BROWNSVILLE
PUBLIC UTILITIES BOARD

Date: May 14, 2026
To: All Vendors
Subject: Addendum #1

REFERENCE: **B028-26 BPUB North Regional Force Main, Phase 1**

This Addendum forms part of the contract and clarifies, corrects or modifies original bid document.

SEE ATTACHED DOCUMENTS

Revisions to Construction Plans

1. Revised sheet 1 to include structural plans (Attachment A).
2. Added sheets S101, S102 & S103 (Attachment A).

Responses to Pre-Bid Meeting Questions

Question 1: Can the Geotech report be made available?

Answer 1: The general geotechnical report (Attachment B) and the geotechnical report for the Drainage Ditch Crossing (Attachment C) are included. However, please note the General Conditions in the Contract Documents, Section 4.2.

Responses to Questions Received After Pre-Bid Meeting

Question 1: There is a bid item #9 that calls for 840 lf of 30” Bored PVC 905 DR-25. Where is this on the project?

Answer 1: Refer to Sheets 10 (Starting at STA 59+50), 11 (Ending at STA 66+75), and 14 (STA 117+24.22).

Question 2: There are a few places where the force main goes under existing utilities that do not have fittings. Is the intent do deflect the pipe?

Answer 2: Yes, the pipe will be deflected per manufacturer’s instructions.

Question 3: From STA 60+00 to STA 67+00 there are several structures that are in the alignment of the force main. Please advise.

Answer 3: This portion of the force main will be bored as specified in Sheets 10 and 11.

Question 4: The ditch crossing at STA 75+00 calls for open cut with casing. Can this be bored in lieu of open cut?

Answer 4: Response: Yes, however contractor will not be compensated for change in means and methods. Contractor will be required to verify flowline clearance as specified in the plans.

Question 5: How far north is the fence being moved?

Answer 5: Where possible, the fence will be relocated to the drainage district's north right-of-way line/private property line.

Question 6: Will initial construction staking be provided by the engineer?

Answer 6: Engineer will provide project control points and benchmarks. As per general notes contractor to provide their own construction staking.

Question 7: At locations where the fence is going to relocated, will it be put back in the same location or on the property line? If the new fence moves to the property line, who will provide property corners?

Answer 7: The fence is to be relocated to the property line. The Engineer will provide property corner points.

The signature of the company agent, for the acknowledgement of this addendum, shall be required. **Complete information below and return via e-mail to: dsolitaire@brownsville-pub.com.**

I hereby acknowledge receipt of this addendum.

Company: _____

Agent Name: _____

Agent Signature: _____

Address: _____

City: _____ **State:**_____ **Zip:**_____

Phone Number: _____ **E-mail address:**_____

If you have any further questions about the bid, call 956-983-6366.

BY: Diane Solitaire
Purchasing Department

halff
1075 Paredes Line Roa
Brownsville, TX 7852
Phone (956) 303-7100
TBPELS Firm No. 312

Project Addendum No.1

Project:	**Brownsville PUB – North Regional Force Main Phase I** **BPUB Bid No. B02826**	**Addendum Date:**	**May 13, 2026**
From:	**John W. Clint, PE**	**Project No.:**	**47277.001**

ADDENDUM No. 1

Revisions to Construction Plans

1. Revised sheet 1 to include structural plans (Attachment A).
2. Added sheets S101, S102 & S103 (Attachment A).

Responses to Pre-Bid Meeting Questions

1. Can the Geotech report be made available?

   The general geotechnical report (Attachment B) and the geotechnical report for the Drainage Ditch Crossing (Attachment C) are included. However, please note the General Conditions in the Contract Documents, Section 4.2.

CONSTRUCTION PLANS
FOR
BROWNSVILLE PUBLIC UTILITIES BOARD
NORTH REGIONAL FORCE MAIN
PHASE 1

BROWNSVILLE, TEXAS

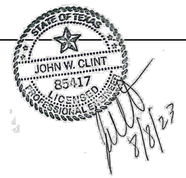
OWNER

BROWNSVILLE P.U.B.
1425 ROBINHOOD DR.
BROWNSVILLE, TX 78521
PHONE (956) 983-6100

UTILITY DISCLAIMER:

THE INFORMATION SHOWN ON THESE DRAWINGS INDICATING SIZE, TYPE AND LOCATION OF UNDERGROUND, SURFACE, AND AERIAL UTILITIES IS NOT GUARANTEED TO BE EXACT OR COMPLETE. THE CONTRACTOR SHALL CONTACT THE TEXAS "ONE CALL" SYSTEM AT 811 48 HOURS PRIOR TO BEGINNING ANY EXCAVATION FOR EXISTING UTILITY LOCATIONS. THE CONTRACTOR SHALL ALSO BE FULLY RESPONSIBLE FOR FIELD VERIFYING LOCATIONS AND ELEVATIONS OF ALL EXISTING UTILITIES AFFECTED BY CONSTRUCTION FOR THIS PROJECT IN ORDER TO AVOID DAMAGING THOSE UTILITIES, AND SHALL IMMEDIATELY ARRANGE FOR REPAIR AND RESTORATION OF CONTRACTOR-DAMAGED UTILITIES TO THE UTILITY COMPANY'S APPROVAL AT THE EXPENSE OF THE CONTRACTOR.

ENGINEER OF RECORD:



HALFF ASSOCIATES, INC.
1075 PAREDES LINE ROAD, SUITE B
BROWNSVILLE, TEXAS 78521
CONTACT: JOHN W. CLINT, P.E.
EMAIL: JCLINT@HALFF.COM
TEL: (956) 303-7110
TBPE FIRM# F-312

DISCLAIMER

THE SEAL(S) APPEARING ON THIS CONSTRUCTION SET WERE AUTHORIZED BY:
JOHN W. CLINT, 85417
ON 07/01/2022
ALTERATION OF SEALED DOCUMENTS WITHOUT PROPER NOTIFICATION TO THE RESPONSIBLE ENGINEER IS AN OFFENSE UNDER THE TEXAS ENGINEERING PRACTICE ACT. THE RECORD COPY OF THIS DRAWING IS ON FILE AT THE OFFICES OF

HALFF ASSOCIATES, INC
1075 PAREDES LINE ROAD
SUITE B
BROWNSVILLE, TEXAS 78521
TBPE FIRM #F-312

B.P.U.B. ENGINEER

MARIE C. LEAL, P.E.

BROWNSVILLE PUBLIC UTILITIES BOARD

BPUB ENGINEER'S STATEMENT

THE ABOVE IDENTIFIED PLANS AND SPECIFICATIONS HAVE BEEN REVIEWED AND FOUND TO BE IN COMPLIANCE WITH THE APPLICABLE ENGINEERING PROVISIONS (WATER AND WASTEWATER IMPROVEMENTS) OF THE MUNICIPAL CODE OF THE CITY OF BROWNSVILLE AND BPUB WATER AND WASTEWATER STANDARD DETAILS. ISSUANCE OF THIS APPROVAL SHALL NOT BE CONSTRUED AS APPROVAL OF CONCEPT FOR THE CONSTRUCTION DETAILS OF THE PROPOSED IMPROVEMENTS AND SHALL NOT IN ANY WAY RELEASE THE DEVELOPER AND THE DESIGN ENGINEER FROM LIABILITY FOR THE ADEQUACY OF THE DESIGN NOR FROM LIABILITY CAUSED BY AND RESULTING FROM THE CONSTRUCTION OF IMPROVEMENTS AS PROVIDED IN THE ABOVE SPECIFIED DOCUMENTS.

_____ DATE _____
MARIE C. LEAL, P.E.
DIRECTOR OF SPECIAL PROJECTS AND WATER / WASTEWATER ENGINEERING,
PLANNING & OPERATIONS
FOR THE BROWNSVILLE PUBLIC UTILITIES BOARD

B.P.U.B. BOARD OF DIRECTORS

GERARDO MARTINEZ	CHAIR
ALONZO "AL" VILLARREAL	VICE CHAIR
DAISY ZAMORA, Ph.D.	SECRETARY/TREASURER
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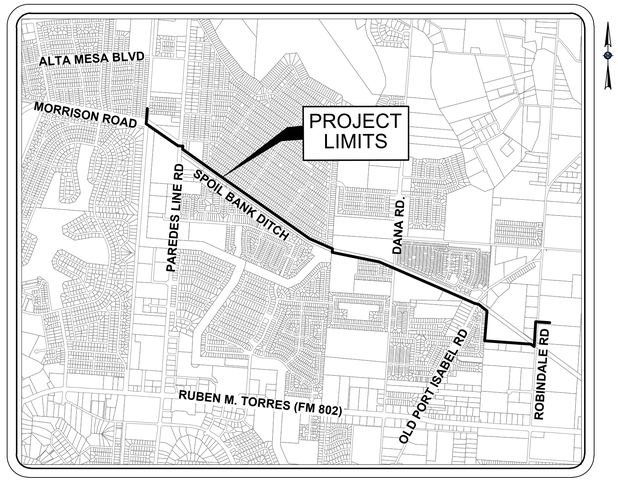
JOSEPH L. HOLLMANN, Ph.D.	MEMBER
MARTIN SARKIS	MEMBER
JOHN .F COWEN JR.	EX-OFFICIO MEMBER, ELECTED



LOCATION MAP
SCALE 1" = 2000'

SHEET INDEX

SHEET #	SHEET NAME
SITE	
1	COVER PAGE
2	GENERAL NOTES
3	GENERAL NOTES
4	PROJECT LAYOUT
5	KEY MAP
6	DIMENSIONAL CONTROL
PLAN & PROFILE-HIKE & BIKE TRAIL	
7	STA 127+00 TO STA 134+00 & STA 10+00 TO STA 19+00
PLAN & PROFILE-ALIGNMENT B	
8	STA 19+00 TO STA 28+00
9	STA 28+00 TO STA 43+00
10	STA 43+00 TO STA 61+00
11	STA 61+00 TO STA 76+00
12	STA 76+00 TO STA 94+50
13	STA 94+50 TO STA 111+00
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17	STA 10+00 TO 14+00
TIE-IN INSERTS	
18	TIE-IN INSERTS A
DETAILS	
19	WASTEWATER DETAILS
20	PAVING DETAILS
21	EROSION CONTROL DETAILS
STRUCTURAL PLANS	
S101	AERIAL CROSSING PLAN & PROFILE
S102	AERIAL CROSSING DETAILS
S103	AERIAL CROSSING DETAILS

PREPARED BY:

1075 PAREDES LINE RD., SUITE B
BROWNSVILLE, TEXAS 78521
TEL. (956) 303-7100
www.halff.com

AVO: 47277 DATE: FEBRUARY 2026

Know what's below. Call before you dig.

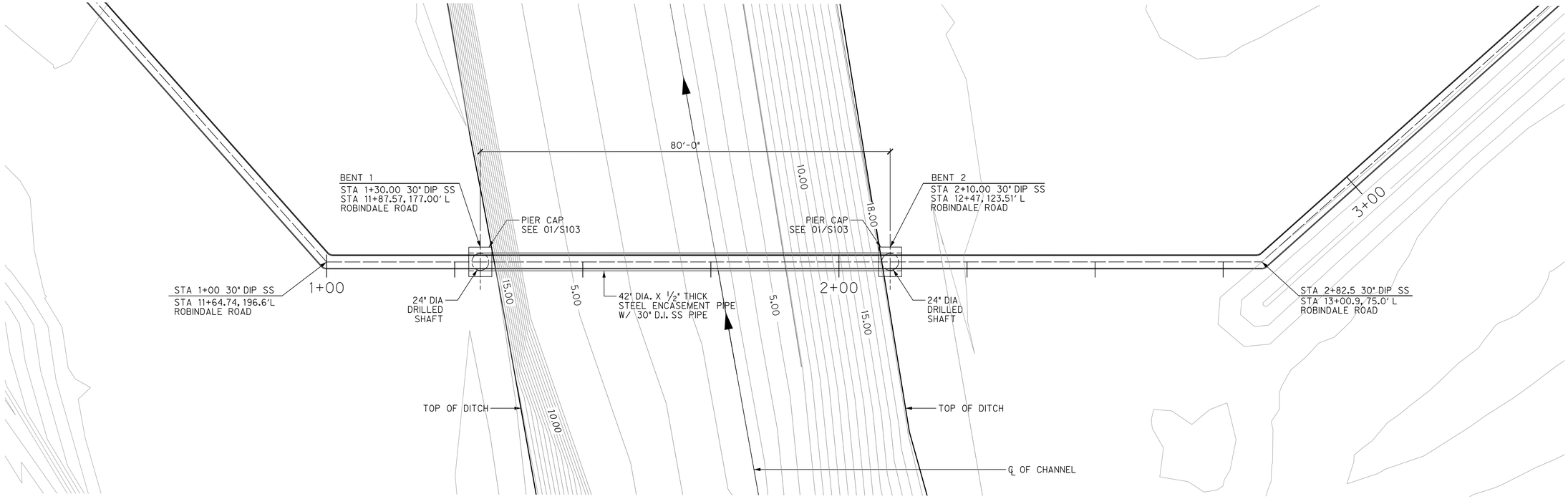
BROWNSVILLE P.U.B.
NORTH REGIONAL FORCE MAIN
PHASE 1
BROWNSVILLE, TEXAS

BROWNSVILLE PUBLIC UTILITIES BOARD

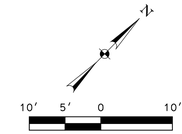
halff
1075 PAREDES LINE RD., SUITE B
BROWNSVILLE, TEXAS 78521
TEL. (956) 303-7100

REVISION NO.	DATE	DESCRIPTION

PROJECT NO.:	47277.001
ISSUED:	5/11/2026
DRAWN BY:	MH/ENH
CHECKED BY:	JWC
SCALE:	AS NOTED
SHEET TITLE:	COVER SHEET



01 S101 PLAN VIEW
SCALE = 1" = 10'-0"



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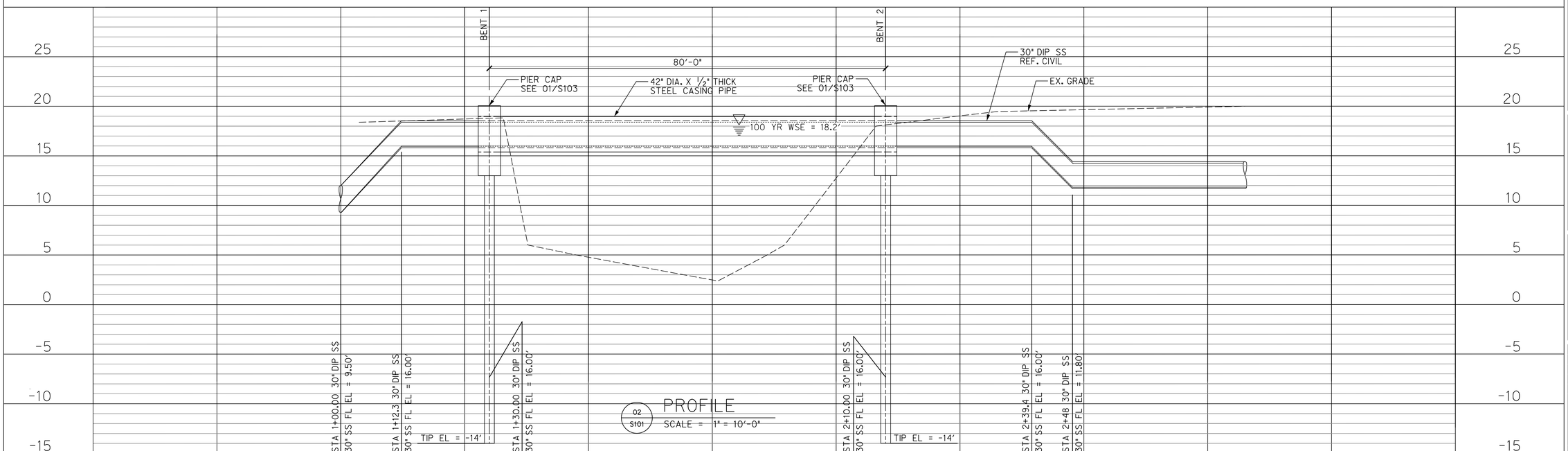
NOTE:
REFER S102 FOR GENERAL NOTES.



02 S101 PROFILE
SCALE = 1" = 10'-0"

BROWNSVILLE P.U.B.
NORTH REGIONAL FORCE MAIN
BROWNSVILLE, TEXAS

BROWNSVILLE PUBLIC UTILITIES BOARD

halff
11111 KATY FREEWAY, SUITE 8
BROOKHOLLOW TOWER II
HOUSTON, TEXAS 77079-2098
TEL: (956) 303-7100

REVISION

NO.	DATE	DESCRIPTION

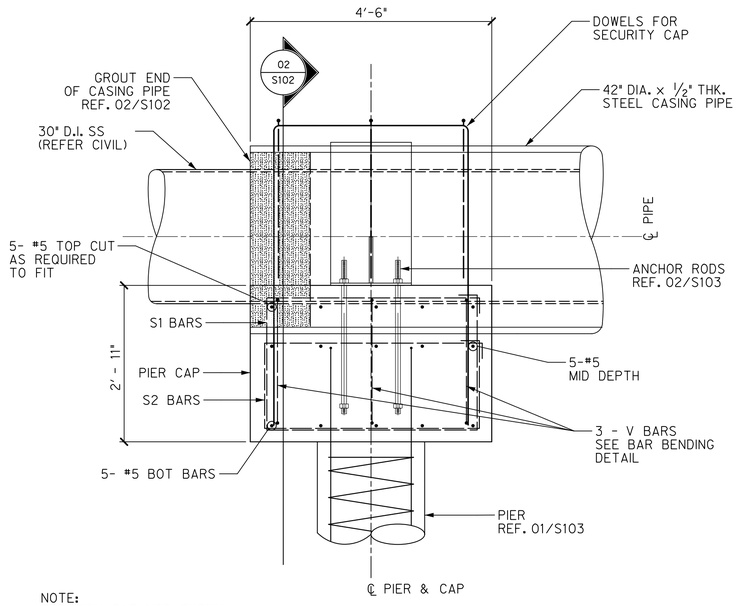
STATE OF TEXAS
JAMES C. VESTER
128858
LICENSED
PROFESSIONAL ENGINEER
9/22/2023
TBPE FIRM #F-312

PROJECT NO.:	47277.001
ISSUED:	9/22/2023
DRAWN BY:	JB
CHECKED BY:	JCV
SCALE:	AS NOTED

SHEET TITLE:
AERIAL CROSSING
PLAN AND PROFILE

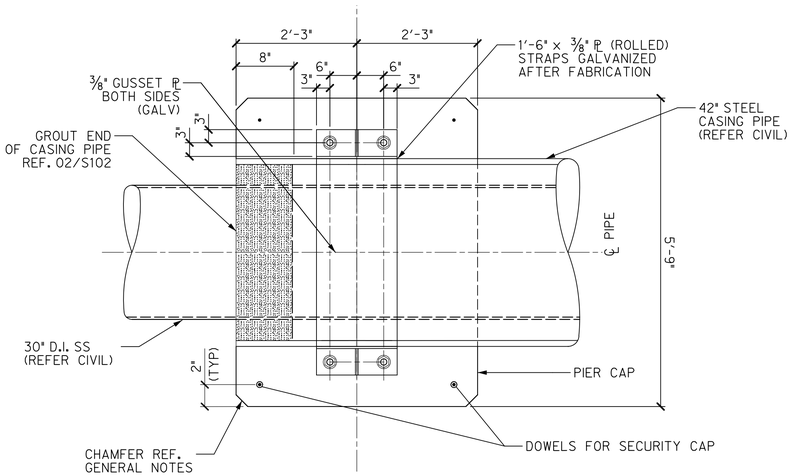
S101

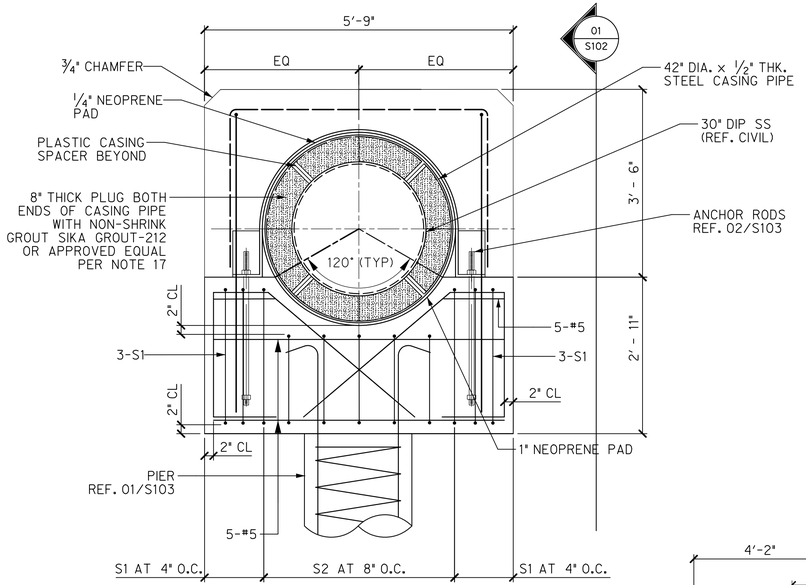
FILE NAME: A:\47000s\47277\001\CADD\Sheets\FTWC-XREF-24x36 BORDER.dwg DATE: August 25, 2023, TIME: 1:24 PM, USER: ahd979 AVO: 47277



NOTE:
SECURITY CAP NOT SHOWN
FOR CLARITY, REFER 03/S102
FOR SECURITY CAP INFO.

01 S102 PIER CAP DETAIL
SCALE = 3/4" = 1'-0"





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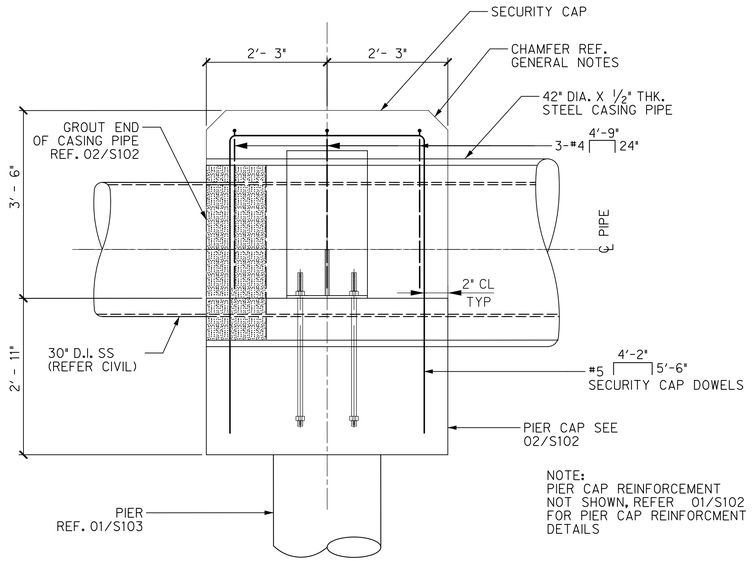

03 S102 SECURITY CAP DETAIL
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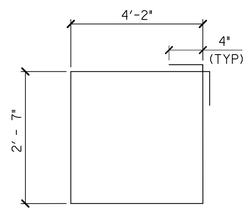
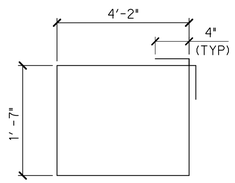
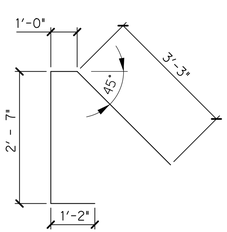


BARS S1 - #3



BARS S2 - #3



BARS V - #4

AERIAL CROSSING GENERAL NOTES:

1. CONSTRUCTION SHALL BE IN ACCORDANCE WITH THESE DRAWINGS AND THE 2014 TXDOT STANDARD SPECIFICATIONS FOR CONSTRUCTION AND MAINTENANCE OF HIGHWAYS, STREETS AND BRIDGES, AND SPECIFICATIONS SUBMITTED HEREIN.
2. CONCRETE FOR DRILLED SHAFTS SHALL BE CLASS "C" WITH A MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 3600 PSIPER TxDOT ITEM 416 WITH TEMPORARY CASING METHOD. ALL OTHER CONCRETE SHALL HAVE A MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 3000 PSI.
3. MIN. CLEAR COVER FOR REINFORCING SHALL BE 2". EXCEPT DRILLED SHAFTS (PIERS) SHALL BE 3".
4. REINFORCING STEEL SHALL CONFORM TO ASTM A615 GRADE 60.
5. THE CONTRACTOR SHALL MAINTAIN ADEQUATE DRAINAGE AT ALL TIMES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL STORM WATER CONTROL, EROSION CONTROL, PUMPING AND DEWATERING TO FACILITATE THE PROPOSED CONSTRUCTION. THIS WORK SHALL BE CONSIDERED INCIDENTAL AND SHALL NOT BE A SEPARATE PAY ITEM.
6. ALL EXPOSED CORNERS SHALL BE CHAMFERED 2" UNLESS OTHERWISE NOTED.
7. THE CONTRACTOR SHALL ENGAGE A REGISTERED SURVEYOR TO PERFORM SURVEYS, LAYOUTS AND MEASUREMENTS FOR PIER WORK. THIS INCLUDES LAYOUT WORK FOR EACH PIER'S ACTUAL FINAL LOCATION, PIER SHALL BE CONSTRUCTED WITHIN THE FOLLOWING CENTERLINE TOLERANCES:
   - o MAXIMUM PERMISSIBLE VARIATION OF LOCATION: NOT MORE THAN 1%.
   - o SHAFTS OUT OF PLUM: NOT MORE THAN 1% OR 2".
   - o CONCRETE CUT-OFF ELEVATION: PLUS 1" TO MINUS 2".
8. TEMPORARY STEEL CASING WILL BE REQUIRED DURING INSTALLATION OF THE DRILLED SHAFTS (AT THE CONTRACTOR'S EXPENSE) TO LIMIT GROUNDWATER SEEPAGE INTO THE SHAFT AND TO PREVENT THE WALLS OF THE SHAFT FROM CAVING OR SLOUGHING.
9. THE CONCRETE SHALL BE PLACED IN A MANNER TO PREVENT THE CONCRETE FROM STRIKING THE REINFORCING CAGE OR THE SIDES OF THE EXCAVATION. CONCRETE SHALL BE TREMIED TO THE BOTTOM OF THE EXCAVATION TO CONTROL THE MAXIMUM FREE FALL OF THE PLASTIC CONCRETE TO LESS THAN 10 FEET.
10. DRILLED SHAFT REINFORCING STEEL SHALL BE PLACED AS SOON AS POSSIBLE AFTER DRILLING COMPLETION. DRILLED SHAFTS SHALL NOT BE LEFT OPEN FOR MORE THAN EIGHT HOURS PRIOR TO CONCRETE PLACEMENT.
11. DRILLED SHAFT INSTALLATION OPERATIONS SHALL BE INSPECTED BY A QUALIFIED GEOTECHNICAL ENGINEER REPRESENTATIVE TO ASSURE COMPLIANCE WITH THE REQUIREMENTS OF THE SHAFT EXCAVATION, CASING INSTALLATION, SEEPAGE PREVENTION & CONCRETE PLACEMENT.
12. ALL DRILLING AND CONSTRUCTION OF DRILLED SHAFTS SHALL BE IN ACCORDANCE WITH THESE DRAWINGS, TXDOT ITEM 416 AND A GEOTECHNICAL REPORT BY MEG ENGINEERING DATED SEPTEMBER 6, 2023, PROJECT NO. 02-23-29122.
13. CONCRETE AND REINFORCING STEEL SHALL BE PLACED IMMEDIATELY AFTER THE EXCAVATION HAS BEEN COMPLETED AND INSPECTED BY THE GEOTECHNICAL ENGINEER OR HIS REPRESENTATIVE TO ASSURE COMPLIANCE WITH DESIGN ASSUMPTIONS AND TO VERIFY:
   - o THE BEARING STRATUM
   - o THE MINIMUM PENETRATION
   - o THE REMOVAL OF ALL SMEAR ZONES AND CUTTINGS
   - o THAT GROUNDWATER SEEPAGE IS CORRECTLY HANDLED
14. PROVIDE PIER BOLSTERS AND CENTERING DEVICES FOR PIER REINFORCEMENT BY PIERSEARCH, OR APPROVED EQUAL.
15. "MUSHROOMING" AT THE TOP OF PIERS IS PROHIBITED.
16. STEEL PIPE SHALL BE EITHER SPIRAL WELDED OR SMOOTH WALL SEAMLESS WITH A MINIMUM YIELD STRENGTH OF 35,000 PSI. COAL TAR EPOXY COATING SHALL BE APPLIED TO THE INTERIOR AND EXTERIOR SURFACES OF THE CASING PIPE.
17. CASING ENDS SHALL BE SEALED WITH GROUT AND SS PIPE SHALL BE SUPPORTED WITH CASING SPACERS. SPACERS SHALL BE PLACED ON THE SPIGOT END OF EACH SEGMENT. SUBSEQUENT SPACERS SHALL BE PLACED AT MAXIMUM 6 FEET INTERVALS.
18. CONTRACTOR SHALL FIELD LOCATE ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION OF DRILLED SHAFTS.

BROWNSVILLE P.U.B.
NORTH REGIONAL FORCE MAIN
BROWNSVILLE, TEXAS

BROWNSVILLE PUBLIC UTILITIES BOARD

halff
1975 PAREDES LINE RD., SUITE B
BROWNSVILLE, TEXAS 78520-5666
TEL. (956) 303-7100

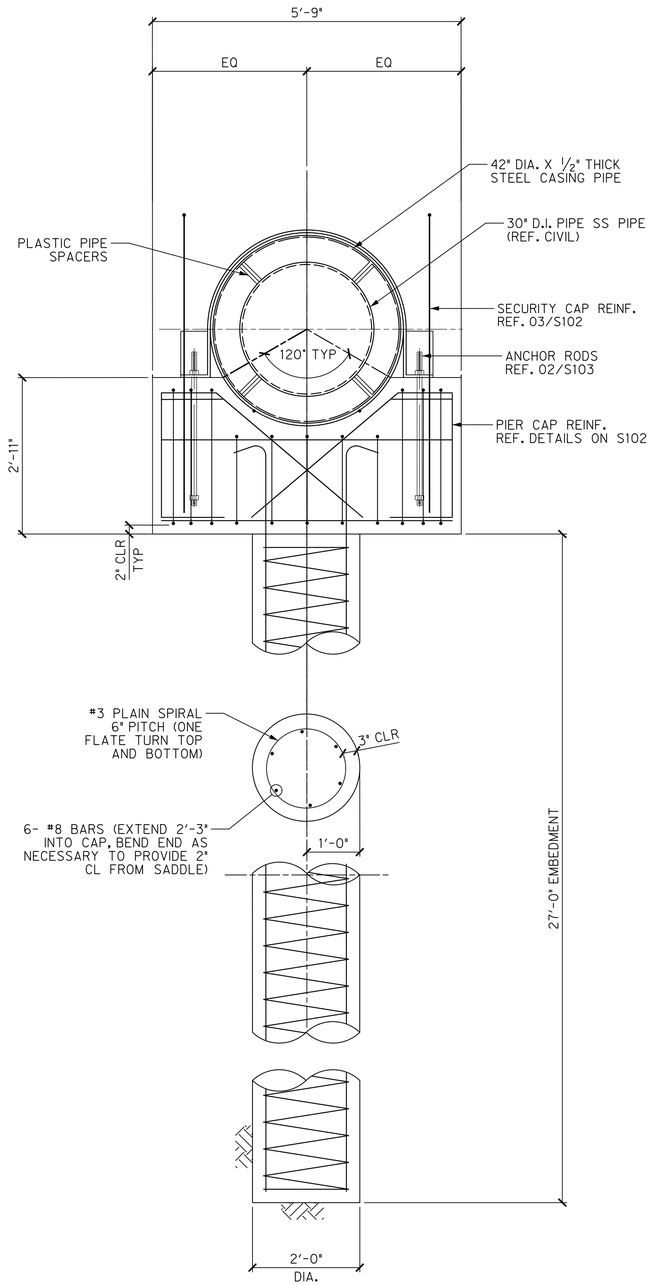
REVISION NO.	DATE	DESCRIPTION

JAMES C. VESTER
128858
LICENSED PROFESSIONAL ENGINEER
9/22/2023
TBPE FIRM #F-312

PROJECT NO.:	47277.001
ISSUED:	9/22/2023
DRAWN BY:	JB
CHECKED BY:	JCV
SCALE:	AS NOTED

SHEET TITLE:
AERIAL CROSSING DETAILS

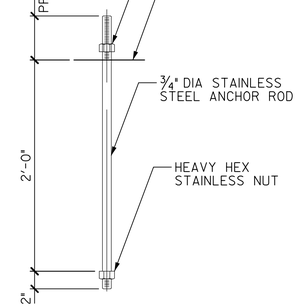
S102



01 S103

AERIAL CROSSING BENT DETAIL

SCALE = 3/4" = 1'-0"



ANCHOR RODS SHALL BE ASTM F1554 GRADE 36

02 S103

ANCHOR ROD DETAIL

SCALE = NTS

BROWNSVILLE P.U.B.
NORTH REGIONAL FORCE MAIN
BROWNSVILLE, TEXAS

BROWNSVILLE PUBLIC UTILITIES BOARD

halff
1975 PAREDES LINE RD., SUITE B
BROWNSVILLE, TEXAS 78521-0566
TEL. (956) 303-7100

REVISION NO.	DATE	DESCRIPTION

JAMES C. VESTER
128858
LICENSED PROFESSIONAL ENGINEER
STATE OF TEXAS
9/22/2023
TBPE FIRM #F-312

PROJECT NO.:	47277.001
ISSUED:	9/22/2023
DRAWN BY:	JB
CHECKED BY:	JCV
SCALE:	AS NOTED

SHEET TITLE:
AERIAL CROSSING DETAILS

S103

MEG GEOTECHNICAL ENGINEERING REPORT

PROPOSED
BROWNSVILLE NORTH REGIONAL FORCE MAIN

BROWNSVILLE, CAMERON COUNTY, TEXAS

Geotechnical Engineering • Construction Materials Engineering & Testing
Environmental • Consulting • Forensics

GEOTECHNICAL ENGINEERING REPORT
FOUNDATION RECOMMENDATIONS
PROPOSED BROWNSVILLE NORTH REGIONAL FORCE MAIN
BROWNSVILLE, CAMERON COUNTY, TEXAS

Prepared For
Mr. David Ramirez, P.E.
Brownsville Public Utilities Board

MEG Report No. 02-22-29160

January 11, 2023

MILLENNIUM ENGINEERS GROUP, INC.
TBPE FIRM NO. F-3913
5804 N. GUMWOOD AVENUE
PHARR, TEXAS 78577
TEL:956-702-8500
FAX:956-702-8140
WWW.MEGENGINEERS.COM

January 11, 2023

David Ramirez, P.E.
Brownsville Public Utilities Board
1425 Robinhood Dr.
Brownsville, TX 78521
(956)983-6348
daramirez@brownsville-pub.com

Subject: **Geotechnical Engineering Report**
MEG Report No. 02-22-29160
Foundation Recommendations
Proposed Brownsville North Regional Force Main
Brownsville, Cameron County, Texas

Dear Mr. Ramirez (CLIENT):

Millennium Engineers Group, Inc. is pleased to submit the enclosed geotechnical engineering report that was prepared for the above subject project. This report addresses the procedures and findings of our geotechnical engineering study. Our recommendations should be incorporated into the design and construction documents for the proposed development.

We want to emphasize the importance that all our recommendations presented in this report and/or addendums to this report be followed. We look forward to continuing our involvement in the project by providing construction monitoring in accordance with the report recommendations and materials testing services during construction. We strongly recommend that we be a part of the preconstruction meeting to address any specific issues that are pertinent to this project.

Thank you for the opportunity to be of service to you in this phase of the project and we would like the opportunity to assist you in the upcoming phases of the project. If you have any questions, please contact our office at the address, telephone, fax or electronic address listed below.

Cordially,
Millennium Engineers Group, Inc.
TBPE Firm No. F-3913

Amos Emerson
Geotechnical Department Manager

Quyet Thang Pham, Ph.D., P.E.
Senior Geotechnical Engineer

The seal appearing on this document was authorized by Quyet Thang Pham, P.E. 131836 on January 11, 2023. Alteration of a sealed document without proper notification to the responsible engineer is an offence under the Texas Engineering Practice Act

Cc: 1 Original and PDF Document

TABLE OF CONTENTS

APPENDIX

1.0 INTRODUCTION

Millennium Engineers Group, Inc. (MEG) has completed and is pleased to submit this document that presents our findings as a result of a geotechnical engineering study of this project to our client. The project site begins approximately 300 feet to the south of the intersection of Emilia Ln and Old Alice Road and extends approximately 8.19 miles ending at about 2700 feet south from the intersection of Morrison Road and Robindale Road in Brownsville, Cameron County, Texas. The project location is shown on the Project Location Map, found in the Appendix section of this report. This report briefly describes the procedures utilized during this study and presents our findings along with our recommendation, for foundation design and construction considerations.

Our scope of services for the project was outlined in MEG proposal No. 02-22-158GR, dated September 07, 2022 and approved by Mr. David Ramirez, P.E. on October 14, 2022.

2.0 PROJECT DESCRIPTION

It is our understanding that the proposed site will accommodate improvements to existing force mains. It is also our understanding that the site of the proposed force main improvements will be approximately 8.19 miles in length. The site construction for the proposed structure is anticipated to be on a slab-on-grade or on-fill foundation provided expansive, soil-related movements will not impair the performance of the structure.

3.0 SCOPE AND LIMITATIONS OF STUDY

This engineering report has been prepared in accordance with accepted geotechnical engineering practices currently exercised by geotechnical engineers in this area. No warranty, expressed or implied, is made or intended. This report is intended for the exclusive use by the client and client's authorized project team for use in preparing design and construction documents for this project only. This report may only be reproduced in its entirety for inclusion in construction documents. This report in its entirety shall not be reproduced or used for any other purposes without the written consent of our firm. This report may not contain sufficient information for purposes of other parties or other uses and is not intended for use in determining construction means and methods.

The recommendations presented in this report are based on data obtained from the soil borings drilled at this site and our understanding of the project information provided to us by our client and other project team members, and the assumption that site grading will result in only minor changes in the existing topography. Subsurface soil conditions have been observed and interpreted at the boring locations only.

This report may not reflect the actual variations of the subsurface conditions across the subject site. It is important to understand that variations may occur due to real geologic conditions or previous uses of the site. The nature and extent of variations across the subject site may not become evident until specific design locations are identified and/or construction commences. The construction process itself may also alter subsurface

conditions. If variations appear evident at the time during the design phase and/or construction phase, we should be notified immediately to determine if our opinions, conclusions and recommendations need to be reevaluated. It may be necessary to perform additional field and laboratory tests and engineering analyses to establish the engineering impact of such variations. These services are additional and are not a part of our project scope.

The engineering report was conducted for the proposed project site described in this report. The conclusions and recommendations contained in this report are not valid for any other project sites. If the project information described in this report is incorrect, is altered, or if new information becomes available, we should be retained to review and modify our recommendations. These services are additional and are not a part of our project scope.

Our scope of services was limited to the proposed work described in this report, and did not address other items or areas. The scope of our geotechnical engineering study does not include environmental assessment of the air, soil, rock or water conditions on or adjacent to the site. No environmental opinions are presented in this report. If the client is concerned with environmental risk at this project site, the client should perform an environmental site assessment.

If final grade elevations are significantly different from existing grades at the time of our field activities (more than plus or minus one (1) foot), our office should be informed about these changes. If desired, we will reexamine our analyses and make supplemental recommendations.

4.0 FIELD EXPLORATION PROCEDURES

Subsurface conditions at the subject site were evaluated by thirteen (13) 20-foot soil borings and five (5) 10-foot soil borings. The Borings were drilled at the locations shown on the Borings Location Map, found in the Appendix section of this report. This location is approximate and distances were measured using a measuring wheel, tape, angles, and/or pacing from existing references. The structural soil borings were drilled in general accordance with American Society of Testing Materials (ASTM) D 420 procedures.

As part of our sampling procedures, the samples were collected in general conformance with ASTM D 1586 procedures. Representative portions of the samples were sealed in containers to reduce moisture loss, identified, packaged, and transported to our laboratory for subsequent testing. In the laboratory, each sample was evaluated and visually classified by a member of our Geotechnical Engineering staff. The geotechnical engineering properties of the strata were evaluated by a series of laboratory tests. The results of the laboratory and field-testing are tabulated on the boring logs and Summary of Soil Sample Analyses which are found in the Attachments section of this report.

Standard penetration test results are noted on the boring logs as blows per 12 inches of penetration. Three 6 inch increments are performed for each standard penetration test. The sum of the blows for the final two 6 inch increments is considered the “standard

penetration resistance value" or "N-value." Where hard or very dense materials were encountered, the tests are terminated as follows: (1) when a total of 50 blows have been applied in any of the 6 inch increments, or (2) when a total of 100 blows have been applied, or (3) when there is no observed advance of the sampler in the application of 10 successive blows. The boring logs in the case of hard or very dense materials will be noted as follows: 50/3", where 50 is the number of blows applied in 3 inches of penetration, or 100/7½" where 100 is the number of blows applied in a total of 7 ½ inches of penetration, or 10/0", where 10 is the number of blows applied in 0 inches of penetration.

Samples will be retained in our laboratory for 30 days after submittal of this report. Other arrangements may be provided at the request of the Client.

5.0 GENERAL SITE CONDITIONS

5.1 Site Description

The project site begins approximately 300 feet to the south of the intersection of Emilia Ln and Old Alice Road and extends approximately 8.19 miles ending at about 2700 feet south from the intersection of Morrison Road and Robindale Road in Brownsville, Cameron County, Texas. The project location is shown on the Project Location Map, found in the Appendix section of this report. At the time of our field operations, the subject site can be described as an undeveloped tract of land. The general topography of the site is relatively flat sloping down to the east with a visually estimated vertical relief of less than 3 feet. Surface drainage is visually estimated to be poor to fair.

5.2 Site Geology

According to the Soil Survey of Cameron County, Texas, published by the United States Department of Agriculture – Soil Conservation Service, the project site appears to be located within the Benito, Cameron, Chargo, Laredo, and Lomalta soil association.

- The Benito series consists of deep, poorly drained, very slowly permeable soils that formed in calcareous alluvial sediments. These soils are on nearly level terraces above normal overflow. Slopes are less than 1 percent. The corresponding soil symbol is BE, Benito clay, ponded.
- The Cameron series consists of deep, moderately well drained, moderately slowly permeable soils that formed in alluvial sediments. These soils are in nearly level bottomlands. Slopes are less than 1 percent. The corresponding soil symbol is CF, Cameron silty clay, saline.
- The Chargo series consists of very deep, moderately well drained, slowly permeable soils that formed in calcareous and saline clayey alluvial sediments. These nearly level soils are on ancient stream terraces. Slopes are less than 1 percent. The corresponding soil symbol is CH, Chargo silty clay.
- The Laredo series consists of very deep, well drained, moderately permeable soils that formed in calcareous, silty alluvium derived from mixed sources. These nearly level to very gently sloping soils occur on rare flood plains or low Holocene stream

terraces. Slope ranges from 0 to 3 percent. The corresponding soil symbol is LC, Laredo silty clay loam, saline.

- The Lomalta series consists of very deep, poorly drained, very slowly permeable soils that formed in clayey deltaic sediments. These soils are on nearly level coastal plains slightly above sea level. Slopes are less than 1 percent. The corresponding soil symbol is LM, Lomalta clay, 0 to 1 percent slopes, occasionally ponded.

5.3 Subsurface Conditions

On the basis of our borings, three (3) generalized strata that possess similar physical and engineering characteristics can describe the subsurface stratigraphy at this site. Table 5.1 summarizes the approximate strata range in our boring logs. These were prepared by visual classification and were aided by laboratory analyses of selected soil samples. The lines designating the interfaces between strata on the boring logs represent approximate boundaries. Transitions between strata may be gradual details for each of the borings can be found on the boring logs in the appendix of this report.

Table 5.1.a. Approximate Subsurface Stratigraphy Depths Segment 1: (B-1, B-4, B-5, B-7, B-14, B-15, B-16, B-17 & B-18 Soil Stratums)

Stratum	Range in Depth, ft[1]	Stratum Description[1]
I[2]	0 – 20	fat CLAY, brown, dry to wet, soft to hard
II[3]	0 – 6	fat CLAY, brown, dry to wet, soft to hard
III[4]	6 – 20	fat CLAY w/ sand, brown, moist to wet, soft to stiff

Note 1: The stratum thickness and depths to strata interfaces are approximate. Our measurements are rounded off to the nearest foot increment and are referenced from ground surface at the time of our drilling activities. Subsurface conditions may vary between the boring locations.
Note 2: Borings B-1, B-14, B-16 & B-17 was only recorded to 10 feet below natural ground.
Note 3: Stratum II is only present in borings B-7 & B-15.
Note 4: Stratum III is only present in borings B-7 & B-15.

Table 5.1.b. Approximate Subsurface Stratigraphy Depths Segment 2: (B-2, B-3, B-8, B-9 & B-19 Soil Stratums)

Stratum	Range in Depth, ft[1]	Stratum Description[1]
I[2]	0 – 20	fat CLAY to lean CLAY, brown, dry to wet, soft to very stiff

Note 1: The stratum thickness and depths to strata interfaces are approximate. Our measurements are rounded off to the nearest foot increment and are referenced from ground surface at the time of our drilling activities. Subsurface conditions may vary between the boring locations.
Note 2: Boring B-2 was only recorded to 10 feet below natural ground.

Table 5.1.c. Approximate Subsurface Stratigraphy Depths Segment 3: (B-10, B-11, B12 & B-13 Soil Stratums)

Stratum	Range in Depth, ft[1]	Stratum Description[1]
I	0 – 4	fat CLAY, brown, dry to moist, stiff to very stiff
II[2]	4 – 20	lean CLAY, to clayey SAND, dry to wet, soft to stiff

Note 1: The stratum thickness and depths to strata interfaces are approximate. Our measurements are rounded off to the nearest foot increment and are referenced from ground surface at the time of our drilling activities. Subsurface conditions may vary between the boring locations.

Note 2: Boring B-11 consisted only of Stratum II from 0 -20 feet below natural ground.

Table 5.2. Approximate Bore Coordinates and Elevations

Boring No.	Coordinates		Elevation, Ft.
	Latitude	Longitude	
B-1	25°59'58.00"N	97°31'7.60"W	23
B-2	26° 0'24.62"N	97°30'51.94"W	24
B-3	26° 0'35.88"N	97°30'49.42"W	22
B-4	26° 0'31.37"N	97°30'9.73"W	19
B-5	26° 0'26.50"N	97°30'10.70"W	25
B-6	BORE INACCESSIBLE		
B-7	26° 0'24.25"N	97°29'20.36"W	20
B-8	26° 0'22.99"N	97°29'7.67"W	17
B-9	25°59'31.93"N	97°29'10.62"W	25
B-10	25°59'28.18"N	97°29'10.94"W	25
B-11	25°59'3.35"N	97°29'13.21"W	27
B-12	25°58'59.16"N	97°29'13.55"W	27
B-13	25°58'20.37"N	97°29'17.06"W	21
B-14	25°58'12.38"N	97°29'5.71"W	20
B-15	25°57'43.02"N	97°28'21.17"W	19
B-16	25°57'38.19"N	97°28'0.14"W	12
B-17	25°57'28.69"N	97°27'37.46"W	16
B-18	25°57'18.58"N	97°27'33.04"W	16
B-19	25°57'16.72"N	97°27'19.47"W	16

5.4 Groundwater Conditions

The dry auger drilling technique was used to complete the soil borings in an attempt to observe the presence of subsurface water. During our drilling operations we encountered the groundwater table to be at approximately six (6) to eight (8) feet below natural ground elevation for short term conditions. Moisture content test exhibited high moisture content at a depth of two (2) feet to eight (8) below natural ground elevation**.** Table 5.2 summarizes the approximate groundwater and cave in depths measured in our explorations. It should be noted that the groundwater level measurements recorded are accurate only for the specific dates on which measurement were obtained and does not show fluctuations throughout the year.

Fluctuations in Groundwater levels are influenced by variations in rainfall and surface water run-off from season to season. The construction process itself may also cause variations in the groundwater level. If the subsurface water elevation is critical to the construction process the contractor should check the subsurface water conditions just prior to construction excavation activities.

Table 5.3. Approximate Groundwater and Cave-in Depths.

Boring No.	Depth to Subsurface Water, Ft[1]		Depth to Cave-In, Ft[1]	
	Time of Drilling	24 Hr. Reading	Time of Drilling	24 Hr. Reading
B-1	10	6	10	7
B-2	9	6	10	7
B-3	11	8	12	9
B-4	10	6	11	7
B-5	10	10	11	11
B-6	BORE INACCESSIBLE			
B-7	11	6	12	7
B-8	10	8	11	9
B-9	11	6	12	7
B-10	9	8	10	9
B-11	9	8	10	9
B-12	8	6	10	7
B-13	11	6	12	7
B-14	10	6	10	7
B-15	9	6	10	7
B-16	10	6	10	7
B-17	None	6	8	7
B-18	9	6	10	7
B-19	13	6	14	7

Note 1: Subsurface water levels and cave-in depths have been rounded to the nearest foot.

Based on the findings in our borings and on our experience in this region, we believe that groundwater seepage will be encountered during site earthwork activities. If groundwater seepage is encountered during site earthwork activities, it may be controlled using temporary earthen berms and/or conventional sump-and-pump dewatering methods.

6.0 LABORATORY TESTING ANALYSIS

6.1 General

The analyses presented in this report are applicable specifically to the proposed project. The data gathered from both the field and laboratory testing programs on soil samples obtained from the borings was utilized to establish geotechnical engineering parameters for the proposed project.

6.2 Moisture Content Testing

The moisture content of a soil is defined as the ratio of the weight of the water in the sample to the dry weight of the soil sample expressed as a percentage. The moisture contents for the samples obtained as part of our geotechnical study were performed in accordance with ASTM D2216. The results varied from eight (8) percent to thirty-seven (37) percent. The boring and corresponding soil samples exhibited dry to saturated field moisture conditions. A list of all the moisture contents by corresponding depth can be found on the boring log.

6.3 Plasticity Index Testing

The Plasticity Index (PI) is known as the difference between the liquid limit and the plastic limit of a soil. These limits are commonly referred to as the Atterberg limits, which describe the consistency of soils with respect to their varying moisture contents. The liquid limit is defined as the moisture content at which soil begins to transition from a plastic to a liquid state, and begins to behave as a liquid material. The plastic limit refers to the water content of a soil at the point of transition from a semisolid to a plastic state where soil starts to exhibit plastic behavior. The plasticity index testing performed in accordance with ASTM D4318 shows the range in which a soil acts in a plastic state. Plasticity Index values for the soils samples performed for this report were found to have a value of two (2) percent, with low to moderate plasticity to seventy (70) percent with a high plasticity rate.

6.4 Particle Size Analysis Testing (Determination of Fines Content)

Standard grain size analysis is used to determine the relative proportions of different grain sizes as they are distributed along a range of different sized sieves. The minus 200 sieve analysis is used commonly as a tool for soil classification and identification using the Unified Soil Classification System. Results for this test are reported as a percentage of soil passing the No. 200 sieve, which has openings 0.075mm wide. This test is also used to determine the suitability of soil for construction purposes and to estimate probable seepage through soils. Generally a %- 200 less than 50% indicates a granular non-cohesive to cohesive soil with large amounts of varying sized grains in the soil composition having high seepage potential. Sieve analysis testing was performed in accordance with ASTM D1140. The % -200 soil values for the samples collected ranged from 29% passing (non-cohesive coarse grained materials such as sands) to 99% passing (cohesive fine grained materials such as clays)

7.0 ENGINEERING ANALYSIS

7.1 General

The following analysis and recommendations presented in this report are based upon the data obtained in our field and laboratory programs, project information provided to us and our experience with similar subsurface and site conditions.

Geotechnical and structural engineers in this general area consider soil movements or Potential Vertical Rise (PVR) of approximately one (1) inch or less to be within acceptable structural design tolerances for most structures but may be different depending on structure use and the desired performance of the foundation. Therefore, movements of the underlying soils are not eliminated and thus one should expect a slab foundation structure to exhibit differential vertical movements. However, structural engineers design slab foundations for the expected magnitude of soil movements without failure of the structure. More stringent soil movement criteria may be established but the owner should consider the exponential increase in cost required to design and construct a structure for such soil movements. Data obtained in this study indicate that the soils at this site have strength characteristics capable of supporting the foundation and structure if designed appropriately. Stratum I is composed of sandy lean clay and has a moderate potential to exhibit volumetric changes. Stratum II is composed of fat clay with sand and has a high potential to exhibit volumetric changes. The potential for soil volumetric changes is dependent on variations in moisture contents of the underlying soils.

7.2 Soil-Related Movements

The anticipated ground movements due to swelling of the underlying soils at this site were estimated for slab foundation construction using the Texas Department of Transportation (TxDOT) procedures of test method TEX-124-E for determining Potential Vertical Rise (PVR). A PVR value of three (3) inches to five and three quarter (5 ¾) inches was estimated for the stratigraphic conditions encountered in our subsurface borings. A surcharge of 1 pound per square inch for the concrete slab, an active zone of 15 feet, and dry subsurface moisture conditions were assumed in estimating the above PVR values.

7.3 Excavation, Sloping and Benching Considerations

The soils encountered in the borings can easily be excavated using conventional earthwork equipment. No major hard soil and/or rock units were encountered in the borings through completion depth. In the case that excavations occur through granular soil or submerged soils it will be necessary to either slope the excavation sidewalls or provide temporary bracing to control excavation wall instability.

The side slopes of excavations through the overburden soils should be made in such a manner to provide for their stability during construction. Pipe lines or other facilities which are constructed prior to or during the currently proposed construction and which require excavation should be protected from loss of end bearing or lateral support.

Temporary construction slopes and/or permanent embankment slopes should be protected from surface runoff water. Site grading should be designed to allow drainage at planned areas where erosion protection is provided instead of allowing surface water to flow down unprotected slopes.

Permanent slopes at the site should be as flat as practical to reduce creep and occurrence of shallow slides. The following slope angles are recommended as maximums. The presented angles refer to the total height of a slope. Site improvement should be

maintained away from the top of the slope to reduce the possibility of damage due to creep or shallow slides.

Table 7.1. Slopes Angles Requirements

Height (ft.)	Horizontal to vertical
0 – 3	1:1
3 – 6	2:1
6 – 9	3:1
>9	4:1

The contractor or persons doing the trenching should adhere to the current Occupational Health and Safety Administration (OSHA) guidelines on trench excavation safety and protection measures. Other industry standards may be applicable. The collection of specific geotechnical data and development of a plan for trench safety, sloping, benching or various types of temporary shoring, is beyond the scope of this study.

7.4 Benching and Keying Recommendations

Benching

Benches shall be excavated per Figure 6.1 into the existing slope to allow for proper compaction. Bench widths shall be a minimum of 5 feet in width. Proposed slopes shall be no greater than 1 unit vertical in 5 units horizontal (20% slope). Benches shall be spaced consecutively. Bench heights shall not exceed the lesser of one-half the bench width, or 10 feet. Placement of the soils shall be conditioned and compacted in accordance with the select fill recommendations of the report.

Keying

Benches shall have a key at the toe of the slope where the slope height exceeds 5 feet or the slope is greater than 1 unit vertical in 5 units horizontal (20% slope. The key shall be a minimum depth of 2 feet and a length not less than 10 feet.

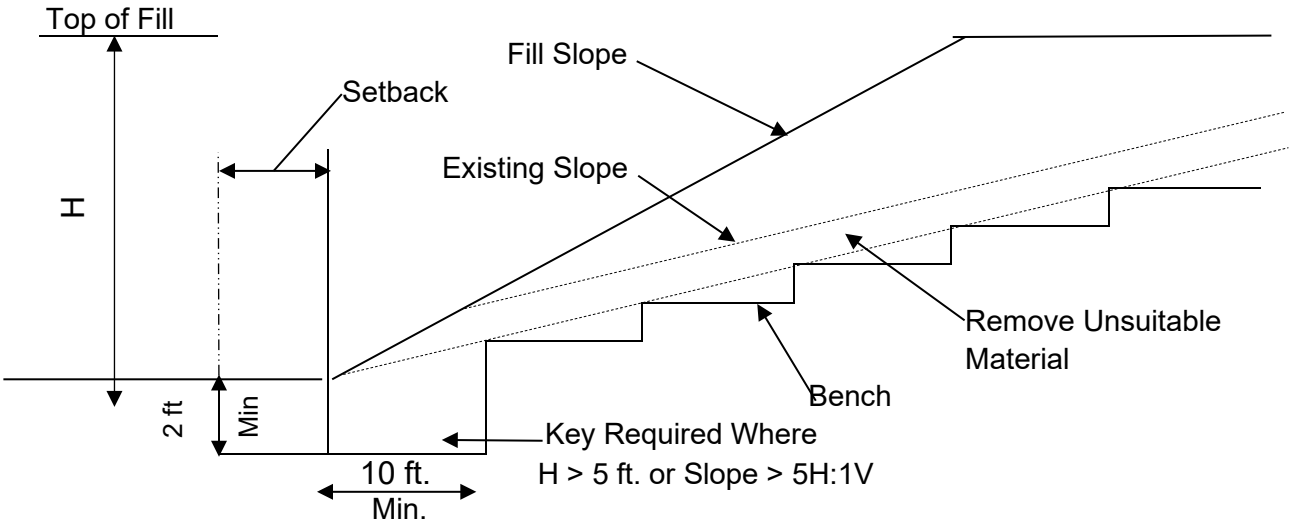


Figure 6.1 Benching Detail

Setbacks

General: Excavation and fill slopes shall be set back from the site boundary in accordance with this section. Setback dimensions shall be measured horizontally, and shall be perpendicular to the site boundary.

Top of excavation slope: The top of excavation slopes shall be set back from the site boundary not less than one-fifth the vertical height of the slope, but not less than 2 feet and need not to exceed 10 feet.

Toe of fill slope: The toe of fill slopes shall be set back from the site boundary not less than one-half the vertical height of the slope, but not less than 2 feet but need not exceed 20 feet.

7.5 Lateral Earth Pressures

Presented below are at-rest, active and passive earth pressure coefficients for various backfill types adjacent to below-grade walls or site retaining walls. At-rest earth pressures are recommended in cases where little wall yield is expected (such as structural below-grade walls). Active earth pressures may be utilized in cases where the walls can exhibit a certain degree of horizontal movements (such as cantilevered retaining walls).

Table 7.2. Earth Pressures

Backfill Type	Estimated Total Unit Weight (pcf)	Angle of Internal Friction Ø, deg	Active Condition		Passive Condition		At rest Condition	
			Earth Pressure Coefficient K_a	Equivalent Fluid Density (pcf)	Earth Pressure Coefficient K_p	Equivalent Fluid Density (pcf)	Earth Pressure Coefficient K_o	Equivalent Fluid Density (pcf)
Washed Gravel	135	33	0.29	40	3.39	460	0.45	60
Crushed Limestone	145	38	0.24	35	4.20	610	0.38	55
Clean Sand	120	30	0.33	40	3.00	360	0.50	60
Pit Run Clayey Gravels or Sands	135	31	0.32	45	3.12	425	0.48	65
On-Site Clays	120	25	0.41	50	2.46	295	0.58	70
On-Site Clayey Sand	115	30	0.33	38	3.00	345	0.50	58
Compacted On-Site Clayey Sand	125	41	0.21	26	4.76	595	0.34	43
Compacted On-Site Clays	125	30	0.33	42	3.00	375	0.50	63

The above values do not include a hydrostatic or ground-level surcharge component. To prevent hydrostatic pressure build-up, retaining walls should incorporate functional drainage (via free-draining aggregate or manufactured drainage mats) within the backfill zone. The effect of surcharge loads, where applicable, should be incorporated into wall pressure diagrams by adding a uniform horizontal pressure component equal to the applicable lateral earth pressure coefficient times the surcharge load, applied to the full height of the wall. The structure walls should be designed for hydrostatic pressures if drainage cannot be provided. Ports for release of hydrostatic pressure need to be provided during construction.

The compactive effort should be controlled during backfill operations adjacent to walls. Over compaction can produced lateral earth pressures in excess of at-rest magnitudes. Compaction levels adjacent to walls should be maintained between 95 and 100 percent of standard proctor (ASTM D 698) maximum dry density.

8.0 PROJECT REVIEW AND QUALITY CONTROL

Each project site is unique and it is important that the appropriate design data, construction drawings, specifications, change orders and related documents be reviewed by the respective design and construction professionals participating in this project. The performance of foundations, construction building pads and/or parking areas for this

project will depend on correct interpretation of our geotechnical engineering report and proper compliance of and adherence to our geotechnical recommendations and to the construction drawings and specifications.

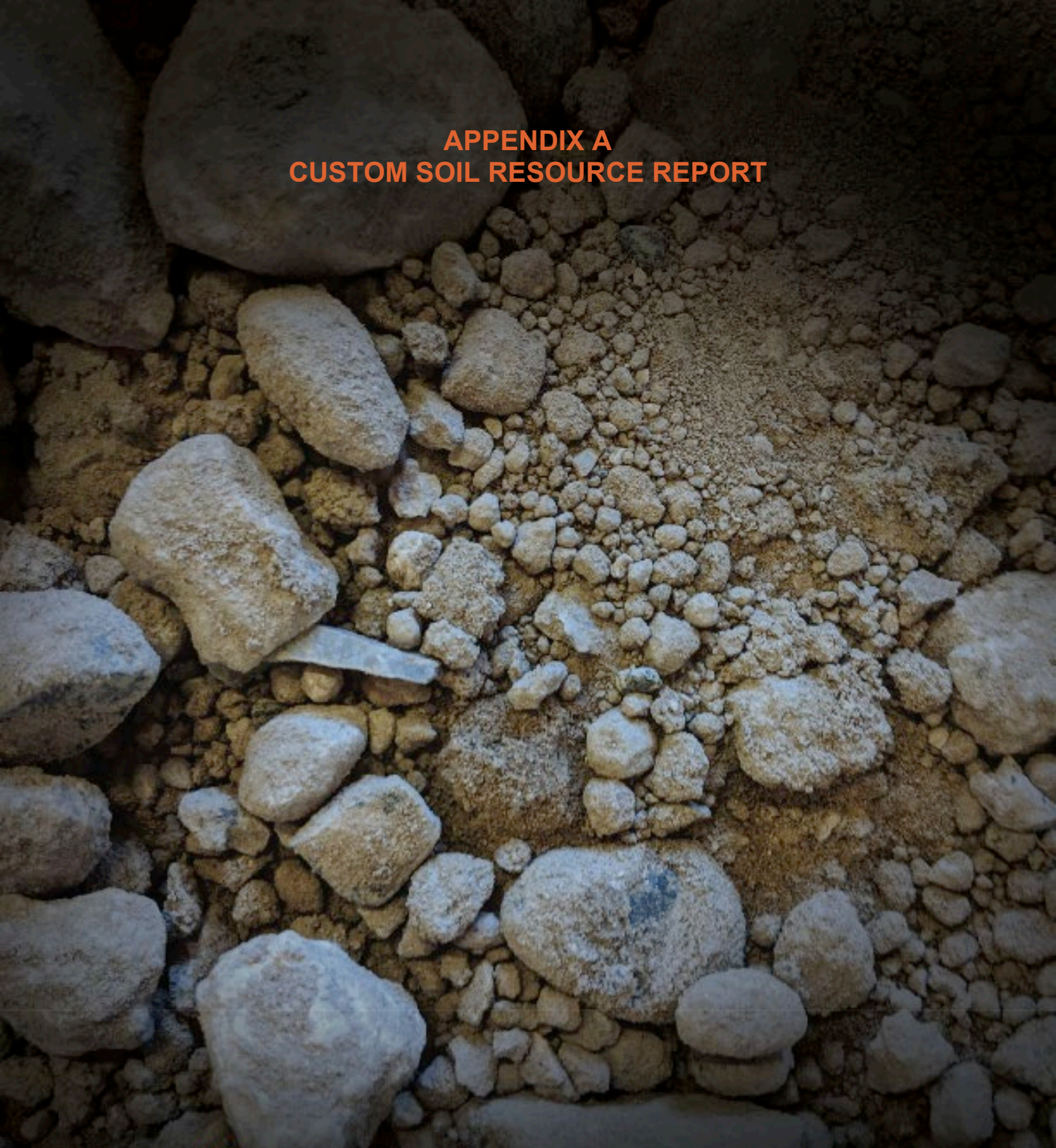
It is important that **MEG** be provided the opportunity to review the final design and construction documents to check that our geotechnical recommendations are properly interpreted and incorporated in the design and construction documents. We cannot be responsible for misinterpretations of our geotechnical recommendations if we have not had the opportunity to review these documents. This review is an additional service and not part of our project scope.

MEG should be retained to provide construction materials testing and observation services during all phases of the construction process of this project. As the Geotechnical Engineer of Record, it is important to let our technical personnel provide these services to make certain that our recommendations are interpreted properly and to ensure that actual field conditions are those described in our geotechnical report. Since our personnel are familiar with this project, **MEG**'s participation during the construction phase of this project would help mitigate any problems resulting from variations or anomalies in subsurface conditions, which are among the most prevalent on construction projects and often lead to delays, changes, costs overruns, and disputes. If the client does not follow all of our recommendations presented in this report and/or addendums to this report, the client assumes the responsibility and liability of such actions and will hold our firm harmless and without responsibility and liability for client's actions.

A construction testing frequency plan and budget needs to be developed for the required construction materials engineering and testing services for this project. Before construction, we recommend that **MEG**, the project design team members and the project general contractor meet and jointly develop the testing plan and budget, as well as review the testing specifications as it pertains to this project. **A failure to implement a complete testing plan will negate the recommendations provided in this report.**

MEG looks forward to the opportunity to provide continued support on this project.

APPENDIX A
CUSTOM SOIL RESOURCE REPORT



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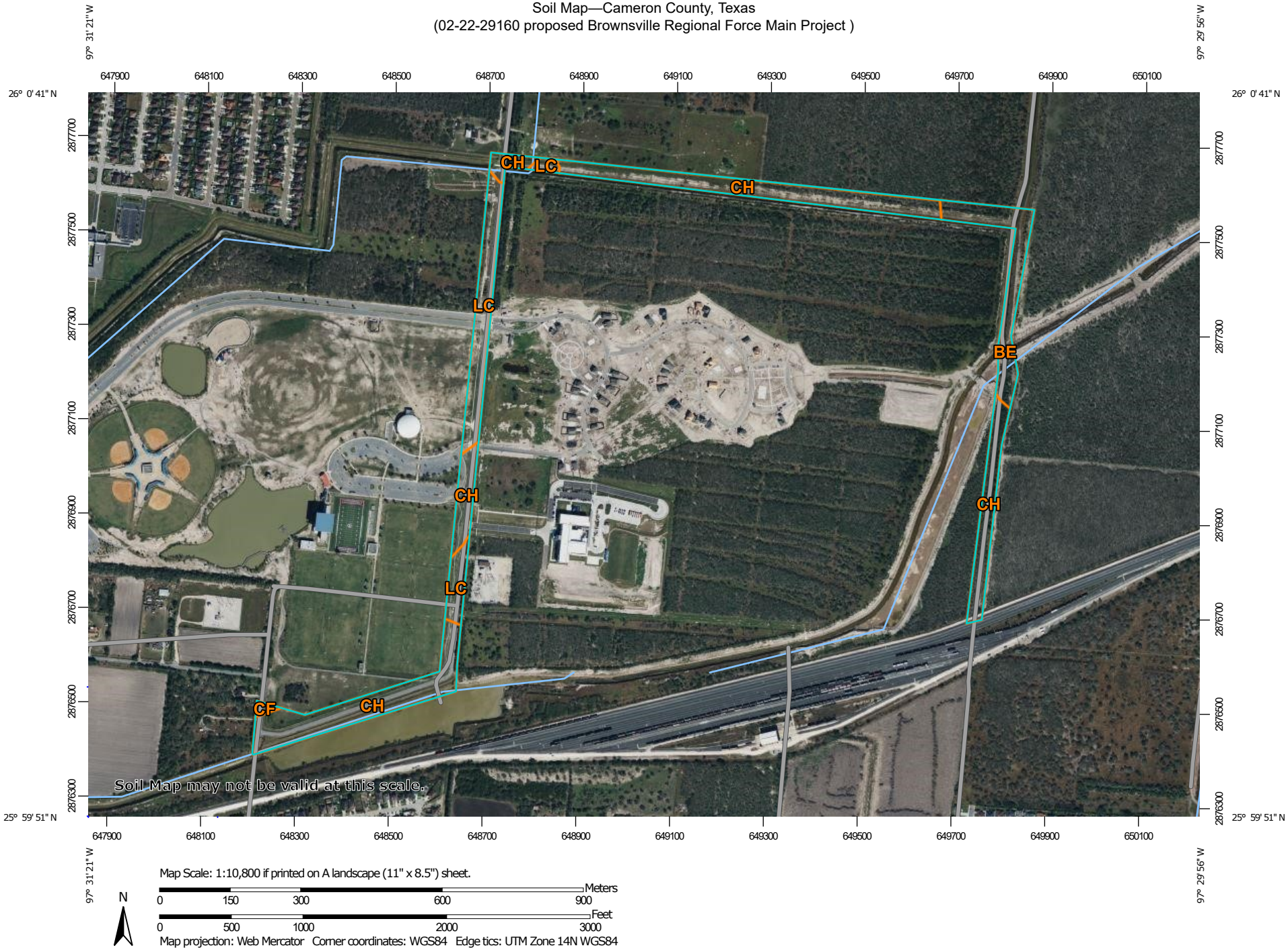
Soil Map—Cameron County, Texas
(02-22-29160 proposed Brownsville Regional Force Main Project)



Map Scale: 1:10,800 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 14N WGS84

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BE	Benito clay, ponded	5.0	15.5%
CF	Cameron silty clay, saline	0.2	0.7%
CH	Chargo silty clay	20.2	63.2%
LC	Laredo silty clay loam, saline	6.6	20.6%
Totals for Area of Interest		**31.9**	**100.0%**

Soil Map—Cameron County, Texas
(02-22-29160 proposed Brownsville Regional Force Main Project)

Map Scale: 1:3,010 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 40 80 160 240

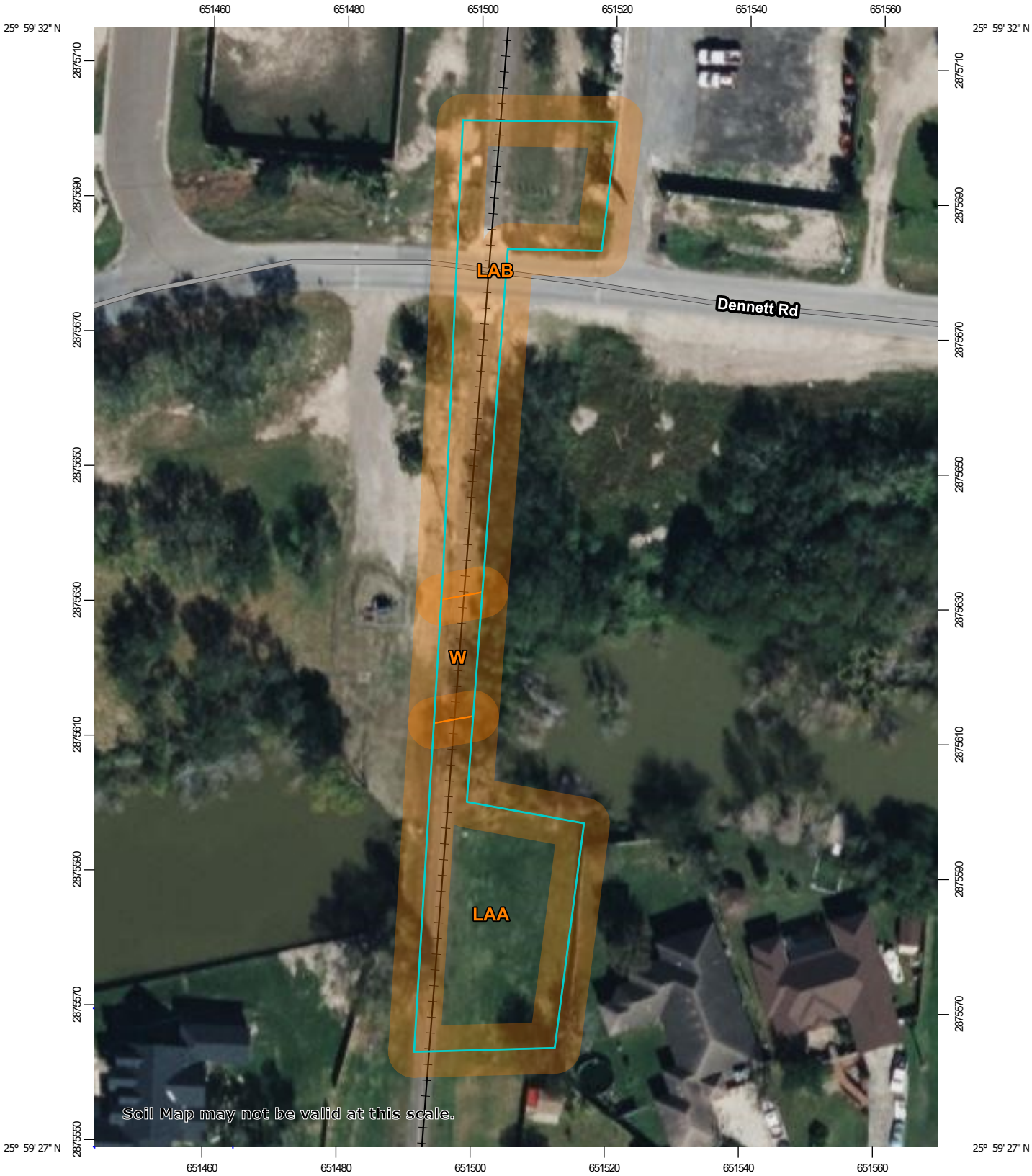
Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 14N WGS84

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
LC	Laredo silty clay loam, saline	3.6	31.8%
LM	Lomalta clay, 0 to 1 percent slopes, occasionally ponded	7.8	68.2%
Totals for Area of Interest		**11.4**	**100.0%**

Soil Map—Cameron County, Texas
(02-22-29160 proposed Brownsville Regional Force Main Project)



Map Scale: 1:811 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 10 20 40 60

Feet
0 35 70 140 210

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 14N WGS84

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
LAA	Laredo silty clay loam 0 to 1 percent slopes, rarely flooded	0.2	49.3%
LAB	Laredo silty clay loam, 1 to 3 percent slopes	0.2	44.4%
W	Water	0.0	6.2%
Totals for Area of Interest		**0.4**	**100.0%**

Soil Map—Cameron County, Texas
(02-22-29160 proposed Brownsville Regional Force Main Project)

Map Scale: 1:1,050 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 14N WGS84

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
LAA	Laredo silty clay loam 0 to 1 percent slopes, rarely flooded	0.7	93.8%
W	Water	0.0	6.2%
Totals for Area of Interest		**0.8**	**100.0%**

Soil Map—Cameron County, Texas
(02-22-29160 proposed Brownsville Regional Force Main Project)

Map Scale: 1:2,450 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 35 70 140 210

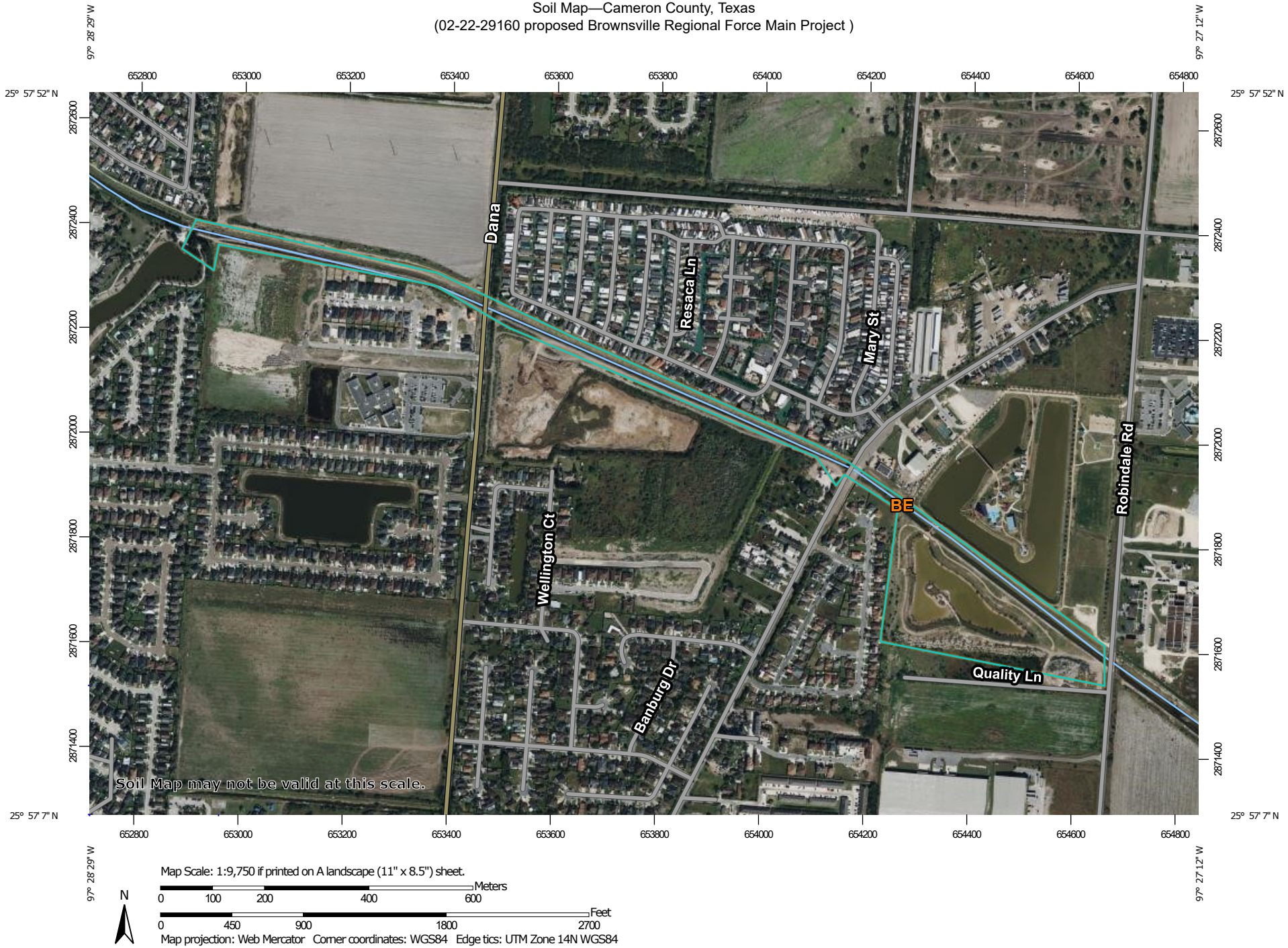
Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 14N WGS84

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BE	Benito clay, ponded	1.2	100.0%
Totals for Area of Interest		**1.2**	**100.0%**

Soil Map—Cameron County, Texas
(02-22-29160 proposed Brownsville Regional Force Main Project)



Map Scale: 1:9,750 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 100 200 400 600

Feet
0 450 900 1800 2700

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 14N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Cameron County, Texas
Survey Area Data: Version 19, Aug 24, 2022

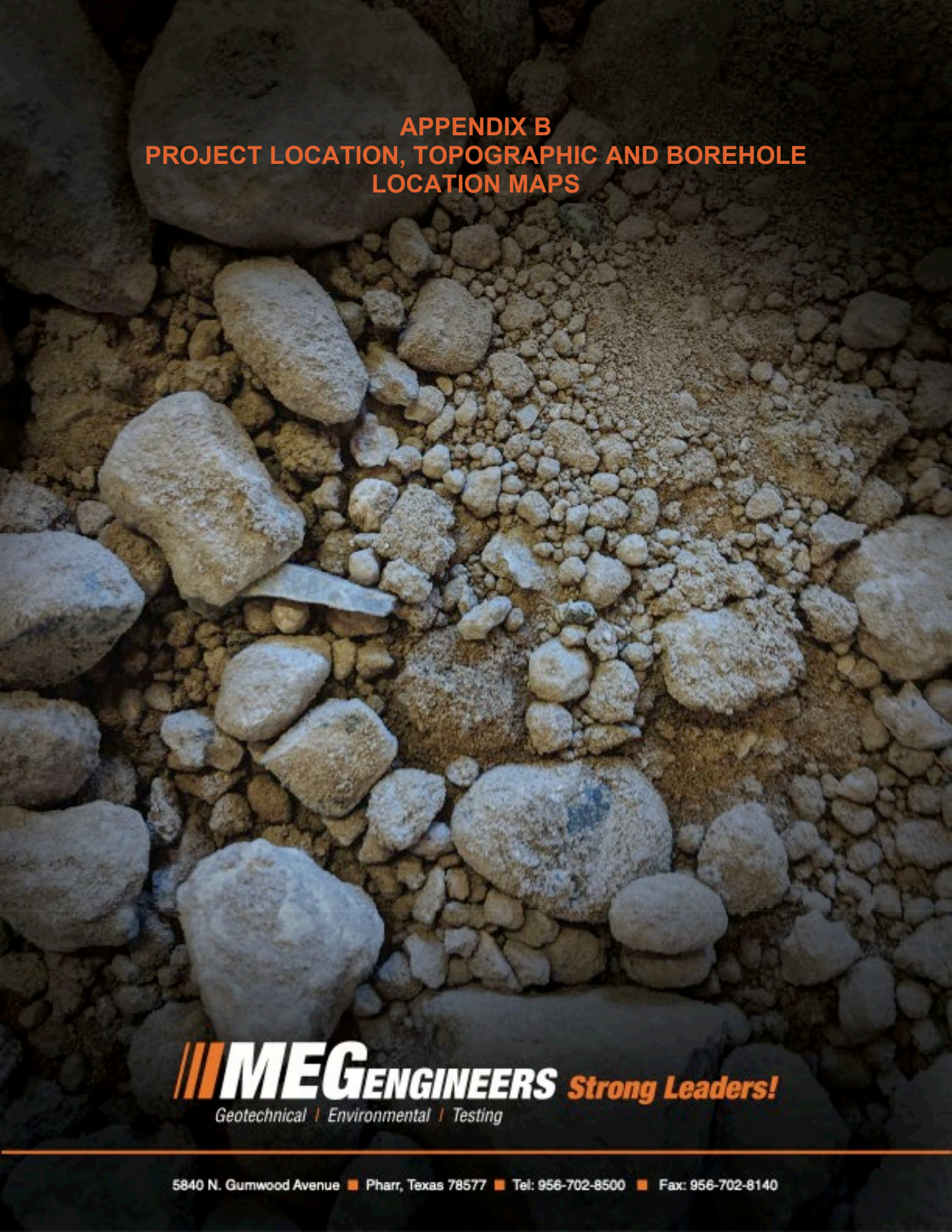
Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 21, 2021—Mar 2, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

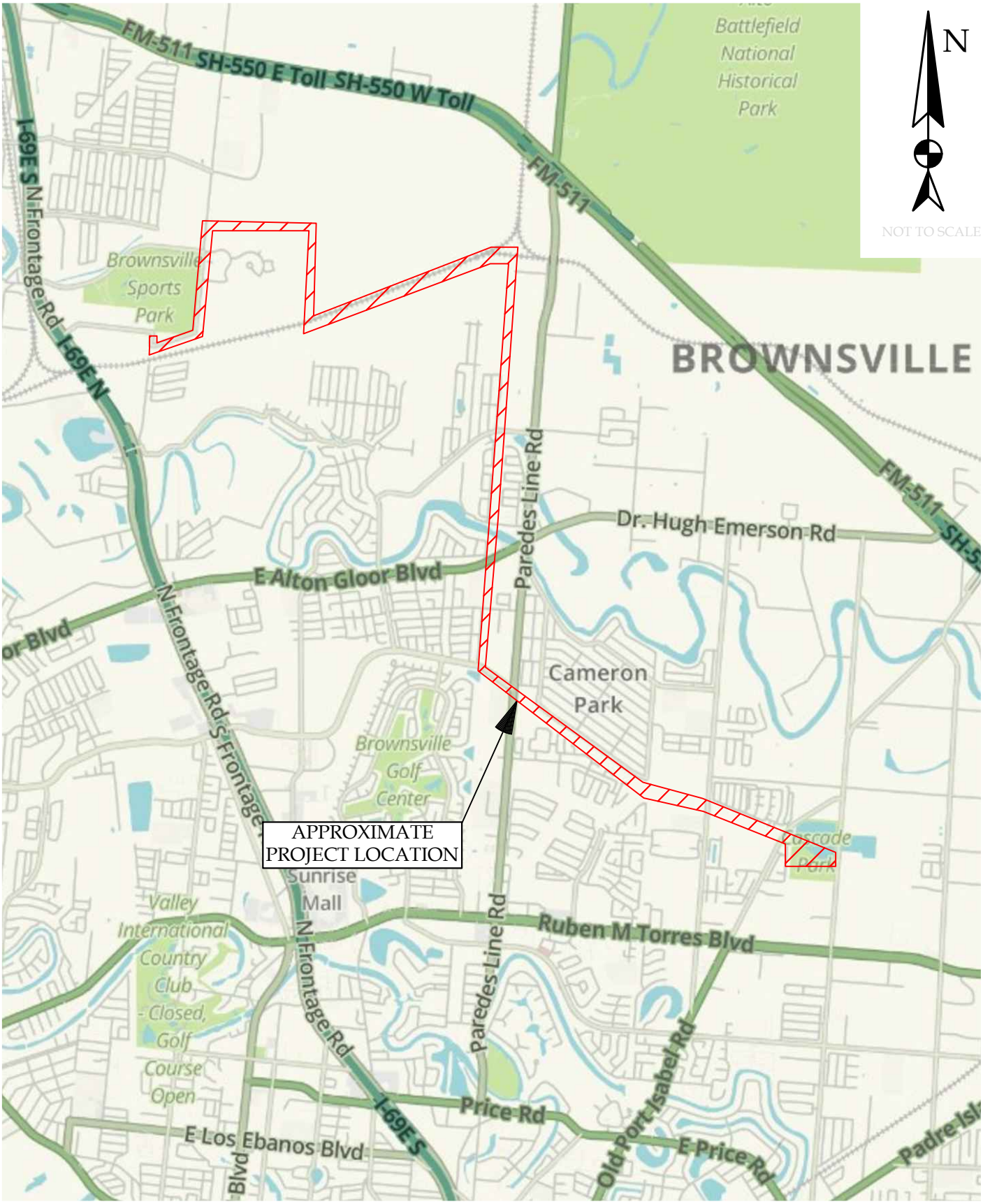
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BE	Benito clay, ponded	30.2	100.0%
Totals for Area of Interest		**30.2**	**100.0%**



APPENDIX B
PROJECT LOCATION, TOPOGRAPHIC AND BOREHOLE LOCATION MAPS

MEG ENGINEERS Strong Leaders!
Geotechnical | Environmental | Testing

5840 N. Gumwood Avenue ■ Pharr, Texas 78577 ■ Tel: 956-702-8500 ■ Fax: 956-702-8140

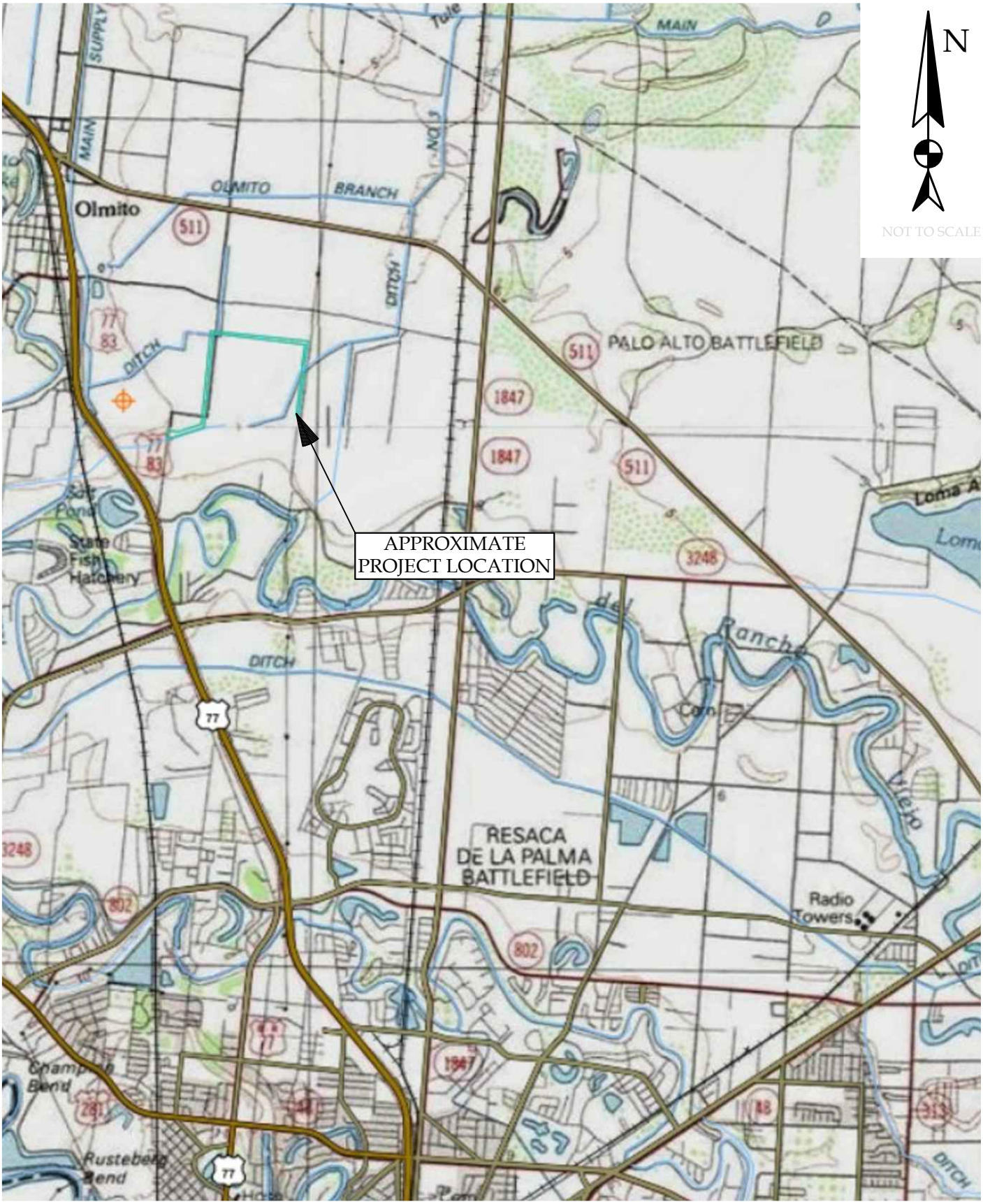


PROJECT SITE LOCATION MAP

PROPOSED
BROWNSVILLE NORTH REGIONAL FORCE
MAIN PROJECT
BROWNSVILLE, CAMERON COUNTY, TEXAS

MILLENNIUM ENGINEERS GROUP, INC.
5804 N. GUMWOOD AVENUE
PHARR, TEXAS 78577
WWW.MEGENGINEERS.COM
TEL: 956-702-8500
FAX: 956-702-8140

MEG PROJECT: 02-22-29160 / DATE: 11/8/2022 / APPROVED BY: A. PALMA / DRAWN BY: L. PUENTES



PROJECT TOPOGRAPHY MAP

PROPOSED
BROWNSVILLE NORTH REGIONAL FORCE
MAIN PROJECT
BROWNSVILLE, CAMERON COUNTY, TEXAS

MILLENNIUM ENGINEERS GROUP, INC.
5804 N. GUMWOOD AVENUE
PHARR, TEXAS 78577
WWW.MEGENGINEERS.COM
TEL: 956-702-8500
FAX: 956-702-8140

MEG PROJECT: 02-22-29160 / DATE: 11/8/2022 / APPROVED BY: A. PALMA / DRAWN BY: L. PUENTES

PROJECT BOREHOLE LOCATION MAP

PROPOSED
BROWNSVILLE NORTH REGIONAL FORCE
MAIN PROJECT
BROWNSVILLE, CAMERON COUNTY, TEXAS

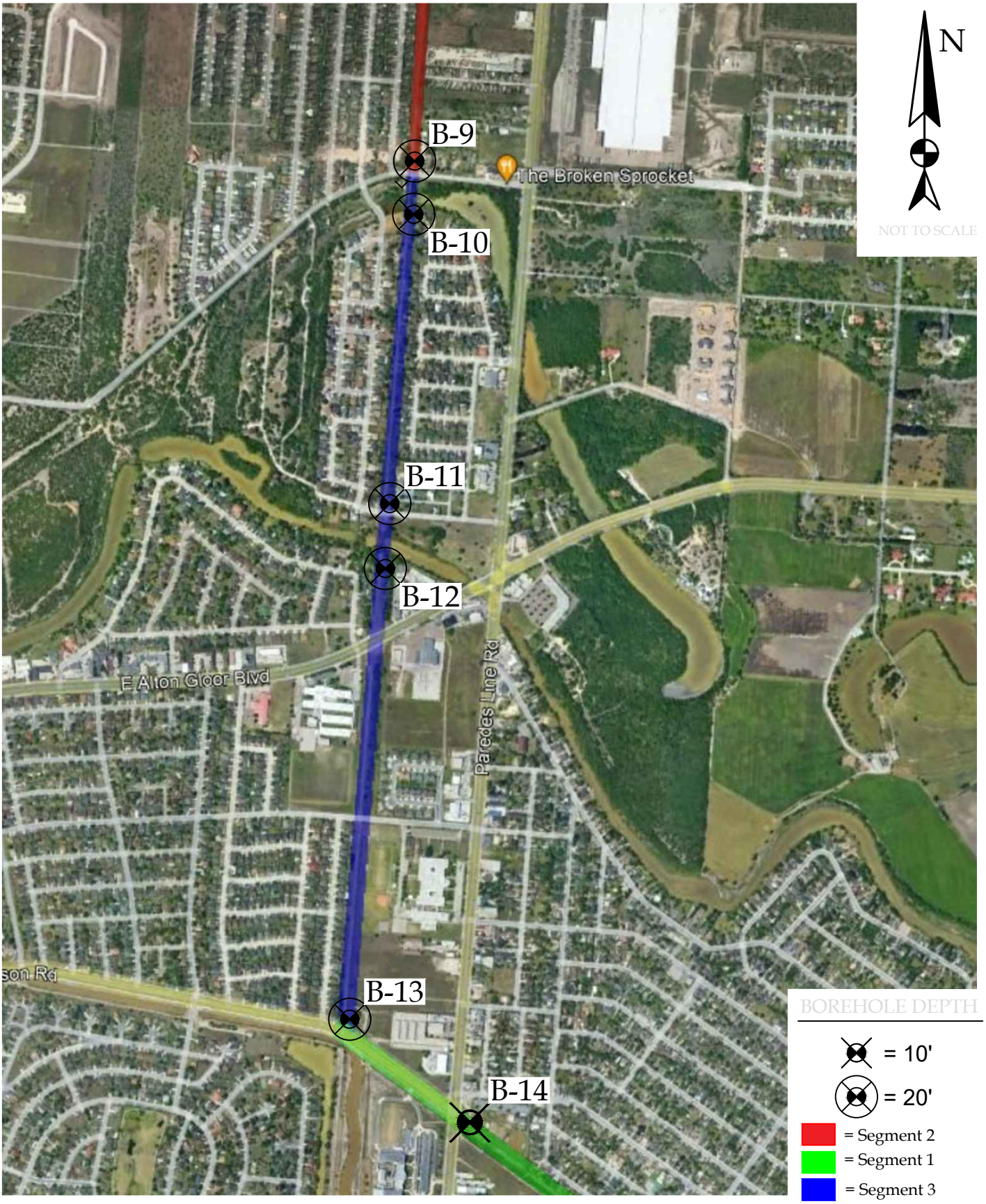
MEG ENGINEERS

MILLENNIUM ENGINEERS GROUP, INC.
5804 N. GUMWOOD AVENUE
PHARR, TEXAS 78577
WWW.MEGENGINEERS.COM
TEL: 956-702-8500
FAX: 956-702-8140

BOREHOLE DEPTH

= 10'
= 20'
= Segment 1
= Segment 2
= Inaccessible Bore

MEG PROJECT: 02-22-29160 / DATE: 11/8/2022 / APPROVED BY: A. PALMA / DRAWN BY: L. PUENTES



MEG PROJECT: 02-22-29160 / DATE: 11/8/2022 / APPROVED BY: A. PALMA / DRAWN BY: L. PUENTES

PROJECT BOREHOLE LOCATION MAP

PROPOSED
BROWNSVILLE NORTH REGIONAL FORCE
MAIN PROJECT
BROWNSVILLE, CAMERON COUNTY, TEXAS

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PROJECT BOREHOLE LOCATION MAP

PROPOSED
BROWNSVILLE NORTH REGIONAL FORCE
MAIN PROJECT
BROWNSVILLE, CAMERON COUNTY, TEXAS

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TEL: 956-702-8500
FAX: 956-702-8140

BOREHOLE DEPTH

= 10' = 20'

= Segment 1 = Segment 2

MEG PROJECT: 02-22-29160 / DATE: 11/8/2022 / APPROVED BY: A. PALMA / DRAWN BY: L. PUENTES

APPENDIX C
PROJECT BORING LOGS AND PROFILE

MEG ENGINEERS Strong Leaders!
Geotechnical | Environmental | Testing

5840 N. Gumwood Avenue ■ Pharr, Texas 78577 ■ Tel: 956-702-8500 ■ Fax: 956-702-8140

Project: **Proposed Brownsville North Regional Force Main**
Project Location: **Brownsville, Cameron County, Texas**
Project Number: **02-22-29160**

Log of Boring B-1
Sheet 1 of 1

Date(s) Drilled **11/10/2022**	Logged By **JP**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **10 feet bgs**
Drill Rig Type **CME 75**	Drilling Contractor **RGV Drilling**	Approximate Surface Elevation **23 feet**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, auto trip**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	UC, ksf
23	0				CH		fat CLAY to fat CLAY w/ sand, brown, dry to wet, soft to hard					
22	1		1	18				16	70	38		
21	2											
20	3		2	24				13				
19	4											
18	5		3	15				21	52	35		
17	6											
16	7		4	13				25				
15	8											
14	9		5	21				29			99	
13	10						Bore Termination					
12	11											
11	12											
10	13											
9	14											
8	15											
7	16											
6	17											
5	18											
4	19											
3	20											
2	21											
1	22											
0	23											
-1	24											
-2	25											
-3	26											
-4	27											
-5	28											
-6	29											
-7	30											

Project: **Proposed Brownsville North Regional Force Main**
Project Location: **Brownsville, Cameron County, Texas**
Project Number: **02-22-29160**

Log of Boring B-2
Sheet 1 of 1

Date(s) Drilled **11/10/2022**	Logged By **JP**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **10 feet bgs**
Drill Rig Type **CME 75**	Drilling Contractor **RGV Drilling**	Approximate Surface Elevation **24 feet**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, auto trip**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	UC, ksf
24	0				CL-CH		fat CLAY to lean CLAY, brown, dry to wet, soft to very stiff					
23	1		1	12				8			93	
22	2											
21	3		2	5				22	40	23		
20	4											
19	5		3	3				24				
18	6											
17	7		4	5				28	55	35		
16	8											
15	9		5	10				28				
14	10						Bore Termination					
13	11											
12	12											
11	13											
10	14											
9	15											
8	16											
7	17											
6	18											
5	19											
4	20											
3	21											
2	22											
1	23											
0	24											
-1	25											
-2	26											
-3	27											
-4	28											
-5	29											
-6	30											

Project: **Proposed Brownsville North Regional Force Main**

Project Location: **Brownsville, Cameron County, Texas**

Project Number: **02-22-29160**

Log of Boring B-3

Sheet 1 of 1

Date(s) Drilled **12/14/2022**	Logged By **JP**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **20 feet bgs**
Drill Rig Type **CME 75**	Drilling Contractor **RGV Drilling**	Approximate Surface Elevation **22 feet**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, auto trip**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	UC, ksf
22	0				CL-CH		fat CLAY to lean CLAY, brown, dry to wet, soft to very stiff					
21	1		1	13				21	51	35		
20	2											
19	3		2	23				8			90	
18	4											
17	5		3	13				9	39	24		
16	6											
15	7		4	14				18			94	
14	8											
13	9		5	18				27	64	40		
12	10											
11	11											
10	12											
9	13											
8	14		6	7				27				
7	15											
6	16											
5	17											
4	18											
3	19		7	9				20				
2	20						Bore Termination					
1	21											
0	22											
-1	23											
-2	24											
-3	25											
-4	26											
-5	27											
-6	28											
-7	29											
-8	30											

Project: **Proposed Brownsville North Regional Force Main**

Project Location: **Brownsville, Cameron County, Texas**

Project Number: **02-22-29160**

Log of Boring B-4

Sheet 1 of 1

Date(s) Drilled **12/14/2022**	Logged By **JP**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **20 feet bgs**
Drill Rig Type **CME 75**	Drilling Contractor **RGV Drilling**	Approximate Surface Elevation **19 feet**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, auto trip**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	UC, ksf
19	0				CH		fat CLAY to fat CLAY w/ sand, brown, dry to wet, soft to hard					
18	1		1	11				21				
17	2											
16	3		2	9				21	64	48		
15	4											
14	5		3	13				24			97	
13	6											
12	7		4	15				25	69	47		
11	8											
10	9		5	14				23			97	
9	10											
8	11											
7	12											
6	13											
5	14		6	12				29	59	39		
4	15											
3	16											
2	17											
1	18											
0	19		7	11				29				
-1	20						Bore Termination					
-2	21											
-3	22											
-4	23											
-5	24											
-6	25											
-7	26											
-8	27											
-9	28											
-10	29											
-11	30											

Project: **Proposed Brownsville North Regional Force Main**
Project Location: **Brownsville, Cameron County, Texas**
Project Number: **02-22-29160**

Log of Boring B-5
Sheet 1 of 1

Date(s) Drilled **12/15/2022**	Logged By **AG**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **20 feet bgs**
Drill Rig Type **DR3**	Drilling Contractor **MEG Drilling**	Approximate Surface Elevation **25 feet**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, auto trip**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	UC, ksf
25	0				CH		fat CLAY to fat CLAY w/ sand, brown, dry to wet, soft to hard					
24	1		1	9				22				
23	2											
22	3		2	7				21	68	48		
21	4											
20	5		3	3				22			97	
19	6											
18	7		4	9				19	65	44		
17	8											
16	9		5	34				19			96	
15	10											
14	11											
13	12											
12	13											
11	14		6	12				23	69	50		
10	15											
9	16											
8	17											
7	18											
6	19		7	11				26				
5	20						Bore Termination					
4	21											
3	22											
2	23											
1	24											
0	25											
-1	26											
-2	27											
-3	28											
-4	29											
-5	30											

Project: **Proposed Brownsville North Regional Force Main**

Project Location: **Brownsville, Cameron County, Texas**

Project Number: **02-22-29160**

Log of Boring B-7

Sheet 1 of 1

Date(s) Drilled **11/11/2022**	Logged By **JP**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **20 feet bgs**
Drill Rig Type **CME 75**	Drilling Contractor **RGV Drilling**	Approximate Surface Elevation **20 feet**
Groundwater Level and Date Measured **14 feet ATD**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, auto trip**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	UC, ksf
20	0				CH		fat CLAY to fat CLAY w/ sand, brown, dry to wet, soft to hard					
19	1		1	12				30	71	54		
18	2											
17	3		2	8				30			99	
16	4											
15	5		3	6				29	51	34		
14	6											
13	7		4	3				33			82	
12	8											
11	9		5	2				24	54	33		
10	10											
9	11											
8	12											
7	13											
6	14		6	4				30				
5	15											
4	16											
3	17											
2	18											
1	19		7	8				30				
0	20						Bore Termination					
-1	21											
-2	22											
-3	23											
-4	24											
-5	25											
-6	26											
-7	27											
-8	28											
-9	29											
-10	30											

Project: **Proposed Brownsville North Regional Force Main**

Project Location: **Brownsville, Cameron County, Texas**

Project Number: **02-22-29160**

Log of Boring B-8

Sheet 1 of 1

Date(s) Drilled **11/10/2022**	Logged By **JP**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **20 feet bgs**
Drill Rig Type **CME 75**	Drilling Contractor **RGV Drilling**	Approximate Surface Elevation **17 feet**
Groundwater Level and Date Measured **13 feet ATD**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, auto trip**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	UC, ksf
17	0				CL-CH		fat CLAY to lean CLAY, brown, dry to wet, soft to very stiff					
16	1		1	12				17				
15	2											
14	3		2	6				22	40	21		
13	4											
12	5		3	5				23			95	
11	6											
10	7		4	3				29	42	23		
9	8											
8	9		5	10				28			98	
7	10											
6	11											
5	12											
4	13											
3	14		6	7				32	54	33		
2	15											
1	16											
0	17											
-1	18											
-2	19		7	12				25				
-3	20						Bore Termination					
-4	21											
-5	22											
-6	23											
-7	24											
-8	25											
-9	26											
-10	27											
-11	28											
-12	29											
-13	30											

Project: **Proposed Brownsville North Regional Force Main**

Project Location: **Brownsville, Cameron County, Texas**

Project Number: **02-22-29160**

Log of Boring B-9

Sheet 1 of 1

Date(s) Drilled **11/10/2022**	Logged By **JP**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **20 feet bgs**
Drill Rig Type **CME 75**	Drilling Contractor **RGV Drilling**	Approximate Surface Elevation **25 feet**
Groundwater Level and Date Measured **14 feet ATD**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, auto trip**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	UC, ksf
25	0				CL-CH		fat CLAY to lean CLAY, brown, dry to wet, soft to very stiff					
24	1		1	15				11				
23	2											
22	3		2	11				21				
21	4											
20	5		3	13				25	56	35		
19	6											
18	7		4	11				27			99	
17	8											
16	9		5	12				26	58	41		
15	10											
14	11											
13	12											
12	13											
11	14		6	10				27			99	
10	15											
9	16											
8	17											
7	18											
6	19		7	7				25	44	29		
5	20						Bore Termination					
4	21											
3	22											
2	23											
1	24											
0	25											
-1	26											
-2	27											
-3	28											
-4	29											
-5	30											

Project: **Proposed Brownsville North Regional Force Main**

Project Location: **Brownsville, Cameron County, Texas**

Project Number: **02-22-29160**

Log of Boring B-10

Sheet 1 of 1

Date(s) Drilled **11/10/2022**	Logged By **JP**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **20 feet bgs**
Drill Rig Type **CME 75**	Drilling Contractor **RGV Drilling**	Approximate Surface Elevation **25 feet**
Groundwater Level and Date Measured **11 feet ATD**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, auto trip**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	UC, ksf
25	0				SC-CH		fat CLAY to clayey SAND, brown, dry to wet, soft to very stiff					
24	1		1	17				17			95	
23	2											
22	3		2	12				18	57	37		
21	4											
20	5		3	6				16				
19	6											
18	7		4	3				23	33	19		
17	8											
16	9		5	5				26				
15	10											
14	11											
13	12											
12	13											
11	14		6	5				29		LS = 0		
10	15											
9	16											
8	17											
7	18											
6	19		7	4				26			29	
5	20						Bore Termination					
4	21											
3	22											
2	23											
1	24											
0	25											
-1	26											
-2	27											
-3	28											
-4	29											
-5	30											

Project: **Proposed Brownsville North Regional Force Main**

Project Location: **Brownsville, Cameron County, Texas**

Project Number: **02-22-29160**

Log of Boring B-11

Sheet 1 of 1

Date(s) Drilled **11/10/2022**	Logged By **JP**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **20 feet bgs**
Drill Rig Type **CME 75**	Drilling Contractor **RGV Drilling**	Approximate Surface Elevation **27 feet**
Groundwater Level and Date Measured **15 feet ATD**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, auto trip**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	UC, ksf
27	0				SC-CH		fat CLAY to clayey SAND, brown, dry to wet, soft to very stiff					
26	1		1	16				13	44	29		
25	2											
24	3		2	8				19		LS = 0		
23	4											
22	5		3	7				12		LS = 0		
21	6											
20	7		4	9				13				
19	8											
18	9		5	8				27			69	
17	10											
16	11											
15	12											
14	13											
13	14		6	12				27			63	
12	15											
11	16											
10	17											
9	18											
8	19		7	3				23				
7	20						Bore Termination					
6	21											
5	22											
4	23											
3	24											
2	25											
1	26											
0	27											
-1	28											
-2	29											
-3	30											

Project: **Proposed Brownsville North Regional Force Main**

Project Location: **Brownsville, Cameron County, Texas**

Project Number: **02-22-29160**

Log of Boring B-12

Sheet 1 of 1

Date(s) Drilled **11/10/2022**	Logged By **JP**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **20 feet bgs**
Drill Rig Type **CME 75**	Drilling Contractor **RGV Drilling**	Approximate Surface Elevation **27 feet**
Groundwater Level and Date Measured **13 feet ATD**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, auto trip**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	UC, ksf
27	0				SC-CH		fat CLAY to clayey SAND, brown, dry to wet, soft to very stiff					
26	1		1	17				15	60	39		
25	2											
24	3		2	12				23				
23	4											
22	5		3	10				19	44	29		
21	6											
20	7		4	11				23			85	
19	8											
18	9		5	10				28				
17	10											
16	11											
15	12											
14	13											
13	14		6	6				31		LS = 0		
12	15											
11	16											
10	17											
9	18											
8	19		7	6				32			33	
7	20						Bore Termination					
6	21											
5	22											
4	23											
3	24											
2	25											
1	26											
0	27											
-1	28											
-2	29											
-3	30											

Project: **Proposed Brownsville North Regional Force Main**

Project Location: **Brownsville, Cameron County, Texas**

Project Number: **02-22-29160**

Log of Boring B-13

Sheet 1 of 1

Date(s) Drilled **11/10/2022**	Logged By **JP**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **20 feet bgs**
Drill Rig Type **CME 75**	Drilling Contractor **RGV Drilling**	Approximate Surface Elevation **21 feet**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, auto trip**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	UC, ksf
21	0				SC-CH		fat CLAY to clayey SAND, brown, dry to wet, soft to very stiff					
20	1		1	10				21				
19	2											
18	3		2	11				30	79	58		
17	4											
16	5		3	7				32				
15	6											
14	7		4	5				27	42	25		
13	8											
12	9		5	3				29			97	
11	10											
10	11											
9	12											
8	13											
7	14		6	9				22			78	
6	15											
5	16											
4	17											
3	18											
2	19		7	8				20	41	28		
1	20						Bore Termination					
0	21											
-1	22											
-2	23											
-3	24											
-4	25											
-5	26											
-6	27											
-7	28											
-8	29											
-9	30											

Project: **Proposed Brownsville North Regional Force Main**
Project Location: **Brownsville, Cameron County, Texas**
Project Number: **02-22-29160**

Log of Boring B-14
Sheet 1 of 1

Date(s) Drilled **11/11/2022**	Logged By **JP**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **10 feet bgs**
Drill Rig Type **CME 75**	Drilling Contractor **RGV Drilling**	Approximate Surface Elevation **20 feet**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, auto trip**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	UC, ksf
20	0				CH		fat CLAY to fat CLAY w/ sand, brown, dry to wet, soft to hard					
19	1		1	12				8				
18	2											
17	3		2	18				23	95	70		
16	4											
15	5		3	15				27			97	
14	6											
13	7		4	11				28				
12	8											
11	9		5	11				26				
10	10						Bore Termination					
9	11											
8	12											
7	13											
6	14											
5	15											
4	16											
3	17											
2	18											
1	19											
0	20											
-1	21											
-2	22											
-3	23											
-4	24											
-5	25											
-6	26											
-7	27											
-8	28											
-9	29											
-10	30											

Project: **Proposed Brownsville North Regional Force Main**
Project Location: **Brownsville, Cameron County, Texas**
Project Number: **02-22-29160**

Log of Boring B-15
Sheet 1 of 1

Date(s) Drilled **11/11/2022**	Logged By **JP**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **20 feet bgs**
Drill Rig Type **CME 75**	Drilling Contractor **RGV Drilling**	Approximate Surface Elevation **19 feet**
Groundwater Level and Date Measured **14 feet ATD**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, auto trip**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	UC, ksf
19	0				CH		fat CLAY to fat CLAY w/ sand, brown, dry to wet, soft to hard					
18	1		1	12				19				
17	2											
16	3		2	14				26			99	
15	4											
14	5		3	9				29	75	54		
13	6											
12	7		4	11				22				
11	8											
10	9		5	12				26	59	40		
9	10											
8	11											
7	12											
6	13											
5	14		6	10				31	68	47		
4	15											
3	16											
2	17											
1	18											
0	19		7	5				30			78	
-1	20						Bore Termination					
-2	21											
-3	22											
-4	23											
-5	24											
-6	25											
-7	26											
-8	27											
-9	28											
-10	29											
-11	30											

Project: **Proposed Brownsville North Regional Force Main**

Project Location: **Brownsville, Cameron County, Texas**

Project Number: **02-22-29160**

Log of Boring B-16

Sheet 1 of 1

Date(s) Drilled **11/11/2022**	Logged By **JP**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **10 feet bgs**
Drill Rig Type **CME 75**	Drilling Contractor **RGV Drilling**	Approximate Surface Elevation **12 feet**
Groundwater Level and Date Measured **Not Encontered**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, auto trip**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	UC, ksf
12	0				CH		fat CLAY to fat CLAY w/ sand, brown, dry to wet, soft to hard					
11	1		1	17				20	75	58		
10	2											
9	3		2	10				30				
8	4											
7	5		3	6				29	67	44	98	
6	6											
5	7		4	7				29				
4	8											
3	9		5	8				27				
2	10						Bore Termination					
1	11											
0	12											
-1	13											
-2	14											
-3	15											
-4	16											
-5	17											
-6	18											
-7	19											
-8	20											
-9	21											
-10	22											
-11	23											
-12	24											
-13	25											
-14	26											
-15	27											
-16	28											
-17	29											
-18	30											

Project: **Proposed Brownsville North Regional Force Main**
Project Location: **Brownsville, Cameron County, Texas**
Project Number: **02-22-29160**

Log of Boring B-17

Sheet 1 of 1

Date(s) Drilled **11/11/2022**	Logged By **JP**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **10 feet bgs**
Drill Rig Type **CME 75**	Drilling Contractor **RGV Drilling**	Approximate Surface Elevation **16 feet**
Groundwater Level and Date Measured **Not Encontered**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, auto trip**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	UC, ksf
16	0				CH		fat CLAY to fat CLAY w/ sand, brown, dry to wet, soft to hard					
15	1		1	13				23				
14	2											
13	3		2	9				24			96	
12	4											
11	5		3	7				30	65	46		
10	6											
9	7		4	6				30				
8	8											
7	9		5	8				33	71	46		
6	10						Bore Termination					
5	11											
4	12											
3	13											
2	14											
1	15											
0	16											
-1	17											
-2	18											
-3	19											
-4	20											
-5	21											
-6	22											
-7	23											
-8	24											
-9	25											
-10	26											
-11	27											
-12	28											
-13	29											
-14	30											

Project: **Proposed Brownsville North Regional Force Main**
Project Location: **Brownsville, Cameron County, Texas**
Project Number: **02-22-29160**

Log of Boring B-18

Sheet 1 of 1

Date(s) Drilled **11/11/2022**	Logged By **JP**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **20 feet bgs**
Drill Rig Type **CME 75**	Drilling Contractor **RGV Drilling**	Approximate Surface Elevation **16 feet**
Groundwater Level and Date Measured **16 feet ATD**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, auto trip**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	UC, ksf
16	0				CH		fat CLAY to fat CLAY w/ sand, brown, dry to wet, soft to hard					
15	1		1	10				25				
14	2											
13	3		2	8				31				
12	4											
11	5		3	7				27	76	58		
10	6											
9	7		4	7				27			94	
8	8											
7	9		5	5				37	68	48		
6	10											
5	11											
4	12											
3	13											
2	14		6	2				34			97	
1	15											
0	16											
-1	17											
-2	18											
-3	19		7	4				29	56	43		
-4	20						Bore Termination					
-5	21											
-6	22											
-7	23											
-8	24											
-9	25											
-10	26											
-11	27											
-12	28											
-13	29											
-14	30											

Project: **Proposed Brownsville North Regional Force Main**

Project Location: **Brownsville, Cameron County, Texas**

Project Number: **02-22-29160**

Log of Boring B-19

Sheet 1 of 1

Date(s) Drilled **11/11/2022**	Logged By **JP**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **20 feet bgs**
Drill Rig Type **CME 75**	Drilling Contractor **RGV Drilling**	Approximate Surface Elevation **16 feet**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, auto trip**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	UC, ksf
16	0				CL-CH		fat CLAY to lean CLAY, brown, dry to wet, soft to very stiff					
15	1		1	9				19	71	55		
14	2											
13	3		2	12				14			88	
12	4											
11	5		3	11				27	65	46	97	
10	6											
9	7		4	5				25				
8	8											
7	9		5	8				29	34	19		
6	10											
5	11											
4	12											
3	13											
2	14		6	4				31				
1	15											
0	16											
-1	17											
-2	18											
-3	19		7	9				20				
-4	20						Bore Termination					
-5	21											
-6	22											
-7	23											
-8	24											
-9	25											
-10	26											
-11	27											
-12	28											
-13	29											
-14	30											

Project: **Proposed Brownsville North Regional Force Main**
Project Location: **Brownsville, Cameron County, Texas**
Project Number: **02-22-29160**

Key to Log of Boring

Sheet 1 of 1

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	UC, ksf
1	2	3	4	5	6	7	8	9	10	11	12	13

COLUMN DESCRIPTIONS

1. Elevation (feet): Elevation (MSL, feet).
2. Depth (feet): Depth in feet below the ground surface.
3. Sample Type: Type of soil sample collected at the depth interval shown.
4. Sample Number: Sample identification number.
5. Sampling Resistance, blows/ft: Number of blows to advance driven sampler one foot (or distance shown) beyond seating interval using the hammer identified on the boring log.
6. Material Type: Type of material encountered.
7. Graphic Log: Graphic depiction of the subsurface material encountered.
8. MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.
9. Water Content, %: Water content of the soil sample, expressed as percentage of dry weight of sample.
10. LL, %: Liquid Limit, expressed as a water content.
11. PI, %: Plasticity Index, expressed as a water content.
12. Percent Fines: The percent fines (soil passing the No. 200 Sieve) in the sample. WA indicates a Wash Sieve, SA indicates a Sieve Analysis.
13. UC, ksf: Unconfined compressive strength, in kips per square foot.

FIELD AND LABORATORY TEST ABBREVIATIONS

CHEM: Chemical tests to assess corrosivity
COMP: Compaction test
CONS: One-dimensional consolidation test
LL: Liquid Limit, percent
PI: Plasticity Index, percent
SA: Sieve analysis (percent passing No. 200 Sieve)
UC: Unconfined compressive strength test, Qu, in ksf
WA: Wash sieve (percent passing No. 200 Sieve)

MATERIAL GRAPHIC SYMBOLS

Fat CLAY, CLAY w/SAND, SANDY CLAY (CH)

Lean-Fat CLAY, CLAY w/SAND, SANDY CLAY (CL-CH)

Clayey SAND to Sandy Fat CLAY, fat CLAY (SC-CH)

TYPICAL SAMPLER GRAPHIC SYMBOLS

- Auger sampler
- Bulk Sample
- 3-inch-OD California w/ brass rings
- CME Sampler
- Grab Sample
- Hand auger sampler
- 2.5-inch-OD Modified California w/ brass liners
- Pitcher Sample
- 2-inch-OD unlined split spoon (SPT)
- Shelby Tube (Thin-walled, fixed head)

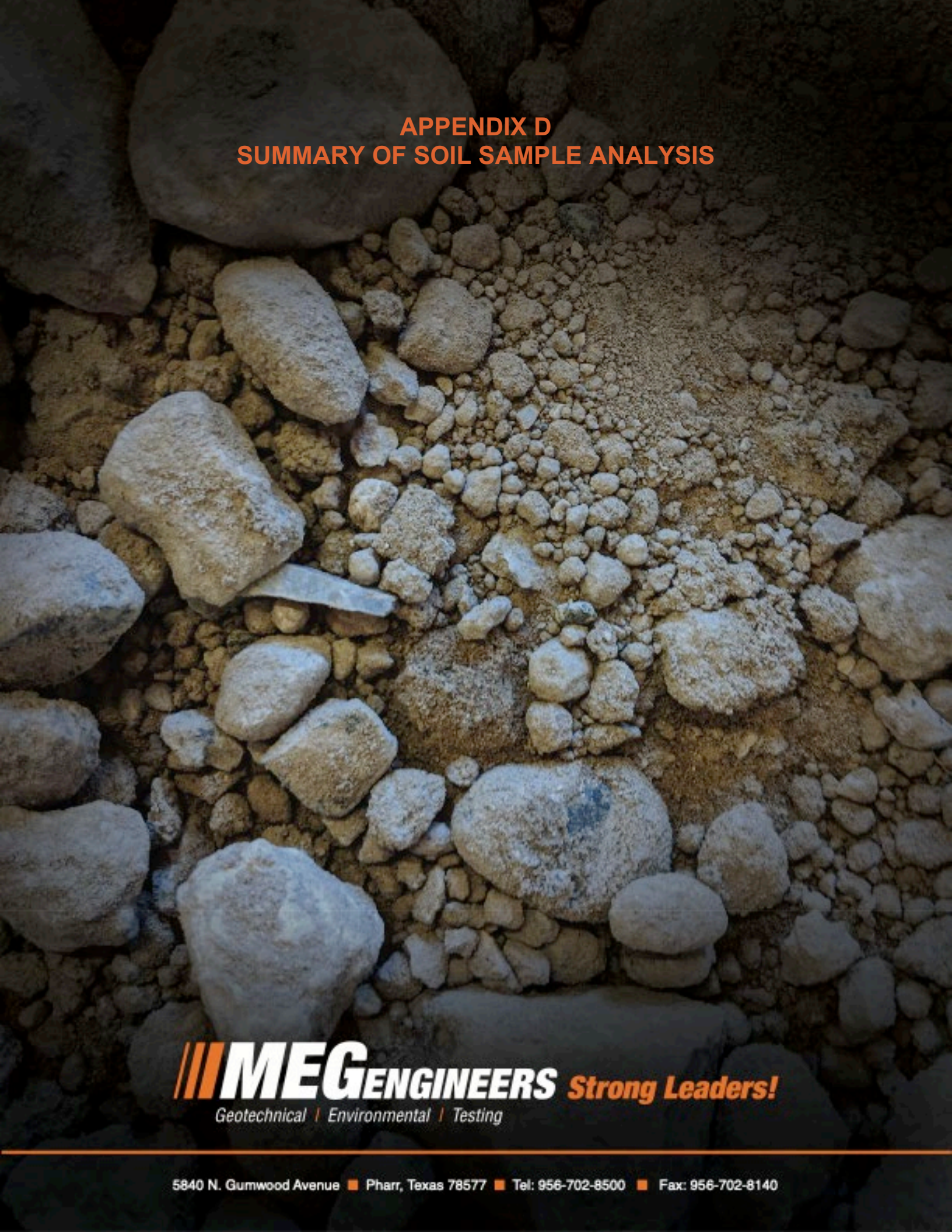
OTHER GRAPHIC SYMBOLS

- Water level (at time of drilling, ATD)
- Water level (after waiting, AW)
- Minor change in material properties within a stratum
- Inferred/gradational contact between strata
- Queried contact between strata

GENERAL NOTES

1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

Figure B-1



APPENDIX D
SUMMARY OF SOIL SAMPLE ANALYSIS

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Summary of Soil Sample Analyses

Project Name: Proposed Brownsville North Regional Force Main

Boring No.	Sample Depth (ft)	Blows Per (ft)	Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	-200% Sieve	Shear Strength (tsf)	Dry Unit Weight (pcf)	USCS
B-1	.5 - 2	18	16	70	32	38				CH
	2.5 - 4	24	13							
	4.5 - 6	15	21	52	18	35				CH
	6.5 - 8	13	25							
	8.5 - 10	21	29				99			
B-2	.5 - 2	12	8				93			
	2.5 - 4	5	22	40	17	23				CL
	4.5 - 6	3	24							
	6.5 - 8	5	28	55	19	35				CH
	8.5 - 10	10	28							
B-3	.5 - 2	13	21	51	15	35				CH
	2.5 - 4	23	8				90			
	4.5 - 6	13	9	39	14	24				CL
	6.5 - 8	14	18				94			
	8.5 - 10	18	27	64	24	40				CH
	13.5 - 15	7	27							
	18.5 - 20	9	20							
B-4	.5 - 2	11	21							
	2.5 - 4	9	21	67	19	48				CH
	4.5 - 6	13	24				97			
	6.5 - 8	15	25	69	22	47				CH
	8.5 - 10	14	23				97			
	13.5 - 15	12	29	59	20	39				CH
	18.5 - 20	11	29							
B-5	.5 - 2	9	22							
	2.5 - 4	7	21	68	20	48				CH
	4.5 - 6	3	22				97			
	6.5 - 8	9	19	65	21	44				CH
	8.5 - 10	34	19				96			
	13.5 - 15	12	23	69	19	50				CH
	18.5 - 20	11	26							

Summary of Soil Sample Analyses

Project Name: Proposed Brownsville North Regional Force Main

Boring No.	Sample Depth (ft)	Blows Per (ft)	Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	-200% Sieve	Shear Strength (tsf)	Dry Unit Weight (pcf)	USCS
B-6	.5 - 2 2.5 - 4 4.5 - 6 6.5 - 8 8.5 - 10 13.5 - 15 18.5 - 20	**BORE INACCESSIBLE**								
B-7	.5 - 2	12	30	71	17	54				CH
	2.5 - 4	8	30				99			
	4.5 - 6	6	29	51	16	34				CH
	6.5 - 8	3	33				82			
	8.5 - 10	2	24	54	17	36				CH
	13.5 - 15	4	30							
	18.5 - 20	8	30							
B-8	.5 - 2	12	17							
	2.5 - 4	6	22	40	18	21				CL
	4.5 - 6	5	23				95			
	6.5 - 8	3	29	42	19	23				CL
	8.5 - 10	10	28				98			
	13.5 - 15	7	32	54	20	33				CH
	18.5 - 20	12	25							
B-9	.5 - 2	15	11							
	2.5 - 4	11	21							
	4.5 - 6	13	25	56	21	35				CH
	6.5 - 8	11	27				99			
	8.5 - 10	12	26	58	17	41				CH
	13.5 - 15	10	27				99			
	18.5 - 20	7	25	44	15	29				CL
B-10	.5 - 2	17	17				95			
	2.5 - 4	12	18	57	20	37				CH
	4.5 - 6	6	16							
	6.5 - 8	3	23	33	13	19				CL
	8.5 - 10	5	26							
	13.5 - 15	5	29			LS = 0				SC
	18.5 - 20	4	26				29			

LS = Linear Shrinkage

Summary of Soil Sample Analyses

Project Name: Proposed Brownsville North Regional Force Main

Boring No.	Sample Depth (ft)	Blows Per (ft)	Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	-200% Sieve	Shear Strength (tsf)	Dry Unit Weight (pcf)	USCS
B-11	.5 - 2	16	13	44	15	29				CL
	2.5 - 4	8	19			LS = 0				SC
	4.5 - 6	7	12			LS = 0				SC
	6.5 - 8	9	13							
	8.5 - 10	8	27				69			
	13.5 - 15	12	27				63			
	18.5 - 20	3	23							
B-12	.5 - 2	17	15	60	21	39				CH
	2.5 - 4	12	23							
	4.5 - 6	10	19	44	16	29				CL
	6.5 - 8	11	23				85			
	8.5 - 10	10	28							
	13.5 - 15	6	31			LS = 0				SC
	18.5 - 20	6	32				33			
B-13	.5 - 2	10	21							
	2.5 - 4	11	30	79	21	58				CH
	4.5 - 6	7	32							
	6.5 - 8	5	27	42	17	25				CL
	8.5 - 10	3	29				97			
	13.5 - 15	9	22				78			
	18.5 - 20	8	20	41	13	28				CL
B-14	.5 - 2	12	8							
	2.5 - 4	18	23	95	25	70				CH
	4.5 - 6	15	27				97			
	6.5 - 8	11	28							
	8.5 - 10	11	26							
B-15	.5 - 2	12	19							
	2.5 - 4	14	26				99			
	4.5 - 6	9	29	75	22	54				CH
	6.5 - 8	11	22							
	8.5 - 10	12	26	59	19	40				CH
	13.5 - 15	10	31	68	20	47				CH
	18.5 - 20	5	30				78			

LS = Linear Shrinkage

Summary of Soil Sample Analyses

Project Name: Proposed Brownsville North Regional Force Main

Boring No.	Sample Depth (ft)	Blows Per (ft)	Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	-200% Sieve	Shear Strength (tsf)	Dry Unit Weight (pcf)	USCS
B-16	.5 - 2	17	20	75	17	58				CH
	2.5 - 4	10	30							
	4.5 - 6	6	29	67	23	44	98			CH
	6.5 - 8	7	29							
	8.5 - 10	8	27							
B-17	.5 - 2	13	23							
	2.5 - 4	9	24				96			
	4.5 - 6	7	30	65	19	46				CH
	6.5 - 8	6	30							
	8.5 - 10	8	33	71	25	46				CH
B-18	.5 - 2	10	25							
	2.5 - 4	8	31							
	4.5 - 6	7	27	76	18	58				CH
	6.5 - 8	7	27				94			
	8.5 - 10	5	37	68	20	48				CH
	13.5 - 15	2	34				97			
	18.5 - 20	4	29	56	14	43				CH
B-19	.5 - 2	9	19	71	16	55				CH
	2.5 - 4	12	14				88			
	4.5 - 6	11	27	65	19	46	97			CH
	6.5 - 8	5	25							
	8.5 - 10	8	29	34	14	19				CL
	13.5 - 15	4	31							
	18.5 - 20	9	20							

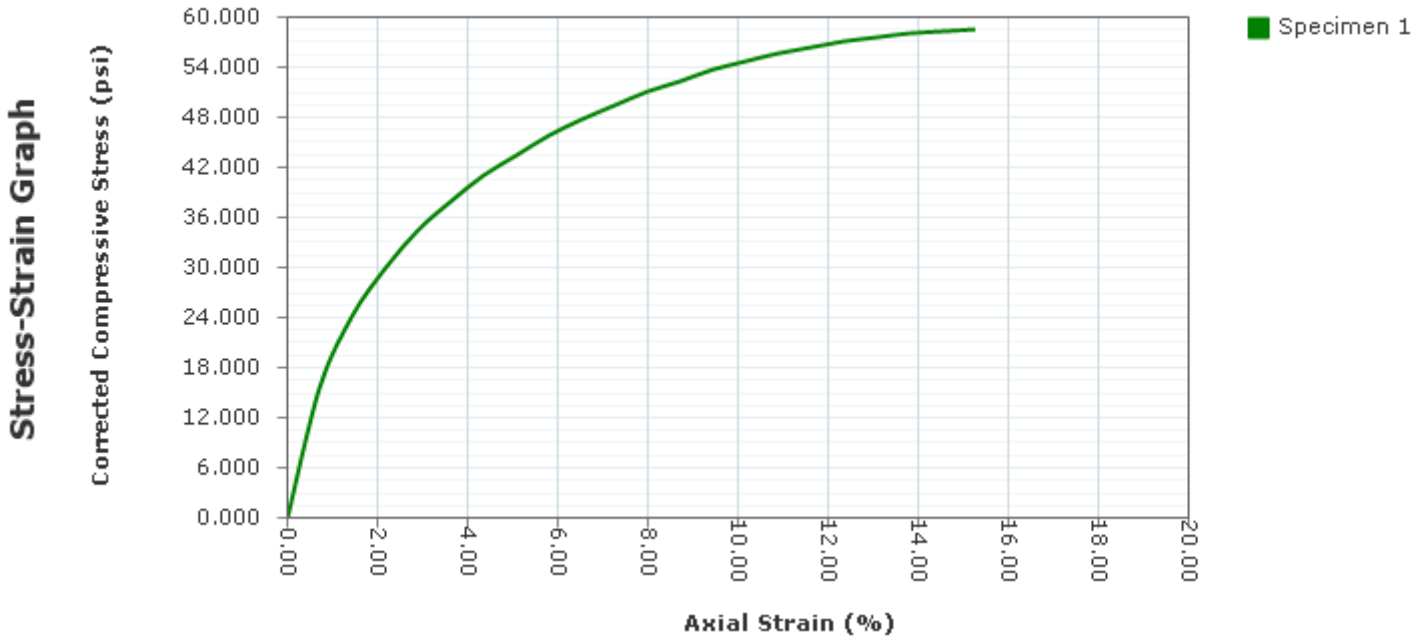
APPENDIX E
UNCONFINED COMPRESSIVE STREGNTH

MEG ENGINEERS Strong Leaders!
Geotechnical | Environmental | Testing

5840 N. Gumwood Avenue ■ Pharr, Texas 78577 ■ Tel: 956-702-8500 ■ Fax: 956-702-8140

Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

ASTM D2166



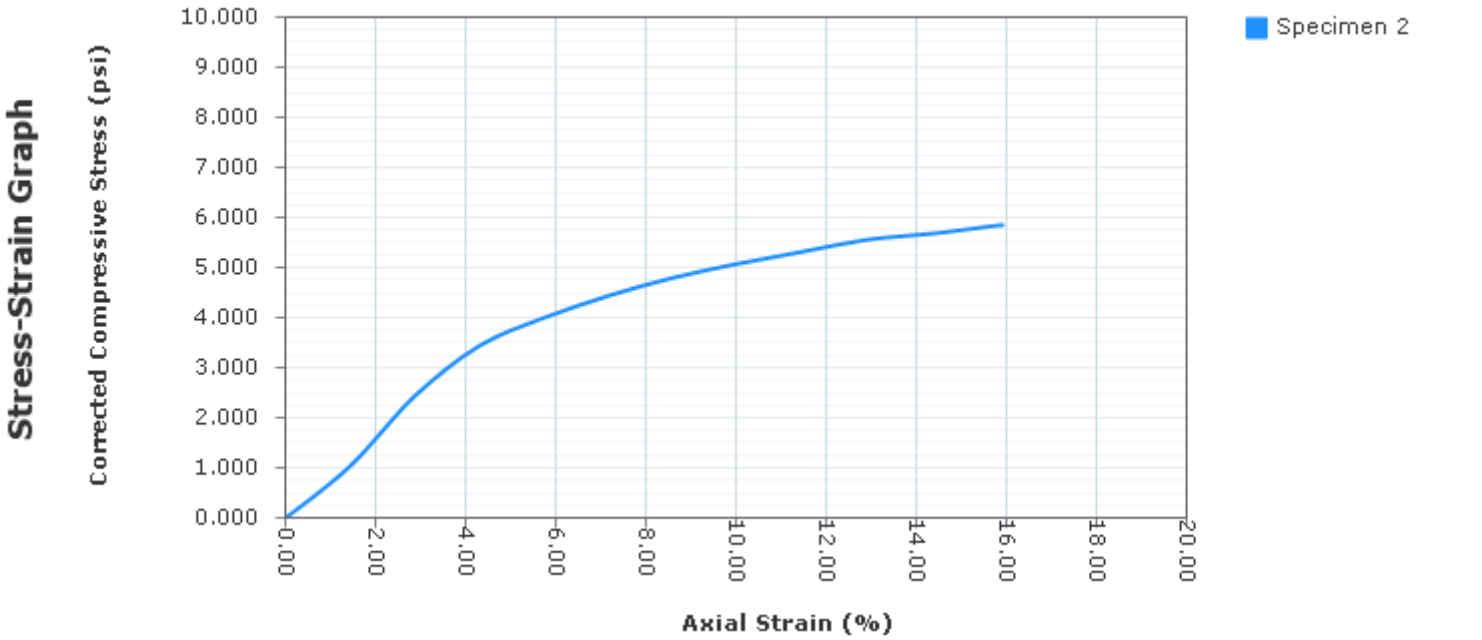
BEFORE TEST	1	2	3	4	5	6	7	8
Moisture Content (%)	25.2							
Dry Density (pcf)	99.12							
Saturation (%)	96.2							
Void Ratio	0.713							
Diameter (in)	1.3873							
Height (in)	2.7773							

TEST DATA	1	2	3	4	5	6	7	8
Unconfined Strength (psi)	58.621							
Undrained Shear Strength (psi)	29.311							
Rate of Strain (in/min)	0.055547							
Strain at Failure (%)	15.3							

PROJECT INFORMATION	SPECIMEN DESCRIPTION
Project Number 02-22-29160	
Project Brownsville North Regional Force Main	
Sample Number: B-1 @ 8.5 - 10	
Client Name: David Ramirez, P.E.	
Brownsville PUB	

Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

ASTM D2166



BEFORE TEST	1	2	3	4	5	6	7	8
Moisture Content (%)		26.1						
Dry Density (pcf)		44.80						
Saturation (%)		25.5						
Void Ratio		2.791						
Diameter (in)		2.9903						
Height (in)		1.4073						

TEST DATA	1	2	3	4	5	6	7	8
Unconfined Strength (psi)		5.857						
Undrained Shear Strength (psi)		2.929						
Rate of Strain (in/min)		0.028147						
Strain at Failure (%)		14.3						

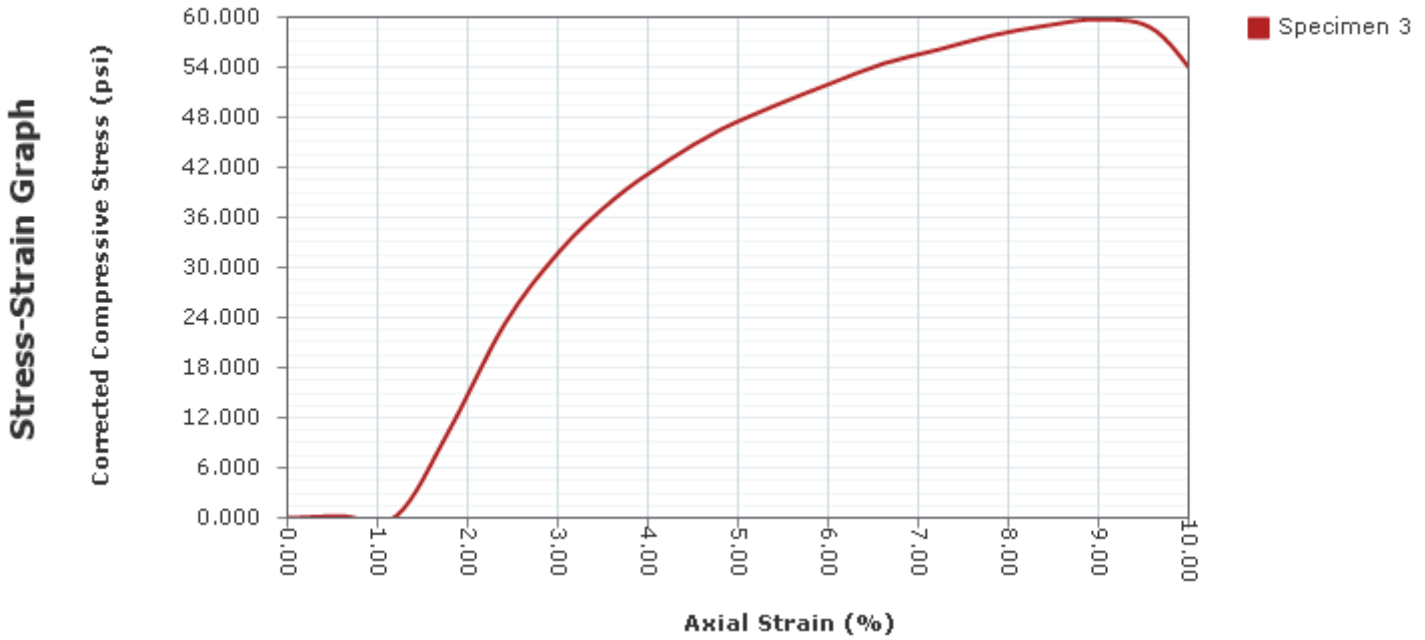
PROJECT INFORMATION	SPECIMEN DESCRIPTION
Project Number 02-22-29160	

Project Brownsville North Regional Force Main

Sample Number: B-2 @ 8.5 - 10
Client Name: David Ramirez, P.E.
Brownsville PUB

Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

ASTM D2166



BEFORE TEST	1	2	3	4	5	6	7	8
Moisture Content (%)			25.9					
Dry Density (pcf)			96.83					
Saturation (%)			93.6					
Void Ratio			0.754					
Diameter (in)			1.3970					
Height (in)			3.3490					

TEST DATA	1	2	3	4	5	6	7	8
Unconfined Strength (psi)			59.847					
Undrained Shear Strength (psi)			29.924					
Rate of Strain (in/min)			0.06698					
Strain at Failure (%)			9.0					

PROJECT INFORMATION

Project Number 02-22-29160

Project Brownsville North Regional Force Main

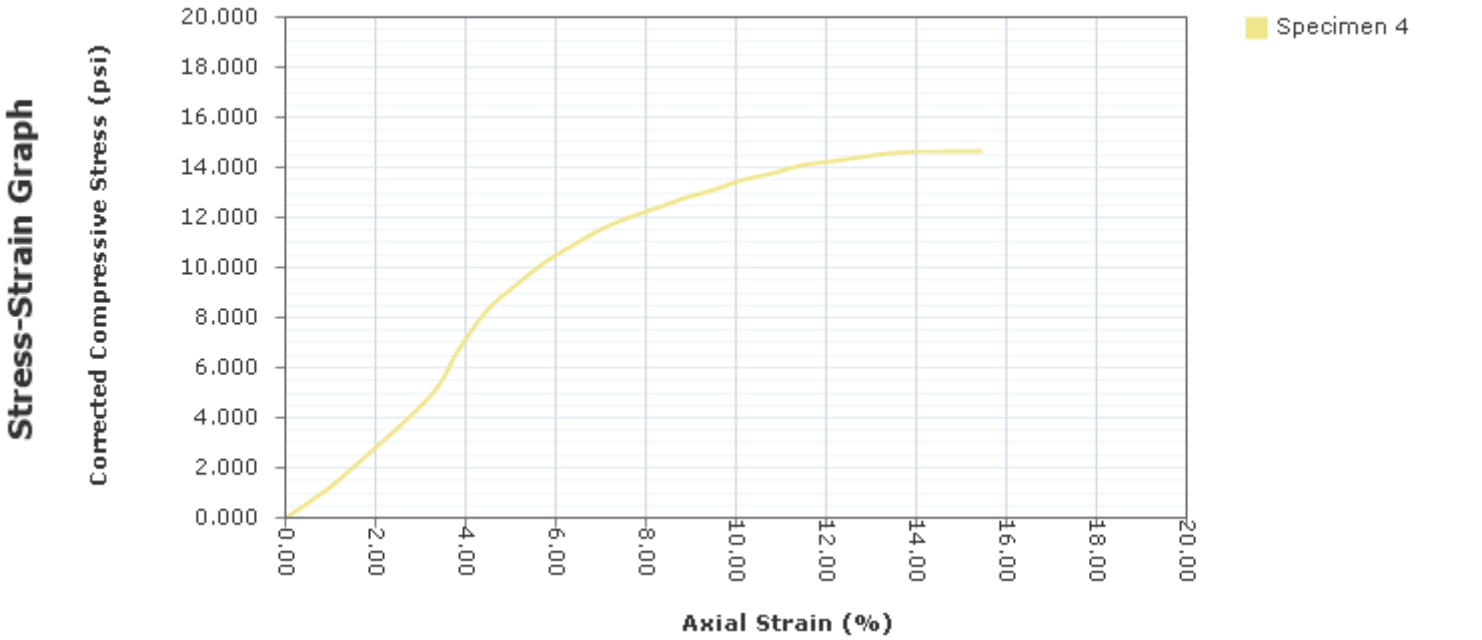
SPECIMEN DESCRIPTION

Sample Number: B-3 @ 8.5 - 10

Client Name: David Ramirez, P.E.
Brownsville PUB

Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

ASTM D2166



BEFORE TEST	1	2	3	4	5	6	7	8
Moisture Content (%)				23.7				
Dry Density (pcf)				104.96				
Saturation (%)				104.3				
Void Ratio				0.618				
Diameter (in)				1.3913				
Height (in)				3.1787				

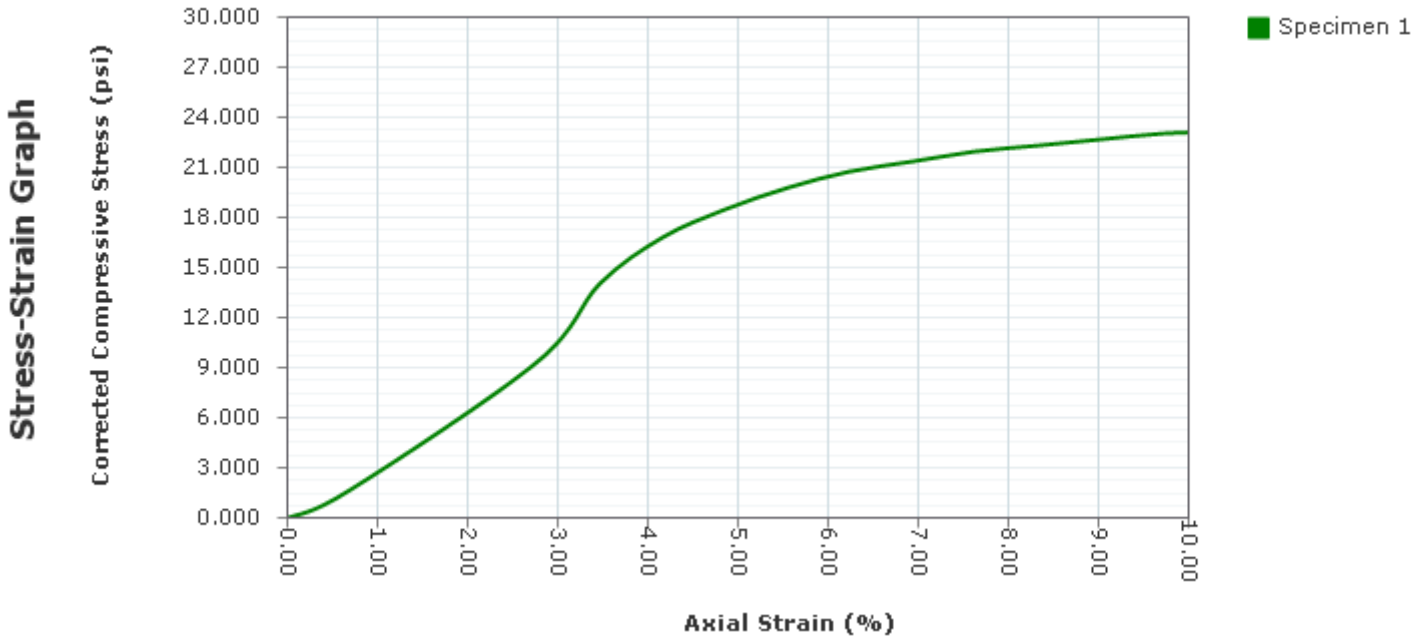
TEST DATA	1	2	3	4	5	6	7	8
Unconfined Strength (psi)				14.638				
Undrained Shear Strength (psi)				7.319				
Rate of Strain (in/min)				0.063573				
Strain at Failure (%)				15.2				

PROJECT INFORMATION	SPECIMEN DESCRIPTION
Project Number	02-22-29160
Project	Brownsville North Regional Force Main

Sample Number: B-3 @ 13.5 - 15
Client Name: David Ramirez, P.E.
Brownsville PUB

Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

ASTM D2166



BEFORE TEST	1	2	3	4	5	6	7	8
Moisture Content (%)	30.5							
Dry Density (pcf)	93.63							
Saturation (%)	102.1							
Void Ratio	0.814							
Diameter (in)	1.4920							
Height (in)	2.9133							

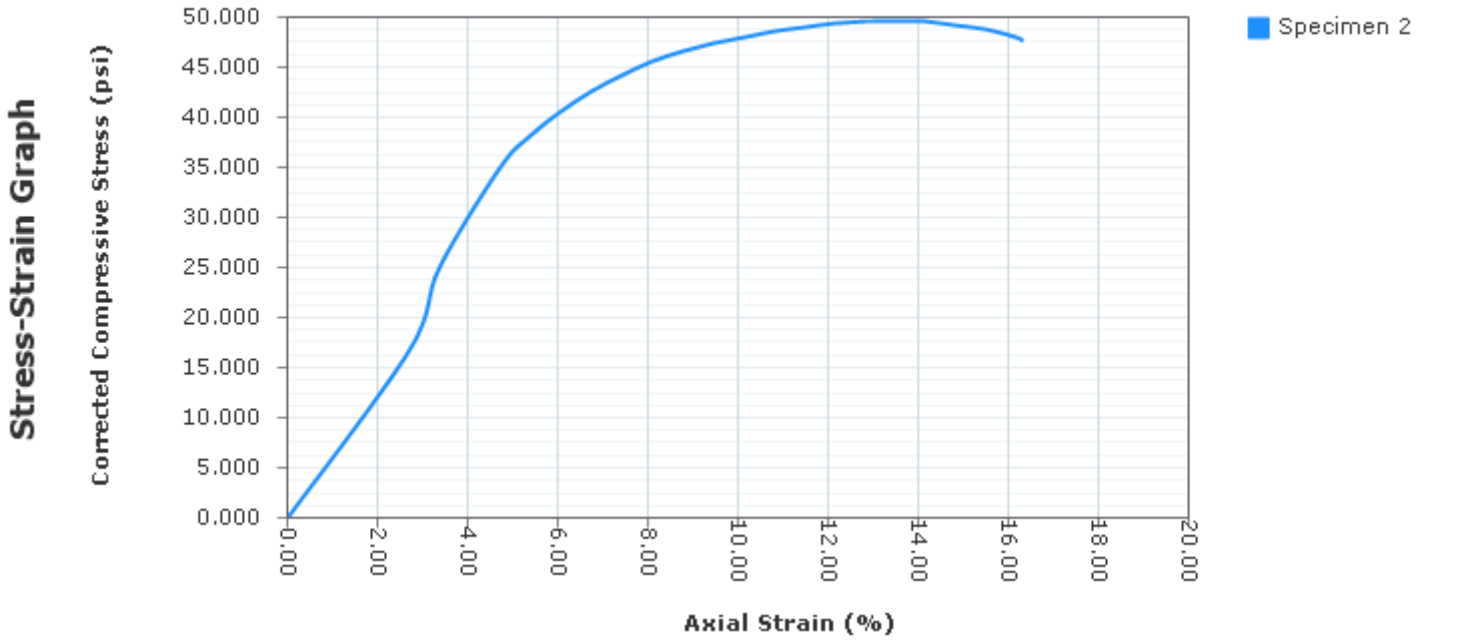
TEST DATA	1	2	3	4	5	6	7	8
Unconfined Strength (psi)	23.194							
Undrained Shear Strength (psi)	11.597							
Rate of Strain (in/min)	0.058267							
Strain at Failure (%)	10.4							

PROJECT INFORMATION	SPECIMEN DESCRIPTION
Project Number 02-22-29160	
Project Brownsville North Regional Force Main	

Sample Number: B-4 @ 18.5 - 20
Client Name: David Ramirez, P.E.
Brownsville PUB

Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

ASTM D2166



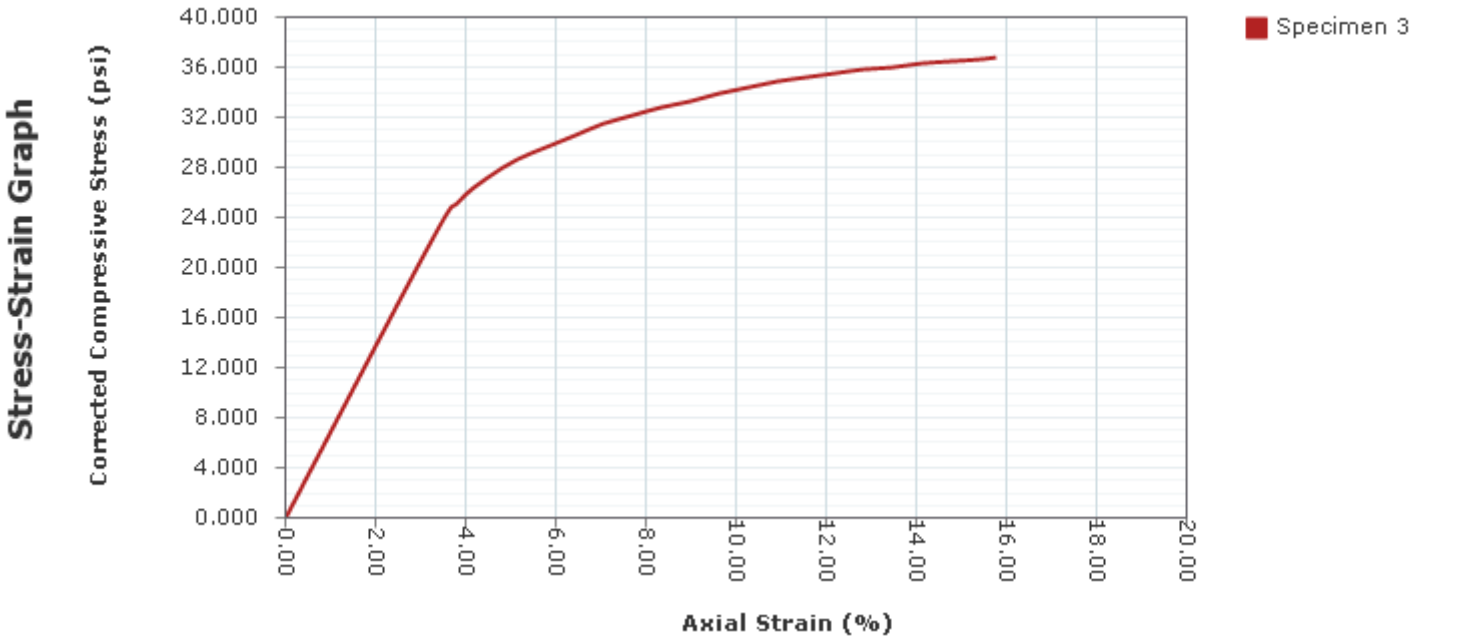
BEFORE TEST	1	2	3	4	5	6	7	8
Moisture Content (%)		23.2						
Dry Density (pcf)		98.39						
Saturation (%)		87.1						
Void Ratio		0.726						
Diameter (in)		1.3730						
Height (in)		2.9940						

TEST DATA	1	2	3	4	5	6	7	8
Unconfined Strength (psi)		49.698						
Undrained Shear Strength (psi)		24.849						
Rate of Strain (in/min)		0.05988						
Strain at Failure (%)		14.8						

PROJECT INFORMATION	SPECIMEN DESCRIPTION
Project Number 02-22-29160	
Project Brownsville North Regional Force Main	
Sample Number: B-5 @ 0.5 - 2	
Client Name: David Ramirez, P.E.	
Brownsville PUB	

Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

ASTM D2166



BEFORE TEST	1	2	3	4	5	6	7	8
Moisture Content (%)			26.7					
Dry Density (pcf)			96.51					
Saturation (%)			95.5					
Void Ratio			0.759					
Diameter (in)			1.3777					
Height (in)			3.1503					

TEST DATA	1	2	3	4	5	6	7	8
Unconfined Strength (psi)			36.743					
Undrained Shear Strength (psi)			18.372					
Rate of Strain (in/min)			0.063007					
Strain at Failure (%)			14.7					

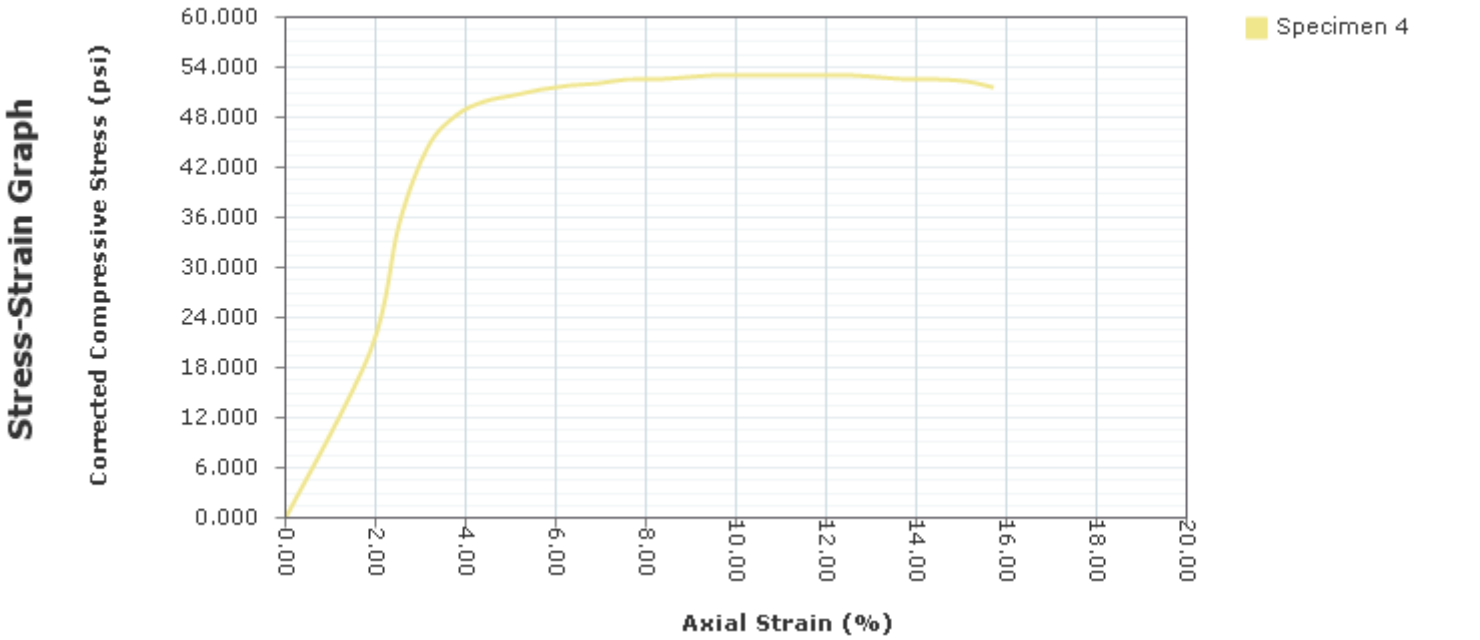
PROJECT INFORMATION	SPECIMEN DESCRIPTION
Project Number 02-22-29160	

Project Brownsville North Regional Force Main

Sample Number: B-5 @ 13.5 - 15
Client Name: David Ramirez, P.E.
Brownsville PUB

Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

ASTM D2166



BEFORE TEST	1	2	3	4	5	6	7	8
Moisture Content (%)				25.1				
Dry Density (pcf)				100.00				
Saturation (%)				97.8				
Void Ratio				0.698				
Diameter (in)				1.3713				
Height (in)				3.2023				

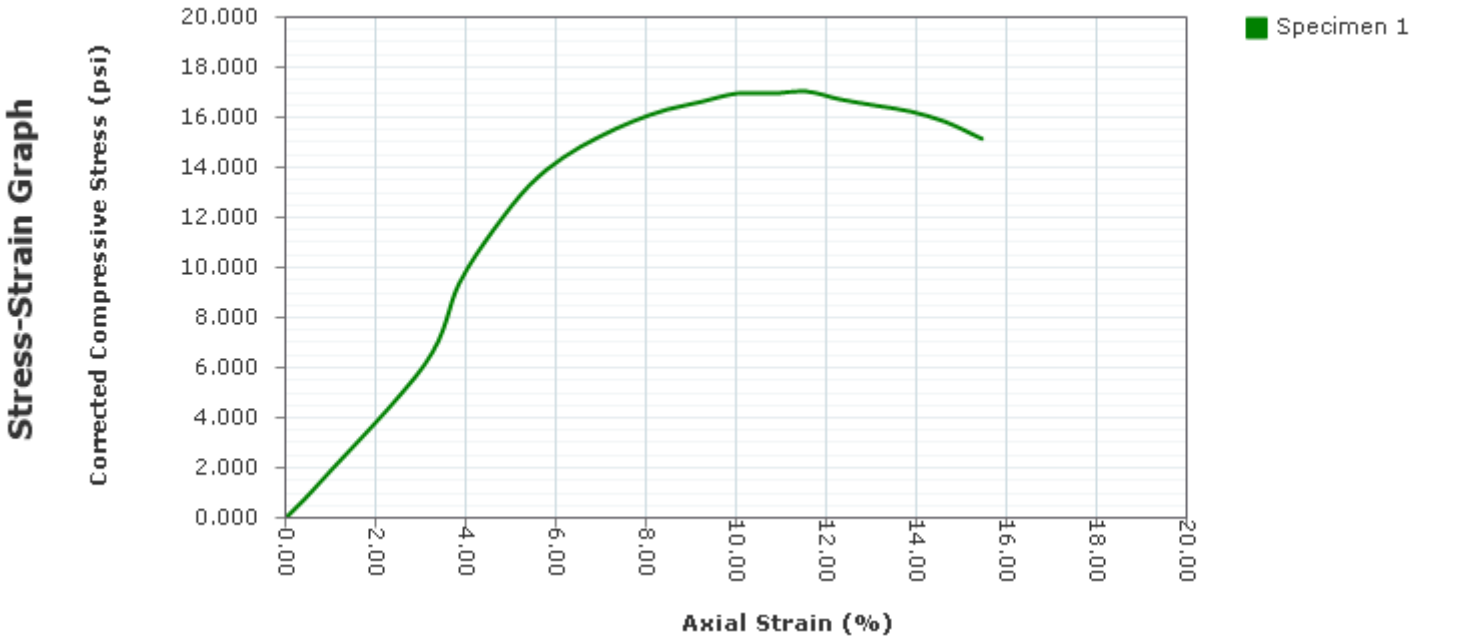
TEST DATA	1	2	3	4	5	6	7	8
Unconfined Strength (psi)				53.127				
Undrained Shear Strength (psi)				26.564				
Rate of Strain (in/min)				0.064047				
Strain at Failure (%)				15.1				

PROJECT INFORMATION	SPECIMEN DESCRIPTION
Project Number	02-22-29160
Project	Brownsville North Regional Force Main

Sample Number: B-5 @ 18.5 - 20
Client Name: David Ramirez, P.E.
Brownsville PUB

Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

ASTM D2166



BEFORE TEST	1	2	3	4	5	6	7	8
Moisture Content (%)	30.2							
Dry Density (pcf)	87.13							
Saturation (%)	86.5							
Void Ratio	0.949							
Diameter (in)	1.3733							
Height (in)	2.6213							

TEST DATA	1	2	3	4	5	6	7	8
Unconfined Strength (psi)	17.040							
Undrained Shear Strength (psi)	8.520							
Rate of Strain (in/min)	0.052427							
Strain at Failure (%)	11.6							

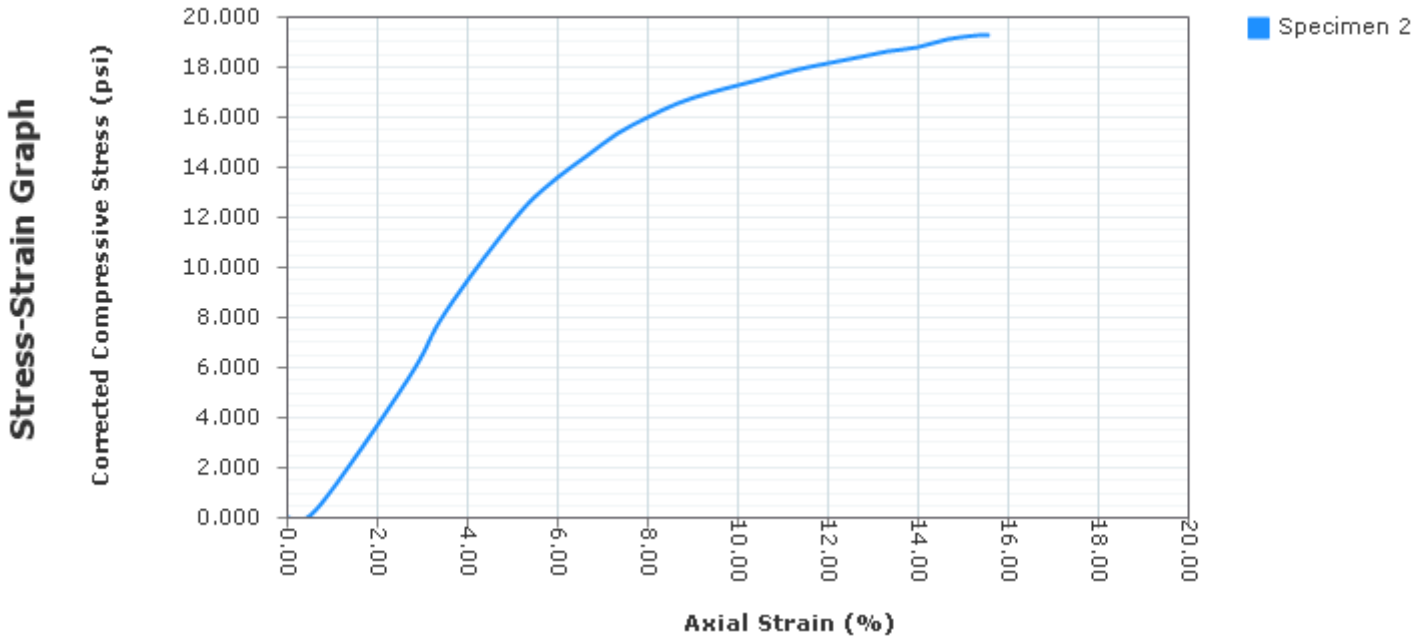
PROJECT INFORMATION	SPECIMEN DESCRIPTION
Project Number 02-22-29160	

Project Brownsville North Regional Force Main

Sample Number: B-7 @ 4.5 - 6
Client Name: David Ramirez, P.E.
Brownsville PUB

Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

ASTM D2166



BEFORE TEST	1	2	3	4	5	6	7	8
Moisture Content (%)		27.3						
Dry Density (pcf)		95.34						
Saturation (%)		95.0						
Void Ratio		0.781						
Diameter (in)		1.4250						
Height (in)		3.0337						

TEST DATA	1	2	3	4	5	6	7	8
Unconfined Strength (psi)		19.311						
Undrained Shear Strength (psi)		9.656						
Rate of Strain (in/min)		0.060673						
Strain at Failure (%)		15.3						

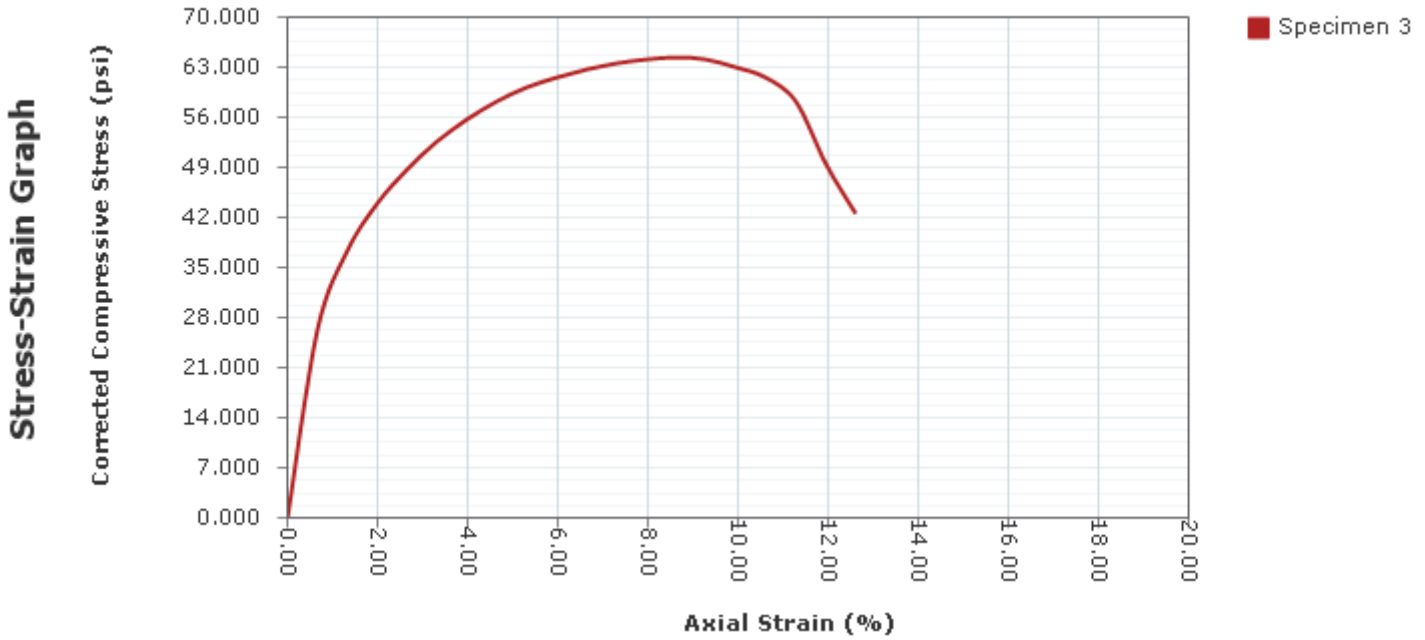
PROJECT INFORMATION	SPECIMEN DESCRIPTION
Project Number 02-22-29160	

Project Brownsville North Regional Force Main

Sample Number: B-9 @ 8.5 - 10
Client Name: David Ramirez, P.E.
Brownsville PUB

Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

ASTM D2166



BEFORE TEST	1	2	3	4	5	6	7	8
Moisture Content (%)			25.9					
Dry Density (pcf)			92.43					
Saturation (%)			84.2					
Void Ratio			0.837					
Diameter (in)			1.3960					
Height (in)			3.0450					

TEST DATA	1	2	3	4	5	6	7	8
Unconfined Strength (psi)			64.301					
Undrained Shear Strength (psi)			32.151					
Rate of Strain (in/min)			0.0609					
Strain at Failure (%)			9.3					

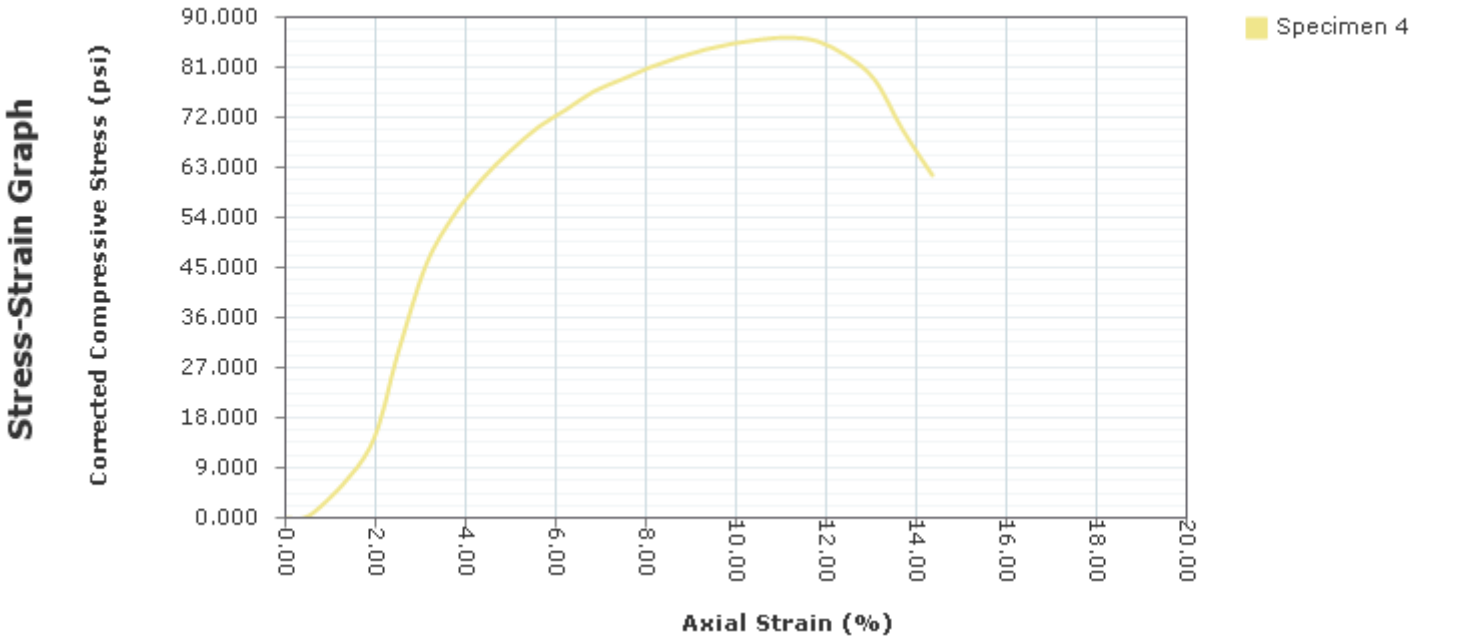
PROJECT INFORMATION	SPECIMEN DESCRIPTION
Project Number 02-22-29160	

Project Brownsville North Regional Force Main

Sample Number: B-14 @ 2.5 - 4
Client Name: David Ramirez, P.E.
Brownsville PUB

Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

ASTM D2166



BEFORE TEST	1	2	3	4	5	6	7	8
Moisture Content (%)				25.0				
Dry Density (pcf)				91.03				
Saturation (%)				78.7				
Void Ratio				0.865				
Diameter (in)				1.3907				
Height (in)				3.2460				

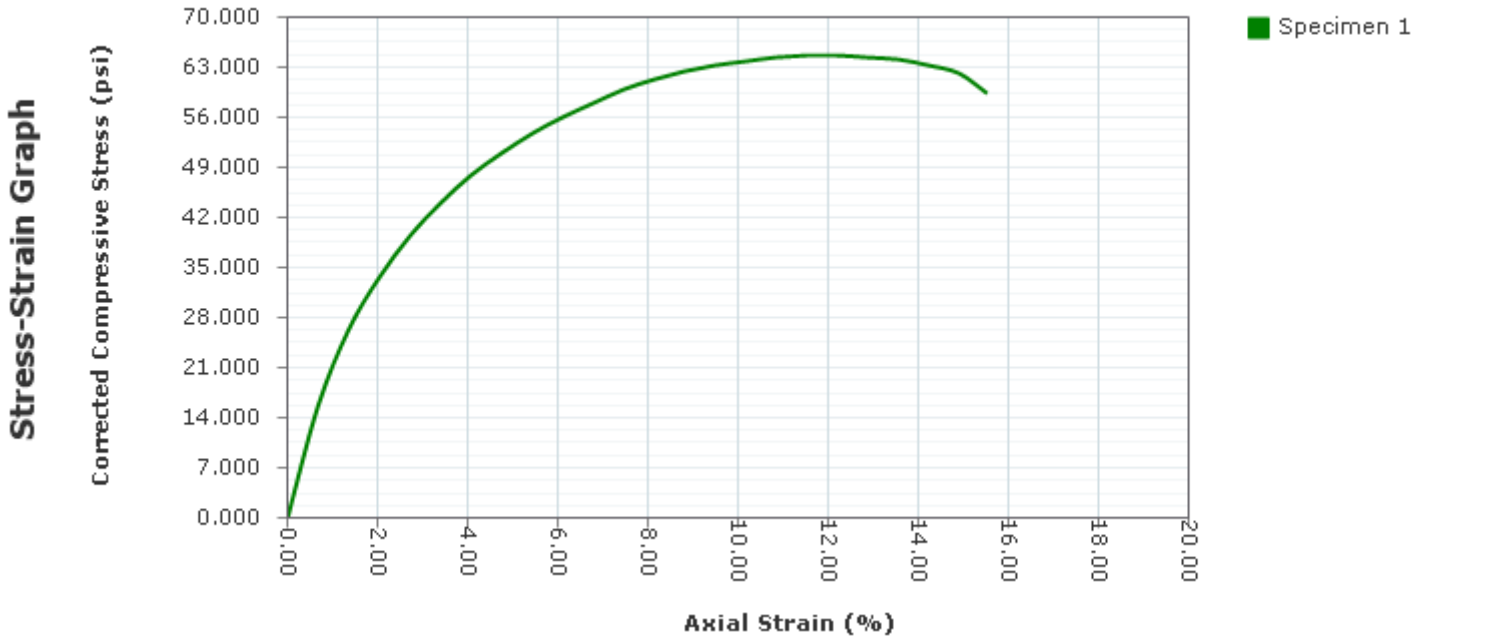
TEST DATA	1	2	3	4	5	6	7	8
Unconfined Strength (psi)				86.343				
Undrained Shear Strength (psi)				43.172				
Rate of Strain (in/min)				0.06492				
Strain at Failure (%)				11.8				

PROJECT INFORMATION	SPECIMEN DESCRIPTION
Project Number	02-22-29160
Project	Brownsville North Regional Force Main

Sample Number: B-14 @ 4.5 - 6
Client Name: David Ramirez, P.E.
Brownsville PUB

Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

ASTM D2166



BEFORE TEST	1	2	3	4	5	6	7	8
Moisture Content (%)	23.3							
Dry Density (pcf)	75.70							
Saturation (%)	51.0							
Void Ratio	1.243							
Diameter (in)	1.5827							
Height (in)	2.9813							

TEST DATA	1	2	3	4	5	6	7	8
Unconfined Strength (psi)	64.663							
Undrained Shear Strength (psi)	32.332							
Rate of Strain (in/min)	0.059627							
Strain at Failure (%)	13.6							

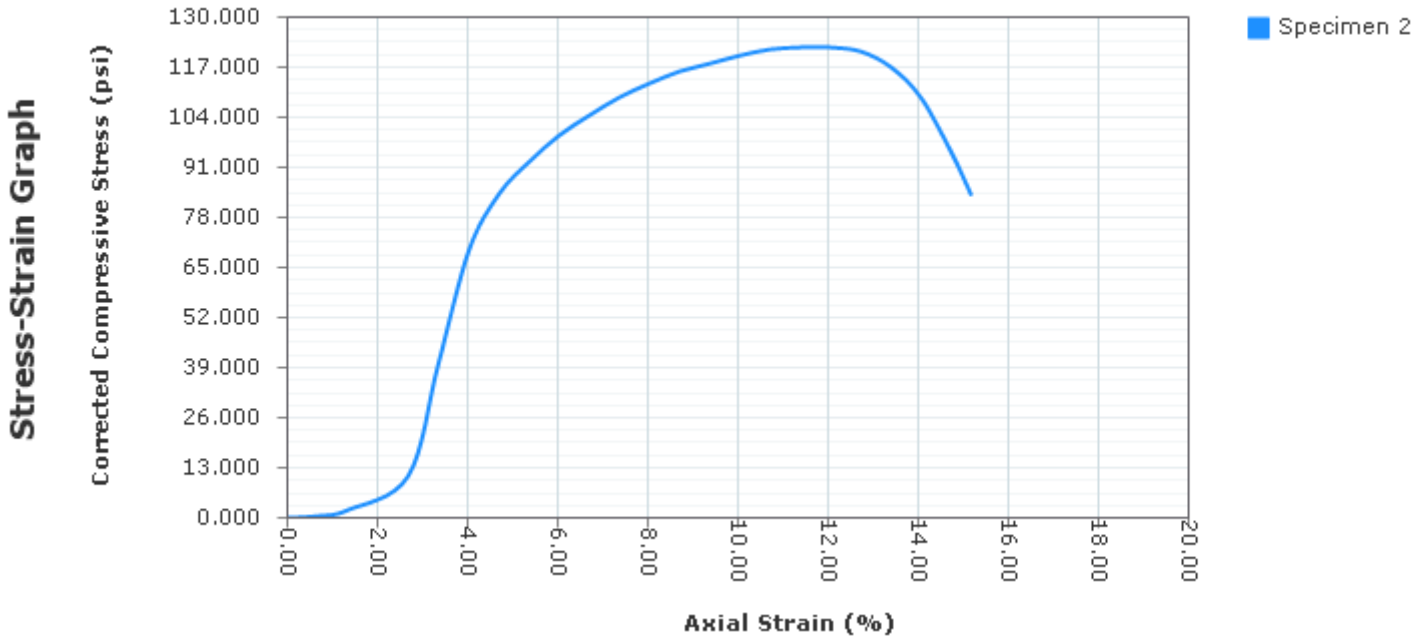
PROJECT INFORMATION	SPECIMEN DESCRIPTION
Project Number 02-22-29160	

Project Brownsville North Regional Force Main

Sample Number: B-14 @ 6.5 - 8
Client Name: David Ramirez, P.E.
Brownsville PUB

Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

ASTM D2166



BEFORE TEST	1	2	3	4	5	6	7	8
Moisture Content (%)		21.8						
Dry Density (pcf)		102.27						
Saturation (%)		89.7						
Void Ratio		0.660						
Diameter (in)		1.3923						
Height (in)		3.0157						

TEST DATA	1	2	3	4	5	6	7	8
Unconfined Strength (psi)		122.457						
Undrained Shear Strength (psi)		61.229						
Rate of Strain (in/min)		0.060313						
Strain at Failure (%)		12.0						

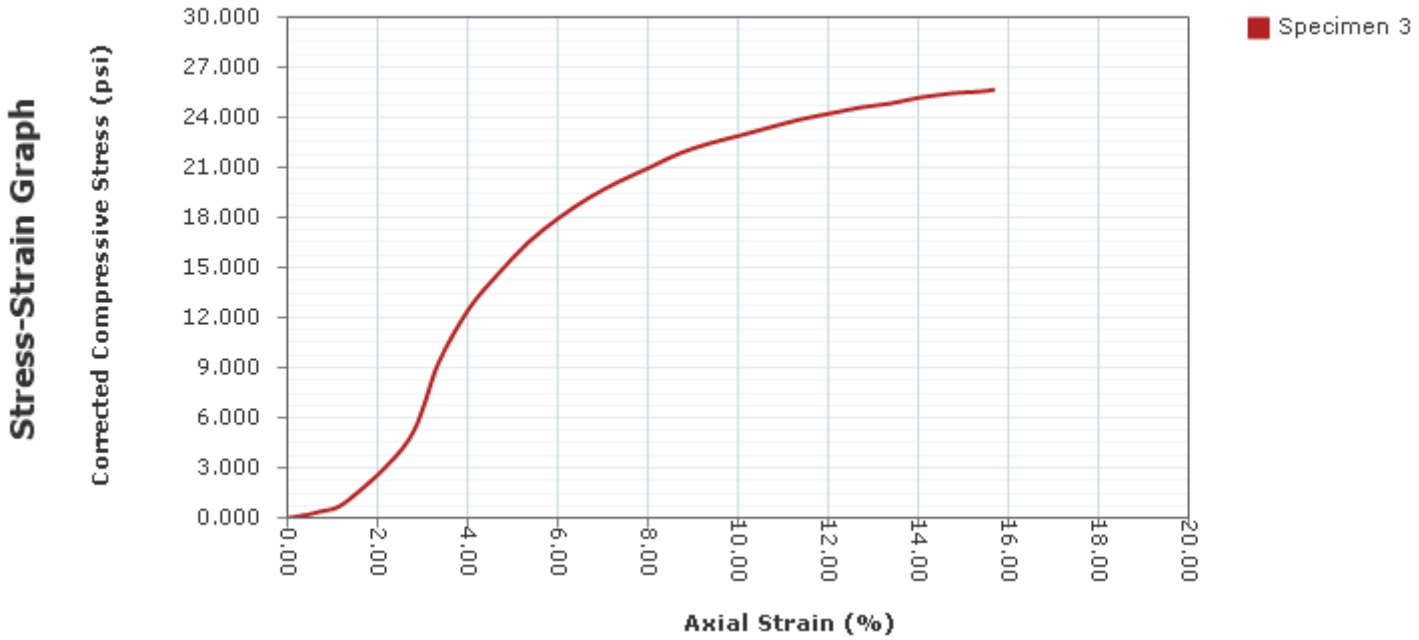
PROJECT INFORMATION	SPECIMEN DESCRIPTION
Project Number 02-22-29160	

Project Brownsville North Regional Force Main

Sample Number: B-15 @ 2.5 - 4
Client Name: David Ramirez, P.E.
Brownsville PUB

Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

ASTM D2166



BEFORE TEST	1	2	3	4	5	6	7	8
Moisture Content (%)			26.6					
Dry Density (pcf)			94.77					
Saturation (%)			91.5					
Void Ratio			0.792					
Diameter (in)			1.3810					
Height (in)			3.0200					

TEST DATA	1	2	3	4	5	6	7	8
Unconfined Strength (psi)			25.656					
Undrained Shear Strength (psi)			12.828					
Rate of Strain (in/min)			0.0604					
Strain at Failure (%)			14.7					

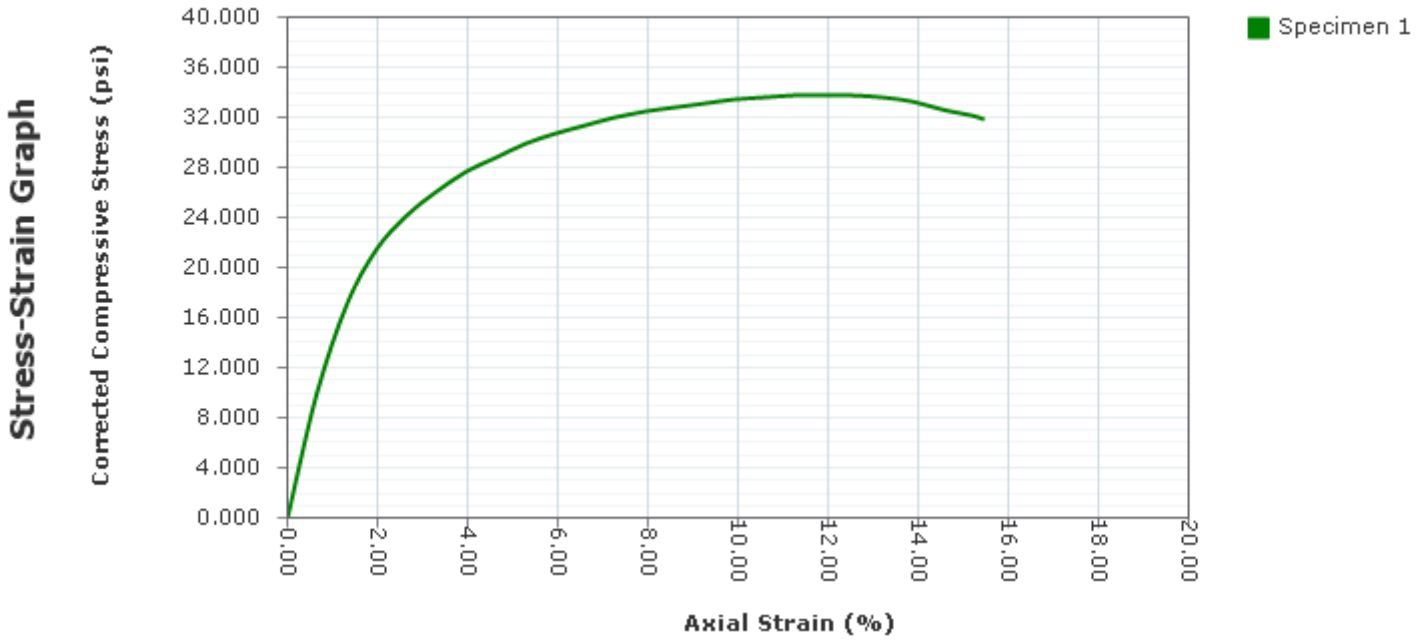
PROJECT INFORMATION	SPECIMEN DESCRIPTION
Project Number 02-22-29160	

Project Brownsville North Regional Force Main

Sample Number: B-16 @ 8.5 - 10
Client Name: David Ramirez, P.E.
Brownsville PUB

Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

ASTM D2166



BEFORE TEST	1	2	3	4	5	6	7	8
Moisture Content (%)	28.1							
Dry Density (pcf)	90.47							
Saturation (%)	87.2							
Void Ratio	0.877							
Diameter (in)	1.3570							
Height (in)	3.0540							

TEST DATA	1	2	3	4	5	6	7	8
Unconfined Strength (psi)	33.722							
Undrained Shear Strength (psi)	16.861							
Rate of Strain (in/min)	0.06108							
Strain at Failure (%)	13.2							

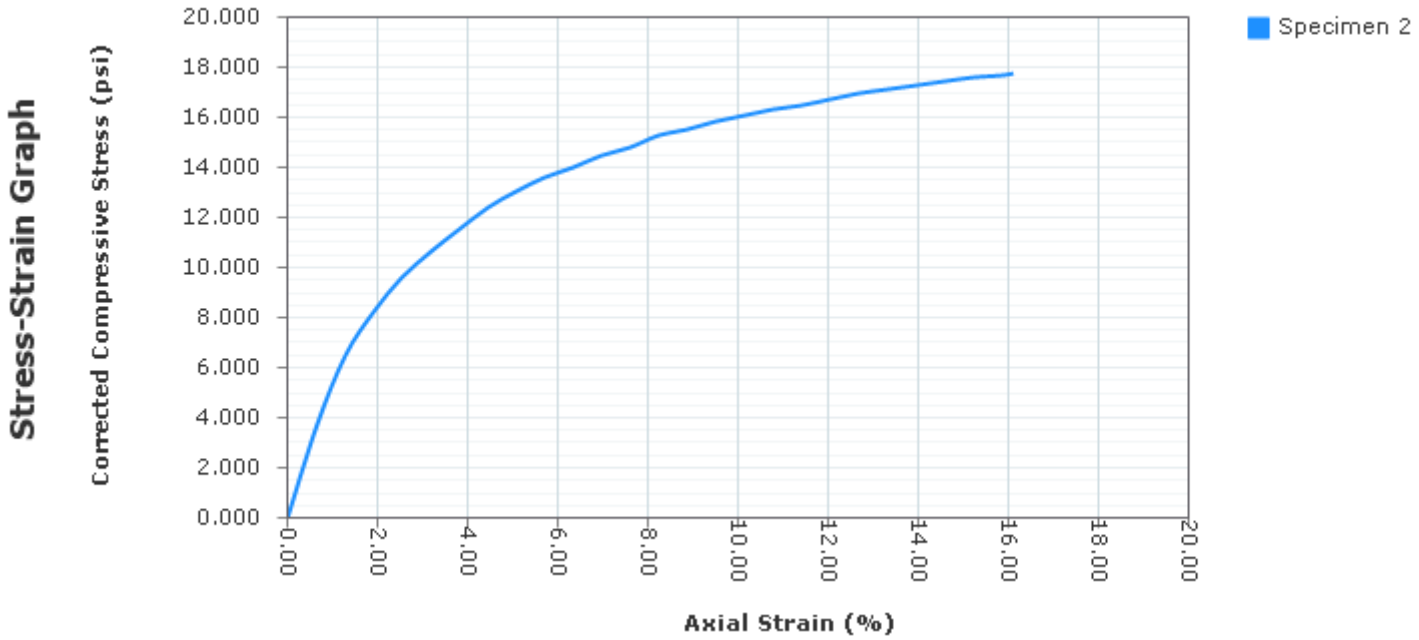
PROJECT INFORMATION	SPECIMEN DESCRIPTION
Project Number 02-22-29160	

Project Brownsville North Regional Force Main

Sample Number: B-18 @ 13.5 - 15
Client Name: David Ramirez, P.E.
Brownsville PUB

Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

ASTM D2166



BEFORE TEST	1	2	3	4	5	6	7	8
Moisture Content (%)		23.5						
Dry Density (pcf)		101.53						
Saturation (%)		94.9						
Void Ratio		0.672						
Diameter (in)		1.4087						
Height (in)		3.1880						

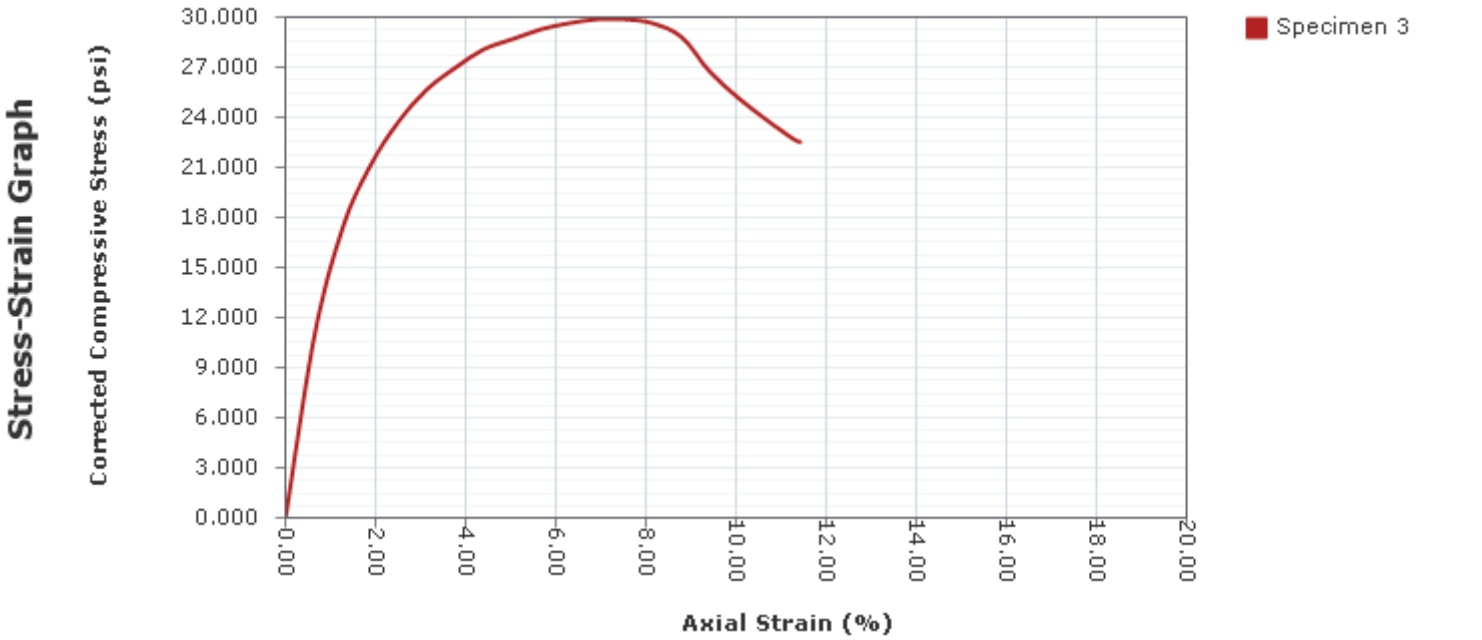
TEST DATA	1	2	3	4	5	6	7	8
Unconfined Strength (psi)		17.724						
Undrained Shear Strength (psi)		8.862						
Rate of Strain (in/min)		0.06376						
Strain at Failure (%)		15.2						

PROJECT INFORMATION	SPECIMEN DESCRIPTION
Project Number 02-22-29160	
Project Brownsville North Regional Force Main	

Sample Number: B-18 @ 18.5 - 20
Client Name: David Ramirez, P.E.
Brownsville PUB

Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

ASTM D2166



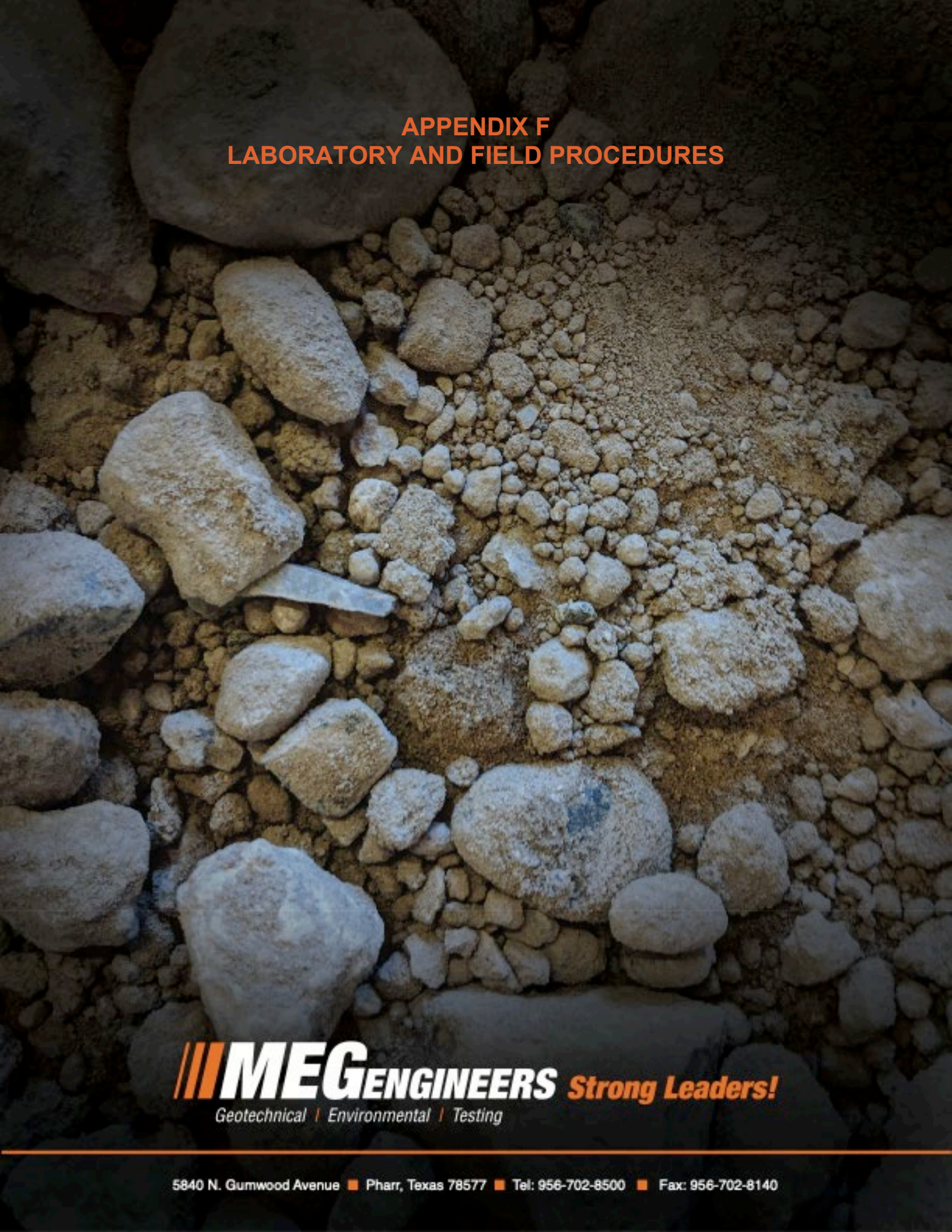
BEFORE TEST	1	2	3	4	5	6	7	8
Moisture Content (%)			26.9					
Dry Density (pcf)			91.96					
Saturation (%)			86.6					
Void Ratio			0.847					
Diameter (in)			1.3490					
Height (in)			3.2173					

TEST DATA	1	2	3	4	5	6	7	8
Unconfined Strength (psi)			29.868					
Undrained Shear Strength (psi)			14.934					
Rate of Strain (in/min)			0.064347					
Strain at Failure (%)			8.2					

PROJECT INFORMATION	SPECIMEN DESCRIPTION
Project Number 02-22-29160	

Project Brownsville North Regional Force Main

Sample Number: B-19 @ 18.5 - 20
Client Name: David Ramirez, P.E.
Brownsville PUB



APPENDIX F
LABORATORY AND FIELD PROCEDURES

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Geotechnical | Environmental | Testing

5840 N. Gumwood Avenue ■ Pharr, Texas 78577 ■ Tel: 956-702-8500 ■ Fax: 956-702-8140

Laboratory and Field Test Procedures

Soil Classification Per ASTM D2487-93:

This soil-testing standard was used for classifying soils according to the Unified Soil Classification System. The soil classifications of the earth materials encountered are as noted in the attached boring logs.

Soil Water Content Per ASTM D2216-92:

This test determines the water content of soil or rock expressed as a percentage of the solid mass of the soil. The test results are listed under **MC** in the attached boring logs.

Soil Liquid Limit Per ASTM D4318-93:

The soil Liquid Limit identifies the upper limit soil water content at which the soil changes from a moldable (plastic) physical state to a liquid state. The Liquid Limit water content is expressed as a percentage of the solid mass of the soil. The test results are listed under **LL** in the attached boring logs.

Soil Plastic Limit Per ASTM D4318-93:

The soil Plastic Limit identifies lower limit soil water content at which the soil changes from a moldable (plastic) physical state to a non-moldable (semi-solid) physical state. The Plastic Limit water content is expressed as a percentage of the solid mass of the soil. The test results are listed under **PL** in the attached boring logs.

Plasticity Index Per ASTM D4318-93:

This is the numeric difference between the Liquid Limit and Plastic Limit. This index also defines the range of water content over which the soil-water system acts as a moldable (plastic) material. Higher Plasticity Index (PI) values indicate that the soil has a greater ability to change in soil volume or shrink and swell with lower or higher water contents, respectively. The test results are listed under **PI** in the attached boring logs.

Standard Penetration Test (SPT) and Split Spoon Sampler (SS) per ASTM D 1586:

This is the standard test method for both the penetration test and split-barrel (spoon) sampling of soils. This sampling method is used for soils or rock too hard for sampling using Shelby Tubes. The method involves penetration of a split spoon sampler into the soil or rock through successive blows of a 140-pound hammer in a prescribed manner.

Blow Counts (N) per ASTM D 1586:

This is the number of blows required to drive a Split Spoon Sampler by means of a 140 pound hammer for a distance of 12 inches in accordance with the variables stated in the test procedures.

Shelby Tube (ST) per ASTM D 1587:

This procedure is for using a thin-walled metal tube to recover relatively undisturbed soil samples suitable for laboratory tests of physical properties.

Dry Density (DD) per ASTM D 2937:

This procedure is for the determination of in-place density of soil. The test results are measured in pounds per cubic foot, pcf.

Unconfined Compression Test (Uc) per ASTM D 2166:

This test method covers the determination of the unconfined compressive strength of cohesive soil in the undisturbed, remolded, or compacted condition, using strain-controlled application of the axial load.

Minus No. 200 Sieve per ASTM D 1140:

This test method covers determination of the amount of material finer than a Number 200 sieve by washing. The results are stated as a percent of the total dry weight of the sample.

Pocket Penetrometer (PP):

This test method is an accepted modification of ASTM D 1558 test method for establishing the moisture-penetration resistance relationships of fine-grained soils. The test results are measured in tons per square foot, tsf. The strength values provided by this method should be considered qualitatively.

Rock Quality Designation (RQD):

The measure of the quality of a rock mass defined by adding intact rock core pieces greater than four inches in length by the total length of core advance.

Recovery Ratio (REC):

The Recovery Ratio is equal to the total length of core recovered divided by the total length of core advance.

Boring Logs:

This is a summary of the above-described information at each boring location.

Millennium Engineers Group
MEG ENGINEERS
Consultants - Geotechnical - Testing

TBPE FIRM N . F
. r .

Area Off ces
5804 N. G mwood A e. Pharr, Te as 78577 956-702-8500
1221 E. Tyler A e. Harl ge , Te as 78550 956-454-8832
5918 McPherso Rd., Ste. 5 Laredo, Te as 78041 956-568-1664

R r O E r R r S **L N 2002**
R r N 1-2
Pr N 02-23-29122 **A . N .** Halff2020 **P** 8

C Halff Assoc ates
Mr. Joh Cl t
1075 Paredes L e Rd Ste. B
Brow s lle, TX 78521

Pr BPUB N. Reg o al Force Ma

L Brow s lle, Camero Co ty, TX

R r D 09/12/2023
S D 09/08/2023
S d B Cro os Oros

Remar s: We are leased to s bm t the attached geotech cal adde d m re ort for the BPUB Reg o al Force Ma Ut l ty Aer al Cross g Brow s lle, Camero Co ty, TX. Please red str b te attached re ort as ecessary. MEG a rec ates yo r b s ess a d loo s forward to co t e wor g w th yo o com g ro ects. We em has e that o r re ort be re ewed to ts f llest, a d to arra ge a co fere ce call w th o e of o r e g eers for a y est o s abo t the re ort.

Res ectf lly S bm tted,
M lle m E g eers Gro l c.

Raul Palma, P.E.

STATE OF TEXAS
RAUL PALMA
65656
REGISTERED
PROFESSIONAL ENGINEER

September 6, 2023

John Clint, P.E.
Vice President, Operations Manager
Halff Associates
1075 Paredes Line Road, Suite B
Brownsville, Texas 78521
jclint@halff.com

Subject: **Addendum No. 1,**
MEG Report No. 02-23-29122
Foundation Recommendations
Proposed BPUB Regional Force Main Utility Aerial Crossing
Brownsville, Cameron County, Texas

Dear Mr. Clint (CLIENT):

Millennium Engineers Group, Inc. is pleased to submit this addendum to the Geotechnical Report as requested by CLIENT. This addendum includes pier foundation recommendations updating the subject report (MEG Geotechnical Engineering Report No. 02-23-29122). This addendum in no way should be used or interpreted on its own. The contents of this addendum should only be used and interpreted in conjunction with the subject report. The information and/or recommendations provided herein should be reviewed by the Owner and Owner's Representative(s). This addendum adds, replaces or revises the subject report as follows:

I. The following sub-sections includes Section 9.0 PIER FOUNDATION RECOMMENDATIONS of the subject report:

9.0 PIER FOUNDATION RECOMMENDATIONS

9.1 Straight Sided Concrete Piers

Items influencing the type of foundation selected for the proposed residence include the design axial and lateral foundation loads, the presence of poorly graded sands and the presence of groundwater. More specifically, the final pier dimensions, particularly to include the required length of pier, will be determined based on the foundation design loads, the depth of the active zone, the potential uplift force imposed by the soils within the active zone and the available side friction capacity and end bearing capacity allotted to the subsurface stratigraphy. Straight-sided piers bearing at a minimum elevation of 15 feet below natural ground may support vertical loads for the proposed structure**. The clays to sandy clays and the water table elevation at this site may require that the concrete piers be placed with casing or the slurry displacement method to prevent collapse of the shaft boring walls.** Based on our depth of exploration at an elevation

of approximately 40 feet below natural ground and the type of structures, pier depths should not exceed a depth of 30 feet below natural ground. The allowable capacities are provided in an attachment in the Appendix section of this report, titled *Allowable Axial Capacity*. For straight sided piers, the contribution of the soils for the top 5 feet of soil embedment and for a length equal to at least 1 pier diameter from the bottom of the shaft should be neglected in the determination of friction capacity. The recommended design parameters include a factor of safety of 2 for skin friction and of 3 for end bearing. The minimum embedment depth was selected to locate the pier base within a specified desired bearing stratum. If the piers are subject to water action, scour may occur. If this is the case, the pier length should be referenced from the level of the maximum scour depth. Likewise, the LPILE analysis should neglect the contribution of soils down to the maximum scour depth.

9.2 Uplift Forces

Within the active zone the concrete piers may be subjected to potential uplift forces. Alternate drying and wetting conditions of the expansive soils surrounding the concrete pier create these uplift forces. The uplift force acting on the piers may be estimated by the following relationship:

Uplift force (tons) = 3.0 x shaft diameter (feet) (with subgrade modifications)

Other uplift forces due to other factors may need to be taken into consideration.

9.3 Allowable Uplift Resistance

The potential uplift forces that may be created by the swelling soils may be resisted by the dead load of the concrete pier plus the allowable uplift resistance provided by the friction between the soil and pier interface. The allowable uplift resistance are provided in an attachment in the Appendix section of this report, titled *Allowable Uplift Resistance*. These values have been estimated with a factor of safety of two (2). Design requirements for reinforcing and for pier penetration derived from compression or uplift loading for the structure is usually sufficient to overcome any effects of expansive soils. However, we recommend that the cross sectional area of the reinforcing steel should not be less than one (1) percent of the gross cross sectional area of the drilled pier shaft. The reinforcing steel should extend from the top to the bottom of the shaft to resist axial tension forces. The final reinforcing requirements should be determined by the project structural engineer.

9.4 Pier Lateral Criteria

Lateral pile analysis including capacity, maximum shear, and maximum bending moment should be evaluated by the project structural engineer using LPILE or similar software. In the following table, MEG presents geotechnical input parameters for the encountered soils. Please note that the depths to the top and bottom of each layer were interpreted

using the data at the explored boring locations and layer boundaries as shown on the boring logs:

Table 9.1. Drilled Pier Geotechnical Input Parameters for LPILE Analysis

Depth	Material	Y_e	C_u	Φ	K	e_{50}
0 to 5	fat CLAY (CH)	Neglect contribution				
5 to 14 (WT at 14 feet)	fat CLAY (CH)	100	750	-	Ks = 100	0.010
14 to 40	sandy fat CLAY to lean CLAY (CH)	50	750	-	Ks = 100	0.010

Where: Y_e = Effective Soil Unit Weight, pcf
C_u = Undrained Soil Shear Strength, psf
Φ = Angle of internal friction, degrees
e_{50} = 50% strain value
K = Modulus of subgrade reaction, pci

9.5 Spacing for Concrete Piers

Concrete pier spacing should be at least three (3) shaft diameters from edge to edge to eliminate any reduction in load carrying capacity of the individual piers.

When utilizing a pier group and the pier spacing is less than three (3) times the pier diameter from edge to edge, the following reduction factors for bearing capacity and skink friction shall apply:

- The minimum recommended pier spacing shall be one and a half (1.5) times the pier diameter from edge to edge. The reduction factor for this spacing is 0.5.
- The reduction factor for pier spacing less than three (3) times the pier diameter but more than one and a half (1.5) times the pier diameter from edge to edge shall be linearly interpolated from the reduction factor values provided herein.

For straight-sided concrete piers, the total settlements based on the bearing pressures are estimated to generally be in the order of one (1) inch or less for properly designed and constructed drilled piers. At this site, the underlain soils exhibit low shear strengths and potential settlements can best be estimated when site grading, foundation dimensions and loads have been established. Most of the settlement beneath each individual pier should occur during the construction phase. Differential settlement

between piers can be expected and should be in the order of 50 to 75 percent of the total pier settlement. For properly designed and constructed piers we estimate the differential settlement between adjacent piers to be in the order of three-fourths (¾) of an inch. A detailed estimate of settlement is outside the scope of this service report. The quality of construction will affect the settlement process of drilled piers more than the soil-structure interaction. Poor drilled pier construction could result in settlements significantly higher than what we have estimated in this report. Utilizing soil-bearing pressures higher than the allowable values presented in this report can also produce significantly higher settlements at individual piers and differential settlement between adjacent piers.

II. ADDENDUM PROJECT REVIEW AND QUALITY CONTROL

Recommendations found in the subject report shall be followed unless in conflict with the recommendations made in this addendum. If conflicting information is found between this addendum, previous applicable addendums if any, and the subject report, **MEG** should be contacted for clarification. Interpretation or clarification by other parties besides **MEG** may be performed incorrectly without complete knowledge of the project site, testing program, engineering analysis and information obtained during the project site visits. Interpretations or clarifications made by other parties are performed entirely at their own risk and liability. Our recommendations should be incorporated into the construction documents for the proposed development. We recommend that the above recommendations and the requirements noted in this addendum, previous applicable addendums and the subject report should be followed by the contractor and that representatives of MEG evaluate the implementation of the recommendations herein and of the construction process. If you have any questions regarding this addendum, please contact our office.

Cordially,
Millennium Engineers Group, Inc.
TBPE Firm No. F-3913

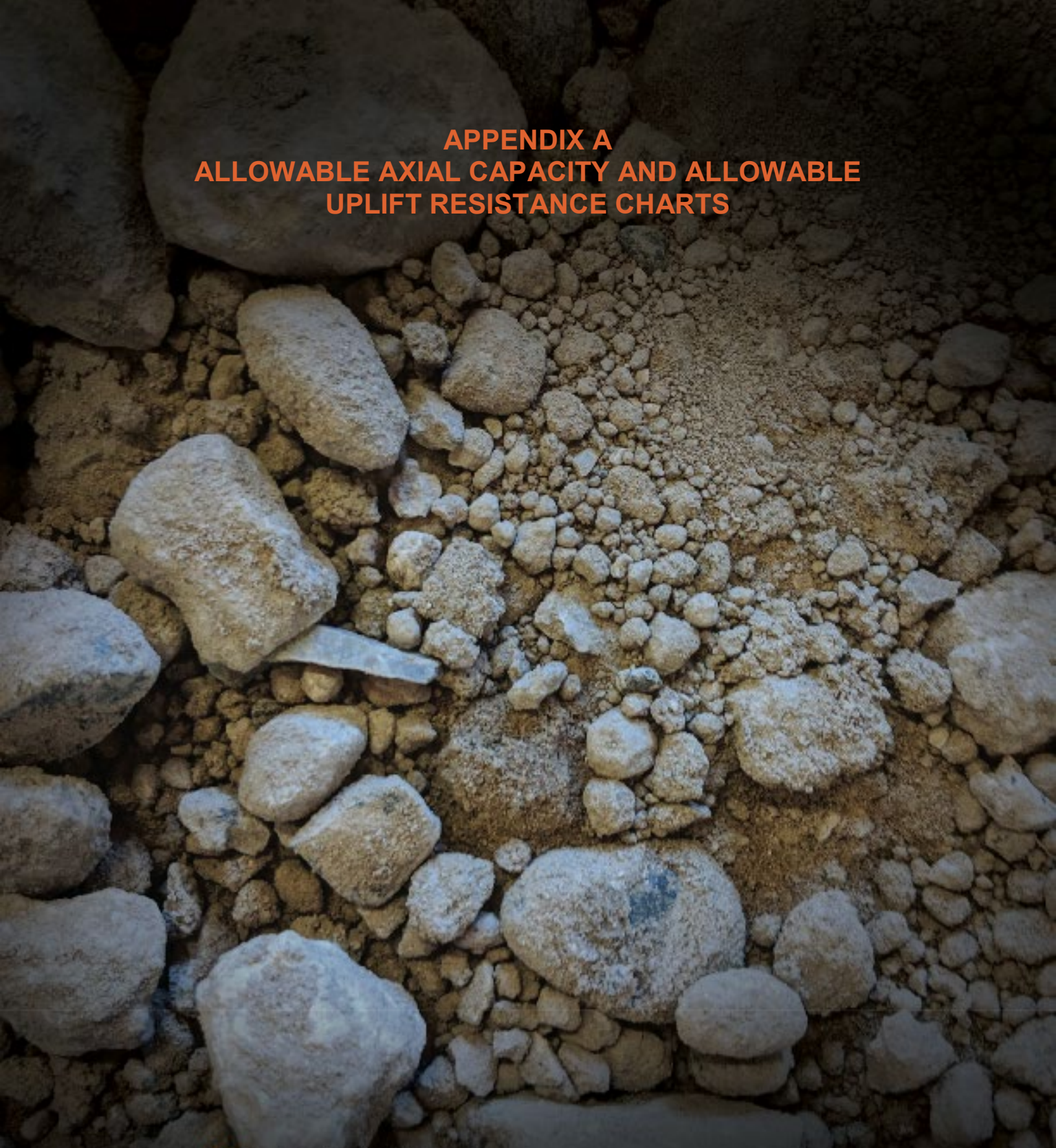
Amos Emerson, P.E.
Geotechnical Department Manager

STATE OF TEXAS
QUYET THANG PHAM
131836
LICENSED PROFESSIONAL ENGINEER

Quyet Thang Pham, Ph.D., P.E.
Geotechnical Engineer

The seal appearing on this document was authorized by Quyet Thang Pham, P.E. 131836 on September 6, 2023. Alteration of a sealed document without proper notification to the responsible engineer is an offence under the Texas Engineering Practice Act

APPENDIX A
ALLOWABLE AXIAL CAPACITY AND ALLOWABLE UPLIFT RESISTANCE CHARTS



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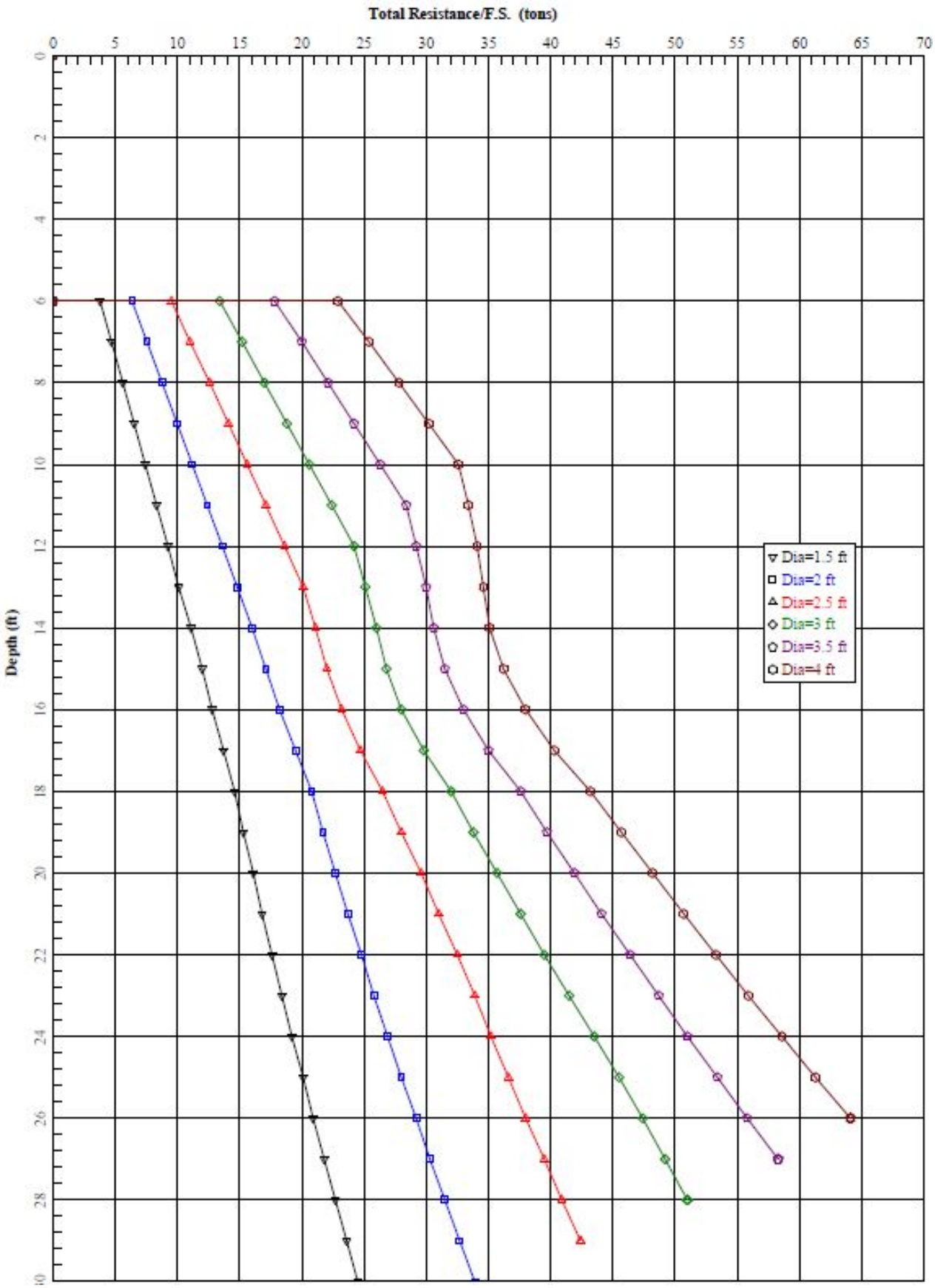

ALLOWABLE AXIAL CAPACITY

PROPOSED
BPUB REGIONAL FORCE MAIN UTILITY AERIAL CROSSING

BROWNSVILLE, CAMERON COUNTY, TEXAS

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30745 E. EXPRESSWAY 83
SAN BENITO, TEXAS 78586
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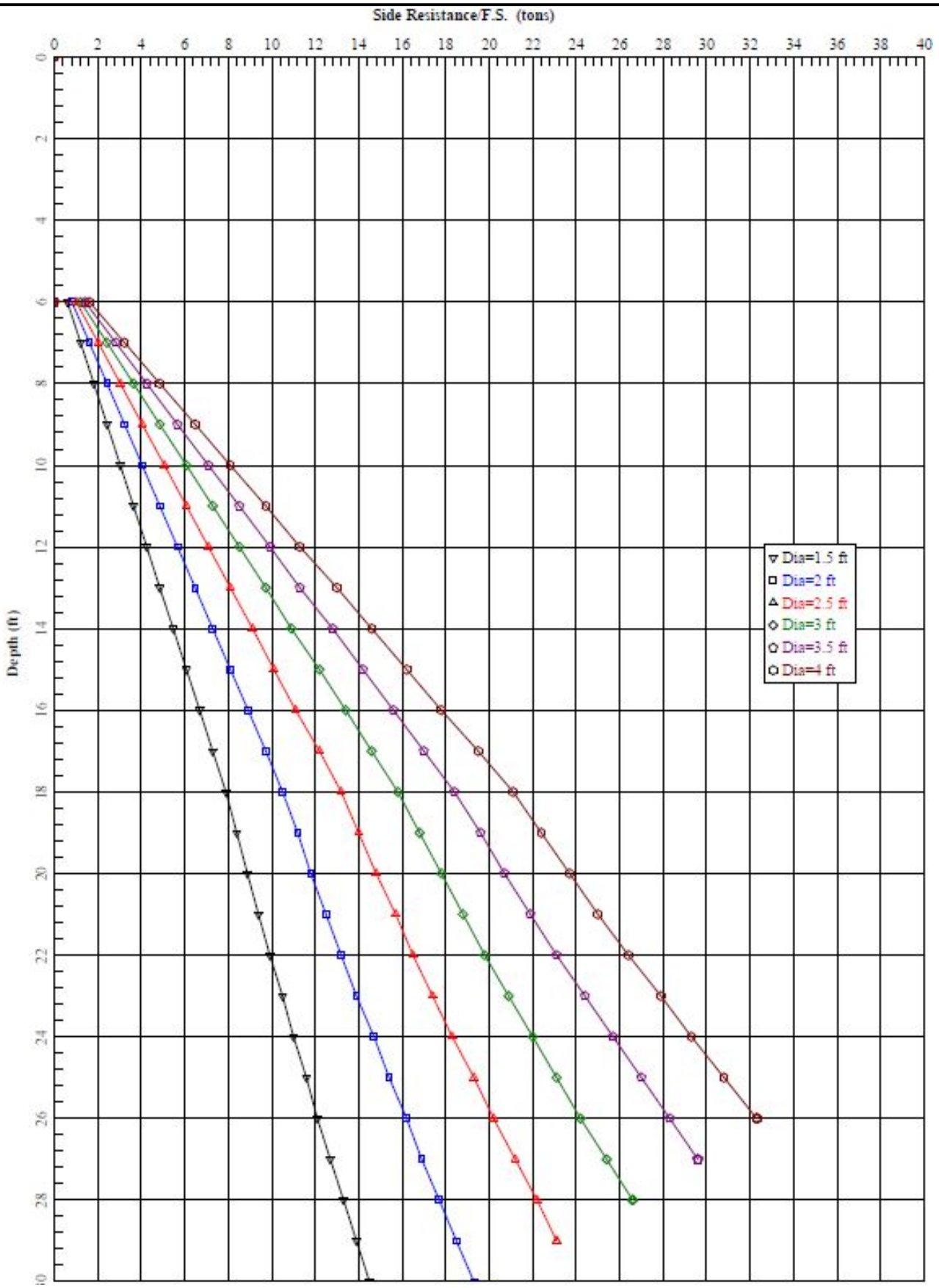
FAX: 956-702-8140

MEG PROJECT: 02-23-29122 / DATE: 8/30/2023 / APPROVED BY: R. PALMA / DRAWN BY: C. OROS



ALLOWABLE AXIAL CAPACITY

PROPOSED
BPUB REGIONAL FORCE MAIN UTILITY AERIAL CROSSING

BROWNSVILLE, CAMERON COUNTY, TEXAS

MILLENNIUM ENGINEERS GROUP, INC.
30745 E. EXPRESSWAY 83
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