

Bridge Foundation Investigation

**Benton Boulevard Extension
Pooler, Chatham County, Georgia**

February 23, 2016
Terracon Project No. ES155153

Prepared for:
McGee Partners, Inc.
Atlanta, Georgia

Prepared by:
Terracon Consultants, Inc.
Savannah, Georgia

Offices Nationwide
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Terracon

Geotechnical ■ Environmental ■ Construction Materials ■ Facilities

February 23, 2016



McGee Partners, Inc.
13 Corporate Boulevard NE
Suite 200
Atlanta, Georgia 30329

Attn: Tommy Crochet, P.E.
P: (770) 938 6400
E: tcrochet@mcgeepartners.com

**Re: Bridge Foundation Investigation
Benton Boulevard Extension**
Pooler, Chatham County, Georgia
Terracon Project No.: ES155153

Dear Mr. Crochet:

Terracon Consultants, Inc. (Terracon) is pleased to submit this Bridge Foundation Investigation (BFI) Report for the design and construction of Benton Boulevard Bridge over St. Augustine Creek. This report has been prepared in general accordance with the QA / QC Manual by the Geotechnical Engineering Bureau of the Georgia Department of Transportation.

Terracon appreciates the opportunity to be of service to you on this project. Should you have any questions concerning this report, or if we may be of further service, please feel free to contact us.

Sincerely,
Terracon Consultants, Inc.

Biraj Gautam, P.E.
Project Geotechnical Engineer



Guoming Lin, Ph.D., P.E., D.GE.
Senior Principal/Senior Consultant

cc: 1 – Client (PDF)

1 – File



Terracon Consultants, Inc. 2201 Rowland Avenue Savannah, Georgia 31404
P (912) 629 4000 F (912) 629 4001 terracon.com/savannah

Bridge Foundation Investigation

Benton Boulevard Extension ■ Pooler, Chatham County, Georgia
 February 23, 2016 ■ Terracon Project No. ES155153



BRIDGE FOUNDATION INVESTIGATION

PROJECT NUMBER	ES155153
P.I. NUMBER	None
LOCATION (See Map)	Benton Boulevard Bridge over St. Augustine Creek

GENERAL INFORMATION

GEOLOGIC FORMATION	The project is geologically sited in the Pamlico Shoreline Complex of the Georgia Coastal Plain Region.
SUBSURFACE FEATURES	<p>The subsurface conditions at the site are uniform across the area explored.</p> <p>In general, the site consists of very loose to loose poorly graded sands with silts to silty / clayey sands to an elevation of about 3 feet with interbedded medium stiff sandy clays at an elevation of about 4 feet. The very loose to loose sands are followed by medium dense poorly graded sands with silts to elevations of about -10 to -13 feet. The medium dense sands are followed by dense to very dense poorly graded sands with silts to silty sands / hard sandy silts to an elevation of about -58 feet, followed by very dense poorly graded sands with silts to silty sands to the termination of borings at elevations of about -71 to -73 feet.</p> <p>Groundwater was encountered at an elevation of around 6 feet in the area where Bents 1, 2 and 3 will be located. Bents 4 will be located in St. Augustine creek with water above the ground surface. In the areas where B5 and B6 will be located, groundwater was at the surface at elevations of about 9 to 7 feet.</p> <p>Reference should be made to the attached soil boring logs for detailed subsurface information.</p>

MAXIMUM PILE DESIGN LOADS

END BEARING = 70% FRICTION = 30%	14" PSC = 60 Tons
	16" PSC = 82 Tons
	18" PSC = 95 Tons
	20" PSC = 110 Tons
	24" PSC = 138 Tons
	30" PSC = 180 Tons
36" PSC = 220 Tons	

Bridge Foundation Investigation

Benton Boulevard Extension ■ Pooler, Chatham County, Georgia
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FOUNDATION RECOMMENDATIONS

<u>BENTS</u>	DRILLED SHAFT	SPREAD FTG	PILE FOOTING	PILE BENT
	(BEARING)	(BEARING)	(PILE TYPE)	(PILE TYPE)
End Bents (1 and 6)	--	--	--	PSC
Intermediate Bents (2, 3, 4 and 5)				PSC

ELEVATIONS

<u>BENTS</u>	<u>BOTTOM OF FTG</u>	<u>MINIMUM TIP</u>	<u>ESTIMATED TIP</u>
End Bents (1 and 6)	--	-15	-20
Intermediate Bents (2,3,4 and 5)	--	-20	-25

NOTES

Elevations	<p>The elevations are based on the drawings and cross sections provided by McGee Partners, Inc. Below are the elevations of existing ground surface at each borehole location. If the surface elevations are significantly different, Terracon should be informed so that modifications to this report can be made as necessary.</p> <p style="text-align: center;"> B1 = 9.0 feet (Bent 1) B2 = 9.0 feet (Bent 2) B3 = 9.0 feet (Bent 3) B6 = 7.0 feet (Bent 4) </p>
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Bridge Foundation Investigation

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PDO	Driving resistance after Minimum Tip Elevations are achieved.																
Waiting Period	None required.																
Pre-drilling	<p>Predrilling may be required to allow the piles to penetrate into the dense sand layer. Jetting or spudding should not be allowed. Pre-drilling, if used, should be performed as per Special Provision 520. If pre-drilling is used, it should be set up to 3 feet above Minimum Tip Elevation. The maximum diameter of the pre-drilled hole should be determined from the following table:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;"><u>Pile Size-PSC</u></th> <th style="text-align: center;"><u>Maximum Pre-drill Hole Size-PSC</u></th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">14"</td> <td style="text-align: center;">12"</td> </tr> <tr> <td style="text-align: center;">16"</td> <td style="text-align: center;">18"</td> </tr> <tr> <td style="text-align: center;">18"</td> <td style="text-align: center;">18"</td> </tr> <tr> <td style="text-align: center;">20"</td> <td style="text-align: center;">24"</td> </tr> <tr> <td style="text-align: center;">24"</td> <td style="text-align: center;">24"</td> </tr> <tr> <td style="text-align: center;">30"</td> <td style="text-align: center;">30"</td> </tr> <tr> <td style="text-align: center;">36"</td> <td style="text-align: center;">36"</td> </tr> </tbody> </table>	<u>Pile Size-PSC</u>	<u>Maximum Pre-drill Hole Size-PSC</u>	14"	12"	16"	18"	18"	18"	20"	24"	24"	24"	30"	30"	36"	36"
<u>Pile Size-PSC</u>	<u>Maximum Pre-drill Hole Size-PSC</u>																
14"	12"																
16"	18"																
18"	18"																
20"	24"																
24"	24"																
30"	30"																
36"	36"																
Test Piles	We recommend that PSC test piles be set up at Bent 4 and Bent 6 to help determine pile order lengths. The test piles should be of sufficient length to reach a depth of 5 feet below the Estimated Tip Elevation. The pile tests should be performed using pile driving analyzer (PDA) both during the initial driving and restrike. The restrike tests should be performed at three days after the initial driving.																
As Built Information	The as-built foundation information should be forwarded to the respective engineering department upon the completion of the foundation system.																
Special Problems	<ul style="list-style-type: none"> i. Soil borings at Bents 4 and 5 could not be performed as part of the BFI report as the areas were under water. We recommend that new borings be performed during construction when the areas are accessible to confirm the pile length pile lengths can be expected. If no borings are performed at those bents, pile driving should be monitored very closely by the owner's engineer for potential need of pile length change. ii. Several residences are located in the vicinity of the proposed bridge. Vibrations from pile driving may cause concern with the property owners. We recommend that the Project Engineer contact the respective department prior to construction to evaluate the need for crack surveys and vibration monitoring. 																

Bridge Foundation Investigation

Benton Boulevard Extension ■ Pooler, Chatham County, Georgia
February 23, 2016 ■ Terracon Project No. ES155153



Prepared By	Biraj Gautam, P.E.	
Reviewed By	Guoming Lin, Ph.D., P.E., D.GE.	
Enclosed:	<u>Appendix A</u> <ul style="list-style-type: none">- Site Location Map- Exploration Location Plan- Field Exploration Description- SPT Boring Cross Section- Soil Profiles and the Proposed Bridge- SPT Boring Logs	<u>Appendix B</u> <ul style="list-style-type: none">- Summary of Laboratory Test Result- General Notes- Unified Soil Classification System- GDOT SP 520-Piling

APPENDIX A FIELD EXPLORATION

- Exhibit A-1 Site Location Map
- Exhibit A-2 Exploration Location Plan
- Exhibit A-3 Field Exploration Description
- Exhibit A-4 SPT Boring Cross Section
- Exhibit A-5 Typical Soil Profile and the Proposed Bridge
- Exhibit A-6 SPT Boring Logs

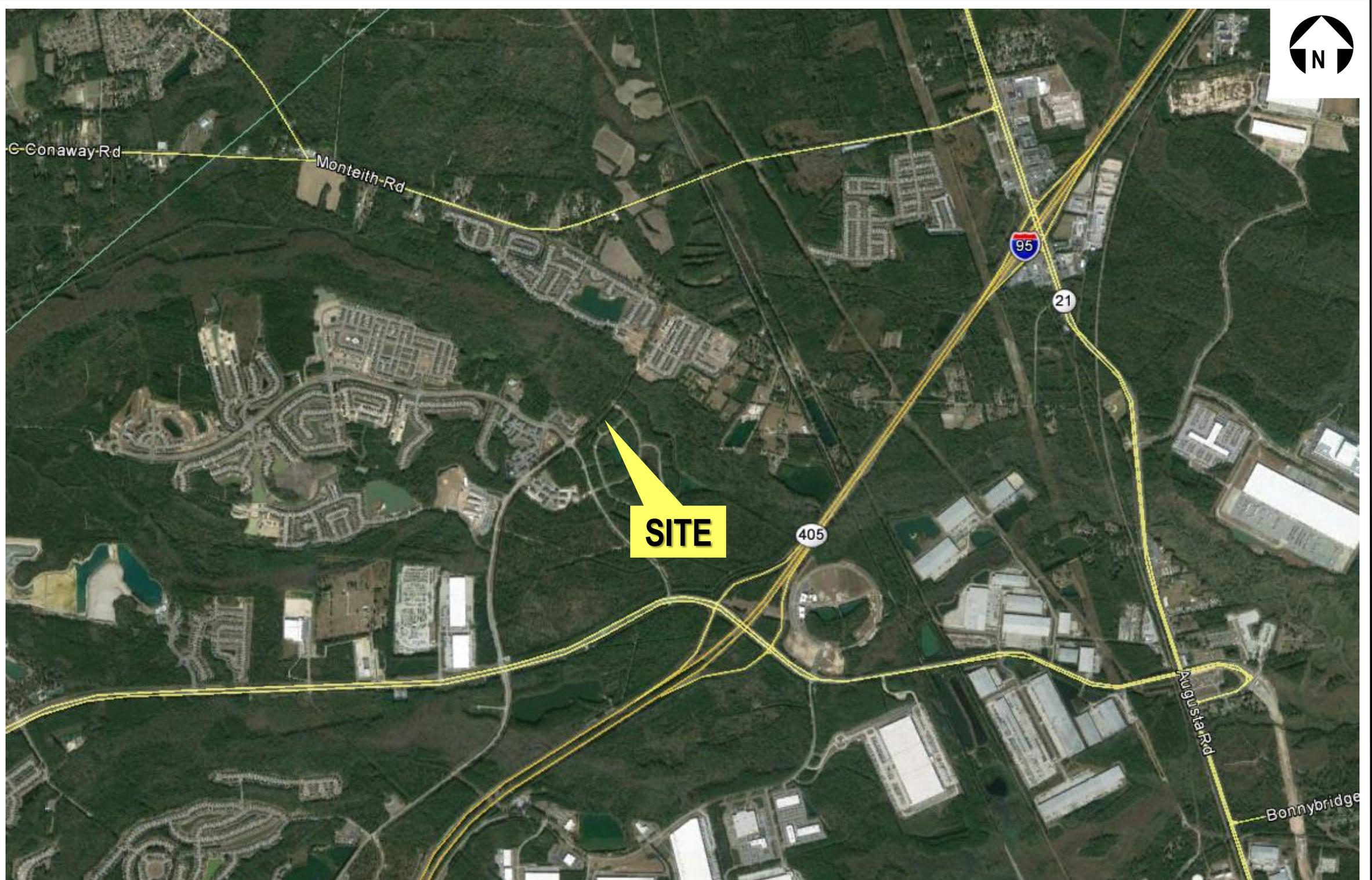


Image Courtesy of
Google Earth™

Project Manager:	BG	Project No.	ES155153
Drawn by:	BG	Scale:	N.T.S.
Checked by:	GL	File Name:	ES155153
Approved by:	GL	Date:	2/23/2016

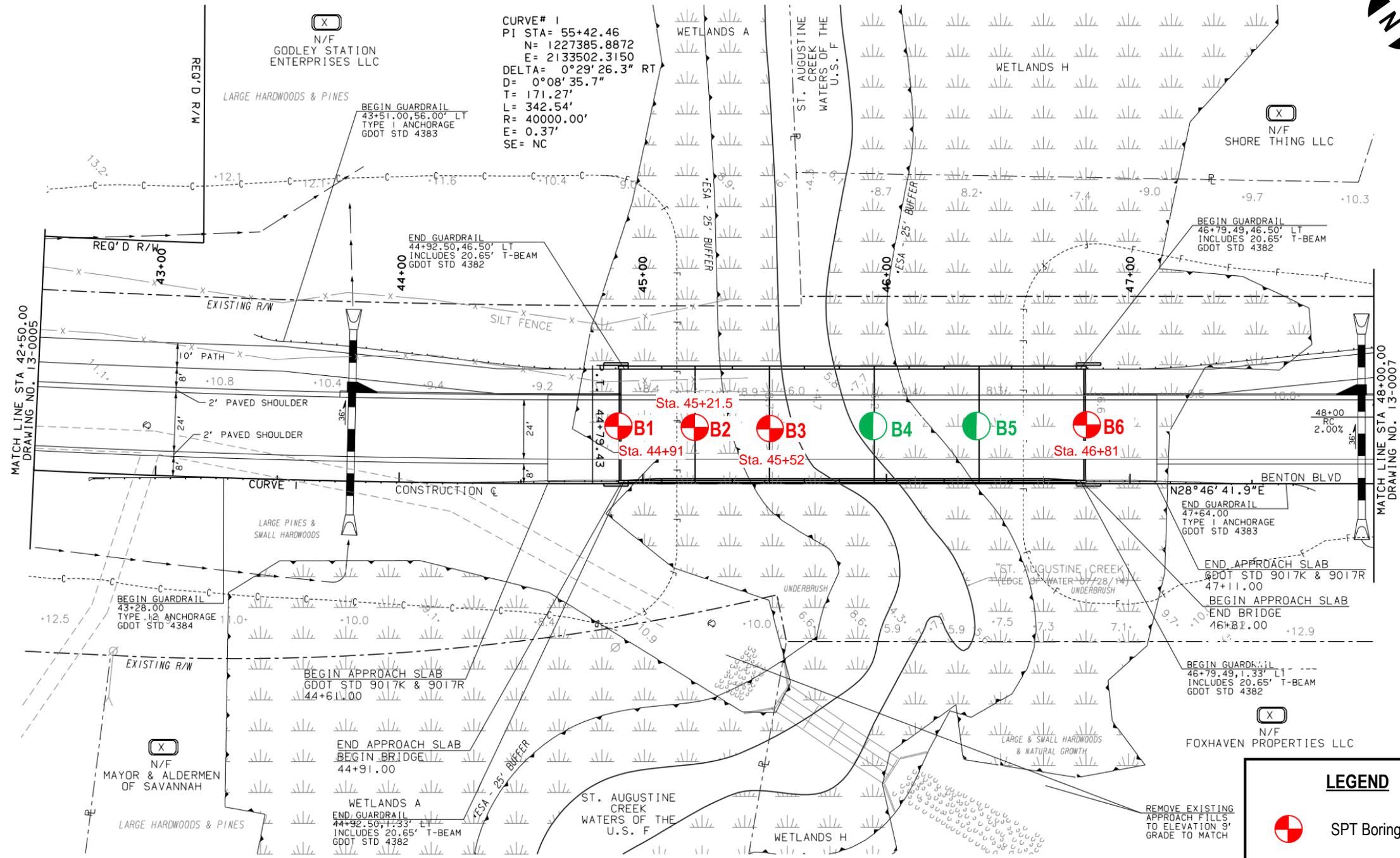
Terracon
 Consulting Engineers & Scientists

2201 Rowland Avenue Savannah, Georgia 31404
 Phone (912) 629 4000 Fax (912) 629 4001

SITE LOCATION MAP

Benton Boulevard Extension
 Pooler
 Chatham County, Georgia

Exhibit:
A-1



LEGEND

-  SPT Boring
-  Boring that could not be performed due to wet areas.

NOTE:
 ALL THE EXPLORATION LOCATIONS WERE LOCATED IN THE FIELD USING A GPS UNIT AND IN REFERENCE TO THE EXISTING FEATURES AND THE STAKED MARKS FOR BRIDGE BENTS. THE EXPLORATION LOCATIONS SHOULD BE CONSIDERED APPROXIMATE. DIAGRAM IS FOR GENERAL LOCATION ONLY AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES.

Project Manager:	BG	Project No.	ES155153
Drawn by:	BG	Scale:	N.T.S.
Checked by:	GL	File Name:	ES155153
Approved by:	GL	Date:	2/23/2016

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EXPLORATION LOCATION PLAN

Benton Boulevard Extension
 Pooler
 Chatham County, Georgia

Exhibit:
A-2

Bridge Foundation Investigation

Benton Boulevard Extension ■ Pooler, Chatham County, Georgia

February 23, 2016 ■ Terracon Project No. ES155153



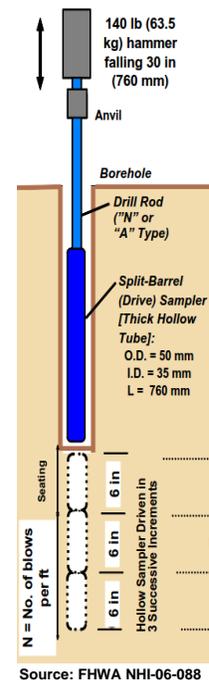
Field Exploration Description

The locations of the SPT borings were determined by Terracon based on the proposed plan and were located in the field using a hand-held GPS unit and in reference to the existing features and the staked marks for bridge bents. The locations of the exploration points are shown in the Exploration Location Plan and should be considered approximate.

Standard Penetration Testing

The SPT borings were performed in accordance with ASTM D 1586 with a track-mounted drilling rig using hollow stem auger methods. Samples of the soil encountered in the borings were obtained using split-barrel sampling procedures. In the split barrel sampling procedure, the number of blows required to advance a standard 2-inch O.D. split barrel sampler the last 12 inches of the typical total 18-inch penetration by means of a 140-pound hammer with a free fall of 30 inches, is the standard penetration resistance value (SPT-N). This value is used to estimate the in situ relative density of cohesionless soils and consistency of cohesive soils. A rope and cathead hammer was used to advance the split-barrel sampler in the borings performed on this site.

Upon completion, the data collected were analyzed and processed by the project engineer.



THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. 11X17 WITH LEGEND SPT.GPJ 2/19/16



Explanation

	Borehole Number		Clayey Sand		Poorly-graded Sand with Clay (or silty clay)		Sandy Fat Clay
	Borehole Lithology		Sandy Silt		Silty Sand		
	Borehole Termination Type						
	Water Level Reading at time of drilling.						
	Water Level Reading after drilling.						

Distance Along Baseline

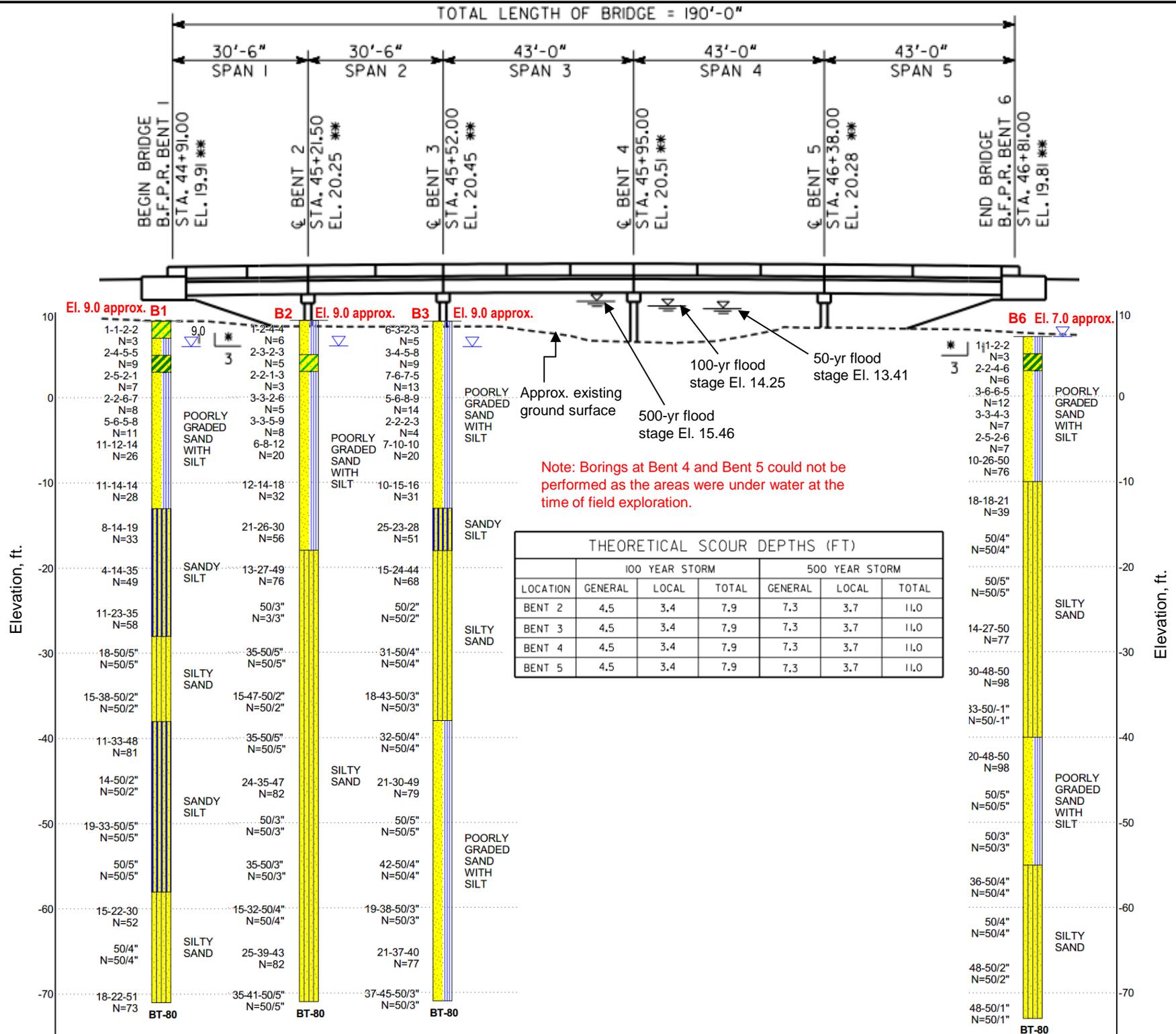
Project Manager: BG
Drawn by: BG
Approved by: GL
Date: 2/23/2016

Project No.: ES155153
Scale: N.T.S.
File Name: ES155153

Terracon
 2201 Rowland Avenue
 Savannah, Georgia
 PH. 912-629-4000 FAX. 912-629-4001

SUBSURFACE PROFILE
 Benton Boulevard Extension
 Pooler
 Chatham County, Georgia

EXHIBIT
A-4



Project Manager: BG
 Drawn by: BG
 Checked by: GL
 Approved by: GL

Project No. ES155153
 Scale: N.T.S.
 File Name: ES155153
 Date: 2/23/2016



SOIL PROFILE AND THE PROPOSED BRIDGE

Benton Boulevard Extension
 Pooler
 Chatham County, Georgia

Exhibit:
A-5

BORING LOG NO. B1

PROJECT: Benton Boulevard Extension

**CLIENT: McGee Partners Inc.
Atlanta, Georgia**

SITE: Pooler, Chatham County, Georgia

GRAPHIC LOG	LOCATION See Exhibit A-2	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	FINES	WATER CONTENT (%)	ATTERBERG LIMITS	
	Surface Elev.: 9 (Ft.) ELEVATION (Ft.)							LL-PL-PI	
2.0	CLAYEY SAND (SC) , fine grained, dark brown, very loose	7	X	X	1-1-2-2 N=3				
4.0	POORLY GRADED SAND WITH SILT (SP-SM) , fine to coarse grained, gray, loose	5	▽	X	2-4-5-5 N=9				
6.0	SANDY FAT CLAY (CH) , gray, medium stiff	5		X	2-5-2-1 N=7		28	67-26-41	
22.0	POORLY GRADED SAND WITH SILT (SP-SM) , fine to coarse grained, gray, loose fine to coarse grained, gray, medium dense fine to coarse grained, gray, medium dense fine to coarse grained, gray, medium dense	10		X	2-2-6-7 N=8 5-6-5-8 N=11				
22.0	SANDY SILT (ML) , dark gray, hard	15		X	11-12-14 N=26				
22.0	SANDY SILT (ML) , dark gray, hard	20		X	11-14-14 N=28	6.2	17		
37.0	SANDY SILT (ML) , dark gray, hard	25		X	8-14-19 N=33				
37.0	SANDY SILT (ML) , dark gray, hard	30		X	4-14-35 N=49				
37.0	SANDY SILT (ML) , dark gray, hard	35		X	11-23-35 N=58				
37.0	SILTY SAND (SM) , fine grained, dark gray, very dense	40		X	18-50/5" N=50/5"				
37.0	SILTY SAND (SM) , fine grained, dark gray, very dense	45		X	15-38-50/2" N=50/2"				

Stratification lines are approximate. In-situ, the transition may be gradual.
The SPT blow counts have not been adjusted for hammer or overburden pressure. The energy transfer ratio is 70.4%.

Hammer Type: Rope and Cathead

Advancement Method:
Hollow Stem Auger with Drill Mud

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).

Notes:

Abandonment Method:

See Appendix B for explanation of symbols and abbreviations.

WATER LEVEL OBSERVATIONS

▽ GWT at the time of drilling



Boring Started: 12/16/2015

Boring Completed: 12/16/2015

Drill Rig: ATV Diedrich D-50

Driller: Austin

Project No.: ES155153

Exhibit: A-6-1

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_SPT.GPJ TERRACON2012.GDT 2/19/16

BORING LOG NO. B1

PROJECT: Benton Boulevard Extension

**CLIENT: McGee Partners Inc.
Atlanta, Georgia**

SITE: Pooler, Chatham County, Georgia

GRAPHIC LOG	LOCATION See Exhibit A-2	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Fines	WATER CONTENT (%)	ATTERBERG LIMITS
	Surface Elev.: 9 (Ft.) ELEVATION (Ft.)							LL-PL-PI
		47.0						
	SANDY SILT (ML) , dark gray, hard							
	dark gray, hard	50	X		11-33-48 N=81	50.1	45	
	dark gray, hard	55	X		14-50/2" N=50/2"			
	dark gray, hard	60	X		19-33-50/5" N=50/5"			
	dark gray, hard	65	X		50/5" N=50/5"			
		67.0						
	SILTY SAND (SM) , fine grained, dark gray, very dense							
	fine grained, dark gray, very dense	70	X		15-22-30 N=52			
	fine grained, dark gray, very dense	75	X		50/4" N=50/4"			
	fine grained, dark gray, very dense	80	X		18-22-51 N=73			
	Boring Terminated at 80 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.
The SPT blow counts have not been adjusted for hammer or overburden pressure. The energy transfer ratio is 70.4%.

Hammer Type: Rope and Cathead

Advancement Method:
Hollow Stem Auger with Drill Mud

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).

Notes:

Abandonment Method:

See Appendix B for explanation of symbols and abbreviations.

WATER LEVEL OBSERVATIONS
<i>GWT at the time of drilling</i>



Boring Started: 12/16/2015	Boring Completed: 12/16/2015
Drill Rig: ATV Diedrich D-50	Driller: Austin
Project No.: ES155153	Exhibit: A-6-1

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_SPT.GPJ TERRACON2012.GDT 2/19/16

BORING LOG NO. B2

PROJECT: Benton Boulevard Extension

**CLIENT: McGee Partners Inc.
Atlanta, Georgia**

SITE: Pooler, Chatham County, Georgia

GRAPHIC LOG	LOCATION See Exhibit A-2	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Fines	WATER CONTENT (%)	ATTERBERG LIMITS
	Surface Elev.: 9 (Ft.) ELEVATION (Ft.)							LL-PL-PI
	POORLY GRADED SAND WITH SILT (SP-SM) , fine grained, brown, loose fine to medium grained, gray, loose	4.0	▽	X	1-2-4-4 N=6			
4.0	CLAYEY SAND (SC) , fine to medium grained, gray, very loose	5		X	2-3-2-3 N=5	10.4	17	
6.0	POORLY GRADED SAND WITH SILT (SP-SM) , fine to medium grained, gray, loose fine to medium grained, gray, loose	3		X	2-2-1-3 N=3			
	POORLY GRADED SAND WITH SILT (SP-SM) , fine to medium grained, gray, loose fine to medium grained, gray, loose	10		X	3-3-2-6 N=5			
	fine to medium grained, gray, medium dense	15		X	6-8-12 N=20			
	fine to medium grained, gray, dense	20		X	12-14-18 N=32			
	fine to medium grained, gray, very dense	25		X	21-26-30 N=56			
27.0	SILTY SAND (SM) , fine grained, gray, very dense	-18		X	13-27-49 N=76	26	33	
	fine grained, gray, very dense	35		X	50/3" N=3/3"			
	fine grained, gray, very dense	40		X	35-50/5" N=50/5"			
	fine grained, gray, very dense	45		X	15-47-50/2" N=50/2"			

Stratification lines are approximate. In-situ, the transition may be gradual.
The SPT blow counts have not been adjusted for hammer or overburden pressure. The energy transfer ratio is 70.4%.

Hammer Type: Rope and Cathead

Advancement Method: Hollow Stem Auger with Drill Mud	See Exhibit A-3 for description of field procedures. See Appendix B for description of laboratory procedures and additional data (if any). Abandonment Method: See Appendix B for explanation of symbols and abbreviations.	Notes:
WATER LEVEL OBSERVATIONS		
▽ GWT at the time of drilling		
<p style="font-size: small; text-align: center;">2201 Rowland Avenue Savannah, Georgia</p>		Boring Started: 12/15/2015 Drill Rig: ATV Diedrich D-50 Project No.: ES155153
		Boring Completed: 12/15/2015 Driller: Austin Exhibit: A-6-2

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_SPT.GPJ TERRACON2012.GDT 2/19/16

BORING LOG NO. B2

PROJECT: Benton Boulevard Extension

**CLIENT: McGee Partners Inc.
Atlanta, Georgia**

SITE: Pooler, Chatham County, Georgia

GRAPHIC LOG	LOCATION See Exhibit A-2	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Fines	WATER CONTENT (%)	ATTERBERG LIMITS
	Surface Elev.: 9 (Ft.) ELEVATION (Ft.)							LL-PL-PI
	SILTY SAND (SM) , fine grained, gray, very dense <i>(continued)</i>							
	fine grained, gray, very dense	50		X	35-50/5" N=50/5"			
	fine grained, gray, very dense	55		X	24-35-47 N=82			
	fine grained, gray, very dense	60		X	50/3" N=50/3"			
	fine grained, gray, very dense	65		X	35-50/3" N=50/3"			
	fine grained, gray, very dense	70		X	15-32-50/4" N=50/4"	26.4	33	
	fine grained, gray, very dense	75		X	25-39-43 N=82			
	fine grained, gray, very dense	80		X	35-41-50/5" N=50/5"			
	Boring Terminated at 80 Feet	80.0						

Stratification lines are approximate. In-situ, the transition may be gradual.
The SPT blow counts have not been adjusted for hammer or overburden pressure. The energy transfer ratio is 70.4%.

Hammer Type: Rope and Cathead

Advancement Method: Hollow Stem Auger with Drill Mud	See Exhibit A-3 for description of field procedures. See Appendix B for description of laboratory procedures and additional data (if any). See Appendix B for explanation of symbols and abbreviations.	Notes:
Abandonment Method:		
WATER LEVEL OBSERVATIONS		Boring Started: 12/15/2015 Drill Rig: ATV Diedrich D-50 Project No.: ES155153
∇ GWT at the time of drilling		Boring Completed: 12/15/2015 Driller: Austin Exhibit: A-6-2

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_SPT.GPJ TERRACON2012.GDT 2/19/16

BORING LOG NO. B3

PROJECT: Benton Boulevard Extension

**CLIENT: McGee Partners Inc.
Atlanta, Georgia**

SITE: Pooler, Chatham County, Georgia

GRAPHIC LOG	LOCATION See Exhibit A-2	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Fines	WATER CONTENT (%)	ATTERBERG LIMITS
	Surface Elev.: 9 (Ft.) ELEVATION (Ft.)							LL-PL-PI
	POORLY GRADED SAND WITH SILT (SP-SM) , fine grained, black, loose, with woods		▽	X	6-3-2-3 N=5			
	fine to medium grained, brown, loose			X	3-4-5-8 N=9			
	fine to coarse grained, gray, medium dense			X	7-6-7-5 N=13			
	fine to coarse grained, gray, medium dense			X	5-6-8-9 N=14			
	fine to medium grained, gray, loose			X	2-2-2-3 N=4	6.1	17	
	fine to medium grained, gray, medium dense			X	7-10-10 N=20			
	fine to medium grained, gray, dense			X	10-15-16 N=31			
	22.0	-13						
	SANDY SILT (ML) , gray, hard			X	25-23-28 N=51			
	27.0	-18						
SILTY SAND (SM) , fine grained, gray, very dense			X	15-24-44 N=68				
fine grained, gray, very dense			X	50/2" N=50/2"	14.6	34		
fine grained, gray, very dense			X	31-50/4" N=50/4"				
fine grained, gray, very dense			X	18-43-50/3" N=50/3"				
		45						

Stratification lines are approximate. In-situ, the transition may be gradual.
The SPT blow counts have not been adjusted for hammer or overburden pressure. The energy transfer ratio is 70.4%.

Hammer Type: Rope and Cathead

Advancement Method: Hollow Stem Auger with Drill Mud	See Exhibit A-3 for description of field procedures. See Appendix B for description of laboratory procedures and additional data (if any). Abandonment Method: See Appendix B for explanation of symbols and abbreviations.	Notes:
WATER LEVEL OBSERVATIONS		
▽ GWT at the time of drilling		
		Boring Started: 12/14/2015 Drill Rig: ATV Diedrich D-50 Project No.: ES155153
		Boring Completed: 12/15/2015 Driller: Austin Exhibit: A-6-3

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_SPT.GPJ TERRACON2012.GDT 2/19/16

BORING LOG NO. B3

PROJECT: Benton Boulevard Extension

CLIENT: McGee Partners Inc.
Atlanta, Georgia

SITE: Pooler, Chatham County, Georgia

GRAPHIC LOG	LOCATION See Exhibit A-2	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Fines	WATER CONTENT (%)	ATTERBERG LIMITS
	Surface Elev.: 9 (Ft.) ELEVATION (Ft.)							LL-PL-PI
		47.0						
	POORLY GRADED SAND WITH SILT (SP-SM) , fine grained, gray, very dense				32-50/4" N=50/4"	10.3	28	
	fine grained, gray, very dense	50						
	fine grained, gray, very dense	55			21-30-49 N=79			
	fine grained, gray, very dense	60			50/5" N=50/5"			
	fine grained, gray, very dense	65			42-50/4" N=50/4"			
	fine grained, gray, very dense	70			19-38-50/3" N=50/3"			
	fine grained, gray, very dense	75			21-37-40 N=77			
	fine grained, gray, very dense	80			37-45-50/3" N=50/3"			
	Boring Terminated at 80 Feet	80						

Stratification lines are approximate. In-situ, the transition may be gradual.
The SPT blow counts have not been adjusted for hammer or overburden pressure. The energy transfer ratio is 70.4%.

Hammer Type: Rope and Cathead

Advancement Method: Hollow Stem Auger with Drill Mud	See Exhibit A-3 for description of field procedures. See Appendix B for description of laboratory procedures and additional data (if any). See Appendix B for explanation of symbols and abbreviations.	Notes:
Abandonment Method:		
WATER LEVEL OBSERVATIONS		Boring Started: 12/14/2015 Drill Rig: ATV Diedrich D-50 Project No.: ES155153
<i>GWT at the time of drilling</i>	2201 Rowland Avenue Savannah, Georgia	Boring Completed: 12/15/2015 Driller: Austin Exhibit: A-6-3

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_SPT.GPJ TERRACON2012.GDT 2/19/16

BORING LOG NO. B6

PROJECT: Benton Boulevard Extension

**CLIENT: McGee Partners Inc.
Atlanta, Georgia**

SITE: Pooler, Chatham County, Georgia

GRAPHIC LOG	LOCATION See Exhibit A-2	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	FINES	WATER CONTENT (%)	ATTERBERG LIMITS
	Surface Elev.: 7 (Ft.) ELEVATION (Ft.)							LL-PL-PI
			▽					
	POORLY GRADED SAND WITH SILT (SP-SM) , fine grained, dark gray, very loose	2.0		X	1-1-2-2 N=3			
	SANDY FAT CLAY (CH) , gray to orange, medium stiff	4.0		X	2-2-4-6 N=6			
	POORLY GRADED SAND WITH SILT (SP-SM) , fine to coarse grained, gray, medium dense fine to coarse grained, gray, loose fine to medium grained, gray, loose	5		X	3-6-6-5 N=12			
		10		X	3-3-4-3 N=7	6	16	
		15		X	2-5-2-6 N=7			
	SILTY SAND (SM) , fine grained, dark gray, dense	17.0		X	10-26-50 N=76			
		-10		X	18-18-21 N=39			
	25		X	50/4" N=50/4"				
	30		X	50/5" N=50/5"				
	35		X	14-27-50 N=77				
	40		X	30-48-50 N=98	35	24		
	45		X	33-50/-1" N=50/-1"				

Stratification lines are approximate. In-situ, the transition may be gradual.
The SPT blow counts have not been adjusted for hammer or overburden pressure. The energy transfer ratio is 70.4%.

Hammer Type: Rope and Cathead

Advancement Method: Hollow Stem Auger with Drill Mud	See Exhibit A-3 for description of field procedures. See Appendix B for description of laboratory procedures and additional data (if any).	Notes:	
Abandonment Method:	See Appendix B for explanation of symbols and abbreviations.		
WATER LEVEL OBSERVATIONS ▽ GWT at the time of drilling		2201 Rowland Avenue Savannah, Georgia	
		Boring Started: 1/21/2016	Boring Completed: 1/22/2016
		Drill Rig: ATV Diedrich D-50	Driller: Austin
		Project No.: ES155153	Exhibit: A-6-4

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_SPT.GPJ TERRACON2012.GDT 2/19/16

BORING LOG NO. B6

PROJECT: Benton Boulevard Extension

**CLIENT: McGee Partners Inc.
Atlanta, Georgia**

SITE: Pooler, Chatham County, Georgia

GRAPHIC LOG	LOCATION See Exhibit A-2	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	Fines	WATER CONTENT (%)	ATTERBERG LIMITS	
	Surface Elev.: 7 (Ft.) ELEVATION (Ft.)							LL-PL-PI	
	DEPTH								
	47.0	-40							
	POORLY GRADED SAND WITH SILT (SP-SM) , fine grained, dark gray, very dense			X	20-48-50 N=98				
	62.0	-55							
	SILTY SAND (SM) , fine grained, dark gray, very dense			X	36-50/4" N=50/4"	15.7	35		
	80.0	-73							
	Boring Terminated at 80 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.
The SPT blow counts have not been adjusted for hammer or overburden pressure. The energy transfer ratio is 70.4%.

Hammer Type: Rope and Cathead

Advancement Method:
Hollow Stem Auger with Drill Mud

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).

Notes:

Abandonment Method:

See Appendix B for explanation of symbols and abbreviations.

WATER LEVEL OBSERVATIONS

GWT at the time of drilling



Boring Started: 1/21/2016

Boring Completed: 1/22/2016

Drill Rig: ATV Diedrich D-50

Driller: Austin

Project No.: ES155153

Exhibit: A-6-4

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_SPT.GPJ TERRACON2012.GDT 2/19/16

APPENDIX B

SUPPORTING DOCUMENT

- Exhibit B-1 Summary of Laboratory Test
 - (a) Atterberg Limit Test Result
 - (b) Grain Size Analysis Result
- Exhibit B-2 General Notes
- Exhibit B-3 Unified Soil Classification System
- Exhibit B-4 GDOT SP 520-Piling

Summary of Soil Laboratory Test

Boring No.	Sample No.	Sample Depth (ft)	Sample Elevation(ft)	Material Description	USCS	Natural Moisture content (%)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Cu	Cc	D90 (mm)	D60 (mm)	D30 (mm)	% Gravel	%Sand	%Fine
B1	B1-3	4 to 6	5 to 3	Sandy fat CLAY	CH	27.8	67	26	41	--	--	--	--	--	--	--	--
	B1-7	18.5 to 20	-9.5 to -11	Poorly graded SAND with silt	SP-SM	16.9	--	--	--	2.98	1.14	3.421	0.674	0.418	2.8	91.0	6.2
	B1-13	48.5 to 50	-39.5 to -41	Sandy SILT	ML	45.0	--	--	--	--	--	0.148	0.086	--	0.0	49.9	50.1
B2	B2-2	2 to 4	7 to 5	Poorly graded SAND with silt	SP-SM	17.4	--	--	--	--	--	2.332	0.728	0.356	1.1	88.5	10.4
	B2-9	28.5 to 30	-19.5 to -21	Silty SAND	SM	32.8	--	--	--	--	--	0.596	0.115	0.079	0.2	73.8	26.0
	B2-17	68.5 to 70	-59.5 to -61	Silty SAND	SM	32.6	--	--	--	--	--	0.137	0.099	0.077	0.0	73.6	26.4
B3	B3-5	8 to 10	1 to -1	Poorly graded SAND with silt	SP-SM	17.2	--	--	--	3.07	1.24	1.943	0.741	0.472	2.9	91.0	6.1
	B3-10	33.5 to 35	-24.5 to -26	Silty SAND	SM	34.2						0.160	0.107	0.084	0.0	85.4	14.6
	B3-13	48.5 to 50	-39.5 to -41	Poorly graded SAND with silt	SP-SM	27.8						0.134	0.103	0.085	0.0	89.7	10.3
B6	B6-5	8 to 10	-1 to -3	Poorly graded SAND with silt	SP-SM	15.5						6.240	1.330	0.472	13.5	80.5	6.0
	B6-11	38.5 to 40	-31.5 to -33	Silty SAND	SM	23.7						0.208	0.101		0.0	65.0	35.0
	B6-16	63.5 to 65	-56.5 to -58	Silty SAND	SM	34.5						0.133	0.102	0.082	0.0	84.3	15.7

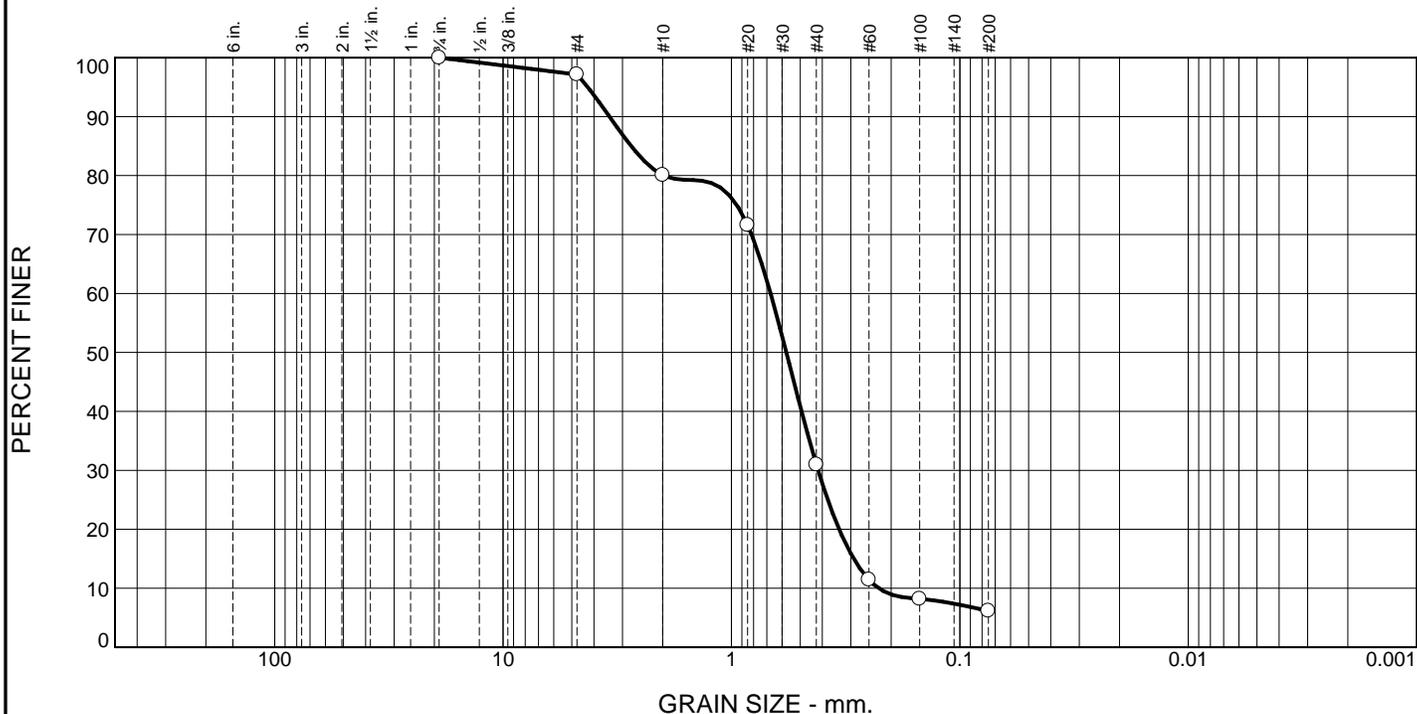
Note:

Surface elevations based on the drawings provided:

B1, B2 and B3: Approximately 9.0 ft.

B6: Approximately 7.0 ft.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.8	17.1	49.1	24.8	6.2	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
#4	97.2		
#10	80.1		
#20	71.6		
#40	31.0		
#60	11.4		
#100	8.2		
#200	6.2		

* (no specification provided)

Material Description

Gray Fine-Medium SAND with Silt

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)= A-1-b

Coefficients

D₉₀= 3.4213 D₈₅= 2.7465 D₆₀= 0.6739
 D₅₀= 0.5750 D₃₀= 0.4176 D₁₅= 0.2914
 D₁₀= 0.2264 C_u= 2.98 C_c= 1.14

Remarks

Date Received: 12/19/2015 **Date Tested:** 1/22/2016
Tested By: JPW
Checked By: GKT
Title: Lab Manager

Location: B1-7

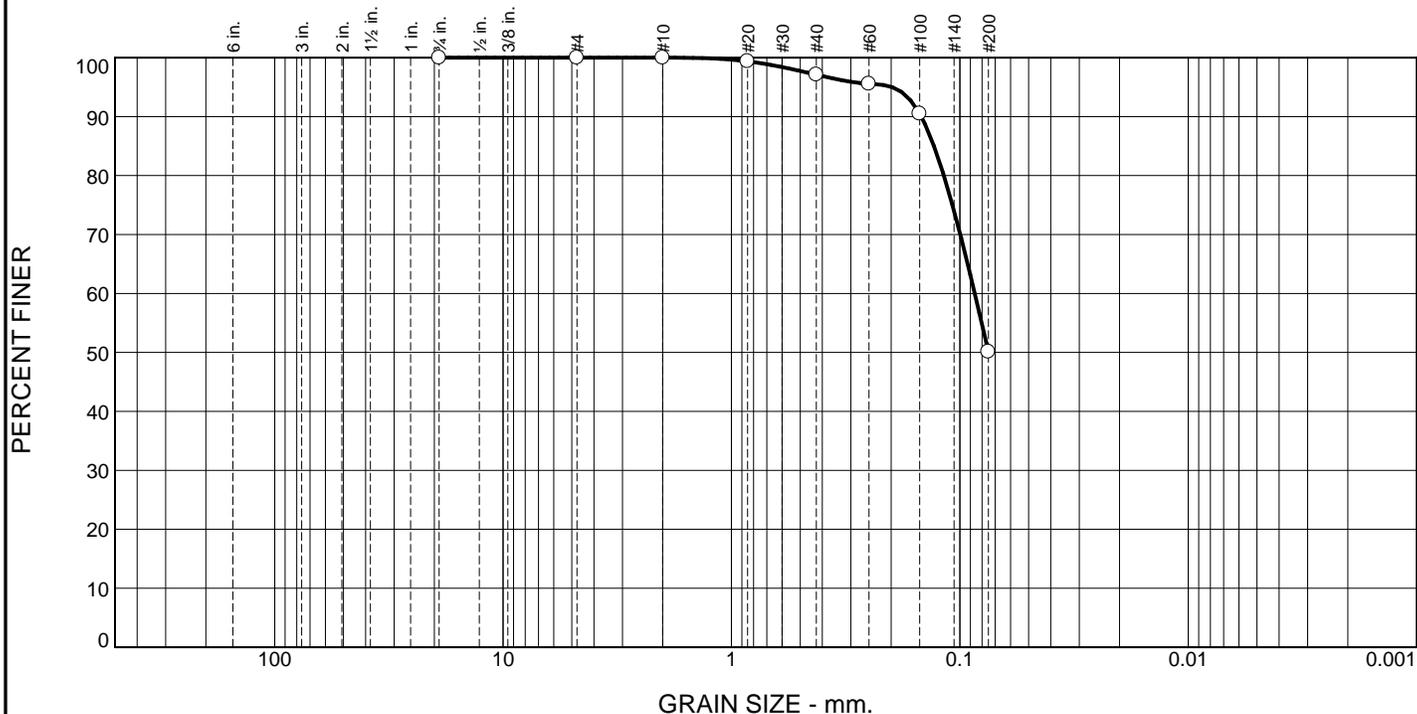
Date Sampled: 12/19/2015



Client: McGee Partners, Inc.
Project: Benton Boulevard Extension
Project No: ES155153

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	2.9	47.0	50.1	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
#4	100.0		
#10	100.0		
#20	99.4		
#40	97.1		
#60	95.6		
#100	90.5		
#200	50.1		

Material Description

Dark Gray Sandy SILT

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= ML AASHTO (M 145)= A-4(0)

Coefficients

D₉₀= 0.1476 D₈₅= 0.1298 D₆₀= 0.0861
D₅₀= D₃₀= D₁₅=
D₁₀= C_u= C_c=

Remarks

Date Received: 12/19/2015 Date Tested: 1/22/2016
Tested By: JPW
Checked By: GKT
Title: Lab Manager

* (no specification provided)

Location: B1-13

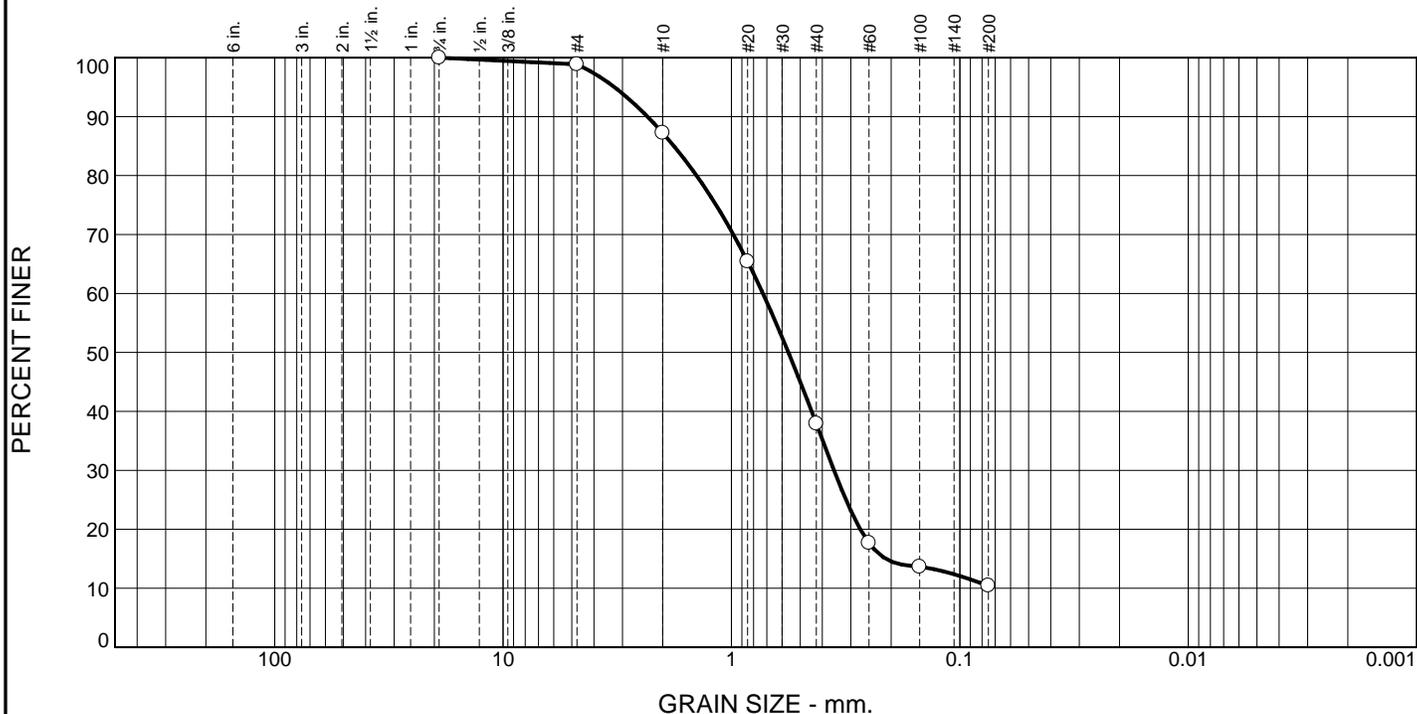
Date Sampled: 12/19/2015



Client: McGee Partners, Inc.
Project: Benton Boulevard Extension
Project No: ES155153

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.1	11.7	49.3	27.5	10.4	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
#4	98.9		
#10	87.2		
#20	65.4		
#40	37.9		
#60	17.7		
#100	13.6		
#200	10.4		

* (no specification provided)

Material Description

Gray Fine-Medium SAND with Silt

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)= A-1-b

Coefficients

D₉₀= 2.3315 D₈₅= 1.7852 D₆₀= 0.7281
D₅₀= 0.5633 D₃₀= 0.3556 D₁₅= 0.2110
D₁₀= C_u= C_c=

Remarks

Date Received: 12/19/2015 Date Tested: 1/22/2016

Tested By: JPW

Checked By: GKT

Title: Lab Manager

Location: B2-2

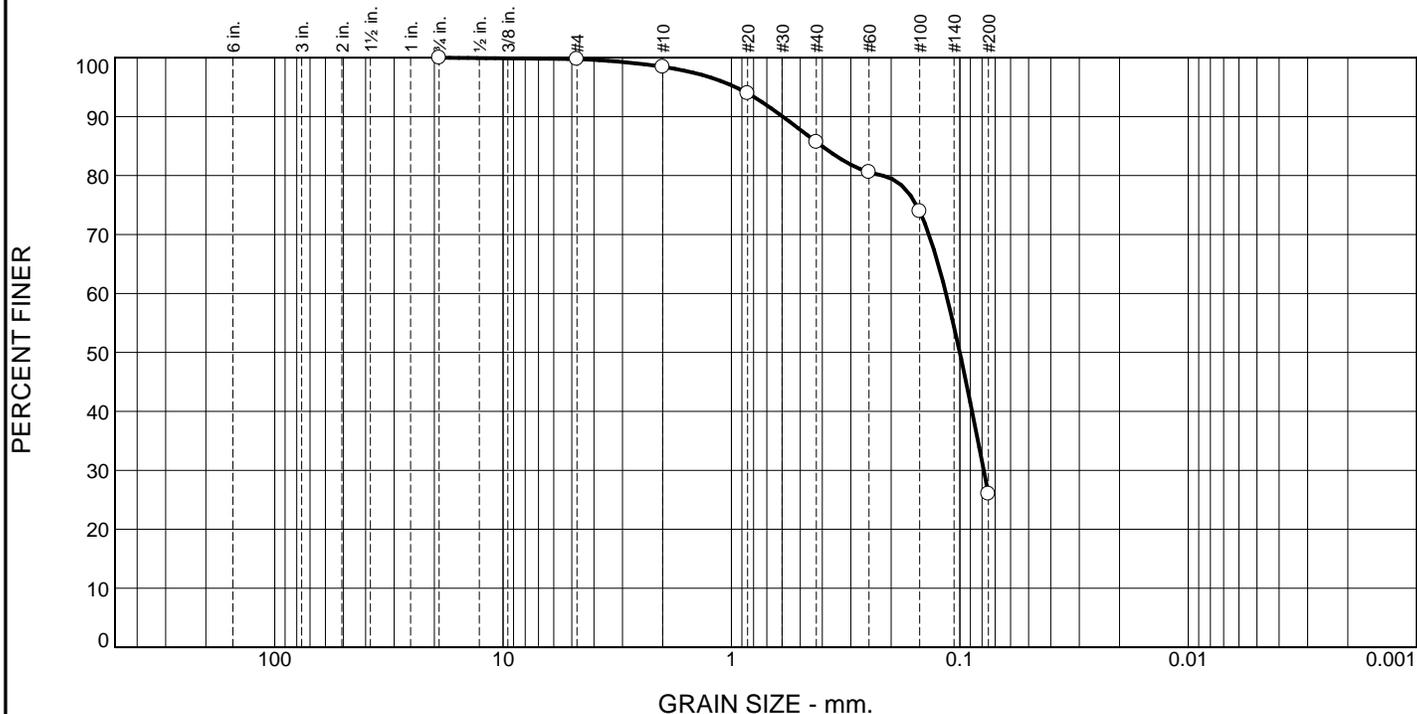
Date Sampled: 12/19/2015



Client: McGee Partners, Inc.
Project: Benton Boulevard Extension
Project No: ES155153

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	1.4	12.7	59.7	26.0	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
#4	99.8		
#10	98.4		
#20	94.0		
#40	85.7		
#60	80.6		
#100	74.0		
#200	26.0		

* (no specification provided)

Material Description

Gray Silty SAND

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-2-4(0)

Coefficients

D₉₀= 0.5961 D₈₅= 0.4017 D₆₀= 0.1150
D₅₀= 0.1001 D₃₀= 0.0786 D₁₅=
D₁₀= C_u= C_c=

Remarks

Date Received: 12/19/2015 Date Tested: 1/22/2016
Tested By: JPW
Checked By: GKT
Title: Lab Manager

Location: B2-9

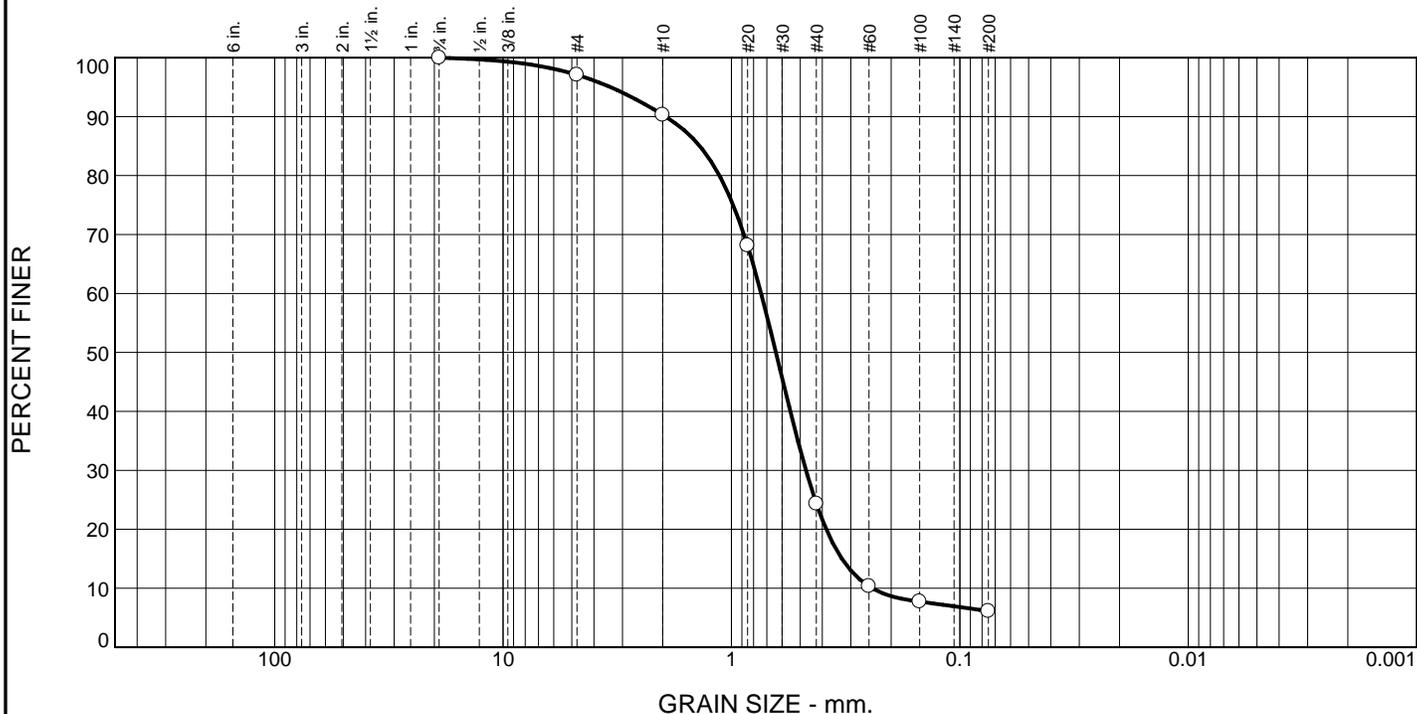
Date Sampled: 12/19/2015



Client: McGee Partners, Inc.
Project: Benton Boulevard Extension
Project No: ES155153

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.9	6.8	66.0	18.2	6.1	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
#4	97.1		
#10	90.3		
#20	68.1		
#40	24.3		
#60	10.3		
#100	7.7		
#200	6.1		

* (no specification provided)

Material Description

Gray Fine-Medium SAND with Silt

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)= A-1-b

Coefficients

D₉₀= 1.9434 D₈₅= 1.3752 D₆₀= 0.7414
 D₅₀= 0.6388 D₃₀= 0.4720 D₁₅= 0.3284
 D₁₀= 0.2418 C_u= 3.07 C_c= 1.24

Remarks

Date Received: 12/19/2015 **Date Tested:** 1/22/2016
Tested By: JPW
Checked By: GKT
Title: Lab Manager

Location: B3-5

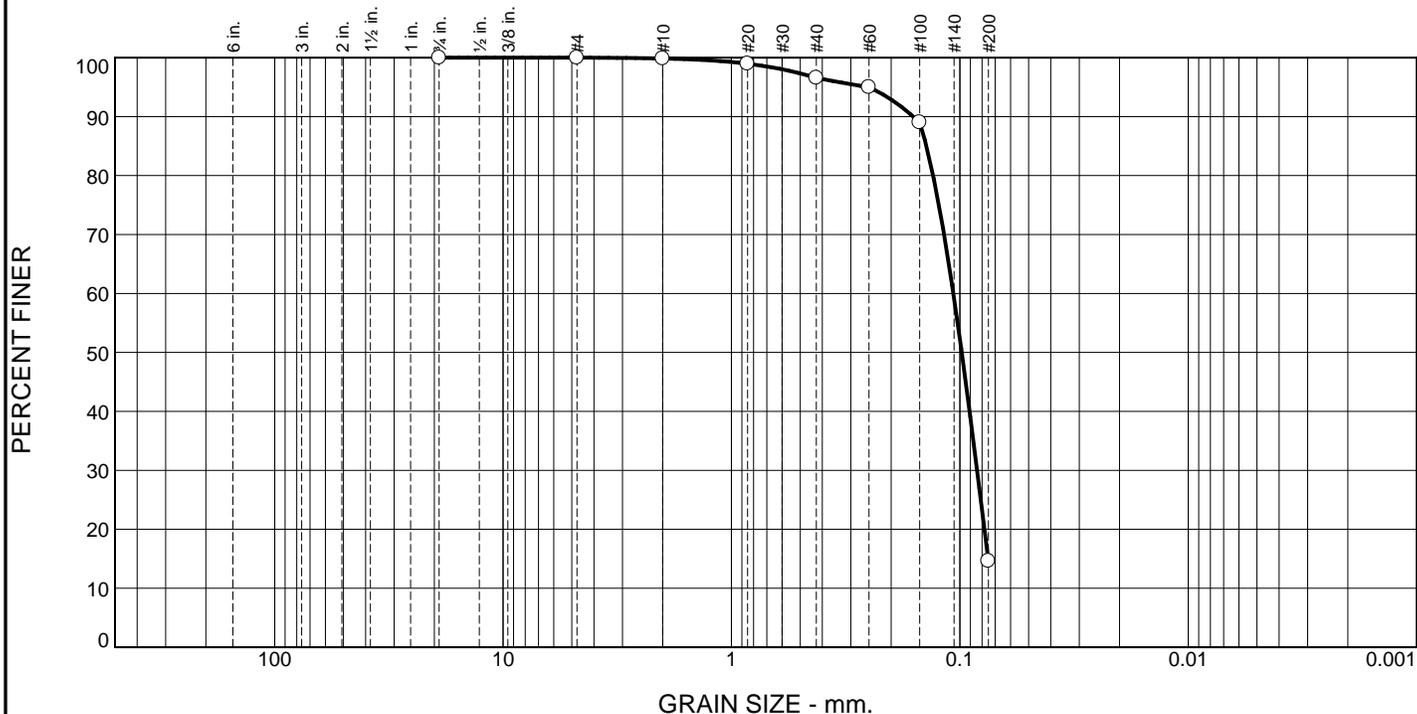
Date Sampled: 12/19/2015



Client: McGee Partners, Inc.
Project: Benton Boulevard Extension
Project No: ES155153

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	3.3	82.0	14.6	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
#4	100.0		
#10	99.9		
#20	99.9		
#40	96.6		
#60	95.0		
#100	89.0		
#200	14.6		

* (no specification provided)

Material Description

Gray Fine Silty SAND

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-2-4(0)

Coefficients

D₉₀= 0.1600 D₈₅= 0.1401 D₆₀= 0.1068
 D₅₀= 0.0982 D₃₀= 0.0840 D₁₅= 0.0752
 D₁₀= C_u= C_c=

Remarks

Date Received: 12/19/2015 Date Tested: 1/22/2016
 Tested By: JPW
 Checked By: GKT
 Title: Lab Manager

Location: B3-10

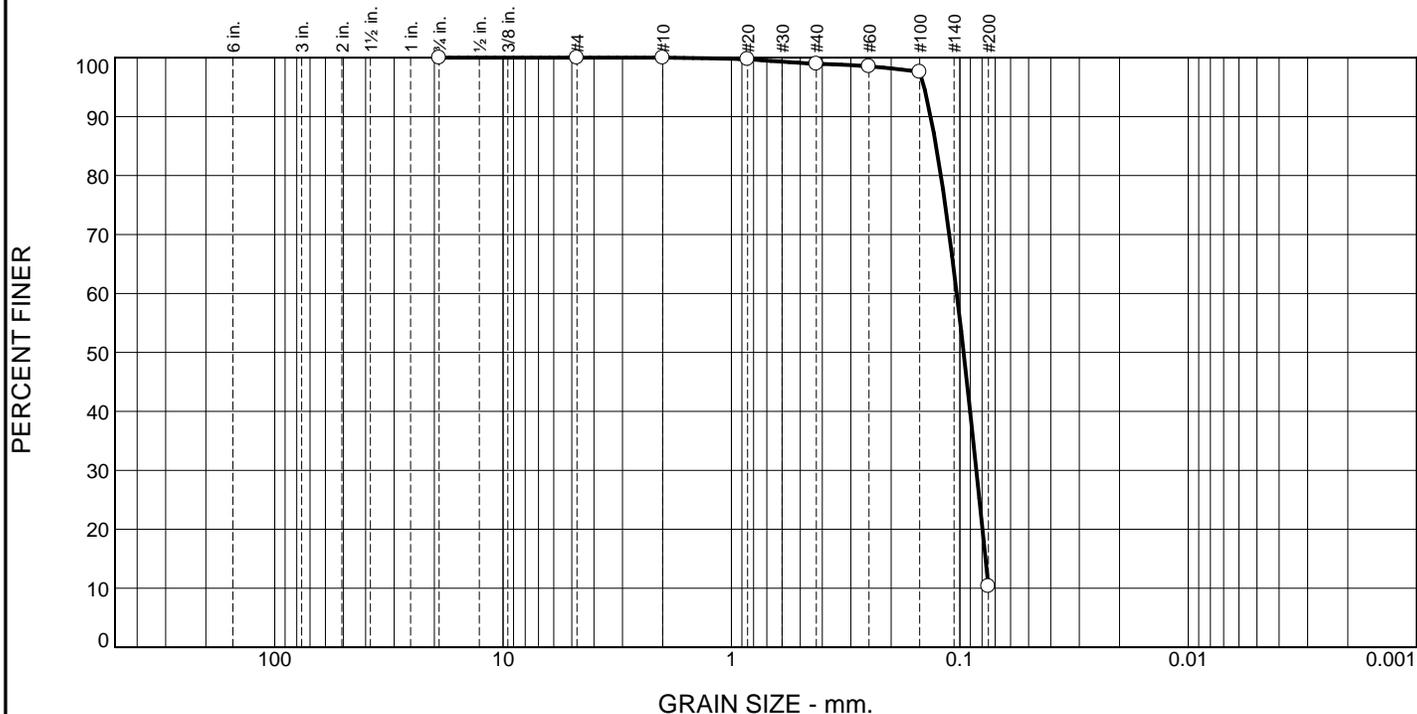
Date Sampled: 12/19/2015



Client: McGee Partners, Inc.
Project: Benton Boulevard Extension
Project No: ES155153

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	1.0	88.7	10.3	

Test Results (D422 & D1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
#4	100.0		
#10	100.0		
#20	99.7		
#40	99.0		
#60	98.5		
#100	97.6		
#200	10.3		

* (no specification provided)

Material Description

Gray Fine SAND with Silt

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)= A-3

Coefficients

D₉₀= 0.1341 D₈₅= 0.1270 D₆₀= 0.1032
 D₅₀= 0.0963 D₃₀= 0.0847 D₁₅= 0.0772
 D₁₀= C_u= C_c=

Remarks

Date Received: 12/19/2015 **Date Tested:** 1/22/2016
Tested By: JPW
Checked By: GKT
Title: Lab Manager

Location: B3-13

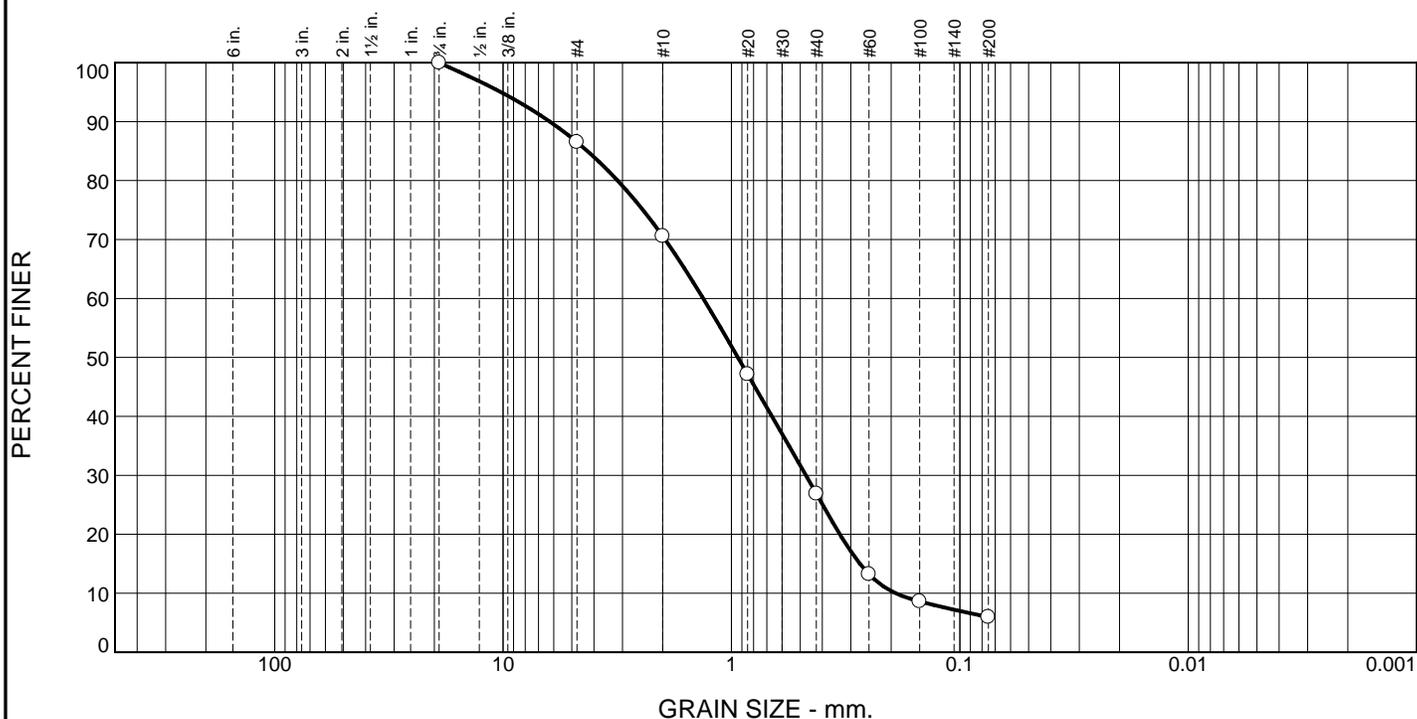
Date Sampled: 12/19/2015



Client: McGee Partners, Inc.
Project: Benton Boulevard Extension
Project No: ES155153

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	13.5	15.9	43.7	20.9	6.0	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
#4	86.5		
#10	70.6		
#20	47.2		
#40	26.9		
#60	13.2		
#100	8.6		
#200	6.0		

* (no specification provided)

Material Description

Gray Fine SAND with Silt

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)= A-1-b

Coefficients

D₉₀= 6.2397 D₈₅= 4.2722 D₆₀= 1.3296
 D₅₀= 0.9372 D₃₀= 0.4724 D₁₅= 0.2738
 D₁₀= 0.1913 C_u= 6.95 C_c= 0.88

Remarks

Date Received: 2/2/2016 Date Tested: 2/10/2016
 Tested By: JPW
 Checked By: GKT
 Title: Lab Manager

Location: B6-5

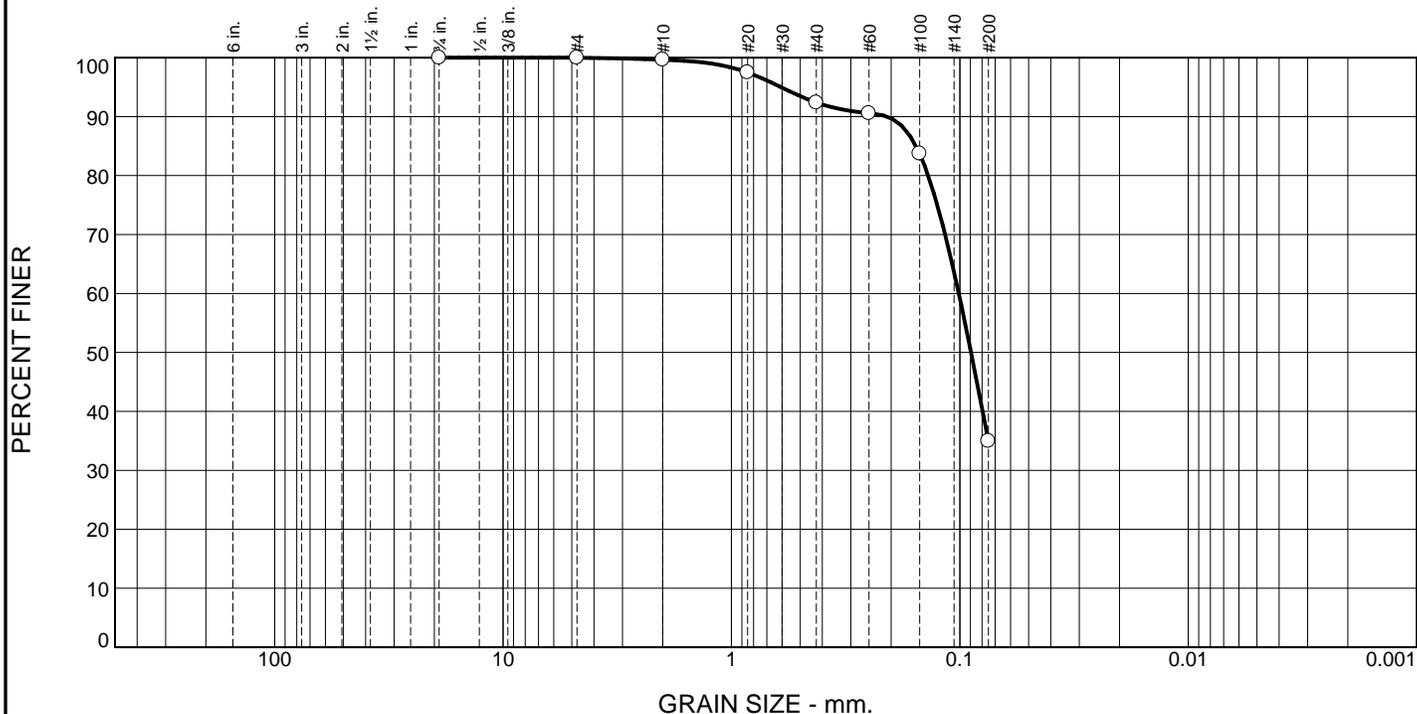
Date Sampled: 1/22/2016



Client: McGee Partners, Inc.
Project: Benton Boulevard Extension
Project No: ES155153

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.4	7.2	57.4	35.0	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
#4	100.0		
#10	99.6		
#20	97.5		
#40	92.4		
#60	90.6		
#100	83.7		
#200	35.0		

* (no specification provided)

Material Description

Gray/Olive Green Silty SAND

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-2-4(0)

Coefficients

D₉₀= 0.2081 D₈₅= 0.1556 D₆₀= 0.1011
D₅₀= 0.0894 D₃₀= D₁₅=
D₁₀= C_u= C_c=

Remarks

Date Received: 2/2/2016 Date Tested: 2/10/2016

Tested By: JPW

Checked By: GKT

Title: Lab Manager

Location: B6-11

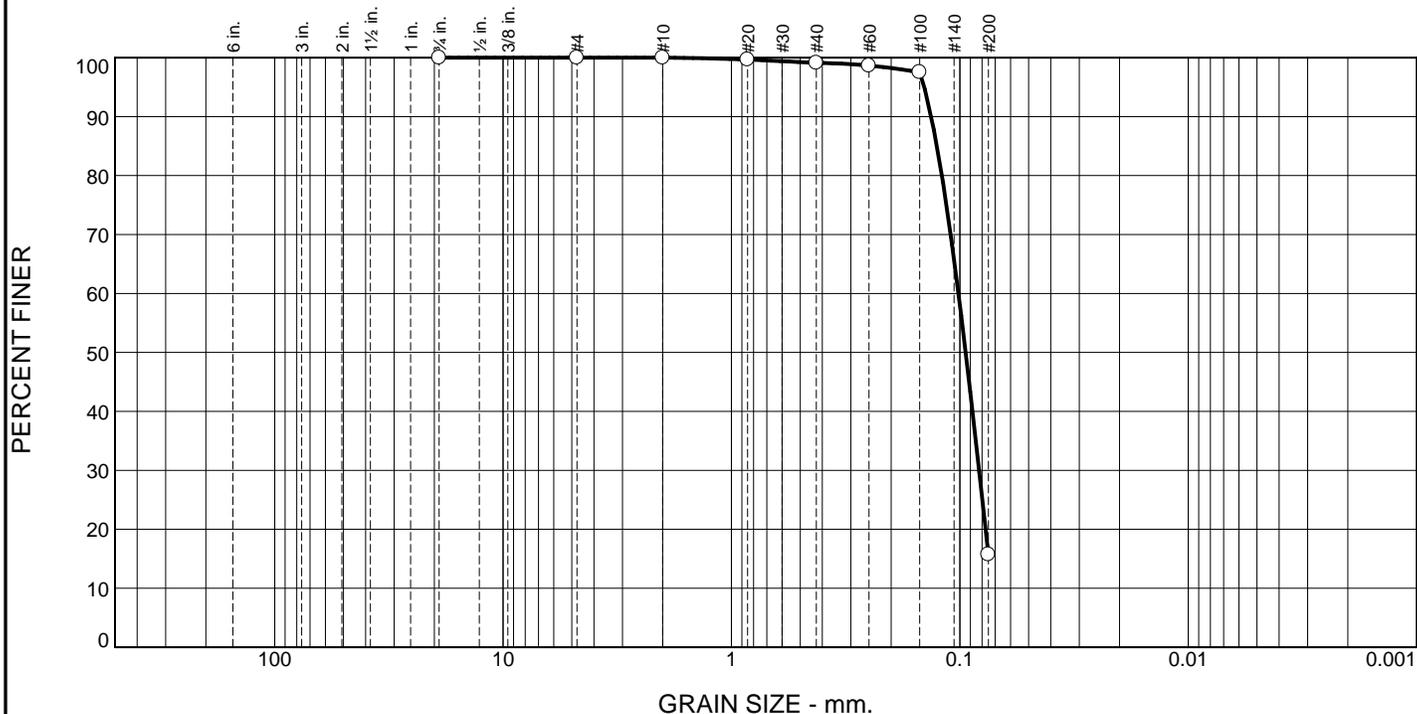
Date Sampled: 1/22/2016



Client: McGee Partners, Inc.
Project: Benton Boulevard Extension
Project No: ES155153

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.9	83.4	15.7	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
#4	100.0		
#10	100.0		
#20	99.7		
#40	99.1		
#60	98.7		
#100	97.5		
#200	15.7		

Material Description

Dark Gray Fine Silty SAND

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-2-4(0)

Coefficients

D₉₀= 0.1334 D₈₅= 0.1260 D₆₀= 0.1015
D₅₀= 0.0943 D₃₀= 0.0824 D₁₅=
D₁₀= C_u= C_c=

Remarks

Date Received: 2/2/2016 Date Tested: 2/10/2016

Tested By: JPW

Checked By: GKT

Title: Lab Manager

* (no specification provided)

Location: B6-16

Date Sampled: 1/22/2016



Client: McGee Partners, Inc.
Project: Benton Boulevard Extension
Project No: ES155153

Figure

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING			GROUNDWATER		Groundwater Initially Encountered	FIELD TESTS	(HP) Hand Penetrometer	
	Auger	Split Spoon			Groundwater Level After a Specified Period of Time		(T) Torvane	
					Static Groundwater Level After a Specified Period of Time		(b/f) Standard Penetration Test (blows per foot)	
	Shelby Tube	Macro Core			No Groundwater Observed		(PID) Photo-Ionization Detector	
				Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.			(OVA) Organic Vapor Analyzer	
	No Recovery	Rock Core						
	Ring Sampler							

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS	RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.		CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
	Descriptive Term (Density)	Std. Penetration Resistance (blows per foot)	Descriptive Term (Consistency)	Undrained Shear Strength (kips per square foot)	Std. Penetration Resistance (blows per foot)
	Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
	Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
	Medium Dense	10 - 29	Medium-Stiff	0.50 to 1.00	5 - 7
	Dense	30 - 50	Stiff	1.00 to 2.00	8 - 14
	Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	above 4.00	> 30	

RELATIVE PROPORTIONS OF SAND AND GRAVEL

<u>Descriptive Term(s) of other constituents</u>	<u>Percent of Dry Weight</u>
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

<u>Descriptive Term(s) of other constituents</u>	<u>Percent of Dry Weight</u>
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

<u>Descriptive Term(s) of other constituents</u>	<u>Percent of Dry Weight</u>
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

<u>Term</u>	<u>Plasticity Index</u>
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests^A

				Soil Classification	
				Group Symbol	Group Name ^B
Coarse Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines ^C	$Cu \geq 4$ and $1 \leq Cc \leq 3^E$	GW	Well-graded gravel ^F
			$Cu < 4$ and/or $1 > Cc > 3^E$	GP	Poorly graded gravel ^F
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines ^D	$Cu \geq 6$ and $1 \leq Cc \leq 3^E$	SW	Well-graded sand ^I
			$Cu < 6$ and/or $1 > Cc > 3^E$	SP	Poorly graded sand ^I
	Sands with Fines More than 12% fines ^D	Fines classify as ML or MH	GM	Silty gravel ^{F,G,H}	
		Fines classify as CL or CH	GC	Clayey gravel ^{F,G,H}	
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	$PI > 7$ and plots on or above "A" line ^J	CL	Lean clay ^{K,L,M}
			$PI < 4$ or plots below "A" line ^J	ML	Silt ^{K,L,M}
	Silts and Clays Liquid limit 50 or more	inorganic	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OL	Organic clay ^{K,L,M,N} Organic silt ^{K,L,M,O}
		organic	PI plots on or above "A" line	CH	Fat clay ^{K,L,M}
		organic	PI plots below "A" line	MH	Elastic Silt ^{K,L,M}
		organic	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OH	Organic clay ^{K,L,M,P} Organic silt ^{K,L,M,O}
Highly organic soils	Primarily organic matter, dark in color, and organic odor			PT	Peat

^ABased on the material passing the 3-in. (75-mm) sieve

^BIf field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^CGravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

^DSands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

$$^E Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

^FIf soil contains $\geq 15\%$ sand, add "with sand" to group name.

^GIf fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^HIf fines are organic, add "with organic fines" to group name.

^IIf soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

^JIf Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^KIf soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

^LIf soil contains $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" to group name.

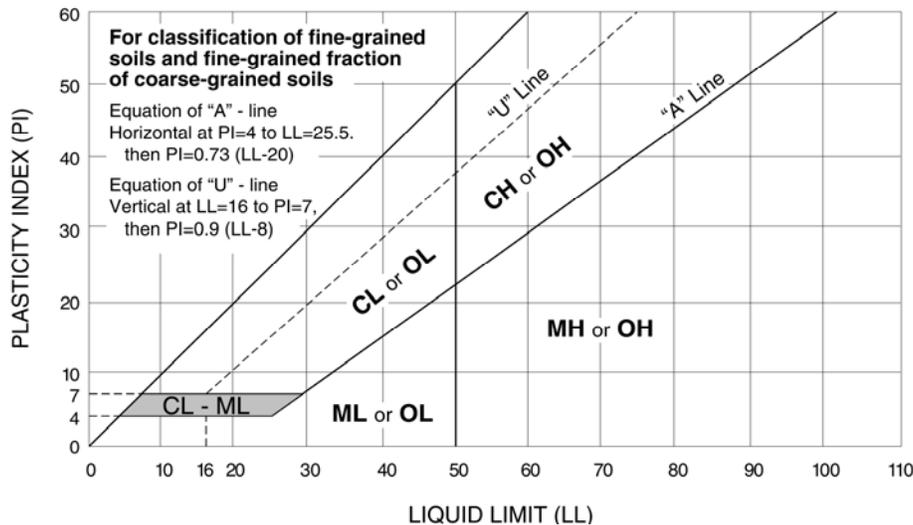
^MIf soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

^N $PI \geq 4$ and plots on or above "A" line.

^O $PI < 4$ or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.



Terracon

Exhibit B-3

**DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA**

SPECIAL PROVISION

**PROJECT NO. STP-007-00(259), Chatham County
P.I. NO. 0007259**

SECTION 520—PILING

Add the following to Subsection 520.3.05.G:

At the Contractor's option, predrilling may be used to loosen dense soil layers to assist in the installation of piling in lieu of spudding or jetting. To predrill, drill an auger into the ground to the required elevation at the pile location. It is not necessary to remove all material or to provide casing. Use one of the following maximum auger diameters corresponding to the pile size:

<u>PSC Pile Size</u>	<u>Maximum Pre-drill Auger Size</u>
14" (350 mm)	12" (300 mm)
16" (400 mm)	18" (450 mm)
18" (450 mm)	18" (450 mm)
20" (500 mm)	24" (600 mm)
24" (600 mm)	24" (600 mm)
30" (750 mm)	30" (750 mm)
36" (900 mm)	36" (900 mm)

There will not be any separate payment made for predrilling.

Office of Materials and Research