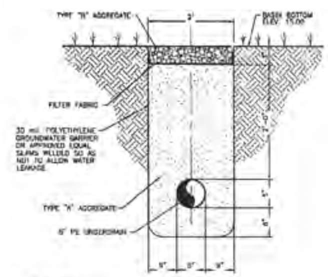


UNDERDRAIN NOTES:

TYPE "A" AGGREGATE: FILTER AGGREGATE FOR UNDERDRAINS SHALL CONSIST OF WASHED MATERIAL MEETING FDOT ROAD & BRIDGE SPECIFICATIONS FOR SILICA SAND & QUARTZ GRAVEL CONTAINING LESS THAN 1% (BY WEIGHT) OF SILT, CLAY AND ORGANIC MATTER. SAID MATERIAL SHALL HAVE UNIFORMITY COEFFICIENT OF 1.5 OR GREATER, AN EFFECTIVE GRAIN SIZE OF 0.20 - 0.55 MILLIMETER AND SIEVE ANALYSIS (IN PERCENT OF TOTAL WEIGHT PASSING) AS FOLLOWS:

3/8" = 95 - 100%
NO. 4 = 91 - 100%
NO. 8 = 85 - 100%
NO. 16 = 65 - 97%
NO. 30 = 25 - 70%
NO. 50 = 5 - 35%
NO. 100 = 0 - 7%
NO. 200 = MAX. 1%

THE AGGREGATE SHALL BE FREE OF ORGANIC MATTER AND OTHER DELETERIOUS MATERIALS. WASHED SHELL & LIMEROCK SHALL NOT BE USED FOR FILTER AGGREGATE. PERMEABILITY OF THE AGGREGATE SHALL BE MINIMUM OF 3.4 FT/HR.

TYPE "B" AGGREGATE: SHALL MEET FDOT SPECIFICATIONS FOR ROAD & BRIDGE CONSTRUCTION, SECTION 901-5, GRADES 4, 467, 5, 56, OR 57, STONE, RIVER GRAVEL OR EQUAL.

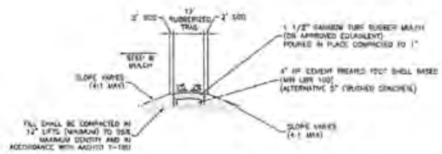
FILTER FABRIC: FILTER FABRIC SHALL BE AMOCO 1198 SYNTHETIC INDUSTRIES EROSION I OR APPROVED EQUAL (WOVEN GEOTEXTILE).

UNDERDRAIN: THE UNDERDRAIN SHALL BE SLOTTED POLYETHYLENE CORRUGATED PIPE A.S.T.M. F-405-77 OR A.A.S.H.T.O. M-252 HAVING A MINIMUM SLOTTED AREA OF 1 SQ. IN./FT. OF PIPE MANUFACTURED BY A.D.S. OR HANCOR, OR APPROVED EQUAL.

TESTING: THE CONTRACTOR SHALL PROVIDE THE ENGINEER WITH SIEVE ANALYSIS & PERCOLATION TEST RESULTS PERFORMED BY AN INDEPENDENT TESTING LABORATORY PRIOR TO DELIVERY OF THE FILTER AGGREGATE MATERIAL ON SITE. FAILURE TO MEET THE SPECIFIED PERMEABILITY OR SIEVE ANALYSIS WILL BE CAUSE FOR REJECTION OF THE MATERIAL.

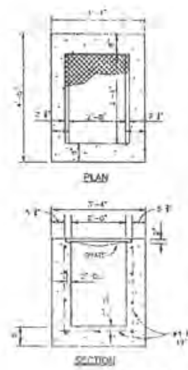
TYPICAL BOTTOM TREATMENT UNDERDRAIN

N.T.S.



TYPICAL RUBBERIZED TRAIL DETAIL

N.T.S.

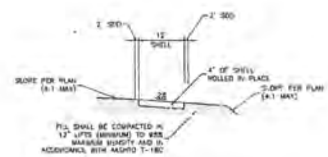


NOTES:

1. INLET SHALL HAVE 3" DIA. HOLE AT THE BOTTOM OF THE BOX CLEAR OF THE PIPE CONSTRUCTION, TO BE PLUGGED WHEN CONCRETE INVERT FORMED.
2. U.S.F. GRATE NO. 6808 (STEEL)
3. FRAME & GRATE SHALL BE OF STEEL CONSTRUCTION COATED WITH 2 APPLICATIONS OF BLACK ENAMEL, 4.0 MILS DRY FILM THICKNESS EACH COAT, 8 MILS TOTAL. COATING SHALL MEET OR EXCEED FDOT SPECIFICATION 971-8. CONTRACTOR SHALL APPLY ONE FIELD COAT TO ANY BARE AREAS AS DETERMINED BY ENGINEER.
4. 3/4" CHAMFER ALL EXPOSED EDGES.
5. 3000 PSI CONCRETE @ 28 DAYS SHALL BE USED THROUGHOUT.
6. POURED CONCRETE INVERT AFTER INLET & PIPE PLACED IN GROUND. 3000 PSI @ 28 DAYS.
7. REINFORCING STEEL SHALL BE INTERMEDIATE GRADE BILLET WITH DEFORMATIONS CONFORMING TO ASTM A-615-76A. ALL STEEL SHALL BE 2" CLEAR UNLESS OTHERWISE NOTED.
8. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS OF THE SKIMMER ASSEMBLY FOR APPROVAL PRIOR TO CONSTRUCTION.

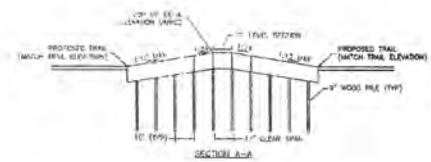
F.D.O.T. TYPE "C" INLET

N.T.S.

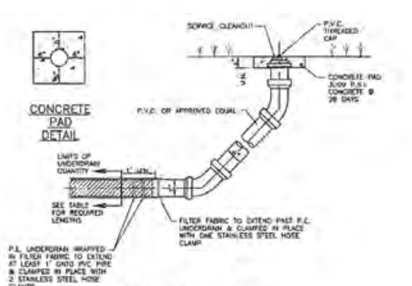


TYPICAL SLOPED SHELL TRAIL DETAIL

N.T.S.

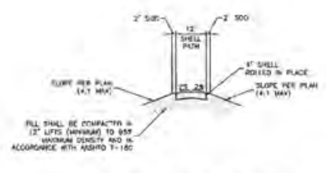


NOTE:
1. SLOPES SHALL BE ADA COMPLIANT. CROSS SLOPES LESS THAN 2%.
2. SUBJECT TO CHANGE BASED ON STRUCTURAL DESIGN BY OTHERS.



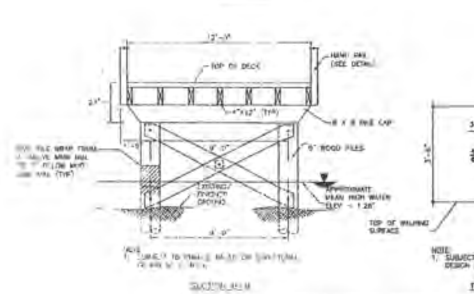
CLEANOUT DETAIL FOR SINGLE UNDERDRAIN FILTER SYSTEM

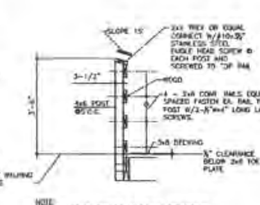
N.T.S.



TYPICAL CENTER CROWNED SHELL TRAIL DETAIL

N.T.S.





NOTE:
1. SUBJECT TO CHANGE BASED ON STRUCTURAL DESIGN BY OTHERS.

TYPICAL PEDESTRIAN BRIDGE DETAIL

N.T.S.

Stantec

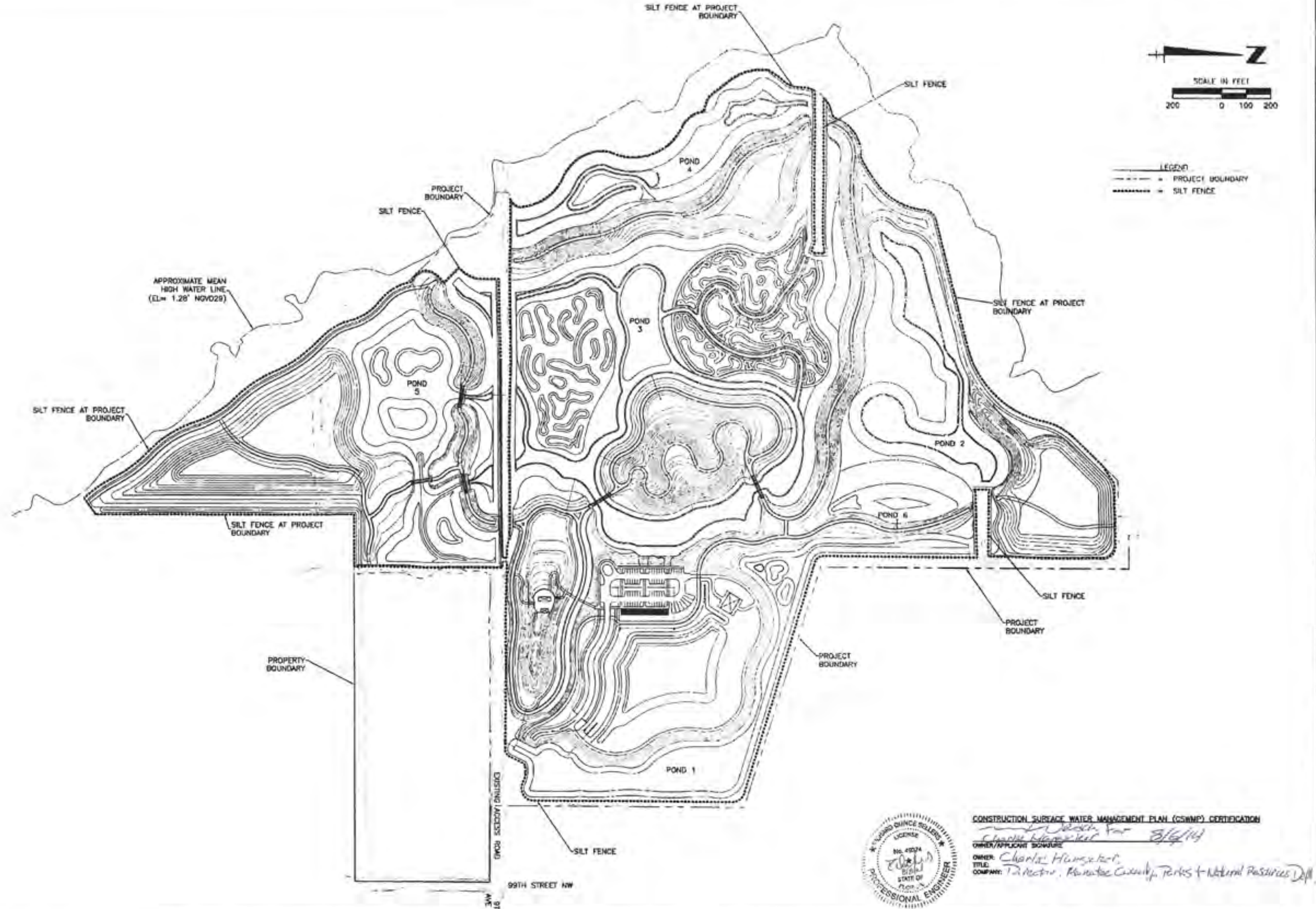
CLIENT: MANATEE BOARD OF COUNTY COMISSIONERS

PROJECT: ROBINSON PRESERVE EXPANSION PHASE II RESTORATION

CONSTRUCTION DETAILS

215510519

32 of 34



CONSTRUCTION SURFACE WATER MANAGEMENT PLAN (CSWMP) CERTIFICATION

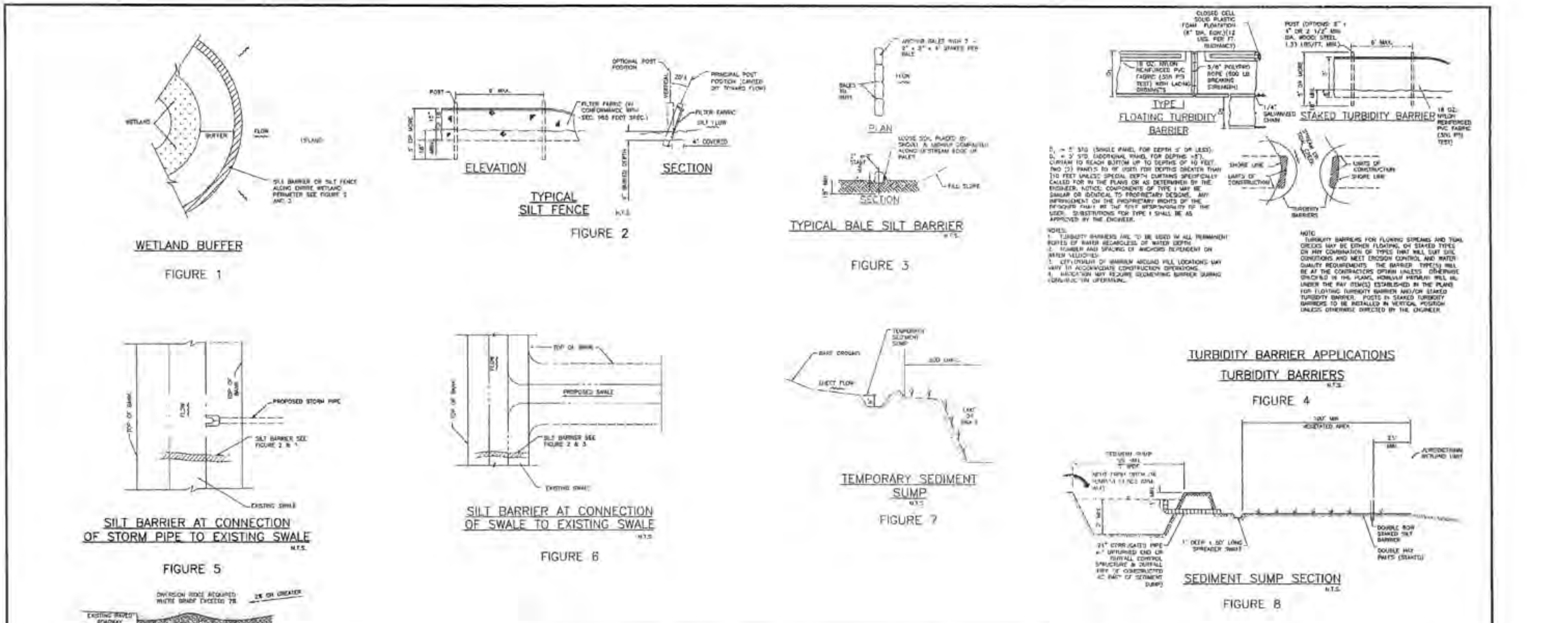
OWNER/APPLICANT SIGNATURE

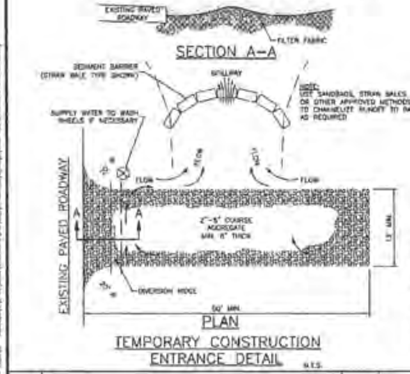
OWNER:
TITLE:
COMPANY:

PROFESSIONAL ENGINEER — STATE OF FLORIDA

Stantec

CLIENT:	MANATEE BOARD OF COUNTY COMISSIONERS
PROJECT:	ROBINSON PRESERVE EXPANSION PHASE II RESTORATION
DATE:	AUGUST 2014
TITLE:	BEST MANAGEMENT PRACTICES PLAN
PROJECT NUMBER	215510519
SHEET	33 of 34





NOTE:
1. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OF FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAY. THIS MAY REQUIRE TOP DRESSING, REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT.
2. WHEN NECESSARY, WHEELS SHALL BE CLEANED PRIOR TO ENTRANCE ONTO PUBLIC RIGHT-OF-WAY.
3. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE THAT DRAINS INTO AN APPROVED SEDIMENT TRAP OR SEDIMENT BASIN.

NOTES:
1. THE CONTRACTOR SHALL ABIDE ALL APPLICABLE CONDITIONS OF THE REGULATORY AGENCY PERMITS AND HAVE COPIES OF THE PERMITS ON SITE. IF IT IS NECESSARY FOR GROUNDWATER DEWATERING TO DISCHARGE OFFSITE, THEN THE CONTRACTOR SHALL OBTAIN ALL APPLICABLE PERMITTING FROM THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION (FDEP). THE CONTRACTOR SHALL BEAR ALL RESPONSIBILITY AND COSTS FOR OBTAINING AND/OR MODIFYING ALL APPLICABLE PERMITTING FOR THE DISCHARGE OF GROUNDWATER DEWATERING AND FOR COMPLYING WITH ALL SWFWMD AND FDEP PERMITTING CONDITIONS.
2. THE CONTRACTOR SHALL STAGE CONSTRUCTION IN PHASES WHENEVER POSSIBLE TO MINIMIZE SOIL LOSS AND CONTROL EROSION.
3. THE CONTRACTOR SHALL PROVIDE A STABILIZED CONSTRUCTION ENTRANCE TO HELP REDUCE VEHICLE TRACKING OF SEDIMENTS. THE PAVED STREET ADJACENT TO THE SITE ENTRANCE WILL BE SWEPT AS REQUIRED TO REMOVE ANY EXCESS MUD, DIRT OR ROCK TRACKED FROM THE SITE. DUMP TRUCKS HAULING MATERIAL FROM THE CONSTRUCTION SHALL BE COVERED WITH A TARPAULIN.
4. THE CONTRACTOR SHALL CONTROL ALL FUGITIVE DUST ORIGINATING ON THIS PROJECT AND SHALL USE WATER, STRAW MULCH, OR OTHER SUITABLE MATERIAL AS REQUIRED.
5. AT A MINIMUM, SILT FENCES, OR EQUIVALENT SEDIMENT CONTROLS ARE REQUIRED FOR ALL SIDE SLOPE AND DOWN SLOPE BOUNDARIES OF THE CONSTRUCTION AREA.
6. ALL CONSTRUCTION DEWATERING (IF NECESSARY) SHALL BE CONTAINED ONSITE AND ALLOWED TO INFILTRATE THE SOIL UNLESS FDEP PERMITTING IS OBTAINED FOR OFFSITE DISCHARGE. ALL DEWATERING GROUNDWATER DISCHARGE SHALL BE ROUTED THROUGH A TEMPORARY SEDIMENT SUMP PRIOR TO DISCHARGE TO WETLANDS, OTHER SURFACE WATER, OR OFFSITE. THE GENERAL PROCESS OF THE DEWATERING SYSTEM, AS DEPICTED HEREIN, SHALL BE ADHERED TO DURING CONSTRUCTION. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO OBTAIN ALL APPLICABLE APPROVALS FOR ANY MODIFICATIONS HE PROPOSES.
7. THE DEWATERING SYSTEM SHALL USE A PUMP AND PIPING THAT IS LESS THAN 6 INCHES IN DIAMETER AND OPERATE LESS THAN A TOTAL OF 30 DAYS/MONTH. ANY DEVIATION FROM THIS REQUIREMENT SHALL REQUIRE A WATER USE PERMIT. THE COST OF A WATER USE PERMIT AND ASSOCIATED MATERIALS SHALL BE BORNE BY THE CONTRACTOR.
8. THE CONTRACTOR SHALL ERECT SILT FENCE, STAKED HAY BALES, STAKED TURBIDITY BARRIERS, AND FLOATING TURBIDITY BARRIERS PRIOR TO COMMENCEMENT OF [illegible] ACTIVITY.
9. REQUIRED EROSION AND SEDIMENT CONTROL MEASURES MUST BE INSTALLED AND MAINTAINED AS REQUIRED THROUGHOUT THE DURATION OF THE CONSTRUCTION PROJECT.
10. ALL EROSION PROTECTION SHALL BE MAINTAINED BY THE CONTRACTOR IN COMPLIANCE WITH SWFWMD, MANATEE COUNTY, AND [illegible] THROUGH THE DURATION OF THE PROJECT. THE CONTRACTOR SHALL INSPECT THE EROSION CONTROL DEVICES WEEKLY AND WITHIN 24 HOURS AFTER EACH RAINFALL EVENT OF 0.5 INCHES OR MORE. ALL MAINTENANCE SHALL BE PERFORMED WITHIN 24 HOURS OF INSPECTION.
11. ALL PRACTICABLE AND NECESSARY EFFORTS SHALL BE TAKEN DURING CONSTRUCTION TO CONTROL AND PREVENT EROSION AND TRANSPORT OF [illegible] AREAS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL RESTORATION EFFORTS THAT MAY BE REQUIRED.
12. EROSION AND SEDIMENT CONTROL DEVICES (SILT FENCE, TURBIDITY BARRIERS, ETC.) ARE DEPICTED IN APPROXIMATE LOCATIONS AND SHALL BE ADAPTED AS NECESSARY WITH THE DIRECTION OF THE PROJECT ECOLOGIST.
13. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVAL AND PROPER DISPOSAL OF ALL EROSION AND SEDIMENT CONTROL DEVICES AT THE COMPLETION OF THE PROJECT.
14. ALL EXCAVATION AND ACCESS TO AND FROM CONSTRUCTION AREAS SHALL BE WITHIN THE LIMITS OF THE PROJECT AREA (I.E., NO ACCESS FROM [illegible] BAYOU, ETC.).

CONSTRUCTION SURFACE WATER MANAGEMENT PLAN (CSWMP) CERTIFICATION

Charlie Hunsicker (signature) — OWNER/APPLICANT SIGNATURE — DATE 8/6/14

OWNER: Charlie Hunsicker, Director
TITLE:
COMPANY: Manatee County Parks + Natural Resources Dept.

CLIENT:	MANATEE BOARD OF COUNTY COMISSIONERS
PROJECT:	ROBINSON PRESERVE EXPANSION PHASE II RESTORATION
DATE	AUGUST 2014
TITLE:	BEST MANAGEMENT PRACTICES DETAILS
PROJECT NUMBER	215510519
SHEET	34 of 34

Stantec

ATTACHMENT BB
Geotechnical Exploration for Robinson Education Center / Ardaman & Associated, Inc., File No. 13-7414 dated 3/27/2014

GEOTECHNICAL EXPLORATION FOR ROBINSON PRESERVE EDUCATION CENTER, 1704 99TH STREET N.W., BRADENTON, MANATEE COUNTY, FLORIDA

Ardaman & Associates, Inc.

OFFICES

FLORIDA

Orlando, 8008 S. Orange Avenue, Orlando, Florida 32809, Phone (407) 855-3860
Bartow, 1525 Centennial Drive, Bartow, Florida 33830, Phone (863) 533-0858
Cocoa, 1300 N. Cocoa Boulevard, Cocoa, Florida 32922, Phone (321) 632-2503
Fort Myers, 9970 Bavaria Road, Fort Myers, Florida 33913, Phone (239) 768-6600
Miami, 2608 W. 84th Street, Hialeah, Florida, 33016, Phone (305) 825-2683
Port St. Lucie, 460 NW Concourse Place, Unit #1, Port St. Lucie, Florida 34986-2248, Phone (772) 878-0072
Sarasota, 78 Sarasota Center Boulevard, Sarasota, Florida 34240, Phone (941) 922-3526
Tallahassee, 3175 West Tharpe Street, Tallahassee, Florida 32303, Phone (850) 576-6131
Tampa, 3925 Coconut Palm Drive, Suite 115, Tampa, Florida 33619, Phone (813) 620-3389
West Palm Beach, 2511 Westgate Avenue, Suite 10, West Palm Beach, Florida 33409, Phone (561) 687-8200

LOUISIANA

Alexandria, 3609 MacLee Drive, Alexandria, Louisiana 71302, Phone (318) 443-2888
Baton Rouge, 316 Highlandia Drive, Baton Rouge, Louisiana 70810, Phone (225) 752-4790
Monroe, 1122 Hayes Street, Monroe, Louisiana 71292, Phone (318) 387-4103
New Orleans, 1305 Distributors Row, Suite 1, Jefferson, Louisiana 70123, Phone (504) 835-2593
Shreveport, 7222 Greenwood Road, Shreveport, Louisiana 71119, Phone (318) 636-3723

MEMBERS:
A.S.F.E.
American Concrete Institute
American Society for Testing and Materials
Florida Institute of Consulting Engineers

ATTACHMENT BB
Geotechnical Exploration for Robinson Education Center / Ardaman & Associated, Inc., File No. 13-7414 dated 3/27/2014

Ardaman & Associates, Inc.

March 27, 2014
File No. 13-7414

TO: Manatee County Property Management Dept.
P.O. Box 1000
Bradenton, FL 34206-1000

Attention: Al Meronek

SUBJECT: Geotechnical Exploration for Robinson Preserve Education Center, 1704 99th Street N.W., Bradenton, Manatee County, Florida

---

Gentlemen:

As authorized per IFAS #W1400077, our firm has completed explorations and analysis of the subsurface soil conditions at the subject site. This report will present the results of our exploration and our recommendations.

This report was prepared for the exclusive use of Manatee County Property Management Dept. for specific application to the subject site. Our services have been performed in accordance with generally-accepted engineering practices. No other warranty, expressed or implied, is made.

We appreciate the opportunity to be of your service. Please contact our office when we may be of further service or should you have any questions concerning this report.

Very truly yours,

ARDAMAN & ASSOCIATES, INC.
Certificate of Authorization No. 5950

3/27/14

Jerry H. Kuehn, P.E.
Senior Project Engineer
Fl License. No. 35557

Gary H. Schmidt, P.E.
Vice President
Fl License No. 12305

JHK/GHS:ly

TABLE OF CONTENTS

1.0 SCOPE

The scope of our services has included the following items:

1. Performing nine (9) Standard Penetration Test borings, seven (7) hand auger borings and two (2) double-ring infiltrometer tests, to determine the nature of the subsurface soils and existing groundwater table levels.

2. Reviewing each soil sample obtained in our field exploration program by a geotechnical engineer in the laboratory for further investigation, classification and assignment of laboratory tests.

3. Analyzing the existing subsurface soil and drainage conditions to:
   a. prepare foundation design recommendations for the proposed buildings,
   b. assess the suitability of the soils for use as fill material in site development.

4. Preparing this report to document the results of our field exploration program, engineering analyses and recommendations.

2.0 FIELD EXPLORATION

Our field exploration program included conducting nine (9) Standard Penetration Test (SPT) borings, seven (7) hand auger borings and two (2) double-ring infiltrometer tests. The number and location of the borings were determined by others.

The test locations are shown on the attached Figure 1. The test borings were staked in the field by others prior to our field explorations.

2.1 Subsurface Soil Borings

The SPT and hand auger borings were performed to determine the existing groundwater table and subsurface soil conditions to a maximum depth of 40 feet below the existing ground surface. The methods and equipment used in the borings are described in Appendix I of this report.

The soil profiles and groundwater table depths encountered at the time of this exploration are shown on the graphical soil profiles (boring logs) on Figures B-1 to B-3. The soil descriptions shown on the soil boring logs are based upon the Unified Soil Classification System (ASTM D-2487).

2.2 Infiltration Tests

Two (2) double-ring infiltrometer (DRI) tests were performed at locations DRI-1 and DRI-2, which are shown on the attached Figure 1. The DRI tests were performed based upon the procedures of ASTM D-3385. Additional information on the test and interpretation of the test results are included in Appendix I.

The test results are summarized on the attached Plates 3 and 4 of Appendix II. The results indicate vertical infiltration rates of 1.6 inch/hour and 0.6 inch/hour for DRI-1 and DRI-2, respectively.

3.0 LABORATORY TESTING

Samples obtained during our field exploration program were thoroughly examined in our laboratory to obtain an accurate definition of the soil profile. Routine tests were performed on selected samples to aid in classification and to better define the engineering properties. These tests included determining the fines (silt and clay) content, water content and organic content. The test results are shown at the respective sample depth on the graphic soil profiles on Figures B-1 to B-3. Based upon the laboratory test results and visual classification procedures, the soils have been classified in general compliance with the Unified Soil Classification System (ASTM D-2487) by a geotechnical engineer.

Limerock bearing ratio (LBR) tests were also performed upon two samples of the near-surface soils. These samples were obtained near proposed parking lot areas, near test locations DRI-1 and DRI-2. The test results are included in Appendix II of this report and indicate LBR values of 40 and 62 for the soil samples tested.

4.0 ANALYSES AND RECOMMENDATIONS

Our scope of work included preparing foundation design recommendations for the proposed buildings and providing an assessment of the soils for use as fill in site development. These will be discussed separately, as follows.

4.1 Building Foundations

Four (4) Standard Penetration Test borings (Nos. B-6 to B-9) were performed within proposed building areas. We understand that the proposed buildings will be one-story structures elevated upon concrete columns. For the purpose of our analyses, we have assumed that wall loads do not exceed 5.0 kips per foot and column loads do not exceed 60 kips.

4.1.1 Foundation Design

With proper preparation of the soils, the structures can be supported on conventionally designed shallow foundation systems. Assuming that the foundation loads are no greater than those indicated above, we anticipate that settlement of the proposed structures will not exceed 1/2 inch. Due to the granular nature of the materials at the site, this settlement will occur primarily during construction.

Note that a relatively thick layer of "topsoil" (described as "mucky sand" or "fine sand with muck" on the boring logs of Figure B-2) was encountered at borings B-7 and B-8, but may also exist at other locations. At these two borings, this layer was approximately one to two feet thick. We recommend that the bottom of the footings be below this layer. Note, however, that the existing groundwater table was encountered at a depth of two feet below the ground surface at some boring locations, indicating the dewatering will likely be necessary at some locations.

Foundations for the proposed structures may be designed for an allowable soil contact pressure of 2,000 pounds per square foot (psf). We recommend that all wall foundations be no less than eighteen inches wide and column foundations be no less than twenty-four inches wide. All foundations should be designed for an equal dead load distribution in accordance with standard building code requirements. A soil cover of eighteen inches, as measured from the bottom of the foundation system to outside adjacent finished grade, should be provided.

4.1.2 Soil Preparation Recommendations

The following soil preparation recommendations are made as a guide to the design professionals, parts of which should be incorporated into the project's general specifications:

1. The building areas, plus a margin of 5 feet outside building perimeter lines, should be cleared and grubbed of all surface vegetation and organic debris.

2. The foundation areas should then be excavated to the footing bottom elevation, being sure to excavate through the full thickness of any surficial muck or organic topsoil. The exposed soils should be compacted with a jumping-jack, vibratory plate or similar compactor to produce a density of at least 95% of Modified Proctor (ASTM D-1557) maximum density to a depth of 1.0 foot below the compacted surface. A representative of Ardaman & Associates should be present during initial compaction efforts.

3. After compaction and testing to verify that the desired compaction has been achieved at this elevation, the foundations may be constructed. Any additional fill required to backfill around or above the foundations shall consisting of clean fine sands containing no more than 10% passing the No. 200 sieve, and having a Unified Soil Classification (ASTM D-2487) of "SP" or "SP-SM." This fill shall be placed in level lifts not exceeding 12 inches loose thickness and compacted to at least 95% of Modified Proctor maximum density prior to the placement of subsequent lifts.

4. A geotechnical engineer or his representative from Ardaman & Associates, Inc., Sarasota office, should inspect and test the compacted excavated elevation and each layer of fill to verify compliance with the above recommendations. In addition, a representative should inspect and test the foundation contact soils immediately prior to concrete placement.

If the control of groundwater is required to achieve the necessary stripping, excavation, proof-rolling, filling, compaction, and any other earthwork, sitework, or foundation subgrade preparation operations required for the project, the actual method(s) of dewatering should be determined by the contractor. Dewatering should be performed to lower the groundwater level to depths that are adequately below excavations and compaction surfaces. Adequate groundwater level depths below excavations and compaction surfaces vary depending on soil type and construction method, and are usually two feet or more. Dewatering solely with sump pumps may not achieve the desired results.

4.2 Excavations and Fill Materials

Borings B-1 to B-6 were performed within the proposed lake excavation area. The soil profiles at these locations are shown on the attached Figure B-1.

In general, soils having a Unified Soil Classification (USCS) of SP or SP-SM are suitable for use as a general construction fill. These soils were encountered from the ground surface to a depth of approximately 20 feet.

The soils at greater depth consisted of silts and clays, much of which were either cemented (calcareous) or in a very stiff to hard condition. Much of these soils will also be highly plastic and difficult to handle. We recommend that excavation of these be avoided.

5.0 CLOSURE

The analyses and recommendations submitted in this report are based upon the results of subsurface borings performed at the locations indicated on the attached Figure 1. This report does not reflect any variations which may occur between the borings. While the borings are representative of the subsurface conditions at the respective locations and for their respective vertical reaches, local variations characteristic of the subsurface materials of the region are anticipated and may be encountered.

The boring logs and related information are based upon the driller's logs and visual examination of selected samples in the laboratory. The delineation between soil types shown on the logs is approximate, and the description represents our interpretation of the subsurface conditions at the designated boring location on the particular date drilled. The absence of a groundwater table listed on a boring log does not indicate that the groundwater table is not within the boring depth, unless expressly stated so.

APPENDIX I

SOIL BORING, SAMPLING & TEST METHODS

SOIL BORING, SAMPLING AND TESTING METHODS

Standard Penetration Test

The Standard Penetration Test (SPT) is a widely accepted method of in situ testing of foundation soils (ASTM D-1586). A 2-foot long, 2-inch O.D. split-barrel sampler attached to the end of a string of drilling rods is driven 18 inches into the ground by successive blows of a 140-pound hammer freely dropping 30 inches. The number of blows needed for each 6 inches of penetration is recorded. The sum of the blows required for penetration of the second and third 6-inch increments of penetration constitutes the test result or N-value. After the test, the sampler is extracted from the ground and opened to allow visual examination and classification of the retained soil sample. The N-value has been empirically correlated with various soil properties allowing a conservative estimate of the behavior of soils under load. The following tables relate N-values to a qualitative description of soil density and, for cohesive soils, an approximate unconfined compressive strength (Qu):

Cohesionless Soils:	N-Value	Description
	0 to 4	Very loose
	4 to 10	Loose
	10 to 30	Medium dense
	30 to 50	Dense
	Above 50	Very dense

Cohesive Soils:	N-Value	Description	Qu (ton/ft^2)
	0 to 2	Very soft	Below 1/4
	2 to 4	Soft	1/4 to 1/2
	4 to 8	Medium stiff	1/2 to 1
	8 to 15	Stiff	1 to 2
	15 to 30	Very stiff	2 to 4
	Above 30	Hard	Above 4

The tests are usually performed at 5-foot intervals. However, more frequent or continuous testing is done by our firm through depths where a more accurate definition of the soils is required. The test holes are advanced to the test elevations by rotary drilling with a cutting bit, using circulating fluid to remove the cuttings and hold the fine grains in suspension. The circulating fluid, which is a bentonitic drilling mud, is also used to keep the hole open below the water table by maintaining an excess hydrostatic pressure inside the hole. In some soil deposits, particularly highly pervious ones, NX-size flush-coupled casing must be driven to just above the testing depth to keep the hole open and/or prevent the loss of circulating fluid.

Representative split-spoon samples from each sampling interval and from every different stratum are brought to our laboratory in air-tight jars for further evaluation and testing, if necessary. After thorough examination and testing of the samples, the samples are discarded unless prior arrangements have been made. After completion of a test boring, the hole is kept open until a steady state groundwater level is recorded. The hole is then sealed, if necessary, and backfilled.

A hammer with an automatic drop release (auto-hammer) is sometimes used. In this case, a correction factor is applied to the raw blow counts, since the energy efficiency of the auto-hammer is greater than that of the safety hammer. Based upon calibration of the auto-hammer (per ASTM D4633) and standard practice, we use a multiplier of 1.24 to correct the auto-hammer blow counts to equivalent safety hammer "N" values.

Hand Auger Borings

Hand auger borings are used, if soil conditions are favorable, when the soil strata are to be determined within a shallow (approximately 5 to 9 feet) depth or when access is not available to power drilling equipment. A 3-inch diameter, hand bucket auger with a cutting head is simultaneously turned and pressed into the ground. The bucket auger is retrieved to the surface at approximately 6-inch intervals and its contents emptied for inspection. The soil sample so obtained is classified and representative samples put in bags or jars and transported to the laboratory for further classification and testing.

Laboratory Test Methods

Soil samples returned to our laboratory are examined by a geotechnical engineer or geotechnician to obtain more accurate descriptions of the soil strata. Laboratory testing is performed on selected samples as deemed necessary to aid in soil classification and to further define engineering properties of the soils. The test results are presented on the soil boring logs at the depths at which the respective sample was recovered, except that grain size distributions or selected other test results may be presented on separate tables, figures or plates as described in this report. The soil descriptions shown on the logs are based upon a visual-manual classification procedure in general accordance with the Unified Soil Classification System (ASTM D-2488-84) and standard practice. Following is a list of abbreviations which may be used on the boring logs or elsewhere in this report.

-200 - Fines Content (percent passing the No. 200 sieve); ASTM D1140
DD - Dry Density of Undisturbed Sample; ASTM D2937
Gs - Specific Gravity of Soil; ASTM D854
k - Hydraulic Conductivity (Coefficient of Permeability)
LL - Liquid Limit; ASTM D423
OC - Organic Content; ASTM D2974
pH - pH of Soil; ASTM D2976
PI - Plasticity Index (LL-PL); ASTM D424
PL - Plastic Limit; ASTM D424
Qp - Unconfined Compressive Strength by Pocket Penetrometer;
Qu - Unconfined Compressive Strength; ASTM D2166 (soil), D7012 (rock)
SL - Shrinkage Limit; ASTM D427
ST - Splitting Tensile Strength; ASTM D3967 (rock)
USCS - Unified Soil Classification System; ASTM D2487, D2488
w - Water (Moisture) Content; ASTM D2216

Soil Classifications

The soil descriptions presented on the soil boring logs are based upon the Unified Soil Classification System (USCS), which is the generally accepted method (ASTM D-2487 and D-2488) for classifying soils for engineering purposes. The following modifiers are the most commonly used in the descriptions.

For Sands:	Modifier	Fines, Sand or Gravel Content*
	with silt or with clay	5% to 12% fines
	silty or clayey	12% to 50% fines
	with gravel or with shell	15% to 50% gravel or shell

For Silts or Clays:	Modifier	Fines, Sand or Gravel Content*
	with sand	15% to 30% sand and gravel; and % sand > % gravel
	sandy	30% to 50% sand and gravel; and % sand > % gravel
	with gravel	15% to 30% sand and gravel; and % sand < % gravel
	gravelly	30% to 50% sand and gravel; and % sand < % gravel

* may be determined by laboratory testing or estimated by visual/manual procedures. Fines content is the combined silt and clay content, or the percent passing the No. 200 sieve.

Other soil classification standards may be used, depending on the project requirements. The AASHTO classification system is commonly used for highway design purposes and the USDA soil textural classifications are commonly used for septic (on-site sewage disposal) system design purposes.

Double-Ring Infiltrometer Test

The double-ring infiltrometer test is used to determine the vertical infiltration rate of in situ soils above the water table. The test procedure is based upon ASTM D-3385.

The test uses two open-ended cylinders (rings), driven concentrically into the soil to a depth of a few inches. The radius of the outer ring is approximately twice that of the inner ring. Both the inner ring and the outer ring are partially filled with water (or other liquid, when appropriate) and the liquid is maintained at a constant level. The volume of liquid added to the inner ring, to maintain the liquid level constant during timed intervals, is used to calculate the incremental infiltration velocity. The maximum steady-state or average incremental infiltration velocity, depending upon the purpose/application of the test, for the inner ring is equivalent to the infiltration rate.

The purpose of the outer ring is to promote one-dimensional, vertical flow beneath the inner ring. The infiltration velocity for the outer ring may also be measured, as a check on the test integrity, but is not used to determine the infiltration rate.

Application of Double-Ring Infiltrometer Test Results

Although the units of the infiltration rate and hydraulic conductivity (k) of soils are similar, there is a distinct difference between these two quantities. They cannot be directly related unless the hydraulic boundary conditions (hydraulic gradient, extent of lateral flow of water, etc.) are known, or can be reliably estimated. In general, however, the infiltration rate near the end of the test is less than the saturated vertical hydraulic conductivity, since a fully saturated condition is generally not achieved by tests of this type and the hydraulic gradient near the end of the test is generally equal to or less than 1.0.

The test results represent a vertical infiltration rate for the conditions under which the test was performed and do not necessarily represent the infiltration rate for other conditions, such as the size of the infiltration basin and the depth of the water table. Some publications, such as EPA 65/1-81-013, recommend using a design infiltration rate that is a small percentage (typically 2% to 10%) of the infiltration rate measured by cylinder (ring) infiltrometers, to compensate for potential clogging of the infiltration surface and to correct for a larger proportion of horizontal flow (relative to vertical flow) that occurs from a small test area relative to a full-size infiltration basin area. This assumes, however, that the vertical infiltration rate (or vertical hydraulic conductivity) is the limiting factor in the basin=s infiltration capacity. At sites where there is a shallow water table or shallow restrictive layer, the infiltration capacity of the full-size basin may be most limited by groundwater mounding, and not by the vertical hydraulic conductivity of the soil at or near the basin bottom. In this case, applying a percentage to a measured vertical infiltration rate or vertical hydraulic conductivity may over-estimate the actual infiltration capacity of the full-size basin, and groundwater mounding analyses should be performed by a professional engineer or geologist with expertise in groundwater hydrology.

APPENDIX II

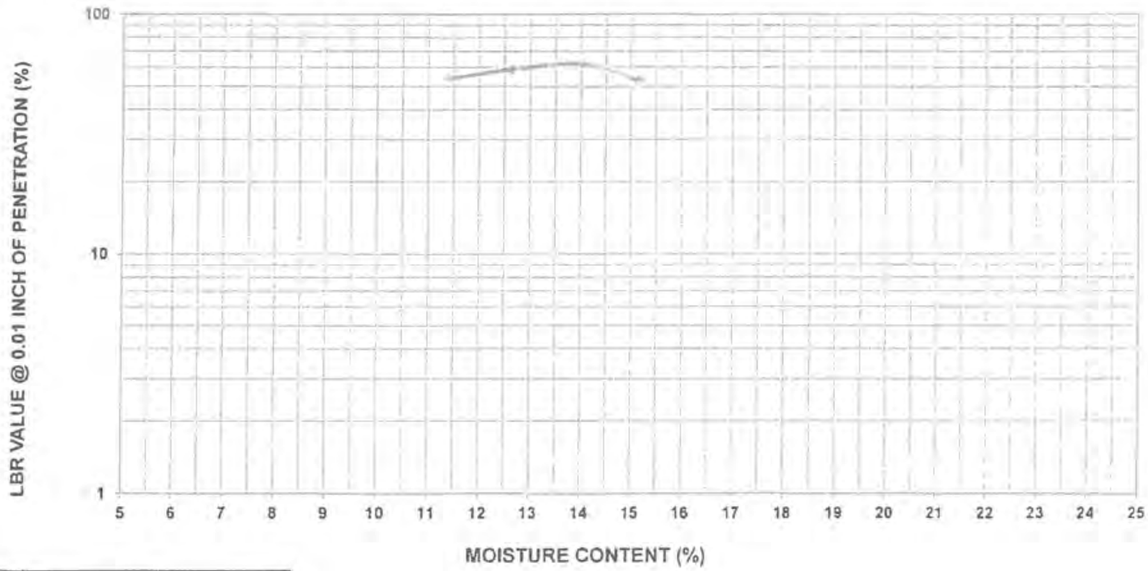
L.B.R. AND D.R.I. TEST RESULTS

Ardaman & Associates, Inc.

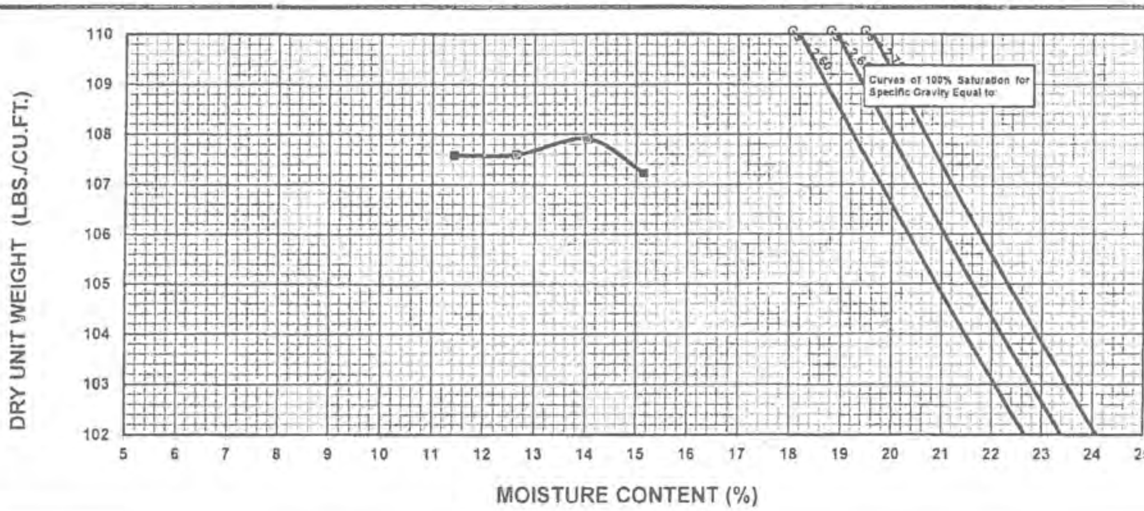
Ardaman & Associates, Inc.
78 Sarasota Center Boulevard
Sarasota, FL 34240
Phone 941-922-3526
FAX 941-922-6743

LIMEROCK BEARING RATIO TEST

Project Name:	Robinson Preserve Education Center	File No.:	13-7414
Project Location:	1704 99th Street NW, Bradenton, Florida	Report No.:	NA
Client Name:	Manatee County Property Management Dept.	Report Date:	2/14/2014
Distribution:	Client, Stantec, Stirling & Wilbur		



LBR Value (%): 62



Maximum Dry Density (lb/ft^3): 108

Optimum Moisture Content (%): 14

Date Sampled:	2/10/2014	Date Molded:	2/12/2014	Lab Sample No.:	5048
Sampled By:	Mark Ochs	Date Tested:	2/14/2014	Tested By:	Chris Oberhoff

Sample Description: Gray fine sand with trace shell fragments and roots (Existing soils)

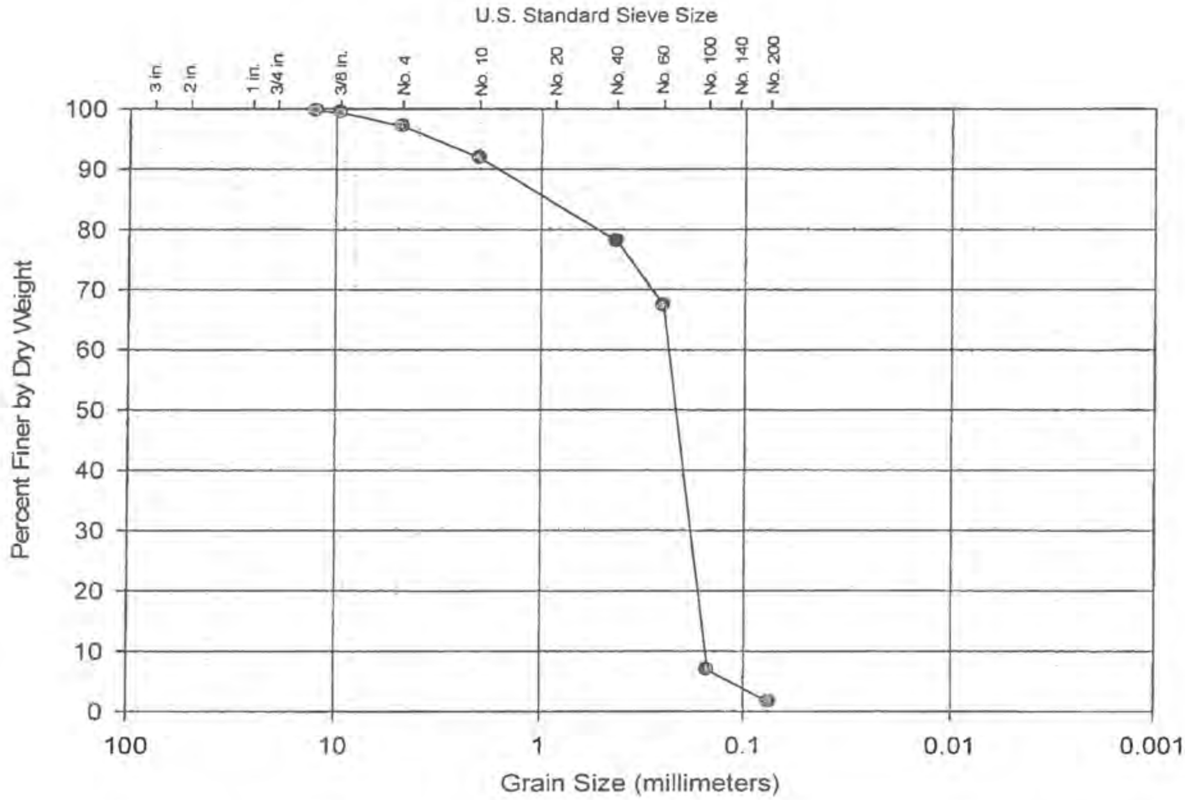
Sample Location: DRI-1

Proposed Use: Subbase

Florida Certificate of Authorization No. 00005950

Gary H. Schmidt, P.E.
Florida License No. 12305

GRAIN SIZE DISTRIBUTION CURVE



Gravel		Sand			Silt	Clay
Coarse	Fine	Coarse	Medium	Fine		

SAMPLE DATA:

Lab Sample No. 5048

Sampling Date: 2/10/14

Soil Description: Gray fine sand with trace shell fragments and roots

SIEVE ANALYSIS:

Sieve Size	Percent Finer
1/2 in.	99.7
3/8 in.	99.4
No. 4	97.1
No. 10	91.8
No. 40	78.1
No. 60	67.4
No. 100	6.9
No. 200	1.5

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

Robinson Preserve Educ. Center
1704 99th Street NW
Bradenton, Florida

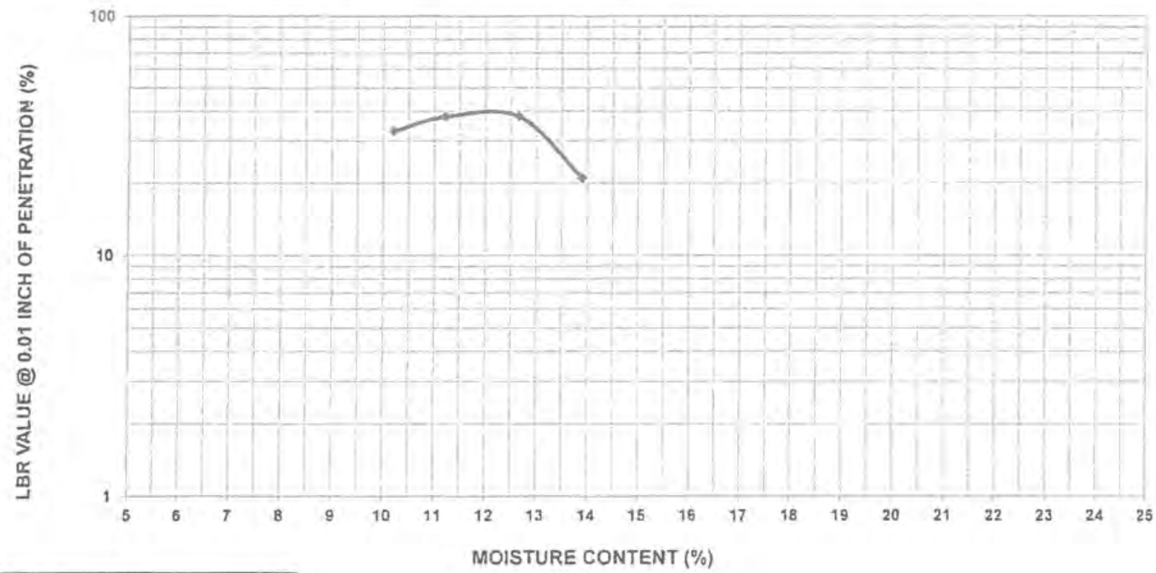
DRAWN BY	MA	CHECKED BY:	GHS	DATE:	3/26/14
FILE NO. 13-7414	APPROVED BY:			PLATE 1	

Ardaman & Associates, Inc.

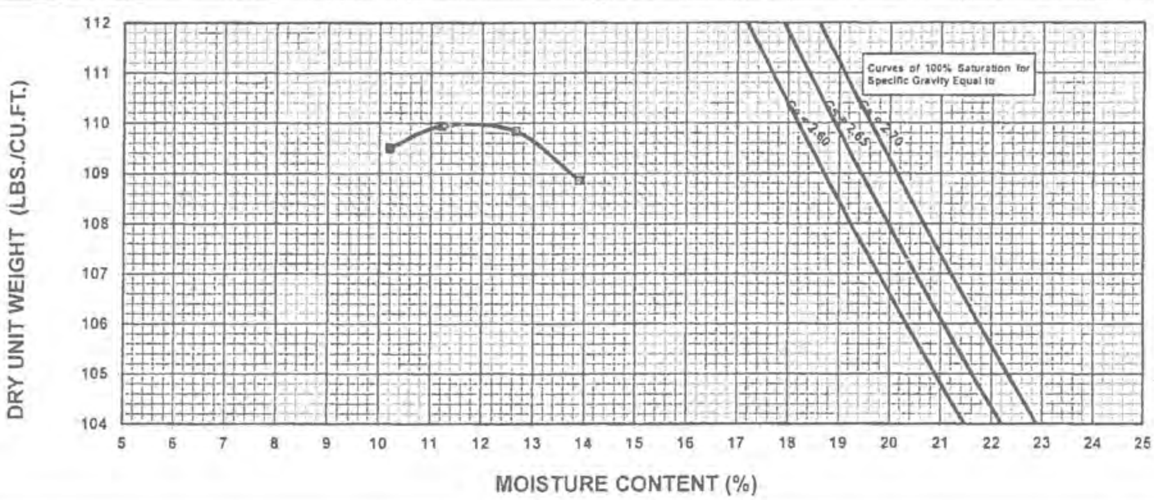
Ardaman & Associates, Inc.
78 Sarasota Center Boulevard
Sarasota, FL 34240
Phone 941-922-3526
FAX 941-922-6743

LIMEROCK BEARING RATIO TEST

Project Name:	Robinson Preserve Education Center	File No.:	13-7414
Project Location:	1704 99th Street NW, Bradenton, Florida	Report No.:	NA
Client Name:	Manatee County Property Management Dept.	Report Date:	2/18/2014
Distribution:	Client, Stantec, Stirling & Wilbur		



LBR Value (%): 40



Maximum Dry Density (lb/ft^3): 110

Optimum Moisture Content (%): 12

Date Sampled:	2/10/2014	Date Molded:	2/13/2014	Lab Sample No.:	5049
Sampled By:	Mark Ochs	Date Tested:	2/17/2014	Tested By:	Chris Oberhoff

Sample Description: Dark gray fine sand with trace silt, shell and organics (Existing soils)

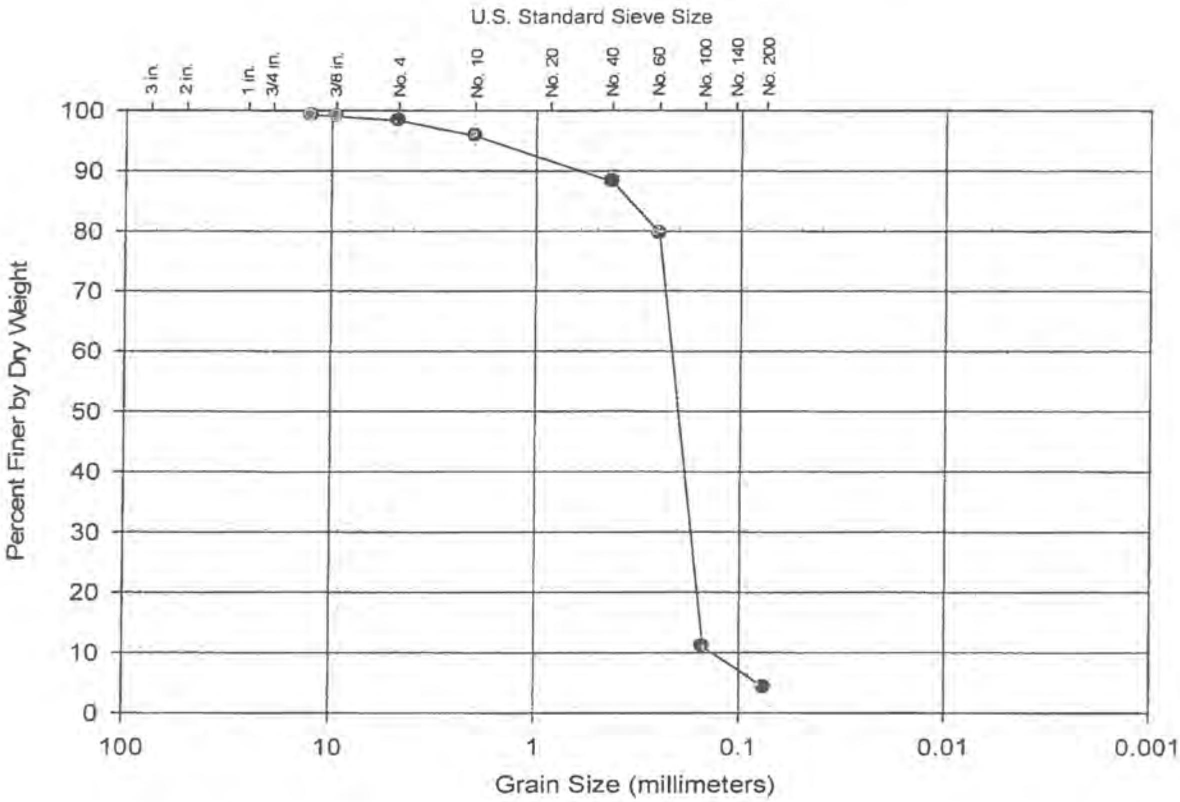
Sample Location: DRI-2

Proposed Use: Subbase

Gary H. Schmidt, P.E.
Florida License No. 12305

Florida Certificate of Authorization No. 00005950

GRAIN SIZE DISTRIBUTION CURVE



Gravel		Sand			Silt	Clay
Coarse	Fine	Coarse	Medium	Fine		

SAMPLE DATA:

Lab Sample No. 5049

Sampling Date: 2/10/14

Soil Description: Dark gray fine sand with trace silt, shell and organics

SIEVE ANALYSIS:

Sieve Size	Percent Finer
1/2 in.	99.3
3/8 in.	99.1
No. 4	98.4
No. 10	95.9
No. 40	88.3
No. 60	79.7
No. 100	11.0
No. 200	4.3

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

Robinson Preserve Educ. Center
1704 99th Street NW
Bradenton, Florida

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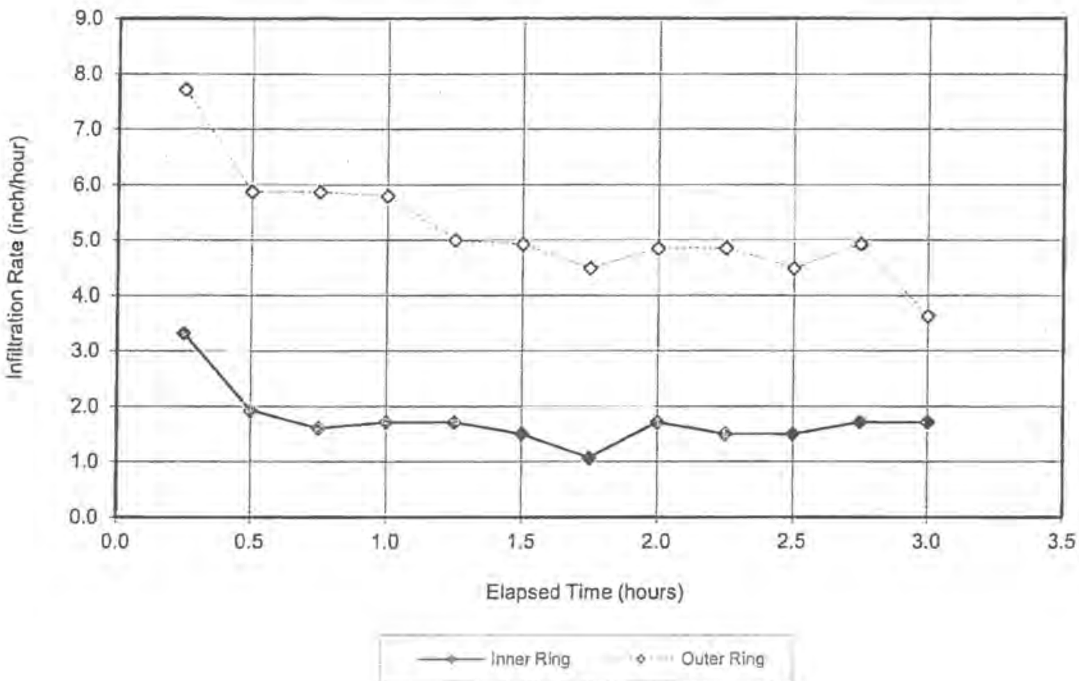
FILE NO 13-7414	APPROVED BY:			PLATE 2	

Double-Ring Infiltrometer



GRAPH DATA:

Elapsed Time (hr:min)	Infiltration Rates Inner Ring (inch/hour)	Outer Ring (inch/hour)
0:15	3.3	7.7
0:30	1.9	5.9
0:45	1.6	5.9
1:00	1.7	5.8
1:15	1.7	5.0
1:30	1.5	4.9
1:45	1.1	4.5
2:00	1.7	4.9
2:15	1.5	4.9
2:30	1.5	4.5
2:45	1.7	4.9
3:00	1.7	3.6

TEST NUMBER: **DRI-1**

Test Date: 10-Feb-14

Test Depth (inch, below grade): 6

Inner Ring - Outside Dia. (inch): 12.4
- Inside Dia. (inch): 12.0
- Water Depth (inch): 6

Outer Ring - Inside Dia. (inch): 24.1
- Water Depth (inch): 6

SOIL PROFILE:

Depth (ft) From	To	Soil Description
		(see profile DRI-1 on Figure B-3)

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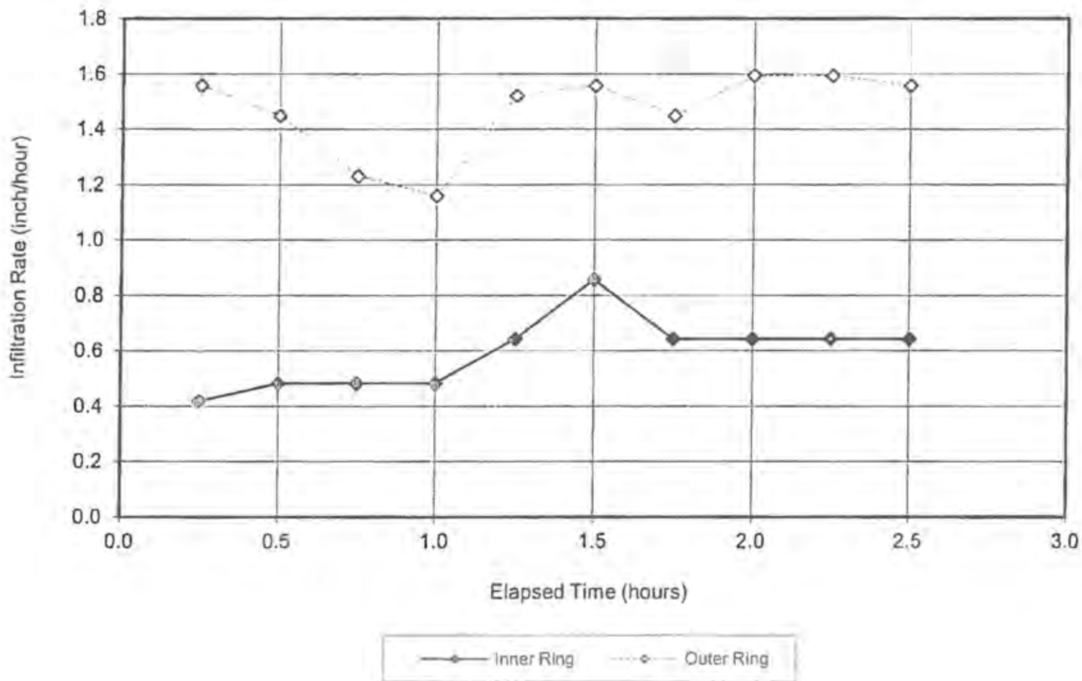
Geotechnical, Environmental and Materials Consultants

Robinson Preserve
1704 99th Street NW
Bradenton, Manatee County, Florida

DRAWN BY JHK	CHECKED BY: JHK	DATE 3/26/14
FILE NO 13-7414	APPROVED BY:	PLATE 3

Double-Ring Infiltrometer



GRAPH DATA:

Elapsed Time (hr:min)	Infiltration Rates Inner Ring (inch/hour)	Outer Ring (inch/hour)
0:15	0.42	1.6
0:30	0.48	1.4
0:45	0.48	1.2
1:00	0.48	1.2
1:15	0.64	1.5
1:30	0.86	1.6
1:45	0.64	1.4
2:00	0.64	1.6
2:15	0.64	1.6
2:30	0.64	1.6

TEST NUMBER: **DRI-2**

Test Date: 29-Jan-14
Test Depth (inch, below grade): 6
Inner Ring - Outside Dia. (inch): 12.4
- Inside Dia. (inch): 12.0
- Water Depth (inch): 6
Outer Ring - Inside Dia. (inch): 24.1
- Water Depth (inch): 6

SOIL PROFILE:

Depth (ft) From	To	Soil Description
		(see profile DRI-2 on Figure B-3)

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Geotechnical, Environmental and Materials Consultants

Robinson Preserve
1704 99th Street NW
Bradenton, Manatee County, Florida

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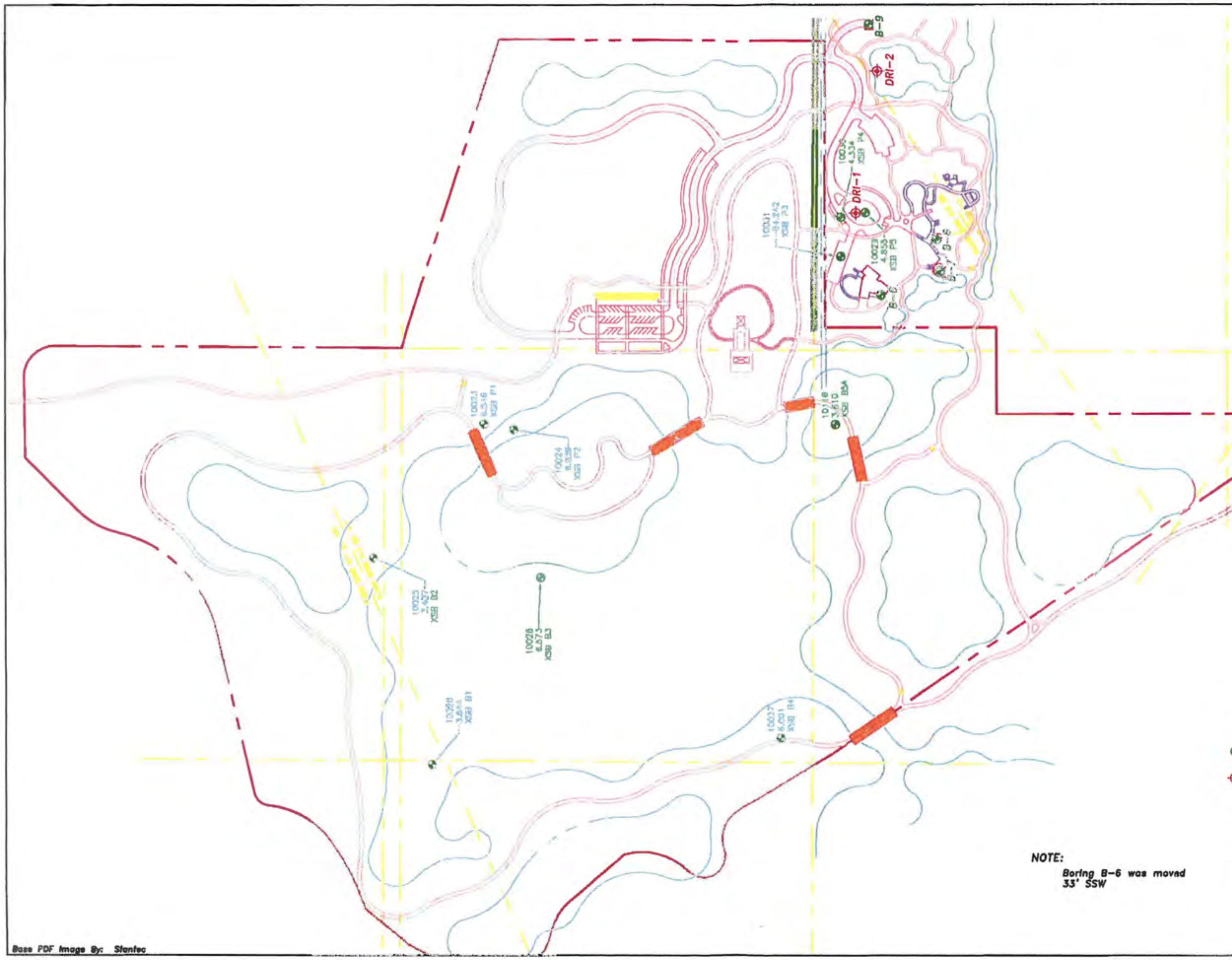
FILE NO.: 13-7414	APPROVED BY:	PLATE 4



SCALE: 1"=300'
(approximate)

TEST BORING LOCATIONS

DOUBLE RING INFILTROMETER LOCATION

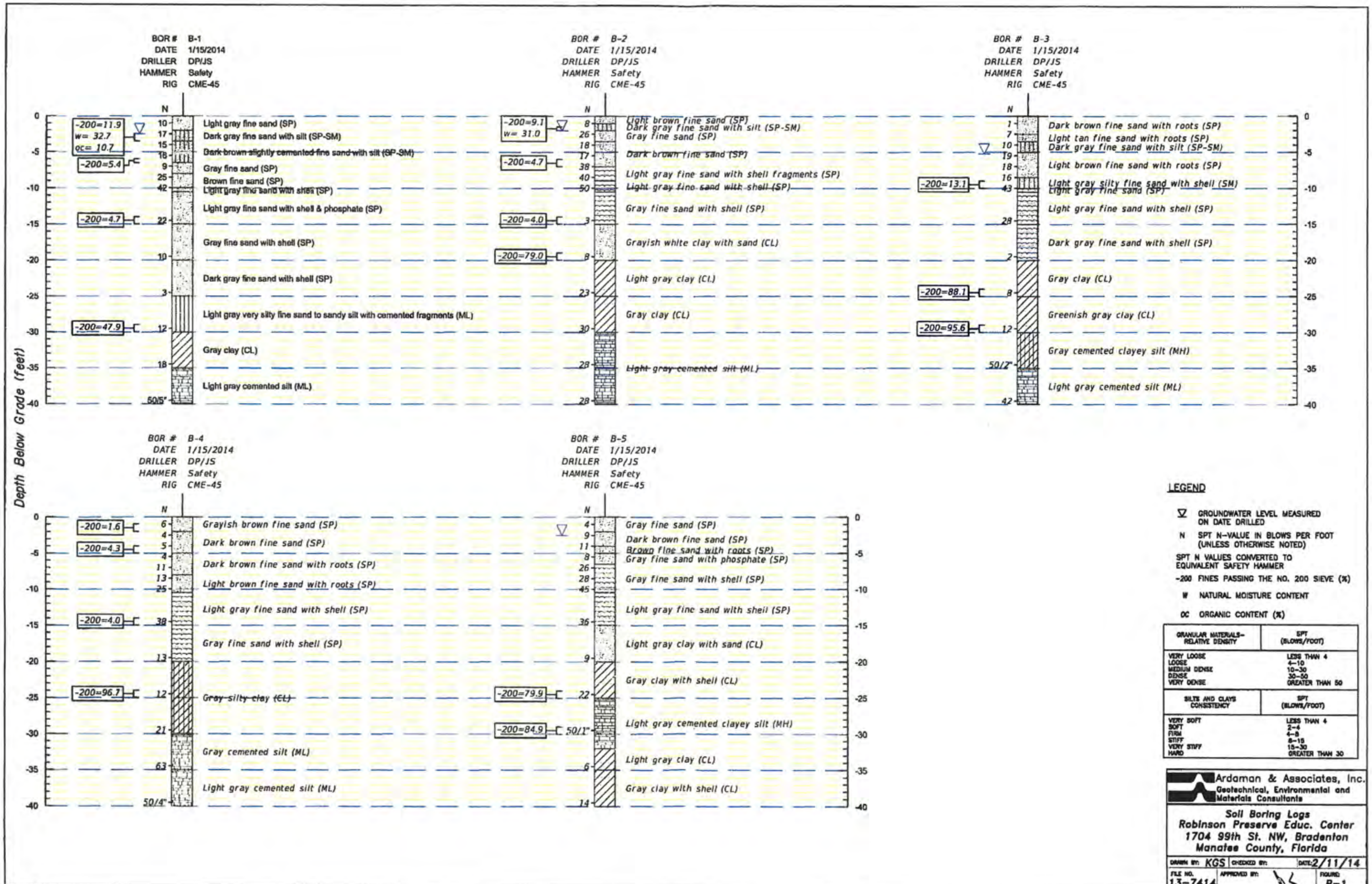
NOTE:

Boring B-6 was moved 33' SSW

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

Test Locations
Robinson Preserve Educ. Center
1704 99th St. NW, Bradenton
Manatee County, Florida

DRAWN BY: KGS	CHECKED BY:	DATE: 2/11/14
FILE NO. 13-7414	APPROVED BY:	FIGURE: 1



Depth Below Grade (feet)
BOR # B-1
DATE 1/15/2014
DRILLER DP/JS
HAMMER Safety
RIG CME-45
N
-200=11.9
w= 32.7
oc= 10.7
-200=5.4
-200=4.7
-200=47.9
Light gray fine sand (SP)
Dark gray fine sand with silt (SP-SM)
Dark brown slightly cemented fine sand with silt (SP-SM)
Gray fine sand (SP)
Brown fine sand (SP)
Light gray fine sand with shell (SP)
Light gray fine sand with shell & phosphate (SP)
Gray fine sand with shell (SP)
Dark gray fine sand with shell (SP)
Light gray very silty fine sand to sandy silt with cemented fragments (ML)
Gray clay (CL)
Light gray cemented silt (ML)
BOR # B-2
DATE 1/15/2014
DRILLER DP/JS
HAMMER Safety
RIG CME-45
-200=9.1
w= 31.0
-200=4.7
-200=4.0
-200=79.0
Light brown fine sand (SP)
Dark gray fine sand with silt (SP-SM)
Gray fine sand (SP)
Dark brown fine sand (SP)
Light gray fine sand with shell fragments (SP)
Light gray fine sand with shell (SP)
Gray fine sand with shell (SP)
Grayish white clay with sand (CL)
Light gray clay (CL)
Gray clay (CL)
Light gray cemented silt (ML)
BOR # B-3
DATE 1/15/2014
DRILLER DP/JS
HAMMER Safety
RIG CME-45
-200=13.1
-200=88.1
-200=95.6
Dark brown fine sand with roots (SP)
Light tan fine sand with roots (SP)
Dark gray fine sand with silt (SP-SM)
Light brown fine sand with roots (SP)
Light gray silty fine sand with shell (SM)
Light gray fine sand (SP)
Light gray fine sand with shell (SP)
Dark gray fine sand with shell (SP)
Gray clay (CL)
Greenish gray clay (CL)
Gray cemented clayey silt (MH)
Light gray cemented silt (ML)
BOR # B-4
DATE 1/15/2014
DRILLER DP/JS
HAMMER Safety
RIG CME-45
-200=1.6
-200=4.3
-200=4.0
-200=96.7
Grayish brown fine sand (SP)
Dark brown fine sand (SP)
Dark brown fine sand with roots (SP)
Light brown fine sand with roots (SP)
Light gray fine sand with shell (SP)
Gray fine sand with shell (SP)
Gray silty clay (CL)
Gray cemented silt (ML)
Light gray cemented silt (ML)
BOR # B-5
DATE 1/15/2014
DRILLER DP/JS
HAMMER Safety
RIG CME-45
-200=79.9
-200=84.9
Gray fine sand (SP)
Dark brown fine sand (SP)
Brown fine sand with roots (SP)
Gray fine sand with phosphate (SP)
Gray fine sand with shell (SP)
Light gray fine sand with shell (SP)
Light gray clay with sand (CL)
Gray clay with shell (CL)
Light gray cemented clayey silt (MH)
Light gray clay (CL)
Gray clay with shell (CL)
LEGEND
GROUNDWATER LEVEL MEASURED ON DATE DRILLED
N SPT N-VALUE IN BLOWS PER FOOT (UNLESS OTHERWISE NOTED)
SPT N VALUES CONVERTED TO EQUIVALENT SAFETY HAMMER
-200 FINES PASSING THE NO. 200 SIEVE (%)
W NATURAL MOISTURE CONTENT
OC ORGANIC CONTENT (%)
GRANULAR MATERIALS- RELATIVE DENSITY
SPT (BLOWS/FOOT)
VERY LOOSE LESS THAN 4
LOOSE 4-10
MEDIUM DENSE 10-30
DENSE 30-50
VERY DENSE GREATER THAN 50
SILTS AND CLAYS CONSISTENCY
SPT (BLOWS/FOOT)
VERY SOFT LESS THAN 4
SOFT 2-4
FIRM 4-8
STIFF 8-15
VERY STIFF 15-30
HARD GREATER THAN 30
Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants
Soil Boring Logs
Robinson Preserve Educ. Center
1704 99th St. NW, Bradenton
Manatee County, Florida
DRAWN BY: KGS
CHECKED BY:
DATE: 2/11/14
FILE NO. 13-7414
APPROVED BY:
FIGURE: B-1