Addendum No. 01
to
DEARNG Contract No. 10-2010
Bethany Beach Training Site – Regional Training Institute (RTI)

This addendum revises referenced Project Plans and Specifications. This addendum forms a part of the Contract described above. The original Contract Documents remain in full force and effect except as modified by the following, which shall take precedence over any contrary provision in the prior documents. Bidder is advised to note receipt of this addendum in the space provided on the Bid Form.

****

SUMMARY OF CHANGES

The following Attachments have been provided:

1. Attachment (1) Pre-Bid meeting minutes for meeting held on 22 May 2013.
2. Attachment (2) Pre-Bid meeting sign-in sheet for meeting held on 22 May 2013.
3. Attachment (3) Subsurface Information for the Delaware Army National Guard Regional Training Institute, Bethany Beach, Delaware.
4. Attachment (4) Hand Auger Borings and Summary of Geophysical Survey Results.
5. Attachment (5) Sussex Water Project Drawing 22932-WATER-01 (2 of 7) (FOR REFERENCE ONLY).

The revisions to the Project Manual, Drawings, and Specifications are as follows:

1. SPECIFICATION SECTION 093000 - PORCELAIN TILE
   Add paragraph:

   1.07 EXTRA STOCK:
   A. Supply an extra 2% of each type tile used in clean and marked cartons.

2. DRAWING C-130 PROPOSED UTILITY PLAN
   Note 6" DIP fire water line segment between Scannell Boulevard and north access road as being not part of this contract.

(End of Summary of Changes)

****

END OF ADDENDUM NO. 1

This Addendum No. 1 to be posted on the State of Delaware Procurement Portal website found at **mymarketplace.delaware.gov.**

Meeting Notes

Meeting Subject:	Prebid Meeting
Meeting Date:	22 May 2013
Start Time:	11:00 AM
End Time:	12:15 PM
Location:	Bethany Beach Training Site, Building 115 163 Scannell Boulevard Bethany Beach, Delaware 19930
Project Name:	Bethany Beach Training Site – Regional Training Institute (RTI)
Project No.:	DEARNG Contract No. 10-2010

Attendees:
Refer to Sign In Sheet attached as part of Addendum 01.

Notes Prepared By:	Kyle Roberts, Burns & McDonnell
Date Notes Issued:	28 May 2013

Meeting Notes:

1. Meeting was called to order by CPT Eugene Bledsoe.
2. This is a mandatory prebid meeting for the purpose of establishing the listing of subcontractors and to answer questions. Attendance of this meeting is a prerequisite for bidding on this contract.
3. Emphasis was made on contractors understanding the requirements provided in the Advertisement for Bids regarding the requirements of sealed bids. Sealed bids will be received by the Delaware Army National Guard (DEARNG) at the Security Officers desk in the Main Lobby of the Joint Force Headquarters, Sherwood Park II, First Regiment Road, Wilmington, Delaware, 19808-2191, until 2:00 PM local time on Friday, June 21, 2013. Bidder bears the risk of late delivery. Any bids received after the stated time will be returned unopened. Refer to the Advertisement for Bids in the specifications.
4. Two complete copies (1 original and 1 copy) of the bid shall be submitted as part of Contractor's sealed bid.
5. Subcontractor lists to be provided as part of Contractor's sealed bid shall be completed in their entirety and shall not be left blank.
6. All addendums will be issued electronically. Addendums will be issued using email addresses provided on the sign in sheet at the prebid meeting. Contractors are required to acknowledge receipt of each Addendum on the Bid Form due as part of the Contractor's sealed bid.
7. The following dates apply to the project:
    a. 5 June – Deadline for requests for substitutions. No requests for substitutions will be allowed beyond June 5.
    b. 12 June – Deadline for questions. No questions or clarifications will be provided beyond June 12.
    c. 14 June – Last anticipated addendum will be issued. No addendum will be provided beyond June 14 unless a change in date and time of the bid opening is required.

   d. 21 June – Bid opening.
8. All permits and fees associated with the project are the responsibility of the Contractor.
9. Review by the Fire Marshall authority is currently underway.
10. This is an FY 2013 MILCON project supporting the DEARNG at Bethany Beach Training Site (BBTS).
11. BBTS complies with the State of Delaware "No Tobacco" policy. This policy extends to contractors performing work at BBTS.
12. DEARNG reserves the right to request names for background checks from the successful contractor.
13. Working hours at BBTS are 0800 to 1700, Monday to Friday.
14. There are two entrances into BBTS, the main north gate and the south gate. The contractor will be given the access code to the south gate and will be responsible for manning south gate for duration of project. DEARNG personnel will move to north gate and will not be responsible for manning the south gate, and will not be responsible for providing security to the project site.
15. Temporary fencing shall be installed around the project perimeter. The boundaries of the temporary construction fence shall be as follows:
    a. The western boundary of the temporary construction fence shall be on the west side of Atkinson Street. Access to the existing parking stalls on the north side of Building 142 shall be maintained for DEARNG personnel.
    b. The northern boundary of the temporary construction fence shall be on the north side of north access road.
    c. The eastern boundary of the temporary construction fence shall be the eastern side of existing Building 147. Access to Building 115 and the parking and turnaround on the west side of Building 115 shall be maintained for DEARNG personnel.
    d. The southern boundary of the temporary construction fence shall be the existing south BBTS perimeter fence.
16. Existing buildings requiring demolition as part of this project are ready for demolition. Lead and asbestos abatement has been conducted by DEARNG and documentation is available.
17. The proposed primary facility for this project consists of one approximate 14,000 square foot facility for training and administration. Supporting site and utility work will include clearing, demolition of existing structures sitework, and utilities, site preparation, storm water/drainage, roadways, sidewalks, utilities, and anti-terrorism/force protection requirements.
18. The project includes commissioning for which the DEARNG has hired a commissioning agent separate from the construction contract. Refer to specification section 019113 that details commissioning requirements.
19. Two alternate bid items (ABI) are included in the project.
    a. ABI #1 is for foldable partitions in the training rooms.
    b. ABI #2 is for the fire pump system room and associated components.

c. Refer to specification section 012300 that details alternates.

20. Project will require a minimum LEED Silver certification. Refer to specification section 0181113.13 that details LEED requirements.
21. Construction waste management is required for this project. Refer to specification section 017419 that details construction waste management and disposal.
22. Contractors are required to utilize ProjectMates, a construction administration software. All RFIs and submittals will be routed through this software. Refer to specification section 013100 that details requirements.
23. Quality Control testing is required on this project. Owner will provide testing and inspection agencies as detailed in the Project Specifications. The Owner will be conducting testing of the Cast-in-Place Concrete (SECTION 03 33 00), Masonry (SECTION 04 20 00), Structural Steel Framing (SECTION 05 12 00), Steel Decking (SECTION 05 31 00), and Cold Formed Metal Framing (SECTION 05 40 00). Contractor will be responsible for coordinating with Owner when inspection and testing are required. Contractor is responsible for quality control measures and testing for other trades where testing is not being provided by Owner.
24. There are two parallel infrastructure repair projects on-going on the site.
    a. A water distribution project is currently underway by Sussex Shores. A section of proposed water distribution piping beneath Buildings 126 and 143 will require installation by Sussex Shores following demolition of Buildings 126 and 143. Coordination will be required by successful contractor with water installation project.
    b. A sanitary improvement project will be underway in the southwest portion of the project site. Coordination will be required by successful contractor with sanitary improvement project.
25. All bidding Requests for Information (RFIs) and questions will be routed from contractors directly to Burns & McDonnell via email. No phone conversations will be permitted. Responses to RFIs and questions will be provided via addendums. Direct all bidding RFIs and questions to Kyle Roberts, Burns & McDonnell, kroberts@burnsmcd.com.
26. Additional walkthroughs shall be scheduled on the following dates:
    a. 29 May – 0900 to 1500.
    b. 5 June – 0900 to 1500.
    c. Contractors shall schedule walkthrough with BBTS Chief Conway (302-326-7693).
27. Contractor is required to provide their own utilities throughout the duration of the project, including electrical, water, and waste. Contractor's temporary connection to BBTS utilities is not allowed.
28. No firearms, weapons, or ordnances in the possession of the contractor will be permitted on the project site.
29. Contractor is responsible for coordinating the disconnection of utilities as part of utility relocation and demolition.
30. Dewatering on the project may be required. Refer to specification section 312319.

31. Test borings have been conducted. Geotechnical investigation will be included as an attachment to Addendum 01.
32. Refer to General Requirements: Article 11 for insurance requirements.
33. Meeting was ended by CPT Eugene Bledsoe.

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Company Name	Representative / Rank	Phone Number	Email
Kant Construction Co, Inc	C.G. Ware / Civ	302 653-6469 / Fax 2168	Lynn@kantconstructionco.com
Mason Construction	Keith Schiding Sr. PM	~~302~~ 410-749-5300	Kschiding@masonconstruct.com Kschiding@masonconstruction.com
Commonwealth Const. Co.	Bill Booth	302-654-6611	BBooth@its commonwealth.com
Tuscan Construction, Inc	Scott Capaldi	3024823364	Posta@TuscanConstruction.com
BCI	Joe Kline Estimator	302-325-2700	jkline@bci-online.com
Bancroft Construction	Todd Bosch - Estimate	302.254.3048	tbosch@bancroftusa.com
Tri-State the Roofers	Steve Winnington	302-995-7027	tri State Roofers@comcast.Net
EDiS Company	James DiGuglielmo Dir. of Field Ops	302-421-5700	JDiguglielmo@EDiscompany.com
VanDemark & Lynch	Cliff Mitchell	302-764-7635 x153	~~cmitchell@~~ cmitchell@VanDemarkLynch.com

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Company Name	Representative / Rank	Phone Number	Email
JOSEPH M. ZIMMER, INC.	JEFF WHITE	410-546-5700	JEFF_WHITE@JMZINC.com
Heritage Concrete	Chip Sheats	302-530-0597	Csheats@heritageconcrete.net
Charles Hutchinson	Batting Lt	302 725 6100	[illegible]
GILLIS GILKERSON INC	Kevin REEDER	410-749-4821	kreeder@gillisgilkerson.com
Bausum & Duckett Electric	John Dorsey	443 497 4277	Johnd@bdelec.net
Bausum & Duckett Electric	Jacob Foy	443 497 4577	JacobF@bdelec.net
J.C. BRIGGS CO	BURLEY CARPENTER	302-856-7033	JCBRIGGSCO@VERIZON.NET
NCM DEMOLITION	RICHARD MOORE	410-742-6161	rmoore@ncmgroup.com
R4R Coatings Joe Barlow	Joe BARLOW	410 860 0693	CLR111@AOL.com
Richard Y Johnson & Son	Dean Johnson	302 422 3732	djohnson@ryjson.com
Ann Hartley Diamond State Engineering	Ann Hartley	(302) 697-3226	tom@diamondelectric.org
Jim Bailey MID-SHORE ELECTRICAL		302-945-2555	jbailey@midshoreelectrical.com
Brian Moyer	DEARNG	302-542-8848	brian.moyer1@us.army.mil
DUFFIELD ASSOCIATES	JOE JAKUBOWSKI	302 239 6634	jjakubowski@duffnet.com

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Company Name	Representative / Rank	Phone Number	Email
whiting-turner	Josh George, pm	302-292-0676	joshua.george@whiting-turner.com
Conventional Builders Inc	Pierce Thompson Sr.	302-422-2429	Conventional builders@comcast.net
AMAKOR, INC.	Steven Serbu	302-834-8664	Amakore aol.com
PERRYMAN	MIKE LESE	215-243-4102	MICHAELL@PERRYMANBC.COM
BW ELECTRIC	MIKE HINES	302-491-6154	BWELECTRIC@COMCAST.NET
DIAMOND ELECTRIC	CHUCK ARNOTT	302-697-3296	CHUCK@DIAMONDELECTRIC.OEG

Company Name	Representative / Rank	Phone Number	Email
GES - GUARDIAN ENVIRON. SERVICES CO.	TONY MARENCO	(302) 918-3070 X105	RSLUSSER@GESONCALL.COM TMARENCO@GESONCALL.COM
HARRY CASWELL, INC	GREG CASWELL	302-945-5322	greg@harry caswell.com
J. S. KRAMER, INC	PETE KRAMER	302-422-3900	jskramergc@aol.com
Wickle Electrical	James Vandeslice	302-856-1001	J.Vandeslice@WickleElectrical.com
FLOWERY - HILL CO	MIKE DONOVAN SUPT	302.322-9500	MIKEDONOVAN@FLOWERYHILL.COM
MIKE GOLDBERG	VISTADESIGN, INC.	410-352-3874	MGOLDBERG@VISTADESIGNINC.COM
DOMINIC AGRESTA	✓	✓	DAGRESTA@VISTADESIGNINC.COM

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DUFFIELD ASSOCIATES

GEOTECHNICAL EVALUATION

DELAWARE ARMY NATIONAL GUARD
REGIONAL TRAINING INSTITUTE
BETHANY BEACH TRAINING SITE
BETHANY BEACH, DELAWARE

September 2011

Prepared for:

Burns & McDonnell Engineering Co., Inc.
9400 Ward Parkway
Kansas City, MO 64114

Prepared by:

Duffield Associates, Inc.
5400 Limestone Road
Wilmington, Delaware 19808

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Geotechnical Engineer

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Senior Geotechnical Engineer

Project No. 5448.GP

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APPENDICES

EXECUTIVE SUMMARY

This report summarizes Duffield Associates, Inc.'s (Duffield Associates) geotechnical evaluation for the proposed Regional Training Institute (RTI) at the Delaware National Guard Bethany Beach Training Site (BBTS). It is proposed to construct a 13,920-square-foot, single-story, at-grade classroom facility with a building finished floor elevation of approximately 7 feet (project datum). Net fills of 2 feet or less are anticipated at the site. Proposed site pavements include a fire lane area along the perimeter of the building. In addition, stormwater management features will be required in association with the new construction. Several existing single-story, at-grade buildings will be demolished at the site of the proposed construction.

The field program consisting of six Standard Penetration Test borings was performed between July 6 and 8, 2011. The subsurface conditions encountered during the test borings performed at the site generally consisted of a layer of loose to medium dense silty-sand and clayey-sand extending to depths ranging between approximately 7 to 8 feet below the ground surface. Beneath this stratum, a layer of medium to stiff-consistency clay extending to depths of approximately 12 to 17 feet below the existing ground surface was observed. Beneath the clay stratum, loose to medium density sands were generally observed to the extent of the test borings. Groundwater was observed during the test borings at depths ranging from approximately 2.4 to 2.8 feet below the existing ground surface.

It is Duffield Associates' opinion that the "natural" site soils, or structural fill placed and compacted over suitable soils, as recommended herein, are generally suitable for supporting the proposed structure on a shallow foundation system and conventional slab-on-grade. Analysis indicates that the shallow foundations bearing on the natural soils, or on compacted structural fill placed over a subgrade of natural soils, could be sized for a maximum allowable bearing pressure of 2,500 pounds per square foot (psf). It is estimated that settlement of foundations bearing on these soils should be on the order of 1 inch or less. The post-construction settlement is estimated to be on the order of approximately ½ inch. Similarly, the estimated post-construction differential settlement is estimated to be ½ inch or less over a typical column spacing of 30 feet.

More detailed conclusions and recommendations for design and construction of the foundation and slab-on-grade system and site pavements are provided in the following report.

I. INTRODUCTION

This report summarizes Duffield Associates, Inc.'s (Duffield Associates) geotechnical evaluation for the proposed Regional Training Institute (RTI) at the Delaware Army National Guard Bethany Beach Training Site (BBTS). Included in this report is a summary of the data obtained during field and laboratory testing programs and a discussion of the subsequent geotechnical analysis. Recommendations for the design and construction of the proposed building foundations, slabs, and site pavements are also provided. These services were provided in general accordance with our agreement dated December 20, 2010 (executed agreement dated June 29, 2011).

To assist with this evaluation, Duffield Associates has been provided with the following:

- A site plan titled "General Location Plan," prepared by W.C. Gomez, dated June 27, 2006;
- A site plan titled "Lines and Grades Plan, Bethany Beach, Phase 1 RTI," as prepared by VanDemark & Lynch, Inc., dated June 21, 2011; and
- A document titled "Technical Guidelines, Subsurface Investigation and Geotechnical Report, Regional Training Institute, Delaware Army National Guard, Bethany Beach Training Site," prepared by Burns & McDonnell Engineering Co., Inc. (Burns & McDonnell), dated June 2011.

Based on the information provided and discussions with Burns & McDonnell's project engineers, it is our understanding that the proposed RTI includes construction of a single-story, at-grade classroom structure covering an area of approximately 13,920 square feet. The site of the proposed development is located at the Bethany Beach Training Site in Bethany Beach, Delaware, bounded to the east by Route 1, to the west by Salt Pond, to the north by marsh land, and to the south by a wooded area. The site is generally flat with an approximate elevation of 5 feet (NGVD 29). The general location of the site is indicated on the Site Location Sketch included in Appendix A of this report.

Anticipated column and wall loads were not available at the time of this report. For purposes of analysis, assumed maximum column loads on the order of 100 kips, and maximum wall loads on the order of 4 kips per linear foot have been utilized. Based on the proposed finished floor elevation of 7 feet (project datum), net fills up to 2 feet are anticipated to achieve finished grade for the proposed structure.

Proposed site pavements include a bituminous concrete driveway surrounding the RTI. The proposed type and frequency of anticipated vehicle traffic was not provided. However, the maximum loading is anticipated to be from fire engine equipment.

Presently, the site is covered by bituminous concrete pavements and several existing single-story, at-grade structures, which are to be demolished as part of the proposed development. The locations of several existing utilities were delineated by Miss Utility and BBTS' personnel, and estimated in the field based on the drawings provided prior to performance of the field testing program. The delineated utilities included electric, sewer, gas, water, and communications.

II. FIELD AND LABORATORY TESTING PROGRAMS

A. PREVIOUS SUBSURFACE EVALUATION

Duffield Associates previously performed a geotechnical evaluation for a proposed Training Facility building in the vicinity of this site, as summarized in a report to the Delaware National Guard, dated June 2006. The evaluation included the performance of a total of 13 test borings (designated as TB-1 through TB-13). The information from this previous evaluation was considered herein. Several of the test boring logs from the previous evaluation are included in Appendix B of this report.

B. STANDARD PENETRATION TEST BORINGS

Six Standard Penetration Test (SPT, performed in general accordance with ASTM D 1586) borings were performed at the site between July 6 and 8, 2011. The borings, designated as borings TB-14 to TB-19, were performed to depths of approximately 20 feet below the existing ground surface. During the performance of the test borings, one test boring (TB-18) was offset approximately 4 feet from the originally proposed location due to encountering an existing utility. The test boring locations relative to the proposed building layout are indicated on the Test Boring Location Sketch enclosed with this report in Appendix A.

The test borings were performed by CGC Geoservices, LLC, under subcontract to Duffield Associates, utilizing a truck-mounted drill rig with hollow stem augers and mud rotary drilling methods. Boring logs, which describe the conditions observed during the field exploration program, are enclosed in Appendix B of this report.

At completion of the drilling, the boreholes were backfilled with bentonite grout. Excess soil was mounded above the boring locations to compensate for potential future settlement of the boring backfill. Further restoration of the borehole locations was beyond the scope of work performed for this geotechnical evaluation. However, additional settlement of the materials backfilled in the boreholes may occur, resulting in a depression or hole in the ground surface. Consequently, future maintenance and restoration of the site may be required.

C. LABORATORY TESTING

Soil samples obtained during the field program were returned to Duffield Associates' laboratory for testing of selected samples. The laboratory testing program for this evaluation included the following:

- Eight samples - determination of natural water content (ASTM D 2216) and silt/clay content in accordance with the United Soil Classification System (percent finer than a No. 200 sieve, ASTM D 1140);
- One sample - Atterberg Limits (ASTM D 4318); and
- Two samples - Modified Proctor testing (ASTM D 1557) and California Bearing Ratio testing (CBR, ASTM D 1883).

A tabular summary of the laboratory testing results, as well as Proctor Curves and plotted CBR results, is included in Appendix C of this report. Results of these laboratory tests are also included on the test boring logs in Appendix B of this report.

No environmental characterization was performed as part of this evaluation.

III. SUBSURFACE CONDITIONS

A. GENERALIZED SITE GEOLOGY

The site of the proposed Bethany Beach Training Facility is located within the Atlantic Coastal Plain Physiographic Province.

Regional geologic mapping by the Delaware Geologic Survey (DGS) indicates that the stratigraphy of the Coastal Plain in the vicinity of the site consists of tidal deposits underlain by two major geologic 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 to sandy and clayey silt.

The depth to rock in this area is on the order of 2,500 feet below grade.

B. STRATIGRAPHIC CONDITIONS

The subsurface conditions encountered during the test borings performed at the site generally consisted of a layer of loose to medium dense silty-sand and clayey-sand extending to depths ranging between approximately 7 to 8 feet below the ground surface. Beneath this stratum, a layer of medium to stiff-consistency sandy clay extending to depths of approximately 12 to 17 feet below the existing ground surface, was observed. Beneath the clay stratum, a layer of loose to medium density sands was generally observed to the extent of the test borings. The soils generally appeared natural and undisturbed, and the conditions observed were similar to those encountered on the BBTS campus during previous evaluations.

For discussion purposes, subsurface conditions encountered during this evaluation can be further described as follows:

SUBSURFACE STRATUM	APPROXIMATE THICKNESS (FT.)	GENERALIZED DESCRIPTION[1]
A	7.0 – 8.0	Dark brown, gray, light brown fine SAND, some to trace silt, trace to "and" clay, trace gravel, trace medium to coarse sand (loose to medium dense), USCS: SM, SP-SM, SC NOTE: trace organic material noted near the ground surface
B	3.8 – 8.8	Dark gray, gray, gray-brown, red-brown, orange-brown, black CLAY, little to "and" fine sand, little to "and" silt (medium to stiff-consistency), USCS: CL
C	3.2 – ---[2]	Gray, gray-brown, white, dark gray, light gray fine SAND, some to trace silt, little to trace clay, little to trace medium to coarse sand, trace gravel (loose to medium density), USCS: SM, SP
D[3]	3.2 – …	Gray CLAY, some silt, little fine sand (stiff consistency), USCS: CL
NOTES:	1. The soil descriptions utilized herein and on the test boring logs are defined in the General Notes within Appendix D. 2. Stratum C not fully penetrated in TB-14, TB-15, TB-16, TB-18, and TB-19. 3. Stratum D only observed in TB-17 and not fully penetrated in this test boring.	

C. GROUNDWATER

Groundwater observations made during the performance of the drilling are noted on the test boring logs included in Appendix B. Groundwater was observed in all of the test borings during the recent evaluation at depths ranging from 2.4 to 2.8 feet below the ground surface. The observance of shallow groundwater was anticipated due to the site's proximity to Salt Pond (located immediately west of the site) and the Atlantic Ocean (located approximately ¼ mile east of the site). Tidal changes may influence the observed groundwater elevation.

Borings performed in the area during our previous evaluation in June 2006 indicated groundwater levels ranging in depth from 3.4 to 3.8 feet below the existing ground surface, which is deeper than the range observed during the current evaluation.

IV. DISCUSSION OF ANALYSIS

A. BUILDING FOUNDATIONS AND SLAB-ON-GRADE

Based on the subsurface data obtained during this evaluation, it is Duffield Associates' opinion that the "natural" site soils (Strata A through D) are generally suitable for supporting the proposed structure on a shallow foundation system and slab-on-grade. Structural fill, placed on "natural" site soils and compacted as recommended in this report, is also considered suitable for supporting a shallow foundation system and slab-on-grade. Although the structure could be supported by a deep foundation system (e.g., drilled piers, driven piles, etc.), it is our opinion that a deep foundation system is not a cost-effective option for the project, and is not discussed further herein.

Analysis indicates that the shallow foundations bearing on the natural soils, or on compacted structural fill placed over a subgrade of natural soils, could be sized for a maximum allowable bearing pressure of 2,500 pounds per square foot (psf). A factor of safety of 3 has been applied in this analysis. This analysis has assumed a shallow foundation system with minimum 3-foot-wide isolated footings supporting column loads and a shallow foundation system with minimum 2-foot-wide continuous footings. This analysis also assumed a minimum burial depth of 18 inches for interior footings and 32 inches for exterior footings.

Based on the design guidelines provided in the International Building Code (IBC), allowable bearing pressure may be increased by one-third for certain transient loading conditions (e.g., wind load, seismic load, etc.). Based on the soil conditions observed at this site, the bearing pressure of the foundations can be increased to 3,300 psf for transient conditions such as wind, in accordance with the IBC design guidelines.

Lateral resistance parameters for the various soil strata are provided in the following section of this report. For typical shallow foundation design, lateral resistance for shallow foundations will come primarily from frictional resistance along the bottom of the footing, with no assumed capacity from the passive wedge. Uplift resistance will come primarily from the weight of the footing. The shallow groundwater conditions of the site should be considered in this analysis as well.

Estimates of foundation settlement were performed to assist in evaluating the effects of the anticipated structural loads on the subsurface conditions. It is estimated that settlement of foundations bearing in the compacted structural fill placed over a subgrade of natural soils (Strata A through D), or bearing directly on "natural" subgrade conditions, should be on the order of 1 inch or less. The post-construction total settlement is estimated to be on the order of approximately ½ inch. Similarly, the estimated post-construction differential settlement is estimated to be ½ inch or less over a typical column spacing of 30 feet.

B. SITE PAVEMENTS

Based on the information available to date, it is assumed that only minor regrading (i.e., net cuts/fills of 2 feet or less) should be required to achieve the finished pavement grades. Based on the test borings performed across the site, the subsurface conditions generally consisted of predominately granular soils.

The predominately granular soils generally correspond to American Association of State Highway and Transportation Officials (AASHTO) classification A-1, A-2, and A-3 classification (i.e., maximum of 35% passing a No. 200 Sieve), which are considered "good" subgrade soils. All other AASHTO classifications are considered "poor" subgrade soils (fine-grained silt or clay soils). "Good" soils are considered better draining, and less frost susceptible materials than the fine-grained, "poor" subgrade materials.

California Bearing Ratio (CBR) testing was performed on composite samples from several of the test borings to aid in determining the support values for the near surface soils observed at the site. Based on the results of the CBR testing and a target compactive density of 95% from the Modified Proctor test, a CBR value on the order of 15 should be utilized in design. If a target compactive density of 90% is used, a CBR value of 8 is recommended.

In addition to the subsurface conditions, the design of site pavements is also dependent on the vehicle loading. Based on the information provided, the vehicles anticipated for the facility includes passenger cars, single-unit trucks, and fire equipment. A frequency of use for these vehicles was not provided. To analyze the proposed pavement section, Duffield Associates utilized Unified Facilities Criteria (UFC) "UFC 3-250-01FA, Pavement Design for Roads, Streets,

Walks, and Open Storage Areas," and "UFC 3-230-18FA, General Provisions and Geometric Design for Roads, Streets, Walks, and Open Storage Areas," dated January 16, 2004. Based on Traffic Category III (traffic containing as much as 15% trucks, but with not more than 1 percent of the total traffic composed of trucks having three or more axles) and Road Classification E (road with 10 to 149 Equivalent Passenger Cars per Hour), Duffield Associates has recommended pavement sections, as included in following section of this report.

Final design of the pavements should be performed based on actual use data, including: traffic type, frequency of traffic, and material properties (e.g., flexural strength or compressive strength of concrete). Specific paving section recommendations are provided in the conclusions and recommendations section of this report.

C. DEMOLITION OF EXISTING BUILDINGS

As part of the proposed construction, several of the existing buildings will have to be demolished. Demolition debris, existing foundations, slabs, or utilities left in-place are not considered suitable to construct over. Their presence may cause differential settlement between building elements. Therefore, existing footings, slabs, pavements and utilities should be removed in their entirety during demolition. Demolition activities should be carefully reviewed and documented to reduce the risk of demolition debris or abandoned foundations or utilities affecting the proposed construction.

V. CONCLUSIONS AND RECOMMENDATIONS

Based on the data obtained in the field and laboratory testing programs and the subsequent geotechnical analysis, the following conclusions and recommendations are presented.

A. DESIGN

1. **Foundation Bearing Capacity.** Foundation analyses were performed assuming that the building will be founded on shallow, spread type-footing bearing on the natural site soils or compacted structural fill. It is Duffield Associates' opinion that the natural site soils (described herein as Strata A through D) are generally considered suitable for supporting the proposed structure on a shallow foundation system. Structural fill placed, compacted and reviewed as recommended in this report, is also considered suitable for supporting shallow building foundations. It is recommended that the proposed foundations be designed for a maximum net allowable bearing pressure of 2,500 psf.

Based on the design guidelines provided in the IBC, allowable bearing pressure may be increased by one-third for certain transient loading conditions (e.g., wind load, seismic load, etc.). Based on the soil conditions observed at this site, the bearing pressure of the foundations can be increased to 3,300 psf for transient conditions, such as wind, in accordance with the IBC design guidelines.

Previously placed fill is not considered suitable for foundation support and should be removed in its entirety from beneath the foundations, if encountered.

2. **Foundation Burial Depth and Size.** The base of all exterior spread footings in areas exposed to frost should be placed at least 32 inches below final exterior grade. Interior foundations in insulated areas should be placed at least 18 inches below the proposed finished floor elevation. 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. All isolated column footings should be at least 3 feet wide and all continuous wall footings should be at least 2 feet wide, regardless of bearing pressure.

3. **Slab-On-Grade.** Ground-supported floor slabs should be designed as free floating and should not be connected to the structural elements (e.g., walls, framing, etc.) of the building. Isolation joints should be utilized at the interface of proposed ground-supported floor slab and structural elements to accommodate potential differential settlement. A minimum of 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.

4. **Seismic Design Parameters.** Based on subsurface conditions encountered during the field exploration at the site, a Site Class "D," as defined by Table 1613.5.2 of the 2006/2009 International Building Code, is recommended.

5. **Pavement Design.** Based on the subsurface conditions encountered, the results of the field and laboratory testing programs, and UFC Traffic Category III and Road Classification E, the pavement sections below are recommended assuming careful subgrade review is performed to identify yielding areas, and the subgrade is compacted to at least 95% of the maximum dry density as determined by the Modified Proctor test (ASTM D 1557).

Flexible Bituminous Concrete Pavement

1-1/2 inches	Bituminous Concrete Wearing Course, Type C
2-1/2 inches	Bituminous Concrete Binder Course, Type B
8 inches	Graded Aggregate Base Course, Type B
	Geotextile Fabric, Geotex 601 or equivalent
12 inches	Total Depth

Loading Dock Portland Cement Concrete (PCC) Section

7 inches	PCC (unreinforced, flexural strength = 650 psi)
6 inches	AASHTO SP-57 Stone
	Geotextile Fabric, Geotex 601 or equivalent
13 inches	Total Depth

These recommended pavement sections may require revision, depending upon the vehicle loading anticipated by the Delaware Army National Guard.

A layer of nonwoven geotextile fabric (e.g., Geotex 601 or equivalent) should be placed directly over the carefully prepared and reviewed subgrade. Adjacent rows of fabric should be overlapped a minimum of 24 inches. The fabric should be placed in a stretched (no wrinkles) state. The geotextile will act as a separator between the base course aggregate and the subgrade, helping to maintain the integrity of the base course. Prior to fabric placement, the top 12 inches of the subgrade should be compacted to at least 95% of the maximum dry density as determined by the Modified Proctor test (ASTM D 1557).

6. **Retaining Walls.** Backfill pressures on "unyielding" retaining walls restrained from rotation at the top should be analyzed using the "at rest" earth pressure coefficient, K_O. The "active" and "passive" earth pressure coefficients, K_A and K_P, respectively, should be utilized for the design of "yielding" retaining walls such as cantilevered walls. Retaining walls should typically be provided with free-draining backfill materials and a drainage system or weep holes to relieve hydrostatic pressures on the walls. The free-draining backfill materials should extend behind the wall with its top at least as wide as 60% of the wall height.

   Recommended lateral earth pressure parameters for design are presented below. These parameters are "ultimate", with no factor of safety applied.

Soil Parameters	Strata A/ C Sand	Strata B/D Sandy Clay	Imported Structural Fill (Type G Borrow)
Moist Unit Weight (pcf)	125	120	130
Cohesion (psf)	0	100	0
Angle of Internal Friction	32	24	34
At Rest Earth Coefficient, K_O	0.47	0.59	0.44
Active Earth Pressure Coefficient, K_A	0.31	0.42	0.28
Passive Earth Pressure Coefficient, K_P	3.25	2.37	3.54
Coefficient of Sliding Friction	0.39	0.29	0.42

7. **Control Joints.** If utilized, masonry walls should be provided with frequent control joints placed at architecturally convenient locations, such as windows and doorways, to provide a "preferred" location for the differential settlement to occur without cracking the walls.

8. **Site Grading.** Site grading should be designed to provide positive drainage away from the proposed building site and pavement areas. Positive site drainage should be maintained throughout the construction activities.

9. **Corrosion Potential.** Soil data published in the United States Department of Agriculture, Soil Conservation Service, Soil Survey of Sussex County, Delaware (issued May 1974) indicates that the shallow site soils range from mildly acidic to mildly alkaline. The shallow site soils observed in the test borings were predominately granular, and granular soils are generally highly resistive materials with low corrosive potential to concrete, steel and ductile iron. Based on this data and Duffield Associates' experience with local practices, it is our opinion that conventional Type 1 cement is suitable for foundation and slab concrete. Where possible, plastic, reinforced concrete and coated metal pipe should be considered for site utilities. Alternatively, corrosion sensitive utilities could be bedded and backfilled with high resistivity soils, such as quartz-based Delaware "Select" Borrow, that are readily available in the area of the site, or predominately granular, on-site soils.

10. **Special Soil Considerations.** Based on our experience, the natural site soils encountered at the site do not exhibit expansive, dispersive or collapsing properties. No special design features are recommended to address these types of conditions at this site.

11. **Assumptions.** Limited structural and site planning information was available at the time of this evaluation. This evaluation has been based on assumptions regarding design loads, finished floor elevations for the proposed structure, and loads on the proposed site pavements. These assumptions should be verified by the project team prior to the completion of their design. If the proposed loading conditions vary from those assumed herein, Duffield Associates should be notified to possibly modify the recommendations provided herein as required.

B. CONSTRUCTION

1. **Demolition of Existing Buildings.** As part of the proposed construction, several existing buildings will have to be demolished. Demolition debris, existing foundations, slabs, or utilities left in-place are not considered suitable as building subgrade, and their presence may cause differential settlement between building elements. Therefore, it is recommended that slabs, foundations, pavement, and utilities within the new building footprint be removed in their entirety. Demolition activities should be carefully reviewed and documented to reduce the risk of demolition debris, abandoned foundations, or utilities affecting the proposed construction.

2. **Proofrolling and Subgrade Preparation.** At the start of construction, the proposed building area should be stripped of all topsoil and pavement. Topsoil in Sussex County tends to be sandy soils with small to moderate quantities of organic material. Occasionally, the brown color from the topsoil can "stain" sandy soils below this surface stratum to give the appearance of a deeper stratum of topsoil. It is recommended that a qualified soils technician, familiar with this report, be present on site during the removal of topsoil to assist the Owner's representative in quantifying the thickness of topsoil to be removed.

   Following rough grading and prior to footing excavation, placement of fill, or construction of the floor slab, it is recommended that the exposed subgrade be proofrolled. The proofroll should be performed using a minimum 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 densify the exposed loose sand subgrade and to identify yielding subgrade conditions. Yielding subgrade conditions encountered within the proposed building and pavement areas should be undercut to firm subgrade conditions and be backfilled in accordance with the recommendations of this report. Provisions for the undercutting and subsequent replacement of these materials should be anticipated by the construction contract documents and project budget estimates. The subgrade review should also confirm the consistency and texture of the exposed soils with the conditions encountered by this evaluation as described herein.

3. **Foundation Subgrade Review.** All foundations and slabs should be placed on firm, dry, non-frozen subgrade. 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. Subgrade review should be performed prior to the placement of reinforcing steel or concrete and should verify the presence of loose to medium density sands, or stiff consistency clays. If these conditions are not encountered at the proposed foundation depth, additional excavation should be performed until they are uniformly encountered across the base of the foundation excavation or, if acceptable to the project's geotechnical engineer, densified in place. Foundation undercut areas should be backfilled with structural fill as recommended herein or, if acceptable to the project's structural engineer, the base of foundation elevation could be lowered to the suitable subgrade soils.

4. **Existing Utilities.** Several active utilities were observed within and around the currently proposed building area. The presence of utilities beneath a structure could result in crushing of the pipe and/or undermining of the proposed foundations and slab-on-grade. Therefore, it is recommended that these utilities be removed and relocated outside of the building area. The resulting excavations should be backfilled with structural fill, placed and compacted in accordance with the recommendations of this report. Alternatively, the existing pipe 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. If these options are not considered feasible, sleeving and fully encapsulating the existing utilities in concrete beneath the proposed building area may be considered, although this presents a greater risk of future undermining.

5. **Re-use of On-Site Soils as Structural Fill.** On-site soils free of organic material, debris, and rock fragments, in excess of 3 inches in their largest dimension, may be suitable as structural fill. The shallow, predominately granular soils at the site were generally encountered a moisture content slightly above that at which compaction as structural fill could be achieved, therefore, some drying of the material could be required.

   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 Delaware Department of Transportation Standard Specifications Select Borrow, Type G 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 or trenches where utilities are removed, and as a base beneath the slab.

6. **Compaction Requirements.** Structural fill utilized within the proposed building area should be placed in loose lifts with a maximum thickness of 8 inches. Each lift of fill placed within the proposed building area (defined as the area extending at least 5 feet beyond the building perimeter) and in the proposed pavement areas 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 trenches and wall backfill, located outside of the proposed building, should be compacted to at least 90% of the maximum dry density. The placement and compaction of structural fill should be monitored on a full-time basis by a qualified technician under the supervision of a geotechnical engineer.

7. **Groundwater Control.** Groundwater was encountered at the site at depths ranging from 2.4 to 2.8 feet below the ground. Based on the subsurface conditions encountered, regional groundwater conditions may be encountered above the depth of typical shallow foundations. The site groundwater level should be considered in selecting the building finished floor elevation and site grades. If groundwater is encountered, localized sumping may be required. Wherever significant quantities of groundwater are encountered during foundation and utility trench excavations, it may become necessary for the resulting excavation to be over excavated by several inches and backfilled with AASHTO SP-57 stone to facilitate sumping and protect the exposed subgrade during construction.

8. **Protection of Subgrade Soils.** Provisions for removal of water by drainage or sumping, as well as consideration in the construction schedule for minimizing the period during which the foundation subgrade soils are exposed, is recommended. Subgrade soils disturbed by precipitation and construction traffic should be either scarified and recompacted, or undercut, and replaced with structural fill as previously discussed.

   Subgrade disturbance could be reduced by maintaining positive surface drainage, by establishing and maintaining a sump throughout the construction period, and by limiting construction traffic on the exposed subgrade soils. Where construction traffic is required over the subgrade soils, construction of a temporary haul road, consisting of at least 8 inches of crushed stone (Delaware No. 3 Stone, "choked off" with Type B aggregate) over a geotextile fabric (e.g., Geotex 315 or equivalent) should be considered. A thicker stone section will likely be required for prolonged heavy use by trucks. Additional stone can be added later as needed.

9. **Excavation Safety.** All utility and foundation excavation should be performed in accordance with OSHA guidelines. Typically, the predominately granular soils encountered at the site can be characterized as Type C soils. Should it be required, all temporary sheeting and shoring should be designed by a qualified engineer registered in the State of Delaware.

10. **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.

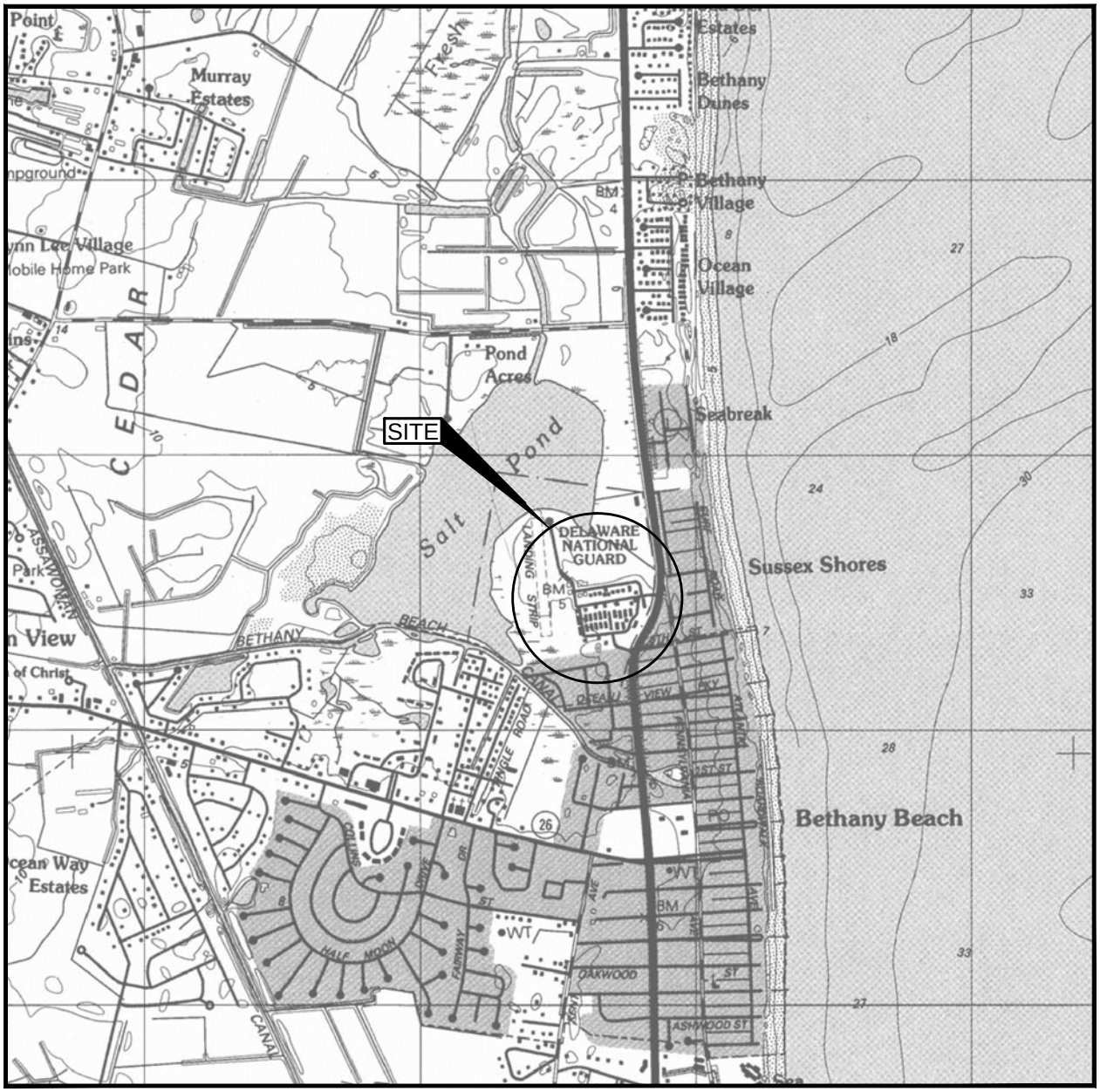
These recommendations have been prepared according to generally accepted soil and foundation engineering standards and are based on the conditions encountered by the sampling performed at the site. It is noted that, although soil quality has been inferred from the interpolation of the sampling data, subsurface conditions beyond the sampling points are, in fact, unknown. As a result, these recommendations may require modifications based on the conditions encountered and exposed during construction excavation. 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. The cost for this construction review is not part of the existing agreement. This report applies solely to the size, type, and location of the building 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 reapproved in writing by Duffield Associates, Inc.

WORD\5448GP.0911-DEARNG BBTS RTI.FINAL RPT

APPENDIX A

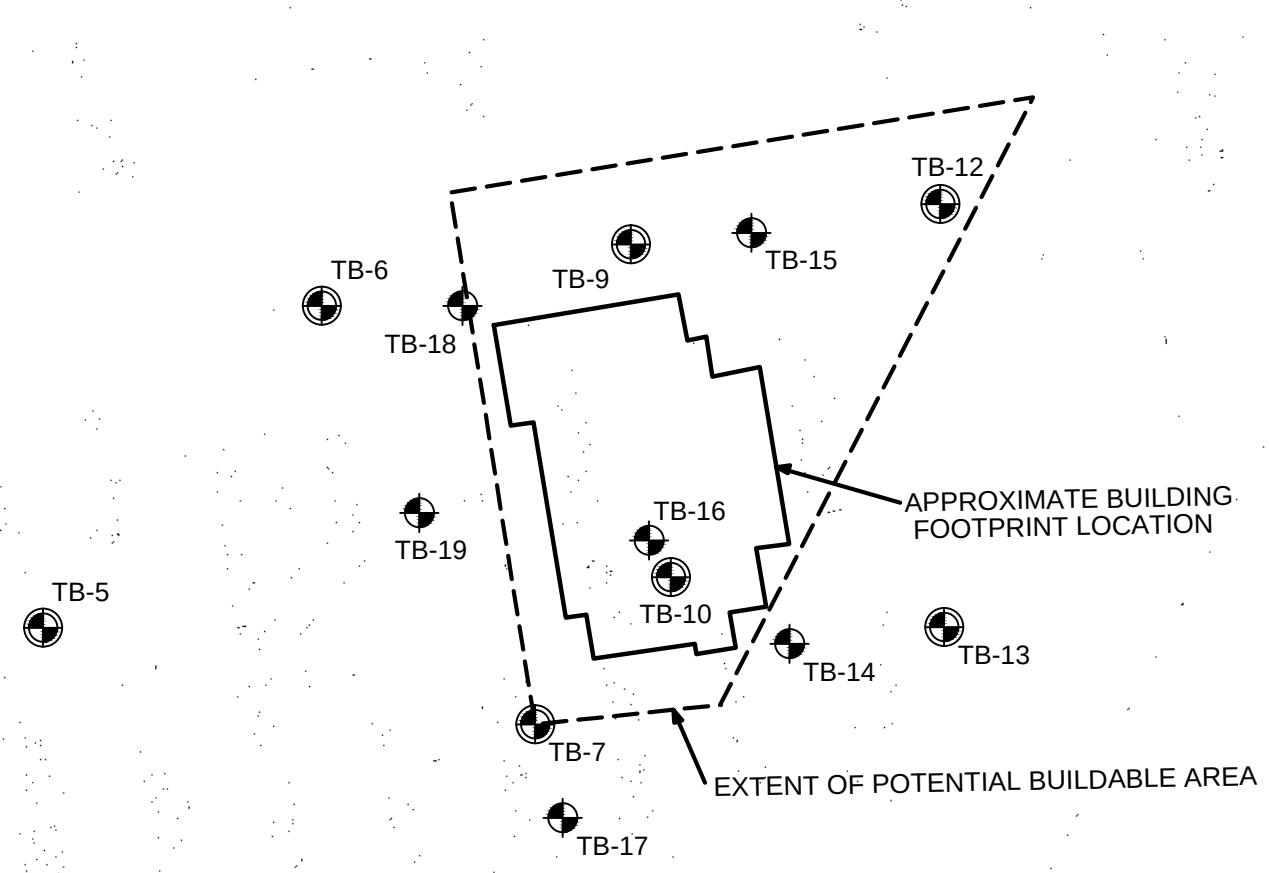
SITE LOCATION SKETCH

TEST BORING LOCATION SKETCH



NOTE:
THIS SITE LOCATION SKETCH IS ADAPTED FROM THE U.S.G.S. TOPOGRAPHIC MAP, 7.5 MINUTE SERIES, FOR BETHANY BEACH, DELAWARE 1993.

DATE: 12 SEPTEMBER 2011	SITE LOCATION SKETCH	**DESIGNED BY:** JJ	DUFFIELD ASSOCIATES *Consultants in the Geosciences*
SCALE: 1"=2000'	**PROPOSED REGIONAL TRAINING INSTITUTE DELAWARE ARMY NATIONAL GUARD**	**DRAWN BY:** ARS	5400 LIMESTONE ROAD WILMINGTON, DE 19808-1232 TEL. (302)239-6634 FAX (302)239-8485
PROJECT NO. 5448.GP		**CHECKED BY:** JJ	OFFICES IN PHILADELPHIA, PA AND GEORGETOWN, DE
SHEET: FIGURE 1	BETHANY BEACH ~ SUSSEX COUNTY ~ DELAWARE	**FILE:** A-5448GP-01	E-MAIL: DUFFIELD@DUFFNET.COM



KEY:

TB-14 - APPROXIMATE LOCATION OF PROPOSED TEST BORING

TB-5 - APPROXIMATE LOCATION OF PREVIOUSLY PERFORMED TEST BORING (MAY, 2006)

NOTE:

THIS SKETCH IS ADAPTED FROM A DRAWING TITLED, "GENERAL LOCATION PLAN," PREPARED BY W.C. GOMEZ ASSOCIATES, INC. AND DATED JUNE 27, 2006.

DATE: 12 SEPTEMBER 2011	TEST BORING LOCATION SKETCH	**DESIGNED BY:** JJ	DUFFIELD ASSOCIATES *Consultants in the Geosciences* 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"=80'	**PROPOSED REGIONAL TRAINING INSTITUTE** **DELAWARE ARMY NATIONAL GUARD**	**DRAWN BY:** ARS	
PROJECT. NO. 5448.GP		**CHECKED BY:** JJ	
SHEET: FIGURE 2	**BETHANY BEACH ~ SUSSEX COUNTY ~ DELAWARE**	**FILE:** A-5448GP-02	

APPENDIX B

TEST BORING LOGS (13)

- TB-5 TO TB-7, TB-9, TB-10, TB-12, AND TB-13 (MAY 2006)
- TB-14 TO TB-19 (JULY 2011)

DUFFIELD ASSOCIATES

TEST BORING TB-5

Geotechnical Evaluation
Delaware Army National Guard
Bethany Beach Training Site
Sussex County, Delaware
Project No: 5448.GC

Date Started : May 25, 2006
Date Completed : May 25, 2006
Logged by : JSD
Weather : Overcast, 60's
Driller/Agency : W. Proud/Feldmann Bros.

Drilling Equipment : Diedrich D-50
Drilling Methods : 3.25" H.S.A. (ASTM D1586)

Sample Condition: Auger Cuttings; Remolded
Water Levels: During Drilling

Depth in feet	Layer Depth feet	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0			SP	Light brown fine SAND, little medium sand, trace coarse sand, trace gravel, trace to no silt (dry to damp)		S-1					
	3.0										▼
5			SM	Brown, grayish brown fine to medium SAND, little silt, trace coarse sand, trace organics (lense of some to and silt from 4.7 to 4.9 feet +/-) (saturated)		S-2	3-3-4-8	1.7			
	7.0		SP-SM	Light brown, dark yellow medium SAND, little coarse sand, trace silt (saturated)		S-3A	10-9-9-11	1.0			
	8.3		SM	Dark gray fine SAND, some silt (saturated)		S-3B					
10	10.0										
15											
20											
25											
30											

NOTES:
1. Soil descriptions & classifications according to ASTM D2488 (Visual-Manual Procedure) and ASTM D2487 (Unified Soil Classification System) along with laboratory analysis if analysis performed.
2. Wet on spoon at 3.4 feet +/- below exlsting ground surface (b.e.g.s.).
3. Water level through augers at 3.4 feet +/- b.e.g.s. with augers at 4.0 feet +/-.
4. Boring terminated approximately 10.0 feet b.e.g.s.
5. Upon removal of augers, borehole caved at 3.4 feet +/- b.e.g.s.

DUFFIELD ASSOCIATES

TEST BORING TB-6

Geotechnical Evaluation
Delaware Army National Guard
Bethany Beach Training Site
Sussex County, Delaware
Project No: 5448.GC

Date Started : May 24, 2006
Date Completed : May 24, 2006
Logged by : JSD
Weather : Clear, 70's
Driller/Agency : W. Proud/Feldmann Bros.

Drilling Equipment : Diedrich D-50
Drilling Methods : 3.25" H.S.A. (ASTM D1586)

Sample Condition: Auger Cuttings; Remolded
Water Levels: During Drilling

Depth in feet	Layer Depth feet	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0											
	0.8		SP-SM	Brown, gray fine to medium SAND, little organics, trace silt, trace coarse sand/gravel(wet)		S-1					
	3.0		SM	Dark brown fine SAND, some silt, little medium sand, trace organics (lenses of silt/clay and fine sand from 4.0 to 4.2 and 4.9 to 5.1 feet +/-) (saturated)		S-2	1-1-2-2	1.7	19.4	20.5	▼
5	7.0		SP-SM	Gray medium SAND, little gravel, little coarse sand, trace shells, trace to no silt (saturated)		S-3	10-20-14-11	1.7			
10	11.8		ML	Gray SILT, little very fine sand, little clay (saturated)		S-4	2-2-4	1.5			
15	16.8		SP	Pale yellow, brownish yellow medium to coarse SAND, little fine sand (saturated)		S-5A	5-7-11	0.8			
	19.1		SM	Gray fine SAND, little silt (saturated)		S-5B					
20	21.8		SP-SM	Dark gray fine SAND, little shells, trace silt (saturated)		S-6	18-27-22	1.1			
25	26.8		SM	Gray fine SAND, some silty clay, trace shells (saturated)		S-7	2-2-3	1.0			
30	30.0										

NOTES:
1. Soil descriptions & classifications according to ASTM D2488 (Visual-Manual Procedure) and ASTM D2487 (Unified Soil Classification System) along with laboratory analysis if analysis performed.
2. Wet on spoon at 3.9 feet +/- below existing ground surface (b.e.g.s.).
3. Water level through augers at 3.4 feet +/- b.e.g.s. with augers at 4.0 feet +/-.
4. Water level in previous excavation at 1.9 feet +/- b.e.g.s.
5. Driller utilized open hole, mud rotary method to wash out augers prior to obtaining samples S-4 thru S-7.
6. Boring terminated approximately 30.0 feet b.e.g.s.

DUFFIELD ASSOCIATES

TEST BORING TB-7

Geotechnical Evaluation
Delaware Army National Guard
Bethany Beach Training Site
Sussex County, Delaware
Project No: 5448.GC

Date Started : May 23, 2006
Date Completed : May 23, 2006
Logged by : JSD
Weather : Clear, 60's
Driller/Agency : W. Proud/Feldmann Bros.

Drilling Equipment: Diedrich D-50
Drilling Methods : 3.25" H.S.A. (ASTM D1586)

Sample Condition: Auger Cuttings; Remolded
Water Levels: ▼ During Drilling

Depth in feet	Layer Depth feet	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0											
	0.7		SP	Brown, grayish brown fine SAND, trace medium to coarse sand, trace gravel, trace organics (damp)		S-1					
	3.5		SM	Light brown, grayish brown fine to medium SAND, little organics, little silt , trace gravel (saturated)		S-2	1-1-4-1	1.4			▼
5	7.0		SP	Gray medium SAND, little gravel, trace coarse sand (saturated)		S-3A	3-5-9-10	2.0			
	8.4		CL	Gray CLAY, some fine sand (micaceous) (saturated)		S-3B					
10	11.8		SP-SM	Gray fine SAND, trace silt (saturated)		S-4	5-8-9	1.1			
15				Gray fine to medium SAND, trace to no silt (lense of some silt from 19.1 to 19.3 feet +/-) (saturated)		S-5	7-6-10	0.9			
20	21.8		SM	Dark gray fine SAND, little silt, trace medium sand (lenses of some shells from 23.8 to 23.9 and 24.1 to 24.2 feet +/-) (saturated)		S-6	10-9-15	1.0			
25	25.0										
30											

NOTES:
1. Soil descriptions & classifications according to ASTM D2488 (Visual-Manual Procedure) and ASTM D2487 (Unified Soil Classification System) along with laboratory analysis if analysis performed.
2. Wet on spoon at 3.8 feet +/- below existing ground surface (b.e.g.s.).
3. Water level through augers at 3.8 feet +/- b.e.g.s. with augers at 4.0 feet +/-.
4. Water level in previous excavation at 3.0 feet +/- b.e.g.s.
5. Driller utilized open hole, mud rotary method to wash out augers prior to obtaining samples S-4 thru S-6.
6. Boring terminated approximately 25.0 feet b.e.g.s.
7. Upon removal of augers, borehole caved at 5.7 feet +/- b.e.g.s.

DUFFIELD ASSOCIATES

TEST BORING TB-9

Geotechnical Evaluation
Delaware Army National Guard
Bethany Beach Training Site
Sussex County, Delaware
Project No: 5448.GC

Date Started : May 24, 2006
Date Completed : May 24, 2006
Logged by : JSD
Weather : Clear, 70's
Driller/Agency : W. Proud/Feldmann Bros.

Drilling Equipment : Diedrich D-50
Drilling Methods : 3.25" H.S.A. (ASTM D1586)

Sample Condition: Auger Cuttings; Remolded
Water Levels: During Drilling

Depth in feet	Layer Depth feet	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0											
	1.0		SP-SM	Light brown, brown fine to medium SAND, little organics, trace silt (damp to wet)		S-1					
	3.2		SC	Dark brown fine SAND, some clay, little organics (saturated)		S-2A	WH/18-2	1.7	29.2	20.3	▼
5				Gray SAME		S-2B					
	7.0		SP	Light brownish gray, grayish white fine to medium SAND, little coarse sand, trace to little gravel, trace to no silt (saturated)		S-3	7-14-14-13	1.4			
10											
	11.8		SM	Gray fine SAND, some silt/clay (silt/clay content decreasing with depth) (saturated)		S-4	3-3-7	1.2			
15											
	16.8		SM	Dark gray, black very fine SAND, little silt (micaceous) (saturated)		S-5	5-8-12	0.9			
20											
	21.8		SP	Gray fine SAND, some shells, trace medium to coarse sand (saturated)		S-6	14-25-28	1.3			
25	25.0										
30											

NOTES:
1. Soil descriptions & classifications according to ASTM D2488 (Visual-Manual Procedure) and ASTM D2487 (Unified Soil Classification System) along with laboratory analysis if analysis performed.
2. Wet on spoon at 4.0 feet +/- below existing ground surface (b.e.g.s.).
3. Water level in previous excavation at 2.4 feet +/- b.e.g.s.
4. Driller utilized open hole, mud rotary method to wash out augers prior to obtaining samples S-4 thru S-6.
5. Boring terminated approximately 25.0 feet b.e.g.s.

DUFFIELD ASSOCIATES

TEST BORING TB-10

Geotechnical Evaluation
Delaware Army National Guard
Bethany Beach Training Site
Sussex County, Delaware
Project No: 5448.GC

Date Started : May 23, 2006
Date Completed : May 23, 2006
Logged by : JSD
Weather : Clear, 60's
Driller/Agency : W. Proud/Feldmann Bros.

Drilling Equipment: Diedrich D-50
Drilling Methods : 3.25" H.S.A. (ASTM D1586)

Sample Condition: Auger Cuttings; Remolded
Water Levels: ▼ During Drilling

Depth in feet	Layer Depth feet	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0											
	0.7			Brown, gray fine to medium SAND, little coarse sand, trace silt, trace organics, trace gravel (wet)		S-1					
			SP-SM	Brownish gray, bluish gray medium SAND, trace to little silt, trace coarse sand, trace organics (saturated)		S-2	1-2-4-8	1.4			▼
5											
	7.0		SM	Gray, orange fine to medium SAND, little silt, trace coarse sand (saturated)		S-3A	3-7-5-5	1.1			
	8.7			Gray CLAY, little fine sand (saturated)		S-3B					
10			CL								
	11.8			Dark gray fine SAND, little medium sand, trace silt, trace coarse sand (saturated)		S-4	5-8-12	1.1			
15			SP-SM								
				Gray fine to medium SAND, trace to no silt (saturated)		S-5	9-10-11	0.8			
20											
	21.8		SM	Dark gray fine SAND, little silt (saturated)		S-6	8-10-12	1.0			
25											
	26.8		CL	Gray CLAY, trace fine sand (saturated)		S-7	2-4-4	1.5			
30	30.0										

NOTES:
1. Soil descriptions & classifications according to ASTM D2488 (Visual-Manual Procedure) and ASTM D2487 (Unified Soil Classification System) along with laboratory analysis if analysis performed.
2. Wet on spoon at 4.5 feet +/- below existing ground surface (b.e.g.s.).
3. Water level in previous excavation at 2.1 feet +/- b.e.g.s.
4. Driller utilized open hole, mud rotary method to wash out augers prior to obtaining samples S-5 thru S-7.
5. Boring terminated approximately 30.0 feet b.e.g.s.
6. Upon removal of augers, borehole caved at 2.4 feet +/- b.e.g.s.

DUFFIELD ASSOCIATES

TEST BORING TB-12

Geotechnical Evaluation
Delaware Army National Guard
Bethany Beach Training Site
Sussex County, Delaware
Project No: 5448.GC

Date Started : May 24, 2006
Date Completed : May 24, 2006
Logged by : JSD
Weather : Clear, 70's
Driller/Agency : W. Proud/Feldmann Bros.

Drilling Equipment : Diedrich D-50
Drilling Methods : 3.25" H.S.A. (ASTM D1586)

Sample Condition: Auger Cuttings; Remolded
Water Levels: During Drilling

Depth in feet	Layer Depth feet	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0											
	0.6			Brown, dark brown fine SAND, trace to little coarse sand/gravel, trace medium sand, trace silt (damp)		S-1					
5			SP-SM	Brown, grayish brown fine to medium SAND, trace silt, trace coarse sand (saturated)		S-2	5-6-6-7	2.0			
				Light gray, grayish brown fine SAND, trace medium sand, trace gravel, trace silt (saturated)		S-3A	6-10-6-8	1.5			
	8.9			Gray CLAY, some fine sand, trace clay, trace organics (wet)		S-3B					
10			CL								
	11.8										
				Gray fine SAND, trace medium sand, trace silt (saturated)		S-4	1-4-6	1.0			
15											
			SP-SM	Gray fine SAND, trace medium to coarse sand, trace to no silt (saturated)		S-5	5-7-7	0.9			
20											
				Dark gray very fine to fine SAND, trace to little silt (lense of shells from 24.2 to 24.3 feet +/-) (some silt in shoe)		S-6	4-5-6	1.1			
25	25.0										
30											

NOTES:
1. Soil descriptions & classifications according to ASTM D2488 (Visual-Manual Procedure) and ASTM D2487 (Unified Soil Classification System) along with laboratory analysis if analysis performed.
2. Wet on spoon at 3.3 feet +/- below existing ground surface (b.e.g.s.).
3. Water level through augers at 3.8 feet +/- b.e.g.s. with augers at 4.0 feet +/-.
4. Driller utilized open hole, mud rotary method to wash out augers prior to obtaining samples S-4 thru S-6.
5. Boring terminated approximately 25.0 feet b.e.g.s.
6. Upon removal of augers, borehole caved at 5.2 feet +/- b.e.g.s.

DUFFIELD ASSOCIATES

TEST BORING TB-13

Geotechnical Evaluation
Delaware Army National Guard
Bethany Beach Training Site
Sussex County, Delaware
Project No: 5448.GC

Date Started : May 24, 2006
Date Completed : May 24, 2006
Logged by : JSD
Weather : Clear, 70's
Driller/Agency : W. Proud/Feldmann Bros.

Drilling Equipment : Diedrich D-50
Drilling Methods : 3.25" H.S.A. (ASTM D1586)

Sample Condition: Auger Cuttings; Remolded
Water Levels: ▼ During Drilling

Depth in feet	Layer Depth feet	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0											
	0.6			Light brown fine to medium SAND, trace silt (wet to saturated)		S-1					▼
			SP-SM	Light brown medium SAND, little fine sand, trace coarse sand, trace silt (saturated)		S-2	2-1-2-4	2.0	5.7	22.9	
5											
				Brownish gray fine SAND, trace to little silt (micaceous) (saturated)		S-3A	4-7-9-9	1.5			
	8.3			Gray, brown, light brown CLAY and fine sand, trace organics (wet)		S-3B					
10			ML								
	11.8										
				Light grayish brown, pale yellow fine to medium SAND, trace silt (saturated)		S-4	12-15-17	1.1			
15			SP-SM								
				Gray medium SAND, little fine sand, trace coarse sand, trace to no silt (saturated)		S-5	11-9-8	0.8			
20											
	21.8										
			SM	Gray very fine to fine SAND, little silt (micaceous) (saturated)		S-6	8-9-13	1.0			
25	25.0										
30											

NOTES:
1. Soil descriptions & classifications according to ASTM D2488 (Visual-Manual Procedure) and ASTM D2487 (Unified Soil Classification System) along with laboratory analysis if analysis performed.
2. Wet on rods at 2.5 feet +/- below existing ground surface (b.e.g.s.).
3. Water level through augers at 3.5 feet +/- b.e.g.s. with augers at 4.0 feet +/-.
4. Driller utilized open hole, mud rotary method to wash out augers prior to obtaining samples S-3 thru S-6.
5. Boring terminated approximately 25.0 feet b.e.g.s.
6. Initial 4 feet of drilling done with Hand Auger.

DUFFIELD ASSOCIATES

TEST BORING TB-14

Geotechnical Evaluation
Proposed Regional Training Institute
DEARNG Bethany Beach Training Site
Bethany Beach, Delaware
Project No. 5448.GP

Date Started : July 6, 2011
Date Completed : July 6, 2011
Logged by : CGCG
Weather :
Driller/Agency : Wayne Proud/CGCG

Drilling Equipment : Truck-Mounted AD II
Drilling Methods : HSA (SPT, ASTM D 1586)

Sample Condition: ⊠ Remolded
Water Levels: ▼ During Drilling

Depth in feet	Layer Depth feet	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				Dark brown, gray fine SAND, little silt, trace fine gravel, trace organics (moist)							
2											▼
4			SM	Light brown, brown, gray-brown fine SAND, little silt, trace coarse sand (wet)	⊠	S-1	3-5-5	1.3			
6				Gray fine SAND, little silt (wet)	⊠	S-2	5-20-22	1.2			
8	8.0										
10			CL	Dark gray, red-brown, orange-brown CLAY, little fine sand (wet)	⊠	S-3	5-6-6	0.9			
12	12.0										
14				Gray, gray-brown fine SAND, little silt, trace medium sand (wet)	⊠	S-4	4-5-11	0.8			
16			SM								
18											
20	20.0			Gray, gray-brown, white fine SAND, little silt, little medium to coarse sand, trace gravel (wet)	⊠	S-5	4-3-5	0.6	19.5	12.3	
22											

NOTES:
1. Test boring terminated at ± 20.0 feet b.e.g.s. (below existing ground surface).
2. Water level observed at ± 2.5 feet b.e.g.s.
3. Hand excavated from ground surface to ± 3.0 feet b.e.g.s.
4. Borehole backfilled with soil cuttings upon completion.

DUFFIELD ASSOCIATES

TEST BORING TB-15

Geotechnical Evaluation
Proposed Regional Training Institute
DEARNG Bethany Beach Training Site
Bethany Beach, Delaware
Project No. 5448.GP

Date Started : July 7, 2011
Date Completed : July 7, 2011
Logged by : CGCG
Weather :
Driller/Agency : Wayne Proud/CGCG

Drilling Equipment : Truck-Mounted AD II
Drilling Methods : HSA (SPT, ASTM D 1586)

Sample Condition: ⊠ Remolded
Water Levels: ▼ During Drilling

Depth in feet	Layer Depth feet	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0			SP-SM	Dark brown, gray fine SAND, trace silt, trace fine gravel, trace organics							▼
2											
	2.9										
4			SM	Gray fine SAND, little silt, trace organics (moist to wet)	⊠	S-1	1-2-5	0.6			
	5.5										
6			SM	Gray, gray-brown fine SAND, little to some silt, trace medium sand (moist to wet)	⊠	S-2	6-10-13	1.2			
8	8.0										
				Gray, gray-brown CLAY and fine SAND, little silt (moist to wet)	⊠	S-3	6-5-4	0.9	29.6	64.2	
10											
12			CL								
				Gray, gray-brown CLAY, some fine sand, little silt (moist to wet)	⊠	S-4	3-7-8	1.3			
14											
16											
	16.8										
18			SM	Gray fine SAND, some silt, little clay (moist to wet)	⊠	S-5	5-7-7	1.1			
20	20.0										
22											

NOTES:
1. Test boring terminated at ± 20.0 feet b.e.g.s. (below existing ground surface).
2. Water level observed at ± 2.5 feet b.e.g.s.
3. Hand excavated from ground surface to ± 3.0 feet b.e.g.s.
4. Borehole backfilled with soil cuttings upon completion.

DUFFIELD ASSOCIATES

TEST BORING TB-16

Geotechnical Evaluation
Proposed Regional Training Institute
DEARNG Bethany Beach Training Site
Bethany Beach, Delaware
Project No. 5448.GP

Date Started : July 6, 2011
Date Completed : July 6, 2011
Logged by : CGCG
Weather :
Driller/Agency : Wayne Proud/CGCG

Drilling Equipment : Truck-Mounted AD II
Drilling Methods : HSA (SPT, ASTM D 1586)

Sample Condition: ⊠ Remolded
Water Levels: ▼ During Drilling

Depth in feet	Layer Depth feet	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0				Dark brown, gray fine SAND, little silt, trace fine gravel, trace organics							
2											▼
4			SM	Gray, dark gray fine SAND, some silt, trace medium sand (wet)	⊠	S-1	3-2-2	1.5			
6				Gray fine SAND, trace silt (wet)	⊠	S-2	3-6-8	1.0	19.7	7.0	
8	8.0										
10			CL	Gray CLAY, little fine sand (wet)	⊠	S-3	2-4-7	1.2			
12	11.8										
14				Gray, dark gray fine SAND, some silt (wet)	⊠	S-4					
16			SM								
18											
20	20.0			Gray, dark gray fine SAND, some silt (wet)	⊠	S-5	6-7-8				
22											

NOTES:
1. Test boring terminated at ± 20.0 feet b.e.g.s. (below existing ground surface).
2. Water level observed at ± 2.4 feet b.e.g.s.
3. Hand excavated from ground surface to ± 3.0 feet b.e.g.s.
4. Borehole backfilled with soil cuttings upon completion.

DUFFIELD ASSOCIATES

TEST BORING TB-17

Geotechnical Evaluation
Proposed Regional Training Institute
DEARNG Bethany Beach Training Site
Bethany Beach, Delaware
Project No. 5448.GP

Date Started : July 8, 2011
Date Completed : July 8, 2011
Logged by : CGCG
Weather :
Driller/Agency : Wayne Proud/CGCG

Drilling Equipment: Truck-Mounted AD II
Drilling Methods : HSA (SPT, ASTM D 1586)

Sample Condition: ⊠ Remolded
Water Levels: ▼ During Drilling

Depth in feet	Layer Depth feet	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0											
2				Dark brown, gray fine SAND, little silt, trace fine gravel, trace organics							▼
4			SM	Brown, gray-brown fine SAND, little clay, trace silt (wet)	⊠	S-1	4-4-5	1.3			
6				Orange-brown, brown, light brown, gray-brown fine SAND, little silt (wet)	⊠	S-2A	5-6-6	1.0			
7.0				Brown, orange-brown, red-brown, gray-brown CLAY and fine SAND, little silt (wet)		S-2B		0.3			
8											
10			CL	Dark gray, black CLAY, some fine sand, little silt (wet) Atterberg Limits: Liquid Limit=29; Plasticity Index=12	⊠	S-3	3-3-4	1.5	27.4	77.5	
11.8											
12											
14			SM	Gray-brown fine SAND, some silt, little clay (wet)	⊠	S-4	7-9-11	0.8			
16											
16.8											
18			CL								
				Gray CLAY, some silt, little fine sand (wet)	⊠	S-5	2-4-11	1.3			
20	20.0										
22											

NOTES:
1. Test boring terminated at ± 20.0 feet b.e.g.s. (below existing ground surface).
2. Water level observed at ± 2.8 feet b.e.g.s.
3. Hand excavated from ground surface to ± 3.0 feet b.e.g.s.
4. Borehole backfilled with soil cuttings upon completion.

DUFFIELD ASSOCIATES

TEST BORING TB-18

Geotechnical Evaluation
Proposed Regional Training Institute
DEARNG Bethany Beach Training Site
Bethany Beach, Delaware
Project No. 5448.GP

Date Started : July 7, 2011
Date Completed : July 7, 2011
Logged by : CGCG
Weather :
Driller/Agency : Wayne Proud/CGCG

Drilling Equipment : Truck-Mounted AD II
Drilling Methods : HSA (SPT, ASTM D 1586)

Sample Condition: ⊠ Remolded
Water Levels: ▼ During Drilling

Depth in feet	Layer Depth feet	GRAPHIC	USCS	DESCRIPTION	SAMPLES	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve	WATER LEVEL
0											
2			SM	Dark brown, gray fine SAND, trace silt, trace fine gravel, trace organics							
4				Gray, light gray fine SAND, little silt, little medium sand (wet)	⊠	S-1	2-1-1	1.2			▼
	5.3										
6			SC	Gray, dark gray fine SAND, some clay, trace medium sand (wet)	⊠	S-2A	WH/0.5'-4-13	1.4	23.8	32.4	
	7.0		SC	Light gray, gray fine SAND and CLAY (wet)		S-2B					
8	8.0										
10				Gray, dark gray CLAY, little fine sand (wet)	⊠	S-3	5-6-5	0.9			
12			CL								
14				Gray, dark gray CLAY, little fine sand (wet)	⊠	S-4	3-3-4	1.4			
16											
	16.8										
18			SM								
20	20.0			Gray-brown, light gray fine SAND, little silt, trace medium sand (wet)	⊠	S-5	4-6-6	0.8			
22											

NOTES:
1. Test boring terminated at ± 20.0 feet b.e.g.s. (below existing ground surface).
2. Water level observed at ± 2.4 feet b.e.g.s.
3. Hand excavated from ground surface to ± 3.0 feet b.e.g.s.
4. Borehole backfilled with soil cuttings upon completion.

DUFFIELD ASSOCIATES

TEST BORING TB-19

Geotechnical Evaluation
Proposed Regional Training Institute
DEARNG Bethany Beach Training Site
Bethany Beach, Delaware
Project No. 5448.GP

Date Started : July 8, 2011
Date Completed : July 8, 2011
Logged by : CGCG
Weather :
Driller/Agency : Wayne Proud/CGCG

Drilling Equipment : Truck-Mounted AD II
Drilling Methods : HSA (SPT, ASTM D 1586)

Sample Condition: ⊠ Remolded
Water Levels: ▼ During Drilling

Depth in feet	Layer Depth feet	USCS	DESCRIPTION	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	Percent Passing 200 Sieve
0		SM	Dark brown, gray fine SAND, trace silt, trace fine gravel, trace organics					
2		SM	Gray, dark gray fine SAND, little silt, trace organics (moist)	S-1	2-2-3	1.1		
4								
5.5								
6		SM	Light gray, gray fine SAND, little silt (wet)	S-2	5-7-14	1.5		
8	8.0							
10		CL	Dark gray CLAY, little fine sand (wet)	S-3	4-5-5	0.9		
11.8								
12								
14		SP	Gray fine SAND, trace silt, trace clay (wet)	S-4	4-6-12	0.8	23.0	3.6
16								
16.8								
18		SM	Gray, light gray fine SAND, little silt, trace medium-coarse sand (wet)	S-5	5-6-9	1.0		
20	20.0							
22								

NOTES:
1. Test boring terminated at ± 20.0 feet b.e.g.s. (below existing ground surface).
2. Water level observed at ± 2.4 feet b.e.g.s.
3. Hand excavated from ground surface to ± 3.0 feet b.e.g.s.
4. Borehole backfilled with soil cuttings upon completion.

APPENDIX C

LABORATORY TEST RESULTS SUMMARY

MODIFIED PROCTOR CURVES (2)

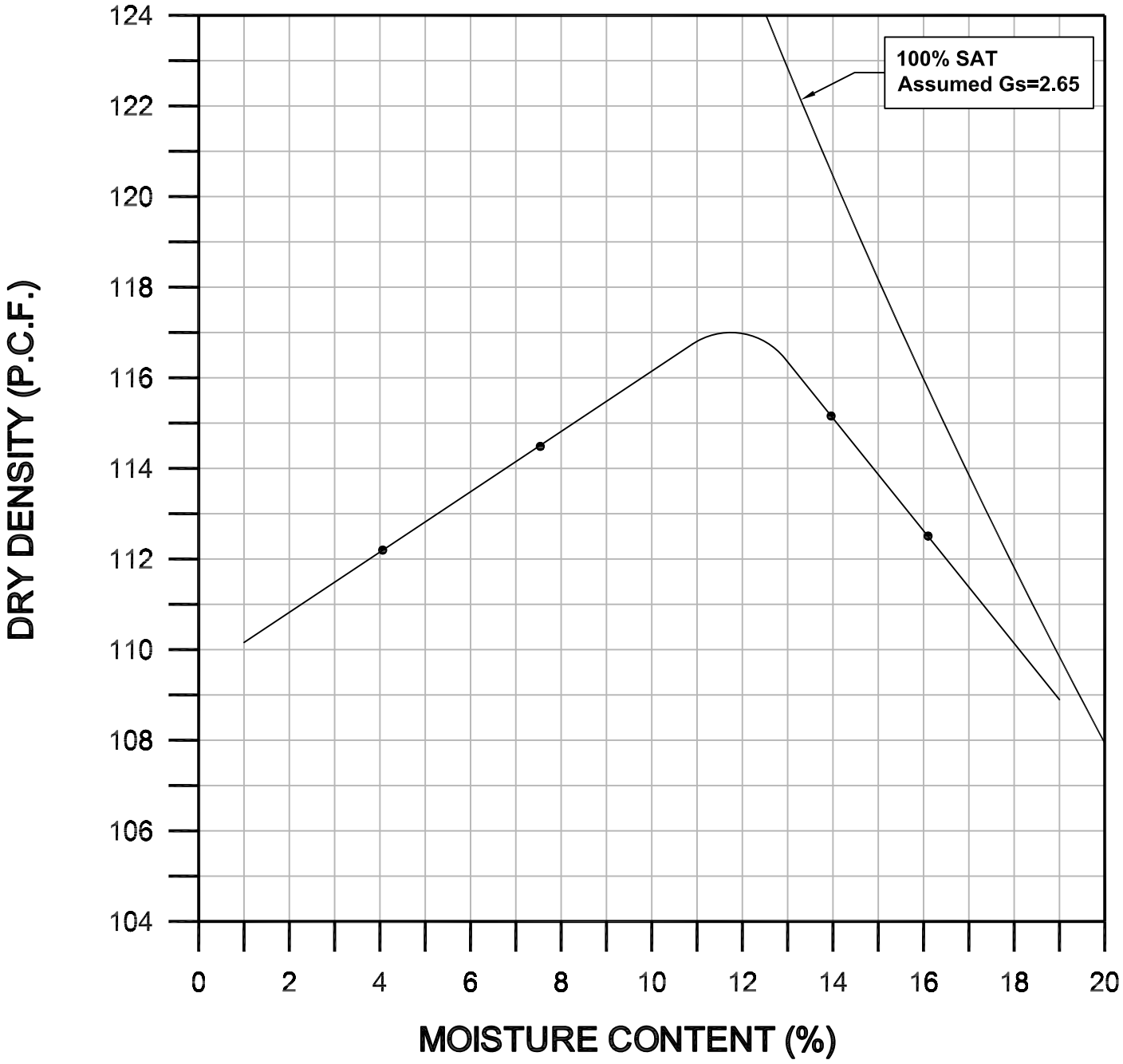
CALIFORNIA BEARING RATIO TEST RESULTS (2)

LABORATORY TEST RESULTS SUMMARY

GEOTECHNICAL EVALUATION
BETHANY BEACH REGIONAL TRAINING CENTER
DELAWARE ARMY NATIONAL GUARD
BETHANY BEACH, DELAWARE

Test Boring No.	Sample Depth (feet below ground surface)	Natural Moisture Content (%)	Less than No. 200 Sieve (%)	Other
TB-14	18.5 – 20.0	19.5	12.3	---
TB-15	8.5 – 10.0	29.6	64.2	---
TB-16	6.0 – 7.5	19.7	7.0	---
TB-17	8.5 – 10.0	27.4	77.5	LL = 29; PI = 12 USCS = CL
TB-18	6.0 – 7.0	23.8	32.4	---
TB-19	13.5 – 15.0	23.0	3.6	---
TB 15/18/19	0 – 3.0	9.6	5.3	USCS = SC AASHTO = A-1 Max. ρ_d = 117.0 pcf Opt. w = 11.8 % CBR Testing (CBR-1)
TB- 14/16/17	0 – 3.0	11.6	12.1	USCS = SC AASHTO = A-2 Max. ρ_d = 119.4 pcf Opt. w = 10.5 % CBR Testing (CBR-2)

NOTES:
LL = Liquid Limit
PI = Plasticity Index
Max. ρ_d = Maximum dry density
Opt. w = Optimum moisture content
CBR = California Bearing Ratio
USCS = Unified Soil Classification System
AASHTO = American Association of State Highway and Transportation Officials



Maximum Dry Density: 117.0 (PCF)
Optimum Moisture Content: 11.8 (%)

Moisture Content of Sample as Received: 9.6 (%)
Percent Passing No. 200 Sieve: 5.3 (%)

Description of Material: Dark brown, gray fine SAND, trace clay, trace fine gravel, trace organics

Modlfied Proctor Test, ASTM D-1557 (Method A)
Source: On-site (Composite Sample from TB No. 15, 18, and 19 cuttings)
Proctor Curve No. CBR-1
Moisture-Density Relationship

DEARNG BBTS RTI
Project No.: 5448.GP
Plotted by: DVC
Date/Checked by: September 2011/ JJ

DUFFIELD ASSOCIATES

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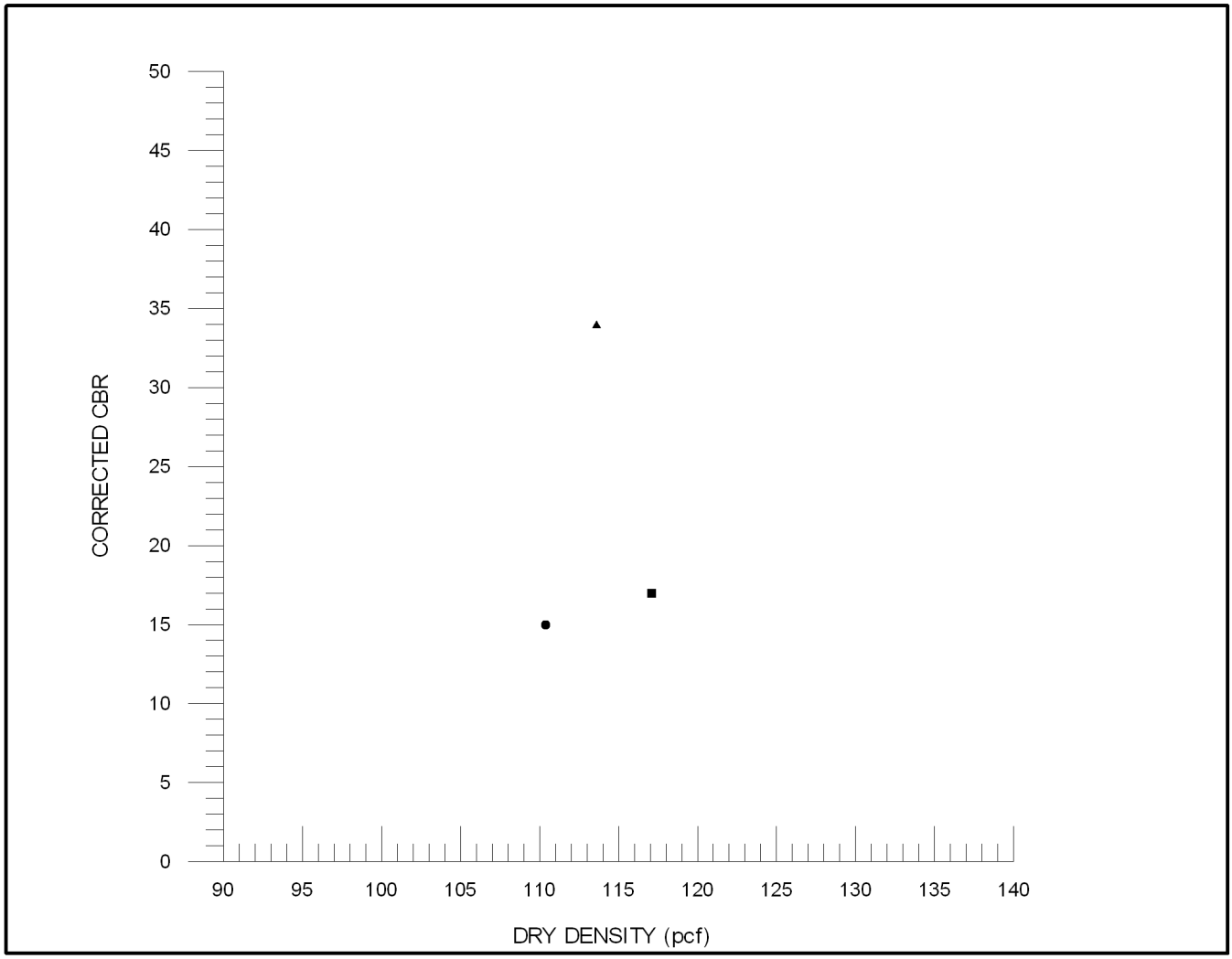
Offices in Delaware, Maryland, Pennsylvania and New Jersey

CALIFORNIA BEARING RATIO TEST, (ASTM: D1883)



Sample Identification: CBR-1
Sample Description: Dark brown, gray fine SAND, trace clay, trace fine gravel, trace organics

Sample Preparation Method: ASTM D1557 (soaked)

Number of blows per lift:	56	25	10
CBR Value:	17	34	15
Dry Density As Compacted (pcf):	117.1	113.6	110.4
Moisture Prior To Compaction (%):	9.4	12.2	9.4
Top Moisture After Test (%):	12.6	12.3	14.6
Swell (%):	0.1	0.0	0.0

Surcharge Weight: 10 lbs

As Received Moisture Content (%): 9.6
Passing No. 200 Sieve (%): 5.3

Proctor Maximium Dry Density (pcf): 117.0
Proctor Optimum Moisture (%): 11.8

Legend
● 10 blows per layer
▲ 25 blows per layer
■ 56 blows per layer

Remarks: CBR Value determined at 0.1" penetration.

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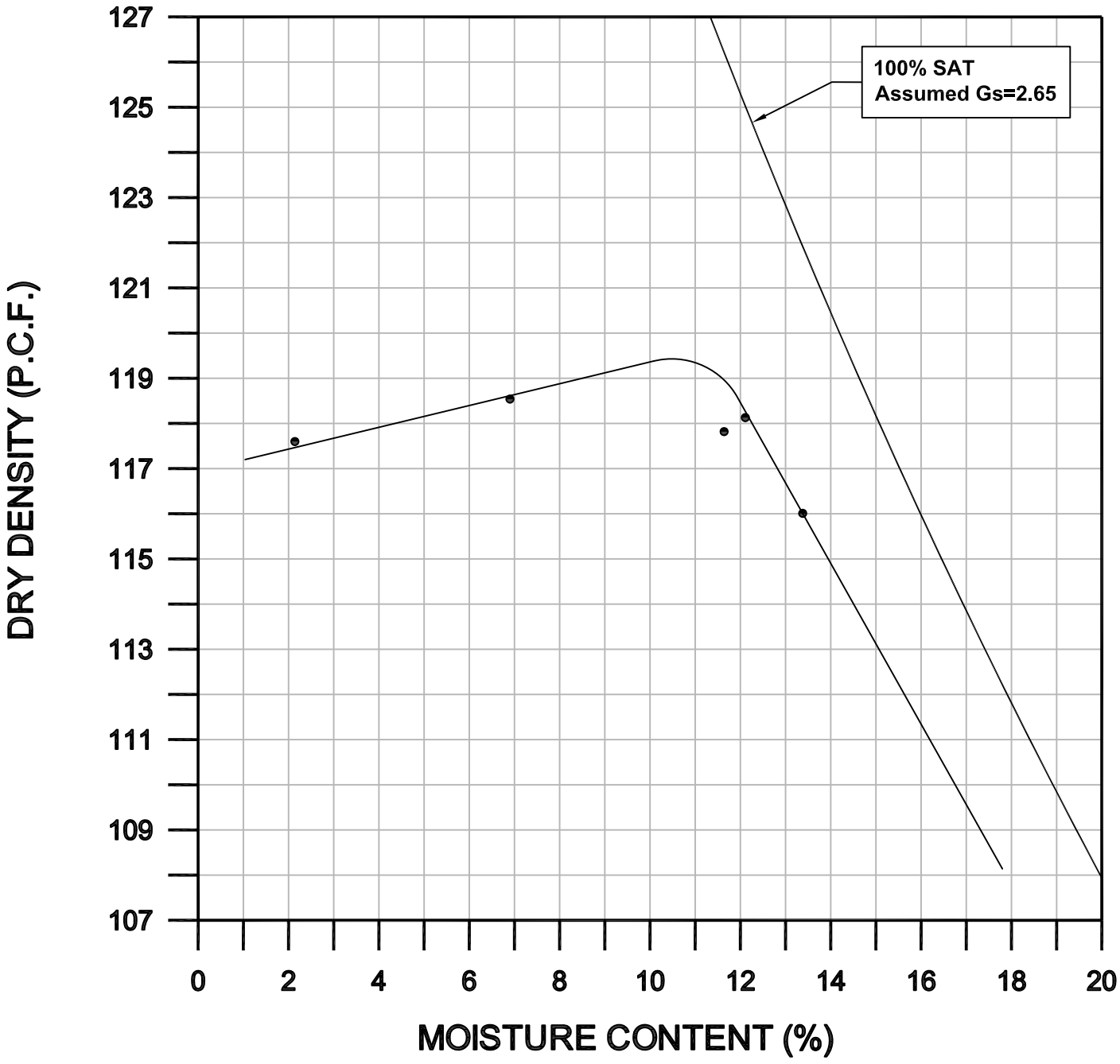
Client: Burns & McDonnell

Project: DEARNG Bethany Beach Training Site
Regional Training Institute
Bethany Beach, Delaware

Project No.: 5448.GP

Date/Chk'd By: July 2011



Maximum Dry Density: 119.4 (PCF)
Optimum Moisture Content: 10.5 (%)

Moisture Content of Sample as Received: 11.6 (%)
Percent Passing No. 200 Sieve: 12.1 (%)

Description of Material: Dark brown, gray fine SAND, little clay, trace fine gravel, trace organics

Modlfied Proctor Test, ASTM D-1557, (Method A)
Source: On-site (Composite Sample from TB No. 14, 16, and 17)
Proctor Curve No. CBR-2
Moisture-Density Relationship

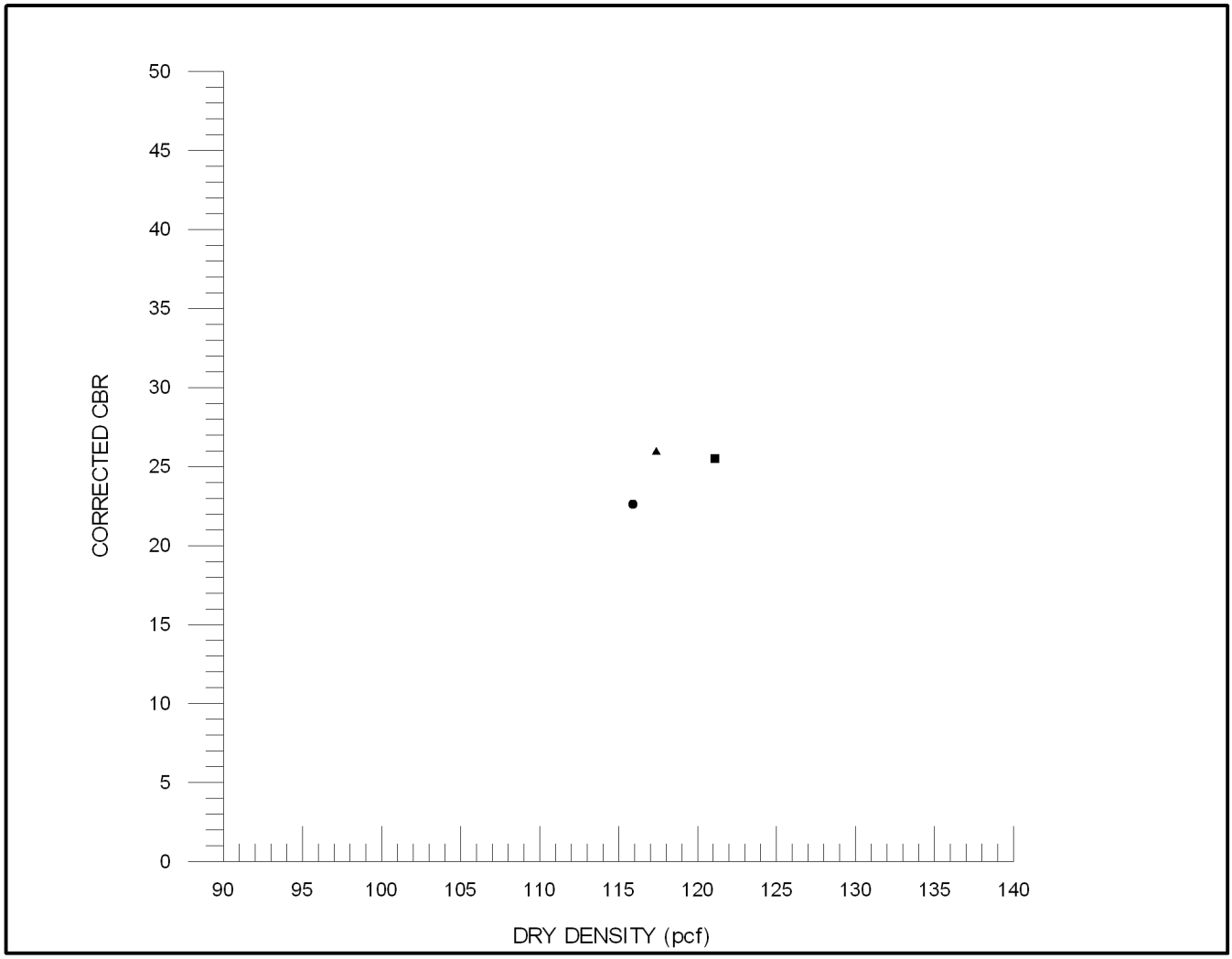
DEARNG BBTS TI
Project No.: 5448.GP
Plotted by: DVC
Date/Checked by: September 2011/ JJV

DUFFIELD ASSOCIATES

Wilmington, Delaware (302)239-6634

Offices in Delaware, Maryland, Pennsylvania and New Jersey

CALIFORNIA BEARING RATIO TEST, (ASTM: D1883)



Sample Identification: CBR-2
Sample Description: Dark brown, gray fine SAND, little clay, trace fine gravel, trace organics

Sample Preparation Method: ASTM D1557 (soaked)

As Received Moisture Content (%): 11.6
Passing No. 200 Sieve (%): 12.1

Proctor Maximium Dry Density (pcf): 119.4
Proctor Optimum Moisture (%): 10.5

Number of blows per lift:	56	25	10
CBR Value:	25.5	26	22.6
Dry Density As Compacted (pcf):	121.1	117.4	115.9
Moisture Prior To Compaction (%):	10.3	10.6	10.6
Top Moisture After Test (%):	12.0	11.5	12.3
Swell (%):	0.0	0.0	0.0

Surcharge Weight: 10 lbs

Legend
● 10 blows per layer
▲ 25 blows per layer
■ 56 blows per layer

Remarks: CBR Value determined at 0.1" penetration.

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Client: Burns & McDonnell

Project: DEARNG Bethany Beach Training Site
Regional Training Institute
Bethany Beach, Delaware

Project No.: 5448.GP

Date/Chk'd By: July 2011

APPENDIX D

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

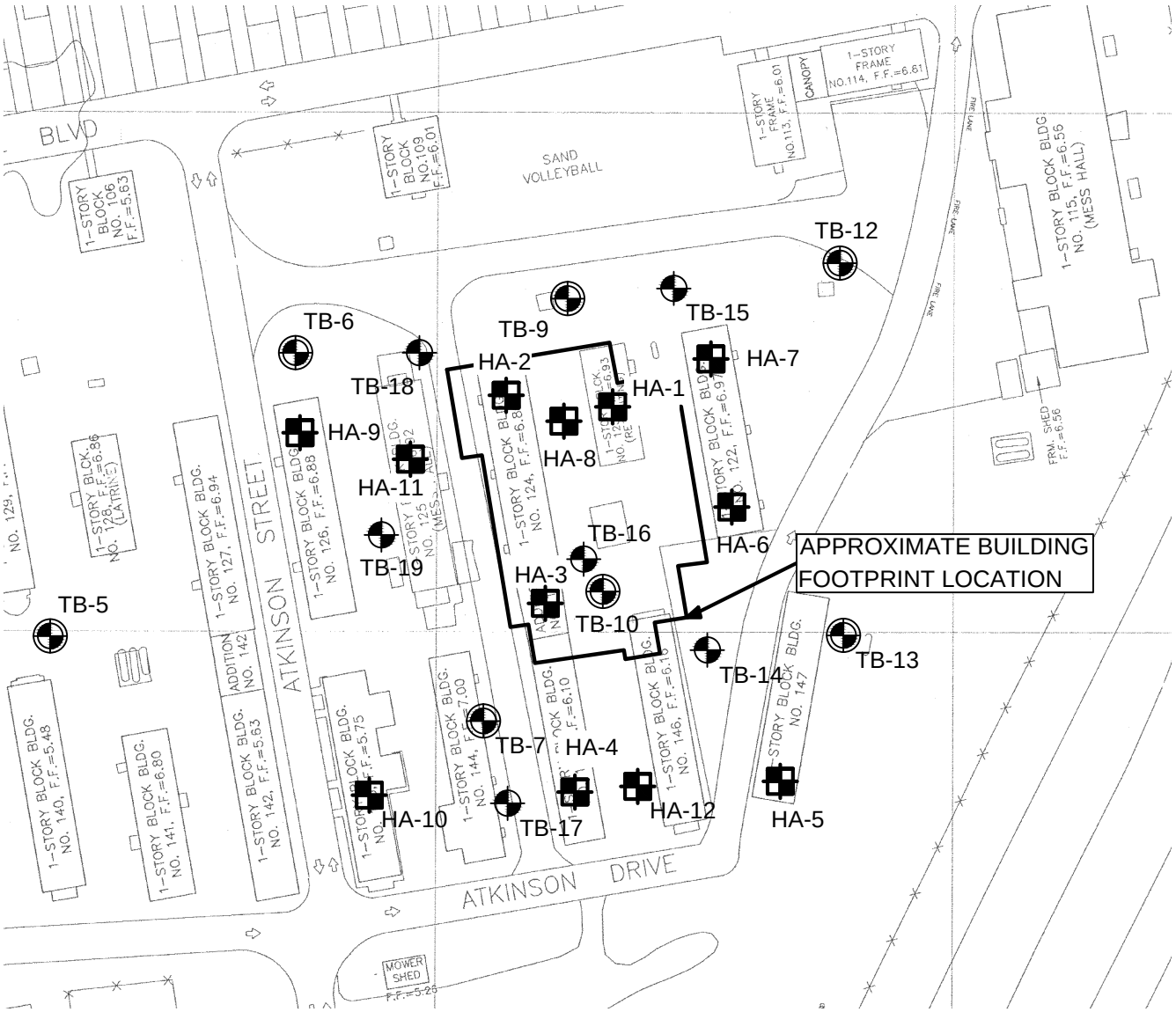
DENSITY: COARSE GRAINED SOILS

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.



KEY:

TB-5 - APPROXIMATE LOCATION OF PREVIOUSLY PERFORMED TEST BORING (MAY 2006)

TB-14 - APPROXIMATE LOCATION OF PREVIOUSLY PERFORMED TEST BORING (JULY 2011)

HA-1 - APPROXIMATE LOCATION OF HAND-AUGER BORING (DECEMBER 2012)

NOTE:

THIS SKETCH IS ADAPTED FROM A DRAWING TITLED, "GENERAL LOCATION PLAN," PREPARED BY W.C. GOMEZ ASSOCIATES, INC., DATED JUNE 27, 2006.

DATE: 15 MAY 2013	BORING LOCATION SKETCH	**DESIGNED BY: JJ**	DUFFIELD ASSOCIATES *Consultants in the Geosciences* 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"=80'	**PROPOSED REGIONAL TRAINING INSTITUTE DELAWARE ARMY NATIONAL GUARD**	**DRAWN BY: BCD**	
PROJECT. NO. 5448.GV		**CHECKED BY: JJ**	
SHEET: FIGURE 1	**BETHANY BEACH ~ SUSSEX COUNTY ~ DELAWARE**	**FILE: A-5448GV-02**	

SUMMARY OF HAND-AUGER BORINGS

PROPOSED REGIONAL TRAINING INSTITUTE
DELAWARE ARMY NATIONAL GUARD
BETHANY BEACH, DELAWARE

Hand-Auger Boring	Location	Comments
HA-2	North end of Bldg. 124	Apparent concrete obstruction observed below soil fill materials at a depth of 1.2 feet
HA-3	Connector between Bldgs. 124 and 145	Boring terminated due to auger refusal at a crushed stone layer and caving of the borehole
HA-6	South end of Bldg. 122	Apparent concrete obstruction observed below soil fill materials at a depth of 1.0 feet
HA-7	North end of Bldg. 122	Apparent concrete obstruction observed below soil fill materials at a depth of 0.9 feet
HA-9	North end of Bldg. 126	Apparent concrete obstruction observed below soil fill materials at a depth of 1.5 feet
HA-11	Middle of Bldg. 125	Apparent concrete obstruction observed below soil fill materials at a depth of 1.3 feet

Notes: The soils encountered in the hand-auger borings generally appeared natural and undisturbed with the exception of the fill materials observed at the location of the six hand-auger borings listed above. Depths refer to depth below top of existing slab-on-grade. Hand-auger borings logs, which describe the conditions observed during the field exploration program, are enclosed.

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HAND-AUGER BORING
DESCRIPTIVE LOG

PROJECT: Proposed Regional Training Institute
Delaware Army National Guard

PROJECT NO.: 5448.GV

CLIENT: Delaware Army National Guard

DATE: December 11, 2012

LOGGED BY: BCD

Boring No.	Depth Range (feet below existing ground surface)	Generalized Soil Description
HA-1	0.0 – 0.7	CONCRETE (approximately 8.5 inches)
	0.7 – 1.2 S-1 at 0.9	Light brown, orange-brown, fine to medium SAND, trace silt, trace organics (roots)
	1.2 – 2.6 S-2 at 1.9	Brown, dark brown, orange-brown, fine to medium SAND, little gravel, trace silt (moist)
	2.6 – -- S-3 at 3.6	Light brown, dark brown, gray fine SAND, little to some organics (roots), trace silt (wet)

NOTES:

(1) Hand-auger boring performed by Duffield Associates, Inc. personnel.
(2) Boring terminated approximately 4.6 feet below the existing ground surface (b.e.g.s.). The ground surface was an existing concrete slab-on-grade.
(3) Water level encountered at approximately 4.1 feet b.e.g.s.
(4) Borehole backfilled with excavated soils and concrete core upon completion.
(5) Soil descriptions and classification were performed in general accordance with ASTM D 2488 (Visual-Manual Procedure), and ASTM D 2487 (Unified Soil Classification System, USCS).

DUFFIELD ASSOCIATES

HAND-AUGER BORING
DESCRIPTIVE LOG

PROJECT: Proposed Regional Training Institute
Delaware Army National Guard

PROJECT NO.: 5448.GV

CLIENT: Delaware Army National Guard

DATE: December 11, 2012

LOGGED BY: BCD

Boring No.	Depth Range (feet below existing ground surface)	Generalized Soil Description
HA-2	0.0 – 0.6	CONCRETE (approximately 6 inches)
	0.6 – 1.2	FILL: Light brown, orange-brown fine sand, trace gravel (dry)
	1.2 – --	CONCRETE obstruction

NOTES:

(1) Hand-auger boring performed by Duffield Associates, Inc. personnel.
(2) Boring terminated approximately 1.2 feet below the existing ground surface (b.e.g.s.) due to auger refusal. The ground surface was an existing concrete slab-on-grade.
(3) Groundwater was not observed during performance of the hand-auger boring.
(4) Borehole backfilled with excavated soils and concrete core upon completion.
(5) Soil descriptions and classification were performed in general accordance with ASTM D 2488 (Visual-Manual Procedure), and ASTM D 2487 (Unified Soil Classification System, USCS).

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HAND-AUGER BORING
DESCRIPTIVE LOG

PROJECT: Proposed Regional Training Institute
Delaware Army National Guard

PROJECT NO.: 5448.GV

CLIENT: Delaware Army National Guard

DATE: December 11, 2012

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Boring No.	Depth Range (feet below existing ground surface)	Generalized Soil Description
HA-3	0.0 – 0.3	CONCRETE (approximately 4 inches)
	0.3 – --	CRUSHED STONE (AASHTO No. 57 Stone)

NOTES:

(1) Hand-auger boring performed by Duffield Associates, Inc. personnel.
(2) Boring terminated approximately 0.7 feet below the existing ground surface (b.e.g.s.) due to auger refusal at stone layer and caving of borehole. The ground surface was an existing concrete slab-on-grade.
(3) Groundwater was not observed during performance of the hand-auger boring.
(4) Borehole backfilled with excavated materials and concrete core upon completion.
(5) Soil descriptions and classification were performed in general accordance with ASTM D 2488 (Visual-Manual Procedure), and ASTM D 2487 (Unified Soil Classification System, USCS).

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HAND-AUGER BORING
DESCRIPTIVE LOG

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Delaware Army National Guard

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Boring No.	Depth Range (feet below existing ground surface)	Generalized Soil Description
HA-4	0.0 – 0.4	CONCRETE (approximately 5 inches)
	0.4 – 0.8	Light brown, brown-orange, yellow, fine SAND, trace silt
	0.8 – 1.8 S-1 at 1.3	Brown, yellow, dark brown, orange, fine SAND, little gravel, trace silt
	1.8 – 2.5 S-2 at 2.2	Brown, dark brown, light brown, fine SAND, trace to little silt (moist)
	2.5 – -- S-3 at 3.5	Light brown, yellow, fine SAND, trace silt (wet)

NOTES:

(1) Hand-auger boring performed by Duffield Associates, Inc. personnel.
(2) Boring terminated approximately 4.4 feet below the existing ground surface (b.e.g.s.). The ground surface was an existing concrete slab-on-grade.
(3) Water level encountered at approximately 4.4 feet b.e.g.s.
(4) Borehole backfilled with excavated soils and concrete core upon completion.
(5) Soil descriptions and classification were performed in general accordance with ASTM D 2488 (Visual-Manual Procedure), and ASTM D 2487 (Unified Soil Classification System, USCS).

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HAND-AUGER BORING
DESCRIPTIVE LOG

PROJECT: Proposed Regional Training Institute
Delaware Army National Guard

PROJECT NO.: 5448.GV

CLIENT: Delaware Army National Guard

DATE: December 11, 2012

LOGGED BY: BCD

Boring No.	Depth Range (feet below existing ground surface)	Generalized Soil Description
HA-5	0.0 – 0.4	CONCRETE (Approximately 5 inches)
	0.4 – 1.5 S-1 at 1.0	Light brown, orange-brown, dark brown, fine SAND, trace silt, trace gravel
	1.5 – 2.7 S-2 at 2.1	Orange-brown, brown, light brown, fine SAND, trace gravel, trace silt (moist)
	2.7 – -- S-3 at 3.8	Yellow, light brown, orange-brown, fine SAND, trace silt (wet)

NOTES:

(1) Hand-auger boring performed by Duffield Associates, Inc. personnel.
(2) Boring terminated approximately 4.9 feet below the existing ground surface (b.e.g.s.). The ground surface was an existing concrete slab-on-grade.
(3) Water level encountered at approximately 3.3 feet b.e.g.s.
(4) Borehole backfilled with excavated soils and concrete core upon completion.
(5) Soil descriptions and classification were performed in general accordance with ASTM D 2488 (Visual-Manual Procedure), and ASTM D 2487 (Unified Soil Classification System, USCS).

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HAND-AUGER BORING
DESCRIPTIVE LOG

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Delaware Army National Guard

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DATE: December 11, 2012

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Boring No.	Depth Range (feet below existing ground surface)	Generalized Soil Description
HA-6	0.0 – 0.6	CONCRETE (approximately 7 inches)
	0.6 – 1.0	FILL: Light brown, orange-brown fine sand, trace gravel (dry)
	1.0 – --	CONCRETE obstruction

NOTES:

(1) Hand-auger boring performed by Duffield Associates, Inc. personnel.
(2) Boring terminated approximately 1.0 feet below the existing ground surface (b.e.g.s.) due to auger refusal. The ground surface was an existing concrete slab-on-grade.
(3) Groundwater was not observed during performance of the hand-auger boring.
(4) Borehole backfilled with excavated soils and concrete core upon completion.
(5) Soil descriptions and classification were performed in general accordance with ASTM D 2488 (Visual-Manual Procedure), and ASTM D 2487 (Unified Soil Classification System, USCS).

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HAND-AUGER BORING
DESCRIPTIVE LOG

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Delaware Army National Guard

PROJECT NO.: 5448.GV

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DATE: December 11, 2012

LOGGED BY: BCD

Boring No.	Depth Range (feet below existing ground surface)	Generalized Soil Description
HA-7	0.0 – 0.5	CONCRETE (approximately 6 inches)
	0.5 – 0.9	FILL: Light brown, orange-brown fine sand, trace gravel (dry)
	0.9 – --	CONCRETE obstruction

NOTES:

(1) Hand-auger boring performed by Duffield Associates, Inc. personnel.
(2) Boring terminated approximately 0.9 feet below the existing ground surface (b.e.g.s.) due to auger refusal. The ground surface was an existing concrete slab-on-grade.
(3) Groundwater was not observed during performance of the hand-auger boring.
(4) Borehole backfilled with excavated soils and concrete core upon completion.
(5) Soil descriptions and classification were performed in general accordance with ASTM D 2488 (Visual-Manual Procedure), and ASTM D 2487 (Unified Soil Classification System, USCS).

DUFFIELD ASSOCIATES

HAND-AUGER BORING
DESCRIPTIVE LOG

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Delaware Army National Guard

PROJECT NO.: 5448.GV

CLIENT: Delaware Army National Guard

DATE: December 11, 2012

LOGGED BY: BCD

Boring No.	Depth Range (feet below existing ground surface)	Generalized Soil Description
HA-8	0.0 – 0.5	TOPSOIL
	0.5 – 1.8	Light brown, brown, orange-brown, white, fine SAND, trace gravel, trace silt
	1.8 – 2.3	Dark brown, brown, gray-brown, fine to medium SAND, trace silt
	2.3 – 2.8 S-1 at 2.6	Light brown, brown, dark brown, fine SAND, little to some organics (roots) (moist)
	2.8 – -- S-2 at 3.4	Light brown, brown, dark brown, fine SAND, trace gravel (wet)

NOTES:

(1) Hand-auger boring performed by Duffield Associates, Inc. personnel.
(2) Boring terminated approximately 4.0 feet below the existing ground surface (b.e.g.s.). The ground surface was an existing concrete slab-on-grade.
(3) Water level encountered at approximately 2.9 feet b.e.g.s.
(4) Borehole backfilled with excavated soils and concrete core upon completion.
(5) Soil descriptions and classification were performed in general accordance with ASTM D 2488 (Visual-Manual Procedure), and ASTM D 2487 (Unified Soil Classification System, USCS).

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HAND-AUGER BORING
DESCRIPTIVE LOG

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Delaware Army National Guard

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Boring No.	Depth Range (feet below existing ground surface)	Generalized Soil Description
HA-9	0.0 – 0.4	CONCRETE (approximately 5 inches)
	0.4 – 1.5 S-1 at 0.4	FILL: Light brown, brown, fine sand, trace gravel, trace silt (dry)
	1.5 – --	CONCRETE obstruction

NOTES:

(1) Hand-auger boring performed by Duffield Associates, Inc. personnel.
(2) Boring terminated approximately 1.5 feet below the existing ground surface (b.e.g.s.) due to auger refusal. The ground surface was an existing concrete slab-on-grade.
(3) Groundwater was not observed during performance of the hand-auger boring.
(4) Borehole backfilled with excavated soils and concrete core upon completion.
(5) Soil descriptions and classification were performed in general accordance with ASTM D 2488 (Visual-Manual Procedure), and ASTM D 2487 (Unified Soil Classification System, USCS).

DUFFIELD ASSOCIATES

HAND-AUGER BORING
DESCRIPTIVE LOG

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Delaware Army National Guard

PROJECT NO.: 5448.GV

CLIENT: Delaware Army National Guard

DATE: December 11, 2012

LOGGED BY: BCD

Boring No.	Depth Range (feet below existing ground surface)	Generalized Soil Description
HA-10	0.0 – 0.4	CONCRETE (approximately 5 inches)
	0.4 – 2.6 S-1 at 1.6	Light brown, orange-brown, dark brown, fine SAND, trace silt
	2.6 – 3.7 S-2 at 2.6	Dark brown, black, orange-brown, SILT, some fine sand, little to some organics (roots) (moist)
	3.7 – 4.6 S-4 at 3.7	Light brown, gray SILT and SAND, trace organics (roots) (moist)
	4.6 – -- S-4 at 4.6	Light brown, gray, fine SAND, some to little silt (wet)

NOTES:

(1) Hand-auger boring performed by Duffield Associates, Inc. personnel.
(2) Boring terminated approximately 5.5 feet below the existing ground surface (b.e.g.s.). The ground surface was an existing concrete slab-on-grade.
(3) Water level encountered at approximately 4.0 feet b.e.g.s.
(4) Borehole backfilled with excavated soils and concrete core upon completion.
(5) Soil descriptions and classification were performed in general accordance with ASTM D 2488 (Visual-Manual Procedure), and ASTM D 2487 (Unified Soil Classification System, USCS).

DUFFIELD ASSOCIATES

HAND-AUGER BORING
DESCRIPTIVE LOG

PROJECT: Proposed Regional Training Institute
Delaware Army National Guard

PROJECT NO.: 5448.GV

CLIENT: Delaware Army National Guard

DATE: December 11, 2012

LOGGED BY: BCD

Boring No.	Depth Range (feet below existing ground surface)	Generalized Soil Description
HA-11	0.0 – 0.4	CONCRETE (approximately 5 inches)
	0.4 – 1.0	FILL: Light brown, brown, orange-brown, fine sand, trace gravel, trace silt (dry)
	1.0 – 1.3	FILL: Light brown, brown, orange-brown, fine sand, little to some gravel, trace silt (dry)
	1.3 – --	CONCRETE obstruction

NOTES:

(1) Hand-auger boring performed by Duffield Associates, Inc. personnel.
(2) Boring terminated approximately 1.3 feet below the existing ground surface (b.e.g.s.) due to auger refusal. The ground surface was an existing concrete slab-on-grade.
(3) Groundwater was not observed during performance of the hand-auger boring.
(4) Borehole backfilled with excavated soils and concrete core upon completion.
(5) Soil descriptions and classification were performed in general accordance with ASTM D 2488 (Visual-Manual Procedure), and ASTM D 2487 (Unified Soil Classification System, USCS).

DUFFIELD ASSOCIATES

HAND-AUGER BORING
DESCRIPTIVE LOG

PROJECT: Proposed Regional Training Institute
Delaware Army National Guard

PROJECT NO.: 5448.GV

CLIENT: Delaware Army National Guard

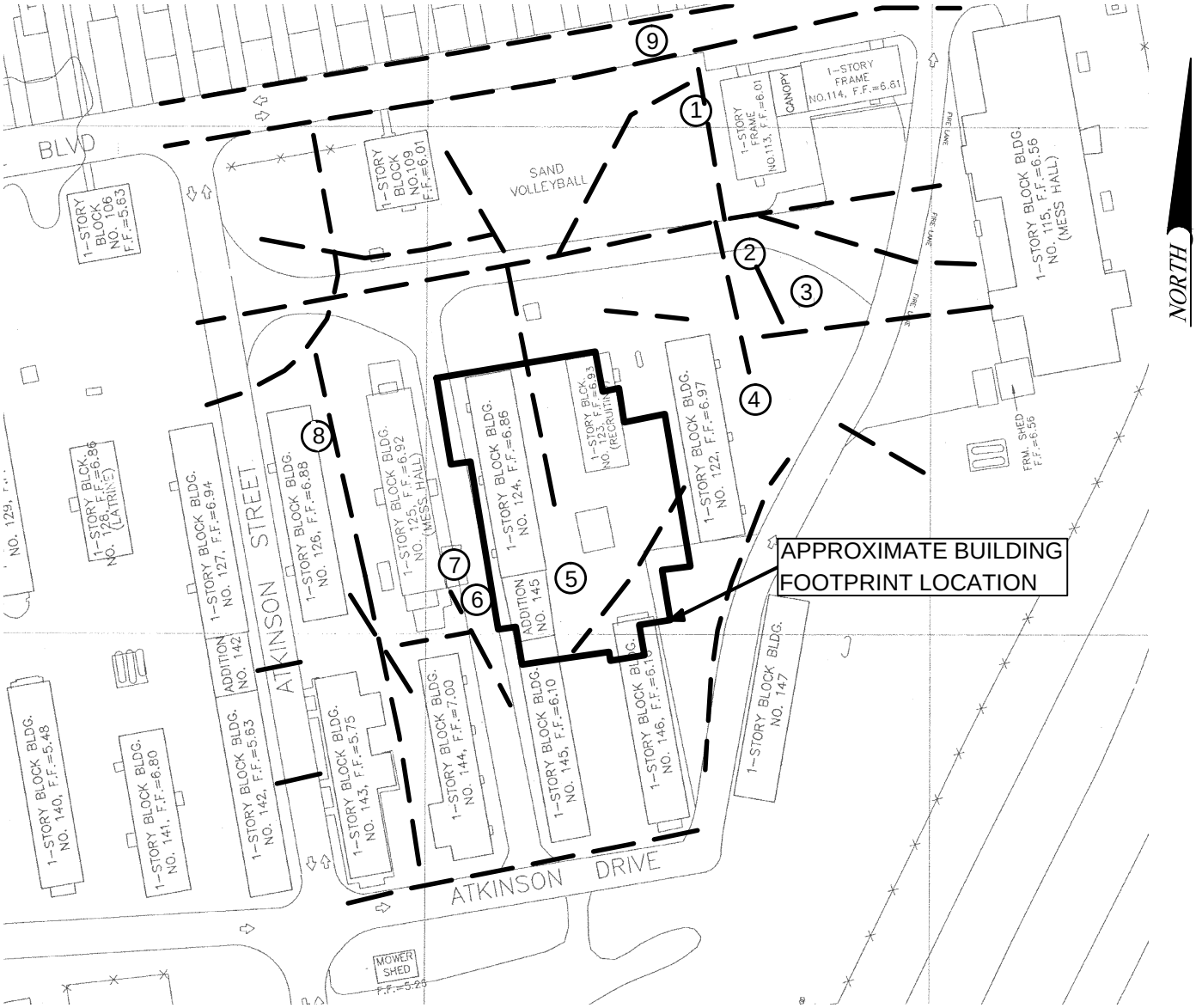
DATE: December 11, 2012

LOGGED BY: BCD

Boring No.	Depth Range (feet below existing ground surface)	Generalized Soil Description
HA-12	0.0 – 0.5	TOPSOIL
	0.5 – 1.8	Light brown, dark brown, orange-brown, fine SAND, trace to little gravel, trace to little silt (moist)
	1.8 – -- S-1 at 2.7	Light brown, dark brown, orange-brown, fine SAND, trace silt (wet)

NOTES:

(1) Hand-auger boring performed by Duffield Associates, Inc. personnel.
(2) Boring terminated approximately 3.7 feet below the existing grass-covered ground surface (b.e.g.s.)
(3) Water level encountered at approximately 3.3 feet b.e.g.s.
(4) Borehole backfilled with excavated soils and concrete core upon completion.
(5) Soil descriptions and classification were performed in general accordance with ASTM D 2488 (Visual-Manual Procedure), and ASTM D 2487 (Unified Soil Classification System, USCS).



KEY:

① - APPROXIMATE LOCATION OF CONDUCTIVITY AND METAL ANOMALIES REPORTED BY ADVANCED GEOLOGICAL SERVICES ON DECEMBER 11, 2012

— — - APPROXIMATE LOCATION OF PREVIOUSLY KNOWN AND UNKNOWN UTILITIES REPORTED BY ADVANCED GEOLOGICAL SERVICES ON DECEMBER 11, 2012

NOTE:

THIS SKETCH IS ADAPTED FROM A DRAWING TITLED, "GENERAL LOCATION PLAN," PREPARED BY W.C. GOMEZ ASSOCIATES, INC., DATED JUNE 27, 2006.

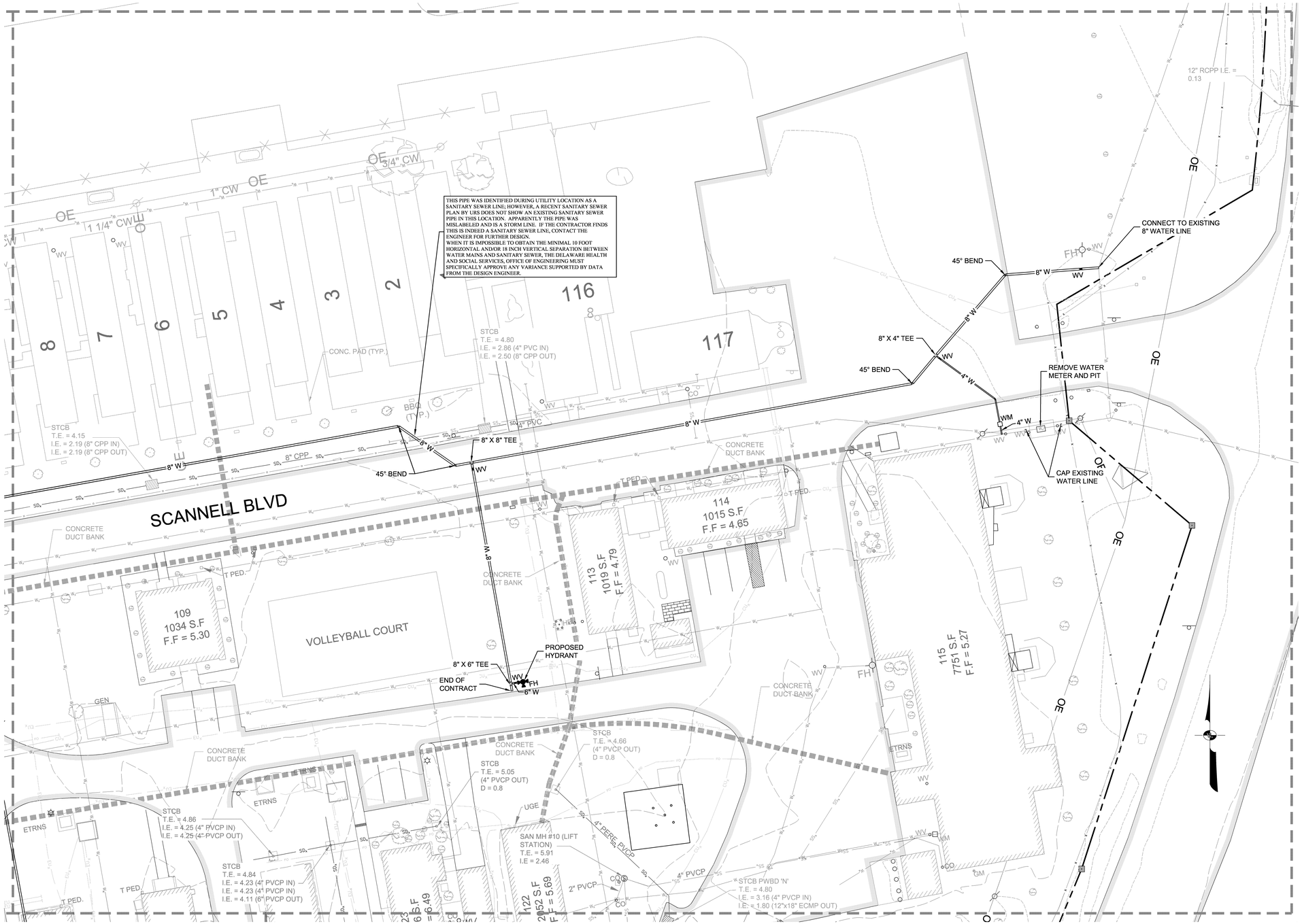
DATE: 15 MAY 2013	APPARENT ANOMALY LOCATION SKETCH	**DESIGNED BY: JJ**	DUFFIELD ASSOCIATES *Consultants in the Geosciences* 5400 LIMESTONE ROAD WILMINGTON, DE 19808-1232 TEL. (302)239-6634 FAX (302)239-8485 OFFICES IN DELAWARE, MARYLAND PENNSYLVANIA AND NEW JERSEY E-MAIL: DUFFIELD@DUFFNET.COM
SCALE: 1"=80'	**PROPOSED REGIONAL TRAINING INSTITUTE DELAWARE ARMY NATIONAL GUARD**	**DRAWN BY: BCD**	
PROJECT. NO. 5448.NW		**CHECKED BY: JJ**	
SHEET: FIGURE 2	**BETHANY BEACH ~ SUSSEX COUNTY ~ DELAWARE**	**FILE: A-5448NW-01**	

SUMMARY OF GEOPHYSICAL SURVEY RESULTS

PROPOSED REGIONAL TRAINING INSTITUTE
DELAWARE ARMY NATIONAL GUARD
BETHANY BEACH, DELAWARE

Anomaly Number	Approximate Location	Approximate Size	Comments
1	West of Bldg. 113	12 feet by 20 feet	Conductivity anomaly
2	Playground northeast of Bldg. 122	25 feet by 25 feet	Conductivity anomaly
3	Playground northeast of Bldg. 122	6 feet by 12 feet	Apparent metal anomaly
4	East of Bldg. 122	40 feet by 40 feet	Apparent metal anomaly
5	Between Bldgs. 124 and 145	20 feet by 35 feet	Conductivity anomaly
6	Between Bldgs. 124 and 145	15 feet by 15 feet	Conductivity anomaly
7	Between Bldgs. 124 and 145	5 feet by 25 feet	Apparent metal anomaly
8	Northeast corner of Bldg. 126	7 feet by 60 feet	Conductivity anomaly
9	South of Trailer 2	15 feet by 40 feet	Apparent metal anomaly
---	Various	---	Previously known and unknown utilities

Notes: The results of the geophysical survey indicated apparent anomalies that can generally be summarized into three types: previously known and unknown buried utilities, apparent metal anomalies, and conductivity anomalies. A location sketch, indicating the approximate location of the anomalies, is included.



LEGEND

EXISTING	PROPOSED	
	N/A	SECURITY FENCE
OE	N/A	OVER HEAD ELECTRICAL SERVICE
	N/A	PROPERTY LINE
W	"W	WATER LINE
SD	N/A	STORM DRAIN
EU	N/A	ELECTRIC LINE
CU	N/A	COMMUNICATION LINE
FO	N/A	FIBER OPTIC LINE
SS	N/A	SANITARY SEWER
	N/A	CONCRETE DUCT BANK
		BUILDING
		SIDEWALK
		PAVING
N/A		GRASS FILTER STRIP
	N/A	PROPANE TANK
	N/A	CONCRETE PAD
	N/A	TRANSFORMER/GENERATOR
	N/A	SHED W/SWITCH GEAR
S	S	SANITARY SEWER MANHOLE
S	N/A	SANITARY SEWER LIFT STATION
CO	N/A	SANITARY SEWER CLEAN OUT
	N/A	PROPERTY MONUMENT
	N/A	DE ARNG ENTRANCE SIGN
	N/A	STORM DRAIN INLET
	N/A	STORM DRAIN MANHOLE
	N/A	TREE/BUSH
WV	WV	WATER VALVE
FH	FH	FIRE HYDRANT
	WM	WATER METER
B	B	BOLLARD
	N/A	LIGHT POLE
		STREET SIGN
	N/A	SATELLITE DISH
	N/A	FLAG POLE
	N/A	UTILITY POLE
T PED	N/A	TELEPHONE PEDESTAL

CONSTRUCTION PLAN
DELAWARE NATIONAL GUARD BETHANY BEACH TRAINING SITE

U.S. ROUTE 1

BALTIMORE HUNDRED SUSSEX COUNTY

DELAWARE

SCALE: 1"=20' SEPTEMBER 25, 2012

20 0 10 20 40 80

GRAPHIC SCALE (FEET)

NO.	DATE	REVISION	BY	APPROVED
2	08-20-13	PER FIRE MARSHAL COMMENTS	CAH	COM
1	08-02-13	PER DIVISION OF PUBLIC HEALTH COMMENTS	CAH	LMD

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SURVEYED BY:

COMPUTED BY: C. HALEY

PROJECT MANAGER C. MITCHELL

DRAWN BY: C. HALEY

FILE NAME	REVISION	SHEET
22932-WATER-01	2	2 OF 7

PERMANENT FILE	QA REVIEW	SIZE

APPROVED BY