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SUBSURFACE SOIL INVESTIGATION
WINSOME SUBDIVISION – WEST KIOWA CREEK
BOX CULVERT CROSSINGS
EL PASO COUNTY, COLORADO

Prepared for:

Winsome, LLC
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Monument, CO 80132

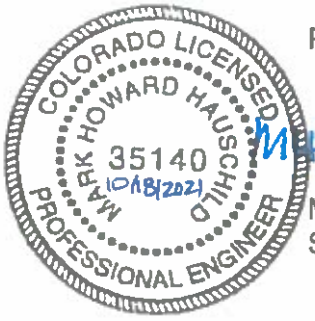
Attn: Joe DesJardin

October 18, 2021

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Logan L. Langford, P.G.
Geologist



Reviewed by:

Mark H. Hauschild, P.E.
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LLL

Encl.

Entech Job No. 211992
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SUBSURFACE SOIL INVESTIGATION
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EL PASO COUNTY, COLORADO

1.0 INTRODUCTION

Winsome, LLC is planning the construction of two culvert crossings over West Kiowa Creek for Alamar Way and Twinkling Star Lane in the Winsome Subdivision located in northeastern El Paso County, Colorado. The approximate location of the site is shown on the Vicinity Map, Figure 1. The planned layout of the proposed culverts is shown on Figures 2 and 3, the Site Plan/Test Boring Location Map.

This report describes the subsurface investigation conducted for the planned bridges and provides recommendations for foundation design and construction. The subsurface soil investigation included drilling test borings at eight (8) locations at the corners of the planned culverts, collecting samples of soil, and conducting a geotechnical evaluation of the investigation findings. The drilling was completed by others, and the field logging and subsurface investigation activities were performed by Entech Engineering, Inc. (Entech). The contents of this report, including the geotechnical evaluation and recommendations, are subject to the limitations and assumptions presented in Section 6.0.

2.0 PROJECT AND SITE DESCRIPTION

It is Entech's understanding that the project will consist of the construction of two culvert crossings over West Kiowa Creek for Alamar Way and Twinkling Star Lane in the Winsome Subdivision. At the time of drilling, the site for the proposed culvert crossing were undisturbed areas in West Kiowa Creek. Water was observed flowing in the creek during our site investigation. Current vegetation on the site consisted of grasses and small shrubs.

3.0 SUBSURFACE EXPLORATIONS AND LABORATORY TESTING

The subsurface conditions were investigated by drilling eight (8) locations near the corners of the planned culverts. The borings were drilled to depths 15 to 20 feet below the existing ground surface using a track-mounted continuous flight auger-drilling rig supplied and operated by Vine Laboratories. Boring Logs descriptive of the subsurface conditions encountered during drilling are presented in Appendix A. At the conclusion of drilling, observations of groundwater levels were made in each of the open borings. The approximate locations of the test borings are indicated on Figures 2 and 3.

Soil samples were obtained/attempted from the borings utilizing the Standard Penetration Test (ASTM D-1586) using split spoon and California Samplers. Results of the Standard Penetration Test (SPT) are included on the Test Boring Logs in terms of N-values expressed in blows per foot (bpf). Soil samples recovered from the borings were visually classified and recorded on the Test Boring Logs. The soil classifications were later verified utilizing laboratory testing and grouped by soil type. The soil type numbers are included on the Test Boring Logs. It should be understood that the soil descriptions shown on the Test Boring Logs may vary between boring location and sample depth.

It should also be noted that the lines of stratigraphic separation shown on the Test Boring Logs represent approximate boundaries between soil types and the actual stratigraphic transitions may be more gradual and vary with location. The Test Boring Logs are presented in Appendix A.

Moisture Content, ASTM D-2216, was obtained in the laboratory for all recovered samples. Grain-Size, ASTM D-422, and Atterberg Limits, ASTM D-4318, were determined for various samples for the purpose of classification and to obtain pertinent engineering characteristics. Volume change testing was performed on selected samples using the FHA Swell Test in order to evaluate potential expansion characteristics of the soil and bedrock. Sulfate testing was performed on select samples to determine the corrosive characteristics of the soils. The Laboratory Test Results are included in Appendix B and summarized in Table 1.

4.0 SUBSURFACE CONDITIONS

One (1) soil type and two (2) bedrock types were encountered in the borings drilled for the subsurface investigation: Type 1: slightly silty to silty sand and clean sand (SM-SW, SM, SW), Type 2: slightly silty to silty sandstone (SM-SW. SM), and Type 3: sandy claystone (CL). The soils were classified in accordance with the Unified Soil Classification System (USCS) using the laboratory testing results and the observations made during drilling.

4.1 Soil and Rock

Soil Type 1 is a slightly silty to silty sand and clean sand (SM-SW, SM, SW). The sand was encountered in all of the test borings at the existing ground surface extending to depth 14 feet and extending to the termination (15 feet deep) of Test Boring Nos. 1, 1A, and 3A. Standard Penetration Testing conducted on the sand resulted in an SPT N-value of 2 to 27 bpf, which indicates very loose to medium states. Moisture content and grain size testing resulted in a moisture content of 5 to 34 percent with approximately 5 to 23 percent of the soil size particles passing the No. 200 sieve. FHA Swell Testing resulted in an expansion pressure of 60 psf, indicating a low expansion potential. Atterberg limit testing was performed on a sample which resulted in a liquid limit of no value with a plastic index of non-plastic. Sulfate testing performed on samples of the sand resulted in less than 0.01 percent sulfate by weight, indicating the sand exhibits negligible potential for concrete degradation due to below grade sulfate attack.

Soil Type 2 is a slightly silty to silty sandstone bedrock (SM-SW, SM). The sandstone was encountered in five of the test borings at depths of 14 feet bgs and extending to termination of the borings (15 to 20 feet). Weathered sandstone was encountered in Test Boring Nos. 1, 1A, and 3A at approximately 14 feet. Standard Penetration Testing conducted on the sandstone resulted in N-values of 50 to greater than 50 bpf, indicating the sandstone is dense to very dense states. Moisture content and grain size testing resulted in moisture contents of 9 to 17 percent with approximately 22 percent of the soil size particles passing the No. 200 sieve. Atterberg limit testing was performed on a sample of sand and resulted in a liquid limit of no value with a plastic index of non-plastic. Sulfate testing performed on a sample of the sandstone resulted in 0.00 percent sulfate by weight, indicating the sandstone exhibits negligible potential for concrete degradation due to below grade sulfate attack.

Soil Type 3 is a sandy claystone bedrock (CL). The claystone was encountered in Test Boring No. 2A at 14 feet bgs and extending to the termination of the test boring (20 feet). Standard Penetration Testing conducted on the soil resulted in N-values of greater than 50 bpf, indicating hard consistencies. Moisture content and grain size testing resulted in moisture contents of 13 and 14 percent with approximately 90 percent of the soil size particles passing the No. 200 sieve. Atterberg limit testing resulted in a liquid limit of 43 and a plastic index of 21. FHA Swell Testing resulted in an expansion pressure of 1690 psf, indicating a moderate expansion potential. Sulfate testing performed on a sample of the siltstone resulted in less than 0.01 percent sulfate by weight, indicating the siltstone exhibits negligible potential for concrete degradation due to below grade sulfate attack.

Additional descriptions and engineering properties of the soil encountered during drilling are included on the boring logs. Laboratory Testing Results are summarized on Table 1 and presented in Appendix B. It should be understood that the soil descriptions reported on the boring logs may vary between boring locations and sampling depths. Similarly, the lines of stratigraphic separation shown on the boring logs represent approximate boundaries between soil types and the actual transitions between types may be more gradual or variable.

4.2 Groundwater

Groundwater was encountered at depths ranging from 2 to 9 feet in the test borings drilled on this site. Groundwater will affect the construction and excavation for the box culverts on this site. Dewatering of the culvert crossings will be needed during construction. Unstable conditions will be encountered where excavations approach the groundwater level. Stabilization using shot rock or geogrids will likely be necessary. It should be noted that groundwater levels, observed at the time of the subsurface investigation, could change due to seasonal variations, changes in land runoff characteristics and future development including of nearby areas.

5.0 GEOTECHNICAL EVALUATION AND RECOMMENDATIONS

The following discussion is based on the subsurface conditions encountered in the borings drilled in the culvert crossing footprints. If subsurface conditions different from those described herein are encountered during construction or if the project elements change from those described, Entech Engineering, Inc. should be notified so that the evaluation and recommendations presented can be reviewed and revised if necessary.

The construction will consist of two culvert crossings over West Kiowa Creek for Alamar Way and Twinkling Star Lane in the Winsome Subdivision. The proposed crossings are expected to utilize reinforced concrete box culverts with riprap soil protection.

Subsurface soil conditions encountered in the test borings drilled for the planned crossings consisted of slightly silty to silty sand overlying silty sandstone and sandy claystone. Bedrock was encountered at depth of 14 feet in the 5 of the 8 test borings. Weathered bedrock was encountered in other borings at 14 feet. The surficial sands and were encountered in very loose to medium dense states. The very loose samples are likely associated with the groundwater levels and possibly slough in the borings as they were caving during drilling. The underlying sandstone was encountered in dense to very dense states, and the underlying claystone was encountered at hard consistencies.

5.1 Foundation Recommendations

The subsurface investigation was performed to gather soil and bedrock information for use in providing foundation recommendations and design values for the proposed bridge structures. Recommendations for bridge supports using driven H-piles, shallow spread footings, and parameters for retaining walls are provided.

5.1.1 Deep Foundation Systems

Driven H-Piles

Based on evaluation of the site subsurface conditions, it is believed that H-piles will achieve most of their compressive strength through end bearing and skin friction in the underlying sandstone and claystone bedrock (Soil Types 2 and 3). Some frictional resistance will also be developed in the overburden sand (Soil Type 1). Design parameters for use in the H-pile design, which include allowable end bearing, side resistance, and resisting factors are presented in Table 2. L Pile parameters for the sand, sandstone, and claystone are also included in Table 2. The recommendations and parameters apply to piles spaced by horizontal distances of at least 3 times the pile width. If the piles are spaced closer, reductions in the allowable pile capacity may be warranted. The following unit weights are recommended for the site soil and bedrock.

Unit weight of native overburden sand	120 pcf
Unit weight of sandstone bedrock	125 pcf
Unit weight of claystone bedrock	125 pcf

It is recommended that full-time observation of the H-pile installation be performed to compile driving logs for each pile. At a minimum, the log should include: the driving resistance per foot of pile and per inch of pile over the last 3 inches; the pile driver make and model; rated energy; pile cushion/condition; observed damage; and final pile top location. The guidance set forth in the State of Colorado Standard Specifications for Road and Bridge Construction, Section 502, Piling, is recommended. Piles should be driven 10 feet into bedrock or refusal, if shallower.

Helical Piers

Helical piers may be appropriate for the proposed foundation on this site. The helical piers should be ICBO approved and installed in accordance with the manufacturer's requirements. The following guidance is provided with respect to the use of helical piers to support the planned structure.

- Helical piers are expected to develop the majority of their support capacity by way of contact with competent native soils or bedrock. Helical piers generally are capable of supporting a 25-kip vertical load per pier when achieving the minimum torque requirements. Specific helical pier loads should be determined by the foundation designer. Helical pier depths of approximately 20 feet are anticipated. The piers may need to be pre-drilled to achieve the recommended torque and depths. Drilling of a test pier at each creek crossing is recommended.

- A Soils Engineer should observe the installation of the helical piers to evaluate that the piers are penetrating into the expected bearing strata as described in this report. Full time observation during helical pier installation for new construction is currently required by the Regional Building Department in El Paso County.

5.1.2 Shallow Foundation Parameters

Structures associated with the bridges can be supported with shallow foundations resting on a uniform bearing pad of structural fill. It should be noted that due to shallow groundwater on this site and the active West Kiowa Creek, extensive subgrade improvements/stabilization are anticipated if shallow foundations are used. The foundation members should bear on uniform pad (minimum 2 to 3 feet thick) of structural fill/gravel placed according to the "Structural Fill" paragraph. Any topsoil or highly organic soils must be removed and the existing subgrade cleared of any debris prior to excavation. Loose soils beneath foundation components will require removal and recompaction. Any expansive soils encountered beneath the foundation will require removal and replacement with non-expansive structural fill compacted according to the "Structural Fill" paragraph. Any new fill should be placed to the requirements of the "Structural Fill" paragraph. On-site granular sands may be used as structural fill as approved by Entech.

Any import material should be approved by Entech prior to hauling to the site. It is anticipated that large rock (8 to 12 inches) may be required to stabilize the subgrade. Geogrid may also be required to establish a stable subgrade in the creek bed.

Provided the above recommendations are followed, an allowable bearing pressure of 2400 psf is recommended for recompacted site sands and for imported granular structural fill, an allowable bearing capacity of 3000 psf is recommended. Footings should extend a minimum of 30 inches below the adjacent exterior surface grade for frost protection. Following the above foundation subgrade preparation recommendations, and adhering to the recommended maximum allowable bearing pressure, it is expected to result in foundation designs which should limit total and differential vertical movements to one inch and ½ inch, respectively.

Foundation excavations are recommended to extend at least 3 feet horizontally beyond the foundation limits in order to provide adequate space for installation of drain materials (if necessary) and placement of controlled fill. All foundation excavation side slopes should be inclined at angles of 1½ horizontal to 1 vertical or flatter, as necessary, to provide for excavation sidewall stability during construction or as required by OSHA regulations.

Entech should observe overexcavated subgrades as well as the overall foundation excavation subgrade and evaluate if the exposed conditions are consistent with those described in this report. Entech should also provide recommendations for overexcavation depth and other subgrade improvements, if necessary, and the need for drain systems based on the excavation conditions observed at that time.

5.1.3 Retaining Wall Parameters

The following values are recommended for use in designing retaining walls with unbalanced lateral loading that may be associated with this project. Roadway/Vehicle surcharge loading is required for wall design.

Recommended Design Values – Lateral Loading

Equivalent fluid density for lateral earth pressure (active), pcf (site granular soils)	45
Equivalent fluid density for lateral earth pressure (passive), pcf	300
Equivalent fluid density for lateral earth pressure (at rest), pcf	60
Soil density (compacted sand), pcf	125
Angle of Internal Friction (loose silty sand)	26°
Angle of Internal Friction (compacted silty sand)	34°
Coefficient of sliding between concrete and silty gravelly sand	0.35
Bearing capacity of sand, psf	2400 psf
Bearing capacity of sandstone, psf	3500 psf

*Note: The above lateral loading design values are for level back slope angles and no surcharge loads. If wall backfill is submerged, water pressures must be taken into account as additional wall loading. If backfill slope angles are greater than zero degrees, or if the backfill is surcharged, the design values must be adjusted to account for additional lateral loading.

Structures associated with the bridges can be supported with shallow foundations resting on a uniform bearing pad of structural fill/stabilized soils. It should be noted that due to shallow groundwater on this site and the active West Kiowa Creek, extensive subgrade improvements are anticipated to support shallow foundations. The foundation members should bear on uniform pad (minimum 2 to 3 feet thick) of structural fill placed according to the "Structural Fill" paragraph. Any topsoil or highly organic soils must be removed and the existing subgrade cleared of any debris prior to excavation. Loose soils beneath foundation components will require removal and recompaction. Areas that require stabilization will likely use shot rock and geogrids/geofabrics. Specific recommendations should be field determined during grading. Any expansive soils encountered beneath the foundation will require removal and replacement with non-expansive structural fill compacted according to the "Structural Fill" paragraph. Any new fill should be placed to the requirements of the "Structural Fill" paragraph. On-site granular sands may be used as structural fill as approved by Entech. Any import material should be approved by Entech prior to hauling to the site.

Provided the above recommendations are followed, an allowable bearing pressure of 2400 psf is recommended for recompacted site sands and for imported granular structural fill, an allowable bearing capacity of 3000 psf is recommended. Footings should extend a minimum of 30 inches below the adjacent exterior surface grade for frost protection. Following the above foundation subgrade preparation recommendations, and adhering to the recommended maximum allowable bearing pressure, it is expected to result in foundation designs which should limit total and differential vertical movements to one inch and ½ inch, respectively.

Foundation excavations are recommended to extend at least 3 feet horizontally beyond the foundation limits in order to provide adequate space for installation of drain materials (if necessary) and placement of controlled fill. All foundation excavation side slopes should be inclined at angles of 1½ horizontal to 1 vertical or flatter, as necessary, to provide for excavation sidewall stability during construction or as required by OSHA regulations.

Entech should observe overexcavated subgrades as well as the overall foundation excavation subgrade and evaluate if the exposed conditions are consistent with those described in this report. Entech should also provide recommendations for overexcavation depth and other subgrade improvements, if necessary, and the need for drain systems based on the excavation conditions observed at that time.

5.2 Site Seismic Classification

Based on the subsurface conditions encountered at the site and in accordance with Section 1613 of the 2015 International Building Code (IBC), the site meets the conditions of a Site Class D.

5.3 Surface and Subsurface Drainage

Positive surface drainage must be maintained around structures to minimize infiltration of surface water. A minimum gradient of 5 percent in the first 10 feet adjacent to foundation components is recommended. A minimum gradient of 2 percent is recommended for paved areas. All grades should be directed away from structures.

5.4 Concrete

Soluble sulfate testing was conducted on samples of the site soils to evaluate the potential for sulfate attack on concrete placed below the surface grade. The test results indicated 0.00 to less than 0.01 percent soluble sulfate by weight for the site soils. The test results indicate the sulfate component of the in-place site soils present a negligible exposure threat to concrete placed below grade that comes into contact with the site soils.

Type II cement is recommended for concrete at this site. To further avoid concrete degradation during construction it is recommended that concrete not be placed on frozen or wet ground. Care should be taken to prevent the accumulation or ponding of water in foundation excavations prior to the placement of concrete. If standing water is present in the foundation excavations, it should be removed by ditching to sumps and pumping the water away from the foundation area prior to concrete placement. If concrete is placed during periods of cold temperatures, the concrete must be kept from freezing. This may require covering the concrete with insulated blankets and adding heat to prohibit freezing.

5.5 Foundation Excavation Observations

Subgrade preparation for bridge foundations and associated improvements should be observed by Entech Engineering prior to construction of the foundation elements in order to verify that (1) no anomalies are present, (2) materials of the proper bearing capacity have been encountered or placed, and (3) no soft, loose, uncontrolled fill material, expansive soil or debris are present in the foundation area prior to concrete placement or backfilling. Pile driving should be observed to verify proper embedment or refusal. Piles should be driven 10 feet into bedrock or refusal. Entech should make final recommendations for over-excavation or stabilization, if required, at the time of excavation observation, if necessary.

5.6 Structural Fill

Areas to receive fill should have all topsoil, organic material or debris removed. Fill must be properly benched. The surface should be scarified and moisture conditioned to within ±2 percent of its optimum moisture content and compacted to 95 percent of its maximum Modified Proctor Dry Density (ASTM D-1557) beneath footings or floor slabs prior to placing new fill.

New fill beneath footings should be non-expansive and be placed in thin lifts not to exceed 6 inches after compaction while maintaining at least 95 percent of its maximum Modified Proctor Dry Density (ASTM D-1557). These materials should be placed at a moisture content conducive to compaction, usually ±2 percent of Proctor optimum moisture content. The placement and compaction of fill should be observed and tested by Entech Engineering, Inc. Imported soils should be approved by Entech Engineering, Inc. prior to being hauled to the site and on-site granular soils prior to placement.

Compacted, non-expansive granular soil, free of organics, debris and cobbles greater than 3-inches in diameter, is recommended for filling foundation components. All fill placed within the foundation areas should be non-expansive and be compacted to a minimum of 95 percent of the soils maximum dry density as determined by the Modified Proctor Test (ASTM D-1557). Fill material placed beneath slabs should be compacted to a minimum of 95 percent of its maximum Modified Proctor Dry Density, ASTM D-1557. Fill material should be placed in horizontal lifts such that each finished lift has a compacted thickness of six inches or less. Fill should be placed at water contents conducive to achieving adequate compaction, usually within ±2 percent of the optimum water content as determined by ASTM D-1557. Mechanical methods can be used for placement and compaction of fill; however, heavy equipment should be kept at distance from the structure to avoid overstressing. No water flooding techniques of any type should be used for compaction or placement of fill material.

5.7 Utility Trench Backfill

Fill placed in utility trenches should be compacted to a minimum of 95 percent of its maximum dry density as determined by the Standard Proctor Test (ASTM D-698) for cohesive soils and 95 percent as determined by the Modified Proctor Test (ASTM D-1557) for cohesionless soils. Fill should be placed in horizontal lifts having a compacted thickness of six inches or less and at a water content conducive to adequate compaction, within ±2 percent of the optimum water content. Mechanical methods should be used for fill placement; however, heavy equipment should be kept at a distance from foundation walls. No water flooding techniques of any type should be used for compaction or placement of utility trench fill.

Trench backfill placement should be performed in accordance with El Paso County specifications. All excavation and excavation shoring/bracing should be performed in accordance with OSHA guidelines.

5.8 General Backfill

Any areas to receive fill outside the foundation limits should have all topsoil, organic material, and debris removed. Fill must be properly benched into existing slopes in order to be adequately compacted. The fill receiving surface should be scarified to a depth of 12-inches and moisture conditioned to ± 2 percent of the optimum water content, and compacted to a minimum of 95 percent of the ASTM D-1557 maximum dry density before the addition of new fill. Fill should be placed in thin lifts not to exceed 6 inches in thickness after compaction while maintaining at least 95 percent of the ASTM D-1557 maximum dry density. Fill material should be free of vegetation and other unsuitable material and shall not contain rocks or fragments greater than 3-inches. Topsoil and strippings should be segregated from all other fill sources on the site. Fill placement and compaction beneath and around foundations, in utility trenches, beneath roadways or other structural features of the project should be observed and tested by Entech during construction.

5.9 Excavation Stability

Excavation sidewalls must be properly sloped, benched and/or otherwise supported in order to maintain stable conditions. All excavation openings and work completed therein shall conform to OSHA Standards as put forward in CFR 29, Part 1926.650-652, (Subpart P).

5.10 Winter Construction

In the event construction of the planned construction occurs during winter, foundations and subgrades should be protected from freezing conditions. Concrete should not be placed on frozen soil and once concrete has been placed, it should not be allowed to freeze. Similarly, once exposed, the foundation subgrade should not be allowed to freeze. During site grading and subgrade preparation, care should be taken to eliminate burial of snow, ice or frozen material within the planned construction area.

5.11 Construction Observations

It is recommended that Entech observe and document the following activities during construction of the building foundations.

- Excavated subgrades and subgrade preparation.
- H-Pile Installation
- Placement of drains (if installed).
- Placement/compaction of fill material for the foundation components and retaining walls.
- Placement/compaction of utility bedding and trench backfill.

6.0 CLOSURE

The subsurface investigation, geotechnical evaluation and recommendations presented in this report are intended for use of Winsome, LLC with application to the construction of two culvert crossings over West Kiowa Creek for Alamar Way and Twinkling Star Lane in the Winsome Subdivision located in northeastern El Paso County, Colorado. In conducting the subsurface investigation, laboratory testing, engineering evaluation and reporting, Entech Engineering, Inc. endeavored to work in accordance with generally accepted professional geotechnical and geologic practices and principles consistent with the level of care and skill ordinarily exercised by members of the geotechnical profession currently practicing in same locality and under similar conditions. No other warranty, expressed or implied is made. During final design and/or construction, if conditions are encountered which appear different from those described in this report, Entech Engineering, Inc. requests that it be notified so that the evaluation and recommendations presented herein can be reviewed and modified as appropriate.

If there are any questions regarding the information provided herein or if Entech Engineering, Inc. can be of further assistance, please do not hesitate to contact us.

TABLE

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT WINSOME LLC
PROJECT WINSOME, FILING 3
JOB NO. 211992

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	SULFATE (WT %)	FHA SWELL (PSF)	SWELL/ CONSOL (%)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION
1	1	2-3			18.7	NV	NP	<0.01			SM	SAND, SILTY
1	2	5			15.8	NV	NP				SM	SAND, SILTY
1	4	5			22.5				60		SM	SAND, SILTY
1	1A	2-3			7.2	NV	NP	<0.01			SM-SW	SAND, SLIGHTLY SILTY
1	3A	1-2			4.7						SW	SAND
1	4A	5			9.5						SM-SW	SAND, SLIGHTLY SILTY
2	3	15			22.1	NV	NP	0.00			SM	SANDSTONE, SILTY
3	2A	15			90.2	43	21	<0.01	1690		CL	CLAYSTONE, SANDY

TABLE 2

Alamar Way and Twinkling Star Lane over West Kiowa Creek Bridge - LPile Design Parameters

Depth Below Existing Ground Surface		Groundwater Elevation (ft) Below Existing Ground	Soil/Rock Description	Axial Pile Capacity Parameters		PRELIMINARY LPile Parameters					
Top	Bottom			Allowable Side Resistance (ksf)	Allowable End Bearing (ksf)	p-y Curve	Unit Weight γ[1] (pcf)	Peak Friction Angle ϕ (deg)	Initial Static Modulus of Subgrade Reaction, k (pci)	Undrained Cohesion s_u (psf)	Strain Factor ε_{50} (in/in)
0	0 to 15 BOE	2 to 9	Slightly Silty Sand	—	—	Sand	120 62[1]	32	25 20[1]	N/A	N/A
14	15 to 20 BOE		Slightly Silty Sandstone	3	30	Sand	125 67[1]	34	225 125[1]	N/A	N/A
14	20 BOE		Sandy Claystone	3	30	Clay	115 57[1]	N/A	500	1500	0.007

[1] = Submerged

FIGURES

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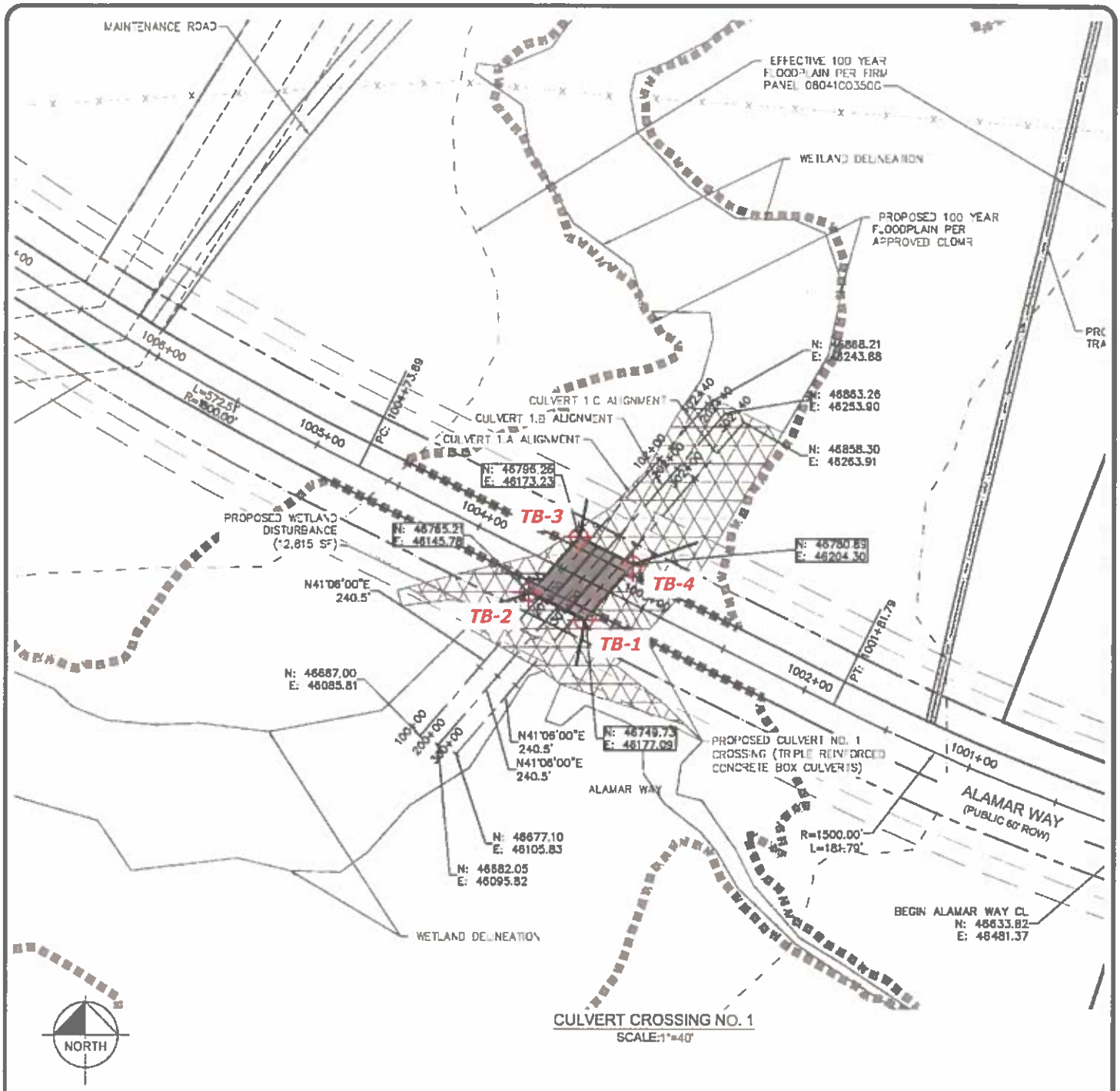
565 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

VICINITY MAP
WINSOME SUBDIVISION – W. KIOWA CREEK
BOX CULVERT CROSSINGS
EL PASO COUNTY, CO
FOR: WINSOME, LLC

DRAWN:	DATE:	CHECKED:	DATE:
LLL	9/16/21		

JOB NO.: 211992

FIG NO.: 1



TB- APPROXIMATE TEST BORING LOCATION AND NUMBER

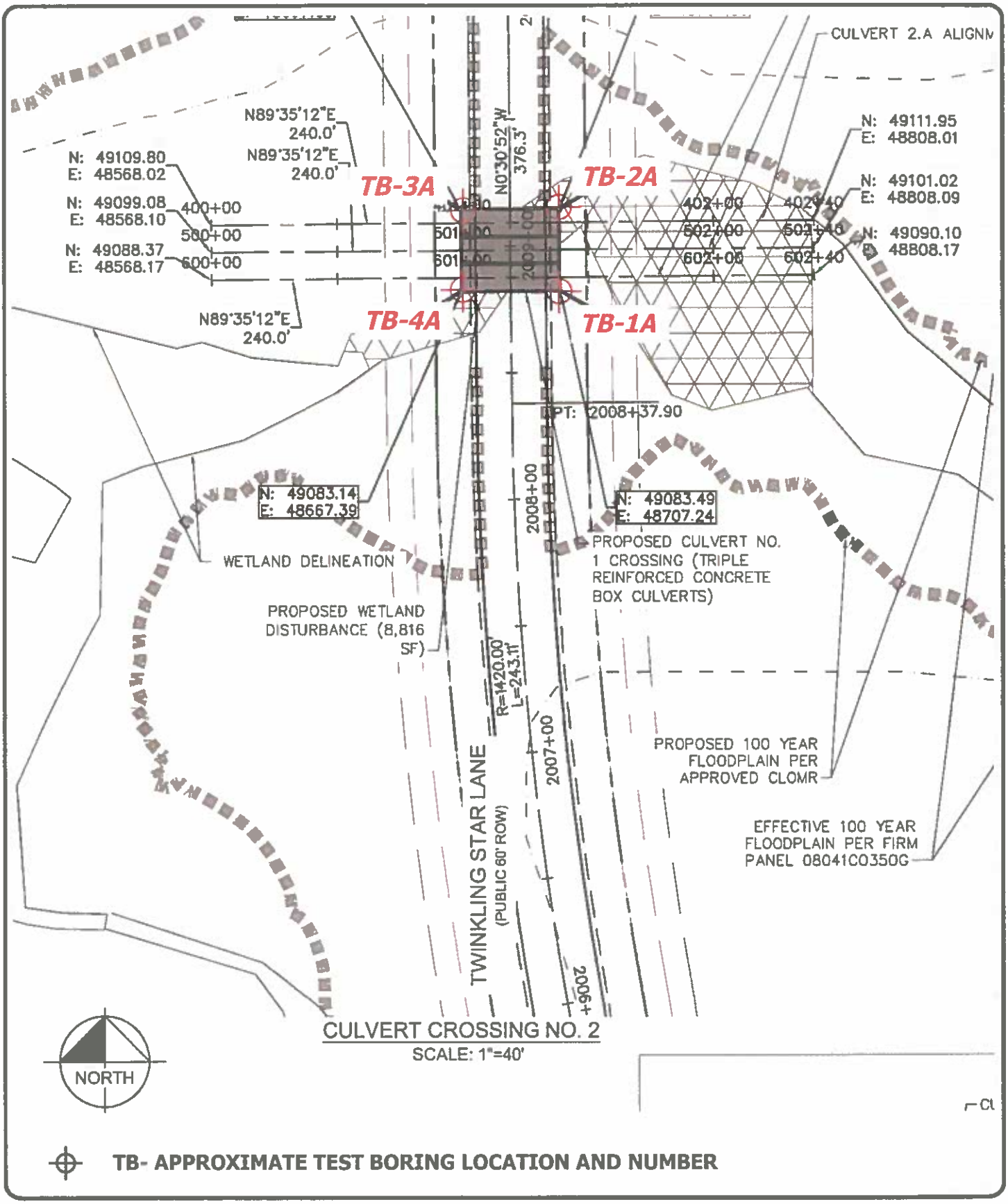
ENTECH ENGINEERING, INC.
303 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

SITE PLAN/TEST BORING LOCATION MAP
WINSOME SUBDIVISION – W. KIOWA CREEK
BOX CULVERT CROSSING NO. 1
EL PASO COUNTY, CO
FOR: WINSOME, LLC

DRAWN:	DATE:	CHECKED:	DATE:
LLL	9/16/21		

JOB NO.: 211992

FIG NO.: 2



CULVERT CROSSING NO. 2

SCALE: 1"=40'

TB- APPROXIMATE TEST BORING LOCATION AND NUMBER

ENTECH ENGINEERING, INC.
385 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

SITE PLAN/TEST BORING LOCATION MAP
WINSOME SUBDIVISION – W. KIOWA CREEK
BOX CULVERT CROSSING NO. 2
EL PASO COUNTY, CO
FOR: WINSOME, LLC

DRAWN:	DATE:	CHECKED:	DATE:
LLL	9/16/21		

JOB NO.: 211992

FIG NO.: 3

APPENDIX A: Test Boring Logs

TEST BORING NO. 1
DATE DRILLED 8/28/2021
Job # 211992

REMARKS

BRIDGE 1

WATER @ 2', 8/28/21

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
SAND, SILTY, FINE TO COARSE GRAINED, GRAY BROWN, VERY LOOSE TO MEDIUM DENSE, WET					
5			2	18.3	1
10			4	28.0	1
WEATHERED SANDSTONE, SILTY, BROWN 15			24	9.2	1
20					

TEST BORING NO. 2
DATE DRILLED 8/28/2021
CLIENT WINSOME LLC
LOCATION WINSOME, FILING 3

REMARKS

BRIDGE 1

WATER @ 4', 8/28/21

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
SAND, SILTY, FINE TO COARSE GRAINED, GRAY BROWN, LOOSE, WET					
5			4	16.4	1
10			7	24.0	1
SANDSTONE, SILTY, FINE TO COARSE GRAINED, GRAY BROWN, VERY DENSE, WET 15			50/8"	8.8	2
20			50/8"	10.2	2

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ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:	DATE:	CHECKED: LLL	DATE: 9/8/21

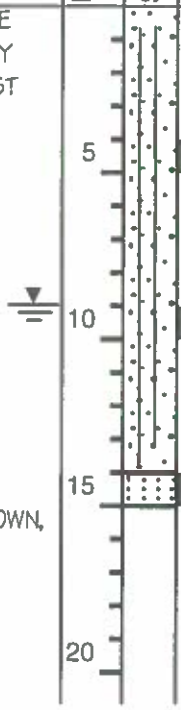
JOB NO. 211992
FIG NO. A- 1

TEST BORING NO. 3
DATE DRILLED 8/28/2021
Job # 211992

REMARKS

BRIDGE 1

WATER @ 9', 8/28/21



Depth (ft)	Samples	Blows per foot	Watercontent %	Soil Type
5		3	33.8	1
10		2	10.5	1
15		50 8"	10.2	2
20				

SAND, SILTY, FINE TO COARSE GRAINED, GRAY BROWN, VERY LOOSE TO VERY DENSE, MOIST TO WET

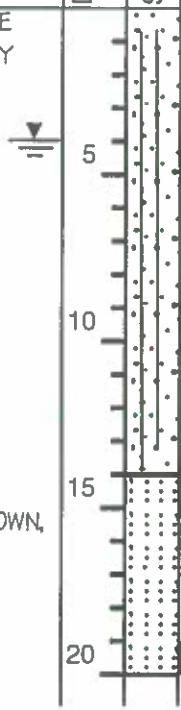
SANDSTONE, SILTY, FINE TO COARSE GRAINED, GRAY BROWN, VERY DENSE, WET

TEST BORING NO. 4
DATE DRILLED 8/28/2021
CLIENT WINSOME LLC
LOCATION WINSOME, FILING 3

REMARKS

BRIDGE 1

WATER @ 4', 8/28/21



Depth (ft)	Samples	Blows per foot	Watercontent %	Soil Type
5		2	15.0	1
10		3	20.3	1
15		50 9"	16.5	2
20		50	13.7	2

SAND, SILTY, FINE TO COARSE GRAINED, GRAY BROWN, VERY LOOSE TO VERY DENSE, WET

SANDSTONE, SILTY, FINE TO COARSE GRAINED, GRAY BROWN, VERY DENSE TO DENSE, WET

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TEST BORING LOG

DRAWN	DATE	CHECKED:	DATE:
		LLL	9/8/21

JOB NO. 211992

FIG NO. A- 2

TEST BORING NO. 1 A
DATE DRILLED 8/28/2021
Job # 211992

REMARKS

BRIDGE 2

WATER @ 4', 8/28/21

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, GRAY BROWN, LOOSE, WET					
5			4	12.2	1
10			5	11.7	1
CLAYEY LENS					
WEATHERED SANDSTONE, CLAYEY, BROWN 15			22	11.3	2
20					

TEST BORING NO. 2 A
DATE DRILLED 8/28/2021
CLIENT WINSOME LLC
LOCATION WINSOME, FILING 3

REMARKS

BRIDGE 2

WATER @ 4', 8/28/21

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
SAND, SILTY, FINE TO COARSE GRAINED, GRAY BROWN, LOOSE, WET					
5			7	12.8	1
10			3	26.7	1
CLAYSTONE, SANDY, BROWN, HARD, WET 15			50/9"	13.6	3
20			50/11"	12.9	3

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
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JOB NO. 211992

FIG NO. A- 3

TEST BORING NO. 3 A
DATE DRILLED 8/28/2021
Job # 211992

REMARKS

BRIDGE 2

WATER @ 4', 8/28/21

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			*	9.5	1
5			4	23.5	1
10			5	23.6	1
15			27	12.9	1
					2
20					

SAND, CLEAN TO SILTY, FINE TO COARSE GRAINED, GRAY BROWN TO DARK BROWN, LOOSE TO MEDIUM DENSE, MOIST TO WET

WEATHERED SANDSTONE, CLAYEY, BROWN

* - BULK SAMPLE TAKEN

TEST BORING NO. 4 A
DATE DRILLED 8/28/2021
CLIENT WINSOME LLC
LOCATION WINSOME, FILING 3

REMARKS

BRIDGE 2

WATER @ 4', 8/28/21

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			4	13.0	1
10			6	4.8	1
15			50/3"	12.6	2
20					

SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, TAN, LOOSE TO VERY DENSE, WET

SANDSTONE, SILTY, FINE TO COARSE GRAINED, GRAY BROWN, VERY DENSE, WET

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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

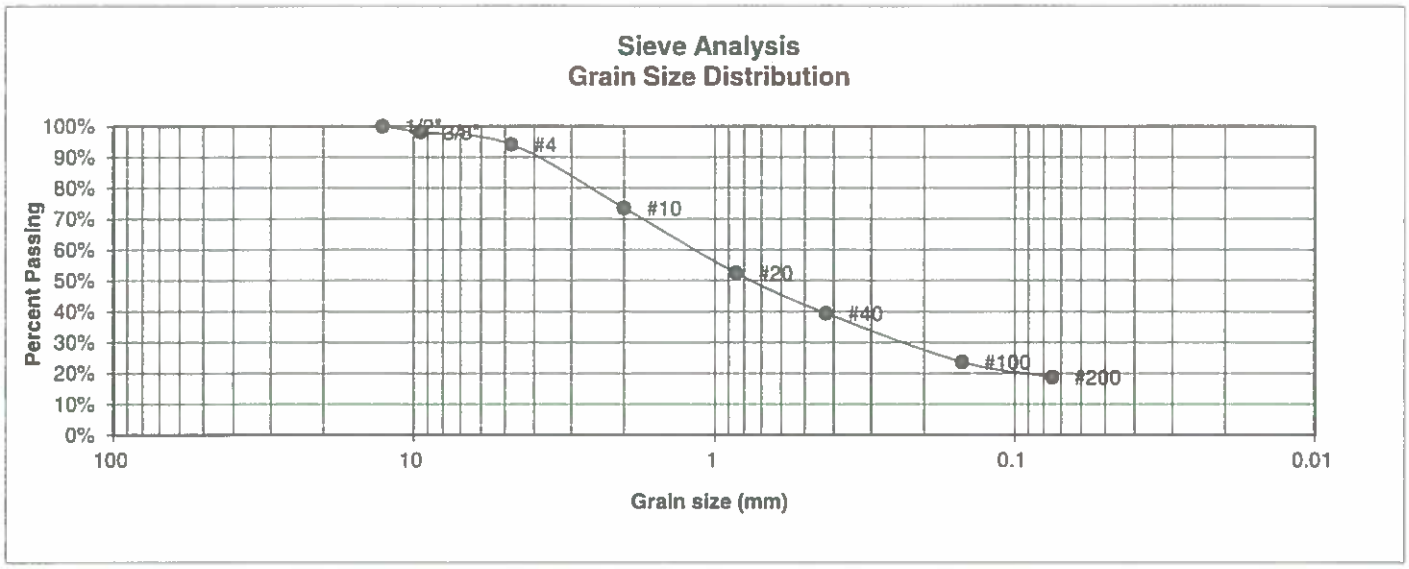
DRAWN:	DATE:	CHECKED:	DATE:
		LLL	9/8/21

JOB NO. 211992

FIG NO. A- 4

APPENDIX B: Laboratory Test Results

UNIFIED CLASSIFICATION	SM	CLIENT	WINSOME LLC
SOIL TYPE #	1	PROJECT	WINSOME, FILING 3
TEST BORING #	1	JOB NO.	211992
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	98.2%
4	94.1%
10	73.6%
20	52.5%
40	39.5%
100	23.7%
200	18.7%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)

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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

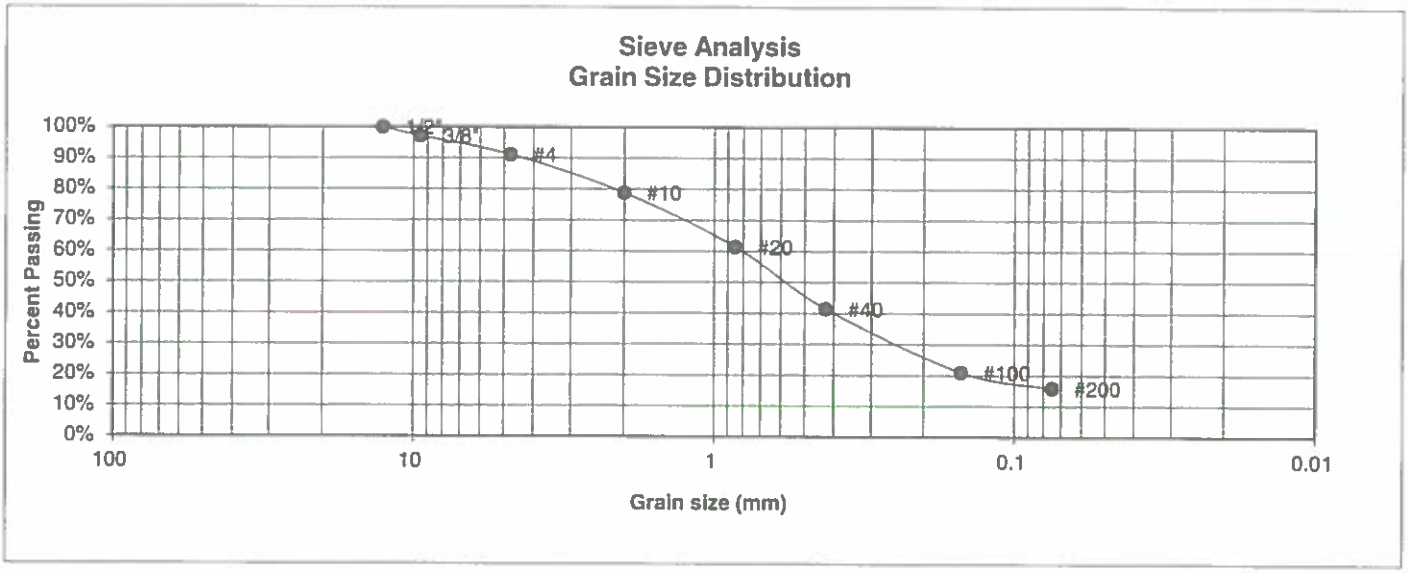
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	9/8/21

JOB NO.: 211992

FIG NO.: B-1

UNIFIED CLASSIFICATION	SM	CLIENT	WINSOME LLC
SOIL TYPE #	1	PROJECT	WINSOME, FILING 3
TEST BORING #	2	JOB NO.	211992
DEPTH (FT)	5	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	97.2%
4	91.1%
10	78.8%
20	61.4%
40	41.4%
100	21.0%
200	15.8%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

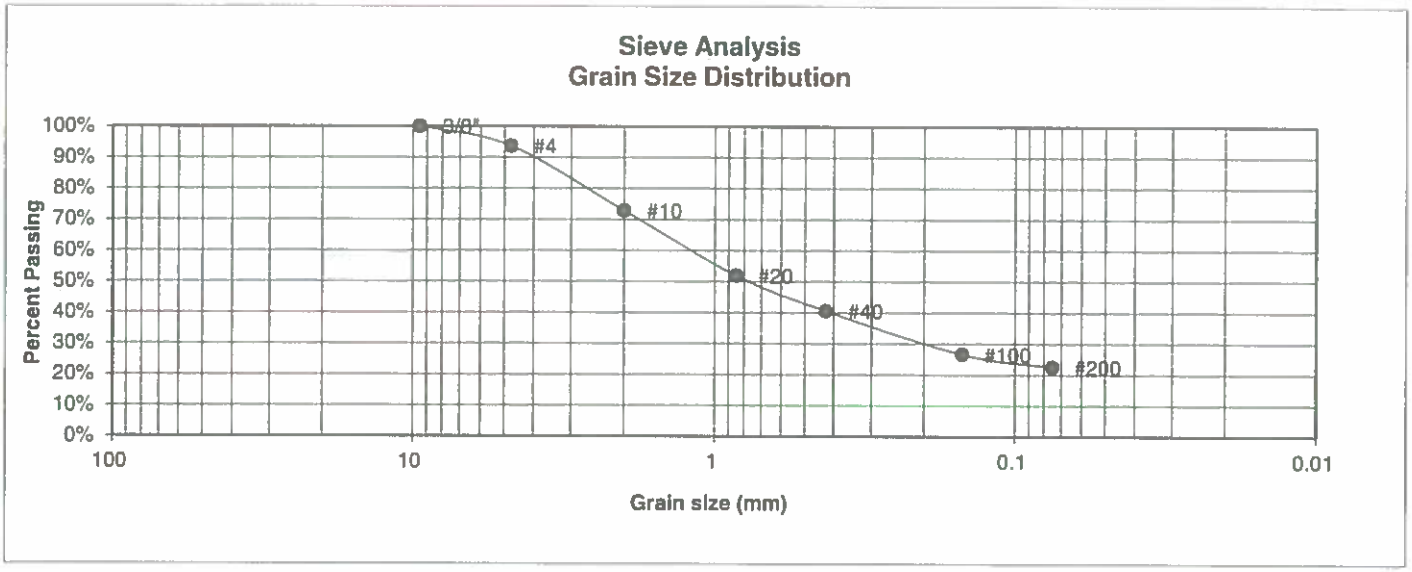
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	9/8/21

JOB NO. 211992

FIG NO. B-2

UNIFIED CLASSIFICATION	SM	CLIENT	WINSOME LLC
SOIL TYPE #	1	PROJECT	WINSOME, FILING 3
TEST BORING #	4	JOB NO.	211992
DEPTH (FT)	5	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	93.7%
10	72.8%
20	52.0%
40	40.6%
100	26.6%
200	22.5%

Atterberg Limits

Plastic Limit	
Liquid Limit	
Plastic Index	

Swell

Moisture at start	9.9%
Moisture at finish	19.7%
Moisture increase	9.8%
Initial dry density (pcf)	104
Swell (psf)	60

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COLORADO SPRINGS, COLORADO 80907

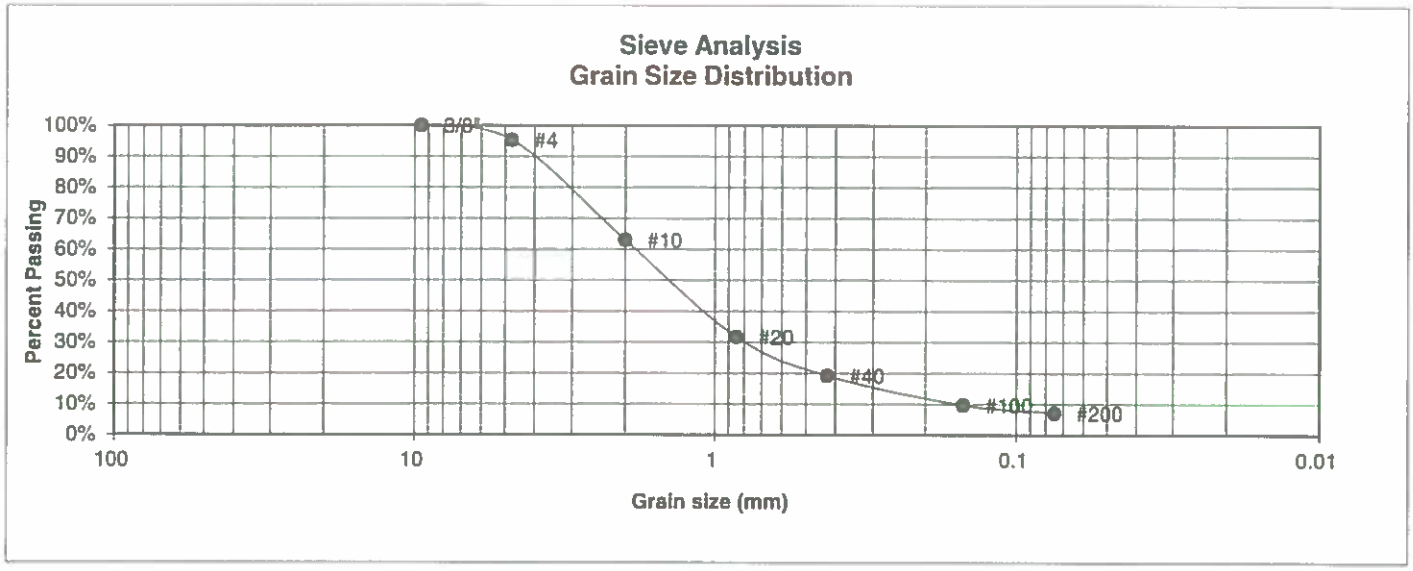
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	9/8/21

JOB NO.: 211992

FIG NO.: B-3

UNIFIED CLASSIFICATION	SM-SW	CLIENT	WINSOME LLC
SOIL TYPE #	1	PROJECT	WINSOME, FILING 3
TEST BORING #	1A	JOB NO.	211992
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	95.3%
10	63.0%
20	31.8%
40	19.2%
100	9.8%
200	7.2%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)

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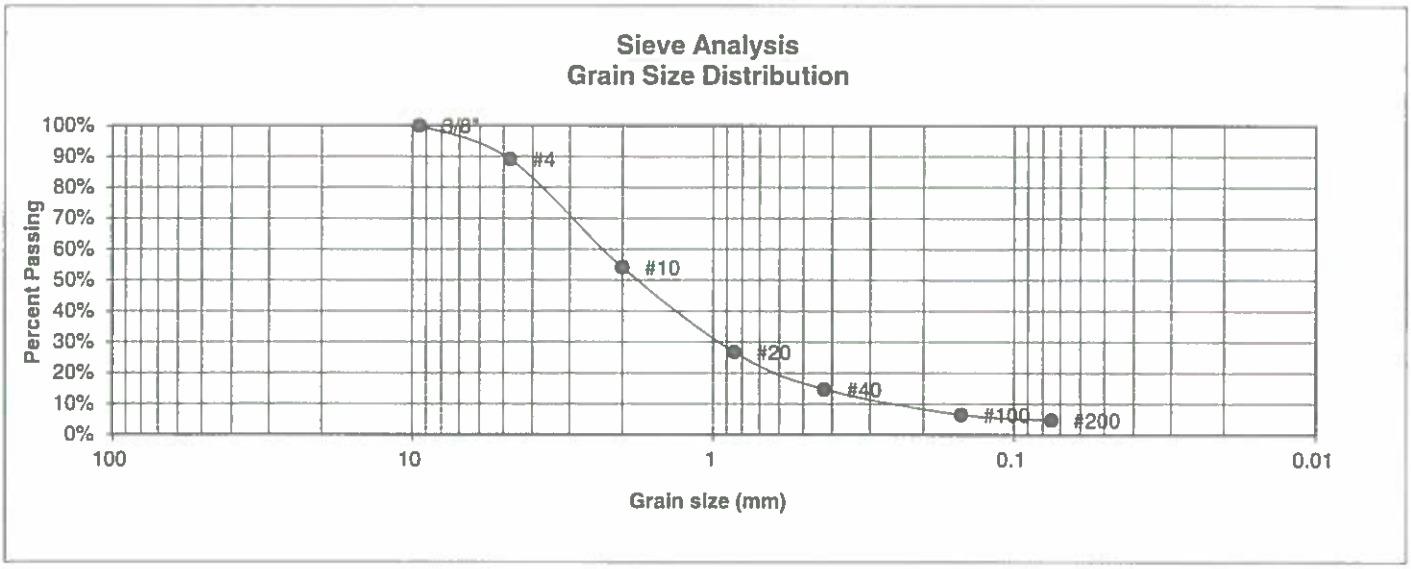
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	9/8/21

JOB NO. 211992

FIG NO. B-4

UNIFIED CLASSIFICATION	SW	CLIENT	WINSOME LLC
SOIL TYPE #	1	PROJECT	WINSOME, FILING 3
TEST BORING #	3A	JOB NO.	211992
DEPTH (FT)	1-2	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	89.1%
10	54.1%
20	26.8%
40	14.7%
100	6.5%
200	4.7%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

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COLORADO SPRINGS, COLORADO 80907

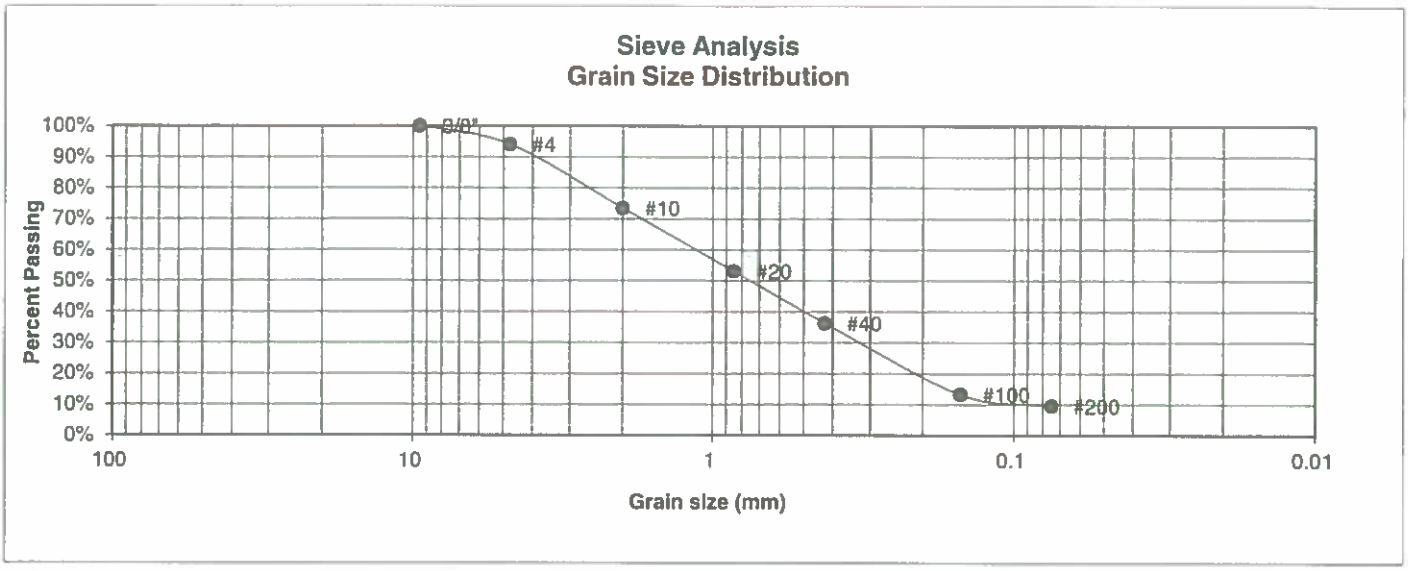
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	9/8/21

JOB NO.: 211992

FIG NO.: B-5

UNIFIED CLASSIFICATION	SM-SW	CLIENT	WINSOME LLC
SOIL TYPE #	1	PROJECT	WINSOME, FILING 3
TEST BORING #	4A	JOB NO.	211992
DEPTH (FT)	5	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	94.1%
10	73.5%
20	53.1%
40	36.3%
100	13.3%
200	9.5%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

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COLORADO SPRINGS, COLORADO 80907

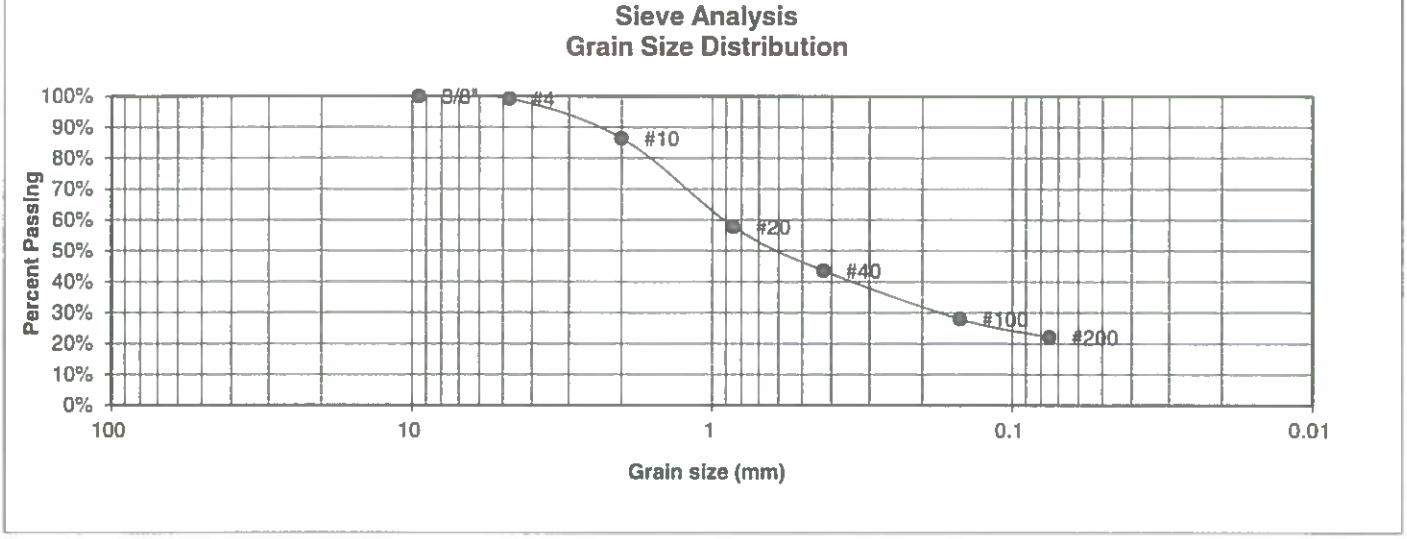
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	9/8/21

JOB NO.: 211992

FIG NO.: B-6

UNIFIED CLASSIFICATION	SM	CLIENT	WINSOME LLC
SOIL TYPE #	2	PROJECT	WINSOME, FILING 3
TEST BORING #	3	JOB NO.	211992
DEPTH (FT)	15	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.2%
10	86.4%
20	57.8%
40	43.6%
100	28.0%
200	22.1%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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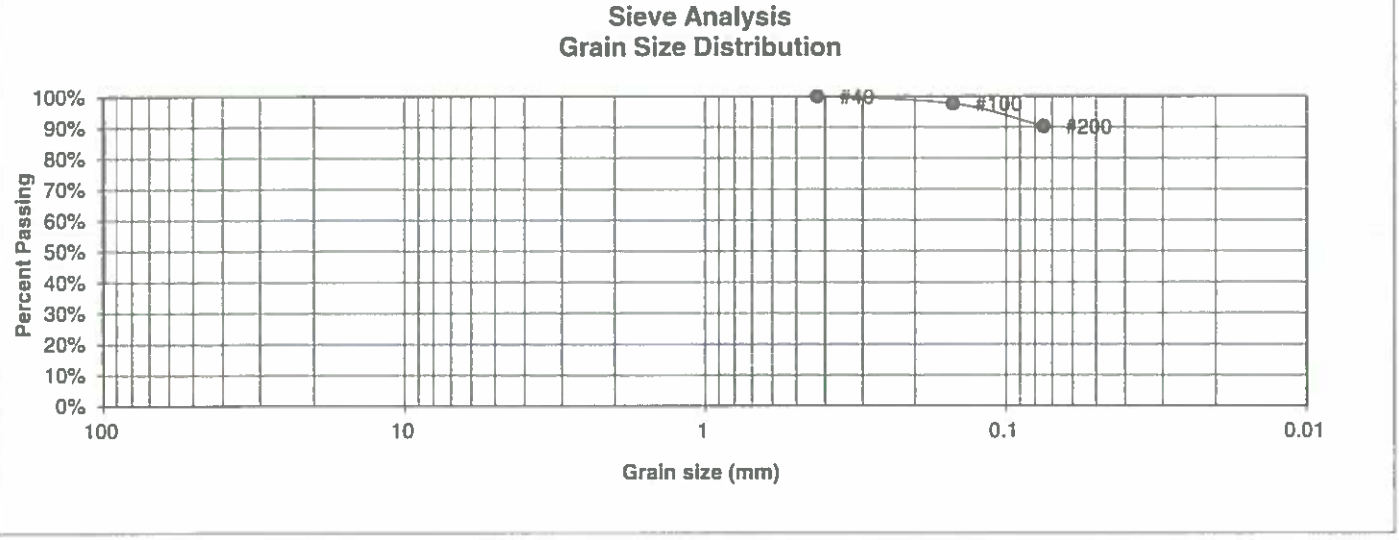
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	9/8/21

JOB NO.: 211992

FIG NO.: B-7

UNIFIED CLASSIFICATION	CL	CLIENT	WINSOME LLC
SOIL TYPE #	3	PROJECT	WINSOME, FILING 3
TEST BORING #	2A	JOB NO.	211992
DEPTH (FT)	15	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	
20	
40	100.0%
100	97.6%
200	90.2%

Atterberg Limits	
Plastic Limit	22
Liquid Limit	43
Plastic Index	21

Swell	
Moisture at start	15.5%
Moisture at finish	23.0%
Moisture increase	7.4%
Initial dry density (pcf)	100
Swell (psf)	1690

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LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	9/8/21

JOB NO.: 211992

FIG NO.: B-8

CLIENT	WINSOME LLC	JOB NO.	211992
PROJECT	WINSOME, FILING 3	DATE	9/8/2021
LOCATION	WINSOME, FILING 3	TEST BY	BL

BORING NUMBER	DEPTH, (ft)	SOIL TYPE NUMBER	UNIFIED CLASSIFICATION	WATER SOLUBLE SULFATE, (wt%)
TB-1	2-3	1	SM	<0.01
TB-1A	2-3	1	SM	<0.01
TB-3	15	2	SM-SW	0.00
TB-2A	15	3	CL	<0.01

QC BLANK PASS

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COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST
SULFATE RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	9/8/21

JOB NO. 211992

FIG NO. B-9