Questa Citizens Ditch Flume Geotechnical Report

Bernalillo County, New Mexico

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Submitted to:

Agua Fria Engineering, LLC

3937 Agua Fria St. Santa Fe, NM, 87507





Submitted By:

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4/26/2026

Attn: Mr. Andy Strasser
Senior Project Manager
Agua Fria Engineering, LLC
3937 Agua Fria St. Santa Fe, NM, 87507

Subject: Taos County-Questa Citizens Ditch: Elevated Flume Upgrade Project Geotechnical Report

Dear Mr. Strasser,

YeDoma Consultants, LLC (YeDoma) has completed our subsurface site investigations and soil report for the subject project. The geotechnical report herein is our final deliverable for the authorized Scope of Services.

Once again, we appreciate the opportunity to support this important water irrigation project. Should you have any questions or require additional information, please do not hesitate to contact me directly at 505-633-6841 or by email at jesse.reinikainen@akurta.com.

Respectively Submitted,

YeDoma Consultants, LLC.



Jesse Reinikainen, PE
Principal Geotechnical Engineer

Copies: Addressee (1)

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1.0 INTRODUCTION

YeDoma Consultants, LLC. (YeDoma) was authorized by Agua Fria Engineering, LLC through a professional service contract to conduct geotechnical services for the Questa Flume project. The end client is the Questa Citizens Ditch Community Ditch Association. The site is located within the Village of Questa, New Mexico (Figure 1). The subsurface work conducted by YeDoma occurred in February 2026 and the results were used as the basis of our findings and recommendations. The site is underlain by terrace alluvium with zones of anomalously weak layers. The acequia crossing is anticipated to require deep foundations to support the elevated flume. As the existing flume spans across a tributary channel, we anticipate that temporary measures will be needed to ensure that the waterway does not interact with the substructure work. The contract work should include a mandatory pre-bid meeting and site visit to ensure that the construction access is properly coordinated.

2.0 PROJECT DESCRIPTION

A geotechnical project summary is presented in Table 1.

Table 1: Geotechnical Project Summary

Owner/Operator: Questa Citizens Ditch Association	**Project Name:** Questa Elevated Flume Project	
Type of Construction: Structural Channel Crossing		
Client: Agua Fria Engineering, LLC	**Latitude**:35.6958	**Longitude:** -105.6205
Investigation Summary: Three (3) probing locations with geophysics, subgrade sampling and laboratory testing of native soil material.		
Project Improvements (Major Features): 1. Channel Crossing **2.** Lightly loaded Structure		
Foundation Type Selection: Subsurface layers include medium dense alluvium. Shallow footings are recommended with provisions for positive drainage to divert water away from substructures.		
Classification System and Criteria	**Site Specific Descriptions**	Soil Description: silty clayey sandy gravel and lean clay.
OSHA	Soil Type C	
Unified Soil Classification	GC, CL	
Seismic Site Classification	Type C/Seismic Zone 1	
Geotechnical/Foundation Design Criteria: 2021 International Building Code (IBC)/Frost Design per ASCE 32-01		
Summary Information included in Geotechnical Report **1.** Ground anomaly identified at GR-01, weak zone from 6.5' to 11.5' below the ground surface. **2.** W8x36 driven piles are recommended to provide bearing resistance to structural loads. **3.** The minimum pile length should extend fifteen (15) feet below the ground surface.		
Construction Phase (Geotechnical Special Inspections Recommended): 1. Verify that construction elevations are properly surveyed. 2. Compliance construction material testing to verify proper driven piling installation. 3. Video the existing condition of building and continuously monitor movement during driving operations. 4. Verify use of required design mix, prepare concrete cylinders for strength testing, determine slump, volumetric air content, temperature of concrete brought to the site.		
Project Schedule: Subsurface investigation completed on February 6th,2026 Flume **Construction:** TBD		

3.0 EXISTING SITE CONDITIONS

The site is in a rural area. The existing conditions are included below.

3.1 Climate

A climatic summary is presented in Table 2. Seasonal variability and climatic factors (environmental effects) are key factors in design, construction, and future performance. For this project, the climate data from the Cerro Station (Western Regional Climate Center, Station Number 291630) is referenced. This station is close to the project area. The record is from 1910 to 2016. Average daily temperatures below freezing (accumulating freezing degree-days) are common during the months of January, February, and December.

Table 2: Climate Summary

Month	Average Total Precipitation (inches)	Average Total Snowfall, (inches)	Average Max. Temperature (°F)	Average Min. Temperature (°F)	Average Daily Temperature (°F)
January	0.56	10.5	36.4	7.5	22.0
February	0.56	9.4	41.4	13.4	27.4
March	0.78	10.3	49.4	20.7	35.1
April	0.89	4.2	59.4	27.7	43.6
May	1.16	0.9	68.8	36.0	52.4
June	0.90	0.0	78.4	44.1	62.3
July	1.94	0.0	81.9	49.6	65.8
August	2.11	0.0	80.0	48.3	64.2
September	1.41	0.1	74.2	41.3	57.8
October	1.08	1.9	63.5	30.3	46.9
November	0.64	6.9	49.4	18.3	33.9
December	0.71	10.8	37.7	8.8	23.3
Annual	**12.73**	**55.0**	**60.0**	**28.8**	**44.4**
Note: Data from the Western Regional Climate Center, based on unofficial values for station 291630.					

The precipitation increases from July to October relative to the rest of the year (monsoon season). Freezing temperatures may occur during the months of October to April.

3.2 Soils

The United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) mapped the entire Bernalillo County. Excerpts from the report are included in the Appendix. The mapping occurred at a scale of 1:24,000 and was accessed by YeDoma staff through an online portal (Web Soil Survey) for the Questa Citizens Ditch Flume project location. In our review, we found one soil type inside the study area and the investigative probing. Information about the soils is tabulated in Table 3.

Table 3: Soil Report Summary

Map Unit Name	Fernando clay loam
Slope	5 – 7%
Symbol	FfC
Parent Material	Alluvium derived from igneous and metamorphic rock
Landforms	Lava plateaus
Drainage, Runoff	Well drained, high runoff
Transmissivity	Moderately high (0.20 – 0.60 in/hr.)
Salinity	Nonsaline to very slightly saline
Depth the restrictive feature	>80 inches
Maximum Calcium Carbonate	25%
Plasticity	Medium plasticity with PI Range (10 - 20)
AASHTO Classification	A-6
Unified Classification System	CL
Note: PI=Plasticity Index, NP=Sample Nonplastic, N/A=Data Not Available, ft= Feet, bgs=Below Ground Surface	

3.3 Groundwater

The State Engineer Office (OSE) well records were reviewed by YeDoma staff for the project. The OSE database has records of numerous wells within the project area. A couple of the wells were considered for our review. Table 4 below presents a summary of the wells chosen for the Questa Citizens Ditch Flume project. Both wells in the area

are close to 60 years old, and the actual groundwater depth is assumed to have fluctuated from the tabulated data presented in this report. The material logged within the water bearing formation is described as unconsolidated sand and gravel within the upper ninety feet bgs. We are characterizing the groundwater depth as shallow and unconfined.

Table 4: OSE Well Summary

Water Right File No.	RG-15794 (Domestic)	RG-16175 (Domestic)
Borehole Proximity	0.1 miles southwest	0.3 miles northeast
Date of Completion	08/1969	02/1969
Depth of Well, *ft bgs*	85	90
Depth to Static Water Level, *ft bgs*	38	32
Water-Bearing Formation	Gravel & Sand (64-85 ft bgs)	Gravel (70-90 ft bgs)
Other Types of Material Encountered	Boulder with clay (35-45 ft bgs) Gravel with clay (45-64 ft bgs)	Clay & Gravel (28-70 ft bgs)
Estimated Yield, *GPM*	N/A	N/A
Note: ft=Feet, bgs=Below Ground Surface, GPM=Gallons per Minute, N/A=Not Available		

3.4 Geologic Setting

The mapping of the area included Statewide Mapping (STATEMAP) of the Southern San Louis Basin, Taos County, New Mexico. The site is mapped as younger alluvial fan deposits comprised of clayey sand, gravel and cobbles. The fan deposit is interfingered with stream terrace deposits with much older Lama formation sand gravel and cobble material units mapped adjacent to the site. Refer to the map illustrated in the Appendix.

4.0 SUBSURFACE INVESTIGATIONS

Subsurface investigations were conducted in February 2026. The work included probing, and sampling to determine subgrade strength and index properties of native soils. The subsurface probing conducted with a super heavy weight (DCP-SH) hammer was used to continuously log downhole conditions and depths of refusal, logging areas of weak loose/soft strata in the shallow subsurface.

4.1 Geotechnical Dynamic Probing Investigation

The probing equipment is referred to as a “Grizzly,” a track drill rig that is equipped with standard penetration hammer (140-pound) with automatic 30” drop height. This is equivalent to 4200-lbs-inch of theoretical energy (DCP-SH) shearing the subsurface material with each consecutive blow. The Anvil is made of high strength steel, and the fixed three-square inch cone has an apex angle of 90° The technique is referred to as "dynamic probing" and is standardized under British Standard BS 22476-2. The number of blows required to drive the penetrometer over 8" (N20) is used by YeDoma to log discrete layers in the subsurface, quantify the in-situ shear strength based on penetration resistance and determine depths for discrete sampling intervals for determining geotechnical parameters.

The workplan was developed based on our understanding of the facility improvements and considering local, state, and regional standards and guidance documents. The probing work was conducted with a three-person crew under the oversight of a licensed geotechnical engineer. The work included continuous probing three locations (designated “GR-01” to “GR-03”) to refusal conditions and a twin hole at GR-01 and GR-03 to sample at various depths downhole with auger flights. We define refusal as twenty consecutive blows that penetrate less than four inches (rod increment). Table 5 presents a tabular summary and more detailed logs are presented in the Appendix.

Table 5: Subsurface Investigation Summary

Location	Elevation (feet)	Easting (Feet)	Northing (Feet)	Latitude (DD)	Longitude (DD)	Total Depth (feet)
GR-01	7274.2	1825017.3	2073162.0	36.6958121	-105.6203162	15.7
GR-02	7266.6	1824957.2	2073152.9	36.6957881	-105.6205214	21.3
GR-03	7265.6	1824928.8	2073137.2	36.6957455	-105.6206187	18.4

Note: Easting and Northing are Grid Coordinates (NAD 83) State Plane Coordinate Datum (3002) New Mexico Central Zone/Feet.

5.0 LABORATORY TESTING

YeDoma's senior engineer provided final approval of the laboratory testing regime. The final testing regime was based on major soil type, our understanding of the roadway improvements, and the local site conditions at the time of the investigation. The samples collected in the field were logged and transported to minimize disturbances and delivered to our AASHTO accredited laboratory in Albuquerque, New Mexico. The testing regime included AASHTO and ASTM test methods and standard procedures. The natural moisture content was preserved in the field using sealed tins and were evaluated by ASTM D2216. Electrochemical testing included minimum resistivity, pH, sulfate, and chloride determination per AASHTO T288/289/290/291. The index tests included determination of the particle size distribution per ASTM D6913, Atterberg limits including the Liquid and Plastic Limits per ASTM D4318. Evaluating the soil-moisture characteristics (soil subgrade strength and expansion pressure) was conducted under the R-value test per ASTM D2844. The specific gravity of soils determined per ASTM D854. The drained shear strength was determined by ASTM D3080.

5.1 Geotechnical Subgrade Testing

Material samples were collected in the field from auger flights and assigned to the ASTM and AASHTO test method regime to determine the index properties of the soil. Index properties (Sieve, PI, R-value, moisture content) are summarized in Table 6. Samples were collected within 9.4 feet bgs.

Table 6: Summary of Subgrade Test Results

Sample ID / Location	Depth (feet)	Soil Description	LL (%)	PI	MC (%)	Soil Type (USCS)	Gravel (%)	Coarse Sand (%)	Med-Fine Sand (%)	Silt and Clay (%)
274-01 / GR-01	0.0 - 4.0	Clayey gravel with sand	31	9	-	GC	41.6	14.2	27.0	17.1
RFV / GR-01	2.5 - 3.0	-	-	-	6.5	-	-	-	-	-
PVL / GR-01	4.0 - 6.0	-	-	-	6.3	-	-	-	-	-
BGT / GR-01	7.0 - 9.0	-	-	-	10.3	-	-	-	-	-
274-04 / GR-01	9.3 - 9.4	-	-	-	16.4	-	-	-	-	-
274-05 /GR-03	0.0 - 5.5	Sandy lean clay	38	19	-	CL	3.1	5.2	31.1	60.6
AGU / GR-03	2.0 - 3.0	-	-	-	8.1	-	-	-	-	-
32A / GR-03	5.0 - 5.5	-	-	-	12.8	-	-	-	-	-

Note: MC=Moisture Content, PI=Plasticity Index, LL= Liquid Limit, NV=No Value, SNP=Sample Nonplastic

5.1.1 R-Value Testing

YeDoma's R-value equipment includes a James Cox and Sons kneading compactor and 50-kip press. YeDoma conducted R-value tests per ASTM 2844, to evaluate the compressive and lateral resistance of native subgrade

material. We rely on the R-value in evaluating the lateral strength of subgrade soil under a compressive load in determining settlement potential, bond strength, and expansion pressure. The test has multiple stages over three days, which includes prepping the sample, curing 12 hours, compacting, and testing the exudation test, placing the molds in frames for an additional 12-hour period to determine the expansion pressure of the compacted specimen, and finally on the third day, extracting the sample into the stabilometer and loading compressive force while logging the horizontal pressures and lateral strength at saturated conditions. The tests are conducted using LabVIEW software developed by Caltrans. The R-Value test summary is presented in Table 7 below and included in the Appendix.

Table 7: R-Value Summary

Sample ID	Location	Depth (feet)	R-Value	Engineering Properties of Remolded Samples			
				MC (%)	Dry Density (pcf)	Expansion Pressure (psf)	Bond Strength (psi)
274-02	GR-01	4.0 - 6.0	72	9.6	129.0	10	14
274-05	GR-03	0.0 - 5.5	23	14.0	119.1	782	40

Note: R-Value at 300 psi exudation, MC=moisture content, Expansion Pressure= swell pressure determined after a minimum of 12 hours set time, Bond Strength=compacted soil peak bond strength determined during the mold extrusion process.

5.1.2 Specific Gravity Testing

YeDoma determined the specific gravity of soils composed of particles smaller than the 2.00 mm (No. 10) sieve by means of a pycnometer according to D854. The results are to be used in direct shear testing.

Table 8: Specific Gravity Summary

Sample ID	Location	Depth (feet)	Calculated Specific Gravity	Specific Gravity based on 20°C
274-01	GR-01	0.0 - 4.0	2.690	2.691
274-03	GR-01	6.0 - 9.0	2.726	2.727
274-04	GR-01	9.2 - 9.4	2.716	2.716

5.1.3 Direct Shear Strength under Consolidated Loading

The drained shear strength was determined in the laboratory per ASTM D3080. The sand material was reconstituted, and three points were assessed by YeDoma's senior engineer to determine the failure envelope, apparent cohesion intercept and angle of shear resistance. The laboratory soil tests were prepared at a dry density of 120 pcf based on our experience with similar soils. The results are summarized in Table 9. The detailed test reports are included in the Appendix. The angle of shear resistance determined by YeDoma are consistent with published values for medium to dense clayey sand material.

Table 9: Direct Shear Summary

Sample ID	Location	Laboratory Soil Test Initial Specimen Conditions	Depth (feet)	Angle of Shear Resistance (°)	Cohesion (psi)
274-01	GR-01	clayey Sand Initial Dry Density 120 pcf at 10% MC	0.0 - 4.0	24.5	0.06

5.1.4 Electrochemical Testing

To evaluate the corrosivity of native subgrade material, the soil resistivity, pH, sulfate, and chloride concentrations were tested on representative samples, refer to the summary of results in Table 11 and individual test reports in the Appendix. The relative level of corrosiveness, commonly accepted by the engineering community (FHWA NHI-09-087) as indicated by resistivity levels, is included in Table 11. The resistivity ranges in the moderately corrosive to mildly corrosive ranges are lower bound values (assuming the material is evaluated per AASHTO T288). A correlated threshold increase is estimated to lead to a corrosion rate of 25 percent higher in each successive aggressiveness range.

Table 10: Effect of Resistivity on Corrosion

Aggressiveness	Resistivity (Ω-cm)
Very Corrosive	<700
Corrosive	700 – 2,000
Moderately Corrosive	2,000 – 5,000
Mildly Corrosive	5,000 – 10,000
Non-Corrosive	> 10,000

Table 11: Electrochemical Summary

Sample ID	Location	Depth (feet)	Chloride (ppm)	Minimum Resistivity (ohm-cm)	pH (SU)	Sulfate (ppm)
274-03	GR-01	6.0 - 9.0	11	1812	7.6	91

ppm=parts per million

6.0 PRELIMINARY DESIGN ANALYSES, FINDINGS AND CONSTRUCTION CONSIDERATIONS

The foundation design conducted by YeDoma considered site specific conditions, information from the in-situ probing, laboratory testing, findings from our desktop study and experience with similar soils. In our evaluation, the shallow subsurface is comprised of clay, sand and gravel (young) alluvium. The subsurface conditions include anomalously low strength material and potential ground voids within a weak zone. The depth of concern is from about six to thirteen feet. Floating a foundation substructure such as a footing foundation may risk differential settlement of the flume and potential distress of the superstructure.

6.1 Seismic Design Parameters

The seismic design category and site class parameters were evaluated by YeDoma. Refer to a summary presented in Table 12. The upper one hundred feet of soil is classified as Site Class "C", noted as S_C. We used a NAD83 Lat/Long Decimal Degree coordinate for the site to determine the parameters for use in building code-based seismic design. Our evaluation is based on AASHTO 2009 Seismic Design Reference for 7% Probability of Exceedance in 75 years (1,000-year Return Period). The seismic risk at the site is minor, and the bridge is classified as within Seismic Zone 1 based on our understanding of the local site conditions. The potential for liquefaction at the site is minor, which is based on the fines content of the near surface soils, the depth to groundwater, and our experience with the regional geologic setting and history of the site.

Table 12: Seismic Design Parameters

PARAMETER	DESCRIPTION	VALUE
SITE COORDINATES	Latitude, decimal degrees	35.6958
	Longitude, decimal degrees	-105.6205
SITE CLASS	Soil Classification (Upper 100 feet)	Site Class "C"
PGA	Mapped Horizontal Peak Ground Acceleration, in units of g	0.092
F_{PGA}	Site coefficient from PGA	1.2
A_S	Design Peak Ground Acceleration, in units of g	0.11
S_S	mapped short-period (0.2 second) spectral acceleration, in units of g	0.216
S_1	Mapped One-second spectral acceleration, in units of g	0.068
F_V	Site coefficient for S1	1.7
S_{D1}	Design One-second spectral acceleration, in units of g	0.1115
S_{DC}	Seismic Design Category	A
	Seismic Zone	1

6.2 Frost Depth

The design frost depth for the site based on climate data is sixteen inches below the ground surface based on the AFI determined by YeDoma. Per IBC 2021 and ASCE 32-01 guide specifications, a portion of the depth to frost can be offset by removal of the frost susceptible material and replacement with non-frost susceptible (NFS) material in the subgrade. YeDoma recommends NFS material be used at the site and that the bottom of footing rest 20 inches below the adjacent ground surface.

We determined that there are two main subunits, subunit A was split into two since there was an anomalously weak layer identified during our investigation. The soil units are discussed in the subsections below:

6.2.1 Subunit A

The material is loose to medium dense clayey sand with gravel. The subunit includes a six-foot, medium dense layer resting above a very weak zone that extends to 11.5' bgs.

6.2.2 Subunit B

Subunit B is relatively weak strength up to about 14' bgs where the strength increase provides adequate bearing conditions for a deep foundation.

Table 13: Geotechnical Design Parameters

Subunit	Estimated Thickness (feet)	Moist Unit Weight (pcf)	ϕ (°)	c' (psf)	K_o EFP (psf)	K_a EFP (psf)	K_p EFP (psf)	Description
A1	6.5	120	28	0	60	38	255	Variability is anticipated
A2	5	60	5	0	55	48	128	Weak Layer
B	-	130	38	0	50	32	276	Dense Clayey Sand and Gravel

F=angle of internal friction, c'=apparent friction, K_o=at rest pressure, K_a=active pressure, Kp=passive pressure, EFP=equivalent fluid pressure *Note- Coulomb analysis

6.3 Foundation Selection

Shallow foundations are problematic for elevated flumes adjacent to stream beds. This is due to potential for scour and settlement of moisture susceptible subgrades. It typically is at the bottom of a hierarchy of foundation selection types. The use of a footing system isn't recommended for this site. The deep foundation options include driven piles and drilled piers. Micropiles, auger-cast piles and helical piles are alternatives which would be expected to be constructable. The deep foundation systems are ideal in locations to span through anomalously weak ground, in areas where the depth of constant moisture exceeds several feet and where shifting ground is a potential risk. The deep foundation must socket adequately into a resilient layer at the tip elevation. At the site, Subunit A2 must be spanned through to properly mitigate risk of shifting ground post construction.

6.4 Bearing Resistance and Settlement

Structural input, such as calculated load cases, was not part of the information available to YeDoma at the time of the report. We have developed a load factor resistance design for the foundations based on driven pile foundations. A summary of results is presented in Table 14.

Table 14: Factored Resistance Design-Capacity and Settlement

Case	Weight (lbf/ft)	Area (in^2)	Nominal Bearing Resistance (kips)	Resistance Factor	Factored Bearing Resistance (kips)	Minimum Tip Elevation (Geotechnical)	Estimated Settlement (inches)*
W8x36 Driven Pile	36	4	56	0.4	22.4	15 feet to socket into dense layer	0.2

*Settlement is estimated by elastic behavior of a loaded structure with a service axial load of two kips.

7.0 CONSTRUCTION RECOMMENDATIONS

YeDoma has prepared construction recommendations based on experience with similar projects. It is noted that this report was issued at the concept plan development stage. We recommend that construction phase testing includes quality assurance compliance testing and verification. Refer to Table 1 of this report for verifications that we recommend be implemented.

Driving an HP 8x36 steel pile into dense sand typically requires a high-energy hammer to overcome significant tip and skin friction resistance. While the exact force depends on depth and specific density, driving resistance in dense sand often requires driving energy in the range of 10 to 20 ft-kips per blow, with maximum impact forces (FMX) often exceeding 200 to 350 kips during hard driving conditions.

Key Factors for Driving HP 8x36 in Dense Sand:
Driving Resistance: Dense sand causes high end-bearing and skin friction. Driving should continue until a penetration rate of roughly 4 to 20 blows per inch is achieved, or until refusal.

Driving Stress: The compressive stress during driving should be monitored to ensure it does not exceed 90% of the steel yield strength (36 ksi for steel H-piles).

Typical Driving Observations: The pile may require 28 blows per inch (or more) when nearing its final, high-capacity depth in dense soil.

7.1 Additional Services

The project should include hold points for geotechnical engineering representatives to review contractor submittals, verify and confirm the adequacy of bearing conditions, and test material for conformance with contract specifications. If the contract plans indicate that the plans are to conform with IBC specifications, than a program of testing and compliance should be considered mandatory. YeDoma offers this additional service, upon request.

7.2 Conclusions

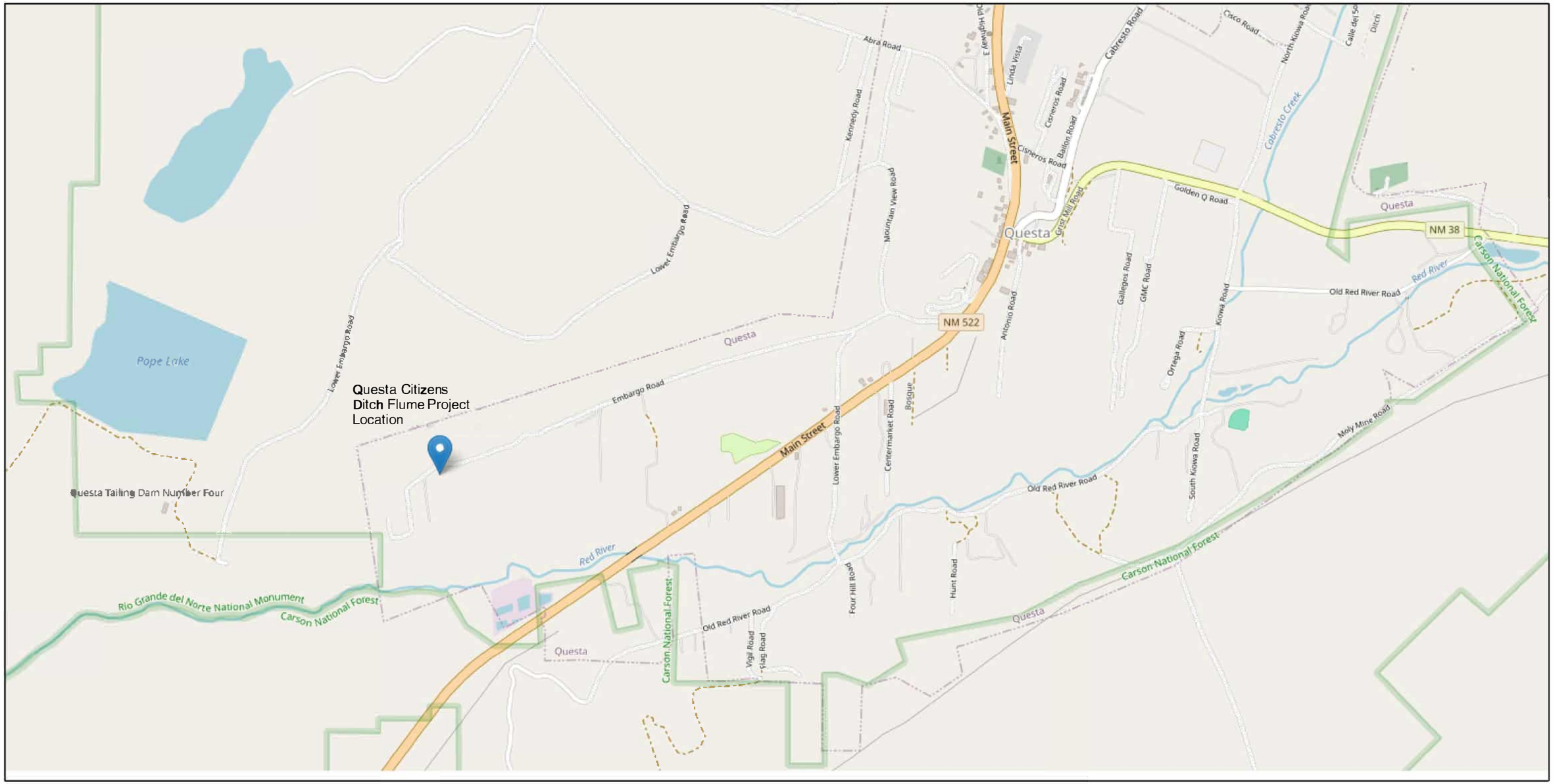
The project is constructible from a geotechnical viewpoint. The geotechnical finding is that the flume should rest on a deep foundation substructure. In our analyses, a w-beam driven pile should be considered. We dispatch field technicians and conduct routine Quality Assurance/ Compliance Testing for soil, aggregate, and concrete material properties. YeDoma recommends site observations, photologs and test reports be collated into project compliance letters to document the construction phase testing.

7.3 Limitations

This report should be read in its entirety and is intended solely for the Client, the owner, and construction subcontractors for the specific project use and in the context and for the express purpose for which it has been delivered. YeDoma makes no warranty whether stated or implied. Our conclusions are based on the time and date when the data was collected, and pertinent information made available to us at the time of reporting. Recommendations are based on information made available at the time of our evaluation and adheres to accepted professional engineering principles and regional practices. Any other use or reliance on this document by any third party is at that party's sole risk and responsibility.

8.0 REFERENCES

	Reference	Website
1.	Earth Explorer	https://earthexplorer.usgs.gov/
2.	Bauer, P.W., Kelson, K.I., Thompson, R.A., and Mansell, M.M. (2021) Geologic Map of the Southern San Luis Basin, Taos County, New Mexico. New Mexico Bureau of Geology and Mineral Resources	https://geoinfo.nmt.edu/
3.	National Geologic Map Database	https://ngmdb.usgs.gov/ngm-bin/ngm_compsearch.pl
4.	Office of the State Engineer Well Data	https://gis.ose.state.nm.us/gisapps/ose_pod_locations/
5.	Seismic Hazard Maps	https://earthquake.usgs.gov/ws/designmaps/aashto-2009.json?latitude=34&longitude=-118&siteClass=C&title=Example
6.	USGS (1995, August). Quaternary Fault and Fold Database of the United States. Retrieved from Earthquake Hazard Program, Quaternary Faults	https://usgs.maps.arcgis.com/apps/webappviewer/index.html?id=5a6038b3a1684561a9b0aadf88412fcf
7.	Web Soil Survey	https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx
8.	Western Regional Climate Center	https://wrcc.dri.edu/



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W E

S

Questa Citizens Ditch Flume Geotech Map

Project: Questa Citizens Ditch Flume Upgrade
Client Agua Fria Engineering, LLC
Grid Coordinates NAD 83 Decimal Degrees

G:\Shared drives\274-Questa GTC\02 Design\GIS\274-Questa-GTC.qgs











Questa Citizens Ditch Flume Existing Conditions

Project: Questa Citizens Ditch Flume Upgrade
Client: Agua Fria Engineering, LLC
Grid Coordinates: NAD 83 Decimal Degrees
Prepared By: JAR Date: 2026-03-01T13:17:53

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OSE POD Location Map



3/5/2026, 2:18:01 PM

1:4,514

0 0.04 0.09 0.18 mi

0 0.05 0.1 0.2 km

274-QuestaGTC-FNL

Override 1

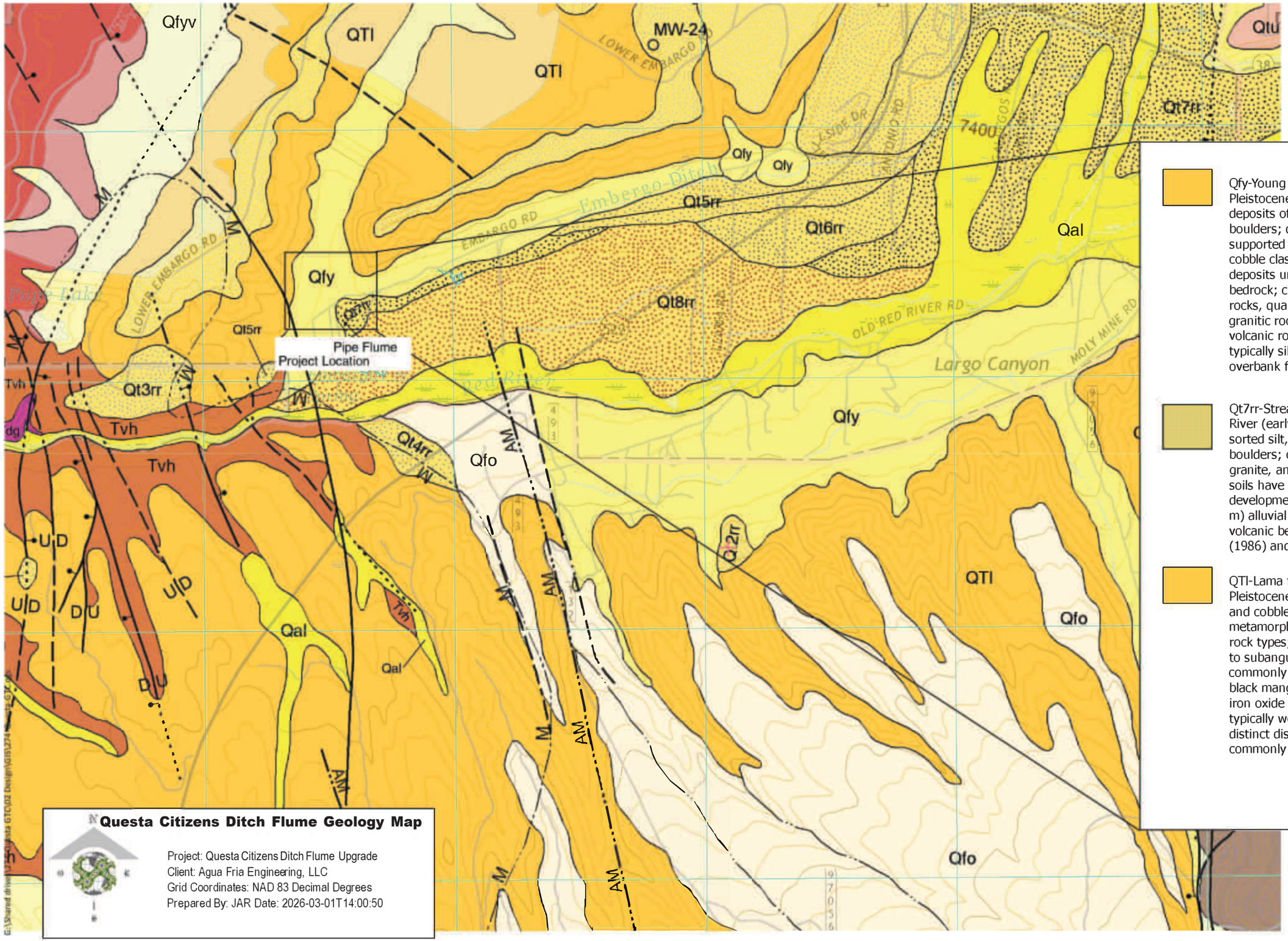
New Mexico State Trust Lands

Subsurface Estate

Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community, Vantor

Online web user

This is an unofficial map from the OSE's online application.



Questa Citizens Ditch Flume Geology Map

Project: Questa Citizens Ditch Flume Upgrade
Client: Agua Fria Engineering, LLC
Grid Coordinates: NAD 83 Decimal Degrees
Prepared By: JAR Date: 2026-03-01T14:00:50

Qfy-Young alluvial-fan deposits (latest Pleistocene to Holocene)—Poorly sorted deposits of silt, sand, pebbles, cobbles and boulders; deposits are typically clast-supported and poorly bedded; pebble and cobble clasts are typically imbricated; terrace deposits unconformably overlie the local bedrock; clasts are primarily sedimentary rocks, quartzite, slate, schist, metavolcanic, granitic rocks, and Tertiary granitic and volcanic rocks; uppermost sediments are typically silty sand probably deposited from overbank flow;

Qt7rr-Stream terrace deposits of the Red River (early to middle Holocene)—Poorly sorted silt, sand, pebbles, cobbles, and boulders; clasts primarily of quartzite, schist, granite, and volcanic rock types; associated soils have stage I calcium carbonate development; typically present as thin (< 5 m) alluvial deposit on strath surfaces cut on volcanic bedrock; equivalent to Qt7 of Kelson (1986) and Pazzaglia (1989).

QTl-Lama formation (Pliocene to early? Pleistocene)—Poorly sorted sand, pebbles, and cobbles; clasts of basalt, quartzite, other metamorphic rock types, and other volcanic rock types; locally high percentage of angular to subangular quartzite pebbles and cobbles; commonly cross-bedded, and stained with black manganese oxide and yellowish-orange iron oxide coatings; oxidized; clasts are typically weathered or grussified; contains distinct discontinuous sandy interbeds; commonly crudely imbricated

-105.6230 -105.6220 -105.6210 -105.6200 -105.6190 -105.6180

36.6970 36.6965 36.6960 36.6955 36.6950

Embargo Rd

Embargo Rd

Embargo Rd

Embargo Rd

Embargo Rd

GR-01

GR-02

GR-03

0

SEIS-01

115

Label	Lat	Long	Elev	North	East
GR-01	36.695765	-105.620607	7265.7	2073144.3	1824932.2
GR-02	36.695788	-105.620521	7266.6	2073152.9	1824957.2
GR-03	36.69582	-105.620292	7274.7	2073165.1	1825024.3

N

W E

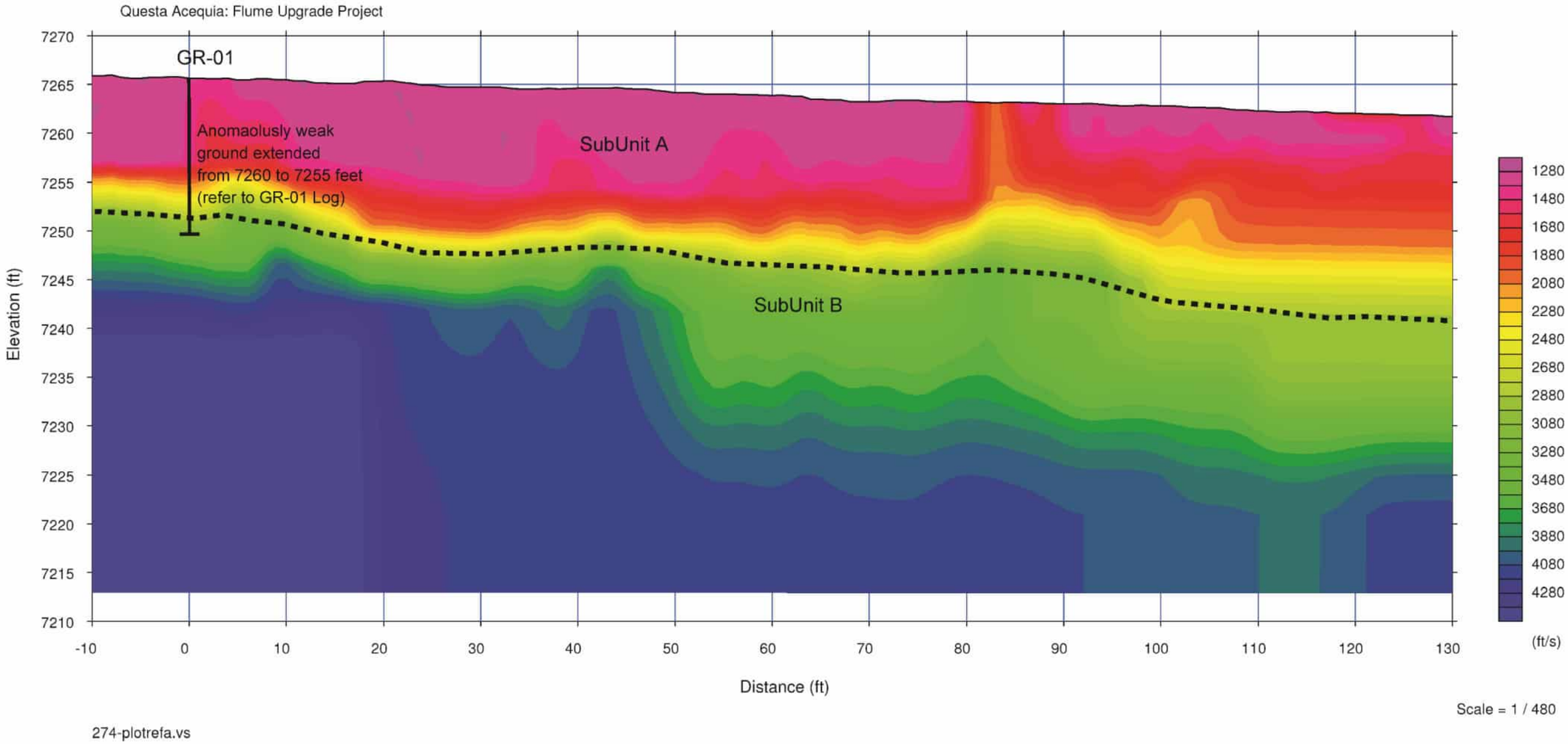
S

Questa Citizens Ditch Flume Geotech Map

Project: QuestaCitizens Flume Upgrade
Client: Agua Fria Engineering, LLC
Grid Coordinates: NAD 83 Decimal Degrees
Prepared By: JAB Date: 2026-03-08T15:48:08

100 0 100 ft

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Seismic Refraction (P-wave) Array SEIS-01

Questa Citizens Ditch Flume Upgrade Project Taos County, New Mexico			**APPENDIX**
TO:	Agua Fria Engineering, LLC	**COMPANY:**	YEDOMA CONSULTANTS. LLC
		ADDRESS: 523 Louisiana Blvd SE Albuquerque, NM 87108	

Custom Soil Resource Report
Soil Map



Map Scale: 1:670 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 5 10 20 30

Feet
0 30 60 120 180

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

Table—Unified Soil Classification (Surface) (621274 - Questa Citizens Ditch Flume)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
FfC	Fernando clay loam, 5 to 7 percent slopes	CL	1.4	100.0%
Totals for Area of Interest			**1.4**	**100.0%**

Rating Options—Unified Soil Classification (Surface) (Questa Citizens Ditch Flume)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Layer Options (Horizon Aggregation Method): Surface Layer (Not applicable)

Table—AASHTO Group Classification (Surface) (Questa Citizens Ditch Flume)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
FfC	Fernando clay loam, 5 to 7 percent slopes	A-6	1.4	100.0%
Totals for Area of Interest			**1.4**	**100.0%**

Rating Options—AASHTO Group Classification (Surface) (Questa Citizens Ditch Flume)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Layer Options (Horizon Aggregation Method): Surface Layer (Not applicable)

Unified Soil Classification (Surface) (Questa Citizens Ditch Flume)

The Unified soil classification system classifies mineral and organic mineral soils for engineering purposes on the basis of particle-size characteristics, liquid limit, and plasticity index. It identifies three major soil divisions: (i) coarse-grained soils having less than 50 percent, by weight, particles smaller than 0.074 mm in diameter; (ii) fine-grained soils having 50 percent or more, by weight, particles smaller than 0.074 mm in diameter; and (iii) highly organic soils that demonstrate certain organic characteristics. These divisions are further subdivided into a total of 15 basic soil groups. The major soil divisions and basic soil groups are determined on the basis of estimated or measured values for grain-size distribution and Atterberg limits. ASTM D 2487 shows the criteria chart used for classifying soil in the Unified system and the 15 basic soil groups of the system and the plasticity chart for the Unified system.

The various groupings of this classification correlate in a general way with the engineering behavior of soils. This correlation provides a useful first step in any field or laboratory investigation for engineering purposes. It can serve to make some general interpretations relating to probable performance of the soil for engineering uses.

For each soil horizon in the database one or more Unified soil classifications may be listed. One is marked as the representative or most commonly occurring. The representative classification is shown here for the surface layer of the soil.

Chemical Soil Properties–Taos County and Parts of Rio Arriba and Mora Counties, New Mexico								
Map symbol and soil name	**Depth**	**Cation-exchange capacity**	**Effective cation-exchange capacity**	**Soil reaction**	**Calcium carbonate**	**Gypsum**	**Salinity**	**Sodium adsorption ratio**
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
FfC—Fernando clay loam, 5 to 7 percent slopes								
Fernando	0-5	20-30	—	7.9-8.4	3-7	0	0.0-2.0	0-2
	5-19	15-30	—	7.9-8.4	5-10	0	0.0-2.0	0-2
	19-60	10-25	—	7.9-8.4	15-25	0	0.0-2.0	0-2

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Engineering Properties–Taos County and Parts of Rio Arriba and Mora Counties, New Mexico														
Map unit symbol and soil name	**Pct. of map unit**	**Hydrologic group**	**Depth**	**USDA texture**	**Classification**		**Pct Fragments**		**Percentage passing sieve number—**				**Liquid limit**	**Plasticity index**
					Unified	**AASHTO**	**>10 inches**	**3-10 inches**	**4**	**10**	**40**	**200**		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
FfC—Fernando clay loam, 5 to 7 percent slopes														
Fernando	85	C	0-5	Clay loam	CL	A-6	0- 0- 0	0- 0- 0	95-98-100	90-95-100	75-80-85	60-65-70	35-38-40	15-18-20
			5-19	Clay loam, silt loam, silty clay loam	CL	A-6	0- 0- 0	0- 0- 0	95-98-100	90-95-100	75-85-95	65-75-85	30-35-40	10-15-20
			19-60	Clay loam, loam, silt loam	CL	A-6	0- 0- 0	0- 0- 0	95-98-100	90-95-100	75-80-85	65-70-75	30-33-35	10-13-15

YeDoma Consultants, LLC

Client: Agua Fria Engineering, LLC
Project: Questa Citizens Ditch Flume
Location: Refer to Site Map

Project Number: 621274

Geotechnical Log Sheet: GR-01

Groundwater Depth (Feet): none
Date Drilled: 2/6/2026

Easting (NAD83-FT): 1825017.3
Northing (NAD83-FT): 2073162
Elevation (ft): 7265.6
Borehole Depth (feet): 15.7
Logged By: JAR

Rel. Elev. (feet)	Log	Geologic Observations: Comments	Depth (feet)	Blows per Four Inches	Blows per Foot	Lab: R-value	Moisture	LL	PI	P#4	P#10	P#200
7265		0-1.31' Clayey gravel with sand (GC), coarse to fine gravel, coarse to fine sand, fines of medium plasticity, moist, very soft to soft			2		6.5	31	9	58	44	17
		1.31-5.91' Clayey gravel with sand, coarse to fine gravel, coarse to fine sand, fines of medium plasticity, moist, stiff			14							
					17							
					18							
			5		16	72	6.3					
7260					18							
		5.91-11.81' Very moist, very loose			6		10.3					
		6.5' - 11.5' Ground Anomaly Very weak material (hazard)			void							
			10		3		16.4					
7255					3							
		11.81-13.78' Loose			1							
					8							
		13.78-15.09' Dense			9							
					43							
7250		15.09-15.75' Very Dense	15		56							
7245			20									
7240			25									
7235			30									

Notes
1. This log presents site specific information which relates only to the location and date investigated.
2. This log shall not be reproduced without written approval from YeDoma Consultants, LLC
3. Blows/foot is a measure of number of blows with 140-lb hammer falling 30"

Remarks:

Template Revision: CV-2024-6-23

Office Location:
523 Louisiana Boulevard SE
Albuquerque, NM, 87108
Web: www.akurta.com

YeDoma Consultants, LLC

Client: Agua Fria Engineering, LLC
Project: Questa Citizens Ditch Flume
Location: Refer to Site Map

Project Number: 621274

Geotechnical Log Sheet: GR-02

Groundwater Depth (Feet): none
Date Drilled: 2/6/2026

Easting (NAD83-FT): 1824957.2
Northing (NAD83-FT): 2073152.9
Elevation (ft): 7266.6
Borehole Depth (feet): 21.3
Logged By: JAR

Rel. Elev. (feet)	Geologic Observations: Log	Geologic Observations: Comments	Depth (feet)	Blows per Four Inches	Blows per Foot	Lab: R-value	Lab: Moisture	Lab: LL	Lab: PI	Lab: P#4	Lab: P#10	Lab: P#200
7265		0-2.3' Sandy Lean Clay (CL) Very soft to firm	5		5							
					4							
		2.3-5.91' Stiff			12							
					14							
					20							
7260		5.91-13.12' Very soft to firm	10		15							
					5							
					4							
					3							
					4							
7255		13.12-16.73' Stiff to very stiff			8							
					9							
					11							
			15		12							
					17							
7250		16.73-17.72' Hard			27							
					16							
		17.72-19.36' Stiff			50							
					17							
		19.36-19.69' Hard	20		34							
		19.69-21' Very stiff			23							
7245		21-21.33' Hard			33							
			25									
7240												
			30									
7235												

Notes
1. This log presents site specific information which relates only to the location and date investigated.
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3. Blows/foot is a measure of number of blows with 140-lb hammer falling 30"

Remarks:

Template Revision: CV-2024-6-23

Office Location:
523 Louisiana Boulevard SE
Albuquerque, NM, 87108
Web: www.akurta.com

YeDoma Consultants, LLC

Client: Agua Fria Engineering, LLC
Project: Questa Citizens Ditch Flume
Location: Refer to Site Map

Project Number: 621274

Geotechnical Log Sheet: GR-03

Groundwater Depth (Feet): none
Date Drilled: 2/6/2026

Easting (NAD83-FT): 1824928.8
Northing (NAD83-FT): 2073137.2
Elevation (ft): 7274.7
Borehole Depth (feet): 18.4
Logged By: JAR

Rel. Elev. (feet)	Log	Geologic Observations: Comments	Depth (feet)	Blows per Four Inches	Blows per Foot	Lab: R-value	Moisture	LL	PI	P#4	P#10	P#200
7270		0-10.83' Sandy lean clay, trace fine gravel, coarse to fine sand, fines of medium plasticity, moist, firm to stiff	5		7 10 12 9 7	23	8.1	38	19	97	92	61
					8		12.8					
7265			10		10 9 9 12							
		10.83-13.12' Stiff to very stiff			11 23 23							
		13.12-13.78' Firm			11							
		13.78-14.44' Very stiff			22							
7260		14.44-16.73' Stiff to very stiff	15		12 16							
		16.73-18.37' Hard			41 38							
7255			20									
7250			25									
7245			30									
7240												

Notes
1. This log presents site specific information which relates only to the location and date investigated.
2. This log shall not be reproduced without written approval from YeDoma Consultants, LLC
3. Blows/foot is a measure of number of blows with 140-lb hammer falling 30"

Remarks:

Template Revision: CV-2024-6-23

Office Location:
523 Louisiana Boulevard SE
Albuquerque, NM, 87108
Web: www.akurta.com

Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Report Date:	2/10/2026	**Sample Date:**	2/6/2026	**Material Type:**	Subgrade
Report No.:	621274-MCReport-01 Questa	**Sampled By:**	YeDoma	**Sample Received:**	2/6/2026
Project Name:	Questa Citizens Ditch Flume	**Test Date:**	2/9/2026		
Project Location:	Questa, NM	**Tested By:**	JP		
Project No.:	621274	**Client:**	Agua Fria Engineering, LLC		
Test Method:	**ASTM D2216-19**				

Method: B **Oven Temperature:** 230 F **Samples Met Mass Requirements?** Yes

Sample #	Sample Location	Depth	Moisture Content (%)
RFV	GR-01	2.5' - 3.0'	6.5
PVL	GR-01	4.0' - 6.0'	6.3
BGT	GR-01	7.0' - 9.0'	10.3
274-04	GR-01	9.3' - 9.4'	16.4
AGU	GR-03	2.0' - 3.0'	8.1
32A	GR-03	5.0' - 5.5'	12.8

Notes/Comments/Deviations from Test Standard:
No portion of any of the samples were excluded. Each sample is representative of one material type.

Report Limitations:
1. This report contains results that relate only to the site-specific sample location tested.
2. This report shall not be reproduced, except in full, without the written approval of YeDoma Consultants, LLC.

Reviewed By: Technical Manager
Jesse Reinikainen, PE

YeDoma Consultants, LLC
523 Louisiana Boulevard Southeast
Albuqueruque, NM 87108

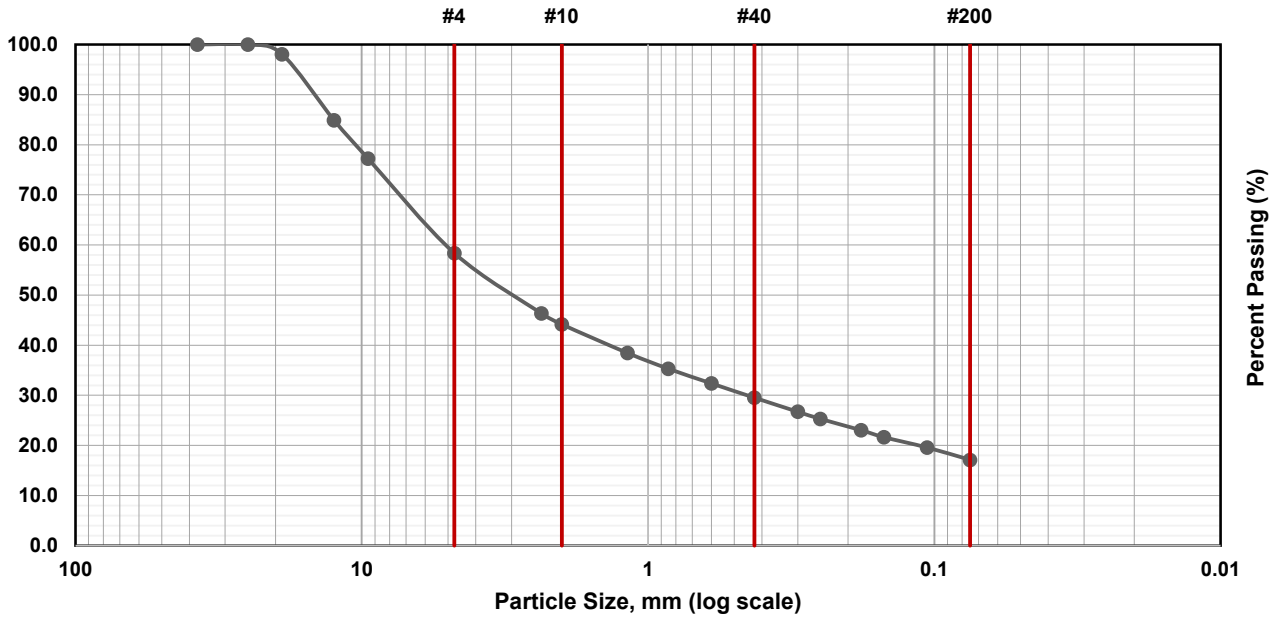
Standard Test Methods for Particle Size Distribution (Gradation) of Soils Using Sieve Analysis

Report Date:	2/17/2026	**Sample Date:**	2/6/2026	**Material Type:**	Subgrade
Report No.:	621274-SieveReport-01	**Sample By:**	YeDoma	**Depth:**	0.0' - 4.0'
Project Name:	Questa Citizens Ditch Flume	**Test Date:**	2/16/2026	**Boring No.:**	GR-01
Project Location:	Questa, NM	**Tested By:**	JP	**Sample Received:**	2/6/2026
Project No.:	621274	**Client:**	Agua Fria Engineering, LLC		

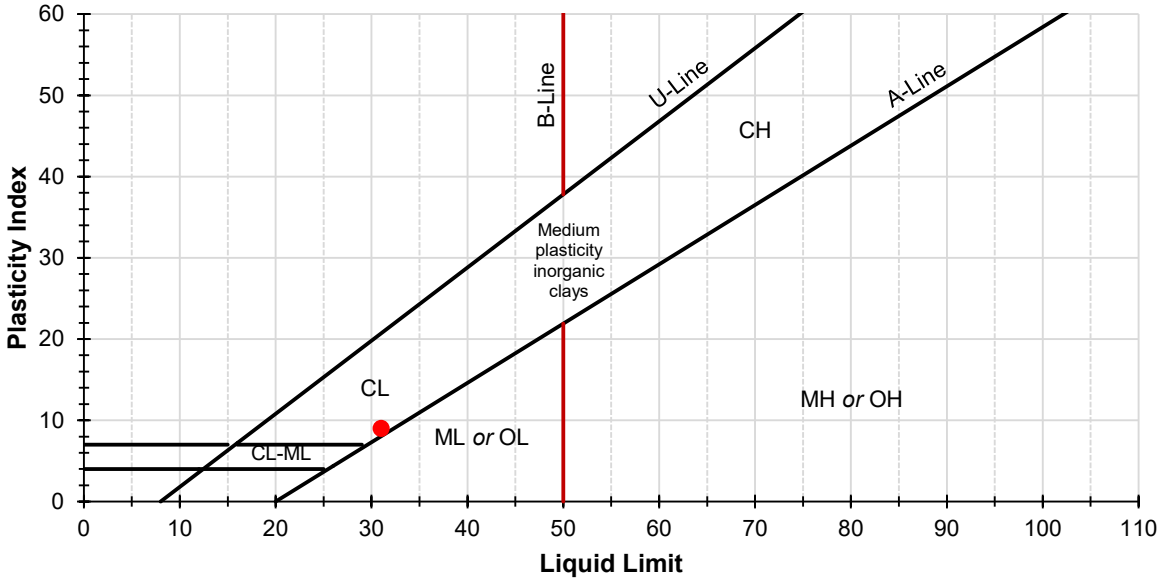
Test Method: **ASTM D6913-17, ASTM C117-23, ASTM D1140-17, ASTM D4318-17, ASTM D2487-17, ASTM D3282-15**

Sample: 274-01 **Soak Time:** 2 Hours **Sample Prep Method:** Oven-dried

Soil Gradation



Plasticity Chart



YeDoma Consultants, LLC
523 Louisiana Boulevard Southeast
Albuquerque, NM 87108

Standard Test Methods for Particle Size Distribution (Gradation) of Soils Using Sieve Analysis

Report Date:	2/17/2026	**Sample Date:**	2/6/2026	**Material Type:**	Subgrade
Report No.:	621274-SieveReport-01	**Sample By:**	YeDoma	**Depth:**	0.0' - 4.0'
Project Name:	Questa Citizens Ditch Flume	**Test Date:**	2/16/2026	**Boring No.:**	GR-01
Project Location:	Questa, NM	**Tested By:**	JP	**Sample Received:**	2/6/2026
Project No.:	621274	**Client:**	Agua Fria Engineering, LLC		

Test Method: **ASTM D6913-17, ASTM C117-23, ASTM D1140-17, ASTM D4318-17, ASTM D2487-17, ASTM D3282-15**

Gradation

C 117-23, D1140-17 used for washing of sieve 75-µm (No. 200)

Dispersion Process: [ ] Ultrasonic bath [ ] Shaking Apparatus [X] None

ASTM D2487 Classification:

Group Name: Clayey gravel with sand

Group Symbol: GC

Classification of Soil-Aggregate Mixtures ASTM D3282-15:

Group Name: A-2-4

Group Index: (0)

Atterberg Limits: ASTM D4318-17

Liquid Limit: 31

Plastic Limit: 22

Plasticity Index: 9

Shape Parameters:

Fineness Modulus: 4.007

C_U: 68.78

C_C: 0.53

D_{60}: 5.159

D_{30}: 0.454

D_{10}: 0.075

Sieve Size	% Passing
1 1/2"	-
1"	100
3/4"	98
1/2"	85
3/8"	77
#4	58
#8	46
#10	44
#16	39
#20	35
#30	32
#40	30
#50	27
#60	25
#80	23
#100	22
#140	20
#200	17

Notes/Comments/Deviations from Test Standard:

Report Limitations:

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2. This report shall not be reproduced, except in full, without the written approval of YeDoma Consultants, LLC.

Reviewed By: Technical Manager
Jesse Reinikainen, PE

YeDoma Consultants, LLC
523 Louisiana Boulevard Southeast
Albuquerque, NM 87108

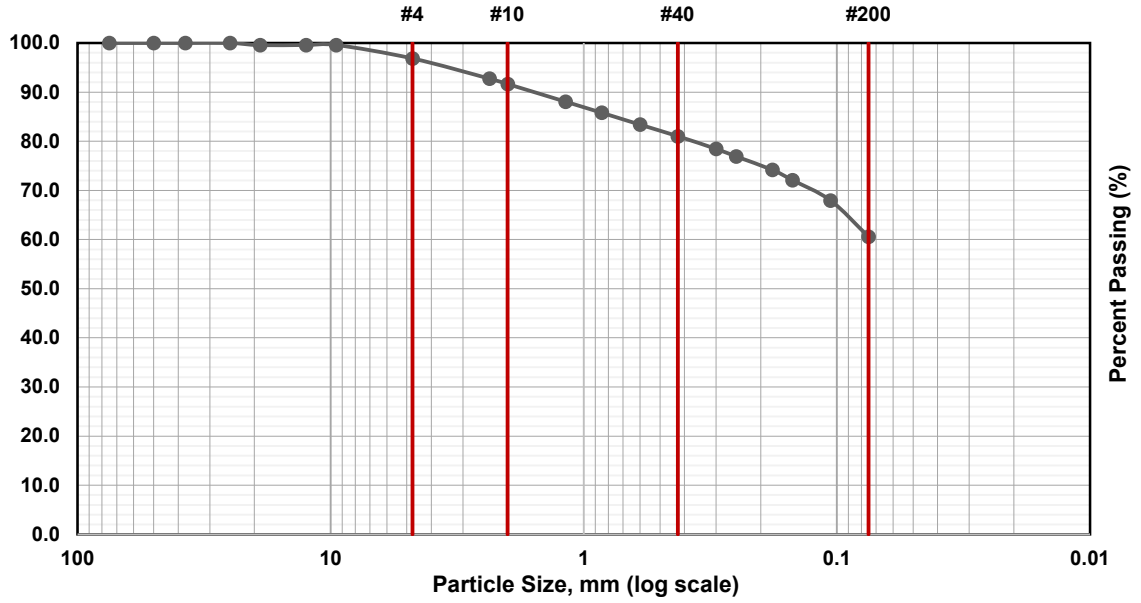
Standard Test Methods for Particle Size Distribution (Gradation) of Soils Using Sieve Analysis

Report Date:	2/17/2026	**Sample Date:**	2/6/2026	**Material Type:**	Subgrade
Report No.:	621274-SieveReport-02	**Sample By:**	YeDoma	**Depth:**	0.0' - 5.5'
Project Name:	Questa-Citizens Ditch Flume	**Test Date:**	2/17/2026	**Boring No.:**	GR-03
Project Location:	Questa, NM	**Tested By:**	DS	**Sample Received:**	2/6/2026
Project No.:	621274	**Client:**	Agua Fria Engineering, LLC		

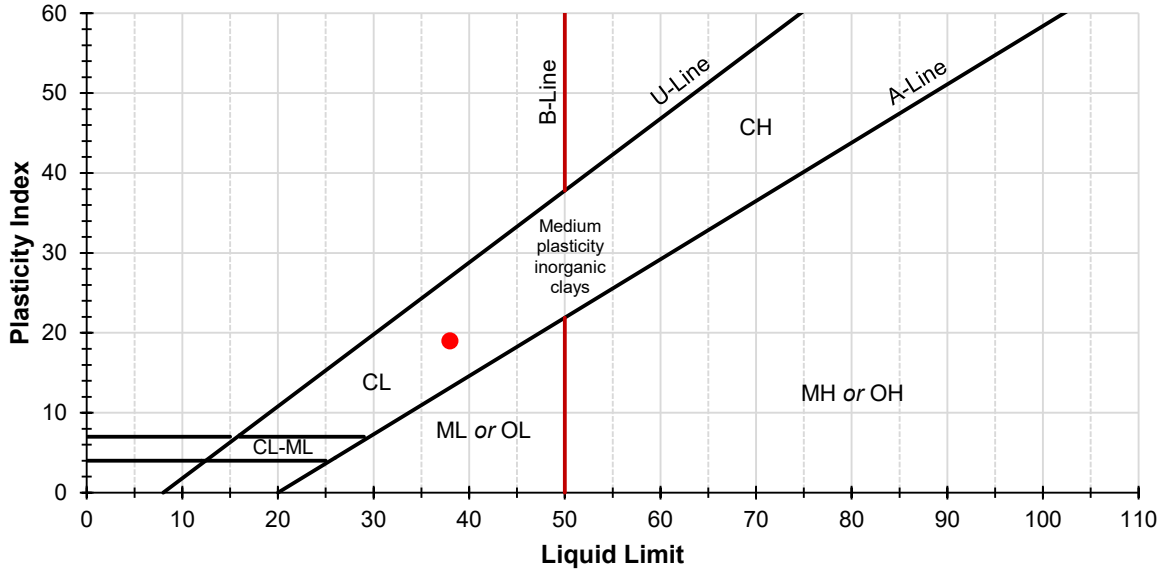
Test Method: **ASTM D6913-17, ASTM C117-23, ASTM D1140-17, ASTM D4318-17, ASTM D2487-17, ASTM D3282-15**

Sample: 274-05 **Soak Time:** 2 Hours **Sample Prep Method:** Oven-dried

Soil Gradation



Plasticity Chart



YeDoma Consultants, LLC
523 Louisiana Boulevard Southeast
Albuquerque, NM 87108

Standard Test Methods for Particle Size Distribution (Gradation) of Soils Using Sieve Analysis

Report Date:	2/17/2026	**Sample Date:**	2/6/2026	**Material Type:**	Subgrade
Report No.:	621274-SieveReport-02	**Sample By:**	YeDoma	**Depth:**	0.0' - 5.5'
Project Name:	Questa Citizens Ditch Flume	**Test Date:**	2/17/2026	**Boring No.:**	GR-03
Project Location:	Questa, NM	**Tested By:**	DS	**Sample Received:**	2/6/2026
Project No.:	621274	**Client:**	Agua Fria Engineering, LLC		

Test Method: **ASTM D6913-17, ASTM C117-23, ASTM D1140-17, ASTM D4318-17, ASTM D2487-17, ASTM D3282-15**

Gradation

C 117-23 used for washing of sieve 75-µm (No. 200)

Dispersion Process: [ ] Ultrasonic bath [ ] Shaking Apparatus [X] None

ASTM D2487 Classification:

Group Name: Sandy lean clay

Group Symbol: CL

Classification of Soil-Aggregate Mixtures ASTM D3282-15:

Group Name: A-6

Group Index: (9)

Atterberg Limits: ASTM D4318-17

Liquid Limit: 38

Plastic Limit: 19

Plasticity Index: 19

Shape Parameters:

Fineness Modulus: 0.893

C_U: 1.00

C_C: 1.00

D_{60}: 0.075

D_{30}: 0.075

D_{10}: 0.075

Sieve Size	% Passing
3"	-
2"	-
1 1/2"	-
1"	100
3/4"	100
1/2"	100
3/8"	100
#4	97
#8	93
#10	92
#16	88
#20	86
#30	83
#40	81
#50	78
#60	77
#80	74
#100	72
#140	68
#200	61

Notes/Comments/Deviations from Test Standard:

Report Limitations:

1. This report contains results that relate only to the site-specific sample location tested.
2. This report shall not be reproduced, except in full, without the written approval of YeDoma Consultants, LLC.

Reviewed By: Technical Manager
Jesse Reinikainen, PE

YeDoma Consultants, LLC
523 Louisiana Boulevard Southeast
Albuquerque, NM 87108

MOTZZ LABORATORY, INC.

Report: 960033
Reported: 2/28/2026
Received: 2/17/2026
PO: 621274

Laboratory Analysis Report

YeDoma Consultants LLC
Jesse Reinikainen
523 Louisiana Blvd SE
Albuquerque NM 87108

Project: Questa Citizens Ditch Flume

Lab Number	Sample ID
960033-1	274-03 (6.0'-9.0')

Test Parameter

Test	*Method*	*Result*	*Units*
pH	AASHTO T289	7.6	SU
Chloride	AASHTO T291	11	ppm
Minimum Resistivity	AASHTO T288	1812	ohm-cm
Sulfate	AASHTO T290	91	ppm

Standard Test Methods for Specific Gravity of Soil Solids by Water Displacement Method

Report Date:	2/16/2026	**Sample Date:**	2/6/2026	**Material Type:**	Subgrade
Report No.:	621274-SpGReport-01	**Sample By:**	YeDoma	**Depth:**	0.0' - 4.0'
Project Name:	Questa Citizens Ditch Flume	**Test Date:**	2/13/2026	**Boring Number:**	GR-01
Project Location:	Questa, NM	**Tested By:**	DS	**Sample Received:**	2/6/2026
Project No.:	621274	**Client:**	Agua Fria Engineering, LLC		
Test Method:	ASTM D854-23, D2487-17				

Classification, ASTM D2487 Group Name: Clayey gravel with sand Group Symbol: GC

[ ] Method A: Procedure for Moist Specimen [X] Method B: Procedure for Oven-Dry Specimen

Dispersion of the specimer *Dispersion Time (min):* 1

[ ] Option 1 - Blender
[ ] Option 2 - Plastic shake bottle with several ceramic balls
[ ] Option 3 - Ultrasonic bath
[X] Option 4 - Simple soaking

Deairing of the specimen *Deair Time (hr):* 2

[ ] Option A - Heat-Only (boiling) [X] Option B - Vacuum-Only [ ] Option C - Combination of Heat and Vacuum

Opening size of the seperation sieve: [ ] 3/8-in. (9.5-mm) [ ] #4 (4.75-mm) [X] #10 (2.00-mm)
Precentage passing the seperation sieve: 44%

		Apparatus Identification	
Sample Number:	274-01		
Sample Mass (g):	125.41	Pycnometer type:	Volumetric
Temp. of Soil + Water Mix (^{o}C):	19.0	Pycnometer Calibration Date:	2/13/2026
Mass of Pycnometer & Water (g):	646.97	Mass of Pycnometer (g):	148.28
Mass of Pycnometer, Soil, Water (g):	725.76	Volume of Pycnometer (mL):	500
Mass of Oven Dried Soil (g):	125.41	Pycnometer ID:	YD-Vol-3
Specific Gravity, G_S	2.690	Vacuum ID:	YD-VP-1
Correction Factor, K, for 20 ^{o}C:	1.00020	Thermomter ID:	YD-Th-3024
Corrected Specific Gravity, $G_{20^{o}C}$ ($G_S \times K$):	**2.691**	Balance ID:	YD-S-2480
		Oven ID:	YD-DO-06595

Notes/Comments/Deviations from Test Standard

Any soil or material excluded from the test
All material retained on the #10 sieve

Report Limitations:
1. This report contains results that relate only to the site-specific sample location tested.
2. This report shall not be reproduced, except in full, without the written approval of YeDoma Consultants, LLC.

Reviewed By: Technical Manager
Jesse Reinikainen, PE

YeDoma Consultants, LLC
523 Louisiana Boulvevard Southeast
Albuquerque, NM 87108

Standard Test Methods for Specific Gravity of Soil Solids by Water Displacement Method

Report Date:	2/16/2026	**Sample Date:**	2/6/2026	**Material Type:**	Subgrade
Report No.:	621274-SpGReport-02	**Sample By:**	YeDoma	**Depth:**	6.0' - 9.0'
Project Name:	Questa Citizens Ditch Flume	**Test Date:**	2/11/2026	**Boring Number:**	GR-01
Project Location:	Questa, NM	**Tested By:**	DS	**Sample Received:**	2/6/2026
Project No.:	621274	**Client:**	Agua Fria Engineering, LLC		
Test Method:	ASTM D854-23, D2487-17				

Classification, ASTM D2487 Group Name: N/A Group Symbol: N/A

[ ] Method A: Procedure for Moist Specimen [X] Method B: Procedure for Oven-Dry Specimen

Dispersion of the specimer *Dispersion Time (min):* 1

[ ] Option 1 - Blender
[ ] Option 2 - Plastic shake bottle with several ceramic balls
[ ] Option 3 - Ultrasonic bath
[X] Option 4 - Simple soaking

Deairing of the specimen *Deair Time (hr):* 2

[ ] Option A - Heat-Only (boiling) [X] Option B - Vacuum-Only [ ] Option C - Combination of Heat and Vacuum

Opening size of the seperation sieve: [ ] 3/8-in. (9.5-mm) [ ] #4 (4.75-mm) [X] #10 (2.00-mm)
Precentage passing the seperation sieve: N/A

		Apparatus Identification	
Sample Number:	274-03		
Sample Mass (g):	105.23	Pycnometer type:	Volumetric
Temp. of Soil + Water Mix (^{o}C):	19.6	Pycnometer Calibration Date:	2/11/2026
Mass of Pycnometer & Water (g):	646.91	Mass of Pycnometer (g):	148.28
Mass of Pycnometer, Soil, Water (g):	713.54	Volume of Pycnometer (mL):	500
Mass of Oven Dried Soil (g):	105.23	Pycnometer ID:	YD-Vol-3
Specific Gravity, G_S	2.726	Vacuum ID:	YD-VP-1
Correction Factor, K, for 20 ^{o}C:	1.00008	Thermomter ID:	YD-Th-3024
Corrected Specific Gravity, $G_{20^{o}C}$ (G_S × K):	**2.727**	Balance ID:	YD-S-2480
		Oven ID:	YD-DO-06595

Notes/Comments/Deviations from Test Standard

Any soil or material excluded from the test
All material retained on the #10 sieve

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523 Louisiana Boulvevard Southeast
Albuquerque, NM 87108

Standard Test Methods for Specific Gravity of Soil Solids by Water Displacement Method

Report Date:	2/18/2026	**Sample Date:**	2/6/2026	**Material Type:**	Subgrade
Report No.:	621274-SpGReport-03	**Sample By:**	YeDoma	**Depth:**	9.2' - 9.4'
Project Name:	Questa Citizens Ditch Flume	**Test Date:**	2/16/2026	**Boring Number:**	GR-01
Project Location:	Questa, NM	**Tested By:**	DS	**Sample Received:**	2/6/2026
Project No.:	621274	**Client:**	Agua Fria Engineering, LLC		
Test Method:	ASTM D854-23, D2487-17				

Classification, ASTM D2487 Group Name: N/A Group Symbol: N/A

[ ] Method A: Procedure for Moist Specimen [X] Method B: Procedure for Oven-Dry Specimen

Dispersion of the specimer *Dispersion Time (min):* 1

[ ] Option 1 - Blender
[ ] Option 2 - Plastic shake bottle with several ceramic balls
[ ] Option 3 - Ultrasonic bath
[X] Option 4 - Simple soaking

Deairing of the specimen *Deair Time (hr):* 2

[ ] Option A - Heat-Only (boiling) [X] Option B - Vacuum-Only [ ] Option C - Combination of Heat and Vacuum

Opening size of the seperation sieve: [ ] 3/8-in. (9.5-mm) [ ] #4 (4.75-mm) [X] #10 (2.00-mm)
Precentage passing the seperation sieve: 0%

		Apparatus Identification	
Sample Number:	274-04		
Sample Mass (g):	117.74	Pycnometer type:	Volumetric
Temp. of Soil + Water Mix (^{o}C):	19.1	Pycnometer Calibration Date:	2/16/2026
Mass of Pycnometer & Water (g):	646.96	Mass of Pycnometer (g):	148.28
Mass of Pycnometer, Soil, Water (g):	721.34	Volume of Pycnometer (mL):	500
Mass of Oven Dried Soil (g):	117.74	Pycnometer ID:	YD-Vol-3
Specific Gravity, G_S	2.716	Vacuum ID:	YD-VP-1
Correction Factor, K, for 20 ^{o}C:	1.00018	Thermomter ID:	YD-Th-3024
Corrected Specific Gravity, $G_{20^{o}C}$ ($G_S \times K$):	**2.716**	Balance ID:	YD-S-2480
		Oven ID:	YD-DO-06595

Notes/Comments/Deviations from Test Standard

Any soil or material excluded from the test
All material retained on the #10 sieve

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Jesse Reinikainen, PE

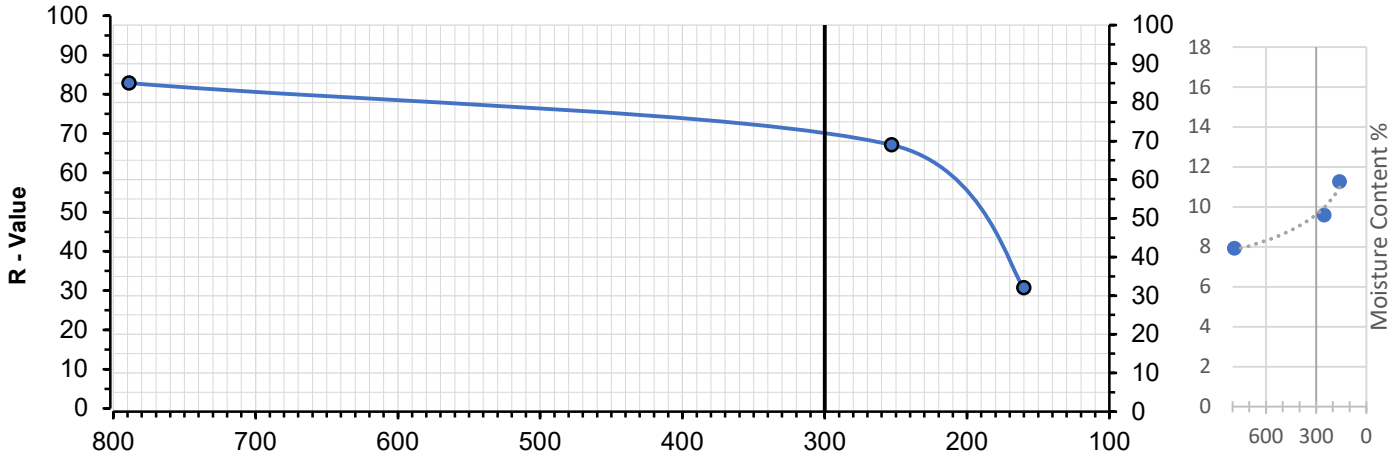
YeDoma Consultants, LLC
523 Louisiana Boulvevard Southeast
Albuquerque, NM 87108

Standard Method of Test for Resistance R-Value and Expansion Pressure of Compacted Soils

Report Date:	2/18/2026	**Sample Date:**	2/6/2026	**Material Type:**	Subgrade
Report No.	621274-RValueReport-01	**Sample By:**	YeDoma	**Depth:**	4.0' - 6.0'
Project Name:	Questa Citizens Ditch Flume	**Test Date:**	2/16/2026	**Boring Number:**	GR-01
Project Location:	Questa, NM	**Tested By:**	RS	**Sample Received:**	2/6/2026
Project No.	621274	**Client:**	Agua Fria Engineering, LLC		
Test Method:	ASTM D2844-18				

Specimen ID: 274-02	**1**	**2**	**3**	**4**
Moisture (%):	7.9	9.6	11.3	
Dry Density (pcf):	130.4	129.0	127.3	
Kneading Compactor Pressure (psi):	350	350	270	
Specimen Height (mm):	62.5	63.8	66.8	
Horizontal Pressure @ 1000 lbs (psi):	8	16	38	
Horizontal Pressure @ 2000 lbs (psi):	14	31	90	
Displacement turns:	4.44	4.62	4.54	
Expansion Pressure (psf):	82	10	0	
Bond Strength (psi):	18	14	10	
R-Value:	85	69	30	
Exudation Pressure (psi):	789	253	160	
Corrected R-Value:	85	69	32	

STABILOMETER GRAPH



R-Value at 300 psi: 72

Notes/Comments/Deviations from Test Standard:

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Jesse Reinikainen, PE

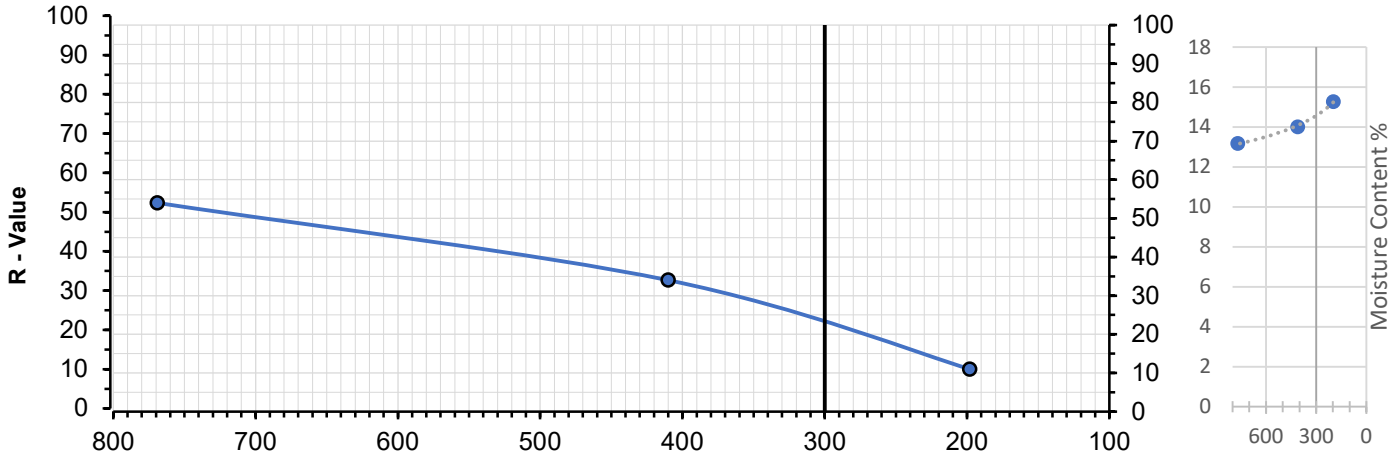
YeDoma Consultants, LLC
523 Louisiana Boulevard Southeast
Albuquerque, NM 87108

Standard Method of Test for Resistance R-Value and Expansion Pressure of Compacted Soils

Report Date:	2/18/2026	**Sample Date:**	2/6/2026	**Material Type:**	Subgrade
Report No.	621274-RValueReport-02	**Sample By:**	YeDoma	**Depth:**	0.0' - 5.5'
Project Name:	Questa Citizens Ditch Flume	**Test Date:**	2/16/2026	**Boring Number:**	GR-03
Project Location:	Questa, NM	**Tested By:**	RS	**Sample Received:**	2/6/2026
Project No.	621274	**Client:**	Agua Fria Engineering, LLC		
Test Method:	ASTM D2844-18				

Specimen ID: 274-05	**1**	**2**	**3**	**4**
Moisture (%):	13.2	14.0	15.3	
Dry Density (pcf):	121.4	119.1	113.2	
Kneading Compactor Pressure (psi):	350	350	130	
Specimen Height (mm):	62.7	63.5	65.5	
Horizontal Pressure @ 1000 lbs (psi):	19	30	55	
Horizontal Pressure @ 2000 lbs (psi):	60	86	133	
Displacement turns:	3.55	4.11	4.67	
Expansion Pressure (psf):	303	782	9	
Bond Strength (psi):	37	40	25	
R-Value:	54	34	10	
Exudation Pressure (psi):	769	410	198	
Corrected R-Value:	54	34	11	

STABILOMETER GRAPH



R-Value at 300 psi: 23

Notes/Comments/Deviations from Test Standard:

Report Limitations:

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Reviewed By: Technical Manager
Jesse Reinikainen, PE

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523 Louisiana Boulevard Southeast
Albuquerque, NM 87108

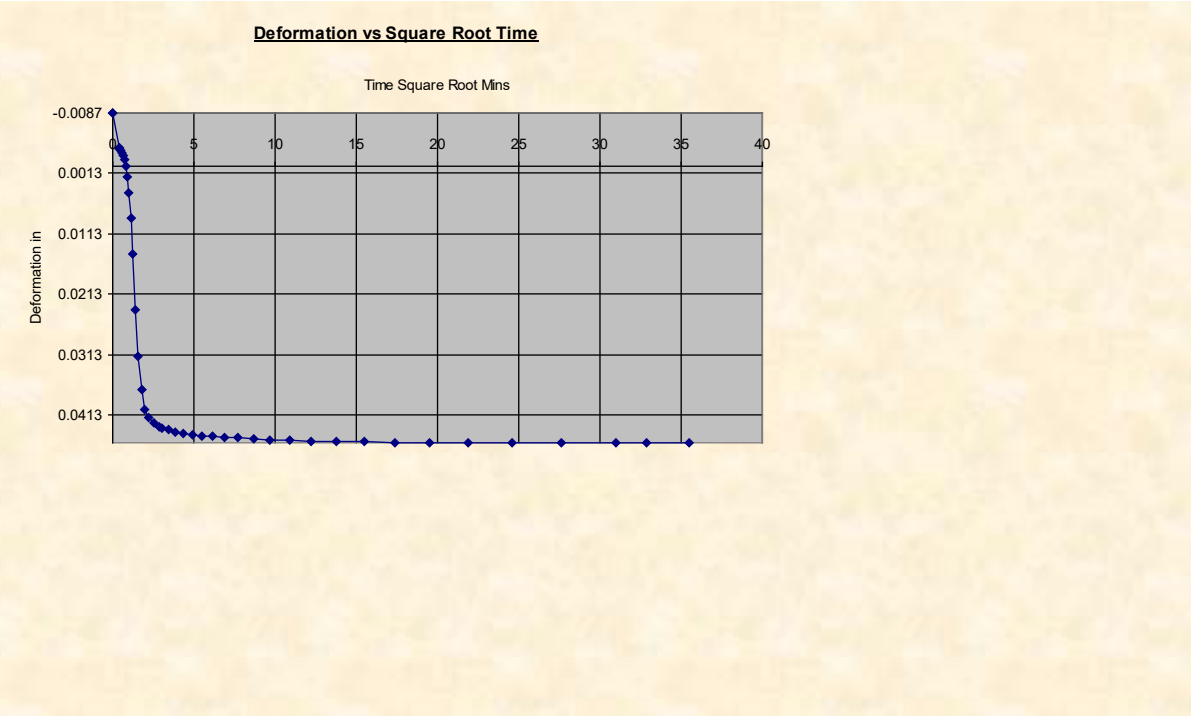
Shear Strength by Direct Shear (Small Shear Box)

Client	Agua Fria Engineering LLC	**Lab Ref**	
Project	Questa Acequia Upgrade	**Job**	621274
Borehole	GR01	**Sample**	27403

Test Details			
Standard	ASTM D3080-03 / AASHTO T236-92	**Particle Specific Gravity**	2.65
Sample Type	Core sample	**Single or Multi Stage**	Single Stage
Lab. Temperature	70.0 deg.F	**Location**	Questa Taos County
Sample Description	Silty Sand with clay		
Variations from procedure	None		

Specimen Details			
Specimen Reference	A	**Description**	
Depth within Sample	0.0000in	**Orientation within Sample**	
Initial Height	1.0000 in	**Area**	4.60820 in2
Structure / Preparation		**Initial Water Content***	10.00 %
Initial Wet Unit Weight	110.62 lbf/ft3	**Degree of Saturation**	41.03 %
Initial Dry Unit Weight	100.57 lbf/ft3	**Initial Voids Ratio**	0.646
Final Wet Unit Weight	134.53 lbf/ft3	**Final Water Content**	21.50%
Final Dry Unit Weight	110.73 lbf/ft3	**Dry Mass**	0.2681 lb
Tested Dry or Submerged	Dry		
Comments			

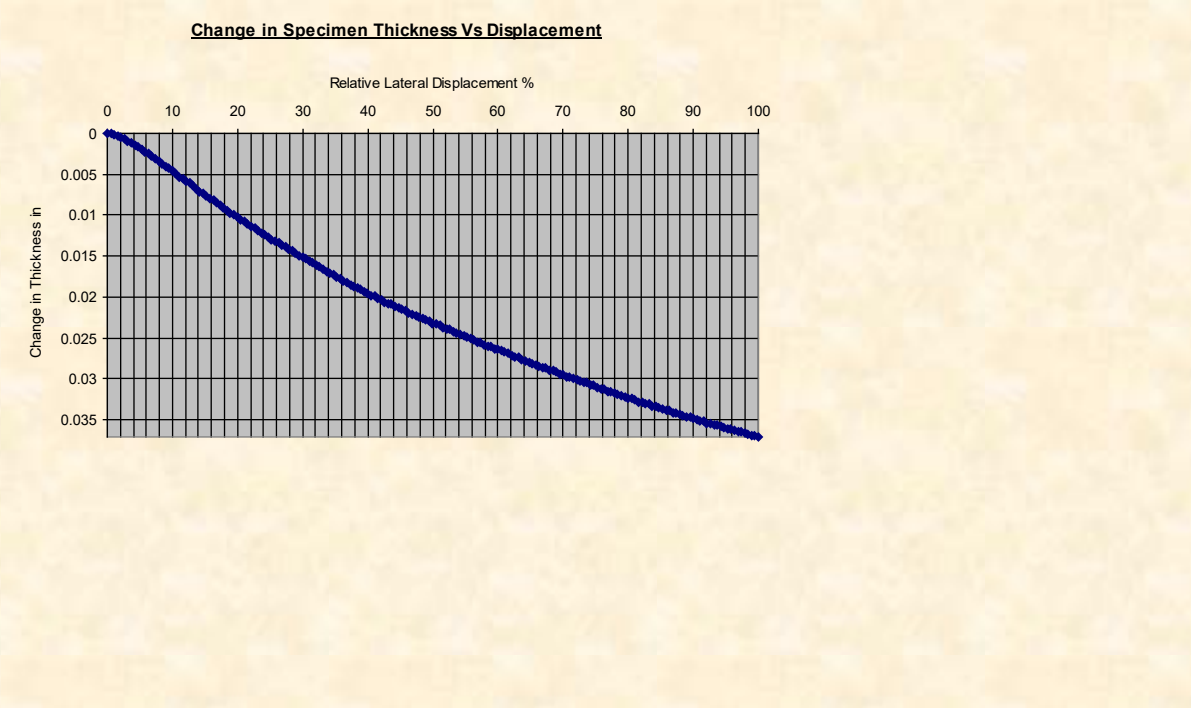
* Calculated from initial and dry weights of whole specimen



Shear Strength by Direct Shear (Small Shear Box)

Client	Agua Fria Engineering LLC	**Lab Ref**	
Project	Questa Acequia Upgrade	**Job**	621274
Borehole	GR01	**Sample**	27403





Rate of Horizontal Displacement	Stage 1: 0.009840in/min

Shear Strength by Direct Shear (Small Shear Box)

Client	Agua Fria Engineering LLC	**Lab Ref**	
Project	Questa Acequia Upgrade	**Job**	621274
Borehole	GR01	**Sample**	27403

Conditions at Failure	
Normal Stress	14.80 psi
Peak Strength	6.90 psi
Horizontal Deformation	0.1006 in
Residual Stress	0.00 psi
Vertical Deformation	0.0732 in

Tested By and Date:	JAR 2/26/2026

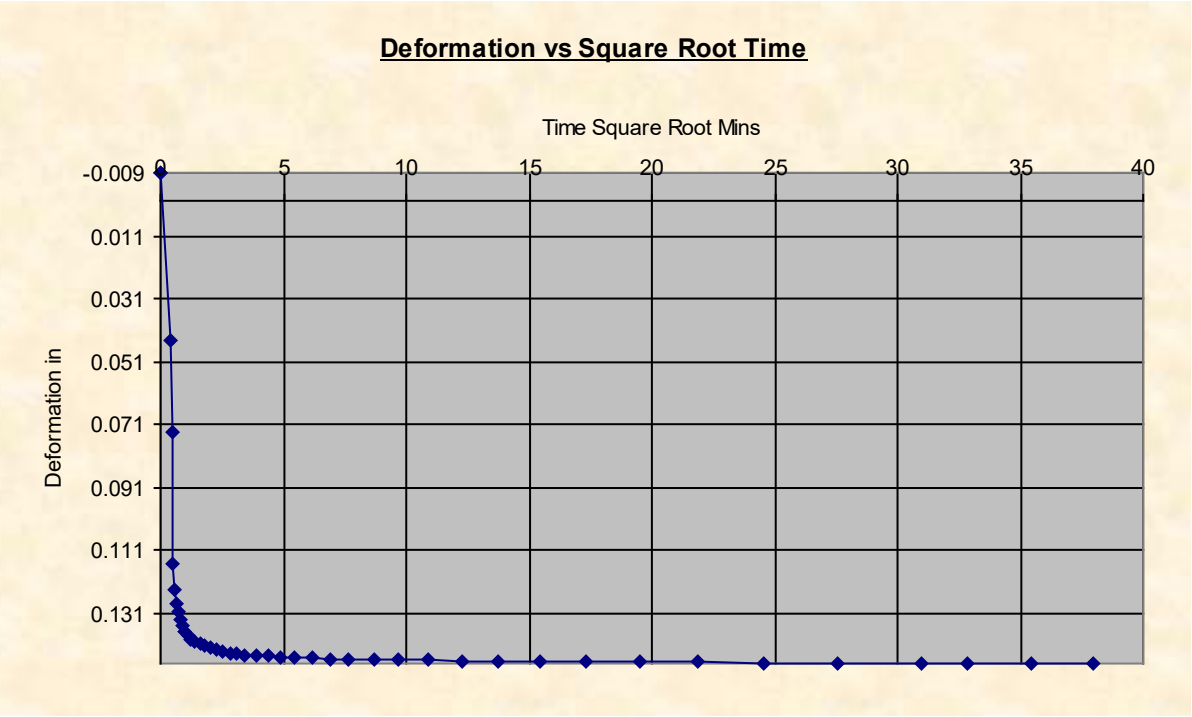
Shear Strength by Direct Shear (Small Shear Box)

Client	Agua Fria Engineering LLC	**Lab Ref**	
Project	Questa Acequia Upgrade	**Job**	621274
Borehole	GR01	**Sample**	27403

Test Details			
Standard	ASTM D3080-03 / AASHTO T236-92	**Particle Specific Gravity**	2.65
Sample Type	Core sample	**Single or Multi Stage**	Single Stage
Lab. Temperature	70.0 deg.F	**Location**	Questa Taos County
Sample Description	Silty Sand with clay		
Variations from procedure	None		

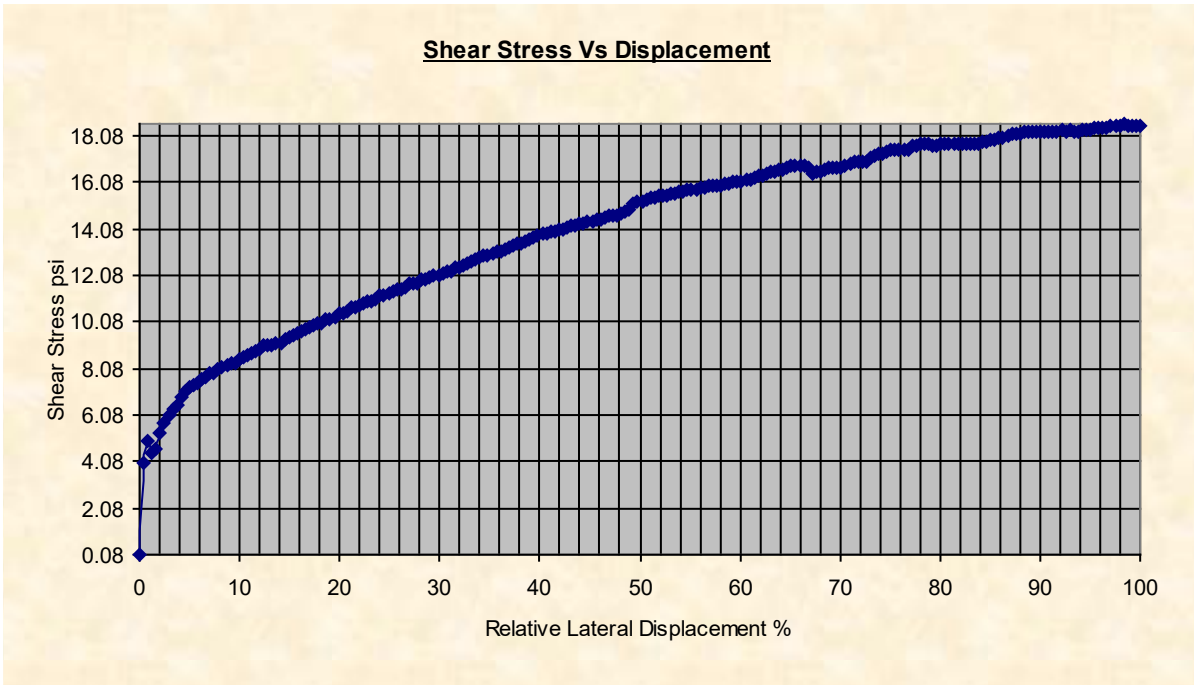
Specimen Details			
Specimen Reference	B	**Description**	
Depth within Sample	0.0000in	**Orientation within Sample**	
Initial Height	1.0000 in	**Area**	4.60820 in2
Structure / Preparation		**Initial Water Content***	10.00 %
Initial Wet Unit Weight	111.37 lbf/ft3	**Degree of Saturation**	41.78 %
Initial Dry Unit Weight	101.25 lbf/ft3	**Initial Voids Ratio**	0.635
Final Wet Unit Weight	147.02 lbf/ft3	**Final Water Content**	17.70%
Final Dry Unit Weight	124.91 lbf/ft3	**Dry Mass**	0.2699 lb
Tested Dry or Submerged	Dry		
Comments			

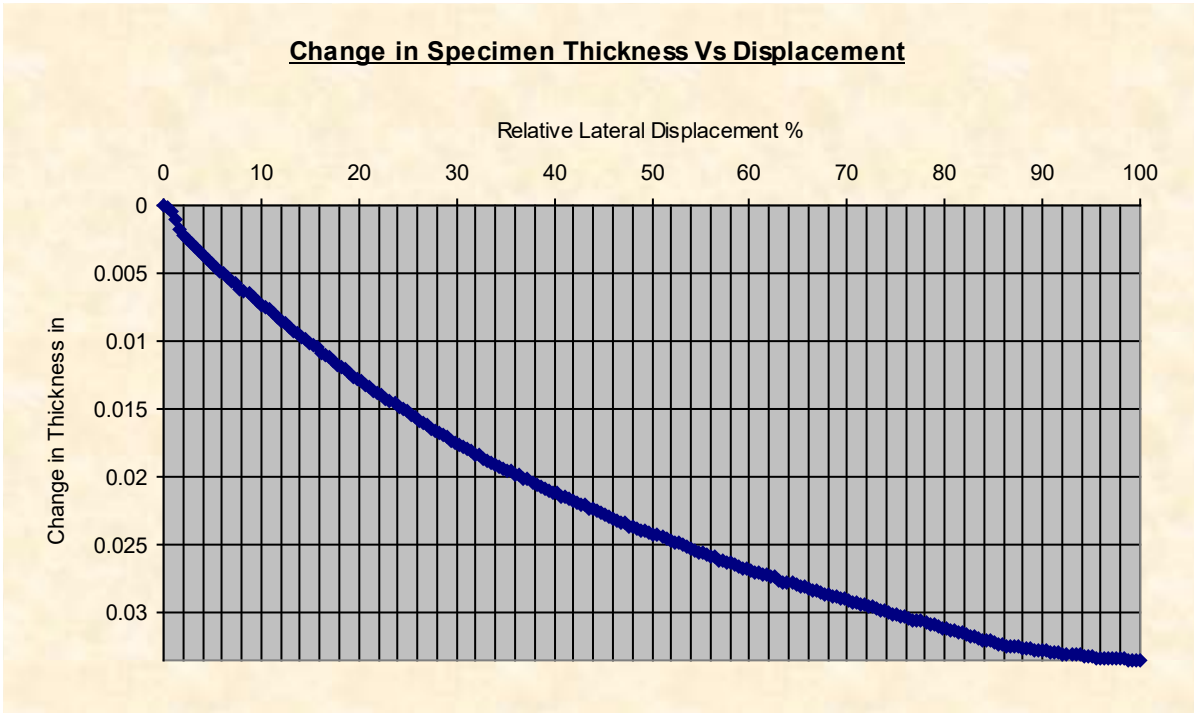
* Calculated from initial and dry weights of whole specimen



Shear Strength by Direct Shear (Small Shear Box)

Client	Agua Fria Engineering LLC	**Lab Ref**	
Project	Questa Acequia Upgrade	**Job**	621274
Borehole	GR01	**Sample**	27403





Rate of Horizontal Displacement	Stage 1: 0.009840in/min

Shear Strength by Direct Shear (Small Shear Box)

Client	Agua Fria Engineering LLC	**Lab Ref**	
Project	Questa Acequia Upgrade	**Job**	621274
Borehole	GR01	**Sample**	27403

Conditions at Failure	
Normal Stress	29.63 psi
Peak Strength	14.30 psi
Horizontal Deformation	0.0997 in
Residual Stress	0.00 psi
Vertical Deformation	0.1703 in

Tested By and Date:	JAR 2/26/2026

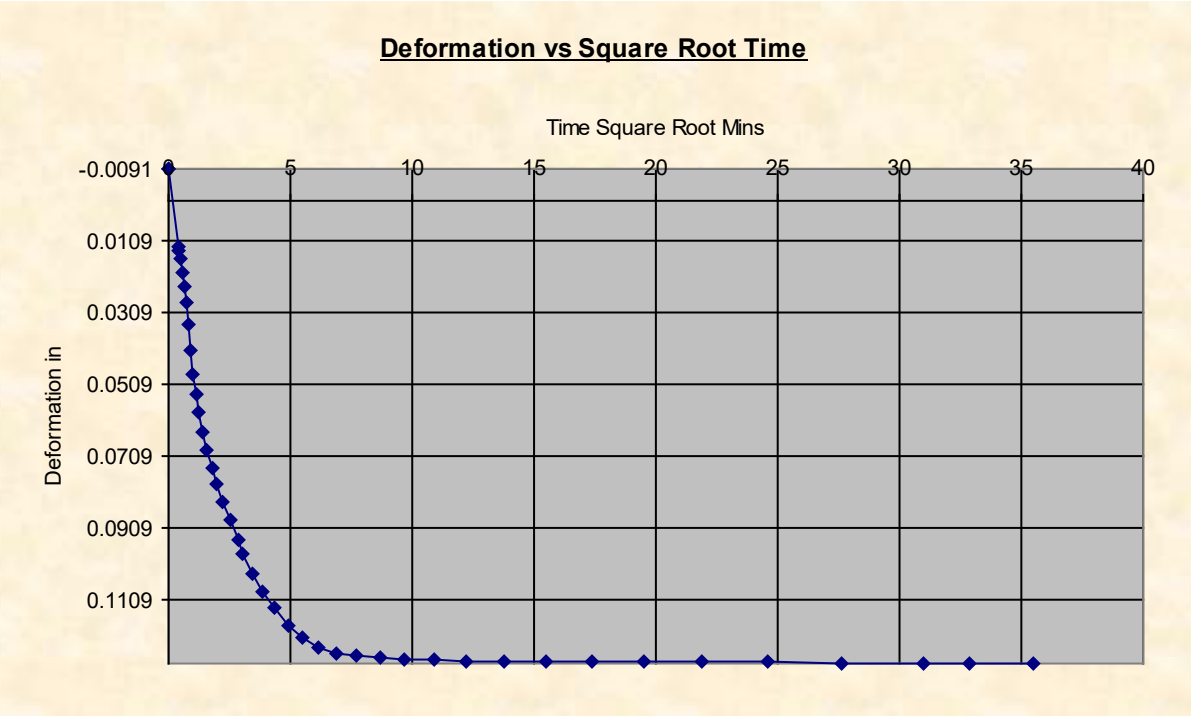
Shear Strength by Direct Shear (Small Shear Box)

Client	Agua Fria Engineering LLC	**Lab Ref**	
Project	Questa Acequia Upgrade	**Job**	621274
Borehole	GR01	**Sample**	27403

Test Details			
Standard	ASTM D3080-03 / AASHTO T236-92	**Particle Specific Gravity**	2.65
Sample Type	Core sample	**Single or Multi Stage**	Single Stage
Lab. Temperature	70.0 deg.F	**Location**	Questa Taos County
Sample Description	Silty Sand with clay		
Variations from procedure	None		

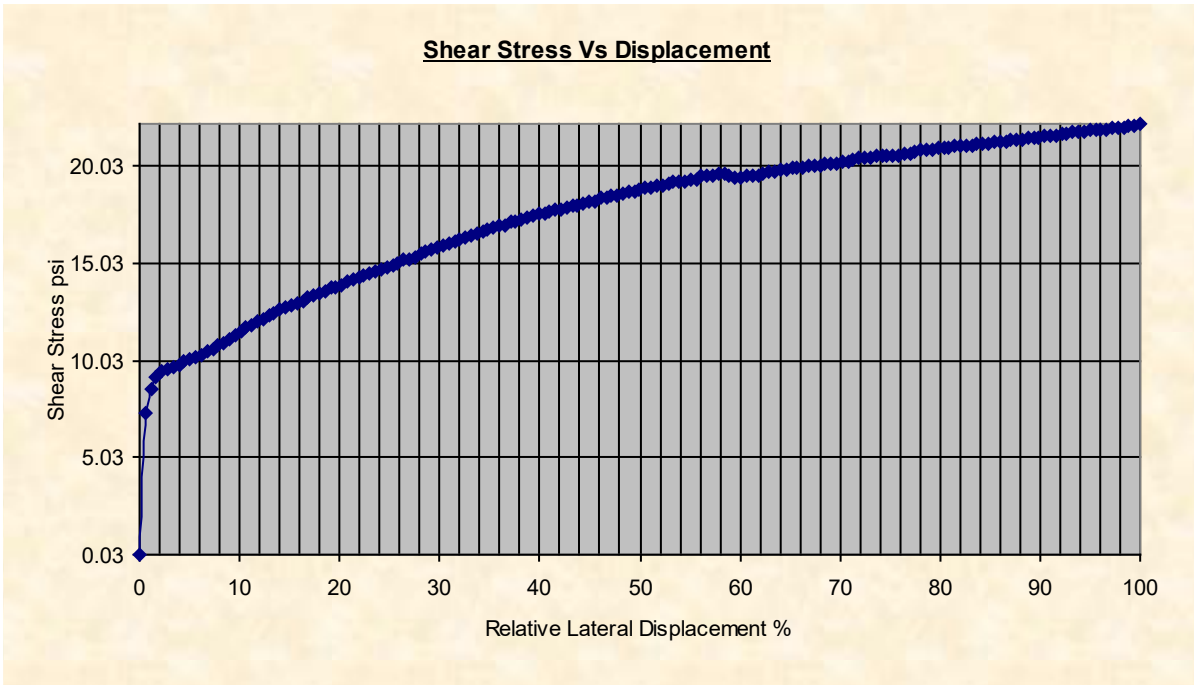
Specimen Details			
Specimen Reference	C	**Description**	
Depth within Sample	0.0000in	**Orientation within Sample**	
Initial Height	1.0000 in	**Area**	4.60820 in2
Structure / Preparation		**Initial Water Content***	10.00 %
Initial Wet Unit Weight	110.62 lbf/ft3	**Degree of Saturation**	41.03 %
Initial Dry Unit Weight	100.57 lbf/ft3	**Initial Voids Ratio**	0.646
Final Wet Unit Weight	141.42 lbf/ft3	**Final Water Content**	16.78%
Final Dry Unit Weight	121.10 lbf/ft3	**Dry Mass**	0.2681 lb
Tested Dry or Submerged	Dry		
Comments			

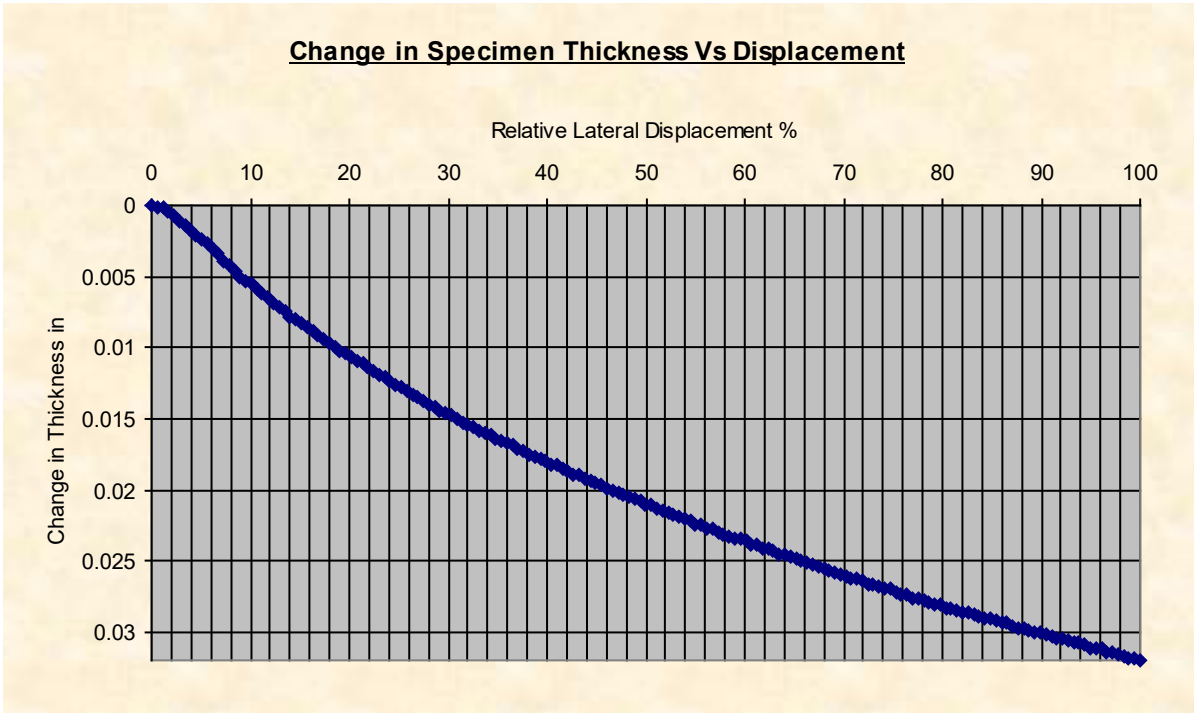
* Calculated from initial and dry weights of whole specimen



Shear Strength by Direct Shear (Small Shear Box)

Client	Agua Fria Engineering LLC	**Lab Ref**	
Project	Questa Acequia Upgrade	**Job**	621274
Borehole	GR01	**Sample**	27403





Rate of Horizontal Displacement	Stage 1: 0.009840in/min

Shear Strength by Direct Shear (Small Shear Box)

Client	Agua Fria Engineering LLC	**Lab Ref**	
Project	Questa Acequia Upgrade	**Job**	621274
Borehole	GR01	**Sample**	27403

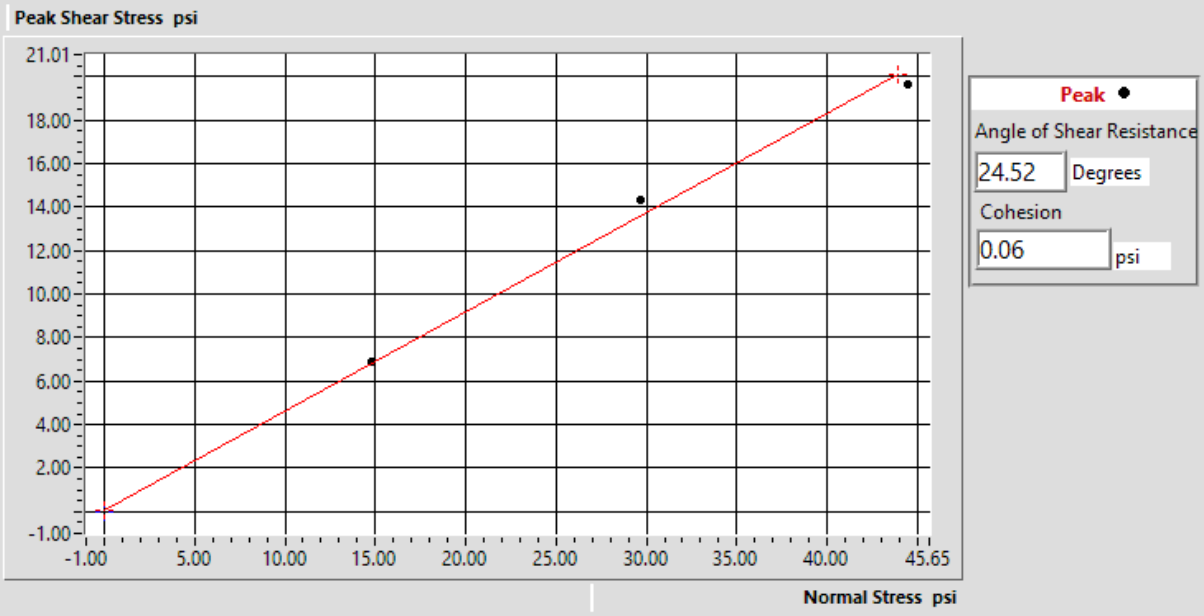
Conditions at Failure	
Normal Stress	44.44 psi
Peak Strength	19.67 psi
Horizontal Deformation	0.0969 in
Residual Stress	0.00 psi
Vertical Deformation	0.1518 in

Tested By and Date:	JAR 2/26/2026

Shear Strength by Direct Shear (Small Shear Box)

Test Summary				
Reference	A	B	C	
Normal Stress	14.80 psi	29.63 psi	44.44 psi	
Peak Strength	6.90 psi	14.30 psi	19.67 psi	
Corresponding Horizontal Displacement	0.1006 in	0.0997 in	0.0969 in	
Residual Stress	N/A	N/A	N/A	
Rate of Shear Displacement	Stage 1: 0.009840in/min	Stage 1: 0.009840in/min	Stage 1: 0.009840in/min	
Final Height	0.9083 in	0.8105 in	0.8305 in	
Sample Area	4.60820 in2	4.60820 in2	4.60820 in2	
Initial Wet Unit Weight	110.62 lbf/ft3	111.37 lbf/ft3	110.62 lbf/ft3	
Initial Dry Unit Weight	100.57 lbf/ft3	101.25 lbf/ft3	100.57 lbf/ft3	
Final Wet Unit Weight	134.53 lbf/ft3	147.02 lbf/ft3	141.42 lbf/ft3	
Final Dry Unit Weight	110.73 lbf/ft3	124.91 lbf/ft3	121.10 lbf/ft3	
Final Moisture Content	21.50 %	17.70 %	16.78 %	
Particle Specific Gravity	2.65	2.65	2.65	
Final Void Ratio	0.4946	0.3249	0.3666	
Final Saturation	115.19%	144.37%	121.32%	

Maximum Shear Stress vs Normal Stress



One Dimensional Consolidation Properties (Oedometer)

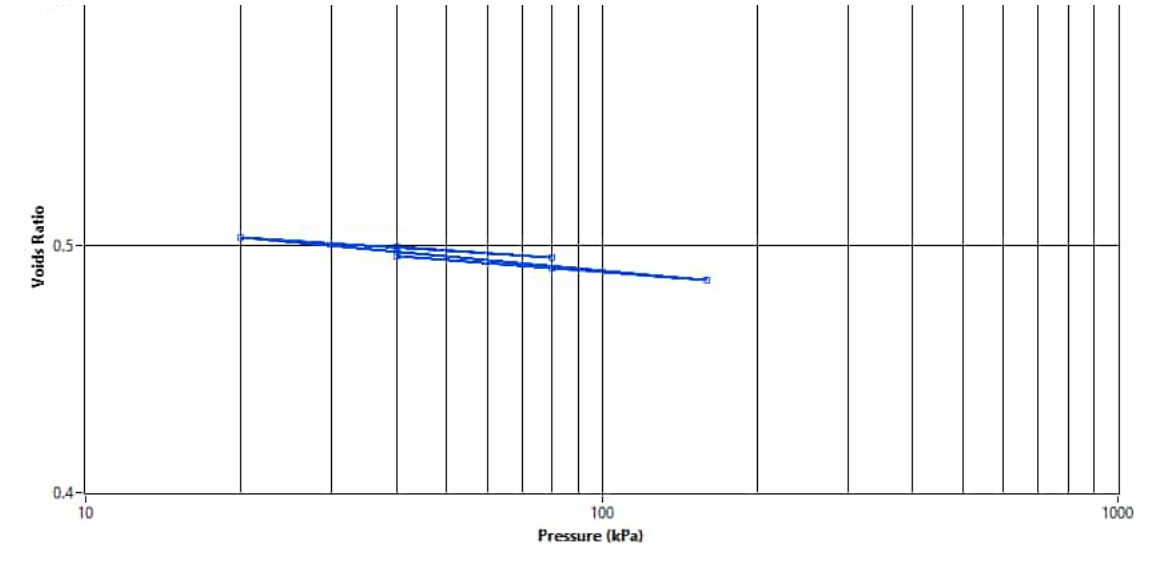
Project ID	274	Client	Aqua Fria Engineering
Borehole ID	B-01	Sample ID	B-01
Location	Questa Citizens Ditch Flume	Sample Depth	3.00 m

Test Details			
Standard	ASTM D2435/D2435M-11 / AASHTO T216-07	Specific Gravity of Solids	2.65 Measured
Test Start Date	2/18/2026	Lab Temperature	20.00 deg.C
Method of Testing (A/B)	A	Liquid Limit	0.00
Sample Type	D (Small disturbed)	Plastic Limit	0.00
Sample Date	9/2/2026	Plastic Index	0.00
Sample Description	Clay		
Sample Comments	moist		
Variations from Procedure			

Specimen Details			
Specimen Reference	B-1	Specimen Code	A
Depth within Sample	0.20 m	Lab Specimen No.	B-1-9
Orientation within Sample	Compacted	Specimen Preparation	Cutting Shoe
Specimen Diameter	50.44 mm	Specimen Height	19.96 mm
Specimen Area	1998.20 mm2	Specimen Volume	39884.17 mm3
Specimen Weight	84.83 g	Test Condition	Inundated
Specimen Details	IN HOUSE		

Test Apparatus			
Ring Number	1	Ring Diameter	50.44 mm
Ring Height	19.96 mm	Ring Weight	68.13 g
Swelling Pressure	0.00 kPa	Drainage	Double-Sided
Lever Ratio	1.00		
Comments	IN HOUSE		

One Dimensional Consolidation Properties (Oedometer)



Project	Questa	Lab Ref	B-1
Project ID	274	Client	Aqua Fria Engineering
Borehole ID	B-01	Sample ID	B-01
Location	Questa Citizens Ditch Flume	Sample Depth	3.00 m

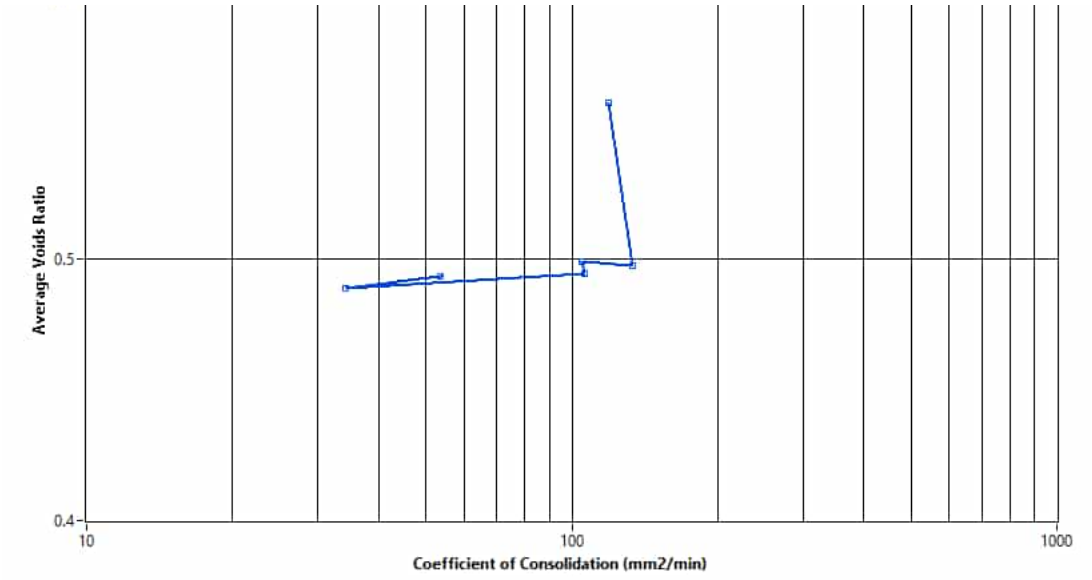
Initial and Final Values			
Initial Moisture Content	21.65 %	Final Moisture Content	19.37 %
Initial Moisture Content from Trimmings	16.40 %		
Initial Dry Density	1.75 Mg/m3	Final Dry Density*	1.77 Mg/m3
Initial Voids Ratio	0.52	Final Void Ratio	0.50
Initial Degree of Saturation	111.27 %	Final Degree of Saturation	103.63 %
		Final Height Differential	19.69 mm

* Value Not Required from Standard

Pressure	Duration	Deformation (Corrected)	d100 (Corrected)	Coefficient of Consolidation (Cv)
40.00 kPa	9.00 mins	0.22 mm	0.21 mm	119.29 m2/yr
80.00 kPa	9.00 mins	0.27 mm	0.27 mm	133.46 m2/yr
20.00 kPa	9.00 mins	0.17 mm	0.17 mm	104.91 m2/yr
160.00 kPa	30.00 mins	0.39 mm	0.34 mm	106.01 m2/yr
80.00 kPa	9.00 mins	0.33 mm	0.33 mm	34.09 m2/yr
40.00 kPa	9.00 mins	0.27 mm	0.28 mm	53.55 m2/yr

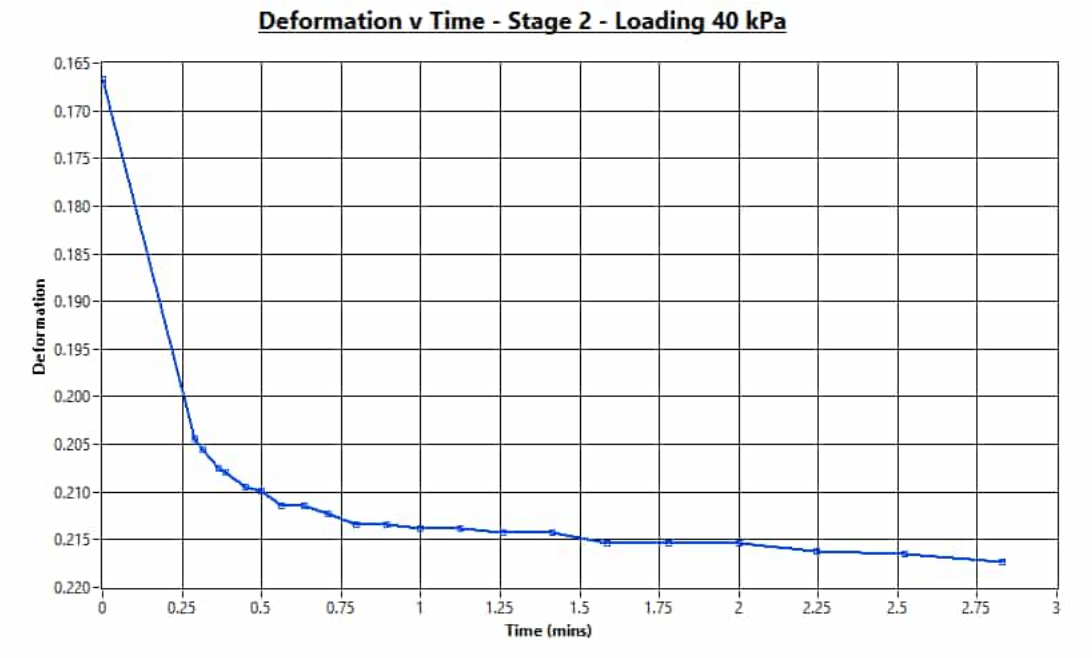
Method of Time Fitting Used	Square Root Time

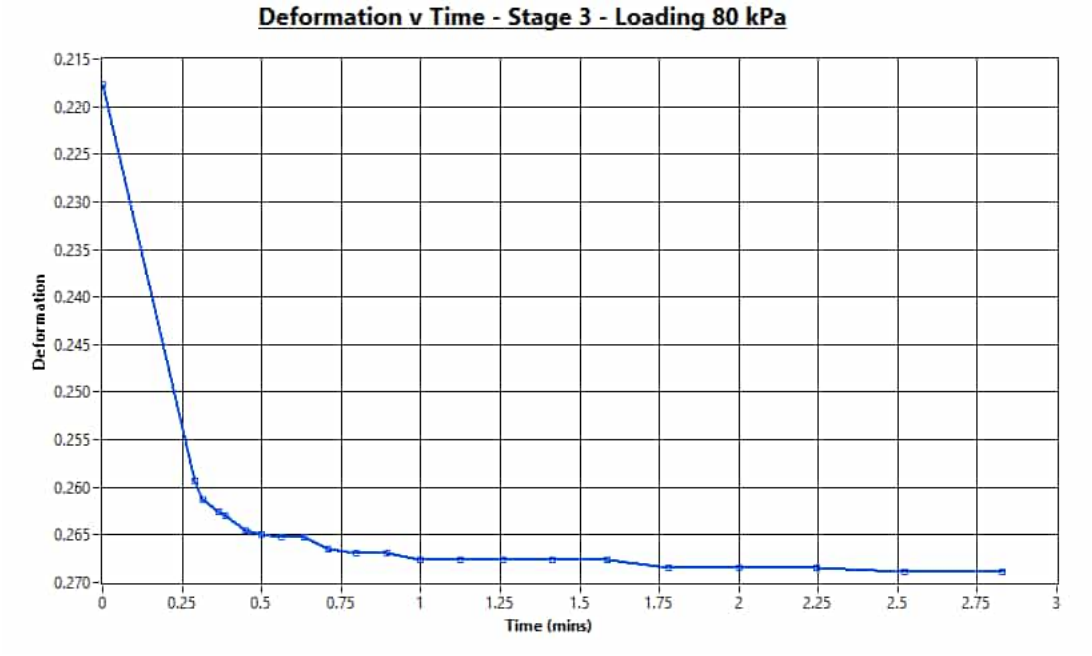
One Dimensional Consolidation Properties (Oedometer)



One Dimensional Consolidation Properties (Oedometer)

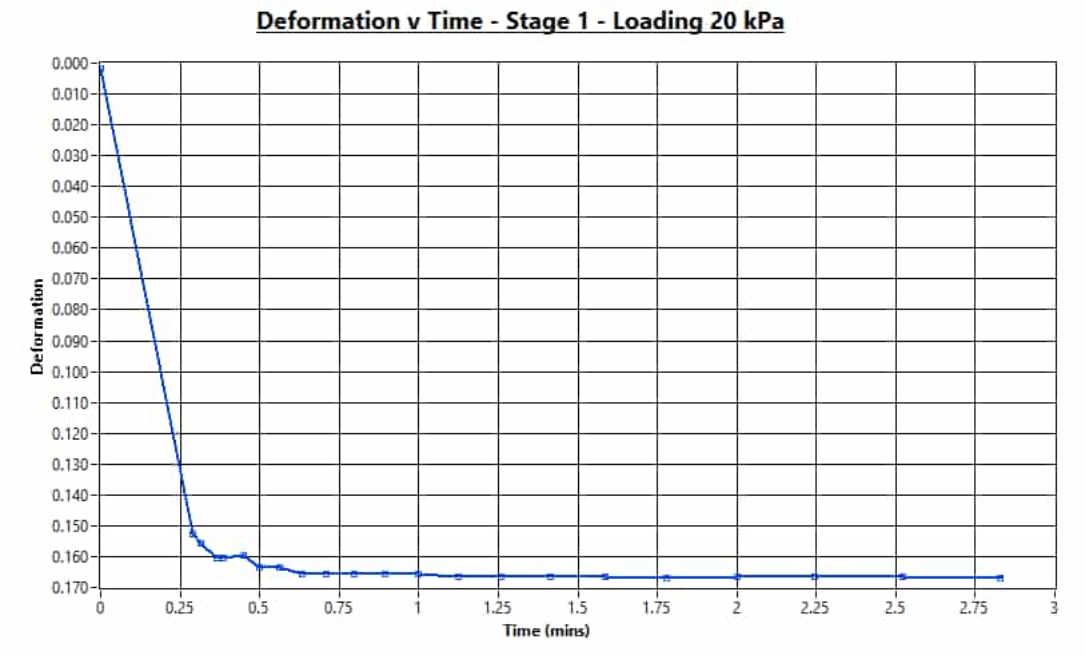
Project ID	274	Client	Aqua Fria Engineering
Borehole ID	B-01	Sample ID	B-01
Location	Questa Citizens Ditch Flume	Sample Depth	3.00 m

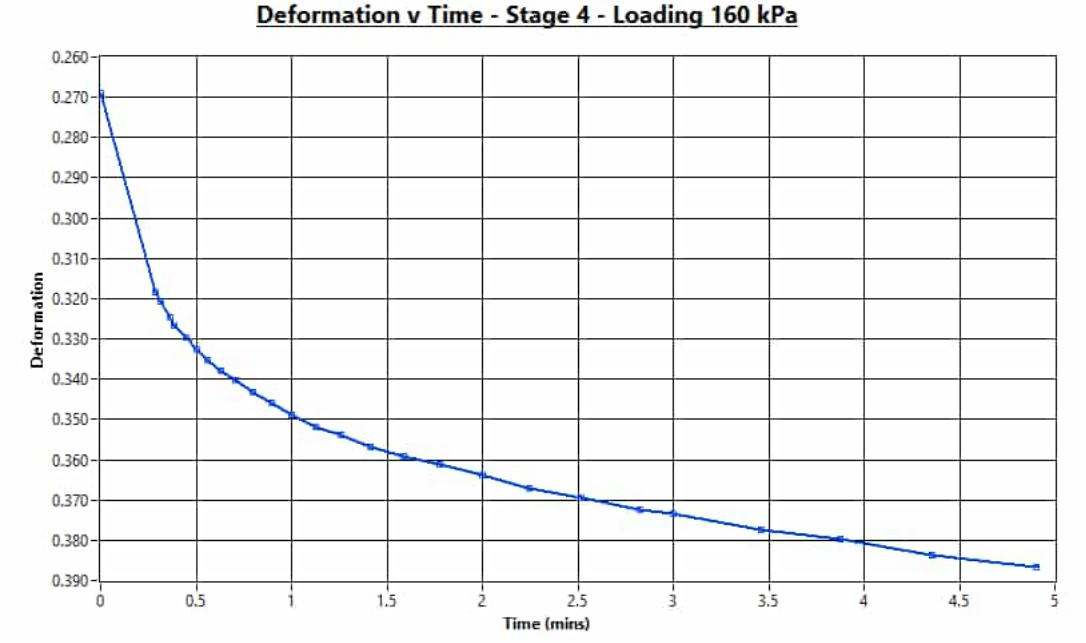




One Dimensional Consolidation Properties (Oedometer)

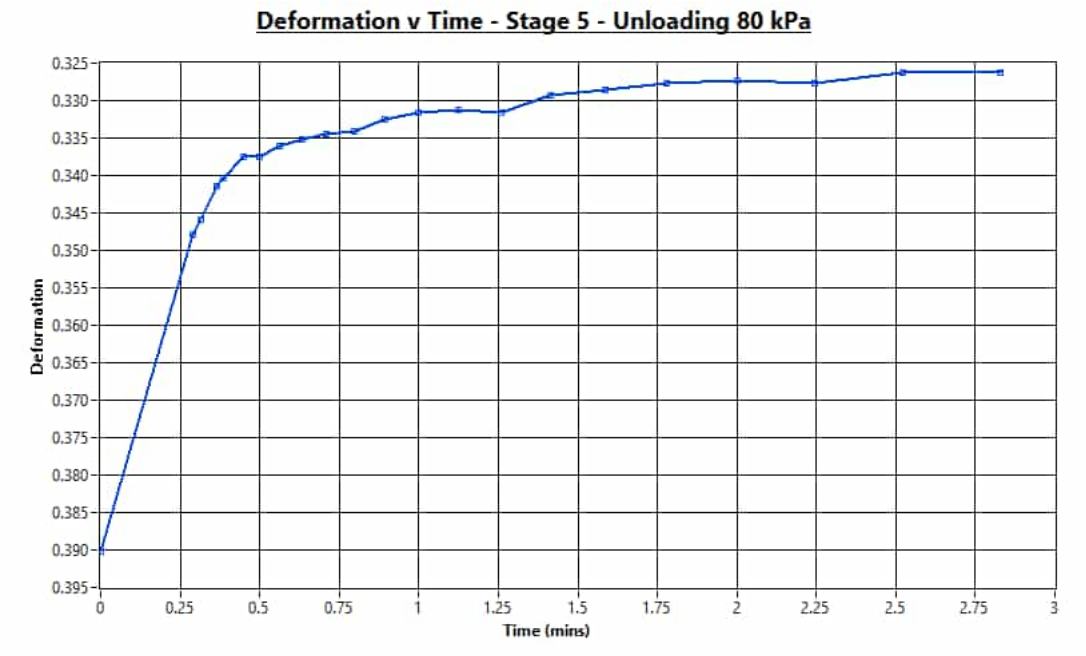
Project ID	274	Client	Aqua Fria Engineering
Borehole ID	B-01	Sample ID	B-01
Location	Questa Citizens Ditch Flume	Sample Depth	3.00 m

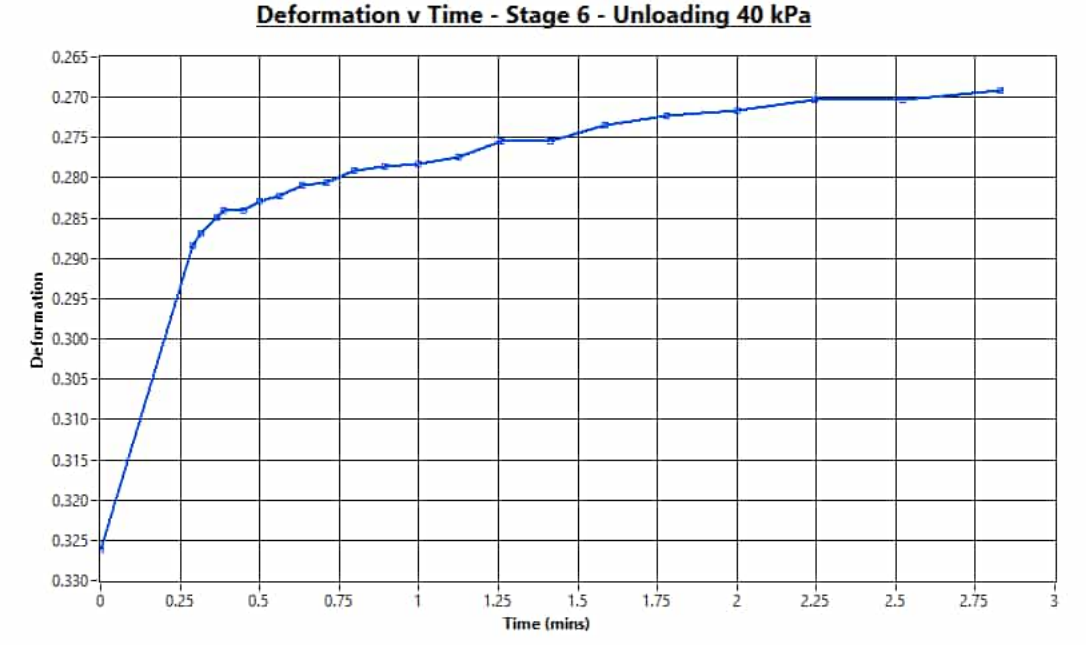




One Dimensional Consolidation Properties (Oedometer)

Project ID	274	Client	Aqua Fria Engineering
Borehole ID	B-01	Sample ID	B-01
Location	Questa Citizens Ditch Flume	Sample Depth	3.00 m

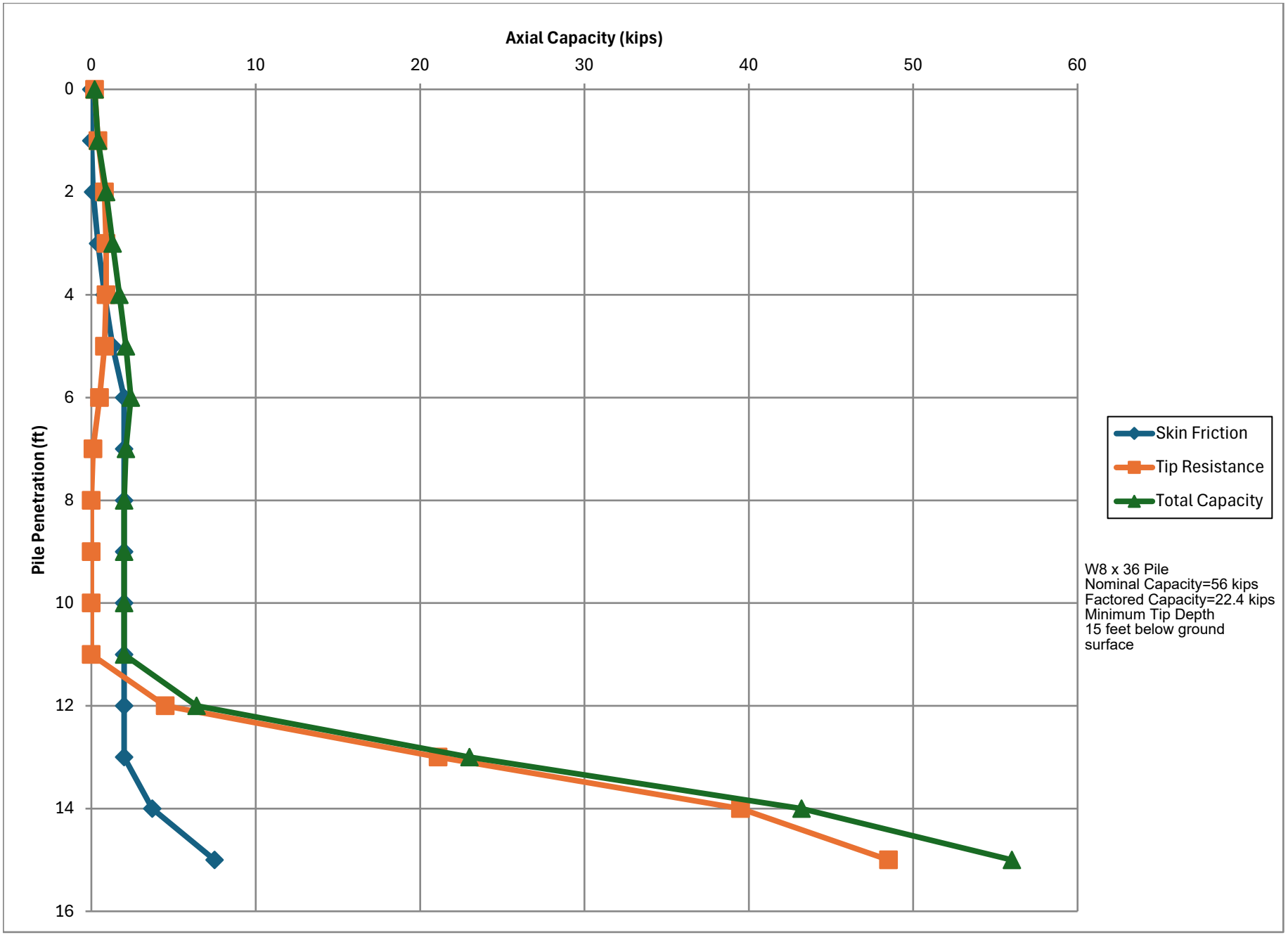




One Dimensional Consolidation Properties (Oedometer)

Project ID	274	Client	Aqua Fria Engineering
Borehole ID	B-01	Sample ID	B-01
Location	Questa Citizens Ditch Flume	Sample Depth	3.00 m

Tested By:	JAR	Date	2/18/2026
Analysed By:	JAR	Date	2/20/2026
Checked By:		Date	
Approved By:		Date	


Axial Capacity (kips)
0
10
20
30
40
50
60
Pile Penetration (ft)
0
2
4
6
8
10
12
14
16
Skin Friction
Tip Resistance
Total Capacity
W8 x 36 Pile
Nominal Capacity=56 kips
Factored Capacity=22.4 kips
Minimum Tip Depth
15 feet below ground
surface