CITY OF HOUSTON
DEPARTMENT OF
PUBLIC WORKS AND ENGINEERING
ENGINEERING AND CONSTRUCTION DIVISION

GEOTECHNICAL STUDY
PROPOSED PUMP AND LIFT STATION RENEWAL/REHABILITATION
POST OAK LANE, STABLEWOOD, BAYOU TIMBER AND BUCKINGHAM

WBS NO. R-000267-0109-3
CITY OF HOUSTON, TEXAS

PROJECT NO. 12-344E

TO

ARCADIS U.S., INC.
HOUSTON, TEXAS

BY

GEOTECH ENGINEERING AND TESTING

SERVICING

TEXAS, LOUISIANA, NEW MEXICO, OKLAHOMA

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Project No.: 12-344E
Report No: 1
Project Type: 24/33/35
June 16, 2014

Attention: Mr. Edward Quiroz, P.E.
Senior Project Manager

GEOTECHNICAL STUDY
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Gentlemen:

Submitted here is Geotech Engineering and Testing (GET) geotechnical study on the study of subsurface conditions for the above referenced project. This study was conducted in general accordance with our Proposal No. P12-132, Revision III, dated October 01, 2012. Authorization to proceed for this study was received through a Subcontract for Consulting Services between Arcadis U.S., Inc. and GET and signed by Mr. Edward Quiroz, P.E., CPM, Senior Project Manager on October 11, 2012.

This report presents the results of our field exploration and laboratory testing together with design recommendations for the construction of the proposed lift station and sanitary sewer lines.

We appreciate the opportunity to be of service. Should you have any questions or need additional assistance, please call.

Very truly yours,

GEOTECH ENGINEERING AND TESTING
TEXAS BOARD OF PROFESSIONAL ENGINEERS
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Appendix B – Piezometer Installation and Abandoned Report

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Appendix D – OSHA Soil Classification

1.0 EXECUTIVE SUMMARY

It is planned to construct a new Woodway No. 1 Lift Station and install new sanitary sewerlines for the subject alignments in City of Houston, Texas. The new lift station will be about 60-ft below the existing grade and 14-ft in diameter. The total linear length of the sanitary sewerlines will be about 19,760 feet. The proposed construction include the following alignments:

LOCATION	ALIGNMENT	FROM	TO
Area – 1	East Friar Lane	Sandringham Drive	1000± ft South of East Friar Lane
Area – 2	Buckingham Drive	Sandringham Drive	1000± ft South of Buckingham Dr.
Area – 3	Memorial Drive	Buckingham Drive	North Post Oak Lane
Area – 4	Stable Creek Blvd.	Pinehaven Drive	Stable Lane
	Stable Lane	Stable Creek Boulevard	Stable Lane
	Stable Lane	Stable Lane	Harness Creek Lane
Area – 5	North Post Oak Lane	Stable Crest Boulevard	Woodway Drive
Area – 6	Woodway Drive	North Post Oak Lane	Sage Road
Area – 7	Sage Road	Woodway Drive	Bayou Timber Lane
	Bayou Timber Lane	Sage Road	800± ft E. of Bayou Timber Lane

We understand the depths of the flow line for the sanitary sewerlines will range from 3- to 50-ft. Furthermore, Buffalo Bayou and a drainage ditch (W137-00-00) cross Woodway Drive near Woodway No.1 Lift Station and Memorial Drive near Holy Rood Lane, respectively. The basic construction technique for the installation of sanitary sewerlines will be augering method. This construction technique will be used to cross Buffalo Bayou and the drainage ditch. In addition, the auger pits will be located outside Harris County Flood Control District easement. Therefore, slope-stability and erosion protection along Buffalo Bayou and the drainage ditch will not be conducted.

This study was conducted is general accordance with the City of Houston (COH) Department of Public Works & Engineering, Chapter 11, Geotechnical and Environmental Guidelines, Dated July 2012 (Ref. 1). This report contains a description of our field and laboratory testing results together with engineering analysis and recommendations for the construction of the proposed facilities along the project alignments.

The soil conditions were explored by conducting thirty-four (34) soil test borings (B-1 through B-34) for the proposed lift station and sanitary sewerlines. The soil borings were drilled along the project alignments to depths ranging from 15- to 105-ft below the existing grade. The soil stratigraphy for the project alignments are summarized as follows:

1. In general, the soil stratigraphy at the lift station and sanitary sewer lines indicates alternate layers of lean clay, lean clay with sand, silty sand, poorly-graded sand with silt and fat clay soils. Details of subsurface conditions along the alignments are presented in the body of the report.

2. Depth to groundwater/perched water will be important for design and construction of the proposed facilities. Water level observations were made during drilling and 24 hours after drilling. Our short-term field exploration along the alignments indicated that groundwater was encountered at depths ranging from 16- to 36-ft below the existing grade. Groundwater rose to depths ranging from 15- to 35-ft below the existing grade after 24 hours of drilling.

3. Borings B-6, B-11, B-18, B-19, B-24 and B-30 were converted to piezometer PZ-1, PZ-2, PZ-3, PZ-4, PZ-5 and PZ-6, respectively, after completion of the borings. The results of piezometer observations indicated that stabilized groundwater level encountered at depths of about 25.5 and 23-ft below the existing ground surface in piezometers PZ-2 and PZ-6, respectively. No stabilized groundwater was encountered in piezometers PZ-1, PZ-3, PZ-4 and PZ-5.

4. We understand that it is planned to construct a new Woodway No.1 Lift Station. The new lift station will be about 60-ft below the existing grade and 14-ft in diameter. We understand the new lift station will be consist of a sunken concrete cassions.

5. We understand that new sanitary sewerlines are planned along the proposed project alignments. The depths of the flow line for the sanitary sewerlines will range from 3- to 50-ft below the existing grade. The basic method of installation of sanitary sewerlines will be augering technique. The bedding and backfill recommendations for the construction of the proposed sanitary sewerlines are presented in this report.

2.0 INTRODUCTION

It is planned to construct Woodway No.1 Lift Station and install new sanitary sewerlines in City of Houston, Texas. A site vicinity map of the proposed project alignments are presented on Plate 1. The new lift station will be about 60-ft below the existing grade and 14-ft in diameter. The total linear length of the sanitary sewerlines will be about 19,760 feet. The proposed installations include the following alignments:

LOCATION	ALIGNMENT	BORING NO.	FROM	TO
Area – 1	East Friar Lane	B-1 through B-3	Sandringham Drive	1000± ft South of East Friar Lane
Area – 2	Buckingham Drive	B-4 through B-6	Sandringham Drive	1000± ft South of Buckingham Dr.
Area – 3	Memorial Drive	B-7 through B-14	Buckingham Drive	North Post Oak Lane
Area – 4	Stable Creek Blvd.	–	Pinehaven Drive	Stable Lane
	Stable Lane	B-15 and B-16	Stable Creek Boulevard	Stable Lane
	Stable Lane	B-17 and B-18	Stable Lane	Harness Creek Lane
Area – 5	North Post Oak Lane	B-19 through B-23	Stable Crest Boulevard	Woodway Drive
Area – 6	Woodway Drive	B-24 through B-30	North Post Oak Lane	Sage Road
Area – 7	Sage Road	B-31 and B-32	Woodway Drive	Bayou Timber Lane
	Bayou Timber Lane	B-33 and 34	Sage Road	800± ft E. of Bayou Timber Lane

We understand the depths of the flow line for the sanitary sewerlines will range from 3- to 50-ft. Furthermore, Buffalo Bayou and a drainage ditch (W137-00-00) cross Woodway Drive near Woodway #1 Lift Station and Memorial Drive near Holy Rood Lane, respectively. The basic construction technique for the installation of sanitary sewerlines will be augering method. This construction technique will be used to cross Buffalo Bayou and the drainage ditch. In addition, the auger pits will be located outside Harris County Flood Control District easement. Therefore, slope-stability and erosion protection along Buffalo Bayou and the drainage ditch will not be conducted.

This study was conducted is general accordance with the City of Houston (COH) Department of Public Works & Engineering, Chapter 11, Geotechnical and Environmental Guidelines, Dated July 2012 (Ref. 1). This report contains a description of our field and laboratory testing results together with engineering analysis and recommendations for the construction of the proposed facilities along the project alignments.

3.0 FIELD EXPLORATION

3.1 Pavement Coring

The existing pavement was cored prior to drilling and sampling. The results of pavement coring show that the existing pavement generally consist of an asphalt overlay underlain by concrete pavement. The existing pavement thicknesses are presented on Plate 2 and on the respective boring logs. The pavement core locations were patched with ready mix grout.

3.2 Drilling and Sampling

At the request of the client, the soil conditions were explored by conducting thirty-four (34) soil test borings (B-1 through B-34) at the project alignments. The soild boring locations were discussed with Mr. Edward L. Nagorski, P.E., Civil Engineer with Arcadis U.S., Inc. prior to drilling. A summary of the borings coordinates, elevations and station number information are presented on Plate 3.

The borings were drilled along the project alignments to depths ranging from 15- to 105-ft below the existing grade. Borings for the sanitary sewerlines (B-1 through B-25 and B-27 through B-34) were drilled continuously to 20-ft and at 5-ft intervals thereafter to the completion depths of the borings. Boring B-26 (Lift Station) was drilled continuously from ground surface to the completion depth of boring at 105-ft. Due to presence of high voltage powerline along a fence, gasline, underground powerlines, storm and sanitary sewerlines and possible waterlines in the area of the existing lift station, Boring B-26 location was offset by about 100-ft to west of the existing lift station for safety reasons and to avoid damaging the above mentioned utilities. Approximate boring locations are presented in Appendix A.

The cohesive soils were sampled in general accordance with the ASTM D 1587. Cohesionless soils were generally sampled with a split-spoon sampler driven in general accordance with the Standard Penetration Test (SPT), ASTM D 1586. This test is conducted by recording the number of blows required for a 140-pound weight falling 30-inches to drive the sampler 12-inches into the soil. Driving resistance for the SPT, expressed as blows per foot of sampler resistance (N), is tabulated on the boring logs.

Soil samples were examined and classified in the field, and cohesive soil strengths were estimated using a calibrated hand penetrometer. This data, together with a classification of the soils encountered and strata limits, is presented on the soil stratigraphy profiles presented in Appendix A. The logs of borings and key to the log terms and symbols are also presented in Appendix A.

Depth to groundwater is important for design and construction of the proposed facilities. For this reason, borings were drilled dry and the depth at which groundwater was first encountered was recorded. A wet rotary technique was used thereafter to the completion depth of the borings. Water level observations made during drilling and shortly after drilling are indicated at the bottom portion of each individual boring log. The boreholes not converted to piezometers were grouted using tremie method after the completion of the field work.

3.3 Piezometer Installation

Piezometer PZ-1 was installed to a depth of about 26-ft in Boring B-6 and piezometers PZ-2 through PZ-6 were installed to a depth of about 30-ft in Borings B-11, B-18, B-19, B-24 and B-30, respectively, after completion of the field work. The piezometers consisted of two-inch diameter PVC riser pipe connected to a 10-ft long section of 0.01-inch slotted well screen. Each piezometer is capped at the top with a water tight flush mounted cap. After the borings were drilled, the riser pipe and well screen assembly were installed in the boreholes, filter sand was placed in the bottom of the boreholes and in the annulus between the borehole wall and the PVC pipe/screen, and subsequently the boreholes were sealed with bentonite from the top of the filter sand to the ground surface. The piezometers were developed by using a bailer to purge several volumes of water from the piezometer riser pipe. Water levels will be periodically measured to evaluate the stabilized groundwater table. The piezometer installation diagram is shown on Plate 4. A summary of the piezometer readings are presented in the "Piezometer Reading Table" on Plates 5 and 6. The piezometers were abandoned, in accordance with the TDLR (Chapter 76 of TAC), the City of Houston Design Manual, Item 11.14-Site Restoration. The piezometer installation and abandonment reports are provided in Appendix B.

4.0 LABORATORY TESTS

4.1 General

Soil classifications and shear strengths were further evaluated by laboratory tests on representative samples of the major strata. The laboratory tests were performed in general accordance with ASTM Standards. Specifically, ASTM D 2487 is used for classification of soils for engineering purposes. Furthermore, summary of test results are presented in Appendix A.

4.2 Classification Tests

As an aid to visual soil classifications, physical properties of the soils were evaluated by classification tests. The tests were conducted in general accordance with ASTM standards. These tests consisted of natural moisture content tests (ASTM D 4643), percent finer than the No. 200 sieve tests (ASTM D 1140) and Atterberg limit determinations (ASTM D 4318, Method A). Similarity of these properties is indicative of uniform strength and compressibility characteristics for soils of essentially the same geological origin. Results of these tests are tabulated on the boring logs at respective sample depths.

4.3 Strength Tests

Undrained shear strengths of the cohesive soils, measured in the field, were verified by calibrated hand penetrometer tests, unconfined compressive strength tests (ASTM D 2166) and torvane tests. Natural water content and dry unit weight were determined routinely for each unconfined compressive strength test. These test results are also presented on the boring logs.

4.4 Soil Sample Storage

Soil samples tested or not tested in the laboratory will be stored for a period of fourteen days subsequent to submittal of this report. The samples will be discarded after this period, unless we are instructed otherwise in writing.

5.0 SITE GEOLOGY

According to the soil survey of Harris County, Texas (prepared by the U.S. Department of Agriculture Soil and Conservation Service (1976), geologically the project areas at the proposed alignment lies on the Aldine-Urban land complex (An), Aris-Urban Land Complex (As), Atasco fine sandy loam (AtB), Lake Charles-Urban Land Complex (Lu), Verland-Urban land complex (Mu) and Nahatche loam (Na). The geologic character of each soil type is described below:

Aldine-Urban land complex (An) – This is a nearly level to gently sloping complex in metropolitan areas and in rural areas where the population is increasing. This soil unit is of minor extent. Areas are irregular in shape and generally range from 30 to 250 acres in size. The slope is mainly 0 to 2 percent but ranges to 3 percent. Native pine and hardwoods are common in most areas. The Aldine soil makes up 25 to 75 percent of this complex, Urban land 10 to 70 percent, and other soils 5 to 20 percent.

The surface layer of the Aldine soil is friable, medium acid, dark grayish brown very fine sandy loam about 5 inches thick. It tongues into a layer of friable, very strongly acid, yellowish brown loam about 9 inches thick. The next layer, about 11 inches thick, is firm, very strongly acid, gray clay that has mottles of yellowish brown and red. Below that, extending to a depth of 6 inches, is a layer of firm, slightly acid, light gray clay loam that has less mottles with depth.

Urban land consists of soils that have been altered or obscured by buildings and other urban structures, making their classifications impractical. Typical structures are single- multiple-unit dwellings, garages, sidewalks, patios, driveways, streets, schools, churches, shopping centers, office buildings, paved parking lots, and industrial parks. Included with Urban land are small areas of the Aldine soil that have been altered by cutting, filling, and grading. In places, 6 to 24 inches of fill material has been added to improve drainage.

Aris-Urban Land Complex (As) – This is nearly level complex in broad, irregular areas that are 30 to 1,000 acres in size. Slopes range from 0 to 1 percent but average about 0.3 percent. The Aris soils makes up 20 to 75 percent of the complex; Urban land 10 to 75 percent, and other soils 5 to 20 percent.

The surface layer of the Aris soil is friable, neutral, dark grayish brown fine sandy loam about 7-inch thick. The layer below that is friable, slightly acid, grayish brown fine sandy loam that extends to a depth of 21-inch. The next layer, extending to a depth of 28-inch, is firm, medium acid, gray sandy clay loam that has tongues and interfingers. The layer below that extends to a depth of 46-inch and is very firm, strongly acid, dark gray clay that has mottles of red and strong brown. The next layer is very firm, medium acid, gray clay that extends to a depth of 60-inch, where it grades to very firm, slightly acid, light gray clay loam.

Atasco fine sandy loam (AtB) – This is a gently sloping soil in oval areas along ridges and natural drainage ways. The areas average about 150 acres, but some are several hundred acres in size. The surface is plane to convex. The slope ranges from 1 to 4 percent but averages about 2.5 percent. The surface layer is friable, strongly acid, dark grayish brown fine sandy loam about 5 inches thick. The layer below that is friable, medium acid, light yellowish brown fine sandy loam about 11 inches thick. The next layer is about 3 inches thick and is friable, very strongly acid, brownish yellow sandy clay loam that has tongues of fine sandy loam. The layer below that extends to a depth of 60 inches and is firm, very strongly acid, yellowish brown clay in the upper part and firm, strongly acid, gray clay that has mottles of yellowish brown and red in the lower part.

This soil is moderately well drained. Surface runoff is medium, and permeability is very slow. The available water capacity is high. The lower part of the soil is saturated for 2 to 4 months in wet seasons. The hazard of erosion is slight to moderate.

Lake Charles-Urban Land Complex (Lu) – This is a nearly level complex in broad, irregular areas that range from 20 acres to about 1,800 acres in size. Slopes are mainly 0 to 1 percent, but range from 0 to 3 percent in some areas leading to drainage ways. Lake Charles soils make up 20 to 85 percent of this unit; Urban land, 10 to 75 percent; and other soils, 15 percent or less. The areas making up this complex are so intricately mixed that separation was not feasible at the scale used in mapping.

The surface layer of the Lake Charles soil is about 36 inches thick. In the upper 22 inches it is very firm, neutral, black clay. In the lower 14 inches it is very firm, mildly alkaline, very dark gray clay. In the layer below that it is about 16 inches thick and is very firm, mildly alkaline, dark gray clay that has intersecting slickensides. The next layer, to a depth of 74 inches, is very firm, mildly alkaline, gray clay that has mottles of olive brown and yellowish brown.

Urban land consists of soils that have been altered or covered by buildings or other urban structures. Classifying these soils is not practical. Typical structures are single- and multiple-unit dwellings, streets, schools, churches, parking lots, office buildings, and shopping centers that are less than 40 acres in size. The Urban land includes remnants of Lake Charles soils that have been altered by cutting, filling, and grading in urban development. In many areas of this mapping unit 6 to 18 inches of fill material covers the natural soil. Included with this complex in mapping are small areas of Beaumont, Bernard, Midland, and Vamont soils. This mapping unit has severe limitations for urban development. The main limitation is the high shrink-swell potential of the clay, which results in buckled streets and sidewalks and cracked walls. Lawns and gardens are difficult to establish because of the high clay content of the soils.

Verland-Urban land complex (Mu) – The soils in this mapping unit are nearly level and are in broad, irregular areas that range in size from about 30 to 600 acres. Slopes range from 0 to 1 percent, but the average is 0.5 percent. Most areas are open prairie, but some are covered with native harwood tress.

These soils make up 20 to 75 percent of this complex, Urban land, 10 to75 percent, and other soils, 15 percent or less. The surface layer is firm, strongly acid dark grayish brown silty clay loam about 7 inches thick. The next layer, extending to a depth of 50 inches, is very firm, dark gray clay that is slightly acid in the upper part and neutral in the lower part. It has slickensides in the upper part. The next layer, to a depth of 72 inches, consists of very firm, moderately alkaline clay that us mottled gray, olive yellow, and brownish yellow.

Included in mapping are small areas of Bernard, Lake Charles, Beaumont, Ozan, and Gessner soils. This mapping unit has severe limitations for urban development. Poor drainage and shrinking and swelling in the underlying layers are the main limitations.

Nahatche loam (Na) – This is a nearly level soil on the flood plains of major streams and tributaries. Mapped areas are oblong and have smooth boundaries. They average about 60 acres, but some areas are 400 acres in size. Slopes range from 0 to 2 percent along some old stream channels but range mainly from 0 to 1 percent, and the average slope is 0.6 percent. A few areas are dissected by old channel scars.

The surface layer is friable, medium acid, dark grayish brown loam about 5 inches thick. The layer below that is friable, medium acid, grayish brown loam over firm, moderately alkaline, gray clay loam that has mottles of light gray and brownish yellow. This soil is somewhat poorlydrained. Surface runoff is slow. Permeability is moderate. The available water capacity is medium.

6.0 GENERAL SOILS AND DESIGN CONDITIONS

6.1 Site Conditions

The project alignments generally consist of either concrete and asphalt paved roadways. In general residences, commercial and educational facilities exist in the vicinity of the project alignments. Project site pictures were taken during our site visit and drilling operations. These pictures are presented in Appendix C.

6.2 General Soil Stratigraphy

Field and laboratory test data indicate that soil stratigraphy along the project alignments are variable. **Details of subsoil conditions at each boring location are presented on the respective boring logs, provided in Appendix A**. General soil stratigraphy for the proposed project alignments are presented in the following report sections:

6.2.1 East Friar Lane and Sandrigham Drive (Borings B-1 through B-3)

Based on Borings B-1 through B-3, the soils can be grouped into six (6) major strata with depth limits and characteristics as follows:

Stratum No.	Range of Depth, ft.	Soil Description*
		EXISTING ASPHALT PAVEMENT (1.0” to 1.2” in Thickness); In Borings B-1 and B-2 only
		EXISTING CONCRETE PAVEMENT (4.7” to 5.5” in Thickness)
I	0.5 – 2	FILL: LEAN CLAY, firm to very stiff, light brown, with root fibers, with ferrous nodules (CL)
II	0.5 – 2	FILL: SILTY SAND, light brown, with root fibers (SM); In Boring B-3 only
III	2 – 14	LEAN CLAY, firm to hard, light brown, with root fibers to 4’, ferrous and calcareous nodules (CL)
IV	2 – 16	LEAN CLAY WITH SAND, very stiff to hard, light brown, with root fibers to 4’, ferrous and calcareous nodules (CL); In Boring B-3 only
V	14 – 23	SILTY SAND, medium dense to dense, light brown (SM); In Boring B-1
VI	14 – 23	POORLY GRADED SAND WITH SILT, medium dense to dense, light brown (SP-SM)

6.2.2 Buckingham Drive (Borings B-4 through B-6)

Based on Borings B-4 through B-6, the soils can be grouped into five (5) major strata with depth limits and characteristics as follows:

Stratum No.	Range of Depth, ft.	Soil Description*
		EXISTING ASPHALT PAVEMENT (1” to 1.4” in Thickness)
		EXISTING CONCRETE PAVEMENT (4.5” to 6.6” in Thickness)
I	0.6 – 2	FILL: SILTY SAND, light brown, with root fibers (SM); In Boring B-4 only
II	0.6 – 2	FILL: SANDY SILT, light brown, with root fibers (ML)
III	2 – 14	LEAN CLAY WITH SAND, very stiff to hard, light brown, brown, reddish brown, with root fibers to 4’, ferrous and calcareous nodules (CL)
IV	14 – 26	POORLY GRADED SAND WITH SILT, medium dense to very dense, light brown (SP-SM)
V	14 – 26	SILTY SAND, medium dense to dense, light brown (SM); In Boring B-5 only

6.2.3 Memorial Drive (Borings B-7 through B-14)

Based on Borings B-7 through B-14, the soils can be grouped into six (6) major strata with depth limits and characteristics as follows:

Stratum No.	Range of Depth, ft.	Soil Description*
		EXISTING CONCRETE PAVEMENT (7" to 10.2" in Thickness)
I	0.9 – 2	FILL: LEAN CLAY WITH SAND, soft to hard, brown, light brown, gray, reddish brown, dark brown, dark gray, with root fibers, ferrous nodules (CL)
II	0.8 – 2	FILL: FAT CLAY, very stiff, light brown, with root fibers, ferrous and calcareous nodules (CH); In Boring B-12 only
III	2 – 16	LEAN CLAY WITH SAND, stiff to hard, light brown, brown, gray, reddish brown, dark gray, with root fibers to 4', ferrous and calcareous nodules (CL)
IV	2 – 16	FAT CLAY, very stiff to hard, light brown, with root fibers to 4', ferrous and calcareous nodules (CH); In Boring B-12 only
V	12 – 36	SILTY SAND, medium dense to very dense, light brown, gray (SM); In Borings B-7 through B-9 and B-12 only
VI	10 – 38	POORLY GRADED SAND WITH SILT, medium dense to very dense, light brown, brown, gray reddish brown (SP-SM); In Borings B-10, B-11, B-12 and B-14 only

6.2.4 Stable Crest Blvd. and Stable Lane (Borings B-15 through B-18)

Based on Borings B-15 through B-18, the soils can be grouped into seven (7) major strata with depth limits and characteristics as follows:

Stratum No.	Range of Depth, ft.	Soil Description*
		EXISTING CONCRETE PAVEMENT (6.0" to 6.3" in Thickness)
I	0.5 – 2	FILL: FAT CLAY, stiff, gray, with root fibers, ferrous and calcareous nodules (CH); In Boring B-15 only
II	0.5 – 2	FILL: LEAN CLAY, stiff to very stiff, light brown, light gray, with root fibers, ferrous nodules sand (CL)
III	2 – 14	FAT CLAY, stiff to very stiff, light gray, gray, reddish brown, with root fibers to 4', ferrous and calcareous nodules (CH); In Boring B-15 only
IV	2 – 6	SILTY SAND, loose to medium dense, light brown, with root fibers to 6', clay pockets (SM); In Boring B-16 only
V	0.5 – 21	LEAN CLAY WITH SAND, stiff to hard, light brown, light gray, brown, reddish brown, with root fibers to 6', ferrous nodules (CL)

Stratum No.	Range of Depth, ft.	Soil Description*
VI	14 – 31	POORLY GRADED SAND WITH SILT, medium dense to dense, light brown, brown (SP-SM); In Borings B-15 and B-16 only
VII	14 – 31	SILTY SAND, medium dense to very dense, light brown, light gray (SM)

6.2.5 North Post Oak Lane (Borings B-19 through B-23)

Based on Borings B-19 through B-23, the soils can be grouped into eight (8) major strata with depth limits and characteristics as follows:

Stratum No.	Range of Depth, ft.	Soil Description*
		EXISTING ASPHALT PAVEMENT (9.5” to 13.0” in Thickness)
I	0.8 – 2	FILL: LEAN CLAY WITH SAND, very stiff, light brown, brown, with root fibers, ferrous and calcareous nodules (CL); In Borings B-19 and B-20 only
II	1 – 2	FILL: SILTY SAND, light brown, dark brown (SM); In Borings B-21 through B-23 only
III	2 – 23	LEAN CLAY WITH SAND, very stiff to hard, light brown, brown, gray, with root fibers to 4’, ferrous and calcareous nodules (CL)
IV	2 – 8	FAT CLAY, stiff to hard, light brown, brown, reddish brown, with ferrous and calcareous nodules (CH); In Borings B-20 through B-22 only
V	16 – 28	FAT CLAY, very stiff to hard, light brown, reddish brown, with ferrous and calcareous nodules (CH); In Boring B-23 only
VI	22 – 40	SILTY SAND, dense to very dense, light gray, light brown, reddish brown; In Borings B-19, B-21 and B-23 only
VII	23 – 30	SANDY SILT, dense, light brown (ML); In Boring B-22 only
VIII	23 – 40	POORLY GRADED SAND WITH SILT, dense to very dense, light brown, reddish brown; In Borings B-20 and B-22 only

6.2.6 Woodway Drive (Borings B-24 through B-30)

Based on Borings B-24 through B-30, the soils can be grouped into eleven (11) major strata with depth limits and characteristics as follows:

Stratum No.	Range of Depth, ft.	Soil Description*
		EXISTING CONCRETE PAVEMENT (7.2” to 10.5” in Thickness)
I	0.6 – 2	FILL: SILTY SAND, light brown, gravel (SM); In Borings B-24 and B-26 only
II	0.8 – 8	FILL: LEAN CLAY WITH SAND, soft to very stiff, light brown, brown, gray, dark brown, with ferrous nodules (CL); In Borings B-24, B-25 and B-30 only
III	0.7 – 10	FILL: FAT CLAY, soft to very stiff, light brown, reddish brown, dark brown, with root fibers to 4’, ferrous and calcareous nodules (CH); In Borings B-28 and B-29 only
IV	0.8 – 48	SILTY SAND, loose to very dense, light brown, brown, reddish brown (SM)
V	2 – 6	LEAN CLAY WITH SAND, very stiff to hard, light brown, with ferrous and calcareous nodules (CL); In Boring B-30
VI	2 – 58	FAT CLAY, stiff to hard, light brown, gray, reddish brown, dark brown, with root fibers to 4’, ferrous and calcareous nodules (CH)
VII	8 – 43	POORLY GRADED SAND WITH SILT, medium dense to very dense, light brown, reddish brown (SP-SM); In Borings B-24 and B-26 only
VIII	64 – 105	SILTY SAND, very dense, light brown, reddish brown (SM); In Boring B-26 only
IX	27 – 38	SANDY SILT, medium dense to dense, reddish brown (ML); In Boring B-30 only
X	16 – 40	LEAN CLAY WITH SAND, stiff to very stiff, light brown, reddish brown, with ferrous and calcareous nodules (CL); In Borings 26 and 30 only
XI	58 – 64	LEAN CLAY WITH SAND, very stiff, light brown, with ferrous nodules (CL), In Boring B-26 only

* Classification in general accordance with the Unified Soil Classification System (ASTM D 2487)

6.2.7 Sage Road and Bayou Timber Lane (Borings B-31 through B-34)

Based on Borings B-31 through B-34, the soils can be grouped into six (6) major strata with depth limits and characteristics as follows:

Stratum No.	Range of Depth, ft.	Soil Description*
		EXISTING ASPHALT PAVEMENT (2” to 3” in Thickness); In Boring B-31 and B-32 only
		EXISTING CONCRETE PAVEMENT (5.5” to 6.8” in Thickness)
I	0.5 – 12	FILL: LEAN CLAY WITH SAND, soft to very stiff, light brown, gray, with ferrous nodules (CL)
II	0.6 – 2	FILL: SILTY SAND, light brown, with clay pockets (SM); In Boring B-34 only
III	4 – 6	FILL: SILTY SAND, medium dense, light brown, with clay pockets (SM); In Boring B-32 only
IV	2 – 10	LEAN CLAY WITH SAND, very stiff, gray, with ferrous nodules (CL); In Boring B-3
V	2 – 23	SILTY SAND, loose to very dense, light brown, gray, reddish brown (SM)
VI	12 – 15	FAT CLAY, stiff to very stiff, reddish brown, with ferrous and calcareous nodules (CH); In Boring B-34 only

6.3 Soil Properties

6.3.1 East Friar Lane and Sandrigham Drive (Borings B-1 through B-3)

Soil strength and index properties and how they relate to design and underground utility installations (sanitary sewer lines and lift station) along the project alignments are summarized below:

Stratum No.	Soil Type	PI(s)	SPT	Soil Expansivity	Soil Strength, tsf	Remarks
I	Fill: Lean Clay (CL)	–	–	–	0.31 – 1.50	–
II	Fill: Silty Sand (SM)	–	–	Non-Expansive	–	Moisture Sensitive
III	Lean Clay (CL)	14 – 29	–	Non- to Moderately Expansive	0.46 – 2.81	–
IV	Lean Clay with Sand (CL)	21 – 28	–	Low to Moderately Expansive	1.50 – 2.75	–
V	Silty Sand (SM)	–	27 – 50	Non-Expansive	–	Moisture Sensitive
VI	Poorly Graded Sand with Silt (SP-SM)	–	24 – 46	Non-Expansive	–	Moisture Sensitive

6.3.2 Buckingham Drive (Borings B-4 through B-6)

Stratum No.	Soil Type	PI(s)	SPT	Soil Expansivity	Soil Strength, tsf	Remarks
I	Fill: Silty Sand (SM)	–	–	Non-Expansive	–	Moisture Sensitive
II	Fill: Sandy Silt (ML)	–	–	Non-Expansive	–	Moisture Sensitive
III	Lean Clay with Sand (CL)	18 – 30	–	Non- to Moderately Expansive	–	–
IV	Poorly Graded Sand with Silt (SP-SM)	–	29 – 60	Non-Expansive	–	Moisture Sensitive
V	Silty Sand (SM)	–	26 – 46	Non-Expansive	–	Moisture Sensitive

6.3.3 Memorial Drive (Borings B-7 through B-14)

Stratum No.	Soil Type	PI(s)	SPT	Soil Expansivity	Soil Strength, tsf	Remarks
I	Fill: Lean Clay with Sand (CL)	19 – 24	–	Non- to Moderately Expansive	0.23 – 2.1	–
II	Fill: Fat Clay (CH)	–	–	–	1.50	–
III	Lean Clay with Sand (CL)	9 – 29	–	Non- to Moderately Expansive	0.93 – 3.41	–
IV	Fat Clay (CH)	35 – 38	–	Expansive	1.50 – 2.75	–
V	Silty Sand (SM)	–	13 – 69	Non-Expansive	–	Moisture Sensitive
VI	Poorly Graded Sand with Silt (SP-SM)	–	14 – 60	Non-Expansive	–	Moisture Sensitive

6.3.4 Stable Crest Blvd. and Stable Lane (Borings B-15 through B-18)

Stratum No.	Soil Type	PI(s)	SPT	Soil Expansivity	Soil Strength, tsf	Remarks
I	Fill: Fat Clay (CH)	–	–	–	0.78	–
II	Fill: Lean Clay (CL)	–	–	–	0.93 – 1.50	–
III	Fat Clay (CH)	32 – 46	–	Expansive	0.87 – 1.90	–
IV	Silty Sand (SM)	–	10 – 14	Non-Expansive	–	Moisture Sensitive
V	Lean Clay with Sand (CL)	16 – 28	–	Non- to Moderately Expansive	0.93 – 2.45	–
VI	Poorly Graded Sand with Silt (SP-SM)	–	14 – 33	Non-Expansive	–	Moisture Sensitive
VII	Silty Sand (SM)	–	21 – 77	Non-Expansive	–	Moisture Sensitive

6.3.5 North Post Oak Lane (Borings B-19 through B-23)

Stratum No.	Soil Type	PI(s)	SPT	Soil Expansivity	Soil Strength, tsf	Remarks
I	Fill: Lean Clay with Sand (CL)	14	–	Non-Expansive	1.24 – 1.50	–
II	Fill: Silty Sand (SM)	–	–	Non-Expansive	–	Moisture Sensitive
III	Lean Clay with Sand (CL)	18 – 30	–	Non- to Moderately Expansive	1.08 – 2.37	–
IV	Fat Clay (CH)	36 – 40	–	Expansive	0.78– 2.80	–
V	Fat Clay (CH)	34	–	Expansive	1.50 – 2.73	Moisture Sensitive
VI	Silty Sand (SM)	–	34 – 53	Non-Expansive	–	Moisture Sensitive

Stratum No.	Soil Type	PI(s)	SPT	Soil Expansivity	Soil Strength, tsf	Remarks
VII	Sandy Silt (ML)	–	35 – 38	Non-Expansive	–	Moisture Sensitive
VIII	Poorly Graded Sand with Silt (SP-SM)	–	41 – 66	Non-Expansive	–	Moisture Sensitive

6.3.6 Woodway Drive (Borings B-24 through B-30)

Stratum No.	Soil Type	PI(s)	SPT	Soil Expansivity	Soil Strength, tsf	Remarks
I	Fill: Silty Sand (SM)	–	–	Non-Expansive	–	Moisture Sensitive
II	Fill: Lean Clay with Sand (CL)	14 – 17	–	Non-Expansive	0.23 – 1.95	–
III	Fill: Fat Clay (CH)	31 – 35	–	Expansive	0.15 – 1.50	–
IV	Silty Sand (SM)	–	10 – 84	Non-Expansive	–	Moisture Sensitive
V	Lean Clay with Sand (CL)	29	–	Moderately Expansive	1.50 – 2.32	–
VI	Fat Clay (CH)	33 – 65	–	Expansive to Highly Expansive	0.56 – 3.07	–
VII	Poorly Graded Sand with Silt (SP-SM)	–	11 – 87	Non-Expansive	–	Moisture Sensitive
VIII	Silty Sand (SM)	–	74 – 93	Non-Expansive	–	Moisture Sensitive
IX	Sandy Silt (ML)	–	21 – 33	Non-Expansive	–	Moisture Sensitive
X	Lean Clay with Sand (CL)	15 – 27	–	Non- to Moderately Expansive	0.84 – 1.50	–
XI	Lean Clay with Sand (CL)	18	–	Non-Expansive	1.20 – 1.50	–

6.3.7 Sage Road and Bayou Timber Lane (Borings B-31 through B-34)

Stratum No.	Soil Type	PI(s)	SPT	Soil Expansivity	Soil Strength, tsf	Remarks
I	Fill: Lean Clay with Sand (CL)	14 – 17	–	Non-Expansive	0.23 – 1.66	–
II	Fill: Silty Sand (SM)	–	–	Non-Expansive	–	Moisture Sensitive
III	Fill: Silty Sand (SM)	–	17	Non-Expansive	–	Moisture Sensitive
IV	Lean Clay with Sand (CL)	14 – 17	–	Non-Expansive	1.08 – 1.75	–
V	Silty Sand (SM)	–	8 – 56	Non-Expansive	–	Moisture Sensitive
VI	Fat Clay (CH)	50	–	Expansive	0.93 – 2.01	–

Legend: PI = Plasticity Index
SPT = Standard Penetration Test

6.4 Water-Level Measurements

The soil borings were first drilled dry to evaluate the presence of perched or free-water conditions. A wet rotary technique was used thereafter to the completion depths of the borings. The levels where free water was first encountered in the open boreholes during drilling and 24 hours after drilling are shown on the boring logs. Our groundwater/perched water measurements are as follows:

Boring No.	Groundwater Elevation, ft. at the Time of Drilling	Groundwater Elevation, ft. After 24 Hour Later	Piezometer Water Elevation, ft	
			1st Reading	2nd Reading
B-1	Dry	Dry	–	–
B-2	Dry	Dry	–	–
B-3	Dry	Dry	–	–
B-4	Dry	Dry	–	–
B-5	Dry	Dry	–	–
B-6/PZ-1	Dry	Dry	Dry	Dry
B-7	36.88	36.88	–	–
B-8	36.89	37.89	–	–
B-9	36.42	38.42	–	–
B-10	35.18	26.18	–	–
B-11/PZ-2	32.04	34.04	34.0	34.5
B-12	26.29	26.29	–	–
B-13	29.29	29.29	–	–
B-14	28.76	28.76	–	–
B-15	32.39	32.39	–	–
B-16	34.50	34.50	–	–
B-17	27.9	27.9	–	–
B-18/PZ-3	Dry	Dry	Dry	Dry
B-19/PZ-4	33.87	33.87	Dry	Dry
B-20	36.46	36.46	–	–
B-21	30.78	30.78	–	–
B-22	31.33	31.33	–	–
B-23	24.26	24.26	–	–
B-24/PZ-5	17.30	17.30	Dry	Dry
B-25	10.38	10.38	–	–
B-26	22.58	23.58	–	–
B-27	12.97	12.97	–	–
B-28	32.40	33.40	–	–

Boring No.	Groundwater Elevation, ft. at the Time of Drilling	Groundwater Elevation, ft. After 24 Hour Later	Piezometer Water Elevation, ft	
			1st Reading	
B-29	33.25	34.25	–	–
B-30/PZ-6	29.93	30.93	29.9	32.9
B-31	Dry	Dry	–	–
B-32	38.67	39.67	–	–
B-33	35.9	35.29	–	–
B-34	Dry	Dry	–	–

Note: Water Elevation referenced from the existing grade.

Fluctuations in groundwater generally occur as a function of seasonal moisture variation, temperature, groundwater withdrawal and future construction activities that may alter the surface drainage and subdrainage characteristics of this site.

An accurate evaluation of the hydrostatic water table in the relatively impermeable clay and low permeability silts/sands requires long term observation of monitoring wells and/or piezometers. It is not possible to accurately predict the pressure and/or level of groundwater that might occur based upon short-term site exploration. In view of this, Borings B-6, B-11, B-18, B-19, B-24 and B-30 were converted to Piezometers PZ-1, PZ-2, PZ-3, PZ-4, PZ-5 and PZ-6, respectively, after completion of field work. The result of piezometer observations are presented in Plates 5 and 6.

We recommend that GET be immediately notified if a noticeable change in groundwater water occurs from that mentioned in our report. We would be pleased to evaluate the effect of any groundwater changes on our design and construction sections of this report.

7.0 LIFT STATION FOUNDATION RECOMMENDATIONS

7.1 General

It is planned to construct Woodway No.1 Lift Station. The new lift station will be about 60-ft below the existing grade and 14-ft in diameter. We understand that the lift station structure will consist of a Sunken Concrete Caisson foundation approximately 60-ft below the existing grade. Boring B-26 was drilled to a depth of 105-ft near the proposed lift station area.

7.2 Foundation Type

We understand that the lift station structure will consist of a Sunken Concrete Caisson foundation approximately 60-ft below the existing grade. The allowable bearing pressures to support the Sunken Concrete Caisson are as follows:

Foundation Type	Soil Type	Anticipated Foundation Depth, ft	Allowable Net Bearing Pressures, psf	
			Dead Load	Total (Dead + Live) Load
Concrete Slab	Lean Clay (CL)	60	3,000	4,500

Foundation proportioned in accordance with the above bearing capacities value will have a factor of safety of 3.0 and 2.0 with respect to shearing failure for dead and total loadings, respectively.

A detailed settlement analysis for the lift station foundation was not within the scope of this study. It is our opinion that the lift station foundation designed using the recommended allowable bearing pressures will experience small settlements that will be within the tolerable limit for the proposed lift station.

7.3 Groundwater Control

7.3.1 General

We understand that the lift station structure will consist of Sunken Concrete Caisson approximately 60-ft below the existing grade. Our short-term field exploration indicates that groundwater was encountered at a depth of about 24-ft below the existing grade in Boring B-26 drilled for the lift station. Groundwater rose to a depth of about 23-ft below the existing grade, after 24 hours of drilling. Hence, groundwater dewatering will be required. **Due to the presence of silty sandy subsoils near the inverted depth and hydrostatic pressure build-up, bottom blow up may occur if an effective dewatering system is not in place at the time of construction.**

Fluctuation in groundwater can occur as a function of seasonal moisture variation. Groundwater control recommendations are presented in the following report sections.

7.3.2 Dewatering Technique

In the event that groundwater is encountered during construction, it is our opinion that the Lift Sation excavation can be dewatered using a wellpoint, multi-stage wellpoint system or ejector systems. Based on the field data, it is our opinion that groundwater should be lowered to a depth of at least three-ft below the deepest excavation grade in order to provide dry working conditions and firm bedding for construction of the lift station foundation. Since the wellpoint suction lift is about 15-ft, multi-stage wellpoint system or ejector systems may be used for dewatering. **Due to the presence of silty sands near the bottom depth of the lift station and the hydrostatic pressure build-up, blow up may occur if an effective dewatering system is not in place at the time of construction.** Design of a dewatering system should consider the amount of groundwater to be lowered and the permeability of the affected soils. The selection and proper implementation of an effective groundwater control system is the responsibility of the contractor. The design of groundwater and surface water should be in accordance with the City of Houston Specifications, Section 01578 − Control of Ground Water and Surface Water.

7.4 Buoyancy

The lift station structure will extend to a depth of approximately 60-ft below the existing grade. This structure will experience uplift loads from the groundwater. The lift station should perform satisfactorily if a design factor of safety against uplift of 2.0 is used. For a sunken caisson the dead weight of the structure plus the frictional resistance developed between the walls of Caisson and natural soils or fill soils can be used in resisting hydrostatic uplift.

The following values can be used for the calculation of frictional resistance to uplift developed along the caisson wall:

Depth below Existing Grade, ft	Soil Type	Recommended Allowable Frictional Resistance, psf
5 – 32	Silty Sand (SM)	200
32 – 40	Lean Clay with Sand (CL)	300
40 – 58	Fat Clay (CH)	500
58 – 60	Lean Clay with Sand (CL)	500

The above values include a factor of safety of 2.0. Frictional resistance for the upper five-ft has been disregarded, since this zone is affected by seasonal moisture changes.

It must be noted that the above allowable frictional resistance values are based on the assumption that successful grouting between the lift station and the surrounding soils would be performed during the construction phase. In order for the values listed above to apply, the grout must fully displace all liquids from outside the caisson and bond thoroughly with the soil outside the caisson.

7.5 Lateral Earth Pressures

The walls of the lift station can be designed for a lateral earth pressure equivalent to fluid having a density of 104 pounds per cubic foot. The design lateral pressure value is based upon the assumption that the groundwater level is near the ground surface, since this condition may exist after a heavy rain or flooding. The effect of surcharge loads at the ground surface should be added to compute later earth pressures. A surcharge load, q, will typically result in a lateral load equal to 0.7q.

7.6 OSHA Soil Classifications

The subsoils can be classified in accordance with Occupational Safety and Health Administration (OSHA) Standards, dated October 31, 1989 of the Federal Register. OSHA classification system categorizes the soil and rock in four types based on shear strength and stability. The description of four (4) types in classification system is summarized in the Appendix D.

Based on our geotechnical exploration and laboratory test results, details of soil classifications at each boring are summarized in the OSHA Soil Classification, presented in Appendix D.

7.7 Excavations

Each side of an excavation or trench which is five-ft or deeper must be protected by sheeting/bracing shoring or sloped. Based on soil strength data and OSHA soil classifications, temporary (less than 24 hours) open-trenched, non-surcharged, and unsupported excavations should be made on slopes of about 1.5(h):1(v). Vertical cuts can be constructed, provided shoring and bracing are used for the excavation wall stability. Benched excavation can also be used with average slopes of about 1(h):1(v) and steps should not be higher than five-ft. In all cases, excavations should conform to OSHA guidelines. Flatter slopes may have to be used if large amounts of sand need to be excavated for deep installations. Specifications should require that no water be allowed to pond in the excavations. The surface slopes should be protected from deterioration and weathering if they are to be left open for more than 24 hours.

Excavations should be performed with equipment capable of providing a relatively clean bearing area. Excavation equipment should not disturb the soil beneath the design excavation bottom and should not leave large amounts of loose soil in the excavation.

8.0 SANITARY SEWERLINES

8.1 General

We understand that sanitary sewerlines will be constructed along the proposed project alignments. We understand the depths of the flow line for the sanitary sewerlines will range from 3- to 50-ft. Furthermore, Buffalo Bayou and a drainage ditch (W137-00-00) cross Woodway Drive near Woodway No.1 Lift Station and Memorial Drive near Holy Rood Lane, respectively. The basic construction techniques for the installation of sanitary sewerlines will be augering method. This construction technique will be used to cross Buffalo Bayou and the drainage ditch. In addition, the auger pits will be located outside Harris County Flood Control District easement. Therefore, slope-stability and erosion protection along Buffalo Bayou and the drainage ditch will not be conducted.

Borings B-1 through B-25 and B-27 through B-34 were drilled along the project alignments for the proposed sanitary sewerlines to depths ranging from 15- to 55-ft below the existing grade. We understand that the proposed sanitary sewerlines will be constructed according to the “City of Houston Specifications, Section 02317 – Excavation and Backfill for Utilities, and Section 02447 – Augering Pipe and Conduit”.

8.2 Augering and Augering Pits

8.2.1 Sanitary Sewerlines

We understand that Augering may be used for the sanitary sewer installations along the proposed alignments. The augering should be conducted in accordance with the "City of Houston Standard Specifications, Section 02447 – Augering Pipe and Conduit or 02448 – Pipe and Casing Augering for Sewers. Augering should be started from approved pit locations. Excavation for pits and shoring installation should conform to the aforementioned "City of Houston Standard Specifications and Section 02317 – Excavation and Backfill for Utilities". If the augering zone is within the cohesionless soils or collapsible soils, install casings as required by "City of Houston Standard Specifications, Section 02447 – Augering Pipe and Conduit". The augering near existing structures or utility lines should be conducted in accordance with the "City of Houston Standard Specifications, Section 02233 – Clearing and Grubbing". Diameter of auger hole should not exceed pipe bell diameter plus 2-inches. The receiving pit distance should conform to the aforementioned City of Houston Standard Specifications. A minimum spacing of 6-inches should be provided between the pipe and walls of bore pit. The maximum allowable width of pit shall be 5-ft unless approved by City Engineers. Width of pit at surface shall not be less than the pit width at the bottom.

The results of our field exploration and laboratory testing indicate that unsatisfactory soils for excavation, such as soft clays and cohesionless soils encountered at various depths in the borings. A summary of the unsatisfactory soils locations and depths is as follows:

Boring(s)	Depth Range, ft.
B-1	14 to 23
B-2	14 to 23
B-3	0 to 2 /16 to 23
B-4	0 to 2 /14 to 23
B-5	0 to 2/14 to 26
B-6	0 to 2/ 14 to 26
B-7	14 to 36
B-8	12 to 36
B-9	0 to 2/14 to 36
B-10	10 to 36
B-11	10 to 36
B-12	16 to 36
B-13	12 to 38
B-14	16 to 38

Boring(s)	Depth Range, ft.
B-15	21 to 31
B-16	2 to 6/14 to 31
B-17	14 to 31
B-18	14 to 31
B-19	22 to 40
B-20	23 to 40
B-21	0 to 2/ 22 to 40
B-22	0 to 2/ 23 to 40
B-23	0 to 2/ 28 to 40
B-24	0 to 2/ 8 to 43
B-25	0 to 2/4 to 48
B-26	0 to 32/64 to 105
B-27	0 to 6/12 to 38
B-28	0 to 2
B-29	14 to 16/18 to 22
B-30	27 to 38
B-31	8 to 23
B-32	4 to 6/ 10 to 23
B-33	10 to 23
B-34	0 to 12

If these conditions are encountered during the time of construction, suitable groundwater control measures should be implemented in accordance with the "City of Houston Standard Specifications, Section 01578 – Control of Groundwater and Surface Water". Furthermore, the contractor may have to over excavate an additional 6-inch and remove unstable or unsuitable materials with approval by geotechnical engineer, then place an equal depth of cement stabilization sand.

Due to potential variability of the on-site soils, unstable trench conditions may still exist in the areas where we did not conduct our borings. If these conditions are encountered during the time of construction, a stable trench should be provided to allow proper bedding and installation.

Sand backfill used in the cement-stabilized sand and sand backfill sections should be free of clay lumps, organic materials, or other deleterious substances, and should have a PI less than 4 for the cement-stabilized sand and less than 7 for the sand backfill section, and not more than 15% passing the No. 200 sieve. Cement stabilized sand should conform to the "City of Houston Standard Specifications, Section 02321 – Cement Stabilized Sand".

8.3 Groundwater Control

8.3.1 General

We understand the depths of the flow line for the sanitary sewerlines will range from 3- to 50-ft. Our short-term field exploration along the alignments indicated that groundwater/perched water was encountered at depths ranging from 16- to 36-ft below the existing grade. Groundwater/perched water rose to depths ranging from 15- to 35-ft below the existing grade after 24 hours of drilling. Furthermore, Borings B-6, B-11, B-18, B-19, B-24 and B-30 were converted to piezometer PZ-1, PZ-2, PZ-3, PZ-4, PZ-5 and PZ-6, respectively, after completion of the borings. The results of piezometer observations indicated that stabilized groundwater levels exist at depths of about 25.5 and 23-ft below the existing ground surface in piezometers PZ-2 and PZ-6, respectively. No stabilized groundwater water levels existed in piezometers PZ-1, PZ-3, PZ-4 and PZ-5. Fluctuations in groundwater can occur as a function of seasonal moisture variations. Groundwater control recommendations are presented in the following report sections.

8.3.2 Dewatering Technique

In the event that groundwater is encountered during construction, it is our opinion that groundwater should be lowered to a depth of at least three-ft below the deepest excavation grade in order to provide dry working conditions and firm bedding. Any minor water inflow in cohesive soil layers can probably be removed using a sump-pump or trench sump-pump. Wellpoint system can be used in the area where silty sand/sandy silt soils are present. Since the wellpoint suction lift is about 15-ft, multi-stage wellpoint system or ejector systems may be used for dewatering. **Due to the presence of sands near invert depth and the hydrostatic pressure build-up, blow up may occur if an effective dewatering system is not in place at the time of construction.**

Design of a dewatering system should consider the amount of groundwater to be lowered and the permeability of the affected soils. The selection and proper implementation of an effective groundwater control system is the responsibility of the contractor. The design of groundwater and surface water should be in accordance with the City of Houston Specifications, Section 01578 − Control of Ground Water and Surface Water.

8.4 OSHA Soil Classifications

The subsoils can be classified in accordance with Occupational Safety and Health Administration (OSHA) Standards, dated October 31, 1989 of the Federal Register. OSHA classification system categorizes the soil and rock in four types based on shear strength and stability. The description of four (4) types in classification system is summarized in the Appendix D.

Based on our geotechnical exploration and laboratory test results, details of soil classifications at each boring are summarized in the OSHA Soil Classification, presented in Appendix D. Furthermore, a letter for trench safety recommendation is provided separately.

8.5 Excavations

Each side of an excavation or trench which is five-ft or deeper must be protected by sheeting/bracing shoring or sloped. Based on soil strength data and OSHA soil classifications, temporary (less than 24 hours) open-trenched, non-surcharged, and unsupported excavations should be made on slopes of about 1.5(h):1(v). Vertical cuts can be constructed, provided shoring and bracing are used for the excavation wall stability. Benched excavation can also be used with average slopes of about 1(h):1(v) and steps should not be higher than five-ft. In all cases, excavations should conform to OSHA guidelines. Flatter slopes may have to be used if large amounts of sand need to be excavated for deep installations. Specifications should require that no water be allowed to pond in the excavations. The surface slopes should be protected from deterioration and weathering if they are to be left open for more than 24 hours.

Excavations should be performed with equipment capable of providing a relatively clean bearing area. Excavation equipment should not disturb the soil beneath the design excavation bottom and should not leave large amounts of loose soil in the excavation.

8.6 Lateral Earth Pressures

In the event that open excavations are not used, the proposed underground utilities can be installed using trench sheeting. The sheeting can be constructed in the form of cantilever sheeting or with bracing. Lateral earth pressures for each method used are summarized on Plate 7. The trenching and shoring operations should follow OSHA Standards. We recommend a geotechnical engineer monitor all phases of trench excavation and bracing to assure trench safety.

8.7 Backfilling for Auger Pits and Auger Holes

Sand backfill used in the cement-stabilized sand and sand backfill sections should be free of clay lumps, organic materials, or other deleterious substances, and should have a PI less than 4 for the cement-stabilized sand and less than 7 for the sand backfill section, and not more than 15% passing the No. 200 sieve.

Cement stabilized sand should conform to the “City of Houston Specifications, Section 02321 – Cement Stabilized Sand”. Backfill should be placed in accordance with “City of Houston Standard Specifications, Section 02317 – Excavation and Backfill for Utilities”. City of Houston Standard Specification Drawing No. 02447-01 should be followed when backfilling the auger pits. The annular space between the pipe and the auger hole should be backfilled to a minimum of 12-inches on both sides beyond the auger pit as indicated in the City of Houston Standard Specification Drawing No. 02447-01.

9.0 CONSTRUCTION CONSIDERATIONS

9.1 Site Preparation

Site preparation should be conducted in accordance with the "City of Houston Standard Specifications, Section 02221 – Removing Existing Pavements and Structures and Section 02233 – Clearing and Grubbing". In general, subgrade preparation should be as follows:

1. The requirement for removal of any existing paving, and subsoil materials will depend on final grades and other alignment information. In general, remove all vegetation, tree roots, organic topsoil, existing foundations, paved areas and any undesirable materials from the construction area. Tree trucks under the pavement should be removed to a root size of less than 0.5-inches. We recommend that the stripping depth be evaluated at the time of construction by a soil technician.

2. The subgrade areas should then be proofrolled with a loaded dump truck or similar pneumatic-tired equipment with loads ranging from 25- to 50-tons. The proofrolling serves to compact surficial soils and to detect any soft or loose zones. The proofrolling should be conducted in accordance with TxDOT Standard Specification Item 216. Any soils deflecting excessively under moving loads should be undercut to firm soils and recompacted. Any subgrade stabilization should be conducted after site proofrolling is completed and approved by the geotechnical engineer. The proofrolling operations should be observed by an experienced geotechnician.

3. Off-site borrow for fill should consist of lean clays with a liquid limit not exceeding 40 and a PI between 12 and 20. These soils should be placed in loose lifts not exceeding eight-inches and compacted to at least 95% of maximum standard Proctor density (ASTM D 698) at moisture contents between optimum and +3% of optimum. Bank sands should not be used as select structural fill. On-site soils, free of organics, (with the exception of sands and silts) are also suitable for use as structural fill.

5. In cut areas, the soil should be excavated to grade and the surficial soil proofrolled and scarified to a minimum depth of six-inches and recompacted to the previously mentioned density and moisture content.

6. Positive site drainage should be developed at the beginning of the project to limit construction difficulties with wet surface soils.

9.2 Suitability of On-Site Soils for Use as Fill

9.2.1 General

Fill requirements should be in accordance with the 'City of Houston Standard Specifications, Section 02316 –Excavation and Backfill for Structures, Section 02317 – Excavation and Backfill for Utilities and Section 02320 – Utility Backfill Materials". The on-site soils can be used as fill materials as described in the following report sections.

9.2.2 Select Backfill

This is the type of fill that can be used for the structures or utilities. These soils should consist of lean clays with plasticity indices between 8 and 20 and amount of passing No. 200 sieve greater than 50 percent.

9.2.3 Random Backfill

This type of fill does not meet the Atterberg limit requirements for select structural fill. This fill should consist of lean clays or fat clays. They can be used for the structures or utilities after treatment.

9.2.4 General Fill

This type of fill consists of silts, sands and clays. However, the silts and sands are moisture sensitive and are difficult to compact in a wet condition (they may pump). Furthermore, these soils can erode easily. Their use is not recommended as backfill materials. They can be used for site grading and in unimproved areas.

9.2.5 On-Site Fill Soil Classification

9.2.5.1 East Friar Lane and Sandrigham Drive (Borings B-1 through B-3)

Based on Borings B-1 through B-3, the on-site soils can be used as fill materials as described below:

Stratum No.[1]	Soil Type	Use as Fill: Select Backfill	Use as Fill: Random Backfill	Use as Fill: General Fill	Notes
I	Fill: Lean Clay with Sand (CL)	–	✓	✓	2, 3
II	Fill: Silty Sand (SM)	–	–	✓	2, 4
III	Lean Clay (CL)	–	✓	✓	2, 3
IV	Lean Clay with Sand (CL)	–	✓	✓	2, 3
V	Silty Sand (SM)	–	–	✓	2, 4
VI	Poorly Graded Sand with Silt (SP-SM)	–	–	✓	2, 4

9.2.5.2 Buckingham Drive (Borings B-4 through B-6)

Based on Borings B-4 through B-6, the on-site soils can be used as fill materials as described below:

Stratum No.[1]	Soil Type	Use as Fill: Select Backfill	Use as Fill: Random Backfill	Use as Fill: General Fill	Notes
I	Fill: Silty Sand (SM)	–	–	✓	2, 4
II	Fill: Sandy Silt (ML)	–	–	✓	2, 4
III	Lean Clay with Sand (CL)	–	✓	✓	2, 3
IV	Poorly Graded Sand with Silt (SP-SM)	–	–	✓	2, 4
V	Silty Sand (SM)	–	–	✓	2, 4

9.2.5.3 Memorial Drive (Borings B-7 through B-14)

Based on Borings B-7 through B-14, the on-site soils can be used as fill materials as described below:

Stratum No.[1]	Soil Type	Use as Fill: Select Backfill	Use as Fill: Random Backfill	Use as Fill: General Fill	Notes
I	Fill: Lean Clay with Sand (CL)	–	✓	✓	2, 3
II	Fill: Fat Clay (CH)	–	✓	✓	2, 5
III	Lean Clay with Sand (CL)	–	✓	✓	2, 3
IV	Silty Sand (SM)	–	–	✓	2, 4
V	Fat Clay (CH)	–	✓	✓	2, 5
VI	Silty Sand (SM)	–	–	✓	2, 4
VII	Poorly Graded Sand with Silt (SP-SM)	–	–	✓	2, 4

9.2.5.4 Stable Creek Blvd. and Stable Lane (Borings B-15 through B-18)

Based on Borings B-15 through B-18, the on-site soils can be used as fill materials as described below:

Stratum No.[1]	Soil Type	Use as Fill			Notes
		Select Backfill	Random Backfill	General Fill	
I	Fill: Fat Clay (CH)	–	✓	✓	2, 5
II	Fill: Lean Clay (CL)	–	✓	✓	2, 3
III	Fat Clay (CH)	–	✓	✓	2, 5
IV	Lean Clay with Sand (CL)	–	✓	✓	2, 3
V	Poorly Graded Sand with Silt (SP-SM)	–	–	✓	2, 4
VI	Silty Sand (SM)	–	–	✓	2, 4

9.2.5.5 North Post Oak Lane (Borings B-19 through B-23)

Based on Borings B-19 through B-23, the on-site soils can be used as fill materials as described below:

Stratum No.[1]	Soil Type	Use as Fill			Notes
		Select Backfill	Random Backfill	General Fill	
I	Fill: Lean Clay (CL)	–	✓	✓	2, 3
II	Fill: Silty Sand (SM)	–	–	✓	2, 4
III	Lean Clay with Sand (CL)	–	✓	✓	2, 3
IV	Fat Clay (CH)	–	✓	✓	2, 5
V	Fat Clay (CH)	–	✓	✓	2, 5
VI	Silty Sand (SM)	–	–	✓	2, 4
VII	Sandy Silt (ML)	–	–	✓	2, 4
VIII	Poorly Graded Sand with Silt (SP-SM)	–	–	✓	2, 4

9.2.5.6 Woodway Drive (Borings B-24 through B-30)

Based on Borings B-24 through B-30, the on-site soils can be used as fill materials as described below:

Stratum No.[1]	Soil Type	Use as Fill: Select Backfill	Use as Fill: Random Backfill	Use as Fill: General Fill	Notes
I	Fill: Silty Sand (SM)	–	–	✓	2, 4
II	Fill: Lean Clay with Sand (CL)	–	✓	✓	2, 3
III	Fill: Fat Clay (CH)	–	✓	✓	2, 5
IV	Silty Sand (SM)	–	–	✓	2, 4
V	Lean Clay with Sand (CL)	–	✓	✓	2, 3
VI	Fat Clay (CH)	–	✓	✓	2, 5
VII	Poorly Graded Sand with Silt (SP-SM)	–	–	✓	2, 4
VIII	Silty Sand (SM)	–	–	✓	2, 4
IX	Sandy Silt (ML)	–	–	✓	2, 4
X	Lean Clay with Sand (CL)	–	✓	✓	2, 3
XI	Lean Clay with Sand (CL)	–	✓	✓	2, 3

9.2.5.7 Sage Road and Bayou Timber Lane (Borings B-31 through B-34)

Based on Borings B-31 and B-34, the on-site soils can be used as fill materials as described below:

Stratum No.[1]	Soil Type	Use as Fill: Select Backfill	Use as Fill: Random Backfill	Use as Fill: General Fill	Notes
I	Fill: Lean Clay with Sand (CL)	–	✓	✓	2, 3
II	Fill: Silty Sand (SM)	–	–	✓	2, 4
III	Fill: Silty Sand (SM)	–	–	✓	2, 4
IV	Lean Clay with Sand (CL)	–	✓	✓	2, 3
V	Silty Sand (SM)	–	–	✓	2, 4
VI	Fat Clay (CH)	–	✓	✓	2, 5

Notes:

1. See soil stratigraphy and design conditions sections of this report for strata description.
2. All fill soils should be free of organics, roots, etc.
3. Soils with PI greater than 20 should be lime modified with 4% by dry weight and can be used as select structural fill.
4. The on-site cohesionless soils are moisture sensitive and erode easily. These soils will pump when they get wet. Compaction difficulties will occur in these soils in a wet condition.
5. These soils, once lime modified (7% by dry weight), can be used as select structural fill.

9.3 Site Drainage

It is recommended that site drainage be well developed. Surface water should be directed away from the structure (use a slope of about 5% in the grass within 10-ft of the structure). No ponding of surface water should be allowed near the structure.

9.4 Construction Surveillance

Construction surveillance and quality control tests should be planned to verify materials and placement in accordance with the specifications. The recommendations presented in this report were based on a discrete number of soil test borings. Soil type and properties may vary across the site. As a part of quality control, if this condition is noted during the construction, we can then evaluate and revise the design and construction to minimize construction delays. We recommend the following quality control procedures be followed by a qualified engineer or technician during the construction of the facility:

- Observe all excavation operations.
- Monitor all phases of trench safety.
- Monitor the dewatering for potential bottom blow up.
- Observe the site stripping and proofrolling.
- Verify the compaction of subgrade soils and backfill soils.
- Evaluate the quality of fill and monitor the fill compaction for all lifts.
- Monitor and test the foundation excavations for, strength, cleanness, depth, size, etc.
- Observe the foundation make-up prior to concrete placement.
- Monitor and test the excavations for strength, cleanness, depth, size, etc.
- Monitor concrete placement, conduct slump tests and make concrete cylinders

It is the responsibility of the client to notify GET of when each phase of the construction is taking place so that proper quality control and procedures are implemented.

10.0 RECOMMENDED ADDITIONAL STUDIES

This report has been based on assumed conditions/characteristics of the proposed project area where specific information was not available. It is recommended that the architect, civil engineer and structural engineer along with any other design professionals involved in this project carefully review these assumptions to ensure they are consistent with the actual planned development. When discrepancies exist, they should be brought to our attention to ensure they do not affect the conclusions and recommendations provided herein. We recommend that GET be retained to review the plans and specifications to ensure that the geotechnical related conclusions and recommendations provided herein have been correctly interpreted as intended.

11.0 STANDARD OF CARE

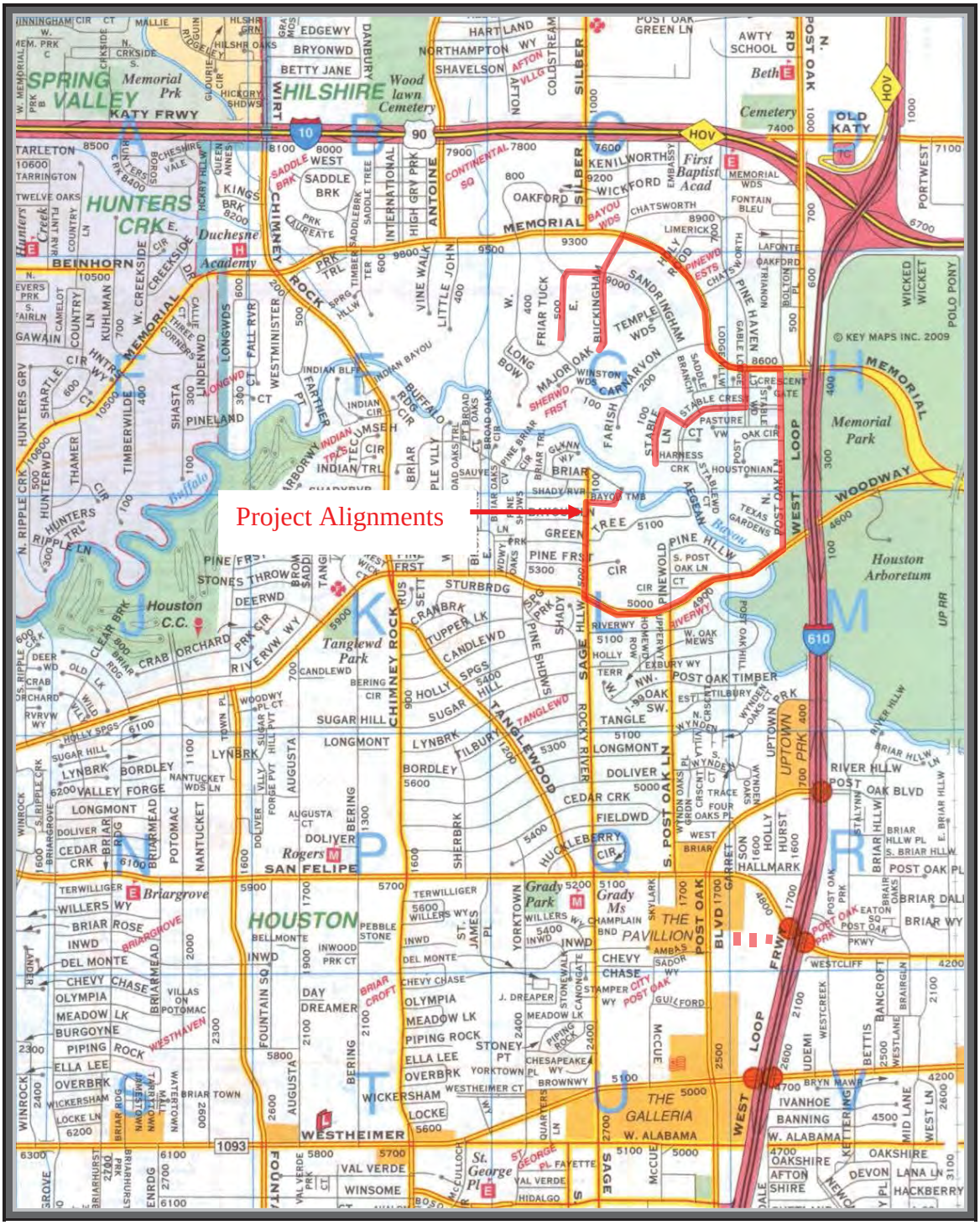
The recommendations described herein were conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the geotechnical engineering profession practicing contemporaneously under similar conditions in the locality of the project. No other warranty or guarantee, expressed or implied, is made other than the work was performed in a proper and workmanlike manner.

12.0 REPORT DISTRIBUTION

This report was prepared for the sole and exclusive use by our client (Arcadis U.S., Inc.) and owner (City of Houston), based on specific and limited objectives. All reports, boring logs, field data, laboratory test results, maps and other documents prepared by GET as instruments of service shall remain the property of GET. GET assumes no responsibility or obligation for the unauthorized use of this report by other parties and for purposes beyond the stated project objectives and work limitations.

13.0 REFERENCES

1. "City of Houston Standard Construction Specifications", Department of Pubic Works and Engineering, City of Houston, July 2012.



SITE VICINITY MAP

PROJECT: Prop. Pump and Lift Station Renewal/Rehabilitation – Post Oak Lane, Stablewood, Bayou Timber and Buckingham, WBS No. R-000267-0109-3, City of Houston, Texas

NORTH

SCALE: NOT TO SCALE	DATE: AUGUST 2013	PROJECT NO.: 12-344E

EXISTING PAVEMENT THICKNESS

Location	Thickness, inches	
	Asphalt Pavement	Concrete Pavement
B-1	1.2	4.7
B-2	1.0	4.8
B-3	-	5.5
B-4	1.0	5.5
B-5	1.4	4.5
B-6	-	6.6
B-7	-	7.0
B-8	-	9.8
B-9	-	7.5
B-10	-	10.2
B-11	-	9.7
B-12	-	9.7
B-13	-	9.5
B-14	-	7.5
B-15	-	6.0
B-16	-	6.3
B-17	-	6.3
B-18	-	6.2
B-19	10.5	-
B-20	9.5	-
B-21	12.0	-
B-22	13.0	-
B-23	12.0	-
B-24	-	10.3
B-25	-	9.9
B-26	-	7.2
B-27	-	9.7
B-28	-	8.5
B-29	-	7.9
B-30	-	10.5
B-31	3.0	5.5
B-32	2.0	5.5
B-33	-	6.5
B-34	-	6.8

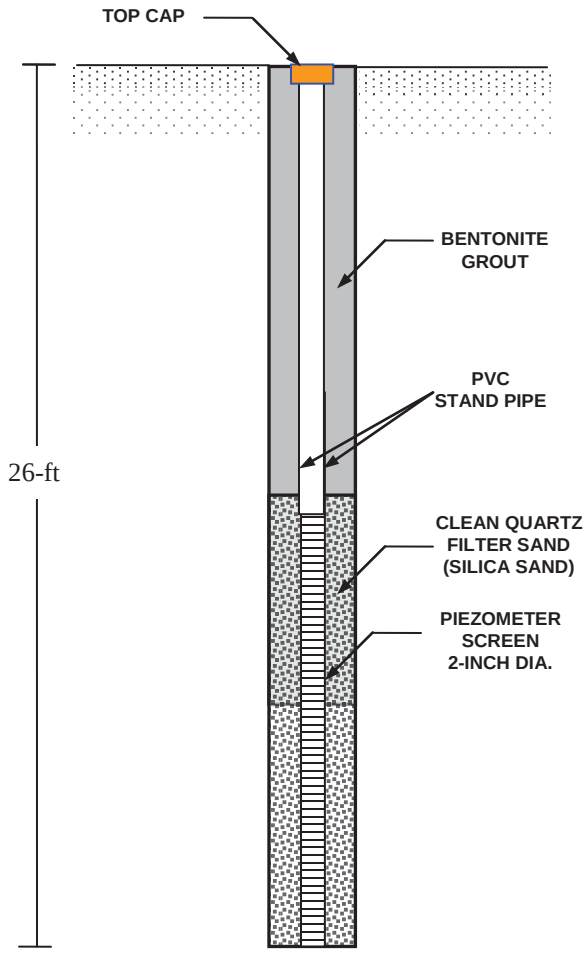
SUMMARY OF BORING INFORMATION

Boring No.	Alignment	Northing	Easting	Elevation	Station No.	Offset
B-1	E Friar Tuck Lane	13846149.31	3088458.66	61.20	2+31.23	0.35 LT
B-2	E Friar Tuck Lane	13846662.43	3088446.13	62.64	7+44.73	0.27 RT
B-3	Sandrigham Drive	13847212.44	3088463.13	63.27	1+99.94	27.51 LT
B-4	Buckingham Drive	13846041.72	3089134.94	60.40	1+47.28	7.23 LT
B-5	Buckingham Drive	13846498.94	3089105.74	62.30	6+13.21	1.64 RT
B-6	Buckingham Drive	13847235.21	3089103.29	62.25	13+49.36	11.53 LT
B-7	Memorial Drive	13847796.56	3089421.89	61.88	1+80.97	5.33 LT
B-8	Memorial Drive	13847687.33	3089764.66	61.89	5+40.90	3.02 LT
B-9	Memorial Drive	13847286.45	3090356.28	61.42	12+58.96	1.78 RT
B-10	Memorial Drive	13846846.44	3090697.62	60.18	18+18.53	5.40 RT
B-11	Memorial Drive	13846517.49	3090810.96	60.04	21+70.73	6.68 RT
B-12	Memorial Drive	13845995.07	3090900.11	60.29	27+01.21	15.59 RT
B-13	Memorial Drive	13845672.13	3091373.26	59.29	32+93.57	11.82 RT
B-14	Memorial Drive	13845696.03	3092025.00	58.76	39+45.71	5.91 RT
B-15	Stablecrest Blvd.	13845091.78	3091306.83	58.39	9+94.96	67.43 LT
B-16	Stablecrest Blvd.	13845050.68	3090854.80	60.50	5+56.05	72.32 LT
B-17	Stable Lane	13844896.44	3090308.82	54.90	1+76.99	13.40 LT
B-18	Stable Lane	13844329.98	3090069.39	58.13	2+82.30	0.03 LT
B-19	N Post Oak Lane	13845174.33	3092123.35	60.87	25+59.98	2.73 LT
B-20	N Post Oak Lane	13844539.35	3092153.84	61.46	19+24.19	2.98 LT
B-21	N Post Oak Lane	13843878.03	3092186.31	61.78	12+62.01	1.12 LT
B-22	N Post Oak Lane	13843410.85	3092208.64	61.33	7+94.25	0.04 LT
B-23	N Post Oak Lane	13843155.73	3092219.92	60.26	5+38.86	1.72 LT
B-24	Woodway Drive	13842699.82	3092133.58	45.30	36+53.60	51.59 LT
B-25	Woodway Drive	13842437.08	3091749.13	45.38	31+80.68	52.83 LT
B-26	Woodway Drive	13842274.57	3091285.09	46.58	26+70.15	55.64 LT
B-27	Woodway Drive	13842122.30	3090907.80	45.97	22+72.91	45.96 LT
B-28	Woodway Drive	13841826.17	3090590.68	48.40	18+28.51	31.45 LT
B-29	Woodway Drive	13841826.17	3090135.67	53.25	13+10.32	19.70 LT
B-30	Woodway Drive	13841652.10	3089498.03	55.93	6+60.75	47.95 LT
B-31	Sage Road	13842395.88	3089001.68	53.89	7+04.15	1.25 RT
B-32	Sage Road	13842765.02	3088989.23	54.67	10+73.54	0.78 RT
B-33	Bayou Timber Ln.	13843409.14	3089063.95	51.29	1+42.28	40.18 LT
B-34	Bayou Timber Ln.	13843704.44	3089517.22	38.09	8+41.39	25.01 LT

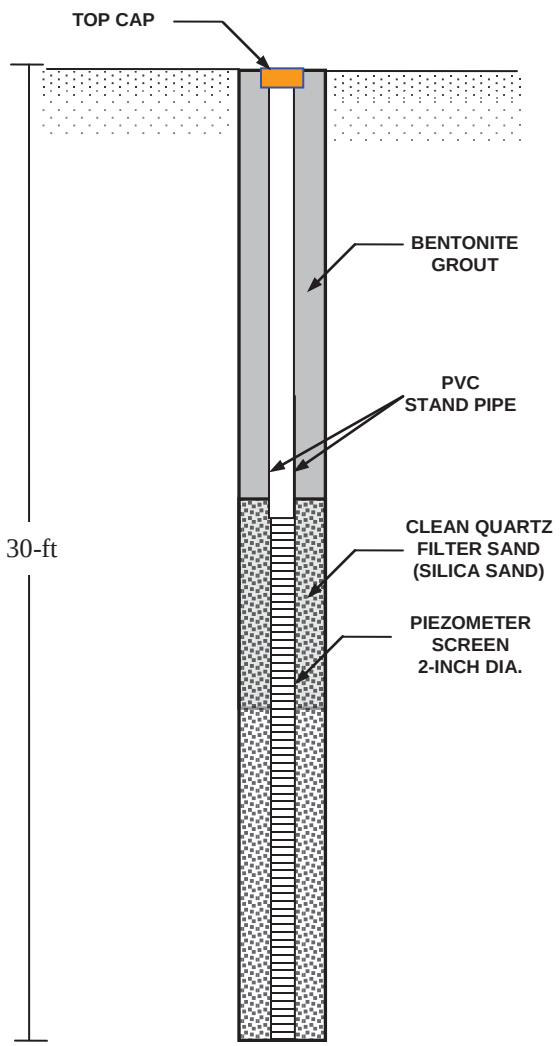
PIEZOMETER INSTALLATION DATA

Piezometer No.	Boring No.	Top of Riser-Height, ft	Piezometer Tip		Depth to Filter Sand, ft.		Bentonite Grout, ft.	
			Depth, ft[(1)]	Screen Length, ft.	Top	Bottom	Top	Bottom
PZ-1	B-6	0.00	26.00	10.00	16.00	26.00	0.00	16.00
PZ-2	B-11	0.00	30.00	10.00	20.00	30.00	0.00	20.00
PZ-3	B-18	0.00	30.00	10.00	20.00	30.00	0.00	20.00
PZ-4	B-19	0.00	30.00	10.00	20.00	30.00	0.00	20.00
PZ-5	B-24	0.00	30.00	10.00	20.00	30.00	0.00	20.00
PZ-6	B-30	0.00	30.00	10.00	20.00	30.00	0.00	20.00

Note: (1) Depth is referenced from the existing ground surface.



Piezometer PZ-1



Piezometers PZ-2 through PZ-6

Note: Drawing is not to scale.

PIEZOMETER READING TABLE

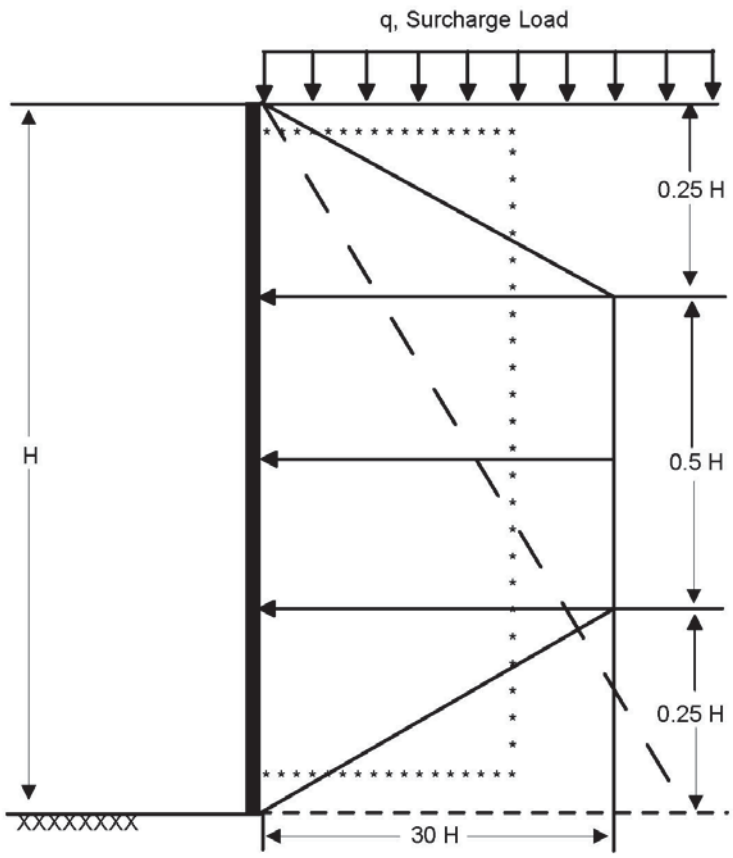
Piezometer No./Depth	Groundwater Depth During Drilling from Ground Surface, ft.	Piezometric Level, ft.					
		December 10, 2012			December 26, 2012		
		Before Bailing	After Bailing		Before Bailing	After Bailing	
			Time (Min.)	Depth		Time (Min.)	Depth
PZ-1 (26') Boring B-6	Dry	Dry	1	Dry	Dry	1	Dry
			2	Dry		2	Dry
			5	Dry		5	Dry
			10	Dry		10	Dry
			20	Dry		20	Dry
			30	Dry		30	Dry
			60	Dry		60	Dry
PZ-2 (30') Boring B-11	25' 0"	26' 0"	1	27' 5"	25' 5"	1	27' 6"
			2	26' 11"		2	27' 2"
			5	26' 5"		5	26' 11"
			10	26' 2"		10	26' 5"
			20	26' 0"		20	25' 11"
			30	26' 0"		30	25' 6"
			60	26' 0"		60	25' 5"

Piezometer No./Depth	Groundwater Depth During Drilling from Ground Surface, ft.	Piezometric Level, ft.					
		July 16, 2013			July 31, 2013		
		Before Bailing	After Bailing		Before Bailing	After Bailing	
			Time (Min.)	Depth		Time (Min.)	Depth
PZ-3 (30') Boring B-18	Dry	Dry	1	Dry	Dry	1	Dry
			2	Dry		2	Dry
			5	Dry		5	Dry
			10	Dry		10	Dry
			20	Dry		20	Dry
			30	Dry		30	Dry
			60	Dry		60	Dry

Piezometer No./Depth	Groundwater Depth During Drilling from Ground Surface, ft.	Piezometric Level, ft.					
		December 18, 2012			January 02, 2013		
		Before Bailing	After Bailing		Before Bailing	After Bailing	
			Time (Min.)	Depth		Time (Min.)	Depth
PZ-4 (30') Boring B-19	27' 0"	Dry	1	Dry	Dry	1	Dry
			2	Dry		2	Dry
			5	Dry		5	Dry
			10	Dry		10	Dry
			20	Dry		20	Dry
			30	Dry		30	Dry
			60	Dry		60	Dry
PZ-5 (30') Boring B-24	28' 0"	Dry	1	Dry	Dry	1	Dry
			2	Dry		2	Dry
			5	Dry		5	Dry
			10	Dry		10	Dry
			20	Dry		20	Dry
			30	Dry		30	Dry
			60	Dry		60	Dry
PZ-6 (30') Boring B-30	25' 0"	25' 0"	Time (Min.)	Depth	23' 0"	Time (Min.)	Depth
			1	27' 1"		1	25' 5"
			2	26' 11"		2	24' 10"
			5	26' 7"		5	24' 7"
			10	26' 2"		10	24' 2"
			20	25' 8"		20	23' 8"
			30	25' 0"		30	23' 0"
			60	25' 0"		60	23' 0"

Note: Borings B-6, B-11, B-18, B-19, B-24 and B-30 were converted to Piezometers PZ-1 through P-6, respectively. The piezometer depths are shown in parenthesis.

LATERAL EARTH PRESSURE DIAGRAM



Legend:

——————— Braced Excavation (stiff clays)
* * * * * * * * * * * * * Braced Excavation (sands)
- - - - - - - - - - - - - - Cantilevered sheeting

Active Pressure:

(a) Braced Excavation (stiff clays) = 0.5q + 30H + 62.4H
(b) Braced Excavation (sands) = 0.4q + 18H + 62.4H
(c) Cantilevered sheeting = 0.7q + 42H + 62.4H

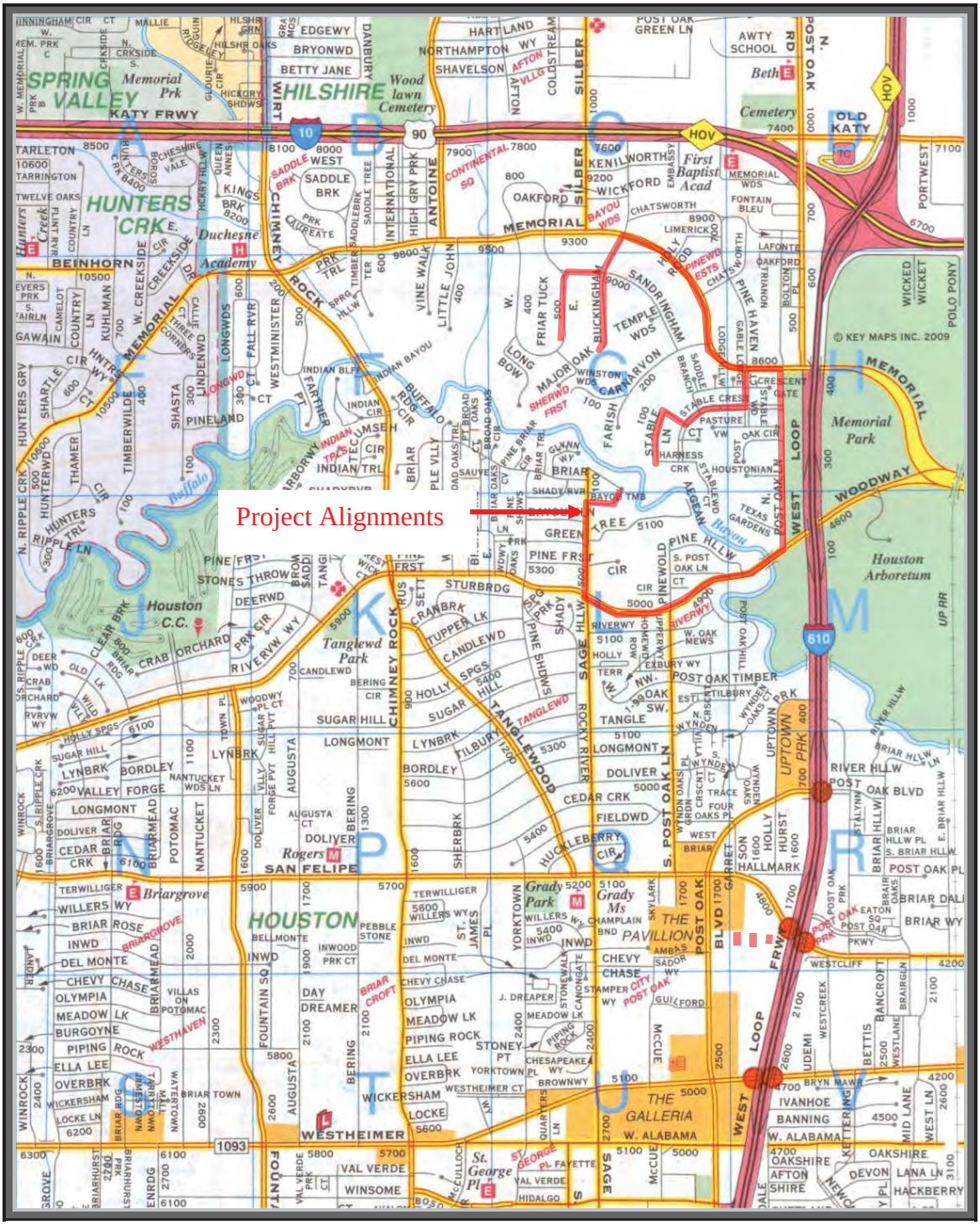
where: q = surcharge load, psf: A value of 250 psf can be assumed.
H = wall height, ft.

Notes:

1. The above Active Pressure Equations account for the groundwater at the surface.
2. The final lateral pressures should be reviewed prior to construction.
3. Trench excavation and construction should be observed by a geotechnical engineer.
4. The means and methods for a safe excavation is the responsibility of the contractor.
5. In case of layered soils, active pressure should be calculated based on the dominant or more critical soil conditions.

APPENDIX A

Site Vicinity Map
Plan of Borings
Soil Stratigraphy Profiles
Logs of Borings
Key to Log Terms and Symbols
Summary of the Laboratory Test Results



SITE VICINITY MAP

PROJECT: Prop. Pump and Lift Station Renewal/Rehabilitation – Post Oak Lane, Stablewood, Bayou Timber and Buckingham, WBS No. R-000267-0109-3, City of Houston, Texas

SCALE: NOT TO SCALE	DATE: AUGUST 2013	PROJECT NO.: 12-344E

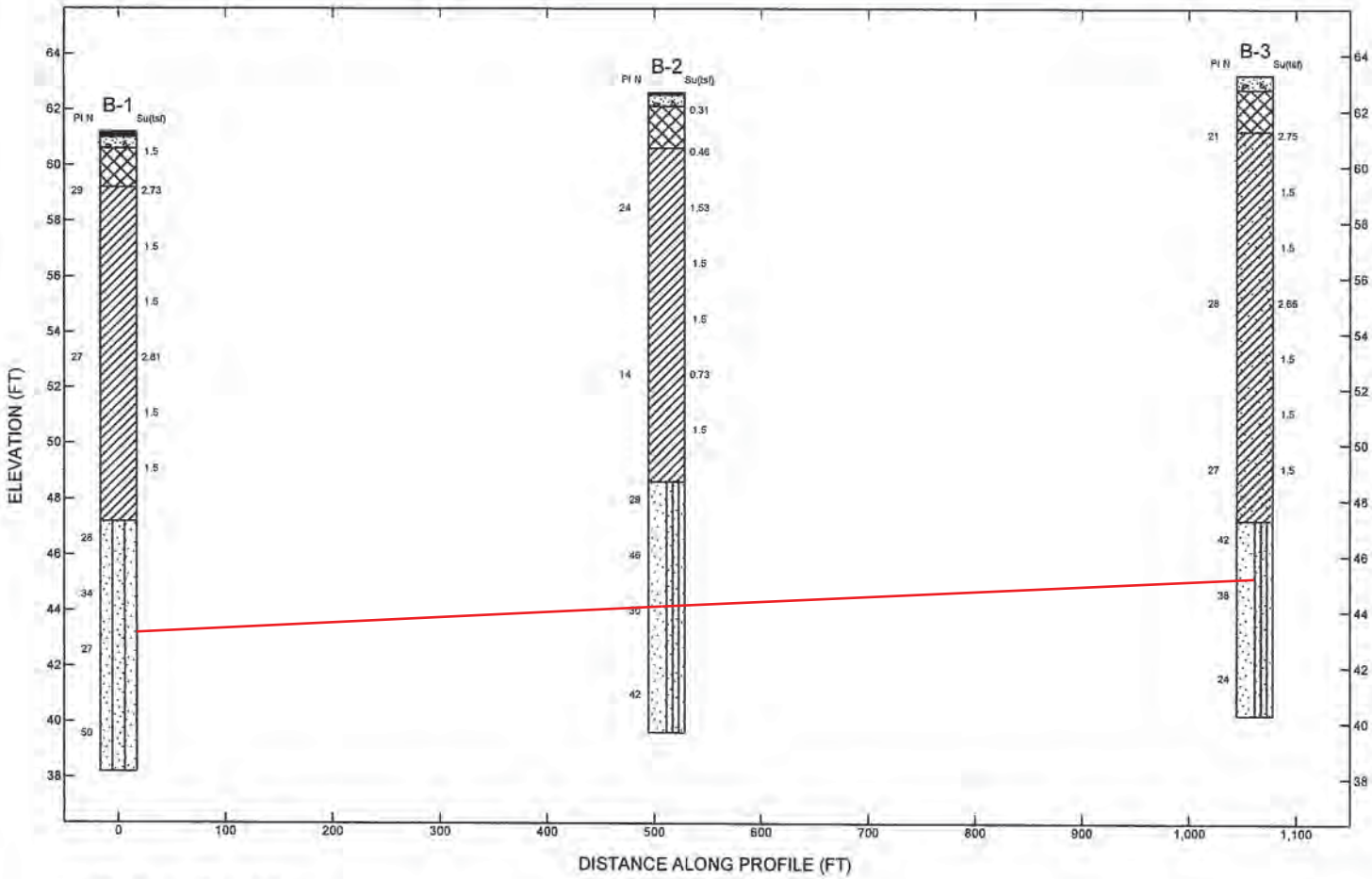
NORTH

PLAN OF BORINGS (borings dimensions and locations are approximate)

PROJECT: Prop. Pump and Lift Station Renewal/Rehabilitation – Post Oak Lane, Stablewood, Bayou Timber and Buckingham, WBS No. R-000267-0109-3, City of Houston, Texas

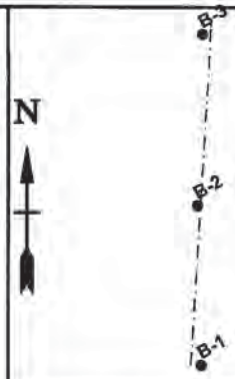
SCALE: NOT TO SCALE	DATE: AUGUST 2013	PROJECT NO.: 12-344E

NORTH



Lithology Graphics

- Asphalt
- Concrete
- Fill
- Lean Clay (CL)
- Silty Sand (SM)
- Poorly-graded Sand with Silt (SP-SM)
- Lean Clay with Sand (CL)



Site Map Scale 1 inch equals 620 feet

Explanation

B-1 — Borehole Number

Borehole Lithology

Water Level Reading at time of drilling.

Water Level Reading after drilling.

0 169

Horizontal Scale

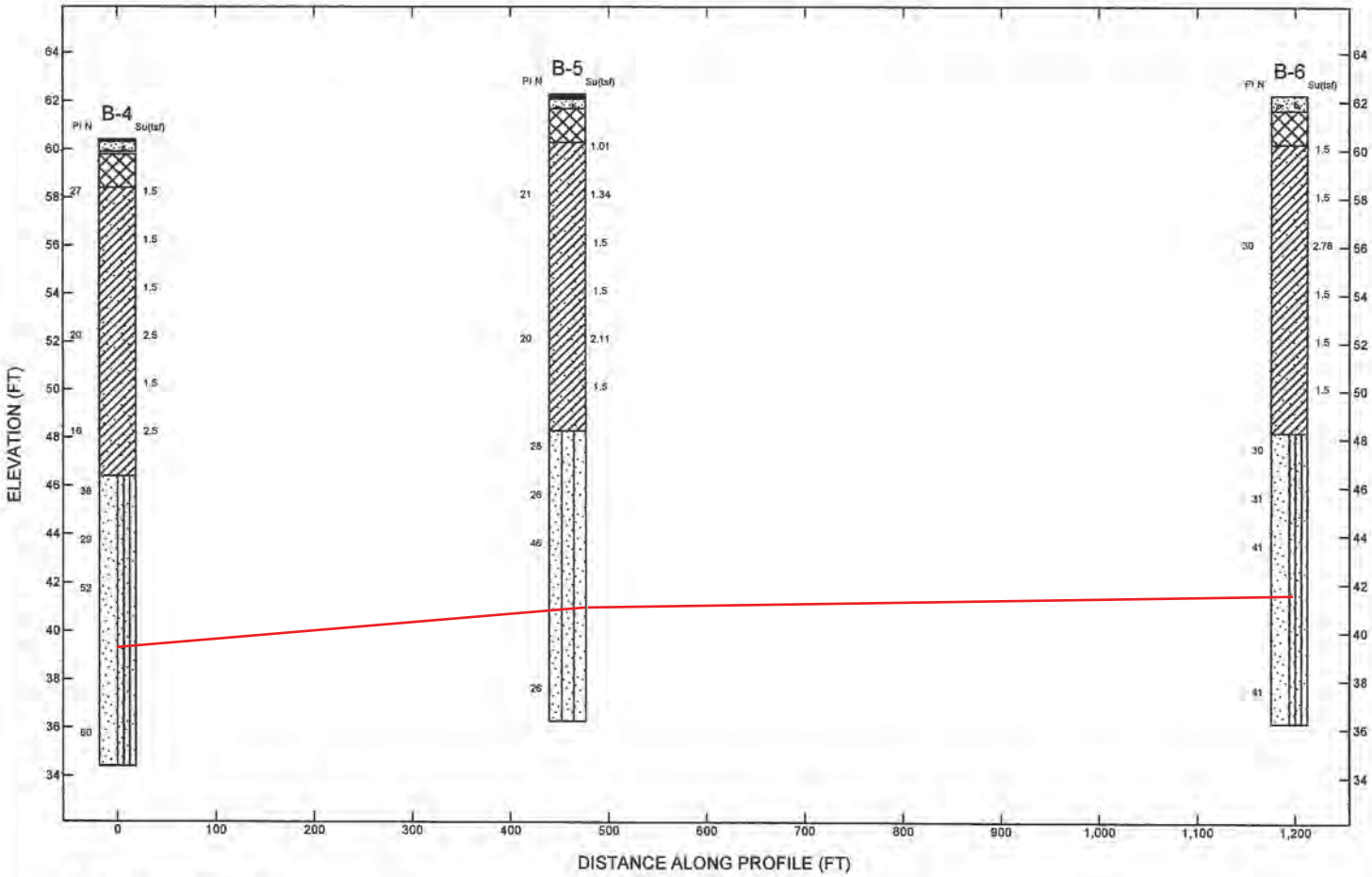
Vertical Exaggeration: 26x

Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022

Proposed Pump and Lift Station Renewal/Rehabilitation

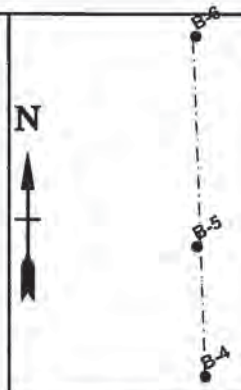
City of Houston, Texas

JOB NUMBER	PLATE NUMBER
R-000267-0109-3	PLATE A-3



Lithology Graphics

- Asphalt
- Concrete
- Fill
- Lean Clay with Sand (CL)
- Poorly-graded Sand with Silt (SP-SM)
- Silty Sand (SM)



Site Map Scale 1 inch equals 675 feet

Explanation

B-4 — Borehole Number

Borehole Lithology

Water Level Reading at time of drilling.

Water Level Reading after drilling.

0 — 185

Horizontal Scale

Vertical Exaggeration: 24.5x

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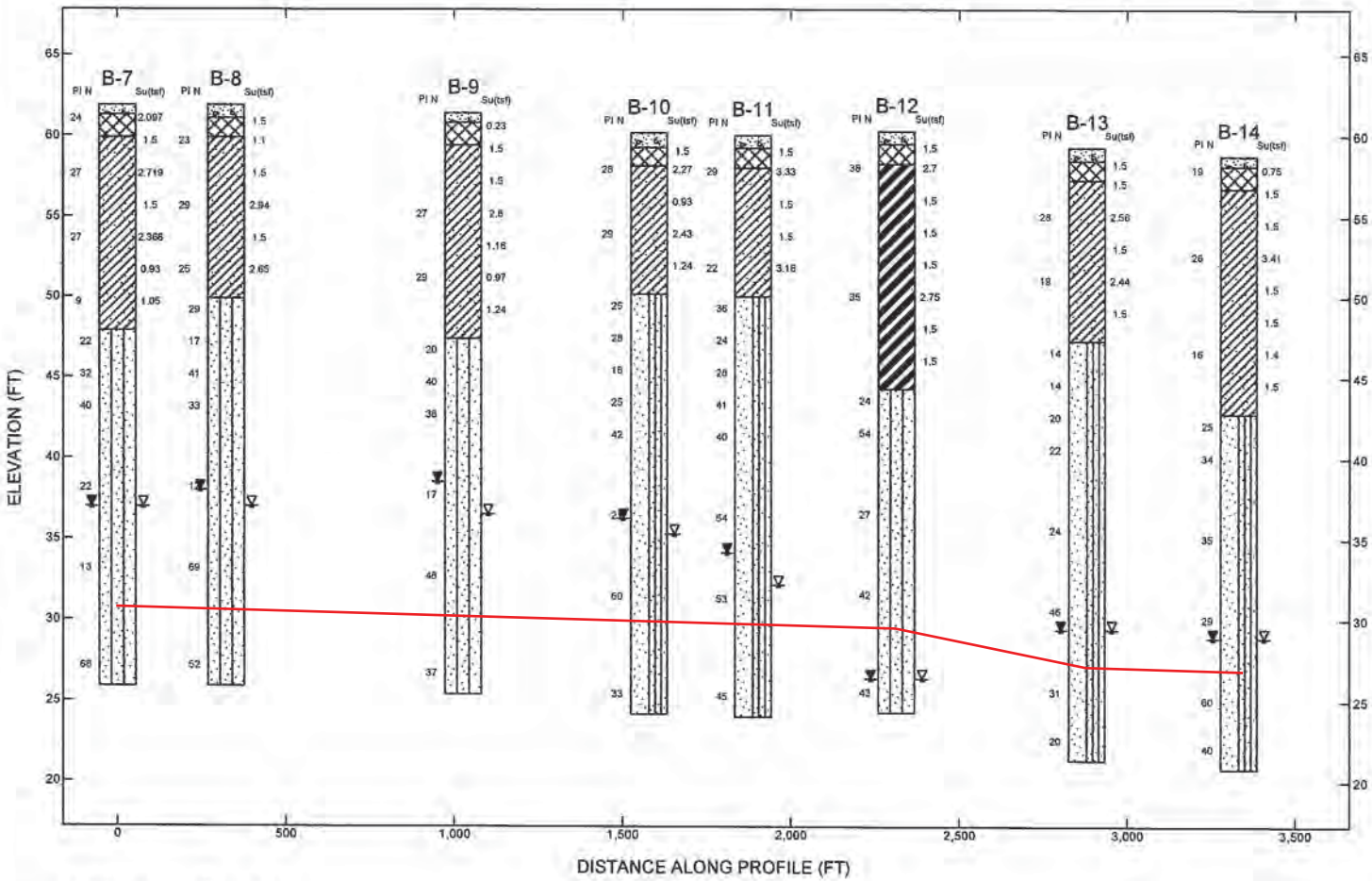
Houston, Texas 77022

Proposed Pump and Lift Station Renewal/Rehabilitation

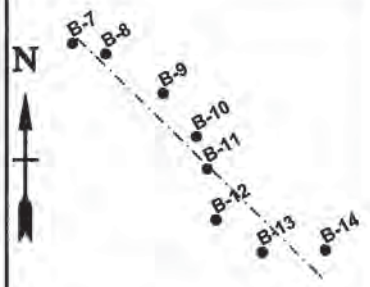
City of Houston, Texas

JOB NUMBER	PLATE NUMBER
R-000267-0109-3	PLATE A-4



Lithology Graphics

- Concrete
- Fill
- Lean Clay with Sand (CL)
- Poorly-graded Sand with Silt (SP-SM)
- Fat Clay (CH)
- Silty Sand (SM)



Site Map Scale 1 inch equals 1,975 feet

Explanation

B-10 — Borehole Number

Borehole Lithology

Water Level Reading at time of drilling.

Water Level Reading after drilling.

0 — 538

Horizontal Scale

Vertical Exaggeration: 48x

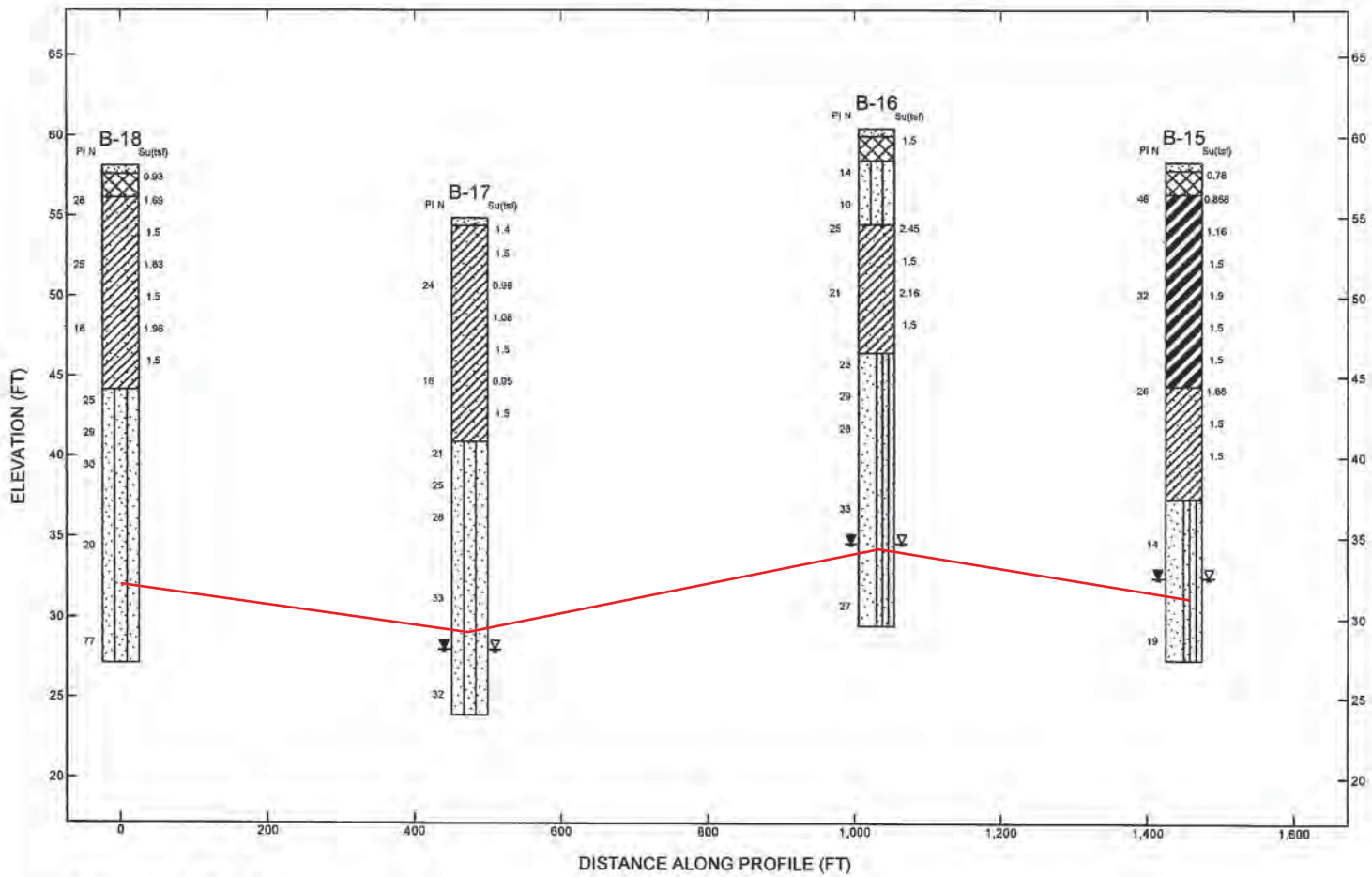
Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022

Proposed Pump and Lift Station Renewal/Rehabilitation

GET GEOTECH ENGINEERING & TESTING

City of Houston, Texas

JOB NUMBER	PLATE NUMBER
R-000267-0109-3	PLATE A-5



Lithology Graphics

- Concrete
- Fill
- Fat Clay (CH)
- Lean Clay with Sand (CL)
- Poorly-graded Sand with Silt (SP-SM)
- Silty Sand (SM)

Site Map Scale 1 inch equals 905 feet

Explanation

B-15 — Borehole Number

Borehole Lithology

Water Level Reading at time of drilling.

Water Level Reading after drilling.

0 — 246

Horizontal Scale

Vertical Exaggeration: 22x

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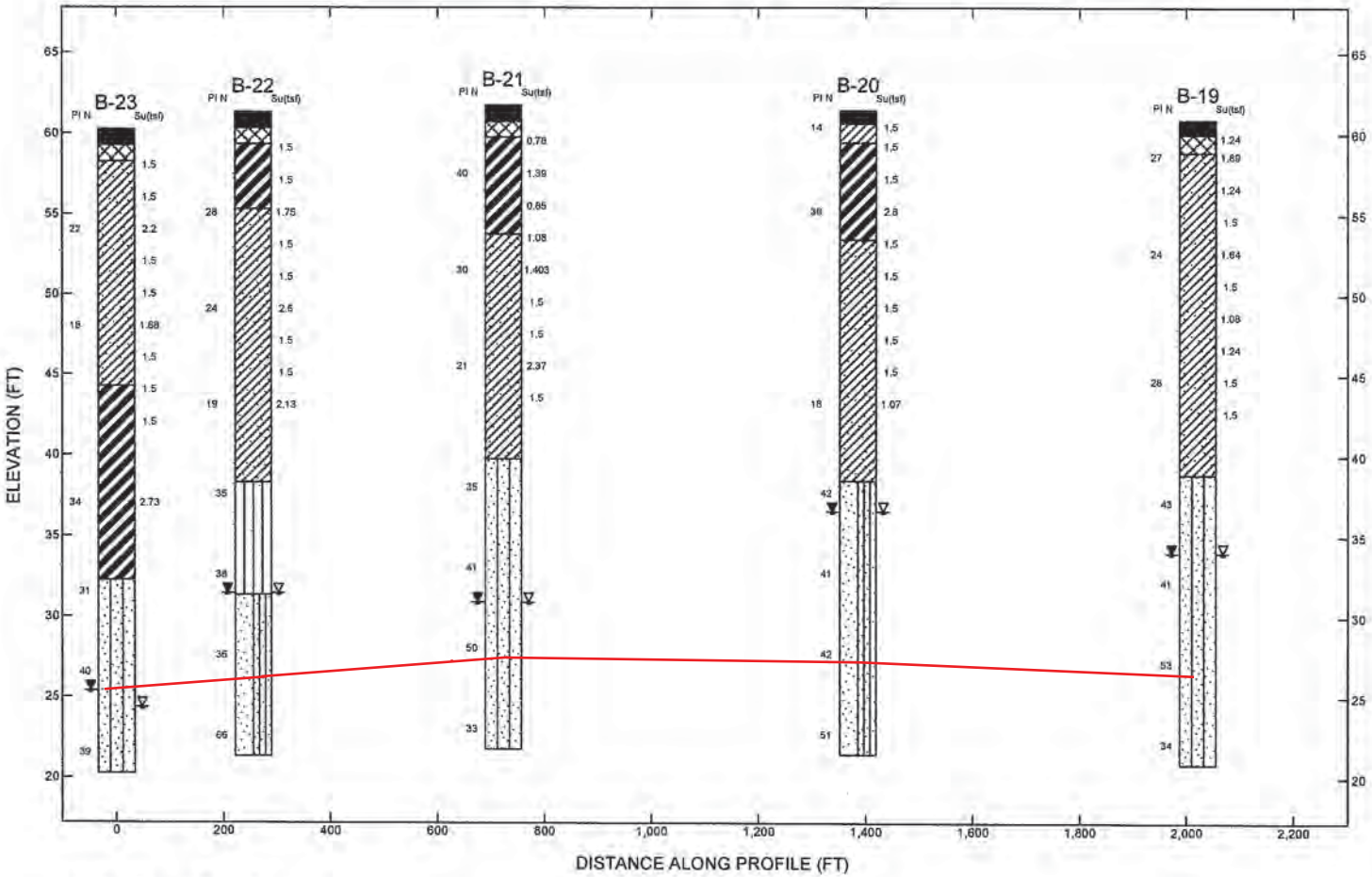
Proposed Pump and Lift Station Renewal/Rehabilitation

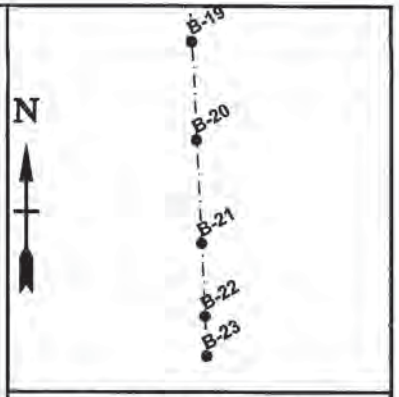
City of Houston, Texas

JOB NUMBER	PLATE NUMBER
R-000287-0109-3	PLATE A-6



Lithology Graphics

- Asphalt
- Fill
- Lean Clay with Sand (CL)
- Silty Sand (SM)
- Lean Clay (CL)
- Fat Clay (CH)
- Poorly-graded Sand with Silt (SP-SM)
- Sandy Silt (ML)



Site Map Scale 1 inch equals 1,240 feet

Explanation

B-19 — Borehole Number

Borehole Lithology

Water Level Reading at time of drilling.

Water Level Reading after drilling.

0 — 338

Horizontal Scale

Vertical Exaggeration: 30x

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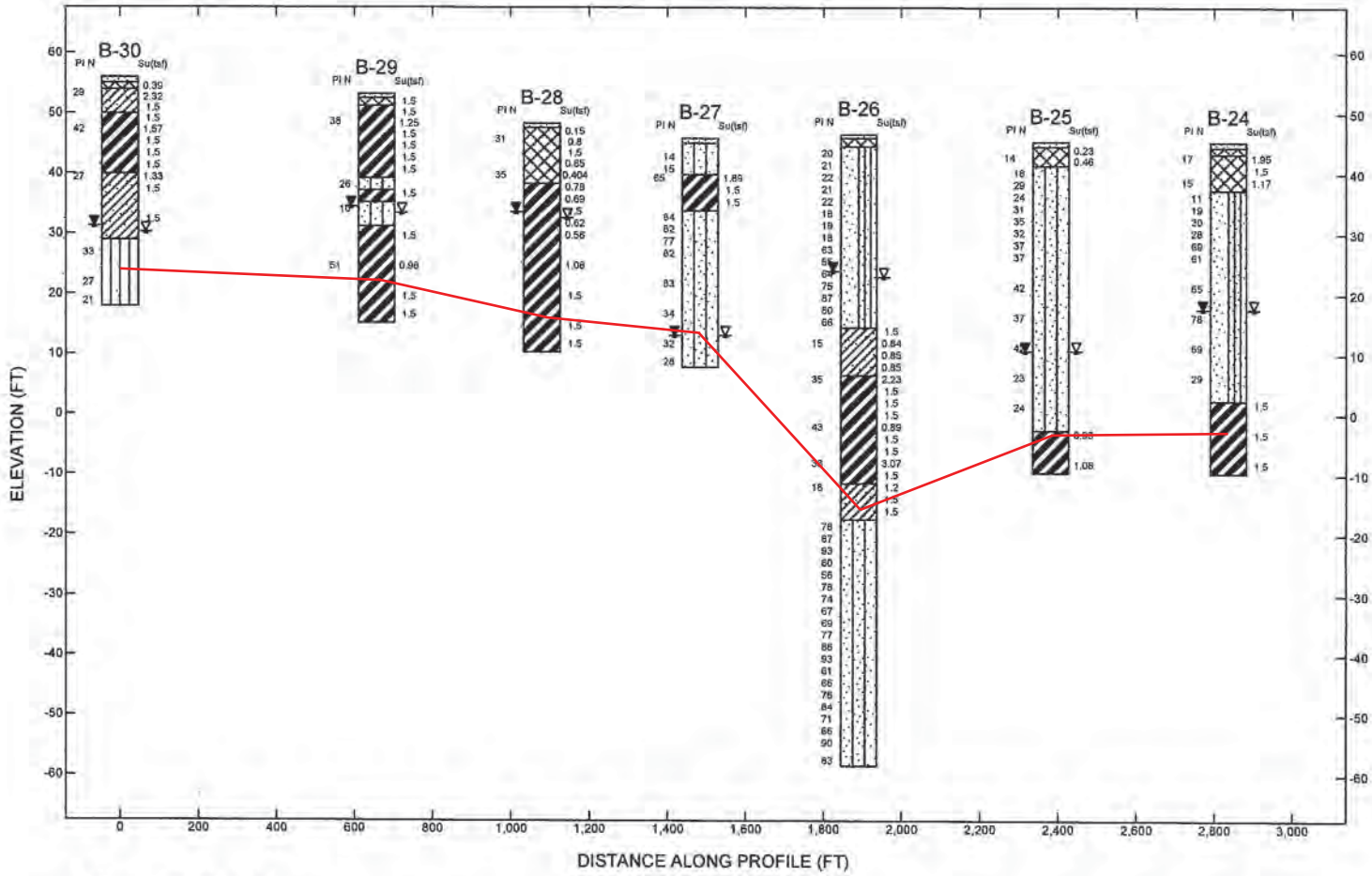
Houston, Texas 77022

Proposed Pump and Lift Station Renewal/Rehabilitation

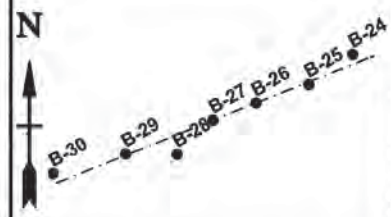
City of Houston, Texas

JOB NUMBER	PLATE NUMBER
R-000267-0109-3	PLATE A-7



Lithology Graphics

- Concrete
- Fill
- Poorly-graded Sand with Silt (SP-SM)
- Fat Clay (CH)
- Silty Sand (SM)
- Lean Clay with Sand (CL)
- Sandy Silt (ML)



Site Map Scale 1 inch equals 1,690 feet

Explanation

B-24 — Borehole Number

Borehole Lithology

Water Level Reading at time of drilling.

Water Level Reading after drilling.

0 — 462

Horizontal Scale

Vertical Exaggeration: 15.5x

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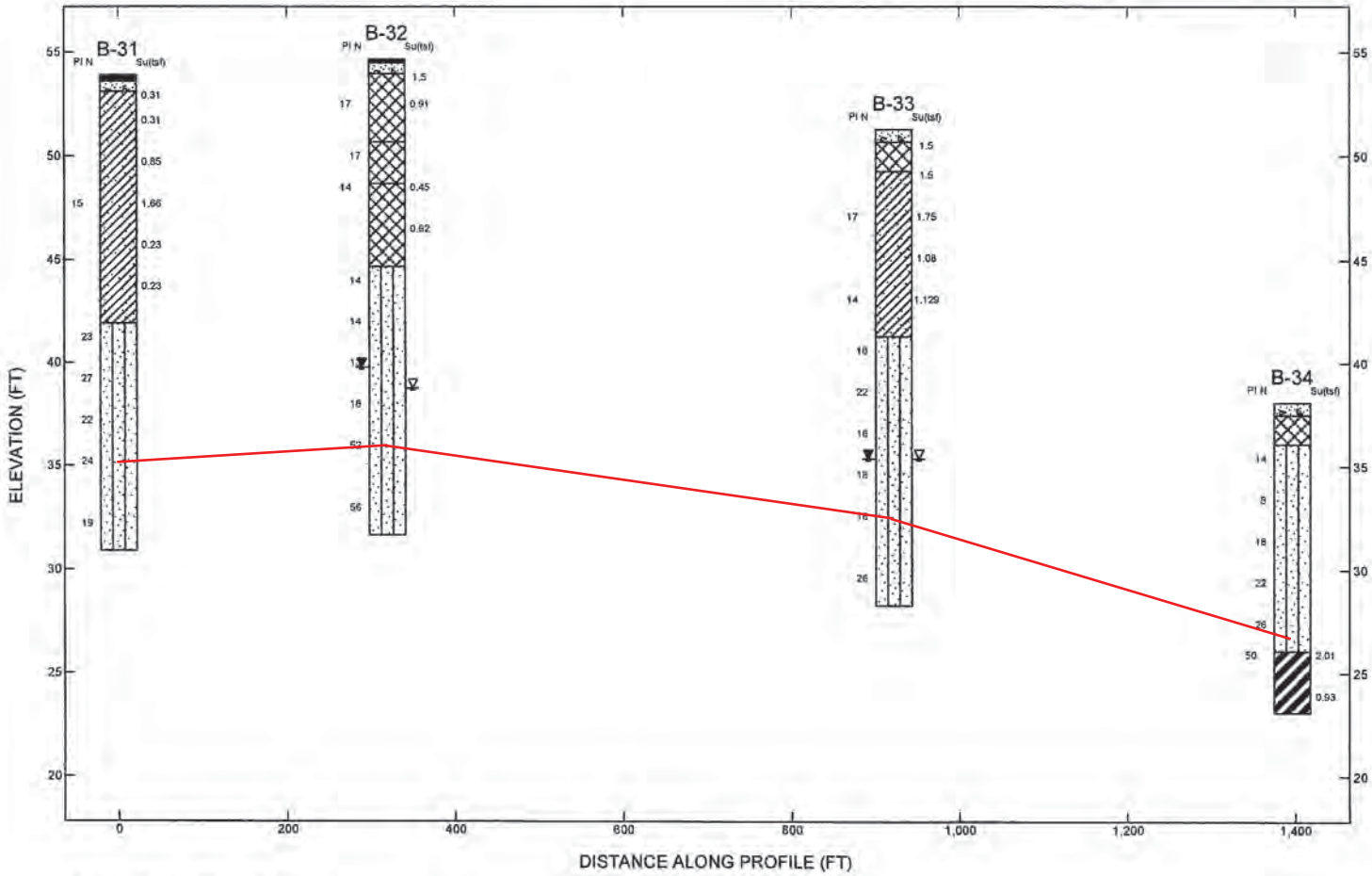
Proposed Pump and Lift Station Renewal/Rehabilitation

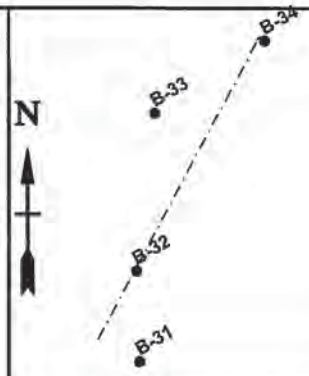
City of Houston, Texas

JOB NUMBER	PLATE NUMBER
R-000267-0109-3	PLATE A-8



Lithology Graphics

- Asphalt
- Concrete
- Lean Clay with Sand (CL)
- Silty Sand (SM)
- Fill
- Fat Clay (CH)



Site Map Scale 1 inch equals 790 feet

Explanation

B-31 — Borehole Number

Borehole Lithology

Water Level Reading at time of drilling.

Water Level Reading after drilling.

0 — 215

Horizontal Scale

Vertical Exaggeration: 24.5x

Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022

Proposed Pump and Lift Station Renewal/Rehabilitation

City of Houston, Texas

JOB NUMBER	PLATE NUMBER
R-000267-0109-3	PLATE A-9

LOG OF BORING NO. B-1

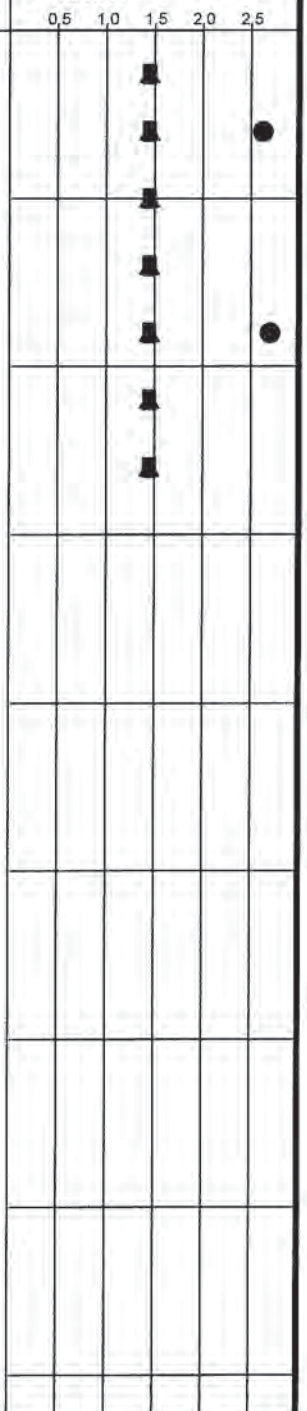
Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 2+31.23
DATE: 11-5-12 COMPLETION DEPTH: 23.0 ft.

ELEVATION: 61.20
NORTHING: 13846149.31
EASTING: 3088458.66
OFFSET: 0.35 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					ASPHALT PAVEMENT (1.2")									
					CONCRETE PAVEMENT (4.7")	17								
					FILL: LEAN CLAY (CL), very stiff, light brown, with root fibers, ferrous nodules	14	48	19	29			120		
					LEAN CLAY (CL), hard, light brown, with root fibers to 4', ferrous and calcareous nodules									
5					- very stiff 4' to 8'	15								
						15								
						9	45	18	27	86		127		
10					- very stiff 10' to 14'	17								
						12								
15	28				SILTY SAND (SM), medium dense, light brown	5				15				
					- dense 16' to 18'									
	34					6								
	27					6								
20					- dense 21 to 23'									
	50					4								
25														
30														
35														
40														

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL



WATER OBSERVATIONS:
NO FREE WATER ENCOUNTERED DURING DRILLING AND 24 HOURS AFTER DRILLING.

DRY AUGER: 0 TO 23 ft.
WET ROTARY: ___ TO ___ ft.

DRILLED BY: Orion
LOGGED BY: George

OVM2 12-344E.GPJ OVM.GDT 8/16/13

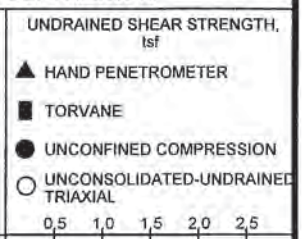
LOG OF BORING NO. B-2

Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 7+44.73
DATE: 11-5-12 COMPLETION DEPTH: 23.0 ft.

ELEVATION: 62.64
NORTHING: 13846662.43
EASTING: 3088446.13
OFFSET: 0.27 RT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0			ASPHALT PAVEMENT (1.0")									
			CONCRETE PAVEMENT (4.8")	28								
			FILL: LEAN CLAY (CL), firm, light brown, with root fibers, ferrous nodules	22								
			LEAN CLAY (CL), firm, light brown, with root fibers to 4', ferrous nodules									
5			- very stiff 4' to 10'	16	40	16	24	89		118		
				18								
				16								
10			- stiff 10' to 12'	13	29	15	14			113		
			- very stiff 12' to 14'	6								
15	29		POORLY GRADED SAND WITH SILT (SP-SM), medium dense, light brown	6								
	46		- dense 16' to 18'	7								
20	30			6				7				
	42		- dense 21' to 23'	5								
25												
30												
35												
40												



WATER OBSERVATIONS:
NO FREE WATER ENCOUNTERED DURING DRILLING AND 24 HOURS AFTER DRILLING.

DRY AUGER: 0 TO 23 ft.
WET ROTARY: ___ TO ___ ft.

DRILLED BY: Orion
LOGGED BY: George

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-3

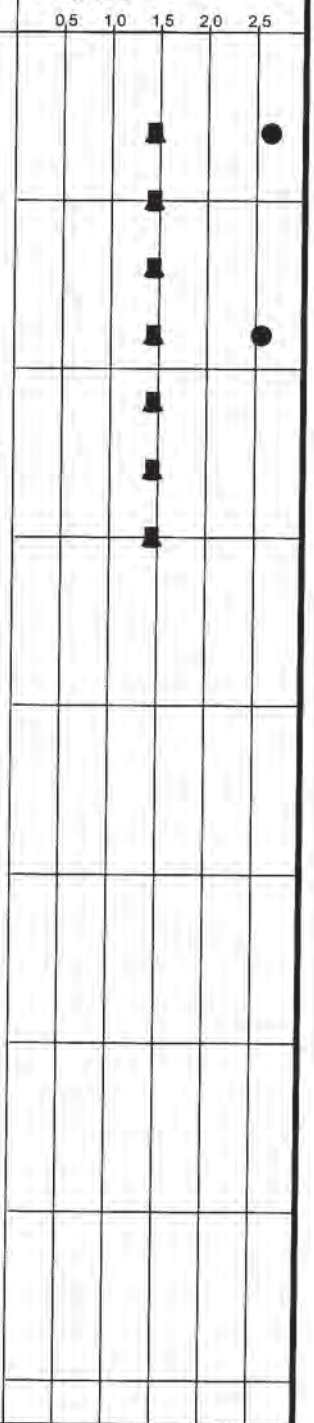
Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 1+99.94
DATE: 11-2-13 COMPLETION DEPTH: 23.0 ft.

ELEVATION: 63.27
NORTHING: 13847212.44
EASTING: 3088463.13
OFFSET: 27.51 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					CONCRETE PAVEMENT (5.5")									
					FILL: SILTY SAND (SM), light brown, with root fibers	3								
					LEAN CLAY WITH SAND (CL), hard, light brown, with root fibers to 4', ferrous and calcareous nodules	9	37	16	21			111		
5					- very stiff 4' to 8'	9								
						11								
						10	46	18	28	83		126		
10					- very stiff 10' to 16'	10								
						15								
15						17	44	17	27	81		123		
	42				POORLY GRADED SAND WITH SILT (SP-SM), dense, light brown	5								
	38					2								
20					- medium dense 21' to 23'									
	24					7				5				
25														
30														
35														
40														

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL



WATER OBSERVATIONS:
NO FREE WATER ENCOUNTERED DURING DRILLING AND 24 HOURS AFTER DRILLING.

DRY AUGER: 0 TO 23 ft.
WET ROTARY: ___ TO ___ ft.

DRILLED BY: Orion
LOGGED BY: George

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-4

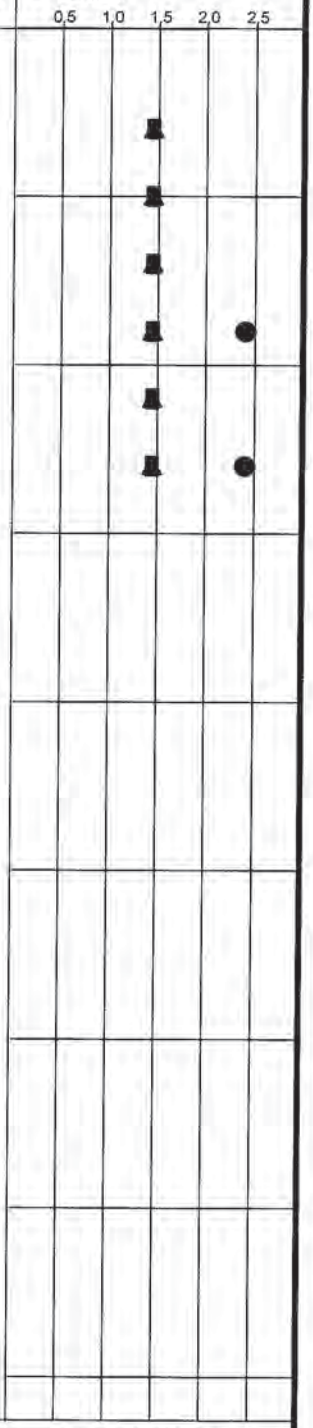
Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 1+47.28
DATE: 11-2-12 COMPLETION DEPTH: 26.0 ft.

ELEVATION: 60.40
NORTHING: 13846041.72
EASTING: 3089134.94
OFFSET: 7.23 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					ASPHALT PAVEMENT (1.0")									
					CONCRETE PAVEMENT (5.5")	13								
					FILL: SILTY SAND (SM), light brown, with root fibers									
					LEAN CLAY WITH SAND (CL), very stiff, light brown, with root fibers to 4', ferrous nodules	19	46	19	27	82		114		
5						16								
						13								
					- hard 8' to 10'	12	37	17	20			120		
10						14								
					- hard 12' to 14'	15	36	18	18	85		117		
15	38				POORLY GRADED SAND WITH SILT (SP-SM), dense, light brown	6								
					- medium dense 16' to 18'									
	29					6								
					- very dense 18' to 26'									
	52					6				12				
20														
25	60					3								
30														
35														
40														

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL



WATER OBSERVATIONS:
NO FREE WATER ENCOUNTERED DURING DRILLING AND 24 HOURS AFTER DRILLING.

DRY AUGER: 0 TO 26 ft.
WET ROTARY: ___ TO ___ ft.

DRILLED BY: Orion
LOGGED BY: George

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-5

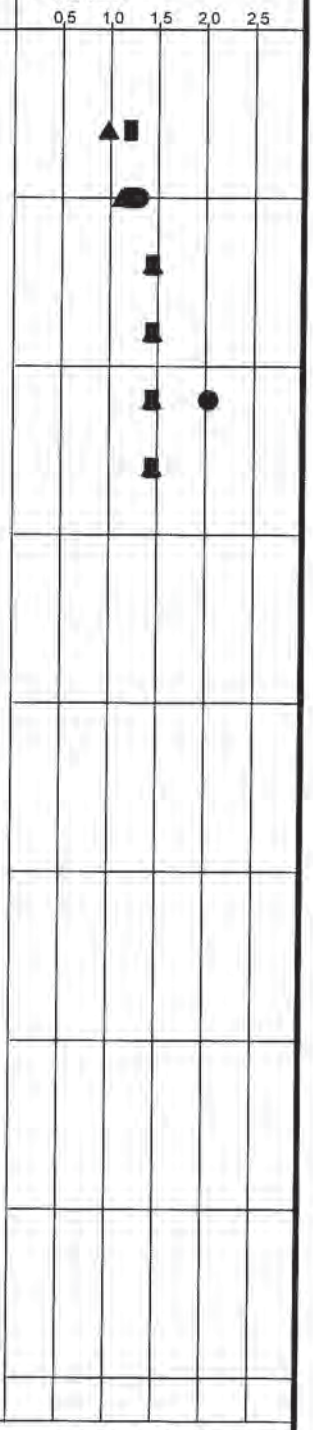
Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 6+13.21
DATE: 11-2-12 COMPLETION DEPTH: 26.0 ft.

ELEVATION: 62.30
NORTHING: 13846498.94
EASTING: 3089105.74
OFFSET: 1.64 RT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					ASPHALT PAVEMENT (1.4")									
					CONCRETE PAVEMENT (4.5")	14				66				
					FILL: SAND SILT (ML), light brown, with root fibers	21								
5					LEAN CLAY WITH SAND (CL), very stiff, light brown, with root fibers to 4', ferrous and calcareous nodules	17	38	17	21			111		
						16								
						15								
10					- hard 10' to 12'	17	37	17	20	78		113		
						20								
15	28				SILTY SAND (SM), medium dense, light brown	14								
	26					9								
20	46				- dense 18' to 20'	7				19				
25	26					6								
30														
35														
40														

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL



WATER OBSERVATIONS:
NO FREE WATER ENCOUNTERED DURING DRILLING AND 24 HOURS AFTER DRILLING.

DRY AUGER: 0 TO 26 ft.
WET ROTARY: ___ TO ___ ft.

DRILLED BY: Orion
LOGGED BY: George

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-6

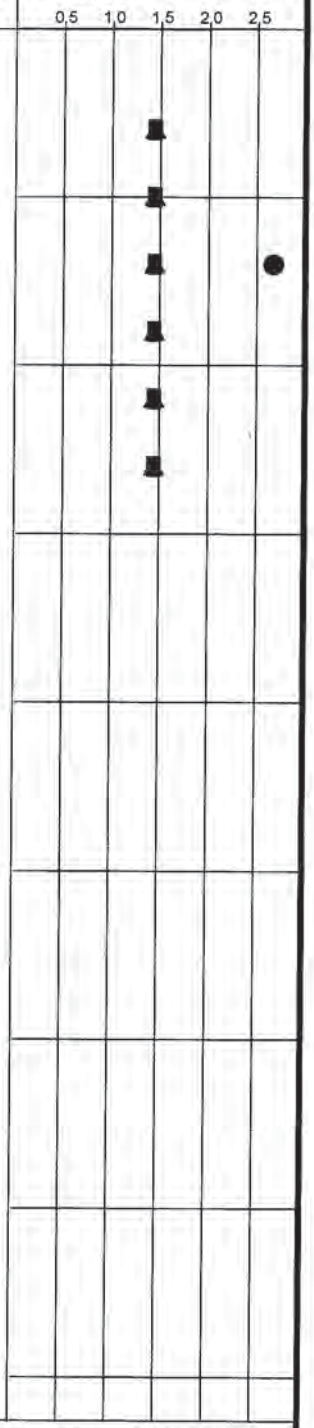
Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 13+49.36
DATE: 11-26-12 COMPLETION DEPTH: 26.0 ft.

ELEVATION: 62.25
NORTHING: 13847235.21
EASTING: 3089103.29
OFFSET: 11.53 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					CONCRETE PAVEMENT (6.6")									
					FILL: SANDY SILT (ML), light brown, with root fibers	4								
					LEAN CLAY WITH SAND (CL), very stiff, brown, reddish brown, with root fiber to 4', ferrous and calcareous nodules	9								
5						9								
					- hard 6' to 8'	8	48	18	30	84		120		
						10								
10						13								
						12								
15	30				POORLY GRADED SAND WITH SILT (SP-SM), medium dense, light brown	6								
					- dense 16' to 26'									
	31					4				12				
	41					5								
20														
25	41					5								
30														
35														
40														

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL



WATER OBSERVATIONS:
NO FREE WATER ENCOUNTERED DURING DRILLING AND 24 HOURS AFTER DRILLING.

DRY AUGER: 0 TO 26 ft.
WET ROTARY: ___ TO ___ ft.

DRILLED BY: Van&Sons
LOGGED BY: Paz

OVM2 12-344E.GPJ OVM.GDT 8/16/13

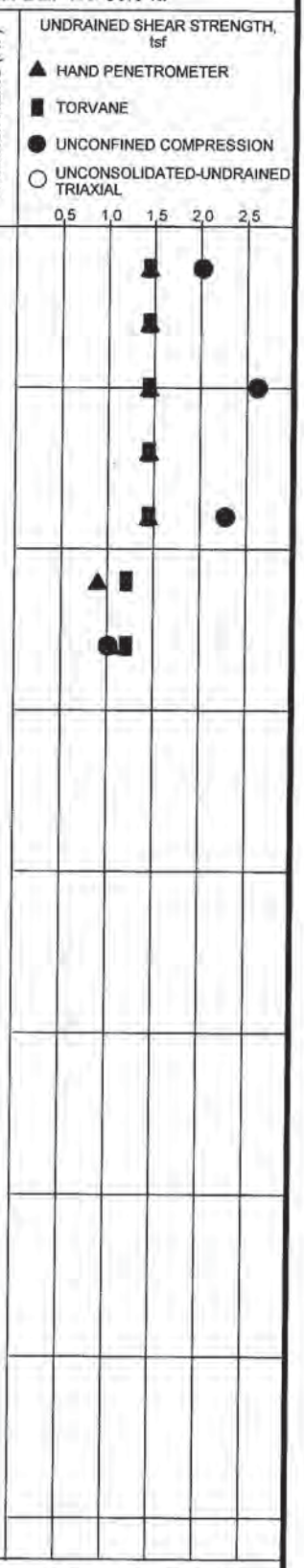
LOG OF BORING NO. B-7

Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 1+80.97
DATE: 11-5-12 COMPLETION DEPTH: 36.0 ft.

ELEVATION: 61.88
NORTHING: 13847796.56
EASTING: 3089421.89
OFFSET: 5.33 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					CONCRETE PAVEMENT (7.0")									
					FILL: LEAN CLAY WITH SAND (CL), hard, brown, with root fibers	12	42	18	24			123		
					LEAN CLAY WITH SAND (CL), very stiff, brown, with root fibers to 4', ferrous and calcareous nodules	12								
5					- hard 4' to 6'	12	45	18	27	78		120		
					- gray 6' to 10'	20								
					- hard 8' to 10'	15	45	18	27			115		
10					- stiff 10' to 12'	14								
						11	24	15	9			119		
15	22				SILTY SAND (SM), medium dense, gray, light brown	12								
	32				- dense 16' to 20'	12								
20	40					8				15				
25	22					20								
30	13					23								
35	68				- very dense 34' to 36'	22								
40														



WATER OBSERVATIONS:
▽ : WATER ENCOUNTERED AT 25.0 ft. DURING DRILLING
▼ : WATER DEPTH AT 25.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 25 ft.
WET ROTARY: 25 TO 36 ft.

DRILLED BY: Orion
LOGGED BY: George

OVM2 12-344E.GPJ OVM.GDT 8/16/13

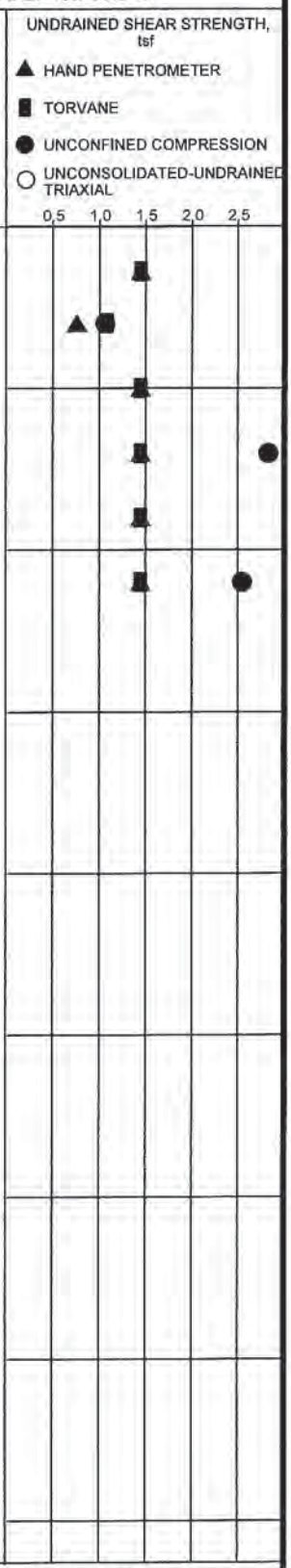
LOG OF BORING NO. B-8

Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 5+40.90
DATE: 11-7-12 COMPLETION DEPTH: 36.0 ft.

ELEVATION: 61.89
NORTHING: 13847687.33
EASTING: 3089764.66
OFFSET: 3.02 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0			CONCRETE PAVEMENT (9.8")									
			FILL: LEAN CLAY WITH SAND (CL), very stiff, gray, with root fiber, ferrous nodules	15								
			LEAN CLAY WITH SAND (CL), very stiff, light brown, with root fibers to 4', ferrous and calcareous nodules	21	40	17	23			104		
5				14								
			- hard 6' to 8'	11	49	20	29	84		123		
			- gray 8' to 12'	10								
10			- hard 10' to 12'	10	44	19	25			128		
	29		SILTY SAND (SM), medium dense, light brown, gray	6				25				
15	17			11								
	41		- dense 16' to 20'	17								
	33			4								
20												
	17			20								
25												
	69		- very dense 28' to 36'	25								
30												
35	52			16								
40												



WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 25.0 ft. DURING DRILLING
▼: WATER DEPTH AT 24.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 25 ft.
WET ROTARY: 25 TO 36 ft.

DRILLED BY: Orion
LOGGED BY: George

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-9

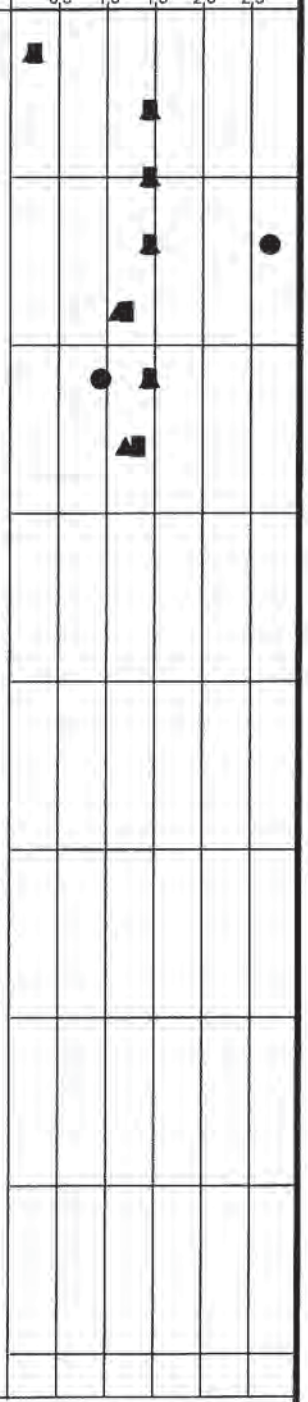
Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 12+58.96
DATE: 11-5-12 COMPLETION DEPTH: 36.0 ft.

ELEVATION: 61.42
NORTHING: 13847286.45
EASTING: 3090356.28
OFFSET: 1.78 RT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					CONCRETE PAVEMENT (7.5")									
					FILL: LEAN CLAY WITH SAND (CL), soft, brown, reddish brown, with root fibers, ferrous nodules	23								
					LEAN CLAY WITH SAND (CL), very stiff, light brown, reddish brown, with root fibers to 4', ferrous and calcareous nodules	14								
5					- hard 6' to 8'	12								
						12	45	18	27			124		
						16								
10					- stiff 10' to 12'	12	47	18	29	79		117		
						16								
15	20				SILTY SAND (SM), medium dense, light brown	9								
	40				- dense 16' to 20'	10								
	38					9								
20														
25	17					23				21				
					- dense, reddish brown, 28' to 36'									
30	48					20								
35	37					20								
40														

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL



WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 25.0 ft. DURING DRILLING
▼: WATER DEPTH AT 23.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 25 ft.
WET ROTARY: 25 TO 36 ft.

DRILLED BY: Orion
LOGGED BY: George

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-10

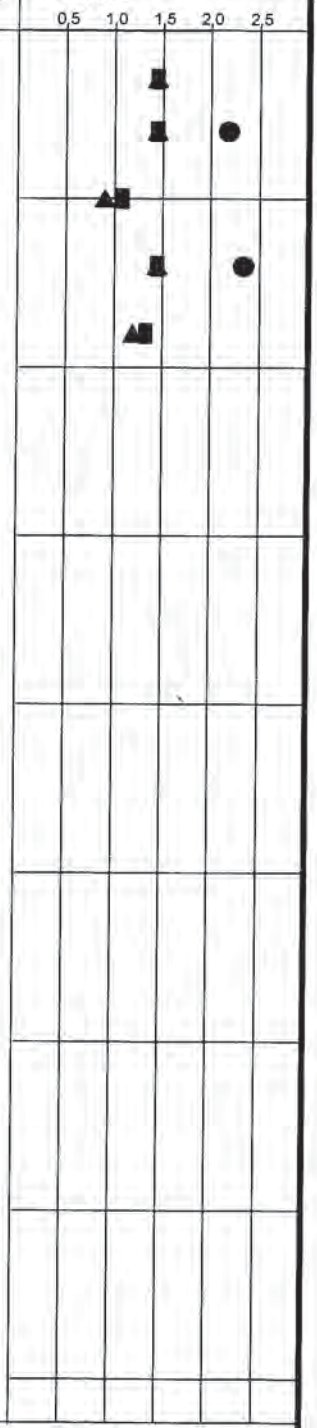
Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 18+18.53
DATE: 11-7-12 COMPLETION DEPTH: 36.0 ft.

ELEVATION: 60.18
NORTHING: 13846846.44
EASTING: 3090697.62
OFFSET: 5.40 RT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0			CONCRETE PAVEMENT (10.2")									
			FILL: LEAN CLAY WITH SAND (CL), very stiff, brown, with root fibers, ferrous nodules	22								
			LEAN CLAY WITH SAND (CL), hard, light brown, brown, with root fibers to 4', ferrous and calcareous nodules	20	46	18	28	83		114		
5			- stiff 4' to 6'	18								
				24	47	18	29			110		
			- very stiff 8' to 10'	22								
10			POORLY GRADED SAND WITH SILT (SP-SM), medium dense, light brown									
	25			5								
	28			5				12				
15	16			5								
	25			4								
	42		- dense 18' to 20'	3								
20			- brown 23' to 36'									
25	21			21								
			- very dense 28' to 30'									
30	60			20				7				
			- dense 34' to 36'									
35	33			19								
40												

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL



WATER OBSERVATIONS:
▽ : WATER ENCOUNTERED AT 25.0 ft. DURING DRILLING
▼ : WATER DEPTH AT 24.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 25 ft.
WET ROTARY: 25 TO 36 ft.

DRILLED BY: Orion
LOGGED BY: George

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-11

Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 21+70.73
DATE: 11-26-12 COMPLETION DEPTH: 36.0 ft.

ELEVATION: 60.04
NORTHING: 13846517.49
EASTING: 3090810.96
OFFSET: 6.68 RT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)	UNDRAINED SHEAR STRENGTH, tsf (▲ HAND PENETROMETER, ■ TORVANE, ● UNCONFINED COMPRESSION, ○ UNCONSOLIDATED-UNDRAINED TRIAXIAL)
0					CONCRETE PAVEMENT (9.7")										
					FILL: LEAN CLAY WITH SAND (CL), very stiff, dark brown, reddish brown, with root fibers, ferrous nodules	16									
					LEAN CLAY WITH SAND (CL), hard, light brown, brown, with root fibers to 4', ferrous nodules	12	48	19	29			122			>>
5					- very stiff 4' to 8'	11									
						13									
						9	38	16	22	77		125			>>
10					POORLY GRADED SAND WITH SILT (SP-SM), dense, light brown										
	36				- medium dense 12' to 16'										
	24					6									
15	28					3									
	41					4									
	40					4				6					
20															
					- very dense 23' to 30'										
	54					3									
25															
					- reddish brown 28' to 36'										
	53					18				6					
30															
35	45					16									
40															

WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 28.0 ft. DURING DRILLING
▼: WATER DEPTH AT 26.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 26 ft.
WET ROTARY: 26 TO 36 ft.

DRILLED BY: Van&Sons
LOGGED BY: Paz

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-12

Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 27+01.21
DATE: 11-7-12 COMPLETION DEPTH: 36.0 ft.

ELEVATION: 60.29
NORTHING: 13845995.07
EASTING: 3090900.11
OFFSET: 15.59 RT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					CONCRETE PAVEMENT (9.7")									
					FILL: FAT CLAY (CH), very stiff, light brown, with root fibers, ferrous and calcareous nodules	14								
					FAT CLAY (CH), hard, light brown, with root fibers to 4', ferrous and calcareous nodules	13	57	19	38			119		
5					- very stiff 4' to 10'	11								
						11								
						13								
10						16	54	19	35	90		116		
					- very stiff 12' to 16'	19								
15						14								
	24				SILTY SAND (SM), medium dense, light brown	6				32				
	54				- very dense 18' to 20'	2								
20														
	27					4								
25														
	42				- dense 28' to 36'	18				16				
30														
35	43					19								
40														

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL
0.5 1.0 1.5 2.0 2.5

WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 34.0 ft. DURING DRILLING
▼: WATER DEPTH AT 34.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 36 ft.
WET ROTARY: ___ TO ___ ft.

DRILLED BY: Orion
LOGGED BY: George

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-13

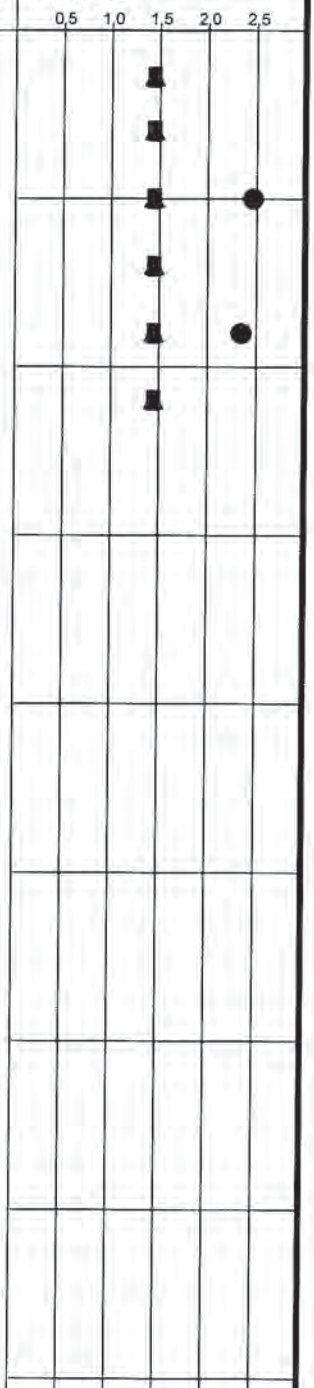
Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 32+93.57
DATE: 11-8-12 COMPLETION DEPTH: 38.0 ft.

ELEVATION: 59.29
NORTHING: 13845672.13
EASTING: 3091373.26
OFFSET: 11.82 RT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					CONCRETE PAVEMENT (9.5")									
					FILL: LEAN CLAY WITH SAND (CL), very stiff, brown, with root fibers, ferrous nodules	14								
					LEAN CLAY WITH SAND (CL), very stiff, light brown, with root fibers to 4', ferrous nodules	8								
5					- hard 4' to 6'	9	46	18	28	77		129		
						14								
					- hard 8 to 10'	14	36	17	19			116		
10						11								
	14				POORLY GRADED SAND WITH SILT (SP-SM), medium dense, light brown	11								
15	14					13								
	20					13								
20	22					5				8				
25	24					4								
					- dense 28' to 35'									
30	46					22								
35	31					22				8				
					- medium dense 36' to 38'									
	20					23								
40														

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL



WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 30.0 ft. DURING DRILLING
▼: WATER DEPTH AT 30.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 30 ft.
WET ROTARY: 30 TO 38 ft.

DRILLED BY: Orion
LOGGED BY: George

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-14

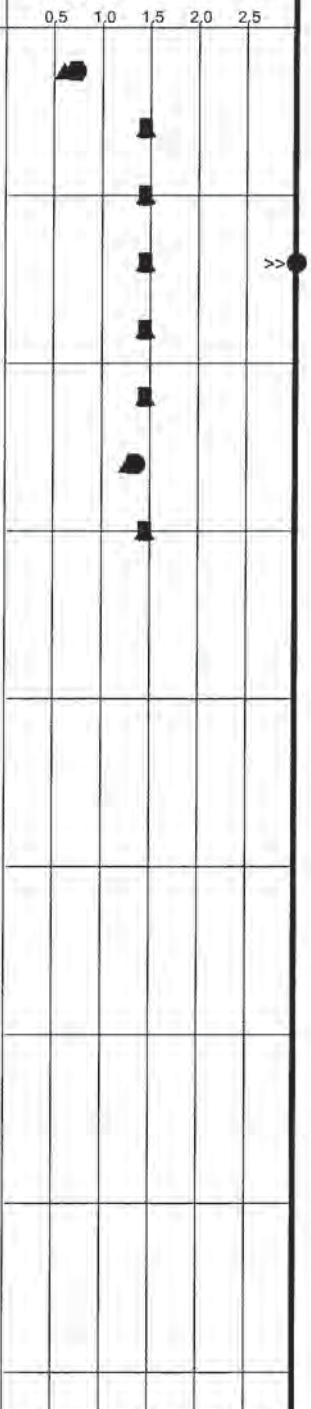
Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 39+45.71
DATE: 11-7-12 COMPLETION DEPTH: 38.0 ft.

ELEVATION: 58.76
NORTHING: 13845696.03
EASTING: 3092025
OFFSET: 5.91 RT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					CONCRETE PAVEMENT (7.5")									
					FILL: LEAN CLAY WITH SAND (CL), stiff, dark gray, with ferrous nodules	20	35	16	19	80		113		
					LEAN CLAY WITH SAND (CL), very stiff, dark gray, with ferrous nodules	12								
5						10								
					- hard 6' to 8'	13	44	18	26			121		
						13								
10						13								
						12	32	16	16			122		
15						9								
	25				POORLY GRADED SAND WITH SILT (SP-SM), medium dense, gray, brown	5				12				
	34				- dense 18' to 25'	6								
20														
	35					5								
25														
	29					14								
30														
	60				- very dense 33' to 35'	17								
35														
	40				- dense 36' to 38'	14								
40														

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL



WATER OBSERVATIONS:
▽ : WATER ENCOUNTERED AT 30.0 ft. DURING DRILLING
▼ : WATER DEPTH AT 30.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 30 ft.
WET ROTARY: 30 TO 38 ft.

DRILLED BY: Orion
LOGGED BY: George

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-15

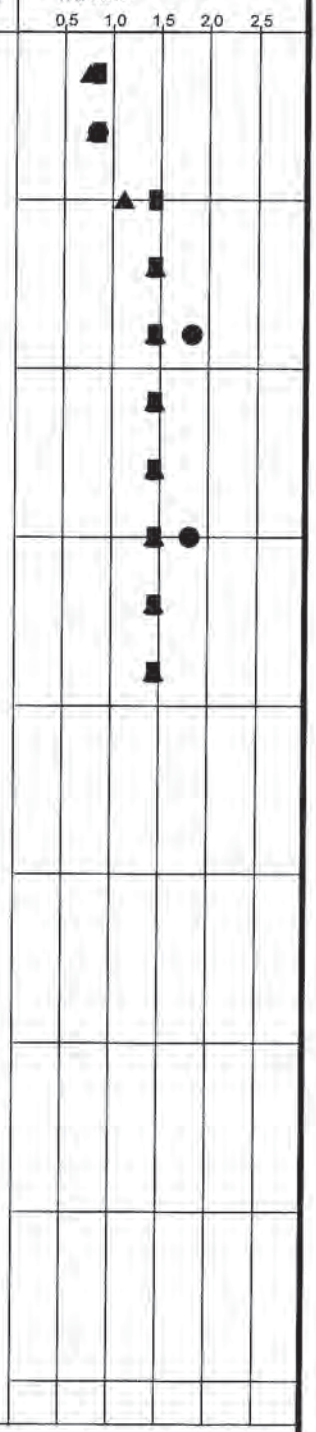
Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 9+94.96
DATE: 7-1-13 COMPLETION DEPTH: 31.0 ft.

ELEVATION: 58.39
NORTHING: 13845091.78
EASTING: 3091306.83
OFFSET: 67.43 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0			CONCRETE PAVEMENT (6.0")									
			FILL: FAT CLAY (CH), stiff, gray, with root fibers, ferrous and calcareous nodules	22								
			FAT CLAY (CH), stiff, light gray, gray, reddish brown, with root fibers to 4', ferrous and calcareous nodules - very stiff 4' to 14'	22	69	23	46	85		101		
5				16								
				14								
				16	50	18	32	88		120		
10				15								
				18								
15			LEAN CLAY WITH SAND (CL), very stiff, light gray, brown, with ferrous nodules	14	43	17	26	72		120		
				17								
				12								
20			POORLY GRADED SAND WITH SILT (SP-SM), medium dense, light brown									
25	14			21				6				
30	19			18								
35												
40												

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL



WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 26.0 ft. DURING DRILLING
▼: WATER DEPTH AT 26.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 31 ft.
WET ROTARY: ___ TO ___ ft.

DRILLED BY: GET (T)
LOGGED BY: Erik

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-16

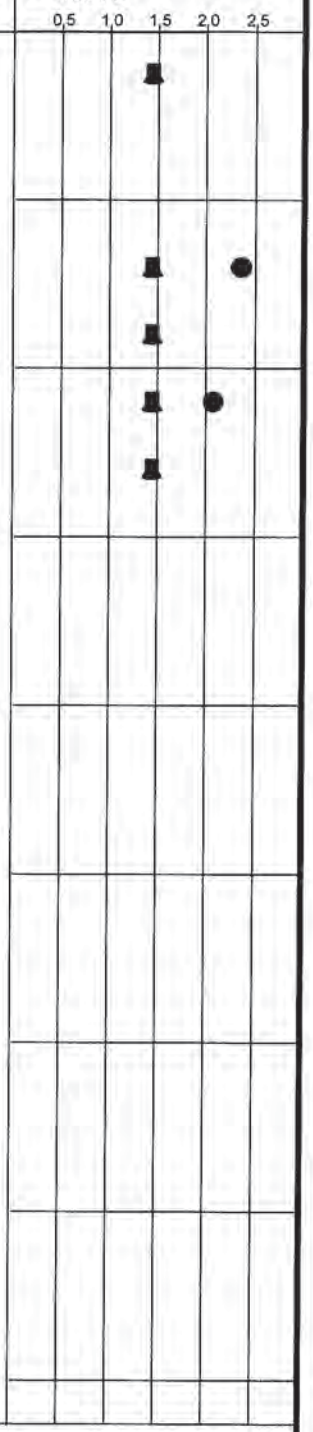
Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 5+56.05
DATE: 7-1-13 COMPLETION DEPTH: 31.0 ft.

ELEVATION: 60.50
NORTHING: 13845050.68
EASTING: 3090854.8
OFFSET: 72.32 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					CONCRETE PAVEMENT (6.3")									
					FILL: LEAN CLAY (CL), very stiff, light brown, with root fibers, ferrous nodules, sands	14								
	14				SILTY SAND (SM), medium dense, light brown, with root fibers to 6', clay pockets	12								
5	10				- loose 4' to 6'	13				19				
					LEAN CLAY WITH SAND (CL), hard, light brown, with ferrous nodules	14	41	16	25			123		
					- very stiff 8' to 10'	19								
10						10	39	18	21	80		127		
					- very stiff 12' to 14'	14								
15	23				POORLY GRADED SAND WITH SILT (SP-SM), medium dense, light brown, brown	20				4				
	29					20								
20	28					20								
					- dense 23' to 25'									
25	33					22				8				
30	27					20								
35														
40														

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL



WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 26.0 ft. DURING DRILLING
▼: WATER DEPTH AT 26.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 31 ft.
WET ROTARY: ___ TO ___ ft.

DRILLED BY: GET (T)
LOGGED BY: Erik

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-17

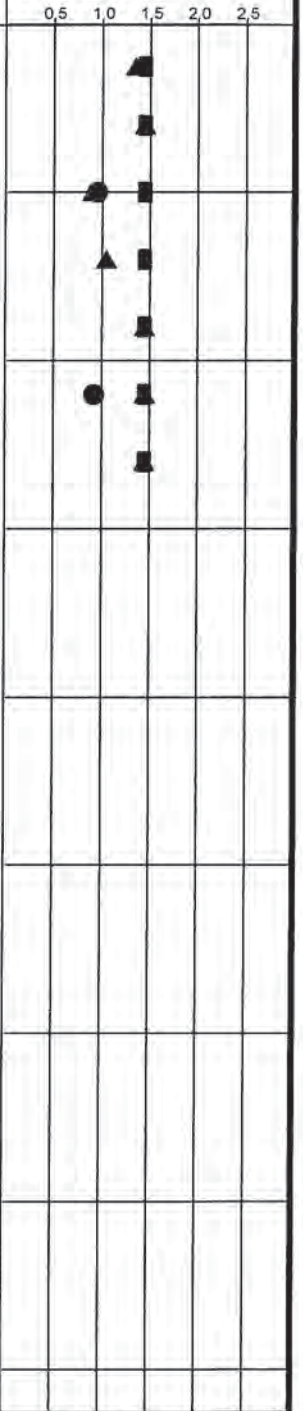
Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 1+76.99
DATE: 7-2-13 COMPLETION DEPTH: 31.0 ft.

ELEVATION: 54.90
NORTHING: 13844896.44
EASTING: 3090308.82
OFFSET: 35.97 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					CONCRETE PAVEMENT (6.3")									
					LEAN CLAY WITH SAND (CL), very stiff, light gray, reddish brown, with root fibers to 4', with ferrous nodules	14								
						15								
					- stiff 4' to 6'									
5						16	40	16	24	73		114		
						15								
						17								
10					- stiff 10' to 12'									
						15	33	17	16	74		117		
						14								
15	21				SILTY SAND (SM), medium dense, light gray, light brown	17								
	25					14				19				
	28					14								
20														
					- dense 23' to 31'									
	33					15								
25														
30	32					14								
35														
40														

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL



WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 27.0 ft. DURING DRILLING
▼: WATER DEPTH AT 27.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 31 ft.
WET ROTARY: ___ TO ___ ft.

DRILLED BY: GET (T)
LOGGED BY: Erik

OVM2 12-344E.GPJ OVM.GDT 8/16/13

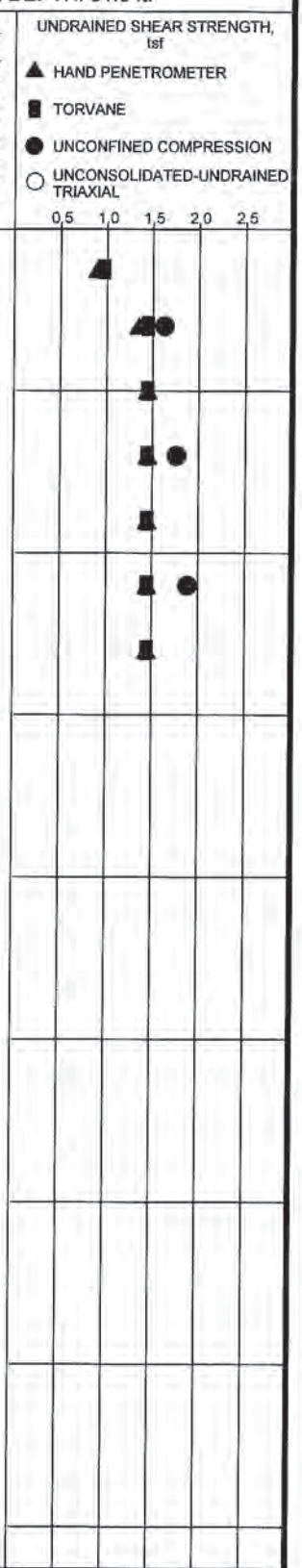
LOG OF BORING NO. B-18

Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 2+82.30
DATE: 7-2-13 COMPLETION DEPTH: 31.0 ft.

ELEVATION: 58.13
NORTHING: 13844329.98
EASTING: 3090069.39
OFFSET: 0.03 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					CONCRETE PAVEMENT (6.2")									
					FILL: LEAN CLAY (CL), stiff, light brown, light gray, with root fibers, ferrous nodules, sands	17								
					LEAN CLAY WITH SAND (CL), very stiff, light gray, light brown, with root fibers to 4', ferrous nodules	15	46	18	28	77		120		
5						17								
						14	44	19	25	79		120		
						15								
10						14	34	16	18	73		118		
						11								
15	25				SILTY SAND (SM), medium dense, light gray	9								
	29					8								
	30					5				16				
20														
	20					8								
25														
30	77				- very dense 29' to 31'	5								
35														
40														



WATER OBSERVATIONS:
NO FREE WATER ENCOUNTERED DURING DRILLING AND 24 HOURS AFTER DRILLING.

DRY AUGER: 0 TO 31 ft.
WET ROTARY: ___ TO ___ ft.

DRILLED BY: Mathers
LOGGED BY: Mason

OVM2 12-344E.GPJ OVM.GDT 8/16/13

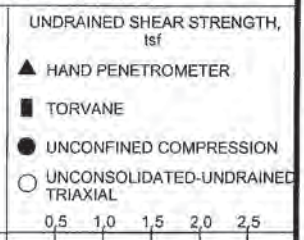
LOG OF BORING NO. B-19

Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 25+59.98
DATE: 12-4-12 COMPLETION DEPTH: 40.0 ft.

ELEVATION: 60.87
NORTHING: 13845174.33
EASTING: 3092123.35
OFFSET: 2.73 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0			ASPHALT PAVEMENT (10.5")									
			FILL: LEAN CLAY WITH SAND (CL), very stiff, brown, with root fibers, ferrous and calcareous nodules	14								
				14	45	18	27			114		
			LEAN CLAY WITH SAND (CL), very stiff, light brown, with root fibers to 4', ferrous and calcareous nodules	14								
5				14								
				16	42	18	24	84		117		
10				15								
				10								
15				15								
				14	46	18	28	83				
				15								
20												
			SILTY SAND (SM), dense, light gray									
25	43			5								
30	41			5								
			very dense 33' to 35'									
35	53			24				23				
40	34			24								



WATER OBSERVATIONS:
▽ : WATER ENCOUNTERED AT 27.0 ft. DURING DRILLING
▼ : WATER DEPTH AT 27.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 26 ft.
WET ROTARY: 26 TO 40 ft.

DRILLED BY: Van&Sons
LOGGED BY: Paz

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-20

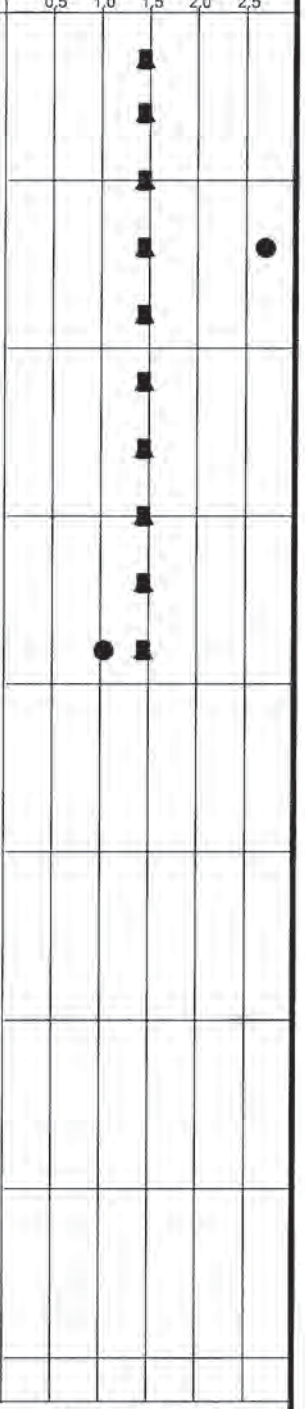
GEOTECH ENGINEERING & TESTING
Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 19+24.19
DATE: 12-5-12 COMPLETION DEPTH: 40.0 ft.

ELEVATION: 61.46
NORTHING: 13844539.35
EASTING: 3092153.84
OFFSET: 2.98 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0			ASPHALT PAVEMENT (9.5")									
			FILL: LEAN CLAY WITH SAND (CL), very stiff, light brown, with root fibers to 2', ferrous nodules	12	28	14	14			111		
			FAT CLAY (CH), very stiff, light brown, reddish brown, with ferrous and calcareous nodules	16								
5				13								
			- hard 6' to 8'	13	55	19	36	89		121		
			LEAN CLAY WITH SAND (CL), very stiff, brown, gray, with ferrous and calcareous nodules	17								
10				16								
				13								
15				13								
				14								
				14	34	16	18			120		
20												
			POORLY GRADED SAND WITH SILT (SP-SM), dense, light brown	5								
25	42											
	41			6				8				
30												
	42			6								
35												
			- very dense, reddish brown 38' to 40'									
	51			17								
40												

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL



WATER OBSERVATIONS:
▽ : WATER ENCOUNTERED AT 25.0 ft. DURING DRILLING
▼ : WATER DEPTH AT 25.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 25 ft.
WET ROTARY: 25 TO 40 ft.

DRILLED BY: Orion
LOGGED BY: George

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-21

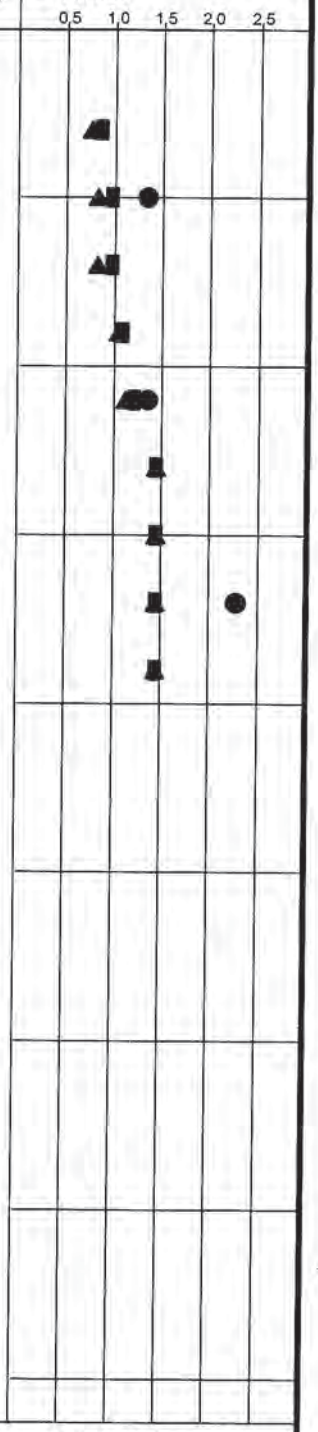
Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 12+62.01
DATE: 12-13-12 COMPLETION DEPTH: 40.0 ft.

ELEVATION: 61.78
NORTHING: 13843878.03
EASTING: 3092186.31
OFFSET: 1.12 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					ASPHALT PAVEMENT (12.0")									
					FILL: SILTY SAND (SM), light brown, dark brown	8								
					FAT CLAY (CH), stiff, brown, light brown, with ferrous and calcareous nodules	19								
5					- very stiff 4' to 6'	17	61	21	40	88		112		
						19								
					LEAN CLAY WITH SAND (CL), very stiff, light brown, brown, with ferrous and calcareous nodules, sands	15								
10						14	48	18	30			118		
						12								
15						13								
					- hard 16' to 18'	11	38	17	21			125		
						12								
20														
					SILTY SAND (SM), dense, light brown, reddish brown									
25	35					8				25				
30	41					6								
35	50					15								
40	33					15								

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL



WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 31.0 ft. DURING DRILLING
▼: WATER DEPTH AT 31.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 31 ft.
WET ROTARY: 31 TO 40 ft.

DRILLED BY: Van&Sons
LOGGED BY: Hauze

OVM2 12-344E.GPJ OVM.GDT 8/16/13

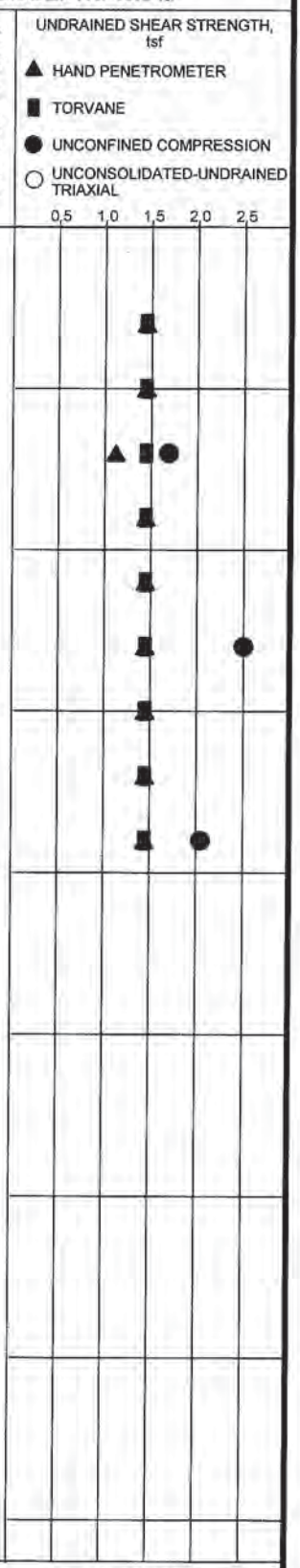
LOG OF BORING NO. B-22

Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 7+94.25
DATE: 12-13-12 COMPLETION DEPTH: 40.0 ft.

ELEVATION: 61.33
NORTHING: 13843410.85
EASTING: 3092208.64
OFFSET: 0.04 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					ASPHALT PAVEMENT (13.0")									
					FILL: SILTY SAND (SM), light brown	12								
					FAT CLAY (CH), very stiff, light brown, with ferrous and calcareous nodules	20								
5						14								
					LEAN CLAY WITH SAND (CL), very stiff, light brown, with ferrous and calcareous nodules	16	45	17	28	84		117		
						12								
10						17								
					- hard 12' to 14'	13	42	18	24			121		
15						12								
						12								
					- hard 18' to 20'	13	34	15	19			116		
20														
					SANDY SILT (ML), dense, light brown									
25	35					10				57				
30	38					4								
					POORLY GRADED SAND WITH SILT (SP-SM), dense, reddish brown									
35	36					19				6				
					- very dense 38' to 40'									
40	66					19								



WATER OBSERVATIONS:
▽ : WATER ENCOUNTERED AT 30.0 ft. DURING DRILLING
▼ : WATER DEPTH AT 30.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 30 ft.
WET ROTARY: 30 TO 40 ft.

DRILLED BY: Van&Sons
LOGGED BY: Hauze

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-23

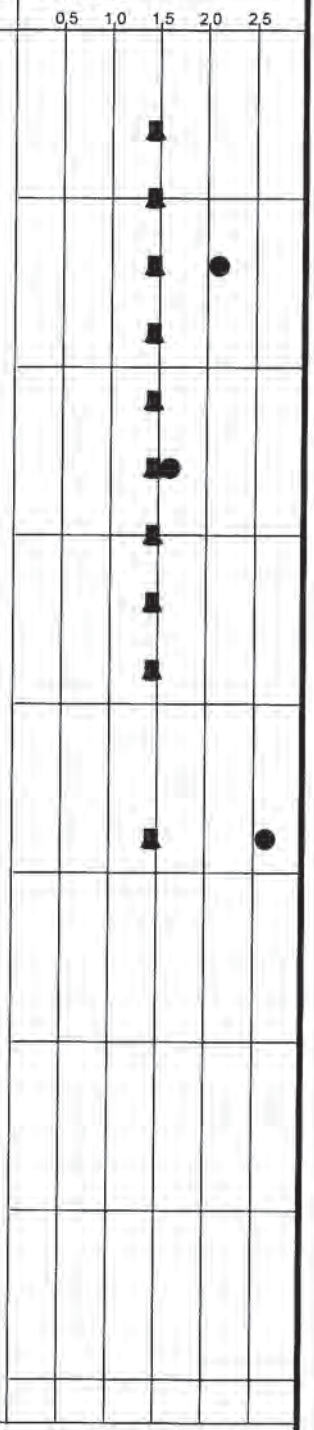
Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 5+38.86
DATE: 12-13-12 COMPLETION DEPTH: 40.0 ft.

ELEVATION: 60.26
NORTHING: 13843155.73
EASTING: 3092219.92
OFFSET: 1.72 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					ASPHALT PAVEMENT (12.0")									
					FILL: SILTY SAND (SM), light brown	12								
					LEAN CLAY WITH SAND (CL), very stiff, light brown, with ferrous and calcareous nodules	22								
5						18								
					- hard 6' to 8'	16	40	18	22	83		114		
						18								
10						14								
						15	34	16	18			120		
15						10								
					FAT CLAY (CH), very stiff, light brown, reddish brown, with ferrous and calcareous nodules	19								
						20								
20														
					- hard 23' to 25'	15	52	18	34			113		
25														
	31				SILTY SAND (SM), dense, reddish brown	11								
30														
35	40					2								
	39					7				22				
40														

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL



WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 36.0 ft. DURING DRILLING
▼: WATER DEPTH AT 35.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 36 ft.
WET ROTARY: 36 TO 40 ft.

DRILLED BY: Van&Sons
LOGGED BY: Hauze

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-24

Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 36+53.60
DATE: 12-4-12 COMPLETION DEPTH: 55.0 ft.

ELEVATION: 45.30
NORTHING: 13842699.82
EASTING: 3092133.58
OFFSET: 51.59 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					CONCRETE PAVEMENT (10.3")									
					FILL: SILTY SAND (SM), light brown, gravel	13								
					FILL: LEAN CLAY WITH SAND (CL), very stiff, light brown, with ferrous nodules	13	33	16	17			116		
5						15								
						14	31	16	15	83		111		
	11				POORLY GRADED SAND WITH SILT (SP-SM), medium dense, light brown	12								
10	19					5								
	30					7								
15	28					4				9				
	69				- very dense, reddish brown 16' to 35'	5								
	61					6								
20														
	65					25								
25														
	78					21								
30														
	69					21								
35														
	29					30								
40														

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL

Continued Next Page

WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 28.0 ft. DURING DRILLING
▼: WATER DEPTH AT 28.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 28 ft.
WET ROTARY: 28 TO 55 ft.

DRILLED BY: Van&Sons
LOGGED BY: Paz

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-24 Cont'd

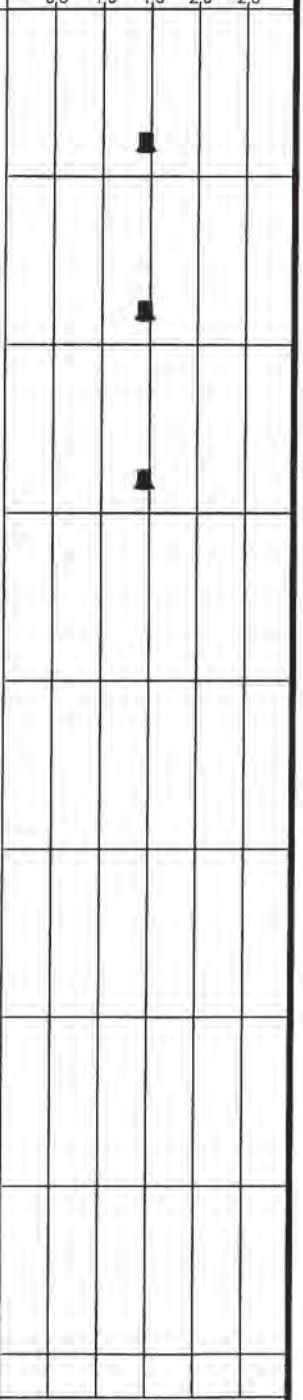
Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 36+53.60
DATE: 12-4-12 COMPLETION DEPTH: 55.0 ft.

ELEVATION: 45.30
NORTHING: 13842699.82
EASTING: 3092133.58
OFFSET: 51.59 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
40					POORLY GRADED SAND WITH SILT (SP-SM), medium dense, light brown									
					FAT CLAY (CH), very stiff, reddish brown, with ferrous and calcareous nodules									
45						25								
50						25								
55						25								
60														
65														
70														
75														
80														

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL



WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 28.0 ft. DURING DRILLING
▼: WATER DEPTH AT 28.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 28 ft.
WET ROTARY: 28 TO 55 ft.

DRILLED BY: Van&Sons
LOGGED BY: Paz

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-25

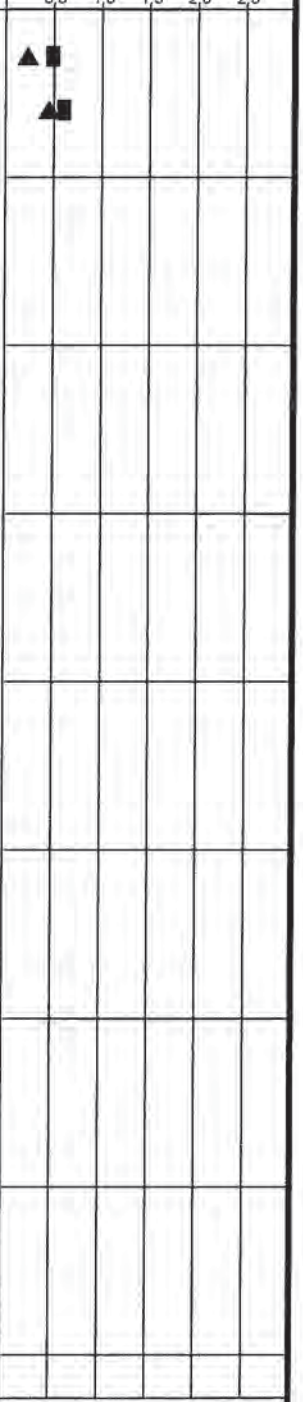
Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 31+80.68
DATE: 12-6-12 COMPLETION DEPTH: 55.0 ft.

ELEVATION: 45.38
NORTHING: 13842437.08
EASTING: 3091749.13
OFFSET: 52.83 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					CONCRETE PAVEMENT (9.9")									
					FILL: LEAN CLAY WITH SAND (CL), soft, brown, gray, with root fibers to 4', ferrous nodules	18								
					- firm 2' to 4'	15	30	16	14	79				
5	18				SILTY SAND (SM), medium dense, brown	15								
	29					12				34				
	24					13								
10					- dense, light brown, 10' to 35'									
	31					14								
	35					6								
15	32					7								
	37					8				16				
	37					8								
20														
					- reddish brown 23' to 45'									
	42					5								
25														
	37					4								
30														
	42					22								
35														
	23					23								
40														

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL



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WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 35.0 ft. DURING DRILLING
▼: WATER DEPTH AT 35.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 35 ft.
WET ROTARY: 35 TO 55 ft.

DRILLED BY: Orion
LOGGED BY: Paz

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-25 Cont'd

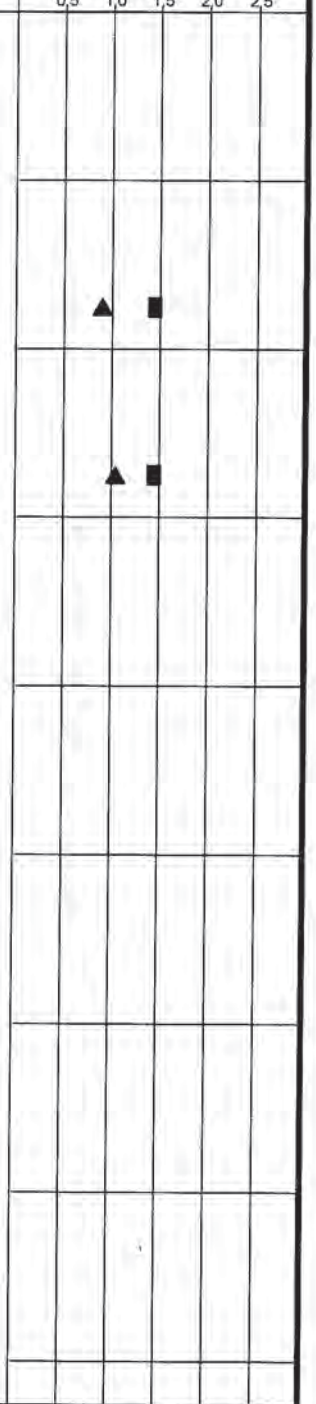
Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 31+80.68
DATE: 12-6-12 COMPLETION DEPTH: 55.0 ft.

ELEVATION: 45.38
NORTHING: 13842437.08
EASTING: 3091749.13
OFFSET: 52.83 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
40					SILTY SAND (SM), medium dense, brown									
45	24					24								
50					FAT CLAY (CH), stiff, reddish brown, with ferrous and calcareous nodules	21								
					- very stiff 53' to 55'	23								
55														
60														
65														
70														
75														
80														

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL



WATER OBSERVATIONS:
▽ : WATER ENCOUNTERED AT 35.0 ft. DURING DRILLING
▼ : WATER DEPTH AT 35.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 35 ft.
WET ROTARY: 35 TO 55 ft.

DRILLED BY: Orion
LOGGED BY: Paz

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-26

Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 26+70.15
DATE: 11-8-12 COMPLETION DEPTH: 105.0 ft.

ELEVATION: 46.58
NORTHING: 13842274.57
EASTING: 3091285.09
OFFSET: 55.64 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					CONCRETE PAVEMENT (7.2")									
					FILL: SILTY SAND (SM), light brown	9				30				
	20				POORLY GRADED SAND WITH SILT (SP-SM), medium dense, light brown	12								
5	21					12								
	22					13								
	21					10								
10	22					11								
	18					7								
15	19					10				10				
	18					7								
	63				- very dense, reddish brown 18' to 32'	7								
20	55					6								
	64					6								
25	75					23								
	87					22								
	80					25								
30	66					29								
					LEAN CLAY WITH SAND (CL), very stiff, reddish brown, with ferrous nodules	22								
35					- stiff 33' to 40'	13	30	15	15			107		
						26								
						19								
40														

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL
0.5 1.0 1.5 2.0 2.5

Continued Next Page

WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 24.0 ft. DURING DRILLING
▼: WATER DEPTH AT 23.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 24 ft.
WET ROTARY: 24 TO 105 ft.

DRILLED BY: Van&Sons
LOGGED BY: Paz

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-26 Cont'd

Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 26+70.15
DATE: 11-8-12 COMPLETION DEPTH: 105.0 ft.

ELEVATION: 46.58
NORTHING: 13842274.57
EASTING: 3091285.09
OFFSET: 55.64 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
40					FAT CLAY (CH), hard, reddish brown, with ferrous and calcareous nodules	29	55	20	35			98		
					- very stiff 42' to 48'	23								
45						28								
						23								
					- stiff 48' to 50'	32	64	21	43	91		94		
50					- very stiff 50' to 54'	18								
					- light brown 52' to 58'	18								
55						15	51	18	33			115		
					- very stiff 56' to 58'	13								
					LEAN CLAY WITH SAND (CL), very stiff, light brown, with ferrous nodules	23	35	17	18	84		103		
60						14								
						19								
65	78				SILTY SAND (SM), very dense, reddish brown, light brown	14								
	87					18								
	93					12								
70	80					21				18				
	56					25								
75	78					30								
	74					22								
	67					21								
80														

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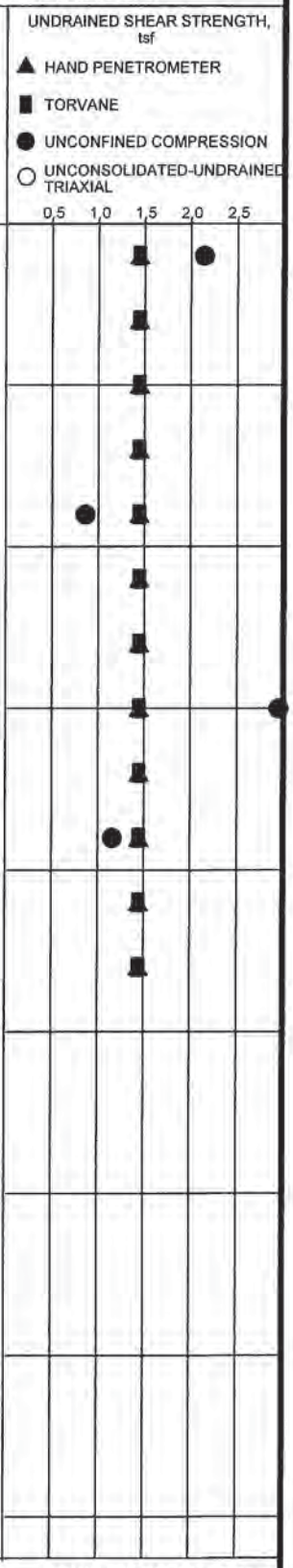


WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 24.0 ft. DURING DRILLING
▼: WATER DEPTH AT 23.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 24 ft.
WET ROTARY: 24 TO 105 ft.

DRILLED BY: Van&Sons
LOGGED BY: Paz

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-26 Cont'd

Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 26+70.15
DATE: 11-8-12 COMPLETION DEPTH: 105.0 ft.

ELEVATION: 46.58
NORTHING: 13842274.57
EASTING: 3091285.09
OFFSET: 55.64 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
80					SILTY SAND (SM), very dense, reddish brown, light brown									
	69			X		20								
	77			X		35				16				
85	86			X		20								
	93			X		24								
	61			X		24								
90	66			X		19								
	76			X		31								
95	84			X		20								
	71			X		27								
	66			X		26								
100	90			X		17								
	83			X		20								
105														
110														
115														
120														

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL
0.5 1.0 1.5 2.0 2.5

WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 24.0 ft. DURING DRILLING
▼: WATER DEPTH AT 23.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 24 ft.
WET ROTARY: 24 TO 105 ft.

DRILLED BY: Van&Sons
LOGGED BY: Paz

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-27

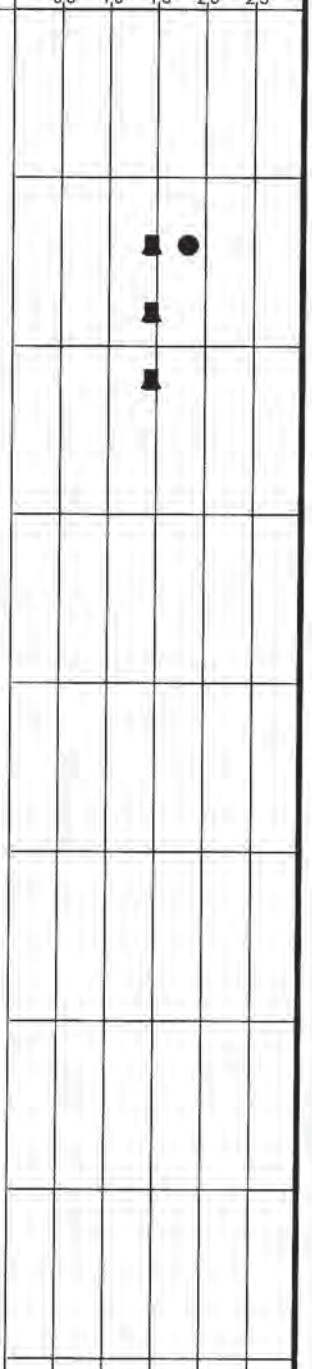
Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 22+72.91
DATE: 11-8-12 COMPLETION DEPTH: 38.0 ft.

ELEVATION: 45.97
NORTHING: 13842122.3
EASTING: 3090907.8
OFFSET: 45.96 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					CONCRETE PAVEMENT (9.7")									
					SILTY SAND (SM), light brown, brown	10								
					- medium dense 2' to 6'									
	14					4				48				
5	15					14								
					FAT CLAY (CH), very stiff, gray, reddish brown, with ferrous and calcareous nodules	10	91	26	65	88		115		
						6								
10						9								
					SILTY SAND (SM), very dense, light brown									
	84					8								
15	82					8				23				
	77					8								
	82					9								
20														
	83					2								
25														
					- dense 28' to 35'									
	34					8								
30														
	32					17								
35					- medium dense 36' to 38'									
	28					13								
40														

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL



WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 33.0 ft. DURING DRILLING
▼: WATER DEPTH AT 33.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 33 ft.
WET ROTARY: 33 TO 38 ft.

DRILLED BY: Orion
LOGGED BY: Paz

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-28

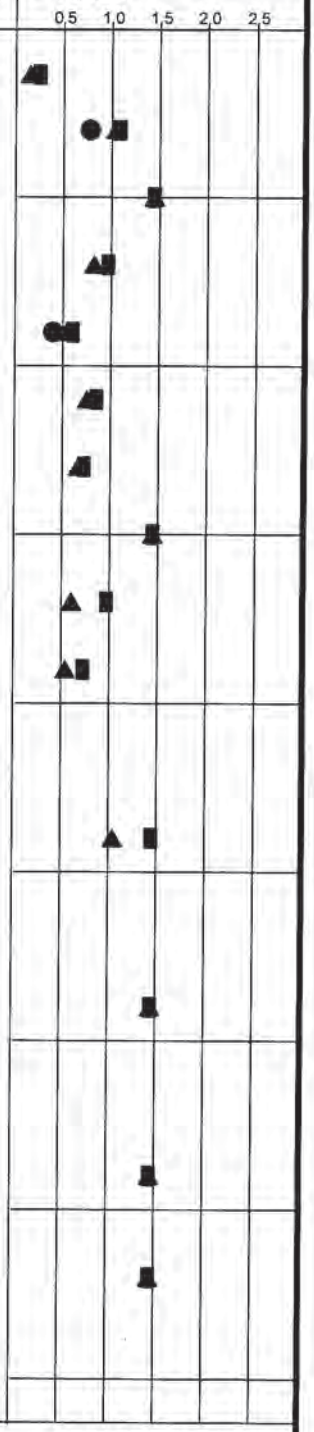
Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 18+28.51
DATE: 12-4-12 COMPLETION DEPTH: 38.0 ft.

ELEVATION: 48.40
NORTHING: 13841826.17
EASTING: 3090590.68
OFFSET: 31.45 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					CONCRETE PAVEMENT (8.5")									
					FILL: FAT CLAY (CH), soft, light brown, ferrous and calcareous nodules	23								
					- stiff 2' to 4'	13	51	20	31			82		
5					- very stiff, dark brown 4' to 6'	14								
					- stiff 6' to 8'	18								
					- firm 8' to 10'	21	54	19	35	91		99		
10					FAT CLAY (CH), stiff, dark brown, with ferrous and calcareous nodules	19								
						16								
15					- very stiff 14' to 16'	15								
						15								
						18								
20														
					- very stiff 23' to 38'	15								
25														
					- reddish brown 28' to 38'	27								
30														
						27								
35						27								
40														

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL



WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 16.0 ft. DURING DRILLING
▼: WATER DEPTH AT 15.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 16 ft.
WET ROTARY: 16 TO 38 ft.

DRILLED BY: Orion
LOGGED BY: Paz

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-29

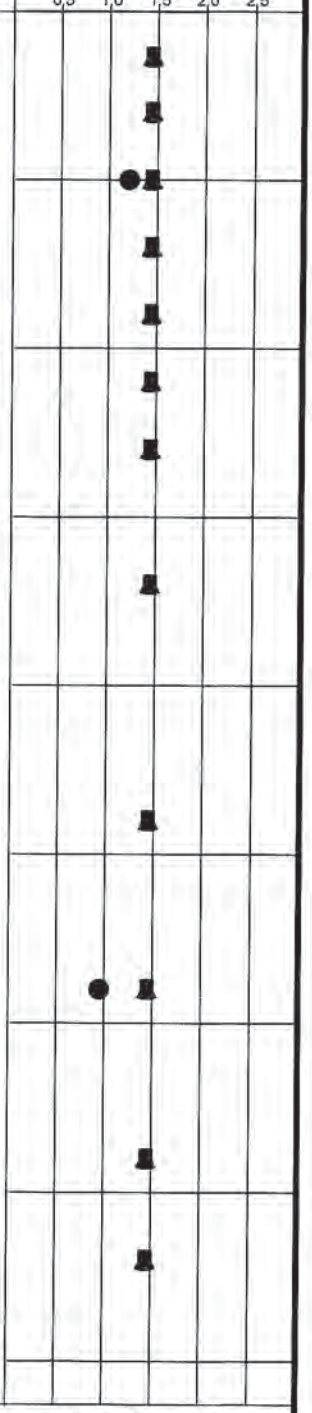
Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 13+10.32
DATE: 12-4-12 COMPLETION DEPTH: 38.0 ft.

ELEVATION: 53.25
NORTHING: 13841826.17
EASTING: 3090135.67
OFFSET: 19.70 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					CONCRETE PAVEMENT (7.9")									
					FILL: FAT CLAY (CH), very stiff, brown, gray, with root fibers	18								
					FAT CLAY (CH), very stiff, light brown, reddish brown, with root fibers to 4', ferrous and calcareous nodules	20								
5						21	58	20	38	88		107		
						23								
						18								
10						16								
						12								
15	26				SILTY SAND (SM), medium dense, light brown	18								
					FAT CLAY (CH), very stiff, reddish brown, with ferrous and calcareous nodules	13								
20	10				SILTY SAND (SM), loose, light brown	29								
					FAT CLAY, very stiff, reddish brown, with ferrous and calcareous nodules	20								
25														
					- stiff 28' to 30'	32	73	22	51			93		
30														
						25								
35						29								
40														

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL



WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 20.0 ft. DURING DRILLING
▼: WATER DEPTH AT 19.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 20 ft.
WET ROTARY: 20 TO 38 ft.

DRILLED BY: Orion
LOGGED BY: Paz

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-30

Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 6+60.75
DATE: 12-5-12 COMPLETION DEPTH: 38.0 ft.

ELEVATION: 55.93
NORTHING: 13841652.1
EASTING: 3089498.03
OFFSET: 47.95 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					CONCRETE PAVEMENT (10.5")									
					FILL: LEAN CLAY WITH SAND (CL), firm, dark brown, with ferrous nodules	26								
					LEAN CLAY WITH SAND (CL), hard, light brown, with ferrous and calcareous nodules	16	46	17	29			114		
5					- very stiff 4' to 6'	15								
					FAT CLAY (CH), very stiff, light brown, reddish brown, with ferrous and calcareous nodules	16								
						16	61	19	42	90		109		
10						20								
						19								
15						12								
					LEAN CLAY WITH SAND (CL), very stiff, light brown, with ferrous and calcareous nodules	16	45	18	27			115		
						16								
20														
						23								
25														
					SAND SILT (ML), dense, reddish brown									
	33					20				63				
30														
					- medium dense 33' to 38'									
	27					24								
35														
	21					19								
40														

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL
0.5 1.0 1.5 2.0 2.5

WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 26.0 ft. DURING DRILLING
▼: WATER DEPTH AT 25.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 25 ft.
WET ROTARY: 25 TO 38 ft.

DRILLED BY: Van&Sons
LOGGED BY: Paz

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-31

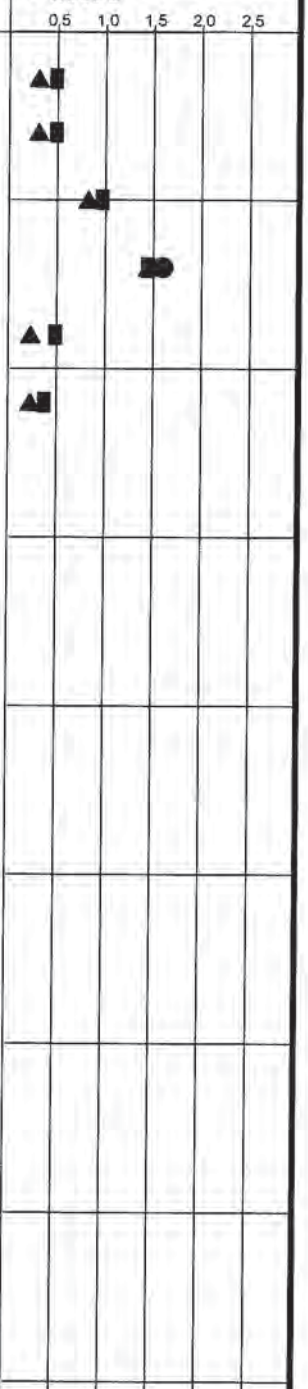
Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 7+04.15
DATE: 12-4-12 COMPLETION DEPTH: 23.0 ft.

ELEVATION: 53.89
NORTHING: 13842395.88
EASTING: 3089001.68
OFFSET: 1.25 RT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					ASPHALT PAVEMENT (3.0")									
					CONCRETE PAVEMENT (5.5")									
					FILL: LEAN CLAY WITH SAND (CL), firm, light brown, with ferrous and calcareous nodules	22								
					- stiff 4' to 6'	20								
5						16								
					- very stiff 6' to 8'	15	31	16	15	85		116		
					- soft 8' to 12'	15								
10						17								
	23				SILTY SAND (SM), medium dense, light brown	17				14				
15	27					20								
	22					14								
	24					18								
20					- reddish brown 21' to 23'									
	19					14								
25														
30														
35														
40														

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL



WATER OBSERVATIONS:
NO FREE WATER ENCOUNTERED DURING DRILLING AND 24 HOURS AFTER DRILLING.

DRY AUGER: 0 TO 23 ft.
WET ROTARY: ___ TO ___ ft.

DRILLED BY: Orion
LOGGED BY: Paz

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-32

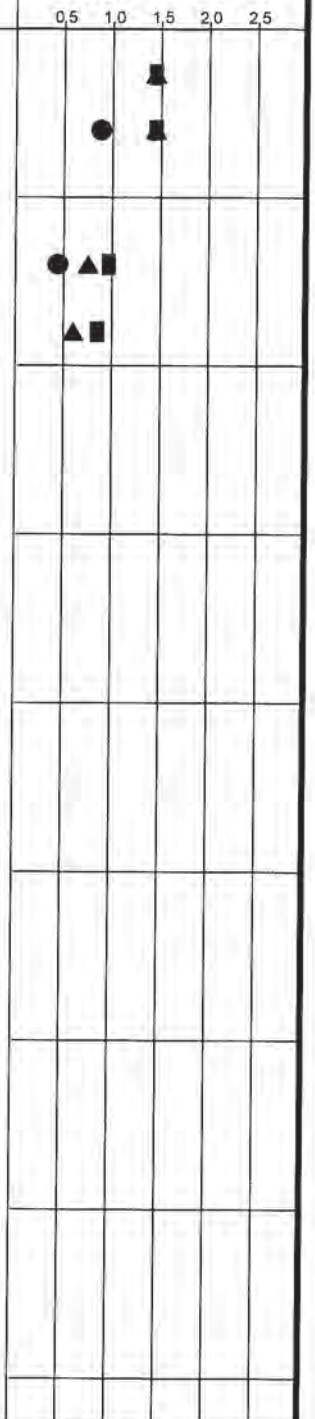
Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 10+73.54
DATE: 12-2-12 COMPLETION DEPTH: 23.0 ft.

ELEVATION: 54.67
NORTHING: 13842765.02
EASTING: 3088989.23
OFFSET: 0.78 RT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					ASPHALT PAVEMENT (2.0")									
					CONCRETE PAVEMENT (5.5")	23								
					FILL: LEAN CLAY WITH SAND (CL), very stiff, light brown, with ferrous nodules	18	34	17	17			111		
					- stiff 2' to 4'									
5	17				FILL: SILTY SAND (SM), medium dense, light brown, with clay pockets	15								
					FILL: LEAN CLAY WITH SAND (CL), stiff, light brown, with ferrous nodules	21	28	14	14	83		105		
						20								
10					SILTY SAND (SM), medium dense, light brown									
	14					16								
	14					15				15				
15	13					13								
	18					16								
					- very dense 18' to 23'									
20	52					16								
	56					15								
25														
30														
35														
40														

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL



WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 16.0 ft. DURING DRILLING
▼: WATER DEPTH AT 15.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 16 ft.
WET ROTARY: 16 TO 23 ft.

DRILLED BY: Orion
LOGGED BY: Paz

OVM2 12-344E.GPJ OVM.GDT 8/16/13

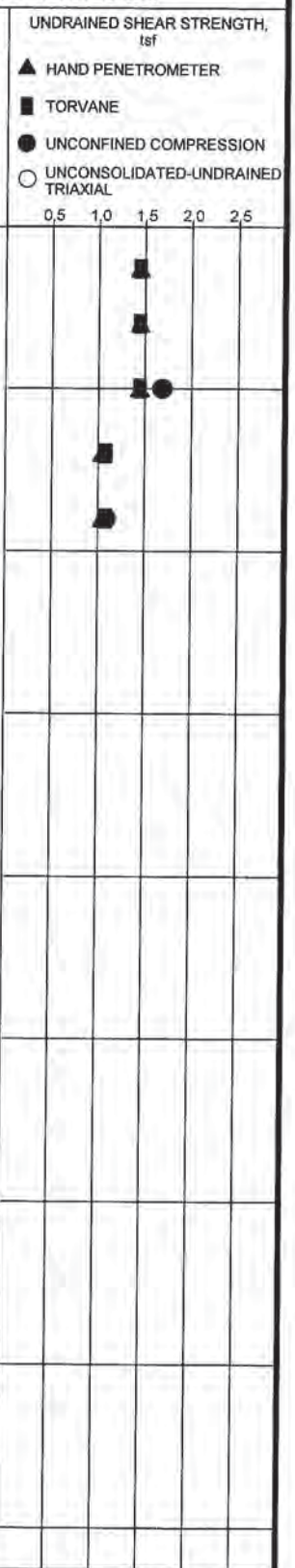
LOG OF BORING NO. B-33

Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 1+42.28
DATE: 11-2-12 COMPLETION DEPTH: 23.0 ft.

ELEVATION: 51.29
NORTHING: 13843409.14
EASTING: 3089063.95
OFFSET: 40.18 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					CONCRETE PAVEMENT (6.5")									
					FILL: LEAN CLAY WITH SAND (CL), very stiff, gray, with ferrous nodules	12								
					LEAN CLAY WITH SAND (CL), very stiff, gray, with ferrous nodules	14								
5						17	33	16	17	83		116		
						24								
						16	30	16	14			121		
10					SILTY SAND (SM), medium dense, gray, light brown									
	16					16								
	22					13				25				
15	16					17								
	18					23								
	16					16				26				
20														
	26					24								
25														
30														
35														
40														



WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 16.0 ft. DURING DRILLING
▼: WATER DEPTH AT 16.0 ft. AFTER 24-HOUR

DRY AUGER: 0 TO 16 ft.
WET ROTARY: 16 TO 23 ft.

DRILLED BY: Orion
LOGGED BY: Paz

OVM2 12-344E.GPJ OVM.GDT 8/16/13

LOG OF BORING NO. B-34

Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-4000 Fax: 713-699-9200

PROJECT: Proposed Pump and Lift Station Renewal/Rehabilitation
LOCATION: City of Houston, Texas
PROJECT NO.: R-000267-0109-3 STATION NO.: 8+41.39
DATE: 11-2-12 COMPLETION DEPTH: 15.0 ft.

ELEVATION: 38.09
NORTHING: 13843704.44
EASTING: 3089517.22
OFFSET: 25.01 LT

DEPTH, ft	SPT N-VALUE blows per foot	OVM, ppm	SYMBOL	SAMPLES	DESCRIPTION	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	PERCENT PASSING NO. 200 SIEVE	SUCTION (pF)	DRY UNIT WEIGHT, pcf	PERCENT COMPACTION	PASSING/FAILING (P/F)
0					CONCRETE PAVEMENT (6.8")									
					FILL: SILTY SAND (SM), light brown, with clay pocket	9								
	14				SILTY SAND (SM), medium dense, light brown - loose 4' to 6'	8								
5	8					8								
	18					22				16				
	22					9								
10	26					17								
					FAT CLAY (CH), very stiff, reddish brown, with ferrous and calcareous nodules - stiff 14' to 15'	28	72	22	50	88		97		
15						24								
20														
25														
30														
35														
40														

WATER OBSERVATIONS:
NO FREE WATER ENCOUNTERED DURING DRILLING

DRY AUGER: 0 TO 15 ft.
WET ROTARY: ___ TO ___ ft.

DRILLED BY: Orion
LOGGED BY: George

OVM2 12-344E.GPJ OVM.GDT 8/16/13

KEY TO LOG TERMS AND SYMBOLS

UNIFIED SOIL CLASSIFICATIONS

Symbol	Material Descriptions
GW	WELL GRADED-GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GM	SILTY GRAVELS, GRAVEL-SAND SILT MIXTURES
GC	CLAY GRAVELS, GRAVEL-SAND CLAY MIXTURES
SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SP	POORLY GRADED SANDS, OR GRAVELLY SANDS, LITTLE OR NO FINES
SM	SILTY SANDS, SAND-SILT MIXTURES a
SC	CLAYEY SANDS, SAND-SILT MIXTURES b
ML	INORGANIC SILTS AND 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, LEAN CLAYS
OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT
	FILL SOILS

TERMS CHARACTERIZING SOIL STRUCTURE

Slickensided	-	Having incline planes of weakness that are slick and glossy in appearance.
Fissured	-	Containing shrinkage cracks frequently filled with fine sand or silt: usually vertical.
Laminated	-	Composed of thin layers of varying colors and soil sample texture.
Interbedded	-	Composed of alternate layers of different soil types.
Calcareous	-	Containing appreciable quantities of calcium carbonate.
Well Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes.
Poorly Graded	-	Predominantly of one grain size, or having a range of sizes with some intermediate sizes missing.
Pocket	-	Inclusion of material of different texture that is smaller than the diameter of the sample.
Parting	-	Inclusion less than ⅛-inch thick extending through the sample.
Seam	-	Inclusion ⅛- to 3-inches thick extending through the sample.
Layer	-	Inclusion greater than 3-inches thick extending through the sample.
Interlayered	-	Soils sample composed of alternating layers of different soil types.
Intermixed	-	Soil samples composed of pockets of different soil type and layered or laminated structure is not evident.

COARSE GRAINED SOILS (major portion retained on No. 200 Sieve): Includes (1) clean gravels and sands, and (2) silty or clayey gravels and sands. Conditions rated according to standard penetration test (SPT)* as performed in the field.

Descriptive Terms	Blows Per Foot*
Very Loose	0 – 4
Loose	5 – 10
Medium Dense	11 – 30
Dense	31 – 50
Very Dense	over 50

* 140 pound weight having a free fall of 30-inches

FINE GRAINED SOILS (major portion passing No. 200 Sieve): Include (1) inorganic or organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength as indicated by hand penetrometer readings or by unconfined compression tests.

Descriptive Term	Undrained Shear Strength Ton/Sq. Ft.
Very Soft	Less than 0.13
Soft	0.13 to 0.25
Firm	0.25 to 0.50
Stiff	0.50 to 1.00
Very Stiff	1.00 to 2.00
Hard	2.00 or higher

NOTE: Slickensided and fissured clays may have lower unconfined compressive strengths than shown above because of weakness or cracks in the soil. The consistency ratings of such soils are based on hand penetrometer readings.

SOIL SAMPLERS

- SHELBY TUBE SAMPLER
- STANDARD PENETRATION TEST
- AUGER SAMPLING

TERMS CHARACTERIZING ROCK PROPERTIES

VERY SOFT OR PLASTIC	Can be remolded in hand: corresponds in consistency up to very stiff in soils.
SOFT	Can be scratched with fingernail.
MODERATELY HARD	Can be scratched easily with knife; cannot be scratched with fingernail. Difficult to scratch with knife.
VERY HARD	Cannot be scratched with knife.
POORLY CEMENTED OR FRIABLE	Easily crumbled.
CEMENTED	Bounded Together by chemically precipitated materials.
UNWEATHERED	Rock in its natural state before being exposed to atmospheric agents.
SLIGHTLY WEATHERED	Noted predominantly by color change with no disintegrated zones.
WEATHERED	Complete color change with zones of slightly decomposed rock.
EXTREMELY WEATHERED	Complete color change with consistency, texture, and general appearance or soil.

SUMMARY OF LABORATORY TEST RESULTS

Geotechnical Consultant's Name: Geotech Engineering and Testing

PROJECT NAME: PROPOSED PUMP AND LIFT STATION RENEWAL/REHABILITATION – POST OAK LANE

COH WBS NUMBER: R-000267-0109-3

CONSULTANT PROJECT NUMBER: 13-344E

BORING NO.	SAMPLE NO.	DEPTH (FT) Top	DEPTH (FT) Bottom	TYPE	SPT	WATER CONTENT(%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL (%)	PL (%)	PI (%)	PERCENT PASSING SIEVE 200 (%)	SHEAR STRENGTH (TSF) UNCONFINED COMPRESSION TEST	UU TEST (CONFINING PRESSURE, TSF)	TORVANE	POCKET PENETROMETER	TYPE OF MATERIAL
B-1	1	0	0.2													Asphalt Pavement
	2	0.2	0.4													Concrete Pavement
	3	0.6	2	UD		17								1.5	1.5	Fill: Lean Clay (CL)
	4	2	4	UD		14	120	48	19	29		120	2.73	1.5	1.5	Lean Clay (CL)
	5	4	6	UD		15								1.5	1.5	Lean Clay (CL)
	6	6	8	UD		15								1.5	1.5	Lean Clay (CL)
	7	8	14	UD		9	127	45	18	27	86	127	2.81	1.5	1.5	Lean Clay (CL)
	8	10	12	UD		17								1.5	1.5	Lean Clay (CL)
	9	12	14	UD		12								1.5	1.5	Lean Clay (CL)
	10	14.5	16	SPT	28	5					15					Silty Sand (SM)
	11	16.5	18	SPT	34	6										Silty Sand (SM)
	12	18.5	20	SPT	27	6										Silty Sand (SM)
	13	21.5	23	SPT	50	4										Silty Sand (SM)

LEGEND:

UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD

SS = SPLIT SPOON SAMPLE

AG = AUGER CUTTINGS

SPT = STANDARD PENETRATION TEST

LL = LIQUID LIMIT

PL = PLASTIC LIMIT

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NOTES:

SUMMARY OF LABORATORY TEST RESULTS

Geotechnical Consultant's Name: Geotech Engineering and Testing

PROJECT NAME: PROPOSED PUMP AND LIFT STATION RENEWAL/REHABILITATION – POST OAK LANE

COH WBS NUMBER: R-000267-0109-3

CONSULTANT PROJECT NUMBER: 13-344E

BORING NO.	SAMPLE NO.	DEPTH (FT) Top	DEPTH (FT) Bottom	TYPE	SPT	WATER CONTENT(%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL (%)	PL (%)	PI (%)	PERCENT PASSING SIEVE 200 (%)	SHEAR STRENGTH (TSF) UNCONFINED COMPRESSION TEST	UU TEST (CONFINING PRESSURE. TSF)	TORVANE	POCKET PENETROMETER	TYPE OF MATERIAL
B-2	1	0	0.1													Asphalt Pavement
	2	0.1	0.5													Concrete Pavement
	3	0.5	2	UD		28								0.62	0.31	Fill: Lean Clay (CL)
	4	2	4	UD		22								0.88	0.46	Lean Clay (CL)
	5	4	6	UD		16	118	40	16	24	89	1.53		1.5	1.5	Lean Clay (CL)
	6	6	8	UD		18								1.5	1.5	Lean Clay (CL)
	7	8	13	UD		16								1.5	1.5	Lean Clay (CL)
	8	10	12	UD		13	113	29	15	14		0.73		1.5	1.5	Lean Clay (CL)
	9	12	14	UD		6								1.5	1.5	Lean Clay (CL)
	10	14.5	16	SPT	29	6										Poorly Graded Sand with Silt (SP-SM)
	11	16.5	18	SPT	46	7										Poorly Graded Sand with Silt (SP-SM)
	12	18.5	20	SPT	30	6					7					Poorly Graded Sand with Silt (SP-SM)
	13	21.5	23	SPT	42	5										Poorly Graded Sand with Silt (SP-SM)

LEGEND:

UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD

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SUMMARY OF LABORATORY TEST RESULTS

Geotechnical Consultant's Name: Geotech Engineering and Testing

PROJECT NAME: PROPOSED PUMP AND LIFT STATION RENEWAL/REHABILITATION – POST OAK LANE

COH WBS NUMBER: R-000267-0109-3

CONSULTANT PROJECT NUMBER: 13-344E

BORING NO.	SAMPLE NO.	DEPTH (FT) Top	DEPTH (FT) Bottom	TYPE	SPT	WATER CONTENT(%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL (%)	PL (%)	PI (%)	PERCENT PASSING SIEVE 200 (%)	SHEAR STRENGTH (TSF) UNCONFINED COMPRESSION TEST	UU TEST (CONFINING PRESSURE. TSF)	TORVANE	POCKET PENETROMETER	TYPE OF MATERIAL
B-3	1	0	0.5													Concrete Pavement
	2	0.5	2	UD		3										Fill: Silty Sand (SM)
	3	2	4	UD		9	111	37	16	21		2.75		1.5	1.5	Lean Clay with Sand (CL)
	4	4	6	UD		9								1.5	1.5	Lean Clay with Sand (CL)
	5	6	8	UD		11								1.5	1.5	Lean Clay with Sand (CL)
	6	8	10	UD		10	126	46	18	28	83	2.66		1.5	1.5	Lean Clay with Sand (CL)
	7	10	12	UD		10								1.5	1.5	Lean Clay with Sand (CL)
	8	12	14	UD		15								1.5	1.5	Lean Clay with Sand (CL)
	9	14	16	UD		17	123	44	17	27	81			1.5	1.5	Lean Clay with Sand (CL)
	10	16.5	18	SPT	42	5										Poorly Graded Sand with Silt (SP-SM)
	11	18.5	20	SPT	38	2										Poorly Graded Sand with Silt (SP-SM)
	12	21.5	23	SPT	24	7					5					Poorly Graded Sand with Silt (SP-SM)

LEGEND:

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SUMMARY OF LABORATORY TEST RESULTS

Geotechnical Consultant's Name: Geotech Engineering and Testing

PROJECT NAME: PROPOSED PUMP AND LIFT STATION RENEWAL/REHABILITATION – POST OAK LANE

COH WBS NUMBER: R-000267-0109-3

CONSULTANT PROJECT NUMBER: 13-344E

BORING NO.	SAMPLE NO.	DEPTH (FT) Top	DEPTH (FT) Bottom	TYPE	SPT	WATER CONTENT(%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL (%)	PL (%)	PI (%)	PERCENT PASSING SIEVE 200 (%)	SHEAR STRENGTH (TSF) UNCONFINED COMPRESSION TEST	UU TEST (CONFINING PRESSURE, TSF)	TORVANE	POCKET PENETROMETER	TYPE OF MATERIAL
B-4	1	0	0.1													Asphalt Pavement
	2	0.1	0.6													Concrete Pavement
	3	0.6	2	UD		13										Fill: Silty Sand (SM)
	4	2	4	UD		19	114	46	19	27	82			1.5	1.5	Lean Clay with Sand (CL)
	5	4	6	UD		16								1.5	1.5	Lean Clay with Sand (CL)
	6	6	8	UD		13								1.5	1.5	Lean Clay with Sand (CL)
	7	8	14	UD		12	120	37	17	20		2.5		1.5	1.5	Lean Clay with Sand (CL)
	8	10	12	UD		14								1.5	1.5	Lean Clay with Sand (CL)
	9	12	14	UD		15	117	36	18	18	85	2.5		1.5	1.5	Lean Clay with Sand (CL)
	10	14.5	16	SPT	38	6										Poorly Graded Sand with Silt (SP-SM)
	11	16.5	18	SPT	29	6										Poorly Graded Sand with Silt (SP-SM)
	12	18.5	20	SPT	52	6					12					Poorly Graded Sand with Silt (SP-SM)
	13	24.5	26	SPT	60	3										Poorly Graded Sand with Silt (SP-SM)

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NOTES:

SUMMARY OF LABORATORY TEST RESULTS

Geotechnical Consultant's Name: Geotech Engineering and Testing

PROJECT NAME: PROPOSED PUMP AND LIFT STATION RENEWAL/REHABILITATION – POST OAK LANE

COH WBS NUMBER: R-000267-0109-3

CONSULTANT PROJECT NUMBER: 13-344E

BORING NO.	SAMPLE NO.	DEPTH (FT) Top	DEPTH (FT) Bottom	TYPE	SPT	WATER CONTENT(%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL (%)	ATTERBERG LIMITS PL (%)	ATTERBERG LIMITS PI (%)	PERCENT PASSING SIEVE 200 (%)	SHEAR STRENGTH (TSF) UNCONFINED COMPRESSION TEST	SHEAR STRENGTH (TSF) UU TEST (CONFINING PRESSURE. TSF)	SHEAR STRENGTH (TSF) TORVANE	SHEAR STRENGTH (TSF) POCKET PENETROMETER	TYPE OF MATERIAL
B-5	1	0	0.2													Asphalt Pavement
	2	0.2	0.6													Concrete Pavement
	3	0.6	2	UD		14					66					Fill: Sandy Silt (ML)
	4	2	4	UD		21								1.25	1.01	Lean Clay with Sand (CL)
	5	4	6	UD		17	111	38	17	21		1.34		1.25	1.16	Lean Clay with Sand (CL)
	6	6	8	UD		16								1.5	1.5	Lean Clay with Sand (CL)
	7	8	10	UD		15								1.5	1.5	Lean Clay with Sand (CL)
	8	10	12	UD		17	113	37	17	20	78	2.11		1.5	1.5	Lean Clay with Sand (CL)
	9	12	14	UD		20								1.5	1.5	Lean Clay with Sand (CL)
	10	14.5	16	SPT	28	14										Silty Sand (SM)
	11	16.5	18	SPT	26	9										Silty Sand (SM)
	12	18.5	20	SPT	48	7					19					Silty Sand (SM)
	13	24.5	26	SPT	26	6										Silty Sand (SM)

LEGEND:

UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD

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SPT = STANDARD PENETRATION TEST

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SUMMARY OF LABORATORY TEST RESULTS

Geotechnical Consultant's Name: Geotech Engineering and Testing

PROJECT NAME: PROPOSED PUMP AND LIFT STATION RENEWAL/REHABILITATION – POST OAK LANE

COH WBS NUMBER: R-000267-0109-3

CONSULTANT PROJECT NUMBER: 13-344E

BORING NO.	SAMPLE NO.	DEPTH (FT) Top	DEPTH (FT) Bottom	TYPE	SPT	WATER CONTENT(%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL (%)	ATTERBERG LIMITS PL (%)	ATTERBERG LIMITS PI (%)	PERCENT PASSING SIEVE 200 (%)	SHEAR STRENGTH (TSF) UNCONFINED COMPRESSION TEST	SHEAR STRENGTH (TSF) UU TEST (CONFINING PRESSURE, TSF)	SHEAR STRENGTH (TSF) TORVANE	SHEAR STRENGTH (TSF) POCKET PENETROMETER	TYPE OF MATERIAL
B-6	1	0	0.6	UD												Concrete Pavement
	2	0.6	2	UD		4										Fill: Sandy Silt (ML)
	3	2	4	UD		9								1.5	1.5	Lean Clay with Sand (CL)
	4	4	6	UD		9								1.5	1.5	Lean Clay with Sand (CL)
	5	6	8	UD		8	120	48	18	30	84	2.78		1.5	1.5	Lean Clay with Sand (CL)
	6	8	10	UD		10								1.5	1.5	Lean Clay with Sand (CL)
	7	10	12	UD		13								1.5	1.5	Lean Clay with Sand (CL)
	8	12	14	UD		12								1.5	1.5	Lean Clay with Sand (CL)
	9	14.5	16	SPT	30	6										Poorly Graded Sand with Silt (SP-SM)
	10	16.5	18	SPT	31	4					12					Poorly Graded Sand with Silt (SP-SM)
	11	18.5	20	SPT	41	5										Poorly Graded Sand with Silt (SP-SM)
	12	24.5	26	SPT	41	5										Poorly Graded Sand with Silt (SP-SM)

LEGEND:

UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD

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SUMMARY OF LABORATORY TEST RESULTS

Geotechnical Consultant's Name: Geotech Engineering and Testing

PROJECT NAME: PROPOSED PUMP AND LIFT STATION RENEWAL/REHABILITATION – POST OAK LANE

COH WBS NUMBER: R-000267-0109-3

CONSULTANT PROJECT NUMBER: 13-344E

BORING NO.	SAMPLE NO.	DEPTH (FT) Top	DEPTH (FT) Bottom	TYPE	SPT	WATER CONTENT(%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL (%)	PL (%)	PI (%)	PERCENT PASSING SIEVE 200 (%)	SHEAR STRENGTH (TSF) UNCONFINED COMPRESSION TEST	UU TEST (CONFINING PRESSURE. TSF)	TORVANE	POCKET PENETROMETER	TYPE OF MATERIAL
B-7	1	0	2													Concrete Pavement
	2	0.6	2	UD		12	123	42	18	24		2.097		1.5	1.5	Fill: Lean Clay with Sand (CL)
	3	2	4	UD		12								1.5	1.5	Lean Clay with Sand (CL)
	4	4	6	UD		12	120	45	18	27	78	2.719		1.5	1.5	Lean Clay with Sand (CL)
	5	6	8	UD		20								1.5	1.5	Lean Clay with Sand (CL)
	6	8	10	UD		15	115	45	18	27		2.368		1.5	1.5	Lean Clay with Sand (CL)
	7	10	12	UD		14								1.25	1.25	Lean Clay with Sand (CL)
	8	12	14	UD		11	119	24	15	9		1.05		1.25	1.25	Lean Clay with Sand (CL)
	9	14.5	16	SPT	22	12										Silty Sand (SM)
	10	16.5	18	SPT	32	12										Silty Sand (SM)
	11	18.5	20	SPT	40	8					15					Silty Sand (SM)
	12	23.5	25	SPT	22	20										Silty Sand (SM)
	13	28.5	30	SPT	13	23										Silty Sand (SM)
	14	34.5	36	SPT	68	22										Silty Sand (SM)

LEGEND:

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NOTES:

SUMMARY OF LABORATORY TEST RESULTS

Geotechnical Consultant's Name: Geotech Engineering and Testing

PROJECT NAME: PROPOSED PUMP AND LIFT STATION RENEWAL/REHABILITATION – POST OAK LANE

COH WBS NUMBER: R-000267-0109-3

CONSULTANT PROJECT NUMBER: 13-344E

BORING NO.	SAMPLE NO.	DEPTH (FT) Top	DEPTH (FT) Bottom	TYPE	SPT	WATER CONTENT(%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL (%)	ATTERBERG LIMITS PL (%)	ATTERBERG LIMITS PI (%)	PERCENT PASSING SIEVE 200 (%)	SHEAR STRENGTH (TSF) UNCONFINED COMPRESSION TEST	SHEAR STRENGTH (TSF) UU TEST (CONFINING PRESSURE. TSF)	SHEAR STRENGTH (TSF) TORVANE	SHEAR STRENGTH (TSF) POCKET PENETRO METER	TYPE OF MATERIAL
B-8	1	0	0.8													Concrete Pavement
	2	0.8	2	UD		15								1.5	1.5	Fill: Lean Clay with Sand (CL)
	3	2	4	UD		21	104	40	17	23		1.1		1.12	0.78	Lean Clay with Sand (CL)
	4	4	6	UD		14								1.5	1.5	Lean Clay with Sand (CL)
	5	6	8	UD		11	123	49	20	29	84	2.94		1.5	1.5	Lean Clay with Sand (CL)
	6	8	10	UD		10								1.5	1.5	Lean Clay with Sand (CL)
	7	10	12	UD		10	128	44	19	25		2.65		1.5	1.5	Lean Clay with Sand (CL)
	8	12.5	14	SPT	29	6					25					Silty Sand (SM)
	9	14.5	16	SPT	17	11										Silty Sand (SM)
	10	16.5	18	SPT	41	17										Silty Sand (SM)
	11	18.5	20	SPT	33	4										Silty Sand (SM)
	12	23.5	25	SPT	17	20										Silty Sand (SM)
	13	28.5	30	SPT	69	25										Silty Sand (SM)
	14	34.5	36	SPT	52	16										Silty Sand (SM)

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BORING NO.	SAMPLE NO.	DEPTH (FT) Top	DEPTH (FT) Bottom	TYPE	SPT	WATER CONTENT(%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL (%)	ATTERBERG LIMITS PL (%)	ATTERBERG LIMITS PI (%)	PERCENT PASSING SIEVE 200 (%)	SHEAR STRENGTH (TSF) UNCONFINED COMPRESSION TEST	SHEAR STRENGTH (TSF) UU TEST (CONFINING PRESSURE. TSF)	SHEAR STRENGTH (TSF) TORVANE	SHEAR STRENGTH (TSF) POCKET PENETROMETER	TYPE OF MATERIAL
B-9	1	0	0.6													Concrete Pavement
	2	0.6	2	UD		23								0.25	0.23	Fill: Lean Clay with Sand (CL)
	3	2	4	UD		14								1.5	1.5	Lean Clay with Sand (CL)
	4	4	6	UD		12								1.5	1.5	Lean Clay with Sand (CL)
	5	6	8	UD		12	124	45	18	27		2.8		1.5	1.5	Lean Clay with Sand (CL)
	6	8	10	UD		16								1.25	1.16	Lean Clay with Sand (CL)
	7	10	12	UD		12	117	47	18	29	79	0.97		1.5	1.5	Lean Clay with Sand (CL)
	8	12	14	UD		16								1.38	1.24	Lean Clay with Sand (CL)
	9	14.5	16	SPT	20	9										Silty Sand (SM)
	10	16.5	18	SPT	40	10										Silty Sand (SM)
	11	18.5	20	SPT	38	9										Silty Sand (SM)
	12	23.5	25	SPT	17	23					21					Silty Sand (SM)
	13	28.5	30	SPT	48	20										Silty Sand (SM)
	14	34.5	36	SPT	37	20										Silty Sand (SM)

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BORING NO.	SAMPLE NO.	DEPTH (FT) Top	DEPTH (FT) Bottom	TYPE	SPT	WATER CONTENT(%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL (%)	PL (%)	PI (%)	PERCENT PASSING SIEVE 200 (%)	SHEAR STRENGTH (TSF) UNCONFINED COMPRESSION TEST	UU TEST (CONFINING PRESSURE. TSF)	TORVANE	POCKET PENETROMETER	TYPE OF MATERIAL
B-10	1	0	0.9													Concrete Pavement
	2	0.9	2	UD		22								1.5	1.5	Fill: Lean Clay with Sand (CL)
	3	2	4	UD		20	114	46	18	28	83	2.27		1.5	1.5	Lean Clay with Sand (CL)
	4	4	6	UD		18								1.12	0.93	Lean Clay with Sand (CL)
	5	6	8	UD		24	110	47	18	29		2.43		1.5	1.5	Lean Clay with Sand (CL)
	6	8	10	UD		22								1.38	1.24	Lean Clay with Sand (CL)
	7	10.5	12	SPT	25	5										Poorly Graded Sand with Silt (SP-SM)
	8	12.5	14	SPT	28	5					12					Poorly Graded Sand with Silt (SP-SM)
	9	14.5	16	SPT	16	5										Poorly Graded Sand with Silt (SP-SM)
	10	16.5	18	SPT	25	4										Poorly Graded Sand with Silt (SP-SM)
	11	18.5	20	SPT	42	3										Poorly Graded Sand with Silt (SP-SM)
	12	23.5	25	SPT	21	21										Poorly Graded Sand with Silt (SP-SM)
	13	28.5	30	SPT	60	20					7					Poorly Graded Sand with Silt (SP-SM)
	14	34.5	36	SPT	33	19										Poorly Graded Sand with Silt (SP-SM)

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BORING NO.	SAMPLE NO.	DEPTH (FT) Top	DEPTH (FT) Bottom	TYPE	SPT	WATER CONTENT(%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL (%)	ATTERBERG LIMITS PL (%)	ATTERBERG LIMITS PI (%)	PERCENT PASSING SIEVE 200 (%)	SHEAR STRENGTH (TSF) UNCONFINED COMPRESSION TEST	SHEAR STRENGTH (TSF) UU TEST (CONFINING PRESSURE. TSF)	SHEAR STRENGTH (TSF) TORVANE	SHEAR STRENGTH (TSF) POCKET PENETRO METER	TYPE OF MATERIAL
B-11	1	0	0.8													Concrete Pavement
	2	0.8	2	UD		16								1.5	1.5	Fill: Lean Clay with Sand (CL)
	3	2	4	UD		12	122	48	19	29		3.33		1.5	1.5	Lean Clay with Sand (CL)
	4	4	6	UD		11								1.5	1.5	Lean Clay with Sand (CL)
	5	6	8	UD		13								1.5	1.5	Lean Clay with Sand (CL)
	6	8	10	UD		9	125	38	16	22	77	3.16		1.5	1.5	Lean Clay with Sand (CL)
	7	10.5	12	SPT	36	6										Poorly Graded Sand with Silt (SP-SM)
	8	12.5	14	SPT	24	6										Poorly Graded Sand with Silt (SP-SM)
	9	14.5	16	SPT	28	3										Poorly Graded Sand with Silt (SP-SM)
	10	16.5	18	SPT	41	4										Poorly Graded Sand with Silt (SP-SM)
	11	18.5	20	SPT	40	4					6					Poorly Graded Sand with Silt (SP-SM)
	12	23.5	25	SPT	54	3										Poorly Graded Sand with Silt (SP-SM)
	13	28.5	30	SPT	53	18					6					Poorly Graded Sand with Silt (SP-SM)
	14	34.5	36	SPT	45	16										Poorly Graded Sand with Silt (SP-SM)

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BORING NO.	SAMPLE NO.	DEPTH (FT) Top	DEPTH (FT) Bottom	TYPE	SPT	WATER CONTENT(%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL (%)	ATTERBERG LIMITS PL (%)	ATTERBERG LIMITS PI (%)	PERCENT PASSING SIEVE 200 (%)	SHEAR STRENGTH (TSF) UNCONFINED COMPRESSION TEST	SHEAR STRENGTH (TSF) UU TEST (CONFINING PRESSURE. TSF)	SHEAR STRENGTH (TSF) TORVANE	SHEAR STRENGTH (TSF) POCKET PENETRO METER	TYPE OF MATERIAL
B-12	1	0														Concrete Pavement
	2	0.8	2	UD		14								1.5	1.5	Fill: Fat Clay (CH)
	3	2	4	UD		13	119	57	19	38		2.7		1.5	1.5	Fat Clay (CH)
	4	4	6	UD		11								1.5	1.5	Fat Clay (CH)
	5	6	8	UD		11								1.5	1.5	Fat Clay (CH)
	6	8	10	UD		13								1.5	1.5	Fat Clay (CH)
	7	10	12	UD		16	116	54	19	35	90	2.75		1.5	1.5	Fat Clay (CH)
	8	12	14	UD		19								1.5	1.5	Fat Clay (CH)
	9	14	16	UD		14								1.5	1.5	Fat Clay (CH)
	10	16.5	18	SPT	24	6					32					Silty Sand (SM)
	11	18.5	20	SPT	54	2										Silty Sand (SM)
	12	23.5	25	SPT	27	4										Silty Sand (SM)
	13	28.5	30	SPT	42	18					16					Silty Sand (SM)
	14	34.5	36	SPT	43	19										Silty Sand (SM)

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BORING NO.	SAMPLE NO.	DEPTH (FT) Top	DEPTH (FT) Bottom	TYPE	SPT	WATER CONTENT(%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL (%)	ATTERBERG LIMITS PL (%)	ATTERBERG LIMITS PI (%)	PERCENT PASSING SIEVE 200 (%)	SHEAR STRENGTH (TSF) UNCONFINED COMPRESSION TEST	SHEAR STRENGTH (TSF) UU TEST (CONFINING PRESSURE. TSF)	SHEAR STRENGTH (TSF) TORVANE	SHEAR STRENGTH (TSF) POCKET PENETRO METER	TYPE OF MATERIAL
B-13	1	0	0.8													Concrete Pavement
	2	0.8	2	UD		14								1.5	1.5	Fill: Lean Clay with Sand (CL)
	3	2	4	UD		8								1.5	1.5	Lean Clay with Sand (CL)
	4	4	6	UD		9	129	46	18	28	77	2.56		1.5	1.5	Lean Clay with Sand (CL)
	5	6	8	UD		14								1.5	1.5	Lean Clay with Sand (CL)
	6	8	10	UD		14	116	36	17	19		2.44		1.5	1.5	Lean Clay with Sand (CL)
	7	10	12	UD		11								1.5	1.5	Lean Clay with Sand (CL)
	8	12.5	14	SPT	14	11										Poorly Graded Sand with Silt (SP-SM)
	9	14.5	16	SPT	14	13										Poorly Graded Sand with Silt (SP-SM)
	10	16.5	18	SPT	20	13										Poorly Graded Sand with Silt (SP-SM)
	11	18.5	20	SPT	22	5					8					Poorly Graded Sand with Silt (SP-SM)
	12	23.5	25	SPT	24	4										Poorly Graded Sand with Silt (SP-SM)
	13	28.5	30	SPT	46	22										Poorly Graded Sand with Silt (SP-SM)
	14	33.5	35	SPT	31	22					8					Poorly Graded Sand with Silt (SP-SM)
	15	36.5	38	SPT	20	23										Poorly Graded Sand with Silt (SP-SM)

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BORING NO.	SAMPLE NO.	DEPTH (FT) Top	DEPTH (FT) Bottom	TYPE	SPT	WATER CONTENT(%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL (%)	PL (%)	PI (%)	PERCENT PASSING SIEVE 200 (%)	SHEAR STRENGTH (TSF) UNCONFINED COMPRESSION TEST	UU TEST (CONFINING PRESSURE. TSF)	TORVANE	POCKET PENETROMETER	TYPE OF MATERIAL
B-14	1	0	0.6													Concrete Pavement
	2	0.6	2	UD		20	113	35	16	19	80	0.75		0.75	0.62	Fill: Lean Clay with Sand (CL)
	3	2	4	UD		12								1.5	1.5	Lean Clay with Sand (CL)
	4	4	6	UD		10								1.5	1.5	Lean Clay with Sand (CL)
	5	6	8	UD		13	121	44	18	26		3.41		1.5	1.5	Lean Clay with Sand (CL)
	6	8	10	UD		13								1.5	1.5	Lean Clay with Sand (CL)
	7	10	12	UD		13								1.5	1.5	Lean Clay with Sand (CL)
	8	12	14	UD		12	122	32	16	16		1.4		1.38	1.32	Lean Clay with Sand (CL)
	9	14	16	UD		9								1.5	1.5	Lean Clay with Sand (CL)
	10	16.5	18	SPT	25	5					12					Poorly Graded Sand with Silt (SP-SM)
	11	18.5	20	SPT	34	6										Poorly Graded Sand with Silt (SP-SM)
	12	23.5	25	SPT	35	5										Poorly Graded Sand with Silt (SP-SM)
	13	28.5	30	SPT	29	14										Poorly Graded Sand with Silt (SP-SM)
	14	33.5	35	SPT	60	17										Poorly Graded Sand with Silt (SP-SM)
	15	36.5	38	SPT	40	14										Poorly Graded Sand with Silt (SP-SM)

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B-15	1	0	0.5													Concrete Pavement
	2	0.5	2	UD		22								0.88	0.78	Fill: Fat Clay (CH)
	3	2	4	UD		22	101	69	23	46	85	0.87		0.88	0.85	Fat Clay (CH)
	4	4	6	UD		16								1.5	1.16	Fat Clay (CH)
	5	6	8	UD		14								1.5	1.5	Fat Clay (CH)
	6	8	10	UD		16	120	50	18	32	88	1.9		1.5	1.5	Fat Clay (CH)
	7	10	12	UD		15								1.5	1.5	Fat Clay (CH)
	8	12	14	UD		18								1.5	1.5	Fat Clay (CH)
	9	14	16	UD		14	120	43	17	26	72	1.88		1.5	1.5	Lean Clay with Sand (CL)
	10	16	18	UD		17								1.5	1.5	Lean Clay with Sand (CL)
	11	18	20	UD		12								1.5	1.5	Lean Clay with Sand (CL)
	12	23	25	SPT	14	21					6					Poorly Graded Sand with Silt (SP-SM
	13	29	31	SPT	19	18										Poorly Graded Sand with Silt (SP-SM

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B-16	1	0	0.5													Concrete Pavement
	2	0.5	2	UD		14								1.5	1.5	Fill: Lean Clay (CL)
	3	2	4	SPT	14	12										Silty Sand (SM)
	4	4	6	SPT	10	13					19					Silty Sand (SM)
	5	6	8	UD		14	123	41	16	25		2.45		1.5	1.5	Lean Clay with Sand (SM)
	6	8	10	UD		19								1.5	1.5	Lean Clay with Sand (SM)
	7	10	12	UD		10	127	39	18	21	80	2.16		1.5	1.5	Lean Clay with Sand (SM)
	8	12	14	UD		14										Poorly Graded Sand with Silt (SP-SM)
	9	14	16	SPT	23	20					4					Poorly Graded Sand with Silt (SP-SM)
	10	16	18	SPT	29	20										Poorly Graded Sand with Silt (SP-SM)
	11	18	20	SPT	28	20										Poorly Graded Sand with Silt (SP-SM)
	12	23	25	SPT	33	22					8					Poorly Graded Sand with Silt (SP-SM)
	13	29	31	SPT	27	20										Poorly Graded Sand with Silt (SP-SM)

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B-17	1	0	0.5													Concrete Pavement
	2	0.5	2	UD		14							1.4	1.5		Lean Clay with Sand (CL)
	3	2	4	UD		15							1.5	1.5		Lean Clay with Sand (CL)
	4	4	6	UD		16	114	40	16	24	73	0.98	0.93	1.5		Lean Clay with Sand (CL)
	5	6	8	UD		15							1.08	1.5		Lean Clay with Sand (CL)
	6	8	10	UD		17							1.5	1.5		Lean Clay with Sand (CL)
	7	10	12	UD		15	117	33	17	16	74	0.95	1.5	1.5		Lean Clay with Sand (CL)
	8	12	14	UD		14							1.5	1.5		Lean Clay with Sand (CL)
	9	14	16	SPT	21	17										Silty Sand (SM)
	10	16	18	SPT	25	14					19					Silty Sand (SM)
	11	18	20	SPT	28	14										Silty Sand (SM)
	12	23	25	SPT	33	15										Silty Sand (SM)
	13	29	31	SPT	32	14										Silty Sand (SM)

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AG = AUGER CUTTINGS

SPT = STANDARD PENETRATION TEST

LL = LIQUID LIMIT

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NOTES:

SUMMARY OF LABORATORY TEST RESULTS

Geotechnical Consultant's Name: Geotech Engineering and Testing

PROJECT NAME: PROPOSED PUMP AND LIFT STATION RENEWAL/REHABILITATION – POST OAK LANE

COH WBS NUMBER: R-000267-0109-3

CONSULTANT PROJECT NUMBER: 13-344E

BORING NO.	SAMPLE NO.	DEPTH (FT) Top	DEPTH (FT) Bottom	TYPE	SPT	WATER CONTENT(%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL (%)	ATTERBERG LIMITS PL (%)	ATTERBERG LIMITS PI (%)	PERCENT PASSING SIEVE 200 (%)	SHEAR STRENGTH (TSF) UNCONFINED COMPRESSION TEST	SHEAR STRENGTH (TSF) UU TEST (CONFINING PRESSURE. TSF)	SHEAR STRENGTH (TSF) TORVANE	SHEAR STRENGTH (TSF) POCKET PENETROMETER	TYPE OF MATERIAL
B-18	1	0	0.5													Concrete Pavement
	2	0.5	2	UD		17							0.93	1		Fill: Lean Clay with Sand (CL)
	3	2	4	UD		15	120	46	18	28	77	1.69	1.4	1.5		Lean Clay with Sand (CL)
	4	4	6	UD		17							1.5	1.5		Lean Clay with Sand (CL)
	5	6	8	UD		14	120	44	19	25	79	1.83	1.5	1.5		Lean Clay with Sand (CL)
	6	8	10	UD		15							1.5	1.5		Lean Clay with Sand (CL)
	7	10	12	UD		14	118	34	16	18	73	1.96	1.5	1.5		Lean Clay with Sand (CL)
	8	12	14	UD		11							1.5	1.5		Lean Clay with Sand (CL)
	9	14	16	SPT	25	9										Silty Sand (SM)
	10	16	18	SPT	29	8										Silty Sand (SM)
	11	18	20	SPT	30	5					16					Silty Sand (SM)
	12	23	25	SPT	20	8										Silty Sand (SM)
	13	29	31	SPT	77	5										Silty Sand (SM)

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BORING NO.	SAMPLE NO.	DEPTH (FT) Top	DEPTH (FT) Bottom	TYPE	SPT	WATER CONTENT(%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL (%)	ATTERBERG LIMITS PL (%)	ATTERBERG LIMITS PI (%)	PERCENT PASSING SIEVE 200 (%)	SHEAR STRENGTH (TSF) UNCONFINED COMPRESSION TEST	SHEAR STRENGTH (TSF) UU TEST (CONFINING PRESSURE. TSF)	SHEAR STRENGTH (TSF) TORVANE	SHEAR STRENGTH (TSF) POCKET PENETROMETER	TYPE OF MATERIAL
B-19	1	0	0.9													Asphalt Pavement
	2	0.9	2	UD		14								1.38	1.24	Fill: Lean Clay with Sand (CL)
	3	2	4	UD		14	114	45	18	27		1.89		1.5	1.32	Lean Clay with Sand (CL)
	4	4	6	UD		14								1.38	1.24	Lean Clay with Sand (CL)
	5	6	8	UD		14								1.5	1.5	Lean Clay with Sand (CL)
	6	8	10	UD		16	117	46	18	28	84	1.64		1.25	1.08	Lean Clay with Sand (CL)
	7	10	12	UD		15								1.5	1.5	Lean Clay with Sand (CL)
	8	12	14	UD		10								1.25	1.08	Lean Clay with Sand (CL)
	9	14	16	UD		15								1.38	1.24	Lean Clay with Sand (CL)
	10	16	18	UD		14		46	18	28	83			1.5	1.5	Lean Clay with Sand (CL)
	11	18	20	UD		15								1.5	1.5	Lean Clay with Sand (CL)
	12	23.5	25	SPT	43	5										Silty Sand (SM)
	13	28.5	30	SPT	41	5										Silty Sand (SM)
	14	33.5	35	SPT	53	24					23					Silty Sand (SM)
	15	38.5	40	SPT	38	24										Silty Sand (SM)

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B-20	1	0	0.8													Asphalt Pavement
	2	0.8	2	UD		12	111	28	14	14				1.5	1.5	Fill: Lean Clay with Sand (CL)
	3	2	4	UD		16								1.5	1.5	Fat Clay (CH)
	4	4	6	UD		13								1.5	1.5	Fat Clay (CH)
	5	6	8	UD		13	121	55	19	36	89	2.8		1.5	1.5	Fat Clay (CH)
	6	8	10	UD		17								1.5	1.5	Fat Clay (CH)
	7	10	12	UD		16								1.5	1.5	Lean Clay with Sand (CL)
	8	12	14	UD		13								1.5	1.5	Lean Clay with Sand (CL)
	9	14	16	UD		13								1.5	1.5	Lean Clay with Sand (CL)
	10	16	18	UD		14								1.5	1.5	Lean Clay with Sand (CL)
	11	18	20	UD		14	120	34	16	18		1.07		1.5	1.5	Lean Clay with Sand (CL)
	12	23.5	25	SPT	42	5										Poorly Graded Sand with Silt (SP-SM)
	13	28.5	30	SPT	41	6					8					Poorly Graded Sand with Silt (SP-SM)
	14	33.5	35	SPT	42	6										Poorly Graded Sand with Silt (SP-SM)
	15	38.5	40	SPT	51	17										Poorly Graded Sand with Silt (SP-SM)

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BORING NO.	SAMPLE NO.	DEPTH (FT) Top	DEPTH (FT) Bottom	TYPE	SPT	WATER CONTENT(%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL (%)	ATTERBERG LIMITS PL (%)	ATTERBERG LIMITS PI (%)	PERCENT PASSING SIEVE 200 (%)	SHEAR STRENGTH (TSF) UNCONFINED COMPRESSION TEST	SHEAR STRENGTH (TSF) UU TEST (CONFINING PRESSURE. TSF)	SHEAR STRENGTH (TSF) TORVANE	SHEAR STRENGTH (TSF) POCKET PENETRO METER	TYPE OF MATERIAL
B-21	1	0	1													Asphalt Pavement
	2	1	2	UD		8								0.88	0.78	Fill: Silty Sand (SM)
	3	2	4	UD		19								1	0.85	Fat Clay (CH)
	4	4	6	UD		17	112	61	21	40	88	1.39		1	0.85	Fat Clay (CH)
	5	6	8	UD		19								1.12	1.08	Fat Clay (CH)
	6	8	10	UD		15								1.25	1.16	Fat Clay (CH)
	7	10	12	UD		14	118	48	18	30		1.403		1.5	1.5	Lean Clay with Sand (CL)
	8	12	14	UD		12								1.5	1.5	Lean Clay with Sand (CL)
	9	14	16	UD		13								1.5	1.5	Lean Clay with Sand (CL)
	10	16	18	UD		11	125	38	17	21		2.37		1.5	1.5	Lean Clay with Sand (CL)
	11	18	20	UD		12										Silty Sand (SM)
	12	23.5	25	SPT	35	8					25					Silty Sand (SM)
	13	28.5	30	SPT	41	6										Silty Sand (SM)
	14	33.5	35	SPT	50	15										Silty Sand (SM)
	15	38.5	40	SPT	33	15										Silty Sand (SM)

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BORING NO.	SAMPLE NO.	DEPTH (FT) Top	DEPTH (FT) Bottom	TYPE	SPT	WATER CONTENT(%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL (%)	ATTERBERG LIMITS PL (%)	ATTERBERG LIMITS PI (%)	PERCENT PASSING SIEVE 200 (%)	SHEAR STRENGTH (TSF) UNCONFINED COMPRESSION TEST	SHEAR STRENGTH (TSF) UU TEST (CONFINING PRESSURE. TSF)	SHEAR STRENGTH (TSF) TORVANE	SHEAR STRENGTH (TSF) POCKET PENETRO METER	TYPE OF MATERIAL
B-22	1	0	1													Asphalt Pavement
	2	1	2	UD		12								1.5	1.5	Fill: Silty Sand (SM)
	3	2	4	UD		20								1.5	1.5	Fat Clay (CH)
	4	4	6	UD		14								1.5	1.16	Fat Clay (CH)
	5	6	8	UD		16	117	45	17	28	84	1.75		1.5	1.5	Fat Clay (CH)
	6	8	10	UD		12								1.5	1.5	Lean Clay with Sand (CL)
	7	10	12	UD		17								1.5	1.5	Lean Clay with Sand (CL)
	8	12	14	UD		13	121	42	18	24		2.6		1.5	1.5	Lean Clay with Sand (CL)
	9	14	16	UD		12								1.5	1.5	Lean Clay with Sand (CL)
	10	16	18	UD		12								1.5	1.5	Lean Clay with Sand (CL)
	11	18	20	UD		13	116	34	15	19		2.13				Sandy Silt (ML)
	12	23.5	25	SPT	35	10					57					Sandy Silt (ML)
	13	28.5	30	SPT	38	4										Sandy Silt (ML)
	14	33.5	35	SPT	36	19					6					Poorly Graded Sand with Silt (SP-SM)
	15	38.5	40	SPT	66	19										Poorly Graded Sand with Silt (SP-SM)

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B-23	1	0	1													Asphalt Pavement
	2	1	2	UD		12								1.5	1.5	Fill: Silty Sand (SM)
	3	2	4	UD		22								1.5	1.5	Lean Clay with Sand (CL)
	4	4	6	UD		18								1.16	1.5	Lean Clay with Sand (CL)
	5	6	8	UD		16	114	40	18	22	83	2.2		1.5	1.5	Lean Clay with Sand (CL)
	6	8	10	UD		18								1.5	1.5	Lean Clay with Sand (CL)
	7	10	12	UD		14								1.5	1.5	Lean Clay with Sand (CL)
	8	12	14	UD		15	120	34	16	18		1.68		1.5	1.5	Lean Clay with Sand (CL)
	9	14	16	UD		10								1.5	1.5	Lean Clay with Sand (CL)
	10	16	18	UD		19								1.5	1.5	Lean Clay with Sand (CL)
	11	18	20	UD		20								1.5	1.5	Fat Clay (CH)
	12	23	25	UD		15	113	52	18	34		2.73		1.5	1.5	Fat Clay (CH)
	13	28.5	30	SPT	31	11										Silty Sand (SM)
	14	33.5	35	SPT	40	2										Silty Sand (SM)
	15	38.5	40	SPT	39	7					22					Silty Sand (SM)

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B-24	1	0	0.9													Concrete Pavement
	2	0.9	2	UD		13										Fill: Silty Sand (SM)
	3	2	4	UD		13	116	33	16	17		1.95		1.5	1.5	Fill: Lean Clay with Sand (CL)
	4	4	6	UD		15								1.5	1.5	Fill: Lean Clay with Sand (CL)
	5	6	8	UD		14	111	31	16	15	83	1.17		1.5	1.5	Fill: Lean Clay with Sand (CL)
	6	8.5	10	SPT	11	12										Poorly Graded Sand with Silt (SP-SM)
	7	10.5	12	SPT	19	5										Poorly Graded Sand with Silt (SP-SM)
	8	12.5	14	SPT	30	7										Poorly Graded Sand with Silt (SP-SM)
	9	14.5	16	SPT	28	4					9					Poorly Graded Sand with Silt (SP-SM)
	10	16.5	18	SPT	69	5										Poorly Graded Sand with Silt (SP-SM)
	11	18.5	20	SPT	61	6										Poorly Graded Sand with Silt (SP-SM)
	12	23.5	25	SPT	65	25										Poorly Graded Sand with Silt (SP-SM)
	13	28.5	30	SPT	78	21										Poorly Graded Sand with Silt (SP-SM)
	14	33.5	35	SPT	69	21										Poorly Graded Sand with Silt (SP-SM)
	15	38.5	40	SPT	29	30										Poorly Graded Sand with Silt (SP-SM)
	16	43	45	UD		25								1.5	1.5	Fat Clay (CH)
	17	48	50	UD		25								1.5	1.5	Fat Clay (CH)
	18	53	55	UD		25								1.5	1.5	Fat Clay (CH)

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B-25	1	0	0.8	UD												Concrete Pavement
	2	0.8	2	UD		18								0.5	0.23	Fill: Lean Clay with Sand (CL)
	3	2	4	UD		15		30	16	14	79			0.62	0.46	Fill: Lean Clay with Sand (CL)
	4	4.5	6.5	SPT	18	15										Silty Sand (SM)
	5	6.5	8.5	SPT	29	12					34					Silty Sand (SM)
	6	8.5	10	SPT	24	13										Silty Sand (SM)
	7	10.5	12	SPT	31	14										Silty Sand (SM)
	8	12.5	14	SPT	35	6										Silty Sand (SM)
	9	14.5	16	SPT	32	7										Silty Sand (SM)
	10	16.5	18	SPT	37	8					16					Silty Sand (SM)
	11	18.5	20	SPT	37	8										Silty Sand (SM)
	12	23.5	25	SPT	42	5										Silty Sand (SM)
	13	28.5	30	SPT	37	4										Silty Sand (SM)
	14	33.5	35	SPT	42	22										Silty Sand (SM)
	15	38.5	40	SPT	23	23										Silty Sand (SM)
	16	43.5	45	SPT	24	24										Silty Sand (SM)
	17	48	50	UD		21								1.5	0.93	Fat Clay (CH)
	18	53	55	UD		23								1.5	1.08	Fat Clay (CH)

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B-26	1	0	0.6													Concrete Pavement
	2	0.6	2	UD		9					30					Fill: Silty Sand (SM)
	3	2.5	4	SPT	20	12										Poorly Graded Sand with Silt (SP-SM)
	4	4.5	6	SPT	21	12										Poorly Graded Sand with Silt (SP-SM)
	5	6.5	8	SPT	22	13										Poorly Graded Sand with Silt (SP-SM)
	6	8.5	10	SPT	21	10										Poorly Graded Sand with Silt (SP-SM)
	7	10.5	12	SPT	22	11										Poorly Graded Sand with Silt (SP-SM)
	8	12.5	14	SPT	18	7										Poorly Graded Sand with Silt (SP-SM)
	9	14.5	16	SPT	19	10					10					Poorly Graded Sand with Silt (SP-SM)
	10	16.5	18	SPT	18	7										Poorly Graded Sand with Silt (SP-SM)
	11	18.5	20	SPT	63	7										Poorly Graded Sand with Silt (SP-SM)
	12	20.5	22	SPT	55	6										Poorly Graded Sand with Silt (SP-SM)
	13	22.5	24	SPT	64	6										Poorly Graded Sand with Silt (SP-SM)
	14	24.5	26	SPT	75	23										Poorly Graded Sand with Silt (SP-SM)
	15	26.5	28	SPT	87	22										Poorly Graded Sand with Silt (SP-SM)
	16	28.5	30	SPT	80	25										Poorly Graded Sand with Silt (SP-SM)
	17	30.5	32	SPT	66	29										Poorly Graded Sand with Silt (SP-SM)
	18	32	34	UD		22								1.5	1.5	Lean Clay with Sand (CL)

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B-26.1	19	34	36	UD		13	107	30	15	15		0.84		1.5	1.5	Lean Clay with Sand (CL)
	20	36	38	UD		26								1.12	0.85	Lean Clay with Sand (CL)
	21	38	40	UD		19								1.12	0.85	Lean Clay with Sand (CL)
	22	40	42	UD		29	98	55	20	35		2.23		1.5	1.5	Fat Clay (CH)
	23	42	44	UD		23								1.5	1.5	Fat Clay (CH)
	24	44	46	UD		28								1.5	1.5	Fat Clay (CH)
	25	46	48	UD		23								1.5	1.5	Fat Clay (CH)
	26	48	50	UD		32	94	64	21	43	91	0.89		1.5	1.5	Fat Clay (CH)
	27	50	52	UD		18								1.5	1.5	Fat Clay (CH)
	28	52	54	UD		18								1.5	1.5	Fat Clay (CH)
	29	54	56	UD		15	115	51	18	33		3.07		1.5	1.5	Fat Clay (CH)
	30	56	58	UD		13								1.5	1.5	Fat Clay (CH)
	31	58	60	UD		23	103	35	17	18	84	1.2		1.5	1.5	Lean Clay with Sand (CL)
	32	60	62	UD		14								1.5	1.5	Lean Clay with Sand (CL)
	33	62	64	UD		19								1.5	1.5	Lean Clay with Sand (CL)
	34	64.5	66	SPT	78	14										Silty Sand (SM)
	35	66.5	68	SPT	87	18										Silty Sand (SM)
	36	68.5	70	SPT	93	12										Silty Sand (SM)

LEGEND:

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NOTES:

SUMMARY OF LABORATORY TEST RESULTS

Geotechnical Consultant's Name: Geotech Engineering and Testing

PROJECT NAME: PROPOSED PUMP AND LIFT STATION RENEWAL/REHABILITATION – POST OAK LANE

COH WBS NUMBER: R-000267-0109-3

CONSULTANT PROJECT NUMBER: 13-344E

BORING NO.	SAMPLE NO.	DEPTH (FT) Top	DEPTH (FT) Bottom	TYPE	SPT	WATER CONTENT(%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL (%)	PL (%)	PI (%)	PERCENT PASSING SIEVE 200 (%)	SHEAR STRENGTH (TSF) UNCONFINED COMPRESSION TEST	UU TEST (CONFINING PRESSURE. TSF)	TORVANE	POCKET PENETROMETER	TYPE OF MATERIAL
B-26.2	37	70.5	72	SPT	80	21					18					Silty Sand (SM)
	38	72.5	74	SPT	56	25										Silty Sand (SM)
	39	74.5	76	SPT	78	30										Silty Sand (SM)
	40	76.5	78	SPT	74	22										Silty Sand (SM)
	41	78.5	80	SPT	67	21										Silty Sand (SM)
	42	80.5	82	SPT	69	20										Silty Sand (SM)
	43	82.5	84	SPT	77	35					16					Silty Sand (SM)
	44	84.5	86	SPT	86	20										Silty Sand (SM)
	45	86.5	88	SPT	93	24										Silty Sand (SM)
	46	88.5	90	SPT	61	24										Silty Sand (SM)
	47	90.5	92	SPT	66	19										Silty Sand (SM)
	48	92.5	94	SPT	76	31										Silty Sand (SM)
	49	94.5	96	SPT	84	20										Silty Sand (SM)
	50	96.5	98	SPT	71	27										Silty Sand (SM)
	51	98.5	100	SPT	66	26										Silty Sand (SM)
	52	100.5	102	SPT	90	17										Silty Sand (SM)
	53	103.5	105	SPT	83	20										Silty Sand (SM)

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B-27	1	0	0.8													Concrete Pavement
	2	0.8	2	UD		10										Silty Sand (SM)
	3	2.5	4.5	SPT	14	4					48					Silty Sand (SM)
	4	4.5	6.5	SPT	15	14										Silty Sand (SM)
	5	6	8	UD		10	115	91	26	65	88	1.89		1.5	1.5	Fat Clay (CH)
	6	8	10	UD		6								1.5	1.5	Fat Clay (CH)
	7	10	12	UD		9								1.5	1.5	Fat Clay (CH)
	8	12.5	14	SPT	84	8										Silty Sand (SM)
	9	14.5	16	SPT	82	8					23					Silty Sand (SM)
	10	16.5	18	SPT	77	8										Silty Sand (SM)
	11	18.5	20	SPT	82	9										Silty Sand (SM)
	12	23.5	25	SPT	83	2										Silty Sand (SM)
	13	28.5	30	SPT	34	8										Silty Sand (SM)
	14	33.5	35	SPT	32	17										Silty Sand (SM)
	15	36.5	38	SPT	28	13										Silty Sand (SM)

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CONSULTANT PROJECT NUMBER: 13-344E

BORING NO.	SAMPLE NO.	DEPTH (FT) Top	DEPTH (FT) Bottom	TYPE	SPT	WATER CONTENT(%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL (%)	ATTERBERG LIMITS PL (%)	ATTERBERG LIMITS PI (%)	PERCENT PASSING SIEVE 200 (%)	SHEAR STRENGTH (TSF) UNCONFINED COMPRESSION TEST	SHEAR STRENGTH (TSF) UU TEST (CONFINING PRESSURE. TSF)	SHEAR STRENGTH (TSF) TORVANE	SHEAR STRENGTH (TSF) POCKET PENETROMETER	TYPE OF MATERIAL
B-28	1	0	0.7													Concrete Pavement
	2	0.7	2	UD		23								0.25	0.15	Fill: Fat Clay (CH)
	3	2	4	UD		13	82	51	20	31		0.8		1.12	1.08	Fill: Fat Clay (CH)
	4	4	6	UD		14								1.5	1.5	Fill: Fat Clay (CH)
	5	6	8	UD		18								1	0.85	Fill: Fat Clay (CH)
	6	8	10	UD		21	99	54	19	35	91	0.404		0.62	0.56	Fill: Fat Clay (CH)
	7	10	12	UD		19								0.88	0.78	Fat Clay (CH)
	8	12	14	UD		16								0.75	0.69	Fat Clay (CH)
	9	14	16	UD		15								1.5	1.5	Fat Clay (CH)
	10	16	18	UD		15								1	0.62	Fat Clay (CH)
	11	18	20	UD		18								0.75	0.56	Fat Clay (CH)
	12	23	25	UD		15								1.5	1.08	Fat Clay (CH)
	13	28	30	UD		27								1.5	1.5	Fat Clay (CH)
	14	33	35	UD		27								1.5	1.5	Fat Clay (CH)
	15	36	38	UD		27								1.5	1.5	Fat Clay (CH)

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B-29	1	0	0.7													Concrete Pavement
	2	0.7	2	UD		18								1.5	1.5	Fill: Fat Clay (CH)
	3	2	4	UD		20								1.5	1.5	Fat Clay (CH)
	4	4	6	UD		21	107	58	20	38	88	1.25		1.5	1.5	Fat Clay (CH)
	5	6	8	UD		23								1.5	1.5	Fat Clay (CH)
	6	8	10	UD		18								1.5	1.5	Fat Clay (CH)
	7	10	12	UD		16								1.5	1.5	Fat Clay (CH)
	8	12	14	UD		12								1.5	1.5	Fat Clay (CH)
	9	14.5	16	SPT	26	18										Silty Sand (SM)
	10	16	18	UD		13								1.5	1.5	Fat Clay (CH)
	11	18.5	20	SPT	10	29										Silty Sand (SM)
	12	23	25	UD		20								1.5	1.5	Fat Clay (CH)
	13	28	30	UD		32	93	73	22	51		0.98		1.5	1.5	Fat Clay (CH)
	14	33	35	UD		25								1.5	1.5	Fat Clay (CH)
	15	36	38	UD		29								1.5	1.5	Fat Clay (CH)

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BORING NO.	SAMPLE NO.	DEPTH (FT) Top	DEPTH (FT) Bottom	TYPE	SPT	WATER CONTENT(%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL (%)	PL (%)	PI (%)	PERCENT PASSING SIEVE 200 (%)	SHEAR STRENGTH (TSF) UNCONFINED COMPRESSION TEST	UU TEST (CONFINING PRESSURE. TSF)	TORVANE	POCKET PENETROMETER	TYPE OF MATERIAL
B-30	1	0	0.9													Concrete Pavement
	2	0.9	2	UD		26								0.88	0.39	Fill: Lean Clay with Sand (CL)
	3	2	4	UD		16	114	46	17	29		2.32		1.5	1.5	Lean Clay with Sand (CL)
	4	4	6	UD		15								1.5	1.5	Lean Clay with Sand (CL)
	5	6	8	UD		16								1.5	1.5	Lean Clay with Sand (CL)
	6	8	10	UD		16	109	61	19	42	90	1.57		1.5	1.5	Fat Clay (CH)
	7	10	12	UD		20								1.5	1.5	Fat Clay (CH)
	8	12	14	UD		19								1.5	1.5	Fat Clay (CH)
	9	14	16	UD		12								1.5	1.5	Fat Clay (CH)
	10	16	18	UD		16	115	45	18	27		1.33		1.5	1.5	Lean Clay with Sand (CL)
	11	18	20	UD		16								1.5	1.5	Lean Clay with Sand (CL)
	12	23	25	UD		23								1.5	1.5	Lean Clay with Sand (CL)
	13	28.5	30	SPT	33	20					63					Sandy Silt (ML)
	14	33.5	35	SPT	27	24										Sandy Silt (ML)
	15	36.5	38	SPT	21	19										Sandy Silt (ML)

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B-31	1	0	0.3													Asphalt Pavement
	2	0.3	0.8													Concrete Pavement
	3	0.8	2	UD		22								0.5	0.31	Fill: Lean Clay with Sand (CL)
	4	2	4	UD		20								0.5	0.31	Fill: Lean Clay with Sand (CL)
	5	4	6	UD		16								1	0.85	Fill: Lean Clay with Sand (CL)
	6	6	8	UD		15	116	31	16	15	85			1.5	1.5	Fill: Lean Clay with Sand (CL)
	7	8	14	UD		15								0.5	0.23	Fill: Lean Clay with Sand (CL)
	8	10	12	UD		17								0.38	0.23	Fill: Lean Clay with Sand (CL)
	9	12.5	14	SPT	23	17					14					Silty Sand (SM)
	10	14.5	16	SPT	27	20										Silty Sand (SM)
	11	16.5	18	SPT	22	14										Silty Sand (SM)
	12	18.5	20	SPT	24	18										Silty Sand (SM)
	13	21.5	23	SPT	19	14										Silty Sand (SM)

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B-32	1	0	0.2													Asphalt Pavement
	2	0.2	0.7													Concrete Pavement
	3	0.7	2	UD		23								1.5	1.5	Fill: Lean Clay with Sand (CL)
	4	2	4	UD		18	111	34	17	17		0.91		1.5	1.5	Fill: Lean Clay with Sand (CL)
	5	4.5	6	SPT	17	15										Fill: Silty Sand (SM)
	6	6	8	UD		21	105	28	14	14	83	0.45		1	0.78	Fill: Lean Clay with Sand (CL)
	7	8	10	UD		20								0.88	0.62	Fill: Lean Clay with Sand (CL)
	8	10.5	12	SPT	14	16										Silty Sand (SM)
	9	12.5	14	SPT	14	15					15					Silty Sand (SM)
	10	14.5	16	SPT	13	13										Silty Sand (SM)
	11	16.5	18	SPT	18	16										Silty Sand (SM)
	12	18.5	20	SPT	52	16										Silty Sand (SM)
	13	21.5	23	SPT	56	15										Silty Sand (SM)

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B-33	1	0	0.6													Concrete Pavement
	2	0.6	2	UD		12								1.5	1.5	Fill: Lean Clay with Sand (CL)
	3	2	4	UD		14								1.5	1.5	Lean Clay with Sand (CL)
	4	4	6	UD		17	116	33	16	17	83	1.75		1.5	1.5	Lean Clay with Sand (CL)
	5	6	8	UD		24								1.12	1.08	Lean Clay with Sand (CL)
	6	8	10	UD		16	121	30	16	14		1.129		1.12	1.08	Lean Clay with Sand (CL)
	7	10.5	12	SPT	14	16										Silty Sand (SM)
	8	12.5	14	SPT	14	13					25					Silty Sand (SM)
	9	14.5	16	SPT	13	17										Silty Sand (SM)
	10	16.5	18	SPT	18	23										Silty Sand (SM)
	11	18.5	20	SPT	52	16					26					Silty Sand (SM)
	12	21.5	23	SPT	56	24										Silty Sand (SM)

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BORING NO.	SAMPLE NO.	DEPTH (FT) Top	DEPTH (FT) Bottom	TYPE	SPT	WATER CONTENT(%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL (%)	ATTERBERG LIMITS PL (%)	ATTERBERG LIMITS PI (%)	PERCENT PASSING SIEVE 200 (%)	SHEAR STRENGTH (TSF) UNCONFINED COMPRESSION TEST	SHEAR STRENGTH (TSF) UU TEST (CONFINING PRESSURE, TSF)	SHEAR STRENGTH (TSF) TORVANE	SHEAR STRENGTH (TSF) POCKET PENETROMETER	TYPE OF MATERIAL
B-34	1	0	0.6													Concrete Pavement
	2	0.6	2	UD		9										Fill: Silty Sand (SM)
	3	2.5	4	SPT	14	8										Silty Sand (SM)
	4	4.5	6	SPT	8	8										Silty Sand (SM)
	5	6.5	8	SPT	18	22					16					Silty Sand (SM)
	6	8.5	10	SPT	22	9										Silty Sand (SM)
	7	10.5	12	SPT	26	17										Silty Sand (SM)
	8	12	14	UD		28	97	72	22	50	88	2.01		1.5	1.32	Fat Clay (CH)
	9	14	15	UD		24								1	0.93	Fat Clay (CH)

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NOTES:

APPENDIX B

Piezometer Installation and Abandonment Reports

Attention Owner:
Confidentiality Privilege Notice on reverse side of owner's copy.

Texas Department of Licensing and Regulation

Water Well Driller/Pump Installer Program
P.O. Box 12157 Austin, Texas 78711 (512) 463-7880 FAX (512) 463-8616
Toll free (800) 803-9202
Email address: water.well@license.state.tx.us

This form must be completed and filed with the department and owner **within 60 days** upon completion of the well.

WELL REPORT

1) Owner

Name	Address	City	State	Zip
City of Houston Geotech Dept	611 Walker Floor 14	Houston	Tx	77002

2) Well Location

County	Physical Address	City	State	Zip
Harris	Sandringham @ Buckingham (pz-1)	Houston	Tx	77024

Lat. ° ' " Long. ° ' " Grid # 65-13-7

3) Type of Work
☒ New Well ☐ Reconditioning
☐ Replacement ☐ Deepening

4) Proposed Use (check) ☒ Monitor ☐ Environmental Soil Boring ☐ Domestic
☐ Industrial ☐ Irrigation ☐ Injection ☐ Public Supply ☐ De-watering ☐ Testwell
☐ Rig Supply ☐ Stock or Livestock If Public Supply, were plans approved? ☐ Yes ☐ No

5) N↑

6) Drilling Date
Started 11/26/12
Completed 11/26/12

Diameter of Hole

Dia. (in)	From (ft)	To (ft)
4	Surface 0	26

7) Drilling Method (check)
☐ Driven ☐ Air Rotary ☒ Mud Rotary
☐ Bored ☐ Air Hammer ☐ Cable Tool
☐ Jetted ☐ Hollow Stem Auger
☐ Reverse Circulation
☐ Other

Formation Log

From (ft)	To (ft)	Description of Formation Material
0	2	Sa
2	14	Cl
14	26	Sa

8) Borehole Completion ☐ Open Hole ☐ Straight Wall
☐ Under-reamed ☐ Gravel Packed ☒ Other 9&12
Gravel Packed interval from ft. to ft. Size:

Casing, Liner, Screen Data

Dia. (in.)	New Or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfr., if commercial	Setting (ft) From	Setting (ft) To	Gage Casing Screen
2	n	Sch 40 PVC Riser	0	10	
2	n	Sch 40 PVC Screen	10	25	.010

9) Annular Seal Data: i.e. *(from 0 ft to 100 ft #sacks & material 13 cement)*
from 0 ft. to 6 ft. #sacks & material .5 cement
from 6 ft. to 8 ft. #sacks & material .5 bentonite
from ____ ft. to ____ ft. #sacks & material
Method Used tremmie
Distance to septic field or other concentrated contamination na ft.
Distance to Property Line ____ ft Method na
Verified: na

10) Surface Completion (If steel cased, leave blank)
☐ Surface Slab Installed ☒ Surface Sleeve Installed
☐ Pitless Adapter Used ☐ Alternative Procedure Used

11) Water Level
Static level na ft. Date 11/26/12
Artesian Flow ____ gpm

12) Packers

Type	Depth	Type	Depth
20/40	8-26		

Plugging Information

From (ft)	To (ft)	Cement/Bentonite Mix	Amount	Method of Placement

13) Plugged ☐ Well plugged within 48 hours
Casing left in well: na Cement/Bentonite placed in well:

14) Type Pump
☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder
☐ Other na
Depth to pump bowls, cylinder, jet, etc., ft.

15) Water Test
Type test ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated
Yield: na gpm with ____ ft. drawdown after ____ hrs.

16) Water Quality
Type of water: ____ Depth of Strata: ____ Was a chemical analysis made? ☐ Yes ☒ No
Did you knowingly penetrate a strata which contains undesirable constituents? ☐ Yes ☒ No If yes, Continue:
Check One: ☐ Naturally poor-quality groundwater – type ____ ☐ Hydrocarbons (i.e. gas, oil, etc.)
☐ Hazardous material/waste contamination encountered ☐ Other (describe) ____
☐ *I certify that while drilling, deepening, or otherwise altering the above described well, undesirable water or constituents was encountered and the landowner was informed that such well must be completed or plugged in such a manner as to avoid injury or pollution.*

Company or Individual's Name (type or print) Van and Sons Drilling Service, Inc
Address 319 John Alber City Houston State Tx Lic. No. 2903M
Signature 1/16/13 Signature Zip 77076 / /

TDLR FORM 001WWD / 9-03 Copies to TDLR - Owner - Driller/Pump Installer

Form provided by Forms On-A-Disk • (214) 340-9429 • FormsOnADisk.com

Attention Owner:
Confidentiality Privilege Notice on reverse side of owner's copy.

Texas Department of Licensing and Regulation

Water Well Driller/Pump Installer Program
P.O. Box 12157 Austin, Texas 78711 (512) 463-7880 FAX (512) 463-8616
Toll free (800) 803-9202
Email address: water.well@license.state.tx.us

This form must be completed and filed with the department and owner within 60 days upon completion of the well.

WELL REPORT

OWNER

Name	Address	City	State	Zip
City of Houston Geotech Dept	611 Walker Floor 14	Houston	Tx	77002

WELL LOCATION

County	Physical Address	City	State	Zip
Harris	8900 Chatsworth (pz-2)	Houston	Tx	77024

Lat. ° ' " Long. ° ' " Grid # 65-13-7

3) Type of Work
☒ New Well ☐ Reconditioning ☐ Replacement ☐ Deepening

4) Proposed Use (check) ☒ Monitor ☐ Environmental Soil Boring ☐ Domestic ☐ Industrial ☐ Irrigation ☐ Injection ☐ Public Supply ☐ De-watering ☐ Testwell ☐ Rig Supply ☐ Stock or Livestock
If Public Supply, were plans approved? ☐ Yes ☐ No

5) N↑

6) Drilling Date
Started 11/26/12
Completed 11/26/12

Diameter of Hole

Dia. (in)	From (ft)	To (ft)
4	Surface 0	36

7) Drilling Method (check)
☐ Driven ☐ Air Rotary ☒ Mud Rotary ☐ Bored ☐ Air Hammer ☐ Cable Tool ☐ Jetted ☐ Hollow Stem Auger ☐ Reverse Circulation ☐ Other

From (ft)	To (ft)	Description and color of formation material
0	2	Sa
2	10	Cl
10	36	Sa

8) Borehole Completion ☐ Open Hole ☐ Straight Wall ☐ Under-reamed ☐ Gravel Packed ☒ Other 9&12
Gravel Packed interval from ft. to ft.

CASING/SCREEN

Dia. (in.)	New Or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial	Setting (ft) From	To	Gage Casing Screen
2	n	Sch 40 PVC Riser	0	20	
2	n	Sch 40 PVC Screen	20	30	.010

9) Annular Seal Data: i.e. (from 0 ft to 100 ft #sacks & material 13 cement)
from 0 ft. to 16 ft. #sacks & material 2 cement
from 16 ft. to 18 ft. #sacks & material .5 bentonite
from ft. to ft. #sacks & material
Method Used tremmie
Distance to septic field or other concentrated contamination na ft.
Distance to Property Line ft Method na
Verified: na

10) Surface Completion (If steel cased, leave blank)
☐ Surface Slab Installed ☒ Surface Sleeve Installed ☐ Pitless Adapter Used ☐ Alternative Procedure Used

11) Water Level
Static level 28 ft. Date 11/26/12
Artesian Flow gpm

12) Packers

Type	Depth
20/40	18-36

FOR USE BY WELL OWNER (if applicable)

13) Plugged ☐ Well plugged within 48 hours
Casing left in well: na Cement/Bentonite placed in well:

From (ft)	To (ft)	From (ft)	To (ft)	Material used & Sacks

14) Type Pump
☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder
☐ Other na
Depth to pump bowls, cylinder, jet, etc., ft.

15) Water Test
Type test ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated
Yield: na gpm with ____ ft. drawdown after ____ hrs.

16) Water Quality
Type of water: ____ Depth of Strata: ____ Was a chemical analysis made? ☐ Yes ☒ No
Did you knowingly penetrate a strata which contains undesirable constituents? ☐ Yes ☒ No If yes, Continue:
Check One: ☐ Naturally poor-quality groundwater – type ____ ☐ Hydrocarbons (i.e. gas, oil, etc.) ☐ Hazardous material/waste contamination encountered ☐ Other (describe) ____
☐ *I certify that while drilling, deepening, or otherwise altering the above described well, undesirable water or constituents was encountered and the landowner was informed that such well must be completed or plugged in such a manner as to avoid injury or pollution.*

Company or Individual's Name (type or print) Van and Sons Drilling Service, Inc Lic. No. 2903M
Address 310 John Alber City Houston State Tx Zip 77076
Signature 1/16/13 Signature / /

TDLR FORM 001WWD / 9-03 Copies to TDLR - Owner - Driller/Pump Installer

Form provided by Forms On-A-Disk · (214) 340-9429 · FormsOnADisk.com

STATE OF TEXAS WELL REPORT for Tracking #327026

Owner:	CITY OF HOUSTON	Owner Well #:	PZ-3
Address:	PROPOSED PUMP AND LIFT STATION HOUSTON , TX	Grid #:	65-13-7
Well Location:	NORTHEAST CORNER OF STABLE LANDE AND HARNESS CREEK LANE HOUSTON , TX	Latitude:	29° 46' 18" N
Well County:	Harris	Longitude:	095° 27' 48" W
Elevation:	No Data	GPS Brand Used:	GARMIN
Type of Work:	New Well	Proposed Use:	Monitor

Drilling Date:	Started: **7/2/2013** Completed: **7/2/2013**
Diameter of Hole:	Diameter: **8.25 in From Surface To 30 ft**
Drilling Method:	**Hollow Stem Auger**
Borehole Completion:	Gravel Packed From: **30 ft to 3.5 ft** Gravel Pack Size: **20/40 SAND**
Annular Seal Data:	1st Interval: **From 30 ft to 3.5 ft with 13.5 BAGS SAND (#sacks and material)** 2nd Interval: **From 3.5 ft to 1.5 ft with 1 BENT.CHIPS (#sacks and material)** 3rd Interval: **From 1.5 ft to 0 ft with 1.2 CEMENT (#sacks and material)** Method Used: **HANDMIX** Cemented By: **MEDI** Distance to Septic Field or other Concentrated Contamination: **No Data** Distance to Property Line: **No Data** Method of Verification: **No Data** Approved by Variance: **No Data**
Surface Completion:	**Alternative Procedure Used**
Water Level:	Static level: **No Data** Artesian flow: **No Data**
Packers:	**BENTONITE CHIPS 3/8 3.5'-2.5'**
Plugging Info:	Casing or Cement/Bentonite left in well: **No Data**
Type Of Pump:	**No Data**
Well Tests:	**No Data**
Water Quality:	Type of Water: **No Data** Depth of Strata: **No Data** Chemical Analysis Made: **No Data** Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**
Certification Data:	The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.
Company Information:	

	MATHERS ENVIRONMENTAL DRILLING INC. 12243 B. FM 529 HOUSTON , TX 77041
Driller License Number:	4850
Licensed Well Driller Signature:	PATRICK L STEPHENS
Registered Driller Apprentice Signature:	No Data
Apprentice Registration Number:	No Data
Comments:	No Data

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking number (Tracking #327026) on your written request.

Texas Department of Licensing & Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL

From (ft) To (ft) Description
0-6.2" CONCRETE
6.2"-2' FILL, LEAN CLAY, STIFF, LIGHT BROWN, LIGHT GRAY
2'-14' LEAN CLAY WITH SAND, VERY STIFF, LIGHT GRAY, LIGHT BROWN
14'-30' POORLY GRADED SAND WITH SILT, MEDIUM DENSE, LIGHT GRAY

CASING, BLANK PIPE & WELL SCREEN DATA

Dia. New/Used Type Setting From/To
2" NEW PLASTIC SCREEN SLOT 0.010 30'-5' SCH.40
2" NEW PLASTIC RISER 5'-0 SCH.40

Attention Owner: Confidentiality Privilege Notice on reverse side of owner's copy.

Texas Department of Licensing and Regulation

Water Well Driller/Pump Installer Program
P.O. Box 12157 Austin, Texas 78711 (512) 463-7880 FAX (512) 463-8616
Toll free (800) 803-9202
Email address: water.well@license.state.tx.us

This form must be completed and filed with the department and owner within 60 days upon completion of the well.

WELL REPORT

1) OWNER

Name	Address	City	State	Zip
City of Houston Geotech Dept	611 Walker Floor 14	Houston	Tx	77002

2) WELL LOCATION

County	Physical Address	City	State	Zip
Harris	8600 N. Post Oak (pz-4)	Houston	Tx	77024

Lat. ° ' " Long. ° ' " Grid # 65-13-7

3) Type of Work
☒ New Well ☐ Reconditioning ☐ Replacement ☐ Deepening

4) Proposed Use (check) ☒ Monitor ☐ Environmental Soil Boring ☐ Domestic ☐ Industrial ☐ Irrigation ☐ Injection ☐ Public Supply ☐ De-watering ☐ Testwell ☐ Rig Supply ☐ Stock or Livestock
If Public Supply, were plans approved? ☐ Yes ☐ No

5) N↑ °

6) Drilling Date
Started 12/4/12
Completed 12/4/12

Diameter of Hole

Dia. (in)	From (ft)	To (ft)
4	Surface 0	40

7) Drilling Method (check)
☐ Driven ☐ Air Rotary ☒ Mud Rotary ☐ Bored ☐ Air Hammer ☐ Cable Tool ☐ Jetted ☐ Hollow Stem Auger ☐ Reverse Circulation ☐ Other

From (ft)	To (ft)	Description and color of formation material
0	22	Cl
22	40	Sa

8) Borehole Completion ☐ Open Hole ☐ Straight Wall ☐ Under-reamed ☐ Gravel Packed ☒ Other 9&12
Gravel Packed interval from ft. to ft. Size

Casing, Blank Pipe and Screen Data

Dia. (in.)	New Or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial	Setting (ft) From	To	Gage Casing Screen
2	n	Sch 40 PVC Riser	0	20	
2	n	Sch 40 PVC Screen	20	30	.010

9) Annular Seal Data: i.e. (from 0 ft to 100 ft #sacks & material 12 cement)
from 0 ft. to 16 ft. #sacks & material 2 cement
from 16 ft. to 18 ft. #sacks & material .5 bentonite
from ft. to ft. #sacks & material
Method Used tremmie
Distance to septic field or other concentrated contamination na ft.
Distance to Property Line ft Method na
Verified: na

10) Surface Completion (If steel cased, leave blank)
☐ Surface Slab Installed ☒ Surface Sleeve Installed ☐ Pitless Adapter Used ☐ Alternative Procedure Used

11) Water Level
Static level na ft. Date / /
Artesian Flow gpm

12) Packers

Type	Depth	Type	Depth
20/40	18-40		

(USE ADDITIONAL SHEET IF NECESSARY)

13) Plugged ☐ Well plugged within 48 hours
Casing left in well: na Cement/Bentonite placed in well:

From (ft)	To (ft)	From (ft)	To (ft)	Material used & weight

14) Type Pump
☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder ☐ Other na
Depth to pump bowls, cylinder, jet, etc., ft.

15) Water Test
Type test ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated
Yield: na gpm with ____ ft. drawdown after ____ hrs.

16) Water Quality
Type of water: ____ Depth of Strata: ____ Was a chemical analysis made? ☐ Yes ☒ No
Did you knowingly penetrate a strata which contains undesirable constituents? ☐ Yes ☒ No If yes, Continue:
Check One: ☐ Naturally poor-quality groundwater – type ____ ☐ Hydrocarbons (i.e. gas, oil, etc.)
☐ Hazardous material/waste contamination encountered ☐ Other (describe) ____

☐ *I certify that while drilling, deepening, or otherwise altering the above described well, undesirable water or constituents was encountered and the landowner was informed that such well must be completed or plugged in such a manner as to avoid injury or pollution.*

Company or Individual's Name (type or print) Van and Sons Drilling Service, Inc Lic. No. 2903M
Address 319 John Alber City Houston State Tx Zip 77076
Signature 1/16/13 Signature / /

TDLR FORM 001WWD / 9-03 Copies to TDLR - Owner - Driller/Pump Installer

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Water Well Driller/Pump Installer Program
P.O. Box 12157 Austin, Texas 78711 (512) 463-7880 FAX (512) 463-8616
Toll free (800) 803-9202
Email address: water.well@license.state.tx.us

This form must be completed and filed with the department and owner within 60 days upon completion of the well.

WELL REPORT

1) OWNER

Name	Address	City	State	Zip
City of Houston Geotech Dept	611 Walker Floor 14	Houston	Tx	77002

2) WELL LOCATION

County	Physical Address	City	State	Zip
Harris	8600 Woodway (pz-5)	Houston	Tx	77024

Lat. ° ' " Long. ° ' " Grid # 65-13-7

3) Type of Work
☒ New Well ☐ Reconditioning
☐ Replacement ☐ Deepening

4) Proposed Use (check) ☒ Monitor ☐ Environmental Soil Boring ☐ Domestic
☐ Industrial ☐ Irrigation ☐ Injection ☐ Public Supply ☐ De-watering ☐ Testwell
☐ Rig Supply ☐ Stock or Livestock If Public Supply, were plans approved? ☐ Yes ☐ No

5) N↑

6) Drilling Date
Started 12/4/12
Completed 12/4/12

Diameter of Hole

Dia. (in)	From (ft)	To (ft)
4	Surface 0	55

7) Drilling Method (check)
☐ Driven ☐ Air Rotary ☒ Mud Rotary
☐ Bored ☐ Air Hammer ☐ Cable Tool
☐ Jetted ☐ Hollow Stem Auger
☐ Reverse Circulation
☐ Other

From (ft)	To (ft)	Description of Formation Material
0	2	Sa
2	8	Cl
8	43	Sa
43	55	Ch

8) Borehole Completion ☐ Open Hole ☐ Straight Wall
☐ Under-reamed ☐ Gravel Packed ☒ Other 9&12
Gravel Packed interval from ft. to ft.

Casing, Screen, Perforations

Dia. (in.)	New Or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial	Setting (ft) From	Setting (ft) To	Gage Casing Screen
2	n	Sch 40 PVC Riser	0	20	
2	n	Sch 40 PVC Screen	20	30	.010

9) Annular Seal Data: i.e. (from 0 ft to 100 ft #sacks & material 12 cement)
from 0 ft. to 16 ft. #sacks & material 2 cement
from 16 ft. to 18 ft. #sacks & material .5 bentonite
from ft. to ft. #sacks & material
Method Used tremmie
Distance to septic field or other concentrated contamination na ft.
Distance to Property Line ft Method na
Verified: na

10) Surface Completion (If steel cased, leave blank)
☐ Surface Slab Installed ☒ Surface Sleeve Installed
☐ Pitless Adapter Used ☐ Alternative Procedure Used

11) Water Level
Static level na ft. Date / /
Artesian Flow gpm

12) Packers

Type	Depth
20/40	18-55

13) Plugged ☐ Well plugged within 48 hours
Casing left in well: na Cement/Bentonite placed in well:

14) Type Pump
☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder
☐ Other na
Depth to pump bowls, cylinder, jet, etc., ft.

15) Water Test
Type test ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated
Yield: na gpm with ft. drawdown after hrs.

16) Water Quality
Type of water: Depth of Strata: Was a chemical analysis made? ☐ Yes ☒ No
Did you knowingly penetrate a strata which contains undesirable constituents? ☐ Yes ☒ No If yes, Continue:
Check One: ☐ Naturally poor-quality groundwater – type ☐ Hydrocarbons (i.e. gas, oil, etc.)
☐ Hazardous material/waste contamination encountered ☐ Other (describe)

☐ *I certify that while drilling, deepening, or otherwise altering the above described well, undesirable water or constituents was encountered and the landowner was informed that such well must be completed or plugged in such a manner as to avoid injury or pollution.*

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Toll free (800) 803-9202
Email address: water.well@license.state.tx.us

This form must be completed and filed with the department and owner within 60 days upon completion of the well.

WELL REPORT

1) Owner

Name	Address	City	State	Zip
City of Houston Geotech Dept	611 Walker Floor 14	Houston	Tx	77002

2) Well Location

County	Physical Address	City	State	Zip
Harris	4050 Woodway (pz-6)	Houston	Tx	77024

Lat. ° ' " Long. ° ' " Grid # 65-13-7

3) Type of Work
☒ New Well ☐ Reconditioning ☐ Replacement ☐ Deepening

4) Proposed Use (check) ☒ Monitor ☐ Environmental Soil Boring ☐ Domestic ☐ Industrial ☐ Irrigation ☐ Injection ☐ Public Supply ☐ De-watering ☐ Testwell ☐ Rig Supply ☐ Stock or Livestock
If Public Supply, were plans approved? ☐ Yes ☐ No

5) N↑

6) Drilling Date
Started 12/5/12
Completed 12/5/12

Diameter of Hole

Dia. (in)	From (ft)	To (ft)
4	Surface 0	38

7) Drilling Method (check)
☐ Driven ☐ Air Rotary ☒ Mud Rotary ☐ Bored ☐ Air Hammer ☐ Cable Tool ☐ Jetted ☐ Hollow Stem Auger ☐ Reverse Circulation ☐ Other

From (ft)	To (ft)	Description and color of formation material
0	28	Cl
28	38	Si

8) Borehole Completion ☐ Open Hole ☐ Straight Wall ☐ Under-reamed ☐ Gravel Packed ☒ Other 9&12
Gravel Packed interval from ft. to ft.

Casing/Liner/Screen

Dia. (in.)	New Or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfr., if commercial	Setting (ft) From	To	Gage Casing Screen
2	n	Sch 40 PVC Riser	0	20	
2	n	Sch 40 PVC Screen	20	30	.010

9) Annular Seal Data: i.e. (from 0 ft to 100 ft #sacks & material 13 cement)
from 0 ft. to 16 ft. #sacks & material 2 cement
from 16 ft. to 18 ft. #sacks & material .5 bentonite
from ft. to ft. #sacks & material
Method Used tremmie
Distance to septic field or other concentrated contamination na ft.
Distance to Property Line ft Method na
Verified: na

10) Surface Completion (If steel cased, leave blank)
☐ Surface Slab Installed ☒ Surface Sleeve Installed ☐ Pitless Adapter Used ☐ Alternative Procedure Used

11) Water Level
Static level 28 ft. Date 12/5/2012
Artesian Flow gpm

12) Packers

Type	Depth

13) Plugged ☐ Well plugged within 48 hours
Casing left in well: na Cement/Bentonite placed in well:

From (ft)	To (ft)	From (ft)	To (ft)	Material used, Sack

14) Type Pump
☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder ☐ Other na
Depth to pump bowls, cylinder, jet, etc., ft.

15) Water Test
Type test ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated
Yield: na gpm with ft. drawdown after hrs.

16) Water Quality
Type of water: Depth of Strata: Was a chemical analysis made? ☐ Yes ☒ No
Did you knowingly penetrate a strata which contains undesirable constituents? ☐ Yes ☒ No If yes, Continue:
Check One: ☐ Naturally poor-quality groundwater – type ☐ Hydrocarbons (i.e. gas, oil, etc.)
☐ Hazardous material/waste contamination encountered ☐ Other (describe)

☐ *I certify that while drilling, deepening, or otherwise altering the above described well, undesirable water or constituents was encountered and the landowner was informed that such well must be completed or plugged in such a manner as to avoid injury or pollution.*

Company or Individual's Name (type or print) Van and Sons Drilling Service, Inc Lic. No. 2903M
Address 319 John Alber City Houston State Tx Zip 77076
Signature 1/16/13 Signature / /

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Texas Department of License and Regulation

Water Well Driller/Pump Installer Program
P.O. Box 12157 Austin, Texas 78711 (512)463-7880 FAX (512)463-8616
Email address: water.well@license.state.tx.us

This form must be completed and filed with the department within 30 days following the plugging of the well.

PLUGGING REPORT

A. WELL IDENTIFICATION AND LOCATION DATA

1) OWNER

Name	Address	City	State	Zip
City of Houston Geotech Dept	611 Walker Floor 14	Houston	Tx	77002

2) WELL LOCATION

County	Physical Address	City	State	Zip
Harris	Sandringham @ Buckingham	Houston	Tx	77024

3) Owner's Well No. 1 | Long. ° ' " | Lat. ° ' " | Grid # 65-13-7

4) Type of Well ☐ Water ☒ Monitor ☐ Injection ☐ De-Watering

Drill, Pump Installer, or Landowner performing the plugging operations **must** locate and identify the location of the well within a specific grid on a full scale gridded map available from Texas Natural Resource Information Service. The location of the well should be denoted within the grid by placing a corresponding dot in the square to the right. The legal description is optional.

5) N↑

B) HISTORICAL DATA ON WELL TO BE PLUGGED (if available)

6) Driller: Eddie Van Antwerp | License No. 2903M

7) Drilled 11/26/2012 | 8) Diameter of hole 4 inches | 9) Total depth of well 20 feet.

C. CURRENT PLUGGING DATA

10) Date well plugged 3/4/2013

12) Name of Driller/Pump Installer or Well Owner performing the plugging: Eddie Van Antwerp

License No. 2903M

13) CASING AND CEMENTING DATA RELATIVE TO THE PLUGGING OPERATIONS.

CASING LEFT IN WELL

DIAMETER (inches)	FROM (feet)	TO (feet)
2	0	20

CEMENT/BENTONITE PLUG(S) PLACED IN WELL

FROM (feet)	TO (feet)	SACKS
0	20	2

11) REMOVE ALL REMOVEABLE CASING

Please check box beside the method of plugging used

- ☒ Tremmie pipe cement from bottom to top.
- ☐ Tremmie pipe bentonite from bottom to 2 feet from surface, cement top 2 feet.
- ☐ Pour in 3/8 bentonite chips when standing water in well is less than 100 feet in depth, cement top 2 feet.
- ☐ Large diameter well filled with clay material from top to bottom.

COMMENTS

1) tried to pull well
2) not enough pvc exposed to grab onto.
3) grouted well material in place.

D. VALIDATION OF INFORMATION INCLUDED IN FORM

I certify that I plugged this well (or the well was plugged under my supervision) and that all of the statements herein are true and correct. I understand that failure to complete items 1 through 13 will result in the report(s) being returned for completion and resubmitted.

Company or Individual's Name (type or print): Van and Sons drilling Service, Inc.

Address: 319 John Alber | City: Houston | State: Tx | Zip: 77076

Signature	Date	Signature	Date
Licensed Driller/Pump Installer	3/6/2013	Apprentice	/ /

Texas Department of License and Regulation

Water Well Driller/Pump Installer Program
P.O. Box 12157 Austin, Texas 78711 (512)463-7880 FAX (512)463-8616
Email address: water.well@license.state.tx.us

This form must be completed and filed with the department within 30 days following the plugging of the well.

PLUGGING REPORT

A. WELL IDENTIFICATION AND LOCATION DATA

1) OWNER

Name	Address	City	State	Zip
City of Houston Geotech Dept	611 Walker Floor 14	Houston	Tx	77002

2) WELL LOCATION

County	Physical Address	City	State	Zip
Harris	8900 Chatsworth	Houston	Tx	77024

3) Owner's Well No. 2 | Long. ° ' " | Lat. ° ' " | Grid # 65-13-7

4) Type of Well ☐ Water ☒ Monitor ☐ Injection ☐ De-Watering

5) N↑

Drill, Pump Installer, or Landowner performing the plugging operations must locate and identify the location of the well within a specific grid on a full scale gridded map available from Texas Natural Resource Information Service. The location of the well should be denoted within the grid by placing a corresponding dot in the square to the right. The legal description is optional.

B) HISTORICAL DATA ON WELL TO BE PLUGGED (if available)

6) Driller: Eddie Van Antwerp | License No. 2903M

7) Drilled 11/26/2012 | 8) Diameter of hole 4 inches | 9) Total depth of well 30 feet.

C. CURRENT PLUGGING DATA

10) Date well plugged 3/4/2013

12) Name of Driller/Pump Installer or Well Owner performing the plugging: Eddie Van Antwerp

License No. 2903M

13) CASING AND CEMENTING DATA RELATIVE TO THE PLUGGING OPERATIONS.

CASING LEFT IN WELL

DIAMETER (inches)	FROM (feet)	TO (feet)
2	0	30

CEMENT/BENTONITE PLUG(S) PLACED IN WELL

FROM (feet)	TO (feet)	SACKS
0	30	2

11) REMOVE ALL REMOVEABLE CASING

Please check box beside the method of plugging used

- ☒ Tremmie pipe cement from bottom to top.
- ☐ Tremmie pipe bentonite from bottom to 2 feet from surface, cement top 2 feet.
- ☐ Pour in 3/8 bentonite chips when standing water in well is less than 100 feet in depth, cement top 2 feet.
- ☐ Large diameter well filled with clay material from top to bottom.

COMMENTS

1) tried to pull well
2) not enough pvc exposed to grab onto.
3) grouted well material in place.

D. VALIDATION OF INFORMATION INCLUDED IN FORM

I certify that I plugged this well (or the well was plugged under my supervision) and that all of the statements herein are true and correct. I understand that failure to complete items 1 through 13 will result in the report(s) being returned for completion and resubmitted.

Company or Individual's Name (type or print): Van and Sons drilling Service, Inc.

Address: 319 John Alber | City: Houston | State: Tx | Zip: 77076

Signature (Licensed Driller/Pump Installer)	Date	Signature (Apprentice)	Date
[signature]	3/6/2013		/ /

TDLR FORM a004WWD Copies to TDLR - Owner - Driller/Pump Installer Form provided by Forms On-A-Disk, Inc. - Dallas, Texas - (214) 340-9429

STATE OF TEXAS PLUGGING REPORT for Tracking #89098

Owner:	City of Houston	Owner Well #:	PZ3
Address:	Proposed Pump and Lift Station Houston , TX	Grid #:	65-13-7
Well Location:	NE Cornertable Lande/Harness Creek Ln Houston , TX	Latitude:	29° 46' 18" N
Well County:	Harris	Longitude:	095° 27' 48" W
		GPS Brand Used:	Magellan GPS
Well Type:	Monitor		

HISTORICAL DATA ON WELL TO BE PLUGGED

Original Well Driller:	Patrick Stephens
Driller's License Number of Original Well Driller:	4850
Date Well Drilled:	7/2/2013
Well Report Tracking Number:	327026
Diameter of Borehole:	8.25 inches
Total Depth of Borehole:	30 feet
Date Well Plugged:	8/6/2013
Person Actually Performing Plugging Operation:	Tom Mathers
License Number of Plugging Operator:	3096
Plugging Method:	Pour in 3/8 bentonite chips when standing water in well is less than 100 feet in depth, cement top 2 feet.
Plugging Variance #:	No Data
Casing Left Data:	1st Interval: 2 inches diameter; From 0 ft to 0 ft 2nd Interval: No Data 3rd Interval: No Data
Cement/Bentonite Plugs Placed in Well:	1st Interval: From 30 ft to 2 ft; Sack(s)/type of cement used: 2.5, bent. chips 2nd Interval: From 2 ft to 0 ft; Sack(s)/type of cement used: 1, cement 3rd Interval: No Data 4th Interval: No Data 5th Interval: No Data
Certification Data:	The plug installer certified that the plug installer plugged this well (or the well was plugged under the plug installer's direct supervision) and that each and all of the statements herein are true and correct. The plug installer understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.
Company Information:	Mathers Environmental Drilling, Inc. 12243 B. FM 529 Houston , TX 77041 3096

Plug Installer License Number:	
Licensed Plug Installer Signature:	**Tom Mathers**
Registered Plug Installer Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Plugging Method Comments:	**No Data**

Please include the plugging report's tracking number (Tracking #89098) on your written request.

Texas Department of Licensing & Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

Texas Department of License and Regulation

Water Well Driller/Pump Installer Program
P.O. Box 12157 Austin, Texas 78711 (512)463-7880 FAX (512)463-8616
Email address: water.well@license.state.tx.us

This form must be completed and filed with the department within 30 days following the plugging of the well.

PLUGGING REPORT

A. WELL IDENTIFICATION AND LOCATION DATA

1) OWNER

Name	Address	City	State	Zip
City of Houston Geotech Dept	611 Walker Floor 14	Houston	Tx	77002

2) WELL LOCATION

County	Physical Address	City	State	Zip
Harris	8600 N. Post Oak	Houston	Tx	77024

3) Owner's Well No. 4 | Long. ° ' " | Lat. ° ' " | Grid # 65-13-7

4) Type of Well ☐ Water ☒ Monitor ☐ Injection ☐ De-Watering

5) N↑

Drill, Pump Installer, or Landowner performing the plugging operations **must** locate and identify the location of the well within a specific grid on a full scale gridded map available from Texas Natural Resource Information Service. The location of the well should be denoted within the grid by placing a corresponding dot in the square to the right. The legal description is optional.

B) HISTORICAL DATA ON WELL TO BE PLUGGED (if available)

6) Driller	License No.
Eddie Van Antwerp	2903M

7) Drilled 12/4/2012 | 8) Diameter of hole 4 inches | 9) Total depth of well 30 feet.

C. CURRENT PLUGGING DATA

10) Date well plugged 3/4/2013

12) Name of Driller/Pump Installer or Well Owner performing the plugging
Eddie Van Antwerp

License No. 2903M

13) CASING AND CEMENTING DATA RELATIVE TO THE PLUGGING OPERATIONS.

CASING LEFT IN WELL

DIAMETER (inches)	FROM (feet)	TO (feet)
2	0	30

CEMENT/BENTONITE PLUG(S) PLACED IN WELL

FROM (feet)	TO (feet)	SACKS
0	30	2

11) REMOVE ALL REMOVEABLE CASING
Please check box beside the method of plugging used

- ☒ Tremmie pipe cement from bottom to top.
- ☐ Tremmie pipe bentonite from bottom to 2 feet from surface, cement top 2 feet.
- ☐ Pour in 3/8 bentonite chips when standing water in well is less than 100 feet in depth, cement top 2 feet.
- ☐ Large diameter well filled with clay material from top to bottom.

COMMENTS

1) tried to pull well
2) not enough pvc exposed to grab onto.
3) grouted well material in place.

D. VALIDATION OF INFORMATION INCLUDED IN FORM

I certify that I plugged this well (or the well was plugged under my supervision) and that all of the statements herein are true and correct. I understand that failure to complete items 1 through 13 will result in the report(s) being returned for completion and resubmitted.

Company or Individual's Name (type or print) Van and Sons drilling Service, Inc.

Address 319 John Alber | City Houston | State Tx | Zip 77076

Signature		Signature	
Licensed Driller/Pump Installer	3/6/2013 Date	Apprentice	/ / Date

Texas Department of License and Regulation

Water Well Driller/Pump Installer Program
P.O. Box 12157 Austin, Texas 78711 (512)463-7880 FAX (512)463-8616
Email address: water.well@license.state.tx.us

This form must be completed and filed with the department within 30 days following the plugging of the well.

PLUGGING REPORT

A. WELL IDENTIFICATION AND LOCATION DATA

1) OWNER

Name	Address	City	State	Zip
City of Houston Geotech Dept	611 Walker Floor 14	Houston	Tx	77002

2) WELL LOCATION

County	Physical Address	City	State	Zip
Harris	8600 Woodway	Houston	Tx	77024

3) Owner's Well No. 5 | Long. ° ' " | Lat. ° ' " | Grid # 65-13-7

4) Type of Well ☐ Water ☒ Monitor ☐ Injection ☐ De-Watering

5) N↑

Drill, Pump Installer, or Landowner performing the plugging operations must locate and identify the location of the well within a specific grid on a full scale gridded map available from Texas Natural Resource Information Service. The location of the well should be denoted within the grid by placing a corresponding dot in the square to the right. The legal description is optional.

B) HISTORICAL DATA ON WELL TO BE PLUGGED (if available)

6) Driller	License No.
Eddie Van Antwerp	2903M

7) Drilled 12/4/2012 | 8) Diameter of hole 4 inches | 9) Total depth of well 30 feet.

C. CURRENT PLUGGING DATA

10) Date well plugged 3/4/2013

11) REMOVE ALL REMOVEABLE CASING

Please check box beside the method of plugging used

- ☒ Tremmie pipe cement from bottom to top.
- ☐ Tremmie pipe bentonite from bottom to 2 feet from surface, cement top 2 feet.
- ☐ Pour in 3/8 bentonite chips when standing water in well is less than 100 feet in depth, cement top 2 feet.
- ☐ Large diameter well filled with clay material from top to bottom.

12) Name of Driller/Pump Installer or Well Owner performing the plugging
Eddie Van Antwerp

License No. 2903M

13) CASING AND CEMENTING DATA RELATIVE TO THE PLUGGING OPERATIONS.

CASING LEFT IN WELL

DIAMETER (inches)	FROM (feet)	TO (feet)
2	0	30

CEMENT/BENTONITE PLUG(S) PLACED IN WELL

FROM (feet)	TO (feet)	SACKS
0	30	2

COMMENTS

1) tried to pull well
2) not enough pvc exposed to grab onto.
3) grouted well material in place.

D. VALIDATION OF INFORMATION INCLUDED IN FORM

I certify that I plugged this well (or the well was plugged under my supervision) and that all of the statements herein are true and correct. I understand that failure to complete items 1 through 13 will result in the report(s) being returned for completion and resubmitted.

Company or Individual's Name (type or print) Van and Sons drilling Service, Inc.

Address 319 John Alber | City Houston | State Tx | Zip 77076

Signature (Licensed Driller/Pump Installer)	Date	Signature (Apprentice)	Date
E Van Antwerp	3/6/2013		/ /

Form provided by Forms On-A-Disk, Inc. - Dallas, Texas - (214) 340-9429

Texas Department of License and Regulation

Water Well Driller/Pump Installer Program
P.O. Box 12157 Austin, Texas 78711 (512)463-7880 FAX (512)463-8616
Email address: water.well@license.state.tx.us

This form must be completed and filed with the department within 30 days following the plugging of the well.

PLUGGING REPORT

A. WELL IDENTIFICATION AND LOCATION DATA

1) OWNER

Name	Address	City	State	Zip
City of Houston Geotech Dept	611 Walker Floor 14	Houston	Tx	77002

2) WELL LOCATION

County	Physical Address	City	State	Zip
Harris	4050 Woodway	Houston	Tx	77024

3) Owner's Well No. 6 | Long. ° ' " | Lat. ° ' " | Grid # 65-13-7

4) Type of Well ☐ Water ☒ Monitor ☐ Injection ☐ De-Watering

5) N↑

Drill, Pump Installer, or Landowner performing the plugging operations **must** locate and identify the location of the well within a specific grid on a full scale gridded map available from Texas Natural Resource Information Service. The location of the well should be denoted within the grid by placing a corresponding dot in the square to the right. The legal description is optional.

B) HISTORICAL DATA ON WELL TO BE PLUGGED (if available)

6) Driller	License No.
Eddie Van Antwerp	2903M

7) Drilled 12/5/2012 | 8) Diameter of hole 4 inches | 9) Total depth of well 30 feet.

C. CURRENT PLUGGING DATA

10) Date well plugged 3/4/2013

12) Name of Driller/Pump Installer or Well Owner performing the plugging
Eddie Van Antwerp

License No. **2903M**

13) CASING AND CEMENTING DATA RELATIVE TO THE PLUGGING OPERATIONS.

CASING LEFT IN WELL

DIAMETER (inches)	FROM (feet)	TO (feet)
2	0	30

CEMENT/BENTONITE PLUG(S) PLACED IN WELL

FROM (feet)	TO (feet)	SACKS
0	30	2

11) REMOVE ALL REMOVEABLE CASING
Please check box beside the method of plugging used

- ☒ Tremmie pipe cement from bottom to top.
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Company or Individual's Name (type or print) | Van and Sons drilling Service, Inc.

Address 319 John Alber | City Houston | State Tx | Zip 77076

Signature		Signature	
Licensed Driller/Pump Installer	3/6/2013 Date	Apprentice	/ / Date

APPENDIX C

Project Site Pictures

PROJECT PICTURES
Project No. 12-344E

P-1 (A Picture of Project Alignment along Memorial Drive)

P-2 (A Picture of Coring and Traffic Control at the intersection of Sandringham and Buckingham)

PROJECT PICTURES
Project No. 12-344E

P-3 (A Picture of Drilling Operations and Traffic Control along Sage Road)

P-4 (A Picture of Grouting using Tremie Method along North Post Oak Lane)

APPENDIX D

OSHA Soil Classification

OSHA SOIL CLASSIFICATION

General

Occupational Safety and Health Administration (OSHA) has required a trench protective system for trenches deeper than five-ft. Trenches that are deeper than five-ft, should be shored, sheeted, braced or laid back to a stable slope, or some other appropriate means of protection should be provided where workers might be exposed to moving ground or caving. OSHA developed a soil classification system to be used as a guideline in determining protective requirements for trench excavations.

OSHA classification system categorizes the soil and rock in four types based on shear strength and stability. These classifications are summarized in the following report sections.

Stable Rock

means natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

Type A Soil

means cohesive soils with an unconfined compressive strength of 1.5-ton per square foot (tsf) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam, silty clay loam, sandy clay loam, caliche and hardpan. No soil is Type A if:

- The soil is fissured; or
- The soil is subject to vibration from heavy traffic, pile driving or similar effects; or

The soil has been previously disturbed; or

- The soil is part of a slope, layered system where the layers dip into the excavation on a slope of 4(h): 1(v) or greater; or
- The material is subject to other factors that would require it to be classified as a less stable material.

Type B Soil

- Cohesive soil with an unconfined compressive strength greater than 0.5 tsf but less than 1.5 tsf; or
- Granular cohesionless soils including: angular gravel, silt, silt loam, sandy loam, and in some case, silty clay loam and sandy clay loam; or
- Previously disturbed soils except those which would otherwise be classified as Type C soil; or
- Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or

- Dry rock that is not stable; or
- Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than 4(h): 1(v), but only if the material would otherwise be classified as Type B.

Type C Soil

- Cohesive soil with an unconfined compressive strength of 0.5 tsf or less; or
- Granular soils including gravel, sand, and loamy sand; or
- Submerged soil or soil from which water is freely seeping; or
- Submerged rock that is not stable; or
- Materials in a sloped, layered system where the layers dip into the excavation on a slope 4 (h) : 1(v) or steeper.

Under the assumption that appropriate groundwater control measures are carried out, and the groundwater table, if present, is lowered and maintained at least 3 feet below the excavation depths, the stable cohesive soils (CL) & (CH), with unconfined compressive strength greater than 0.5 tsf, are classified as OSHA soil Type "B". The granular soils, which are less stable, are classified as OSHA soil Type "C".

Based on our geotechnical exploration and laboratory test results details of soil classifications at each boring are summarized below:

OSHA SOIL TYPE

Boring No.	Depth Range [(1)], ft	Soil Type	OSHA Soil Classification
B-1	0 – 2	Fill: Lean Clay (CL)	B
	2 – 14	Lean Clay (CL)	B
	14 – 23	Silty Sand (SM)	C
B-2	0 – 2	Fill: Lean Clay (CL)	C
	2 – 4	Lean Clay (CL)	C
	4 – 14	Lean Clay (CL)	B
	14 – 23	Poorly Graded Sand with Silt (SP-SM)	C
B-3	0 – 2	Fill: Silty Sand (SM)	C
	2 – 16	Lean Clay with Sand (CL)	B
	16 – 23	Poorly Graded Sand with Silt (SP-SM)	C

Boring No.	Depth Range [1], ft	Soil Type	OSHA Soil Classification
B-4	0 – 2	Fill: Silty Sand (SM)	C
	2 – 14	Lean Clay with Sand (CL)	B
	14 – 26	Poorly Graded Sand with Silt (SP-SM)	C
B-5	0 – 2	Fill: Sandy Silt (ML)	C
	2 – 14	Lean Clay with Sand (CL)	B
	14 – 26	Silty Sand (SM)	C
B-6	0 – 2	Fill: Sandy Silt (ML)	C
	2 – 14	Lean Clay with Sand (CL)	B
	14 – 26	Poorly Graded Sand with Silt (SP-SM)	C
B-7	0 – 2	Fill: Lean Clay with Sand (CL)	B
	2 – 14	Lean Clay with Sand (CL)	B
	14 – 36	Silty Sand (SM)	C
B-8	0 – 2	Fill: Lean Clay with Sand (CL)	B
	2 – 12	Lean Clay with Sand (CL)	B
	12 – 36	Silty Sand (SM)	C
B-9	0 – 2	Fill: Lean Clay with Sand (CL)	C
	2 – 14	Lean Clay with Sand (CL)	B
	14 – 36	Silty Sand (SM)	C
B-10	0 – 2	Fill: Lean Clay with Sand (CL)	B
	2 – 10	Lean Clay with Sand (CL)	B
	10 – 36	Poorly Graded Sand with Silt (SP-SM)	C
B-11	0 – 2	Fill: Lean Clay with Sand (CL)	B
	2 – 10	Lean Clay with Sand (CL)	B
	10 – 36	Poorly Graded Sand with Silt (SP-SM)	C
B-12	0 – 2	Fill: Fat Clay (CH)	B
	2 – 16	Fat Clay (CH)	B
	16 – 36	Silty Sand (SM)	C
B-13	0 – 2	Fill: Lean Clay with Sand (CL)	B
	2 – 12	Lean Clay with Sand (CL)	B

Boring No.	Depth Range [1], ft	Soil Type	OSHA Soil Classification
B-13	12 – 38	Poorly Graded Sand with Silt (SP-SM)	C
B-14	0 – 2	Fill: Lean Clay with Sand (CL)	B
	2 – 16	Lean Clay with Sand (CL)	B
	16 – 38	Poorly Graded Sand with Silt (SP-SM)	C
B-15	0 – 2	Fill: Fat Clay (CH)	B
	2 – 14	Fat Clay (CH)	B
	14 – 21	Lean Clay with Sand (CL)	B
	21 – 31	Poorly Graded Sand with Silt (SP-SM)	C
B-16	0 – 2	Fill: Lean Clay with Sand (CL)	B
	2 – 6	Silty Sand (SM)	C
	6 – 14	Lean Clay with Sand (CL)	B
	14 – 31	Poorly Graded Sand with Silt (SP-SM)	C
B-17	0 – 14	Lean Clay with Sand (CL)	B
	14 – 31	Poorly Graded Sand with Silt (SP-SM)	C
B-18	0 – 2	Fill: Lean Clay with Sand (CL)	B
	2 – 14	Lean Clay with Sand (CL)	B
	14 – 31	Poorly Graded Sand with Silt (SP-SM)	C
B-19	0 – 2	Fill: Lean Clay with Sand (CL)	B
	2 – 22	Lean Clay with Sand (CL)	B
	22 – 40	Silty Sand (SM)	C
B-20	0 – 2	Fill: Lean Clay with Sand (CL)	B
	2 – 8	Fat Clay (CH)	B
	8 – 22	Lean Clay with Sand (CL)	B
	22 – 40	Silty Sand (SM)	C
B-21	0 – 2	Fill: Silty Sand (SM)	C
	2 – 8	Fat Clay (CH)	B
	8 – 22	Lean Clay with Sand (CL)	B
	22 – 40	Silty Sand (SM)	C

Boring No.	Depth Range [1], ft	Soil Type	OSHA Soil Classification
B-22	0 – 2	Fill: Silty Sand (SM)	C
	2 – 6	Fat Clay (CH)	B
	6 – 22	Lean Clay with Sand (CL)	B
	22 – 30	Sandy Silt (ML)	C
	30 – 40	Poorly Graded Sand with Silt (SP-SM)	C
B-23	0 – 2	Fill: Silty Sand (SM)	C
	2 – 16	Lean Clay with Sand (CL)	B
	16 – 28	Fat Clay (CH)	B
	28 – 40	Silty Sand (SM)	C
B-24	0 – 2	Fill: Silty Sand (SM)	C
	2 – 8	Fill: Lean Clay with Sand (CL)	B
	8 – 43	Poorly Graded Sand with Silt (SP-SM)	C
	43 – 55	Fat Clay (CH)	C
B-25	0 – 4	Fill: Lean Clay with Sand (CL)	C
	4 – 48	Silty Sand (SM)	C
	48 – 55	Fat Clay (CH)	C
B-26	0 – 2	Fill: Silty Sand (SM)	C
	2 – 32	Poorly Graded Sand with Silt (SP-SM)	C
	32 – 40	Lean Clay with Sand (CL)	C
	40 – 58	Fat Clay (CH)	C
	58 – 64	Lean Clay with Sand (CL)	C
	64 – 105	Silty Sand (SM)	C
B-27	0 – 6	Silty Sand (SM)	C
	6 – 12	Fat Clay (CH)	B
	12 – 38	Lean Clay with Sand (CL)	C
B-28	0 – 2	Fill: Fat Clay (CH)	C
	2 – 8	Fill: Fat Clay (CH)	B
	8 – 10	Fill: Fat Clay (CH)	C
	10 – 16	Fat Clay (CH)	B

Boring No.	Depth Range [1], ft	Soil Type	OSHA Soil Classification
B-28	16 – 38	Fat Clay (CH)	C
B-29	0 – 2	Fill: Fat Clay (CH)	B
	2 – 14	Fat Clay (CH)	B
	14 – 16	Silty Sand (SM)	C
	16 – 18	Fat Clay (CH)	B
	16 – 22	Silty Sand (SM)	C
	22 – 38	Fat Clay (CH)	C
B-30	0 – 2	Fill: Lean Clay with Sand (CL)	C
	2 – 6	Lean Clay with Sand (CL)	B
	6 – 16	Fat Clay (CH)	B
	16 – 27	Lean Clay with Sand (CL)	B
	27 – 38	Sandy Silt (ML)	C
B-31	0 – 4	Fill: Lean Clay with Sand (CL)	C
	4 – 8	Fill: Lean Clay with Sand (CL)	B
	8 – 12	Fill: Lean Clay with Sand (CL)	C
	12 – 23	Silty Sand (SM)	C
B-32	0 – 4	Fill: Lean Clay with Sand (CL)	B
	4 – 6	Fill: Silty Sand (SM)	C
	6 – 8	Fill: Lean Clay with Sand (CL)	C
	8 – 10	Fill: Lean Clay with Sand (CL)	B
	10 – 23	Silty Sand (SM)	C
B-33	0 – 2	Fill: Lean Clay with Sand (CL)	B
	2 – 10	Lean Clay with Sand (CL)	B
	10 – 23	Silty Sand (SM)	C
B-34	0 – 2	Fill: Silty Sand (SM)	C
	2 – 12	Silty Sand (SM)	C
	12 – 15	Fat Clay (CH)	B

Note: 1. Refer to each boring log for soils stratigraphy