



August 16, 2024

Mr. Jason Bing, RA, LEED AP  
Director, Capitol Programs  
Ann Arbor Public Schools  
2555 South State Street  
Ann Arbor, Michigan 48104

RE: Letter Report of Infiltration Evaluation  
Ann Arbor Public Schools  
Lakewood Elementary School  
344 Gralake Avenue  
City of Ann Arbor, Washtenaw County, Michigan 48103  
G2 Project No. 243117

Dear Mr. Bing:

We have completed the infiltration investigation related to the proposed site improvements at the Lakewood Elementary Campus located at the above address in Ann Arbor, Michigan. Stormwater collected at the site will be directed to several stormwater management structures designed to infiltrate the water into the ground. The focus of this report is related to the development of soil parameters for use in the design of the proposed infiltration structures.

We conducted our infiltration investigation in general accordance with the Washtenaw County Water Resource Commission's (WCWRC) revised "Rules and Guidelines - Procedures & Design Criteria for Stormwater Management Systems" dated October 17, 2016. We conducted the scope of our investigation within soil borings to avoid disrupting/damaging the functionality of the active site.

We appreciate the opportunity to be of service to Ann Arbor Public Schools on this project and look forward to discussing the recommendations presented herein. In the meantime, if you have any questions regarding this report or any other matter pertaining to the project, please call us.

Sincerely,

**G2 Consulting Group, LLC**

Patrick Guisinger  
Geotechnical Technician

PJG/MGD/pjg

Michael G. Dagher, P.E.  
Project Manager



## FIELD OPERATIONS

We performed a geotechnical investigation leading up to the execution of our infiltration testing program. Based on the results of our investigation we recommended several areas at the site that may be conducive to infiltration. Using the encountered soil and groundwater conditions as well as recommendations from our team, Midwestern Consulting determined the quantity, depth, and location of the infiltration tests. We present the approximate locations of the soil borings on the Infiltration Boring Location Plan, Plate No. 1, enclosed with this letter. We estimated the ground surface elevations at the as-drilled soil boring locations based on topographical information presented on the drawing titled "AAPS Lakewood Elementary Soil Boring Plan" dated May 17, 2024 by Midwestern Consulting. If you would like more accurate positional information at the boring locations, we recommend the as-drilled locations be determined with conventional surveying techniques.

The infiltration soil borings were excavated by Xterra Drilling using a 4x4 truck-mounted rotary drilling rig. The driller used 2-1/4 inch inside diameter hollow stem augers to advance the soil borings to the target depths. We directed the driller to obtain soil samples in general accordance with the Standard Penetration Test (SPT) method (ASTM D1586). The SPT involves driving a 2-inch outside-diameter split-spoon sampler into the ground with a 140-lb hammer falling 30 inches. The sampler is driven in three successive 6-inch increments, with the number of blows for each increment recorded. The number of blows required to advance the sample the final 12 inches is referred to as the Standard Penetration Resistance (N or N-value). We present the blow counts for each 6-inch increment and the resulting N-values on the individual infiltration soil boring logs at the depths they were determined.

We offset from the relevant test locations previously drilled in the geotechnical phase of this project and drilled without sampling to a depth approximately 1-1/2 feet above the target test elevation. We directed the driller to obtain one or more confirmatory samples with the bottom depth roughly corresponding to the target test elevation. Following confirmation of the soil layer, we set up the apparatus for infiltration testing.

We placed the soil samples obtained in the field in sealed containers and transported the samples to our Ann Arbor office for testing and classification. During the drilling operations, a G2 representative maintained a log of the encountered subsurface soil and groundwater conditions to be used in conjunction with our analysis of the site. The final soil boring logs are based on the field logs and laboratory soil classification and testing. Upon completion of the drilling operations, we backfilled the resulting excavations with auger spoils.

## FIELD AND LABORATORY TESTING

We subjected representative soils samples to laboratory testing to determine soil parameters pertinent to our evaluation of the site as it relates to infiltration. An experienced geotechnical engineer classified the soil samples in accordance with the G2 General Note Terminology and applications of the Unified Soil Classification System (Visual-Manual). Laboratory testing on representative samples included:

- ASTM D2216 – Moisture Content
- ASTM D2488 – Visual-Manual Soil Classification (USCS)
- ASTM D1140 – Percent Finer than No. 200 Sieve

We estimated the unconfined compressive strength of cohesive soils using a spring-loaded hand penetrometer. The hand penetrometer estimates the unconfined compressive strength to a maximum of 4-1/2 tons per square foot by measuring the resistance of the soil sample to the penetration of a spring-loaded cylinder.

We conducted our infiltration investigation in general accordance with the Washtenaw County Water



Resource Commission's (WCWRC) revised "Rules and Guidelines – Procedures & Design Criteria for Stormwater Management Systems" dated October 17, 2016. We performed infiltration tests in general accordance with the encased falling head permeability test; however, adapted to the performance of the test within a soil boring.

The results of the moisture content and unconfined compressive strength determinations are shown on the individual soil boring logs at the depths the samples were taken. We present the soil boring logs on Figure Nos. 1 through 4 enclosed with this letter. We present the results of our grainsize distribution tests on Figure No. 5 enclosed with this letter. We present the results of our infiltration tests on Figure Nos. 6 and 7 enclosed with this letter. We will retain the soil samples for a period of 60-days following the issuance of this report after which they will be discarded. If you would like to have the soil samples, please let us know.

## **SITE CONDITIONS**

The Lakewood Elementary School campus is located at 344 Gralake Avenue in Ann Arbor, Michigan. The campus is bounded by residential parcels to the north and east, and by wooded/undeveloped areas to the south and west. The campus consists of a single-story, slab-on-grade school building with associated bituminous pavement access/service drives and parking areas, PCC sidewalks, three (3) playground areas, and community gardens. The remainder of the campus is grass covered and includes numerous mature trees.

Based on the provided topographical survey, existing surface grades throughout the campus range from elevation 944 to 967 feet. More specifically, existing surface grades within the proposed building and pavements range from elevation 855 to 960 feet and 950 to 961 feet. In general, existing surface grades appear to be sloping downward from east to west.

## **SOIL AND GROUNDWATER CONDITIONS**

### **Original Soil Borings (SB-12 and SB-13)**

Approximately 4 to 5 inches of topsoil is present at the ground surface of soil borings SB-12 and SB-13. Fill consisting of sandy clay is present beneath the topsoil in soil boring SB-13 extending to a depth of 6 feet. The topsoil in soil boring SB-12 and the fill in soil boring SB-13 is underlain by native sandy clay extending to a depth of approximately 10 feet. Native granular soils comprised of gravelly sand, silty sand, and sandy silt are present beneath the upper sandy clay extending to the explored depth in soil boring SB-12 and to a depth of approximately 15 feet in soil boring SB-13. The gravelly sand in soil boring SB-13 is underlain by sandy clay extending to the explored depth.

The cohesive fill soils are stiff to very stiff in consistency having moisture contents ranging from 13 to 18 percent and unconfined compressive strengths ranging from 3,000 to 7,000 psf. A layer of soft sandy is present beneath the fill in SB-13 extending to a depth of approximately 7-1/2 feet having a natural moisture content of 19 percent and an unconfined compressive strength of 600 psf. The remaining native sandy clay is very stiff to hard in consistency having a natural moisture content ranging from 12 to 17 percent and unconfined compressive strengths ranging from 6,500 to more than 9,000 psf. The native granular soils are medium compact to compact having Standard Penetration Test (SPT) N-values ranging from 28 to 52 blows per foot (bpf).

We did not observe measurable groundwater within soil borings SB-12 or SB-13 either during or upon completion of the drilling operations.



### Infiltration Borings (IN-SB-12 and IN-SB-13)

We drilled soil borings IN-SB-12 and IN-SB-13 without sampling extending from the ground surface to a point approximately 1-1/2 feet above the target test layer. At this depth, we obtained at least one SPT sample to confirm the target soil layer.

At IN-SB-12, we encountered medium compact gravelly sand at a depth of 10-1/2 feet, having a SPT N-value of 24 bpf, extending to the explored depth of 12 feet. At IN-SB-13, we encountered hard sandy clay at a depth of 9 feet, having a moisture content of 13 percent and an unconfined compressive strength of more than 9,000 psf, extending to a depth of 10-1/2 feet. The sandy clay in IN-SB-13 is underlain by very compact gravelly sand having an SPT N-value of 52 bpf extending to the explored depth.

We did not observe measurable groundwater within soil borings IN-SB-12 or IN-SB-13 either during or upon completion of the drilling operations.

### General

Fluctuations in perched and long-term groundwater levels should be anticipated due to seasonal variations and following periods of prolonged precipitation. Groundwater observations made during the drilling operations in predominantly cohesive soils are not necessarily indicative of the static groundwater level. This is due to the low permeability of such soils and the tendency of the drilling operations to seal off natural paths of groundwater flow.

The stratification depths shown on the soil boring logs represent the soil conditions at the boring locations. Variations will occur away from the boring locations. Additionally, the stratigraphic lines represent the approximate boundary between soil types. The transition may be more gradual than what is shown. We have prepared the soil boring logs based on the field logs of encountered soil conditions supplemented by laboratory classification and testing. We present General Notes Terminology, defining the nomenclature used on the soil boring logs and elsewhere in this report as Figure No. 8.

### INFILTRATION CONSIDERATIONS

We present the results of our infiltration evaluation in the following table:

Test Pit No.	Ground Surface Elevation (ft) <sup>1</sup>	Groundwater Elevation (ft) <sup>2</sup>	Test Elevation (ft)	Soil Type (USCS <sup>3</sup> )	Observed Infiltration Rate (iph) <sup>4</sup>
IN-SB-12	954.5	---	12	Gravelly Sand (SP-SM)	8.6
IN-SB-13	955.3	---	12-1/2	Gravelly Sand (SP-SM)	18.5

- Notes:
1. Estimated based on available topographical information.
  2. Estimated at completion of excavation operations - no measurable groundwater.
  3. Description in general accordance with Visual-Manual Unified Soil Classification System (ASTM D2488).
  4. Represents infiltration rate for duration of final trial.

Please note, the observed infiltration rates presented in the above table have not been reduced using a factor-of-safety. The stormwater system engineer-of-record should use an appropriate factor of safety based on their experience with the design, construction, and performance of similar systems. We understand the WCWRC recommends observed infiltration rates be reduced by a factor of safety equal to 2.0 for use in design.



Based on the results of our infiltration evaluation, we recommend the proposed stormwater management structures be designed to infiltrate collected water into the ground at the evaluated elevations. Discrepancies between the design infiltration rate and the observed soil types can be attributed to the percentage of material passing the No. 200 sieve in addition to the in-situ relative density of the encountered soil types.

We recommend that a qualified geotechnical engineer or technician be present on-site during the excavation of the stormwater management structures to verify that soils at the base of the proposed structures are consistent with soil conditions identified within this report.

### GENERAL COMMENTS

If changes occur in the design, location, or concept of the project, conclusions and recommendations contained in this report are not valid unless G2 Consulting Group, LLC reviews the changes. G2 Consulting Group, LLC will then confirm any assumptions regarding the project scope presented herein or make changes in writing. The scope of the present investigation was limited to evaluation of subsurface conditions at the proposed test pit locations. No chemical or environmental testing or analyses were included in the scope of this investigation.

We base the analyses and recommendations submitted in this report upon the data from the test pit performed at the approximate locations shown on the Infiltration Boring Location Plan, Plate No. 1. This report does not reflect variations that may occur between the actual test pit location and the actual stormwater management structure location. The nature and extent of any such variations may not become clear until the time of construction. We recommend G2 Consulting Group, LLC observe all geotechnical related work, including subgrade preparation and engineered fill placement.

We appreciate the opportunity to be of service to you on this project and look forward to discussing the results presented. In the meantime, if you have any questions regarding this report or any other matter pertaining to the project, please call us.

Sincerely,

**G2 Consulting Group, LLC**

Handwritten signature of Patrick Guisinger in blue ink.

Patrick Guisinger  
Geotechnical Technician

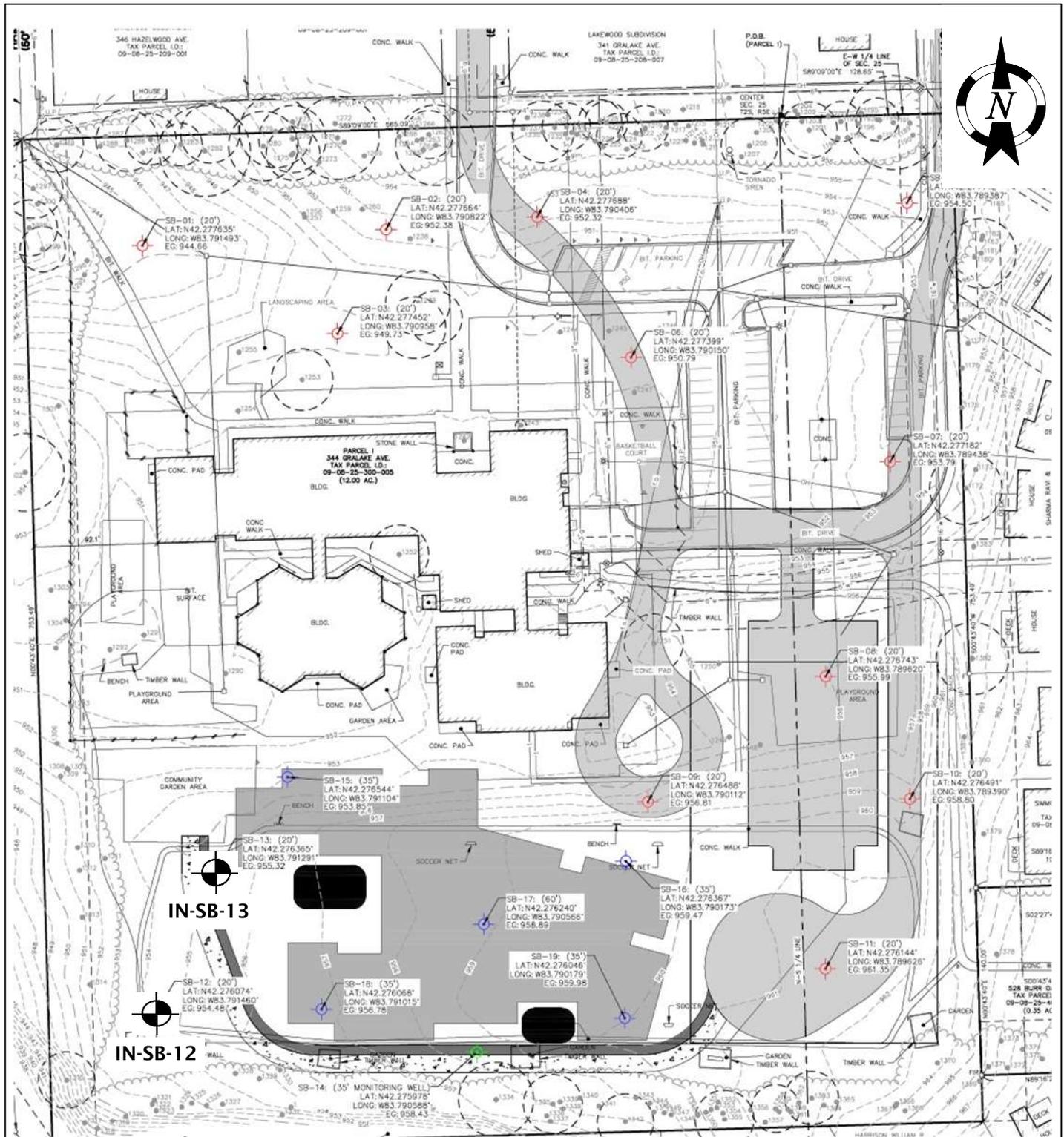
Handwritten signature of Michael G. Dagher in blue ink.

Michael G. Dagher, P.E.  
Project Manager

PJG/MGD/pjg

- Encl: Plate No. 1 – Infiltration Boring Location Plan  
Figure No. 1 through 4 – Soil and Infiltration Boring Logs  
Figure No. 5 – Grainsize Distribution Results  
Figure No. 6 and 7 – Encased Falling Head Infiltration Test Results  
Figure No. 8 – G2 General Notes Terminology





**Legend**

 Soil borings performed by Strata Drilling, Inc. on 8/5/2024

**Notes**

- IN-SB-12 and IN-SB-13 offset approximately five feet from previous soil borings SB-12 and SB-13

**Infiltration Boring Location Plan**

Lakewood Elementary School  
344 Gralake Road  
Ann Arbor, Michigan 48103



Project No. 243117	
Drawn by: PJG	
Date: 8/9/24	Plate No. 1
Scale: NTS	

Project Name: Lakewood Elementary School

Project Location: 344 Gralake Avenue  
Ann Arbor, Michigan

G2 Project No. 243117

Latitude: 42.276074° Longitude: -83.791460°



Soil Boring No. SB-12

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 954.5 ft	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Dark Brown Sandy Clay with trace silt and gravel (5 inches)	0.4	S-01	4 4 3	7	12.6		8000*
949.5		Very Stiff to Hard Brown Sandy Clay with trace silt and gravel (Brown Sand Seam @ 7 feet)	5	S-02	5 9 10	19	12.6		6500*
				S-03	4 6 6	12	13.1		7000*
944.5			10.0	S-04	5 9 10	19	13.5		9000*
		Medium Compact Grayish Brown Gravelly Sand with trace clay; possible cobbles							
939.5			15.0	S-05	12 13 15	28			
		Compact Light Brown Silty Sand							
934.5		Light Brown Sandy Silt	19.5 20.0	S-06	10 16 18	34			
		End of Boring @ 20 ft							
929.5			25						
924.5			30						
919.5			35						
914.5			40						

Total Depth: 20 ft  
 Drilling Date: June 19, 2024  
 Inspector: J. Anton  
 Contractor: Strata Drilling, Inc.  
 Driller: B. Sienkiewicz

Water Level Observation:  
 Dry during and upon completion of drilling operations

Notes:  
 Borehole collapsed at 13-1/2 ft after auger removal  
 \* Calibrated Hand Penetrometer

Drilling Method:  
 3-1/4 inch inside diameter hollow-stem auger

Excavation Backfilling Procedure:  
 Borehole backfilled with auger cuttings

SOIL / PAVEMENT BORING 243117.GPJ 20150116.G2 CONSULTING DATA TEMPLATE.GDT 8/16/24

Figure No. 1

Project Name: Lakewood Elementary School

Project Location: 344 Gralake Avenue  
Ann Arbor, Michigan

G2 Project No. 243117

Latitude: 42.276353° Longitude: -83.791314°



Soil Boring No. IN-SB-12

CONSULTING GROUP

SUBSURFACE PROFILE

SOIL SAMPLE DATA

ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 954.5 ft	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
949.5		(Profile Drilled to 10-1/2 feet)	5						
944.5			10						
			Medium Compact Brown Gravelly Sand with trace silt (Finer than #200 = 6.4%) (Observed Infiltration Rate = 8.6 iph)	10.5 12.0	S-01	12 11 13	24		
		End of Boring @ 12 ft							
939.5			15						
934.5			20						

SOIL / PAVEMENT BORING 243117.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 8/16/24

Total Depth: 12 ft  
Drilling Date: August 5, 2024  
Inspector: C. Gross  
Contractor: Xterra Drilling  
Driller: B. Hansen

Water Level Observation:  
Dry during and upon completion of drilling operations

Excavation Backfilling Procedure:  
Borehole backfilled with auger cuttings

Drilling Method:  
2-1/4 inch inside diameter hollow-stem auger

Figure No. 2

Project Name: Lakewood Elementary School

Project Location: 344 Gralake Avenue  
Ann Arbor, Michigan

G2 Project No. 243117

Latitude: 42.276365° Longitude: -83.791460°



Soil Boring No. SB-13

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 955.3 ft	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Dark Brown Sandy Clay with trace silt and gravel (3 inches)	0.3						
		Fill: Very Stiff Brown Sandy Clay with trace silt and gravel	2.5	S-01	4 5 5	10	13.2		7000*
		Fill: Stiff Brown Sandy Clay with trace silt and gravel			2 2 2	4	17.7		3000*
950.3			5	S-02					
		Soft Brown Sandy Clay with trace silt and gravel	6.0		1 2				
		Very Stiff Brown Sandy Clay with trace silt and gravel	7.5	S-03	3	5	19.2		600**
945.3			10.0	S-04	4 6 8	14	17.0		7500*
		Compact Grayish Brown Gravelly Sand with trace clay; occasional cobbles			26 21 15	36			
940.3			15.0	S-05					
		Hard Brown Sandy Clay with trace silt and gravel			5 9 11	20	14.1		9000*
935.3			20.0	S-06					
		End of Boring @ 20 ft							
930.3			25						
925.3			30						
920.3			35						
915.3			40						

Total Depth: 20 ft  
 Drilling Date: June 19, 2024  
 Inspector: J. Anton  
 Contractor: Strata Drilling, Inc.  
 Driller: J. Haynor

Water Level Observation:  
 Dry during and upon completion of drilling operations

Notes:  
 Borehole collapsed at 10 ft after auger removal  
 \* Calibrated Hand Penetrometer  
 \*\* Torvane

Drilling Method:  
 3-1/4 inch inside diameter hollow-stem auger

Excavation Backfilling Procedure:  
 Borehole backfilled with auger cuttings

SOIL / PAVEMENT BORING 243117.GPJ 20150116.G2 CONSULTING DATA TEMPLATE.GDT 8/16/24

Figure No. 3

Project Name: Lakewood Elementary School

Project Location: 344 Gralake Avenue  
Ann Arbor, Michigan

G2 Project No. 243117

Latitude: 42.276099° Longitude: -83.791416°



Soil Boring No. IN-SB-13

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 955.3 ft	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
950.3		(Profile Drilled to 9 feet)	5						
			9.0						
945.3		Hard Brown Sandy Clay with trace gravel	10	S-01	9 14 17	31	12.8		9000*
			10.5						
		Very Compact Brown Gravelly Sand with trace silt (Finer than #200 = 10.6%) (Observed Infiltration Rate = 18.5 iph)	12.5	S-02	17 26 26	52			
		End of Boring @ 12.5 ft							
940.3			15						
935.3			20						

SOIL / PAVEMENT BORING 243117.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 8/16/24

Total Depth: 12.5 ft  
 Drilling Date: August 5, 2024  
 Inspector: C. Gross  
 Contractor: Xterra Drilling  
 Driller: B. Hansen

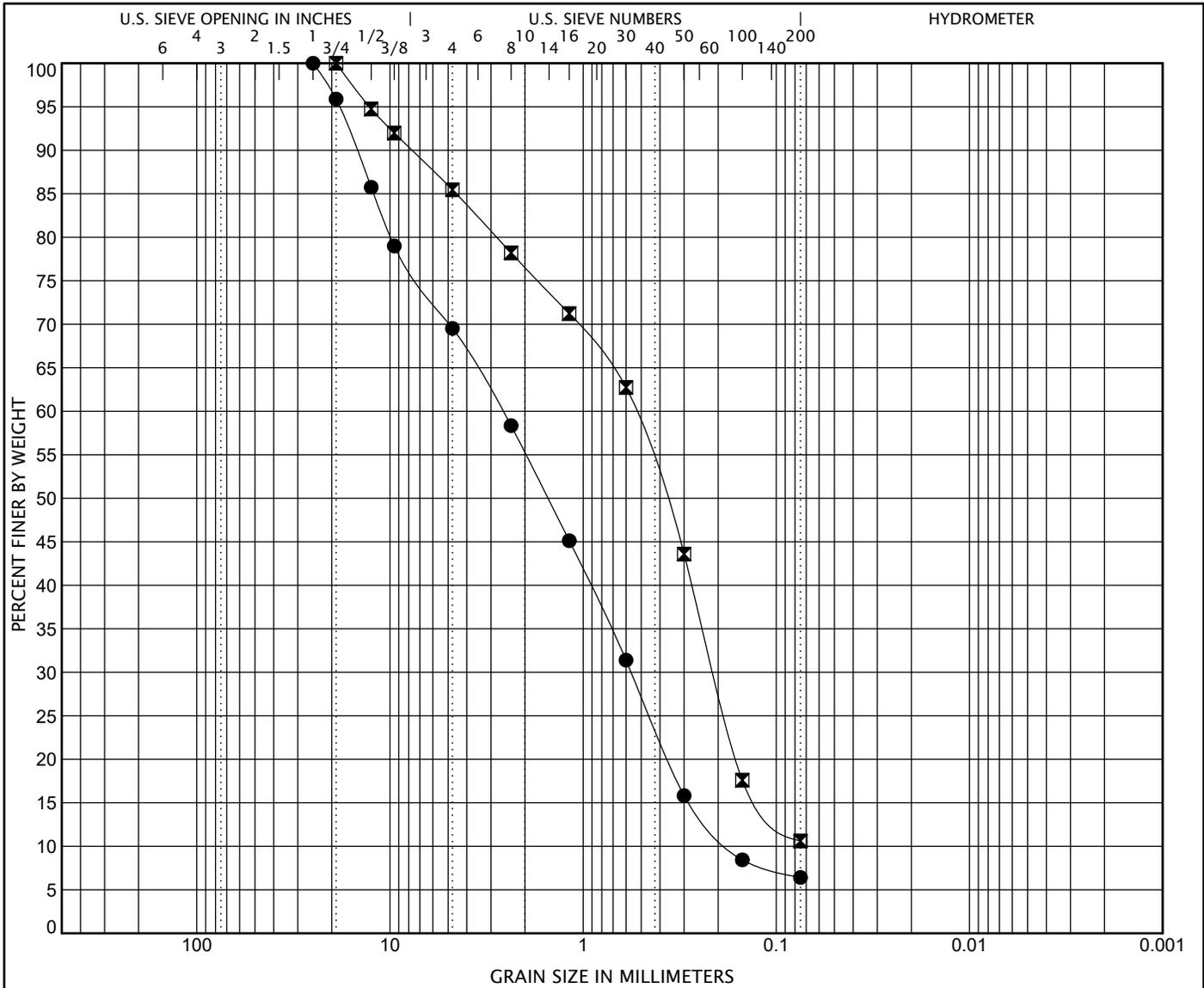
Water Level Observation:  
 Dry during and upon completion of drilling operations

Notes:  
 \* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:  
 Borehole backfilled with auger cuttings

Drilling Method:  
 2-1/4 inch inside diameter hollow-stem auger

Figure No. 4



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen ID	Description	LL	PL	PI	Cc	Cu		
● IN-SB-1S-01	Brown Gravelly Sand with trace silt				0.7	15.1		
☒ IN-SB-1S-02	Brown Gravelly Sand with trace silt				1.1	7.7		
Specimen ID	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● IN-SB-1S-01	25	2.616	0.564	0.174	30.5	63.1	6.4	
☒ IN-SB-1S-02	19	0.543	0.209		14.5	74.8	10.6	

### GRAIN SIZE DISTRIBUTION

Project Name: Lakewood Elementary School  
 Project Location: 344 Galake Avenue  
 Ann Arbor, Michigan  
 G2 Project No.: 243117



Figure No. 5

U.S. GRAIN SIZE 243117.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 8/14/24

# G2 Consulting Group, LLC

## Encased Falling Head Infiltration Test (WCWRC 2016)



Project: Proposed Lakewood Elementary School Job No.: 243117  
 Location of Project: Ann Arbor, MI Test Pit No. IN-SB-12 Depth (in) 144  
 Description of Soil: Gravelly Sand Depth of Test (in): 144  
 Tested By: Patrick Guisinger Date of Testing: 8/7/2024  
 Casing Diameter (in): 4 Casing Embedment (in): 6  
 Initial Head of Water (in): 12 Pre-Soak Time (min): 60

Reading No.	Trial 1		Trial 2		Trial 3	
	Elapsed Time (min)	Depth Reading (in)	Elapsed Time (min)	Depth Reading (in)	Elapsed Time (min)	Depth Reading (in)
1	0	12	0	12	0	12
2	10	10 1/8	10	10 3/8	10	10 ←
3	20	8 6/8	20	8 5/8	20	8 3/8
4	30	7 1/8	30	7	30	6 7/8
5	40	5 1/8	40	5 3/8	40	5 4/8
6	50	3 5/8	50	4 2/8	50	4 4/8
7	60	2 3/8	60	3	60	3 3/8 ←
8						
9						
10						
11						
12						
13						

Reading No.	Trial 1	Trial 2	Trial 3
	Infiltration Rate (in/hr)	Infiltration Rate (in/hr)	Infiltration Rate (in/hr)
1	---	---	---
2	11.5	10.1	12.2
3	7.9	10.1	9.4
4	10.1	10.1	9.4
5	11.5	9.4	7.9
6	9.4	7.2	6.5
7	7.2	7.2	6.5
8	---	---	---
9	---	---	---
10	---	---	---
11	---	---	---
12	---	---	---
13	---	---	---

Elapsed Time (min)	Head Drop (in)	Observed Infiltration Rate (iph)
60	8 10/16	8.6

- Notes:
1. Refer to "Rules and Guidelines - Procedures & Design Criteria for Stormwater Management Systems", WCWRC, Rev. Oct. 2016.
  2. ← = Used in Calculating Infiltration Rate

# G2 Consulting Group, LLC

## Encased Falling Head Infiltration Test (WCWRC 2016)



Project: Proposed Lakewood Elementary School Job No.: 243117  
 Location of Project: Ann Arbor, MI Test Pit No. IN-SB-13 Depth (in) 150  
 Description of Soil: Gravelly Sand Depth of Test (in): 150  
 Tested By: Patrick Guisinger Date of Testing: 8/7/2024  
 Casing Diameter (in): 4 Casing Embedment (in): 6  
 Initial Head of Water (in): 12 Pre-Soak Time (min): 60

Reading No.	Trial 1		Trial 2		Trial 3	
	Elapsed Time (min)	Depth Reading (in)	Elapsed Time (min)	Depth Reading (in)	Elapsed Time (min)	Depth Reading (in)
1	0	12	0	12	0	12
2	5	10 4/8	5	9	5	10 2/8
3	10	8 5/8	10	7 2/8	10	8 2/8
4	15	7 1/8	15	6 1/8	15	6 6/8
5	20	5 4/8	20	4 3/8	20	5 1/8
6	25	4 1/8	25	3	25	4
7	30	2 5/8	30	1 5/8	30	2 6/8
8						
9						
10						
11						
12						
13						

Reading No.	Trial 1	Trial 2	Trial 3
	Infiltration Rate (in/hr)	Infiltration Rate (in/hr)	Infiltration Rate (in/hr)
1	---	---	---
2	18.7	36.0	21.6
3	21.6	21.6	23.0
4	18.7	12.9	18.7
5	18.7	21.6	18.7
6	17.3	15.8	14.4
7	17.3	15.8	14.4
8	---	---	---
9	---	---	---
10	---	---	---
11	---	---	---
12	---	---	---
13	---	---	---

Elapsed Time (min)	Head Drop (in)	Observed Infiltration Rate (iph)
30	9 4/16	18.5

- Notes:
1. Refer to "Rules and Guidelines - Procedures & Design Criteria for Stormwater Management Systems", WCWRC, Rev. Oct. 2016.
  2. ← = Used in Calculating Infiltration Rate

## GENERAL NOTES TERMINOLOGY

Unless otherwise noted, all terms herein refer to the Standard Definitions presented in ASTM 653.

### PARTICLE SIZE

Boulders	- greater than 12 inches
Cobbles	- 3 inches to 12 inches
Gravel - Coarse	- 3/4 inches to 3 inches
- Fine	- No. 4 to 3/4 inches
Sand - Coarse	- No. 10 to No. 4
- Medium	- No. 40 to No. 10
- Fine	- No. 200 to No. 40
Silt	- 0.005mm to 0.074mm
Clay	- Less than 0.005mm

### CLASSIFICATION

The major soil constituent is the principal noun, i.e. clay, silt, sand, gravel. The second major soil constituent and other minor constituents are reported as follows:

<b>Second Major Constituent (percent by weight)</b>	<b>Minor Constituent (percent by weight)</b>
Trace - 1 to 12%	Trace - 1 to 12%
Adjective - 12 to 35%	Little - 12 to 23%
And - over 35%	Some - 23 to 33%

### COHESIVE SOILS

If clay content is sufficient so that clay dominates soil properties, clay becomes the principal noun with the other major soil constituent as modifier, i.e. sandy clay. Other minor soil constituents may be included in accordance with the classification breakdown for cohesionless soils, i.e. silty clay, trace sand, little gravel.

<b>Consistency</b>	<b>Unconfined Compressive Strength (psf)</b>	<b>Approximate Range of (N)</b>
Very Soft	Below 500	0 - 2
Soft	500 - 1,000	3 - 4
Medium	1,000 - 2,000	5 - 8
Stiff	2,000 - 4,000	9 - 15
Very Stiff	4,000 - 8,000	16 - 30
Hard	8,000 - 16,000	31 - 50
Very Hard	Over 16,000	Over 50

Consistency of cohesive soils is based upon an evaluation of the observed resistance to deformation under load and not upon the Standard Penetration Resistance (N).

<b>Density Classification</b>	<b>COHESIONLESS SOILS Relative Density %</b>	<b>Approximate Range of (N)</b>
Very Loose	0 - 15	0 - 4
Loose	16 - 35	5 - 10
Medium Compact	36 - 65	11 - 30
Compact	66 - 85	31 - 50
Very Compact	86 - 100	Over 50

Relative Density of cohesionless soils is based upon the evaluation of the Standard Penetration Resistance (N), modified as required for depth effects, sampling effects, etc.

### SAMPLE DESIGNATIONS

- AS - Auger Sample - Cuttings directly from auger flight
- BS - Bottle or Bag Samples
- S - Split Spoon Sample - ASTM D 1586
- LS - Liner Sample with liner insert 3 inches in length
- ST - Shelby Tube sample - 3 inch diameter unless otherwise noted
- PS - Piston Sample - 3 inch diameter unless otherwise noted
- RC - Rock Core - NX core unless otherwise noted

STANDARD PENETRATION TEST (ASTM D 1586) - A 2.0 inch outside-diameter, 1-3/8 inch inside-diameter split barrel sampler is driven into undisturbed soil by means of a 140-pound weight falling freely through a vertical distance of 30 inches. The sampler is normally driven three successive 6-inch increments. The total number of blows required for the final 12 inches of penetration is the Standard Penetration Resistance (N).