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GEOTECHNICAL AND PAVEMENT DESIGN REPORT
10707 MALTESE POINT
PEYTON, COLORADO

Prepared for:
WD Construction
919 W. Cucharras Street, Suite 100
Colorado Springs, CO 80905

Attn: Bill Tibbit

March 25, 2024

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Stuart Wood
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SW:JCG/

Entech Job No. 240324

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ENTECH ENGINEERING, INC.

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1 Introduction

Entech Engineering Inc. (Entech) completed this geotechnical and pavement design report for a new building and associated site improvements located at 10707 Maltese Point in Peyton, Colorado. This report describes the subsurface exploration program conducted at the site and provides recommendations for foundation design, pavement design sections, and construction considerations. Our services were completed for WD Construction in accordance with our geotechnical and pavement design service agreement dated February 9, 2024. The contents of this report, including the geotechnical evaluation and recommendations, are subject to the limitations and assumptions presented in Section 8.

2 Project and Site Description

We understand that the project will consist of the construction of a new 8,950 square foot metal frame structure and associated site improvements to be located at 10707 Maltese Point in Peyton, Colorado. The location of the project site is shown on the Vicinity Map (Figure 1). Site improvements include an access lane and passenger vehicle parking lot to be paved with asphalt.

At the time of drilling, the property was a large flat vacant lot. Vegetation consists of sparse native grass and weeds. Building loads are expected to be light to moderate. The property is surrounded by large vacant to commercial lots. We understand that a detention pond will be located at the south side of the property.

3 Subsurface Explorations and Laboratory Testing

3.1 Subsurface Exploration Program

Subsurface conditions at the project site were explored by five test borings, designated TB-1 through TB-5, drilled on March 6, 2024 at the approximate locations shown on the Site and Exploration Plan (Figure 2). Three of the borings were drilled within the footprint of the proposed building. Two additional borings were drilled in the parking lot and access drive to provide pavement design recommendations. The borings in the building footprints were drilled to depths of 20 feet below the existing ground surface (bgs), the borings drilled in the parking and drive areas were drilled to depths of 10 feet bgs. The drilling was performed using a truck-mounted, continuous flight auger drill rig supplied and operated by Entech. Descriptive boring logs providing the lithologies of the subsurface conditions encountered during drilling are presented in Appendix A. Groundwater levels were measured in each of the open boreholes at the conclusion of drilling.

Soil and bedrock samples were obtained from the borings utilizing the Standard Penetration Test (ASTM D1586) using a split-barrel California sampler. Results of the Standard Penetration Test (SPT) are included on the boring logs in terms of N-values expressed in blows per foot (bpf). Soil and bedrock samples recovered from the borings were visually classified and recorded on the boring logs. The soil and bedrock classifications were later verified utilizing laboratory testing and grouped by soil type. The soil and bedrock type numbers are included on the boring logs. It should be understood that the soil and bedrock descriptions shown on the boring logs may vary between boring locations and sample depths. It should also be noted that the lines of stratigraphic separation shown on the boring logs represent approximate boundaries between soil and bedrock types and the actual stratigraphic transitions may be more gradual or variable with location.

3.2 Geotechnical Index and Engineering Property Testing

Water content testing (ASTM D2216) was performed on the samples recovered from the borings and the results are shown on the boring logs. Grain-Size Analysis (ASTM D422) and Atterberg Limits testing (ASTM D4318) were performed on selected samples to assist in classifying the materials encountered in the borings. One-dimensional swell or collapse testing (ASTM D4546) was performed to evaluate the expansive characteristics and collapse potential of the soil. Soluble sulfate testing was performed on select soil samples to evaluate the potential for below-grade degradation of concrete due to sulfate attack.

For pavement design, a Modified Proctor (ASTM D1557) and California Bearing Ratio (CBR) test (ASTM D1883) were completed on a bulk sample from the roadway subgrade. The Laboratory Testing Results are presented in Appendix B and summarized in Table B-1.

4 Subsurface Conditions

Two primary soil types and two bedrock types were encountered in the test borings drilled for the subsurface exploration program. Each soil and bedrock type was classified in accordance with the Unified Soil Classification System (USCS) and the American Association of State Highway and Transportation Officials (AASHTO) soil classification system using the laboratory testing results and the observations made during drilling.

4.1 Soil and Bedrock

Subsurface conditions for the proposed project site consisted of native loose to medium dense silty sand to sand with silt (Soil Type 1) encountered in all the test borings from the existing ground surface and extended to depths of 7 to 13 feet bgs. Hard sandy clay (Soil Type 2) was encountered below the Soil Type 1 sands in three of the test borings at 7 to 9 feet and extended to depths of 12 to 14 feet or to the termination of the boring at 10 feet. Sandstone bedrock, or very dense clayey sand when classified as a soil (Soil Type 3), was encountered in borings TB-1, TB-2, and TB-3 at depths ranging from 13 to 18 feet and extended to the termination of the borings (20 feet). Claystone bedrock, or hard sandy clay when classified as a soil (Soil Type 4) was encountered overlying the sandstone bedrock in TB-2 and TB-3 beginning at 12 to 14 feet and extended to 16 to 18 feet. The AASHTO soil classifications of the subgrade Soil Type 1 was A-1-b, and A-4.

Swell or collapse testing on samples of the site clayey soils resulted in a volume change of 0.5%. The results indicate a low expansion potential. One dimensional swell or collapse testing on the claystone bedrock resulted in a volume change of 1.2% indicating a low to moderate expansion potential.

4.2 Groundwater

Depth to groundwater was measured in each of the borings at the conclusion of drilling. Groundwater was encountered in TB-1 at 5 feet and in TB-2 at 9 feet during, or subsequent to, drilling. It should be noted that groundwater levels could change due to seasonal variations, changes in land runoff characteristics, and future development of nearby areas.

5 Geotechnical Evaluation and Recommendations

The following discussion is based on the subsurface conditions encountered in the borings drilled in the planned lot for construction. 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.

As discussed in Section 2, we understand that the site will be developed with the construction of a new large metal building. The proposed building is expected to have a shallow foundation and slab on grade floors.

5.1 Shallow Foundations

Upon completion of proper subgrade preparation as described in Section 7.1.1, the proposed structure may be supported with a shallow spread footing foundation placed on dense and unyielding granular soils. The suitability of subgrades should be field determined.

Refer to Exhibit 1 for the recommended allowable bearing capacity value. Groundwater was encountered in borings TB-1 and TB-2 at 5 and 9 feet bgs, respectively. We recommend keeping all foundation components a minimum of 3 feet above the groundwater table if possible. Groundwater, if encountered near foundation grade, will likely create unstable subgrade conditions, and stabilization with shot rock and/or geogrid may be required as discussed in Section 7.1.2.

Shallow foundations shall not be placed on loose granular soil, cohesive soil, uncontrolled fill, or bedrock. Refer to Sections 7.1.1 for further discussion. Actual bearing capacities and the need for overexcavation will be verified at the time of the open excavation observation (Section 7.9).

For design, continuous spread footings are recommended to have a minimum width of 16 inches, and individual column footings for main support beams should have minimum plan dimensions of 24 inches on each side in order to avoid punching failure into the supporting subgrade soils. Exterior footings should extend a minimum of 30 inches below the adjacent exterior site grade for frost protection.

Foundation walls should be designed to resist lateral pressures generated by the soils used for backfill. Recommended active equivalent fluid density parameters for the on-site granular soils are provided in Exhibit 1. Clay soils (more than 50% passing the No. 200 sieve) are not recommended for backfill against the walls unless properly moisture conditioned. It should be noted that the equivalent design parameters apply to level backfill conditions. If sloping backfill conditions exist, pressures will increase substantially depending on the conditions adjacent to the walls. Surcharge loading should also be considered in wall designs. Equivalent fluid pressures for sloping conditions should be determined on an individual basis.

Exhibit 1: Foundation Design Parameters

Design Parameter	Value
Allowable Bearing Capacity [1]	
Recompacted site sands or granular fill	2,000 psf
Lateral Earth Pressure Equivalent Fluid Density [2]	
Active Conditions - Granular Backfill	40 pcf

pcf = pounds per cubic foot; psf = pounds per square foot

Notes:

1. Assumes a minimum embedment of 30 inches for frost protection.
2. Assumes level backfill conditions.

5.2 On-Grade Floor Slabs

On-grade floor slabs for the planned structure should be supported on moisture-conditioned, compacted, site granular soils, or imported granular fill prepared in accordance with Section 7.1.1. Any loose soils or uncontrolled fill encountered will require removal according to Section 7.1.1.

Grade-supported floor slabs should be separated from other building structural components and utility penetrations to allow for possible future vertical movement. Interior partition walls should be constructed in such a manner so as not to transfer slab movement into the overlying floor(s) and/or roof members, should slab movement occur. Control joints in grade-supported slabs are recommended at 10- to 15-foot perpendicular spacings to control cracking. If slab movement cannot be tolerated, a structural floor system should be used.

5.3 Detention Pond

We understand that a detention pond will be located on the south side of the project site. Based on boring TB-5 we anticipate silty sands to a depth of 9 feet overlying clayey sand. We recommend that detention pond slopes be constructed at 3H:1V (horizontal to vertical).

5.4 Seismic Site Classification

Based on the subsurface conditions encountered at the site, and in accordance with Section 1613 of the 2021 *International Building Code* (IBC), the site meets the conditions of Site Class D.

5.5 Surface and Subsurface Drainage

Positive surface drainage is recommended around the building's perimeter to minimize infiltration of surface water into the supporting foundation soils. A minimum ground surface slope of 5% in the first 10 feet adjacent to exterior foundation walls is recommended for unpaved areas. For paved areas and other impervious surfaces, a minimum slope of 2% is adequate. All roof drains and gutter downspouts should be extended to discharge well beyond the building's foundation backfill zone or be connected to a storm sewer system.

To help minimize infiltration of water into the foundation zone, vegetative plantings placed close to foundation walls should be limited to those species having low watering requirements and irrigated grass should not be located within 5 feet of the foundation. Similarly, sprinklers are not recommended to discharge water within 5 feet of foundations. Irrigation near foundations should be limited to the minimum amount sufficient to maintain vegetation. Application of more irrigation water than necessary can increase the potential for slab and foundation movement.

Perimeter drains are recommended for usable space below grade (areas where the interior slab or bottom of the crawl space is below the exterior grade). A typical perimeter drain detail is shown in Figure 3.

6 Pavement Design Recommendations

Pavement design recommendations were made based on guidance from the *Pavement Design Criteria for El Paso County*. We understand that the access lane and passenger vehicle parking lot will be paved with asphalt.

6.1 Pavement Subgrade Conditions

Two test borings (TB-4 and TB-5) were drilled to depths of approximately 10 feet in the parking lot and access road areas. The soils at the roadway subgrade depth consisted of silty sand. Soil Type 1 was used to evaluate the subgrade support characteristics of pavement based on laboratory testing. The Type 1 subgrade soils classified as A-1-b, and A-4 using the AASHTO classification system.

California Bearing Ratio (CBR) testing was performed on a representative bulk sample of the silty sand (Soil Type 1) from TB-4 to determine the support characteristics of the subgrade soils for the roadway sections. The results of the CBR testing are presented in Appendix B and summarized in Exhibit 1.

Exhibit 2: Pavement Subgrade Laboratory Summary

Design Parameter	Value
Soil Type	1 – Silty Sand
CBR at 95%	42.18
Design CBR	10
Liquid Limit	NV
Plasticity Index	NP
Percent Passing 200	23.8
AASHTO Classification	A-1-b
Group Index	0
Unified Soils Classification	SM

6.2 Swell Mitigation

El Paso County criteria requires mitigation of expansive soils for roadway subgrade that have a swell of 2% or greater with a 150 pound per square foot surcharge. Based on the swell testing, mitigation for expansive soils is not required for this site.

6.3 Traffic Loading

Traffic data is not available for the private parking lot and access road. Based on the Colorado Asphalt Pavement Association (CAPA), *Guideline for Design and Construction of Asphalt Parking Lots in Colorado* (2006), an 18-kip equivalent single axle loading (ESAL) of 100,000 is appropriate for moderate traffic levels which includes passenger cars and light trucks.

6.4 Pavement Designs

The pavement sections were determined utilizing the *El Paso County Pavement Design Criteria*, design ESAL, and the CBR testing. Design parameters used in the pavement analysis for the parking and access drives are presented in Exhibit 3.

Exhibit 3: Pavement Design Parameters

Design Parameter	Value
Reliability	75%
Standard Deviation	0.44
Serviceability Loss (Δ psi)	2.0
Design CBR	10
Resilient Modulus	15,000 psi
Structural Coefficients	
Hot Bituminous Pavement	0.44
Aggregate Basecourse	0.11

The recommended pavement section is presented in Exhibit 4. Any additional grading may result in subgrade soils with different support characteristics. The following pavement sections should be re-evaluated if additional grading is performed.

Exhibit 4: Recommended Pavement Sections

Pavement Area	Design ESAL	Alternative
Access Drive and Parking Areas	100,000	1. 4.0 inches HMA over 4.0 inches ABC

ABC = Aggregate Base Course; ESAL = equivalent single axle loads; HMA = Hot Mix Asphalt

7 Construction Recommendations

7.1 Earthwork Recommendations for Structures

7.1.1 Subgrade Preparation

Foundations and on-grade floor slabs may be placed on dense and unyielding granular soil. The final subgrade should then be scarified 12 inches, moisture conditioned to +/- 2% of the optimum moisture, and recompacted in place (refer to Section 7.1.3). Refer to Section 7.1.2 for shallow groundwater recommendations. All soil beneath the foundation and slabs should be free of organics, debris, and cobbles larger than 3 inches in diameter. Uncontrolled fill or loose soil will require removal to suitable, dense underlying soils and recompacted in place or replaced with granular fill (Section 7.1.3 and 7.1.4).

7.1.2 Shallow Groundwater

Shallow groundwater was encountered in the test borings at depths of 5 to 9 feet. We recommend keeping foundation elements a minimum of 3 feet above groundwater. If groundwater is encountered during subgrade preparation, we recommend overexcavating loose, wet soils to a depth of 12 inches below the base of foundation elements, pushing 2- to 4-inch shot rock into the subgrade for stabilization, as required, followed by a layer of Tensar BX1200 geogrid (or equivalent). We then recommend placing compacted granular fill in accordance with Section 7.1.3 and 7.1.4. After placement of backfill, the subgrade should be proof rolled and evaluated to ensure that subgrade is not pumping. Based on the groundwater conditions encountered at the time of excavation, dewatering methods may be required, which could include diversion ditches, pumping, or capillary drains. Entech should observe the overexcavated subgrade to verify existing conditions and provide additional recommendations if required.

7.1.3 Granular Fill

Granular fill placed beneath foundation components and floor slabs shall consist of non-expansive, granular soil, free of organic matter, unsuitable materials, debris, and cobbles larger than 3 inches in diameter. Entech should approve any site or imported granular material to be used within the foundation area.

7.1.4 Fill Placement and Compaction

Granular fill placed within the foundation area should be compacted to a minimum of 95% of its maximum Modified Proctor Dry Density (ASTM D1557) at +/-2% of optimum moisture content. Fill material should be placed in horizontal lifts such that each finished lift has a compacted thickness of 6 inches or less. Mechanical methods can be used for placement and compaction of fill; however, heavy equipment should be kept at a distance from foundation walls and below slab infrastructure to avoid overstressing. No water flooding techniques of any type should be used for compaction or placement of foundation or floor slab fill material.

Fill placement and compaction beneath and around foundations should be observed and tested by Entech during construction. Density tests should be performed frequently to verify compaction with the first density test performed at the overexcavated subgrade elevation and with additional testing once each 12 to 18 inches of granular fill has been placed.

7.2 Pavements

Pavement design recommendations provided herein are contingent on good construction practices, and poor construction techniques may result in poor performance. Our analyses assumed that this project will be constructed according to the *El Paso County Pavement Design Criteria.*

7.2.1 Pavement Subgrade Preparation

Proper subgrade preparation is required for adequate pavement performance. Paving areas should be cleared of all deleterious materials including but not limited to existing pavements, utility poles, and fence poles. Surface vegetation should be removed by stripping, with the depth to be field determined.

We recommend that paving areas be moisture conditioned to a depth of 18 inches. After overexcavating 12 inches of the pavement subgrade, the final subgrade surface for pavement areas should be scarified an additional 8 inches, moisture conditioned to within 0 to +3% of its optimum moisture, and recompacted in place to 95% of its maximum Standard Proctor Dry Density ASTM D698. The overexcavated material can then be placed in 6-inch lifts to the same specifications as described above. The compacted surface below pavements should be proof-rolled with a fully loaded, tandem-axle, 10-yard dump truck or equivalent. Any areas that are delineated to be soft, loose, or yielding during proof-rolling should be removed and reconditioned or replaced.

7.2.2 Aggregate Base Course

Aggregate Base Course (ABC) materials shall conform to the *El Paso County Standard Specification Manual*, Section D-6. ABC materials should be compacted to a minimum of 95% of its maximum Modified Proctor Dry Density (ASTM D1557) at +/-2% of optimum moisture content.

7.3 Excavation Potential

Excavation of the site soils should be feasible with rubber-tired equipment.

7.4 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).

7.5 Utility Trench Backfill

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.

Fill placement and compaction in utility trenches should be observed and tested by Entech during construction. Fill should be placed in horizontal lifts having a compacted thickness of 6 inches or less and at a water content conducive to adequate compaction, within +/-2% of optimum water content. No water flooding techniques of any type should be used for compaction or placement of utility trench fill.

7.6 General Backfill

Any areas to receive general grading fill 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, moisture conditioned to +/-2% of the optimum water content, and compacted to a minimum of 95% of the ASTM D1557 maximum dry density or the ASTM D698 maximum dry density for cohesive soils 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% of the ASTM D1557 or ASTM D698 maximum dry density. Fill material should be free of vegetation and other unsuitable material and should not contain cobbles or fragments larger 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, or beneath roadways or other structural features of the project should be observed and tested by Entech during construction.

7.7 Concrete Degradation Due to Sulfate Attack

Sulfate solubility testing was conducted on several samples recovered from the test borings to evaluate the potential for sulfate attack on concrete placed below surface grade. The test results indicated 0.00 to less than 0.01% soluble sulfate (by weight). The test results indicate the sulfate component of the in-place soils presents a negligible exposure threat to concrete placed below the site grade.

Type IL or Type II cement is recommended for all concrete on this site. Care should be taken to prevent the accumulation or ponding of water in the foundation excavation prior to the placement of concrete. If standing water is present in the foundation excavation, it should be removed by ditching to sumps and pumping the water away from the foundation area prior to concrete placement.

7.8 Winter Construction

In the event construction of the planned facility 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. This may require covering the concrete with insulated blankets and adding heat to prohibit freezing. During site grading and subgrade preparation, care should be taken to eliminate the burial of snow, ice, or frozen material within the planned construction area.

7.9 Foundation Excavation and Construction Observation

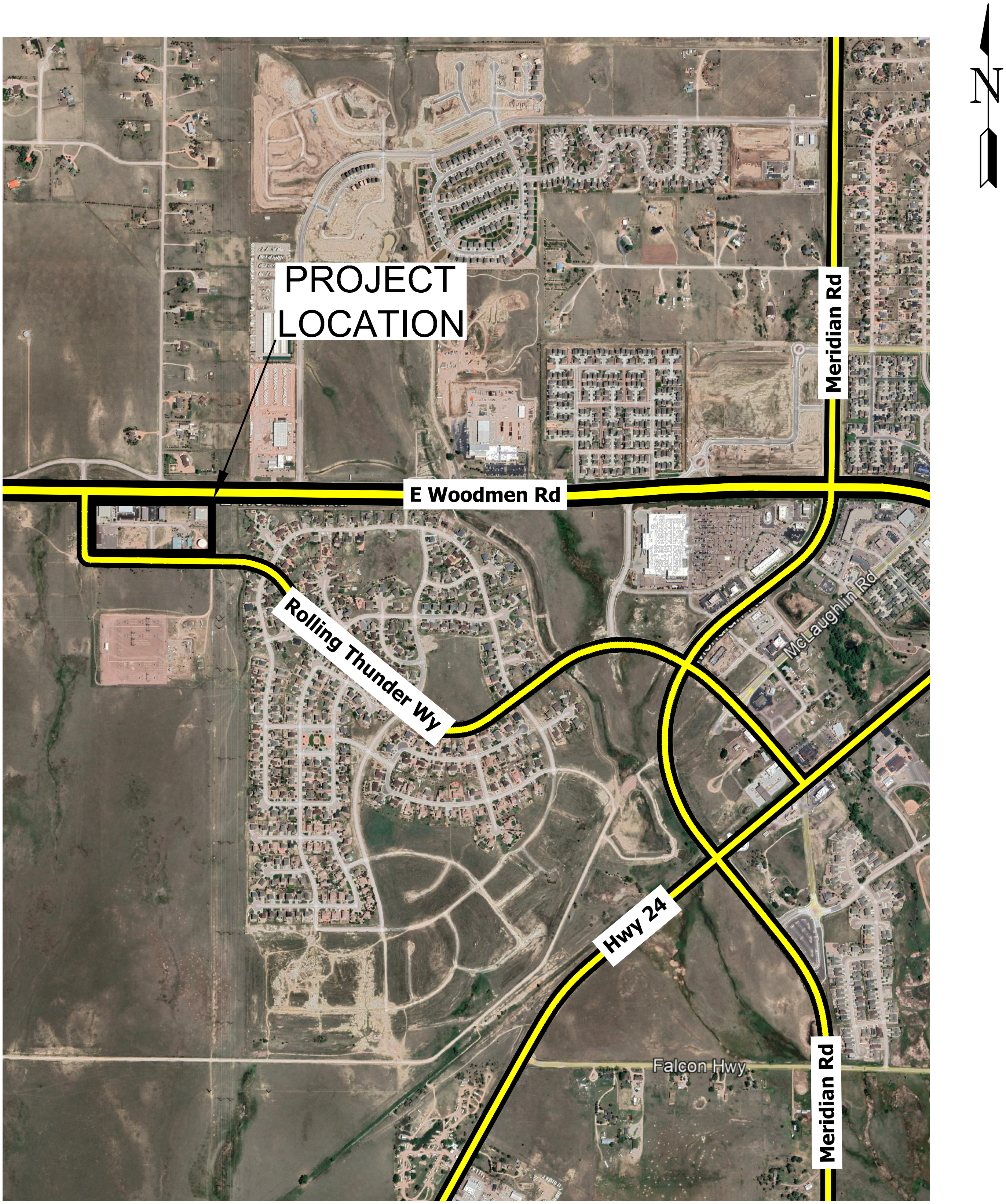
Subgrade preparation for building foundations should be observed by Entech prior to construction of the footings and floor slabs in order to verify that (1) no anomalies are present, (2) materials similar to those described in this report have been encountered or placed, and (3) no soft spots, expansive or organic soil, or debris are present in the foundation area prior to concrete placement or backfilling. Entech should make final recommendations for overexcavation, if required, and foundation drainage at the time of excavation observation, if necessary.

In addition, Entech should observe and document the placement and compaction of utility bedding and trench backfill.

8 Closure

The subsurface investigation, geotechnical evaluation, and recommendations presented in this report are intended for use by WD Construction with application to the planned new metal building and associated site improvements located at 10707 Maltese Point in Peyton, Colorado. In conducting the subsurface exploration program, 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 the same locality and under similar conditions. No other warranty, expressed or implied, is made. During final design and/or construction, if conditions are encountered that appear different from those described in this report, Entech Engineering, Inc. requests to 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.



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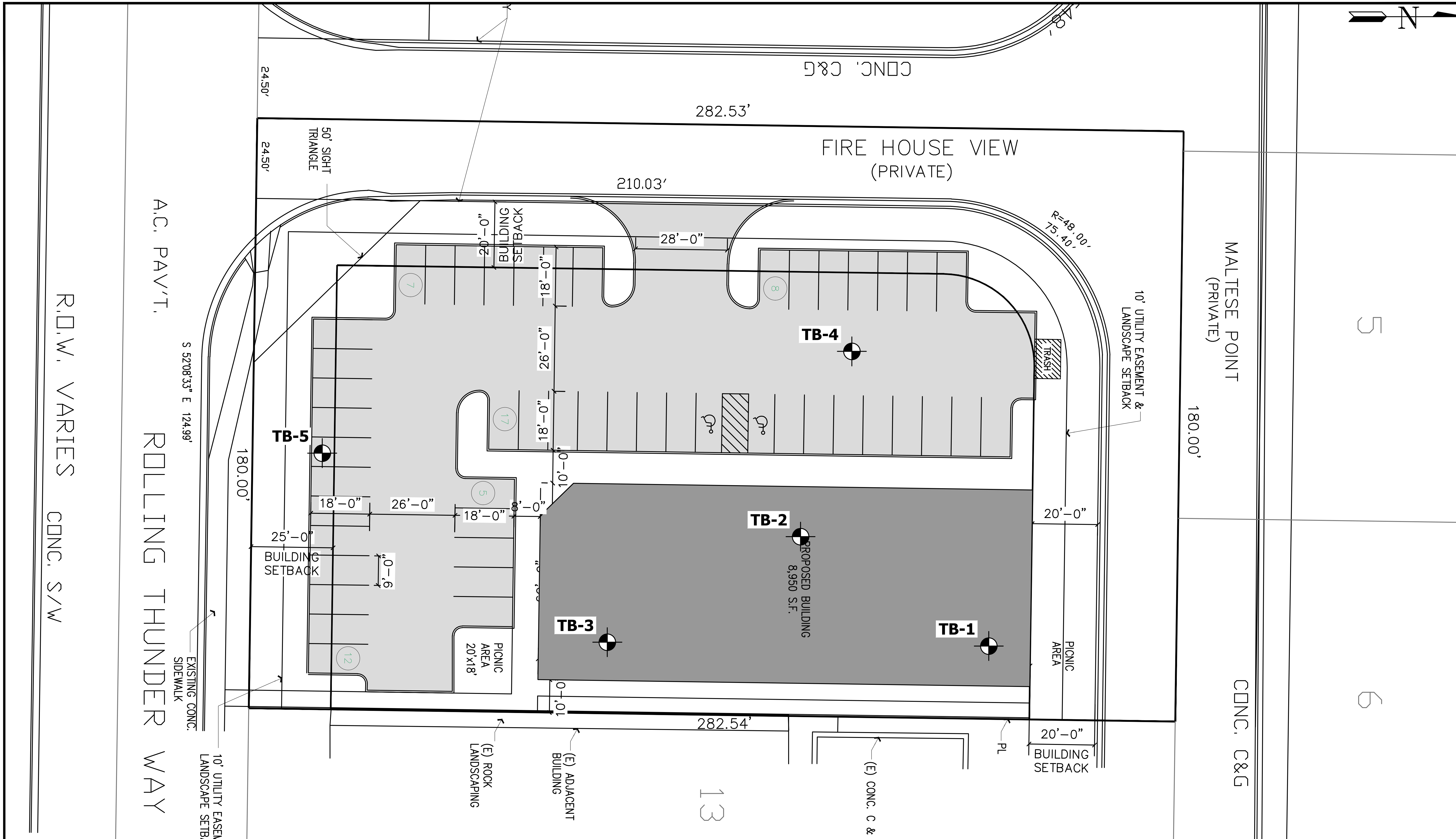
VICINITY MAP

10707 MALTESE POINT
WD CONSTRUCTION

JOB NO.
240324

FIG. 1



TB- APPROXIMATE TEST BORING LOCATION AND NUMBER

ENTECH ENGINEERING, INC.

SITE AND EXPLORATION PLAN

10707 MALTESE POINT
WD CONSTRUCTION

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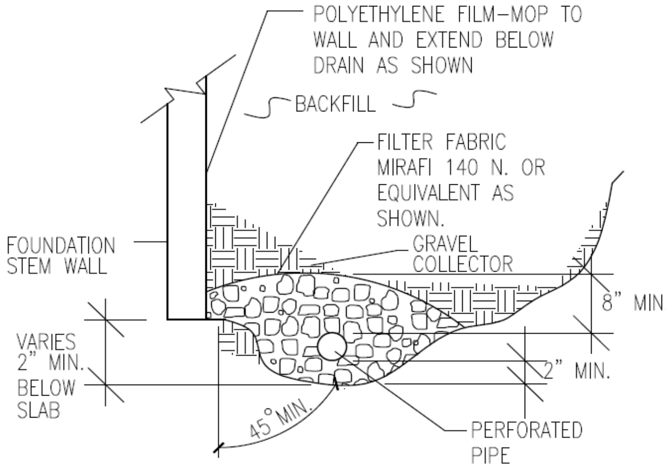
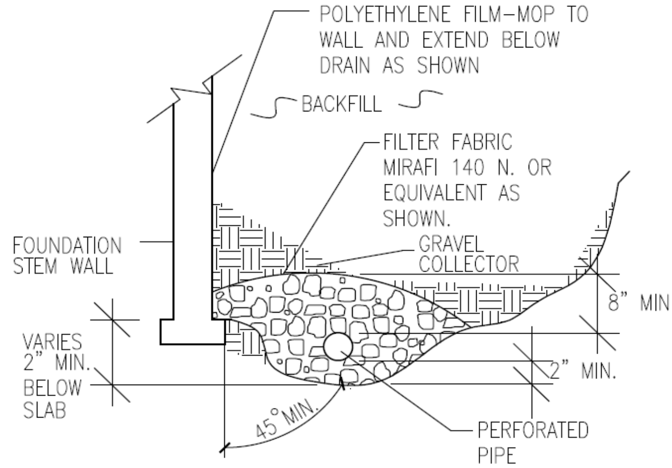
FIG. 2





NOTES:

–GRAVEL SIZE IS RELATED TO DIAMETER OF PIPE PERFORATIONS–85% GRAVEL GREATER THAN 2x PERFORATION DIAMETER.

–PIPE DIAMETER DEPENDS UPON EXPECTED SEEPAGE. 4–INCH DIAMETER IS MOST OFTEN USED.

–ALL PIPE SHALL BE PERFORATED PLASTIC. THE DISCHARGE PORTION OF THE PIPE SHOULD BE NON–PERFORATED PIPE.

–FLEXIBLE PIPE MAY BE USED UP TO 8 FEET IN DEPTH, IF SUCH PIPE IS DESIGNED TO WITHSTAND THE PRESSURES. RIGID PLASTIC PIPE WOULD OTHERWISE BE REQUIRED.

–MINIMUM GRADE FOR DRAIN PIPE TO BE 1% OR 3 INCHES OF FALL IN 25 FEET.

–DRAIN TO BE PROVIDED WITH A FREE GRAVITY OUTFALL, IF POSSIBLE. A SUMP AND PUMP MAY BE USED IF GRAVITY OUT FALL IS NOT AVAILABLE.

ENTECH ENGINEERING, INC.	**PERIMETER DRAIN DETAIL** 10707 MALTESE POINT WD CONSTRUCTION	JOB NO. 240324 **FIG. 3**

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APPENDIX A: Test Boring Logs

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TABLE A-1

DEPTH TO GROUNDWATER & BEDROCK

TEST BORING	DEPTH TO GROUNDWATER (ft.)	DEPTH TO BEDROCK (ft.)
1	5	13
2	9	14
3	>20	12
4	>10	>10
5	>10	>10

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Client: WD Construction
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TEST BORING 1
DATE DRILLED 3/6/2024
REMARKS

WATER @ 5', 3/6/24

Description	Depth (ft)	Blows per foot	Watercontent %	Soil Type
SAND, SILTY to WITH SILT, TAN to BROWN, MEDIUM DENSE, DRY to WET		16	2.6	1
	5	11	13.1	1
	10	29	13.6	1
SANDSTONE, VERY WEAK, GRAY, HIGHLY WEATHERED (SAND, CLAYEY, VERY DENSE, MOIST)	15	50/11"	9.9	3
	20	50/9"	11.3	3

TEST BORING 2
DATE DRILLED 3/6/2024
REMARKS

WATER @ 9', 3/6/24

Description	Depth (ft)	Blows per foot	Watercontent %	Soil Type
SAND, SILTY, BROWN, LOOSE to MEDIUM DENSE, MOIST		5	8.1	1
	5	17	7.6	1
CLAY, SANDY, BROWN, HARD, MOIST	10	40	9.0	2
CLAYSTONE, VERY WEAK, GRAY, MODERATELY WEATHERED (CLAY, SANDY, HARD, MOIST)	15	50/10"	11.9	4
SANDSTONE, VERY WEAK, GRAY, COMPLETELY WEATHERED (SAND, CLAYEY, VERY DENSE, MOIST)	20	50/8"	10.4	3

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TEST BORING LOGS

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FIG. A-1

TEST BORING 3

DATE DRILLED 3/6/2024

REMARKS

DRY TO 20', 3/6/24

Description	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
18" TOPSOIL SAND, SILTY to SLIGHTLY SILTY, LIGHT BROWN, LOOSE to MEDIUM DENSE, MOIST				9	4.6	1
	5			28	8.2	1
CLAY, SANDY, BROWN, HARD, MOIST	10			39	9.2	2
CLAYSTONE, VERY WEAK, GRAY, MODERATELY WEATHERED (CLAY, SANDY, HARD, MOIST)	15			50/10"	12.6	4
SANDSTONE, VERY WEAK, GRAY, COMPLETELY WEATHERED (SAND, CLAYEY, VERY DENSE, MOIST)	20			50/7"	11.1	3

TEST BORING 4

DATE DRILLED 3/6/2024

REMARKS

DRY TO 10', 3/6/24

Description	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
12" TOPSOIL SAND, SILTY, DARK BROWN to BROWN, LOOSE to MEDIUM DENSE, MOIST				7	11.7	1
	5			7	7.0	1
	10			22	10.9	1
	15					
	20					

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TEST BORING LOGS

10707 MALTESE POINT
WD CONSTRUCTION

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FIG. A-2

TEST BORING 5
DATE DRILLED 3/6/2024
REMARKS

DRY TO 10', 3/6/24

Description	Depth (ft)	Blows per foot	Watercontent %	Soil Type
SAND, SILTY, TAN to BROWN, MEDIUM DENSE to DENSE, DRY to MOIST		15	2.6	1
	5	33	6.8	1
CLAY, SANDY, GRAY, HARD, MOIST	10	44	9.2	2
	15			
	20			

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TEST BORING LOGS

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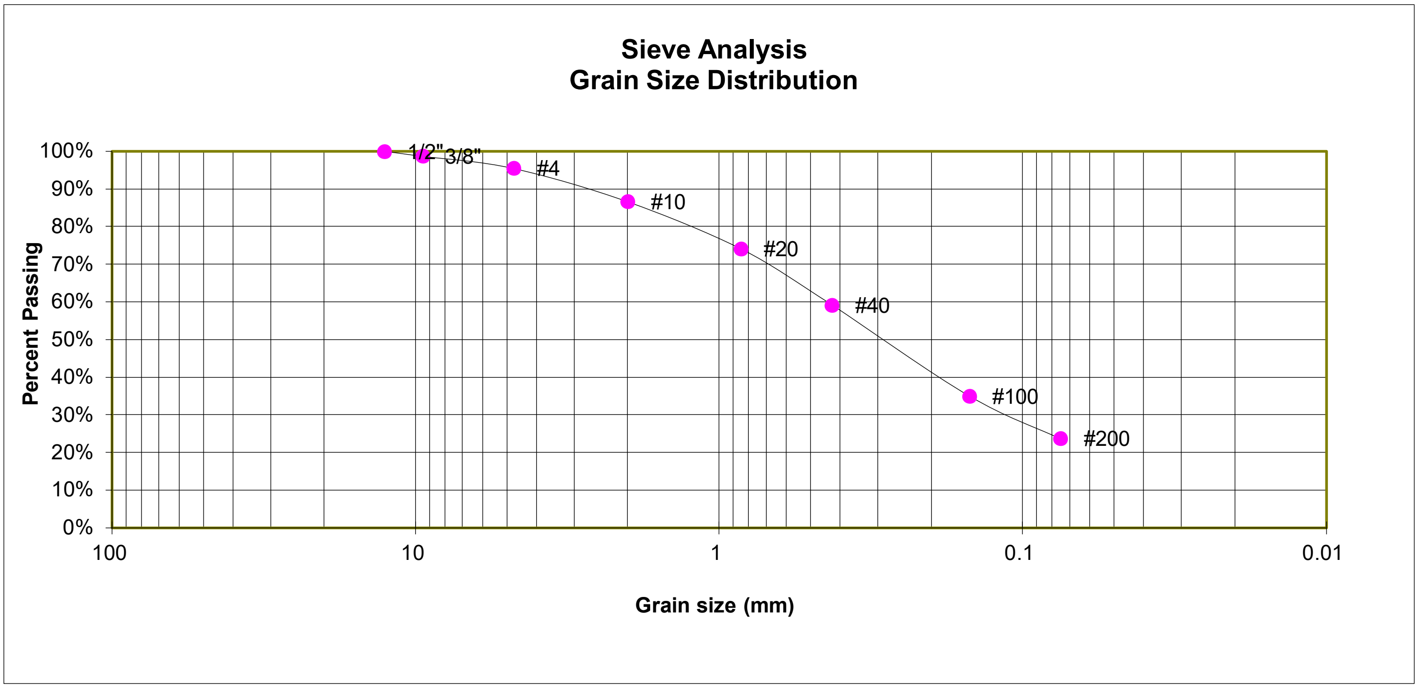
FIG. A-3

APPENDIX B: Laboratory Test Results

TABLE B-1
SUMMARY OF LABORATORY TEST RESULTS

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX	SULFATE (WT %)	AASHTO CLASS.	SWELL/ CONSOL (%)	USCS	SOIL DESCRIPTION
1, CBR	4	0-3			23.8	NV	NP	NP	<0.01	A-1-b		SM	SAND, SILTY
1	1	2-3			7.2	NV	NP	NP	0.00			SW-SM	SAND, WITH SILT
1	4	1-2			36.8	NV	NP	NP	0.00	A-4		SM	SAND, SILTY
1	5	1-2			3.8	NV	NP	NP		A-1-b		SW	SAND, SLIGHTLY SILTY
2	2	10	13.8	118.8	51.3	26	17	9	<0.01		0.5	CL	CLAY, SANDY
3	1	15			27.9	29	20	9	<0.01			SC	SANDSTONE (SAND, CLAYEY)
4	3	15	13.1	113.4	52.7	36	24	12	0.00		1.2	CL	CLAYSTONE (CLAY, SANDY)

TEST BORING	4	SOIL DESCRIPTION	SAND, SILTY
DEPTH (FT)	0-3	SOIL TYPE	1, CBR



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	98.7%
4	95.5%
10	86.7%
20	74.1%
40	59.2%
100	35.0%
200	23.8%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

USCS CLASSIFICATION: SM
AASHTO CLASSIFICATION: A-1-b
AASHTO GROUP INDEX: 0

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

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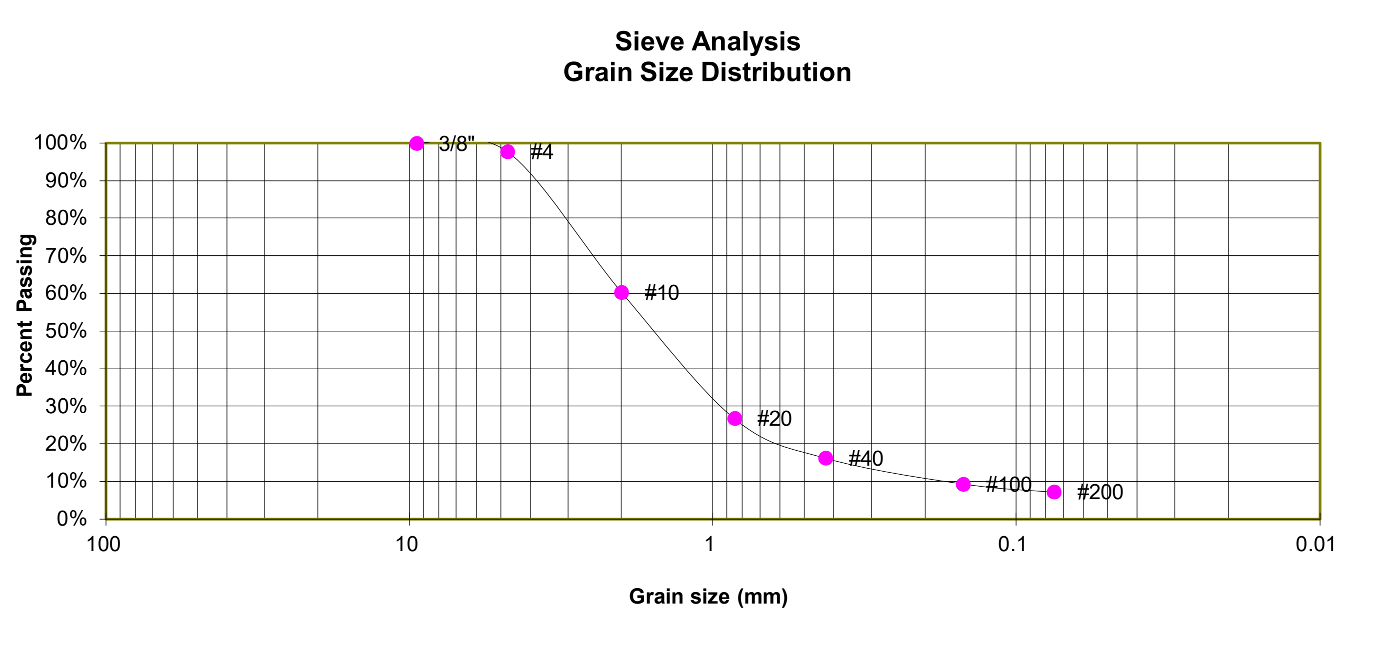
FIG. B-1

TEST BORING	1	SOIL DESCRIPTION	SAND, WITH SILT
DEPTH (FT)	2-3	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	97.7%
10	60.3%
20	26.8%
40	16.2%
100	9.3%
200	7.2%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

USCS CLASSIFICATION: SW-SM

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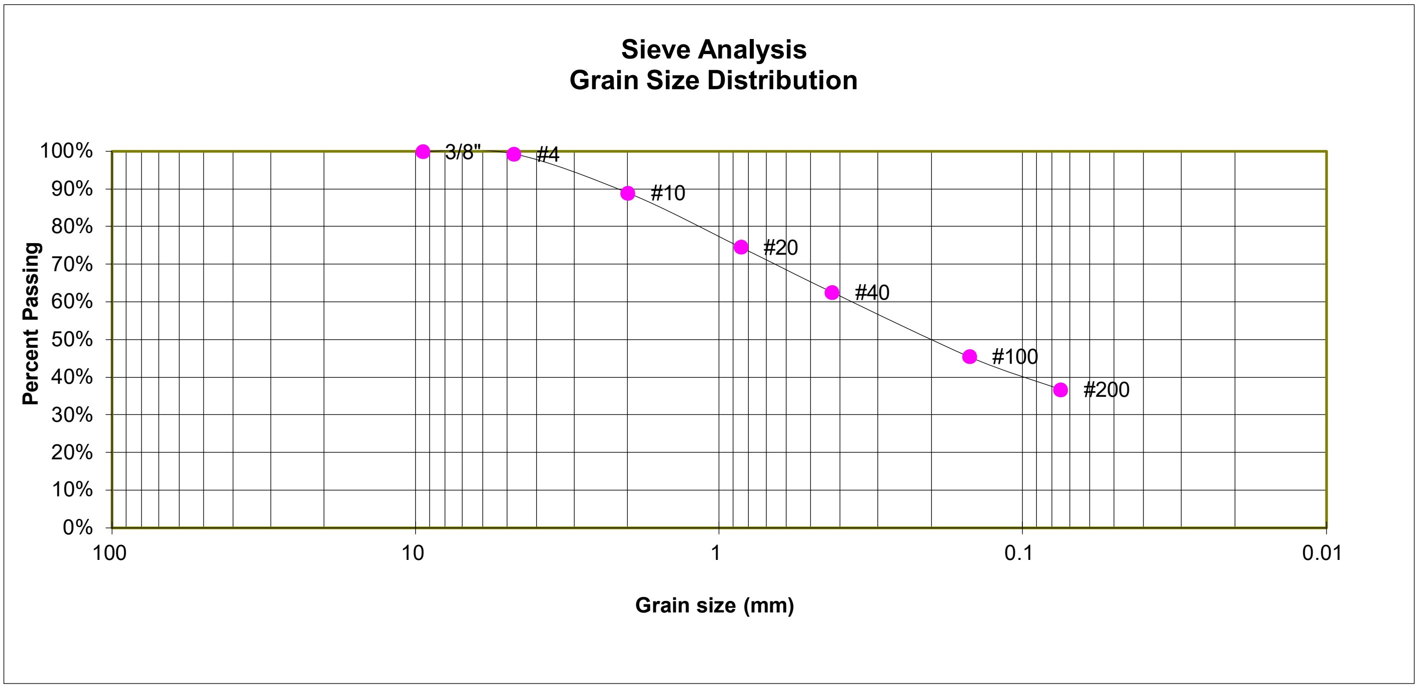
FIG. B-2

TEST BORING	4	SOIL DESCRIPTION	SAND, SILTY
DEPTH (FT)	1-2	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.3%
10	89.0%
20	74.6%
40	62.6%
100	45.5%
200	36.8%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SM
AASHTO CLASSIFICATION:	A-4
AASHTO GROUP INDEX:	0

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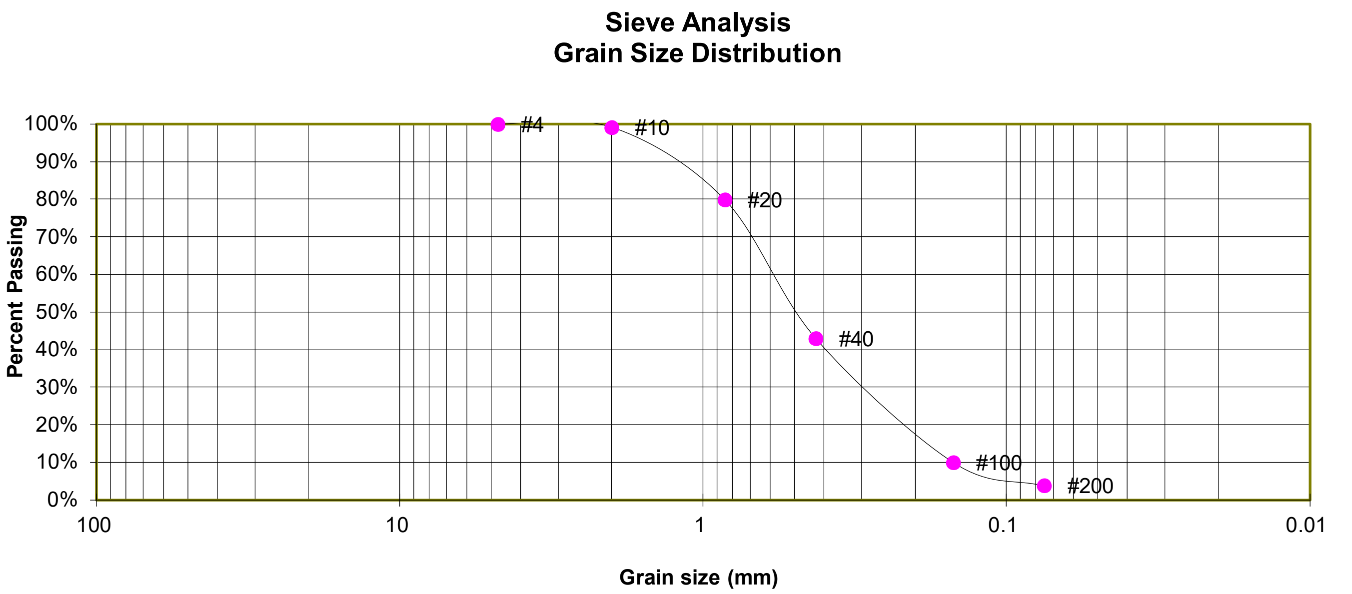
FIG. B-3

TEST BORING	5	SOIL DESCRIPTION	SAND, SLIGHTLY SILTY
DEPTH (FT)	1-2	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.2%
20	79.9%
40	43.0%
100	10.0%
200	3.8%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SW
AASHTO CLASSIFICATION:	A-1-b
AASHTO GROUP INDEX:	0

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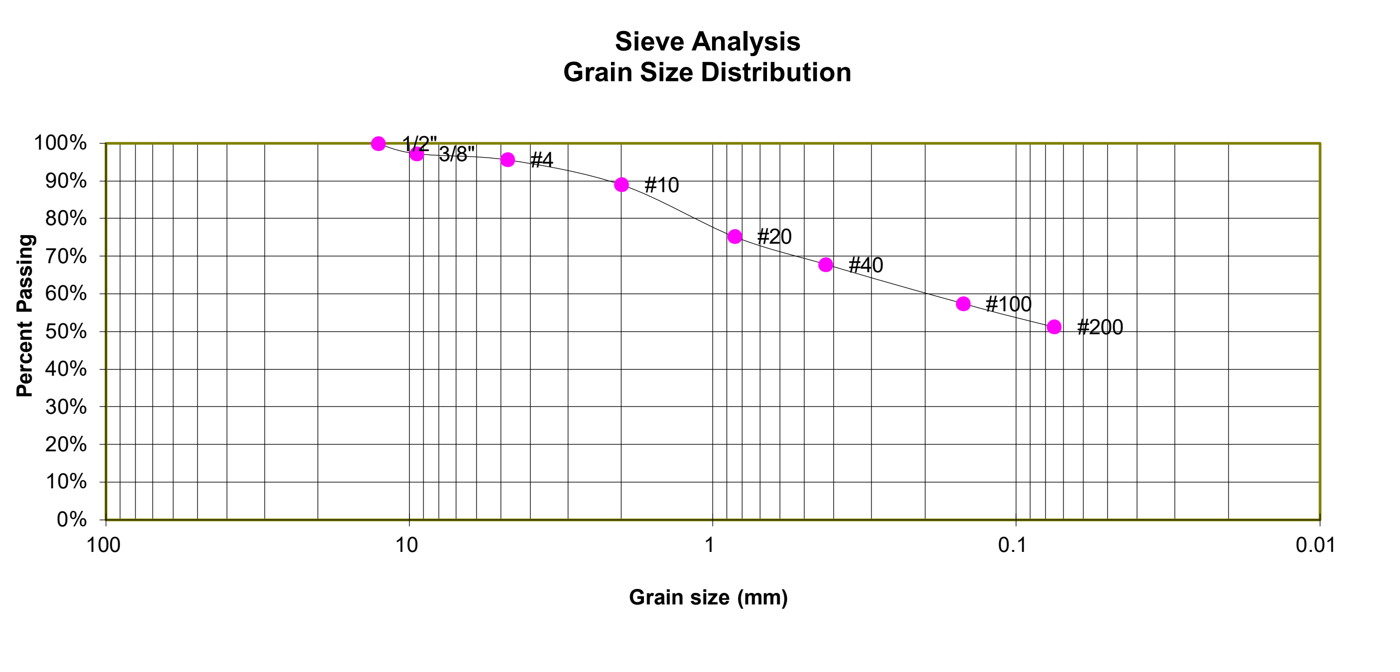
FIG. B-4

TEST BORING	2	SOIL DESCRIPTION	CLAY, SANDY
DEPTH (FT)	10	SOIL TYPE	2



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	97.3%
4	95.7%
10	89.0%
20	75.3%
40	67.8%
100	57.5%
200	51.3%

ATTERBERG LIMITS

Plastic Limit	17
Liquid Limit	26
Plastic Index	9

SOIL CLASSIFICATION

USCS CLASSIFICATION: CL

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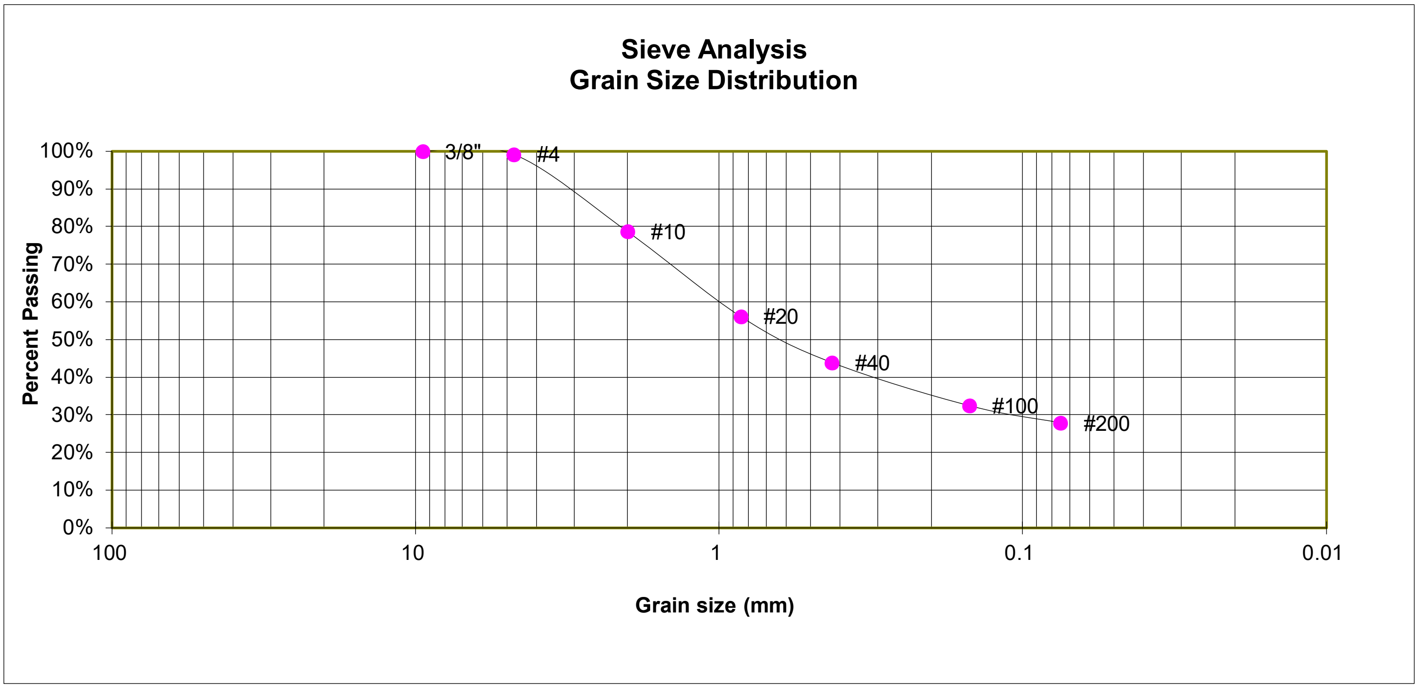
FIG. B-5

TEST BORING	1	SOIL DESCRIPTION	SANDSTONE (SAND, CLAYEY)
DEPTH (FT)	15	SOIL TYPE	3



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.2%
10	78.7%
20	56.2%
40	43.9%
100	32.5%
200	27.9%

ATTERBERG LIMITS

Plastic Limit	20
Liquid Limit	29
Plastic Index	9

SOIL CLASSIFICATION

USCS CLASSIFICATION: SC

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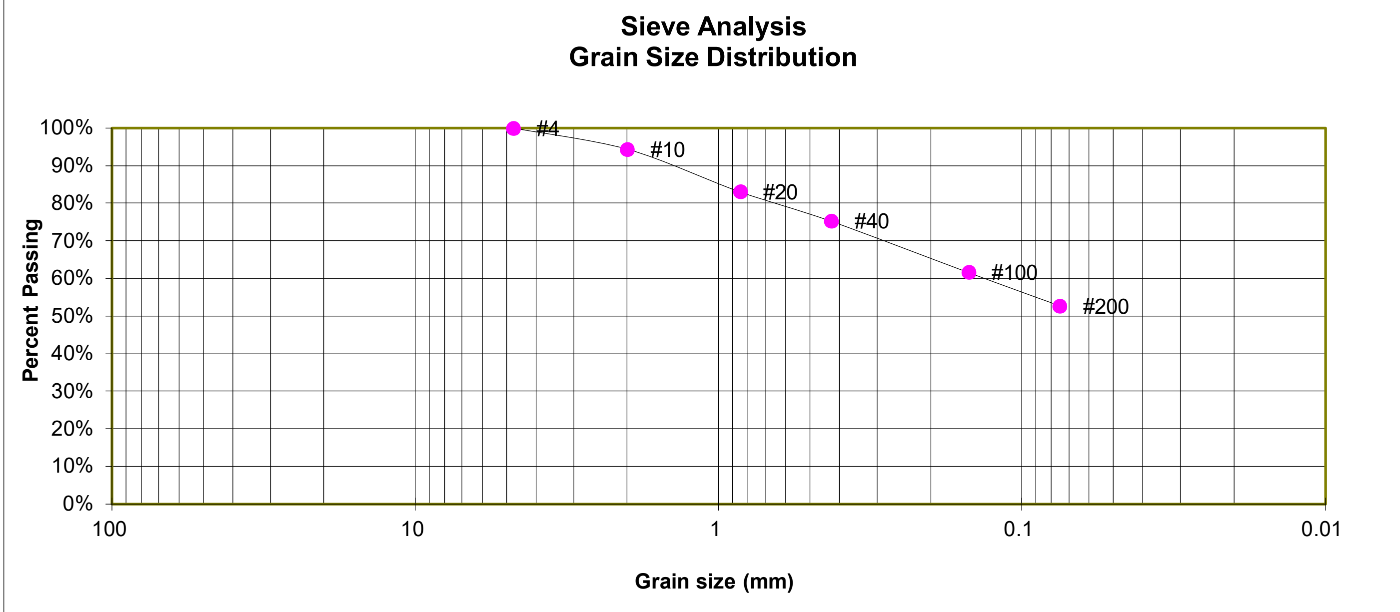
FIG. B-6

TEST BORING	3	SOIL DESCRIPTION	CLAYSTONE (CLAY, SANDY)
DEPTH (FT)	15	SOIL TYPE	4



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	94.4%
20	83.1%
40	75.2%
100	61.7%
200	52.7%

ATTERBERG LIMITS

Plastic Limit	24
Liquid Limit	36
Plastic Index	12

SOIL CLASSIFICATION

USCS CLASSIFICATION: CL

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LABORATORY TEST RESULTS

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FIG. B-7

TEST BORING	2	SOIL DESCRIPTION	CLAY, SANDY
DEPTH (FT)	10	SOIL TYPE	2

SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF):	119
NATURAL MOISTURE CONTENT:	13.8%
SWELL/COLLAPSE (%):	0.5%

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SWELL TEST RESULTS

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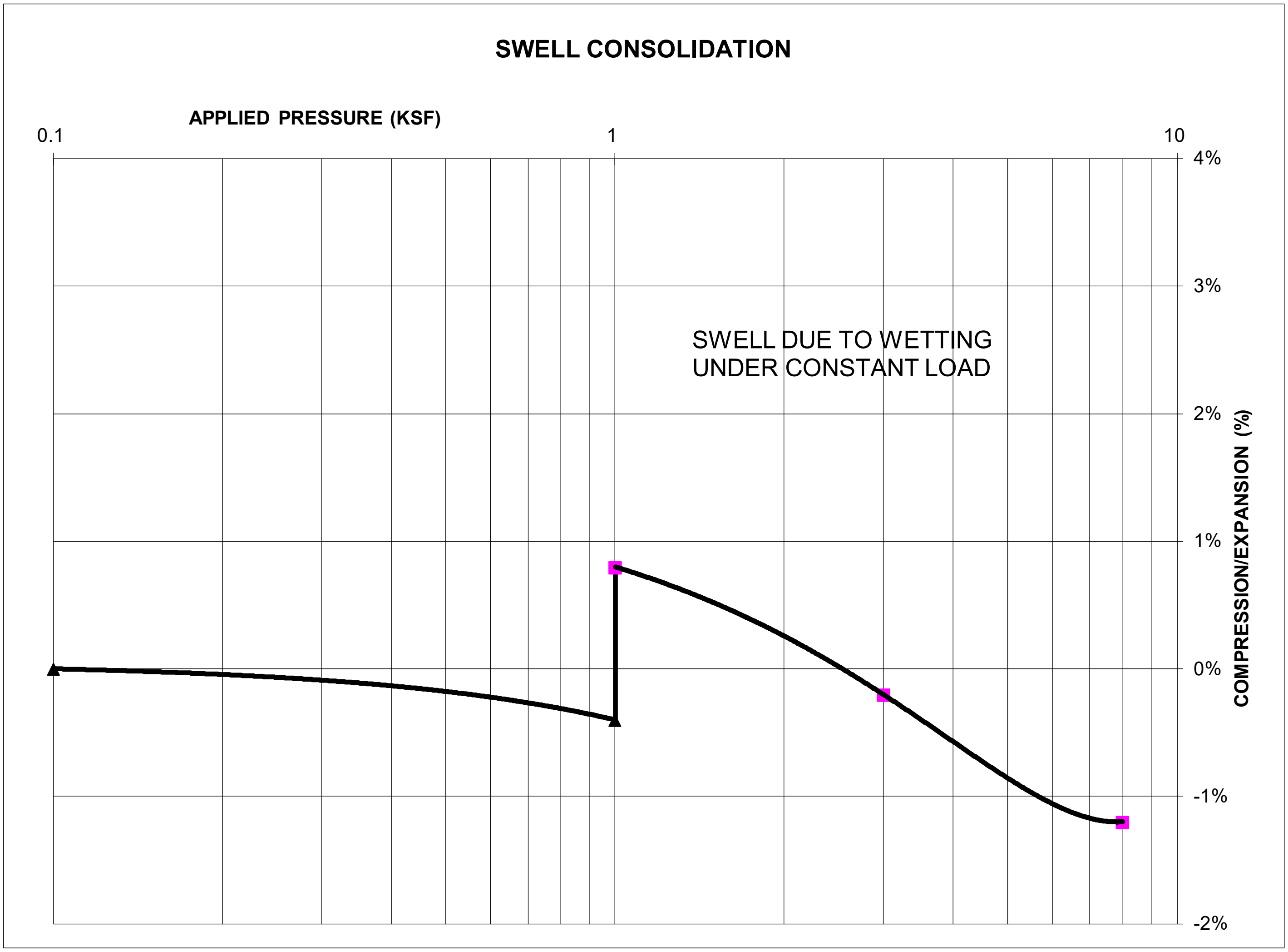
FIG. B-8

TEST BORING	3	SOIL DESCRIPTION	CLAYSTONE (CLAY, SANDY)
DEPTH (FT)	15	SOIL TYPE	4



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF): 113

NATURAL MOISTURE CONTENT: 13.1%

SWELL/COLLAPSE (%): 1.2%

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SWELL TEST RESULTS

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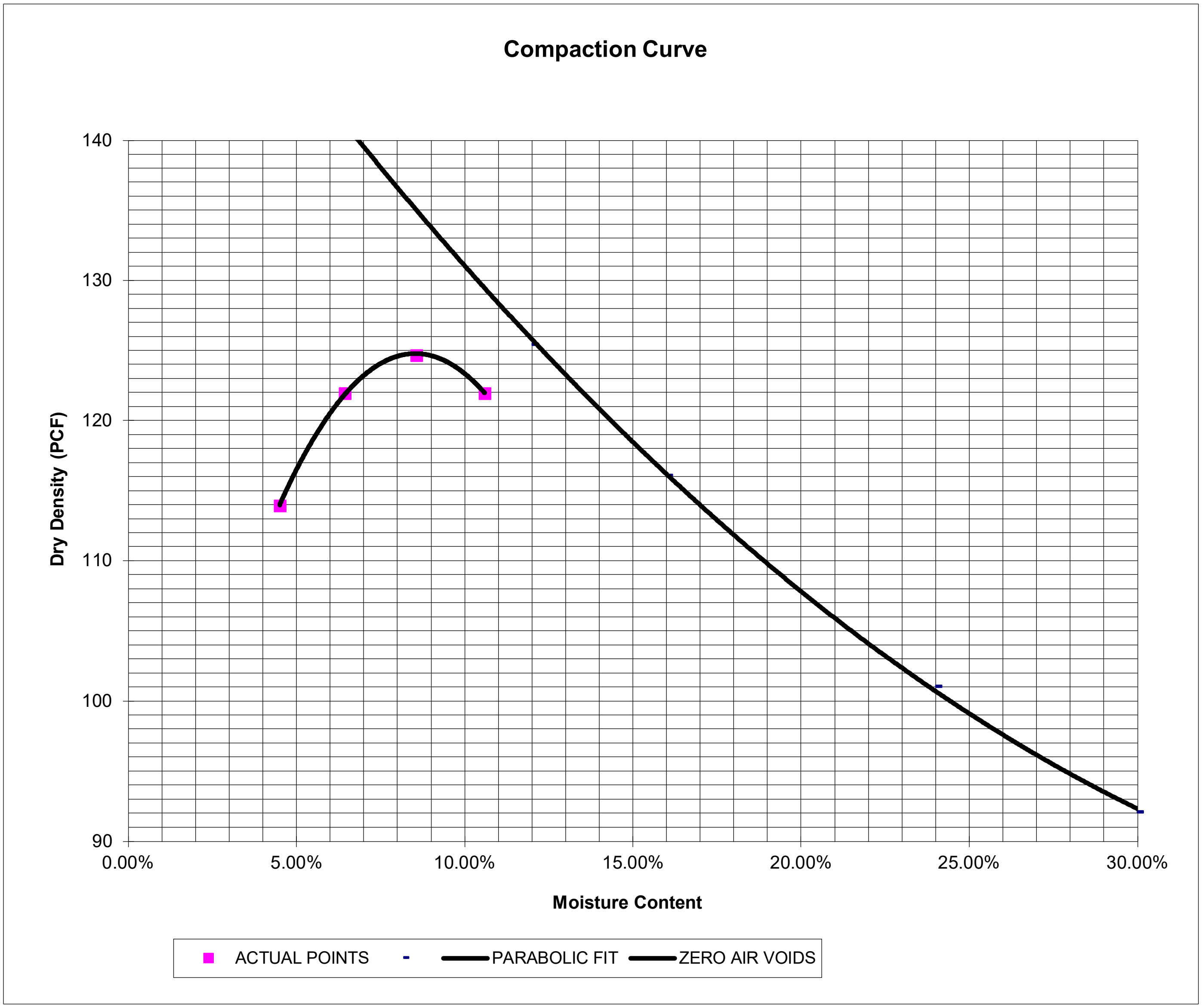
FIG. B-9

SAMPLE LOCATION TB-4 @ 0-3' | SOIL DESCRIPTION SAND, SILTY, BROWN
SOIL TYPE 1

PROCTOR DATA

IDENTIFICATION:	SM
PROCTOR TEST #:	1
TEST BY:	DK
TEST DESIGNATION:	ASTM-1557-A
MAXIMUM DRY DENSITY (PCF):	124.9
OPTIMUM MOISTURE:	8.6



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LABORATORY TEST RESULTS

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FIG. B-10

SAMPLE LOCATION TB-4 @ 0-3'	SOIL DESCRIPTION SAND, SILTY, BROWN
DEPTH (FT) 0	SOIL TYPE 1

CBR TEST LOAD DATA

Piston Diameter (cm): 4.958
Piston Area (in^2): 2.993

Penetration Depth (inches)	10 BLOWS Mold # 1 Load (lbs)	Stress (psi)	25 BLOWS Mold # 2 Load (lbs)	Stress (psi)	56 BLOWS Mold # 3 Load (lbs)	Stress (psi)
0.000	0	0.00	0	0.00	0	0.00
0.025	199	66.50	422	141.02	590	197.16
0.050	274	91.56	668	223.22	1213	405.35
0.075	335	111.95	829	277.03	1711	571.76
0.100	393	131.33	1055	352.55	2425	810.36
0.125	465	155.39	1264	422.39	2868	958.39
0.150	530	177.11	1429	477.53	3238	1082.04
0.175	585	195.49	1578	527.32	3529	1179.28
0.200	628	209.86	1688	564.08	3799	1269.50
0.300	775	258.98	2121	708.77	4618	1543.19
0.400	884	295.40	2332	779.28	4738	1583.29
0.500	1015	339.18	2694	900.25	5114	1708.93

MOISTURE AND DENSITY DATA

	Mold # 1	Mold # 2	Mold # 3
Can #	399	400	41
Wt. Can	8.39	8.36	8.31
Wt. Can+Wet	301.02	322.9	292.73
Wt. Can+Dry	266.35	288.51	263.96
Wt. H20	34.67	34.39	28.77
Wt. Dry Soil	257.96	280.15	255.65
Moisture Content	13.44%	12.28%	11.25%
Wet Density (PCF)	121.6	128.1	133.3
Dry Density (PCF)	112.0	117.9	122.7
% Compaction	90%	94%	98%
CBR	13.13	35.25	81.04

PROCTOR DATA

Maximum Dry Density (pcf)	124.9
Optimum Moisture	8.6
90% of Max. Dry Density (pcf)	112.4
95% of Max. Dry Density (pcf)	118.7

CBR at 90% of Max. Density = 14.74	~ R VALUE 45
CBR at 95% of Max. Density = 42.18	~ R VALUE 75

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LABORATORY TEST RESULTS

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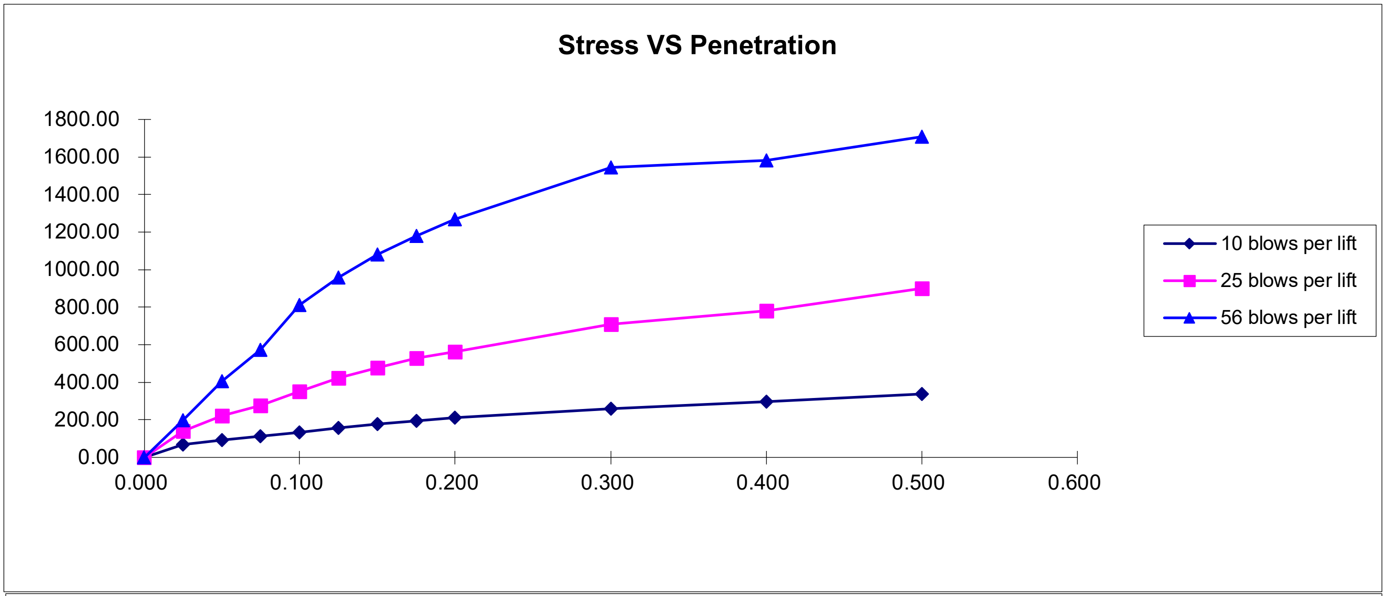
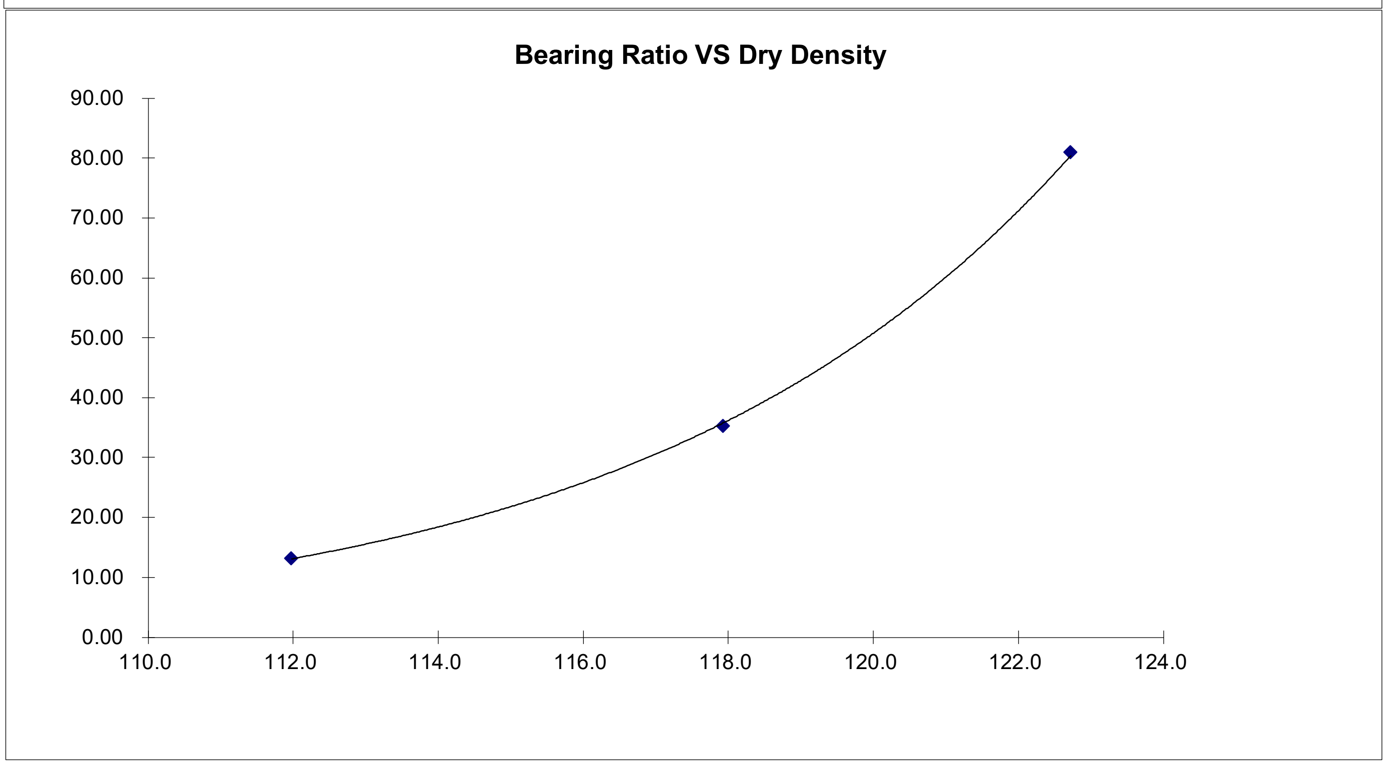
FIG. B-11

SAMPLE LOCATION TB-4 @ 0-3' SOIL DESCRIPTION SAND, SILTY, BROWN
DEPTH (FT) 0 SOIL TYPE 0





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LABORATORY TEST RESULTS

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FIG. B-12

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APPENDIX C: Pavement Design Calculations

FLEXIBLE PAVEMENT DESIGN

PROJECT DATA

Project Location WD Construction 10707 Maltese Point Parking Lot and Access Drive

Job Number: 240324

DESIGN DATA

Equivalent (18-kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	100,000
Design CBR	CBR =	10
Standard Deviation	S_o =	0.44
Loss in Serviceability	Δpsi =	2.0
Reliability	Reliability =	75
Reliability (z-statistic)	Z_R =	-0.67
Soil Resilient Modulus	M_R =	15,000 psi

Required Structural Number (SN): → SN = 1.61

DESIGN EQUATIONS

Resilient Modulus

If using CBR: $M_R = (CBR) \times 1{,}500$

If using R-Value: $M_R = 10^{[(S_1 + 18.72)/6.24]}$ where: $S_1 = [(R\text{-value} - 5) / 11.29] + 3$

Required Structural Number

$$\log_{10} W_{18} = Z_R * S_O + 9.36 * \log_{10}(SN+1) - 0.20 + \frac{\log_{10}\left[\frac{\Delta PSI}{4.2 - 1.5}\right]}{0.40 + \frac{1094}{(SN+1)^{5.19}}} + 2.32 * \log_{10} M_R - 8.07$$

Pavement Section Thickness

$SN^* = C_1D_1 + C_2D_2$ where:

C_1 = Strength Coefficient - HMA

C_2 = Strength Coefficient - ABC

D_1 = Depth of HMA (inches)

D_2 = Depth of ABC (inches)

RECOMMENED THICKNESSES

Layer	Material	Coefficient	Thickness (D^*_i)	SN^*_i	SN
1	HMA	C_1 = 0.44	4.0 inches	1.760	-
2	ABC	C_2 = 0.11	4.0 inches	0.440	
			SN* =	2.200	1.61

Pavement SN > Required SN, Design is Acceptable

FIG. C-1