

CASE STUDY

WASHINGTON D.C. - 46 STELCOR PILES FOR THRUST BLOCK REINFORCEMENT

INSTALLER:

Creative Concepts Group, Inc.

GEOTECHNICAL ENGINEER:

D.C. Clean Rivers Project

STRUCTURAL ENGINEER:

Bryant Blake P.E.

ARCHITECT:

Reitan Architects LLC

LOADS:

Anticipated - 200 kips factored (compression and tension)

Actual - 102 Kips (Compression) 114 Kips (Tension)

Piles were intended to go 62' but all piles met refusal at approximately 30'.

PILE DETAIL:

STELCOR 1600

18" tip or drive plate

16" corrugated grout column

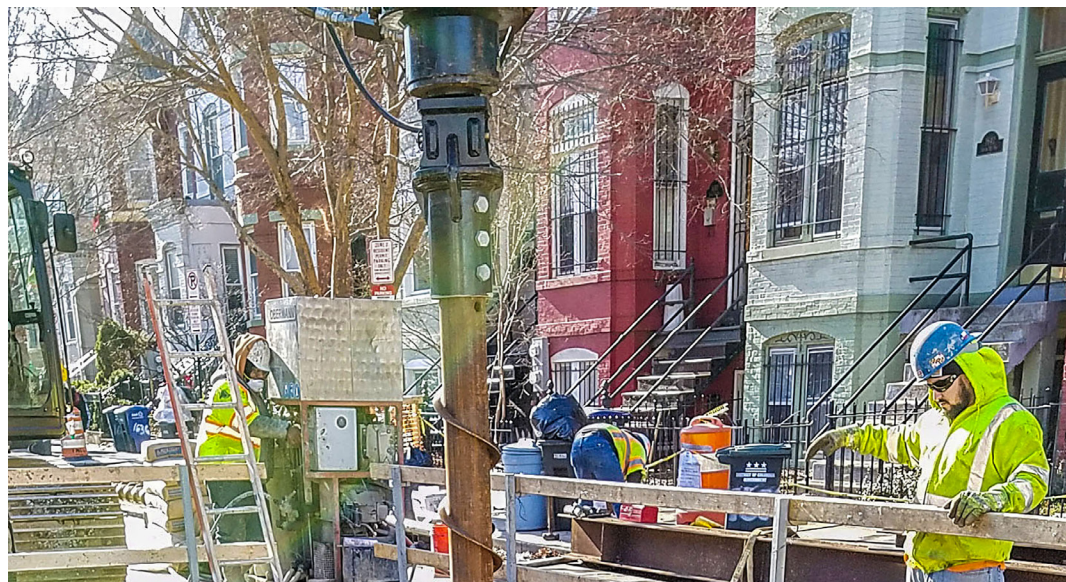
13" solid grout column

8" reverse auger

5.5" O.D. X 0.361" W.T. - 80 ksi central shaft

SOILS + EMBEDMENT DEPTH:

Soils consisted of clayey sands, silty sand, and silty gravel with sand. (See soils report)



STELCOR PILES WERE ABLE TO BEAR MUCH HIGHER LOADS AT LESSER DEPTHS, SAVING TIME AND MONEY



OVERVIEW:

The Clean Rivers Project is DC Water's ongoing program to reduce combined sewer overflows into the District's waterways. The Project is a massive infrastructure and support program designed to capture and clean wastewater during rainfalls before it ever reaches the rivers. The project is comprised of a system of deep tunnels, sewers and diversion facilities to capture combined sewer overflows and deliver them to a wastewater treatment plant.

CHALLENGE:

This particular section of tunnel runs down the center of a busy road, so scheduling was restrictive and keeping install time to a minimum was a priority. There was also limited access for installation equipment and staging materials. In addition, the installation of piles was weather dependent, and therefore subject to change without notice.

SOLUTION:

Creative Concepts Group, Inc. presented STELCOR Drilled-In Displacement Micropiles (DDM) to the D.C. Water & Sewer Department as an alternate. Engineers believed that a helical pulldown pile was substandard and would have failed in torsion at less than 20,000 ft-lbf. A STELCOR pile was tested and exceeded the requirements. STELCOR had a resistance of 30,000 to 40,000 ft-lbf in the top 10 feet and had a torque capacity of over 50,000 ft-lbf. With limited access and a tight schedule, a total of 46 STELCOR piles were installed for this thrust block reinforcement foundation. The STELCOR piles were able to bear higher loads at lesser depths, saving time and money.



Report of Stelcore Axial Tension Load Testing

Location: **Division U – Utility Relocation**

1600 6th Street NW, Washington D.C., 20001

FTG Project No.: F16044

Prepared For: **Creative Concepts Group, Inc.**

Date: January 4, 2017



Foundation Test Group, Inc. • 11408 Cronridge Dr., Suite K • Owings Mills, Maryland 21117

PH: (410)517-0715 • FAX: (410)517-0716

January 4, 2017

Bryan Neumann
President



Creative Concepts Group, Inc.

56 Pebble Drive
Baltimore, Maryland 21225



Subject: **Report of Stelcore Axial Tension Load Testing**
Division U – Utility Relocation
1600 6th Street NW, Washington D.C. 20001
FTG Project No.: F16044

Dear Mr. Neumann:

Pursuant to our proposal, Foundation Test Group, Inc. (FTG) has completed static axial tensile load testing services for the test pile "TP" at the above referenced site (See Appendix A for site location).

Services with respect to monitoring of load testing instrumentation, performance of the load test, and preparation of a report of the test results were provided.

We appreciate being of service to you on this project and look forward to providing continued deep foundation design and testing services to you.

If you have any questions regarding this test report, please do not hesitate to contact us at (410)517-0715.

Very truly yours,

for **Foundation Test Group, Inc.**

Jeffrey W. Goodwin, P.E.





EXECUTIVE SUMMARY:

- Stelcore test pile (TP) was installed by ***Creative Concepts Group, Inc. (CCGI)*** on December 20, 2016 and axially load tested by ***Foundation Test Group, Inc. (FTG)*** on December 29, 2016.
- The pile tested consisted of an upper cased portion of 2.5-feet and a lower uncased soil bond zone of 30.0-feet. The pile diameter was 6-in. and contained a full length 76mm steel all-thread hollow core bar. Grout strength tested at 4,390 psi on September 20, 2016. The test pile had a total drilled depth of 32.0-feet below existing slab surface.
- For the tension test, at an applied load of 114.0 kips (100% design load) top of pile displacement for the test pile was 0.36-inches. At the maximum applied test load of 148 kips (130% design load), top of pile displacement for the test pile was 0.65-inches. Net movement after unloading was 0.26-inches.
- Based upon the test results and our professional experience, the test pile has an **allowable capacity of 68 kips and an ultimate capacity of 136 kips.**





TEST PILE INSTALLATION:

The test pile was installed by ***Creative Concepts Group, Inc.*** on December 20, 2016. Test pile locations and dimensions were approved in advance by the contractor. The test pile consisted of a 28-foot long section containing a 5.5-inch Stelcore pile with a 12-inch diameter displacement head. Pile installation was terminated when the pile could not be advanced past a depth of 28-feet due to an obstruction. Grout was pooled around the top of the pile throughout installation and pulled down by flighted augers as the pile was advanced. After reaching refusal the 5.5-inch diameter hollow core of the pile was filled with grout. Grout used for all portions of test pile installation had a compressive strength of at least 5,500 psi. Complete pile installation logs and grout compressive strength reports are included as Appendix E at the end of this report.

TEST FRAME ASSEMBLY:

For the load test, timber crane mats composed of 6"x6" timber were placed approximately adjacent to the test pile. A steel test beam (2xMC18x58 channels bolted together) were placed on top of the crane mats and over the test pile. The top of the pile was fitted with a cap that bolted to the 5.5-inch diameter steel core of the pile. A 1 ¾-inch diameter all-thread reinforcing bar was attached to the pile cap and extended through the center of the steel test beam. A 350-kip center-hole jack was placed over the all-thread bar and on top of the test beam and secured with a nut and plate. Load test setup photos are included as Appendix D at the end of this report.

MONITORING INSTRUMENTATION:

In addition to the calibrated jack and pressure gauge, the following instrumentation was used during the load test:

4 - Displacement gauges (0.0001" division)- attached at top of the pile. (Used to measure the pile top downward movement)

1 – 1/100th inch scale – attached to the hydraulic jack as a secondary reference used to verify displacement gauge readings.

Calibrations for the jack, pressure and displacement gages are included as Appendix B at the end of this report.





AXIAL LOAD TEST:

Axial load testing was performed under the direction of Mr. Thomas Clingan, P.E. of **Foundation Test Group, Inc.** on December 29, 2016. The load test apparatus and testing assistance was provided by **Creative Concepts Group, Inc.** Axial load testing was performed in accordance with the **ASTM D3689 Standard Test Methods for Deep Foundations Under Static Axial Tensile Load.**

Load was applied to the top of the test pile in increments of approximately 10% of the design load (see Appendix B for jack calibration). Each increment was held for a minimum of 4 minutes, with readings taken at 1, 2, and 4 minutes after the application of load. The 100% design load was held for 15 minutes to monitor pile for creep. Total pile displacement at 100% design load for TP was 0.36-inches. The rate of movement with respect to load began to substantially increase after 136-kips (120% of design load). While attempting to increase the test load to 160 kips (140% design load), the pile top continuously pulled out of the ground. Further attempts to increase load resulted in continued displacement. Total displacements at 148-kips (130% of design load) immediately prior to failure for TP was 0.65-inches. The test pile was unloaded in 4 equal decrements. Net movement after unloading for TP was 0.26-inches.

The pile was analyzed for load versus displacement. Based on the data collected and our professional experience the pile has an **allowable capacity of 68 kips** and **ultimate capacity of 136 kips**. Complete load test data is included as Appendix C at the end of this report.

CLOSURE:

We have made the above recommendations based upon the available site information. If you have any questions, please do not hesitate to contact us at (410)-517-0715.

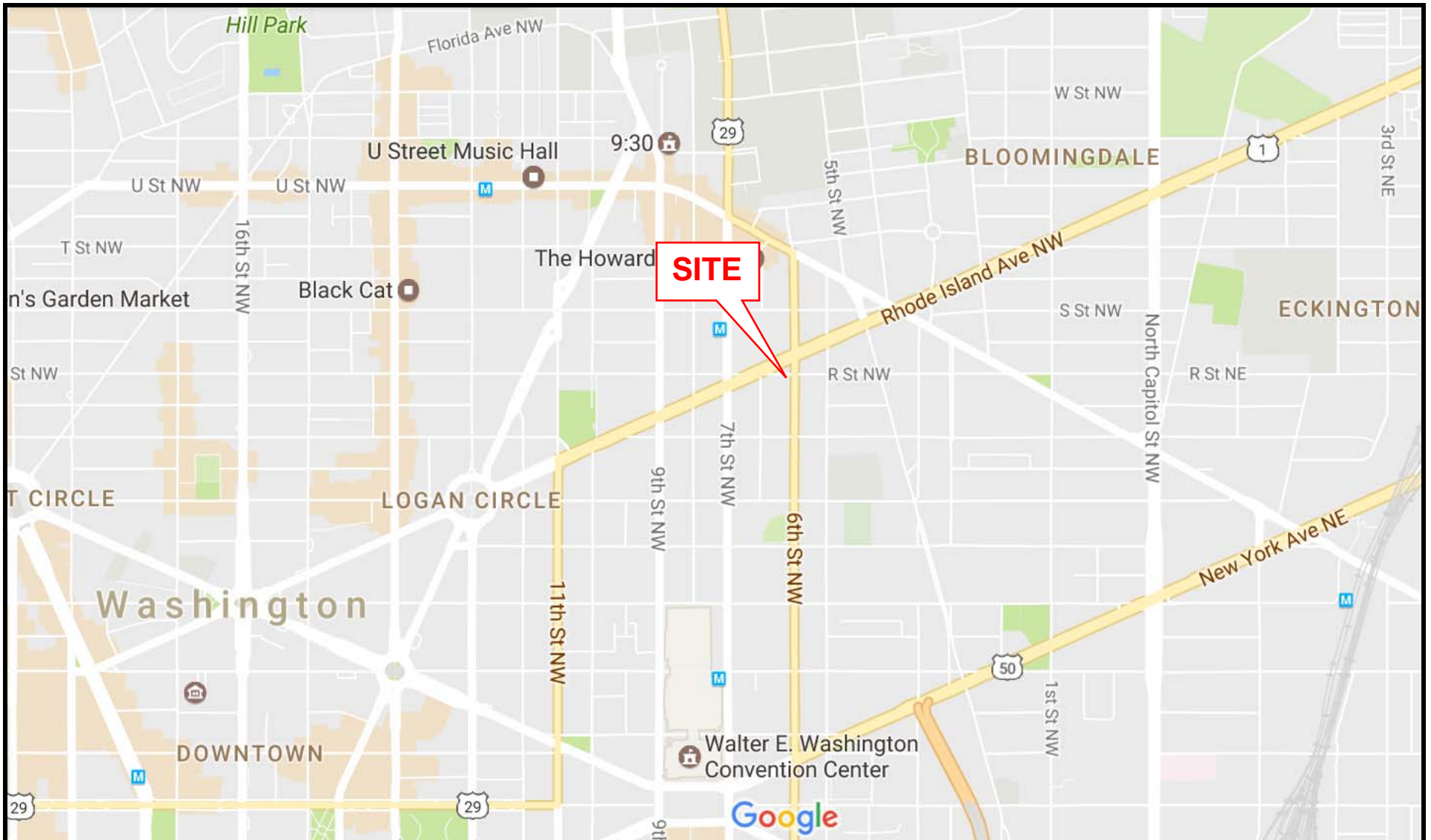




APPENDIX A

**Site Location
Site Aerial Location**





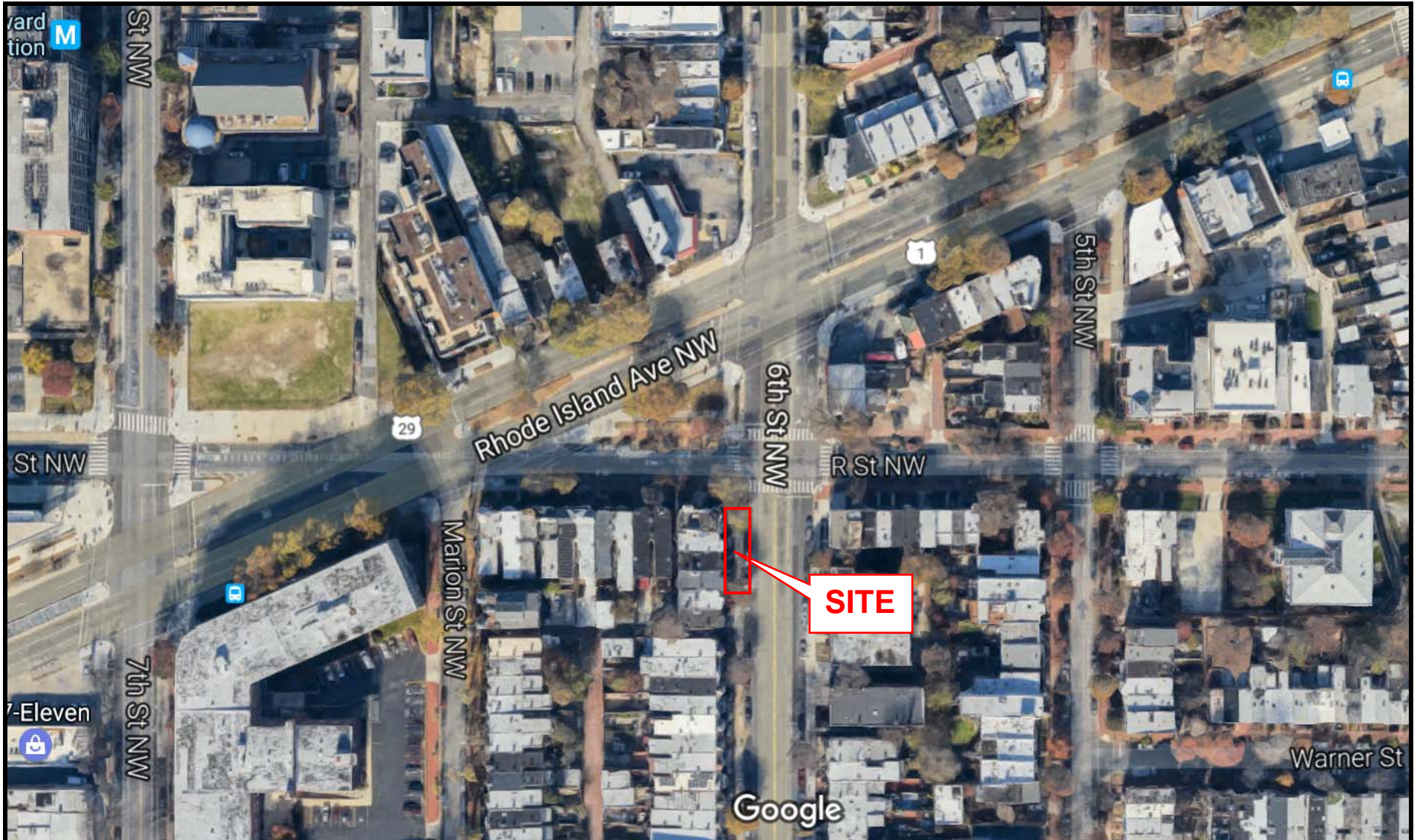
FOUNDATION TEST GROUP, INC.

11408 Cronridge Drive, Suite K, Owings Mills, Maryland 21117
Phone: (410)517-0715 • Fax: (410)517-0716

Project Location Map

Division U – Utility Relocation
1600 6th Street NW
Washington, D.C. 20001
FTG Project No.: F16044

Figure No.: 1



FOUNDATION TEST GROUP, INC.

Project Aerial Map

Division U – Utility Relocation

1600 6th Street NW

Washington, D.C. 20001

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Figure No.: 2



APPENDIX B

Jack & Pressure Gage Calibration Dial Gauge Calibrations



175 TONS

Calibrated By: ED CARLSON

Date: 10/6/2016

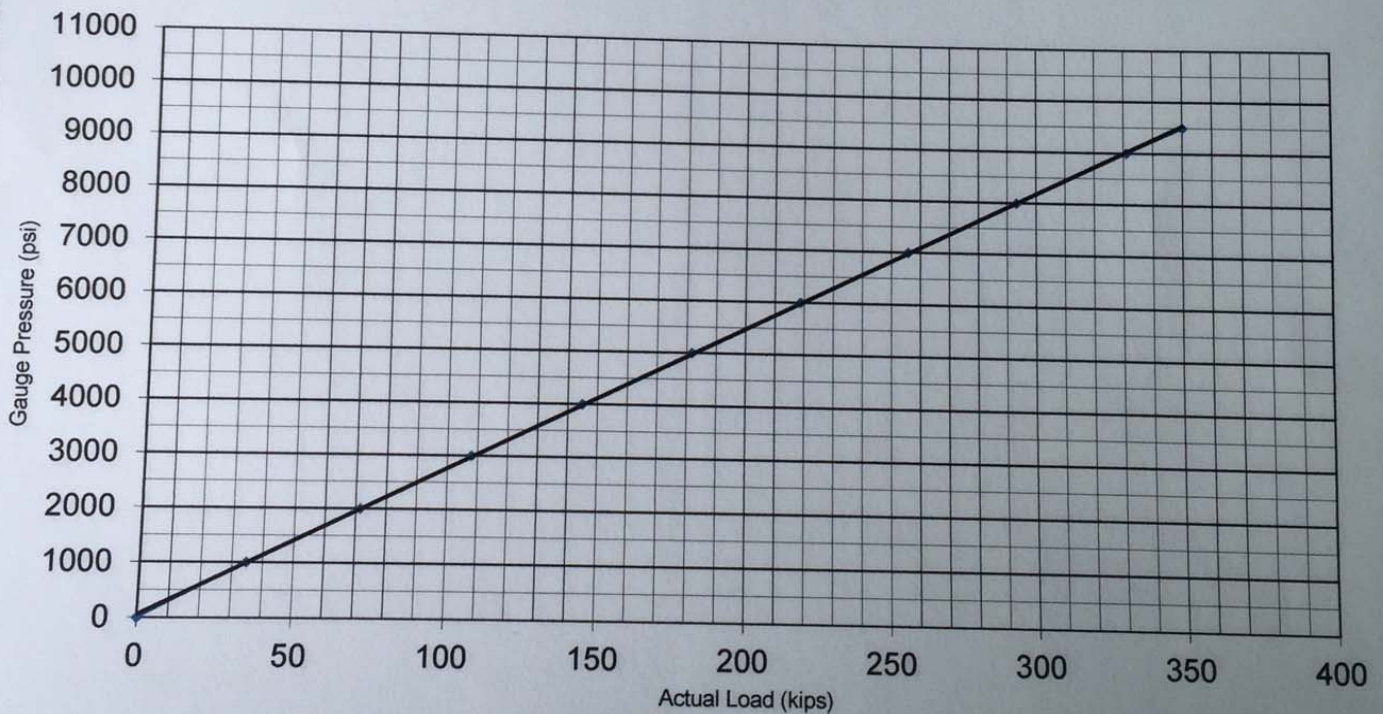
Load Cell #: 8191M

<u>Gauge Reading (psi)</u>	<u>Load (kips)</u>
0	0.0
1000	34.6
2000	71.5
3000	108.0
4000	144.9
5000	181.7
6000	218.7
7000	255.8
8000	293.2
9000	330.9
9500	350.0

Ram #: 175-8-CCG1

Gauge#: 175-8-CCG1

175 TONS CALIBRATION CURVE 175-8-CCG1



$$y = 27.082x + 56.566$$



VStructural, LLC
8006 Haute Court
Springfield, VA 22150
(703) 451-4300
(703) 451-0862 fax
www.vsl.net

Digital Gage Calibration Summary



Gage Type: Chicago Dial Indicator Company
Logic Plus – LG2820
Range - 4-inches
Scale Interval – 0.0001-inches

Gage Marking	Serial No.	Certificate No.	Date of Calibration	Calibration Current Through
1	031341995	40073	10/25/2014	10/25/2017
2	063315679	47789	02/01/2016	02/01/2019
3	062481686	47665	02/01/2016	02/01/2019
4	063315678	47664	02/01/2016	02/01/2019
5	031341994	40075	10/25/2014	10/25/2017
6	063315680	40072	10/25/2014	10/25/2017

Per ASTM D1143 (Axial Compression), Section 7.1.4, Dial Gages should be calibrated within three years of use.

Per ASTM D3689 (Tension), Section 7.1.4, Dial Gages should be calibrated within three years of use.

Per ASTM D3966 (Lateral), Section 7.1.4, Dial Gages should be calibrated within three years of use.





Gage 1

Chicago Dial Indicator Co.
1372 Redeker Road
Des Plaines, IL. 60016
ISO Registered Firm

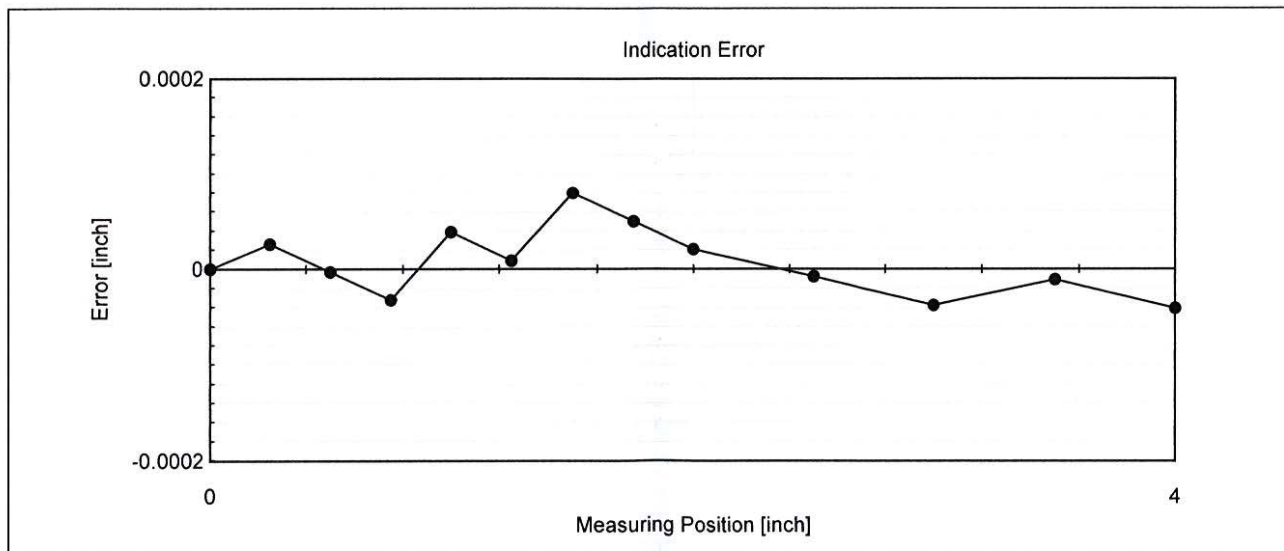
Factory Certificate of Calibration

Product Name	LOGIC PLUS	Name of Inspection Standard	CDI .0001/4.0
Model No.	LG2820	Unit	inch
Serial No.	031341995	Scale Interval	0.0001 inch
Certificate No.	40073	Measuring Range	4 inch
		Reference Point	0 inch
		End Point	4 inch

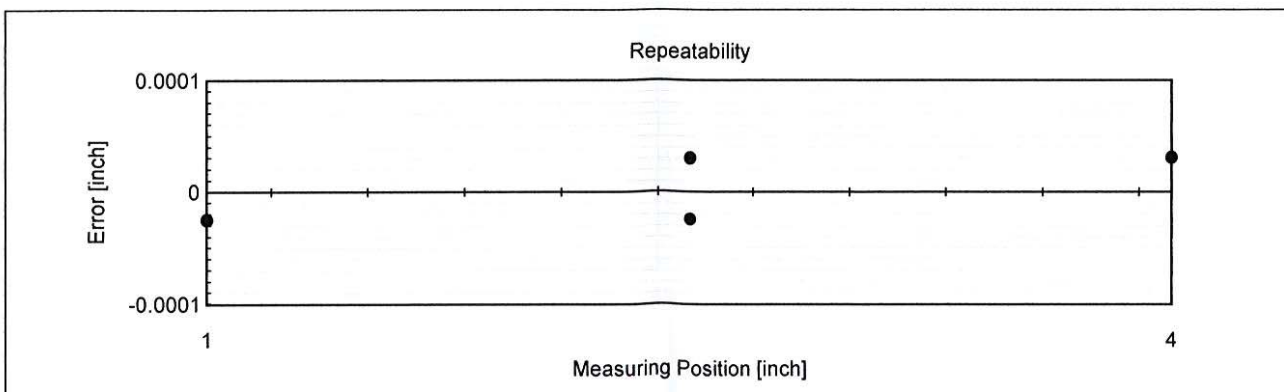
N.I.S.T. No. 821/268795-03

Inspection Item Name	Result	Permissible Value	Judgment
Indication Error	0.0001206 inch	0.0002 inch	GO
Hysteresis	-----	-----	N/A
Repeatability	0.0000559 inch	0.0001 inch	GO
Max. Measuring Force	-----	-----	N/A

Inspection Item Name	Judgment
Inspection of Function and Appearance	GO



Indication Error is the sum of accuracy and quantizing error.



Repeatability is taken at three positions, with five readings at each position.

Phone: 847-827-7186
Fax: 847-827-0478
Website: www.dialindicator.com

Signature: _____

10/25/2014

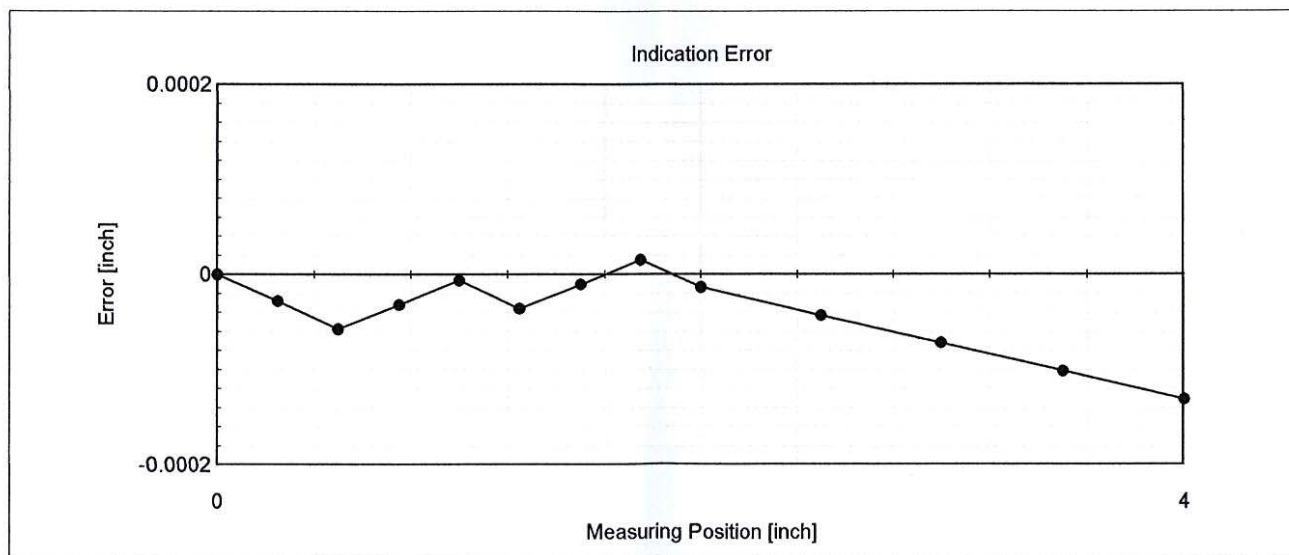
Factory Certificate of Calibration

Product Name	LOGIC PLUS	Name of Inspection Standard	CDI .0001/4.0
Model No.	LG2820	Unit	inch
Serial No.	063315679	Scale Interval	0.0001 inch
Certificate No.	47789	Measuring Range	4 inch
		Reference Point	0 inch
		End Point	4 inch

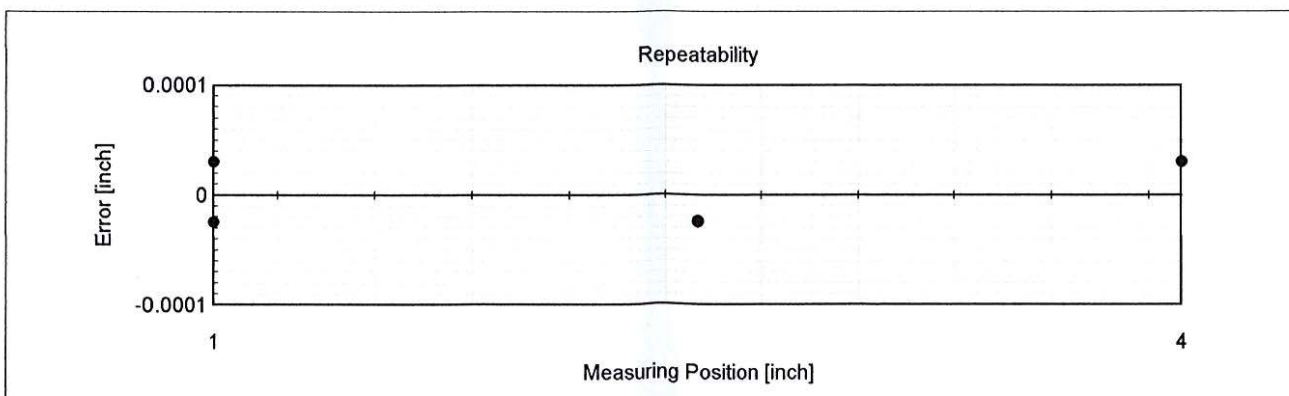
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Inspection Item Name	Result	Permissible Value	Judgment
Indication Error	0.0001462 inch	0.0002 inch	GO
Hysteresis	-----	-----	N/A
Repeatability	0.0000551 inch	0.0001 inch	GO
Max. Measuring Force	-----	-----	N/A

Inspection Item Name	Judgment
Inspection of Function and Appearance	GO



Indication Error is the sum of accuracy and quantizing error.



Repeatability is taken at three positions, with five readings at each position.

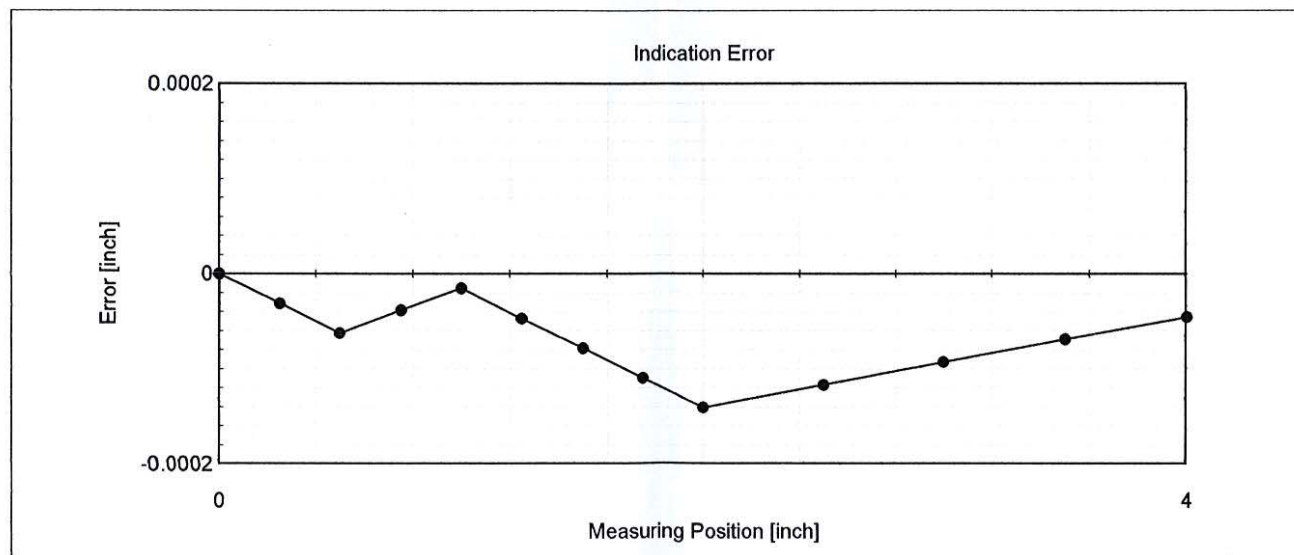
Factory Certificate of Calibration

Product Name	LOGIC PLUS	Name of Inspection Standard	CDI .0001/4.0
Model No.	LG2820	Unit	inch
Serial No.	062481636	Scale Interval	0.0001 inch
Certificate No.	47665	Measuring Range	4 inch
		Reference Point	0 inch
		End Point	4 inch

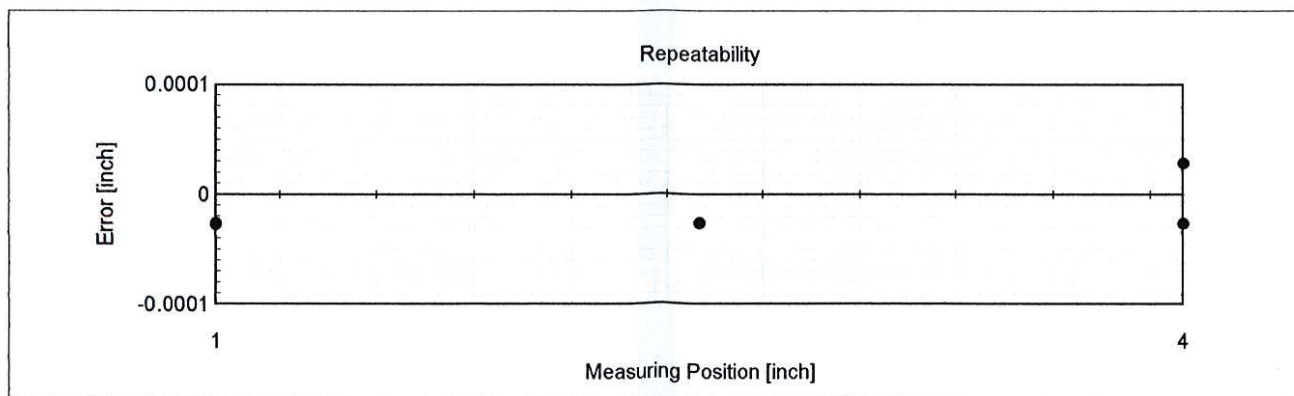
N.I.S.T. No. 821/268795-03

Inspection Item Name	Result	Permissible Value	Judgment
Indication Error	0.0001415 inch	0.0002 inch	GO
Hysteresis	-----	-----	N/A
Repeatability	0.0000555 inch	0.0001 inch	GO
Max. Measuring Force	-----	-----	N/A

Inspection Item Name	Judgment
Inspection of Function and Appearance	GO



Indication Error is the sum of accuracy and quantizing error.



Repeatability is taken at three positions, with five readings at each position.

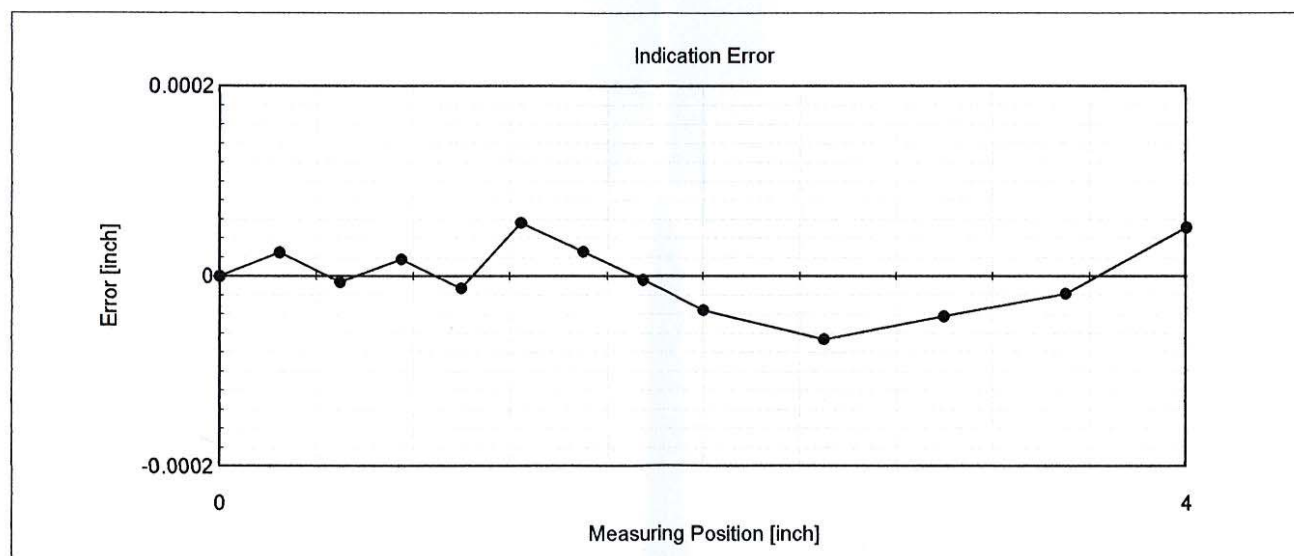
Factory Certificate of Calibration

Product Name	LOGIC PLUS	Name of Inspection Standard	CDI .0001/4.0
Model No.	LG2820	Unit	inch
Serial No.	063315678	Scale Interval	0.0001 inch
Certificate No.	47664	Measuring Range	4 inch
		Reference Point	0 inch
		End Point	4 inch

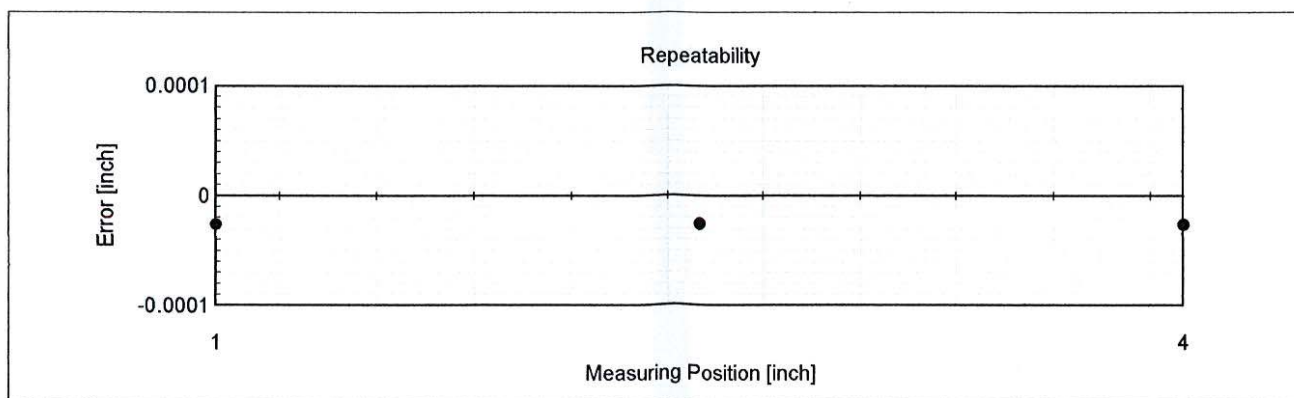
N.I.S.T. No. 821/268795-03

Inspection Item Name	Result	Permissible Value	Judgment
Indication Error	0.0001226 inch	0.0002 inch	GO
Hysteresis	-----	-----	N/A
Repeatability	0.0000012 inch	0.0001 inch	GO
Max. Measuring Force	-----	-----	N/A

Inspection Item Name	Judgment
Inspection of Function and Appearance	GO



Indication Error is the sum of accuracy and quantizing error.



Repeatability is taken at three positions, with five readings at each position.

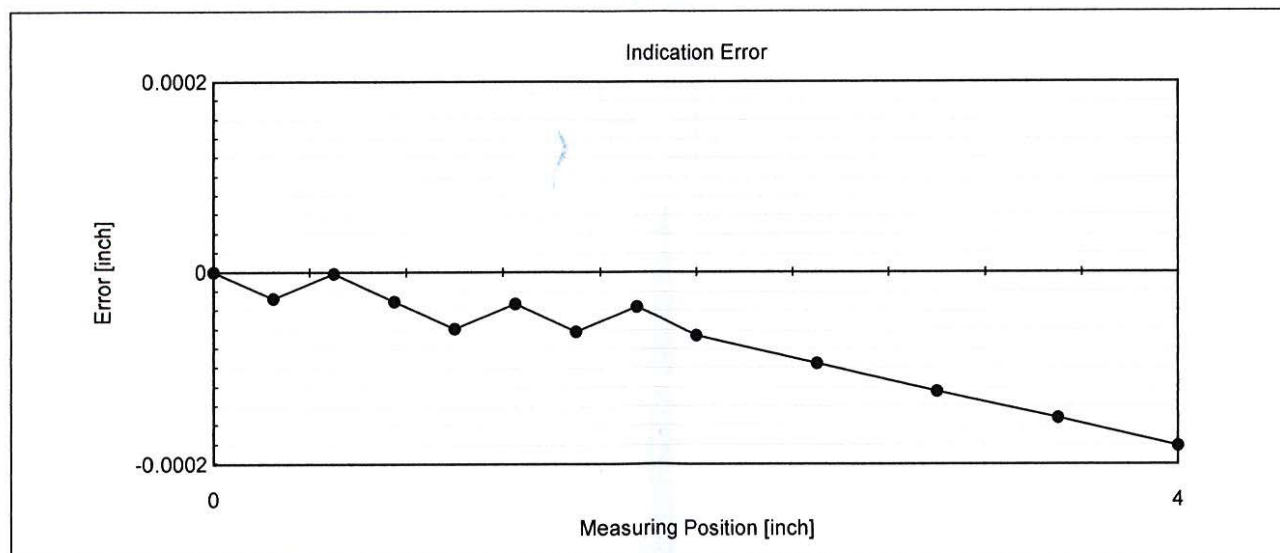
Factory Certificate of Calibration

Product Name	LOGIC PLUS	Name of Inspection Standard	CDI .0001/4.0
Model No.	LG2820	Unit	inch
Serial No.	031341994	Scale Interval	0.0001 inch
Certificate No.	40075	Measuring Range	4 inch
		Reference Point	0 inch
		End Point	4 inch

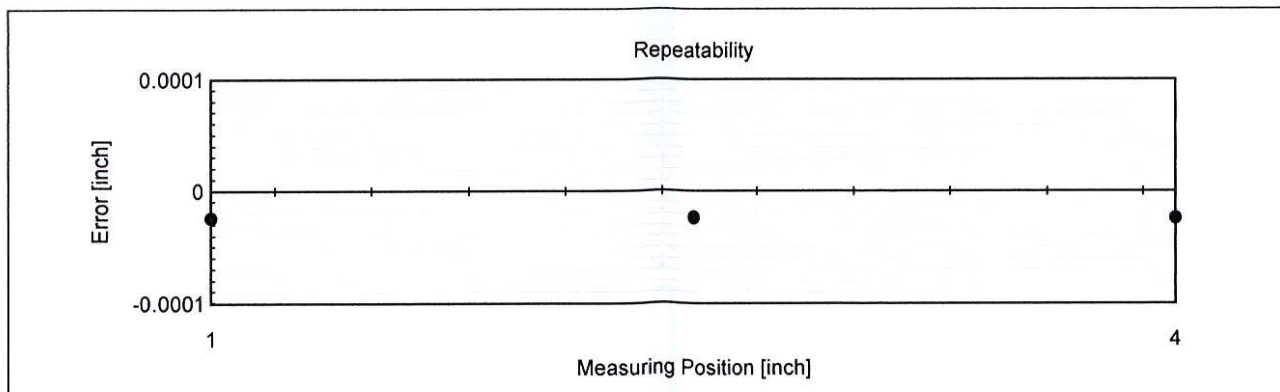
N.I.S.T. No. 821/268795-03

Inspection Item Name	Result	Permissible Value	Judgment
Indication Error	0.0001817 inch	0.0002 inch	GO
Hysteresis	-----	-----	N/A
Repeatability	0.0000012 inch	0.0001 inch	GO
Max. Measuring Force	-----	-----	N/A

Inspection Item Name	Judgment
Inspection of Function and Appearance	GO



Indication Error is the sum of accuracy and quantizing error.



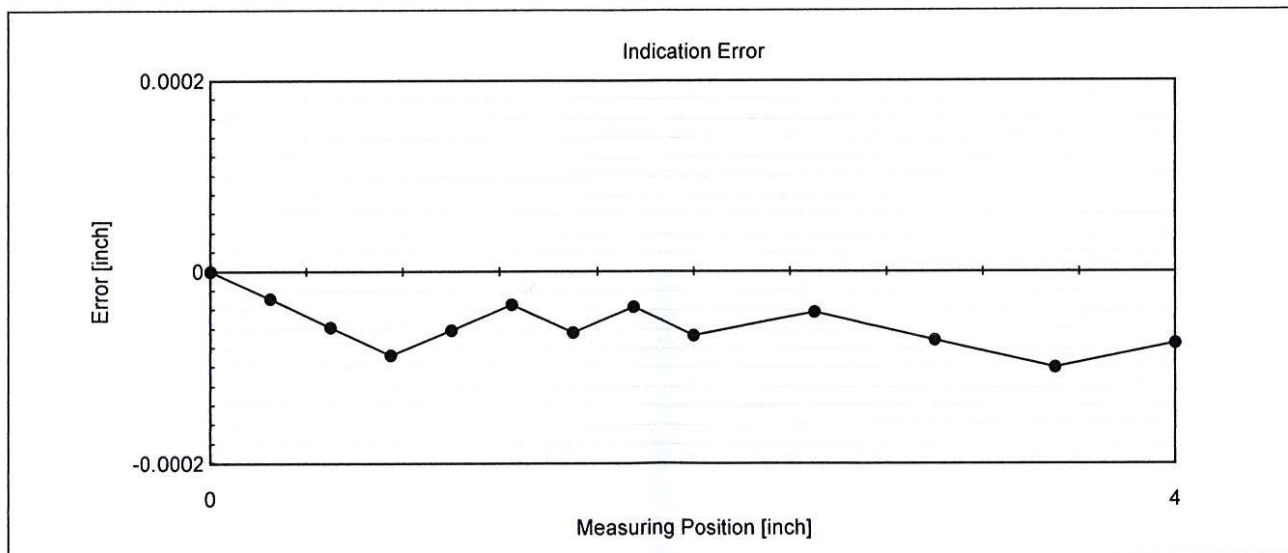
Repeatability is taken at three positions, with five readings at each position.

Factory Certificate of Calibration

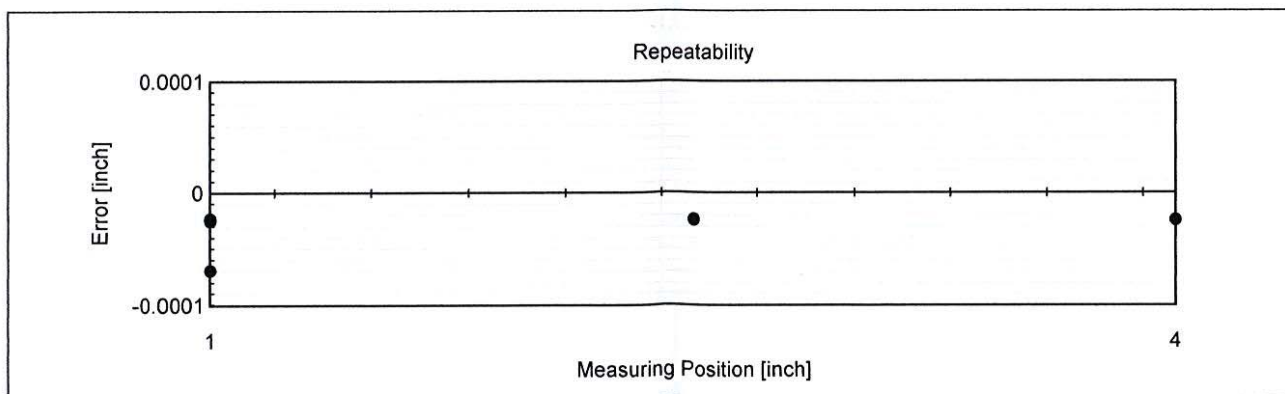
Product Name	LOGIC PLUS	Name of Inspection Standard	CDI .0001/4.0
Model No.	LG2820	Unit	inch
Serial No.	063315680	Scale Interval	0.0001 inch
Certificate No.	40072	Measuring Range	4 inch
		Reference Point	0 inch
		End Point	4 inch
N.I.S.T. No. 821/268795-03			

Inspection Item Name	Result	Permissible Value	Judgment
Indication Error	0.0001007 inch	0.0002 inch	GO
Hysteresis	-----	-----	N/A
Repeatability	0.0000457 inch	0.0001 inch	GO
Max. Measuring Force	-----	-----	N/A

Inspection Item Name	Judgment
Inspection of Function and Appearance	GO



Indication Error is the sum of accuracy and quantizing error.



Repeatability is taken at three positions, with five readings at each position.

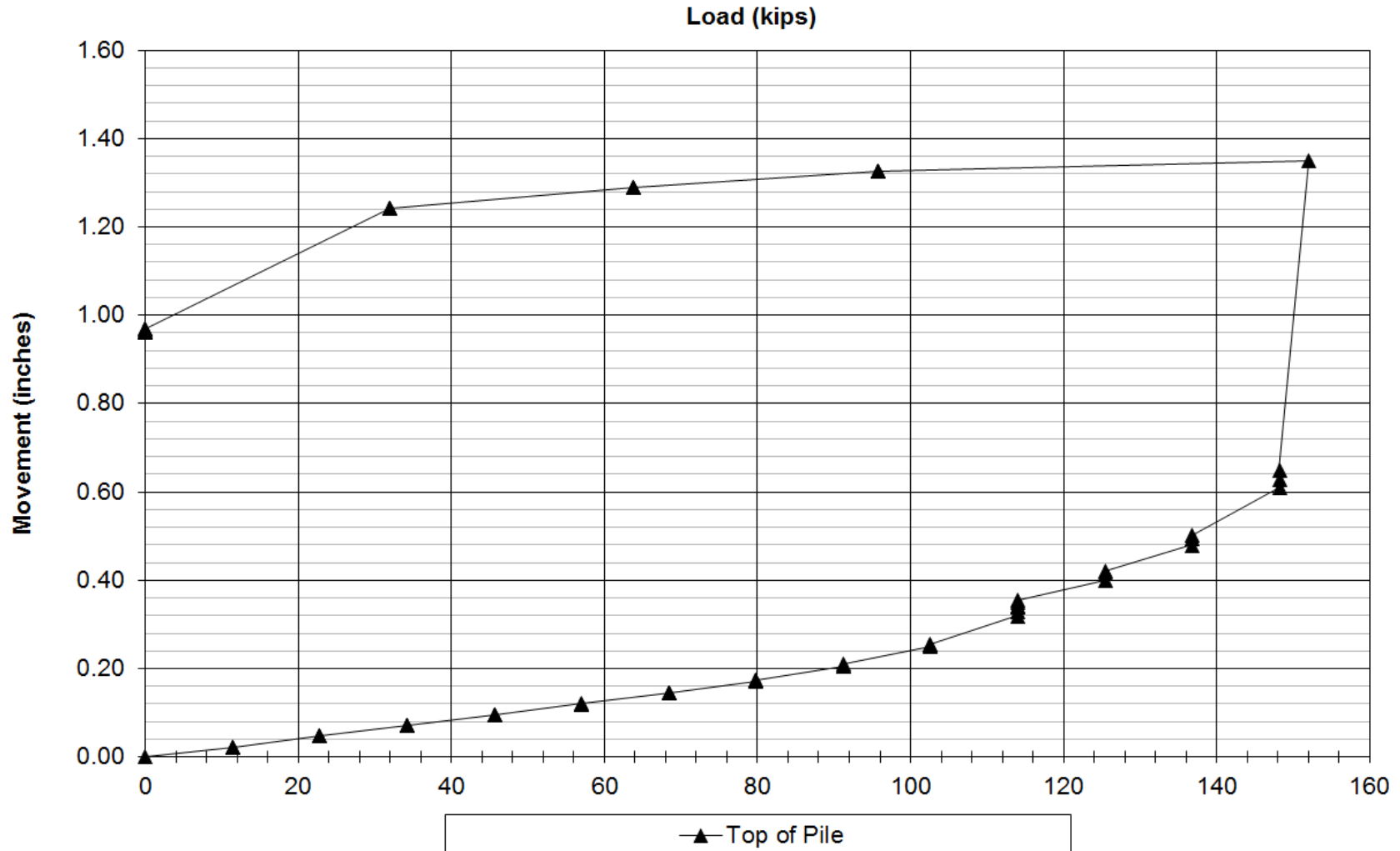


Appendix C

**Load – Movement Curve
Load – Creep Curve
Reduced Load Test Data**



Load - Movement Curve



**FOUNDATION TEST
GROUP, INC.**

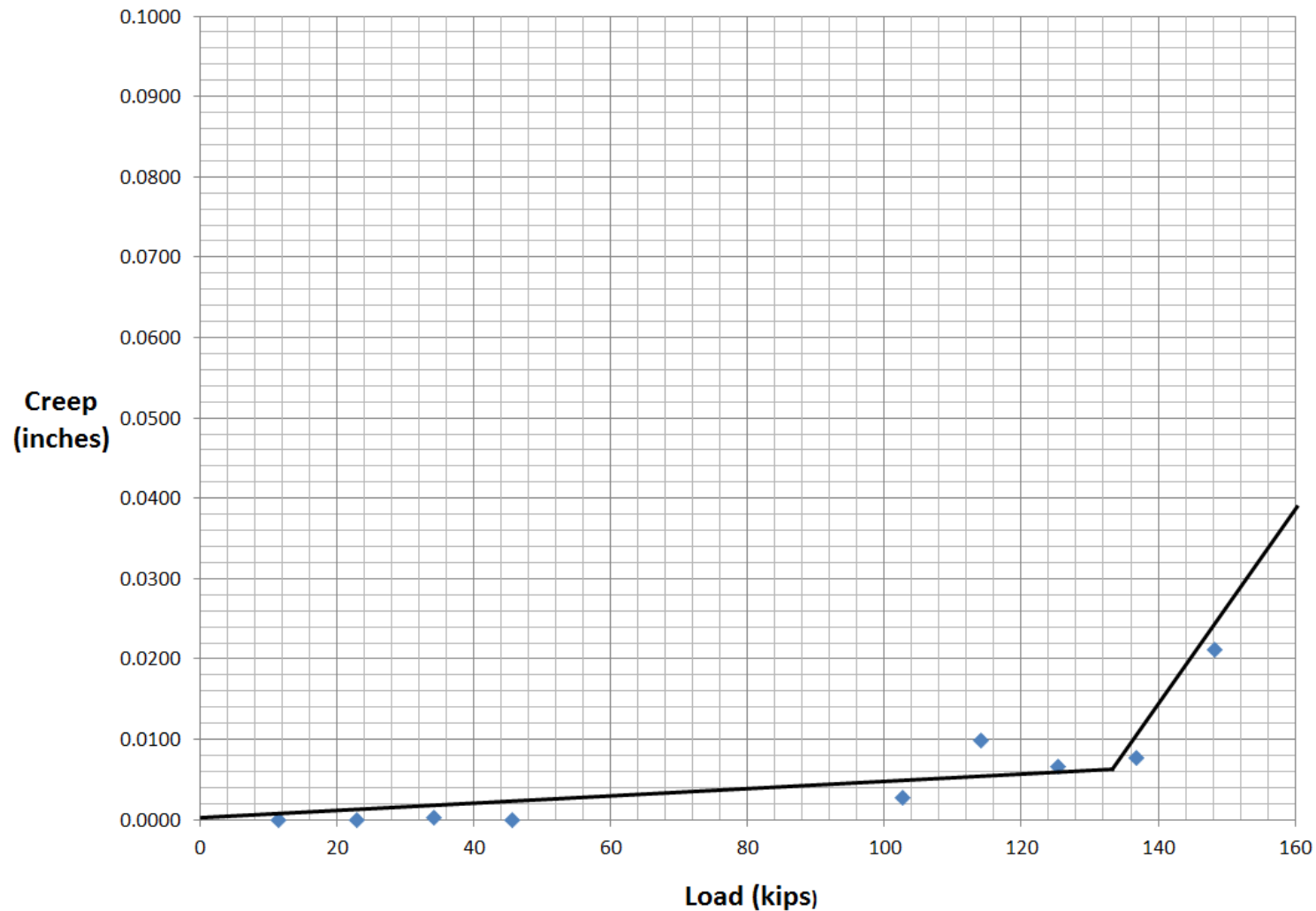
Load vs. Movement Curve

Division U – Utility Relocation
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Graph No.: 1

Load- Creep Curve



**FOUNDATION TEST
GROUP, INC.**

Load vs. Creep Curve

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Graph No.: 2

Division U Utility Relocation

Test File No.:	TP-1	FTG Project No.:	F16044	Design capacity (kips):	114
Date of test:	12/29/2016	Date of Installation:	12/20/2016	Test load (kips):	148
Client:	Creative Concepts Group, Inc.	Total grout volume(CF):	10 bags	Pile diameter (in.):	12
ASTM/Spec.:	ASTM D3689, Procedure A	Surface elevation:		Pile length (ft.):	28
Page No.:	Page 1 of 3	Pile top elevation:		Compressive strength (PSI):	5,600

Load Interval	Minutes After Start	Percent of Design Load	Load (kips)	Pressure (psi)	Displacement (inches)					Creep (inches)	TP Scale	Notes
					Gage 1	Gage 2	Gage 3	Gage 4	Average			
0	0.0	0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	
1L1	1.0	10%	11.4	365	0.022	0.043	0.024	0.002	0.023			
1L1	2.0	10%	11.4	365	0.022	0.043	0.024	0.002	0.023			
1L1	4.0	10%	11.4	365	0.022	0.043	0.024	0.002	0.023	0.000		
1L2	1.0	20%	22.8	674	0.032	0.068	0.062	0.027	0.047			
1L2	2.0	20%	22.8	674	0.032	0.068	0.062	0.027	0.047			
1L2	4.0	20%	22.8	674	0.032	0.068	0.062	0.027	0.047	0.000		
1L3	1.0	30%	34.2	983	0.043	0.090	0.098	0.051	0.071			
1L3	2.0	30%	34.2	983	0.043	0.090	0.098	0.051	0.071			
1L3	4.0	30%	34.2	983	0.043	0.090	0.100	0.051	0.071	0.000		
1L4	1.0	40%	45.6	1292	0.056	0.114	0.133	0.077	0.095			
1L4	2.0	40%	45.6	1292	0.056	0.114	0.134	0.077	0.095			
1L4	4.0	40%	45.6	1292	0.056	0.114	0.134	0.077	0.095	0.000		
1L5	1.0	50%	57.0	1600	0.073	0.138	0.166	0.104	0.120			
1L5	2.0	50%	57.0	1600	0.073	0.138	0.166	0.104	0.120			
1L5	4.0	50%	57.0	1600	0.073	0.138	0.166	0.105	0.121	0.001		
1L6	1.0	60%	68.4	1909	0.091	0.161	0.195	0.130	0.144			
1L6	2.0	60%	68.4	1909	0.091	0.161	0.195	0.130	0.144			
1L6	4.0	60%	68.4	1909	0.093	0.163	0.195	0.130	0.145	0.001		
1L7	1.0	70%	79.8	2218	0.115	0.188	0.226	0.156	0.171			
1L7	2.0	70%	79.8	2218	0.116	0.189	0.228	0.159	0.173			
1L7	4.0	70%	79.8	2218	0.116	0.189	0.228	0.159	0.173	0.000	0.12	



Foundation Test Group, Inc. • 11408 Cronridge Drive, Suite K • Owings Mills MD 21117
(410)517-0715 • Fax (410)517-0716



Division U Utility Relocation

Test Pile No.:	TP-1	FTG Project No.:	F16044	Design capacity (kips):	114
Date of test:	12/29/2016	Date of Installation:	12/20/2016	Test load (kips):	148
Client:	Creative Concepts Group, Inc.	Total grout volume(CF):	10 bags	Pile diameter (in.):	12
ASTM/Spec.:	ASTM D3689, Procedure A	Surface elevation:		Pile length (ft.):	28
Page No.:	Page 2 of 3	Pile top elevation:		Compressive strength (PSI):	5,600

Load Interval	Minutes After Start	Percent of Design Load	Load (kips)	Pressure (psi)	Displacement (inches)					Creep (inches)	TP Scale	Notes
					Gage 1	Gage 2	Gage 3	Gage 4	Average			
1L8	1.0	80%	91.2	2526	0.144	0.220	0.263	0.190	0.204			
1L8	2.0	80%	91.2	2526	0.144	0.220	0.263	0.190	0.204			
1L8	4.0	80%	91.2	2526	0.150	0.226	0.270	0.197	0.211	0.007		
1L9	1.0	90%	102.6	2835	0.187	0.265	0.314	0.238	0.251			
1L9	2.0	90%	102.6	2835	0.187	0.265	0.316	0.240	0.252			
1L9	4.0	90%	102.6	2835	0.193	0.271	0.316	0.240	0.255	0.003		
1L10	1.0	100%	114.0	3144	0.257	0.338	0.390	0.293	0.319			
1L10	2.0	100%	114.0	3144	0.268	0.348	0.400	0.302	0.329			
1L10	4.0	100%	114.0	3144	0.278	0.359	0.410	0.311	0.339	0.010	0.27	
1L10	5.0	100%	114.0	3144	0.281	0.361	0.413	0.313	0.342			
1L10	10.0	100%	114.0	3144	0.288	0.369	0.420	0.319	0.349			
1L10	15.0	100%	114.0	3144	0.295	0.376	0.426	0.325	0.355			
1L11	1.0	110%	125.4	3453	0.338	0.421	0.473	0.369	0.400			
1L11	2.0	110%	125.4	3453	0.352	0.435	0.487	0.383	0.414			
1L11	4.0	110%	125.4	3453	0.359	0.442	0.494	0.389	0.421	0.007		
1L12	1.0	120%	136.8	3761	0.418	0.504	0.556	0.442	0.480			
1L12	2.0	120%	136.8	3761	0.436	0.522	0.572	0.443	0.493			
1L12	4.0	120%	136.8	3761	0.445	0.529	0.580	0.450	0.501	0.008	0.46	
1L13	1.0	130%	148.2	4070	0.550	0.638	0.692	0.562	0.610			
1L13	2.0	130%	148.2	4070	0.570	0.656	0.709	0.577	0.628			
1L13	4.0	130%	148.2	4070	0.592	0.678	0.730	0.598	0.649	0.021		
1L14	1.0	140%	159.6	4379	1.308	1.389	1.452	1.246	1.349		1.35	
1L14	2.0	140%	159.6	4379								
1L14	4.0	140%	159.6	4379								

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(410)517-0715 • Fax (410)517-0716



Division U Utility Relocation

Test Pile No.:	TP-1	FTG Project No.:	F16044	Design capacity (kips):	114
Date of test:	12/29/2016	Date of Installation:	12/20/2016	Test load (kips):	148
Client:	Creative Concepts Group, Inc.	Total grout volume(CF):	10 bags	Pile diameter (in.):	12
ASTM/Spec.:	ASTM D3689, Procedure A	Surface elevation:		Pile length (ft.):	28
Page No.:	Page 3 of 3	Pile top elevation:		Compressive strength (PSI):	5,600

Load Interval	Minutes After Start	Percent of Design Load	Load (kips)	Pressure (psi)	Displacement (inches)					Creep (inches)	TP Scale	Notes
					Gage 1	Gage 2	Gage 3	Gage 4	Average			
1UL1	1.0	84%	95.8	2650	1.265	1.349	1.411	1.278	1.326			
1UL1	2.0	84%	95.8	2650	1.265	1.349	1.411	1.278	1.326			
1UL1	4.0	84%	95.8	2650	1.265	1.349	1.411	1.278	1.326			
1UL2	1.0	56%	63.8	1785	1.228	1.309	1.379	1.246	1.290			
1UL2	2.0	56%	63.8	1785	1.228	1.309	1.379	1.246	1.290			
1UL2	4.0	56%	63.8	1785	1.228	1.309	1.379	1.246	1.290			
1UL3	1.0	28%	31.9	921	1.177	1.253	1.335	1.205	1.242			
1UL3	2.0	28%	31.9	921	1.176	1.252	1.335	1.205	1.242			
1UL3	4.0	28%	31.9	921	1.176	1.252	1.335	1.205	1.242			
1UL4	1.0	0%	0.0	0	1.025	1.022	1.033	0.799	0.970			
1UL4	2.0	0%	0.0	0	1.023	1.020	1.032	0.798	0.968			
1UL4	4.0	0%	0.0	0	1.018	1.015	1.028	0.794	0.964			
1UL4	5.0	0%	0.0	0	1.017	1.014	1.027	0.789	0.962			
1UL4	10.0	0%	0.0	0	1.019	1.014	1.027	0.793	0.963			
1UL4	15.0	0%	0.0	0	1.016	1.013	1.026	0.792	0.962		1.09	



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Appendix D

Load Test Photos





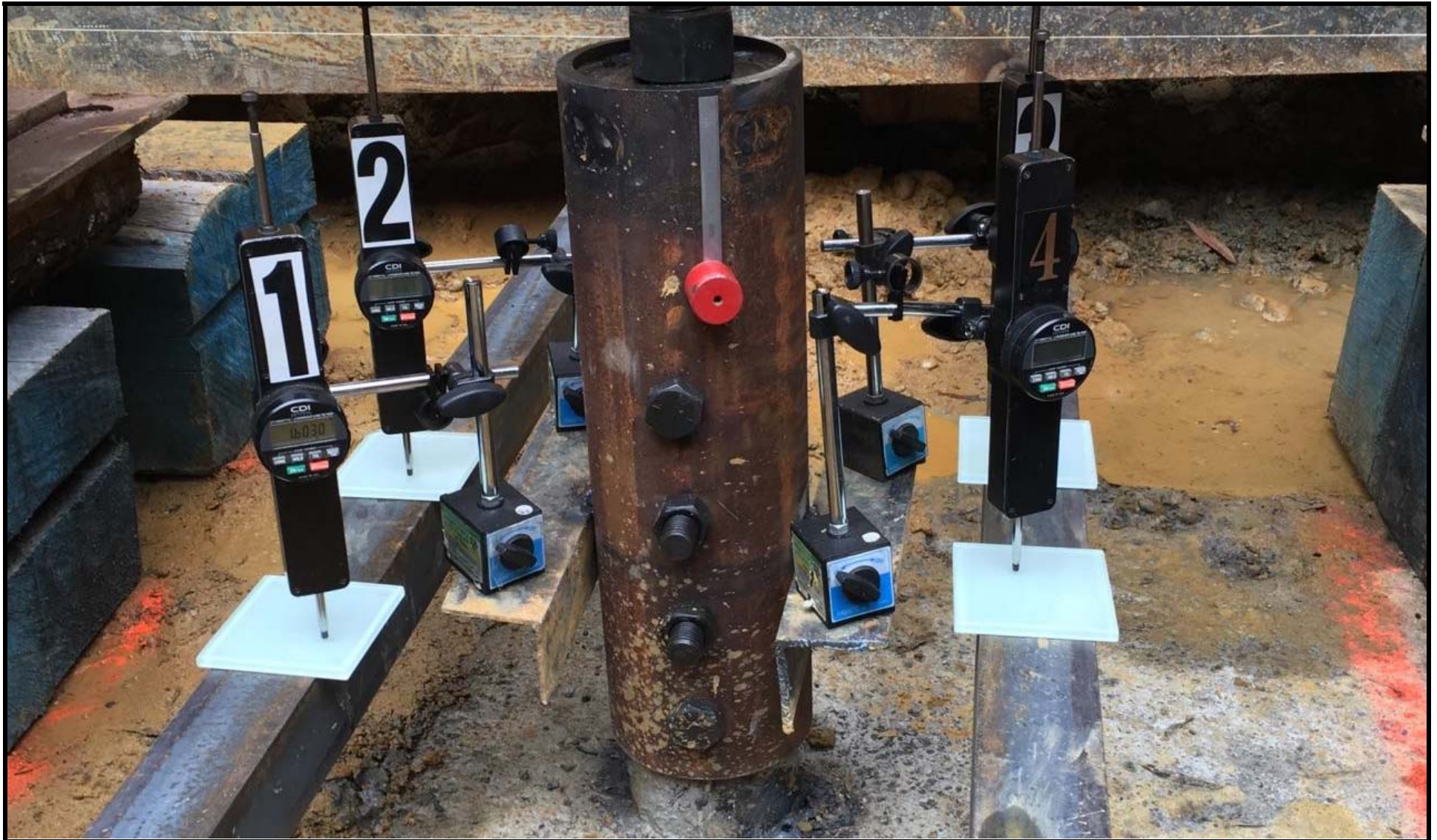
FOUNDATION TEST GROUP, INC.

11408 Cronridge Drive, Suite K, Owings Mills, Maryland 21117
Phone: (410)517-0715 • Fax: (410)517-0716

Load Test Setup

Division U - Utility Relocation
1600 6th Street NW
Washington, D.C. 20001
FTG Project No.: F16044

Photo No.: 1



FOUNDATION TEST GROUP, INC.

11408 Cronridge Drive, Suite K, Owings Mills, Maryland 21117
Phone: (410)517-0715 • Fax: (410)517-0716

Load Test Setup

Division U - Utility Relocation
1600 6th Street NW
Washington, D.C. 20001
FTG Project No.: F16044

Photo No.: 2



Appendix E

Installation Log Grout Compressive Strength Report





Email: info@idl-grp.com

JOB NAME: Division "U"	ENGINEER: Bryant Blake
DATE: 12-20-16	PILE DESIGN CAPACITY IN KIPS: 114
TYPE OF STRUCTURE: Thrust Block	PILE TYPE: Tension
DISPLACEMENT HEAD DIAMETER: 12"	STEEL CORE DIMENSION: 5.5"

[illegible]



CONCRETE DAILY TEST REPORT

Job No:294Q

Job Name:Div. U - NEB Tunnel Utility Relocations

Address:Intersection of 6th st. NW and R st. NW

Client:BAKKA GROUP

Molding Date:12/20/2016

County:Washington DC

Permit Number:

Contractor:Fort Myer CC

JOB SITE INFORMATION:

Specimen Information Provided By: Misbah

Time: 11:45 AM

Pour Location: Grout for Filling Test Pile at intersection. Supporting Thrust Block over 48" diameter water pipe

No Of Specimen Molded: 6

Pour Yards:

Set No: 1

Weather: Cloudy

Air Temperature: 40

Concrete Temperature:

Air Content:

Slump(inches):

Unit weight(pcf):

Compression Strength: 4000

SUPPLIER TICKET INFORMATION (MATERIAL USED):

Supplier Name: MIX ON SITE

Plant No:

Ticket No:

Concrete Mix No:

Truck No:

Cement(IB/YD3):

Source:

Cement Type: Mortar

Fine Aggr(IB/YD3):

Source:

Type:

Coarse Arrg(IB/YD3):

Source:

Type:

Water(gal/yd3):

Add Mixture Amount:

Water Added On Site:

Add Mixture Added On Site:

TEST RESULTS:

Specimen No	Test Date	Test Age	Curing code	Design Strength (psi)	Breaking Loads(lbs)	Strength(psi)	Percent Strength	Avg Diameter	Cross Sec area(inch)	Break Type
73702	12/27/2016	7	Field	4000	30636	7700	193		3.98	3
73702	12/27/2016	7	Field	4000	22267	5650	141		3.94	2
73702	12/27/2016	7	Field	4000	24202	6130	153		3.95	3
73702	01/17/2017	28	Lab			0	0			
73702	01/17/2017	28	Lab			0	0			
73702	01/17/2017	28	Lab			0	0			

Remarks:

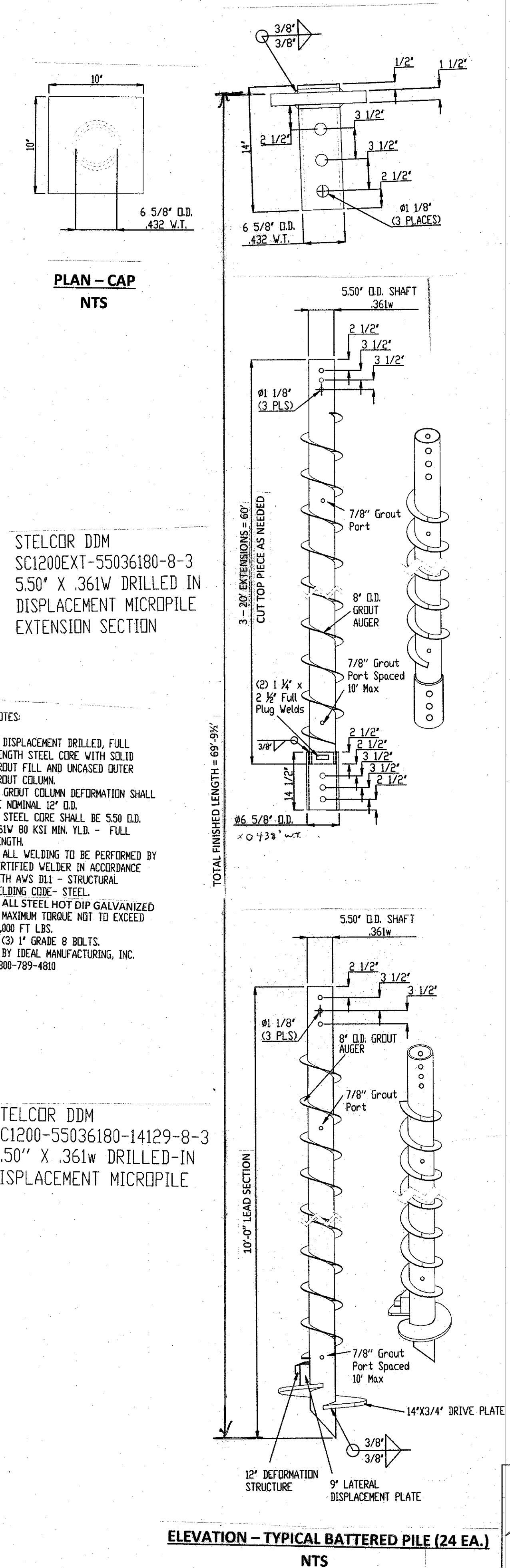
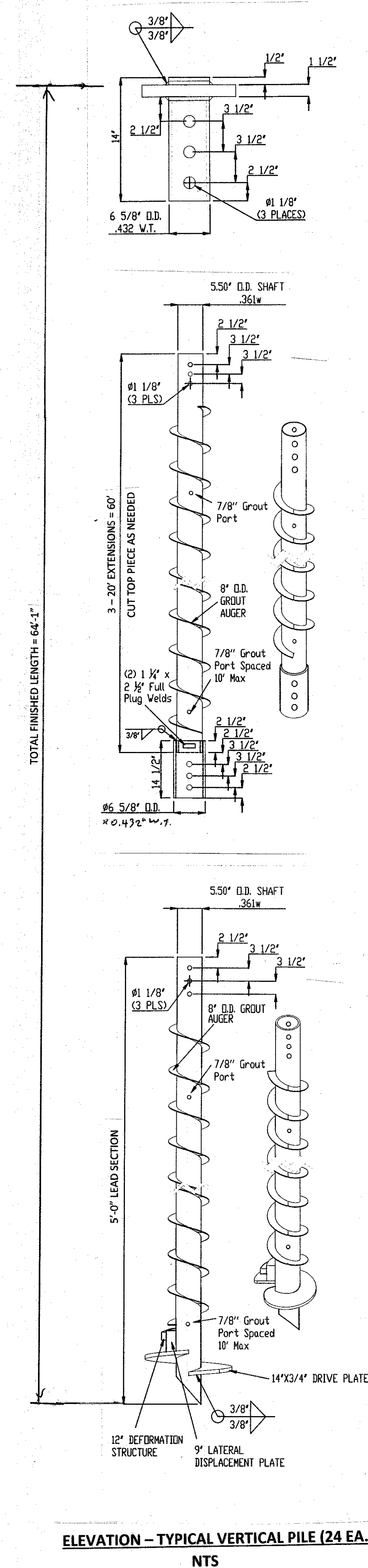
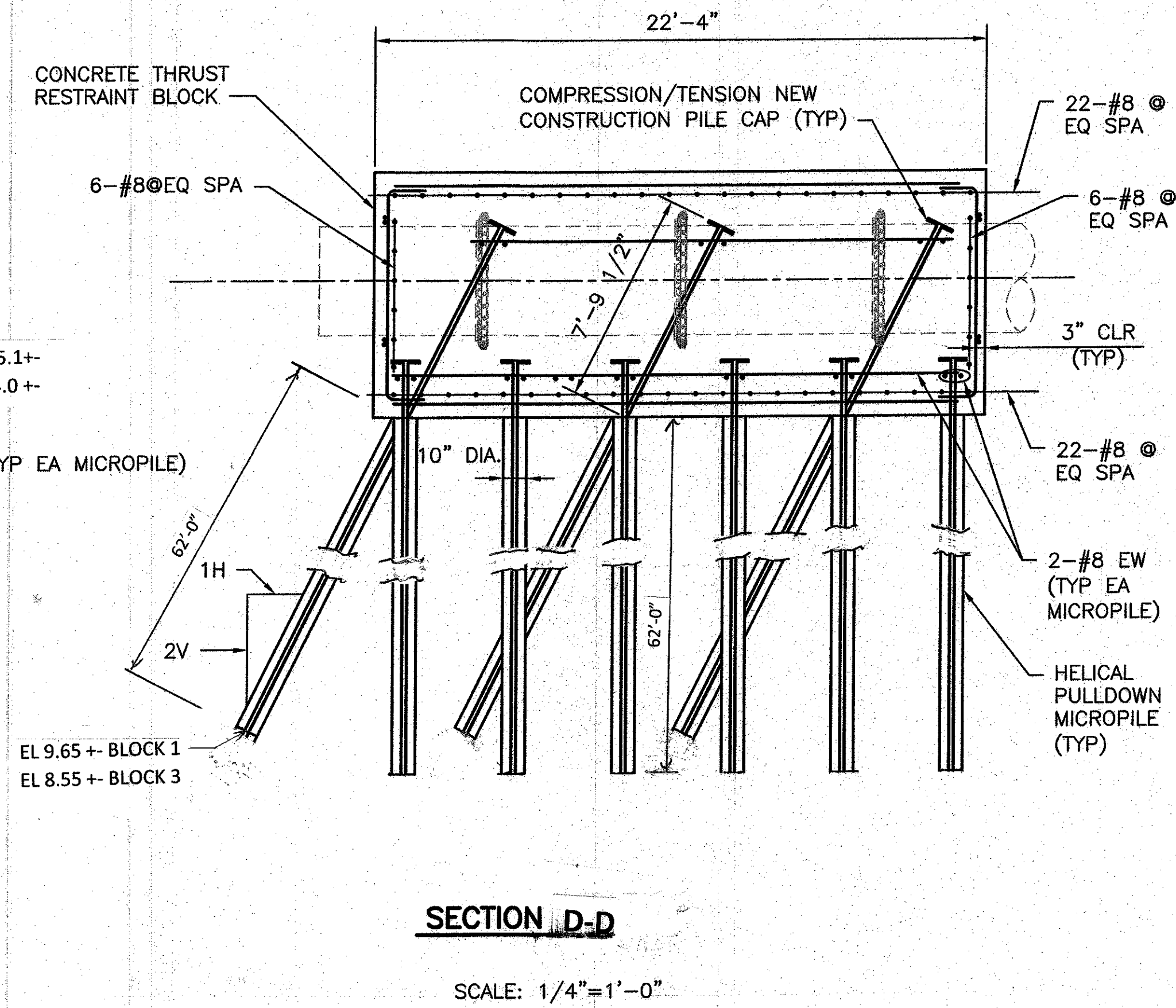
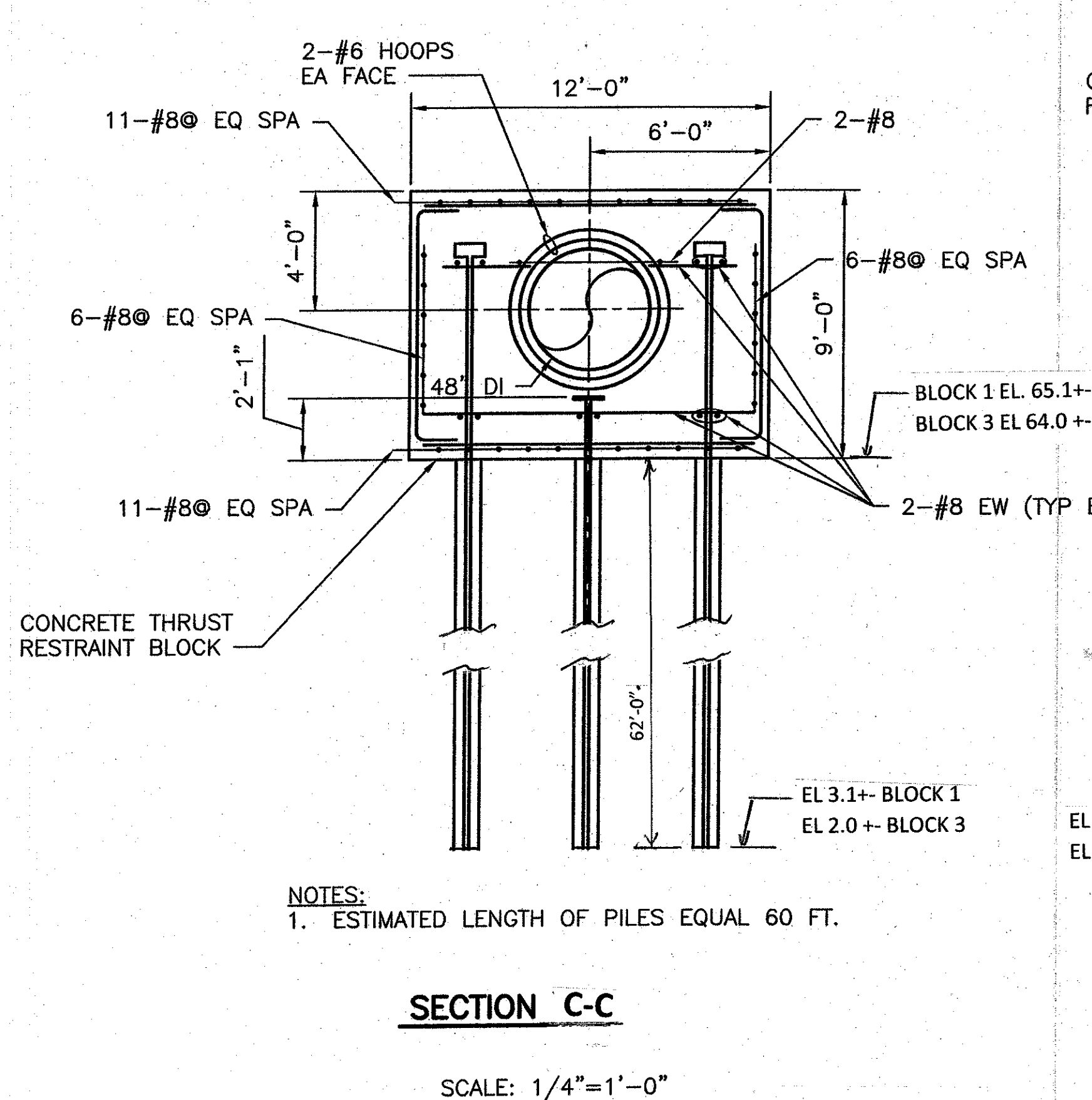
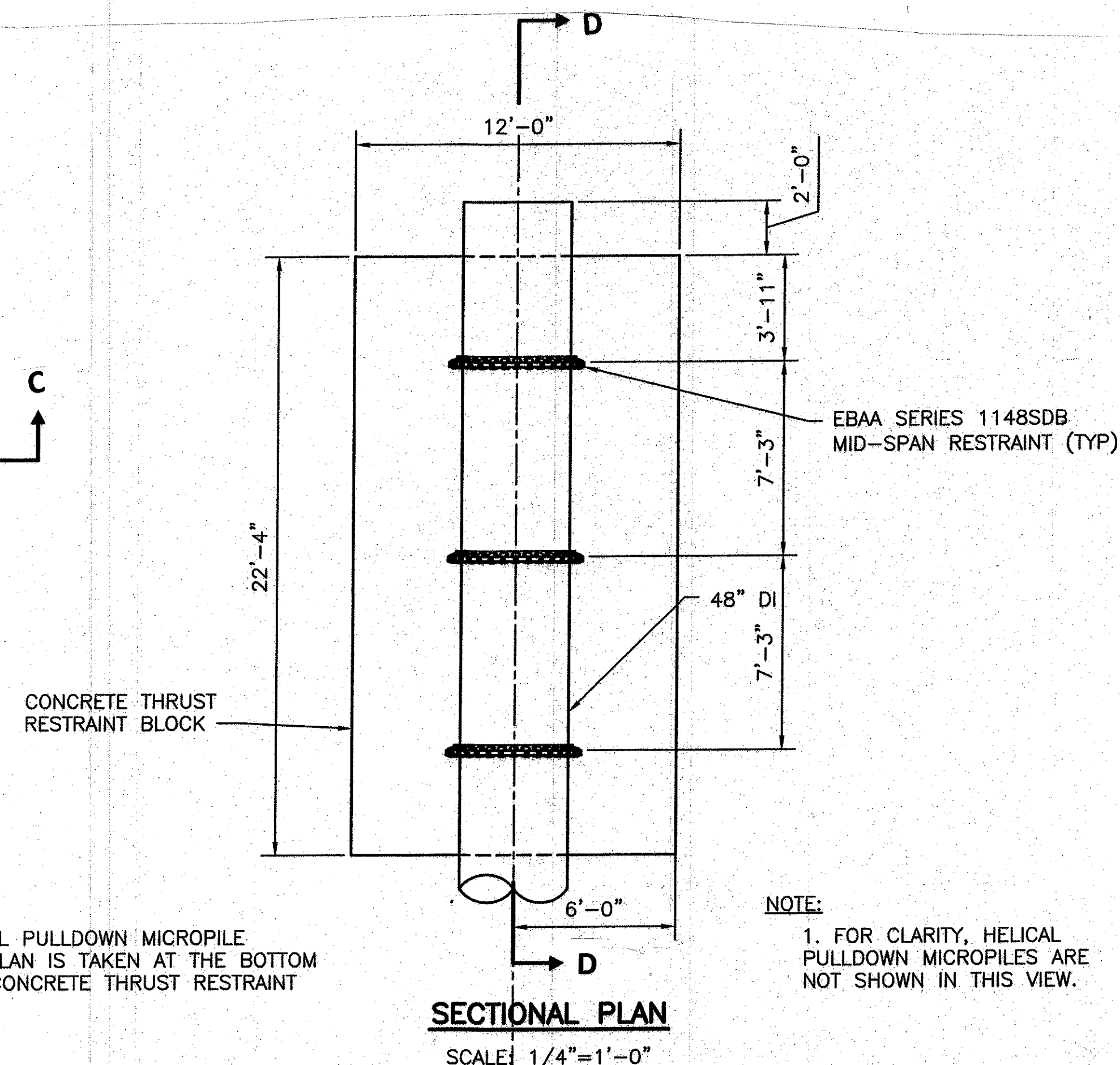
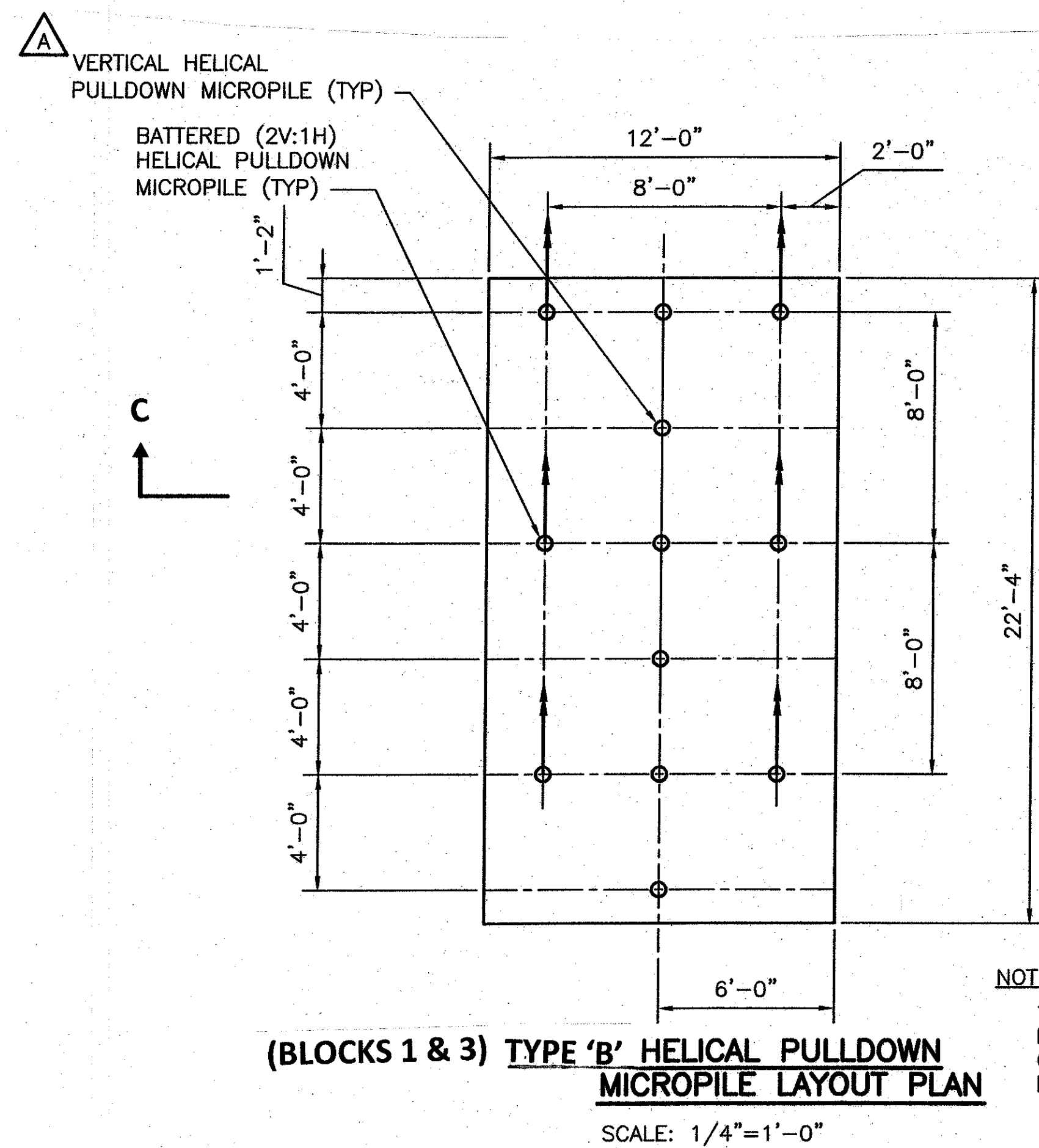
Cylinders molded and cured in accordance with ASTM C-31 unless
Cylinders tested in accordance with ASTM C-39 uniess noted.
Field cure in field conditions unless noted.
Slump Test in accordance with ASTM C143.
Concrete Temperature in accordance with ASTM C1064
Sample in accordance with ASTM C-172
Exclusions to ASTM C94 Yield/Unit Weight (ASTM C138) not determined, unless noted.
Air Content (ASTM C231) unless noted.

Specimans were ground plane in accordance with Section 6.2 of C39

From Revised on December 28, 2016 (Soil Consultants, Inc)

Date: December 28, 2016

REVIEWED BY



CREATIVE CONCEPTS, INC.

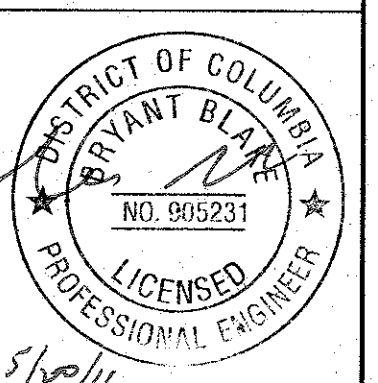
56 PEBBLE DRIVE, BALTIMORE MD 21225, PH 410-760-7216

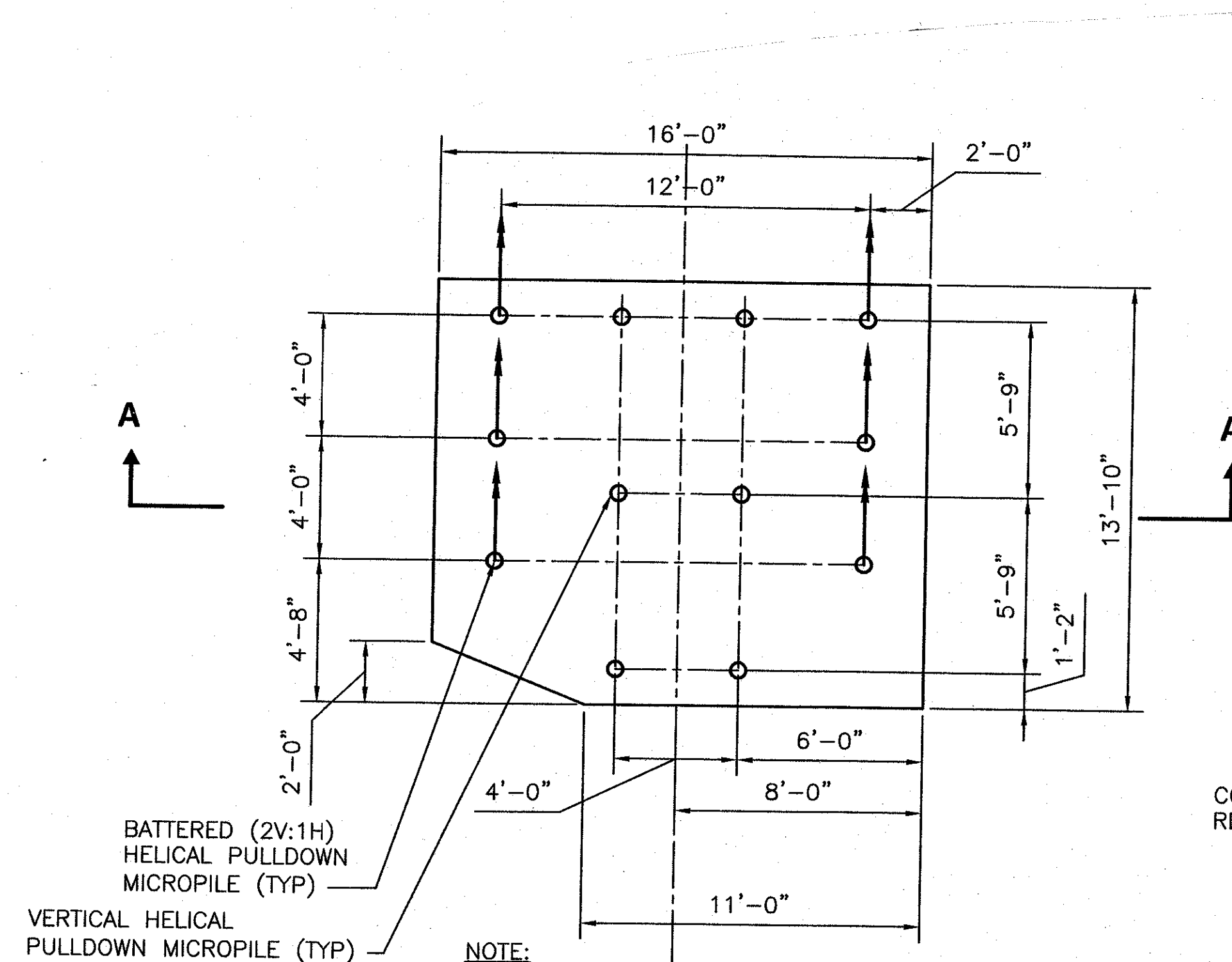
Job No: 16001 A
Scale: As Shown
Date: May 20, 2016
Sheet: 3 of 6

Designed by: BEB
Drawn by: BEB
Checked by: BPE

Helical Pulldown Micropiles at Thrust Blocks
R Street, NE Boundary Tunnel Utility Relocations

Fort Meyer Construction
Washington, DC



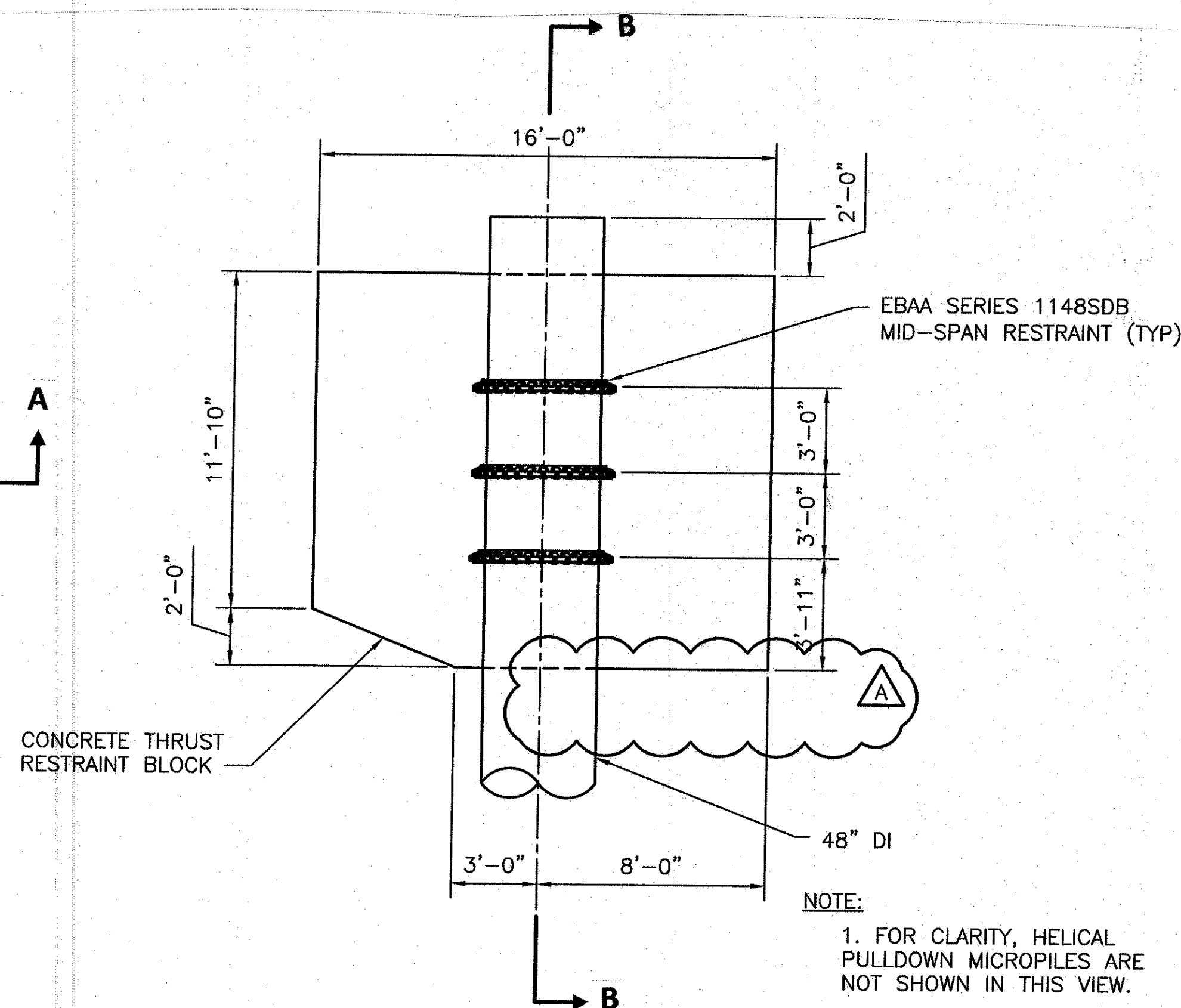


NOTE:

1. HELICAL PULLDOWN MICROPILE LAYOUT PLAN IS TAKEN AT THE BOTTOM OF THE CONCRETE THRUST RESTRAINT BLOCK.

(BLOCKS 2 & 4) TYPE 'A' HELICAL PULLDOWN MICROPILE LAYOUT PLAN

SCALE: 1/4"=1'-0"

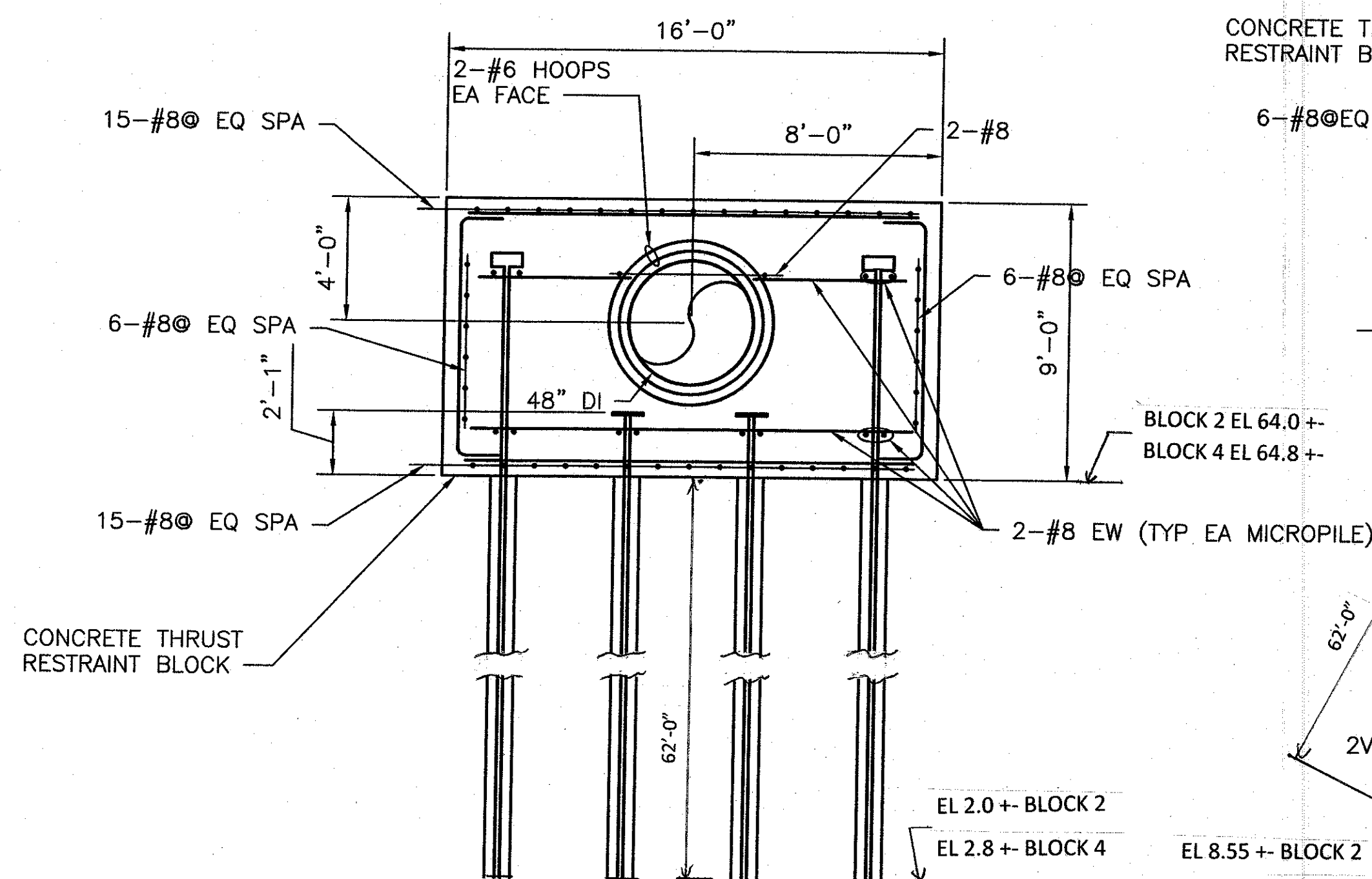


NOTE:

1. FOR CLARITY, HELICAL PULLDOWN MICROPILES ARE NOT SHOWN IN THIS VIEW.

SECTIONAL PLAN

SCALE: 1/4"=1'-0"

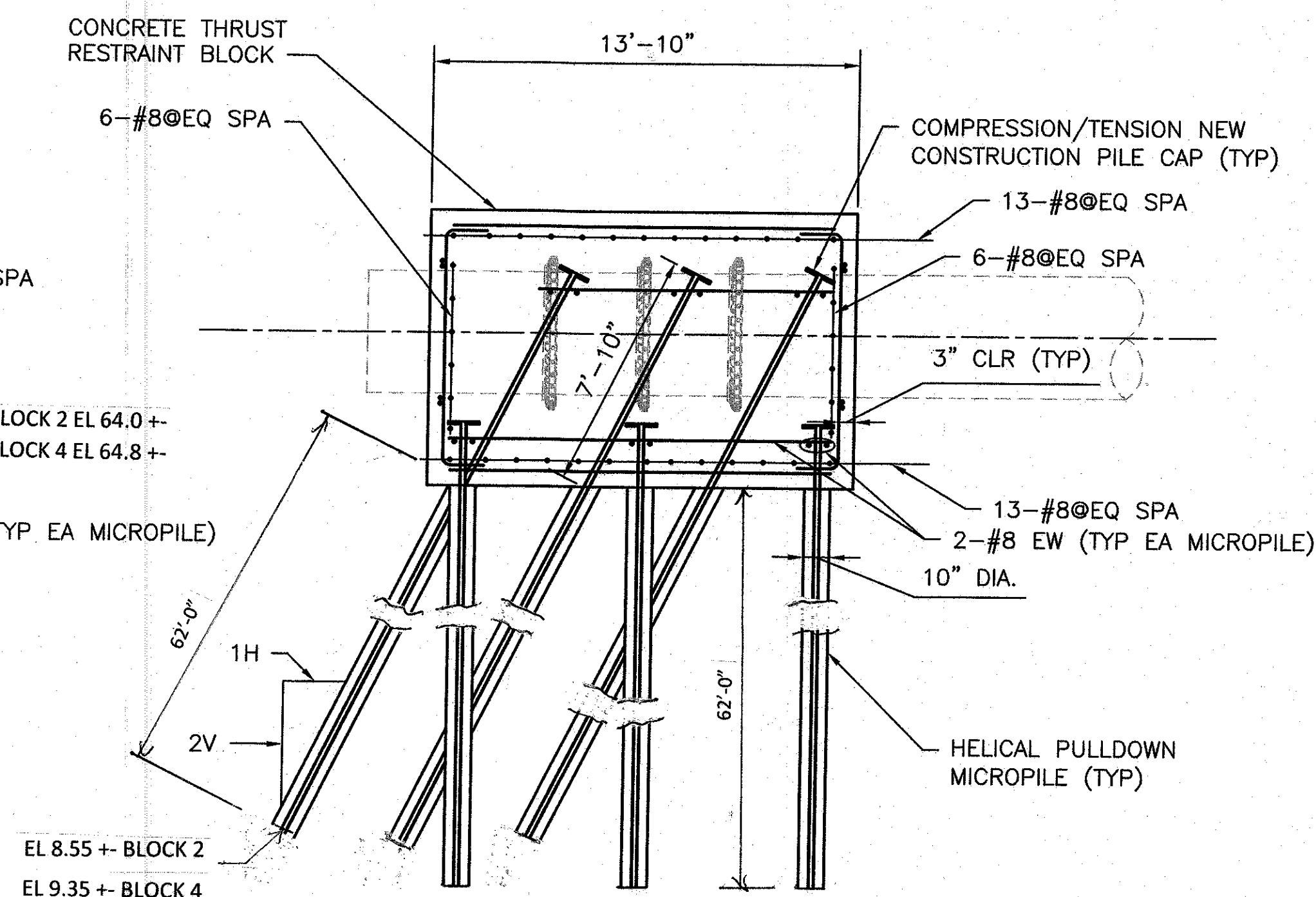


NOTES:

1. ESTIMATED LENGTH OF PILES EQUAL 60 FT.

SECTION A-A

SCALE: 1/4"=1'-0"



SECTION B-B

SCALE: 1/4"=1'-0"

General Notes

- 1.) Helical Pulldown Micropiles (HPM) designed for an allowable compressive load of 102 kips and an allowable tension load of 114 kips each. Helical Pulldown Micropiles designed for a factored load of 200 kips in both compression and tension.
- 2.) Helical Pulldown Micropiles designed in accordance with the IBC 2012 and the project specifications.
- 3.) Helical Pulldown Micropiles to be comprised of 5.50" O.D. x 0.361" wall STELCOR shaft with 14"/12"/9" soil displacement head and 8" reverse continuous flighted auger. The shaft is to consist of steel with a minimum yield strength of 80 ksi.
- 4.) Helical Pulldown Micropiles to be grouted with 4,000 psi neat cement grout mixed with a colloidal mixer.
- 5.) All pile steel components including plates and nuts to be hot dip galvanized per ASTM A153.
- 6.) All bearing plates to be 10"x10"x1.5" as supplied by Ideal Manufacturing.
- 7.) Cement shall conform to ASTM C150 Portland Cement Type I/II.
- 8.) Mixing water for cement grout shall be clean and potable and shall be free from substances that may be injurious to cement and steel.
- 9.) One Helical Pulldown Micropile is to be tension load tested to 200% of design load (114k x 2 = 228 k) per project specifications. An additional 2 Helical Pulldown Micropiles to be tension proof tested to 100% of design load (114 kips) per project specifications.
- 10.) Helical Pulldown Piles to be installed to minimum depth indicated. Installation drive head to have a minimum torsional capacity of 50,000 foot-lbs. Torque applied to piles shall not exceed 50,000 ft-lbs.
- 11.) Excavation to be shored and excavated down to bottom of thrust cap prior to installation of Helical Pulldown Micropiles.
- 12.) Contact Miss Utility prior to installation of Helical Pulldown Micropiles.

Construction Method:

- 1.) Attach lead section of STELCOR Helical Pulldown Micropile to drill head and locate tip at centerline of pile location provided by surveyor.
- 2.) Advance lead section approximately 30" into the ground and commence flow of grout.
- 3.) Grout shall flow continuously to fill annulus created by Helical Pulldown Micropile displacement head, and shall keep the grout level between ground level and a depth of 24" throughout installation.
- 4.) At each extension, stop the drive head and remove from pile end by removing drive pins as necessary, and attach a pile extension and connect with specified type and number of bolts then reattach drive head. Continue this process until design depth is reached.
- 5.) Maintain a continuous level of grout throughout the installation process. Upon completion of the pile, maintain a grout level at the top of finished pile or above.
- 6.) Cut the top of pile to the correct elevation using a portable band saw.
- 7.) Chip top of grout to required finish elevation where required.
- 8.) Install steel pile bearing cap.

Allowable Pile Tolerance:

- 1.) Centerline of piles shall be no more than 2" from indicated plan location.
- 2.) Pile plumbness shall be within 2% of design alignment.
- 3.) Top elevation of pile shall be plus 1" to minus 2" maximum from vertical elevation indicated.
- 4.) Centerline of vertical shaft shall be not more than 3/4" from centerline of pile.

Documentation / Installation Records:

The contractor shall provide the Owner copies of HPM installation records within 24 hours after each installation is completed. Formal copies shall be submitted on a weekly basis. These installation records shall include, but are not limited to, the following information:

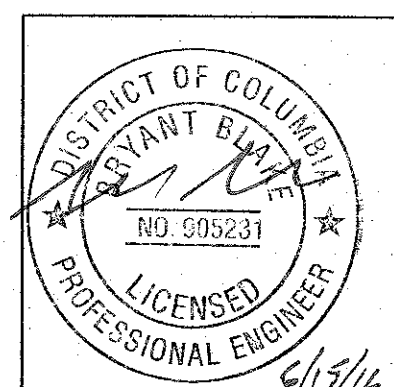
- 1.) Name of project and contractor
- 2.) Name of contractor's supervisor during installation
- 3.) Date and time of installation.
- 4.) Name and model of installation equipment.
- 5.) Type of torque indicator used.
- 6.) Location of HPM by assigned identification number.
- 7.) Actual HPM type and configuration, including lead section (number and size of helical plates), number and type of extension sections, and manufacturer's SKU numbers.
- 8.) Total length of installed HPM.
- 9.) Cut off elevation.
- 10.) Inclination of HPM.
- 11.) Installation torque at one foot intervals for the final 10 feet.
- 12.) Grout quantities pulled down on a per section basis.
- 13.) Actual grout column diameter and length.
- 14.) Comments pertaining to interruptions, obstructions, or other relevant information.
- 15.) Rated load capacities.

Installation Description - Permitting

- 1.) Prior to the start of installation an DRCA miscellaneous soil boring permit must be obtained for each property where helical pulldown micropiles will be installed.

Installation Description - Environmental Protection

- 1.) Any excess grout, grout pump and grout handling equipment washout, and grout that reaches the ground surface shall be conveyed or diverted to a leakproof container or impermeable collection area. Work shall be in accordance with specification sections 31 25 00 and 01 35 43 and the SWPPP in the RFP documents.



CREATIVE CONCEPTS, INC.

56 PEBBLE DRIVE, BALTIMORE MD 21225, PH 410-760-7216

Job No: 16001 A
Scale: As Shown
Date: May 20, 2016
Sheet: 4 of 6

Designed by: BEB
Drawn by: BEB
Checked by: BPE

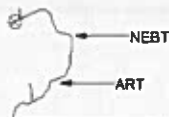
Helical Pulldown Micropiles at Thrust Blocks

R Street, NE Boundary Tunnel Utility Relocations

Fort Meyer Construction

Washington, DC

6/15/16 Added Installation Notes



Log of Boring NEBBC-31

PROJECT: CSO LONG TERM CONTROL PLAN

PROJECT LOCATION: WASHINGTON DC COORD. SYS./DATUM: MD NAD 83/2011/DC DPW

PROJECT NUMBER: DCFA # 421-WSA COORDINATES: N 454333.45 E 1307831.58

DATE STARTED: 7/22/2014	DRILL METHOD: HSA/Mud Rotary	Groundwater Observations			
DATE COMPLETED: 7/25/2014	HAMMER TYPE/WEIGHT: Automatic/140lbs		Date	Time	Depth (ft)
LOGGED BY: E.Ebwe/R. Munschauer	CASING TYPE: Steel / PVC				Casing Depth (ft)
CHECKED BY: K. Bell	CASING SIZE: 3-1/4" I.D. / 8-1/4" I.D./ 8" I.D.	Encountered	07-16-2014	-	1.8
DRILLING CONTRACTOR: Free State	BIT TYPE/SIZE: Drag/ 5-7/8" O.D.				
DRILL RIG: CME-75	BOREHOLE DEPTH: 149.5 FT				
DRILLER: Joe Scribellito	SURFACE ELEVATION: 84.27 FT				

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS GRAPHIC LOG	SAMPLES			WELL	MOISTURE CONTENT ATTERBERG	Pocket Pen. (tsf)	Torvane (tsf)	REMARKS AND TESTS
				NUMBER	TYPE	BLOWS					
		Asphalt and aggregate (0.0' - 1.0')									0.0': Performed soft dig on 07/16/14 from 0.0' to 8.0'. No utilities were encountered.
		(FILL) Sampled as wet, grayish brown and brown, fine to medium, Clayey Sand, estimated 15-25% fines, estimated <5% fine gravel, estimated <5% mica, angular to subangular gravel, occasional organics, contains pockets of gray and yellowish brown Lean Clay, contains wood and plastic fragments	SC								0.0': Advanced boring with 3-1/4" I.D. HSA to 20.0'.
80		Wet, dark grayish brown and brown, fine to medium, SILTY SAND, estimated 15 - 25% fines, estimated <5% fine gravel, estimated <5% mica, subangular gravel, occasional organics as roots, slight organic odor, contains stains of black	SM								1.8': Encountered water. Slight organic odor.
5		At 6.0' changes to brown and dark brown, fine to coarse, rounded to subrounded gravel									
75		Wet, dark yellowish brown, fine to coarse, SILTY SAND WITH GRAVEL, estimated 15 - 25% fines, estimated 15 - 25% fine to coarse gravel, angular to subrounded gravel, contains cobbles, scattered organics, slight organic odor	SM								
10											
70		Wet, medium dense, strong brown, fine to coarse, SILTY GRAVEL WITH SAND, estimated 15 - 25% fines, estimated 15 - 25% fine to coarse sand	GM	S-1		11-18-11-13	10" (42%)				
15											
65		Moist, very stiff, very dark greenish gray, high plasticity, FAT CLAY WITH SAND, estimated 15 - 25% fine to medium sand, estimated <5% fine gravel, estimated <5% lignite, subrounded to subangular gravel, soft lignite, (G1)	CH	S-2		6-11-13-16	16" (67%)				
20											



DC Clean Rivers Project

5000 Overlook Avenue, SW,
Washington DC, 20032
Phone: 202.787.2251 Fax: 202.787.2297

B = Bulk Sample S = Split Spoon Sample D = Denison Sample
G = Geoprobe T = Shelby Tube Sample RC = Rock Core
PS = Piston Sample P = Pitcher Sample SC = Sonic Core

SHEET 1 of 7

Log of Boring NEBBC-31

PROJECT: CSO LONG TERM CONTROL PLAN

PROJECT LOCATION: WASHINGTON DC

PROJECT NUMBER: DCFA # 421-WSA



DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC LOG	SAMPLES			WELL	MOISTURE CONTENT		Pocket Pen. (tsf)	Torvane (tsf)	REMARKS AND TESTS
					NUMBER	TYPE	BLOWS		REC (IN.) (%)	ATTERBERG			
		At 20.0' changes to hard, dark greenish gray with mottles of light greenish gray			S-3		22-13-20-21		20" (83%)				20.0': Switched to 8-1/4" I.D. HSA and advanced HSA to 20.0'. Encountered obstruction at 3.0' and 3.5'. Driller was able to drill past obstruction. Installed 8" Sch. 40 permanent PVC casing to 20.5'. Grouted casing in place with cement bentonite grout. Switched to mud rotary drilling.
		At 21.1' changes to contains weak cementation											
60		At 24.0' changes to very stiff	CH		S-4		5-7-11-12		24" (100%)				
25		At 25.8' contains soil fracture with slickensided surfaces oriented approximately 30-45 degrees											
		Moist, medium dense, greenish gray, fine to medium, SILTY SAND, estimated 15 - 25% fines, estimated <5% mica, (G3A)			S-5		6-8-11-14		24" (100%)				
55													
30		At 34.0' changes to Wet, contains pockets of FAT CLAY	SM		S-6		6-9-13-20		24" (100%)				
50													
35													
45		At 39.0' changes to light yellowish brown and reddish yellow			S-7		4-7-9-13		24" (100%)				
40													
		Moist, medium dense, light gray with stains of black, fine to medium, CLAYEY SAND, estimated 15 - 25% fines, estimated <5%	SC										



DC Clean Rivers Project

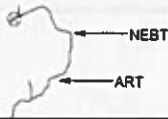
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Washington DC, 20032
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B = Bulk Sample S = Split Spoon Sample D = Denison Sample
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SHEET 2 of 7

Log of Boring NEBBC-31

PROJECT: CSO LONG TERM CONTROL PLAN
PROJECT LOCATION: WASHINGTON DC
PROJECT NUMBER: DCFA # 421-WSA



DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC LOG	SAMPLES			WELL	MOISTURE CONTENT		Pocket Pen. (tsf)	Torvane (tsf)	REMARKS AND TESTS
					NUMBER	TYPE	BLOWS	REC (IN.) (%)	ATTERBERG				
40		lignite, soft lignite, contains stains of reddish yellow, (G3A)											
45					S-8		6-6-7-13	24" (100%)					
35		At 49.0' changes to light gray and strong brown, fine to coarse, estimated 5 - 10% fine gravel, subrounded to subangular gravel	SC		S-9		5-12-18-20	24" (100%)					
50													
30		At 54.0' changes to strong brown with streaks of light gray, estimated <5% fine gravel			S-10		8-11-13-17	24" (100%)					
55		At 54.9' contains a 1.5" layer of FAT CLAY At 55.3' changes to light gray											
25		Moist, very stiff, very dark greenish gray with mottles of greenish gray, high plasticity, ELASTIC SILT, estimated 5 - 10% fine to medium sand, (G1)			S-11		5-7-10-15	24" (100%)					
60			MH										
20		At 64.0' changes to estimated <5% fine gravel, angular to subrounded gravel At 64.6' contains a 2.5" layer of light gray CLAYEY SAND WITH GRAVEL At 65.0' contains soil fractures with slickensided surfaces oriented approximately 30-45 degrees at 65', 65.1', and 65.4'			S-12		7-9-9-17	22" (92%)					
65													

WASA SONIC CONV COMBO - DC CRP LOGO LTCP FINAL DATABASE.GPJ LTCP FINAL DATABASE.GPJ 10/5/14 REV-4



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5000 Overlook Avenue, SW,
Washington DC, 20032
Phone: 202.787.2251 Fax: 202.787.2297

B = Bulk Sample S = Split Spoon Sample D = Denison Sample
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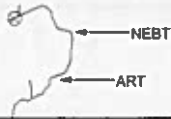
SHEET 3 of 7

Log of Boring NEBBC-31

PROJECT: CSO LONG TERM CONTROL PLAN

PROJECT LOCATION: WASHINGTON DC

PROJECT NUMBER: DCFA # 421-WSA



DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC LOG	SAMPLES			WELL	MOISTURE CONTENT ATTERBERG	Pocket Pen. (tsf)	Torvane (tsf)	REMARKS AND TESTS
					NUMBER	TYPE	BLOWS					
15		At 69.0' changes to estimated <5% mica										
70			MH		S-13		8-11-14-23	24" (100%)				
		Moist, very stiff, dark greenish gray with mottles of greenish gray, medium plasticity, SANDY ELASTIC SILT, estimated 30 - 45% fine sand, estimated <5% mica, estimated <5% lignite, soft lignite, (G1)										
10			MH		S-14		5-8-11-16	24" (100%)				
75												
5		Wet, medium dense, light gray, fine to medium, CLAYEY SAND, estimated 15 - 25% fines, estimated <5% fine gravel, subrounded gravel, (G3A)			S-15		5-9-12-24	24" (100%)				
80		At 80.5' changes to fine to coarse, estimated 5 - 10% fine gravel, rounded to subangular gravel										
0		At 84.0' changes to estimated <5% fine gravel, estimated <5% mica	SC		S-16		8-14-16-21	24" (100%)				84.0' pH: 7.9
85												
-5		At 89.0' changes to estimated 30 - 45% fines, contains pockets of FAT CLAY			S-17		9-10-16-13	24" (100%)				
90		At 89.6' contains a 1.5" layer of FAT CLAY At 90.1' contains a 2.5" layer of FAT CLAY At 90.3' changes to estimated <5% lignite, crisp and soft lignite										



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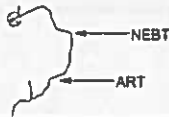
SHEET 4 of 7

A diagram of a fish's head and anterior body. The eye is at the top left. Two arrows point to specific locations: one labeled 'NEBT' points to a spot on the dorsal midline, and another labeled 'ART' points to a spot on the ventral midline, both located posterior to the eye.

PROJECT NUMBER: DCFA # 421-WSA

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC LOG	SAMPLES			WELL	MOISTURE CONTENT		Pocket Pen. (tsf)	Torvane (tsf)	REMARKS AND TESTS		
					NUMBER	TYPE	BLOWS		REC (IN.)	(%)				ATTERBERG	
														MC	PL
		At 90.5' contains a 2.5" layer of FAT CLAY At 90.7' contains a 4" layer of CLAYEY SAND											90.7' Bit chatter.		
		At 92.5' changes to light greenish gray and gray, fine to coarse, estimated 15 - 25% fines, contains pockets of ELASTIC SILT													
-10		At 94.0' changes to greenish gray													
95				S-18	X	6-8-9-7	24"	(100%)							
-15		At 99.0' changes to estimated 5 - 10% fine gravel, subrounded gravel											99.0' Drill bit and rig chatter.		
100				S-19	X	11-13-16-20	24"	(100%)							
-20		At 104.0' changes to dense													
105				S-20	X	9-16-17-20	22"	(92%)					106.0' Driller stated harder drilling.		
-25															
110				S-21	X	10-14-20-26	24"	(100%)							
		DECOMPOSED ROCK, sampled as moist, hard, greenish gray, low plasticity, Silt with Sand, estimated 15-25% fine to coarse sand, estimated <5% fine gravel, angular to subangular gravel, gravel as decomposed rock											112.0' Driller stated harder drilling.		
-30		At 114.3' contains soil fracture with		S-22	X	27-50/3"	9"								

Log of Boring NEBBC-31



PROJECT: CSO LONG TERM CONTROL PLAN

PROJECT LOCATION: WASHINGTON DC

PROJECT NUMBER: DCFA # 421-WSA

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC LOG	SAMPLES			WELL	MOISTURE CONTENT		Pocket Pen. (tsf)	Torvane (tsf)	REMARKS AND TESTS
					NUMBER	TYPE	BLOWS		REC (IN.) (%)	ATTERBERG			
118		slickensided surfaces oriented approximately 30-40 degrees							(100%)	MC PL F			
120	-35	At 118.7' contains a 6" layer of tumbled gravel Very weak to weak, highly weathered to moderately weathered, intensely fractured, very dark greenish gray, AMPHIBOLITE SCHIST, poorly foliated, contains multiple joints and fractures from 10-85 degrees, very closely spaced, rough, spotty filled with silt and sand, contains poorly healed to moderately healed joints, partially filled with quartz and sand At 119.6' changes to highly fractured At 120.5' joints partially filled with iron staining to 121.7'			S-23 RC-1		50/1"		1" (100%) 8" (100%)				118.7': Low recovery for sample S-33 due to gravel lodged in the sampler shoe. 118.9': Switched to rock core.
125	-40	At 124.5' contains multiple joints and fractures from 10-60 degrees, very closely spaced to closely spaced, slightly rough, spotty filled with silt and sand, contains moderately healed joints filled with quartz At 127.8' changes to Very weak, highly weathered, intensely fractured, to 128.1' At 128.1' changes to Weak, moderately weathered, intensely fractured to highly fractured, to 132.4'			RC-2				59" (98%)				
130	-45	At 129.8' changes to Medium strong to strong			RC-3				60" (100%)				129.5': Core tumbled in barrel, rubble zone to 129.8'.
135	-50	At 133.4' changes to intensely fractured to highly fractured, to 133.8' At 134.6' changes to contains a 15" layer of SANDY SILT, possible shear zone At 135.9' changes to Weak to medium strong, intensely fractured to highly fractured			RC-4 RC-5				60" (100%) 48" (100%)				134.5': Due to highly weathered and highly fractured nature of rock, driller pulled/reinserted rods several times during coring.



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Log of Boring NEBBC-37

PROJECT: CSO LONG TERM CONTROL PLAN

PROJECT LOCATION: WASHINGTON DCCOORD. SYS./DATUM: MD NAD 83/2011/DC DPW

PROJECT NUMBER: DCFA # 421-WSA COORDINATES: N 454216.177 E 1307818.87

DATE STARTED: 3/12/2014

DATE COMPLETED: 3/24/2014

LOGGED BY: R. Munschauer

CHECKED BY: K. Bell

DRILLING CONTRACTOR: Frontz

DRILL RIG: Versa Sonic

DRILLER: Joe Henley

DRILL METHOD: Sonic

HAMMER TYPE/WEIGHT: Automatic/140 lbs

CASING TYPE: Steel

CASING SIZE: 8" I.D. / 10" I.D.

BIT TYPE/SIZE: Button / 4" / 6" I.D.

BOREHOLE DEPTH: 127.0 FT

SURFACE ELEVATION: 81.87 FT

Groundwater Observations

Date	Time	Depth	Casing Depth

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS GRAPHIC LOG	SAMPLES				WELL	MOISTURE CONTENT		Pocket Pen. (tsf)	Torvane (tsf)	REMARKS AND TESTS
				NUMBER	TYPE	BLOWS	REC (IN.) (%)		ATTERBERG				
		Asphalt (0.0' - 0.3')											
		Base gravel (0.3' - 0.6')											
		(FILL) Sampled as moist, brown and strong brown, medium plasticity, Sandy Lean Clay, estimated 30-45% fine to medium sand, estimated <5% mica, contains fine gravel size slag fragments											0.0' : Performed soft dig on 03/07/14 from 0.0' to 9.0'. No utilities were encountered.
80			CL										
5													
		Moist, strong brown and dark yellowish black, fine to coarse, SILTY GRAVEL WITH SAND, estimated 30 - 45% fine to coarse sand, estimated 15 - 25% fines, estimated <5% mica, rounded to subangular gravel	GM										
75													
		Moist, brown to strong brown, fine to coarse, SILTY SAND WITH GRAVEL, estimated 15 - 25% fines, estimated 15 - 25% fine to coarse gravel, estimated <5% mica, rounded to subrounded gravel	SM										
10													
		Moist, strong brown, fine to coarse, SILTY GRAVEL WITH SAND, estimated 30 - 45% fine to coarse sand, estimated 15 - 25% fines, rounded to subrounded gravel	GM	SC-1									9.0' : Advanced 10" steel casing to 9'.
70													
		At 13.5' changes to olive yellow											
		Moist, medium dense, olive yellow, fine to coarse, SILTY SAND, estimated 30 - 45% fines, estimated 5 - 10% fine gravel, subrounded gravel	SM	S-1		4-4-8-12	13" (54%)						14.0' : Very strong petroleum odor from 14.0' to 19.0'. 14.0' : VOC = 846 ppm
15													
		At 16.0' changes to fine to medium, no gravel											
65													



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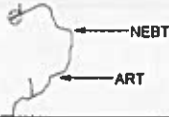
SHEET 1 of 7

Log of Boring NEBBC-37

PROJECT: CSO LONG TERM CONTROL PLAN

PROJECT LOCATION: WASHINGTON DC

PROJECT NUMBER: DCFA # 421-WSA



DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC LOG	SAMPLES			WELL	MOISTURE CONTENT		Pocket Pen. (tsf)	Torvane (tsf)	REMARKS AND TESTS
					NUMBER	TYPE	BLOWS	REC (IN.) (%)	ATTERBERG	LL			
			SM		SC-2								
		Moist, light bluish gray, fine to medium, CLAYEY SAND, estimated 30 - 45% fines	SC										17.8' : Strong petroleum odor, sheen, and staining observed on sample from 17.8' to 18.4'.
20		Moist, medium dense, pale yellow with bands of yellowish brown, fine to medium, SILTY SAND, estimated 30 - 45% fines			S-2		5-8-11-12	24" (100%)					19.0' : Sample SC-3 collected from 19'-21'.
60			SM		S-3		3-4-13-11	22" (92%)					
		At 23.6' changes to yellowish brown, estimated 5 - 10% fine gravel, subrounded gravel			SC-4								23.0' : SC-4 sample recovery indicated 11% elongation upon recovery
25		At 23.8' contains a 2" layer of fine gravel size weakly cemented iron nodules			S-4		3-4-7-8	24" (100%)					24.0' : Sample SC-5 collected from 24'-26'; sample recovery indicated 50% elongation upon recovery.
		Moist, light bluish gray, high plasticity, SANDY FAT CLAY, estimated 30 - 45% fine sand, (G1)	CH										
55		Moist, medium dense, light bluish gray, fine to medium, SILTY SAND, estimated 30 - 45% fines, (G3A)			S-5		5-7-10-11	24" (100%)					
		At 27.1' contains a 6" layer of bluish gray FAT CLAY WITH SAND, estimated 15-25% fine sand			SC-6								28.0' : SC-6 sample recovery indicated 14% elongation upon recovery
		At 29.0' changes to estimated 15 - 25% fines											
30		At 30.0' changes to fine to coarse, estimated <5% mica			S-6		5-9-11-14	24" (100%)					30.0' : Advanced 10" steel casing to 30.0'. Flushed hole using 6" steel casing to depth.
		At 30.2' contains a 6" layer of light bluish gray, medium plasticity, LEAN CLAY WITH SAND, estimated 15-25% fine sand	SM		SC-7								
50													
					S-7		4-8-12-15	24" (100%)					
35													
		At 35.4' changes to light yellowish brown and pale yellow, contains bands of orangish brown											
45		At 35.9' changes to contains bands of light reddish yellow											



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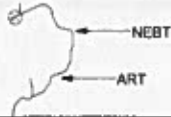
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Log of Boring NEBBC-37

PROJECT: CSO LONG TERM CONTROL PLAN

PROJECT LOCATION: WASHINGTON DC

PROJECT NUMBER: DCFA # 421-WSA



DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC LOG	SAMPLES				WELL	MOISTURE CONTENT		Pocket Pen. (tsf)	Torvane (tsf)	REMARKS AND TESTS
					NUMBER	TYPE	BLOWS	REC (IN.) (%)		ATTERBERG				
					SC-8									
40			SM		S-8		6-9-13-15	24" (100%)						
		At 41.2' changes to estimated <5% fine gravel, subrounded gravel												
40					SC-9									
		Moist, medium dense, light yellowish brown and pale yellow, fine to medium, CLAYEY SAND, estimated 30 - 45% fines, estimated <5% fine gravel, subrounded gravel, (G3A)												
45					S-9		7-12-14-14	23" (96%)						
		At 46.0' changes to estimated 15 - 25% fines, subrounded to subangular gravel, contains pockets of light greenish gray FAT CLAY												
35					SC-10									
		At 49.0' changes to no gravel, no FAT CLAY pockets	SC											
50					S-10		4-12-16-16	17" (71%)						
		At 50.0' changes to contains pockets of dark gray SILT to 51'												
30					SC-11									
		At 51.5' changes to estimated <5% fine gravel, subrounded gravel, gravel as weakly cemented iron nodules At 52.1' changes to contains pockets of light greenish gray FAT CLAY At 52.8' changes to estimated 30 - 45% fines												
		At 53.6' changes to light reddish yellow												
55					S-11		5-9-11-15	24" (100%)						
		Moist, very stiff, black, high plasticity, FAT CLAY WITH SAND, estimated 15 - 25% fine to medium sand, (G1) At 54.3' changes to fine sand At 54.9' changes to dark gray	CH											
		At 55.7' changes to black												
25												3.75 4.0 3.75		56.0' : SC-12 sample recovery indicated 48% elongation upon recovery

WASA SONIC CONV COMBO CORE -DCCRP LTCP FINAL DATABASE.GPJ DXF TRIAL 4.GPJ 7/14/14 REV-4



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Log of Boring NEBBC-37

PROJECT: CSO LONG TERM CONTROL PLAN

PROJECT LOCATION: WASHINGTON DC

PROJECT NUMBER: DCFA # 421-WSA

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC LOG	SAMPLES			WELL	MOISTURE CONTENT		Pocket Pen. (tsf)	Torvane (tsf)	REMARKS AND TESTS
					NUMBER	TYPE	BLOWS		REC (IN.) (%)	RQD (%)			
		At 57.0' changes to contains a 2" layer of SILTY SAND	CH		SC-12								
		Moist, greenish gray, medium plasticity, SANDY FAT CLAY, estimated 30 - 45% fine to medium sand, estimated <5% lignite, soft lignite, (G1)	CH		S-12		8-13-21-23	24" (100%)					
		At 59.0' changes to crisp lignite											
		Moist, greenish gray, fine to medium, CLAYEY SAND, estimated 15 - 25% fines, (G3A)											
		At 61.0' changes to estimated <5% fine gravel, subrounded gravel											
		At 62.0' changes to estimated 30 - 45% fines, contains pockets of greenish gray FAT CLAY, no gravel	SC		SC-13								
		At 64.0' changes to medium dense, fine to coarse, estimated 15 - 25% fines											
		Moist, dark gray, medium plasticity, ELASTIC SILT WITH SAND, estimated 15 - 25% fine sand, estimated <5% mica, estimated <5% lignite, soft/crisp lignite, (G1)	MH		SC-14								
		At 66.0' changes to medium dense, fine to coarse, estimated 15 - 25% fines											
		Moist, greenish gray, fine, SILTY SAND, estimated 30 - 45% fines, estimated <5% mica, contains fine to coarse sand size, weakly to moderately cemented clay nodules, (G3A)	SM		P-1			24" (100%)					
		Moist, greenish gray and dark gray, medium plasticity, ELASTIC SILT WITH SAND, estimated 15 - 25% fine to medium sand, estimated <5% mica, (G1)											
		At 72.2' changes to estimated <5% lignite, crisp lignite											
		At 72.5' contains a 2" layer of SILTY SAND, estimated 30-45% fines	MH		SC-15								
		At 73.9' contains a 1" layer of SILTY SAND, estimated 30-45% fines											
		Moist, gray and dark gray, fine to medium, SILTY SAND, estimated 30 - 45% fines, estimated 5 - 10% lignite, estimated <5% mica, crisp lignite, (G3A)	SM		S-14		7-11-20-19	24" (100%)					
		Moist, gray, medium plasticity, SANDY SILT, estimated 30 - 45% fine sand, estimated 5 - 10% lignite, estimated <5% mica, crisp lignite, (G2)	ML										

61.0' : SC-13 sample recovery indicated 3% elongation upon recovery

66.0' : SC-14 sample recovery indicated 13% elongation upon recovery

76.0' : SC-16 sample recovery indicated 33% elongation upon recovery

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Log of Boring NEBBC-37

PROJECT: CSO LONG TERM CONTROL PLAN

PROJECT LOCATION: WASHINGTON DC

PROJECT NUMBER: DCFA # 421-WSA

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC LOG	SAMPLES			WELL	MOISTURE CONTENT		Pocket Pen. (tsf)	Torvane (tsf)	REMARKS AND TESTS
					NUMBER	TYPE	BLOWS	REC (IN.) (%)	QD (%)	ATTERBERG			
										MC PL LL			
		At 77.5' contains a 6" layer of moist, gray, fine to medium, SILTY SAND, estimated 30-45% fines, estimated <5% mica, estimated <5% lignite, crisp lignite	ML		SC-16								
		At 78.0' changes to gray to dark gray, estimated <5% lignite, crisp lignite											
80		Moist, dense, light greenish gray, fine to medium, SILTY SAND, estimated 15 - 25% fines, estimated <5% fine gravel, estimated <5% mica, subrounded gravel, (G3A)			S-15	X	7-11-20-23	24" (100%)					
		At 81.4' contains pockets of greenish gray FAT CLAY	SM		SC-17								81.0' : SC-17 sample recovery indicated 7% elongation upon recovery
0		At 81.7' changes to estimated 5 - 10% fine to coarse gravel											
		At 84.4' contains a 5" layer of greenish gray FAT CLAY			S-16	X	7-13-20-20	24" (100%)					
85		At 85.0' contains a 1" layer of greenish gray FAT CLAY											
		At 85.2' changes to estimated 30 - 45% fines			SC-18								86.0' : SC-18 sample recovery indicated 20% elongation upon recovery
		At 86.1' changes to laminated to thinly laminated with light gray CLAYEY SAND			S-17	X	7-11-13-15	24" (100%)					
		At 89.0' changes to medium dense			SC-19								91.0' : SC-19 sample recovery indicated 22% elongation upon recovery
		At 91.2' contains a 4" layer of moist, greenish gray, high plasticity, FAT CLAY WITH SAND, estimated 15-25% fine to medium sand	SC										
		At 91.7' contains a 6" layer of moist, greenish gray, high plasticity, GRAVELLY FAT CLAY WITH SAND, estimated 15-25% fine to coarse sand, estimated 15-25% fine to coarse gravel, subrounded gravel			S-18	X	12-18-23-25	24" (100%)					
		Moist, greenish gray, fine to coarse, CLAYEY SAND WITH GRAVEL, estimated 30 - 45% fines, estimated 15 - 25% fine to coarse gravel, rounded to subrounded gravel, (G3A)	SC										
95		Moist, dense, greenish gray, fine to coarse, CLAYEY SAND, estimated 30 - 45% fines, estimated 5 - 10% fine gravel, rounded to subrounded gravel, (G3A)											
		Moist, greenish gray, fine to medium, CLAYEY SAND, estimated 15 - 25% fines, estimated 5 - 10% fine to coarse gravel, estimated <5% mica, subrounded gravel, (G3A)	SC										96.0' : SC-20 sample recovery indicated 22% elongation upon recovery

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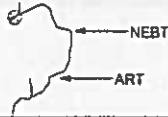
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Log of Boring NEBBC-37

PROJECT: CSO LONG TERM CONTROL PLAN

PROJECT LOCATION: WASHINGTON DC

PROJECT NUMBER: DCFA # 421-WSA



DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC LOG	SAMPLES			WELL	MOISTURE CONTENT		Pocket Pen. (tsf)	Torvane (tsf)	REMARKS AND TESTS
					NUMBER	TYPE	BLOWS		REC (IN.) (%)	ATTERBERG			
										MC PL LI			
										20 40 60 80			
100		At 98.7' contains a 3" layer of GRAVELLY FAT CLAY WITH SAND At 99.0' changes to medium dense, estimated <5% gravel	SC		SC-20								
					S-19		7-13-15-18	24" (100%)					
-20		At 101.0' contains a 5" layer of moist, greenish gray, low to medium plasticity, SANDY SILT, estimated 30-45% fine to coarse sand, estimated <5% fine gravel, subrounded gravel At 101.4' contains an 8.5" layer of moist, greenish gray, low to medium plasticity, SANDY SILT WITH GRAVEL, estimated 30-45% fine to coarse sand, estimated 15-25% fine to coarse gravel, subrounded gravel	ML		SC-21								101.0' : SC-21 sample recovery indicated 48% elongation upon recovery
105		Moist, greenish gray, low plasticity, SANDY SILT, estimated 30 - 45% fine to medium sand, estimated <5% fine gravel, estimated <5% mica, subrounded gravel, (G2) At 102.4' contains a 3" layer of SILTY SAND, estimated 15-25% fines			S-20		9-14-19-21	22" (92%)					
-25		Moist, dense, greenish gray, fine to medium, CLAYEY SAND, estimated 15 - 25% fines, estimated <5% mica, contains fine to coarse sand size, weakly to moderately cemented sand nodules, (G3A) At 104.0' no cemented sand nodules	SC		SC-22								106.0' : SC-22 sample recovery indicated 5% elongation upon recovery
110		At 108.5' contains coarse sand to coarse gravel size, weakly cemented sand nodules At 109.5' changes to fine to coarse, estimated <5% fine gravel, subrounded gravel, contains pockets of greenish gray FAT CLAY			S-21		13-36-50-46	24" (100%)					
-30		Moist, light greenish gray dark olive brown, fine to coarse, SILTY GRAVEL WITH SAND, estimated 30 - 45% fines, estimated 15 - 25% fine to coarse sand, contains pockets of dark gray, contains coarse gravel size moderately to strongly cemented soil, (G3B)	GM		SC-23								111.0' : SC-23 sample recovery indicated 30% elongation upon recovery 112.0' : Increased drilling pressure.
115		DECOMPOSED ROCK, sampled as moist, grayish green with mottles of olive, high plasticity, Elastic Silt with Sand and Gravel, estimated 15-25% fine to medium sand, estimated 15-25% fine to coarse gravel, subangular to angular gravel, contains mottles of light grayish green, contains moderately to strongly cemented gravel			SC-24								114.0' : SC-24 sample recovery indicated 58% elongation upon recovery
-35								60" (100%)					



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WASA SONIC CONV COMBO CORE -DCCRP LTCP_FINAL_DATABASE.GPJ DXF TRIAL 4.GPJ 7/14/14 REV-4

Log of Boring NEBBC-37



PROJECT: CSO LONG TERM CONTROL PLAN

PROJECT LOCATION: WASHINGTON DC

PROJECT NUMBER: DCFA # 421-WSA

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC LOG	SAMPLES			WELL	MOISTURE CONTENT			Pocket Pen. (tsf)	Torvane (tsf)	REMARKS AND TESTS	
					NUMBER	TYPE	BLOWS		REC (IN.) (%)	RQD (%)	ATTERBERG				
										MC	PL	LI			
										20	40	60	80		
120					SC-25										119.0' : Two attempts needed to recover sample SC-25. 119.0' : SC-25 sample recovery indicated 22% elongation upon recovery
-40		Weak to medium strong, moderately weathered to slightly weathered, intensely fractured to highly fractured, dark greenish gray, AMPHIBOLITE SCHIST, moderately foliated, contains multiple joints and fractures from 10-85 degrees, very closely spaced to closely spaced, slightly rough, spotty filling with silt, contains poorly healed to moderately healed joints partially filled with quartz													
125					RC-1										122.0' : Switched to rock coring with 2.4" diameter HQ core sampler.
-45															

BORING COMPLETED AT 127.0 FT ON 3/24/2014 AT HOURS.
Upon completion, installed 2" monitoring well with 0.020" well screen placed from 104' to 114' and No. 2 sand filter from 102' to 126'. Installed a Vibrating Wire Piezometer (S/N 047359) at 50' on a 1" tremie pipe.

Note 1:

Soil Samples were field screened for soil vapors at intervals of approximately 2' down to 9' and at intervals of approximately 2'-5' to a depth of 111'. Soil vapor screening was also performed at the casing collar. Field screening was performed using a MultiRAE 4-gas meter. Screening for VOC's, LEL, and H2S are "ND", and O2 was 20.4%-20.9% unless otherwise noted.

Note 2:

"ND" = Not Detected

Instrument Detection Limits:

VOCs: 0.1 ppm
H2S: 1 ppm
LEL: 1%
O2: 0.1%

WASA SONIC CONV COMBO CORE -DCCRP LTCP_FINAL_DATABASE.GPJ DXF TRIAL 4.GPJ 7/14/14 REV 4



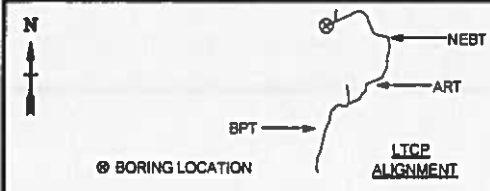
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Log of Boring NEBBC-43



PROJECT: CSO LONG TERM CONTROL PLAN

PROJECT LOCATION: WASHINGTON DC COORD. SYS./DATUM: MD NAD 83/2011/DC DPW

PROJECT NUMBER: DCFA # 421-WSA COORDINATES: N 453804.486 E 1306593.07

DATE STARTED: 6/4/2013	DRILL METHOD: HSA/Mud Rotary	Groundwater Observations			
DATE COMPLETED: 6/12/2013	HAMMER TYPE/WEIGHT: Automatic/140 lbs		Date	Time	Depth
LOGGED BY: P. Mahato	CASING TYPE: Steel / PVC				Casing Depth
CHECKED BY: K. Bell	CASING SIZE: 6" I.D.				
DRILLING CONTRACTOR: E2CR	BIT TYPE/SIZE: HSA/3-1/4" / Tricone Roller/5-7/8"				
DRILL RIG: CME-75	BOREHOLE DEPTH: 119.0 FT				
DRILLER: Edward Hill	SURFACE ELEVATION: 76.84 FT				

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC LOG	SAMPLES				WELL	MOISTURE CONTENT			Pocket Pen. (tsf)	Torvane (tsf)	REMARKS AND TESTS
					NUMBER	TYPE	BLOWS	REC (IN.) (%)		MC	PL	LL			
		Grass and topsoil (0.0' - 0.5')													0.0' : Performed soft dig on 05/28/13 from 0.0' to 9.0'. No utilities were encountered.
75		(FILL) Sampled as moist, grayish brown to light yellowish brown, medium plasticity, Lean Clay with Sand, estimated 15-25% fine sand, estimated <5% fine gravel, estimated <5% mica, angular to subangular gravel, scattered organics as roots	CL												0.0' : Advanced boring with 3-1/4" ID HSA.
5		(FILL) Sampled as moist, yellowish brown to strong brown, medium plasticity, Sandy Lean Clay, estimated 30-45% fine to medium sand, estimated 5-10% fine to coarse gravel, estimated <5% mica, contains coarse sand size asphalt fragments	CL												
70		At 8.0' changes to light gray and gray													8.0' : Heavy rig chatter from 8' to 13'. Possible cobble.
10		(FILL) Sampled as moist, very dense, light gray, fine to coarse, Poorly Graded Gravel with Silt and Sand, estimated 15-25% fine to coarse sand, estimated 5-10% fines, contains asphalt fragments	GP-GM		S-1		11-43-76-26	11" (46%)							
65		(FILL) Sampled as moist, dark gray, Lean Clay with Sand, estimated 15-25% fine sand, contains numerous organics as tree roots	CL												
15		Moist, very stiff, grayish green to dark greenish gray, medium plasticity, SANDY ELASTIC SILT, estimated 30 - 45% fine to medium sand, estimated <5% mica, contains mottles of strong brown	MH		S-2		9-8-11-12	0" (NR)							13.0' : Following retrieval of SPT sample S-2, reinserted 3" diameter modified California sampler in SPT interval. Collected additional sample for geotechnical classification.
60		Moist, grayish green, fine, SILTY SAND, estimated 15 - 25% fines, estimated <5% mica, (G3A)			T-1			23" (96%)							
20		At 18.0' changes to medium dense	SM		S-3		5-8-11-13	24" (100%)							17.0' : No pocket penetrometer or torvane measurements collected due to granular material.

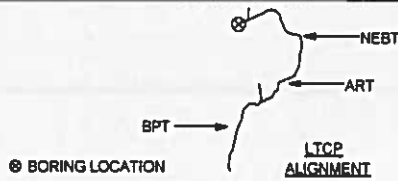


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WASA SONIC CONV COMBO CORE - DCCRP LTCP_FINAL DATABASE.GPJ DXF TRIAL 4.GPJ 11/4/13 REV-4

Log of Boring NEBBC-43



PROJECT: CSO LONG TERM CONTROL PLAN
 PROJECT LOCATION: WASHINGTON DC
 PROJECT NUMBER: DCFA # 421-WSA

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC LOG	SAMPLES				WELL	MOISTURE CONTENT			Pocket Pen. (tsf)	Torvane (tsf)	REMARKS AND TESTS
					NUMBER	TYPE	BLOWS	REC (IN.) (%)		RQD (%)	ATTERBERG				
55															
		At 23.0' changes to estimated 30 - 45% fines			S-4		6-9-9-15	24" (100%)							
25		At 25.0' changes to estimated <5% lignite, soft lignite			S-5		4-6-9-14	23" (96%)							
50		At 27.0' changes to grayish green with mottles of reddish yellow			S-6		6-7-10-11	23" (96%)							
		At 29.0' changes to light yellowish brown													
30			SM		S-7		7-10-13-18	23" (96%)							
		At 31.0' changes to fine to medium, estimated 15 - 25% fines			S-8		6-11-15-18	19" (79%)							
45		At 33.0' changes to fine to coarse, estimated <5% fine gravel, subrounded to subangular gravel			S-9		13-13-15-18	22" (92%)							
		At 35.0' changes to very thinly bedded with FAT CLAY			S-10		4-13-14-17	21" (88%)							
40		At 37.0' changes to dense At 37.5' contains a 4" layer of greenish gray FAT CLAY At 38.0' changes to grayish green			S-11		13-15-19-27	24" (100%)							
		At 39.0' changes to medium dense													
40					S-12		4-6-13-11	24" (100%)							
		Moist, dark greenish gray, low plasticity, SANDY SILT, estimated 30 - 45% fine sand, estimated <5% mica, (G2) At 41.0' changes to very stiff, dark greenish gray and grayish green													
35			ML		S-13		9-10-12-17	24" (100%)							
		At 43.0' changes to estimated <5% lignite, soft lignite													

25.0' : Advanced permanent 6" diameter schedule 40 PVC casing to 25.0'.
 25.0' : Driller switched to mud rotary with tricone roller bit.

38.0' : Slight rig chatter from 38' to 39'. Possible gravel layer.

41.0' : Driller added bentonite to thicken the drilling fluid.



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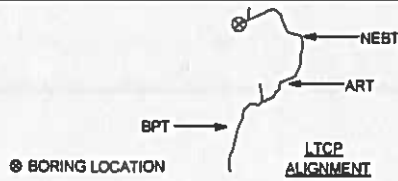
SHEET 2 of 6

Log of Boring NEBBC-43

PROJECT: CSO LONG TERM CONTROL PLAN

PROJECT LOCATION: WASHINGTON DC

PROJECT NUMBER: DCFA # 421-WSA



DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC LOG	SAMPLES				WELL	MOISTURE CONTENT		Pocket Pen. (tsf)	Torvane (tsf)	REMARKS AND TESTS		
					NUMBER	TYPE	BLOWS	REC (IN.) (%)		RQD (%)	WELL				ATTERBERG	
															W	P
45			ML		S-14		10-10-14-20	24" (100%)								
		Moist, medium dense, greenish gray, fine to medium, SILTY SAND, estimated 15 - 25% fines, estimated <5% mica, contains weakly cemented clay nodules, (G3A)			S-15		9-11-15-22	24" (100%)								
30		At 47.0' changes to dense														
		At 48.1' changes to fine to coarse	SM		S-16		11-15-20-34	23" (96%)								
		At 49.0' changes to very dense, estimated <5% lignite, soft lignite														
50					S-17		0-16-40-100/1"	19" (100%)								
		At 50.5' contains a 6" layer of moist, grayish green, fine to coarse, CLAYEY SAND WITH GRAVEL, estimated 30-45% fines, estimated 30-45% fine gravel, subrounded gravel			S-18		26-30-34-37	24" (100%)						50.5' : Heavy rig chatter from 50.5' to 51.0'. Possible cobble.		
		Moist, very dense, grayish green, fine to medium, CLAYEY SAND, estimated 30 - 45% fines, estimated <5% mica, (G3A)			S-19		30-36-42-43	18" (75%)								
55		At 55.0' changes to dense, dark greenish gray														
		At 57.0' changes to fine to coarse, estimated <5% fine gravel, subrounded gravel	SC		S-20		15-16-24-34	24" (100%)								
					S-21		10-18-22-31	24" (100%)						57.0' : Following retrieval of SPT sample S-21, reinserted 3" diameter modified California sampler in SPT interval. Collected additional sample for environmental testing.		
		At 59.0' changes to very dense, greenish gray to light greenish gray, fine to medium, estimated 15 - 25% fines, estimated <5% lignite			S-22		16-26-30-30	12" (50%)								
60																
		Moist, dense, dark olive brown, fine to medium, SILTY SAND, estimated 15 - 25% fines, estimated <5% mica, (G3A)			S-23		11-19-20-31	24" (100%)								
65		At 63.0' changes to very dense, greenish gray and olive brown, estimated 5 - 10% fine gravel, subrounded gravel	SM		S-24		100/5"	5" (100%)						63.0' : Heavy rig chatter from 63' to 64'.		
		Moist, brown, fine, POORLY GRADED GRAVEL, estimated 5 - 10% fine to medium sand, estimated <5% fines, rounded to subrounded gravel, (G5)	GP											64.0' : Auger refusal. Switched to rock coring using NQ diamond bit.		
		DECOMPOSED ROCK, sampled as moist, greenish gray, fine to coarse, Clayey Sand, estimated 15-25% fines, estimated 5-10% fine to coarse gravel, estimated <5% mica, gravel as rounded to subangular rock fragments			RC-1			17" (28%)	0							



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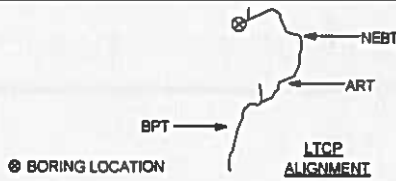
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Log of Boring NEBBC-43

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DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC LOG	SAMPLES				WELL	MOISTURE CONTENT			Pocket Pen. (tsf)	Torvane (tsf)	REMARKS AND TESTS	
					NUMBER	TYPE	BLOWS	REC (IN.) (%)		RQD (%)	ATTERBERG					
											MC	PL	FL			
											20	40	60	80		
70		At 69.0' contains an 11" layer of Poorly Graded Gravel														
5		Weak, highly weathered, intensely fractured, light gray and yellowish brown, TREMOLITE AMPHIBOLITE, poorly foliated, contains multiple joints and fractures oriented at 20-80 degrees, very closely spaced, rough to slightly rough, filled to spotty with clay At 71.0' changes to Medium strong, moderately weathered At 72.5' changes to moderately weathered to slightly weathered			RC-2			51" (85%)	0							
75																
0																
80		At 79.0' changes to Strong, fresh, highly fractured to moderately fractured, contains 10 joints at 20-60 degrees, closely to moderately spaced, slightly rough, spotty filled with clay														
-5																
85		At 84.0' changes to contains 9 joints at 20-40 degrees, closely to moderately spaced, smooth, spottly filled with clay, contains multiple well healed to healed joints														
-10																
90		At 89.0' changes to contains 8 joints at 20-60 degrees, closely to moderately spaced, spotty filled with clay														

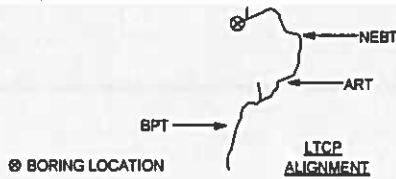


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Log of Boring NEBBC-43



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DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC LOG	SAMPLES				WELL	MOISTURE CONTENT				Pocket Pen. (tsf)	Torvane (tsf)	REMARKS AND TESTS
					NUMBER	TYPE	BLOWS	REC (IN.) (%)		ATTERBERG	LL	PL	U			
-15					RC-6			60" (100%)	80							
95		At 94.0' changes to contains 4 joints at 40-70 degrees, closely to moderately spaced, spotty filled with clay and calcium carbonate, weak HCl reaction in joints														
-20					RC-7			60" (100%)	91							
100		At 99.0' changes to intensely fractured, contains 3 joints at 50 degrees, very closely spaced, slightly rough to rough, spotty filled with clay At 100.0' changes to highly fractured to moderately fractured, contains 6 joints at 20-70 degrees, closely to moderately spaced, spotty filled with clay and calcium carbonate, weak HCl reaction in joints														
-25					RC-8			60" (100%)	77							
105		At 104.0' changes to contains 4 joints, closely to moderately spaced, slightly rough, spotty filled with clay and calcium carbonate, weak HCl reaction in joints														
-30					RC-9			60" (100%)	87							
110		At 109.0' changes to contains 5 joints at 20-70 degrees, closely to moderately spaced, smooth, spotty filled with clay and calcium carbonate, weak HCl reaction in joints														
-35					RC-10			60" (100%)	82							
		At 114.0' changes to contains 2 joints at 20-30 degrees, widely spaced, smooth,														

WASA SONIC CONV COMBO CORE DCCRP LTCP FINAL DATABASE.GPJ DXF TRIAL 4.GPJ 11/4/13 REV-4



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SHEET 5 of 6

DEPTH (FT)		ELEV. (FT)		DESCRIPTION	USCS	GRAPHIC LOG	SAMPLES				WELL	MOISTURE CONTENT			Pocket Pen. (tsf)	Torvane (tsf)	REMARKS AND TESTS	
													ATTERBERG					
													MC	PL				LL
119.0				spotty filled with clay		RC-11				57" (95%)	95							
<p>BORING COMPLETED AT 119.0 FT ON 6/12/2013 AT 1150 HOURS. Upon completion, installed 2" monitoring well with 0.020" well screen placed from 44.0' to 54.0' and gravel pack from 41.8.0' to 64.0'. Borehole was backfilled with bentonite chips from 64.0' to 119.0'.</p> <p><u>Note 1:</u> Soil Samples were field screened for soil vapors at intervals of approximately 1-3' down to 8' and at most sampling intervals to a depth of 64'. Field screening was performed using a MultiRAE 4-gas meter. Screening for VOC's, LEL, and H2S are "ND", and O2 was 20.9% unless otherwise noted.</p> <p><u>Note 2:</u> "ND" = Not Detected</p> <p><u>Instrument Detection Limits:</u> VOCs: 0.1 ppm H2S: 1 ppm LEL: 1% O2: 0.1%</p>																		

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