Geotechnical Engineering Study

El Paso Water (EPW) – Cedar Grove Cast Iron Water Line Replacement
El Paso, El Paso County, Texas
Garver Project 19W06330
LOI File No. J22-1-678

Prepared for:
Garver
221 N. Kansas St., Ste. 730
El Paso, Texas 79901

Prepared by:
LOI ENGINEERS
2101 E. Missouri Avenue, Suite B
El Paso, Texas 79903

January 24, 2023

File No. J22-1-678
January 24, 2023

Mr. Marco Ramirez, P.E.
Garver LLC
221 N. Kansas St., Ste. 730
El Paso, Texas 79901

Re: Geotechnical Engineering Report
El Paso Water (EPW) Cedar Grove Cast Iron Water Line Replacement
Garver Project No. 19W06330
El Paso, El Paso County, Texas

Dear Mr. Ramirez:

We thank you for the opportunity to present the enclosed geotechnical engineering report for the above referenced project. This engineering report was prepared in accordance with the scope of services as presented in our proposal No. 21-511, dated April 6, 2022, and authorized via on July 22, 2022. The information we are presenting herein describes the procedures utilized for field and laboratory investigation, along with the results of our study.

It was a pleasure to work with you on this phase of your project, and we look forward to assist you further during the subsequent construction activities. If you have any questions regarding the information we present herein, please call us.

Respectfully submitted,
LOI ENGINEERS

Timothy J, Martin, E.I.T.
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1.0 INTRODUCTION

We have completed the geotechnical engineering study for the proposed El Paso Water (EPW) Cedar Grove Cast Iron Water Line Replacement project. We were authorized to conduct this study via by Mr. Daniel N. Olson, P.E., Vice President of Garver, LLC, executed on July 22, 2022.

2.0 PROJECT DESCRIPTION AND OBJECTIVE

The project consists of the replacement of about 11,031 linear feet of cast iron and asbestos cement pipe, located generally along Mimosa Avenue, in El Paso, Texas. The extents of the alignment are as follows:

Table 1 Water Line Parameters

Water Line	Boring No.	Station	Utility Type	Roadway	Length (LF)
1	B-1 B-3 B-5 B-7	STA 1+60 STA 11+25 STA 24+40 STA 30+50	8" Water	Mimosa Avenue	3,265
2	B-2	STA 53+50	8" Water	Tulip Court	388
5	B-4	STA 106+80	8" Water	Papaya Street	1,054
8	B-6	STA 161+15	8" Water	S. Carolina Drive	1,024
10	B-8	STA 91+80	8" Water	Baywood Road	477

The subsurface exploration including boring locations, was developed by client. The General Location Map is shown in Appendix A as Sheet A-1.1.

3.0 FIELD AND LABORATORY INVESTIGATION

3.1 Field Exploration

In our initial field exploration phase, we drilled eight soil borings to depths of 11½ feet below ground surface (BGS) along the proposed water line alignment. We drilled and

sampled the soil borings in general accordance with ASTM D-6151 and D-1586 procedures with a truck-mounted CME-75 drill rig. We located the borings in the field using property corners and street references included in the project plans provided by Client.

The soil boring locations are shown in the Boring Location Plan included in Appendix A of this report in Sheet A-1.2. We also prepared a log of each soil boring to delineate the soil strata studied at the site. The soil boring logs (B-1 through B-8) are included in Appendix A of this report as Sheets A-2 through A-9. A key to the soil terminology used in the logs is included in Appendix B of this report as Sheets B-1 and B-2.

We conducted Standard Penetration Tests (SPT) at each representative soil strata in the soil borings to determine the relative density or consistency of the resident soils. The SPT is a widely recognized procedure that provides a numerical value of the soil strata being tested, indicating the number of blows that it takes for a standard 140-pound weight hammer with a standard 30-inch free fall drop to penetrate 12 inches into the soil. The SPT values for the soil strata in the soil borings are included in the soil boring logs.

As part of our field exploration, we collected representative soil samples from the soil borings at regular depth intervals using a standard 2-inch diameter split spoon sampler. We identified and labeled the samples according to boring number and depth, visually classified them according to ASTM D-2488, and placed them in moisture-proof containers for transportation to the laboratory for further evaluation and testing.

Unless we receive prompt notification from Client, we will store the samples collected from the field investigation in our laboratory for a period of 90 days from the date of this report, after which time we will discard the samples.

3.2 Geotechnical Laboratory Testing

In the laboratory, we determined the moisture content, particle size analysis, percent passing the No. 200 sieve, and Atterberg Limits of selected samples. We conducted these tests to determine the physical and engineering properties of representative soils at the

site. These tests also allowed us to properly classify the resident soils in accordance with the Unified Soil Classification System (USCS). The results of our tests are included in the soil boring logs, adjacent to the depth at which the sample was recovered.

In addition, we conducted four (4) Moisture-Density Relationship tests, in accordance with ASTM D-1557. The results of these tests can be found on Sheets A-13.

Table 2: Laboratory Testing Program

Type of Test	Number of Tests
Moisture Content (ASTM D-2216)	40
Percent Passing No. 200 Sieve (ASTM D-1140)	33
Grain Size Distribution Analysis (ASTM D-6913)	7
Atterberg Limits (ASTM D-4318)	12
Moisture-Density Relationship Curve (ASTM D-1557)	4

4.0 GENERAL SITE CONDITIONS

4.1 Site Geology

The project site is located on the Rio Grande flood plain. According to the Soil Conservation Service of El Paso County, the soils in this area correspond to the Harkey-Glendale association, which is described as nearly level soils that have loamy very fine sand to silty clay loam underlying material.

4.2 Site Topography and Site Conditions

The project area is relatively level. The water line alignment is located primarily within the right-of-way of Mimosa Avenue, in El Paso, El Paso County, Texas. The water line alignments are located within the existing pavement areas, which are topped with hot-mix asphaltic concrete (flexible) pavement. The existing asphalt pavement thickness at the boring locations ranged from 2 inches to 4 inches in thickness. The existing pavement was underlain by base course material ranging from 6 inches to 8 inches in thickness.

Table 3 Existing Pavement Conditions

Boring No.	Existing Asphalt Thickness (Inches)	Existing Base Course Thickness (Inches)
B-1	4	8
B-2	4	8
B-3	4	8
B-4	2	6
B-5	3	8
B-6	3	8
B-7	2	8
B-8	3	-

4.3 Site Vegetation

At the time of our field phase, the site was relatively free of vegetation.

4.4 Soil Stratigraphy

The soils we encountered in the borings can be grouped into three generalized soil strata as follows:

Stratum A, consisting of brown fine grained silty and clayey sands occasionally intermixed with various amounts of fine gravel, was encountered from ground surface elevation in soil borings B-1, B-4, B-7, and underlying the Stratum B and Stratum C soils in soil borings B-5 and B-8, and interbedded in the Stratum C soils in boring B-1, and extended to depths ranging from 2½ feet to the total explored depth of 11½ feet BGS. These soils were encountered at a very loose to dense relative density, with SPT values ranging from 4 to 46 blows per foot of penetration. These soils were encountered at a dry to moist condition, with tested moisture content values ranging from 4 to 17 percent, and percent finer than the No. 200 sieve test results ranging from 13 to 37 percent. These soils exhibited a maximum tested liquid limit of 45 and yielded a maximum plasticity index of 32. Soils in this stratum can be classified as SC or SM in accordance with the USCS.

Stratum B, consisting of brown-multicolor poorly-graded sands occasionally intermixed with various amounts of silt, was encountered from ground surface elevation in soil boring B-3, B-5, B-6, and underlying the Stratum A and Stratum B soils in soil borings B-1, B-2, B-4, B-7, and B-8, and extended to depths ranging from 7½ feet to the total explored depth

of 11½ feet BGS. These soils were encountered at a loose to dense relative density, with SPT values ranging from 5 to 37 blows per foot of penetration. These soils were encountered at a dry condition, with tested moisture content values ranging from 2 to 4 percent, and percent finer than the No. 200 sieve test results ranging from 3 to 12 percent. These soils exhibited non-plastic characteristics. Soils in this stratum can be classified as SP or SP-SM in accordance with the USCS.

Stratum C, consisting of brown lean, fat, and silty clays occasionally intermixed with various amounts of and fine grained sand, was encountered from ground surface elevation in soil borings B-2 and B-8, and underlying the Stratum A and Stratum B soils in soil borings B-1 and B-3, and interbedded in the Stratum A soils in boring B-1, and extended to depths ranging from 2½ feet to the total explored depth of 11½ feet BGS. These soils were encountered at a soft to very stiff consistency, with SPT values ranging from 2 to 18 blows per foot of penetration. These soils were encountered at a moist to very moist condition, with tested moisture content values ranging from 11 to 30 percent, and percent finer than the No. 200 sieve test results ranging from 54 to 81 percent. These soils exhibited tested liquid limit values ranging from 23 to 55, and yielded plasticity index values ranging from 7 to 36. Soils in this stratum can be classified as CL, CH, or CL-ML in accordance with the USCS.

4.5 Groundwater

Groundwater was not present in the borings drilled during the time of our field exploration. The groundwater table at the site is anticipated to be at depths well below the pipe invert elevations at the site.

5.0 ENGINEERING EVALUATION

5.1 Vertical Movements

We calculated the Potential Vertical Rise (PVR) of the existing soil profile from our soil borings in accordance with Texas Department of Transportation (TxDOT) method Tex 124-

E. The soils encountered in our borings exhibited moderate plasticity characteristics. The calculated PVR of the existing soil conditions was less than ½-inch.

5.2 Site Preparation

The existing flexible pavement and associated concrete flatwork in the subject area, as well as any vegetation, shall be removed and properly disposed of off-site per applicable local regulations prior to grading/excavation operations. The exposed subgrade shall be processed as per the select fill section of this report. Soils at their present condition may not provide adequate support for concrete flatwork and/or pavement sections, unless properly processed, moisture-conditioned, and compacted as indicated in this report.

5.3 Trench Guidelines

We recommend adequate protection on the faces of the excavations to prevent hazards from falling material. Adequate sloping on the faces of the excavations should also be implemented to avoid possible soil sloughing.

The Occupational Safety and Health Administration (OSHA) classifies soils for the purpose of defining stable slopes to be used in trenching applications.

The soils found during our field exploration, are considered Type C materials. For temporary slopes in soil trenching for this project, Type C soils can have a maximum slope of 1½:1 (H:V).

The contractor may be required to utilize shielded trench systems during the construction phase whenever excavations deeper than 5 feet are required taking into consideration site constraints such as vehicular traffic, existing underground lines (fuel, natural gas, telecommunication, and water), overhead lines, and existing structures.

We should note that the information included in this report is for design purposes, and is not intended to provide a trench safety plan. The contractor should develop a trench safety plan in accordance with the requirements of OSHA and specifications in the

project plans. If trench shields will be used, these should be selected appropriately to retain the lateral loads from the native coarse grained soils.

5.4 Lateral Earth Pressures

We recommend the following values to be used in earth pressure computations, considering the Rankine method for lateral earth pressure computation having cohesionless or granular native materials as follows:

$$\Phi = 28°$$
$$\gamma_w = 120 \text{ lb/ft}^3$$

Additionally, the equivalent fluid density, considering the equivalent fluid method with the appropriate k value, may be computed as follows:

$$G_h = k*\gamma_w$$

For concrete or masonry walls, the wall-soil interface friction coefficient may be computed as follows:

$$\Phi_w = 0.67*\tan(\Phi)$$

Coefficients of active and passive earth pressure are given below, along with the coefficient for the possible at-rest condition:

$$k_a = 0.36$$
$$k_p = 2.77$$
$$k_o = 0.53$$

5.5 Seismic Considerations

The seismic site classification for the subject area was evaluated using the criteria given in the 2015 International Building Code (2015 IBC). Based on the project information and

soil test borings, we recommend the parameters shown in Table 4 be used for design purposes.

Table 4: Seismic Design Parameters (2015 International Building Code)

Parameter	Value
Site Class	D
Site Location (latitude, longitude)	31.737894444, -106.38465555
S_{MS} – Spectral Response Acceleration for Short Periods	0.538g
S_{M1} – Spectral Response Acceleration for a 1-Second Period	0.254g
S_{DS} – Design Spectral Response Acceleration for Short Periods	0.359g
S_{D1} – Design Spectral Response Acceleration for a 1-Second Period	0.17g

5.6 Flexible Pavement Recommendations

Flexible pavements will be used in the reconstruction of the roadway after the water line installation. Therefore, we used the City of El Paso Design Standards for Construction a traffic loading of 269,000 equivalent single-axle load (ESAL) applications. This parameter is estimated based on the parking characteristics and estimated automobile traffic for a design period of 20 years. Additionally, based on our laboratory analysis we assigned a California Bearing Ratio (CBR) value of 5 for pavement design calculations.

We recommend that the flexible pavement consists of the following minimum thickness section for the traffic conditions:

Table 5: Flexible Pavement Recommendations

Pavement Component	Minimum Thickness (in.)
Hot-Mix Asphaltic Concrete	Match existing asphalt thickness
Crushed Stone Base Course	6
Select Fill (95% compaction)	18
Natural Subgrade (90% compaction)	8

As a minimum, the HMAC material should conform to Type C, in accordance with the City of El Paso standards. The HMAC mix should have a minimum 1,500 pounds of Marshall Stability when compacted at 75 blows in accordance with ASTM D-1559, and should have a flow between 8 and 16. The HMAC course should be placed at a target density of at least 98 percent.

The Crushed Stone Base Course (CSBC) should be Item 247, Type A, Grade 3 in accordance with the Texas Department of Transportation (TxDOT) Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges. CSBC materials should be placed in loose lifts not exceeding 6 inches in compacted thickness, and compacted to a minimum 100 percent of maximum dry density and a moisture content within plus or minus 2 percent, in accordance with ASTM D-1557.

5.7 Select Fill

Select fill material used for site grading should be granular, cohesionless, and free of deleterious material and particles over 4 inches in greatest dimension. Soils proposed for use as fill materials should be classified in accordance with ASTM D-2487. The following soils classified in accordance with the Unified Soil Classification System (USCS) can be considered satisfactory for use as select fill.

> GM, GC, GW-GM, GW-GC, GP, GP-GM and GP-GC, SM, SC, SW-SM, SW-SC, SP-SM, SW-SC and SC-SM.

The following USCS-classified soils are not considered satisfactory for use as select fill.

> CH, CL, MH, ML, OH, OL and PT, or soils that exceed a liquid limit of 40 and a plasticity index of 15.

The Stratum A and Stratum B soils encountered in our soil borings are suitable for use as select fill material, provided they meet the above criteria for acceptable fill materials. The Stratum C soils in our borings are **NOT** suitable for use as select fill.

Select fill should be placed in uniform layers not exceeding 8 inches in compacted thickness, moisture-conditioned to add the amount of moisture required for optimum compaction and compacted to a minimum of 95 percent of maximum density in accordance with ASTM D-1557 (modified Proctor) procedures. The moisture content should be at plus or minus 3 percent of optimum moisture content in accordance with ASTM D-1557.

This compaction requirement also applies to the subgrade soils that will receive select fill. However, if the subgrade soils consist of cohesive soils such as CL or CH, or if the plasticity index exceeds 18, the subgrade soils should be compacted to a minimum of 90 percent of the above standard.

Compaction of the fill material and subgrade soils should be conducted with approved types of pneumatic, power or tamping equipment. Determination of density in the field should be conducted in accordance with ASTM D-2922 or D-1556.

5.8 Pipe Bedding and Trench Backfill

Pipe bedding and backfill material should be placed in uniform layers not exceeding 8 inches in compacted thickness, moisture-conditioned to add the amount of moisture required for optimum compaction, and compacted to a minimum of 95 percent of maximum density in accordance with ASTM D-1557 (modified Proctor) procedures. Soil moisture content should be at ±3 percent of the optimum moisture content in accordance with the above standard. Refer to Appendix C for El Paso Water Standard Details for bedding and backfill of pressure pipe and gravity pipe in dry and wet conditions. Use the following soil types for the design standards shown in Appendix C.

Table 6: Pipe Bedding Recommendations

Soil Class	Soil Type ASTM D-2487	Soil Description
Class I	None	Manufactured aggregates, angular, crushed rock, crushed gravel with maximum particle size of 1½ inches per ASTM D-2321
Class II	GW, GP, SW, SP	Coarse grained sands and gravels per ASTM D-2487 with maximum particle size of 1½ inches per ASTM D-2322
Class III	GM, GC, SM, SC	Coarse grained sands with fines per ASTM D-2487 with maximum particle size of 1½ inches per ASTM D-2323

5.9 New Construction near Existing Structures and Utilities

Contractor shall exercise extreme care during excavation and site preparation near existing underground utilities, manhole structures, utility poles, trees, and residential structures, to avoid encroaching into the existing bearing soils, hence preventing adversely affecting or undermining the performance and structural integrity. We

recommend that before any excavation or earthwork takes place, all underground utilities be located to prevent damages to the existing infrastructure. We also recommend that any underground utilities that may encroach the proposed water and sewer lines be decommissioned, removed, and/or relocated, and the voids be filled with select fill as recommended in Section 5.7 of this report.

We recommend that ten days prior to commencing any excavation near existing structures or utilities, the contractor shall submit a plan described how they will protect the existing structures or utilities during construction activities. Protective measures may include, but may not be limited to temporary shoring and/or phased excavation.

6.0 ADDITIONAL CONSIDERATIONS

6.1 Construction Monitoring

We recommend that Client retain LOI ENGINEERS during the construction phase of this project to verify the findings of our study, and to provide supplemental data to this study in the event that site conditions vary from those described in this report.

The geotechnical engineer should also conduct testing of fill materials used for earthwork operations at the following frequencies:

- At least one (1) moisture-density relationship (ASTM D-1557) and soil classification tests (ASTM D-6913 and ASTM D-4318) for each type of material encountered, or imported material to be used.
- Soil density (compaction) testing in accordance with ASTM D-6938 or D-1556 using the following testing frequencies:
    - Pipe area – A minimum of one (1) density test per lift (8-inch compacted) for every 200 linear feet for pipe bedding and backfill operations, or at least three (3) tests per lift, whichever is greater.
    - Pavement area – A minimum of one (1) density test per lift (8-inch compacted) for every 2,000 square feet.

Sampling and testing for quality assurance of concrete materials should be performed at the following frequency:

- A minimum of one (1) set of four specimens should be collected for every 50 cubic yards of concrete placed, or fraction thereof. Concrete field testing shall include temperature, slump, and air content (if applicable).

Sampling and testing for quality assurance of asphaltic concrete materials should be performed at the following frequencies:

- A minimum of one (1) hot-mix asphaltic concrete (HMAC) analysis, to include Marshall test, Rice test, asphalt content and gradation, and Marshall flow and stability, for every 500 tons of HMAC material.
- A minimum of one (1) nuclear density test in accordance with ASTM D-2950 for every 2,000 square feet.

6.2 Limitations

We have performed our professional services and have obtained the data presented in this report in accordance with generally accepted geotechnical engineering principles and practices. The information in this report is based on the data obtained from six representative test borings and laboratory testing conducted on representative samples, and on our knowledge of the project conditions at the time of our subsurface soil study.

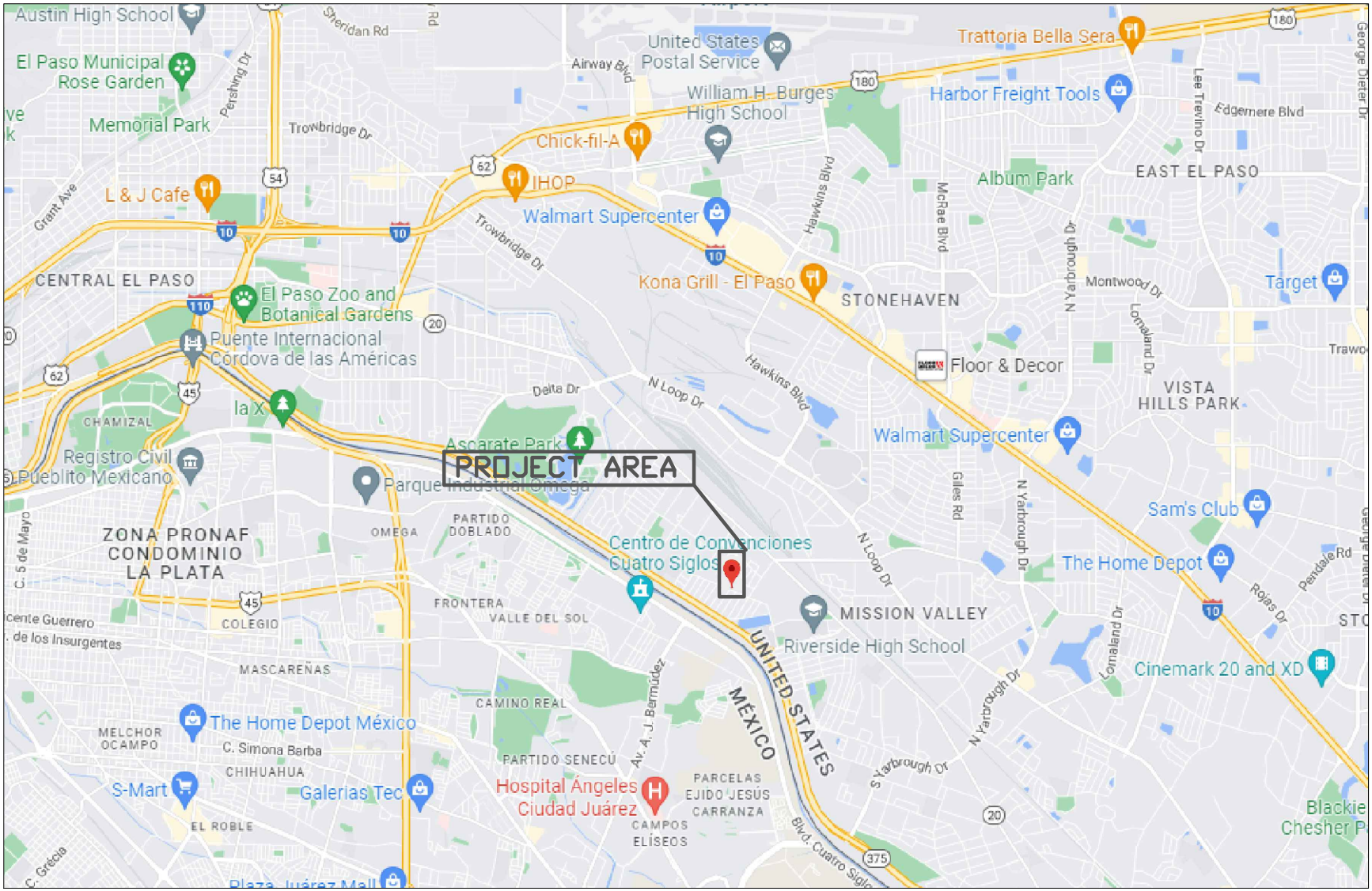
The data in this report reflects subsurface soil conditions only at the specific sampling location, time of sampling, and to the depths indicated in our report. This report is not intended to identify or address any potential environmental concerns associated with the project site.

We recommend that Client notify LOI ENGINEERS of any changes to the project conditions considered in this report, so that we may provide pertinent modifications to our recommendations if deemed necessary. Additionally, once construction commences, we should be notified of any unusual site conditions that appear to vary

from those reported herein, so that we may conduct further investigations and prepare supplemental recommendations if deemed necessary.

We conducted this investigation for the purpose of defining the subsurface soil conditions for the El Paso Water (EPW) Cedar Grove Cast Iron Water Line Replacement project, in El Paso, El Paso County, Texas. Use of this information for projects other than the one described herein will not be adequate.

APPENDIX A



LEGEND	GEOTECHNICAL CONSULTANT	PROJECT CONSULTANT	DRAWING TITLE: GENERAL LOCATION MAP
APPROXIMATE PROJECT LOCATION	LOI ENGINEERS 915-781-1532 2101 E. MISSOURI AVE SUITE B EL PASO, TEXAS 79903	GARVER USA 221 N KANSAS STREET, SUITE 730 EL PASO, TEXAS 79901	PROJECT NAME: CEDAR GROVE AREA CAST IRON WATER MAIN REPLACEMENT EL PASO, EL PASO COUNTY, TEXAS

DRAWN BY	REVIEWED BY	APPROVED BY	SCALE
S.V.	D.G.	B.O.	N.T.S.
PROJECT No.	FILE NAME	DATE	SHEET No.
J22-1-678	SITE PLAN	7/21/22	A-1.1

LEGEND	GEOTECHNICAL CONSULTANT	PROJECT CONSULTANT	DRAWING TITLE: BORING LOCATION PLAN
B-1 APPROXIMATE BORING LOCATION AND NUMBER	LOI ENGINEERS 915-781-1532 2101 E. MISSOURI AVE SUITE B EL PASO, TEXAS 79903	GARVER USA 221 N KANSAS STREET, SUITE 730 EL PASO, TEXAS 79901	PROJECT NAME: CEDAR GROVE AREA CAST IRON WATER MAIN REPLACEMENT EL PASO, EL PASO COUNTY, TEXAS

DRAWN BY	REVIEWED BY	APPROVED BY	SCALE
S.V.	D.G.	B.O.	N.T.S.
PROJECT No.	FILE NAME	DATE	SHEET No.
J22-1-678	SITE PLAN	7/21/22	A-1.2

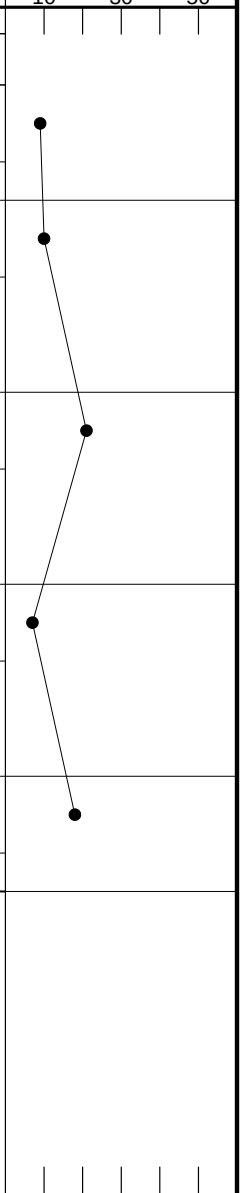
LOG OF TEST BORING No. B-1

Project name: EPW Cedar Grove Water Line Replacement
File No.: J22-1-678
Date Drilled: 12/19/22
Boring Location: See Sheet A-1.2
Elevation (ft): N/A North: N/A West: N/A

ENGINEERS

Elevation and Depth (ft.)	Samples	Soil symbols	Soil Description	USCS symbol	Moisture content,%	Minus #200 sieve, %	Liquid limit	Plastic limit	Plasticity index	Blows per foot (N)
0			4" ASPHALT PAVEMENT							
			8" BASE COURSE MATERIAL							
			SAND, fine grained, silty, brown, loose,dry to moist	SM	10	34	NV	NV	NP	9
2.5			CLAY, fat, brown, stiff, saturated	CH	38	90	55	16	39	10
5			SAND, fine grained, clayey, brown, medium dense, dry to moist	SC	10	26				21
7.5			CLAY, fat, sandy, brown, firm, very moist	CH	21	54	54	16	38	7
10			SAND, poorly graded with silt, brown-multicolor, medium dense, dry	SP-SM	4	6				18
			Termination depth at 11.5 feet							
12.5										
15										

SPT N-Value CURVE



Groundwater Table Data

Depth	Date	Time
N/A	N/A	N/A

Sample Type
- Auger cutting
- 2" O.D. split spoon
- 3" O.D. split tube
- Thin-walled Shelby tube

Rig type: CME-55
Boring type: HSA
Drilled by: FM
Logger: CR
Sheet No.: **A-2**

LOG OF TEST BORING No. B-2

Project name: EPW Cedar Grove Water Line Replacement
File No.: J22-1-678
Date Drilled: 12/19/22
Boring Location: See Sheet A-1.2
Elevation (ft): N/A North: N/A West: N/A

ENGINEERS

Elevation and Depth (ft.)	Samples	Soil symbols	Soil Description	USCS symbol	Moisture content,%	Minus #200 sieve, %	Liquid limit	Plastic limit	Plasticity index	Blows per foot (N)	SPT N-Value CURVE (10 30 50)
0			4" ASPHALT PAVEMENT								
			8" BASE COURSE MATERIAL								
			SAND, silty, sandy, brown, stiff, dry to moist	ML	6	52	NV	NV	NP	10	
2.5			SAND, poorly graded with silt, brown-multicolor, medium dense, dry		2	12				12	
5				SP-SM	3	6				11	
7.5			-loose at 7.5 feet		3	7				5	
10			SAND, poorly graded, brown-multicolor, loose, dry	SP	2	3				6	
			Termination depth at 11.5 feet								
12.5											
15											

Groundwater Table Data

Depth	Date	Time
N/A	N/A	N/A

Sample Type
- Auger cutting
- 2" O.D. split spoon
- 3" O.D. split tube
- Thin-walled Shelby tube

Rig type: CME-55
Boring type: HSA
Drilled by: FM
Logger: CR
Sheet No.: **A-3**

LOG OF TEST BORING No. B-3

Project name: EPW Cedar Grove Water Line Replacement
File No.: J22-1-678
Date Drilled: 12/19/22
Boring Location: See Sheet A-1.2
Elevation (ft): N/A North: N/A West: N/A

ENGINEERS

Elevation and Depth (ft.)	Samples	Soil symbols	Soil Description	USCS symbol	Moisture content,%	Minus #200 sieve, %	Liquid limit	Plastic limit	Plasticity index	SPT N-Value: Blows per foot (N)	SPT N-Value CURVE (10 30 50)
0			4" ASPHALT PAVEMENT								
			8" BASE COURSE MATERIAL								
			SAND, poorly graded with silt, brown-multicolor, medium dense, dry	SP-SM	2	9	NV	NV	NP	19	
2.5					4	9				11	
5			-loose at 5 feet		3	5				8	
7.5			SAND, poorly graded, brown-multicolor, loose, dry	SP	3	4				8	
10			CLAY, fat, sandy, brown, firm, very moist	CH	21	78	53	17	36	8	
			Termination depth at 11.5 feet								
12.5											
15											

Groundwater Table Data

Depth	Date	Time
N/A	N/A	N/A

Sample Type
- Auger cutting
- 2" O.D. split spoon
- 3" O.D. split tube
- Thin-walled Shelby tube

Rig type: CME-55
Boring type: HSA
Drilled by: FM
Logger: CR
Sheet No.: **A-4**

LOG OF TEST BORING No. B-4

Project name: EPW Cedar Grove Water Line Replacement
File No.: J22-1-678
Date Drilled: 12/19/22
Boring Location: See Sheet A-1.2
Elevation (ft): N/A North: N/A West: N/A

ENGINEERS

Elevation and Depth (ft.)	Samples	Soil symbols	Soil Description	USCS symbol	Moisture content,%	Minus #200 sieve, %	Liquid limit	Plastic limit	Plasticity index	Blows per foot (N)	SPT N-Value CURVE (10 30 50)
0			2" ASPHALT PAVEMENT								
			6" BASE COURSE MATERIAL								
			SAND, fine grained, silty, brown, medium dense, dry to moist	SM	8	25				12	
2.5					8	27	NV	NV	NP	10	
5			-very loose at 5 feet		5	15				4	
7.5			-medium dense at 7.5 feet		4	34				15	
10			SAND, poorly graded with silt, brown-multicolor, medium dense, dry	SP-SM	4	7				15	
			Termination depth at 11.5 feet								
12.5											
15											

Groundwater Table Data

Depth	Date	Time
N/A	N/A	N/A

Sample Type
- Auger cutting
- 2" O.D. split spoon
- 3" O.D. split tube
- Thin-walled Shelby tube

Rig type: CME-55
Boring type: HSA
Drilled by: FM
Logger: CR
Sheet No.: **A-5**

LOG OF TEST BORING No. B-5

Project name: EPW Cedar Grove Water Line Replacement
File No.: J22-1-678
Date Drilled: 12/19/22
Boring Location: See Sheet A-1.2
Elevation (ft): N/A North: N/A West: N/A

ENGINEERS

Elevation and Depth (ft.)	Samples	Soil symbols	Soil Description	USCS symbol	Moisture content,%	Minus #200 sieve, %	Liquid limit	Plastic limit	Plasticity index	SPT N-Value: Blows per foot (N)	SPT N-Value CURVE (10 30 50)
0			3" ASPHALT PAVEMENT								
			8" BASE COURSE MATERIAL								
			SAND, poorly graded with silt, brown-multicolor, medium dense, dry	SP-SM	4	8	NV	NV	NP	23	
2.5			SAND, poorly graded, brown-multicolor, medium dense, dry	SP	4	4				29	
5			-dense at 5 feet		3	3				37	
7.5			SAND, poorly graded with silt, brown-multicolor, medium dense, dry	SP-SM	4	8				14	
10			SAND, fine grained, clayey, brown, medium dense, moist	SC	17	36	45	13	32	10	
12.5			Termination depth at 11.5 feet								
15											

Groundwater Table Data

Depth	Date	Time
N/A	N/A	N/A

Sample Type
- Auger cutting
- 2" O.D. split spoon
- 3" O.D. split tube
- Thin-walled Shelby tube

Rig type: CME-55
Boring type: HSA
Drilled by: FM
Logger: CR
Sheet No.: **A-6**

LOG OF TEST BORING No. B-6

Project name: EPW Cedar Grove Water Line Replacement
File No.: J22-1-678
Date Drilled: 12/19/22
Boring Location: See Sheet A-1.2
Elevation (ft): N/A North: N/A West: N/A

ENGINEERS

Elevation and Depth (ft.)	Samples	Soil symbols	Soil Description	USCS symbol	Moisture content,%	Minus #200 sieve, %	Liquid limit	Plastic limit	Plasticity index	Blows per foot (N)	SPT N-Value CURVE
0			3" ASPHALT PAVEMENT								
			8" BASE COURSE MATERIAL								
			SAND, poorly graded with silt, brown-multicolored, medium dense, dry	SP-SM	4	11	NV	NV	NP	18	
2.5					3	12				14	
5			-loose at 5 feet		4	11				9	
7.5			SAND, poorly graded, brown-multicolored, medium dense, dry	SP	3	3				14	
10			-loose at 10 feet		2	3				5	
			Termination depth at 11.5 feet								
12.5											
15											

SPT N-Value CURVE: 10 30 50

Groundwater Table Data

Depth	Date	Time
N/A	N/A	N/A

Sample Type
- Auger cutting
- 2" O.D. split spoon
- 3" O.D. split tube
- Thin-walled Shelby tube

Rig type: CME-55
Boring type: HSA
Drilled by: FM
Logger: CR
Sheet No.: **A-7**

LOG OF TEST BORING No. B-7

Project name: EPW Cedar Grove Water Line Replacement
File No.: J22-1-678
Date Drilled: 12/19/22
Boring Location: See Sheet A-1.2
Elevation (ft): N/A North: N/A West: N/A

ENGINEERS

Elevation and Depth (ft.)	Samples	Soil symbols	Soil Description	USCS symbol	Moisture content,%	Minus #200 sieve, %	Liquid limit	Plastic limit	Plasticity index	SPT N-Value: Blows per foot (N)	SPT N-Value CURVE (10 30 50)
0			2" ASPHALT PAVEMENT 8" BASE COURSE MATERIAL								
			SAND, fine grained, silty, brown, dense, dry	SM	4	13	NV	NV	NP	35	
2.5			SAND, poorly graded, brown-multicolored, medium dense, dry	SP	3	3				19	
5			SAND, poorly graded with silt, brown-multicolored, medium dense, dry to moist	SP-SM	5	5				16	
7.5			-loose at 7.5 feet		5	5				7	
10			-medium dense at 10 feet		5	6				18	
12.5			Termination depth at 11.5 feet								
15											

Groundwater Table Data

Depth	Date	Time
N/A	N/A	N/A

Sample Type
- Auger cutting
- 2" O.D. split spoon
- 3" O.D. split tube
- Thin-walled Shelby tube

Rig type: CME-55
Boring type: HSA
Drilled by: FM
Logger: CR
Sheet No.: **A-8**

LOG OF TEST BORING No. B-8

Project name: EPW Cedar Grove Water Line Replacement
File No.: J22-1-678
Date Drilled: 12/19/22
Boring Location: See Sheet A-1.2
Elevation (ft): N/A North: N/A West: N/A

ENGINEERS

Elevation and Depth (ft.)	Samples	Soil symbols	Soil Description	USCS symbol	Moisture content,%	Minus #200 sieve, %	Liquid limit	Plastic limit	Plasticity index	SPT N-Value: Blows per foot (N)	SPT N-Value CURVE (10 30 50)
0			3" ASPHALT PAVEMENT								
			CLAY, fat, sandy, brown, firm, dry to moist	CH	25	63	81	24	57	5	
2.5			SAND, fine grained, clayey, brown, dense, dry to moist	SC	6	37				35	
5			SAND, fine grained, silty, brown, dense, dry to moist	SM	5	19				46	
7.5			SAND, poorly graded with silt, brown-multicolor, medium dense, dry to moist	SP-SM	5	11				22	
10					6	11				20	
			Termination depth at 11.5 feet								
12.5											
15											

Groundwater Table Data

Depth	Date	Time
N/A	N/A	N/A

Sample Type
- Auger cutting
- 2" O.D. split spoon
- 3" O.D. split tube
- Thin-walled Shelby tube

Rig type: CME-55
Boring type: HSA
Drilled by: FM
Logger: CR
Sheet No.: **A-9**

SUMMARY OF RESULTS

Project: Cedar Grove Area Cast Iron Water Main Replacement
El Paso, El Paso County, Texas

LOI Project No.: J22-1-678

Date: 12/20/22

Boring No.	Depth (ft.)	% Moisture Content	% Material passing # 4	% Material passing # 40	% Material minus # 200	LL	PL	PI	Soil Classification
1	0-1½	10			34	NV	NV	NP	Silty sand (SM)
1	2½-4	38			90	55	16	39	Fat clay (CH)
1	5-6½	10			26				Clayey sand (SC)
1	½-9 (UPPE	21			54	54	16	38	Sandy fat clay (CH)
1	10-11½	4			6				Poorly-graded sand with silt (SP-SM)
2	0-1½	6			52	NV	NV	NP	Silty sand (SM)
2	2½-4	2			12				Poorly-graded sand with silt (SP-SM)
2	5-6½	3			6				Poorly-graded sand with silt (SP-SM)
2	7½-9	3	98	90	7				Poorly-graded sand with silt (SP-SM)
2	10-11½	2			3				Poorly-graded sand (SP)
3	0-1½	2			9	NV	NV	NP	Poorly-graded sand with silt (SP-SM)
3	2½-4	4			9				Poorly-graded sand with silt (SP-SM)
3	5-6½	3	99	96	5				Poorly-graded sand with silt (SP-SM)
3	7½-9	3			4				Poorly-graded sand (SP)
3	11½ (UPP	21			78	53	17	36	Sandy fat clay (CH)
4	0-1½	8			25				Silty sand (SM)
4	2½-4	8			27	NV	NV	NP	Silty sand (SM)
4	5-6½	5	97	95	15				Silty sand (SM)

SUMMARY OF RESULTS

Project: Cedar Grove Area Cast Iron Water Main Replacement
El Paso, El Paso County, Texas

LOI Project No.: J22-1-678

Date: 12/20/22

Boring No.	Depth (ft.)	% Moisture Content	% Material passing # 4	% Material passing # 40	% Material minus # 200	LL	PL	PI	Soil Classification
4	7½-9	4			34				Silty sand (SM)
4	10-11½	4			7				Poorly-graded sand with silt (SP-SM)
5	0-1½	4			8	NV	NV	NP	Poorly-graded sand with silt (SP-SM)
5	2½-4	4			4				Poorly-graded sand (SP)
5	5-6½	3			3				Poorly-graded sand (SP)
5	7½-9	4			8				Poorly-graded sand with silt (SP-SM)
5	11½ (UPI	17			36	45	13	32	Clayey sand (SC)
6	0-1½	4			11	NV	NV	NP	Poorly-graded sand with silt (SP-SM)
6	2½-4	3	92	83	12				Poorly-graded sand with silt (SP-SM)
6	5-6½	4			11				Poorly-graded sand with silt (SP-SM)
6	7½-9	3			3				Poorly-graded sand (SP)
6	10-11½	2			3				Poorly-graded sand (SP)
7	0-1½	4			13	NV	NV	NP	Poorly-graded sand with silt (SP-SM)
7	2½-4	3	98	94	3				Poorly-graded sand (SP)
7	5-6½	5			5				Poorly-graded sand with silt (SP-SM)
7	7½-9	5			5				Poorly-graded sand with silt (SP-SM)
7	10-11½	5			6				Poorly-graded sand with silt (SP-SM)
8	0-1½	25			63	81	24	57	Sandy fat clay (CH)

SUMMARY OF RESULTS

Project: Cedar Grove Area Cast Iron Water Main Replacement
El Paso, El Paso County, Texas

LOI Project No.: J22-1-678

Date: 12/20/22

Boring No.	Depth (ft.)	% Moisture Content	% Material passing # 4	% Material passing # 40	% Material minus # 200	LL	PL	PI	Soil Classification
8	**2½-4**	**6**			**37**				Clayey sand (SC)
8	**5-6½**	**5**			**19**				Silty sand (SM)
8	**7½-9**	**5**	100	96	**11**				Poorly-graded sand with silt (SP-SM)
8	**10-11½**	**6**			**11**				Poorly-graded sand with silt (SP-SM)

REPORT OF MOISTURE-DENSITY RELATIONSHIP, SIEVE ANALYSIS, AND PLASTICITY INDEX

ASTM D-2487, C-136, D-4318, D-1557

Project Name: Cedar Grove Area Cast Iron Water Main Replacement
El Paso, El Paso County, Texas

Project Number: J22-1-678

Client: Garver USA
221 N Kansas Street, Suite 730
El Paso, Texas 79901

Sample date: 12/19/22

Sample Location: Existing material; Sample collected at Soil Boring B-2; 0'-3' in depth.

Sampler: FM

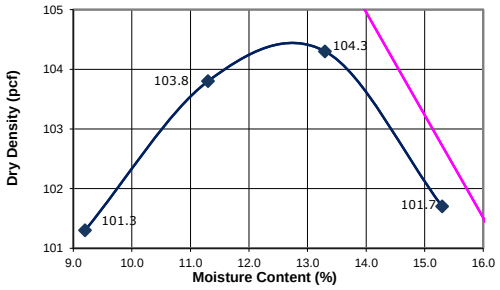
Soil Classification: Poorly-graded sand with silt (SP-SM)

Sample Number: 121922-B2

Method Used: B
Preparation: Dry
Rammer: Mechanical
Specific Gravity: 2.40 (estimated)
As Received Water Content: 4 %

Corrected Maximum Dry Unit Weight: 104.4 pcf
Corrected Optimum Water Content: 12.7 %

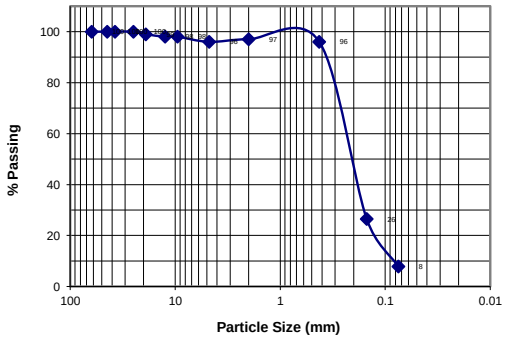
Moisture-Density Relationship Curve



Sieve Analysis

Sieve Opening Size		Retained (%)		Passing (%)	
Std.	mm	Actual	Specs.	Actual	Specs.
2-1/2"	62.50	0	-	100	-
1-3/4"	44.50	0	-	100	-
1-1/2"	37.50	0	-	100	-
1"	25.00	0	-	100	-
3/4"	19.00	1	-	99	-
1/2"	12.50	2	-	98	-
3/8"	9.50	2	-	98	-
#4	4.75	4	-	96	-
#10	2.00	3	-	97	-
#40	0.425	4	-	96	-
#100	0.150	74	-	26	-
#200	0.075	92	-	8	-

Grain-Size Distribution



Gradation Parameters

D_{10}=	0.08	C_c=	1.14
D_{30}=	0.16	C_u=	3.38
D_{60}=	0.28	-	-

Plasticity Index

Process: Air-dry

Actual:	**LL=**	NV	**PL=**	NV	**PI=**	NP
Typical:	**LL=**	-	**PL=**	-	**PI=**	-

REPORT OF MOISTURE-DENSITY RELATIONSHIP, SIEVE ANALYSIS, AND PLASTICITY INDEX

ASTM D-2487, C-136, D-4318, D-1557

Project Name: Cedar Grove Area Cast Iron Water Main Replacement
El Paso, El Paso County, Texas

Project Number: J22-1-678

Client: Garver USA
221 N Kansas Street, Suite 730
El Paso, Texas 79901

Sample date: 12/19/22

Sample Location: Existing material; Sample collected at Soil Boring B-3; 0'-3' in depth.

Sampler: FM

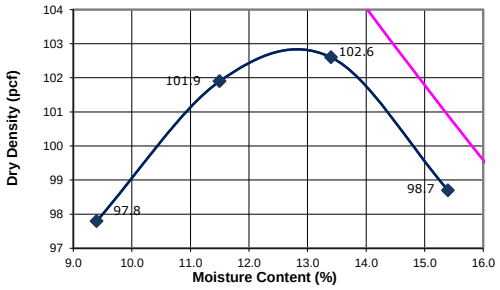
Soil Classification: Poorly-graded sand with silt (SP-SM)

Sample Number: 121922-B3

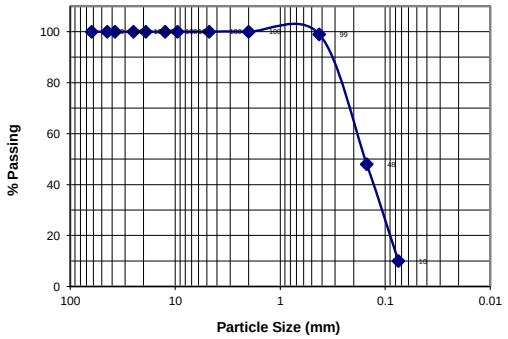
Method Used: B
Preparation: Dry
Rammer: Mechanical
Specific Gravity: 2.30 (estimated)
As Received Water Content: 4 %

Corrected Maximum Dry Unit Weight: 102.9 pcf
Corrected Optimum Water Content: 12.8 %

Moisture-Density Relationship Curve



Grain-Size Distribution



Sieve Analysis

Sieve Opening Size		Retained (%)		Passing (%)	
Std.	mm	Actual	Specs.	Actual	Specs.
2-1/2"	62.50	0	-	100	-
1-3/4"	44.50	0	-	100	-
1-1/2"	37.50	0	-	100	-
1"	25.00	0	-	100	-
3/4"	19.00	0	-	100	-
1/2"	12.50	0	-	100	-
3/8"	9.50	0	-	100	-
#4	4.75	0	-	100	-
#10	2.00	0	-	100	-
#40	0.425	1	-	99	-
#100	0.150	52	-	48	-
#200	0.075	90	-	10	-

Gradation Parameters

D_{10}=	0.08	C_c=	0.81
D_{30}=	0.11	C_u=	2.86
D_{60}=	0.21	-	-

Plasticity Index

Process: Air-dry

Actual:	**LL=**	NV	**PL=**	NV	**PI=**	NP
Typical:	**LL=**	-	**PL=**	-	**PI=**	-

REPORT OF MOISTURE-DENSITY RELATIONSHIP, SIEVE ANALYSIS, AND PLASTICITY INDEX

ASTM D-2487, C-136, D-4318, D-1557

Project Name: Cedar Grove Area Cast Iron Water Main Replacement
El Paso, El Paso County, Texas

Project Number: J22-1-678

Client: Garver USA
221 N Kansas Street, Suite 730
El Paso, Texas 79901

Sample date: 12/19/22

Sample Location: Existing material; Sample collected at Soil Boring B-5; 0'-3' in depth.

Sampler: FM

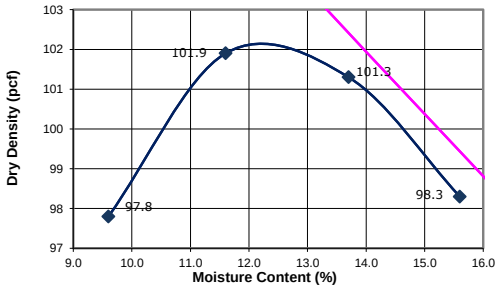
Soil Classification: Silty sand (SM)

Sample Number: 121922-B5

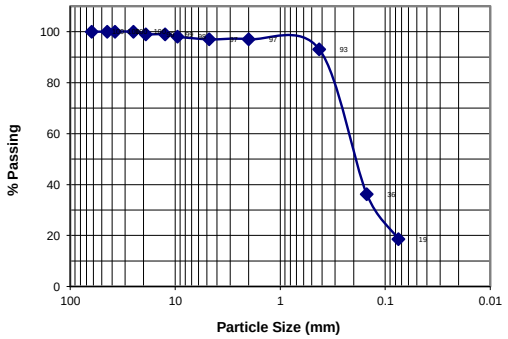
Method Used: B
Preparation: Dry
Rammer: Mechanical
Specific Gravity: 2.40 (estimated)
As Received Water Content: 3 %

Corrected Maximum Dry Unit Weight: 102.1 pcf
Corrected Optimum Water Content: 12.2 %

Moisture-Density Relationship Curve



Grain-Size Distribution



Sieve Analysis

Sieve Opening Size		Retained (%)		Passing (%)	
Std.	mm	Actual	Specs.	Actual	Specs.
2-1/2"	62.50	0	-	100	-
1-3/4"	44.50	0	-	100	-
1-1/2"	37.50	0	-	100	-
1"	25.00	0	-	100	-
3/4"	19.00	1	-	99	-
1/2"	12.50	1	-	99	-
3/8"	9.50	2	-	98	-
#4	4.75	3	-	97	-
#10	2.00	3	-	97	-
#40	0.425	7	-	93	-
#100	0.150	64	-	36	-
#200	0.075	81	-	19	-

Gradation Parameters

D_{10}=	0.04	C_c=	1.43
D_{30}=	0.12	C_u=	6.58
D_{60}=	0.26	-	-

Plasticity Index

Process: Air-dry

Actual:	**LL=**	NV	**PL=**	NV	**PI=**	NP
Typical:	**LL=**	-	**PL=**	-	**PI=**	-

REPORT OF MOISTURE-DENSITY RELATIONSHIP, SIEVE ANALYSIS, AND PLASTICITY INDEX

ASTM D-2487, C-136, D-4318, D-1557

Project Name: Cedar Grove Area Cast Iron Water Main Replacement
El Paso, El Paso County, Texas

Project Number: J22-1-678

Client: Garver USA
221 N Kansas Street, Suite 730
El Paso, Texas 79901

Sample date: 12/19/22

Sample Location: Existing material; Sample collected at Soil Boring B-8; 0'-3' in depth.

Sampler: FM

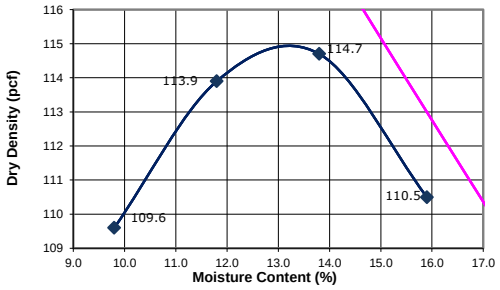
Soil Classification: Silt with sand (ML)

Sample Number: 121922-B8

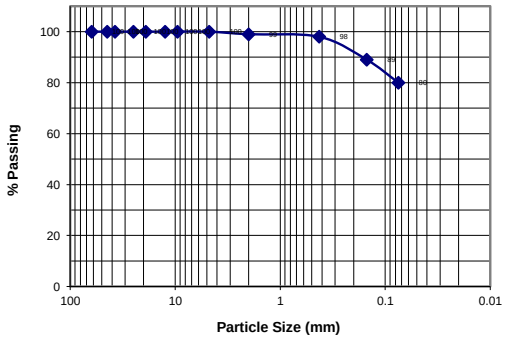
Method Used: B
Preparation: Dry
Rammer: Mechanical
Specific Gravity: 2.40 (estimated)
As Received Water Content: 6 %

Corrected Maximum Dry Unit Weight: 115.0 pcf
Corrected Optimum Water Content: 13.2 %

Moisture-Density Relationship Curve



Grain-Size Distribution



Sieve Analysis

Sieve Opening Size		Retained (%)		Passing (%)	
Std.	mm	Actual	Specs.	Actual	Specs.
2-1/2"	62.50	0	-	100	-
1-3/4"	44.50	0	-	100	-
1-1/2"	37.50	0	-	100	-
1"	25.00	0	-	100	-
3/4"	19.00	0	-	100	-
1/2"	12.50	0	-	100	-
3/8"	9.50	0	-	100	-
#4	4.75	0	-	100	-
#10	2.00	1	-	99	-
#40	0.425	2	-	98	-
#100	0.150	11	-	89	-
#200	0.075	20	-	80	-

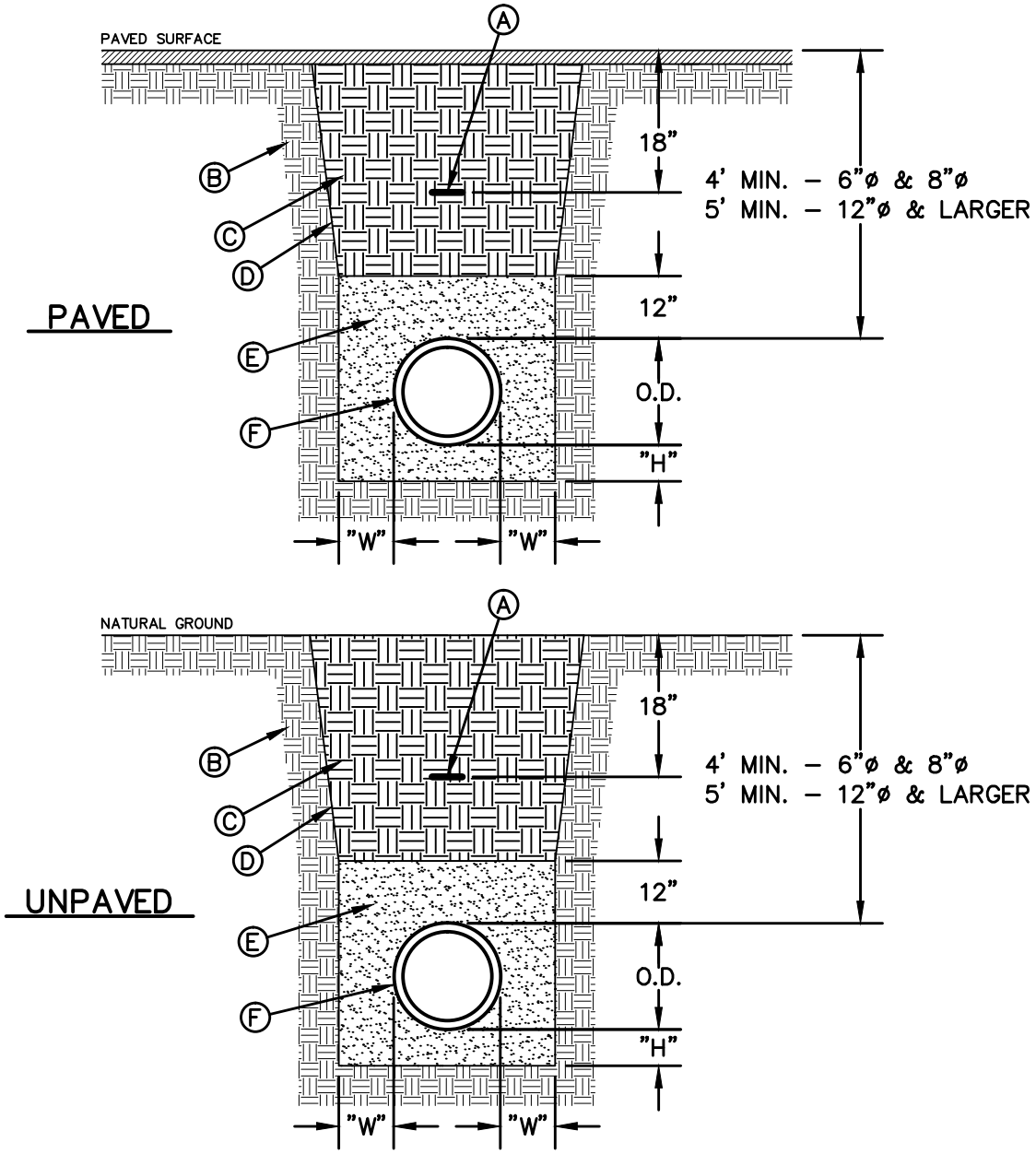
Gradation Parameters

D_{10}=	0.01	C_c=	1.50
D_{30}=	0.03	C_u=	6.00
D_{60}=	0.06	-	-

Plasticity Index

Process: Air-dry

Actual:	**LL=**	NV	**PL=**	NV	**PI=**	NP
Typical:	**LL=**	-	**PL=**	-	**PI=**	-



GENERAL NOTES:

1. BEDDING FOR PRESSURE AND GRAVITY PIPE IN DRY CONDITIONS.
2. PROVIDE TRENCH SAFETY SYSTEM FOR TRENCH DEPTHS GREATER THAN 5 FEET.
3. IF THE NATIVE MATERIAL EXCAVATED FROM THE TRENCH IS UNSUITABLE AS BACKFILL MATERIAL, OR THE REQUIRED COMPACTION IS UNATTAINABLE, THE CONTRACTOR SHALL, AT HIS EXPENSE, IMPORT SELECT MATERIAL TO BE MIXED WITH OR USED IN PLACE OF THE NATIVE MATERIAL. SELECT MATERIAL MUST BE APPROVED BY EPWU. SUBSTITUTE SOIL CEMENT SLURRY (1–SACK) IF REQUIRED IN SPECS.

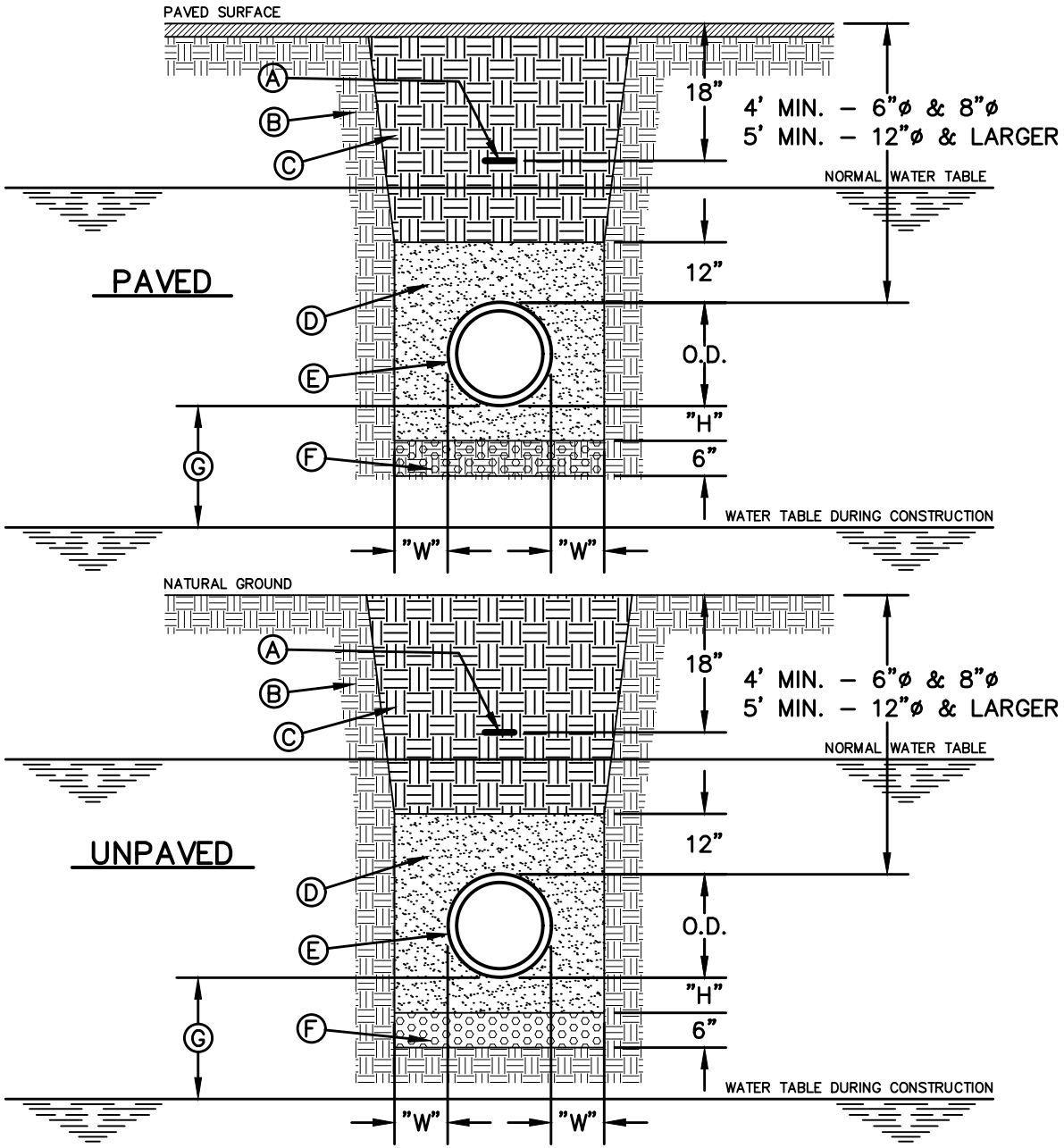
CONSTRUCTION KEY NOTES:

A. APPROVED MARKING TAPE.
B. UNDISTURBED STABLE MATERIAL.
C. NATIVE MATERIAL BACKFILL.
   PAVED CONDITION: COMPACT TO 90% DENSITY PER ASTM D–1557 MODIFIED PROCTOR.
   UNPAVED CONDITION: COMPACT TO 85% DENSITY PER ASTM D–1557 MODIFIED PROCTOR.
   (*SEE NOTE #3 IF THESE PREVIOUS CONDITIONS CANNOT BE MET.)
D. SLOPE TRENCH IN SANDY SOIL CONDITIONS.
E. USE CLASS II OR CLASS III SAND PER ASTM D–2487. NATIVE MATERIAL OR IMPORTED SELECT MATERIAL MEETING OR EXCEEDING THIS REQUIREMENT MAY BE USED. COMPACT TO 85% DENSITY PER ASTM D–1557 MODIFIED PROCTOR (OR 90% D–698 STANDARD PROCTOR).
F. APPROVED PIPE.
G. TRENCH DIMENSIONS AS FOLLOWS:

PIPE DIAMETER	"H"
6" – 30"	4"
GREATER THAN 30"	6"

PIPE DIAMETER	"W"
6" – 30"	8"
GREATER THAN 30"	12"

STANDARD DETAIL	DATE: 4/24/2007 REV: 2/21/2011	EMBEDMENT CLASS "A" FOR PRESSURE PIPE AND GRAVITY PIPE DRY CONDITIONS	N.T.S.	el paso WATER	DETAIL No. 171



GENERAL NOTES:

1. BEDDING FOR PRESSURE PIPE IN WET CONDITIONS.
2. PROVIDE TRENCH SAFETY SYSTEM FOR TRENCH DEPTHS GREATER THAN 5 FEET.
3. A DRY TRENCH MUST BE MAINTAINED WHILE PLACING BEDDING.
4. IF THE NATIVE MATERIAL EXCAVATED FROM THE TRENCH IS UNSUITABLE AS BACKFILL MATERIAL, OR THE REQUIRED COMPACTION IS UNATTAINABLE, THE CONTRACTOR SHALL, AT HIS EXPENSE, IMPORT SELECT MATERIAL TO BE MIXED WITH OR USED IN PLACE OF THE NATIVE MATERIAL. SELECT MATERIAL MUST BE APPROVED BY EPWU. SUBSTITUTE SOIL CEMENT SLURRY (1–SACK) IF REQUIRED IN SPECS.

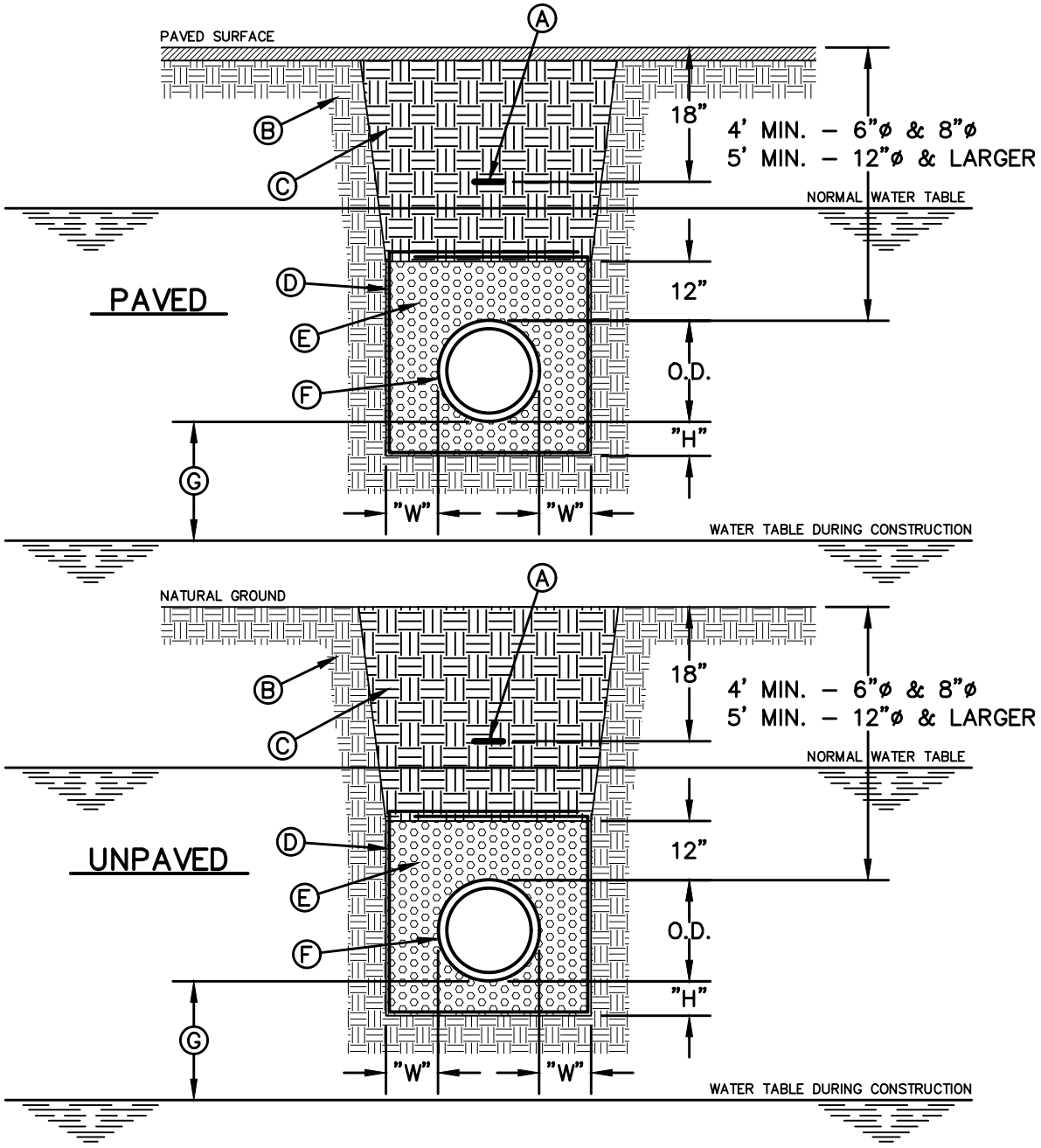
CONSTRUCTION KEY NOTES:

A. APPROVED MARKING TAPE.
B. UNDISTURBED STABLE MATERIAL.
C. NATIVE MATERIAL BACKFILL.
PAVED CONDITION: COMPACT TO 90% DENSITY PER ASTM D–1557 MODIFIED PROCTOR.
UNPAVED CONDITION: COMPACT TO 85% DENSITY PER ASTM D–1557 MODIFIED PROCTOR.
(*SEE NOTE #4 IF THESE PREVIOUS CONDITIONS CANNOT BE MET.)
D. USE CLASS II OR CLASS III SAND PER ASTM D–2487. NATIVE MATERIAL OR IMPORTED SELECT MATERIAL MEETING OR EXCEEDING THIS REQUIREMENT MAY BE USED. COMPACT TO 85% DENSITY PER ASTM D–1557 MODIFIED PROCTOR (OR 90% D–698 STANDARD PROCTOR).
E. APPROVED PIPE (WRAP DUCTILE IRON OR STEEL PIPE IN APPROVED POLYETHYLENE SHEETING, MINIMUM 6 MIL THICKNESS).
F. USE CLASS I GRAVEL PER ASTM D–2321 AND D–2487. NO COMPACTION REQUIRED. USE MINIMAL TAMPING, RODDING OR HAUNCH SLICING CAREFULLY IN THE EMEBEDMENT ZONE. IF REQUIRED BY THE ENGINEER, TEST PER ASTM D–4254 PERCENT OF RELATIVE DENSITY.
G. 18" MINIMUM UNLESS OTHERWISE SPECIFIED.
H. TRENCH DIMENSIONS AS FOLLOWS:

PIPE DIAMETER	"H"
6" – 30"	4"
GREATER THAN 30"	6"

PIPE DIAMETER	"W"
6" – 30"	8"
GREATER THAN 30"	12"

STANDARD DETAIL	DATE: 5/7/2007 REV: 7/6/2020	EMBEDMENT CLASS "B" FOR PRESSURE PIPE WET CONDITIONS	N.T.S.	el paso WATER	DETAIL No. 172



GENERAL NOTES:

1. BEDDING FOR GRAVITY PIPE IN WET CONDITIONS.
2. PROVIDE TRENCH SAFETY SYSTEM FOR TRENCH DEPTHS GREATER THAN 5 FEET.
3. A DRY TRENCH MUST BE MAINTAINED WHILE PLACING BEDDING AND GEOTECHNICAL FABRIC.
4. IF THE NATIVE MATERIAL EXCAVATED FROM THE TRENCH IS UNSUITABLE AS BACKFILL MATERIAL, OR THE REQUIRED COMPACTION IS UNATTAINABLE, THE CONTRACTOR SHALL, AT HIS EXPENSE, IMPORT SELECT MATERIAL TO BE MIXED WITH OR USED IN PLACE OF THE NATIVE MATERIAL. SELECT MATERIAL MUST BE APPROVED BY EPWU. SUBSTITUTE SOIL CEMENT SLURRY (1–SACK) IF REQUIRED IN SPECS.

CONSTRUCTION KEY NOTES:

A. APPROVED MARKING TAPE.
B. UNDISTURBED STABLE MATERIAL.
C. NATIVE MATERIAL BACKFILL.
   PAVED CONDITION: COMPACT TO 90% DENSITY PER ASTM D–1557 MODIFIED PROCTOR.
   UNPAVED CONDITION: COMPACT TO 85% DENSITY PER ASTM D–1557 MODIFIED PROCTOR.
   (*SEE NOTE #4 IF THESE PREVIOUS CONDITIONS CANNOT BE MET.)
D. APPROVED GEOTECHNICAL FABRIC WITH A STANDARD OVERLAP THAT IS 2 FEET EXCEPT WHERE TRENCH WIDTH EXCEEDS 3 FEET, THE OVERLAP AT TOP SHALL BE 3 FEET.
E. USE CLASS I GRAVEL PER ASTM D–2321 AND D–2487. NO COMPACTION REQUIRED. USE MINIMAL TAMPING, RODDING OR HAUNCH SLICING CAREFULLY IN THE EMBEDMENT ZONE. IF REQUIRED BY THE ENGINEER, TEST PER ASTM D–4254 PERCENT OF RELATIVE DENSITY.
F. APPROVED PIPE.
G. 18" MINIMUM UNLESS OTHERWISE SPECIFIED.
H. TRENCH DIMENSIONS AS FOLLOWS:

PIPE DIAMETER	"H"
6" – 30"	4"
GREATER THAN 30"	6"

PIPE DIAMETER	"W"
6" – 30"	8"
GREATER THAN 30"	12"

STANDARD DETAIL	DATE: 5/7/2007 REV: 7/6/2020	EMBEDMENT CLASS "C" FOR GRAVITY PIPE WET CONDITIONS	N.T.S.	el paso WATER	DETAIL No. 173

APPENDIX B

SOIL TERMINOLOGY

COARSE GRAINED SOILS: More than 50 percent retained on No. 200 sieve. Includes fine, medium, or coarse grained (depending on grain size) gravel and sand, and silty and/or clayey gravel and sand. Density is described according to relative density measured in the laboratory, or sampler resistance in the field as follows:

Penetration Resistance* (Blows per Foot)	Descriptive Term	Relative Density** (Percent)
0 – 4	Very Loose	0 - 15
5 - 9	Loose	15 – 35
10 - 29	Medium Dense	35 – 65
30 - 49	Dense	65 - 85
More than 50	Very Dense	85 - 100

* From Standard Penetration Test with 140-pound hammer, 30-inch drop.
** From relative density tests on undisturbed sand sample.

FINE GRAINED SOILS: More than 50 percent passing through the No. 200 sieve. Includes organic and inorganic silt and clay, gravelly and/or sandy silt and clay, silty clay, and clayey silt. Consistency is described according to shear strength, from unconfined compression tests in the laboratory, penetrometer tests in the field or laboratory, or sampler resistance in the field as follows:

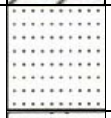
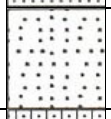
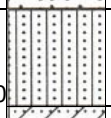
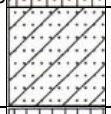
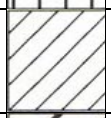
Compressive Strength* (Tons per Square Foot)	Descriptive Term	Penetration Resistance** (Blows per Foot)
Less than 0.25	Very Soft	Less than 2
0.25 - 0.50	Soft	2 - 4
0.50 - 1.00	Firm	5 - 8
1.00 - 2.00	Stiff	9 - 15
2.00 - 4.00	Very Stiff	16 - 50
4.00 and higher	Hard	50 and higher

* From unconfined compression strength test.
** From Standard Penetration Test with 140-pound hammer, 30 inch drop.

Slicken sided: With inclined planes of weakness of slick and glassy appearance.
Fissured: With shrinkage cracks that are frequently filled with fine sand.
Laminated: With thin layers of varying colors and texture.
Interbedded: With alternate layers of different soil types.
Calcareous: With noticeable quantities of calcium carbonate.
Sensitive: Applies to cohesive soils that are subject to loss of strength when remolded.
Well graded: With wide range in grain sizes and good distribution of intermediate particle sizes.
Poorly graded: With one predominant grain size, or a poor distribution with intermediate sizes missing.

SOIL SYMBOLS

Identification of the major soil divisions used to distinguish the change of a different stratum. For their combinations and a more detailed description, see UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487-00)

MAJOR SOIL DIVISIONS			SOIL SYMBOL	USCS SYMBOL	TYPICAL NAME
Coarse-Grained Soils (< 50% pass No. 200 sieve)	GRAVELS (<50% pass No. 4 sieve)	Clean Gravels (< 5% pass No. 200 sieve)		**GW**	Well-Graded Gravels
				**GP**	Poorly-Graded Gravels
		Gravels with fines (> 12% pass No. 200 sieve)		**GM**	Silty Gravels
				**GC**	Clayey Gravels
	SANDS (> 50% pass No. 4 sieve)	Clean Sands (< 5% pass No. 200 sieve)		**SW**	Well-Graded Sands
				**SP**	Poorly-Graded Sands
		Sands with fines (> 12% pass No. 200 sieve)		**SM**	Silty Sands
				**SC**	Clayey Sands
Fine-Grained Soils (> 50% pass No. 200 sieve)	SILTS	Silts of Low Plasticity (*LL < 50)		**ML**	Inorganic Silts (slightly plastic)
		Silts of High Plasticity (*LL > 50)		**MH**	Inorganic Silts (elastic)
	CLAYS	Clays of Low Plasticity (*LL < 50)		**CL**	Inorganic Clays (lean clays)
		Clays of High Plasticity (*LL > 50)		**CH**	Inorganic Clays (Fat clays)

*Liquid Limit of the soil
NV: No value obtained; NP: Non-plastic