Construction & Geotechnical Material Testing, Inc.

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Telephone (630) 595-1111 ♦ Fax (630) 595-1110

August 31, 2021

Mr. Scott Drabicki, P.E.
Clark Dietz, Inc.
625 57th Street, 6th Floor
Kenosha, Wisconsin 53140

CGMT Project No. 21G0386

Reference: ***Report of Subsurface Exploration and Geotechnical Engineering Services, Force Main Replacements, Various Locations, Lake County, Illinois***

Dear Mr. Drabicki:

CGMT, Inc. has completed the subsurface exploration and geotechnical engineering analyses for the Force Main Replacements located along N. Cedar Crest Drive, N. Lakeside Drive and N. Jackson Drive in Lake County, Illinois. This report describes the subsurface exploration procedures, laboratory testing, and geotechnical recommendations for project construction. A Boring Location Plan is included in the Appendix of this report along with the Boring Logs performed for the exploration.

We appreciate this opportunity to be of service to the Clark Dietz, Inc. during the design phase of this project. If you have any questions with regard to the information and recommendations presented in this report, or if we can be of further assistance to you in any way during the planning or construction of this project, please do not hesitate to contact us.

Respectfully,

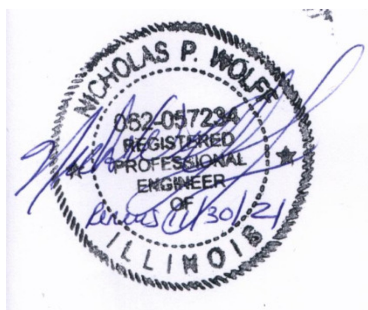
CONSTRUCTION AND GEOTECHNICAL MATERIAL TESTING, INC.

Pratik Patel, P.E.
Vice President

3pc: Encl.

REPORT OF

SUBSURFACE EXPLORATION AND
GEOTECHNICAL ENGINEERING SERVICES



FORCE MAIN REPLACEMENTS
VARIOUS LOCATIONS
LAKE COUNTY, ILLINOIS

CGMT PROJECT NO. 21G0386

FOR

CLARK DIETZ, INC.
KENOSHA, WISCONSIN

AUGUST 31, 2021

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EXECUTIVE SUMMARY

Construction & Geotechnical Material Testing, Inc. (CGMT) has completed your subsurface exploration and geotechnical engineering project. The subsurface conditions encountered during our exploration and CGMT's conclusions and recommendations are summarized below. This summary should not be considered apart from the entire text of the report with all the qualifications and considerations mentioned herein. Details of our conclusions and recommendations are discussed in the following sections and in the Appendix of this report.

The project site is located along N. Cedar Crest Drive, N. Lakeside Drive and N. Jackson Drive in Lake County Illinois. A total of eight (8) borings, B-1 through B-8 were performed for this project. The soil conditions encountered at the borings performed at the site are summarized as follows:

Approximately 3 to 10 inches of asphalt pavement underlain by approximately 2 to 9 inches of aggregate base course were encountered at the ground surface in the Borings B-1 through B-6 and B-8. Approximately 7 inches of topsoil was encountered at the ground surface in the Boring B-7. The surface materials were underlain by dark brown or brown firm to very stiff silty clay fill soils that extended to depths of approximately 3½ to 8½ feet below the existing grade in the Borings B-1, B-2, B-4 and B-5. The surface materials were underlain by natural, brown or brown and gray hard silty clay soils that extended to the boring termination depth of approximately 10 feet below the existing grade in the Boring B-3. The surface materials were underlain by brown loose to medium dense sand fill soils that extended to a depth of approximately 4½ feet below the existing grade in the Boring B-6. The surface materials were underlain by natural, brown hard silty clay soils that extended to a depth of approximately 8½ feet below the existing grade in the Boring B-7. The surface materials were underlain by brown sand and gravel medium dense fill soils that extended to a depth of approximately 3½ feet below the existing grade in the Boring B-8. The silty clay fill soils were underlain by brown stiff sandy clay fill soils that extended to the boring termination depth of approximately 10 feet below the existing grade in the Boring B-1. The silty clay fill soils were underlain by natural, brown very stiff to hard silty clay soils that extended to the boring termination depth of approximately 10 feet below the existing grade in the Boring B-2. The silty clay fill soils were underlain by brown stiff sandy clay fill soils that extended to a depth of approximately 6 feet below the existing grade in the Boring B-4. The silty clay fill soils were underlain by natural, brown and gray stiff silty clay soils that extended to a depth of approximately 8½ feet below the existing grade in the Boring B-5. The sand fill soils were underlain by natural, brown, brown and gray or gray stiff to very stiff silty clay soils that extended to the boring termination depth of approximately 10 feet below the existing grade in the Boring B-6. The silty clay soils were underlain by natural, brown loose sand soils that extended to the boring termination depth of approximately 10 feet below the existing grade in the Boring B-7. The sand and gravel fill soils were underlain by natural, brown and gray or gray very stiff to hard silty clay soils that extended to the boring termination depth of approximately 10 feet below the existing grade in the Boring B-8. The sandy clay fill soils were underlain by natural, brown and gray hard silty clay soils that extended to the boring termination depth of approximately 10 feet below the existing grade in the Boring B-4. The silty clay soils were underlain by natural, gray hard sandy clay soils that extended to the boring termination depth of approximately 10 feet below the existing grade in the Boring B-5.

We anticipate the new force main will be installed with conventional cut and cover excavation techniques. Based on the boring data, the new force main is anticipated to be installed in primarily in the interbedded, natural, cohesive or granular soils or the existing fill soils. These soils are generally considered suitable for direct pipe support provided that bedding material meeting the pipe manufacturer's recommendations is placed beneath the pipe. Subgrade soils that become saturated, loosened and/or softened during construction operations could be overexcavated and replaced. Backfill material in the overexcavated areas should consist of the on-site sand soils or 1-inch maximum size crushed stone or gravel containing no fines. The granular fill should be placed in lifts not more than 8 inches thick and compacted using vibratory equipment.

Horizontal Directional Drilling (HDD) is typically used when trenching or open excavation is not practical, such as water crossings, road/railway crossings, or in other sensitive crossings.

HDD is compatible with a wide range of soil conditions. Glacial till soils may be laden with cobbles and boulders. The presence of obstacles should be anticipated during the force main installation. In addition, very loose, soft, squeezing, collapsible, or flowing soils that are not self-supporting and highly permeable, large-grained cohesionless soils and fractured rock are problematic for HDD. These problematic soils could present some difficulties related to bore stability, settlement, and inadvertent drilling fluid returns, depending on the type of soil. Based on the boring field and laboratory test data, the soils encountered in the Borings B-6, B-7 and B-8 may be problematic soils for HDD installation.

We recommend that the force main excavations, preparation of subgrades, and pavement construction be monitored full-time by a CGMT geotechnical engineer or his representative to verify that the exposed subgrade materials will be suitable for the pavement support.

Report Prepared By:

Blake Sloan

Blake A. Sloan
Staff Engineer

Report Reviewed By:

Nicholas Wolff

Nicholas P. Wolff, P.E.
Geotechnical Engineer

1
PROJECT OVERVIEW

Introduction

This report presents the results of our subsurface exploration and engineering services for the Force Main Replacements in Lake County, Illinois. A General Location Plan included in the Appendix of this report, shows the approximate location of this project.

Project Description

ITEM	DESCRIPTION
Site Layout	See Boring Location Diagram in the Appendix
Proposed Construction	Based on the information provided to us, the proposed construction will consist of the installation of new force mains at various locations in Lake County, Illinois. We anticipate the new force main will be installed with standard cut and cover installation techniques. Horizontal Directional Drilling (HDD) installation may be considered for water crossings, road/railway crossings, or in other sensitive crossings.
Grading and Existing Site Considerations	Site grading including cuts and fills are anticipated to be less than 1 foot will be needed to develop the final site grades across the site.

Scope of Work

The conclusions and recommendations contained in this report are based on the soil borings performed in the vicinity of the proposed pavement areas, and associated laboratory testing of selected soil samples. The scope of the subsurface exploration included the following.

Number of Borings	Depth (feet)
8	10

The results of the soil borings, along with a Boring Location Plan showing the approximate locations where the borings were performed, are included in the Appendix of this report. Once the samples were returned to our laboratory we laboratory tests on selected representative soil samples from the borings to evaluate pertinent engineering properties, and, we analyzed the field and laboratory data to develop appropriate engineering recommendations.

The purpose of this report is to provide information and geotechnical engineering recommendations with regard to:

- Subsurface Soil and Groundwater Conditions
- Site Preparation and Earthwork

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EXPLORATION RESULTS

Site Description

ITEM	DESCRIPTION
Project Locations	The project site is located along N. Cedar Crest Drive, N. Lakeside Drive and N. Jackson Drive in Lake County, Illinois
Existing Site Improvements	At the time of our exploration the project site, the right of ways along N. Cedar Crest Drive, N. Lakeside Drive and N. Jackson Drive were covered with grass and trees.

Soil Conditions

A total of eight (8) borings, B-1 through B-8 were performed for this project. The soil conditions encountered at the borings performed at the site are summarized as follows:

Approximately 3 to 10 inches of asphalt pavement underlain by approximately 2 to 9 inches of aggregate base course were encountered at the ground surface in the Borings B-1 through B-6 and B-8. Approximately 7 inches of topsoil was encountered at the ground surface in the Boring B-7. The surface materials were underlain by dark brown or brown firm to very stiff silty clay fill soils that extended to depths of approximately 3½ to 8½ feet below the existing grade in the Borings B-1, B-2, B-4 and B-5. The surface materials were underlain by natural, brown or brown and gray hard silty clay soils that extended to the boring termination depth of approximately 10 feet below the existing grade in the Boring B-3. The surface materials were underlain by brown loose to medium dense sand fill soils that extended to a depth of approximately 4½ feet below the existing grade in the Boring B-6. The surface materials were underlain by natural, brown hard silty clay soils that extended to a depth of approximately 8½ feet below the existing grade in the Boring B-7. The surface materials were underlain by brown sand and gravel medium dense fill soils that extended to a depth of approximately 3½ feet below the existing grade in the Boring B-8. The silty clay fill soils were underlain by brown stiff sandy clay fill soils that extended to the boring termination depth of approximately 10 feet below the existing grade in the Boring B-1. The silty clay fill soils were underlain by natural, brown very stiff to hard silty clay soils that extended to the boring termination depth of approximately 10 feet below the existing grade in the Boring B-2. The silty clay fill soils were underlain by brown stiff sandy clay fill soils that extended to a depth of approximately 6 feet below the existing grade in the Boring B-4. The silty clay fill soils were underlain by natural, brown and gray stiff silty clay soils that extended to a depth of approximately 8½ feet below the existing grade in the Boring B-5. The sand fill soils were underlain by natural, brown, brown and gray or gray stiff to very stiff silty clay soils that extended to the boring termination depth of approximately 10 feet below the existing grade in the Boring B-6. The silty clay soils were underlain by natural, brown loose sand soils that extended to the boring termination depth of approximately 10 feet below the existing grade in the Boring B-7. The sand and gravel fill soils were underlain by natural, brown and gray or gray very stiff to hard silty clay soils that extended to the boring termination depth of approximately 10 feet below the existing grade in the Boring B-8. The sandy clay fill soils were underlain by natural, brown and gray hard silty clay soils that extended to the boring termination depth of approximately 10 feet below the existing grade in the Boring B-4. The silty clay soils were underlain by natural, gray hard sandy clay soils that extended to the boring termination depth of approximately 10 feet below the existing grade in the Boring B-5.

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SOILS	SOIL CHARACTERISTICS
Fill: Cohesive Soils	4 to 18 blows per foot Unconfined Compressive Strengths: 0.5 to 3.0 tsf; Firm to Very Stiff Moisture Contents: 8.1 to 24.6 percent Dry Densities: 96.7 lbs/ft^3
Fill: Granular Soils	6 to 13 blows per foot; Loose to Medium Dense Moisture Contents: 6.3 to 8.7 percent
Silty Clay Soils	4 to 50+ blows per foot Unconfined Compressive Strengths: 1.0 to 4.5+ tsf; Stiff to Hard Moisture Contents: 12.6 to 29.9 percent
Sandy Clay Soils	18 blows per foot Unconfined Compressive Strengths: 4.5+ tsf; Hard Moisture Contents: 7.8 percent
Sand Soils	7 blows per foot; Loose Moisture Contents: 5.6 percent

The specific soil types observed at the borings are noted on the boring logs, enclosed in the Appendix.

Groundwater Observations

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

Groundwater Summary

BORINGS	GROUNDWATER LEVELS	
	DURING DRILLING	IMMEDIATELY AFTER COMPLETION
Boring B-1 through B-6 and B-8	None	None
Boring B-7	7½ feet	None

Glacial till soils in the Midwest frequently oxidize from gray to brown above the level at which the soil remains saturated. The seasonal high water table is often interpreted to be near this zone of color change. Based on the results of this exploration, the season high water table may be located at depths of approximately 8½ feet below the existing grade.

More definitive evidence of prevailing groundwater levels could be obtained through the use of groundwater monitoring wells, which CGMT could install and monitor if requested.

It should be noted that the groundwater level can vary based on precipitation, evaporation, surface run-off and other factors not immediately apparent at the time of this exploration. Surface water runoff will be a factor during general construction, and steps should be taken during construction to control surface water runoff and to remove any water that may accumulate in the proposed excavations as well as floor slab and pavement areas. Precipitation generally varies seasonally. To assist in anticipating groundwater fluctuations changes throughout the year, average monthly precipitation is provided in the table below. Average precipitation levels were obtained from wunderground.com.

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The Monthly Precipitation for the Antecedent 1-year Period Prior to the Drilling Operations

Month	January	February	March	April	May	June	July	August	September	October	November	December	Total
Normal Precipitation (inches)	1.27	1.02	1.26	0.71	1.79	6.49	2.19	0.80	3.18	3.58	1.72	2.55	26.56

*Average precipitation levels were obtained from wunderground.com

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ANALYSIS AND RECOMMENDATIONS

Overview

The following recommendations have been developed on the basis of the previously described project characteristics and subsurface conditions encountered. If there are any changes to the project characteristics or if different subsurface conditions are encountered during construction, CGMT should be consulted so that the recommendations of this report can be reviewed.

The force main installation methods that could be considered would include:

- Cut and Cover Trench Excavation
- Horizontal Directional Drilling (HDD)

Cut and Cover Trench Excavation

We anticipate the new force main will be installed with conventional cut and cover excavation techniques. Based on the boring data, the new force main is anticipated to be installed in primarily in the interbedded, natural, cohesive or granular soils or the existing fill soils. These soils are generally considered suitable for direct pipe support provided that bedding material meeting the pipe manufacturer's recommendations is placed beneath the pipe. Subgrade soils that become saturated, loosened and/or softened during construction operations could be overexcavated and replaced. Backfill material in the overexcavated areas should consist of the on-site sand soils or 1-inch maximum size crushed stone or gravel containing no fines. The granular fill should be placed in lifts not more than 8 inches thick and compacted using vibratory equipment.

Care should be taken during excavation to protect the structural integrity of any existing structures, pavements or adjacent underground utilities. In particular, the interface of any existing trench backfill and native soils can form a ready failure surface where intersected by excavations for new utilities. Temporary sheeting, shoring, and underpinning may be required depending upon factors such as the depth of the excavation, limitations on width of the excavation, the location of existing structures, groundwater and soils conditions. We could provide lateral earth pressure parameters for design of braced excavations, if requested. The geometry of the braced excavation area with reference to the surrounding structures and their loading would need to be defined for this type of analysis.

Some lateral movement of shoring and bracing systems normally occurs which can cause some loss of support for surrounding pavements or utilities. Portions of pavement nearest the excavations can be removed so that the remaining pavement base can be recompacted and stabilized after trench excavations are backfilled and shoring is removed, so that reflective cracking of pavements is reduced.

All vehicles, construction equipment and soil piles should be kept a significant lateral distance from the crest of confined excavations to maintain safe working conditions. Vehicles and soil piles located adjacent to excavations and the roadway embankment, would significantly influence the stability of the slopes as outlined by the OSHA regulations. A more detailed stability analysis would be required for these conditions. Exposed excavations slope faces should be protected from the elements.

Harmful odors could be encountered in the trench excavations during construction. The contractor should check for gas and/or oxygen deficiency prior to any workers entering the excavations. All the necessary monitoring and safety precautions should be strictly observed during construction.

Horizontal Directional Drilling (HDD)

Horizontal Directional Drilling (HDD) is typically used when trenching or open excavation is not practical, such as water crossings, road/railway crossings, or in other sensitive crossings.

HDD is compatible with a wide range of soil conditions. Glacial till soils may be laden with cobbles and boulders. The presence of obstacles should be anticipated during the force main installation. In addition, very loose, soft, squeezing, collapsible, or flowing soils that are not self-supporting and highly permeable, large-grained cohesionless soils and fractured rock are problematic for HDD. These problematic soils could present some difficulties related to bore stability, settlement, and inadvertent drilling fluid returns, depending on the type of soil. Based on the boring field and laboratory test data, the soils encountered in the Borings B-6, B-7 and B-8 may be problematic soils for HDD installation.

The problematic soils for HDD installation encountered in the borings can be summarized in the table below:

Problematic Soils for HDD Installation

Boring	Material	Depth
Boring B-6	Brown Sand Soils – Not Self-Supporting and Highly Permeable Soils	1 to 4½ feet
Boring B-7	Brown Sand Soils – Not Self-Supporting and Highly Permeable Soils	8½ to 10 feet
Boring B-8	Brown Sand and Gravel Soils – Not Self-Supporting and Highly Permeable Soils	1 to 3½ feet

The presence of obstructions within fill soils or cobbles and boulders within the glacial clay profile along the proposed alignment are possible, and plans and specifications should include provisions for the protection of the pipe during horizontal drilling operations and the removal of such obstructions.

Trench Backfill

The uppermost 2 feet of fill placed in paved areas should consist of well-graded granular material, such as IDOT gradation CA-6. Backfill should be placed in lifts not exceeding 9-inches in loose thickness and each lift compacted with vibratory equipment to at least 95 percent of the material's modified Proctor maximum dry density (ASTM D-1557). The moisture content of the granular fill should be within 3 percent below and 3 percent above the optimum moisture content for the material based on the modified Proctor test (ASTM D-1557).

Cohesive soils may be suitable for reuse as fill provided the trench is wide enough to allow placement of fill in relatively thin lifts and proper sheepsfoot-type compaction equipment can access the trenches. However, we do recommend some limitations to the use of the cohesive soils. Some portions of the clay soils excavated from the trench may have water contents that are too high for immediate use as trench backfill and there is the likelihood that compaction of on-site soils will require some moisture adjustment.

General Construction Considerations

We recommend that the subgrade preparation, installation of the new force main be monitored by a CGMT geotechnical engineer or his representative to verify that the exposed subgrade materials will be suitable for the new force main and are consistent with the boring log information obtained during this geotechnical exploration. We would be pleased to provide these services. Methods of verification and identification such as proofrolling, DCP testing and hand auger probe holes will be necessary to further evaluate the subgrade soils and identify unsuitable soils. The contractor should be prepared to overexcavate any unsuitable subgrade soils that may be encountered at isolated locations.

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

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

Excavations should comply with the requirements of OSHA 29CFR, Part 1926, Subpart P, "Excavations" and its appendices, as well as other applicable codes. This document states that the contractor is solely responsible for the design and construction of stable, temporary excavations. The excavations should not only be in accordance with current OSHA excavation and trench safety standards but also with applicable local, state, and federal regulations. The contractor should shore, slope or bench the excavation sides when appropriate. In no case should excavations extend below the level of adjacent structures, utilities or pavements, unless underpinning or other adequate support is provided. Site safety is the sole responsibility of the contractor, who shall also be responsible for the means, methods and sequencing of construction operations.

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EXPLORATION PROCEDURES

Subsurface Exploration Procedures

The soil borings were located in the field by a CGMT Field Engineer based on the proposed boring site plan provided to us. As required by the State of Illinois, the driller notified Illinois One-Call System, JULIE, to verify underground utilities in the vicinity of the project site prior to drilling operations.

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

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

Laboratory Testing Program

Representative soil samples were selected and tested in our laboratory to check field classifications and to determine pertinent engineering properties. The laboratory testing program included visual classifications and unconfined compressive strength and moisture content determinations.

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

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

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

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CLOSING

We recommend that the construction activities be monitored by CGMT to provide the necessary overview and to check the suitability of the subgrade soils for supporting the new force main. Once the final design becomes available, CGMT must be contacted to review the recommendations presented herein.

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

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

APPENDIX

Vicinity Map

Boring Location Plan(s)

Boring Log(s)

Core Picture(s)

Unified Soil Classification System

Reference Notes for Boring Logs

VICINITY MAP

N

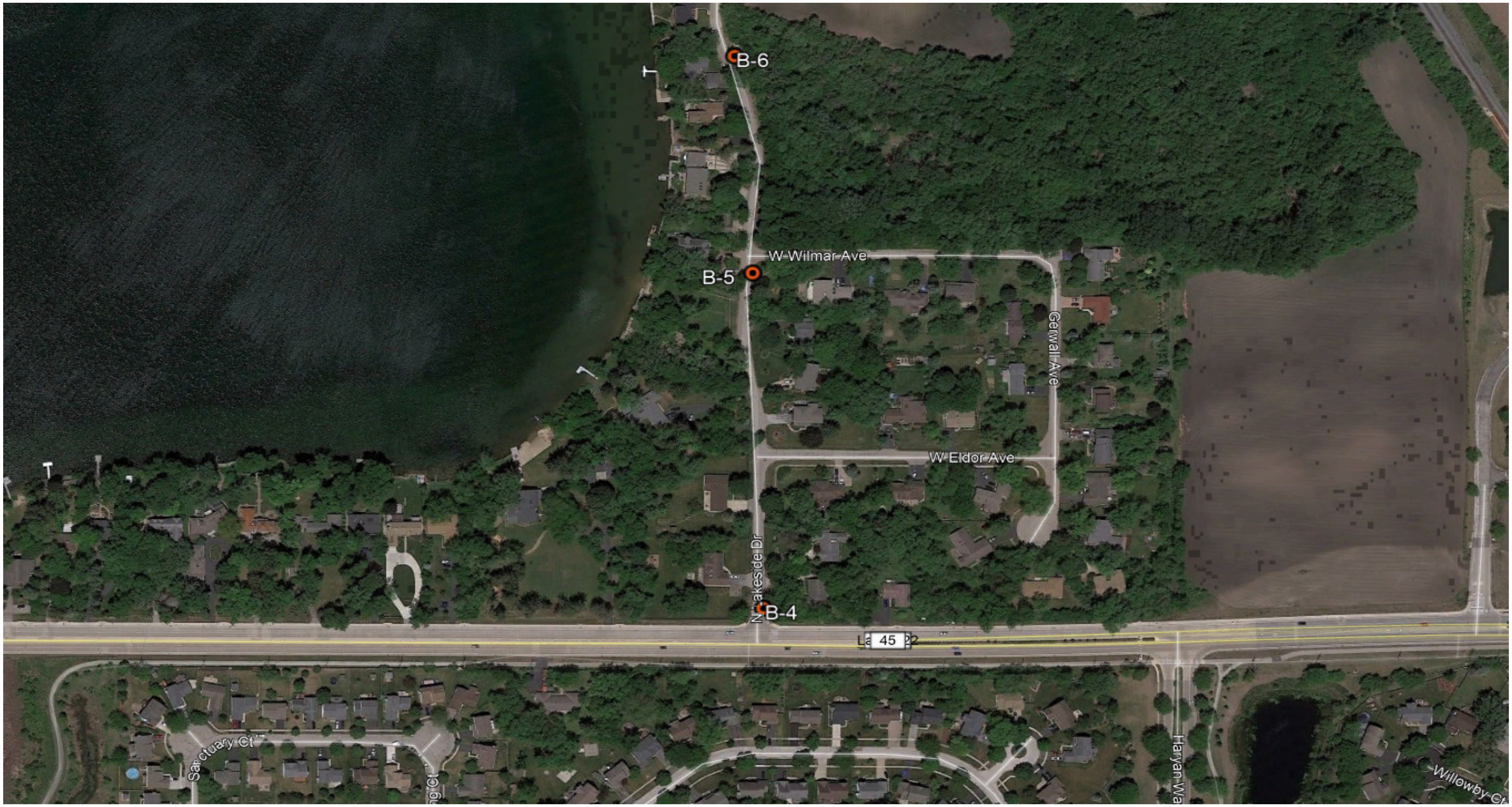
CGMT Project No. 21G0386
Force Main Replacements,
Various Locations,
Lake County, Illinois

Drawing Not To Scale

LEGEND

- Approximate Soil Boring Location

Soil Boring Location Diagram	
Force Main Replacements	
N. Cedar Crest Drive Lake Villa, Illinois 60046	
Project Manager	Project Number
N. Wolff	21G0386
Date	Sheet Number
8/31/2021	Fig. 1

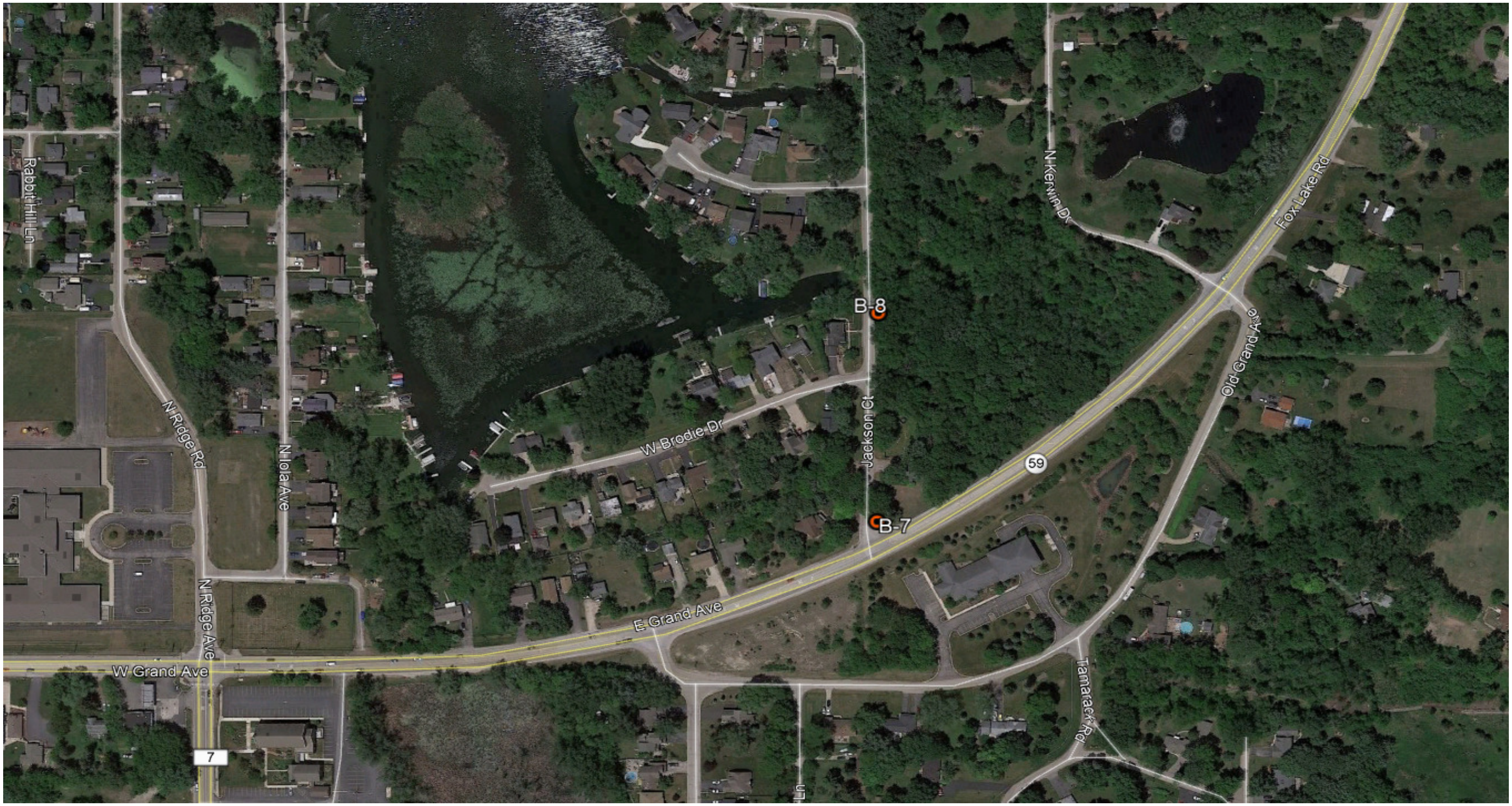


Drawing Not To Scale

LEGEND

- Approximate Soil Boring Location

Soil Boring Location Diagram	
Force Main Replacements	
N. Lakeside Drive Grayslake, Illinois 60030	
Project Manager	Project Number
N. Wolff	21G0386
Date	Sheet Number
8/31/2021	Fig. 2



Drawing Not To Scale

N

LEGEND

- Approximate Soil Boring Location

Soil Boring Location Diagram	
Force Main Replacements	
N. Jackson Drive Ingleside, Illinois 60041	
Project Manager	Project Number
N. Wolff	21G0386
Date	Sheet Number
8/31/2021	Fig. 3

Soil Boring Log

Construction & Geotechnical Material Testing, Inc.
60 Martin Lane, Elk Grove Village, Illinois 60007
Telephone (630) 595-1111 ♦ Fax (630) 595-1110

Soil Boring Prepared for:
Mr. Scott Drabicki, P.E.
Clark Dietz, Inc.
625 57th Street, 6th Floor
Kenosha, Wisconsin 53140

Boring No.: B-01
Date: Friday, August 20, 2021
Project: Force Main Replacements
N. Cedar Crest Drive
Lake Villa, Illinois 60046
Project No.: 21G0386
Boring Location: See Boring Location Diagram
Logged By: L.S.H.
Ground Elevation:

Sheet 1 of 1

Elevation	Depth	Strata	Soil / Rock Description	Sample Type & No. Depth Interval (Ft) Recovery (in)	Blow Count	Moisture Content (%)	Unconfined Compressive Strength (TSF)	Notes & Test Results
	0.0		Approximately 3" of Asphalt Pavement Approximately 9" of Aggregate Base Course					Unconfined compressive strength of soil samples estimated using a calibrated penetrometer.
	1.0 2.0		Silty Clay, Trace Sand and Gravel, brown, firm to very stiff (CL FILL)	SS-1 1.0' - 2.5' 8" Recovery	1 2 2	18.9	0.5	
	3.0							
	4.0			SS-2 3.5' - 5.0' 8" Recovery	3 3 3	14.7	1.0	
	5.0							
	6.0 7.0			SS-3 6.0' - 7.5' 10" Recovery	3 3 5	20.2	2.0	Dry Density: 6.0' - 7.5' = 96.7 lbs/ft^3
	8.0							
	9.0		Sandy Clay, Trace Gravel, brown, stiff (CL FILL)	SS-4 8.5' - 10.0' 17" Recovery	4 3 5	17.0	1.5	
	10.0		END of BORING at 10 Feet					
	11.0							
	12.0							
	13.0							
	14.0							
	15.0							
	16.0							
	17.0							
	18.0							
	19.0							
	20.0							

Drilling Contractor: J.S.
Drilling Method: 3¼" H.S.A. Split Spoon Sampling
Drilling Equipment: CME-45 Truck Mounted Drill Rig
REVIEWED BY: NPW

Water Level (Ft.)
During Drilling: None
Immediately After Drilling: None

Soil Boring Log

Construction & Geotechnical Material Testing, Inc.
60 Martin Lane, Elk Grove Village, Illinois 60007
Telephone (630) 595-1111 ♦ Fax (630) 595-1110

Soil Boring Prepared for:
Mr. Scott Drabicki, P.E.
Clark Dietz, Inc.
625 57th Street, 6th Floor
Kenosha, Wisconsin 53140

Boring No.: B-02
Date: Friday, August 20, 2021
Project: Force Main Replacements
N. Cedar Crest Drive
Lake Villa, Illinois 60046
Project No.: 21G0386
Boring Location: See Boring Location Diagram
Logged By: L.S.H.
Ground Elevation:

Sheet 1 of 1

Elevation	Depth	Strata	Soil / Rock Description	Sample Type & No. Depth Interval (Ft) Recovery (in)	Blow Count	Moisture Content (%)	Unconfined Compressive Strength (TSF)	Notes & Test Results
	0.0		Approximately 8" of Asphalt Pavement Approximately 4" of Aggregate Base Course					Unconfined compressive strength of soil samples estimated using a calibrated penetrometer.
	1.0–2.0		Silty Clay, Trace Sand and Gravel, brown, very stiff (CL FILL)	SS-1 1.0' - 2.5' 12" Recovery	9 8 10	8.1	3.0	
	3.0							
	4.0		Silty Clay, Trace Sand and Gravel, brown, very stiff to hard (CL)	SS-2 3.5' - 5.0' 8" Recovery	2 2 4	16.8	3.75	
	5.0							
	6.0–7.0			SS-3 6.0' - 7.5' 18" Recovery	4 8 9	16.5	4.5+	
	8.0							
	9.0			SS-4 8.5' - 10.0' 18" Recovery	4 6 12	15.8	4.5+	
	10.0		END of BORING at 10 Feet					
	11.0							
	12.0							
	13.0							
	14.0							
	15.0							
	16.0							
	17.0							
	18.0							
	19.0							
	20.0							

Drilling Contractor: J.S.
Drilling Method: 3¼" H.S.A. Split Spoon Sampling
Drilling Equipment: CME-45 Truck Mounted Drill Rig
REVIEWED BY: NPW

Water Level (Ft.)
During Drilling: None
Immediately After Drilling: None

Soil Boring Log

Construction & Geotechnical Material Testing, Inc.
60 Martin Lane, Elk Grove Village, Illinois 60007
Telephone (630) 595-1111 ♦ Fax (630) 595-1110

Soil Boring Prepared for:
Mr. Scott Drabicki, P.E.
Clark Dietz, Inc.
625 57th Street, 6th Floor
Kenosha, Wisconsin 53140

Boring No.: B-03
Date: Friday, August 20, 2021
Project: Force Main Replacements
N. Cedar Crest Drive
Lake Villa, Illinois 60046
Project No.: 21G0386
Boring Location: See Boring Location Diagram
Logged By: L.S.H.
Ground Elevation:

Elevation	Depth	Strata	Soil / Rock Description	Sample Type & No. Depth Interval (Ft) Recovery (in)	Blow Count	Moisture Content (%)	Unconfined Compressive Strength (TSF)	Notes & Test Results
	0.0		Approximately 4" of Asphalt Pavement Approximately 8" of Aggregate Base Course					Unconfined compressive strength of soil samples estimated using a calibrated penetrometer.
	1.0 2.0		Silty Clay, Trace Sand and Gravel, brown, hard (CL)	SS-1 1.0' - 2.5' 14" Recovery	3 5 7	15.1	4.5+	
	3.0							
	4.0 5.0		Silty Clay, Trace Sand and Gravel, brown and gray, hard (CL)	SS-2 3.5' - 5.0' 18" Recovery	5 9 14	16.5	4.5+	
	6.0							
	7.0			SS-3 6.0' - 7.5' 18" Recovery	4 9 14	15.5	4.5+	
	8.0							
	9.0			SS-4 8.5' - 10.0' 18" Recovery	4 9 12	19.0	4.5+	
	10.0		END of BORING at 10 Feet					
	11.0							
	12.0							
	13.0							
	14.0							
	15.0							
	16.0							
	17.0							
	18.0							
	19.0							
	20.0							

Drilling Contractor: J.S.
Drilling Method: 3¼" H.S.A. Split Spoon Sampling
Drilling Equipment: CME-45 Truck Mounted Drill Rig
REVIEWED BY: NPW

Water Level (Ft.)
During Drilling: None
Immediately After Drilling: None

Soil Boring Log

Construction & Geotechnical Material Testing, Inc.
60 Martin Lane, Elk Grove Village, Illinois 60007
Telephone (630) 595-1111 ♦ Fax (630) 595-1110

Soil Boring Prepared for:
Mr. Scott Drabicki, P.E.
Clark Dietz, Inc.
625 57th Street, 6th Floor
Kenosha, Wisconsin 53140

Boring No.: B-04
Date: Friday, August 20, 2021
Project: Force Main Replacements
N. Lakeside Drive
Grayslake, Illinois 60030
Project No.: 21G0386
Boring Location: See Boring Location Diagram
Logged By: L.S.H.
Ground Elevation:

Sheet 1 of 1

Elevation	Depth	Strata	Soil / Rock Description	Sample Type & No. Depth Interval (Ft) Recovery (in)	Blow Count	Moisture Content (%)	Unconfined Compressive Strength (TSF)	Notes & Test Results
	0.0		Approximately 6" of Asphalt Pavement Approximately 6" of Aggregate Base Course					Unconfined compressive strength of soil samples estimated using a calibrated penetrometer.
	1.0 2.0		Silty Clay, Trace Sand and Gravel, dark brown, stiff (CL FILL)	SS-1 1.0' - 2.5' 12" Recovery	4 2 3	22.7	1.5	
	3.0							
	4.0 5.0		Sandy Clay, Trace Gravel, brown, stiff (CL FILL)	SS-2 3.5' - 5.0' 16" Recovery	2 3 3	17.8	1.25	
	6.0 7.0		Silty Clay, Trace Sand and Gravel, brown and gray, hard (CL)	SS-3 6.0' - 7.5' 18" Recovery	5 6 7	14.7	4.5+	
	8.0							
	9.0			SS-4 8.5' - 10.0' 18" Recovery	4 8 8	16.2	4.0	
	10.0		END of BORING at 10 Feet					
	11.0							
	12.0							
	13.0							
	14.0							
	15.0							
	16.0							
	17.0							
	18.0							
	19.0							
	20.0							

		Water Level (Ft.)	
Drilling Contractor:	J.S.		
Drilling Method:	3¼" H.S.A. Split Spoon Sampling	**During Drilling:**	None
Drilling Equipment:	CME-45 Truck Mounted Drill Rig	**Immediately After Drilling:**	None
	REVIEWED BY: NPW		

Soil Boring Log

Construction & Geotechnical Material Testing, Inc.
60 Martin Lane, Elk Grove Village, Illinois 60007
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Soil Boring Prepared for:
Mr. Scott Drabicki, P.E.
Clark Dietz, Inc.
625 57th Street, 6th Floor
Kenosha, Wisconsin 53140

Boring No.: B-05
Date: Friday, August 20, 2021
Project: Force Main Replacements
N. Lakeside Drive
Grayslake, Illinois 60030
Project No.: 21G0386
Boring Location: See Boring Location Diagram
Logged By: L.S.H.
Ground Elevation:

Sheet 1 of 1

Elevation	Depth	Strata	Soil / Rock Description	Sample Type & No. Depth Interval (Ft) Recovery (in)	Blow Count	Moisture Content (%)	Unconfined Compressive Strength (TSF)	Notes & Test Results
	0.0		Approximately 8" of Asphalt Pavement Approximately 4" of Aggregate Base Course					Unconfined compressive strength of soil samples estimated using a calibrated penetrometer.
	1.0–2.0		Silty Clay, Trace Sand and Gravel, dark brown, very stiff (CL FILL)	SS-1 1.0' - 2.5' 12" Recovery	2 2 4	24.6	2.75	
	3.0							
	4.0–5.0		Silty Clay, Trace Sand and Gravel, brown and gray, stiff (CL)	SS-2 3.5' - 5.0' 14" Recovery	3 5 50	18.2	1.75	
	5.0							
	6.0–7.0			SS-3 6.0' - 7.5' 18" Recovery	3 4 5	19.9	1.0	
	8.0							
	9.0		Sandy Clay, Trace Gravel, gray, hard (CL)	SS-4 8.5' - 10.0' 18" Recovery	4 8 10	7.8	4.5+	
	10.0		END of BORING at 10 Feet					
	11.0							
	12.0							
	13.0							
	14.0							
	15.0							
	16.0							
	17.0							
	18.0							
	19.0							
	20.0							

Drilling Contractor: J.S.
Drilling Method: 3¼" H.S.A. Split Spoon Sampling
Drilling Equipment: CME-45 Truck Mounted Drill Rig
REVIEWED BY: NPW

Water Level (Ft.)
During Drilling: None
Immediately After Drilling: None

Soil Boring Log

Construction & Geotechnical Material Testing, Inc.
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Soil Boring Prepared for:
Mr. Scott Drabicki, P.E.
Clark Dietz, Inc.
625 57th Street, 6th Floor
Kenosha, Wisconsin 53140

Boring No.: B-06
Date: Friday, August 20, 2021
Project: Force Main Replacements
N. Lakeside Drive
Grayslake, Illinois 60030
Project No.: 21G0386
Boring Location: See Boring Location Diagram
Logged By: L.S.H.
Ground Elevation:

Sheet 1 of 1

Elevation	Depth	Strata	Soil / Rock Description	Sample Type & No. Depth Interval (Ft) Recovery (in)	Blow Count	Moisture Content (%)	Unconfined Compressive Strength (TSF)	Notes & Test Results
	0.0		Approximately 10" of Asphalt Pavement Approximately 2" of Aggregate Base Course					Unconfined compressive strength of soil samples estimated using a calibrated penetrometer.
	1.0		Sand, Trace Gravel, brown, loose to medium dense (SP FILL)	SS-1 1.0' - 2.5' 18" Recovery	6 6 6	6.3	-	
	2.0							
	3.0							
	4.0			SS-2 3.5' - 5.0' 18" Recovery	3 3 3	8.7 16.0	- 1.5	
	5.0		Silty Clay, Trace Sand and Gravel, brown, stiff (CL)					
	6.0		Silty Clay, Trace Sand and Gravel, brown and gray, very stiff (CL)	SS-3 6.0' - 7.5' 18" Recovery	1 1 3	15.9	2.0	
	7.0							
	8.0							
	9.0		Silty Clay, Trace Sand and Gravel, gray, stiff (CL)	SS-4 8.5' - 10.0' 18" Recovery	1 2 2	14.0	1.0	
	10.0		END of BORING at 10 Feet					
	11.0							
	12.0							
	13.0							
	14.0							
	15.0							
	16.0							
	17.0							
	18.0							
	19.0							
	20.0							

Drilling Contractor: J.S.
Drilling Method: 3¼" H.S.A. Split Spoon Sampling
Drilling Equipment: CME-45 Truck Mounted Drill Rig
REVIEWED BY: NPW

Water Level (Ft.)
During Drilling: 7½ feet
Immediately After Drilling: None

Soil Boring Log

Construction & Geotechnical Material Testing, Inc.
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Soil Boring Prepared for:
Mr. Scott Drabicki, P.E.
Clark Dietz, Inc.
625 57th Street, 6th Floor
Kenosha, Wisconsin 53140

Boring No.: B-07
Date: Friday, August 20, 2021
Project: Force Main Replacements
N. Jackson Drive
Ingleside, Illinois 60041
Project No.: 21G0386
Boring Location: See Boring Location Diagram
Logged By: L.S.H.
Ground Elevation:

Sheet 1 of 1

Elevation	Depth	Strata	Soil / Rock Description	Sample Type & No. Depth Interval (Ft) Recovery (in)	Blow Count	Moisture Content (%)	Unconfined Compressive Strength (TSF)	Notes & Test Results
	0.0		Approximately 7" of Topsoil					Unconfined compressive strength of soil samples estimated using a calibrated penetrometer.
	1.0		Silty Clay, Trace Sand and Gravel, brown, hard (CL)	SS-1 1.0' - 2.5' 18" Recovery	4 6 20	16.8	4.5+	
	2.0							
	3.0							
	4.0			SS-2 3.5' - 5.0' 18" Recovery	9 15 18	12.6	4.5+	
	5.0							
	6.0							
	7.0			SS-3 6.0' - 7.5' 18" Recovery	5 8 11	15.7	4.5+	
	8.0							
	9.0		Sand, Trace Gravel, brown, loose (SP)	SS-4 8.5' - 10.0' 18" Recovery	2 3 4	5.6	-	
	10.0		END of BORING at 10 Feet					
	11.0							
	12.0							
	13.0							
	14.0							
	15.0							
	16.0							
	17.0							
	18.0							
	19.0							
	20.0							

Drilling Contractor: J.S.
Drilling Method: 3¼" H.S.A. Split Spoon Sampling
Drilling Equipment: CME-45 Truck Mounted Drill Rig
REVIEWED BY: NPW

Water Level (Ft.)
During Drilling: None
Immediately After Drilling: None

Soil Boring Log

Construction & Geotechnical Material Testing, Inc.
60 Martin Lane, Elk Grove Village, Illinois 60007
Telephone (630) 595-1111 ♦ Fax (630) 595-1110

Soil Boring Prepared for:
Mr. Scott Drabicki, P.E.
Clark Dietz, Inc.
625 57th Street, 6th Floor
Kenosha, Wisconsin 53140

Boring No.:	**B-08**
Date:	Friday, August 20, 2021
Project:	Force Main Replacements N. Jackson Drive Ingleside, Illinois 60041
Project No.:	21G0386
Boring Location:	See Boring Location Diagram
Logged By:	L.S.H.
Ground Elevation:	

Sheet 1 of 1

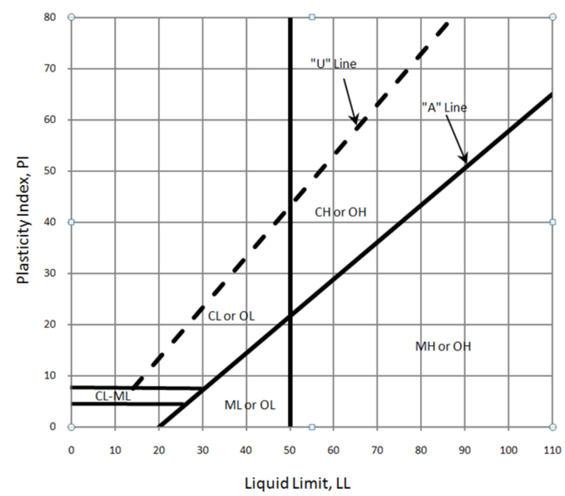
Elevation	Depth	Strata	Soil / Rock Description	Sample Type & No. Depth Interval (Ft) Recovery (in)	Blow Count	Moisture Content (%)	Unconfined Compressive Strength (TSF)	Notes & Test Results
	0.0		Approximately 8" of Asphalt Pavement Approximately 4" of Aggregate Base Course					Unconfined compressive strength of soil samples estimated using a calibrated penetrometer.
	1.0–2.0		Sand and Gravel, brown, medium dense (SP-GP FILL)	SS-1 1.0' - 2.5' 18" Recovery	7 7 6	6.5	-	
	3.0							
	4.0		Silty Clay, Trace Sand and Gravel, brown and gray, very stiff to hard (CL)	SS-2 3.5' - 5.0' 18" Recovery	2 3 5	20.9	3.0	
	5.0							
	6.0–7.0			SS-3 6.0' - 7.5' 18" Recovery	3 6 7	20.0	4.5+	
	8.0							
	9.0		Silty Clay, Trace Sand and Gravel, gray, very stiff (CL) Saturated	SS-4 8.5' - 10.0' 18" Recovery	3 3 6	29.9	3.0	
	10.0		END of BORING at 10 Feet					
	11.0							
	12.0							
	13.0							
	14.0							
	15.0							
	16.0							
	17.0							
	18.0							
	19.0							
	20.0							

Drilling Contractor: J.S.
Drilling Method: 3¼" H.S.A. Split Spoon Sampling
Drilling Equipment: CME-45 Truck Mounted Drill Rig
REVIEWED BY: NPW

Water Level (Ft.)
During Drilling: None
Immediately After Drilling: None

UNITED SOIL CLASSIFICATION SYSTEM
(ASTM D-2487)

Major Division		Group Symbol	Typical Names		Classification Criteria
Coarse-grained soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	GW	Well-graded gravels and gravel-sand mixtures, little or no fines	Classification on basis of percentage of fines: Less than 5% pass No. 200 sieve: GW, GP, SW, SP; More than 12% pass No. 200 sieve: GM, GC, SM, SC; 5% to 12% pass No. 200 sieve: Borderline classification requiring use of dual symbol	$C_u = D_{60}/D_{10}$ greater than 4 $C_z = (D_{30})^2/(D_{10}XD_{60})$ between 1 & 3
		GP	Poorly graded gravels and gravel-sand mixtures, little or no fines		Not meeting both criteria for GW
		GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits plot below "A" line or plasticity index less than 4
		GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits plot above "A" line and plasticity index greater than 7
	Sands More than 50% of coarse fraction passes No. 4 sieve	SW	Well-graded sands and gravelly sands, little or no fines		$C_u = D_{60}/D_{10}$ greater than 6 $C_z = (D_{30})^2/(D_{10}XD_{60})$ between 1 & 3
		SP	Poorly graded sands and gravelly sands, little or no fines		Not meeting both criteria for SW
		SM	Silty sands, sand-silt mixtures		Atterberg limits plot below "A" line or plasticity index less than 4
		SC	Clayey sands, sand-clay mixtures		Atterberg limits plot above "A" line and plasticity index greater than 7
Fine-grained soils 50% or more passing No. 200 sieve	Silts and Clays Liquid limit 50% or less	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands		Note: U-line represents approximate upper limit of LL and PI combinations natural soils (empirically determined). ASTM D-2487
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
		OL	Organic silts and organic silty clays of low plasticity		
	Silts and Clays Liquid limit greater than 50%	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts		
		CH	Inorganic clays of high plasticity, fat clays		
		OH	Organic clays of medium to high plasticity		
Highly organic soils		Pt	Peat, muck and other highly organic soils		Fibrous organic matter; will char, burn or glow



Plasticity chart for the classification of fine-grained soils. Tests made on fraction finer than No. 40 sieve

Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC, well-graded gravel-sand mixture with clay binder

UNIFIED SOIL CLASSIFICATION SYSTEM

REFERENCE NOTES FOR BORING LOGS

I. <u>Drilling and Sampling Symbols:</u>

SS – Split Spoon Sampler	RB – Rock Bit Drilling
ST – Shelby Tube Sampler	BS – Bulk Sample of Drilling
RC – Rock Core: NX, BX, AX	PA – Power Auger (no sample)
PM – Pressuremeter	HSA – Hollow Stem Auger
DC – Dutch Cone Penetrometer	WS – Wash Sample

Standard Penetration (Blows/Ft) refers to the blows per foot of a 140 lb. hammer falling 30 inches on a 2 inch O.D. split spoon sampler, as specified in ASTM D-1586. The blow count is commonly referred to as the N-value.

II. <u>Correlation of Penetration Resistances to Soil Properties:</u>

<u>Relative Density-Sands, Silts</u>

SPT – N	Relative Density
0 – 3	Very Loose
4 – 9	Loose
10 – 29	Medium Dense
30 – 49	Dense
50 – 80	Very Dense

<u>Consistency of Cohesive Soils</u>

Unconfined Compressive Strength, Qp, tsf	Consistency
under 0.25	Very Soft
0.25 – 0.49	Soft
0.50 – 0.99	Firm
1.00 – 1.99	Stiff
2.00 – 3.99	Very Stiff
4.00 – 8.00	Hard
over 8.00	Very Hard

III <u>Unified Soil Classification Symbols:</u>

GP	Poorly Graded Gravel	ML	Low Plasticity Silt
GW	Well Graded Gravel	MH	High Plasticity Silt
GM	Silty Gravel	CL	Low Plasticity Clay
GC	Clayey Gravel	CH	High Plasticity Clay
SP	Poorly Graded Sand	OL	Low Plasticity Organic
SW	Well Graded Sand	OH	High Plasticity Organic
SM	Silty Sand	CL-ML	Dual Classification (Typical)
SC	Clayey Sand		

IV. <u>Water Level Measurement Symbol:</u>

WL	Water Level	BCR	Before Casing Removal
WS	While Sampling	ACR	After Casing Removal
WD	While Drilling	WCI	Wet Cave In
		DCI	Dry Cave In

The water levels are those water levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in a granular soil. In clays and plastic silts, the accurate determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally applied.