

Addendum #4

Addendum Date: September 9, 2026
Project: ARNG 26010-BBTSTRACK– BBTS Running Track Lighting
DEARNG Contract 2026-10

The work herein shall be considered part of the bid documents for the referenced project and carried out in accordance with the following supplemental instructions issued in accordance with the Contract Documents without change in Contract Sum or Contract Time. Acknowledge receipt of addendum on the bid form as indicated.

General:

1. All hardware shall be stainless steel throughout.
2. All concrete mix shall have water-cement ratio of 0.40.

RFIs:

1. Light pole detail #1 on drawing E-500 shows an overall height of 14' including 2 1/2' relevel of pole base. Poles are manufactured in 2' increments. Would a 12' pole be acceptable with an overall height of 14' 6"?

Response: Yes. See revised drawing.

2. Light fixture schedule shows lights being 208v. Panel feeding lights is rated at 277/480 please advise if multi volt lights are acceptable

Response:

- **Lighting schedule to be revised in this addendum; type SL light fixtures shall be 480V 1PH.**
- **The type B fixtures shall be compatible with the voltage of the existing bollard's circuit(s). Contractor to confirm existing circuit voltage in the field, but assume multi-voltage 120-277V is acceptable for bidding.**

3. Is a site visit available with access to shed #6, and building 134?

Response: Site visit requests available; provide date and time via e-mail.

4. Installing the pole bases will generate excess dirt spoils. Is there a spot on site that the spoils can be stockpiled and remain on site, or do we need to include removal of all spoils from the site?

Response: No on-site stockpile area will be provided. Material shall be imported or hauled off continuously in accordance with the work progression.

5. Considering the 4ft depth of the pole bases and related excavations, has there been any bore samples taken to determine if the water table is going to be an issue?

Response: According to a geotechnical evaluation performed in October 2020, groundwater was observed at depths ranging between approximately 2.8 to 3.2 feet below grade. Due to seasonal and annual variations in precipitation, groundwater fluctuations of several feet should be anticipated. Coordination with DNREC will be required to permit any dewatering activities. Filter bags may be required to ensure sediment laden water is treated prior to release.

Attachments:

1. Geotechnical evaluation October 2020.
2. E-000
 - a. Revised the type SL light fixture's voltage, description, and catalog number. Added a basis of design pole model number. Pole to be aluminum.
3. E-500
 - a. Revised the pole detail. Fixture mounting height to 14'-6" AFG. Concrete light pole base 36" diameter embedded 3 feet below grade. Provide 12- #6 vertical bars and #3 ties at 12" centers. Concrete mix water-cement ratio 0.40.

END

October 19, 2020

Ed Lupinek, C.P.E.
StudioJAED
2500 Wrangle Hill Road
Fox Run Office Plaza, Suite 110
Bear, DE 19701

RE: Duffield Associates, Inc. Project No. 12440.GE
Geotechnical Evaluation
Proposed Fitness Center
Delaware Army National Guard
Bethany Beach Training Site
Bethany Beach, Delaware

Dear Mr. Lupinek:

Duffield Associates, Inc. (Duffield) has completed our geotechnical evaluation for the proposed fitness center at the Delaware Army National Guard Bethany Beach Training Site located in Bethany Beach, Delaware. The evaluation is summarized in the following report, which includes the data obtained in our field and laboratory programs, the subsurface conditions encountered, and our recommendations for the design and construction of the building foundation and slab-on-grade systems, as well as the stormwater management facilities. These services were performed in general accordance with our agreement dated August 18, 2020.

We appreciate this opportunity to be of service to you and will remain available to assist you and your team as design progresses and into the construction phase of the building. Should you have any questions concerning this evaluation, we encourage you to contact us.

Sincerely,

DUFFIELD ASSOCIATES, INC.



Alison R. Schoch P.E.
Geotechnical Engineer



Matthew B. Van Rensler, P.E.
Geotechnical Division Director

ARS/MBV:hjd
12440GE.1020-DEARNG BBTS FITNESS CENTER.RPT

Enclosure: Report

**Geotechnical Evaluation
Proposed Fitness Center
Delaware Army National Guard
Bethany Beach Training Site
Bethany Beach, Delaware**

October 19, 2020



DUFFIELD
ASSOCIATES
Soil, Water & the Environment

Civil

Water/Natural Resources

Geotechnical

Environmental

Construction Review

Coastal/Waterfront



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EXECUTIVE SUMMARY

The following report summarizes Duffield Associates Inc.'s (Duffield's) Geotechnical Evaluation for the proposed fitness center located at the Delaware Army National Guard Bethany Beach Training Site in Bethany Beach, Delaware. This report includes information regarding the field and laboratory testing programs, the subsurface conditions encountered, and recommendations for the design and construction of the proposed building foundations and slab-on-grade, as well as the stormwater management facilities. These services were performed in general accordance with our agreement with StudioJAED dated August 18, 2020.

Proposed site development is anticipated to include a new single-story 6,800 square-foot fitness center building surrounding the sidewalk and new pavement area. The building will be constructed at-grade (i.e., no basement).

On September 22, 2020, Duffield performed three test pit excavations in the vicinity of the proposed building. In addition, Duffield reviewed subsurface information from previous geotechnical evaluations at the site (performed in 2006 and 2011) for the building adjacent to the proposed fitness center. Beneath a surficial layer of topsoil, the subsurface conditions observed in the test pits can generally be described as loose to medium-dense sand with varying amount of silt to the extent of the test pits, with a thin interbedded layer of clay and clayey-sand observed at depths ranging between approximately 2.8 to 3.7 feet below the existing ground surface. Moderate to rapid water seepage was observed in each of the test pits at depths ranging between approximately 2.8 to 3.2 feet below grade. The seepage appeared to be "perched" water above the clay and sandy clay layer. Groundwater was measured in two of the test pits at depths of approximately 5.5 feet, approximately 30 minutes after excavations were completed.

Based on the observed subsurface conditions and the design information provided by the project team, Duffield provides these comments and recommendations:

- Site preparation is anticipated to include removal of the existing one-story building and other small structures located within the footprint of the proposed fitness center. In addition, existing topsoil and pavement should be removed from the building area. Following removal of existing structures, utilities, and the surficial fill, resulting excavations should be backfilled with structural fill placed and compacted as recommended in this report.
- The proposed fitness center could be supported on a conventional shallow foundation system and slab-on-grade. If encountered during foundation construction, the soft to medium consistency clay soils should be undercut from footing areas. Resulting undercuts should be backfilled with structural fill placed and compacted as recommended in this report.
- Foundations should be designed for a maximum allowable bearing pressure of 2,000 pounds per square foot (psf). Total foundation settlement is estimated to be on the order of 1 inch or less, and a differential settlement on the order of a ½ inch or less over a distance of 25 feet.
- Due to the shallow groundwater conditions at the site, as well as the presence of a shallow "limiting layer" of clay and sandy-clay soils, stormwater management practices that use infiltration of stormwater into the natural site soils, as the primary means of stormwater control, is not considered to be practical at the site.

Additional information, discussion, and recommendations are provide further herein.

PROJECT SUMMARY

PROPOSED CONSTRUCTION

- Site development of the fitness center is anticipated to include a new 1-story building with a footprint of approximately 148-feet by 46 feet, with surrounding sidewalk and pavement areas.
- The building is proposed to be constructed at-grade (i.e., no basement) with assumed finished floor elevation that will approximately match the existing grades (i.e., net cuts/fills of less than 2 feet).
- Structural information (i.e., building type, loads, etc.) was not available at the time of this report. Therefore, Duffield has assumed structural loads on the order of 4 kips per linear foot for walls and maximum column loads on the order of 100 kips.

REFERENCES UTILIZED

- A Request for Proposal document titled “Delaware Army National Guard, Bethany Beach Training Site, Proposed Fitness Center, Geotechnical Scope of Services,” undated.
- An untitled drawing indicating the location and dimensions of the proposed fitness center building relative to other site features, undated.
- A drawing titled “GPRS Project Findings Map, Prepared for StudioJAED, Location: DE Air Nat Guard, Bethany Beach, DE,” prepared by GPRS, which indicates existing delineated utilities located within the proposed fitness center building area.
- A document titled “Geotechnical Evaluation, Delaware Army National Guard, Regional Training Institute, Bethany Beach Training Site, Bethany Beach, Delaware,” prepared by Duffield Associates, Inc., dated September 2011, which contained geotechnical information for the building adjacent to the proposed fitness center.

EXISTING SITE CONDITIONS

The area of the proposed fitness center is located in an area that is currently a relatively flat grass field occupied by a one-story building with a footprint of approximately 1,200 square feet and sand volley-ball court. Several existing below-grade utilities were delineated within the building area including electric, water, gas, communications, sanitary and storm sewer, and unknown utilities.

FIELD AND LABORATORY TESTING

PREVIOUS GEOTECHNICAL EVALUATIONS

- Duffield has performed previous geotechnical evaluations at the site for the Regional Training Institute building located adjacent to the proposed fitness center on the south side in June 2006 and July 2011. During these evaluations, 19 Standard Penetration Test (SPT) borings were performed. The subsurface information from the referenced 2011 report was reviewed by Duffield to assist with the development of this report.

TEST PIT EXCAVATIONS AND INFILTRATION TESTING

- On September 22, 2020, three test pit excavations were performed at the site to review subsurface conditions in the vicinity of the proposed fitness center. The test pits were performed to depths ranging between approximately 3.5 to 7.5 feet below grade. Extensive caving of sidewalls was observed during the performance of the test pits, which made deeper advancement of the test pits difficult.
- The test pit excavations were performed by CGC Geoservices, LLC, an affiliate company of Duffield, utilizing a rubber-tired backhoe.
- In location TP-1, following completion of the test pit, an additional excavation was offset for performance of one single-ring infiltration test. The testing was performed in general accordance with DNREC 3.06.2.A-1 “Soil Investigation Procedures for Stormwater BMPs” and Appendix 1, “Soil Investigation Procedures for Stormwater Best Management Practices” of the “Delaware Post Construction Stormwater BMP Standards & Specifications” (February 2019).
- At completion, the excavations were backfilled with soil cuttings and compacted with backhoe bucket. Additional settlement and softening of the soil replaced in the excavation areas may occur, resulting in a depression or hole in the ground surface. Consequently, future maintenance and restoration of the site may be required.
- The approximate test pit and infiltration test locations are indicated on the enclosed Test Pit and Infiltration Test Location Sketch, in addition to the approximate locations of the previously performed test borings at the site during the referenced 2006 and 2011 evaluations. Test pit logs, which describe the conditions observed during the field exploration program, are enclosed.

LABORATORY TESTING

Following the field program, the samples were returned to Duffield’s office and laboratory testing was performed on the selected samples. The results of the laboratory testing are summarized below. No environmental testing or characterization was performed.

LOCATION	SAMPLE NO.	APPROX. DEPTH (FT)	MOISTURE CONTENT (%) (ASTM D2216)	PERCENT PASSING NO. 200 SIEVE (%) (ASTM D1140)
TP-1	S-2	3.5	21.5	35.6
	S-3	5.5	17.6	5.2
TP-2	S-1	1.7	12.2	0.7
	S-3	4.7	15.9	11.1
LOCATION	SAMPLE NO.	APPROX. DEPTH (FT)	MOISTURE CONTENT (%) (ASTM D2216)	PERCENT PASSING NO. 270 SIEVE (%) (USDA)
IT-1	S-1	1.0	7.3	7.6

SUBSURFACE CONDITIONS

GENERALIZED SITE GEOLOGY

Based on Delaware Geologic Survey (DGS) mapping, the project site is located in the Atlantic Coastal Plain Physiographic Province. DGS mapping indicates that the stratigraphy of the Coastal Plain in the vicinity of the site consists of tidal deposits underlain by two major geological units, the Pleistocene Age Omar Formation and the underlying Miocene to Late Pliocene Age Beaverdam Formation. The Omar Formation typically consists of gray clayey-sand to sandy-silt that contains scattered shell fragments. Scattered beds of fine sand and silty-fine sand are common. The underlying Beaverdam Formation typically consists of fine to coarse sand with interbeds of fine silty sand and clayey-silt. The depth to rock in this area is on the order of 2,500 feet below grade.

STRATIGRAPHIC CONDITIONS

Beneath a surficial layer of topsoil, the subsurface conditions observed in the test pits can generally be described as loose to medium dense sand with varying amount of silt to the extent of the test pits. A thin interbedded layer of clay and clayey-sand observed at depths ranging between approximately 2.8 to 3.7 feet below the existing ground surface. These soil conditions generally appeared to be consistent with the nearby test boring logs performed during the previous evaluation at the site.

For discussion purposes, the subsurface conditions can be further described as follows:

SUBSURFACE STRATUM	APPROXIMATE THICKNESS (FEET)	GENERALIZED DESCRIPTION ^[1]
A ^[2]	0.5 – 0.7	TOPSOIL (approx. 6 to 8 inches);
B	2.1 – 3.2	Brown, gray fine to medium SAND, little to trace silt (moist, loose density); USCS: SM, SP
C	0.3 – 0.5	Black, brown, gray CLAY, some fine sand, trace organics, and fine SAND and CLAY, trace organics (moist to wet, soft to medium consistency); USCS: CL, SC
D	--- ^[3]	Brown, light brown, gray fine SAND, little medium to coarse sand, little to trace silt (wet, loose to medium density); USCS: SM, SP-SM, SP
Notes:	1. The soil descriptions utilized herein and on the test pit logs are defined in the attached General Notes. 2. Stratum A not observed in test pit TP-1. 3. Stratum D not fully penetrated in test pits.	

GROUNDWATER

- During performance of the test pits, moderate to rapid water seepage was observed in each of the test pits at depths ranging between approximately 2.8 to 3.2 feet below grade. The seepage appeared to be “perched” water above the clay and sandy clay layer of Stratum C. Groundwater was measured in test pits TP-1 and TP-2 at depths of approximately 5.5 feet, approximately 30 minutes after excavations were completed.

- During the previous evaluations performed at the site in 2006 and 2011, groundwater was observed at depths ranging between approximately 2.4 to 2.8 feet below the existing grade. It is likely that the site's proximity to the Salt Pond (located approximately 1,400 feet west and 950 feet northwest of the site) and the Atlantic Ocean (located approximately ¼ mile east of the site) may influence groundwater elevations at the site.
- Groundwater mapping by DGS and the current DNREC well permit database indicates average groundwater levels in "normal," and "wet" conditions may be less than 3 feet below grade. Due to seasonal and annual variations in precipitation, groundwater fluctuations of several feet should be anticipated.

DISCUSSION OF ANALYSIS

SITE PREPARATION

Site development will include demolition of the existing one-story brick building located within the proposed fitness center footprint. It is Duffield's recommendation that existing foundations and slabs are removed in their entirety. In addition, the existing equipment, tank structures, and pavement areas should be removed from the building area prior to placement of structural fill or concrete for the new building. The resulting excavations during demolition should be backfilled with structural fill placed and compacted as recommended in this report.

SHALLOW FOUNDATION AND SLAB-ON-GRADE SYSTEM

The soft to medium stiff and loose Stratum C clay and sandy clay, was observed at depths ranging between approximately 2.8 to 3.7 feet below the existing grade and was observed to have a thickness ranging between 0.3 to 0.5 feet thick in the test pits. Due to the soft consistency and observed organic content in this Stratum, it is Duffield's opinion that if soft clay soils are observed during foundation construction, they should be undercut to firm granular conditions beneath the footings. Undercut soils can be backfilled with structural fill and compacted as recommended in this report. The granular, natural site soils observed in the test pits are generally suitable for supporting the proposed building on a shallow foundation system and slab-on-grade system. Structural fill, placed and compacted as recommended herein, is also considered suitable for support of proposed building.

INFILTRATION TEST RESULTS

One single-ring infiltration test was performed at the site at a relatively shallow depth. The following table summarizes the results of the infiltration testing.

INFILTRATION TEST LOCATION	APPROX. TEST DEPTH (FT.)	USDA DESCRIPTION	USCS DESCRIPTION	OBSERVED FIELD INFILTRATION RATE (IN/HR)
IT-1	1.0	Sand	Poorly graded silty-sand	4.0

It should be noted that a factor of safety has not been applied to the field infiltration rates indicated above. A factor of safety of 2.0 is typically recommended for design of stormwater management areas based on single-ring infiltration testing.

Although infiltration testing was performed at the site, it is likely that groundwater levels will be higher than those observed during test pit excavations. Furthermore, "DNREC Sediment & Stormwater Technical document Section A-1 Soil Investigation Procedures for Stormwater BMPs," dated February 2019, requires infiltration systems to be founded a minimum of 2 feet above the limiting layer, such as a seasonal high water table or relatively impermeable layer such as clay. The perched water conditions observed in the test pits indicate that the Stratum C clay and sandy-clay layer is an apparent "impermeable" layer. Based on these conditions, it is likely that a stormwater management facility which utilizes infiltration into the soils as a primary means of stormwater control is not practical at this site.

DESIGN RECOMMENDATIONS

1. ALLOWABLE FOUNDATION BEARING CAPACITY AND SETTLEMENT

- It is Duffield's opinion that the natural granular soils encountered below surficial topsoil are generally considered suitable for supporting the proposed building on a shallow spread footing foundation and slab-on-grade system following subgrade preparation and review, as discussed further herein. Structural fill, placed, compacted and reviewed as recommended in this report, is also considered suitable for supporting shallow foundations. If the Stratum C clay soils are encountered during footing construction, it is recommended that the foundations bear below the bottom of the clay on firm and dry Stratum D sands.
- It is recommended that the proposed foundations for the fitness center be designed for a maximum net allowable bearing pressure of 2,000 pounds per square foot.
- Based on the results of the analysis performed as part of this evaluation, it is estimated that maximum total foundation settlement for the proposed structure should be on the order of 1 inch or less, with a post-construction differential settlement on the order of ½ inch over a distance of 25 feet.

2. FOUNDATION BURIAL DEPTH AND SIZE

- The base of all footings in areas exposed to frost should be placed at least 24 inches below final exterior grade.
- Interior foundations in insulated areas should be placed at least 18 inches below the proposed finished floor elevation.
- All continuous wall footings should be at least 2-feet wide, and all isolated column footings should be at least 3-feet wide, regardless of bearing pressure.
- If a winter construction schedule is proposed for the foundations, provisions for the protection of shallow foundations from frost heave during construction should be included in the contract specifications.

3. SLAB-ON-GRADE

- Ground-supported floor slabs should be designed as free floating and should not be connected to the other structural elements (e.g., walls, framing, etc.) of the buildings. Isolation joints should be utilized at the interface of proposed ground-supported floor slabs and structural elements to accommodate potential differential settlement.
- A minimum 10 mil polyethylene vapor barrier and free-draining subbase, consisting of at least 4 inches of poorly graded crushed stone aggregate such as AASHTO SP-57 stone, should be provided beneath all floor slabs.
- Subgrade conditions should be modeled for design utilizing a subgrade modulus, K_s of 150 pci, provided subgrade preparation is performed as recommended in this report.

4. SEISMIC DESIGN PARAMETERS

Based on the subsurface conditions encountered during the field exploration at the site and the review of regional geologic maps, a “D” site classification is recommended for the analysis of seismic conditions, as defined by 1613.3.2 of the 2018 International Building Code and Chapter 20 of the American Society of Civil Engineers Minimum Design Loads for Buildings and Other Structures (ASCE/SEI 7-16).

5. CONTROL JOINTS

Masonry walls should be provided with frequent control joints placed at architecturally convenient locations (e.g., windows and doorways) to provide a “preferred” location for differential settlement to occur to reduce the potential for cracking of the walls.

6. EXISTING UTILITIES

The presence of utilities beneath a structure could result in crushing of pipes and/or undermining of proposed buildings. Therefore, it is recommended that any existing utilities be removed and relocated outside of the proposed building area. The resulting excavations should be backfilled with structural fill, placed and compacted in accordance with the recommendations of this report. Alternatively, existing pipes could be abandoned left in-place, and grouted “full” throughout its length. If the utilities cannot be relocated outside of the proposed building area, foundations should be designed to bear at or below the invert elevations of the pipe.

7. STORMWATER MANAGEMENT AREA DESIGN

It is recommended that the designer of the stormwater management facilities utilize the most recent version of the “DNREC Sediment & Stormwater Technical document Section A-1 Soil Investigation Procedures for Stormwater BMPs,” dated February 2019. It is noted that the minimum infiltration rate for all runoff reduction and infiltration practices is 1.0 in/hr, and infiltration systems are required to be founded a minimum of 2 feet above the limiting layer, such as a seasonal high water table or relatively impermeable layer such as clay.

Based on the subsurface conditions and shallow groundwater in the area of the proposed stormwater management facility, it is Duffield’s opinion that a stormwater management area that uses infiltration of stormwater into the natural soils as a primary means of stormwater control is not practical at the site.

8. SITE GRADING

Site grading should be designed to provide positive drainage away from the proposed construction area. Positive site drainage should be maintained throughout the construction activities.

CONSTRUCTION RECOMMENDATIONS

1. PROOFROLLING AND SUBGRADE PREPARATION

- At the start of construction, the site should be stripped of all topsoil and bituminous concrete pavement and rough excavated to proposed grades. The existing slab and foundation elements located at the site should be removed in their entirety to firm, dry natural soils. The resulting excavations made by existing structure demolition should be backfilled with structural fill, placed and compacted as recommended herein.
- Following rough grading and prior to footing excavation, placement of fill, or construction of the pavements or floor slabs, it is recommended that the exposed subgrade in the building area, as well as the pavement area, be proofrolled. The proofrolling should be performed using a minimum of two passes of a 10-ton static roller or a fully-loaded tandem dump truck in the presence of a qualified soils technician working under the supervision of a geotechnical engineer. The purpose of the proofrolling is to identify yielding subgrade conditions. The proposed construction area should be proofrolled at least 5 feet beyond the construction perimeters.
- Yielding subgrade conditions encountered within the proposed building and pavement areas should be undercut to firm, subgrade conditions, and backfilled with compacted structural fill placed in accordance with the recommendations of this report. If acceptable to the project's engineer, granular soils may also be densified in place. The subgrade review should confirm the consistency and texture of the exposed soils with the conditions encountered by this evaluation, as described herein.

2. FOUNDATION SUBGRADE REVIEW

- All shallow foundations should be placed on firm, dry, non-frozen subgrade consisting of medium dense or denser sand or medium stiff or stiffer clay, or on structural fill, placed and compacted as recommended herein. Foundation excavations should be reviewed by a qualified technician working under the supervision of a geotechnical engineer who is familiar with the recommendations of this report.
- If soft/loose or unsuitable subgrade conditions are encountered at the proposed building or pavement area depths, additional excavation should be performed until they are uniformly encountered across the base of the foundation's excavation or, if acceptable to the project geotechnical engineer, the natural sand soils can be densified in place. Foundation undercut areas should be backfilled with structural fill as recommended herein.

3. RE-USE OF ON-SITE SOILS AS STRUCTURAL FILL

- On-site soils free of organic material, topsoil, miscellaneous fill, debris, and rock fragments in excess of 3 inches in their largest dimension may be suitable as structural fill.
- A majority of the on-site materials that will be available as fill from the excavations will consist of the Stratum B sand. These soils are considered suitable for backfill, as long as they are free of debris and the moisture content of the soils is within the range in which the specified compaction requirements can be achieved. The shallow soils observed in the test pits were generally observed to have moisture contents slightly higher than the range at which specified compaction requirements can be achieved, and therefore, some drying of the soils may be necessary.

- If sufficient quantities of suitable on-site soils are not available for structural fill, imported borrow consisting of predominately granular soils conforming to the requirements of DelDOT Standard Specifications Borrow Type C (Backfill) should be utilized. AASHTO SP-57 stone could also be utilized as structural fill at locations, as recommended by the project engineer, and should be considered for localized, relatively deep fills such as foundation undercuts.

4. COMPACTION REQUIREMENTS

- Structural fill should be placed in loose lifts with a maximum thickness of 8 inches.
- Each lift of fill placed within the proposed building construction area (defined as the area extending at least 5 feet beyond the foundation element perimeters) should be compacted to at least 95% of the maximum dry density, as determined by the Modified Proctor test (ASTM D 1557).
- Structural fill for utility, located outside of the proposed building areas and for site pavements, should be compacted to at least 90% of the Modified Proctor maximum dry density.
- The placement and compaction of structural fill should be monitored on a full-time basis by a qualified technician working under the supervision of a geotechnical engineer.

5. EXCAVATION SAFETY

All utility and foundation excavation should be performed in accordance with OSHA guidelines. Typically, the Strata B sands can be characterized by OSHA CFR Part 1926 Excavation Standards as Type C soils. Should it be required, all temporary sheeting, shoring, benching, and sloping should be designed by a qualified engineer registered in the State of Delaware.

6. PROTECTION OF SUBGRADE SOILS

If foundation excavations are left open, precipitation may result in the collection of water within the excavation. Provisions for removal of water by drainage or sumping are recommended. Subgrade soils disturbed by precipitation and construction traffic should be either scarified and re-compacted, or undercut and replaced with structural fill as previously recommended in this report.

7. GROUNDWATER CONTROL

Based on the depth of groundwater observed in the test pit excavations and previously performed test borings at the site, it is possible that groundwater may be encountered during excavation of building foundations or utility construction, and localized sumping may be required to control stormwater runoff into excavations during construction. It is recommended that wherever groundwater is encountered during shallow foundation or utility excavations, the resulting excavation should be over excavated by at least 4 inches and replaced with AASHTO SP-57 stone to protect the exposed subgrade soils and to facilitate sumping.

8. SUBSURFACE DATA

All contractors interested in bidding on phases of this work, which involve subsurface conditions, should be given full access to this report so that they can develop their own interpretations of the available data.

9. CONSTRUCTION REVIEW

It is recommended that the project budget include provisions for the cost for independent construction monitoring of the earthwork and foundation construction by a qualified engineering firm retained by the Owner, to review conformance of construction with the recommendations of the project geotechnical evaluation, as well as the project plans and specifications.

QUALIFICATIONS

The recommendations of this report have been prepared according to generally accepted soil and foundation engineering practice, and are based on the conditions encountered by the test pit excavations performed at the site. Although soil quality has been inferred from the interpolation of the sampling data, you should explicitly note that subsurface conditions beyond the test pit excavations are, in fact, unknown. Should any conditions encountered during construction differ from those described in this report, this office should be notified immediately in order to review, and possibly modify these recommendations. This report applies solely to the size, type, and location of the structures described herein. In the event that changes are proposed, this report will not be considered valid unless the changes have been reviewed and the recommendations of this report modified and re-approved in writing by Duffield Associates, Inc.

ENCLOSURES

SITE LOCATION SKETCH

TEST PIT LOCATION SKETCH

TEST PIT LOGS

INFILTRATION TEST RESULTS

GENERAL NOTES

SITE LOCATION SKETCH

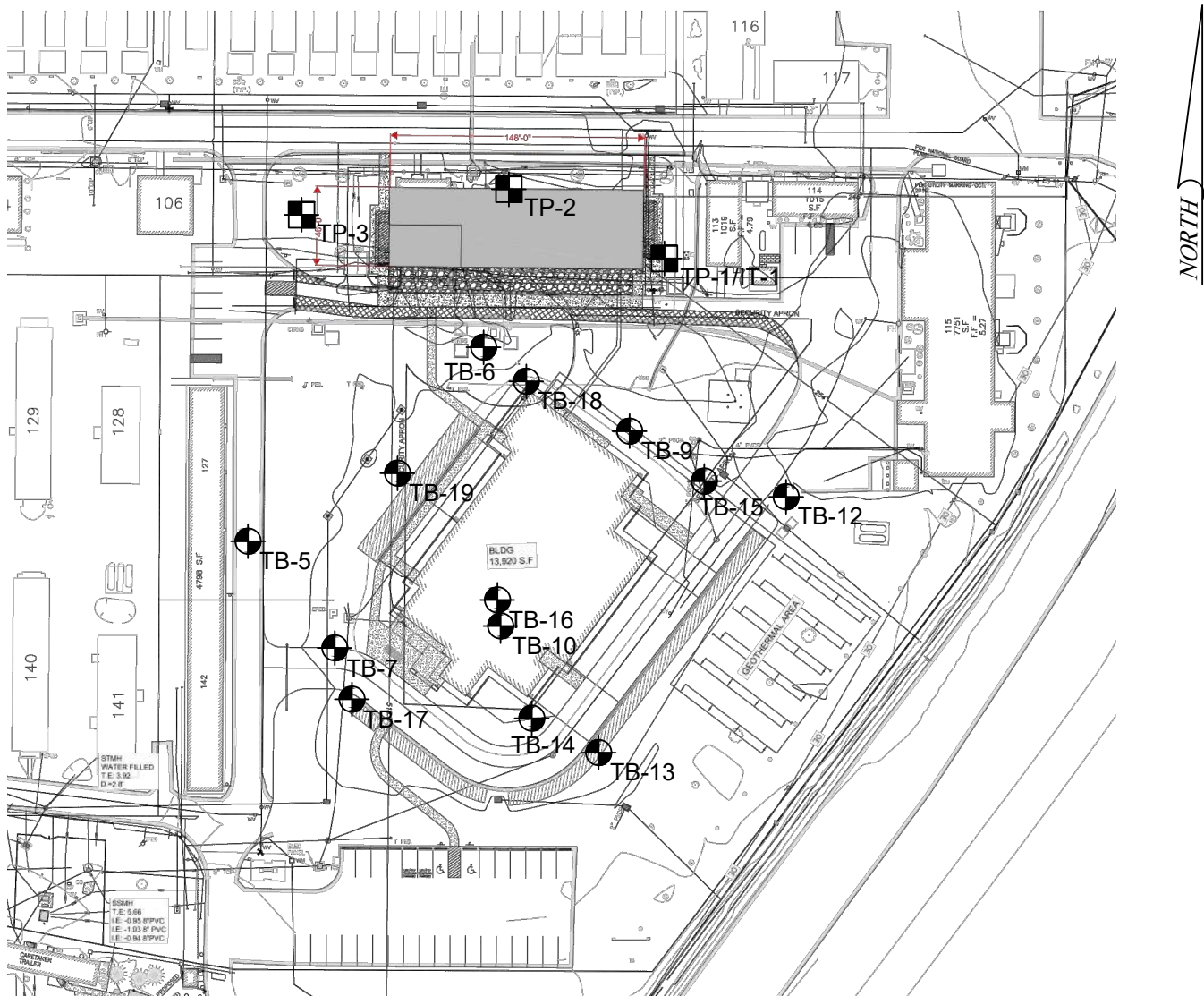


NOTE:

THIS SKETCH IS ADAPTED FROM A 7.5 MINUTE SERIES U.S.G.S TOPOGRAPHIC MAP TITLED "BETHANY BEACH, DE" DATED 2019.

DATE: 19 OCTOBER 2020	SITE LOCATION SKETCH DEARNG BETHANY BEACH TRAINING SITE PROPOSED FITNESS CENTER BETHANY BEACH~ SUSSEX COUNTY ~ DELAWARE	DESIGNED BY: ARS	 DUFFIELD ASSOCIATES Soil, Water & the Environment 5400 LIMESTONE ROAD WILMINGTON, DE 19808-1232 TEL. 302.239.6634 FAX 302.239.8485 OFFICES IN DELAWARE, MARYLAND PENNSYLVANIA AND NEW JERSEY E-MAIL: DUFFIELD@DUFFNET.COM
SCALE: 1"=2000'		DRAWN BY: ARS	
PROJECT. NO. 12440.GE		CHECKED BY: MBV	
SHEET: FIGURE 1		FILE: A-12440GE-01	

TEST PIT LOCATION SKETCH



KEY:



TP-1

- APPROXIMATE LOCATION OF TEST PIT/INFILTRATION TEST (CURRENT EVALUATION)



TB-X

- APPROXIMATE LOCATION OF TEST BORING (PREVIOUS EVALUATIONS 2006 & 2011)

NOTE:

THIS SKETCH IS ADAPTED FROM AN UNTITLED, UNDATED DRAWING PROVIDED BY STUDIOJAED.

DATE:
19 OCTOBER 2020

SCALE:
1" = 100'

PROJECT. NO.
12440.GE

SHEET:
FIGURE 2

TEST PIT AND INFILTRATION TEST LOCATION SKETCH

**DEARNG BETHANY BEACH TRAINING SITE
PROPOSED FITNESS CENTER**

BETHANY BEACH~SUSSEX COUNTY~DELAWARE

DESIGNED BY: ARS

DRAWN BY: ARS

CHECKED BY: MBV

FILE: A-12440GE-02



5400 LIMESTONE ROAD
WILMINGTON, DE 19808-1232
TEL. 302.239.6634
FAX 302.239.8485

OFFICES IN DELAWARE, MARYLAND
PENNSYLVANIA AND NEW JERSEY

E-MAIL: DUFFIELD@DUFFNET.COM

TEST PIT LOGS



TEST PIT TP-1

(Page 1 of 1)

Geotechnical Evaluation
Proposed Fitness Center
Bethany Beach Training Site
Bethany Beach, Delaware
Duffield Associates, Inc. Project No. 12440.GE

Date Started : September 22, 2020 Contractor : CGC Geoservices, LLC
Date Completed : September 22, 2020 Excavation Equip. : Rubber-Tire Backhoe
Logged by : JLR
Weather : Clear, 60s

Depth in feet	Layer Depth feet	GRAPHIC	USCS	Water Levels	Sample Number	Sample Depth (ft)	Moisture Content (%)	Percent Passing 200 Sieve	Remarks	WATER LEVEL
				▼ During Excavation ▽ At completion						
0										
			SM	Brown fine to medium SAND, little to some silt (moist, loose density)						
1.5										
2			SP	Gray fine to medium SAND, trace silt (moist, loose density)	S-1					
3.2										
3.7			SC	Black, gray fine SAND and CLAY, trace organics (moist to wet, loose)	S-2		21.5	35.6		▼
4										
			SP	Brown fine to medium SAND, trace silt (wet, loose to medium density)	S-3		17.6	5.2		▽
6										
7.5										
8										
10										

NOTES:

- Test pit excavation performed to ± 7.5 feet below existing ground surface (b.e.g.s.)
- During excavation, moderate to rapid water seepage observed at ± 3.2 feet b.e.g.s. Groundwater level at ± 5.5 feet b.e.g.s, approximately 30 minutes after excavation completed.
- Moderate to extensive sidewall caving observed from ± 1.0 to 3.8 feet b.e.g.s.
- Test pit excavation backfilled with soil cuttings upon completion.
- Soil descriptions performed in general accordance with ASTM D2488, the Practice for Description and Identification of Soils (Visual-Manual Procedure).

during excavation and at ± 7.5 feet b.e.g.s. Test pit depth could not advance due to extensive caving at ± 7.5 feet.



TEST PIT TP-2

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Geotechnical Evaluation
Proposed Fitness Center
Bethany Beach Training Site
Bethany Beach, Delaware
Duffield Associates, Inc. Project No. 12440.GE

Date Started : September 22, 2020 Contractor : CGC Geoservices, LLC
Date Completed : September 22, 2020 Excavation Equip. : Rubber-Tire Backhoe
Logged by : JLR
Weather : Clear, 60s

Depth in feet	Layer Depth feet	GRAPHIC	USCS	Water Levels	Sample Number	Sample Depth (ft)	Moisture Content (%)	Percent Passing 200 Sieve	Remarks	WATER LEVEL
				▼ During Excavation ▽ At completion						
0										
	0.7									
			SP		S-1		12.2	0.7		
2										
	2.8		CL		S-2					▼
	3.1									
			SP-SM		S-3		15.9	11.1		
4										
	6.5		SP		S-4					
	7.5									▽
6										
8										
10										

NOTES:

- Test pit excavation performed to ± 7.5 feet below existing ground surface (b.e.g.s.)
- During excavation, moderate to rapid water seepage observed at ± 2.8 feet b.e.g.s. Groundwater level at ± 5.5 feet b.e.g.s, approximately 30 minutes after excavation completed.
- Moderate to extensive sidewall caving observed from ± 1.5 to 3.5 feet b.e.g.s.
- Test pit excavation backfilled with soil cuttings upon completion.
- Soil descriptions performed in general accordance with ASTM D2488, the Practice for Description and Identification of Soils (Visual-Manual Procedure).

during excavation and at ± 7.5 feet b.e.g.s. Test pit depth could not advance due to extensive caving at ± 7.5 feet.



TEST PIT TP-3

(Page 1 of 1)

Geotechnical Evaluation
Proposed Fitness Center
Bethany Beach Training Site
Bethany Beach, Delaware
Duffield Associates, Inc. Project No. 12440.GE

Date Started : September 22, 2020 Contractor : CGC Geoservices, LLC
Date Completed : September 22, 2020 Excavation Equip. : Rubber-Tire Backhoe
Logged by : JLR
Weather : Clear, 60s

Depth in feet	Layer Depth feet	GRAPHIC	USCS	Water Levels ▼ During Excavation	Sample Number	Sample Depth (ft)	Moisture Content (%)	Percent Passing 200 Sieve	Remarks	WATER LEVEL
				DESCRIPTION						
0				TOPSOIL (± 6 inches)						
0.5			SP	Light brown, light gray fine SAND, trace silt (moist, loose density)	S-1					
2										
3.0			CL	Brown CLAY, some fine sand, trace organics (moist to wet, soft to medium consistency)	S-2					
3.3			SM	Light brown fine to medium SAND, little silt (wet, loose density)						
3.5										
4										
6										
8										
10										

NOTES:

- Test pit excavation performed to ± 3.5 feet below existing ground surface (b.e.g.s.)
- During excavation, moderate to rapid water seepage observed at ± 3.0 feet b.e.g.s.
- Moderate to extensive sidewall caving observed from ± 0.5 to 3.0 feet b.e.g.s. during excavation and at ± 3.5 feet b.e.g.s. Test pit depth could not advance due to extensive caving at ± 3.5 feet.
- Test pit excavation backfilled with soil cuttings upon completion.
- Soil descriptions performed in general accordance with ASTM D2488, the Practice for Description and Identification of Soils (Visual-Manual Procedure).

INFILTRATION TEST RESULTS

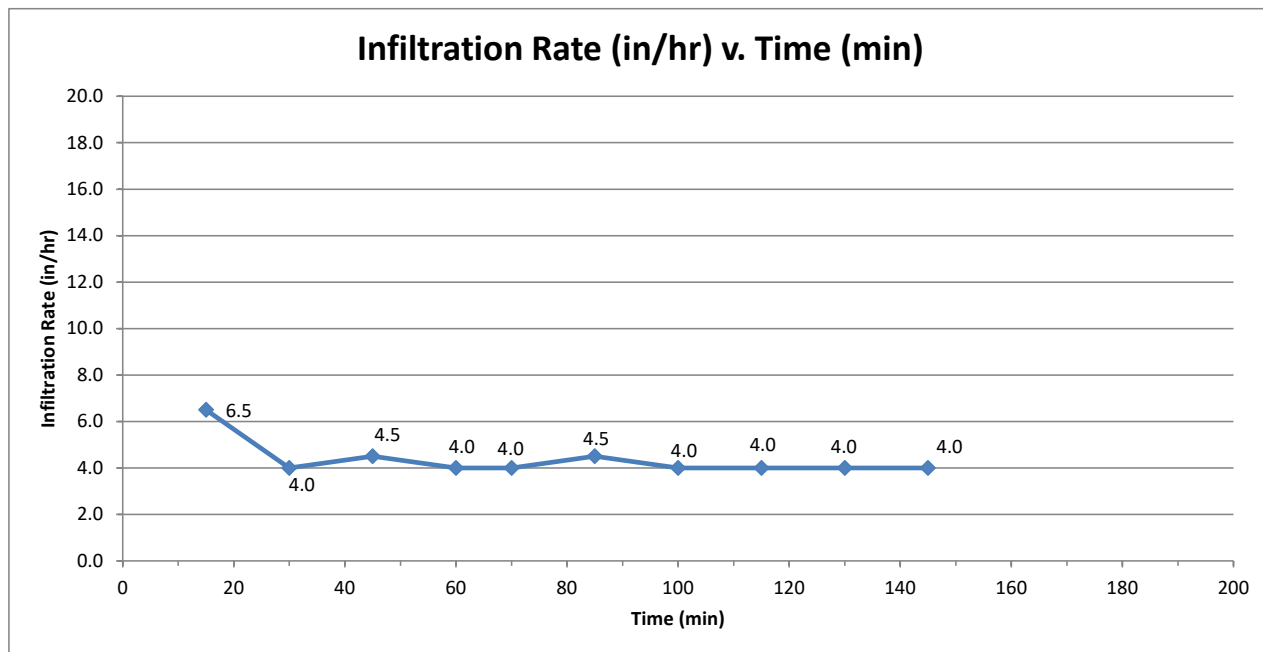
PROJECT: DEARNG BETHANY BEACH TRAINING SITE
 PROPOSED FITNESS CENTER
 PROJECT NO.: 12440.GE

DATE: 9/22/20

TEST NO. IT-1

TEST TYPE: SINGLE-RING

time	time (min)	Δ time (min)	reading (in)	refilled (in)	drop (in)	k(in/hr)
12:29	--	--	--	7 1/2	--	--
12:44	15	15	5 7/8	6	1.63	6.5
12:59	30	15	5	6	1.00	4.0
13:14	45	15	4 7/8	6	1.13	4.5
13:29	60	15	5	--	1.00	4.0
13:39	70	10	--	6	--	
13:54	85	15	4 7/8	6	1.13	4.5
14:09	100	15	5.00	6	1.00	4.0
14:24	115	15	5	6	1.00	4.0
14:39	130	15	5	6	1.00	4.0
14:54	145	15	5	--	1.00	4.0



NOTES:

- 1.) Test performed at $\pm$ 1.0 feet below existing grade.
- 2.) Presoak performed for 1 hours prior to start of test.

GENERAL NOTES

GENERAL NOTES

DUFFIELD ASSOCIATES uses the following definitions and terminology to classify and correlate the field and laboratory samples.

VISUAL UNIFIED CLASSIFICATIONS: The soil samples are described by color, major constituent, modifiers (by percentage), and density (or consistency). Coarse Grained or Granular Soils have more than 50% of their dry weight retained on a No. 200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a No. 200 sieve; they are described as: clays or clayey silts if they are cohesive and silts if they are noncohesive. In addition to gradation, granular soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their strength or consistency and their plasticity.

The Unified Soil Classification symbols are:

COARSE GRAINED SOILS

GW - Well graded gravels
 GP - Poorly graded gravels
 GM - Silty gravels
 GC - Clayey gravels
 SW - Well graded sands
 SP - Poorly graded sands
 SM - Silty sands
 SC - Clayey sands

FINE GRAINED SOILS

ML - Silts of low plasticity
 CL - Clays of low to medium plasticity
 OL - Organic silt clays of low plasticity
 MH - Silts of high plasticity
 CH - Clays of high plasticity
 OH - Organic silt clays of high plasticity
 PT - Peat and highly organic soils

SIZE DESCRIPTION

F - Fine
 M - Medium
 C - Coarse
 G - Gravel

MODIFIERS (PERCENTAGE)

Tr - Trace	1 - 10%
Ltl - Little	11 - 20%
Some	21 - 35%
& - And	36 - 50%

COLOR

Or - Orange	Blk - Black	Vc - Varicolored
Yel - Yellow	Gr - Gray	Dk - Dark
Br - Brown	R - Red	Lt - Light

DENSITY: COARSE GRAINED SOILS

Very loose	4 blows/ft or less
Loose	5 to 10 blows/ft
Medium	11 to 30 blows/ft
Dense	31 to 50 blows/ft
Very Dense	51 blows/ft or more

CONSISTENCY: FINE GRAINED SOILS

Very soft	2 blows/ft or less
Soft	3 to 4 blows/ft
Medium	5 to 8 blows/ft
Stiff	9 to 15 blows/ft
Very stiff	16 to 30 blows/ft
Hard	31 blows/ft or more

NOTE: The Standard Penetration Test "N" value is the number of blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split spoon sampler, except where otherwise noted.