HENLEY | JOHNSTON
& ASSOCIATES

geotechnical and construction materials consultants

January 9, 2015
Report No. 14465G

City of Dallas
Public Works and Transportation Department
320 E. Jefferson Blvd, Room 307
Dallas, Texas 75203
ATTN: Mr. Vincent Lewis, P.E.
Email: Vincent.lewis@dallascityhall.com

RE: Geotechnical Investigation
Recycling Facility
McCommas Bluff Land fill
Dallas, Texas

Gentlemen:

Presented herein is the report of a geotechnical investigation conducted by Henley-Johnston & Associates, Inc. for the above referenced project.

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.

JOHN W. JOHNSTON
30968

Oziel Bautista
Project Manager

John W. Johnston, P.E.
President

The seal appearing on this document was authorized by John W. Johnston, P.E. 30968 on January 09, 2015.

Firm Registration No.: F-1238
Copies submitted (1) City of Dallas – Mr. Vincent Lewis, P.E.

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INVESTIGATION AND ANALYSIS

Introduction

This report presents the results of a subsurface investigation performed for a new metal framed recycling facility at the McCommas Bluff Landfill site in Dallas, Texas. Recommendations for a ground supported floor-slab and floating floor slab are provided. Post-construction movements are to be limited to the order of 1-inch if a floating floor slab foundation is used.

The purpose of this investigation has been to provide recommendations for evaluation, design, and construction of the foundation. This investigation has consisted of drilling and sampling, laboratory testing, engineering analysis, and preparation of this report. Recommendations are presented in the following sections.

This report is specific to this site. 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

Subsurface conditions were evaluated with ten soil borings. Locations of the borings were dictated by site accessibility and are presented on Plate 1. Borings were drilled using a truck-mounted rig equipped with continuous flight augers and extended to depths of 20 to 30 feet below existing (November & December 2014) grades. Relatively undisturbed samples of cohesive soil were obtained with three-inch diameter Shelby tubes. Fine grained sands was sampled and evaluated using Standard Penetration Test (SPT). Unweathered limestone was evaluated using the TxDOT Cone Penetration Test (CPT). Drilling and sampling were done in general accordance with ASTM methods and standards.

All samples were transported to our laboratory for visual classification and testing. Soils were visually classified according to the Unified Soil Classification System (USCS). Rock materials were described using standard geological nomenclature. 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 gradation (percent passing No. 200 Sieve). Absorption Pressure-Swell tests were conducted to evaluate the potential for soil related heave. The strengths of selected samples were investigated by Unconfined Compression test. Results of the laboratory tests are presented on Plates 2 through 4.

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 alluvial (i.e. transported) clay, sandy clay to clayey sand and fine grained sands over unweathered limestone associated with the Upper Cretaceous Austin Chalk.

At the surface of Boring Nos. 1, 2, 3 and 4, clay and sandy clay fill was encountered. The fill was gray, dark brown to brown and light brown in appearance, moderately plastic (CL), contained varying amounts of limestone, sub-rounded gravel and brick fragments and extended to depths of 1 to 12 feet below current grades.

Alluvial clay, sandy clay to clayey sand and fine grained sands were encountered at the surface of Boring Nos. 5 through 10 and below the fill material in Boring Nos. 1 through 4. The clay to sandy clay soils were dark brown, brown to light brown and dark grayish-brown in appearance, moderately plastic, and contained varying amounts of limestone fragments. The clayey sand to fine grained sands were light brown, gray to dark grayish-brown and brown in appearance, ranged from loose (relative density) to dense and contained varying amounts of sub-rounded and coarse gravel. Boring No. 4 terminated within the alluvial soil at a depth of 30 feet.

Unweathered limestone was located in the rest of the borings at depths of 15 to 28 feet. The unweathered limestone was hard (rock hardness classification), gray in appearance and continued through the termination depths of 20 to 30 feet in these borings.

Based on soil moisture and pocket penetrometer values, the soil profiles were relatively dry at the time of the field investigation.

Ground water was present in all borings at depths ranging from 6 to 27-1/2 feet during drilling and post-drilling water level observations. The presence and depth to ground water will change with seasonal rainfall.

Potential Vertical Movements

Considering the combination of both cohesive and granular soils, movements at this site will be manifested as both settlement and heave over the life of the structure. Based on the results of the Standard Penetration Test and Absorption Pressure-Swell tests, the total amount of differential soil-related movement is anticipated to be on the order of 1-inch.

DESIGN AND CONSTRUCTION RECOMMENDATIONS

Introduction

It is anticipated that foundation loads may be supported on a ground-supported stiffened slab or with a floating floor slab foundation. Considering the movements of 1-inch, remediation is not required for a floating floor slab coupled with a perimeter pier and beam system.

Recommendations for both types of designs are presented in the following paragraphs.

Foundation Recommendations

The foundation may consist of a perimeter, pier supported grade beam with interior column loads supporting on individual piers; or a ground-supported stiffened slab. Recommendations for both types of design are presented in the following paragraphs. It should be noted that some differential movement of the foundation should be expected for either option. If no soil-related movement is acceptable, a pier-and-beam design with a suspended floor should be used. Recommendations for this type of design can be provided upon request.

Floating Floor Slab Recommendations

For a floating floor design, it is recommended that the interior slab should not be structurally connected to the perimeter grade beam. The perimeter grade beam may be founded on straight-shaft piers that penetrate a minimum 12 feet below existing grades into the sandy clay and fine grained sands or penetrate a minimum of 1-foot into the gray unweathered limestone which was encountered in all borings with the exception of Boring No. 4.

Piers founded in the sandy clay and fine grained sands should be designed for an allowable end bearing of 4 ksf, and skin friction of 0.9-ksf. Both of these values may be used considering a Factor of Safety of 3 against a shear or plunging failure. The piers also may be designed against uplift using a negative skin friction of 0.7 ksf. The skin friction values should only be applied to that portion of the pier shaft below the minimum penetration depth of 12 feet.

Piers founded in the gray unweathered limestone should be designed for an allowable end bearing of 40 ksf, and skin friction of 5 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 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 5 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.

Temperature reinforcing should be adequate to resist uplift forces associated with heaving of the surrounding clay soil. A minimum of one No. 5 vertical bar should be used.

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

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

Pier shaft excavations should be clean of all debris and dry prior to placement of concrete. To minimize the sloughing of granular soils and ground water into pier excavations, it is recommended that temporary casing be used.

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 Procedures

Each pier installation should be vertical (within acceptable tolerances), placed in proper plan location and cleaned prior to concrete placement. Reinforcing steel cages should be prefabricated in a rigid manner to allow expedient placement of both steel and concrete into the excavation. It is essential that excavation of piers and the placement of both steel and concrete be completed in a continuous operation. In all cases, no portion of the stratum being counted on to provide structural support should be exposed to atmospheric conditions for more than eight hours following the completion of excavation prior to the placement of concrete.

In order to confirm compliance with specifications and acceptability of the bearing stratum and pier excavation, a qualified and experienced geotechnical observer from this office should be present at all times during foundation installation.

A minimum 6-inch void should be established and maintained below any pier-supported grade beams or pier caps to allow for heave of the subsurface soils. Retainer boards should be provided along the exterior of the grade beams to prevent soils from infiltrating into the void space over the life of the structures.

Ground-Supported 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-inch, 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.

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)[1] method. For this site, an

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[1] 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 23 was used. Considering slopes of less than 5% and using an unconfined compressive strength (Q_u) of 2 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 20. A Climatic Rating (C_W) of 20 is considered appropriate for this site.

Based on the above values, a Support Index (C) of 0.93 is applicable for the BRAB Method, and a value of 0.05 (1-C) should be used for a WRI design. With the WRI method, a cantilevered length (l_c) of 2.3 feet was derived using the previous information. It is recommended the l_c be increased by a factor of 1.5 with a minimum length of 6 feet used for analysis purposes[2]

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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[2] *Recommended Practice for the Design of Residential Foundations*, Version 1, Texas Section of the American Society of Civil Engineers (2002), p 10.

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

Table 1
PTI DESIGN VALUES
(PVM = 1-inch)
Recycling Facility
McCommas Bluff Landfill- Dallas, Texas

Lift Condition	**Edge Moisture Variation Distance e_m (ft.)**	**Differential Movement y_m (in.)**
Center Lift	7.9	0.6
Edge Lift	4.1	0.9

Grade beams should penetrate a minimum of 12 inches below finished grade and rest on undisturbed soil or compacted and tested fill. Beams may be sized using an allowable net bearing pressure of 3 ksf. This 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.

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 residence.

If possible, trees should not be planted directly next to the structure. 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 to a depth of 6 feet from finished grades. 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.

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.

Paving Recommendations

Asphalt Pavement:

Flexible asphalt pavement may be used for parking and drives. The upper six inches of subgrade below asphalt pavement should be stabilized using approximately 6% hydrated lime (27 pounds per square yard) to achieve a treated soil with a Plasticity Index of 15 or less. It is recommended that site specific testing of the subgrade be performed to evaluate the actual amount of lime required to provide a stabilized subgrade. Lime should be placed in general accordance with Item 301.2 LIME TREATMENT the North Central Texas Council of Government (NCTCOG) *Standard Specifications for Public Works Construction* published in 2004. Lime treated soils should be compacted to a minimum of 95% of the maximum dry unit weight (ASMM D-698) with moisture contents at or above optimum.

For light truck and car traffic the following section is recommended:

1” Type D Asphalt Surface Course over,

2” Type A or B Coarse Graded Base Course.

For heavy truck traffic the following section is recommended:

2” Type D Asphalt Surface Course over,

4” Type A or B Coarse Graded Base Course.

All asphalt should be placed in accordance with Item 302 of the NCTCOG standard. Compaction tests and air void verification should be conducted to evaluate the in-place density of the asphalt pavement.

All joints within asphalt pavements should be sealed and maintained to limit water infiltration into the subgrade soils.

Concrete Pavement:

Sections for reinforced concrete paving were evaluated using the Interim AASHO and PCA methods[4]. Considering light vehicular traffic and less than six, fully loaded trucks per day, the following sections are recommended for a 20-year life span.

For light truck and car traffic the following section is recommended:

5” of 3,000 psi Portland Cement Concrete over,

6” of recompacted subgrade.

For heavy truck traffic up to 6 vehicles per day the following section is recommended:

6” of 3,000 psi Portland Cement Concrete over,

6” of recompacted subgrade.

Routes for trash trucks should have the following:

7” of 3,000 psi Portland Cement Concrete over,

6” of recompacted subgrade.

Subgrade soils below concrete pavements should be compacted to a minimum of 95% (ASTM D-698) with moisture contents between 0 and +4 percentage points.

Concrete pavement should be reinforced with No. 3 deformed bars on 18-inch centers. No. 4 smooth dowels should be used at expansion and construction joints on 12-inch centers.

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[4] Yoder, E.J., and Witczak, M.W., *Principles of Pavement Design*, 2nd Ed., John Wiley & Sons, Inc., New York, NY, pp 605 to 608.

Control joints should be installed in the pavement within four hours after concrete has been placed, not after completion of the pour. Joint spacing and depth should conform to the recommendations presented in the latest version of *Joint Design for Concrete Highways and Street Pavements*, produced by PCA. Spacing between control joints should not exceed 15-feet. All joints should be sealed and periodically maintained. This will limit the potential for water to infiltrate into the subgrade.

Expansion joints should consist of doweled keyways, thickened sections, or steel dowels supported on a non-deteriorating medium such as bituminous mastic or bituminous impregnated cellulous[5]. All expansion joints should be filled completely with sealant to the pavement surface.

It should be noted that all fill below pavements to be placed within the City of Dallas right-of-way must be compacted to a minimum of 98% of the maximum dry unit weight as determined by ASTM D-698. A moisture content of at least +1 percentage point above optimum is recommended.

Sidewalk subgrade within the City of Dallas right-of-way must be compacted to a minimum of 95% of the maximum dry unit weight as determined by ASTM D-698. A moisture content of at least +1 percentage point above optimum is recommended.

Furthermore, lime stabilization of approach subgrade within the City of Dallas right-of-way will be required regardless of the type of pavement section used. Lime stabilization should be conducted in general accordance with Item 301.2 LIME TREATMENT the North Central Texas Council of Government (NCTCOG) *Standard Specifications for Public Works Construction* published in 2004. Lime treated soils below city paving should be compacted to a minimum of 98% of the maximum dry unit weight (ASTM D-698). A moisture content of 0 to +4 percentage points above optimum is recommended.

Earthwork Recommendations

Prior to construction all areas to receive improvements should be stripped of organic materials.

On-site soils should be placed in maximum 8-inch loose lifts and compacted to a minimum of 95% and a maximum of 98% of the maximum dry unit weight as determined by ASTM D-698. Moisture content should be between 0 and +4 percentage points above optimum.

Fill around perimeter grade beams should be cleaned of all construction debris and sand, and placed in a controlled manner. Use of clean, compacted fill will lower the potential for water to migrate into the subgrade soils. Sand or gravel should not be used as backfill against perimeter beams.

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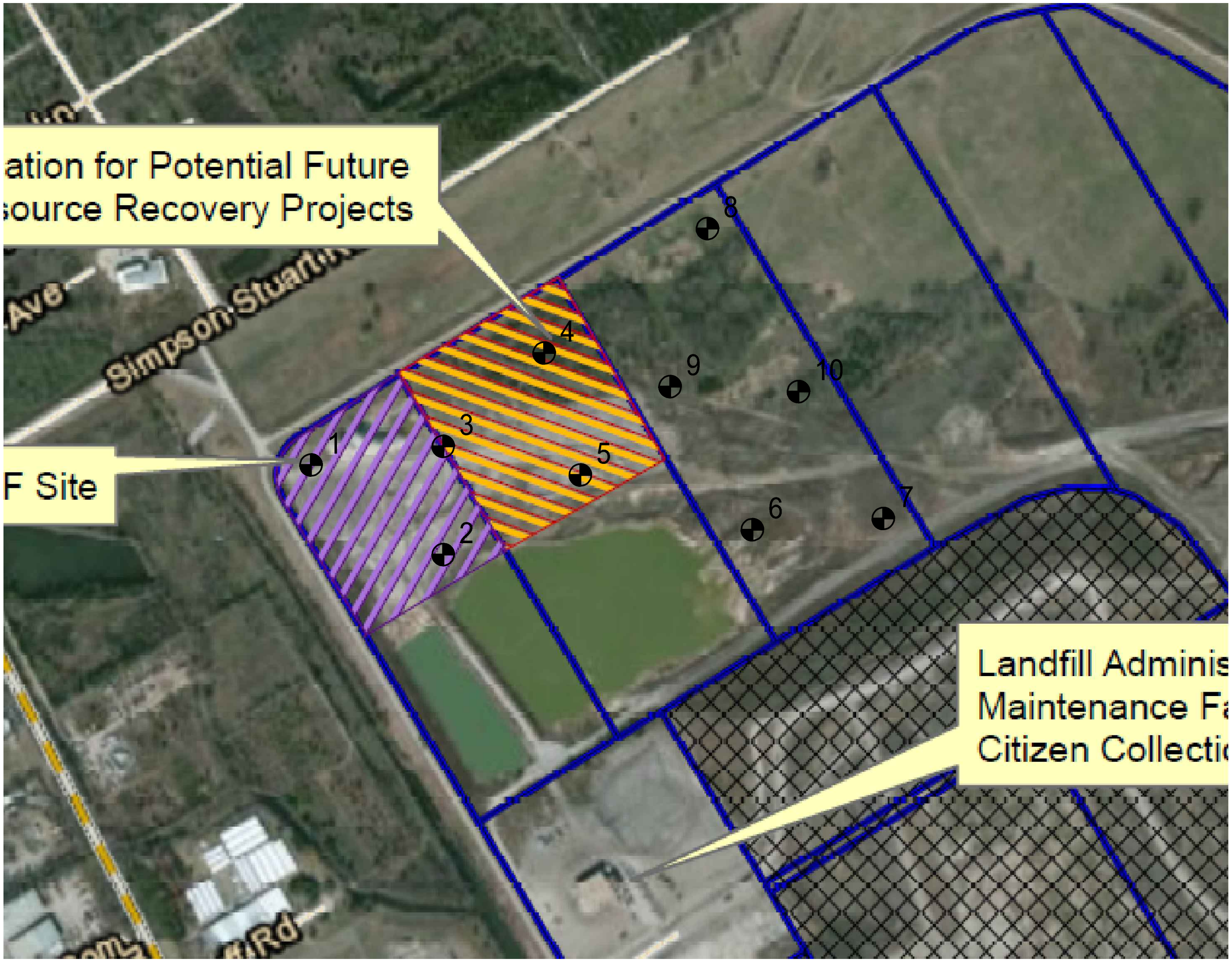
[5] *Guide for Design and Construction of Concrete Parking Lots*, ACI Committee 330, NRMCA Publication MSP 34, January 1988, p 330R-8.

If the fill material encountered across this site has not been placed in a controlled manner it is recommended that the material be evaluated for in-place density and moisture content using a portable nuclear density gauge. The fill soils will need to be excavated in one-foot lifts and the exposed materials tested until natural, undisturbed soils are encountered. If excavation and compaction of this fill material is not an option then it is recommended that all foundations at this site be pier supported as outlined in the pier recommendations section of this report.

Construction Inspection and Testing

It is recommended that a representative of Henley-Johnston & Associates, Inc. be retained to monitor pier foundation construction on a full-time basis to ensure compliance with the recommendations of this report.

Field density tests should be conducted on those areas that will receive fill. All fill should be tested at a rate of one test per lift for every 2,500 square feet of area, or fraction thereof. These field tests are to confirm proper compaction and moisture of fill materials. Backfill within utility trenches should receive density testing at a rate of one test per 8-inch lift for every 50 linear feet or fraction thereof.



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NOT TO SCALE

HJA HENLEY | JOHNSTON
& ASSOCIATES

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TEXAS FIRM REGISTRATION NO. F-1238

RECYCLING FACILITY
McCOMMAS BLUFF LANDFILL
DALLAS, TEXAS

BORING LOCATION PLAN

HJA No.: 14465G

DATE: JANUARY 2015

PLATE 1

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					14.4	
1	1.0 – 2.0	31	17			11.4	CL
1	2.0 – 3.5						
1	3.5 – 5.0				15.8	5.1	NONPLASTIC
2	1.0 – 2.0	25	14	124.9		10.9	CL
2	2.0 – 3.0			128.9		10.4	
3	0.0 – 1.0					12.0	
3	1.0 – 2.0					17.7	
3	2.0 – 3.0	32	15	106.9		14.3	CL
3	3.0 – 4.0					12.6	
3	4.0 – 5.0			114.5		14.1	
3	5.0 – 6.0					20.0	
3	6.0 – 7.0					12.9	
3	7.0 – 8.0					19.9	
3	8.0 – 9.0					14.7	
3	9.0 – 10.0	28	13	117.8		12.9	CL
3	14.0 – 15.0					10.0	
3	19.0 – 20.0				6.9		
4	0.0 – 1.0					18.1	
4	1.0 – 2.0	45	23			22.5	CL
4	2.0 – 3.0					14.9	
4	3.0 – 4.0					14.3	
4	4.0 – 5.0					8.1	
4	5.0 – 6.0	30	17	115.0		12.9	CL
4	8.5 – 10.0				31.7	11.7	
4	13.5 – 15.0				16.4	7.7	

SUMMARY OF INDEX PROPERTIES

BORING NUMBER	DEPTH (ft.)	LIQUID LIMIT (%)	PLASTIC INDEX	DUW (pcf)	FINER #200 (%)	MOISTURE CONTENT (%)	UNIFIED SOIL CLASSIFICATION
5	0.0 – 1.5					6.2	
5	3.5 – 5.0				10.3	9.9	NONPLASTIC
5	13.5 – 15.0				8.1	12.9	
6	3.0 – 4.0					9.7	NONPLASTIC
6	8.5 – 10.0				43.6	20.3	
7	0.0 – 1.0					20.1	
7	1.0 – 2.0	27	16	125.2		12.6	CL
7	3.5 – 5.0				41.1	15.7	
7	13.5 – 15.0				25.6	18.2	NONPLASTIC
8	1.0 – 2.0	32	19			13.1	CL
8	3.5 – 5.0				38.7	8.6	
9	1.0 – 2.0				51.9	10.7	NONPLASTIC
9	3.5 – 5.0				51.2	11.0	
10	1.0 – 2.0	24	12		57.4	11.9	CL

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	272.0	3.4	0.0	FILL: SANDY CLAY, light brown
3	2.0 – 3.0	1,125.0	5.7	1.1	FILL: SANDY CLAY, brown
3	9.0 – 10.0	776.0	3.4	0.4	FILL: SANDY CLAY, dark brown
4	5.0 – 6.0	1,552.0	6.4	1.7	SANDY CLAY, light brown

GEOTECHNICAL INVESTIGATION
REPORT NO. 14465G
RECYCLING FACILITY
McCOMMAS BLUFF LANDFILL
DALLAS, TEXAS

SUMMARY OF UNCONFINED COMPRESSION TESTS - SOIL

BORING NUMBER	DEPTH (ft.)	PEAK STRESS (psi)	FAILURE STRAIN (%)	MATERIAL DESCRIPTION
2	2.0 – 3.0	109.3	10.7	FILL: SANDY CLAY, light brown
3	4.0 – 5.0	47.2	6.0	FILL: SANDY CLAY, very stiff, dark brown
7	1.0 – 2.0	42.1	7.2	SANDY CLAY, light brown

CLASSIFICATION SYMBOLS

SOIL

■		Asphalt or Lignite
▨		Concrete
▨		Fill
▨	GW	Gravel or Sandy Gravel well graded
▨	GP	Gravel or Sandy Gravel poorly graded
▨	GM	Silty Gravel or Silty Sandy Gravel
▨	GC	Clayey Gravel or Clayey Sandy Gravel
▨	SW	Sand or Gravelly Sand well graded
▨	SP	Sand or Gravelly Sand poorly graded
▨	SM	Silty Sand or Silty Gravelly Sand
▨	SC	Clayey Sand or Clayey Gravelly Sand
▨	ML	Silts, Sandy Silts, Gravelly Silts, or Diatomaceous Soils
▨	CL	Low Plasticity Clays, Sandy Clays, or Gravelly Clays
▨	OL	Organic Silts or Low Plasticity Organic Clays
▨	MH	Micaceous Clays or Diatomaceous Soil
▨	CH	High Plasticity Clays
▨	OH	High Plasticity Organic Clays

ROCK

▨	Ls	Limestone
▨	Sh	Shale
▨		Marl
▨	Ss	Sandstone
▨		Fracture Zone
▨		Weathered Zone

ABBREVIATIONS

abnt.	abundant
ang.	angular
aren.	arenaceous
arg.	argillaceous
bdd.	bedded
bdg.	bedding
bent.	bentonite
bldr.	boulder
BT	Brazil Tensile
calc.	calcareous
carb.	carbonaceous
cbl.	cobble
cgl.	conglomerate
clst.	claystone
cmt.	cemented
dia.	diameter
dk.	dark
DUW	Dry Unit Weight
El.	elevation
fossil.	fossiliferous
frac.	fracture
gyp.	gypsiferous
incl.	inclusion
intbdd.	interbedded
jnt.	joint
lam.	laminated
LL	Liquid Limit
lt.	light
MC	Moisture Content
ME	Modulus of Elasticity
med.	medium
min.	minutes
mod.	moderately
nod.	nodule
occ.	occasional
part.	particle
Pen.	Penetrometer
phos.	phosphatic
PI	Plasticity Index
py.	pyritized
Qu	Unconfined Compression
Rec.	recovery
rnd.	rounded
RQD	Rock Quality Designation
sat.	saturated
sept.	septarian
sev.	severely
sil.	siliceous
sli.	slightly
slk.	slickensided
T.D.	Total Depth
v.	very
wea.	weathered

CONSISTENCIES AND HARDNESS DESCRIPTIONS

FOR SANDS, GRAVELS, & SANDY SILTS

Modified from Peck, 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 & SANDY CLAYS

(COHESIVE SOILS)

Modified from Peck, 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 MODIFERS (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 heavy hammer blows

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TEXAS FIRM REGISTRATION NO. F-1238

RECYCLING FACILITY
McCOMMAS BLUFF LANDFILL
DALLAS, TEXAS

HJA No.: 14465G

DATE: NOVEMBER 2014

LEGEND, LITHOLOGY, SOIL CONSISTENCY,
& RELATIVE ROCK HARDNESS

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LOG OF BORING
RECYCLING FACILITY McCOMMAS BLUFF LANDFILL DALLAS, TEXAS

PROJECT No.: 14465G
BORING No.: 1
SHEET 1 of 2
LOCATION: SEE PLATE 1
GROUND ELEVATION:

DRILL DATE: 11/14/14
METHOD: SHELBY TUBE /SPLIT SPOON THD TO 30.0'

STANDARD PENETRATION (BPF) +
TEXAS CONE PENETRATION ⊕
POCKET PENETROMETER READING X (tsf): 1.0, 2.0, 3.0, 4.0, 5.0, 6.0

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION, (feet)	CORE DRILLED	CORE RECOVERED	STANDARD PENETRATION (BPF) / TEXAS CONE PENETRATION / POCKET PENETROMETER READING X (tsf)
	FILL: CLAY, slightly silty, with limestone fragments, very stiff, gray				X
	SANDY CLAY, with limestone fragments, very stiff, brown				X
2.5	SAND, fine, medium dense to loose, light brown				
					+ 17 BPF (9,9,8)
5.0					+ 7 BPF (4,4,3)
7.5					
10.0					+ 7 BPF (4,4,3)
12.5					
15.0					+ 12 BPF (3,5,7)
17.5					▽ W.L. = 17.6' upon completion
	SAND, medium, with coarse gravel, medium dense, light brown				
20.0					+ 18 BPF (6,10,8)
22.5					
					+ 20 BPF (2,6,14)

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LOG OF BORING

RECYCLING FACILITY
McCOMMAS BLUFF LANDFILL
DALLAS, TEXAS

PROJECT No.: 14465G
BORING No.: 1
SHEET 2 of 2
LOCATION: SEE PLATE 1
GROUND ELEVATION:

DRILL DATE: 11/14/14
METHOD: SHELBY TUBE /SPLIT SPOON THD TO 30.0'

STANDARD PENETRATION (BPF) +
TEXAS CONE PENETRATION ⊕
POCKET PENETROMETER READING X (tsf)

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION, (feet)	CORE DRILLED	CORE RECOVERED	1.0 2.0 3.0 4.0 5.0 6.0
			SAND, medium, with coarse gravel, medium dense, light brown				
			LIMESTONE, hard, gray				
27.5							
30.0			TOTAL DEPTH: 30.0'				⊕ THD 50 = 0" 50 = 1/8"
32.5							
35.0							
37.5							
40.0							
42.5							
45.0							
47.5							

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LOG OF BORING

RECYCLING FACILITY
McCOMMAS BLUFF LANDFILL
DALLAS, TEXAS

PROJECT No.: 14465G
BORING No.: 2
SHEET 1 of 1
LOCATION: SEE PLATE 1
GROUND ELEVATION:

DRILL DATE: 12/02/14
METHOD: SHELBY TUBE /SPLIT SPOON THD TO 20.0'

STANDARD PENETRATION (BPF) +
TEXAS CONE PENETRATION ⊕
POCKET PENETROMETER READING X (tsf)
1.0 2.0 3.0 4.0 5.0 6.0

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION, (feet)	CORE DRILLED	CORE RECOVERED	STANDARD PENETRATION (BPF) + / TEXAS CONE PENETRATION ⊕ / POCKET PENETROMETER READING X (tsf)
			FILL: SANDY CLAY, with sub-rounded gravel and calcareous nodules, very stiff, brown				X
			FILL: SANDY CLAY, with calcareous particles, very stiff, light brown				X
2.5							X
			FILL: SANDY CLAY, with sub-rounded gravel, limestone fragments and iron stones, stiff, light brown				X
5.0			SAND, medium, loose to medium dense, light brown				
							+ 16 BPF (9,7,9)
7.5							▽ W.L. = 8.0' upon completion
10.0							+ 7 BPF (2,3,4)
12.5							
15.0			LIMESTONE, hard, gray				+ 23 BPF (1,3,20)
17.5							
20.0			TOTAL DEPTH: 20.0'				⊕ THD 50 = 1-1/4" 50 = 1/2"
22.5							

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TEXAS FIRM REGISTRATION NO. F-1238

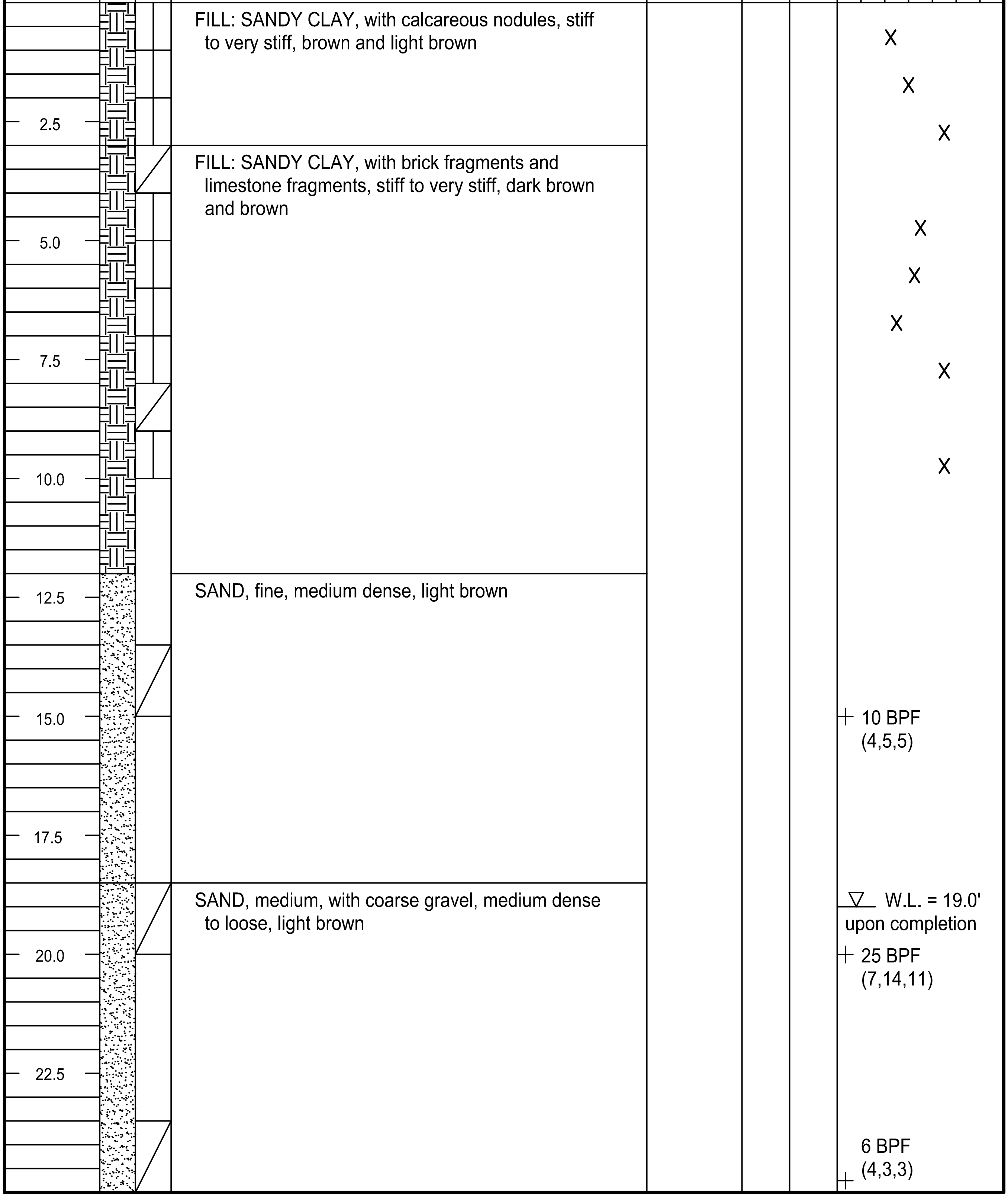
LOG OF BORING

RECYCLING FACILITY McCOMMAS BLUFF LANDFILL DALLAS, TEXAS

PROJECT No.: 14465G
BORING No.: 3
SHEET 1 of 2
LOCATION: SEE PLATE 1
GROUND ELEVATION:

DRILL DATE: 11/14/14
METHOD: SHELBY TUBE /SPLIT SPOON THD TO 30.0'

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION, (feet)	CORE DRILLED	CORE RECOVERED	STANDARD PENETRATION (BPF) + / TEXAS CONE PENETRATION ⊕ / POCKET PENETROMETER READING X (tsf) 1.0 2.0 3.0 4.0 5.0 6.0



FILL: SANDY CLAY, with calcareous nodules, stiff to very stiff, brown and light brown

FILL: SANDY CLAY, with brick fragments and limestone fragments, stiff to very stiff, dark brown and brown

SAND, fine, medium dense, light brown

+ 10 BPF (4,5,5)

SAND, medium, with coarse gravel, medium dense to loose, light brown

▽ W.L. = 19.0' upon completion

+ 25 BPF (7,14,11)

6 BPF (4,3,3) +

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LOG OF BORING

RECYCLING FACILITY
McCOMMAS BLUFF LANDFILL
DALLAS, TEXAS

PROJECT No.: 14465G
BORING No.: 3
SHEET 2 of 2
LOCATION: SEE PLATE 1
GROUND ELEVATION:

DRILL DATE: 11/14/14
METHOD: SHELBY TUBE /SPLIT SPOON THD TO 30.0'

STANDARD PENETRATION (BPF) +
TEXAS CONE PENETRATION ⊕

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION, (feet)	CORE DRILLED	CORE RECOVERED	POCKET PENETROMETER READING X (tsf) 1.0 2.0 3.0 4.0 5.0 6.0
25.0–30.0 (27.5)			LIMESTONE, hard, gray				
30.0			TOTAL DEPTH: 30.0'				⊕ THD 21 = 6" 50 = 4-3/4"
32.5							
35.0							
37.5							
40.0							
42.5							
45.0							
47.5							

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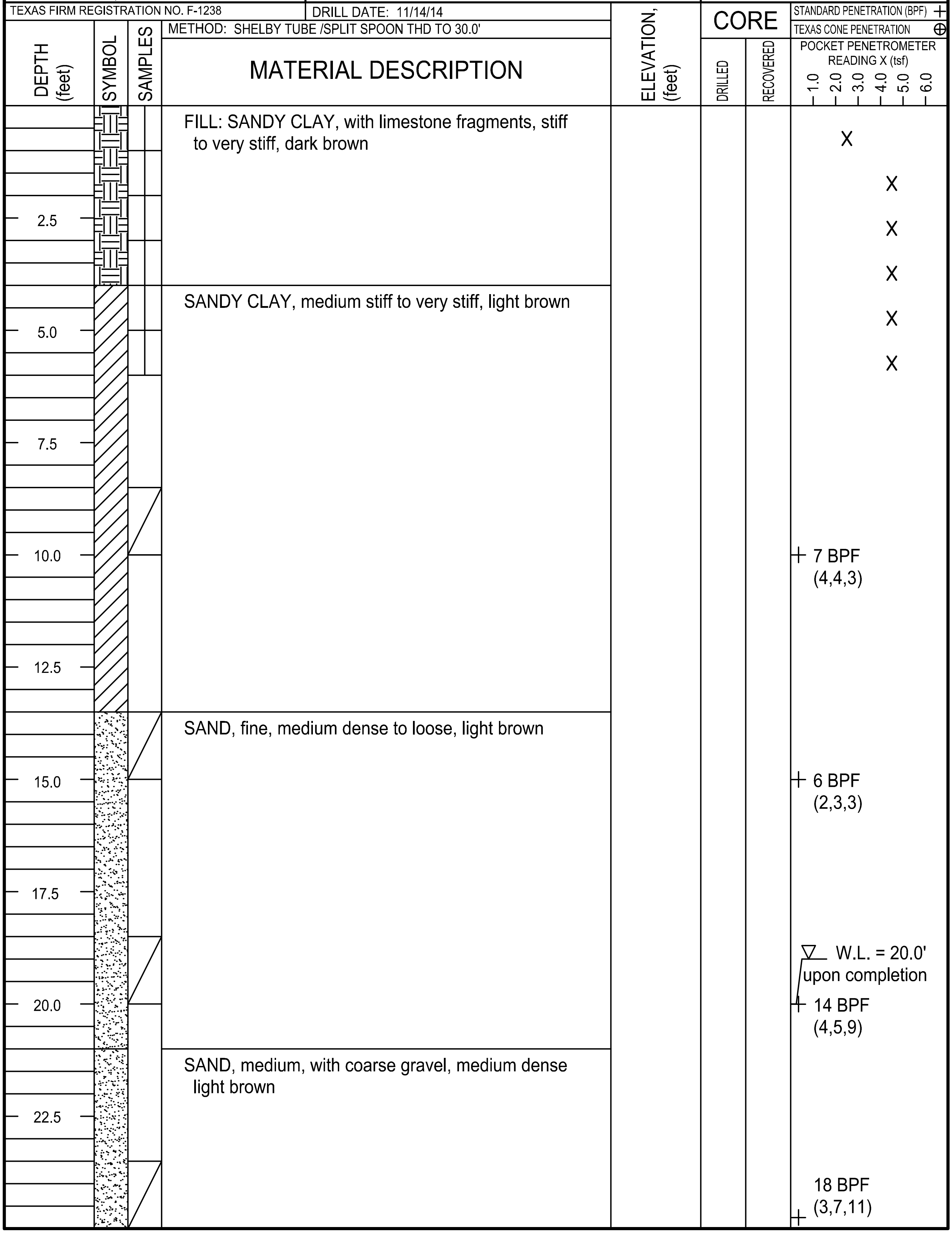
TEXAS FIRM REGISTRATION NO. F-1238

LOG OF BORING
RECYCLING FACILITY McCOMMAS BLUFF LANDFILL DALLAS, TEXAS

PROJECT No.: 14465G
BORING No.: 4
SHEET 1 of 2
LOCATION: SEE PLATE 1
GROUND ELEVATION:

DRILL DATE: 11/14/14
METHOD: SHELBY TUBE /SPLIT SPOON THD TO 30.0'



FILL: SANDY CLAY, with limestone fragments, stiff to very stiff, dark brown

SANDY CLAY, medium stiff to very stiff, light brown

7 BPF (4,4,3)

SAND, fine, medium dense to loose, light brown

6 BPF (2,3,3)

W.L. = 20.0' upon completion

14 BPF (4,5,9)

SAND, medium, with coarse gravel, medium dense light brown

18 BPF (3,7,11)

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LOG OF BORING
RECYCLING FACILITY
McCOMMAS BLUFF LANDFILL
DALLAS, TEXAS

PROJECT No.: 14465G
BORING No.: 4
SHEET 2 of 2
LOCATION: SEE PLATE 1
GROUND ELEVATION:

DRILL DATE: 11/14/14
METHOD: SHELBY TUBE /SPLIT SPOON THD TO 30.0'

STANDARD PENETRATION (BPF) +
TEXAS CONE PENETRATION ⊕
POCKET PENETROMETER READING X (tsf)
1.0 2.0 3.0 4.0 5.0 6.0

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION, (feet)	CORE DRILLED	CORE RECOVERED	STANDARD PENETRATION (BPF) / TEXAS CONE PENETRATION / POCKET PENETROMETER READING X (tsf)
27.5			SAND, medium, with coarse gravel, medium dense, light brown				
30.0			TOTAL DEPTH: 30.0'				+ 29 BPF (3,9,20)
32.5							
35.0							
37.5							
40.0							
42.5							
45.0							
47.5							

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LOG OF BORING
RECYCLING FACILITY
McCOMMAS BLUFF LANDFILL
DALLAS, TEXAS

PROJECT No.: 14465G
BORING No.: 5
SHEET 1 of 1
LOCATION: SEE PLATE 1
GROUND ELEVATION:

TEXAS FIRM REGISTRATION NO. F-1238
DRILL DATE: 11/14/14
METHOD: SHELBY TUBE /SPLIT SPOON THD TO 25.0'

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION, (feet)	CORE DRILLED	CORE RECOVERED	STANDARD PENETRATION (BPF) + TEXAS CONE PENETRATION ⊕ POCKET PENETROMETER READING X (tsf) 1.0 2.0 3.0 4.0 5.0 6.0
			SAND, fine, loose, light brown				
							+ 7 BPF (1,3,4)
2.5							
5.0							+ 7 BPF (3,4,3)
7.5							▽ W.L. = 7.4' upon completion
			SAND, medium, with coarse gravel, loose, light brown				
10.0							+ 6 BPF (2,2,4)
12.5							
			SAND, medium, with fine, subrounded gravel, medium dense, light brown				
15.0							+ 16 BPF (2,6,10)
17.5							
			LIMESTONE, hard, gray				
20.0							⊕ THD 50 = 3/4" 50 = 1/4"
22.5							
							THD 50 = 1/2" ⊕ 50 = 0"

TOTAL DEPTH: 25.0'

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LOG OF BORING

RECYCLING FACILITY
McCOMMAS BLUFF LANDFILL
DALLAS, TEXAS

PROJECT No.: 14465G
BORING No.: 6
SHEET 1 of 2
LOCATION: SEE PLATE 1
GROUND ELEVATION:

DRILL DATE: 12/02/14
METHOD: SHELBY TUBE /SPLIT SPOON THD TO 30.0'

STANDARD PENETRATION (BPF) +
TEXAS CONE PENETRATION ⊕
POCKET PENETROMETER READING X (tsf): 1.0 2.0 3.0 4.0 5.0 6.0

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION, (feet)	CORE DRILLED	CORE RECOVERED	POCKET PENETROMETER READING X (tsf)
	CLAY, slightly silty, with limestone fragments, stiff to very stiff, dark grayish-brown				X
					X
2.5	SANDY CLAY, with limestone fragments and iron stones, stiff, light brown				X
	CLAYEY SAND, loose to medium dense, light brown				X
5.0					+ 12 BPF (4,5,7)
7.5					
					▽ W.L. = 9.0' upon completion
10.0					+ 3 BPF (1,1,2)
12.5	SAND, medium, with fine to coarse gravel, medium dense, light brown				
15.0					+ 11 BPF (6,4,7)
17.5					
20.0					+ 23 BPF (1,7,16)
22.5					
	LIMESTONE, hard, gray				43 BPF + (2,4,39)

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LOG OF BORING

RECYCLING FACILITY
McCOMMAS BLUFF LANDFILL
DALLAS, TEXAS

PROJECT No.: 14465G
BORING No.: 6
SHEET 2 of 2
LOCATION: SEE PLATE 1
GROUND ELEVATION:

DRILL DATE: 12/02/14
METHOD: SHELBY TUBE /SPLIT SPOON THD TO 30.0'

STANDARD PENETRATION (BPF) +
TEXAS CONE PENETRATION ⊕

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION, (feet)	CORE DRILLED	CORE RECOVERED	POCKET PENETROMETER READING X (tsf) 1.0 2.0 3.0 4.0 5.0 6.0
			LIMESTONE, hard, gray				
27.5							
30.0			TOTAL DEPTH: 30.0'				⊕ THD 50 = 3/4" 50 = 1/2"
32.5							
35.0							
37.5							
40.0							
42.5							
45.0							
47.5							

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LOG OF BORING
RECYCLING FACILITY
McCOMMAS BLUFF LANDFILL
DALLAS, TEXAS

PROJECT No.: 14465G
BORING No.: 7
SHEET 1 of 1
LOCATION: SEE PLATE 1
GROUND ELEVATION:

DRILL DATE: 11/14/14
METHOD: SHELBY TUBE /SPLIT SPOON THD TO 25.0'

STANDARD PENETRATION (BPF) +
TEXAS CONE PENETRATION ⊕
POCKET PENETROMETER READING X (tsf) 1.0 2.0 3.0 4.0 5.0 6.0

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION, (feet)	CORE DRILLED	CORE RECOVERED	PENETRATION / POCKET PENETROMETER
	SANDY CLAY, very stiff, gray and light brown				X X
2.5	SAND, fine, loose, gray				
5.0					+ 5 BPF (2,3,2) ▽ W.L. = 6.2' upon completion
7.5					
	SAND, fine, very loose to medium dense, light brown				
10.0					+ 3 BPF (2,1,2)
12.5					
15.0					+ 13 BPF (3,4,9)
17.5					
	LIMESTONE, hard, gray				
20.0					+ 23 BPF (14,9,14)
22.5					
					⊕ THD 50 = 1/2" 50 = 0"

TOTAL DEPTH: 25.0'

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LOG OF BORING

RECYCLING FACILITY
McCOMMAS BLUFF LANDFILL
DALLAS, TEXAS

PROJECT No.: 14465G
BORING No.: 8
SHEET 1 of 2
LOCATION: SEE PLATE 1
GROUND ELEVATION:

DRILL DATE: 12/04/14
METHOD: SHELBY TUBE /SPLIT SPOON THD TO 30.0'

STANDARD PENETRATION (BPF) +
TEXAS CONE PENETRATION ⊕

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION, (feet)	CORE DRILLED	CORE RECOVERED	POCKET PENETROMETER READING X (tsf) 1.0 2.0 3.0 4.0 5.0 6.0
			CLAY, slightly silty, with calcareous particles, very stiff, dark brown				X
			SANDY CLAY, with calcareous particles, very stiff, brown				X
2.5							X
			CLAYEY SAND, medium dense, light brown				
5.0							+ 11 BPF (3,5,6)
7.5							
			SAND, fine, very loose to medium dense, light brown				
10.0							+ 16 BPF (4,7,9)
12.5							
15.0							+ 8 BPF (2,2,6)
17.5							
20.0							+ 2 BPF (1,1,1)
22.5							
							+ 4 BPF (1,1,3)

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LOG OF BORING

RECYCLING FACILITY
McCOMMAS BLUFF LANDFILL
DALLAS, TEXAS

PROJECT No.: 14465G
BORING No.: 8
SHEET 2 of 2
LOCATION: SEE PLATE 1
GROUND ELEVATION:

DRILL DATE: 12/04/14
METHOD: SHELBY TUBE /SPLIT SPOON THD TO 30.0'

STANDARD PENETRATION (BPF) +
TEXAS CONE PENETRATION ⊕

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION, (feet)	CORE DRILLED	CORE RECOVERED	POCKET PENETROMETER READING X (tsf) 1.0 2.0 3.0 4.0 5.0 6.0
			SAND, fine, very loose to medium dense, light brown				∇ W.L. = 27.0' upon completion
27.5			LIMESTONE, hard, gray				
30.0			TOTAL DEPTH: 30.0'				⊕ THD 50 = 1" 50 = 3/4"
32.5							
35.0							
37.5							
40.0							
42.5							
45.0							
47.5							

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LOG OF BORING
RECYCLING FACILITY
McCOMMAS BLUFF LANDFILL
DALLAS, TEXAS

PROJECT No.: 14465G
BORING No.: 9
SHEET 1 of 2
LOCATION: SEE PLATE 1
GROUND ELEVATION:

DRILL DATE: 12/04/14
METHOD: SHELBY TUBE /SPLIT SPOON THD TO 30.0'

STANDARD PENETRATION (BPF) +
TEXAS CONE PENETRATION ⊕
POCKET PENETROMETER READING X (tsf): 1.0 2.0 3.0 4.0 5.0 6.0

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION, (feet)	CORE DRILLED	CORE RECOVERED	PENETRATION / POCKET PENETROMETER
			CLAYEY SAND, medium dense, dark grayish-brown and brown				X
							X
			SANDY CLAY, stiff, brown				
2.5							
5.0							+ 14 BPF (4,6,8)
			SAND, fine, medium dense, light brown				
7.5							
10.0							+ 16 BPF (8,8,8)
12.5							
15.0							+ 13 BPF (3,4,9)
17.5							
			SAND, fine, with coarse sub-rounded gravel, loose, light brown				
20.0							+ 5 BPF (2,3,2)
22.5							
							4 BPF (2,2,2) +

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LOG OF BORING
RECYCLING FACILITY
McCOMMAS BLUFF LANDFILL
DALLAS, TEXAS

PROJECT No.: 14465G
BORING No.: 9
SHEET 2 of 2
LOCATION: SEE PLATE 1
GROUND ELEVATION:

TEXAS FIRM REGISTRATION NO. F-1238
DRILL DATE: 12/04/14
METHOD: SHELBY TUBE /SPLIT SPOON THD TO 30.0'

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION, (feet)	CORE DRILLED	CORE RECOVERED	STANDARD PENETRATION (BPF) + TEXAS CONE PENETRATION ⊕ POCKET PENETROMETER READING X (tsf) 1.0 2.0 3.0 4.0 5.0 6.0
27.5	░		SAND, fine, with coarse sub-rounded gravel, loose, light brown				∇ W.L. = 27.0' upon completion
30.0	▦	╱	LIMESTONE, hard, gray				⊕ THD 50 = 1-1/2" 50 = 3/4"
			TOTAL DEPTH: 30.0'				
32.5							
35.0							
37.5							
40.0							
42.5							
45.0							
47.5							

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LOG OF BORING
RECYCLING FACILITY
McCOMMAS BLUFF LANDFILL
DALLAS, TEXAS

PROJECT No.: 14465G
BORING No.: 10
SHEET 1 of 2
LOCATION: SEE PLATE 1
GROUND ELEVATION:

DRILL DATE: 12/04/14
METHOD: SHELBY TUBE /SPLIT SPOON THD TO 30.0'

STANDARD PENETRATION (BPF) +
TEXAS CONE PENETRATION ⊕
POCKET PENETROMETER READING X (tsf) 1.0 2.0 3.0 4.0 5.0 6.0

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION, (feet)	CORE DRILLED	CORE RECOVERED	STANDARD PENETRATION (BPF) / POCKET PENETROMETER READING X (tsf)
	CLAYEY SAND, medium dense, dark brown				X
	SANDY CLAY, with iron staining, very stiff, reddish-brown and light brown				X
2.5					X
5.0					+ 19 BPF (6,7,12)
7.5					
10.0					+ 22 BPF (9,14,8)
12.5	SAND, fine, with calcareous nodules, medium dense, light brown				
15.0					+ 11 BPF (2,4,7)
17.5					
	SAND, fine, slightly silty, with sub-rounded gravel, loose, light brown				
20.0					+ 6 BPF (2,2,4)
22.5					
					5 BPF (2,3,2) +

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TEXAS FIRM REGISTRATION NO. F-1238

LOG OF BORING
RECYCLING FACILITY
McCOMMAS BLUFF LANDFILL
DALLAS, TEXAS

PROJECT No.: 14465G
BORING No.: 10
SHEET 2 of 2
LOCATION: SEE PLATE 1
GROUND ELEVATION:

DRILL DATE: 12/04/14
METHOD: SHELBY TUBE /SPLIT SPOON THD TO 30.0'

STANDARD PENETRATION (BPF) +
TEXAS CONE PENETRATION ⊕

DEPTH (feet)	SYMBOL	SAMPLES	MATERIAL DESCRIPTION	ELEVATION, (feet)	CORE DRILLED	CORE RECOVERED	POCKET PENETROMETER READING X (tsf) 1.0 2.0 3.0 4.0 5.0 6.0
27.5			SAND, fine, slightly silty, with sub-rounded gravel, loose, light brown				▽ W.L. = 27.5' upon completion
30.0			LIMESTONE, hard, gray				⊕ THD 50 = 1-1/2" 50 = 1"
			TOTAL DEPTH: 30.0'				

27.5
30.0
32.5
35.0
37.5
40.0
42.5
45.0
47.5