GENERAL GEOTECHNICAL SUBSURFACE SOILS EVALUATION REPORT

FOR

PROPOSED BAILEY DETENTION POND & TORNILLO DETENTION POND PROJECT

VINTON AVENUE AND WENCHO DRIVE
EL PASO COUNTY, TEXAS
CQC PROJECT NO. AGCQC19-049

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EL PASO, TEXAS 79902

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January 22, 2020

Moreno Cardenas Inc.
2505 East Missouri Avenue
El Paso, Texas 79902

Attn: Mr. Mark Medina, P.E., CFM
Vice President

Re: **General Subsurface Soils Evaluation and Percolation Testing**
Proposed Bailey Detention Pond & Tornillo Detention Pond Project
Vinton Avenue and Seventh Street, Canutillo, Texas
George Strait Drive and Wencho Drive, Tornillo, Texas
El Paso County, Texas
CQC Project No. AGCQC19-049

Dear Mr. Medina:

In accordance with our approved scope of work, CQC Testing and Engineering, L.L.C. (CQC) is pleased to provide **Moreno Cardenas Inc.** (Client) with this report for the above referenced project. This report presents the results of our subsurface exploration borings, boring logs, laboratory engineering soil classification test results, soil percolation test results and geotechnical recommendations to guide the design of storm water detention ponds to be designed by our Client.

Attached to this report is Appendix A, which contains a General Geotechnical Subsurface Exploration Boring Location Aerial Plans (Sheets A1-1 and A1-2), City of El Paso Flood Zone Aerial Plans (Sheets A1-3 and A1-4), Subsurface Exploration Vertical Boring Logs (Sheet A2 through A5), Soil Sample Particle Size Analysis Test Reports (Sheets A6 through A11), Summary of Laboratory Engineering Soil Classification Test Results (Sheet A12), Soil Moisture-Density Relationship Test Results (Sheet A13 and A14), Soil Percolation Test Results (Sheets A15 and A16), Soil Direct Shear Test Results (Sheet A17 through A20). Appendix C presents general site condition photographs.

I. General Project Description

Based on general information, aerial photos and FEMA Flood Zone plans provided by our Client, the proposed projects consist of the improvement of the detention ponds described below.

1.) Bailey Detention Pond Project

The proposed Bailey Detention Pond is located at Vinton Avenue and Seventh Street in Canutillo, El Paso County, Texas. The improvements consist of the design and construction of a single (1) main detention pond with three (3) minor ponds to be used for additional overflow capacity. The site is currently an undeveloped vacant tract of land at the proposed main pond and an arroyo within the area of the proposed minor ponds. The main and minor detention ponds will have a total area of approximately 180,000 square feet with a maintenance road and ramp, and pond depths ranging from approximately 8 to 15 feet.

2.) Tornillo Detention Pond Project

The proposed Tornillo Detention Pond is located at George Strait Drive and Wencho Drive in Tornillo, El Paso County, Texas. The improvements consist of a main detention pond located on the east quadrant of the intersection of George Strait Drive and Wencho Drive. The detention pond will have an area of approximately 130,000 square feet with a maintenance road, maintenance ramp, and an average depth of approximately 15 feet. The site is currently an undeveloped vacant tract of land bounded by private residential properties.

As requested, our scope of services consisted of generally evaluating the subsurface soil conditions within the general pond sites, collect subsurface soils information, conduct Standard Penetration Tests (SPT's) to evaluate the soil bearing resistance of the subsurface soils and develop recommendations to guide the design of the proposed stormwater detention ponds.

II. Site Geologic Considerations

The Geologic Atlas of Texas (Van Horn-El Paso Sheet, Revised 1995) published by the Bureau of Economic Geology at the University of Texas at Austin indicates that the Bailey and Tornillo pond site are located in areas of Young Quaternary Alluvium Formation deposits. These formations typically consist of areas of alluvium along the Rio Grande and this is particularly true for the Bailey Pond Site. Soil deposits such as sands, silts, clays and gravels are encountered within these geologic formations. These deposits are usually variable over relatively short distances.

Based on the City of El Paso floodplain maps, the project areas are partially within Floodplains. The Flood Zone Maps can be found in Sheets A1-3 and A1-4 for ease of reference. It is not known if the areas within the project limits were raised outside of the floodplain areas. Please note that the indicated floodplain paths on the exhibits may not represent the exact floodplain path locations within each site and shall vary. It is recommended this be further evaluated with a topographic survey and drainage analysis. Site surface grading should be designed in a manner that will provide positive surface drainage for each pond site. This is particularly true in areas where surface water shall traverse pond slopes and around new flume structures.

III. Existing Site Conditions, Topography and Vegetation

The following table summarizes our general comments with respect to the visual topography within the project site areas.

Table 1. General Site Description & Visual Topography and Vegetation Comments

Location	General Comments
Bailey Detention Pond Area	This general project area extends from Second Street to Seventh Street (refer to Sheet A1-1). Based on our general site observations, this area has a difference in elevation due to the presence of an earthen drainage channel. This project area is generally covered with gravels on the surface, short weeds and perennial grasses. The detention pond improvements are located adjacently to the north of Vinton Avenue. The area is bounded by residential buildings and vacant private properties.

Tornillo Detention Pond Area	This general project area is located in the northeast quadrant of the intersection of George Strait Drive and Wencho Drive (refer to Sheet A1-2). Based on our general site observations, the area exhibits changes in elevation and several arroyos also traverse the site. The area is covered with creosote bushes, short weeds and perennial grasses. The area is bounded by residential buildings.

IV. Seismic Considerations

Based on our review of the current International Building Code and Site Classification for Seismic Design Definitions in conjunction with our review of the geologic conditions in the project area and the SPT data collected from borings drilled to a maximum depth of 40 feet, it is our professional opinion that a Site Class C for the Bailey Pond Site and D for the Tornillo Pond Site may be considered in design for these proposed detention pond sites.

Based on Soil Site Classes C and D, seismic ground motion values are defined in the table below. The seismic coefficients were generated through the SEAOC/OSHPD website. The values should be verified by the project structural engineer prior to use in structural analysis. CQC should be informed if the reported values vary significantly.

Table 2 – Seismic Ground Motion Values

Location (Site Class)	Latitude	Longitude	Period (Seconds)	Spectral Accelerations (g)	Site Coefficient, F_a	Site Coefficient, F_v
Bailey Detention Pond (C)	31.71275	-106.36699	0.2 (S_s)	0.352	1.522	-
			1.0 (S_1)	0.167	-	2.38
Tornillo Detention Pond (D)	31.81179	-106.46588	0.2 (S_s)	0.285	1.20	-
			1.0 (S_1)	0.124	-	1.69

V. General Field Evaluation Methods and Testing

As requested, our subsurface exploration evaluation consisted of completing a total of four (4) vertical exploration borings with a rotary drilling rig and hollow stem auger drilling techniques within the proposed detention pond sites. Two (2) borings were drilled to approximate depths ranging from 20 to 30 within the Bailey Pond and two (2) borings were drilled to a maximum depth of 40 feet within the Tornillo Pond, each below the existing surface elevation at the time of our drilling activities as indicated in the attached General Geotechnical Subsurface Exploration Boring & Percolation Test Location Aerial Plans in Sheets A1-1 and A1-2. The borings were logged during our drilling operations by a member of our geotechnical engineering staff. Our boring logs are presented in Sheets A2 through A5.

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. Our soil classification tests (i.e., moisture contents, particle size analysis and Atterberg Limit Tests) were performed in accordance with accepted ASTM test procedures D

2216, D 1140, D 2217, D 6913, and D 4318, respectively. In general, the results of our tests and estimated "N-Values" are presented in our boring logs and Summary of Laboratory Engineering Soil Classification Test Results in Sheet A12. At the completion of our drilling activities, the borings were backfilled with auger cuttings and firmly compacted at the ground surface.

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

Table 3 – Summary of Subsurface Soil Boring Site Evaluation

Summary of Field Investigation					
Borehole No.	**Structure Location**	**Approximate Termination Depth (ft.)**	**No. Split-Spoon Samples**	**No. Grab Samples**	**Observed Groundwater or Water Seepage Depth (ft.)**
BB-1	Bailey Detention Pond	30	9	-	NE
BB-2	Bailey Detention Pond	20	7	-	NE
TB-1	Tornillo Detention Pond	40	11	-	NE
TB-2	Tornillo Detention Pond	40	11	-	NE

NE- Not encountered at the time of completion of our field exploration activities.

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.

VI. Soil Classification Laboratory 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 4 – Summary of Performed Soil Engineering Classification Tests

Type of Test	Total Number Conducted
Moisture Content Tests	27
Atterberg Limit Tests	18
Soil Particle Size Analysis Tests	25
Soil Moisture-Density Relationship Tests	2
Soil Direct Shear Tests	2

Selected soil particle size analysis test results are reported in our boring logs and Sheets A6 through A11. A summary of our laboratory engineering soil classification test results is reported in Sheet A12 for ease of reference.

VII. Soil Moisture-Density Relationship Test Results

At the time of our drilling activities, two (2) bulk subgrade soil samples were obtained from boring locations TB-2 and BB-2 for soil moisture-density relationship testing. The samples were collected from an approximate depth of 5 to 10 feet below the existing ground surface elevations during our drilling activities. The results of our soil moisture-density relationship tests (i.e., proctors) conducted on the collected soil samples are presented in Sheets A13 and A14. The optimum dry density and moisture content values are presented in the table below.

Table 5 – Summary of Soil Moisture-Density Relationship Test Results

Borehole No.	Sample Depth (ft)	ASTM D-1557 Test Method	Soil Classification	Opt. Dry Density (pcf)	Opt. Moisture (%)
BB-2	5 – 8	C	Fine to Medium Grained, Gravelly, Poorly Graded Sand (SP)	136.6	6.1
TB-2	10	A	Fine to Medium Grained, Silty Sand (SM)	126.8	8.7

VIII. Soil Direct Shear Test Results

Two (2) Direct Shear Tests were performed in accordance with ASTM D 3080 – "Direct Shear Test of Soils under Consolidated Drained Conditions". The direct shear tests were performed on soil samples collected from borings BB-2 at a depth of approximately 15 feet and TB-2 at approximately 15 feet. The tested soil samples were remolded to estimated dry densities of 126 to 135 pounds per cubic foot (pcf). The soil samples were tested with normal stresses ranging from 1 to 10 psi. The results of our tests are presented in Sheets A17 through A20. In general, the tested soil samples exhibited peak angles of internal friction ranging from 45º to 49.9º and cohesion values ranging from 1.6 to 2.4 psi for the remolded samples.

IX. Subsurface Soil Conditions

Based on our soil classifications and laboratory tests, the subsurface soils encountered in our exploration borings at the proposed detention ponds may be described by four (4) generalized soil types. The logged depth of the soil formation types is approximately delineated in our boring logs. Due to the geologic location of the site, it is possible for variations in the types and depths of the soil formations to occur over relatively short distances.

Table 6 – Summary of Subsurface Soil Classification & Strength

Type	General Description	Consistency (TCP Blow Counts)	Moisture Content (%)	Atterberg Limits		%Passing No. 200	USCS Classification
				Plastic Limit	Plasticity Index		
I	Fine to Medium Grained Sand with varying amounts of silt and calcareous material	Medium Dense to Very Dense (10 to 50)	1.0 to 8.0	Relatively Non-Plastic		4 to 44	SM, SP and SP-SM

	***Remarks*:** These soils were encountered interbedded in borings BB-2, TB-1 and TB-2 at depth ranging from surface to 40 feet. This soil type shall be susceptible to soil sloughing during excavations. These soils are considered Class III Pipe Backfill soil materials. These soils do not meet the Pond Slope Select Backfill (PSSB) specifications						
II	Fine to Medium Grained Silty, Clayey Sand	Loose to Medium Dense (5 to 18)	6.0 to 7.0	22	6	46	SC-SM
	Remarks: These soils are encountered in boring TB-2 at depths ranging from 7 to 20 feet. This soil type shall be susceptible to soil sloughing during excavations. These soils are considered Class III Pipe Backfill soil materials. These soils may be considered suitable Select Fill and Pond Slope Select Backfill materials.						
III	Low Plasticity Clay with sit and Non-plastic silts	Very Stiff (16 to 27)	4.0 to 7.0	23	6	63 to 66	CL-ML, ML
	Pocket Penetrometer Reading (tsf): *Test not achievable. This soil type is considered Friable.*						
	Remarks: These soils were encountered in borings BB-1 and TB-1 at depths ranging from 7 to 15 feet. These soils are not considered suitable for use as Select Fill and Backfill soil materials. These clayey soils are considered Class IV soil materials. The clayey soils shall also exhibit relatively lower percolation rates if encountered at the bottom of the ponds. These soils may be blended with Type II soil materials to meet recommended Pond Slope Select Backfill material requirements.						
IV	Well Graded, Poorly Graded or Silty, Fine, Subangular Gravel with sand and silt	Medium Dense to Very Dense (13 to 62)	1.0 to 4.0	Non-Plastic		1 to 14	GM, GW, GP, GP-GM
	Remarks: These soils were encountered in borings BB-1 and BB-2 at depth ranging from approx. ground surface to 30 feet. This soil type shall be susceptible to erosion and sloughing when excavated and exposed to environmental impacts (i.e., wind, precipitation, surface water drainage, and vibratory movement). These gravels may be considered Class II or III soil materials, depending on soils classification test results when excavated and stockpiled. The encountered and tested Type IV gravels are not considered Pond Slope Select Backfill unless they are blended with cohesive clayey sand soil materials to increase their plasticity.						

Based on our laboratory results, we anticipate that the on-site soils may be suitable to form pond slopes, however shall be susceptible to erosion. All imported fill soil materials must be Pond Select Backfill and meet with the requirements of Section XVI.

X. Groundwater Depth Considerations

At the time of our drilling operations groundwater and/or water seepage was not observed or encountered in our vertical borings within the proposed detention pond sites. Based on our geotechnical field experience in these areas, the static groundwater elevation is below the anticipated maximum excavation depth of 15 feet specified for the ponds.

XI. Rockwall Foundation Considerations

We understand that the construction of rock wall structures along the eastern perimeter of the proposed Bailey and Tornillo detention ponds may be required. We recommend that rock wall foundations be designed with an allowable bearing capacity of 1,500 psf. The minimum continuous footing embedment depth shall be 18 inches and minimum footing width shall be 18 inches. The continuous footing should be supported by a minimum of 18 inches of compacted approved Select Fill soils. The recommended amounts of Select Fill below foundation elements should extend at least 6 inches beyond the edges of the footings.

Select Fill soils should be moisture conditioned and compacted to a minimum of 95 percent of maximum dry density in accordance with ASTM D1557 and maintained within ±3 percent of optimum moisture content until finally covered. Wall footing sliding analysis may utilize a soil friction resistance value of 0.35 at the bottom of the footing. Please note that the final design of the footing and bearing depth shall be performed by the project civil engineer.

Weak or compressible soil zones identified during compaction of the rockwall foundation supporting soils should be removed and replaced with properly compacted suitable Select Fill to a minimum depth of 8 inches or to a depth required to appropriately bridge over these soils, whichever is deeper.

XII. Below Grade Lateral Earth Pressures

The proposed below grade structures and utility related to the proposed detention pond sites 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. All rockwalls shall be backfilled with approved Select Fill soils as recommended in Section XVI of this report.

Table 7 – Earth Pressure Coefficients

Soil Type	Estimated Total Unit Weight (pcf)	Presumptive Soil Angle of Internal Friction (deg)	Lateral Earth Pressure Coefficients	Lateral Earth Pressure Coefficients	Equivalent Fluid Weight (pcf)	Equivalent Fluid Weight (pcf)
			At-Rest (K_o)	Active (K_a)	At-Rest (K_o)	Active (K_a)
Structural Fill (Base Course)	145	42	0.33	0.20	49	30
Select Fill Soils (PI<15)	125	32	0.47	0.31	59	39
Silty, Well Graded or Poorly Graded Gravels	135	40	0.35	0.21	47	28
Silty Sands	120	30	0.50	0.33	60	40
Poorly Graded Sands	125	29	0.51	0.34	64	42

The lateral pressure with depth may be estimated with the following equation;

$$P_s = K_o \gamma_s (H-H_w) + K_o(\gamma_s - \gamma_w)H_w + \gamma_w H_w + q\,K_o$$

Where;
P = lateral earth pressure at calculated depth, psf
K_o = At-rest lateral earth pressure coefficient (typically used for long-term cases)
γ_s = Total wet unit weight of soil, pcf
H = Depth of structure from ground surface to calculated depth, ft
H_w = Positive vertical downward depth of water from reported highest depth.

Note when calculation depth is above reported water depth, then H_w term in equation is considered zero

γ_w = Unit weight of water, pcf

q = surcharge pressure, psf (typical only considered to 20 feet)
light loads (i.e., pedestrians and soil stockpiles) – 50 psf,
moderate (i.e., light equipment) – 150 psf,
heavy (i.e., heavy duty equipment) – 250 psf or more

XIII. General Sitework Structures

Where ground-supported site work such as walkways, curbs and flume structures, differential movements should be anticipated. We recommend that a minimum of 12 inches of compacted Select Fill be placed below specified sitework structures for the proposed detention pond sites. The suitable Select Fill should be compacted to a minimum of 95 percent of maximum dry density determined in accordance with ASTM D 1557. The moisture content of these soils should be maintained at ±3 percent of optimum moisture content until covered.

The existing subgrade soils within the project limits that shall support compacted suitable Select Fill below site work structures should be cleared of all vegetation, organic matter, topsoil, construction debris and/or any foreign matter. The cleared subgrade soils should be scarified to a minimum depth of 8 inches and re-compacted to 95 percent of maximum dry density determined in accordance with ASTM D 1557 and maintained within ±3 percent of optimum moisture content until permanently covered. Cohesive clayey subgrade soils (i.e., soils with a PI greater than 18) should be compacted to a least 90 percent of maximum dry density per ASTM D 1557 with a water content within 0 to +3 percentage points of optimum. Weak or compressible soil zones identified during compaction operations should be removed and replaced with properly compacted suitable Select Fill to a minimum depth of 8 inches or as required to appropriately bridge over these soils, whichever is deeper.

XIV. Soil Infiltration Considerations

As requested, three (3) soil percolation tests were performed within the proposed detention ponds sites. Two (2) soils percolation tests were performed within Bailey Detention Ponds area to approximate depths of 10 feet and 20 feet below the existing ground elevation at locations BP-1 and BP-2 indicated in Sheet A1-1. A single (1) soil percolation test was performed within the Tornillo Detention Pond at an approximate depth of 20 feet below the existing ground elevation at location TP-1 indicated in Sheet A1-2. Our soil percolation test information is presented in Sheets A15 and A16. Based on our test results, a soil percolation value of about 10 minutes per inch was estimated from our test results. In general, our test results indicate that the subsurface soils shall exhibit a moderate infiltration rate into the subsurface soils at the test locations. It should be noted that normal and steady water infiltration through the subsurface soils shall be highly dependent on the degree of sediment built-up at the bottom of the ponds, which shall ultimately decrease the infiltration rate. Periodic maintenance and cleaning shall be required in order to ensure that proper and steady infiltration continues to occur. The delineation of the lateral extent or lateral water seepage of storm water infiltration and impacts to adjacent structures was beyond our scope of work, but should be considered by our Client and the owner.

Due to the possible variability of the subsurface soils throughout the proposed detention pond sites, we highly recommend to consider a minimum soil percolation value of 60 minutes per inch in the civil design of the new detention ponds. Please note that a percolation test may not serve as an accurate test to model the infiltration rate of collected water, especially due to the build-up of sediments and suspended particles of soil when the detention ponds are in service.

XV. Soil Slope Considerations

The encountered subsurface soils within the proposed Bailey Detention Pond consist of gravels and silty or poorly graded sands. It is our understanding that the pond shall be specified with 4:1 (horizontal:vertical) slopes. A general slope stability analysis was performed based on the encountered soil conditions within the proposed pond areas and our laboratory soil classification test results. A factor of safety of 2.5 was estimated considering a circular slip failure plane model.

The encountered subsurface soils within the proposed Tornillo Detention Pond generally consist of clays and silty or poorly graded sands. Similarly, it is our understanding that the proposed pond shall be specified with 3:1 slopes. A factor of safety of 2.6 was estimated considering a similar circular slip failure plane model based on the soil conditions encountered at this pond site.

In order to mitigate erosion of encountered sands within the proposed detention pond sites, it is recommended that slopes be protected from localized erosion. The following items may be considered to mitigate localized slope erosion as contemplated by our Client.

- The owner should consider placing loose rock rip-rap along the slopes to reduce erosion within select areas. Surface water flows are anticipated to run down slope sections. It is recommended that the stone be angular, durable (exhibit an LA Abrasion not greater than 40 and chemically sound), non-weathered, and uniform in size (i.e., 8 to 12 inches). The slope angle should also be considered in the final design to ensure that the loose rock rip-rap shall be stable. A commercially available geo-textile fabric should be placed between the finished slope surface and placed rock rip-rap.

- Alternatively the pond slopes may also be covered with a minimum of 8 inches of “Pond Slope Select Backfill (PSSB)” soils that meet the requirements of Section XVI of this report. The PSSB soils should be compacted to a minimum of 90 percent of maximum dry density per ASTM D 1557. The moisture content of the fill soils should be maintained within +/-2 percent of optimum moisture content until covered. Compaction of side slopes should be parallel to the long direction of the side slopes. The PSSB soils should not extend more than 36 inches into bottom of the planned pond or a length that may compromise the infiltration rate of collected storm water into the subsurface soils. The PSSB fill material shall also be keyed into the existing soils at the bottom of the slope. In addition, the bottom of pond should not be compacted to mitigate poor subsurface soil drainage.

- In general, it is recommended that prior to placement of a geotextile or rock rip-rap, the exposed cut slopes should be cleared of all debris and vegetation. The slopes should be compacted to a minimum of 90 percent of maximum dry density per ASTM D 1557. The moisture content of the slope soils should be maintained within +/-2 percent of optimum moisture content until permanently covered. Compaction of side slopes should be parallel to the long direction of the side slopes. Earthwork grading of the slopes should consider the installation of erosion control measures (i.e., geofabrics or rock rip rap) in order to maintain the specified design grades.

- Where applicable, the civil engineer should consider the items indicated above in the design of the detention ponds and safety precautions to protect the general public. It is recommended that the project civil engineer perform their own analysis to evaluate the stability of the slopes to be designed. In the event that additional soil related design parameters or physical properties are required, CQC should be contacted.

- In addition if applicable, it is recommended that at least 6 to 8 inches of relatively low permeability clayey sands or clayey gravels or base course material be placed above the perimeter maintenance roads, as a means to reduce surface water flow paths through the slopes, which in turn may further instigate erosion.

- In general, contractors interested in bidding the subject project shall be responsible for conducting their own tests to verify the actual depths of the soil formations within the project limits to perform earthwork operations and estimates. The owner shall not incur additional costs for variations in the soil formations within the project limits and/or additional excavation requirements by the contractor. The results of our tests are intended for engineering evaluation purposes and not for the contractor's evaluation use and/or interpretation for earthwork requirements.

XVI. Fill Materials

A. Select Fill should consist of granular clayey, silty sands or sandy clayey, silty gravel mixtures, free of clay lumps, deleterious materials, organic material, vegetation, roots, cobbles 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 exhibit an optimum dry density of at least 120 pcf determined in accordance with ASTM D-1557. Select Fill soils should meet the gradation requirements below.

Table 8 - 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).

In general, approved Select Fill shall not be placed in loose lifts greater than 8 inches. Select Fill shall be compacted to at least 95 percent of maximum dry density determined per ASTM D-1557. The moisture content of Select Fill shall be maintained within +/- 3 percent of optimum moisture content until finally covered

In general, excavations shall be backfilled with suitable Select Fill to the specified finished grade elevations.

B. Native Fill Soils (Existing On-Site Soils) should consist of granular clayey, silty sands or sandy gravel mixtures, free of clay lumps, clay balls, deleterious materials, vegetation, organic material, roots, cobbles or boulders over 3 inches in nominal size. Native Fill soils are not considered suitable Select Fill or Pond Slope Select Backfill soils unless they meet the requirements of this report section. The Native Fill soils shall have a liquid limit less than 35 and a plasticity index of 12 or less. Suitable Native Fill soils should meet the gradation requirements below.

Table 9 - 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. The blended soils should meet the requirements of Native Fill above.

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 18 are not considered suitable for use as Native Fill and Select Fill soil materials.

C. Pond Slope Select Backfill (PSSB)

The Pond Slope Select Backfill (PSSB) should consist of granular sands which are free of clay lumps, deleterious materials, organic material, cobbles or boulders over 4 inches in nominal size and should have a liquid limit less than 40 and a plasticity index of 7 to 15. The PSSB shall also exhibit a maximum dry density of at least 120 pcf. PSSB shall meet one or a group of the following soil classifications in accordance with the USCS: SC-SM, SC, GC-GM, GC and the other requirements above. Sandy gravels or poorly graded gravels (i.e., GC, GC-GM, GM, GP-GM and GP-GC) and non-plastic by test may also be considered as suitable for use as PSSB provided that these soils exhibit a linear bar shrinkage of at least 6 percent or greater. The linear bar shrinkage test shall be conducted in accordance with TEX Method 107-E.

The PSSB should also meet the minimum gradation requirements tabulated below or specified TXDOT gradation for base coarse material approved for use.

Table 10 - Pond Slope Select Backfill Gradation Requirements

Sieve Size (square opening)	% Passing by Weight
3-inch	100
3/4-inch	70 – 100
No. 4	40 – 100
No. 200	13 – 45

The general contractor should adjust the cut slopes in order to compensate for the recommended additional PSSB soil layer above the cut slopes to maintain the design finished grade elevations and bottom of pond elevation.

D. Utility Line Backfill Soil Classifications

The following soil backfill classifications are typically designated for utility pipe line 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, and Class IV 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 12 and exhibit an optimum dry density of at least 115 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.

XVII. Construction Materials Testing

We recommend that construction materials inspection and testing of site work, fill placement, footing 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) Soil 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) soil compaction test per lift at 100 lineal feet spacing along pond slopes and rockwall foundation excavations and/or pipe bedding and backfill operations, according to

ASTM D 6938 or D 1556.

4. A minimum of one (1) soil compaction test per each lift of subgrade preparation and/or fill placement for each drainage structure according to ASTM D 6938 or D 1556.

5. 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 3-cube specimens for lab curing and testing in accordance with applicable ASTM procedures. At least one set 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 (1 cube) and 28 days (2 cubes) 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 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 day's 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.

7. 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 of the concrete materials during significant periods of high (above 95˚ F) and low (below 35° F) temperatures.

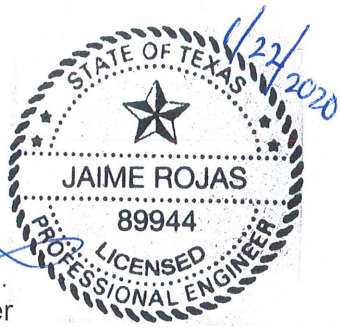
XVIII. General Soil Evaluation Considerations

As requested, the information presented within this report are based on the data obtained from four (4) vertical borings and three (3) soil percolation tests performed at the approximate locations indicated on the attached General Geotechnical Subsurface Exploration Soil Boring & Percolation Test Location Aerial Plans, Sheets A1-1 and A1-2. This report may not reflect all the variations that may occur at the time of pond construction. The nature and extent of the variations may not become evident until during the course of construction.

If variations appear during construction, CQC should be contacted immediately, it may be necessary for a reevaluation of the information presented in 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 site history or known conditions of concern were discussed or disclosed to CQC by our Client or owner.

Thank you and please feel free to contact us if you have any questions regarding the contents of this report.

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



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Jaime Rojas, P.E.
Principal Engineer
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2.) File

Attachments: Appendix A

1.) General Geotechnical Subsurface Exploration Boring Location Aerial Plans, Sheets A1-1 and A1-2
2.) City of El Paso – Flood Zone Aerial Plans, Sheets A1-3 and A1-4
3.) Vertical Exploration Boring Logs, Sheets A2 through A5
4.) Soil Particle Size Analysis Test Results, Sheets A6 through A11
5.) Summary of Laboratory Engineering Soil Classification Test Results, Sheet A12
6.) Soil Moisture-Density Relationship Test Results, Sheets A13 and A14
7.) Soil Percolation Test Results, Sheets A15 and A16
8.) Soil Direct Shear Test Results, Sheets A17 through A20

Appendix B

1.) Geotechnical Report Technical Reference Information, Sheet B1
2.) Soil Classification Chart, Sheet B2
3.) Geotechnical Report Soil Classification Reference Information, Sheet B3

Appendix C

1.) General Site Condition Photographs, Sheet C1

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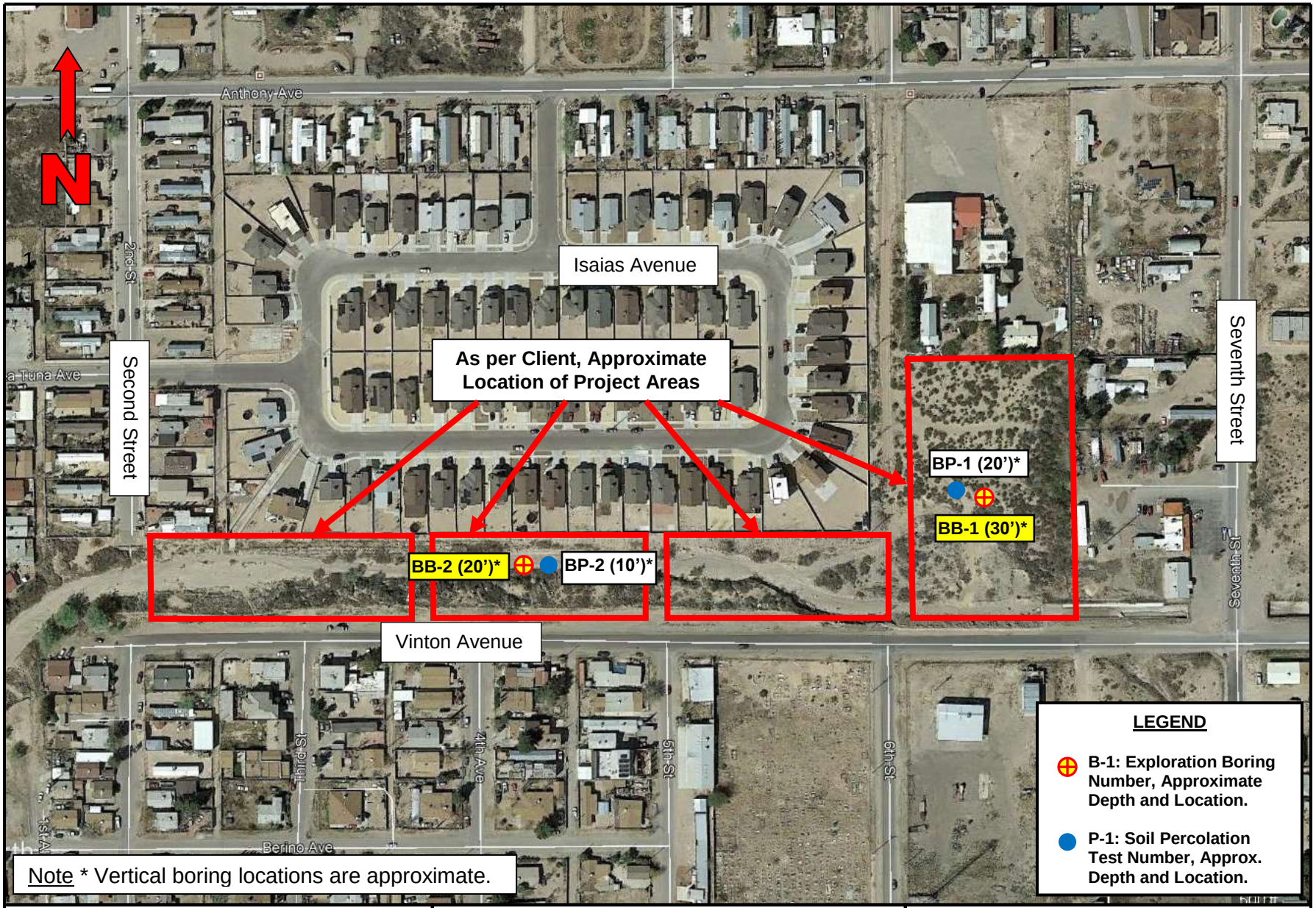
APPENDIX A

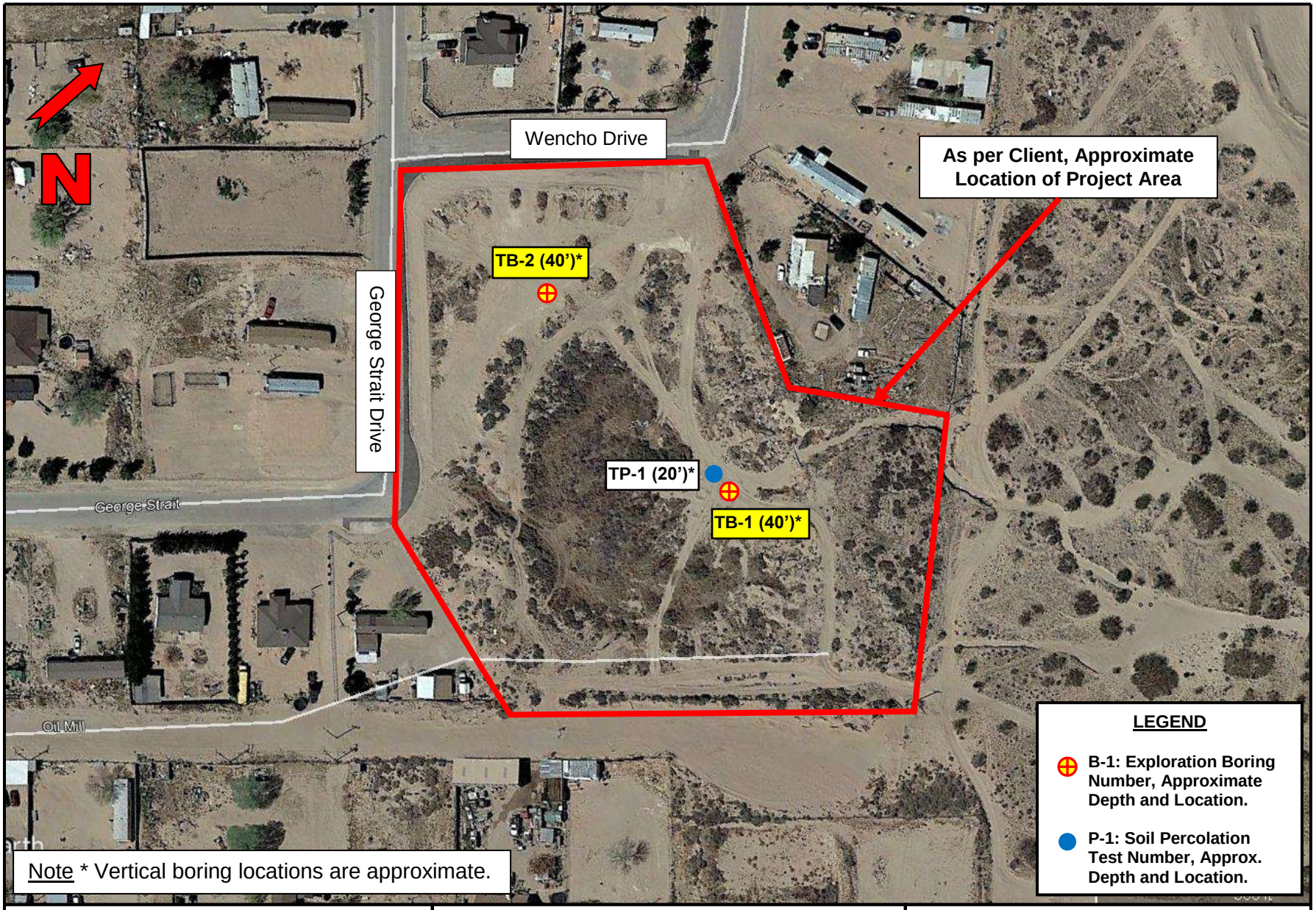


construction quality control
testing and engineering

General Geotechnical Subsurface Exploration Boring & PercolationTest Location Aerial Plan

Bailey Detention Pond Project
Vinton Avenue and Seventh Street
Canutillo, El Paso County, Texas

Client: Moreno Cardenas Inc.	
CQC Project No. AGCQC19-049	
Scale: NTS	Check by: JR
Date: 12/20/19	Sheet A1-1

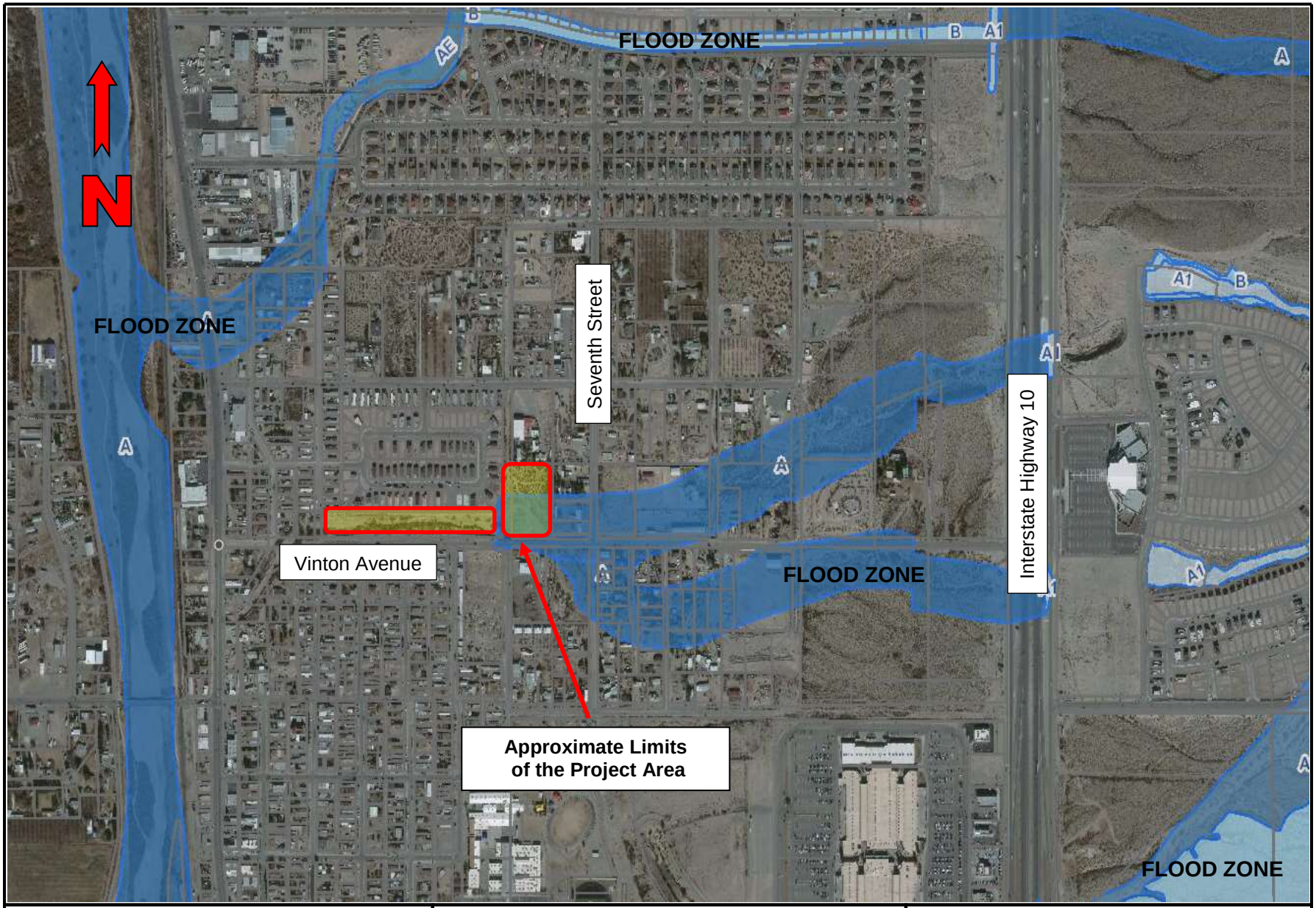


construction quality control
testing and engineering

General Geotechnical Subsurface Exploration
Boring & Percolation Test Location Aerial Plan

Tornillo Detention Pond Project
George Strait Drive and Wencho Drive
Tornillo, El Paso County, Texas

Client: Moreno Cardenas Inc.	
CQC Project No. AGCQC19-049	
Scale: NTS	Check by: JR
Date: 12/20/19	Sheet A1-2



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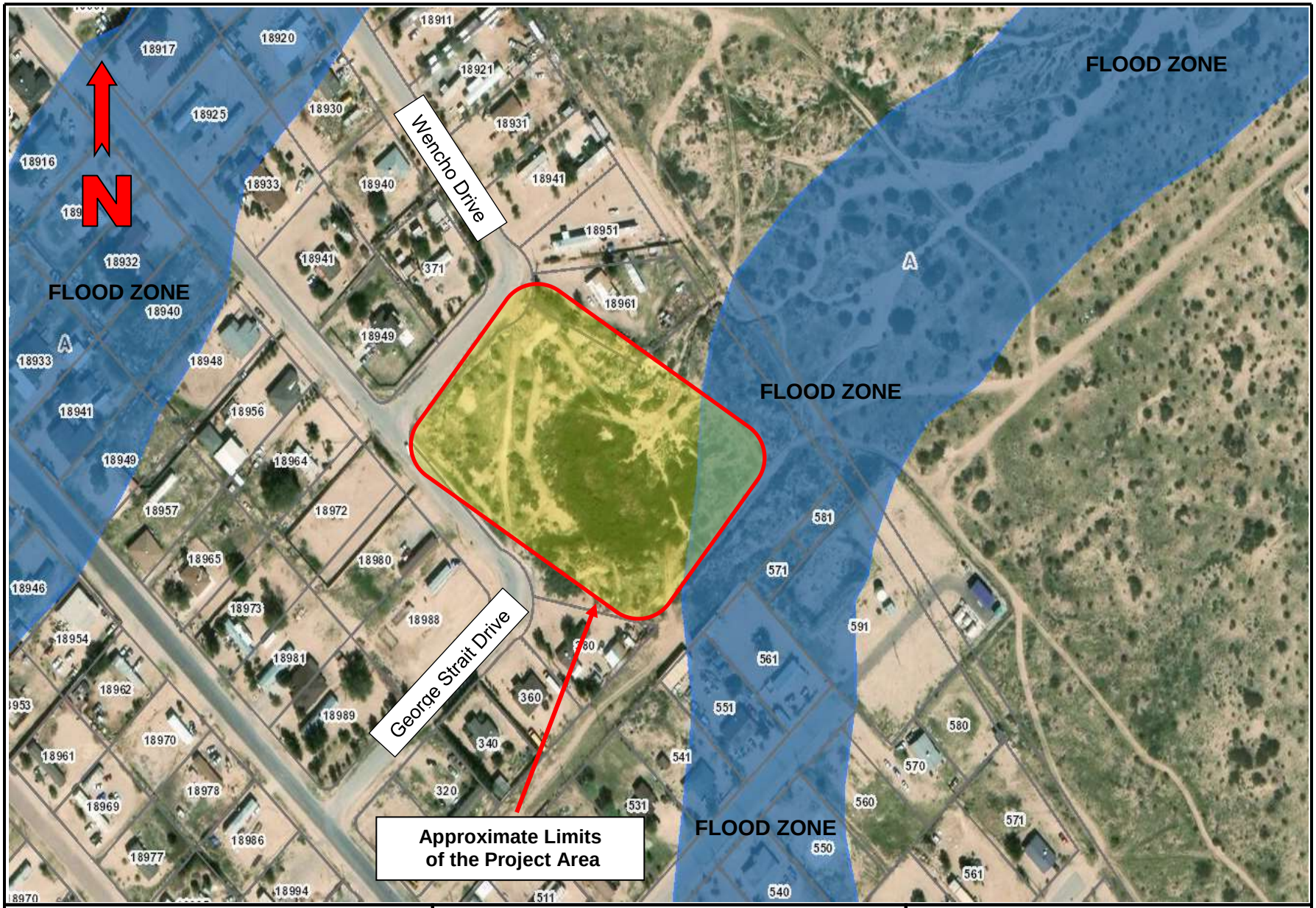
City of El Paso - Flood Zone Aerial Plan

General Geotechnical Subsurface Soil Evaluation
Bailey Detention Pond Project
Vinton Avenue and Seventh Street
Canutillo, El Paso County, Texas

Client: Moreno Cardenas Inc.	
CQC Project No. AGCQC19-049	
Scale: NTS	Check by: JR
Date: 12/22/19	Sheet A1-3



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testing and engineering

City of El Paso - Flood Zone Aerial Plan

General Geotechnical Subsurface Soil Evaluation
Tornillo Detention Pond Project
George Strait Drive and Wencho Drive
Tornillo, El Paso County, Texas

Client: Moreno Cardenas Inc.	
CQC Project No. AGCQC19-049	
Scale: NTS	Check by: JR
Date: 12/22/19	Sheet A1-4

CQC Testing and Engineering LLC - TBPE Firm No. F-10632
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El Paso, Texas 79904
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BORING NUMBER BB-1

CLIENT Moreno Cardenas Inc.
PROJECT NAME Bailey and Tornillo Detention Ponds Project
PROJECT NUMBER AGCQC19-049
PROJECT LOCATION Vinton Avenue and Wencho Drive
DATE STARTED 10/8/19 **COMPLETED** 10/8/19
GROUND ELEVATION Ext. Grade **HOLE SIZE** 6 inches
DRILLING CONTRACTOR CQC **DRILLED BY** MN
GROUND WATER LEVELS:
DRILLING METHOD CME-75 w/3-1/4" ID HSA
AT TIME OF DRILLING ---
LOGGED BY PG **CHECKED BY** BL
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	SS 1		GRAVEL, Fine, Subangular, Sandy, Non-Plastic, Poorly Graded, Light Brown to Multicolored, Medium Dense, Dry.	3-3-10 (13)	1.5	44	2	NP		GP
	SS 2		GRAVEL, Fine, Subangular, Sandy, Non-Plastic, Poorly Graded, Brown, Medium Dense, Dry with silt.	2-4-9 (13)						
5	SS 3			5-6-11 (17)	1.4	54	10	NP		GP-GM
	SS 4		SILT, Non-Plastic, Light Brown, Very Stiff, Slightly Moist with some calcareous material.	8-8-8 (16)	4.1	91	66	NP		ML
10	SS 5			10-12-15 (27)						
15	SS 6		GRAVEL, Fine, Subangular, Non-Plastic, Poorly Graded, Light Brown, Dense, Dry with silt.	14-34-28 (62)	0.8	37	10	NP		GP-GM
20	SS 7		GRAVEL, Fine, Subangular, Sandy, Non-Plastic, Silty, Light Brown, Medium Dense, Dry.	4-6-18 (24)	1.8	55	14	NP		GM
25	SS 8		SAND, Fine to Coarse Grained, Poorly Graded, Light Brown to Multicolored, Medium Dense, Dry with gravel.	6-11-15 (26)	1.1					
30	SS 9		NOTE: SS- Split Spoon Sample	5-8-12 (20)						
			Bottom of borehole at 30.0 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 BB-2

CLIENT Moreno Cardenas Inc.
PROJECT NAME Bailey and Tornillo Detention Ponds Project
PROJECT NUMBER AGCQC19-049
PROJECT LOCATION Vinton Avenue and Wencho Drive
DATE STARTED 10/8/19 **COMPLETED** 10/8/19
GROUND ELEVATION Ext. Grade **HOLE SIZE** 6 inches
DRILLING CONTRACTOR CQC **DRILLED BY** MN
GROUND WATER LEVELS:
DRILLING METHOD CME-75 w/3-1/4" ID HSA
AT TIME OF DRILLING ---
LOGGED BY PG **CHECKED BY** BL
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	SS 1		SAND, Fine to Medium Grained, Non-Plastic, Gravelly, Poorly Graded, Brown to Multicolored, Medium Dense, Dry.	3-4-6 (10)						
	SS 2			7-8-15 (23)	1.3	79	4	NP		SP
5	SS 3		- Dense below approx. 5 feet.	17-19-21 (40)	1.1					
	SS 4		GRAVEL, Fine, Subangular, Sandy, Well Graded, Light Brown, Medium Dense, Dry.	14-13-16 (29)	0.1	16	1	NP		GW
10	SS 5		SAND, Fine to Coarse Grained, Non-Plastic, Silty, Tannish Brown, Medium Dense, Slightly Moist.	14-12-12 (24)	3.7	95	22			
15	SS 6			15-11-12 (23)						
	SS 7		- Brown to multicolored, very dense below approx. 18-1/2 feet.	13-50/4"	3.9	74	14	NP		SM
20			NOTE: SS - Split Spoon Sample Bottom of borehole at 20.0 feet.							

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

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THE INFORMATION PRESENTED SHOULD NOT BE SEPARATED FROM THE GEOTECHNICAL REPORT

CQC STANDARD LOG W/ POCKET PEN 19-049_LOGS.GPJ GINT STD US LAB.GDT

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BORING NUMBER TB-1

CLIENT Moreno Cardenas Inc.
PROJECT NAME Bailey and Tornillo Detention Ponds Project
PROJECT NUMBER AGCQC19-049
PROJECT LOCATION Vinton Avenue and Wencho Drive
DATE STARTED 10/10/19 **COMPLETED** 10/10/19
GROUND ELEVATION Ext. Grade **HOLE SIZE** 6 inches
DRILLING CONTRACTOR CQC **DRILLED BY** MN
GROUND WATER LEVELS:
DRILLING METHOD CME-75 w/3-1/4" ID HSA
AT TIME OF DRILLING ---
LOGGED BY PG **CHECKED BY** BL
AT END OF DRILLING ---
NOTES Boring Location: See Attached Boring Location Plan, Sheet A1-2
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	SS 1		SAND, Fine to Medium Grained, Non-Plastic, Silty, Light Brown to Reddish Brown, Loose, Slightly Moist. These soils may be susceptible to soil sloughing when excavated.	3-3-3 (6)	2.7	100	22	NP		SM
	SS 2			2-3-3 (6)						
5	SS 3		- Medium dense below approx. 5 feet.	4-6-8 (14)	5.2	99	27			
	SS 4		CLAY, Low Plasticity, Silty, Brown, Very Stiff, Slightly Moist to Moist with caliche lumps.	5-6-11 (17)	7.0	99	63	6		CL-ML
10	SS 5		SAND, Fine to Medium Grained, Non-Plastic, Silty, Brown, Medium Dense, Slightly Moist.	4-5-10 (15)	5.9	99	44	NP		SM
15	SS 6		- Light brown with some calcareous material below approx. 15 feet.	4-2-12 (14)	3.5	99	25	NP		SM
20	SS 7			4-5-6 (11)						
25	SS 8		SAND, Fine to Coarse Grained, Non-Plastic, Poorly Graded, Light Brown, Medium Dense, Slightly Moist with silt.	5-5-8 (13)	2.8	98	11	NP		SP-SM
30	SS 9			7-7-8 (15)	5.3	99	29			
35	SS 10		- Light brown to multicolored, dense below approx. 35 feet.	10-13-26 (39)	1.7	93	8	NP		SP-SM
40	SS 11		NOTE: SS - Split Spoon Sample Bottom of borehole at 40.0 feet.	17-18-16 (34)						

▲ 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 TB-2

CLIENT Moreno Cardenas Inc. **PROJECT NAME** Bailey and Tornillo Detention Ponds Project

PROJECT NUMBER AGCQC19-049 **PROJECT LOCATION** Vinton Avenue and Wencho Drive

DATE STARTED 10/10/19 **COMPLETED** 10/10/19 **GROUND ELEVATION** Ext. Grade **HOLE SIZE** 6 inches

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

DRILLING METHOD CME-75 w/3-1/4" ID HSA **AT TIME OF DRILLING** ---

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

NOTES Boring Location: See Attached Boring Location Plan, Sheet A1-2 **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	SS 1		SAND, Fine to Medium Grained, Non-Plastic, Poorly Graded, Light Brown to Multicolored, Loose, Slightly Moist with silt. These soils may be susceptible to soil sloughing when excavated.	3-2-4 (6)	3.2	98	11	NP		SP-SM
	SS 2			3-3-3 (6)	3.5	97	11			
5	SS 3			2-3-3 (6)						
	SS 4		SAND, Fine to Medium Grained, Silty, Clayey, Brown, Loose, Slightly Moist. These soils may be susceptible to soil sloughing when excavated.	4-2-3 (5)	6.8	99	46	6		SC-SM
10	SS 5			3-4-5 (9)						
15	SS 6		- Medium dense below approx. 15 feet.	6-9-9 (18)	5.3	99	42			
20	SS 7		SAND, Fine to Coarse Grained, Non-Plastic, Silty, Reddish Brown, Medium Dense, Slightly Moist.	5-4-15 (19)	5.0	99	25	NP		SM
25	SS 8			5-5-7 (12)	5.1	99	21			
30	SS 9			6-6-7 (13)	3.5	99	19			
35	SS 10		- Light brown and brown to multicolored below approx. 35 feet.	8-8-14 (22)	8.3	99	34	NP		SM
40	SS 11		NOTE: SS - Split Spoon Sample Bottom of borehole at 40.0 feet.	3-10-12 (22)						

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

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Fx: (915) 771-7786

SOIL PARTICLE SIZE ANALYSIS TESTS

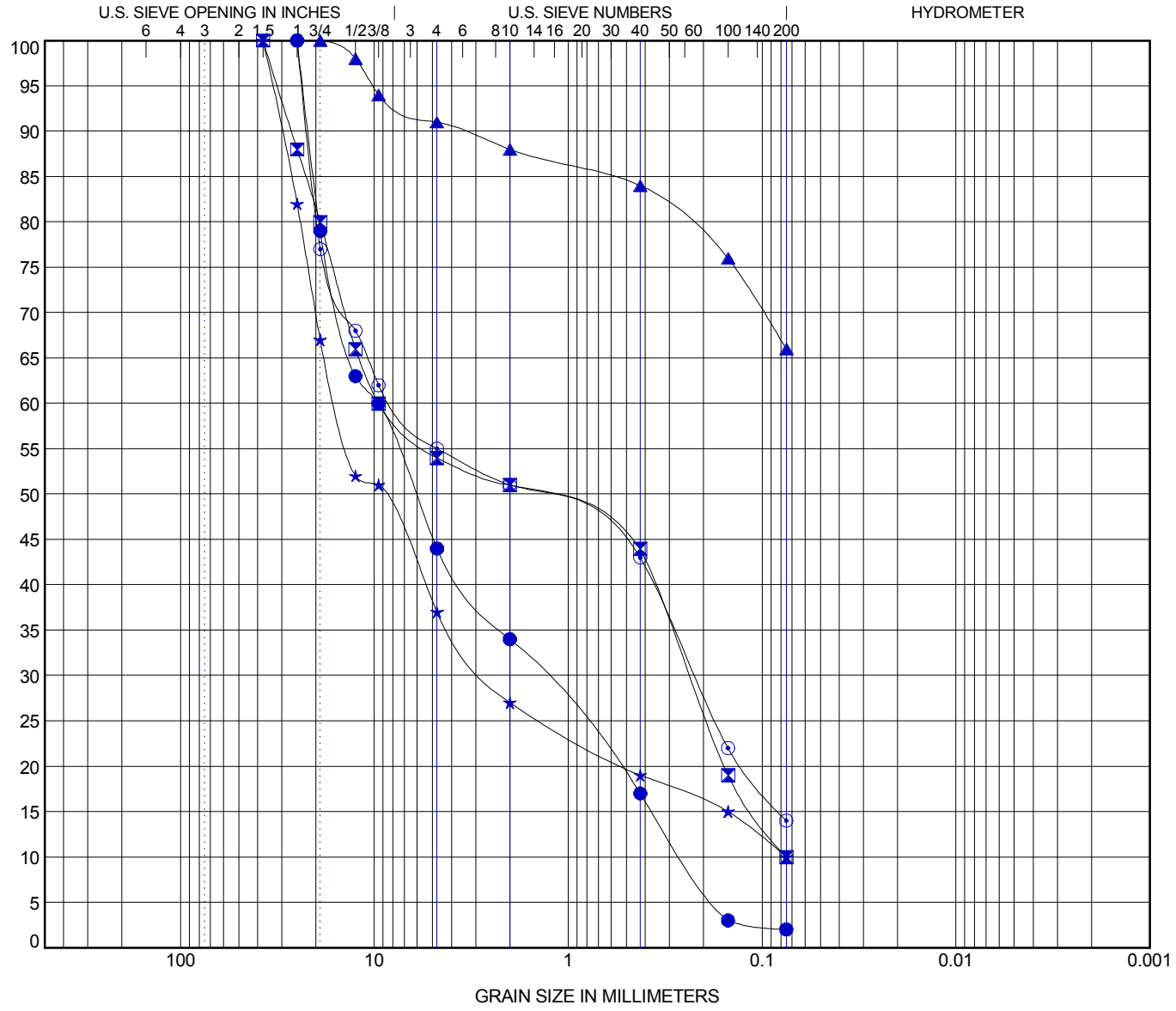
Test Method: ASTM D6913

CLIENT Moreno Cardenas Inc.

PROJECT NAME Bailey and Tornillo Detention Ponds Project

PROJECT NUMBER AGCQC19-049

PROJECT LOCATION Vinton Avenue and Wencho Drive



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
BB-1	0.0 - 1.5	POORLY GRADED GRAVEL with SAND(GP)	NP	NP	NP	0.80	37.63
BB-1	5.0 - 6.5	POORLY GRADED GRAVEL with SILT and SAND(GP-GM)	NP	NP	NP	0.08	126.67
BB-1	7.5 - 9.0	SANDY SILT(ML)	NP	NP	NP		
BB-1	15.0 - 16.5	POORLY GRADED GRAVEL with SILT and SAND(GP-GM)	NP	NP	NP	5.73	208.37
BB-1	20.0 - 21.5	SILTY GRAVEL with SAND(GM)	NP	NP	NP		

BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
BB-1	0.0 - 1.5	25	9.5	1.389	0.252	56.0	42.0	2.0	
BB-1	5.0 - 6.5	37.5	9.5	0.237	0.075	46.0	44.0	10.0	
BB-1	7.5 - 9.0	19				9.0	25.0	66.0	
BB-1	15.0 - 16.5	37.5	15.628	2.593	0.075	63.0	27.0	10.0	
BB-1	20.0 - 21.5	25	7.793	0.223		45.0	41.0	14.0	

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SOIL PARTICLE SIZE ANALYSIS TESTS

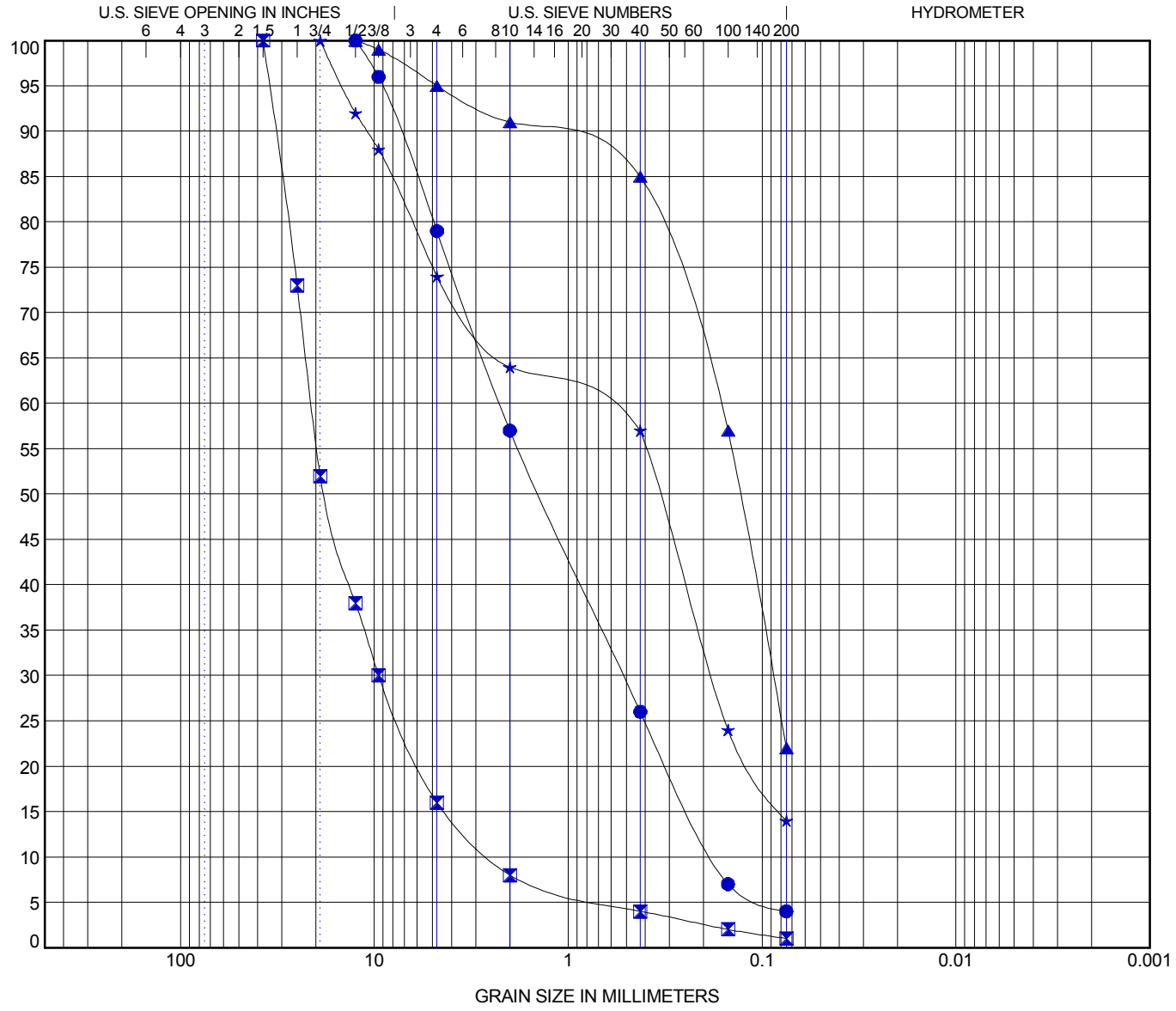
Test Method: ASTM D6913

CLIENT Moreno Cardenas Inc.

PROJECT NAME Bailey and Tornillo Detention Ponds Project

PROJECT NUMBER AGCQC19-049

PROJECT LOCATION Vinton Avenue and Wencho Drive



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	BB-2	2.5 - 3.3	POORLY GRADED SAND with GRAVEL(SP)	NP	NP	NP	0.68	12.73
⊠	BB-2	7.5 - 8.3	WELL-GRADED GRAVEL with SAND(GW)	NP	NP	NP	1.72	8.50
▲	BB-2	10.0 - 10.8						
★	BB-2	18.5 - 19.3	SILTY SAND with GRAVEL(SM)	NP	NP	NP		

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	BB-2	2.5 - 3.3	12.5	2.25	0.519	0.177	21.0	75.0	4.0	
⊠	BB-2	7.5 - 8.3	37.5	21.094	9.5	2.483	84.0	15.0	1.0	
▲	BB-2	10.0 - 10.8	12.5	0.168	0.088		5.0	73.0	22.0	
★	BB-2	18.5 - 19.3	19	0.825	0.181		26.0	60.0	14.0	

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SOIL PARTICLE SIZE ANALYSIS TESTS

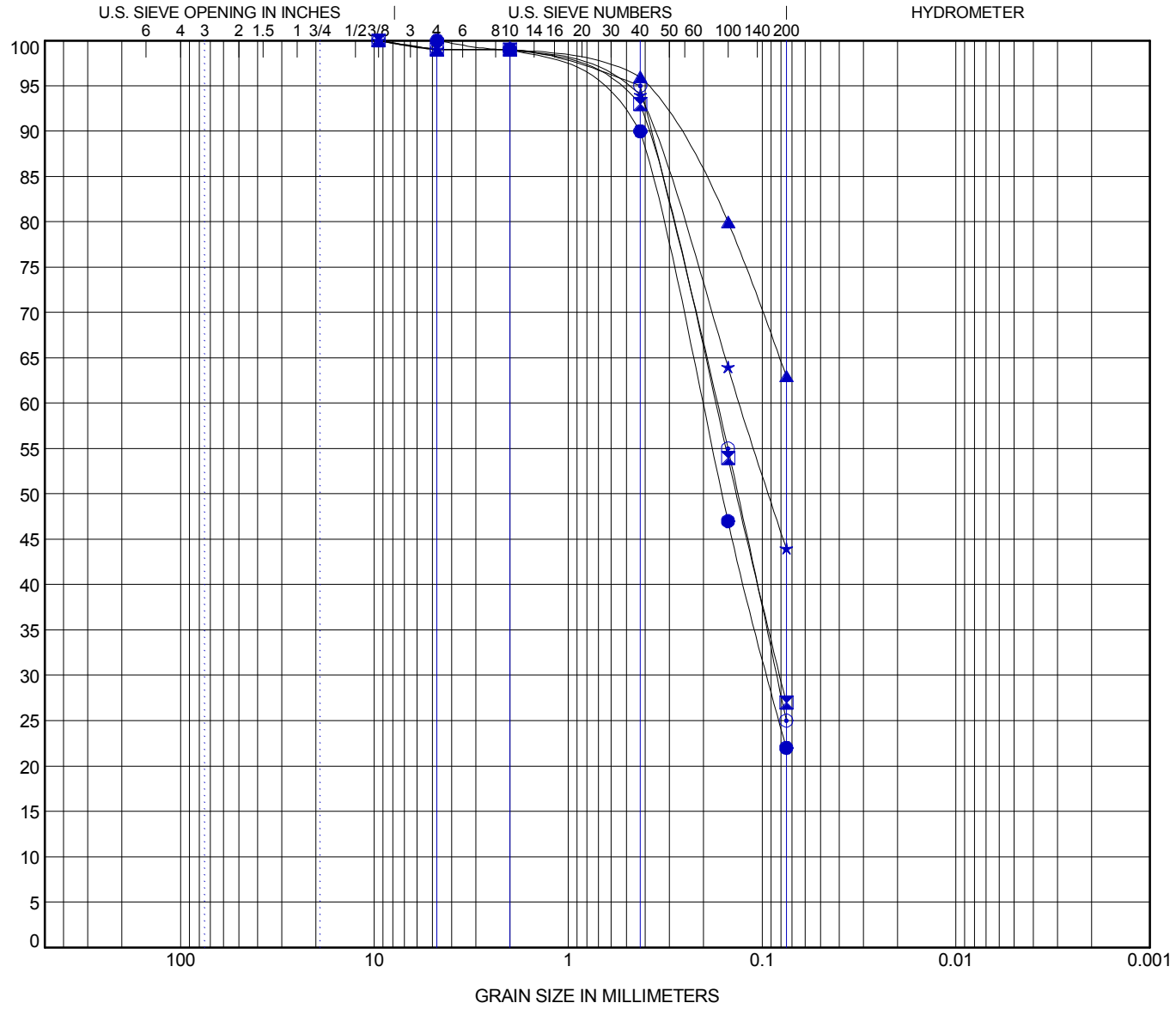
Test Method: ASTM D6913

CLIENT Moreno Cardenas Inc.

PROJECT NAME Bailey and Tornillo Detention Ponds Project

PROJECT NUMBER AGCQC19-049

PROJECT LOCATION Vinton Avenue and Wencho Drive



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE		DEPTH	Classification	LL	PL	PI	Cc	Cu
●	TB-1	0.0 - 1.5	SILTY SAND(SM)	NP	NP	NP		
⊠	TB-1	5.0 - 6.5						
▲	TB-1	7.5 - 9.0	SANDY SILTY CLAY(CL-ML)	23	17	6		
★	TB-1	10.0 - 11.5	SILTY SAND(SM)	NP	NP	NP		
⊙	TB-1	15.0 - 16.5	SILTY SAND(SM)	NP	NP	NP		

BOREHOLE		DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TB-1	0.0 - 1.5	4.75	0.206	0.094		0.0	78.0	22.0	
⊠	TB-1	5.0 - 6.5	9.5	0.176	0.081		1.0	72.0	27.0	
▲	TB-1	7.5 - 9.0	9.5				1.0	36.0	63.0	
★	TB-1	10.0 - 11.5	9.5	0.131			1.0	55.0	44.0	
⊙	TB-1	15.0 - 16.5	9.5	0.171	0.084		1.0	74.0	25.0	

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

SOIL PARTICLE SIZE ANALYSIS TESTS

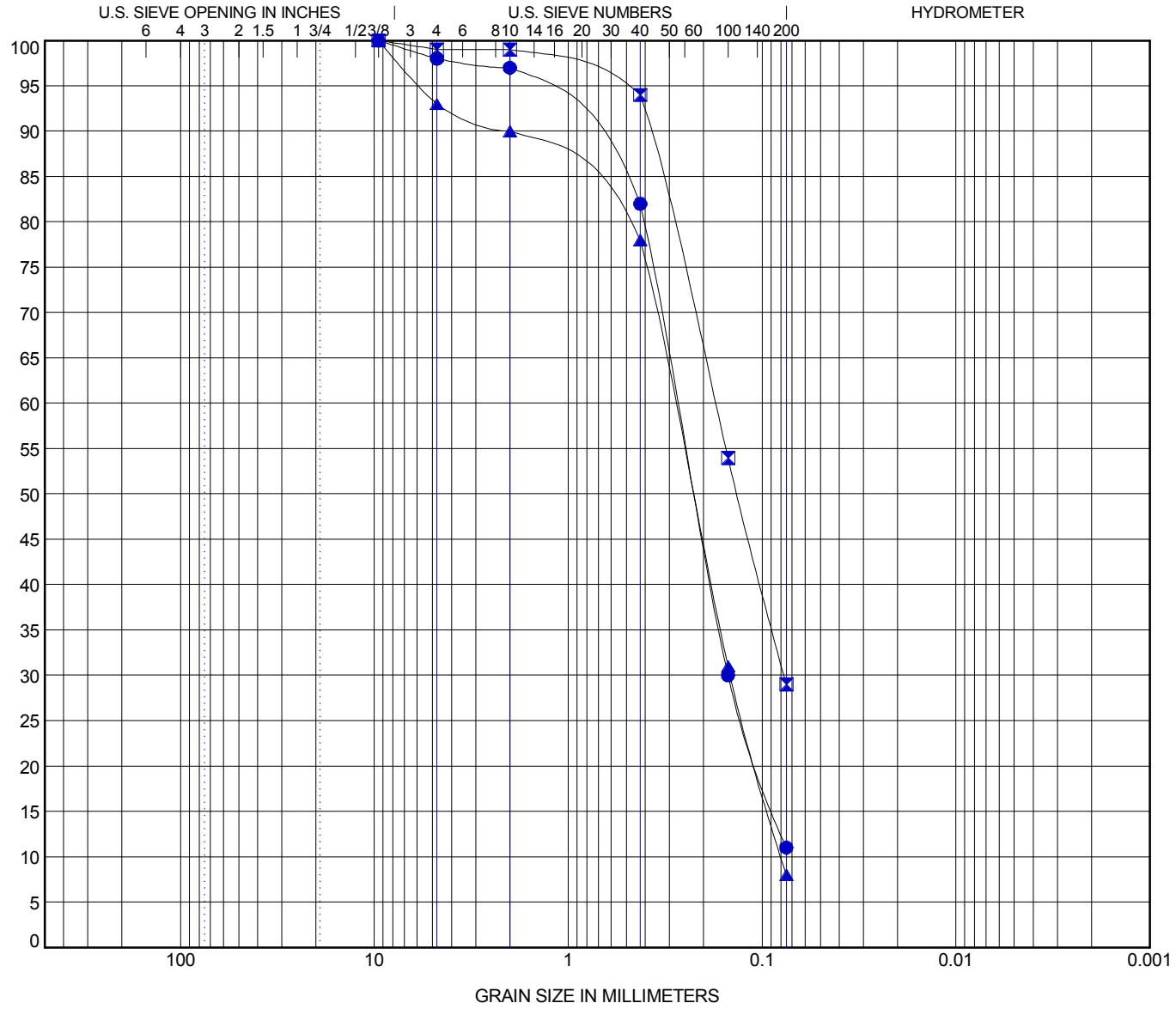
Test Method: ASTM D6913

CLIENT Moreno Cardenas Inc.

PROJECT NAME Bailey and Tornillo Detention Ponds Project

PROJECT NUMBER AGCQC19-049

PROJECT LOCATION Vinton Avenue and Wencho Drive



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE		DEPTH	Classification	LL	PL	PI	Cc	Cu
●	TB-1	25.0 - 26.5	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP	1.14	3.78
⊠	TB-1	30.0 - 31.5						
▲	TB-1	35.0 - 36.5	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP	0.93	3.58

BOREHOLE		DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TB-1	25.0 - 26.5	9.5	0.274	0.15		2.0	87.0	11.0	
⊠	TB-1	30.0 - 31.5	9.5	0.175	0.077		1.0	70.0	29.0	
▲	TB-1	35.0 - 36.5	9.5	0.285	0.146	0.08	7.0	85.0	8.0	

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SOIL PARTICLE SIZE ANALYSIS TESTS

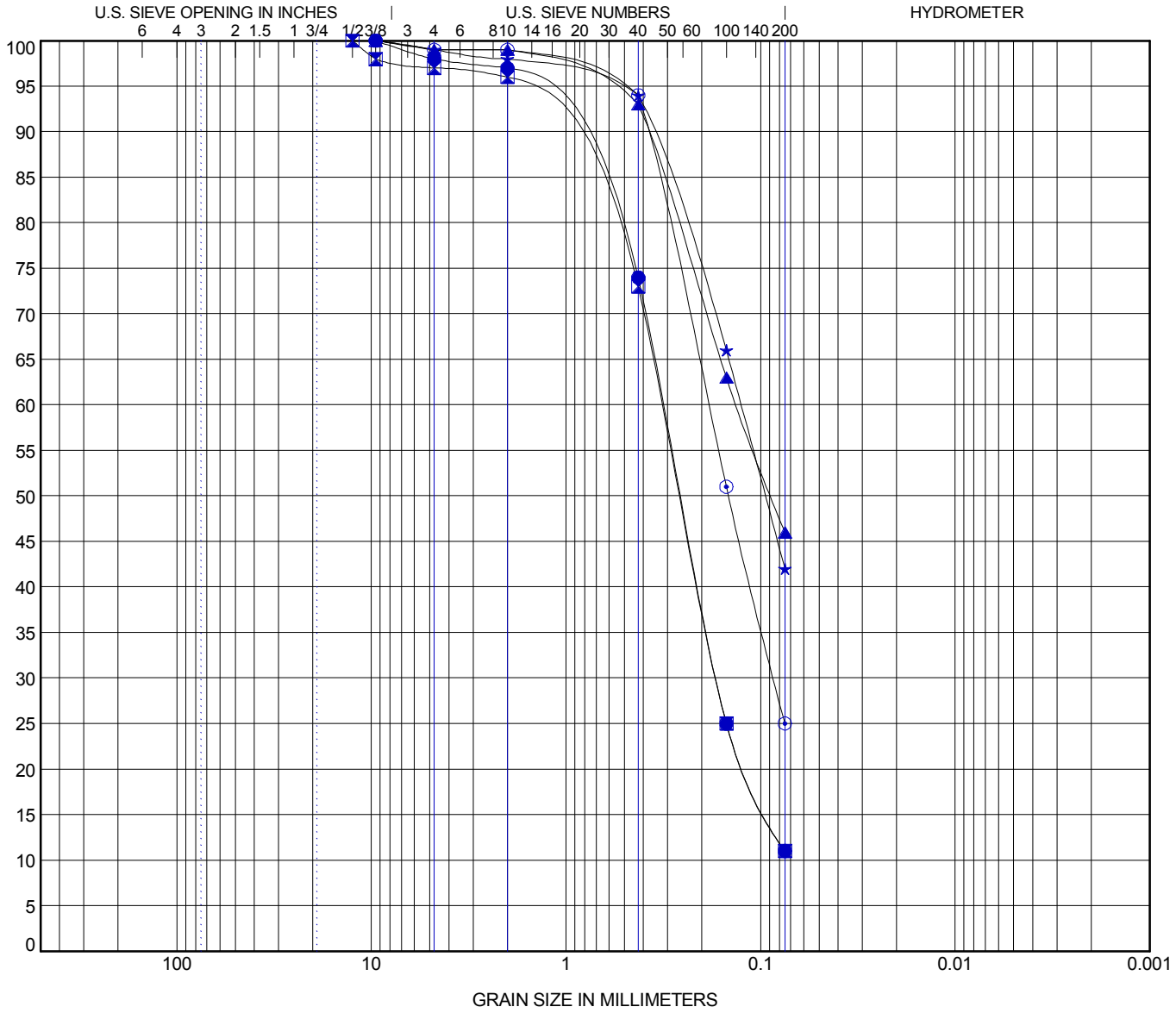
Test Method: ASTM D6913

CLIENT Moreno Cardenas Inc.

PROJECT NAME Bailey and Tornillo Detention Ponds Project

PROJECT NUMBER AGCQC19-049

PROJECT LOCATION Vinton Avenue and Wencho Drive



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
● TB-2	0.0 - 1.5	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP	1.24	4.42
⊠ TB-2	2.5 - 4.0					1.22	4.49
▲ TB-2	7.5 - 9.0	SILTY, CLAYEY SAND(SC-SM)	22	16	6		
★ TB-2	15.0 - 16.5						
⊙ TB-2	20.0 - 21.5	SILTY SAND(SM)	NP	NP	NP		

BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● TB-2	0.0 - 1.5	9.5	0.316	0.167		2.0	87.0	11.0	
⊠ TB-2	2.5 - 4.0	12.5	0.321	0.167		3.0	86.0	11.0	
▲ TB-2	7.5 - 9.0	9.5	0.133			1.0	53.0	46.0	
★ TB-2	15.0 - 16.5	9.5	0.126			1.0	57.0	42.0	
⊙ TB-2	20.0 - 21.5	9.5	0.187	0.086		1.0	74.0	25.0	

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SOIL PARTICLE SIZE ANALYSIS TESTS

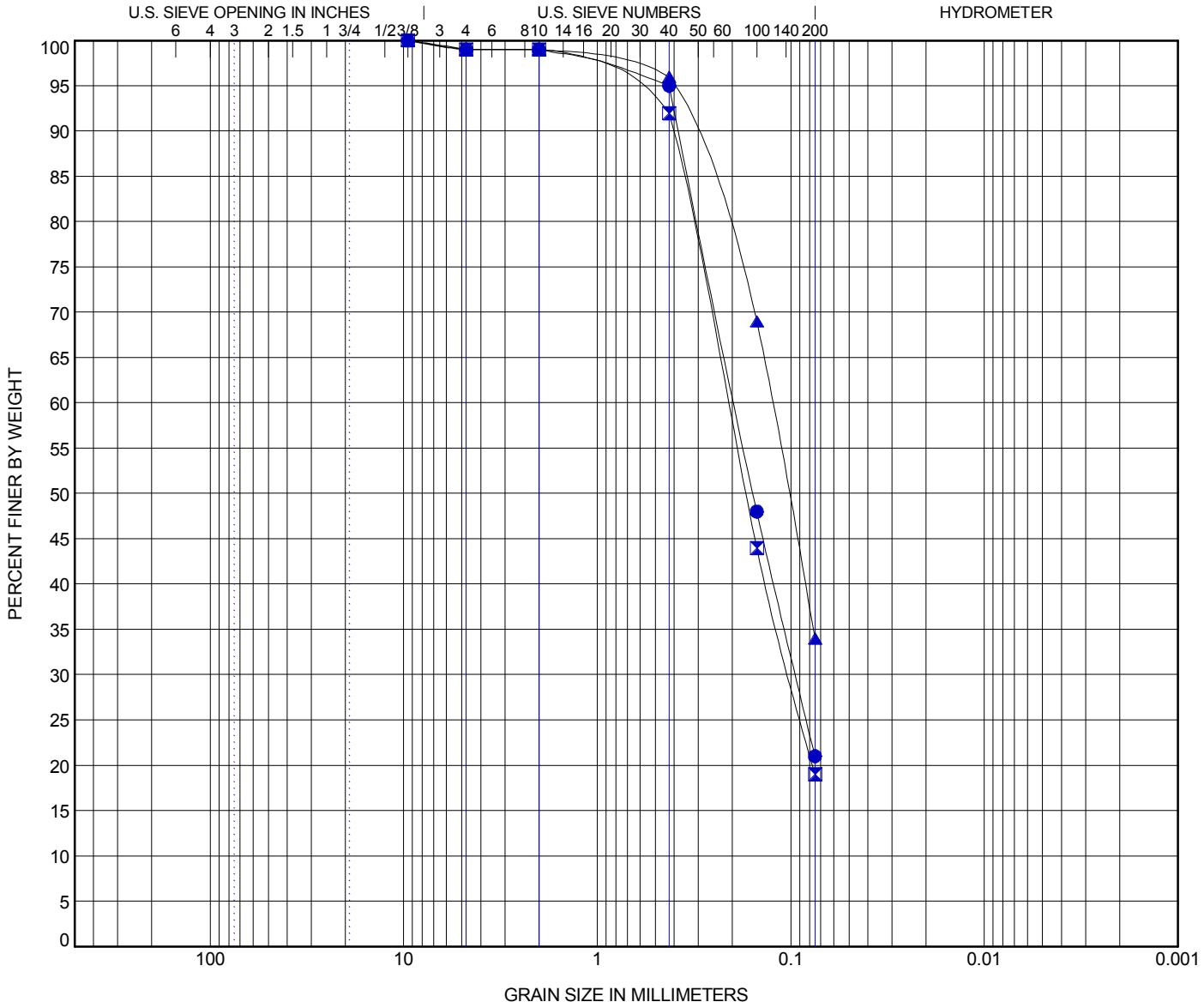
Test Method: ASTM D6913

CLIENT Moreno Cardenas Inc.

PROJECT NAME Bailey and Tornillo Detention Ponds Project

PROJECT NUMBER AGCQC19-049

PROJECT LOCATION Vinton Avenue and Wencho Drive



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
● TB-2	25.0 - 26.5						
⊠ TB-2	30.0 - 31.5						
▲ TB-2	35.0 - 36.5	SILTY SAND(SM)	NP	NP	NP		

BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● TB-2	25.0 - 26.5	9.5	0.196	0.094		1.0	78.0	21.0	
⊠ TB-2	30.0 - 31.5	9.5	0.212	0.102		1.0	80.0	19.0	
▲ TB-2	35.0 - 36.5	9.5	0.126			1.0	65.0	34.0	

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SUMMARY OF LABORATORY ENGINEERING SOIL CLASSIFICATION TEST RESULTS

CLIENT Moreno Cardenas Inc. **PROJECT NAME** Bailey and Tornillo Detention Ponds Project

PROJECT NUMBER AGCQC19-049 **PROJECT LOCATION** Vinton Avenue and Wencho Drive

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
BB-1	0.0- 1.5	13	1.5	NP	NP	NP	44	2			GP
	2.5- 4.0	13									
	5.0- 6.5	17	1.4	NP	NP	NP	54	10			GP-GM
	7.5- 9.0	16	4.1	NP	NP	NP	91	66			ML
	10.0- 11.5	27									
	15.0- 16.5	62	0.8	NP	NP	NP	37	10			GP-GM
	20.0- 21.5	24	1.8	NP	NP	NP	55	14			GM
	25.0- 26.5	26	1.1								
	28.5- 30.0	20									
BB-2	0.0- 1.5	10									
	2.5- 4.0	23	1.3	NP	NP	NP	79	4			SP
	5.0- 6.5	40	1.1								
	7.5- 9.0	29	0.1	NP	NP	NP	16	1			GW
	10.0- 11.5	24	3.7				95	22			
	15.0- 16.5	23									
	18.5- 20.0	50 / 4"	3.9	NP	NP	NP	74	14			SM
TB-1	0.0- 1.5	6	2.7	NP	NP	NP	100	22			SM
	2.5- 4.0	6									
	5.0- 6.5	14	5.2				99	27			
	7.5- 9.0	17	7.0	23	17	6	99	63			CL-ML
	10.0- 11.5	15	5.9	NP	NP	NP	99	44			SM
	15.0- 16.5	14	3.5	NP	NP	NP	99	25			SM
	20.0- 21.5	11									
	25.0- 26.5	13	2.8	NP	NP	NP	98	11			SP-SM
	30.0- 31.5	15	5.3				99	29			
	35.0- 36.5	39	1.7	NP	NP	NP	93	8			SP-SM
	38.5- 40.0	34									
TB-2	0.0- 1.5	6	3.2	NP	NP	NP	98	11			SP-SM
	2.5- 4.0	6	3.5				97	11			
	5.0- 6.5	6									
	7.5- 9.0	5	6.8	22	16	6	99	46			SC-SM
	10.0- 11.5	9									
	15.0- 16.5	18	5.3				99	42			
	20.0- 21.5	19	5.0	NP	NP	NP	99	25			SM
	25.0- 26.5	12	5.1				99	21			
	30.0- 31.5	13	3.5				99	19			
	35.0- 36.5	22	8.3	NP	NP	NP	99	34			SM
	38.5- 40.0	22									

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

SOIL MOISTURE - DENSITY RELATIONSHIP TEST RESULTS

PROJECT NO.: AGCQC19-049

PROJECT NAME: General Geotechnical Subsurface Soils Evaluation
Bailey and Tornillo Detention Ponds Project
Vinton Avenue and Wencho Drive
El Paso, El Paso County, Texas

SAMPLE INFORMATION

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

SOIL SAMPLE LOCATION: TB-2 **SAMPLE DATE:** 10/10/2019

SOIL SAMPLE APPROX. DEPTH: 10'

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

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	0	100
No. 10	1	99
No. 40	11	89
No. 100	47	53
No. 200	69.2	30.8

NS- Not Specified

Atterberg Limits Test
Test Method: ASTM D 4318

Limit Test	Index Test Result
LL	-
PL	-
PI	NP

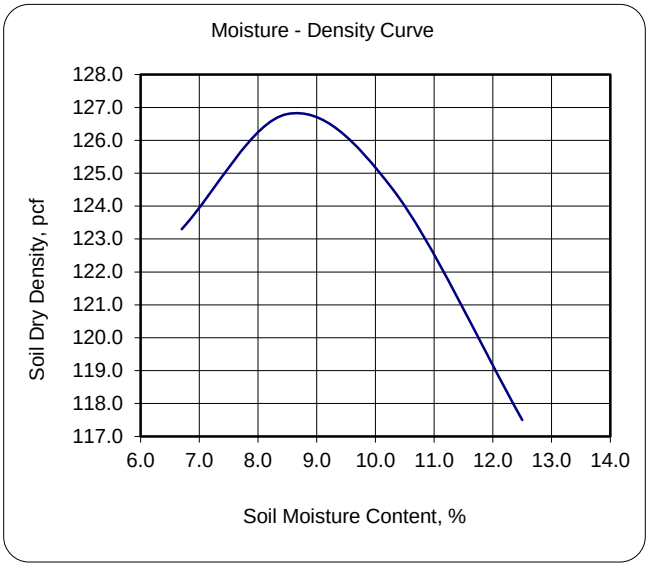
NP-Non Plastic
NS - Not Specified

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	6.7	123.3
2	8.5	126.8
3	10.3	124.5
4	12.5	117.5

Maximum Dry Density, pcf: **126.8**
Optimum Moisture Content, %: **8.7**



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.: AGCQC19-049

PROJECT NAME: General Geotechnical Subsurface Soils Evaluation
Bailey and Tornillo Detention Ponds Project
Vinton Avenue and Wencho Drive
El Paso, El Paso County, Texas

SAMPLE INFORMATION

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

SOIL SAMPLE LOCATION: BB-2 **SAMPLE DATE:** 10/8/2019

SOIL SAMPLE APPROX. DEPTH: 5 - 8'

SOIL TYPE/DESCRIPTION: On Site Subsurface Soils / SAND, Fine to Medium Grained, Gravelly, Poorly Graded, 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"	13	87
3/4"	15	85
1/2"	29	71
3/8"	35	65
No. 4	46	54
No. 10	55	45
No. 40	73	27
No. 100	91	9
No. 200	95.6	4.4

NS- Not Specified

Atterberg Limits Test

Test Method: ASTM D 4318

Limit Test	Index Test Result
LL	-
PL	-
PI	NP

NP-Non Plastic
NS - Not Specified

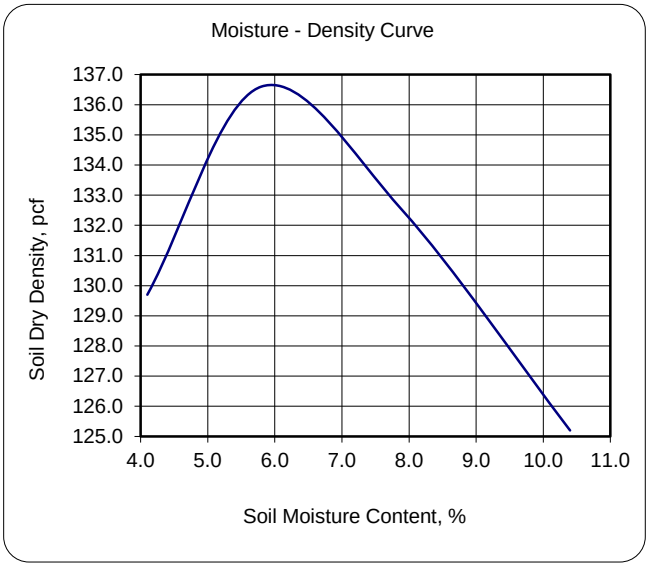
Soil Classification: **SP**
Test Method: ASTM D 2487

Moisture-Density Relationship Test

Test Method: ASTM D 1557, Method "C"

Test Sample No.	Moisture Content (%)	Sample Dry Density (pcf)
1	4.1	129.7
2	5.8	136.6
3	7.9	132.5
4	10.4	125.2

Maximum Dry Density, pcf: **136.6**
Optimum Moisture Content, %: **6.1**



SOIL PERCOLATION TEST RESULTS

DATE: December 22, 2019

CQC PROJECT NO.: AGCQC19-049
PROJECT NAME: General Geotechnical Subsurface Soils Evaluation
Bailey Detention Pond Project
El Paso, El Paso County, Texas

TEST INFORMATION

TEST DATE: October 8, 2019
TEST HOLE CLOSURE: Backfilled with Existing Soil Material
GROUNDWATER DEPTH: None Observed
BP-1 to BP-2: READING INTERVAL / TOTAL TEST TIME: 10 minutes / 60 minutes

Hole No.	Approx. Test Depth (ft.)	Visual Soil Description at Bottom of Borehole	Estimated Percolation Rate at Test Depth: min./in.
BP-1	20	SAND, Fine to Coarse Grained, Poorly Graded, Light Brown with silt	≤10
BP-2	10	SAND, Fine to Coarse Grained, Poorly Graded, Tannish Brown with silt	≤10

1. Test bore holes were saturated for a period of at least 3 hours before testing.
2. Percolation tests were performed within the approximate location indicated on the General Geotechnical Subsurface Exploration Boring & Percolation Test Location Aerial Plan, Sheet A1-1.
3. Please note that a percolation test may not serve as an accurate model to test the infiltration rate of collected water, especially due to the build-up of sediments and suspended particles of soil when the ponding area is in service.

Remarks: Based on our percolation test results, the tested subsurface soils exhibited a relatively rapid infiltration rate into the subsurface soils. In addition, it should be noted that normal and steady water infiltration through the subsurface soils is highly dependent on the degree of sediment built-up at the bottom of the detention pond, which shall ultimately decrease the infiltration rate. Due to the possible variability of the subsurface soils throughout the project site, we highly recommend to consider a minimum soil percolation value of 60 minutes per inch in the civil design of proposed detention pond, as required. It is highly recommended that our Client consider the specification of a soil percolation or infiltration test to be performed once the pond has been cut to the design invert elevation. The delineation of the lateral extent or lateral seepage of water infiltration and impacts to adjacent structures or properties was beyond our scope of work, but should be considered by the owner.

SOIL PERCOLATION TEST RESULTS

DATE: December 23, 2019

CQC PROJECT NO.: AGCQC19-049
PROJECT NAME: General Geotechnical Subsurface Soils Evaluation
Tornillo Detention Pond Project
El Paso, El Paso County, Texas

TEST INFORMATION

TEST DATE: October 10, 2019
TEST HOLE CLOSURE: Backfilled with Existing Soil Material
GROUNDWATER DEPTH: None Observed
TP-1: READING INTERVAL / TOTAL TEST TIME: 10 minutes / 60 minutes

Hole No.	Approx. Test Depth (ft.)	Visual Soil Description at Bottom of Borehole	Estimated Percolation Rate at Test Depth: min./in.
TP-1	20	SAND, Fine to Medium Grained, Silty, Light Brown	≤10

1. Test bore hole was saturated for a period of at least 3½ hours before testing.
2. Percolation test was performed within the approximate location indicated on the General Geotechnical Subsurface Exploration Boring & Percolation Test Location Aerial Plan, Sheet A1-2.
3. Please note that a percolation test may not serve as an accurate model to test the infiltration rate of collected water, especially due to the build-up of sediments and suspended particles of soil when the ponding area is in service.

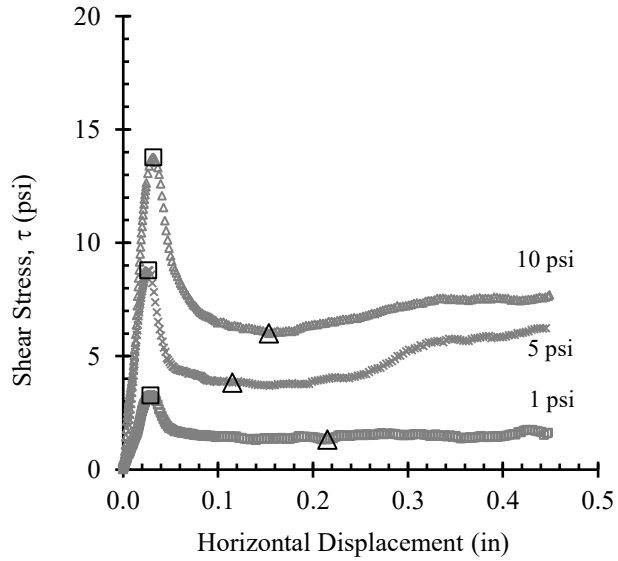
Remarks: Based on our percolation test results, the tested subsurface soils exhibited a relatively rapid infiltration rate into the subsurface soils. In addition, it should be noted that normal and steady water infiltration through the subsurface soils is highly dependent on the degree of sediment built-up at the bottom of the detention pond, which shall ultimately decrease the infiltration rate. Due to the possible variability of the subsurface soils throughout the project site, we highly recommend to consider a minimum soil percolation value of 60 minutes per inch in the civil design of proposed detention pond, as required. It is highly recommended that our Client consider the specification of a soil percolation or infiltration test to be performed once the pond has been cut to the design invert elevation. The delineation of the lateral extent or lateral seepage of water infiltration and impacts to adjacent structures or properties was beyond our scope of work, but should be considered by the owner.

Beyond Engineering & Testing, LLC
3801 Doris Lane, Suite B
Round Rock, TX 78664
(512) 358-6048

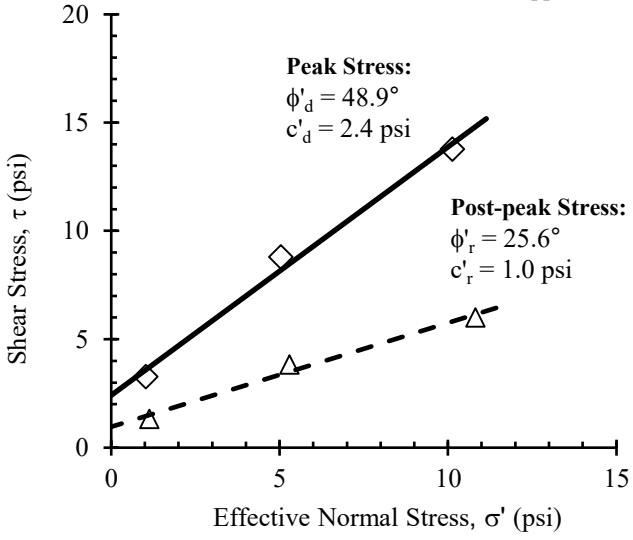
Direct Shear of Soil Under Consolidated-Drained Conditions

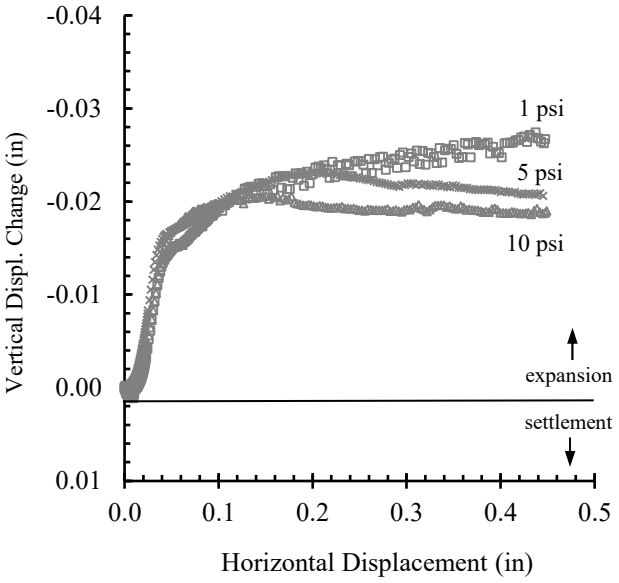
Client: CQC Testing & Engineering, LLC
Project: Bailey & Tornillo Ponds (PN: AGCQC19-049)
Specimen: B-2 at 15 ft - Bailey

Beyond Project No.: LT1910128
Test Method: ASTM D3080
Test Date: 11/15/19



Note: Area Correction Has Been Applied





Sample Number		1	2	3
Initial Condition	Diameter, in	2.51	2.51	2.50
	Height, in (before consol)	1.04	1.04	1.05
	Water Content, %	5.8	5.7	5.9
	Saturation, %	55.1	53.5	54.3
	Dry Unit Weight, pcf	129.9	129.6	128.6
	Void Ratio	0.28	0.28	0.29
Post Consol	Height, in (prior to shear)	1.03	1.04	1.03
	Final Water Content, %	12.5	12.8	12.4
	Dry Unit Weight, pcf	130.4	129.7	130.1
	Void Ratio	0.27	0.28	0.28
Peak Normal Stress, σ' (psi)		1.0	5.0	10.1
Peak Shear Stress, τ (psi)		3.3	8.8	13.8
Displacement at Failure (in)		0.03	0.03	0.03
Displacement rate (in/min)		0.0005	0.0005	0.0005
Peak Strength Parameters	ϕ'_d, degrees			**48.9**
	c'_d, psi			**2.4**
Post-peak Strength Parameters	ϕ'_r, degrees			**25.6**
	c'_r, psi			**1.0**

Note: Specimens remolded to 135.0 pcf dry unit weight at 6 % water content. The specific gravity of 2.66 was assumed.

Cheng-Wei Chen, Ph.D. 11/15/19
Analysis & Quality Review/Date

Specimens prepared by: T.D.

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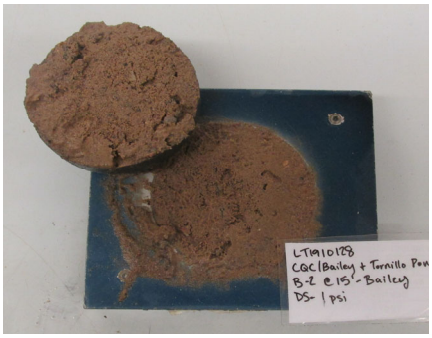
Round Rock, TX 78664
(512) 358-6048

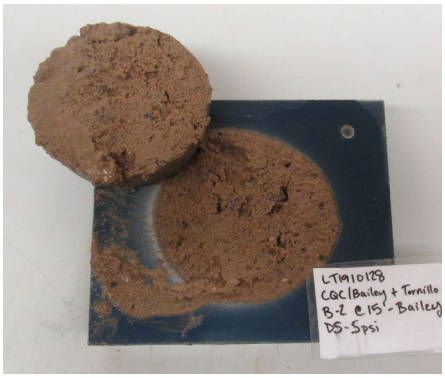
Direct Shear of Soil Appendix

Client: CQC Testing & Engineering, LLC
Project: Bailey & Tornillo Ponds (PN: AGCQC19-049)
Specimen: B-2 at 15 ft - Bailey

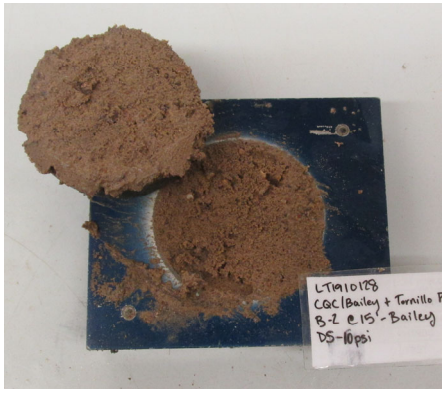
Beyond Project No.: LT1910128
Test Method: ASTM D3080
Test Date: 11/15/19



(a) Normal Load = 1 psi



(b) Normal Load = 5 psi



(c) Normal Load = 10 psi

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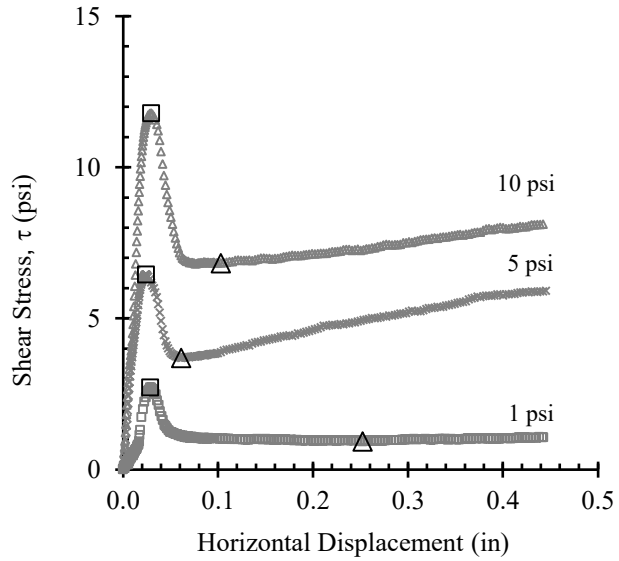
(512) 358-6048

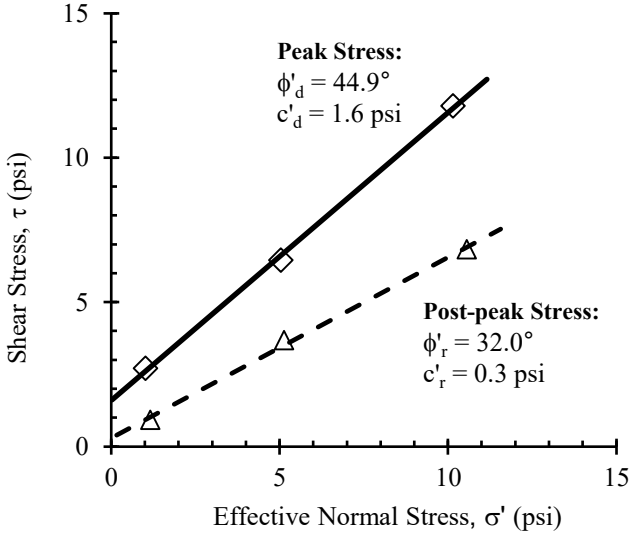
Direct Shear of Soil Under Consolidated-Drained Conditions

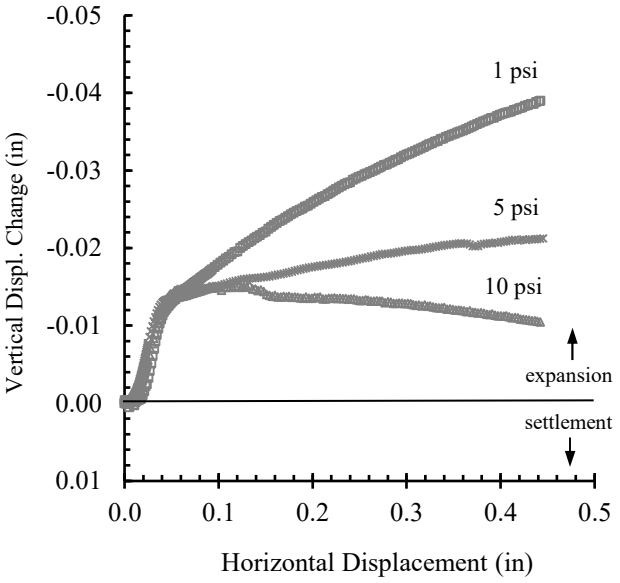
Client: CQC Testing & Engineering, LLC
Project: Bailey & Tornillo Ponds (PN: AGCQC19-049)
Specimen: B-2 at 15 ft - Tornillo

Beyond Project No.: LT1910128
Test Method: ASTM D3080
Test Date: 11/08/19



Note: Area Correction Has Been Applied





Sample Number		1	2	3
Initial Condition	Diameter, in	2.50	2.51	2.50
	Height, in (before consol)	1.00	1.00	1.00
	Water Content, %	8.1	8.2	8.1
	Saturation, %	67.8	66.2	66.4
	Dry Unit Weight, pcf	126.1	124.9	125.5
	Void Ratio	0.32	0.33	0.32
Post Consol	Height, in (prior to shear)	1.00	1.00	1.00
	Final Water Content, %	13.8	12.8	12.1
	Dry Unit Weight, pcf	126.1	124.8	126.2
	Void Ratio	0.32	0.33	0.32
Peak Normal Stress, σ' (psi)		1.0	5.0	10.2
Peak Shear Stress, τ (psi)		2.7	6.5	11.8
Displacement at Failure (in)		0.03	0.02	0.03
Displacement rate (in/min)		0.0005	0.0005	0.0005
Peak Strength Parameters	ϕ'_d, degrees			**44.9**
	c'_d, psi			**1.6**
Post-peak Strength Parameters	ϕ'_r, degrees			**32.0**
	c'_r, psi			**0.3**

Note: Specimens remolded to 126.0 pcf dry unit weight at 8 % water content. The specific gravity of 2.66 was assumed.

Cheng-Wei Chen, Ph.D. 11/15/19
Analysis & Quality Review/Date

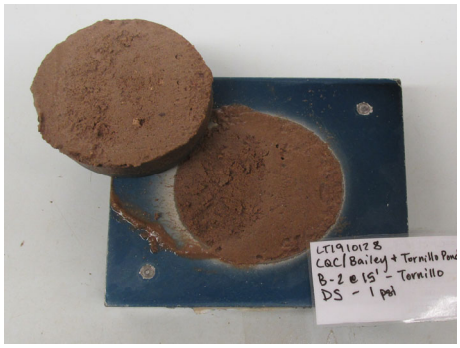
Specimens prepared by: T.D.

Beyond Engineering & Testing, LLC
3801 Doris Lane, Suite B
Round Rock, TX 78664
(512) 358-6048

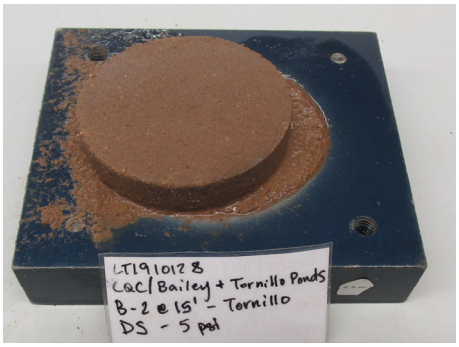
Direct Shear of Soil Appendix

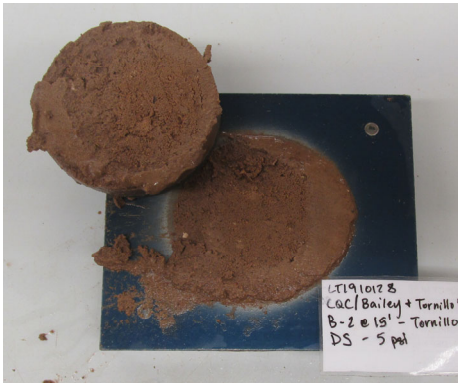
Client: CQC Testing & Engineering, LLC
Project: Bailey & Tornillo Ponds (PN: AGCQC19-049)
Specimen: B-2 at 15 ft - Tornillo

Beyond Project No.: LT1910128
Test Method: ASTM D3080
Test Date: 11/08/19

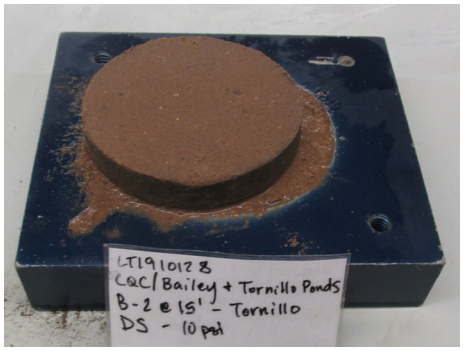


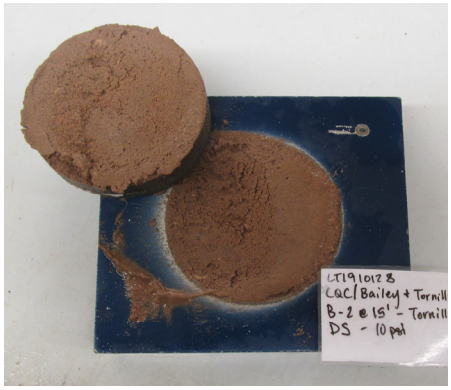
(a) Normal Load = 1 psi





(b) Normal Load = 5 psi





(c) Normal Load = 10 psi

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			

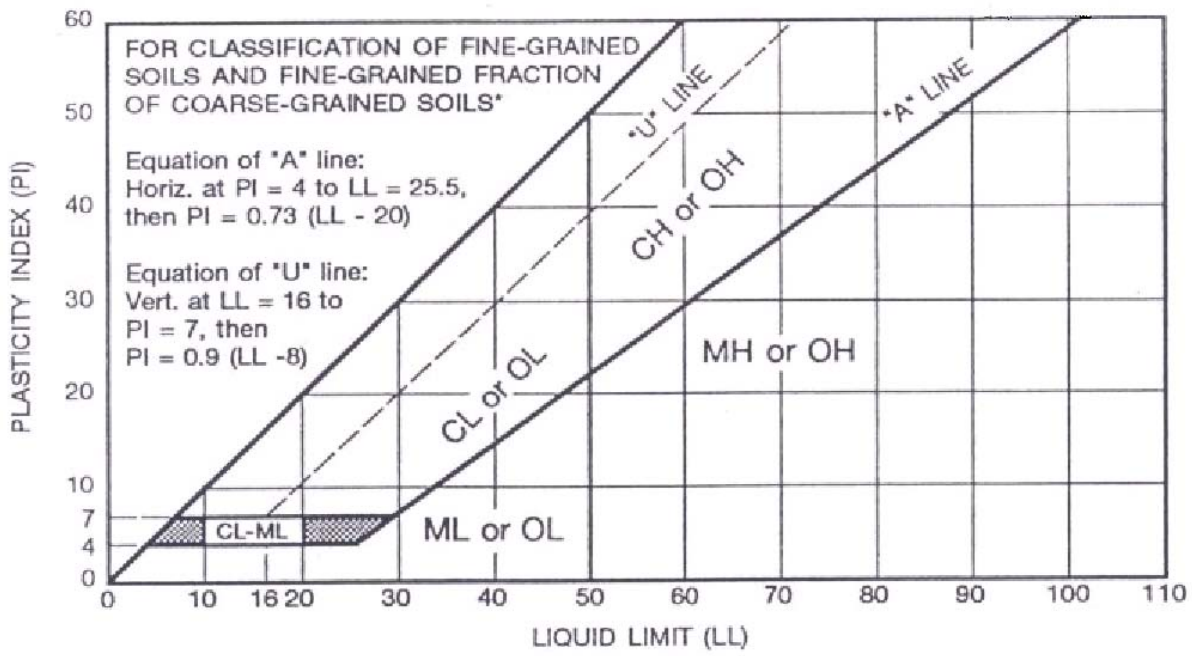
SOIL CLASSIFICATION CHART

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: Bailey and Tornillo Detention Ponds Project
Tornillo & Canutillo, El Paso County, Texas

PHOTO NO. 1: General view of the proposed Tornillo Detention Pond looking northeast and existing site conditions.

PHOTO NO. 2: General view of the proposed Bailey Detention Pond looking northwest and existing conditions.

PHOTO NO. 3: General view of drilling activities at exploration vertical boring TB-2 location.

PHOTO NO. 4: General view of drilling activities at exploration vertical boring BB-1 location.

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