



CONSULTANTS • LABORATORIES

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December 31, 2019

EXHIBIT P

Mr. Daniel J. Neff, P.E.
Neff and Associates
6405 York Road
Parma Heights, Ohio 44011

Re: **Subsurface Exploration**
Nathan Hale Park Storm Basin
Parma Heights, Cuyahoga County, Ohio
Geo-Sci Project No. 39322.11

Dear Mr. Neff:

As per our proposal, Geo-Sci has completed the soil borings for the above-noted project. The results of the exploration including geotechnical recommendations for the proposed Nathan Hale Park storm basin are included herewith.

Upon completion of the plans, it is recommended that Geo-Sci review the final design to verify that the geotechnical design recommendations have been properly implemented. Furthermore, it is recommended that the geotechnical engineer and/or representative be onsite during earthwork operations to observe field conditions at the time of construction.

We appreciate the opportunity to work with you on this project. Should you have any questions or if we may be of further assistance, please contact us at (440) 234-8985.

Sincerely,
Geo-Sci, Inc.

George W. Aboumrad, P.E.
President

Enclosure: Geotechnical Report



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1. Project Description

Based upon the information provided, the project includes the construction of a regional stormwater retention basin to help alleviate flooding in Parma Heights, the proposed basin located at Nathan Hale Park Parma Heights, Cuyahoga County, Ohio, as shown in the aerial photograph below:

Figure 1. Aerial Photograph



2. Field Investigation

A total of six (6) test borings were drilled and sampled. Borings B-1, B-3, and B-5 were drilled to the depth of 20 feet each, below existing grade. Borings B-2, B-4 and B-6 were drilled to depths ranging from approximately 27.0 to 30.0 feet, below the existing surface grade. The test boring locations were selected and field located by Neff and Associates personnel. The generalized test boring locations are depicted on the attached Boring Location Plan (**Appendix A**). The test borings were advanced using 3-1/4 inch I.D. Hollow Stem Augers. Representative samples were collected using a standard two-inch O.D. and 1-3/8 inch I.D. split barrel sampler driven into the soil by means of a 140-pound hammer falling freely through a distance of 30 inches (Standard Penetration Test, ASTM D 1586). The groundwater levels at the test boring locations were measured at encounter and upon completion of the drilling operations. All samples were returned to Geo-Sci's laboratory in Berea, Ohio for further analysis. Individually typed test-boring logs are enclosed for your review. Please note that the sample depths shown on the boring logs are at the top of the sampling interval.

3. Laboratory Testing

Laboratory tests were performed on selected soil samples. Both classification and engineering property tests were performed to obtain various parameters for use in design and construction of the project. **Table 1.** below provides a summary of the laboratory testing performed on select samples:

Table 1. Summary of Laboratory Testing

Test	Standard	# of Tests
Moisture Content	ASTM D2216	44
Atterberg Limits	ASTM D4318	6
Grain Size	ASTM D422	6
Total Petroleum Hydrocarbon (TPH)	8015M	30
Benzene, Toluene, Ethylbenzene and Xylenes (BTEX)	5035/8260	48

Liquid limit, plasticity index and moisture content results are shown on the individually typed test-boring logs (**Appendix B**). The results of the grain size distributions are provided in (**Appendix C**). The soil samples were classified in general accordance with the Unified Soil Classification System (USCS). Note that the visual descriptions provided on the logs are based upon an empirical Northeast Ohio nomenclature with the actual USCS symbol provided immediately after in parenthesis. Testing was performed in general accordance with the American Society for Testing Materials (ASTM) and other generally accepted methods.

CEL Cardinal Environmental Laboratories, LLC performed chemical analysis on a total of twelve (12) soil samples. The Total Petroleum Hydrocarbon (TPH) tests were performed on six (6) solid soil samples. Benzene, Toluene, Ethylbenzene and Xylenes (**BTEX**) tests were performed on six (6) solid soil samples. The test results are shown on the laboratory analysis report attached (**Appendix D**).

4. Subsurface Conditions

The subsurface conditions are summarized in the **Table 2.** below:

Table 2. Summary of Subsurface Conditions

Test Boring	Boring Depth (ft)	Surface Cover
B-1	20.0	25" Topsoil
B-2	30.0	8" Topsoil
B-3	20.0	10" Topsoil
B-4	30.0	16" Topsoil
B-5	20.0	14" Topsoil
B-6	27.0	8" Topsoil

In general, the on-site soils consisted primarily of medium stiff to hard brown and gray turning to gray silty clay with varying amounts of sand and gravel fragments. Also, medium dense gray fine to coarse well graded sand with trace of gravel was encountered in boring B-6.

Groundwater was encountered in five (5) borings within the explored depths during drilling and upon completion of drilling operations.

Table 3. Groundwater

Test Boring	During Drilling Depth (ft)	At Completion Depth (ft)
B-1	11.5	13.0
B-2	21.0	18.5
B-3	12.0	21.0
B-4	17.0	8.5
B-5	None	None
B-6	13.0	13.5

For specific conditions at various depths, please refer to the enclosed test-boring logs (Appendix B). **It should also be noted that groundwater levels could fluctuate with seasonal changes.**

5. Conclusions and Recommendations

It is our understanding that the project consists of the construction of a regional stormwater retention basin to help alleviate flooding in Parma Heights. Based on the subsurface conditions encountered, our subsequent analyses, and the assumption that conditions away from the test boring are similar to those encountered, the following recommendations were prepared and are presented below.

5.1. Stormwater Retention Basins

It is our understanding that the maximum depth of the proposed storm water retention basins, although not yet designed, will be approximately 20 to 30 feet below existing surface grades at its lowest point, resting mostly within cohesive silty clay soils or granular sandy soils. As a result of the soils encountered during drilling operations, our conclusion is that the existing soils cannot be considered impermeable. A soil with a permeability of 10^{-8} cm/sec or less should be used for providing an impermeable cap for the bottom and sides of the stormwater retention basins, if stormwater detention is intended. The impermeable cap should have a minimum thickness of 2 feet and should be placed in an engineered manner, in accordance with the *Earthwork General Guidelines* of this report. Strict quality control should be maintained during all earthwork operations.

It is our recommendation that slopes should be a minimum of 3 to 1 (Horizontal: Vertical) or flatter for ease in mowing, maintaining and stability enhancement. Provisions to minimize slope erosion should be made and should include providing diversions ditches or grading the embankment at the top of the slopes to divert runoff away from the slope, and providing adequate vegetation.

The contractor should be prepared for dewatering prior to excavation and during any earthwork operations. Precautions should be taken during all earthwork operations to protect the work site from flooding, ponding, or inundation by poor or improper surface drainage. Temporary provisions should be made during the rainy season to adequately direct surface drainage away from and off the work site.

Based upon the findings of the field exploration program, laboratory testing and subsequent engineering analysis, the followings are presented for your consideration:

5.2. Groundwater

Groundwater was noted at various depths throughout the investigated area. The water level should be addressed during the hydraulic design of the basin. Although the groundwater levels could fluctuate with seasonal changes. In order to determine accurately the average elevation of the true groundwater table, it is essential to install monitoring wells and take periodic groundwater level readings, especially during extended periods of wetness. However, the installation of monitoring wells was not included in Geo-Sci's scope of services for this project.

5.3. Earthwork General Guidelines

- Prior to construction, remove all existing topsoil, trees, vegetation, soft soils, soils contaminated with more than three percent organics by weight and any other unsuitable soils or materials from the proposed storm water retention basin.
- Prior to backfill operations, all cut areas should be proofrolled to detect yielding soil conditions. Any yielding areas discovered should be addressed according to the project specifications. Stabilization of localized unstable areas may be achieved by conditioning the soil to its optimum moisture content and recompacting.
- The soil used for fill construction should be clean, inert cohesive soil, free of unsuitable matter, approved by the geotechnical engineer. Unsuitable matter includes roots and debris. Shale should not be used as fill. The clay liner should meet the following criteria:
 - Dry Density > 110 pcf
 - Minimum Plasticity Index (PI) = 15
 - Organic Content < 3%
 - Permeability of 10^{-8} cm/sec or less
- Following subgrade approval by the geotechnical engineer, an initial three-inch layer of fill material should be placed on the scarified subgrade. Successive layers should have a maximum thickness of six inches in the loose state.
- The clay liner shall be compacted in maximum 6-inch lifts to a minimum of 98% of the laboratory maximum dry density as determined by a Standard Proctor Test, ASTM D 698, at 0 to +3 percent of the optimum moisture content. The liner shall not be placed dry of optimum.
- Inspection, control, and testing of each fill layer as well as subgrades, should be conducted by soil technicians under the supervision of a geotechnical engineer for determining field densities, moisture content, selecting fill material, and ensuring adequate site preparation.
- All surfaces should be sealed and sloped to promote free drainage. In the event that work is interrupted for a prolonged period, the surface should be re-tested prior to resuming work to

check for possible excessive changes in moisture and density, in which case the surface should be treated accordingly before additional lifts can be placed.

- Both lateral and parallel bonding benches should be provided where fill is being placed on slope side, in order to key the new fill into the competent original soil.

5.4. Chemical Analysis

The Total Petroleum Hydrocarbon (TPH) and Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) test results are shown on the laboratory analysis report attached (Appendix D). All TPH and BTEX test results are below detection limits. The purpose of this analysis is to offer a preliminary assessment of the situation where a release of petroleum has occurred from unidentified source.

Ohio Environmental Protection Agency (OEPA) issued the regulations of the environmental pollution. OHIO EPA issued the petroleum contaminated sites guidance document for emergency response actions. Petroleum Action Levels (PPM) are summarized in Table 4. Below:

*Table 4. Petroleum Action Levels (PPM)

CONSTITUENTS	CATEGORY 1	CATEGORY 2	CATEGORY 3	CATEGORY 4
Total Score	< 46 Points	46 - 60 Points	61 - 75 Points	> 75 Points
Soil BTEX	0.006 ppm Benzene 4 ppm Toluene 6 ppm Ethylbenzene 28 ppm Total Xylenes	0.17 ppm Benzene 7 ppm Toluene 10 ppm Ethylbenzene 47 ppm Total Xylenes	0.335 ppm Benzene 9 ppm Toluene 14 ppm Ethylbenzene 67 ppm Total Xylenes	0.5 ppm Benzene 12 ppm Toluene 18 ppm Ethylbenzene 85 ppm Total Xylenes
Ground Water BTEX	0.005 ppm Benzene 1 ppm Toluene 0.7 ppm Ethylbenzene 10 ppm Total Xylenes	0.005 ppm Benzene 1 ppm Toluene 0.7 ppm Ethylbenzene 10 ppm Total Xylenes	0.005 ppm Benzene 1 ppm Toluene 0.7 ppm Ethylbenzene 10 ppm Total Xylenes	0.005 ppm Benzene 1 ppm Toluene 0.7 ppm Ethylbenzene 10 ppm Total Xylenes
Soil TPH (Gasoline)	105 ppm TPH	300 ppm TPH	450 ppm TPH	600 ppm TPH
Soil TPH (Others)	380 ppm TPH	642 ppm TPH	904 ppm TPH	1156 ppm TPH

*Petroleum Contaminated Sites Guidance Document for Emergency Response Actions (March, 2005).

6. Excavation Considerations

During construction of the project, it is anticipated that, predominantly, silty clay, well graded sand and natural soils will be encountered. We anticipate that conventional excavation equipment is likely to be sufficient for excavation within the explored 20 to 30 feet of silty clay and/ or well graded sand.

Excavations into the "stiff" or better silty clay soils are expected to remain stable for relatively short periods of time. Excavation into cohesionless, soft, and/or wet soils will require lateral support or appropriate sloping of the sidewalls. The site restrictions of the project may limit available lateral distance for construction of slopes to keep the excavation sidewalls stable. It is recommended that all excavated material be stockpiled at a minimum

horizontal distance of 15 feet away from the edges of the excavation, or transported away from the site as excavation occurs.

Also, the contractor should be aware that slope height, slope inclination, or excavation depths (including utility trench excavation) should in no case exceed those specified in local, state, or federal safety regulations, e.g. OSHA Health and Safety Standards for excavations, 29 CFR part 1926, or successor regulations. Such regulations are strictly enforced and, if they are not followed, the Owner, Contractor, and/or earthwork and utility subcontractors could be liable for substantial penalties.

7. Groundwater

It should be noted that the water levels reported are indications of conditions existing at the locations at the times of observations only. In order to determine accurately the average elevation of the true groundwater table, it is essential to install monitoring wells and take periodic groundwater level readings, especially during extended periods of wetness. However, the installation of additional monitoring wells was not included in Geo-Sci's scope of services for this project.

8. Construction Monitoring

It is recommended that Geo-Sci be retained to review the project specifications prior to construction. In addition, it is also recommended that competent geotechnical personnel be present at the site during construction to examine the earthwork operations, to verify subsurface conditions outlined in this report, and to make any changes deemed appropriate. If requested, Geo-Sci would welcome the opportunity to provide field monitoring services during construction.

9. Limitations

The preceding recommendations were based on the subsurface stratification observed at the location tested. Assumptions were made that this stratification is representative of that of the entire site. This assumption should be verified during excavation and, if changes occur, we should be notified so we may examine the conditions, review and revise our recommendations accordingly.

This report was completed using the professional standards currently applicable to the industry for the site and proposed construction described herein. Modifications in the plans should be brought to our attention so we may review and revise our recommendations accordingly.

Appendix A: Boring Location Plan

Appendix B: Boring Logs



LOG OF BORING

Project: Nathan Hale Park Storm Basin **Boring No.:** B-01
Location: Parma Heights, Ohio **Project No.:** 39322.11
Elevation: _____
Client: Neff & Associates **Station & Offset:** _____
Driller: Ohio TestBor, Inc. **Coordinates:** not surveyed
Start Date: 12/11/19 **Completion Date:** 12/11/19 **Total Depth:** 20 ft
Water Depth: **At Encounter** 11.5 ft **At Completion** 13 ft **After** _____ **Hours** _____

Graphic Log	Description	Sample	Depth (ft.)	SPT blows / 6"	N-Value	% WC	LL	PI	Hand Pen Range
0	25" TOPSOIL mixed with fill material								
		1	1.0	4-6-8	14	17.3			3.00
	Stiff to very stiff brown SILTY CLAY, some sand, trace gravel, moist. (CL)	2	3.5	5-7-9	16	19.0			4.00
5		3	6.0	5-8-10	18	17.1			3.75
		4	8.5	7-12-14	26	15.5	29	9	4.5+
10		5	13.5	2-3-3	6	12.3			4.5+
	Medium stiff to stiff gray CLAYEY SILT, little sand, trace gravel, wet to moist. (CL) Note: Cave-in @ 12.0ft.	6	18.5	4-5-7	12	16.7			1.75
15									
20									

LOG OF BORING INDIVIDUAL SAMPLE DEPTHS 39322.GPJ GEO-SCI.GDT 12/26/19

Termination Depth @ 20 ft.



LOG OF BORING

Project: Nathan Hale Park Storm Basin **Boring No.:** B-02
Location: Parma Heights, Ohio **Project No.:** 39322.11
Elevation: _____
Client: Neff & Associates **Station & Offset:** _____
Driller: Ohio TestBor, Inc. **Coordinates:** not surveyed
Start Date: 12/11/19 **Completion Date:** 12/11/19 **Total Depth:** 30 ft
Water Depth: **At Encounter** 21 ft **At Completion** 18.5 ft **After** _____ **Hours** _____

Graphic Log	Description	Sample	Depth (ft.)	SPT blows / 6"	N-Value	% WC	LL	PI	Hand Pen Range
0	8" TOPSOIL								
	Stiff to very stiff brown SILTY CLAY, some sand, trace gravel, wet to moist. (CL)	1	1.0	4-5-7	12	20.7			1.75
5		2	3.5	3-5-7	12	17.3			1.50
		3	6.0	7-9-11	20	15.9			1.75
10		4	8.5	6-11-13	24	15.6	30	10	4.5+
	Very stiff gray SILTY CLAY, some sand, trace gravel, damp to moist. (CL)	5	13.5	6-11-13	24	11.4			4.5+
15		6	18.5	6-9-10	19	11.6			4.5+
20									

LOG OF BORING INDIVIDUAL SAMPLE DEPTHS 39322.GPJ GEO-SCI.GDT 12/26/19



LOG OF BORING

Project: Nathan Hale Park Storm Basin

Boring No.: B-02

Client: Neff & Associates

Project No.: 39322.11

Graphic Log	Description	Sample	Depth (ft.)	SPT blows / 6"	N-Value	% WC	LL	PI	Hand Pen Range
20	Very stiff gray <u>SILTY CLAY</u> , some sand, trace gravel, damp to moist. (CL) (Continued)								
25		7	23.5	7-7-9	16	16.9			0.50
	Note: Sand layers throughout 23.0 - 30.0ft.								
30	Termination Depth @ 30 ft.	8	28.5	10-12-16	28	10.0 14.6			0.50 0.50
35									
40									



LOG OF BORING

Project: Nathan Hale Park Storm Basin **Boring No.:** B-03
Location: Parma Heights, Ohio **Project No.:** 39322.11
Elevation: _____
Client: Neff & Associates **Station & Offset:** _____
Driller: Ohio TestBor, Inc. **Coordinates:** not surveyed
Start Date: 12/11/19 **Completion Date:** 12/11/19 **Total Depth:** 20 ft
Water Depth: **At Encounter** 12 ft **At Completion** 21 ft **After** _____ **Hours** _____

Graphic Log	Description	Sample	Depth (ft.)	SPT blows / 6"	N-Value	% WC	LL	PI	Hand Pen Range
0	10" TOPSOIL								
	Stiff to hard brown <u>SILTY CLAY</u> , little sand, trace gravel, moist. (CL)	1	1.0	3-6-8	14	16.2			3.50
		2	3.5	5-9-10	19	12.8			4.5+
5		3	6.0	7-13-19	32	16.7	36	16	4.5+
	Very stiff brown and gray <u>SILTY CLAY</u> , some sand, trace gravel, moist. (CL) Note: Sand layer @ 9.5ft.	4	8.5	8-11-12	23	15.4			4.50
10						13.5			N/A
	Stiff to very stiff gray <u>SILTY CLAY</u> with silt lenses, some sand, trace gravel, wet to damp. (CL)	5	13.5	4-5-8	13	22.2			N/A
15		6	18.5	8-9-11	20	10.4			3.50
20									

Termination Depth @ 20 ft.

LOG OF BORING INDIVIDUAL SAMPLE DEPTHS 39322.GPJ GEO-SCI.GDT 12/26/19



LOG OF BORING

Project: Nathan Hale Park Storm Basin **Boring No.:** B-04
Location: Parma Heights, Ohio **Project No.:** 39322.11
Elevation: _____
Client: Neff & Associates **Station & Offset:** _____
Driller: Ohio TestBor, Inc. **Coordinates:** not surveyed
Start Date: 12/11/19 **Completion Date:** 12/11/19 **Total Depth:** 30 ft
Water Depth: **At Encounter** 17 ft **At Completion** 8.5 ft **After** _____ **Hours** _____

Graphic Log	Description	Sample	Depth (ft.)	SPT blows / 6"	N-Value	% WC	LL	PI	Hand Pen Range
0	16" TOPSOIL								
	Stiff to very stiff brown <u>SILTY CLAY</u> , little sand, trace gravel, wet to moist. (CL)	1	1.0	3-4-6	10	21.0			2.50
5		2	3.5	4-5-7	12	16.8	34	13	4.5+
		3	6.0	6-10-14	24	17.1			4.5+
10	Very stiff to hard gray <u>SILTY CLAY</u> , little sand, trace gravel, moist to damp. (CL)	4	8.5	5-7-8	15	12.9			4.5+
15		5	13.5	11-16-17	33	10.0			4.5+
20	Very stiff to hard gray <u>SILTY CLAY</u> with sand lenses, some sand, trace gravel, moist to damp. (CL)	6	18.5	10-10-17	27	14.7			2.00

LOG OF BORING INDIVIDUAL SAMPLE DEPTHS 39322.GPJ GEO-SCI.GDT 12/26/19



LOG OF BORING

Project: Nathan Hale Park Storm Basin

Boring No.: B-04

Client: Neff & Associates

Project No.: 39322.11

Graphic Log	Description	Sample	Depth (ft.)	SPT blows / 6"	N-Value	% WC	LL	PI	Hand Pen Range
20	Very stiff to hard gray <u>SILTY CLAY</u> with sand lenses, some sand, trace gravel, moist to damp. (CL) (Continued)								
25		7	23.5	7-12-12	24	17.2			3.50
30		8	28.5	17-50/6"	50/6"	8.8			4.5+
	Termination Depth @ 30 ft.								
35									
40									



LOG OF BORING

Project: Nathan Hale Park Storm Basin Boring No.: B-05
 Location: Parma Heights, Ohio Project No.: 39322.11
 Elevation: _____

Client: Neff & Associates Station & Offset: _____

Driller: Ohio TestBor, Inc. Coordinates: not surveyed

Start Date: 12/11/19 Completion Date: 12/11/19 Total Depth: 20 ft

Water Depth: At Encounter None At Completion None After _____ Hours _____

Graphic Log	Description	Sample	Depth (ft.)	SPT blows / 6"	N-Value	% WC	LL	PI	Hand Pen Range
0	14" TOPSOIL								
	Stiff brown and gray SILTY CLAY, little sand, trace gravel, trace root hairs, wet to moist. (CL)	1	1.0	3-4-6	10	23.7			2.00
5		2	3.5	3-4-7	11	17.2			3.25
		3	6.0	6-7-8	15	14.0			4.5+
10	Very stiff gray SILTY CLAY, some sand, trace gravel, moist to damp. (CL)	4	8.5	8-9-10	19	13.6	26	9	4.5+
		5	13.5	10-11-12	23	12.0			4.5+
15		6	18.5	6-9-11	20	10.8			4.5+
20									

LOG OF BORING INDIVIDUAL SAMPLE DEPTHS 39322.GPJ GEO-SCI.GDT 12/26/19

Termination Depth @ 20 ft.



LOG OF BORING

Project: Nathan Hale Park Storm Basin **Boring No.:** B-06
Location: Parma Heights, Ohio **Project No.:** 39322.11
Elevation: _____
Client: Neff & Associates **Station & Offset:** _____
Driller: Ohio TestBor, Inc. **Coordinates:** not surveyed
Start Date: 12/11/19 **Completion Date:** 12/11/19 **Total Depth:** 27 ft
Water Depth: **At Encounter** 13 ft **At Completion** 13.5 ft **After** _____ **Hours** _____

Graphic Log	Description	Sample	Depth (ft.)	SPT blows / 6"	N-Value	% WC	LL	PI	Hand Pen Range
0	8" TOPSOIL								
	Stiff to very stiff brown <u>SILTY CLAY</u> , some sand, trace gravel, moist. (CL)	1	1.0	3-5-6	11	19.1			3.00
5		2	3.5	4-6-9	15	14.4			4.5+
		3	6.0	6-8-11	19	16.0	31	11	4.5+
10	Stiff to very stiff gray <u>SILTY CLAY</u> with silt lenses, trace sand, gravel, moist. (CL)	4	8.5	7-11-14	25	14.9			4.5+
		5	13.5	4-6-8	14	15.6			N/A
15		6	18.5	8-12-15	27	12.1			4.5+
20									

LOG OF BORING INDIVIDUAL SAMPLE DEPTHS 39322.GPJ GEO-SCI.GDT 12/26/19



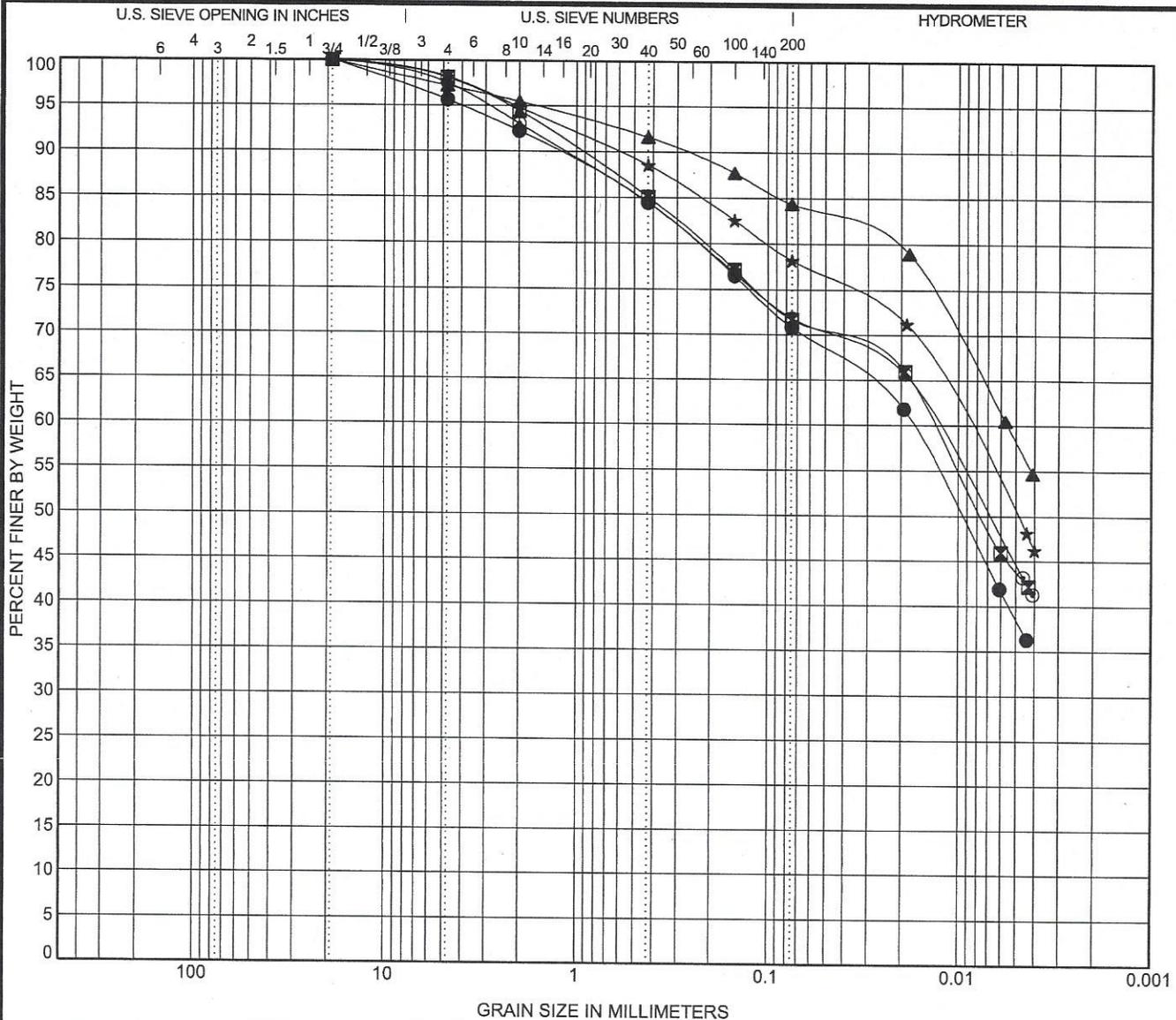
LOG OF BORING

Project: Nathan Hale Park Storm Basin
Client: Neff & Associates

Boring No.: B-06
Project No.: 39322.11

Graphic Log	Description	Sample	Depth (ft.)	SPT blows / 6"	N-Value	% WC	LL	PI	Hand Pen Range
20	Stiff to very stiff gray <u>SILTY CLAY</u> with silt lenses, trace sand, gravel, moist. (CL) <i>(Continued)</i>								
25	Medium dense gray fine to coarse <u>WELL-GRADED SAND</u> , trace gravel, wet. (SW)	7	23.5	7-11-13	24	11.8			N/A
	Termination Depth @ 27 ft.								
30									
35									
40									

Appendix C: Grain Size Distribution



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification					LL	PL	PI	Cc	Cu
● B-01 S-3	LEAN CLAY with SAND (CL)					29	20	9		
☒ B-02 S-4	LEAN CLAY with SAND (CL)					30	20	10		
▲ B-03 S-3	LEAN CLAY with SAND (CL)					36	20	16		
★ B-04 S-2	LEAN CLAY with SAND (CL)					34	21	13		
◎ B-05 S-4	LEAN CLAY with SAND (CL)					26	17	9		

Specimen Identification	D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-01 S-3	19	0.01			4.4	24.9	32.3	38.5
☒ B-02 S-4	19	0.008			1.9	26.4	27.8	43.9
▲ B-03 S-3	19				2.8	12.8	26.2	58.1
★ B-04 S-2	19	0.005			1.8	20.0	28.0	50.2
◎ B-05 S-4	19	0.007			2.5	25.6	27.3	44.5

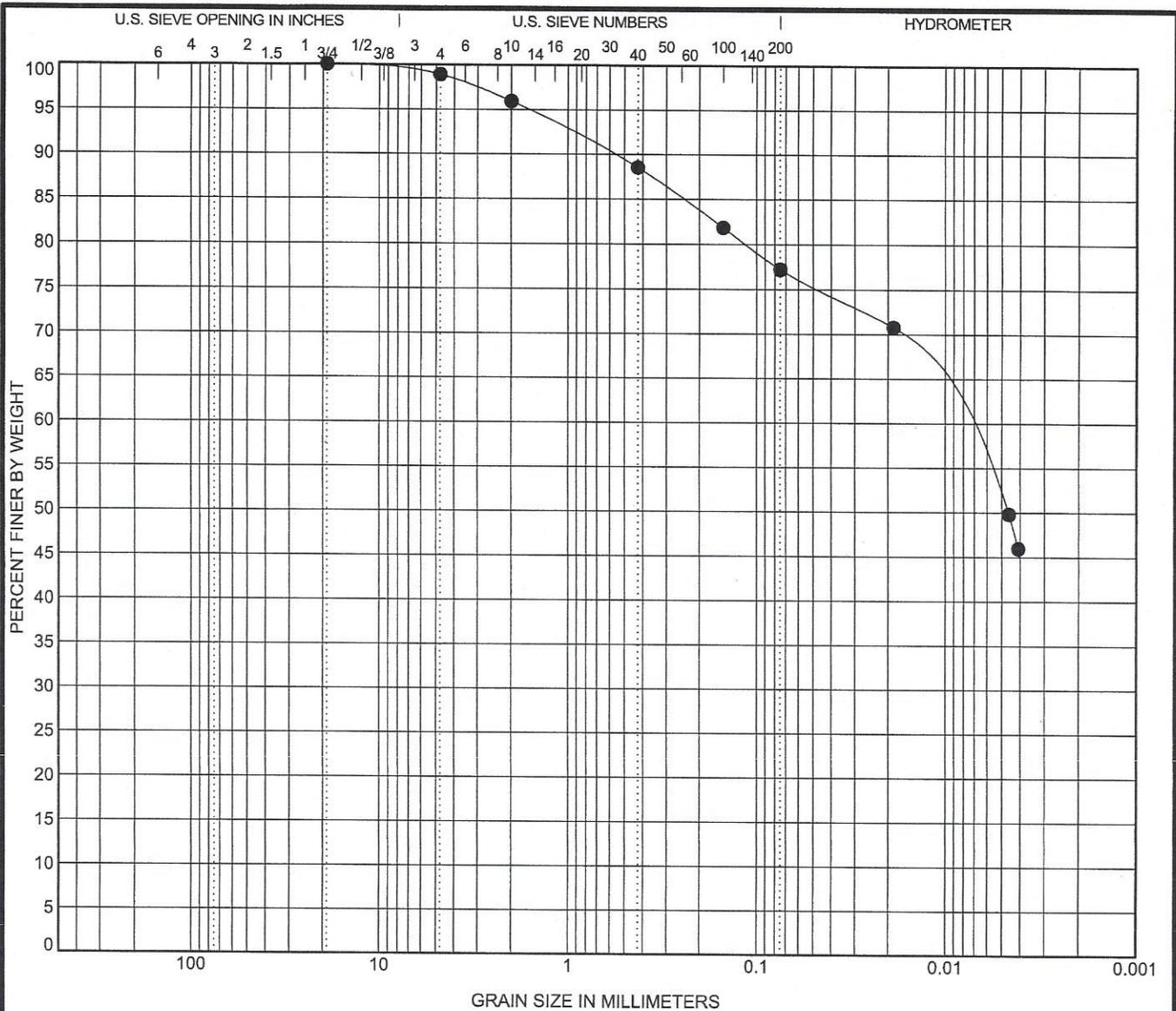


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GRAIN SIZE DISTRIBUTION

Project: Nathan Hale Park Storm Basin
 Location: Parma Heights, Ohio
 Number: 39322.11

US GRAIN SIZE 39322.GPJ GEO.SCI.GDT 12/23/19



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● B-06 S-3	LEAN CLAY with SAND (CL)	31	20	11		

Specimen Identification	D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-06 S-3	19	0.005			1.1	21.7	26.2	51.0



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GRAIN SIZE DISTRIBUTION
 Project: Nathan Hale Park Storm Basin
 Location: Parma Heights, Ohio
 Number: 39322.11

U.S. GRAIN SIZE 39322.GPJ GEO-SCI.GDT 12/23/19

Appendix D: Total Petroleum Hydrocarbon (TPH) & Benzene, Toluene, Ethylbenzene & Xylenes (BTEX)



CHAIN OF CUSTODY
CARDINAL ENVIRONMENTAL LABORATORIES
 2870 SALT SPRINGS ROAD, YOUNGSTOWN, OH 44509
 PHONE: (330) 797-8844 FAX: (330) 797-3264
 E-mail: cel@cardinalenviro.com

Billing Information (If different from Customer Information)

Client Name _____ PO # _____
 Address _____ City/State _____ Zip _____ Phone _____

CUSTOMER INFORMATION

Company Name Geo-Sci Laboratory, Inc.
 Address 110 Blaze Industrial Parkway
 City/State/Zip Berea, OH 44017
 Contact Person Chris Hemme
 Phone 440-234-8985 Fax _____

ANALYSIS REQUIRED

CEI #	Customer Sample ID	Date Collected	Time Collected	Grabs Comp.	Matrix	No. Cont.	Remarks	TPH											
219121603	B-1 / 8.5-10	12/11/19					Jas Sample												
219121604	2 / 13.5-15																		
219121605	3 / 3.5 - 5																		
219121606	4 / 6 - 7.5																		
219121607	5 / 13.5-15																		
219121608	6 / 8.5-10																		

CEI #	Customer Sample ID	Date Collected	Time Collected	Grabs Comp.	Matrix	No. Cont.	Remarks
219121603	B-1 / 8.5-10	12/11/19					Jas Sample
219121604	2 / 13.5-15						
219121605	3 / 3.5 - 5						
219121606	4 / 6 - 7.5						
219121607	5 / 13.5-15						
219121608	6 / 8.5-10						

Collector's Name <u>Alex / Ohio Test Bar, Inc.</u>	Relinquished By <u>Chris Hemme</u>	Date/Time <u>12-13-19</u>	Received By	Date/Time
Collector's Signature	Relinquished By	Date/Time	Received By	Date/Time
FOR PUBLIC WATER SUPPLY (PWS) ONLY		Witnessed By	Date/Time	Remarks
Copy sent to EPA? Yes No If Yes, Which Branch?	Received for Laboratory By <u>Geoff Peller</u>	Date/Time <u>12/11/19</u>		
PWS ID Number	Method of Shipment	Order Temp		
County				
Type of Sample (Raw, Distribution, Plant, etc)				

WHITE - LAB COPY YELLOW - REPORT BLUE ANALYTICAL COPY PINK CUSTOMER COPY

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Laboratory Analysis Report

Client: GEO-SCI
Attn: GEORGE ABOUMRAD
110 BLAZE INDUSTRIAL PKWY
SUITE A
BEREA, OHIO 44107

Lab Number: 219121603
Sample ID: B-1 / 8.5-10

Date Sampled: 12/11/2019
Time Sampled: 0:00
Date Received: 12/16/2019
Report Date: 12/19/2019
Comments:

Sample Desc.
Sampler Name: ALEX OHIO TESTBOR
Sample Matrix: Solid
PO#

Analyte	Result	Unit	Detection Limit	Method	Analysis Date	Analyst
HEAVY DISTILLATES	BDL	mg/kg	20	8015M	12/18/2019	JP
Diesel Range Organics	BDL	mg/kg	15	8015M	12/18/2019	JP
Gasoline Range Organics	BDL	mg/kg	5	8015M	12/18/2019	JP
Total Petroleum Hydrocarbons (TPH)	BDL	mg/Kg	15	8015M	12/18/2019	JP
ROGATES				8015M		
PTP	65	%	50-150	8015M	12/18/2019	JP

BDL = Below Detection Limit

Results Approved By:

John Pflugh, Lab Manager 

Tricia Presco, Chemist 

Mike Robbins, Chemist _____

Ohio EPA Drinking Water Certification: 898

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Laboratory Analysis Report

Client: GEO-SCI
Attn: GEORGE ABOUMRAD
110 BLAZE INDUSTRIAL PKWY
SUITE A
BEREA, OHIO 44107

Lab Number: 219121604
Sample ID: 2 / 13.5-15

Date Sampled: 12/11/2019

Time Sampled:

Date Received: 12/16/2019

Report Date: 12/19/2019

Comments:

Sample Desc.

Sampler Name: ALEX OHIO TESTBOR

Sample Matrix: Solid

PO#

Analyte	Result	Unit	Detection Limit	Method	Analysis Date	Analyst
HEAVY DISTILLATES	BDL	mg/kg	20	8015M	12/18/2019	JP
Diesel Range Organics	BDL	mg/kg	15	8015M	12/18/2019	JP
Gasoline Range Organics	BDL	mg/kg	5	8015M	12/18/2019	JP
Total Petroleum Hydrocarbons (TPH)	BDL	mg/Kg	15	8015M	12/18/2019	JP
ROGATES				8015M		JP
PTP	67	%	50-150	8015M	12/18/2019	JP

BDL = Below Detection Limit

Results Approved By:

John Pflugh, Lab Manager

Tricia Presco, Chemist

Mike Robbins, Chemist

Ohio EPA Drinking Water Certification: 898

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Laboratory Analysis Report

Client: GEO-SCI
Attn: GEORGE ABOUMRAD
110 BLAZE INDUSTRIAL PKWY
SUITE A
BEREA, OHIO 44107

Lab Number: 219121605
Sample ID: 3 / 3.5-5

Date Sampled: 12/11/2019
Time Sampled:
Date Received: 12/16/2019
Report Date: 12/19/2019
Comments:

Sample Desc.
Sampler Name: ALEX OHIO TESTBOR
Sample Matrix: Solid
PO#

Analyte	Result	Unit	Detection Limit	Method	Analysis Date	Analyst
HEAVY DISTILLATES	BDL	mg/kg	20	8015M	12/18/2019	JP
Diesel Range Organics	BDL	mg/kg	15	8015M	12/18/2019	JP
Gasoline Range Organics	BDL	mg/kg	5	8015M	12/18/2019	JP
Total Petroleum Hydrocarbons (TPH)	BDL	mg/Kg	15	8015M	12/18/2019	JP
ROGATES				8015M		
PTP	58	%	50-150	8015M	12/18/2019	JP

BDL = Below Detection Limit

Results Approved By:

John Pflugh, Lab Manager

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Laboratory Analysis Report

Client: GEO-SCI
Attn: GEORGE ABOUMRAD
110 BLAZE INDUSTRIAL PKWY
SUITE A
BEREA, OHIO 44107

Lab Number: 219121606
Sample ID: 4 / 6-7.5

Date Sampled: 12/11/2019
Time Sampled:
Date Received: 12/16/2019
Report Date: 12/19/2019
Comments:

Sample Desc.
Sampler Name: ALEX OHIO TESTBOR
Sample Matrix: Solid
PO#

Analyte	Result	Unit	Detection Limit	Method	Analysis Date	Analyst
HEAVY DISTILLATES	BDL	mg/kg	20	8015M	12/18/2019	JP
Diesel Range Organics	BDL	mg/kg	15	8015M	12/18/2019	JP
Gasoline Range Organics	BDL	mg/kg	5	8015M	12/18/2019	JP
Total Petroleum Hydrocarbons (TPH)	BDL	mg/Kg	15	8015M	12/18/2019	JP
ROGATES				8015M		
PTP	65	%	50-150	8015M	12/18/2019	JP

BDL = Below Detection Limit

Results Approved By:

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Laboratory Analysis Report

Client: GEO-SCI
Attn: GEORGE ABOUMRAD
110 BLAZE INDUSTRIAL PKWY
SUITE A
BEREA, OHIO 44107

Lab Number: 219121607
Sample ID: 5 / 13.5-15

Date Sampled: 12/11/2019

Time Sampled:

Date Received: 12/16/2019

Report Date: 12/19/2019

Comments:

Sample Desc.

Sampler Name: ALEX OHIO TESTBOR

Sample Matrix: Solid

PO#

Analyte	Result	Unit	Detection Limit	Method	Analysis Date	Analyst
HEAVY DISTILLATES	BDL	mg/kg	20	8015M	12/18/2019	JP
Diesel Range Organics	BDL	mg/kg	15	8015M	12/18/2019	JP
Gasoline Range Organics	BDL	mg/kg	5	8015M	12/18/2019	JP
Total Petroleum Hydrocarbons (TPH)	BDL	mg/Kg	15	8015M	12/18/2019	JP
ROGATES				8015M		
PTP	102	%	50-150	8015M	12/18/2019	JP

BDL = Below Detection Limit

Results Approved By:

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Laboratory Analysis Report

Client: GEO-SC1
Attn: GEORGE ABOUMRAD
110 BLAZE INDUSTRIAL PKWY
SUITE A
BEREA, OHIO 44107

Lab Number: 219121608
Sample ID: 6 / 8.5-10

Date Sampled: 12/11/2019
Time Sampled:
Date Received: 12/16/2019
Report Date: 12/19/2019
Comments:

Sample Desc.
Sampler Name: ALEX OHIO TESTBOR
Sample Matrix: Solid
PO#

Analyte	Result	Unit	Detection Limit	Method	Analysis Date	Analyst
HEAVY DISTILLATES	BDL	mg/kg	20	8015M	12/18/2019	JP
Diesel Range Organics	BDL	mg/kg	15	8015M	12/18/2019	JP
Gasoline Range Organics	BDL	mg/kg	5	8015M	12/18/2019	JP
Total Petroleum Hydrocarbons (TPH)	BDL	mg/Kg	15	8015M	12/18/2019	JP
ROGATES				8015M		
PTP	83	%	50-150	8015M	12/18/2019	JP

BDL = Below Detection Limit

Results Approved By:

John Pflugh, Lab Manager

Tricia Presco, Chemist

Mike Robbins, Chemist

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Phone: (330) 797-8844 • Fax: (330) 797-3264 • 1-800-523-0347

Laboratory Analysis Report

Client: **GEO-SCI**
Attn: **GEORGE ABOUMRAD**
110 BLAZE INDUSTRIAL PKWY
SUITE A
BEREA, OHIO 44107

Lab Number: **219121609**
Sample ID: **B-1 / 13.5-15**

Date Sampled: **12/11/2019**
Time Sampled:
Date Received: **12/16/2019**
Report Date: **12/19/2019**
Comments:

Sample Desc.
Sampler Name: **ALEX OHIO TESTBOR**
Sample Matrix: **Solid**
PO#

Analyte	Result	Unit	Detection Limit	Method	Analysis Date	Analyst
BTEX				5035/8260		
Benzene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
Toluene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
Ethyl Benzene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
p-Xylene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
o-Xylene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
SURROGATES				5035/8260		
Dibromofluorobenzene	112	%	80-124 %	5035/8260	12/18/2019	JP
Toluene-d8	83	%	69-118 %	5035/8260	12/18/2019	JP
Bromofluorobenzene	90	%	56-116 %	5035/8260	12/18/2019	JP

BDL = Below Detection Limit

Results Approved By:

John Pflugh, Lab Manager 

Tricia Presco, Chemist 

Mike Robbins, Chemist _____

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Laboratory Analysis Report

Client: GEO-SCI
Attn: GEORGE ABOUMRAD
110 BLAZE INDUSTRIAL PKWY
SUITE A
BEREA, OHIO 44107

Lab Number: 219121610
Sample ID: 2 / 6-7.5

Date Sampled: 12/11/2019
Time Sampled:
Date Received: 12/16/2019
Report Date: 12/19/2019
Comments:

Sample Desc.
Sampler Name: ALEX OHIO TESTBOR
Sample Matrix: Solid
PO#

Analyte	Result	Unit	Detection Limit	Method	Analysis Date	Analyst
BTEX				5035/8260		
Benzene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
Toluene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
Ethyl Benzene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
Xylene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
o-Xylene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
SURROGATES				5035/8260		
Dibromofluorobenzene	105	%	80-124 %	5035/8260	12/18/2019	JP
Toluene-d8	85	%	69-118 %	5035/8260	12/18/2019	JP
Bromofluorobenzene	100	%	56-116 %	5035/8260	12/18/2019	JP

BDL = Below Detection Limit

Results Approved By:

John Pflugh, Lab Manager

Tricia Presco, Chemist

Mike Robbins, Chemist

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Laboratory Analysis Report

Client: **GEO-SCI**
Attn: **GEORGE ABOUMRAD**
110 BLAZE INDUSTRIAL PKWY
SUITE A
BEREA, OHIO 44107

Lab Number: **219121611**
Sample ID: **3 TOP / 8.5-10**

Date Sampled: **12/11/2019**
Time Sampled:
Date Received: **12/16/2019**
Report Date: **12/19/2019**
Comments:

Sample Desc.
Sampler Name: **ALEX OHIO TESTBOR**
Sample Matrix: **Solid**
PO#

Analyte	Result	Unit	Detection Limit	Method	Analysis Date	Analyst
BTEX				5035/8260		
Benzene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
Toluene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
Ethyl Benzene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
Xylene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
o-Xylene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
SURROGATES				5035/8260		
Dibromofluorobenzene	102	%	80-124 %	5035/8260	12/18/2019	JP
Toluene-d8	105	%	69-118 %	5035/8260	12/18/2019	JP
Bromofluorobenzene	102	%	56-116 %	5035/8260	12/18/2019	JP

BDL = Below Detection Limit

Results Approved By:

John Pflugh, Lab Manager

Tricia Presco, Chemist

Mike Robbins, Chemist

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Laboratory Analysis Report

Client: GEO-SCI
Attn: GEORGE ABOUMRAD
110 BLAZE INDUSTRIAL PKWY
SUITE A
BEREA, OHIO 44107

Lab Number: 219121612
Sample ID: 4 / 8.5-10

Date Sampled: 12/11/2019
Time Sampled:
Date Received: 12/16/2019
Report Date: 12/19/2019
Comments:

Sample Desc.
Sampler Name: ALEX OHIO TESTBOR
Sample Matrix: Solid
PO#

Analyte	Result	Unit	Detection Limit	Method	Analysis Date	Analyst
BTEX				5035/8260		
Benzene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
Toluene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
Ethyl Benzene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
Xylene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
o-Xylene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
SURROGATES				5035/8260		
Dibromofluorobenzene	94	%	80-124 %	5035/8260	12/18/2019	JP
Toluene-d8	96	%	69-118 %	5035/8260	12/18/2019	JP
Bromofluorobenzene	90	%	56-116 %	5035/8260	12/18/2019	JP

BDL = Below Detection Limit

Results Approved By:

John Pflugh, Lab Manager

Tricia Presco, Chemist

Mike Robbins, Chemist

Ohio EPA Drinking Water Certification: 898

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Laboratory Analysis Report

Client: GEO-SCI
Attn: GEORGE ABOUMRAD
110 BLAZE INDUSTRIAL PKWY
SUITE A
BEREA, OHIO 44107

Lab Number: 219121613
Sample ID: 5 / 6-7.5

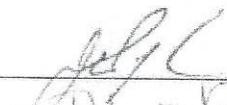
Date Sampled: 12/11/2019
Time Sampled:
Date Received: 12/16/2019
Report Date: 12/19/2019
Comments:

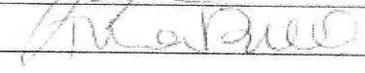
Sample Desc.
Sampler Name: ALEX OHIO TESTBOR
Sample Matrix: Solid
PO#

Analyte	Result	Unit	Detection Limit	Method	Analysis Date	Analyst
BTEX				5035/8260		
Benzene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
Toluene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
Ethyl Benzene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
p-Xylene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
o-Xylene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
SURROGATES				5035/8260		
Dibromofluorobenzene	117	%	80-124 %	5035/8260	12/18/2019	JP
Toluene-d8	84	%	69-118 %	5035/8260	12/18/2019	JP
Bromofluorobenzene	94	%	56-116 %	5035/8260	12/18/2019	JP

BDL = Below Detection Limit

Results Approved By:

John Pflugh, Lab Manager 

Tricia Presco, Chemist 

Mike Robbins, Chemist _____

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Laboratory Analysis Report

Client: GEO-SCI
Attn: GEORGE ABOUMRAD
110 BLAZE INDUSTRIAL PKWY
SUITE A
BEREA, OHIO 44107

Lab Number: 219121614
Sample ID: 6 / 13.5-15

Date Sampled: 12/11/2019
Time Sampled:
Date Received: 12/16/2019
Report Date: 12/19/2019
Comments:

Sample Desc.
Sampler Name: ALEX OHIO TESTBOR
Sample Matrix: Solid
PO#

Analyte	Result	Unit	Detection Limit	Method	Analysis Date	Analyst
BTEX				5035/8260		
Benzene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
Toluene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
Ethyl Benzene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
Xylene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
o-Xylene	BDL	mg/kg	0.005	5035/8260	12/18/2019	JP
SURROGATES				5035/8260		
Dibromofluorobenzene	114	%	80-124 %	5035/8260	12/18/2019	JP
Toluene-d8	79	%	69-118 %	5035/8260	12/18/2019	JP
Bromofluorobenzene	82	%	56-116 %	5035/8260	12/18/2019	JP

BDL = Below Detection Limit

Results Approved By:

John Pflugh, Lab Manager

Tricia Presco, Chemist

Mike Robbins, Chemist

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