GEOTECHNICAL EXPLORATION

MONTRACHET

East of R.M. Highway No. 2871 and North of Team Ranch Road
Fort Worth, Texas
ALPHA Report No. W191783
September 19, 2019

Prepared for:

MONSERRAT HILLS, LLC
6000 Western Place, Suite #110
Fort Worth, Texas 76107
Attention: Mr. Donnie Siratt

Prepared By:

ALPHA TESTING
WHERE IT ALL BEGINS

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September 19, 2019

Montserrat Hills, LLC
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Attention: Mr. Donnie Siratt

Re: Geotechnical Exploration
Montrachet
East of R.M. Highway No. 2871 and North of Team
Ranch Road
Fort Worth, Texas
ALPHA Report No. W191783

Attached is the report of the geotechnical exploration performed for the project referenced above. 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.

This report contains results of field explorations and laboratory testing and an engineering interpretation of these with respect to available project characteristics. The results and analyses were used to develop recommendations to aid design and construction of residential foundations. Recommendations for public streets will be provided in separate reports.

ALPHA TESTING, INC. appreciates the opportunity to be of service on this project. If we can be of further assistance, such as providing the final geotechnical exploration, please contact our office.

Sincerely,

ALPHA TESTING, INC.

BRIAN J. HOYT
115748

September 19, 2019

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Director of Geotechnical Engineering

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1.0 PURPOSE AND SCOPE

The purpose of this geotechnical exploration is for ALPHA TESTING, INC. (ALPHA) to evaluate for the Montserrat 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 construction. 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.

2.0 PROJECT CHARACTERISTICS

It is proposed to develop a residential subdivision (Montrachet) on a 40-acre tract of land located north of Team Ranch Road, about a quarter mile east of R.M. Highway No. 2871 in Fort Worth, Texas. A site plan illustrating the general outline of the property is provided as Figure 1, the Boring Location Plan, in the Appendix.

At the time the field exploration was performed, the site consisted of a vacant tract of land with scattered trees. No information regarding previous development on the site was provided to us.

Review of grading plans prepared by ANA Consultants (File No. W-2643, Sheets 116 and 117 dated September 4, 2019) indicates the site generally slopes down towards the southeast about 50 ft (Appx. Elev. 836 ft to Appx. Elev. 786 ft). The referenced grading plans indicate cuts of up to 13 ft and fills of up to 10 ft will be required to achieve final grade in the building pad areas.

The grading plans were not finalized for nine (9) of the larger lots located on the eastern end of the site (Lots 13 through 16 of Block 1, Lots 10 and 11 of Block 2, Lots 22, 23 and 24 of Block 3). Based on conversations with the Client we understand final pad elevations in these lots will be determined by the future lot owners. For the purpose of our analysis, we have assumed maximum cuts and fills of up to 4 ft will be required to achieve final grade in these building pad areas.

Present plans provide for construction of single-family residences. The new structures are expected to create light loads to be carried by the foundations. We understand the new structures will be supported with slab-on-grade foundations designed for potential movements of 4½ inches or less. No below-grade slabs are planned.

Retaining walls varying in height up to 8 ft are planned along the boundaries of the proposed subdivision and around two planned detention ponds at the southern edge of the site. Global stability analyses and recommendations for retaining walls and slopes on the site will be provided in an addendum to this report.

3.0 FIELD EXPLORATION

Subsurface conditions on the site were explored by drilling a total of thirty nine (39) test borings. Thirty three (33) test borings were drilled to a depth of about 20 ft each and five (5) test borings were drilled to a depth of about 25 ft each. Boring 39 was planned to a depth of 20 ft but was terminated at a depth of about 17 ft below the ground surface due to auger refusal on hard rock. The test borings were performed in general accordance with ASTM Standard D 420 using standard rotary drilling equipment. The approximate location of each test boring is shown on the Boring Location Plan, Figure 1, enclosed in the Appendix. Details of drilling and sampling operations are briefly summarized in Methods of Field Exploration, Section A-1 of the Appendix.

Subsurface types encountered during the field exploration are presented on Log of Boring sheets included in the Appendix. The boring logs contain our Field Technician's and Engineer's interpretation of conditions believed to exist between actual samples retrieved. Therefore, these 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.

4.0 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 foundation design and earthwork construction. A brief description of testing procedures used in the laboratory can be found in Methods of Laboratory Testing, Section B-1 of the Appendix. Individual test results are presented on Log of Boring sheets or on summary data sheets enclosed in the Appendix.

5.0 GENERAL SUBSURFACE CONDITIONS

Based on geological atlas maps available from the Bureau of Economic Geology, published by the University of Texas at Austin, the project site lies within the Kiamichi formation. This formation generally consists of limestone with marl (limey shale) layers. Residual overburden soils associated with these undivided formations generally consist of clay soils with low to high shrink/swell potential. The Duck Creek Limestone formation is situated just south and west of the site and the undivided Goodland Limestone and Walnut Clay formation is situated just north and east of the site. These formations also generally consist of limestone and marl with low to high shrink/swell potential overburden clays. Geological formations can be highly variable at or near geological interfaces, 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 20 ft or 25 ft termination depth of the borings. Clay and/or shaly clay extended to the 17 ft and 20 ft termination depth of Borings 1, 3, 6, 7, 10, 11, 19, 27, 38 and 39. Boring 39 was terminated at a depth of about 17 ft due to auger refusal on hard limestone. 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 and 35 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 materials encountered in the borings are considered relatively impermeable and are expected 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 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 Log of Boring sheets provided in the Appendix.

6.0 DESIGN RECOMMENDATIONS

The following design recommendations were developed on the basis of the previously described Project Characteristics (Section 2.0) and General Subsurface Conditions (Section 5.0). If project criteria change, our office should conduct a review to determine if modifications to the recommendations are required. Further, it is recommended our office be provided with a copy of the final building plans and specifications for review prior to construction.

The following recommendations are based on grading plans and grading assumptions referenced in Section 2.0. Cutting and filling on the site other than depicted on the referenced grading plans or discussed in Section 2.0 can alter the recommended foundation design parameters. Therefore, it is recommended our office be contacted before performing other cutting and filling on site to verify appropriate design parameters are utilized for final foundation design. Also, our office should be provided with final grading plans to verify our recommendations.

6.1 Slab Foundations and Subgrade Improvements to Reduce Movements

Slab-on-grade foundations should be designed with exterior and interior grade beams adequate to provide sufficient rigidity to the foundation system. A net allowable soil bearing pressure of 1.5 kips per sq ft may be used for design of all grade beams bearing on undisturbed cuts in onsite clays, on limestone, on fill placed as recommended in Section 7.3, or on moisture improved material placed as recommended in Section 6.1.1. Grade beams should bear a minimum depth of 12 inches below final grade and should have a minimum width of 10 inches considering the recommended bearing pressure.

To reduce cracking as normal movements occur in foundation soils, all grade beams and floor slabs should be adequately reinforced. It is common to experience some minor cosmetic distress to structures with slab-on-grade foundation systems due to normal ground movements. A properly designed and constructed moisture barrier should be placed between the slabs and subgrade soils to retard moisture migration through the slabs.

Conditions encountered in the test borings, planned grading and results of the laboratory tests reveal variations in highly expansive clay thickness and expansive properties across the site. Such variations in clay thickness and expansive properties will directly affect design parameters used for slab-on-grade type foundations. Therefore, lots with apparently common average clay thickness, similar expansive clay properties and similar corresponding estimated potential movements have been grouped into **Zones I, II and III** and delineated on the Boring Location Plan, Figure 1.

Subgrade improvement in the respective **Zones** (see Figure 1) should be performed using the information summarized in Table A.

TABLE A
Estimated Potential Seasonal Movements and Recommended Subgrade Improvement

ZONE	ESTIMATED POTENTIAL MOVEMNT, INCHES	IMPROVEMENT REQUIRED TO REDUCE MOVMENTS TO 4 ½ INCHES
I	Up to 4½	No Improvement Required
II	Up to 6	4 ft Moisture Conditioning
III	Up to 7	6 ft Moisture Conditioning

Potential seasonal movements were estimated using results of absorption swell tests, in general accordance with methods outlined by the Texas Department of Transportation (TxDOT) Test Method Tex-124-E and engineering judgment and experience. Estimated movements were calculated assuming the moisture content of the in-situ soil within the normal zone of seasonal moisture content change varies between a "current" condition and a "wet" condition as defined by Tex-124-E. Also, it was assumed a 1 psi surcharge load from the floor slab acts on the subgrade soils. Movements exceeding those predicted herein could occur if construction commences after an extended dry period, if positive drainage of surface water is not maintained or if soils are subject to an outside water source, such as leakage from a utility line or subsurface moisture migration from off-site locations.

Potential seasonal movements were estimated assuming fill material used to raise the grade will consist of onsite or similar material with a plasticity index of 50 or less. If the plasticity index of material used to raise the grade is higher than 50, potential movements could be higher than our estimates.

Potential movements estimated for slab foundations in **Zones II and III** (see Figure 1 for delineation of Zones) are considered outside normal design tolerances without subgrade improvement as presented in Table A. Movement of slab foundations in **Zones II and III** could be reduced to not more than about 4½ inches by using moisture conditioning the upper 4 ft or 6 ft of soil below final grade, respectively, as recommended in Table A. Recommendations for moisture conditioning are discussed further in Section 6.1.1.

In choosing moisture conditioning as a method of slab movement reduction, the Client is accepting some post construction movement of slabs (about 4½ inches). Therefore, the Client understands and acknowledges that in the geographical region covered by this report, a potential movement of 4½ inches is considered a reasonable compromise between foundation design and construction cost and the amount of allowable movement of the foundation.

6.1.1 Subgrade Improvement Using Moisture Conditioning in Zones II and III

Estimated potential movements of slab foundations in **Zone II and III** could be reduced to about 4½ inches by moisture-conditioning the uppermost 4 ft or 6 ft of on-site soils below final grade, respectively, as recommended in Table A.

Shallow limestone was encountered in several of the borings and could be encountered within the recommended depth of moisture conditioning, particularly near zone boundaries and lots with large differential grading requirements. Provided the limestone is at least 3 ft thick and sufficiently hard, it is not required to over-excavate limestone to install moisture conditioned soils. Test pits should be performed to verify the thickness and nature of the limestone prior to terminating moisture conditioning shallower than the recommended depths. ALPHA should be retained to observe the test pits.

Moisture-conditioning consists of over-excavating (where necessary) and/or filling with on-site soil that is compacted at a “target” moisture content at least 5 percentage points above the material’s optimum moisture content as determined by the standard Proctor method (ASTM D 698). The moisture-conditioned soil should be compacted to a dry density between 93 and 98 percent of standard Proctor maximum dry density. Moisture-conditioning with on-site soil should extend throughout the entire building pad area and at least 5 ft beyond the perimeter of the designated building pad (as indicated on the referenced project grading plans). Plastic sheeting (6 to 8 mil thickness) should be placed above the moisture-conditioned soil for long-term maintenance of the moisture content of the conditioned soil. This sheeting should be placed 8 to 12 inches below final grade and should also extend at least 5 ft beyond the perimeter of the building pad. Following completion of moisture-conditioning and placement of the plastic sheeting, estimated movements in **Zone II and III** should not exceed about 4½ inches.

The purpose of moisture-conditioning is to reduce the free swell of the moisture-conditioned soils to 1 percent or less. Additional laboratory tests (i.e., standard Proctors, absorption swell tests, etc.) should be conducted during construction to verify that the “target” moisture content for moisture-conditioning (estimated at 5 percentage points above the material’s optimum moisture content as defined by ASTM D 698) is sufficient to reduce the free swell potential of the processed soil to 1 percent or less.

Moisture conditioning should be observed and tested on a full time basis by a representative of ALPHA to verify the moisture conditioned clays are placed with the proper lift thickness, moisture content, and density.

6.2 Post-Tensioning Institute, Design of Post-Tensioned Slabs-on-Grade

Design parameters in Table B are based on the conditions encountered in the borings and using information and correlations published by PTI Third Edition and VOLFLO 1.5 computer program provided by Geostructural Tool Kit, Inc. (GTI).

TABLE B
PTI Design Parameters
Potential Seasonal Movement = 4½ inches
(In Zone I and after subgrade improvement discussed in Section 6.1.1 in Zones II and III)

	EDGE LIFT	CENTER LIFT
Edge Moisture Distance, ft (em)	4.0	8.5
Differential Soil Movement, inches (y_m)	2.2 (swell)	1.6 (shrink)

6.3 Drainage and Other Considerations

Adequate drainage should be provided to reduce seasonal variations in the moisture content of foundation soils. All pavement and sidewalks within 5 ft of the residences should be sloped away from the structures to prevent ponding of water around the foundations. Final grades within 5 ft of the structures should be adjusted to slope away from the structures at a minimum slope of 2 percent. **Maintaining positive surface drainage throughout the life of the structures is essential.**

In areas with pavement or sidewalks adjacent to the new structures, a positive seal must be maintained between the structure and the pavement or sidewalk to minimize seepage of water into the underlying supporting soils. Post-construction movement of pavement and flat-work is common. Normal maintenance should include examination of all joints in paving and sidewalks, etc. as well as re-sealing where necessary.

Several factors relate to civil and architectural design and/or maintenance, which can significantly affect future movements of the foundation and floor slab system:

- Large trees and shrubs should not be allowed closer to the foundations than a horizontal distance equal to roughly one-half of their mature height due to their significant moisture demand upon maturing.

- Moisture conditions should be maintained "constant" around the edge of the slabs. Ponding of water in planters, in unpaved areas, and around joints in paving and sidewalks can cause slab movements beyond those predicted in this report.

- Planter box structures placed adjacent to the buildings should be provided with a means to assure concentrations of water are not available to the subsoil stratigraphy.

- Architectural design of the floor slabs should avoid additional features such as wing walls as extensions of the slab.

- The root systems from any existing trees at this site will have dried and desiccated the surrounding clay soils, resulting in soil with near-maximum swell potential. Clay soils surrounding tree root mats within the building areas or areas to be covered with grade slabs (including, but not limited to, sidewalks, patios and driveways) should be removed to a depth of 1 ft below the root ball and compacted in-place with moisture and density control as described in Section 7.3.

Trench backfill for utilities should be properly placed and compacted as outlined in Section 7.4 and in accordance with requirements of local City standards. Since granular bedding backfill is used for most utility lines, the backfilled trench should not become a conduit and allow access for surface or subsurface water to travel toward the new structures. Concrete cut-off collars or clay plugs should be provided where utility lines cross building lines to prevent water from traveling in the trench backfill and entering beneath the structures.

7.0 GENERAL CONSTRUCTION PROCEDURES AND GUIDELINES

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 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.

7.1 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 slab foundations, flatwork 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 10 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 Section 7.3.

- 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 Section 7.3.

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 Section 7.3, 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.

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.

7.2 Foundation Excavations

All foundation excavations should be properly monitored to verify loose, soft, or otherwise undesirable materials are removed and foundations will bear on satisfactory material. Soil exposed in the base of all foundation (grade beam) excavations should be protected against detrimental change in condition, such as surface sloughing or side disturbance, rain, or excessive drying.

Surface runoff should be drained away from excavations and not allowed to pond in the bottom of the excavation. Concrete for foundations should be placed as soon as practical after the excavation is made. That is, the exposed foundation soils should not be allowed to become excessively dry or wet before placement of concrete.

7.3 Fill Compaction

The following recommendations pertain to general fill placement. Moisture conditioned soil should be placed as recommended in Section 6.1.1.

Clay and shaly clay soils with a plasticity index equal to or greater than 25 should be compacted to a dry density between 93 and 98 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 6 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.

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

Processed limestone used as fill should be compacted to at least 95 percent of standard Proctor maximum dry density. The compacted moisture content of the processed limestone 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. Individual rock pieces larger than 6 inches in dimension should not be used as fill. However, if rock fill is utilized within 3 ft below the bottom of floor slabs, the maximum allowable size of individual rock pieces should be reduced to 3 inches. Processed limestone used as fill should incorporate sufficient fines to prevent the presence of voids around larger diameter rock pieces. 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.

7.4 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.

7.5 Groundwater

Groundwater was not encountered in the borings. However, from our experience, shallower groundwater could be encountered in excavations for foundations, 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 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.

8.0 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 these services.

ALPHA 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 in Section 2.0. 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 is not responsible for damages resulting from workmanship of designers or contractors. 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.

APPENDIX

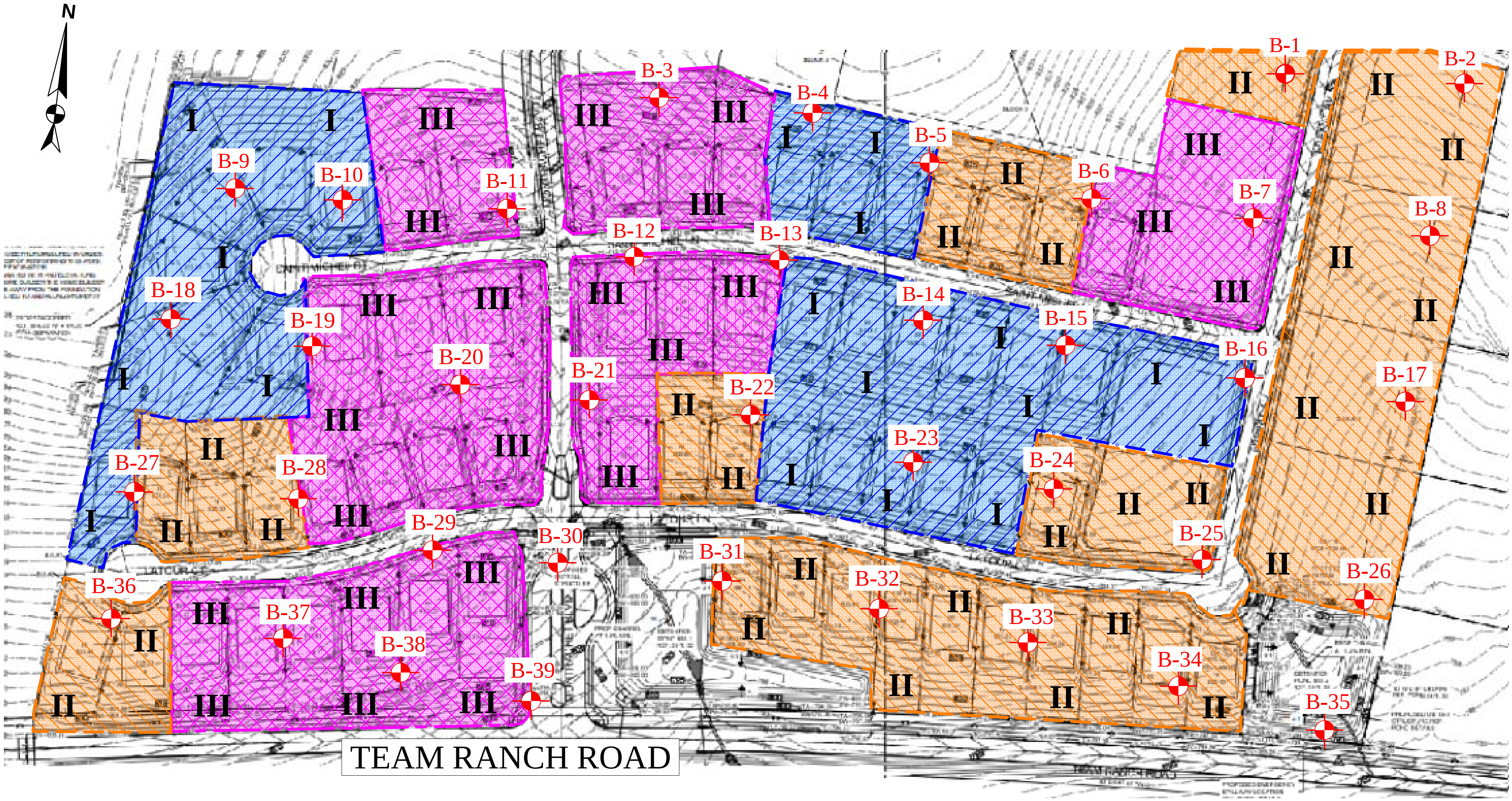
A-1 METHODS OF FIELD EXPLORATION

Using standard rotary drilling equipment, a total of 39 test borings were performed for this geotechnical exploration at the approximate locations shown on the Boring Location Plan, Figure 1. The boring locations were staked by using a handheld GPS device or by pacing/taping and estimating right angles from landmarks which could be identified in the field and as shown on the site plan provided during this study. The locations of the test borings shown on the Boring Location Plan are considered accurate only to the degree implied by the methods used to define them.

Relatively undisturbed samples of the cohesive subsurface materials were obtained by hydraulically pressing 3-inch O.D. thin-wall sampling tubes into the underlying soils at selected depths (ASTM D 1587). These samples were removed from the sampling tubes in the field and evaluated visually. One representative portion of each sample was sealed in a plastic bag for use in future visual evaluation and possible testing in the laboratory.

A modified version of the Texas Cone Penetration (TCP) test was completed in the field to determine the apparent in-place strength characteristics of the rock type materials. A 3-inch diameter steel cone driven by a 170-pound hammer dropped 24 inches is the basis for TxDOT strength correlations. In this case, ALPHA TESTING, INC. has modified the procedure by using a 140-pound hammer dropping 30-inches for completion of the field test. Depending on the resistance (strength) of the materials, either the number of blows of the hammer required to provide 12 inches of penetration, or the inches of penetration of the cone due to 100 blows of the hammer are recorded on the field log and are shown on the Log of Boring sheets as “TX Cone” (reference TxDOT Test Method TEX 132-E, as modified).

Logs of the borings are included in the Appendix. The logs show visual descriptions of subsurface strata encountered using the Unified Soil Classification System. Sampling information, pertinent field data, and field observations are also included. Samples not consumed by testing will be retained in our laboratory for at least 14 days and then discarded unless the Client requests otherwise.



GEOTECHNICAL EXPLORATION
MONTRACHET
EAST OF R.M. HIGHWAY NO. 2871
AND NORTH OF TEAM RANCH ROAD
FORT WORTH, TEXAS
ALPHA PROJECT NO. W191783

ALPHA TESTING
WHERE IT ALL BEGINS

FIGURE 1

BORING LOCATION PLAN

⊕ **APPROXIMATE BORING LOCATION**

▨ I **ZONE I**

▨ II **ZONE II**

▨ III **ZONE III**

B-1 METHODS OF LABORATORY TESTING

Representative samples were evaluated and classified by a qualified member of the Geotechnical Division and the boring logs were edited as necessary. To aid in classifying the subsurface materials and to determine the general engineering characteristics, natural moisture content tests (ASTM D 2216), Atterberg-limit tests (ASTM D 4318)), percent material passing the No. 200 sieve tests (ASTM D 1140) and dry unit weight determinations were performed on selected samples. In addition, unconfined compressive strength tests (ASTM D 2166) and pocket-penetrometer tests were conducted on selected soil samples to evaluate soil shear strength. Results of these laboratory tests are provided on the Log of Boring sheets.

In addition to the Atterberg-limit tests, the expansive properties of the clay soils were further analyzed by absorption swell tests. The swell test is performed by placing a selected sample in a consolidation machine and applying either the approximate current or expected overburden pressure and then allowing the sample to absorb water. When the sample exhibits very little tendency for further expansion, the height increase is recorded and the percent free swell and total moisture gain calculated. Results of the absorption swell tests are provided on the Swell Test Data sheet, Figure 2 included in this Appendix.

Boring No.	Sample Depth (ft)	Pressure (psf, vert.)	Material Description	Liquid Limit	Plastic Limit	Plasticity Index	Initial Moisture	Final Moisture	Free Swell
1	3	375	Dark Brown CLAY	67	21	46	21%	25%	0.7%
1	7	875	Tan and Gray SHALY CLAY				16%	18%	0.8%
7	3	375	Dark Brown CLAY				14%	24%	4.1%
7	7	875	Tan SHALY CLAY	58	18	40	15%	17%	0.4%
9	7	875	Tan CLAY	54	18	36	19%	29%	5.9%
11	9	1125	Tan SHALY CLAY	56	18	38	15%	22%	3.2%
14	9	1125	Tan and Gray SHALY CLAY				19%	30%	0.4%
17	9	1125	Tan CLAY	69	21	48	19%	22%	0.9%
20	7	875	Tan CLAY				20%	25%	0.0%
24	5	625	Tan CLAY	48	23	25	16%	19%	2.0%
28	9	1125	Tan and Gray CLAY	56	19	37	19%	22%	0.3%
30	3	375	Tan CLAY	49	19	30	9%	20%	1.9%
32	3.5	438	Tan CLAY	52	17	35	16%	23%	0.0%
34	4.5	563	Brown CLAY				13%	20%	2.1%
36	3	375	Tan CLAY	65	22	43	18%	24%	2.5%
36	9	1125	Tan SHALY CLAY	31	15	16	16%	20%	0.0%
39	14.5	1813	Gray SHALY CLAY	68	21	47	19%	26%	0.0%

SWELL TEST RESULTS

W191783 - Montrachet - Foundations, Paving and Sewer Outfalls

East of R.M. Highway No. 2871 and North of Team Ranch Road, Fort Worth , Texas

FIGURE 2

ALPHA TESTING
WHERE IT ALL BEGINS

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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	▦	16.0	◣		100/ 6"									
	▦	Gray LIMESTONE with shale seams and layers												
20	▦	20.0	◣		100/ 5"									
		TEST BORING TERMINATED AT 20 FT												
25														

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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														
	▦	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	
			■			4.5+				7				
20.0			■			4.5+				12				
		TEST BORING TERMINATED AT 20 FT												

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BORING NO.: 4
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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														

ALPHA TESTING
WHERE IT ALL BEGINS

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BORING NO.: 5
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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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WHERE IT ALL BEGINS

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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				
		TEST BORING TERMINATED AT 20 FT												
25														

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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				
	▨		■			4.5+	11.4		106	15				4.1
	▨	4.0	■											
5	▨	Tan SHALY CLAY with calcareous deposits	■			4.5+				15				
	▨		■			4.5+				15	58	18	40	0.4
	▨		■			4.5+				21				
10	▨													
	▨	13.0												
	▦	Gray LIMESTONE with shale seams												
15	▦		◣		100/ 7"									
	▦	16.0												
	▨	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			◣		100/ 7"									
		18.0												
		Gray SHALE												
20		20.0	◣		100/ 1.5"									
		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: 8/14/2019 **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	◣		100/ 0.5"									
		6.0												
	▨	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			◣		99/ 6.5"									
		16.0												
	▨	Tan and Gray SHALY CLAY												
20			■			4.5+				12				
		22.0												
	☰	Gray SHALE												
25		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														

ALPHA TESTING
WHERE IT ALL BEGINS

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BORING NO.: 12
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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	
					52/ 12"									
		2.0												
		Tan CLAY with calcareous deposits				4.5+				11				
5						4.5+				13				
						4.25				11	58	19	39	
		8.0												
		Tan SHALY CLAY				4.5+				15				
10														
		14.0												
15		Tan LIMESTONE with clay seams and layers			75/ 12"									
		19.0												
20		Gray SHALE			100/ 4"									
		20.0												
		TEST BORING TERMINATED AT 20 FT												
25														

ALPHA TESTING
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 with limestone fragments 2.0	■			4.5+				12	63	22	41	
5	▦	Tan LIMESTONE with clay seams and layers	◣		100/ 3"									
10	▦	14.0	◣		100/ 4"									
15	▤	Gray SHALE	◣		100/ 4"									
20	▤	20.0	◣		100/ 0.75"									
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+				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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BORING NO.: 15
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+				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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BORING NO.: 16
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+				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"									
		Gray SHALE												
20		20.0	◣		100/ 0.5"									
		TEST BORING TERMINATED AT 20 FT												
25														

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BORING NO.: 17
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				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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BORING NO.: 18
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	■							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												
15	▨	Tan and Gray SHALY CLAY	■			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
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 2.0	■			4.5+				15	72	25	47	
	▨	Tan CLAY with calcareous deposits	■			4.5+				5				
5	▨		■			4.5+				14	66	24	42	
	▨	8.0	■			4.0				20				0.0
	▨	Tan and Gray SHALY CLAY	■			4.5+				18				
10	▨													
15	▨	19.0	■			4.5+				16				
20	▦	Tan LIMESTONE with clay seams and layers 20.0	◣		100/ 1"									
		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+				15	76	25	51	
	▨		■			4.5+				14				
		4.0												
5	▨	Light Brown CLAY	■			4.5+				19				
	▨		■			3.5				17				
		8.0												
	▦	Tan LIMESTONE with clay seams and layers												
10	▦		◣		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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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 2.0	■			4.5+				12				
	▨	Light Brown CLAY	■			4.5+	2.6		120	11	52	17	35	
5	▨	6.0	■			4.5+				14				
	▦	Tan LIMESTONE with clay seams and layers	◣		100/ 4"									
10	▦	12.0	◣		100/ 3"									
15	☰	Gray SHALE	◣		100/ 1.75"									
20	☰	20.0	◣		100/ 1"									
		TEST BORING TERMINATED AT 20 FT												
25														

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BORING NO.: 23
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 2.0	■			4.5+				16	74	25	49	
	▨	Tan CLAY with calcareous deposits	■			4.5+				15				
5	▨	6.0	■			3.25				19				
	▦	Tan LIMESTONE with clay seams and layers	◣		100/ 3"									
10	▦	14.0	◣		100/ 1.5"									
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					100/ 0.75"									
		20.0												
		TEST BORING TERMINATED AT 20 FT												
25														

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BORING NO.: 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 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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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														

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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 with limestone fragments	2.0	■			4.5+				15				
5	▦	Tan LIMESTONE with clay seams and layers		◣		100/ 0.25"									
10	▦		13.0	◣		100/ 10"									
15	▨	Tan SHALY CLAY		■							16	58	20	38	
20	▨		20.0	■							17				
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+				8				
						4.5+				12	56	19	37	
5						3.75				12				
		6.0												
		Tan and Gray CLAY				4.5+	4.2		117	11				
						4.5+				17	56	19	37	0.3
10														
		13.0												
		Tan SHALY CLAY												
15						3.75				18	65	21	44	
		18.0												
		Gray LIMESTONE with shale seams and layers			100/ 1.25"									
20		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: 8/8/2019 **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														

ALPHA TESTING
WHERE IT ALL BEGINS

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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		Tan CLAY with calcareous deposits				3.25				20				
						4.5+				11				
10		10.0				4.5+				19	65	22	43	
		Tan LIMESTONE with clay seams and layers			100/ 3.5"									
15		16.0			100/ 1"									
20		Gray LIMESTONE with shale seams and layers 20.0			100/ 1"									
25		TEST BORING TERMINATED AT 20 FT												

ALPHA TESTING
WHERE IT ALL BEGINS

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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 2.0	■			4.5+				15	74	22	52	
		Light Brown CLAY 4.0	■			4.5+				14				
5		Tan CLAY with sand	■			4.5+	3.7		113	12				
			■			2.5				17				
			■			1.75		82		20	54	19	35	
10		12.0												
15		Tan LIMESTONE with clay seams and layers 17.0	◣		100/ 1.25"									
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.: 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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WHERE IT ALL BEGINS

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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												
20	▦	Gray LIMESTONE with shale seams and layers 20.0	◣		100/ 1"									
		TEST BORING TERMINATED AT 20 FT												
25														

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WHERE IT ALL BEGINS

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BORING NO.: 35
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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BORING NO.: 36
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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	■			4.5+				15				
	▨	2.0	■											
	▨	Tan CLAY with limestone fragments	■			4.5+				16	65	22	43	2.5
5	▨		■			3.25				19				
	▨	6.0	■											
	▧	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	◣		100/ 1.5"									
	▦	19.0												
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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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+				14	70	21	49	
	▨	Tan CLAY with calcareous deposits	■			4.5+				11				
5	▨	6.0	■			4.5+	3.7		111	14				
	▨	Tan SHALY CLAY with sand	■			4.5+		84		18	65	20	45	
10	▨	10.0	■			4.5+				15				
	▦	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														

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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+				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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WHERE IT ALL BEGINS

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BORING NO.: 39
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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	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															

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