Professional Service Industries, Inc.
5555 Canal Rd., Cleveland, OH 44125
(216) 447-1335 (P) & (216) 642-7008 (F)

October 30, 2020

Mr. Eric Fallon, P.E.
Senior Project Engineer
CT Consultants, Inc.
3875 Embassy Parkway, Suite 200
Akron, OH 44333
efallon@ctconsultants.com

Re: Geotechnical Subsurface Exploration Report
Proposed Sanitary Sewer Replacement
Washington Street SE and Short Street
Hartville, Stark County, Ohio
PSI Project No.: 0142-2091

Dear Mr. Fallon:

Per your request, Professional Service Industries, Inc. (PSI) is pleased to submit this Geotechnical Engineering Services Report for the above referenced project. The results of this exploration, together with our recommendations, are to be found in the accompanying report.

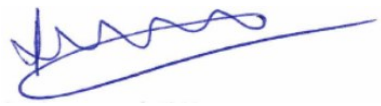
After the plans and specifications are complete, PSI should review the final design and specifications in order to verify that the earthwork and recommendations are properly interpreted and implemented. **It is considered imperative that the geotechnical engineer and/or its representative be present during earthwork operations and sewer line installation to observe the field conditions with respect to the design assumptions and specifications. PSI will not be held responsible for interpretations and field quality control observations made by others.**

If you have any questions pertaining to this report, please contact our office at (216) 447-1335. PSI would be pleased to continue providing geotechnical services throughout the implementation of the project, and we look forward to working with you and your organization on this and future projects.

Respectfully submitted,

PROFESSIONAL SERVICE INDUSTRIES, INC.





Joseph Corrigan
Project Engineer

Surya Thapa, P.E.
Geotechnical Department Manager

A. Veeramani, P.E.
Director/Principal Consultant

Subsurface Exploration Report

For the Proposed

Sanitary Sewer Replacement
Washington Street SE and Short Street
Hartville, Stark County, Ohio

Joseph Corrigan
Project Engineer

Prepared for

CT Consultants, Inc.
3875 Embassy Parkway, Suite 200
Akron, Ohio 44136

Surya Thapa, P.E.
Geotechnical Department Manager

Prepared by

Professional Service Industries, Inc.
5555 Canal Road
Cleveland, OH 44125

A. Veeramani, P.E.
Director/Principal Consultant

PSI Project No. 0142-2091

TABLE OF CONTENTS

LIST OF APPENDICES

1 PROJECT INFORMATION

1.1 PROJECT AUTHORIZATION

This report presents the results of a geotechnical subsurface exploration and evaluation conducted for CT Consultants, Inc. in connection with the proposed Sanitary Sewer Replacement project, in the City of Hartville, Stark County, Ohio. PSI's services for this project were performed in accordance with PSI Proposal No. 0142-295200, dated January 20, 2020. Authorization to perform this exploration and analysis was in the form of Purchase Order No. 248-20, dated February 3, 2020.

1.2 PROJECT DESCRIPTION

Based on the provided information, it is understood that the proposed project will involve the replacement of the sanitary sewer line with an 8-inch-diameter pipe, in the City of Hartville, Ohio. The proposed sanitary sewer line will be installed at about 6 to 8 feet below the existing grades, and will measure approximately 1,600 feet in length. No other information is available at the time of this report.

The geotechnical recommendations presented in this report are based on the available project information, the proposed location of the sewer line on the site, and the subsurface materials described in this report. If any of the information we have been given or have assumed is incorrect, please contact us so that we may amend the recommendations presented accordingly. PSI will not be responsible for the implementation of its recommendations when it is not notified of changes in the project.

1.3 PURPOSE AND SCOPE OF SERVICES

The purpose of this study was to explore the subsurface conditions at the site and to prepare recommendations for the design and installation of the sewer line, site preparation, and other construction considerations. Our scope for this service included a project site reconnaissance, drilling and sampling six (6) test borings, completing a laboratory testing program, and submitting an engineering analysis and evaluation of the subsurface materials.

The scope of services for the geotechnical exploration did not include an environmental assessment for the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, groundwater or air, on or below or around this site. Any statements in this report or on the boring logs regarding odors, colors or unusual or suspicious items or conditions are strictly for the information of the client. PSI's scope also did not include any service to investigate or detect the presence of moisture, mold or other biological contaminants in or around any structure, or any service that was designed or intended to prevent or lower the risk of the occurrence or the amplification of the same. The Client should be aware that mold is ubiquitous to the environment with mold amplification occurring when building materials are impacted by moisture. The Client should also be aware that site conditions are outside of PSI's control, and that mold amplification will likely occur, or continue to occur, in the presence of moisture. As such, PSI cannot and shall not be held responsible for the occurrence or reoccurrence of mold amplification.

2 SITE AND SUBSURFACE CONDITIONS

2.1 SITE LOCATION AND DESCRIPTION

The proposed sewer line will be located between MH-7A (Lat: 40.959898°; Long:-81.332055°) and MH-1 (Lat: 40.957454°; Long:-81.329544°) in the City of Hartville, Ohio. The existing surface of the site within the project limits is covered with asphalt concrete, grass, and gravel. The project area is predominantly surrounded by residential and commercial properties. Surface drainage was fair at the time of the field drilling operations. PSI recommends that any existing utility lines be checked and marked prior to construction activities.

2.2 SUBSURFACE CONDITIONS

The subsurface conditions at the site were explored with a total of six (6) test borings. The test borings were drilled to depths of approximately 15 to 20 feet below the existing surface grades. The approximate boring locations are shown on the Boring Location Plan presented in the *Appendix* of this report. The locations for the test borings were selected by PSI and located in the field relative to existing site features and based on site accessibility.

The borings were advanced utilizing 3¼ inch inside diameter, hollow-stem auger drilling methods. Soil samples were routinely obtained during the drilling process. Selected soil samples were later tested in the laboratory to obtain soil material properties for the foundation, floor slabs and pavement recommendations. Drilling, sampling, and laboratory testing were accomplished in general accordance with ASTM procedures.

The types of subsurface materials encountered in the test borings have been visually classified. The results of the visual classifications, Standard Penetration tests, moisture contents and water level observations are presented on the boring logs in the *Appendix* of this report. Representative samples of the soils were placed in sample jars and are now stored in the laboratory for further analysis, if requested. Unless notified to the contrary, all samples will be disposed of after 60 days following the date of this report.

At test borings B-1, B-2, B-4, B-5, and B-6, the surface of the site was covered with a 1-inch-thick layer of topsoil. At test boring B-3, the surface of the site was covered with a 6-inch-thick layer of asphalt pavement. The thickness and composition of the surface materials should be considered variable throughout the site.

At test boring locations B-1 and B-6, a layer of fill material was encountered, extending to a depth of about 3.5 feet below the existing grade. The fill material consisted primarily of lean clay, sandy silt, sand with gravel, with varying amounts of silt, organics, and slag fragments. The fill material exhibited moisture contents ranging from 17 to 80 percent. The cohesive fill materials exhibited a soft to medium stiff consistency, and the granular fill materials exhibited a medium dense relative density, based on the Standard Penetration tests. The engineering characteristics of the fill material, such as strength, composition, and thickness, should be considered to be variable.

Underlying the surface and fill materials, natural soils were encountered, extending to the terminal depths of 15 to 35 feet below the surface grade at each boring location. The natural soils consisted primarily of lean clay, sandy silt, silty sand, and silty gravel. **Highly organic peat soils were also encountered, in test borings B-1, B-2, and B-4**. **The organic peat soils exhibited moisture contents ranging from 46 to 761 percent**. The non-organic natural soils exhibited moisture contents ranging from 7 to 35 percent**.** The natural cohesive soils exhibited a very soft to very stiff consistency, and the natural granular soils exhibited a very loose to medium dense relative density, based on the Standard Penetration tests.

The subsurface description is of a generalized nature provided to highlight the major strata encountered. The boring logs included in the Appendix should be reviewed for specific information at the individual boring locations. The stratifications shown on the boring logs represent the conditions only at the actual test positions. Variations may occur and should be expected between the boring locations. The stratifications represent the approximate boundary between the subsurface materials, and the transition may be gradual or not clearly defined.

2.3 GROUNDWATER LEVEL MEASUREMENTS

Groundwater was encountered in all test borings expect B-3, at depths ranging from 3.5 to 8.5 feet below the existing grade during the drilling operations. Note that groundwater levels fluctuate seasonally as a function of rainfall. During a time of year or weather different from the time of drilling, there may be a considerable change in the water table. Furthermore, the water levels in the boreholes often are not representative of the actual groundwater level, because the boreholes remain open for a relatively short time. Therefore, we recommend that the contractor determine the actual groundwater levels at the time of construction to evaluate groundwater impact on the construction procedures.

3 EVALUATION AND RECOMMENDATIONS

3.1 GEOTECHNICAL DISCUSSION – PEAT SOILS

Peat is a soil material consisting mainly of plant remains in various degrees of decomposition. Peat is characterized by very high moisture contents, high compressibility, and very low shear strength. Consequently, building on peat entails a large amount of uncertainty, including consolidation and creep settlement (several inches to a few feet) over extended periods of time, even with small loading. Therefore, peat deposits present difficult ground conditions for construction, necessitating high initial cost, frequent maintenance, and design.

Highly organic peat soils were encountered at test boring locations B-1, B-2, and B-4, extending to depths of 16 to 29.5 feet below existing surface grades. The peat soils exhibited organic contents ranging from 44 to 47 percent, and should be considered highly compressible.

Based on the proposed construction, depths of the existing organic soils, and shallow groundwater levels, complete removal and replacement of the organic soils would not be feasible for the proposed development. Extreme precautions should be taken during the excavation and backfilling procedures. It is our opinion that the following two options should be considered for the sanitary sewer replacement:

3.1.1 INTERMEDIATE FOUNDATION SYSTEM (HELICAL PILES OR RAP/VSC)

The proposed sanitary sewer can be supported on ‘intermediate’ foundations, supported on improved ground through the installation of drilled helical piles or rammed aggregate piers or a system of vibrated stone columns (RAP/VSC) to support the sewer lines. The advantage of RAP/VSC or Helical systems is that they can be installed relatively quickly and prevent the need to undercut poor soil layers. However, additional test borings and analysis will be required to identify the limits and depth of the organic soils along the sewer alignment.

3.1.2 GEOGRID SUPPORT SYSTEM

Alternatively, the proposed sanitary sewer can be supported on 'improved' ground through a system of layered geogrid and granular engineered fill. This pipe support system should be designed and installed by a specialty contractor.

3.2 SANITARY SEWER LINE EXCAVATION SUPPORT

Based on the information provided by CT Consultants, Inc., the proposed sewer line will bear within the area's natural soil and peat layers. In view of the results of the test boring operations, laboratory test studies, analysis and provided information, consideration should be given to the following factors in the design and installation of the proposed pit excavations and sewer line installation.

Due to the nature of the subsurface formation encountered and as per OSHA excavation regulations, open cut excavation is possible up to a maximum depth of twenty (20) feet. The excavation slopes should follow OSHA guidelines for type 'C' soils. However, due to nature of the subsurface materials identified, temporary excavation support along with dewatering will be required for the sewer installation. The contractor or specialty subcontractor should be responsible to design and install the required system. For the various subsurface formations encountered, the following soil parameters may be adopted for determining lateral earth pressures:

Type of Soil	Unit Weight (pcf)	Undrained Shear Strength	Drained Shear Strength
Existing Fill (Clay)	110	C = 800 psf	ϕ' = 22°, C' = 50 psf
Existing Fill (Sand)	120	ϕ' = 30°	ϕ' = 28°, C' = 0 psf
Lean Clay	120	C = 1,000 psf	ϕ' = 25°, C' = 100 psf
Silty Sand	120	ϕ' = 30°	ϕ' = 30°, C' = 0 psf
Peat	**60**	**C = 0 psf**	**ϕ' = 0°, C' = 0 psf**

The design groundwater depth should be determined based on the actual groundwater conditions encountered in the field during construction.

3.3 SANITARY SEWER LINE PIPE SUPPORT

For the structural and functional integrity of the utilities, it is imperative that the pipes have adequate foundation, i.e., the subsurface materials should have adequate support capabilities and be able to provide uniform bedding to the pipe. The bedding may be provided either with shaped bottom and tamped backfill, or by compacted granular bedding with tamped backfill. The granular bedding should meet the specification for Type 2 bedding (i.e., ODOT's Construction and Material Specifications Item #703.11). The bedding shall extend up around the pipe for a depth of 6 inches or 30 percent of the outside diameter of the pipe, whichever is greater. The remainder of the backfill should be compacted soil. Granular bedding not only provides firm uniform support for the pipe but also stabilizes the trench bottom.

The subsoil at and below the sewer line bearing elevation may exhibit relatively loose or soft structural states. Within such sectors, undercutting and replacement of the questionable soils with coarse aggregates (such as #1 and #2 stones) will be required. The precise extent of undercutting or stabilization can be decided only in the field following careful visual examination of the exposed bearing materials.

3.4 MANHOLE STRUCTURES

Within the area's overburden soils, freestanding excavations will not be possible for the proposed manhole structures. Therefore, a lateral support system will be required for the manhole excavations. The magnitude of the lateral earth pressures may be calculated utilizing the previously outlined soil parameters.

It is recommended that the maximum soil bearing pressures resulting from the above-discussed loading conditions, as well as the weight of the manhole and other facilities associated with the structure, should not exceed 2,000 psf. Based on the recommended bearing pressure, the anticipated settlement will be less than 1.0-inch. It is recommended that suitability of the bearing surfaces be verified by the project's geotechnical engineer.

3.5 BACKFILL OPERATIONS

Any backfill required against the manhole structures and utility trench should consist of freely draining granular materials. The backfill is to be placed on a controlled lift-by-lift basis. Individual fill lifts are to be of maximum 8-inch loose measure thickness, and each individual lift is to be adjusted in moisture content to within plus or minus 2 percent of the optimum moisture content as determined by ASTM D-698. The fill materials are to be systematically compacted, such that an in-place density of at least 98 percent of the maximum laboratory density as determined by the above-referenced ASTM method is achieved.

It must be recognized that, over a time period, the backfill against the manholes will be saturated. Under this circumstance it is possible that the bottom slab for the manhole will be subjected to hydrostatic uplift that should be considered in the design. Uplift may be resisted either by assuring that the dead loads of the proposed structure counterbalance the buoyancy forces or by providing a system of pressure relief valves. Lateral pressures acting on the manholes can be defined based on the drained shear strength parameters (recommended in Section 3.1 above) plus hydrostatic pressure. Specifications should require that the resulting fill materials' densities be verified by test measurements conducted by the geotechnical engineer.

3.6 ENGINEERED FILL

Materials selected for use as structural fill should not contain more than 5 percent by weight of organic matter, waste construction debris, or other deleterious materials. Fill materials should have a standard Proctor maximum dry density of greater than 110 pounds per cubic foot (pcf), an Atterberg Liquid Limit of less than 40, a Plasticity Index of less than 15, and a maximum particle size of 3 inches or less. Structural fill should consist of non-expansive materials. Pyritic and/or potentially expansive materials, such as mine tailings, shales and slag should not be used as structural fill.

Based on the results of the boring explorations, the on-site fill soils are not suitable for reuse as engineered fill. The on-site natural soils are suitable for reuse as engineered fill. If the on-site natural soils are used for fill, close moisture content control will be required to achieve the recommended degree of compaction. PSI anticipates that disking and aerating the soils during a warm, dry period may be necessary to lower the moisture content. If engineered fill placement must proceed during a wet or cool time of the year, it may likely be infeasible to re-use the on-site soils as engineered fill and imported fill materials would be required. If wet or cool season earthwork is necessary, we recommend the use of imported fill materials such as ODOT No. 304 or 411 crushed aggregate.

4 CONSTRUCTION CONSIDERATIONS

4.1 GROUNDWATER CONTROL

Groundwater was encountered in all test borings expect B-3, at depths ranging from 3.5 to 8.5 feet below the existing grade during the drilling operations. Therefore, groundwater may be encountered during excavation. Accordingly, a gravity drainage system, sump pump or other conventional dewatering procedure, as deemed necessary by the field conditions, should be implemented throughout construction, such that the groundwater is always controlled and maintained at an elevation of at least 2 feet below the excavation bottom. Every effort should be made to keep the excavations dry if water is encountered.

4.2 EXCAVATIONS

In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, Part 1926, Subpart P." This document was issued to better ensure the safety of workers entering trenches or excavations. It is mandated by this federal regulation that all excavations, whether they be utility trenches, basement excavations or foundation excavations, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced. If they are not followed closely, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person" as defined in "CFR Part 1926," should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

We are providing this information solely as a service to our client. PSI is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred. If the excavations are left open and exposed to the elements for a significant length of time, desiccation of the clays may create minute shrinkage cracks which could allow large pieces of clay to collapse or slide into the excavation.

Materials removed from the excavation should not be stockpiled immediately adjacent to the excavation, inasmuch as this load may cause a collapse of the embankment.

4.3 WEATHER CONSIDERATIONS

The soils encountered at this site are known to be sensitive to disturbances caused by construction traffic and to changes in moisture content. During wet weather periods, increases in the moisture content of the soil can cause significant reduction in the soil strength and support capabilities. Care should be exercised during the grading operations at the site. Due to the fine-grained nature of the surficial soils, the traffic of heavy equipment, including heavy compaction equipment, may very well create pumping and a general deterioration of those soils in the presence of water. Therefore, the grading should, if possible, be performed during a dry season. A layer of crushed stone may be required to allow the movement of construction traffic over the site during the rainy season. The contractor should maintain positive site drainage and if wet/pumping conditions occur, the contractor will be

responsible to over excavate the wet soils and replace them with a properly compacted engineered fill. During wet seasons, limestone stabilization may be required to place engineered fill.

5 GEOTECHNICAL RISK

The concept of risk is an important aspect of the geotechnical evaluation. The primary reason for this is that the analytical methods used to develop geotechnical recommendations do not comprise an exact science. Site exploration identifies actual subsurface conditions only at those points where samples are taken. A geotechnical report is based on conditions that existed at the time of the subsurface exploration. The analytical tools which geotechnical engineers use are generally empirical and must be used in conjunction with engineering judgment and experience. Therefore, the solutions and recommendations presented in the geotechnical evaluation should not be considered risk-free and, more importantly, are not a guarantee that the interaction between the soils and the proposed structure will perform as planned. The engineering recommendations presented in the preceding sections constitute PSI's professional estimate of those measures that are necessary for the proposed structure to perform according to the proposed design based on the information generated and referenced during this evaluation, and PSI's experience in working with these conditions.

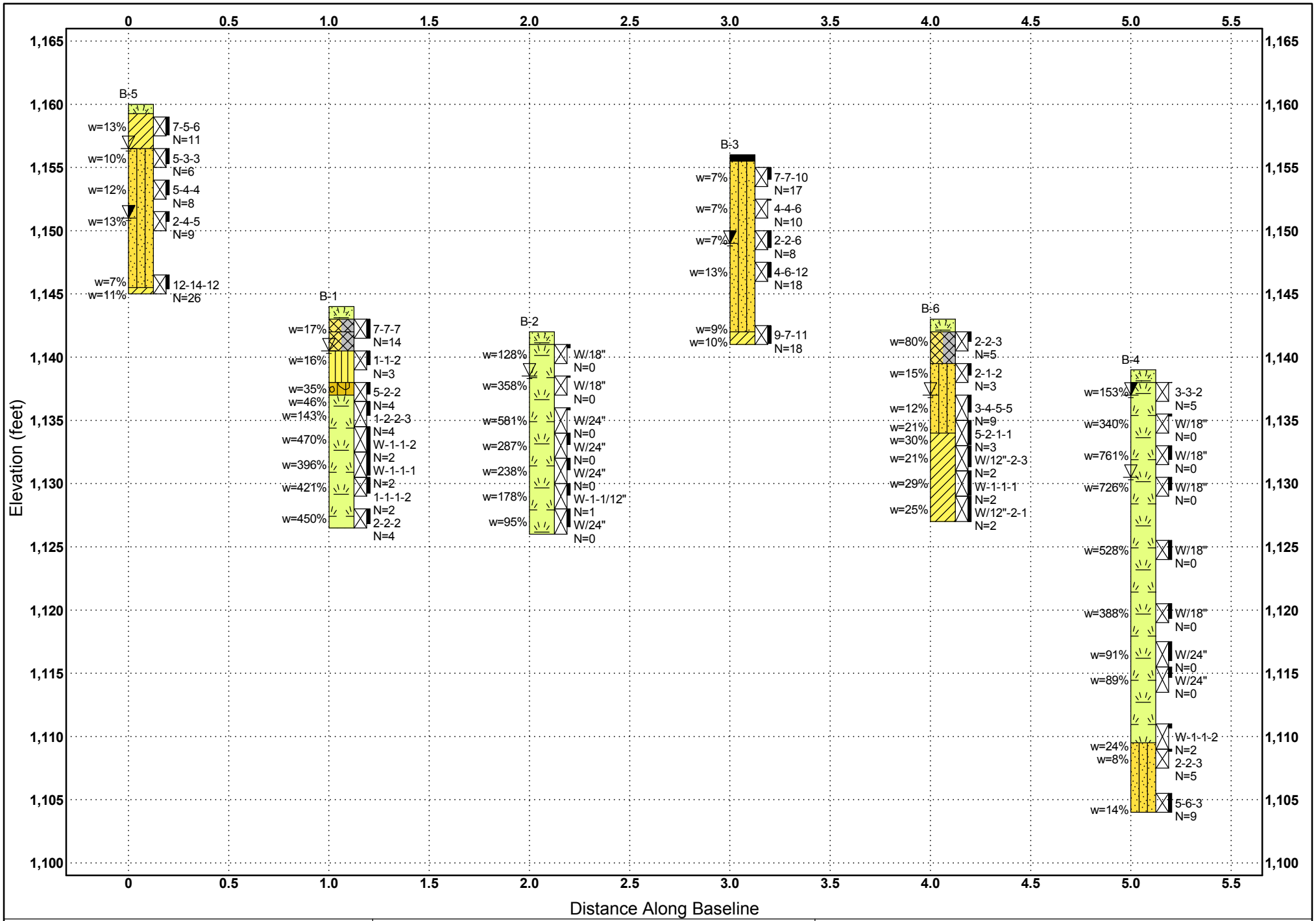
6 REPORT LIMITATIONS

The recommendations submitted in this report are based on the available subsurface information obtained by PSI and design details furnished by CT Consultants, Inc. If there are any revisions to the plans for the proposed structures, or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be retained to determine if changes in the recommendations are required. If PSI is not retained to perform these functions, PSI will not be responsible for the impact of those conditions on the geotechnical recommendations for the project.

The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein, have been presented after being prepared in accordance with generally accepted professional engineering practice in the fields of foundation engineering, soil mechanics and engineering geology. No other warranties are implied or expressed.

After the plans and specifications are complete, it is recommended that PSI be provided the opportunity to review the final design and specifications, in order to verify that the earthwork and recommendations are properly interpreted and implemented. At that time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of CT Consultants, Inc. for the specific application to the proposed Sewer Line Replacement in the City of Hartville, Stark County, Ohio.

intertek psi	**Sanitary Sewer Replacement** **Washington Street SE and Short Street** **Hartville, Stark County, OH**	**Prepared By: JC** **Date: 9/30/20** **Not to Scale**	**Boring Location Plan** **PSI Project No. 0142-2091**



intertek psi
Professional Service Industries, Inc.
5555 Canal Road
Cleveland, OH 44125
Telephone: (216) 447-1335

Profile

Sanitary Sewer Replacement
PSI Project Number: 0142-2091

BORING B-1

DATE STARTED:	10/2/20	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	10/2/20	**DRILLER:** TS	**LOGGED BY:** JC
COMPLETION DEPTH	17.5 ft	**DRILL RIG:**	CME-55 ATV
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	1,144 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:		**HAMMER TYPE:**	Automatic
LONGITUDE:		**EFFICIENCY**	87%
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	AV

REMARKS: **Approximate elevation obtained from Stark County GIS

Water

While Drilling	3.5 feet
Upon Completion	None
Caved @	N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			12" Topsoil	Topsoil			
		1	18	Medium Dense, Moist, Dark Brown and Black SAND with Gravel, Trace Silt/Slag Fragments	Fill	7-7-7 N=14	17	
				Soft, Damp, Dark Brown Sandy SILT, Trace Gravel/Slag Fragments	Fill			
1140		2	13	Soft, Moist, Brown Sandy SILT	ML	1-1-2 N=3	16	
	5	3	11	Loose, Wet, Gray Silty GRAVEL with Sand	GM	5-2-2 N=4	35	Non-Plastic Fines=11.2%
				Very Soft to Soft, Saturated, Black PEAT			46	
1135		4	13			1-2-2-3 N=4	143	>>
	10	5	23			W-1-1-2 N=2	470	>>
		6	22		PT	W-1-1-1 N=2	396	>>
1130		7	15			1-1-1-2 N=2	421	>>
	15	8	14			2-2-2 N=4	450	>>

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0

intertek psi
Professional Service Industries, Inc.
5555 Canal Road
Cleveland, OH 44125
Telephone: (216) 447-1335

PROJECT NO.: 0142-2091
PROJECT: Sanitary Sewer Replacement
LOCATION: Washington Street SE and Short Street
Hartville, Ohio

The stratification lines represent approximate boundaries. The transition may be gradual.

BORING B-2

DATE STARTED:	10/2/20	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	10/2/20	**DRILLER:** TS	**LOGGED BY:** JC
COMPLETION DEPTH	16.0 ft	**DRILL RIG:**	CME-55 ATV
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	1,142 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:		**HAMMER TYPE:**	Automatic
LONGITUDE:		**EFFICIENCY**	87%
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	AV

Water

While Drilling	3.5 feet
Upon Completion	None
Caved @	N/A

BORING LOCATION:

REMARKS: **Approximate elevation obtained from Stark County GIS

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ Moisture × PL ◪ LL ✚ (0 / 25 / 50) STRENGTH, tsf Qu ▲ Qp ✳ (0 / 2.0 / 4.0)	Additional Remarks
	0					12" Topsoil	Topsoil				
						Very Soft, Saturated, Black PEAT					
1140				1	3			W/18" N=0	128	>>×	
						**Low Recovery, Auger Sample taken @3.5'-5'					
				2	1			W/18" N=0	358	>>×	
	5										
						**Low Recovery, Auger Sample taken @6'-7.5'					
1135				3	2	**Organic Content: 46.7%		W/24" N=0	581	>>×	
							PT				
				4	11			W/24" N=0	287	>>×	
	10										
				5	11			W/24" N=0	238	>>×	
1130											
				6	11			W-1-1/12" N=1	178	>>×	
	15			7	17			W/24" N=0	95	>>×	

intertek psi

Professional Service Industries, Inc.
5555 Canal Road
Cleveland, OH 44125
Telephone: (216) 447-1335

PROJECT NO.: 0142-2091
PROJECT: Sanitary Sewer Replacement
LOCATION: Washington Street SE and Short Street
Hartville, Ohio

The stratification lines represent approximate boundaries. The transition may be gradual.

BORING B-3

DATE STARTED:	10/1/20	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	10/1/20	**DRILLER:** TS	**LOGGED BY:** JC
COMPLETION DEPTH	15.0 ft	**DRILL RIG:**	CME-55 ATV
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	1,156 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:		**HAMMER TYPE:**	Automatic
LONGITUDE:		**EFFICIENCY**	87%
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	AV

REMARKS: **Approximate elevation obtained from Stark County GIS

Water

While Drilling	None
Upon Completion	None
Caved @	7.0 feet

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			6" Asphalt Pavement	Pavement			
1155		1	11	Loose to Medium Dense, Moist, Brown Silty SAND with Gravel		7-7-10 N=17	7	
				**Pushed Rock, Auger Sample taken @3.5'-5'				
		2	1			4-4-6 N=10	7	
	5							
1150		3	16	**Trace Clay @ 6.0'-7.5'	SM	2-2-6 N=8	7	Non-Plastic Fines=6.5%
		4	14			4-6-12 N=18	13	
	10							
1145							9	
		5	17	Very Stiff, Moist, Gray Lean CLAY with Sand, Trace Gravel	CL	9-7-11 N=18	10	
	15							

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
Moisture ✕ PL ◪ LL ✚
0 25 50
STRENGTH, tsf
Qu ▲ Qp ✳
0 2.0 4.0

intertek psi
Professional Service Industries, Inc.
5555 Canal Road
Cleveland, OH 44125
Telephone: (216) 447-1335

PROJECT NO.: 0142-2091
PROJECT: Sanitary Sewer Replacement
LOCATION: Washington Street SE and Short Street
Hartville, Ohio

The stratification lines represent approximate boundaries. The transition may be gradual.

BORING B-4

DATE STARTED:	10/1/20	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	10/1/20	**DRILLER:** TS	**LOGGED BY:** JC
COMPLETION DEPTH	35.0 ft	**DRILL RIG:**	CME-55 ATV
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	1,139 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:		**HAMMER TYPE:**	Automatic
LONGITUDE:		**EFFICIENCY**	87%
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	AV

Water

While Drilling	8.5 feet
Upon Completion	None
Caved @	2.0 feet

BORING LOCATION:

REMARKS: **Approximate elevation obtained from Stark County GIS

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			12" Topsoil	Topsoil			
		1	0	Very Soft to Soft, Saturated, Black PEAT **No recovery, Auger Sample taken @1'-2.5'		3-3-2 N=5	153	>>
1135		2	2	**Low recovery, Auger Sample taken @3.5'-5'		W/18" N=0	340	>>
	5	3	13			W/18" N=0	761	>>
1130		4	12	**Organic Content: 44.3%	PT	W/18" N=0	726	>>
	10							
1125		5	18			W/18" N=0	528	>>
	15							
1120		6	14			W/18" N=0	388	>>
	20			*Continued Next Page*				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
Moisture ✕ PL ◪ LL ✚
0 25 50
STRENGTH, tsf
Qu ▲ Qp ✳
0 2.0 4.0

intertek psi
Professional Service Industries, Inc.
5555 Canal Road
Cleveland, OH 44125
Telephone: (216) 447-1335

PROJECT NO.: 0142-2091
PROJECT: Sanitary Sewer Replacement
LOCATION: Washington Street SE and Short Street
Hartville, Ohio

The stratification lines represent approximate boundaries. The transition may be gradual.

BORING B-4

DATE STARTED:	10/1/20	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	10/1/20	**DRILLER:** TS	**LOGGED BY:** JC
COMPLETION DEPTH	35.0 ft	**DRILL RIG:**	CME-55 ATV
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	1,139 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:		**HAMMER TYPE:**	Automatic
LONGITUDE:		**EFFICIENCY**	87%
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	AV

REMARKS: **Approximate elevation obtained from Stark County GIS

Water		
	While Drilling	8.5 feet
	Upon Completion	None
	Caved @	2.0 feet

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ Moisture × PL ◪ LL ✚ (0, 25, 50) STRENGTH, tsf Qu ▲ Qp ✳ (0, 2.0, 4.0)	Additional Remarks
	20					Very Soft to Soft, Saturated, Black PEAT **No recovery, Auger Sample taken @1'-2.5'					
				7	18	**Attempted Shelby tube sample @21.5'-23.5', no recovery		W/24" N=0	91	>>	
1115				8	10		PT	W/24" N=0	89	>>	
	25					**Attempted Shelby tube sample @26'-28', no recovery					
				1	0						
1110				9	4			W-1-1-2 N=2	24	×	
	30					Very Loose to Loose, Wet, Gray Silty SAND, Trace Gravel					
				10	2			2-2-3 N=5	8	◎×	
							SM				
1105				11	18			5-6-3 N=9	14	■×	Non-Plastic Fines=7.5%
	35										

intertek psi

Professional Service Industries, Inc.
5555 Canal Road
Cleveland, OH 44125
Telephone: (216) 447-1335

PROJECT NO.: 0142-2091
PROJECT: Sanitary Sewer Replacement
LOCATION: Washington Street SE and Short Street
Hartville, Ohio

The stratification lines represent approximate boundaries. The transition may be gradual.

BORING B-5

DATE STARTED:	10/1/20	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	10/1/20	**DRILLER:** TS	**LOGGED BY:** JC
COMPLETION DEPTH	15.0 ft	**DRILL RIG:**	CME-55 ATV
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	1,160 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:		**HAMMER TYPE:**	Automatic
LONGITUDE:		**EFFICIENCY**	87%
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	AV

REMARKS: **Approximate elevation obtained from Stark County GIS

Water

While Drilling	3.5 feet
Upon Completion	None
Caved @	9.0 feet

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %
	0					12" Topsoil	Topsoil		
				1	17	Stiff, Moist, Brown Lean CLAY with Sand, Trace Gravel	CL	7-5-6 N=11	13
				2	14	Loose to Medium Dense, Moist, Brown Silty SAND, Trace Gravel		5-3-3 N=6	10
1155	5								
				3	14			5-4-4 N=8	12
				4	9		SM	2-4-5 N=9	13
1150	10								
				5	13			12-14-12 N=26	7
1145	15					Very Stiff, Moist, Brown Lean CLAY with Sand, Trace Gravel	CL		11

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0

Additional Remarks

intertek psi

Professional Service Industries, Inc.
5555 Canal Road
Cleveland, OH 44125
Telephone: (216) 447-1335

PROJECT NO.: 0142-2091
PROJECT: Sanitary Sewer Replacement
LOCATION: Washington Street SE and Short Street
Hartville, Ohio

The stratification lines represent approximate boundaries. The transition may be gradual.

BORING B-6

DATE STARTED:	10/2/20	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	10/2/20	**DRILLER:** TS	**LOGGED BY:** JC
COMPLETION DEPTH	16.0 ft	**DRILL RIG:**	CME-55 ATV
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	1,143 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:		**HAMMER TYPE:**	Automatic
LONGITUDE:		**EFFICIENCY**	87%
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	AV

REMARKS: **Approximate elevation obtained from Stark County GIS

Water		
	While Drilling	6.0 feet
	Upon Completion	None
	Caved @	N/A

BORING LOCATION:

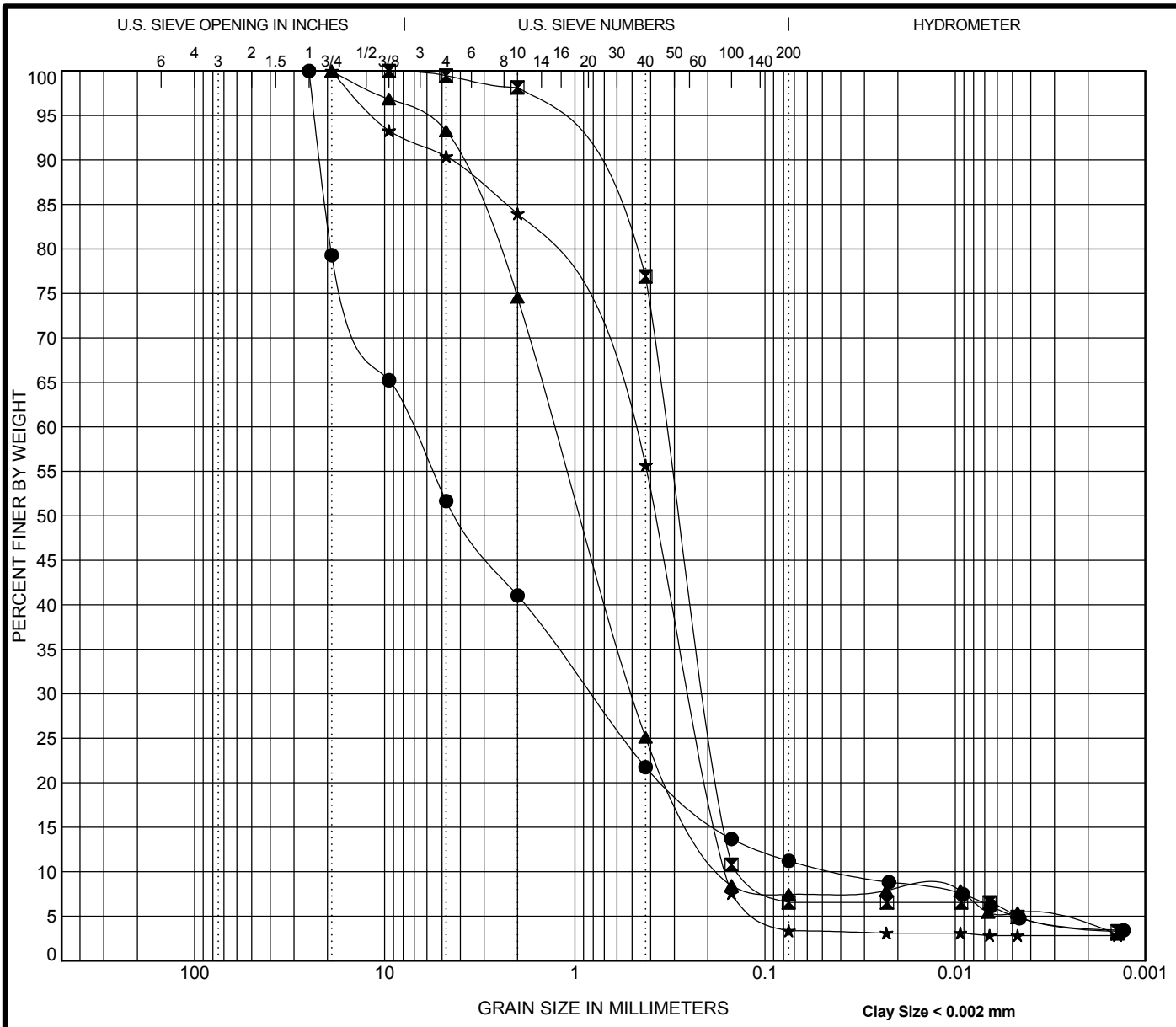
Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			12" Topsoil	Topsoil			
		1	9	Medium Stiff, Wet, Black Lean CLAY, Trace Sand/Organics	Fill	2-2-3 N=5	80	>>X
1140		2	11	Very Loose to Loose, Wet, Gray Silty SAND with Gravel		2-1-2 N=3	15	
	5	3	16		SM	3-4-5-5 N=9	12	
1135		4	23			5-2-1-1 N=3	21 / 30	Non-Plastic Fines=3.4%
	10	5	20	Medium Stiff to Very Soft, Moist to Wet, Black and Gray, Lean CLAY, Trace Organics	CL	W/12"-2-3 N=2	21	
1130		6	23			W-1-1-1 N=2	29	
	15	7	24			W/12"-2-1 N=2	25	

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
Moisture PL LL
0 25 50
STRENGTH, tsf
Qu Qp
0 2.0 4.0

intertek psi
Professional Service Industries, Inc.
5555 Canal Road
Cleveland, OH 44125
Telephone: (216) 447-1335

PROJECT NO.: 0142-2091
PROJECT: Sanitary Sewer Replacement
LOCATION: Washington Street SE and Short Street
Hartville, Ohio

The stratification lines represent approximate boundaries. The transition may be gradual.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	B-1	6.5	Silty GRAVEL with Sand (GM)	NP	NP	NP	2.31	179.92
⊠	B-3	6.8	Silty SAND, Trace Gravel (SM)	NP	NP	NP	0.96	2.47
▲	B-4	34.8	Well-Graded SAND, Trace Gravel/Silt/Clay (SW)	NP	NP	NP	1.17	7.67
★	B-6	8.5	Poorly-Graded SAND, Trace Gravel/Silt/Clay (SP)	NP	NP	NP	0.70	3.40

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-1	6.5	25	7.271	0.824	0.04	48.3	40.4	7.3	3.9
⊠	B-3	6.8	9.5	0.326	0.203	0.132	0.5	92.9	2.8	3.8
▲	B-4	34.8	19	1.268	0.495	0.165	6.7	85.8	3.8	3.7
★	B-6	8.5	19	0.538	0.244	0.158	9.6	87.0	0.5	2.8

intertek psi
Professional Service Industries, Inc.
5555 Canal Road
Cleveland, OH 44125
Telephone: (216) 447-1335
Fax: (216) 642-7008

GRAIN SIZE DISTRIBUTION

Project: Sanitary Sewer Replacement
PSI Job No.: 0142-2091
Location: Washington Street SE and Short Street
Hartville, Ohio

GENERAL NOTES

SAMPLE IDENTIFICATION

The Unified Soil Classification System (USCS), AASHTO 1988 and ASTM designations D2487 and D-2488 are used to identify the encountered materials unless otherwise noted. Coarse-grained soils are defined as having more than 50% of their dry weight retained on a #200 sieve (0.075mm); they are described as: boulders, cobbles, gravel or sand. Fine-grained soils have less than 50% of their dry weight retained on a #200 sieve; they are defined as silts or clay depending on their Atterberg Limit attributes. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size.

DRILLING AND SAMPLING SYMBOLS

SFA: Solid Flight Auger - typically 4" diameter flights, except where noted.
HSA: Hollow Stem Auger - typically 3¼" or 4¼ I.D. openings, except where noted.
M.R.: Mud Rotary - Uses a rotary head with Bentonite or Polymer Slurry
R.C.: Diamond Bit Core Sampler
H.A.: Hand Auger
P.A.: Power Auger - Handheld motorized auger

SS: Split-Spoon - 1 3/8" I.D., 2" O.D., except where noted.
ST: Shelby Tube - 3" O.D., except where noted.
BS: Bulk Sample
PM: Pressuremeter
CPT-U: Cone Penetrometer Testing with Pore-Pressure Readings

SOIL PROPERTY SYMBOLS

N: Standard "N" penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2-inch O.D. Split-Spoon.
N_{60}: A "N" penetration value corrected to an equivalent 60% hammer energy transfer efficiency (ETR)
Q_u: Unconfined compressive strength, TSF
Q_p: Pocket penetrometer value, unconfined compressive strength, TSF
w%: Moisture/water content, %
LL: Liquid Limit, %
PL: Plastic Limit, %
PI: Plasticity Index = (LL-PL),%
DD: Dry unit weight, pcf
▼,▽,▼ Apparent groundwater level at time noted

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Relative Density	N - Blows/foot
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	50 - 80
Extremely Dense	80+

ANGULARITY OF COARSE-GRAINED PARTICLES

Description	Criteria
Angular:	Particles have sharp edges and relatively plane sides with unpolished surfaces
Subangular:	Particles are similar to angular description, but have rounded edges
Subrounded:	Particles have nearly plane sides, but have well-rounded corners and edges
Rounded:	Particles have smoothly curved sides and no edges

GRAIN-SIZE TERMINOLOGY

Component	Size Range
Boulders:	Over 300 mm (>12 in.)
Cobbles:	75 mm to 300 mm (3 in. to 12 in.)
Coarse-Grained Gravel:	19 mm to 75 mm (¾ in. to 3 in.)
Fine-Grained Gravel:	4.75 mm to 19 mm (No.4 to ¾ in.)
Coarse-Grained Sand:	2 mm to 4.75 mm (No.10 to No.4)
Medium-Grained Sand:	0.42 mm to 2 mm (No.40 to No.10)
Fine-Grained Sand:	0.075 mm to 0.42 mm (No. 200 to No.40)
Silt:	0.002 mm to 0.075 mm
Clay:	<0.002mm to <0.005 mm depending on agency

PARTICLE SHAPE

Description	Criteria
Flat:	Particles with width/thickness ratio > 3
Elongated:	Particles with length/width ratio > 3
Flat & Elongated:	Particles meet criteria for both flat and elongated

RELATIVE PROPORTIONS OF FINES

Descriptive Term	% Dry Weight
Trace:	< 5%
With:	5% to 12%
Modifier:	>12%

GENERAL NOTES

(Continued)

CONSISTENCY OF FINE-GRAINED SOILS

Q_U - TSF	N - Blows/foot	Consistency
0 - 0.25	0 - 2	Very Soft
0.25 - 0.50	2 - 4	Soft
0.50 - 1.00	4 - 8	Firm (Medium Stiff)
1.00 - 2.00	8 - 15	Stiff
2.00 - 4.00	15 - 30	Very Stiff
4.00 - 8.00	30 - 50	Hard
8.00+	50+	Very Hard

MOISTURE CONDITION DESCRIPTION

Description	Criteria
Dry:	Absence of moisture, dusty, dry to the touch
Moist:	Damp but no visible water
Wet:	Visible free water, usually soil is below water table

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term	% Dry Weight
Trace:	< 15%
With:	15% to 30%
Modifier:	>30%

STRUCTURE DESCRIPTION

Description	Criteria
Stratified:	Alternating layers of varying material or color with layers at least ¼-inch (6 mm) thick
Laminated:	Alternating layers of varying material or color with layers less than ¼-inch (6 mm) thick
Fissured:	Breaks along definite planes of fracture with little resistance to fracturing
Slickensided:	Fracture planes appear polished or glossy, sometimes striated
Blocky:	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Lensed:	Inclusion of small pockets of different soils
Layer:	Inclusion greater than 3 inches thick (75 mm)
Seam:	Inclusion 1/8-inch to 3 inches (3 to 75 mm) thick extending through the sample
Parting:	Inclusion less than 1/8-inch (3 mm) thick

SCALE OF RELATIVE ROCK HARDNESS

Q_U - TSF	Consistency
2.5 - 10	Extremely Soft
10 - 50	Very Soft
50 - 250	Soft
250 - 525	Medium Hard
525 - 1,050	Moderately Hard
1,050 - 2,600	Hard
>2,600	Very Hard

ROCK BEDDING THICKNESSES

Description	Criteria
Very Thick Bedded	Greater than 3-foot (>1.0 m)
Thick Bedded	1-foot to 3-foot (0.3 m to 1.0 m)
Medium Bedded	4-inch to 1-foot (0.1 m to 0.3 m)
Thin Bedded	1¼-inch to 4-inch (30 mm to 100 mm)
Very Thin Bedded	½-inch to 1¼-inch (10 mm to 30 mm)
Thickly Laminated	1/8-inch to ½-inch (3 mm to 10 mm)
Thinly Laminated	1/8-inch or less "paper thin" (<3 mm)

ROCK VOIDS

Voids	Void Diameter
Pit	<6 mm (<0.25 in)
Vug	6 mm to 50 mm (0.25 in to 2 in)
Cavity	50 mm to 600 mm (2 in to 24 in)
Cave	>600 mm (>24 in)

GRAIN-SIZED TERMINOLOGY

(Typically Sedimentary Rock)

Component	Size Range
Very Coarse Grained	>4.76 mm
Coarse Grained	2.0 mm - 4.76 mm
Medium Grained	0.42 mm - 2.0 mm
Fine Grained	0.075 mm - 0.42 mm
Very Fine Grained	<0.075 mm

ROCK QUALITY DESCRIPTION

Rock Mass Description	RQD Value
Excellent	90 -100
Good	75 - 90
Fair	50 - 75
Poor	25 -50
Very Poor	Less than 25

DEGREE OF WEATHERING

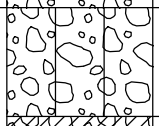
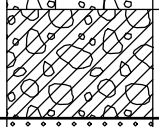
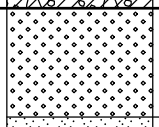
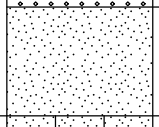
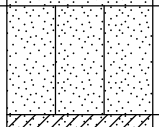
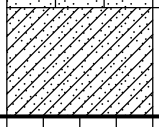
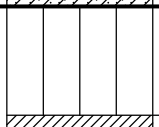
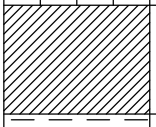
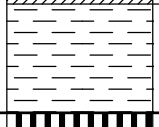
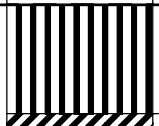
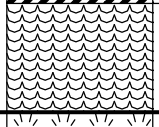
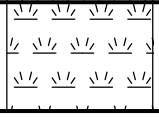
Slightly Weathered: Rock generally fresh, joints stained and discoloration extends into rock up to 25 mm (1 in), open joints may contain clay, core rings under hammer impact.

Weathered: Rock mass is decomposed 50% or less, significant portions of the rock show discoloration and weathering effects, cores cannot be broken by hand or scraped by knife.

Highly Weathered: Rock mass is more than 50% decomposed, complete discoloration of rock fabric, core may be extremely broken and gives clunk sound when struck by hammer, may be shaved with a knife.

SOIL CLASSIFICATION CHART

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	(LITTLE OR NO FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	(LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES		SM	SILTY SANDS, SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS