HJA
HENLEY | JOHNSTON
& ASSOCIATES

geotechnical and construction materials consultants

December 29, 2017
Report No. 16721G - Revised

Urban Edge Developers, Ltd.
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RE: Geotechnical Investigation
Urban Commons
LBJ and Forest Lane
Dallas, Texas

Gentlemen:

Presented herein is the report of a geotechnical investigation conducted by Henley-Johnston & Associates, Inc. for the above referenced project. Information contained herein is based on the initial geotechnical investigation conducted in July 2016, and the additional work performed in December 2017.

We appreciate the opportunity to provide this report to you. If we can be of further service or if you desire any additional information, please do not hesitate to call.

Signed,

HENLEY-JOHNSTON & Associates, Inc.

Benjamin Clarke

James F. Phipps

JAMES F. PHIPPS
84778

Benjamin Clarke, E.I.T.
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The seal appearing on this document was authorized by James F. Phipps, P.E. 84778 on December 29, 2017.

Firm Registration No.: F-1238
Copies submitted (1) Urban Edge Developers, Ltd. – Diane Cheatham

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INVESTIGATION AND ANALYSIS

Introduction

This report presents the results of a subsurface investigation performed for the Urban Commons residential development located north of the Forest Lane and LBJ Highway intersection in Dallas, Texas. It was understood that approximately 60 residential lots are to be part of this development. The purpose of this investigation was to evaluate subsurface conditions and provide recommendations for design and construction of the foundation and proposed retaining wall. It was anticipated that ground-supported slabs would be used to provide foundation support.

The initial phase of this investigation was conducted in July 2016. Borings 11 and 13 were not accessible for the drilling equipment at that time. These borings were completed in December 2017 after clearing of the site and development of the residential lots.

Both phases of this investigation were conducted in accordance with the “Recommended Practice for the Design of Residential Foundations” produced by the Texas Section American Society of Civil Engineers.

This report is specific to this phase of the development. Persons using the recommendations herein for projects and/or designs not covered by this report do so at their own risk.

Field and Laboratory Investigation

Due to the size and layout of the project, subsurface conditions were evaluated using 13 soil borings. Locations of the borings were dictated by site accessibility and presented on Plates 1 and 2. Borings were drilled using a truck-mounted rig equipped with continuous flight augers and extended to depths of 10 to 15 feet below existing (July 2016 and December 2017) grades. Drilling and sampling were done in general accordance with ASTM methods and standards. Relatively undisturbed samples of cohesive soil were obtained with three-inch diameter Shelby tubes. Weathered and unweathered limestone were evaluated using the TxDOT Cone Penetration Test (CPT).

All samples were transported back to the laboratory for visual classification and testing. Soils were visually classified according to the Unified Soil Classification System (USCS). Rock materials were described using standard geologic nomenclature. The Boring Logs and a key to terms and symbols used on the logs are attached.

Selected samples were tested to evaluate engineering properties, soil movement, and confirm visual classification. Tests conducted included Atterberg Limits (ASTM D-4318), moisture content determinations (ASTM D-2216) and partial gradations (percent passing No. 200 Sieve). Absorption Pressure-Swell and Free-Swell tests were conducted to evaluate the potential for soil related heave. The strengths of selected samples were investigated by Unconfined Compression tests. Results of the laboratory tests are presented on Plates 3 through 6.

The unconsolidated-undrained multi-stage triaxial compression test was performed on a selected cohesive sample. In this test, performed in general accordance with ASTM D 2850, a cylindrical sample is enclosed in a membrane and subjected to a confining pressure of about one-half the estimated overburden pressure. The sample is loaded axially to incipient failure while not permitting drainage from the specimen. Upon reaching incipient failure, the confining pressure is doubled and the specimen again loaded to incipient failure. This process is repeated a third time and the sample is loaded past failure. The results of these tests are summarized on Plate 6 and are presented graphically on Plate 7 as stress-strain curves and Mohr’s diagrams.

Surface and Subsurface Conditions

At the time of the field investigation the property was open and undeveloped. Within the depths drilled, subsurface conditions consisted of fill and residual (i.e. formed in place) clay soils over weathered and unweathered limestone associated with the Upper Cretaceous Austin Chalk Formation.

At the surface of Boring Nos.1 through 3, 5, 7, 10, 11, 12, and 13, fill clay was encountered. This fill material was generally brown and gray in appearance, moderately plastic (CL) and extended to depths of 1 to 6 feet below existing grades. Calcareous particles, limestone fragments, and gravel were encountered within the fill material at varying concentrations.

Residual clays were located directly below the fill material and at the surface of Boring Nos. 4, 6 and 8. The residual clay soils generally ranged with depth from dark brown to light brown in appearance, and from highly plastic (CH) to moderately plastic (CL). These soils contained varying amounts of calcareous particles and limestone fragments. The clays continued to depths of 1-1/2 to 12 feet below existing grades and were underlain by severely weathered to weathered limestone.

Severely weathered to weathered limestone was encountered at the surface of Boring No. 9 and directly underlying the clay and fill material. The weathered limestone was soft to moderately hard (rock hardness classification), tan in appearance, and was underlain by unweathered limestone at depths of 7 to 13 feet below existing grades. This unweathered limestone was hard, gray in appearance, and continued through the termination depth of the borings.

Based on soil moisture and pocket penetrometer values, the soil profiles across the site varied from moist to dry at the time of the field investigation.

Ground water was not encountered during the field investigation. The presence and depth to ground water should be expected to change with seasonal rainfall. When present, ground water will perch above the gray unweathered limestone, migrating through the open cracks and fractures of the overlying weathered rock.

Potential Vertical Movement Analysis

Soil movements within residual clay soils are seasonal in nature. After periods of rain, the clays expand resulting in heave of overlying elements. During dry seasons, these soils shrink which results in settlement of ground-supported features.

Potential Vertical Movements (PVM) were evaluated using TxDOT Method 124E[1] and results of the Absorption Pressure-Swell tests. Based on this analysis, total soil movements from a dry to saturated state are anticipated to be on the order of 1 to 2 inches. This is considering that less than 2 feet of additional fill is placed below the foundation under controlled conditions as outlined in the **Earthwork Recommendations** section.

If a foundation were to be constructed over a dry subgrade, greater amounts of movement should be anticipated.

This office should be allowed to review final grading plans to evaluate if changes to the estimated PVM are warranted due to planned cuts and fills across the site.

DESIGN AND CONSTRUCTION RECOMMENDATIONS

Introduction

It is anticipated that a ground-supported foundation will be used for structural support. Considering PVM of 1 to 2 inches for dry conditions, remedial earthwork is not considered necessary for this site. Recommendations for design and construction of the foundation are presented in the following sections.

Foundation Recommendations

Current literature indicates 4 to 4-1/2 inches is the maximum amount of movement a ground supported, stiffened slab can withstand. Considering PVM on the order of 1 to 2 inches, a ground supported, stiffened slab may be used if some post-construction movement is acceptable. If no movement can be tolerated, a suspended floor coupled with a pier and beam foundation should be used. Recommendations for this type of design can be provided upon request.

Ground-Supported Foundation Recommendations

A ground-supported foundation may be either conventionally reinforced or post-tensioned. A conventionally reinforced foundation may be designed using the Wire Reinforcement Institute (WRI) and/or the Building Research and Advisory Board (BRAB)[2] method. For this site, an

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[1] "Method for Determining the Potential Vertical Rise, PVR." Texas Department of Transportation Method Tex-124-E, 1978.

[2] Building Research Advisory Board, "Report 33 to the Federal Housing Administration Criteria for Selection and Design of Residential Slab-on-Ground," Publication 1571 National Academy of Sciences, Washington, D.C., 1968.

Average Weighted Plasticity Index (PI_w) of 29 was used. Considering slopes of less than 5% and using an unconfined compressive strength (Q_u) of 4 kips per square foot (ksf), a Slope Correction Factor (C_S) of 1.0 and an Over-consolidation Correction Factor (C_O) of 0.85 should be used with the WRI Method. This results in an Effective PI of 25. A Climatic Rating (C_W) of 20 is considered appropriate for this site.

Based on the above values, a Support Index (C) of 0.86 is applicable for the BRAB Method, and a value of 0.10 (1-C) should be used for a WRI design. With the WRI method, a cantilevered length (l_c) of 3.8 feet was derived using the previous information.

Design of post-tensioned slabs is based on the Edge Moisture Variation Distance (e_m), and the anticipated Differential Movements (y_m) that can occur over this distance e_m. The e_m is based on the amount of anticipated annual rainfall and is derived from the Thornthwaite Index (TI). This index is measured in inches and indicates the amount of rainfall above or below the amount needed to support plant growth. It has been found that irrigation and landscaping can increase the TI by several inches. For this project a modified TI of +10 was used.

Differential movements (y_m) for design of slabs can be determined according to the Post-Tensioning Institute (PTI)[3]. Differential movements for center lift and edge lift conditions are based on type of clay minerals, velocity of moisture flow through the subgrade, and depth to constant soil suction. If the adverse effects of vegetation, site drainage, and slope have been corrected, differential movements may be calculated using the method presented in the PTI manual.

Based on experience in the North Texas area, differential movements for slabs on-ground can approach the total potential movement estimated from laboratory test results.

The e_m and y_m values presented in Table 1 were derived using the PTI method. These values were modified considering the effect of irrigation on the TI and the results of the PVM analysis. Values in Table 1 may be used for dry subsurface conditions.

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[3] *Design and Construction of Post-Tensioned Slabs-on-Ground*, 3rd Edition, Post-Tensioning Institute, Phoenix, AZ (2008).

Table 1 **PTI DESIGN VALUES for DRY CONDITIONS** **(PVM = 1 to 2 inches)** **Urban Commons** **LBJ and Forest Lane – Dallas, Texas**		
Lift Condition	**Edge Moisture Variation Distance e_m (ft.)**	**Differential Movement y_m (in.)**
Center Lift	8.7	1.1
Edge Lift	4.4	1.7

Grade beams should penetrate a minimum of 12 inches below finished grade and rest on undisturbed soil, tan limestone, or compacted and tested fill. Beams bearing on undisturbed soil or fill may be sized using an allowable net bearing pressure of 3.0 ksf. Beams bearing on competent, tan limestone may be sized using an allowable net bearing pressure of 6.0 ksf. These allowable bearing value contains a Factor of Safety of 3 considering a shear failure.

The foundation should be designed to conform to the stiffness criteria presented in Table 6.2 of the current PTI Manual for different types of construction.

Pier Recommendations

If piers will be used to limit the amount of differential movement, these foundations should be designed as straight-shaft elements and penetrate either a minimum of 3 feet into competent, tan weathered limestone which was located at depths of 1-1/2 to 12 feet, or 1 foot into the gray unweathered limestone which was encountered at depths of 7 to 13 feet below existing grades. All piers should have a minimum overall length of 6 feet.

Piers founded in the tan weathered limestone may be designed for an allowable end bearing of 10.0 ksf, and skin friction of 1.6 ksf. Both of these values may be used considering a Factor of Safety of 3 against a shear or plunging failure. The piers may be designed against uplift using a negative skin friction of 1.0 ksf. The skin friction values should only be applied to that portion of the pier shaft below the minimum penetration of 3 feet into the tan weathered limestone.

Piers founded in the gray unweathered limestone should be designed for an allowable end bearing of 30.0 ksf, and skin friction of 4.6 ksf. Both of these values may be used considering a Factor of Safety of 3 against a shear or plunging failure. The piers may be designed against uplift using a negative skin friction of 3.5 ksf. These skin friction values should only be applied to that portion of the pier shaft below the minimum penetration of 1-foot into the gray limestone. Piers founded within the gray limestone may also include the skin friction developed from contact with the tan limestone for that portion of a shaft within the weathered rock.

Piers will also be subjected to uplift forces associated with heaving of the subsurface soils. These forces will be approximately 0.6 ksf acting over the upper 4 feet of the pier shaft surface area. Resistance to uplift will be a function of the dead weight of the concrete in the pier, foundation loads, and negative skin friction.

The weight of the concrete may be neglected when determining foundation loads.

Settlements of approximately ½-inch should be anticipated with a pier foundation.

A minimum clear spacing of two shaft diameters should be maintained between individual piers.

Pier shaft excavations should be clean of all debris and dry prior to placement of concrete. Ground water was not encountered during drilling operations within the depth drilled. Ground water may develop after periods of prolonged rainfall and/or irrigation. It is recommended an allowance be made for the use of temporary casing in the event water is encountered during pier construction. Concrete should be placed within eight hours after each shaft is drilled.

Excess concrete at the top of the pier shaft should be removed prior to placement of the exterior grade beam. This is to reduce the potential for soils to swell against the foundation.

Construction Considerations

Expansion joints should be installed at locations selected by the architect to allow for deflection of interior walls.

All loose soils, debris, and water should be removed from grade beam and pier excavations prior to placing concrete. The width and depth of grade beams should not vary across the length of the beam.

A vapor barrier should be installed below the slab. All penetrations and joints should be sealed to lower the potential for migration of moisture through the floor. Plastic sheeting used for vapor retarders below the slabs should be draped or cut in such a way as to allow concrete to be placed directly against the sidewalls of the grade beam excavations.

Sand and gravel should not be used to bed utility lines. Utility excavations should be backfilled using on-site soils placed under controlled conditions as outlined in the **Earthwork Recommendations** section. As a minimum, a four-foot long clay plug should be installed below the exterior grade beam where utility lines transition below the foundation. This clay plug should be installed as outlined in the **Earthwork Recommendations** section. If possible, all utility trenches should be sloped to drain away from the foundation.

Positive drainage away from the foundation should be established during construction and maintained throughout the life of the structure. Landscaping beds should be designed and maintained to prevent water from ponding next to the foundation. Ponded water will increase subsurface moisture and consequently increase the potential for heave.

Irrigation lines or heads should not be placed directly next to the foundation. It is recommended that all irrigation lines be kept a minimum of five feet from the edge of the structures.

If possible, trees should not be planted directly next to the house. Over time, vegetation will desiccate the clays, resulting in shrinkage of the subgrade. This shrinkage will be manifested as settlement of ground supported foundations. All trees should be planted a minimum of 1-1/2 times the mature height of the tree from the foundation. If trees will be planted next to the structure, consideration should be given to installing a vertical root barrier between the tree and the foundation. As a minimum the barrier should consist of a four-inch wide lean concrete wall extending either to the top of the tan weathered limestone, or to a depth of 6 feet from finished grades, whichever occurs first. An alternative is to use a minimum 6-mil thick plastic sheet draped within the excavation and backfilled using sand or gravel. Alternately, a “root-barrier” system similar to that produced by DeepRoot® may be installed around the perimeter of the foundation. Vegetation should be planted outside of the root barrier, away from the foundation. Grade beams penetrating at least 6 inches into the tan limestone will also act as a root barrier.

Any trees to be cleared from or within ten feet of the building pad should have the root systems removed and the excavations filled with on-site soils placed under controlled conditions. Soils should be placed as presented in the **Earthwork Recommendations** section.

Retaining Wall Recommendations

Site retaining walls may be designed based on lateral earth pressures that will act against it. The magnitude of pressure will be a function of the type of materials used to backfill against the walls. Considering the use of on-site materials, an equivalent fluid pressure of 55 pounds per cubic foot (pcf) can be used for “active conditions”. For the “at-rest” condition, an equivalent fluid pressure of 75 pcf should be used. The volume of soil that will act against the wall may be calculated as a wedge having an angle of 35^0 past the vertical at the base of the wall and extending into the retained slope.

Resistance to sliding will be a function of “passive” earth pressure, friction between the base of the wall and the underlying soils, and the weight of the soil over the toe of the wall. A passive earth pressure of 295 pcf can be used to estimate resistance to sliding. A value of 0.35 may also be used to evaluate friction between the base and limestone. For any situation where the wall is resting on clay, an adhesion of 200 psf should be used. If applicable, a dry unit weight of 100 pcf may be used to estimate the dead weight of the soil over the toe of the wall.

Proper drainage should be provided behind any wall to limit the development of hydrostatic pressures. As a minimum, a 4-inch diameter, perforated flexible pipe wrapped in filter fabric should be placed at the base of the wall. This pipe should be installed on a minimum 2% slope and discharge at the end of the wall. The pipe should be placed in a minimum 12-inch by 12-inch gravel bed. The gravel should conform to ASTM C-57 standards and be wrapped in filter fabric. Place the pipe with a minimum of 2 inches of gravel between the subgrade and the bottom of the pipe.

Weeps should also be installed along the wall on approximate 10-foot center. These weeps should consist of minimum 2-inch diameter PVC pipes inclined on at least a 5% slope to drain towards the front of the wall. The interior end of the weeps should be capped with filter fabric to limit the loss of the fine material from behind the wall. Weeps should communicate with the gravel drain behind the wall.

On-site soils used to backfill behind the wall should be placed in accordance with the **Earthwork Recommendations** section. The final two feet of fill behind the wall should consist of on-site clays, compacted to a minimum of 95% (ASTM D-698) with a moisture content of +1 percentage points of optimum.

Alternately, free draining gravel meeting the requirements of ASTM C 57 for gradation may be used as backfill within the prescribed 35^0 envelope. A lateral earth pressure of 45 pcf may be used to design the wall if gravel backfill is used.

Gravel backfill should be placed in maximum 6-inch loose lifts and compacted using remote operated rollers until there is no noticeable consolidation of the material. Additional lifts may then be added to raise the grade behind the wall.

Retaining walls may be founded on shallow strip footings if some movement of the walls is acceptable. Footings may be designed using an allowable bearing capacity of 3.0 kips per square foot (ksf) at a depth of 2 feet below finished grade and bear on undisturbed soils or tested and compacted fill. Footings bearing on tan limestone may be sized using an allowable net bearing pressure of 6.0 ksf. This allowable bearing value contains a Factor of Safety of 3 considering a shear failure. The walls should be designed to accommodate total settlements of approximately 1 inch, with differential settlements not to exceed ¾ of an inch.

Earthwork Recommendations

Prior to construction, the site should be stripped of all organic soils. Areas that will underlay fill or pavement should be proof-rolled prior to fill operations. Any soft areas should be excavated to firm soils (pocket penetrometer reading of 2.0 tons per square foot or greater), and then filled using on-site materials. On-site soils should be placed in maximum eight-inch loose lifts and compacted to a minimum of 95% of the maximum density as determined by ASTM D-698. Moisture content should be a minimum of +2% above optimum.

If additional fill will be required to bring the pad to finished subgrade, on-site soils or equivalent should be used. <u>These soils should be placed and compacted to the moisture and density as outlined above.</u>

Excavated limestone used as fill should be reduced to a maximum nominal diameter of 3 inches and placed in maximum 8-inch loose lifts. Limestone fragments should be compacted to a minimum of 95% (ASTM D-698) with moisture contents between –2 and +3 percentage points of optimum.

If required, imported select fill should have a Liquid Limit of 30 or less and a Plasticity Index of 5 to 15. Select fill should be placed in maximum 8-inch loose lifts and compacted to a dry density between 95 and 98 percent of the maximum dry density obtained by the Standard Proctor Compaction Test (ASTM D 698). The moisture content of the compacted soils should be maintained between –2 and +2 percent of the optimum value (determined from ASTM D 698).

Fill around perimeter grade beams should be on site clay, cleaned of all construction debris and placed in a controlled manner as discussed in the previous paragraph. Use of clean, compacted fill will lower the potential for water to migrate below the slab and into the subgrade soils.

Construction Testing and Observation

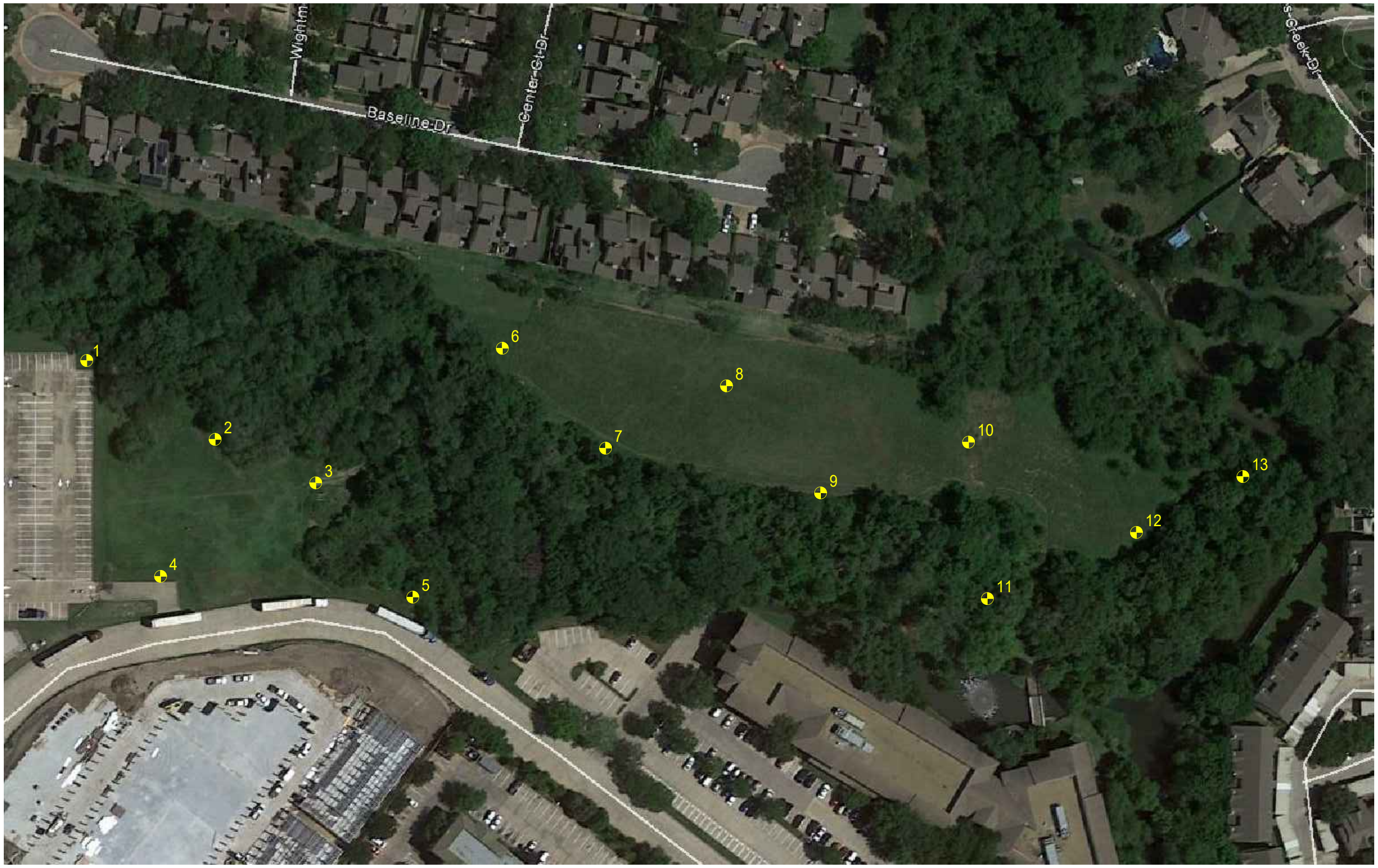
It is recommended that a representative of Henley-Johnston & Associates, Inc. be retained to visually inspect the foundation excavation prior to placement of concrete to confirm proper bearing stratum and adherence with the recommendations of this report.

All soils used to construct the building pads may consist of on-site materials or equivalent. These soils should be placed under controlled conditions as outlined above. Each pad should be tested for the proper levels of moisture and density at a rate of one test per lift for every building pad.

Field density testing is not considered necessary for those pads where only cut is required to achieve finished elevation. Pads with less than 1 foot of fill will also not require density testing. Field density testing must be conducted during placement of fill. Samples of the fill material should be submitted to the testing laboratory a minimum of 72 hours prior to commencing earthwork operations to allow for evaluation of the maximum density and optimum moisture of the fill soils.

LEGEND

◐ SOIL BORING



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NOT TO SCALE

HENLEY | JOHNSTON & ASSOCIATES

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TEXAS FIRM REGISTRATION NO. F-1238

URBAN COMMONS
LBJ AND FOREST LANE
DALLAS, TEXAS

HJA No.: 16721G

DATE: JULY 2016

BORING LOCATION PLAN

PLATE 1

LEGEND

◐ SOIL BORING

Urban Commons - Diagrammatic Site Plan

06 June 2016

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TEXAS FIRM REGISTRATION NO. F-1238

URBAN COMMONS
LBJ AND FOREST LANE
DALLAS, TEXAS

BORING LOCATION PLAN

HJA No.: 16721G

DATE: JULY 2016

PLATE 2

GEOTECHNICAL INVESTIGATION
REPORT NO. 16721G
URBAN COMMONS
LBJ AND FOREST LANE
DALLAS, TEXAS

SUMMARY OF INDEX PROPERTIES

BORING NUMBER	DEPTH (ft.)	LIQUID LIMIT (%)	PLASTIC INDEX	DUW (pcf)	FINER #200 (%)	MOISTURE CONTENT (%)	UNIFIED SOIL CLASSIFICATION
1	0.0 – 1.0					11.0	
1	1.0 – 2.0					10.6	
1	2.0 – 3.0					7.9	
2	0.0 – 1.0					9.5	
2	1.0 – 2.0	38	19	100.9		9.7	CL
2	2.0 – 3.0					11.0	
3	0.0 – 1.0					12.6	
3	1.0 – 2.0					13.5	
3	2.0 – 3.0	47	24	99.2		16.3	CL
3	3.0 – 4.0				42.2	11.6	
3	4.0 – 5.0					16.2	
4	0.0 – 1.0					9.8	
4	1.0 – 2.0					7.3	
5	0.0 – 1.0					11.8	
5	1.0 – 2.0				63.4	13.7	
5	2.0 – 3.0					9.0	
5	3.0 – 4.0					14.9	
5	4.0 – 5.0					12.0	
6	0.0 – 1.0					15.9	
6	1.0 – 2.0	43	24			15.6	CL
6	2.0 – 3.0					15.7	
7	0.0 – 1.0					15.4	
7	1.0 – 2.0					19.3	

SUMMARY OF INDEX PROPERTIES

BORING NUMBER	DEPTH (ft.)	LIQUID LIMIT (%)	PLASTIC INDEX	DUW (pcf)	FINER #200 (%)	MOISTURE CONTENT (%)	UNIFIED SOIL CLASSIFICATION
7	2.0 – 3.0					18.5	
7	3.0 – 4.0	42	22	99.7		17.8	CL
7	4.0 – 5.0					14.6	
7	5.0 – 6.0					14.7	
8	0.0 – 1.0					14.2	
8	1.0 – 2.0	43	21			15.0	CL
8	2.0 – 3.0					14.6	
9	0.0 – 1.0					11.3	
9	1.0 – 2.0					12.9	
9	2.0 – 3.0					13.5	
10	0.0 – 1.0					14.9	
10	1.0 – 2.0	46	27			19.2	CL
10	2.0 – 3.0			108.2		20.3	
10	3.0 – 4.0					20.4	
10	4.0 – 5.0					22.6	
10	5.0 – 6.0					22.3	
10	6.0 – 7.0					20.3	
11	0.0 – 1.0					15.8	
11	1.0 – 2.0				89.8	17.1	
11	2.0 – 3.0					15.7	
11	3.0 – 4.0					14.7	
11	4.0 – 5.0	45	17	113.3		15.7	
11	5.0 – 6.0					16.3	
11	6.0 – 7.0					15.5	
11	7.0 – 8.0					10.4	

SUMMARY OF INDEX PROPERTIES

BORING NUMBER	DEPTH (ft.)	LIQUID LIMIT (%)	PLASTIC INDEX	DUW (pcf)	FINER #200 (%)	MOISTURE CONTENT (%)	UNIFIED SOIL CLASSIFICATION
12	0.0 – 1.0					10.8	
12	1.0 – 2.0					22.3	
12	2.0 – 3.0					28.3	
12	3.0 – 4.0	59	35	91.9		27.3	CH
12	4.0 – 5.0					23.3	
12	5.0 – 6.0			109.8		20.6	
12	6.0 – 7.0					21.3	
12	7.0 – 8.0					20.5	
12	8.0 – 9.0	47	28	104.5		20.3	CL
12	9.0 – 10.0					22.1	
13	0.0 – 1.0					11.9	
13	1.0 – 2.0	42	27	111.8		11.7	CL
13	2.0 – 3.0					10.1	
13	4.0 – 5.0					7.3	
13	6.0 – 7.0					12.2	
13	7.0 – 8.0					10.9	
13	8.0 – 9.0					10.7	
13	9.0 – 10.0	42	26	113.5		11.4	CL

SUMMARY OF FREE-SWELL TESTS

BORING NUMBER	DEPTH (ft.)	SWELL PRESSURE (psf)	GAIN IN MOISTURE (%)	PERCENT SWELL (%)	MATERIAL DESCRIPTION
11	4.0 – 5.0	576.0	8.2	3.0	CLAY, hard, brown
13	1.0 – 2.0	144.0	7.3	3.5	FILL: CLAY, hard, light brown and light gray
13	9.0 – 10.0	1,296.0	3.5	0.0	CLAY, hard, light brown

SUMMARY OF ABSORPTION PRESSURE-SWELL TESTS

BORING NUMBER	DEPTH (ft.)	SWELL PRESSURE (psf)	GAIN IN MOISTURE (%)	PERCENT SWELL (%)	MATERIAL DESCRIPTION
2	1.0 – 2.0	970.0	11.0	0.6	FILL: CLAY, hard, gray and light brown
7	3.0 – 4.0	466.0	7.1	0.4	CLAY, hard, brown
12	3.0 – 4.0	349.0	3.8	0.2	CLAY, very stiff to hard, dark brown
12	8.0 – 9.0	272.0	2.6	0.0	CLAY, very stiff, light brown

SUMMARY OF UNCONFINED COMPRESSION TESTS - SOIL

BORING NUMBER	DEPTH (ft.)	PEAK STRESS (psi)	FAILURE STRAIN (%)	MATERIAL DESCRIPTION
3	2.0 – 3.0	75.7	4.2	FILL: CLAY, hard, light brown and light gray
10	2.0 – 3.0	38.7	6.7	CLAY, very stiff, brown

SUMMARY OF UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TESTS -SOIL

BORING NUMBER	DEPTH (ft.)	PEAK STRESS (psi)	FAILURE STRAIN (%)	MATERIAL DESCRIPTION
12	5.0 – 6.0	48.0	24.2	CLAY, hard, brown

TEXAS FIRM REGISTRATION NO. F-1238

LEGEND, LITHOLOGY, SOIL CONSISTENCY & RELATIVE ROCK HARDNESS

Urban Commons
LBJ and Forest Lane
Dallas, Texas

OF BORINGS:
PROJECT No.: 16721G
DRILL DATE: 12/14/17
METHOD: Shelby Tube to 11'

Strata symbols

▨	LOW PLASTICITY CLAYS, SANDY CLAYS, OR GRAVELLY CLAYS (CL)
▦	LIMESTONE, weathered
▦	LIMESTONE, unweathered
▨	HIGH PLASTICITY CLAYS (CH)
▩	FILL

Misc. Symbols

✕	Pocket Penetrometer (tsf)
⊗	TxDOT CPT (inches per 100 blows)

Soil Samplers

▯	Undisturbed thick wall Shelby tube
⊠	TxDOT CPT
▧	Auger bag sample

FOR SANDS, GRAVELS, & SANDY SILTS

Modified from Peak, Hanson & Thornburn (1974)

Consistency	Standard Penetration Resistance (N)
Very Loose	Less than 4
Loose	4 to 10
Medium Dense	10 to 30
Dense	30 to 50
Very Dense	Greater than 50

FOR CLAYS AND SANDY CLAYS
(COHESIVE SOILS)

Modified from Peak, Hanson & Thornburn (1974)

Consistency	Unconfined Compression (tsf)	Standard Penetration Resistance (N)
Very Soft	Less than 0.25	Less than 2
Soft	0.25 to 0.5	2 to 4
Medium Stiff	0.5 to 1.0	4 to 8
Stiff	1.0 to 2.0	8 to 15
Very Stiff	2.0 to 4.0	15 to 30
Hard	Greater than 4.0	Greater than 30

RELATIVE HARDNESS MODIFIERS (ROCK)
(RELATED TO FRESH SAMPLE)

Modified from SCS EWP, Tech Guide No. 4

Hardness	Rule of Thumb Test
Soft	Permits denting by moderate finger pressure
Firm	Resists denting by fingers but can be penetrated by pencil point to medium to shallow depth (No. 2 pencil)
Mod. Hard	Very shallow penetration of pencil point, can be scratched by knife and in some instances cut with knife
Hard	No pencil penetration, can be scratched with knife, can be broken by light to moderate hammer blows
Very Hard	Cannot be scratched by knife, can be broken by repeated hammer blows

HENLEY | JOHNSTON & ASSOCIATES

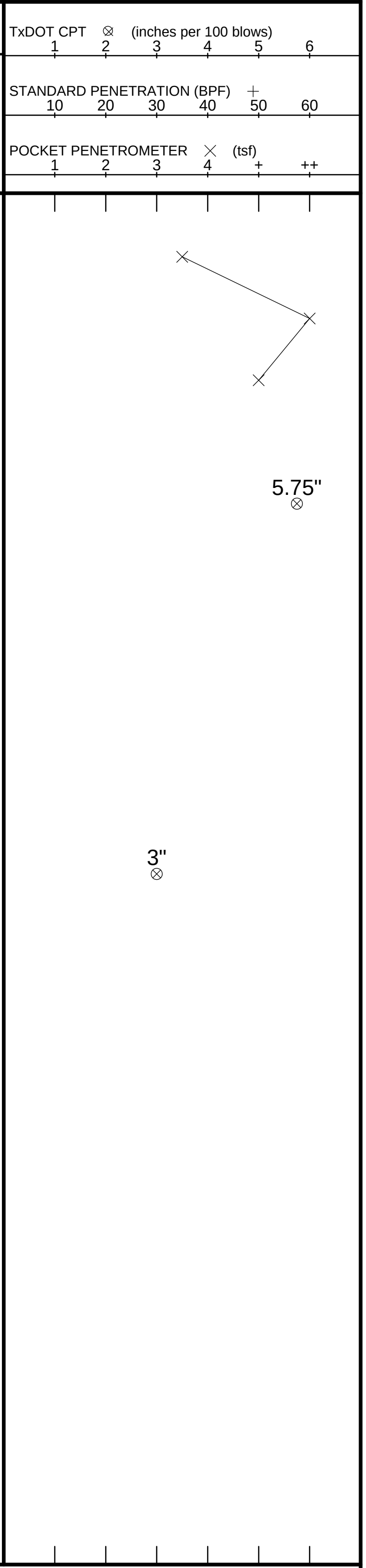
DRILL DATE: 7/26/16
METHOD: Shelby Tube to 11'

LOG OF BORING

Urban Commons
LBJ and Forest Lane
Dallas, Texas

PROJECT No.:	16721G
BORING No.:	1
STATION:	
SHEET:	1 of 1
LOCATION:	See Plate 1
GROUND ELEVATION:	

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	CORE RECOVERED (ft.)	CORE RQD (%)
0	FILL: CLAY, with calcareous nodules and limestone fragments, very stiff to hard, light gray and brown			
2.5	LIMESTONE, severely weathered, soft, tan			
3	LIMESTONE, weathered, moderately hard, tan			
9	LIMESTONE, hard, gray			
11	TOTAL DEPTH: 11.0'			



Ground Water During Drilling (ft.): DRY
Ground Water at Completion (ft.): DRY

HENLEY | JOHNSTON & ASSOCIATES

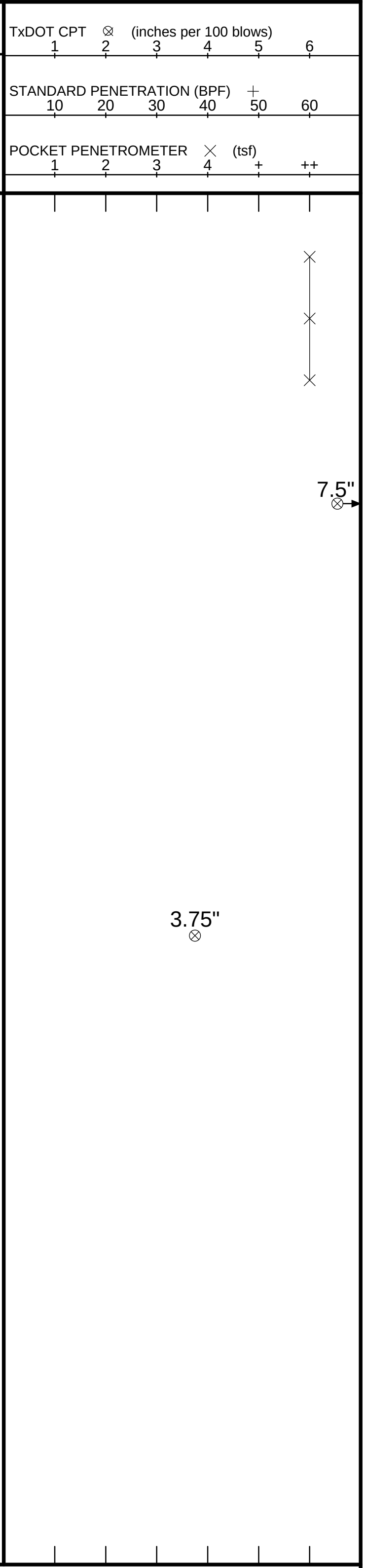
DRILL DATE: 7/26/16
METHOD: Shelby Tube to 12'

LOG OF BORING

Urban Commons
LBJ and Forest Lane
Dallas, Texas

PROJECT No.:	16721G
BORING No.:	2
STATION:	
SHEET:	1 of 1
LOCATION:	See Plate 1
GROUND ELEVATION:	

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION (feet)	CORE RECOVERED (ft.)	CORE RQD (%)
0			FILL: CLAY, with limestone fragments, calcareous nodules and subangular to subrounded gravel, hard, brown, gray and light brown			
3						
			LIMESTONE, weathered, moderately hard, tan			
6						
9						
			LIMESTONE, hard, gray			
12			TOTAL DEPTH: 12.0'			
15						
18						
21						



Ground Water During Drilling (ft.): DRY
Ground Water at Completion (ft.): DRY

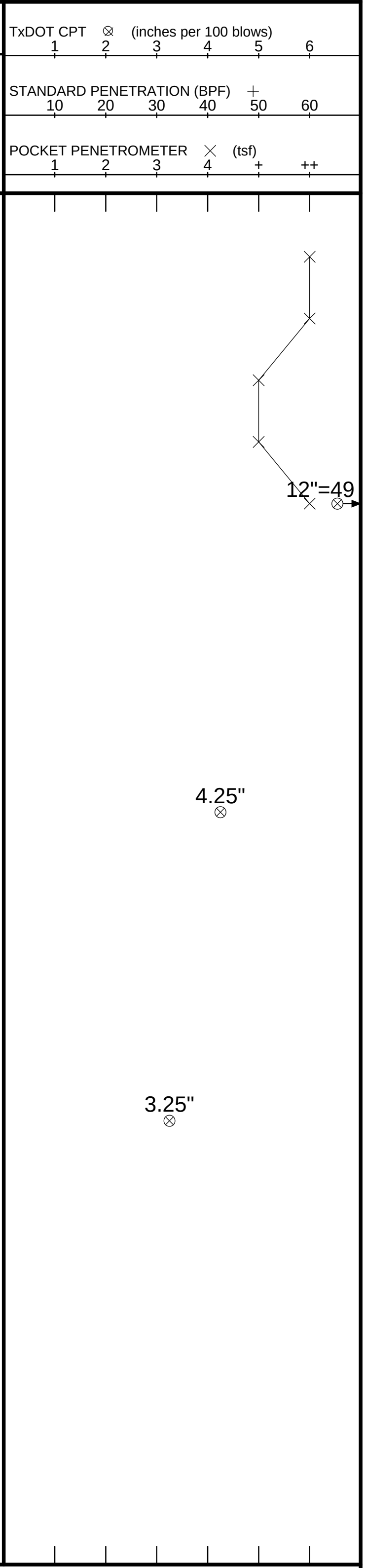
DRILL DATE: 7/26/16
METHOD: Shelby Tube to 15'

LOG OF BORING

Urban Commons
LBJ and Forest Lane
Dallas, Texas

PROJECT No.: 16721G
BORING No.: 3
STATION:
SHEET: 1 of 1
LOCATION: See Plate 1
GROUND ELEVATION:

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION (feet)	CORE RECOVERED (ft.)	CORE RQD (%)
0			FILL: CLAY, with limestone fragments and calcareous nodules, hard, brown, light brown and light gray			
3						
			LIMESTONE, weathered, moderately hard, tan			
6						
9						
12						
			LIMESTONE, hard, gray			
15			TOTAL DEPTH: 15.0'			
18						
21						



Ground Water During Drilling (ft.): DRY
Ground Water at Completion (ft.): DRY

HENLEY | JOHNSTON & ASSOCIATES

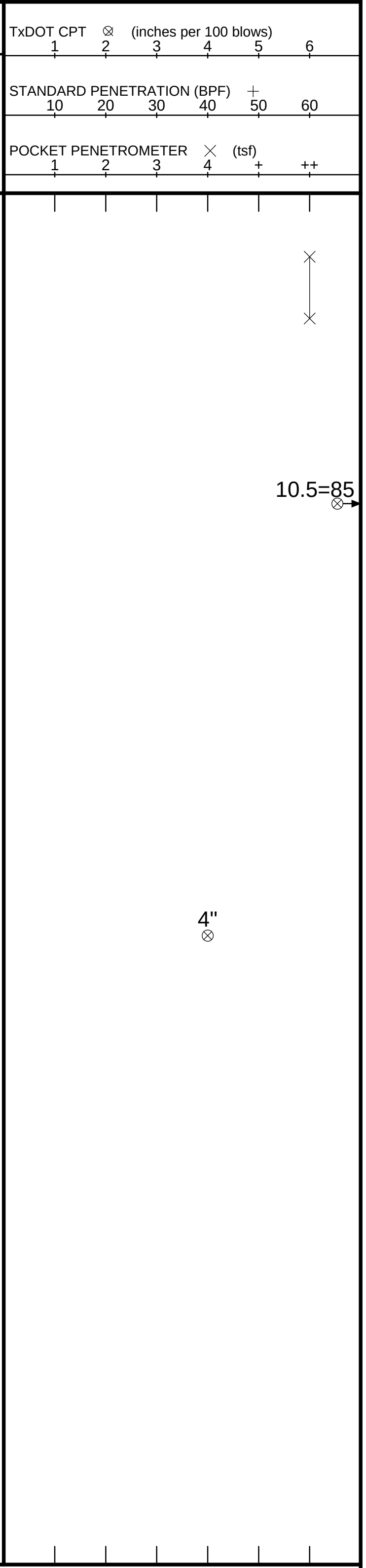
DRILL DATE: 7/26/16
METHOD: Shelby Tube to 12'

LOG OF BORING

Urban Commons
LBJ and Forest Lane
Dallas, Texas

PROJECT No.: 16721G
BORING No.: 4
STATION:
SHEET: 1 of 1
LOCATION: See Plate 1
GROUND ELEVATION:

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION (feet)	CORE RECOVERED (ft.)	CORE RQD (%)
0			CLAY, slightly silty, with calcareous nodules and limestone fragments, hard, brown			
			LIMESTONE, severely weathered, soft, tan			
			LIMESTONE, weathered, moderately hard, tan			
3						
6						
9			LIMESTONE, hard, gray			
12			TOTAL DEPTH: 12.0'			
15						
18						
21						



Ground Water During Drilling (ft.): DRY
Ground Water at Completion (ft.): DRY

HENLEY | JOHNSTON & ASSOCIATES

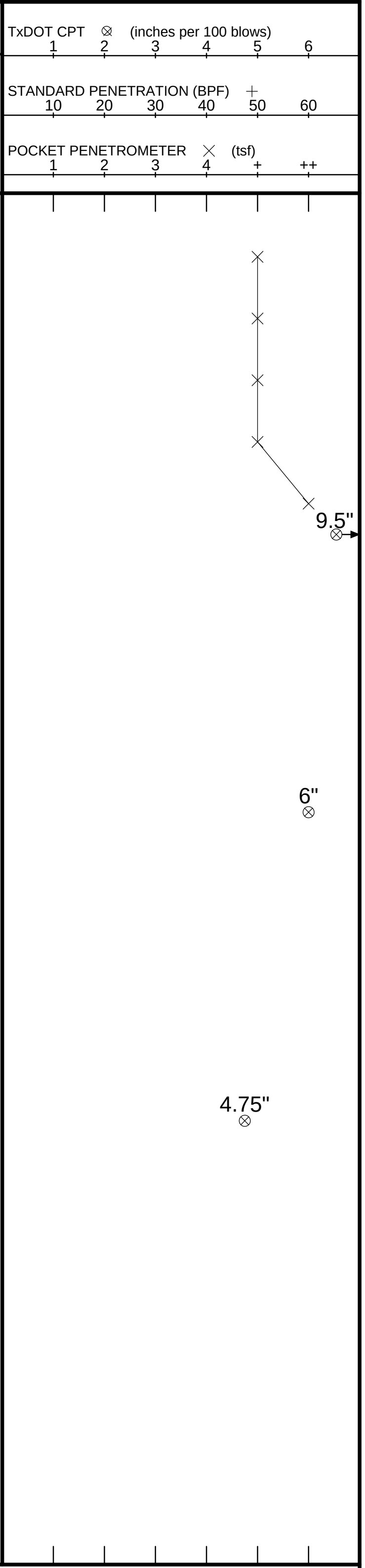
DRILL DATE: 7/26/16
METHOD: Shelby Tube to 15'

LOG OF BORING

Urban Commons
LBJ and Forest Lane
Dallas, Texas

PROJECT No.:	16721G
BORING No.:	5
STATION:	
SHEET:	1 of 1
LOCATION:	See Plate 1
GROUND ELEVATION:	

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION (feet)	CORE RECOVERED (ft.)	CORE RQD (%)
0			FILL: CLAY, with limestone fragments and calcareous nodules, hard, brown, light brown and light gray			
3			CLAY, slightly silty, with calcareous nodules and limestone fragments, hard, brown			
			LIMESTONE, weathered, moderately hard, tan			
12			LIMESTONE, hard, gray			
15			TOTAL DEPTH: 15.0'			



Ground Water During Drilling (ft.): DRY
Ground Water at Completion (ft.): DRY

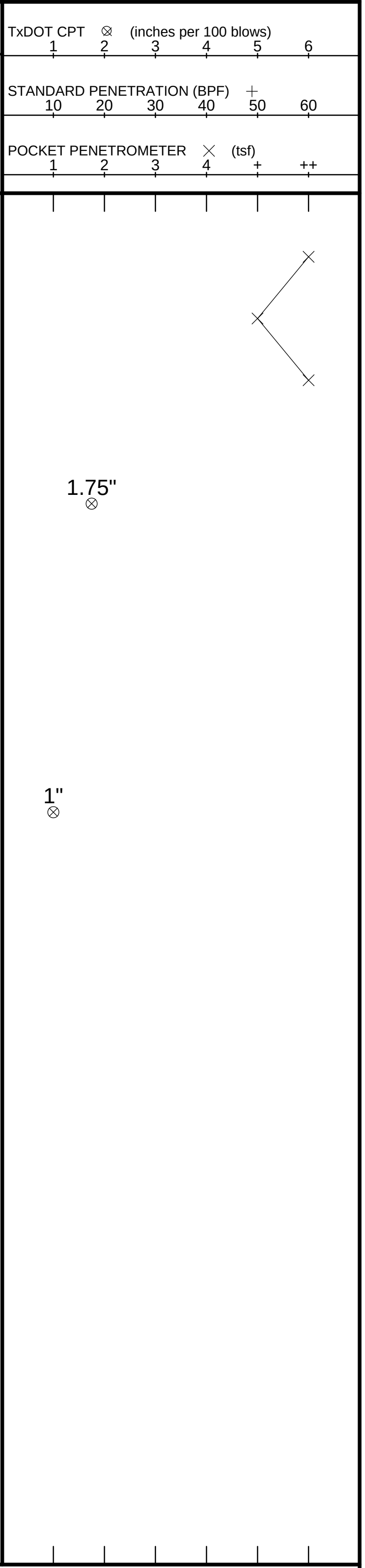
DRILL DATE: 7/26/16
METHOD: Shelby Tube to 10'

LOG OF BORING

Urban Commons
LBJ and Forest Lane
Dallas, Texas

PROJECT No.: 16721G
BORING No.: 6
STATION:
SHEET: 1 of 1
LOCATION: See Plate 1
GROUND ELEVATION:

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION (feet)	CORE RECOVERED (ft.)	CORE RQD (%)
0			CLAY, slightly silty, with calcareous nodules, hard, brown			
3			LIMESTONE, severely weathered, soft, tan			
6			LIMESTONE, weathered, moderately hard, tan			
9			LIMESTONE, hard, gray			
			TOTAL DEPTH: 10.0'			
12						
15						
18						
21						



Ground Water During Drilling (ft.): DRY
Ground Water at Completion (ft.): DRY

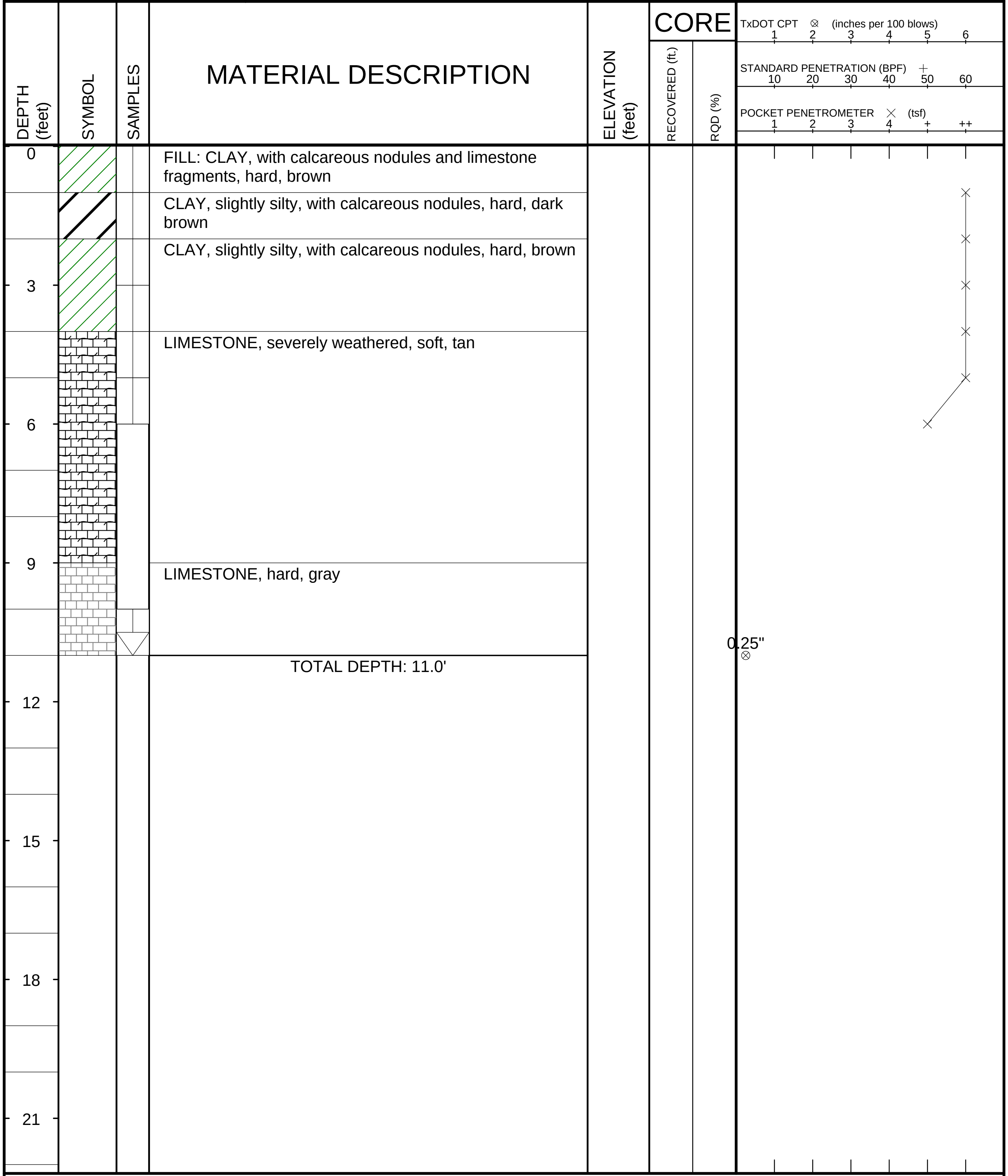
HENLEY | JOHNSTON & ASSOCIATES

DRILL DATE: 7/26/16
METHOD: Shelby Tube to 11'

LOG OF BORING

Urban Commons
LBJ and Forest Lane
Dallas, Texas

PROJECT No.: 16721G
BORING No.: 7
STATION:
SHEET: 1 of 1
LOCATION: See Plate 1
GROUND ELEVATION:



FILL: CLAY, with calcareous nodules and limestone fragments, hard, brown

CLAY, slightly silty, with calcareous nodules, hard, dark brown

CLAY, slightly silty, with calcareous nodules, hard, brown

LIMESTONE, severely weathered, soft, tan

LIMESTONE, hard, gray

TOTAL DEPTH: 11.0'

Ground Water During Drilling (ft.): DRY
Ground Water at Completion (ft.): DRY

HENLEY | JOHNSTON & ASSOCIATES

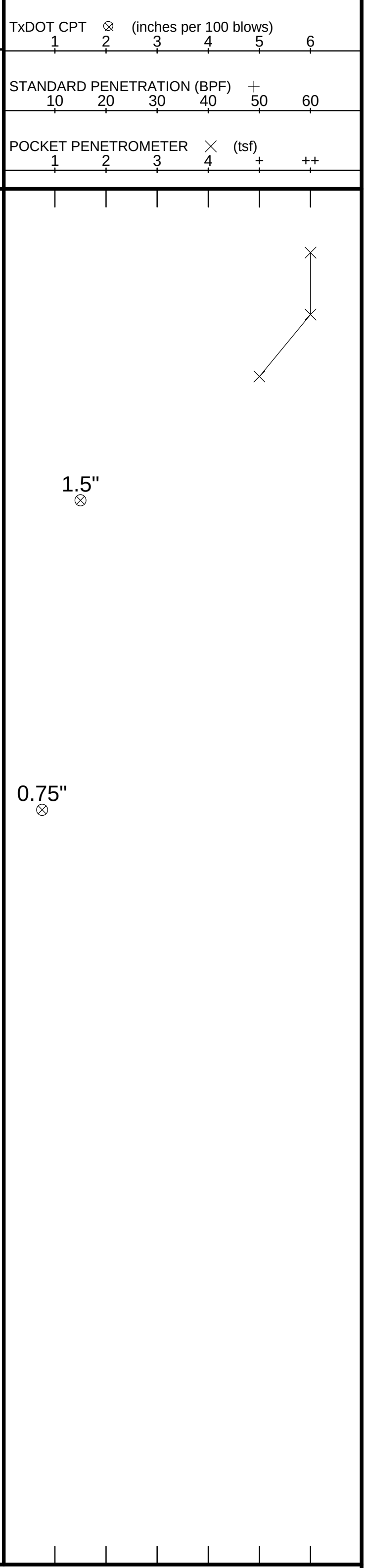
DRILL DATE: 7/26/16
METHOD: Shelby Tube to 10'

LOG OF BORING

Urban Commons
LBJ and Forest Lane
Dallas, Texas

PROJECT No.: 16721G
BORING No.: 8
STATION:
SHEET: 1 of 1
LOCATION: See Plate 1
GROUND ELEVATION:

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION (feet)	CORE RECOVERED (ft.)	CORE RQD (%)
0			CLAY, slightly silty, with calcareous nodules, hard, brown			
3			LIMESTONE, severely weathered, soft, tan			
			LIMESTONE, weathered, moderately hard, tan			
6						
			LIMESTONE, hard, gray			
9						
			TOTAL DEPTH: 10.0'			
12						
15						
18						
21						



Ground Water During Drilling (ft.): DRY
Ground Water at Completion (ft.): DRY

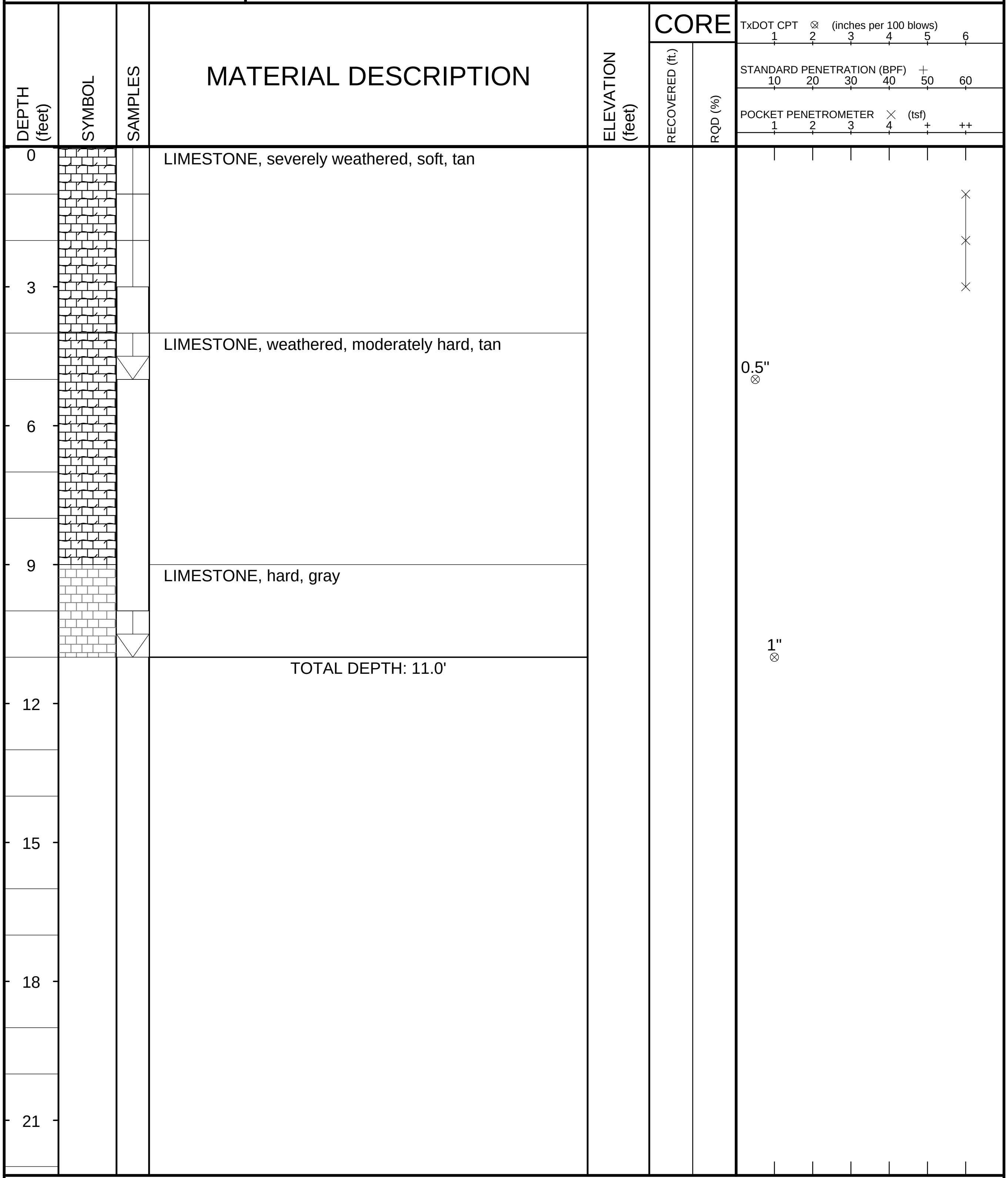
HENLEY | JOHNSTON & ASSOCIATES

DRILL DATE: 7/26/16
METHOD: Shelby Tube to 11'

LOG OF BORING

Urban Commons
LBJ and Forest Lane
Dallas, Texas

PROJECT No.:	16721G
BORING No.:	9
STATION:	
SHEET:	1 of 1
LOCATION:	See Plate 1
GROUND ELEVATION:	



LIMESTONE, severely weathered, soft, tan

LIMESTONE, weathered, moderately hard, tan

LIMESTONE, hard, gray

TOTAL DEPTH: 11.0'

Ground Water During Drilling (ft.): DRY
Ground Water at Completion (ft.): DRY

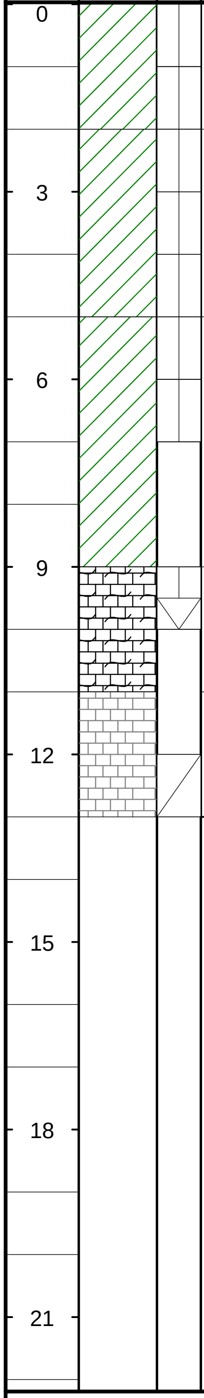
DRILL DATE: 7/26/16
METHOD: Shelby Tube to 13'

LOG OF BORING

Urban Commons
LBJ and Forest Lane
Dallas, Texas

PROJECT No.: 16721G
BORING No.: 10
STATION:
SHEET: 1 of 1
LOCATION: See Plate 1
GROUND ELEVATION:

DEPTH (feet) | SYMBOL | SAMPLES | MATERIAL DESCRIPTION | ELEVATION (feet) | CORE: RECOVERED (ft.), RQD (%)



CLAY, slightly silty, with calcareous nodules and subangular to subrounded gravel, hard, dark brown

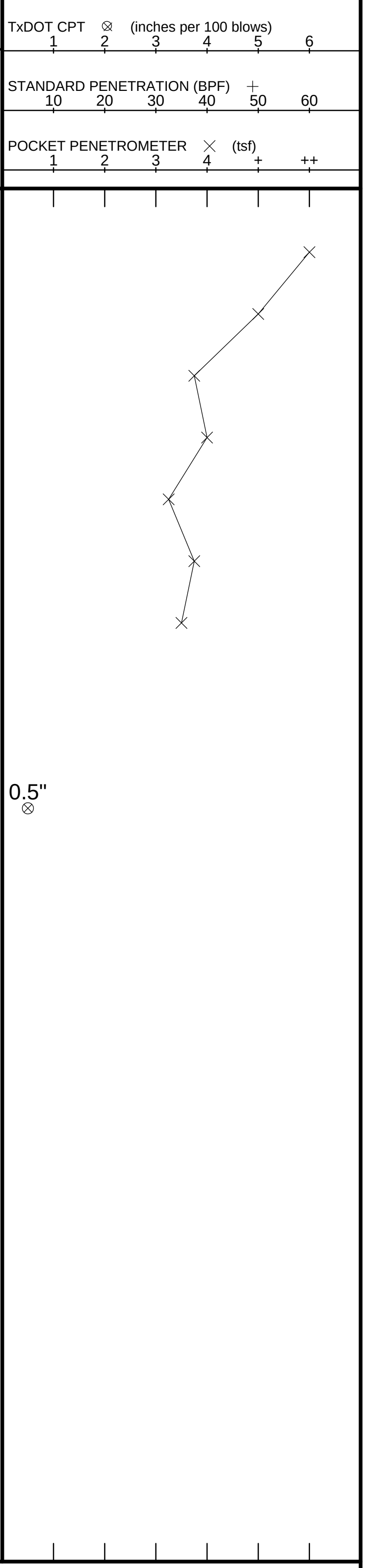
CLAY, slightly silty, with calcareous nodules, very stiff, brown

CLAY, slightly silty, with calcareous nodules and iron staining, very stiff, light brown

LIMESTONE, weathered, moderately hard, tan

LIMESTONE, hard, gray

TOTAL DEPTH: 13.0'



Ground Water During Drilling (ft.): DRY
Ground Water at Completion (ft.): DRY

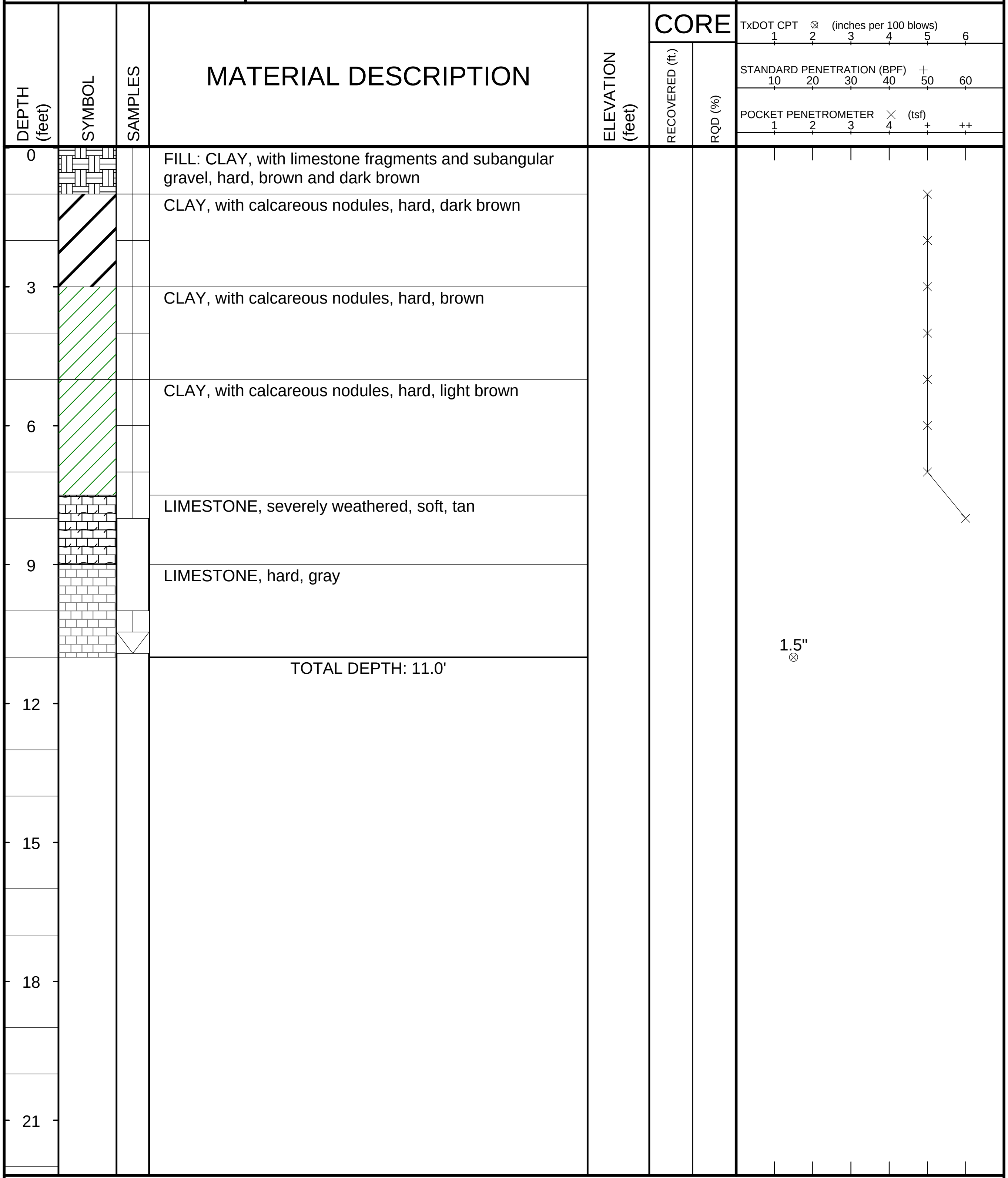
HENLEY | JOHNSTON & ASSOCIATES

DRILL DATE: 12/14/17
METHOD: Shelby Tube to 11'

LOG OF BORING

Urban Commons
LBJ and Forest Lane
Dallas, Texas

PROJECT No.: 16721G
BORING No.: 11
STATION:
SHEET: 1 of 1
LOCATION: See Plate 1
GROUND ELEVATION:



FILL: CLAY, with limestone fragments and subangular gravel, hard, brown and dark brown

CLAY, with calcareous nodules, hard, dark brown

CLAY, with calcareous nodules, hard, brown

CLAY, with calcareous nodules, hard, light brown

LIMESTONE, severely weathered, soft, tan

LIMESTONE, hard, gray

TOTAL DEPTH: 11.0'

Ground Water During Drilling (ft.): DRY
Ground Water at Completion (ft.): DRY

HENLEY | JOHNSTON & ASSOCIATES

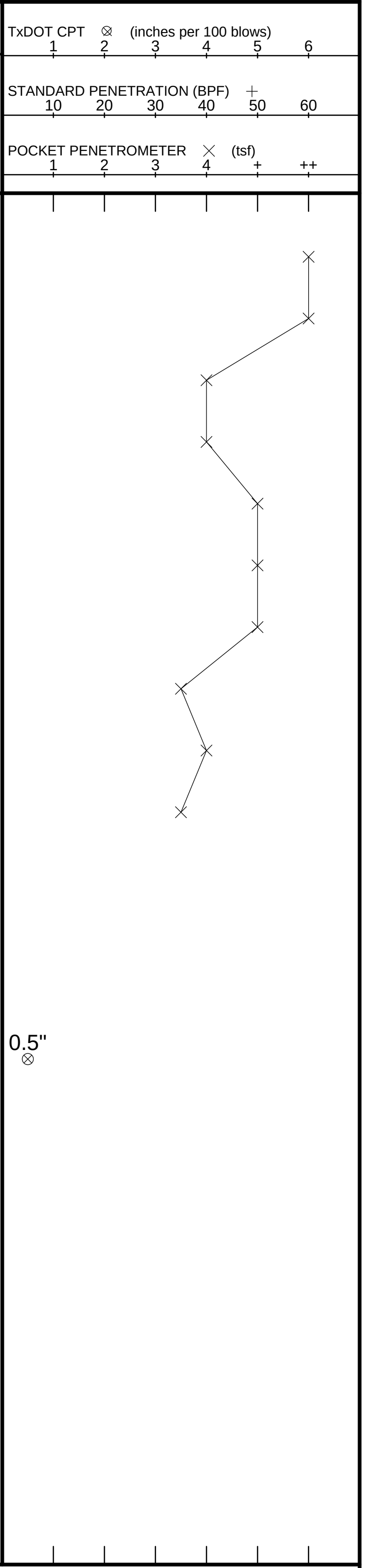
DRILL DATE: 7/26/16
METHOD: Shelby Tube to 14'

LOG OF BORING

Urban Commons
LBJ and Forest Lane
Dallas, Texas

PROJECT No.: 16721G
BORING No.: 12
STATION:
SHEET: 1 of 1
LOCATION: See Plate 1
GROUND ELEVATION:

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	CORE RECOVERED (ft.)	CORE RQD (%)
0	FILL: CLAY, with calcareous nodules and limestone fragments, hard, light brown and light gray			
1.5	CLAY, slightly silty, with calcareous nodules, very stiff to hard, dark brown			
5	CLAY, slightly silty, with calcareous nodules, hard, brown			
7	CLAY, slightly silty, with calcareous nodules and iron staining, very stiff, light brown			
12	LIMESTONE, hard, gray			
14	TOTAL DEPTH: 14.0'			



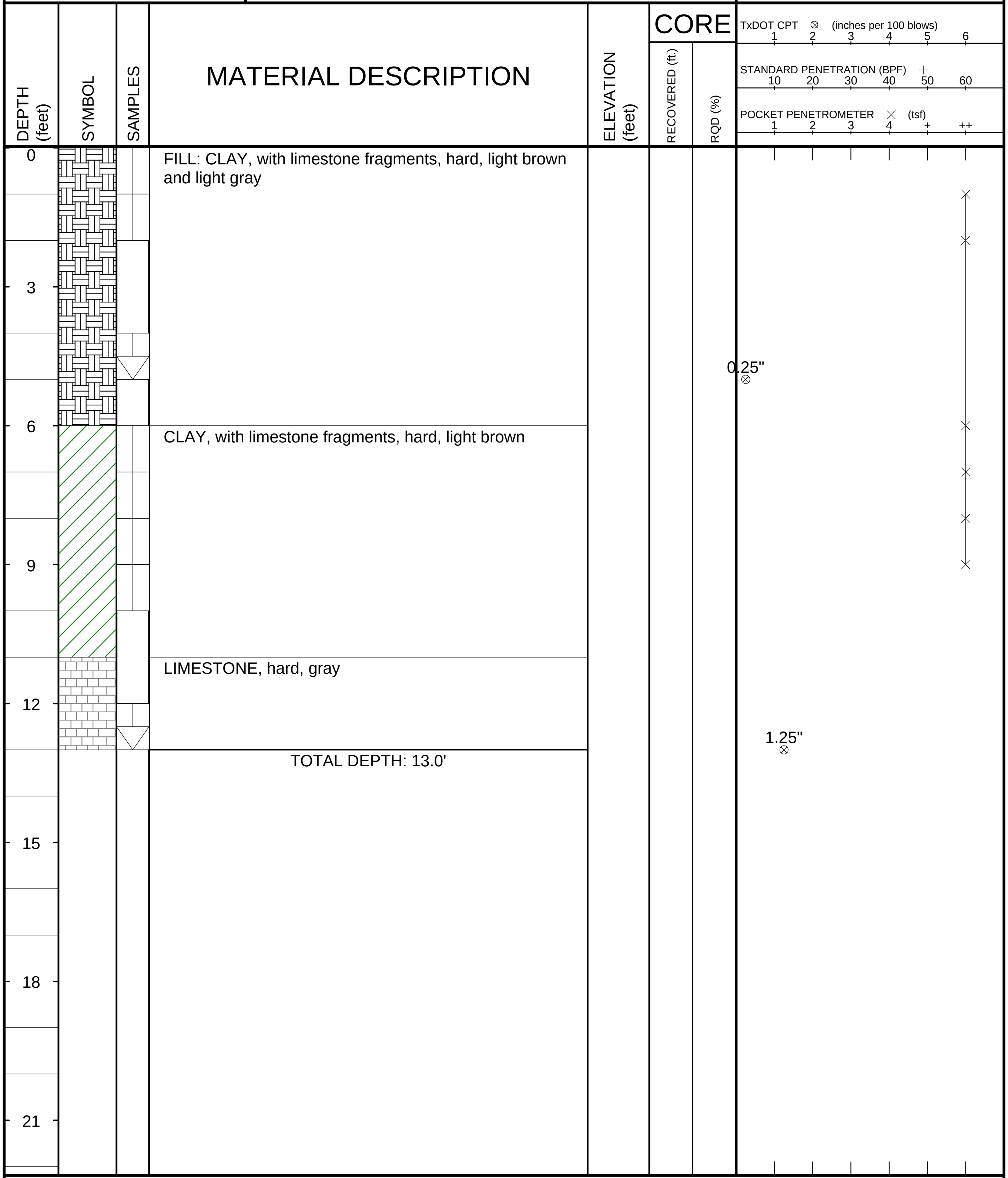
Ground Water During Drilling (ft.): DRY
Ground Water at Completion (ft.): DRY

DRILL DATE: 12/14/17
METHOD: Shelby Tube to 11'

LOG OF BORING

Urban Commons
LBJ and Forest Lane
Dallas, Texas

PROJECT No.:	16721G
BORING No.:	13
STATION:	
SHEET:	1 of 1
LOCATION:	See Plate 1
GROUND ELEVATION:	



FILL: CLAY, with limestone fragments, hard, light brown and light gray

CLAY, with limestone fragments, hard, light brown

LIMESTONE, hard, gray

TOTAL DEPTH: 13.0'

Ground Water During Drilling (ft.): DRY
Ground Water at Completion (ft.): DRY