resourceful. naturally.
engineering and environmental consultants

BARR

Geotechnical Investigation Summary

To: Vadnais Lake Area Water Management Organization
From: Levi Brown, P.E. and Brent Theroux, P.E.
Subject: Geotechnical Investigation Summary for Wilkinson 319
Date: April 17, 2022
Project: Barr Project No. 23621418

Background and Existing Site Conditions

The location of the Wilkinson 319 pre-design investigation is northwest of Centerville Road and County Road H2 E in North Oaks, Minnesota. The access gate is located west of approximately 5550 Centerville Road, North Oaks, MN. At the time of this investigative summary report, proposed construction includes a water retention basin and a high-flow bypass structure.

There is an existing farmstead to the northwest of the site, and Wilkinson Lake lies straight north of the site about half a mile. According to publicly available topographical information, the project area is generally flat, around elevation 900 feet, with lesser elevations through the existing drainageways. The surrounding farm fields typically increase in elevation up to greater than 910 feet.

From a brief review of historical aerial photographs (Google Earth), it appears that the existing drainageways or ditches have been in place since before 1991.

The purpose of the Wilkinson 319 project is to design a water quality improvement project within the agricultural and conservation easement held by the Minnesota Land Trust (MLT) on North Oaks Company (NOC) property. In March of 2021, Barr completed a feasibility study for three conceptual alternatives for the water quality project. These alternatives were presented to stakeholders including NOC, VLAWMO, MLT, and permitting agencies for review and informal comment. Following the development of these concepts, Barr completed additional investigative services to better inform the design of the project including the geotechnical investigation described in this memo.

Geology

According to the USDA Web Soil Survey, the site is noted to primarily consist of Seelyeville Muck, which is noted to be very poorly drained soils formed in organic materials. These soils are primarily located in flood plains and glacial lake plains. The project site is in a primarily undeveloped field.

Subsurface Conditions

Two soil borings, SB21-01 and SB21-02, were completed at the project site on March 29, 2022, by Haugo Geotechnical Services. Soil boring SB21-01 was drilled and sampled using a truck-mounted rig; soil

boring SB21-02 was drilled and sampled with an ATV rig. The monitoring well was blind drilled and set at SB21-01 with an ATV rig.

The borings were performed to depths of approximately 30 feet below ground surface to evaluate soils in proposed development areas. The northern boring (SB21-01) had a fully screened standpipe monitoring well installed in the borehole after collection of soil samples for future monitoring of groundwater elevation. This boring was located on the northern edge of the proposed retention basin, near the anticipated location of a future outlet structure. The second soil boring, SB21-02, was drilled near the center of the proposed retention basin. The boring locations are depicted in the attached boring location plan.

Samples were collected by Standard Penetration Test (SPT) split-spoon samplers approximately every 2.5 feet, with two 3-inch diameter thin-walled samples collected in SB21-01 and three thin-walled samples collected in SB21-02. The SPT samples were jarred and sealed and transported to Soil Engineering Testing (SET) for laboratory testing.

Soil boring SB21-01 encountered fat clay with trace organics approximately 6.5 feet below existing grade. This was underlain by sandy lean clay transitioning to clayey sand at approximately 17 feet. Clayey sand was encountered from approximately 17 feet to a depth of approximately 25.5 feet, with a small sandy lean clay layer from approximately 21.5 to 23 feet. A small silt layer was encountered from approximately 25.5 feet to 26.5 feet, underlain by sandy lean clay to the boring termination depth of approximately 31 feet. Very low blow counts (N values) from Standard Penetration Test (SPT) samples were encountered in the upper 11 feet of SB21-01 in the fat clay and upper sandy lean clay. These were typically weight of hammer samples (N=0) except for the higher blow count sample collected at the surface which was noted to be frozen soil. N values generally increased below a depth of 11 feet, ranging from 9 to 18 in the granular soils from 19 to 26.5 feet depth, and from 25 to 29 in the lower sandy lean clay.

Soil boring SB21-02 encountered organic soil (a mix of peat and organic silt) approximately 19 feet below existing grade. The organic soil was underlain by silt without organics to depth of approximately 21.5 feet. Soil from approximately 21.5 to 29 feet was primarily granular soil consisting of sand with silt, with clayey sand encountered from 24 to 26.5 feet. Sandy lean clay was encountered from approximately 29 feet below existing grade to the termination depth of approximately 31 feet below existing surface. Very low N values from SPT samples were encountered in the upper 24 feet of SB21-02 in the organic soils and upper sandy soil. These were typically weight of hammer samples (N=0) except for the slightly higher N value sample collected at the surface which was noted to be frozen soil. N values increased below a depth of 24 feet, ranging from 5 to 8 in the granular soil from 24 to 29 feet, and equaling 6 in the lower sandy lean clay.

Groundwater was encountered during drilling operations in both borings at depths ranging from approximately 4.5 to 19 feet below existing grade. After drilling was completed, water levels stabilized at 7.3 feet below grade in SB21-01 and at 3.5 feet below existing grade in SB21-02.

Laboratory Testing

Laboratory testing included four tests for water content, five tests for water content with density, seven tests for Atterberg Limits, two sieve analyses, three passing No. 200 sieve tests, and five tests for organic content. The results of the testing are listed on the attached boring logs and the attached laboratory test results.

Limitations

This report has been prepared in order to provide the results of a subsurface investigation to aid in future design. It is not intended to provide any design recommendations for the proposed retention basin or high flow bypass and is strictly for the purpose of providing subsurface information. The scope is limited to the specific project and location described herein.

Certification

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the state of Minnesota.

Levi E. Brown, P.E.
PE #: 59350

4/17/22
Date

Reviewed by:

Brent A. Theroux, P.E.
PE #: 44276

4/17/22
Date

Attachments

Boring Location Plan

Boring Logs (SB21-01 and SB21-02)

Laboratory Testing Results


Boring Location Plan
Wilkinson 319 Pre-Design Investigation
5550 Centerville Rd, North Oaks, MN
Legend
Soil Boring
Soil Boring with Well
SB21-01 (with well)
SB21-02
Centerville Rd
N
1000 ft
Google Earth

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING SB21-01

Project:	Wilkinson 319 Pre-Design	Surface Elevation:	900.0 ft
Job No.:	23621418.00	Drilling Method:	HSA
Location:	Ramsey County, MN	Sampling Method:	SS, 3T
Coordinates:	Lat: 45.105836° Long: 93.060918°	Completion Depth:	31.0 ft
Datum:	NAD83		

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION		Graphic Log	Samples	Sample No.	% Recovery	SPT, N value or RQD %
	0	Surface Elev.: 900.0 ft						
		TOPSOIL - FAT CLAY (CH): dark brown; frozen; trace organics; trace sand.				1	100	16
		898.5 ft	1.5ft					
		FAT CLAY (CH): dark brown; moist to wet; very soft; slightly organic.				2	28	0
895	5					3	75	
		893.5 ft						
		SANDY LEAN CLAY (CL): gray; moist to wet; very soft to stiff.	6.5ft			4	67	1
		9ft: trace gravel.						
890	10					5	100	0
						6	100	
885	15					7	100	7
		883.0 ft						
		CLAYEY SAND (SC): gray; saturated; loose to medium dense.	17.0ft			8	100	9
880	20					9	100	10
		878.5 ft						
		SANDY LEAN CLAY (CL): reddish gray; very stiff; trace gravel.	21.5ft			10	100	19
		877.0 ft	23.0ft					
875	25	CLAYEY SAND (SC): fine to coarse grained; gray; saturated; medium dense; trace gravel.				11	100	18
		874.5 ft	25.5ft					
		SILT (ML): reddish gray; saturated; very stiff.	26.5ft					
		873.5 ft				12	67	29
		SANDY LEAN CLAY (CL): reddish gray; very stiff; trace gravel.						
870	30	869.0 ft				13	67	25
		Bottom of Boring at 31.0 feet	31.0ft					

STANDARD PENETRATION TEST DATA N in blows/ft ◎
10 20 30 40
REC%
RQD % ◆
20 40 60 80
SHEAR STRENGTH, tsf
□ Qp/2
0 2.5 5

NATURAL DRY DENSITY (pcf) ☆
80 100 120
WATER CONTENT (%) ×
PL LL
20 40 60

Date Boring Started:	3/28/22 2:25 pm
Date Boring Completed:	3/29/22 10:45 am
Logged By:	TDM2
Drilling Contractor:	Haugo Geotechnical Services
Drill Rig:	45

Water Levels (ft)

▼ End of Drilling	7.3
▼ At Time of Drilling	4.5

Remarks: 25' offset to the north
Elevation estimated from publicly available topographic information.

Weather: Sunny, 35°F

M:\GINT\PROJECTS\23621418.00 - NORTH OAKS.GPJ BARRLIBRARY.GLB BOREHOLE LOG REPORT BARR TEMPLATE.GDT

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING SB21-02

Project:	Wilkinson 319 Pre-Design	Surface Elevation:	900.0 ft
Job No.:	23621418.00	Drilling Method:	HSA
Location:	Ramsey County, MN	Sampling Method:	SS, 3T
Coordinates:	Lat: 45.104885° Long: 93.060916°	Completion Depth:	31.0 ft
Datum:	NAD83		

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION	Graphic Log	Samples	Sample No.	% Recovery	SPT, N value or RQD %
	0	Surface Elev.: 900.0 ft					
	0	TOPSOIL - FAT CLAY (CH): dark brown; frozen; trace organics.			1	67	3
		0.5ft: moist. 1.5ft					
		898.5 ft					
		PEAT AND ORGANIC SILT (PT): dark brown; moist; very soft; mixed at times, trace shells.			2	63	
895	5				3	17	0
					4	100	
890	10				5	100	0
					6	67	0
885	15				7	50	
		883.5 ft					
		ORGANIC SILT (OL): dark brown; moist; very soft. 16.5ft			8	78	0
		881.0 ft					
880	20	SILT (ML): gray; moist; very soft. 19.0ft			9	100	0
		878.5 ft					
		POORLY GRADED SAND WITH SILT (SP-SM): fine grained; gray; saturated; very loose; trace gravel. 21.5ft			10	100	0
		876.0 ft					
875	25	CLAYEY SAND (SC): gray; saturated; loose; trace gravel. 24.0ft			11	100	5
		873.5 ft					
		POORLY GRADED SAND WITH SILT (SP-SM): fine to coarse grained; gray; saturated; loose; trace gravel. 26.5ft			12	100	8
		871.0 ft					
870	30	SANDY LEAN CLAY (CL): gray; medium stiff; trace gravel. 29.0ft			13	100	6
		869.0 ft					
		31.0ft					
		Bottom of Boring at 31.0 feet					

STANDARD PENETRATION TEST DATA N in blows/ft ◎
10 20 30 40
REC% ▬▬
RQD % ◆
20 40 60 80
SHEAR STRENGTH, tsf
□ Qp/2
0 2.5 5

NATURAL DRY DENSITY (pcf) ☆
80 100 120
WATER CONTENT (%) ×
PL LL
20 40 60

Date Boring Started:	3/29/22 2:30 pm	Water Levels (ft)	
Date Boring Completed:	3/29/22 3:50 pm	At Time of Drilling	19.0
Logged By:	TDM2	0 hrs End of Drilling	16.1
Drilling Contractor:	Haugo Geotechnical Services	0.5 hrs End of Drilling	3.5
Drill Rig:	CME-750		

Remarks: Elevation estimated from publicly available topographic information.

Weather: Cloudy, 40°F

M:\GINT\PROJECTS\23621418.00 - NORTH OAKS.GPJ BARRLIBRARY.GLB BOREHOLE LOG REPORT BARR TEMPLATE.GDT

Water Content Test Summary (ASTM:D2216)

Project: North Oaks — Job: 13689

Client: Barr Engineering Company — Date: 4/6/2022

Sample Information & Classification

Boring #	SB21-01	SB21-01	SB21-02	SB21-02				
Sample #	8	11	8	12				
Depth (ft)	17-18.5	24.5-26	17-18.5	27-28.5				
Type	Jar	Jar	Jar	Jar				
Material Classification	Clayey Sand w/a little gravel (SC)	Clayey Sand w/a little gravel (SC)	Organic Silt (OH)	Sand w/silt and a little gravel, medium to fine grained (SP-SM)				
Water Content (%)	15.2	16.4	357.5	15.9				

Sample Information & Classification

Boring #								
Sample #								
Depth (ft)								
Type								
Material Classification								
Water Content (%)								

Sample Information & Classification

Boring #								
Sample #								
Depth (ft)								
Type								
Material Classification								
Water Content (%)								

Sample Information & Classification

Boring #								
Sample #								
Depth (ft)								
Type								
Material Classification								
Water Content (%)								

Laboratory Test Summary

Project: North Oaks **Job:** 13689

Client: Barr Engineering Company **Date:** 4/6/22

Sample Information & Classification

Boring #	SB21-01	SB21-01	SB21-02	SB21-02	SB21-02		
Sample #	3	6	2	4	7		
Depth (ft)	4.5-6.5	12-14	2-4	7-9	14.5-16.5		
Type or BPF	TWT	TWT	TWT	TWT	TWT		
Classification	Fat Clay, slightly organic (CH)	Sandy Lean Clay w/a trace of gravel (CL)	Sapric Peat (PT)	Organic Silt w/shells (OH)	Mix of Organic Silt (OH) and Sapric Peat (PT)		

Water Content, Dry Density (ASTM:D7263)

Water Content (%)	48.2	15.9	496.8	274.8	537.9		
Dry Density (pcf)	74.2	114.1	10.1	19.3	10.8		

Sample Information & Classification

Boring #							
Sample #							
Depth (ft)							
Type or BPF							
Classification							

Water Content, Dry Density (ASTM:D7263)

Water Content (%)							
Dry Density (pcf)							

Sample Information & Classification

Boring #							
Sample #							
Depth (ft)							
Type or BPF							
Classification							

Water Content, Dry Density (ASTM:D7263)

Water Content (%)							
Dry Density (pcf)							

9530 James Ave South

SOIL ENGINEERING TESTING, INC.

Bloomington, MN 55431

Organic Content Test Summary (ASTM:D2974)

Project: North Oaks — Job: 13689

Client: Barr Engineering Company — Date: 4/6/2022

Sample Information & Classification								
Boring #	SB21-01	SB21-01	SB21-02	SB21-02	SB21-02			
Sample #	3	6	2	4	7			
Depth (ft)	4.5-6.5	12-14	2-4	7-9	14.5-16.5			
Type	TWT	TWT	TWT	TWT	TWT			
Material Classification	Fat Clay, slightly organic (CH)	Sandy Lean Clay w/a trace of gravel (CL)	Sapric Peat (PT)	Organic Silt w/shells (OH)	Mix of Organic Silt (OH) and Sapric Peat (PT)			
Organic Content (%)	2.9	1.3	78.1	25.6	50.2			

Sample Information & Classification								
Boring #								
Sample #								
Depth (ft)								
Type								
Material Classification								
Organic Content (%)								

Sample Information & Classification								
Boring #								
Sample #								
Depth (ft)								
Type								
Material Classification								
Organic Content (%)								

Sample Information & Classification								
Boring #								
Sample #								
Depth (ft)								
Type								
Material Classification								
Organic Content (%)								

Laboratory Test Summary

Project: North Oaks Job: 13689

Client: Barr Engineering Company Date: 4/6/2022

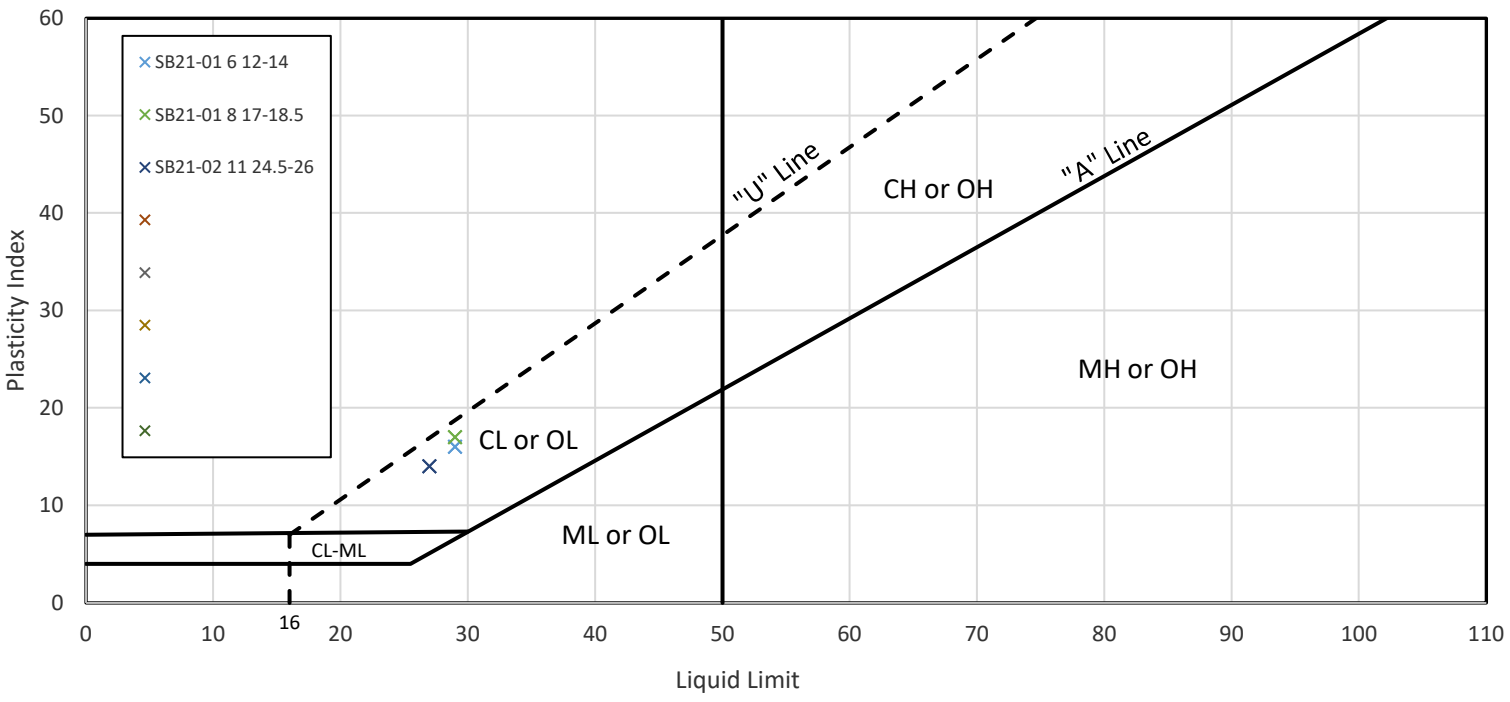
Sample Information & Classification

Boring #	SB21-01	SB21-01	SB21-02					
Sample #	6	8	11					
Depth (ft)	12-14	17-18.5	24.5-26					
Sample Type	TWT	Jar	Jar					
Material Classification	Sandy Lean Clay w/a trace of gravel (CL)	Clayey Sand w/a little gravel (SC)	Clayey Sand w/a trace of gravel (SC)					

Atterberg Limits (ASTM:D4318)

Liquid Limit	29	29	27					
Plastic Limit	13	12	13					
Plasticity Index	16	17	14					

Plasticity Chart (ASTM:D2487)



9530 James Ave South

SOIL ENGINEERING TESTING, INC.

Bloomington, MN 55431

Laboratory Test Summary

Project: North Oaks Job: 13689

Client: Barr Engineering Company Date: 4/6/2022

Sample Information & Classification

Boring #	SB21-01	SB21-02	SB21-02	SB21-02
Sample #	3	2	4	8
Depth (ft)	4.5-6.5	2-4	7-9	17-18.5
Sample Type	TWT	TWT	TWT	Jar
Material Classification	Fat Clay, slightly organic (CH)	Sapric Peat (PT)	Organic Silt w/shells (OH)	Organic Silt (OH)

Atterberg Limits (ASTM:D4318)

	Air Dried	Oven Dried	Air Dried	Oven Dried	Air Dried	Oven Dried	Air Dried	Oven Dried
Liquid Limit	56	46	390	164	209	123	673	121
Plastic Limit	21		242		125		76	
Plasticity Index	35		148		84		597	

Sample Information & Classification

Boring #				
Sample #				
Depth (ft)				
Sample Type				
Material Classification				

Atterberg Limits (ASTM:D4318)

	Air Dried	Oven Dried	Air Dried	Oven Dried	Air Dried	Oven Dried	Air Dried	Oven Dried
Liquid Limit								
Plastic Limit								
Plasticity Index								

9530 James Ave South

SOIL ENGINEERING TESTING, INC.

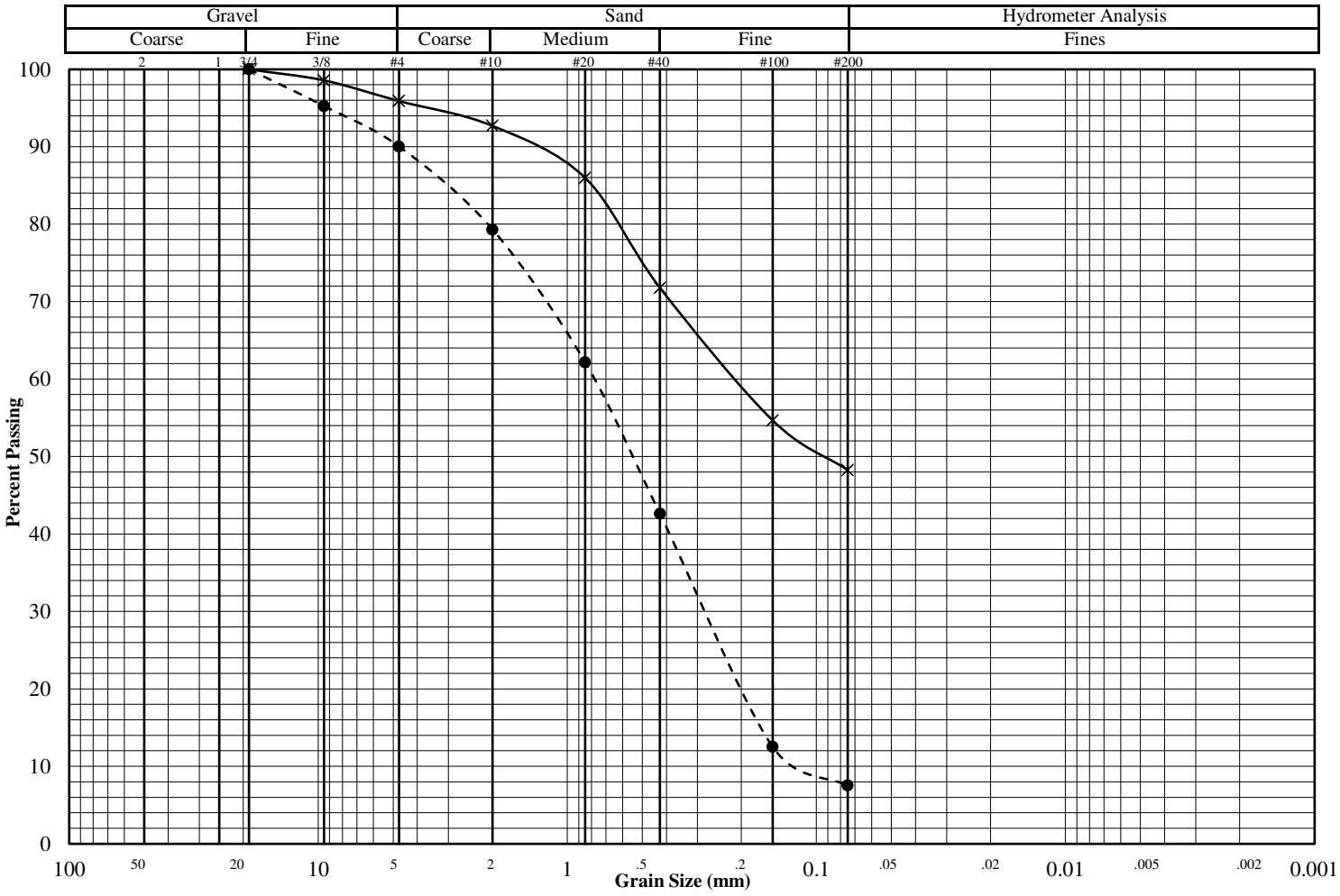
Bloomington, MN 55431

Grain Size Distribution ASTM D422-16

Job No. : **13689**

Project:	North Oaks	Test Date:	3/31/22
Reported To:	Barr Engineering Company	Report Date:	4/6/22

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
*	SB21-01	11	24.5-26	Jar	Clayey Sand w/a little gravel (SC)
●	SB21-02	12	27-28.5	Jar	Sand w/silt and a little gravel, medium to fine grained (SP-SM)
◇					



Additional Results	*	●	◇
Liquid Limit			
Plastic Limit			
Plasticity Index ASTM:D4316			
Water Content ASTM:D2216	16.4	15.9	
Dry Density (pcf) ASTM:D7263			
Specific Gravity ASTM:D854			
Porosity			
Organic Content ASTM:D2974			
pH ASTM:D4972 Method B			

	Percent Passing		
	*	●	◇
Mass (g)	284.5	306.9	
2"			
1.5"			
1"			
3/4"	100.0	100.0	
3/8"	98.6	95.3	
#4	95.9	90.0	
#10	92.7	79.3	
#20	86.0	62.2	
#40	71.8	42.6	
#100	54.7	12.5	
#200	48.3	7.5	

	*	●	◇
D_{60}			
D_{30}			
D_{10}			
C_U			
C_C			

Remarks:

(* = assumed)

9530 James Ave South

SOIL ENGINEERING TESTING, INC.

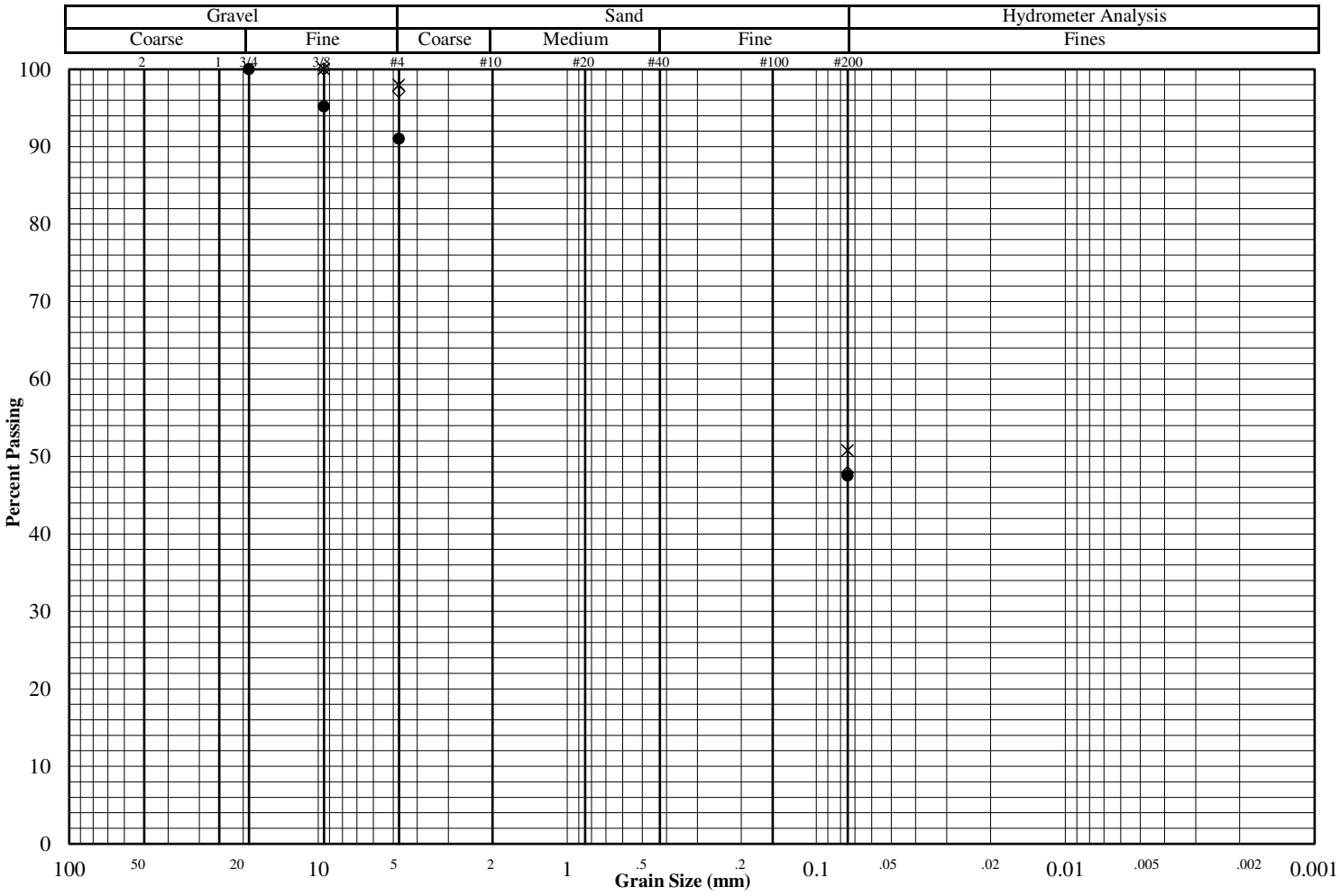
Bloomington, MN 55431

Grain Size Distribution ASTM D1140

Job No. : **13689**

Project:	North Oaks	Test Date:	3/31/22
Reported To:	Barr Engineering Company	Report Date:	4/4/22

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
*	SB21-01	6	12-14	TWT	Sandy Lean Clay w/a trace of gravel (CL)
●	SB21-01	8	17-18.5	Jar	Clayey Sand w/a little gravel (SC)
◇	SB21-02	11	24.5-26	Jar	Clayey Sand w/a trace of gravel (SC)



Additional Results	*	●	◇
Liquid Limit	29	29	27
Plastic Limit	13	12	13
Plasticity Index ASTM:D4316	16	17	14
Water Content ASTM:D2216	15.9	15.2	
Dry Density (pcf) ASTM:D7263	114.1		
Specific Gravity ASTM:D854			
Porosity			
Organic Content ASTM:D2974	1.3		
pH ASTM:D4972 Method B			

(* = assumed)

	Percent Passing		
	*	●	◇
Mass (g)	212.5	121.7	110.0
2"			
1.5"			
1"			
3/4"		100.0	
3/8"	100.0	95.2	100.0
#4	98.0	91.0	97.2
#10			
#20			
#40			
#100			
#200	50.8	47.5	47.9

	*	●	◇
D_{60}			
D_{30}			
D_{10}			
C_U			
C_C			

Remarks:

9530 James Ave South

SOIL ENGINEERING TESTING, INC.

Bloomington, MN 55431