GEOTECHNICAL INVESTIGATION
NEIGHBORHOOD STREET RECONSTRUCTION
(NSR) 456
WBS NO. N-000388-0001-3
HOUSTON, TEXAS

REPORT NO. 1140202901

Prepared for:

BURY-HOU, INC.

Houston, Texas

Submitted by:

GEOTEST ENGINEERING, INC.

Houston, Texas

March 2, 2015

Key Map Nos. 449 T, U, X Y & 489 B

GEOTEST ENGINEERING, INC.

Geotechnical Engineers & Materials Testing

5600 Bintliff Drive Houston, Texas 77036 Telephone: (713) 266-0588
Fax: (713) 266-2977

Report No. 1140202901
March 2, 2015

Ms. Hillary Passovoy, P.E.
Bury-Hou, Inc.
7660 Woodway Drive, Suite 400
Houston, Texas 77063

Reference: Geotechnical Investigation
Neighborhood Street Reconstruction
(NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

Dear Ms. Passovoy:

Presented herein is our final geotechnical investigation report for the Neighborhood Street Reconstruction Project – NSR 456 in Houston, Texas. A draft report was submitted to you on December 10, 2014. This final report supersedes all previously submitted reports, transmittals, etc. for the referenced project. This study was authorized by Agreement Between Engineer and Consultant on April 29, 2014 by accepting our Proposal No. 1140322099 dated April 16, 2014.

We appreciate this opportunity to be of service to you. If you have any questions regarding the report, or if we can be of further service to you, please call us.

Sincerely,
GEOTEST ENGINEERING, INC.
TBPE Registration No. F-410

STATE OF TEXAS
3/2/15
NARESH KOLLI
110928
LICENSED
PROFESSIONAL ENGINEER

Naresh Kolli, P.E.
Assistant Project Manager

STATE OF TEXAS
3/2/15
MOHAN BALLAGERE
87622
LICENSED
PROFESSIONAL ENGINEER

Mohan Ballagere, P.E.
Vice President

MB/NK/ego
Copies Submitted: (2+1-pdf)
PC38:\Geotechnical\40202901F.doc

TABLE OF CONTENTS

		Page
EXECUTIVE SUMMARY		1
1.0	INTRODUCTION	3
	1.1 General	3
	1.2 Authorization	3
	1.3 Location and Description of Project	3
	1.4 Purpose and Scope	4
2.0	FIELD INVESTIGATION	5
	2.1 General	5
	2.2 Geotechnical Borings	5
	2.3 Piezometer Installation	6
3.0	LABORATORY TESTING	7
4.0	SUBSURFACE CONDITIONS	8
	4.1 Geology	8
	4.2 General Fault Information	8
	4.3 Existing Paving	8
	4.4 Soils Stratigraphy	10
	4.5 Range of Weak Soils Encountered at Pipe Invert Zone in Borings	11
	4.6 Water Levels	11
	4.7 Environmental Concerns	13
5.0	ENGINEERING ANALYSES AND RECOMMENDATIONS	14
	5.1 General	14
	5.2 Trench Excavation	14
	5.2.1 Geotechnical Parameters	14
	5.2.2 Excavation Stability	14
	5.2.3 Groundwater Control	16
	5.2.4 Bedding and Backfill for Water Line, Sanitary Sewer and Sanitary Sewer Force Main	18
	5.3 Piping System Thrust Restraint	18
	5.3.1 Restrained Joints	18

TABLE OF CONTENTS (Continued)

Page

5.4 Structures 19

5.4.1 Description 19

5.4.2 Foundation Conditions 19

5.4.3 Foundation Design Recommendations 20

5.4.4 Protection of Below Grade Structures 22

5.4.5 Groundwater Control During Construction 22

5.4.6 Structure Backfill 22

5.5 Pavement Structure Design 22

5.5.1 Design Parameters 23

5.5.2 Recommended Pavement Section 24

5.5.3 Preparation of Pavement Subgrade 25

6.0 CONSTRUCTION CONSIDERATIONS 27

6.1 Groundwater Control 27

7.0 LIMITATIONS 29

TABLES

Table

Summary of Boring Information 1

Geotechnical Design Parameter Summary – Open Cut Excavation 2

ILLUSTRATIONS

Figure

Vicinity Map 1

Plan of Borings 2

Boring Log Profile ..... 3.1 thru 3.9

Symbols and Abbreviations Used on Boring Log Profile 4

Trench Support Earth Pressure ..... 5.1 thru 5.3

Stability of Bottom for Braced Cut 6

Thrust Forces Acting on a Bend 7

Lateral Earth Pressure Diagram for Permanent Wall ..... 8.1 thru 8.3

Uplift Pressure and Resistance 9

TABLE OF CONTENTS (Continued)

APPENDIX A

	Figure
Log of Borings	A-1 thru A-29
Symbols and Terms Used on Boring Logs	A-30
Piezometer Installation Report	A-31 thru A-35

APPENDIX B

	Figure
Summary of Laboratory Test Results	B-1 thru B-29
Grain Size Distribution Curves	B-30 thru B-35
Results of California Bearing Ratio (CBR) Tests	B-36a thru B-36c
Dry Density Versus CBR	B-36d

APPENDIX C

Piezometer Installation/Abandonment Reports

APPENDIX D

Pavement Design Calculations

EXECUTIVE SUMMARY

A geotechnical investigation was performed for the design and construction of the proposed Neighborhood Street Reconstruction Project - NSR 456 in Houston, Texas. The detailed description of the project is presented in Section 1.3 of this report.

The purposes of this study were to evaluate soil and groundwater conditions and to provide geotechnical recommendations for the proposed Neighborhood Street Reconstruction Project - NSR 456. The investigation included drilling and sampling twenty nine (29) borings to depths ranging from 12 to 24 feet, installing piezometers in five (5) existing borings, performing laboratory tests on soil samples recovered from the borings, performing engineering analyses and developing geotechnical recommendations and preparing a geotechnical report.

The principal findings and conclusions developed from this investigation are as follows:

- The subsurface soil beneath pavement or below existing grade as encountered in borings GB-1 through GB-29 along various streets in NSR 456 project area consists of generally cohesive soils with intermittent and or underlain by cohesionless soils to the explored depths of 13 to 24 feet except in borings GB-1, GB-2, GB-3, GB-6, GB-11, GB-12, GB-20 and GB-26. In borings GB-1, GB-2, GB-3, GB-6A, GB-11, GB-12, GB-20 and GB-26, the subsurface soils consist of cohesive soils to the explored depths of 13 to 24 feet. The cohesive soils consist of soft to hard dark gray, gray, brown, yellowish brown and reddish brown sandy lean clay, lean clay with sand, fat clay with sand and fat clay. The cohesionless soil consists of medium dense to dense brown, gray and yellow silty sand, fine sand with silt and clayey sand. Fill material consisting of soft to stiff gray sandy lean clay with calcareous nodules, shell fragments, limestone and grass roots was encountered between the depths of 0 to 10 feet in borings GB-20 and GB-28.
- Based on the available information from U.S. Geological Survey (USGS) Maps and information contained in house relating to geologic faults for the project alignment, the nearest known fault is Long Point Fault, which is approximately 0.5 miles south of the project alignment.

- Groundwater was first encountered at depths ranging from 10 to 24 feet during drilling in borings GB-3, GB-4, GB-5, GB-9, GB-10, GB-14, GB-15, GB-16, GB-18, GB-19 and GB-22 through GB-29. The groundwater level, measured 20 minutes after water was first encountered, ranged from 6.6 to 16.0 feet in these borings. In piezometer borings GB-1P, GB-6AP, GB-11P, GB-17P and GB-25AP, the water level measured on July 29, 2014 ranged from 7.4 to 17 feet.

- The existing paving as obtained in the soil borings GB-1 through GB-29 consists of 3.0 to 7.0 inches of asphalt over 2 to 18 inches of sand, limestone and shell mix.

- All excavation operations for utilities should be carried out in accordance with OSHA standards and the City of Houston Standard Specifications. The backfill for utilities should be designed and constructed in accordance with City of Houston Standard Specification No. 02317.
- The recommended pavement for various streets in NSR 456 project area are given below:

Wycliffe Drive

Pavement, Course	**Thickness, inches**
Reinforced Concrete	8
5% Lime-stabilized subgrade	8
or	
3% Lime and 9% Flyash Stabilized Subgrade (near boring GB-10)	

Other Streets

Pavement, Course	**Thickness, inches**
Reinforced Concrete	6
5% Lime-stabilized subgrade	6
or	
3% Lime and 9% Flyash stabilized subgrade (near boring GB-24B)	

The details of pavement section are provided in Section 5.4 of this report.

1.0 INTRODUCTION

1.1 General

The City of Houston selected Bury-Hou, Inc. (Engineer), to perform engineering services for the design and construction of Neighborhood Street Reconstruction Project (NSR) 456 in Houston, Texas. Bury-Hou, Inc., retained Geotest Engineering, Inc. (Consultant) as a part of the design team to perform geotechnical investigation for the above project.

1.2 Authorization

This study was authorized by Agreement Between Engineer and Consultant on April 29, 2014 by accepting our Proposal No. 1140322099 dated April 16, 2014.

1.3 Location and Description of Project

The project is located along Wycliffe Drive and other streets including Mayfield Drive, Buescher Drive, Mayfield Road, Ivyridge Drive, Hazelhurst Drive, Shadow Wood Drive, Britt Way Street Skyview Drive, Sherwood Forest and Metronome Drive in Houston, Texas. The project alignment is bounded by Hammerly Boulevard to the north, Brittmore Road to the east, Interstate IH-10 to the south and Upland Drive to the west, within the Key Map Pages and Grids 449 T, U, X Y & 489 B.

The project is comprised of approximately 15,580 LF of neighborhood street improvements along various streets with utilities replacement for NSR 456 Project. The utilities include sanitary sewer and water line. The size of the water line ranges from 8 to 12 inches and placed at depth of approximately 5 feet. The size of the sanitary sewer ranges from 6 to 15 inches and placed at depths ranging from 6 to 14 feet. The project also includes construction of a 12 to 16 inch sanitary sewer force main at some locations and placed at depths ranging from 9 to 13 feet. The proposed construction is by open cut method. The existing pavement along the streets will be replaced with new concrete pavement. The vicinity map of the project alignment is shown on Figure 1.

1.4 Purpose and Scope

The purposes of this study were to evaluate soil and groundwater conditions and to provide geotechnical recommendations for the design and construction of the proposed Neighborhood Street Reconstruction along with utilities (water and sanitary sewer) replacement within the NSR 456 Project Area. The scope of this investigation consisted of the following:

- Drilled and sampled twenty nine (29) borings to depths ranging from 12 to 24 feet.
- Converted five (5) borings into piezometers to monitor long term ground water level.
- Performed appropriate laboratory tests including a California Bearing Ratio test in accordance with ASTM methods on selected samples to develop engineering properties of the soil.
- Reviewed available fault information to evaluate the potential for known active faults that may impact the project.
- Performed engineering analyses in accordance with the City of Houston Design Manual (July 2012) to develop geotechnical recommendations for the design and construction of the proposed Neighborhood Street Reconstruction along with utilities (water and sanitary sewer) replacement for NSR 456 Project Area.
- Prepared a geotechnical report that will include all field data, laboratory test data and geotechnical recommendations.
- Prepared a separate soil type report for trench (open cut) excavation.

2.0 FIELD INVESTIGATION

2.1 General

After obtaining the utilities clearance of proposed twenty nine (29) marked borings in the field, the borings were drilled to the explored depths utilizing a truck mounted drilling rig. Traffic control devices and personnel were utilized during coring and drilling to maintain safety of drill crew and people driving in the streets. All the drilling and sampling were performed in accordance with appropriate ASTM procedures.

2.2 Geotechnical Borings

Subsurface conditions for the project alignment were explored by drilling and sampling twenty nine (29) soil borings (designated as GB-1 through GB-29) each to depths ranging from 12 to 24 feet. During our field investigation obstructions were encountered due to the existing utilities at boring locations GB-6, GB-24, GB-25, GB-27 and GB-28 at depths ranging from 15 inches to 12 feet. Offset borings were drilled to proposed explored depths at these locations. The approximate boring locations are shown on Figure 2, Plan of Borings. Survey information (Northing and Easting coordinates and ground surface elevation) of completed borings was provided to us by Bury-Hou, Inc. The survey information of completed borings is summarized in Table 1.

In general, samples were obtained continuously to the depth of 20 feet, and intermittent sampling afterwards to the termination depths of 24 feet for all borings, except in boring GB-1 and GB-2 where continuous sampling was done to the termination depth of 24 feet. Cohesive soils were obtained with a 3-inch thin-walled tube sampler in general accordance with ASTM Method D 1587 and samples of granular soils were obtained with a 2-inch diameter split-barrel sampler in general accordance with ASTM Method D 1586. Each sample was removed from the sampler in the field, carefully examined and then logged by an experienced soils technician. Suitable portions of each sample were sealed and packaged for transportation to Geotest's Laboratory. The shear strength of cohesive soil samples was estimated using a pocket penetrometer in the field. Driving resistances for the split-barrel sampler were recorded as "Blows per Foot" on the boring logs. All the borings,

except the ones converted to piezometers, were grouted with cement-bentonite grout after completion of drilling and obtaining water level measurements.

Detailed descriptions of the soils encountered in the borings are given on the boring logs presented on Figures A-1 through A-29 in Appendix A. A key to symbols and terms used on boring logs is given on Figure A-30 in Appendix A.

2.3 Piezometer Installation

During the field investigation, piezometers were installed in the open borehole of borings GB-1, GB-6A, GB-11, GB-17 and GB-25A. After installation, the piezometer installation reports were submitted to Texas Department of Licensing and Regulations (TDLR). The location of the piezometers, designated as GB-1P, GB-6AP, GB-11P, GB-17P and GB-25AP, are shown on Figure 2 (Plan of Borings). The piezometer installation report showing the details of the construction of the piezometers along with various water level measurements are provided on Figures A-31 through A-35 in Appendix A.

The piezometers were abandoned in place after taking the final water level measurements. The TDLR piezometer installation and abandonment reports are presented in Appendix C.

3.0 LABORATORY TESTING

The laboratory testing program was designed to evaluate the pertinent physical properties and shear strength characteristics of the subsurface soils. Classification tests were performed on selected samples to aid in soil classification. All the tests were performed in accordance with ASTM Standards.

Undrained shear strengths of selected cohesive samples were measured by unconsolidated undrained (UU) triaxial compression tests (ASTM D 2850). The results of the UU triaxial compression tests are plotted on the boring logs as solid squares. The shear strength of cohesive samples was measured in the field with a calibrated hand pocket penetrometer and also in the laboratory with a Torvane. The shear strength values obtained from the penetrometer and Torvane are plotted on the boring logs as open circles and triangles, respectively.

Measurements of moisture content and dry unit weight were taken for each UU triaxial compression test sample. Moisture content (ASTM D 2216) measurements were also made on other samples to define the moisture profile at each boring location. The liquid and plastic limit tests (ASTM D 4318) and percent passing No. 200 sieves (ASTM D 1140) were performed on appropriate samples. Sieve analysis (ASTM D 422) was also performed on selected cohesionless soil samples.

The result of all tests are tabulated or summarized on the boring logs presented on Figures A-1 through A-29 in Appendix A. The summary of laboratory tests is also presented in a tabular form on Figures B-1 through B-29 in Appendix B. The grain size distribution curves are presented on Figures B-30 through B-35 in Appendix B.

California Bearing Ratio (CBR) test (ASTM D 1883) was performed on a composite sample of the surficial soils (from 0' - 6') from borings GB-1, GB-2, GB-3, GB-5, GB-6, GB-8, GB-9, GB-14, GB-17, GB-19, GB-20, GB-22, GB-23, GB-26 and GB-28. The bearing ratios were measured at different compacted densities. The results of these tests were presented on Figures B-36a through B-36c and the relationship between dry density and CBR was presented on Figure B-36d in Appendix B.

4.0 SUBSURFACE CONDITIONS

4.1 Geology

The project area lies in the Beaumont Formation. The clays and sands of the Beaumont Formation are over-consolidated as a result of desiccation from frequent rising and lowering of the sea level and the groundwater table. Consequently, clays of this formation have moderate to high shear strength and relatively low compressibility. The sands of the Beaumont Formation are typically very fine and often silty. Further, there is occasional evidence in the Houston area of the occurrence of cemented material (sandstone and siltstone) deposits within the Beaumont Formation.

4.2 General Fault Information

A review of information in the Geotest library, relating to known surface and subsurface geologic faults in the general area of the project alignment, was undertaken. The available information consisted of U.S. Geological and NASA maps, open file reports and information contained in our files relating to geologic faults in the project alignment.

Based on the available information from U.S. Geological Survey (USGS) Maps and information contained in house relating to geologic faults for the project alignment, the nearest known fault is Long Point Fault, which is approximately 0.5 miles south of the project alignment. Hence, a Phase I Geological Fault Study is not warranted for this project.

4.3 Existing Paving

The existing paving as obtained in the soil borings GB-1 through GB-29 consists of 3.0 to 7.0 inches of asphalt over 2 to 18 inches of sand, limestone and shell mix.

The details of the existing pavement thickness at each of the boring locations for NSR 456 project area are summarized below:

Boring Nos.	**Asphalt Thickness (in)**	**Base (in)**	**Total (in.)**
GB-1 (GB-1P)	7.0	5.0	12.0
GB-2	5.0	4.0	9.0
GB-3	6.0	18.0	24.0
GB-4	6.0	4.0	10.0
GB-5	6.0	4.0	10.0
GB-6	5.0	4.0	9.0
GB-6A (GB-6A)	5.0	4.0	9.0
GB-7	6.0	4.0	10.0
GB-8	6.0	4.0	10.0
GB-9	6.0	4.0	10.0
GB-10	6.0	4.0	10.0
GB-11 (GB-11P)	5.0	4.0	9.0
GB-12	6.0	4.0	10.0
GB-13	6.0	4.0	10.0
GB-14	8.0	4.0	12.0
GB-15	8.0	6.0	14.0
GB-16	5.0	4.0	9.0
GB-17 (GB-17P)	6.0	5.0	11.0
GB-18	4.0	5.0	9.0
GB-19	4.0	6.0	10.0
GB-20	4.0	2.0	6.0
GB-21	4.0	6.0	10.0
GB-22	4.0	2.0	6.0
GB-23	3.0	9.0	12.0
GB-24	3.0	12.0	15.0
GB-24A	3.0	12.0	15.0
GB-24B	3.0	12.0	15.0
GB-25	6.0	4.0	10.0
GB-25A (GB-25AP)	4.0	2.0	6.0
GB-26	4.0	6.0	10.0
GB-27A	3.0	7.0	10.0
GB-28	4.0	6.0	10.0
GB-28A	4.0	6.0	10.0
GB-29	4.0	6.0	10.0

Base includes sand, limestone and shell mix.

4.4 Soils Stratigraphy

Based on the subsurface soils encountered in the boreholes, nine (9) boring log profiles were developed and are presented on Figures 3.1 through 3.9. To the left of each boring shown on the profile is an indication of the consistency or density of each stratum. More than one consistency for an individual stratum indicates that the consistency is different at different depths within the stratum. For cohesive soils, consistency is related to the undrained shear strength of the soil. For cohesionless soils, the density of soil is measured by standard penetration test blows of the soil. To the right of each boring shown on the profile is the overall classification of the soil contained within each stratum. The symbols and abbreviations used on the boring log profile are given on Figure 4. The soil classification is based on ASTM Standards.

The subsurface soil beneath pavement or below existing grade as encountered in borings GB-1 through GB-29 and as shown on boring log profiles 3.1 through 3.9 along various streets in NSR 456 project area consists of generally cohesive soils with intermittent and/or underlain by cohesionless soils to the explored depths of 12 to 24 feet except in borings GB-1, GB-2, GB-3, GB-6, GB-11, GB-12, GB-20 and GB-26. In borings GB-1, GB-2, GB-3, GB-6A, GB-11, GB-12, GB-20 and GB-26, the subsurface soils consist of cohesive soils to the explored depths of 12 to 24 feet. The cohesive soils consist of soft to hard dark gray, gray, brown, yellowish brown and reddish brown sandy lean clay, lean clay with sand, fat clay with sand and fat clay. The cohesionless soil consists of medium dense to dense brown, gray and yellow silty sand, fine sand with silt and clayey sand. Fill material consisting of soft to very stiff gray sandy lean clay with calcareous/ferrous nodules and shell fragments, was encountered below the pavement between the depths of 4 inches to 4 feet in boring GB-20 and 4 inches to 10 feet in boring GB-28.

The Fat Clay and Fat Clay with Sand are of high to very high plasticity with a liquid limits ranging from 56 to 94 and a plasticity indices ranging from 34 to 61. The Lean Clay with sand and Sandy Lean Clay are of low to high plasticity with a liquid limits ranging from 20 to 49 and plasticity indices ranging from 8 to 29. The fines content (percent passing No. 200 sieve) of Silty Sand and Clayey Sand ranges from 13 to 39 percent. The fines content of Fine Sand with silt ranges from 6 to 10 percent. The fines content of Sandy Lean Clay ranges from 50 to 70 percent. The fines content of Lean

Clay with sand and fat clay with sand ranges from 71 to 81 percent. The percent fines of Fat Clay ranges from 89 to 100 percent.

4.5 Range of Weak Soils Encountered at Pipe Invert Zone in Borings

The range of soft cohesive soils as encountered in borings are given below:

Location/Street	**Boring No.**	**Range of Depths of Weak Soils Encountered, ft**		**Soil Type**
		From	To	
Wycliffe Drive	GB-7	8	10	Soft Sandy Lean Clay
Buescher Drive	GB-20	2	4	Fill: Soft sandy lean clay
Mayfield Road	GB-24B	14	16	Soft Lean Clay with sand
Ivyridge Road	GB-25A	8	10	Soft Sandy Lean Clay
Shadow Wood Drive	GB-28	4	8	Soft Sandy Lean Clay
	GB-28A	2	4	Soft Sandy Lean Clay

Thus, extra precaution should be carried out by using appropriate construction equipment and methods to protect ground during the installation of utilities through the weak soil areas.

4.6 Water Levels

Groundwater was first encountered at depths ranging from 10 to 24 feet during drilling in borings GB-3, GB-4, GB-5, GB-9, GB-10, GB-14, GB-15, GB-16, GB-18, GB-19 and GB-22 through GB-29. The groundwater level, measured 15 minutes after water was first encountered, ranged from 6.6 to 16.0 feet in these borings. In piezometer borings GB-1P, GB-6AP, GB-11P, GB-17P and GB-25AP, the water level measured on July 29, 2014 ranged from 7.4 to 17 feet. The detailed water level information is presented in the table below.

Boring No.	**Groundwater Depth During Drilling (ft) (After 15 min)**	**Groundwater Depth 30 Days After Drilling (ft)**
GB-1 (GB-1P)	--	10.4 (7-29-14)
GB-3	15.0	N/A
GB-4	9.5	N/A
GB-5	12.0	N/A
GB-6A (GB-6AP)	--	7.4 (7-29-14)
GB-9	8.4	N/A
GB-10	8.3	N/A
GB-11 (GB-11P)	--	17.0 (7-29-14)
GB-14	9.2	N/A
GB-15	12.5	N/A
GB-16	16.0	N/A
GB-17 (GB-17P)	--	11.2 (7-29-14)
GB-18	11.4	N/A
GB-19	12.0	N/A
GB-22	10.0	N/A
GB-23	12.0	N/A
GB-24B	9.3	N/A
GB-25A (GB-25AP)	10.0	11.1 (7-29-14)
GB-26	6.6	N/A
GB-27A	12.0	N/A
GB-28A	12.0	N/A
GB-29	8.6	N/A

However, it should be noted that various environmental and man-made factors such as amount of precipitation, nearby subsurface construction activities, and change in area drainage can substantially influence the groundwater level.

4.7 Environmental Concerns

No environmental concerns were noticed during drilling in the borings GB-1 through GB-29 drilled for this study.

5.0 ENGINEERING ANALYSES AND RECOMMENDATIONS

5.1 General

The project is comprised of approximately 15,580 LF of neighborhood street reconstruction along various streets with utilities replacement for NSR 456 Project. The utilities include sanitary sewer and water line. The size of the water line ranges from 8 to 12 inches and placed at depth of approximately 5 feet. The size of the sanitary sewer ranges from 6 to 15 inches and placed at depths ranging from 6 to 14 feet. The project also includes construction of a 12 to 16 inch sanitary sewer force main at some locations and placed at depths ranging from 9 to 13 feet. The proposed construction is by open cut method. The existing pavement along the streets will be replaced with new concrete pavement.

5.2 Trench Excavation

Based on the information provided by Bury-Hou, Inc., it is understood that the water line, sanitary sewer and sanitary sewer force main will be installed by open cut method of construction. The following subsections provide information for the design and construction of the water line, sanitary sewer and sanitary sewer force main open cut method of excavations.

5.2.1 Geotechnical Parameters. Based on the soil conditions revealed by the borings GB-1 through GB-29, geotechnical parameters were developed for the design of open cut construction for water line, sanitary sewer and sanitary sewer force main installation. The design parameters are provided in Table 2. For design, the groundwater level should be assumed to exist at the ground surface.

5.2.2 Excavation Stability. The open excavation may be shored or laid back to a stable slope or supported by some other equivalent means used to provide safety for workers and adjacent structures, if any. The excavating operations should be in accordance with OSHA Standards, OSHA 2207, Subpart P, latest revision and the City of Houston Standard Specification.

- Excavation Shallower Than 5 Feet - Excavations that are less than 5 feet deep **(critical height)** should be effectively protected when an indication of dangerous ground movement is anticipated.

- Excavations Deeper Than 5 Feet - Excavations that are deeper than 5 feet should be sloped, shored, sheeted, braced or laid back to a stable slope or supported by some other equivalent means or protection such that workers are not exposed to moving ground or cave-ins. The slopes and shoring should be in accordance with the trench safety requirements as per OSHA Standards. The following items provide design criteria for excavation stability.

  (i) OSHA Soil Type. Based on the soil conditions revealed by borings drilled for this study and assumed groundwater level at surface, OSHA soil type "C" should be used for determination of allowable maximum slope and/or the design of shoring along the alignment for full proposed depth of open excavation. For shoring deeper than 20 feet, an engineering evaluation is required.

  (ii) Excavation Support Earth Pressure. Based on the subsurface conditions indicated by our field investigation and laboratory testing results, excavation support earth pressure diagrams are developed and are presented on Figures 5.1 through 5.3. These pressure diagrams can be used for the design of temporary trench bracing. For a trench box, a lateral earth pressure resulting from an equivalent fluid with a unit weight of 96 pcf can be used. The effects of any surcharge loads at the ground surface should be added to the computed lateral earth pressures. A surcharge load, q, will typically result in a lateral load equal to 0.5 q. The above value of equivalent fluid pressure is based on assumption that the groundwater level is near the ground surface, since these conditions may exist after a heavy rain or flooding.

  (iii) Bottom Stability. In braced cuts, if tight sheeting is terminated at the base of the cut, the bottom of the excavation can become unstable. The parameters that govern the stability of the excavation base are the soil shear strength and the differential

hydrostatic head between the groundwater level within the retained soils and the groundwater level at the interior of the trench excavation. For cut in cohesive soils as predominantly encountered for the proposed excavation depths (6 to 14 feet) in all the borings, the bottom stability can be evaluated as outlined on Figure 6. However, for installation of sanitary sewer line and sanitary sewer force main due to the presence of water bearing silty sand and fine sand with silt at the invert depths and within 3 to 3.5 feet of invert depth, dewatering will be necessary to avoid bottom stability problems.

5.2.3 Groundwater Control. Excavations for the water line, sanitary sewer and sanitary sewer force main may encounter groundwater seepage to varying degrees depending upon the groundwater conditions at the time of construction and the location and depth of the trench. Based on the soil conditions identified in the borings for the proposed water line, sanitary sewer and sanitary sewer force main installation, all the excavations (for excavation depths of 6 to 14 feet) will be in cohesive soils with intermittent cohesionless soils or cohesive over cohesionless soils. In general for cohesive soils as encountered in all the borings for the excavation depths, the groundwater (if encountered) may be managed by collection in excavation bottom sumps for pumped disposal. However, during sanitary sewer line and sanitary sewer force main installation, due to the presence of water bearing silty sand and fine sand with silt at the invert depths and within 3 to 3.5 feet of invert depth, dewatering will be required. Dewatering such as vacuum well points up to 15 feet may be required to lower ground water level at least 5 feet below the bottom of excavation. For open cut excavation near borings GB-4, GB-5, GB-7, GB-8, GB-19, GB-21, GB-23, GB-24B, GB-25A, GB-27A, GB-28A and GB-29, the excavation will be in cohesive soils or cohesive with the intermittent thin layer of silty sand layer (1 to 2 feet) above the excavation bottom. In these areas the groundwater may be controlled by using eductor well system if can be successfully lowered 5 feet below the excavation bottom or alternatively installing continuous interlock (water tight) sheet piling with trench bottom sumps for pumped disposal. The dewatering system should be pumping well ahead of the time before excavation starts so that a steady state condition (at least 5 feet below the proposed excavation bottom) is achieved. The range of depths where cohesionless soils encountered in borings are presented in the table below.

Location/Street	**Boring No.**	**Range of Depths of Cohesionless Soils Encountered, ft**		**Soil Type**
		From	To	
Wycliffe Drive	GB-4	12	13	Silty Sand
	GB-5	12	14	Fine Sand with silt
	GB-7	12	13	Silty Sand
		16	18	Silty Sand
	GB-8	12	14	Silty Sand
	GB-9	12	20	Silty Sand
	GB-10	0.9	2	Silty Sand
		12	18	Silty Sand
	GB-13	14	16	Fine Sand with Silt
	GB-14	14	16	Silty Sand
	GB-15	11.5	13	Silty Sand
	GB-16	12.5	20	Silty Sand
	GB-17	12	14	Silty Sand
	GB-18	10	18	Silty Sand
Mayfield Road	GB-19	10	16	Silty Sand
	GB-21	10	16	Silty Sand
Ivyridge Road	GB-22	10	16	Fine Sand with silt
Hazelhurst Drive	GB-23	8	14	Clayey Sand and Silty Sand
Mayfield Road	GB-24B	10	14	Silty Sand
Ivyridge Road	GB-25A	10	14	Fine Sand with silt
Britt Way Street	GB-27A	12	16	Silty Sand
Shadow Wood Drive	GB-28A	10	14	Silty Sand
	GB-29	12	16	Silty Sand

It is recommended that the actual groundwater conditions should be verified by the contractor at the time of construction and that groundwater control should be performed in general accordance with the City of Houston Standard Specifications, Section 01578.

5.2.4 Bedding and Backfill for Water Line, Sanitary Sewer and Sanitary Sewer Force Main. In general, excavation and backfill for utilities should be designed and constructed in accordance with the City of Houston Standard Specification No. 02317, Subsection 3.09 and 3.10 "Excavation and Backfill for Utilities."

Bedding and backfill for sanitary sewer and sanitary sewer force main should be in accordance with City of Houston Standard Specification Section 02317 and Drawing No. 02317-03. Bedding and backfill for water line should be in accordance with City of Houston Standard Specification Section 02317 and Drawing No. 02317-04.

5.3 Piping System Thrust Restraint

Unbalanced thrust forces will occur at any point in the pipe where the direction or cross sectional area of the flow changes. The force diagram shown in Figure 7 illustrates the thrust force generated by flow at a bend in the pipe. The equations for computing this thrust force are also given in this figure. The thrust force will often require more resistance or support than is available just from the pipe bearing against the backfill. In order to prevent intolerable movement and overstressing of the pipe, suitable buttressing should be provided.

Based on the drawings provided to us, it was noted that several horizontal bends are proposed which may require restraint in addition to that supplied by the pipe bearing on the backfill. In general, thrust blocks, both horizontal and vertical and restrained joints are common methods of supplying additional reaction. However, it is noted that restrained joints are considered for supplying additional reaction for the project and is discussed below.

5.3.1 Restrained Joints. Where thrust blocks are not practical, restrained joints, allowing thrust and shear forces to be transmitted across the pipe joints, are employed to allow a number of pipe sections to act integrally in bearing. The equations necessary to determine the restrained pipe length on each side of the bend are given below:

$$L = \frac{PA \ \ Sin(\theta / 2)}{f(2W_e + W_p + W_w)}$$

where, L = restrained pipe length on each side of the bend, in feet

P = internal pressure, in pounds per square inch

A = cross sectional area of first unrestrained pipe joint, in square inches

θ = deflection angle of bend, in degrees

f = co-efficient of friction between pipe and soil (recommended 0.3)

W_e = overburden load, in pounds per liner foot = $\Upsilon_b B_c H$

W_p = weight of pipe, in pounds per linear foot

W_w = weight of water in pipe, in pounds per linear foot

Υ_b = wet unit weight of backfill material, in pounds per cubic foot (recommended 120 pcf)

B_c = pipe outer diameter, in feet

H = earth cover, in feet

Reinforced concrete encasement may be used in lieu of the manufactured joint restrained system. The equations and soil parameters given above can be used for the design of reinforced concrete encasement.

5.4 Structures

5.4.1 Description. The structure associated with this project will be new manholes. The new manholes for sanitary sewer will be placed at depths ranging from 6 to 15 feet.

5.4.2 Foundation Conditions. Based on the soil conditions revealed by the borings GB-1 through GB-29, the manholes bottom will be in medium stiff to hard lean clay with sand, medium dense silty sand and fine sand with silt.

5.4.3 Foundation Design Recommendations. The following items provide recommendations and design criteria for construction of the new manholes.

- Allowable Bearing Pressures. The mat foundation for supporting the new manholes placed at a depths ranging from 6 to 13 feet [into soft to hard lean clay w/sand, medium dense silty sand and fine sand with silt] should be designed for an allowable (net) bearing pressure as detailed below.

Street	**From**	**To**	**Borings**	**Depth, ft**	**Allowable Bearing Pressure, psf**
Wycliff	IH-10	Timberline	GB-1 thru GB-6A	12 – 15	2,000
	Timberline	Chatterton	GB-7 thru GB-10	7 – 12	2,500
	Chatterton	End	GB-10 thru GB-18	7.5 – 11	2,000
Mayfield Dr.	Wycliff	Buescher	GB-19	9 – 10	2,500
Mayfield Dr.	Buescher	Brittmore	GB-21 and GB-24B	7 – 13	2,500
Buescher	Hazelhurst	End	GB-19 and GB-20	5 – 7	2,000
Ivyridge Lane	Buescher	Brittmore	GB-22 and GB-25A	6.5 – 9.5	1,250
Hazelhurst Drive	Buescher	Brittmore	GB-20 and GB-23	6 – 12	3,000
Shadow Wood	Wycliff	Brittmore	GB-26, GB-28A, and GB-29	5 – 12.5	2,500
Brittway St.	Shadow Wood	Shadow Wood	GB-27A	6.5 – 9	2,000

The allowable bearing pressures include a safety factor of 2.0.

The above recommendations assume that the final bearing surfaces consist of undisturbed natural soils and that underlying semi-transmissive zones are properly pressure-relieved and stable undisturbed bearing surfaces are attained.

- Bottom Stability. In braced cut, if sheeting is terminated at the base of the cut, the bottom of the excavation can become unstable under a certain condition. This condition is governed by the shear strength of the soils and by the differential hydrostatic head. For cut in cohesive soils as predominantly encountered for the proposed excavation depths (6 to 14 feet) in all the borings, the bottom stability can be evaluated as outlined on Figure 6. However, for installation of sanitary sewer line and sanitary sewer force main due to the presence of water bearing silty sand and fine sand with silt at the invert depths and within 3 to 3.5 feet of invert depth, dewatering will be necessary to avoid bottom stability problems.

- Lateral Earth Pressure. The pressure diagrams presented on Figure 5.1 through 5.3 can be used for the design of braced excavation. The lateral earth pressure diagrams presented on Figures 8.1 through 8.3 is applicable for the design of the permanent walls.

- Hydrostatic Uplift Resistance. Structures extending below the groundwater level should be designed to resist uplift pressure resulting from excess piezometric head. Design uplift pressures should be computed based on the assumption that the water table is at ground surface. To resist the hydrostatic uplift at the bottom of the structure, one of the following sources of resistance can be utilized in each of the designs.

  a. Dead weight of structure,
  b. Weight of soil above base extensions plus weight of structure, or
  c. Soil-wall friction plus dead weight of structure.

  The uplift force and resistance to uplift should be computed as detailed on Figure 9. In determining the configuration and dimensions of the structure using one of the approaches presented on Figure 9, the following factors of safety are recommended.

a. Dead weight of concrete structure, $S_{f1} = 1.10$,

b. Weight of soil (backfill) above base extension, $S_{f2} = 1.5$, and

c. Soil-wall friction, $S_{f3} = 3.0$.

Friction resistance should be discounted for the upper 5 feet, since this zone is affected by seasonal moisture changes.

5.4.4 Protection of Below Grade Structures. The design of the proper means for protection of below grade structures will depend upon the potential of the aggressivity or corrosivity of soil and groundwater properties. The aggressivity testing was not within the scope of this study. The design of the protection of below grade structures is beyond the scope of services for this study.

5.4.5 Groundwater Control During Construction. The groundwater control should be followed in accordance with section 5.2.3 of this report.

5.4.6 Structure Backfill. Excavations for the proposed structures should be backfilled in accordance with the City of Houston Standard Specifications, Section 02316, "Excavation and Backfill for Structures."

5.5 Pavement Structure Design

It is understood that approximately 15,580 linear feet of existing pavement along Wycliffe Drive and other streets in NSR 456 Project Area will be reconstructed with a rigid pavement. The other streets in the project area include Mayfield Drive, Buescher Drive, Mayfield Road, Ivyridge Drive, Hazelhurst Drive, Shadow Wood Drive, Britt Way Street Skyview Drive, Sherwood Forest and Metronome Drive. The pavement design presented below was developed in accordance with "AASHTO Guide for Design of Pavement Structures," 1993 Edition.

5.5.1 Design Parameters

Subgrade Soil Properties. Based on the laboratory CBR test data obtained from the natural subgrade soils, the effective roadbed soil resilient modulus (M_R) is estimated to be about 4,928 psi. Based on an estimated resilient modulus of the 8-inch and 6-inch lime-stabilized subgrade, the effective modulus of subgrade reaction (k) is estimated to be about 89 pci and 84 pci, respectively.

Traffic Data. No traffic data is provided to us for the project alignment. Based on Houston Regional Traffic Counts Map, the traffic data is estimated for Wycliffe Drive and other streets. The details were given below.

A traffic data of 1.78 x 10^6 and 5.9 x 10^6– 18 kips ESALs over a 20 year and 50 year design period was utilized respectively for the pavement design of Wycliffe Drive and a traffic data of 0.54x 10^6 and 1.85 x 10^6– 18-kip ESALs over a 20-year and design period was utilized for the pavement design of other streets. **This traffic volume is based on total average daily traffic (ADT) volume of 3,234 vehicles for Wycliffe Drive and 1,500 vehicles for other streets from Houston Regional traffic counts map (this traffic data was extrapolated from a traffic volume of 2,760 for Wycliffe Drive and 1,260 for other streets in year 2006)**. **A distribution of 95% passenger cars, 3.5% light trucks and 1.5% heavy trucks were assumed for the Wycliffe Drive and 97% passenger cars, 2% light trucks and 1% heavy trucks were assumed for other streets.**

Other Design Parameters. Other design parameters used in the development of rigid pavement thickness are given below:

Material Properties of Concrete:

Modulus of Elasticity of Concrete (E_c): 3,372,166 psi

Mean value of Modulus of Rupture of Concrete after 28 days

(S'_c): 600 psi (based on compressive strength of 3,500 psi) (for 30 years)

(S'_c): 630 psi (based on compressive strength of 4,000 psi) (for 50 years)

Load Transfer coefficient (J): 3.2

Drainage coefficient (C_d): 1.2

Overall Standard Deviation (S_o): 0.35

Reliability Level (R): 95%

Reliability Level (R): 80% (for residential streets)

Serviceability Index

Initial (P_o): 4.5

Terminal (P_t): 2.50

Reinforcement Variables

Allowable Working Stress (f_s): 45,000 psi (grade 60 steel)

Friction Factor (F): 1.8

It should be noted that the design parameters for 50 year pavement design was provided to us by City of Houston (COH), Interoffice Correspondence letter dated December 31, 2014.

5.5.2 Recommended Pavement Section

Based on the design parameters described above, the AASHTO design procedures and design parameters provided by COH, the thickness of rigid pavement was determined. The recommended pavement section is given below:

Wycliffe Drive

Pavement, Course	**Thickness, Inches**	
	20-Years	**50-Years**
Reinforced Concrete	8	10
5% Lime-stabilized subgrade Or 3% Lime and 9% Flyash Stabilized (near boring GB-10)	8	12

Other Streets

Pavement, Course	**Thickness, Inches**	
	20-Years	**50-Years**
Reinforced Concrete	6	8
5% Lime-stabilized subgrade Or 3% Lime and 9% Flyash Stabilized (near boring GB-24B)	6	8

Based on the reinforcement variables and recommended pavement section, the required longitudinal and transverse reinforcing steel (No. 4, Grade 60 Steel) can be determined for concrete pavement per Table 1 of City of Houston Drawing No. 02751-01 (Revised July 1, 2009).

5.5.3 Preparation of Pavement Subgrade

Based on the field and laboratory test data, the subgrade soils at the finished grade of the project site consists of medium to high plasticity sandy lean clay except near borings GB-10 and GB-24B, where the subgrade soils consist of silty sand or very sandy lean clay. These sandy lean soils have medium to high volume change potential. Hence, lime stabilization of the sandy lean clay subgrade will be required to reduce the swell potential due to volume changes and to accelerate the construction and provide a stable subgrade on which to construct the pavement section. The subgrade soils should be stabilized with approximately 5 percent lime to a depth of at least 6 to 8 inches. The area near borings GB-10 and GB-24B, the subgrade soils should be stabilized with 3 percent lime and 9 percent fly ash to a depth of 6 to 9 inches. The estimated quantities of lime and fly ash for a 6-inch and 8 inch subgrade with a soil dry unit weight of 110 pcf are given below.

Percent and Stabilized Subgrade Thickness	**Estimated Quantity of Lime per square yard, lb**	**Estimated Quantity of Flyash per square yard, lb**
5% lime and 6 inch	25	--
5% lime and 8 inch	33	--
5% lime and 12 inch	50	--

Percent and Stabilized Subgrade Thickness	**Estimated Quantity of Lime per square yard, lb**	**Estimated Quantity of Flyash per square yard, lb**
3% lime and 9% flyash and 6 inch	15	45
3% lime and 9% flyash and 8 inch	20	59
3% lime and 9% flyash and 12 inch	30	89

It should be noted that quantity of lime and lime and fly ash were calculated based on the dry unit weight determined from the specific boring locations only.

Subgrade preparation for the proposed pavement after removing the existing pavement should consist of stripping, proof-rolling, and stabilization. The following procedures for subgrade preparation are recommended:

1. Strip the surficial soils to a suitable depth to remove all surficial vegetation and achieve grade. In isolated areas where soft, compressible, or very loose soils are encountered, additional stripping may be required. Stripping should extend to a minimum of 2 feet in the adjacent open (unpaved) area, where it exists beyond the edge of the proposed pavement.

2. After stripping, the exposed surface should be proof-rolled with a minimum of 3 passes of a 30-ton pneumatic-tired roller or a partially loaded truck utilizing a tire pressure of approximately 90 psi. If rutting develops, the tire pressure should be reduced. The purpose of the proof-rolling operation is to identify any underlying zones or pockets of soft soils so these weak materials can be removed and replaced.

3. Lime stabilization of cohesive subgrade should be performed in accordance with City of Houston Standard Specification No. 02336, “Lime-Stabilized Subgrade.” Lime/fly ash stabilization of cohesionless or very sandy clay subgrade should be performed in accordance with City of Houston Standard Specification No. 02337, “Lime/Fly Ash Stabilized Subgrade”.

6.0 CONSTRUCTION CONSIDERATIONS

6.1 Groundwater Control

Excavations for the water line, sanitary sewer and sanitary sewer force main may encounter groundwater seepage to varying degrees depending upon the groundwater conditions at the time of construction and the location and depth of the trench. Based on the soil conditions identified in the borings for the proposed water line, sanitary sewer and sanitary sewer force main installation, all the excavations (for excavation depths of 6 to 14 feet) will be in cohesive soils with intermittent cohesionless soils or cohesive over cohesionless soils. In general for cohesive soils as encountered in all the borings for the excavation depths, the groundwater (if encountered) may be managed by collection in excavation bottom sumps for pumped disposal. However, during sanitary sewer line and sanitary sewer force main installation, due to the presence of water bearing silty sand and fine sand with silt at the invert depths and within 3 to 3.5 feet of invert depth, dewatering will be required. Dewatering such as vacuum well points up to 15 feet may be required to lower ground water level at least 5 feet below the bottom of excavation. For open cut excavation near borings GB-4, GB-5, GB-7 and GB-8, the excavation will be in cohesive soils or cohesive with the intermittent thin layer of silty sand layer (1 to 2 feet) above the excavation bottom. In these areas the groundwater may be controlled by using eductor well system if can be successfully lowered 5 feet below the excavation bottom or alternatively installing continuous interlock (water tight) sheet piling with trench bottom sumps for pumped disposal. The dewatering system should be pumping well ahead of the time before excavation starts so that a steady state condition (at least 5 feet below the proposed excavation bottom) is achieved. The range of depths where cohesionless soils encountered in borings are presented in the table below.

Location/Street	**Boring No.**	**Range of Depths of Cohesionless Soils Encountered, ft**		**Soil Type**
		From	**To**	
Wycliffe Drive	GB-4	12	13	Silty Sand
	GB-5	12	14	Fine Sand with silt

Location/Street	**Boring No.**	**Range of Depths of Cohesionless Soils Encountered, ft**		**Soil Type**
		From	**To**	
Wycliffe Drive	GB-7	12	13	Silty Sand
		16	18	Silty Sand
	GB-8	12	14	Silty Sand
	GB-9	12	20	Silty Sand
	GB-10	0.9	2	Silty Sand
		12	18	Silty Sand
	GB-13	14	16	Fine Sand with Silt
	GB-14	14	16	Silty Sand
	GB-15	11.5	13	Silty Sand
	GB-16	12.5	20	Silty Sand
	GB-17	12	14	Silty Sand
	GB-18	10	18	Silty Sand
Mayfield Road	GB-19	10	16	Silty Sand
	GB-21	10	16	Silty Sand
Ivyridge Road	GB-22	10	16	Fine Sand with silt
Hazelhurst Drive	GB-23	8	14	Clayey Sand and Silty Sand
Mayfield Road	GB-24B	10	14	Silty Sand
Ivyridge Road	GB-25A	10	14	Fine Sand with silt
Britt Way Street	GB-27A	12	16	Silty Sand
Shadow Wood Drive	GB-28A	10	14	Silty Sand
	GB-29	12	16	Silty Sand

It is recommended that the actual groundwater conditions should be verified by the contractor at the time of construction and that groundwater control should be performed in general accordance with the City of Houston Standard Specifications, Section 01578.

7.0 LIMITATIONS

The description of subsurface conditions and the design information contained in this report are based on the soil borings made at the time of drilling at specific locations. However, some variation in soil conditions may occur between soil borings. Should any subsurface conditions other than those described in our boring logs be encountered, Geotest should be immediately notified so that further investigation and supplemental recommendations can be provided. The depth of the groundwater level may vary with changes in environmental conditions such as frequency and magnitude of rainfall. The stratification lines on the log of borings represent the approximate boundaries between soil types, however, the transition between soil types may be more gradual than depicted.

This report has been prepared for the exclusive use of City of Houston, Texas, and Bury-Hou, Inc., for the NSR 456 project. This report shall not be reproduced without the written permission of Geotest Engineering, Inc., the City of Houston or Bury-Hou, Inc.

TABLES

	Table
Summary of Boring Information	1
Geotechnical Design Parameter Summary – Open Cut Excavation	2

TABLE 1

SUMMARY OF BORING INFORMATION

Location/ Street	Boring No.	Depth (feet)	Northing	Easting	Elevation (feet)
Wycliffe Drive	GB-1 (GB-1P)	24	13850732.63	3055221.80	87.45
	GB-2	24	13851385.55	3055204.83	89.35
	GB-3	24	13851865.56	3055197.54	90.76
	GB-4	24	13852420.08	3055169.18	90.69
	GB-5	24	13852701.52	3055168.54	90.78
	GB-6	4	13853262.55	3055154.17	89.76
	GB-6A (GB-6AP)	22	13853262.55	3055154.17	89.76
	GB-7	22	13853638.81	3055126.29	89.75
	GB-8	22	13854220.23	3055120.34	90.20
	GB-9	22	13854762.34	3055088.61	90.35
	GB-10	22	13855220.45	3055080.87	91.74
	GB-11 (GB-11P)	21	13855755.19	3055051.19	91.85
	GB-12	21	13856238.09	3055044.09	92.14
	GB-13	21	13856687.47	3055021.78	92.48
	GB-14	21	13857205.28	3055011.60	92.49
	GB-15	13	13857830.53	3054981.49	93.21
Sherwood Forest Street	GB-16	23	1385887.32	3054977.06	92.84
Wycliffe Drive	GB-17 (GB-17P)	20	13858747.02	3054949.33	92.78
	GB-18	20	13857905.02	3054792.23	92.61
Mayfield	GB-19	20	13854368.92	3055517.51	89.64
Buescher Drive	GB-20	14	13854855.49	3055638.75	89.83
Mayfield Road	GB-21	23	13854246.33	3055906.89	89.68
Ivyridge Road	GB-22	20	13854555.07	3056030.34	89.26

TABLE 1 (cont'd)

SUMMARY OF BORING INFORMATION

Location/ Street	Boring No.	Depth (feet)	Northing	Easting	Elevation (feet)
Hazelhurst Drive	GB-23	20	13854895.28	3056172.02	89.57
Mayfield Road	GB-24	2	13854271.54	3056386.10	89.30
	GB-24A	2	13854271.54	3056386.10	89.30
	GB-24B	23	13854271.54	3056386.10	89.30
Ivyridge Road	GB-25	12	13854588.91	3056456.94	89.65
	GB-25A (GB-25AP)	20	13854588.91	3056456.94	89.65
Shadow Wood Drive	GB-26	12	13857505.51	3055414.57	92.09
Britt Way Street	GB-27A	20	13857263.28	3055787.49	92.14
Shadow Wood Drive	GB-28	10	13857549.04	3056054.13	92.42
	GB-28A	23	13857549.04	3056054.13	92.42
	GB-29	23	13857567.59	3056396.06	91.99

Note: The survey information is provided by Bury, Inc.

TABLE 2

GEOTECHNICAL DESIGN PARAMETER SUMMARY
OPEN-CUT EXCAVATION

Street	Boring Nos.	Stratigraphic Unit	Range of Depths, ft	Wet** Unit Weight, γ, pcf	Submerged Unit Weight, γ', pcf	Undrained Cohesion, psf	Internal Friction Angle, φ, degree
Wycliffe Drive	GB-1 through GB-3	Cohesive	*0-4	127	64	1,000	--
			4-8	125	63	1,500	--
			8-10	129	65	1,200	--
			10-14	125	63	1,500	--
			14-24	128	64	2,000	--
	GB-4 and GB-5	Cohesive	*0-8	126	63	800	--
			8-12	130	65	1,400	--
		Cohesionless	12-14	105	53	--	30
		Cohesive	14-24	130	65	2,000	--
	GB-6A	Cohesive	*0-10	132	66	1,000	--
			10-12	133	67	500	--
			12-16	135	68	1,200	--
			16-22	132	66	2,000	--
	GB-7	Cohesive	*0-8	132	66	1,600	--
			8-12	133	67	500	--
		Cohesionless	12-13	110	55	--	30
		Cohesive	13-16	120	60	1,200	--
		Cohesionless	16-18	115	58	--	30
		Cohesive	18-22	125	63	4,200	--
	GB-8	Cohesive	*0-4	125	63	900	--
			4-12	130	65	1,400	--
		Cohesionless	12-14	110	55	--	30
		Cohesive	14-22	130	65	2,000	--
	GB-9 and GB-10	Cohesive	*0-12	130	65	1,000	--
		Cohesionless	12-20	120	60	--	30
		Cohesive	20-22	125	63	900	--
	GB-11 and GB-12	Cohesive	*0-12	127	64	1,000	--
			12-14	130	65	400	--
			14-21	122	61	1,500	--
	GB-13 and GB-14	Cohesive	*0-4	132	66	1,000	--
		Cohesionless	4-14	125	63	1,400	--
		Cohesive	14-16	106	53	--	30
			16-21	120	60	1,400	--
	GB-15	Cohesive	*0-8	130	65	3,500	--
			8-11.5	125	63	1,000	--
		Cohesionless	11.5-13	110	55	--	30
Sherwood Forest Street	GB-16	Cohesive	*0-8	128	64	2,000	--
			8-12.5	128	64	800	--
		Cohesionless	12.5-20	116	58	--	30
		Cohesive	20-23	125	63	2,000	--
Wycliffe Drive	GB-17	Cohesive	*0-10	132	66	3,000	--
			10-12	132	66	2,000	--
		Cohesionless	12-14	118	59	--	30
		Cohesive	14-20	121	61	800	--
	GB-18	Cohesive	*0-10	125	63	1,200	--
		Cohesionless	10-18	120	60	--	30
		Cohesive	18-20	128	64	1,400	--

TABLE 2 (cont'd)

GEOTECHNICAL DESIGN PARAMETER SUMMARY
OPEN-CUT EXCAVATION

Street	Boring Nos.	Stratigraphic Unit	Range of Depths, ft	Wet** Unit Weight, γ, pcf	Submerged Unit Weight, γ', pcf	Undrained Cohesion, psf	Internal Friction Angle, φ, degree
Mayfield Drive	GB-19	Cohesive	*0-10	134	67	1,000	--
		Cohesionless	10-16	116	58	--	30
		Cohesive	16-20	117	59	1,000	--
Buescher Drive	GB-20	Cohesive	*0-4	132	66	800	--
			4-14	130	65	1,200	--
Mayfield Road and Ivyridge Street	GB-21 and GB-22	Cohesive	*0-10	130	65	1,000	--
		Cohesionless	10-16	115	58	--	30
		Cohesive	16-23	130	65	1,600	--
Hazelhurst Drive	GB-23	Cohesive	*0-8	132	66	1,600	--
		Cohesionless	8-14	125	63	--	30
		Cohesive	14-20	129	64	2,500	--
Mayfield Road and Ivyridge Street	GB-24B and GB-25A	Cohesive	*0-8	130	65	600	--
			8-10	125	63	500	--
		Cohesionless	10-14	116	58	--	30
		Cohesive	14-16	125	63	500	--
			16-23	130	65	1,400	--
Shadow Wood Drive	GB-26	Cohesive	*0-12	128	64	1,000	--
	GB-27 thru GB-29	Cohesive	*0-8	130	65	800	--
			8-12	132	66	1,000	--
		Cohesionless	12-16	116	58	--	30
		Cohesive	16-23	125	63	1,000	--

1. Cohesive soils include Fat Clay, Fat Clay w/sand, Lean Clay w/sand and Sandy Lean Clay.
2. Cohesionless soils include silty sand, fine sand with silt and clayey sand.

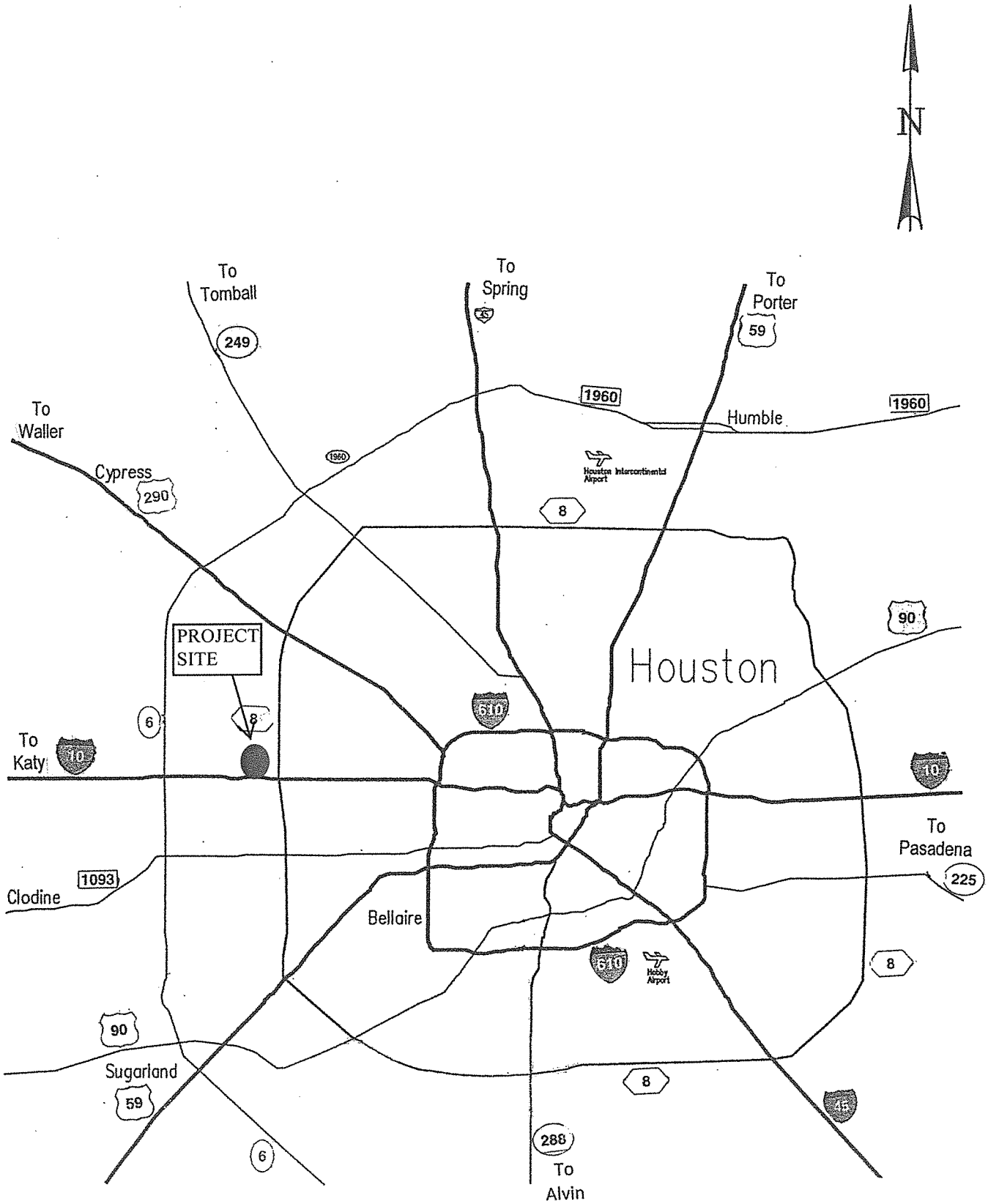
* 0 feet – Below the pavement

** The wet unit weight is based on the average value for each layer, where more than one boring is used.

ILLUSTRATIONS

	Figure
Vicinity Map	1
Plan of Borings	2
Boring Log Profile	3.1 thru 3.9
Symbols and Abbreviations Used on Boring Log Profile	4
Trench Support Earth Pressure	5.1 thru 5.3
Stability of Bottom for Braced Cut	6
Thrust Forces Acting on a Bend	7
Lateral Earth Pressure Diagram for Permanent Wall	8.1 thru 8.3
Uplift Pressure and Resistance	9

Job No. 1140202901



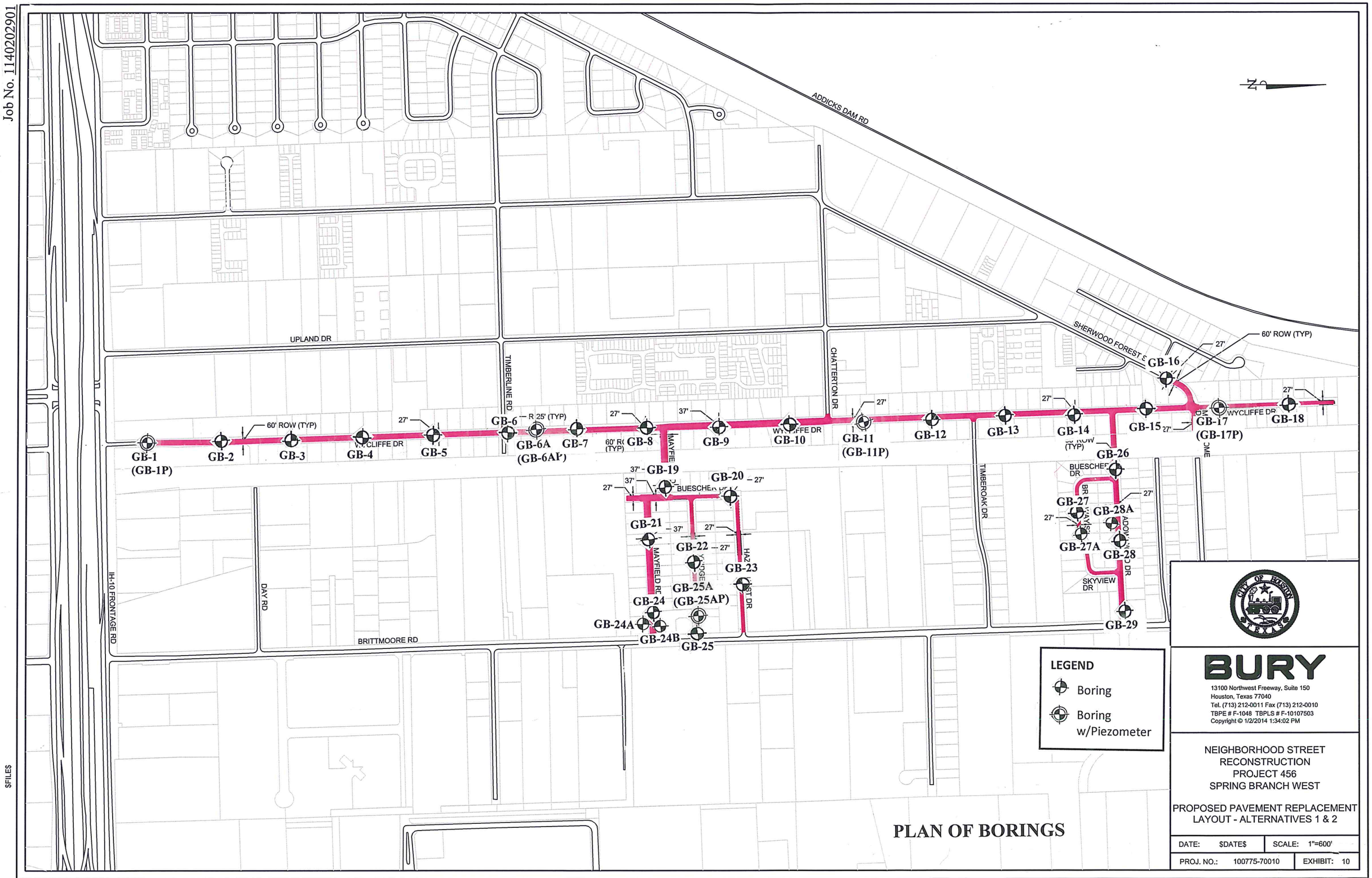
VICINITY MAP

(NOT TO SCALE)

Geotest Engineering, Inc.

FIGURE 1

Job No. 1140202901



BURY

13100 Northwest Freeway, Suite 150
Houston, Texas 77040
Tel. (713) 212-0011 Fax (713) 212-0010
TBPE # F-1048 TBPLS # F-10107503
Copyright © 1/2/2014 1:34:02 PM

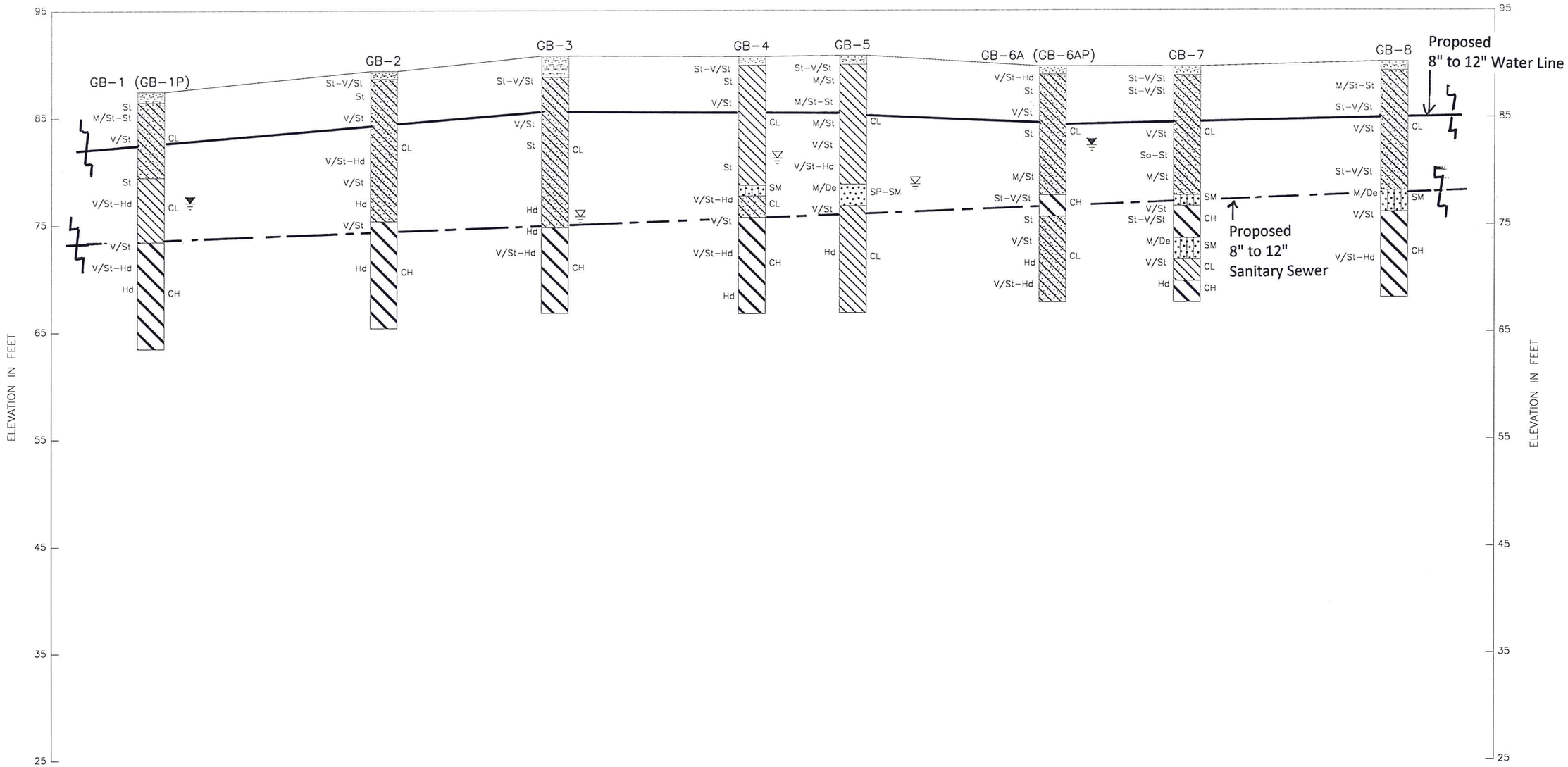
NEIGHBORHOOD STREET RECONSTRUCTION
PROJECT 456
SPRING BRANCH WEST

PROPOSED PAVEMENT REPLACEMENT LAYOUT - ALTERNATIVES 1 & 2

DATE: $DATE$	SCALE: 1"=600'
PROJ. NO.: 100775-70010	EXHIBIT: 10

$FILE$

FIGURE 2



GENERAL NOTES:

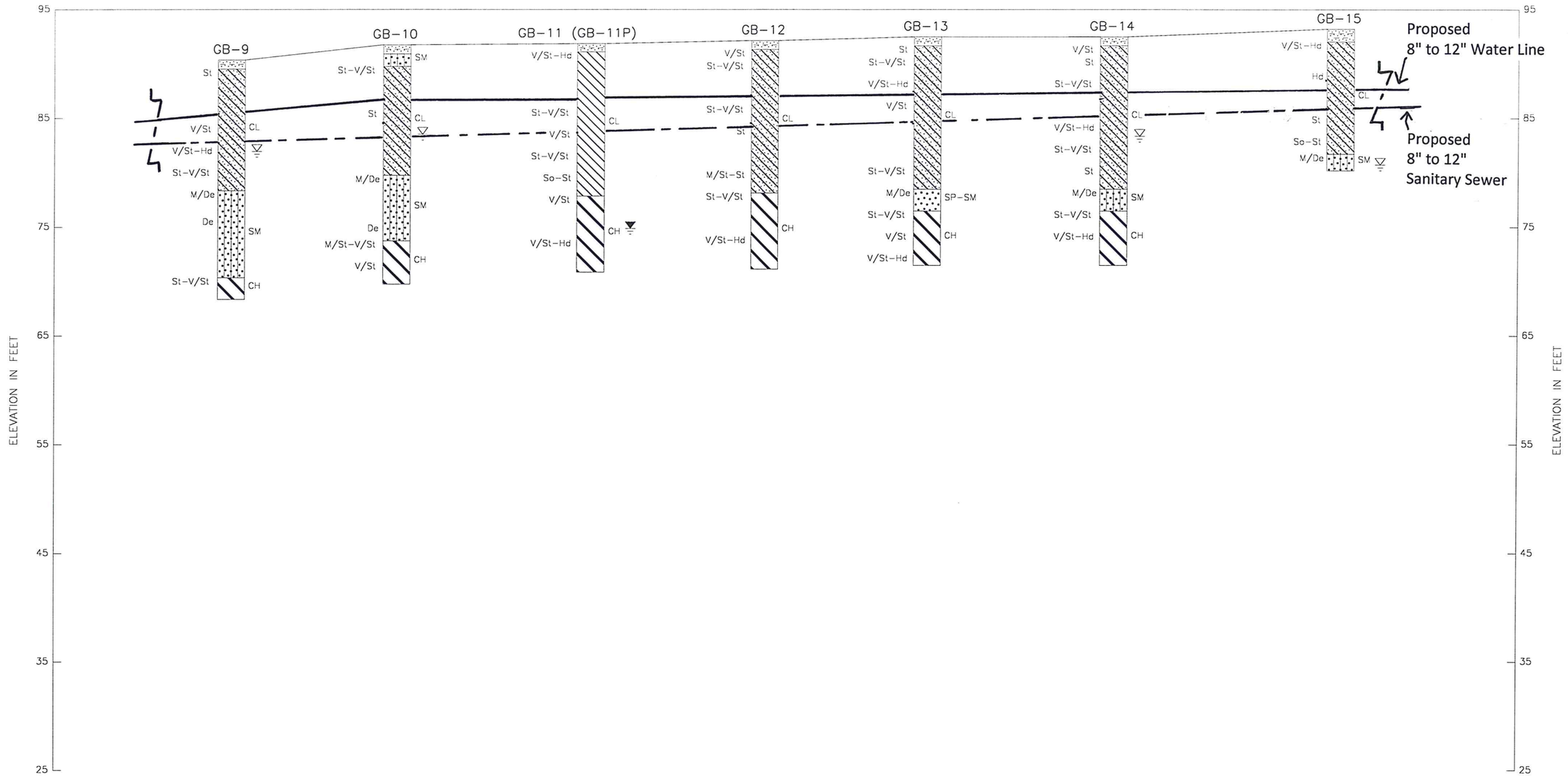
1. See Figure 2 for approximate location of borings and profile section.
2. Data concerning subsurface conditions have been obtained at boring locations only. Actual conditions between borings may differ from the profile shown here.
3. See logs of boring for detailed description of soils encountered in each borehole.
4. See Figure 4 for symbols and abbreviations used on this profile.
5. Ground surface elevation at each boring location was based on survey data provided to us by Bury, Inc.

BORING LOG PROFILE

Wycliff Drive

0 150 300 450 600

HORIZONTAL SCALE IN FEET



GENERAL NOTES:

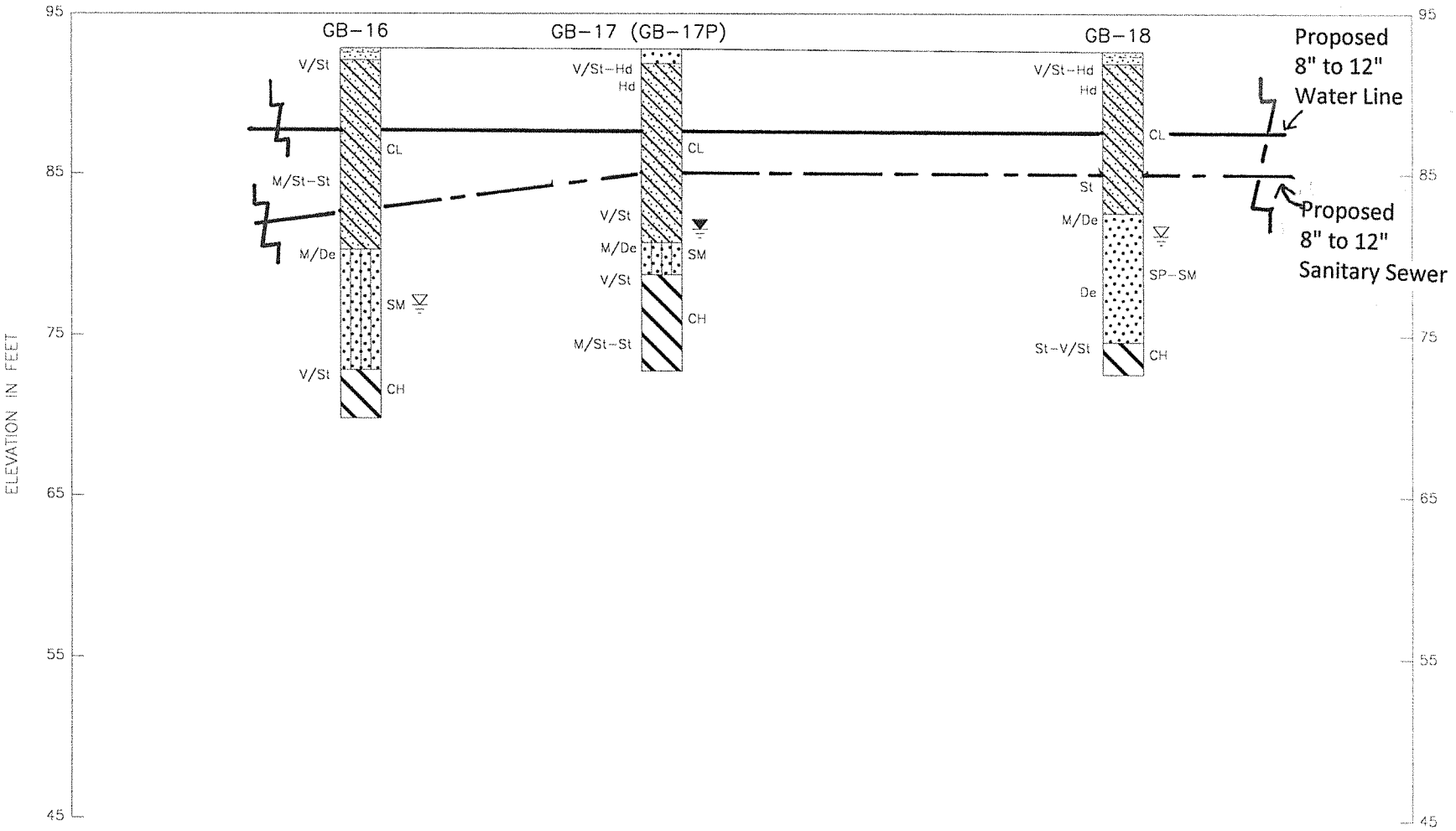
1. See Figure 2 for approximate location of borings and profile section.
2. Data concerning subsurface conditions have been obtained at boring locations only. Actual conditions between borings may differ from the profile shown here.
3. See logs of boring for detailed description of soils encountered in each borehole.
4. See Figure 4 for symbols and abbreviations used on this profile.
5. Ground surface elevation at each boring location was based on survey data provided to us by Bury, Inc.

BORING LOG PROFILE

Wycliff Drive

0 150 300 450 600

HORIZONTAL SCALE IN FEET



GENERAL NOTES:

1. See Figure 2 for approximate location of borings and profile section.
2. Data concerning subsurface conditions have been obtained at boring locations only. Actual conditions between borings may differ from the profile shown here.
3. See logs of boring for detailed description of soils encountered in each borehole.
4. See Figure 4 for symbols and abbreviations used on this profile.
5. Ground surface elevation at each boring location was based on survey data provided to us by Bury, Inc.

BORING LOG PROFILE

Wycliff Dr. & Shwood Forest

0 150 300 450 600

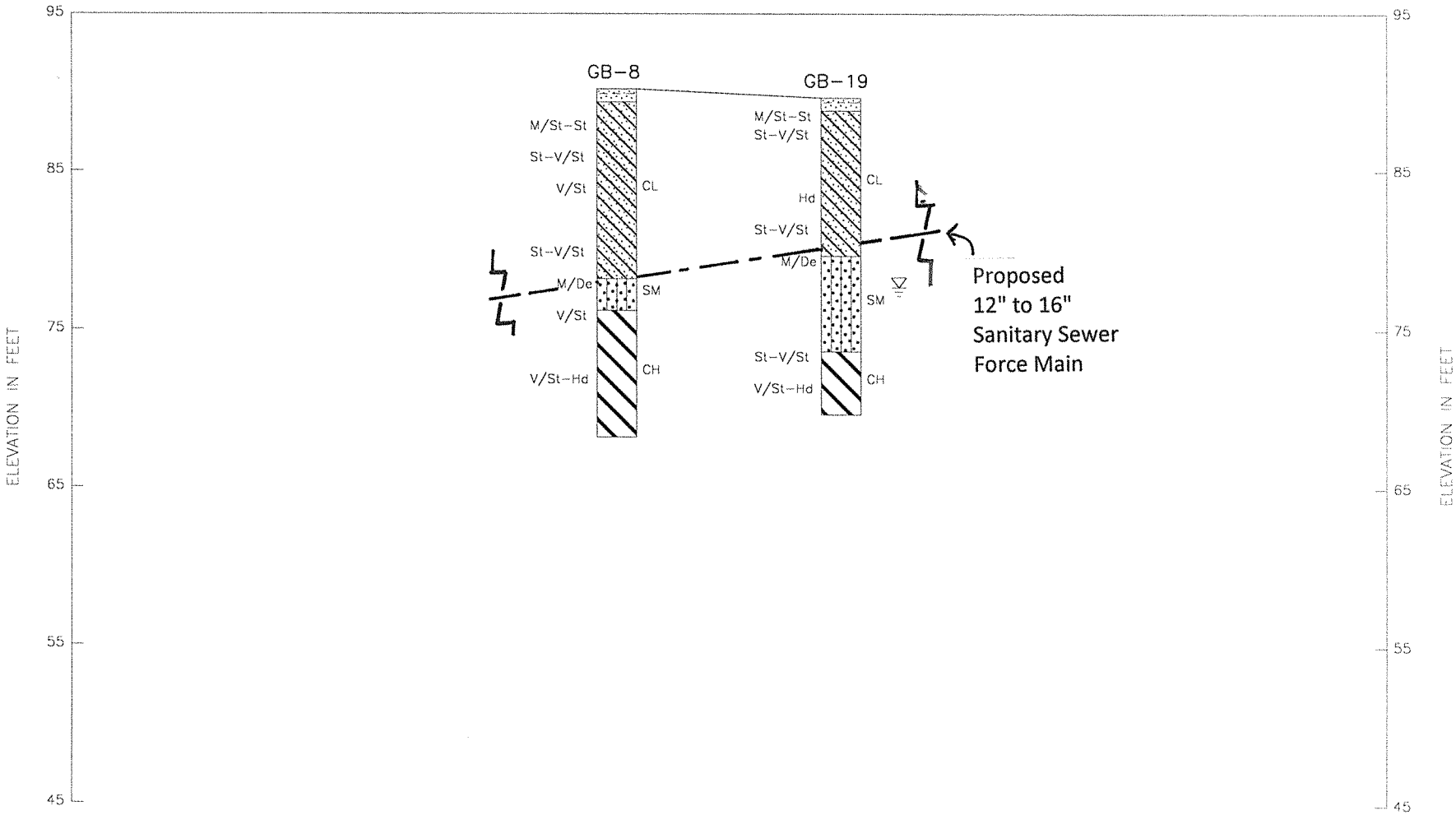
HORIZONTAL SCALE IN FEET

Job No. 1140202901

Geotest Engineering, Inc.

FIGURE 3.3

Job No. 1140202501



GENERAL NOTES:

1. See Figure 2 for approximate location of borings and profile section.
2. Data concerning subsurface conditions have been obtained at boring locations only. Actual conditions between borings may differ from the profile shown here.
3. See logs of boring for detailed description of soils encountered in each borehole.
4. See Figure 4 for symbols and abbreviations used on this profile.
5. Ground surface elevation at each boring location was based on survey data provided to us by Bury, Inc.

BORING LOG PROFILE

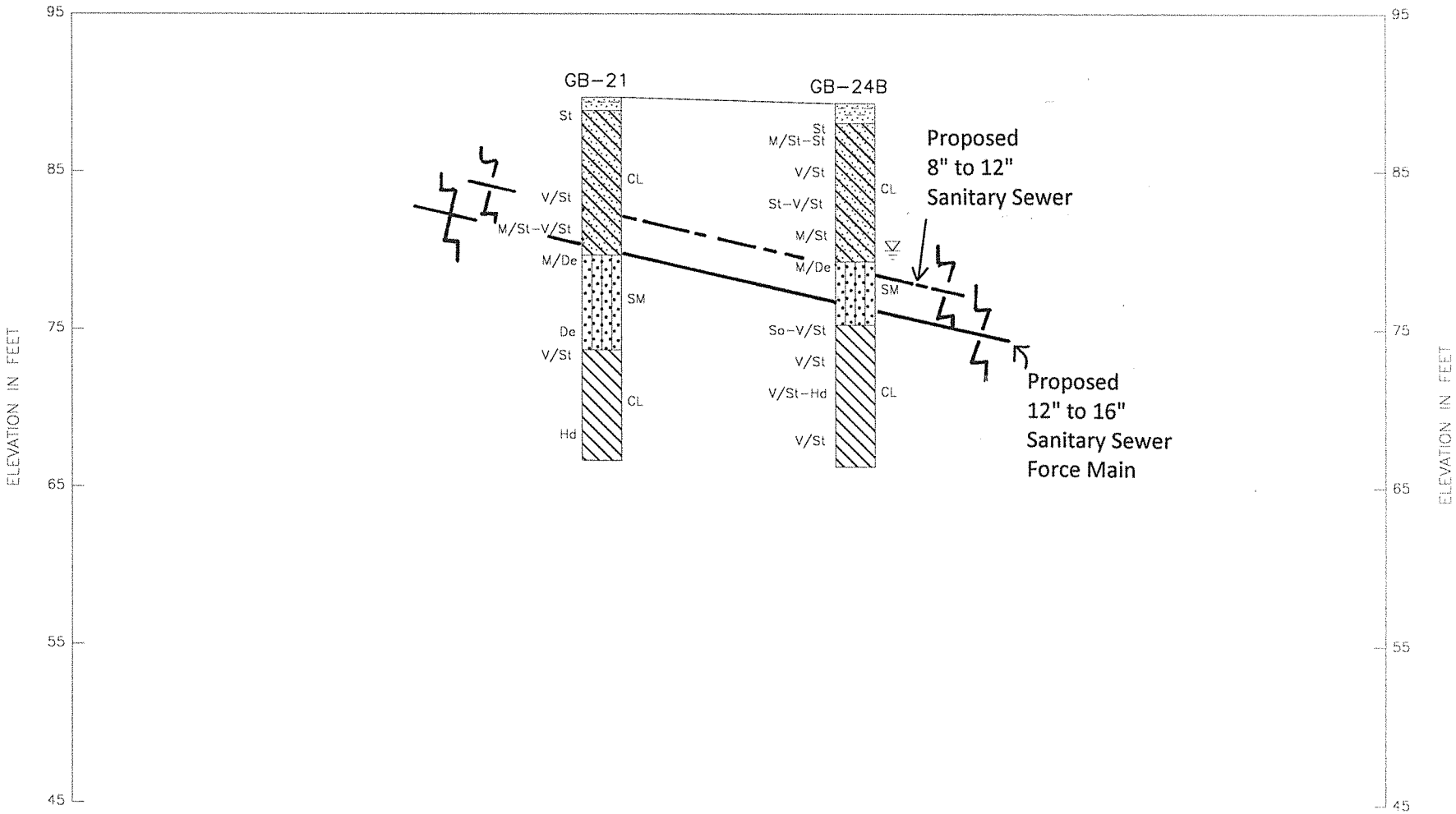
Mayfield Drive

0 150 300 450 600

HORIZONTAL SCALE IN FEET

Geotest Engineering, Inc.

FIGURE 3.4



GENERAL NOTES:

1. See Figure 2 for approximate location of borings and profile section.
2. Data concerning subsurface conditions have been obtained at boring locations only. Actual conditions between borings may differ from the profile shown here.
3. See logs of boring for detailed description of soils encountered in each borehole.
4. See Figure 4 for symbols and abbreviations used on this profile.
5. Ground surface elevation at each boring location was based on survey data provided to us by Bury, Inc.

BORING LOG PROFILE

Mayfield Road

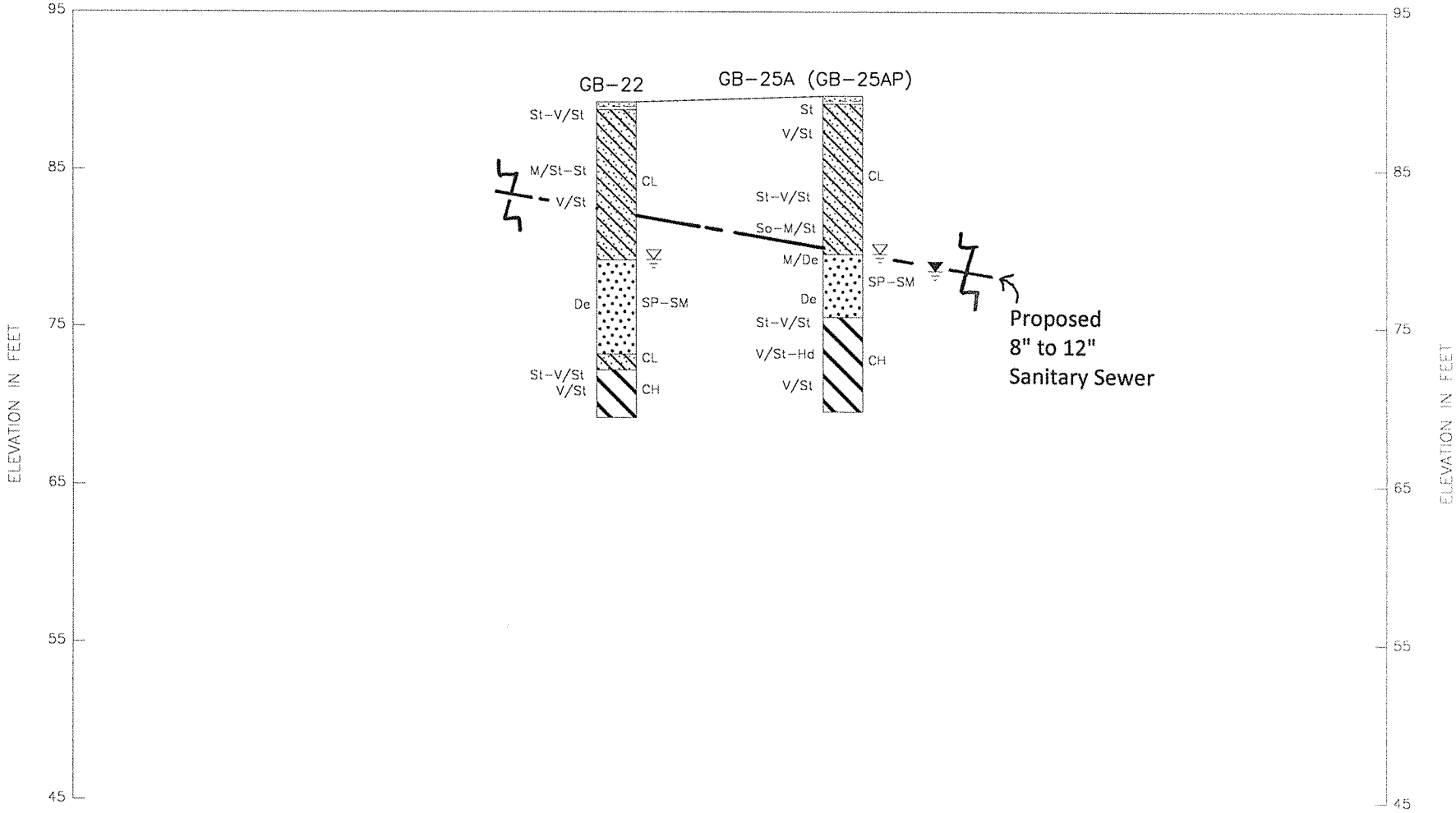
0 150 300 450 600

HORIZONTAL SCALE IN FEET

Job No. 1140202901

Geotest Engineering, Inc.

FIGURE 3.5



GENERAL NOTES:

1. See Figure 2 for approximate location of borings and profile section.
2. Data concerning subsurface conditions have been obtained at boring locations only. Actual conditions between borings may differ from the profile shown here.
3. See logs of boring for detailed description of soils encountered in each borehole.
4. See Figure 4 for symbols and abbreviations used on this profile.
5. Ground surface elevation at each boring location was based on survey data provided to us by Bury, Inc.

BORING LOG PROFILE

Ivyridge Road

0 150 300 450 600

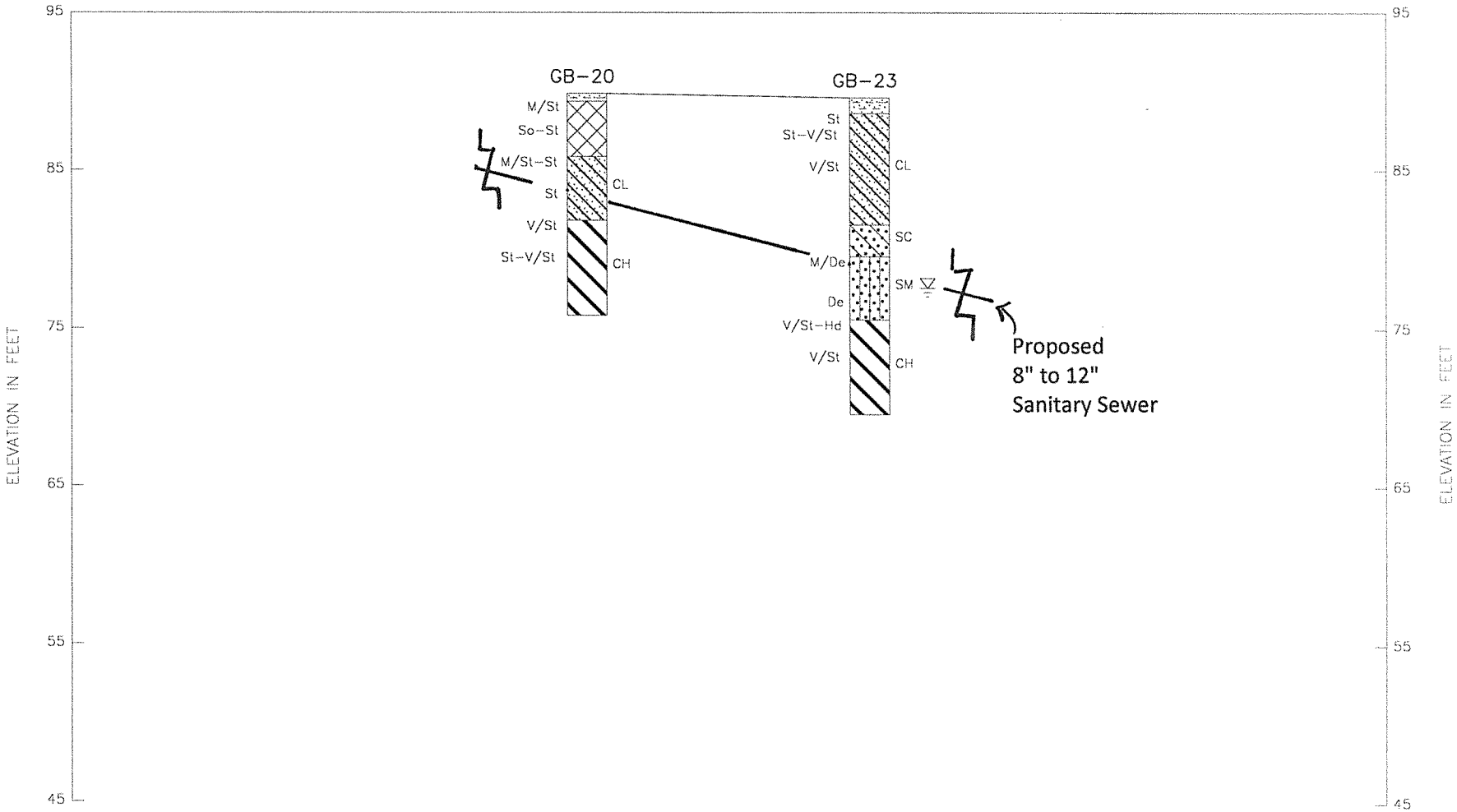
HORIZONTAL SCALE IN FEET

Job No. 1140202901

Geotest Engineering, Inc.

FIGURE 3.6

Job No. 1140202901



GENERAL NOTES:

1. See Figure 2 for approximate location of borings and profile section.
2. Data concerning subsurface conditions have been obtained at boring locations only. Actual conditions between borings may differ from the profile shown here.
3. See logs of boring for detailed description of soils encountered in each borehole.
4. See Figure 4 for symbols and abbreviations used on this profile.
5. Ground surface elevation at each boring location was based on survey data provided to us by Bury, Inc.

BORING LOG PROFILE

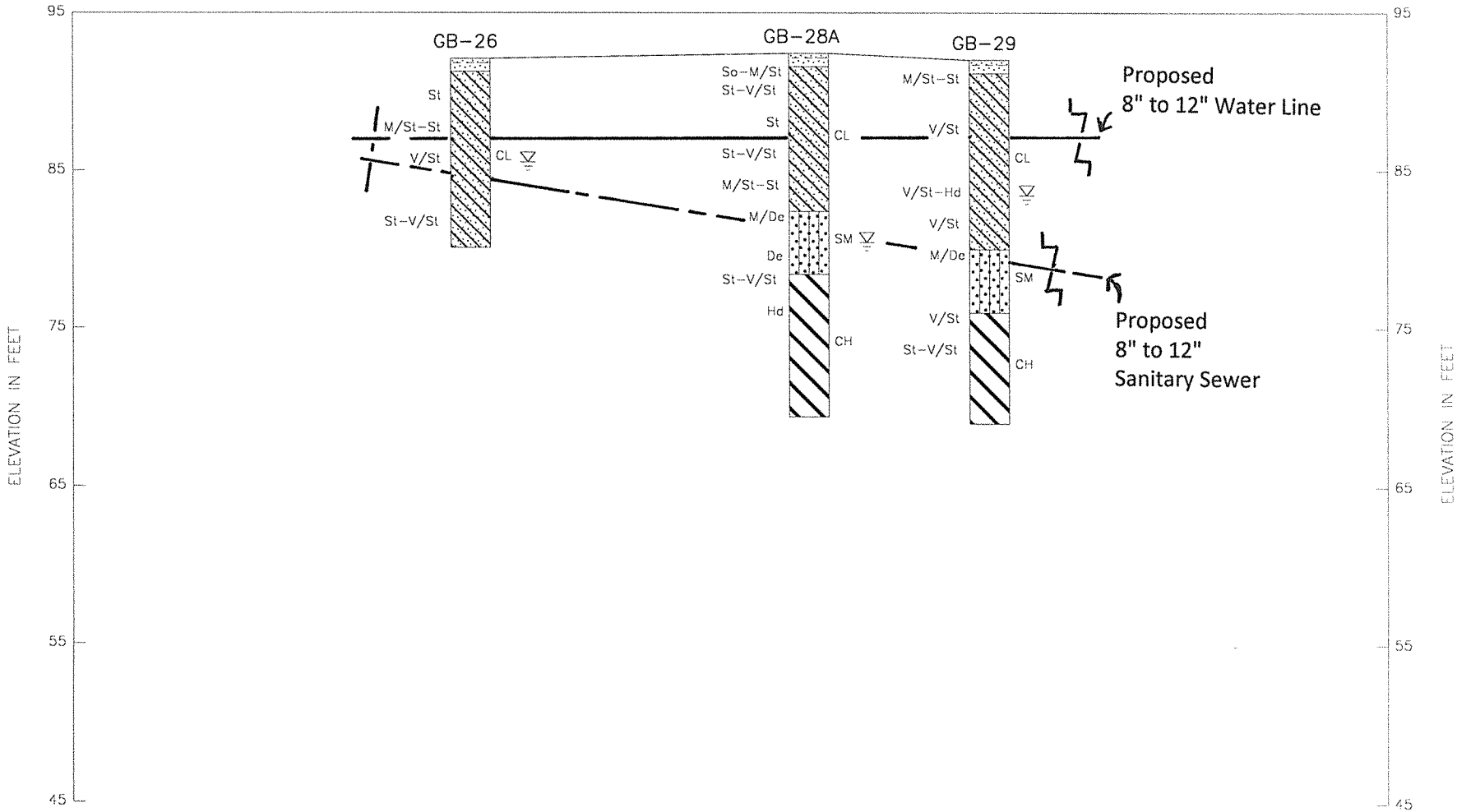
Hazelhurst Drive

0 150 300 450 600

HORIZONTAL SCALE IN FEET

Geotest Engineering, Inc.

FIGURE 3.7



GENERAL NOTES:

1. See Figure 2 for approximate location of borings and profile section.
2. Data concerning subsurface conditions have been obtained at boring locations only. Actual conditions between borings may differ from the profile shown here.
3. See logs of boring for detailed description of soils encountered in each borehole.
4. See Figure 4 for symbols and abbreviations used on this profile.
5. Ground surface elevation at each boring location was based on survey data provided to us by Bury, Inc.

BORING LOG PROFILE

Shadow Wood Drive

0 150 300 450 600

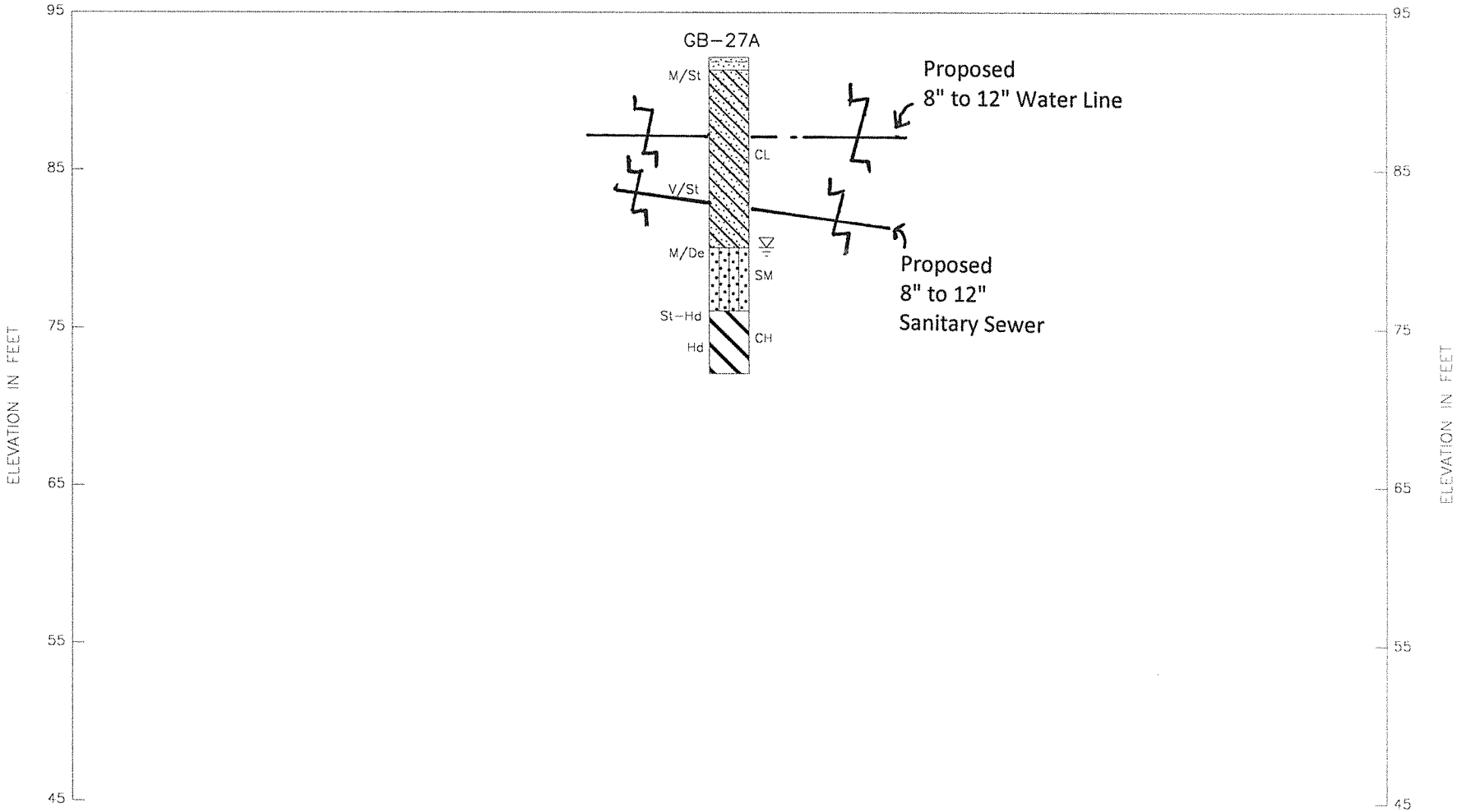
HORIZONTAL SCALE IN FEET

Job No. 1140202901

Geotest Engineering, Inc.

FIGURE 3.8

Job No. 1140202901



GENERAL NOTES:

1. See Figure 2 for approximate location of borings and profile section.
2. Data concerning subsurface conditions have been obtained at boring locations only. Actual conditions between borings may differ from the profile shown here.
3. See logs of boring for detailed description of soils encountered in each borehole.
4. See Figure 4 for symbols and abbreviations used on this profile.
5. Ground surface elevation at each boring location was based on survey data provided to us by Bury, Inc.

BORING LOG PROFILE

Britt Way Street

0 150 300 450 600

HORIZONTAL SCALE IN FEET

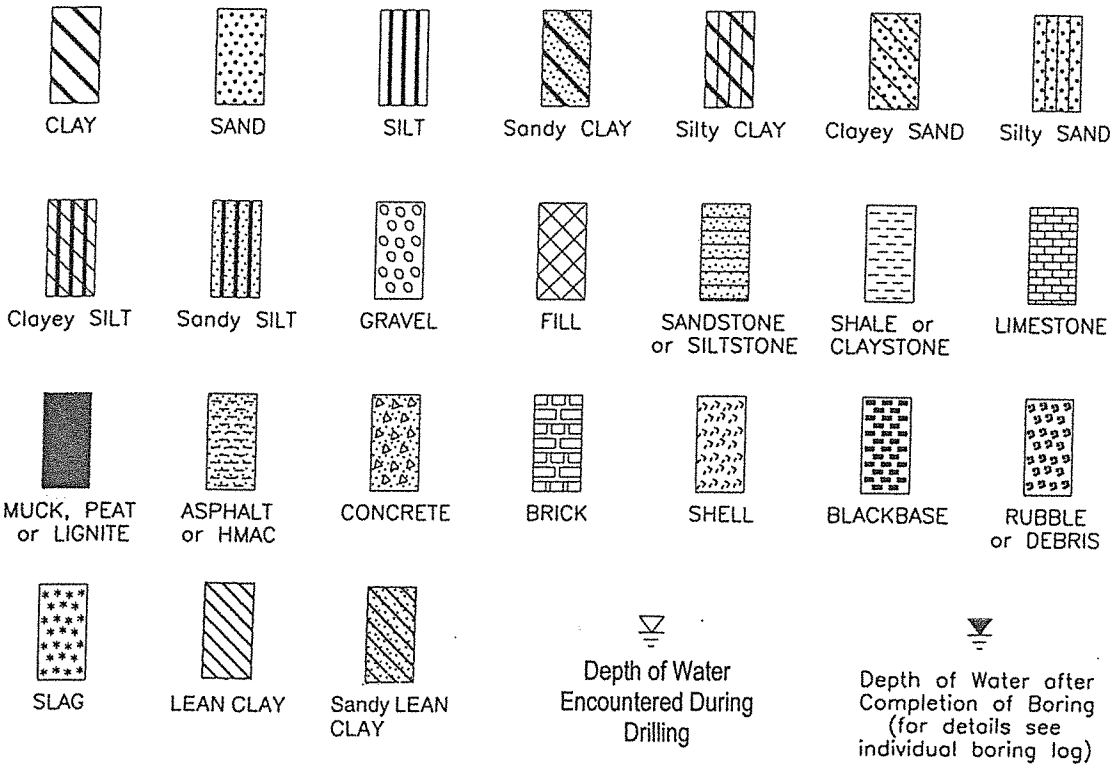
Geotest Engineering, Inc.

FIGURE 3.9

Job No. 1140202901

SYMBOLS AND ABBREVIATIONS USED ON BORING LOG PROFILE

LEGEND



ABBREVIATIONS USED FOR CONSISTENCY/DENSITY

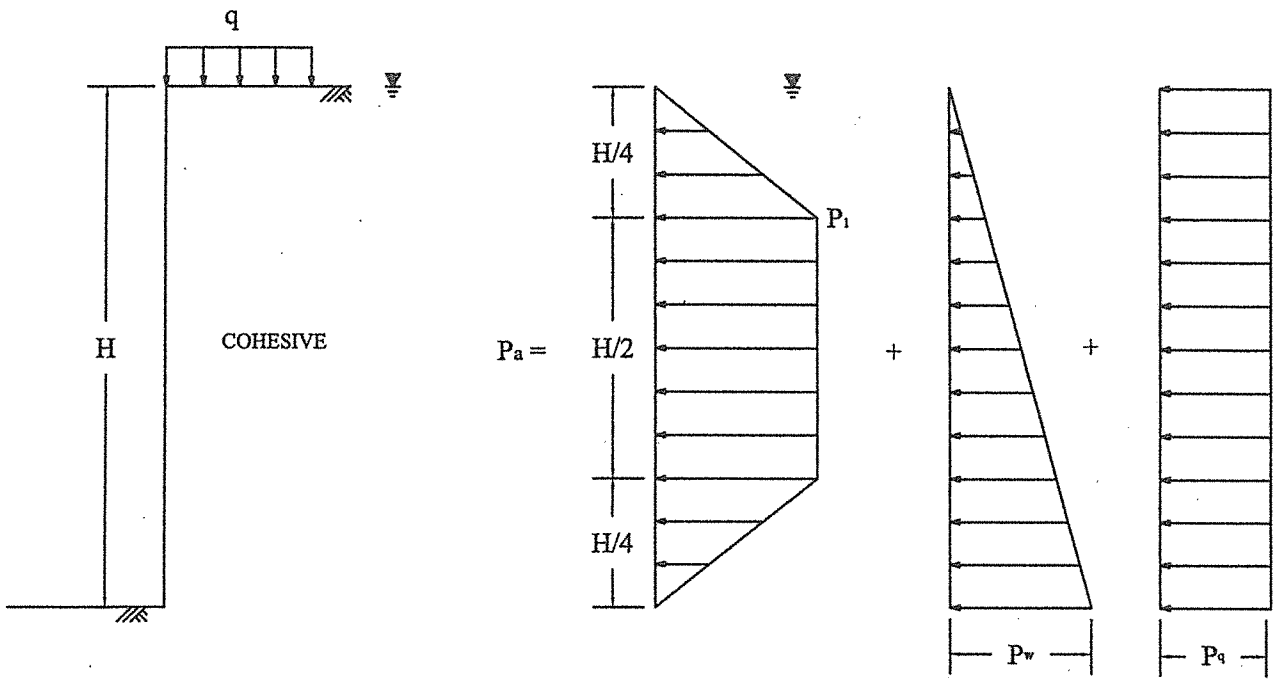
COHESIVE SOILS

V/So : Very Soft
So : Soft
Fm : Firm
M/St : Medium Stiff
St : Stiff
V/St : Very Stiff
Hd : Hard
V/Hd : Very Hard

COHESIONLESS SOILS

V/Lo : Very Loose
Lo : Loose
S/Co : Slightly Compact
Co : Compact
M/De : Medium Dense
De : Dense
V/De : Very Dense

Job No. 1140202901



TYPICAL SOIL PARAMETERS

BRACED WALL

See Table 2 for typical values of soil parameters

For $\gamma H/c \leq 4$

$P_1 = 0.3\ \gamma_c' H$
$P_w = \gamma_w H = 62.4\ H$
$P_q = 0.5\ q$

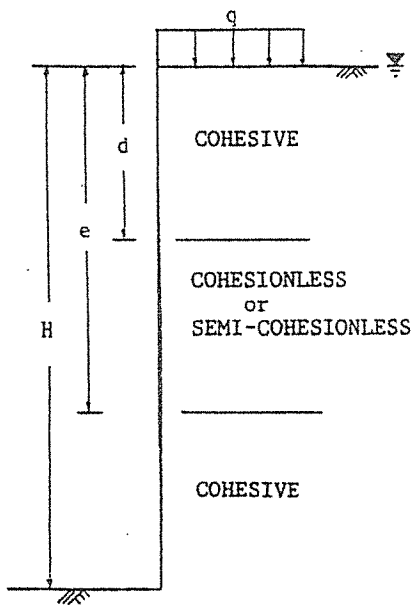
Where:

γ_c' = Submerged unit weight of cohesive soil, pcf;
γ_w = Unit weight of water, pcf;
q = Surcharge load at surface, psf;
P_a = Lateral pressure, psf;
P_1 = Active earth pressure, psf;
P_q = Horizontal pressure due to surcharge, psf;
P_w = Hydrostatic pressure due to groundwater, psf;
H = Depth of braced excavation, feet
c = Shear strength of cohesion soil, psf;

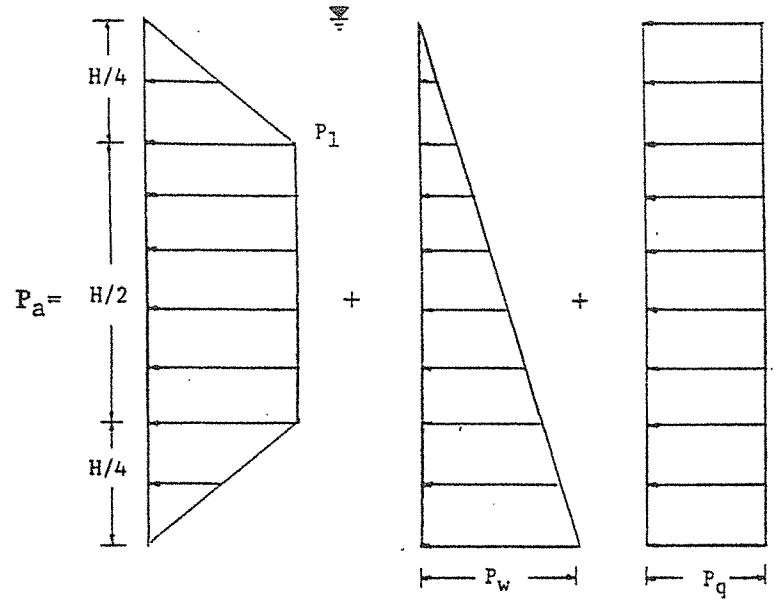
TRENCH SUPPORT EARTH PRESSURE

SUBMERGED COHESIVE SOIL

Job No. 1140202901



TYPICAL SOIL PARAMETERS



BRACED WALL

See Table 2 for typical values of soil parameters

$$P_1 = 0.3\ \gamma'_{avg}\ H$$

$$P_w = \gamma_w\ H = 62.4\ H$$

$$P_q = 0.5q$$

$$\gamma'_{avg} = \frac{\gamma_c'\ d + \gamma_s'\ (e-d) + \gamma_c'\ (H-e)}{H}$$

$$\gamma_w = 62.4 \text{ pcf}$$

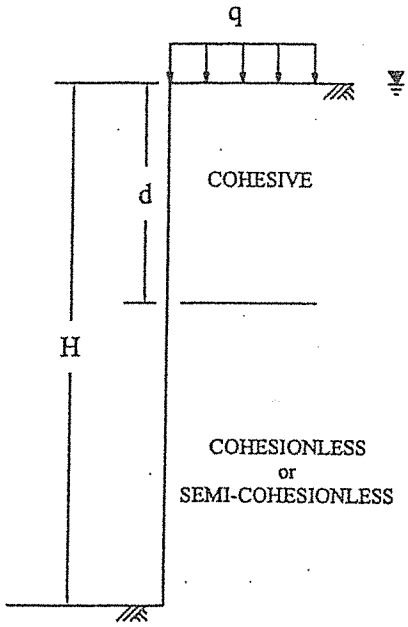
Where:

- γ_c' = Submerged unit weight of cohesive soil, pcf ;
- γ_s' = Submerged unit weight of cohesionless or semi-cohesionless soil, pcf ;
- γ_w = Unit weight of water, pcf;
- γ'_{avg} = Average submerged unit weight of soil, pcf ;
- q = Surcharge load at surface, psf;
- P_a = Lateral pressure, psf;
- P_1 = Active earth pressure, psf;
- P_q = Horizontal pressure due to surcharge, psf;
- P_w = Hydrostatic pressure due to groundwater, psf;
- H = Depth of braced excavation, feet

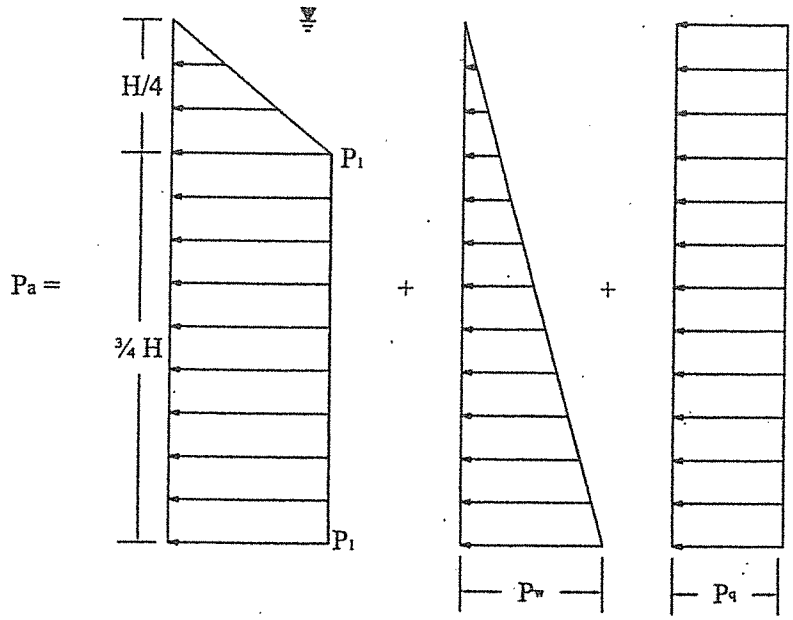
TRENCH SUPPORT EARTH PRESSURE

SUBMERGED COHESIVE SOIL
INTERBEDDED WITH COHESIONLESS OR
SEMI-COHESIONLESS SOIL

Job No. 1140202901



TYPICAL SOIL PARAMETERS



BRACED WALL

See Table 2 for typical values of soil parameters

$$\gamma'_{avg} = \frac{\gamma_c' \, d + \gamma_s' \, (H-d)}{H}$$

$P_1 = 0.3 \, \gamma'_{avg} \, H$
$P_w = 62.4 \, H$
$P_q = 0.5 \, q$

Where:

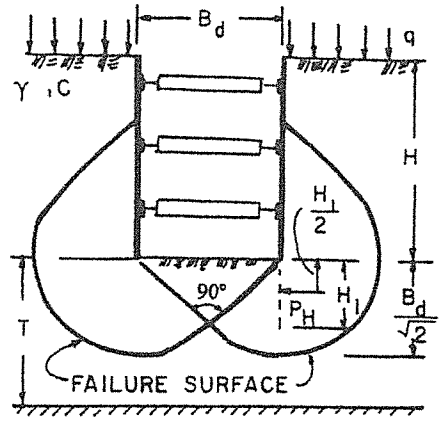
- γ_c' = Submerged unit weight of cohesive soil, pcf;
- γ_s' = Submerged unit weight of cohesionless soil, pcf;
- γ'_{avg} = Average submerged unit weight of soils, pcf;
- q = Surcharge load at surface, psf;
- P_a = Lateral pressure, psf;
- P_1 = Active earth pressure, psf;
- P_q = Horizontal pressure due to surcharge, psf;
- P_w = Hydrostatic pressure due to groundwater, psf;
- H = Depth of braced excavation, feet

TRENCH SUPPORT EARTH PRESSURE

SUBMERGED COHESIVE SOIL OVER
COHESIONLESS OR SEMI-COHESIONLESS SOIL

Job No. 1140202901

CUT IN COHESIVE SOIL,
DEPTH OF COHESIVE SOIL UNLIMITED ($T > 0.7\ B_d$)
L = LENGTH OF CUT



If sheeting terminates at base of cut:

$$\text{Safety factor, } F_S = \frac{N_C C}{\gamma H + q}$$

N_C = Bearing capacity factor, which depends on dimensions of the excavation : B_d , L and H (use N_C from graph below)

C = Undrained shear strength of clay in failure zone beneath and surrounding base of cut

γ = Wet unit weight of soil (see Table 2)

q = Surface surcharge (assumed q = 500 psf)

If safety factor is less than 1.5, sheeting or soldier piles must be carried below the base of cut to insure stability - (see note)

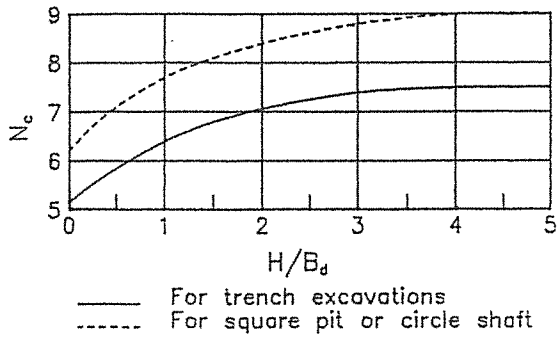
$$H_1 = \text{Buried length} = \frac{B_d}{2} \geq 5 \text{ feet}$$

Note : If soldier piles are used, the center to center spacing should not exceed 3 times the width or diameter of soldier pile .

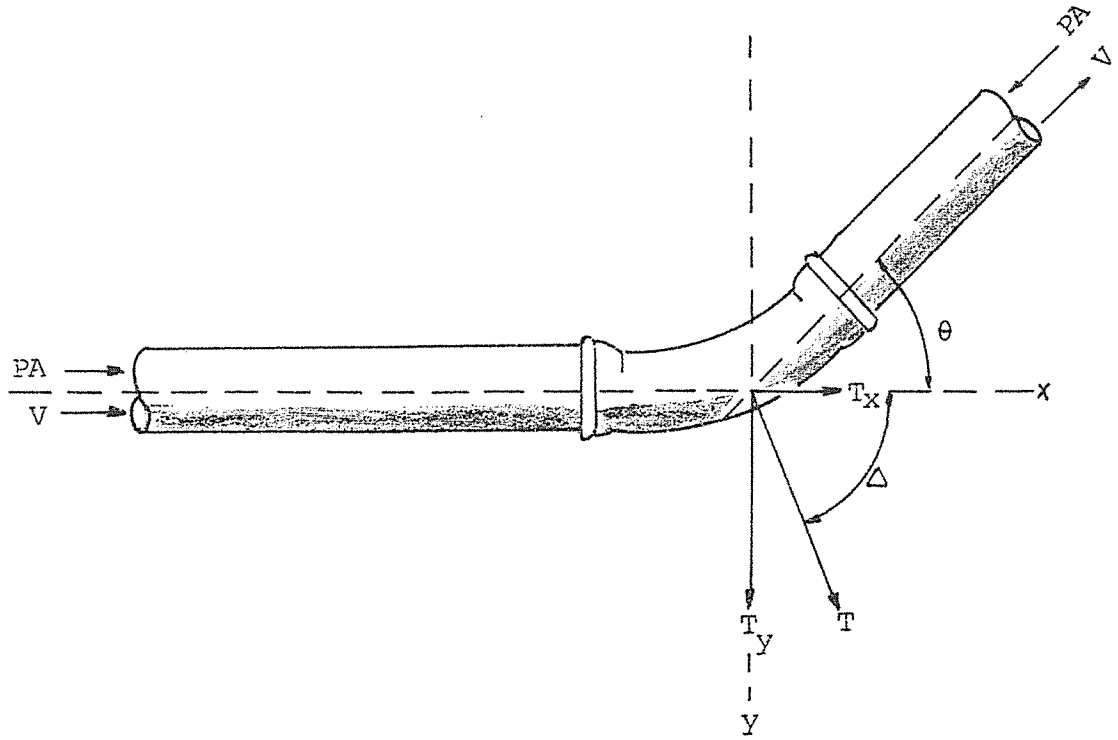
Force on buried length, P_H:

If $H_1 > \frac{2}{3}\frac{B_d}{\sqrt{2}}$, $P_H = 0.7\ (\gamma\ HB_d - 1.4CH - \pi CB_d)$ in lbs/ linear foot

If $H_1 < \frac{2}{3}\frac{B_d}{\sqrt{2}}$, $P_H = 1.5H_1\ (\gamma\ H - \frac{1.4CH}{B_d} - \pi C)$ in lbs/ linear foot



STABILITY OF BOTTOM
FOR
BRACED CUT



$T_x = PA\ (1 - \cos\theta)$

$T_y = PA \sin\theta$

$T = 2\ PA \sin\frac{\theta}{2}$

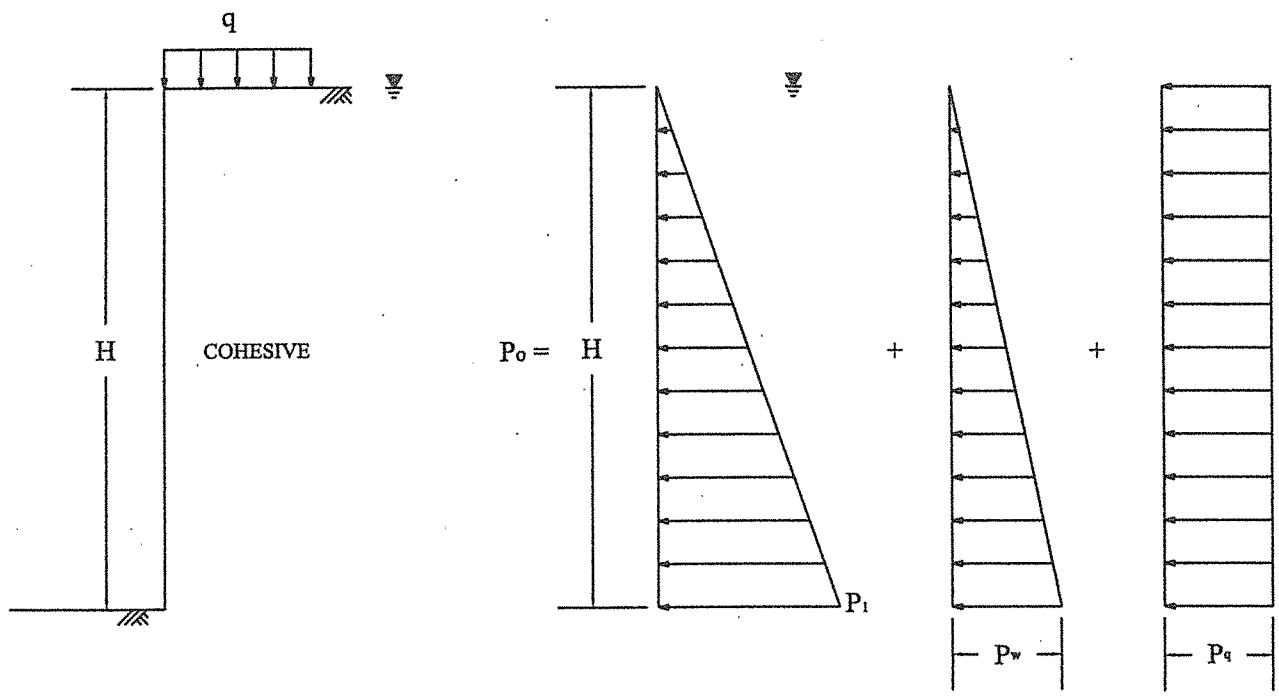
$\Delta = (90 - \frac{\theta}{2})$

Where:

- T is the resultant force on the bend
- T_x is the component of thrust force in x-direction
- T_y is the component of thrust force in y-direction
- P is the maximum sustained pressure
- A is the pipe cross-sectional area
- θ is the bend deflection angle
- Δ is the angle between T and X-axis
- V is the fluid velocity

THRUST FORCES ACTING ON A BEND

Job No. 1140202901



TYPICAL SOIL PARAMETERS

See Table 2 for typical values of soil parameters

$K_{oc} = 1.0$

PERMANENT WALL

$P_1 = K_{oc}\,\gamma_c'\,H$
$P_w = \gamma_w\,H = 62.4\,H$
$P_q = 0.5\,q$

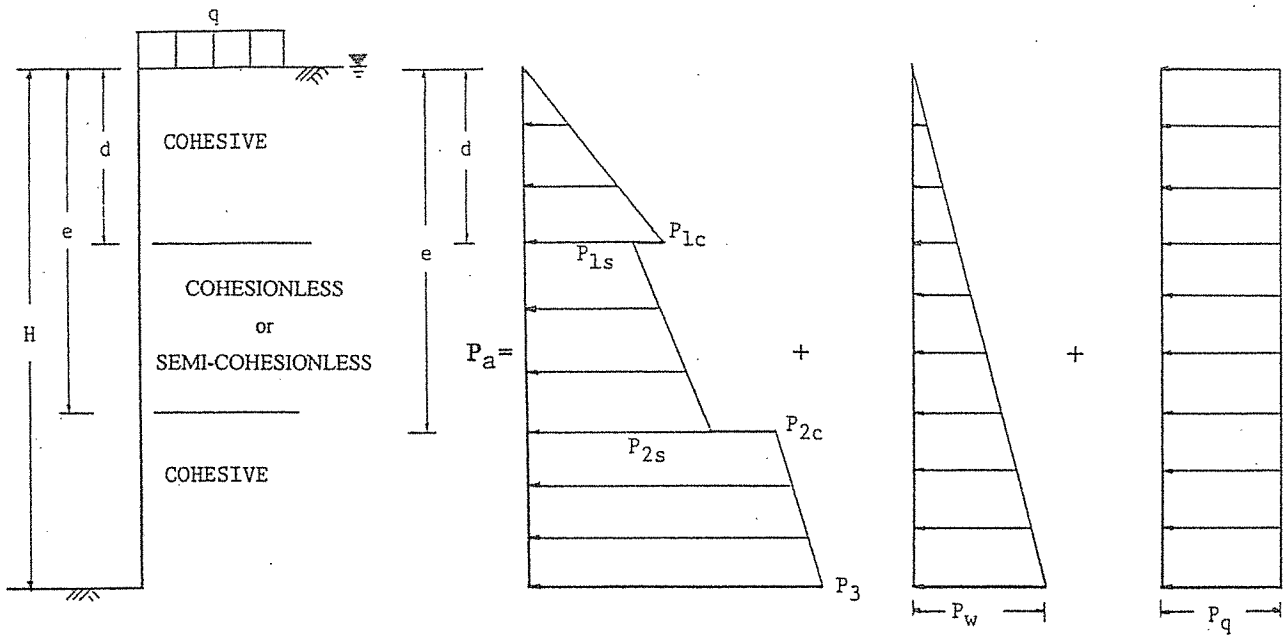
Where:

γ_c' = Submerged unit weight of cohesive soil, pcf;
K_{oc} = Coefficient of at-rest earth pressure in cohesive soil;
γ_w = Unit weight of water, pcf;
q = Surcharge load at surface, psf;
P_o = Lateral pressure, psf;
P_1 = At-rest earth pressure, psf;
P_q = Horizontal pressure due to surcharge, psf;
P_w = Hydrostatic pressure due to groundwater, psf;
H = Depth of excavation, feet

LATERAL EARTH PRESSURE DIAGRAM FOR PERMANENT WALL

SUBMERGED COHESIVE SOIL

Job No. 1140202901



TYPICAL SOIL PARAMETERS

See Table 2 for typical values of soil parameters

$K_{oc} = 1.0$

$K_{os} = 1 - \sin\phi_s$

$\gamma_w = 62.4$ psf

PERMANENT WALL

$P_{1c} = \gamma'_c\, d\, K_{oc}$

$P_{1s} = \gamma'_c\, d\, K_{os}$

$P_{2s} = P_{1s} + \gamma'_s\, (e-d)\, K_{os}$

$P_{2c} = [\gamma'_c\, d + \gamma'_s\, (e-d)]\, K_{oc}$

$P_3 = [\gamma'_c\, d + \gamma'_s\, (e-d) + \gamma'_c\, (H-e)]\, K_{oc}$

$P_w = \gamma_w\, H = 62.4\, H$

$P_q = 0.5\, q$

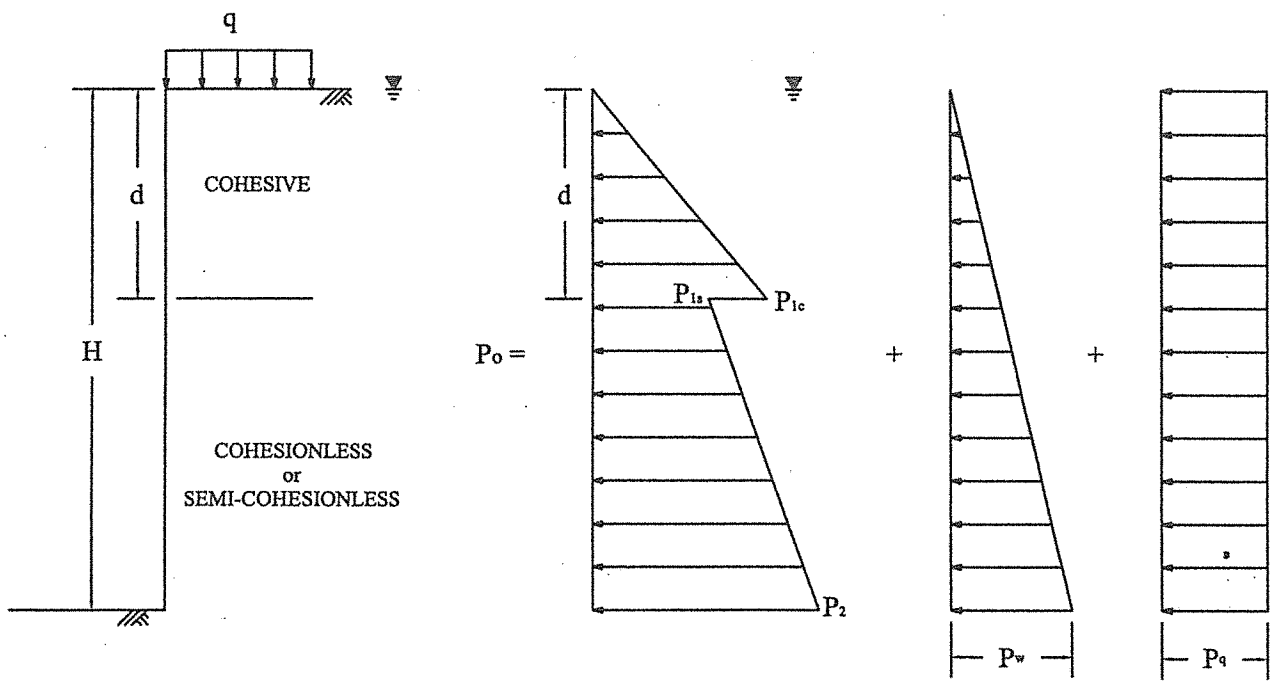
Where:

γ_c' = Effective unit weight of cohesive soil, pcf;
γ_s' = Effective unit weight of cohesionless or semi-cohesionless soil, pcf;
ϕ_s = Internal friction angle of cohesionless or semi-cohesionless soil, degree;
K_{oc} = Coefficient of earth pressure at rest in cohesive soils;
Ko_{as} = Coefficient of earth pressure at rest in cohesionless or semi-cohesionless soil;
γ_w = Unit weight of water, pcf;
q = Surcharge load at surface, psf;
P_a = Lateral pressure, psf;
P_i, P_{ic}, P_{is} = Earth pressure at rest, psf; i = 1, 2, 3;
P_q = Horizontal pressure due to surcharge, psf;
P_w = Hydrostatic pressure due to groundwater, psf;
H = Height of wall, feet

LATERAL EARTH PRESSURE DIAGRAM FOR PERMANENT WALL

SUBMERGED COHESIVE SOIL INTERBEDDED WITH COHESIONLESS OR SEMI-COHESIONLESS SOIL

Job No. 1140202901



TYPICAL SOIL PARAMETERS

PERMANANT WALL

See Table 2 for typical values of soil parameters

$K_{oc} = 1.0$
$K_{os} = 1\text{-}\sin\phi_s$

$P_{1c} = \gamma_c' \, d \, K_{oc}$
$P_{1s} = \gamma_c' \, d \, K_{os}$
$P_2 = [\gamma_c' \, d + \gamma_s' \, (H\text{-}d)] \, K_{os}$
$P_w = \gamma_w \, H = 62.4 \, H$
$P_q = 0.5 \, q$

Where:

γ_c' = Submerged unit weight of cohesive soil, pcf;
γ'_s = Submerged unit weight of cohesionless or semi-cohesionless soil, pcf;
ϕ_s = Internal friction angle of cohesionless or semi-cohesionless soil, degree;
K_{oc} = Coefficient of at-rest earth pressure in cohesive soil;
K_{os} = Coefficient of at-rest earth pressure in cohesionless or semi-cohesionless soil;
γ_w = Unit weight of water, pcf;
q = Surcharge load at surface, psf;
P_o = Lateral pressure, psf;
P_i, P_{ic}, P_{is} = At-rest earth pressure, psf; i = 1, 2;
P_q = Horizontal pressure due to surcharge, psf;
P_w = Hydrostatic pressure due to groundwater, psf;
H = Height of wall, feet

LATERAL EARTH PRESSURE DIAGRAM FOR PERMANENT WALL

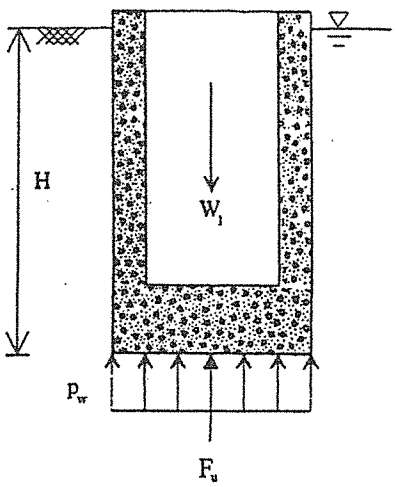
SUBMERGED COHESIVE SOIL OVER COHESIONLESS OR SEMI-COHESIONLESS SOIL

Geotest Engineering, Inc.

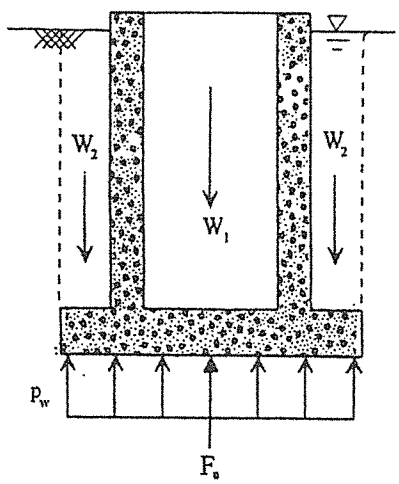
FIGURE 8.3

Job No. 114020290 1

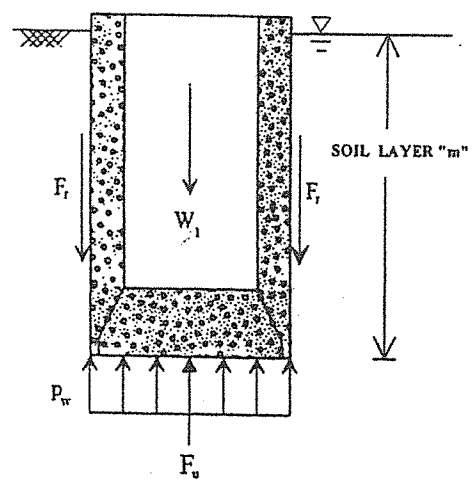
(a) DEAD WEIGHT OF STRUCTURE



(b) WEIGHT OF SOIL ABOVE BASE EXTENSION PLUS DEAD WEIGHT OF STRUCTURE



(c) SOIL-WALL FRICTION PLUS DEAD WEIGHT OF STRUCTURE



$p_w = H\gamma_w$

$F_u = A_b p_w$

$\frac{W_1}{Sf_1} = F_u$

See Table 2 for typical values of soil parameters

$p_w = H\gamma_w$

$F_u = A_b p_w$

$\frac{W_1}{Sf_1} + \frac{W_2}{Sf_2} = F_u$

$p_w = H\gamma_w$

$F_u = A_b p_w$

$\frac{W_1}{Sf_1} + \frac{F_r}{Sf_3} = F_u$

Predominantly Cohesive Soils, $F_r = \alpha c_m A_m$

Predominantly Cohesionless Soils, $F_r = p_m A_m K \tan \delta_m$

Where:

A_b	=	area of base, sq. ft.
A_m	=	cylindrical surface area of layer "m" , sq. ft.
c_m	=	undrained cohesion of soil layer "m", psf.
F_u	=	hydrostatic uplift force, lbs.
F_r	=	frictional resistance, lbs.
H	=	height of buried structure, ft.
K	=	coefficient of lateral pressure = 0.5.
p_m	=	average overburden pressure for layer "m," psf.
p_w	=	hydrostatic uplift pressure, psf.
$Sf_{1,2,3}$	=	factor of safety.
W_1	=	dead weight of concrete structure, lbs.
W_2	=	weight of backfill above base extension, lbs.
α	=	cohesion reduction factor = 0.5.
δ_m	=	friction angle between soil layer "m" and concrete wall, degrees = 0.75 ϕ_m
ϕ_m	=	internal angle of friction of soil layer "m", degrees.
γ_w	=	unit weight of water = 62.4 pcf.

UPLIFT PRESSURE AND RESISTANCE

APPENDIX A

	Figure
Log of Borings	A-1 thru A-29
Symbols and Terms Used on Boring Logs	A-30
Piezometer Installation Report	A-31 thru A-35

LOG OF BORING NO. GB-1 (GB-1P)

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13850732.63, E 3055221.80
Wycliffe Drive; See Plan of Borings (Figure 2)

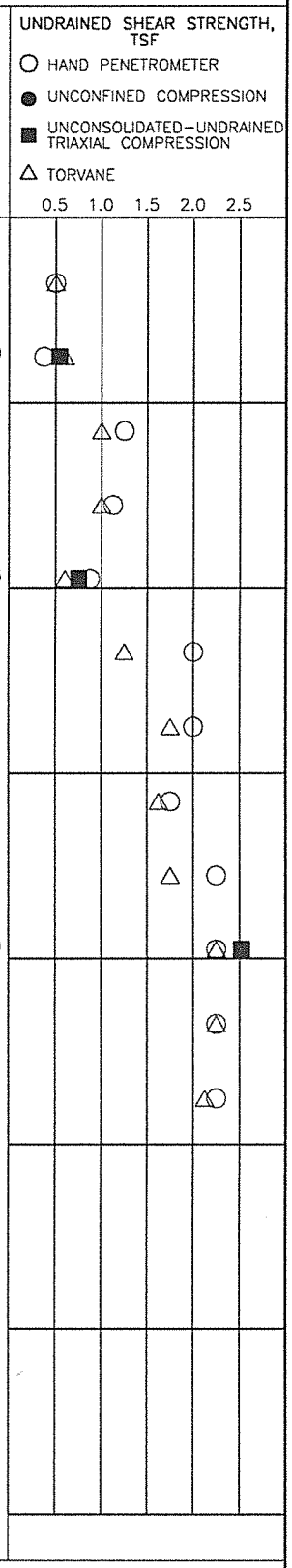
COMPLETION DEPTH : 24.0 FT.

SURFACE ELEVATION : 87.45 FT.

DATE : 05-16-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 24.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
87.4	0	7" Asphalt over 5" Sand and Shell Mix							
86.4		Stiff dark yellowish gray SANDY LEAN CLAY (CL) -medium stiff to stiff 2'-4' -w/ferrous stains 2'-8' -very stiff w/calcareous and ferrous nodules 4'-8'				18			
				69	108	18	49	20	29
	5					16			
						15			
79.4		Stiff reddish brown and gray LEAN CLAY (CL) w/sand -w/sand seams, ferrous nodules, and ferrous stains 10'-12' -very stiff to hard 10'-14'							
	10			81	106	22	46	20	26
						16			
						22			
73.4		Very stiff gray and brown FAT CLAY (CH) w/calcareous nodules -very stiff to hard w/clay stones 16'-18' -hard reddish brown and gray 18'-24'							
	15					22			
						20			
	20			100	105	22	65	25	40
						22			
63.4						21			
	25	NOTE : See piezometer GB-1P for water level measurements.							
	30								
	35								



DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
⊻: WATER DEPTH AT 10.4 FT., HOLE OPEN TO 24.0 FT. ON 07-29-14.

Geotest Engineering, Inc.

FIGURE A-1

LOG OF BORING NO. GB-2

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13851385.55, E 3055204.83
Wycliffe Drive; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 24.0 FT.

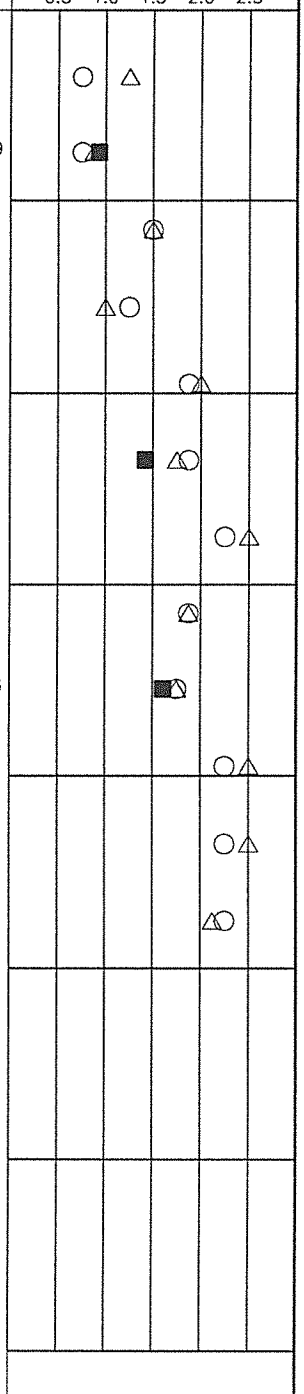
SURFACE ELEVATION : 89.35 FT.

DATE : 05-19-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 24.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
89.3	0	5" Asphalt over 4" Sand and Shell Mix							
88.6		Stiff to very stiff yellowish brown and gray SANDY LEAN CLAY (CL) w/ferrous nodules				17			
				64	115	16	35	16	19
	5	-stiff w/calcareous nodules 2'-4'				15			
		-very stiff 4'-8'							
		-grayish brown w/ferrous stains 4'-14'				17			
		-very stiff to hard w/calcareous nodules 8'-10'				16			
	10	-very stiff 10'-12'							
		-hard 12'-14'			118	15			
75.3						15			
	15	Very stiff gray and brown FAT CLAY (CH) w/ferrous nodules and ferrous stains				20			
		-w/sand seams 14'-16'							
		-hard 18'-24'		94	109	22	60	24	36
	20	-w/clay stone seams 20'-22'				22			
						20			
65.3						21			
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE



DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 24.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-2

LOG OF BORING NO. GB-3

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13851865.56, E 3055197.54
Wycliffe Drive; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 24.0 FT.

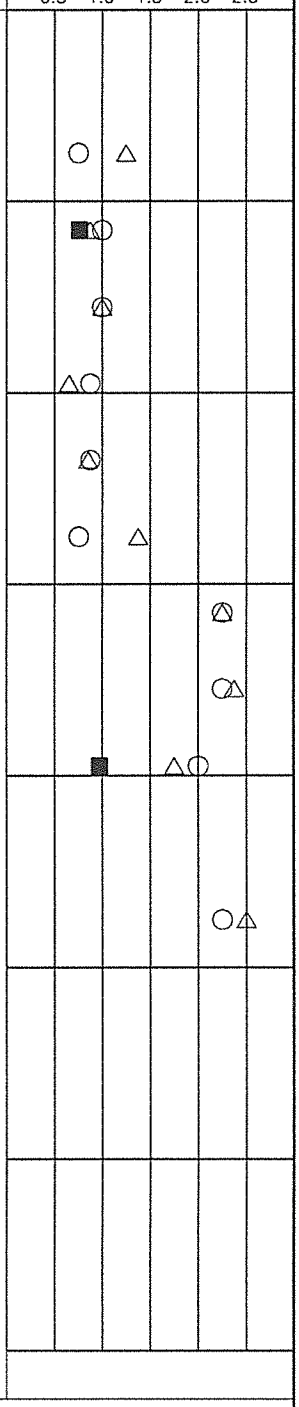
SURFACE ELEVATION : 90.76 FT.

DATE : 05-19-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 24.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
90.8	0	6" Asphalt over 18" Gray Sand and Shell Mix							
88.8		Stiff to very stiff gray SANDY LEAN CLAY (CL) w/ferrous nodules and ferrous stains			117	16			
	5	-yellowish brown and gray 4'-8'		68	117	17	34	17	17
		-very stiff 6'-8'				19			
		-stiff w/calcareous nodules 8'-12'				21			
	10	-gray and brown 8'-16'				20			
		-hard 14'-16'				17			
	15					15			
74.8		Hard gray and brown FAT CLAY (CH) w/calcareous nodules				17			
		-very stiff to hard 18'-20'							
	20	-reddish brown and gray 18'-25'		96	111	20	57	23	34
66.8						21			
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE



DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 24.0 FT. DURING DRILLING; AFTER 15.0 MIN. AT 15.0 FT.
HOLE OPEN TO 24.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-3

LOG OF BORING NO. GB-4

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13852420.08, E 3055169.18
Wycliffe Drive; See Plan of Borings (Figure 2)

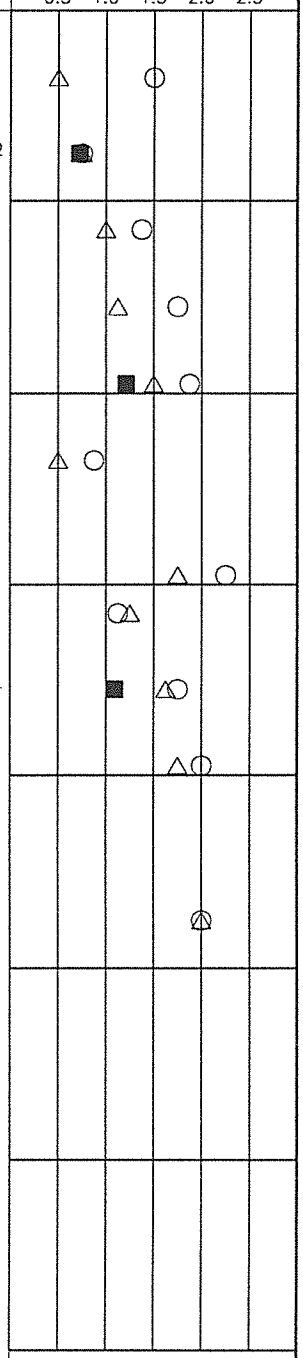
COMPLETION DEPTH : 24.0 FT.

SURFACE ELEVATION : 90.69 FT.

DATE : 05-19-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 12.0 FT.
WET ROTARY : 12.0 TO 24.0 FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
90.7	0	6" Asphalt over 4" Sand and Shell Mix							
89.9		Stiff to very stiff dark gray LEAN CLAY (CL) w/sand				13			
		-stiff 2'-4'		77	114	16	26	14	12
		-very stiff w/ferrous nodules and ferrous stains 4'-10'				19			
	5	-yellowish brown and gray 6'-8'				18			
		-w/calcareous nodules 8'-10'			115	16			
	10	-stiff reddish brown and gray 10'-12'				17			
78.7		Gray SILTY SAND (SM)							
77.7		Very stiff to hard yellowish brown and gray SANDY LEAN CLAY (CL) w/sand seams	25	70		18			
75.7	15					14			
						16			
		Very stiff yellowish brown and gray FAT CLAY (CH) w/calcareous and ferrous nodules		93	107	22	56	22	34
		-very stiff to hard 18'-20'				20			
	20	-hard reddish brown and gray 22'-24'							
66.7						24			
	25								
	30								
	35								



DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 12.0 FT. DURING DRILLING; AFTER 15.0 MIN. AT 9.5 FT.
HOLE OPEN TO 24.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-4

LOG OF BORING NO. GB-5

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13852701.52, E 3055168.54
Wycliffe Drive; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 24.0 FT.

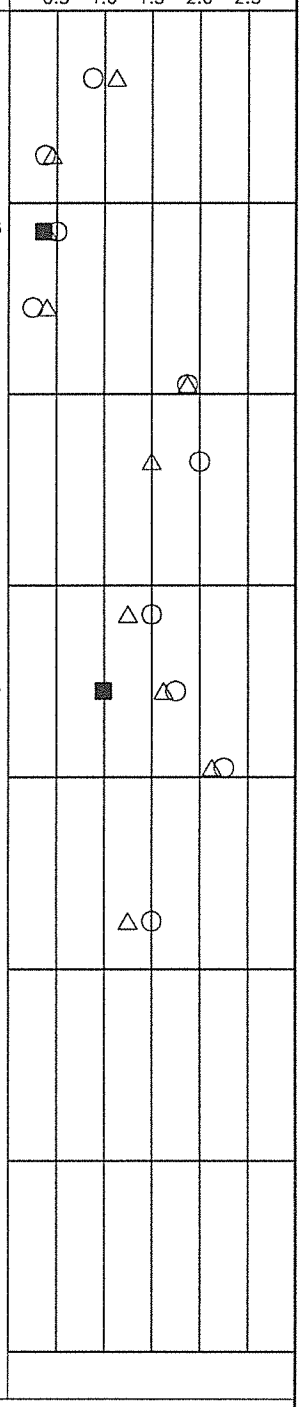
SURFACE ELEVATION : 90.78 FT.

DATE : 05-19-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 14.0 FT.
WET ROTARY : 14.0 TO 24.0 FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
90.8	0	6" Asphalt over 4" Sand and Limestone Mix							
89.9		Stiff to very stiff gray and brown LEAN CLAY (CL) w/sand, calcareous and ferrous nodules			111	18			
						21			
	5	-medium stiff 2'-4'							
		-medium stiff to stiff 4'-6'		74	107	23	46	20	26
		-medium stiff 6'-8'							
		-very stiff yellowish brown and gray 8'-10'				17			
		-w/ferrous stains 8'-12'							
	10	-very stiff to hard 10'-12'				15			
						16			
78.8		Medium dense gray FINE SAND (SP-SM) w/silt	15	6		21			
76.8	15	Very stiff reddish brown and gray LEAN CLAY (CL) w/sand and ferrous nodules				15			
		-w/silt seams 14'-16'							
		-hard 18'-20'		77	117	15	30	14	16
	20					17			
66.8						18			
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE



DEPTH TO WATER IN BORING :
▽: FREE WATER ENCOUNTERED AT 12.0 FT. DURING DRILLING.
HOLE OPEN TO 24.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-5

LOG OF BORING NO. GB-6

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13853262.55, E 3055154.17
Wycliffe Drive; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 4.0 FT.

SURFACE ELEVATION : 89.76 FT.

DATE : 05-16-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 4.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, TSF (○ HAND PENETROMETER; ● UNCONFINED COMPRESSION; ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION; △ TORVANE) 0.5 1.0 1.5 2.0 2.5
89.8	0			5" Asphalt over 4" Sand and Shell Mix								
89.0				Very stiff to hard gray SANDY LEAN CLAY (CL) -w/calcareous nodules 1'-4' -stiff yellow and gray 2'-4'				14				△ ○
85.8								17				○△
	5			NOTE : Hard obstruction was encountered at 4' and boring was offset to GB-6A.								
	10											
	15											
	20											
	25											
	30											
	35											

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 4.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-6

LOG OF BORING NO. GB-6A (GB-6AP)

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13853262.55, E 3055154.17
Wycliffe Drive; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 22.0 FT.

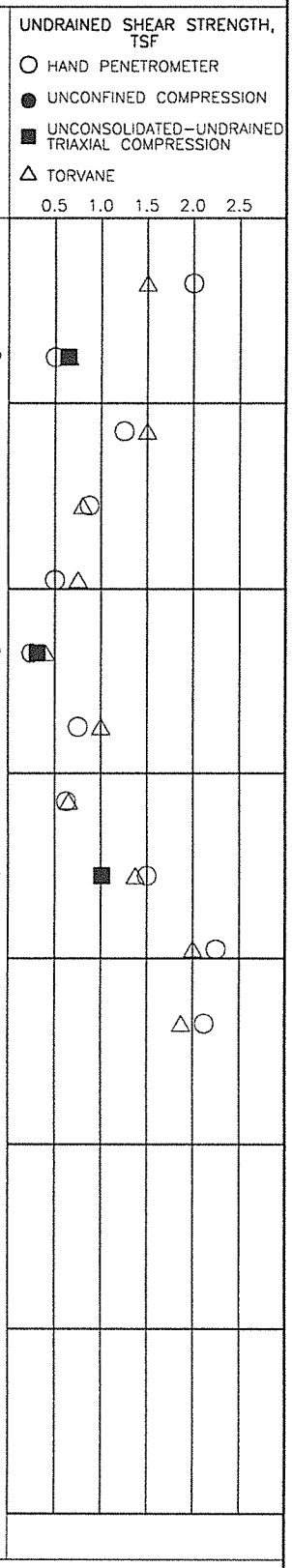
SURFACE ELEVATION : 89.76 FT.

DATE : 05-16-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 22.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
89.8	0	5" Asphalt over 4" Sand and Shell Mix							
89.0		Very stiff to hard gray and brown SANDY LEAN CLAY (CL) w/calcareous nodules and ferrous stains			120	14			
		-stiff 2'-4'		70	117	17	30	15	15
	5	-very stiff 4'-6'				15			
		-stiff 6'-10'				16			
	10	-medium stiff 10'-12'				18			
77.8		Stiff to very stiff reddish brown and gray FAT CLAY (CH) w/calcareous nodules		50	112	19	29	16	13
75.8		Stiff gray and brown SANDY LEAN CLAY (CL) w/calcareous nodules				33			
	15	-very stiff 16'-18'				18			
		-hard 18'-20'		56	120	16	31	15	16
	20	-very stiff to hard 20'-22'				17			
67.8						16			
	25								
	30								
	35								

NOTE :
See piezometer GB-6AP for water level measurements.



DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
▼: WATER DEPTH AT 7.4 FT., HOLE OPEN TO 22.0 FT. ON 07-29-14.

Geotest Engineering, Inc.

FIGURE A-6A

LOG OF BORING NO. GB-7

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13853638.81, E 3055126.29
Wycliffe Drive; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 22.0 FT.

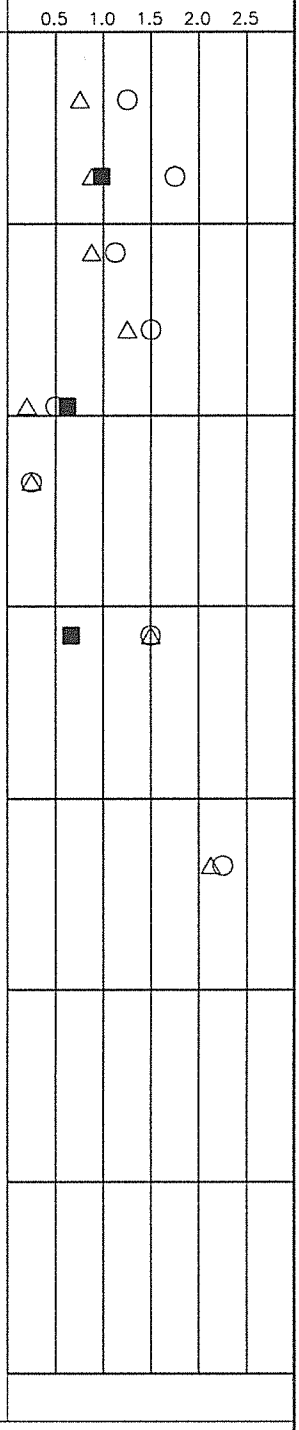
SURFACE ELEVATION : 89.75 FT.

DATE : 05-16-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 14.0 FT.
WET ROTARY : 14.0 TO 22.0 FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
89.8	0	6" Asphalt over 4" Sand and Shell Mix							
88.9		Stiff to very stiff dark gray SANDY LEAN CLAY (CL) w/calcareous nodules and ferrous stains				14			
				53	116	14	29	15	14
	5	-stiff to very stiff 2'-6'				14			
		-yellowish brown and gray 4'-6'							
		-very stiff 6'-8'				14			
		-soft to stiff 8'-10'							
	10	-medium stiff 10'-12'			113	19	27	17	10
						19			
77.8		Gray SILTY SAND (SM)							
76.8		Very stiff reddish brown and gray FAT CLAY (CH)	16			25			
	15	-stiff to very stiff 14'-16'		98	92	33	59	23	36
73.8		Medium dense gray SILTY SAND (SM) w/clay seams	24	25		22			
71.8		Very stiff gray and red LEAN CLAY (CL) w/calcareous nodules	23			10			
69.8	20	Hard reddish brown and gray FAT CLAY (CH)				20			
67.8									

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE



DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 22.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-7

LOG OF BORING NO. GB-8

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13854220.23, E 3055120.34
Wycliffe Drive; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 22.0 FT.

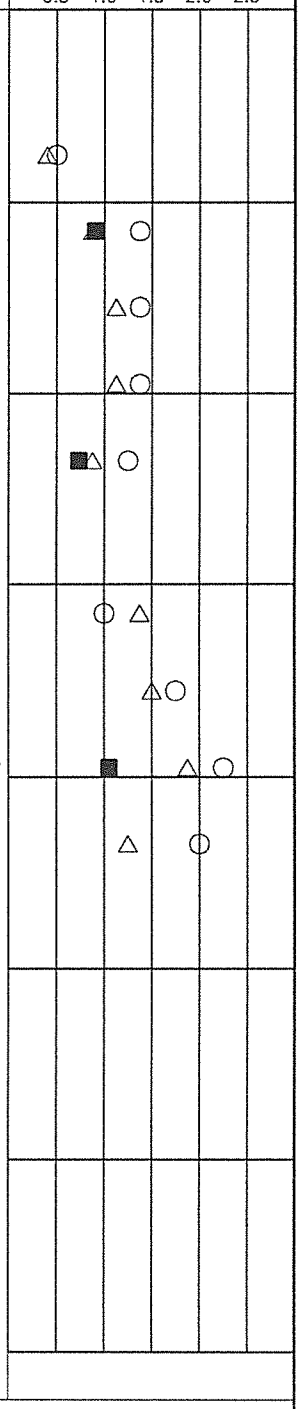
SURFACE ELEVATION : 90.20 FT.

DATE : 05-20-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 14.0 FT.
WET ROTARY : 14.0 TO 22.0 FT.

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
90.2	0	6" Asphalt over 4" Sand and Shell Mix							
89.4		Yellowish brown SANDY LEAN CLAY (CL)				9			
		-medium stiff to stiff 2'-4'		63		17	37	16	21
		-stiff to very stiff 4'-6'							
	5	-very stiff 6'-10'			118	14			
		-w/sand seams 6'-12'				16			
	10	-stiff to very stiff 10'-12'				17			
78.2		Medium dense yellowish brown and gray SILTY SAND (SM)			107	21			
76.2			21	39		22			
	15	Very stiff reddish brown and gray FAT CLAY (CH) w/calcareous nodules and silt seams				29			
		-very stiff to hard 18'-22'				32			
	20			99	96	28	78	28	50
68.2						29			
	25								
	30								
	35								



DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 22.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-8

LOG OF BORING NO. GB-9

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13854762.34, E 3055088.61
Wycliffe Drive; See Plan of Borings (Figure 2)

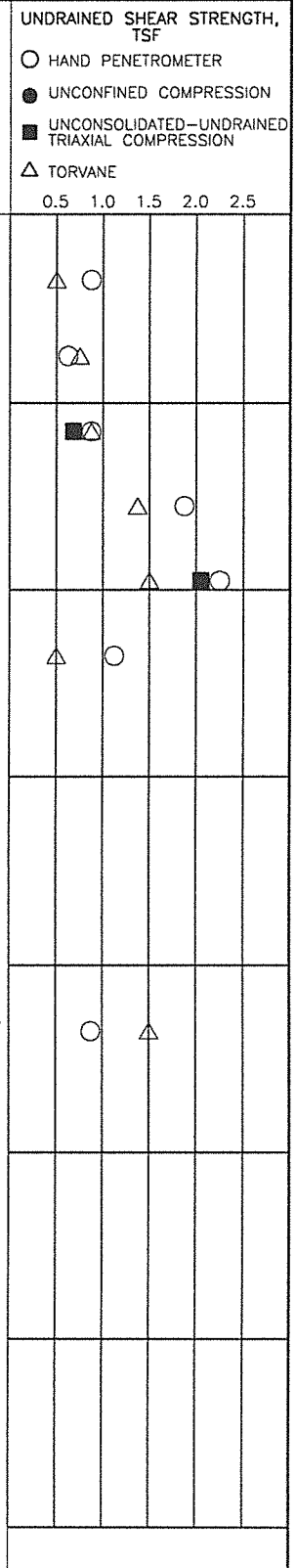
COMPLETION DEPTH : 22.0 FT.

SURFACE ELEVATION : 90.35 FT.

DATE : 05-20-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 12.0 FT.
WET ROTARY : 12.0 TO 22.0 FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
90.3	0	6" Asphalt over 4" Gray Sand and Shell Mix							
89.5		Stiff dark gray SANDY LEAN CLAY (CL) w/calcareous nodules			117	16			
		-yellowish brown and gray w/sand seams 2'-10'		58		16	37	16	21
	5	-w/ferrous stains 4'-6'			113	17			
		-very stiff 6'-8'							
		-very stiff to hard 8'-10'				13			
	10	-stiff to very stiff reddish brown and gray 10'-12'			115	15			
78.3		Medium dense yellowish brown and gray SILTY SAND (SM)				16			
		-dense 14.5'-18'	21	17		21			
	15		48			21			
			42			19			
			22			20			
70.3	20	Stiff to very stiff reddish brown and gray FAT CLAY (CH)		98		31	75	28	47
68.3									
	25								
	30								
	35								



DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 12.0 FT. DURING DRILLING; AFTER 15.0 MIN. AT 8.4 FT.
HOLE OPEN TO 22.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-9

LOG OF BORING NO. GB-10

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13855220.45, E 3055080.87
Wycliffe Drive; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 22.0 FT.

SURFACE ELEVATION : 91.74 FT.

DATE : 05-20-14

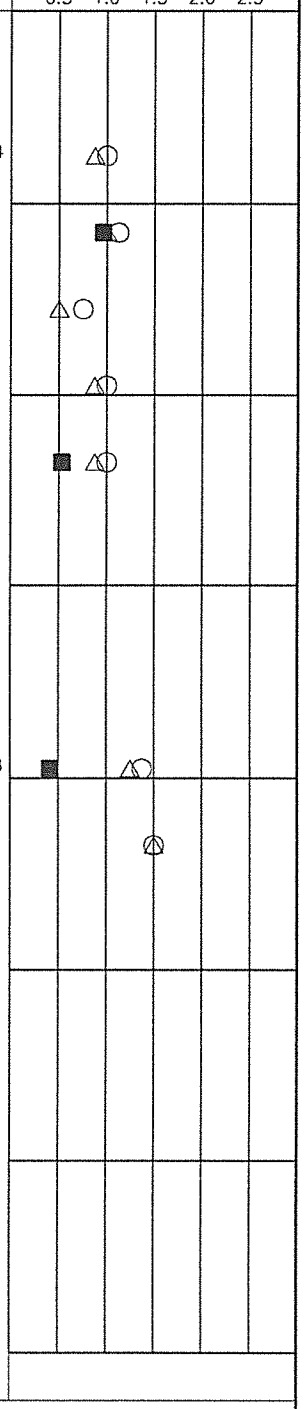
SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 14.0 FT.
WET ROTARY : 14.0 TO 22.0 FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
91.7	0	6" Asphalt over 4" Sand and Shell Mix							
90.9						10			
89.7		Dark gray SILTY SAND (SM) w/clay seams							
		Stiff to very stiff yellowish brown and gray SANDY LEAN CLAY (CL)		58		16	30	16	14
	5	-stiff 6'-8'			119	14			
		-w/vertical sand seams 6'-12'				18			
	10					18			
79.7					112	18			
		Medium dense yellowish brown and gray SILTY SAND (SM)	14	33		18			
	15	-gray 14.5'-16'	23			21			
		-dense 16.5'-18'	49			19			
73.7		Medium stiff to very stiff yellowish brown and gray FAT CLAY (CH)		99	94	33	89	31	58
	20	-very stiff 20'-22'							
69.7						30			
	25								
	30								
	35								

SAMPLES

SYMBOL

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE



DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 14.0 FT. DURING DRILLING; AFTER 15.0 MIN. AT 8.3 FT.
HOLE OPEN TO 22.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-10

LOG OF BORING NO. GB-11 (GB-11P)

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13855755.19, E 3055051.19
Wycliffe Drive; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 21.0 FT.

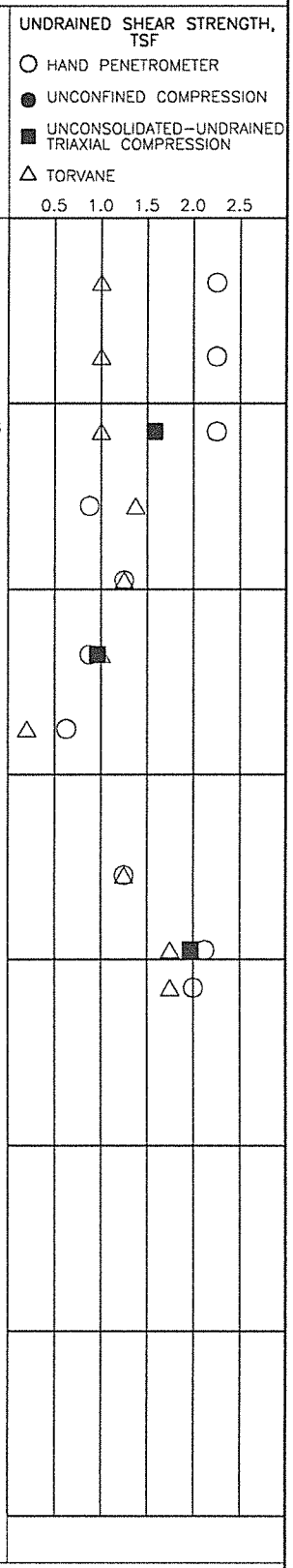
SURFACE ELEVATION : 91.85 FT.

DATE : 05-16-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 21.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
91.8	0			5" Asphalt over 4" Sand and Shell Mix							
91.1				Very stiff to hard gray and brown LEAN CLAY (CL) w/sand and calcareous nodules			113	10			
						71		13			
	5			-gray 4'-6'							
				-stiff to very stiff w/ferrous nodules and ferrous stains 6'-8'			122	12	29	13	16
				-reddish brown and gray 6'-14'				15			
				-very stiff 8'-10'				17			
	10			-stiff to very stiff 10'-12'							
				-soft to stiff w/sand seams 12'-14'		71	110	20	36	17	19
								19			
77.8											
	15			Very stiff reddish brown and gray FAT CLAY (CH) w/calcareous nodules	20	99		38			
				-very stiff to hard 18'-21'				30			
	20					99	99	28	72	27	45
70.8								24			
	25										
	30										
	35										

NOTE :
See piezometer GB-11P for water level measurements.



DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
▼: WATER DEPTH AT 17.0 FT., HOLE OPEN TO 21.0 FT. ON 07-29-14.

Geotest Engineering, Inc.

FIGURE A-11

LOG OF BORING NO. GB-12

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13856238.09, E 3055044.09
Wycliffe Drive; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 21.0 FT.

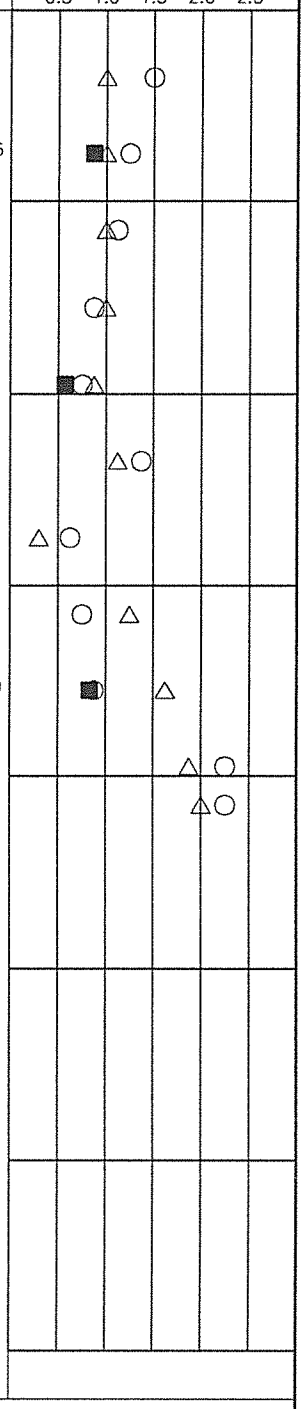
SURFACE ELEVATION : 92.14 FT.

DATE : 05-20-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 21.0 FT.
WET ROTARY : -- TO -- FT.

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
92.1	0	6" Asphalt over 4" Sand and Shell Mix							
91.3		Very stiff dark gray SANDY LEAN CLAY (CL) w/calcareous and ferrous nodules				14			
				64	121	15	30	15	15
	5	-stiff to very stiff 2'-4'				15			
		-stiff to very stiff 6'-8'							
		-yellowish brown and gray w/ferrous stains 6'-10'				17			
		-stiff gray and brown 8'-10'							
	10				107	20			
		-medium stiff to stiff w/sand seams 12'-14'				20			
						18			
78.1		Stiff to very stiff reddish brown and gray FAT CLAY (CH) w/calcareous nodules							
	15					38			
		-very stiff to hard 18'-21'		99	97	26	63	24	39
	20					27			
71.1						26			
	25								
	30								
	35								



DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 21.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-12

LOG OF BORING NO. GB-13

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13856687.47, E 3055021.78
Wycliffe Drive; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 21.0 FT.

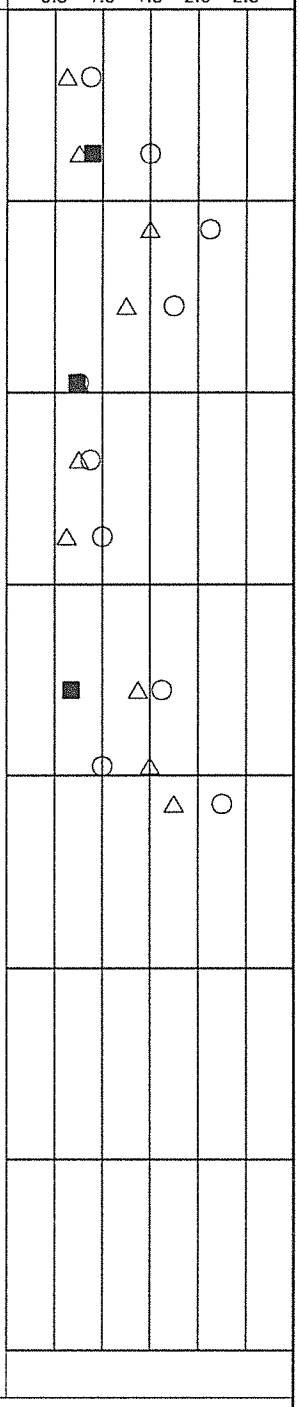
SURFACE ELEVATION : 92.48 FT.

DATE : 05-20-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 21.0 FT.
WET ROTARY : -- TO -- FT.

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
92.5	0	6" Asphalt over 4" Sand and Shell Mix							
91.6		Stiff dark gray and gray SANDY LEAN CLAY (CL) w/sand seams			104	13			
		-stiff to very stiff 2'-4'		70	115	15	30	15	15
	5	-w/calcareous nodules 2'-8'							
		-very stiff to hard 4'-6'				14			
		-yellowish brown and gray 4'-14'				15			
		-very stiff w/ferrous nodules, ferrous stains, and vertical sand seams 6'-8'			109	18			
	10	-w/silt seams 8'-14'							
		-stiff to very stiff 12'-14'				25			
						20			
78.5	15	Medium dense gray FINE SAND (SP-SM) w/silt	21	9		14			
76.5		Stiff to very stiff reddish brown and gray FAT CLAY (CH) w/calcareous nodules		99	92	34	80	29	51
		-very stiff w/sand seams 18'-20'				28			
	20	-very stiff to hard 20'-21'				28			
71.5									
	25								
	30								
	35								



DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 21.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

LOG OF BORING NO. GB-14

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13857205.28, E 3055011.60
Wycliffe Drive; See Plan of Borings (Figure 2)

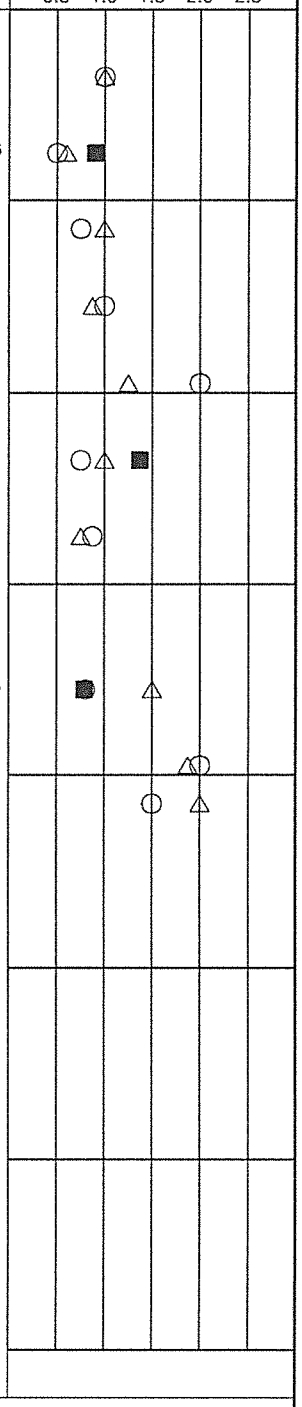
COMPLETION DEPTH : 21.0 FT.

SURFACE ELEVATION : 92.49 FT.

DATE : 05-16-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 15.0 FT.
WET ROTARY : 15.0 TO 21.0 FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
92.5	0	8" Asphalt over 4" Limestone, Shell, and Sand Mix				16			
91.7		Very stiff dark gray SANDY LEAN CLAY (CL) w/sand seams -stiff 2'-4' -yellowish brown and gray 2'-10' -stiff to very stiff 4'-8' -w/calcareous nodules 6'-8' -w/ferrous nodules and ferrous stains 6'-14' -very stiff to hard 8'-10' -stiff to very stiff 10'-12' -reddish brown and gray 10'-14' -stiff 12'-14'		69	112	18	45	19	26
	5					17			
						18			
	10					16			
					116	19			
						18			
78.5	15	Medium dense brown and gray SILTY SAND (SM)	16	23		18			
76.5		Stiff to very stiff reddish brown and gray FAT CLAY (CH) w/calcareous nodules -very stiff to hard 18'-21'		99	93	26	69	26	43
	20					27			
71.5						24			
	25								
	30								
	35								



DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 15.0 FT. DURING DRILLING; AFTER 15.0 MIN. AT 9.2 FT.
HOLE OPEN TO 21.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-14

LOG OF BORING NO. GB-15

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13857830.53, E 3054981.49
Wycliffe Drive; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 13.0 FT.

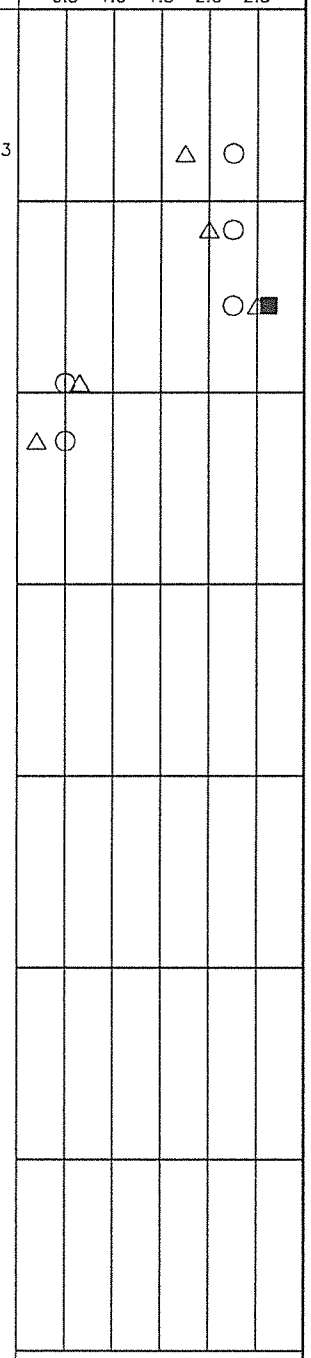
SURFACE ELEVATION : 93.21 FT.

DATE : 05-16-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 12.5 FT.
WET ROTARY : 12.5 TO 13.0 FT.

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
93.2	0	8" Asphalt over 6" Limestone, Sand, and Shell Mix							
92.0		Very stiff to hard SANDY LEAN CLAY (CL) w/calcareous and ferrous nodules and ferrous stains		58	122	5 10	29	16	13
	5	-hard 4'-8'				8			
		-stiff 8'-10'			123	11			
	10	-soft to stiff w/sand seams 10'-12'				17 18			
81.7		Medium dense gray SILTY SAND (SM)	26	21		20			
80.2									
	15								
	20								
	25								
	30								
	35								



DEPTH TO WATER IN BORING :
▽: FREE WATER ENCOUNTERED AT 12.5 FT. DURING DRILLING.
HOLE OPEN TO 13.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-15

LOG OF BORING NO. GB-16

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13858187.32, E 3054977.06
Sherwood Forest Street; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 23.0 FT.

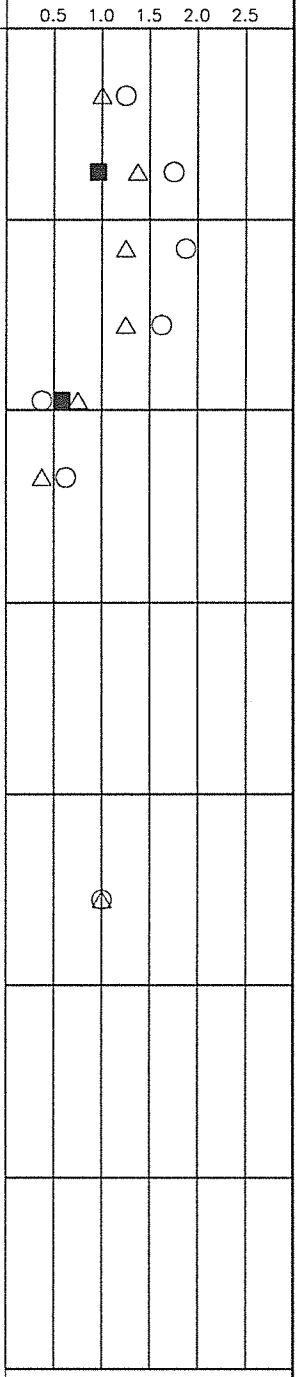
SURFACE ELEVATION : 92.84 FT.

DATE : 05-16-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 16.0 FT.
WET ROTARY : 16.0 TO 23.0 FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
92.8	0	5" Asphalt over 4" Sand and Shell Mix							
92.1		Very stiff yellowish brown and gray SANDY LEAN CLAY (CL) w/sand seams, calcareous and ferrous nodules, and ferrous stains			110	17			
				53	114	14	30	15	15
	5					13			
		-medium stiff to stiff 8'-12'				15			
					108	20			
	10					17			
80.3		Medium dense yellowish brown and gray SILTY SAND (SM)	22	14		20			
	15		17			21			
			28			24			
			26						
72.8	20	Very stiff reddish brown and gray FAT CLAY (CH) -w/sand seams 20'-21.5'	28			39			
69.8				99		37	81	29	52
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE



DEPTH TO WATER IN BORING :
▽: FREE WATER ENCOUNTERED AT 16.0 FT. DURING DRILLING.
HOLE OPEN TO 23.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-16

LOG OF BORING NO. GB-17 (GB-17P)

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13858747.02, E 3054949.33
Wycliffe Drive; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 20.0 FT.

SURFACE ELEVATION : 92.78 FT.

DATE : 05-16-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 20.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
92.8	0	6" Asphalt over 5" Sand and Shell Mix							
91.9		Very stiff to hard gray and brown SANDY LEAN CLAY (CL) w/calcareous nodules and ferrous stains				6			
				59	126	9	39	17	22
	5	-hard 2'-8'							
		-w/sand seams 6'-8'				9			
		-yellowish brown and gray 8'-10'				10			
	10	-very stiff 10'-12'			122	14			
						16			
80.8		Medium dense yellowish brown SILTY SAND (SM)							
			21	19		18			
78.8	15	Very stiff gray and brown FAT CLAY (CH)							
			19			38			
		-medium stiff to stiff reddish brown and gray 16'-18'		99	89	36	66	25	41
						37			
72.8	20	-w/calcareous nodules 18'-20'							

NOTE :
See piezometer GB-17P for water level measurements.

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
▼: WATER DEPTH AT 11.2 FT., HOLE OPEN TO 20.0 FT. ON 07-29-14.

Geotest Engineering, Inc.

FIGURE A-17

LOG OF BORING NO. GB-18

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13857905.02, E 3054792.23
Wycliffe Drive; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 20.0 FT.

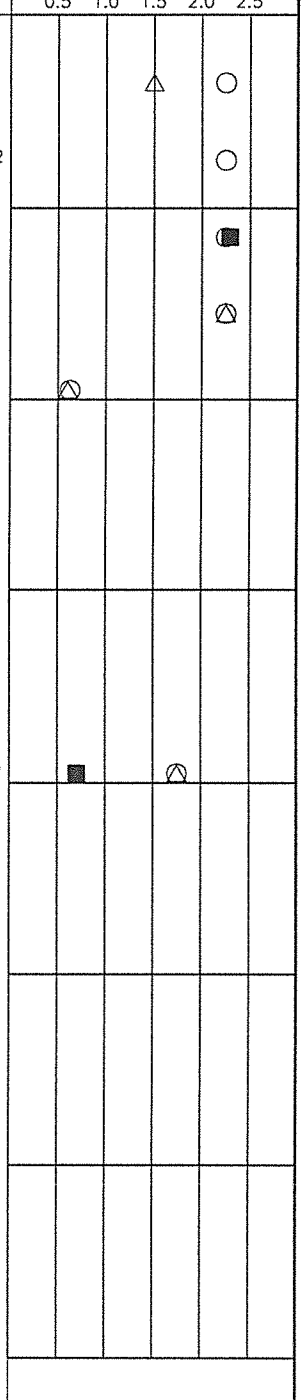
SURFACE ELEVATION : 92.61 FT.

DATE : 05-15-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 12.0 FT.
WET ROTARY : 12.0 TO 20.0 FT.

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
92.6	0	4" Asphalt over 5" Sand and Shell Mix							
91.9		Very stiff to hard gray SANDY LEAN CLAY (CL) w/calcareous and ferrous nodules and ferrous stains			120	7			
				52		8	26	14	12
	5	-hard 2'-8'			124	8			
		-stiff yellowish brown and gray 8'-10'				15			
82.6	10					15			
		Medium dense gray and brown FINE SAND (SP-SM) w/silt	19			17			
			29			19			
	15	-dense 14.5'-18'	32	8		22			
			35			20			
74.6		Stiff to very stiff reddish brown and gray FAT CLAY (CH) w/ferrous nodules and ferrous stains		89	102	26	64	25	39
72.6	20								
	25								
	30								
	35								



DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 12.0 FT. DURING DRILLING; AFTER 10.0 MIN. AT 11.4 FT.
HOLE OPEN TO 20.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-18

LOG OF BORING NO. GB-19

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13854368.92, E 3055517.51
Mayfield Road; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 20.0 FT.

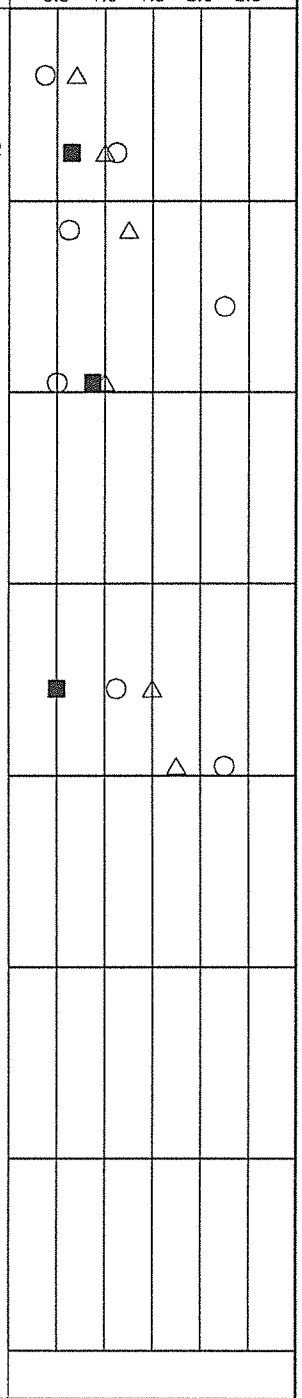
SURFACE ELEVATION : 89.64 FT.

DATE : 05-14-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 12.0 FT.
WET ROTARY : 12.0 TO 20.0 FT.

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
89.6	0	4" Asphalt over 6" Sand and Shell Mix							
88.8		Medium stiff to stiff dark gray SANDY LEAN CLAY (CL) w/calcareous and ferrous nodules and ferrous stains				17			
				57	116	16	40	18	22
	5	-stiff to very stiff gray and brown w/sand seams 2'-6'				16			
		-hard 6'-8'				15			
		-stiff to very stiff 8'-10'			117	16			
79.6	10	Medium dense gray and brown SILTY SAND (SM)	16	18		20			
		-w/silt seams 14.5'-16'	26			22			
	15		29			25			
73.6		Stiff to very stiff reddish brown and gray FAT CLAY (CH) w/calcareous nodules and ferrous stains		98	83	41	94	33	61
		-very stiff to hard 18'-20'				20			
69.6	20								
	25								
	30								
	35								



DEPTH TO WATER IN BORING :
▽: FREE WATER ENCOUNTERED AT 12.0 FT. DURING DRILLING.
HOLE OPEN TO 20.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-19

LOG OF BORING NO. GB-20

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13854855.49, E 3055638.75
Buescher Drive; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 14.0 FT.

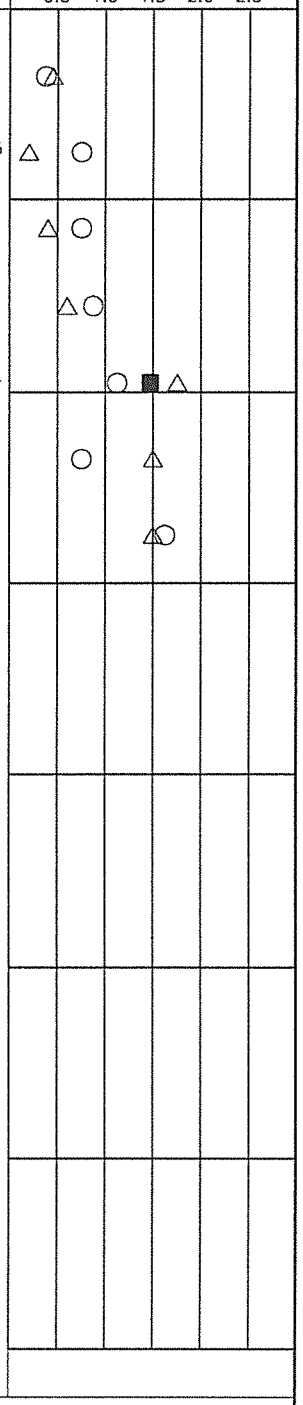
SURFACE ELEVATION : 89.83 FT.

DATE : 05-14-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 14.0 FT.
WET ROTARY : -- TO -- FT.

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
89.8	0	4" Asphalt over 2" Sand and Shell Mix							
89.3		FILL: medium stiff gray and brown sandy lean clay w/calcareous nodules and shell fragments			108	19			
85.8	5	-soft to stiff 2'-4'		63		12	31	16	15
		Medium stiff to stiff brown and gray SANDY LEAN CLAY (CL)				15			
81.8		-stiff 6'-8'				16			
	10	Very stiff gray and brown FAT CLAY (CH) w/sand, calcareous and ferrous nodules		76	108	22	56	22	34
		-stiff to very stiff 10'-12'				24			
75.8		-reddish brown and gray 10'-14'				35			
	15								
	20								
	25								
	30								
	35								



DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 14.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-20

LOG OF BORING NO. GB-21

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13854246.33, E 3055906.89
Mayfield Road; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 23.0 FT.

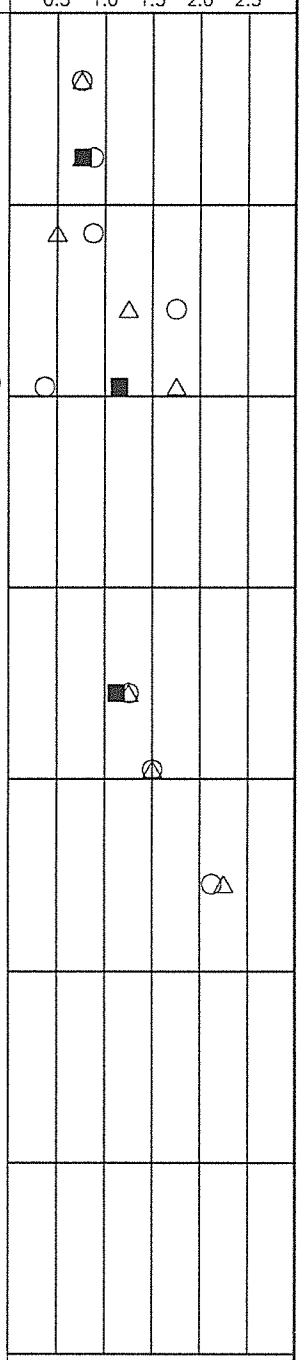
SURFACE ELEVATION : 89.68 FT.

DATE : 05-14-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 12.0 FT.
WET ROTARY : 12.0 TO 23.0 FT.

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
89.7	0	4" Asphalt over 6" Sand and Shell Mix							
88.8		Stiff gray SANDY LEAN CLAY (CL) w/ferrous nodules and ferrous stains				15			
				53	116	15	26	15	11
	5					16			
		-very stiff 6'-8'							
		-yellowish brown and gray 6'-10'				14			
		-medium stiff to very stiff 8'-10'							
				51	119	15	27	17	10
79.7	10	Medium dense brown and gray SILTY SAND (SM)							
			17			20			
			16	23		22			
		-dense 14.5'-16'							
	15		40			22			
73.7		Very stiff gray and brown LEAN CLAY (CL) w/sand							
				71	117	17	38	17	21
	20					16			
		-hard 21'-23'							
66.7						15			
	25								
	30								
	35								



DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 23.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-21

LOG OF BORING NO. GB-22

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13854555.07, E 3056030.34
Ivyridge Road; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 20.0 FT.

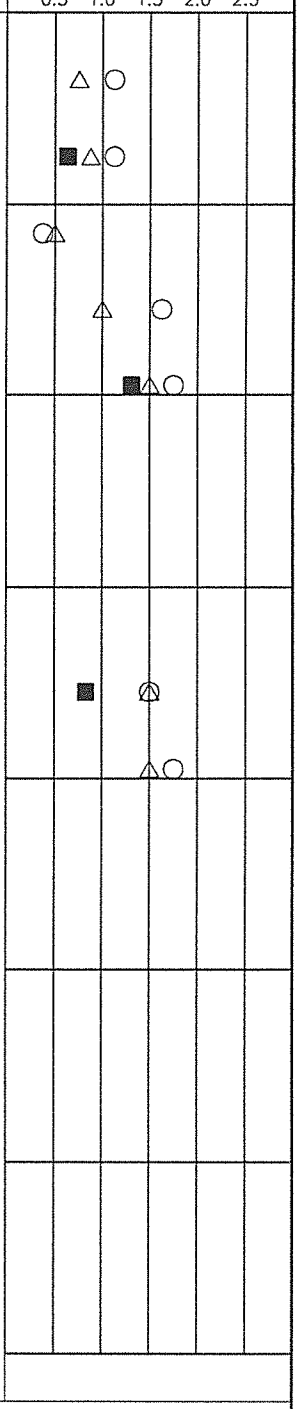
SURFACE ELEVATION : 89.26 FT.

DATE : 05-14-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 12.0 FT.
WET ROTARY : 12.0 TO 20.0 FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
89.3	0	4" Asphalt over 2" Sand and Shell Mix							
88.8		Stiff to very stiff gray SANDY LEAN CLAY (CL) w/sand seams			116	15			
		-medium stiff to stiff 4'-6'		66	112	16	37	12	25
	5	-very stiff 6'-10'				8			
						14			
79.3	10				118	15			
		Gray FINE SAND (SP-SM) w/silt				19			
		-dense 12.5'-16'	30	9		20			
	15		34			20			
73.3		Yellowish brown and gray SANDY LEAN CLAY (CL)			91	31	76	28	48
72.3		Stiff to very stiff reddish brown FAT CLAY (CH) w/calcareous nodules		95		19			
69.3	20	-very stiff 18'-20'							
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE



DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 12.0 FT. DURING DRILLING; AFTER 15.0 MIN. AT 10.0 FT.
HOLE OPEN TO 20.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-22

LOG OF BORING NO. GB-23

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13854895.28, E 3056172.02
Hazelhurst Drive; See Plan of Borings (Figure 2)

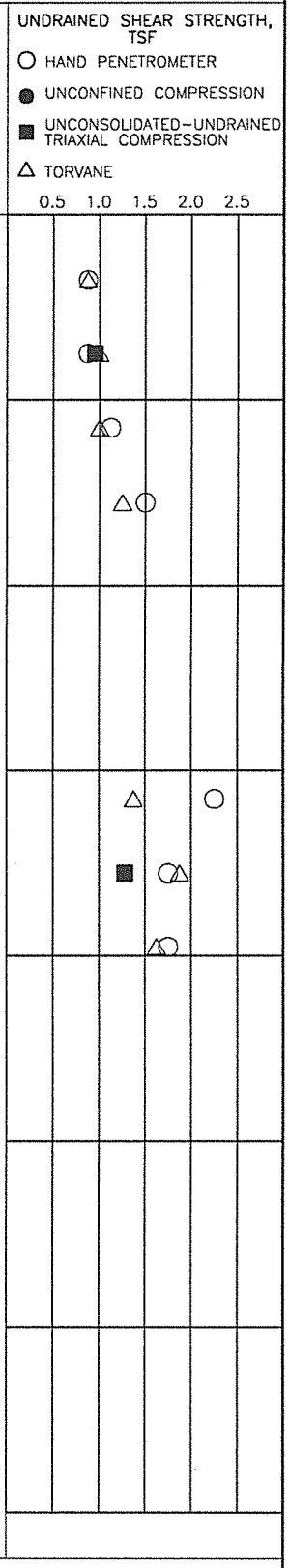
COMPLETION DEPTH : 20.0 FT.

SURFACE ELEVATION : 89.57 FT.

DATE : 05-14-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 12.0 FT.
WET ROTARY : 12.0 TO 20.0 FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
89.6	0	3" Asphalt over 9" Sand and Shell							
88.6		Stiff gray SANDY LEAN CLAY (CL) w/ferrous stains -stiff to very stiff 2'-4' -very stiff 4'-8' -yellowish brown and gray 4'-10'			115	16			
				58	117	16	34	14	20
	5					15			
						15			
81.6		Yellowish brown and gray CLAYEY SAND (SC)		28		17	25	14	11
79.6	10	Medium dense gray and brown SILTY SAND (SM) -dense 12.5'-14'	17			21			
			36	12		21			
75.6	15	Very stiff to hard reddish brown and gray FAT CLAY (CH) w/calcareous nodules -very stiff 16'-20'				28			
				98	100	29	75	28	47
						27			
69.6	20								
	25								
	30								
	35								



DEPTH TO WATER IN BORING :
▽: FREE WATER ENCOUNTERED AT 12.0 FT. DURING DRILLING.
HOLE OPEN TO 20.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-23

LOG OF BORING NO. GB-24

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13854271.54, E 3056386.10
Mayfield Road; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 2.0 FT.

SURFACE ELEVATION : 89.30 FT.

DATE : 05-14-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 2.0 FT.
WET ROTARY : -- TO -- FT.

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE

ELEVATION, FEET	DEPTH, FEET	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, TSF (0.5 1.0 1.5 2.0 2.5)
89.3	0			3" Asphalt over 12" Sand and Shell Mix								
87.3												
				NOTE : Obstruction encountered at 15" and boring was offset to GB-24A.								
	5											
	10											
	15											
	20											
	25											
	30											
	35											

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 2.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-24

LOG OF BORING NO. GB-24A

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13854271.54, E 3056386.10
Mayfield Road; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 2.0 FT.

SURFACE ELEVATION : 89.30 FT.

DATE : 05-14-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 2.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, TSF (○ HAND PENETROMETER ● UNCONFINED COMPRESSION ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION △ TORVANE) 0.5 1.0 1.5 2.0 2.5
89.3	0			3" Asphalt over 12" Sand and Shell Mix								
87.3				NOTE : Obstruction encountered at 15" and boring was offset to GB-24B.								
	5											
	10											
	15											
	20											
	25											
	30											
	35											

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 2.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-24A

LOG OF BORING NO. GB-24B

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13854271.54, E 3056386.10
Mayfield Road; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 23.0 FT.

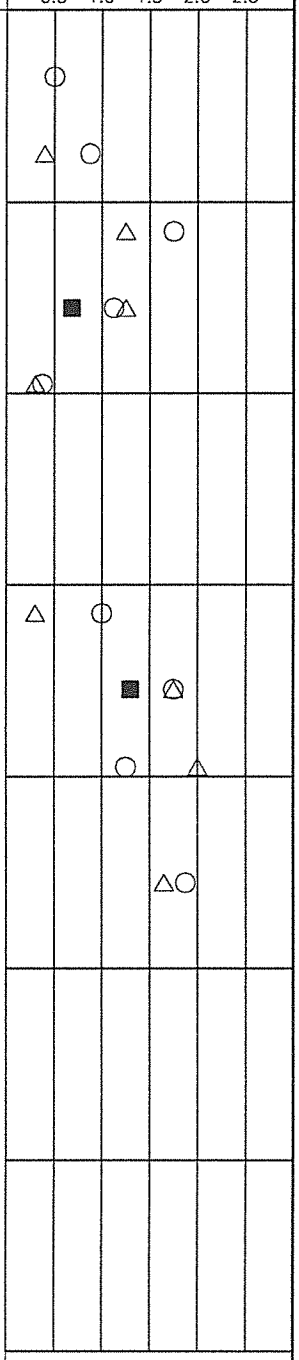
SURFACE ELEVATION : 89.30 FT.

DATE : 05-14-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 12.0 FT.
WET ROTARY : 12.0 TO 23.0 FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
89.3	0	3" Asphalt over 12" Sand and Shell Mix							
88.1		Stiff gray SANDY LEAN CLAY (CL) w/ferrous nodules and ferrous stains		54	114	9	20	12	8
		-medium stiff to stiff 2'-4'				14			
	5	-very stiff yellowish gray and brown 4'-6'				14			
		-stiff to very stiff 6'-8'							
		-medium stiff 8'-10'			117	16			
						16			
79.3	10	Medium dense yellowish brown and gray SILTY SAND (SM)	19	27		19			
			22			22			
75.3	15	Soft to very stiff gray and brown LEAN CLAY (CL) w/sand				17			
		-very stiff 16'-18'		74	122	12	36	16	20
		-very stiff to hard w/sand and silt seams 18'-20'				15			
	20	-very stiff 21'-23'				14			
66.3									
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE



DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 12.0 FT. DURING DRILLING; AFTER 15.0 MIN. AT 9.3 FT.
HOLE OPEN TO 23.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-24B

LOG OF BORING NO. GB-25

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13854588.91, E 3056456.94
Ivyridge Road; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 2.0 FT.

SURFACE ELEVATION : 89.65 FT.

DATE : 05-14-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 2.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, TSF (○ HAND PENETROMETER; ● UNCONFINED COMPRESSION; ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION; △ TORVANE) 0.5 1.0 1.5 2.0 2.5
89.7	0			6" Asphalt over 4" Limestone Base								
88.8												
87.7				Medium stiff dark gray SANDY LEAN CLAY (CL) w/ferrous nodules								○
	5			NOTE : Hard Obstruction was encountered at 2 feet and boring was offset to GB-25A.								
	10											
	15											
	20											
	25											
	30											
	35											

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 2.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-25

LOG OF BORING NO. GB-25A (GB-25AP)

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13854588.91, E 3056456.94
Ivyridge Road; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 20.0 FT.

SURFACE ELEVATION : 89.65 FT.

DATE : 05-14-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 20.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
89.7	0	4" Asphalt over 2" Sand and Shell Mix							
89.2		Stiff gray and brown SANDY LEAN CLAY (CL) w/ferrous nodules and ferrous stains				15			
		-very stiff 2'-6'		57	119	14	31	16	15
	5	-yellowish brown and gray 4'-6'				15			
		-stiff to very stiff w/vertical sand seams and calcareous nod			107	24			
		-soft to medium stiff w/sand seams 8'-10'				15			
79.7	10	Medium dense gray and brown FINE SAND (SP-SM) w/silt	20	10		21			
		-dense 12.5'-14'	30			21			
75.7	15	Stiff to very stiff reddish brown and gray FAT CLAY (CH) w/silt seams		99	98	26	56	22	34
		-very stiff to hard 16'-18'				25			
		-very stiff w/ferrous stains 18'-20'				35			
69.7	20								
	25								
	30								
	35								

NOTE :
See piezometer GB-25AP for water level measurements.

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE

DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 12.0 FT. DURING DRILLING; AFTER 15.0 MIN. AT 10.0 FT.
▼: WATER DEPTH AT 11.1 FT., HOLE OPEN TO 20.0 FT. ON 07-29-14.

Geotest Engineering, Inc.

FIGURE A-25A

LOG OF BORING NO. GB-26

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13857505.51, E 3055414.57
Shadow Wood Drive; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 12.0 FT.

SURFACE ELEVATION : 92.09 FT.

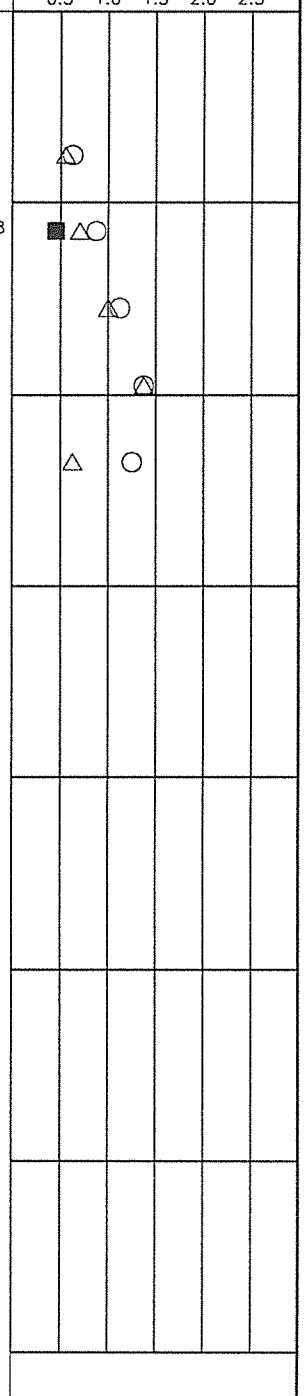
DATE : 05-15-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 10.0 FT.
WET ROTARY : 10.0 TO 12.0 FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
92.1	0	4" Asphalt over 6" Limestone and Shell Mix							
91.3		Gray SANDY LEAN CLAY (CL) w/ferrous stains							
		-stiff 2'-4'				16			
		-medium stiff to stiff 4'-6'							
	5	-w/vertical sand seams and ferrous nodules 4'-10'		64	110	18	36	18	18
		-gray and brown 4'-12'							
		-very stiff 6'-10'				17			
	10	-stiff to very stiff 10'-12'				17			
80.1						16			
	15								
	20								
	25								
	30								
	35								

SAMPLES

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE



DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 10.0 FT. DURING DRILLING; AFTER 15.0 MIN. AT 6.6 FT.
HOLE OPEN TO 12.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-26

LOG OF BORING NO. GB-27A

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13857263.28, E 3055787.49
Britt Way Street; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 20.0 FT.

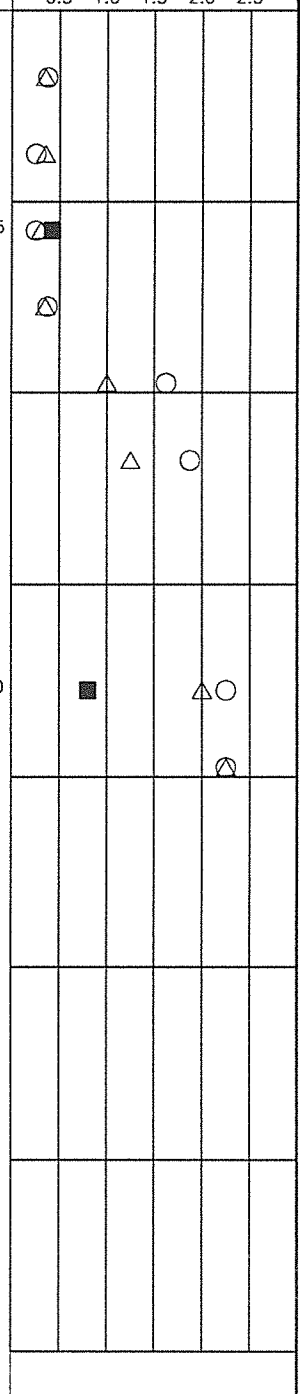
SURFACE ELEVATION : 92.14 FT.

DATE : 05-15-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 12.0 FT.
WET ROTARY : 12.0 TO 20.0 FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
92.1	0	3" Asphalt over 7" Limestone and Shell Mix							
91.3		Medium stiff dark gray SANDY LEAN CLAY (CL) w/calcareous nodules			112	17			
						18			
	5	-yellowish gray 2'-4' -w/ferrous nodules 2'-12'		55	115	18	30	15	15
		-very stiff yellowish brown and gray 8'-12'				19			
	10					15			
80.1		Medium dense yellowish brown and gray SILTY SAND (SM)				17			
			24	13		21			
	15		19			18			
76.1		Stiff to hard reddish brown and gray FAT CLAY (CH) w/ferrous nodules -w/calcareous nodules 16'-18'		99	92	32	78	28	50
72.1	20	-hard 18'-20'				22			
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE



DEPTH TO WATER IN BORING :
▽: FREE WATER ENCOUNTERED AT 12.0 FT. DURING DRILLING.
HOLE OPEN TO 20.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-27A

LOG OF BORING NO. GB-28

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13857549.04, E 3056054.13
Shadow Wood Drive; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 10.0 FT.

SURFACE ELEVATION : 92.42 FT.

DATE : 05-15-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 10.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, TSF (○ HAND PENETROMETER, ● UNCONFINED COMPRESSION, ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION, △ TORVANE) 0.5 1.0 1.5 2.0 2.5
92.4	0			4" Asphalt over 6" Limestone and Shell Mix								
91.6				FILL: very stiff brown and gray sandy lean clay -medium stiff 2'-4' -w/ferrous nodules and shell 2'-6' -soft 4'-8' -medium stiff 8'-10'								
	5											
82.4	10			NOTE : Hard Obstruction was encountered at 10'. Boring was offset to GB-28A.								
	15											
	20											
	25											
	30											
	35											

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 10.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

LOG OF BORING NO. GB-28A

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13857549.04, E 3056054.13
Shadow Wood Drive; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 23.0 FT.

SURFACE ELEVATION : 92.42 FT.

DATE : 05-15-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 12.0 FT.
WET ROTARY : 12.0 TO 23.0 FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
92.4	0	4" Asphalt over 6" Limestone and Shell Mix							
91.6		Soft to medium stiff gray SANDY LEAN CLAY (CL) w/calcareous nodules			111	20			
		-stiff to very stiff 2'-4'		57		15	47	21	26
	5	-stiff 4'-6'							
		-w/ferrous nodules 4'-8'			116	14			
		-yellowish brown and gray 4'-10'				16			
		-stiff to very stiff 6'-8'							
		-medium stiff to stiff 8'-10'				16			
82.4	10	Medium dense yellowish brown and gray SILTY SAND (SM)	14	29		18			
		-dense 12.5'-14'	35			22			
78.4	15	Stiff to very stiff reddish brown and gray FAT CLAY (CH)		97	92	30	89	31	58
		-w/silt seams 16'-18'				24			
		-hard w/calcareous nodules 16'-23'				23			
	20								
69.4						26			
	25								
	30								
	35								

SYMBOL / SAMPLES

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
▽: FREE WATER ENCOUNTERED AT 12.0 FT. DURING DRILLING.
HOLE OPEN TO 23.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-28A

LOG OF BORING NO. GB-29

PROJECT : Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas

PROJECT NO. : 1140202901

LOCATION : N 13857567.59, E 3056396.06
Shadow Wood Drive; See Plan of Borings (Figure 2)

COMPLETION DEPTH : 23.0 FT.

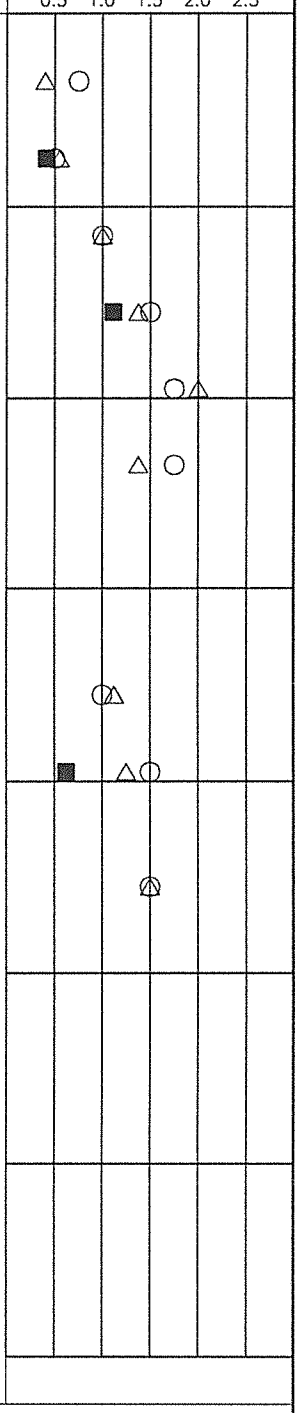
SURFACE ELEVATION : 91.99 FT.

DATE : 05-15-14

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 12.0 FT.
WET ROTARY : 12.0 TO 23.0 FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
92.0	0	4" Asphalt over 6" Sand and Shell Mix							
91.2		Medium stiff to stiff dark gray SANDY LEAN CLAY (CL) w/ferrous stains		63	120	15	25	14	11
		-yellow and gray 2'-4'			112	17			
	5	-very stiff yellowish brown and gray 4'-8'				15			
		-w/ferrous nodules 4'-10'							
		-very stiff to hard 8'-10'			121	15			
	10	-very stiff 10'-12'				16			
80.0		Medium dense gray SILTY SAND (SM)				16			
			15	13		21			
	15		26			21			
76.0		Very stiff reddish brown and gray FAT CLAY (CH)							
		-stiff to very stiff 18'-20'				25			
	20			97	95	29	68	26	42
69.0						31			
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE



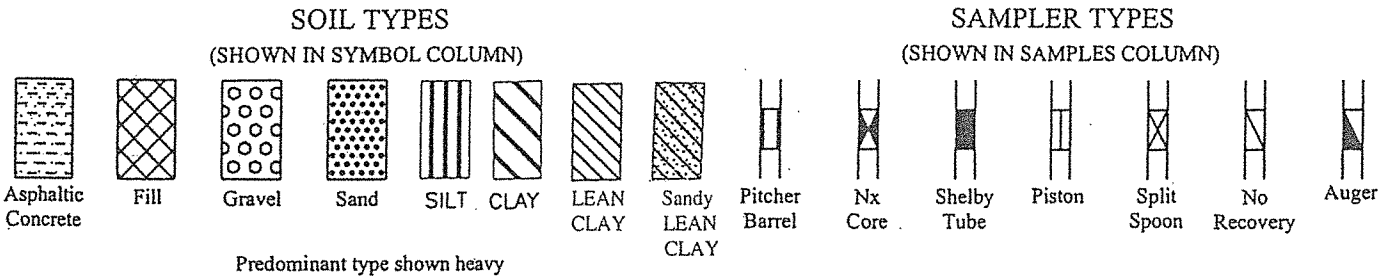
DEPTH TO WATER IN BORING :
⊻: FREE WATER 1st ENCOUNTERED AT 12.0 FT. DURING DRILLING; AFTER 5.0 MIN. AT 8.6 FT.
HOLE OPEN TO 23.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-29

Job No. 1140202901

SYMBOLS AND TERMS USED ON BORING LOGS



TERMS DESCRIBING CONSISTENCY OR CONDITION

Basic Soil Type	Density or Consistency	Standard Penetration Resistance, (1) Blows/ft.	Unconfined Compressive Strength (q_u), (2) Tons/sq. ft.
Cohesionless	Very loose	Less than 4	Not applicable
	Loose	4 to <10	Not applicable
	Medium dense	10 to <30	Not applicable
	Dense	30 to <50	Not applicable
	Very dense	50 or greater	Not applicable
Cohesive	Very soft	Less than 2	Less than 0.25
	Soft	2 to <4	0.25 to <0.5
	Firm/Medium stiff	4 to <8	0.5 to <1.0
	Stiff	8 to <15	1.0 to <2.0
	Very stiff	15 to <30	2.0 to <4.0
	Hard	30 or greater	4 or greater

(1) Number of blows from 140-lb. weight falling 30-in. to drive 2-in. OD, 1-3/8-in. ID, split barrel sampler (ASTM D1586)

(2) q_u may also be approximated using a pocket penetrometer

TERMS CHARACTERIZING SOIL STRUCTURE

Parting: -paper thin in size Seam: -1/8" to 3" thick Layer: -greater than 3"

Slickensided	- having inclined planes of weakness that are slick and glossy in appearance.
Fissured	- containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.
Laminated	- composed of thin layers of varying color and 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 size missing.
Flocculated	- pertaining to cohesive soils that exhibit a loose knit or flakey structure.

Job No. 1140202901

PIEZOMETER INSTALLATION REPORT

PROJECT NAME: NEIGHBORHOOD STREET RECONSTRUCTION (NSR) PROJECT 456 WBS NO.: N-000388-0001-3; HOUSTON, TEXAS		PIEZOMETER NUMBER: GB-1P
GEOTECHNICAL CONSULTANT GEOTEST ENGINEERING, INC.	DESIGN CONSULTANT BURY, INC.	HOUSTON, TEXAS

COMPLETION DATE 05-16-14

DRY AUGERED 0 TO 24 FT

WASH BORED -- TO -- FT

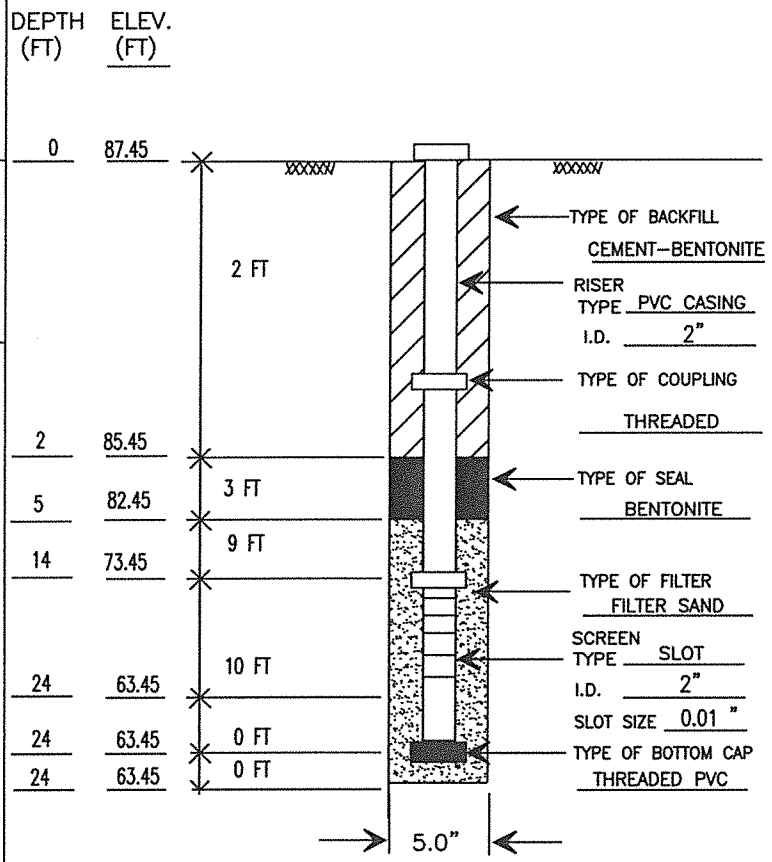
DRILLING FLUID: WATER

DEVELOPMENT DATE: 05-16-14

METHOD OF DEVELOPMENT: BAILING

WATER LEVEL READINGS:

DATE	DEPTH (TOG)	ELEVATION
05-17-14	22.0	65.5
06-30-14	9.8	77.7
07-29-14	10.4	77.1



(NOT TO SCALE)

REMARKS:

NOTES:

1. DIMENSIONS NOMINAL UNLESS OTHERWISE NOTED
2. TOG = TOP OF GROUND

DRILLED BY: ET	STARTED: 05-16-14	NORTHING: 13850732.63 EASTING: 3055221.80
LOGGED BY: JG	COMPLETED: 05-16-14	GROUND LEVEL (MSL): 87.45
CHECKED BY: NK	APPROVED BY: MB	SHEET 1 OF 1

Job No. 1140202901

PIEZOMETER INSTALLATION REPORT

PROJECT NAME: NEIGHBORHOOD STREET RECONSTRUCTION (NSR) PROJECT 456 WBS NO.: N-000388-0001-3; HOUSTON, TEXAS		PIEZOMETER NUMBER: GB-6AP
GEOTECHNICAL CONSULTANT GEOTEST ENGINEERING, INC.	DESIGN CONSULTANT BURY, INC.	HOUSTON, TEXAS

COMPLETION DATE 05-16-14

DRY AUGERED 0 TO 22 FT

WASH BORED -- TO -- FT

DRILLING FLUID: WATER

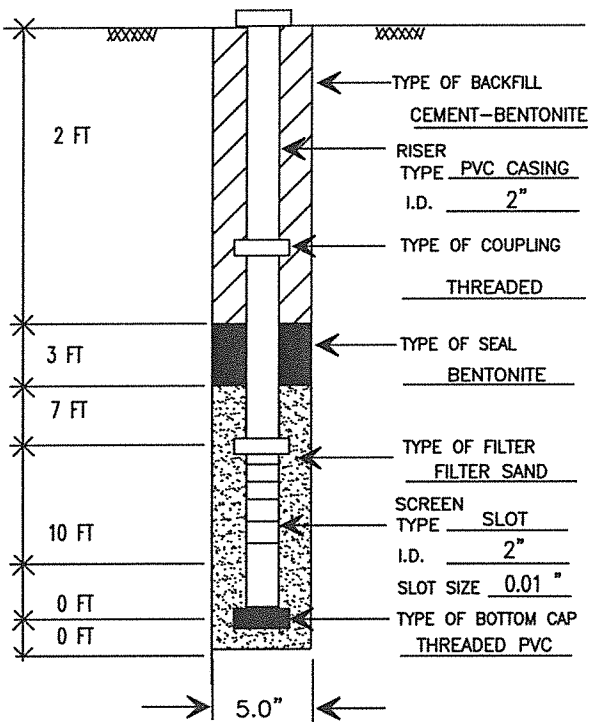
DEVELOPMENT DATE: 05-16-14

METHOD OF DEVELOPMENT: BAILING

WATER LEVEL READINGS:

DATE	DEPTH (TOG)	ELEVATION
05-17-14	8.3	81.5
06-30-14	7.4	82.4
07-29-14	7.4	82.4

DEPTH (FT)	ELEV. (FT)
0	89.76
2	87.76
5	84.76
12	77.76
22	67.76
22	67.76
22	67.76



(NOT TO SCALE)

REMARKS:

NOTES:

1. DIMENSIONS NOMINAL UNLESS OTHERWISE NOTED
2. TOG = TOP OF GROUND

DRILLED BY: ET	STARTED: 05-16-14	NORTHING: 13853262.55 EASTING: 3055154.17
LOGGED BY: JG	COMPLETED: 05-16-14	GROUND LEVEL (MSL): 89.76
CHECKED BY: NK	APPROVED BY: MB	SHEET 1 OF 1

Job No. 1140202901

PIEZOMETER INSTALLATION REPORT

PROJECT NAME: NEIGHBORHOOD STREET RECONSTRUCTION (NSR) PROJECT 456 WBS NO.: N-000388-0001-3; HOUSTON, TEXAS		PIEZOMETER NUMBER: GB-11P
GEOTECHNICAL CONSULTANT GEOTEST ENGINEERING, INC.	DESIGN CONSULTANT BURY, INC.	HOUSTON, TEXAS

COMPLETION DATE 05-16-14

DRY AUGERED 0 TO 21 FT

WASH BORED -- TO -- FT

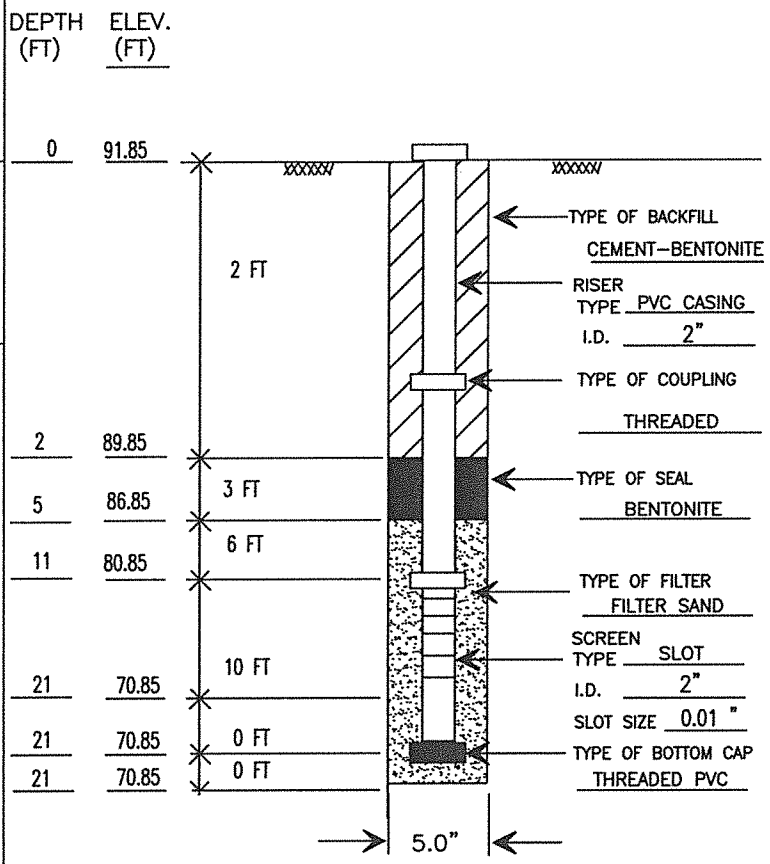
DRILLING FLUID: WATER

DEVELOPMENT DATE: 05-16-14

METHOD OF DEVELOPMENT: BAILING

WATER LEVEL READINGS:

DATE	DEPTH (TOG)	ELEVATION
05-17-14	20.5	71.4
06-30-14	14.6	77.3
07-29-14	17.0	74.9



(NOT TO SCALE)

REMARKS:

NOTES:

1. DIMENSIONS NOMINAL UNLESS OTHERWISE NOTED
2. TOG = TOP OF GROUND

DRILLED BY: ET	STARTED: 05-16-14	NORTHING: 13855755.19 EASTING: 3055051.19
LOGGED BY: JG	COMPLETED: 05-16-14	GROUND LEVEL (MSL): 91.85
CHECKED BY: NK	APPROVED BY: MB	SHEET 1 OF 1

Job No. 1140202901

PIEZOMETER INSTALLATION REPORT

PROJECT NAME: NEIGHBORHOOD STREET RECONSTRUCTION (NSR) PROJECT 456 WBS NO.: N-000388-0001-3; HOUSTON, TEXAS		PIEZOMETER NUMBER: GB-17P
GEOTECHNICAL CONSULTANT GEOTEST ENGINEERING, INC.	DESIGN CONSULTANT BURY, INC.	HOUSTON, TEXAS

COMPLETION DATE 05-16-14

DRY AUGERED 0 TO 20 FT

WASH BORED -- TO -- FT

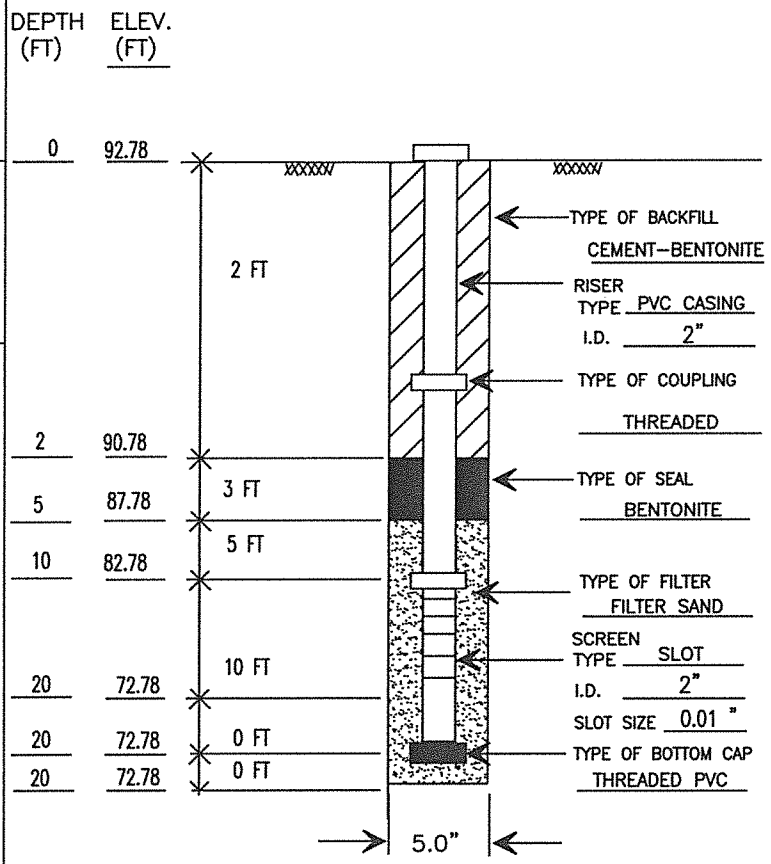
DRILLING FLUID: WATER

DEVELOPMENT DATE: 05-16-14

METHOD OF DEVELOPMENT: BAILING

WATER LEVEL READINGS:

DATE	DEPTH (TOG)	ELEVATION
05-17-14	12.0	80.8
06-30-14	12.0	80.8
07-29-14	11.2	81.6



(NOT TO SCALE)

REMARKS:

NOTES:

1. DIMENSIONS NOMINAL UNLESS OTHERWISE NOTED
2. TOG = TOP OF GROUND

DRILLED BY: ET	STARTED: 05-16-14	NORTHING: 13858747.02 EASTING: 3054949.33
LOGGED BY: JG	COMPLETED: 05-16-14	GROUND LEVEL (MSL): 92.78
CHECKED BY: NK	APPROVED BY: MB	SHEET 1 OF 1

Job No. 1140202901

PIEZOMETER INSTALLATION REPORT

PROJECT NAME: NEIGHBORHOOD STREET RECONSTRUCTION (NSR) PROJECT 456 WBS NO.: N-000388-0001-3; HOUSTON, TEXAS		PIEZOMETER NUMBER: GB-25AP
GEOTECHNICAL CONSULTANT GEOTEST ENGINEERING, INC.	DESIGN CONSULTANT BURY, INC.	HOUSTON, TEXAS

COMPLETION DATE 05-14-14

DRY AUGERED 0 TO 20 FT

WASH BORED -- TO -- FT

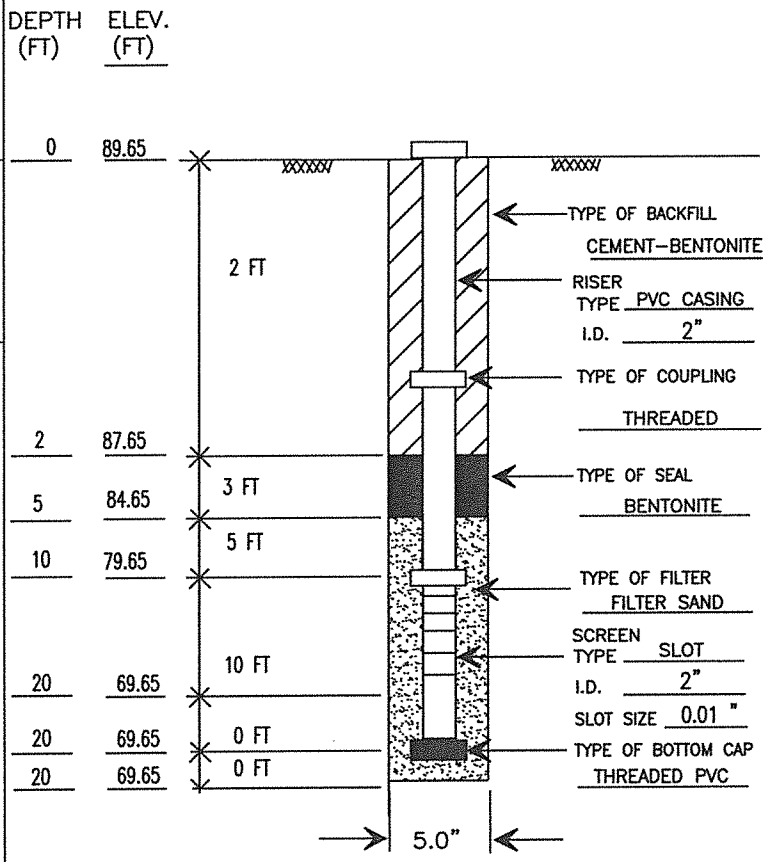
DRILLING FLUID: WATER

DEVELOPMENT DATE: 05-14-14

METHOD OF DEVELOPMENT: BAILING

WATER LEVEL READINGS:

DATE	DEPTH (TOG)	ELEVATION
05-17-14	9.3	80.4
06-30-14	9.7	80.0
07-29-14	11.1	78.6



(NOT TO SCALE)

REMARKS:

NOTES:

1. DIMENSIONS NOMINAL UNLESS OTHERWISE NOTED
2. TOG = TOP OF GROUND

DRILLED BY: ET	STARTED: 05-14-14	NORTHING: 13854588.91 EASTING: 3056456.94
LOGGED BY: JG	COMPLETED: 05-14-14	GROUND LEVEL (MSL): 89.65
CHECKED BY: NK	APPROVED BY: MB	SHEET 1 OF 1

APPENDIX B

	Figure
Summary of Laboratory Test Results	B-1 thru B-29
Grain Size Distribution Curves	B-30 thru B-35
Results of California Bearing Ratio (CBR) Tests	B-36a thru B-36c
Dry Density Versus CBR	B-36d

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-1 (GB-1P)	2	1.0	2.0	UD		18									0.50	0.50	Sandy Lean Clay
	3	2.0	4.0	UD		18	108	49	20	29	69		0.54	0.29	0.60	0.38	Sandy Lean Clay
	4	4.0	6.0	UD		16									1.00	1.25	Sandy Lean Clay
	5	6.0	8.0	UD		15									1.00	1.13	Sandy Lean Clay
	6	8.0	10.0	UD		22	106	46	20	26	81		0.75	0.72	0.60	0.88	Lean Clay
	7	10.0	12.0	UD		16									1.25	2.00	Lean Clay
	8	12.0	14.0	UD		22									1.75	2.00	Lean Clay
	9	14.0	16.0	UD		22									1.63	1.75	Fat Clay
	10	16.0	18.0	UD		20									1.75	2.25	Fat Clay
	11	18.0	20.0	UD		22	105	65	25	40	100		2.52	1.44	2.25	2.25	Fat Clay
	12	20.0	22.0	UD		22									2.25	2.25	Fat Clay
	13	22.0	24.0	UD		21									2.13	2.25	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-1

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-2	2	0.8	2.0	UD		17									1.25	0.75	Sandy Lean Clay
	3	2.0	4.0	UD		16	115	35	16	19	64		0.93	0.29	0.88	0.75	Sandy Lean Clay
	4	4.0	6.0	UD		15									1.50	1.50	Sandy Lean Clay
	5	6.0	8.0	UD		17									1.00	1.25	Sandy Lean Clay
	6	8.0	10.0	UD		16									2.00	1.88	Sandy Lean Clay
	7	10.0	12.0	UD		15	118						1.42	0.86	1.75	1.88	Sandy Lean Clay
	8	12.0	14.0	UD		15									2.50	2.25	Sandy Lean Clay
	9	14.0	16.0	UD		20									1.88	1.88	Fat Clay
	10	16.0	18.0	UD		22	109	60	24	36	94		1.61	1.30	1.75	1.75	Fat Clay
	11	18.0	20.0	UD		22									2.50	2.25	Fat Clay
	12	20.0	22.0	UD		20									2.50	2.25	Fat Clay
	13	22.0	24.0	UD		21									2.13	2.25	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-3	4	2.0	4.0	UD		16	117								1.25	0.75	Sandy Lean Clay
	5	4.0	6.0	UD		17	117	34	17	17	68		0.76	0.43	0.88	1.00	Sandy Lean Clay
	6	6.0	8.0	UD		19									1.00	1.00	Sandy Lean Clay
	7	8.0	10.0	UD		21									0.65	0.88	Sandy Lean Clay
	8	10.0	12.0	UD		20									0.85	0.88	Sandy Lean Clay
	9	12.0	14.0	UD		17									1.38	0.75	Sandy Lean Clay
	10	14.0	16.0	UD		15									2.25	2.25	Sandy Lean Clay
	11	16.0	18.0	UD		17									2.38	2.25	Fat Clay
	12	18.0	20.0	UD		20	111	57	23	34	96		0.97	1.44	1.75	2.00	Fat Clay
	13	22.0	24.0	UD		21									2.50	2.25	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-3

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-4	2	0.8	2.0	UD		13									0.50	1.50	Lean Clay
	3	2.0	4.0	UD		16	114	26	14	12	77		0.72	0.29	0.75	0.75	Lean Clay
	4	4.0	6.0	UD		19									1.00	1.38	Lean Clay
	5	6.0	8.0	UD		18									1.13	1.75	Lean Clay
	6	8.0	10.0	UD		16	115						1.21	0.72	1.50	1.88	Lean Clay
	7	10.0	12.0	UD		17									0.50	0.88	Lean Clay
	8	12.5	14.0	SS	25	18					70						Sandy Lean Clay
	9	14.0	15.0	UD		14									1.75	2.25	Sandy Lean Clay
	10	15.0	16.0	UD		16									1.25	1.13	Fat Clay
	11	16.0	18.0	UD		22	107	56	22	34	93		1.09	1.30	1.63	1.75	Fat Clay
	12	18.0	20.0	UD		20									1.75	2.00	Fat Clay
	13	22.0	24.0	UD		24									2.00	2.00	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-5	2	0.8	2.0	UD		18	111								1.13	0.88	Lean Clay
	3	2.0	4.0	UD		21									0.45	0.38	Lean Clay
	4	4.0	6.0	UD		23	107	46	20	26	74		0.36	0.43	0.40	0.50	Lean Clay
	5	6.0	8.0	UD		17									0.40	0.25	Lean Clay
	6	8.0	10.0	UD		15									1.88	1.88	Lean Clay
	7	10.0	12.0	UD		16									1.50	2.00	Lean Clay
	8	12.5	14.0	SS	15	21					6						Sand
	9	14.0	16.0	UD		15									1.25	1.50	Lean Clay
	10	16.0	18.0	UD		15	117	30	14	16	77		0.99	1.30	1.63	1.75	Lean Clay
	11	18.0	20.0	UD		17									2.13	2.25	Lean Clay
	12	22.0	24.0	UD		18									1.25	1.50	Lean Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-5

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-6A (GB-6AP)	2	0.0	2.0	UD		14	120								1.50	2.00	Sandy Lean Clay
	3	2.0	4.0	UD		17	117	30	15	15	70		0.64	0.29	0.65	0.50	Sandy Lean Clay
	4	4.0	6.0	UD		15									1.50	1.25	Sandy Lean Clay
	5	6.0	8.0	UD		16									0.80	0.88	Sandy Lean Clay
	6	8.0	10.0	UD		18									0.75	0.50	Sandy Lean Clay
	7	10.0	12.0	UD		19	112	29	16	13	50		0.31	0.86	0.40	0.25	Sandy Lean Clay
	8	12.0	14.0	UD		33									1.00	0.75	Fat Clay
	9	14.0	16.0	UD		18									0.65	0.63	Sandy Lean Clay
	10	16.0	18.0	UD		16	120	31	15	16	56		1.01	1.30	1.38	1.50	Sandy Lean Clay
	11	18.0	20.0	UD		17									2.00	2.25	Sandy Lean Clay
	12	20.0	22.0	UD		16									1.88	2.13	Sandy Lean Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-6A

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-7	2	0.8	2.0	UD		14									0.75	1.25	Sandy Lean Clay
	3	2.0	4.0	UD		14	116	29	15	14	53		0.98	0.29	0.88	1.75	Sandy Lean Clay
	4	4.0	6.0	UD		14									0.88	1.13	Sandy Lean Clay
	5	6.0	8.0	UD		14									1.25	1.50	Sandy Lean Clay
	6	8.0	10.0	UD		19	113	27	17	10			0.62	0.72	0.20	0.50	Sandy Lean Clay
	7	10.0	12.0	UD		19									0.25	0.25	Sandy Lean Clay
	8	12.5	14.0	SS	16	25											Fat Clay
	9	14.0	16.0	UD		33	92	59	23	36	98		0.66	1.15	1.50	1.50	Fat Clay
	10	16.5	18.0	SS	24	22					25						Silty Sand
	11	18.5	20.0	SS	23	10											Lean Clay
	12	20.0	22.0	UD		20									2.13	2.25	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-8	2	0.8	2.0	AG		9											Sandy Lean Clay
	3	2.0	4.0	UD		17		37	16	21	63				0.40	0.50	Sandy Lean Clay
	4	4.0	6.0	UD		14	118						0.90	0.43	0.88	1.38	Sandy Lean Clay
	5	6.0	8.0	UD		16									1.13	1.38	Sandy Lean Clay
	6	8.0	10.0	UD		17									1.13	1.38	Sandy Lean Clay
	7	10.0	12.0	UD		21	107						0.73	0.86	0.88	1.25	Sandy Lean Clay
	8	12.5	14.0	SS	21	22					39						Silty Sand
	9	14.0	16.0	UD		29									1.38	1.00	Fat Clay
	10	16.0	18.0	UD		32									1.50	1.75	Fat Clay
	11	18.0	20.0	UD		28	96	78	28	50	99		1.05	1.44	1.88	2.25	Fat Clay
	12	20.0	22.0	UD		29									1.25	2.00	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-8

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-9	2	0.8	2.0	UD		16	117								0.50	0.88	Sandy Lean Clay
	3	2.0	4.0	UD		16		37	16	21	58				0.75	0.63	Sandy Lean Clay
	4	4.0	6.0	UD		17	113						0.68	0.43	0.88	0.88	Sandy Lean Clay
	5	6.0	8.0	UD		13									1.38	1.88	Sandy Lean Clay
	6	8.0	10.0	UD		15	115						2.05	0.72	1.50	2.25	Sandy Lean Clay
	7	10.0	12.0	UD		16									0.50	1.13	Sandy Lean Clay
	8	12.5	14.0	SS	21	21					17						Silty Sand
	9	14.5	16.0	SS	48	21											Silty Sand
	10	16.5	18.0	SS	42	19											Silty Sand
	11	18.5	20.0	SS	22	20											Silty Sand
	12	20.0	22.0	UD		31		75	28	47	98				1.50	0.88	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-9

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-10	2	0.8	2.0	UD		10											Silty Sand
	3	2.0	4.0	UD		16		30	16	14	58				0.88	1.00	Sandy Lean Clay
	4	4.0	6.0	UD		14	119						0.96	0.43	1.00	1.13	Sandy Lean Clay
	5	6.0	8.0	UD		18									0.50	0.75	Sandy Lean Clay
	6	8.0	10.0	UD		18									0.88	1.00	Sandy Lean Clay
	7	10.0	12.0	UD		18	112						0.53	0.86	0.88	1.00	Sandy Lean Clay
	8	12.5	14.0	SS	14	18					33						Silty Sand
	9	14.5	16.0	SS	23	21											Silty Sand
	10	16.5	18.0	SS	49	19											Silty Sand
	11	18.0	20.0	UD		33	94	89	31	58	99		0.41	1.44	1.25	1.38	Fat Clay
	12	20.0	22.0	UD		30									1.50	1.50	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-11 (GB-11P)	2	0.8	2.0	UD		10	113								1.00	2.25	Lean Clay
	3	2.0	4.0	UD		13					71				1.00	2.25	Lean Clay
	4	4.0	6.0	UD		12	122	29	13	16			1.58	0.43	1.00	2.25	Lean Clay
	5	6.0	8.0	UD		15									1.38	0.88	Lean Clay
	6	8.0	10.0	UD		17									1.25	1.25	Lean Clay
	7	10.0	12.0	UD		20	110	36	17	19	71		0.96	0.86	1.00	0.88	Lean Clay
	8	12.0	14.0	UD		19									0.20	0.63	Lean Clay
	9	14.5	16.0	SS	20	38					99						Fat Clay
	10	16.0	18.0	UD		30									1.25	1.25	Fat Clay
	11	18.0	20.0	UD		28	99	72	27	45	99		1.97	1.44	1.75	2.13	Fat Clay
	12	20.0	21.0	UD		24									1.75	2.00	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-11

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-12	2	0.8	2.0	UD		14									1.00	1.50	Sandy Lean Clay
	3	2.0	4.0	UD		15	121	30	15	15	64		0.87	0.29	1.00	1.25	Sandy Lean Clay
	4	4.0	6.0	UD		15									1.00	1.13	Sandy Lean Clay
	5	6.0	8.0	UD		17									1.00	0.88	Sandy Lean Clay
	6	8.0	10.0	UD		20	107						0.57	0.72	0.88	0.75	Sandy Lean Clay
	7	10.0	12.0	UD		20									1.13	1.38	Sandy Lean Clay
	8	12.0	14.0	UD		18									0.30	0.63	Sandy Lean Clay
	9	14.0	16.0	UD		38									1.25	0.75	Fat Clay
	10	16.0	18.0	UD		26	97	63	24	39	99		0.83	1.30	1.63	0.88	Fat Clay
	11	18.0	20.0	UD		27									1.88	2.25	Fat Clay
	12	20.0	21.0	UD		26									2.00	2.25	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-13	2	0.8	2.0	UD		13	104								0.63	0.88	Sandy Lean Clay
	3	2.0	4.0	UD		15	115	30	15	15	70		0.89	0.29	0.75	1.50	Sandy Lean Clay
	4	4.0	6.0	UD		14									1.50	2.13	Sandy Lean Clay
	5	6.0	8.0	UD		15									1.25	1.75	Sandy Lean Clay
	6	8.0	10.0	UD		18	109						0.73	0.72	0.75	0.75	Sandy Lean Clay
	7	10.0	12.0	UD		25									0.75	0.88	Sandy Lean Clay
	8	12.0	14.0	UD		20									0.63	1.00	Sandy Lean Clay
	9	14.5	16.0	SS	21	14					9						Sand
	10	16.0	18.0	UD		34	92	80	29	51	99		0.67	1.30	1.38	1.63	Fat Clay
	11	18.0	20.0	UD		28									1.50	1.00	Fat Clay
	12	20.0	21.0	UD		28									1.75	2.25	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-14	2	1.0	2.0	UD		16									1.00	1.00	Sandy Lean Clay
	3	2.0	4.0	UD		18	112	45	19	26	69		0.90	0.29	0.60	0.50	Sandy Lean Clay
	4	4.0	6.0	UD		17									1.00	0.75	Sandy Lean Clay
	5	6.0	8.0	UD		18									0.88	1.00	Sandy Lean Clay
	6	8.0	10.0	UD		16									1.25	2.00	Sandy Lean Clay
	7	10.0	12.0	UD		19	116						1.37	0.86	1.00	0.75	Sandy Lean Clay
	8	12.0	14.0	UD		18									0.75	0.88	Sandy Lean Clay
	9	14.5	16.0	SS	16	18					23						Silty Sand
	10	16.0	18.0	UD		26	93	69	26	43	99		0.79	1.30	1.50	0.80	Fat Clay
	11	18.0	20.0	UD		27									1.88	2.00	Fat Clay
	12	20.0	21.0	UD		24									2.00	1.50	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-15	2	1.2	2.0	UD		5											Sandy Lean Clay
	3	2.0	4.0	UD		10	122	29	16	13	58				1.75	2.25	Sandy Lean Clay
	4	4.0	6.0	UD		8									2.00	2.25	Sandy Lean Clay
	5	6.0	8.0	UD		11	123						2.62	0.58	2.50	2.25	Sandy Lean Clay
	6	8.0	10.0	UD		17									0.65	0.50	Sandy Lean Clay
	7	10.0	11.5	UD		18									0.20	0.50	Sandy Lean Clay
	8	11.5	13.0	SS		20					21						Silty Sand

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-16	2	0.8	2.0	UD		17	110								1.00	1.25	Sandy Lean Clay
	3	2.0	4.0	UD		14	114	30	15	15	53		0.96	0.29	1.38	1.75	Sandy Lean Clay
	4	4.0	6.0	UD		13									1.25	1.88	Sandy Lean Clay
	5	6.0	8.0	UD		15									1.25	1.63	Sandy Lean Clay
	6	8.0	10.0	UD		20	108						0.58	0.72	0.75	0.38	Sandy Lean Clay
	7	10.0	12.0	UD		17									0.38	0.63	Sandy Lean Clay
	8	12.5	14.0	SS	22	20					14						Silty Sand
	9	14.5	16.0	SS	17	21											Silty Sand
	10	16.5	18.0	SS	28	24											Silty Sand
	11	18.5	20.0	SS	26												Silty Sand
	12	20.0	21.5	SS	28	39											Fat Clay
	13	21.0	23.0	UD	28	39		81	29	52	99				1.00	1.00	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-16

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-17 (GB-17P)	2	0.9	2.0	UD		6									1.75	2.25	Sandy Lean Clay
	3	2.0	4.0	UD		9	126	39	17	22	59		2.78	0.29	2.50	2.25	Sandy Lean Clay
	4	4.0	6.0	UD		9									2.50	2.25	Sandy Lean Clay
	5	6.0	8.0	UD		10									2.50	2.25	Sandy Lean Clay
	6	8.0	10.0	UD		14	122						2.55	0.72	1.50	1.63	Sandy Lean Clay
	7	10.0	12.0	UD		16									1.00	1.25	Sandy Lean Clay
	8	12.5	14.0	SS	21	18					19						Silty Sand
	9	14.5	16.0	SS	19	38											Fat Clay
	10	16.0	18.0	UD		36	89	66	25	41	99		0.35	1.30	0.50	0.38	Fat Clay
	11	18.0	20.0	UD		37									1.00	1.25	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-17

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-18	2	0.8	2.0	UD		7	120								1.50	2.25	Sandy Lean Clay
	3	2.0	4.0	UD		8		26	14	12	52					2.25	Sandy Lean Clay
	4	4.0	6.0	UD		8	124						2.29	0.43		2.25	Sandy Lean Clay
	5	6.0	8.0	UD		15									2.25	2.25	Sandy Lean Clay
	6	8.0	10.0	UD		15									0.60	0.63	Sandy Lean Clay
	7	10.0	11.5	SS	19	17											Sand
	8	12.5	14.0	SS	29	19											Sand
	9	14.5	16.0	SS	32	22					8						Sand
	10	16.5	18.0	SS	35	20											Sand
	11	18.0	20.0	UD		26	102	64	25	39	89		0.70	1.44	1.75	1.75	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-19	2	0.8	2.0	UD		17									0.70	0.38	Sandy Lean Clay
	3	2.0	4.0	UD		16	116	40	18	22	57		0.65	0.29	1.00	1.13	Sandy Lean Clay
	4	4.0	6.0	UD		16									1.25	0.63	Sandy Lean Clay
	5	6.0	8.0	UD		15										2.25	Sandy Lean Clay
	6	8.0	10.0	UD		16	117						0.87	0.72	1.00	0.50	Sandy Lean Clay
	7	10.5	12.0	SS	16	20					18						Silty Sand
	8	12.5	14.0	SS	26	22											Silty Sand
	9	14.5	16.0	SS	29	25											Silty Sand
	10	16.0	18.0	UD		41	83	94	33	61	98		0.50	1.30	1.50	1.13	Fat Clay
	11	18.0	20.0	UD		20									1.75	2.25	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-20	2	0.5	2.0	UD		19	108								0.45	0.38	Fill
	3	2.0	4.0	UD		12		31	16	15	63				0.20	0.75	Fill
	4	4.0	6.0	UD		15									0.40	0.75	Sandy Lean Clay
	5	6.0	8.0	UD		16									0.60	0.88	Sandy Lean Clay
	6	8.0	10.0	UD		22	108	56	22	34	76		1.47	0.72	1.75	1.13	Fat Clay
	7	10.0	12.0	UD		24									1.50	0.75	Fat Clay
	8	12.0	14.0	UD		35									1.50	1.63	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-21	2	0.8	2.0	UD		15									0.75	0.75	Sandy Lean Clay
	3	2.0	4.0	UD		15	116	26	15	11	53		0.76	0.29	0.75	0.88	Sandy Lean Clay
	4	4.0	6.0	UD		16									0.50	0.88	Sandy Lean Clay
	5	6.0	8.0	UD		14									1.25	1.75	Sandy Lean Clay
	6	8.0	10.0	UD		15	119	27	17	10	51		1.15	0.72	1.75	0.38	Sandy Lean Clay
	7	10.5	12.0	SS	17	20											Silty Sand
	8	12.5	14.0	SS	16	22					23						Silty Sand
	9	14.5	16.0	SS	40	22											Silty Sand
	10	16.0	18.0	UD		17	117	38	17	21	71		1.12	1.30	1.25	1.25	Lean Clay
	11	18.0	20.0	UD		16									1.50	1.50	Lean Clay
	12	21.0	23.0	UD		15									2.25	2.13	Lean Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-21

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-22	2	0.5	2.0	UD		15	116								0.75	1.13	Sandy Lean Clay
	3	2.0	4.0	UD		16	112	37	12	25	66		0.63	0.29	0.88	1.13	Sandy Lean Clay
	4	4.0	6.0	UD		8									0.50	0.38	Sandy Lean Clay
	5	6.0	8.0	UD		14									1.00	1.63	Sandy Lean Clay
	6	8.0	10.0	UD		15	118						1.31	0.72	1.50	1.75	Sandy Lean Clay
	7	10.0	12.0	UD		19											Sand
	8	12.5	14.0	SS	30	20					9						Sand
	9	14.5	16.0	SS	34	20											Sand
	10	16.0	18.0	UD		31	91	76	28	48			0.83	1.30	1.50	1.50	Fat Clay
	11	18.0	20.0	UD		19					95				1.50	1.75	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-23	2	1.0	2.0	UD		16	115								0.88	0.88	Sandy Lean Clay
	3	2.0	4.0	UD		16	117	34	14	20	58		0.95	0.29	1.00	0.88	Sandy Lean Clay
	4	4.0	6.0	UD		15									1.00	1.13	Sandy Lean Clay
	5	6.0	8.0	UD		15									1.25	1.50	Sandy Lean Clay
	6	8.0	10.0	UD		17					28		0.31	0.72			Clayey Sand
	7	10.5	12.0	SS	17	21											Silty Sand
	8	12.5	14.0	SS	36	21					12						Silty Sand
	9	14.0	16.0	UD		28									1.38	2.25	Fat Clay
	10	16.0	18.0	UD		29	100	75	28	47	98		1.28	1.30	1.88	1.75	Fat Clay
	11	18.0	20.0	UD		27									1.63	1.75	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-24B	2	1.3	2.0	UD		9	114	20	12	8	54					0.50	Sandy Lean Clay
	3	2.0	4.0	UD		14									0.40	0.88	Sandy Lean Clay
	4	4.0	6.0	UD		14									1.25	1.75	Sandy Lean Clay
	5	6.0	8.0	UD		16	117						0.68	0.58	1.25	1.13	Sandy Lean Clay
	6	8.0	10.0	UD		16									0.30	0.38	Sandy Lean Clay
	7	10.5	12.0	SS	19	19					27						Silty Sand
	8	12.5	14.0	SS	22	22											Silty Sand
	9	14.0	16.0	UD		17									0.30	1.00	Lean Clay
	10	16.0	18.0	UD		12	122	36	16	20	74		1.30	1.30	1.75	1.75	Lean Clay
	11	18.0	20.0	UD		15									2.00	1.25	Lean Clay
	12	21.0	23.0	UD		14									1.65	1.88	Lean Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-24B

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-25A (GB-25AP)	2	0.5	2.0	UD		15									0.75	0.63	Sandy Lean Clay
	3	2.0	4.0	UD		14	119	31	16	15	57				1.63	1.50	Sandy Lean Clay
	4	4.0	6.0	UD		15									1.25	1.88	Sandy Lean Clay
	5	6.0	8.0	UD		24	107						0.71	0.58	0.70	1.00	Sandy Lean Clay
	6	8.0	10.0	UD		15									0.15	0.25	Sandy Lean Clay
	7	10.5	12.0	SS	20	21					10						Sand
	8	12.5	14.0	SS	30	21											Sand
	9	14.0	16.0	UD		26	98	56	22	34	99		0.72	1.15	1.38	1.13	Fat Clay
	10	16.0	18.0	UD		25									1.63	2.25	Fat Clay
	11	18.0	20.0	UD		35									1.50	1.63	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-25A

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-26	3	2.0	4.0	UD		16									0.55	0.63	Sandy Lean Clay
	4	4.0	6.0	UD		18	110	36	18	18	64		0.45	0.43	0.70	0.88	Sandy Lean Clay
	5	6.0	8.0	UD		17									1.00	1.13	Sandy Lean Clay
	6	8.0	10.0	UD		17									1.38	1.38	Sandy Lean Clay
	7	10.0	12.0	UD		16									0.63	1.25	Sandy Lean Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-27A	2	0.8	2.0	UD		17	112								0.35	0.38	Sandy Lean Clay
	3	2.0	4.0	UD		18									0.35	0.25	Sandy Lean Clay
	4	4.0	6.0	UD		18	115	30	15	15	55		0.42	0.43	0.30	0.25	Sandy Lean Clay
	5	6.0	8.0	UD		19									0.35	0.38	Sandy Lean Clay
	6	8.0	10.0	UD		15									1.00	1.63	Sandy Lean Clay
	7	10.0	12.0	UD		17									1.25	1.88	Sandy Lean Clay
	8	12.5	14.0	SS	24	21					13						Silty Sand
	9	14.5	16.0	SS	19	18											Silty Sand
	10	16.0	18.0	UD		32	92	78	28	50	99		0.80	1.30	2.00	2.25	Fat Clay
	11	18.0	20.0	UD		22									2.25	2.25	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-27A

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-28A	2	0.8	2.0	UD		20	111								0.30	0.13	Sandy Lean Clay
	3	2.0	4.0	UD		15		47	21	26	57				0.88	1.13	Sandy Lean Clay
	4	4.0	6.0	UD		14	116						0.76	0.43	0.88	0.75	Sandy Lean Clay
	5	6.0	8.0	UD		16									0.75	1.13	Sandy Lean Clay
	6	8.0	10.0	UD		16									0.50	0.38	Sandy Lean Clay
	7	10.5	12.0	SS	14	18					29						Silty Sand
	8	12.5	14.0	SS	35	22											Silty Sand
	9	14.0	16.0	UD		30	92	89	31	58	97		0.47	1.15	1.38	1.63	Fat Clay
	10	16.0	18.0	UD		24									2.13	2.25	Fat Clay
	11	18.0	20.0	UD		23									2.13	2.25	Fat Clay
	12	21.0	23.0	UD		26									2.25	2.25	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-28A

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

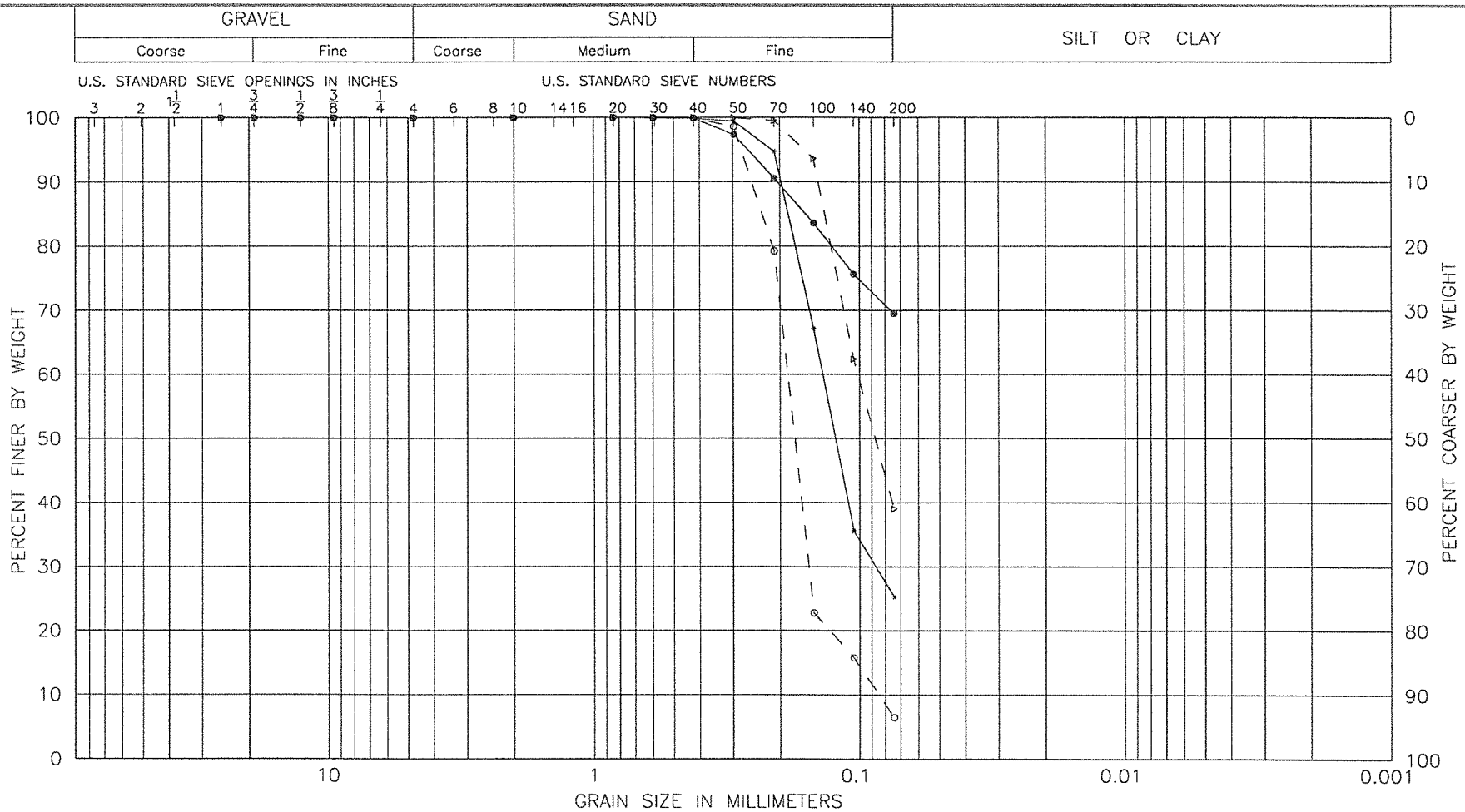
PROJECT NAME: Neighborhood Street Reconstruction (NSR) Project 456
WBS No. N-000388-0001-3
Houston, Texas
PROJECT NUMBER: 1140202901

BORING NO.	SAMPLE No.	SAMPLE Depth (ft.) Top	SAMPLE Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-29	2	0.8	2.0	UD		15	120	25	14	11	63				0.40	0.75	Sandy Lean Clay
	3	2.0	4.0	UD		17	112						0.41	0.29	0.55	0.50	Sandy Lean Clay
	4	4.0	6.0	UD		15									1.00	1.00	Sandy Lean Clay
	5	6.0	8.0	UD		15	121						1.11	0.58	1.38	1.50	Sandy Lean Clay
	6	8.0	10.0	UD		16									2.00	1.75	Sandy Lean Clay
	7	10.0	12.0	UD		16									1.38	1.75	Sandy Lean Clay
	8	12.5	14.0	SS	15	21					13						Silty Sand
	9	14.5	16.0	SS	26	21											Silty Sand
	10	16.0	18.0	UD		25									1.13	1.00	Fat Clay
	11	18.0	20.0	UD		29	95	68	26	42	97		0.62	1.44	1.25	1.50	Fat Clay
	12	21.0	23.0	UD		31									1.50	1.50	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

Job No. 1140202901



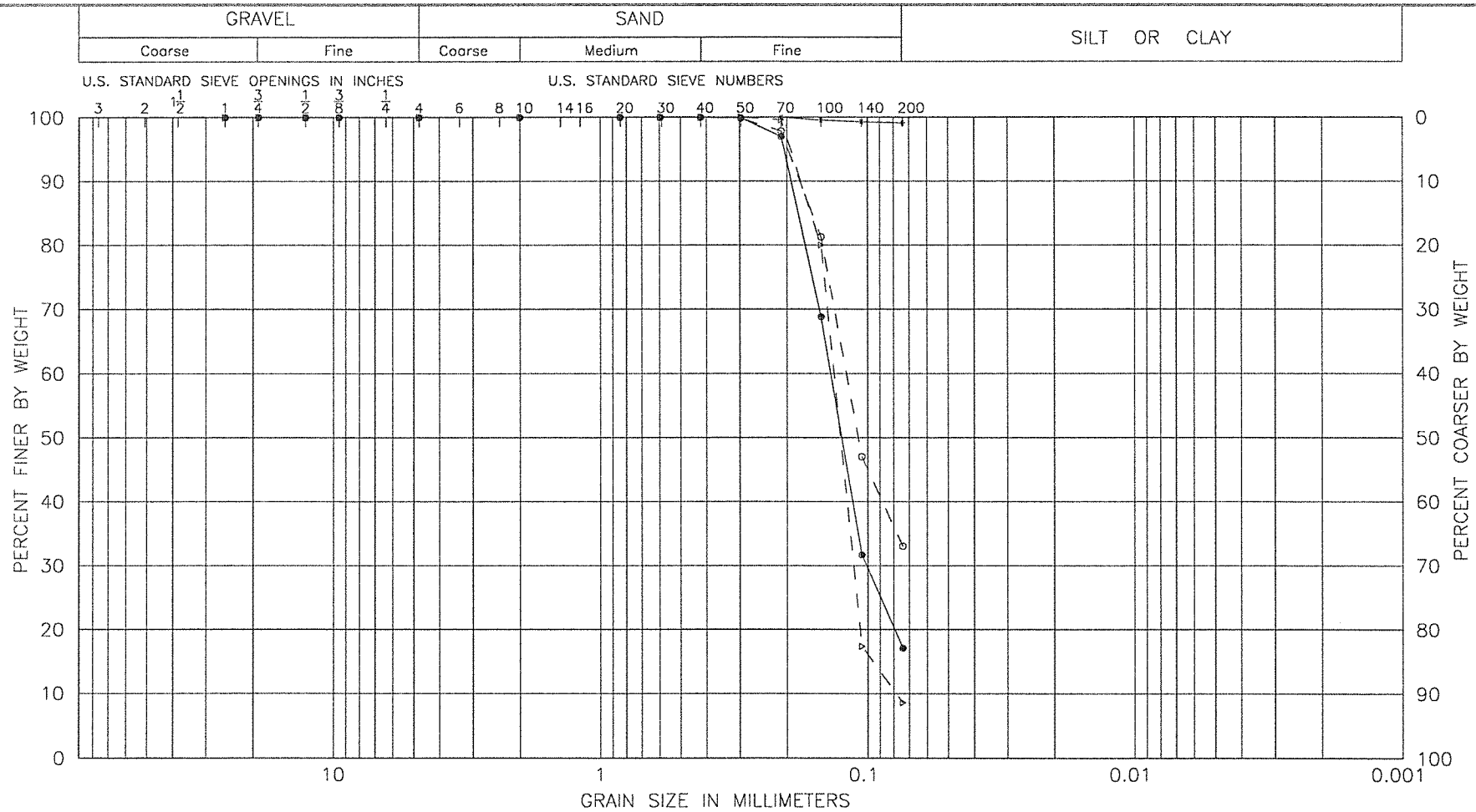
LEGEND	BORING NO.	SAMPLE NO.	DEPTH FT.	SAMPLE DESCRIPTION
●—●—●—●	GB-4	S-8	12.5-14.0	Yellowish brown and gray sandy lean clay
○—○—○—○	GB-5	S-8	12.5-14.0	Gray fine sand w/silt
×—×—×—×	GB-7	S-10	16.5-18.0	Gray silty sand w/clay seams
▷—▷—▷—▷	GB-8	S-8	12.5-14.0	Yellowish brown and gray silty sand

GRAIN SIZE DISTRIBUTION CURVES

Geotest Engineering, Inc.

FIGURE B-30

Job No. 1140202901



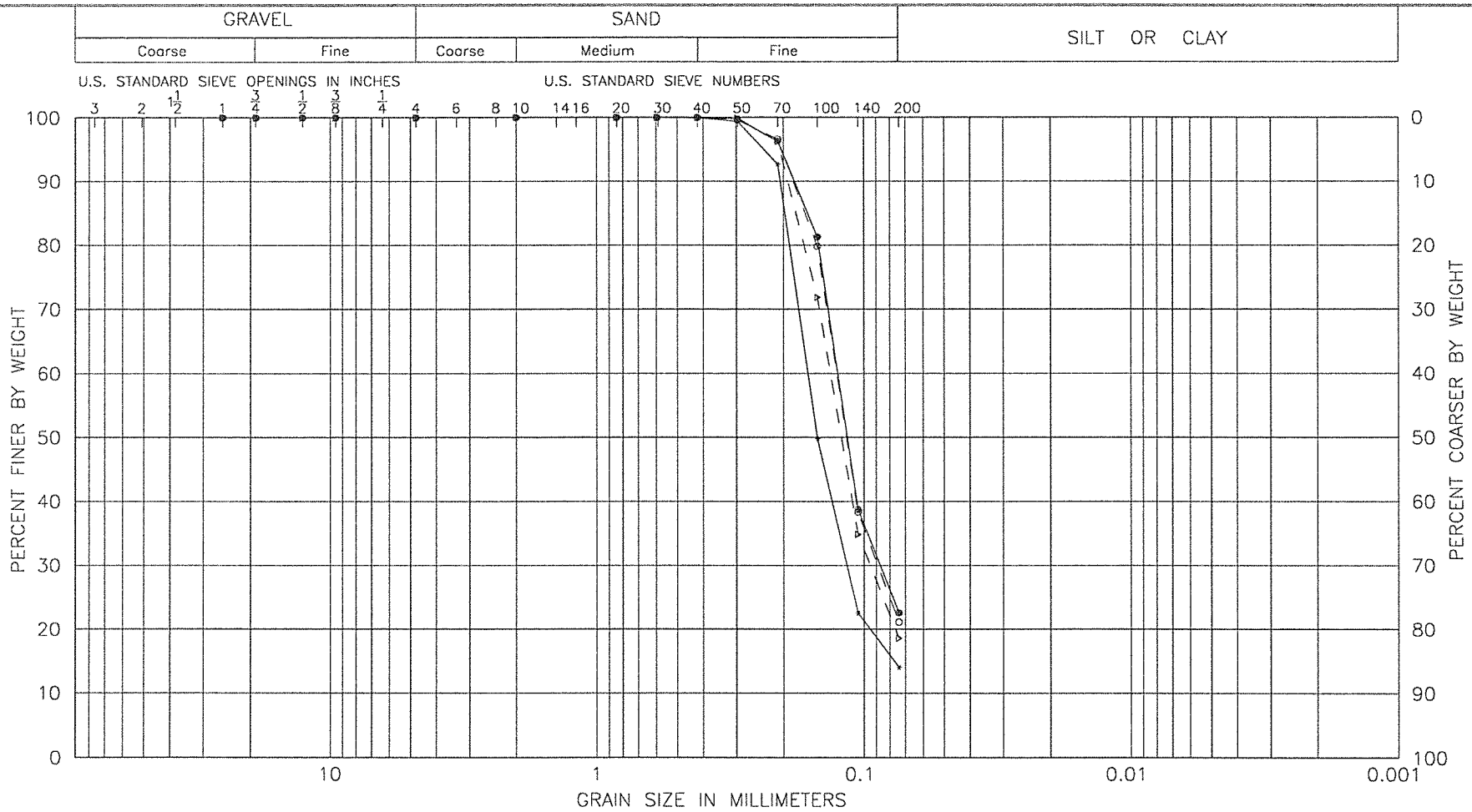
LEGEND	BORING NO.	SAMPLE NO.	DEPTH FT.	SAMPLE DESCRIPTION
●—●—●—●	GB-9	S-8	12.5-14.0	Yellowish brown and gray silty sand
○—○—○—○	GB-10	S-8	12.5-14.0	Yellowish brown and gray silty sand
×—×—×—×	GB-11	S-9	14.5-16.0	Reddish brown and gray fat clay w/calcareous nodules
▷—▷—▷—▷	GB-13	S-9	14.5-16.0	Gray fine sand w/silt

GRAIN SIZE DISTRIBUTION CURVES

Geotest Engineering, Inc.

FIGURE B-31

Job No. 1140202901



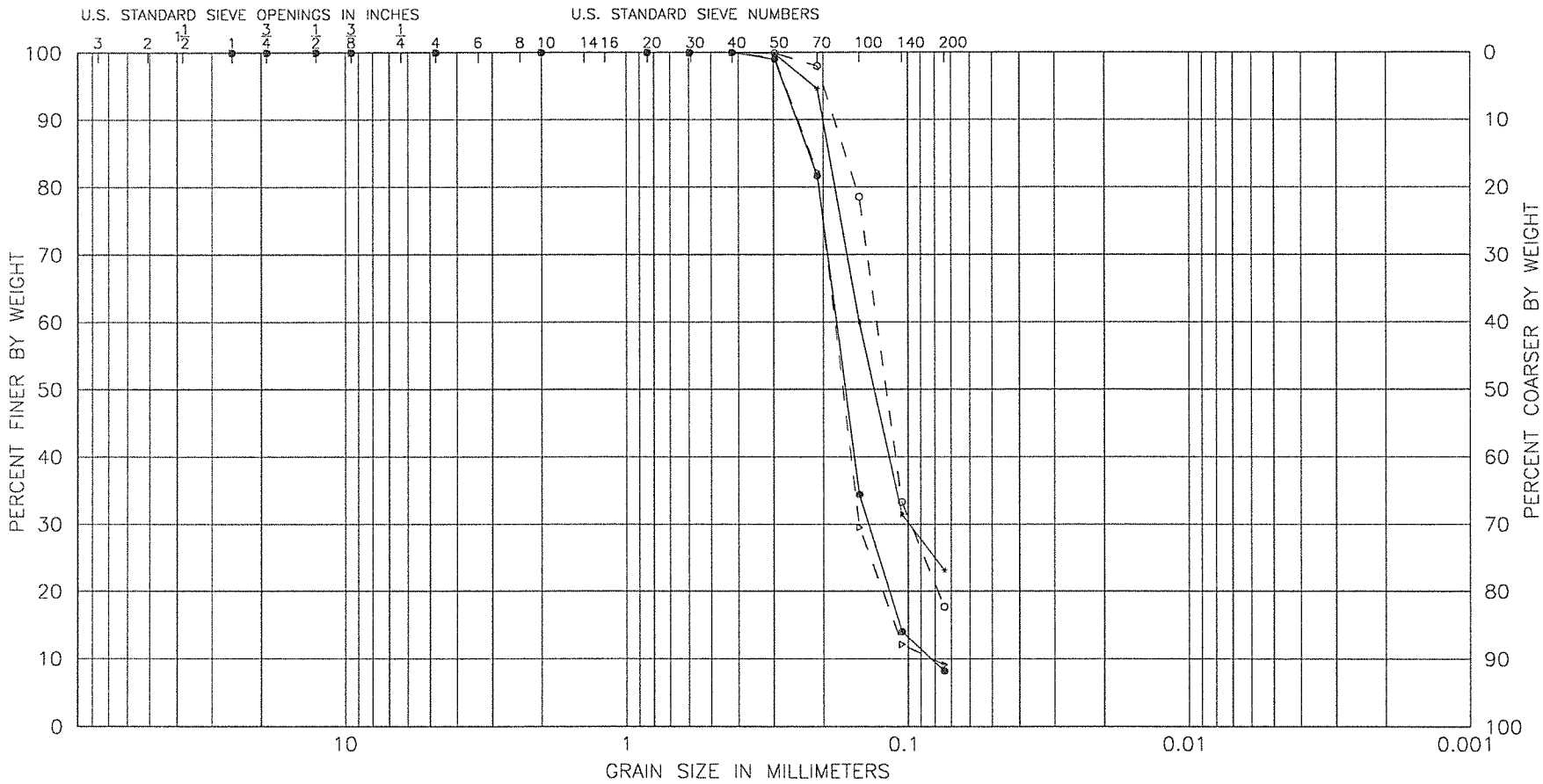
LEGEND	BORING NO.	SAMPLE NO.	DEPTH FT.	SAMPLE DESCRIPTION
	GB-14	S-9	14.5-16.0	Brown and gray silty sand
	GB-15	S-8	12.0-13.5	Gray silty sand
	GB-16	S-8	12.5-14.0	Yellowish brown and gray silty sand
	GB-17	S-8	12.5-14.0	Yellowish brown silty sand

GRAIN SIZE DISTRIBUTION CURVES

Geotest Engineering, Inc.

FIGURE B-32

Job No. 1140202901



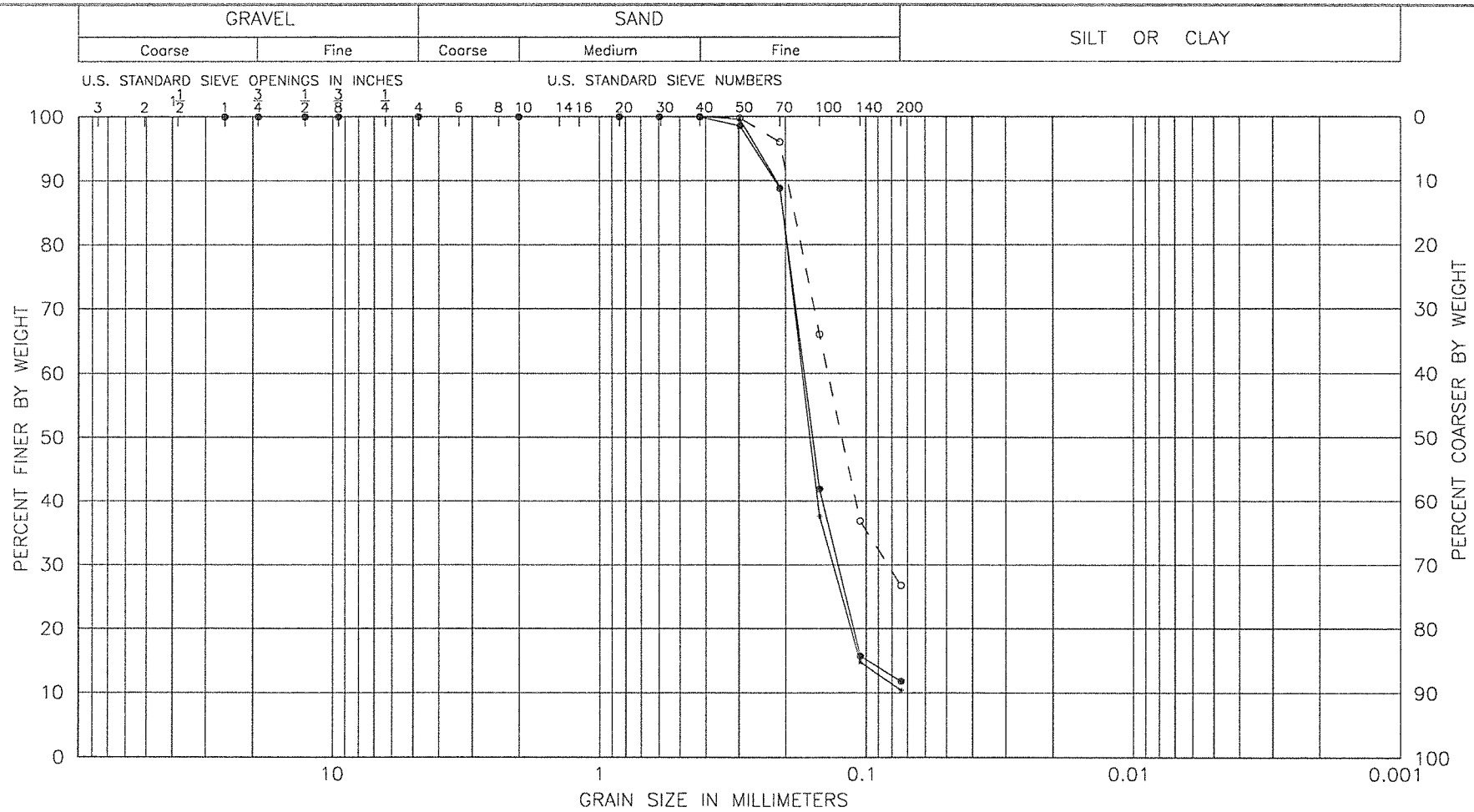
LEGEND	BORING NO.	SAMPLE NO.	DEPTH FT.	SAMPLE DESCRIPTION
●—●—●—●	GB–18	S–9	14.5–16.0	Gray and brown fine sand w/silt
○—○—○—○	GB–19	S–7	10.5–12.0	Gray and brown silty sand
×—×—×—×	GB–21	S–8	12.5–14.0	Brown and gray silty sand
▷—▷—▷—▷	GB–22	S–8	12.5–14.0	Gray fine sand w/silt

GRAIN SIZE DISTRIBUTION CURVES

Geotest Engineering, Inc.

FIGURE B–33

Job No. 1140202901



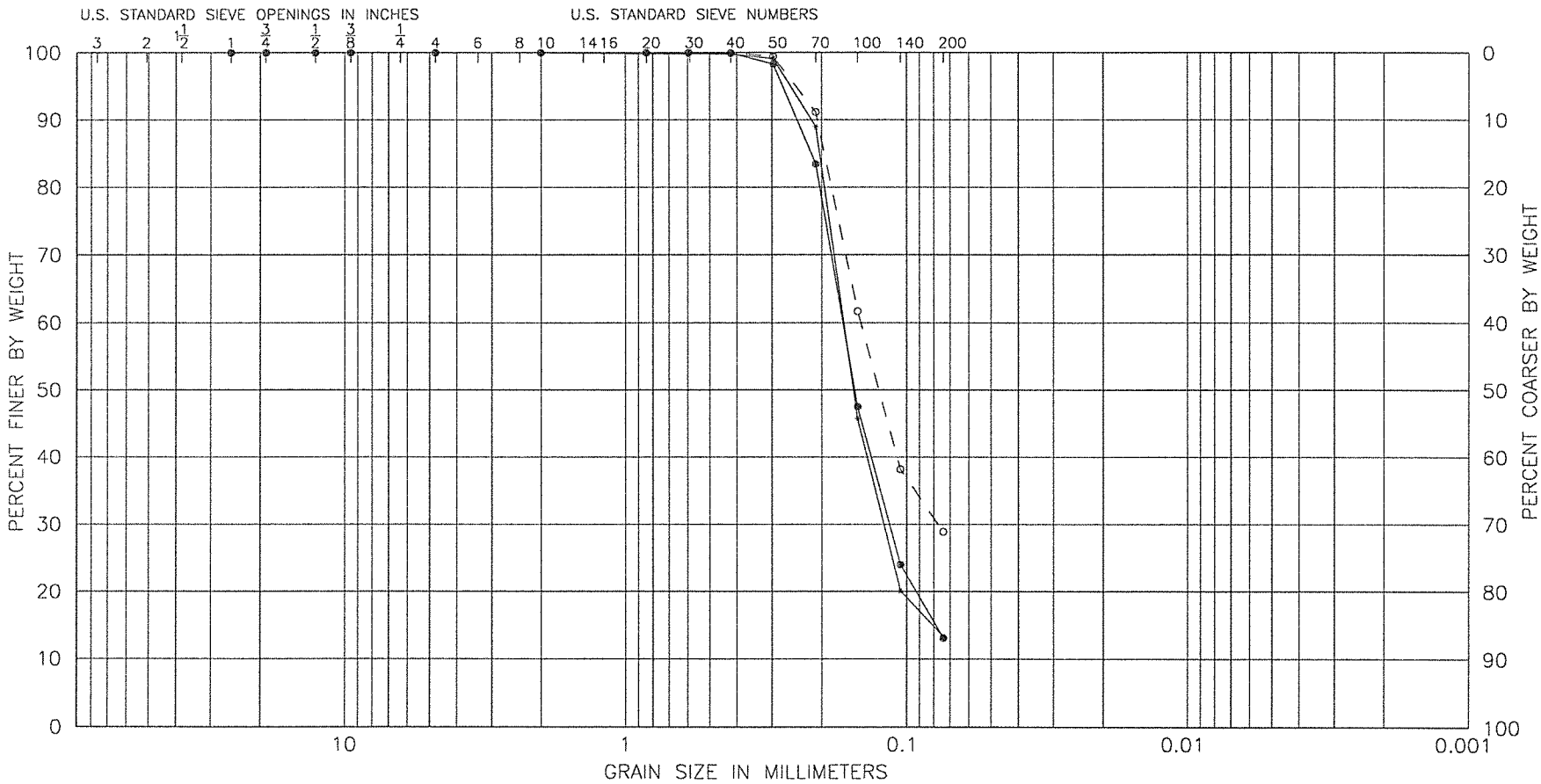
LEGEND	BORING NO.	SAMPLE NO.	DEPTH FT.	SAMPLE DESCRIPTION
●—●—●—●	GB-23	S-8	12.5-14.0	Gray and brown silty sand
○—○—○—○	GB-24B	S-7	10.5-12.0	Yellowish brown and gray silty sand
×—×—×—×	GB-25A	S-7	10.5-12.0	Gray and brown fine sand w/silt

GRAIN SIZE DISTRIBUTION CURVES

Geotest Engineering, Inc.

FIGURE B-34

Job No. 1140202901



LEGEND	BORING NO.	SAMPLE NO.	DEPTH FT.	SAMPLE DESCRIPTION
●—●—●—●	GB-27A	S-8	12.5-14.0	Yellowish brown and gray silty sand
○—○—○—○	GB-28A	S-6	10.5-12.0	Yellowish brown and gray silty sand
×—×—×—×	GB-29	S-8	12.5-14.0	Gray silty sand

GRAIN SIZE DISTRIBUTION CURVES

Geotest Engineering, Inc.

FIGURE B-35

CALIFORNIA BEARING RATIO (CBR) OF LABORATORY-COMPACTED SOILS

ASTM D1883

Project: Neighborhood Street Reconstruction (NSR) Project 456 **Job No.:** 1140202901

Sample Location: Composite Sample GB-1, GB-2, GB-3, GB-5, GB-6, GB-8, GB-9, GB-14, GB-17, GB-19, GB-20, GB-22, GB-23, GB-26 and GB-28 (0'-6')

Sample Description: Brown and gray Lean Clay with sand

Liquid Limit: 31 **Plastic Limit:** 16 **Plasticity Index:** 15

Method of Compaction: ☒ ASTM D698
☐ ASTM D1557

Blows per layer: 10

Sample Condition: ☒ soaked ☐ unsoaked

Dry Density before soaking 103.7 pcf

Dry Density after soaking 103.0 pcf

Moisture Content:

Before compaction	15.0 %
After compaction	15.0 %
Top 1-in layer after soaking	19.0 %
Average after soaking	18.8 %

Swell 0.676 %

Bearing Ratio 1.21 % (☒ soaked ☐ unsoaked)

Surcharge 10 lbs

CALIFORNIA BEARING RATIO (CBR) OF LABORATORY-COMPACTED SOILS

ASTM D1883

Project: Neighborhood Street Reconstruction (NSR) Project 456 **Job No.:** 1140202901

Sample Location: Composite Sample GB-1, GB-2, GB-3, GB-5, GB-6, GB-8, GB-9, GB-14, GB-17, GB-19, GB-20, GB-22, GB-23, GB-26 and GB-28 (0'-6')

Sample Description: Brown and gray Lean Clay with sand

Liquid Limit: 31 **Plastic Limit:** 16 **Plasticity Index:** 15

Method of Compaction: ☒ ASTM D698
☐ ASTM D1557

Blows per layer: 25

Sample Condition: ☒ soaked ☐ unsoaked

Dry Density before soaking 113.2 pcf

Dry Density after soaking 112.8 pcf

Moisture Content:

Before compaction	15.0 %
After compaction	14.9 %
Top 1-in layer after soaking	15.9 %
Average after soaking	15.5 %

Swell 0.349 %

Bearing Ratio 3.75 % (☒ soaked ☐ unsoaked)

Surcharge 10 lbs

CALIFORNIA BEARING RATIO (CBR) OF LABORATORY-COMPACTED SOILS

ASTM D1883

Project: Neighborhood Street Reconstruction (NSR) Project 456 **Job No.:** 1140202901

Sample Location: Composite Sample GB-1, GB-2, GB-3, GB-5, GB-6, GB-8, GB-9, GB-14, GB-17, GB-19, GB-20, GB-22, GB-23, GB-26 and GB-28 (0'-6')

Sample Description: Brown and gray Lean Clay with sand

Liquid Limit: 31 **Plastic Limit:** 16 **Plasticity Index:** 15

Method of Compaction: ☒ ASTM D698
☐ ASTM D1557

Blows per layer: 56

Sample Condition: ☒ soaked ☐ unsoaked

Dry Density before soaking 119.5 pcf

Dry Density after soaking 119.1 pcf

Moisture Content:

Before compaction	14.9 %
After compaction	14.9 %
Top 1-in layer after soaking	15.7 %
Average after soaking	15.3 %

Swell 0.316 %

Bearing Ratio 4.44 % (☒ soaked ☐ unsoaked)

Surcharge 10 lbs

Job No. 11401202901

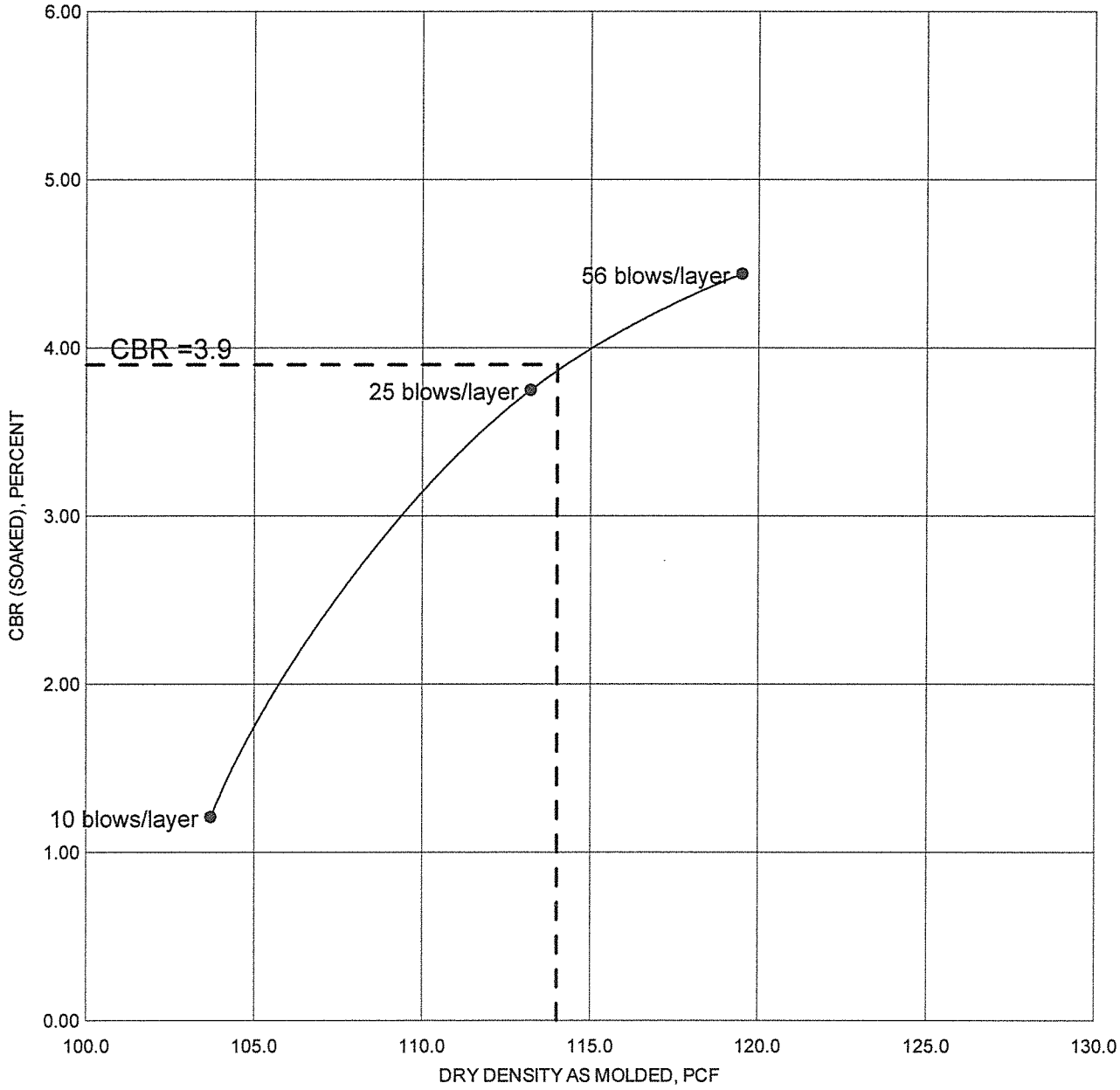
Project: Neighborhood Street Reconstruction (NSR) Project 456

Sample Location: GB-1, GB-2, GB-3, GB-5, GB-6, GB-8, GB-9, GB-14, GB-17, GB-19, GB-20, GB-22, GB-23, GB-26 and GB-28 (0'-6')

Sample Description: Brown and gray Lean Clay with sand

Liquid Limit: 31 **Plastic Limit:** 16 **Plasticity Index:** 15

Dry Density (pcf): 114



DRY DENSITY VERSUS CBR
(ASTM D 1883)

Geotest Engineering, Inc.

FIGURE B-36d

APPENDIX C

Piezometer Installation/Abandonment Reports

STATE OF TEXAS WELL REPORT for Tracking #370580

Owner:	**Geotest Engineering**	Owner Well #:	**GB-1P** NSR
Address:	**5600 Bintliff Houiston , TX 77036**	Grid #:	**65-12-5**
Well Location:	**1015 Wycliff Drive Houston , TX 77079**	Latitude:	**29° 47' 59" N**
Well County:	**Harris**	Longitude:	**095° 34' 30" W**
Elevation:	**No Data**	GPS Brand Used:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Date:	Started: **5/16/2014** Completed: **5/16/2014**
Diameter of Hole:	Diameter: **5 in From Surface To 24 ft**
Drilling Method:	**Hollow Stem Auger**
Borehole Completion:	**Open Hole**
Annular Seal Data:	1st Interval: **From 0 ft to 2 ft with 1 Portland (#sacks and material)** 2nd Interval: **From 2 ft to 5 ft with 1 Bentonite (#sacks and material)** 3rd Interval: **From 5 ft to 24 ft with 8 Sand (#sacks and material)** Method Used: **No Data** Cemented By: **No Data** 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:	**Surface Slab Installed**
Water Level:	Static level: **No Data** Artesian flow: **No Data**
Packers:	**No Data**
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:	**Envirotech Drilling Services 2718 S. Brompton Drve Pearland , TX 77584**
Driller License Number:	**58171**

Licensed Well Driller Signature:	**Jaime Vasquez**
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 **#370580**) 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	**5**	**Grout.**
5	**24**	**Sand.**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
2 in	**New**	**PVC Casing**	**0 to 5**
2 in	**New**	**PVC Screen**	**5 to 24**

STATE OF TEXAS PLUGGING REPORT for Tracking #96021

Owner:	**Geotest Engineering**	Owner Well #:	**GB-1P**
Address:	**5600 Bintliff Houston , TX 77036**	Grid #:	**65-12-5**
Well Location:	**1015 Wycliff Drive Houston , TX 77079**	Latitude:	**29° 47' 59" N**
Well County:	**Harris**	Longitude:	**095° 34' 30" W**
		GPS Brand Used:	**No Data**

Well Type: **Water**

HISTORICAL DATA ON WELL TO BE PLUGGED

Original Well Driller:	**Jaime Vasquez**
Driller's License Number of Original Well Driller:	**58171**
Date Well Drilled:	**5/16/2014**
Well Report Tracking Number:	**370580**
Diameter of Borehole:	**5 in inches**
Total Depth of Borehole:	**24 ft feet**

Date Well Plugged:	**7/29/2014**
Person Actually Performing Plugging Operation:	**Jaime Vasquez**
License Number of Plugging Operator:	**58171**
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: **No Data** 2nd Interval: **No Data** 3rd Interval: **No Data**
Cement/Bentonite Plugs Placed in Well:	1st Interval: **From 0 ft to 2 ft; Sack(s)/type of cement used: 1 Portland** 2nd Interval: **From 2 ft to 5 ft; Sack(s)/type of cement used: 1 Bentonite** 3rd Interval: **From 5 ft to 24 ft; Sack(s)/type of cement used: 9 Sand** 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:	**Envirotech Drilling Services 2718 S. Brompton Drive Pearland , TX 77584** **58171**

Plug Installer License Number:	
Licensed Plug Installer Signature:	**Jaime Vasquez**
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 **#96021**) on your written request.

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

STATE OF TEXAS WELL REPORT for Tracking #370579

Owner:	**Geotest Engineering**	Owner Well #:	**GB-6AP** NSR
Address:	**5600 Bintliff Houiston , TX 77036**	Grid #:	**65-12-5**
Well Location:	**1501 Wycliff Drive Houston , TX 77079**	Latitude:	**29° 47' 59" N**
Well County:	**Harris**	Longitude:	**095° 34' 30" W**
Elevation:	**No Data**	GPS Brand Used:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Date:	Started: **5/16/2014** Completed: **5/16/2014**
Diameter of Hole:	Diameter: **5 in From Surface To 22 ft**
Drilling Method:	**Hollow Stem Auger**
Borehole Completion:	**Open Hole**
Annular Seal Data:	1st Interval: **From 0 ft to 2 ft with 1 Portland (#sacks and material)** 2nd Interval: **From 2 ft to 5 ft with 1 Bentonite (#sacks and material)** 3rd Interval: **From 5 ft to 22 ft with 8 Sand (#sacks and material)** Method Used: **No Data** Cemented By: **No Data** 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:	**Surface Slab Installed**
Water Level:	Static level: **No Data** Artesian flow: **No Data**
Packers:	**No Data**
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:	**Envirotech Drilling Services 2718 S. Brompton Drve Pearland , TX 77584**
Driller License Number:	**58171**

Licensed Well Driller Signature:	**Jaime Vasquez**
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 **#370579**) 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	**5**	**Grout.**
5	**22**	**Sand.**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
2 in	**New**	**PVC Casing**	**0 to 5**
2 in	**New**	**PVC Screen**	**5 to 22**

STATE OF TEXAS PLUGGING REPORT for Tracking #96020

Owner:	**Geotest Engineering**	Owner Well #:	**GB-6AP**
Address:	**5600 Bintliff Houston , TX 77036**	Grid #:	**65-12-5**
Well Location:	**1501 Wycliff Drive Houston , TX 77079**	Latitude:	**29° 47' 59" N**
Well County:	**Harris**	Longitude:	**095° 34' 30" W**
		GPS Brand Used:	**No Data**

Well Type: **Water**

HISTORICAL DATA ON WELL TO BE PLUGGED

Original Well Driller:	**Jaime Vasquez**
Driller's License Number of Original Well Driller:	**58171**
Date Well Drilled:	**5/16/2014**
Well Report Tracking Number:	**370579**
Diameter of Borehole:	**5 in inches**
Total Depth of Borehole:	**22 ft feet**

Date Well Plugged:	**7/29/2014**
Person Actually Performing Plugging Operation:	**Jaime Vasquez**
License Number of Plugging Operator:	**58171**
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: **No Data** 2nd Interval: **No Data** 3rd Interval: **No Data**
Cement/Bentonite Plugs Placed in Well:	1st Interval: **From 0 ft to 2 ft; Sack(s)/type of cement used: 1 Portland** 2nd Interval: **From 2 ft to 5 ft; Sack(s)/type of cement used: 1 Bentonite** 3rd Interval: **From 5 ft to 22 ft; Sack(s)/type of cement used: 8 Sand** 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:	**Envirotech Drilling Services 2718 S. Brompton Drive Pearland , TX 77584** **58171**

Plug Installer License Number:	
Licensed Plug Installer Signature:	**Jaime Vasquez**
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 **#96020**) on your written request.

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

STATE OF TEXAS WELL REPORT for Tracking #370575

Owner:	**Geotest Engineering**	Owner Well #:	**GB-11** NSR
Address:	**5600 Bintliff** **Houiston , TX 77036**	Grid #:	**65-12-5**
Well Location:	**1809 Wycliff Drive** **Houston , TX 77079**	Latitude:	**29° 47' 59" N**
Well County:	**Harris**	Longitude:	**095° 34' 30" W**
Elevation:	**No Data**	GPS Brand Used:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Date:	Started: **5/16/2014** Completed: **5/16/2014**
Diameter of Hole:	Diameter: **5 in From Surface To 21 ft**
Drilling Method:	**Hollow Stem Auger**
Borehole Completion:	**Open Hole**
Annular Seal Data:	1st Interval: **From 0 ft to 2 ft with 1 Portland (#sacks and material)** 2nd Interval: **From 2 ft to 5 ft with 1 Bentonite (#sacks and material)** 3rd Interval: **From 5 ft to 21 ft with 8 Sand (#sacks and material)** Method Used: **No Data** Cemented By: **No Data** 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:	**Surface Slab Installed**
Water Level:	Static level: **No Data** Artesian flow: **No Data**
Packers:	**No Data**
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:	**Envirotech Drilling Services** **2718 S. Brompton Drve** **Pearland , TX 77584**
Driller License Number:	**58171**

Licensed Well Driller Signature:	**Jaime Vasquez**
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 **#370575**) 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 to 5-	**Grout.**
5 to 21-	**Sand.**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
2 in	**New**	**PVC Casing**	**0 to 5**
2 in	**New**	**PVC Screen**	**5 to 21**

STATE OF TEXAS PLUGGING REPORT for Tracking #96019

Owner:	**Geotest Engineering**	Owner Well #:	**GB-11**
Address:	**5600 Bintliff Houston , TX 77036**	Grid #:	**65-12-5**
Well Location:	**1809 Wycliff Drive Houston , TX 77079**	Latitude:	**29° 47' 59" N**
Well County:	**Harris**	Longitude:	**095° 34' 30" W**
		GPS Brand Used:	**No Data**

Well Type: **Water**

HISTORICAL DATA ON WELL TO BE PLUGGED

Original Well Driller:	**Jaime Vasquez**
Driller's License Number of Original Well Driller:	**58171**
Date Well Drilled:	**5/16/2014**
Well Report Tracking Number:	**370575**
Diameter of Borehole:	**5 in inches**
Total Depth of Borehole:	**21 ft feet**

Date Well Plugged:	**7/29/2014**
Person Actually Performing Plugging Operation:	**Jaime Vasquez**
License Number of Plugging Operator:	**58171**
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: **No Data** 2nd Interval: **No Data** 3rd Interval: **No Data**
Cement/Bentonite Plugs Placed in Well:	1st Interval: **From 0 ft to 2 ft; Sack(s)/type of cement used: 1 Portland** 2nd Interval: **From 2 ft to 5 ft; Sack(s)/type of cement used: 1 Bentonite** 3rd Interval: **From 5 ft to 21 ft; Sack(s)/type of cement used: 8 Sand** 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:	**Envirotech Drilling Services 2718 S. Brompton Drive Pearland , TX 77584** **58171**

Plug Installer License Number:	
Licensed Plug Installer Signature:	**Jaime Vasquez**
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 **#96019**) on your written request.

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

STATE OF TEXAS WELL REPORT for Tracking #370583

Owner:	**Geotest Engineering**	Owner Well #:	**GB-17** NSR
Address:	**5600 Bintliff Houiston , TX 77036**	Grid #:	**65-12-5**
Well Location:	**2110 Wycliff Drive Houston , TX 77079** 2029	Latitude:	**29° 47' 59" N**
Well County:	**Harris**	Longitude:	**095° 34' 30" W**
Elevation:	**No Data**	GPS Brand Used:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Date:	Started: **5/16/2014** Completed: **5/16/2014**
Diameter of Hole:	Diameter: **5 in From Surface To 20 ft**
Drilling Method:	**Hollow Stem Auger**
Borehole Completion:	**Open Hole**
Annular Seal Data:	1st Interval: **From 0 ft to 2 ft with 1 Portland (#sacks and material)** 2nd Interval: **From 2 ft to 5 ft with 1 Bentonite (#sacks and material)** 3rd Interval: **From 5 ft to 20 ft with 8 Sand (#sacks and material)** Method Used: **No Data** Cemented By: **No Data** 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:	**Surface Slab Installed**
Water Level:	Static level: **No Data** Artesian flow: **No Data**
Packers:	**No Data**
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:	**Envirotech Drilling Services 2718 S. Brompton Drve Pearland , TX 77584**
Driller License Number:	**58171**

Licensed Well Driller Signature:	**Jaime Vasquez**
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 **#370583**) 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	**5**	**Grout.**
5	**20**	**Sand.**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
2 in	**New**	**PVC Casing**	**0 to 5**
2 in	**New**	**PVC Screen**	**5 to 20**

STATE OF TEXAS PLUGGING REPORT for Tracking #96023

Owner:	**Geotest Engineering**	Owner Well #:	**GB-17**
Address:	**5600 Bintliff Houston , TX 77036**	Grid #:	**65-12-5**
Well Location:	**2110 Wycliff Drive Houston , TX 77079**	Latitude:	**29° 47' 59" N**
Well County:	**Harris**	Longitude:	**095° 34' 30" W**
		GPS Brand Used:	**No Data**

Well Type: **Water**

HISTORICAL DATA ON WELL TO BE PLUGGED

Original Well Driller:	**Jaime Vasquez**
Driller's License Number of Original Well Driller:	**58171**
Date Well Drilled:	**5/16/2014**
Well Report Tracking Number:	**370583**
Diameter of Borehole:	**5 in inches**
Total Depth of Borehole:	**20 ft feet**

Date Well Plugged:	**7/29/2014**
Person Actually Performing Plugging Operation:	**Jaime Vasquez**
License Number of Plugging Operator:	**58171**
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: **No Data** 2nd Interval: **No Data** 3rd Interval: **No Data**
Cement/Bentonite Plugs Placed in Well:	1st Interval: **From 0 ft to 2 ft; Sack(s)/type of cement used: 1 Portland** 2nd Interval: **From 2 ft to 5 ft; Sack(s)/type of cement used: 1 Bentonite** 3rd Interval: **From 5 ft to 20 ft; Sack(s)/type of cement used: 8 Sand** 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:	**Envirotech Drilling Services 2718 S. Brompton Drive Pearland , TX 77584** **58171**

Plug Installer License Number:	
Licensed Plug Installer Signature:	**Jaime Vasquez**
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 **#96023**) on your written request.

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

STATE OF TEXAS WELL REPORT for Tracking #370582

Owner:	**Geotest Engineering**	Owner Well #:	**GB-25AP** NSR
Address:	**5600 Bintliff** **Houiston , TX 77036**	Grid #:	**65-12-5**
Well Location:	**10900 Ivy Ridge** 10907 **Houston , TX 77079**	Latitude:	**29° 47' 59" N**
Well County:	**Harris**	Longitude:	**095° 34' 30" W**
Elevation:	**No Data**	GPS Brand Used:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Date:	Started: **5/14/2014** Completed: **5/14/2014**
Diameter of Hole:	Diameter: **5 in From Surface To 20 ft**
Drilling Method:	**Hollow Stem Auger**
Borehole Completion:	**Open Hole**
Annular Seal Data:	1st Interval: **From 0 ft to 2 ft with 1 Portland (#sacks and material)** 2nd Interval: **From 2 ft to 5 ft with 1 Bentonite (#sacks and material)** 3rd Interval: **From 5 ft to 20 ft with 8 Sand (#sacks and material)** Method Used: **No Data** Cemented By: **No Data** 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:	**Surface Slab Installed**
Water Level:	Static level: **No Data** Artesian flow: **No Data**
Packers:	**No Data**
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:	**Envirotech Drilling Services** **2718 S. Brompton Drve** **Pearland , TX 77584**
Driller License Number:	**58171**

Licensed Well Driller Signature:	**Jaime Vasquez**
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 **#370582**) 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	**5**	**Grout.**
5	**20**	**Sand.**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
2 in	**New**	**PVC Casing**	**0 to 5**
2 in	**New**	**PVC Screen**	**5 to 20**

STATE OF TEXAS PLUGGING REPORT for Tracking #96022

Owner:	**Geotest Engineering**	Owner Well #:	**GB-25AP**
Address:	**5600 Bintliff** **Houston , TX 77036**	Grid #:	**65-12-5**
Well Location:	**10900 Ivy Ridge** **Houston , TX 77079**	Latitude:	**29° 47' 59" N**
Well County:	**Harris**	Longitude:	**095° 34' 30" W**
		GPS Brand Used:	**No Data**

Well Type: **Water**

HISTORICAL DATA ON WELL TO BE PLUGGED

Original Well Driller:	**Jaime Vasquez**
Driller's License Number of Original Well Driller:	**58171**
Date Well Drilled:	**5/14/2014**
Well Report Tracking Number:	**370582**
Diameter of Borehole:	**5 in inches**
Total Depth of Borehole:	**20 ft feet**

Date Well Plugged:	**7/29/2014**
Person Actually Performing Plugging Operation:	**Jaime Vasquez**
License Number of Plugging Operator:	**58171**
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: **No Data** 2nd Interval: **No Data** 3rd Interval: **No Data**
Cement/Bentonite Plugs Placed in Well:	1st Interval: **From 0 ft to 2 ft; Sack(s)/type of cement used: 1 Portland** 2nd Interval: **From 2 ft to 5 ft; Sack(s)/type of cement used: 1 Bentonite** 3rd Interval: **From 5 ft to 20 ft; Sack(s)/type of cement used: 8 Sand** 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:	**Envirotech Drilling Services** **2718 S. Brompton Drive** **Pearland , TX 77584** **58171**

Plug Installer License Number:	
Licensed Plug Installer Signature:	**Jaime Vasquez**
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 **#96022**) on your written request.

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

APPENDIX D

Pavement Design Calculations

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Rigid Design Inputs

Agency: City of Houston
Company: Geotest Engineering, Inc.
Contractor:
Project Description: NSR 456
Location: Wycliff Drive_20YR

Rigid Pavement Design/Evaluation

PCC Thickness	7.66	**inches**	**Load Transfer, J**	3.20	
Design ESALs	1,787,048		**Mod. Subgrade Reaction, k**	89	**psi/in**
Reliability	95.00	**percent**	**Drainage Coefficient, Cd**	1.20	
Overall Deviation	0.35		**Initial Serviceability**	4.50	
Modulus of Rupture	600	**psi**	**Terminal Serviceability**	2.50	
Modulus of Elasticity	3,372,165	**psi**			

Modulus of Subgrade Reaction (k-value) Determination

Resilient Modulus of the Subgrade	4,928.3	**psi**
Resilient Modulus of the Subbase	20,000.0	**psi**
Subbase Thickness	8.00	**inches**
Depth to Rigid Foundation	0.00	**feet**
Loss of Support Value (0,1,2,3)	1.0	

Modulus of Subgrade Reaction	88.50	**psi/in**

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

ESAL Data by Vehicle Type

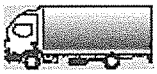
Agency: City of Houston
Company: Geotest Engineering, Inc.
Contractor:
Project Description: NSR 456
Location: Wycliff Drive_20YR

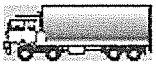
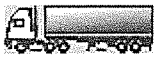
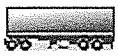
Traffic Factor

Estimated Rigid Thickness	7.66	**inches**
Estimated Structural Number	3.9	
Terminal Serviceability	2.5	
Design Life	20	**years**
Annual Growth Rate	2.00	**percent**
Traffic Input by	Day	

Traffic Input by

Design Lane

Vehicle	Axle Load	Axle Type	Number
	2.00	Single	
	0.00		
	2.00	Single	3,072
	10.00	Single	
	0.00		
	24.00	Single	0
	12.00	Single	
	0.00		
	24.00	Tandem	113

Vehicle	Axle Load	Axle Type	Number
	12.00	Single	
	16.00	Single	
	34.00	Tandem	48
	12.00	Single	
	34.00	Tandem	
	34.00	Tandem	0
	12.00	Single	
	34.00	Tandem	
	34.00	Tandem	
	34.00	Tandem	
	34.00	Tandem	0

Total Rigid ESALs **1,787,048**

Total Flexible ESALs **1,371,737**

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Rigid Design Inputs

Agency: City of Houston
Company: Geotest Engineering, Inc.
Contractor:
Project Description: NSR 456
Location: Other Streets_20YR

Rigid Pavement Design/Evaluation

PCC Thickness	5.51	**inches**	**Load Transfer, J**	3.20	
Design ESALs	546,583		**Mod. Subgrade Reaction, k**	84	**psi/in**
Reliability	80.00	**percent**	**Drainage Coefficient, Cd**	1.20	
Overall Deviation	0.35		**Initial Serviceability**	4.50	
Modulus of Rupture	600	**psi**	**Terminal Serviceability**	2.50	
Modulus of Elasticity	3,372,166	**psi**			

Modulus of Subgrade Reaction (k-value) Determination

Resilient Modulus of the Subgrade	4,928.3	**psi**
Resilient Modulus of the Subbase	20,000.0	**psi**
Subbase Thickness	6.00	**inches**
Depth to Rigid Foundation	0.00	**feet**
Loss of Support Value (0,1,2,3)	1.0	

Modulus of Subgrade Reaction	84.20	**psi/in**

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

ESAL Data by Vehicle Type

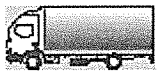
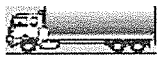
Agency: City of Houston
Company: Geotest Engineering, Inc.
Contractor:
Project Description: NSR 456
Location: Other Streets_20YR

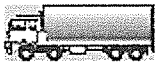
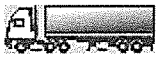
Traffic Factor

Estimated Rigid Thickness	5.51	**inches**
Estimated Structural Number	3.2	
Terminal Serviceability	2.5	
Design Life	20	**years**
Annual Growth Rate	2.00	**percent**
Traffic Input by	Day	

Traffic Input by

Design Lane

Vehicle	Axle Load	Axle Type	Number
	2.00	Single	
	0.00		
	2.00	Single	1,455
	10.00	Single	
	0.00		
	24.00	Single	0
	12.00	Single	
	0.00		
	24.00	Tandem	30

Vehicle	Axle Load	Axle Type	Number
	12.00	Single	
	16.00	Single	
	34.00	Tandem	15
	12.00	Single	
	34.00	Tandem	
	34.00	Tandem	0
	12.00	Single	
	34.00	Tandem	
	34.00	Tandem	
	34.00	Tandem	
	34.00	Tandem	0

Total Rigid ESALs **546,583**

Total Flexible ESALs **417,412**

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Rigid Design Inputs

Agency: City of Houston
Company: Geotest Engineering, Inc.
Contractor:
Project Description: NSR 456
Location: Other Streets_50YR

Rigid Pavement Design/Evaluation

PCC Thickness	7.51	**inches**	**Load Transfer, J**	3.20	
Design ESALs	1,835,881		**Mod. Subgrade Reaction, k**	89	**psi/in**
Reliability	95.00	**percent**	**Drainage Coefficient, Cd**	1.20	
Overall Deviation	0.35		**Initial Serviceability**	4.50	
Modulus of Rupture	630	**psi**	**Terminal Serviceability**	2.50	
Modulus of Elasticity	3,604,997	**psi**			

Modulus of Subgrade Reaction (k-value) Determination

Resilient Modulus of the Subgrade	4,928.3	**psi**
Resilient Modulus of the Subbase	20,000.0	**psi**
Subbase Thickness	8.00	**inches**
Depth to Rigid Foundation	0.00	**feet**
Loss of Support Value (0,1,2,3)	1.0	

Modulus of Subgrade Reaction	88.50	**psi/in**

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

ESAL Data by Vehicle Type

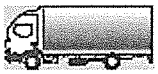
Agency: City of Houston
Company: Geotest Engineering, Inc.
Contractor:
Project Description: NSR 456
Location: Other Streets_50YR

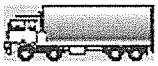
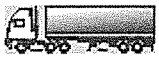
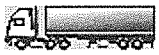
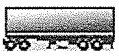
Traffic Factor

Estimated Rigid Thickness	7.51	**inches**
Estimated Structural Number	3.9	
Terminal Serviceability	2.5	
Design Life	50	**years**
Annual Growth Rate	2.00	**percent**
Traffic Input by	Day	

Traffic Input by

Design Lane

Vehicle	Axle Load	Axle Type	Number
	2.00	Single	
	0.00		
	2.00	Single	1,455
	10.00	Single	
	0.00		
	24.00	Single	0
	12.00	Single	
	0.00		
	24.00	Tandem	30

Vehicle	Axle Load	Axle Type	Number
	12.00	Single	
	16.00	Single	
	34.00	Tandem	15
	12.00	Single	
	34.00	Tandem	
	34.00	Tandem	0
	12.00	Single	
	34.00	Tandem	
	34.00	Tandem	
	34.00	Tandem	
	34.00	Tandem	0

Total Rigid ESALs **1,835,881**

Total Flexible ESALs **1,413,281**

Monday, March 2, 2015 10:39:33AM

Engineer: W.M.

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Rigid Design Inputs

Agency: City of Houston
Company: Geotest Engineering, Inc.
Contractor:
Project Description: NSR 456
Location: Wycliff Drive_50YR

Rigid Pavement Design/Evaluation

PCC Thickness	9.05	**inches**	**Load Transfer, J**	3.20	
Design ESALs	5,921,502		**Mod. Subgrade Reaction, k**	98	**psi/in**
Reliability	95.00	**percent**	**Drainage Coefficient, Cd**	1.20	
Overall Deviation	0.35		**Initial Serviceability**	4.50	
Modulus of Rupture	630	**psi**	**Terminal Serviceability**	2.50	
Modulus of Elasticity	3,604,997	**psi**			

Modulus of Subgrade Reaction (k-value) Determination

Resilient Modulus of the Subgrade	4,928.3	**psi**
Resilient Modulus of the Subbase	20,000.0	**psi**
Subbase Thickness	12.00	**inches**
Depth to Rigid Foundation	0.00	**feet**
Loss of Support Value (0,1,2,3)	1.0	

Modulus of Subgrade Reaction	97.70	**psi/in**

Monday, March 2, 2015 10:43:40AM

Engineer: W.M.

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

ESAL Data by Vehicle Type

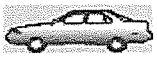
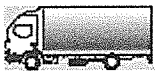
Agency: City of Houston
Company: Geotest Engineering, Inc.
Contractor:
Project Description: NSR 456
Location: Wycliff Drive_50YR

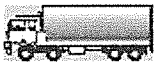
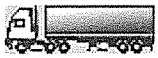
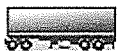
Traffic Factor

Estimated Rigid Thickness	9.05	**inches**
Estimated Structural Number	4.6	
Terminal Serviceability	2.5	
Design Life	50	**years**
Annual Growth Rate	2.00	**percent**
Traffic Input by	Day	

Traffic Input by

Design Lane

Vehicle	Axle Load	Axle Type	Number
	2.00	Single	
	0.00		
	2.00	Single	3,072
	10.00	Single	
	0.00		
	24.00	Tandem	113
	12.00	Single	
	0.00		
	34.00	Tandem	0

Vehicle	Axle Load	Axle Type	Number
	12.00	Single	
	16.00	Single	
	34.00	Tandem	49
	12.00	Single	
	34.00	Tandem	
	34.00	Tandem	0
	12.00	Single	
	34.00	Tandem	
	34.00	Tandem	
	34.00	Tandem	
	34.00	Tandem	0

Total Rigid ESALs **5,921,502**

Total Flexible ESALs **4,217,321**