GEOTECHNICAL REPORT

Proposed IDOT Pump Station #38

IDOT Project D-91-086-16, PTB 178-001, Contract 62B65

City of Lake Forest

Lake County, Illinois

Prepared for:

Knight E/A
221 North LaSalle Street
Suite 300
Chicago, Illinois 60601

Prepared by:

Geo Services, Inc.
805 Amherst Court
Suite 204
Naperville, Illinois 60565
(630) 305-9186

JOB NO. 16017

10/18/18

Geo Services, Inc.
Geotechnical, Environmental and Civil Engineering

October 18, 2018

Knight E/A
221 North LaSalle Street, Suite 300
Chicago, IL 60601

Attn: Mr. John C. Murillo, P.E.

GSI Project No. 16017

Re: Geotechnical Report
Proposed IDOT Pump Station #38
IDOT Project No. D-91-086-16, PTB# 178-001, Contract 62B65
Lake Forest, IL.

Dear Mr. Murillo:

The following report presents the geotechnical analysis and recommendations for the construction of the proposed IDOT Pump Station #38 located at the southeast quadrant of US 41/C&NW RR/Skokie Valley Bike Path and Deerpath Road, Lake Forest, Illinois. A total of three (3) pump station borings (PS-01, PS-02 and PS-02A) were completed at the site by Geo Services, Inc. (GSI). Copies of the soil boring diagram, along with the boring logs, are included in this report.

If there are any questions regarding the information submitted herein, please do not hesitate to contact us.

Very truly yours,

GEO SERVICES, Inc.

Richard Realeza
Project Manager
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enc.

TABLE OF CONTENTS

SECTION 01: INTRODUCTION

The following report presents the results of the geotechnical investigation performed for the proposed IDOT Pump Station #38 located in the southeast quadrant US 41/C&NW RR/Skokie Valley Bike Path and Deerpath Road, Lake Forest, Illinois. This report is based upon the boring information obtained (PS-01, PS-02 and PS-02A, which were drilled in the month of September, 2017 at the proposed pump station site.

Boring locations were selected by Geo Services, Inc. and were reviewed and approved by Knight E/A. Boring locations were laid out in the field by GSI personnel at the proposed locations using a GPS handheld device. Offsets were made by the GSI field personnel, where borings were inaccessible to the drill rig at the pre-marked boring locations. Elevations of the as-drilled borings were taken from topographic information provided by Knight E/A and are shown on the boring logs.

The project is located in Lake Forest, Lake County, Illinois with the following range/township information: T44N R12E, Section 32. The project location is shown on the site location map included in the Appendix.

This report includes a site location map, boring location diagrams, soil profile and boring logs, as well as, descriptions of soil and groundwater conditions, recommendations pertaining to the design and construction of the pump station and general construction considerations for the site.

SECTION 02: PROJECT DESCRIPTION

The proposed IDOT Pump Station #38 will consist of the new pump station construction to be located approximately 80 feet southeast from Skokie Valley Bike Path and Deerpath Road, and 90 feet south of the proposed detention basin #1. Due to anticipated high volumes of stormwater runoff from the Deerpath Road underpass beneath US 41 and the C&NW Railroad, creating a new pump station will improve stormwater management in this area. The existing stormwater pipes are planned to be tied-in to a detention basin and to the newly constructed wet well and pump station.

The footprint/base slab area of the newly reconstructed wet well chamber (with pump pit and discharge pipes) will be approximately 1,470 square feet. Based on the cross-section drawings provided by Knight E/A, the wet well chamber will be approximately 35 feet deep, indicating the proposed structure to bear at elevations ranging from EL. 635 to 636 feet. The proposed concrete mat foundation will be approximately 4.5 feet thick. Wet well walls are proposed to be approximately 2 feet thick. Per Lake Forest Village Code, the pump station building is to be designed per 2003 IBC (per Village Code) and based on Load & Resistance Factor Design (LRFD).

Approximate preliminary loads for the pump station were provided by Knight E/A, and are as follows:

- Weight of Structure = 3,580,000 lbs (service load)
- Maximum Volume of Water in Pump Station = 460,000 lbs (service)
- Total Maximum Weight = 4,040,000 lbs (service)
- Bearing Pressure = 2,750 psf (service)
- Bearing Pressure = 3,850 psf (factored)

SECTION 03: SUBSURFACE INVESTIGATION PROCEDURES

Borings PS-01, PS-02 and PS-02A were performed during the month of September, 2017. The borings were drilled using a truck and/or ATV-mounted drilling rig equipped with a CME automatic hammer, advanced by hollow stem augers to depths of 30 feet, and then switching to rotary drilling to completion. Representative soil samples were obtained employing split spoon sampling procedures in accordance with AASHTO Method T-206. Samples obtained in the field were brought to our laboratory for further examination and testing.

Split spoon sampling involves driving a 2.0-inch outside diameter split-barrel sampler into the soil with a 140-pound weight falling freely through a distance of 30 inches. Blow counts are recorded at 6" intervals and the blow counts are shown on the boring logs. The number of blows required to advance the sampler the last 12 inches is termed the Standard Penetration Resistance (N). The N-value is an indication of the relative density of the soil.

SECTION 04: LAB TESTING PROGRAM

The test procedures were performed in accordance with test procedures discussed in the IDOT Geotechnical Manual. All split-spoon samples obtained from the drilling operation were visually classified in the field. Cohesive samples were tested in the field for unconfined compressive strength using an IDOT modified RIMAC test device and/or calibrated penetrometer.

The soil testing program included performing water content, density and either unconfined compression and/or calibrated penetrometer tests on the cohesive samples recovered. Water content tests were performed on the non-cohesive samples recovered. These tests were performed upon representative portions of the samples obtained in the field. The results of the above testing, along with a visual classification of the material based upon both the Illinois textural classification and the AASHTO Soil Classification System, are indicated on the boring logs.

SECTION 05: SUBSURFACE AND GROUNDWATER CONDITIONS

5.1 Soil Conditions

Boring logs can be found in Appendix C. The stratification lines shown on the boring logs represent the approximate boundary between soil types, and the actual transition may be gradual.

Surface conditions at the boring locations indicated 8 to 12 inches of topsoil, and 2.5 feet of sandy clay loam with stone fill beneath topsoil at boring PS-01. The soil profile generally consists of thick layers of stiff to hard clay to clay loam to boring termination at elevations ranging from 570 to 620 feet.

Moisture contents of the cohesive soils ranged from mid-teens to low twenties. Granular soils had moisture contents that ranged from low to mid-teens.

5.2 Groundwater Conditions

Groundwater was encountered at approximate elevation 624 to 652 feet at boring PS-02A before and after switching to rotary drilling techniques. Groundwater was dry at borings PS-01 and PS-02. Based on the coloration change of the soils from brown and gray to gray, we estimate the long term water table at elevation 658 to 665 feet. Fluctuations in the amount of water accumulated and in the hydrostatic water table can be anticipated depending upon variations in precipitation, and surface runoff.

SECTION 06: GEOTECHNICAL ANALYSIS

6.1 Seismic Conditions

Per 2003 IBC Building Code, the site has a seismic design category of A based on short-period (0.2 second) response acceleration, and a seismic design category of B based on 1-second period response acceleration; the project site is considered to be in a low seismic area. Liquefiable layers are not expected to impact the design of the new pump station.

6.2 Settlement Analysis

Based on a factored bearing pressure of 3,850 psf for the mat foundations, settlement is calculated to be less than 1 inch for the pump station chamber footprint; this calculated settlement also applies to the paving areas outside the pump station chamber. No settlement concerns are anticipated for the pump station well chamber. The paved areas around the pump station should also have settlements less than an inch

assuming proper construction backfilling/compaction techniques are followed when backfilling the pump station foundation excavation.

SECTION 07: PUMP STATION WET WELL FOUNDATION RECOMMENDATIONS

7.1 Pump Station Foundation Recommendation

The pump station's wet well chamber and pump pit structures are proposed to be founded on approximately 4.5-foot thick reinforced concrete mat foundation. Based on the results of the soil borings, the support of the mat foundations will be based on very stiff to very stiff clay soils to approximate bottom of footing foundation at elevation 636.5 feet of the pump station chamber footprint. Conditions of the bearing material should be evaluated in the field by the Geotechnical Engineer at the time of construction.

The pump station chamber foundation, as well as the pump station building support to be constructed over the chamber structure (as shown in the cross-section plans provided by Knight E/A) can be designed for a maximum gross allowable bearing capacity of 4.5 kips per square foot (ksf) based on stiff to very stiff clay encountered at approximate elevations 635 to 636 feet, using resistance factor of 0.45 (per AASTHO LRFD Bridge Manual, Table 10.5.5.2.2-1).

All soils which become softened or loosened at the base of foundation excavation areas or subgrade areas should be carefully recompacted or removed prior to placement of foundation concrete. No foundation concrete should be placed in areas of ponded water or frozen soil.

7.2 Pump Station Wet Well Chamber Construction

Based on the pump station cross-sections as provided by Knight E/A, the construction of the well chamber will require a temporary soil retention system.

Open cut excavation will not be an option for the wet well construction due to the depth of excavation.

Based on the cross-sections provided by Knight E/A, the construction of the wet well chamber may need temporary soil retention system. Cantilevered sheet piling will not be feasible for temporary soil retention since the proposed retained height of approximately 35 feet is beyond limits of the IDOT Temporary Sheet Piling Design charts 3.13.1. A tie-back wall system (soldier pile and lagging of steel sheeting) or other temporary wall system provided by the Contractor will be needed as alternative soil retention. The soil parameters for lateral resistance shown in Table 1 of this report may be used for design of temporary retention system.

7.3 Bottom Floor Slab Construction

Based on the upper stratum clay soils encountered beneath the bottom elevation of the proposed mat foundation, we do not anticipate the use of seal coating. However, a "mud mat" may be placed prior to the installation of the mat foundation. The "mud mat" can consist of a lean concrete mix to resist the hydrostatic uplift and to provide a watertight, dry working surface condition for construction of the floor slab. Once the bottom floor slab is reached and leveled, the bottom floor slab is cast either directly on a mud mat over very stiff cohesive soils. Sump pits and pumps and/or dewatering methods will be needed to control groundwater seepage inside the wet well and relieve any buildup of hydrostatic pressure on the mud mat.

7.4 Lateral Earth Support (For Earth Retention)

The earth retention system should be designed to resist the appropriate lateral earth pressures. Allowances should be made for any surcharge loads adjacent to the earth retention system. The retention system should be designed for hydrostatic pressure. The base of the wall chamber is anticipated to be founded in stiff to very stiff clay soils. According to the NAVFAC Design Manual 7.2, a value of 0.55 may be used for the coefficient of friction (ultimate) between the concrete foundation and clay soils. On the following Table 1 is a tabulation of lateral soil parameters to be used for design of the earth retention system.

Table 1 – Soil Parameters for Lateral Resistance of Earth Retention System

Material (elevation)	Unit Weight (pcf)	Drained Friction Angle (°)	Allowable Bond Strength (ksf) [1]	Undrained Cohesion (psf)	Lateral Modulus of Subgrade Reaction (pci)	Strain
Hard Clay (670 to 658)	125	32	1.2	5,000	2,500	0.004
Stiff to Very Stiff Clay (658 to 603)	125	28	0.5	2,000	800	0.005
Medium Stiff to Stiff Clay (603 to 589)	120	28	0.4	1,000	500	0.007
Very Stiff to Hard Clay (589 to 570)	125	32	1.0	4,500	2,000	0.004

Note: 1. Allowable bond strength is determined from the Ultimate Bond Stress divided by Factor of Safety of 3.0. Allowable bond strength assumes gravity grouted, straight shaft anchors. Average Ultimate Bond Stress values are referenced from FHWA Geotechnical Engineering Circular No. 4, Table 7 (page 73).

7.5 General Wall Design for the Pump Station Wet Well Chamber

Table 2 below provides the recommended earth pressures to be used for design of pump station wet well chamber wall. Earth pressures are influenced by the structural design of the walls, wall restraint conditions, construction methods, as well as backfill materials and compaction.

Table 2 –Lateral Earth Pressure Coefficients for the Pump Station Wet Well Chamber

Earth Pressure Conditions	Coefficient for Backfill Type	Equivalent Fluid Density (pcf)	Surcharge Pressure, p_1 (psf)	Earth Pressure, p_2 (psf)
At-Rest (Ko), Above Water Table	Granular - 0.46	57.5	(0.46)S	(57.5)H
	Cohesive or Mixed Backfill - 0.52	65	(0.52)S	(65)H
At-Rest (Ko), Below Water Table [1]	Granular - 0.46	29	(0.46)S	(29)H
	Cohesive or Mixed Backfill - 0.52	32.5	(0.52)S	(32.5)H

Note: 1. If below water table, the full hydrostatic head (62.4 psf/ft) also needs to be included.

Applicable conditions to the above include:

- Uniform surcharge, where S is surcharge pressure
- In-situ soil backfill weight a maximum of 125 pcf
- Horizontal backfill, compacted between 95 and 98 percent of modified Proctor maximum dry density
- Loading from heavy compaction equipment not included
- With hydrostatic pressures acting on wall
- No dynamic loading
- No safety factor included in soil parameters

Allowances should be made for any surcharge loads adjacent to the pump station chamber structure.

7.6 General Construction Considerations for the Pump Station Wet Well Chamber

For backfill material requirements placed between the temporary retaining wall and permanent walls, backfill should be in compliance with Section 502, Article 202.03, Article 204.02, Article 205.05, and Article 205.06 of the IDOT Standard Specifications for Road and Bridge construction. Backfill behind the wall may consist of compacted, granular material or clay fill. In addition, we recommend limiting top size to no greater than 6 inches in diameter to allow for ease of installation of deep foundations for support of the outside slabs.

We recommend that the backfill be compacted to at least 95 percent of the maximum dry density as determined by ASTM D 1557(Modified Proctor) method of test due to the amount of backfill going in (approximate depth of 35 feet) to limit settlement of the backfill and speed rate of the settlement. Proper moisture control is essential to achieve the desired densities.

Sump pits and pumps and/or dewatering methods may be needed to control groundwater in the deepest excavations based on the groundwater level encountered within the boring strata. Whenever groundwater is encountered, steps should be taken to allow the construction to be completed in relatively dry conditions.

The excavation walls will have to be shored or the sides of the excavations will have to be properly sloped in accordance with OSHA regulations. Movement of adjacent soils near the edge of and into excavation areas should be prevented. All excavations should be performed in accordance with the latest Occupational Safety and Health Administration (OSHA) requirements. Allowances should be made for any surcharge loads adjacent to the excavation areas.

SECTION 08: DRIVEWAY/PAVEMENT RECOMMENDATIONS

We understand that the newly paved driveway/parking lot will be constructed at the south section of the proposed IDOT Pump Station #38. Based on the cross-sections provided by Knight E/A, the lot grade will at approximate elevation 671 feet. Considering the condition of the existing clay material at the pump station site (based on the blow-counts, moisture contents and soil strengths), the existing clay soils appear suitable for supporting the drive way/pavement.

If any unsuitable or soft areas are encountered at the time of construction, it is recommended that these soils be undercut and replaced with an approved embankment fill per IDOT Standard Specifications for Road and Bridge Construction guidelines. The actual extent of stripping and undercutting of unstable soils should be determined in the field at the time of construction by the geotechnical engineer. In addition, standard proctor tests can be performed help estimate the degree of compaction of the existing soils.

For the new paved areas, we recommend the stripping of all topsoil (if any) from the surface prior to use. After this stripping operation and before placing any fill, we recommend that the exposed sub base or subgrade be proofrolled. Proofrolling aids in providing a firm subgrade for new pavement and for delineating soft or disturbed areas that may exist at or slightly below the sub base/subgrade level. Proofrolling may be accomplished with a fully loaded, tandem-axle dump truck or other equipment providing an equivalent subgrade loading. A minimum gross weight of 25 tons is recommended for the proofrolling equipment.

New embankment fill should consist of approved low-plasticity cohesive or granular materials that are free of organic matter and debris. The fill should have a maximum of 3 inches nominal particle size. Low plasticity cohesive soil should have a liquid limit of less than 45% and a plasticity index less than 20%, and the moisture content of the fill should not vary by more than ±3% of the optimum moisture content. Suitable granular fill materials include crushed materials meeting the IDOT gradation CA-6. Fill material used in pavement subgrade should also be non-frost susceptible. New fill should be placed in maximum 9-inch loose lifts compacted to a minimum of 95% of the maximum dry density obtained in accordance with ASTM Standard D-698, modified Proctor method.

The new fill materials should be placed during weather conditions and at moisture contents that permit the recommended degree of compaction to be obtained. Adjustment in the soil's moisture content may be required to obtain the recommended degree of compaction. The use of clay soils as a fill material during the winter, early spring or late fall will likely be limited because of poor weather conditions. The clay and silty clay soils present at the site are considered suitable for use as fill materials.

In new pavement sections where granular base materials are used over cohesive (clay) subgrade materials, it is possible that water can collect and become trapped causing a saturated subgrade condition which may soften the subgrade and increase the effects of frost action in these soils resulting in premature deterioration of the pavement section.

The clay fill soils found at the site are sensitive to remolding in the presence of water. Control of surface water from precipitation is required. Active measures, including proper grading and the use of inlets and storm drains, must be taken to properly drain the excavated areas. Construction traffic directly on the subgrade soils should be minimized.

Care should be taken in the design and construction of paved areas to provide rapid drainage of surface water and to develop surface drainage patterns which will divert water away from the pavement edges. When water is allowed to pond on or adjacent to the pavement, the subgrade may become saturated and accelerate pavement deterioration.

During excavation for the proposed improvements, movement of adjacent soils into the excavation should be prevented. All excavations should be performed in accordance with the latest Occupational Safety and Health Administration (OSHA) requirements.

SECTION 09: GENERAL QUALIFICATIONS

The analysis and recommendations presented in this report are based upon the data obtained from the soil borings performed at the indicated locations and from any other information discussed in this report. This report does not reflect any variations that may occur between borings or across the site. In addition, the soil samples cannot be relied on to accurately reflect the strata variations that usually exist between sampling locations. The nature and extent of such variations may not become evident until construction. If variations appear evident, it will be necessary to reevaluate the recommendations of the report. In addition, it is recommended that Geo Services Inc. be retained to perform construction observation and thereby provide a complete professional geotechnical engineering service through the observational method.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No other warranties, either expressed or implied, are intended or made. In the event that any changes in the nature, design or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report modified or verified in writing by the geotechnical engineer. Also note that Geo Services Inc. is not responsible for any claims, damages, or liability associated with any other party's interpretation of this report's subsurface data or reuse of the report's subsurface data or engineering analyses without the express written authorization of Geo Services Inc.

APPENDIX A

GENERAL NOTES

GENERAL NOTES

CLASSIFICATION

American Association of State Highway & Transportation Officials (AASHTO) System used for soil classification.

Cohesionless Soils

Relative Density	No. of Blows per foot N
Very Loose	0 to 4
Loose	4 to 10
Medium Dense	10 to 30
Dense	30 to 50
Very Dense	Over 50

TERMINOLOGY

Streaks are considered to be paper thick. **Lenses** are considered to be less than 2 inches thick. **Layers** are considered to be less than 6 inches thick. **Stratum** are considered to be greater than 6 inches thick.

Cohesive Soils

Consistency	Unconfined Compressive Strength - qu (tsf)
Very Soft	Less than 0.25
Soft	0.25 - 0.5
Medium Stiff	0.5 - 1.0
Stiff	1.0 - 2.0
Very Stiff	2.0 - 4.0
Hard	Over 4.0

DRILLING AND SAMPLING SYMBOLS

SS:	Split Spoon 1-3/8" I.D., 2" O.D.	HS:	Housel Sampler
ST:	Shelby Tube 2" O.D., except where noted	WS:	Wash Sample
AS:	Auger Sample	FT:	Fish Tail
DB:	Diamond Bit - NX: BX: AX	RB:	Rock Bit
CB:	Carboloy Bit - NX: BX: AX	WO:	Wash Out
OS:	Osterberg Sampler		

Standard "N" Penetration: Blows per foot of a 140 lb. hammer falling 30" on a 2" O.D. Split Spoon

WATER LEVEL MEASUREMENT SYMBOLS

WL:	Water	WD:	While Drilling
WCI:	Wet Cave In	BCR:	Before Casing Removal
DCI:	Dry Cave In	ACR:	After Casing Removal
WS:	While sampling	AB:	After Boring

Water levels indicated on the boring logs are the levels measured in the boring at the times indicated. In pervious soils, the indicated elevations are considered reliable ground water levels. In impervious soils, the accurate determination of ground water elevations is not possible in even several days observation, and additional evidence on ground water elevations must be sought.

APPENDIX B

SOIL BORING PLAN

PC-01
PC-02
PC-03
PC-04
PC-05
PC-06
PC-07
PC-08
PC-09
PC-10
RP-01
RR-01
RR-02
JP-01
DP-01
DP-02
RW-01
RW-02
PS-01
PS-02
PS-02A
45+00
50+00
55+00
FAITH LUTHERAN CHURCH
16" HIGH PRESSURE GAS MAIN
W. DEERPATH ROAD
CHILTERN DRIVE
DEERPATH SQUARE
SKOKIE HIGHWAY (US-41)
AHWAHNEE LANE
TEE BOX
GREEN
SAND TRAP
MATCHLINE STATION 57+00
N 0° 08' 25" E
150.00
N
GRAPHIC SCALE
50' 0 50' 100' 200'

Borings included in the IDOT Pump Station #38 Geotechnical Report (dated 10/18/18)

Geo Services, Inc.
Geotechnical, Environmental & Civil Engineering
805 Amherst Court, Suite 204
Naperville, Illinois 60565
(630) 355-2838

USER NAME = *USER*	DESIGNED - RWC	REVISED -	
	DRAWN - RWC	REVISED -	
PLOT SCALE = *SCALE*	CHECKED - AJP	REVISED -	
PLOT DATE = *DATE*	DATE - 8/1/2018	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

FAP 346 (US ROUTE 41) @ DEERPATH ROAD
SOIL BORING LOCATION DIAGRAM

SCALE 1"=100' | SHEET 1 OF 2 SHEETS | STA. 42+00 TO STA. 57+00

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
346	(130S)I; (21&21S)-I	LAKE	2	1
IDOT PROJECT No. D-91-086-16		CONTRACT NO. 62B65		
ILLINOIS	FED. AID PROJECT			

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APPENDIX C

SOIL BORING LOGS

Geo Services, Inc.
Geotechnical, Environmental & Civil Engineering
805 Amherst Court, Suite 204
Naperville, Illinois 60565
(630) 355-2818

GSI Job No. 16017

SOIL BORING LOG

Date 9/5/17

ROUTE FAP 346 **DESCRIPTION** Pump Station **LOGGED BY** JT

SECTION _____ **LOCATION** SW 1/4, **SEC.** 32, **TWP.** T44N, **RNG.** R12E, 3rd **PM**

COUNTY Lake **DRILLING METHOD** Hollow Stem Auger/Rotary **HAMMER TYPE** CME Automatic

STRUCT. NO. _____
Station _____

BORING NO. PS-01
Station 53+94
Offset 57.70ft Right
Ground Surface Elev. 670.50 **ft**

Surface Water Elev. n/a **ft**
Stream Bed Elev. n/a **ft**

Groundwater Elev.:
First Encounter Dry to -10.0 **ft**
Upon Completion n/a **ft**
After 24 **Hrs.** - **ft**

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				8.0" TOPSOIL with Stone-black
				669.83
			12	SANDY CLAY LOAM with Stone-dark brown & black-medium dense (Fill)
	5			
	6		11	
	5			
				667.50
				SILTY CLAY-brown & gray hard
	3			
-5	5	4.2	24	
	7	B		
				665.00
				CLAY-brown-stiff to hard
	3			
	5	5.5	19	
	7	B		
	3			
	8	7.9	16	
-10	12	B		
				becoming gray @ -10.5'
	5			
	8	5.3	18	
	13	B		
	5			
	8	3.6	17	
-15	14	B		
	3			
	5	1.9	15	
	6	B		
	3			
	4	1.7	21	
-20	7	B		

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				CLAY-brown-stiff to hard *(continued)*
	3			
	5	2.0	18	
	7	B		
	3			
-25	5	1.9	21	
	6	B		
	2			
	4	1.9	22	
	6	B		
	3			
	4	1.1	23	
-30	5	B		
	2			
	4	1.2	24	
-35	4	B		
	4			
	6	1.9	19	
-40	9	B		

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, from 137 (Rev. 8-99)

Z:\PROJECTS\2016\16017 KNIGHT EA, IDOT PUMP STATION 38 FAP 346 (PTB 178, ITEM 1)\16017 BORING LOGS\16017_LOG.GPJ 10/15/18

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SOIL BORING LOG

GSI Job No. 16017

Date 9/5/17

ROUTE FAP 346 **DESCRIPTION** Pump Station **LOGGED BY** JT

SECTION _____ **LOCATION** SW 1/4, **SEC.** 32, **TWP.** T44N, **RNG.** R12E, 3rd **PM**

COUNTY Lake **DRILLING METHOD** Hollow Stem Auger/Rotary **HAMMER TYPE** CME Automatic

STRUCT. NO. _____
Station _____

BORING NO. PS-01
Station 53+94
Offset 57.70ft Right
Ground Surface Elev. 670.50 ft

Surface Water Elev. n/a ft
Stream Bed Elev. n/a ft

Groundwater Elev.:
First Encounter Dry to -10.0 ft
Upon Completion n/a ft
After 24 **Hrs.** - ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
CLAY-brown-stiff to hard *(continued)*			
	6		
-45	8 9	2.0 B	23
	3		
-50	4 7	1.5 B	19
	4		
-55	7 9	2.2 B	20
	2		
-60	10 13	3.0 P	22
CLAY-brown-stiff to hard *(continued)*			
	4		
-65	5 6	1.0 B	27
603.50			
SILTY CLAY LOAM-gray-soft			
	3		
-70	3 4	0.3 B	21
598.50			
CLAY-gray-medium stiff to stiff			
	2		
-75	2 4	1.2 B	17
	2		
-80	3 4	0.6 B	22

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, from 137 (Rev. 8-99)

Z:\PROJECTS\2016\16017 KNIGHT EA, IDOT PUMP STATION 38 FAP 346 (PTB 178, ITEM 1)\16017 BORING LOGS\16017_LOG.GPJ 10/15/18

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SOIL BORING LOG

GSI Job No. 16017
Page 3 **of** 3
Date 9/5/17

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Stream Bed Elev. n/a **ft**

Groundwater Elev.:
First Encounter Dry to -10.0 **ft**
Upon Completion n/a **ft**
After 24 **Hrs.** - **ft**

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
CLAY-gray-medium stiff to stiff *(continued)* 589.50				
Drillers Observation: Possible boulder 588.50				
CLAY LOAM-gray-hard		18		
		23 35	8.8 B	11
	-85			
		14		
		21 33	12.2 S	10
	-90			
		9		
		12 22	5.3 B	12
	-95			
		12		
End Of Boring @ -100.0'. Boring backfilled with cuttings. 570.50	-100	12 18	5.6 B	14

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The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, from 137 (Rev. 8-99)

Geo Services, Inc.
Geotechnical, Environmental & Civil Engineering
805 Amherst Court, Suite 204
Naperville, Illinois 60565
(630) 355-2818

SOIL BORING LOG

GSI Job No. 16017

Date 9/13/17

ROUTE FAP 346 **DESCRIPTION** Pump Station **LOGGED BY** JT

SECTION _____ **LOCATION** SW 1/4, **SEC.** 32, **TWP.** T44N, **RNG.** R12E, 3rd **PM**

COUNTY Lake **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** Diedrich Automatic

STRUCT. NO. _____
Station _____

BORING NO. PS-02
Station 54+32
Offset 89.00ft Right
Ground Surface Elev. 670.50 ft

Surface Water Elev. n/a ft
Stream Bed Elev. n/a ft

Groundwater Elev.:
First Encounter 652.0 ft ▼
Upon Completion 624.5 ft ▽
After 24 **Hrs.** - ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
12.0" TOPSOIL-black			
669.50			13
CLAY-brown & gray-hard	7		
	8 9	5.8 B	21
	6		
	8 10	4.5 P	19
-5			
	7		
	17 17	4.5 P	16
	4		
	9 14	8.1 B	16
-10			
660.00			
CLAY LOAM-gray-hard	9		
	11 9	4.5 P	13
657.50			
CLAY-gray-stiff to very stiff	4		
	6 8	2.8 B	18
-15			
	4		
	5 7	2.2 B	19
▼			
	3		
	4 5	1.1 B	19
-20			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
CLAY-gray-stiff to very stiff *(continued)*			
	3		
	3 6	1.8 B	19
	2		
	5 7	1.9 B	18
-25			
	4		
	5 6	1.9 B	21
	2		
	5 6	2.1 B	21
-30			
	2		
	4 5	1.9 B	22
-35			
633.50			
SILTY CLAY-gray-very stiff	2		
	5 8	2.7 B	19
-40			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
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BBS, from 137 (Rev. 8-99)

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SOIL BORING LOG

GSI Job No. 16017
Page 2 **of** 2
Date 9/13/17

ROUTE FAP 346 **DESCRIPTION** Pump Station **LOGGED BY** JT

SECTION _____ **LOCATION** SW 1/4, **SEC.** 32, **TWP.** T44N, **RNG.** R12E, 3rd **PM**

COUNTY Lake **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** Diedrich Automatic

STRUCT. NO. _____
Station _____

BORING NO. PS-02
Station 54+32
Offset 89.00ft Right
Ground Surface Elev. 670.50 **ft**

Surface Water Elev. n/a **ft**
Stream Bed Elev. n/a **ft**

Groundwater Elev.:
First Encounter 652.0 **ft** ▼
Upon Completion 624.5 **ft** ▽
After 24 **Hrs.** - **ft**

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
SILTY CLAY-gray-very stiff *(continued)*				
	5			
-45	8 11	2.3 B	19	
▽				
623.50				
CLAY-gray-very stiff	4			
End Of Boring @ -50.0'. Boring backfilled with cuttings.	5 6	2.1 B	19	
620.50 -50				
-55				
-60				

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The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

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GSI Job No. 16017

SOIL BORING LOG

Date 9/5/17

ROUTE FAP 346 **DESCRIPTION** Pump Station **LOGGED BY** JT

SECTION _____ **LOCATION** SW 1/4, **SEC.** 32, **TWP.** T44N, **RNG.** R12E, 3rd **PM**

COUNTY Lake **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** CME Automatic

STRUCT. NO. _____
Station _____

BORING NO. PS-02A
Station 54+32
Offset 99.00ft Right
Ground Surface Elev. 670.50 ft

Surface Water Elev. n/a ft
Stream Bed Elev. n/a ft

Groundwater Elev.:
First Encounter 627.0 ft ▼
Upon Completion 630.5 ft ▽
After 24 **Hrs.** - ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
8.0" TOPSOIL-black			
669.83			
CLAY LOAM-brown & gray-hard			26
	5		
	6	7.8	16
	7	B	
	5		
	8	8.0	17
-5	11	B	
665.00			
CLAY to CLAY LOAM-gray-stiff to hard			
	7		
	11	9.0	18
	17	B	
	5		
	8	5.5	19
-10	11	B	
	4		
	8	2.8	19
	10	B	
	3		
	3	2.3	19
-15	5	B	
	3		
	5	2.2	18
	7	B	
	3		
	6	1.7	20
-20	7	B	

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
CLAY to CLAY LOAM-gray-stiff to hard *(continued)*			
	3		
	5	2.2	20
	7	B	
	2		
	5	1.8	21
-25	6	B	
	2		
	4	2.6	21
	7	B	
	3		
	4	2.2	22
-30	6	B	
	3		
	4	2.0	23
-35	6	B	
	3		
	5	4.4	16
▽ -40	8	B	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
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SECTION _____ **LOCATION** SW 1/4, **SEC.** 32, **TWP.** T44N, **RNG.** R12E, 3rd **PM**

COUNTY Lake **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** CME Automatic

STRUCT. NO. _____
Station _____

BORING NO. PS-02A
Station 54+32
Offset 99.00ft Right
Ground Surface Elev. 670.50 **ft**

Surface Water Elev. n/a **ft**
Stream Bed Elev. n/a **ft**

Groundwater Elev.:
First Encounter 627.0 **ft** ▼
Upon Completion 630.5 **ft** ▽
After 24 **Hrs.** - **ft**

DESCRIPTION	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
CLAY to CLAY LOAM-gray-stiff to hard *(continued)*				
	▼	4		
		6 11	2.3 P	19
	-45			
		4		
End Of Boring @ -50.0'. Boring backfilled with cuttings.	620.50 -50	6 8	2.6 B	17
	-55			
	-60			

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The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)