ENTECH
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PAVEMENT DESIGN REPORT
GLEN AT WIDEFIELD FILING NO. 12
EL PASO COUNTY, COLORADO

Prepared for:
Glen Development Company
c/o Cross Company
3 Widefield Boulevard
Colorado Springs, CO 80904

Attn: Rudy Cross

Documents for allowance of CTS will be uploaded to EDARP.
- 2024 Clarification on CTS
- Memo 2 - ElPasoCTS

April 24, 2024

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Stuart Wood
Staff Geologist

Reviewed by:

COLORADO LICENSED
JOSEPH C GOODE III
52381
PROFESSIONAL ENGINEER

Digitally signed by Joseph C Goode III
Date: 04/24/24

Joseph C. Goode III, P.E.
Sr. Engineer

SW:JCG/ed
Entech Job No. 231853

ENTECH ENGINEERING, INC.

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1 Introduction

Entech Engineering, Inc. (Entech) completed a subsurface exploration program and a pavement design for roadways within the Glen at Widefield Development Filing No. 12. This report describes the subsurface exploration program conducted for the proposed roadway improvements and provides pavement section alternatives and construction recommendations. Entech participated in this project as a subconsultant to Glen Development Company in accordance with our subconsultant agreement, dated February 28, 2024. The contents of this report, including the pavement design recommendations, are subject to the limitations and assumptions presented in Section 7.

2 Project Description

The Glen at Widefield Filing No. 12 is located west of Marksheffel Boulevard, north of Mesa Ridge Parkway, and south of Fontaine Boulevard in southeast Colorado Springs, Colorado (Figure 1). The proposed roadway construction includes portions of Golden Buff Drive, Lanceleaf Drive, and the cul-de-sacs Ground Cherry Trail and Dwarf Clover Court. The extents of our investigation are shown in Figure 2. The topography of the site is relatively level with rough-graded roads and utilities installed. Surrounding properties include vacant land or land being developed for residential lots. Vegetation was absent due to recent site grading.

3 Subsurface Explorations and Laboratory Testing

3.1 Subsurface Exploration Program

Subsurface conditions at the project site were explored by fifteen test borings, designated TB-1 through TB-15, drilled on March 4, 5, and 12, 2024. The locations of the test borings are shown on the Site and Exploration Plan (Figure 2). The borings were drilled to depths of 5 to 10 feet below the existing ground surface (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 classifications were later verified utilizing laboratory testing and grouped by soil type. The soil type numbers are included on the boring logs. It should be understood that the soil descriptions shown on the boring logs may vary between boring location and sample depths. It should also be noted that the lines of stratigraphic separation shown on the boring logs represent approximate boundaries between soil 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 on select samples to determine the expansive or compressive characteristics of the soil. For pavement design, a standard proctor (ASTM D698) and California Bearing Ratio (CBR) test (ASTM D1883) were completed. Soluble sulfate testing was performed on select soil samples to evaluate the potential for below-grade degradation of concrete due to sulfate attack. The laboratory testing results are presented in Appendix B and summarized in Table B-1.

Strength testing was performed on two sets of soil/cement composite samples. Testing was performed on soil samples prepared with 2% and 4% Portland Cement Type 1L or Type II. A compression strength of 125 pounds per square inch (psi) is recommended for cement-stabilized subgrade. The 7-day average strength value of the 2% mix was 219 psi. The 7-day strength of the 4% mix was 255 psi. A 2% mix is recommended based on the laboratory test results. A summary of the testing results is attached in Appendix B, Table B-2.

4 Subgrade Conditions

Two primary soil types and one bedrock type were encountered in the test borings drilled for the subsurface investigation. Each soil 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 Subsurface Conditions

Subsurface conditions along the proposed roadway generally consisted of medium stiff to stiff sandy clay fill (Soil Type 1). Isolated areas of clay with sand fill and medium dense clayey sand fill were also encountered (Soil Type 1). Native dense clayey sand to very stiff to hard native sandy clay (Soil Type 2) was also encountered. Claystone bedrock (Soil Type 3) was encountered in 4 of the borings. The Type 3 claystone was encountered below the subgrade zone of influence and was not considered in this pavement design. Water soluble sulfate tests indicated that the soils exhibit a negligible to severe potential for sulfate attack. Laboratory test results are presented in Appendix B and are summarized in Table B-1. All soils for the project classified as AASHTO A-6 and A-7-6.

4.2 Groundwater

Groundwater was not encountered in the test borings. Groundwater fluctuations are possible and will depend on seasonal variations, local precipitation, runoff, and other factors, however, we do not anticipate groundwater to affect the proposed construction.

5 Pavement Design Recommendations

Pavement design recommendations were made in accordance with the *El Paso County Engineering Criteria Manual (ECM).*

5.1 Subgrade Conditions

California Bearing Ratio (CBR) testing was performed on a representative sample of the Type 1 sandy clay fill subgrade from TB-3 to determine the support characteristic 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 1: Subsurface Laboratory Testing Summary

Design Parameter	Value
Soil Type	1 – Sandy Clay Fill
CBR at 95%	3.44
Design CBR	3.44
Liquid Limit	37
Plasticity Index	16
Percent Passing 200	61.1
AASHTO Classification	A-6
Unified Soils Classification	CL

5.2 Swell Mitigation

El Paso County requires swell mitigation for soils with swell testing results greater than 2% under a 150 pounds per square foot (psf) surcharge. Laboratory testing on the subgrade soils resulted in a range of volume changes from 1.8% to 9.0%. Based on the swell testing, mitigation for expansive soils will be required on this site. We recommend swell mitigation in the form of moisture treatment to a depth of 3 feet. Refer to Section 6.1.1 for subgrade preparation and moisture treatment recommendations.

Please include reference to TIS included with SF2224

5.3 Traffic Loading

Traffic data is not available for The Glen at Widefield Filing No.12; however, the roadways classify as urban local residential and urban local low-volume residential based on the current development plans. The *El Paso County Engineering Criteria Manual* provides default 18-kip equivalent single axle loadings (ESAL) based on the street classifications (ECM Section D.3.3, Table D-2). For design, default ESAL values of 292,000 and 36,500 were used for the urban local residential (Golden Buff Drive) and local low-volume residential designations, respectively.

5.4 Pavement Design

The pavement sections were determined utilizing the *El Paso County Engineering Criteria Manual*, the CBR testing, and default ESALs. Design parameters used in the pavement analysis are presented in Exhibit 2.

Exhibit 2: Pavement Design Parameters

Design Parameter	Value
Reliability	80%
Standard Deviation	0.45
Serviceability Loss (Δ psi)	2.5
Design CBR	3.44
Resilient Modulus	5,160 psi
Structural Coefficients	
Hot Bituminous Pavement	0.44
Aggregate Base Course	0.11
Cement Treated Subgrade	0.14

Pavement sections recommended for the roadways at The Glen at Widefield Filing No. 12 including hot mix asphalt (HMA) over aggregate base course (ABC) and HMA over cement-

treated subgrade (CTS) composite sections are summarized in Exhibit 3. The pavement design calculations are presented in Appendix C.

Exhibit 3: Recommended Pavement Sections

Pavement Area	Design ESAL	Alternative [1]
Golden Buff Drive	292,000	1. 5.0 inches HMA over 8.0 inches ABC
		2. 5.0 inches HMA over 8.0 inches CTS
Ground Cherry Trail, Dwarf Clover Court, and Lanceleaf Drive	36,500	1. 4.0 inches HMA over 4.0 inches ABC
		2. 4.0 inches HMA over 8.0 inches CTS

ABC = Aggregate Base Course; ESAL = equivalent single axle loads; HMA = Hot Mix Asphalt; CTS = Cement Treated Subgrade

Notes:

1. All pavement alternatives meet the minimum HMA and ABC thickness required per El Paso County Pavement Design Manual.

As discussed in Section 6.3, sulfate testing indicated from 0.0 to 0.23% by weight of sulfate. Traditional CTS methods are appropriate for sulfate contents less than 3.0%

Please provide a source for this value. EPC has had recent CTS issues with sulfate content

6 Construction Recommendations

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 Engineering Criteria Manual* and the Pikes Peak Region Asphalt Paving Specifications.

6.1 Earthwork Recommendations for Pavement Subgrade

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, if any, should be removed by stripping, with the depth to be field determined.

6.1.1 Moisture Treatment

To provide the recommended swell mitigation we recommend moisture treatment to a depth of 3 feet. This will require overexcavating 2 feet of subgrade soils, scarifying an additional 12 inches,

moisture conditioning the scarified subgrade to within +1% to +3% of its optimum moisture content, and compacting it to 95% of the Standard Proctor Maximum Dry Density ASTM D698. The overexcavated subgrade soils can then be replaced in 6-inch compacted lifts to the same specifications as described above.

6.1.2 Subgrade Preparation – Aggregate Base Course Alternatives

If pavement section alternatives are selected utilizing aggregate base course (ABC), the final moisture-treated subgrade surface 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 re

Please see the 2024 Clarification on CTS issued by the County Engineer. A Deviation request will be required to proceed with CTS which has a 21 day review period. All items from Memo 2 must be addressed in the deviation request.

6.1.3 Cement-treated Subgrade

For pavement section alternatives utilizing cement-treated subgrade (CTS), the subgrade shall be stabilized prior to placement of the asphalt by the addition of cement to a depth of at least 10 inches. The amount of cement applied shall be a minimum of 2% (by weight) of the subgrade's maximum dry density as determined by the Modified Proctor Test (ASTM D1557) for granular soils or by the Standard Proctor Test (ASTM D698) for cohesive soils. Based on local experience, we recommend that the design mix be increased by 1% in the field to account for waste and construction variability. The cement should be spread evenly on the subgrade surface and be thoroughly mixed into the subgrade over a 10-inch depth, as specified, such that a uniform blend of soil and cement is achieved. Prior to application or mixing of the cement, the upper 10 inches of subgrade should be thoroughly moisture conditioned to the soil's optimum water content or as much as 2% more than the optimum water content as necessary to provide a compactable soil condition. Densification of the cement-stabilized subgrade should be completed to obtain a compaction of at least 95% of the subgrade maximum dry density as determined by the Modified Proctor Test (ASTM D1557) or by the Standard Proctor Test (ASTM D698). Satisfactory compaction of the subgrade shall occur within 90 minutes from the time of mixing the cement into the subgrade.

The following conditions shall be observed as part of the subgrade stabilization:

- Type I/II of Type 1L cement as supplied; a local supplier shall be used. All cement used for stabilization should come from the same source. If cement sources are changed, a new laboratory mix design should be completed.

- Moisture conditioning of the subgrade and/or mixing of the cement into the subgrade shall not occur when soil temperatures are below 40 degrees F. Cement-treated subgrades should be maintained at a temperature of 40 degrees F or greater until the subgrade has been compacted as required.
- Cement placement, cement mixing, and compaction of the cement-treated subgrade should be observed by a qualified geotechnical engineer. The geotechnical engineer should complete in-situ compaction tests and construct representative compacted specimens of the treated subgrade material for subsequent laboratory quality assurance testing.

Pending the results of the field density testing, microfracturing of the stabilized subgrade may be required. Soil strengths in excess of 200 psi require microfracturing.

6.1.4 Fill Placement and Compaction

Granular fill placed as part of the pavement subgrade shall consist of non-expansive, granular soil, free of organic matter, unsuitable materials, debris, and cobbles greater than 3 inches in diameter. Additionally, any granular fill placed as part of the roadway subgrade should have a minimum CBR of 10. All granular fill placed within the pavement subgrade 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. Entech should approve any imported fill to be used within the pavement subgrade area prior to delivery to the site.

6.2 Aggregate Base Course

ABC materials shall conform to the *El Paso County Standard Specifications Manual*, Section 300 Aggregate Base Course. 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.

6.3 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. The test results indicated less than 0.01% to 0.23% soluble sulfate (by weight). The test results indicate the sulfate component of the in-place soils presents a negligible to severe exposure threat to concrete placed below the site grade.

Type V cement is typically recommended for the manufacture of any concrete that will come into contact with the site materials presenting severe exposure. If Type V cement is not readily

available, concrete which includes cement that meets ASTM C150 Type II requirements, 20% fly ash, and has a maximum water-to-cement ratio of 0.45 and air entrainment of 5% to 7% can be used to provide similar resistance. 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 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. 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.

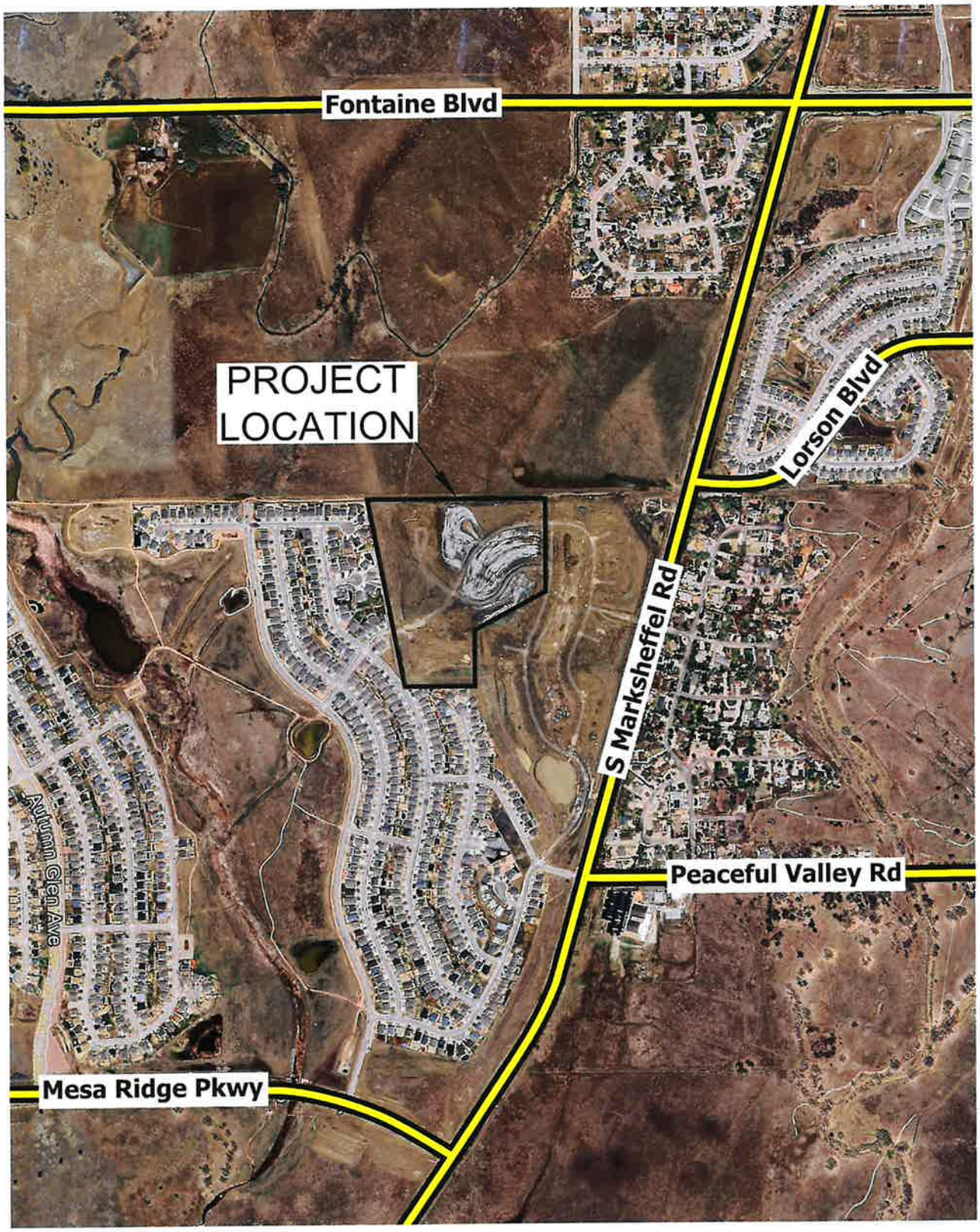
6.4 Construction Observation

Subgrade preparation for pavement structures should be observed by Entech 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 pavement subgrade prior to paving.

7 Closure

The subsurface investigation, geotechnical evaluation, and recommendations presented in this report are intended for use by Glen Development Company with application to the paving of the Glen at Widefield Filing No. 12 project in southeast 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 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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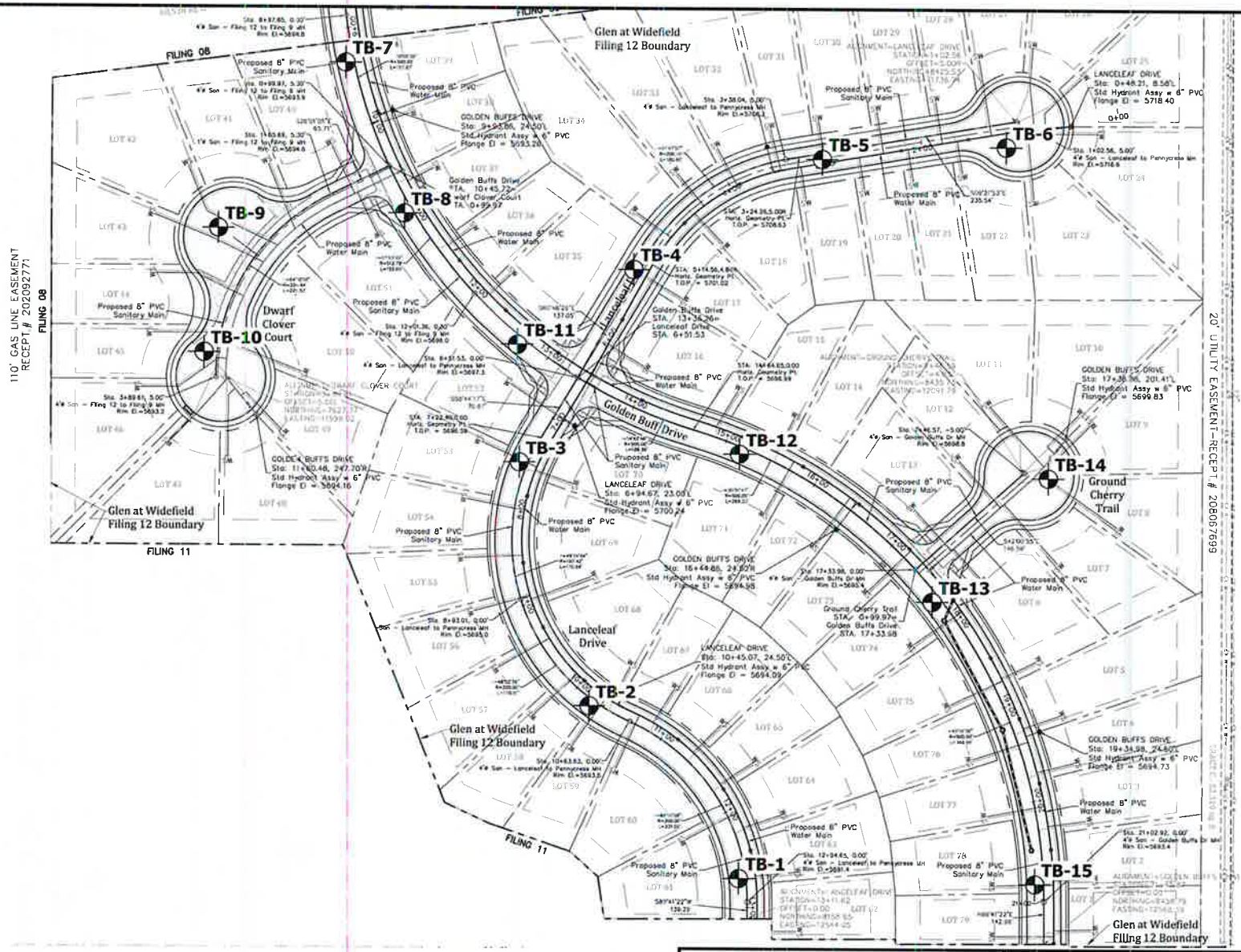
VICINITY MAP

GLEN AT WIDEFIELD FILING No. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. 1



TB- APPROXIMATE TEST BORING LOCATION AND NUMBER

ENTECH ENGINEERING, INC.

SITE AND EXPLORATION PLAN

GLEN AT WIDEFIELD FILING No. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. 2

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APPENDIX A: Test Boring Logs

TEST BORING 1
DATE DRILLED 3/4/2024
REMARKS

DRY TO 5', 3/4/24

FILL 0-5', SAND, CLAYEY, BROWN, MEDIUM DENSE, MOIST

Depth (ft)	Samples	Blows per foot	Watercontent %	Soil Type
		19	9.9	1
5		17	13.5	1

TEST BORING 2
DATE DRILLED 3/4/2024
REMARKS

DRY TO 5', 3/4/24

FILL 0-5', CLAY, SANDY, BROWN, STIFF, MOIST

Depth (ft)	Samples	Blows per foot	Watercontent %	Soil Type
		14	12.2	1
5		10	13.9	1

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TEST BORING LOGS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

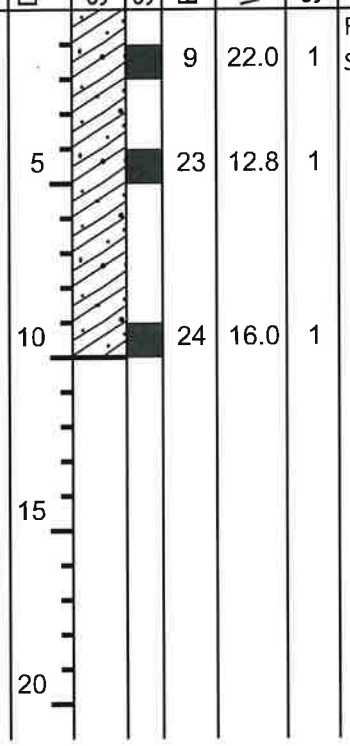
FIG. A-1

TEST BORING 3
DATE DRILLED 3/4/2024

REMARKS

DRY TO 10', 3/4/24

FILL 0-10', CLAY, SANDY, BROWN, STIFF to VERY STIFF, MOIST



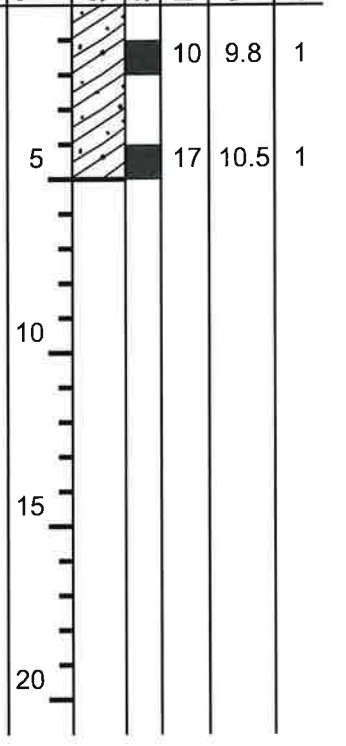
Blows per foot	Watercontent %	Soil Type
9	22.0	1
23	12.8	1
24	16.0	1

TEST BORING 4
DATE DRILLED 3/4/2024

REMARKS

DRY TO 5', 3/4/24

FILL 0-5', CLAY, SANDY, BROWN, STIFF to VERY STIFF, MOIST



Blows per foot	Watercontent %	Soil Type
10	9.8	1
17	10.5	1

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TEST BORING LOGS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. A-2

TEST BORING 5
DATE DRILLED 3/4/2024

REMARKS

DRY TO 5', 3/4/24

FILL 0-5', CLAY, WITH SAND, BROWN, STIFF, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			11	10.5	1
5			11	15.2	1
10					
15					
20					

TEST BORING 6
DATE DRILLED 3/4/2024

REMARKS

DRY TO 10', 3/4/24

FILL 0-1', CLAY, SANDY, BROWN
CLAY, SANDY, LIGHT BROWN, VERY STIFF to HARD, MOIST

CLAYSTONE, VERY WEAK, GRAY, WEATHERED (CLAY, SANDY, HARD, MOIST)

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
					1
			22	7.2	2
5			33	8.8	2
10			50/6"	8.5	3
15					
20					

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TEST BORING LOGS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. A-3

TEST BORING 7
DATE DRILLED 3/5/2024

REMARKS

DRY TO 5', 3/5/24

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
FILL 0-5', CLAY, SANDY, BROWN, STIFF, MOIST			10	14.6	1
5			15	12.4	1
10					
15					
20					

TEST BORING 8
DATE DRILLED 3/5/2024

REMARKS

DRY TO 5', 3/5/24

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
FILL 0-5', CLAY, SANDY, BROWN, STIFF to MEDIUM STIFF, MOIST			9	12.5	1
5			6	18.3	1
10					
15					
20					

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TEST BORING LOGS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

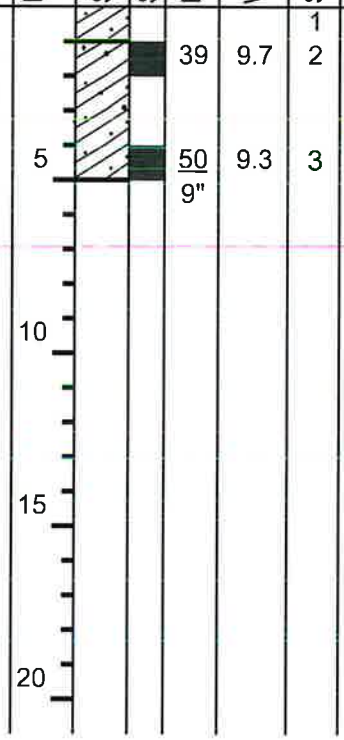
JOB NO. 231853

FIG. A-4

TEST BORING 9
DATE DRILLED 3/5/2024
REMARKS

DRY TO 5', 3/5/24

FILL 0-1', CLAY, SANDY, BROWN
CLAY, SANDY, GRAY, HARD, MOIST (CLAYSTONE, VERY WEAK, HIGHLY WEATHERED)



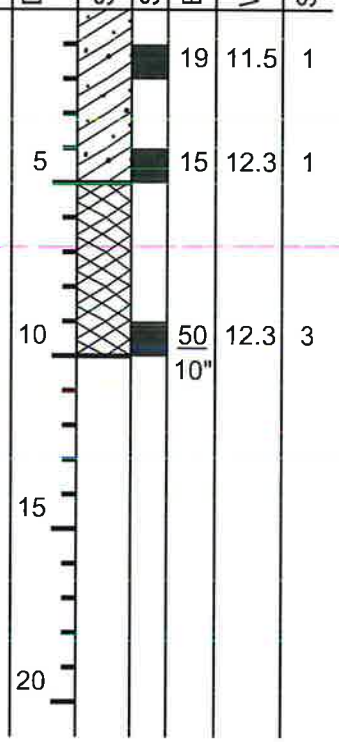
Blows per foot	Watercontent %	Soil Type
39	9.7	1
		2
50/9"	9.3	3

TEST BORING 10
DATE DRILLED 3/5/2024
REMARKS

DRY TO 10', 3/5/24

FILL 0-5', CLAY, SANDY, BROWN, VERY STIFF, MOIST

CLAYSTONE, VERY WEAK, GRAY, HIGHLY WEATHERED (CLAY, SANDY, HARD, MOIST)



Blows per foot	Watercontent %	Soil Type
19	11.5	1
15	12.3	1
50/10"	12.3	3

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TEST BORING LOGS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. A-5

TEST BORING 11
DATE DRILLED 3/5/2024

REMARKS

DRY TO 10', 3/5/24

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
					1
			40	10.6	2
5			36	12.7	2
10			50/6"	11.7	3
15					
20					

FILL 0-1', CLAY, SANDY, BROWN

CLAY, SANDY, BROWN, HARD, MOIST

CLAYSTONE, VERY WEAK, BROWN, SLIGHTLY WEATHERED (CLAY, SANDY, HARD, MOIST)

TEST BORING 12
DATE DRILLED 3/5/2024

REMARKS

DRY TO 5', 3/5/24

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			26	11.6	1
5			25	12.4	1
10					
15					
20					

FILL 0-5', CLAY, SANDY, VERY STIFF, MOIST

ENTECH ENGINEERING, INC.

TEST BORING LOGS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

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FIG. A-6

TEST BORING 13
DATE DRILLED 3/12/2024
REMARKS

DRY TO 5', 3/12/24

FILL 0-5', CLAY, SLIGHTLY SANDY, BROWN, VERY STIFF to MEDIUM STIFF, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			16	18.1	1
5			7	15.0	1
10					
15					
20					

TEST BORING 14
DATE DRILLED 3/12/2024
REMARKS

DRY TO 5', 3/12/24

FILL 0-1', CLAY, SANDY, BROWN
SAND, CLAYEY, GRAY, DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
					1
			30	8.7	2
5			37	7.6	2
10					
15					
20					

ENTECH ENGINEERING, INC.

TEST BORING LOGS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

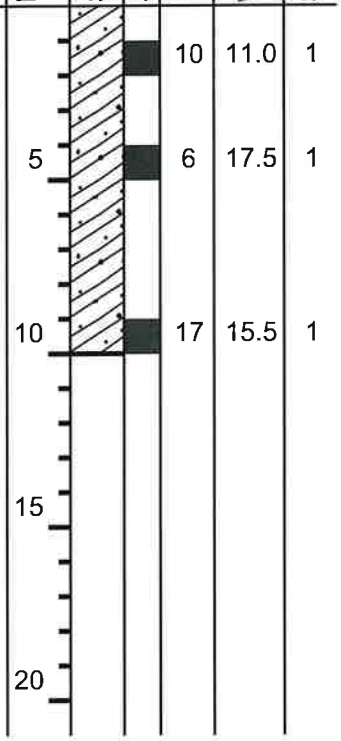
JOB NO. 231853

FIG. A-7

TEST BORING 15
DATE DRILLED 3/12/2024

REMARKS

DRY TO 10', 3/12/24



	Blows per foot	Watercontent %	Soil Type
FILL 0-10', CLAY, SANDY, BROWN, MEDIUM STIFF to VERY STIFF, MOIST	10	11.0	1
	6	17.5	1
	17	15.5	1

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TEST BORING LOGS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. A-8

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APPENDIX B: Laboratory Test Results

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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 %)	SWELL/ COLLAPSE (%)	AASHTO CLASS.	USCS	SOIL DESCRIPTION
1, CBR	3	0-3			61.1	37	21	16			A-6	CL	FILL, CLAY, SANDY
1	1	1-2	13.7	117.7	41.1	30	17	13		2.1	A-6	SC	FILL, SAND, CLAYEY
1	2	1-2	14.6	113.7	57.2	36	17	19	0.20	1.9	A-6	CL	FILL, CLAY, SANDY
1	3	1-2	27.3	106.4	60.6	37	19	18		2.0	A-6	CL	FILL, CLAY, SANDY
1	4	1-2	12.8	105.3	59.5	35	18	17	0.23	2.8	A-6	CL	FILL, CLAY, SANDY
1	5	1-2	12.5	111.4	71.5	37	22	15		4.3	A-6	CL	FILL, CLAY, WITH SAND
1	7	1-2	17.6	102.6	50.5	38	19	19		1.8	A-6	CL	FILL, CLAY, SANDY
1	8	1-2	16.6	107.4	67.0	44	21	23		1.8	A-7-6	CL	FILL, CLAY, SANDY
1	10	1-2	11.6	111.5	60.7	36	20	16		4.3	A-6	CL	FILL, CLAY, SANDY
1	12	1-2	13.0	119.2	62.0	36	18	18		1.9	A-6	CL	FILL, CLAY, SANDY
1	13	1-2	19.0	96.7	87.7	52	29	23		9.0	A-7-6	CH	FILL, CLAY, SLIGHTLY SANDY
1	15	1-2	14.0	103.1	59.3	36	17	19		1.5	A-6	CL	FILL, CLAY, SANDY
2	6	1-2	8.0	90.3	61.5	31	21	10	0.00	1.8	A-6	CL	CLAY, SANDY
2	9	1-2	11.7	114.7	66.6	39	22	17		4.6	A-6	CL	CLAY, SANDY
2	11	1-2	12.1	121.2	51.6	32	22	10		3.1	A-6	CL	CLAY, SANDY
2	14	1-2	9.8	117.2	37.7	30	20	10		5.5	A-6	SC	SAND, CLAYEY
2	11	1-3			65.3							CL	CLAY, SANDY
3	6	10	9.9	117.7	57.4	33	17	16	<0.01	2.8	A-6	CL	CLAYSTONE (CLAY, SANDY)
3	9	5	12.2	115.6	60.1	41	21	20		5.0	A-7-6	CL	CLAYSTONE (CLAY, SANDY)
3	10	10	14.8	113.3	67.7	27	13	14		4.2	A-6	CL	CLAYSTONE (CLAY, SANDY)
3	11	10	12.5	116.7	67.2	35	18	17		2.4	A-6	CL	CLAYSTONE (CLAY, SANDY)

Project: Glen at Widefield, Filing 12
Client: Glen Development
Job No: 231853

ENTECH ENGINEERING, INC.

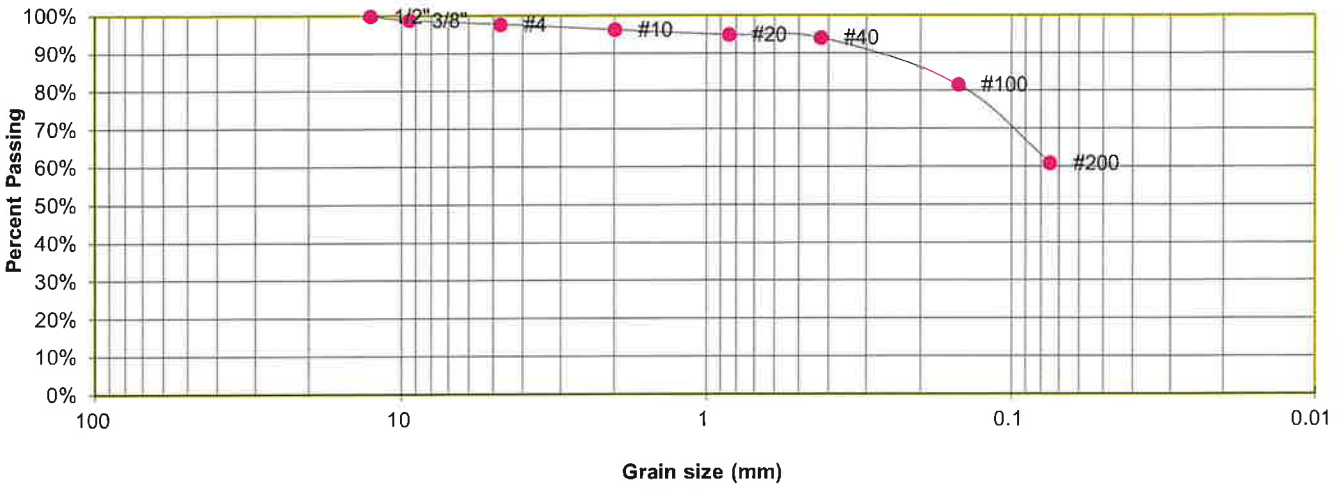
TABLE B-2
SUMMARY OF CTS TEST RESULTS

FIELD SAMPLE ID: SAND, SILTY
SOIL ADDITIVE: TYPE I/II CEMENT
CURING METHOD: 100° HUMIDIFIED OVEN

ADDITIVE %	WATER %	DENSITY (dry)	AGE (days)	STRENGTH (psi)
2	11.1	109.6	7	214
2	11.1	109.5	7	224
2	11.1	109.1	7	219
			AVERAGE:	**219**
4	11.1	109.0	7	269
4	11.1	109.3	7	256
4	11.1	109.2	7	240
			AVERAGE:	**255**

TEST BORING 3	SOIL DESCRIPTION FILL, CLAY, SANDY
DEPTH (FT) 0-3	SOIL TYPE 1, CBR

Sieve Analysis
Grain Size Distribution



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	98.9%
4	97.8%
10	96.3%
20	95.0%
40	94.1%
100	81.7%
200	61.1%

ATTERBERG LIMITS

Plastic Limit	21
Liquid Limit	37
Plastic Index	16

SOIL CLASSIFICATION

USCS CLASSIFICATION:	CL
AASHTO CLASSIFICATION:	A-6
AASHTO GROUP INDEX:	7

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

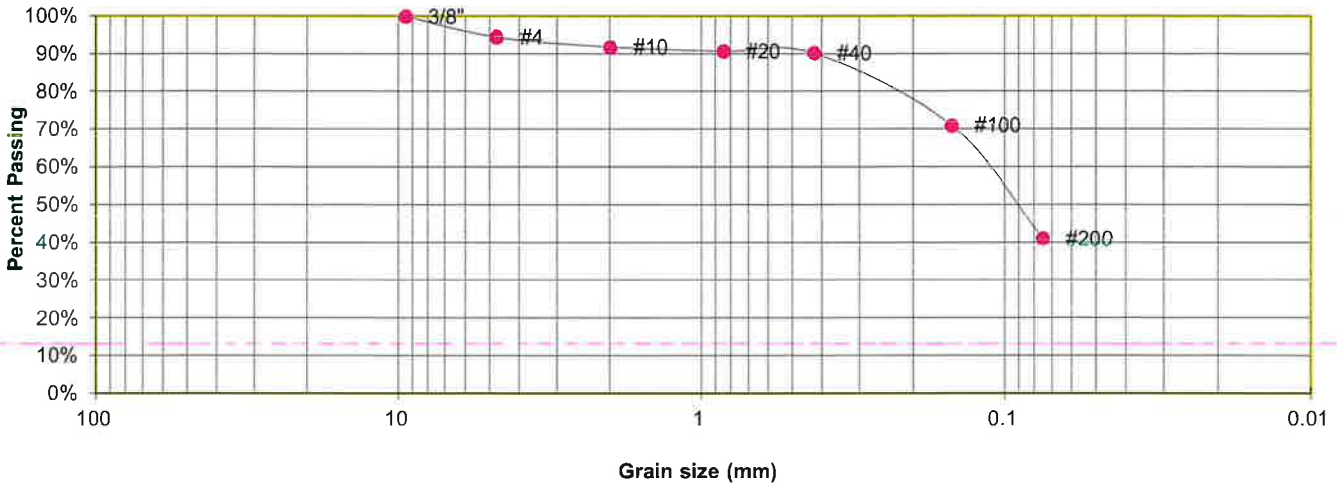
GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-1

TEST BORING	1	SOIL DESCRIPTION	FILL, SAND, CLAYEY
DEPTH (FT)	1-2	SOIL TYPE	1

Sieve Analysis
Grain Size Distribution



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	94.5%
10	91.8%
20	90.8%
40	90.2%
100	71.1%
200	41.1%

ATTERBERG LIMITS

Plastic Limit	17
Liquid Limit	30
Plastic Index	13

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SC
AASHTO CLASSIFICATION:	A-6
AASHTO GROUP INDEX:	2

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

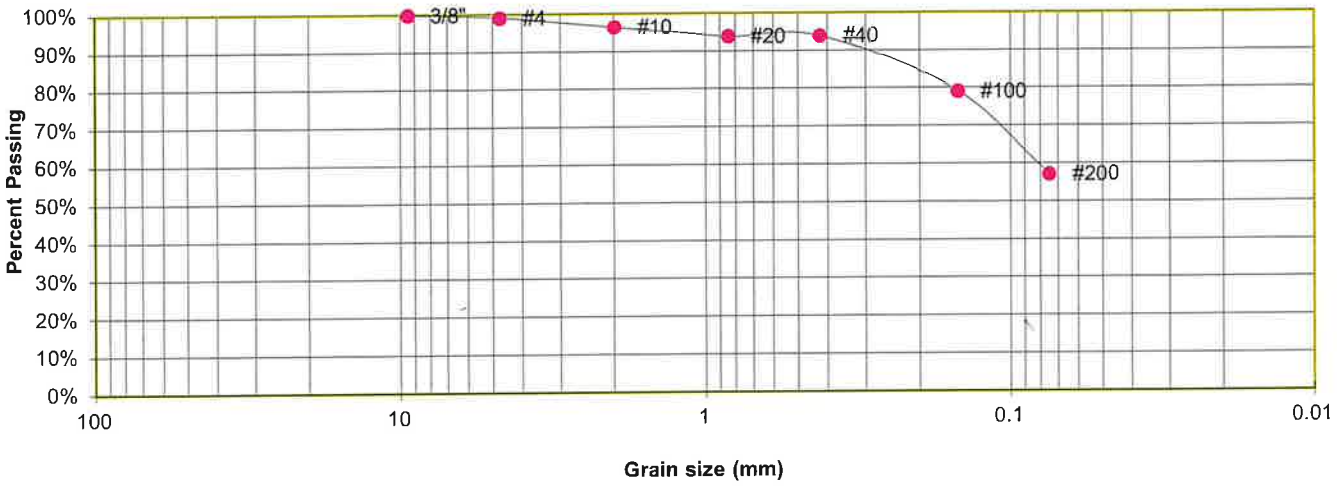
GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-2

TEST BORING	2	SOIL DESCRIPTION	FILL, CLAY, SANDY
DEPTH (FT)	1-2	SOIL TYPE	1

Sieve Analysis
Grain Size Distribution



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.2%
10	96.5%
20	94.0%
40	94.0%
100	79.2%
200	57.2%

ATTERBERG LIMITS

Plastic Limit	17
Liquid Limit	36
Plastic Index	19

SOIL CLASSIFICATION

USCS CLASSIFICATION:	CL
AASHTO CLASSIFICATION:	A-6
AASHTO GROUP INDEX:	8

ENTECH ENGINEERING, INC.

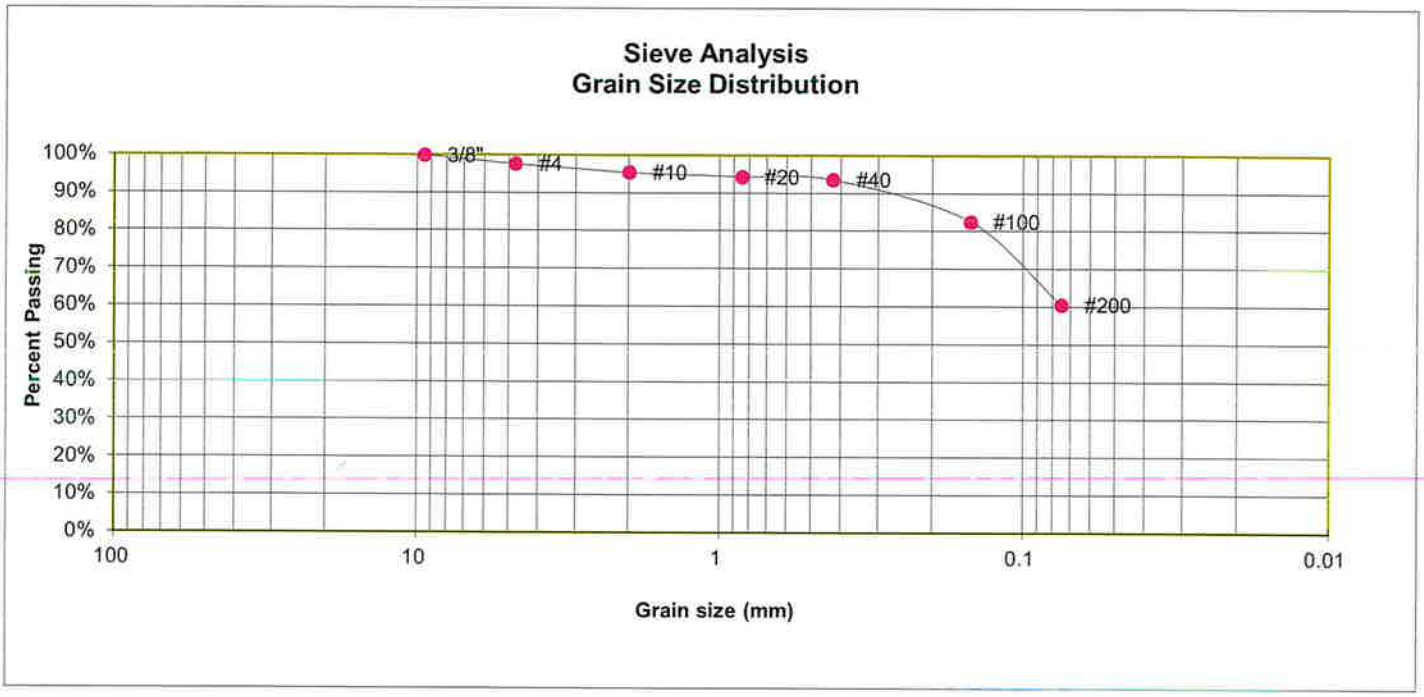
LABORATORY TEST RESULTS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-3

TEST BORING	3	SOIL DESCRIPTION	FILL, CLAY, SANDY
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	97.7%
10	95.5%
20	94.4%
40	93.6%
100	82.6%
200	60.6%

ATTERBERG LIMITS

Plastic Limit	19
Liquid Limit	37
Plastic Index	18

SOIL CLASSIFICATION

USCS CLASSIFICATION:	CL
AASHTO CLASSIFICATION:	A-6
AASHTO GROUP INDEX:	8

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

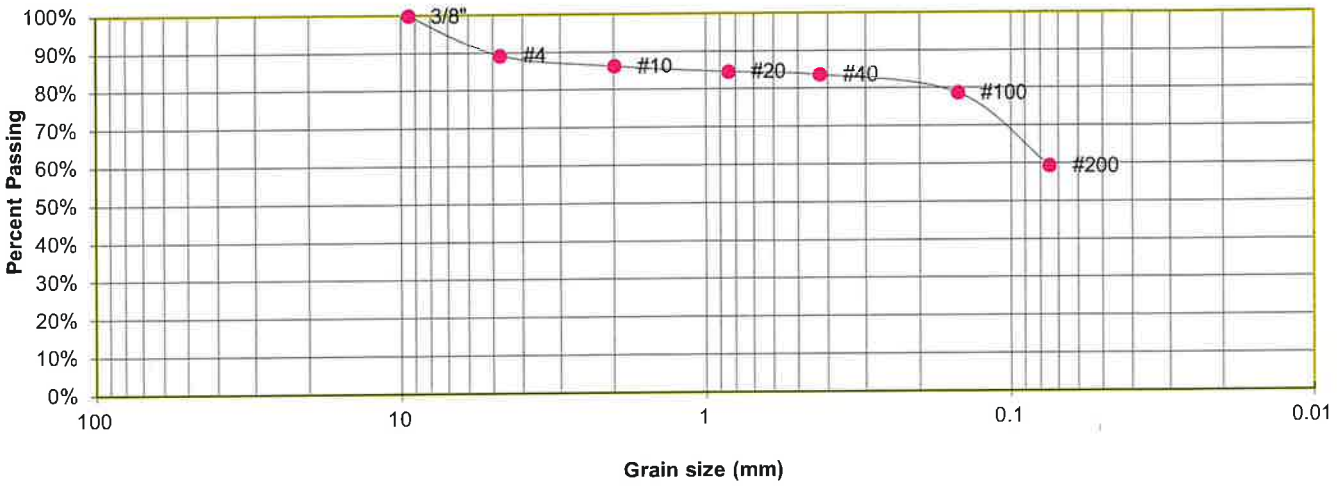
GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-4

TEST BORING	4	SOIL DESCRIPTION	FILL, CLAY, SANDY
DEPTH (FT)	1-2	SOIL TYPE	1

Sieve Analysis
Grain Size Distribution



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	89.3%
10	86.3%
20	84.7%
40	83.8%
100	78.9%
200	59.5%

ATTERBERG LIMITS

Plastic Limit	18
Liquid Limit	35
Plastic Index	17

SOIL CLASSIFICATION

USCS CLASSIFICATION:	CL
AASHTO CLASSIFICATION:	A-6
AASHTO GROUP INDEX:	8

ENTECH ENGINEERING, INC.

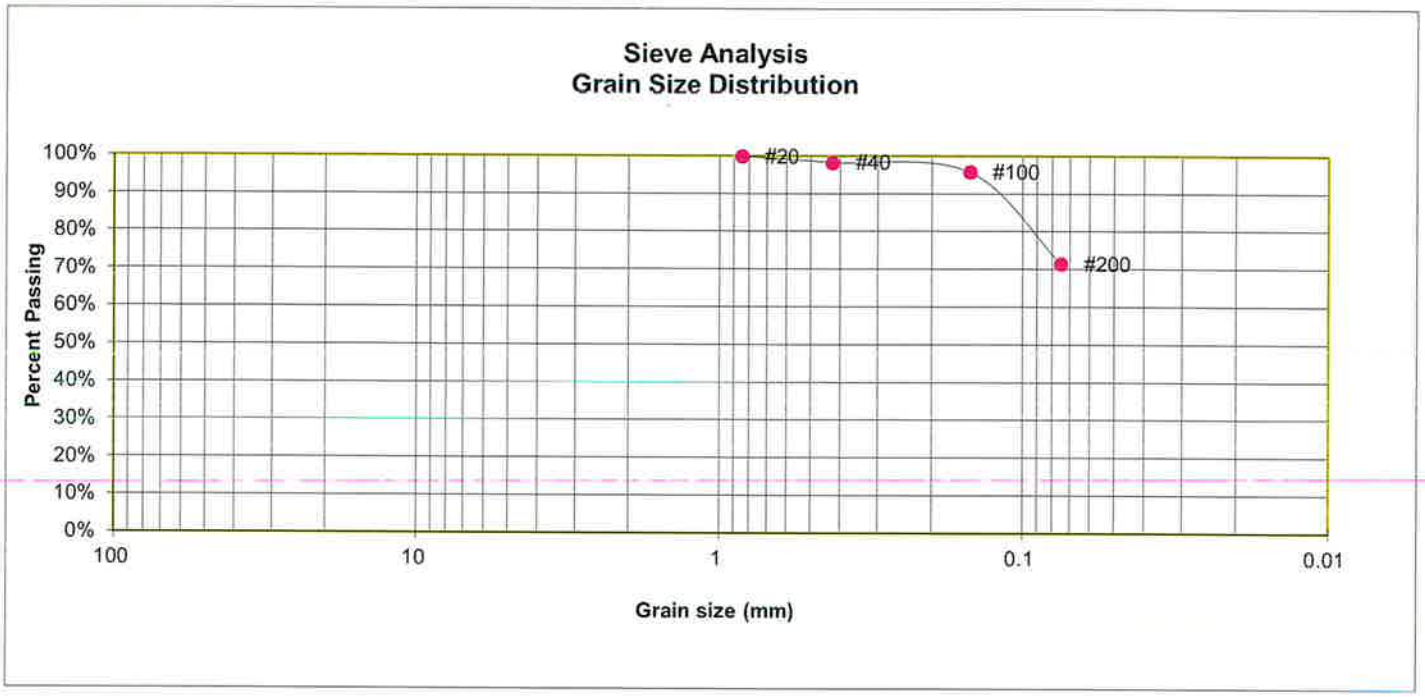
LABORATORY TEST RESULTS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-5

TEST BORING	5	SOIL DESCRIPTION	FILL, CLAY, WITH SAND
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	
10	
20	100.0%
40	98.3%
100	95.9%
200	71.5%

ATTERBERG LIMITS

Plastic Limit	22
Liquid Limit	37
Plastic Index	15

SOIL CLASSIFICATION

USCS CLASSIFICATION:	CL
AASHTO CLASSIFICATION:	A-6
AASHTO GROUP INDEX:	10

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

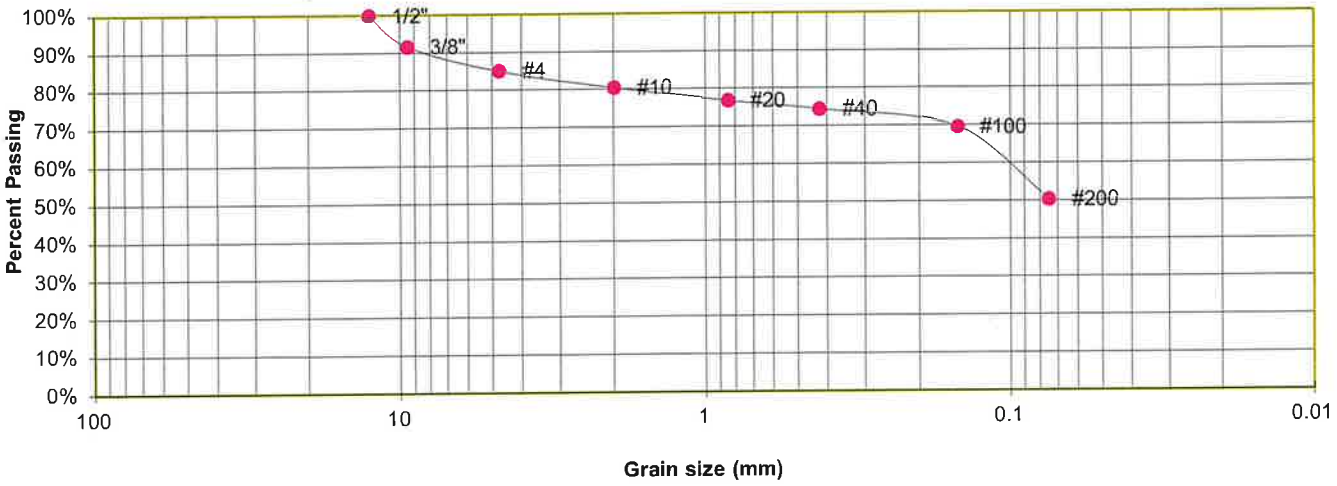
GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-6

TEST BORING	7	SOIL DESCRIPTION	FILL, CLAY, SANDY
DEPTH (FT)	1-2	SOIL TYPE	1

Sieve Analysis
Grain Size Distribution



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	91.7%
4	85.1%
10	80.6%
20	77.0%
40	74.6%
100	69.8%
200	50.5%

ATTERBERG LIMITS

Plastic Limit	19
Liquid Limit	38
Plastic Index	19

SOIL CLASSIFICATION

USCS CLASSIFICATION:	CL
AASHTO CLASSIFICATION:	A-6
AASHTO GROUP INDEX:	6

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

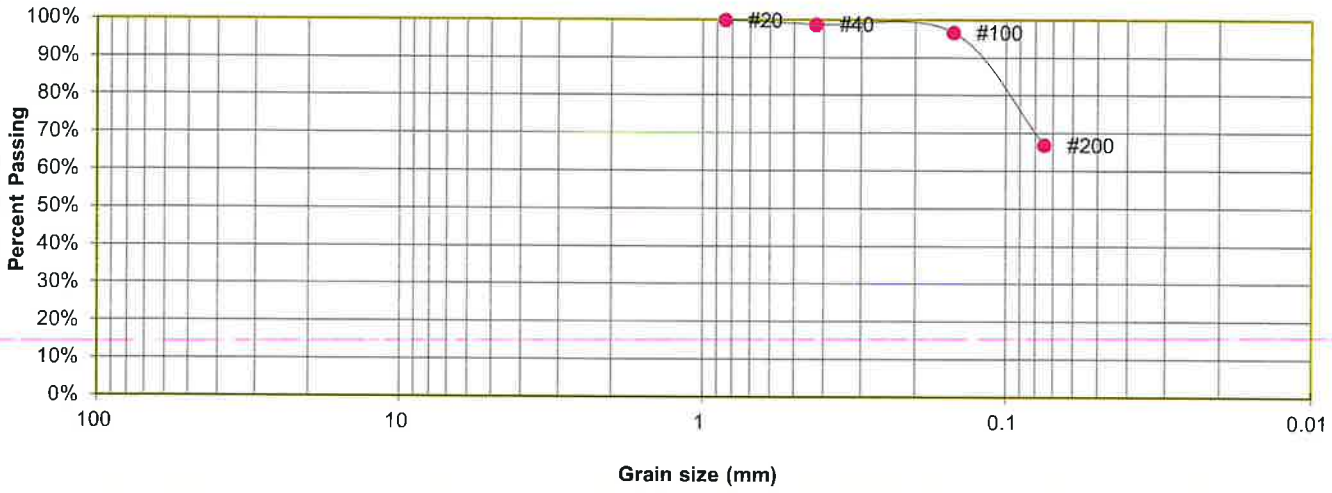
GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-7

TEST BORING	8	SOIL DESCRIPTION	FILL, CLAY, SANDY
DEPTH (FT)	1-2	SOIL TYPE	1

Sieve Analysis
Grain Size Distribution



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	
20	100.0%
40	98.9%
100	96.8%
200	67.0%

ATTERBERG LIMITS

Plastic Limit	21
Liquid Limit	44
Plastic Index	23

SOIL CLASSIFICATION

USCS CLASSIFICATION:	CL
AASHTO CLASSIFICATION:	A-7-6
AASHTO GROUP INDEX:	14

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

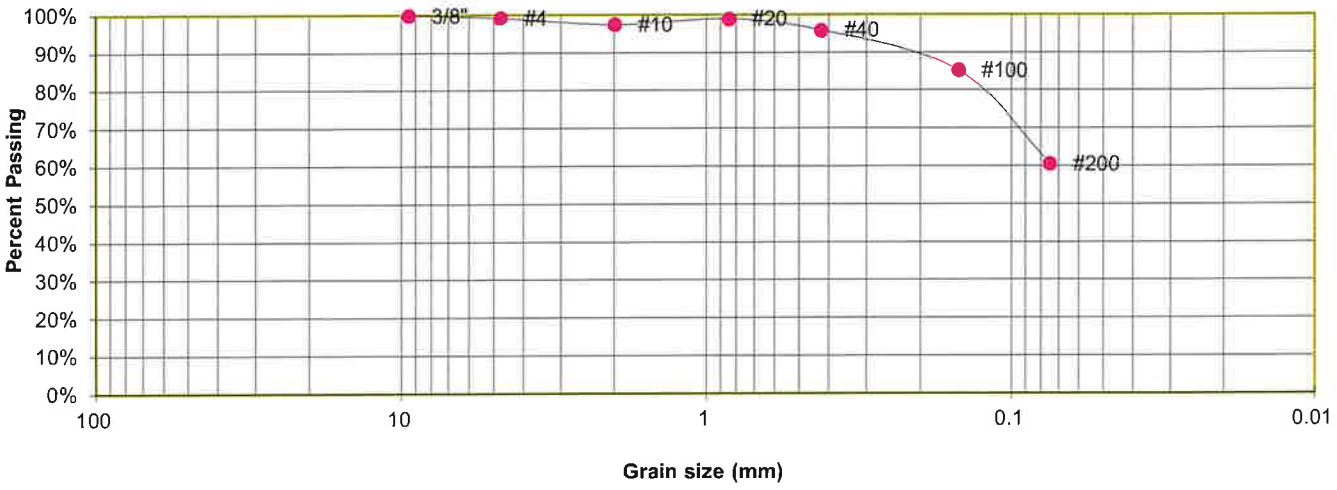
GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-8

TEST BORING 10	SOIL DESCRIPTION FILL, CLAY, SANDY
DEPTH (FT) 1-2	SOIL TYPE 1

Sieve Analysis
Grain Size Distribution



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.3%
10	97.5%
20	99.0%
40	96.0%
100	85.3%
200	60.7%

ATTERBERG LIMITS

Plastic Limit	20
Liquid Limit	36
Plastic Index	16

SOIL CLASSIFICATION

USCS CLASSIFICATION:	CL
AASHTO CLASSIFICATION:	A-6
AASHTO GROUP INDEX:	8

ENTECH ENGINEERING, INC.

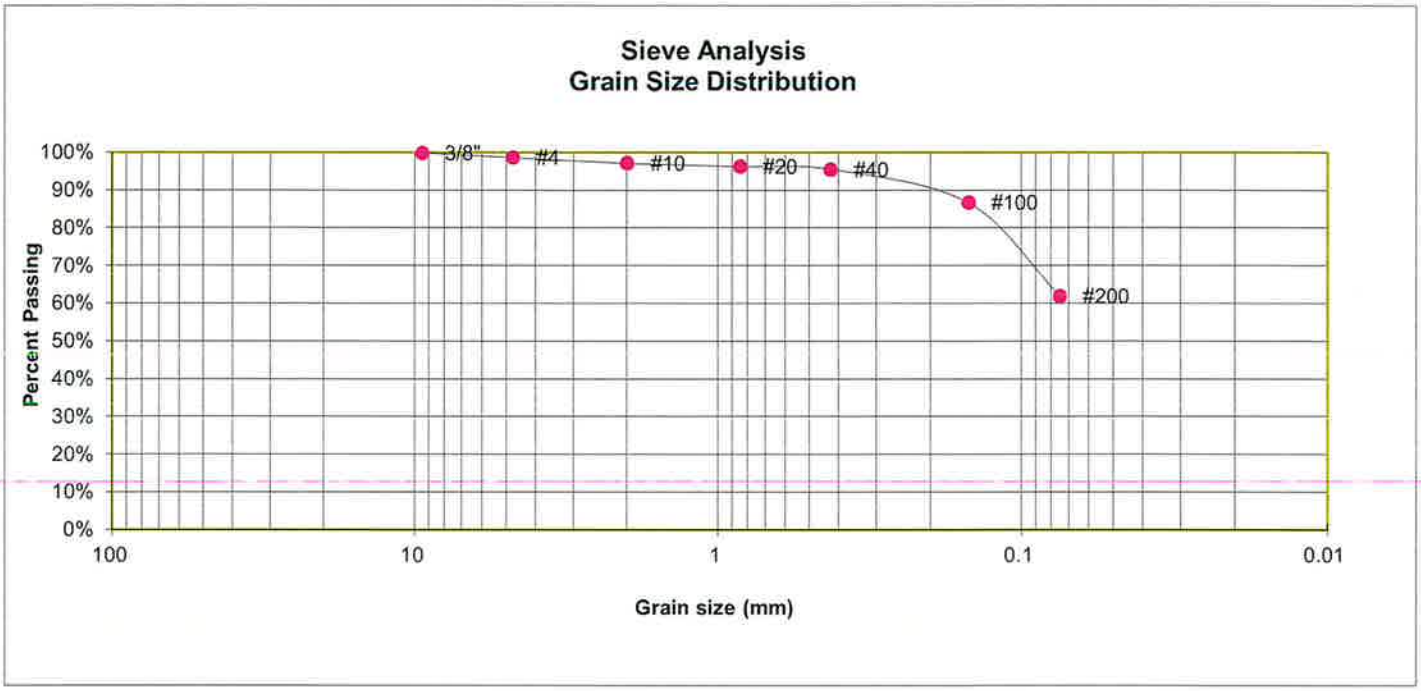
LABORATORY TEST RESULTS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-9

TEST BORING	12	SOIL DESCRIPTION	FILL, CLAY, SANDY
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	98.7%
10	97.2%
20	96.4%
40	95.6%
100	86.9%
200	62.0%

ATTERBERG LIMITS

Plastic Limit	18
Liquid Limit	36
Plastic Index	18

SOIL CLASSIFICATION

USCS CLASSIFICATION:	CL
AASHTO CLASSIFICATION:	A-6
AASHTO GROUP INDEX:	9

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

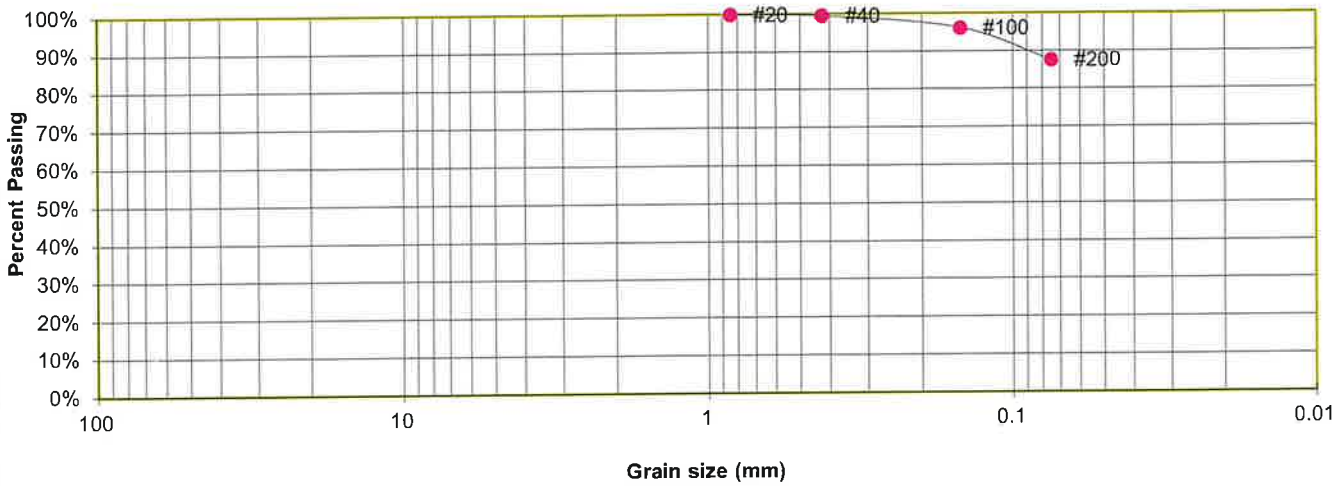
GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-10

TEST BORING	13	SOIL DESCRIPTION	FILL, CLAY, SLIGHTLY SANDY
DEPTH (FT)	1-2	SOIL TYPE	1

Sieve Analysis
Grain Size Distribution



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	
20	100.0%
40	99.6%
100	96.3%
200	87.7%

ATTERBERG LIMITS

Plastic Limit	29
Liquid Limit	52
Plastic Index	23

SOIL CLASSIFICATION

USCS CLASSIFICATION:	CH
AASHTO CLASSIFICATION:	A-7-6
AASHTO GROUP INDEX:	20

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

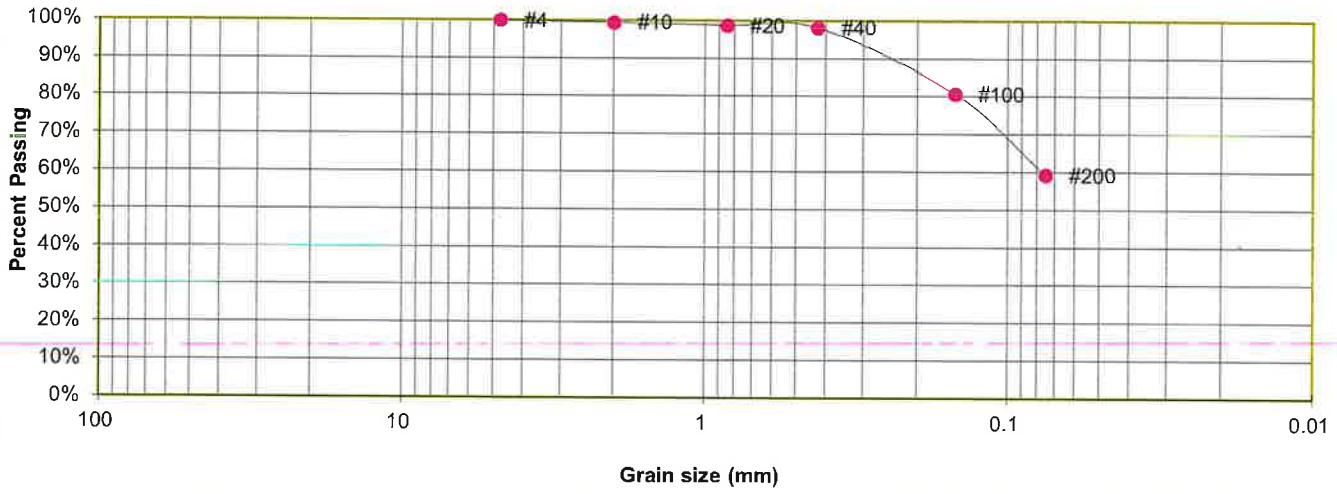
GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-11

TEST BORING	15	SOIL DESCRIPTION	FILL, CLAY, SANDY
DEPTH (FT)	1-2	SOIL TYPE	1

Sieve Analysis
Grain Size Distribution



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.5%
20	98.8%
40	98.2%
100	80.8%
200	59.3%

ATTERBERG LIMITS

Plastic Limit	17
Liquid Limit	36
Plastic Index	19

SOIL CLASSIFICATION

USCS CLASSIFICATION:	CL
AASHTO CLASSIFICATION:	A-6
AASHTO GROUP INDEX:	8

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

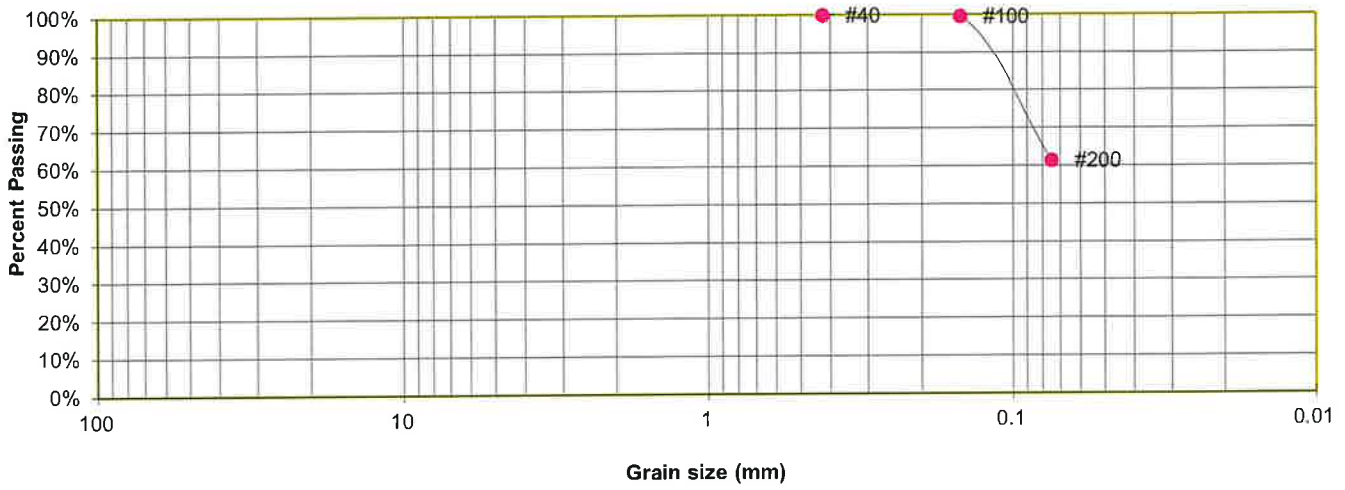
GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-12

TEST BORING	6	SOIL DESCRIPTION	CLAY, SANDY
DEPTH (FT)	1-2	SOIL TYPE	2

Sieve Analysis
Grain Size Distribution



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	
20	
40	100.0%
100	99.7%
200	61.5%

ATTERBERG LIMITS

Plastic Limit	21
Liquid Limit	31
Plastic Index	10

SOIL CLASSIFICATION

USCS CLASSIFICATION:	CL
AASHTO CLASSIFICATION:	A-6
AASHTO GROUP INDEX:	4

ENTECH ENGINEERING, INC.

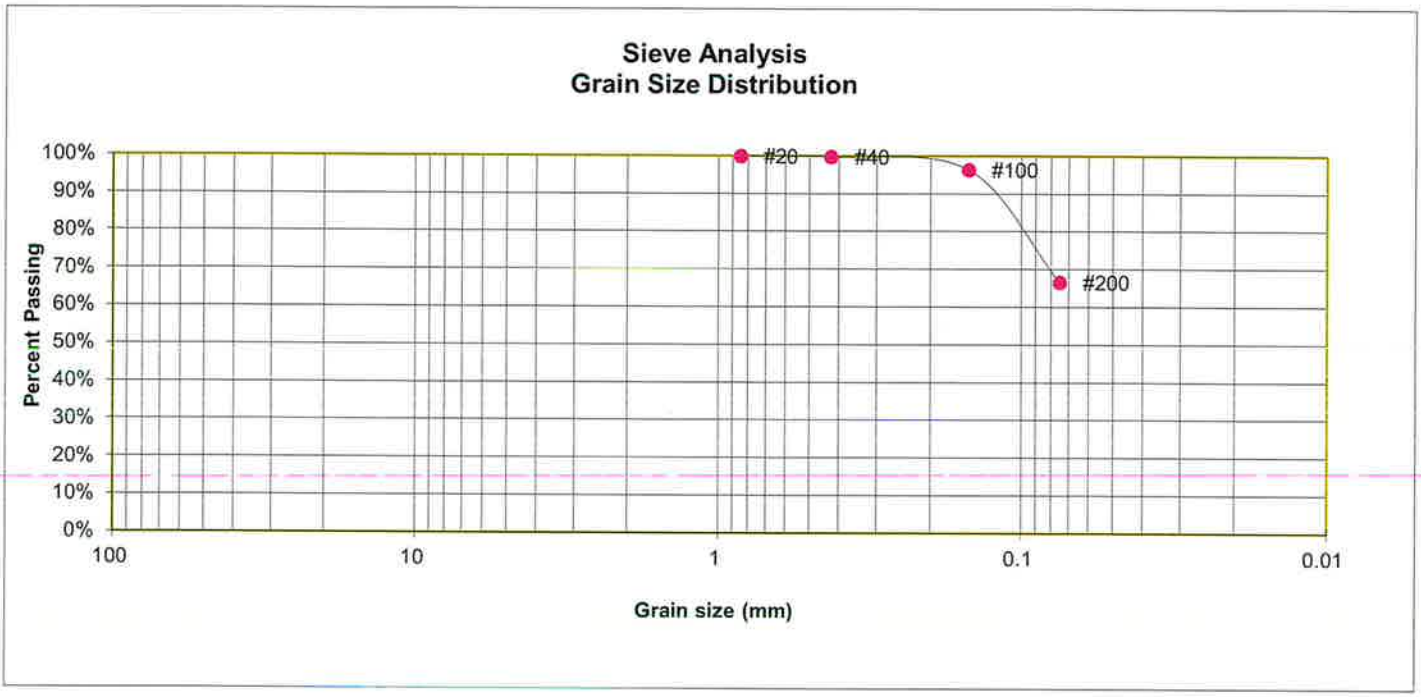
LABORATORY TEST RESULTS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-13

TEST BORING	9	SOIL DESCRIPTION	CLAY, SANDY
DEPTH (FT)	1-2	SOIL TYPE	2



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	
20	100.0%
40	99.8%
100	96.4%
200	66.6%

ATTERBERG LIMITS

Plastic Limit	22
Liquid Limit	39
Plastic Index	17

SOIL CLASSIFICATION

USCS CLASSIFICATION:	CL
AASHTO CLASSIFICATION:	A-6
AASHTO GROUP INDEX:	10

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

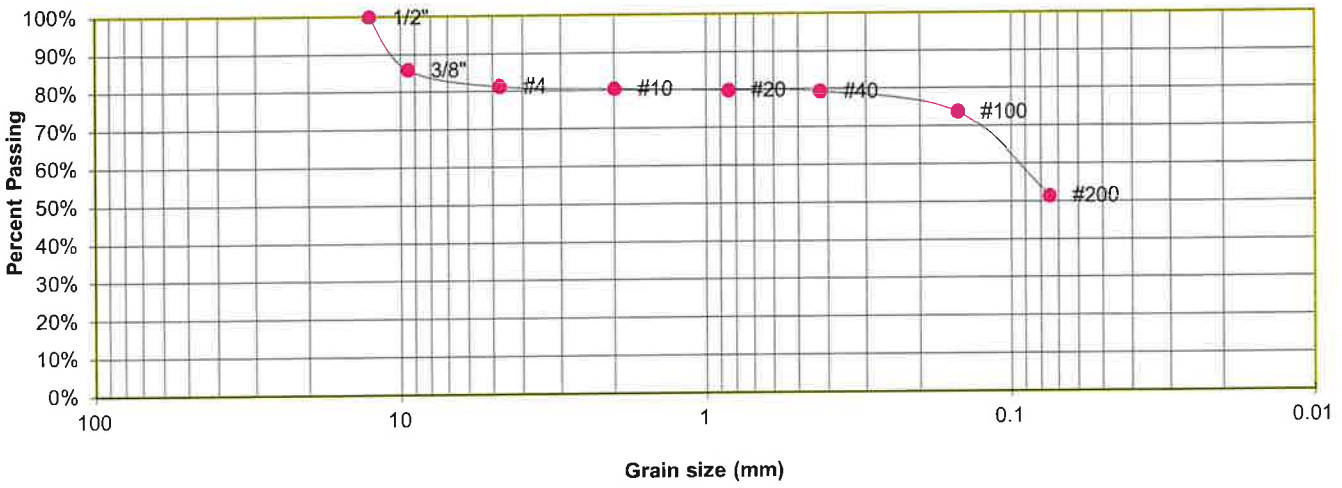
GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-14

TEST BORING	11	SOIL DESCRIPTION	CLAY, SANDY
DEPTH (FT)	1-2	SOIL TYPE	2

Sieve Analysis
Grain Size Distribution



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	86.0%
4	81.4%
10	80.6%
20	80.0%
40	79.5%
100	73.9%
200	51.6%

ATTERBERG LIMITS

Plastic Limit	22
Liquid Limit	32
Plastic Index	10

SOIL CLASSIFICATION

USCS CLASSIFICATION:	CL
AASHTO CLASSIFICATION:	A-6
AASHTO GROUP INDEX:	3

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

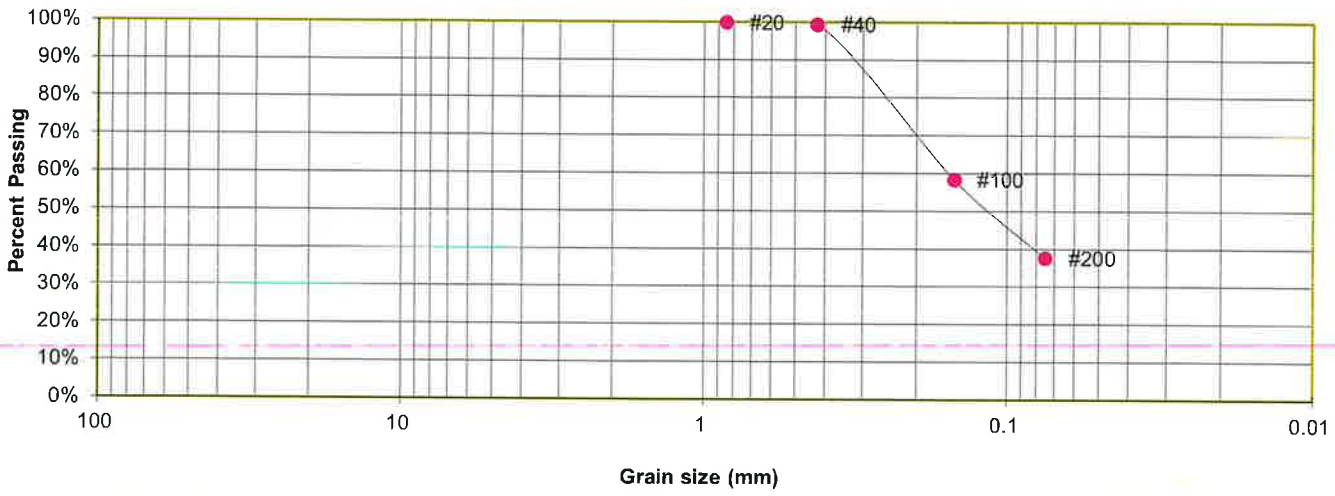
GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-15

TEST BORING	14	SOIL DESCRIPTION	SAND, CLAYEY
DEPTH (FT)	1-2	SOIL TYPE	2

Sieve Analysis
Grain Size Distribution



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	
20	100.0%
40	99.5%
100	58.4%
200	37.7%

ATTERBERG LIMITS

Plastic Limit	20
Liquid Limit	30
Plastic Index	10

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SC
AASHTO CLASSIFICATION:	A-6
AASHTO GROUP INDEX:	0

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

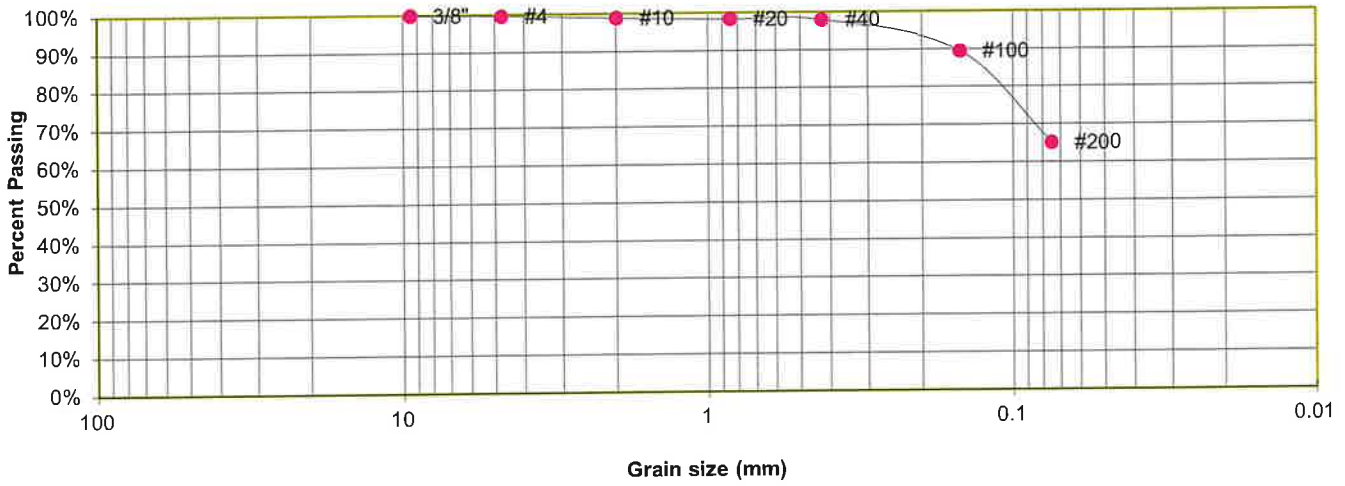
GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-16

TEST BORING	11	SOIL DESCRIPTION	CLAY, SANDY
DEPTH (FT)	1-3	SOIL TYPE	2

Sieve Analysis
Grain Size Distribution



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.7%
10	98.9%
20	98.4%
40	98.1%
100	89.6%
200	65.3%

SOIL CLASSIFICATION

USCS CLASSIFICATION: CL
AASHTO CLASSIFICATION:
AASHTO GROUP INDEX:

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

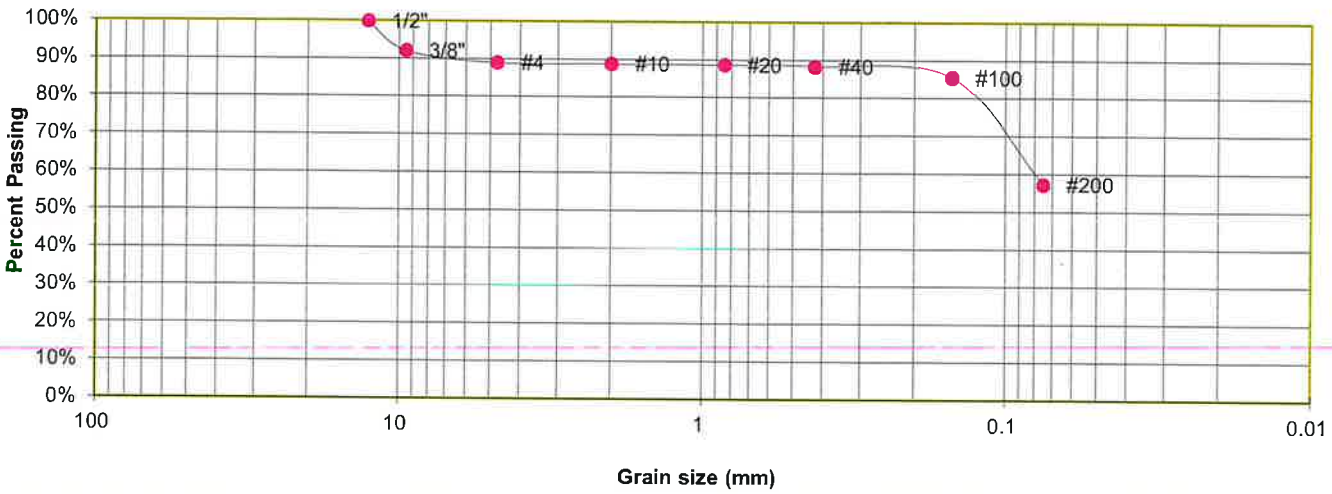
GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-17

TEST BORING	6	SOIL DESCRIPTION	CLAYSTONE (CLAY, SANDY)
DEPTH (FT)	10	SOIL TYPE	3

Sieve Analysis
Grain Size Distribution



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	92.1%
4	89.0%
10	88.9%
20	88.7%
40	88.5%
100	85.5%
200	57.4%

ATTERBERG LIMITS

Plastic Limit	17
Liquid Limit	33
Plastic Index	16

SOIL CLASSIFICATION

USCS CLASSIFICATION:	CL
AASHTO CLASSIFICATION:	A-6
AASHTO GROUP INDEX:	6

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

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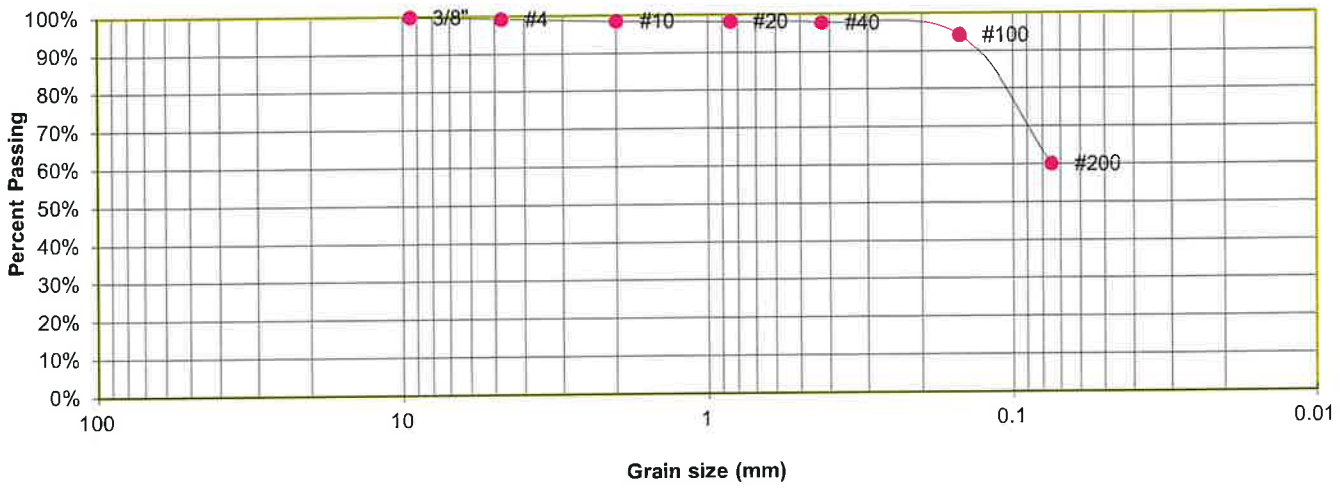
FIG. B-18

TEST BORING	9	SOIL DESCRIPTION	CLAYSTONE (CLAY, SANDY)
DEPTH (FT)	5	SOIL TYPE	3

Sieve Analysis
Grain Size Distribution



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.3%
10	98.6%
20	98.2%
40	97.8%
100	94.4%
200	60.1%

ATTERBERG LIMITS

Plastic Limit	21
Liquid Limit	41
Plastic Index	20

SOIL CLASSIFICATION

USCS CLASSIFICATION:	CL
AASHTO CLASSIFICATION:	A-7-6
AASHTO GROUP INDEX:	10

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

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GLEN DEVELOPMENT

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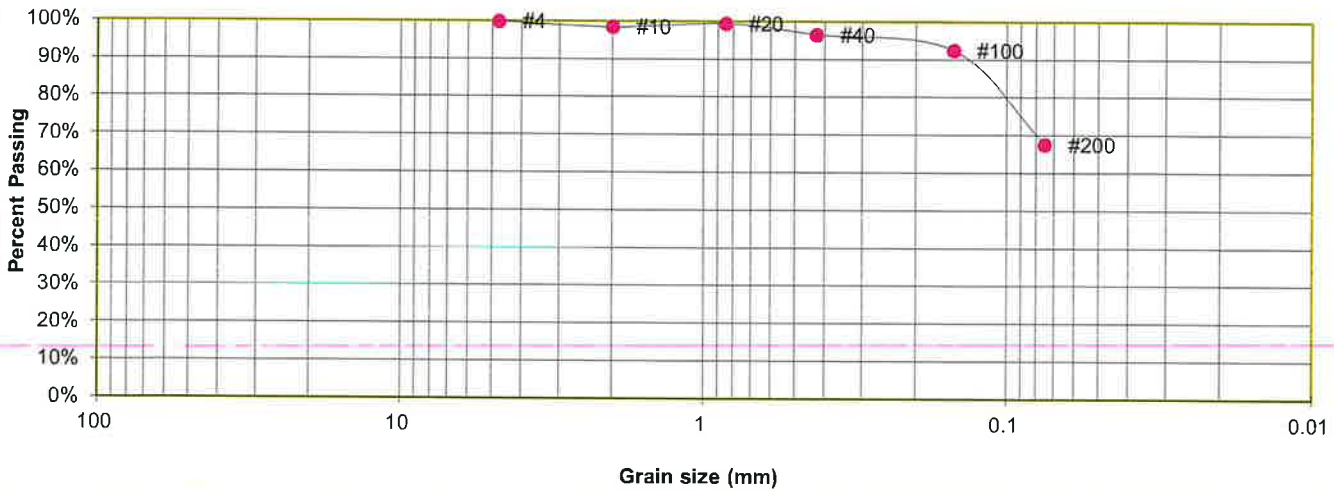
FIG. B-19

TEST BORING	10	SOIL DESCRIPTION	CLAYSTONE (CLAY, SANDY)
DEPTH (FT)	10	SOIL TYPE	3

Sieve Analysis
Grain Size Distribution



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.6%
20	99.5%
40	96.6%
100	92.5%
200	67.7%

ATTERBERG LIMITS

Plastic Limit	13
Liquid Limit	27
Plastic Index	14

SOIL CLASSIFICATION

USCS CLASSIFICATION:	CL
AASHTO CLASSIFICATION:	A-6
AASHTO GROUP INDEX:	6

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

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GLEN DEVELOPMENT

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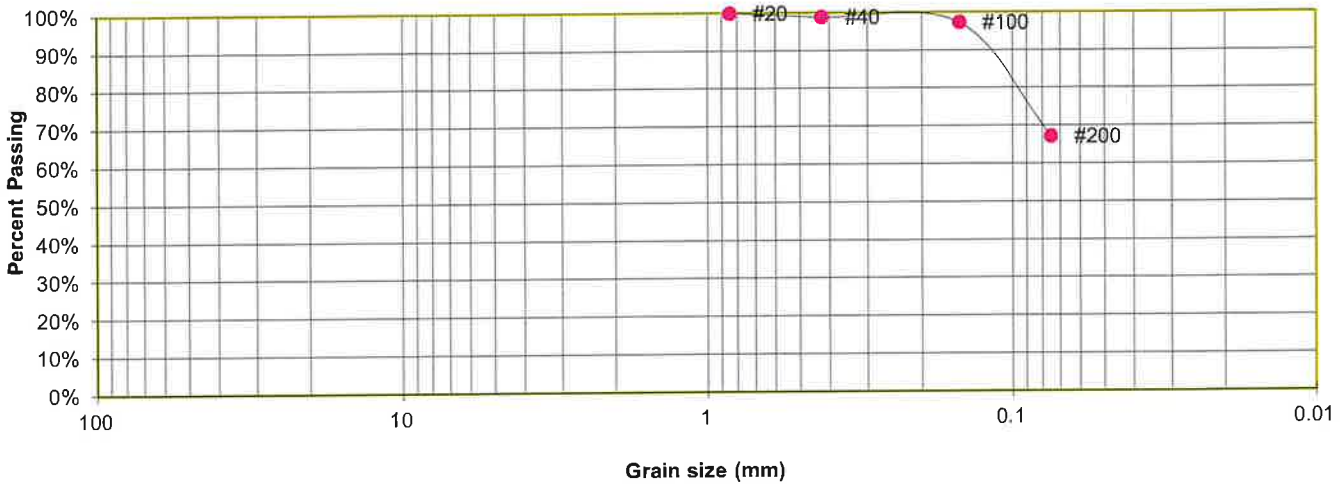
FIG. B-20

TEST BORING	11	SOIL DESCRIPTION	CLAYSTONE (CLAY, SANDY)
DEPTH (FT)	10	SOIL TYPE	3

Sieve Analysis
Grain Size Distribution



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	
20	100.0%
40	98.9%
100	97.4%
200	67.2%

ATTERBERG LIMITS

Plastic Limit	18
Liquid Limit	35
Plastic Index	17

SOIL CLASSIFICATION

USCS CLASSIFICATION:	CL
AASHTO CLASSIFICATION:	A-6
AASHTO GROUP INDEX:	10

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

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GLEN DEVELOPMENT

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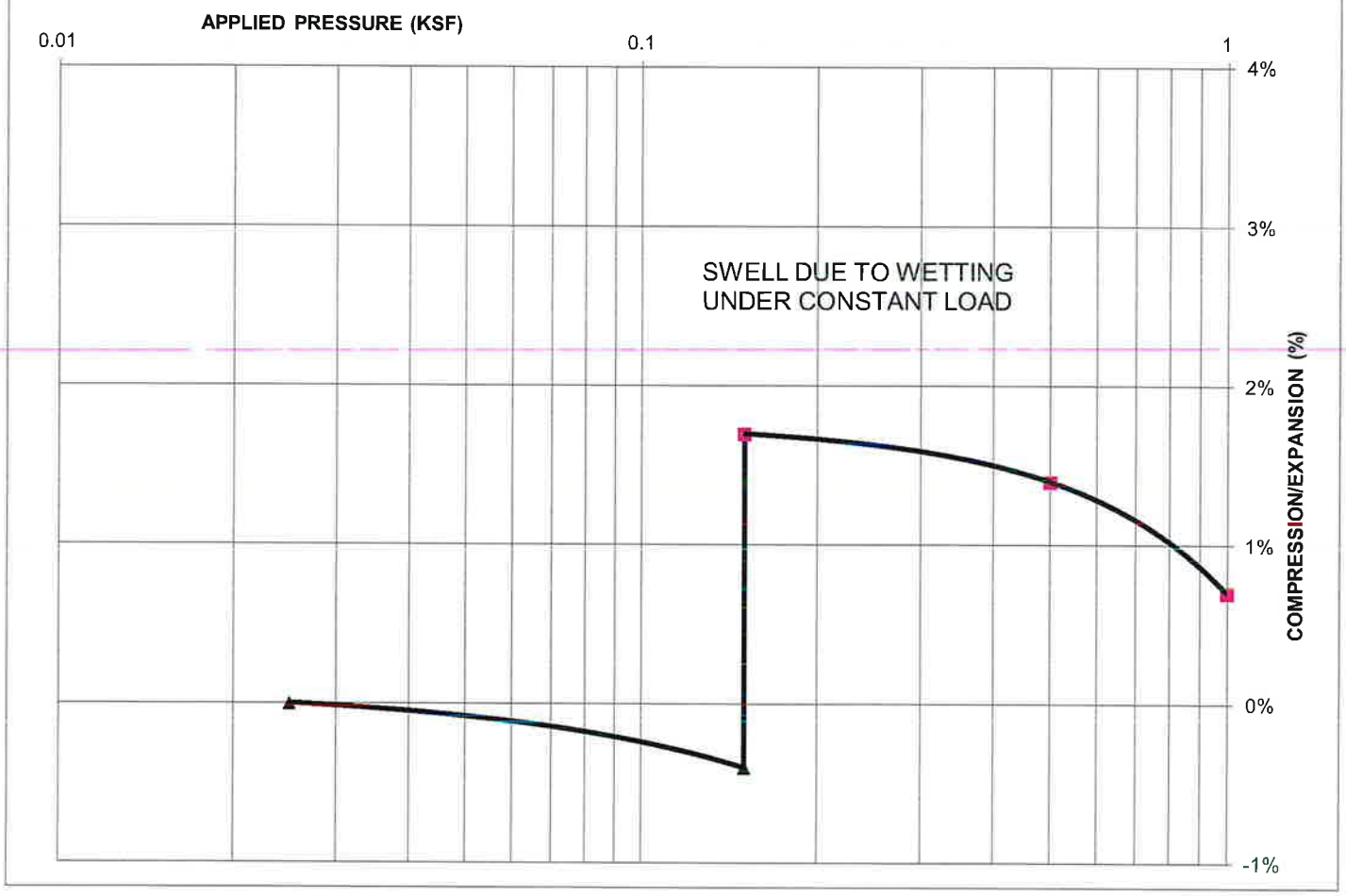
FIG. B-21

TEST BORING	1	SOIL DESCRIPTION	FILL, SAND, CLAYEY
DEPTH (FT)	1-2	SOIL TYPE	1

SWELL CONSOLIDATION



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF):	118
NATURAL MOISTURE CONTENT:	13.7%
SWELL/COLLAPSE (%):	2.1%

ENTECH ENGINEERING, INC.

SWELL TEST RESULTS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

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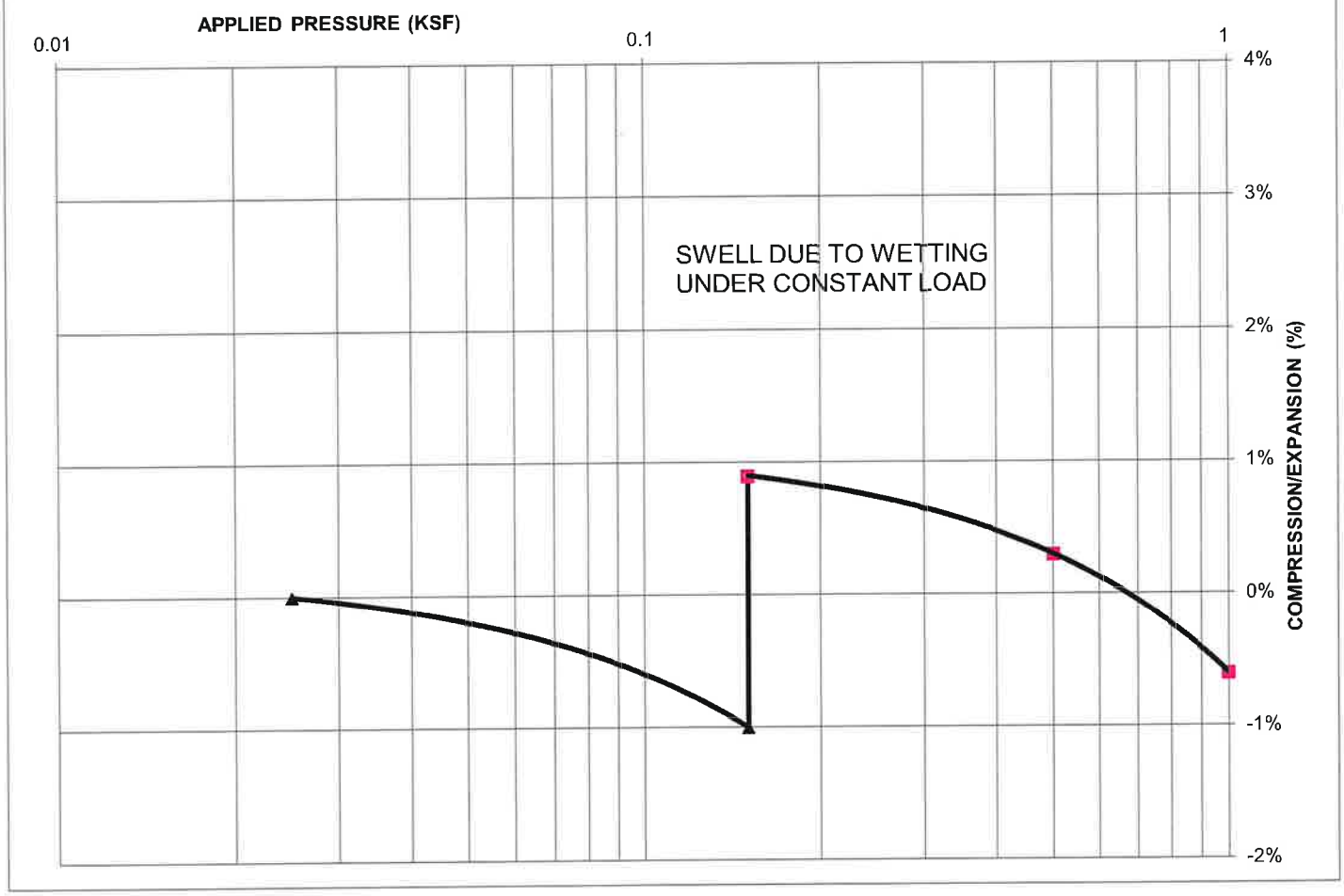
FIG. B-22

TEST BORING	2	SOIL DESCRIPTION	FILL, CLAY, SANDY
DEPTH (FT)	1-2	SOIL TYPE	1

SWELL CONSOLIDATION



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF):	114
NATURAL MOISTURE CONTENT:	14.6%
SWELL/COLLAPSE (%):	1.9%

ENTECH ENGINEERING, INC.

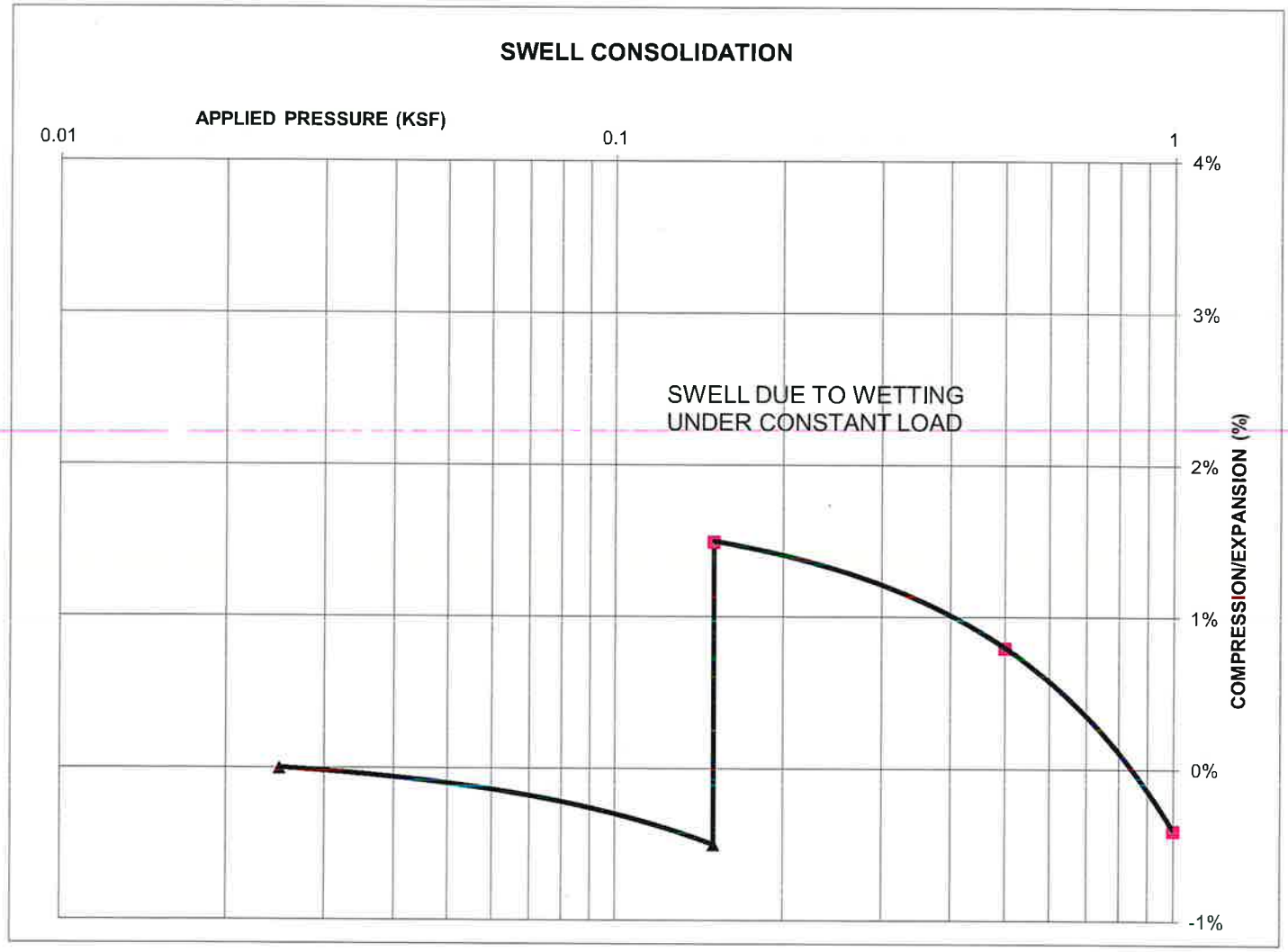
SWELL TEST RESULTS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-23

TEST BORING	3	SOIL DESCRIPTION	FILL, CLAY, SANDY
DEPTH (FT)	1-2	SOIL TYPE	1



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF):	106
NATURAL MOISTURE CONTENT:	27.3%
SWELL/COLLAPSE (%):	2.0%

ENTECH ENGINEERING, INC.

SWELL TEST RESULTS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

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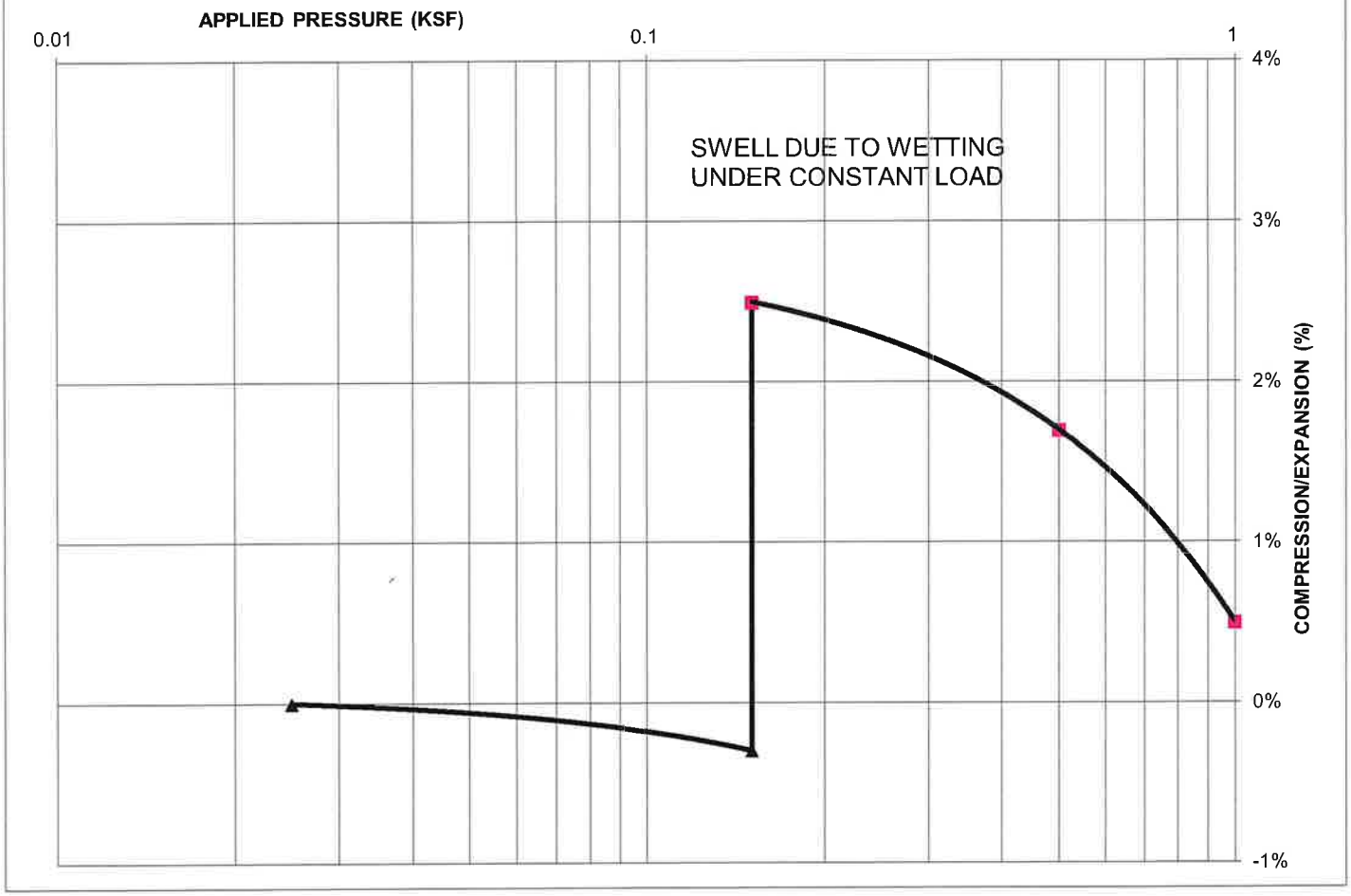
FIG. B-24

TEST BORING	4	SOIL DESCRIPTION	FILL, CLAY, SANDY
DEPTH (FT)	1-2	SOIL TYPE	1

SWELL CONSOLIDATION



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF):	105
NATURAL MOISTURE CONTENT:	12.8%
SWELL/COLLAPSE (%):	2.8%

ENTECH ENGINEERING, INC.

SWELL TEST RESULTS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

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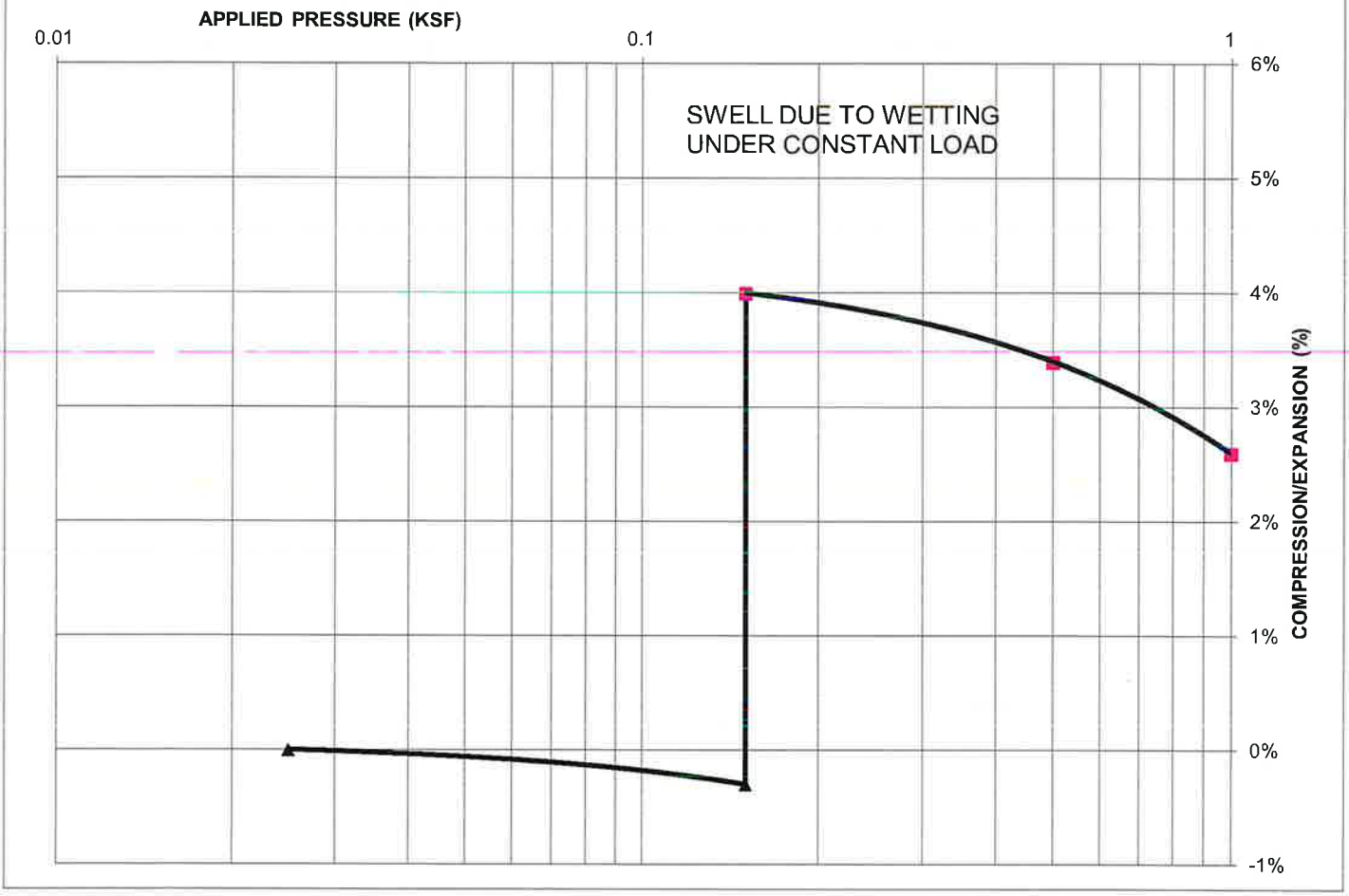
FIG. B-25

TEST BORING	5	SOIL DESCRIPTION	FILL, CLAY, SANDY
DEPTH (FT)	1-2	SOIL TYPE	1

SWELL CONSOLIDATION



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF):	111
NATURAL MOISTURE CONTENT:	12.5%
SWELL/COLLAPSE (%):	4.3%

ENTECH ENGINEERING, INC.

SWELL TEST RESULTS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

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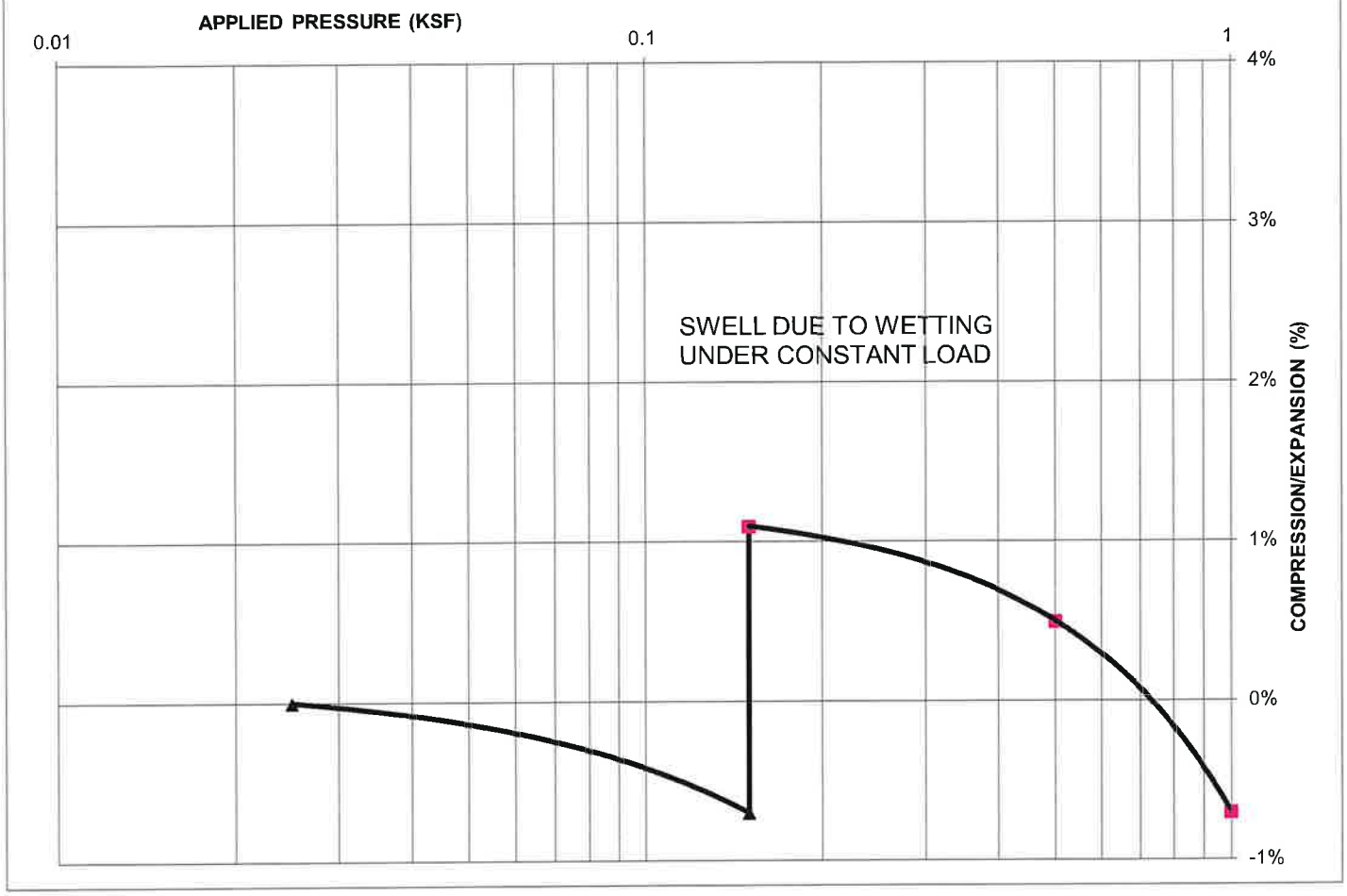
FIG. B-26

TEST BORING	7	SOIL DESCRIPTION	FILL, CLAY, SANDY
DEPTH (FT)	1-2	SOIL TYPE	1

SWELL CONSOLIDATION



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF):	103
NATURAL MOISTURE CONTENT:	17.6%
SWELL/COLLAPSE (%):	1.8%

ENTECH ENGINEERING, INC.

SWELL TEST RESULTS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

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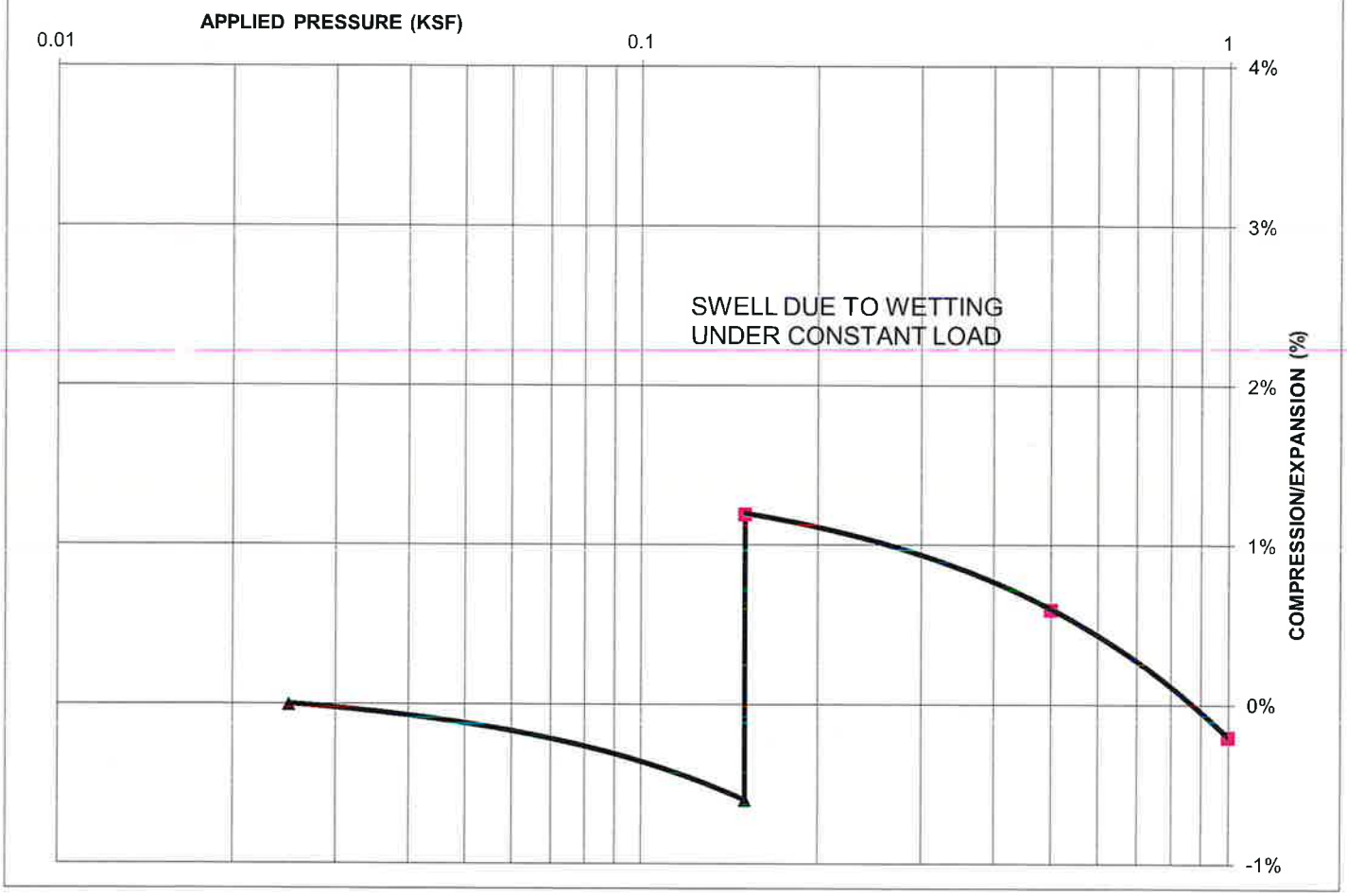
FIG. B-27

TEST BORING	8	SOIL DESCRIPTION	FILL, CLAY, SANDY
DEPTH (FT)	1-2	SOIL TYPE	1

SWELL CONSOLIDATION



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF):	107
NATURAL MOISTURE CONTENT:	16.6%
SWELL/COLLAPSE (%):	1.8%

ENTECH ENGINEERING, INC.

SWELL TEST RESULTS

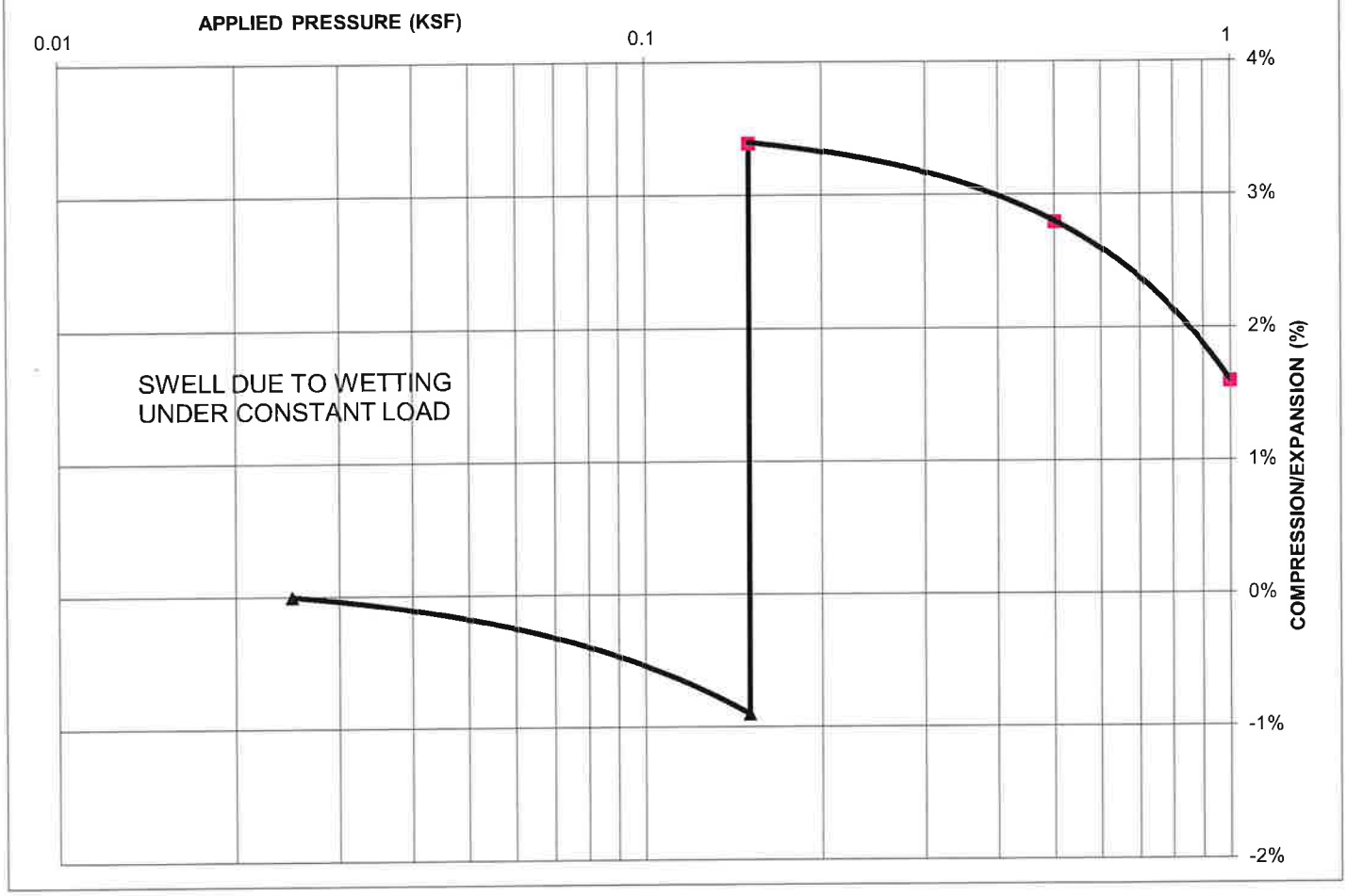
GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-28

TEST BORING	10	SOIL DESCRIPTION	FILL, CLAY, SANDY
DEPTH (FT)	1-2	SOIL TYPE	1

SWELL CONSOLIDATION



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF):	111
NATURAL MOISTURE CONTENT:	11.6%
SWELL/COLLAPSE (%):	4.3%

ENTECH ENGINEERING, INC.

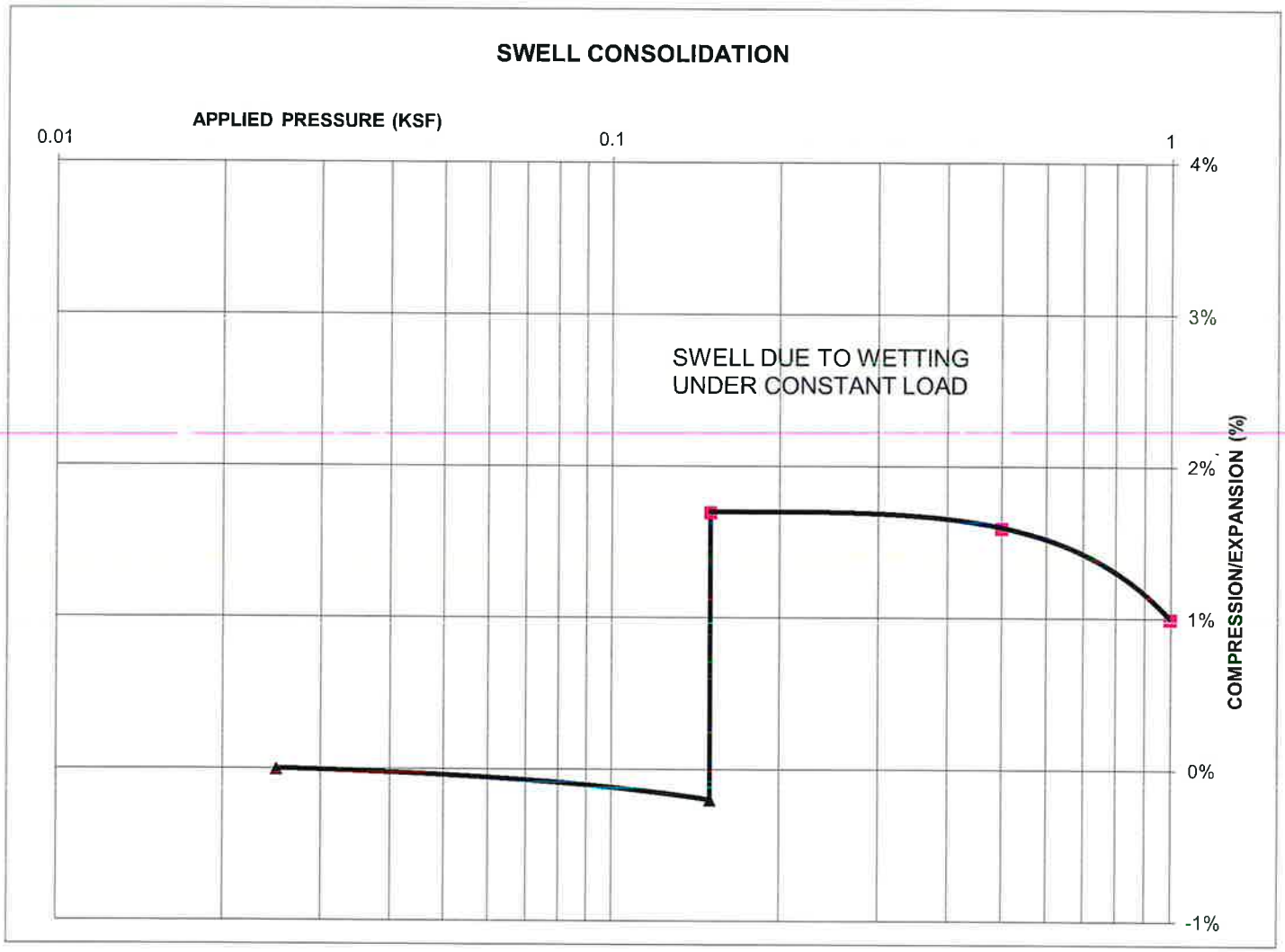
SWELL TEST RESULTS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-29

TEST BORING	12	SOIL DESCRIPTION	FILL, CLAY, SANDY
DEPTH (FT)	1-2	SOIL TYPE	1



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF):	119
NATURAL MOISTURE CONTENT:	13.0%
SWELL/COLLAPSE (%):	1.9%

ENTECH ENGINEERING, INC.

SWELL TEST RESULTS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

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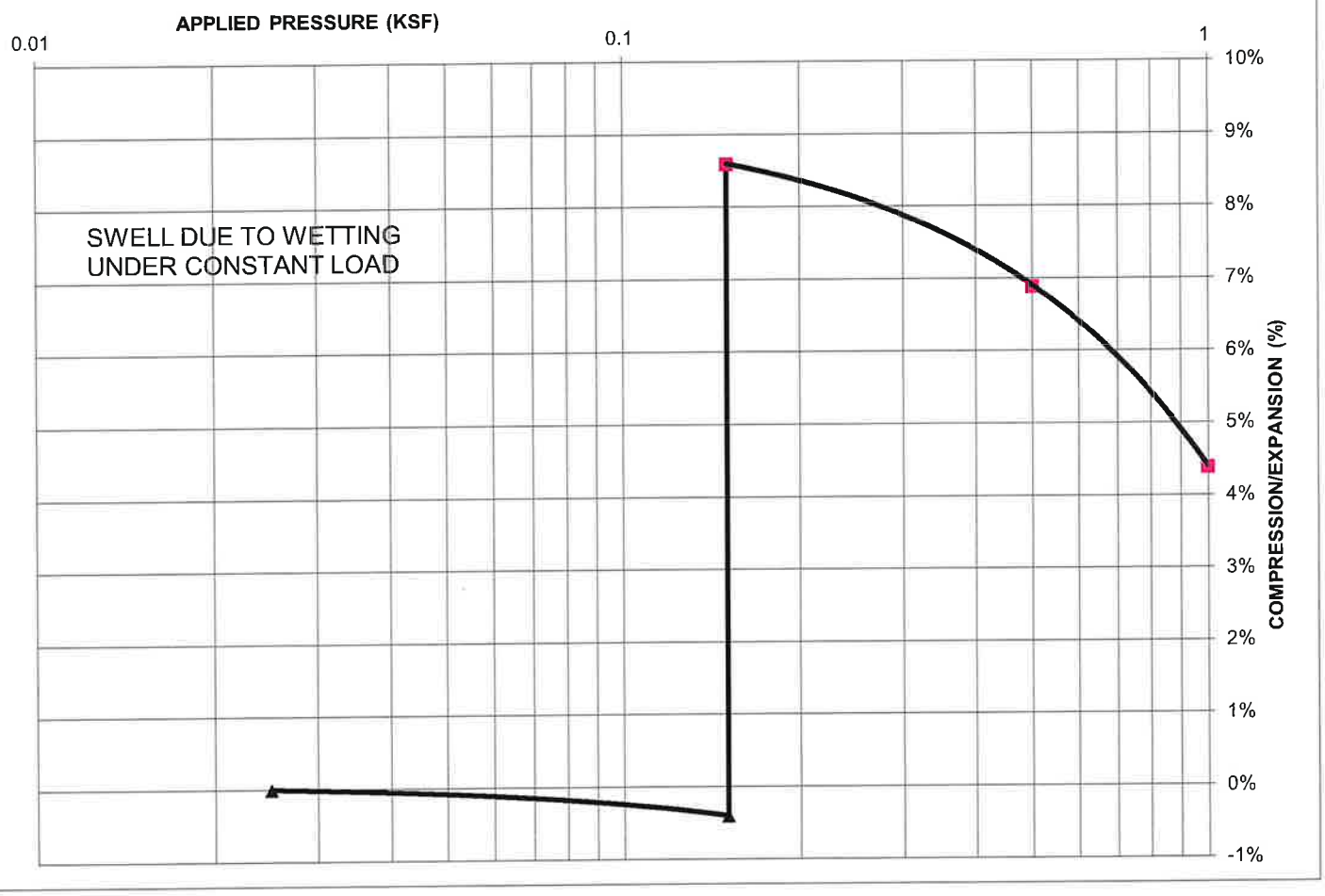
FIG. B-30

TEST BORING	13	SOIL DESCRIPTION	FILL, CLAY, WITH SAND
DEPTH (FT)	1-2	SOIL TYPE	1

SWELL CONSOLIDATION



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF):	97
NATURAL MOISTURE CONTENT:	19.0%
SWELL/COLLAPSE (%):	9.0%

ENTECH ENGINEERING, INC.

SWELL TEST RESULTS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

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FIG. B-31

TEST BORING	15	SOIL DESCRIPTION	FILL, SAND, CLAYEY
DEPTH (FT)	1-2	SOIL TYPE	1

SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF):	103
NATURAL MOISTURE CONTENT:	14.0%
SWELL/COLLAPSE (%):	1.5%

ENTECH ENGINEERING, INC.

SWELL TEST RESULTS

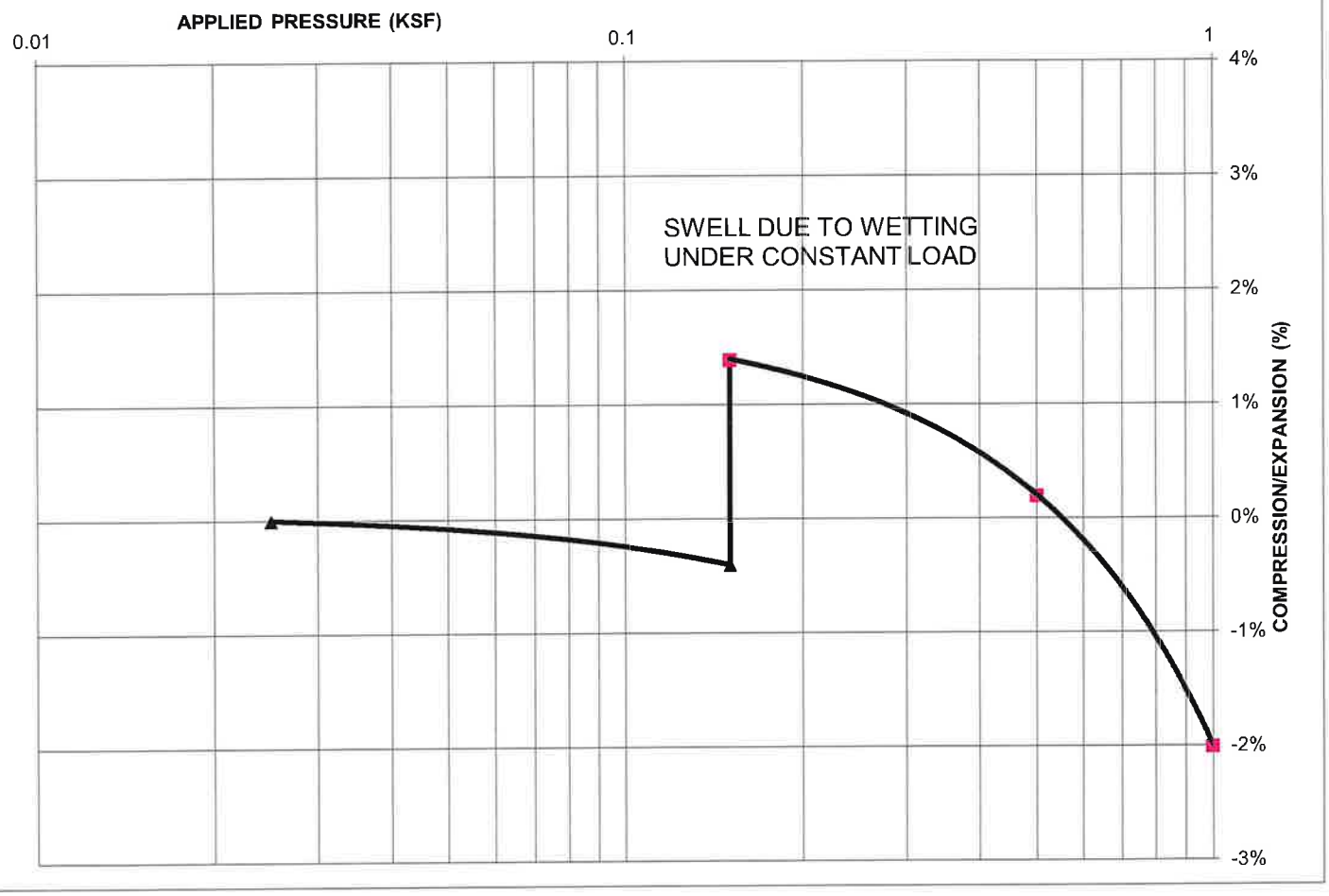
GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-32

TEST BORING	6	SOIL DESCRIPTION	CLAY, SANDY
DEPTH (FT)	1-2	SOIL TYPE	2

SWELL CONSOLIDATION



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF):	90
NATURAL MOISTURE CONTENT:	8.0%
SWELL/COLLAPSE (%):	1.8%

ENTECH ENGINEERING, INC.

SWELL TEST RESULTS

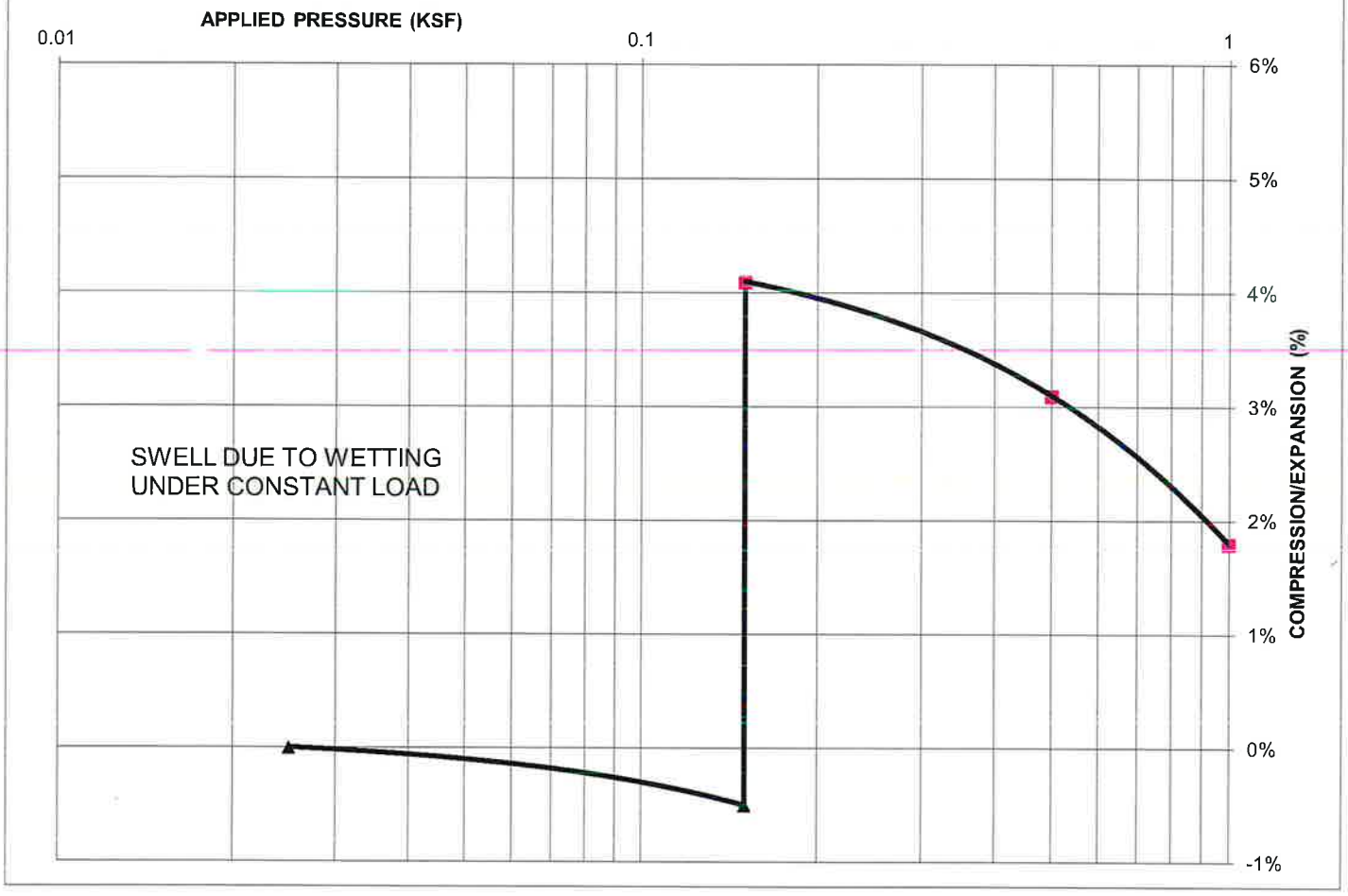
GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-33

TEST BORING	9	SOIL DESCRIPTION	CLAY, SANDY
DEPTH (FT)	1-2	SOIL TYPE	2

SWELL CONSOLIDATION



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF):	115
NATURAL MOISTURE CONTENT:	11.7%
SWELL/COLLAPSE (%):	4.6%

ENTECH ENGINEERING, INC.

SWELL TEST RESULTS

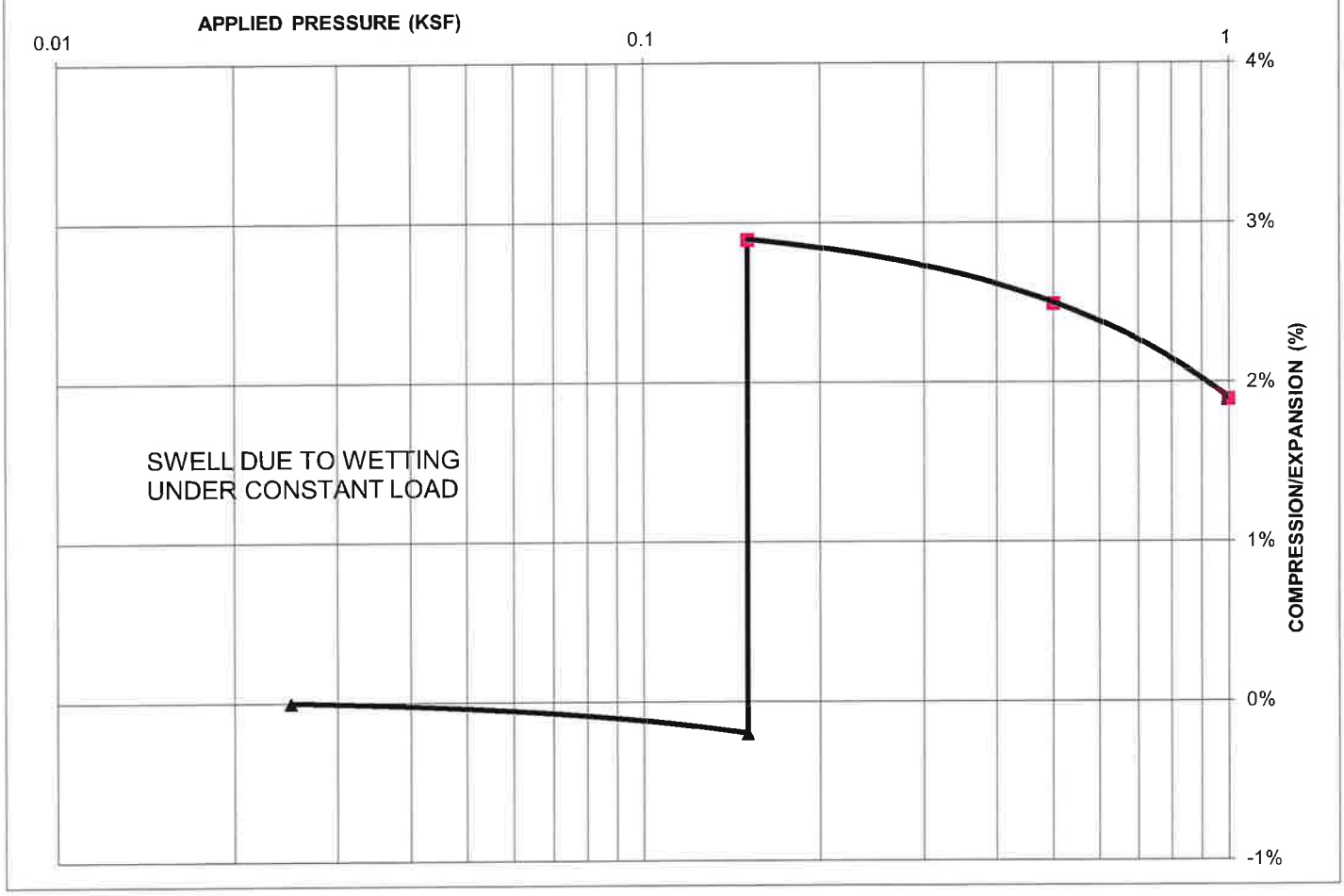
GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-34

TEST BORING	11	SOIL DESCRIPTION	CLAY, SANDY
DEPTH (FT)	1-2	SOIL TYPE	2

SWELL CONSOLIDATION



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF):	121
NATURAL MOISTURE CONTENT:	12.1%
SWELL/COLLAPSE (%):	3.1%

ENTECH ENGINEERING, INC.

SWELL TEST RESULTS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

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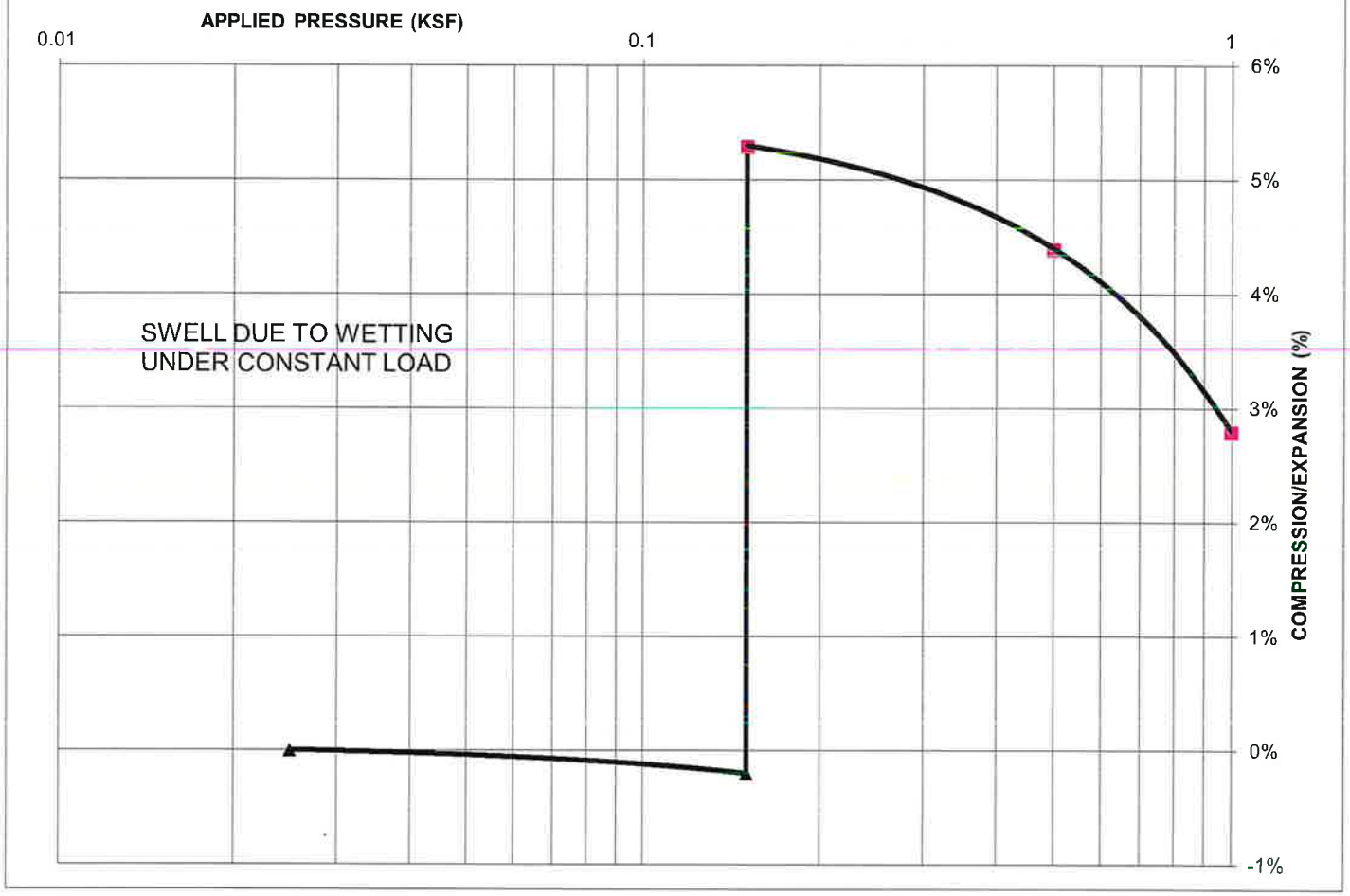
FIG. B-35

TEST BORING	14	SOIL DESCRIPTION	SAND, CLAYEY
DEPTH (FT)	1-2	SOIL TYPE	2

SWELL CONSOLIDATION



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF):	117
NATURAL MOISTURE CONTENT:	9.8%
SWELL/COLLAPSE (%):	5.5%

ENTECH ENGINEERING, INC.

SWELL TEST RESULTS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

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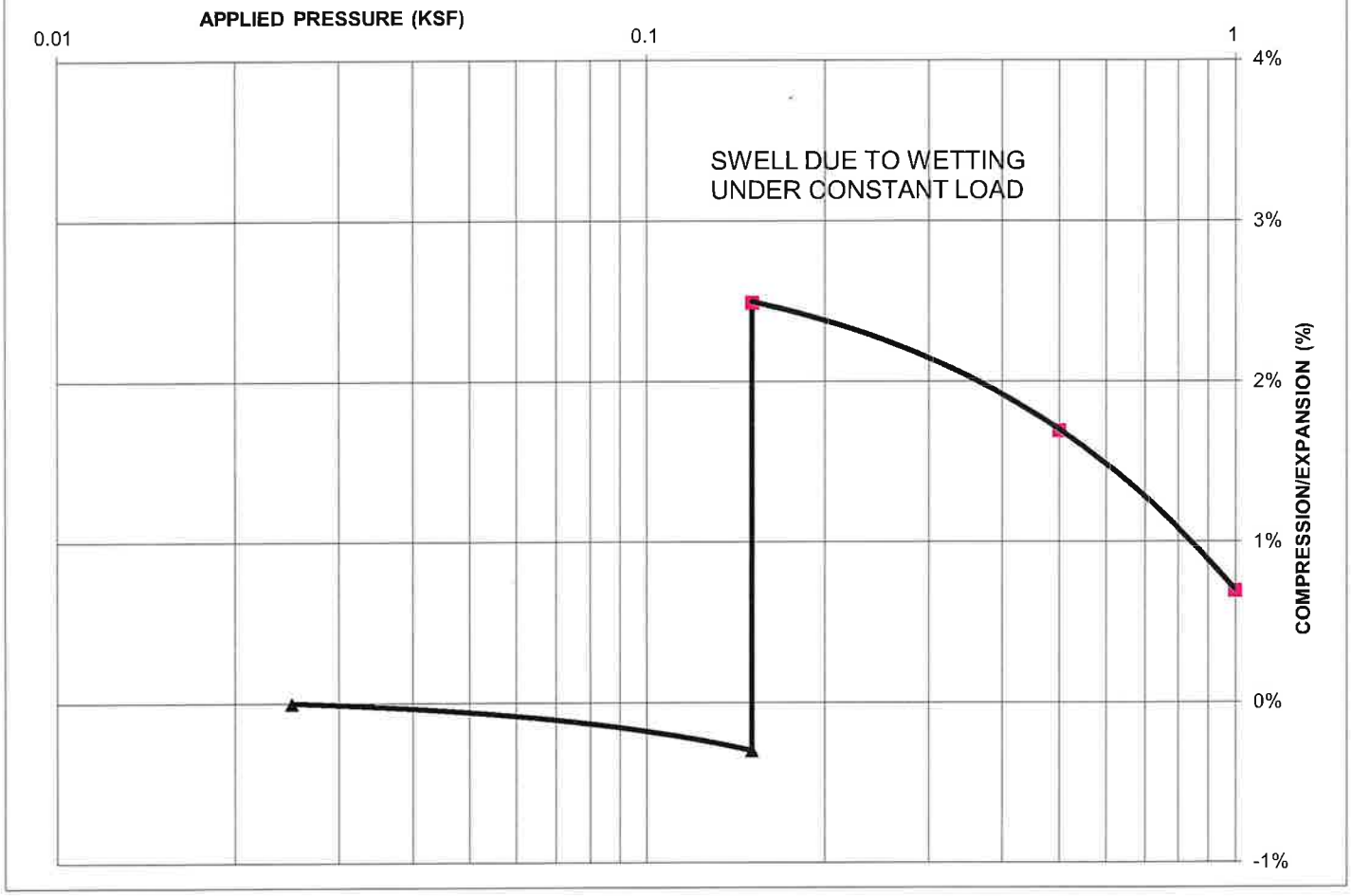
FIG. B-36

TEST BORING	6	SOIL DESCRIPTION	CLAYSTONE (CLAY, SANDY)
DEPTH (FT)	10	SOIL TYPE	3

SWELL CONSOLIDATION



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF):	118
NATURAL MOISTURE CONTENT:	9.9%
SWELL/COLLAPSE (%):	2.8%

ENTECH ENGINEERING, INC.

SWELL TEST RESULTS

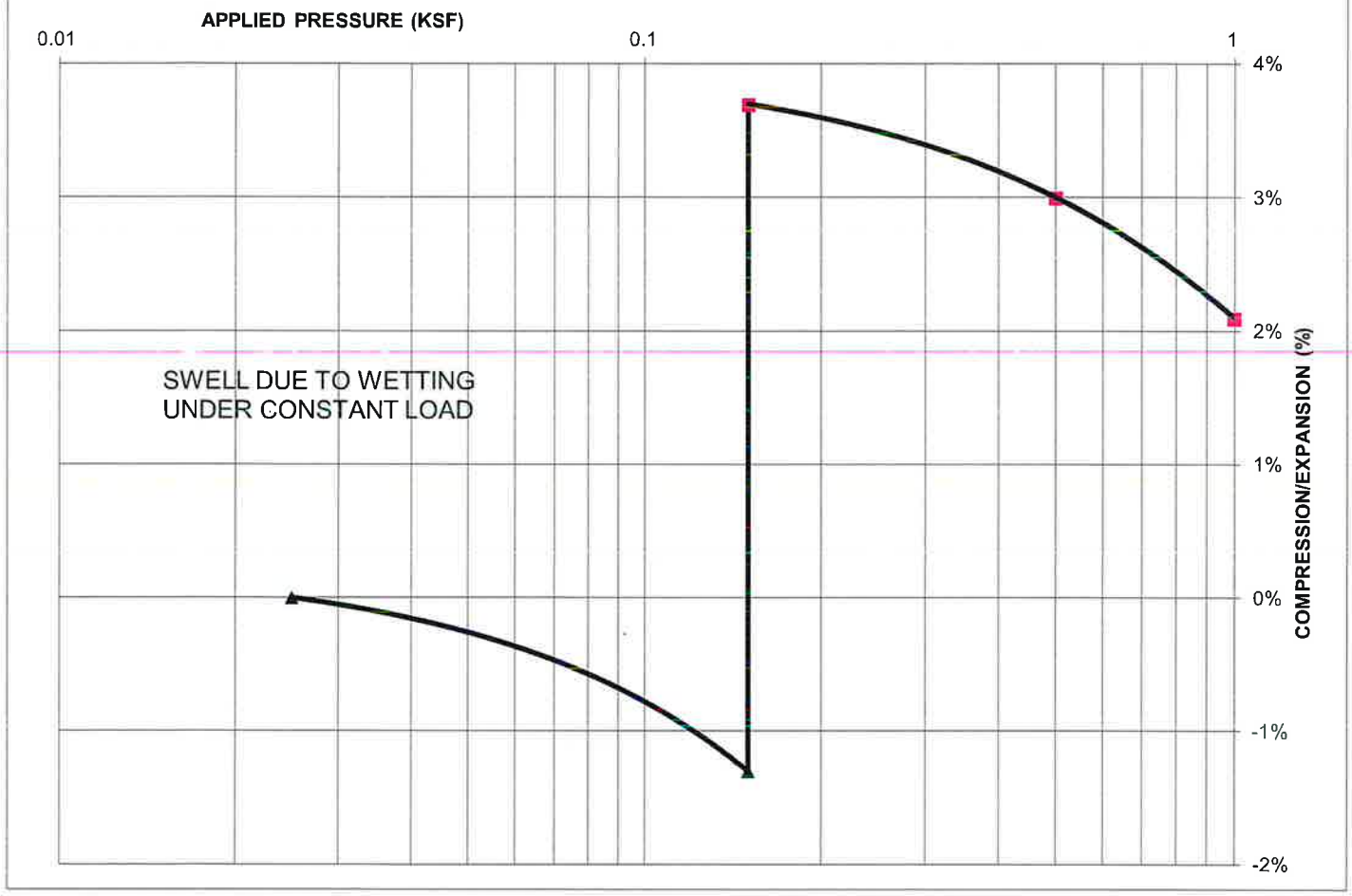
GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-37

TEST BORING	9	SOIL DESCRIPTION	CLAYSTONE (CLAY, SANDY)
DEPTH (FT)	5	SOIL TYPE	3

SWELL CONSOLIDATION



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF):	116
NATURAL MOISTURE CONTENT:	12.2%
SWELL/COLLAPSE (%):	5.0%

ENTECH ENGINEERING, INC.

SWELL TEST RESULTS

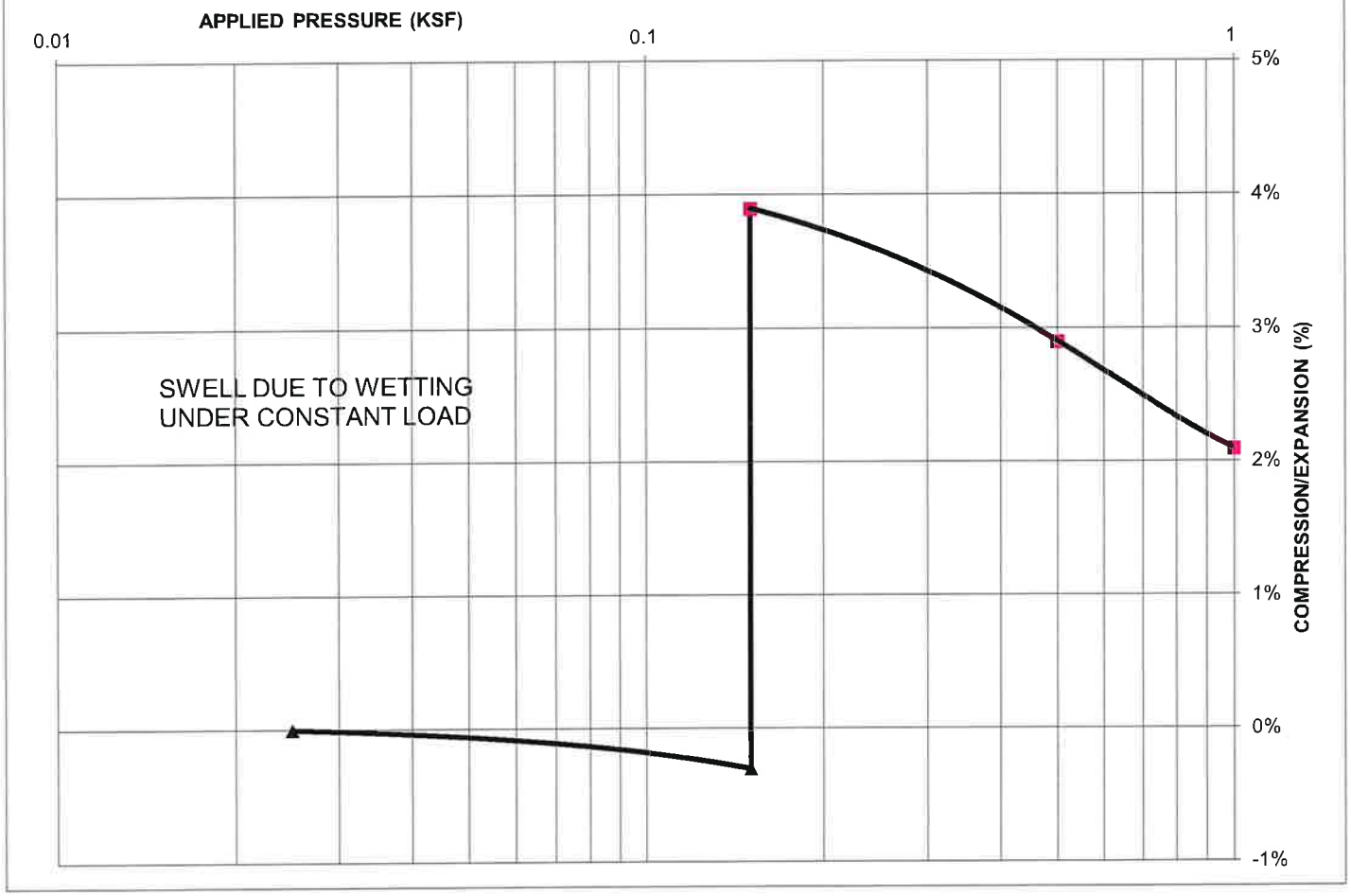
GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-38

TEST BORING	10	SOIL DESCRIPTION	CLAYSTONE (CLAY, SANDY)
DEPTH (FT)	10	SOIL TYPE	3

SWELL CONSOLIDATION



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF):	113
NATURAL MOISTURE CONTENT:	14.8%
SWELL/COLLAPSE (%):	4.2%

ENTECH ENGINEERING, INC.

SWELL TEST RESULTS

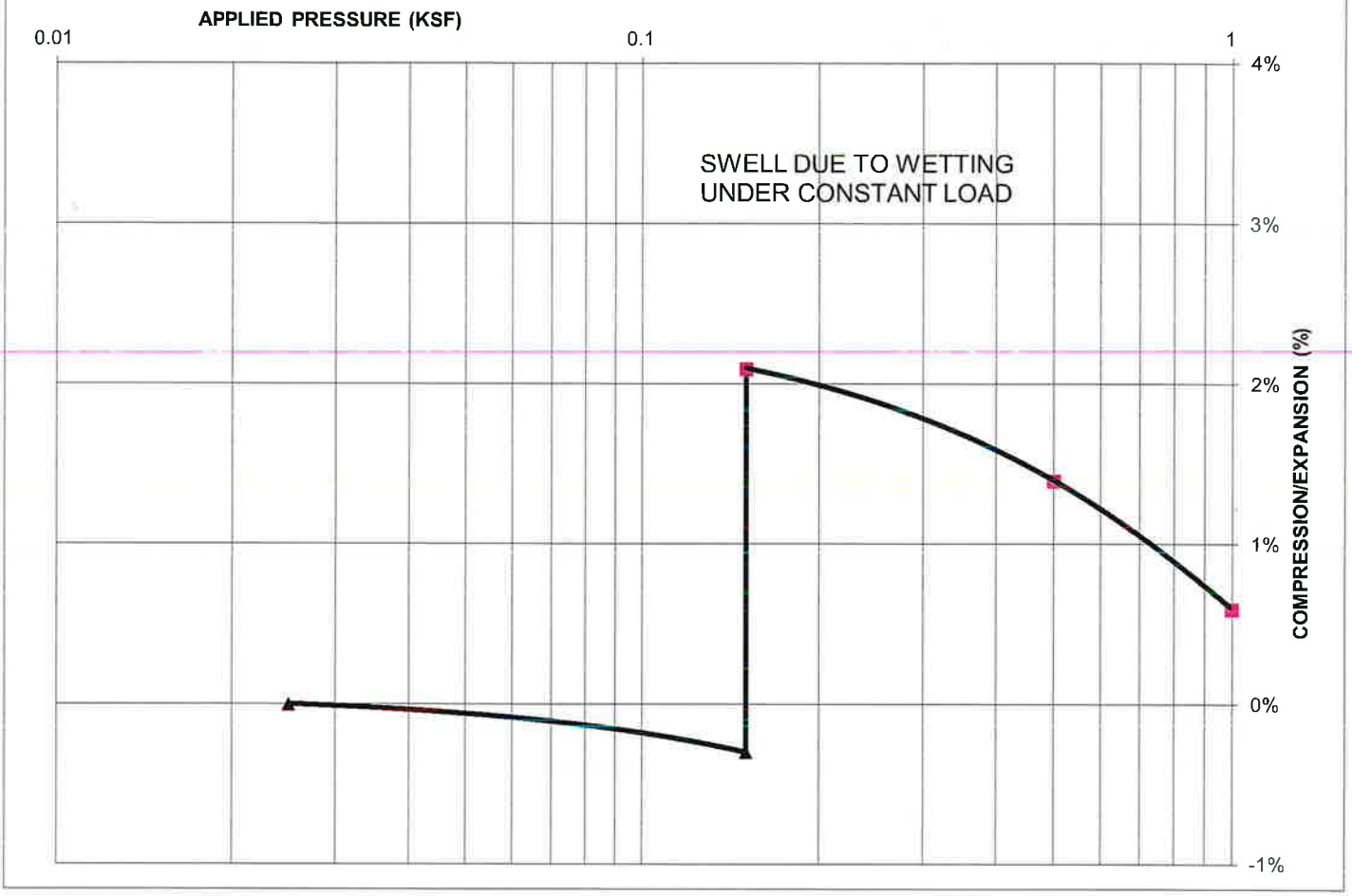
GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-39

TEST BORING	11	SOIL DESCRIPTION	CLAYSTONE (CLAY, SANDY)
DEPTH (FT)	10	SOIL TYPE	3

SWELL CONSOLIDATION



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF):	117
NATURAL MOISTURE CONTENT:	12.5%
SWELL/COLLAPSE (%):	2.4%

ENTECH ENGINEERING, INC.

SWELL TEST RESULTS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

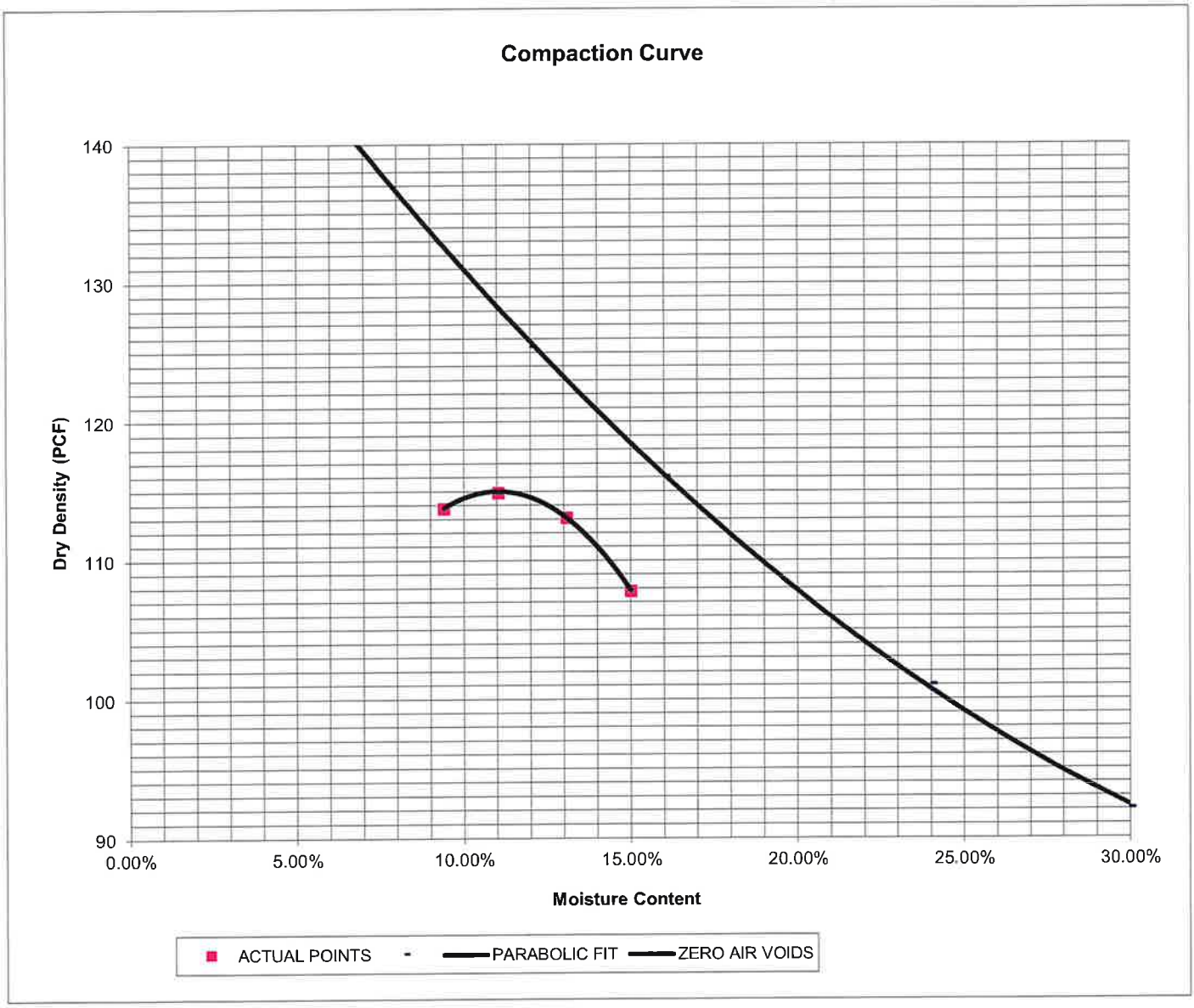
FIG. B-40

SAMPLE LOCATION TB-3 @ 0-3'

SOIL DESCRIPTION FILL, CLAY, SANDY, BROWN
SOIL TYPE 1

PROCTOR DATA

IDENTIFICATION:	CL
PROCTOR TEST #:	1
TEST BY:	BL
TEST DESIGNATION:	ASTM-698-A
MAXIMUM DRY DENSITY (PCF):	114.9
OPTIMUM MOISTURE:	11.1



ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-41

SAMPLE LOCATION TB-3 @ 0-3' SOIL DESCRIPTION FILL, CLAY, SANDY, BROWN
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)	10 BLOWS Mold # 1 Stress (psi)	25 BLOWS Mold # 2 Load (lbs)	25 BLOWS Mold # 2 Stress (psi)	56 BLOWS Mold # 3 Load (lbs)	56 BLOWS Mold # 3 Stress (psi)
0.000	0	0.00	0	0.00	0	0.00
0.025	35	11.70	68	22.72	121	40.43
0.050	45	15.04	88	29.41	158	52.80
0.075	51	17.04	98	32.75	181	60.48
0.100	56	18.71	106	35.42	204	68.17
0.125	61	20.38	119	39.77	221	73.85
0.150	64	21.39	126	42.11	226	75.52
0.175	69	23.06	131	43.78	232	77.53
0.200	71	23.73	133	44.44	244	81.54
0.300	78	26.07	156	52.13	299	99.92
0.400	84	28.07	173	57.81	332	110.94
0.500	93	31.08	186	62.16	365	121.97

MOISTURE AND DENSITY DATA

	Mold # 1	Mold # 2	Mold # 3
Can #	117	307	361
Wt. Can	8.55	9.06	8.58
Wt. Can+Wet	297.65	245.68	230.46
Wt. Can+Dry	238.6	202.08	191.66
Wt. H20	59.05	43.6	38.8
Wt. Dry Soil	230.05	193.02	183.08
Moisture Content	25.67%	22.59%	21.19%
Wet Density (PCF)	114.1	121.7	128.4
Dry Density (PCF)	102.7	109.6	115.6
% Compaction	89%	95%	101%
CBR	1.87	3.54	6.82

PROCTOR DATA

Maximum Dry Density (pcf)	114.9
Optimum Moisture	11.1
90% of Max. Dry Density (pcf)	103.4
95% of Max. Dry Density (pcf)	109.2

CBR at 90% of Max. Density = 2.04	~ R VALUE 6
CBR at 95% of Max. Density = 3.44	~ R VALUE 7.5

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

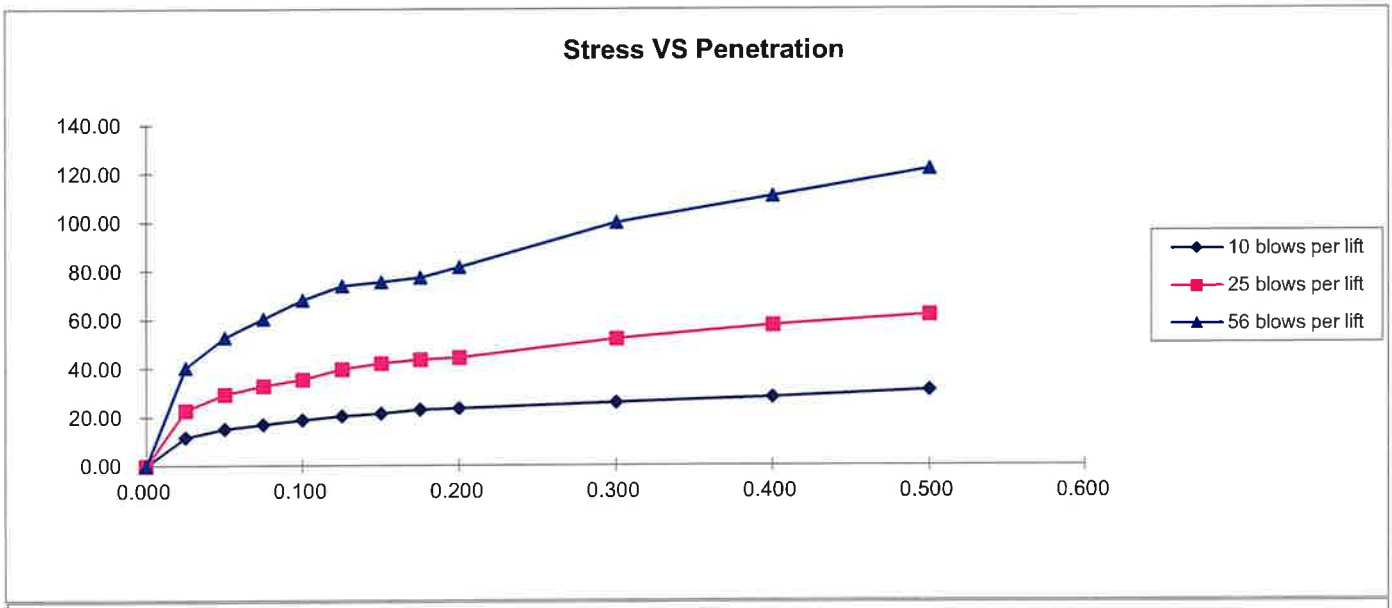
GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

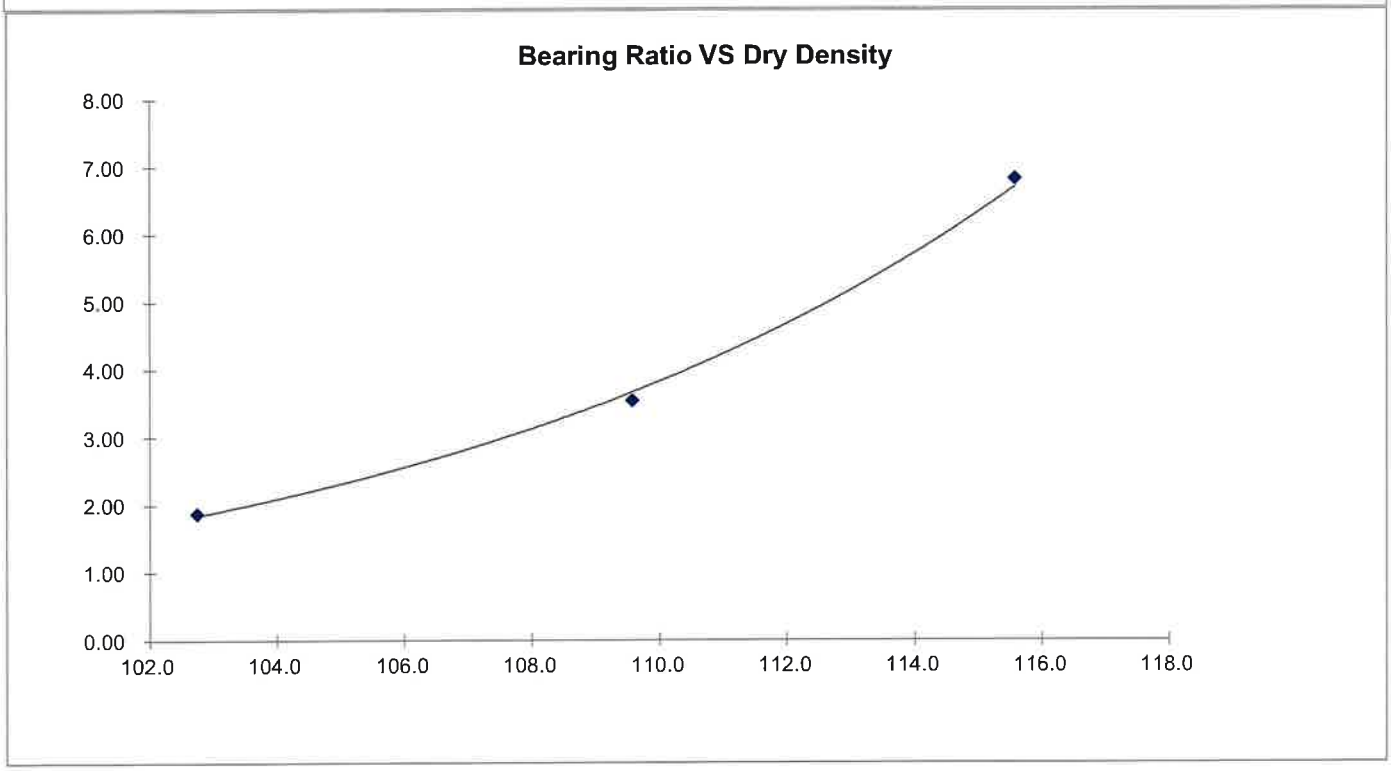
JOB NO. 231853

FIG. B-42

SAMPLE LOCATION TB-3 @ 0-3'

SOIL DESCRIPTION FILL, CLAY, SANDY, BROWN
SOIL TYPE 1





ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

GLEN AT WIDEFIELD, FILING NO. 12
GLEN DEVELOPMENT

JOB NO. 231853

FIG. B-43

ENTECH
ENGINEERING, INC.

APPENDIX C: Pavement Design Calculations

FLEXIBLE PAVEMENT DESIGN

PROJECT DATA

Project Location: Glen at Widefield F12 - Urban Local

Job Number: 231853

DESIGN DATA

Equivalent (18-kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	292,000
Design CBR	CBR =	3.4
Standard Deviation	S_o =	0.45
Loss in Serviceability	Δpsi =	2.5
Reliability	Reliability =	80
Reliability (z-statistic)	Z_R =	-0.84
Soil Resilient Modulus	M_R =	5,100 psi

Required Structural Number (SN): → SN = 2.90

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	5.0 inches	2.200	-
2	ABC	C_2 = 0.11	8.0 inches	0.880	
			SN* =	3.080	2.90

Pavement SN > Required SN, Design is Acceptable

FIG. C-1

ENTECH ENGINEERING, INC.

FLEXIBLE PAVEMENT DESIGN

PROJECT DATA

Project Location: Glen at Widefield F12 - Urban Local

Job Number: 231853

DESIGN DATA

Equivalent (18-kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	292,000
Design CBR	CBR =	3.4
Standard Deviation	S_o =	0.45
Loss in Serviceability	Δpsi =	2.5
Reliability	Reliability =	80
Reliability (z-statistic)	Z_R =	-0.84
Soil Resilient Modulus	M_R =	5,100 psi

Required Structural Number (SN): → SN = 2.90

DESIGN EQUATIONS

Resilient Modulus

If using CBR:

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

If using R-Value:

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

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 - CTS

D_1 = Depth of HMA (inches)

D_2 = Depth of CTS (inches)

RECOMMENED THICKNESSES

Layer	Material	Coefficient	Thickness (D^*_i)	SN^*_i	SN
1	HMA	C_1 = 0.44	5.0 inches	2.200	-
2	CTS	C_2 = 0.11	8.0 inches	0.880	
			SN* = 3.080		2.90

Pavement SN > Required SN, Design is Acceptable

FIG. C-2

ENTECH ENGINEERING, INC.

FLEXIBLE PAVEMENT DESIGN

PROJECT DATA

Project Location: Glen at Widefield F12 - Urban Local Low Volume

Job Number: 231853

DESIGN DATA

Equivalent (18-kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	36,500	
Design CBR	CBR =	3.4	
Standard Deviation	S_o =	0.45	
Loss in Serviceability	Δpsi =	2.5	
Reliability	Reliability =	80	
Reliability (z-statistic)	Z_R =	-0.84	
Soil Resilient Modulus	M_R =	5,100	psi

Required Structural Number (SN): → SN = 2.12

DESIGN EQUATIONS

Resilient Modulus

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

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

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		2.12

Pavement SN > Required SN, Design is Acceptable

FIG. C-3

FLEXIBLE PAVEMENT DESIGN

PROJECT DATA

Project Location: Glen at Widefield F12 - Urban Local Low Volume

Job Number: 231853

DESIGN DATA

Equivalent (18-kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	36,500
Design CBR	CBR =	3.4
Standard Deviation	S_o =	0.45
Loss in Serviceability	Δpsi =	2.5
Reliability	Reliability =	80
Reliability (z-statistic)	Z_R =	-0.84
Soil Resilient Modulus	M_R =	5,100 psi

Required Structural Number (SN): → SN = 2.12

DESIGN EQUATIONS

Resilient Modulus

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

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

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 - CTS

D_1 = Depth of HMA (inches)

D_2 = Depth of CTS (inches)

RECOMMENED THICKNESSES

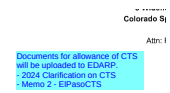
Layer	Material	Coefficient	Thickness (D^*_i)	SN^*_i	SN
1	HMA	C_1 = 0.44	4.0 inches	1.760	-
2	CTS	C_2 = 0.11	8.0 inches	0.880	
			SN* = 2.640		2.12

Pavement SN > Required SN, Design is Acceptable

FIG. C-4

Pavement Report resubmit.pdf Markup Summary

Engineer (4)



Subject: Engineer
Page Label: 1
Author: dotdilts
Date: 5/6/2024 4:54:39 PM
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Color:
Layer:
Space:

Documents for allowance of CTS will be uploaded to EDARP.
- 2024 Clarification on CTS
- Memo 2 - ElPasoCTS

Subject: Engineer
Page Label: 8
Author: dotdilts
Date: 5/7/2024 8:37:53 AM
Status:
Color:
Layer:
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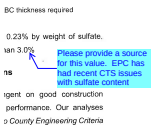
Please see the 2024 Clarification on CTS issued by the County Engineer. A Deviation request will be required to proceed with CTS which has a 21 day review period. All items from Memo 2 must be addressed in the deviation request.



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Author: dotdilts
Date: 5/7/2024 8:45:35 AM
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Please provide a source for this value. EPC has had recent CTS issues with sulfate content

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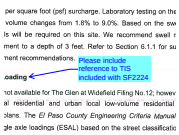

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Author: dotdilts
Date: 5/7/2024 9:43:30 AM
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Layer:
Space:

Please include reference to TIS included with SF2224