GENERAL GEOTECHNICAL SURFACE SOILS EVALUATION REPORT

FOR

HILLCREST ESTATES NEW WATERLINE PROJECT

ZARAGOZA ROAD AND LAURA LANE
EL PASO,EL PASO COUNTY, TEXAS
CQC PROJECT NO. AGCQC20-040

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December 9, 2020 (Final Report Date March 4, 2022)

Moreno Cardenas Inc.
2505 E. Missouri Avenue
El Paso, Texas 79903

Attn: **Mr. Brian J. Klaes, P.E., LEED AP**
Vice President

Re: **General Geotechnical Subsurface Soils Evaluation Report**
County of El Paso – Hillcrest Center Water Improvement Phase I Project
Zaragoza Road and Laura Lane
El Paso, El Paso County, Texas
CQC Project No.: AGCQC20-040

Dear Mr. Klaes,

In accordance with our scope of services under our contract agreement and proposal PGCQC16-081, dated October 22, 2016 (Revised January 10, 2020), CQC Testing and Engineering, L.L.C. (CQC) is pleased to provide **Moreno Cardenas Inc. (Client)** with our general subsurface soils evaluation report for the above referenced project. This report presents the results of our soil exploration borings, laboratory engineering soil classification test results, guidance information with respect to suitability of observed and tested subsurface soils, bearing resistance, potential construction use for pipeline backfilling and general trench safety guideline considerations. At the time this report was submitted, specific design plans and specifications were not available for CQC's review. We recommend that this information be provided to CQC, so that we may review and/or modify our recommendations submitted within this report, as necessary.

Thank you for selecting our firm for geotechnical consulting services and we look forward to working with the design team on the construction phase of this project. Please feel free to contact us if you have any questions regarding the contents of this report or if we may assist you with other services.

Respectfully Submitted,
CQC Testing and Engineering, L.L.C.
TBPE Firm Registration No. F-10632

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3/4/2022
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Section 1.0 – General Project Information

This general geotechnical subsurface soils evaluation report has been prepared for the use of **Moreno Cardenas, Inc. (Client)** for the County of El Paso Hillcrest Center Water Improvement Phase I Project. Based on general information provided by our Client, we understand that the project consists of the installation of approximately 17,500 linear feet of a 8-inch diameter water line within Hillcrest Estates in far east El Paso, El Paso County, Texas (refer to Sheet A1-1). We anticipate that the waterline invert depth shall be at about 8 feet below the existing ground surface elevations. The project also includes the installation of domestic service lines and 16 fire hydrants.

Our scope of services for this project consisted of generally evaluating the subsurface soil conditions along the new water line alignment route by collecting subsurface soil information, conducting Standard Penetration Tests (SPT's) and developing soil related information with respect to the suitability of the on-site soils, engineering soil classifications, bearing resistance, and potential construction use for waterline backfilling.

The following sections of this report present our field evaluation methods, site soil-related considerations, estimated allowable bearing capacity values, and guideline information with respect to site preparation, pipe embedment, soil backfilling and trench safety considerations. Please note that the entire report should be read for a thorough understanding of our evaluation, findings, and guideline recommendations. CQC Testing and Engineering, LLC (CQC) should be contacted through a written statement if our stated understanding of the project is not correct and/or if the owner changes the new water system route for this project. Waterline route changes may result in our information and recommendations within this report to be invalid without further review and evaluation by CQC.

1.1 - Site Geologic Considerations

The Geologic Atlas of Texas (Van Horn-El Paso Sheet, Revised 1983) published by the Bureau of Economic Geology at the University of Texas at Austin indicates that the project area is located within an area of Windblown Sands (Qws) and Young Quaternary (Qb) deposits. These deposits typically consist of large sand dunes, lacustrine and fluviatile deposits. These geologic formations will contain deposits of silt, sand, clay, and gypsum. These deposits are usually variable over relatively short distances. The near subsurface geology of the project area has been disturbed by commercial and residential development. The geologic atlas also indicated that the project site is located within an area that contains multiple fault zones.

Based on the encountered soils formations and past experience it should be considered that it is possible to encounter dense to very dense caliche formations along the waterline excavations. These formations of caliche or calcareous material are not considered suitable Select Fill or backfill soil materials. Modifications of these soils such as blending with other suitable soil materials or complete removal and replacement shall be required.

Based on our review of the City of El Paso floodplain maps, the project area appears to be outside of a flood zone. A general Flood Zone Aerial Plan is presented on Appendix A, Sheet A1-2 for reference. The indicated flood plain information and zones on the aerial plan may not represent the exact flood plain path locations. It is recommended this be further evaluated with a site specific topographic survey and drainage analysis.

Please note that our scope of work did not include the specific delineation of faults along the waterline route. However, these services may be provided as an additional scope of work and services to our Client, if required.

1.2 – Existing Site Conditions and Topography

The waterline routes are located within a County of El Paso streets; Gerard Drive, Bernard Lane, Laura Lane, Augusto Drive, Martha Lane, Thelma Lane, Emma Lane, Rebecca Lane, Flora Lane and Christine Lane. The project area contains residential housing, mechanic shops, junk yards, and logistic yards. The pipeline route appears to be relatively flat with no major elevation change. Gerard Drive, Bernard Lane, Laura Lane and Augusto Drive are paved with asphaltic concrete material and Martha Lane, Thelma Lane, Emma Lane, Rebecca Lane, Flora Lane and Christine Lane are currently unpaved. All vertical subsurface exploration borings were performed on the unpaved shoulder areas.

CQC was not provided with any historical survey plans, historical topographic surveys, historical photographs, historical grading plans, environmental reports or construction reports for review from our Client. Therefore, CQC has no knowledge if previous roadway excavations or fill required to construct the existing roadways were appropriately backfilled with suitable soils and tested for compaction verification.

1.3 – Seismic Considerations

On March 26, 2020 a 5.0 magnitude earthquake occurred near the town of Mentone, Texas that resulted in tremors in El Paso, El Paso County, Texas. There was a total of 5 earthquakes that registered near the town of Mentone. The earthquakes have registered on the richter scale between 2.6 to 5.0. The tremors were felt

throughout West Texas. It is not known if any of the existing public utility infrastructure within the project streets exhibited any damage or movement.

Seismic ground motion values are defined in the table below. The seismic coefficients were generated through Seismic Design Maps, a USGS web service developed by the Structural Engineers Association of California's (SEAOC) and California's Office of Statewide Health Planning and Development (OSHPD). These values should be verified by the project structural engineer prior to use in structural analysis, as applicable. CQC should be informed if the reported values vary significantly.

Table 1 - Seismic Ground Motion Values

Latitude	Longitude	Site Classification	Period (Seconds)	Spectral Accelerations (g)	Site Coefficient, F_a	Site Coefficient, F_v
31.80940100	-106.21276600	D	0.2 (S_s)	0.29	1.568	-
			1.0 (S_1)	0.095	-	2.400

Remarks: Site Class is based on the current National Earthquake Hazards Reduction Program (NEHRP 2015) and Site Classification for Seismic Design Definitions in conjunction with our review of the geologic conditions in the area. In the event that the owner and/or design representative is interested in determining the building code Site Class with a higher degree of accuracy, additional tests beyond our original requested scope of work shall be required.

Section 2.0 – General Subsurface Soils Evaluation Methods and Testing

As requested, the subsurface soils along the new waterline were evaluated by completing seven (7) vertical exploration borings with a truck mounted drilling rig. The approximate boring locations are shown in the "General Geotechnical Subsurface Exploration Boring Location Aerial Plan" presented in Sheet A1-1. A summary of our subsurface vertical boring evaluation is reported in the Table 2 below. Our vertical exploration boring logs are presented in Sheets A2 through A8.

Our engineering soil classification tests (i.e., moisture contents, soil particle size analysis and Atterberg Limit Tests) were performed in accordance with accepted ASTM test procedures. In general, the results of our tests and estimated "N-Values" are presented in our soil boring logs and Summary of Laboratory Engineering Soil Classification Test Results in Sheet A16. In general, at the completion of our drilling activities, the borings were backfilled to the ground surface elevations.

The following table summarizes the completion depth of our borings, type of samples, number of soil samples collected, and observed groundwater or water seepage depth at the time of our drilling operations.

Table 2 – Summary of Subsurface Vertical Boring Evaluation

Borehole No.	Approximate Termination Depth (ft.)	No. Split-Spoon Samples	No. Grab Samples	Approx. Observed Groundwater / Water Seepage Depth (ft.)
B-1	11 ½	5	-	NE
B-2	11 ½	5	-	NE
B-3	11 ½	5	-	NE
B-4	11 ½	5	-	NE
B-5	11 ½	5	-	NE
B-6	11 ½	5	-	NE
B-7	11 ½	5	-	NE

Remarks: The vertical borings were logged during our drilling operations by a member of our geotechnical engineering staff. During our drilling operations, Standard Penetration Tests (SPT's) were performed in general conformance with ASTM D 1586. Soil samples were collected within a split-spoon sampler at discrete depth intervals and were containerized and transported to our laboratory for further observation and engineering soil classification testing on selected samples.
NE- Not encountered immediately at the completion of our subsurface exploration borings.

Contractors interested in bidding the project shall perform their own tests to verify the types of materials or review historical plans of the area to evaluate the excavation requirements prior to bidding the project. Please refer to Section 10.2 for additional specification considerations.

Please note that the collected soil samples from our soils evaluation shall be stored for a period of up to 60 days after the submittal of this report, if a longer period of storage is required by our Client, CQC should be informed in writing.

2.1 - Laboratory Engineering Soil Classification Testing

In the laboratory, selected soil samples were evaluated and visually classified by our geotechnical engineering staff in general accordance with the Unified Soil Classification System (USCS). The geotechnical engineering properties of selected soil samples were evaluated by the following tests:

Table 3 – Summary of Performed Engineering Soil Classification Tests

Type of Test	ASTM/TXDOT Test Procedure	Total Number Conducted
Moisture Content Tests	D 2216	25
Atterberg Limit Tests	D 4318	25
Soil Particle Size Analysis Tests	D 6913	25
Soil Moisture-Density Relationship Tests	D 1557	6
Soil California Bearing Ratio (CBR) Tests	D 1883	4
Soil Resistivity Tests	Tex-129-E	7
Soil pH Test	Tex-128-E	7

Selected soil particle size analysis test results are reported in Sheets A9 through A15.

2.2 – Soil Moisture-Density Relationship Test Results

At the time of our drilling activities, six (6) bulk soil samples were obtained from the reported boring locations for soil moisture-density relationship testing. The samples were collected during our drilling activities from auger cuttings from below the existing ground elevation to the reported depths. The test results are reported in Sheets A17 through A22.

Table 4 – Summary of Soil Moisture-Density Relationship Test Results

Borehole No.	Approx. Sample Depth (ft)	Test Method D1557	Soil Classification[1]	Plasticity Index	Opt. Dry Density (pcf)	Opt. Moisture (%)
B-1	0 - 5	A	SC-SM	4	121.0	10.9
B-2	0 - 5	B	SC-SM	4	125.6	8.9
B-4	5 - 10	B	SC	9	120.0	11.2
B-5	5 – 7-1/2	B	SM	NP	111.2	16.1
B-6	0 - 5	A	SM	NP	122.6	8.6
B-7	0 - 5	A	SM	NP	118.2	12.3

NP – None Plastic.
Note [1] - Soil description is reported in our test results in Sheets A17 through A22.

2.3 – Soil California Bearing Ratio (CBR) Test Results

The results of four (4) California Bearing Ratio (CBR) tests conducted on the collected samples from the reported borings are summarized in the table below and Sheets A23 through A26. The tests were performed in general accordance with ASTM standard test method D 1883. Based on our CBR test results, the soils at the sample locations shall provide a relatively high level of support for the new replacement pavement section along the removed pavement areas.

Table 5 – Summary of California Bearing Ratio (CBR) Test Results

Borehole No.	Sample Depth (ft)	Dry Density prior to Soaking (pcf)	Dry Density after Soaking (pcf)	Swell %	CBR at 0.1" Pen.	CBR at 0.2" Pen.	Support Level
B-1	0 - 5	114.8	111.2	0.0667	47	45	High
B-2	0 - 5	119.5	115.8	0.1556	39	32	High
B-6	0 - 5	118.0	115.2	0.0667	34	41	High
B-7	0 - 5	111.3	107.6	0.1778	37	32	High

2.4 - Laboratory Soil Resistivity Test Results

In general, testing was performed on seven (7) samples collected from approximately from 5 to 10 feet in borings B-1 through B-7. The soil resistivity test results along with a graphical plots are presented in Sheets A27 through A33. Based on these results that aid in better defining the potential corrosion properties of subsurface soils, the tested subsurface soils may be considered mildly corrosive to extremely corrosive at a moist to saturated state, particularly for steel pipe or casings (See table below).

Based on our soil resistivity tests, we recommend that in order to mitigate potential steel corrosion, Type II Portland cement should be utilized in concrete mix designs for this project, as applicable. The specification of cathodic protection should also be considered where applicable.

Table 6 – Corrosivity Ratings Based on Soil Resistivity

Soil Resistivity (ohm-cm)	Corrosivity Rating
> 20,000	Non-Corrosive
10,000 to 20,000	Mildly Corrosive
5,000 to 10,000	Moderately Corrosive
3,000 to 5,000	Corrosive
1,000 to 3,000	Highly Corrosive
< 1,000	Extremely Corrosive

Remarks: This test is conducted by using a portable resistivity meter and a small acrylic box. The resistivity values obtained may represent the resistivity of the tested soil samples. The test consists of adding moisture to the soil in the box until the lowest resistance reading before an increase is noted. This reading is used to calculate the resistivity of the soil using the soil box factor.

2.5 – pH Test Results

Corrosion is the disintegration of a material due to chemical reactions with its surroundings. Any contact between the soil material and any concrete structures, buried steel structures or metal appurtenances could result in corrosive reactions. In order to evaluate the potential corrosivity of the subsurface soils, pH tests are typically performed on soil samples. Selected soil samples from our soil borings were tested in the laboratory for pH content in accordance with TEX-128 E.

Table 7 – Summary of Soil pH Test Results

Borehole No.	Sample Depth (ft)	pH
B-1	5-10	10.0
B-2	5-10	9.5
B-3	5-10	8.9
B-4	5-10	9.9
B-5	5-10	9.3
B-6	5-10	9.7
B-7	5-10	10.2

Soils with a pH ranging from 5 to 9 are generally not considered to affect corrosion rates. However, soils with a pH of 4 or less represent a serious corrosion risk to common construction materials.

Section 3.0 – Subsurface Soil Classification and Strength Considerations

Based on our soil classifications and laboratory tests, the subsurface soils encountered in our exploration borings may be described by generalized soil stratums presented in the following table. The logged depth of the soil formation types are approximately delineated in our boring logs. Due to the geologic location of the project area, it is possible for variations in the types and depths of the soil formations to occur over relatively short distances.

Table 8- – Summary of Subsurface Soil Classification & Strength

Stratum	General Description	Consistency (SPT Blow Counts)	Moisture Content (%)	Atterberg Limits		%Passing No. 200	USCS Classification
				Liquid Limit	Plasticity Index		
I	Silty Sand, Clayey Sand and Poorly Graded Sand. Fine to medium grained with calcareous material and various amounts of silt.	Loose to Very Dense (9 to 63)	2.6 to 15.4	31 to 37	12 to 19	14 to 45	SM, SC and SP-SM
	Remarks: [1] Subsurface soil zones which exhibit SPT values less than 11 blows per foot shall be susceptible to soil sloughing and collapse when unconfined during waterline excavations. A particular very loose soil zone was encountered in boring B-2 at an approximate depth ranging from 2 to 5 feet below the existing ground surface elevation. [2] In general, encountered Stratum I soils in our borings may be primarily considered Class III Backfill soil materials, provided that soil plasticity index values are less than 15. The encountered sands should be considered OSHA Type C soil materials. The encountered soils are not considered suitable pipe bedding soil material, unless approved by the engineer of record. Verification engineering soil classification testing (i.e., sieve analysis, plasticity index and soil moisture density relationship tests) shall be performed at the time of construction. [3] Encountered caliche and/or calcareous soil formations are not considered suitable Select Fill and backfill soil materials. Calcareous soils shall be replaced and/or blended with other on-site or imported suitable Select Fill soil materials. Layer of white caliche material shall be difficult to blend and compact. If these caliche layers are encountered they shall be replaced with suitable backfill soil materials. [4] In general, soil formations with SPT-N values greater than 25 shall require heavy equipment to perform excavations. The approximate depths where medium dense to very dense and/or very stiff soil formations were encountered are reported on our boring logs.						
II	Lean and Fat Clay with various amounts of sand.	Very Stiff (28 to 49)	14.3 to 17.9	32 to 51	19 to 39	51 to 74	CH and CL
	Remarks: [1] The clays soils were encountered interbedded and below the Stratum I soils below a depth of about 7 ½ feet in borings B-1, B-5 and B-7. [2] Stratum II soils are not considered suitable for use as Select Fill and backfill soil materials for this project. [3] These clayey soils with a PI greater than 18 shall be susceptible to soil shrinkage and swelling movements. [4] Encountered and tested clays shall be susceptible to consolidation settlement when saturated. [5] The reported clay soil stratums in our boring logs are considered Class IV soils materials.						

Based on our observation of the tested soils, it appears that some of the calcareous soil formations may contain gypsum. Soils with a high content of gypsum shall be susceptible to collapse when saturated with moisture. These soils typically consist of whittish-brown sandy soils that are friable with slight bearing pressures. In the event that these types of formations are identified during excavation, CQC should be notified to observe the encountered conditions to provide additional recommendations.

All imported fill soil materials shall meet the Select Fill requirements of Section 10.0.

3.1 - Groundwater Depth Considerations

At the time of our drilling activities, groundwater or water seepage was not observed or encountered immediately at the completion of our subsurface exploratory borings. The groundwater depth in this area is anticipated to be below an anticipated maximum excavation depth of 10 feet for this project. In general, the subsurface soils were encountered at a relatively dry to moist condition. The moisture content of tested soil samples ranged from about 3.0 to 18.0 percent.

Please note that it is possible to encounter shallower perched water zones or water seepage where relatively high permeability soils overlay low permeability soils. In the event that perched water is encountered at shallower depths during construction, the water seepage should be appropriately removed. If an "artesian" condition is encountered it may be bridged with suitable Controlled Low Strength Materials (CLSM) or approved gravel rock. The proposed CLSM or gravel rock should be approved by the engineer of record through a submittal process. In any event, CQC should be immediately contacted to perform site observations of the noted conditions to develop additional recommendations, if necessary.

3.2 - Soil Related Movement Considerations

The results of our observations and soil classification tests were used to evaluate the Potential Vertical Rise (PVR) of the subsurface soils in accordance with a published empirical method. This method is used to estimate the potential vertical movements of cohesive soils based on the plasticity index (PI) of the soil. The procedure allows the reduction of the initial estimated PVR for the existing soil conditions and/or dry soil profile through surcharge addition (i.e., fill soil pressure or load pressures) and replacement of the cohesive materials with non-plastic soils.

Based on our soil classification test results, the potential soil related ground movements for the encountered soils in our borings were estimated. Our estimates were based on the Texas Department of

Transportation, Method for Determining the Potential Vertical Rise (PVR) Tex-124-E procedures. Based on the encountered soil moisture conditions, a surcharge pressure of at least 1 psi and an active soil zone of 15 feet; the following PVR values where estimated for each boring.

Table 9 - Estimated PVR Values

Borehole No. [1]	Estimated PVR Value (in.)
B-1	0.42
B-2	Negligible
B-3	Negligible
B-4	0.23
B-5	0.64
B-6	Negligible
B-7	0.41

[1] Borehole approximate locations are indicated in General Geotechnical Subsurface Exploration Boring Location Aerial Plan in Sheet A1-1.

According to the results, the encountered subsurface clayey soils along the pipeline route exhibit a relatively low to moderate potential for swelling. Based on the invert depths of the water line we anticipate that the majority of the encountered plastic to highly plastic clay soils shall be removed and replaced with suitable approved back fill soil materials along the pipeline trench at the time of construction. The estimated PVR movements should be considered in the design of flat site work (i.e., sidewalks, ramps, etc.), which shall be primarily influenced by the estimated potential vertical movement.

3.3 - Drainage Considerations

Drainage is an important key to the successful performance of any excavation and soil supported structure or waterline. Positive surface drainage should be established prior to and be maintained during and after construction to prevent water from ponding within or adjacent to the water system installation trenches. It is also possible for sinkholes to be created if trenches are left open during periods of significant rainfall events, especially in construction areas that have significant vertical changes in elevation.

3.4 – Waterline Subgrade Preparation Considerations

The existing subgrade soils that will support compacted Select Fill and/or Class III backfill soil materials and waterline structures should be cleared of all vegetation, organic matter, topsoil and/or any foreign matter. Prior to Select Fill placement, the existing soils at the pipe embedment elevation shall be overexcavated and replaced with Select Fill and/or Class III backfill soils to a minimum 12 inches below the bottom of the pipe. At the established cut depth, the subgrade soils with a PI less than 18 shall be scarified and recompacted to 95 percent

of maximum dry density determined per ASTM D 1557. Moisture content of subgrade shall be maintained within ±3 percent of optimum moisture content until permanently covered. Cohesive clay subgrade soils (i.e., soils with a PI greater than 18) should be compacted to at least 90 percent of maximum dry density per ASTM D 1557 with water content within 0 to 3 percentage points of optimum. The contractor should also control the application of moisture to the subgrade soils during earthwork operations to mitigate potential subgrade pumping. Weak or compressible soil zones identified during earthwork operations should be removed and replaced with properly compacted Select Fill or approved rock material to a minimum depth of 8 inches or as required to appropriately bridge over these soils, whichever is deeper.

Once the subgrade soils have been compacted and tested, prepared exposed subgrade soils shall be proof rolled with manual equipment such as jumping jack or robotic compactors that may access excavation trenches. Weak or pumping compressible soil zones identified during proof rolling shall be over excavated and replaced with Select Fill to a minimum depth of 12 inches or as required to appropriately bridge over these soils, whichever is deeper. Any subgrade areas that demonstrates permanent deformation greater than ½ inch shall also be over excavated and replaced with compacted Select Fill material.

It is recommended that a unit bid price be requested from bidding contractors for the placement of gravel material (i.e, minimum of ½ inch to 4 inch clean, uniformly angular, or rounded limestone gravel) at the over-excavation bottom cut depth, in the event that pumping of the subgrade soils is experienced. The placement of gravel shall serve as bridge over soft or loose wet spots at the bottom of the cut elevation.

The earthwork contractor shall consider that excavation slopes may have to be at least 3:1 or shored to control sloughing of the relatively dry Stratum I poorly graded and/or silty sands in order to conduct earthwork activities and place approved soil fill material and pipe sections.

Section 4.0 – Soil Bearing Capacity and Design Considerations

4.1 – Waterline Design Considerations

During time this report was submitted the waterline embedment depth alignment was not available. Therefore, base on initial information provided by our client we anticipate that the waterline invert depth shall be at about 8 feet below the existing ground surface elevations. The encountered subsurface soils at the anticipated waterline invert depths are anticipated to provide an allowable soil bearing capacity of 2,500 pounds per square

foot (psf). The recommendations in the following sections of this report should also be considered in the design of the waterline, associated structures, waterline embedment and backfilling.

4.2 - Earth and Vehicle Loads

The pipe analysis and design should consider the vehicular traffic loads, earth backfill loads, pipe laying methods, bending stresses, potential for settlement, and estimated pipe deflections. The following soil related design parameters may be considered in the pipe design analysis. CQC should be contacted if additional soil related information is required to supplement waterline design and analysis.

- Soil Related Design Parameters

-γ_s ≥120 pcf (Estimated Soil Total unit weight)
-Category 1 - Sandy & Gravel Profile
- E' = 500 psi (Presumptive Allowable Modulus of Soil Reaction for Sandy Gravels andClean Sand Backfill Bedding Soils)

4.3 – Thrust Blocks

We anticipate that thrust blocks shall be specified at curves and turns of the proposed waterline, a passive earth resistance of 350 pounds per cubic foot may be used for design purposes. Thrust blocks should bear solidly against undisturbed trench walls in all directions.

Section 5.0 – Below Grade Lateral Earth Pressures

The proposed below grade structures and waterlines related to this project will be subjected to vertical and lateral earth pressures depending upon the type of backfill soil. The table below presents at-rest (K_o) pressure coefficients for select backfill soils. The K_o pressures are recommended for cases where the structures will experience little yield. Select backfill soils should meet the requirements of Select Fill or as required by the project specifications, whichever is more stringent.

The estimated unit weights of soil in the table below may also be utilized to estimate vertical earth loads above the buried water pipes and boxes. Vehicles live loads and surcharge pressures should also be considered in analysis, as applicable.

Table 10 – Earth Pressure Coefficients

Soil Type	Estimated Total Unit Weight Ranges (pcf)	Presumptive Soil Angle of Internal Friction Ranges (deg)	Lateral Earth Pressure Coefficients		Equivalent Fluid Weight (pcf)	
			At-Rest (K_o)	Active (K_a)	At-Rest (K_o)	Active (K_a)
Structural Fill (Base Course Material)	145	42	0.33	0.20	49	30
Select Fill Soils (Select Backfill Soil) (PI<15)	125	32	0.50	0.30	60	40
Silty Sands	125	32	0.47	0.31	59	39
Poorly Graded Sands	125	34	0.44	0.28	53	34
Clayey Sands	135	28	0.53	0.36	72	49
Clays	120	-	0.80	0.66	96	80

Section 6.0 – General Trench Safety Considerations

The following report sections present general trench safety excavation considerations.

6.1 – Trench Safety Considerations

Trench excavations of more than 4 feet in depth and extending to a maximum depth of 20 feet may be supported with shielded systems in accordance with OSHA regulations. Shielded systems, such as trench boxes, should not be subjected to loads exceeding those which the system was designed to withstand. Shields may be stacked, provided that they are installed in a manner to resist lateral displacements or other hazardous movements of the shield in the event of sudden changes in lateral loads, such as sidewall collapse, or impact from excavation equipment or any other potential force. Braced Trench Box Systems may also be utilized for excavations extending to 20 feet, provided that they are designed and rated for the specific excavation depths and soil materials.

Employees shall not be allowed in shielded trenches when shields are being installed, removed, or moved vertically or horizontally. Employees should not be permitted in trenches that show possible loss of soil from behind or below the bottom of the shield. Hard hats and warning vests or other highly visible Personal Protection Equipment (PPE) should be worn by all employees.

Surface encumbrances, such as boulders and vegetation, located so as to create a hazard to employees involved in excavation work or in the vicinity thereof at any time during operations, shall be removed, properly supported or made safe before excavation begins. Existing underground utility lines shall be located prior to performing excavations and protected during excavation construction. Excavations should not undermine existing structures and should be at least 10 feet from the toe of any structure.

When mobile equipment is operated adjacent to an excavation, a warning system should be utilized such as barricades, hand or mechanical signals, or stop logs.

Properly designed means of access and egress from excavations should be provided for employees. Structural members used as ramps and/or runways over excavations 6 feet or more in depth should be equipped with guardrails and should be uniform in thickness and supported properly to prevent displacements. Stairways, ladders, ramps, or other safe means of egress shall be located in trench excavations that are 4 feet in depth or more in depth so as to require no more than 25 feet of lateral travel for employees.

A "competent person" shall inspect and document the excavation conditions trench systems and equipment daily and notify the contractor's superintendent of any conditions which may adversely affect the reliability and safety of the excavation. The excavations shall also be inspected after each rainstorm or when any changes in conditions occur that can increase the possibility of a cave-in or slide. If evidence of possible cave-ins or slides is apparent, all work in the excavation shall cease until the necessary precautions for sloping or bracing have been taken to safeguard the employees and trench. Any loose soil shall be scaled from the slope and removed from the excavation to protect workers against falling soil.

The atmosphere within a trench deeper than 4 feet shall be tested when there is a possibility of oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or build-up of hazardous gases. Ventilation should be provided to prevent flammable gas build-up to 20 percent of lower explosive limit of the gas. In addition, testing should be conducted as often as necessary to ensure that the atmosphere remains safe. Emergency rescue procedures and equipment should be readily available at all times, especially where hazardous atmospheric conditions could exist or develop during work in an excavation. Employees entering deep confined excavations should wear a safety harness with a lifeline securely attached to the harness.

A health and safety plan and emergency rescue plan should be established and maintained by the general contractor at all times during the project. In the event of an injury or emergency situation, it is imperative to follow all guidelines as detailed in the most recent OSHA Standards for the Construction Industry Manual, including completion of all necessary forms, accident procedures, and report documentation. After rescue operations are implemented the accident area should be closed off and made safe until an OSHA inspector visits the site and documents conditions after immediate notification. Emergency contact information should be posted on the site at all times during excavation activities.

Excavations of earth material to a level not greater than 2 feet below the bottom of a shield may be permitted, provided that the soil sidewalls are stable. Shields should extend to a minimum of 18 inches above the top of the vertical side or crest of the excavation.

The trench box system should be used in accordance with the Manufacturer's recommendations in accordance with the requirements of a trench safety plan and current OSHA regulations. Excavation safety systems for trenches shall be designed by a licensed professional engineer for all anticipated depths for this project.

It shall be the contractor's responsibility to document and record all daily excavation activities in accordance with OSHA regulations. CQC and our Client shall have no liability for the selected means and methods utilized by the contractor to perform excavations.

Section 7.0 – Pipe Embedment and Backfill Considerations

As indicated above, the following recommendations should be considered in the design of the waterline embedment and backfilling specifications.

Bidding contractors shall anticipate that approved import of suitable backfill soil materials shall be required to meet the specified backfill soil requirements for the pipe zone and embedment zone where clays are encountered. Existing on-site soils may be processed with other on-site soils or blended with suitable imported Select Fill material to meet the specified backfill soil requirements. Excavated Class IV and V clay soil layers shall be stockpiled separately and remove and disposed of properly.

Based on the results from our exploration borings and soil classification tests, the encountered Stratum I sands along the waterline alignment are anticipated to consist primarily of Class III backfill soil materials. Caliche soil layers are not considered suitable backfill soil materials. The pipeline backfill soil materials shall meet the specified requirements and/or pipeline manufacturer requirements. The following table presents general guidelines for backfill soil materials. Section 10.0 of this report presents backfill soil material specifications.

Table 11 - Pipeline Backfill Material Guidelines

BACKFILL ZONE	BACKFILL MATERIAL TYPE	ASTM COMPACTION REQUIREMENTS
Below Pipe Embedment Zone	Class III or Select Fill	95% per ASTM D-1557
Embedment Pipe Zone	Class I, II or as specified	90% per ASTM D-1557
Trench Backfill Above Pipe Zone	Class III or Select Fill	90% per ASTM D-1557
Backfill Material from Finished Surface to 36-inches	Class III or Select Fill	95% per ASTM D-1557

Additional Requirements:

1) The moisture content of the backfill materials shall be maintained within ±3% of optimum moisture content or as specified. Pipe zone backfill material shall be maintained within +/- 2 % optimum moisture content.

2) The supporting subgrade soils at the cut excavation that shall support embedment backfill material and the pipes should be stripped of all vegetation, organic matter, clay soil lumps, topsoil, construction/pavement debris and/or any foreign matter.

3) In general, embedment soil materials and pipes should not be directly supported by soils classified as CH, CL, MH, ML, OH, OL and PT under the USCS in all cases.

4) Please note that the pipe zone is typically defined as the area extending from the bottom of the trench to 12 inches above the top of the pipe and extending to the undisturbed trench walls on both sides of the pipe.

7.1 – Vault or Manhole Structure Considerations

Based on the understanding of the project, we anticipate that water improvements may include the installation of structure concrete vault boxes. We recommend that manhole bases be supported by a minimum of 8 inches of compacted Structural Fill material, TXDOT Standard Specification 2014-Item 247, Type A, Grade 3. The Structural Fill shall be placed in loose lifts not to exceed 6 inches to allow proper consolidation of the backfill material. The Structural Fill should be compacted to at least 95 percent of the maximum dry density as per ASTM D 1557. The suitable subgrade soils that shall support the base coarse material should be compacted to at least 95 percent of maximum dry density per ASTM D 1557. The moisture content of the subgrade soils shall be maintained within ± 3 percent of optimum moisture content until permanently covered.

Section 8.0 – Pavement Replacement and Site Work Improvement Considerations

We recommend that the specified replacement pavement section consist of at least 3 inches of Type C - AC material underlie by a minimum of 12 inches of approved CLSM (soil cement backfill). The CLSM may consist of a soil-cement stabilized backfill material. The CLSM should exhibit a minimum compressive strength of 150 psi at 7 days. The CLSM should be allowed to cure appropriately and equipment should not be allowed on the CLSM if the material exhibits a permanent deformation greater than ¼ inch. The proposed CLSM should be submitted to the engineer of record for review and approval through a submittal process. The proposed CLSM submittal should also contain compressive strength data for review and consideration by the engineer of record.

Asphaltic-Concrete (AC) pavement material shall conform to a TXDOT - Item 340, Type C material with a minimum of 1,500 pounds of Marshall Stability (75 blows, ASTM D 1559), a flow between 0.08 inches and 0.16 inches, air voids between 3 to 5 percent, and should be placed at a target of 98 percent of laboratory Marshall

value. The asphalt content for the mix should be determined based on the Marshall Mix Design method. The bitumen material should be a performance grade material such as a PG70-22.

The existing soils that will support compacted approved Select Fill and / or flexible base course material, or flow-able soil cement backfill should be cleared of all vegetation, organic matter, topsoil, construction debris, and/or any foreign matter. The subgrade soils should be scarified to a depth of 8 inches and re-compacted to 95 percent of maximum dry density determined by ASTM D 1557. The moisture content of the subgrade soils should be maintained within the range of ±3 percent of optimum moisture content. Weak or compressible soil zones identified during earthwork operations should be removed and replaced with properly compacted Select Fill to a minimum depth of 8 inches or as required to appropriately bridge over these soils, whichever is deeper. Proof rolling operations should be observed by a member of CQC to document subgrade preparation.

Section 9.0 – Additional Evaluation Considerations

In excavations adjacent to existing structures, precautions should be taken not to undermine or damage existing structures, footings, and/or utility lines. Precautions should be taken to prevent distresses to nearby existing structures.

As typically expected with construction activities and relatively large excavation projects, a degree of vibratory impacts should be expected. Our scope of work did not include an assessment of the condition of private structures or facilities adjacent to the water system limits nor opinions or statements of potential impacts. In accordance with the typical provisions of construction contracts the general contractor shall be responsible for monitoring of existing structures. As required, the general contractor shall develop a vibration and ground settlement monitoring plan before, during the course of construction and after all construction activities have been completed at the project site. The plan may include the set-up of an array of monitoring points near the waterline and at radial distances from construction activities to monitor potential ground movements. It may be necessary for the contractor to retain the services of a licensed professional engineer or geologist to develop a monitoring plan and provide site monitoring services as needed. It may be necessary for the contractor to establish a contingency plan for potential observed movements of adjacent structures. The development of a settlement monitoring program was beyond our scope of work; however, we may meet with our Client and owner to further discuss this issue, as required. The US Bureau of Mines, FHWA – “Geotechnical Instrumentation for Monitoring Field Performance” manual and ASCE publications may be referenced to establish a monitoring plan

and set maximum vibration peak particle velocity (i.e., typically less than 0.2 in/sec.) and frequency thresholds to ensure that vibrations are maintained below these limits during construction.

Section 10.0 – Project Specification Information

10.1 – Fill Materials

A. Structural Fill shall consist of a crushed stone base (CSB) coarse material conforming to requirements of a TXDOT Item 247 – Flexible Base, Type A, Grade 3 soil material. The flexible base material should meet the gradation requirements below, exhibit a liquid limit less than 35 and plasticity index of 12 or less. The flexible base material should also exhibit a maximum dry density of at least 135 pcf determined in accordance with ASTM D 1557. It is not recommended that recycled concrete base material be considered as a substitute for the requirement above, unless approved by the project civil engineer or owner.

Table 12 – Structural Fill Gradation Requirements

Sieve Size (square opening)	% Passing by Weight
2½ -inch	100
1¾ -inch	90 – 100
No. 4	25 – 55
No. 40	15 – 50

B. Select Fill should consist of granular clayey, silty sands or sandy clayey, silty gravel mixtures, free of clay lumps, clay balls, deleterious materials, organic material, vegetation, roots, cobbles or boulders over 3 inches in nominal size. The Select Fill should have a liquid limit less than 35 and a plasticity index of 12 or less. The Select Fill shall also exhibit an optimum dry density of at least 112 pcf determined in accordance with ASTM D-1557. Select Fill soils should also meet the gradation requirements below.

Table 13 – Select Fill Gradation Requirements

Sieve Size (square opening)	% Passing by Weight
3-inch	100
3/4-inch	70 – 100
No. 4	45 – 100
No. 200	5 – 45

Select Fill soils should classify as SP-SM, SM, SC, SC-SM, GM, GC, GC-GM, GP-GM, and GP-GC in accordance with the Unified Soil Classification System (USCS).

C. Native Fill Soils (Existing On-Site Soils) should consist of granular clayey, silty sands or sandy gravel mixtures, free of clay lumps, deleterious materials, vegetation, organic material, roots, cobbles or boulders over 3 inches in nominal size. Native Fill soils are not considered suitable Structural Fill or Select Fill soils unless approved by the architect and/or engineer of record. The Native Fill soils shall have a liquid limit less than 40 and a plasticity index of 15 or less. Suitable Native Fill soils should meet the gradation requirements below. Native Fill soils are not considered specified Imported Structural Fill or Select Fill soils unless they strictly meet the requirements of Select Fill specified above.

Table 14 – Native Fill Soil Gradation Requirements

Sieve Size (square opening)	% Passing by Weight
3-inch	100
3/4-inch	70 – 100
No. 4	45 – 100
No. 200	3 – 45

Native Fill soils classified in the following list according to the USCS may be considered satisfactory for use Native Fill soils: SM, SW, SC, SP-SM, SP-SC, SC-SM, GW, GP, GM, GC, GP-GM and GP-GC, provided that these soils also meet the requirements above.

It is recommended that on-site soils classified as SP be blended with low-plasticity clayey sands or as appropriate to mitigate potential soil sloughing during excavations in these types of soils and to create a relatively stable blended soil material that exhibits adequate bearing capacity.

Soils classified as CH, CL, MH, ML, OH, OL and PT or a combination of these under the USCS classification and soils that exhibit a plasticity index greater than 15 are not considered suitable for use as Structural Fill, Select Fill and Native Fill soil materials.

D. Recycled Flexible Base Coarse Material, if approved by the design engineer and owner, recycled base material shall be granular, free of clay lumps, deleterious materials, cobbles or boulders over 3 inches and crushed asphalt particles no greater than 1-3/4 inches in nominal size. Recycled base materials that shall be utilized should not contain more than 20% of asphaltic-concrete particles and should not be greater than 3-inches, unless approved by the owner and engineer. The recycled base soil materials should also meet the gradation requirements tabulated below.

Table 15 - Recycled Paving Materials Aggregate Base Grading Requirements

Sieve Size (square opening)	% Passing by Weight
1 -3/4-inch	100
No. 4	60 Max.
No. 40	50 Max.
No. 200	18 Max.

The recycled base should have a liquid limit less than 40, a plasticity index no greater than 12, and should also exhibit an optimum dry density of at least 130 pcf when determined in accordance with ASTM D1557. The recycled base material aggregates should also be tested in accordance with ASTM C-131-"Laboratory Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine" and should exhibit a maximum percent loss of 40. Recycled base soil materials should be classified as SC, SC-SM, GP, GP-GM, GP-GC, GC, and GC-GM in accordance with the USCS or similar AASHTO classifications.

It is not recommended that the recycled base materials be blended with approved new imported base materials unless authorized by the owner and design engineer of record.

E. Water and Utility Line Backfill Soil Classifications The following soil backfill classifications are typically designated for utility plumbing pipe backfill materials. **It is not recommended that slag be utilized for the backfill material unless approved by the engineer of record.** Class I, Class II, Class III, Class IV, and Class V materials may be defined as follows:

- **CLASS I** material may be manufactured angular, well-graded, crushed stone per ASTM D-2321 with a maximum particle size of 1½ inches. The following materials shall be acceptable under this class designation: ASTM D-448 – Stone Sizes 4, 46, 5, 56, 57, and 6. Pea Gravel and other uniformly graded material are not acceptable under this class. A gradation of Class I material shall be submitted by the Contractor to the Engineer for approval prior to use.

- **CLASS II** material may be coarse sands and gravels per ASTM D-2487 with maximum particle size of 1½ inches, including variously graded sands and gravels, containing less than 12 percent fines (material passing the #200 sieve) generally granular and non-cohesive, either wet or dry. Soil types GW, GP, SW and SP are included in this class. (i.e., typically required within pipe zone). Proposed Class II material shall be submitted by the Contractor to the Engineer for evaluation and approval prior to use.

- **CLASS III** material may be fine sands, clayey sand mixtures, clayey gravel and sand mixtures, suitable clean native sands and gravels. Class III materials shall also be free of clay lumps, deleterious materials, cobbles or boulders over 3-inches in nominal size. Class III materials should have a liquid limit less than 35 and a plasticity index less than or equal to 15 and exhibit an optimum dry density of at least 112 pcf. Soils classified in the following list according to the USCS and ASTM may be considered satisfactory for use as Class III backfill soil materials above the pipe zone as approved by the project engineer of record: SM, SW, SC, SP-SM, SP-SC, SC-SM, GW, GP, GM, GC, GP-GM and GP-GC. Proposed Class III material shall be submitted by the Contractor to the Engineer for evaluation and approval prior to use.

- **CLASS IV and V** material may be classified as CH, CL, MH, ML, OH, OL and PT under the USCS. These soils **shall not be used** as backfill materials, unless approved by the engineer of record.

10.2 – Additional Specification and Construction Considerations

The following report section presents specific conditions that we have noted during our evaluation and should be considered by our Client and design team with respect to earthwork estimates and operations.

- At the time that this report was completed, a final civil design grading plan had not been provided for the review of CQC. We anticipate that new subgrade elevations shall remain within +/- 1 foot of the existing grade elevations. Site work should be performed in accordance with the Site Preparation section of this report or as required by the project plans and specifications, whichever is more stringent.

- The project Contractor shall be responsible for conducting their own tests to verify the actual depths of the soil types and ground water within the project limits to perform earthwork. The owner shall not incur additional costs for additional excavations or removal of encountered variable unclassified soils, shallow water seepage and subgrade pumping, buried materials or utilities. Unforeseen conditions such as buried slabs, structures and soil cement backfill materials above existing utility lines may be encountered during construction. If our Client and/or Owner are concerned with these potential conditions, other relatively non-destructive methods such as Ground Penetrating Radar (G.P.R.) and potholing may be performed as an additional service, if requested by the Owner. The boring logs and data in this report are intended for engineering design purposes. Bidding contractors may consider the information presented in this report at their own risk. If deemed necessary, bidding contractors shall collect additional subsurface information for use and/or interpretation for earthwork or demolition estimates that comply with the project specifications and plans to complete the specified work prior to bidding.

- The indicated suitability of the on-site soils and use as suitable Select Fill in this report should be considered by the design team and bidding general contractor.

- The contractor should consider that it is possible for sloughing (i.e., erosion) of the sandy soils to occur during excavations for this project. Sloughing of granular soils may hinder the installation of form work

and cause excavations to be wider than expected. Proper shoring, moisture conditioning and compaction of these soils may mitigate potential soil sloughing.

- Based on our soil borings and soil classification tests, the soils encountered at this site should be considered Type "C" soils under current Occupational Safety and Health Administration (OSHA) regulations (Standard – 29 CFR-Part 1926.650, Subpart P- Excavations) pertaining to excavations. In excavations penetrating these soils, the non-permanent sloping and benching schemes specified for Type "C" soils under the OSHA regulations require that the excavation sidewalls be sloped no steeper than 1½:1 (horizontal: vertical). Trenches or excavations 4 feet and deeper shall require the development of a trench safety plan to protect employees and the general public. Please note that it is the contractor's responsibility to assign a "competent" person to perform daily inspections and required documentation in accordance with OSHA regulations. In addition, OSHA limits excavations to 20 feet when excavations utilize soil benching and sloping methods and braced/shored trench box (i.e., rated) shielded systems designed by a licensed professional engineer. Trench excavations utilizing sheet piling systems or un-braced temporary shielded systems per OSHA regulations shall be designed by a licensed professional engineer for any excavation depth in consideration to protect the health and safety of all workers and the public.

- When utility lines are removed and/or installed at this site, the utility contractor should adequately over-excavate the soils in the utility line trench area and backfill with properly compacted in-situ or pipe backfill soils to mitigate potential settlements caused by uncontrolled backfill during construction. In-situ and/or pipe backfill soils should be placed in loose lifts not to exceed 8 inches in thickness to the finished subgrade elevation or in accordance with the project plans and specifications, whichever is more stringent. Prior to placing the specified pipe backfill soils, the existing native soils at the bottom of the trench should be scarified and re-compacted to a minimum 95 percent of the maximum dry density as determined by ASTM D 1557 or as directed by the owners inspector.

10.3 - Construction Materials Testing

We recommend that construction materials inspection and testing of site work, fill placement, pipeline excavations, concrete placement, and all other applicable materials and structures be performed by CQC. The specification testing program should include the following testing frequencies as a minimum or as required by the project specifications and plans, whichever is more stringent:

1. At least one (1) Moisture-Density Relationship test (Proctor) for each type of in-situ soil and/or imported material to be used, according to ASTM D 1557. Additional soil samples for testing shall be requested by the General Contractor during the course of earthwork operations to ensure that the fill materials are maintained consistently within the specified requirements.

2. At least one (1) Soil Classification (Sieve Analysis and Atterberg Limits Test) for each type of in-situ soil and/or imported material to be used, according to ASTM D 6913 and D 4318. Additional soil samples for testing shall be requested by the General Contractor during the course of earthwork operations to ensure that the fill materials are maintained consistently within the specified requirements.

3. A minimum of one (1) nuclear density test per 8 inch lift at 100 to 150 lineal feet spacing for pipe bedding and backfill operations shall be performed, according to ASTM D 6938 or D 1556.

4. Sampling and testing for quality assurance of placed **mortar**, Type S (minimum compressive strength of 1800 psi) should be performed for the project. The design strength of the mortar mix shall be evaluated by collecting 6-cube specimens for lab curing and testing in accordance with applicable ASTM procedures. At least two (2) sets of 3 mortar cubes should be collected for every day of mortar placement or as directed by the project engineer. The mortar specimens should be tested at 7 days (2 cubes) and 28 days (4 cubes) for verification of the specified design strength or as directed by the project plans and specifications. Cube samples may be also placed on hold for testing beyond 28 days.

5. Sampling and testing for quality assurance of placed **grout** materials (3/8" maximum aggregate with a minimum compressive strength of 2,500 psi) should be performed for the project. Grout field testing shall include testing for temperature and slump (8 to 10 inches maximum). The design strength of the grout mix shall be evaluated by collecting prisms specimens molded with on-site CMU blocks for lab curing and testing in accordance with applicable ASTM procedures. At least one set of four (4) grout prisms should be collected for each days batching or as directed by the project engineer. Grout with additives should be batched and placed in not more than 2 cubic yard volumes. The grout specimens should be tested at 7 days (1 prism) and 28 days (3 prisms) for verification of the specified design strength or as directed by the project plans and specifications.

6. Sampling and testing for quality assurance of placed **concrete** materials should be performed for the project. Concrete field testing shall include testing for temperature, slump and air content (if required). The design strength of the concrete mix shall be evaluated by collecting cylindrical concrete compression test specimens for lab curing and testing in accordance with applicable ASTM procedures. At least one set of four (4) 6-inch x 12-inch or five (5) 4-inch x 8-inch concrete cylinders should be collected for every 50 cubic yards or less of poured concrete or as directed by the project engineer. The concrete specimens should be tested at 7 days (1 cylinder) and 28 days (4 cylinders) for verification of the specified design strength or as directed by the project plans and specifications. The ACI guidelines for hot weather and cold weather concreting should be followed to mitigate the potential poor performance and shrinkage/contraction cracking of the concrete materials during significant periods of high (above 95° F) and low (below 35° F) temperatures.

Section 11.0 – Soils Evaluation Report Considerations and Limitations

The analysis and recommendations in this report are based on the data obtained from seven (7) subsurface exploration vertical borings performed at the approximate locations indicated on the attached General Geotechnical Subsurface Exploration Boring Location Aerial Plan, Sheet A1-1. This report may not reflect all the variations that may occur between the vertical borings. The nature and extent of the variations may not become evident until during the course of construction. This is specifically true of the encountered caliche layers. If variations appear during construction, CQC should be contacted immediately, it may be necessary for a

reevaluation of our recommendations provided within this report to be made after performing on-site observations during the construction period and noting the characteristics of any variations. No other information relevant to the project limits history or known conditions of concern were discussed or disclosed to CQC by our Client or design representatives.

The scope of our soil evaluation did not include surveying services, ground water study, sinkhole study, landslide study, soil slope stability analysis, delineation of buried structures or material, preparation of engineering plans, specifications, cost estimates, an environmental assessment of the property's air, soil, water, site fault delineation and evaluation, preparation of a dewatering plan, trench safety and/or shoring plan, delineation of subsurface flowing water or rock conditions either on or adjacent to the project site limits, therefore no opinions and/or conclusions are presented in this report. Our geotechnical scope of work for this site did not include an environmental assessment or chemical testing and analysis of the subsurface soils.

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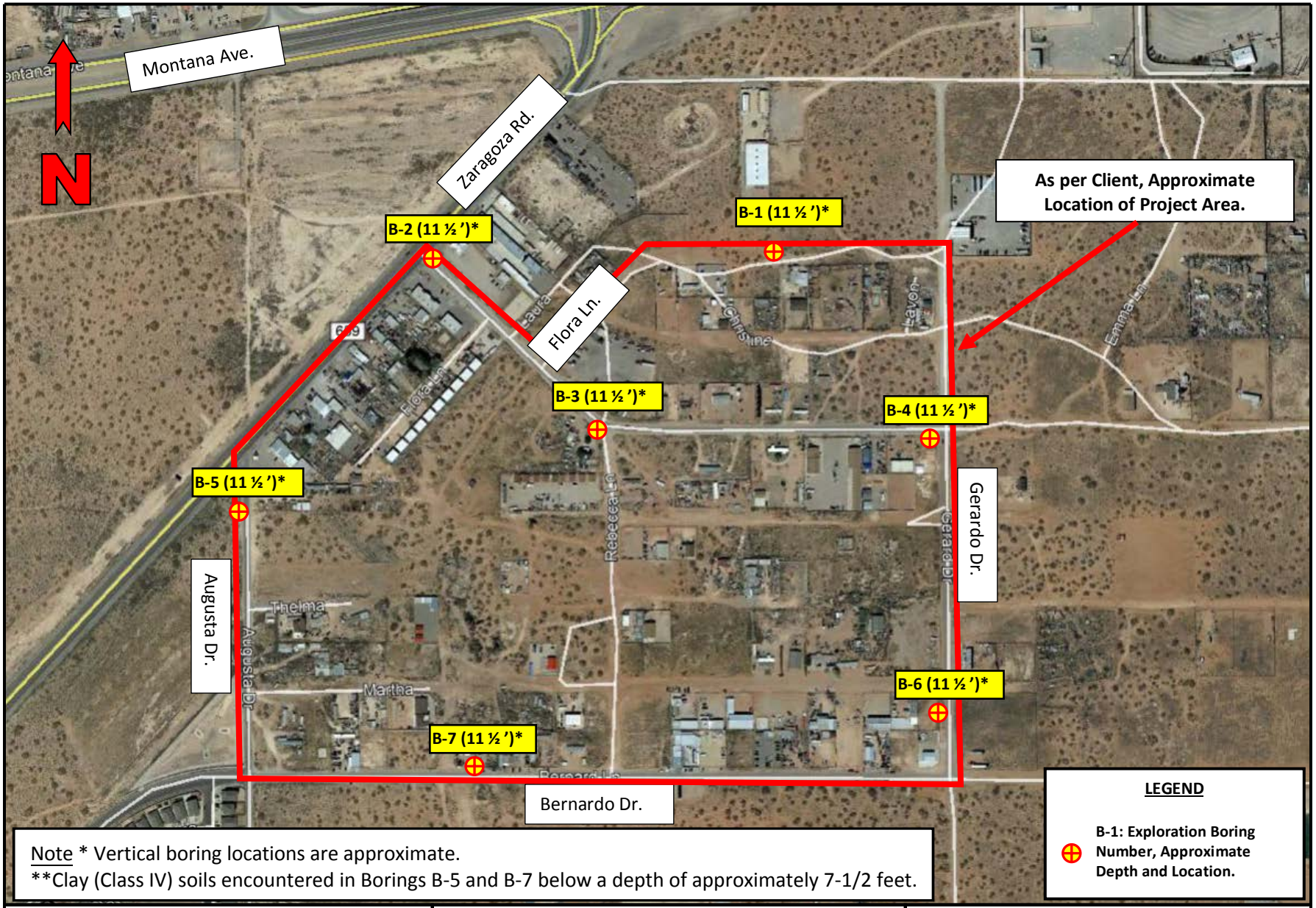
APPENDIX A



Note * Vertical boring locations are approximate.
**Clay (Class IV) soils encountered in Borings B-5 and B-7 below a depth of approximately 7-1/2 feet.

construction quality control testing and engineering

General Geotechnical Subsurface Exploration Boring Location Aerial Plan

Hillcrest Estates New Waterline Project
N. Zaragoza Road and Laura Lane
El Paso, El Paso County, Texas

Client: Moreno Cardenas Inc.	
CQC Project No. AGCQC20-040	
Scale: NTS	Check by: JR
Date: 12/9/2020	Sheet A1-1

construction quality control testing and engineering

City of El Paso - Flood Zone Aerial Plan

Hillcrest Estates New Waterline Project
N. Zaragoza Road and Laura Lane
El Paso, El Paso County, Texas

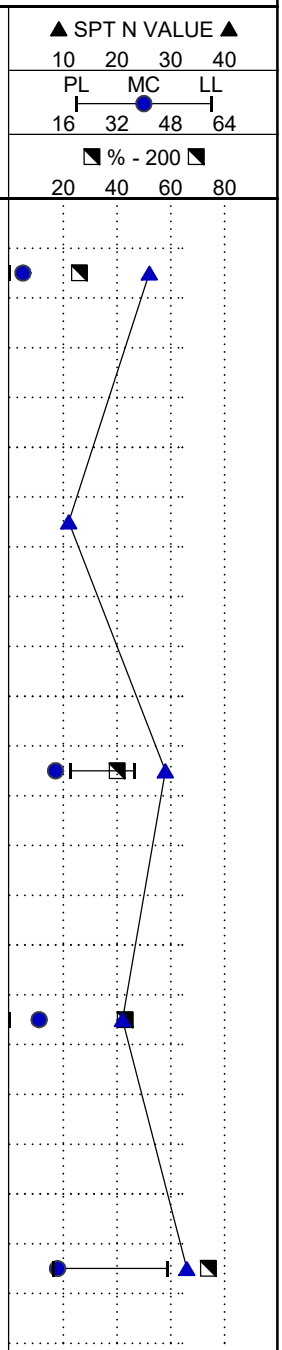
Client: Moreno Cardenas Inc.	
CQC Project No. AGCQC20-040	
Scale: NTS	Check by: JR
Date: 12/09/2020	Sheet A1-2

CQC Testing and Engineering LLC - TBPE Firm No. F-10632
4606 Titanic Avenue
El Paso, Texas 79904
Ph: (915) 771-7766
Fx: (915) 771-7786

BORING NUMBER B-1

CLIENT Moreno Cardenas Inc.
PROJECT NAME Hillcrest Estates New Waterline Project
PROJECT NUMBER AGCQC20-040
PROJECT LOCATION North Zaragoza Road and Laura Lane
DATE STARTED 10/13/20 **COMPLETED** 10/13/20
GROUND ELEVATION Ext Grade **HOLE SIZE** 9 inches
DRILLING CONTRACTOR CQC **DRILLED BY** SC
GROUND WATER LEVELS:
DRILLING METHOD CME-75 w/ 4-1/4" ID HSA
AT TIME OF DRILLING ---
LOGGED BY PG **CHECKED BY** JLA
AT END OF DRILLING ---
NOTES Boring Location: See Attached Boring Location Plan, Sheet A1-1
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	BLOW COUNTS (N VALUE)	% Moisture Content	% - 4	% - 200	PI (LL-PL)	Pocket Pen. (tsf)	USCS
0.0	SS 1		SAND, Fine Grained, Silty, Tannish Brown to Multicolored, Medium Dense, Moist.	9-11-15 (26)	4.0	97	26	NP		SM
2.5	SS 2			4-4-7 (11)						
5.0	SS 3		SAND, Fine Grained, Clayey, Tannish Brown to Whiteish Brown, Medium Dense, Slightly Moist with calcareous material and clay nodules. - Dense caliche layer below approximately 5 feet. Layer appears to extend from approx. 5 to 7-1/2 feet. - Cave-in was measured from approx. 5 to 10 feet.	8-12-17 (29)	13.7	100	40	19		SC
7.5	SS 4		SAND, Fine Grained, Silty, Tannish Brown to Multicolored, Medium Dense, Moist.	7-10-11 (21)	8.8	100	43	NP		SM
10.0	SS 5		LEAN CLAY, Plastic, Dark Brown to Tannish Brown, Very Stiff, Slightly Moist with sand and traces of calcareous material.	12-13-20 (33)	14.3	100	74	34	3.0	CL
			NOTE: SS- Split Spoon Sample Bottom of borehole at 11.5 feet.							



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4606 Titanic Avenue
El Paso, Texas 79904
Ph: (915) 771-7766
Fx: (915) 771-7786

BORING NUMBER B-2

CLIENT Moreno Cardenas Inc. **PROJECT NAME** Hillcrest Estates New Waterline Project

PROJECT NUMBER AGCQC20-040 **PROJECT LOCATION** North Zaragoza Road and Laura Lane

DATE STARTED 10/13/20 **COMPLETED** 10/13/20 **GROUND ELEVATION** Ext Grade **HOLE SIZE** 9 inches

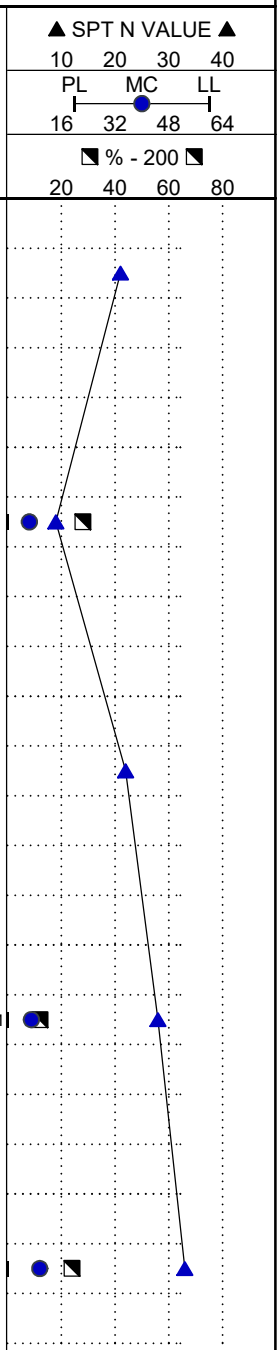
DRILLING CONTRACTOR CQC **DRILLED BY** SC **GROUND WATER LEVELS:**

DRILLING METHOD CME-75 w/ 4-1/4" ID HSA **AT TIME OF DRILLING** ---

LOGGED BY PG **CHECKED BY** JLA **AT END OF DRILLING** ---

NOTES Boring Location: See Attached Boring Location Plan, Sheet A1-1 **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	BLOW COUNTS (N VALUE)	% Moisture Content	% - 4	% - 200	PI (LL-PL)	Pocket Pen. (tsf)	USCS
0.0	SS 1		SAND, Fine Grained, Silty, Tannish Brown to Multicolored, Medium Dense, Slightly Moist to Moist.	10-11-10 (21)						
2.5	SS 2		- Light brown to tannish brown, loose at approx. 2-1/2 feet. - Encountered loose sandy soils shall be susceptible to soil sloughing during excavation and elastic settlement.	4-4-5 (9)	6.5	97	28	NP		SM
5.0	SS 3		- Medium dense below approx. 5 feet. - Cave-in was measured from approx. 5 to 10 feet.	4-7-15 (22)						
7.5	SS 4		SAND, Fine to Medium Grained, Poorly Graded, Light Brown to Tannish Brown, Medium Dense, Moist with silt.	5-15-13 (28)	7.1	88	12	NP		SP-SM
10.0	SS 5		SAND, Fine to Medium Grained, Silty, Tannish Brown to Multicolored, Dense, Moist with traces of calcareous material.	8-12-21 (33)	9.6	82	24	NP		SM
			NOTE: SS- Split Spoon Sample Bottom of borehole at 11.5 feet.							



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BORING NUMBER B-3

CLIENT Moreno Cardenas Inc. **PROJECT NAME** Hillcrest Estates New Waterline Project

PROJECT NUMBER AGCQC20-040 **PROJECT LOCATION** North Zaragoza Road and Laura Lane

DATE STARTED 10/13/20 **COMPLETED** 10/13/20 **GROUND ELEVATION** Ext Grade **HOLE SIZE** 9 inches

DRILLING CONTRACTOR CQC **DRILLED BY** SC **GROUND WATER LEVELS:**

DRILLING METHOD CME-75 w/ 4-1/4" ID HSA **AT TIME OF DRILLING** ---

LOGGED BY PG **CHECKED BY** JLA **AT END OF DRILLING** ---

NOTES Boring Location: See Attached Boring Location Plan, Sheet A1-1 **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	BLOW COUNTS (N VALUE)	% Moisture Content	% - 4	% - 200	PI (LL-PL)	Pocket Pen. (tsf)	USCS
0.0	SS 1		SAND, Fine Grained, Silty, Tannish Brown to Multicolored, Medium Dense, Slightly Moist to Moist.	10-12-18 (30)	3.4	100	25	NP		SM
2.5	SS 2		- Fine to medium grained at approx. 2-1/2 feet.	8-9-12 (21)	6.6	87	16	NP		SM
5.0	SS 3		- Light brown to tannish brown at approx. 5 feet. - Cave-in was measured from approx. 5 to 10 feet.	7-8-9 (17)						
7.5	SS 4			7-14-16 (30)	8.1	93	26	NP		SM
10.0	SS 5			13-14-11 (25)						
			NOTE: SS- Split Spoon Sample Bottom of borehole at 11.5 feet.							

▲ SPT N VALUE ▲
10 20 30 40
PL MC LL
16 32 48 64
% - 200
20 40 60 80

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BORING NUMBER B-4

CLIENT Moreno Cardenas Inc. **PROJECT NAME** Hillcrest Estates New Waterline Project

PROJECT NUMBER AGCQC20-040 **PROJECT LOCATION** North Zaragoza Road and Laura Lane

DATE STARTED 10/13/20 **COMPLETED** 10/13/20 **GROUND ELEVATION** Ext Grade **HOLE SIZE** 9 inches

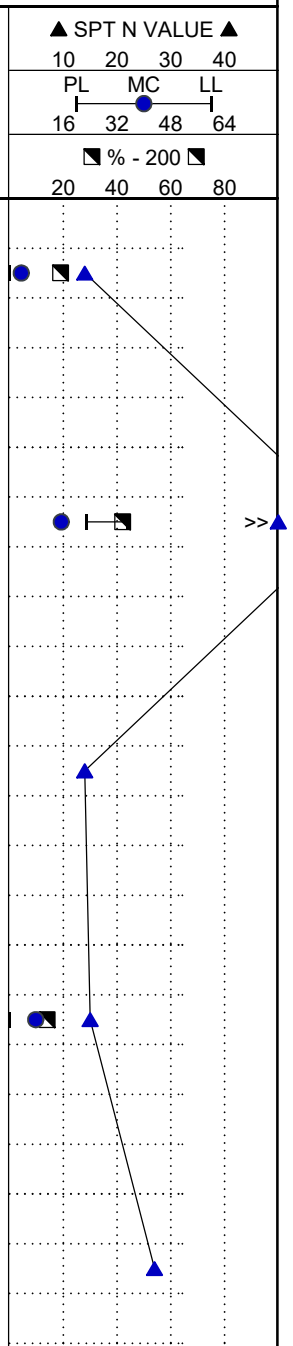
DRILLING CONTRACTOR CQC **DRILLED BY** SC **GROUND WATER LEVELS:**

DRILLING METHOD CME-75 w/ 4-1/4" ID HSA **AT TIME OF DRILLING** ---

LOGGED BY PG **CHECKED BY** JLA **AT END OF DRILLING** ---

NOTES Boring Location: See Attached Boring Location Plan, Sheet A1-1 **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	BLOW COUNTS (N VALUE)	% Moisture Content	% - 4	% - 200	PI (LL-PL)	Pocket Pen. (tsf)	USCS
0.0	SS 1		SAND, Fine Grained, Silty, Tannish Brown to Multicolored, Medium Dense, Slightly Moist.	7-8-6 (14)	3.5	100	19	NP		SM
2.5	SS 2		SAND, Fine Grained, Clayey, Tannish Brown to Whittish Brown, Very Dense, Slightly Moist to Moist with calcareous material and clay nodules. - Dense caliche layer below approximately 2-1/2 feet. Layer appears to extend from approx. 2-1/2 to 5 feet.	22-32-31 (63)	15.4	97	42	12		SC
5.0	SS 3			13-6-8 (14)						
7.5	SS 4		SAND, Fine to Medium Grained, Silty, Tannish Brown to Multicolored, Medium Dense, Moist.	5-6-9 (15)	7.8	98	14	NP		SM
10.0	SS 5			9-12-15 (27)						
			NOTE: SS- Split Spoon Sample Bottom of borehole at 11.5 feet.							



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BORING NUMBER B-5

CLIENT Moreno Cardenas Inc.
PROJECT NAME Hillcrest Estates New Waterline Project
PROJECT NUMBER AGCQC20-040
PROJECT LOCATION North Zaragoza Road and Laura Lane
DATE STARTED 10/13/20 **COMPLETED** 10/13/20
GROUND ELEVATION Ext Grade **HOLE SIZE** 9 inches
DRILLING CONTRACTOR CQC **DRILLED BY** SC
GROUND WATER LEVELS:
DRILLING METHOD CME-75 w/ 4-1/4" ID HSA
AT TIME OF DRILLING ---
LOGGED BY PG **CHECKED BY** JLA
AT END OF DRILLING ---
NOTES Boring Location: See Attached Boring Location Plan, Sheet A1-1
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	BLOW COUNTS (N VALUE)	% Moisture Content	% - 4	% - 200	PI (LL-PL)	Pocket Pen. (tsf)	USCS
0.0	SS 1		SAND, Fine to Medium Grained, Silty, Dark Brown to Tannish Brown, Medium Dense, Slightly Moist to Moist.	12-10-13 (23)	4.3	88	22	NP		SM
2.5	SS 2		- Light brown to tannish brown at approx. 2-1/2 feet.	4-9-11 (20)	8.2	83	21	NP		SM
5.0	SS 3		- Fine to coarse grained, tannish brown to multicolored at approx. 5 feet.	7-14-13 (27)						
7.5	SS 4		LEAN CLAY, Sandy, Plastic, Dark Brown to Tannish Brown, Very Stiff, Slightly Moist with traces of calcareous material.	15-24-25 (49)	14.3	100	66	30	3.5	CL
10.0	SS 5		FAT CLAY, Plastic, Dark Brown to Tannish Brown, Very Stiff, Moist with sand and traces of calcareous material.	10-13-30 (43)	15.9	100	71	39	4.5	CH
			NOTE: SS- Split Spoon Sample Bottom of borehole at 11.5 feet.							

▲ SPT N VALUE ▲
10 20 30 40
PL MC LL
16 32 48 64
% - 200
20 40 60 80

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BORING NUMBER B-6

CLIENT Moreno Cardenas Inc.
PROJECT NAME Hillcrest Estates New Waterline Project
PROJECT NUMBER AGCQC20-040
PROJECT LOCATION North Zaragoza Road and Laura Lane
DATE STARTED 10/13/20 **COMPLETED** 10/13/20
GROUND ELEVATION Ext Grade **HOLE SIZE** 9 inches
DRILLING CONTRACTOR CQC **DRILLED BY** SC
GROUND WATER LEVELS:
DRILLING METHOD CME-75 w/ 4-1/4" ID HSA
AT TIME OF DRILLING ---
LOGGED BY PG **CHECKED BY** JLA
AT END OF DRILLING ---
NOTES Boring Location: See Attached Boring Location Plan, Sheet A1-1
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	BLOW COUNTS (N VALUE)	% Moisture Content	% - 4	% - 200	PI (LL-PL)	Pocket Pen. (tsf)	USCS
0.0	SS 1		SAND, Fine Grained, Silty, Tannish Brown to Multicolored, Medium Dense, Dry to Moist.	10-13-9 (22)	2.6	100	18	NP		SM
2.5	SS 2		- Fine to medium grained, tannish brown to whittish brown with gypsum and clay nodules at approx. 2-1/2 feet.	13-8-4 (12)	10.4	69	17	NP		SM
5.0	SS 3		- Tannish brown to light brown, dense, moist with traces of calcareous material. - Cave-in was measured from approx. 5 to 10 feet.	6-14-19 (33)	14.7	98	33	NP		SM
7.5	SS 4		- Medium dense at approx. 7-1/2 feet.	10-12-16 (28)						
10.0	SS 5		SAND, Fine Grained, Clayey, Tannish Brown to Dark Brown, Medium Dense, Slightly Moist with clay nodules.	7-14-15 (29)	12.9	100	45	15		SC
			NOTE: SS- Split Spoon Sample Bottom of borehole at 11.5 feet.							

▲ SPT N VALUE ▲
10 20 30 40
PL MC LL
16 32 48 64
% - 200
20 40 60 80

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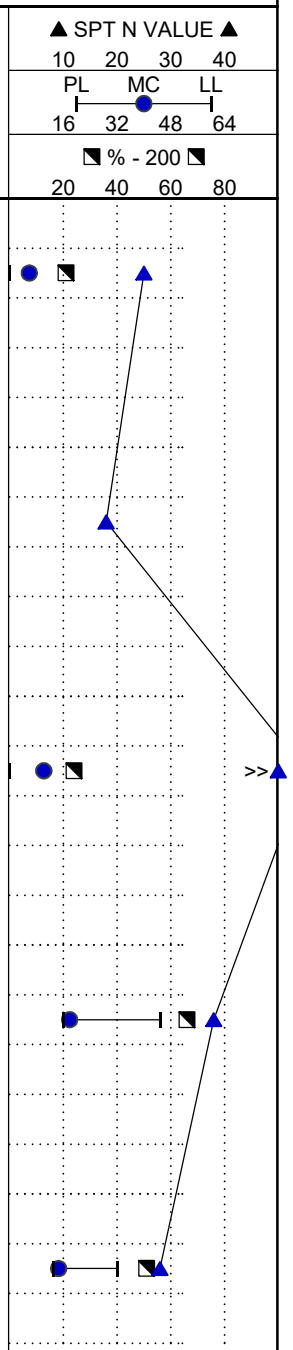
BORING NUMBER B-7

CLIENT Moreno Cardenas Inc.
PROJECT NAME Hillcrest Estates New Waterline Project
PROJECT NUMBER AGCQC20-040
PROJECT LOCATION North Zaragoza Road and Laura Lane
DATE STARTED 10/13/20 **COMPLETED** 10/13/20
GROUND ELEVATION Ext Grade **HOLE SIZE** 9 inches
DRILLING CONTRACTOR CQC **DRILLED BY** SC
GROUND WATER LEVELS:
DRILLING METHOD CME-75 w/ 4-1/4" ID HSA
AT TIME OF DRILLING ---
LOGGED BY PG **CHECKED BY** JLA
AT END OF DRILLING ---
NOTES Boring Location: See Attached Boring Location Plan, Sheet A1-1
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	BLOW COUNTS (N VALUE)	% Moisture Content	% - 4	% - 200	PI (LL-PL)	Pocket Pen. (tsf)	USCS
0.0	SS 1		SAND, Fine to Medium Grained, Silty, Tannish Brown to Multicolored, Medium Dense, Moist.	11-13-12 (25)	5.9	92	21	NP		SM
2.5	SS 2		- Light brown to tannish brown below approx. 2-1/2 feet.	8-9-9 (18)						
5.0	SS 3		- Very dense at approx. 5 feet.	15-30-25 (55)	10.2	92	24	NP		SM
7.5	SS 4		LEAN CLAY, Sandy, Plastic, Dark Brown to Tannish Brown, Very Stiff, Slightly Moist.	18-20-18 (38)	17.9	100	66	29	4.0	CL
10.0	SS 5			8-13-15 (28)	14.6	100	51	19	2.5	CL
			NOTE: SS- Split Spoon Sample Bottom of borehole at 11.5 feet.							



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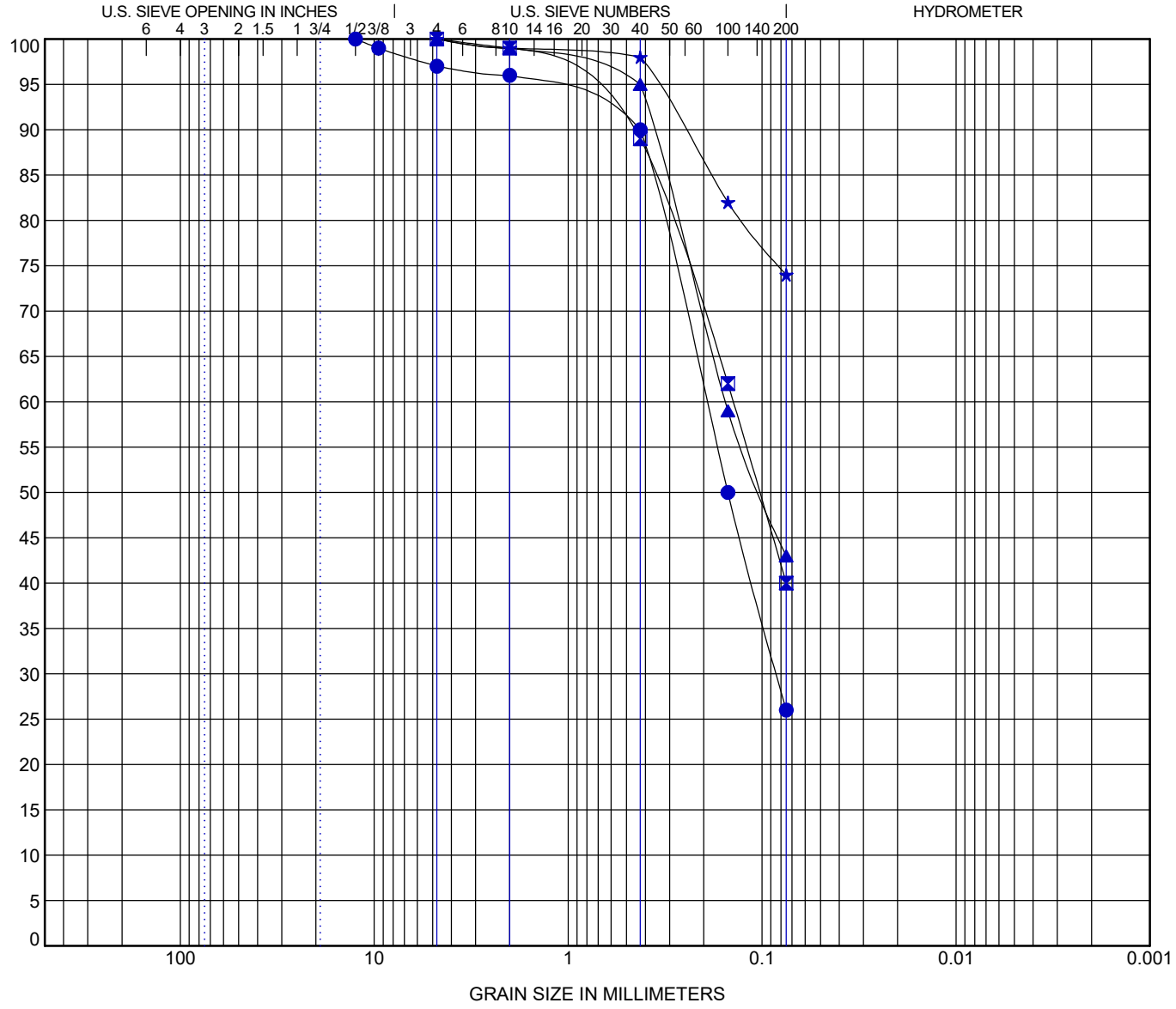
SOIL PARTICLE SIZE ANALYSIS TESTS

Test Method: ASTM D6913

CLIENT Moreno Cardenas Inc. **PROJECT NAME** Hillcrest Estates New Waterline Project

PROJECT NUMBER AGCQC20-040 **PROJECT LOCATION** North Zaragoza Road and Laura Lane



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	B-1	0.0 - 1.5	SILTY SAND(SM)	NP	NP	NP		
⊠	B-1	5.0 - 6.5	CLAYEY SAND(SC)	37	18	19		
▲	B-1	7.5 - 9.0	SILTY SAND(SM)	NP	NP	NP		
★	B-1	10.0 - 11.5	LEAN CLAY with SAND(CL)	47	13	34		

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-1	0.0 - 1.5	12.5	0.195	0.084		3.0	71.0	26.0	
⊠	B-1	5.0 - 6.5	4.75	0.141			0.0	60.0	40.0	
▲	B-1	7.5 - 9.0	4.75	0.154			0.0	57.0	43.0	
★	B-1	10.0 - 11.5	4.75				0.0	26.0	74.0	

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SOIL PARTICLE SIZE ANALYSIS TESTS

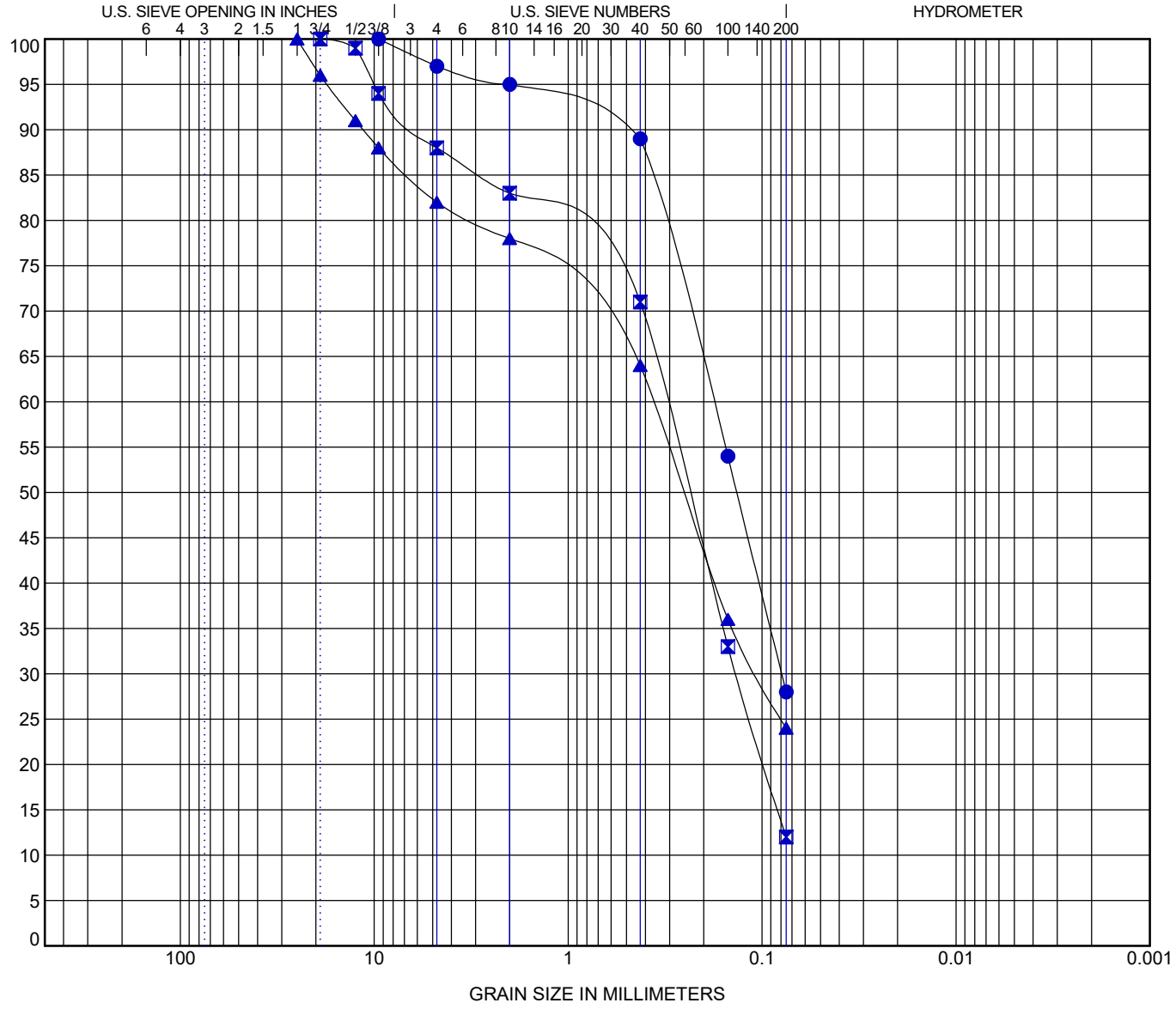
Test Method: ASTM D6913

CLIENT Moreno Cardenas Inc.

PROJECT NAME Hillcrest Estates New Waterline Project

PROJECT NUMBER AGCQC20-040

PROJECT LOCATION North Zaragoza Road and Laura Lane



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	B-2	2.5 - 4.0	SILTY SAND(SM)	NP	NP	NP		
⊠	B-2	7.5 - 9.0	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP	0.84	4.48
▲	B-2	10.0 - 11.5	SILTY SAND with GRAVEL(SM)	NP	NP	NP		

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-2	2.5 - 4.0	9.5	0.179	0.079		3.0	69.0	28.0	
⊠	B-2	7.5 - 9.0	19	0.314	0.136		12.0	76.0	12.0	
▲	B-2	10.0 - 11.5	25	0.366	0.106		18.0	58.0	24.0	

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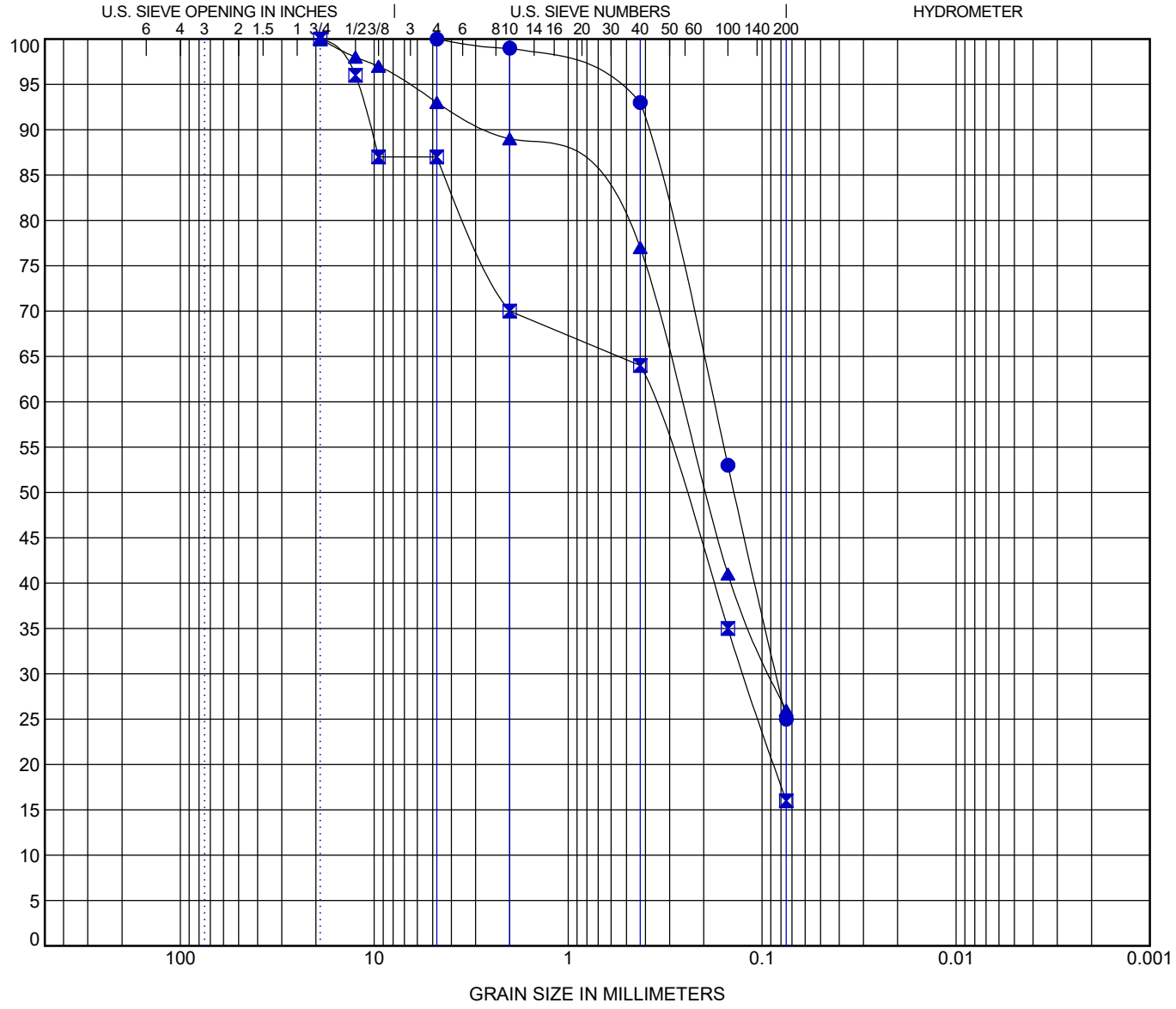
SOIL PARTICLE SIZE ANALYSIS TESTS

Test Method: ASTM D6913

CLIENT Moreno Cardenas Inc. **PROJECT NAME** Hillcrest Estates New Waterline Project

PROJECT NUMBER AGCQC20-040 **PROJECT LOCATION** North Zaragoza Road and Laura Lane



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
● B-3	0.0 - 1.5	SILTY SAND(SM)	NP	NP	NP		
⊠ B-3	2.5 - 4.0	SILTY SAND(SM)	NP	NP	NP		
▲ B-3	7.5 - 9.0	SILTY SAND(SM)	NP	NP	NP		

BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-3	0.0 - 1.5	4.75	0.18	0.085		0.0	75.0	25.0	
⊠ B-3	2.5 - 4.0	19	0.368	0.125		13.0	71.0	16.0	
▲ B-3	7.5 - 9.0	19	0.26	0.09		7.0	67.0	26.0	

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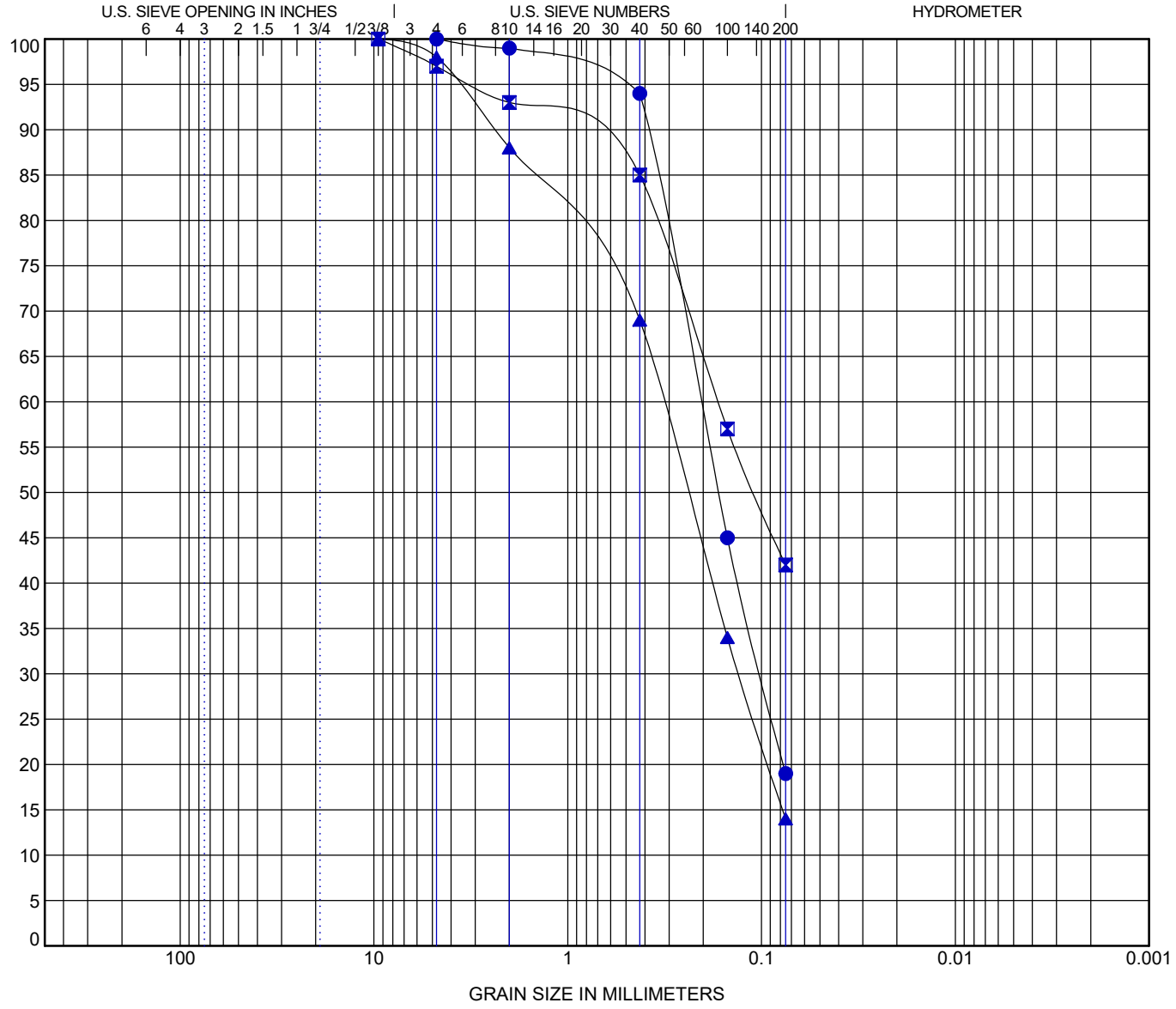
SOIL PARTICLE SIZE ANALYSIS TESTS

Test Method: ASTM D6913

CLIENT Moreno Cardenas Inc. **PROJECT NAME** Hillcrest Estates New Waterline Project

PROJECT NUMBER AGCQC20-040 **PROJECT LOCATION** North Zaragoza Road and Laura Lane



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	B-4	0.0 - 1.5	SILTY SAND(SM)	NP	NP	NP		
⊠	B-4	2.5 - 4.0	CLAYEY SAND(SC)	35	23	12		
▲	B-4	7.5 - 9.0	SILTY SAND(SM)	NP	NP	NP		

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-4	0.0 - 1.5	4.75	0.206	0.101		0.0	81.0	19.0	
⊠	B-4	2.5 - 4.0	9.5	0.168			3.0	55.0	42.0	
▲	B-4	7.5 - 9.0	9.5	0.325	0.131		2.0	84.0	14.0	

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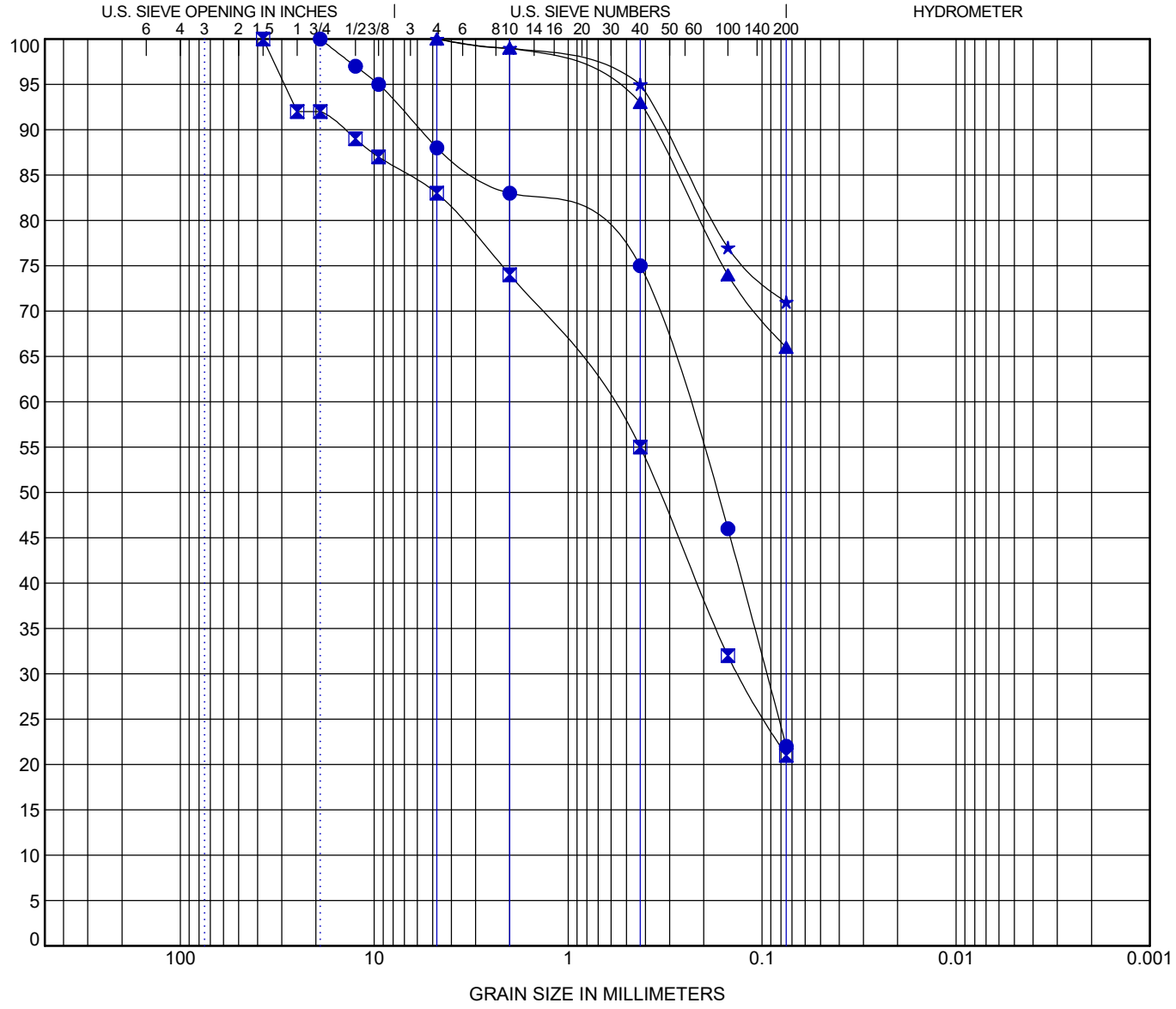
SOIL PARTICLE SIZE ANALYSIS TESTS

Test Method: ASTM D6913

CLIENT Moreno Cardenas Inc. **PROJECT NAME** Hillcrest Estates New Waterline Project

PROJECT NUMBER AGCQC20-040 **PROJECT LOCATION** North Zaragoza Road and Laura Lane



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	B-5	0.0 - 1.5	SILTY SAND(SM)	NP	NP	NP		
⊠	B-5	2.5 - 4.0	SILTY SAND with GRAVEL(SM)	NP	NP	NP		
▲	B-5	7.5 - 9.0	SANDY LEAN CLAY(CL)	43	13	30		
★	B-5	10.0 - 11.5	FAT CLAY with SAND(CH)	51	12	39		

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-5	0.0 - 1.5	19	0.248	0.094		12.0	66.0	22.0	
⊠	B-5	2.5 - 4.0	37.5	0.639	0.132		17.0	62.0	21.0	
▲	B-5	7.5 - 9.0	4.75				0.0	34.0	66.0	
★	B-5	10.0 - 11.5	4.75				0.0	29.0	71.0	

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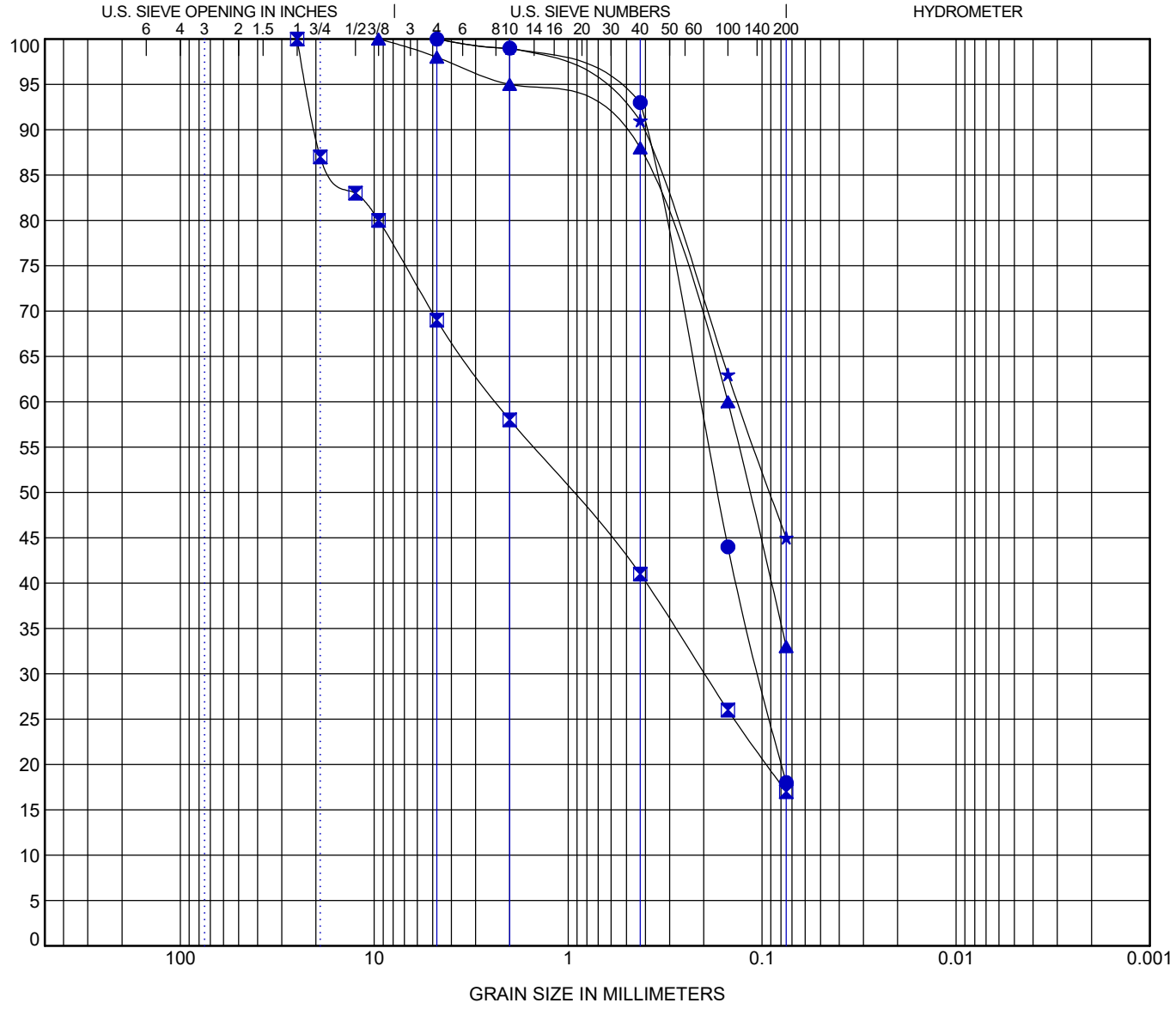
SOIL PARTICLE SIZE ANALYSIS TESTS

Test Method: ASTM D6913

CLIENT Moreno Cardenas Inc. **PROJECT NAME** Hillcrest Estates New Waterline Project

PROJECT NUMBER AGCQC20-040 **PROJECT LOCATION** North Zaragoza Road and Laura Lane



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	B-6	0.0 - 1.5	SILTY SAND(SM)	NP	NP	NP		
⊠	B-6	2.5 - 4.0	SILTY SAND with GRAVEL(SM)	NP	NP	NP		
▲	B-6	5.0 - 6.5	SILTY SAND(SM)	NP	NP	NP		
★	B-6	10.0 - 11.5	CLAYEY SAND(SC)	31	16	15		

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-6	0.0 - 1.5	4.75	0.211	0.103		0.0	82.0	18.0	
⊠	B-6	2.5 - 4.0	25	2.341	0.198		31.0	52.0	17.0	
▲	B-6	5.0 - 6.5	9.5	0.15			2.0	65.0	33.0	
★	B-6	10.0 - 11.5	4.75	0.134			0.0	55.0	45.0	

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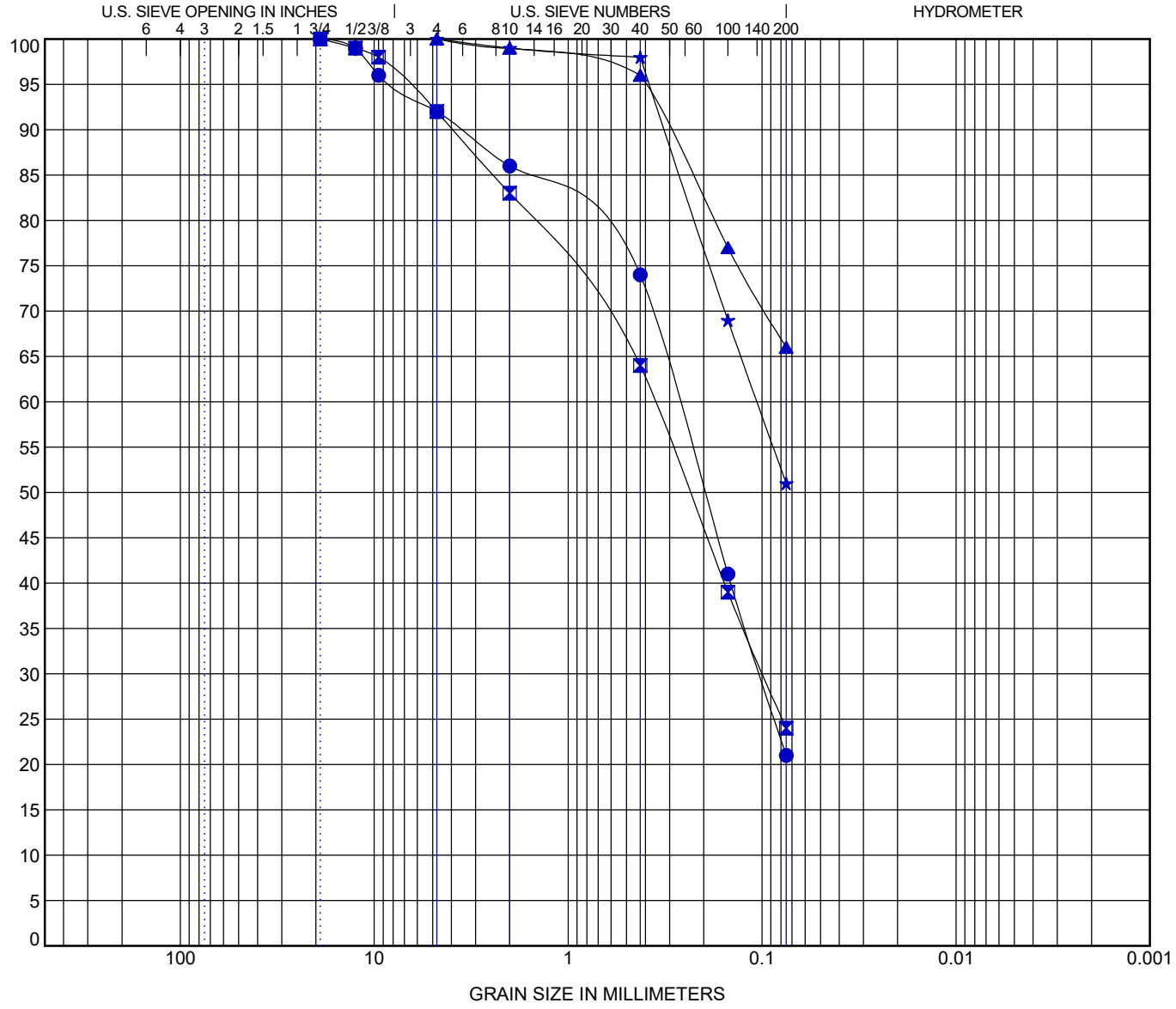
SOIL PARTICLE SIZE ANALYSIS TESTS

Test Method: ASTM D6913

CLIENT Moreno Cardenas Inc. **PROJECT NAME** Hillcrest Estates New Waterline Project

PROJECT NUMBER AGCQC20-040 **PROJECT LOCATION** North Zaragoza Road and Laura Lane



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	B-7	0.0 - 1.5	SILTY SAND(SM)	NP	NP	NP		
⊠	B-7	5.0 - 6.5	SILTY SAND(SM)	NP	NP	NP		
▲	B-7	7.5 - 9.0	SANDY LEAN CLAY(CL)	45	16	29		
★	B-7	10.0 - 11.5	SANDY LEAN CLAY(CL)	32	13	19		

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-7	0.0 - 1.5	19	0.273	0.102		8.0	71.0	21.0	
⊠	B-7	5.0 - 6.5	19	0.36	0.099		8.0	68.0	24.0	
▲	B-7	7.5 - 9.0	4.75				0.0	34.0	66.0	
★	B-7	10.0 - 11.5	4.75	0.106			0.0	49.0	51.0	

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SUMMARY OF LABORATORY ENGINEERING SOIL CLASSIFICATION TEST RESULTS

CLIENT Moreno Cardenas Inc. **PROJECT NAME** Hillcrest Estates New Waterline Project

PROJECT NUMBER AGCQC20-040 **PROJECT LOCATION** North Zaragoza Road and Laura Lane

Borehole	Depth	N - Value	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 4	% Passing No. 200	Pocket Pen. (tsf)	Total Unit Weight (pcf)	Classification
B-1	0.0- 1.5	26	4.0	NP	NP	NP	97	26			SM
	2.5- 4.0	11									
	5.0- 6.5	29	13.7	37	18	19	100	40			SC
	7.5- 9.0	21	8.8	NP	NP	NP	100	43			SM
	10.0- 11.5	33	14.3	47	13	34	100	74	3.0		CL
B-2	0.0- 1.5	21									
	2.5- 4.0	9	6.5	NP	NP	NP	97	28			SM
	5.0- 6.5	22									
	7.5- 9.0	28	7.1	NP	NP	NP	88	12			SP-SM
	10.0- 11.5	33	9.6	NP	NP	NP	82	24			SM
B-3	0.0- 1.5	30	3.4	NP	NP	NP	100	25			SM
	2.5- 4.0	21	6.6	NP	NP	NP	87	16			SM
	5.0- 6.5	17									
	7.5- 9.0	30	8.1	NP	NP	NP	93	26			SM
	10.0- 11.5	25									
B-4	0.0- 1.5	14	3.5	NP	NP	NP	100	19			SM
	2.5- 4.0	63	15.4	35	23	12	97	42			SC
	5.0- 6.5	14									
	7.5- 9.0	15	7.8	NP	NP	NP	98	14			SM
	10.0- 11.5	27									
B-5	0.0- 1.5	23	4.3	NP	NP	NP	88	22			SM
	2.5- 4.0	20	8.2	NP	NP	NP	83	21			SM
	5.0- 6.5	27									
	7.5- 9.0	49	14.3	43	13	30	100	66	3.5		CL
	10.0- 11.5	43	15.9	51	12	39	100	71	4.5		CH
B-6	0.0- 1.5	22	2.6	NP	NP	NP	100	18			SM
	2.5- 4.0	12	10.4	NP	NP	NP	69	17			SM
	5.0- 6.5	33	14.7	NP	NP	NP	98	33			SM
	7.5- 9.0	28									
	10.0- 11.5	29	12.9	31	16	15	100	45			SC
B-7	0.0- 1.5	25	5.9	NP	NP	NP	92	21			SM
	2.5- 4.0	18									
	5.0- 6.5	55	10.2	NP	NP	NP	92	24			SM
	7.5- 9.0	38	17.9	45	16	29	100	66	4.0		CL
	10.0- 11.5	28	14.6	32	13	19	100	51	2.5		CL

Construction Materials Testing
Geotechnical Engineering
Environmental Site Assessments
Forensic Analysis/Testing

SOIL MOISTURE - DENSITY RELATIONSHIP TEST RESULTS

PROJECT NO.: AGCQC20-040

PROJECT NAME: **General Geotechnical Subsurface Soils Evaluation**
Hillcrest Estates New Waterline Project
Various Locations
El Paso, El Paso County, Texas

SAMPLE INFORMATION

PROCTOR NO.: 1 **SAMPLED BY:** PG

SOIL SAMPLE LOCATION: B-1 **SAMPLE DATE:** 10/13/2020

SOIL SAMPLE APPROX. DEPTH: 0'-5'

SOIL TYPE/DESCRIPTION: On Site Subsurface Soils/ SAND, Fine to Medium Grained, Silty, Clayey, Tannish Brown to Multicolored.

SAMPLE TEST RESULTS

Sieve Analysis Test
Test Method: ASTM D 6913

Sieve Size/No.	Percent Retained	Percent Passing
3"	0	100
2-1/2"	0	100
1-1/2"	0	100
1"	0	100
3/4"	0	100
1/2"	0	100
3/8"	0	100
No. 4	2	98
No. 10	8	92
No. 40	17	83
No. 100	49	51
No. 200	66.7	33.3

Atterberg Limits Test
Test Method: ASTM D 4318

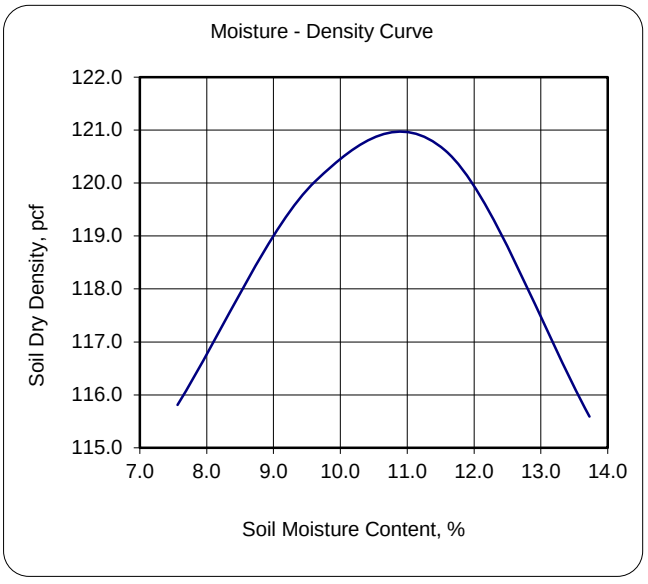
Limit Test	Index Test Result
LL	22
PL	18
PI	4

Soil Classification: **SC-SM**
Test Method: ASTM D 2487

Moisture-Density Relationship Test
Test Method: ASTM D 1557, Method "A"

Test Sample No.	Moisture Content (%)	Sample Dry Density (pcf)
1	7.6	115.8
2	9.6	120.0
3	11.6	120.6
4	13.7	115.6

Maximum Dry Density, pcf: **121.0**
Optimum Moisture Content, %: **10.9**



SOIL MOISTURE - DENSITY RELATIONSHIP TEST RESULTS

PROJECT NO.: AGCQC20-040

PROJECT NAME: **General Geotechnical Subsurface Soils Evaluation**
Hillcrest Estates New Waterline Project
Various Locations
El Paso, El Paso County, Texas

SAMPLE INFORMATION

PROCTOR NO.: 2 **SAMPLED BY:** PG

SOIL SAMPLE LOCATION: B-2 **SAMPLE DATE:** 10/13/2020

SOIL SAMPLE APPROX. DEPTH: 0-5'

SOIL TYPE/DESCRIPTION: On Site Subsurface Soils/SAND, Fine to Medium Grained, Silty, Clayey, Tannish Brown to Multicolored.

SAMPLE TEST RESULTS

Sieve Analysis Test
Test Method: ASTM D 6913

Sieve Size/No.	Percent Retained	Percent Passing
3"	0	100
2-1/2"	0	100
1-1/2"	0	100
1"	0	100
3/4"	0	100
1/2"	3	97
3/8"	4	96
No. 4	11	89
No. 10	15	85
No. 40	22	78
No. 100	56	44
No. 200	74.4	25.6

Atterberg Limits Test
Test Method: ASTM D 4318

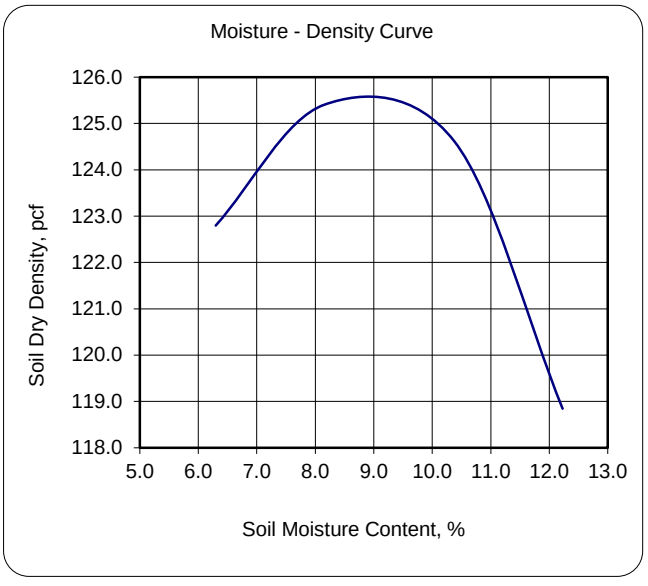
Limit Test	Index Test Result
LL	23
PL	19
PI	4

Soil Classification: **SC-SM**
Test Method: ASTM D 2487

Moisture-Density Relationship Test
Test Method: ASTM D 1557, Method "B"

Test Sample No.	Moisture Content (%)	Sample Dry Density (pcf)
1	6.3	122.8
2	8.2	125.4
3	10.4	124.6
4	12.2	118.8

Maximum Dry Density, pcf: **125.6**
Optimum Moisture Content, %: **8.9**



Construction Materials Testing
Geotechnical Engineering
Environmental Site Assessments
Forensic Analysis/Testing

SOIL MOISTURE - DENSITY RELATIONSHIP TEST RESULTS

PROJECT NO.: AGCQC20-040

PROJECT NAME: **General Geotechnical Subsurface Soils Evaluation**
Hillcrest Estates New Waterline Project
Various Locations
El Paso, El Paso County, Texas

SAMPLE INFORMATION

PROCTOR NO.: 3 **SAMPLED BY:** PG

SOIL SAMPLE LOCATION: B-4 **SAMPLE DATE:** 10/13/2020

SOIL SAMPLE APPROX. DEPTH: 5'-10'

SOIL TYPE/DESCRIPTION: On Site Subsurface Soils/ SAND, Fine to Medium Grained, Clayey, Dark Brown to Tannish Brown with clay nodules.

SAMPLE TEST RESULTS

Sieve Analysis Test
Test Method: ASTM D 6913

Sieve Size/No.	Percent Retained	Percent Passing
3"	0	100
2-1/2"	0	100
1-1/2"	0	100
1"	0	100
3/4"	1	99
1/2"	3	97
3/8"	4	96
No. 4	9	91
No. 10	14	86
No. 40	21	79
No. 100	54	46
No. 200	67.0	33.0

Atterberg Limits Test
Test Method: ASTM D 4318

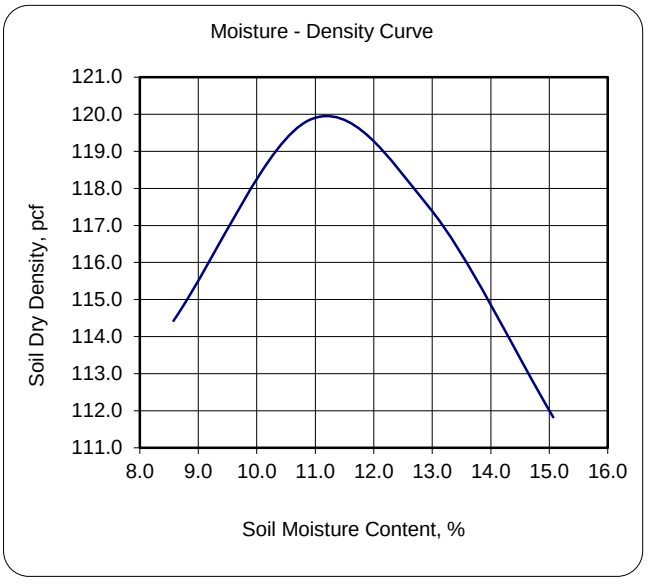
Limit Test	Index Test Result
LL	26
PL	17
PI	9

Soil Classification: **SC**
Test Method: ASTM D 2487

Moisture-Density Relationship Test
Test Method: ASTM D 1557, Method "B"

Test Sample No.	Moisture Content (%)	Sample Dry Density (pcf)
1	8.6	114.4
2	10.9	119.8
3	12.9	117.5
4	15.1	111.8

Maximum Dry Density, pcf: **120.0**
Optimum Moisture Content, %: **11.2**



Construction Materials Testing
Geotechnical Engineering
Environmental Site Assessments
Forensic Analysis/Testing

SOIL MOISTURE - DENSITY RELATIONSHIP TEST RESULTS

PROJECT NO.: AGCQC20-040

PROJECT NAME: **General Geotechnical Subsurface Soils Evaluation**
Hillcrest Estates New Waterline Project
Various Locations
El Paso, El Paso County, Texas

SAMPLE INFORMATION

PROCTOR NO.: 4 **SAMPLED BY:** PG

SOIL SAMPLE LOCATION: B-5 **SAMPLE DATE:** 10/13/2020

SOIL SAMPLE APPROX. DEPTH: 5'-7-1/2'

SOIL TYPE/DESCRIPTION: On Site Subsurface Soils/ SAND, Fine to Coarse Grained, Silty, Tannish Brown to Multicolored with gravel.

SAMPLE TEST RESULTS

Sieve Analysis Test
Test Method: ASTM D 6913

Sieve Size/No.	Percent Retained	Percent Passing
3"	0	100
2-1/2"	0	100
1-1/2"	0	100
1"	0	100
3/4"	1	99
1/2"	2	98
3/8"	4	96
No. 4	13	87
No. 10	29	71
No. 40	51	49
No. 100	73	27
No. 200	82.8	17.2

Atterberg Limits Test
Test Method: ASTM D 4318

Limit Test	Index Test Result
LL	-
PL	-
PI	NP

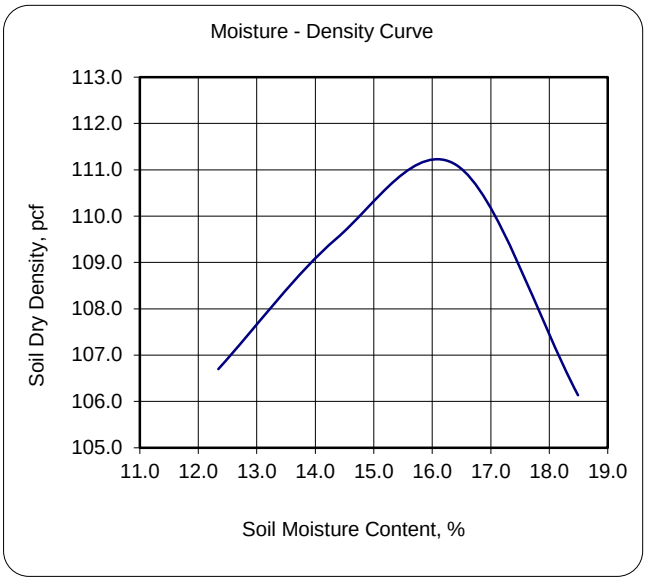
NP-Non Plastic

Soil Classification: **SM**
Test Method: ASTM D 2487

Moisture-Density Relationship Test
Test Method: ASTM D 1557, Method "B"

Test Sample No.	Moisture Content (%)	Sample Dry Density (pcf)
1	12.3	106.7
2	14.4	109.5
3	16.4	111.1
4	18.5	106.1

Maximum Dry Density, pcf: **111.2**
Optimum Moisture Content, %: **16.1**



construction quality control
testing and engineering

Construction Materials Testing
Geotechnical Engineering
Environmental Site Assessments
Forensic Analysis/Testing

SOIL MOISTURE - DENSITY RELATIONSHIP TEST RESULTS

PROJECT NO.: AGCQC20-040

PROJECT NAME: **General Geotechnical Subsurface Soils Evaluation**
Hillcrest Estates New Waterline Project
Various Locations
El Paso, El Paso County, Texas

SAMPLE INFORMATION

PROCTOR NO.: 5 **SAMPLED BY:** PG

SOIL SAMPLE LOCATION: B-6 **SAMPLE DATE:** 10/13/2020

SOIL SAMPLE APPROX. DEPTH: 0'-5'

SOIL TYPE/DESCRIPTION: On Site Subsurface Soils/ SAND, Fine Grained, Silty, Tannish Brown to Multicolored.

SAMPLE TEST RESULTS

Sieve Analysis Test
Test Method: ASTM D 6913

Sieve Size/No.	Percent Retained	Percent Passing
3"	0	100
2-1/2"	0	100
1-1/2"	0	100
1"	0	100
3/4"	0	100
1/2"	2	98
3/8"	2	98
No. 4	4	96
No. 10	5	95
No. 40	11	89
No. 100	61	39
No. 200	82.2	17.8

Atterberg Limits Test
Test Method: ASTM D 4318

Limit Test	Index Test Result
LL	-
PL	-
PI	NP

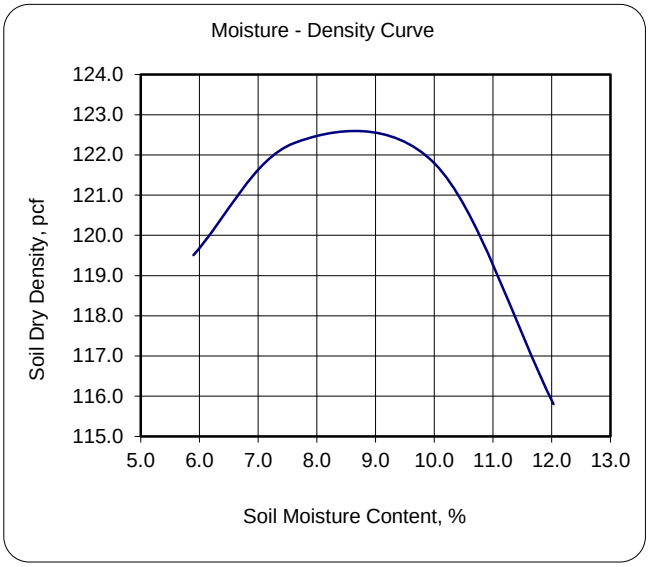
NP-Non Plastic

Soil Classification: **SM**
Test Method: ASTM D 2487

Moisture-Density Relationship Test
Test Method: ASTM D 1557, Method "A"

Test Sample No.	Moisture Content (%)	Sample Dry Density (pcf)
1	5.9	119.5
2	7.6	122.3
3	10.0	121.8
4	12.0	115.8

Maximum Dry Density, pcf: **122.6**
Optimum Moisture Content, %: **8.6**



construction quality control
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Construction Materials Testing
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Environmental Site Assessments
Forensic Analysis/Testing

SOIL MOISTURE - DENSITY RELATIONSHIP TEST RESULTS

PROJECT NO.: AGCQC20-040

PROJECT NAME: **General Geotechnical Subsurface Soils Evaluation**
Hillcrest Estates New Waterline Project
Various Locations
El Paso, El Paso County, Texas

SAMPLE INFORMATION

PROCTOR NO.: 6 **SAMPLED BY:** PG

SOIL SAMPLE LOCATION: B-7 **SAMPLE DATE:** 10/13/2020

SOIL SAMPLE APPROX. DEPTH: 0'-5'

SOIL TYPE/DESCRIPTION: On Site Subsurface Soils/ SAND, Fine to Medium Grained, Silty, Tannish Brown to Multicolored.

SAMPLE TEST RESULTS

Sieve Analysis Test
Test Method: ASTM D 6913

Sieve Size/No.	Percent Retained	Percent Passing
3"	0	100
2-1/2"	0	100
1-1/2"	0	100
1"	0	100
3/4"	0	100
1/2"	1	99
3/8"	2	98
No. 4	4	96
No. 10	18	82
No. 40	28	72
No. 100	59	41
No. 200	75.5	24.5

Atterberg Limits Test
Test Method: ASTM D 4318

Limit Test	Index Test Result
LL	-
PL	-
PI	NP

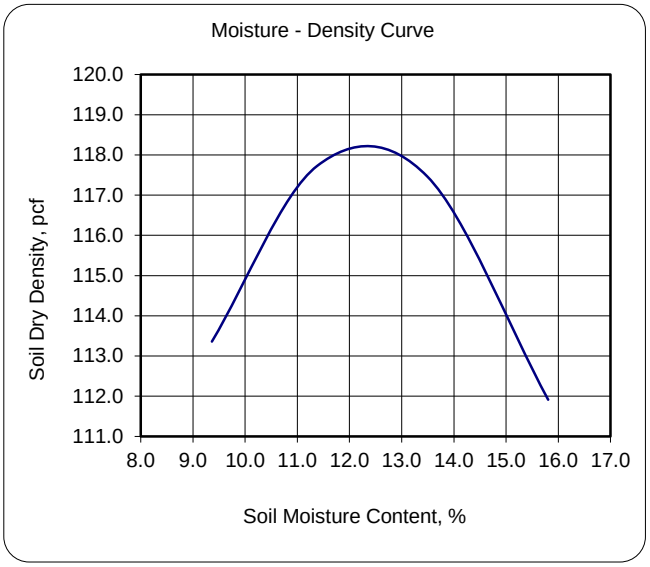
NP-Non Plastic

Soil Classification: **SM**
Test Method: ASTM D 2487

Moisture-Density Relationship Test
Test Method: ASTM D 1557, Method "A"

Test Sample No.	Moisture Content (%)	Sample Dry Density (pcf)
1	9.4	113.4
2	11.4	117.7
3	13.5	117.5
4	15.8	111.9

Maximum Dry Density, pcf: **118.2**
Optimum Moisture Content, %: **12.3**



4606 Titanic Avenue
El Paso, Texas 79904
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SOIL CALIFORNIA BEARING RATIO (CBR) TEST RESULTS
ASTM D - 1883

PROJECT NO.: AGCQC20-040

PROJECT NAME: **General Geotechnical Subsurface Soils Evaluation**
Hillcrest Estates New Waterline Project
Various Locations
El Paso, El Paso County, Texas

SAMPLE INFORMATION

PROCTOR NO.: 1 **SAMPLED BY:** PG

SOIL SAMPLE LOCATION: B-1 **SAMPLE DATE:** 10/13/2020

SOIL SAMPLE DEPTH: 0'-5'

SOIL TYPE/DESCRIPTION: On Site Subsurface Soils/ SAND, Fine to Medium Grained, Silty, Tannish Brown to Multicolored.

TEST SPECIMEN INFORMATION:

Soil Sample Height, in.	4-1/2"
Soil Sample Approx. Diameter, in.	6"
Soil Optimum Dry Density, pcf	121.0
Soil Optimum Moisture Content, %	10.9

CBR Test Data:

Stress Contact Area, in²	3.02
Sample Surcharge Load, lbs.	12.5
Soaking Period, hr's.	96

SPECIMEN SWELL TEST INFORMATION:

Intial Swell Reading:	0.5200
Final Swell Reading:	0.5230
Sample Vertical Swell, %	0.0667

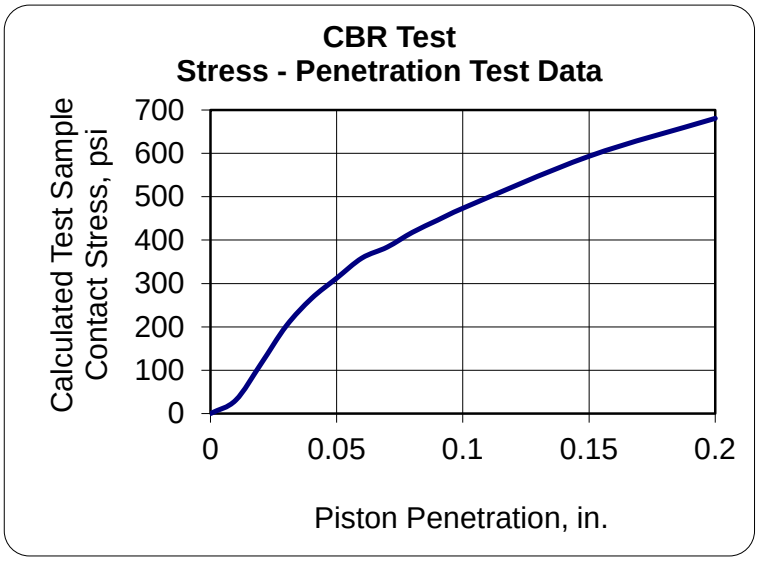
	Before Soaking	After Soaking
Dry Density, pcf	114.8	111.2
Moisture, %	10.8	14.3
% Compaction	94.9	91.9

UNCORRECTED CALCULATED SOAKED CBR VALUES:

CBR @ 0.1" Penetration	47
CBR @ 0.2" Penetration	45

Stress Versus Penetration Data

PEN.	Load, lbs.	Stress, psi
0	0	0
0.01	93	31
0.02	346	115
0.03	610	202
0.04	801	265
0.05	943	312
0.06	1083	359
0.07	1159	384
0.08	1262	418
0.09	1347	446
0.1	1430	474
0.15	1792	593
0.2	2056	681



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SOIL CALIFORNIA BEARING RATIO (CBR) TEST RESULTS
ASTM D - 1883

PROJECT NO.: AGCQC20-040

PROJECT NAME: **General Geotechnical Subsurface Soils Evaluation**
Hillcrest Estates New Waterline Project
Various Locations
El Paso, El Paso County, Texas

SAMPLE INFORMATION

PROCTOR NO.: 2 **SAMPLED BY:** PG

SOIL SAMPLE LOCATION: B-2 **SAMPLE DATE:** 10/13/2020

SOIL SAMPLE DEPTH: 0'-5'

SOIL TYPE/DESCRIPTION: On Site Subsurface Soils/SAND, Fine to Medium Grained, Silty, Tannish Brown to Multicolored.

TEST SPECIMEN INFORMATION:

Soil Sample Height, in.	4-1/2"
Soil Sample Approx. Diameter, in.	6"
Soil Optimum Dry Density, pcf	125.6
Soil Optimum Moisture Content, %	8.9

CBR Test Data:

Stress Contact Area, in²	3.02
Sample Surcharge Load, lbs.	12.5
Soaking Period, hr's.	96

SPECIMEN SWELL TEST INFORMATION:

Intial Swell Reading:	0.1800
Final Swell Reading:	0.1870
Sample Vertical Swell, %	0.1556

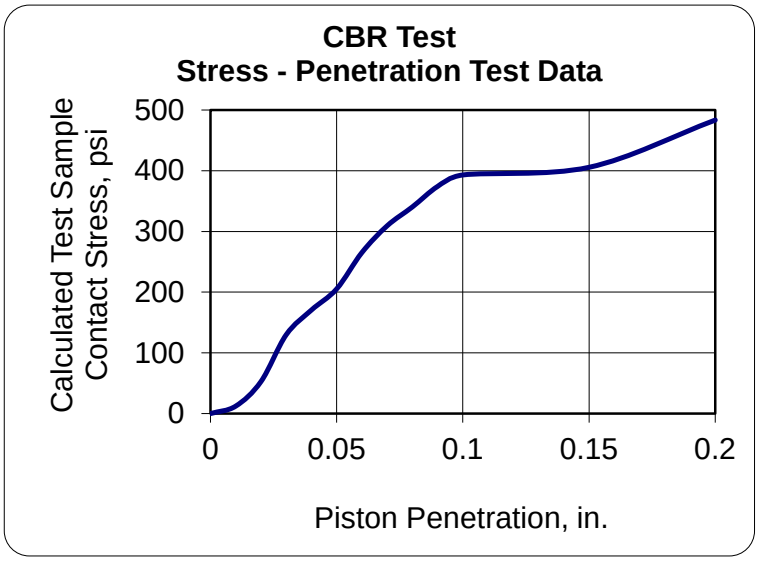
	Before Soaking	After Soaking
Dry Density, pcf	119.5	115.8
Moisture, %	8.8	12.2
% Compaction	95.1	92.2

UNCORRECTED CALCULATED SOAKED CBR VALUES:

CBR @ 0.1" Penetration	39
CBR @ 0.2" Penetration	32

Stress Versus Penetration Data

PEN.	Load, lbs.	Stress, psi
0	0	0
0.01	37	12
0.02	159	53
0.03	392	130
0.04	515	171
0.05	620	205
0.06	801	265
0.07	934	309
0.08	1028	340
0.09	1130	374
0.1	1187	393
0.15	1225	406
0.2	1460	483



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SOIL CALIFORNIA BEARING RATIO (CBR) TEST RESULTS
ASTM D - 1883

PROJECT NO.: AGCQC20-040

PROJECT NAME: **General Geotechnical Subsurface Soils Evaluation**
Hillcrest Estates New Waterline Project
Various Locations
El Paso, El Paso County, Texas

SAMPLE INFORMATION

PROCTOR NO.: 5 **SAMPLED BY:** PG

SOIL SAMPLE LOCATION: B-6 **SAMPLE DATE:** 10/13/2020

SOIL SAMPLE DEPTH: 0'-5'

SOIL TYPE/DESCRIPTION: On Site Subsurface Soils/ SAND, Fine Grained, Silty, Tannish Brown to Multicolored.

TEST SPECIMEN INFORMATION:

Soil Sample Height, in.	4-1/2"
Soil Sample Approx. Diameter, in.	6"
Soil Optimum Dry Density, pcf	122.6
Soil Optimum Moisture Content, %	8.6

CBR Test Data:

Stress Contact Area, in^2	3.02
Sample Surcharge Load, lbs.	12.5
Soaking Period, hr's.	96

SPECIMEN SWELL TEST INFORMATION:

Intial Swell Reading:	0.1890
Final Swell Reading:	0.1920
Sample Vertical Swell, %	0.0667

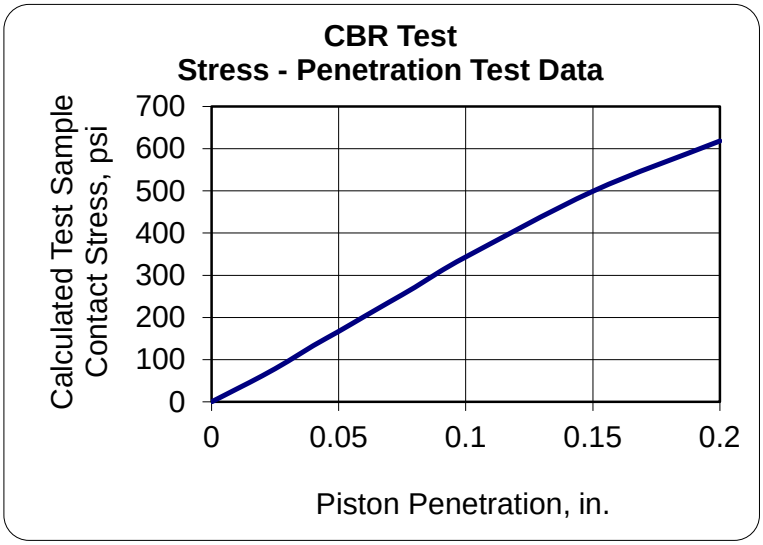
	Before Soaking	After Soaking
Dry Density, pcf	118.0	115.2
Moisture, %	8.7	11.3
% Compaction	96.2	94.0

UNCORRECTED CALCULATED SOAKED CBR VALUES:

CBR @ 0.1" Penetration	34
CBR @ 0.2" Penetration	41

Stress Versus Penetration Data

PEN.	Load, lbs.	Stress, psi
0	0	0
0.01	93	31
0.02	187	62
0.03	290	96
0.04	402	133
0.05	504	167
0.06	610	202
0.07	715	237
0.08	820	272
0.09	934	309
0.1	1037	343
0.15	1507	499
0.2	1867	618



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SOIL CALIFORNIA BEARING RATIO (CBR) TEST RESULTS
ASTM D - 1883

PROJECT NO.: AGCQC20-040

PROJECT NAME: **General Geotechnical Subsurface Soils Evaluation**
Hillcrest Estates New Waterline Project
Various Locations
El Paso, El Paso County, Texas

SAMPLE INFORMATION

PROCTOR NO.: 6 **SAMPLED BY:** PG

SOIL SAMPLE LOCATION: B-7 **SAMPLE DATE:** 10/13/2020

SOIL SAMPLE DEPTH: 0'-5'

SOIL TYPE/DESCRIPTION: On Site Subsurface Soils/ SAND, Fine to Medium Grained, Silty, Tannish Brown to Multicolored.

TEST SPECIMEN INFORMATION:

Soil Sample Height, in.	4-1/2"
Soil Sample Approx. Diameter, in.	6"
Soil Optimum Dry Density, pcf	118.2
Soil Optimum Moisture Content, %	12.3

CBR Test Data:

Stress Contact Area, in^2	3.02
Sample Surcharge Load, lbs.	12.5
Soaking Period, hr's.	96

SPECIMEN SWELL TEST INFORMATION:

Intial Swell Reading:	0.6540
Final Swell Reading:	0.6620
Sample Vertical Swell, %	0.1778

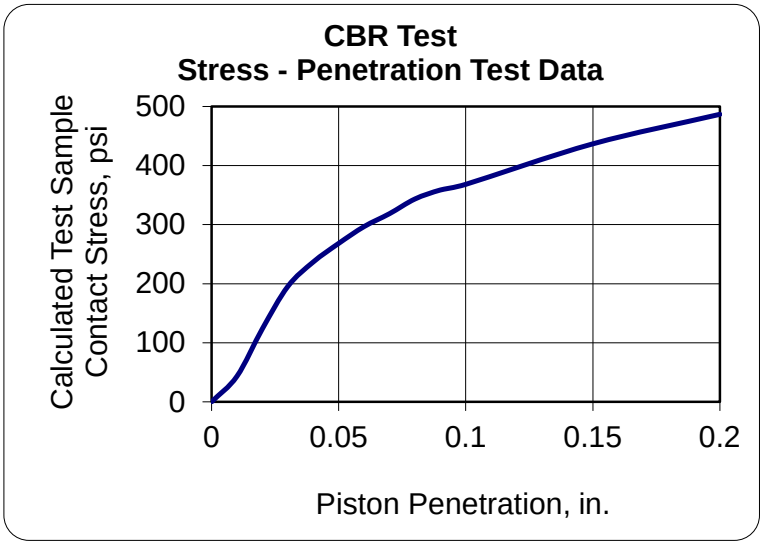
	Before Soaking	After Soaking
Dry Density, pcf	111.3	107.6
Moisture, %	12.2	15.9
% Compaction	94.2	91.0

UNCORRECTED CALCULATED SOAKED CBR VALUES:

CBR @ 0.1" Penetration	37
CBR @ 0.2" Penetration	32

Stress Versus Penetration Data

PEN.	Load, lbs.	Stress, psi
0	0	0
0.01	131	43
0.02	374	124
0.03	590	195
0.04	715	237
0.05	810	268
0.06	896	297
0.07	962	319
0.08	1037	343
0.09	1083	359
0.1	1112	368
0.15	1319	437
0.2	1470	487



SOIL RESISTIVITY TEST RESULTS

MEASURING THE RESISTIVITY OF SOIL MATERIALS

Tex-129-E / AASTHO T 288

PROJECT NO.: AGCQC20-040

PROJECT NAME: **General Geotechnical Subsurface Soils Evaluation**
Hillcrest Estates New Waterline Project
Various Locations
El Paso, El Paso County, Texas

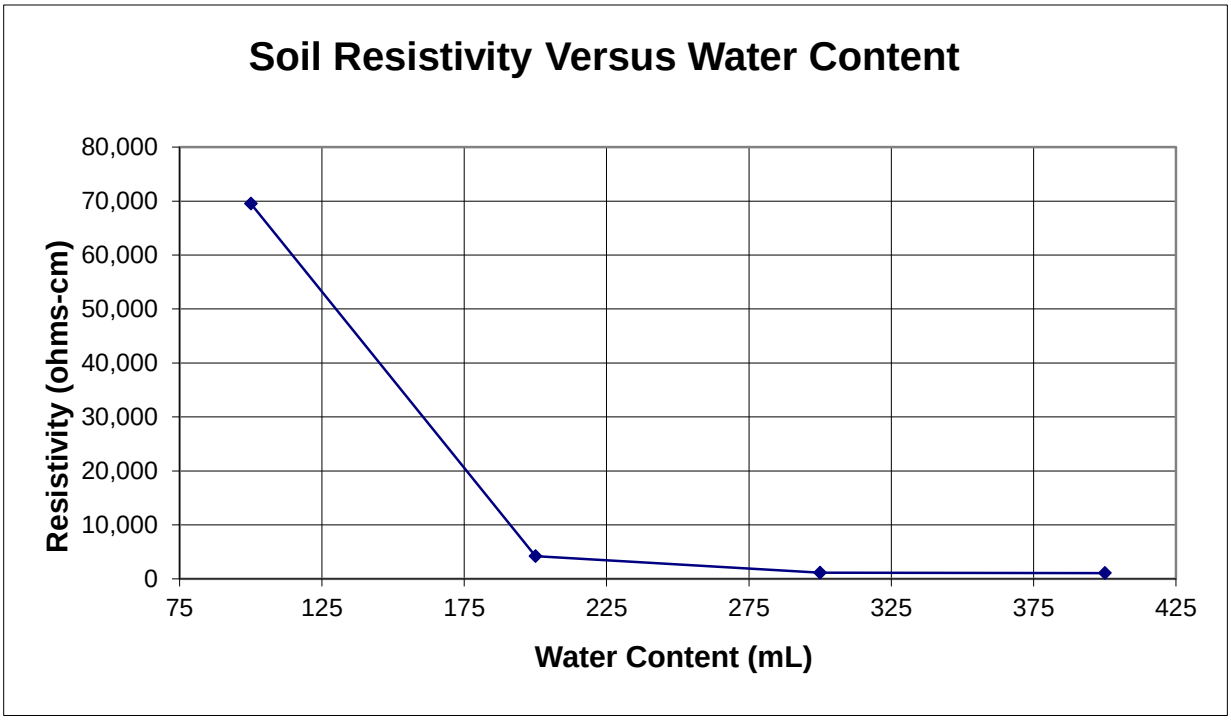
SAMPLE LOCATION: B-1

SAMPLE DEPTH: 5' - 10'

SOIL TYPE/DESCRIPTION: SAND, Fine to Medium Grained, Silty, Clayey, Tannish Brown to Multicolored with calcareous material and clay nodules.

Water Added (mL)	Dial Reading	Multiplier	Resistance (ohms)	Box Factor	Resistivity (ohms-cm)
100	6.1	10^4	61,000	1.14	69,540
200	3.7	10^3	3,700	1.14	4,218
300	1.0	10^3	1,000	1.14	1,140
400	9.3	10^2	930	1.14	1,060

The approximate resistivity readings reported above are in accordance with TxDOT Designation: Tex-129-E / AASTHO T-288 test procedure.



SOIL RESISTIVITY TEST RESULTS

MEASURING THE RESISTIVITY OF SOIL MATERIALS

Tex-129-E / AASTHO T 288

PROJECT NO.: AGCQC20-040

PROJECT NAME: **General Geotechnical Subsurface Soils Evaluation**
Hillcrest Estates New Waterline Project
Various Locations
El Paso, El Paso County, Texas

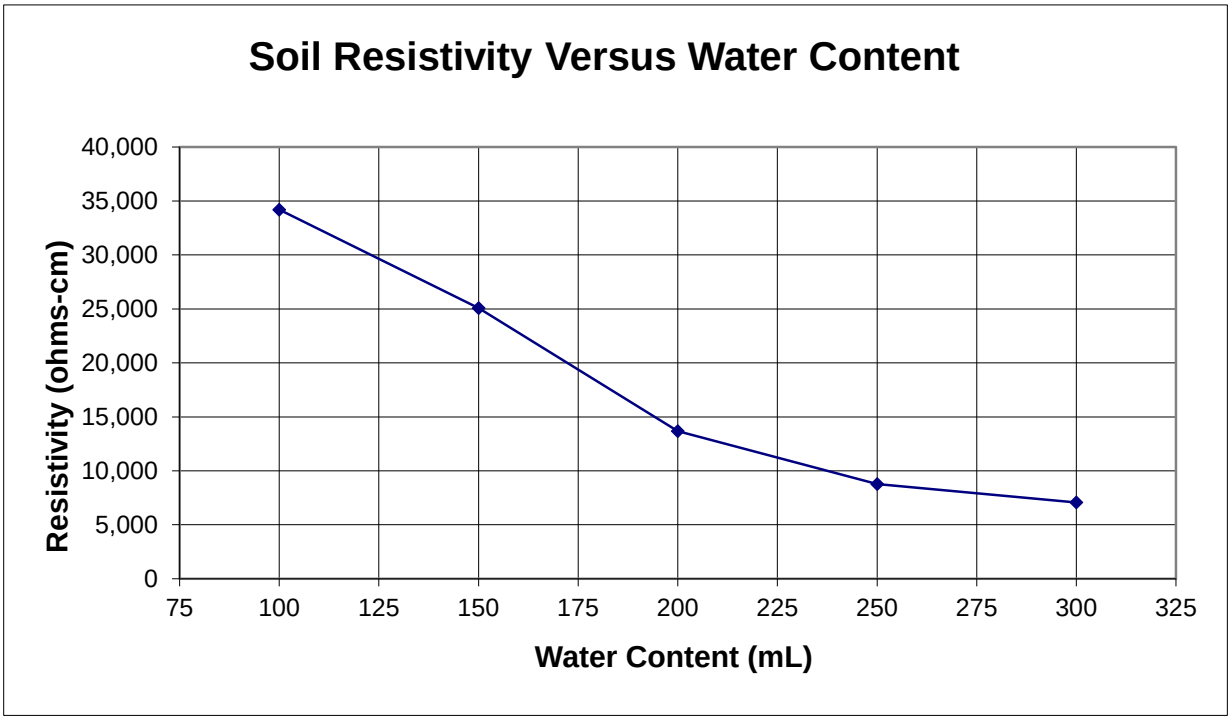
SAMPLE LOCATION: B-2

SAMPLE DEPTH: 5' - 10'

SOIL TYPE/DESCRIPTION: SAND, Fine to Medium Grained, Silty, Light Brown to Tannish Brown.

Water Added (mL)	Dial Reading	Multiplier	Resistance (ohms)	Box Factor	Resistivity (ohms-cm)
100	3.0	10^4	30,000	1.14	34,200
150	2.2	10^4	22,000	1.14	25,080
200	1.2	10^4	12,000	1.14	13,680
250	7.7	10^3	7,700	1.14	8,778
300	6.2	10^3	6,200	1.14	7,068

The approximate resistivity readings reported above are in accordance with TxDOT Designation: Tex-129-E / AASTHO T-288 test procedure.



SOIL RESISTIVITY TEST RESULTS

MEASURING THE RESISTIVITY OF SOIL MATERIALS

Tex-129-E / AASTHO T 288

PROJECT NO.: AGCQC20-040

PROJECT NAME: **General Geotechnical Subsurface Soils Evaluation**
Hillcrest Estates New Waterline Project
Various Locations
El Paso, El Paso County, Texas

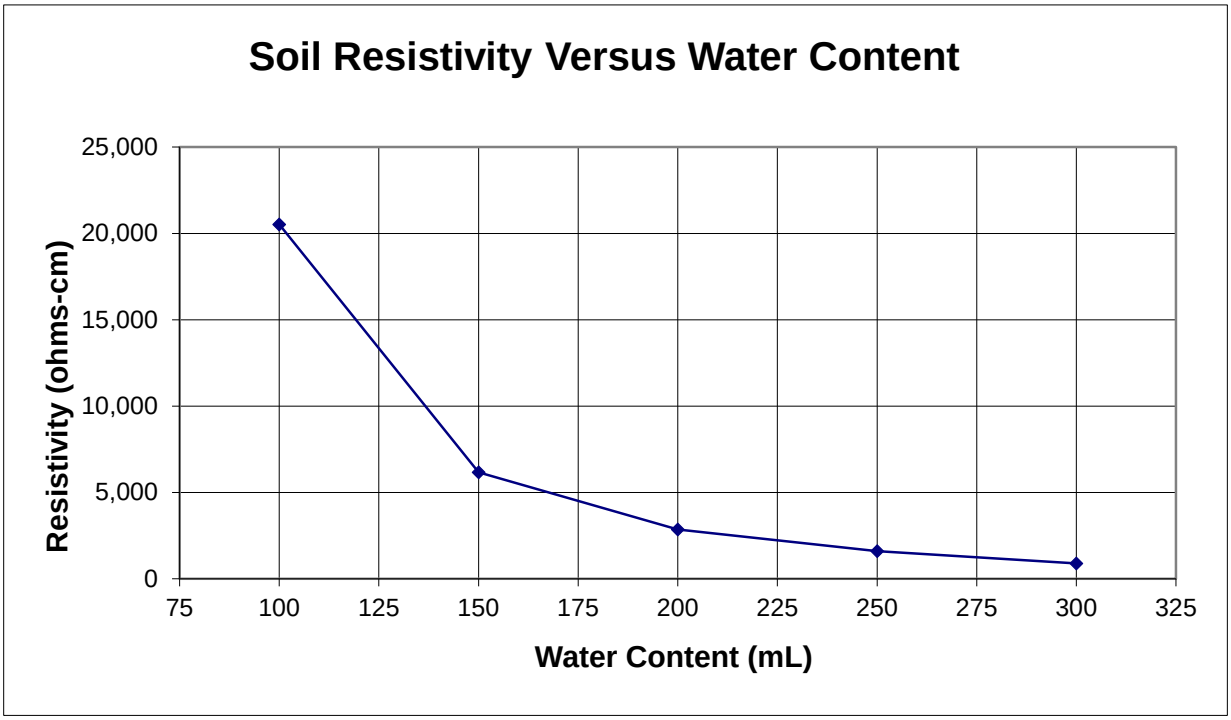
SAMPLE LOCATION: B-3

SAMPLE DEPTH: 5'-10'

SOIL TYPE/DESCRIPTION: SAND, Fine to Medium Grained, Silty, Tannish Brown to Multicolored.

Water Added (mL)	Dial Reading	Multiplier	Resistance (ohms)	Box Factor	Resistivity (ohms-cm)
100	1.8	10^4	18,000	1.14	20,520
150	5.4	10^3	5,400	1.14	6,156
200	2.5	10^3	2,500	1.14	2,850
250	1.4	10^3	1,400	1.14	1,596
300	7.8	10^2	780	1.14	889

The approximate resistivity readings reported above are in accordance with TxDOT Designation: Tex-129-E / AASTHO T-288 test procedure.



construction quality control
testing and engineering

Construction Materials Testing
Geotechnical Engineering
Environmental Site Assessments
Forensic Analysis/Testing

SOIL RESISTIVITY TEST RESULTS

MEASURING THE RESISTIVITY OF SOIL MATERIALS

Tex-129-E / AASTHO T 288

PROJECT NO.: AGCQC20-040

PROJECT NAME: **General Geotechnical Subsurface Soils Evaluation**
Hillcrest Estates New Waterline Project
Various Locations
El Paso, El Paso County, Texas

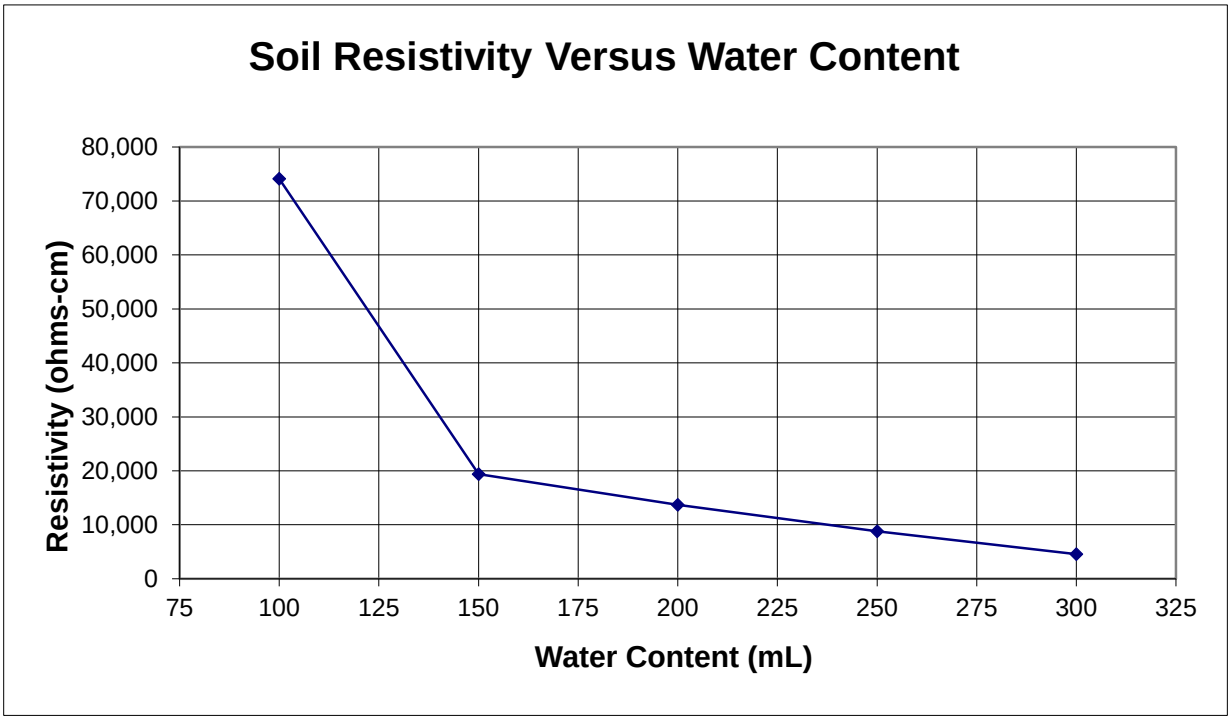
SAMPLE LOCATION: B-4

SAMPLE DEPTH: 5'-10'

SOIL TYPE/DESCRIPTION: SAND, Fine to Medium Grained, Silty, Tannish Brown to Light Brown with calcareous material and clay nodules.

Water Added (mL)	Dial Reading	Multiplier	Resistance (ohms)	Box Factor	Resistivity (ohms-cm)
100	6.5	10^4	65,000	1.14	74,100
150	1.7	10^4	17,000	1.14	19,380
200	1.2	10^4	12,000	1.14	13,680
250	7.7	10^3	7,700	1.14	8,778
300	4.0	10^3	4,000	1.14	4,560

The approximate resistivity readings reported above are in accordance with TxDOT Designation: Tex-129-E / AASTHO T-288 test procedure.



SOIL RESISTIVITY TEST RESULTS

MEASURING THE RESISTIVITY OF SOIL MATERIALS

Tex-129-E / AASTHO T 288

PROJECT NO.: AGCQC20-040

PROJECT NAME: **General Geotechnical Subsurface Soils Evaluation**
Hillcrest Estates New Waterline Project
Various Locations
El Paso, El Paso County, Texas

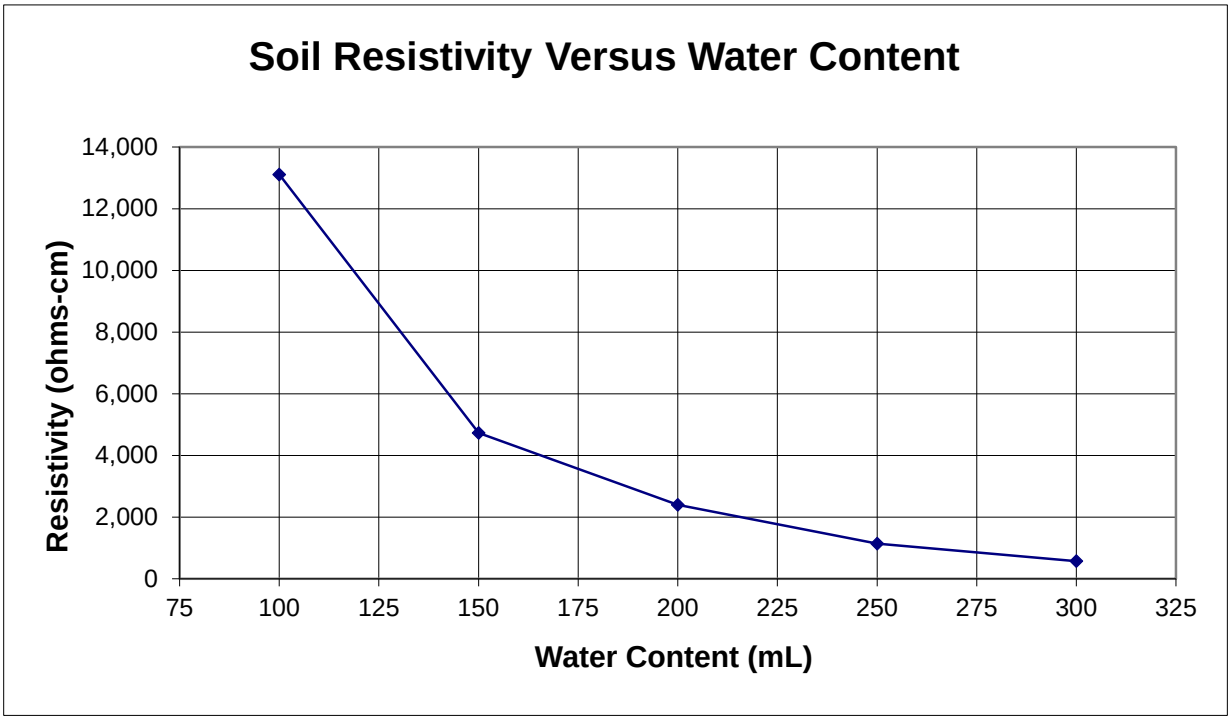
SAMPLE LOCATION: B-5

SAMPLE DEPTH: 5' - 7-1/2'

SOIL TYPE/DESCRIPTION: SAND, Fine to Medium Grained, Silty, Tannish Brown to Multicolored with traces of clay nodules.

Water Added (mL)	Dial Reading	Multiplier	Resistance (ohms)	Box Factor	Resistivity (ohms-cm)
100	2.3	10^4	23,000	0.57	13,110
150	8.3	10^3	8,300	0.57	4,731
200	4.2	10^3	4,200	0.57	2,394
250	2.0	10^3	2,000	0.57	1,140
300	1.0	10^3	1,000	0.57	570

The approximate resistivity readings reported above are in accordance with TxDOT Designation: Tex-129-E / AASTHO T-288 test procedure.



SOIL RESISTIVITY TEST RESULTS

MEASURING THE RESISTIVITY OF SOIL MATERIALS

Tex-129-E / AASTHO T 288

PROJECT NO.: AGCQC20-040

PROJECT NAME: **General Geotechnical Subsurface Soils Evaluation**
Hillcrest Estates New Waterline Project
Various Locations
El Paso, El Paso County, Texas

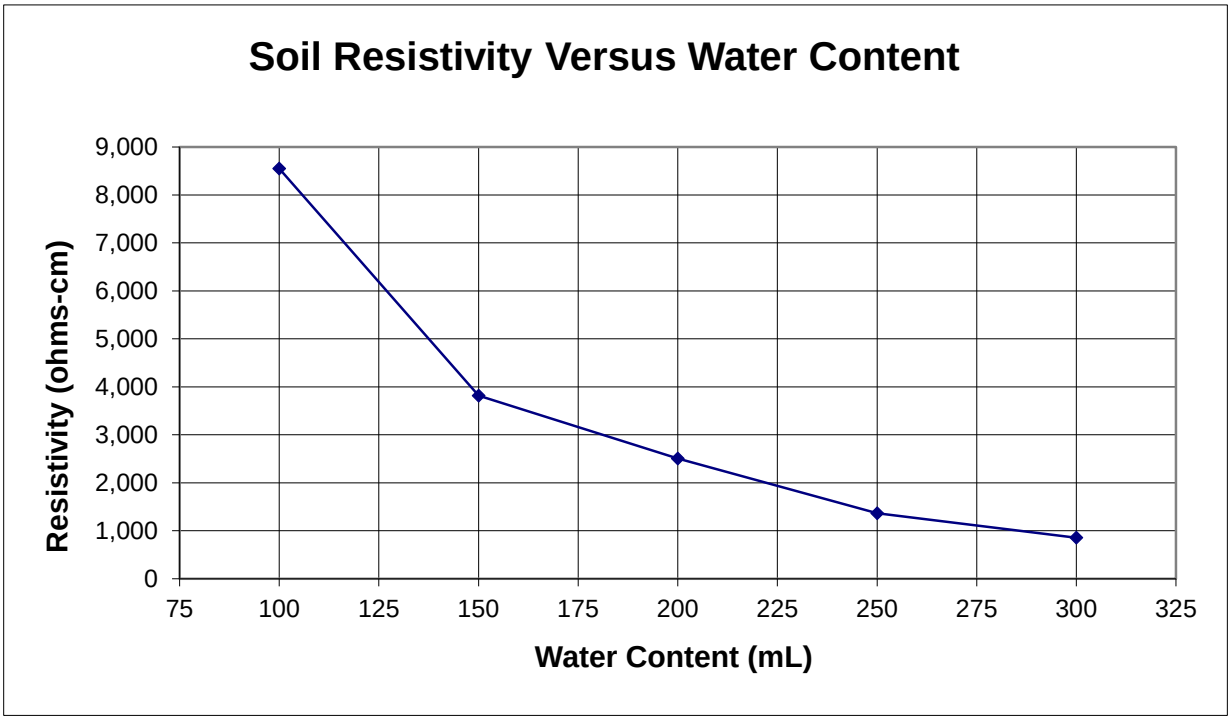
SAMPLE LOCATION: B-6

SAMPLE DEPTH: 5' - 10'

SOIL TYPE/DESCRIPTION: SAND, Fine to Medium Grained, Silty, Light Brown to Tannish Brown.

Water Added (mL)	Dial Reading	Multiplier	Resistance (ohms)	Box Factor	Resistivity (ohms-cm)
100	1.5	10^4	15,000	0.57	8,550
150	6.7	10^3	6,700	0.57	3,819
200	4.4	10^3	4,400	0.57	2,508
250	2.4	10^3	2,400	0.57	1,368
300	1.5	10^3	1,500	0.57	855

The approximate resistivity readings reported above are in accordance with TxDOT Designation: Tex-129-E / AASTHO T-288 test procedure.



SOIL RESISTIVITY TEST RESULTS

MEASURING THE RESISTIVITY OF SOIL MATERIALS

Tex-129-E / AASTHO T 288

PROJECT NO.: AGCQC20-040

PROJECT NAME: **General Geotechnical Subsurface Soils Evaluation**
Hillcrest Estates New Waterline Project
Various Locations
El Paso, El Paso County, Texas

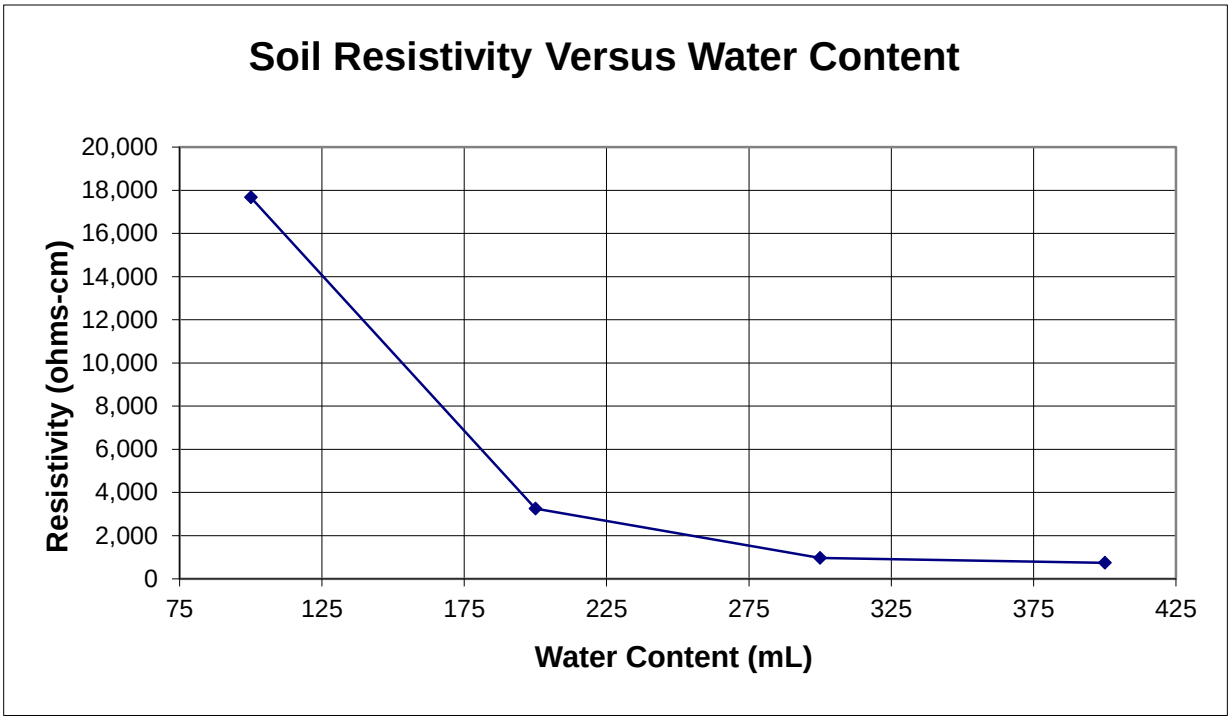
SAMPLE LOCATION: B-7

SAMPLE DEPTH: 5' - 7-1/2'

SOIL TYPE/DESCRIPTION: SAND, Fine to Coarse Grained, Silty, Light Brown to Tannish Brown.

Water Added (mL)	Dial Reading	Multiplier	Resistance (ohms)	Box Factor	Resistivity (ohms-cm)
100	3.1	10^4	31,000	0.57	17,670
200	5.7	10^3	5,700	0.57	3,249
300	1.7	10^3	1,700	0.57	969
400	1.3	10^3	1,300	0.57	741

The approximate resistivity readings reported above are in accordance with TxDOT Designation: Tex-129-E / AASTHO T-288 test procedure.



APPENDIX B

GEOTECHNICAL REPORT
TECHNICAL REFERENCE INFORMATION

DEFINITION OF DESCRIPTIVE TERMS

DENSITY OF GRANULAR SOILS

SPT N Value	Relative Density
< 4	Very Loose
4 – 10	Loose
11 – 30	Med. Dense
31 – 50	Dense
50 – 80	Very Dense
> 80	Hard

CONSISTENCY OF COHESIVE SOILS

SPT N Value	Consistency
< 2	Very Soft
2 – 4	Soft
5 – 8	Medium Stiff
9 – 15	Stiff
16 – 50	Very Stiff
> 80	Very Hard

DEGREE OF PLASTICITY

Nonplastic –	Has no cohesion; will not roll into a thread.
Trace of Plasticity –	Barely hold its shape when rolled into a thread.
Low Plasticity –	Has sufficient cohesion to form a thread but will quickly rupture when deformed.
Med. Plasticity –	Has considerable cohesion. Can be molded into a thread and will withstand considerable deformation without rupture.
High Plasticity –	Can be kneaded like dough without trace of rupture.

MOISTURE DESCRIPTIONS

	GRANULAR SOILS	COHESIVE SOILS
Dry	No Apparent Moisture	No Apparent Moisture
Slightly Moist	< Than 3% by Weight	< Less Than Plastic Limit
Moist	3% to 9% by Weight	Approximately Plastic Limit
Very Moist	> 9% by Weight	> than PL but < than LL
Wet	Submerged or Saturated	Submerged or Saturated

PLASTICITY

Cohesion TSF	Plasticity Index	Degree of Plasticity
0-0.125	0-5	None
0.125-0.25	5-10	Low
0.25-0.5	10-20	Moderate
0.5-1.0	20-40	Plastic
1.0-2.0	> 40	Highly Plastic
> 2.0		

ABBREVIATIONS

V. – Very	Fl. – Fairly	Sl. – Slightly	Med. – Medium
Tr. – Trace	< - Less Than	> - Greater Than	PL – Plastic Limit
Mod. – Moderately			

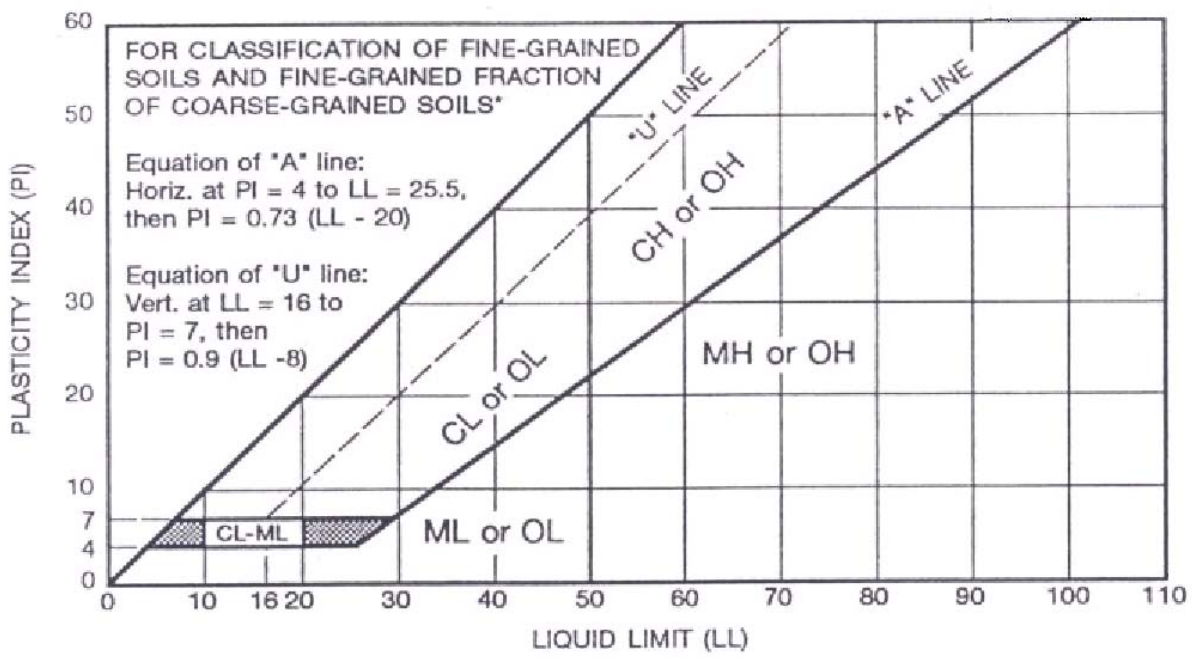
SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

GEOTECHNICAL REPORT
SOIL CLASSIFICATION REFERENCE INFORMATION

Cohesive Soil Classification Chart



U.S. STANDARD SIEVE

	12"	3"	¾"	4	10	40	200		
BOULDERS	COBBLES	GRAVEL			SAND			SILT	CLAY
		COARSE	FINE		COARSE	MEDIUM	FINE		
152	76.2	19.1	4.76	2.00	0.420	0.074	0.002		

SOIL GRAIN SIZE IN MILLIMETERS

Laboratory Test Methods:

Moisture Content Tests:

Moisture Contents are determined from representative portions of a soil sample. The samples initial weight is recorded and it is then dried to a constant weight. From this data the moisture content is calculated.

Atterberg Limit Tests:

Liquid Limit (LL), Plastic Limit (PL) and Shrinkage Limit (SL) tests are performed to aid in the classification of soils and to determine the plasticity and volume change characteristics of the materials. The Liquid Limit is the minimum moisture content at which a soil will flow as a heavy viscous fluid. The Plastic Limit is the minimum moisture content at which the soil behaves as a plastic material. The Shrinkage Limit is the moisture content below which no further volume change will take place with continued drying. The Plasticity Index (PI) is the numeric difference between the Liquid Limit and the Plastic Limit and indicates the range of moisture content over which a soil remains plastic.

Grain Size Distribution Test (Particle Size Analysis, Sieve Analysis):

The distribution of soils finer than the No. 200 sieve is determined by passing a representative soil sample through a standard set of nested sieves. The weight of material retained on each sieve is determined and the percentage passing (or retained) is calculated. For determination of the percentage of material finer than the No. 200 sieve, the specimen is first washed through the sieve. The distribution of the materials finer than the No. 200 is determined by use of the different size particles while suspended in water.

APPENDIX C

CLIENT: Moreno Cardenas Inc.

PROJECT NAME: **Hillcrest Estates New Waterline Project**
Zaragoza Road and Laura Lane
El Paso, El Paso County, Texas

PHOTO NO. 1: General southeast view of site and existing conditions at Laura Lane.

PHOTO NO. 2: General north view of site and existing conditions at Laura Lane.

PHOTO NO. 3: General south view of site and existing conditions at Gerard Drive.

PHOTO NO. 4: General east view of site and existing conditions at Flora Drive.

CLIENT: Moreno Cardenas Inc.

PROJECT NAME: **Hillcrest Estates New Waterline Project**
Zaragoza Road and Laura Lane
El Paso, El Paso County, Texas

PHOTO NO. 5: General south view of site and existing conditions at Gerard Drive.

PHOTO NO. 6: General east view of site and existing conditions at Bernard Lane.

PHOTO NO. 7: General south view of site and existing conditions at Augusta Drive.

PHOTO NO. 8: General view of our subsurface soil drilling operations at vertical boring B-1.

CLIENT: **Moreno Cardenas Inc.**

PROJECT NAME: **Hillcrest Estates New Waterline Project**
Zaragoza Road and Laura Lane
El Paso, El Paso County, Texas

PHOTO NO. 9: General view of our subsurface soil drilling operations at vertical boring B-2.

PHOTO NO. 10: General view of our subsurface soil drilling operations at vertical boring B-4.

PHOTO NO. 11: General view of our subsurface soil drilling operations at vertical boring B-5.

PHOTO NO. 12: General view of our subsurface soil drilling operations at vertical boring B-6.

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