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**ROADWAY GEOTECHNICAL REPORT**  
**Deerpath Road at FAP 346 (US Route 41) and the C&NW RR**  
**IDOT Project D-91-086-16, PTB 178-001, Contract 62B65**  
**City of Lake Forest**  
**Lake County, Illinois**

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**Prepared for:**

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**Prepared by:**

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**JOB NO. 16017**

**08/10/18**

August 10, 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: Roadway Geotechnical Report (RGR)  
Deerpath Road at FAP 346 (US Route 41) and the C&NW Railroad  
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 roadway reconstruction for the Deerpath Road near US 41 and the C&NW Railroad located in Lake Forest, Illinois. Listed below are the fourteen (14) borings and twelve (12) pavement cores completed at the site by Geo Services, Inc. (GSI) that were used in formulating our analysis for this RGR report:

- Detention Pond (DP) borings – DP-01 to DP-06
- Railroad (RR) borings – RR-01 and RR-02
- Jacking Pit (JP) boring – JP-01
- Storm Sewer (SS) borings – SS-01 to SS-03
- Retaining Wall (RW) borings – RW-01 and RW-02
- Pavement Cores (PC) – PC-01 to PC-12

Copies of these boring logs, along with a boring location diagram, are included in this report.

If there are any questions with regard to the information submitted in this report, or if we can be of further assistance to you in any way, please do not hesitate to contact us.

Very truly yours,

GEO SERVICES, INC.

  
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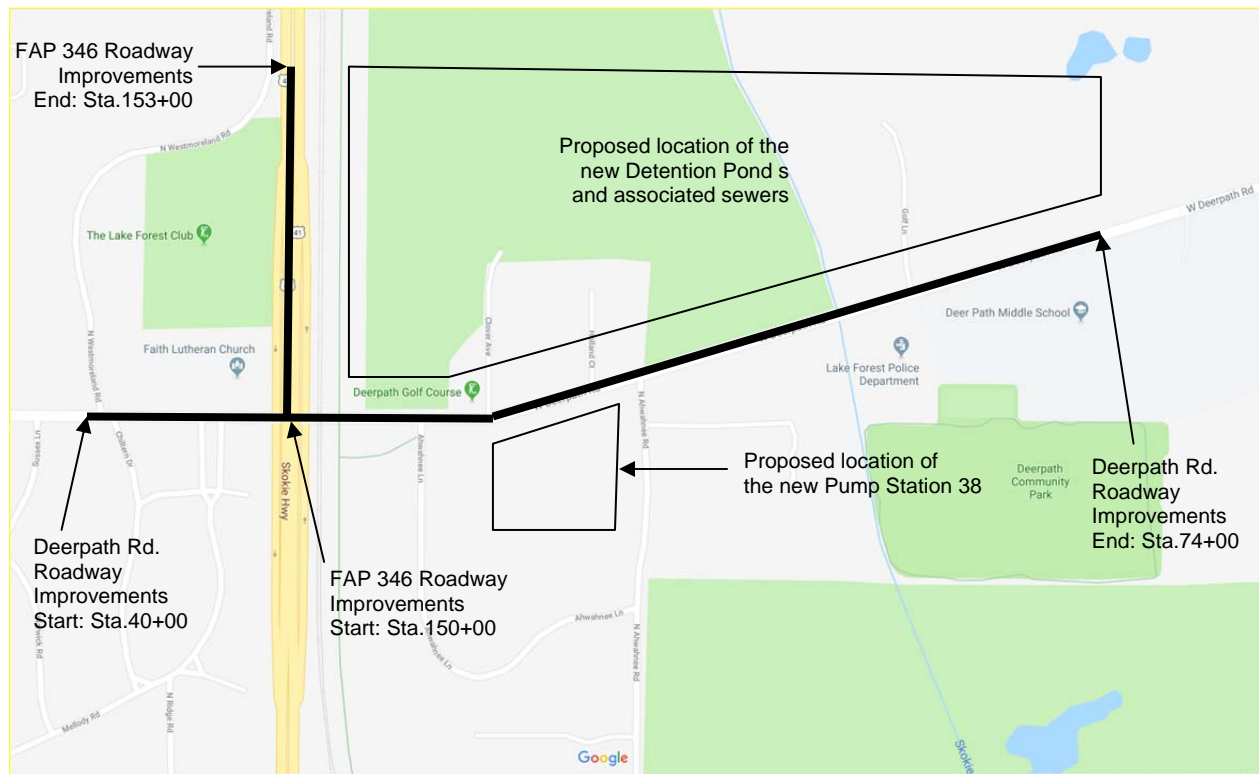
## **SECTION 01: INTRODUCTION**

This report presents the results of the geotechnical investigation for the proposed roadway improvements under IDOT Job No. D-91-086-16, located along Deerpath Road near FAP 346 (US Route 41) and the C&NW railroad from approximate Station 40+00 to 74+00, and along FAP 346 (US Route 41) from approximate Station 150+00 to 153+00 in Lake County, Illinois. Geo Services, Inc. (GSI) selected the boring locations in cooperation with Knight E/A. The results of the fourteen (14) soil borings (DP-01 to DP-06, RR-01 and RR-02, JP-01, RW-01 and RW-02 and SS-01 to SS-03) and twelve (12) pavement cores (PC-01 to PC-12) completed by GSI, along with a site location map, soil boring location diagrams, and laboratory test results are included with this report.

The proposed improvements along Deerpath Road will begin near the intersection of Deerpath Road and FAP 346 (US Route 41) and the C&NW Railroad (Station 40+00) extending to approximately 0.6 miles east to the intersection of Deerpath Road and Ahwanee Road (Station 74+00), and along the intersection of FAP 346 (US Route 41) and Deerpath Road (Station 150+00) extending to approximately 300 feet north of the intersection. The project location is shown on the site map on the following page. The proposed improvements will consist of roadway resurfacing, and the construction of two storm water detention basins with associated sewer pipelines to alleviate the ongoing flooding issue during heavy rainfall events, especially in the underpass of Deerpath Road beneath FAP 346 (US Route 41) and C&NW Railroad. The proposed centerline grade is assumed to be similar to the existing grade for the majority of the alignment.

Note that the proposed roadway, detention pond and sewer plans, profiles and cross-section drawings were not provided at the time of this report preparation.

STATE OF ILLINOIS  
DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
PLANS FOR PROPOSED  
Along Deerpath Road (Sta. 40+00 to 74+00)  
Along FAP 346/US Route 41 (Sta. 150+00 to 153+00)  
Roadway Improvements  
Lake County, IL.  
GEO SERVICES JOB No.16017



## **SECTION 02: SUBSURFACE INVESTIGATION PROCEDURES**

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 Geo Services, Inc. personnel at the proposed locations using a GPS device. Elevations were taken from topographic information provided by Knight E/A and are shown on the boring logs.

The borings were drilled in the months of September, 2017 and January, 2018 (see boring logs for specific dates). Boring were performed with an ATV or truck-mounted drilling rig equipped with a CME automatic hammer, and were advanced by means of hollow stem augers or rotary drilling techniques. Representative soil samples were obtained employing split spoon sampling procedures in accordance with AASHTO Method T-206. Samples obtained in the field were returned 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.

Upon completion of the drilling (at 20 feet depth) and sampling at boring DP-05, a 2-inch diameter PVC ground water monitoring well was installed. The well consists of a 10-foot long 0.010 slot Schedule 40 PVC well screen with flush coupled PVC riser pipe, and a flush mounted steel cover. Sand was filled around and 2 feet above the screen. Also, 2 feet of bentonite was used to seal the sand above.

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

Pavement cores were also performed within the project limits using a 4-inch diameter diamond bit core barrel and Milwaukee coring machine. The cores were extended through the existing pavement to the underlying base materials. Thicknesses of the pavement cores were recorded before core holes were patched. Results are included with this report and can be found in the Pavement Core Summary found in Appendix D of the report.

## **SECTION 03: LAB TESTING PROGRAM**

The soil testing program included performing water content, density and either unconfined compression and/or calibrated penetrometer tests on the 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.

In addition to the regular lab testing program, Atterberg Limits (AASHTO T-89/90) and Particle Size Analysis (AASHTO T-88) tests were performed on select samples from the borings. The tests were performed upon representative portions of the samples obtained in the field and results can be found in Appendix E. Table below is a summary of the lab data taken from the boring performed for this report.

**Table 1 – Lab Data Summary**

Boring No.	Sample Depth (feet)	Material Description	LL	PL	PI	% Gravel	% Sand	% Silt & Clay
JP-01	3.5 to 5.0	Silty Clay (A-7)	42	22	20	0.0	0.4	99.6
RP-01	18.5 to 20.0	Clay (A-6)	32	17	15	5.6	10.3	84.1
SS-01	3.5 to 5.0	Silty Clay (A-7)	43	21	22	0.6	9.4	90.0
SS-03	3.5 to 5.0	Silty Loam (A-4)	21	16	5	1.1	21.2	77.7

## **SECTION 04: 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. Variation in soil conditions between boring locations should be expected during construction.

Surface conditions at the boring locations taken along the roadway, paved-shoulder areas of FAP 346 (US Route 41) consisted of 13 to 14 inches of asphalt with 10 inches of gravel. Surface conditions at the boring locations drilled at non-paved, off-shoulder areas consisted of 8 to 14 inches of topsoil. The sub-soils generally can be categorized as stiff to hard clay to clay loam fill and native soils with a strata of granular (medium dense clayey sand and gravel) strata generally with thickness of 6 to 7 feet. The borings generally indicated Qu values between 0.5 and 8.8 tons per square foot (tsf) with an average Qu of about 3.0 tsf and moisture contents in the high teens to high twenties.

## **SECTION 05: GROUND WATER CONDITIONS**

Three of the total borings (4 out of 12) used for this investigation encountered groundwater at elevations ranging from 631 to 664 feet, either during drilling or after the drilling completion. Where borings extended deep enough to encounter the gray colored soils that typically represent a saturated condition and therefore the estimated long term water level, the elevation of the color change was approximately in the range of 644 to 651 feet below existing ground surface. Fluctuations in the amount of water accumulated and in the hydrostatic water table can be anticipated depending upon variations in precipitation and surface runoff.

In addition to the during drilling ground water levels observed, groundwater monitoring well was installed at DP-05 borehole (at the existing golf course area) after drilling and sampling to provide ground water level readings. The results of the monitoring well at boring DP-05 are noted in the table below.

**Table 2 – Water Level Data (Elevation in feet)**

Date	Well at DP-05 Elevation (depth in feet)
9/12/17	Dry
12/12/17	657.6 (-2.5)
8/10/18	651.8 (-8.3)

## **SECTION 06: PAVEMENT CONDITIONS**

Pavement cores were performed along the shoulders of the Deerpath Road and FAP 346 (US Route 41) roadways. In general, pavement cores consisted of 2.5 to 16.25 inches of poor to well consolidated asphalt pavement overlying 7.25 to 10 inches of well consolidated concrete pavement.

Pavement Core Summary is included with this report and can be found in Appendix D of the report.



## **SECTION 07: ANALYSIS**

### **Settlement (for the Roadways)**

For the existing roadway, the proposed centerline grades for the majority of the alignment are assumed to match or be similar to existing grade. Assuming that the roadway will only be resurfaced, very little or no embankment fills are to be placed throughout the alignment for the improved roadways. No settlement issues were identified.

### **Slope Stability (for the Roadways)**

Assuming the majority of the roadway alignment will match the existing grade or will have little or no fill, the proposed roadways should have side slopes of 3:1 (horizontal to vertical) or flatter. For the proposed cut slopes, and the stiff to hard clay soils encountered in these borings, slope stability concerns should not be expected.

### **Slope Stability (for the Proposed Detention Ponds)**

Two (2) detention ponds are proposed to be constructed in the existing golf course area located in the northeast quadrant of Deerpath Road and Skokie Valley Bike Path located east of FAP 346 (US Route 41) and the C&NW Railroad. For the detention pond cut slopes, the side slopes should be constructed at 3:1 slope (horizontal to vertical ratio). With the recommended cut slopes of 3:1 (horizontal to vertical ratio), and the stiff to hard clay soils encountered in the detention pond borings (DP-01 thru DP-06), the slope stability factor of safety (FOS) is expected to be 1.7 or greater. Slope stability concerns should not be expected.

Please note that the proposed detention pond plans and cross-section drawings were not received at the time of the report preparation; Geo Services, Inc. will review the proposed sections and will update this report once the detention pond drawings are provided.

### **Drainage Conditions**

Boring logs can be found in Appendix C of this report. The upper strata soils encountered fill or native cohesive soils (clay and clay loam). Moisture contents for the upper fill soils were typically in the percentage range of mid-teens to low-twenties. According to the IDOT Geotechnical Manual (Section 3.1.4, Table 3-1), these soils would classify as having "fair" drainage, with the exception of an area at boring SS-03, to which soils would classify as having "poor" drainage.

Assuming that no new embankment fill will be added and the existing curb and gutter section is greater than 0.5% grade slope, the drainage conditions is rated as "fair to good".

## **SECTION 08: RECOMMENDATIONS**

### **General Recommendations**

The roadways will include pavement resurfacing, construction of new combination concrete curb and gutter, sidewalk replacement, as well as, installation of new storm sewer lines in limited sections. Based on the results of the nearest soil boring information (stiff to very stiff clay to clay loam), the subgrade should provide adequate support for the resurfaced roadway, new curbs and the new sidewalk and no areas of remedial treatment were identified. In areas where full depth patching is deemed necessary, the exposed subgrade should be observed by a geotechnical engineer and any topsoil, organic, unsuitable or deleterious material removed.

For estimation purposes, we recommend a nominal 10% remedial treatment of the project roadway alignment (assuming 12 inches for quantity purposes) to be included in the drawing plans and specifications.

Undercutting, if any, should be performed in such a manner as to minimize disturbance to the undercut subgrade. Heavy equipment traffic directly on the undercut subgrade should be minimized. The actual need for the recommended treatment should be determined in the field at the time of construction based on guidelines presented in the Illinois Department of Transportation Geotechnical Manual under the direction of a licensed geotechnical engineer. Evaluation of soils in the field should be performed based on the guidelines presented in the IDOT Subgrade Stability Manual.

Prior to placing any fill at the site, it is recommended that the exposed surface at or near grade be proofrolled with the heaviest available equipment to determine if there are any localized deposits of soft or unsuitable materials. During the proofrolling procedure, the exposed surface is rolled with the heaviest piece of construction equipment available at the site, such as a heavily loaded tandem axle dump truck having a gross weight of not less than 25 tons. Any such deposits, as observed by deflection of the subgrade under the wheels of the proofrolling equipment, should be removed and replaced with an approved fill free of organic matter and debris. The clay, clay loam and sandy/silty clay loam soils are sensitive to moisture changes and some softening/disturbance of the exposed soils should be expected following periods of precipitation. The remediation may include undercutting and placement of a stabilization stone such as IDOT gradation CA-1 or PGEs materials or approved fill material.

In addition, borrow and excavation material should be in accordance with Section 6.2 of the IDOT Geotechnical Manual. In particular, soils shall be tested and conform to the

required testing and permissible limits as defined in the following table (taken from Table 6-1 in the IDOT Geotechnical Manual). Materials that do not meet the permissible limits should be confined to the embankment core encompassed with at least 24-inches of cover material, which meet testing requirements in the following Table 3.

**Table 3 – Requirements of Borrow Soils for Top 24-in Subgrade**

Required Test	AASHTO Method	Permissible Limit
SDD (at OMC)	T-99 (Method C)	90 pcf min *
Organic Content	T-194	10% max
Percent Silt and Fine Sand	T-88	65% max **
PI	T-90	12% min
LL	T-89	50% max
Shear Strength © at 95% SDD	T-208 or T-234	1,000 psf min ***
SO <sub>3</sub> ****	ASTM C-618	5% max

- \* As Per Standard Specification
- \*\* Frost Susceptibility Criteria
- \*\*\* For Engineered Embankments which are greater than 15ft in height or greater
- \*\*\*\* Only for CCB

Fill materials placed at the site should consist of an approved, inorganic material, compacted to a minimum 90% of AASHTO T-99 (ASTM D-698), standard proctor method. Moisture levels for fill material should be maintained within a maximum  $\pm 3\%$  of the optimal moisture content or as directed by the engineer.

Construction of the proposed roadway improvements should be performed in accordance with the current Illinois Department of Transportation (IDOT) “Standard Specifications for Road and Bridge Construction. In particular, refer to Section 202, “Earth and Rock Excavation”, Section 205, “Embankment” and Section 301, “Subgrade Preparation”.

**Drainage Recommendations**

Underdrains are required to properly drain the aggregate subgrade, and at low areas in the profiles, especially at the underpass of Deerpath Road beneath FAP 346 (US Route 41) and the C&NW Railroad. Transverse underdrains should also be installed at an interval of 300 feet between low points, except at high points. The drains should be 4-inch diameter, placed at a depth of 30 inches and installed in accordance with Check Sheet No. 19 of the Supplemental Specifications and Recurring Special Provisions adopted January 1, 2013.

Efforts should be made to keep exposed subgrade areas dry during construction. Adequate drainage should be provided at the site to minimize any increase in moisture content of the foundation and pavement subgrade soils. All pavements should be sloped away from the structures to prevent ponding of water around them. The final site drainage should also be designed such that runoff onto adjacent properties is controlled properly.

### **Jacking Pit Recommendations**

We understand that it is planned to install a bypass sewer (draining runoff from west of FAP 346 (US Route 41), outlets to the proposed detention pond) from the using jacking construction techniques to limit interruptions of the crossing C&NW rail lines. Based on the soil conditions at borings JP-01, RR-01, and RP-01, the proposed pipeline will be situated in the stiff clay soils as encountered in the boring logs. The clay soils will provide adequate support for the pipeline at the estimated invert elevations (about 10 feet below ground level), and may be designed using a maximum net allowable soil bearing pressure of 2,500 psf. The net allowable soil bearing pressure refers to the pressure which may be transmitted to the foundation soils in excess of the final minimum surrounding overburden pressure

However, boring RR-02 had encountered medium dense sandy clay loam fill soils at shallower depths at approximate elevation 663 to 666 feet. In this instance where excavations encounter granular soils, it is possible that a quick or semi-quick condition may occur at the base of the excavation following the release in confining overburden pressure and from construction activity. If such a condition is encountered, the excavation should be thoroughly dewatered and any soils loosened as a result of this quick or semi-quick condition should be removed and replaced with a compacted crushed stone.

Adhesion values to use for jacking pressure requirements can be found in Table 4 of this report in the **Lateral Soil Recommendations** section of this report.

Due to the nature of the jacked-tunnel construction, we anticipate that there will be some settlement beneath the tracks of the C&NW Railroad during jacking operations. The amount of settlement will be highly dependent on construction techniques for soil excavation during tunnel jacking. We recommend that the contractor monitor track elevations and settlements during and immediately after the completion of construction activities for the tunnel and that a plan for leveling of the ballast to maintain the tracks be implemented if and when unacceptable amounts of track settlement occur.

### **Sewer Construction Recommendations**

New sewer pipes are proposed to outlet runoff to the proposed detention ponds to alleviate flooding problems during heavy rainfall event at the underpass of Deerpath Road beneath US 41. The new sewer pipes are estimated to bear at approximately 10 to 15 feet below existing grade. Based on the soil conditions at borings SS-01, SS-02, and SS-03, the proposed pipeline will typically bear in stiff to hard clay soils as encountered in the boring logs. The structures located within these soils at the proposed invert elevations may be designed using a net allowable soil bearing pressure of 3,000 psf.

For the cohesive soil conditions as encountered in the borings, we expect that a trench/utility box can be used for installation of the sewers. If the excavations intercept sand or silt layers, it may be necessary to use the sand-box method where these soils are present. The sand-box method involves backfilling the pipe laid in the trench box to within 4 feet of existing grade prior to excavating for the next trench box movement, keeping the excavation for the next trench box movement to a minimum beyond the sides of the trench box, moving the trench box as soon as the excavation is performed and backfilling the annular space between the trench box and surrounding earth with trench backfill immediately after the trench box is moved. In addition, all excavations should be backfilled to within 4 feet of existing grade at the end of each work day. If silt / sand soils are intercepted in the sewer trench excavation (though it is not expected), it is also possible for localized ground loss to occur during excavation and provisions should be made for slightly wider excavations in these areas.

Deeper excavations, such as for the new Type A and Type B manhole structures, may require the use of temporary sheet piling or a soldier pile and lagging retention system. The limits of sheet piling or other earth retention measures required will depend upon the specific subsurface conditions encountered at the time of construction and the quality of construction operations as they relate to dewatering and excavation.

Based on the predominately cohesive soil profile encountered, the estimated depth of the water table and the proposed pipe invert elevations, significant problems resulting from groundwater infiltration during construction are generally not anticipated. Standard sump pump and pit procedures should be adequate to dewater the excavations.

### **Detention Pond Construction Recommendations**

The results of the borings indicate that the construction of a detention pond will be mainly in clay soils that extend below the water table.

The predominately stiff to hard clay soil profile at borings DP-01 to DP-06 are considered suitable for the proposed detention ponds to approximately 10 feet below grade. Slopes of 3:1 (horizontal to vertical) in the stiff clay soils are typically considered safe for long-term stability. Construction of the detention ponds should include the

installation of a clay liner to reduce seepage out of the ponds. We recommend a minimum compacted clay liner of 2 to 3 feet thick be provided.

Dewatering with multiple sump pump and pit procedures or possibly a system of well points will be required to temporarily lower the groundwater in the pond area to allow for construction “in the dry”.

Surface runoff can cause significant erosion in the slope. The top of the embankment slope must be graded away from the pond to prevent surface water from draining down slope. To prevent hydrostatic pressure from developing below the clay liner and causing “blow-outs” when the ponds are drained for maintenance, a drainage layer should be provided and outlet to the storm water system.

**Lateral Soil Recommendations**

Table 4 contains a summary of lateral soil parameters to be used for jacking-pit design and design of temporary shoring designs for the pipeline construction.

**Table 4 – Soil Parameters for Lateral Resistance**

Material (Elevation, feet)	Moist Unit Weight (pcf)	Drained Friction Angle (°)	Undrained Cohesion (psf)	Lateral Modulus of Subgrade Reaction (pci) <sup>1</sup>	Active Earth Pressure Coefficient k <sub>a</sub>	Strain <sup>1</sup>	Adhesion (psf)
Medium Stiff to Stiff Clay to Clay Loam (668 to 653)	120	26	750	100	0.36	0.010	600
Very Stiff to Hard Clay (653 to 640)	125	28	3,000	1,000	0.33	0.005	1,000
Medium Dense Clayey Sand and Gravel (640 to 633)	125	28	n/a	120	0.33	--	--
Hard Clay (633 to 616)	130	32	4,000	1,200	0.31	0.005	1,250

Note: 1. Values recommended for use in design from L-pile Software Manual.

he passive earth pressure for the cohesive soils should be determined using the shear strength of the soil, which can be taken as ½ the unconfined strength shown on the boring logs. For granular soils (if any), a passive resistance of 360 pcf can be used.

Allowances should be made for any surcharge loads adjacent to the retaining structure. Heavy construction equipment, building materials, excavated soil, and vehicular traffic should not be allowed within a distance equal to 1/3 the excavation depth from the edge of any excavation.

Where the stability of adjacent existing structures may be impacted by excavation operations, support systems such as shoring, bracing, or underpinning may be required to provide structural stability and to protect personnel working within the excavation. Shoring, bracing, or underpinning required for the project (if any) should be designed by a Structural Engineer (SE) registered in the State of Illinois.

All excavations that extend greater than 4 feet in depth should be designed in accordance with OSHA regulations with properly sloped or braced sides to prevent excavation instability. Stockpiles of material or equipment should not be placed near the top of excavation slopes.

## **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 soils 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

<u>Relative Density</u>	<u>No. of Blows per foot N</u>
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

<u>Consistency</u>	<u>Unconfined Compressive Strength - qu (tsf)</u>
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: Carboly Bit - NX: BX: AX	WO: Wash Out
OS: Osterberg Sampler	

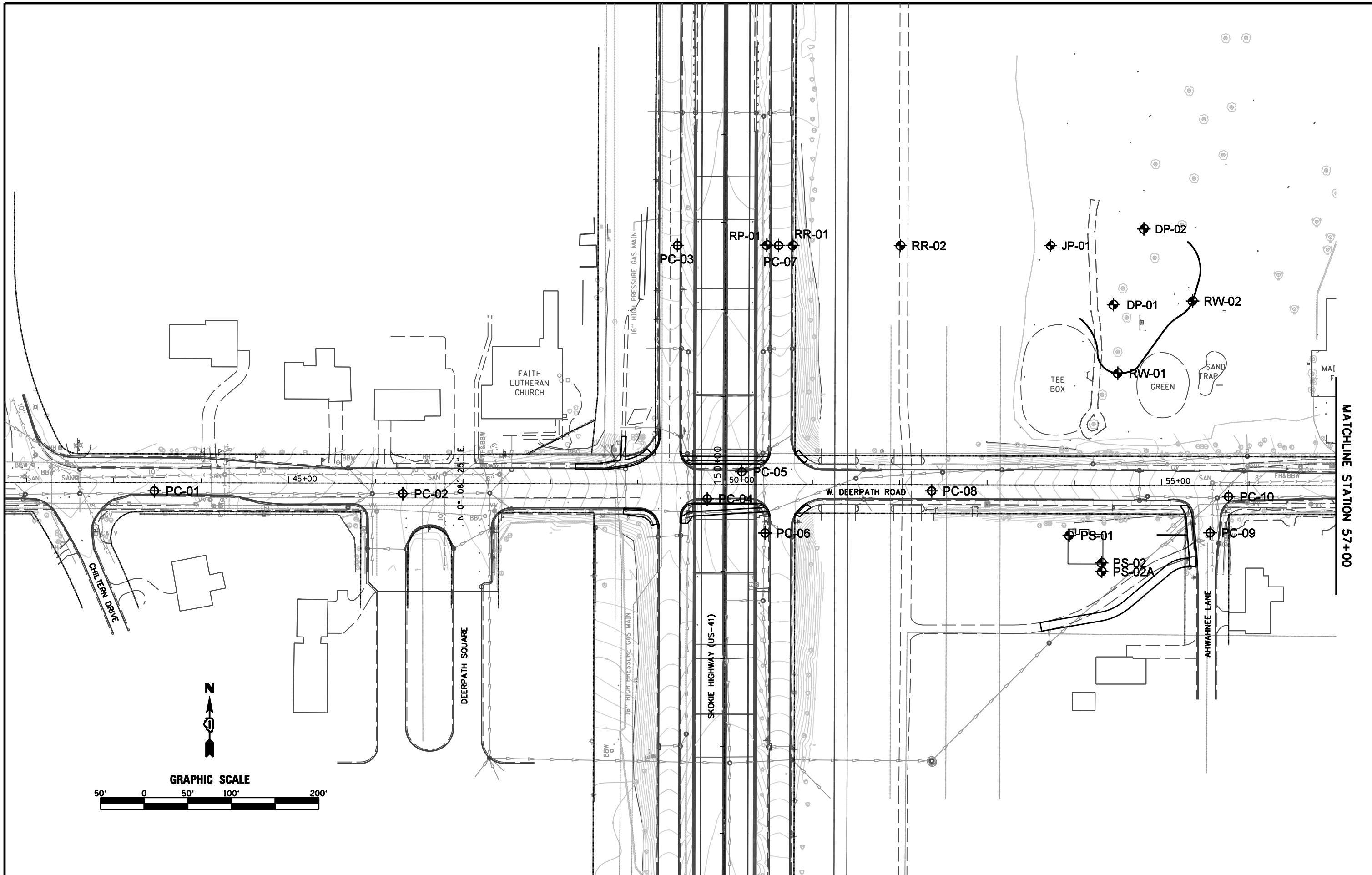
Standard "N" Penetration: Blows per foot of a 140 lb. hammer falling 30" on a 2" O.D. Split Spoon

### 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**



MATCHLINE STATION 57+00

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

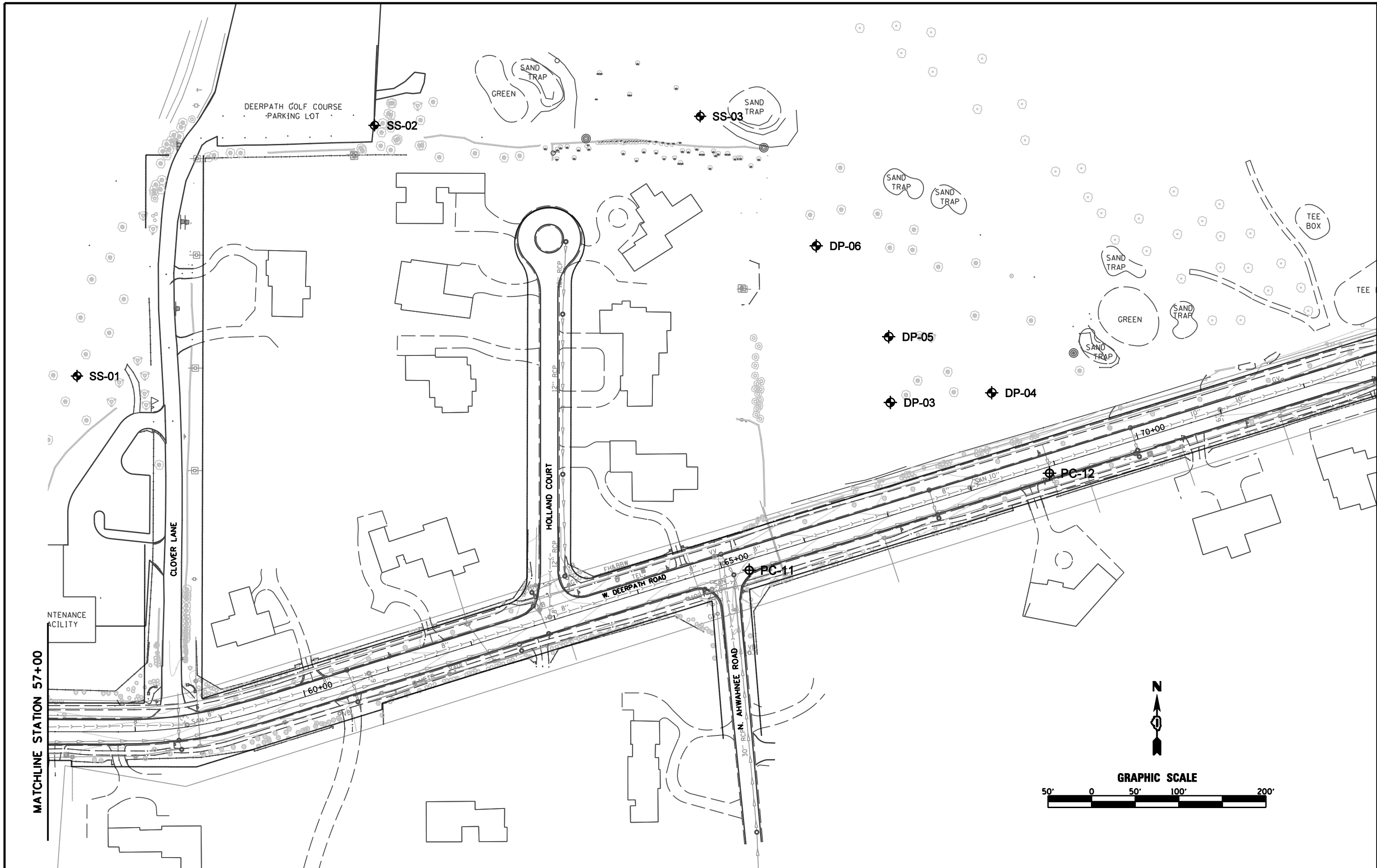
USER NAME : *USER*	DESIGNED - RWC	REVISED -
DRAWN - RWC	REVISOR -	
CHECKED - AJP	REVISOR -	
DATE - 8/1/2018	REVISOR -	

**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	(1305); (21&215)-1	LAKE	2	1
IDOT PROJECT No. D-91-086-16		CONTRACT NO. 62B65		
ILLINOIS FED. AID PROJECT				



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 -	
CHECKED - AJP	REVISED -	
DATE - 8/1/2018	REVISED -	
PLOT SCALE : *SCALE*		
PLOT DATE : *DATE*		

**STATE OF ILLINOIS  
 DEPARTMENT OF TRANSPORTATION**

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

SCALE 1"=100'    SHEET 2 OF 2 SHEETS    STA. 57+00 TO STA. 72+00

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
346	(1305); (21&215)-1	LAKE	2	2
IDOT PROJECT No. D-91-086-16			CONTRACT NO. 62B65	
ILLINOIS FED. AID PROJECT				

## **APPENDIX C**

### **SOIL BORING LOGS AND MONITORING WELL LOG**

# SOIL BORING LOG

ROUTE FAP 346 DESCRIPTION Detention Pond LOGGED BY NM

SECTION \_\_\_\_\_ LOCATION NW 1/4, SEC. 32, TWP. T44N, RNG. R12E, 3<sup>rd</sup> PM

COUNTY Lake DRILLING METHOD Hollow Stem Auger HAMMER TYPE Diedrich Automatic

STRUCT. NO. Station	DEPTH H (ft)	BLOW S (/6")	UCS Qu (tsf)	MOIST T (%)	Surface Water Elev. Stream Bed Elev.	DEPTH H (ft)	BLOW S (/6")	UCS Qu (tsf)	MOIST T (%)
					n/a ft n/a ft				
BORING NO. <u>DP-01</u> Station <u>54+44</u> Offset <u>206.60ft Left</u> Ground Surface Elev. <u>666.50</u> ft					Groundwater Elev.: First Encounter <u>Dry</u> ft Upon Completion <u>Dry</u> ft After _____ Hrs. _____ ft				
12.0" TOPSOIL-black 665.50				42	CLAY-brown & gray-stiff to hard (continued)				
CLAY-brown & gray-stiff to hard		2					2		
		2	1.5	23			3	1.9	21
		2	B				5	B	
		3					2		
		3	2.3	20			3	1.6	23
	-5	3	P			-25	5	B	
becoming gray @ -5.5'		2					3		
		5	4.4	17			4	1.8	19
		7	B				5	B	
		3					3		
		5	1.9	17			4	2.7	22
	-10	8	B		End Of Boring @ -30.0'. Boring backfilled with cuttings.	636.50	6	B	
		4							
		7	4.9	17					
		9	B						
		3							
		5	3.5	19					
	-15	6	B			-35			
		3							
		4	2.8	25					
		6	B						
		3							
		4	2.7	20					
	-20	6	B			-40			

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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)

# SOIL BORING LOG

ROUTE FAP 346 DESCRIPTION Detention Pond LOGGED BY NM

SECTION \_\_\_\_\_ LOCATION NW 1/4, SEC. 32, TWP. T44N, RNG. R12E, 3<sup>rd</sup> PM

COUNTY Lake DRILLING METHOD Hollow Stem Auger HAMMER TYPE Diedrich Automatic

STRUCT. NO. Station	DEPTH H (ft)	BLOW S (/6")	UCS Qu (tsf)	MOIST T (%)	Surface Water Elev. Stream Bed Elev.	DEPTH H (ft)	BLOW S (/6")	UCS Qu (tsf)	MOIST T (%)
					n/a ft n/a ft				
BORING NO. <u>DP-02</u> Station <u>54+79</u> Offset <u>293.50ft Left</u> Ground Surface Elev. <u>667.80</u> ft					Groundwater Elev.: First Encounter <u>649.3</u> ft ▼ Upon Completion <u>646.8</u> ft ▼ After _____ Hrs. _____ ft				
14.0" TOPSOIL-black				24	CLAY to CLAY LOAM-brown & gray-medium stiff to hard (continued)		4		
	666.63	2					5	2.3	18
CLAY to CLAY LOAM-brown & gray-medium stiff to hard		3	0.8	29			7	B	
		2					3		
		4	2.6	21			6	2.2	20
	-5	4	B			-25	7	B	
becoming gray @ -5.5'		3					3		
		6	4.9	16			5	2.2	24
		7	B				6	B	
		3					4		
		6	5.8	17	End Of Boring @ -30.0'. Boring backfilled with cuttings.		4	2.6	23
	-10	9	B			637.80 -30	6	B	
sand seams from -11.0' to -12.5'		6							
		8	2.3	17					
		10	P						
		3							
		6	4.0	16					
	-15	8	B			-35			
		3							
		6	2.2	19					
		7	B						
		3							
		4	2.4	19					
	-20	6	B			-40			

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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)

# SOIL BORING LOG

ROUTE FAP 346 DESCRIPTION Detention Pond LOGGED BY NM

SECTION \_\_\_\_\_ LOCATION NE 1/4, SEC. 32, TWP. T44N, RNG. R12E, 3<sup>rd</sup> PM

COUNTY Lake DRILLING METHOD Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. Station	DEPTH H (ft)	BLOW S (/6")	UCS Qu (tsf)	MOIST T (%)	Surface Water Elev. Stream Bed Elev.	DEPTH H (ft)	BLOW S (/6")	UCS Qu (tsf)	MOIST T (%)
					n/a ft n/a ft				
BORING NO. <u>DP-03</u> Station <u>67+41</u> Offset <u>124.20ft Left</u> Ground Surface Elev. <u>659.50</u> ft					Groundwater Elev.: First Encounter <u>645.5</u> ft ▼ Upon Completion <u>642.0</u> ft ▼ After _____ Hrs. _____ ft				
12.0" TOPSOIL-black 658.50				37	CLAY to CLAY LOAM-brown & gray-medium stiff to hard (continued)		3		
CLAY to CLAY LOAM-brown & gray-medium stiff to hard		2					6	1.7	16
		3	B				6	B	
		2					3		
		3	1.2	23			5	2.3	16
		-5	3	B			-25	9	B
		6					4		
		10	7.2	17			5	1.6	17
		12	B				6	B	
		3					3		
	becoming gray @ -8.0'		6	4.4	15		5	1.4	21
	-10	9	B		End Of Boring @ -30.0'. Boring backfilled with cuttings.	629.50	-30	6	B
	3								
	3	1.5	15						
	6	B							
	3								
	4	1.8	17						
	-15	4	P				-35		
	3								
	3	0.8	19						
	6	B							
	3								
	4	1.8	19						
	-20	5	B				-40		

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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)



# SOIL BORING LOG

ROUTE FAP 346 DESCRIPTION Detention Pond LOGGED BY NM

SECTION \_\_\_\_\_ LOCATION NE 1/4, SEC. 32, TWP. T44N, RNG. R12E, 3<sup>rd</sup> PM

COUNTY Lake DRILLING METHOD Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO.	DEPTH	BLOW	UCS	MOIST	Surface Water Elev.	DEPTH	BLOW	UCS	MOIST
Station	(ft)	(/6")	(tsf)	(%)	(ft)	(/6")	(tsf)	(%)	(ft)
DP-04					n/a				
68+55					n/a				
100.50ft Left									
658.70									

DESCRIPTION	DEPTH (ft)	BLOW (/6")	UCS (tsf)	MOIST (%)	DEPTH (ft)	BLOW (/6")	UCS (tsf)	MOIST (%)
10.0" TOPSOIL-black	0			30				
CLAY to CLAY LOAM-brown & gray-stiff to hard	2		1.8	21	4		1.9	17
	3		P		7		B	
	2				4			
	4		3.3	17	4		1.3	26
	-5		B		-25		B	
	2				5			
	3		3.2	16	6		2.1	18
	6		B		9		B	
becoming gray @ -8.0'	3				4			
	6		5.3	15	6		2.6	18
	-10		B		8		B	
					628.70			
	4				-30			
	6		3.2	16				
	7		B					
	2							
	3		1.9	18				
	-15		B		-35			
	4							
	4		1.4	17				
	7		B					
	2							
	3		1.8	17				
	-20		B		-40			

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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)

# SOIL BORING LOG

ROUTE FAP 346 DESCRIPTION Detention Pond LOGGED BY NM

SECTION \_\_\_\_\_ LOCATION NE 1/4, SEC. 32, TWP. T44N, RNG. R12E, 3<sup>rd</sup> PM

COUNTY Lake DRILLING METHOD Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. Station	DEPTH H (ft)	BLOW S (/6")	UCS Qu (tsf)	MOIST T (%)	Surface Water Elev. Stream Bed Elev.	DEPTH H (ft)	BLOW S (/6")	UCS Qu (tsf)	MOIST T (%)
					n/a ft n/a ft				
BORING NO. <u>DP-05</u> Station <u>67+61</u> Offset <u>196.80ft Left</u> Ground Surface Elev. <u>660.10</u> ft					Groundwater Elev.: First Encounter <u>Dry</u> ft Upon Completion <u>Dry</u> ft After _____ Hrs. _____ ft				
14.0" TOPSOIL-black				26	CLAY to CLAY LOAM-brown & gray-stiff to hard (continued)		3		
658.93		2					5	1.9	20
CLAY to CLAY LOAM-brown & gray-stiff to hard		2	1.1	20			6	B	
		3	B						
		3					3		
		3	2.3	18			5	3.3	21
	-5	3	B			-25	8	B	
		5					4		
		2	7.3	15			5	2.7	17
		9	B				9	B	
becoming gray @ -8.0'		4					5		
		5	3.2	16	End Of Boring @ -30.0'. Boring backfilled with bentonite to -20.0'. Set 20.0' of 2.0" PVC.	630.10	8	5.8	15
	-10	8	B			-30	13	B	
		3							
		4	2.7	16					
		5	B						
		3							
		4	1.7	17					
	-15	5	B			-35			
		4							
		5	1.9	15					
		7	B						
		7							
		7	1.5	17					
	-20	7	P			-40			

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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)

# Monitoring Well Installation Record

GSI Job No.: 16017  
 Installation Date: 9/8/2017  
 Drilling Method: Hollow Stem Augers  
 Station: 67+61  
 Offset: 196.80' Left

Well No.: **DP-05**  
 Project Name: IDOT Pump Station 38, Lake Forest, Illinois  
 Northing: 2033445.5  
 Easting: 1113411.8

Elevation

660.1 Top of Protective Casing  
659.6 Top of Riser Pipe  
659.3 Ground Surface  
659.3 Top of Annular Sealant

Annular Space Details

Type of Surface Seal: Portland Cement Concrete  
 Type of Annular Sealant: Portland/Bentonite Grout  
 Type of Bentonite Seal (Granular/Pellet): 1/4" Pellets  
 Type of Sand Pack: No. 5 Silica Sand

Well Construction Materials

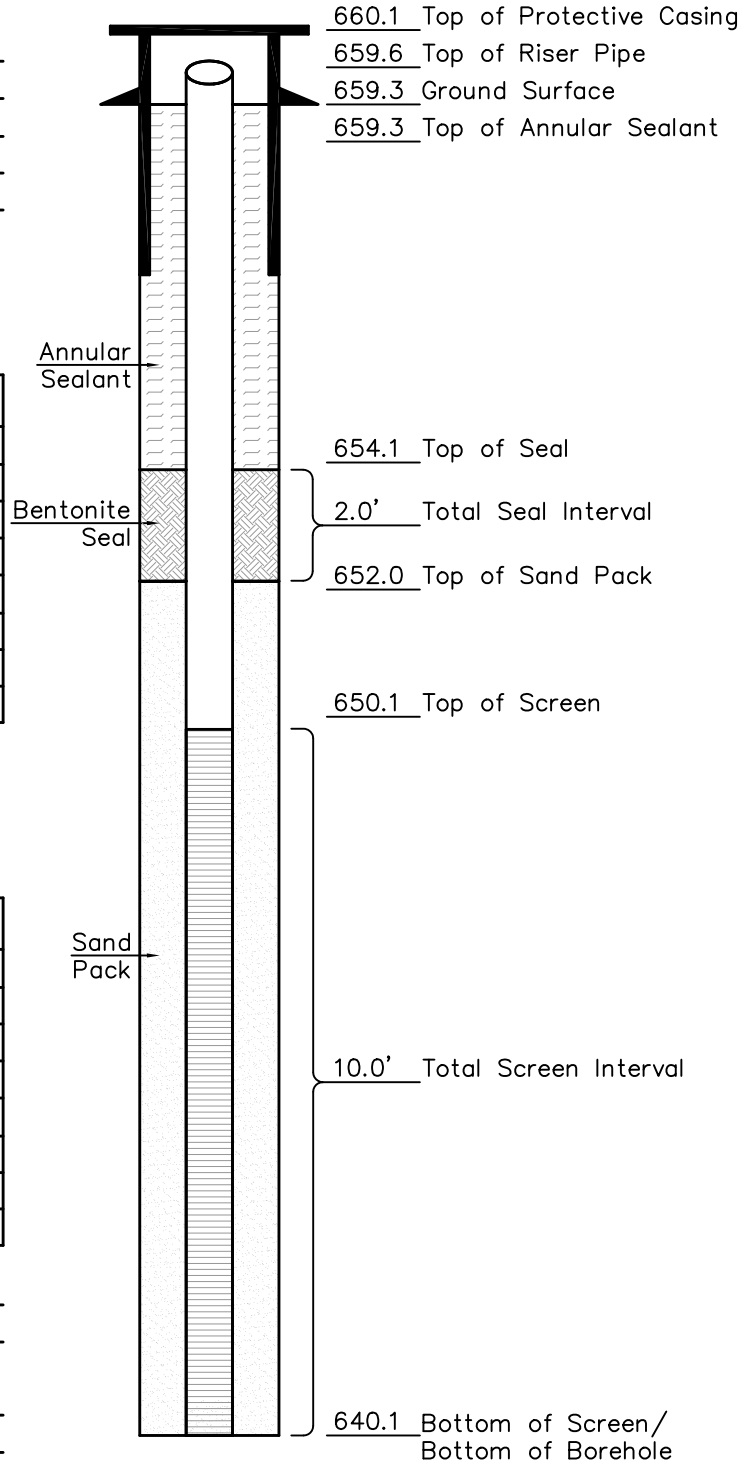
Item	PVC (Specify Type)	Other (Specify Type)
Riser Coupling	Threaded	
Riser Pipe Above W.T.	Schedule 40	
Riser Pipe Below W.T.	Schedule 40	
Screen	Schedule 40	
Coupling Joint (Screen to Riser)	Threaded	
Protective Casing		Steel Handhole
Bottom Plug	Schedule 40	
Well Cap	Locking	

Measurements

Item	Measurement
Riser Pipe Length	n/a
Screen Length	10.0'
Screen Slot Size	10 Slot
PVC Pipe Diameter	2"
Protective Casing Length	n/a
Depth To Water	n/a
Elevation Of Water	Dry
Bottom Plug	Yes

Comments: Screen plug rests on bottom of borehole.

Completed By: RWC



# SOIL BORING LOG

ROUTE FAP 346 DESCRIPTION Detention Pond LOGGED BY NM

SECTION \_\_\_\_\_ LOCATION NE 1/4, SEC. 32, TWP. T44N, RNG. R12E, 3<sup>rd</sup> PM

COUNTY Lake DRILLING METHOD Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. Station	DEPTH H (ft)	BLOW S (/6")	UCS Qu (tsf)	MOIST T (%)	Surface Water Elev. Stream Bed Elev.	DEPTH H (ft)	BLOW S (/6")	UCS Qu (tsf)	MOIST T (%)
					n/a ft n/a ft				
BORING NO. <u>DP-06</u> Station <u>67+13</u> Offset <u>321.00ft Left</u> Ground Surface Elev. <u>661.20</u> ft					Groundwater Elev.: First Encounter <u>Dry</u> ft Upon Completion <u>Dry</u> ft After _____ Hrs. _____ ft				
14.0" TOPSOIL-black				20	CLAY to CLAY LOAM-brown & gray-stiff to hard (continued)				
	660.03						3		
CLAY to CLAY LOAM-brown & gray-stiff to hard		2					6	1.4	17
		4	5.7	15			6	B	
		6	B						
		4					5		
		6	6.0	15			5	1.3	20
	-5	8	B			-25	6	B	
		5					5		
		10	7.3	16			6	3.8	17
		10	B				7	B	
becoming gray @ -8.0'		3					5		
		5	3.2	16	End Of Boring @ -30.0'. Boring backfilled with cuttings.		6	2.3	19
	-10	7	B			631.20 -30	6	B	
		3							
		4	1.9	17					
		6	B						
		2							
		4	1.8	17					
	-15	5	B			-35			
		5							
		5	2.2	15					
		7	B						
		3							
		4	1.4	16					
	-20	5	B			-40			

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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)

# SOIL BORING LOG

ROUTE FAP 346 DESCRIPTION Jacking Pit LOGGED BY NM

SECTION \_\_\_\_\_ LOCATION NE 1/4, SEC. 32, TWP. T44N, RNG. R12E, 3<sup>rd</sup> PM

COUNTY Lake DRILLING METHOD Hollow Stem Auger HAMMER TYPE Diedrich Automatic

STRUCT. NO. Station	DEPTH H (ft)	BLOW S (/6")	UCS Qu (tsf)	MOIST S (%)	Surface Water Elev. Stream Bed Elev.	DEPTH H (ft)	BLOW S (/6")	UCS Qu (tsf)	MOIST S (%)
					n/a ft n/a ft				
BORING NO. <u>JP-01</u> Station <u>53+72</u> Offset <u>274.00ft Left</u> Ground Surface Elev. <u>667.00</u> ft					Groundwater Elev.: First Encounter <u>Dry</u> ft Upon Completion <u>Dry</u> ft After _____ Hrs. _____ ft				
12.0" TOPSOIL-black 666.00				34	CLAY-gray-stiff to hard (continued)				
SILTY CLAY-brown & gray-medium stiff to stiff (A-7)	2					3			
	2	1.3		36		4	1.9		19
	2	B				5	B		
	1					3			
	1	0.8		34		5	1.9		18
	-5	2	B			-25	5	B	
661.50									
CLAY-gray-stiff to hard	3					4			
	4	1.1		19		5	1.9		22
	4	B				6	B		
	2					3			
	3	2.9		18		6	2.0		22
	-10	5	B		End Of Boring @ -30.0'. Boring backfilled with cuttings.	637.00 -30	6	B	
	4								
	6	4.9		16					
	9	B							
	3								
	6	5.0		17					
	-15	8	B			-35			
	3								
	3	2.2		21					
	5	B							
	2								
	4	1.4		21					
	-20	4	B			-40			

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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)

# SOIL BORING LOG

ROUTE FAP 346 DESCRIPTION Receiving Pit LOGGED BY NM

SECTION \_\_\_\_\_ LOCATION NW 1/4, SEC. 32, TWP. T44N, RNG. R12E, 3<sup>rd</sup> PM

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

STRUCT. NO. Station	DEPTH H (ft)	BLOW S (/6")	UCS Qu (tsf)	MOIST T (%)	Surface Water Elev. Stream Bed Elev.	DEPTH H (ft)	BLOW S (/6")	UCS Qu (tsf)	MOIST T (%)
					n/a ft n/a ft				
BORING NO. <u>RP-01</u> Station <u>50+47</u> Offset <u>273.70ft Left</u> Ground Surface Elev. <u>665.70</u> ft					Groundwater Elev.: First Encounter <u>Dry to -10.0</u> ft Upon Completion <u>n/a</u> ft After _____ Hrs. _____ ft				
13.0" ASPHALT					CLAY-brown & gray-medium stiff to hard (A-6) (continued)				
	664.62								
CLAY-brown & gray-medium stiff to hard (A-6)		3					2		
		2	3.5	18			4	1.0	22
		4	B				8	B	
		5					2		
		6	3.0	17			3	1.3	22
		8	B				5	B	
	-5								
becoming gray @ -5.5'						640.20			
		2			CLAYEY SAND & GRAVEL-gray-medium dense		3		
		4	1.9	20			7		15
		5	B				5		
		2					6		
		3	2.0	19			13		16
		5	B				9		
	-10								
		3							
		4	0.9	20		633.70			
		5	B		CLAY-gray-very stiff				
		3					6		
		4	1.2	18			10	2.3	17
		7	B				13	B	
	-15								
		4							
		4	1.5	22					
		6	P						
		4					6		
		5	0.9	21	End Of Boring @ -40.0'. Boring backfilled with cuttings.		9	3.4	17
		8	B				15	B	
	-20					625.70	-40		

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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)

# SOIL BORING LOG

ROUTE FAP 346 DESCRIPTION UP Railroad LOGGED BY NM

SECTION \_\_\_\_\_ LOCATION NW 1/4, SEC. 32, TWP. T44N, RNG. R12E, 3<sup>rd</sup> PM

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

STRUCT. NO. Station	DEPTH H (ft)	BLOW S (/6")	UCS Qu (tsf)	MOIST T (%)	Surface Water Elev. Stream Bed Elev.	DEPTH H (ft)	BLOW S (/6")	UCS Qu (tsf)	MOIST T (%)
					n/a ft				
					n/a ft				
BORING NO. <u>RR-01</u> Station <u>50+77</u> Offset <u>273.50ft Left</u> Ground Surface Elev. <u>665.00</u> ft					Groundwater Elev.: First Encounter <u>Dry to -10.0</u> ft Upon Completion <u>n/a</u> ft After _____ Hrs. _____ ft				
14.0" ASPHALT, 10.0" GRAVEL					CLAY-gray-stiff to hard (continued)				
		29					3		
	663.00	3	4.7	17			4	1.3	22
CLAY LOAM-brown & gray-hard		5	B				8	B	
		5					4		
		7	5.4	14			7	1.4	20
		9	B				7	B	
	-5						-25		
659.50					639.50				
CLAY-gray-stiff to hard		6			CLAYEY SAND & GRAVEL-gray-medium dense		8		
		8	4.2	18			6		9
		12	B				11		
		3					8		
		5	3.6	14			8		14
		9	B				8		
	-10						-30		
		3							
		5	1.5	19	633.00				
		6	B		CLAY-gray-hard				
		3					6		
		5	1.7	20			9	4.0	17
		7	B				14	B	
	-15						-35		
		3							
		4	1.1	21					
		5	B						
		2					6		
		5	1.5	18	End Of Boring @ -40.0'. Boring backfilled with cuttings.		8	2.2	18
		6	B				14	B	
	-20						625.00	-40	

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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)

# SOIL BORING LOG

ROUTE FAP 346 DESCRIPTION UP Railroad LOGGED BY RJ

SECTION \_\_\_\_\_ LOCATION NW 1/4, SEC. 32, TWP. T44N, RNG. R12E, 3<sup>rd</sup> PM

COUNTY Lake DRILLING METHOD Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. Station	DEPTH H (ft)	BLOW S (/6")	UCS Qu (tsf)	MOIST S (%)	Surface Water Elev.	DEPTH H (ft)	BLOW S (/6")	UCS Qu (tsf)	MOIST S (%)
					n/a ft				
BORING NO. <u>RR-02</u> Station <u>52+00</u> Offset <u>273.70ft Left</u> Ground Surface Elev. <u>669.00</u> ft					Groundwater Elev.:				
					First Encounter	<u>663.0</u> ft ▼			
					Upon Completion	<u>650.0</u> ft ▼			
					After _____ Hrs.	ft			
6.0" TOPSOIL-black	668.50				SANDY CLAY LOAM-gray-stiff	648.50			
CLAY LOAM-brown & gray-hard (Fill)		6		28	(continued)		4		
		8	4.5	17	CLAY-gray-stiff to very stiff		5	1.5	19
		10	P				5	B	
	666.00								
SANDY CLAY LOAM-brown & gray-medium dense (Apparent Fill)		2					3		
		3		19			4	1.8	20
		-5	8			-25	5	B	
	663.50								
CLAY LOAM-brown & gray-stiff to hard	▼	5					3		
		10	5.0	18			4	1.6	20
		14	B				6	B	
		7					3		
		10	6.5	17			6	1.4	20
		-10	14	B		-30	7	B	
becoming gray @ -10.5'									
		6							
		9	4.8	16					
		15	B						
		4					4		
		7	4.2	17			4	2.2	23
		-15	10	B		-35	6	B	
		4							
		6	1.9	18					
		8	B						
	651.00								
SANDY CLAY LOAM-gray-stiff	▽	2					4		
		4	1.4	11	End Of Boring @ -40.0'. Boring backfilled with cuttings.		7	1.9	21
		-20	7	B		-40	10	B	
						629.00			

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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)



# SOIL BORING LOG

ROUTE FAP 346 DESCRIPTION Retaining Wall LOGGED BY NM

SECTION \_\_\_\_\_ LOCATION NW 1/4, SEC. 32, TWP. T44N, RNG. R12E, 3<sup>rd</sup> PM

COUNTY Lake DRILLING METHOD Hollow Stem Auger HAMMER TYPE Diedrich Automatic

STRUCT. NO. Station	DEPTH H (ft)	BLOW S (/6")	UCS Qu (tsf)	MOIST T (%)	Surface Water Elev. Stream Bed Elev.	DEPTH H (ft)	BLOW S (/6")	UCS Qu (tsf)	MOIST T (%)
					n/a ft				
					n/a ft				
BORING NO. <u>RW-01</u> Station <u>54+49</u> Offset <u>128.20ft Left</u> Ground Surface Elev. <u>666.10</u> ft					Groundwater Elev.:				
					First Encounter <u>631.6</u> ft ▼				
					Upon Completion <u>634.1</u> ft ▼				
					After _____ Hrs. _____ ft				
12.0" TOPSOIL-black					CLAY-gray-stiff to hard (continued)				
665.10				47			3		
CLAY-gray-stiff to hard		2					4	1.6	14
		2	1.5	20			7	B	
		3	P						
		2					3		
		3	2.7	21			5	1.9	21
		4	B				7	B	
	-5					-25			
		5					3		
		6	5.7	16			5	1.9	22
		10	B				5	B	
		4					4		
		7	5.7	17			6	2.2	21
	-10	11	B			-30	7	B	
		3							
		6	3.8	16					
		9	B			634.10 ▼			
		2			CLAYEY SAND-gray-medium dense				
		4	1.2	16			4		
		5	B				6		17
	-15					-35	7		
		3							
		4	1.9	20					
		6	B						
						629.10			
		3			CLAY-gray-very stiff				
		4	2.0	20			5		
		6	B				7	2.3	18
	-20					-40	10	B	

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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)

# SOIL BORING LOG

ROUTE FAP 346 DESCRIPTION Retaining Wall LOGGED BY NM

SECTION \_\_\_\_\_ LOCATION NW 1/4, SEC. 32, TWP. T44N, RNG. R12E, 3<sup>rd</sup> PM

COUNTY Lake DRILLING METHOD Hollow Stem Auger HAMMER TYPE Diedrich Automatic

STRUCT. NO. \_\_\_\_\_  
 Station \_\_\_\_\_

BORING NO. RW-01  
 Station 54+49  
 Offset 128.20ft Left  
 Ground Surface Elev. 666.10 ft

DEPTH (ft)	BLOWS (/6")	UCS (tsf)	MOIST (%)
	6		
	9	2.5	22
-45	11	B	
	5		
	9	1.3	23
616.10 -50	10	B	

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

Groundwater Elev.:

First Encounter 631.6 ft ▼  
 Upon Completion 634.1 ft ∇  
 After \_\_\_\_\_ Hrs. \_\_\_\_\_ ft

CLAY-gray-very stiff (continued)

End Of Boring @ -50.0'. Boring backfilled with cuttings.

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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)

# SOIL BORING LOG

ROUTE FAP 346 DESCRIPTION Retaining Wall LOGGED BY NM

SECTION \_\_\_\_\_ LOCATION NW 1/4, SEC. 32, TWP. T44N, RNG. R12E, 3<sup>rd</sup> PM

COUNTY Lake DRILLING METHOD Hollow Stem Auger HAMMER TYPE Diedrich Automatic

STRUCT. NO. Station	DEPTH H (ft)	BLOW S (/6")	UCS Qu (tsf)	MOIST S (%)	Surface Water Elev. Stream Bed Elev.	DEPTH H (ft)	BLOW S (/6")	UCS Qu (tsf)	MOIST S (%)
					n/a ft n/a ft				
BORING NO. <u>RW-02</u> Station <u>55+35</u> Offset <u>211.00ft Left</u> Ground Surface Elev. <u>666.50</u> ft					Groundwater Elev.: First Encounter <u>Dry</u> ft Upon Completion <u>Dry</u> ft After _____ Hrs. _____ ft				
18.0" TOPSOIL-black				49	CLAY to CLAY LOAM-brown & gray-stiff to hard (continued)		3		
	665.00	2					4	1.3	20
CLAY to CLAY LOAM-brown & gray-stiff to hard		2		46			5	B	
		3					3		
		4	2.1	21			3	1.5	18
		5	B			-25	6	B	
becoming gray @ -5.5'		3					3		
		5	4.6	17			4	1.8	21
		8	B				6	B	
		6					3		
		8	6.1	18			5	1.9	22
	-10	12	B			-30	6	B	
		4							
		5	3.1	19					
		8	B						
		3					4		
		3	1.9	15			8	4.4	17
	-15	6	B			-35	10	B	
		3							
		4	1.6	14					
		6	B						
		3					4		
		4	1.5	18			6	1.8	19
	-20	6	B			-40	8	P	

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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)

# SOIL BORING LOG

ROUTE FAP 346 DESCRIPTION Retaining Wall LOGGED BY NM

SECTION \_\_\_\_\_ LOCATION NW 1/4, SEC. 32, TWP. T44N, RNG. R12E, 3<sup>rd</sup> PM

COUNTY Lake DRILLING METHOD Hollow Stem Auger HAMMER TYPE Diedrich Automatic

STRUCT. NO. Station	DEPTH H (ft)	BLOW W S (/6")	UCS Qu (tsf)	MOIST S T (%)	Surface Water Elev. _____ ft Stream Bed Elev. _____ ft
BORING NO. <u>RW-02</u> Station <u>55+35</u> Offset <u>211.00ft Left</u> Ground Surface Elev. <u>666.50</u> ft					Groundwater Elev.: First Encounter _____ ft Upon Completion _____ ft After _____ Hrs. _____ ft
CLAY to CLAY LOAM-brown & gray-stiff to hard (continued)					
		5			
		7	2.2	20	
	-45	9	B		
		4			
End Of Boring @ -50.0'. Boring backfilled with cuttings.		5	1.6	24	
	616.50 -50	7	B		
	-55				
	-60				

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# SOIL BORING LOG

ROUTE FAP 346 DESCRIPTION Storm Sewer LOGGED BY NM

SECTION \_\_\_\_\_ LOCATION NW 1/4, SEC. 32, TWP. T44N, RNG. R12E, 3<sup>rd</sup> PM

COUNTY Lake DRILLING METHOD Hollow Stem Auger HAMMER TYPE Diedrich Automatic

STRUCT. NO. _____ Station _____	D E P T H  (ft)	B L O W S  (/6")	U C S  (tsf)	M O I S T  (%)	Surface Water Elev. _____ n/a ft
					Stream Bed Elev. _____ n/a ft
BORING NO. <u>SS-01</u> Station <u>57+32</u> Offset <u>408.20ft Left</u> Ground Surface Elev. <u>668.40</u> ft					Groundwater Elev.: First Encounter <u>664.4</u> ft ▼ Upon Completion <u>Dry</u> ft After _____ Hrs. _____ ft

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8" TOPSOIL-black 667.73					
CLAY LOAM-brown & gray-hard (Apparent Fill) 665.40	5				28
	4	4.5		15	
	4	P			
SILTY CLAY-brown & gray-medium stiff (A-7) 662.90	1				
	2	0.7		32	
	2	B			
CLAY-brown & gray-stiff to hard becoming gray @ -8.0'	6				
	12	8.8		18	
	13	B			
	3				
	5	3.6		17	
	7	B			
	2				
	3	1.9		19	
	4	B			
	2				
	4	1.8		20	
	4	B			
	2				
	4	1.3		19	
	5	B			
End Of Boring @ -20.0'. Boring backfilled with cuttings. 648.40	3				
	4	1.8		21	
	5	B			

# SOIL BORING LOG

ROUTE FAP 346 DESCRIPTION Storm Sewer LOGGED BY NM

SECTION \_\_\_\_\_ LOCATION NW 1/4, SEC. 32, TWP. T44N, RNG. R12E, 3<sup>rd</sup> PM

COUNTY Lake DRILLING METHOD Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. \_\_\_\_\_  
 Station \_\_\_\_\_

BORING NO. SS-02  
 Station 62+70  
 Offset 602.90ft Left  
 Ground Surface Elev. 667.70 ft

DEPTH (ft)	BLOW COUNT (/6")	UCS (tsf)	MOISTURE (%)
---------------	------------------------	--------------	-----------------

Surface Water Elev. n/a ft  
 Stream Bed Elev. n/a ft  
 Groundwater Elev.:  
 First Encounter Dry ft  
 Upon Completion Dry ft  
 After \_\_\_\_\_ Hrs. \_\_\_\_\_ ft

8.0" TOPSOIL-black				
	667.03			24
CLAY to CLAY LOAM-brown & gray-stiff to hard		4		
		6	7.5	17
		8	B	
		5		
		7	5.3	14
		9	B	
	-5			
		4		
		8	7.5	17
		12	B	
		4		
		8	6.4	17
	-10	11	B	
becoming gray @ -10.5		3		
		4	1.3	13
		3	B	
		2		
		3	2.0	16
	-15	3	B	
		3		
		3	1.5	19
		4	B	
		3		
End Of Boring @ -20.0'. Boring backfilled with cuttings.		3	1.8	19
	647.70	7	B	
	-20			

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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)

# SOIL BORING LOG

ROUTE FAP 346 DESCRIPTION Storm Sewer LOGGED BY NM

SECTION \_\_\_\_\_ LOCATION NW 1/4, SEC. 32, TWP. T44N, RNG. R12E, 3<sup>rd</sup> PM

COUNTY Lake DRILLING METHOD Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. _____ Station _____	D E P T H  (ft)	B L O W S  (/6")	U C S  (tsf)	M O I S T  (%)	Surface Water Elev. _____ n/a ft
					Stream Bed Elev. _____ n/a ft
BORING NO. <u>SS-03</u> Station <u>66+30</u> Offset <u>502.40ft Left</u> Ground Surface Elev. <u>660.90</u> ft					Groundwater Elev.: First Encounter _____ Dry ft
					Upon Completion _____ Dry ft After _____ Hrs. _____ ft

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12.0" TOPSOIL-black					
659.90				33	
SANDY CLAY LOAM-brown & gray-medium stiff		2			
		2	0.5	21	
		3	P		
657.90					
SILTY LOAM-brown & gray-stiff (A-4)		2			
		2	1.0	21	
		-5	P		
655.40					
CLAY to CLAY LOAM-gray-stiff to hard		6			
		7	6.6	15	
		11	B		
		4			
		7	8.8	14	
		-10	B		
		5			
		8	5.7	15	
		12	B		
		4			
		8	4.5	14	
		-15	B		
		4			
		5	2.7	16	
		2	B		
		3			
End Of Boring @ -20.0'. Boring backfilled with cuttings.		4	1.2	18	
640.90	-20	4	B		

**APPENDIX D**  
**PAVEMENT CORE LOGS**





# PAVEMENT CORE SUMMARY

Project: DOT Pump Station 38, Lake Forest, Illinois GSI Job No.: 16017  
 Location: FAP 346 Date: 9/6/2017  
 County: Lake Cored By: TZ  
 Client: Knight Checked By: AJP

CORE NO.	THICKNESS (in.)	MATERIAL DESCRIPTION
PC-01	1.0 2.5 1.75 1.5 2.0 7.25	Northing: 2032986.5      Easting: 1111094.0 ASPHALT—poorly consolidates, fine to medium coarse aggregate. ASPHALT—well consolidated, medium coarse aggregate. ASPHALT—well consolidated, medium coarse aggregate. ASPHALT—porous, fine to medium coarse aggregate. ASPHALT—well consolidated, fine to medium coarse aggregate. CONCRETE—well consolidated.
		Northing: 2032983.4      Easting: 1111378.5 ASPHALT—well consolidated, fine to medium coarse aggregate. ASPHALT—porous, fine to medium coarse aggregate. CONCRETE—fractured.
PC-02	1.5 2.5 8.25	Northing: 2033267.5      Easting: 1111692.9 ASPHALT—well consolidated, fine to medium coarse slag aggregate. ASPHALT—well consolidated, fine to medium coarse aggregate. ASPHALT—well consolidated, fine to medium coarse aggregate. ASPHALT—well consolidated, fine to medium coarse aggregate. ASPHALT—well consolidated, fine to medium coarse aggregate.
		Northing: 2032977.4      Easting: 1111727.0 ASPHALT—well consolidated, fine to medium coarse aggregate. ASPHALT—porous, fine to medium coarse aggregate. CONCRETE—fractured @ base.
PC-03	2.25 2.0 4.25 3.5 4.25	Northing: 2033008.3      Easting: 1111766.6 ASPHALT—well consolidated, fine to medium coarse aggregate. ASPHALT—porous, fine to medium coarse aggregate. CONCRETE—highly fractured.
		Northing: 2032938.2      Easting: 1111793.2 ASPHALT—fractured, fine to medium coarse slag aggregate. ASPHALT—fractured, fine to medium coarse aggregate. ASPHALT—very poorly consolidated, fine to medium coarse aggregate. GRAVEL
PC-04	1.5 0.75 10.0	Northing: 2033267.5      Easting: 1111808.6 ASPHALT—well consolidated, fine to medium coarse slag aggregate. ASPHALT—well consolidated, fine to medium coarse aggregate. ASPHALT—well consolidated, fine to medium coarse aggregate. CONCRETE—highly fractured.
		Northing: 2032986.5      Easting: 1111984.0 ASPHALT—well consolidated, fine to medium coarse aggregate. ASPHALT—porous, fine to medium coarse aggregate. ASPHALT—well consolidated, fine to medium coarse aggregate. ASPHALT—well consolidated, fine to medium coarse aggregate. ASPHALT—slightly porous, fine to medium coarse aggregate.
PC-05	2.0 2.0 2.0 10.0	Northing: 2032938.4      Easting: 1112302.8 ASPHALT—well consolidated, fine to medium coarse aggregate. ASPHALT—porous, fine to medium coarse aggregate. CRUSHED STONE—2" nominal aggregate size.
PC-06	1.75 1.75 1.5 7.0	
PC-07	2.0 2.0 2.0 10.0	
PC-08	1.75 1.5 4.25 4.25 2.5	
PC-09	2.25 2.0 6.0	



## PAVEMENT CORE SUMMARY

Project: DOT Pump Station 38, Lake Forest, Illinois GSI Job No.: 16017  
 Location: FAP 346 Date: 9/6/2017  
 County: Lake Cored By: TZ  
 Client: Knight Checked By: AJP

CORE NO.	THICKNESS (in.)	MATERIAL DESCRIPTION
PC-10	2.0 5.5	Northing: 2032979.9      Easting: 1112323.9
		ASPHALT—well consolidated, fine to medium coarse aggregate. ASPHALT—well consolidated, fine to medium coarse aggregate.
PC-11	2.75 2.5	Northing: 2033177.6      Easting: 1113251.8
		ASPHALT—slightly porous, fine to medium coarse aggregate. ASPHALT—well consolidated, fine to medium coarse aggregate.
PC-12	1.75 3.25	Northing: 2033288.9      Easting: 1113596.3
		ASPHALT—well consolidated, fine to medium coarse aggregate. ASPHALT—well consolidated, fine to medium coarse aggregate.

# PAVEMENT CORE PHOTO LOG

Project: DOT Pump Station 38, Lake Forest, Illinois GSI Job No.: 16017  
Location: FAP 346 Date: 9/6/2017  
County: Lake Cored By: TZ  
Client: Knight Checked By: AJP



Core No.: PC-01 Core Location: Northing: 2032986.5 Easting: 1111094.0



Core No.: PC-02 Core Location: Northing: 2032983.4 Easting: 1111378.5

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

# PAVEMENT CORE PHOTO LOG

Project: DOT Pump Station 38, Lake Forest, Illinois GSI Job No.: 16017  
Location: FAP 346 Date: 9/6/2017  
County: Lake Cored By: TZ  
Client: Knight Checked By: AJP



Core No.: PC-03 Core Location: Northing: 2033267.5 Easting: 1111692.9



Core No.: PC-04 Core Location: Northing: 2032977.4 Easting: 1111727.0

# PAVEMENT CORE PHOTO LOG

Project: DOT Pump Station 38, Lake Forest, Illinois GSI Job No.: 16017  
Location: FAP 346 Date: 9/6/2017  
County: Lake Cored By: TZ  
Client: Knight Checked By: AJP



Core No.: PC-05 Core Location:    Northing: 2033008.3 Easting: 1111766.6



Core No.: PC-06 Core Location:    Northing: 2032938.2 Easting: 1111793.2

# PAVEMENT CORE PHOTO LOG

Project: DOT Pump Station 38, Lake Forest, Illinois GSI Job No.: 16017  
Location: FAP 346 Date: 9/6/2017  
County: Lake Cored By: TZ  
Client: Knight Checked By: AJP



Core No.: PC-07 Core Location:    Northing: 2033267.5 Easting: 1111808.6



Core No.: PC-08 Core Location:    Northing: 2032986.5 Easting: 1111984.0

# PAVEMENT CORE PHOTO LOG

Project: DOT Pump Station 38, Lake Forest, Illinois GSI Job No.: 16017  
Location: FAP 346 Date: 9/6/2017  
County: Lake Cored By: TZ  
Client: Knight Checked By: AJP



Core No.: PC-09 Core Location:    Northing: 2032938.4 Easting: 1112302.8



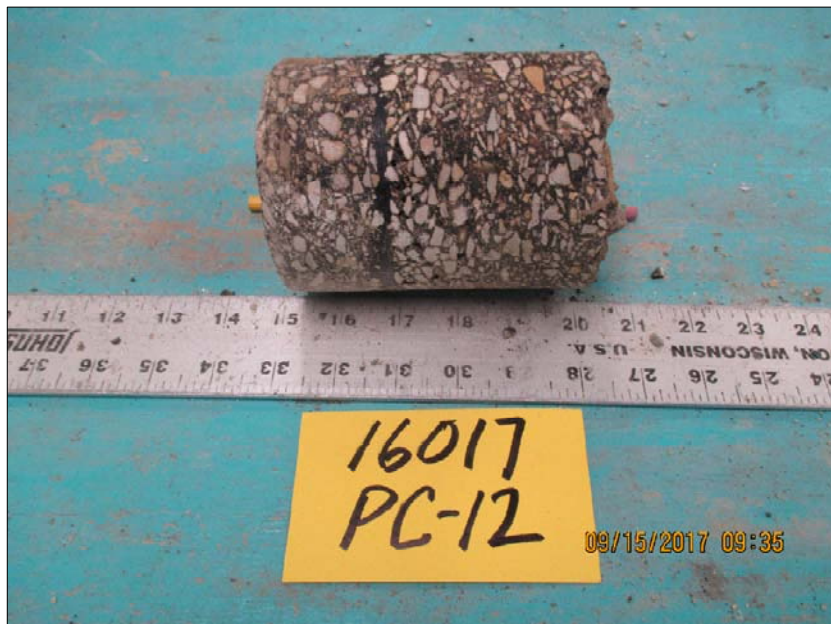
Core No.: PC-10 Core Location:    Northing: 2032979.9 Easting: 1112323.9

# PAVEMENT CORE PHOTO LOG

Project: DOT Pump Station 38, Lake Forest, Illinois GSI Job No.: 16017  
Location: FAP 346 Date: 9/6/2017  
County: Lake Cored By: TZ  
Client: Knight Checked By: AJP



Core No.: PC-11 Core Location: Northing: 2033177.6 Easting: 1113251.8

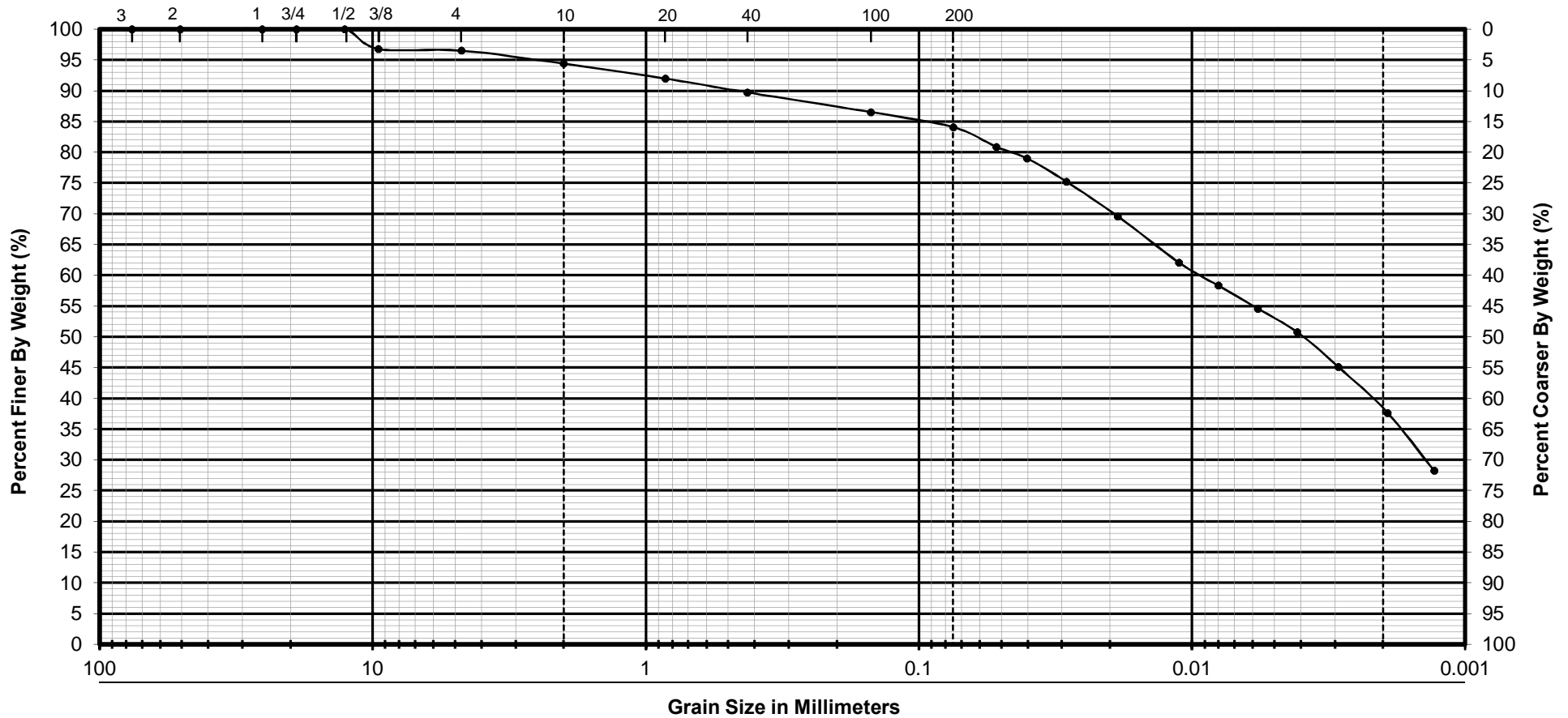


Core No.: PC-12 Core Location: Northing: 2033288.9 Easting: 1113596.3




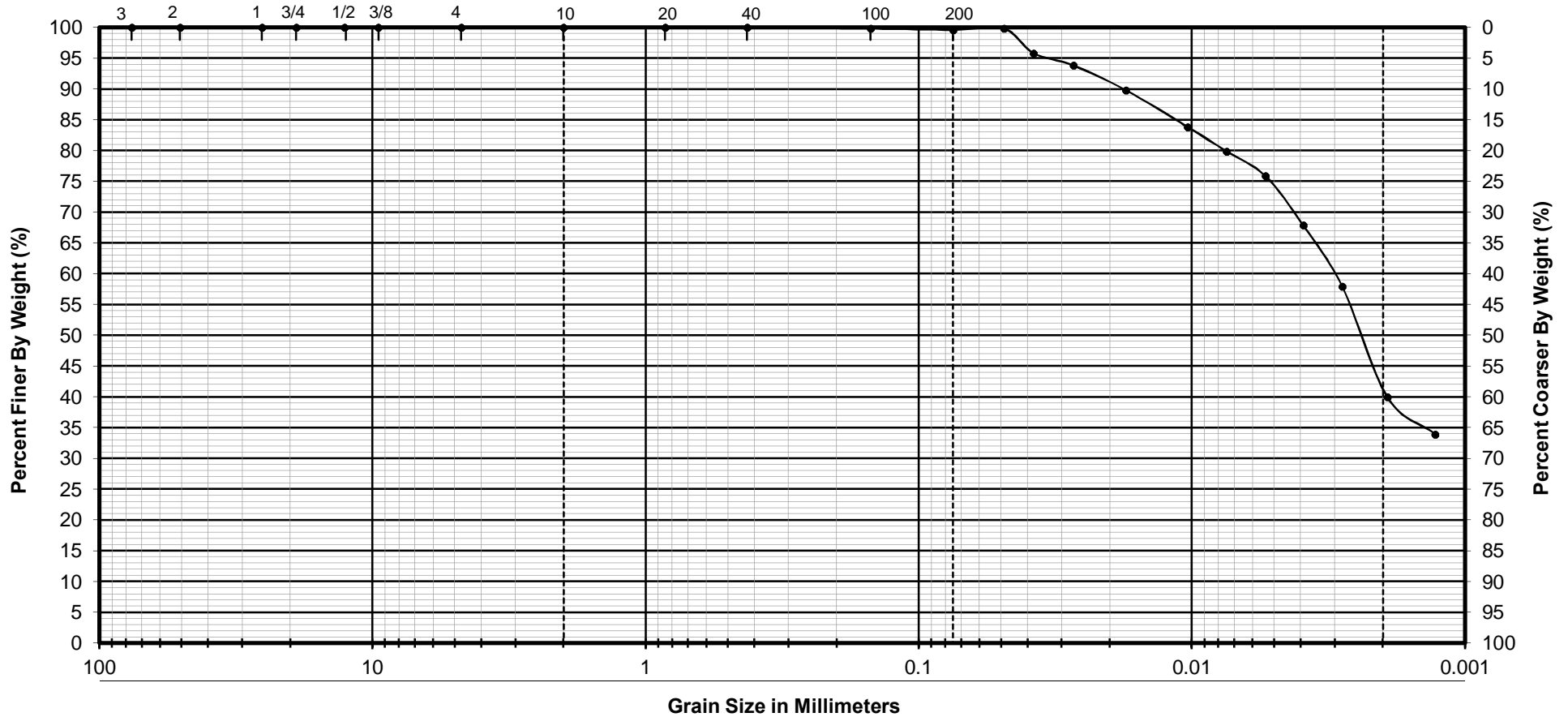
## **APPENDIX E**

### **LAB DATA**




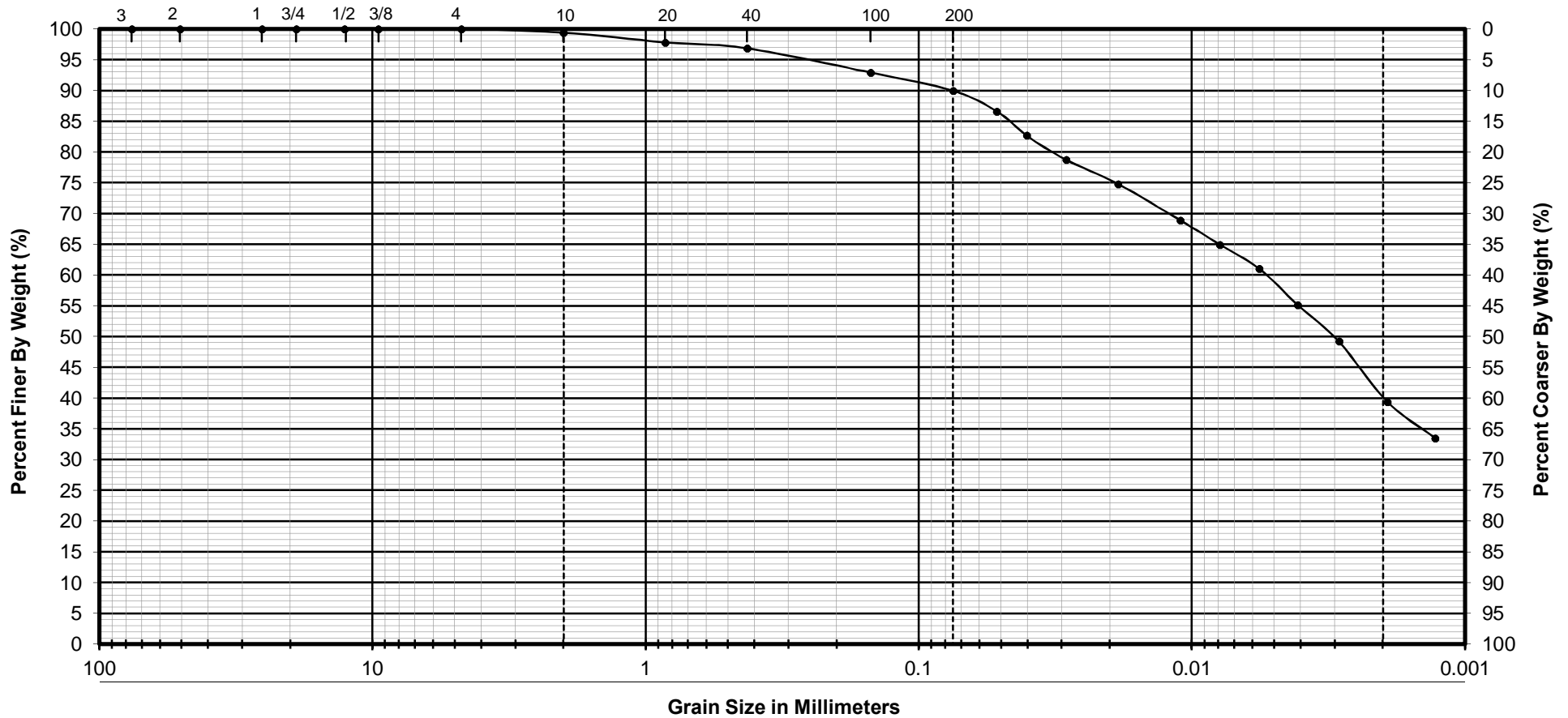
GRAVEL	SAND		SILT	CLAY
	COARSE	FINE		

Boring No.	RP-01	CLASSIFICATION		PARTICLE SIZE ANALYSIS-AASHTO T88	
Sample No.	9	CLAY A-6 gray Group Index 11 % Gravel 5.6 % Sand 10.3 % Silt 46.5 % Clay 37.6		IDOT Pump station 38, FAP 346 PTB 178, Item 1 Lake Forest, Illinois  <b>Geo Services, Inc.</b> <small>Geotechnical, Environmental and Civil Engineering An MBE - DBE Firm</small> 1235 E. Davis St., Arlington Heights, IL 60005 Phone 847-253-3845 • Fax 847-253-0482	
Depth	18.5'-20.0'				
Liquid Limit	32				
Plastic Limit	17				
Plasticity Index	15				
Test By	MT				
Date	9/28/17				
Reviewed By	RR				
Job No	16017				




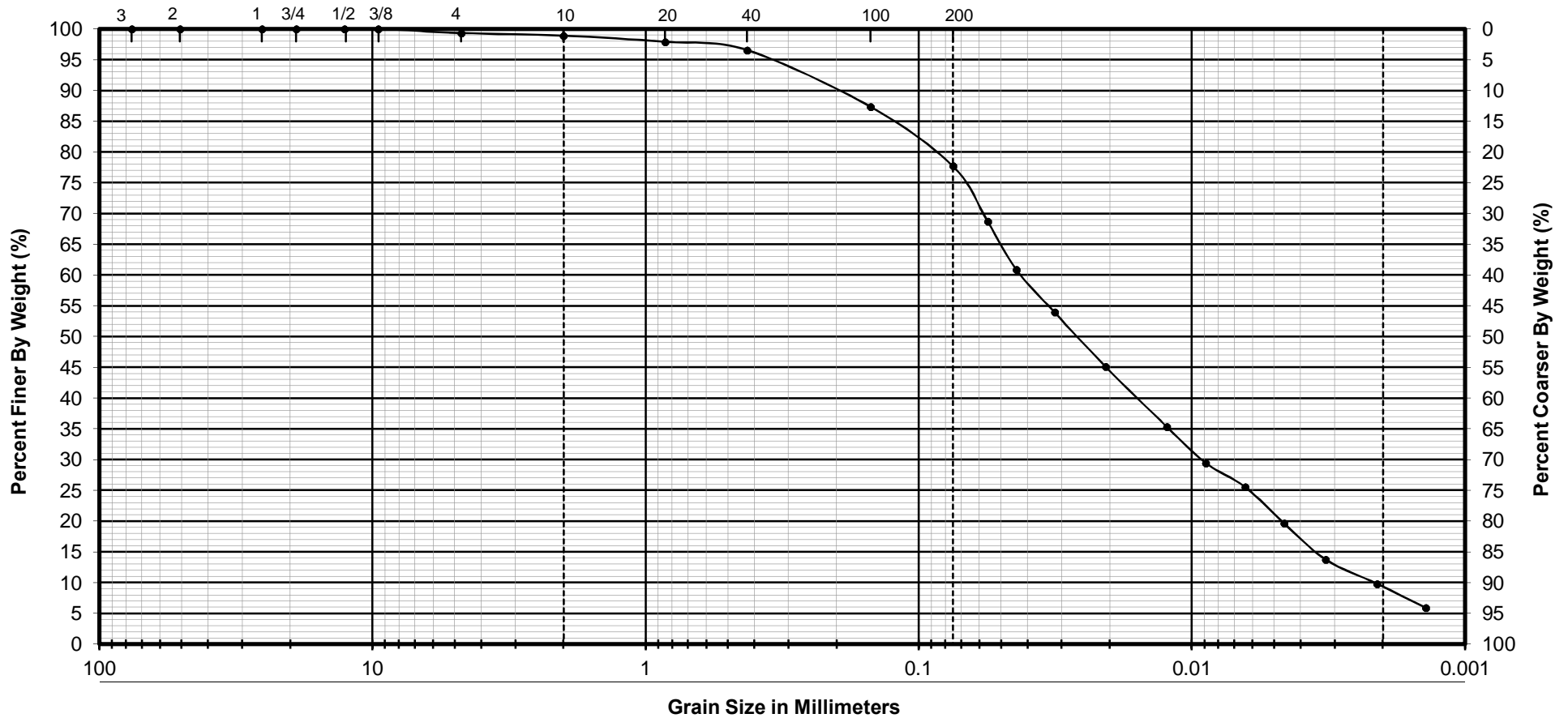
GRAVEL	SAND		SILT	CLAY
	COARSE	FINE		

Boring No.	JP-01	CLASSIFICATION		PARTICLE SIZE ANALYSIS-AASHTO T88	
Sample No.	3	<b>SILTY CLAY</b> <b>A-7</b> <b>gray</b> Group Index      22 % Gravel          0.0 % Sand             0.4 % Silt              59.7 % Clay             39.9		IDOT Pump station 38, FAP 346 PTB 178, Item 1 Lake Forest, Illinois   <b>Geo Services, Inc.</b> <small>Geotechnical, Environmental and Civil Engineering An MBE - DBE Firm</small> 1235 E. Davis St., Arlington Heights, IL 60005 Phone 847-253-3845 • Fax 847-253-0482	
Depth	3.5'-5.0'				
Liquid Limit	42				
Plastic Limit	22				
Plasticity Index	20				
Test By	MT				
Date	9/28/17				
Reviewed By	RR				
Job No	16017				




GRAVEL	SAND		SILT	CLAY
	COARSE	FINE		

Boring No.	SS-01	CLASSIFICATION	PARTICLE SIZE ANALYSIS-AASHTO T88
Sample No.	3	<p style="text-align: center;"><b>SILTY CLAY</b> A-7 gray</p> <p>Group Index      21</p> <p>% Gravel        0.6</p> <p>% Sand            9.4</p> <p>% Silt             50.6</p> <p>% Clay            39.4</p>	<p style="text-align: center;">IDOT Pump station 38, FAP 346 PTB 178, Item 1 Lake Forest, Illinois</p> <p style="text-align: center;"> <b>Geo Services, Inc.</b> Geotechnical, Environmental and Civil Engineering An MBE - DBE Firm</p> <p>1235 E. Davis St., Arlington Heights, IL 60005 Phone 847-253-3845 • Fax 847-253-0482</p>
Depth	3.5'-5.0'		
Liquid Limit	43		
Plastic Limit	21		
Plasticity Index	22		
Test By	MT		
Date	9/28/17		
Reviewed By	RR		
Job No	16017		



GRAVEL	SAND		SILT	CLAY
	COARSE	FINE		

Boring No.	SS-03	CLASSIFICATION	PARTICLE SIZE ANALYSIS-AASHTO T88
Sample No.	3	<p style="text-align: center;"><b>SILTY LOAM</b> A-4 brown/gray</p> <p>Group Index      1</p> <p>% Gravel          1.1</p> <p>% Sand             21.2</p> <p>% Silt              67.9</p> <p>% Clay             9.8</p>	<p style="text-align: center;">IDOT Pump station 38, FAP 346 PTB 178, Item 1 Lake Forest, Illinois</p> <p style="text-align: center;"> <b>Geo Services, Inc.</b> Geotechnical, Environmental and Civil Engineering An MBE - DBE Firm</p> <p>1235 E. Davis St., Arlington Heights, IL 60005 Phone 847-253-3845 • Fax 847-253-0482</p>
Depth	3.5'-5.0'		
Liquid Limit	21		
Plastic Limit	16		
Plasticity Index	5		
Test By	MT		
Date	9/28/17		
Reviewed By	RR		
Job No	16017		

## **APPENDIX F**

**BBS 2640**

Route FAP-346  
 Section D-91-086-16, PTB# 178-001  
 County Lake  
 Location Deerpath Road at FAP 346 (US Route 41)  
 and the C&NW Railroad

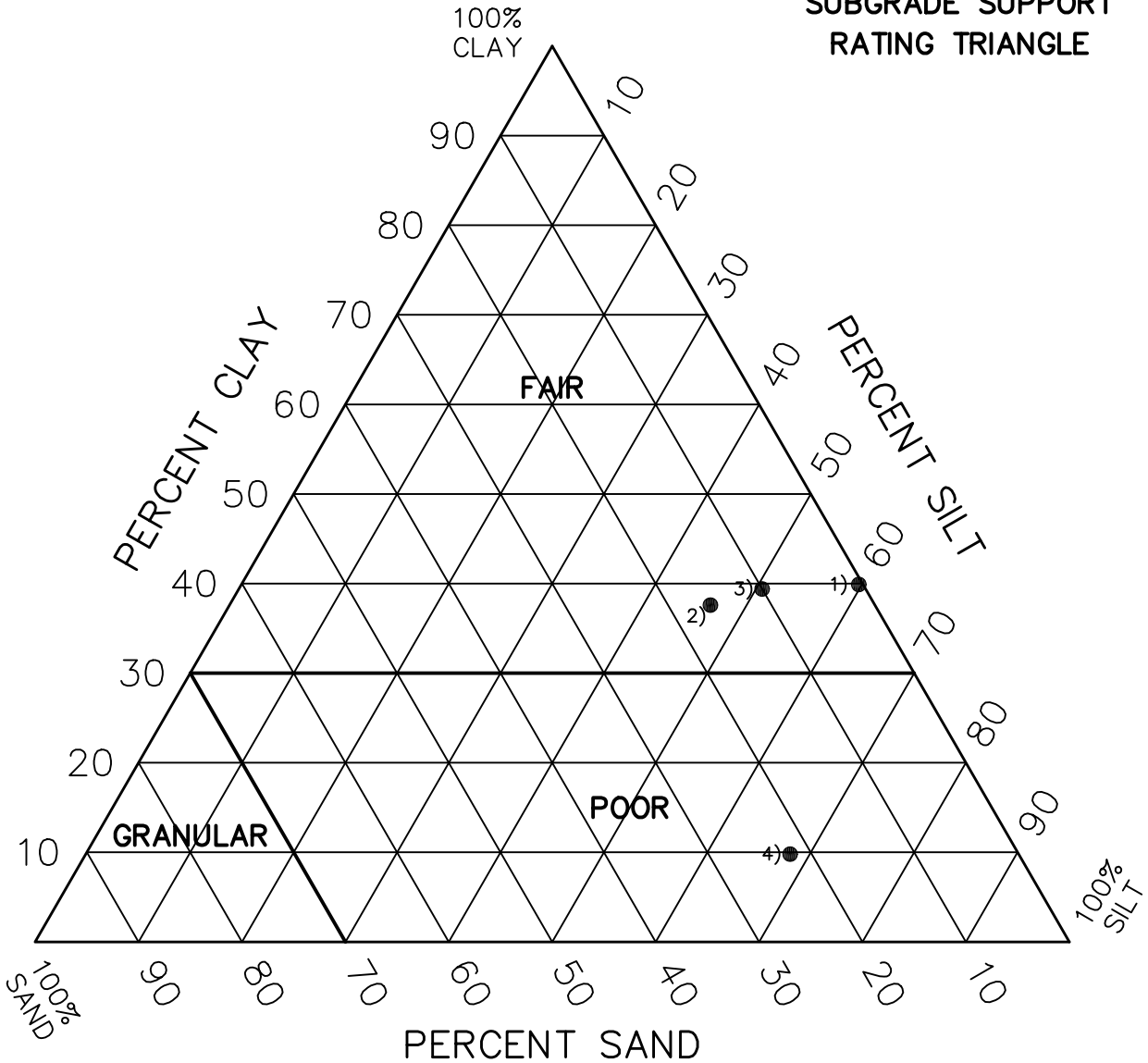
Boring No./Sample No.	JP-01/S-3	RP-01/S-9	SS-01/S-3	SS-03/S-3
Station	53+72	50+47	57+32	66+30
Offset	274.0' Left	273.7' Left	408.2' Left	502.4' Left
Depth	3.5'-5.0'	18.5'-20.0'	3.5'-5.0'	3.5'-5.0'
AASHTO Classification	A-7	A-6	A-7	A-4
Illinois Textural Classification	SILTY CLAY	CLAY	SILTY CLAY	SILTY LOAM
Gradation Passing – 1"	100%	100%	100%	100%
¾"	100%	100%	100%	100%
½"	100%	100%	100%	100%
No. 4	100%	96.5	100%	99.3
No. 10	100%	94.4	99.4	98.9
No. 40	100%	89.7	96.8	96.5
No. 100	99.8	86.5	92.9	87.3
No. 200	99.6	84.1	90.0	77.7
Gravel (AASHTO T-88)	0.0	5.6	0.6	1.1
Sand (AASHTO T-88)	0.4	10.3	9.4	21.2
Silt (AASHTO T-88)	59.7	46.5	50.6	67.9
Clay (AASHTO T-88)	39.9	37.6	39.4	9.8
Liquid Limit (AASHTO T-89)	42	32	43	21
Plasticity Index (AASHTO T-90)	20	15	22	5
Std. Dry Density pcf (AASHTO T-99)	--	--	--	--
Optimum Moisture (AASHTO T-99)	--	--	--	--
Subgrade Support Rating	FAIR	FAIR	FAIR	POOR
Organic Content	--	--	--	--
Insitu Moisture	34	17	32	21

## **APPENDIX G**

### **SUBGRADE STABILITY RATING (SSR) TRIANGLE**



**SUBGRADE SUPPORT RATING TRIANGLE**



**NOTES:**

1. If granular soils are encountered, the soils report should note alternatives to the 12 inch improved subgrade policy
2. Soil Separate Sizes:  
 Sand: 2.0 mm to 0.074 mm  
 Silt: 0.074 mm to 0.002 mm  
 Clay: Below 0.002 mm

- SAMPLES
- 1) ● JP-01 (3.5'-5.0')
- 2) ● RP-01 (18.5'-20.0')
- 3) ● SS-01 (3.5'-5.0')
- 4) ● SS-03 (3.5'-5.0')

SUBGRADE SUPPORT RATING (SSR)	 <b>Geo Services, Inc.</b> Geotechnical, Environmental & Civil Engineering 805 Amherst Court, Suite 204 Naperville, Illinois 60565 (630) 355-2838	DRAWN BY	MT
Roadway Geotechnical Report Deerpath Road at FAP 346 (US Route 41) and the C&NW Railroad IDOT Project No. D-91-086-16, PTB# 178-001, Contract 62B65 Lake Forest, Lake County, IL.		APPROVED BY	RR
		DATE	07-31-2018
		JOB NO.	16017