ALPHA TESTING
WHERE IT ALL BEGINS

Geotechnical
Construction Materials
Environmental
TBPE Firm No. 813

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October 17, 2019

Monserrat Hills, LLC
6000 Western Place, Suite #110
Fort Worth, Texas 76107

Attention: Mr. Donnie Siratt

Re: Pavement Recommendations
Montrachet-Foundations, Paving, and Sewer Outfalls
East of R.M. Highway No. 2871 and North of Team Ranch Road
Fort Worth, Texas
ALPHA Report No. W191783-B

Submitted herein are the recommended pavement sections for public streets of the proposed subdivision (Montrachet). The site is generally located north of Team Ranch Road, about a quarter mile east of R.M. Highway No. 2871 in Fort Worth, Texas. This study was authorized by Mr. Donnie Siratt on August 6, 2019 and performed in accordance with ALPHA Proposal No. 71240-Rev3 dated August 6, 2019. Additional recommendations for foundations and retaining walls will be issued under separate reports.

The purpose of this study is to develop pavement sections for public streets in the subject subdivision in accordance with the City of Fort Worth Pavement Design Manual (January 2015). We understand the proposed street within the subdivision could be classified as "Residential-Urban", "Collector" or "Arterial", as described in the referenced manual.

PURPOSE AND SCOPE

The purpose of this geotechnical exploration is for ALPHA TESTING, INC. ("ALPHA") to evaluate for the Monserrat Hills, LLC ("Client") some of the physical and engineering properties of subsurface materials at selected locations on the subject site with respect to formulation of appropriate geotechnical design parameters for the proposed pavement. The field exploration was accomplished by securing subsurface samples from widely spaced test borings performed across the expanse of the site. Engineering analyses were performed from results of the field exploration and results of laboratory tests performed on representative samples.

Also included are general comments pertaining to reasonably anticipated construction problems and recommendations concerning earthwork and quality control testing during construction. This information can be used to evaluate subsurface conditions and to aid in ascertaining construction meets project specifications.

Recommendations provided in this report were developed from information obtained in test borings depicting subsurface conditions only at the specific boring locations and at the particular time designated on the logs. Subsurface conditions at other locations may differ from those observed at the boring locations, and subsurface conditions at boring locations may vary at different times of the year. The scope of work may not fully define the variability of subsurface materials and conditions that are present on the site.

The nature and extent of variations between borings may not become evident until construction. If significant variations then appear evident, our office should be contacted to re-evaluate our recommendations after performing on-site observations and possibly other tests.

SUMMARY OF RECOMMENDATIONS

Table A contains a summary of pavement section requirements for proposed street at the subject project.

TABLE A
Summary of Pavement Section Requirements

Street Classification	Residential -Urban	Collector	Arterial
PCC Pavement Thickness(in) placed on lime stabilized subgrade soil	6	7½	10
28-day Concrete Compressive Strength (psi)	3,600	3,600	3,600
Subgrade Treatment	6 inches Lime	8 inches Lime	8 inches Lime
Application Rate (lbs per sq yd)	36	48	48
Reinforcing Bar No.	3	3	4
Reinforcing Bar Spacing (in)	18	18	18

Further recommendations and analyses used to develop the summary in Table A are provided further in this report.

FIELD EXPLORATION

Subsurface conditions on the site were explored by drilling a total of 64 test borings. Forty (40) test borings were drilled to a depth of about 20 ft each, two (2) test borings were drilled to a depth of about 15 ft each, twelve (12) test borings were drilled to a depth of about 10 ft each and ten (10) test borings were drilled to a depth of about 25 ft each. The test borings were performed in general accordance with ASTM D 420 using standard rotary drilling equipment. The approximate location of each boring is shown on the attached Boring Location Plan, Figure 1.

Subsurface types encountered during the field exploration are presented on the attached Log of Boring sheets (boring logs). These boring logs contain our Field Technician's and Engineer's interpretation of conditions believed to exist between actual samples retrieved. Therefore, the boring logs contain both factual and interpretive information. Lines delineating subsurface strata on the boring logs are approximate and the actual transition between strata may be gradual.

LABORATORY TESTS

Selected samples of the subsurface materials were tested in the laboratory to evaluate their engineering properties as a basis in providing recommendations for pavement sections design and earthwork construction. The following laboratory tests were performed to facilitate pavement section recommendations:

- Moisture Content (ASTM D 2216)
- Atterberg-Limits (ASTM D 4318)
- Unconfined Compressive Strength (ASTM D 2166)
- Sulfate Content (TX-145-E Part II)
- Lime Series (Plasticity Index vs. Lime Content)

In addition to conventional laboratory testing to assess engineering properties of the soils, a bulk sample obtained in the vicinity of Boring 41 was used for a moisture-density relationship test (standard Proctor, ASTM D 698) and California Bearing Ratio test (CBR, ASTM D 1183). Individual test results are presented as Figure 2 and Figure 3, respectively.

GENERAL SUBSURFACE CONDITIONS

Based on geological atlas maps available from the Bureau of Economic Geology, published by the University of Texas at Austin, the southern three-quarters of the project site lie within the Kiamichi formation the northern quarter lies within the undivided Goodland Limestone and Walnut Clay formation. The Duck Creek Limestone formation is situated just south and west of the site. These formations generally consist of limestone with marl (limey shale) layers. Residual overburden soils associated with these formations generally consist of clays with low to high shrink/swell potential. Subsurface conditions at geological interfaces can be highly variable, as evidenced on the boring logs.

Subsurface conditions encountered in most of the borings generally consisted of clay extending to depths of about 1 ft to 19 ft below the ground surface underlain by limestone and/or shale extending to the respective termination depth of the borings (about 10 ft to 25 ft). Clay and/or shaly clay extended to the respective termination depth (about 10 ft to 25 ft) in about one third of the borings. Boring 39 was terminated at a depth of about 17 ft below the ground surface due to auger refusal on hard limestone. Limestone was encountered at the surface and extended to the 10 ft or 20 ft termination depth of Borings 50, 57 and 59. Limestone layers about 2 ft to 13 ft thick were encountered within the clay and/or shaly clay in Borings 3, 9, 10, 14, 19, 27, 32, 35, 55 and 62 at depths of about 1 ft to 10 ft. More detailed stratigraphic information is presented on the attached Log of Boring sheets.

Most of the subsurface materials encountered in the borings are relatively impermeable and are anticipated to have a relatively slow response to water movement. Therefore, several days of observation would be required to evaluate actual groundwater levels within the depths explored. Also, the groundwater level at the site is anticipated to fluctuate seasonally depending on the amount of rainfall, prevailing weather conditions and subsurface drainage characteristics.

Groundwater was not encountered in the borings. However, it is common to encounter seasonal groundwater from natural fractures within the clayey matrix, at the soil/rock (limestone and/or shale) interface or from fractures in the rock (limestone and/or shale), particularly during or after periods of precipitation. If more detailed groundwater information is required, monitoring wells or piezometers can be installed.

Further details concerning subsurface materials and conditions encountered can be obtained from the attached boring logs.

ENGINEERING ANALYSIS AND RECOMENDATIONS

Calculations used to determine the required pavement thickness are based only on the physical and engineering properties of the materials and conventional thickness determination procedures. Related civil design factors such as subgrade drainage, shoulder support, cross-sectional configurations, surface elevations, joint design and environmental factors will significantly affect the service life and must be included in preparation of the construction drawings and specifications but were not included in the scope of this study. Normal periodic maintenance will be required for all pavement to achieve the design life of the pavement system.

Pavement Subgrade Preparation

Based on review of the borings, it is expected the pavement subgrade could consist of clay soils or similar onsite materials used for grading the site. The pavement subgrade could also consist of limestone in some areas depending on the given location along the alignment and grading requirements. Since the subgrade conditions and required treatments could vary along the proposed road alignment, ALPHA should be retained to observe construction to verify conditions are as expected. Also, we should be provided with the final grading plan for review prior to construction to verify or modify in writing the recommendations contained in this report.

The exposed clayey surface soils should be scarified to a depth of 6 inches and 8 inches for Residential Urban and Collector/Arterial streets, respectively and mixed with a minimum 32 lbs per sq yard of hydrated lime (by dry soil weight) for Residential Urban streets and 42 lbs per sq yard for Collector and Arterial streets in conformance with TxDOT Standard Specifications Item 260. The recommended application rate for Residential-Urban streets and Collector/Arterial streets equates to about 7 percent based on a dry soil unit weight of 100 pcf. The results of lime series tests performed on representative clay samples are attached (Figures 4A through 4D). This application rate is considered a preliminary estimate. Samples of the actual pavement subgrade will require additional testing to verify the required application rate.

We recommend lime stabilization procedures extend at least 1 ft beyond the edge of the pavement to reduce effects of seasonal shrinking and swelling upon the extreme edges of pavement. The soil-lime mixture should be compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698) and within the range of 0 to 4 percentage points above the mixture's optimum moisture content. In all areas where hydrated lime is used to stabilize subgrade soil, routine Atterberg-limit tests should be performed to verify the resulting plasticity index of the soil-lime mixture is at/or below 15.

Mechanical lime stabilization of the pavement subgrade soil will not prevent normal seasonal movement of the underlying untreated materials. Pavement and other flatwork constructed at final grades could experience soil-related potential seasonal movements of about 7 inches depending on the depth of limestone from final grade, as discussed in ALPHA Report No. W191783 containing geotechnical recommendations for foundations.

Lime stabilization of the pavement subgrade is not required where the pavement subgrade consists of limestone. In pavement areas where limestone is exposed after final subgrade elevation is achieved, on-site lime stabilized clay cuttings, on-site processed limestone cuttings, or flexible base material could be used as a leveling course (as needed) to provide a smooth surface for placement of the pavement.

A California Bearing Ratio (CBR) test performed for this specific project indicates the CBR values for the natural clay soil tested could be about 5.4 to 6.8 (Figure 3). Following improvement with lime, the CBR value for the lime stabilized clayey soils is expected to be at least 10.

Portland Cement Concrete Pavement Section

Using the 1993 AASHTO pavement design procedures (WinPAS computer program distributed by American Concrete Pavement Association), the following design parameters were used in analyses of the PCC pavement section.

• Compressive strength of concrete	3,600 psi at 28 days	
• Modulus of Elasticity	4,000,000 psi	
• Modulus of Rupture	620 psi	
• Modulus of Subgrade Reaction*	280 pci	
• Load Transfer Co-efficient	3.0	
• Drainage Coefficient	1.0	
• Initial PSI	4.5	
• Terminal PSI for	2.0	(Residential Urban)
	2.25	(Collector)
	2.5	(Arterial)
• Standard Deviation	0.39	
• Reliability	85 percent	

*Subgrade prepared with lime stabilization, or graded limestone as discussed in the previous section.

Using the Street Classification of “Residential-Urban” as described in the referenced Fort Worth Pavement Design Manual, it is estimated annual traffic volume will be about 35,000 Equivalent Single Axle Loads (ESALs) in one direction over a 25-year design life with 0.5 percent annual traffic growth. Based on this, we estimate the cumulative ESALs over the design life of the Residential Urban street pavement to be about 930,000.

Using the Street Classification of "Collector" as described in the referenced Fort Worth Pavement Design Manual, the annual traffic volume will be about 100,000 Equivalent Single Axle Loads (ESALs) in one direction over a 25-year design life with 1.5 percent annual traffic growth. Based on this, we estimate the cumulative ESALs over the design life of the pavement to be about 3,000,000.

Using the Street Classification of "Arterial" as described in the referenced Fort Worth Pavement Design Manual, the annual traffic volume will be about 300,000 Equivalent Single Axle Loads (ESALs) in one direction over a 30-year design life with 2.5 percent annual traffic growth. Based on this, we estimate the cumulative ESALs over the design life of the pavement to be about 13,000,000.

If the actual expected traffic volume is different than used for our analysis herein, our office should be provided with the actual expected traffic volume so that we can re-evaluate our recommendations.

Based on the subgrade preparations recommended herein, the projected traffic volume and stated design parameters, a minimum 6-inch section of Portland cement concrete is required for Residential Urban classified streets, a minimum 7½-inch section of Portland cement concrete is required for Collector classified streets and a minimum 10-inch section of Portland cement concrete is required for Arterial classified streets at this project.

PCC should have a minimum 3,600 psi compressive strength at 28 days. The concrete section should be placed over a properly prepared subgrade as discussed herein. Concrete should be designed with 5 ± 1 percent entrained air. Reinforcing steel for concrete pavement should be in accordance with Table 4.1 of the referenced Pavement Design Manual. Joints and saw-cutting in concrete should be in accordance with Section Four of the referenced Pavement Design Manual.

Drainage and Maintenance

Routine maintenance, including sealing of cracks and joints should be performed over the life of the pavement. Adequate drainage should be provided to reduce seasonal variations in the moisture content of subgrade soils. **Maintaining positive surface drainage throughout the life of the pavement is essential.**

Soluble Sulfates

A total of seven (7) samples obtained from the borings were tested for soluble sulfate concentrations. Results of the laboratory testing (TxDOT Test Method TEX-145-E Part II) are summarized in Table B.

TABLE B Soluble Sulfates				
Sample No.	**Boring No.**	**Depth, ft**	**Material Type**	**Soluble Sulfate, mg/Kg (ppm)**
1	7	2-4	Dark Brown Clay with calcareous nodes	41
2	23	2-4	Tan Clay with calcareous deposits	61
3	33	0-2	Brown Clay with calcareous deposits	87
4	46	2-4	Dark Brown Clay with calcareous nodes	47
5	48	2-4	Dark Brown Clay with calcareous nodes	63
6	63	2-4	Light Brown Clay with calcareous deposits	62
7	64	2-4	Light Brown Clay with limestone fragments	194

Based on the results of laboratory testing, the soluble sulfate content measured in the samples tested is considered relatively low (<3,000 ppm). It should be noted that concentrations of soluble sulfates in soil are typically very localized and concentrations in other areas of the site could vary significantly. Therefore, it is recommended sulfate sampling/testing be performed along the pavement subgrade during construction. During construction, experienced geotechnical personnel should make close observations for possible sulfate reactions.

GENERAL CONSTRUCTION PROCEDURES AND RECOMMENDATIONS

Variations in subsurface conditions could be encountered during construction. To permit correlation between test boring data and actual subsurface conditions encountered during construction, it is recommended a registered Professional Engineering firm be retained to observe construction procedures and materials.

Some construction problems, particularly degree or magnitude, cannot be reasonably anticipated until the course of construction. The recommendations offered in the following paragraphs are intended not to limit or preclude other conceivable solutions, but rather to provide our observations based on our experience and understanding of the project characteristics and subsurface conditions encountered in the borings.

Site Preparation and Grading

Limestone was encountered within 4 ft of the ground surface in several borings. Limestone will likely be encountered during general grading and excavations. This limestone could be hard and may be difficult to excavate. Rock excavation methods (including, but not limited to rock teeth, rippers, jack hammers, or sawcutting) may be required to remove this limestone. Crushing equipment could be required if it is desired to use excavated limestone as fill. The contractor selected should have experience with excavation in hard limestone.

All areas supporting pavement or areas to receive new fill should be properly prepared.

After completion of the necessary stripping, clearing, and excavating and prior to placing any required fill, the exposed subgrade should be carefully evaluated by probing and testing. Any undesirable material (organic material, wet, soft, or loose soil) still in place should be removed.

The exposed subgrade should be further evaluated by proof-rolling with a heavy pneumatic tired roller, loaded dump truck or similar equipment weighing approximately 25 tons to check for pockets of soft or loose material hidden beneath a thin crust of possibly better soil. Proof-rolling procedures should be observed routinely by a Professional Engineer or his designated representative. Any undesirable material (organic material, wet, soft, or loose soil) exposed from the proof-roll should be removed and replaced with well-compacted material as outlined in the Fill Compaction section.

Prior to placement of any fill, the exposed subgrade should then be scarified to a minimum depth of 6 inches and recompacted as outlined in the Fill Compaction section.

If fill is to be placed on existing slopes (natural or constructed) steeper than six horizontal to one vertical (6:1), the fill materials should be benched into the existing slopes in such a manner as to provide a minimum bench width of five (5) ft. This should provide a good contact between the existing soils and new fill materials, reduce potential sliding planes, and allow relatively horizontal lift placements.

Even if fill is properly compacted as recommended in the Fill Compaction section, fills in excess of about 10 ft are still subject to settlements over time of up to about 1 to 2 percent of the total fill thickness. This should be considered when planning or placing deep fills, especially where utilities are planned below pavement.

Slope stability analysis of embankments (natural or constructed) and global stability analysis for retaining walls was not within the scope of this study.

The contractor is responsible for designing any excavation slopes, temporary sheeting or shoring. Design of these structures should include any imposed surface surcharges. Construction site safety is the sole responsibility of the contractor, who shall also be solely responsible for the means, methods and sequencing of construction operations. The contractor should also be aware that slope height, slope inclination or excavation depths (including utility trench excavations) should in no case exceed those specified in local, state and/or federal safety regulations, such as OSHA Health and Safety Standard for Excavations, 29 CFR Part 1926, or successor regulations. Stockpiles should be place well away from the edge of the excavation and their heights should be controlled so they do not surcharge the sides of the excavation. Surface drainage should be carefully controlled to prevent flow of water over the slopes and/or into the excavations. Construction slopes should be closely observed for signs of mass movement, including tension cracks near the crest or bulging at the toe. If potential stability problems are observed, a geotechnical engineer should be contacted immediately. Shoring, bracing or underpinning required for the project (if any) should be designed by a professional engineer registered in the State of Texas.

Due to the nature of the clay soils found near the surface at most of the borings, traffic of heavy equipment (including heavy compaction equipment) may create pumping and general deterioration of shallow soils. Therefore, some construction difficulties should be anticipated during periods when these soils are saturated.

Fill Compaction

The following compaction recommendations pertain to general filling and site grading. The pavement subgrade should be prepared as discussed in the Pavement Subgrade Preparation section.

Clay and shaly clay soils with a plasticity index equal to or greater than 25 should be compacted to a dry density between 95 and 100 percent of standard Proctor maximum dry density (ASTM D 698). The compacted moisture content of the clays during placement should be within the range of 2 to 5 percentage points above optimum.

Clay and sandy clay soils with a plasticity index less than 25 should be compacted to a dry density of at least 95 percent of standard Proctor maximum dry density (ASTM D 698) and within the range of 1 percentage point below to 3 percentage points above the material's optimum moisture content.

Clayey soils used as fill should be processed and the largest particle or clod should be less than 6 inches prior to compaction.

Processed limestone or other rock-like materials used as fill should be compacted to at least 95 percent of standard Proctor maximum dry density. The compacted moisture content of limestone or other rock-like materials used as fill is not considered crucial to proper performance. However, if the material's moisture content during placement is within 3 percentage points of optimum, the compactive effort required to achieve the minimum compaction criteria may be minimized. In general, processed limestone used as fill should have a maximum particle size of 6 inches. However, any processed limestone used as fill within 3 ft of the final pavement subgrade elevation should have a maximum particle size of 3 inches. A gradation of at least 40 percent passing a standard No. 4 sieve is recommended.

In cases where mass fills are more than 10 ft deep, the fill/backfill below 10 ft should be compacted to at least 100 percent of standard Proctor maximum dry density (ASTM D-698) and within 2 percentage points of the material's optimum moisture content. The portion of the fill/backfill shallower than 10 ft should be compacted as outlined herein.

Compaction should be accomplished by placing fill in about 8-inch thick loose lifts and compacting each lift to at least the specified minimum dry density. Field density and moisture content tests should be performed on each lift.

In general site grading areas where final fill slopes will be four horizontal to one vertical (4:1) or steeper and greater than 5 ft in height, field density and moisture content tests should be performed on each lift.

Utilities

In cases where utility lines are more than 10 ft deep, the fill/backfill below 10 ft should be compacted to at least 100 percent of standard Proctor maximum dry density (ASTM D 698) and within –2 to +2 percentage points of the material's optimum moisture content. The portion of the fill/backfill shallower than 10 ft should be compacted as previously outlined. Density tests should be performed on each lift (maximum 12-inch thick) and should be performed as the trench is being backfilled.

Even if fill is properly compacted, fills in excess of about 10 ft are still subject to settlements over time of up to about 1 to 2 percent of the total fill thickness. This should be considered when designing utility lines under pavements and/or other areas with deep fill.

If utility trenches or other excavations extend to or beyond a depth of 5 ft below construction grade, the contractor or others shall be required to develop an excavation safety plan to protect personnel entering the excavation or excavation vicinity. The collection of specific geotechnical data and the development of such a plan, which could include designs for sloping and benching or various types of temporary shoring, is beyond the scope of this study. Any such designs and safety plans shall be developed in accordance with current OSHA guidelines and other applicable industry standards.

Groundwater

Groundwater was not encountered in the borings. However, groundwater seepage could be encountered from the subsurface stratigraphy in excavations for pavement, utilities and other general excavations at this site. The risk of seepage increases with depth of excavation and during or after periods of precipitation. Standard sump pits and pumping may be adequate to control seepage on a local basis.

In any areas where cuts are made, attention should be given to possible seasonal water seepage that could occur through natural cracks and fissures in the newly exposed stratigraphy. The risk of seepage is increased where limestone is exposed in excavations and slopes or is near final grade. In these areas subsurface drains may be required to intercept seasonal groundwater seepage. The need for these or other dewatering devices should be carefully addressed during construction. Our office could be contacted to visually observe final grades to evaluate the need for such drains.

LIMITATIONS

Professional services provided in this geotechnical exploration were performed, findings obtained, and recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. The scope of services provided herein does not include an environmental assessment of the site or investigation for the presence or absence of hazardous materials in the soil, surface water or groundwater. ALPHA, upon written request, can be retained to provide same.

ALPHA TESTING, INC. is not responsible for conclusions, opinions or recommendations made by others based on this data. Information contained in this report is intended for the exclusive use of the Client (and their designated design representatives), and is related solely to design of the specific structures outlined on the cover page of this report. No party other than the Client (and their designated design representatives) shall use or rely upon this report in any manner whatsoever unless such party shall have obtained ALPHA's written acceptance of such intended use. Any such third party using this report after obtaining ALPHA's written acceptance shall be bound by the limitations and limitations of liability contained herein, including ALPHA's liability being limited to the fee paid to it for this report. Recommendations presented in this report should not be used for design of any other structures except those specifically described in this report. In all areas of this report in which ALPHA may provide additional services if requested to do so in writing, it is presumed that such requests have not been made if not evidenced by a written document accepted by ALPHA. Further, subsurface conditions can change with passage of time. Recommendations contained herein are not considered applicable for an extended period of time after the completion date of this report. It is recommended our office be contacted for a review of the contents of this report for construction commencing more than one (1) year after completion of this report. Non-compliance with any of these requirements by the Client or anyone else shall release ALPHA from any liability resulting from the use of, or reliance upon, this report.

Recommendations provided in this report are based on our understanding of information provided by the Client about characteristics of the project. If the Client notes any deviation from the facts about project characteristics, our office should be contacted immediately since this may materially alter the recommendations. Further, ALPHA TESTING, INC. is not responsible for damages resulting from workmanship of designers or contractors and it is recommended the Owner retain qualified personnel, such as a Geotechnical Engineering firm, to verify construction is performed in accordance with plans and specifications.

CLOSURE

All recommendations in the referenced geotechnical report remain unchanged unless specifically modified herein. We appreciate the opportunity to be of service. Please contact us with any questions or comments.

Sincerely,

ALPHA TESTING, INC.

STATE OF TEXAS
BRIAN J. HOYT
115748
LICENSED PROFESSIONAL ENGINEER

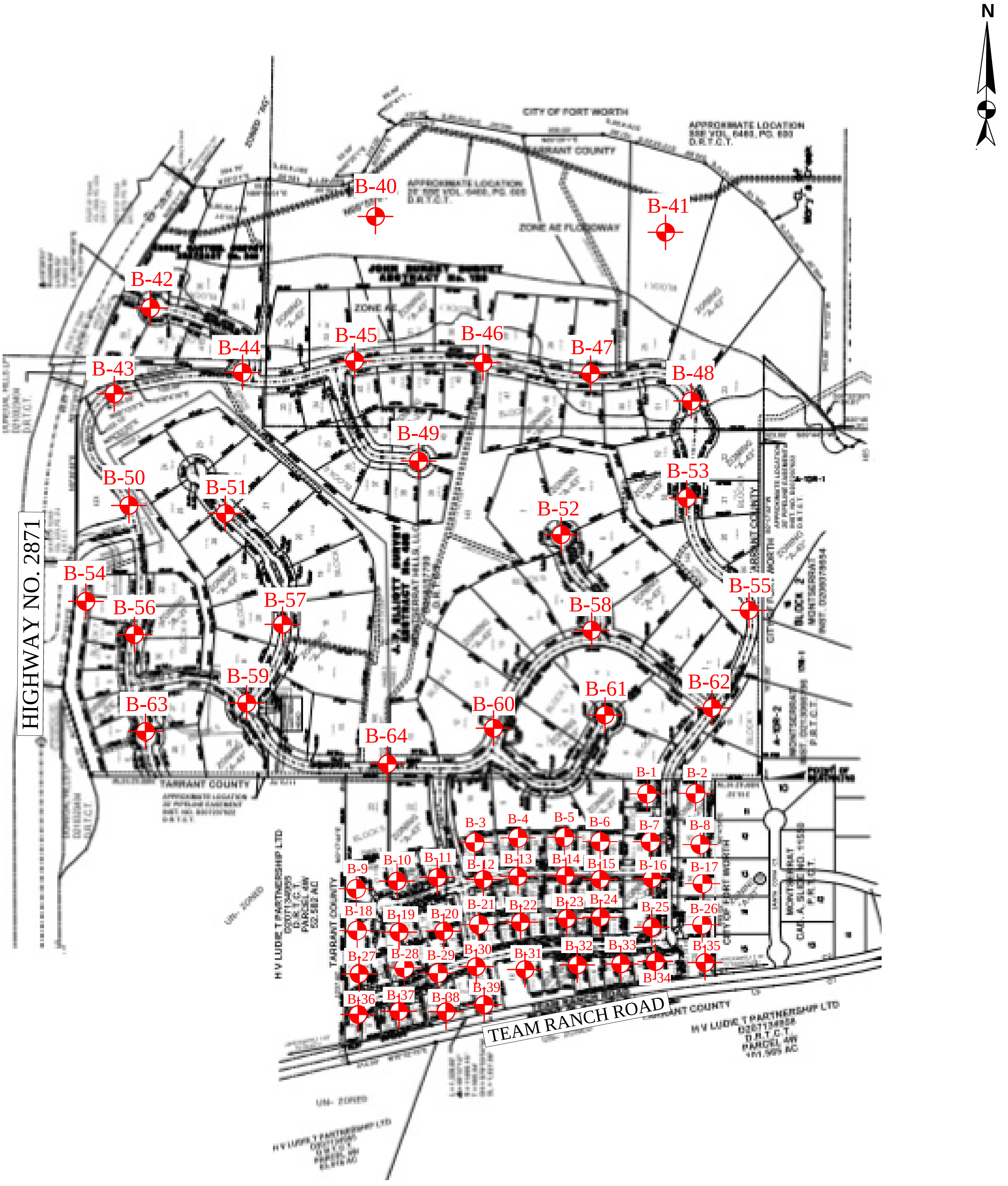
October 17, 2019

Mark L. McKay, P.E.
Director of Geotechnical Engineering

Brian J. Hoyt, P.E.
Geotechnical Department Manager

BJH/MLM/kc
Copies: (1-PDF) Client

Attachments:
- Boring Location Plan – Figure 1
- Moisture-Density Relationship- Figure 2
- California Bearing Ratio- Figure 3
- Mechanical Lime Series – Figures 4A through 4D
- WinPAS Analysis Results
- Log of Borings
- Key to Soil Symbols and Classifications



PAVEMENT RECOMMENDATIONS
MONTRACHET-FOUNDATIONS, PAVING,
AND SEWER OUTFALLS
EAST OF R.M. HIGHWAY NO. 2871 AND
NORTH OF TEAM RANCH ROAD
FORT WORTH, TEXAS
ALPHA PROJECT NO. W191783-B

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FIGURE 1

BORING LOCATION PLAN

⌖ **APPROXIMATE BORING LOCATION**

REPORT OF MOISTURE DENSITY RELATIONSHIP RESULTS
(ASTM D698-A)

Project No: W191783

Date: 07/30/19

Material Description: Dark Brown Clay
Classification: CH
Sample Location: Boring 41
Maximum Dry Unit Weight (pcf): **94.9**
Optimum Moistuire Content (%): **22.3**

LL: 58
PL: 19
PI : 39
% Passing #200: 88.3%

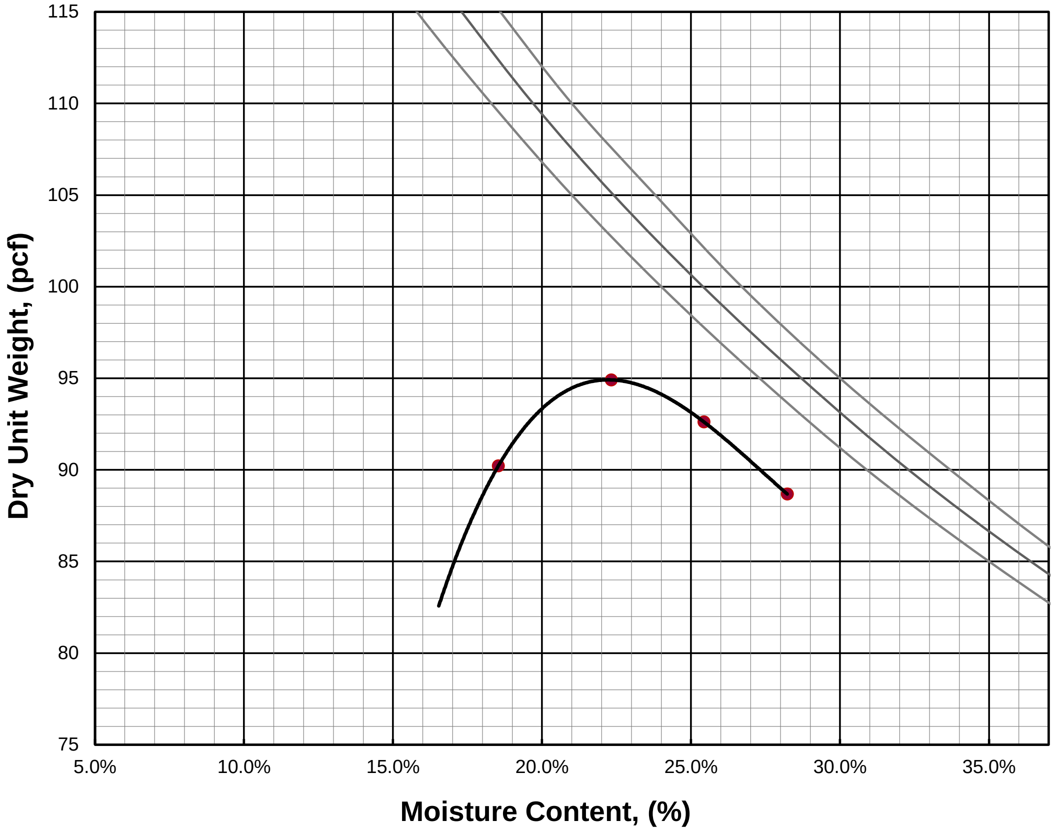

FIGURE 2

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REPORT OF CALIFORNIA BEARING RATIO RESULTS
(ASTM D1883)

Project No: W191783-B

Date: 08/08/19

Material Description:	Dark Brown Sandy Clay
Sample Location:	Near B41
CBR @ 0.10 Inches =	6.80%
CBR @ 0.20 Inches =	5.40%

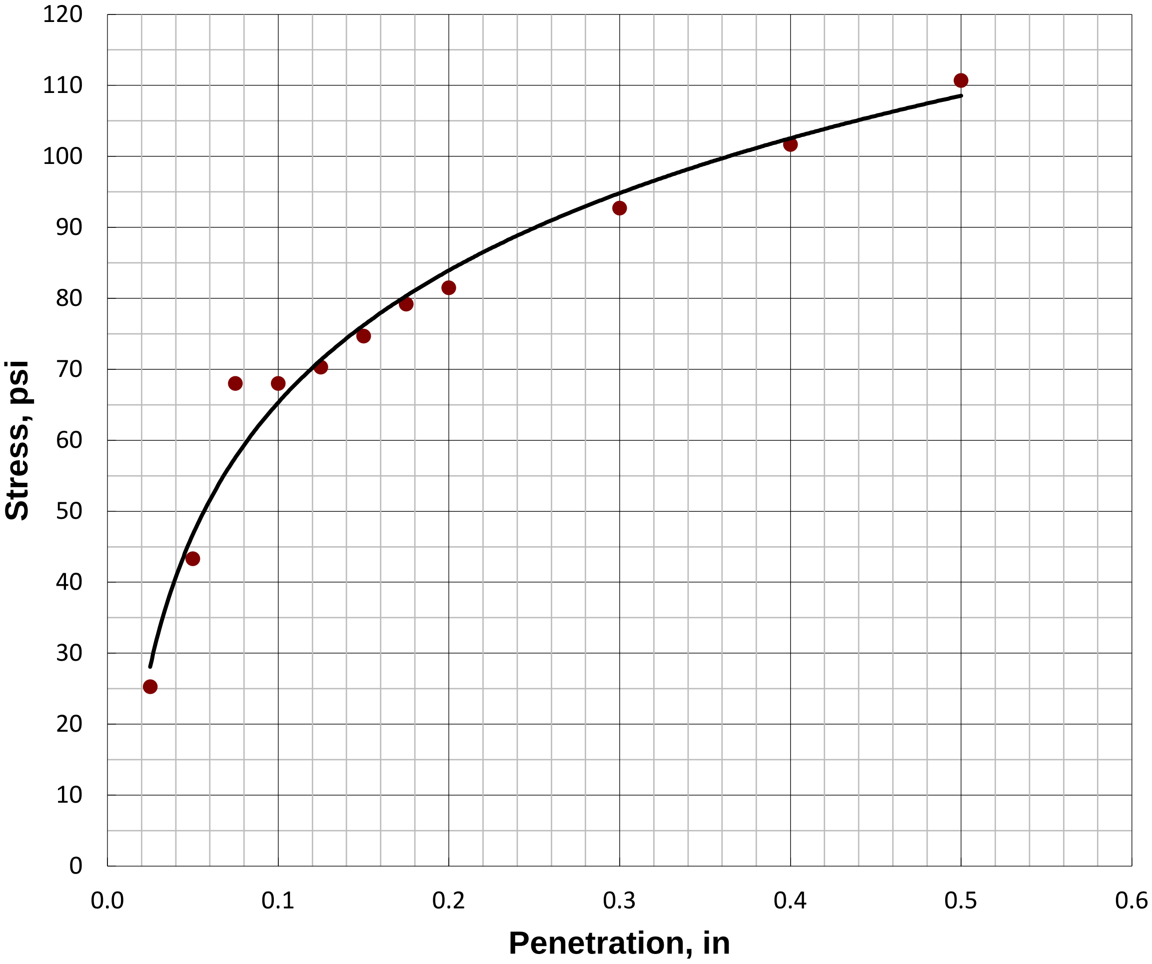

FIGURE 3

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REPORT OF MECHANICAL LIME SERIES RESULTS

Project No: W191783-B

Date: 09/09/19

Borings: 1, 4, 11, 14 and 16

% Lime	0%	2%	4%	6%	8%
PI	43	19	16	13	9

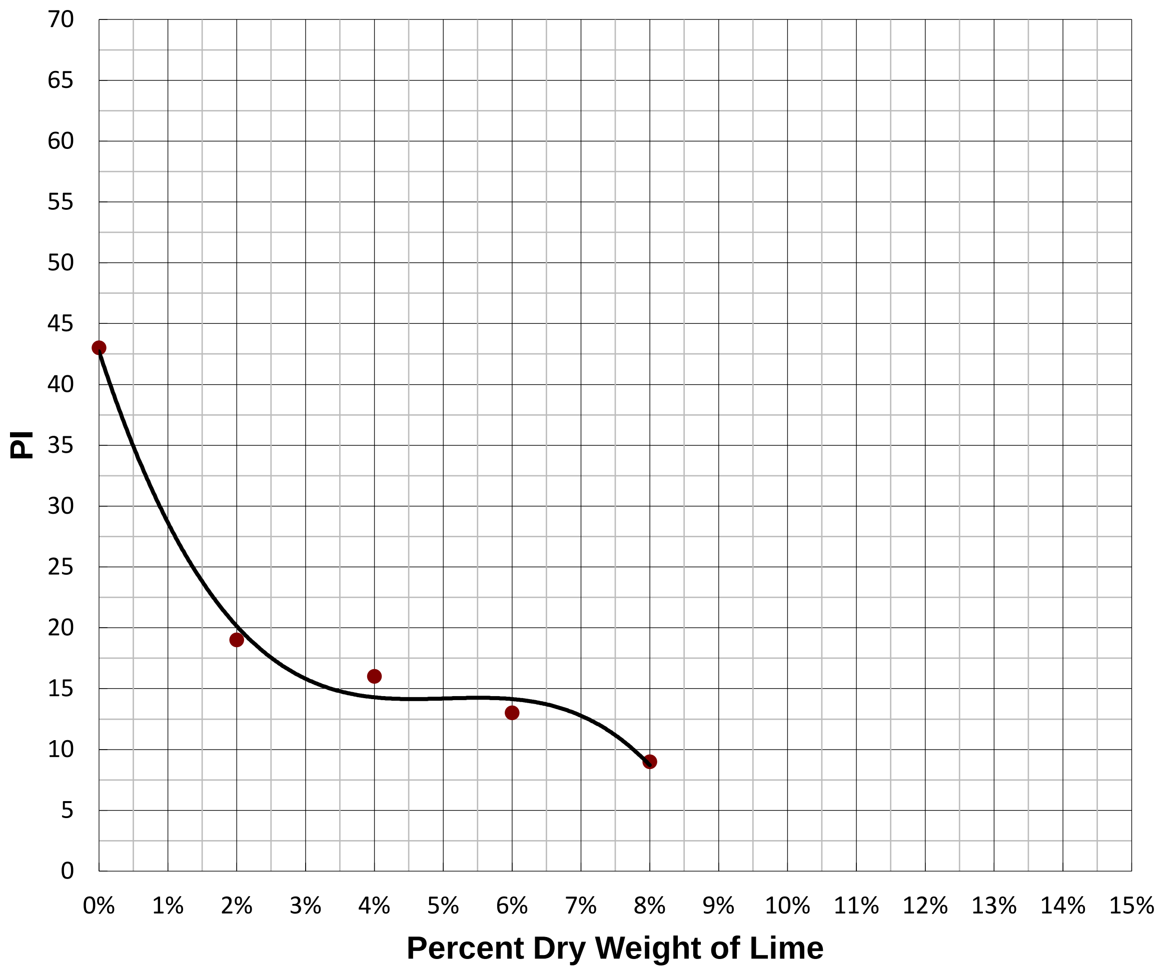

FIGURE 4A

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REPORT OF MECHANICAL LIME SERIES RESULTS

Project No: W191783-B

Date: 09/09/19

Borings 17, 20, 22, 27 and 33

% Lime	0%	2%	4%	6%	8%
PI	43	20	18	16	14

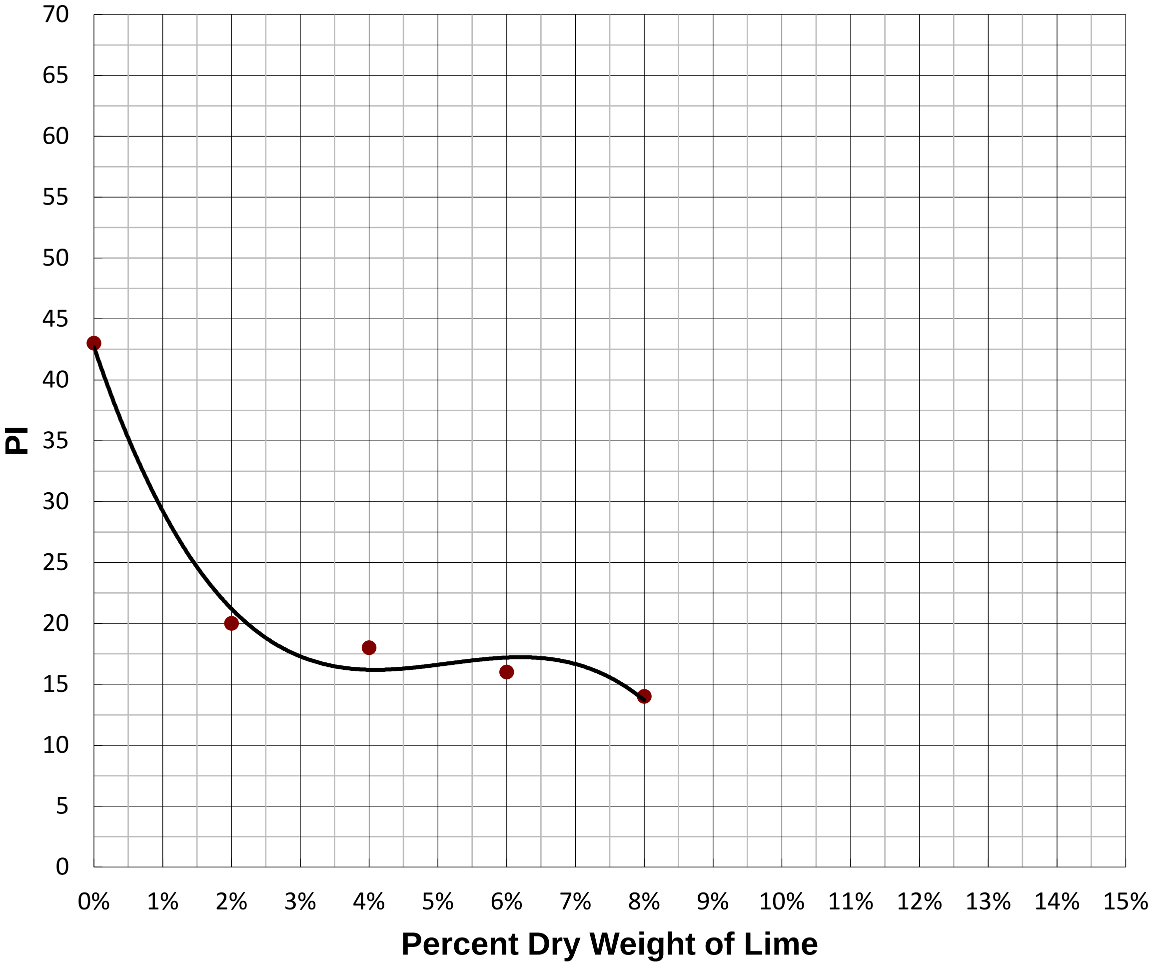

FIGURE 4B

REPORT OF MECHANICAL LIME SERIES RESULTS

Project No: W191783-B

Date: 09/03/19

Borings: 45, 46, 47, 48 and 49

% Lime	0%	2%	4%	6%	8%
PI	41	22	17	13	10

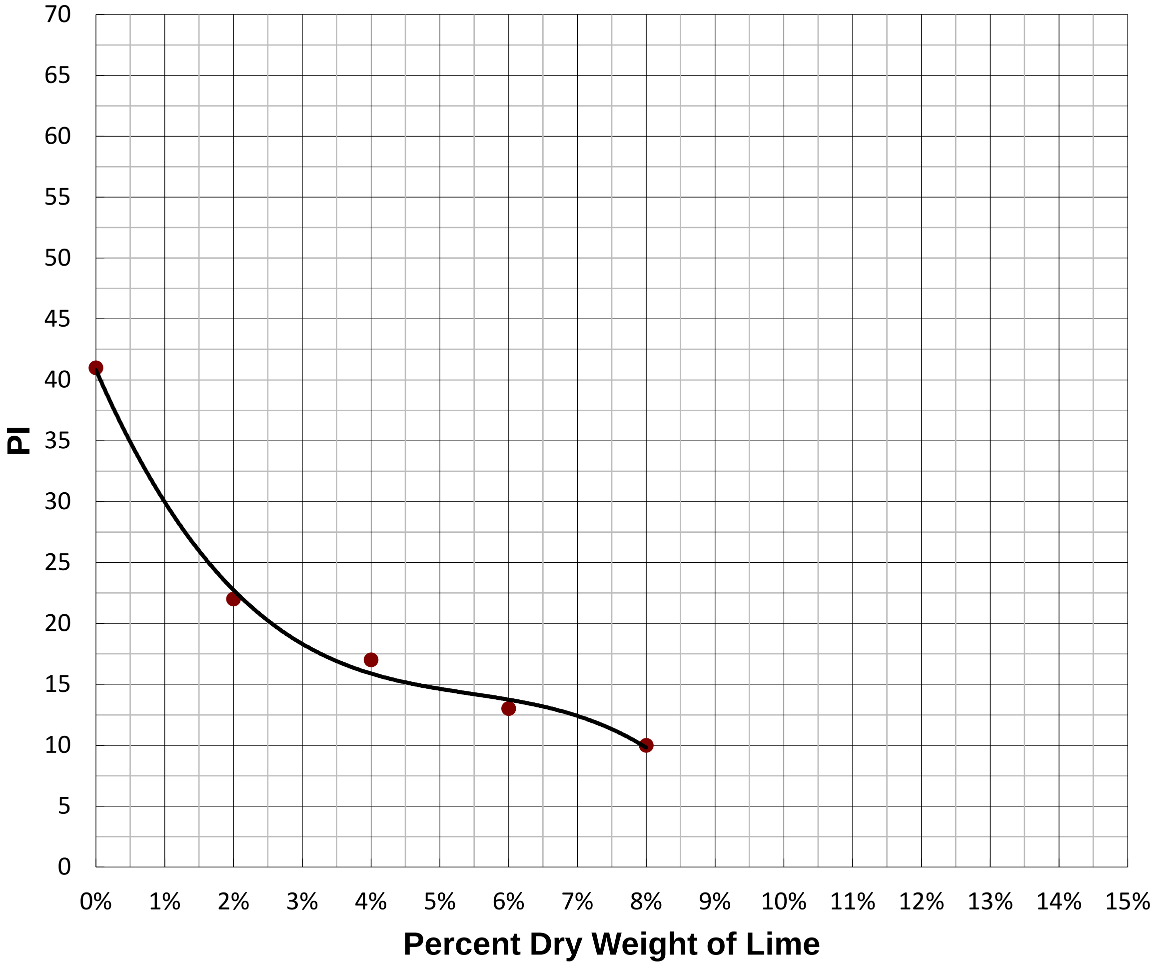

FIGURE 4C

REPORT OF MECHANICAL LIME SERIES RESULTS

Project No: W191783-B

Date: 09/03/19

Borings: 51, 62, 63 and 64

% Lime	0%	2%	4%	6%	8%
PI	37	19	16	14	12

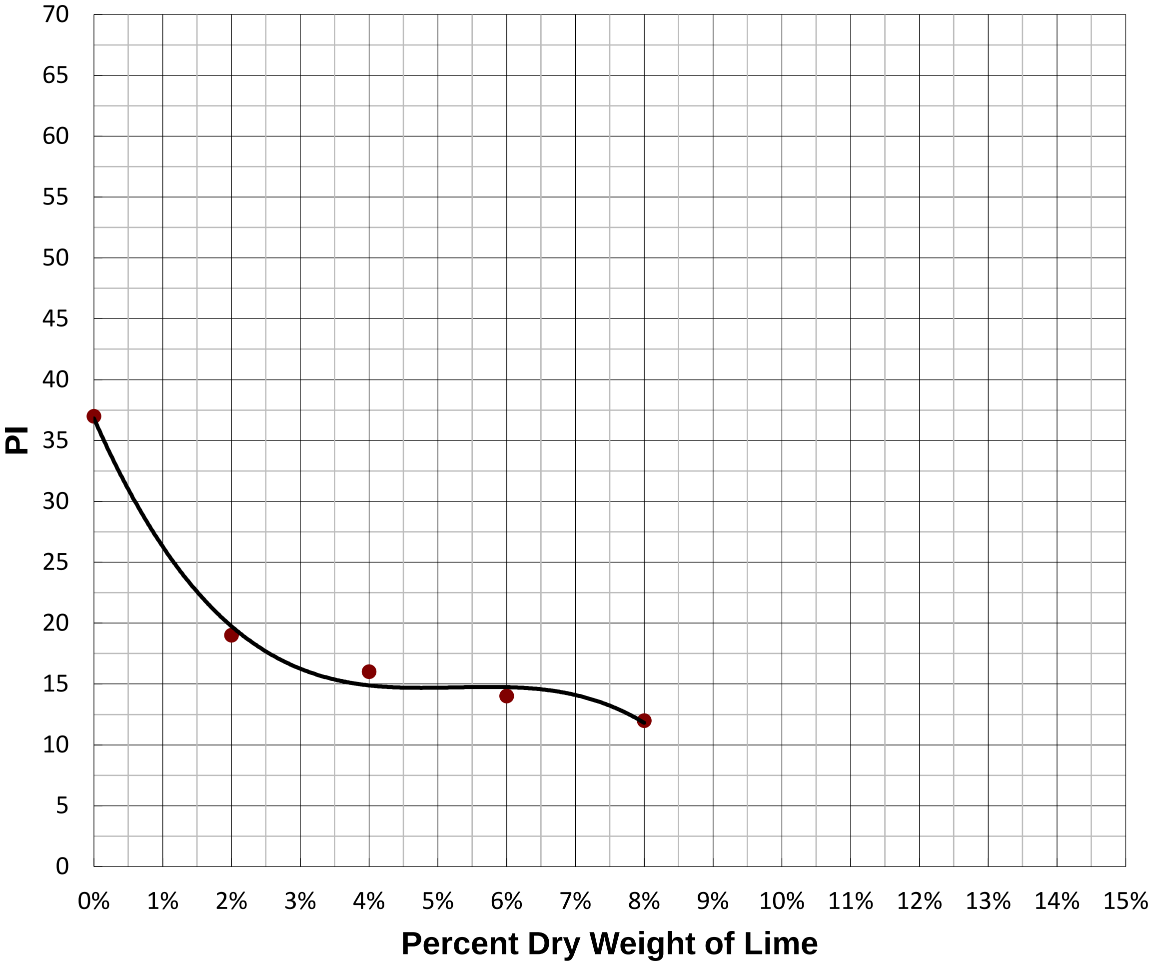

FIGURE 4D

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Rigid Design Inputs

Agency: City of Fort Worth
Company: Alpha Testing Inc.
Contractor:
Project Description: Residential Pavement Analysis
Location: Fort Worth, TX

Rigid Pavement Design/Evaluation

PCC Thickness	5.91	**inches**	**Load Transfer, J**	3.00	
Design ESALs	930,000		**Mod. Subgrade Reaction, k**	280	**psi/in**
Reliability	85.00	**percent**	**Drainage Coefficient, Cd**	1.00	
Overall Deviation	0.39		**Initial Serviceability**	4.50	
Modulus of Rupture	620	**psi**	**Terminal Serviceability**	2.00	
Modulus of Elasticity	4,000,000	**psi**			

Modulus of Subgrade Reaction (k-value) Determination

Resilient Modulus of the Subgrade	0.0	**psi**
Resilient Modulus of the Subbase	0.0	**psi**
Subbase Thickness	0.00	**inches**
Depth to Rigid Foundation	0.00	**feet**
Loss of Support Value (0,1,2,3)	0.0	

Modulus of Subgrade Reaction	280.00	**psi/in**

Thursday, April 23, 2015 1:12:04PM

Engineer:

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Rigid Design Inputs

Agency: City of Fort Worth
Company: Alpha Testing Inc.
Contractor:
Project Description: Collector Pavement Analysis
Location: Fort Worth, TX

Rigid Pavement Design/Evaluation

PCC Thickness	7.52	**inches**	**Load Transfer, J**	3.00	
Design ESALs	3,000,000		**Mod. Subgrade Reaction, k**	280	**psi/in**
Reliability	85.00	**percent**	**Drainage Coefficient, Cd**	1.00	
Overall Deviation	0.39		**Initial Serviceability**	4.50	
Modulus of Rupture	620	**psi**	**Terminal Serviceability**	2.25	
Modulus of Elasticity	4,000,000	**psi**			

Modulus of Subgrade Reaction (k-value) Determination

Resilient Modulus of the Subgrade	0.0	**psi**
Resilient Modulus of the Subbase	0.0	**psi**
Subbase Thickness	0.00	**inches**
Depth to Rigid Foundation	0.00	**feet**
Loss of Support Value (0,1,2,3)	0.0	

Modulus of Subgrade Reaction	280.00	**psi/in**

Thursday, April 23, 2015 1:11:04PM

Engineer: ______________________

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Rigid Design Inputs

Agency: City of Fort Worth
Company: Alpha Testing Inc.
Contractor:
Project Description: Arterial Pavement Analysis
Location: Fort Worth, TX

Rigid Pavement Design/Evaluation

PCC Thickness	9.87	**inches**	**Load Transfer, J**	3.00	
Design ESALs	13,000,000		**Mod. Subgrade Reaction, k**	280	**psi/in**
Reliability	85.00	**percent**	**Drainage Coefficient, Cd**	1.00	
Overall Deviation	0.39		**Initial Serviceability**	4.50	
Modulus of Rupture	620	**psi**	**Terminal Serviceability**	2.50	
Modulus of Elasticity	4,000,000	**psi**			

Modulus of Subgrade Reaction (k-value) Determination

Resilient Modulus of the Subgrade	0.0	**psi**
Resilient Modulus of the Subbase	0.0	**psi**
Subbase Thickness	0.00	**inches**
Depth to Rigid Foundation	0.00	**feet**
Loss of Support Value (0,1,2,3)	0.0	
Modulus of Subgrade Reaction	280.00	**psi/in**

Thursday, April 23, 2015 1:09:59PM

Engineer: ______________________

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BORING NO.: 1
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/16/2019 **End Date:** 8/16/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in):

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Dark Brown CLAY with calcareous nodules	■			4.5+				20				
	▨	4.0	■			4.5+				17	67	21	46	0.7
5	▨	Tan CLAY with calcareous deposits 6.0	■			4.5+				13				
	▨	Tan and Gray SHALY CLAY with calcareous deposits	■			4.5				15				0.8
	▨		■			4.5+				17	75	25	50	
10	▨													
15	▨	16.0	■			4.5+				10				
	▨	Gray SHALY CLAY												
20	▨	20.0	■							17				
		TEST BORING TERMINATED AT 20 FT												
25														

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BORING NO.: 2
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/16/2019 **End Date:** 8/16/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY with limestone fragments	■											
2.0	▨		◣		100/ 11"									
		Tan WEATHERED LIMESTONE with clay seams and layers												
5			◣		76/ 12"									
10			◣		63/ 12"									
15			◣		100/ 6"									
16.0														
		Gray LIMESTONE with shale seams and layers												
20.0			◣		100/ 5"									
20		TEST BORING TERMINATED AT 20 FT												
25														

ALPHA TESTING
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BORING NO.: 3
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/15/2019 **End Date:** 8/15/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY with limestone fragments	■							12				
	▨		◣		100/ 10.5"									
	▨	4.0												
5	▦	Tan WEATHERED LIMESTONE with clay seams and layers	◣		75/ 12"					4				
	▦	6.0												
	▨	Brown CLAY with gravel	■			4.5+				9	53	18	35	
	▨	8.0												
	▨	Tan and Brown SHALY CLAY with limestone fragments and calcareous deposits	■			4.5+				9	61	21	40	
10	▨													
15	▨		■			4.5+				7				
20	▨	20.0	■			4.5+				12				
		TEST BORING TERMINATED AT 20 FT												
25														

BORING NO.: 4
Sheet 1 of 1
PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/15/2019 **End Date:** 8/15/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY with limestone fragments	■			4.5+				14				
	▨	2.0	◣		98/ 10"									
	▦	Tan WEATHERED LIMESTONE with clay seams and layers												
5	▦		◣		40/ 12"									
10	▦		◣		100/ 9"									
	▦	14.0												
15	▦	Gray LIMESTONE with shale seams and layers	◣		80/ 12"									
20	▦	20.0	◣		100/ 8"									
		TEST BORING TERMINATED AT 20 FT												
25														

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BORING NO.: 5
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/15/2019 **End Date:** 8/15/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY with limestone fragments	■							11	63	23	40	
	▨	2.0	◣		100/ 9"									
	▦	Tan LIMESTONE with clay seams and layers												
5	▦		◣		55/ 12"									
10	▦		◣		77/ 12"									
15	▦		◣		100/ 7"									
20	▦		◣		100/ 5"									
25	▦	25.0	◣		100/ 4"									
		TEST BORING TERMINATED AT 25 FT												

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BORING NO.: 6
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/16/2019 **End Date:** 8/16/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in):

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY with limestone fragments 2.0	■			4.5+				16				
	▨	Tan CLAY with limestone fragments and calcareous deposits	■			4.5+				13	60	19	41	
5	▨	6.0	■			4.5+				13				
	▨	Tan SHALY CLAY with calcareous deposits	■			4.5+				15				
10	▨	10.0	■			4.5				19				
15	▨	Tan SHALY CLAY	■			4.5+	3.4		109	17	62	20	42	
20	▨	20.0	■			4.5+				17				
25		TEST BORING TERMINATED AT 20 FT												

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BORING NO.: 7
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/16/2019 **End Date:** 8/16/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Dark Brown CLAY with calcareous nodules	■			4.5+				19				
	▨	4.0	■			4.5+	11.4		106	15				4.1
5	▨	Tan SHALY CLAY with calcareous deposits	■			4.5+				15				
	▨		■			4.5+				15	58	18	40	0.4
	▨		■			4.5+				21				
10	▨	13.0												
15	▦	Gray LIMESTONE with shale seams 16.0	◣		100/7"									
	▨	Gray SHALY CLAY												
20	▨	20.0	■			4.5+				16				
		TEST BORING TERMINATED AT 20 FT												
25														

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BORING NO.: 8
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/19/2019 **End Date:** 8/19/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Dark Brown CLAY with calcareous nodules 2.0	■			4.5+				17				
	▨	Tan CLAY with calcareous deposits	■			4.5+				9	52	19	33	
5	▨	6.0	■							9				
		Tan WEATHERED LIMESTONE with clay seams and layers	◣		60/12"									
10			◣		100/8"									
15		18.0	◣		100/7"									
		Gray SHALE												
20		20.0	◣		100/1.5"									
		TEST BORING TERMINATED AT 20 FT												
25														

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BORING NO.: 9
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/14/2019 **End Date:** 8/14/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY with limestone fragments	■			4.5+				17				
	▨	3.0	◣		57/ 12"					13				
5	▦	Tan LIMESTONE with clay seams 6.0	◣		100/ 0.5"									
	▨	Tan CLAY with calcareous deposits	■			4.5+				15	54	18	36	5.9
10	▨	10.0												
	▦	Tan WEATHERED LIMESTONE with clay seams	◣		77/ 12"					12				
15	▦	16.0	◣		99/ 6.5"									
20	▨	Tan and Gray SHALY CLAY 22.0	■			4.5+				12				
25	▤	Gray SHALE 25.0	◣		100/ 3.5"									
		TEST BORING TERMINATED AT 25 FT												

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BORING NO.: 10
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/14/2019 **End Date:** 8/14/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft): ______

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY with limestone fragments	■			4.5+				17				
	▨	3.0	◣		58/ 12"					11				
5	▦	Tan WEATHERED LIMESTONE with clay seams and layers												
10	▦		◣		72/ 12"									
15	▦	16.0	◣		100/ 9"									
	▨	Tan and Gray SHALY CLAY												
20	▨	20.0	■			4.5+				20	71	24	47	
		TEST BORING TERMINATED AT 20 FT												
25														

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BORING NO.: 11
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/14/2019 **End Date:** 8/14/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): -

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY	■			4.5+				25				
	▨		■			4.5+				18				
5	▨	6.0	■			4.5+	2.3		99	24				
	▨	Tan SHALY CLAY	■			4.5+				14				
	▨		■			4.5+				15	56	18	38	3.2
10	▨													
15	▨		■			4.5+				11				
	▨	19.0												
20	▨	Gray SHALY CLAY 20.0	■			4.5+				16	59	18	41	
		TEST BORING TERMINATED AT 20 FT												
25														

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BORING NO.: 12
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/14/2019 **End Date:** 8/14/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY with limestone fragments	■							12	64	23	41	
	▨	2.0	◣		52/ 12"									
	▨	Tan CLAY with calcareous deposits	■			4.5+				11				
5	▨		■			4.5+				13				
	▨	8.0	■			4.25				11	58	19	39	
	▨	Tan SHALY CLAY	■			4.5+				15				
10	▨	14.0												
15	▦	Tan LIMESTONE with clay seams and layers 19.0	◣		75/ 12"									
20	☰	Gray SHALE 20.0	◣		100/ 4"									
25		TEST BORING TERMINATED AT 20 FT												

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BORING NO.: 13
Sheet 1 of 1
PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/13/2019 **End Date:** 8/13/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY with limestone fragments	■			4.5+				12	63	22	41	
		2.0												
	▦	Tan LIMESTONE with clay seams and layers	◣		100/ 3"									
5	▦													
10	▦		◣		100/ 4"									
	▦	14.0												
15	☰	Gray SHALE	◣		100/ 4"									
20	☰	20.0	◣		100/ 0.75"									
		TEST BORING TERMINATED AT 20 FT												
25														

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BORING NO.: 14
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/13/2019 **End Date:** 8/13/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION		Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY	2.0	■			4.5+				15				
5	▦	Tan LIMESTONE with clay seams and layers	8.0	◣		100/ 3"									
10	▨	Tan and Gray SHALY CLAY		■			4.5+				19				0.4
15	▨		17.0	■							21	72	26	46	
20	☰	Gray SHALE	20.0	◣		100/ 1"									
25		TEST BORING TERMINATED AT 20 FT													

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PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/13/2019 **End Date:** 8/13/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION		Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY	2.0	■			4.5+				13	65	23	42	
	▦	Tan LIMESTONE with clay seams and layers		◣		100/ 5"									
5	▦														
10	▦			◣		100/ 3"									
	▦		14.0												
15	☰	Gray SHALE		◣		100/ 1"									
20	☰		20.0	◣		100/ 0.75"									
		TEST BORING TERMINATED AT 20 FT													
25															

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WHERE IT ALL BEGINS

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PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/13/2019 **End Date:** 8/13/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY 2.0	■			4.5+				16				
	▨	Tan CLAY with calcareous deposits and limestone fragments 4.0	■			4.5+				10	61	18	43	
5	▦	Tan LIMESTONE with clay seams and layers	◣		100/ 5"									
10	▦		◣		100/ 4"									
15	▦	16.0	◣		100/ 2.5"									
20	☰	Gray SHALE 20.0	◣		100/ 0.5"									
		TEST BORING TERMINATED AT 20 FT												
25														

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PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/13/2019 **End Date:** 8/13/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft): ______

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
		Brown CLAY				4.5+				21				
						4.5+	5.9		102	15				
5						4.5+				18	76	24	52	
		6.0												
		Tan CLAY with calcareous deposits				4.5+				15				
						3.0				19	69	21	48	0.9
10														
		14.0												
15		Tan LIMESTONE with clay seams and layers			100/ 5"									
		17.0												
		Gray SHALE												
20		20.0			100/ 0.75"									
		TEST BORING TERMINATED AT 20 FT												
25														

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PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/8/2019 **End Date:** 8/8/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION		Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY	1.0	■							16	77	26	51	
	▦	Tan LIMESTONE with clay seams and layers		◣		100/ 1.5"									
5	▦			◣		100/ 1"									
10	▦			◣		100/ 2.5"									
15	▦			◣		100/ 1.5"									
20	▦		20.0	◣		100/ 1.25"									
		TEST BORING TERMINATED AT 20 FT													
25															

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BORING NO.: 19
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/8/2019 **End Date:** 8/8/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION		Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY	1.0	■			4.5+				10				
	▦	Tan LIMESTONE with clay seams		◣		100/ 1"									
5	▦			◣		100/ 1"									
10	▦			◣		100/ 1.5"									
	▦		13.0												
	▨	Tan and Gray SHALY CLAY													
15	▨			■			4.5+				16	66	21	45	
20	▨		20.0	■			3.0				22				
		TEST BORING TERMINATED AT 20 FT													
25															

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BORING NO.: 20
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PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/8/2019 **End Date:** 8/8/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY	■			4.5+				15	72	25	47	
		2.0												
	▨	Tan CLAY with calcareous deposits	■			4.5+				5				
5	▨		■			4.5+				14	66	24	42	
	▨		■			4.0				20				0.0
		8.0												
	▨	Tan and Gray SHALY CLAY	■			4.5+				18				
10	▨													
15	▨		■			4.5+				16				
		19.0												
20		Tan LIMESTONE with clay seams and layers 20.0	◣		100/ 1"									
		TEST BORING TERMINATED AT 20 FT												
25														

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BORING NO.: 21
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PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/12/2019 **End Date:** 8/12/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY	■			4.5+				15	76	25	51	
	▨		■			4.5+				14				
		4.0												
5	▨	Light Brown CLAY	■			4.5+				19				
	▨		■			3.5				17				
		8.0												
10		Tan LIMESTONE with clay seams and layers	◣		100/ 2.5"									
		14.0												
15	☰	Gray SHALE	◣		100/ 1"									
20	☰		◣		100/ 1.25"									
25	☰	25.0	◣		100/ 0.75"									
		TEST BORING TERMINATED AT 25 FT												

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BORING NO.: 22
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/12/2019 **End Date:** 8/12/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
		Brown CLAY				4.5+				12				
		2.0												
		Light Brown CLAY				4.5+	2.6		120	11	52	17	35	
5						4.5+				14				
		6.0												
		Tan LIMESTONE with clay seams and layers			100/ 4"									
10					100/ 3"									
		12.0												
		Gray SHALE												
15					100/ 1.75"									
20					100/ 1"									
		20.0												
		TEST BORING TERMINATED AT 20 FT												
25														

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PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/12/2019 **End Date:** 8/12/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY	■			4.5+				16	74	25	49	
	▨	2.0	■											
	▨	Tan CLAY with calcareous deposits	■			4.5+				15				
5	▨		■			3.25				19				
	▨	6.0	■											
	▦	Tan LIMESTONE with clay seams and layers	◣		100/ 3"									
10	▦		◣		100/ 1.5"									
	▦	14.0												
15	▦	Gray LIMESTONE with shale seams and layers	◣		100/ 1"									
20	▦	20.0	◣		100/ 0.75"									
		TEST BORING TERMINATED AT 20 FT												
25														

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PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/12/2019 **End Date:** 8/12/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY	■			4.5+				17				
	▨		■			4.5+				13				
	▨	4.0	■											
5	▨	Tan CLAY with calcareous deposits	■			4.5				16	48	23	25	2.0
	▨	6.0	■											
	▦	Tan LIMESTONE with clay seams and layers	◣		100/ 4"									
10	▦		◣		100/ 3"									
	▦	12.0												
	▦	Gray LIMESTONE with shale seams and layers												
15	▦		◣		100/ 1"									
20	▦	20.0	◣		100/ 0.75"									
		TEST BORING TERMINATED AT 20 FT												
25														

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BORING NO.: 25
Sheet 1 of 1
PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/12/2019 **End Date:** 8/12/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY with limestone fragments	■							15	65	25	40	
	▨		■							6				
	▨	4.0	■							5				
5	▦	Tan LIMESTONE with clay seams and layers	◣		100/ 5"									
10	▦		◣		100/ 4"									
	▦	11.0												
	▦	Gray LIMESTONE with shale seams and layers												
15	▦		◣		100/ 1"									
20	▦	20.0	◣		100/ 0.75"									
		TEST BORING TERMINATED AT 20 FT												
25														

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Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/12/2019 **End Date:** 8/12/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY with limestone fragments 2.0	■			4.5+				12	68	26	42	
	▦	Tan LIMESTONE with clay seams and layers	◣		100/ 5"									
5	▦													
10	▦		◣		100/ 4"									
15	▦	17.0	◣		100/ 3"									
	▦	Gray LIMESTONE with shale seams and layers												
20	▦	20.0	◣		100/ 1"									
		TEST BORING TERMINATED AT 20 FT												
25														

ALPHA TESTING
WHERE IT ALL BEGINS

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BORING NO.: 27
Sheet 1 of 1
PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/8/2019 **End Date:** 8/8/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY with limestone fragments	■			4.5+				15				
	▨	2.0												
	▦	Tan LIMESTONE with clay seams and layers												
5	▦		◣		100/ 0.25"									
10	▦		◣		100/ 10"									
	▦	13.0												
	▨	Tan SHALY CLAY												
15	▨		■							16	58	20	38	
20	▨	20.0	■							17				
		TEST BORING TERMINATED AT 20 FT												
25														

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PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/8/2019 **End Date:** 8/8/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
		Tan CLAY with limestone fragments				4.5+				8				
						4.5+				12	56	19	37	
5		6.0				3.75				12				
		Tan and Gray CLAY				4.5+	4.2		117	11				
						4.5+				17	56	19	37	0.3
10		13.0												
15		Tan SHALY CLAY				3.75				18	65	21	44	
		18.0												
20		Gray LIMESTONE with shale seams and layers 20.0			100/ 1.25"									
25		TEST BORING TERMINATED AT 20 FT												

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PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/8/2019 **End Date:** 8/8/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft): ______________

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
		Tan CLAY with limestone fragments	■			4.5+				11				
			■			4.5+				9				
		4.0	■											
5		Tan and Gray CLAY with calcareous deposits	■			4.5+				10				
			■			4.5+				24	85	28	57	
		8.0	■											
		Tan LIMESTONE with clay seams and layers												
10			◣		100/ 7"									
		12.0												
		Gray SHALE												
15			◣		100/ 1.5"									
20		20.0	◣		100/ 1.25"									
		TEST BORING TERMINATED AT 20 FT												
25														

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BORING NO.: 30
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/7/2019 **End Date:** 8/7/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY 2.0	■			4.5+				14				
	▨	Tan CLAY with calcareous deposits 4.0	■			4.5+				10	49	19	30	1.9
5 10	▨	Tan CLAY with calcareous deposits 10.0	■			3.25 4.5+ 4.5+				20 11 19	 65	 22	 43	
15	▦	Tan LIMESTONE with clay seams and layers 16.0	◣ ◣		100/ 3.5" 100/ 1"									
20	▦	Gray LIMESTONE with shale seams and layers 20.0	◣		100/ 1"									
25		TEST BORING TERMINATED AT 20 FT												

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BORING NO.: 31
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/7/2019 **End Date:** 8/7/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY	■			4.5+				15	74	22	52	
		2.0												
	▨	Light Brown CLAY	■			4.5+				14				
		4.0												
5	▨	Tan CLAY with sand	■			4.5+	3.7		113	12				
	▨		■			2.5				17				
	▨		■			1.75		82		20	54	19	35	
10	▨													
		12.0												
	▦	Tan LIMESTONE with clay seams and layers												
15	▦		◣		100/ 1.25"									
		17.0												
	▦	Gray LIMESTONE with shale seams and layers												
20	▦	20.0	◣		100/ 1"									
		TEST BORING TERMINATED AT 20 FT												
25														

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BORING NO.: 32
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/7/2019 **End Date:** 8/7/2019
Drilling Method: CONTINUOUS FLIGHT AUGER
Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY 2.0	■			4.5+				17				
	▦	Tan LIMESTONE with clay seams 3.0	◣		100/ 7"									
	▨	Tan CLAY with limestone fragments and calcareous deposits	■			4.5+				16	52	17	35	0.0
5		6.0				3.75				16				
	▦	Tan LIMESTONE with clay seams and layers 8.0	⌇							12				
	▨	Tan CLAY with sand 9.0	■			3.75		70		21	59	21	38	
10	▦	Gray LIMESTONE with shale seams and layers	◣		100/ 1.5"									
15	▦		◣		100/ 1.25"									
20	▦	20.0	◣		100/ 0.75"									
		TEST BORING TERMINATED AT 20 FT												
25														

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BORING NO.: 33
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/12/2019 **End Date:** 8/12/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
		Brown CLAY with calcareous deposits	■			4.5+				21				
			■			4.5+				10	58	19	39	
		4.0												
5		Tan LIMESTONE with clay seams and layers	◣		100/ 4.5"									
		8.0												
		Gray LIMESTONE with shale seams												
10			◣		100/ 3"									
15			◣		100/ 1"									
20		20.0	◣		100/ 0.75"									
		TEST BORING TERMINATED AT 20 FT												
25														

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BORING NO.: 34
Sheet 1 of 1
PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/7/2019 **End Date:** 8/7/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY with calcareous deposits	■			4.5+				12				
	▨		■			4.5+				10	57	18	39	
5	▨		■			4.5+				10				2.1
	▨	8.0												
10	▨	Tan SHALY CLAY 10.0	■			4.5				24	66	23	43	
	▦	Tan LIMESTONE with clay seams and layers	◣		100/ 1"									
15	▦		◣		100/ 1.5"									
	▦	17.0												
	▦	Gray LIMESTONE with shale seams and layers												
20	▦	20.0	◣		100/ 1"									
		TEST BORING TERMINATED AT 20 FT												
25														

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Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/7/2019 **End Date:** 8/7/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Tan CLAY	■			4.25				21				
	▨	3.0	■			4.5+	1.4		99	20				
	▦	Tan LIMESTONE with clay seams 4.0	◣		100/ 6.5"									
5	▨	Tan CLAY with limestone fragments 6.0	■			4.5+				15	72	21	51	
	▦	Tan LIMESTONE with clay seams and layers												
10	▦		◣		100/ 2"									
15	▦	15.0	◣		100/ 0.75"									
	▦	Gray LIMESTONE with shale seams and layers												
20	▦		◣		100/ 0.5"									
25	▦	25.0	◣		100/ 0.5"									
		TEST BORING TERMINATED AT 25 FT												

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PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/1/2019 **End Date:** 8/1/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY with limestone fragments 2.0	■			4.5+				15				
	▨	Tan CLAY with limestone fragments	■			4.5+				16	65	22	43	2.5
5	▨	6.0	■			3.25				19				
	▨	Tan SHALY CLAY with sand and limestone fragments	■			3.0				27				
	▨		■			4.5+		88		18	31	15	16	0.0
10	▨	14.0												
15	▦	Tan LIMESTONE with clay seams and layers 19.0	◣		100/ 1.5"									
20	▦	Gray LIMESTONE with shale seams and layers	◣		100/ 3.5"									
25	▦	25.0	◣		100/ 3"									
		TEST BORING TERMINATED AT 25 FT												

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Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/1/2019 **End Date:** 8/1/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY with limestone fragments	■			4.5+				14	70	21	49	
		2.0												
	▨	Tan CLAY with calcareous deposits	■			4.5+				11				
5			■			4.5+	3.7		111	14				
		6.0												
	▨	Tan SHALY CLAY with sand	■			4.5+		84		18	65	20	45	
			■			4.5+				15				
10		10.0												
	▦	Tan LIMESTONE with clay seams and layers	◣		100/ 2.25"									
15			◣		100/ 3.25"									
20		20.0	◣		100/ 2.75"									
		TEST BORING TERMINATED AT 20 FT												
25														

BORING NO.: 38
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/1/2019 **End Date:** 8/1/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY with limestone fragments 2.0	■			4.5+				12				
5	▨	Tan CLAY with calcareous deposits and limestone fragments 6.0	■			4.5+				9	47	20	27	
	▨	Tan SHALY CLAY with sand	■			4.5+				19				
10	▨	14.0	■			4.0				25				
15	▨	Brown SANDY CLAY, shaly 17.0	■			3.75		69		26	54	18	36	
20	▨	Gray SHALY CLAY 20.0	■											
25		TEST BORING TERMINATED AT 20 FT												

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BORING NO.: 39
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/1/2019 **End Date:** 8/1/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft): ______

Depth, feet	Graphic Log	MATERIAL DESCRIPTION		Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY	2.0	■			4.5+				16				
	▨	Tan CLAY with calcareous deposits	4.0	■			3.0				20				
5	▨	Brown CLAY with calcareous nodules	6.0	■			4.5+				10	61	20	41	
	▨	Tan CLAY with sand		■			2.75		84		21	52	19	33	
	▨			■			4.5+				28				
10	▨														
	▨		14.0												
15	▨	Gray SHALY CLAY with sand		■			4.5+				17	68	21	47	0.0
	▨		17.0	◣		100/ 0"									
		TEST BORING TERMINATED AT 17 FT DUE TO AUGER REFUSAL ON HARD ROCK													
20															
25															

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BORING NO.: 40
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/21/2019 **End Date:** 8/21/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in):

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Dark Brown CLAY with calcareous nodules	■			4.5+				15	54	17	37	
	▨	2.0	■											
	▨	Brown CLAY	■			4.5+				11				
5	▨		■			4.5+				12	67	22	45	0.0
	▨		■			4.5+	12.9		118	14				
	▨		■			4.0				18				
10	▨													
	▨	13.0												
	▨	Tan SANDY CLAY												
15	▨	15.0	■			3.25		56		9	33	15	18	
		TEST BORING TERMINATED AT 15 FT												
20														
25														

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BORING NO.: 41
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/21/2019 **End Date:** 8/21/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in):

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
		Dark Brown CLAY with calcareous nodules 2.0				4.5+				11				
		Brown CLAY				4.5+				12	42	20	22	0.3
5						4.5+				9				
		8.0				4.5+				13				
10		Light Brown CLAY 13.0				4.5				14	41	19	22	0.0
15		Tan SANDY CLAY with gravel 15.0								8				
		TEST BORING TERMINATED AT 15 FT												
20														
25														

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BORING NO.: 42
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PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/21/2019 **End Date:** 8/21/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in):

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Dark Brown CLAY	■			4.5+				11				
	▨		■			4.5+				12	56	20	36	4.0
	▨	4.0	■											
5	▨	Brown CLAY	■			4.5+	8.3		116	14				
	▨		■			4.5+				15				
	▨		■			4.5+				17				
10	▨	11.0												
	▨	Brown SHALY CLAY												
15	▨		■			3.5	2.6		109	18	54	19	35	
20	▨	20.0	■			4.25				16				
		TEST BORING TERMINATED AT 20 FT												
25														

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BORING NO.: 43
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PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/21/2019 **End Date:** 8/21/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in):

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Dark Brown CLAY with calcareous nodules	■			4.5+				10				
	▨		■			4.5+				13	38	17	21	
		4.0												
5	▨	Brown CLAY with calcareous nodules	■			4.5+				12				0.0
	▨		■			4.5+				11				
	▨		■			4.5+	2.6		119	12				
10	▨													
		12.0												
	▨	Brown SHALY CLAY												
15	▨		■			4.5+				12	36	17	19	0.0
20	▨		■			4.5				12				
25	▨	25.0	■			3.25				12				
		TEST BORING TERMINATED AT 25 FT												

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BORING NO.: 44
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PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/21/2019 **End Date:** 8/21/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in):

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY with calcareous nodules	■			4.5+				6				
	▨		■			4.5+				8	38	19	19	
5	▨	5.0	■			4.5+				7				
		Tan WEATHERED LIMESTONE with clay seams and layers	◣		100/ 8.5"									
10			◣		95/ 12"									
15			◣		100/ 7"									
20		20.0	◣		100/ 6"									
		TEST BORING TERMINATED AT 20 FT												
25														

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BORING NO.: 45
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/21/2019 **End Date:** 8/21/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in):

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Dark Brown CLAY with calcareous nodules	■			4.5+				12				
	▨		■			4.5+				12				
	▨	4.0	■											
5	▨	Brown SHALY CLAY	■			4.5+				14				
	▨		■			4.5				18	50	23	27	0.4
	▨		■			4.0				19				
10	▨	10.0	■											
		TEST BORING TERMINATED AT 10 FT												
15														
20														
25														

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BORING NO.: 46
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/21/2019 **End Date:** 8/21/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in):

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Dark Brown CLAY with calcareous nodules	■			4.5+				9				
	▨		■			4.5+				17				
5	▨		■			4.5+				15	55	19	36	
	▨	6.0	■											
	▨	Light Brown CLAY with calcareous nodules	■			4.5+				15				
	▨		■			4.5+				10				
10	▨	10.0	■											
		TEST BORING TERMINATED AT 10 FT												
15														
20														
25														

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BORING NO.: 47
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/21/2019 **End Date:** 8/21/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in):

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Dark Brown CLAY with calcareous nodules	■			4.5+				8				
	▨		■			4.5+				12				
	▨	4.0	■											
	▨	Brown CLAY with calcareous nodules	■											
5	▨		■			4.5+				16				
	▨		■			4.5+				17	59	20	39	
	▨		■			4.0				19				
10	▨	10.0	■											
		TEST BORING TERMINATED AT 10 FT												
15														
20														
25														

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BORING NO.: 48
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/21/2019 **End Date:** 8/21/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in):

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Dark Brown CLAY with calcareous nodules	■			4.5+				15				
	▨		■			4.5+				13				
5	▨	6.0	■			4.5+				13	36	18	18	
	▨	Brown CLAY with calcareous nodules	■			4.5+				15				
10	▨	10.0	■			4.5+				16				
		TEST BORING TERMINATED AT 10 FT												
15														
20														
25														

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BORING NO.: 49
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/21/2019 **End Date:** 8/21/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in):

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Dark Brown CLAY with calcareous nodules	■			4.5+				12				
	▨	4.0	■			4.5+				14				
5	▨	Light Brown CLAY with calcareous nodules	■			4.5+				15				
	▨		■			4.5+				14	40	18	22	0.0
10	▨	10.0	■			4.5				15				
		TEST BORING TERMINATED AT 10 FT												
15														
20														
25														

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BORING NO.: 50
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/20/2019 **End Date:** 8/20/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
		Tan WEATHERED LIMESTONE with clay seams and layers	◣		100/ 6"									
5			◣		92/ 11"									
10			◣		100/ 11"									
15		15.0	◣		100/ 8"									
		Tan LIMESTONE with clay seams and layers												
20		20.0	◣		100/ 4.5"									
		TEST BORING TERMINATED AT 20 FT												
25														

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PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/20/2019 **End Date:** 8/20/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Tan CLAY with limestone fragments	■			4.5+				13				
	▨		■			4.5+				14	55	20	35	
5	▨		■			4.5+				8				
		6.0												
	▦	Tan WEATHERED LIMESTONE with clay seams and layers	◣		100/ 8"									
10	▦		◣		100/ 6.5"									
		10.0												
		TEST BORING TERMINATED AT 10 FT												
15														
20														
25														

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BORING NO.: 52
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/19/2019 **End Date:** 8/19/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Tan CLAY with limestone fragments	■			4.5+				28				
	▨		■			4.5+	7.3		111	13	61	18	43	
		4.0												
5	▦	Tan LIMESTONE with clay seams and layers	◣		100/ 5"									
10	▦		◣		100/ 4"									
15	▦		◣		100/ 5.5"									
		16.0												
20	▦	Gray LIMESTONE with shale seams and layers	◣		100/ 3"									
25	▦	25.0	◣		100/ 2.5"									
		TEST BORING TERMINATED AT 25 FT												

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BORING NO.: 53
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PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/13/2019 **End Date:** 8/13/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
		Brown CLAY with limestone fragments												
						4.5+				7				
						4.5+				11				
5						4.5+				16	50	19	31	0.3
						4.5+	1.8		112	8				
		8.0												
		Tan LIMESTONE with clay seams and layers												
10					100/ 1.5"									
15					100/ 1"									
		17.0												
		Gray LIMESTONE with shale seams and layers												
20					100/ 0.75"									
25		25.0			100/ 0.75"									
		TEST BORING TERMINATED AT 25 FT												

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BORING NO.: 54
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/20/2019 **End Date:** 8/20/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft): ____

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Tan CLAY with limestone fragments	■			4.5+				12				
	▨		■			4.5+	7.0		107	18	68	24	44	
	▨	4.0	■											
5		Tan WEATHERED LIMESTONE with clay seams and layers	◣		100/ 11"									
10			◣		62/ 12"									
15			◣		100/ 9.5"									
		16.0												
		Gray LIMESTONE with shale seams and layers												
20			◣		100/ 8.5"									
25		25.0	◣		100/ 6"									
		TEST BORING TERMINATED AT 25 FT												

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BORING NO.: 55
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PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/13/2019 **End Date:** 8/13/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
		Brown CLAY with limestone fragments	■			4.5+				10				
			■			4.5+	4.1		112	8	37	17	20	
5			■			4.5+				10				
		6.0												
		Tan LIMESTONE with clay seams and layers	◣		100/ 3"									
10			◣		100/ 6"									
		13.0												
		Light Brown CLAY												
15		15.0	■							16	47	23	24	
		Tan LIMESTONE with clay seams and layers	◣		100/ 4"									
20		20.0	◣		100/ 1"									
		TEST BORING TERMINATED AT 20 FT												
25														

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BORING NO.: 56
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/20/2019 **End Date:** 8/20/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY with limestone fragments	■			4.5+				11	57	22	35	
		2.0												
	▨	Light Brown CLAY with calcareous nodules	■			4.5+				17				
5			■			4.5+				10				1.2
		8.0												
10	▦	Tan WEATHERED LIMESTONE with clay seams and layers	◣		100/ 12"									
15			◣		90/ 11"									
		18.0												
20	☰	Gray SHALE	◣		100/ 7"									
		20.0												
		TEST BORING TERMINATED AT 20 FT												
25														

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BORING NO.: 57
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PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/20/2019 **End Date:** 8/20/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
		Tan WEATHERED LIMESTONE with clay seams and layers								7				
			◣		100/ 10"									
5			◣		64/ 12"									
10		10.0	◣		100/ 7"									
		TEST BORING TERMINATED AT 10 FT												
15														
20														
25														

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PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/19/2019 **End Date:** 8/19/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft): ______

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY with limestone fragments	■								44	24	20	
	▨	2.0	◣		100/ 8"									
		Tan LIMESTONE with clay seams and layers												
5			◣		100/ 4.5"									
10			◣		100/ 6"									
15			◣		100/ 6"									
		18.0												
	☰	Gray SHALE												
20	☰		◣		100/ 6"									
25	☰	25.0	◣		100/ 3"									
		TEST BORING TERMINATED AT 25 FT												

BORING NO.: 59
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/19/2019 **End Date:** 8/19/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
		Tan LIMESTONE with clay seams and layers	◣		100/ 3"									
5			◣		100/ 1"									
10		10.0	◣		100/ 0.75"									
		TEST BORING TERMINATED AT 10 FT												
15														
20														
25														

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PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/19/2019 **End Date:** 8/19/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▽ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY with limestone fragments 1.0	■							9	59	22	37	
	▦	Tan LIMESTONE with clay seams and layers	◣		100/ 7"									
5	▦		◣		100/ 5"									
10	▦	10.0	◣		100/ 4"									
		TEST BORING TERMINATED AT 10 FT												
15														
20														
25														

ALPHA TESTING
WHERE IT ALL BEGINS

5058 Brush Creek Rd.
Fort Worth, Texas 76119
Phone: 817-496-5600
Fax: 817-496-5608
www.alphatesting.com

BORING NO.: 61
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/19/2019 **End Date:** 8/19/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 140 / 30

GROUND WATER OBSERVATIONS
▽ On Rods (ft): NONE
▼ After Drilling (ft): DRY
▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY with limestone fragments	■							5	44	22	22	
	▨	2.0	◣		100/ 6.5"									
	▦	Tan WEATHERED LIMESTONE with clay seams and layers												
5	▦		◣		100/ 8"									
10	▦	10.0	◣		76/ 11"									
	▦	Tan LIMESTONE with clay seams and layers												
15	▦		◣		100/ 6"									
20	▦	20.0	◣		100/ 3.5"									
		TEST BORING TERMINATED AT 20 FT												
25														

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BORING NO.: 62
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/13/2019 **End Date:** 8/13/2019
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Hammer Drop (lbs / in): 140 / 30

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Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Brown CLAY with limestone fragments 2.0	■			4.5+				12	65	20	45	
	▦	Tan LIMESTONE with clay seams and layers 4.0								4				
5	▨	Light Brown CLAY 6.0	■			4.0				24	71	24	47	
	▦	Tan LIMESTONE with clay seams and layers	◣		100/ 3"									
10	▦	10.0	◣		100/ 5"									
		TEST BORING TERMINATED AT 10 FT												
15														
20														
25														

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BORING NO.: 63
Sheet 1 of 1

PROJECT NO.: W191783

Client: Monserrat Hills, LLC
Project: Montrachet - Foundations, Paving and Sewer Outfalls
Start Date: 8/20/2019 **End Date:** 8/20/2019
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Fort Worth , Texas
Surface Elevation:
West:
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Hammer Drop (lbs / in):

GROUND WATER OBSERVATIONS
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▼ After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
	▨	Light Brown CLAY with calcareous deposits	■			4.5+				9				
	▨		■			4.5+				19	50	16	34	
5	▨	6.0	■			4.5+				22				
	▨	Tan and Gray SHALY CLAY 8.0	■			4.5+				19	75	26	49	4.7
10	▨	Tan CLAY with limestone fragments 10.0	■			4.5+				8	54	19	35	
		TEST BORING TERMINATED AT 10 FT												
15														
20														
25														

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BORING NO.: 64
Sheet 1 of 1

PROJECT NO.: W191783

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Start Date: 8/20/2019 **End Date:** 8/20/2019
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Hammer Drop (lbs / in): 140 / 30

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	▨	Light Brown CLAY with limestone fragments	■											
	▨		■			4.5+				8				
	▨		■			4.5+				11				
5	▨		■			4.5+				14				
	▨	8.0	■			4.0				16	59	19	40	
	▦	Tan LIMESTONE with clay seams and layers												
10	▦	10.0	◣		100/ 5"									
		TEST BORING TERMINATED AT 10 FT												
15														
20														
25														

ALPHA TESTING

WHERE IT ALL BEGINS

KEY TO SOIL SYMBOLS AND CLASSIFICATIONS

SOIL & ROCK SYMBOLS

- ▨ (CH), High Plasticity CLAY
- ▨ (CL), Low Plasticity CLAY
- ▨ (SC), CLAYEY SAND
- ░ (SP), Poorly Graded SAND
- ░ (SW), Well Graded SAND
- ▥ (SM), SILTY SAND
- ▥ (ML), SILT
- ▥ (MH), Elastic SILT
- ▦ LIMESTONE
- ▤ SHALE / MARL
- ░ SANDSTONE
- ▢ (GP), Poorly Graded GRAVEL
- ● (GW), Well Graded GRAVEL
- ▨ (GC), CLAYEY GRAVEL
- ▥ (GM), SILTY GRAVEL
- ▤ (OL), ORGANIC SILT
- ▤ (OH), ORGANIC CLAY
- ▩ FILL

SAMPLING SYMBOLS

- ■ SHELBY TUBE (3" OD except where noted otherwise)
- ☒ SPLIT SPOON (2" OD except where noted otherwise)
- ▮ AUGER SAMPLE
- ◩ TEXAS CONE PENETRATION
- ◫ ROCK CORE (2" ID except where noted otherwise)

RELATIVE DENSITY OF COHESIONLESS SOILS (blows/ft)

VERY LOOSE	0 TO 4
LOOSE	5 TO 10
MEDIUM	11 TO 30
DENSE	31 TO 50
VERY DENSE	OVER 50

SHEAR STRENGTH OF COHESIVE SOILS (tsf)

VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
FIRM	0.50 TO 1.00
STIFF	1.00 TO 2.00
VERY STIFF	2.00 TO 4.00
HARD	OVER 4.00

RELATIVE DEGREE OF PLASTICITY (PI)

LOW	4 TO 15
MEDIUM	16 TO 25
HIGH	26 TO 35
VERY HIGH	OVER 35

RELATIVE PROPORTIONS (%)

TRACE	1 TO 10
LITTLE	11 TO 20
SOME	21 TO 35
AND	36 TO 50

PARTICLE SIZE IDENTIFICATION (DIAMETER)

BOULDERS	8.0" OR LARGER
COBBLES	3.0" TO 8.0"
COARSE GRAVEL	0.75" TO 3.0"
FINE GRAVEL	5.0 mm TO 3.0"
COURSE SAND	2.0 mm TO 5.0 mm
MEDIUM SAND	0.4 mm TO 5.0 mm
FINE SAND	0.07 mm TO 0.4 mm
SILT	0.002 mm TO 0.07 mm
CLAY	LESS THAN 0.002 mm