

**FOCUSED FEASIBILITY STUDY REPORT
FOR
40TH AVENUE PROJECT AREA
IN THE ST. LOUIS RIVER AREA OF CONCERN**

August 28, 2015

APPENDIX D. GEOTECHNICAL SAMPLING AND ANALYSIS



DEPARTMENT OF THE ARMY
DETROIT DISTRICT, CORPS OF ENGINEERS
477 MICHIGAN AVENUE
DETROIT MI 48226-2550

CELRE-EC-G

7 July 2015

MEMORANDUM FOR RECORD

SUBJECT: Feasibility Stage Subgrade Settlement and Island Consolidation Potential, 40th Avenue Proposed Island Creation Sites.

1. This memorandum for record (MFR) provides a summary and feasibility stage discussion regarding the potential for subgrade settlement and dredge material island consolidation at the proposed 40th Avenue island creation sites in St. Louis Bay, Duluth – Superior Harbor. The focus of this MFR is the proposed island creation locations in the southern portion of the 40th Avenue AOC.

2. This MFR has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations contained in this report were based on the applicable standards of the profession at the time this report was prepared. No other warranty, express or implied is made.

3. The analyses and recommendations submitted herein are based, in part, upon the data obtained from the subsurface explorations. Based on the nature of soil borings, the potential extent of variations between the identified borings will not become evident until island creation activities begin. In the event that any changes in the nature, design, or location of the proposed islands are planned, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed and conclusions modified or verified in writing. Once the preferred alternative is selected, further analysis related to this subject will be required.

4. References:

a. GEI, Inc. "Subsurface Investigation Report, FY14 St. Louis Area of Concern Geotechnical Investigation – 40th Avenue West", 2014.

b. GEI, Inc. "Organic Material Photo Log, FY14 St. Louis River Area of Concern Investigation – 40th Avenue West", 2015.

c. Kazemian, S., et al. "A state of the art review of peat: Geotechnical engineering perspective", *International Journal of Physical Sciences*, 6(8), 1974-1981, 2011.

d. Mesri, G. and Ajlouni, M. "Engineering Properties of Fibrous Peats", *Journal of Geotechnical and Geoenvironmental Engineering*, 133(7), 850-866, 2007.

CELRE-EC-G

SUBJECT: Feasibility Stage Subgrade Settlement and Island Consolidation Potential, 40th Avenue Proposed Island Creation Sites.

e. U.S. Army Corps of Engineers Engineer Manual (EM) 1110-1-1904, "Settlement Analysis", (1990).

5. A map of the boring locations where GEI performed their 2014 investigation program is provided as an enclosure. The map also includes an overlay of the proposed island locations and the 1908 Sanborn Fire Insurance map showing the former location of docks and other structures which are no longer present on site.

6. The thickest proposed dredge material placement of 12 feet is located at the proposed island near Boring Location G-7.

7. Based on GEI's 2014 investigation, the subgrade beneath the proposed island locations have strong local heterogeneities but broadly consist of 5 to 20 feet of very loose/very soft layers of silt, organic silt, silty sand, and peat deposits underlain by slightly more competent layers of sand, silt and silty clay (low and high plasticity).

8. Material identified as peat may represent pre-industrial deposits related to the formation of St. Louis Bay during the Glacial Epoch or (more likely) represent byproducts from post-1850 industrial activities taking place on the Bay (e.g. the extensive logging, milling and shipping operations that reached their peak around the turn of the 20th century). Much of the 40th Avenue South site is within the footprint of the former Alger Smith Lumber Docks & Yard (see enclosed map) and organic deposits encountered in this area may represent wastage, dumping and loss related to the timber and sawmill specific industrial activity at this site.

9. The total settlement of the proposed island creation site is a combination of the subgrade settlement beneath the proposed islands and the consolidation of the placed dredge material used to create the islands. Item 10 describes the subgrade settlement beneath the proposed islands and Item 11 describes consolidation within the placed dredge material.

10. For feasibility and planning purposes, our best feasibility stage estimate of subgrade settlement beneath the proposed islands is 10% to 25% the total proposed island fill height. For example, for an island dredge material fill thickness of 12 feet, this would represent an estimate 1 to 3 feet of subgrade consolidation. Most of the subgrade settlement will occur within the first few years following island creation. However, thick deposits of high plasticity clay were encountered at several of the boring locations which may indicate that subgrade consolidation will continue beyond 5+ years as these deposits consolidate relatively slowly. During the design process, this estimate will be further refined.

CELRE-EC-G

SUBJECT: Feasibility Stage Subgrade Settlement and Island Consolidation Potential, 40th Avenue Proposed Island Creation Sites.

11. The amount and time rate of consolidation that will occur within the dredged material following island creation placement is highly dependent on the type of material that will be placed at the sites. The relatively sandy material placed during the FY13 and FY14 seasons of the 21st Avenue Pilot Project consolidated almost immediately following placement with little evidence of continued consolidation. Finer grained material will have a longer period of consolidation however.

12. Based on the potential for subgrade settlement and consolidation, additional placements (beyond the initial island creation placement) of dredge material on the created islands to maintain target elevations may be required.

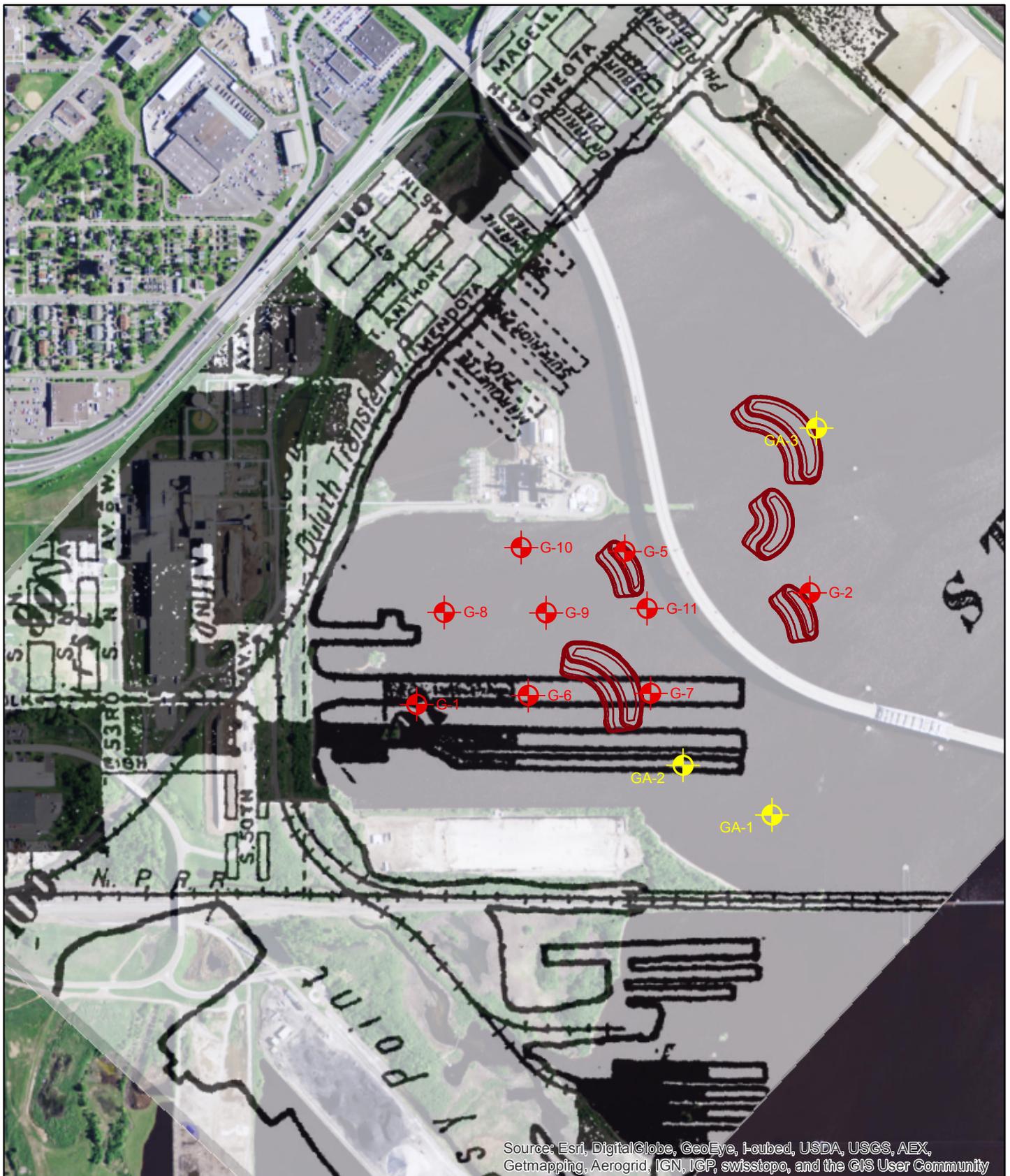
13. It is strongly recommended that extensive use of settlement plates, bathymetric surveys, land surveys and physical observation of the placed islands be conducted to monitor the overall performance of the created islands and refine design performance estimates with actual field results.

14. Point of Contact for this memorandum is the undersigned at 313-226-3529 or luke.vermeulen@usace.army.mil.

 Digitally signed by
VERMEULEN.LUKE.1270248051
DN: c=US, o=U.S. Government,
ou=DoD, ou=PKI, ou=USA,
cn=VERMEULEN.LUKE.1270248051
Date: 2015.07.07 14:14:44 -04'00'

Encl
Project Area Map with Historical Overlay

Luke Vermeulen
Geotechnical Engineer
Geotech and Structures Branch



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Historical South 40th Ave

40th Avenue RAP, Duluth MN

Legend

-  Geotechnical Boring Locations
-  Geotechnical Boring & Env. Sampling Locations
-  40th Island Creation Areas



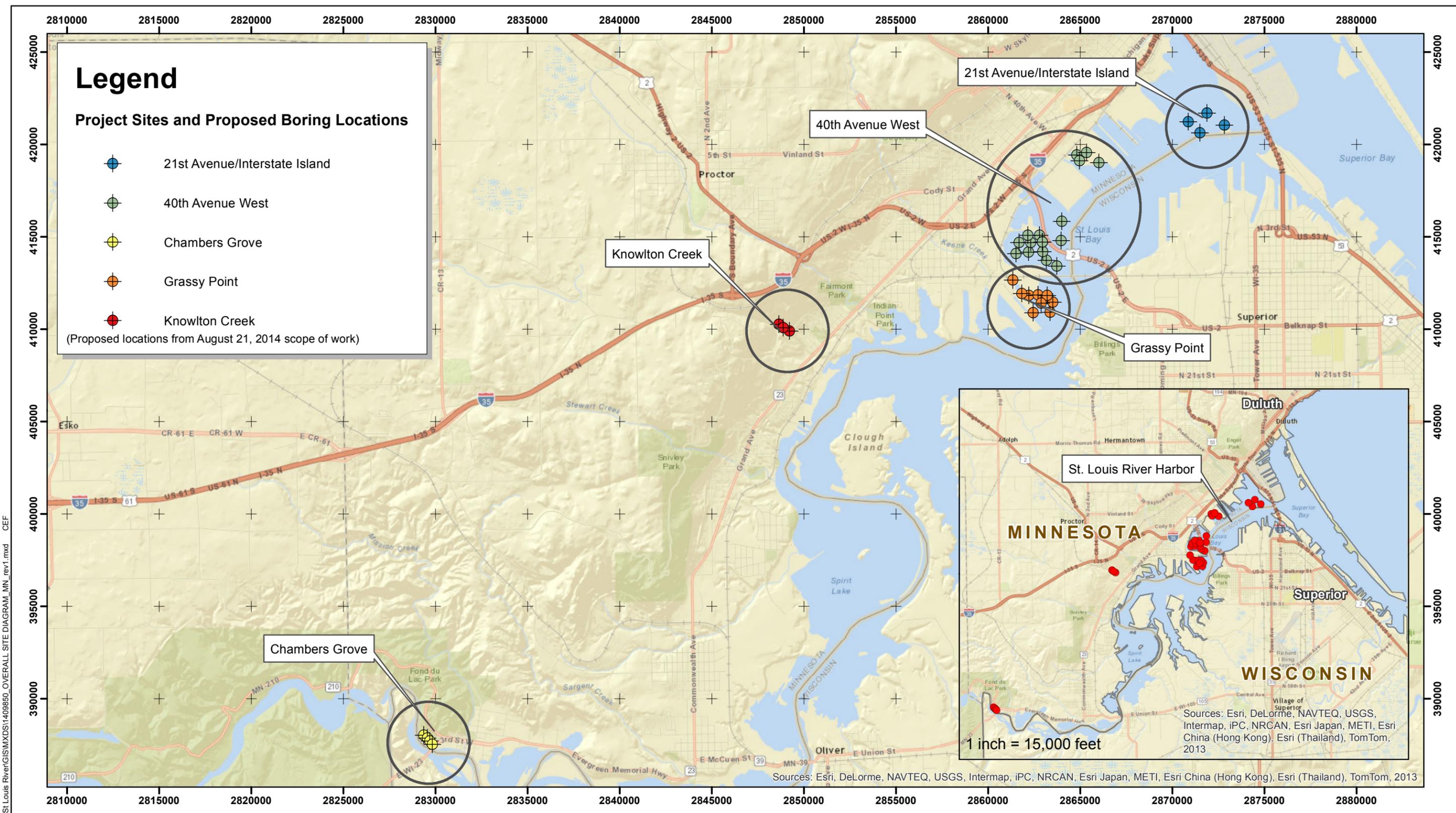
Notes: NAD83 State Plane Minnesota North FIPS 2201 Coordinate System
Historical Map: 1908 Duluth Sanborn Map

AS OF Date: 7/7/2015

Appendix A

Figures

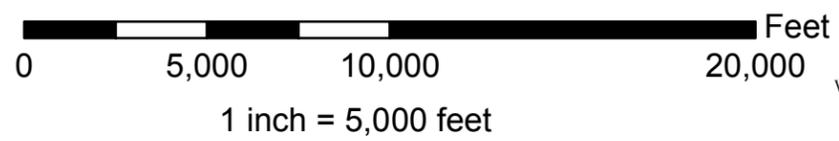
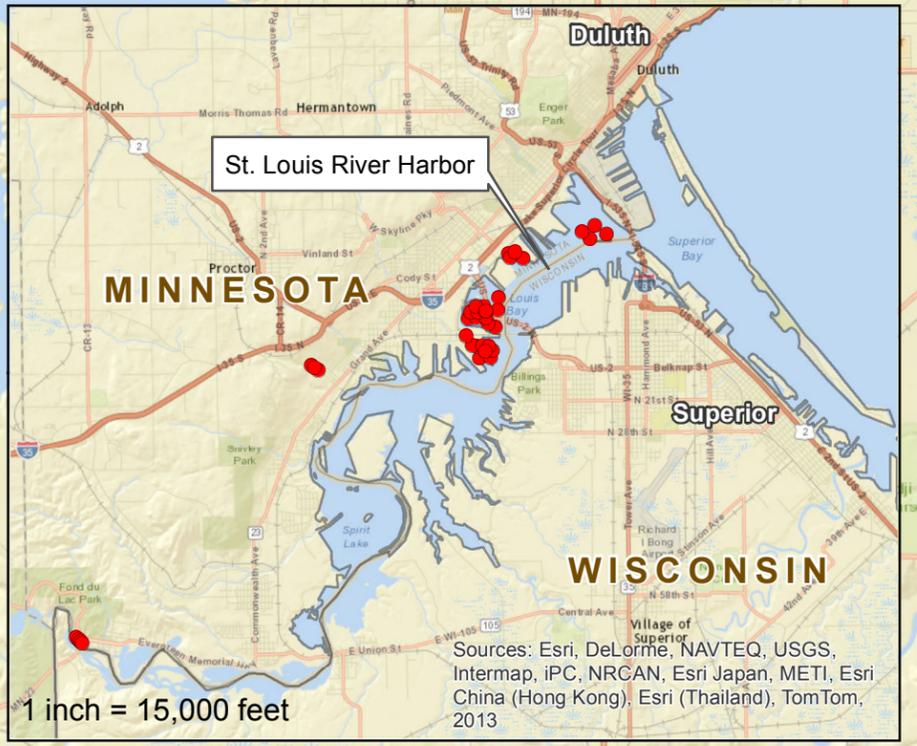
- Figure 1 – Proposed Boring Locations
- Figure 2 – As Drilled Boring Locations
- Figure 3 – Boring Location Difference
- Figure 4 – Location of Cross-Section Profiles
- Figure 5 – Cross Section Profile A-A'
- Figure 6 – Cross Section Profile B-B'
- Figure 7 – Cross Section Profile C-C'



Legend

Project Sites and Proposed Boring Locations

- 21st Avenue/Interstate Island
- 40th Avenue West
- Chambers Grove
- Grassy Point
- Knowlton Creek
(Proposed locations from August 21, 2014 scope of work)



United States Army Corps of Engineers

FY14 St. Louis River Area of Concern
Geotechnical Investigation - Specific Area of Interest
(W912P6-14-D-0002), Delivery Order DC01



1409850

SITE LOCATION AND SAMPLING SITES WITHIN THE AREA OF CONCERN

DATE: JANUARY 2015

FIGURE 1

20OCT2014 J:\2014\1409850_St.Louis.River\GIS\MXD\1409850_OVERALL_SITE_DIAGRAM_MN_rev1.mxd CEF

Projected CoordinateSystem: NAD_1983_StatePlane_Minnesota_North_FIPS_2201_Feet

Legend

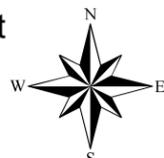
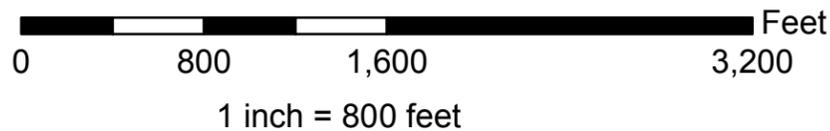
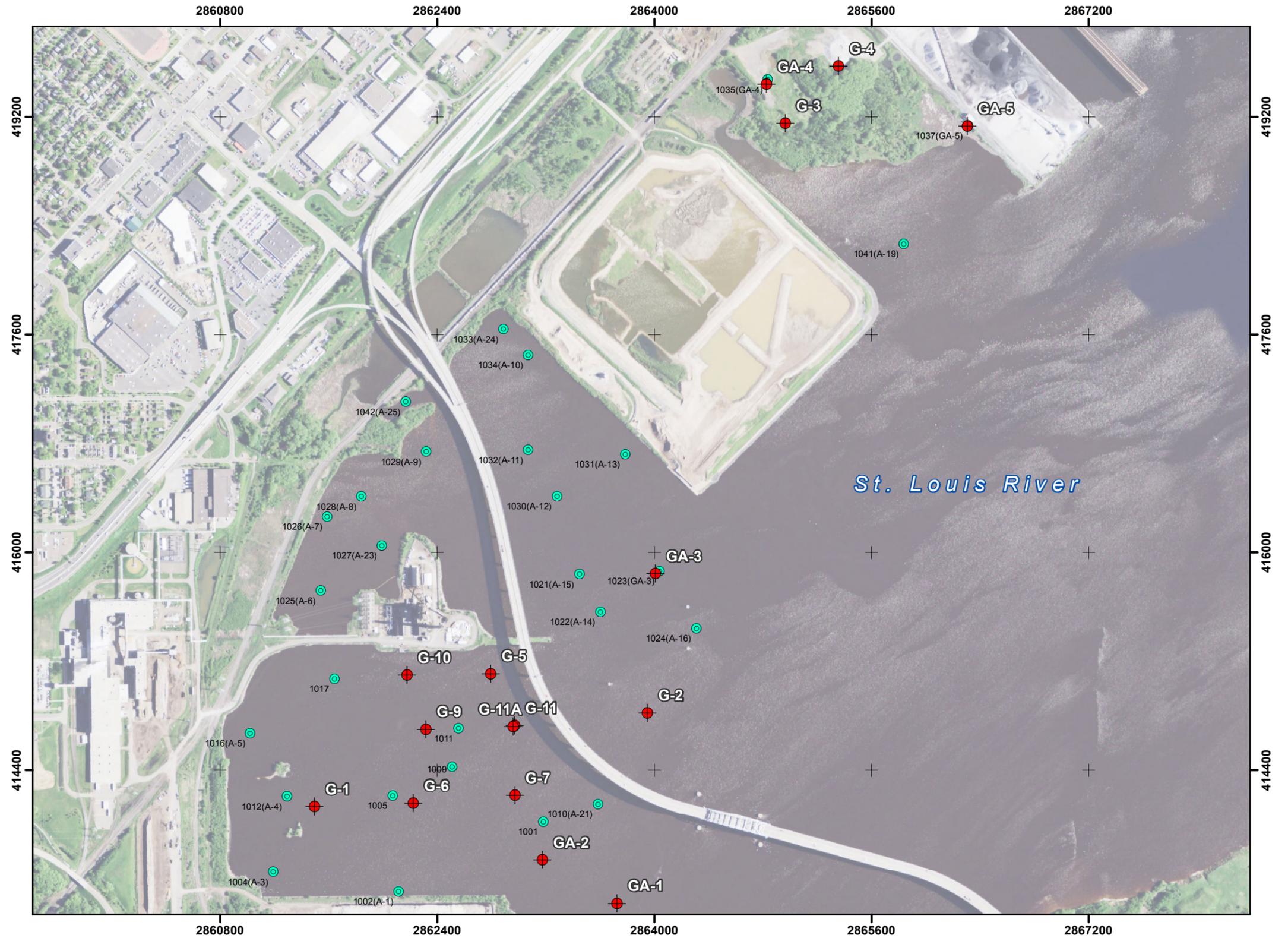
-  As Drilled Boring Locations
-  Environmental Sample Locations

Boring Number	Northing	Easting
GA-1	413,422.0	2,863,727.0
GA-2	413,741.0	2,863,178.0
GA-3	415,845.0	2,864,010.0
GA-4	419,442.5	2,864,828.1
GA-5	419,133.6	2,866,307.8
G-1	414,133.0	2,861,499.0
G-2	414,822.0	2,863,952.0
G-3	419,154.1	2,864,967.6
G-4	419,573.3	2,865,360.1
G-5	415,110.0	2,862,796.0
G-6	414,159.0	2,862,225.0
G-7	414,215.0	2,862,974.0
G-8	Not Drilled	
G-9	414,702.0	2,862,319.0
G-10	415,099.0	2,862,180.0
G-11	414,729.0	2,862,972.0
G-11A	414,719.0	2,862,962.0

Notes:
 1. Location of water borings determined using a Trimble GEO 7X hand-held GPS receiver. Location of borings on land determined by Alta Land Survey.
 2. Environmental boring data provided by Stantec



1 in = 10,000 feet



United States Army Corps of Engineers

FY14 St. Louis River Area of Concern
 Geotechnical Investigation - Specific Area of Interest
 (W912P6-14-D-0002), Delivery Order DC01

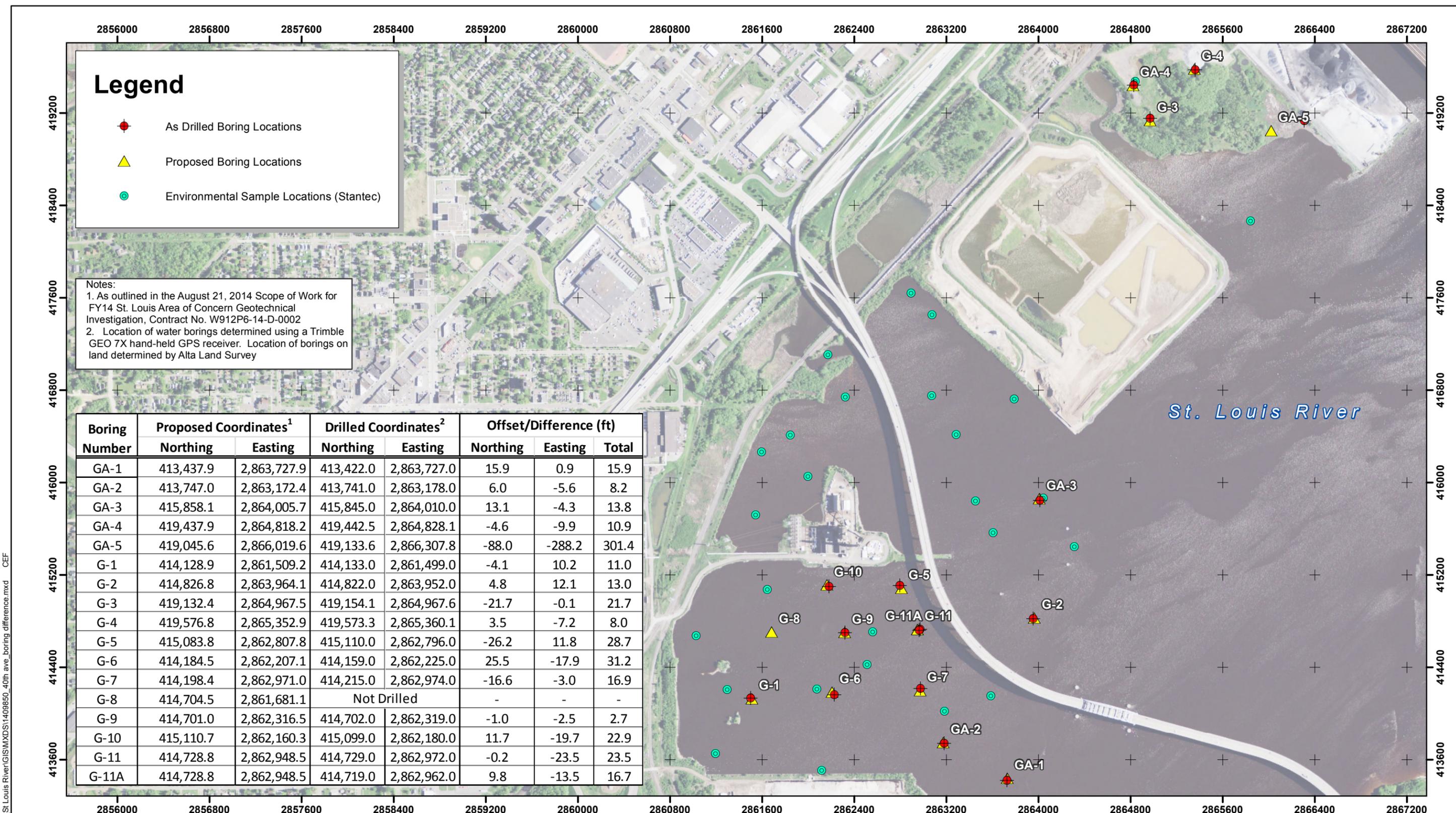


1409850

40TH AVENUE WEST
 AS DRILLED BORING LOCATIONS

DATE: JANUARY 2015

FIGURE 2



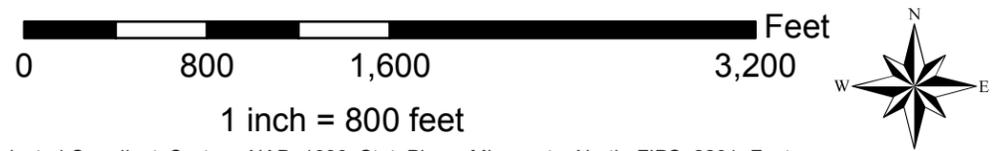
Legend

- As Drilled Boring Locations
- ▲ Proposed Boring Locations
- Environmental Sample Locations (Stantec)

Notes:
 1. As outlined in the August 21, 2014 Scope of Work for FY14 St. Louis Area of Concern Geotechnical Investigation, Contract No. W912P6-14-D-0002
 2. Location of water borings determined using a Trimble GEO 7X hand-held GPS receiver. Location of borings on land determined by Alta Land Survey

Boring Number	Proposed Coordinates ¹		Drilled Coordinates ²		Offset/Difference (ft)		
	Northing	Easting	Northing	Easting	Northing	Easting	Total
GA-1	413,437.9	2,863,727.9	413,422.0	2,863,727.0	15.9	0.9	15.9
GA-2	413,747.0	2,863,172.4	413,741.0	2,863,178.0	6.0	-5.6	8.2
GA-3	415,858.1	2,864,005.7	415,845.0	2,864,010.0	13.1	-4.3	13.8
GA-4	419,437.9	2,864,818.2	419,442.5	2,864,828.1	-4.6	-9.9	10.9
GA-5	419,045.6	2,866,019.6	419,133.6	2,866,307.8	-88.0	-288.2	301.4
G-1	414,128.9	2,861,509.2	414,133.0	2,861,499.0	-4.1	10.2	11.0
G-2	414,826.8	2,863,964.1	414,822.0	2,863,952.0	4.8	12.1	13.0
G-3	419,132.4	2,864,967.5	419,154.1	2,864,967.6	-21.7	-0.1	21.7
G-4	419,576.8	2,865,352.9	419,573.3	2,865,360.1	3.5	-7.2	8.0
G-5	415,083.8	2,862,807.8	415,110.0	2,862,796.0	-26.2	11.8	28.7
G-6	414,184.5	2,862,207.1	414,159.0	2,862,225.0	25.5	-17.9	31.2
G-7	414,198.4	2,862,971.0	414,215.0	2,862,974.0	-16.6	-3.0	16.9
G-8	414,704.5	2,861,681.1	Not Drilled		-	-	-
G-9	414,701.0	2,862,316.5	414,702.0	2,862,319.0	-1.0	-2.5	2.7
G-10	415,110.7	2,862,160.3	415,099.0	2,862,180.0	11.7	-19.7	22.9
G-11	414,728.8	2,862,948.5	414,729.0	2,862,972.0	-0.2	-23.5	23.5
G-11A	414,728.8	2,862,948.5	414,719.0	2,862,962.0	9.8	-13.5	16.7

06NOV2014 J:\2014\1409850_St.Louis.River\GIS\MXD\1409850_40th_ave_boring_difference.mxd CEF



United States Army Corps of Engineers FY14 St. Louis River Area of Concern Geotechnical Investigation - Specific Area of Interest (W912P6-14-D-0002), Delivery Order DC01	 1409850	40TH AVENUE WEST BORING LOCATION DIFFERENCE - PROPOSED VS. AS DRILLED LOCATIONS DATE: JANUARY 2015
		FIGURE 3

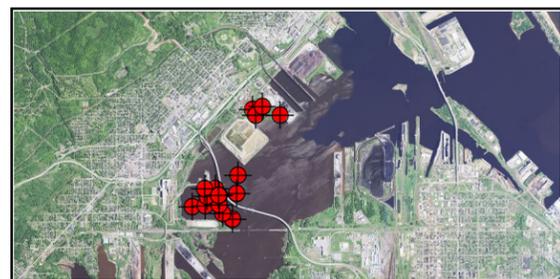
Projected CoordinateSystem: NAD_1983_StatePlane_Minnesota_North_FIPS_2201_Feet
 Background Image: http://gis.apfo.usda.gov/arcgis/services/NAIP/Minnesota_2013_1m_NC/ImageServer

Legend

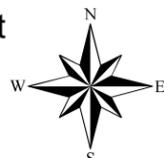
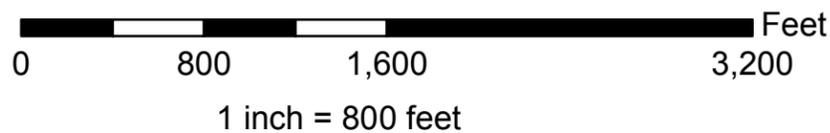
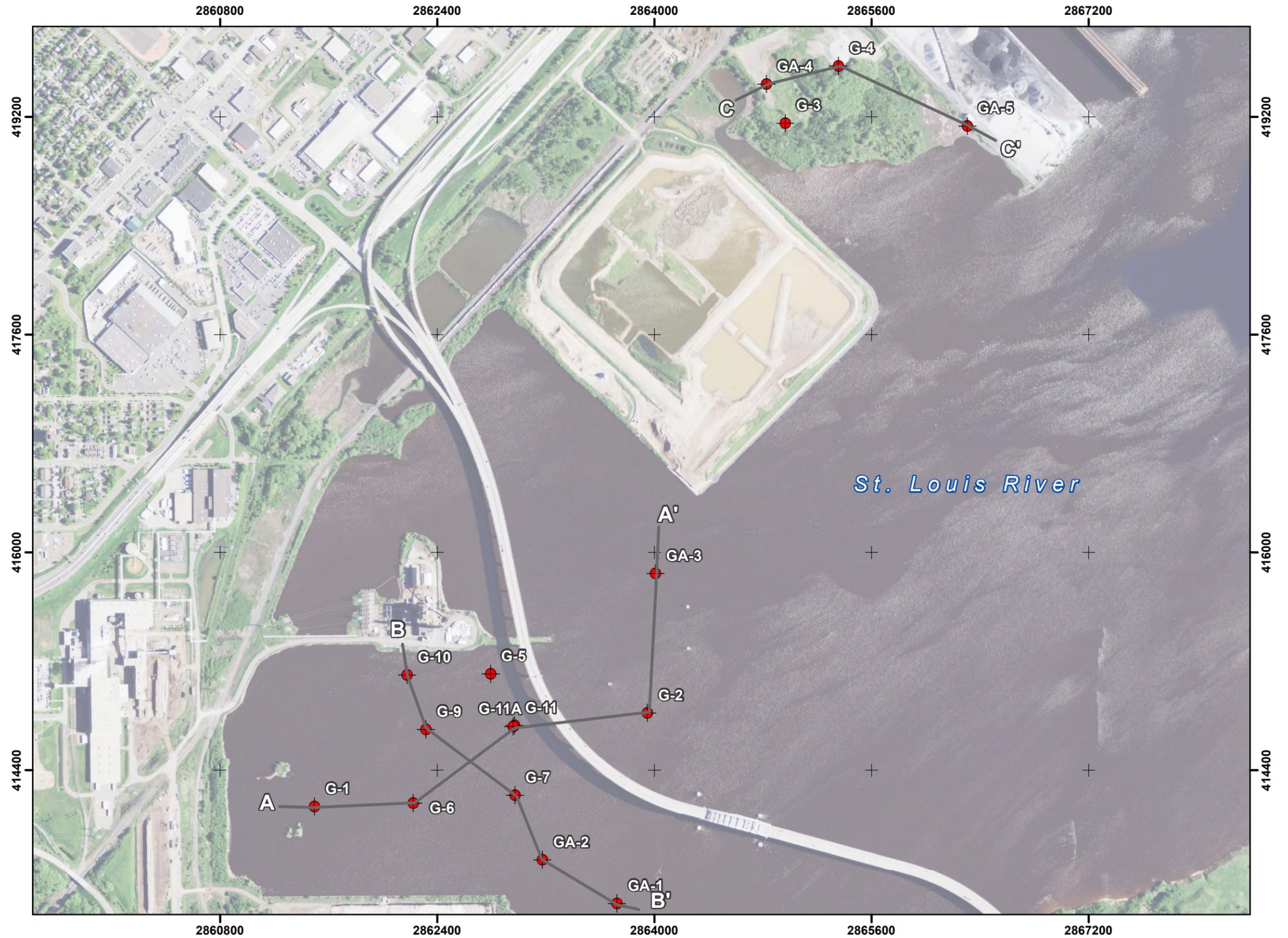
 As Drilled Boring Locations

Boring Number	Northing	Easting
GA-1	413,422.0	2,863,727.0
GA-2	413,741.0	2,863,178.0
GA-3	415,845.0	2,864,010.0
GA-4	419,442.5	2,864,828.1
GA-5	419,133.6	2,866,307.8
G-1	414,133.0	2,861,499.0
G-2	414,822.0	2,863,952.0
G-3	419,154.1	2,864,967.6
G-4	419,573.3	2,865,360.1
G-5	415,110.0	2,862,796.0
G-6	414,159.0	2,862,225.0
G-7	414,215.0	2,862,974.0
G-8	Not Drilled	
G-9	414,702.0	2,862,319.0
G-10	415,099.0	2,862,180.0
G-11	414,729.0	2,862,972.0
G-11A	414,719.0	2,862,962.0

Notes:
 1. Location of water borings determined using a Trimble GEO 7X hand-held GPS receiver. Location of borings on land determined by Alta Land Survey.
 2. Environmental boring data provided by Stantec



1 in = 10,000 feet



United States Army Corps of Engineers

FY14 St. Louis River Area of Concern
 Geotechnical Investigation - Specific Area of Interest
 (W912P6-14-D-0002), Delivery Order DC01

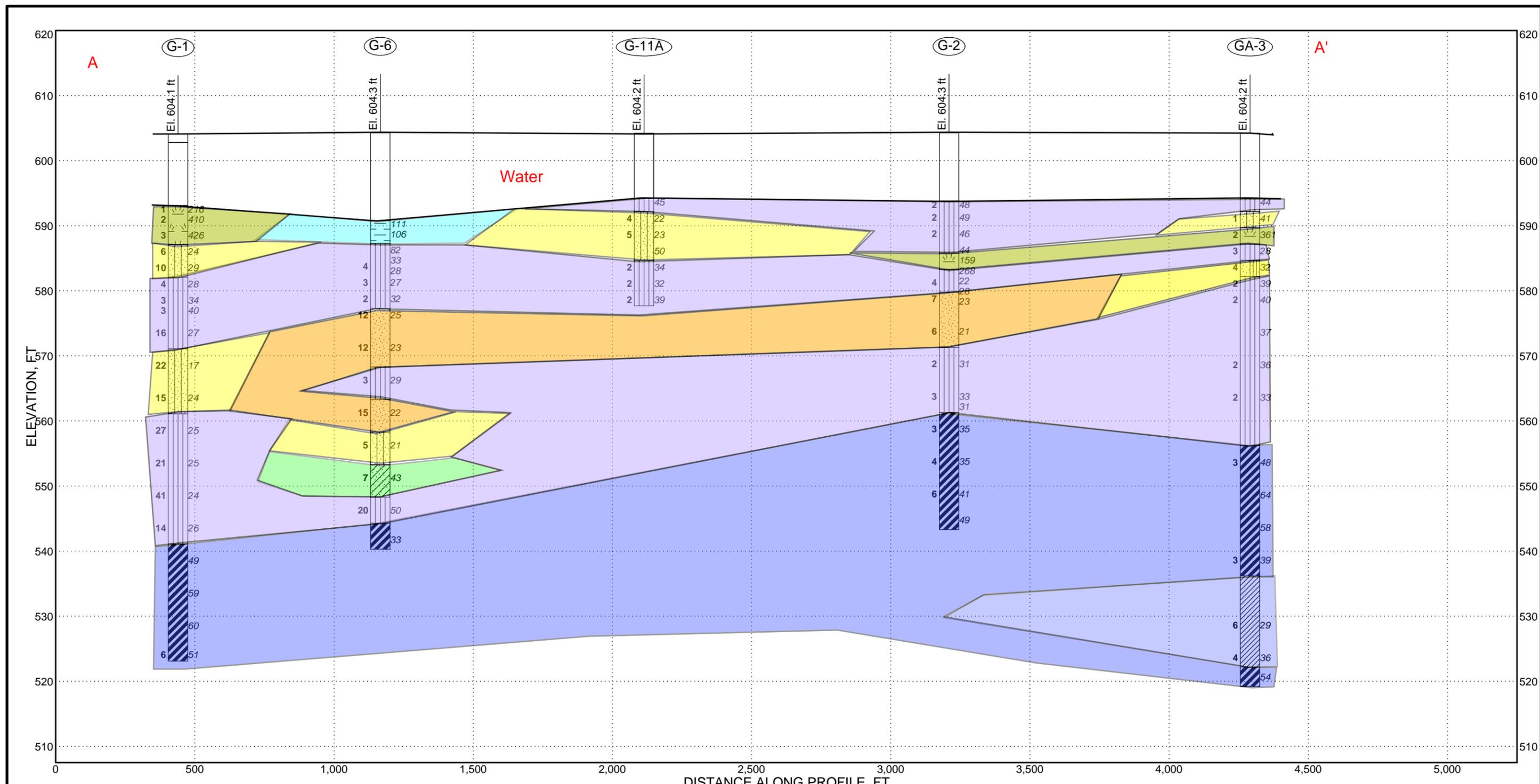


1409850

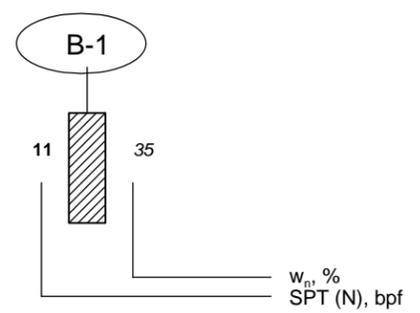
40TH AVENUE WEST
 LOCATION OF CROSS-SECTION PROFILE

DATE: JANUARY 2015

FIGURE 4



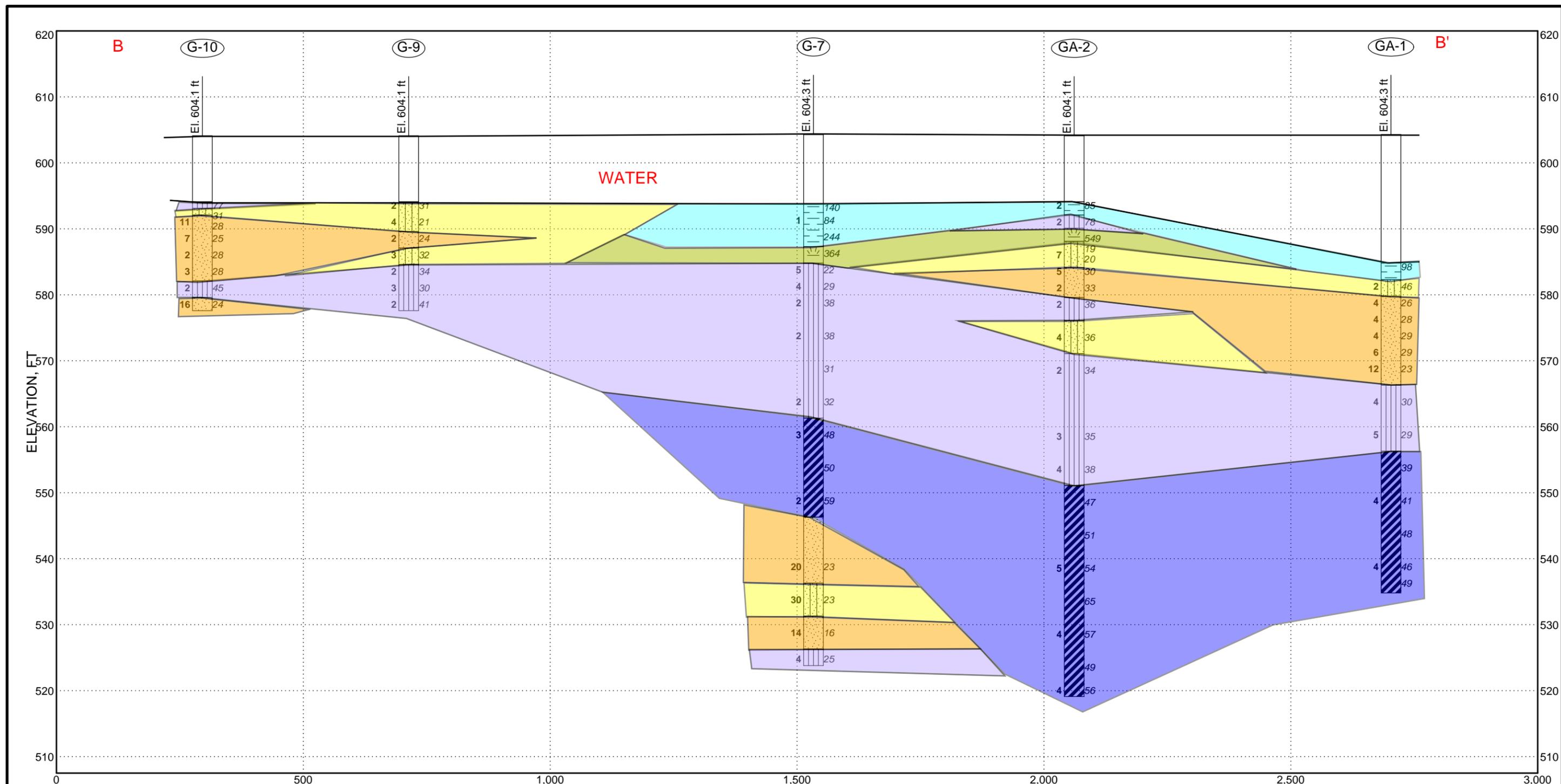
Legend



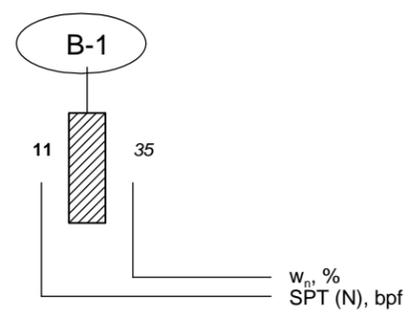
DRAWING IS SHOWN WITH A 23.5x VERTICAL EXAGGERATION

APPROXIMATE VERTICAL SCALE: 1 inch = 15 ft APPROXIMATE HORIZONTAL SCALE: 1 inch = 350 ft

United States Army Corps of Engineers FY14 St. Louis River Area of Concern Geotechnical Investigation - Specific Area of Interest (W912P6-14-D-002), Delivery Order DC01	 Project: 1409850	Figure 5 - Cross Section Profile A-A' January 2015	Fig. 5
---	----------------------	--	--------



- Legend**
- ML
 - SM
 - SP
 - OL
 - PT
 - CH

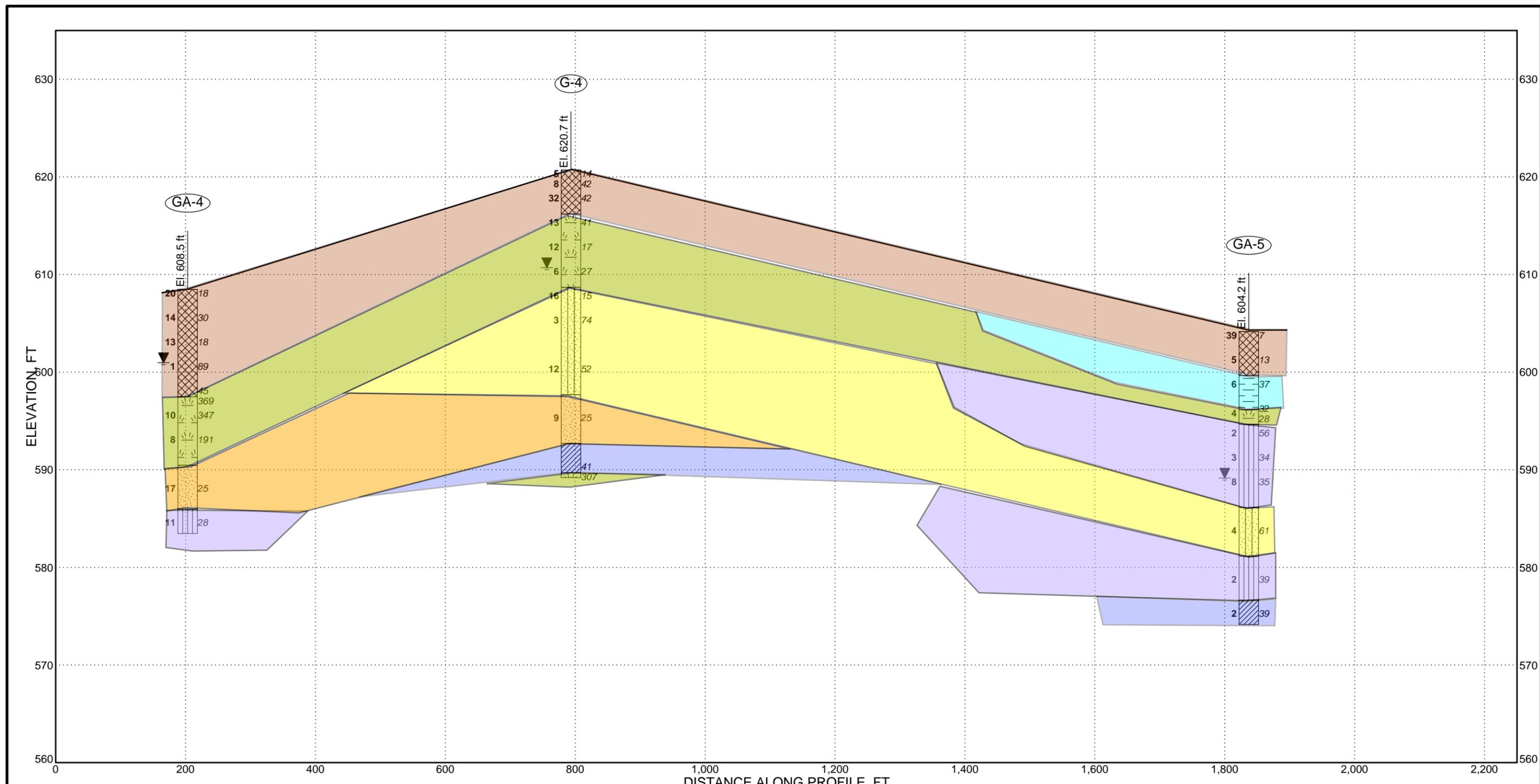


DRAWING IS SHOWN WITH A 13.5x VERTICAL EXAGGERATION

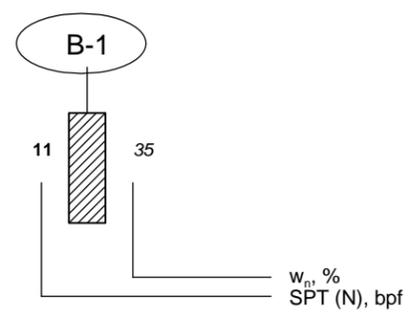
APPROXIMATE VERTICAL SCALE: 1 inch = 15 ft

APPROXIMATE HORIZONTAL SCALE: 1 inch = 200 ft

<p>United States Army Corps of Engineers</p> <p>FY14 St. Louis River Area of Concern Geotechnical Investigation - Specific Area of Interest (W912P6-14-D-0002), Delivery Order DC01</p>	<p>GEI Consultants</p>	<p>Figure 6 - Cross Section Profile B-B'</p>
Project: 1409850	January 2015	Fig. 6



- Legend**
- FILL
 - PT
 - SM
 - SP
 - CL
 - ML
 - OL



DRAWING IS SHOWN WITH A 15x VERTICAL EXAGGERATION

APPROXIMATE VERTICAL SCALE: 1 inch = 10 ft

APPROXIMATE HORIZONTAL SCALE: 1 inch = 150 ft

United States Army Corps of Engineers FY14 St. Louis River Area of Concern Geotechnical Investigation - Specific Area of Interest (W912P6-14-D-0002), Delivery Order DC01	 GEI Consultants	Figure 7 - Cross Section Profile C-C' Project: 1409850 January 2015 Fig. 7
--	----------------------------	--

Appendix D

Tables

- Table 1 – Boring Location, Elevation, and Depth Summary
- Table 2 – Summary of Laboratory Testing Results

TABLE 1
St. Louis River Area of Concern Geotechnical Investigation - FY14
Boring Location, Elevation and Depth Summary

Boring Number	Drilled Coordinates ¹		Date Drilled	Total Depth Drilled (feet)	Elevation Top of Water ²	Elevation Barge Deck	Height of Deck Above Water (feet)	Depth of Water (feet)	Elevation Top of Sediment (feet)	Elevation Top of Ground ³
	Northing	Easting								
<i>40th Avenue West</i>										
GA-1	413422	2863727	9/24/2014	69.5 from barge deck	603.0	604.3	1.3	18.2	584.8	NA
GA-2	413741	2863178	9/22/2014	85.0 from barge deck	602.8	604.1	1.3	8.7	594.1	NA
GA-3	415845	2864010	9/23/2014	85.0 from barge deck	602.9	604.2	1.3	8.7	594.2	NA
GA-4	419442.5	2864828.1	9/30/2014	25.0	NA	NA	NA	NA	NA	608.47
GA-5	419133.6	2866307.8	9/30/2014	30.0	NA	NA	NA	NA	NA	604.15
G-1	414133	2861499	9/20/2014	81.0 from barge deck	602.8	604.1	1.3	9.7	593.1	NA
G-2	414822	2863952	9/12/2014	61.0 from barge deck	603.0	604.3	1.3	9.2	593.8	NA
G-3	419154.1	2864967.6	9/30/2014	30.0	NA	NA	NA	NA	NA	612.88
G-4	419573.3	2865360.1	9/30/2014	31.5	NA	NA	NA	NA	NA	620.65
G-5	415110	2862796	9/24/2014	62.0 from barge deck	603.0	604.3	1.3	8.2	594.8	NA
G-6	414159	2862225	9/12/2014	64.0 from barge deck	603.0	604.3	1.3	12.2	590.8	NA
G-7	414215	2862974	9/25/2014	80.5 from barge deck	603.0	604.3	1.3	9.2	593.8	NA
G-8	Not Drilled									
G-9	414702	2862319	9/22/2014	26.5 from barge deck	602.8	604.1	1.3	8.7	594.1	NA
G-10	415099	2862180	9/22/2014	26.5 from barge deck	602.8	604.1	1.3	8.7	594.1	NA
G-11	414729	2862972	9/23/2014	26.5 from barge deck	602.9	604.2	1.3	9.0	593.9	NA
G-11A	414719	2862962	9/11/2014	26.5 from barge deck	602.9	604.2	1.3	8.7	594.2	NA

1 = Projected Coordinate System NAD 1983 State Plane Minnesota North FIPS 2201. Location of water borings determined using a Trimble GEO 7X hand-held GPS receiver. Location of borings on land determined by Alta Land Survey Company.

2 = Water Level of Lake Superior recorded at NOAA Station 9099064 Duluth, MN, and averaged between 8:00 am and 5:00 pm local time. Water level elevation in 1985 International Great Lakes Datum (IGLD85)

3 = Elevation of ground surface in 1988 North American Vertical Datum 1988 (NAVD88). Surveyed by Alta Land Survey Company

TABLE 2
Proposed Laboratory Testing Program
FY14 St. Louis River Area of Concern Geotechnical Investigation
40th Avenue

Test Description	Test Method	Number of Tests	Remarks
Visual Classification	ASTM D2488	175	All samples
Moisture Content	ASTM D2216	175	Each cohesive or silt sample
Laboratory Hand Penetrometer		175	Each cohesive sample
Atterberg Limits	ASTM D4318	17	One per stratum of cohesive material
Hydrometer (Combined) Analysis	ASTM D422	17	One per Atterberg Limit (same sample)
Sieve Analysis	ASTM D6913	17	One per stratum of non-cohesive material
U-U (Q) Test (incl. extrusion, unit weight & moisture)	ASTM D2850	7	Selected undisturbed cohesive samples (3 point, 0.5x, 1x and 2x effective overburden weight)
Direct Shear (incl. extrusion, unit weight, & moisture)	ASTM D3080	5	Selected undisturbed cohesive samples (3 point, 0.5x, 1.5x and 2x effective overburden weight)
One Dimensional Consolidation (incl. specific gravity)	ASTM D4546	5	Selected cohesive samples (goal- 1 per cohesive stratum)
Percent Organic (Loss on Ignition)	ASTM D2974	5	Selected Peat layers (if encountered)

Appendix E

Boring Logs

DRILLING LOG	DIVISION USACE	INSTALLATION Detroit District	SHEET 1 OF 5 SHEETS
	1. PROJECT FY14 SLRAOC - 40th Avenue		10. SIZE AND TYPE OF BIT 3 7/8" Roller Bit
2. LOCATION (Coordinates or Station) MN State Plane North NAD 83 N 414,133 E 2,861,499		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY Strata Earth Services, LLC		12. MANUFACTURER'S DESIGNATION OF DRILL Diedrich-25	
4. HOLE NO. (As shown on drawing title and file number) G-1		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED UNDISTURBED
5. NAME OF DRILLER B. McCarthy		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED --- DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN (FT.)		16. DATE HOLE STARTED 9/20/2014	COMPLETED 9/20/2014
8. DEPTH DRILLED INTO ROCK (FT.)		17. ELEVATION TOP OF HOLE +604.1 IGLD85	
9. TOTAL DEPTH OF HOLE (FT.) 81.0		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+604.1	0.0		Barge Deck			
+602.8	1.3		Water - St. Louis River			
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
+593.1	11.0					
	11		Peat - some organic silt - dark brown - very loose - wet (Pt)	46.7	1 11.0 12.5	WOH, WOH, 1 N = 1 WC = 215.9%
+591.6	12.5		Peat - black - very loose - wet (Pt)	73.3	2 12.5 14.0	2, 1, 1 (3" Split spoon) N = 2 WC = 410.4%
	13					

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.1		Hole No. G-1		
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District			
			SHEET 2 OF 5 SHEETS			
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+587.1	15.0		Peat - black - very loose - wet (Pt) (continued)	46.7	3 15.0 16.5	1 1, 2 (3" Split spoon) N = 3 WC = 426.2%
+582.1	17.0		Silty fine sand - trace clay - loose to medium dense - wet (SM)	73.3	4 17.5 19.0	3, 2, 4 (3" Split spoon) N = 6 WC = 24.4%
+582.1	20.0		Silty fine sand - trace clay - loose to medium dense - wet (SM)	73.3	5 20.0 21.5	6, 5, 5 N = 10 WC = 28.8%
+576.1	22.0		Silty fine sand - trace clay - loose to medium dense - wet (SM)	80.0	6 22.5 24.0	2, 2, 2 N = 4 Qp = 0.25 tsf WC = 27.9%
+576.1	25.0		Silty fine sand - trace clay - loose to medium dense - wet (SM)	60.0	7 25.0	3 WC = 33.8%
+576.1	26.0		Silty fine sand - trace clay - loose to medium dense - wet (SM)	50.0	25.5 7A 25.5 26.5	2, 1 N = 3 WC = 40.1%
+576.1	28.0		Silty fine sand - trace clay - loose to medium dense - wet (SM)			
	29.0		Silt - trace to some fine sand - brown - medium dense - wet (ML)			
	30.0		Silt - trace to some fine sand - brown - medium dense - wet (ML)	73.3	8 30.0 31.5	10, 8, 8 N = 16 WC = 27.3%
	31.0		Silt - trace to some fine sand - brown - medium dense - wet (ML)			

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.1		Hole No. G-1			
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District			SHEET 3 OF 5 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g	
+571.1	33.0		Silt - trace to some fine sand - brown - medium dense - wet (ML) (continued)				
	33		Silty fine sand - brown - medium dense - wet (SM)				
	34						
	35			66.7	9 35.0 36.5	11, 12, 10 N = 21 WC = 17.0%	
	36						
	37						
	38						
	39						
	40			73.3	10 40.0 41.5	7, 7, 8 N = 15 WC = 23.9%	
	41						
	42						
+561.1	43.0		Silt - trace to some clay and fine sand - brown - medium to dense - wet (ML)				
	43		Silt - trace to some clay and fine sand - brown - medium to dense - wet (ML)				
	44						
	45			80.0	11 45.0 46.5	8, 12, 15 N = 27 WC = 25.1%	
	46						
	47						
	48						
	49						

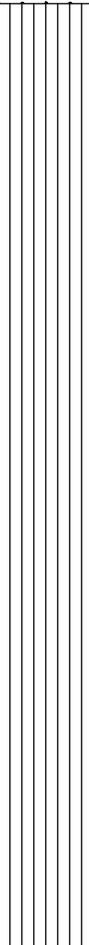
DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.1		Hole No. G-1			
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District			SHEET 4 OF 5 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g	
	51		Silt - trace to some clay and fine sand - brown - medium to dense - wet (ML) (continued)	66.7	12 50.0 51.5	8, 10, 11 N = 21 WC = 25.0%	
	52						
	53						
	54						
	55			66.7	13 55.0 56.5	13, 19, 22 N = 41 WC = 24.0%	
	56						
	57						
	58						
	59						
	60			93.3	14 60.0 61.5	12, 7, 7 N = 14 WC = 26.3%	
	61						
	62						
+541.1	63.0						
	63		Clay - some silt - trace fine to medium sand - brown - very stiff to hard (CH)				
	64						
	65				100.0	15 65.0 67.0	Torvane (Su) = 2.5 tsf to 4.5 tsf WC = 49.4% ST: 65'-67'
	66						
	67						

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.1		Hole No. G-1					
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District		SHEET 5 OF 5 SHEETS				
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g			
+535.6	68.5		Clay - trace to some silt - trace fine sand - brown - hard to stiff (CH)			Torvane (Su) = 3.5 tsf to 5.0 tsf WC = 59.0% ST: 70'-72'			
	69						100.0	16 70.0 72.0	
	70								
	71								
	72								
	73								
	74								
	75						75.0	17 75.0 77.0	Torvane (Su) = 3.0 tsf to 4.5 tsf WC = 60.3% ST: 75'-77'
	76								
	77								
	78								
	79								
	80			100.0	18 79.5 81.0	3, 3, 3 N = 6 Qp = 1.0 tsf WC = 50.8%			
+523.1	81.0		End of Boring Boring advanced to 79.5 feet with rock bit and drilling fluid HW casing driven to 11.0 feet below river bottom Boring backfilled with cement bentonite grout						
	82								
	83								
	84								
	85								

DRILLING LOG	DIVISION USACE	INSTALLATION Detroit District	SHEET 1 OF 4 SHEETS
	1. PROJECT FY14 SLRAOC - 40th Avenue		10. SIZE AND TYPE OF BIT 3 7/8" Roller Bit
2. LOCATION (Coordinates or Station) MN State Plane North NAD 83 N 414,822 E 2,863,952		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY Strata Earth Services, LLC		12. MANUFACTURER'S DESIGNATION OF DRILL Diedrich-25	
4. HOLE NO. (As shown on drawing title and file number) G-2		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED UNDISTURBED
5. NAME OF DRILLER B. McCarthy		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED --- DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN (FT.)		16. DATE HOLE STARTED 9/12/2014	COMPLETED 9/12/2014
8. DEPTH DRILLED INTO ROCK (FT.)		17. ELEVATION TOP OF HOLE +604.3 IGLD85	
9. TOTAL DEPTH OF HOLE (FT.) 61.0		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+604.3	0.0		Barge Deck			
+603.0	1.3		Water - St. Louis River			
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
+593.8	10.5					
	11		Silt - some organic silt - trace fine to coarse gravel - dark brown - very loose - wet (ML)	53.3	1 10.5 12.0	1, 1, 1 N = 2 WC = 48.0%
+592.3	12.0					
	13		Silt - some clay - trace fine sand and root fibers - brown - very loose - wet (ML)	73.3	2 12.5 14.0	1, 1, 1 N = 2 WC = 48.7%

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.3		Hole No. G-2			
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District		SHEET 2 OF 4 SHEETS		
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g	
+585.8	15		Silt - some clay - trace fine sand and root fibers - brown - very loose - wet (ML) (continued)	93.3	3 15.0 16.5	WOH, 1, 1 N = 2 WC = 45.9%	
	16						
	17						
	18			90.0	4A 17.5 18.5		WOH, 1 N = 1/6" WC = 43.9%
+583.3	18.5		Peat - trace organic silt - black - very loose to loose - wet (Pt)	100.0	4B 18.5 19.0	1/6" WC = 159.3%	
	19						
	20			60.0	5A 20.0 21.0		1, 4 N = 4/6" WC = 267.5%
+579.8	21.0		Silt - trace fine sand - occasional fine sand seams and layers - brown - loose - wet (ML)	100.0	5B 21.0 21.5	5/6" WC = 22.1%	
	22						
	23			60.0	6 22.5 24.0		2, 2, 2 N = 4 WC = 28.4%
	24						
+579.8	24.5		Fine to medium sand - trace silt - brown - loose - wet (SP)	46.7	7 25.0 26.5	4, 4, 3 N = 7 WC = 23.1%	
	25						
	26						
	27						
	28						
	29						
	30			60.0	8 30.0 31.5	4, 4, 2 N = 6 WC = 21.1%	
	31						

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.3		Hole No. G-2				
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District		SHEET 3 OF 4 SHEETS			
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g		
+571.3	33.0		Fine to medium sand - trace silt - brown - loose - wet (SP) (continued)					
	33		Silt - trace clay and fine sand - brown - very loose - wet (ML)	86.7	9 35.0 36.5	1, 1, 1 N = 2 WC = 30.5%		
	34							
	35							
	36							
	37							
	38							
	39							
	40					75.0	10A 40.0 41.2	2, 1, 2 N = 3 WC = 33.2%
	41							
	42					23.1	10B 41.2 42.5	WC = 31.3%
+561.3	43.0		Silty clay - trace fine sand - brown - soft to hard (CH)					
	43							
	44							
	45					100.0	11 45.0 46.5	2, 1, 2 N = 3 Qp = 0.25 tsf WC = 35.1%
	46							
	47							
	48							
	49							

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.3		Hole No. G-2		
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District		SHEET 4 OF 4 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
	51		Silty clay - trace fine sand - brown - soft to hard (CH) (continued)	100.0	12 50.0 51.5	2, 2, 2 N = 4 Qp = 0.75 tsf WC = 35.2%
	52					
	53					
	54					
	55					
	56			100.0	13 55.0 56.5	2, 3, 3 N = 6 Qp = 0.75 tsf WC = 40.5%
	57					
	58					
	59					
	60			100.0	14 59.0 61.0	Torvane (Su) = 2.5 tsf to 2.0 tsf WC = 48.8% ST: 59'-61'
+543.3	61.0					
	62		End of Boring Boring advanced to 59.0 feet with rock bit and drilling fluid HW casing driven to 9.5 feet below river bottom Boring backfilled with cement bentonite grout			
	63					
	64					
	65					
	66					
	67					

DRILLING LOG	DIVISION USACE	INSTALLATION Detroit District	SHEET 1
			OF 2 SHEETS
1. PROJECT FY14 SLRAOC - 40th Avenue		10. SIZE AND TYPE OF BIT 3 7/8" Roller Bit	
2. LOCATION (Coordinates or Station) MN State Plane North NAD 83 N 419,154 E 2,864,968		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY Strata Earth Services, LLC		12. MANUFACTURER'S DESIGNATION OF DRILL Diedrich-25	
4. HOLE NO. (As shown on drawing title and file number) G-3		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED : UNDISTURBED :	
5. NAME OF DRILLER B. McCarthy		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED --- DEG. FROM VERT.		15. ELEVATION GROUND WATER 602.9	
7. THICKNESS OF OVERBURDEN (FT.)		16. DATE HOLE STARTED 9/30/2014 COMPLETED 9/30/2014	
8. DEPTH DRILLED INTO ROCK (FT.)		17. ELEVATION TOP OF HOLE +612.9 NAVD88	
9. TOTAL DEPTH OF HOLE (FT.) 30.0		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g	
+612.9	0.0		Fill: Silty fine sand - trace fine to coarse gravel - black - loose - moist (SM)	53.3	1 0.0 1.5	1, 2, 3 N = 5 WC = 34.8%	
	1						
	2						
	3			73.3	2 2.5 4.0	3, 3, 3 N = 6 WC = 22.8%	
+608.4	4.5		Peat - trace fine to medium sand - black - loose - moist (Pt)	100.0	3A 5.0 6.0	3, 4 N = 4/6" WC = 45.1%	
	5						
+606.9	6.0		Clay - some silt - trace to some fine to medium sand - trace fine to coarse gravel - occasional organic silt pockets - brown - very stiff to hard (CH)	100.0	3B 6.0 6.5	3/6" Qp = 3.0 tsf WC = 19.8%	
	7						
	8				40.0	4 7.5 9.0	3, 5, 5 N = 10 Qp = 3.0 tsf WC = 22.4%
	9						
	10			100.0	5 10.0 12.0	Torvane (Su) = 4.0 tsf WC = 34.5% ST: 10'-12'	
+600.4	12.5		Silty fine sand - brown - medium dense - wet (SM)	66.7	6 12.5 14.0	4, 8, 8 N = 16 WC = 32%	
	13						

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 612.9		Hole No. G-3		
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District			
			SHEET 2 OF 2 SHEETS			
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+598.4	14.5		Fibrous peat - black - loose - wet (Pt)	60.0	7 15.0 16.5	2, 2, 4 N = 6 WC = 235.8%
	15					
	16					
	17					
+594.9	18.0		Woody peat - brown - loose - wet (Pt)	50.0	8A 20.0 21.0	4, 3 N = 3/6"
	18					
	19					
	20					
+591.9	21.0		Silt - some clay - trace fine sand - brown - loose - wet (ML)	60.0	8B 21.0 21.5	3/6" WC = 45.6%
	21					
	22					
	23					
+589.4	23.5		Fine sand - trace to some silt - brown - medium dense - wet (SP-SM)	66.7	9 25.0 26.5	6, 6, 7 N = 13 WC = 57.2%
	24					
	25					
	26					
	27					
	28					
	29					
+582.9	30.0		End of Boring Boring advanced to 7.5 feet with solid-stem auger Boring advanced from 7.5 to 28.5 feet with rock bit and drilling fluid HW casing driven to 10.0 feet Boring backfilled with cement bentonite grout	66.7	10 28.5 30.0	4, 6, 11 N = 17 WC = 59.0%
	30					
	31					

DRILLING LOG		DIVISION USACE	INSTALLATION Detroit District	SHEET 1 OF 2 SHEETS
1. PROJECT FY14 SLRAOC - 40th Avenue		10. SIZE AND TYPE OF BIT 3 7/8" Roller Bit		
2. LOCATION (Coordinates or Station) MN State Plane North NAD 83 N 419,573 E 2,865,360		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)		
3. DRILLING AGENCY Strata Earth Services, LLC		12. MANUFACTURER'S DESIGNATION OF DRILL Diedrich-25		
4. HOLE NO. (As shown on drawing title and file number) G-4		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		
5. NAME OF DRILLER B. McCarthy		14. TOTAL NUMBER CORE BOXES		
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED --- DEG. FROM VERT.		15. ELEVATION GROUND WATER 610.7		
7. THICKNESS OF OVERBURDEN (FT.)		16. DATE HOLE STARTED 9/30/2014 COMPLETED 9/30/2014		
8. DEPTH DRILLED INTO ROCK (FT.)		17. ELEVATION TOP OF HOLE +620.7 NAVD88		
9. TOTAL DEPTH OF HOLE (FT.) 30.0		18. TOTAL CORE RECOVERY FOR BORING %		
		19. SIGNATURE OF INSPECTOR		

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g		
+620.7	0.0	[Cross-hatched pattern]	Fill: Fine to coarse gravel - some fine to coarse sand - trace silt - gray - loose - moist (GP)	40.0	1A	5 WC = 13.5%		
+620.2	0.5			50.0	0.0			
+618.7	1	[Cross-hatched pattern]	Fill: Silt - some fine sand - brown - loose - moist (ML)		1B	4, 4 N = 8 WC = 42.4%		
	2.0				0.5			
+616.2	3	[Cross-hatched pattern]	Fill: Silty fine to medium sand - trace fine to coarse gravel - black - dense - moist (SM)	33.3	2	4, 14, 18 N = 32 WC = 41.7%		
	4				2.5			
	4.5				4.0			
+608.7	5	[Wavy pattern]	Peat - some fine to medium sand - black - medium dense to loose - moist to wet (Pt)	46.7	3	6, 6, 7 N = 13 WC = 41.1%		
	6				5.0			
	7				6.5			
	8				86.7		4	4, 6, 6 N = 12 WC = 16.6%
	9				7.5			
10		9.0						
+606.2	12.0	[Vertical line pattern]	Silty fine to medium sand - some fine to coarse gravel - medium dense - wet (SM)	46.7	5	3, 3, 3 N = 6 WC = 26.6%		
	13				10.0			
	14				11.5			
+606.2	14.5	[Vertical line pattern]	Fine to coarse sand - some silt and fine to coarse gravel - gray - very loose - wet (SM)	46.7	6	17, 10, 6 N = 162 WC = 15.3%		
	15				12.5			
					14.0			
				33.3	7	3, 2, 1 N = 3 WC = 73.8%		
					15.0			
					16.5			

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 620.7		Hole No. G-4		
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District			
PROJECT			INSTALLATION		SHEET 2 OF 2 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+602.7	17.0 - 18.0		Fine to coarse sand - some silt and fine to coarse gravel - gray - very loose - wet (SM) (continued)			
	18.0 - 23.0		Silty fine sand - trace to some peat - brown - medium dense - wet (SM)	66.7	8 20.0 21.5	4, 6, 6 N = 12 WC = 51.6%
+597.7	23.0 - 28.0		Fine sand - trace silt - brown - loose - wet (SP)	66.7	9 25.0 26.5	4, 4, 5 N = 9 WC = 25.0%
+592.7	28.0 - 31.0		Silty clay - brown - stiff (CL)	100.0	10A 30.0 31.0	2, 3 N = 3/6" Qp = 1.0 tsf WC = 41.4%
+589.7	31.0 - 31.5		Peat - black - loose - wet (Pt)	100.0	10B 31.0 31.5	4/6" WC = 306.9%
	31.5 - 36.0		End of Boring Boring advanced to 7.5 feet with solid-stem auger Boring advanced from 7.5 to 30.0 feet with rock bit and drilling fluid HW casing driven to 10.0 feet Boring backfilled with cement bentonite grout			

DRILLING LOG	DIVISION USACE	INSTALLATION Detroit District	SHEET 1 OF 4 SHEETS
	1. PROJECT FY14 SLRAOC - 40th Avenue		10. SIZE AND TYPE OF BIT 3 7/8" Roller Bit
2. LOCATION (Coordinates or Station) MN State Plane North NAD 83 N 415,110 E 2,862,796		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY Strata Earth Services, LLC		12. MANUFACTURER'S DESIGNATION OF DRILL Diedrich-25	
4. HOLE NO. (As shown on drawing title and file number) G-5		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED UNDISTURBED
5. NAME OF DRILLER B. McCarthy		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED --- DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN (FT.)		16. DATE HOLE STARTED 9/24/2014	COMPLETED 9/24/2014
8. DEPTH DRILLED INTO ROCK (FT.)		17. ELEVATION TOP OF HOLE +604.3 IGLD85	
9. TOTAL DEPTH OF HOLE (FT.) 62.0		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+604.3	0.0		Barge Deck			
+603.0	1.3		Water - St. Louis River			
+594.8	9.5		Silt - some organic silt - trace to some fine sand - brown - very loose - wet (ML)	53.3	1 9.5 11.0	WOH, WOH, WOH N = 0 WC = 46.9%
+592.3	12.0		Silty fine sand - brown - loose - wet (SM)	60.0	2A 12.5 13.0	5 WC = 28.7%
+591.3	13.0		Fine sand - trace to some silt - brown - loose - wet (SP-SM)	50.0	2B 13.0 14.0	2, 2 N = 4 WC = 24.9%

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.3		Hole No. G-5		
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District		SHEET 2 OF 4 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+587.3	17.0		Fine sand - trace to some silt - brown - loose - wet (SP-SM) (continued)	66.7	3 15.0 16.5	3, 3, 3 N = 6 WC = 26.8%
+579.8	24.5		Silt - some fine sand - brown - very loose - wet (ML)	60.0	4 17.5 19.0	2, 1/12" N = 1 WC = 36.3%
				73.3	5 20.0 21.5	3, 2, 1 N = 3 WC = 41.6"
				86.7	6 22.5 24.0	12, 1, 1 N = 2 WC = 19.8%
+576.3	28.0		Silt - some clay - trace fine sand - brown - very loose - wet (ML)	86.7	7 25.0 26.5	1, 1, 1 N = 2 WC = 37.3%
+573.3	31.0		Silty clay - trace fine sand - brown - medium (CL)	60.0	8A 30.0 31.0	5, 8 N = 8/6" Qp = 0.5 tsf WC = 55.5%
			Silty fine sand - medium dense - very loose - wet (SM)	100.0	8B 31.0 31.5	9 N = 9/6" WC = 24.9%

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.3		Hole No. G-5			
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District			SHEET 3 OF 4 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g	
	33		Silty fine sand - medium dense - very loose - wet (SM) (continued)				
	34						
	35				80.0	9 35.0 36.5	10, 11, 8 N = 19 WC = 26.1%
	36						
	37						
	38						
	39						
	40				66.7	10 40.0 41.5	3, 2, 4 N = 6 WC = 25.6%
	41						
	42						
	43						
	44						
	45			80.0	11 45.0 46.5	1, 1, 2 N = 3 WC = 26.2%	
	46						
	47						
+556.3	48.0						
	48		Silt - some clay - trace to some fine to medium sand - occasional silty sand seams and layers - brown (ML)				
	49						

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.3		Hole No. G-5		
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District		SHEET 4 OF 4 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+549.3	55.0		Silt - some clay - trace to some fine to medium sand - occasional silty sand seams and layers - brown (ML) (continued)	75.0	12 50.0 52.0	ST: 50'-52'
+547.8	56.5		Silty fine sand - brown - medium dense - wet (SM)	66.7	13 55.0 56.5	9, 11, 10 N = 21 WC = 23.8%
+542.3	62.0		Clay - some silt - trace fine to medium sand - brown - hard (CH)	100.0	14 60.0 62.0	Torvane (Su) = 4.0 tsf to 5.0 tsf WC = 62.2%
			End of Boring Boring advanced to 60.0 feet with rock bit and drilling fluid HW casing driven to 12.0 feet below water surface Boring backfilled with cement bentonite grout			

DRILLING LOG	DIVISION USACE	INSTALLATION Detroit District	SHEET 1 OF 4 SHEETS
1. PROJECT FY14 SLRAOC - 40th Avenue		10. SIZE AND TYPE OF BIT 3 7/8" Roller Bit	
2. LOCATION (Coordinates or Station) MN State Plane North NAD 83 N 414,159 E 2,862,225		11. DATUM FOR ELEVATION SHOWN (<i>TBM or MSL</i>)	
3. DRILLING AGENCY Strata Earth Services, LLC		12. MANUFACTURER'S DESIGNATION OF DRILL Diedrich-25	
4. HOLE NO. (<i>As shown on drawing title and file number</i>) G-6		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED : UNDISTURBED :	
5. NAME OF DRILLER B. McCarthy		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED --- DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN (FT.)		16. DATE HOLE STARTED : 9/12/2014 COMPLETED : 9/12/2014	
8. DEPTH DRILLED INTO ROCK (FT.)		17. ELEVATION TOP OF HOLE +604.3 IGLD85	
9. TOTAL DEPTH OF HOLE (FT.) 64.0		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (<i>Drilling time, water loss, depth weathering, etc., if significant</i>) g	
+604.3	0.0		Barge Deck				
+603.0	1.3		Water - St. Louis River				
	1						
	2						
	3						
	4						
	5						
	6						
	7						
	8						
	9						
	10						
	11						
	12						
+590.8	13.5						

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.3		Hole No. G-6			
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District				
			SHEET 2 OF 4 SHEETS				
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g	
+587.3	14		Organic silt - some inorganic silt - trace root fibers - dark brown - very loose - wet (OL)	40.0	1 13.5 15.0	WOH, WOH, WOH N = 0 WC = 110.9%	
	15				2 15.0 16.5	WOH, WOH, WOH N = 0 WC = 106.2%	
	16						
+584.8	17.0		Silt - some fine sand - trace to some organic silt - brown and dark brown - very loose - wet (ML)	70.0	3A 17.5 18.5	WOH, WOH, WOH N = 0/6" WC = 82.1%	
	18				80.0	3B 18.5 19.0	3/6" WC = 32.8%
	19						
+577.3	19.5		Silt - trace to some clay - brown - loose to very loose -wet (ML)	93.3	4 20.0 21.5	6, 3, 1 N = 4 WC = 27.9%	
	20						
	21						
	22						
	23				73.3	5 22.5 24.0	1, 2, 1 N = 3 WC = 27.2%
	24						
+577.3	25		Silt - trace to some clay - brown - loose to very loose -wet (ML)	100.0	6 25.0 26.5	WOH, 1, 1 N = 2 WC = 32.0%	
	26						
	27.0						
	27		Fine sand - trace silt - brown - medium dense - wet (SP)	66.7	7 27.5 29.0	7, 5, 7 N = 12 WC = 24.9%	
	28						
	29						
	30						

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.3		Hole No. G-6		
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District			
PROJECT			SHEET 3		OF 4 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+568.3	31	[Dotted pattern]	Fine sand - trace silt - brown - medium dense - wet (SP) (continued)	53.3	8 32.5 34.0	6, 6, 6 N = 12 WC = 23.2%
	32					
+563.3	33	[Vertical lines]	Silt - some fine sand - brown - very loose - wet (ML)	66.7	9 37.5 39.0	4, 2, 1 N = 3 WC = 29.3%
	34					
+558.3	35	[Dotted pattern]	Fine sand - trace silt - brown - medium dense - wet (SP)	60.0	10 42.5 44.0	6, 7, 8 N = 15 WC = 21.9%
	36.0					
	37	[Vertical lines]	Silty fine to medium sand - trace fine to coarse gravel - brown - loose - wet (SM)	86.7	11 47.5 49.0	5, 3, 2 N = 5 WC = 20.9%
	38					
	39					
	40					
	41.0					
	42					
	43					
	44					
	45					
	46.0					
	47					
	48					

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.3		Hole No. G-6		
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District		SHEET 4 OF 4 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+553.3	49 50 51.0		Silty fine to medium sand - trace fine to coarse gravel - brown - loose - wet (SM) (continued)			WC = 21.8%
+548.3	51 52 53 54 55 56.0		Clayey fine to medium sand - some silt - brown - loose - wet (SC)	40.0	12 52.5 54.0	8, 3, 4 N = 7 WC = 43.4%
+544.3	56 57 58 59 60.0		Silt - some clay - trace fine sand - brown - medium dense - wet (ML)	40.0	13 57.5 59.0	9, 10, 10 N = 20 WC = 50.2%
+540.3	60 61 62 63 64.0		Clay - some silt - trace fine sand - brown - very stiff to hard (CH)	30.0	14 62.0 64.0	Torvane (Su) = 1.75 tsf to 2.0 tsf WC = 32.9% ST: 62'-64'
	65		End of Boring Boring advanced to 62.0 feet with rock bit and drilling fluid HW casing driven to 21.5 feet below river bottom Boring backfilled with cement bentonite grout			

DRILLING LOG	DIVISION USACE	INSTALLATION Detroit District	SHEET 1 OF 5 SHEETS
	1. PROJECT FY14 SLRAOC - 40th Avenue		10. SIZE AND TYPE OF BIT 3 7/8" Roller Bit
2. LOCATION (Coordinates or Station) MN State Plane North NAD 83 N 414,215 E 2,862,974		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY Strata Earth Services, LLC		12. MANUFACTURER'S DESIGNATION OF DRILL Diedrich-25	
4. HOLE NO. (As shown on drawing title and file number) G-7		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED UNDISTURBED
5. NAME OF DRILLER B. McCarthy		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED --- DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN (FT.)		16. DATE HOLE STARTED 9/25/2014	COMPLETED 9/25/2014
8. DEPTH DRILLED INTO ROCK (FT.)		17. ELEVATION TOP OF HOLE +604.3 IGLD85	
9. TOTAL DEPTH OF HOLE (FT.) 80.5		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+604.3	0.0		Barge Deck			
+603.0	1.3		Water - St. Louis River			
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
+593.8	10.5					
	11		Organic silt - some inorganic silt - trace fine sand and wood pieces - dark brown - very loose - wet (OL)	100.0	1 10.5 12.0	WOH, WOH, WOH N = 0 WC = 140.4%
	12					
	13			33.3	2 12.5 14.0	WOH, 1/12" N = 1 WC = 83.6%

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.3		Hole No. G-7		
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District		SHEET 2 OF 5 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+587.3	15		Organic silt - some inorganic silt - trace fine sand and wood pieces - dark brown - very loose - wet (OL) (continued)	53.3	3 15.0 16.5	WOH, WOH, WOH N = 0 WC = 244.2%
	16					
+584.8	17.0		Peat - trace wood - black - very loose - wet - (Pt)	20.0	4 17.5 19.0	WOH, WOH, WOH N = 0 WC = 363.6%
	18					
+579.8	19		Silt - some fine sand - brown - loose - wet (ML)	66.7	5 20.0 21.5	4, 2, 3 N = 5 WC = 21.9%
	20					
+579.8	21		Silt - some clay - trace to some fine to medium sand - brown - very loose - wet (ML)	40.0	6 22.5 24.0	2, 2, 2 N = 4 WC = 29.1%
	22					
+579.8	23		Silt - some clay - trace to some fine to medium sand - brown - very loose - wet (ML)	80.0	7 25.0 26.5	1, 1, 1 N = 2 WC = 38.4%
	24					
+579.8	25		Silt - some clay - trace to some fine to medium sand - brown - very loose - wet (ML)	86.7	8 30.0 31.5	1, 1, 1 N = 2 WC = 37.6%
	26					
	27					
	28					
	29					
	30					
	31					

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.3		Hole No. G-7			
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District			SHEET 3 OF 5 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g	
	33		Silt - some clay - trace to some fine to medium sand - brown - very loose - wet (ML) (continued)				
	34						
	35				100.0	9 35.0 37.0	WC = 30.6% ST: 35'-37'
	36						
	37						
	38						
	39						
	40				100.0	10 40.0 41.5	1, 1, 1 N = 2 WC = 31.5%
	41						
	42						
+561.3	43.0		Silty clay - trace fine sand - brown - very soft to very stiff (CH)				
	44						
	45				100.0	11 45.0 46.5	1, 1, 2 N = 3 Qp = 0.25 tsf WC = 48.0%
	46						
	47						
	48						
	49						

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.3		Hole No. G-7				
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District		SHEET 4 OF 5 SHEETS			
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g		
	51		Silty clay - trace fine sand - brown - very soft to very stiff (CH) (continued)	100.0	12	Torvane (Su) = 1.0 tsf to 1.75 tsf WC = 50.4% ST: 50'-52'		
	52				50.0			
	53				52.0			
	54							
	55					100.0	13	1, 1, 1 N = 2 Qp = 0.5 tsf WC = 59.1%
	56						55.0	
	57				56.5			
	58							
	59							
	60			75.0	14	Torvane (Su) = <0.1 tsf ST: 60'-61.5'		
	61				60.0			
+543.3	61.0				62.0			
	62		Fine to medium sand - trace silt and coarse sand - brown - medium dense - wet (SP)					
	63							
	64							
	65					60.0	15	12, 10, 10 N = 20 WC = 22.7%
	66						65.0	
	67						66.5	
	68							
+536.3	68.0							

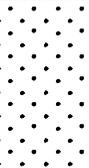
DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.3		Hole No. G-7		
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District			
			SHEET 5 OF 5 SHEETS			
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+531.3	69 70 71 72 73.0		Silty fine sand - brown - dense - wet (SM)	66.7	16 70.0 71.5	4, 15, 15 N = 30 WC = 22.6%
+526.3	73 74 75 76 77 78.0		Fine to medium sand - trace silt - brown - medium dense - wet (SP)	60.0	17 75.0 76.5	10, 8, 6 N = 14 WC = 16.0%
+523.8	78 79 80 80.5		Silt - trace to some clay - brown - loose - wet (ML)	86.7	18 79.0 80.5	3, 2, 2 N = 4 WC = 25.2%
	81 82 83 84 85		End of Boring Boring advanced to 79.0 feet with rock bit and drilling fluid HW casing driven to 12.0 feet below river bottom Boring backfilled with cement bentonite grout			

DRILLING LOG	DIVISION USACE	INSTALLATION Detroit District	SHEET 1 OF 2 SHEETS
	1. PROJECT FY14 SLRAOC - 40th Avenue		10. SIZE AND TYPE OF BIT 3 7/8" Roller Bit
2. LOCATION (Coordinates or Station) MN State Plane North NAD 83 N 414,702 E 2,862,319		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY Strata Earth Services, LLC		12. MANUFACTURER'S DESIGNATION OF DRILL Diedrich-25	
4. HOLE NO. (As shown on drawing title and file number) G-9		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED UNDISTURBED
5. NAME OF DRILLER B. McCarthy		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED --- DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN (FT.)		16. DATE HOLE STARTED 9/22/2014	COMPLETED 9/22/2014
8. DEPTH DRILLED INTO ROCK (FT.)		17. ELEVATION TOP OF HOLE +604.1 IGLD85	
9. TOTAL DEPTH OF HOLE (FT.) 26.5		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+604.1	0.0		Barge Deck			
+602.8	1.3		Water - St. Louis River			
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
+594.1	10.0					
	10					
	11		Silty fine sand - trace fine gravel - brown - very loose to loose - wet (SM)	33.3	1 10.0 11.5	WOH, 1, 1 N = 2 WC = 31.4%
	12					
	13			86.7	2 12.5 14.0	5, 3, 1 N = 4 WC = 21.0%

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.1		Hole No. G-9		
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District			SHEET 2 OF 2 SHEETS
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+589.6	14.5		Fine to medium sand - trace silt - brown - very loose - wet (SP)	53.3	3 15.0 16.5	2, 1, 1 N = 2 WC = 24.0%
+587.1	17.0					
+584.6	17.7		Silty fine sand - brown - very loose - wet (SM)	66.7	4 17.5 19.0	2, 2, 1 N = 3 WC = 32.4%
	18.0					
+579.6	19.5		Silt - some fine sand - brown - very loose - wet (ML)	46.7	5 20.0 21.5	2, 1, 1 N = 2 WC = 33.8%
	20.0					
	22.0					
	23.0					
+577.6	24.5		Silt - trace to some clay and fine sand - brown - very loose - wet (ML)	80.0	7 25.0 26.5	2, 1, 1 N = 2 WC = 40.5%
	25.0					
+577.6	26.5		End of Boring Boring advanced to 25.0 feet with rock bit and drilling fluid HW casing driven to 5.0 feet below river bottom Boring backfilled with cement bentonite grout			
	27.0					
	28.0					
	29.0					
	30.0					
31.0						

DRILLING LOG	DIVISION USACE	INSTALLATION Detroit District	SHEET 1
			OF 2 SHEETS
1. PROJECT FY14 SLRAOC - 40th Avenue		10. SIZE AND TYPE OF BIT 3 7/8" Roller Bit	
2. LOCATION (Coordinates or Station) MN State Plane North NAD 83 N 415,099 E 2,862,180		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY Strata Earth Services, LLC		12. MANUFACTURER'S DESIGNATION OF DRILL Diedrich-25	
4. HOLE NO. (As shown on drawing title and file number) G-10		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	
5. NAME OF DRILLER B. McCarthy		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED --- DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN (FT.)		16. DATE HOLE STARTED 9/22/2014 COMPLETED 9/22/2014	
8. DEPTH DRILLED INTO ROCK (FT.)		17. ELEVATION TOP OF HOLE +604.1 IGLD85	
9. TOTAL DEPTH OF HOLE (FT.) 26.5		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+604.1	0.0		Barge Deck			
+602.8	1.3		Water - St. Louis River			
+594.1	10.0					
+593.1	11.0		Silt - some organic silt - trace fine sand - brown - very loose - wet (ML)	70.0	1A 10.0 11.0	1, 1 N = 1/6" WC = 77.4%
+592.1	12.0		Fine to medium sand - some silt - trace wood - brown - very loose to wet (SM)	100.0	1B 11.0 11.5	1/6" WC = 30.8%
	13		Fine sand - trace silt - brown - medium dense to very loose - wet (SP)	60.0	2 12.5 14.0	5, 5, 6 N = 11 WC = 27.5%

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.1		Hole No. G-10				
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District			SHEET 2 OF 2 SHEETS		
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g		
	15		Fine sand - trace silt - brown - medium dense to very loose - wet (SP) (continued)	46.7	3 15.0 16.5	3, 3, 4 N = 7 WC = 25.4%		
	16							
	17							
	18					46.7	4 17.5 19.0	1, 1, 1 N = 2 WC = 27.8%
	19							
	20					40.0	5 20.0 21.5	1, 1, 2 N = 3 WC = 27.7%
	21							
+582.1	22.0							
	22		Silt - some fine sand - brown - very loose - wet (ML)	66.7	6 22.5 24.0	1, 1, 1 N = 2 WC = 45.0%		
	23							
+579.6	24.5							
	25		Fine sand - trace silt - brown - medium dense - wet (SP)	53.3	7 25.0 26.5	4, 8, 8 N = 16 WC = 23.6%		
	26							
+577.6	26.5							
	27		End of Boring Boring advanced to 25.0 feet with rock bit and drilling fluid HW casing driven to 5.0 feet Boring backfilled with cement bentonite grout					
	28							
	29							
	30							
	31							

DRILLING LOG	DIVISION USACE	INSTALLATION Detroit District	SHEET 1
			OF 2 SHEETS
1. PROJECT FY14 SLRAOC - 40th Avenue		10. SIZE AND TYPE OF BIT 3 7/8" Roller Bit	
2. LOCATION (Coordinates or Station) MN State Plane North NAD 83 N 414,729 E 2,862,972		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY Strata Earth Services, LLC		12. MANUFACTURER'S DESIGNATION OF DRILL Diedrich-25	
4. HOLE NO. (As shown on drawing title and file number) G-11		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	
5. NAME OF DRILLER B. McCarthy		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED --- DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN (FT.)		16. DATE HOLE STARTED 9/23/2014 COMPLETED 9/23/2014	
8. DEPTH DRILLED INTO ROCK (FT.)		17. ELEVATION TOP OF HOLE +604.2 IGLD85	
9. TOTAL DEPTH OF HOLE (FT.) 26.5		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+604.2	0.0		Barge Deck			
+602.9	1.3		Water - St. Louis River			
+593.9	10.3					
+592.2	12.0		Silt - trace to some fine sand and clay - brown - very loose - wet (ML)	46.7	1 10.3 11.8	WOH, WOH, WOH N = 0 WC = 43.2%
	13		Silty fine sand - brown - loose - wet (SM)	80.0	2 12.5 14.0	7, 3, 2 N = 5 WC -26.0%

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.2		Hole No. G-11		
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District		SHEET 2 OF 2 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+589.7	14.5		Silty fine sand - brown - loose - wet (SM) <i>(continued)</i>			
	15		Fine to medium sand - trace silt - brown - loose - wet (SP)	53.3	3 15.0 16.5	4, 3, 3 N = 6 WC = 18.6%
+587.2	17.0					
	17		Wood - some silt - brown and black - loose - wet (Pt)			
+586.2	18.0			80.0	4A 17.5 18.0	2 WC = 99.4%
	18		Silt - trace to some fine sand - brown - very loose - wet (ML)	80.0	4B 18.0 19.0	2, 2 N = 4 WC = 36.7%
	19					
	20			66.7	5 20.0 21.5	2, 1/12" N = 1 WC = 40.3%
	21					
+582.2	22.0					
	22		Silt - trace to some clay and fine sand - brown - very loose - wet (ML)	73.3	6 22.5 24.0	1, 1, 1 N = 2 WC = 36.6%
	23					
	24					
	25					
	26				7 25.0 26.5	2, 1, 1 N = 2 WC = 36.7%
+577.7	26.5					
	27		End of Boring Boring advanced to 25.0 feet with rock bit and drilling fluid HW casing driven to 10.0 feet below river bottom Boring backfilled with cement bentonite grout			
	28					
	29					
	30					
	31					

DRILLING LOG	DIVISION USACE	INSTALLATION Detroit District	SHEET 1 OF 2 SHEETS
	1. PROJECT FY14 SLRAOC - 40th Avenue		10. SIZE AND TYPE OF BIT 3 7/8" Roller Bit
2. LOCATION (Coordinates or Station) MN State Plane North NAD 83 N 414,719 E 2,862,962		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY Strata Earth Services, LLC		12. MANUFACTURER'S DESIGNATION OF DRILL Diedrich-25	
4. HOLE NO. (As shown on drawing title and file number) G-11A		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED UNDISTURBED
5. NAME OF DRILLER B. McCarthy		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED --- DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN (FT.)		16. DATE HOLE STARTED 9/11/2014	COMPLETED 9/11/2014
8. DEPTH DRILLED INTO ROCK (FT.)		17. ELEVATION TOP OF HOLE +604.2 IGLD85	
9. TOTAL DEPTH OF HOLE (FT.) 26.5		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+604.2	0.0		Barge Deck			
+602.9	1.3		Water - St. Louis River			
	10.0		Silt - some organic silt - trace fine sand - dark brown - very loose - wet (ML)	40.0	1 10.0 11.5	WOH, WOH, WOH N = 0 WC = 45.2%
+592.2	12.0		Silt fine sand - brown - loose to very loose - wet (SM)	60.0	2 12.5 14.0	3, 2, 2 N = 4 WC = 22.2

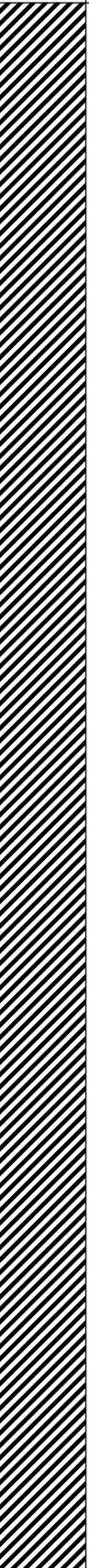
DRILLING LOG (Cont Sheet)			ELEVATION TOP OF HOLE 604.2		Hole No. G-11A	
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District		SHEET 2 OF 2 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+584.7	15		Silt fine sand - brown - loose to very loose - wet (SM) (continued)	66.7	3 15.0 16.5	3, 2, 3 N = 5 WC = 23.3%
	16					
	17					
	18			73.3	4 17.5 19.0	2, 1, 1 WC = 49.7%
	19					
+577.7	19.5		Silt - trace to some clay and fine sand - brown - very loose - wet (ML)			
	20			66.7	5 20.0 21.5	WOH, 1, 1 N = 2 WC = 33.6%
	21					
	22					
	23			86.7	6 22.5 24.0	1, 1, 1 N = 2 WC = 31.9%
	24		End of Boring Boring advanced to 25.0 feet with rock bit and drilling fluid HW casing driven to 5.0 feet below river bottom Boring backfilled with cement bentonite grout			
	25			80.0	7 25.0 26.5	1, 1, 1 N = 2 wc = 38.9%
	26					
	26.5					
	27					
	28					
	29					
	30					
	31					

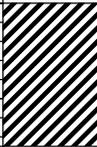
DRILLING LOG	DIVISION USACE	INSTALLATION Detroit District	SHEET 1 OF 5 SHEETS
	1. PROJECT FY14 SLRAOC - 40th Avenue		10. SIZE AND TYPE OF BIT 3 7/8" Roller Bit
2. LOCATION (Coordinates or Station) MN State Plane North NAD 83 N 413,422 E 2,863,727		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY Strata Earth Services, LLC		12. MANUFACTURER'S DESIGNATION OF DRILL Diedrich-25	
4. HOLE NO. (As shown on drawing title and file number) GA-1		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED UNDISTURBED
5. NAME OF DRILLER B. McCarthy		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED --- DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN (FT.)		16. DATE HOLE STARTED 9/24/2014	COMPLETED 9/24/2014
8. DEPTH DRILLED INTO ROCK (FT.)		17. ELEVATION TOP OF HOLE +604.3 IGLD85	
9. TOTAL DEPTH OF HOLE (FT.) 69.5		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+604.3	0.0		Barge Deck			
+603.0	1.3		Water - St. Louis River			
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					
	12					
	13					

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.3		Hole No. GA-1		
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District		SHEET 2 OF 5 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
	15		Water - St. Louis River (continued)			
	16					
	17					
	18					
	19					
+584.8	19.5					
	20		Organic silt - some inorganic silt - trace to some fine sand - brown - very loose - wet (OL)	40.0	1 19.5 21.5	WOH, WOH, WOH, WOH N = 0 WC = 98.4%
	21					
+582.3	22.0					
	22		Silty fine sand - brown and dark brown - very loose - wet (SM)	53.3	2 22.5 24.0	WOH, 1, 1 N = 2 WC = 45.9%
	23					
	24					
+579.8	24.5					
	25		Fine sand - trace silt - brown - loose - wet (SP)	46.7	3 25.0 26.5	2, 2, 2 N = 4 WC = 25.8%
	26					
	27					
	28			53.3	4 27.5 29.0	2, 2, 2 N = 4 WC = 27.6%
	29					
	30			40.0	5 30.0 31.5	3, 2, 2 N = 4 WC = 29.3%
	31					

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.3		Hole No. GA-1		
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District		SHEET 3 OF 5 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+569.8	33		Fine sand - trace silt - brown - loose - wet (SP) (continued)	53.3	6	5, 3, 3 N = 6 WC = 29.2%
	34			32.5	34.0	
+566.3	34.5		Fine to medium sand - trace silt and fine to coarse gravel - brown - medium dense - wet (SP)	33.3	7	2, 2, 10 N = 12 WC = 23.1%
	35					
+556.3	36		Silt - trace to some clay - trace fine sand - brown - loose - wet (ML)	80.0	8	2, 2, 2 N = 4 WC = 30.4%
	37					
+556.3	38.0		Silt - trace to some clay - trace fine sand - brown - loose - wet (ML)	86.7	9	2, 2, 3 N = 5 WC = 29.0%
	39					
	40		Silty clay - trace to some fine sand - brown - stiff to hard (CH)			
	41					
	42		Silty clay - trace to some fine sand - brown - stiff to hard (CH)			
	43					
	44		Silty clay - trace to some fine sand - brown - stiff to hard (CH)			
	45					
	46		Silty clay - trace to some fine sand - brown - stiff to hard (CH)			
	47					
	48.0		Silty clay - trace to some fine sand - brown - stiff to hard (CH)			
	48					
	49		Silty clay - trace to some fine sand - brown - stiff to hard (CH)			
	49					

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.3		Hole No. GA-1				
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District		SHEET 4 OF 5 SHEETS			
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g		
			Silty clay - trace to some fine sand - brown - stiff to hard (CH) (continued)	100.0	10 50.0 52.0	Torvane (Su) = 1.5 tsf to 2.25 tsf WC = 39.4% ST: 50'-52'		
	51							
	52							
	53							
	54							
	55					100.0	11 55.0 56.5	1, 2, 2 N = 4 Qp = 1.0 tsf WC = 41.0%
	56							
	57							
	58							
	59							
	60					100.0	12 60.0 62.0	Torvane (Su) = 2.5 tsf to 3.0 tsf WC = 47.5% ST: 60'-62'
	61							
	62							
	63							
	64							
	65			100.0	13 65.0 66.5	2, 2, 2 N = 4 Qp = 1.0 tsf WC = 45.6%		
	66							
	67			100.0	14 67.5	Torvane (Su) = 4.0 tsf to 3.75 tsf WC = 48.7%		

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.3		Hole No. GA-1		
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District		SHEET 5 OF 5 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+534.8	69.5		Silty clay - trace to some fine sand - brown - stiff to hard (CH) (continued)		69.5	ST: 67.5'-69.5'
	70		End of Boring Boring advanced to 68.0 feet with rock bit and drilling fluid HW casing driven to 12.0 feet below river bottom Boring backfilled with cement bentonite grout			
	71					
	72					
	73					
	74					
	75					
	76					
	77					
	78					
	79					
	80					
	81					
	82					
	83					
	84					
	85					

DRILLING LOG	DIVISION USACE	INSTALLATION Detroit District	SHEET 1 OF 6 SHEETS
1. PROJECT FY14 SLRAOC - 40th Avenue		10. SIZE AND TYPE OF BIT 3 7/8" Roller Bit	
2. LOCATION (Coordinates or Station) MN State Plane North NAD 83 N 413,741 E 2,863,178		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY Strata Earth Services, LLC		12. MANUFACTURER'S DESIGNATION OF DRILL Diedrich-25	
4. HOLE NO. (As shown on drawing title and file number) GA-2		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	
5. NAME OF DRILLER B. McCarthy		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED --- DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN (FT.)		16. DATE HOLE STARTED 9/22/2014 COMPLETED 9/22/2014	
8. DEPTH DRILLED INTO ROCK (FT.)		17. ELEVATION TOP OF HOLE +604.1 IGLD85	
9. TOTAL DEPTH OF HOLE (FT.) 85.0		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR	

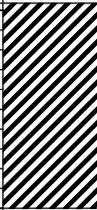
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+604.1	0.0		Barge Deck			
+602.8	1.3		Water - St. Louis River			
+594.1	10.0		Organic silt - some inorganic silt - trace fine sand - dark brown - very loose - wet (OL)	66.7	1 10.0 11.5	1, 1, 1 (3" split spoon) N = 2 WC = 85.0%
+592.1	12.0		Silt - trace to some organic silt - trace fine sand and wood - very loose - wet (ML)	73.3	2 12.5 14.0	WOH, 1, 1 (3" split spoon) N = 2 WC = 77.8%

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.1		Hole No. GA-2		
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District		SHEET 2 OF 6 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVER- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+590.1	14.0		Fibrous peat - black - loose - wet (Pt)			
	15.0			50.0	3A 15.0 16.0	1, 1 (3" split spoon) N = 1/6" WC = 548.5%
+588.1	16.0		Silty fine sand - brown - loose - wet (SM)	100.0	3B 16.0 16.5	3 (3" split spoon) N = 3/6" WC = 19.0%
	17.0					
	18.0			86.7	4 17.5 19.0	3, 4, 3 (3" split spoon) N = 7 WC = 19.7%
	19.0					
+584.1	20.0		Fine sand - trace silt - brown - very loose - wet (SP)	53.3	5 20.0 21.5	6, 3, 2 N = 5 WC = 30.1%
	21.0					
	22.0					
	23.0			53.3	6 22.5 24.0	2, 1, 1 N = 2 WC = 33.2%
	24.0					
+579.6	24.5		Silt - trace to some clay and fine sand - brown - very loose - wet (ML)	80.0	7 25.0 26.5	2, 1, 1 N = 2 WC = 35.6%
	25.0					
	26.0					
	27.0					
+576.1	28.0		Silty fine sand - brown - loose - wet (SM)			
	29.0					
	30.0			73.3	8 30.0 31.5	1, 2, 2 N = 4 WC = 35.7%

DRILLING LOG (Cont Sheet)			ELEVATION TOP OF HOLE 604.1		Hole No. GA-2		
PROJECT FY14 SLRAOC - 40th Avenue				INSTALLATION Detroit District		SHEET 3 OF 6 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g	
+571.1	31		Silty fine sand - brown - loose - wet (SM) (continued)				
	32						
+566.1	33.0		Silt - trace to some clay and fine sand - brown - very loose - wet (ML)	86.7	9 35.0 36.5	1, 1, 1 N = 2 WC = 34.4%	
	34						
	35		Silt - some clay - trace fine to coarse sand - occasional silty sand seams and layers - brown - very loose to loose - wet (ML)	90.0	10 40.0 42.0	ST: 40'-42'	
	36						
	37						
	38.0						
	39						
	40						
	41						
	42						
	43						
	44						
	45			100.0	11 45.0 46.5	2 1, 2 N = 3 WC = 34.8%	
	46						
	47						
	48						

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.1		Hole No. GA-2		
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District		SHEET 4 OF 6 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
	49		Silt - some clay - trace fine to coarse sand - occasional silty sand seams and layers - brown - very loose to loose - wet (ML) (continued)			1, 2, 2 N = 4 WC = 38.3%
	50			100.0	12 50.0 51.5	
	51					
	52					
+551.1	53.0		Silty clay - trace fine sand - brown - hard to medium (CH)			Torvane (Su) = 3.0 tsf to 2.75 tsf WC = 46.5% ST: 55'-57'
	54			100.0	13 55.0 57.0	
	55					
	56					
	57					
	58					
	59					
	60			100.0	14 60.0 62.0	
	61					
	62					
	63				Qp = 0.5 tsf Torvane (Su) = 2.75 tsf to 2.5 tsf WC = 50.9% ST: 60'-62'	
	64					
	65		100.0	15 65.0		
					2, 2, 3 N = 5	

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.1		Hole No. GA-2				
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District			SHEET 5 OF 6 SHEETS		
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g		
	66		Silty clay - trace fine sand - brown - hard to medium (CH) (continued)		66.5	Qp = 0.75 tsf WC = 53.5%		
	67							
	68							
	69							
	70					100.0	16 70.0 72.0	Torvane (Su) = 2.0 tsf to 3.5 tsf WC = 64.8% ST: 70'-72'
	71							
	72							
	73							
	74							
	75					100.0	17 75.0 76.5	2, 2, 2 N = 4 Qp = 0.5 tsf WC = 57.3%
	76							
	77							
	78							
	79							
	80			85.0	18 80.0 82.0	Torvane (Su) = 1.5 tsf to 3.0 tsf WC = 48.6% ST: 80'-82'		
	81							
	82							

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.1		Hole No. GA-2		
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District		SHEET 6 OF 6 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+519.1	83 84 85.0		Silty clay - trace fine sand - brown - hard to medium (CH) (continued)	100.0	19 83.5 85.0	2, 2, 2 N = 4 Qp = 0.5 tsf WC = 56.0%
	85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100		End of Boring Boring advanced to 83.5 feet with rock bit and drilling fluid HW casing driven to 7.0 feet below river bottom Boring backfilled with cement bentonite grout			

DRILLING LOG	DIVISION USACE	INSTALLATION Detroit District	SHEET 1 OF 6 SHEETS
1. PROJECT FY14 SLRAOC - 40th Avenue		10. SIZE AND TYPE OF BIT 3 7/8" Roller Bit	
2. LOCATION (Coordinates or Station) MN State Plane North NAD 83 N 415,845 E 2,864,010		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY Strata Earth Services, LLC		12. MANUFACTURER'S DESIGNATION OF DRILL Diedrich-25	
4. HOLE NO. (As shown on drawing title and file number) GA-3		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED : UNDISTURBED :	
5. NAME OF DRILLER B. McCarthy		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED --- DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN (FT.)		16. DATE HOLE STARTED 9/23/2014 COMPLETED 9/23/2014	
8. DEPTH DRILLED INTO ROCK (FT.)		17. ELEVATION TOP OF HOLE +604.2 IGLD85	
9. TOTAL DEPTH OF HOLE (FT.) 85.0		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+604.2	0.0		Barge Deck			
+602.9	1.3		Water - St. Louis River			
	2.0					
	3.0					
	4.0					
	5.0					
	6.0					
	7.0					
	8.0					
	9.0					
	10.0					
+594.2	10.0		Silt - some organic silt - brown - very loose - wet (ML)	46.7	1 10.0 11.5	WOH, WOH, WOH N = 0 WC = 44.0%
+592.2	12.0		Silty fine sand - brown - very loose - wet (SM)	80.0	2 12.5 14.0	WOH, 1/12" N = 1 C = 41.0%

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.2		Hole No. GA-3			
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District			SHEET 2 OF 6 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g	
+589.7	14		Silty fine sand - brown - very loose - wet (SM) (continued)			1, 1, 1 N = 2 WC = 360.9%	
	14.5						
+587.2	15		Fibrous peat - black - very loose - wet (Pt)	53.3	3		
	16				15.0		
	17.0				16.5		
+584.7	17		Silt - trace to some fine sand - brown - loose - wet (ML)	53.3	4		1, 1, 2 N = 3 WC = 28.3%
	18				17.5		
	19				19.0		
+582.2	19.5		Fine sand - trace to some silt - brown - loose - wet (SP-SM)			3, 2, 2 N = 4 WC = 32.4%	
	20			60.0	5		
	21				20.0		
+576.2	22.0		Silt - trace to some fine sand - brown - very loose - wet (ML)			1, 1, 1 N = 2 WC = 38.9%	
	23			100.0	6		
	24				22.5		
	25				24.0		
	26			80.0	7	2, 1, 1 N = 2 WC = 40.1%	
	27				25.0		
	28.0				26.5		
+576.2	28		Silt - trace to some clay and fine sand - brown - very loose - wet (ML)			Torvane (Tv) = 0.75 tsf to 1.0 tsf WC = 37.2% ST: 30'-32'	
	29			35.0	8		
	30				30.0		
					32.0		

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.2		Hole No. GA-3			
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District			SHEET 3 OF 6 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g	
	31		Silt - trace to some clay and fine sand - brown - very loose - wet (ML) (continued)				
	32						
	33						
	34						
	35				86.7	9 35.0 36.5	1, 1, 1 N = 2 WC = 36.1%
	36						
	37						
	38						
	39						
	40				100.0	10 40.0 41.5	1, 1, 1 N = 2 WC = 33.0%
	41						
	42						
	43						
	44						
	45			20.0	11 45.0 47.0	Qp = 0.25 tsf ST: 45'-47'	
	46						
	47						
+556.2	48.0						

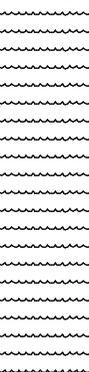
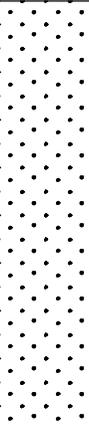
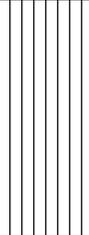
DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.2		Hole No. GA-3				
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District					
			SHEET 4 OF 6 SHEETS					
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g		
	49		Silty clay - trace fine sand - occasional silt seams and layers - brown - soft to hard (CH) (continued)					
	50					100.0	12 50.0 51.5	1, 1, 2 N = 3 Qp = 0.25 tsf WC = 47.9%
	51							
	52							
	53							
	54							
	55					15.0	13 55.0 57.0	Torvane (Tv) = 0.75 tsf WC = 64.2% ST: 55'-57'
	56							
	57							
	58							
	59							
	60					100.0	14 60.0 62.0	Torvane (Tv) = 2.25 tsf WC = 58.0% ST: 60'-62'
	61							
	62							
	63							
	64							
	65			100.0	15 65.0	2, 1, 2 N = 3		

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.2		Hole No. GA-3				
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District		SHEET 5 OF 6 SHEETS			
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g		
	66		Silty clay - trace fine sand - occasional silt seams and layers - brown - soft to hard (CH) (continued)		66.5	Qp = 0.75 tsf WC = 38.6%		
	67							
+536.2	68.0		Silty clay - some fine to medium sand - trace fine gravel - brown - very stiff to medium (CL)			Torvane (Tv) = 1.5 tsf WC = 33.9% ST: 70'-72'		
	69							
	70				100.0		16 70.0 72.0	
	71							
	72							
	73							
	74							
	75				86.7		17 75.0 76.5	2, 3, 3 N = 6 WC = 28.8%
	76							
	77							
	78							
	79							
	80			100.0	18 80.0 81.5	2, 2, 2 N = 4 Qp = 0.5 tsf WC = 35.5%		
	81							
+522.2	82.0		Silty clay - trace fine sand - brown - stiff to very stiff (CH)					

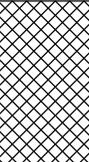
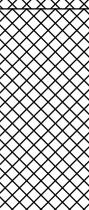
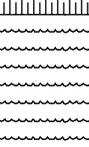
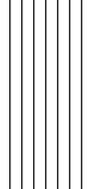
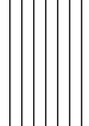
DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.2		Hole No. GA-3		
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District			SHEET 6 OF 6 SHEETS
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+519.2	83 84 85.0		Silty clay - trace fine sand - brown - stiff to very stiff (CH) (continued)	100.0	19 83.0 85.0	Torvane (Tv) = 1.5 tsf to 2.5 tsf WC = 54.3% ST: 83'-85'
	85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100		End of Boring Boring advanced to 83.0 feet with rock bit and drilling fluid HW casing driven to 12.0 feet below river bottom Boring backfilled with cement bentonite grout			

DRILLING LOG	DIVISION USACE	INSTALLATION Detroit District	SHEET 1
			OF 2 SHEETS
1. PROJECT FY14 SLRAOC - 40th Avenue		10. SIZE AND TYPE OF BIT 3 7/8" Roller Bit	
2. LOCATION (Coordinates or Station) MN State Plane North NAD 83 N 419,443 E 2,864,828		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY Strata Earth Services, LLC		12. MANUFACTURER'S DESIGNATION OF DRILL Diedrich-25	
4. HOLE NO. (As shown on drawing title and file number) GA-4		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED : UNDISTURBED :	
5. NAME OF DRILLER B. McCarthy		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED --- DEG. FROM VERT.		15. ELEVATION GROUND WATER 601.0	
7. THICKNESS OF OVERBURDEN (FT.)		16. DATE HOLE STARTED 9/30/2014 COMPLETED 9/30/2014	
8. DEPTH DRILLED INTO ROCK (FT.)		17. ELEVATION TOP OF HOLE +608.5 NAVD88	
9. TOTAL DEPTH OF HOLE (FT.) 25.0		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+608.5	0.0		Fill: Silty fine to medium sand - trace clay and fine to coarse gravel - brown - medium dense - moist (SM)	100.0	1 0.0 1.5	3, 10, 10 N = 20 WC = 17.8%
+606.5	2.0		Fill: Silty clay - some fine sand - trace to some fine to coarse gravel - brown - very stiff (CL)	60.0	2 2.5 4.0	4, 7, 7 N = 14 Qp = 2.0 tsf WC = 29.6%
			Fill: Silty fine sand - gray - very loose - moist to wet (SM)	60.0	3 5.0 6.5	3, 6, 7 N = 13 Qp = 2.5 tsf WC = 17.6%
+601.5	7.0		Fill: Silty fine sand - some wood - brown - loose - wet (SM)	100.0	4 7.5 9.0	1, 1/12" N = 1 WC = 89.3%
+599.0	9.5		Peat - black - loose - wet (Pt)	50.0	5A 10.0 11.0	2, 2 N = 2/6" WC = 44.8%
+597.5	11.0		Wood peat - brown - medium dense to loose - wet (Pt)	100.0	5B 11.0 11.5	3/6" WC = 369.0%
+596.5	12.0			33.3	6 12.5 14.0	3, 5, 5 N = 10 WC = 347.3%

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 608.5		Hole No. GA-4		
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District		SHEET 2 OF 2 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+590.5	15.0		Wood peat - brown - medium dense to loose - wet (Pt) (continued)	33.3	7 15.0 16.5	6, 3, 5 N = 8 WC = 190.6%
+586.0	18.0		Fine sand - trace silt - brown - medium dense - wet (SP)	66.7	8 20.0 21.5	8, 7, 10 N = 17 WC = 24.6%
+583.5	22.5		Silt - trace to some fine sand - brown - medium dense - wet (ML)	80.0	9 23.5 25.0	7, 7, 4 N = 11 WC = 27.5%
	25.0		End of Boring Boring advanced to 7.5 feet with solid-stem auger Boring advanced from 7.5 to 23.5 feet with rock bit and drilling fluid HW casing driven to 10.0 feet Boring backfilled with cement bentonite grout			

DRILLING LOG	DIVISION USACE	INSTALLATION Detroit District	SHEET 1
			OF 2 SHEETS
1. PROJECT FY14 SLRAOC - 40th Avenue		10. SIZE AND TYPE OF BIT 3 7/8" Roller Bit	
2. LOCATION (Coordinates or Station) MN State Plane North NAD 83 N 419,134 E 2,866,308		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY Strata Earth Services, LLC		12. MANUFACTURER'S DESIGNATION OF DRILL Diedrich-25	
4. HOLE NO. (As shown on drawing title and file number) GA-5		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED UNDISTURBED
5. NAME OF DRILLER B. McCarthy		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED --- DEG. FROM VERT.		15. ELEVATION GROUND WATER	589.2
7. THICKNESS OF OVERBURDEN (FT.)		16. DATE HOLE STARTED	9/30/2014
8. DEPTH DRILLED INTO ROCK (FT.)		16. DATE HOLE COMPLETED	9/30/2014
9. TOTAL DEPTH OF HOLE (FT.) 30.0		17. ELEVATION TOP OF HOLE +604.2 NAVD88	
		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+604.2	0.0		Fill: Gravelly fine to coarse sand - trace to some silt - brown - dense - moist (SP-SM)	66.7	1 0.0 1.5	17, 18, 21 N = 39 WC = 6.5%
+602.2	2.0		Fill: Silty fine to medium sand - trace to some fine to coarse gravel - trace wood - black - loose - moist (SM)	53.3	2 2.5 4.0	4, 2, 3 N = 5 WC = 12.8%
+599.7	4.5		Organic silt - some fine sand - trace wood - dark brown and brown - loose - moist (OL)	53.3	3 5.0 6.5	1, 2, 4 N = 6 WC = 37.1%
+596.2	8.0		Peat - some fine sand - brown and black - loose - moist (Pt)	100.0	4A 7.5 8.0	1 WC = 31.5%
+594.7	9.5		Silt - trace to some clay and fine sand - brown - very loose - moist (ML)	30.0	4B 8.0 9.0	1, 3 N = 4 WC = 38.2%
	10			6.7	5 10.0 11.5	1, 1, 1 N = 2 WC = 56.0%
	11			73.3	6 12.5 14.0	1, 1, 2 N = 3 WC = 33.6%

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 604.2		Hole No. GA-5		
PROJECT FY14 SLRAOC - 40th Avenue			INSTALLATION Detroit District		SHEET 2 OF 2 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+589.7	14.5		Silt - trace to some fine sand - brown - loose - moist to wet (ML)	80.0	7 15.0 16.5	1, 3, 5 N = 8 WC = 35.4%
+586.2	18.0		Silty fine sand - trace to some peat and wood - dark brown - loose - wet (SM)	100.0	8 20.0 21.5	2, 2, 2 N = 4 WC = 60.6%
+581.2	23.0		Silt - trace to some clay and fine sand - black - very loose - wet (ML)	80.0	9 25.0 26.5	1, 1, 1 N = 2 WC = 39.4%
+576.7	27.5		Silty clay - trace fine sand - brown - soft (CL)	93.3	10 28.5 30.0	1, 1, 1 N = 2 Qp = 0.25 tsf WC = 39.1%
+574.2	30.0		End of Boring Boring advanced to 7.5 feet with solid-stem auger Boring advanced from 7.5 to 28.5 feet with rock bit and drilling fluid HW casing driven to 10.0 feet Boring backfilled with cement bentonite grout			