GEOTECHNICAL BASELINE REPORT
PROPOSED SAN JACINTO VALLEY WATER BANKING, ENHANCED RECHARGE AND RECOVERY PROGRAM PROJECT
PHASE 1 WELL EQUIPPING AND TREATMENT FACILITIES
EASTERN MUNICIPAL WATER DISTRICT (EMWD)
SAN JACINTO, CALIFORNIA

Prepared for

TETRA TECH
17885 Von Karman Avenue, Suite 500
Irvine, California 92614

Project No. 11875.001

March 27, 2018

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

March 27, 2018

Project No. 11875.001

TETRA TECH
17885 Von Karman Avenue, Suite 500
Irvine, California 92614

Attention: Mr. Steve Ellis, P.E., BCEE
Senior Project Manager – Water/Wastewater

Subject: Geotechnical Baseline Report, Proposed San Jacinto Valley Water Banking, Enhanced Recharge and Recovery Program Project
Phase 1 Well Equipping and Treatment Facilities
Eastern Municipal Water District (EMWD), San Jacinto, California

In accordance with your authorization and our proposals dated July 5, 2017 (revised December 18, 2017), Leighton Consulting, Inc. is pleased to present this *Geotechnical Baseline Report* (GBR) for the subject project. Primary purpose of the GBR is to establish a contractual statement/baseline of geotechnical/geologic conditions to be encountered during pipeline construction, thereby providing a common basis for bidding. As such, it should be understood that this GBR is meant to reflect a reasonable allocation of risk between EMWD and the Contractor based on available subsurface data to date. Contractors should perform their own exploration, as they deem necessary to characterize this alignment for their intended means and methods of construction. We also recommend that this GBR be read and reviewed in conjunction with our *Geotechnical Exploration* report performed for this project (Leighton, 2018).

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to call our Temecula office.

Respectfully submitted,

LEIGHTON CONSULTING, INC.

Simon I. Saiid, GE 2641
Principal Engineer

Robert F. Riha, CEG 1921
Senior Principal Geologist

Distribution: (2) addressee (plus one electronic copy/CD)

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

1.1 Project/Alignment Description

The proposed pipeline alignment is generally located within the right-of-ways (ROW) of existing public roadways as depicted on Figure 1, *Site Location Map*. The project consists of equipping 5 groundwater extraction well facilities (well sites 27, 201, 202, 203, and 205), associated conveyance pipelines, and requisite (centralized) groundwater treatment facility (see Figure 2). More specifically, this Eastern Municipal Water District's (EMWD's) project consists of the following:

- A proposed Hewitt Treatment Plant located northwest of East Evans Street and South Hewitt Street in San Jacinto, California. The types of facilities on this site include filter tanks with slab on grade foundations, a small masonry block building for electrical and chemical storage, a booster pump station, and a 0.87 MG steel or concrete storage tank which may be either at grade or partially buried.
- Miscellaneous improvements at 4 well sites (201, 202, 203, and 205) located within less than a mile of the treatment facility.
- Three separate transmission pipelines from the well sites to the treatment plant site at Hewitt Street, approximately 10,000 Linear Feet in total length. These pipelines will typically have less than 7 feet of cover.

Site topography is generally flat along the proposed alignment and at the well sites.

1.2 Purpose and Scope

Primary purpose of this GBR is to set anticipated geotechnical baseline conditions to be encountered during construction of the proposed pipelines, as a common basis for bidding. This GBR presents an interpretation of geotechnical data collected during our prior subsurface exploration (Leighton, 2018), including estimation/distribution of different materials to be encountered and anticipated behavior of these materials during pipeline construction. Baseline conditions described in this report provide a partial basis for the contractor to prepare construction bids, and serve as the reference for resolution of claims related to differing site conditions. For work affected by subsurface conditions, bids should be based on baseline conditions presented in the GBR and the project plans. For work affected by surface conditions (such as overhead utilities or environmentally restricted areas), bids should be based on observable surface conditions, which can be observed during the site visit and described in contract documents.

Risks associated with conditions consistent with, or less adverse than, these baseline conditions are allocated to the contractor. Those risks associated with conditions more adverse than the baseline conditions are accepted by the Owner. The provision of baseline conditions in the contract is not a warranty that baseline conditions will be encountered. These baseline conditions are rather the contractual standard that the Owner and the successful bidder will agree to use when interpreting differing or unusual site conditions. Owner accepts the risks for conditions that are less favorable than the stated baseline conditions and will negotiate with the contractor for additional compensation if these four conditions exist:

- The contractor has demonstrated that they were able to perform the work within the baseline conditions prior to encountering a change in conditions.
- The actual conditions encountered are more adverse than baseline conditions.
- The contractor can document that the geotechnical conditions are more adverse than those described in this GBR and that exposed conditions materially and significantly increased cost and/or time required to complete the work.
- The contractor has made diligent efforts to complete the work described in the contract documents, including any changes to methods, equipment, labor and materials made necessary by the more adverse conditions.

If all of the foregoing conditions are met, **then** additional compensation will be negotiated, based on the provisions described in project contract documents.

1.3 Hierarchy of Documents

This GBR was prepared based primarily on our previous subsurface exploration report (Leighton, 2018); which provides details of the geotechnical exploration, drilling methods, laboratory testing procedures and test results, and provides recommendations for design and construction of this pipeline project. Baseline conditions presented in this GBR shall take precedence over geotechnical conditions presented in the referenced report.

1.4 Materials Sources and Reviewed Reports

In addition to our previous subsurface exploration report (Leighton, 2018), we have performed a review of published geologic maps and in-house data relevant to this area (see References).

2.0 GEOTECHNICAL CONDITIONS

Presented below are "baseline" site geologic/geotechnical conditions based on review of pertinent literature and the site-specific field exploration (Leighton, 2018).

2.1 Regional Geology

The overall site is located within a prominent natural geomorphic province in southwestern California known as the Peninsular Ranges. This province is characterized by steep, elongated ranges and valleys that trend northwestward. More specifically, the project area is located within the San Jacinto Valley, southwest of the San Jacinto River. The San Jacinto Valley is a relatively flat lying depositional surface flanked by northwest trending hills and mountains. This valley is divided on the east by an alluvial filled graben and on the west by a broad, gently eastward sloping alluvial fan. This northwest trending graben is bounded on the northeast by the main trace of the San Jacinto Fault, and on the southwest by the Casa Loma segment of the San Jacinto Fault Zone.

Sediment from the San Jacinto River has filled the San Jacinto Valley. The thickness of the sediment extends below depths 500 feet in the southwest portion of the valley. Seismic and gravity surveys indicate that approximately 6,500 feet to 7,900 feet of alluvial sediment cover the basement bedrock in the valley (Lofgren, 1975 and 1976).

2.2 Geologic Hazards

Geologic hazards including liquefaction and earthquake faulting are presented in the referenced geotechnical report (Leighton, 2018).

2.3 Subsurface Conditions

The proposed well sites and pipeline alignments are underlain by alluvial valley deposits and surficial fill materials associated with existing streets subgrade/ surface improvements. The fill/alluvial soils generally consisted of silty sand (SM) and well- to poorly-graded sand (SW/SP) with few gravel. Interbedded layers of sandy silt (ML) and silty-sandy clay (CL) were also encountered, especially along the western portion of the overall project area. These sandy silt and clay layers were encountered closest to the surface at Hewitt Treatment Plant. Based on available subsurface exploration data, baseline estimates for soils along this alignment in the upper 10 feet below existing ground surface are tabulated below:

Table 1. Baseline Estimates / Ranges (Upper 10 feet)

Material	Ranges for Entire Alignment	Baseline Estimate	Basis for Estimate
Sandy Soils SM/SC/SP/SW	70 to 90%	-	Borings Logs
Silty/clayey Soils ML/CL Materials	10 to 30%	30%	Borings Logs
Cobbles	1 to 15%	15%	Borings Logs

Where our borings penetrated existing asphalt, the measured thickness of asphaltic concrete and aggregate base layers are listed in Table 2 below

Table 2. Existing Pavement Thickness

Boring #	Location (see Figure 4)	Approx. AC Thickness (Inches)	Approx. Aggregate Base Thickness (Inches)
LB-2	E 7th Street	4.0	11.0
LB-4	E Shaver Street	5.0	5.0
LB-8	Old Second Street	4.0	4.0
LB-9	E Evans Street	4.5	6.0
LB-10	E Evans Street	3.5	7.0

*Borings not listed were not drilled through pavement.

2.4 Surface and Groundwater

Groundwater is not expected to be encountered along the pipeline alignment or at the well sites within the depth explored (10 to 25 feet). However, depending on rainfall and seasonal variation, groundwater (or perched water) may exist at shallow depths in these alluvial deposits. Historic groundwater data recorded in a nearby well #337761N1169515W001 (California DWR, 2018) indicates groundwater levels to exist at elevation 1126.42 msl or approximately 448 feet below ground surface (BGS)

3.0 CONSTRUCTION RECOMMENDATIONS

3.1 Summary of Findings

Soils along the pipeline alignment should be readily excavated by conventional trench excavating equipment (backhoes/excavators) in good working conditions using conventional cut-and-cover methods. Soils along this alignment will predominantly be **Type C** Cal OSHA classified soils, as cohesionless and subject to caving.

3.2 Earthwork Considerations

Earthwork associated with the proposed pipelines should be performed in accordance with applicable EMWD Specifications, "*Standard Specifications for Public Works Construction*" (Greenbook, latest edition) and the project plans and specifications. Trench excavation should be performed in accordance with the project plans, specifications, and all applicable Cal-OSHA requirements. The contractor should expect and consider the following during pipe installation:

- ***Pipeline Subgrade***: Where excavation/compaction cause a yielding subgrade or groundwater or very moist soils (typically >15% moisture or more than 4% above optimum per ASTM 1557) are encountered or the subgrade become disturbed due to localized seepage or surface water, the contractor should excavate these soils to a maximum depth of 2 feet and replace with dryer or more suitable materials to provide a stable bottom. Crushed rock (½-inch maximum size) may be used if found necessary to stabilize bottom of trench prior to placing bedding materials.
- ***Well Sites / Pad Subgrade:*** The subgrade preparation for any settlement sensitive structure at the well sites should consist of over-excavation (OX) of a minimum 5-foot below existing ground surface or 3 feet below design subgrade level, whichever is deeper. Elsewhere for any miscellaneous structures or pavement construction, a minimum of 2-foot OX should be performed. This fill should be compacted to minimum of 90 percent relative compaction per ASTM 1557. Native soils are generally considered suitable as backfill / structural fill for proposed pads.
- ***Bedding Materials***: Prior to backfilling, pipes should be bedded in and covered with a uniform, granular material that has a Sand Equivalent (SE) of 30 or greater, and a gradation meeting requirements of the pipe manufacturer. Onsite soils are expected to be too silty to be considered for bedding material. A minimum cover of 12 inches of bedding material should be provided above the top of the pipe.

- ***Trench Backfill***: Native soils are generally considered suitable as backfill materials over the pipe bedding zone. However, in some areas, such as in the vicinity of LB-6 and LB-8 (up to 30 percent of overall excavated soils), the silty/clayey soils may be too moist and require to be dried back to near optimum moisture content in order to achieve relative compaction. In some areas, it might be more cost-effective to remove and replace these moist materials with dryer (or near optimum moisture) soils.
- ***Shrinkage/Subsidence***: Change in volume of excavated and recompacted soil varies according to initial density, which is a function of soil type and location. This volume change is represented as a percentage increase (bulking) or decrease (shrinkage) in volume of fill after removal and recompaction. Subsidence occurs as natural ground is moisture-conditioned and densified to receive fill. The baseline estimates for earth volume changes during proper recompaction are as follows:
  - ***Shrinkage***: Shrinkage due to recompaction of soils will vary with depth (shrinkage typically decreases with depth). We estimate shrinkage to range from 8 to 16 percent in the upper 10 feet BGS.
  - ***Subsidence***: Subsidence due solely to scarification, moisture conditioning and recompaction of the exposed bottom of trench, is estimated to be on the order of 0.1 foot or less. This should be added to the above shrinkage value for the recompacted fill zone to calculate overall recompaction lowering of grade.

3.3 Temporary Excavations

During construction, exposed earth material conditions should be regularly evaluated to verify that conditions are as anticipated. The contractor is responsible for providing the "competent person" required by OSHA standards to evaluate soil conditions. Close coordination between the competent person and geotechnical consultant should be maintained to facilitate construction while providing safe excavations. Existing artificial fill and alluvial soils encountered are classified as **OSHA soil Type C**. Therefore, unshored temporary excavations should be no steeper than 1½:1 (horizontal:vertical), for a height no-greater-than (≤) 20 feet (*California Construction Safety Orders*, Appendix B to Section 1541.1, Table B-1). These recommended temporary excavations assume a level ground surface for a distance equal to one-and-a-half (x1.5) the depth of excavation. For steeper temporary slopes, deeper excavations, and/or where sloping terrain exists within close proximity to excavation (<1.5xdepth), appropriate shoring methods or flatter slopes may be required to protect the workers in the excavation and adjacent improvements. Such methods should be implemented by the contractor and approved by the geotechnical consultant.

If the sloped open cut excavation is not feasible based on requirements above and due to existing pavements, utilities and/or structures, excavations for the proposed pipeline should be supported by a temporary shoring system such as cross-braced hydraulic shoring, conventional shields, sheet piles, and/or soldier piles and wood lagging. Choice of shoring system should be left to the contractor's judgment since scheduling, economic considerations and/or the individual contractor's construction experience may determine which method is more economical and/or appropriate. The contractor and shoring designer should also perform additional geotechnical studies as necessary to refine the means-and-methods of shoring construction.

Shoring systems should be designed by a California licensed civil or structural engineer. As preliminary design guidelines, we present the following geotechnical parameters for shoring design. The following lateral earth pressures are recommended for temporary shoring supporting encountered alignment soils with level ground behind the shoring. Passive pressure also may be used to compute lateral soil resistance, if necessary, for sheet piles. Earth pressures provided are ultimate values and a safety factor should be applied as appropriate.

Table 3. Static Lateral Earth Pressures

Conditions[1]	Static Equivalent Fluid Weight (pcf)
Active (cantilever)	36
At-Rest (braced)	55
Passive[2]	300

1. For temporary excavations only, with level backfill, not including surcharges
2. Passive equivalent fluid pressure may be doubled for isolated soldier piles spaced at least 2½ diameters on-center. Passive resistance should not exceed 3,000 pounds-per-square-foot (psf)

Determination of appropriate design conditions (active or at-rest) depends on shoring flexibility. If a rotation of more than 0.001 radian (0.06 degrees) is allowed, active pressure conditions apply; otherwise, at-rest condition governs.

Surcharge loads (dead or live) should be added to the indicated lateral earth pressures and should be applied uniformly, if such loads are within a horizontal distance that is less-than the exposed shoring height. The corresponding lateral earth pressure will approximately be 33-percent of the vertical surcharge for active conditions, and 50-percent for at-rest conditions. Surcharge pressures from

concentrated loads should be evaluated after geometric constraints and loading conditions are determined on individual basis.

3.4 Dewatering During Trench Excavations

If encountered in trench excavations, groundwater control, such as dewatering, will be required to limit instability of the pipeline and aid in foundation construction and soil backfill. Dewatering or any other suitable method for stabilizing excavation bottom may be selected by the contractor based on actual groundwater conditions encountered and based on the contractor's chosen means-and-methods of construction. The selected method by the contractor should be able to effectively mitigate bottom-heave for stabilize subgrade soils during pipe installation and backfilling. Discharge of groundwater during excavation should comply with all environmental regulations.

4.0 LIMITATIONS

Baseline conditions were developed using judgment to interpolate and/or extrapolate between exploration locations and laboratory data. This judgment applied in the interpolations and extrapolations reflects the views of the Owner and design consultant team in describing baseline conditions. No amount of exploration, testing, and analysis can precisely predict subsurface characteristics and behavior during construction. Ground behavior in response to construction often depends on the means-and-methods of construction selected by the contractor including equipment, operators, techniques, materials and procedures.

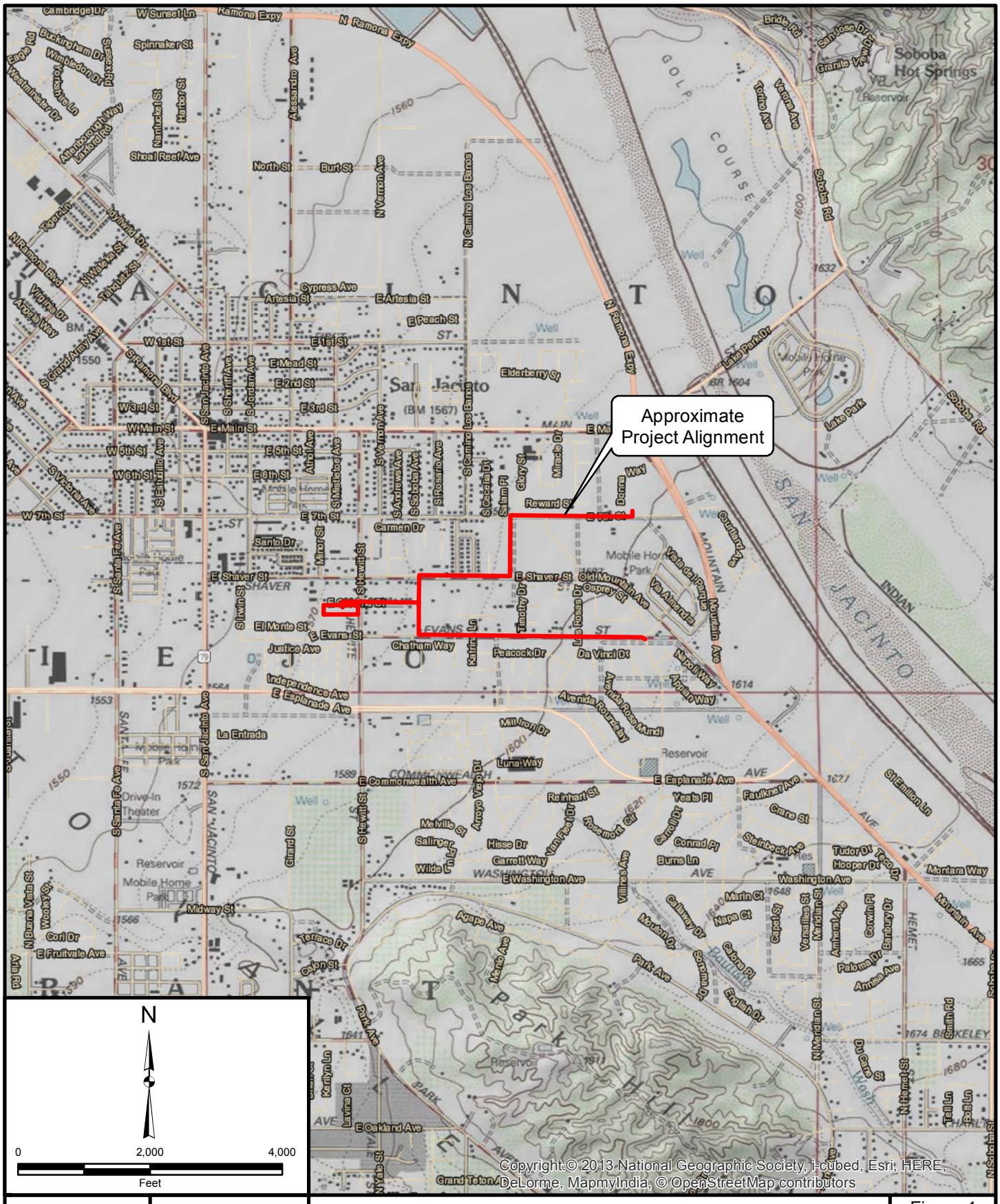
This GBR is only valid for the project described on Figure 2 and in Section 1.1 of this report. Changes in horizontal or vertical alignment or project location will require reevaluation by Leighton Consulting, Inc.

R E F E R E N C E S

Leighton Consulting, Inc., 2018, Geotechnical Exploration, Proposed San Jacinto Valley Water Banking, Enhanced Recharge and Recovery Program Project, Phase 1 Well Equipping and Treatment Facilities, Eastern Municipal Water District (EMWD), San Jacinto, California, dated March 4.

Morton, D.M., 2006, Geologic Map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California, U.S. Geological Survey Open-File Report 2006-1217, Version 1.0, map scale 1:100,000.

Public Works Standard, Inc., 2018, Greenbook, *Standard Specifications for Public Works Construction*: BNI Building News, Anaheim, California.



Project: 11875.001	Eng/Geol: SIS/RFR
Scale: 1 " = 2,000 '	Date: January 2018

Base Map: Bing Maps 2018
Thematic Information: Leighton
Author: Leighton Geomatics (mmurphy)

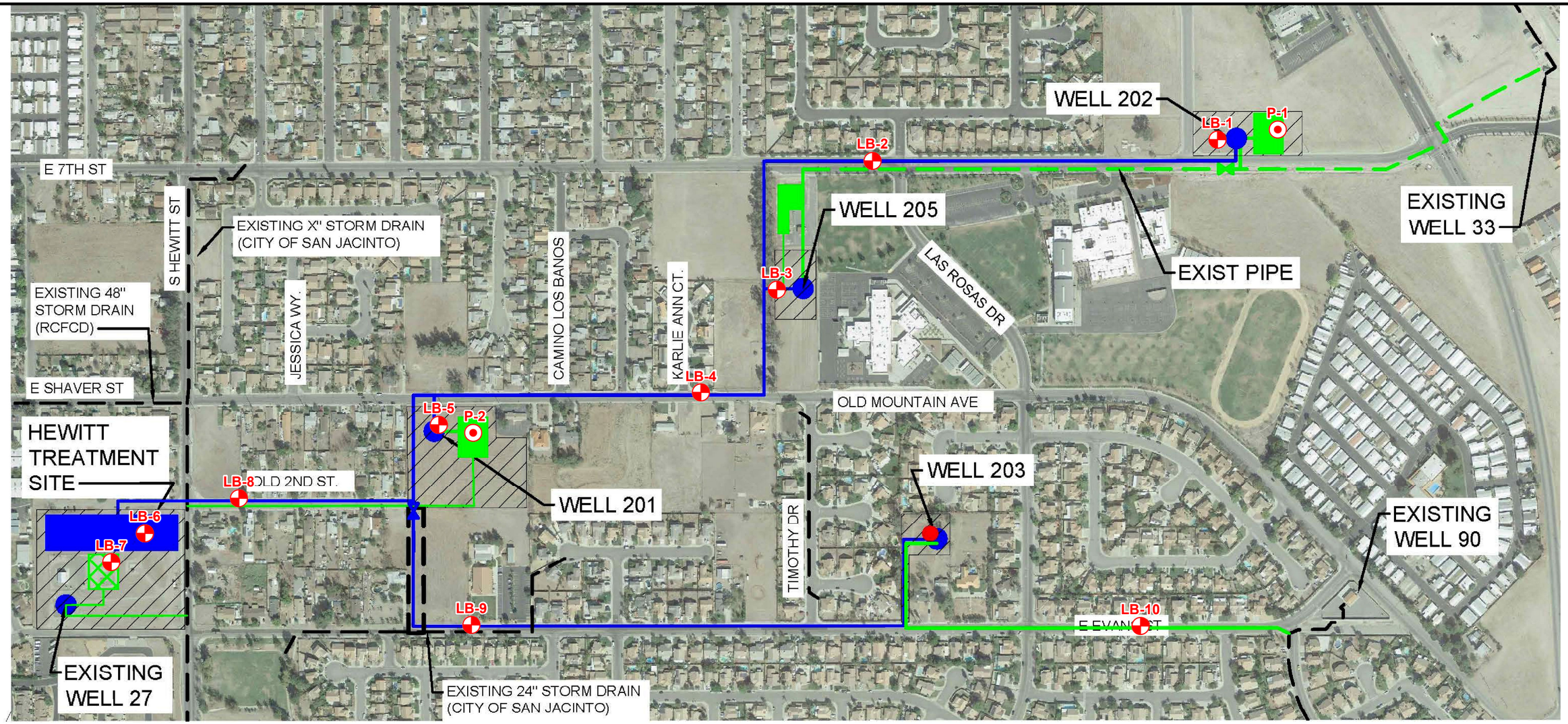
SITE LOCATION MAP

EMWD SJVWB-ERRP Phase 1
Well Equipping and Treatment Facilities
San Jacinto, California

Figure 1

Leighton

Map Saved as V:\Drafting\11875\001\Maps\11875-001_F01_SLM_2018-01-17.mxd on 1/17/2018 3:01:21 PM



LEGEND:

WELL WASTE LINE

EXISTING STORM DRAIN

WELL DISCHARGE LINE

PROPERTY LINE

PERCOLATION BASIN

EXISTING PERCOLATION BASIN

LB-10 Approximate Boring Location

P-2 Approximate Percolation Test Location

N

0 400 800

Feet

Project: 11875.001	Eng/Geol: SIS/RFR
Scale: 1 " = 400 '	Date: January 2018

Base Map: Figure 4, Treatment at Hewitt Site Waste Discharge to Existing Well Waste Lines, Alternative #4, by Tetra Tech, August 2017.

Author: Leighton Geomatics (mmurphy)

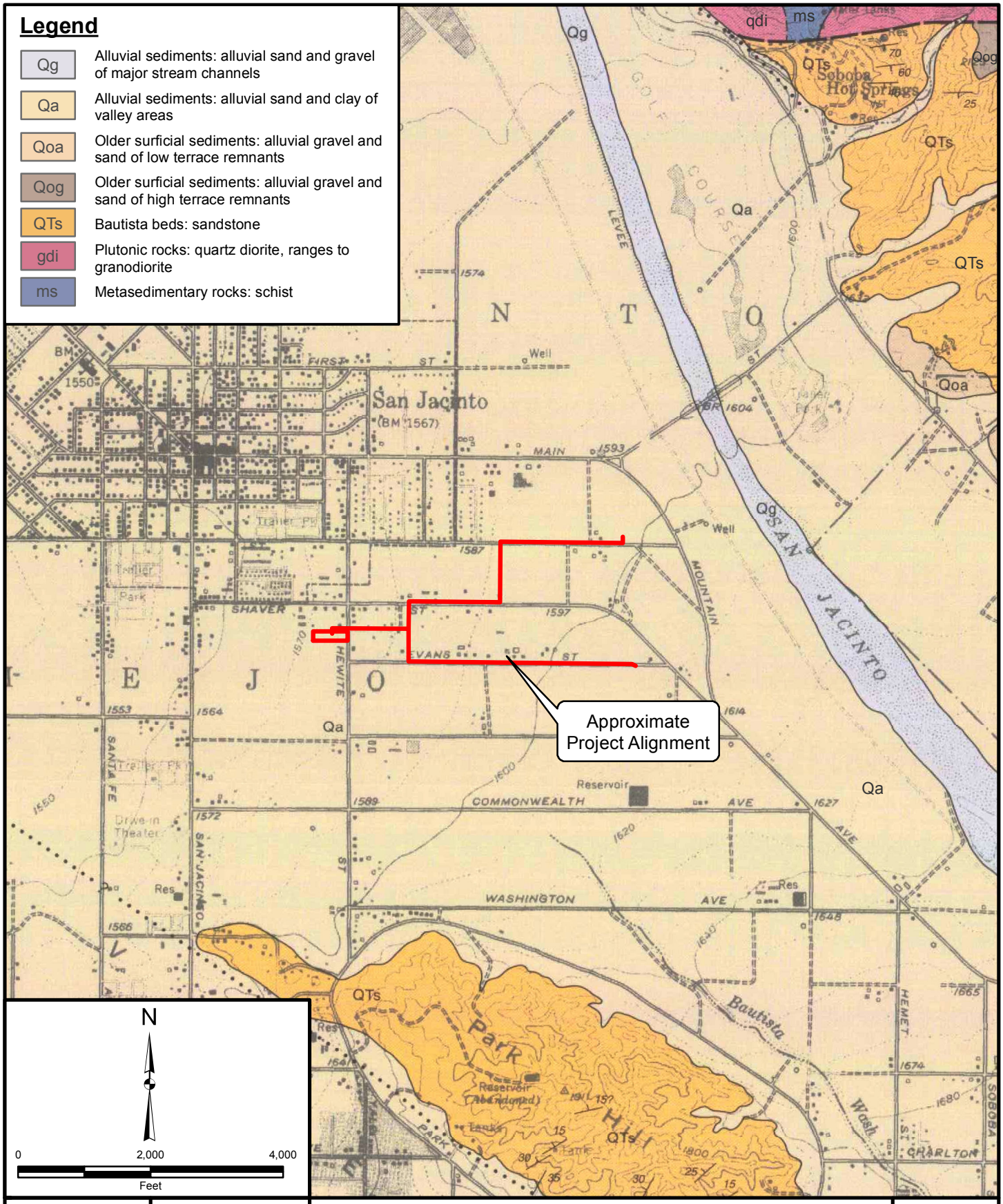
BORING LOCATION MAP

EMWD SJVWB-ERRP Phase 1
Well Equipping and Treatment Facilities
San Jacinto, California

Figure 2

Leighton

Map Saved as P:\Drafting\11875\001\Maps\11875-001_F02_BLM_2018-01-17.mxd on 1/31/2018 9:15:16 AM



Project: 11875.001	Eng/Geol: SIS/RFR
Scale: 1 " = 2,000 '	Date: January 2018

Base Map: Bing Maps 2018
Thematic Information: Leighton
Author: Leighton Geomatics (mmurphy)

REGIONAL GEOLOGY MAP

EMWD SJVWB-ERRP Phase 1
Well Equipping and Treatment Facilities
San Jacinto, California

Figure 3

Leighton

Map Saved as P:\Drafting\11875\001\Maps\11875-001_F03_RGM_2018-01-23.mxd on 1/23/2018 9:16:11 AM

APPENDIX A

Geotechnical Borings

Relatively undisturbed soil samples were obtained at selected intervals within the borings using a California ring sampler, with 2.42-inch inside diameter brass rings, driven into the soil with a 140-pound hammer free falling 30-inches in general accordance with ASTM Test Method D3550. The numbers of blows required for each 6 inches of drive penetration were noted in the field and are recorded on the boring logs. Unless otherwise indicated, the blows per foot recorded on the boring logs represent the number of blows required to drive 18 inches in 6 inch increments. In addition, disturbed bag (or bulk) samples were also obtained from soil cuttings. Types of samples obtained from each location are shown on the boring logs at corresponding depths. Our borings were backfilled with soil cuttings obtained during the drilling. Representative earth-material samples obtained from these subsurface explorations were transported to our Temecula geotechnical laboratory for evaluation and appropriate testing.

The attached subsurface exploration logs and related information depict subsurface conditions only at the locations indicated and at the particular date designated on the logs. Subsurface conditions at other locations may differ from conditions occurring at these locations. The passage of time may result in altered subsurface conditions due to environmental changes. In addition, any stratification lines on the logs represent the approximate boundary between soil types and the transition may be gradual.

GEOTECHNICAL BORING LOG LB-1

Project No.	11875.001	**Date Drilled**	1-8-18
Project	EMWD Well Head Treatment Facilities	**Logged By**	BSS
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Automatic - 30" Drop	**Ground Elevation**	'
Location	Well 202 - See Boring Location Map	**Sampled By**	BSS

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			B-1				SM	SILTY SAND, medium dense, brown, dry to moist, fine to coarse sand, (20% fines, MD: 125.7 @ 9.8%)	SA, MD
				R-1	5 12 8	101	3		with gravel and cobbles, medium dense, grayish brown, moist, fine sand	
	5			R-2 B-2	4 7 10	100	2		loose, light brownish gray, dry to moist, fine to coarse sand	
	10			R-3	6 12 13				medium dense, light gray, moist, fine to coarse sand with fine gravel	
	15			R-4	6 11 12			SW-SM	Well-graded SAND with SILT, medium dense, grayish brown, moist, fine to coarse sand with fine gravel	
	20			R-5	12 25 31	107	2	SW	Well-graded SAND, dense, grayish brown, dry to moist, fine to coarse sand with fine gravel, some gravel	
	25			R-6	13 19 21			SM	SILTY SAND, medium dense, grayish brown, moist, fine to medium sand, micaceous	
									Drilled to 25' Sampled to 26.5' Groundwater not encountered Backfilled with soil cuttings (1/8/18)	
	30									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

GEOTECHNICAL BORING LOG LB-2

Project No.	11875.001	**Date Drilled**	1-8-18
Project	EMWD Well Head Treatment Facilities	**Logged By**	BSS
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	BSS

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0								4 inches Asphalt over 11 inches Base	
								SP-SM	Poorly graded SAND with SILT, medium dense, brown, dry to moist, fine to medium sand, few gravel	
	5			R-1 B-1	7 8 10	101	3	SW	Well-graded SAND, medium dense, light gray, dry to moist, fine to coarse sand with fine gravel, few silt (3% fines, SE=55, MD: 116.8 @ 11.2%)	SA, CR, SE, MD
	10			R-2	11 19 20	112	2		with gravel, medium dense, light gray, dry, fine to coarse sand	
									Drilled to 10' Sampled to 11.5' Groundwater not encountered Backfilled with soil cuttings and quikrete concrete on top (1/8/18)	
	15									
	20									
	25									
	30									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

GEOTECHNICAL BORING LOG LB-3

Project No.	11875.001	**Date Drilled**	1-8-18
Project	EMWD Well Head Treatment Facilities	**Logged By**	BSS
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Automatic - 30" Drop	**Ground Elevation**	'
Location	Well 205 - See Boring Location Map	**Sampled By**	BSS

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0							SM	SILTY SAND, loose, light brown, dry, fine to medium sand	
				R-1	5 7 11	91	3	SW	Well-graded SAND with GRAVEL, medium dense, light gray, dry, fine to coarse sand, some silt	
	5			R-2	5 7 10	88	3		medium dense, light yellowish brown, dry to moist, fine to coarse sand, some gravel and trace cobbles	
	10			R-3	12 18 23	111	3		medium dense, light brownish gray, moist, fine to coarse sand, some gravel, micaceous	
	15			R-4	21 50-6"			CL	SANDY Lean CLAY, hard, grayish brown, dry to moist, fine to medium sand, some calcium carbonate	
	20			R-5	23 36 42			SM	SILTY SAND, dense, grayish brown, dry to moist, fine sand, some interbedded clay layers	
	25			R-6	25 40 50			SC-SM	SILTY, CLAYEY SAND, dense, grayish brown, dry to moist, fine sand, few gravel	
	30								Drilled to 25' Sampled to 26.5' Groundwater not encountered Backfilled with soil cuttings (1/8/18)	

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG LB-4

Project No.	11875.001	**Date Drilled**	1-8-18
Project	EMWD Well Head Treatment Facilities	**Logged By**	BSS
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	BSS

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0								5 inches Asphalt over 5 inches Base	
				B-1				SM	SILTY SAND, medium dense, dark brown, moist, fine sand, some gravel (SE = 19, 24% fines)	-200, CR, SE
									some coarse sand	
	5			R-1	5 9 15	108	11		medium dense, olive brown, moist, fine sand, porous (CO = -0.15%)	CO
	10			R-2	11 13 25	116	10	SC-SM	SILTY, CLAYEY SAND, medium dense, grayish brown, moist, fine sand, micaceous	
									Drilled to 10' Sampled to 11.5' Groundwater not encountered Backfilled with soil cuttings and quikrete concrete on top (1/8/18)	
	15									
	20									
	25									
	30									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG LB-5

Project No.	11875.001	**Date Drilled**	1-8-18
Project	EMWD Well Head Treatment Facilities	**Logged By**	BSS
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	Well 201 - See Boring Location Map	**Sampled By**	BSS

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S							*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	
	0							SM	SILTY SAND, medium dense, brown, dry to moist, fine sand	
	5			R-1 B-1	5 9 13	94	5		medium dense, grayish brown, dry to moist, fine sand, more silt toward the bottom (MD: 120.5 @ 13.0, CO = -0.35%)	CO, MD
	10			R-2	7 9 13	115	12	ML	SANDY SILT, stiff, grayish brown, dry to moist, fine sand, some caliche	
	15			R-3	13 13 16			CL-ML	SILTY CLAY with sand, stiff, grayish brown, moist, fine sand, some Silty SAND	
	20			R-4	23 28 35			SW	Well-graded SAND, dense, light gray, dry, fine to coarse sand with fine gravel	
	25			R-5	13 27 21				dense, light gray, dry, fine to coarse sand with fine gravel, some clay at the bottom	
									Drilled to 25' Sampled to 26.5' Groundwater not encountered Backfilled with soil cuttings (1/8/18)	
	30									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG LB-6

Project No.	11875.001	**Date Drilled**	1-8-18
Project	EMWD Well Head Treatment Facilities	**Logged By**	BSS
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	Treatment Facilities - See Boring Location Map	**Sampled By**	BSS

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0							SM	SILTY SAND, loose, grayish brown, dry, fine sand, few gravel	
				R-1	5 6 8	107	3		loose, olive brown, moist, fine sand, some coarse sand	
	5			R-2	5 5 7	93	2	ML	SANDY SILT, stiff, grayish brown, moist, fine sand, (CO = 0%)	CR
	10			R-3	6 8 10	95	19	CL-ML	SILTY CLAY with sand, stiff, dark grayish brown, moist, fine sand, micaceous	
	15			R-4	25 25 21			SM	SILTY SAND, dense, olive brown, dry to moist, fine sand, micaceous, some oxidation	
	20			R-5	12 20 30			SW	Well-graded SAND, dense, light gray, dry, fine to coarse sand with fine gravel	
	25			R-6	15 23 32			SM	SILTY SAND, dense, dark olive brown, moist, fine to coarse sand, some interbedded clay layers	
									Drilled to 25' Sampled to 26.5' Groundwater not encountered Backfilled with soil cuttings (1/8/18)	
	30									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG LB-7

Project No.	11875.001	**Date Drilled**	1-8-18
Project	EMWD Well Head Treatment Facilities	**Logged By**	BSS
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	BSS

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S							*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	
	0			B-1				SM	SILTY SAND, medium dense, grayish brown, dry to moist, fine to medium sand, trace gravel (44% fines, 1% gravel, EI = 10, MD: 127.3 @ 9.7)	SA, EI, MD
				R-1	4 6 11	112	8		medium dense, grayish brown, moist, fine to medium sand	
	5			R-2	5 6 12	111	14		medium dense, olive brown, moist, fine sand, micaceous, some interbedded silt layers	
	10			R-3	8 9 12	105	10		medium dense, olive brown, moist, fine sand, micaceous, few clay layers	
	15			R-4	6 9 25			CL	Lean CLAY with SAND, medium stiff, dark grayish brown, moist, fine sand	
								SM	SILTY SAND, medium dense, dark olive brown, moist, fine sand, micaceous	
									Drilled to 15' Sampled to 16.5' Groundwater not encountered Backfilled with soil cuttings (1/8/18)	
	20									
	25									
	30									

SAMPLE TYPES:

B	BULK SAMPLE
C	CORE SAMPLE
G	GRAB SAMPLE
R	RING SAMPLE
S	SPLIT SPOON SAMPLE
T	TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

GEOTECHNICAL BORING LOG LB-8

Project No.	11875.001	**Date Drilled**	1-8-18
Project	EMWD Well Head Treatment Facilities	**Logged By**	BSS
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	BSS

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S							*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	
	0								4 inches Asphalt over 4 inches Base	
								SM	SILTY SAND, medium dense, olive brown, moist, fine sand, some gravel	
	5			R-1 B-1	4 4 4	93	21	CL/SM	SANDY Lean CLAY, medium stiff, dark grayish brown, moist, fine sand, some silty sand layers (EI = 8)	EI, CR
	10			R-2	6 10 12	93	23	ML	SANDY SILT, stiff, olive brown, dry to moist, fine sand, to Silty SAND	
									Drilled to 10' Sampled to 11.5' Groundwater not encountered Backfilled with soil cuttings and quikrete concrete on top (1/8/18)	
	15									
	20									
	25									
	30									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

GEOTECHNICAL BORING LOG LB-9

Project No.	11875.001	**Date Drilled**	1-8-18
Project	EMWD Well Head Treatment Facilities	**Logged By**	BSS
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	BSS

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S							*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	
	0								4.5 inches Asphalt over 6 inches Base	
								SM	SILTY SAND, medium dense, dark brown, moist, fine sand, few gravel	
	5			R-1 B-1	5 6 10	107	11		medium dense, dark olive brown, moist, fine sand, few clay layers (CO = -0.07, SE = 11)	CO, CR
	10			R-2	3 3 6			CL	Lean CLAY with SAND, medium stiff, dark grayish brown, moist, fine sand	
									Drilled to 10' Sampled to 11.5' Groundwater not encountered Backfilled with soil cuttings and quikrete concrete on top (1/8/18)	
	15									
	20									
	25									
	30									

SAMPLE TYPES:

B	BULK SAMPLE
C	CORE SAMPLE
G	GRAB SAMPLE
R	RING SAMPLE
S	SPLIT SPOON SAMPLE
T	TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

GEOTECHNICAL BORING LOG LB-10

Project No.	11875.001	**Date Drilled**	1-8-18
Project	EMWD Well Head Treatment Facilities	**Logged By**	BSS
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	BSS

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S							*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	
	0								3.5 inches Asphalt over 7 inches Base	
								SM	SILTY SAND, medium dense, light brown, moist, fine to medium sand, some gravel	
				B-1						
	5			R-1	4 8 9	107	2	SW	Well-graded SAND with GRAVEL, medium dense, light gray, dry, fine to coarse sand, some cobbles (MD: 128.9 @ 7.0)	MD, CR
	10			R-2	8 11 15				medium dense, light brownish gray, dry to moist, fine to coarse sand with fine gravel, (no recovery)	
									Drilled to 10' Sampled to 11.5' Groundwater not encountered Backfilled with soil cuttings and quikrete concrete on top (1/8/18)	
	15									
	20									
	25									
	30									

SAMPLE TYPES:

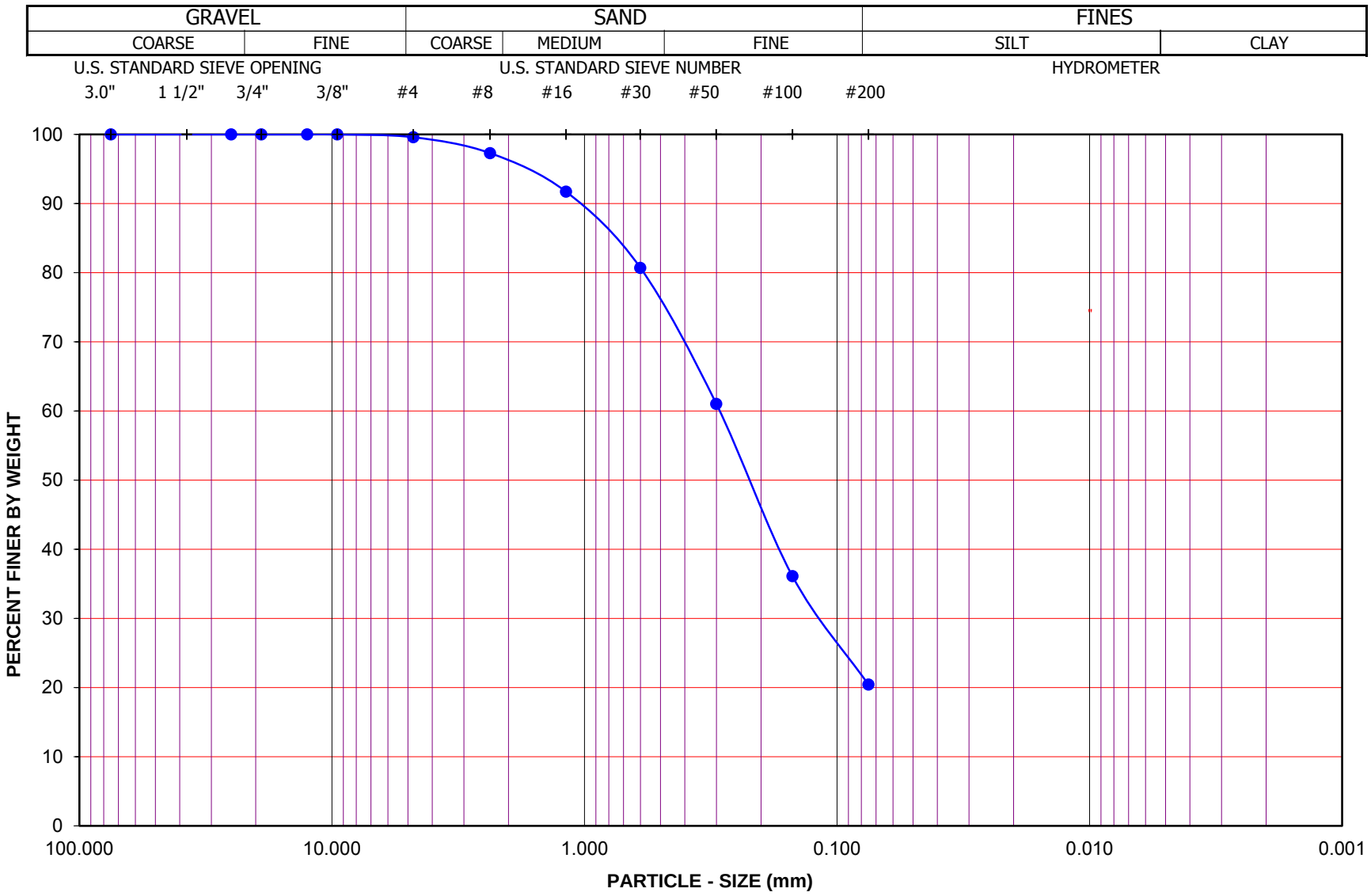
B	BULK SAMPLE
C	CORE SAMPLE
G	GRAB SAMPLE
R	RING SAMPLE
S	SPLIT SPOON SAMPLE
T	TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

APPENDIX B

Geotechnical Laboratory Testing Results



Project Name: EMWD Wellhead Treatment Phase 1

Project No.: 11875.001

Boring No.: LB-1 Sample No.: B-1

Depth (feet): 0.5 - 5.0 Soil Type : SM

Soil Identification: Silty Sand (SM), Brown.

GR:SA:FI : (%) 0 : 80 : 20

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 6913

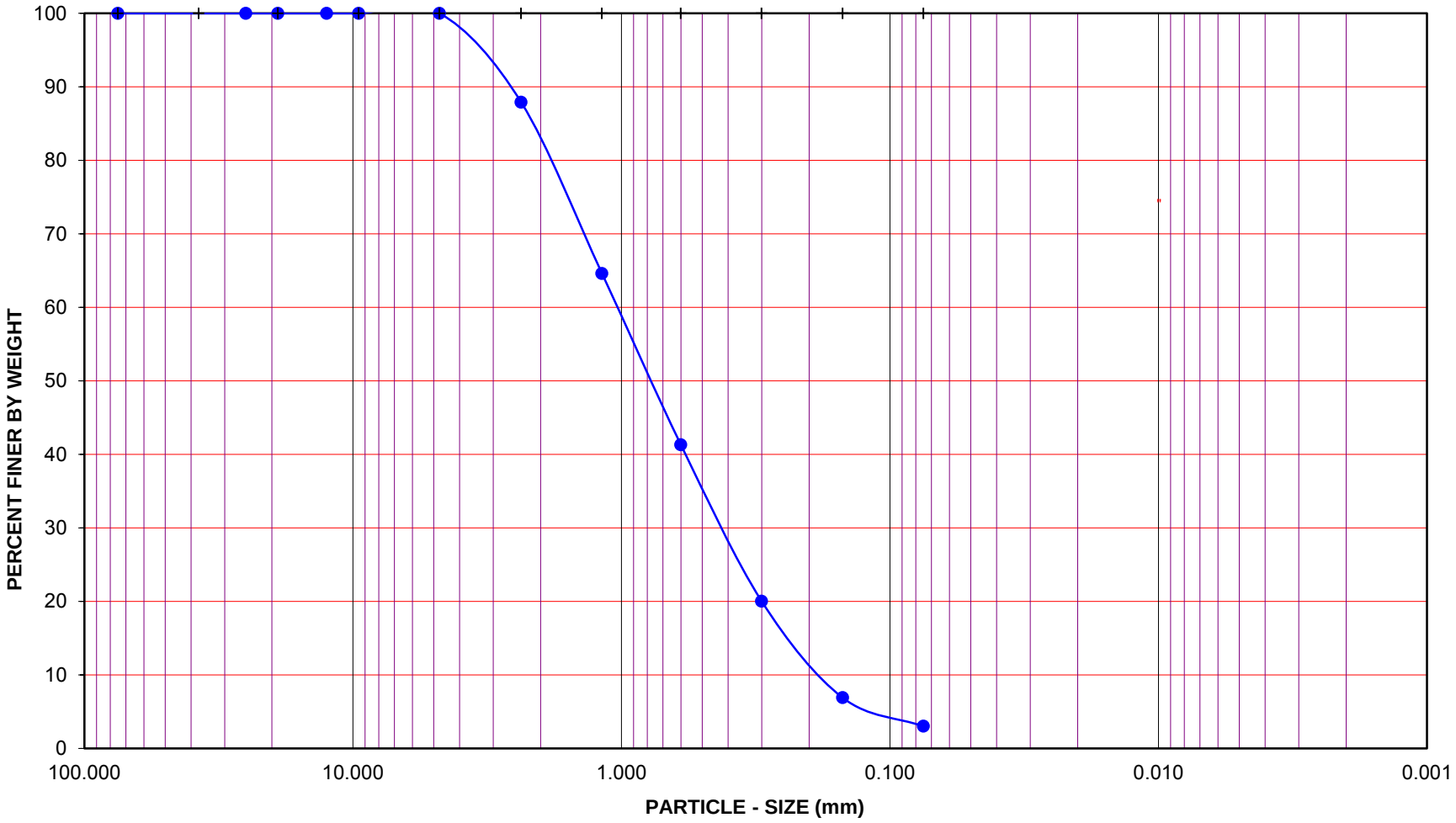
Jan-18

GRAVEL		SAND			FINES	
COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY

U.S. STANDARD SIEVE OPENING: 3.0" 1 1/2" 3/4" 3/8"

U.S. STANDARD SIEVE NUMBER: #4 #8 #16 #30 #50 #100 #200

HYDROMETER



Project Name: EMWD Wellhead Treatment Phase 1

Project No.: 11875.001

Boring No.: LB-2 Sample No.: B-1

Depth (feet): 5.0 - 8.0 Soil Type : SW

Soil Identification: Well Graded Sand (SW), Light Brown.

GR:SA:FI : (%) 0 : 97 : 3

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 6913

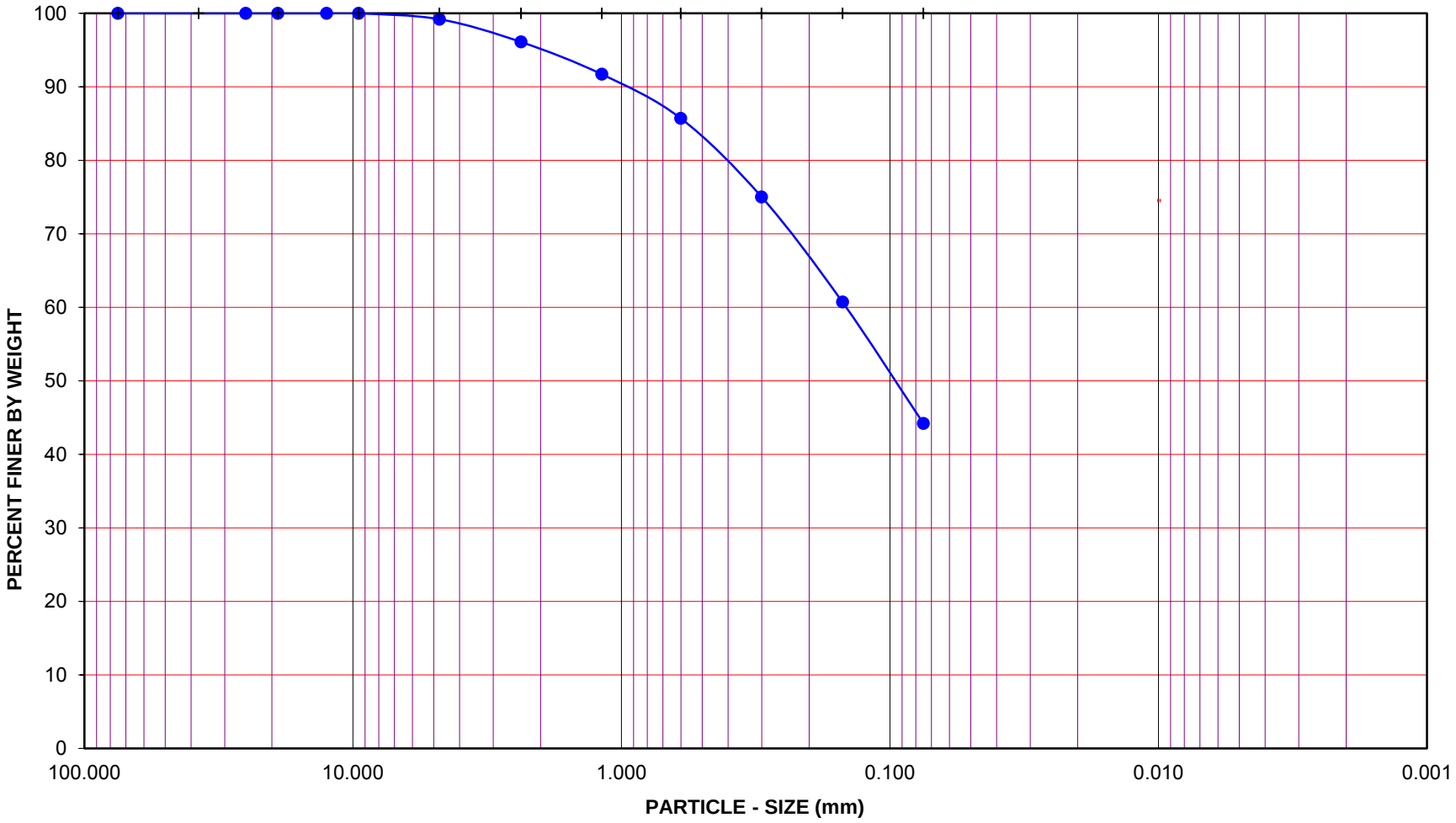
Mar-18

GRAVEL		SAND			FINES	
COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY

U.S. STANDARD SIEVE OPENING: 3.0" | 1 1/2" | 3/4" | 3/8"

U.S. STANDARD SIEVE NUMBER: #4 | #8 | #16 | #30 | #50 | #100 | #200

HYDROMETER



Project Name: EMWD Wellhead Treatment Phase 1

Project No.: 11875.001

Boring No.: LB-7 Sample No.: B-1

Depth (feet): 1.0 - 6.0 Soil Type : SM

Soil Identification: Silty Sand (SM), Brown.

GR:SA:FI : (%) 1 : 55 : 44

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 6913

Jan-18

Leighton

SAND EQUIVALENT TEST

ASTM D 2419 / DOT CA Test 217

Project Name:	EMWD Wellhead Treatment Phase 1	Tested By:	F. Mina	Date:	3/9/18
Project No. :	11875.001	Computed By:	F. Mina	Date:	3/9/18
Client:	Tetra Tech	Checked By:	M. Vinet	Date:	3/12/18

Boring No.	Sample No.	Depth (ft.)	Soil Description	T1	T2	T3	T4	R1	R2	SE	Average SE
LB-2	B-1	5.0 - 8.0	Well Graded Sand (SW)	11:15	11:25	11:27	11:47	7.1	3.8	54	**55**
				11:17	11:27	11:29	11:49	7.4	4.0	55	

T1 = Starting Time

T2 = (T1 + 10 min) Begin Agitation

T3 = Settlement Starting Time

T4 = (T3 + 20 min) Take Clay Reading (R1)

Sand Equivalent = R2 / R1 * 100

Record SE as Next Higher Integer

Leighton

SAND EQUIVALENT TEST

ASTM D 2419 / DOT CA Test 217

Project Name:	EMWD Wellhead Treatment Phase 1	Tested By:	F. Mina	Date:	1/19/18
Project No. :	11875.001	Computed By:	F. Mina	Date:	1/19/18
Client:	Tetra Tech	Checked By:	M. Vinet	Date:	1/26/18

Boring No.	Sample No.	Depth (ft.)	Soil Description	T1	T2	T3	T4	R1	R2	SE	Average SE
LB-4	B-1	1.0 - 6.0	Silty Sand (SM)	12:15	12:25	12:27	12:47	10.0	1.9	19	**19**
				12:17	12:27	12:29	12:49	9.8	1.8	19	

T1 = Starting Time

T2 = (T1 + 10 min) Begin Agitation

T3 = Settlement Starting Time

T4 = (T3 + 20 min) Take Clay Reading (R1)

Sand Equivalent = R2 / R1 * 100

Record SE as Next Higher Integer

Leighton

SAND EQUIVALENT TEST

ASTM D 2419 / DOT CA Test 217

Project Name:	EMWD Wellhead Treatment Phase 1	Tested By:	F. Mina	Date:	1/19/18
Project No. :	11875.001	Computed By:	F. Mina	Date:	1/19/18
Client:	Tetra Tech	Checked By:	M. Vinet	Date:	1/26/18

Boring No.	Sample No.	Depth (ft.)	Soil Description	T1	T2	T3	T4	R1	R2	SE	Average SE
LB-9	B-1	5.0 - 8.0	Silt with Sand (ML)s	12:19	12:29	12:31	12:51	11.7	1.2	11	**11**
				12:21	12:31	12:33	12:53	11.9	1.3	11	

T1 = Starting Time

T2 = (T1 + 10 min) Begin Agitation

T3 = Settlement Starting Time

T4 = (T3 + 20 min) Take Clay Reading (R1)

Sand Equivalent = R2 / R1 * 100

Record SE as Next Higher Integer

Leighton

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	EMWD Wellhead Treament Phase 1	Tested By:	F. Mina	Date:	03/09/18
Project No.:	11875.001	Input By:	M. Vinet	Date:	03/12/18
Boring No.:	LB-1	Depth (ft.):	0.5 - 5.0		
Sample No.:	B-1				
Soil Identification:	Silty Sand (SM), Brown.				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03340 *Ram Weight = 10 lb.; Drop = 18 in.*

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	5511	5566	5633	5605		
Weight of Mold (g)	3542	3542	3542	3542		
Net Weight of Soil (g)	1969	2024	2091	2063		
Wet Weight of Soil + Cont. (g)	2369.0	2443.5	2496.4	2748.6		
Dry Weight of Soil + Cont. (g)	2262.0	2295.1	2310.6	2529.0		
Weight of Container (g)	419.8	420.9	415.1	696.4		
Moisture Content (%)	5.8	7.9	9.8	12.0		
Wet Density (pcf)	130.0	133.6	138.0	136.2		
Dry Density (pcf)	122.8	123.8	125.7	121.6		

Maximum Dry Density (pcf) **125.7** **Optimum Moisture Content (%)** **9.8**

PROCEDURE USED

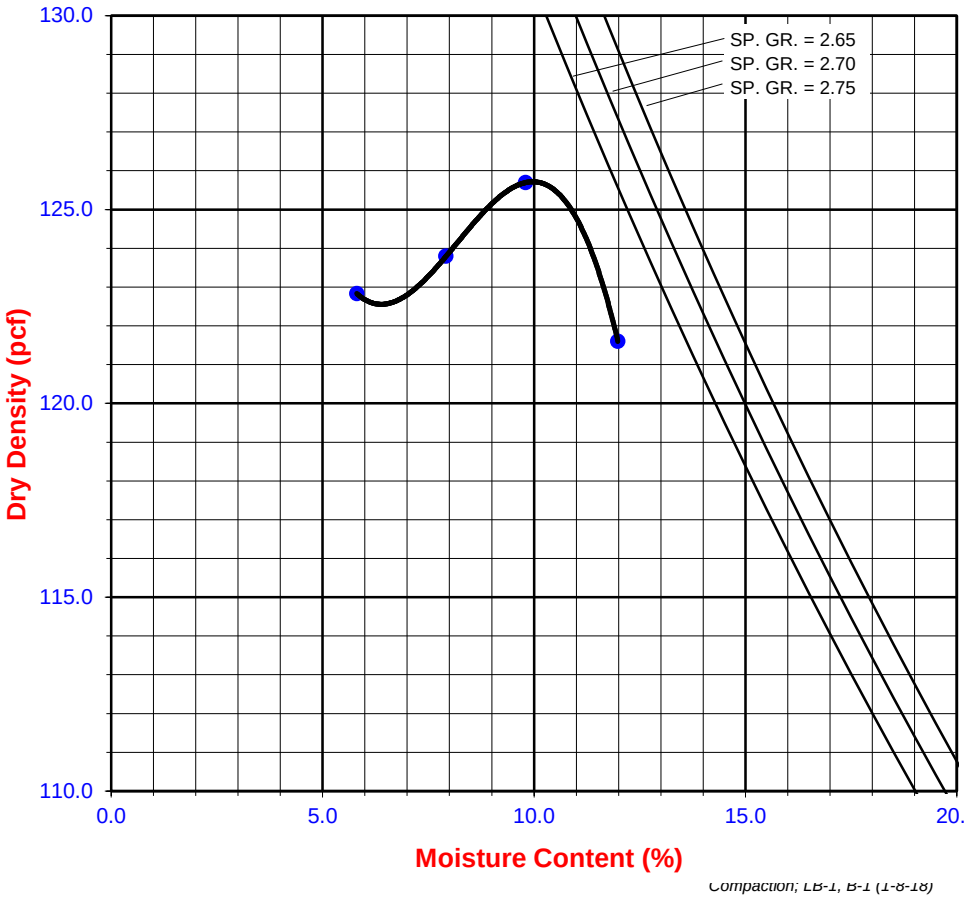
[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
0:80:20
GR:SA:FI

Atterberg Limits:
LL,PL,PI



Leighton

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	EMWD Wellhead Treament Phase 1	Tested By:	F. Mina	Date:	03/09/18
Project No.:	11875.001	Input By:	M. Vinet	Date:	03/12/18
Boring No.:	LB-2	Depth (ft.):	5.0 - 8.0		
Sample No.:	B-1				
Soil Identification:	Well Graded Sand (SW), Light Brown.				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03340 *Ram Weight = 10 lb.; Drop = 18 in.*

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	5476	5525	5520			
Weight of Mold (g)	3542	3542	3542			
Net Weight of Soil (g)	1934	1983	1978			
Wet Weight of Soil + Cont. (g)	2620.2	2686.1	2897.5			
Dry Weight of Soil + Cont. (g)	2449.5	2467.0	2645.0			
Weight of Container (g)	699.7	716.2	946.5			
Moisture Content (%)	9.8	12.5	14.9			
Wet Density (pcf)	127.7	130.9	130.6			
Dry Density (pcf)	116.3	116.3	113.7			

Maximum Dry Density (pcf) **116.8** **Optimum Moisture Content (%)** **11.2**

PROCEDURE USED

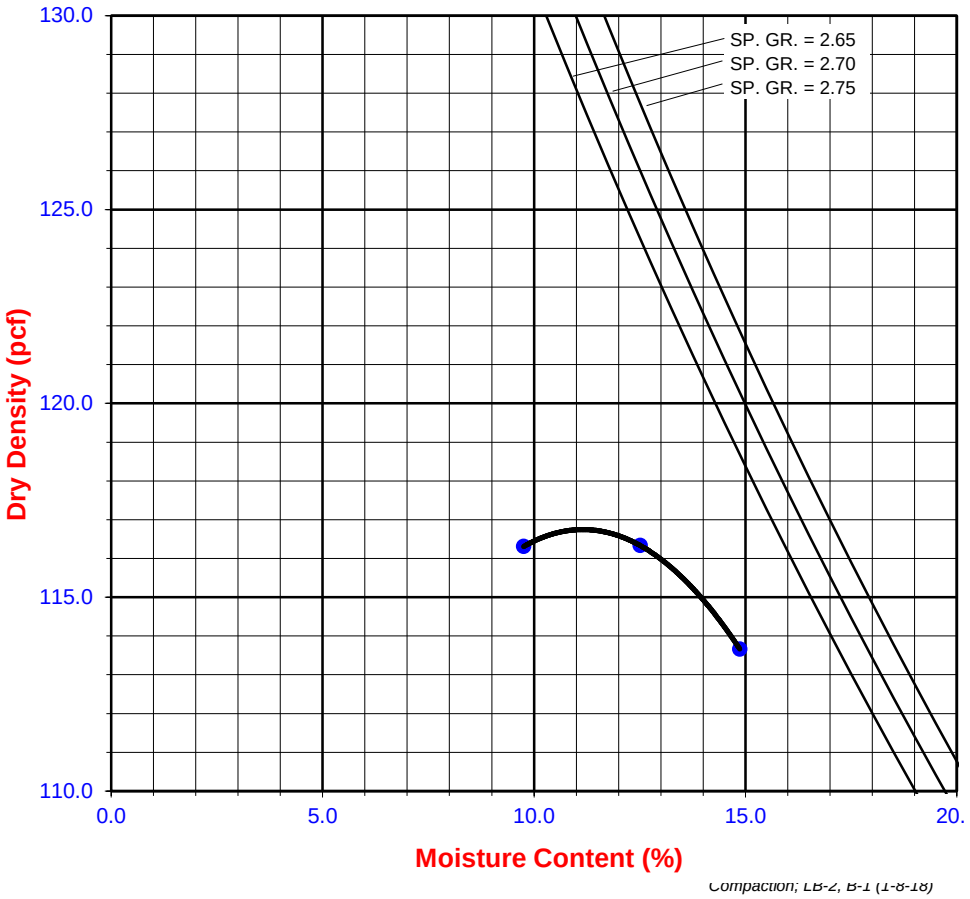
[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
0:97:3
GR:SA:FI

Atterberg Limits:
LL,PL,PI



Leighton

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	EMWD Wellhead Treament Phase 1	Tested By:	F. Mina	Date:	01/23/16
Project No.:	11875.001	Input By:	M. Vinet	Date:	01/26/18
Boring No.:	LB-5	Depth (ft.):	5.5 - 8.0		
Sample No.:	B-1				
Soil Identification:	Poorly Graded Sand with Silt (SP-SM), Yellowish Brown.				

Preparation Method: [X] Moist [ ] Dry — [X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03340 *Ram Weight = 10 lb.; Drop = 18 in.*

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	5471	5553	5607	5590		
Weight of Mold (g)	3542	3542	3542	3542		
Net Weight of Soil (g)	1929	2011	2065	2048		
Wet Weight of Soil + Cont. (g)	1971.2	2177.1	2180.5	2270.4		
Dry Weight of Soil + Cont. (g)	1812.8	1977.4	1941.8	1998.9		
Weight of Container (g)	44.3	171.1	127.5	227.4		
Moisture Content (%)	9.0	11.1	13.2	15.3		
Wet Density (pcf)	127.3	132.7	136.3	135.2		
Dry Density (pcf)	116.9	119.5	120.5	117.2		

Maximum Dry Density (pcf) 120.5 **Optimum Moisture Content (%)** 13.0

PROCEDURE USED

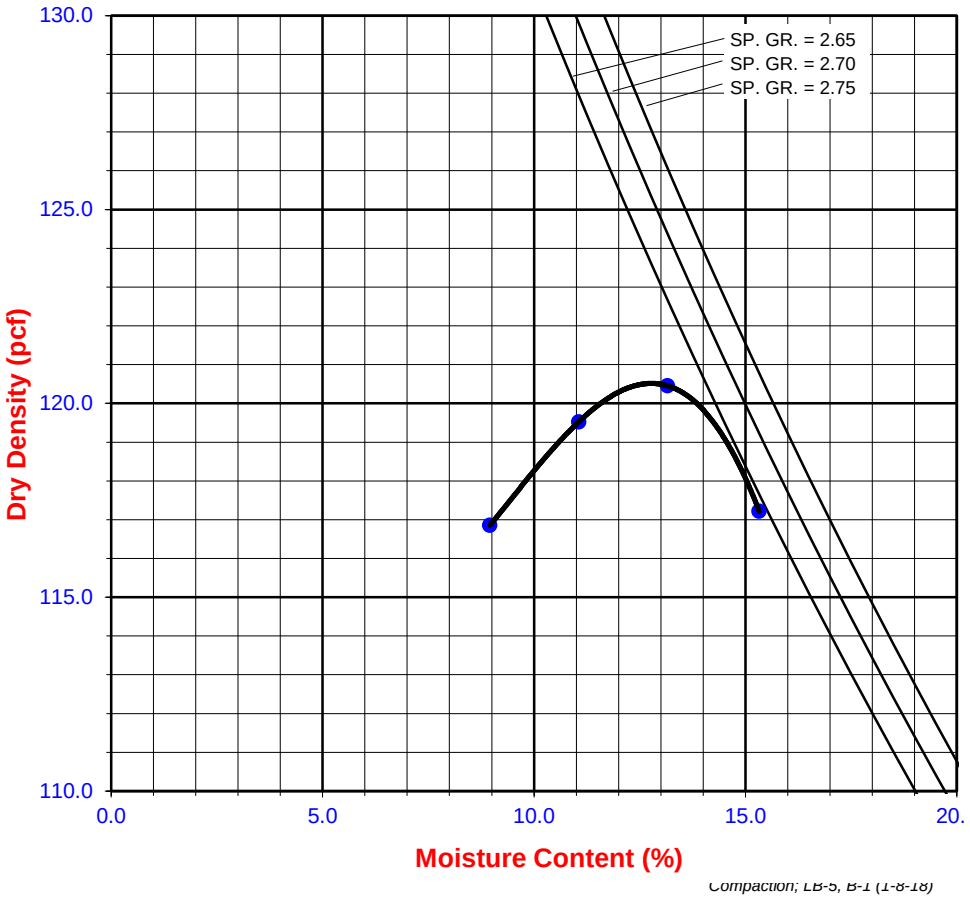
[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
GR:SA:FI

Atterberg Limits:
LL,PL,PI



MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	EMWD Wellhead Treament Phase 1	Tested By:	F. Mina	Date:	01/23/16
Project No.:	11875.001	Input By:	M. Vinet	Date:	01/26/18
Boring No.:	LB-7	Depth (ft.):	1.0 - 6.0		
Sample No.:	B-1				
Soil Identification:	Silty Sand (SM), Brown.				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03340 *Ram Weight = 10 lb.; Drop = 18 in.*

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	5587	5667	5641			
Weight of Mold (g)	3542	3542	3542			
Net Weight of Soil (g)	2045	2125	2099			
Wet Weight of Soil + Cont. (g)	2450.8	2249.2	2334.9			
Dry Weight of Soil + Cont. (g)	2301.5	2051.9	2107.7			
Weight of Container (g)	408.9	130.4	239.8			
Moisture Content (%)	7.9	10.3	12.2			
Wet Density (pcf)	135.0	140.3	138.5			
Dry Density (pcf)	125.1	127.2	123.5			

Maximum Dry Density (pcf) **127.3** **Optimum Moisture Content (%)** **9.7**

PROCEDURE USED

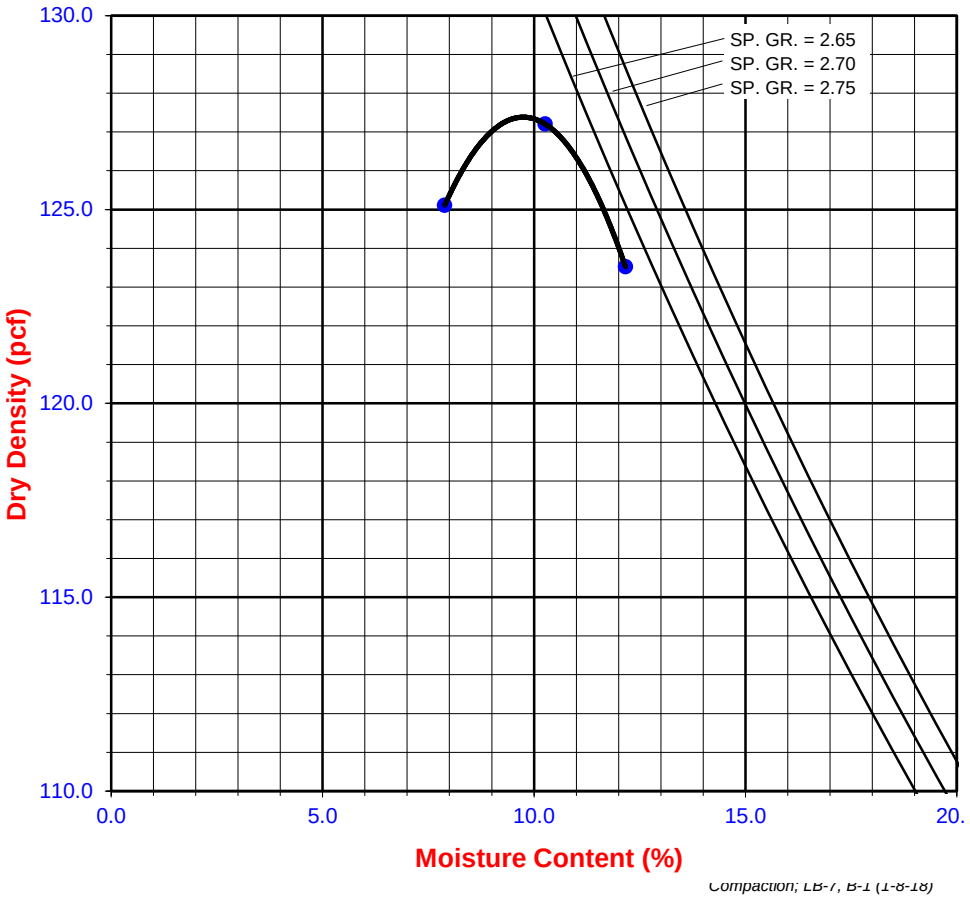
[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
1:55:44
GR:SA:FI

Atterberg Limits:
LL,PL,PI



MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	EMWD Wellhead Treament Phase 1	Tested By:	F. Mina	Date:	01/23/16
Project No.:	11875.001	Input By:	M. Vinet	Date:	01/26/18
Boring No.:	LB-10	Depth (ft.):	5.0 - 7.0		
Sample No.:	B-1				
Soil Identification:	Silty Sand (SM), Yellowish Brown.				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03340 *Ram Weight = 10 lb.; Drop = 18 in.*

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	5595	5644	5627			
Weight of Mold (g)	3542	3542	3542			
Net Weight of Soil (g)	2053	2102	2085			
Wet Weight of Soil + Cont. (g)	2338.9	2315.4	2268.4			
Dry Weight of Soil + Cont. (g)	2226.3	2166.5	2082.2			
Weight of Container (g)	290.0	267.6	200.6			
Moisture Content (%)	5.8	7.8	9.9			
Wet Density (pcf)	135.5	138.7	137.6			
Dry Density (pcf)	128.1	128.7	125.2			

Maximum Dry Density (pcf) 128.9 **Optimum Moisture Content (%)** 7.0

PROCEDURE USED

[ ] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[X] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

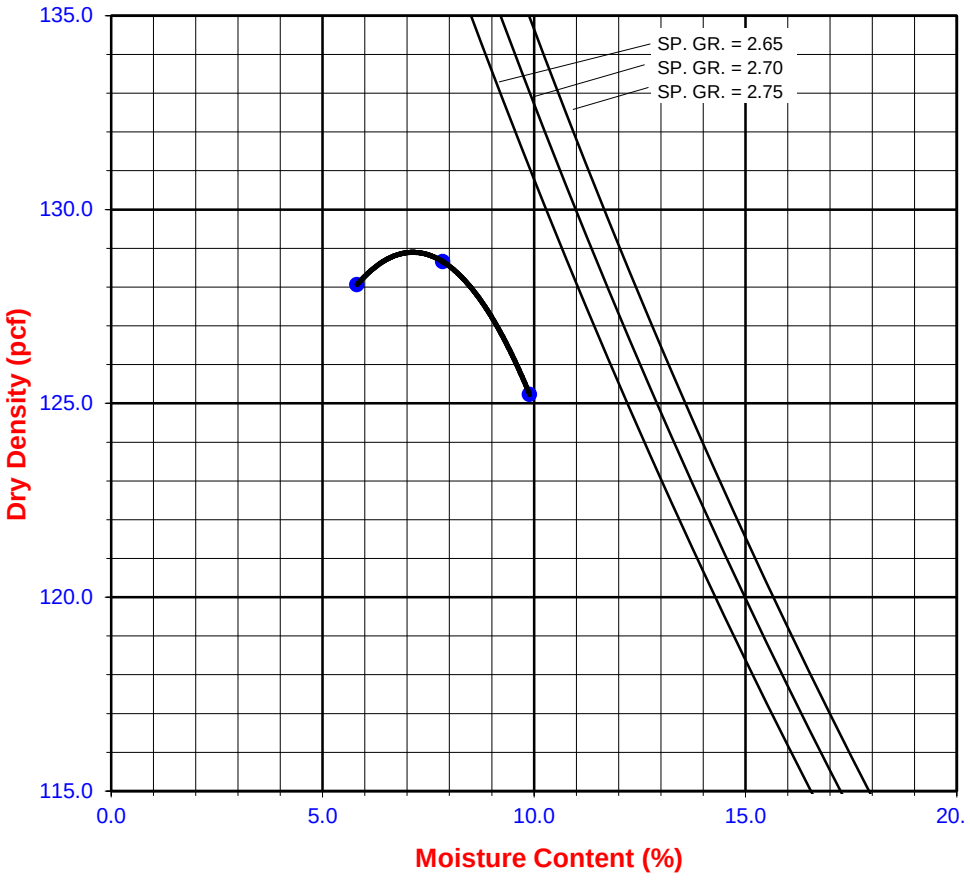
[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:

GR:SA:FI

Atterberg Limits:

LL,PL,PI



Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	EMWD Wellhead Treatment Phase 1	Tested By:	F. Mina	Date:	1/18/18
Project No. :	11875.001	Checked By:	M. Vinet	Date:	1/26/18
Boring No.:	LB-7	Depth:	1.0 - 6.0		
Sample No. :	B-1	Location:	N/A		
Sample Description:	Silty Sand (SM), Gray.				

Dry Wt. of Soil + Cont. (gm.)	2500.2
Wt. of Container No. (gm.)	0.0
Dry Wt. of Soil (gm.)	2500.2
Weight Soil Retained on #4 Sieve	157.8
Percent Passing # 4	93.7

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0095
Wt. Comp. Soil + Mold (gm.)	610.5	639.8
Wt. of Mold (gm.)	208.8	208.8
Specific Gravity (Assumed)	2.70	2.70
Container No.	8	8
Wet Wt. of Soil + Cont. (gm.)	350.1	639.8
Dry Wt. of Soil + Cont. (gm.)	324.1	366.8
Wt. of Container (gm.)	50.1	208.8
Moisture Content (%)	9.5	17.5
Wet Density (pcf)	121.2	128.8
Dry Density (pcf)	110.7	109.6
Void Ratio	0.523	0.538
Total Porosity	0.344	0.350
Pore Volume (cc)	71.1	73.1
Degree of Saturation (%) [S meas]	**49.0**	**87.8**

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h.

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
1/18/18	12:00	1.0	0	0.5000
1/18/18	12:10	1.0	10	0.5000
	Add Distilled Water to the Specimen			
1/19/18	8:30	1.0	1220	0.5095
1/19/18	9:30	1.0	1280	0.5095

Expansion Index (EI meas) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	9.5
Expansion Index (Report) = Nearest Whole Number or Zero (0) if Initial Height is > than Final Heigh	**10**

Rev. 03-08

Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	EMWD Wellhead Treatment Phase 1	Tested By:	F. Mina	Date:	1/18/18
Project No. :	11875.001	Checked By:	M. Vinet	Date:	1/26/18
Boring No.:	LB-8	Depth:	5.0 - 8.0		
Sample No. :	B-1	Location:	N/A		
Sample Description:	Silty Sand (SM), Gray				

Dry Wt. of Soil + Cont. (gm.)	3780.3
Wt. of Container No. (gm.)	0.0
Dry Wt. of Soil (gm.)	3780.3
Weight Soil Retained on #4 Sieve	18.4
Percent Passing # 4	99.5

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0075
Wt. Comp. Soil + Mold (gm.)	588.0	622.7
Wt. of Mold (gm.)	199.2	199.2
Specific Gravity (Assumed)	2.70	2.70
Container No.	7	7
Wet Wt. of Soil + Cont. (gm.)	350.1	622.7
Dry Wt. of Soil + Cont. (gm.)	320.4	350.3
Wt. of Container (gm.)	50.1	199.2
Moisture Content (%)	11.0	20.9
Wet Density (pcf)	117.3	126.8
Dry Density (pcf)	105.7	104.9
Void Ratio	0.596	0.608
Total Porosity	0.373	0.378
Pore Volume (cc)	77.3	78.8
Degree of Saturation (%) [S meas]	**49.9**	**92.9**

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h.

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
1/18/18	12:15	1.0	0	0.5000
1/18/18	12:25	1.0	10	0.5000
	Add Distilled Water to the Specimen			
1/19/18	8:30	1.0	1205	0.5075
1/19/18	9:30	1.0	1265	0.5075

Expansion Index (EI meas) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	7.5
Expansion Index (Report) = Nearest Whole Number or Zero (0) if Initial Height is > than Final Heigh	**8**

Rev. 03-08

Leighton

One-Dimensional Swell or Settlement Potential of Cohesive Soils

(ASTM D 4546) -- Method 'B'

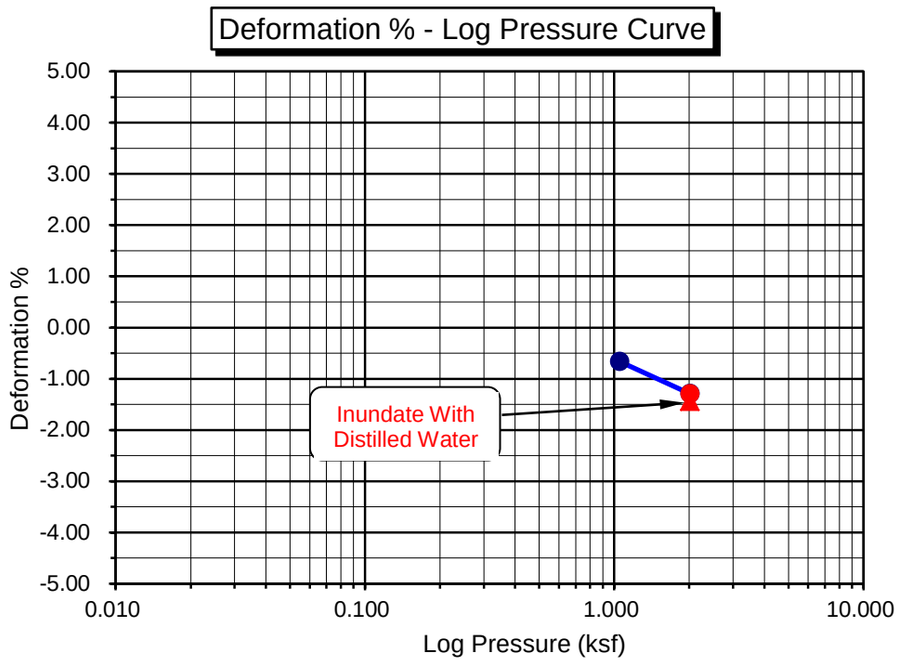
Project Name: EMWD Wellhead Treatment Phase 1 | Tested By: M. Vinet | Date: 1/22/18
Project No.: 11875.001 | Checked By: M. Vinet | Date: 1/26/18
Boring No.: **LB-4** | Sample Type: IN SITU
Sample No.: **R-1** | Depth (ft.) 5.0
Sample Description: Silty Sand (SM), Brown.
Source and Type of Water Used for Inundation: Arrowhead (Distilled)
** Note: Loading After Wetting (Inundation) not Performed Using this Test Method.

Initial Dry Density (pcf):	104.5
Initial Moisture (%):	11.0
Initial Height (in.):	1.0000
Initial Dial Reading (in):	0.0000
Inside Diameter of Ring (in):	2.416

Final Dry Density (pcf):	106.1
Final Moisture (%) :	21.4
Initial Void ratio:	0.6124
Specific Gravity (assumed):	2.70
Initial Degree of Saturation (%):	48.4

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
1.050	0.0066	0.9934	0.00	-0.66	0.6018	-0.66
2.013	0.0129	0.9871	0.00	-1.29	0.5916	-1.29
H2O	0.0144	0.9856	0.00	-1.44	0.5892	-1.44

Percent Swell / Settlement After Inundation = -0.15



Leighton

One-Dimensional Swell or Settlement Potential of Cohesive Soils

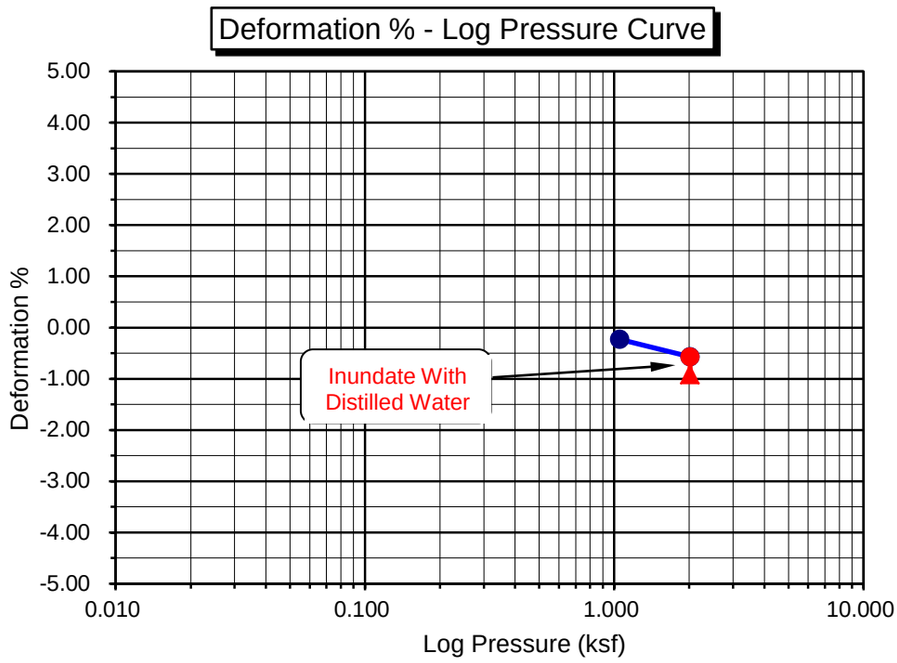
(ASTM D 4546) -- Method 'B'

Project Name: EMWD Wellhead Treatment Phase 1 | Tested By: M. Vinet | Date: 1/22/18
Project No.: 11875.001 | Checked By: M. Vinet | Date: 1/26/18
Boring No.: **LB-5** | Sample Type: IN SITU
Sample No.: **R-1** | Depth (ft.) 5.0
Sample Description: Poorly Graded Sand with Silt (SP-SM), Grayish Brown.
Source and Type of Water Used for Inundation: Arrowhead (Distilled)
** Note: Loading After Wetting (Inundation) not Performed Using this Test Method.

Initial Dry Density (pcf):	91.0	Final Dry Density (pcf):	91.9
Initial Moisture (%):	5.0	Final Moisture (%) :	27.6
Initial Height (in.):	1.0000	Initial Void ratio:	0.8518
Initial Dial Reading (in):	0.0000	Specific Gravity (assumed):	2.70
Inside Diameter of Ring (in):	2.416	Initial Degree of Saturation (%):	15.8

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
1.050	0.0023	0.9977	0.00	-0.23	0.8475	-0.23
2.013	0.0057	0.9943	0.00	-0.57	0.8412	-0.57
H2O	0.0092	0.9908	0.00	-0.92	0.8347	-0.92

Percent Swell / Settlement After Inundation = -0.35



Leighton

One-Dimensional Swell or Settlement Potential of Cohesive Soils

(ASTM D 4546) -- Method 'B'

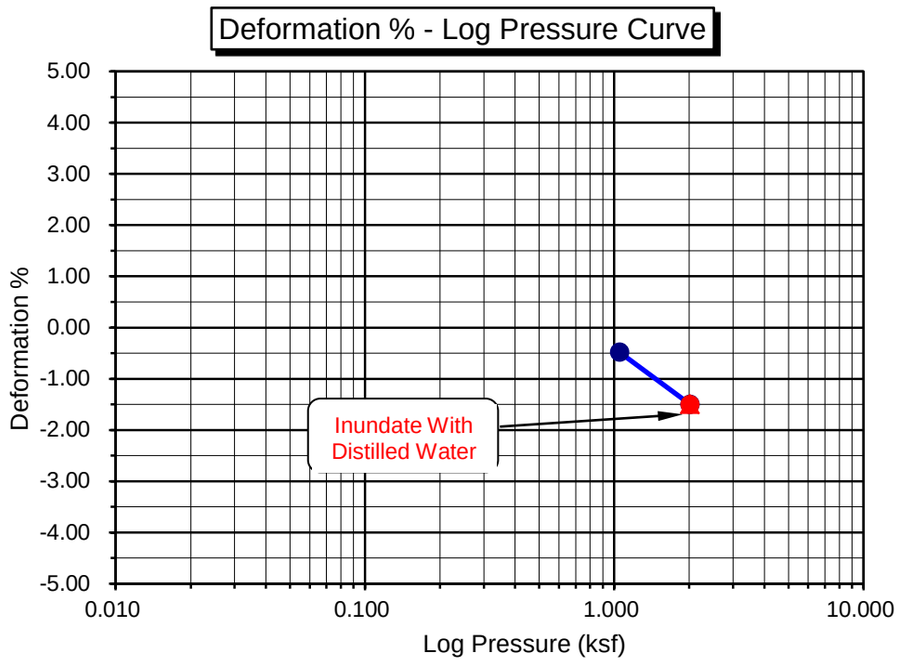
Project Name: EMWD Wellhead Treatment Phase 1 | Tested By: M. Vinet | Date: 1/22/18
Project No.: 11875.001 | Checked By: M. Vinet | Date: 1/26/18
Boring No.: **LB-6** | Sample Type: IN SITU
Sample No.: **R-2** | Depth (ft.) 5.0
Sample Description: Silt (ML), Brown.
Source and Type of Water Used for Inundation: Arrowhead (Distilled)
** Note: Loading After Wetting (Inundation) not Performed Using this Test Method.

Initial Dry Density (pcf):	91.0
Initial Moisture (%):	23.4
Initial Height (in.):	1.0000
Initial Dial Reading (in):	0.0000
Inside Diameter of Ring (in):	2.416

Final Dry Density (pcf):	92.4
Final Moisture (%) :	29.6
Initial Void ratio:	0.8516
Specific Gravity (assumed):	2.70
Initial Degree of Saturation (%):	74.2

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
1.050	0.0048	0.9952	0.00	-0.48	0.8427	-0.48
2.013	0.0150	0.9850	0.00	-1.50	0.8238	-1.50
H2O	0.0150	0.9850	0.00	-1.50	0.8238	-1.50

Percent Swell / Settlement After Inundation = 0.00



Leighton

One-Dimensional Swell or Settlement Potential of Cohesive Soils

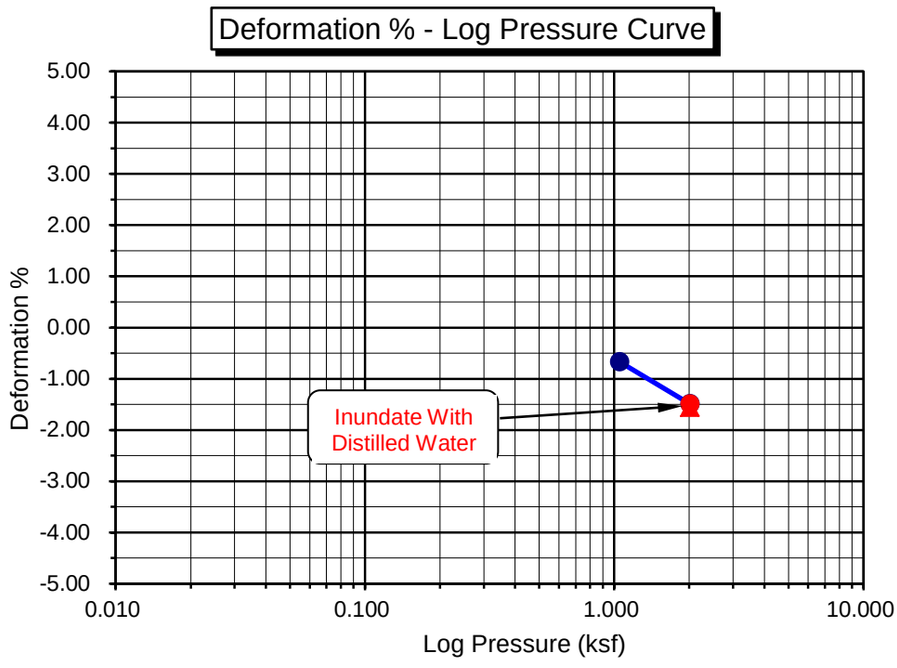
(ASTM D 4546) -- Method 'B'

Project Name: EMWD Wellhead Treatment Phase 1 | Tested By: M. Vinet | Date: 1/22/18
Project No.: 11875.001 | Checked By: M. Vinet | Date: 1/26/18
Boring No.: **LB-9** | Sample Type: IN SITU
Sample No.: **R-1** | Depth (ft.) 5.0
Sample Description: Sandy Silt s(ML), Brown.
Source and Type of Water Used for Inundation: Arrowhead (Distilled)
** Note: Loading After Wetting (Inundation) not Performed Using this Test Method.

Initial Dry Density (pcf):	103.6	Final Dry Density (pcf):	105.3
Initial Moisture (%):	11.4	Final Moisture (%) :	20.5
Initial Height (in.):	1.0000	Initial Void ratio:	0.6268
Initial Dial Reading (in):	0.0000	Specific Gravity (assumed):	2.70
Inside Diameter of Ring (in):	2.416	Initial Degree of Saturation (%):	49.0

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
1.050	0.0067	0.9933	0.00	-0.67	0.6159	-0.67
2.013	0.0149	0.9851	0.00	-1.49	0.6025	-1.49
H2O	0.0156	0.9844	0.00	-1.56	0.6014	-1.56

Percent Swell / Settlement After Inundation = -0.07



Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 643

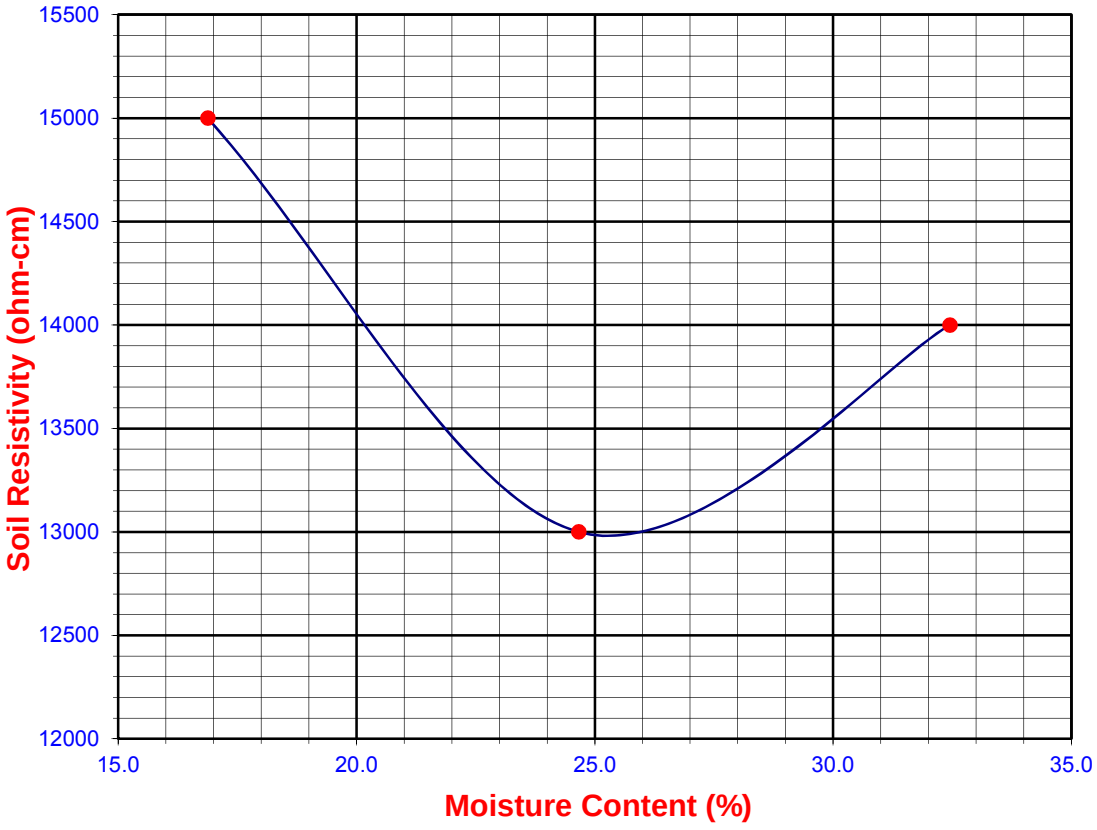
Project Name:	EMWD Wellhead Treatment Phase 1		Tested By :	O. Figueroa	Date: 01/24/18
Project No. :	11875.001		Data Input By:	J. Ward	Date: 01/26/18
Boring No.:	LB-2		Depth (ft.) :	5-8	
Sample No. :	B-1				
Soil Identification:*	Olive SW-SM				

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	20	16.88	15000	15000
2	30	24.67	13000	13000
3	40	32.45	14000	14000
4				
5				

Moisture Content (%) (MCi)	1.31
Wet Wt. of Soil + Cont. (g)	182.64
Dry Wt. of Soil + Cont. (g)	181.02
Wt. of Container (g)	57.71
Container No.	
Initial Soil Wt. (g) (Wt)	130.16
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 643	
12980	**25.3**	**54**	**20**	**7.75**	**21.3**



Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 643

Project Name: EMWD Wellhead Treatment Phase 1 | Tested By : O. Figueroa | Date: 01/24/18

Project No. : 11875.001 | Data Input By: J. Ward | Date: 01/26/18

Boring No.: LB-4 | Depth (ft.) : 1-6

Sample No. : B-1

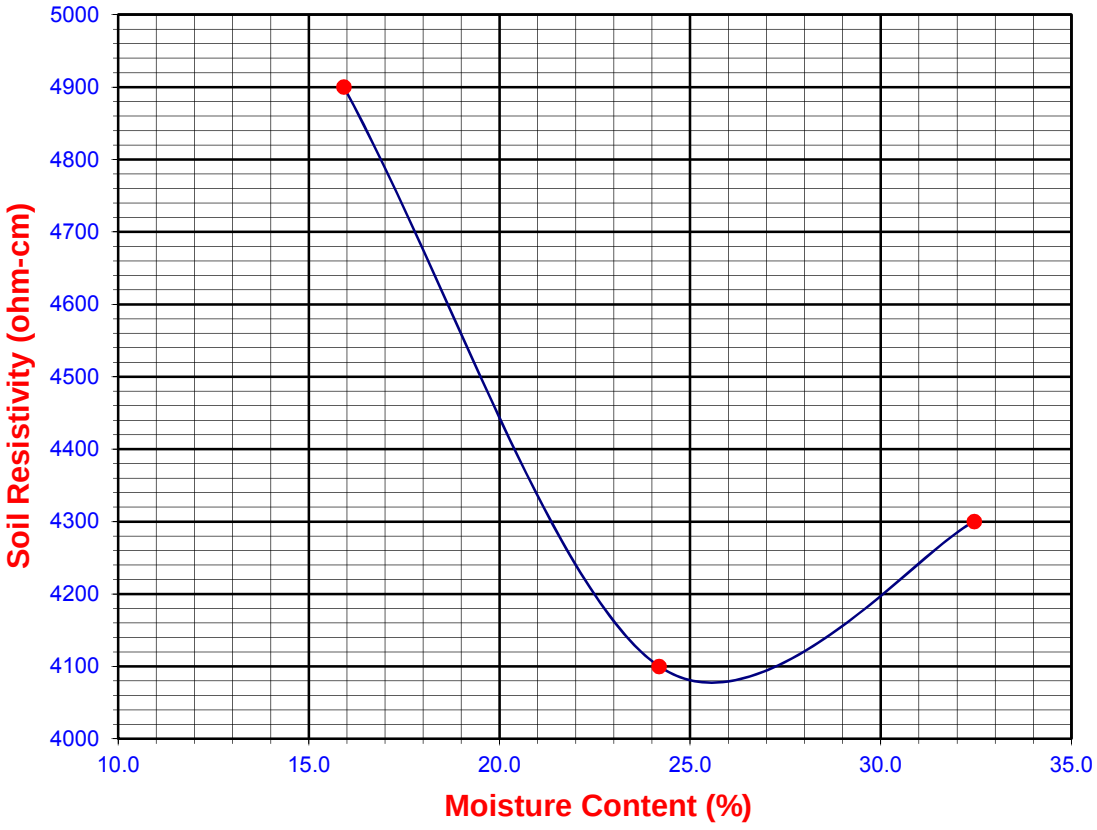
Soil Identification:* Olive SM

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	10	15.92	4900	4900
2	20	24.19	4100	4100
3	30	32.46	4300	4300
4				
5				

Moisture Content (%) (MCi)	7.65
Wet Wt. of Soil + Cont. (g)	167.62
Dry Wt. of Soil + Cont. (g)	159.44
Wt. of Container (g)	52.55
Container No.	
Initial Soil Wt. (g) (Wt)	130.21
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 643	
4075	**25.6**	**160**	**65**	**7.72**	**21.6**



Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 643

Project Name:	EMWD Wellhead Treatment Phase 1		Tested By :	O. Figueroa	Date: 01/24/18
Project No. :	11875.001		Data Input By:	J. Ward	Date: 01/26/18
Boring No.:	LB-8		Depth (ft.) :	5-8	
Sample No. :	B-1				

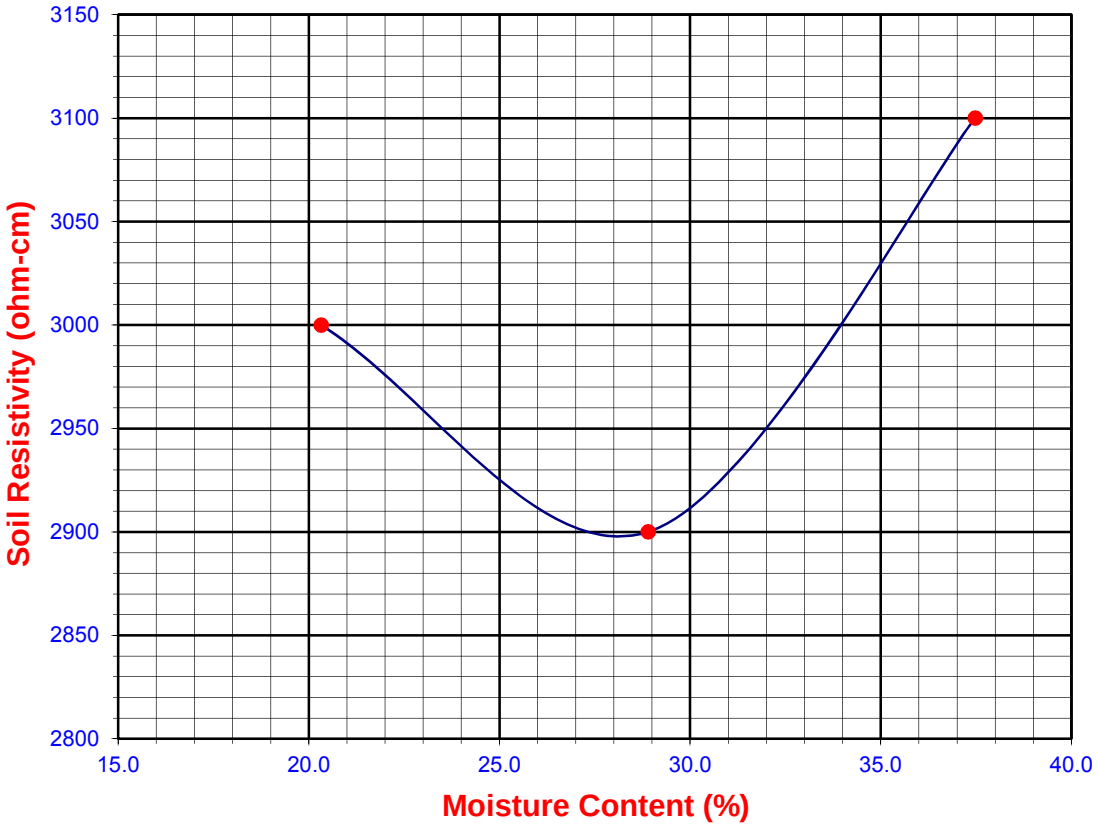
Soil Identification:* Gray SM

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	10	20.32	3000	3000
2	20	28.90	2900	2900
3	30	37.48	3100	3100
4				
5				

Moisture Content (%) (MCi)	11.75
Wet Wt. of Soil + Cont. (g)	197.58
Dry Wt. of Soil + Cont. (g)	183.62
Wt. of Container (g)	64.79
Container No.	
Initial Soil Wt. (g) (Wt)	130.30
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 643	
2898	**28.1**	**140**	**34**	**8.45**	**21.5**



Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 643

Project Name:	EMWD Wellhead Treatment Phase 1		Tested By :	G. Berdy	Date: 01/25/18
Project No. :	11875.001		Data Input By:	J. Ward	Date: 01/26/18
Boring No.:	LB-9		Depth (ft.) :	5-8	
Sample No. :	B-1				

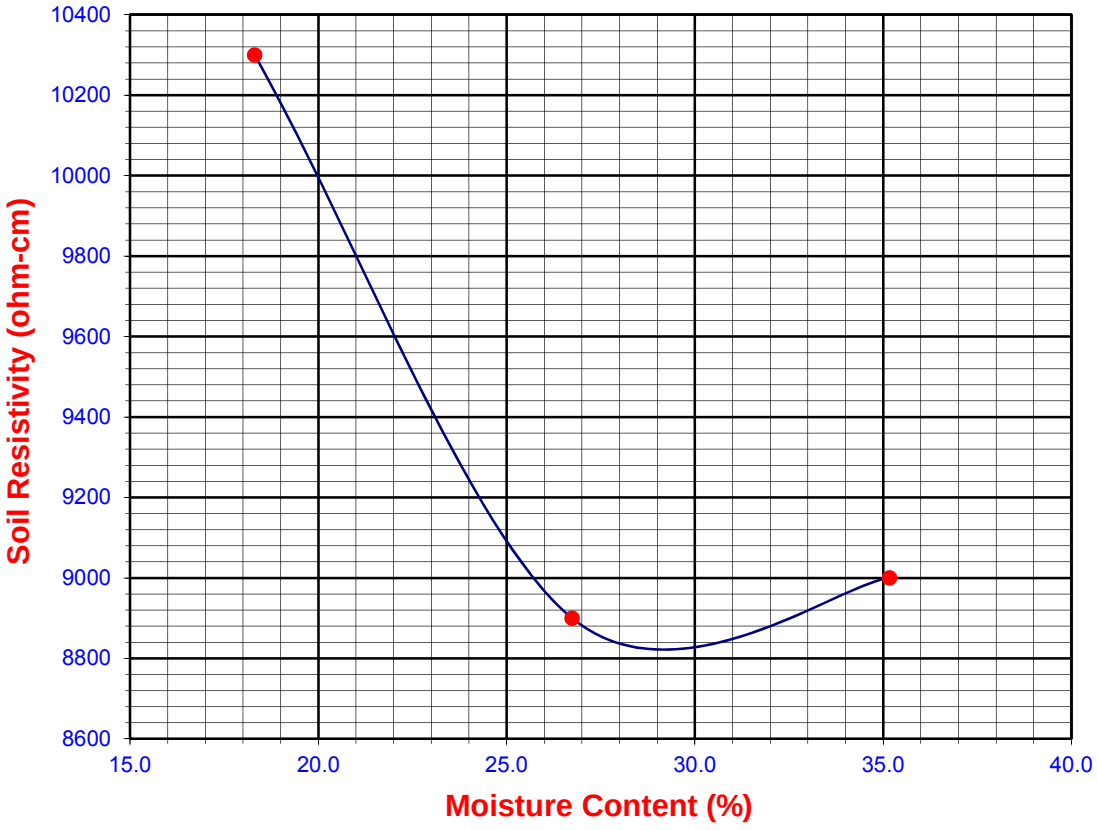
Soil Identification:* Olive (ML)s

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	10	18.31	10300	10300
2	20	26.74	8900	8900
3	30	35.17	9000	9000
4				
5				

Moisture Content (%) (MCi)	9.87
Wet Wt. of Soil + Cont. (g)	162.26
Dry Wt. of Soil + Cont. (g)	152.98
Wt. of Container (g)	58.98
Container No.	
Initial Soil Wt. (g) (Wt)	130.29
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 643	
8820	**29.2**	**91**	**44**	**7.79**	**21.4**



Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 643

Project Name:	EMWD Wellhead Treatment Phase 1		Tested By :	G. Berdy	Date: 01/25/18
Project No. :	11875.001		Data Input By:	J. Ward	Date: 01/26/18
Boring No.:	LB-10		Depth (ft.) :	5-7	
Sample No. :	B-1				

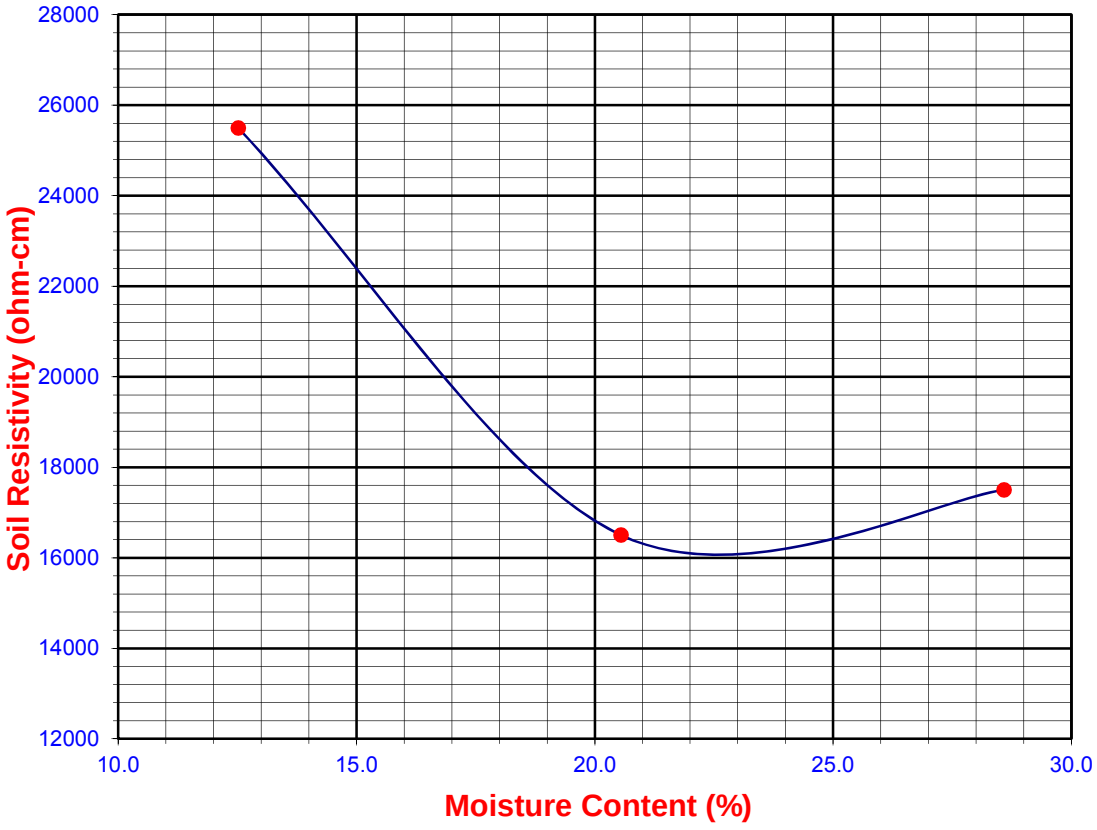
Soil Identification:* Yellowish brown SM

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	10	12.52	25500	25500
2	20	20.55	16500	16500
3	30	28.59	17500	17500
4				
5				

Moisture Content (%) (MCi)	4.48
Wet Wt. of Soil + Cont. (g)	202.28
Dry Wt. of Soil + Cont. (g)	196.10
Wt. of Container (g)	58.29
Container No.	
Initial Soil Wt. (g) (Wt)	130.05
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 643	
16000	**22.6**	**103**	**42**	**7.60**	**21.3**



Leighton

TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name: EMWD Wellhead Treatment Phase 1 Tested By : G. Berdy Date: 01/22/18

Project No. : 11875.001 Data Input By: J. Ward Date: 01/26/18

Boring No.	LB-1	LB-7		
Sample No.	B-1	B-1		
Sample Depth (ft)	0.5-5	1-6		
Soil Identification:	Brown SM	Brown SM		
Wet Weight of Soil + Container (g)	186.43	187.53		
Dry Weight of Soil + Container (g)	181.43	177.79		
Weight of Container (g)	36.58	58.68		
Moisture Content (%)	3.45	8.18		
Weight of Soaked Soil (g)	100.33	100.14		

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	304	308		
Crucible No.	16	15		
Furnace Temperature (°C)	860	860		
Time In / Time Out	9:00/9:45	9:00/9:45		
Duration of Combustion (min)	45	45		
Wt. of Crucible + Residue (g)	25.0940	25.5523		
Wt. of Crucible (g)	25.0923	25.5511		
Wt. of Residue (g) (A)	0.0017	0.0012		
PPM of Sulfate (A) x 41150	69.95	49.38		
PPM of Sulfate, Dry Weight Basis	**72**	**54**		

CHLORIDE CONTENT, DOT California Test 422

ml of Extract For Titration (B)				
ml of AgNO3 Soln. Used in Titration (C)				
PPM of Chloride (C -0.2) * 100 * 30 / B				
PPM of Chloride, Dry Wt. Basis	**N/A**	**N/A**		

pH TEST, DOT California Test 643

pH Value	**N/A**	**N/A**		
Temperature °C				