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**GEOTECHNICAL REPORT
CATHEDRAL ROCK CHURCH
846 STRUTHERS RANCH ROAD
MONUMENT, COLORADO**

Prepared for:
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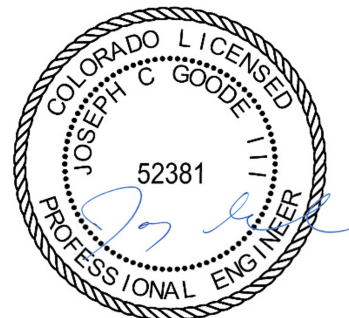
November 13, 2024

Respectfully Submitted,

ENTECH ENGINEERING, INC.

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Entech Job No. 241718

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1 Introduction

Entech Engineering Inc. (Entech) completed this geotechnical report for the proposed Cathedral Rock Church in Monument, Colorado. This report describes the subsurface exploration program conducted for the planned structure and provides recommendations for foundation design and construction considerations. Our services were completed for Hammers Construction in accordance with our Subconsultant Agreement dated August 27, 2024. The contents of this report, including the geotechnical evaluation and recommendations, are subject to the limitations and assumptions presented in Section 7.

2 Project and Site Description

The project will consist of the new construction of two proposed buildings for Cathedral Rock Church at 846 Struthers Ranch Road in the southern section of Monument, Colorado. The project site is located southeast of the intersection of West Baptist Road and Struthers Road as shown on the Vicinity Map (Figure 1). The proposed buildings are surrounded by other commercial buildings to the south and residential properties to the north and east.

We anticipate the building will include slab-on-grade construction. Building loads are expected to be light to moderate. At the time of drilling, the property was a relatively level vacant lot. Native weeds, grass, and bushes were found in the new build areas.

3 Subsurface Explorations and Laboratory Testing

3.1 Subsurface Exploration Program

Subsurface conditions at the project site were explored by four test borings, designated TB-1 through TB-4, drilled on October 15, 2024 at the approximate locations shown on the Site and Exploration Plan (Figure 2). TB-1 and TB-2 were drilled to depths of 20 feet below existing ground surface (bgs) within the footprint of the proposed Phase I building. TB-3 and TB-4 were drilled to depths of 20 feet bgs within the footprint of the proposed Phase II building. 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, and subsequent to, 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/collapse testing (ASTM D4546) was performed to evaluate the expansive characteristics and collapse potential of the cohesive material found on-site. 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.

4 Subsurface Conditions

One soil type was encountered in the test borings drilled for the subsurface exploration program. The soil type was classified in accordance with the Unified Soil Classification System (USCS) soil classification system using the laboratory testing results and the observations made during drilling.

4.1 Soil and Bedrock

Soils encountered on-site were classified as native very loose to very dense sand with silt and clayey sand (SW-SM, SC, [Soil Type 1]). The native sand was encountered in all of the test borings from ground surface to the termination depth of the borings, 20 feet bgs. One-dimensional swell or collapse testing on a sample of clayey sand from TB-1 at a depth of 20 feet resulted in a volume change of 2.2% indicating a moderate to high expansion potential.

4.2 Groundwater

Depth to groundwater was measured in each of the borings at the conclusion of, and subsequent to, drilling. Groundwater was not encountered in any of the of the borings completed on-site. 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 construction area. 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 new construction of two buildings and other associated site improvements for Cathedral Rock Church. The proposed buildings are expected to have shallow foundation systems. Loose site soils must be addressed as discussed below.

5.1 Shallow Foundations

The proposed structure may be supported with a shallow spread footing foundation. Due to the very loose sands encountered at footing grades, we recommend that the foundation be placed on a minimum of 3 feet of prepared site granular fill to provide a competent uniform bearing surface. The base of the overexcavation should be evaluated for the presence of loose soils, and the overexcavation should extend to dense and unyielding conditions. Refer to Section 6.1.1 subgrade and overexcavation preparation recommendations. Refer to Exhibit 1 for the recommended allowable bearing capacity value. Actual bearing capacities will be verified at the time of the open excavation observation (Section 6.9).

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. 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 ^{1,2}	
3 feet of Recompacted Site Granular Soils	2,000 psf
Lateral Earth Pressure Equivalent Fluid Density ³	
Active Conditions – Site Granular Fill	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. Up to 1 inch of total settlement and ½ inch of differential settlement is anticipated for the bearing capacity value provided, assuming subgrades are prepared in accordance with Section 6.
3. Assumes level backfill conditions.

Groundwater was not encountered in the test borings. Fluctuation in groundwater levels can change due to seasonal variations and changes in land runoff characteristics. It is anticipated that groundwater is at sufficient depth on the site as to not affect the proposed building construction.

5.2 On-Grade Floor Slabs

On-grade floor slabs for the planned structures should be supported on a minimum of 3 feet of recompacted and moisture conditioned site soils prepared in accordance with Section 6.1.1. Any loose soils, or uncontrolled fill encountered will require mitigation in accordance to Section 6.1.1.

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 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.

5.4 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 Construction Recommendations

6.1 Earthwork Recommendations for Structures

6.1.1 Subgrade Preparation

Loose sands were encountered on-site and must be mitigated prior to placement of foundation elements. Building pad foundation and slab-on-grade subgrade should be overexcavated a minimum 2.5 feet or to underlying dense and unyielding subgrade, whichever is greater. Once the final subgrade elevation is reached, the overexcavated subgrade should then be scarified an additional 6 inches, moisture conditioned to +/- 2% of the Proctor optimum moisture and

recompacted in place to 95% of the Modified Proctor (ASTM D1557) maximum dry density. The overexcavated material can then be replaced in 6-inch compacted lifts to the same specifications as described above. With this method of mitigation, differential movement may still occur across foundation elements. The final depth of overexcavation should be determined during the excavation observation. Overexcavations should extend laterally beyond planned footings a minimum distance equal to the depth below planned footings (e.g. a 3-foot overexcavation should extend 3 feet beyond the edge of the foundation).

6.1.2 Granular Fill

Granular fill 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.

6.1.3 Fill Placement and Compaction

Granular fill should be compacted to a minimum of 95% of the Modified Proctor (ASTM D1557) maximum dry density 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.

6.2 Excavation Potential

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

6.3 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).

6.4 Utility Trench Backfill

Trench backfill placement should be performed in accordance with the Town of Monument 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.

6.5 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 6 inches, a minimum of 95% of the Modified Proctor (ASTM D1557) maximum dry density at +/-2% of optimum moisture content before the addition of new fill. Fill should be placed in thin lifts not to exceed 6 inches in thickness. 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 other structural features of the project should be observed and tested by Entech during construction.

6.6 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% 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.

6.7 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.

6.8 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.

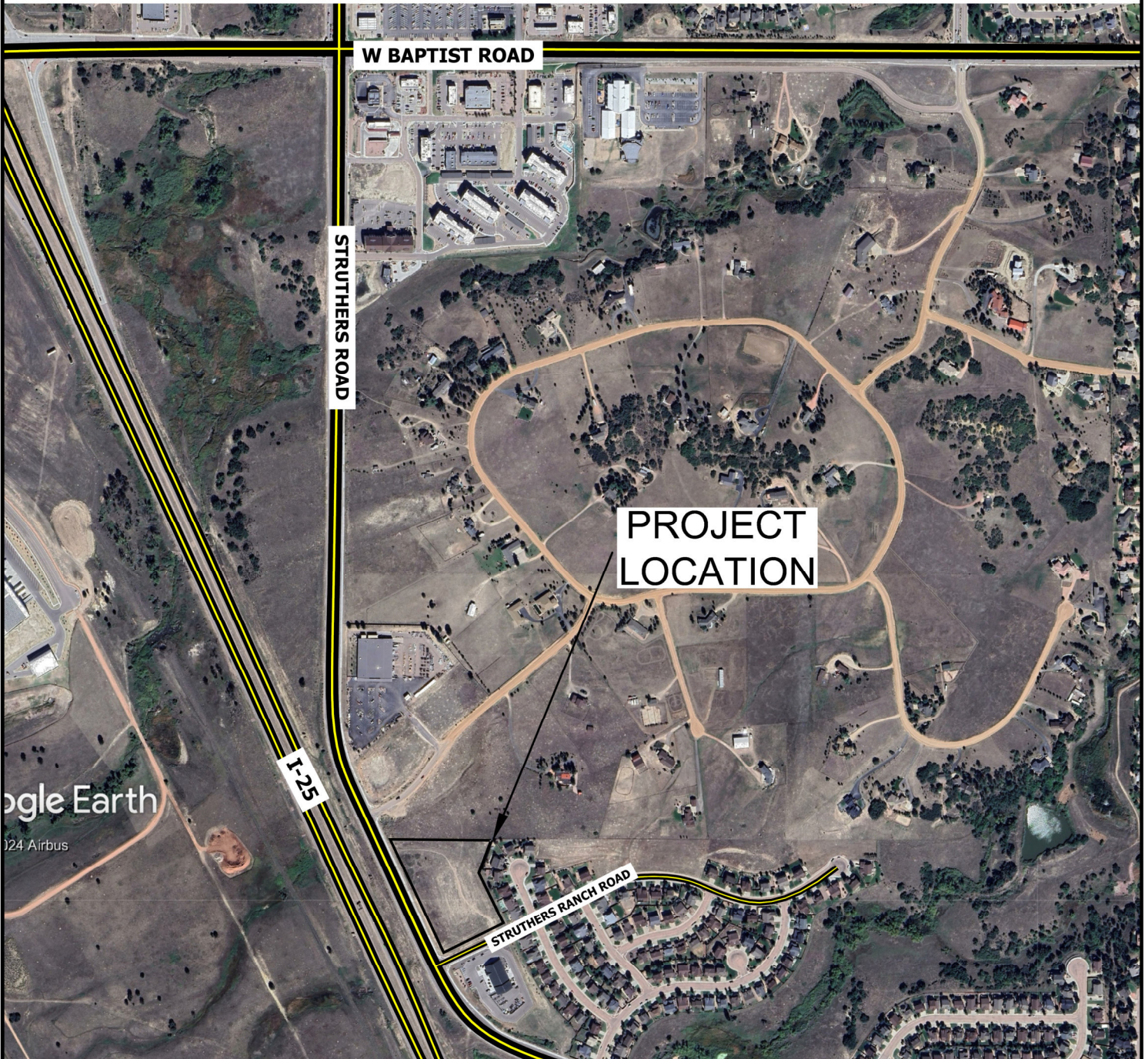
In addition, Entech should observe and document the placement and compaction of utility bedding and trench backfill.

7 Closure

The subsurface investigation, geotechnical evaluation, and recommendations presented in this report are intended for use by Hammers Construction with application to the planned new buildings for Cathedral Rock Church in Monument, 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.



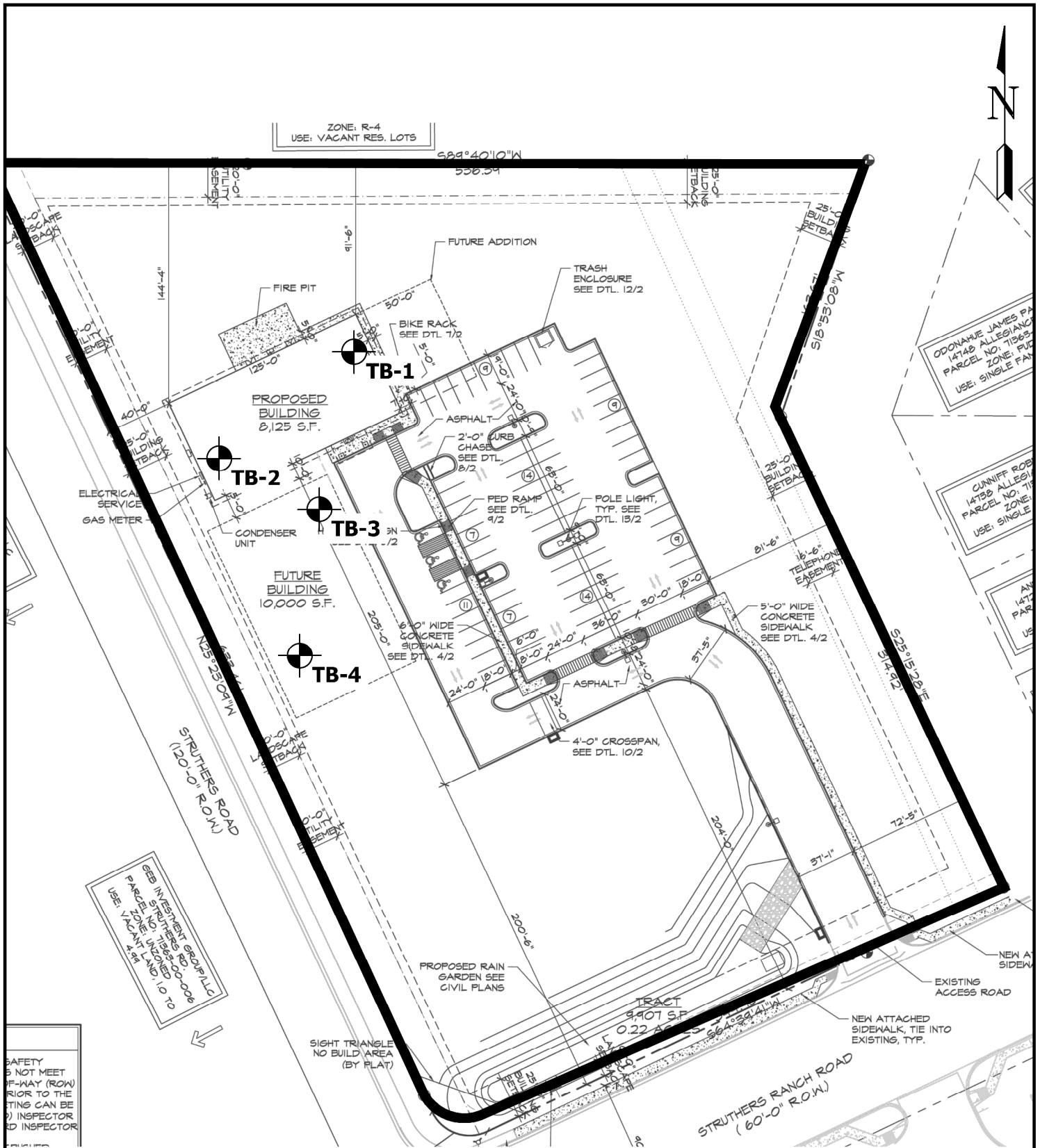
If there are any questions regarding the information provided herein, or if Entech Engineering, Inc. can be of further assistance, please do not hesitate to contact us.



VICINITY MAP
CATHEDRAL ROCK CHURCH
HAMMERS CONSTRUCTION

JOB NO.
241718

FIG. 1



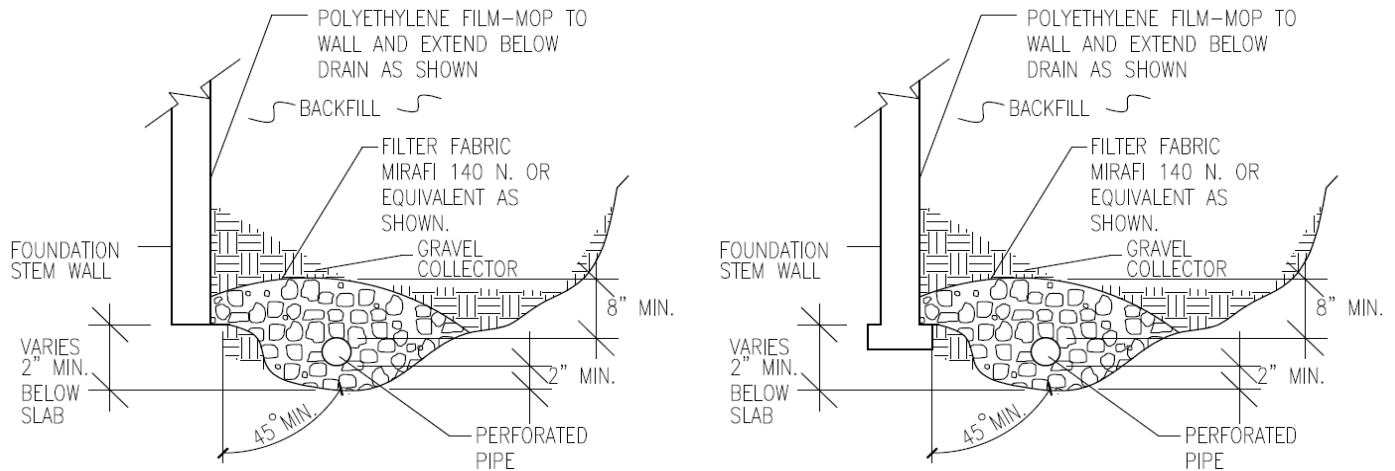
 **TB- APPROXIMATE TEST BORING LOCATION AND NUMBER**



SITE AND EXPLORATION PLAN
 CATHEDRAL ROCK CHURCH
 HAMMERS CONSTRUCTION

JOB NO.
 241718

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 OUTFALL IS NOT AVAILABLE.



PERIMETER DRAIN DETAIL

CATHEDRAL ROCK CHURCH
HAMMERS CONSTRUCTION

JOB NO.
241718

FIG. 3



APPENDIX A: Test Boring Logs

TEST BORING 1
DATE DRILLED 10/15/2024

TEST BORING 2
DATE DRILLED 10/15/2024

REMARKS

REMARKS

DRY TO 20', 10/15/24

DRY TO 17.5', 10/30/24

12" TOPSOIL
SAND, SILTY, BROWN to TAN,
VERY LOOSE to VERY DENSE, DRY
to MOIST

12" TOPSOIL
SAND, SILTY, BROWN to TAN,
LOOSE to VERY DENSE, DRY to
MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			9	2.1	1
5			3	2.9	1
10			50	11.0	1
15			50 6"	7.0	1
20			18	21.2	1

SAND, CLAYEY, LIGHT BROWN,
MEDIUM DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			10	1.1	1
5			4	1.1	1
10			40	4.3	1
15			50 6"	2.6	1
20			50 9"	4.9	1



TEST BORING LOGS

CATHEDRAL ROCK CHURCH
HAMMERS CONSTRUCTION

JOB NO.
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FIG. A-1

TEST BORING 3
 DATE DRILLED 10/15/2024

TEST BORING 4
 DATE DRILLED 10/15/2024

REMARKS

REMARKS

DRY TO 18', 10/30/24

DRY TO 17.5', 10/30/24

12" TOPSOIL
 SAND, SILTY, BROWN to TAN,
 MEDIUM DENSE to VERY DENSE,
 DRY to MOIST

12" TOPSOIL
 SAND, SILTY, BROWN to TAN,
 VERY LOOSE to MEDIUM DENSE,
 DRY to MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			25	1.5	1
5			19	3.6	1
10			23	7.1	1
15			50 6"	4.5	1
20			50	13.8	1

SAND, CLAYEY, LIGHT BROWN,
 VERY DENSE, MOIST

SAND, CLAYEY, LIGHT BROWN,
 MEDIUM DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			9	1.9	1
5			3	2.0	1
10			27	4.1	1
15			22	9.0	1
20			27	15.9	1



TEST BORING LOGS

CATHEDRAL ROCK CHURCH
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FIG. A-2



APPENDIX B: Laboratory Test Results

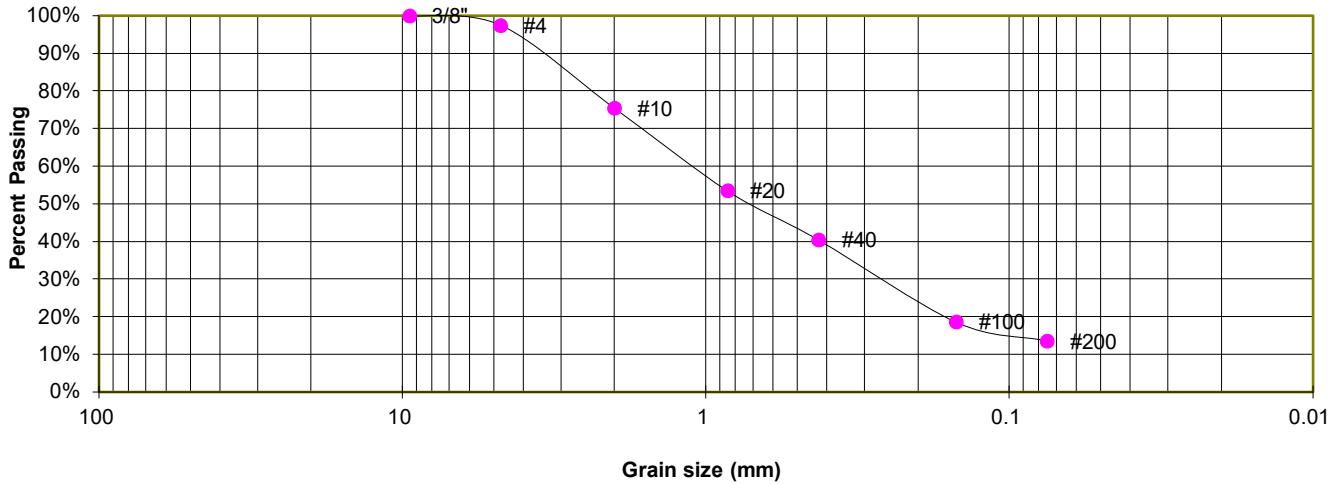
**TABLE B-1
SUMMARY OF LABORATORY TEST RESULTS**

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX	SULFATE (WT %)	SWELL/ CONSOL (%)	USCS	SOIL DESCRIPTION
1	1	20	22.1	103.1	13.6	29	20	9	0.00	2.2	SC	SAND, CLAYEY
1	2	5	1.1		10.0	NV	NP	NP	0.00		SW-SM	SAND, WITH SILT
1	3	10	7.1		11.2						SW-SM	SAND, WITH SILT
1	4	5	2.0		6.9						SW-SM	SAND, WITH SILT

TEST BORING 1
 DEPTH (FT) 20

SOIL DESCRIPTION SAND, CLAYEY
 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	97.4%
10	75.4%
20	53.5%
40	40.4%
100	18.6%
200	13.6%

ATTERBERG LIMITS

Plastic Limit	20
Liquid Limit	29
Plastic Index	9

SOIL CLASSIFICATION

USCS CLASSIFICATION: SC



LABORATORY TEST RESULTS

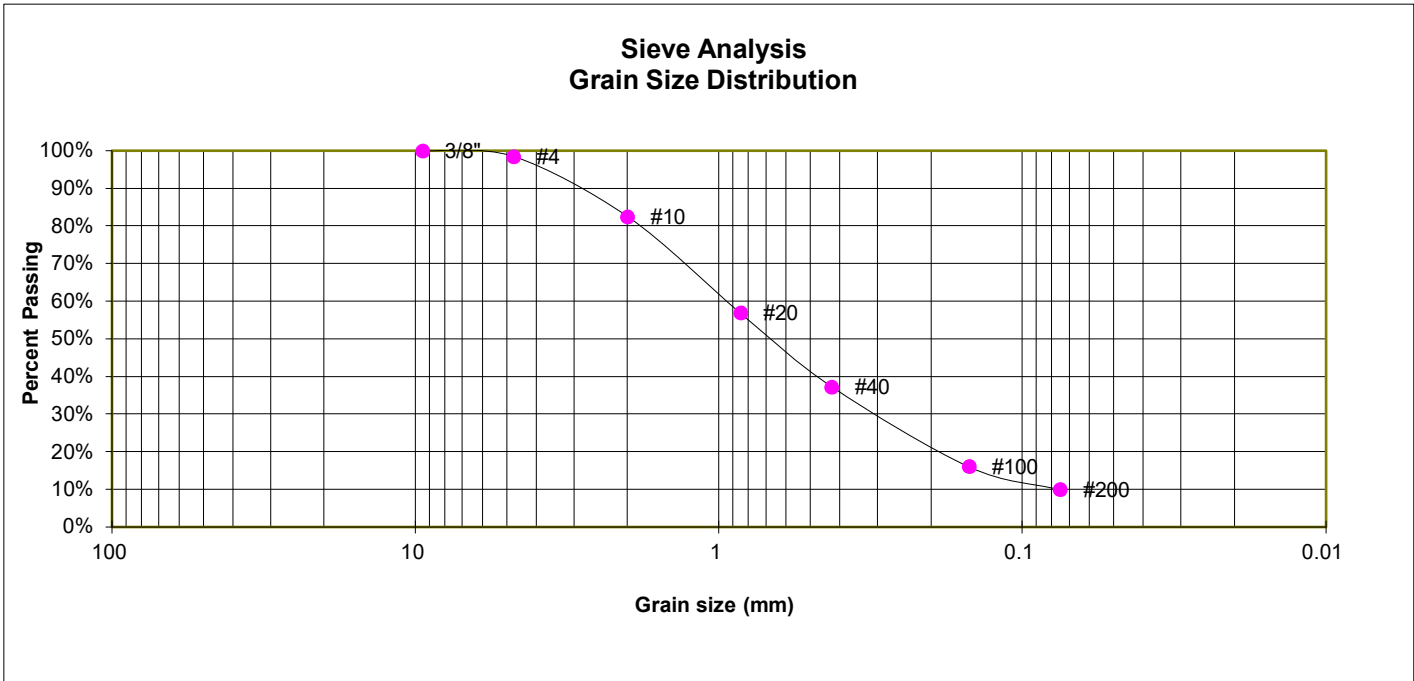
CATHEDRAL ROCK CHURCH
 HAMMERS CONSTRUCTION

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 241718

FIG. B-1

TEST BORING 2
 DEPTH (FT) 5

SOIL DESCRIPTION SAND, WITH SILT
 SOIL TYPE 1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.5%
10	82.5%
20	56.9%
40	37.3%
100	16.1%
200	10.0%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

USCS CLASSIFICATION: SW-SM



LABORATORY TEST RESULTS

CATHEDRAL ROCK CHURCH
 HAMMERS CONSTRUCTION

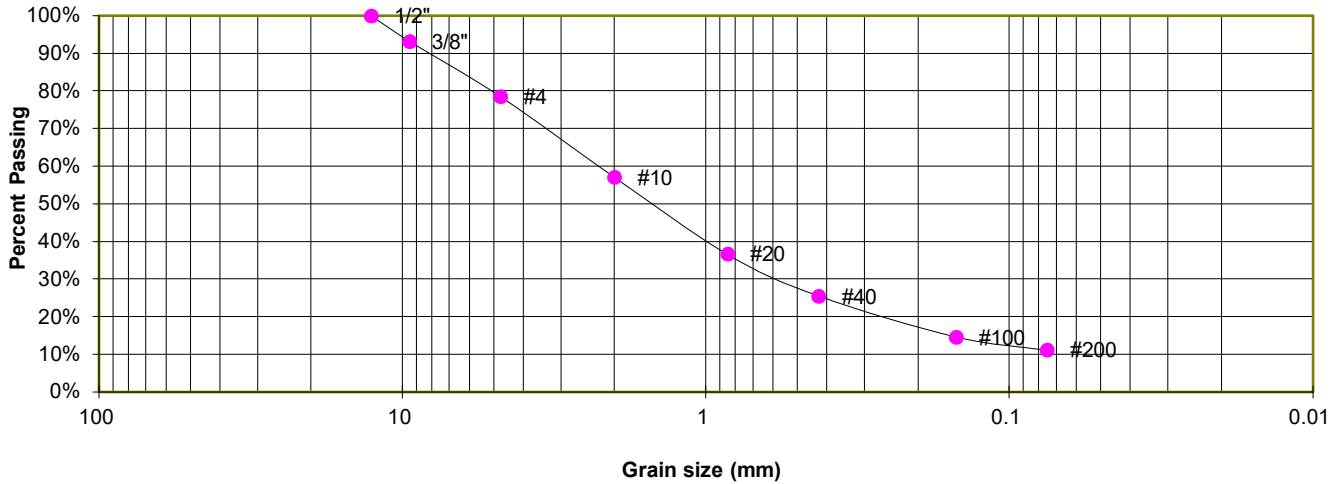
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FIG. B-2

TEST BORING 3
 DEPTH (FT) 10

SOIL DESCRIPTION SAND, WITH SILT
 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"	93.2%
4	78.5%
10	57.1%
20	36.7%
40	25.5%
100	14.6%
200	11.2%

SOIL CLASSIFICATION

USCS CLASSIFICATION: SW-SM



LABORATORY TEST RESULTS

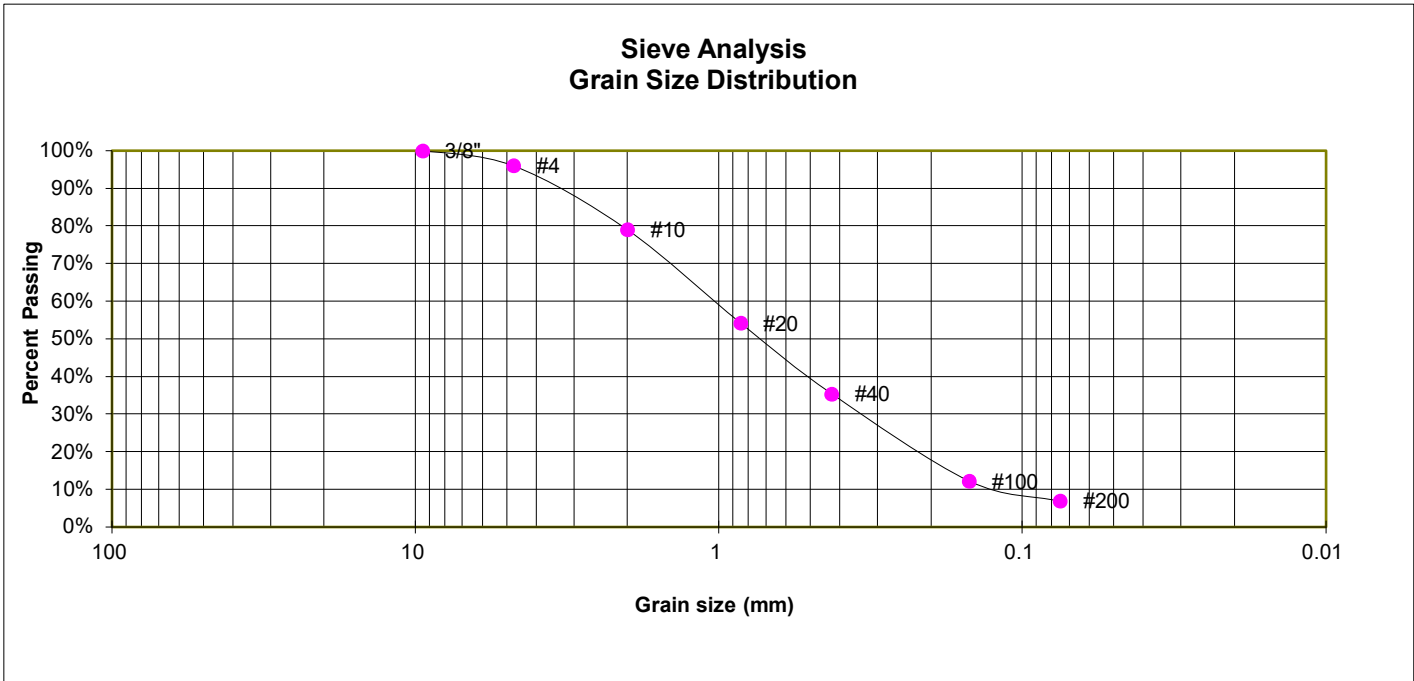
CATHEDRAL ROCK CHURCH
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FIG. B-3

TEST BORING 4
DEPTH (FT) 5

SOIL DESCRIPTION SAND, WITH SILT
SOIL TYPE 1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.0%
10	79.0%
20	54.3%
40	35.4%
100	12.3%
200	6.9%

SOIL CLASSIFICATION

USCS CLASSIFICATION: SW-SM



LABORATORY TEST RESULTS

CATHEDRAL ROCK CHURCH
HAMMERS CONSTRUCTION

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FIG. B-4

TEST BORING 1
DEPTH (FT) 20

SOIL DESCRIPTION SAND, CLAYEY
SOIL TYPE 1



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF): 103
NATURAL MOISTURE CONTENT: 22.1%
SWELL/COLLAPSE (%): 2.2%



SWELL TEST RESULTS

CATHEDRAL ROCK CHURCH
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FIG. B-5