ARIAS & ASSOCIATES
Geotechnical • Environmental • Testing

September 30, 2013
Arias Job No. 2011-605

Via Email: Jonathan.Vorheis@CH2M.com

Mr. Jonathan Vorheis, P.E.
CH2M HILL
9311 San Pedro, Suite 800
San Antonio, Texas 78216

RE: Summary of Geotechnical Results
SAWS C-13 Sanitary Sewer Project – Additional Bores
San Antonio, Texas

Dear Mr. Vorheis:

We are pleased to provide the field results for the above referenced project in this letter. The scope of service for this study was requested and authorized by you.

SCOPE OF SERVICES

Our scope of services consisted of: (1) field logging of the borings to determine soil and groundwater conditions, and to determine whether foundation slabs extend beyond existing manholes; and (2) developing soil boring logs summarizing the field data. Boring locations and depths were determined by CH2M HILL.

SOIL BORINGS

The site location is depicted on the Vicinity Map, Figure 1 in Appendix A. Photographs taken at some of the soil boring locations are also included in Appendix A.

Three (3) soil borings were drilled along North Alamo Street on August 29, 2013. The approximate locations of the borings are shown on the Boring Location Plan included as Figure 2 of Appendix A. Boring logs and a key to terms and symbols are presented in Appendix B and C, respectively.

As requested by CH2M HILL, laboratory testing was not conducted on the samples collected.

The field exploration for this project was performed in general accordance with the applicable ASTM specifications, as described in Appendix D. Details of the field exploration can be provided upon request.

FIELD OBSERVATIONS

The initial borehole for Boring B-101 was drilled at 63½ inches west of the manhole center, as shown on the plans provided by CH2M HILL. During the drilling operations, an obstruction was encountered at about 13.5 feet (i.e. possible concrete) and the hole was abandoned and moved

to a second location at 79 inches west of manhole center. No obstructions were encountered during the drilling of Boring B-101 at the second location. Thus, the Log of Boring B-101 represents a composite of the subsurface conditions encountered in the two borings drilled about 15½ inches apart.

The initial borehole for Boring B-102 was drilled at 68½ inches west of the manhole center, and was drilled to about 36 feet without encountering an obstruction such as concrete. Another borehole was located 60 inches west of the manhole center (i.e. 8½ inches away from the initial B-102) and was drilled to about 28 feet without encountering an obstruction, such as concrete, as noted on the Log of Boring B-102.

Boring B-103 was drilled at 46½ inches west of center of manhole. No obstructions, such as concrete, were encountered during the drilling operations of this borehole.

VARIATIONS

Subsurface conditions may vary between boring locations. Transition boundaries, contacts, and/or groundwater levels noted on the boring logs to separate material types are approximate. Actual contacts may be gradual and vary at different locations. If conditions encountered during construction indicate more variation than established as a result of this study, we should be contacted to evaluate the significance of the changed conditions.

GENERAL COMMENTS

This report was prepared for the above referenced project exclusively for the use of CH2M HILL and the project design team. This report has been prepared in accordance with generally accepted geotechnical engineering practice with a degree of care and skill ordinarily exercised by reputable geotechnical engineers practicing in this area.

CLOSING

It has been a pleasure to provide you this service. Please feel free to call should you have any questions.

Sincerely,
Arias & Associates, Inc.
TBPE Registration No: F-32

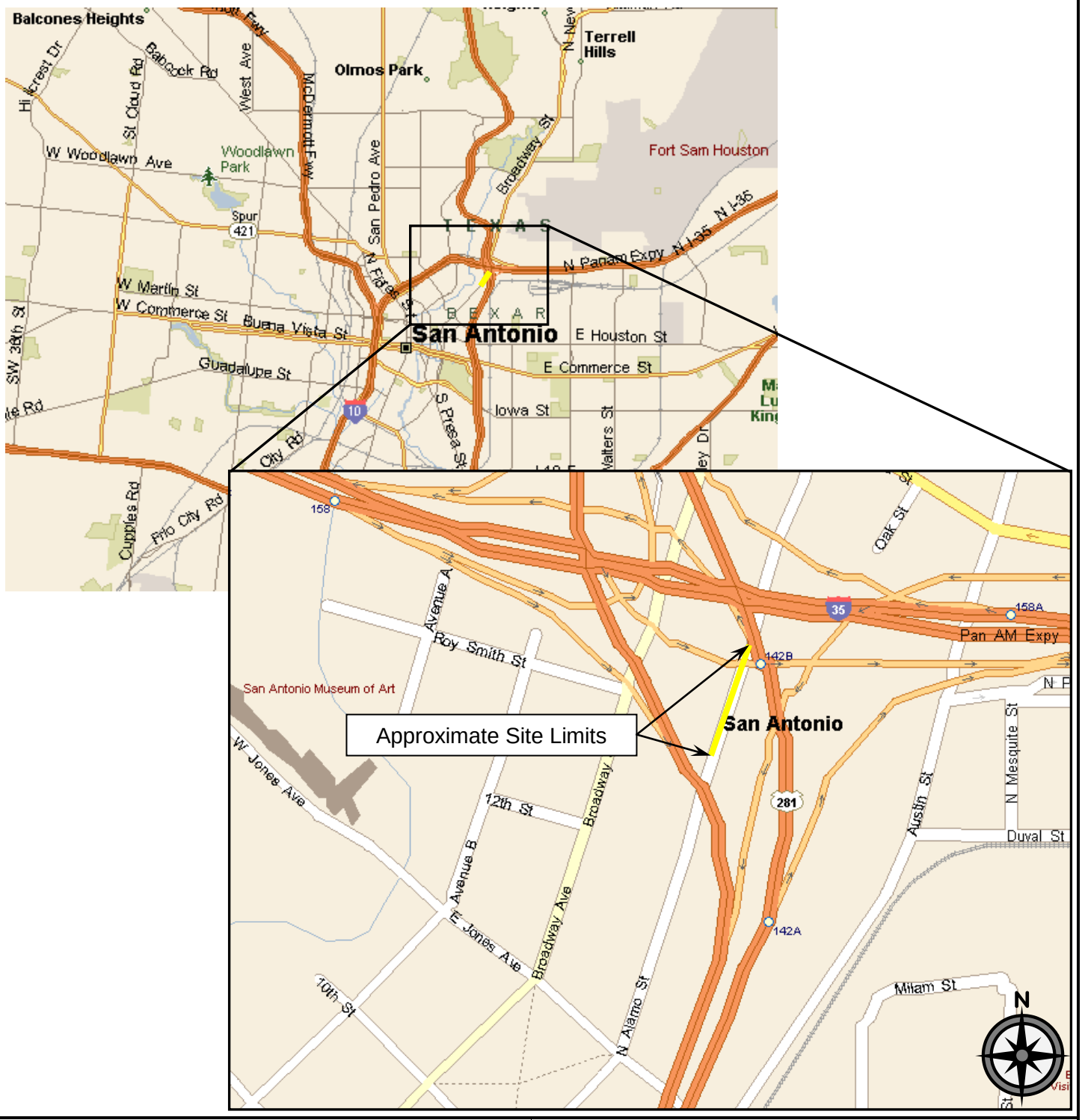
Priya P. Lad, E.I.T.
Graduate Engineer

Timothy J. Fox, P.E.
Senior Geotechnical Engineer

List of Appendices:

APPENDIX A: Figures and Site Photographs
APPENDIX B: Boring Logs
APPENDIX C: Key to Terms
APPENDIX D: Field Exploration

APPENDIX A: FIGURES AND SITE PHOTOGRAPHS



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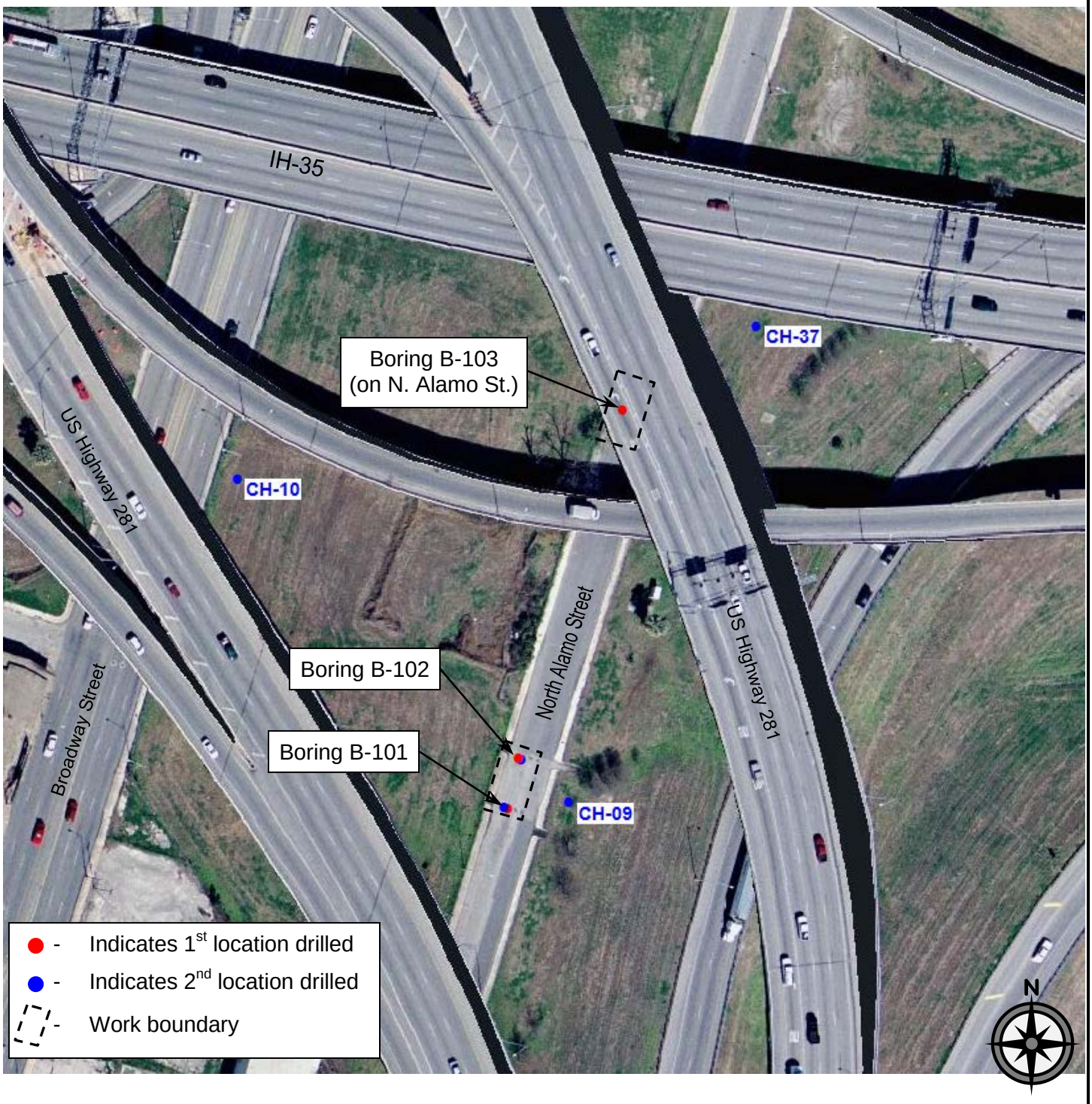
VICINITY MAP

Manhole Investigation
SAWS C-13 Project
San Antonio, Bexar County, Texas

Date: October 1, 2013	Job No.: 2011-605
Drawn By: PPL	Checked By: TJF
Approved By: SAH	Scale: N.T.S.

Figure 1



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BORING LOCATION PLAN

Manhole Investigation
SAWS C-13 Project
San Antonio, Bexar County, Texas

Date: October 1, 2013	Job No.: 2011-605
Drawn By: TAS	Checked By: TJF
Approved By: SAH	Scale: N.T.S.

Figure 2

Photo 1 – View looking northeast to the proposed locations of Boring B-101 and B-102.

Photo 2 – View looking northeast to the proposed location of Boring B-103.

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SITE PHOTOS

Manhole Investigation
SAWS C-13 Project
San Antonio, Bexar County, Texas

Date: September 19, 2013	Job No.: 2011-605
Drawn By: PPL	Checked By: TJF
Approved By: SAH	Scale: N.T.S.

Appendix A

Photo 3 – View looking southwest at the drilling operations of Boring B-102.

Photo 4 – View looking southwest at the drilling operations of Boring B-103.

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SITE PHOTOS

Manhole Investigation
SAWS C-13 Project
San Antonio, Bexar County, Texas

Date: September 19, 2013	Job No.: 2011-605
Drawn By: PPL	Checked By: TJF
Approved By: SAH	Scale: N.T.S.

Appendix A

APPENDIX B: BORING LOGS

Boring Log No. B-101

Project: **SAWS C-13 Sewer Project**
San Antonio, Texas

Sampling Date: 8/29/13

Location: See Boring Location Plan

Backfill: Grout and patched

Soil Description	Depth (ft)		SN	PP	N
1" of Asphalt					
12" of Concrete					
FILL: SANDY GRAVEL (GM)			SS		6
GRAVELLY FAT CLAY (CH), firm, dark gray brown, (possible fill)	5				
- very stiff to hard below 6 ft.			T	6.0	
	10				
GRAVELLY FAT CLAY (CH), very hard, gray brown, with calcareous nodules (possible fill)			SS		68
GRAVELLY FAT CLAY (CH), very hard, gray brown, with calcareous nodules	15				
			SS		72
GRAVELLY FAT CLAY (CH), very stiff, light gray brown	20				
			SS		25
FAT CLAY (CH), very stiff to hard, tan			SS		25
	25		T	7.5	
			T	6.0	
			T	6.5	
	30				
			T	6.0	
			T	7.5	
	35		T	9.0	

Borehole terminated at 36 feet

Note: Drilled 1st hole 63.5 inches west from center of manhole. Encountered obstruction at 13.5 feet (i.e. possible concrete) and abandoned hole. Moved 2nd hole to 79 inches west of center of manhole. This is a composite boring log; soils encountered to 13.5 feet are from the 1st hole and soils encountered below 13.5 feet to the termination depth are from the 2nd hole.

Groundwater Data:
During drilling: Not encountered

Field Drilling Data:
Logged By: J. Kniffen
Driller: Austin Geo-Logic
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 36 ft

Nomenclature Used on Boring Log

Split Spoon (SS)

Thin-walled tube (T)

PP = Pocket Penetrometer (tsf)
N = SPT Blow Count

2011-605.GPJ 9/19/13 (BORING LOG SA12-01.ARIASSA12-01.GDT.LIBRARY2012.GLB)

Arias & Associates, Inc.

Job No.: 2011-605

Boring Log No. B-102

Project: **SAWS C-13 Sewer Project**
San Antonio, Texas

Sampling Date: 8/29/13

Location: See Boring Location Plan

Backfill: Grout and patched

Soil Description	Depth (ft)		SN	PP	N
1" of Asphalt 8" of Concrete					
FILL: FAT CLAY (CH), very soft, tan			SS		1
	5				
FILL: GRAVELLY FAT CLAY (CH), stiff, gray brown			SS		12
FILL: GRAVELLY FAT CLAY (CH), very stiff, light gray brown	10				
			SS		20
FILL: SANDY GRAVEL (GM), loose, light gray brown	15				
			SS		6
FILL: Fine SAND (SP), very loose, light gray brown, wet	20				
			SS		2
FAT CLAY (CH), very stiff, tan	25		SS		22
- hard below 30 ft.	30		T	6.0	
FAT CLAY (CH), hard, dark gray	35		T	11.25	

Borehole terminated at 36 feet

Note: Drilled hole 68.5 inches west of center of manhole. Moved to 60 inches west of manhole and drilled hole to about 28 feet without encountering an obstruction such as concrete.

Groundwater Data:
During drilling: Not encountered

Field Drilling Data:
Logged By: J. Kniffen
Driller: Austin Geo-Logic
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 36 ft

Nomenclature Used on Boring Log

Split Spoon (SS) Thin-walled tube (T)

PP = Pocket Penetrometer (tsf)
N = SPT Blow Count

2011-605.GPJ 9/19/13 (BORING LOG SA12-01.ARIASSA12-01.GDT.LIBRARY2012.GLB)

Arias & Associates, Inc.

Job No.: 2011-605

Boring Log No. B-103

Project: **SAWS C-13 Sewer Project**
San Antonio, Texas

Sampling Date: 8/29/13

Location: See Boring Location Plan

Backfill: Grout and patched

Soil Description	Depth (ft)		SN	PP	N
1" of Asphalt					
9" of Concrete					
FILL: SANDY FAT CLAY with Gravel (CH), soft to firm, gray brown			SS		3
	5		T	1.0	
	10		SS		4
	15		SS		3
FILL: Fine SAND (SP), very loose, light gray brown	20				
FAT CLAY (CH), hard, tan	25				
	30				
	35		T	8.0	

Borehole terminated at 35 feet

Note: Drilled hole 46.5 inches west of center of manhole.

Groundwater Data:
During drilling: Not encountered

Field Drilling Data:
Logged By: J. Kniffen
Driller: Austin Geo-Logic
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 35 ft

Nomenclature Used on Boring Log

Split Spoon (SS) Thin-walled tube (T)

PP = Pocket Penetrometer (tsf)
N = SPT Blow Count

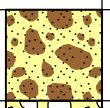
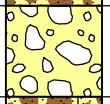
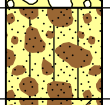
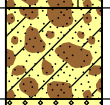
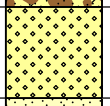
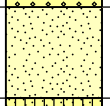
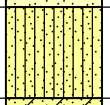
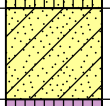
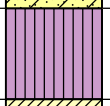
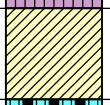
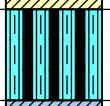
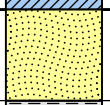
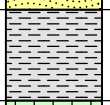
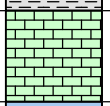
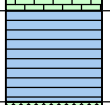
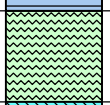
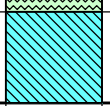
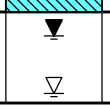
2011-605.GPJ 9/19/13 (BORING LOG SA12-01.ARIASSA12-01.GDT.LIBRARY2012.GLB)

Arias & Associates, Inc.

Job No.: 2011-605

APPENDIX C: KEY TO TERMS

KEY TO CLASSIFICATION SYMBOLS USED ON BORING LOGS

MAJOR DIVISIONS			GROUP SYMBOLS		DESCRIPTIONS
COARSE-GRAINED SOILS More Than Half of Material LARGER Than No. 200 Sieve size	GRAVELS More Than Half of Coarse Fraction is LARGER Than No. 4 Sieve Size	Clean Gravels (Little or no Fines)	GW		Well-Graded Gravels, Gravel-Sand Mixtures, Little or no Fines
			GP		Poorly-Graded Gravels, Gravel-Sand Mixtures, Little or no Fines
		Gravels With Fines (Appreciable Amount of Fines)	GM		Silty Gravels, Gravel-Sand-Silt Mixtures
			GC		Clayey Gravels, Gravel-Sand-Clay Mixtures
	SANDS More Than Half of Coarse Fraction is SMALLER Than No. 4 Sieve Size	Clean Sands (Little or no Fines)	SW		Well-Graded Sands, Gravelly Sands, Little or no Fines
			SP		Poorly-Graded Sands, Gravelly Sands, Little or no Fines
		Sands With Fines (Appreciable Amount of Fines)	SM		Silty Sands, Sand-Silt Mixtures
			SC		Clayey Sands, Sand-Clay Mixtures
FINE-GRAINED SOILS More Than Half of Material is SMALLER Than No. 200 Sieve Size	SILTS & CLAYS	Liquid Limit Less Than 50	ML		Inorganic Silts & Very Fine Sands, Rock Flour, Silty or Clayey Fine Sands or Clayey Silts with Slight Plasticity
			CL		Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays
	SILTS & CLAYS	Liquid Limit Greater Than 50	MH		Inorganic Silts, Micaceous or Diatomaceous Fine Sand or Silty Soils, Elastic Silts
			CH		Inorganic Clays of High Plasticity, Fat Clays
FORMATIONAL MATERIALS	SANDSTONE				Massive Sandstones, Sandstones with Gravel Clasts
	MARLSTONE				Indurated Argillaceous Limestones
	LIMESTONE				Massive or Weakly Bedded Limestones
	CLAYSTONE				Mudstone or Massive Claystones
	CHALK				Massive or Poorly Bedded Chalk Deposits
	MARINE CLAYS				Cretaceous Clay Deposits
	GROUNDWATER				Indicates Final Observed Groundwater Level Indicates Initial Observed Groundwater Location

Arias & Associates, Inc.

APPENDIX D: FIELD EXPLORATION

FIELD EXPLORATION

The field exploration program included drilling at selected locations within the site and intermittently sampling the encountered materials. The boreholes were drilled using either single flight auger (ASTM D 1452) or hollow-stem auger (ASTM D 6151). Samples of encountered materials were obtained using a split-barrel sampler while performing the Standard Penetration Test (ASTM D 1586), using a thin-walled tube sampler (ASTM D 1587), or by taking material from the auger as it was advanced (ASTM D 1452). The sample depth interval and type of sampler used is included on the soil boring log. Arias' field representative visually logged each recovered sample and placed a portion of the recovered sampled into a plastic bag for transport to our laboratory.

SPT N values and blow counts for those intervals where the sampler could not be advanced for the required 18-inch penetration are shown on the soil boring log. If the test was terminated during the 6-inch seating interval or after 10 hammer blows were applied used and no advancement of the sampler was noted, the log denotes this condition as blow count during seating penetration. Penetrometer readings recorded for thin-walled tube samples that remained intact also are shown on the soil boring log.