.
- The Finished Floor (FF) Elevation of the addition is expected to match the existing FF at approximate Elevation 871.8.
- It is understood that the existing boiler house has a 9.5-foot deep basement where the new and existing buildings will meet.
- It is expected that spread footings will match the existing footings where the new and existing buildings will meet. Otherwise, the use of shallow footings is generally anticipated for the addition.
- Column and floor slab loadings are not expected to exceed 100 kips and 500 pounds per square foot (psf). It is assumed that wall loads will not exceed 6 kips per lineal foot (klf).

The project site is located on the south side of the West Boiler House (Heating Plant) on the north side of Douglas Drive North at the NIU Campus in DeKalb, Illinois. It is located on the east side of Grant Drive East. The building addition may extend into and possibly across existing Douglas Drive North. The majority of the site is covered by bituminous (asphalt) pavements. A grassy area with a few spruce trees is located at the northwest part of the project site. The site generally slopes gently away from the existing building and towards the south. Ground surface elevations at the soil boring locations ranged from 869.9 to 871.5.

Numerous utilities were noted to run through the project site. It is understood that many abandoned utilities associated with the boiler house extended from the existing plant towards the south.

The results of field and laboratory testing and recommendations based upon these data are included in this report. Specifically addressed are building foundations and mass-grading/floor slabs on grade.

2.0 FIELD EXPLORATION AND LABORATORY TESTING

A total of six (6) soil borings (numbered 1, 2, 3, 4, 5 and 6B) have been performed by TSC at the project site at the locations generally selected by the design team. However, some offsetting of borings was performed due to the interference with trees and underground utilities. Reference is made to the Boring Location Plan in the Appendix for the approximate drilling layout, ground surface elevations also being shown. The boring locations and elevations at the borings were provided by the project surveyors, Todd Surveying.

Borings 1-4 and 6B were drilled to a depth of 15 feet below existing grade. Boring 5, located near the existing building, was extended to a depth of 25 feet.

The borings were drilled and samples tested according to currently recommended American Society for Testing and Materials specifications. Soil sampling was performed at 2½ foot intervals to a depth of 10 to 15 feet and at no greater than 5-foot intervals thereafter in conjunction with the Standard Penetration Test, for which driving resistance to a 2" split-spoon sampler (N value in blows per foot) provides an indication of the relative density of granular materials and consistency of cohesive soils. Water level readings were taken during and following completion of drilling operations.

Soil samples were examined in the laboratory to verify field descriptions and to classify them in accordance with the Unified Soil Classification System. Laboratory testing included moisture content determinations for all cohesive and intermediate (silt or loamy) soil types. An estimate of unconfined compressive strength was obtained for all inorganic native clay soils using a calibrated pocket penetrometer, with direct methods used on intact samples. Dry unit weight tests were also performed upon some cohesive soil samples.

Reference is made to the boring logs in the Appendix which indicate subsurface stratigraphy and soil descriptions, results of field and laboratory tests, as well as water level observations. Definitions of descriptive terminology are also included. While strata changes are shown as a definite line on the boring logs, the actual transition between soil layers will probably be more gradual. It should be noted that in the absence of foreign substances, it is often nearly impossible to distinguish fill materials from disturbed native soil samples.

3.0 DISCUSSION OF TEST DATA

Bituminous concrete pavement was found at the surface of Borings 2 - 5 and 6B. Approximately 5 to 6 inches in thickness of bituminous concrete was found at the surface of Borings 2, 4 and 6B located within the Douglas Drive North pavement, generally underlain by about 17 to 20 inches of sand and gravel base material. At Borings 3 and 5 located in asphalt parking lots on the south side of the boiler house, 2.5 to 3.0 inches of bituminous concrete was found, underlain by about 4 to 8 inches of base course. These pavement thicknesses were estimated from the disturbed sides of the augered borehole and should be considered very approximate; pavement cores may be taken if more accurate measurements or detailed material descriptions are required.

Man-made fill (or “possible fill”) materials were found underlying the base course at Borings 3, 4, 5 and 6B and at the surface of Boring 1, extending to depths of 3.0 to 4.5 feet below existing grade. The fill samples were variable in consistency, primarily consisting of silty to sandy clays at Borings 1-4 and 6B and silt at Boring 5. The silty clay fill materials generally exhibited unconfined compressive strengths (as estimated by a pocket penetrometer) of 2.25 to 4.5 tons per square foot (tsf) at moisture contents of 15 to 20 percent. However, sandy clay described as “possible fill” sampled in Boring 3 between 3.0 and 4.5 feet exhibited an unconfined compressive strength of 0.5 tsf. The silt fill in Boring 5 exhibited a Standard Penetration Test “N” value of 14 blows per foot (bpf).

Native tough to hard, very silty clays were encountered below the fill or base course materials in Borings 1 and 2, extending to a depth of 5.5 and 3.0 feet below existing grade, respectively. These cohesive soils exhibited unconfined compressive strengths of 1.75 to 4.5+ tsf at moisture contents of 16 to 22 percent.

Native, loamy wash-type deposits, generally described as layers of loose to firm clayey silts, fine sand, and/or stiff to very tough silty to very silty clays, were found below the aforementioned materials in the borings, extending to depths of 9.0 to 15+ feet below existing grade. The loamy sand and silt soils typically exhibited N values ranging from 6 to 14 bpf. The wash-type clays were typified by unconfined compressive strengths of 1.0 to 2.75 tsf at moisture contents generally ranging from 12 to 27 percent.

Tough to very tough, "glacial till" type clays were encountered at depths of 9.0 to 13.0 feet in Borings 2, 5 and 6B, extending to the bottom of the borings. These deeper clays typically exhibited unconfined compressive strengths of 1.5 to 3.5 tsf at moisture contents of 11 to 14 percent.

Groundwater was encountered in Borings 3, 4 and 6B while drilling at depths of 8 to 13 feet below existing grade. Upon completion of drilling and removal of augers, water was measured in these borings at depths of 7 to 12 feet below existing grade. These other three (3) borings (1, 2 and 5) were "dry" both during and upon completion of drilling.

4.0 ANALYSIS AND RECOMMENDATIONS

4.1 General Overview

Pavement and/or existing man-made fill materials were found at the surface of all of the borings, extending to depths of approximately 2.0 to 4.5 feet below existing grade. The underlying native soils generally were described as layers of stiff to very tough silty to very silty clays and/or loose to firm clayey silts and silty fine sands. These deposits extended to depths of 9 to 15+ feet below existing grade, and they were underlain by tough to very tough glacial till silty clays at Borings 2, 5 and 6B.

The existing fill (and pavement) materials are not recommended for support of foundations. It is recommended that existing fill, pavement and any topsoil type materials be undercut from beneath footings and replaced with coarse aggregate "structural fill" during the time of foundation construction. Spread footings proportioned for 2500 psf would then bear at conventional depths upon this engineered backfill.

The native soils found a short distance below the existing fill often consisted of stiff to tough very silty clays and loose to firm or very moist to wet clayey silts or silty fine sands. These materials are typically considered marginally suitable for support of spread footings proportioned for 2500 psf bearing and/or are likely to exhibit instability when exposed by excavation. It is recommended that they be undercut a minimum of 1 to 2 feet and replaced with coarse aggregate “structural fill” in order to provide adequate bearing capacity and/or a stable platform for footing construction.

Please refer to the following sections of the report for more detailed recommendations.

4.2 Building Foundations/Bearing Table

It is assumed that it is desired to utilize a foundation system consisting of conventional spread/continuous wall footings for the proposed addition. It is recommended that foundation excavations extend down through the fill and pavement (and any topsoil) materials until the native, inorganic clay, clayey silt or silty fine sand deposits are reached. Where marginal strength /stability materials are found at footing grade, it is recommended that foundations be overexcavated a minimum of 1 to 2 feet, the exact thicknesses to be determined at the time of construction. It is then recommended that the foundation excavations be backfilled with coarse aggregate “structural fill”. The spread (and continuous) wall footings would then bear upon the “structural fill” backfill at the proposed conventional shallow depths.

Summarized in the following table is the shallowest depth and corresponding elevation at which the native, inorganic soils considered suitable for 2500 psf bearing were found at each boring location. The ground surface reference elevation at each boring is also shown. Foundation support recommendations also provided for conventional interior and exterior footings bearing at approximately 2.0 and 4.0 feet below FF, respectively.

Boring	Ground Surface Elevation	Native 2500 psf Bearing		Foundation Support Recommendations, FF = 871.8	
		Depth in Feet	Elevation	Interior Footings, Elev. 869.8	Exterior Footings, Elev. 867.8
1	871.5	3.0 CL	868.5	1.5' U	CL
2	869.9	2.0 CL	868.0	2.0' U	CL
3	870.9	4.5 S, L	866.5	3.5' U	1.5' U
4	870.7	3.0 S	867.5	2.5' U	0.5' U/S
5	871.0	3.0 S, L	868.0	2.0' U	S
6B	870.8	3.0 S, L	867.5	2.5' U	0.5' U/S

Legend

CL Tough to hard native clays considered suitable for 2500 psf bearing found at footing bearing elevation.

L Low-strength clays or relatively loose silts or sands found below shallowest bearing depth shown.

S Clayey silt or silty sand bearing soils present - if unstable conditions develop, undercut footing excavations 1 to 2 feet and replace with structural backfill.

U Recommended Undercut depth, in feet, below assumed footing bearing elevation to reach native 2500 psf bearing soil.

It is recommended that foundation excavations extend through the shallow pavement and fill deposits (including the soft clay possible fill in Boring 3). As can be seen in the above table, foundation excavations extending to depths ranging from 2.0 to 4.5 feet below existing grade are recommended in order to reach the native, inorganic soils considered suitable for 2500 psf bearing.

Native tough to hard very silty clay soils were encountered directly below the fill or pavement in Borings 1 and 2 as well as at anticipated exterior (frost-depth) footing grade in Borings 1 and 2. Native, inorganic clays exhibiting a minimum unconfined compressive strength of 1.25 tsf are considered suitable for support of spread footings proportioned for 2500 psf bearing.

In order to reach the native 2500 psf bearing soils, foundation overexcavations (undercuts) ranging from 1.5 to 3.5 feet in thickness are anticipated for interior footings at all of the borings. Undercuts ranging from 0.5 to 1.5 feet are anticipated in order to reach native bearing soils at exterior footing grade at Borings 3, 4 and 6B.

It is recommended that any foundation undercuts required to reach the native, inorganic soils considered suitable for 2500 psf bearing be replaced with coarse aggregate "structural fill". The base of the foundation overexcavations should extend at least 6 inches beyond each footing face for every foot in depth of overdig. The undercuts should be replaced with crushed stone or crushed gravel between 1/4 to 3 inches in size and containing no fines; IDOT gradations CA-1 and CA-7 meet these criteria. This "structural" fill should be spread in 12-inch layers loose thickness, each lift to be densified using vibratory compaction equipment or by tamping with a backhoe bucket. Footings constructed on this open-graded crushed stone or crushed gravel backfill may be proportioned to exert a maximum net allowable bearing pressure of 2500 pounds per square foot (psf).

Native, loose to firm, silty sand and/or clayey silt soils, often in a very moist condition, were found directly below the fill, pavements and/or soft clay deposits at Borings 3-5 and 6B, as well as at or near anticipated exterior footing grade in Borings 4, 5 and 6B. While these "loamy" deposits are considered suitable for 2500 psf bearing in a confined state, they will tend to become unstable when exposed by excavation and subjected to construction activities in the presence of free moisture. If unstable conditions develop, or can be anticipated to develop, then it is recommended that the silty sand or clayey silt bearing soils be undercut 1 to 2 feet and replaced with coarse aggregate "structural" fill per the guidelines presented above. Exact determinations of necessary undercuts should be determined in the field at the time of construction.

It is understood that the existing building has a basement in the area where the addition will meet the existing building. It is further understood that the basement floor is approximately 9.5 feet below the FF. It is expected that basement level footings are likely bearing at an elevation on the order of 860.5, or about 11.5 feet below FF. Borings 3 and 5 were drilled near the existing building. Native, tough to very tough silty clays were found at this anticipated footing bearing grade in these two (2) borings. These native clays are considered suitable for 2500 psf bearing.

In order to preclude disproportionately small footing sizes, it is recommended that all continuous wall footings be made at least 24 inches wide and isolated foundations at least 3.0 feet square, regardless of calculated dimensions. For frost considerations, all exterior footings should be constructed at least 3.5 feet below outside finished grade and 4.0 feet for foundations located outside of heated building limits. An IBC site seismic classification of "D" is recommended for foundation design.

4.3 Mass-Grading

It is recommended that proposed building and pavement areas be cleared of vegetation prior to mass-grading. Stripping operations should also generally include the removal of any surficial topsoil and other decomposable plant matter. It is recommended that bituminous concrete (asphalt) pavement also be removed. The building and pavement areas should then be proof-rolled, in order to detect the presence of unsuitable or unstable soil types. The proof-roll should be performed using a loaded dump truck or other approved piece of heavy construction equipment. All soft or unsuitable materials determined by proof-rolling should be removed and replaced.

Engineered fill placed at the site should consist of approved granular materials or inorganic clays. It is recommended that compaction for building pad and pavement areas be to a minimum of 95 and 90 percent of maximum dry density, respectively, as determined by the Modified Proctor test (ASTM D 1557). However, the uppermost 2.0 feet of fill below final subgrade in pavement areas should be compacted to 95 percent Modified Proctor density. The fill should be placed in approximate 9 inch lifts loose measure for cohesive soils and up to 12 inches for granular materials, each lift to be compacted to the specified density prior to the placement of additional fill.

Moisture control is important in the compaction of many soil types, and it is recommended that the water content of new fill be within one (1) percentage point below and three (3) percentage points above optimum moisture as established by its laboratory compaction curve. If the soil is compacted too dry, it will have an apparent stability which will be lost if it later becomes saturated. If the soil is too wet, the Contractor will not be able to achieve proper compaction. It can be anticipated that any on-site borrow will generally need to be reduced in moisture content in order to meet compaction specifications. Thus, good drying weather would be needed in order to utilize these materials. A Modulus of Subgrade Reaction (k) of 125 pci is recommended for floor slab design.

Fill deposits consisting primarily of silt were found at a shallow depth in Boring 5. The traffic of heavy construction equipment frequently causes silt, silty/clayey sand and very silty or sandy clay deposits to experience a short-term decrease in stability. The associated soft and spongy condition of exposed soils is commonly referred to as “pumping” in this area. It is recommended that heavy construction equipment be detoured around any areas where pumping conditions are found to be developing. Depending upon grading requirements and specific site conditions, solutions to a persistent pumping problem may include use of geotextile fabric, removal of unstable soils and replacement with about 1 to 2 feet of coarse, crushed granular backfill, such as 3 inch rock (CA-1), construction of trench drains or a combination thereof.

It is expected that some pavement construction will be part of this project. It is recommended that a nominal Illinois Bearing Ratio (IBR) or California Bearing Ratio (CBR) value of 2.5 be used in the design of pavements. Soil (silts, very silty to sandy clays and silty sands) and groundwater conditions indicative of a potential frost heave problem were found at shallow depths in the borings. The only way to completely avoid the potential for problems with frost heave would be to remove the existing soils down to frost depth (considered to be 4 feet) and replace the undercuts with non-frost susceptible material, likely needing to be kept drained using underdrains. Alternately, consideration could be given to the use of full depth HMA or P.C. Concrete pavement sections, as these sections generally exhibit less distress due to frost heave/thaw effects than conventional flexible HMA pavement sections.

Base course materials should conform to IDOT gradation CA-6 and be compacted to 95 percent Modified Proctor density or 100 percent of the Standard Proctor (ASTM D 698) maximum density value. Bituminous materials should conform to IDOT HMA requirements, Standard Specifications for Road and Bridge Construction. They should be compacted to between 93 and 97 percent of their theoretical maximum density, the “Big D” as determined by IDOT.

4.4 Groundwater Management/Excavations

Groundwater was encountered in the borings at depths as shallow as 7 feet below existing ground surface. The accumulation of run-off water or seepage at the base of excavations be expected to occur during foundation construction and site work. The Contractor should be prepared to remove these accumulations by dewatering procedures, as a minimum to include pumping from strategically placed sumps.

Excavations at the project site may generally expected to encounter various soil types including man-made fill, soft to very tough clays, silts and sands. All slope angles and protection systems for either open cut or supported excavations should be designed to meet or exceed all current applicable OSHA regulations. It should be noted that excavation safety is solely the responsibility of the contractor.

5.0 CLOSURE

It is recommended that full-time observation and testing services be provided by Testing Service Corporation personnel during foundation construction, so that the soils at undercut and foundation levels can be observed and tested. In addition, building materials, stripping and undercutting, fill placement and compaction as well as slab-on-grade and pavement construction should be observed and tested for compliance with the recommended procedures and specifications.

This report has been prepared without benefit of final building or grading plans. It is therefore suggested that Testing Service Corporation review these plans when available, to check the accuracy of this report as it may be affected, to verify the correct interpretation of recommendations contained herein and to modify the findings accordingly. Additional borings may be suggested at that time, to delineate potential problem areas as well as to fill in any gaps in information.

The analysis and recommendations submitted in this report are based upon the data obtained from the six (6) soil borings performed at the locations indicated on the Boring Location Plan. This report does not reflect any variations which may occur between these borings, the nature and extent of which may not become evident until during the course of construction. If variations are then identified, recommendations contained in this report should be re-evaluated after performing on-site observations.

We are available to review this report with you at your convenience.

Prepared by,

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Senior Geotechnical Engineer

Steven R. Koester
Vice President
Registered Professional Engineer
Illinois No. 062-049549

TSC

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APPENDIX

UNIFIED CLASSIFICATION CHART

LEGEND FOR BORING LOGS

BORING LOGS

BORING LOCATION PLAN

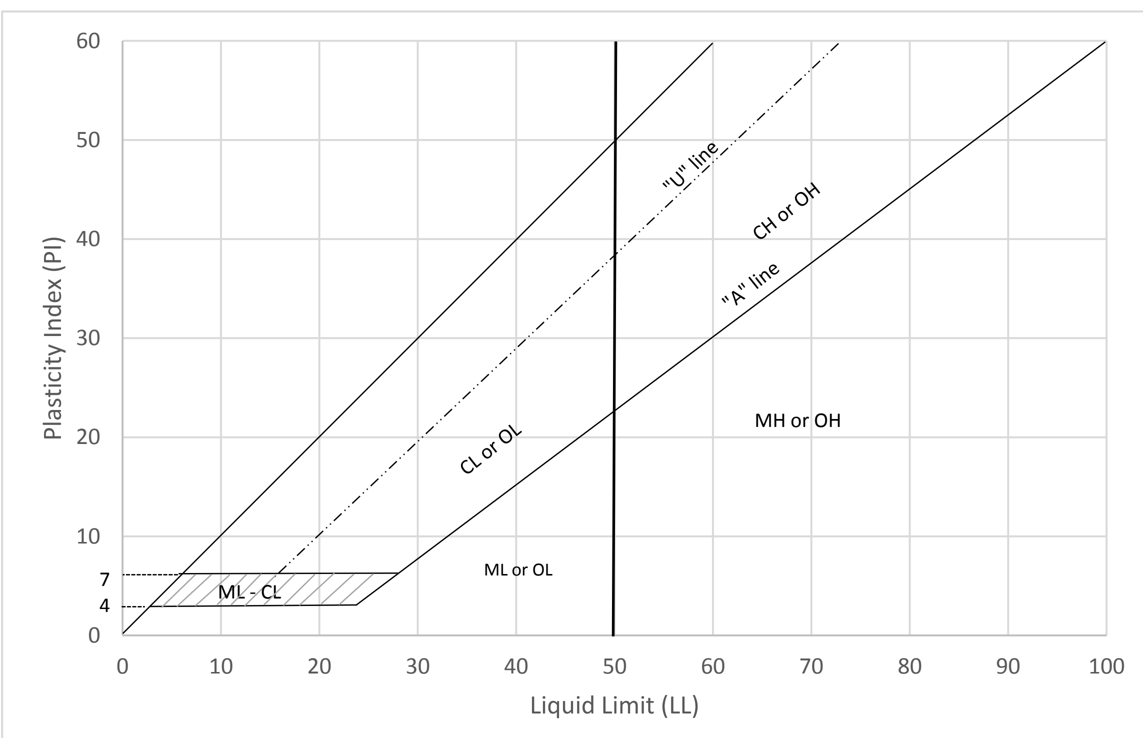
Testing Service Corporation

Unified Classification Chart

CRITERIA FOR ASSIGNING GROUP SYMBOLS AND GROUP NAMES USING LABORATORY TEST [a]				SOIL CLASSIFICATION	
				Group Symbol	GROUP NAME [b]
COARSE - GRAINED SOILS more than 50% retained on No. 200 sieve	GRAVELS More than 50% of coarse fraction retained on No. 4 sieve	CLEAN GRAVELS less than 5% fines [c]	$C_u \geq 4$ and $1 \leq C_c \leq 3$ [e]	GW	Well-graded gravel [f]
			$C_u < 4$ and/or $1 > C_c > 3$ [e]	GP	Poorly-graded gravel [f]
		GRAVELS WITH FINES more than 12% fines [c]	Fines classify as ML or MH	GM	Silty gravel [f, g, h]
			Fines classify as CL or CH	GC	Clayey gravel [f, g, h]
	SANDS 50% or more of coarse fraction passes No. 4 sieve	CLEAN SANDS less than 5% fines [d]	$C_u \geq 6$ and $1 \leq C_c \leq 3$ [e]	SW	Well-graded sand [i]
			$C_u < 6$ and/or $1 > C_c > 3$ [e]	SP	Poorly-graded sand [i]
		SANDS WITH FINES more than 12% fines [d]	Fines classify as ML or MH	SM	Silty sand [g, h, f]
			Fines classify as CL or CH	SC	Clayey sand [g, h, f]
FINE - GRAINED SOILS 50% or more passed the No. 200 sieve	SILTS & CLAYS Liquid limit less than 50%	Inorganic	PI > 7 or plots on or above "A" line j	CL	Lean clay [k, l, m]
			PI < 4 or plots below "A" line j	ML	Silt [k, l, m]
		Organic	$\frac{\text{Liquid limit – oven dried}}{\text{Liquid limit – not dried}} < 0.75$	OL	Organic clay [k, l, m, n] Organic silt [k, l, m, o]
	SILTS & CLAYS Liquid limit 50% or more	Inorganic	PI plots on or above "A" line	CH	Fat clay [k, l, m]
			PI plots below "A" line	MH	Elastic silt [k, l, m]
		Organic	$\frac{\text{Liquid limit – oven dried}}{\text{Liquid limit – not dried}} < 0.75$	OH	Organic clay [k, l, m, p] Organic silt [k, l, m, q]
Highly organic soils		Primarily organic matter, dark in color, and organic odor		PT	Peat

a. Based on the material passing the 3-inch (75-mm) sieve.
b. If field sample contained cobbles and/or boulders, add "with cobbles and/or boulders" to group name
c. Gravels with 5 to 12% fines required dual symbols
   GW-GM well graded gravel with silt
   GW-GC well graded gravel with clay
   GP-GM poorly graded gravel with silt
   GP-GC poorly graded gravel with clay
d. Sands with 5 to 12% fines require dual symbols
   SW-SM well graded sand with silt
   SW-SC well graded sand with clay
   SP-SM poorly graded sand with silt
   SP-SC poorly graded sand with clay
e. $C_u = D_{60}/D_{10}$ $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

f. If soils contains ≥ 15% sand, add "with sand" to group name.
g. If fines classify as CL-ML, use dual symbol GC-GM, SC-SM
h. If fines are organic, add "with organic fines" to group name
i. If soils contains ≥ 15% gravel, add "with gravel" to group name
j. If Atterberg Limits plot in hatched area, soil is a CL – ML, silty clay
k. If soils contains 15 to 29% plus No. 200, add "with sand" or "with gravel" whichever is predominant
l. If soil contains ≥ 30% plus No. 200, predominantly sand, add "sandy" to group name.
m. If soils contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name
n. PI ≥ 4 and plots on or above "A" line
o. PI ≥ 4 and plots below "A" line
p. PI plots on or above "A" line
q. PI plots below "A" line



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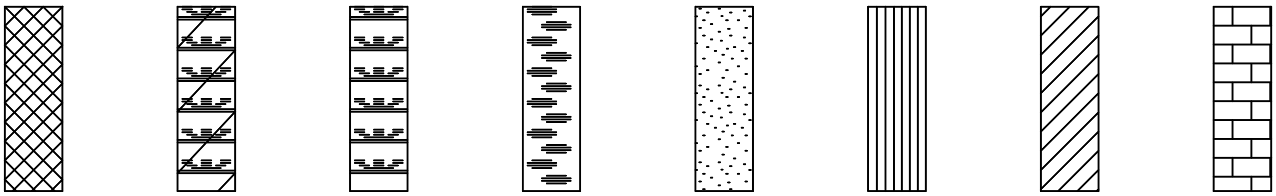
LEGEND FOR BORING LOGS



FILL | TOPSOIL | PEAT | GRAVEL | SAND | SILT | CLAY | DOLOMITE

SAMPLE TYPE

SS	=	Split Spoon
ST	=	Thin-Walled Tube
A	=	Auger
MC	=	Macro-Core (Geo Probe)

WATER LEVELS:

▼ (with bar)	While Drilling
▽	End of Boring
▼	24 Hours

FIELD AND LABORATORY TEST DATA

N	=	Standard Penetration Resistance in Blows per Foot
WC	=	In-Situ Water Content
Qu	=	Unconfined Compressive Strength in Tons per Square Foot
	*	Pocket Penetrometer Measurement: Maximum Reading = 4.5 tsf
γ_{DRY}	=	Dry Unit Weight in Pounds per Cubic Foot

SOIL DESCRIPTION

MATERIAL	PARTICLE SIZE RANGE
BOULDER	Over 12 inches
COBBLE	12 inches to 3 inches
Coarse GRAVEL	3 inches to ¾ inch
Small GRAVEL	¾ inch to No. 4 Sieve
Coarse SAND	No. 4 Sieve to No. 10 Sieve
Medium SAND	No. 10 Sieve to No. 40 Sieve
Fine SAND	No. 40 Sieve to No. 200 Sieve
SILT and CLAY	Passing No. 200 Sieve

COHESIVE SOILS

CONSISTENCY	Qu (tsf)
Very Soft	Less than 0.3
Soft	0.3 to 0.6
Stiff	0.6 to 1.0
Tough	1.0 to 2.0
Very Tough	2.0 to 4.0
Hard	4.0 and over

COHESIONLESS SOILS

RELATIVE DENSITY	N (bpf)
Very Loose	0 - 4
Loose	4 - 10
Firm	10 - 30
Dense	30 - 50
Very Dense	50 and over

MODIFYING TERM	PERCENT BY WEIGHT
Trace	1 - 10
Little	10 - 20
Some	20 - 35

PROJECT **West Boiler House Expansion, Stadium Drive East, DeKalb, Illinois**

CLIENT **Middough, Inc., Oak Brook, Illinois**

TSC

BORING **1** DATE STARTED **7-18-19** DATE COMPLETED **7-18-19** JOB **L-89,788**

ELEVATIONS

GROUND SURFACE **871.5**

END OF BORING **856.5**

WATER LEVEL OBSERVATIONS

WHILE DRILLING **Dry**

AT END OF BORING **Dry**

24 HOURS

SAMPLE NO.	SAMPLE TYPE	N	WC	Qu	γDRY	DEPTH	ELEV.	SOIL DESCRIPTIONS
1	SS	9	18.7	4.5*	106	3.0	868.5	FILL - Brown, greenish-gray and black silty CLAY, little sand, trace organic, moist (CL/CH)
2	SS	9	21.5	1.75*		5.5	866.0	Tough greenish-gray and brown very silty CLAY, little sand, trace root seams, moist (CL)
3	SS	8	16.7			8.0	863.5	Loose brown clayey SILT, some fine sand, moist to very moist (ML)
4	SS	13	18.9			13.0	858.5	Firm gray clayey SILT, little fine sand, very moist (ML)
5	SS	11	12.4	2.75*				Very tough grayish-brown very silty CLAY, little sand, occasional silt seams, moist (CL)

DISTANCE BELOW SURFACE IN FEET: 0, 5, 10, 15, 20, 25, 30

* Approximate unconfined compressive strength based on measurements with a calibrated pocket penetrometer.

CME-type Automatic Hammer used to drive sampler.

End of Boring at 15.0'

DRILL RIG NO. **334**

Division lines between deposits represent approximate boundaries between soil types; in-situ, the transition may be gradual.

PROJECT **West Boiler House Expansion, Stadium Drive East, DeKalb, Illinois**

CLIENT **Middough, Inc., Oak Brook, Illinois**

TSC

BORING **2** DATE STARTED **7-18-19** DATE COMPLETED **7-18-19** JOB **L-89,788**

ELEVATIONS		WATER LEVEL OBSERVATIONS	
GROUND SURFACE	869.9	WHILE DRILLING	Dry
END OF BORING	854.9	AT END OF BORING	Dry
		24 HOURS	

SAMPLE NO.	TYPE	N	WC	Qu	γDRY	DEPTH	ELEV.	SOIL DESCRIPTIONS
						0.4	869.5	5" Bituminous Concrete
A						1.8	868.1	Brown silty SAND and GRAVEL Base Course, moist (SM/GM)
1 B	SS	10	16.1	4.5+*	113	3.0	866.9	Hard greenish-gray very silty CLAY, trace sand, trace organic seams, moist (CL)
2	SS	12	16.1					
3	SS	9	16.4			8.0	861.9	Loose to firm brown clayey SILT, little fine sand, moist to very moist (ML)
4	SS	5	13.5	1.25*		13.0	856.9	Tough pinkish-gray very silty CLAY, little sand, trace gravel, very moist (CL-ML)
5	SS	9	12.4	2.37 2.5*				Very tough pinkish-gray silty CLAY, some sand, trace gravel, moist (CL)

DISTANCE BELOW SURFACE IN FEET: 0, 5, 10, 15, 20, 25, 30

* Approximate unconfined compressive strength based on measurements with a calibrated pocket penetrometer.

CME-type Automatic Hammer used to drive sampler.

End of Boring at 15.0'

DRILL RIG NO. **334**

Division lines between deposits represent approximate boundaries between soil types; in-situ, the transition may be gradual.

TSC_EOB 89788.GPJ TSC_ALL.GDT 8/28/19

PROJECT **West Boiler House Expansion, Stadium Drive East, DeKalb, Illinois**

CLIENT **Middough, Inc., Oak Brook, Illinois**

TSC

BORING **3** DATE STARTED **7-18-19** DATE COMPLETED **7-18-19** JOB **L-89,788**

ELEVATIONS		WATER LEVEL OBSERVATIONS	
GROUND SURFACE	870.9	WHILE DRILLING	13.0 '
END OF BORING	855.9	AT END OF BORING	7.0 '
		24 HOURS	

LENGTH RECOVERY	SAMPLE NO.	SAMPLE TYPE	N	WC	Qu	γ DRY	DEPTH	ELEV.	SOIL DESCRIPTIONS
							0.2	870.7	2½" Bituminous Concrete
							0.8	870.1	Sand and Gravel Base Course
	1	SS	6	19.5	2.25*	107			FILL - Brown and black silty CLAY, little sand, trace organic, moist (CL/CH)
							3.0	867.9	Soft brown sandy CLAY, trace organic, very moist (CL-ML) [Possible Fill]
	A 2 B	SS	2	20.1 26.5	0.5* 1.25*		4.5	866.4	Tough brown and gray very silty CLAY and SILT layers, very moist (CL-ML/ML)
							5.5	865.4	Loose brown silty fine SAND, very moist (SM) ▽
	3	SS	9	16.5					
							8.0	862.9	Loose brown clayey SILT and silty fine SAND layers, very moist (ML/SM)
	A 4 B	SS	6	13.5 13.0	 1.75*		9.0	861.9	Tough pinkish-brown silty CLAY, little to some sand, moist (CL)
							13.0	857.9	▼ Firm gray silty fine SAND, wet (SM)
	5	SS	14						

DISTANCE BELOW SURFACE IN FEET: 0, 5, 10, 15, 20, 25, 30

* Approximate unconfined compressive strength based on measurements with a calibrated pocket penetrometer.

CME-type Automatic Hammer used to drive sampler.

End of Boring at 15.0'

DRILL RIG NO. **334**

Division lines between deposits represent approximate boundaries between soil types; in-situ, the transition may be gradual.

PROJECT **West Boiler House Expansion, Stadium Drive East, DeKalb, Illinois**

CLIENT **Middough, Inc., Oak Brook, Illinois**

TSC

BORING **4** DATE STARTED **7-18-19** DATE COMPLETED **7-18-19** JOB **L-89,788**

ELEVATIONS		WATER LEVEL OBSERVATIONS	
GROUND SURFACE	870.7	WHILE DRILLING	8.0 '
END OF BORING	855.7	AT END OF BORING	12.0 '
		24 HOURS	

SAMPLE NO.	TYPE	N	WC	Qu	γDRY	DEPTH	ELEV.	SOIL DESCRIPTIONS
								6" Bituminous Concrete
						0.5	870.2	Brown silty SAND, some gravel Base Course slightly moist (SM/GM)
A 1 B	SS	12	14.6	3.0*	115	2.0	868.7	FILL - Brown and black silty CLAY, trace to little sand, trace gravel and organic, moist (CL)
						3.0	867.7	Firm brown silty fine SAND and clayey SILT layers, moist (SM/ML)
2	SS	13						
						5.5	865.2	Tough to very tough pinkish-brown very silty CLAY, some sand, occasional silt and sand seams, moist (CL-ML)
3	SS	8	12.9	2.0*				
						8.0	862.7	Firm pinkish-gray clayey SILT, little fine sand, occasional sand seams, moist (ML)
4	SS	14	13.9					
						13.0	857.7	Very tough gray very silty CLAY, little sand, moist (CL)
5	SS	12	13.8	3.75*				

DISTANCE BELOW SURFACE IN FEET: 0, 5, 10, 15, 20, 25, 30

* Approximate unconfined compressive strength based on measurements with a calibrated pocket penetrometer.

CME-type Automatic Hammer used to drive sampler.

End of Boring at 15.0'

DRILL RIG NO. **334**

Division lines between deposits represent approximate boundaries between soil types; in-situ, the transition may be gradual.

PROJECT **West Boiler House Expansion, Stadium Drive East, DeKalb, Illinois**

CLIENT **Middough, Inc., Oak Brook, Illinois**

TSC

BORING **5** DATE STARTED **7-18-19** DATE COMPLETED **7-18-19** JOB **L-89,788**

ELEVATIONS

GROUND SURFACE **871.0**

END OF BORING **846.0**

WATER LEVEL OBSERVATIONS

WHILE DRILLING **Dry**

AT END OF BORING **Dry**

24 HOURS

DISTANCE BELOW SURFACE IN FEET

SAMPLE NO.	SAMPLE TYPE	N	WC	Qu	γ DRY	DEPTH	ELEV.	SOIL DESCRIPTIONS
						0.3	870.7	3" Bituminous Concrete
						0.7	870.3	SAND and GRAVEL Base Course
1	SS	14	9.0					FILL - Brown SILT, little to some fine sand, trace clay, moist (ML)
						3.0	868.0	
2	SS	12	16.9					Firm brown clayey SILT, trace to some fine sand, occasional fine sand seams, moist to very moist (ML)
3	SS	15	17.4					
						8.0	863.0	
A	SS	9	14.6	1.0*	121			Stiff to tough grayish-brown very silty CLAY, trace sand, very moist (CL-ML)
4			13.5	1.75*	122	9.5	861.5	
B								Tough to very tough brownish-gray silty CLAY, little to some sand, trace gravel, moist (CL)
5	SS	9	12.7	2.52 2.25*	126			
						13.0	858.0	
6	SS	10	12.4	1.5*	125			
7	SS	17	10.5	3.0*	131			Tough to very tough silty CLAY, little to some sand, trace gravel, moist (CL)
8	SS	15	10.8	3.5*	131			

* Approximate unconfined compressive strength based on measurements with a calibrated pocket penetrometer.

CME-type Automatic Hammer used to drive sampler.

End of Boring at 25.0'

DRILL RIG NO. **334**

Division lines between deposits represent approximate boundaries between soil types; in-situ, the transition may be gradual.

PROJECT **West Boiler House Expansion, Stadium Drive East, DeKalb, Illinois**

CLIENT **Middough, Inc., Oak Brook, Illinois**

TSC

BORING **6B** DATE STARTED **7-18-19** DATE COMPLETED **7-18-19** JOB **L-89,788**

ELEVATIONS		WATER LEVEL OBSERVATIONS	
GROUND SURFACE	870.8	WHILE DRILLING	8.0 '
END OF BORING	855.8	AT END OF BORING	7.0 '
		24 HOURS	

SAMPLE NO.	SAMPLE TYPE	N	WC	Qu	γDRY	DEPTH	ELEV.	SOIL DESCRIPTIONS
						0.4	870.4	5" Bituminous Concrete
1A	SS	13	4.2					Brown silty SAND and GRAVEL Base Course, moist (SM/GM)
1B			17.5	2.5*	114	2.1	868.7	FILL - Brown, gray and black silty CLAY, trace to little sand, trace organic, moist (CL)
						3.0	867.8	
2	SS	13	19.0					Firm brown silty fine SAND, very moist (SM)
						5.5	865.3	
3	SS	13	19.2					Firm brown SILT with fine sand and silty fine sand layers, very moist to wet (ML/SM)
4A	SS	8	16.9			9.0	861.8	Very tough pinkish-brown silty CLAY, some sand, trace gravel, moist (CL)
						9.5	861.3	
4B			13.9	3.0*	123			Tough pinkish-gray silty CLAY, some sand, trace gravel, moist (CL)
4C			13.1	1.0*	124			
5	SS	12	13.1	1.75*	124			

DISTANCE BELOW SURFACE IN FEET: 0, 5, 10, 15, 20, 25, 30

* Approximate unconfined compressive strength based on measurements with a calibrated pocket penetrometer.

CME-type Automatic Hammer used to drive sampler.

End of Boring at 15.0'

DRILL RIG NO. **334**

Division lines between deposits represent approximate boundaries between soil types; in-situ, the transition may be gradual.

TOPOGRAPHIC EXHIBIT

NORTHERN ILLINOIS UNIVERSITY
CAMPUS BOILER REPLACEMENT PROJECT

VERTICAL AND HORIZONTAL CONTROL

VERTICAL CONTROL (Source):
National Geodetic Survey PID: MF0459
Survey Disk in conc monument
Elevation= 854.94 (NAVD 88)

HORIZONTAL CONTROL (Source):
National Geodetic Survey PID: AH2904
Stainless Steel Rod in sleeve
Northing: 1,935,791.33 (NAD 83)
Easting: 898,825.31 (NAD 83)

Control Point #1
Northing: 1,919,923.14 (NAD 83)
Easting: 863,701.13 (NAD 83)
Elevation: 875.02 (NAVD 88)

Control Point #2
Northing: 1,920,178.91 (NAD 83)
Easting: 863,729.21 (NAD 83)
Elevation: 870.64 (NAVD 88)

Control Point #3
Northing: 1,919,851.70 (NAD 83)
Easting: 863,997.77 (NAD 83)
Elevation: 871.13 (NAVD 88)

UTILITY STRUCTURES (STRUCTURE # (657))

154 curb inlet
Rim=869.18
SW Inv=866.00

179 Sanitary Manhole
Rim=869.99
N Inv=858.62
S Inv=858.72
W Inv=858.75

221 curb inlet
Rim=869.50
SE Inv=866.08

267 curb inlet
Rim=867.74
E Inv=864.31

312 Sanitary Manhole
Rim=873.83
Bench=858.48
SW Inv=858.48

453 curb inlet
Rim=869.38
W/NW Inv=866.31

555 storm manhole
Rim=869.74
N Inv=862.39
NE Inv=865.40
E Inv=862.58
SE/N Inv=866.00
SE/S Inv=862.66
S Inv=862.60
W Inv=862.65

656 inlet
Rim=874.70
Bench=865.61

657 inlet
Rim=875.00
NW Inv=866.08

658 Sanitary Manhole
Rim=870.58
Bench=859.15

683 inlet
Rim=874.88
NW Inv=865.05
E/SE Inv=865.38
SE Inv=865.36

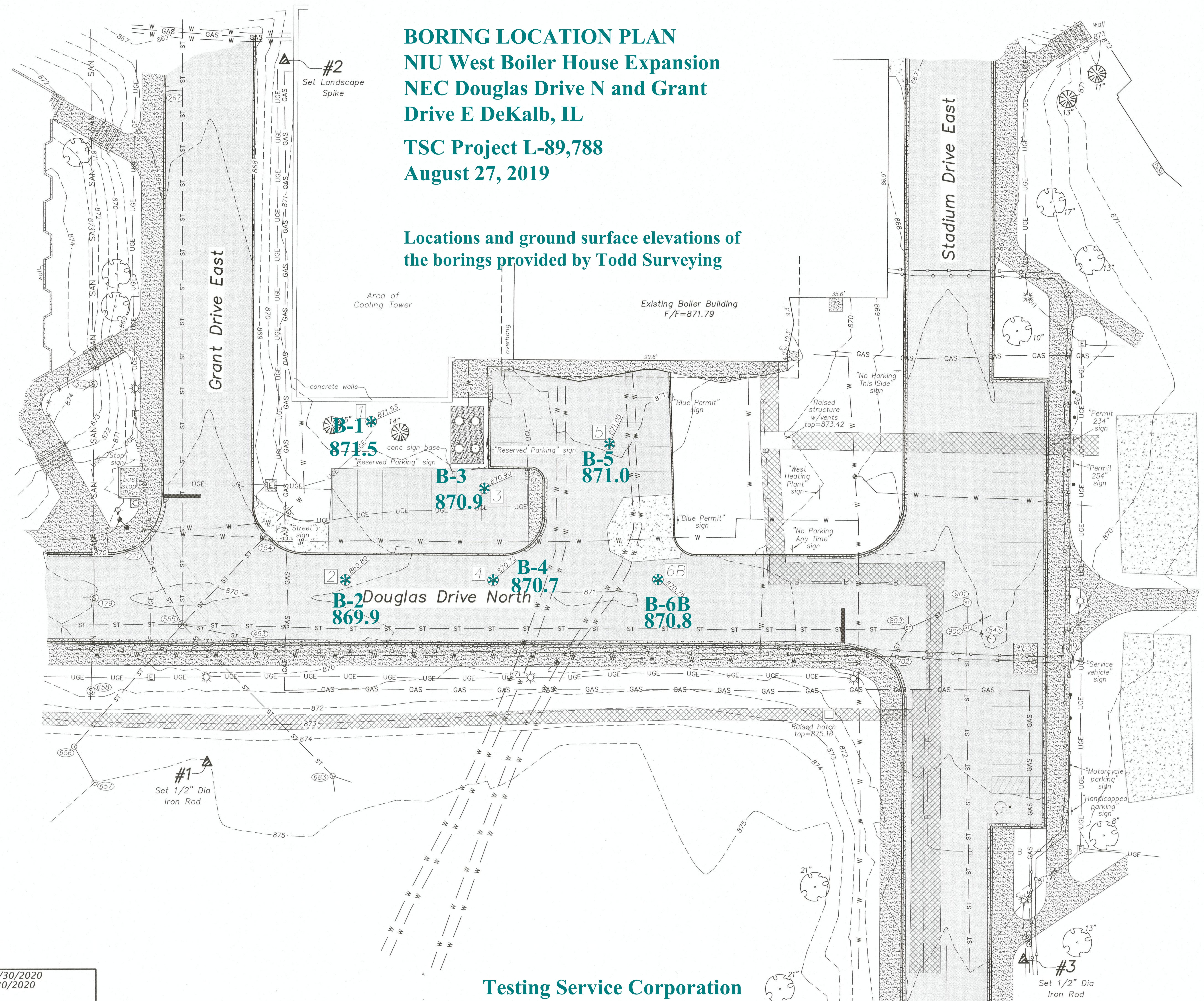
702 curb inlet
Rim=869.44
NE Inv=865.41

843 inlet
Rim=868.91
NW Inv=865.20

899 storm manhole
Rim=869.41
W Inv=863.89
SW Inv=865.21
S Inv=864.11
NE Inv=857.33

900 storm manhole
Rim=869.21
N Inv=864.11
S Inv=864.18
E Inv=865.14
SE Inv=865.36

901 storm manhole
Rim=869.13
S Inv=864.19
SW Inv=857.55



Testing Service Corporation
650 D Peace Rd
DeKalb, IL 60115

Legend

- = coniferous tree and tree size
- = deciduous tree and tree size
- = sign
- = sign post
- = handicapped parking
- = light pole
- E = electric handhole
- S = sanitary manhole
- = inlet
- = square inlet
- ST = storm manhole
- = fire hydrant
- = water valve
- = soil boring
- = control point
- GAS = gas line
- = fence
- ST = storm line
- SAN = sanitary line
- = striping
- B = FBO (fiber-optic line)
- = CHWS (chilled water supply service)
- = CHWR (chilled water return service)
- W = water line
- UGE = underground electric line
- --719-- = contour line
- = concrete curb
- = concrete curb and gutter
- = gravel
- = concrete
- = tunnel
- = asphalt

PREPARED ON AUGUST 20, 2019 BY:

ERIC C. POKORNY
I.P.L.S. NO. 3818

PROFESSIONAL LAND SURVEYOR
ERIC C. POKORNY
035-003818
YORKVILLE, IL
STATE OF ILLINOIS

N
S

Scale: 1" = 20'
N = North E = East
S = South W = West
(XX.XX') = Record Distance
XX.XX' = Measured Distance

Michel C. Ensalaco, P.L.S. 2768, Exp. 11/30/2020
Eric C. Pokorny, P.L.S. 3818, Exp. 11/30/2020

TODD SURVEYING
Professional Land Surveying Services
"Cornerstone Surveying PC"
759 John Street, Suite D
Yorkville, IL 60560
Phone: 630-892-1309 Fax: 630-892-5544

Survey is only valid if original seal is shown in red.

Client: Middough, Inc.		
Book #:2454/sh	Drawn By: JG.EP	Plat #: 13584
Reference:		
Field Work Completed: 8/14/2019		
Rev. Date	Rev. Description	
Project Number: 2019-0658		