



**APPENDIX A.1
STRATIGRAPHIC BORING LOGS
S-1 THROUGH S-5**

OVERBURDEN BORING LOG

SITE ID: S-1	
Page 1 of 3	
CLIENT:	Confidential
SITE NAME:	Cottage Grove, MN
PROJECT NO.:	02181.002.030.0001
Area Name:	WWTP
Drilling Contractor:	A. E. T. (Operator - Shaun Graski)
Drilling Equipment:	HSA (0' - 19.5')
Logged By:	G. Witmer
Area Description:	In grass, ~100' E of MW-105
ELEV (GRND)^a NORTHING:	
EASTING:	
Depth to Water (ft bgs)	
Total Boring Depth (ft bgs)	
Depth to Refusal (ft bgs):	
Boring Diameter (inches):	
Spit-spoon Length	
Location Type: () Geoprobe () Well	
(X) Soil Boring () Other:	
Completion Zone: (X) Overburden () Bedrock	
Completion Type: () Monitoring Well	
(X) Abandoned by Grout	
() Other (Provide Comments)	
Date Begin	8/21/2007
Date End	8/24/2007

ELEV. (ft msl)	Sample Interval (ft bgs)	Recovery ft/ft	Moisture	Color	Grain Size				Strength	OVM	Blow Count	Lithic Description
					Gr	S	SI	CI				
-807	0 - 0.5								0.0	2-8-11-12	Gravelly loamy soil with roots	
	0.5 - 1.5										Black to dark brown gravelly sand (fill)	
	1.5 - 2			7.5 YR 3/2							Brown sandy clay	
	2 - 4			7.5 YR 5/5						8-10-8-8	Brown f.g. sandy silt	
	4.5 - 6.5			10 YR 6/6						5-5-4-3	Light yellowish brown silty sand (f.g.)	
	7 - 9	Dry		10 YR 7/3						4-8-9-9	Pale brown f.g. - m.g. sand, silty stringer @ 7.5' BGS	
	9.5 - 11.5	Dry		10 YR 7/3						5-8-8-10	as above	
	12 - 13			10 YR 6/6						8-10-9-8	Light yellowish brown silt with f.g. sand	
	13 - 14			10 YR 7/3							Pale brown f.g. - m.g. sand A/A	
	14.5 - 16.5									3-8-11-12	Variogated m.g. sand and gravel (black, brown, reddish tan), interbeds of sand (lacks gravel)	
-787.5	19.5 - 21.5								0.0	7-18-19-15	as above with silt, gravel has shaley appearance	
	24.5 - 26.5			7.5 YR 6/3					0.0	14-15-15-15	Light brown f.g. - m.g. sand	
	29.5 - 31.5			7.5 YR 6/3					0.0	13-15-12-14	as above	
	34.5 - 36.5			7.5 YR 6/3					0.0	15-11-14-17	as above	
	39.5 - 41.5			7.5 YR 6/3					0.0	14-17-21-27	Light brown f.g. sand	
	44.5 - 46.5			7.5 YR 6/3					0.0	16-24-30-38	as above	
-757.5	49.5 - 51.5			7.5 YR 6/3					0.0	20-19-22-29	Light brown f.g. - c.g. sand with gravel	
	54.5 - 56.5			7.5 YR 6/3					0.0	18-16-15-17	Light brown m.g. sand with gravel	
	59.5 - 61.5			7.5 YR 6/3					0.0	20-23-40-38	Light brown f.g. - m.g. sand, tr. silt	
	64.5 - 66.5			7.5 YR 6/3					0.0	20-29-36-44	as above	
	69.5 - 71.5			7.5 YR 6/3					0.0	40-50/0.4	Light brown f.g. sand, tr. silt	
	74.5 - 76.5			7.5 YR 6/3					0.0	41-43-50/0.4	as above	
	79.5 - 81.5			7.5 YR 6/3					0.0	36-50/0.4	as above	
	84.5 - 86.5			7.5 YR 6/3					0.0	57-50/0.4	as above	
-717.5	89.5 - 91.5		Wet	7.5 YR 6/3					0.0	36-31-32-33	Light brown f.g. - m.g. sand	

ft bgs/ msl : feet below ground surface/ mean sea level
 Strength: Very Soft (V. Sft), Soft, Firm, Very Firm (V. Firm)



OVERBURDEN BORING LOG

SITE ID **S-1**

Page 2 of 3

Date Begin 8/21/2007
Date End 8/24/2007

Location Type: () Geoprobe () Well
(X) Soil Boring () Other:
Completion Zone: (X) Overburden () Bedrock
Completion Type: () Monitoring Well
(X) Abandoned by Grout
() Other (Provide Comments)
2.0'

ELEV (GRND)^a
NORTHING:
EASTING:

Depth to Water (ft bgs)
Total Boring Depth (ft bgs)
Depth to Refusal (ft bgs):
Boring Diameter (inches):
Split-spoon Length

CLIENT: Confidential
Cottage Grove, MN
PROJECT NO.: 02181.002.030.0001
Area Name: WWTP
A. E. T. (Operator - Shaun Graski)
HSA (0' -19.5')
Drilling Contractor: Mud-Rotary (19.5'- 239.5')
G. Wiltmer/ J. Hunter
Logged By:
Area Description: In grass, ~100' E of MW-105

ELEV. (ft msl)	Sample Interval (ft bgs)	Recovery ft	Moisture	Color Munsell	Grain Size					Strength	OVM PPM	Blow Count Blows/ 6" 6"-6"-6"	Lithic Description
					Gr	S	SI	CI					
	94.5 - 96.5			7.5 YR 6/3							0.0	38-45-49-50/0.4	as above
	99.5 - 101.5		Wet	7.5 YR 6/3							0.0	23-18-18-21	Light brown sandy gravel, poorly sorted
	104.5 - 105.5		V.MST	7.5 YR 6/3							0.0	16-16-17-22	Light brown silt, tr. f.g. sand
	105.5 - 106.5		V. MST	10 YR 4/1							0.0		Dark gray silty v.f.g.-f.g. sand
	109.5 - 111.5	2	Wet	7.5 YR 6/4	80	15	5	5	Soft			33-16-17-32	Brown v.f.g.-m.g. sand, subrounded to subangular, silty, stringer occurs 109.1-109.3'
	114.5 - 116.5	1.5	Wet	5 YR 3/4	80	15	5	5	Soft			27-28-37-50/0.4	Dark reddish brown m.g.-v.c.g. sand, subrided to ang., silty stringer at 115.5', low qtz. content
	119.5 - 121.5	1	Wet	5 YR 3/4	80	15	5	5	Soft			28-32-44-50	as above
~687.5	124.5 - 126.5	1/1	Wet	5 YR 3/4	80	15	5	5	Soft			56-64/0.4	as above, grain size decr. (f.g.-c.g.)
	129.5 - 131.5	2	Wet	5 YR 3/4	85	10	5	5	Soft			19-27-37-35	as above, sorting incr. (m.g.-c.g.)
	134.5 - 136.5	2	Wet	5 YR 3/4	85	10	5	5	Soft			30-44-42-44	as above, sorting decr. (f.g.-c.g.), subangular to angular
	139.5 - 141.5	1.5	Wet	5 YR 3/4	5	80	10	5	Soft			36-42-43-44	as above, grain size incr. (m.g.-v.c.g.), tr. gravel
	144.5 - 146.5	1.5	Wet	7.5 YR 3/4	5	80	10	5	Soft				Dark brown v.c.g.-m.g. sand A/A, tr. gravel, subrounded to subangular
~657.5	149.5 - 151.5	1	Wet	7.5 YR 3/4	85	10	5	5	Soft			25-27-42-39	as above, sorting incr. (v.c.g.-c.g.), subangular
	154.5 - 156.5	1	Wet	7.5 YR 3/4	85	10	5	5	Soft			25-33-41-48	as above, sieve-analysis sample collected
	159.5 - 161.5	12	Wet	7.5 YR 3/4	85	10	5	5	Soft			29-33-59-60	Dark brown m.g.-v.c.g. sand as above, subrounded
	164.5 - 166.5		Wet	7.5 YR 3/4	85	10	5	5	Loose				as above, well-sorted (c.g.), sieve-analysis sample collected
	169.5 - 171.5		Wet	7.5 YR 3/4	85	10	5	5	Loose			16-44-49-61	as above, driller notes that mud "hinned-out (due to GW)" at 167.5'
	174.5 - 176.5	16	Wet	7.5 YR 3/4	5	80	10	5	Loose			30-35-49-42	as above, tr. gravel, subrounded to subangular, sieve-sample collected
~627.5	179.5 - 181.5	18	Wet	7.5 YR 3/4	15	70	10	5	Loose			41-48-42-34	Dark brown sand and gravel, rounded, f.g. sand seam at 181.2'
	184.5 - 186.5	15	Wet	7.5 YR 3/4	80	15	5	5	Loose			25-28-35-39	Dark brown f.g.-c.g. sand, subrounded to angular, sieve samp. collect.
	189.5 - 191.5	14	Wet	7.5 YR 3/4	5	75	15	5	Loose			27-47-83-90	as above, rounded, tr. gravel
	194.5 - 196.5		Wet	7.5 YR 3/4	25	60	10	5	Loose			78-88	Dark brown gravelly sand, rounded
	199.5 - 201.5	8	Wet	7.5 YR 3/4	25	60	10	5	Loose			200/0.4	as above, poor recovery due to large gravel stuck in shoe
	204.5 - 206.5		Wet	7.5 YR 3/4	25	60	10	5	Loose				No split-spoon sample collected

^aElevation of Top of Casing given in feet from mean sea level.
ft bgs/ msl. ; feet below ground surface/ mean sea level
Strength: Very Soft (V. St), Soft, Firm, Very Firm (V. Frm)



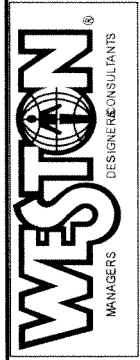
OVERBURDEN BORING LOG

CLIENT: Confidential Cottage Grove, MN 02181.002.030.0001 WWTP A. E. T. (Operator - Shaun Graski) HSA (0' -19.5') Mud-Rotary (19.5' - 239.5') J. Hunter In grass, ~100' E of MW-105	SITE ID S-1	ELEV (GRND)* NORTHING: EASTING: Depth to Water (ft bgs) Total Boring Depth (ft bgs) Depth to Refusal (ft bgs): Boring Diameter (inches): Split-spoon Length
Date Begin: 8/21/2007 Date End: 8/24/2007		Location Type: () Geoprobe () Well (X) Soil Boring () Other: Completion Zone: (X) Overburden () Bedrock Completion Type: () Monitoring Well (X) Abandoned by Grout () Other (Provide Comments)

ELEV. (ft msl)	Sample Interval (ft bgs)	Recovery	Moisture	Color	Grain Size				Strength	OVM	Blow Count	Lithic Description
					Gr	S	SI	CI				
209.5	211.5	16	Wet	7.5 YR 3/4	5	75	15	5	Loose	52-73-66-53	Dark brown f.g.-c.g. sand, tr. gravel	
~592.5	214.5	22	Wet	5 YR 4/1		60	30	10	Loose	20-28-70-131	Dark gray silty v.f.g. sand, well rounded	
	216	216.5	Wet	7.5 YR 4/4	2	85	10	3	Loose		Dark brown f.g.-c.g. sand, subangular to subrounded	
	219.5	220.5	Wet	7.5 YR 4/4	2	85	10	3			as above	
	220.5	221.5		7.5 YR 4/4		87	10	3			as above, sorting incr. (m.g.-c.g.)	
	224.5	226.5									No split-spoon sample collected	
	229.5	230	Wet	5 YR 4/2	20	60	15	5			Dark reddish gray silty sandy gravel, rounded, possibly slough	
~577	230	230.5	Wet	5 YR 6/1							Gray angular gravel, possibly fract. bedrock (granular)	
	230.5	231		7.5 YR N4	10	35	50	5			Dark gray f.g. sandy silt w/ rounded gravel	
	231	231.2		7.5 YR N5							Gray angular gravel, possibly fract. ss. bedrock	
~572.6	234.4			GLEYS 5G							Drill cuttings* Pale green shaly siltstone fragments (St. Lawrence Unit?)	
	238.5										Pale green cuttings absent, possible lithologic change (to Franconia Unit?)	
~567.5	239.5	239.7								200/0.1	corresponds to driller's observation of change in rock(?) strength	
											No recovery (refusal)	

*Elevation of Top of Casing given in feet from mean sea level.
 f.g., m.g., c.g. : Fine-, Medium-, and Coarse-grained
 Moisture: Dry, Moist (Mst), Wet, Saturated (Sat)

ft bgs/ msl. : feet below ground surface/ mean sea level
 Strength: Very Soft (V. Sft), Soft, Firm, Very Firm (V. Frm)



OVERBURDEN BORING LOG

SITE ID **S-2**

Page 1 of 2

CLIENT: Confidential
SITE NAME: Cottage Grove, MN
PROJECT NO.: 02181.002.030.0001
Area Name: WWTP
Drilling Contractor: A. E. T. (Operator - Shaun Graski)
Drilling Equipment: HSA (0' - 21.5')
Mud-Rotary (21.5' - 254.5')
Logged By: J. Hunter
Area Description: In grass between SW corner of Bldg. 185 and perimeter road

ELEV (GRND)*
NORTHING:
EASTING:
Depth to Water (ft bgs)
Total Boring Depth (ft bgs)
Depth to Refusak (ft bgs):
Boring Diameter (inches):
Split-spoon length

Date Begin 8/27/2007
Date End 8/30/2007
Location Type: () Geoprobe () Well
(X) Soil Boring () Other:
Completion Zone: (X) Overburden () Bedrock
Completion Type: () Monitoring Well
(X) Abandoned by GROUT
() Other (Provide Comments)

ELEV. (ft msl)	Sample Interval (ft bgs)	Recovery (in.)	Moisture	Color	Grain Size					Strength	OVM	Blow Count Blows/6"-8"-6"-6"	Lithic Description
					Gr	S	SI	Cl	GI				
0	0.5	22	Wet	10 YR 2/2	2	30	48	20		Firm	0.4	2-5-8-11	Very dark brown organic soil, sandy silt, root, no odor
0.5	2		Sl. Mst	10 YR 3/2	2	30	48	20		Firm			Very dark grayish brown sandy silt with dark yellowish brown mottling
9.5	11.5	19	Sl. Mst	10 YR 4/4	2	65	30	3		Loose	0.4	3-5-4-6	Brown m.g.-c.g. sand w/ silty seams interbedded throughout
19.5	21	19	Dry-Mst	10 YR 5/3	2	75	20	3		Loose	0.3	12-18-23-18	as above, f.g.-m.g., angular to subrounded, Qtz. content high, finer grained with increasing depth
21	21.5		Dry	10 YR 5/3	25	55	15	5		Loose			Dark brown sandy gravel, low Qtz. content, angular to rounded as above, rounded, silt content decreasing
29.5	31.5	16	Dry	10 YR 5/3	30	55	10	5		Loose	0.0	17-13-20-20	Yellowish brown silt, tr. sand, cohesive where wet
39.5	41.5	24	V. Mst	10 YR 5/4	25	60	15			Soft		4-4-6-8	as above, tr. Fe-stained partings
49.5	51.5	24	V. Mst	10 YR 5/4	25	60	15			Soft		6-8-8-11	Yellowish brown silty v.f.g.-f.g. sand, well rounded, high Qtz. content
59.5	61.5	19	V. Mst	10 YR 5/4	55	40	5			Soft		18-19-19-24	as above, tr. Fe-staining
69.5	71.5	19	Wet	10 YR 5/3	75	20	5			Soft	0.0	17-20-17-21	Brown v.f.g.- f.g. sand, rounded, high Qtz. %, tr. silt as above, f.g.-m.g., tr. Fe-staining
79.5	81.5	19	Wet	10 YR 5/3	80	15	5			Soft		20-18-16-14	Brown f.g.-c.g. sand, lower Qtz.%, rounded to subrounded, tr. silt
89.5	91.5	18	Sat	7.5 YR 5/4	80	15	5			Loose		26-21-31-38	Brown silty sand, mded to submded, tr. gravel
99.5	101.5	17	Sat	7.5 YR 5/4	2	65	25	8		Loose		31-36-38-44	Brown silty sand, distinct laminations of sandy silt and c.g. sand, graded, Fe-staining @ layer horizons
109.5	111.5	16	Sat	7.5 YR 5/4	65	30	5			Soft		9-7-12-17	Dark reddish brown silty sand, mded to subangular as above, f.g.-c.g., decr. Qtz. %, equant & submded
119.5	121.5	17	V. Mst	5 YR 3/4	65	30	5			Loose		34-39-45-47	as above, trace gravel
129.5	131.5	16	Sat	5 YR 3/4	75	20	5			Loose		30-29-32-40	Dark reddish gray v.c.g.-f.g. sand, elongate&submd. tr. gravel
139.5	141.5	17	Sat	5 YR 3/4	5	75	15	5		Loose		25-28-34-33	Dark reddish gray f.g.-c.g. sand, lacks gravel, reddish color may be due Fe-staining on individual grains or Fe-containing lithics
149.5	151.5	18	Sat	5 YR 4/2	5	85	8	2		Loose		50/0.4	Dark reddish gray gravelly f.g.-c.g. sand, well-mded, ss gravel
159.5	161.5	9	Sat	5 YR 4/2	85	13	2			Loose		55-26-28-30	as above, v.f.g.- c.g. sand, lacks gravel, mded, equant, low Qtz. %
169.5	171.5	10	Wet	5 YR 4/2	20	70	8	2		Loose		48-43-41-41	as above
179.5	181.5	20	Wet	5 YR 4/2	88	10	2			Loose			
189.5	191.5	18	V. Wet	5 YR 4/2	88	10	2			Loose			

*Elevation of Top of Casing given in feet from mean sea level.
f.g., m.g., c.g. : Fine-, Medium- and Coarse-grained
Moisture: Dry, Moist (Mst), Wet, Saturated (Sat)
ft bgs/ fmsl : feet below ground surface/ mean sea level
Strength: Very Soft (V. Sft), Soft, Firm, Very Firm (V. Firm)



OVERBURDEN BORING LOG

SITE ID **S-2**

Page 2 of 2

Date Begin 8/27/2007
Date End 8/30/2007

ELEV (GRND)^a
NORTHING:
EASTING:

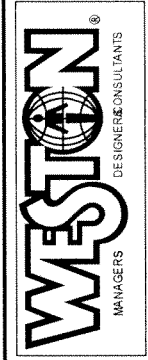
Depth to Water (ft bgs)
Total Boring Depth (ft bgs) 254.5'
Depth to Refusal (ft bgs):
Boring Diameter (inches):
Split-spoon length
2.0'

Location Type: () Geoprobe () Well
(X) Soil Boring () Other:
Completion Zone: (X) Overburden () Bedrock
Completion Type: () Monitoring Well
(X) Abandoned by Grout
() Other (Provide Comments)

CLIENT: Confidential
SITE NAME: Cottage Grove, MN
PROJECT NO.: 02181.002.030.0001
Area Name: WWTP
Drilling Contractor: A. E. T. (Operator - Shaun Graski)
Drilling Equipment: HSA (0' - 21.5')
Mud-Rotary (21.5' - 254.5')
Logged By: J. Hunter
Area Description: In grass between SW corner of Bldg. 185 and perimeter road

ELEV. (ft msl)	Sample Interval (ft bgs)	Recovery (in.)	Moisture	Color	Grain Size					Strength	OWM PPM	Blow Count Blows/ 6"-6'-6"	Lithic Description
					G	S	SI	CI	CL				
199.5	201.5	20	V. Wet	5 YR 3/4	5	83	10	2		Loose		41-43-48-56	Dark reddish brown f.g. - c.g. sand, tr. rmded gravel,
209.5	211.5	8	V. Wet	5 YR 3/4	5	78	15	2		Loose		27-28-27-34	as above, (no recovery on 1st split-spoon)
219.5	221.5	12	Sat	5 YR 3/4		83	15	2		Loose		31-55-50/0.4	as above, v.f.g. - m.g. sand, lacks gravel
229.5	231.5	12	Wet	5 YR 3/4		83	15	2		Loose		42-51-50/0.4	as above
239.5	240.5	9/12	Wet	5 YR 3/4	10	73	15	2		Loose		42-223	as above, tr. rmded gravel near shoe, sss-like angular gravels in shoe
242	247			5 Y 5/1									Drill cuttings* Gray silty / till-like frags, tr. gravels
249.5	249.6	1/1	V. Wet	5 GY 4/1						CompR	300/0.1		Dark greenish gray ss, f.g., rounded, high Qtz%, w/ dark greenish gray glaucophane (<i>Praconia Unit</i>)
249.5	254.5			5 GY 4/1						CompR			Drill cuttings* as above, glauconitic SS

^aElevation of Top of Casing given in feet from mean sea level.
f.g., m.g. : Fine-, Medium-, and Coarse-grained
Moisture: Dry, Moist (Mst), Wet, Saturated (Sat)
Strength: Very Soft (V. Sft), Soft, Firm, Very Firm (V. Frm)



BEDROCK BORING LOG

SITE ID: S-3	Page 1 of 2
DATE BEGIN: 21-Jul-08	DATE END:

CLIENT: Confidential
SITE NAME: Cottage Grove, MN
PROJECT NO.: 02181-002-050-0001
DRILLING CO.: American Engineering & Testing
LOGGED BY: John Hunter
DRILL METHOD: HSA/ Mud-rotary
SITE TYPE: Stratigraphic boring
COMMENTS: Boring near MW-109 south of the D5 area.

ELEV. (GRND): _____
NORTHING: _____
EASTING: _____
DEPTH TO BEDROCK (fbs): 244.00
HSA BOREHOLE DIA. (in): 8.25
MUD ROTARY BOREHOLE DIA. (in): 8.00

DEPTH TO WATER (BGS): _____
TOTAL BORING DEPTH (fbs): 245.00

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet fbs)	MOISTURE	SOIL STRENGTH	SOIL TEXTURE			Blow Count	ELEVATION (feet msl)	LOCATION DESCRIPTION	LITHOLOGIC DESCRIPTION
					G	S	C				
0-99	in	from 0 to 99									Borehole remained to 99 feet. See boring log for MW109 for the shallow stratigraphy.
99-101	100	99	Dry	Loose	92	6	2	7-13-15-21			Yellowish brown f.g. SAND
109-111	100	109	Dry	Loose	95	5		16-18-20-22			Yellowish brown m.g. poorly sorted SAND, poly lithic grains
119-121	100	119		Loose	90	8	2	16-20-21-26			Dark yellowish brown poorly sorted v. f.g. to m.g. sand, poly lithic grains
129-131	100	129		Loose	25	70	3	20-19-15-11			Gray poorly sorted v. f.g. to c.g. gravelly SAND, poly lithic grains, dolomitic (carbonate) gravel r/n to HCl
139-141	100	139		Loose	10	85	3				Brown poorly sorted m.g. to v.c.g. SAND with gravel, poly lithic grains
		140		Soft	15	80	3	13-23-28-16			Brown poorly sorted m.g. to v.c.g. gravelly sand, poly lithic grains, gravel subangular to rounded
149-151	16	149	Sat	Soft	75	25					Reddish brown silty f.g. to m.g. SAND, poly lithic grains, slight r/n to HCl
159-161	16	159	Sat	Soft	15	70	10	33-29-37-41			Dark yellowish brown moderately sorted f.g. to c.g. gravelly SAND with silt
169-171	17	169	Sat	Soft	15	68	15	34-66-138-36			Dark yellowish brown c.g. well sorted gravelly silty SAND, coarse-grained gravel to 2", poly lithic
		179		Loose	2	85	8	41-36-44-44			Brown to red poorly sorted m.g. to c.g. SAND, poly lithic grains
		181		Loose							2.5YR 4/8
189-191	16	189	Sat	Soft	85	5	2	28-43-45-47			Reddish brown poorly sorted m.g. to c.g. SAND, poly lithic grains
199-201	21	199	Sat	Loose	18	70	10	34-70-126-98			Reddish brown poorly sorted m.g. to c.g. SAND, gravel rounded to 1.5", poly lithic grains
		200		Soft	92	6	2	49-55-62-53			Yellowish red poorly sorted f.g. to c.g. SAND, poly lithic grains
209-211	18	209	Sat	Soft	85	12	3				Reddish brown well sorted v.f.g. to f.g. SAND with silt
219-221	22	219	Sat	Loose	10	78	10	28-34-39-60			Yellowish red poorly sorted f.g. to c.g. SAND, poly lithic grains
		223-226		Firm	2	90	5	72-123-158-173			Reddish brown well sorted f.g. SAND
		229-231		Firm	60	20	10	na			Begin Rotary Drilling
		239-240		Firm	15	25	40	30-45-43-35			Brownish yellow sandy GRAVEL, carbonate flakes in fluid returns
244.5-244.6	3	244.55		Firm	12	35	40	300/5			Grayish brown clayey sandy silt TILL
					95	3	2	300/1			Grayish brown sandy silty TILL
											Olive f.g. SAND, quartz and greenish black grains (glauconite?). Suspected Sandstone bedrock
											BORING TERMINATED AT 245 fbs

MOISTURE	TEXTURAL TERMS	LITHOLOGY	CORE TEXTURE
Dry	Fr	Ur	Weathered
Moist	Blk	So	Loose
Wet	Str	Op / Og	friable
Sat	MH	Os	rubble
Wpr	gnd	Op	competent
	tm	Cj	Jordan Sandstone



SOIL BORING LOG

SITE ID: S-4	Page 1 of 1
DATE BEGIN: 16-Jul-08	
DATE END: 21-Jul-08	
DEPTH TO WATER (BGS): ~95.0'	
TOTAL BORING DEPTH (ftgs): 230.00	

CLIENT: Confidential	ELEV. (GRND): ~785'
SITE NAME: Cottage Grove, MN	NORTHING:
PROJECT NO.: 02181-002-050-0001	EASTING:
DRILLING CO.: American Engineering & Testing	DEPTH TO BEDROCK (ftgs): ~227.0
LOGGED BY: John Hunter	HSA BOREHOLE DIA. (in): 8.25
DRILL METHOD: HSA/Mud-rotary	MUD ROTARY BOREHOLE DIA. (in): 3.00
SITE TYPE: Stratigraphic boring	

COMMENTS: Boring near MW-109 south of the D5 area.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet ftgs)	MOISTURE	SOIL STRENGTH	SOIL TEXTURE			ELEVATION (feet msl)	LITHOLOGY	CORE TEXTURE	Rock weathered to secondary minerals				
					G	S	Cl								
9.5-11.5	19	9.5 to 11.5	Dry	Soft	2	90	6	2	4-5-7-9	Blows/ 6"-6'-6"-6"	Yellowish brown poorly-sorted f.g. to m.g. SAND, poly-lithic grains	Munsell Code	10YR 5/4	10YR 5/4	Yellowish brown moderate- to poorly-sorted f.g. to m.g. SAND, poly-lithic grains
19.5-21.5	18	19.5 to 21.5	Dry	Soft	5	90	3	2	7-4-3-4		Yellowish brown moderate- to poorly-sorted f.g. to m.g. SAND, poly-lithic grains	10YR 5/4	10YR 5/4	Yellowish brown moderate- to poorly-sorted f.g. to m.g. SAND, poly-lithic grains	
29.5-31.5	18	29.5 to 31.5	Dry	Loose	10	85	3	2	5-7-15-22		Pale brown f.g. to m.g. SAND, poly-lithic grains, gravel to 1.5"	10YR 6/3	10YR 6/3	Pale brown f.g. to m.g. SAND, poly-lithic grains, gravel to 1.5"	
39.5-41.5	19	39.5 to 41.5	Dry	Loose	2	90	4	4	8-10-13-16		Light yellowish brown well- to moderate-sorted f.g. to m.g. SAND, gravel subrounded	2.5YR 6/3	2.5YR 6/3	Light yellowish brown well- to moderate-sorted f.g. to m.g. SAND, gravel subrounded	
49.5-51.5	19	49.5 to 51.5	Dry	Loose	10	86	2	2	8-9-12-13		Brown poorly-sorted f.g. to c.g. SAND, poly-lithic grains, subrounded to subangular gravel	10YR 5/3	10YR 5/3	Brown poorly-sorted f.g. to c.g. SAND, poly-lithic grains, subrounded to subangular gravel	
59.5-61.5	19	59.5 to 61.5	Mst	Loose	8	88	2	2	8-10-11-13		Yellow poorly-sorted f.g. to c.g. SAND, gravel subrounded to rounded	10YR 5/4	10YR 5/4	Yellow poorly-sorted f.g. to c.g. SAND, gravel subrounded to rounded	
69.5-71.5	19	69.5 to 71.5	Dry	Soft	2	90	5	3	19-22-22-23		Light yellowish brown moderate- to well-sorted f.g. to m.g. SAND	10YR 6/3	10YR 6/3	Light yellowish brown moderate- to well-sorted f.g. to m.g. SAND	
79.5-81.5	23	79.5 to 81.5	Dry	Soft	2	87	8	3	19-26-28-27		Yellowish brown well-sorted v.f.g. to f.g. SAND	10YR 5/4	10YR 5/4	Yellowish brown well-sorted v.f.g. to f.g. SAND	
89.5-91.5	23	89.5 to 91.5	Dry	Soft	2	87	8	3	15-28-27-40		As above	10YR 5/4	10YR 5/4	As above	
99.5-101.5	24	99.5 to 101.5	Wet	Soft	2	90	5	3	20-32-31-37		Brown well-sorted v.f.g. SAND	10YR 4/3	10YR 4/3	Brown well-sorted v.f.g. SAND	
109-111	23	109 to 111	Wet	Soft	2	90	5	3	20-32-31-37		Brown well-sorted v.f.g. SAND	10YR 4/3	10YR 4/3	Brown well-sorted v.f.g. SAND	
119-121	15	119 to 121	Sat	Soft	20	68	10	2	22-24-22-24		Dark yellowish brown gravelly, poorly-sorted SAND, some silt, gravel rounded to subangular, less than 1/2"	10YR 4/4	10YR 4/4	Dark yellowish brown gravelly, poorly-sorted SAND, some silt, gravel rounded to subangular, less than 1/2"	
129-131	15	129 to 131	Sat	Soft	20	60	15	5	27-23-21-24		Dark yellowish brown gravelly, silty, poorly-sorted f.g. to c.g. SAND	10YR 4/4	10YR 4/4	Dark yellowish brown gravelly, silty, poorly-sorted f.g. to c.g. SAND	
139-141	17	139 to 141	Sat	Soft	5	90	6	4	23-28-34-33		Brown poorly-sorted v.f. To m.g. SAND, few gravel	7.5YR 4/3	7.5YR 4/3	Brown poorly-sorted v.f. To m.g. SAND, few gravel	
149-151	16	149 to 151	Sat	Soft	5	90	3	2	20-21-28-30		Reddish brown well-sorted m.g. SAND	5YR 5/4	5YR 5/4	Reddish brown well-sorted m.g. SAND	
159-161		159 to 161	Sat	Loose	25	70	3	2	27-20-28-31		Reddish brown poorly-sorted f.g. to c.g. gravelly SAND, gravel less than 1/2", rounded to subrounded	5YR 5/3	5YR 5/3	Reddish brown poorly-sorted f.g. to c.g. gravelly SAND, gravel less than 1/2", rounded to subrounded	
169-171		169 to 171	Sat	Soft	8	85	5	2	23-29-45-52		Brown well-sorted SAND with few gravel	7.5YR 4/3	7.5YR 4/3	Brown well-sorted SAND with few gravel	
179-181		179 to 181	Sat	Soft	5	83	10	2	38-46-49-40		Reddish brown well-sorted f.g. to m.g. SAND	5YR 4/4	5YR 4/4	Reddish brown well-sorted f.g. to m.g. SAND	
189-191		189 to 191	Sat	Soft	5	90	3	2	38-51-53-50		Brown well-sorted m.g. SAND	7.5YR 4/4	7.5YR 4/4	Brown well-sorted m.g. SAND	
199-201		199 to 201	Sat	Soft	20	65	10	5	35-123-154-58		Brown poorly-sorted gravelly f.g. to m.g. SAND, gravel rounded, some zones of dark gray sand.	7.5YR 4/3	7.5YR 4/3	Brown poorly-sorted gravelly f.g. to m.g. SAND, gravel rounded, some zones of dark gray sand.	
209-211	na	209 to 211	na	na					na		No split-spoon collected	na	na	No split-spoon collected	
219-221		219 to 221	Sat	Firm	15	75	5	5	not recorded		Brown SAND as above	7.5YR 4/3	7.5YR 4/3	Brown SAND as above	
229-231	12/12	229 to 230	Sat	Hard	na	na	na	na	not recorded		D. Greenish gray SANDSTONE of the Franconia formation (contact at 227.0' BGS indicated by increased hardness)	GLE1Y 6/2	GLE1Y 6/2	D. Greenish gray SANDSTONE of the Franconia formation (contact at 227.0' BGS indicated by increased hardness)	

MOISTURE

Dry

Met

Wet

Sat

Wpr

TEXTURAL TERMS

Fr

Blk

Str

Mt

grd

fm

LITHOLOGY

Ur

So

Op / Og

Os

Op

Cj

CORE TEXTURE

Weathered

Loose

friable

rubble

competent


Rock weathered to secondary minerals

Rock Unconsolidated (sand)

Rock Competent, weak, crumbly

Rock Competent, recovery rubbery

Rock Competent, recovery solid



UNPAVED DESIGN SOLUTIONS
1-201-712-9300

SOIL BORING LOG

SITE ID: S-5	Page 1 of 2
DATE BEGIN: 11-Jul-08	
DATE END: 16-Jul-08	

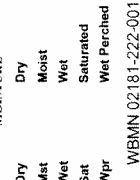
CLIENT: Confidential Cottage Grove, MN	ELEV. (GRND):
PROJECT NO.: 02181-002-050-0001	NORTHING:
DRILLING CO.: American Engineering & Testing	EASTING:
LOGGED BY: G. Witmer	DEPTH TO BEDROCK (fbs): ~167.5'
DRILL METHOD: HSA/Mud-rotary	HSA BOREHOLE DIA. (in): 8.25
SITE TYPE: Stratigraphic boring	MUD ROTARY BOREHOLE DIA. (in): 3.00

DEPTH TO WATER (BGS): 19.0'
TOTAL BORING DEPTH (fbs): 169.5'
TOTAL WELL DEPTH (fbs): na

COMMENTS: Driller is Shaun Grudski, helper is Scott Baker

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet fbs)	MOISTURE	SOIL STRENGTH		SOIL TEXTURE			Blow Count	ELEVATION (feet msl)	LOCATION DESCRIPTION	LITHOLOGIC DESCRIPTION
				from	to	G	S	SI				
0-2	18	0	Mst	Firm		75	25	0	0	705.00	Farthest east of stratigraphic borings, near "East Cove". Exact location is SE corner of elevated clearing (along access road) just west of cove.	Grass, gravel and sand
4-6	18	0.5	Mst	Firm		75	75	25				Brown f.g. - m.g. sand, some gravel and silt
10-12	24	5	Mst	Firm		80	20					Brown f.g. - m.g. sand, some silt
15-17	18	10	Mst	Firm		90	10					D. Brown v.f.g. silty sand, root traces
20-22	24	15	Mst	Firm		90	10					D. Brown v.f.g.-f.g. silty sand
25-27	24	20	Sat	Firm		90	10					Brown v.f.g.-f.g. sand, trace gravel and root traces
30-32	24	21	Sat	Firm		90	10					D. Brown f.g. sand
35-37	24	22	Sat	Firm		90	10					Brown f.g.-m.g. sand, some c.g. sand, rounded to subangular
40-42	24	25	Sat	Firm		10	90					A/A, increased c.g. sand, trace gravel
45-47	24	30	Sat	Firm		10	90					A/A, m.g.-c.g. sand and gravel (0.25" to 1.0" diameter)
50-52	24	35	Sat	Firm		10	90					A/A, increased f.g. sand
55-57	24	40	Sat	Firm		5	95					A/A, v.f.g.-f.g. sand, some m.g.-c.g. sand, trace gravel
60-62	24	42	Sat	Firm		10	90					A/A, f.g.-c.g. sand, some m.g.-c.g. sand, trace gravel
65-67	24	45	Sat	Firm		10	90					A/A, v.f.g. - f.g. sand
70-72	18	50	Sat	Firm		100	100					L. Yellow brn. f.g.-m.g. sand
75-77	24	55	Sat	Firm		100	100					L. Brn. v.f.g. - f.g. sand
80-82	24	60	Sat	Firm		5	95					A/A, f.g.-m.g. sand, trace c.g. sand, some gravel
85-87	24	65	Sat	Firm		5	95					A/A, v.f.g.-f.g. sand, some m.g.-c.g. sand, trace gravel
90-92	24	70	Sat	Firm		10	90					A/A, f.g. - c.g. sand, some rounded gravel and ss lithics
100-102	24	75	Sat	Firm		100	100					Reddish brown f.g. sand
104-106	15	80	Sat	Firm		15	75	8	2			A/A
109-111	24	85	Sat	Firm		5	75	20	0			Reddish brown f.g. - m.g. sand

MOISTURE	TEXTURAL TERMS	LITHOLOGY		CORE TEXTURE			
		Fr	Blk	Ur	So	Weathered	Loose
Dry	Very Fine-Grained			Urban Drift	Rock weathered to secondary minerals		
Moist	Fine-Grained			Glacial Drift	Rock Unconsolidated (sand)		
Wet	Medium-Grained			Plateville / G	Rock Consolidated, weak, crumbly		
Sat	Coarse-Grained			St. Peter Sand	Rock Competent recovery rubble		
Wp	Very Coarse-Grained			Prairie du Chi	Rock Competent, recovery solid		
				Jordan Sandstone			



BEDROCK BORING LOG

SITE ID: S-5	Page 2 of 2
DATE BEGIN: 11-Jul-08	
DATE END: 16-Jul-08	
DEPTH TO WATER (BGS): 19.0'	
TOTAL BORING DEPTH (fbgs): 169.5'	
TOTAL WELL DEPTH (fbgs): na	

CLIENT: Confidential	ELEV. (GRND): _____
SITE NAME: Cottage Grove, MN	NORTHING: _____
PROJECT NO.: 02181-002-050-0001	EASTING: _____
DRILLING CO.: American Engineering & Testing	DEPTH TO BEDROCK (fbgs): ~167.5'
LOGGED BY: G. Wilmer / J. Hunter	HSA BOREHOLE DIA. (in): 8.25
DRILL METHOD: HSA / Mud-rotary	MUD ROTARY BOREHOLE DIA. (in): 3.00
SITE TYPE: Stratigraphic boring	

COMMENTS:

Farthest east of stratigraphic borings, near "East Cove". Exact location is SE corner of elevated clearing (along access road) just west of cove.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (feet bgs)	MOISTURE	SOIL STRENGTH		SOIL TEXTURE			Blow Count	ELEVATION (feet ms)	LOCATION DESCRIPTION	LITHOLOGIC DESCRIPTION
				G	S	SI	C	Munsell Code				
114-116	15	114 to 116	Sat	Firm	5	75	20		17-19-22-19		A/A, tr. gravel (0.5" diameter)	
119-121	18	119 to 121	Sat	Firm	10	85	3	2	17-13-12-11		Brown SP, c.g., tr. coarse gravel (rounded)	7.5 yr 4/3
124-126	12	124 to 126	Sat	Firm	60	30	8	2	16-12-14-15		Brown GW, f.g., some c.g. (rounded), some sand (rounded to subangular), trace fines	7.5 yr 5/4
129-131	10	129 to 130	Sat	Firm	50	30	15	5	131-200+0.3		L. Brown GW with sand, some fines, gravel is either well-rounded or angular, dominant lithic is pale brown granular carbonate (strong rxn. to dilute HCL)	7.5 yr 6/3
134-136	3	134 to 134.5	Sat	Firm	50	25	20	5	195-0.25		GW, some fines (pale green), gravels are either angular or rounded (rounded content decreased), pale brown carbonate gravels increased	7.5 yr 4/1
139-141	6	139 to 140	Sat	Firm	45	20	25	10	310		Pale brown GM, angular c.g. carbonate gravels, some silty (plastic) partings, cohesive as unit (fines result of weathering locally??)	10 yr 6/3
144-146	21	144 to 146	Sat	Firm	40	25	25	10	88-75-47-47		Reddish brown GM A/A, carbonate lithics decreased, sand is m.g.-c.g., some silts: fines	5 yr 4/3
149-151	12	149 to 150	Sat	Firm	20	65	10	5	106-151		Brown SW, v.f.g.-m.g., some coarse gravel, gravel lithology is as above, fine content decreases	7.5 yr 4/3
159-161	4	159 to 159.5	Sat	Firm	50	15	25	10	236-0.33		Pale brown GM, with pale green silt, most gravels are angular, some are of pale green (ss) sand is f.g., ss reacts weakly to dilute HCL.	10 yr 6/3
167.5	na	167.5	Sat	Firm	0	30	60	10	na		<<WASH SAMPLE>> Pale green sandy silt, possible St. Lawrence formation(?)	GLE1 6/2
169.5-169.6	1	169.5 to 169.6	Sat	Firm	0	90	10	0	400		Qz. sand (well-rounded, v.f.g.), weak rxn. to dilute HCL.	GLE1 6/2
											<<POOR RECOVERY>> Pale green SS, f.g. well-rounded, well-sorted, tr. silt, no rxn. to dilute HCL	

MOISTURE	TEXTURAL TERMS	LITHOLOGY	CORE TEXTURE
Dry	Fr	Ur	Weathered
Moist	Blk	So	Loose
Wet	Str	Op / O	friable
Saturated	Mtl	Os	Rock Unconsolidated (sand)
Wet Perched	grd	Op	Rock Consolidated, weak, crumbly
	trn	Cj	Rock Competent recovery rubby
			Rock Competent, recovery solid

