

BECC

*Birmingham Engineering
& Construction Consultants, Inc.*

Geotechnical Engineering Services

Report for Subsurface Exploration and Engineering Evaluation for

*Navy Lodge Addition
NCBC Gulfport*

Gulfport, Mississippi

BECC Project Number: R1-9056

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December 8, 2009

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Subject: Report of Subsurface Exploration and
Geotechnical Engineering Evaluation for
Navy Lodge Addition – *NCBC Gulfport*
Gulfport, Mississippi
BECC Project Number: R1-9056

Dear Mr. Smith:


Birmingham Engineering and Construction Consultants, Inc. (*BECC*) has completed the authorized Subsurface Exploration and Geotechnical Engineering Evaluation for the subject project. This work was conducted in accordance with the agreement between BECC and the Mason and Hanger Group, detailed in our proposal Q1-9109R dated September 14, 2009.

The purpose of our work was to perform a limited subsurface exploration and geotechnical engineering evaluation for a new proposed lodge addition located at Combat Battalion Center in Gulfport, Mississippi. This report outlines the exploration procedures used, exhibits the data obtained, and presents our conclusions and recommendations. The recommendations provided herein are for the exclusive use of the proposed project. Further geotechnical exploration may be required once final design plans have been determined.

We sincerely appreciate the opportunity to have worked with you on this project. If you have any questions or if we may be of further service to you, please call us.

Respectfully submitted,
BECC, Inc.


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BORING LOCATION MAP
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1.0 EXECUTIVE SUMMARY

The project will consist of the construction of a new proposed lodge addition located at the Naval Combat Battalion Center in Gulfport, Mississippi. Our exploration was performed for general recommendations for the design-build project. The following is a brief summary of our explorations to date, including findings and conclusions and recommendations. Refer to subsequent sections within this report for detailed discussions of these topics.

- Five (5) soil test borings were drilled in the proposed building area to depths 50 feet, with one extending to 100 feet below the surface. The soil encountered was typically a loose to medium dense sand and clayey sand in the upper 8 feet, loose to medium dense sand and silty sand between 8 and 30 feet, very loose or very soft to loose of soft clayey sands, clay and silt from 30 to 50 feet, and medium dense to very hard silty and clayey sand and clay deeper than 50 feet. The material varied in coloration from red-brown to gray. Generally, the material was classified as poorly-graded silty sand (*SP*) and clayey sand (*SC*) with deeper soils classifying as clayey sand (*SC*) to clay (*CH*). Groundwater was encountered at approximately 3 to 6 feet below the ground surface at the time of our drilling.
- After removal of all vegetation and structures, the on-site near surface soils should be densified using a vibratory roller (*10 ton minimum weight*). The densification should be performed until the density test results indicate a dry density of at least 95 percent of the maximum dry density, by Modified Proctor (*ASTM D 1557*). Moisture conditioning of on-site soils to levels near the optimum moisture content may be necessary prior to the densification.
- A deep foundation system is recommended for the proposed structure. Pile capacities and other design parameters are presented in detail within this report. Based on the borings performed at the site and our knowledge of the site geology, we recommend a seismic site class definition of “F” be used in design calculations (*Table 1615.1.1 of the International Building Code, 2009*).
- Engineered fill should be compacted to a minimum of 95% of the Modified Proctor maximum dry density (*ASTM D 1557*) at a moisture content within 2% of the soil’s optimum moisture content.
- Bituminous pavement for standard vehicle parking should consist of minimum 6 inches of MDOT 825 B crushed aggregate base stone or crushed concrete, 2 inches of BC-1 bituminous concrete binder layer, and 1 inch of SC-1 bituminous concrete wearing surface. Heavy duty pavement sections for utility truck traffic should consist of a minimum 6 inches of MDOT 825 B crushed aggregate base stone or crushed concrete, 3 inches of BC-1 bituminous concrete binder layer, and 2 inches of SC-1 bituminous concrete wearing surface.
- Floor slab support should be considered with a subgrade reaction modulus of 200 pci for on-site soils.

NOTE: *This executive summary presents selected elements of our findings and recommendations only. It does not present crucial details needed for the proper application of our findings and recommendations. Our findings, recommendations, and application are related only through the full report, and are best evaluated with the active participation of the geotechnical engineer who developed them.*



2.0 SCOPE OF WORK

The purpose of our work was to perform a limited subsurface exploration and geotechnical engineering evaluation for an addition to the Navy Lodge at the Naval Combat Battalion Center in Gulfport, Mississippi. This work was conducted in accordance with the agreement between BECC and the Mason and Hanger Group, detailed in our proposal Q1-9109R dated September 14, 2009. The following items were included as part of our limited scope of work:

1. Five (5) soil test borings were drilled in the proposed building area to varying depths: four borings to 50 feet, and one boring to 100 feet below the ground surface.
2. Standard penetration tests were performed within the borings at each sample depth.
3. Laboratory tests to include Natural Moisture Content, Atterberg Limits, Percent Finer #200 Sieve, Mechanical Sieve Analysis, and California Bearing Ratio (*CBR*) Tests.
4. A geotechnical engineering report is to include the following items:
 - i. A dimensioned plot showing the location of test borings and/or excavations relative to local site features. Include road names and building numbers.
 - ii. A log of each boring shown individually on letter size sheets.
 - iii. The identification of the soils from the most recent USDA NRCS Soil Survey.
 - iv. Recommendations for foundation type, floor slab type and soil parameters to be used in design, including but not limited to: bearing capacity of natural or compacted soil; modulus of subgrade reaction, provisions to mitigate the effects of expansive soils; mitigation of the effects of liquefaction, differential settlement, and varying soil strength; minimum foundation depth for frost protection; and the effects of adjacent loads.
 - v. Expected total and differential settlement.
 - vi. Pile and pier foundation information. This information shall include, but not limited to the following:
 - Recommended pier or pile types and installed capacities.
 - Recommended center-to-center spacing of piers or piles.
 - Driving criteria.
 - Installation procedures.
 - Field inspection and reporting procedures (to include procedures for verification of the installed bearing capacity where required).
 - Pier or pile load test requirements.
 - Durability of pier or pile material.
 - Designation of bearing stratum or strata.
 - Reductions for group action, where necessary.



- vii. Special design and construction provisions for footings, foundations or slabs founded on expansive soils, as necessary.
- viii. Seismic site classification based on either shear wave velocity, Standard Penetration Resistance or Undrained Shear Strength as required by the International Building Code section 1615.1.
- ix. Lateral Earth Coefficients – (used in Retaining Wall Design)
 - Coefficient of Active Earth Pressure, “ k_a ”
 - Coefficient of Passive Earth Pressure, “ k_p ”
 - Coefficient of At-Rest Earth Pressure, “ k_o ”

***NOTE:** Our scope of work did not include evaluation of surface or subsurface environmental conditions normally associated with Phase I and Phase II Environmental Assessments, flood zone evaluations, velocity zone considerations, or any conditions related to local storm surges.*

3.0 PROJECT & SITE DESCRIPTION

The Navy Lodge Addition site was located approximately 250 ft east and 200 ft north of the northeast corner on 1st street and Ladd Circle. Several landmarks documented the boring site location. Navy lodging building 331 was approximately 150’ southeast of the boring site. Housing units 1000 to 1004 were located 50’ west of the site location. A baseball field, with a metal chain link fence isolating the field in the southern part of the field, was approximately 50’, and 250’ east of the Dependant activities center from the location of the boring site holes. In the northern and lower southern portion of the site two concrete sidewalk cut through going from east to west across the site. The site was an open park area for recreational activities by residents of the base.

Vegetation on the boring site included young long leaf pine trees and lawn grass. Lawn vegetation covered all the ground areas on the site and long leaf pine trees were located throughout the site. The topography of the site was relatively level with a slight incline at the northern portions of the site. The incline caused water pooling in the lower part of the site when a rain event occurred. However a drainage ditch ran from north to south through the site. The drainage ditch is located on the west side of the site. A street light was located on the north side of the sidewalk approximately 20’ from boring #4.

We understand the structure will be two levels. Detailed column or wall loads were not available to BECC at the time of this report.



4.0 SITE GEOLOGY

According to the Mississippi Geological Survey, the site is located in Alluvium Coastal Deposits, part of the Quaternary System & Holocene Age Systems in Harrison County.

Soils in this region were deposited by coastal delta waters and primarily consist of a mixture of unlithified sand (1/16 to 2 mm); an unconsolidated deposit consisting essentially of medium-grained clastic particles, and gravel composed predominantly of more or less rounded pebbles and small stones.

4.1 SEISMIC AND LIQUEFACTION CONSIDERATIONS

The subsurface conditions at the site consists of fine to medium grained quartz sands. There are soils at the site which are vulnerable to potential failure under seismic loading. These soils consist of loose clean sands (SP) located below the water table. Based on the borings performed at the site, we recommend a seismic site class definition of "F" be used in design calculations (*Table 1613.5.2 of the International Building Code, 2009*).

The computer program LIQUFAC developed by NAVFAC was used to evaluate the site's liquefaction potential. The sands between about 15 to 35 feet deep have the most potential to liquefy during an earthquake. The maximum surface ground acceleration was obtained from the USGS hazard maps. A value of 0.06g was used in our analysis. According to the hazard maps, the site has a 2% chance in 50 years there will be a ground acceleration of 0.06g or greater. The following is a summary of the analysis:

Soil Zone Depth (ft)	Maximum Acceleration (g)	Earthquake Magnitude (M)	Factor of Safety Against Liquefaction
15 to 35	0.06	4.0	1.32
		5.0	1.14
		6.0	0.97

The analysis indicates that the site is susceptible to liquefaction if an earthquake of 6.0 or greater occurs. Based on the USGS hazards maps there is a low risk of an earthquake of 6.0 or greater for this site location. Also, the foundation system for the structure will probably be a deep pile system that will be located below the soils that are at risk of liquefaction.



5.0 SUBSURFACE EXPLORATION

5.1 FIELD EXPLORATION

BECC performed five (5) borings between November 4th and 5th, 2009. The borings were located in the field prior to arrival of a BECC representative. The boring locations are shown on the “Boring Location Plan” in the Appendix and should be considered approximate.

5.2 SOIL BORINGS

Soil drilling and sampling operations were conducted according to ASTM D 1586. The test borings were advanced by mechanically twisting continuous steel auger flights. Within the test borings, soil samples were obtained with a standard 1.4 inch I.D., 2 inch O.D. split spoon sampler. The sampler was first seated 6 inches to penetrate any loose cuttings and was then driven an additional 12 inches with blows of a 140 pound hammer falling 30 inches. The number of blows (N) required to drive the sampler the final 12 inches of penetration is the “Standard Penetration Resistance”. The penetration resistance, when properly evaluated, is an index of the soil strength.

Representative portions of the samples obtained were then sealed in air-tight containers and transported to our laboratory. In the laboratory, the samples were classified by a geotechnical engineer. The soil description and the penetration resistance at the specific boring locations are indicated on the Logs of Boring in the Appendix. The samples were transported to our laboratory to perform additional tests. All the samples will be stored on our premises for 60 days from submittal of this report and then discarded unless additional storage time is requested. Examinations of boreholes for indications of groundwater level were performed during drilling.



6.0 LABORATORY TESTS

In addition to the field exploration, a laboratory testing program was conducted to ascertain additional engineering characteristics of the subgrade materials and for construction recommendations. To supplement the visual classification of the soil samples, the following tests were performed (*results are shown on the "Geotechnical Lab Summary" and the "Log of Boring" sheets in the Appendix*):

6.1 NATURAL MOISTURE CONTENT (ASTM D 2216)

Natural moisture contents ($M\%$) were determined on selected samples. The natural moisture content is the ratio, expressed as a percentage, of the weight of water in a given amount of soil to the weight of solid particles.

6.2 ATTERBERG LIMIT TESTS (ASTM D 4318)

Atterberg Limit tests were performed on the selected samples to determine how the characteristics change upon variation in moisture stage. The limits are bracketed by the Liquid Limit (LL) and the Plastic Limit (PL). The Liquid Limit is the moisture content at which the soil will flow as a heavy viscous fluid. The Plastic Limit is the moisture content at which the soil is between the "plastic" and semi-solid stage. The soil's Plasticity Index (PI) is the difference between the Liquid Limit and the Plastic Limit. The PI is often used as the indicator of the soil's expansive tendencies. The greater the difference between the LL and the PL , the more potentially expansive the soil can be.

6.3 PERCENT PASSING #200 SIEVE (ASTM D 1140)

Wash #200 tests were performed on the selected samples to determine the amount of "fines" in the represented soil. "Fines" are defined as particles with a grain size equal to or less than a diameter of 0.075 millimeters. These particles are typically found in silts, clays, and silty clays, but can be present in silty sands.

6.4 PARTICLE DISTRIBUTION OF AGGREGATES (ASTM C 136)

The soil samples were mechanically sieved using various sieve sizes necessary for determining the distribution of particle sizes in each sample. This data was used to correlate our visual descriptions with the Unified Soil Classification System.

6.5 DESCRIPTION OF SOILS (VISUAL-MANUAL PROCEDURE) (ASTM D 2488)

The soil samples were visually examined by our engineer and soil descriptions were provided. Representative samples were then selected and tested to determine soil classification as described above. This data was used to correlate our visual descriptions with the Unified Soil Classification System.



6.6 LABORATORY CALIFORNIA BEARING RATIOS (ASTM D 1883)

The California Bearing Ratio, usually abbreviated as CBR, is a punching shear test. The CBR value is a semi-empirical index of the soil's strength and deflection characteristics, and has been correlated with pavement performance to establish design curves for pavement thickness. The test was performed on 6-inch diameter, 5-inch thick discs of compacted soil, confined in a steel cylinder.

The specimens were soaked for 96 hours prior to testing. A piston approximately 2-inches in diameter was then forced into the soil at a standard rate to determine the resistance to penetration. The CBR is the ratio, expressed as a percentage, of the actual load required to produce a 0.1 inch deflection and of that required for the same deflection in a certain standard crushed stone.

A CBR test was performed on a bulk sample obtained from the auger cuttings of the soil borings in the proposed parking area. The results of the CBR test are given in the "Geotechnical Lab Summary" and the "Report of Moisture Density/CBR Relationships" sheets in the Appendix.

7.0 SUBSURFACE CONDITIONS

Details of the subsurface conditions encountered by the test borings are shown on the "Log of Boring" sheets in the Appendix of this report. The general subsurface conditions encountered and their pertinent characteristics are described in the following paragraphs. The stratification lines indicated on the Logs of Boring represent approximate boundaries between soil types. However, the actual transition may be gradual. Conditions represented by the test borings should be considered applicable only at the test boring locations on the dates shown, and it should be assumed that the conditions may be different at other locations at other times.

7.1 UPPER SOILS (0 TO 8 FEET BELOW THE SURFACE)

Upper soils were composed of sands and clayey sands, which generally varied in color from gray-brown to yellow-red. Standard penetration resistance tests (*N-values*) within the upper soils ranged from 5 to 21 blows per foot (bpf), indicating a loose to medium dense consistency. **N-values in this zone varied, but averaged 12 bpf, indicating an average medium dense consistency.** Loose soils were typically in the upper 5 feet and transitioned to a typical medium dense consistency below.

Laboratory tests performed on the soils resulted in a classification of a poorly-graded sands (*SP*) and clayey sands (*SC*) based on the Unified Soil Classification System (*USCS*). Natural moisture content tests on the material ranged from 11.0% to 22.2%. See the "Geotechnical Lab Summary" in the Appendix for more details.



7.2 UPPER-MIDDLE SOILS (8 TO 30 FEET BELOW THE SURFACE)

Upper-middle soils were composed of sands and silty to clayey sands, which generally varied in color from gray-brown to dark brown. **N-values within the upper-middle soils ranged from 3 to 25 bpf, indicating a very loose to medium dense consistency sands.**

Laboratory tests performed on the soils resulted in a classification of a poorly-graded sands and silty sands (*SP & SP-SM*) and clayey sands (*SC*), based on the Unified Soil Classification System (*USCS*). Natural moisture content tests on the material ranged from 18.1% to 31.4%. See the “Geotechnical Lab Summary” in the Appendix for more details.

7.3 MIDDLE-LOWER SOILS (30 TO 50 FEET BELOW THE SURFACE)

Middle-lower soils were composed of sands, sometimes sandy clay and silt, which were generally gray in color. N-values within the middle-lower soils ranged from 0 bpf to 30 bpf, indicating a very loose to medium dense consistency. **N-values in this zone varied but averaged 5 bpf, indicating a typical very loose to loose consistency.** The higher N-values were not typical in this zone and were typically encountered at the stratification lines between differently classified materials, such as from sand to clayey sand.

Laboratory tests performed on the soils resulted in a variation of classifications of clayey sand (*SC*), very low-plasticity silt (*ML*), and low to medium plasticity clays (*CL*) based on the *USCS*. Natural moisture content tests on the material ranged from 20.1% to 48.3%. See the “Geotechnical Lab Summary” in the Appendix for more details.

7.4 LOWER SOILS (DEEPER THAN 50 FEET BELOW THE SURFACE)

Lower soils were composed of sands, clayey sands, and clays, which generally varied in color from gray to blue-gray. N-values within the deep soils ranged from 18 to greater than 100 bpf, indicating a medium dense to very dense consistency. **N-values in this zone varied but averaged 40 bpf, indicating a typical very dense consistency.** The higher N-values were encountered in the deeper clayey sands from 90 to 100 feet below the surface.

Laboratory tests performed on the soils resulted in a classification of a poorly-graded silty sand (*SP-SM*), clayey sand (*SC*) and high-plasticity clay (*CH*), based on the *USCS*. Natural moisture content tests on the material ranged from 18.0% to 39.3%. Three Atterberg Limits tests were performed on the deep clay material resulting in liquid limits (*LL*) ranging from 63 to 69 and plasticity indexes (*PI*) ranging from 42 to 46, with 72.1% to 86.5% of particles passing a #200 sieve. This high-plasticity material was encountered between 70 and 100 feet below the existing surface. See the “Geotechnical Lab Summary” in the Appendix for more details.



7.5 GROUNDWATER

Groundwater was encountered at 3 and 6 feet below the surface in each boring during drilling operations. The presence or absence of water in the boreholes at the time of drilling does not necessarily mean that groundwater will or will not be present at other times. Groundwater levels fluctuate seasonally and are related to the amount of rainfall received in months prior to the observations.

8.0 SITE PREPARATION AND GRADING CONSIDERATIONS

A review of the final grading plans should be conducted by BECC, Inc., and subsequently some of the comments and recommendations included in this report may require modifications.

8.1 EXISTING STRUCTURES & SITE CLEARING

All existing structures (*including above and below ground construction*) within the areas to be developed, should be removed prior to the initiation of construction. Removal should include any asphalt, vegetation, topsoil, underground pipes and utilities, etc., that might interfere with construction. If abandoned underground utilities are to be removed prior to initiation of construction, provisions should be made in the construction specifications and budget to restore the subgrade to a stable condition. Restoration should include backfilling and compaction of the excavated natural areas.

8.2 RECONDITIONING OF ON-SITE SOILS

After removal of all vegetation and structures, the on-site near surface soils should be densified using a vibratory roller (*10 ton minimum weight*). The densification process should be monitored by means of in-place density tests at the surface. The densification should be performed until the density test results indicate a dry density of at least 95 percent of the maximum dry density, by Modified Proctor (*ASTM D 1557*). Moisture conditioning of on-site soils to levels near the optimum moisture content may be necessary prior to the densification.

8.3 CONDITIONING OF THE SUBGRADE SOILS

Following the densification process, areas which are at grade, or which are to receive fill should be evaluated by a BECC representative. This observation may include proofrolling with a loaded dump truck or other pneumatic-tired construction equipment. The geotechnical engineer, by field examination, can determine the extent of any undercutting or reconditioning necessary to prepare an adequate subgrade. Provisions should be made in the construction specifications and budget for undercutting and/or stabilizing of poor quality upper soils. The specifications should also state that clean engineered fill must be used to replace all undercut soils.



8.4 CONTROLLED STRUCTURAL FILL

In our opinion, engineered fill at the site should be free of organics and debris, and rocks greater than 3 inches in size. Structural fills should be composed of soils with a liquid limit less than 50 and a plasticity index of 25 or less, and have a maximum dry density of greater than 100 pcf. All fill should be compacted to a minimum of 95 percent of maximum dry density, as determined by the Modified Proctor (*ASTM D 1557*). A sufficient number of field density tests should be performed to evaluate the grading contractor's performance during filling. Lift thickness for general fills should be limited to eight inches loose measure. Backfilling in limited access areas such as utility trenches should have a lift thickness limited to six inches loose measure.

We recommend structural fill be placed within 2 percent of optimum moisture content. The grading contractor should acknowledge the importance of proper fill moisture conditioning. **We suggest that the project specifications address that both fill compaction and acceptable moisture content be required for the acceptance of structural fills.** It will be particularly important to have a water truck available if filling takes place during the hot, dry summer months.

8.5 BACKFILLING OF UTILITY TRENCHES

Backfilling of storm drain and utility trenches is often accomplished in an uncontrolled manner, leading to subsequent settlement of the fill and cracking of pavements. In our opinion, utility trenches should be backfilled with acceptable fill in six inch lifts and compacted to specifications with pneumatic-piston tampers to the project requirements. Should seepage occur in utility trenches, it may be necessary to "floor" the trench with compacted open-graded gravel to provide a dry working surface.

8.6 SURFACE DRAINAGE & PROTECTION OF SOILS DURING GRADING

Proper surface drainage will be important during grading at the site. If the soils become wet after being exposed it may become necessary to undercut or recondition. On many projects reworking of disturbed soils becomes a point of controversy. In our opinion, the specifications for this project should provide performance guidelines for protection of exposed soils and correction of disturbed areas.



9.0 FOUNDATION RECOMMENDATIONS

The evaluations stated in the following paragraphs are based on the general data obtained through our exploration and experience with similar structures and subgrade conditions. Detailed column or wall loads were not available to BECC at the time of this report. Additional geotechnical exploration and evaluation may be necessary once final plans and design parameters have been determined.

Based on the structure type information provided by Mason and Hanger and the very loose sands encountered below the surface at the site, we recommend the building be supported on deep foundations such as auger cast concrete piles or driven precast concrete piles. The following table lists design parameters for various size auger cast piles and driven piles installed to varying depths:

PILE CAPACITIES (Allowable)					
Pile Type	Pile Size (in.)	Pile Length (ft.)	Downward Capacity (kips)	Upward Capacity (kips)	Estimated Settlement (in.)
Auger Cast	16	50	47	27	0.06
	16	75	114	78	0.11
	16	95	284	224	0.37
	18	50	59	32	0.07
	18	75	136	91	0.10
	18	95	330	256	0.34
	Driven Precast Concrete	12	50	61	34
12		75	125	87	0.15
12		95	281	227	0.39
14		50	81	43	0.04
14		75	156	107	0.13
14		95	341	270	0.42

We recommend a pile spacing of twice the pile diameter but not less than 30 inches. At least one compressive pile load test (ASTM D1143, standard loading) should be performed to twice the design load to confirm foundation design calculations, construction procedures, and the contractor's ability to install the specified piling. Documentation of the test pile program will verify recommendations for this foundation system including specific installation procedures (driving criteria) and final design depth.



10.0 BITUMINOUS PAVEMENT RECOMMENDATIONS

In areas that will be paved and are not at grade or will be cut, the soils exposed should be scarified, moisture conditioned and compacted to 95% of their Modified Proctor maximum dry density. The rational pavement design method requires a CBR test be performed on the **actual soils** exposed at finished subgrade level.

In areas that will be paved and are not at grade or will be cut, the soils exposed should be scarified, moisture conditioned and compacted to 95% of their Modified Proctor maximum dry density. The rational pavement design method requires a CBR test be performed on the **actual soils** exposed at finished subgrade level.

We understand that new bituminous pavement will be required in the parking area for the new facility. Laboratory CBR values for the on-site soils varied from 7 to 24. We recommend a typical **minimum** MDOT “ST” designation pavement section (*automobile parking lot*) with good subgrade condition (*CBR value of 6 or greater*) of 6 inches of MDOT 825 B crushed aggregate base stone or crushed concrete, 2 inches of BC-1 bituminous concrete binder layer, and 1 inch of SC-1 bituminous concrete wearing surface.

Pavement areas subject to truck traffic should consist of 6 inches of MDOT 825 B crushed aggregate base stone or crushed concrete, 3 inches of BC-1 bituminous concrete binder layer, and 2 inches of SC-1 bituminous concrete wearing surface. All pavement materials and installation procedures should meet the Mississippi Department of Transportation (*MDOT*) specifications.

10.1 GENERAL PAVEMENT CONSIDERATIONS

Typically during construction, pavement subgrades become disturbed because of traffic and environmental conditions. Prior to construction of pavements, it is essential that the subgrade be restored to a properly compacted condition. The specifications should include notes pertaining to subgrade restoration immediately prior to pavement construction.



11.0 FLOOR SLAB SUPPORT

Floor slab support may be achieved from medium dense reconditioned surface soils. We recommend a maximum modulus of soil reaction of 200 pci, based on the soil types encountered during our exploration. We also recommend soils in floor slab areas be compacted to a minimum of 95% of the Modified Proctor maximum dry density (*ASTM D 1557*). In our opinion, a maximum particle size of one inch is for the underslab granular material should be considered.

On most projects, there is a significant delay between initial grading and the time when the contractor is ready to construct the floor slabs. Even though the soils may have been placed and compacted in the manner discussed in the following sections, exposure to weather, construction traffic, etc., can destroy the integrity of subgrade soils. On many projects, this becomes a point of controversy when remedial work is required for proper floor slab support.

Prior to the construction of floor slabs, the subgrade should be evaluated by a geotechnical engineer. This evaluation may include proofrolling. We suggest that provisions be included in the project specifications for the contractor to restore the subgrade soils to an acceptable condition, (as discussed in this report) prior to the construction of slabs. Such restoration may include moisture conditioning of the surficial soils and recompaction to the project requirements.



12.0 RETAINING WALLS

Walls that also function as retaining walls and are restricted from movement should be designed for an “at rest” pressure condition. The design earth pressure is also a function of the type of material retained, slope profile, surcharge loads, hydrostatic conditions, and potential for future loading.

12.1 DESIGN PARAMETERS

We recommend that the walls be backfilled with free-draining granular material (#57 crushed aggregate or “clean” sands (SP or SW) compacted in maximum 8” loose lifts in a 45° wedge extending up from the wall foundation. Under these conditions, the following design parameters are recommended:

Material	#57 stone	Sand (SP or SW)
Active Pressure	30 pcf ($k_a=0.27$)	40 pcf($k_a=0.27$)
At-Rest Pressure	47 pcf ($k_o=0.43$)	60 pcf ($k_o=0.50$)
Unit Weight	110 pcf	120 pcf
Passive Pressure of On-Site Soils	---	360 pcf*($k_p=0.50$)
Coefficient of Friction between Footing Concrete and Bearing Soils	---	0.40

* value is allowable passive pressure to limit wall deflection

12.2 CONSTRUCTION CONSIDERATION

The earth pressures discussed above are based on a fully drained condition. Retaining walls should be provided with weep holes and/or foundation drainage as appropriate. **If walls are constructed below the water table, groundwater forces will needed to be added to the forces listed in the above table.**

Below grade walls designed for an “Active Pressure” condition are anticipated to move after backfill is placed. This commonly results in some settlement of the backfill soil and movement of structures supported on the fill. Future settlement can be reduced by allowing sufficient time for wall movement after backfilling and prior to other construction.

Retaining wall problems often occur due to improper construction practices such as backfilling with unsuitable material, inadequate compaction, damage to waterproofing, and improper installation of drains. In addition, all debris, water and soft or loose soils should be removed from behind retaining walls prior to backfilling and compaction. Proper field quality control by the contractor will be necessary for long term satisfactory performance of basement and retaining walls.



13.0 CONSTRUCTION MONITORING

We strongly recommend that Birmingham Engineering and Construction Consultants, Inc. be retained to provide a comprehensive construction-monitoring program when the project proceeds. This program would assist the owner in determining that the work is being carried out in general conformance with the plans and specifications and help avoid the potential of change orders and cost overruns. Construction monitoring includes testing of construction materials such as compacted fill and concrete. Also included is engineering observation during the site preparation, foundation and wall construction phases of the project.

Monitoring/testing during the earthwork and foundation construction phases is particularly important since assumptions and evaluations have been made based on the soil boring data. Confirmation that actual subsurface conditions are comparable to the assumed conditions is an essential part of the subsurface exploration process.

13.1 SUBGRADE OBSERVATION, PROOFROLLING

The purpose of proofrolling will be to densify the exposed near-surface soils and also to reveal soft pockets of soil that will require remedial measures. Areas that pump or rut during the proofrolling operations should be undercut or reconditioned. The geotechnical engineer can determine the depth and extent of areas that will require undercutting.

13.2 FILL MONITORING

We recommend that in-place density tests should be performed in the field by an engineering technician to evaluate the contractor's performance with regard to meeting the project specifications for fill placement. A commonly used testing frequency is one test per eight to twelve inch lift to fill placed per 2,500 square feet of fill area. The engineering technician can assist the grading contractor in soil moisture content evaluation by performing on-site fill moisture content tests.

13.3 FOUNDATION EXCAVATIONS & CONSTRUCTION

We recommend that the excavations for foundations be observed and tested by a BECC representative. Such testing is necessary to determine the appropriateness of the bearing level, the adequacy of the bearing materials and the conformity of the foundation to the specification with respect to depth, planned dimensions, cleanliness, etc.

For deep foundation systems, we recommend a BECC representative be present for installation observation and testing. Such quality control is important to insure proper installation and provide documentation of procedures and material used during construction.



14.0 GENERAL REMARKS/REPORT LIMITATIONS

This report has been prepared for the exclusive use of the **Mason and Hanger Group and the United States Navy** for specific application to the subject project. All recommendations contained in this report have been made in accordance with generally accepted geotechnical engineering practices. No other warranties are implied or expressed. In addition, the analysis and recommendations submitted in this report are based in part upon the data obtained from the soil test borings. The nature and extent of variations between the borings may not become evident until construction. If variations then appear evident, it may be necessary to re-evaluate the recommendations of this report.

We emphasize that this report was for general site conditions and not intended for design purposes. Contractors reviewing this report should acknowledge that the evaluations or recommendations and discussions herein are for general site conditions that may be encountered during construction and a final geotechnical exploration and evaluation should be performed for design purposes.

If significant changes are made in the character of the proposed development, a consultation should be arranged to review them with respect to prevailing subsurface conditions. At that time, it may be necessary to submit supplementary recommendations.

It is imperative that the geotechnical engineer be provided the opportunity to review the final plans and specifications to verify that the recommendations in this report are properly interpreted. It will be the client's responsibility to furnish the final grading and foundation plans to a BECC engineer for the necessary review. If the geotechnical engineer is not accorded the privilege of making this recommended review, we can assume no responsibility for misinterpretation of our recommendations.



APPENDIX A

GEOTECHNICAL LAB SUMMARY

Project Name: Navy Lodge Addition - NCBC Gulfport

BECC Project No.: R1-9056

Boring	Sample		% < #200	%M	LL	PL	PI	D10 Grain size (mm)	D30 Grain Size (mm)	D60 Grain Size (mm)	C _u	C _z	USCS
	Start Depth (ft.)	End Depth (ft.)											
B-1	1.0	2.5	23.6	11.0			---	0.0010	0.2350	0.3900	390.00	141.60	SC or SM
B-1	6.0	7.5		18.4			---				---	---	---
B-1	8.5	10.0	5.6	22.6			---	0.1650	0.2150	0.3500	2.12	0.80	SP-SM or SP-SC
B-1	18.5	20.0		22.8			---				---	---	---
B-1	23.5	25.0	15.6	31.3			---	0.1500	0.1850	0.2500	1.67	0.91	SC or SM
B-1	28.5	30.0	81.8	48.3	47	14	33				---	---	CL
B-1	33.5	35.0		45.6			---				---	---	---
B-1	38.5	40.0		30.4			---				---	---	---
B-1	43.5	45.0		22.4			---				---	---	---
B-1	48.5	50.0	34.8	28.3	28	12	16				---	---	SC
B-2	3.5	5.0		14.4			---				---	---	---
B-2	6.0	7.5		11.9			---				---	---	---
B-2	8.5	10.0		21.5			---				---	---	---
B-2	13.5	15.0	6.2	22.4			---	0.1700	0.2000	0.3000	1.76	0.78	SP-SM or SP-SC
B-2	18.5	20.0		21.7			---				---	---	---
B-2	23.5	30.0		30.3			---				---	---	---
B-2	33.5	35.0	25.9	31.6			---	0.0975	0.1700	0.5500	5.64	0.54	SC or SM
B-2	38.5	40.0		29.2			---				---	---	---
B-2	43.5	45.0		28.8			---				---	---	---

GEOTECHNICAL LAB SUMMARY

Project Name: Navy Lodge Addition - NCBC Gulfport

BECC Project No.: R1-9056

Boring	Sample		% < #200	%M	LL	PL	PI	D10 Grain size (mm)	D30 Grain Size (mm)	D60 Grain Size (mm)	C _u	C _z	USCS
	Start Depth (ft.)	End Depth (ft.)											
B-2	48.5	50.0	50.3	22.0	28	11	17				---	---	CL
B-3	1.0	2.5		16.1			---				---	---	---
B-3	3.5	5.0	3.0	22.6			---	0.0016	0.2250	0.3200	200.00	98.88	SP
B-3	6.0	7.5	4.9	21.1			---	0.1700	0.2400	0.3250	1.91	1.04	SP
B-3	8.5	10.0	2.0	22.3			---	0.1700	0.2600	0.3600	2.12	1.10	SP
B-3	13.5	15.0		18.3			---				---	---	---
B-3	23.5	25.0		23.0			---				---	---	---
B-3	28.5	30.0		22.7			---				---	---	---
B-3	33.5	35.0		31.4			---				---	---	---
B-3	38.5	40.0		32.4			---				---	---	---
B-3	43.5	45.0	26.6	41.2	31	8	23				---	---	SC
B-3	48.5	50.0		27.8			---				---	---	---
B-3	53.5	55.0		18.0			---				---	---	---
B-3	58.5	60.0	9.6	20.2			---	0.0900	0.2100	0.3400	3.78	1.44	SP-SM or SP-SC
B-3	68.5	70.0	22.9	24.9			---	0.0600	0.1000	0.1850	3.08	0.90	SC or SM
B-3	73.5	75.0	72.1	38.8	69	27	42				---	---	CH
B-3	78.5	80.0		39.3			---				---	---	---
B-3	83.5	85.0		28.1			---				---	---	---
B-3	88.5	90.0	76.1	33.9	65	27	38				---	---	CH

GEOTECHNICAL LAB SUMMARY

Project Name: Navy Lodge Addition - NCBC Gulfport

BECC Project No.: R1-9056

Boring	Sample		% < #200	%M	LL	PL	PI	D10 Grain size (mm)	D30 Grain Size (mm)	D60 Grain Size (mm)	C _u	C _z	USCS
	Start Depth (ft.)	End Depth (ft.)											
B-3	93.5	95.0		35.6			---				---	---	---
B-3	98.5	100.0	86.5	32.5	63	17	46				---	---	CH
B-4	1.0	2.5	23.5	16.6			---	0.0620	0.2300	0.3450	5.56	2.47	SC or SM
B-4	3.5	5.0		21.1			---				---	---	---
B-4	6.0	7.5	4.7	22.2			---	0.1900	0.2700	0.3800	2.00	1.01	SP
B-4	8.5	10.0		26.0			---				---	---	---
B-4	13.5	15.0		20.4			---				---	---	---
B-4	18.5	20	6.1	23.6			---	0.0850	0.1250	0.1900	2.24	0.97	SP-SM or SP-SC
B-4	28.5	30.0		36.8			---				---	---	---
B-4	33.5	35.0		30.0			---				---	---	---
B-4	43.5	45.0	34.6	29.8			---	0.0700	0.1000	0.1800	2.57	0.79	SC or SM
B-4	48.5	50.0		20.1			---				---	---	---
B-5	1.0	2.5	26.8	14.7			---	0.0550	0.2400	0.3700	6.73	2.83	SC or SM
B-5	3.5	5.0		15.4			---				---	---	---
B-5	6.0	7.5	10.4	19.5			---	0.2200	0.3000	0.4000	1.82	1.02	SP-SM or SP-SC
B-5	13.5	15		18.1			---				---	---	---
B-5	18.5	20.0		21.5			---				---	---	---
B-5	23.5	25.0		24.8			---				---	---	---
B-5	33.5	35.0		28.7			---				---	---	---

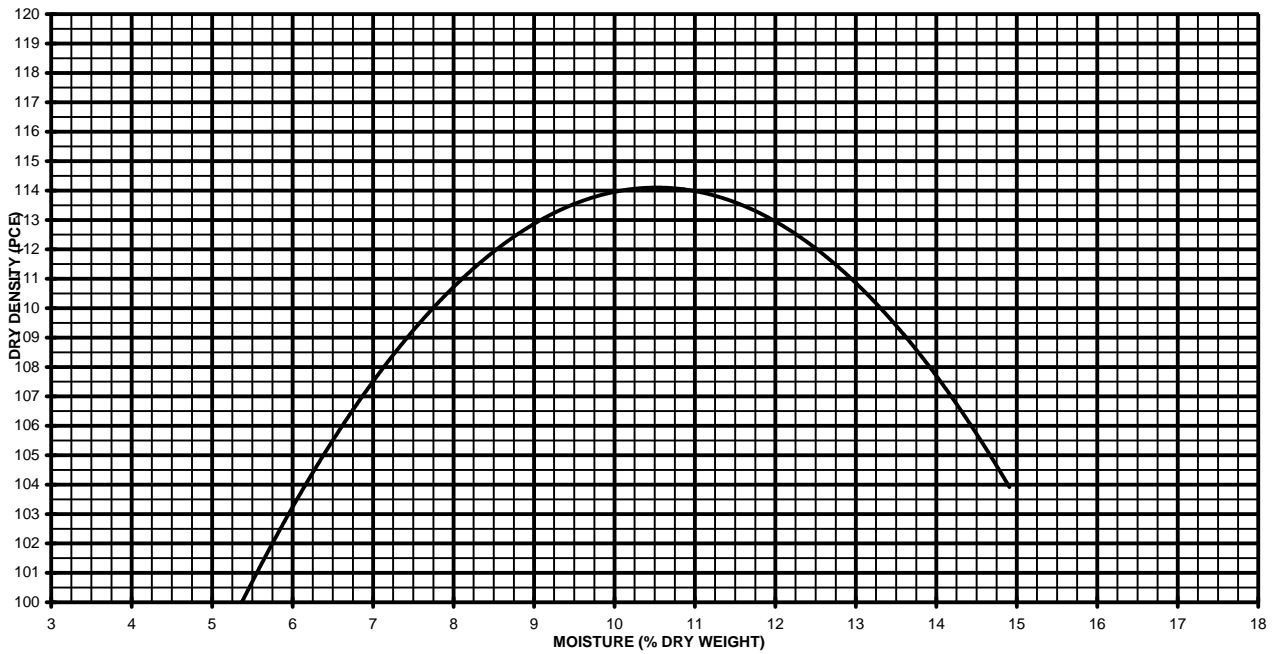
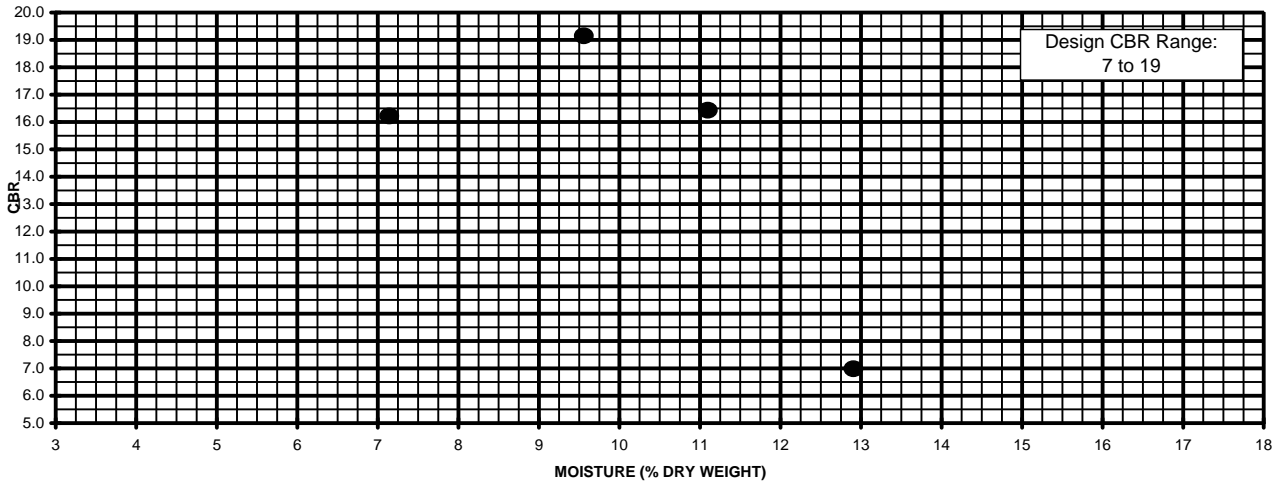
GEOTECHNICAL LAB SUMMARY


Project Name: Navy Lodge Addition - NCBC Gulfport

BECC Project No.: R1-9056

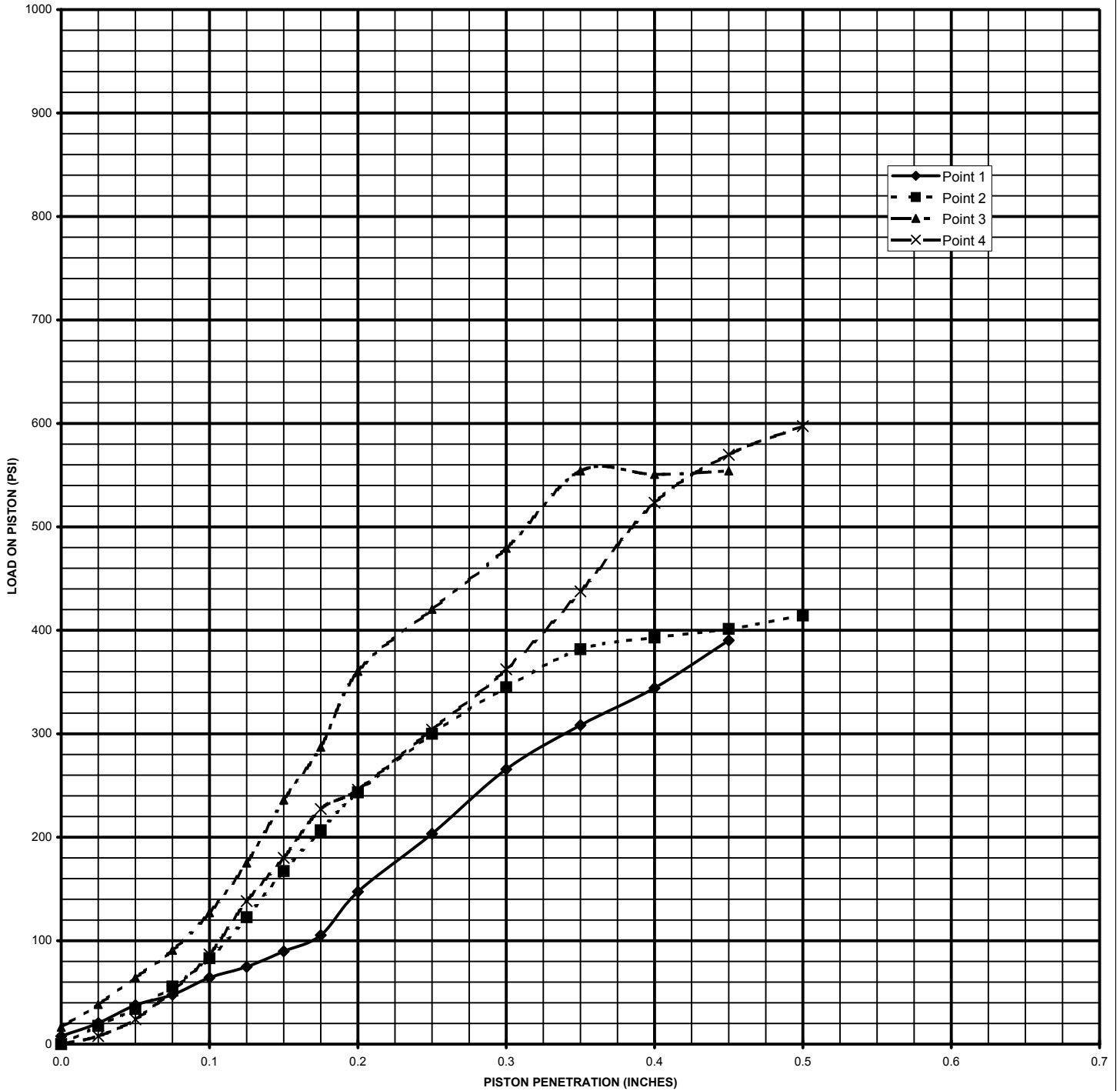
Boring	Sample		% < #200	%M	LL	PL	PI	D10 Grain size (mm)	D30 Grain Size (mm)	D60 Grain Size (mm)	C _u	C _z	USCS
	Start Depth (ft.)	End Depth (ft.)											
B-5	38.5	40.0	52.1	28.6	22	21	1				---	---	ML
B-5	43.5	45.0	26.5	31.8	30	15	15				---	---	SC
B-5	48.5	50.0		29.0			---				---	---	---

**REPORT OF MOISTURE-DENSITY / CBR RELATIONSHIP
ASTM D1883**



Elev./ Depth	USCS Classification	Swell Range (%) MIN MAX	G _s	L.L.	P.I.	% > ¾"	% > No. 4	% < No. 200
---	SM	0.09% 0.17%	---	---	---	---	---	13.7
Project Name: Project Number: Sample Location:	Navy Lodge Addition - NCBC Gulfport R1-9056 B-2 & B-3	Maximum Dry Density: 114.0 PCF	Material Description: Brown Silty SAND					
 BECC Birmingham Engineering & Construction Consultants, Inc.	Optimum Moisture Content: 10.5 %	Sample Number: G95131-9056	Remarks:					
	Design CBR Range 7 to 19	Test Method:	<input type="checkbox"/> Standard ASTM D 698 <input type="checkbox"/> Procedure A <input checked="" type="checkbox"/> Modified ASTM D 1557 <input type="checkbox"/> Procedure B <input type="checkbox"/> Procedure C					

CALIFORNIA BEARING RATIO TEST RESULTS
ASTM D1883



Project: Navy Lodge Addition - NCBC Gulfport
 Project #: R1-9056
 Date: 11/20/2009



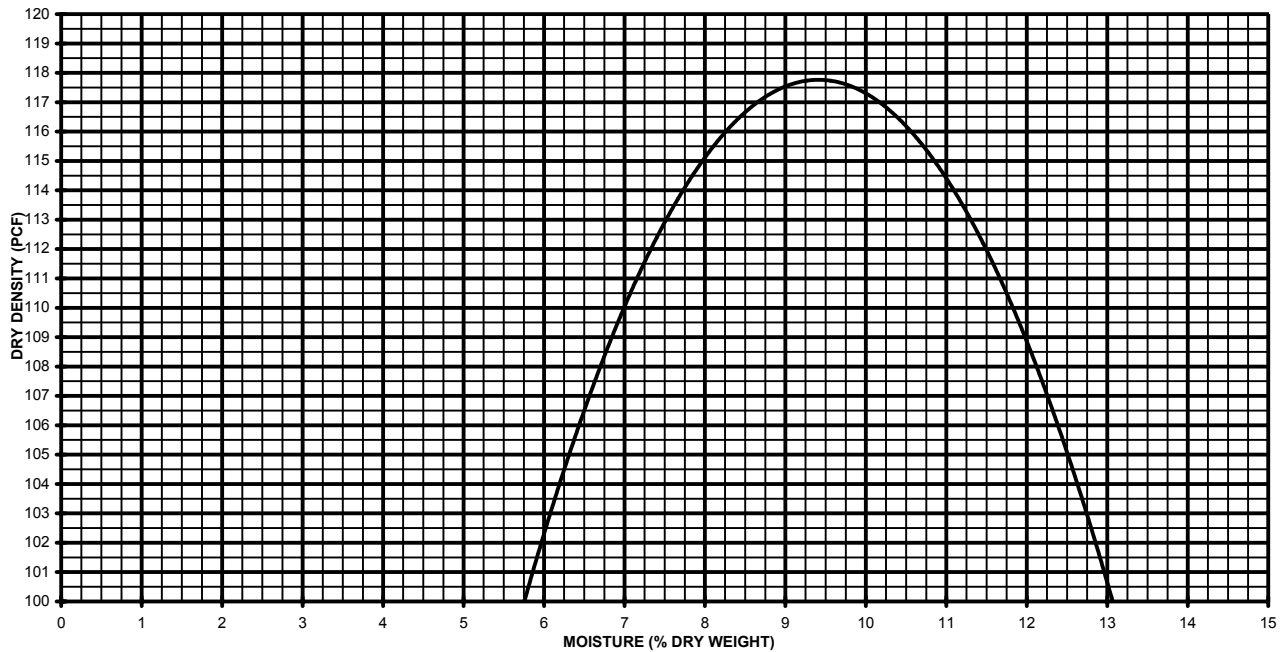
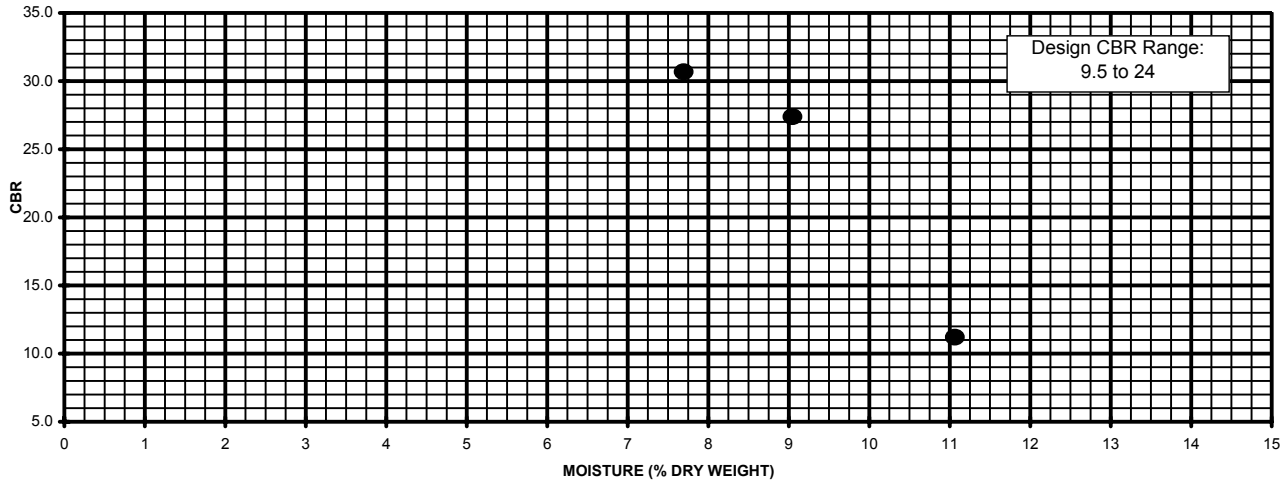
BECC
 Birmingham Engineering &
 Construction Consultants, Inc.


Sample No.	Molding Moisture (%)	Pre-Soak Dry Density (PCF)	Post-Soak Dry Density (PCF)	Post-Soak Moisture Content (%)	Change In Dry Density (PCF)	Swell (%)
Point 1	12.91%	112.0	112.8	12.91%	0.75	0.17%
Point 2	7.13%	111.6	112.9	13.40%	1.29	0.15%
Point 3	9.50%	112.8	115.1	12.87%	2.37	0.09%
Point 4	11.07%	112.4	113.5	12.28%	1.06	0.09%

Sample Number: G95131-9056

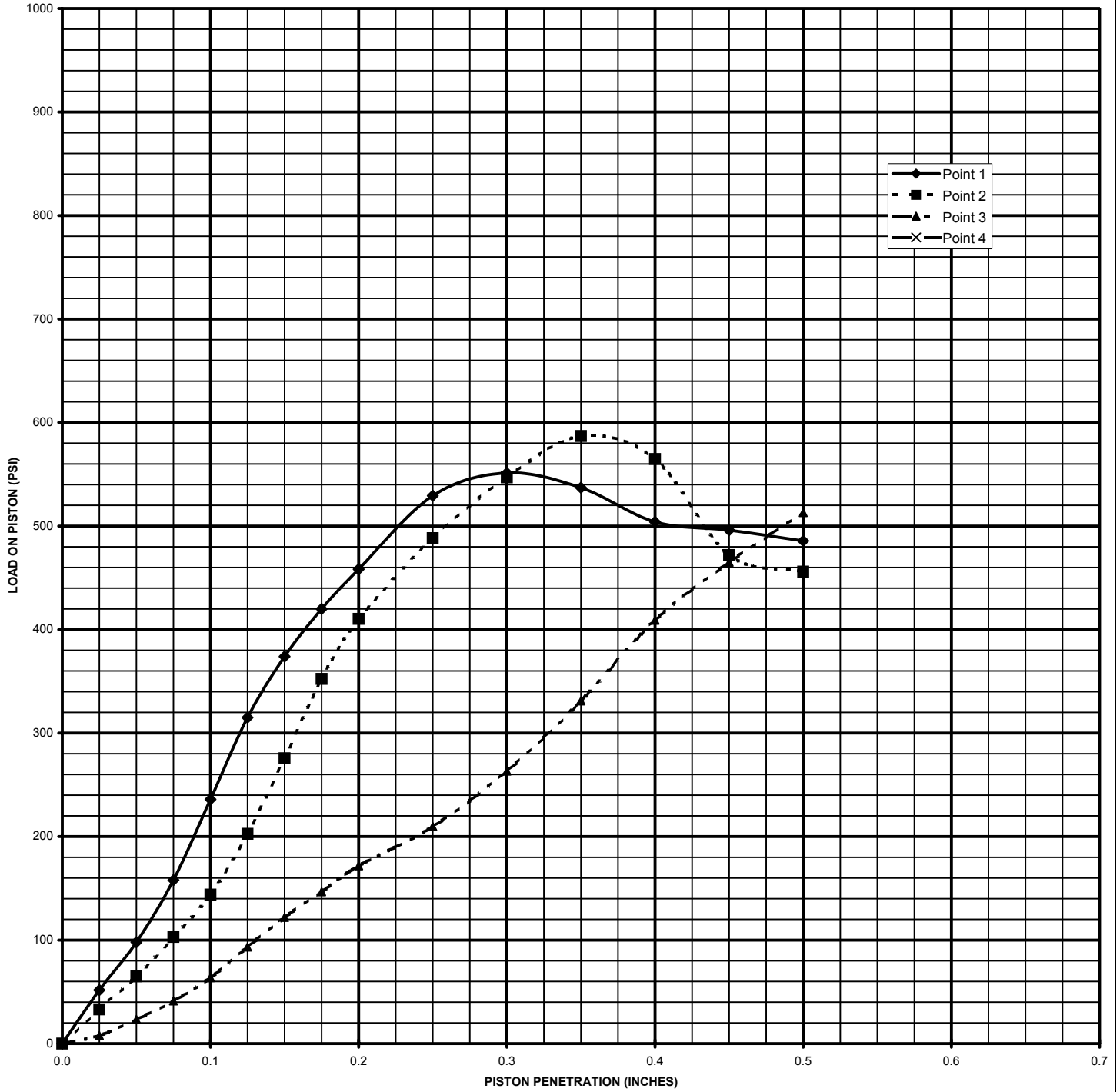
Sample Description: Brown Silty SAND

**REPORT OF MOISTURE-DENSITY / CBR RELATIONSHIP
ASTM D1883**



Elev./ Depth	USCS Classification	Swell Range (%) MIN MAX	G _s	L.L.	P.I.	% > ¾"	% > No. 4	% < No. 200
---	SM	0.09% 0.17%	---	---	---	---	---	12.2
Project Name: Project Number: Sample Location:	Navy Lodge Addition - NCBC Gulfport R1-9056 B-4 & B-5	Maximum Dry Density: 117.5 PCF	Material Description: Brown Silty SAND					
 BECC Birmingham Engineering & Construction Consultants, Inc.	Optimum Moisture Content: 9.5 %	Sample Number: G95132-9056	Remarks:					
	Design CBR Range: 9.5 to 24	Test Method: <input type="checkbox"/> Standard ASTM D 698 <input checked="" type="checkbox"/> Modified ASTM D 1557						

CALIFORNIA BEARING RATIO TEST RESULTS
ASTM D1883



Project: Navy Lodge Addition - NCBC Gulfport
 Project #: R1-9056
 Date: 11/20/2009

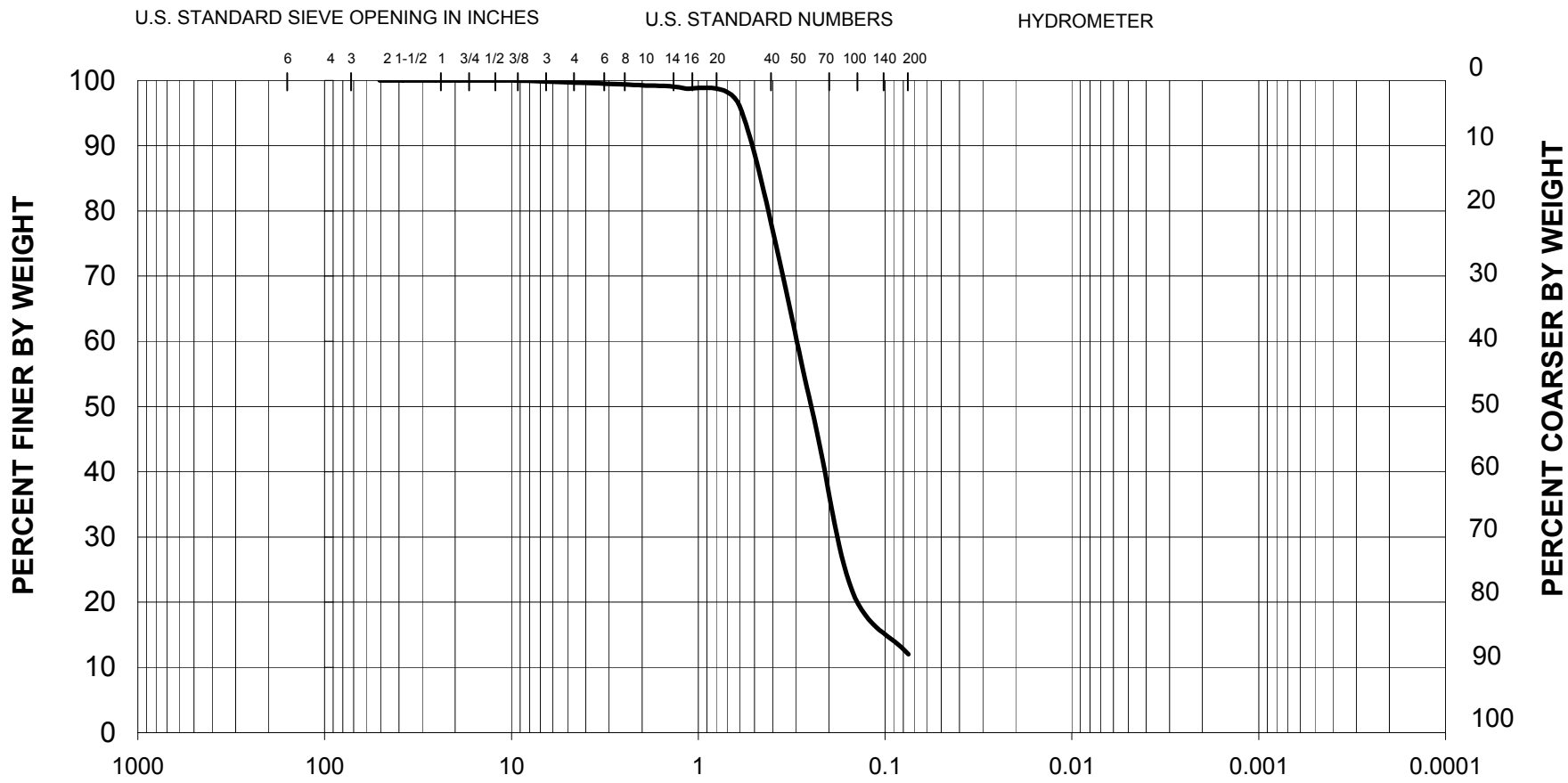


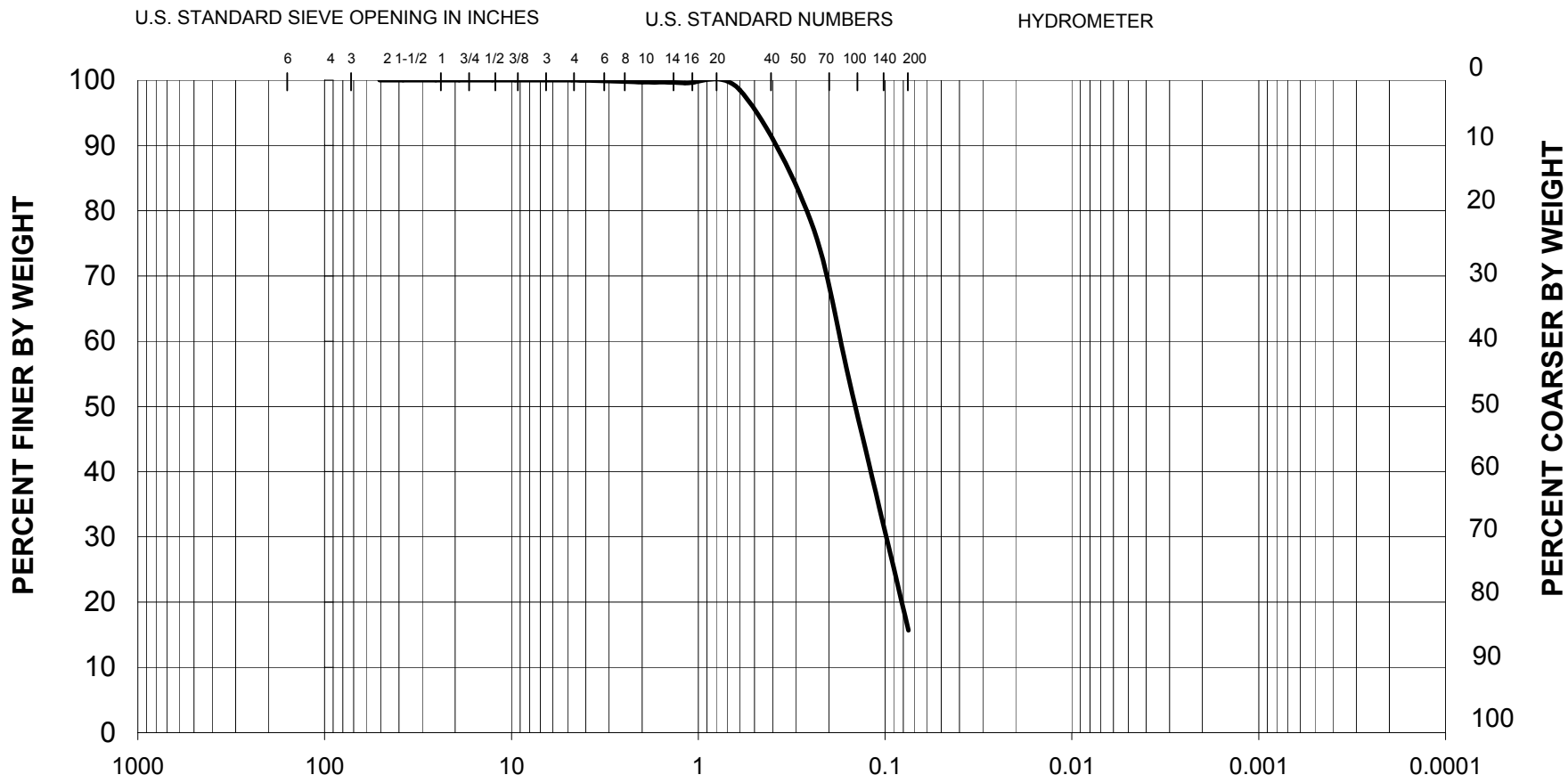
BECC
 Birmingham Engineering &
 Construction Consultants, Inc.

Sample No.	Molding Moisture (%)	Pre-Soak Dry Density (PCF)	Post-Soak Dry Density (PCF)	Post-Soak Moisture Content (%)	Change In Dry Density (PCF)	Swell (%)
Point 1	7.74%	115.4	116.4	11.69%	0.94	0.17%
Point 2	9.14%	115.7	116.3	12.19%	0.60	0.13%
Point 3	11.12%	114.5	115.7	11.93%	1.11	0.09%
Point 4						

Sample Number: G95132-9056

Sample Description: Brown Silty SAND





— G95127-9056 ····· Limit Requirements Min

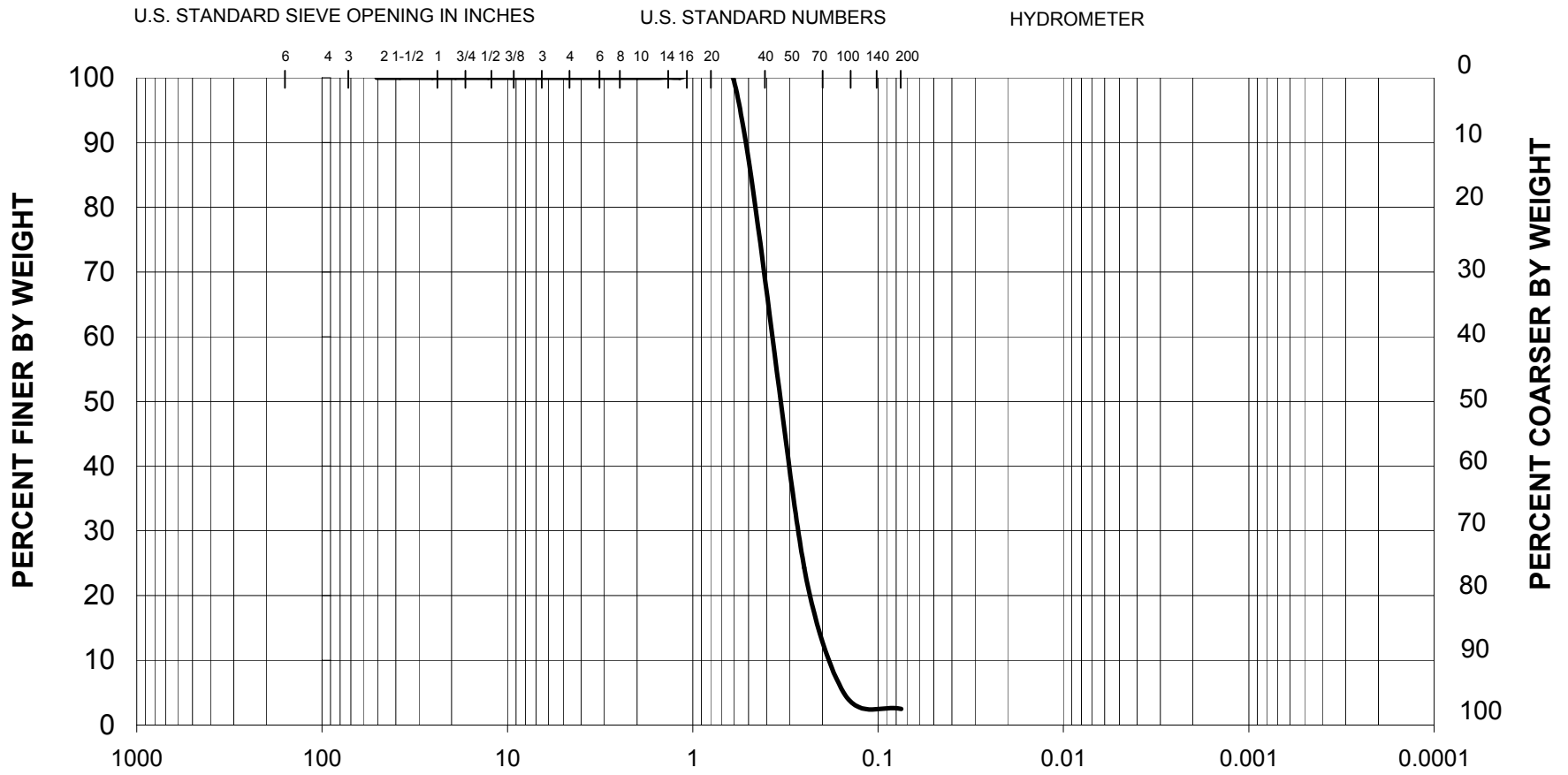
COBBLES	GRAVEL		SAND		SILT OR CLAY
	COARSE	FINE	COARSE	FINE	



Birmingham Engineering & Construction Consultants, Inc.
 360 Industrial Lane, Birmingham, AL 35211
 (205) 941-1119 FAX: (205) 941-1198

Project Name: Navy Lodge Addition
Project Number: R1-9056
Client: Mason and Hanger
Client Representative: Ron Smith
Report Date: 11/13/2009
Sample Location: B-4 / 43.5-45





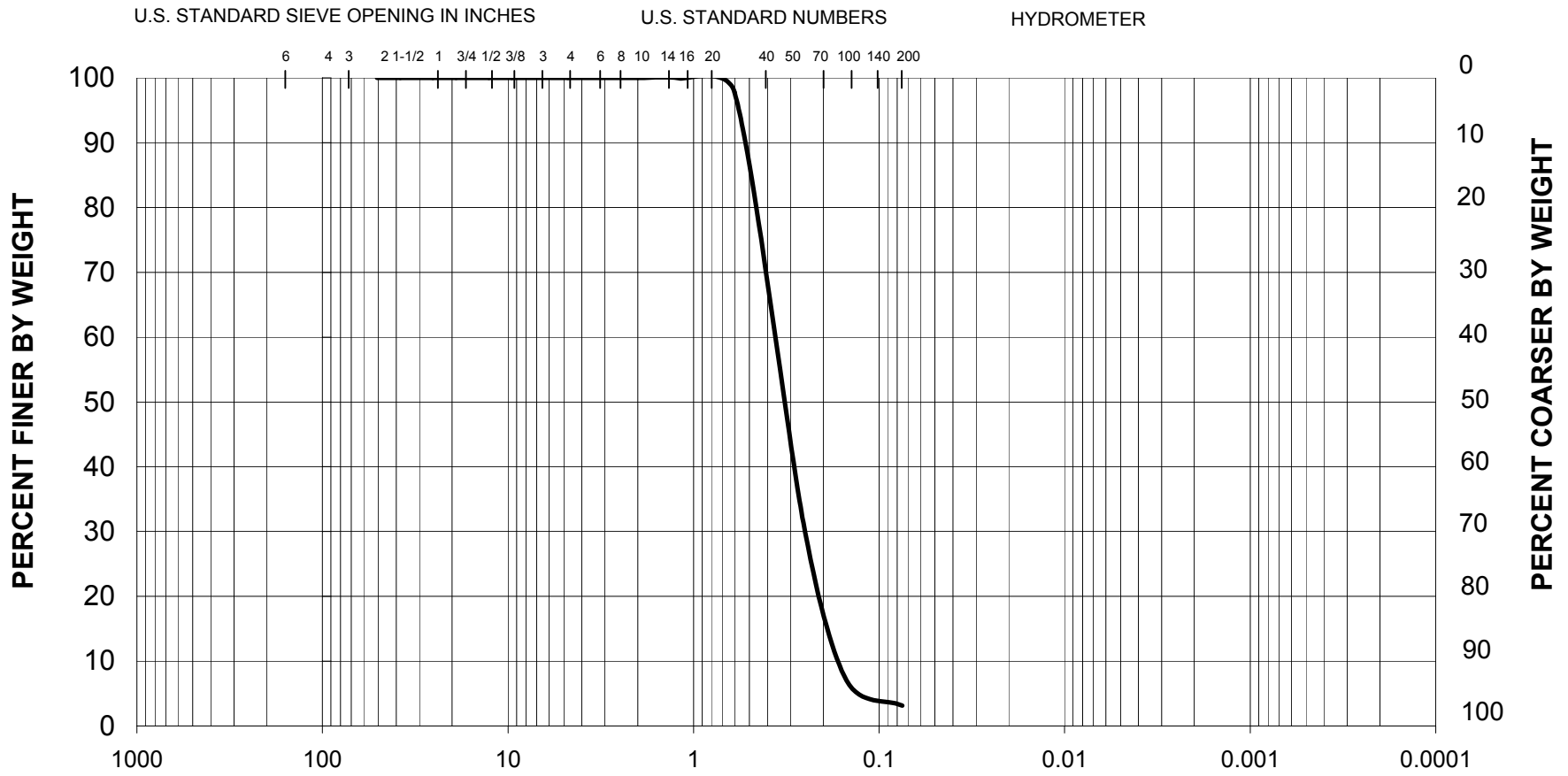
— G95127-9056 ····· Limit Requirements Min

COBBLES	GRAVEL		SAND		SILT OR CLAY
	COARSE	FINE	COARSE	FINE	



Birmingham Engineering & Construction Consultants, Inc.
 360 Industrial Lane, Birmingham, AL 35211
 (205) 941-1119 FAX: (205) 941-1198

Project Name: Navy Lodge Additions
Project Number: R1-9056
Client: Mason and Hanger
Client Representative: Ron Smith
Report Date: 11/13/2009
Sample Location: B-4 / 6-7.5



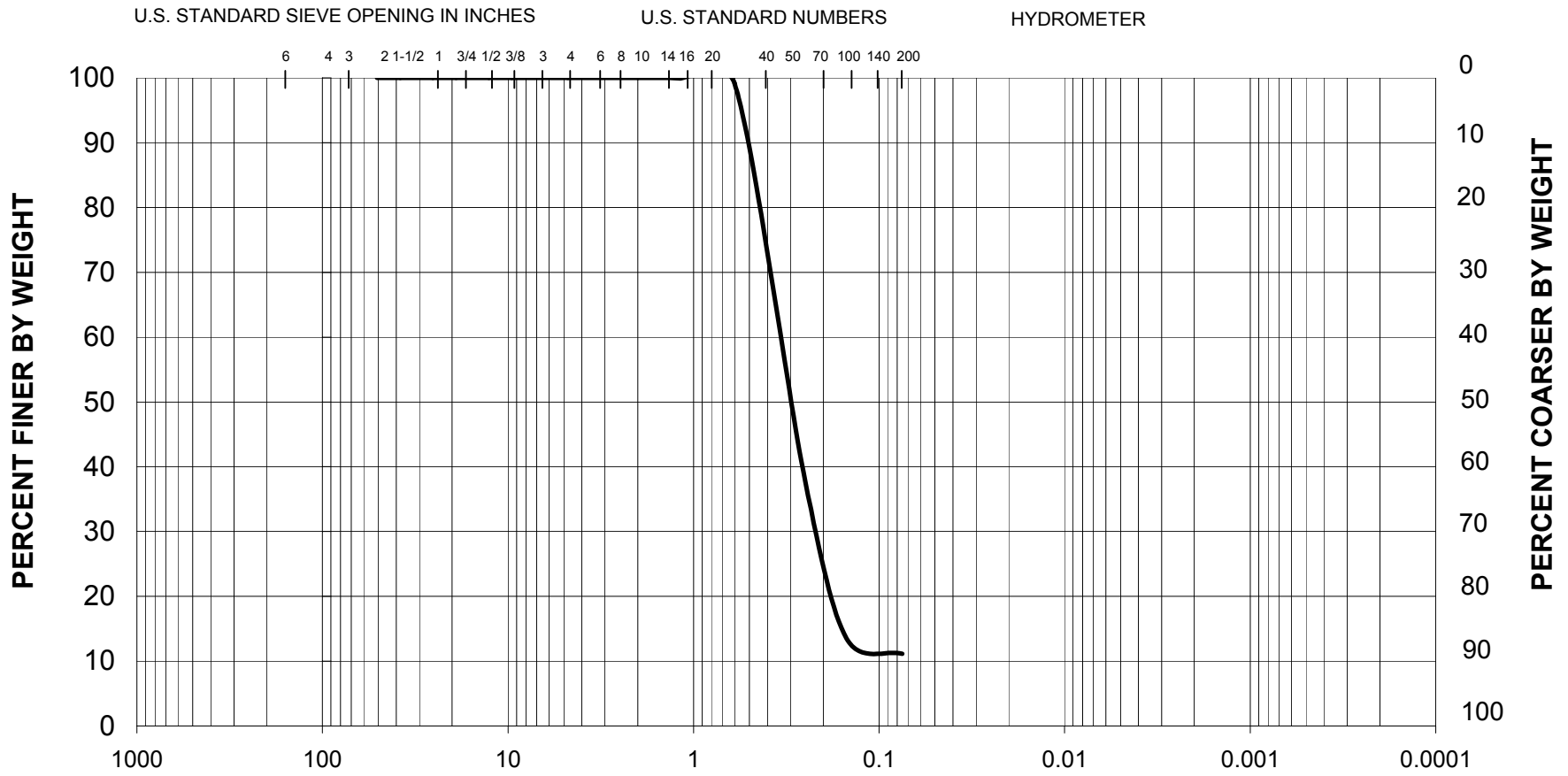
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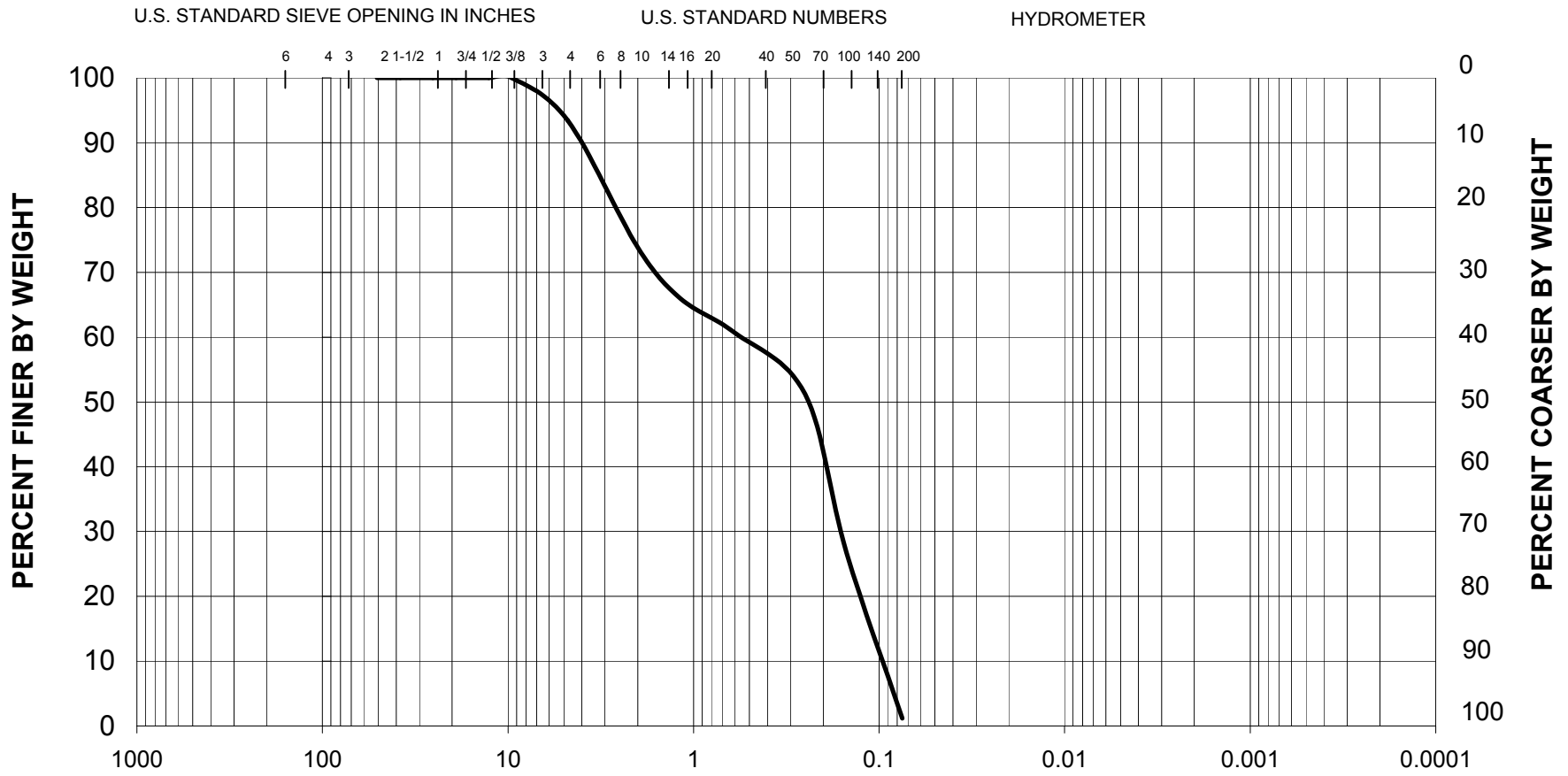
COBBLES	GRAVEL		SAND		SILT OR CLAY
	COARSE	FINE	COARSE	FINE	

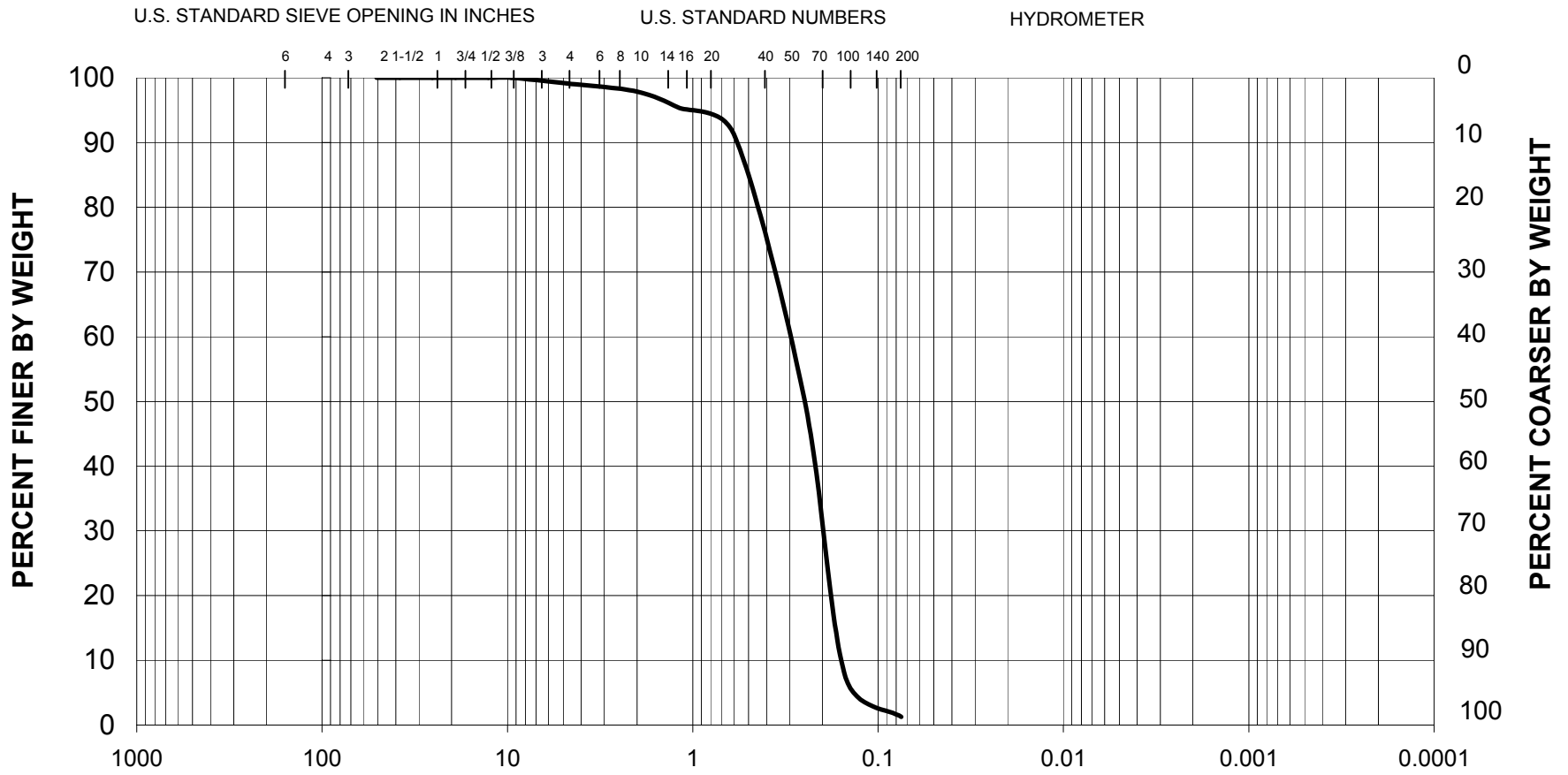


Birmingham Engineering & Construction Consultants, Inc.
 360 Industrial Lane, Birmingham, AL 35211
 (205) 941-1119 FAX: (205) 941-1198

Project Name: Navy Lodge Addition
Project Number: R1-9056
Client: Mason and Hanger
Client Representative: Ron Smith
Report Date: 11/12/2009
Sample Location: B-3 / 8.5-10







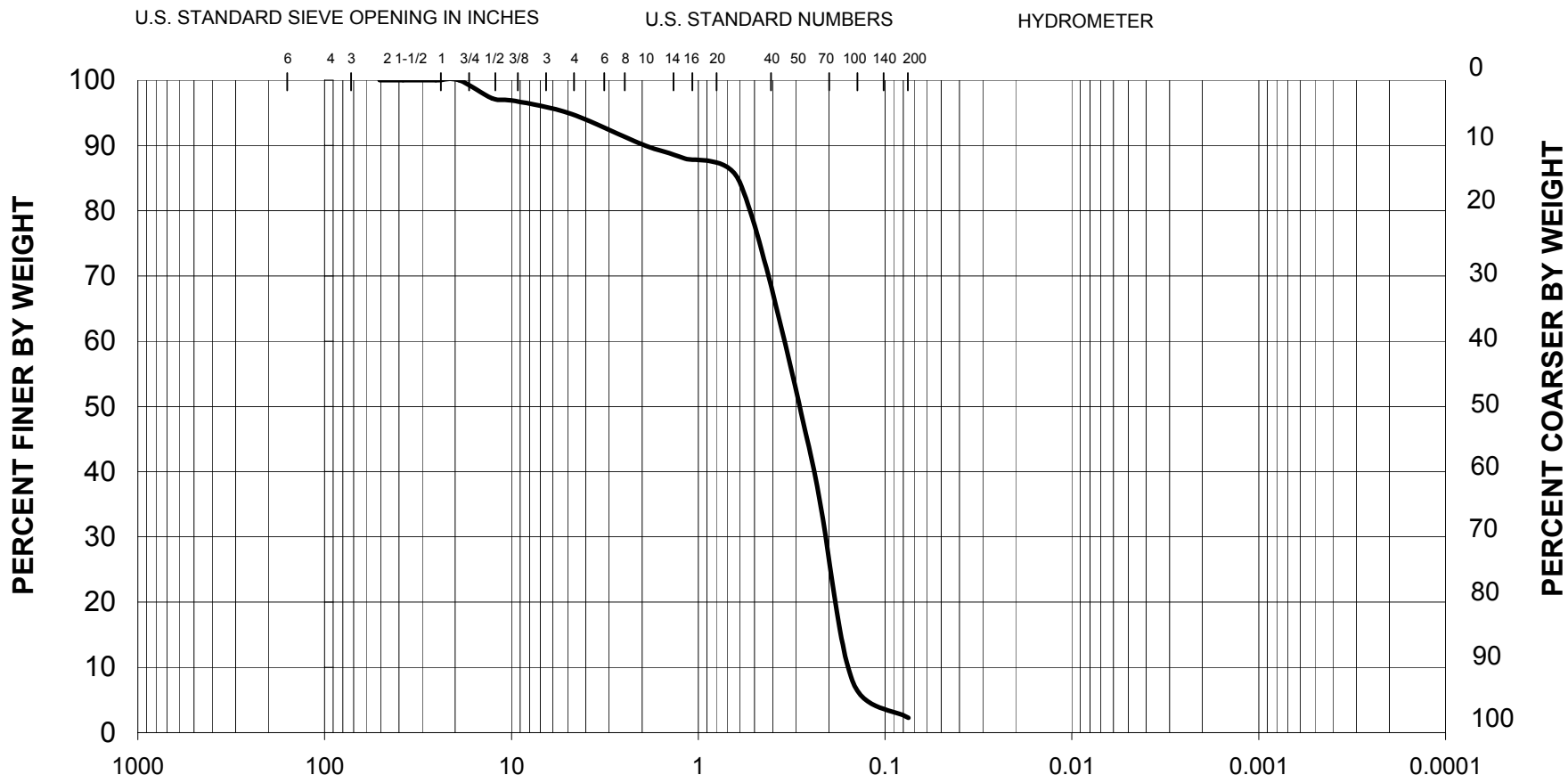
— G95127-9056 ····· Limit Requirements Min

COBBLES	GRAVEL		SAND		SILT OR CLAY
	COARSE	FINE	COARSE	FINE	



Birmingham Engineering & Construction Consultants, Inc.
 360 Industrial Lane, Birmingham, AL 35211
 (205) 941-1119 FAX: (205) 941-1198

Project Name: Navy Lodge Addition
Project Number: R1-9056
Client: Mason and Hanger
Client Representative: Ron Smith
Report Date: 11/11/2009
Sample Location: B-2/ 13.5-15



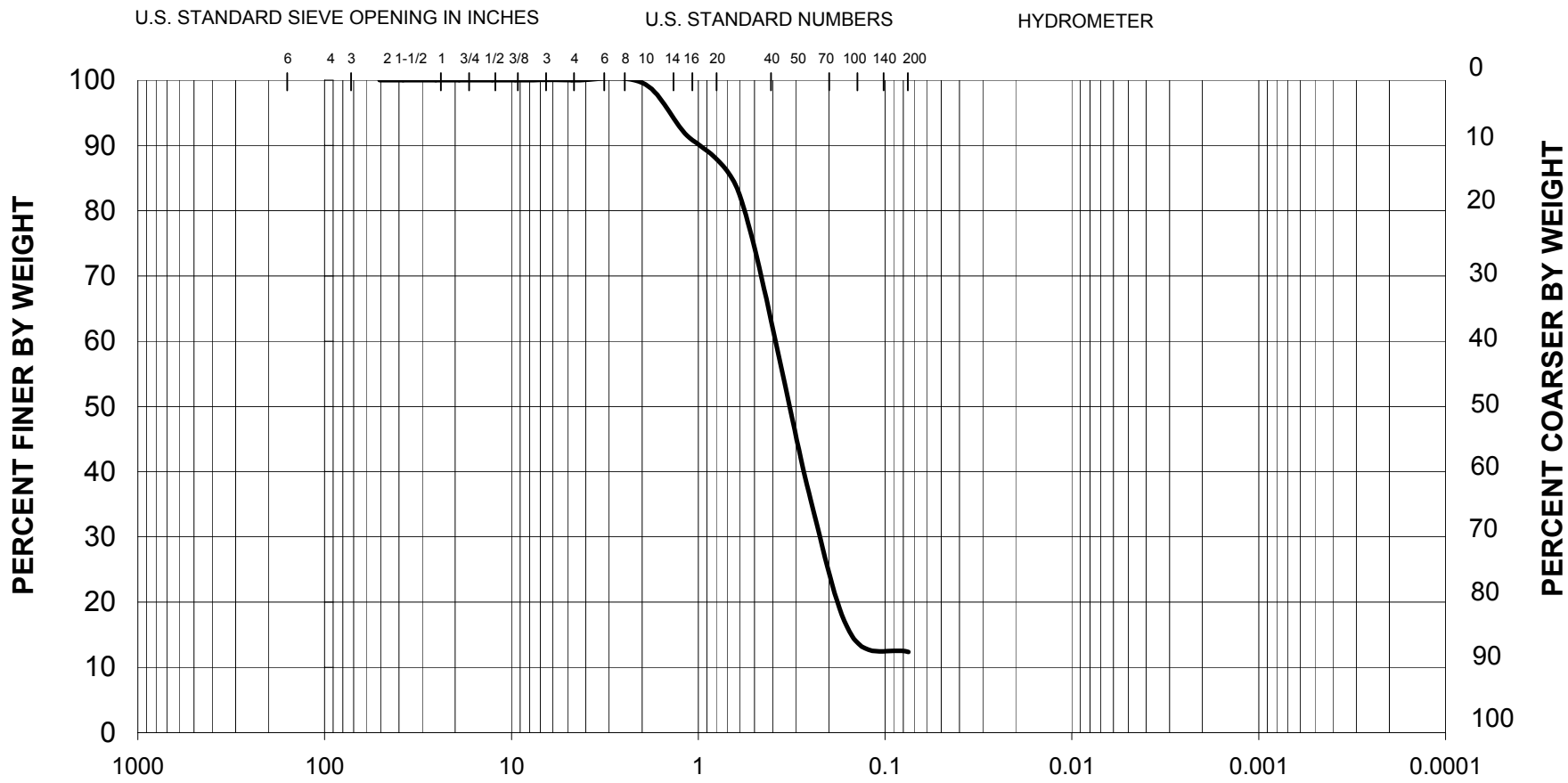
— G95127-9056 ····· Limit Requirements Min

COBBLES	GRAVEL		SAND		SILT OR CLAY
	COARSE	FINE	COARSE	FINE	



Birmingham Engineering & Construction Consultants, Inc.
 360 Industrial Lane, Birmingham, AL 35211
 (205) 941-1119 FAX: (205) 941-1198

Project Name: Navy Lodge Addition
Project Number: R1-9056
Client: Mason and Hanger
Client Representative: Ron Smith
Report Date: 11/11/2009
Sample Location: B-1/ 8.5-10



— G95 ····· Limit Requirements Min ····· Limit Requirements Max

COBBLES	GRAVEL		SAND		SILT OR CLAY
	COARSE	FINE	COARSE	FINE	

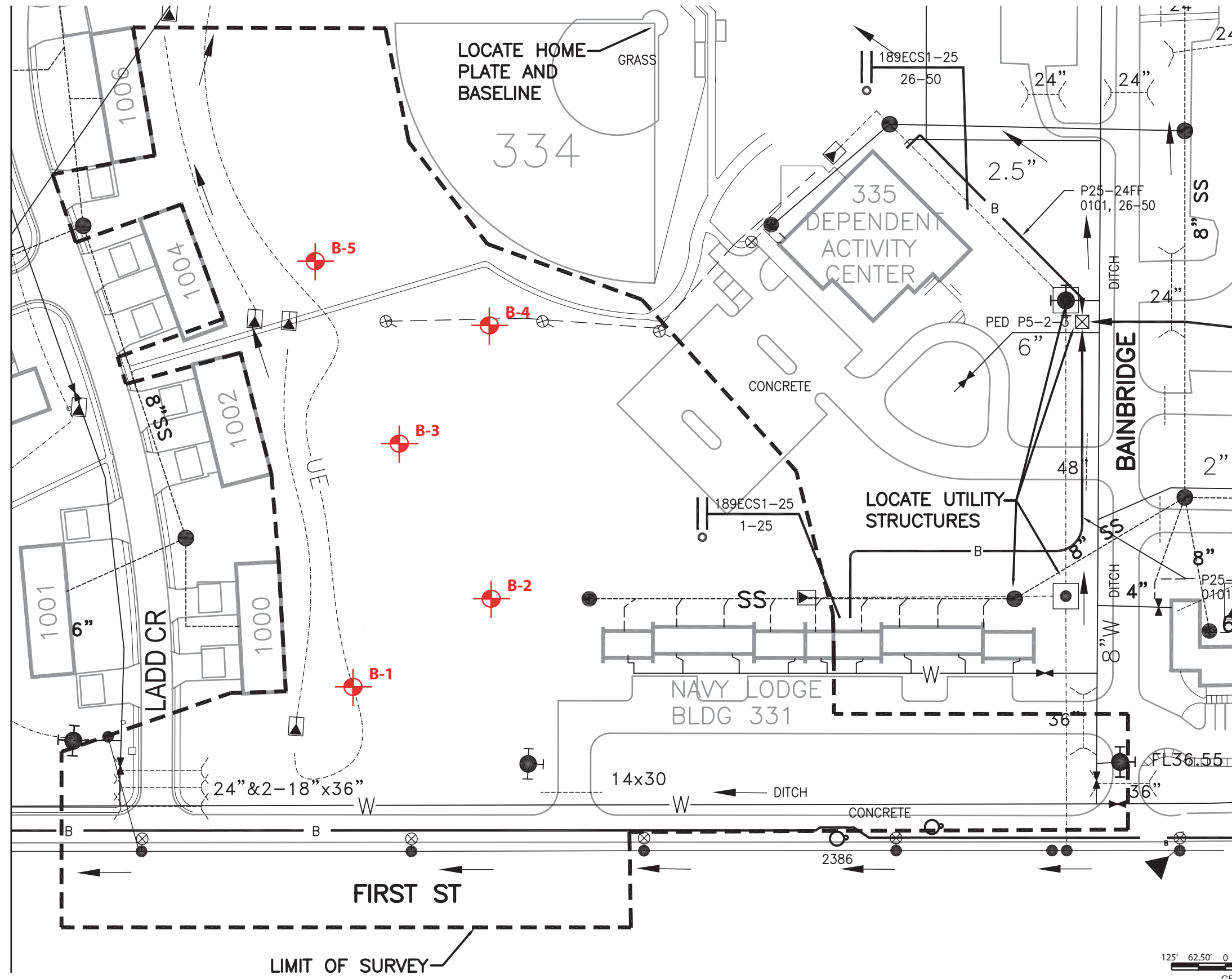




Birmingham Engineering & Construction Consultants, Inc.
 360 Industrial Lane, Birmingham, AL 35211
 (205) 941-1119 FAX: (205) 941-1198

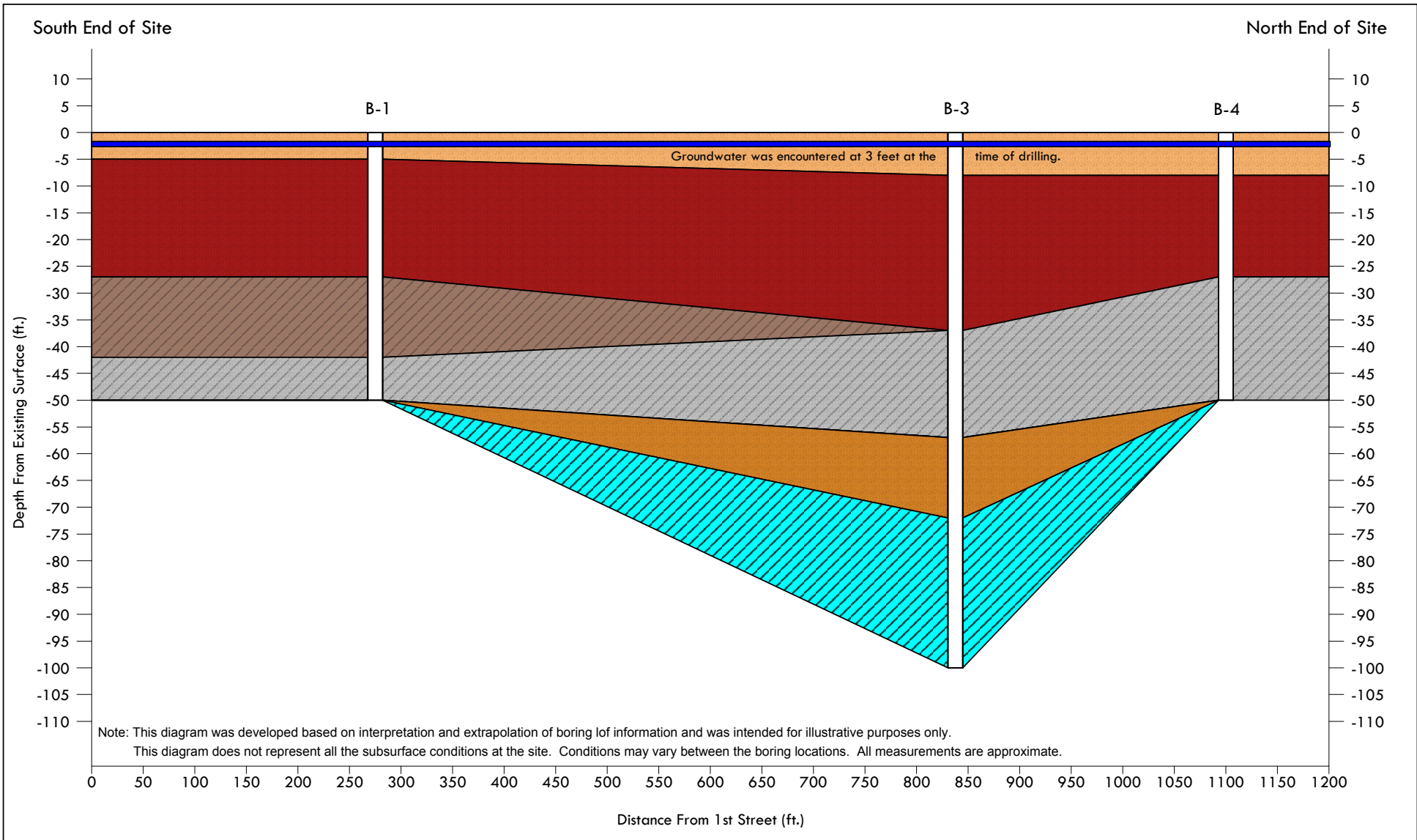
Project Name: Navy Lodge Additions
Project Number: R1-9056
Client: Mason & Hanger
Client Representative: Ron Smith
Report Date: 11/11/2009
Sample Location: Boring 1: depth 1-2.5

APPENDIX B

NOTE: Preliminary concept map was provided by Mason and Hanger and was modified by BECC for illustrative purposes only. Measurements and bore locations should be considered approximate.



Project Name	Location	BECC Project No.	LEGEND	MAP SCALE	
Navy Lodge Addition - CBC Gulfport <i>Boring Location Plan</i>	Gulfport, MS	R1-9056	 - Bore Location	1" ~ 250'	



CLIENT: Mason and Hanger Group
 PROJECT: Navy Lodge Addition
 Gulfport NCBC

Gulfport, Mississippi

BECC Project No. R1-9056

Birmingham Engineering &
BECC
 Construction Consultants, Inc.

SUBSURFACE CROSS SECTION

Facing West

Soils Spanning From South to North
 Across the Site

CROSS SECTION LEGEND

- VERY LOOSE to MEDIUM DENSE Sand (shallow)
- VERY LOOSE to MEDIUM DENSE Silty or Clayey Sand
- SOFT to MEDIUM STIFF Sandy Clay
- VERY LOOSE to LOOSE CLayey Sand
- VERY LOOSE to MEDIUM DENSE Silty or Clayey Sand
- VERY STIFF to HARD High-Plasticity Clay



Date Completed : November 4, 2009

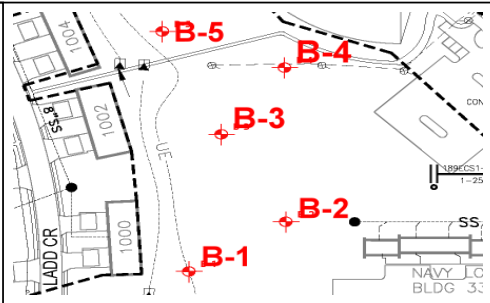
Boring Location : SEE LOCATION MAP

Hole Diameter : 6 in.

Drilling Method : Hollow Auger/Rotary Wash

Sampling Method : Split Spoon

Geology : Alluvium Coastal Deposits



CLIENT: Mason and Hanger Group
PROJECT: Navy Lodge Addition - NCBC

Gulfport, MS

BECC Project # R1-9056

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	Water Levels		Sampler Type		Samples	Sample Type	N-Value	N-Value Graph	Moisture Content (%)	Liquid Limit (LL)	Plasticity Index (PI)	% Finer #200 Sieve	Uniformity Coefficient (Cu)	Coefficient of Gradation (Cz)	Water Level	REMARKS
				▼ After drilling	▽ During drilling	SS Split Spoon	ST Shelby Tube												
				DESCRIPTION															
0		SC		TOPSOIL: Approximately 2"				1	SS	16		11.0			23.6	390.0	141.60		Boring locations were located in the field prior to arrival of BECC, Inc. Groundwater was encountered at 6 feet below the surface at the time of drilling.
				Medium dense gray-brown clayey SAND				2	SS	5									
5				Loose gray-brown SAND				3	SS	14		18.4							
				Medium dense light to dark gray-brown silty SAND				4	SS	25		22.6		5.6	2.12	0.80			
10		SP-SM						5	SS	18									
15				Loose to very loose gray-brown clayey SAND				6	SS	7		22.8							
20		SC						7	SS	4		31.3		15.6	1.67	0.91			
25				Very soft dark gray sandy CLAY				8	SS	0		48.3	47	33	81.8				
30		CL						9	SS	5		45.6							
35				Medium stiff to soft dark gray sandy CLAY				10	SS	3		30.4							
40				Loose dark gray clayey SAND				11	SS	6		22.4							
45		SC						12	SS	5		28.3	28	16	34.8				
50				Loose dark gray clayey SAND															
55				Boring terminated @ 50 feet															

Drilled By : South Brother's Drilling

Logged By : Jeremy Mitchell, P.E.

LOG OF BORING B-1



Date Completed : November 4, 2009

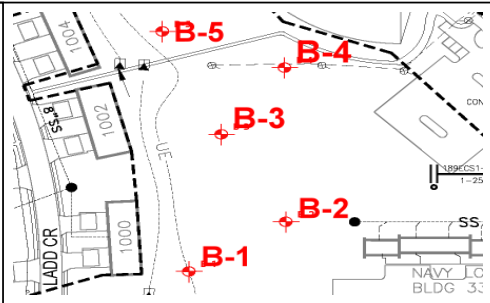
Boring Location : SEE LOCATION MAP

Hole Diameter : 6 in.

Drilling Method : Hollow Auger/Rotary Wash

Sampling Method : Split Spoon

Geology : Alluvium Coastal Deposits



CLIENT: Mason and Hanger Group
PROJECT: Navy Lodge Addition - NCBC

Gulfport, MS

BECC Project # R1-9056

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	Water Levels		Sampler Type		Samples	Sample Type	N-Value	N-Value Graph	Moisture Content (%)	Liquid Limit (LL)	Plasticity Index (PI)	% Finer #200 Sieve	Uniformity Coefficient (Cu)	Coefficient of Gradation (Cz)	Water Level	REMARKS		
				▼ After drilling	▽ During drilling	SS Split Spoon	ST Shelby Tube													DC Diamond Core	
				DESCRIPTION																	
0				TOPSOIL: Approximately 2"																	
0				Very loose brown-red SAND																	
0				Medium dense gray SAND																	
5																					
5				Medium dense to loose gray-brown SAND																	
10			SP-SM																		
10				Loose gray-brown SAND																	
15																					
15				Very loose dark gray-brown clayey SAND																	
20																					
20				Very loose dark gray clayey SAND																	
25																					
25				Very loose dark gray sandy CLAY																	
30																					
30				Soft dark gray sandy CLAY																	
35			SC																		
35																					
40																					
40																					
45																					
45																					
50			CL																		
50				Boring terminated @ 50 feet																	

Drilled By : South Brother's Drilling

Logged By : Jeremy Mitchell, P.E.

LOG OF BORING B-2



Date Completed : November 5, 2009

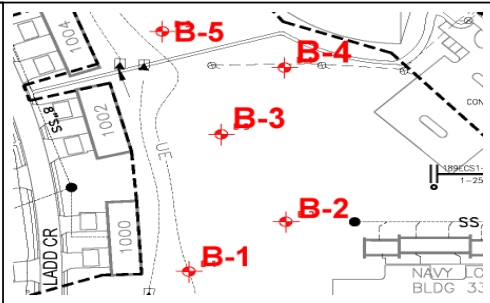
Boring Location : SEE LOCATION MAP

Hole Diameter : 6 in.

Drilling Method : Hollow Auger/Rotary Wash

Sampling Method : Split Spoon

Geology : Alluvium Coastal Deposits



CLIENT: Mason and Hanger Group
 PROJECT: Navy Lodge Addition - NCBC

Gulfport, MS

BECC Project # R1-9056

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	Water Levels		Sampler Type		Samples	Sample Type	N-Value	N-Value Graph	Moisture Content (%)	Liquid Limit (LL)	Plasticity Index (PI)	% Finer #200 Sieve	Uniformity Coefficient (Cu)	Coefficient of Gradation (Cz)	Water Level	REMARKS		
				▼ After drilling	▽ During drilling	SS Split Spoon	ST Shelby Tube													DC Diamond Core	
				DESCRIPTION																	
0				TOPSOIL: Approximately 2"																	Boring locations were located in the field prior to the arrival of BECC, Inc. Groundwater was encountered at 3 feet below the surface at the time of drilling.
				Loose yellow-red clayey SAND																	
5		SP		Medium dense light yellow-red-gray SAND																	
10		SP		Loose to medium dense dark brown SAND																	
15																					
20				Very loose to loose dark brown SAND																	
25																					
30																					
35																					
40				Medium dense dark gray SAND																	
45		SC		Very loose to loose dark gray clayey SAND																	
50																					

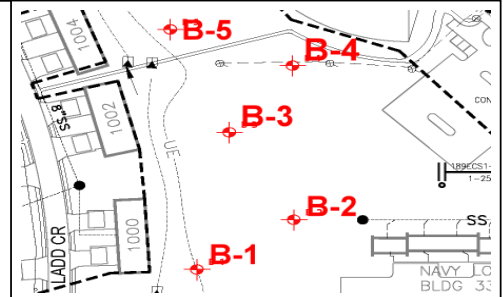
Drilled By : South Brother's Drilling

Logged By : Jeremy Mitchell, P.E.

LOG OF BORING B-3

(Page 1 of 2)

Date Completed : November 5, 2009
Boring Location : SEE LOCATION MAP
 Hole Diameter : 6 in.
 Drilling Method : Hollow Auger/Rotary Wash
 Sampling Method : Split Spoon
 Geology : Alluvium Coastal Deposits



CLIENT: Mason and Hanger Group
 PROJECT: Navy Lodge Addition - NCBC

Gulfport, MS

BECC Project # R1-9056

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	Water Levels		Sampler Type		Samples	Sample Type	N-Value	N-Value Graph	Moisture Content (%)	Liquid Limit (LL)	Plasticity Index (PI)	% Finer #200 Sieve	Uniformity Coefficient (Cu)	Coefficient of Gradation (Cz)	Water Level	REMARKS	
				▼ After drilling	▽ During drilling	SS Split Spoon	ST Shelby Tube													
				DESCRIPTION																
50				Medium dense dark gray silty SAND																
55								13	SS	22		18.0								
60		SP-SM						14	SS	21		20.2								
65				No recovery in sample 15																
65								15	SS	30					9.6	3.78	1.44			
70		SC		Medium dense dark gray clayey SAND																
70								16	SS	18		24.9		22.9	3.08	0.90				
75				Very stiff gray-blue CLAY																
75								17	SS	22		38.8	69	42	72.1					
80		CH						18	SS	25		39.3								
85								19	SS	34		28.1								
90								20	SS	31		33.9	65	38	76.1					
95		CH		Very hard gray-blue CLAY																
95								21	SS	100+		35.6								
100								22	SS	100+		32.5	63	46	86.5					

Drilled By : South Brother's Drilling
 Logged By : Jeremy Mitchell, P.E.

LOG OF BORING B-3



Date Completed : November 4, 2009

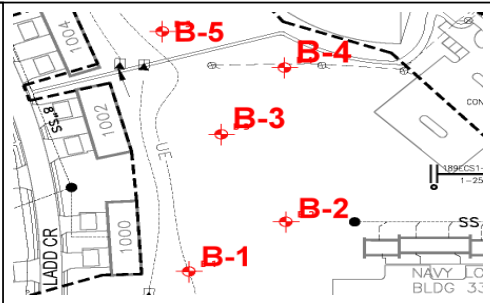
Boring Location : SEE LOCATION MAP

Hole Diameter : 6 in.

Drilling Method : Hollow Auger/Rotary Wash

Sampling Method : Split Spoon

Geology : Alluvium Coastal Deposits



CLIENT: Mason and Hanger Group
PROJECT: Navy Lodge Addition - NCBC

Gulfport, MS

BECC Project # R1-9056

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	Water Levels		Sampler Type		Samples	Sample Type	N-Value	N-Value Graph	Moisture Content (%)	Liquid Limit (LL)	Plasticity Index (PI)	% Finer #200 Sieve	Uniformity Coefficient (Cu)	Coefficient of Gradation (Cz)	Water Level	REMARKS											
				▼ After drilling	▽ During drilling	SS Split Spoon	ST Shelby Tube													DC Diamond Core										
				DESCRIPTION																										
0		SC		TOPSOIL: Approximately 2"																	Boring locations were located in the field prior to arrival of BECC, Inc. Groundwater was encountered at 3 feet below the surface at the time of drilling.									
0-5		SP		Loose yellow-red-brown clayey SAND																1		SS	7		16.6		23.5	5.56	2.47	▽
5-7				Medium dense light to dark gray-brown SAND																2		SS	14		21.1					
7-8				Loose dark brown SAND																3		SS	15		22.2	4.7	2.00	1.01		
8-10				Loose dark brown SAND																4		SS	5		26.0					
10-15				Medium dense dark gray-brown silty SAND																5		SS	19		20.4					
15-20		SP-SM		Medium dense dark gray-brown silty SAND																6		SS	13		23.6	6.1	2.24	0.97		
20-25				Medium dense dark gray-brown silty SAND																7		SS	12							
25-30				Very loose dark gray clayey SAND																8		SS	3		36.8					
30-35				Very loose dark gray clayey SAND																9		SS	2		30.0					
35-40				Very loose dark gray clayey SAND																10		SS	4							
40-45				Very loose dark gray clayey SAND																11		SS	3		29.8	34.6	2.57	0.79		
45-50		SC		Very loose to loose dark gray clayey SAND																12	SS	6		20.1						
50-55				Boring terminated @ 50 feet																										

Drilled By : South Brother's Drilling

Logged By : Jeremy Mitchell, P.E.

LOG OF BORING B-4



Date Completed : November 4, 2009

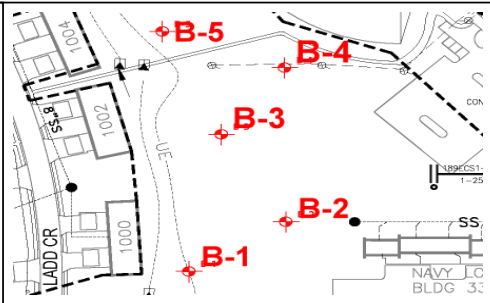
Boring Location : SEE LOCATION MAP

Hole Diameter : 6 in.

Drilling Method : Hollow Auger/Rotary Wash

Sampling Method : Split Spoon

Geology : Alluvium Coastal Deposits



CLIENT: Mason and Hanger Group
PROJECT: Navy Lodge Addition - NCBC

Gulfport, MS

BECC Project # R1-9056

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	Water Levels		Sampler Type		Samples	Sample Type	N-Value	N-Value Graph	Moisture Content (%)	Liquid Limit (LL)	Plasticity Index (PI)	% Finer #200 Sieve	Uniformity Coefficient (Cu)	Coefficient of Gradation (Cz)	Water Level	REMARKS		
				▼ After drilling	▽ During drilling	SS Split Spoon	ST Shelby Tube													DC Diamond Core	
				DESCRIPTION																	
0		SC		TOPSOIL: Approximately 2"																	Boring locations were located in the field prior to arrival of BECC, Inc. Groundwater was encountered at 3 feet below the surface at the time of drilling.
0-5				Loose yellow-red-brown clayey SAND																	
5-12				Medium dense gray-brown silty SAND																	
12-22		SP-SM		Very loose to loose dark gray SAND																	
22-32				Soft to medium stiff gray sandy SILT																	
32-42		ML																			
42-50				Loose gray clayey SAND																	
50		SC																			
50				Boring terminated @ 50 feet																	

Drilled By : South Brother's Drilling

Logged By : Jeremy Mitchell, P.E.

LOG OF BORING B-5