Attachment M-1 Soil Boring Locations and Findings

E.1 Other Geotechnical Analysis

Laboratory testing was performed on the upper-brown silty clay, the lower-gray silty clay, and the sand soils to evaluate soil properties for seepage and stability modeling.

E.1.1 Upper and Lower Clay Soils

Grain-size testing for both the upper-brown and lower-gray sandy-clay soils in Quarry Creek indicated about 55 to 65 percent fines (about 15 percent clay and 35 to 40 percent silt) with about 35 to 40 percent sand and about 1 to 8 percent gravel. Atterberg limit test results indicate the clay soils have low plasticity and low liquid limit values. According to the Unified Soil Classification System, the sandy clay soils are considered lean clay (CL).

Natural moisture contents of the sandy-clay glacial-till soils generally ranged from 12.5 to 18 percent, with the higher moisture contents at shallow depths in borings B-5 and B-6. Generally, the natural moisture contents were slightly above the plastic limit determined from Atterberg limit testing. This indicates that the soils are in a moist state, not saturated.

Unit weight testing on the soil samples indicated dry unit weight values of 106 to 118.5 pounds per cubic foot (pcf) for the upper clay soil unit and 110.5 to 119.5 pcf for the lower clay soil unit. Moist unit weight values calculated from dry density and corresponding moisture content test results ranged from 124.1 to 133 pcf for the upper clay soil unit and from 129.8 to 137.1 pcf for the lower clay soil unit. Unit weight values for the upper clay units of 128 pcf (moist weight) and 133 pcf (saturated weight), and a saturated unit weight of 138 pcf for the lower clay units, respectively, were selected for data inputs in the geotechnical analyses performed for this 30% design report.

Saturated hydraulic conductivity testing indicated permeability values ranging from $2.4x10^{-7}$ to $3.2x10^{-8}$ cm/sec for the upper brown clay and from $1.3x10^{-7}$ to $2.5x10^{-8}$ cm/sec for the lower gray clay. This data was also used in the geotechnical analyses that were performed for this 30% design report.

E.1.2 Sand Soils

Grain-size testing of the sand soils indicated the sand soils typically consisted of 70 to 95 percent sand and 5 to 15 percent fines. Most of the samples had little-to-no gravel, but one sample (SB__) had up to 20 percent gravel.

The sand soils had a moisture content ranging from about 0.5 percent up to 19 percent, with most values between about 1.5 and 6 percent. Soil intact samples of the sand soils were not obtained, but based on remolded test samples, a moist unit weight of 100 pcf and a saturated unit weight of 115 pcf was used for the analyses performed of the sand soils.

Saturated hydraulic conductivity testing indicated a permeability of $1x10^{-3}$ cm/sec, which was used for seepage modeling performed for the 30% design report.

E.1.3 Shear Strength Values

Undrained soil conditions occur when loading is applied relatively quickly and pore water pressures within the soils increase until they are drained (the water is squeezed out). Laboratory testing of the clay soils indicated undrained shear strengths ranging from 3,180 to 3,930 pounds per square foot (psf) for the upper clay soil unit and from 1,820 to 4,660 psf for the lower till. For slope stability modeling, average undrained shear strength parameters of 2,700 and 3,400 psf for the upper and lower clay soil units, respectively, were selected. The sand soils are considered to be more permeable and will only act as a drained soil, as discussed below.

Drained soil behavior occurs when: (1) materials have relatively high permeability, prohibiting an increase in pore water pressures, (2) the loading is applied slowly enough that there is not a significant increase in pore water pressures, or (3) pore water pressures have dissipated. Direct shear testing was performed on each of the three soil types to evaluate the drained strength of the materials. The results of the direct shear test indicated a friction angle of 32 degrees with a cohesion intercept of 446 psf for the lower clay soils, and a friction angle of 31.5 degrees (with no cohesion intercept) for the sand soils. These values have been used for the drained slope stability analysis. A drained friction angle and cohesion of 30.5 degrees and 268 psf from testing for Blakeley Ravine was used for the geotechnical analyses that were performed during the feasibility phase of this project. The soils testing performed for the Quarry Creek ravine soils reveal them to have slightly less strength than what was estimated during the feasibility phase of this work.

LOG OF BORING SB-1-13

BARR

Project: Quarry Creek Ravine Stabilization | Location: Blakeley, Minnesota | Client: Scott County Water Management Organization

Barr Project Number: 23701027

Surface Elev.: 878.9 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)
875.9	0	CLAYEY TOPSOIL: dark brown; moist.
	3.0	POORLY GRADED SAND (SP): fine to medium grained; light brown; moist; trace gravel.
867.4	11.5	WELL GRADED SAND (SW): fine to coarse grained; brown; moist; trace gravel.
864.9	14.0	POORLY GRADED SAND (SP): fine to medium grained; light brown; moist.

Continued Next Page

Graphic Log | Sample Type & Rec. | STANDARD PENETRATION TEST DATA (N in blows/ft) | WATER CONTENT % (PL, LL) | SIEVE ANALYSIS (GRAVEL, SAND, SILT, CLAY, FINES)

Physical Properties

WC %	γ pcf	ϕ °	Q_u tsf	Q_p tsf	Gs	RQD %
4.2						
19						
3.8						
7						
3.5						
15						
4.2						
2.8						
1.1						

Completion Depth:	85.0
Date Boring Started:	10/28/13
Date Boring Completed:	10/29/13
Logged By:	JWH
Drilling Contractor:	Braun
Drilling Method:	
Ground Surface Elevation:	878.9
Coordinates:	Lat: 44.61279° Long: -93.81408°
Datum:	

Remarks:

SAMPLE TYPES

- Split Spoon

WATER LEVELS (ft)

- Dry Cave-in Depth 84.5
- After Drilling Dry
- At Time of Drilling Dry

LEGEND

- MC Moisture Content
- γ Dry Unit Weight
- ϕ Friction Angle
- Q_u Unconfined Compression
- Q_p Hand Penetrometer UC
- Gs Specific Gravity
- RQD Rock Quality Designation

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

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BARR

LOG OF BORING SB-1-13

Project: Quarry Creek Ravine Stabilization | Location: Blakeley, Minnesota | Client: Scott County Water Management Organization

Barr Project Number: 23701027

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)	Graphic Log	Sample Type & Rec.	STANDARD PENETRATION TEST DATA (N in blows/ft)	WATER CONTENT % (PL — LL)	SIEVE ANALYSIS (GRAVEL / SAND / SILT / CLAY / FINES)	Physical Properties: WC %	γ pcf	ϕ °	Q_u tsf	Q_p tsf	Gs	RQD %
830	45	POORLY GRADED SAND (SP): fine to medium grained; light brown; moist. *(Continued)*			13, 18			4.4						
	828.4													
825	50	POORLY GRADED SAND (SP): fine to medium grained; light brown; moist; trace gravel.			14, 17, 19			6.1						
	50.5							3.3	98.2	31.6				
820	55				9									
	60				23, 20			1.4						
815	65				29									
	809.9													
810	70	WELL GRADED SAND (SW): fine to coarse grained; brown; moist; trace gravel.			22, 23, 33			1.5						
	69.0													
805	75													
	802.9													
800	80	SILTY SAND (SM).			>>98									
	76.0													
795	85				>>57			4.8	94.4	31.4				
	793.9													
		Bottom of Boring at 85.0 feet												
	85.0													
	90													

Completion Depth:	85.0
Date Boring Started:	10/28/13
Date Boring Completed:	10/29/13
Logged By:	JWH
Drilling Contractor:	Braun
Drilling Method:	
Ground Surface Elevation:	878.9
Coordinates:	Lat: 44.61279° Long: -93.81408°
Datum:	

Remarks:

SAMPLE TYPES

- Split Spoon

WATER LEVELS (ft)

- Dry Cave-In Depth 84.5
- After Drilling Dry
- At Time of Drilling Dry

LEGEND

- MC Moisture Content
- γ Dry Unit Weight
- ϕ Friction Angle
- Q_u Unconfined Compression
- Q_p Hand Penetrometer UC
- Gs Specific Gravity
- RQD Rock Quality Designation

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

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LOG OF BORING SB-2-13

Sheet 1 of 2

Project: Quarry Creek Ravine Stabilization | Location: Blakeley, Minnesota | Client: Scott County Water Management Organization

Barr Project Number: 23701027

Surface Elev.: 883.0 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)	Graphic Log	Sample Type & Rec.	STANDARD PENETRATION TEST DATA (N in blows/ft)	WATER CONTENT % (PL — LL)	SIEVE ANALYSIS (GRAVEL / SAND / SILT / CLAY / FINES)	Physical Properties: WC %	γ pcf	ϕ °	Q_u tsf	Q_p tsf	Gs	RQD %
880	0	881.0 CLAYEY TOPSOIL: dark brown; moist.												
		SAND WITH SILT (SM): fine grained; tan to brown; moist. 2.0			8									
875	5	878.0 POORLY GRADED SAND (SP): fine to medium grained; light brown; moist. 5.0			7, 20			2.1						
		874.5 WELL GRADED SAND (SW): fine to coarse grained; brown; moist; trace gravel. 8.5			14, 10			26.6						
870	10	871.0 POORLY GRADED SAND (SP): fine to medium grained; light brown; moist. 12.0			19, 12			6.2						
		867.5 WELL GRADED SAND (SW): fine to coarse grained; tan to brown; moist. 15.5			7, 14			2.8						
865	15	863.5 POORLY GRADED SAND (SP): fine to medium grained; tan to brown; moist. 19.5			25, 10		20 — 90	4.5						
		860.0 WELL GRADED SAND (SW): fine to coarse grained; tan to brown; moist. 23.0			10, 16									
860	20				21, 24			3.4						
		846.0 POORLY GRADED SAND (SP): fine to medium grained; tan to brown; moist. 37.0			33			6.1						
855	25	840.5 42.5			>>50/3"									
		Continued Next Page												
850	30													
845	35													
840	40													
	45													

Completion Depth:	77.0
Date Boring Started:	10/28/13
Date Boring Completed:	10/28/13
Logged By:	JWH
Drilling Contractor:	Braun
Drilling Method:	
Ground Surface Elevation:	883.0
Coordinates:	Lat: 44.61133° Long: -93.81495°
Datum:	

Remarks:

SAMPLE TYPES
- Split Spoon

WATER LEVELS (ft)
- After Drilling: Dry
- At Time of Drilling: Dry

LEGEND
- MC Moisture Content
- γ Dry Unit Weight
- ϕ Friction Angle
- Q_u Unconfined Compression
- Q_p Hand Penetrometer UC
- Gs Specific Gravity
- RQD Rock Quality Designation

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

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LOG OF BORING SB-2-13

Project: Quarry Creek Ravine Stabilization | Location: Blakeley, Minnesota | Client: Scott County Water Management Organization

Barr Project Number: 23701027

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)	Graphic Log	Sample Type & Rec.	STANDARD PENETRATION TEST DATA (N in blows/ft)	WATER CONTENT % (PL — LL)	SIEVE ANALYSIS (GRAVEL / SAND / SILT / CLAY / FINES)	WC %	γ pcf	ϕ °	Q_u tsf	Q_p tsf	Gs	RQD %
840	45	836.5 WELL GRADED SAND (SW): fine to coarse grained; tan to brown; moist. *(Continued)*			34, 34	×		12						
835		46.5 POORLY GRADED SAND (SP): fine to medium grained; tan to brown; moist.												
	50	832.0			37, >>56	×		2.7						
830		51.0 POORLY GRADED SAND (SP): fine to medium grained; tan to brown; moist; trace gravel.												
	55				38, >>73									
825														
	60				47, 44	×		9.4						
820														
	65				>>56, 44									
815														
	70				>>69									
810														
	75	806.0			>>60	×		10.9						
		Bottom of Boring at 77.0 feet 77.0												
	80													
	85													
	90													

Completion Depth:	77.0
Date Boring Started:	10/28/13
Date Boring Completed:	10/28/13
Logged By:	JWH
Drilling Contractor:	Braun
Drilling Method:	
Ground Surface Elevation:	883.0
Coordinates:	Lat: 44.61133° Long: -93.81495°
Datum:	

Remarks:

SAMPLE TYPES

☒ Split Spoon

WATER LEVELS (ft)

▽ After Drilling Dry
▽ At Time of Drilling Dry

LEGEND

MC Moisture Content
γ Dry Unit Weight
ϕ Friction Angle
Q_u Unconfined Compression
Q_p Hand Penetrometer UC
Gs Specific Gravity
RQD Rock Quality Designation

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LOG OF BORING SB-3-13

Project: Quarry Creek Ravine Stabilization | Location: Blakeley, Minnesota | Client: Scott County Water Management Organization

Barr Project Number: 23701027

Surface Elev.: 888.5 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)	Graphic Log	Sample Type & Rec.	STANDARD PENETRATION TEST DATA (N in blows/ft)	WATER CONTENT % (PL — LL)	SIEVE ANALYSIS (GRAVEL / SAND / SILT / CLAY / FINES)	Physical Properties: WC %	γ pcf	ϕ °	Q_u tsf	Q_p tsf	Gs	RQD %
885	0	887.5 CLAYEY TOPSOIL: dark brown; moist.			10							4.5		
		SANDY SILT (ML): brown; moist; trace to little clay. 1.0												
	5	884.5			14			5.6						
		883.0 SANDY CLAY (CL): brown; moist; trace silt. 4.0			16									
880		SILTY SAND (SM): very fine to fine grained; tan; moist. 5.5												
		880.0												
	10	878.5 POORLY SORTED SAND (SW): fine to coarse grained; brown; moist; trace gravel. 8.5			15									
		10.0												
875		POORLY SORTED SAND (SP): fine to medium grained; brown to tan; moist.			11			19.2						
	15				13									
					17									
870		869.0												
	20	CLAYEY SAND (SC): fine to medium grained; brown; moist. 19.5			27									
		866.0			20			12.2	118.5		3.4			
865		SILTY CLAY (CL): brown; moist; trace sand, trace gravel. 22.5										2.75		
	25	861.5			26			8.4						
		SILTY CLAY (CL): gray; moist; trace sand, trace gravel. 27.0										3.25		
860					>>66/8"									
	30											3		
					13									
855						12.7 29.3		12.5				2		
	35				10									
					13							2		
850														
	40				22							1.75		
					31									
845												1.75		
	45													

Continued Next Page

Completion Depth:	77.0
Date Boring Started:	10/31/13
Date Boring Completed:	11/1/13
Logged By:	WWK
Drilling Contractor:	Braun
Drilling Method:	
Ground Surface Elevation:	888.5
Coordinates:	Lat: 44.60978° Long: -93.81367°
Datum:	

Remarks:

SAMPLE TYPES: Split Spoon; 3-inch Shelby Tube

WATER LEVELS (ft): After Drilling Dry; At Time of Drilling Dry

LEGEND: MC Moisture Content; γ Dry Unit Weight; ϕ Friction Angle; Q_u Unconfined Compression; Q_p Hand Penetrometer UC; Gs Specific Gravity; RQD Rock Quality Designation

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

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BARR

LOG OF BORING SB-3-13

Project: Quarry Creek Ravine Stabilization | Location: Blakeley, Minnesota | Client: Scott County Water Management Organization

Barr Project Number: 23701027

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)
840.5	48.0	SAND WITH SILT (SM): very fine to fine grained; tan to brown; moist.
828.0	60.5	WELL GRADED SAND (SW): fine to coarse grained; tan to brown; moist; trace gravel.
811.5	77.0	Bottom of Boring at 77.0 feet

Graphic Log | Sample Type & Rec.

STANDARD PENETRATION TEST DATA — N in blows/ft (10, 20, 30, 40)

WATER CONTENT % — PL, LL (20, 40, 60)

SIEVE ANALYSIS — GRAVEL, SAND, SILT, CLAY, FINES (20, 40, 60, 80)

Depth, feet	N in blows/ft	WC %	γ pcf	ϕ °	Q_u tsf	Q_p tsf	Gs	RQD %	Sieve
45	25	16.5				1.75			
50		15.3	117.4		2.78				
55	88/11"								
60	83								0–85
65	77	4.4							
70	50/3"	0.9							
75	50/4"								
	88/11"	0.9							4–95
	50/4"	1.1							
	50/3"								
	50/4"								
	50/5"	0.4							
	50/4"								

Completion Depth:	77.0
Date Boring Started:	10/31/13
Date Boring Completed:	11/1/13
Logged By:	WWK
Drilling Contractor:	Braun
Drilling Method:	
Ground Surface Elevation:	888.5
Coordinates:	Lat: 44.60978° Long: -93.81367°
Datum:	

Remarks:

SAMPLE TYPES: Split Spoon; 3-inch Shelby Tube

WATER LEVELS (ft): After Drilling Dry; At Time of Drilling Dry

LEGEND: MC Moisture Content; γ Dry Unit Weight; ϕ Friction Angle; Q_u Unconfined Compression; Q_p Hand Penetrometer UC; Gs Specific Gravity; RQD Rock Quality Designation

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

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LOG OF BORING SB-4-13

Project: Quarry Creek Ravine Stabilization | Location: Blakeley, Minnesota | Client: Scott County Water Management Organization

Barr Project Number: 23701027

Surface Elev.: 970.6 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)	Graphic Log	Sample Type & Rec.	STANDARD PENETRATION TEST DATA (N in blows/ft)	WATER CONTENT % (PL — LL)	SIEVE ANALYSIS (GRAVEL / SAND / SILT / CLAY / FINES)	WC %	γ pcf	ϕ °	Q_u tsf	Q_p tsf	Gs	RQD %
970	0	969.1 CLAYEY TOPSOIL: dark brown; moist.			11, 21							4.5		
		SANDY CLAY (CL): brown to dark brown; moist; little silt, trace gravel, whitish veins. 1.5			15			12.8				3.5		
965	5				11			17.2	105.9		3.16	1.5		
					9		1, 39, 82	19.7	107.7			2		
960	10	958.6			10			20	106			2		
		SANDY SILT TO SILTY SAND (SM): very fine to fine grained; brown; moist; trace clay. 12.0												
955	15	955.6 SILTY CLAY (CL): brownish gray; moist to wet; trace sand, trace gravel, oxidized partings. 15.0			10			18.7	109		3.45	2.75		
					15							3.25		
950	20	948.6						16.2	115.2		2.81			
		SILTY CLAY (CL): gray; moist to wet; trace sand, trace gravel. 22.0			13							1.75		
945	25				11							1.75		
					11			13.2				1.75		
940	30				10							1		
								13.9	119.4					
935	35	932.6			10							1.25		
		931.6 CLAYEY SILT (ML): gray; wet. 38.0			7							0.75		
930	40	SILTY CLAY (CL): gray; moist to wet; trace sand, trace gravel. 39.0			8							1.25		
	45	Continued Next Page												

Completion Depth:	74.5
Date Boring Started:	10/29/13
Date Boring Completed:	10/29/13
Logged By:	WWK
Drilling Contractor:	Braun
Drilling Method:	
Ground Surface Elevation:	970.6
Coordinates:	Lat: 44.60654° Long: -93.81395°
Datum:	

Remarks:

SAMPLE TYPES: Split Spoon; 3-inch Shelby Tube

WATER LEVELS (ft): At Time of Drilling 17.0

LEGEND: MC Moisture Content; γ Dry Unit Weight; ϕ Friction Angle; Q_u Unconfined Compression; Q_p Hand Penetrometer UC; Gs Specific Gravity; RQD Rock Quality Designation

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

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BARR

LOG OF BORING SB-4-13

Project: Quarry Creek Ravine Stabilization | Location: Blakeley, Minnesota | Client: Scott County Water Management Organization

Barr Project Number: 23701027

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)	Graphic Log	Sample Type & Rec.	STANDARD PENETRATION TEST DATA (N in blows/ft)	WATER CONTENT % (PL — LL)	SIEVE ANALYSIS (GRAVEL, SAND, SILT, CLAY, FINES)	Physical Properties: WC %	γ pcf	ϕ °	Q_u tsf	Q_p tsf	Gs	RQD %
925	45	SILTY CLAY (CL): gray; moist to wet; trace sand, trace gravel. *(Continued)*			9, 13			15.4				1.25		
												1.75		
920	50				16			15	118.6		2.71			
					18							3		
915	55				31							3		
					23									
910	60	908.6						12.3				4.5		
		906.6 POORLY SORTED SAND (SP): fine to medium grained; gray; wet.			13									
		62.0			15							4.5		
905	65	903.6 SILTY CLAY (CL): gray; moist to wet; trace sand, trace gravel, occassional cobbles. 64.0												
		901.6 SANDY SILT TO SILTY SAND (SM): very fine to fine grained; gray; moist; trace clay. 67.0			37							4		
900	70	SILTY CLAY (CL): gray; moist to wet; trace sand, trace gravel. 69.0			23			15.6				2.25		
		896.1			26									
	75	Bottom of Boring at 74.5 feet 74.5												
	80													
	85													
	90													

Completion Depth:	74.5
Date Boring Started:	10/29/13
Date Boring Completed:	10/29/13
Logged By:	WWK
Drilling Contractor:	Braun
Drilling Method:	
Ground Surface Elevation:	970.6
Coordinates:	Lat: 44.60654° Long: -93.81395°
Datum:	

Remarks:

SAMPLE TYPES: Split Spoon; 3-inch Shelby Tube

WATER LEVELS (ft): At Time of Drilling 17.0

LEGEND: MC Moisture Content; γ Dry Unit Weight; ϕ Friction Angle; Q_u Unconfined Compression; Q_p Hand Penetrometer UC; Gs Specific Gravity; RQD Rock Quality Designation

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

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LOG OF BORING SB-5-13

Project: Quarry Creek Ravine Stabilization | Location: Blakeley, Minnesota | Client: Scott County Water Management Organization

Barr Project Number: 23701027

Surface Elev.: 984.6 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)	Graphic Log	Sample Type & Rec.	STANDARD PENETRATION TEST DATA (N in blows/ft)	WATER CONTENT % (PL — LL)	SIEVE ANALYSIS (GRAVEL / SAND / SILT / CLAY / FINES)	WC %	γ pcf	ϕ °	Q_u tsf	Q_p tsf	Gs	RQD %
	0	983.6 CLAYEY TOPSOIL: dark brown; moist.												
		SANDY CLAY (CL): brown and gray; moist; little silt. 1.0			13, 13							3.25		
980	5	978.6										2.75		
		SANDY CLAY (CL): brownish gray; moist; little silt, trace coarse sand to gravel. 6.0			10			18.4	107.7		3.93	2		
975	10	974.6			9							3.5		
		SILTY CLAY (CL): gray; moist to wet; trace sand, trace gravel. 10.0			7			18.9				1.25		
970	15				3							2		
		965.1			7			25.4				1		
965	20	963.6 SANDY SILT TO SILTY SAND (SM): very fine to fine grained; gray; moist to wet; trace clay. 19.5										2		
		SILTY CLAY (CL): gray; moist to wet; trace sand, trace gravel. 21.0			10		2, 43, 84	14.6				3.25		
960	25				16							1.25		
					11									
955	30				3			18.4	111.1	31.9	1.82	1.5		
					9							1.25		
950	35	947.6				12.6, 28.5								
		CLAYEY SILT (ML): gray; wet. 37.0			4			18.1				0.5		
945	40	942.6												
		SILTY CLAY (CL): gray; moist to wet; trace sand, trace gravel. 42.0			18							0.25		
940	45	Continued Next Page												

Completion Depth:	60.0
Date Boring Started:	10/30/13
Date Boring Completed:	10/30/13
Logged By:	WWK
Drilling Contractor:	Braun
Drilling Method:	
Ground Surface Elevation:	984.6
Coordinates:	Lat: 44.60347° Long: -93.81907°
Datum:	

Remarks:

SAMPLE TYPES: Split Spoon; 3-inch Shelby Tube

WATER LEVELS (ft): Dry Cave-in Depth 41.0; After Drilling Dry; At Time of Drilling 20.0

LEGEND: MC Moisture Content; γ Dry Unit Weight; ϕ Friction Angle; Q_u Unconfined Compression; Q_p Hand Penetrometer UC; Gs Specific Gravity; RQD Rock Quality Designation

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

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LOG OF BORING SB-5-13

Project: Quarry Creek Ravine Stabilization | Location: Blakeley, Minnesota | Client: Scott County Water Management Organization

Barr Project Number: 23701027

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)	Graphic Log	Sample Type & Rec.	STANDARD PENETRATION TEST DATA (N in blows/ft)	WATER CONTENT % (PL — LL)	SIEVE ANALYSIS (GRAVEL / SAND / SILT / CLAY / FINES)	Physical Properties: WC %	γ pcf	ϕ °	Q_u tsf	Q_p tsf	Gs	RQD %
	45	SILTY CLAY (CL): gray; moist to wet; trace sand, trace gravel. *(Continued)*						16.6	111.3		2.84			
935	50				13, 10, 7							1.75, 1.25		
930	55				14							2.25		
925	60	924.6 Bottom of Boring at 60.0 feet 60.0			16			12.7				1.75		
	65													
	70													
	75													
	80													
	85													
	90													

Completion Depth:	60.0
Date Boring Started:	10/30/13
Date Boring Completed:	10/30/13
Logged By:	WWK
Drilling Contractor:	Braun
Drilling Method:	
Ground Surface Elevation:	984.6
Coordinates:	Lat: 44.60347° Long: -93.81907°
Datum:	

Remarks:

SAMPLE TYPES: Split Spoon; 3-inch Shelby Tube

WATER LEVELS (ft): Dry Cave-in Depth 41.0; After Drilling Dry; At Time of Drilling 20.0

LEGEND: MC Moisture Content; γ Dry Unit Weight; ϕ Friction Angle; Q_u Unconfined Compression; Q_p Hand Penetrometer UC; Gs Specific Gravity; RQD Rock Quality Designation

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BARR

LOG OF BORING SB-6-13

Project: Quarry Creek Ravine Stabilization | Location: Blakeley, Minnesota | Client: Scott County Water Management Organization

Barr Project Number: 23701027

Surface Elev.: 985.3 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)
982.3	0	CLAYEY TOPSOIL: dark brown; moist.
	3.0	SANDY CLAY (CL): brown with gray; moist; little silt, trace gravel, whitish veins.
974.8	10	
971.8	10.5	SILTY CLAY (CL): brownish gray; moist to wet; trace sand, trace gravel, oxidized partings.
969.3	13.5	SILTY CLAY (CL): gray; moist to wet; trace sand, trace gravel.
	16.0	WELL GRADED SAND (SW): fine to coarse grained; gray; wet; trace to little gravel.
965.3	20	
	20.0	SILTY CLAY (CL): gray; moist to wet; trace sand, trace gravel.
954.3	30	
	31.0	SILTY CLAY (CL): gray; moist to wet; medium stiff; trace sand, trace gravel.
	45	

Continued Next Page

Graphic Log | Sample Type & Rec.

STANDARD PENETRATION TEST DATA — N in blows/ft (10, 20, 30, 40)

WATER CONTENT % — PL, LL (20, 40, 60)

SIEVE ANALYSIS — GRAVEL, SAND, SILT, CLAY, FINES (20, 40, 60, 80)

Physical Properties	WC %	γ pcf	ϕ °	Q_u tsf	Q_p tsf	Gs	RQD %
					4.5		
	12.1	112.2			4		
					2.5		
	26.2				1.5		
					2		
	10.9						
					2.75		
					2.25		
	18.5	110.7		2.08			
					1.75		
					2.25		
	16				1		
					1.25		
	14.7	119.5		4.66			
	16.5				0.5		
	14.8				1		

Completion Depth:	67.0
Date Boring Started:	10/30/13
Date Boring Completed:	10/30/13
Logged By:	WWK
Drilling Contractor:	Braun
Drilling Method:	
Ground Surface Elevation:	985.3
Coordinates:	Lat: 44.60157° Long: -93.82579°
Datum:	

Remarks:

SAMPLE TYPES: Split Spoon; 3-inch Shelby Tube

WATER LEVELS (ft): After Drilling — Dry; At Time of Drilling 19.5

LEGEND: MC Moisture Content; γ Dry Unit Weight; ϕ Friction Angle; Q_u Unconfined Compression; Q_p Hand Penetrometer UC; Gs Specific Gravity; RQD Rock Quality Designation

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

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BARR

LOG OF BORING SB-6-13

Sheet 2 of 2

Project: Quarry Creek Ravine Stabilization | Location: Blakeley, Minnesota | Client: Scott County Water Management Organization

Barr Project Number: 23701027

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)	Graphic Log	Sample Type & Rec.	STANDARD PENETRATION TEST DATA (N in blows/ft)	WATER CONTENT % (PL — LL)	SIEVE ANALYSIS (GRAVEL / SAND / SILT / CLAY / FINES)	Physical Properties: WC %	γ pcf	ϕ °	Q_u tsf	Q_p tsf	Gs	RQD %
	45	SILTY CLAY (CL): gray; moist to wet; medium stiff; trace sand, trace gravel. *(Continued)*			11, 12							1		
935	50				12							1.25		
								15.7	117.2		4.24			
930	55				10							1.25		
					11							1.25		
925	60	923.3			12							1		
		SILTY CLAY (CL): gray; moist to wet; very stiff; trace sand, trace gravel. 62.0						15.6				1.25		
					21							3.5		
920	65	918.3			23			12.7				4		
		Bottom of Boring at 67.0 feet 67.0												
	70													
	75													
	80													
	85													
	90													

Completion Depth:	67.0
Date Boring Started:	10/30/13
Date Boring Completed:	10/30/13
Logged By:	WWK
Drilling Contractor:	Braun
Drilling Method:	
Ground Surface Elevation:	985.3
Coordinates:	Lat: 44.60157° Long: -93.82579°
Datum:	

Remarks:

SAMPLE TYPES

Split Spoon; 3-inch Shelby Tube

WATER LEVELS (ft)

After Drilling Dry
At Time of Drilling 19.5

LEGEND

MC Moisture Content
γ Dry Unit Weight
ϕ Friction Angle
Q_u Unconfined Compression
Q_p Hand Penetrometer UC
Gs Specific Gravity
RQD Rock Quality Designation

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

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