PROPOSED OFFICE BUILDING
GREEN COVE SPRINGS, FLORIDA

ENVIRONMENTAL RESOURCE
PERMIT APPLICATION

June 15, 2023

SUMMARY

The proposed project site is located at 310 Orange Avenue in Green Cove Springs, Florida. The project consists of constructing an office building and associated parking and site improvements. The project area is 1.10 acres and, upon completion of the project, will be 75.0% impervious over the whole site. Stormwater treatment will be provided by an onsite retention system that will outfall to Governors Creek.

Treatment volume for the site is included in the proposed dry retention facility. The facility contains **0.21 ac-ft** of treatment volume providing for more than **2.3 inches** of runoff from the site. The nutrient removal efficiency is met in the proposed facility. The retention facility includes an internal control weir at elevation 8.1'. Overflow from the facility is to Governors Creek.

Calculations, which follow, show that the proposed pond and its' controls will attenuate the peak flow rate for the 25 year, 24-hour storm to **2.3 cfs** with **0.6'** of freeboard compared to a peak pre-development flow calculated to be **2.3 cfs**.

There are no wetlands on the site.

BCE Ref. No. 23-004

Respectfully submitted,

Colin D. Groff, PE

SUPPORTING INFORMATION

I. SITE INFORMATION

Area maps and soils data are included in this report.

II. ENVIRONMENTAL CONSIDERATIONS

The proposed project will not impact any jurisdictional wetlands.

III. PLANS

The plans for the project are submitted herewith.

IV. CONSTRUCTION TECHNIQUES

All contractors working on this project will be bound by strict specifications with regard to erosion and siltation control, with limits on turbidity. Dewatering of work areas will be limited in time and discharge will be to temporary sediment traps. Record drawings will be required from the Contractor. Certification of permit conformance will be by the Owner's consulting engineer.

V. OPERATION & MAINTENANCE

The developed land will be under the ownership and control of the owner. Routine maintenance will include mowing the area and checking for erosion after significant storm events. Eroded areas will be revegetated when necessary.

VI. WATER USE

The site will be served by City of Green Cove Springs for both potable water and wastewater disposal.

The project is not expected to require any Consumptive Use or Water Use permitting.

REPORT OF GEOTECHNICAL EXPLORATION
KNIGHT CENTER
GREEN COVE SPRINGS, FLORIDA
LEGACY PROJECT NO. 23-1132.1

Prepared for:

Mr. Robert Hartwig
R. Hartwig Construction, LLC
P.O. Box 10193
Fleming Island

Prepared by:

Legacy Engineering, Inc.
6415 Greenland Road
Jacksonville, Florida 32258
Phone: 904.721.1100
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June 15, 2023

LEGACY
ENGINEERING

June 15, 2023

Mr. Robert Hartwig
R. Hartwig Construction, LLC
P.O. Box 10193
Fleming Island 32006

Report of Geotechnical Exploration and Engineering Services
Knight Center
Governor's Street and US 17
Green Cove Springs, Florida
Legacy Project No. 23-1132.1

Dear Mr. Hartwig:

As you have requested and authorized, Legacy Engineering, Inc. has completed a preliminary geotechnical exploration for the subject project. The exploration was performed to evaluate the general subsurface conditions within the proposed building areas and to provide guidelines to facilitate foundation support, earthwork preparation, pavement design, drainage, and retaining wall design.

We appreciate this opportunity to be of service as your geotechnical consultant on this phase of the project. If you have any questions, or if we may be of any further service, please contact us.

Sincerely:
Legacy Engineering, Inc.

Joseph Aganon, E.I.
Geotechnical Engineer

Lewis E. Hay, P.E.
Senior Geotechnical Engineer
Licensed, Florida No. 48098

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1.0 PROJECT INFORMATION

1.1 Site Location and Description

The site of the subject project is located directly southwest of the intersection of Governor Street and Highway 17 in Green Cove Springs, Florida. West of the site lies the St. Johns River while the east and north are bounded by Governor Street and Highway 17, respectively. To the south of the site are residential structures. The site topography sloped down toward the west Governor's Street to the St. Johns River. Topographic relief across the site is approximately 12 feet. The topographic relief across the proposed building area is approximately 8 feet.

1.2 Project Description

Project information was provided through correspondence with Mr. Robert Hartwig of R. Hartwig Construction, LLC. We were provided with a copy of the Site Layout Plan/Preliminary Site Plan dated May 9, 2023, prepared by Cypress Management and Design. The provided document shows the layout of the proposed construction, property boundary limits, and adjacent roadways.

Based on the information provided to us, we understand the proposed project will consist of constructing a 3-story, 5,900 square foot concrete block building at the subject site. We also understand that a stormwater retention pond will be contained within concrete block walls. We also understand an 8-foot concrete block retaining wall will be constructed along the west side of the property. It is desired to perform a geotechnical exploration to provide recommendations for foundation design, building support, pavement design, drainage design and retaining wall design. We have not been provided with the structural loading information for the proposed building at this time; however, we have assumed that wall and individual column loads will not exceed 4 klf and 60 kips, respectively. Soil supported floor loads are not expected to exceed 50 psf. We have also assumed that earthwork cuts and fills for the site will be limited to approximately 5 feet or less.

2.0 FIELD EXPLORATION

2.1 Soil Borings

In order to explore the subsurface conditions throughout the area of the proposed building, two (2) Standard Penetration Test (SPT) borings (B1 to B2) were drilled to a depth of 25 feet below the existing grades. Within the areas of the retaining wall and parking and driveway areas, we will drilled five (5) auger borings to depths of 5 and 6 feet each. Auger boring A1 was terminated at feet due to borehole instability associated with the groundwater conditions. Within the area of the proposed stormwater management pond, we drilled two (2) SPT borings to a depth of 15 feet each. The borings were located using a hand-held differentially corrected Global Positioning System (GPS) unit and should be considered accurate to the degree implied by the method utilized. The SPT and auger borings were conducted in accordance with ASTM D 1586 and ASTM D 1452, respectively. The subsurface conditions encountered at each boring

location, and the recorded groundwater levels, are presented on the Generalized Soil Profile and Boring Records in Appendix A.

2.2 Relatively Undisturbed Soil Samples

Two (2) relatively undisturbed soil samples (Shelby Tubes) were obtained from the upper 18 to 24 inches between the pond boring locations for the purpose of performing permeability (hydraulic conductivity) testing. The soil samples were obtained using a thin-walled, 3-inch O.D., 16 gauge tube (Shelby tube). One tube was oriented vertically, and one tube was oriented horizontally at the boring location. The Shelby tubes were carefully removed from the ground, secured and transported to our laboratory for permeability testing. The sampling procedure is described by ASTM D 1587.

3.0 LABORATORY TESTING

3.1 Index Testing

Soil samples recovered during the field exploration were visually classified in accordance with ASTM D 2488. Limited laboratory testing consisted of fines content, moisture content and organic content tests to assist in classification and estimation of soil properties. The results of the testing are presented on the Boring Records in Appendix A.

3.2 Permeability Testing

Permeability (hydraulic conductivity) tests were conducted on the undisturbed soil samples to estimate the permeability coefficients of the soil. The coefficient of permeability is a measure of a soil's ability to transmit water under hydraulic loading conditions. It typically is a required input parameter for groundwater modeling, such as dry pond recoveries, background seepage, etc. The laboratory permeability test is typically conducted by placing the undisturbed soil sample in a permeameter, and while in the permeameter, the soil sample is subjected to differential hydraulic loading over a period of time. The volume of water that is transmitted through the soil sample is recorded, and along with the known hydraulic loading conditions, Darcy's law is utilized to calculate the permeability coefficient. The permeability coefficients are shown on the drainage recommendations (Section 5.0).

4.0 GENERAL SUBSURFACE CONDITIONS

4.1 General Soil Profile

The boring locations and general subsurface conditions that were encountered are graphically illustrated on the Field Exploration Plan and Generalized Soil Profile in Appendix A. A detailed description of the subsurface conditions encountered is presented on the Test Boring and Auger Boring Records in Appendix A. When reviewing these records, it should be understood that the soil conditions may change significantly between and away from the boring locations. The following discussion summarizes the soil conditions encountered.

Beneath 3 to 4 inches of topsoil, the SPT borings in the building area encountered loose to firm fine sands (SP) and fine sands with silt (SP-SM) to a depth of 11.5 to 12.5 feet. Firm to very dense clayey fine sands (SC) were then penetrated to the boring termination depths of 25 feet.

Below 4 inches of topsoil, the SPT borings in the proposed stormwater retention pond area encountered very loose to very firm fine sands (SP), very loose to loose fine sands with silt (SP-SM) and firm silty fine sands (SM) to the boring termination depth of 15 feet below the existing grades. An exception to this general soil profile occurred at boring PB1 where brick fragments were penetrated between 3 and 4 feet.

Below 4 to 6 inches of topsoil, the auger borings in the pavement and retaining wall areas penetrated fine sands (SP) and fine sands with silt (SP-SM) to the boring termination depths of 5 to 6 feet.

4.2 Groundwater Level

The groundwater level was measured at the boring locations, subsequent to boring completion, at depths of 3.3 to 5.0 feet below the existing site grades. The depth of the groundwater level encountered at each boring location is presented on the Generalized Soil Profile and the Test Boring Records in Appendix A.

The groundwater table will fluctuate depending on seasonal rainfall activity, tidal fluctuations, seasonal variations, adjacent construction, surface water runoff, etc. Should rainfall intensity exceed normal quantities or should other variables that affect the seasonal high groundwater level be altered, the groundwater profile at the site could change significantly. The seasonal high groundwater table at this site is anticipated to range from 1 to 4.5 feet below the existing grade and will vary with the site topography.

5.0 DRAINAGE RECOMMENDATIONS

5.1 Drainage Parameters

The following parameters presented in the table below can be utilized for drainage design. A factor of safety of at least 2 should be utilized for design purposes. The permeability rates for the fine sands in the construction areas are presented in the table below.

Sample Location	Aquifer Depth (1)	Estimated Seasonal High Ground Water Depth (1)	Horizontal Permeability Rate	Vertical Permeability Rate
ST1	15 ft (2)	2.0 feet (1)	29.8 ft/day	27.5 ft/day

(1) Depth below grade, at the boring location, existing at time of exploration.
(2) Aquifer depth limited to boring termination depth.

6.0 BUILDING AREA RECOMMENDATIONS

6.1 General

The following preliminary recommendations are made based upon a review of the attached soil test data, our understanding of the proposed construction, and experience with similar projects and subsurface conditions. If the structural loads, construction locations, or grading information change from those discussed previously, we request the opportunity to review and possibly amend our recommendations with respect to those changes.

Please report to us any conditions encountered during construction that were not observed during the performance of the borings. We will review, and provide additional evaluation as required.

The loose sandy soils encountered by the borings will require surface compaction with a vibratory drum roller prior to the placement of any elevating fill.

6.2 Building Foundations

Based on the results of the subsurface exploration, we consider the subsurface conditions at the site adaptable for support of the proposed building on a properly designed and constructed conventional shallow foundation system. Provided the soils are prepared in accordance with the Site Preparation Section (Section 6.3) of this report, the following parameters may be used for foundation design.

6.2.1 Bearing Pressure

The maximum allowable net soil bearing pressure for shallow foundations should not exceed 2,500 pounds per square foot (psf). Net bearing pressure is defined as the soil bearing pressure at the base of the foundation in excess of the natural overburden pressure. The foundations should be designed based upon the maximum load that could be imposed by all loading conditions.

6.2.2 Foundation Size

The minimum widths recommended for any isolated column footing and continuous wall footings are 24 inches and 18 inches, respectively. Even though the maximum allowable soil bearing pressure may not be fully achieved, these width recommendations should control the size of the foundations.

6.2.3 Bearing Depth

The exterior foundations should bear at a depth of at least 18 inches below the finished exterior grades and the interior footings should bear at a depth of at least 18 inches below the finish floor elevation to provide confinement to the bearing level soils. We recommend stormwater and surface water be diverted away from the building exterior, both during and after construction, to reduce the possibility of erosion adjacent to the exterior footings.

6.2.4 Bearing Material

The foundations may bear on compacted existing or structural fill/backfill. The bearing level soils, after compaction, should exhibit densities of at least 95 percent of the maximum dry density as determined by ASTM D 1557 (Modified Proctor), to the depth described subsequently in the Site Preparation section of the report. In addition to compaction, the bearing soils must exhibit stability and be free of "pumping" conditions.

6.2.5 Settlement Estimates

Post-construction settlement of the structure will be influenced by several interrelated factors, such as (1) subsurface stratification and strength/compressibility characteristics of the bearing soils; (2) footing size, bearing level, applied loads, and resulting bearing pressures beneath the foundations; (3) site preparation and earthwork construction techniques used by the contractor, and (4) external factors, including but not limited to vibration from offsite sources and groundwater fluctuations beyond those normally anticipated for the naturally-occurring site and soil conditions which are present.

Our settlement estimate for the structure is based upon adherence to the site preparation recommendations presented later in this report. Any deviation from these recommendations could result in an increase in the post-construction settlement of the structure.

Due to the sandy nature of the site soils, we expect a significant portion of anticipated settlement to be elastic in nature. This settlement is expected to occur rapidly, upon application of the fill and dead loads during and immediately following construction. Using the recommended maximum bearing pressure, the assumed maximum structural loads presented in this report, and the field and laboratory test data which we have correlated to the strength and compressibility characteristics of the subsurface soils, we estimate the total settlement of the structure will be on the order of one inch or less.

Differential settlement results from differences in applied bearing pressures and the variations in the compressibility characteristics of the subsurface soils. Based on the subsurface conditions as determined by the borings, it is anticipated that differential settlement will be approximately one-half of the total settlement.

6.3 Site Preparation for Shallow Foundations

We recommend the following site preparation guidelines for the foundation areas:

1. Prior to construction, the location of any existing underground utility lines within the construction area should be established. Provisions should then be made to relocate interfering utilities to appropriate locations. It should be noted that if underground pipes are not properly removed or plugged, they may serve as conduits for subsurface erosion which may subsequently lead to excessive settlement of the overlying structure.

2. Implement temporary groundwater control measures, as required. The groundwater should be maintained at least two feet below the depth of any excavations required during construction and two feet below compacted surfaces. Temporary groundwater control measures should be the responsibility of the contractor.

3. Strip the proposed construction limits of all grass, roots, topsoil and other deleterious materials within and 5 feet beyond the perimeter of the proposed structure and pavement areas. Expect initial clearing and grubbing depths to be on the order of 4 inches more or less. Some areas may require more than 12 inches of stripping to remove concentrated root zones whereas other areas may require less than 4 inches.

4. Compact the exposed soil surface using a medium-weight vibratory drum roller (3 to 4-foot drum diameter and 4 to 6 tons static weight) until density test results equivalent to at least 95 percent of the Modified Proctor Test (ASTM D 1557) maximum dry density are uniformly achieved to a depth of at least 12 inches. We recommend making at least eight to ten overlapping coverages of the building area in perpendicular directions with the roller in order to increase the density and improve the uniformity of the underlying loose sandy soils. The soils should exhibit moisture contents within 2 percent of the optimum moisture content as determined by the Modified Proctor Test (ASTM D 1557) at the time of compaction.

   Should the soils experience pumping and soil strength loss during the compaction operations, compaction work should be immediately terminated and (1) the disturbed soils removed and backfilled with dry structural fill soils which are then compacted, or (2) the excess moisture content within the disturbed soils allowed to dissipate before recompacting.

5. Place any required structural fill to grade in loose lifts not exceeding a thickness of 12 inches when using the roller described above. Compact each lift until the density test results equivalent to at least 95 percent of the Modified Proctor maximum dry density (ASTM D 1557) have been achieved.

6. Test the compacted surface for density at a minimum of one test location per 2,500 square feet of the proposed building area (minimum of three test locations).

7. Excavate, compact and test footing excavations for density to a depth of one foot below the foundation bearing level. We recommend that you perform one density test per every 100 feet of wall footing, and test one out of every four column footings. Compaction operations in confined areas, such as footing excavations, can best be performed with a lightweight vibratory sled or other hand-held compaction equipment.

7.0 PAVEMENT RECOMMENDATIONS

7.1 General

We understand the subject project will utilize a flexible asphaltic concrete pavement section. In the following sections, we have presented our recommendations to guide pavement design and site preparation.

7.2 Pavement Section Recommendations

Our recommendations for pavement sections are presented below. Detailed traffic loading conditions were not available; therefore, we have provided pavement sections which can accommodate loading conditions typical of the subject construction over a design life of 20 years. The light duty pavement sections are based on 500,000 Equivalent Single Axle Loads (ESALs) of 18 kips. The heavy-duty pavement sections are based on 1,500,000 ESALs.

Pavement Section	**Asphalt [1] Thickness (in)**	**Base Course [2] Thickness (in)**	**Stabilized [3] Subgrade (in)**
Light Duty Asphalt	1.5	6.0	12
Heavy Duty Asphalt	2.0	8.0	12

1) Flexible pavement should consist of FDOT SP 9.5 or SP 12.5 mix.
2) Base course should consist of limerock exhibiting an LBR of at least 100, or crushed concrete exhibiting an LBR of at least 130. Limerock and crushed concrete base course materials and gradations should conform to FDOT Standard Specifications for Road and Bridge Construction Sections 911 and 204, respectively.
3) Stabilized subgrade should exhibit an LBR of at least 40.

7.3 Site Preparation for Pavements

We recommend the following site preparation guidelines for pavement construction:

1. Prior to construction, the location of any existing underground utility lines within the construction area should be established. Provisions should then be made to relocate interfering utilities to appropriate locations. It should be noted that if underground pipes are not properly removed or plugged, they may serve as conduits for subsurface erosion which may subsequently lead to excessive settlement.

2. Implement temporary groundwater control measures, as required. The groundwater should be maintained at least two feet below the depth of any excavations required during construction and two feet below compacted surfaces. Temporary groundwater control measures should be the responsibility of the contractor.

3. Strip the proposed construction limits of all grass, roots, topsoil, and other deleterious materials within, and 3 feet beyond, the proposed pavement limits. Expect initial clearing and grubbing to depths of approximately 4 inches more or less.

4. After stripping and grubbing, compact the exposed soil surface with a medium-weight vibratory drum roller (3 to 4-foot drum diameter and 5 to 7 tons static weight until densities of at least 95 percent of the modified Proctor maximum dry density (ASTM D 1557) are achieved to a depth of at least one foot below the exposed surface with the exception that densities of at least 98 percent should be obtained in the upper 12 inches below the base course. We recommend the compacted soils exhibit moisture contents within 2 percent of the optimum moisture content as determined by the Modified Proctor Test (ASTM D 1557).

   Again, should the soils experience pumping and soil strength loss during the compaction operations, compaction work should be immediately terminated and (1) the disturbed soils removed and backfilled with dry structural fill soils which are then compacted, or (2) the excess moisture content within the disturbed soils allowed to dissipate before recompacting.

5. Test the compacted surface for density at a frequency of not less than one test location per 10,000 square feet of pavement area or one test per 300 linear feet of roadway.

6. Place any required structural fill to grade in the pavement areas in loose lifts not exceeding 12 inches. Compact each lift until densities of at least 95 percent of the Modified Proctor maximum dry density (ASTM D 1557) have been achieved within each lift of the compacted structural fill, with the exception that densities of at least 98 percent should be obtained in the upper 12 inches below pavement base course. Structural fill and backfill is typically defined as non-plastic, inorganic, granular soil having less than 10 percent material passing the No. 200 mesh sieve (relatively clean sand). Typically, the material should exhibit moisture contents within 2 percent of the Modified Proctor optimum moisture content (ASTM D 1557) during the compaction operations.

7. Perform density tests within each lift of fill at a frequency of not less than one test location per 10,000 square feet of pavement area or one test per 300 linear feet of roadway.

8. Place and compact base course until density test results of at least 100 percent of the modified Proctor maximum dry density are achieved. Compaction operations should be conducted with the drum roller noted above.

9. Perform density tests within the base course at a frequency of not less than one test location per 10,000 square feet of pavement area or 300 linear feet of roadway.

7.4 Additional Pavement Considerations

7.4.1 Asphaltic Concrete Pavement

Asphaltic concrete mixes should be a current FDOT approved design of the materials used. Samples of the materials delivered to the project should be tested to verify that the aggregate gradation and asphalt content satisfies the mix design requirements.

After placement and field compaction, core the wearing surface to evaluate material thickness and to perform laboratory density tests on the compacted asphalt. Obtain cores at frequencies of at least one core per 3,000 square feet of placed pavement, or a minimum of two cores per day of production.

7.4.2 Groundwater Separation

Groundwater, if not maintained below the base course an adequate distance, can result in weakened subgrade and base course soils, and therefore a greatly reduced pavement life. It is recommended the seasonal high groundwater level be maintained at least 24 inches below base courses. If the recommended vertical separation cannot be achieved through grading or permanent surface drainage improvements, underdrains can be considered to maintain the groundwater level at the recommended depths.

8.0 RETAINING WALL DESIGN

8.1 Lateral Earth Parameters

The table below provides soil parameters that can be utilized by the wall designer for the sheet piling/wall support. A suitable factor of safety should be utilized for the retaining wall design.

LATERAL EARTH PRESSURES

Soil Depth (ft)	Dry Unit Weight (pcf)	Saturated Unit Weight (pcf)	Buoyant Unit Weight (pcf)	K_a	K_p	K_o	Φ (degrees)	C (psf)	δ
Fill	110	122	60	0.31	3.25	0.47	32	0	20
0-6	105	117	55	0.33	3.0	0.50	30	0	20

K_a = coefficient of active lateral earth pressure
K_p = coefficient of passive lateral earth pressure
K_o = coefficient of at-rest lateral earth pressure
Φ = angle of internal friction
C = cohesion
δ = wall friction angle

The retaining wall should be installed to a sufficient depth below the mudline to ensure stability and prevent toe failures. A heavy, non-woven geotextile can be placed against the face of the retaining wall to prevent the migration of sandy backfill soils through construction joints. Fill and backfill placed behind the wall should be placed in uniform 4 to 6-inch loose lifts and compacted

to a minimum density of 95 percent of the Modified Proctor maximum dry density using light-weight walk-behind vibratory compactors. To minimize the lateral earth stresses imparted to the retaining wall, over compaction should be avoided and larger compaction equipment should not be used within 5 lateral feet of the wall. Larger vibratory rollers should be operated in static mode when utilized near the retaining wall. We recommend the soil, at the time of compaction, exhibit moisture contents within 2 percent of the soil optimum moisture content as determined by the Modified Proctor Test (ASTM D 1557).

8.2 Hydrostatic Pressure

The designer should consider the potential effects of hydrostatic pressure exerted by groundwater on the retaining walls. To help reduce significant hydrostatic pressure on the walls, a wall drain could be placed near the base of the walls. A number of commercially available geosynthetic composite drainage systems are available for retaining wall designs. Clean backfill should be utilized within five feet of the wall, thereby improving drainage. Structural fill and backfill is typically defined as non-plastic, inorganic, granular soil having less than 10 percent material passing the No. 200 mesh sieve (relatively clean sand). The drain should collect the groundwater and positively convey it away from the wall. It is recommended clean-outs be utilized so periodic maintenance of the drains can be conducted.

9.0 RETENTION POND RECOMMENDATIONS

9.1 General

The drainage system includes a stormwater retention pond. Based on the size of the proposed pond, suitable soils excavated for the pond construction can be a fill source for site development.

9.2 Borrow Suitability

The borings in the pond area were intended, in part, to provide an indication of the suitability of the soils for use as structural fill and backfill. The fine sands (SP) and fine sands with silt (SP-SM) are suitable for use as structural fill and backfill material. The fine sands typically exhibit higher permeability rates than the fine sands with silt, and therefore, are more desirable for use in areas requiring substantial drainage potential.

We recommend that soils containing bricks or brick rubble (see boring PB1) be segregated for disposal during the pond excavation. In addition, the fine sand with silt and organics penetrated from 5.5 to 9.5 feet in boring PB2 should also be segregated for disposal due to elevated organic content. The silty fine sands (SM) encountered below a depth of 11.5 feet in boring PB2 should not be used as structural due to moisture sensitivity associated with an elevated fines content. If allowed to dry, however, the silty sands could be mixed with cleaner sandy soils to produce an acceptable blend.

The soils in the proposed pond area that are below the groundwater level will have moisture contents in excess of the Modified Proctor optimum moisture content and will require

stockpiling or spreading to dry and reduce moisture contents to within 2 percent of the optimum moisture content corresponding to the required degree of compaction.

10.0 LIMITATIONS

We have conducted the preliminary geotechnical engineering evaluation in accordance with principles and practices normally accepted in the geotechnical engineering profession. Our analysis and recommendations are dependent on the information provided to us. Legacy Engineering, Inc. is not responsible for independent conclusions or interpretations based on the information presented in this report.

APPENDIX A

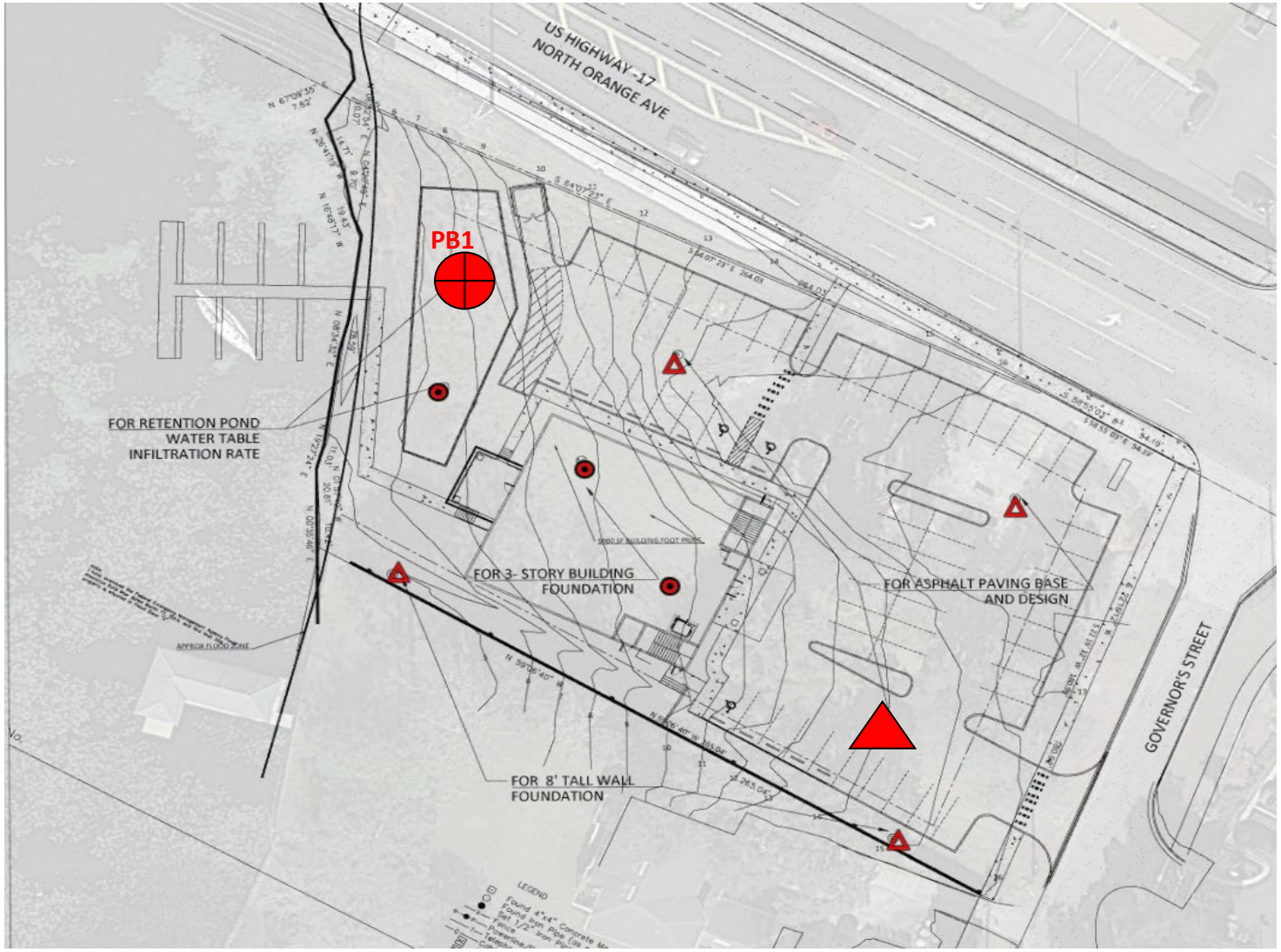
FIELD EXPLORATION PLAN

GENERALIZED SOIL PROFILE

TEST BORING RECORD

AUGER BORING RECORD

SUMMARY OF LABORATORY INDEX TEST RESULTS



LEGEND

Approximate SPT Boring Locations

Approximate Auger Boring Locations

Approxmiate Shelby Tube Location

N
W E
S

Reference: Plan Created Using Provided Plan

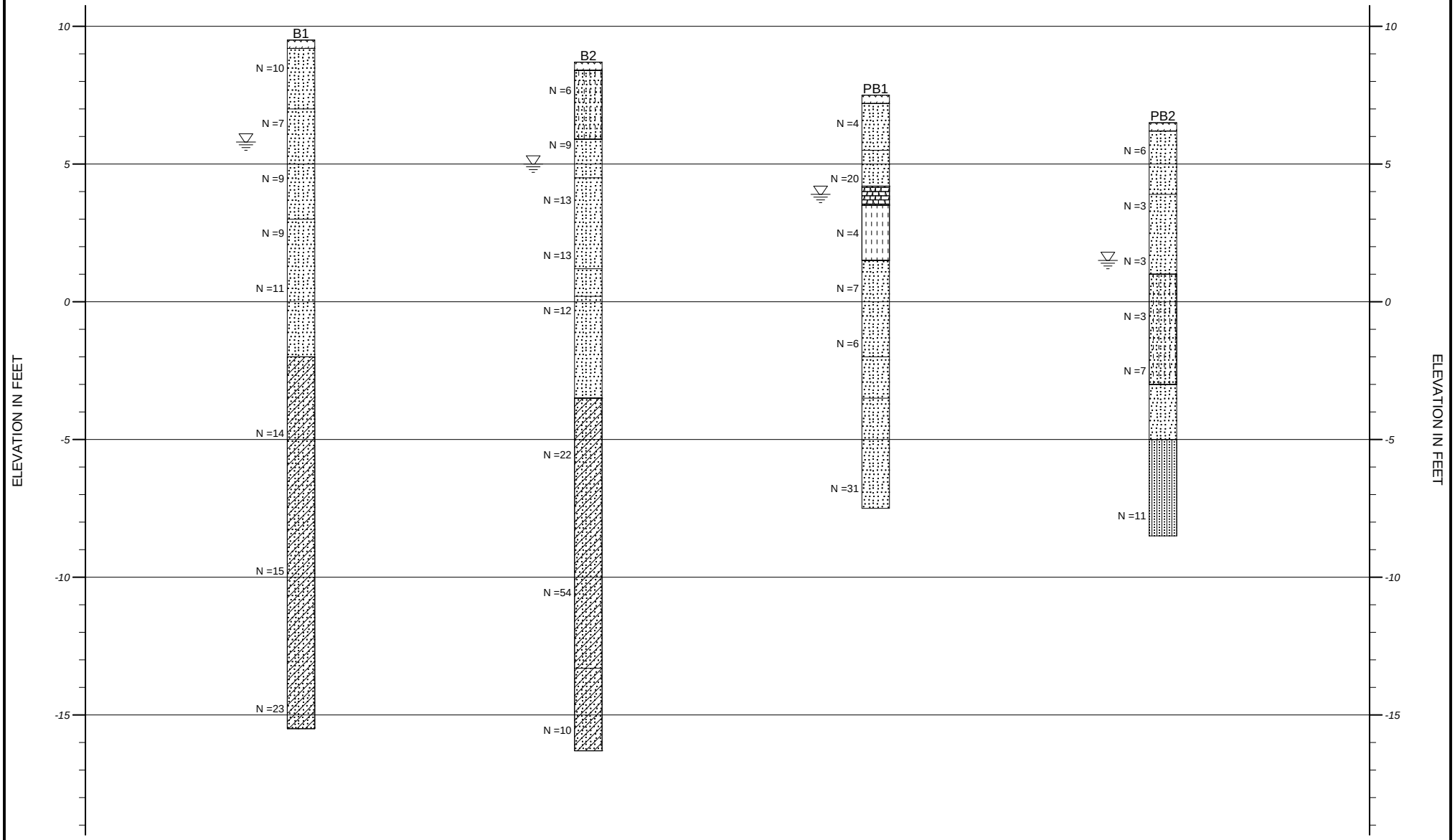
Field Exploration Plan

KNIGHT CENTER

Green Cove Springs, Florida

LEGACY ENGINEERING

Date: 06/13/2023	Proj. No.: 23-1132.1	Figure 1



Strata symbols

- Topsoil
- Fine SAND (SP)
- Clayey to Very Clayey Fine SAND (SC)
- Fine SAND with Silt (SP-SM)
- Brick Fragments
- No Return
- Silty Fine SAND (SM)

Ground Water Depth

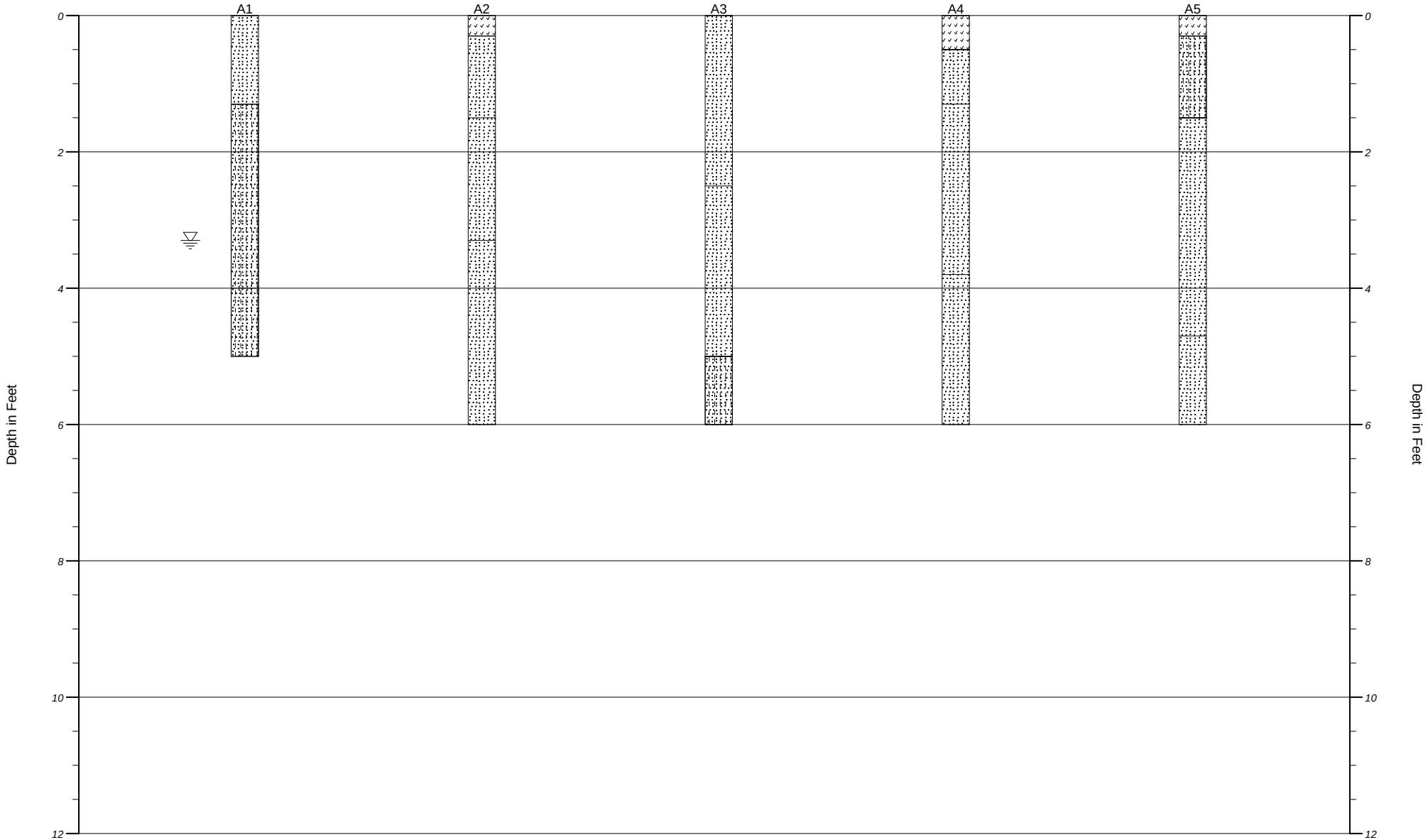
Legacy Engineering, Inc.

GENERALIZED SOIL PROFILE

HORIZONTAL SCALE:	DRAWN BY/APPROVED BY	DATE DRAWN
VERTICAL SCALE: 1"=5'	JEEII/JEEII	6/15/2023

Knight Center
Green Cove Springs, Florida

PROJECT NO. 23-1132 | FIGURE NUMBER 2



Strata symbols

- Fine SAND (SP)
- Fine SAND with Silt (SP-SM)
- Topsoil

Ground Water Depth

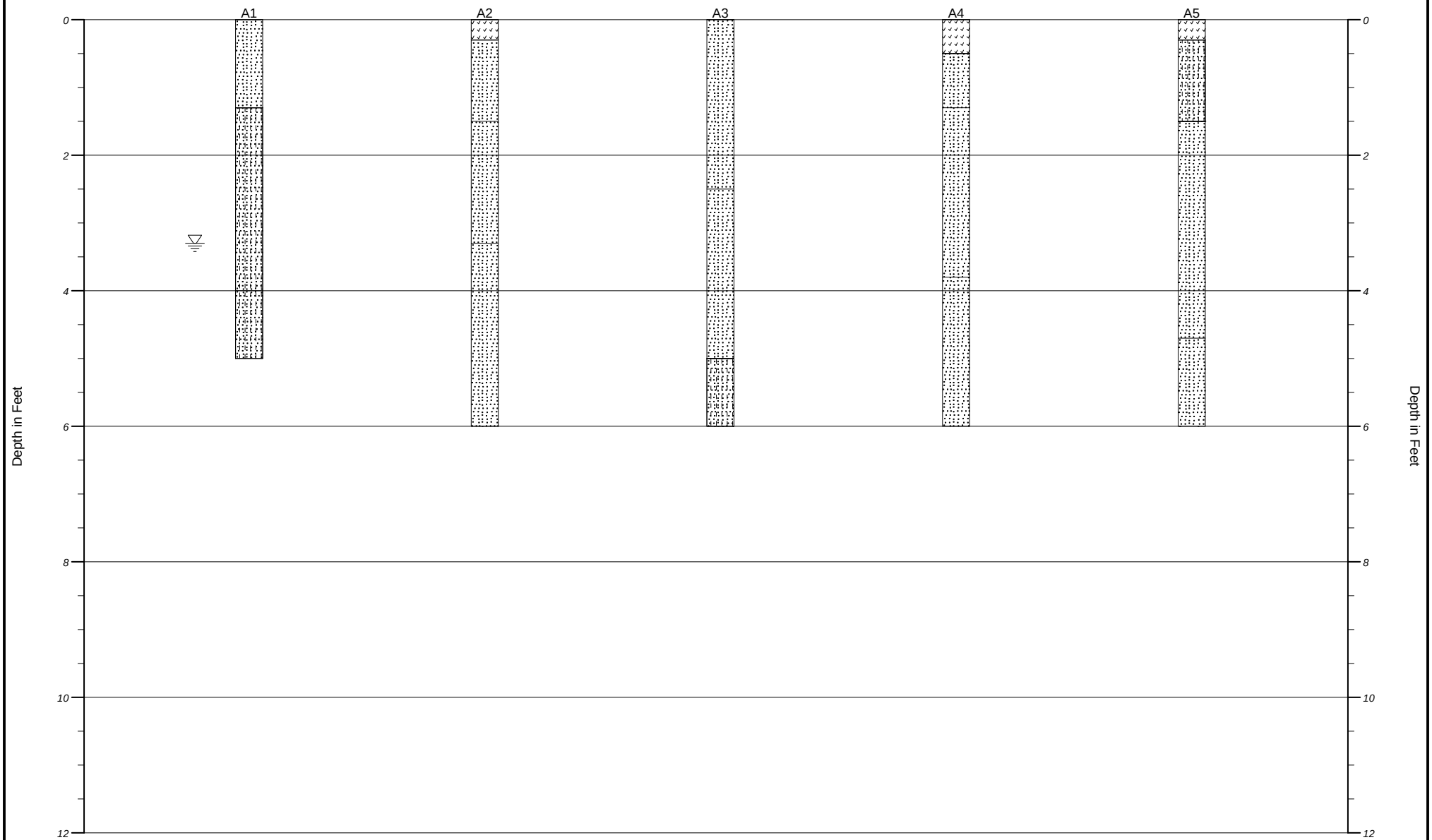
Legacy Engineering, Inc.

GENERALIZED SOIL PROFILE

HORIZONTAL SCALE:	DRAWN BY/APPROVED BY	DATE DRAWN
VERTICAL SCALE: 1"=2'	JEEII/JEEII	6/15/2023

Knight Center
Green Cove Springs, Florida

PROJECT NO. 23-1132 | FIGURE NUMBER 2



Strata symbols

- Fine SAND (SP)
- Fine SAND with Silt (SP-SM)
- Topsoil

Ground Water Depth

Legacy Engineering, Inc.

GENERALIZED SOIL PROFILE

HORIZONTAL SCALE:	DRAWN BY/APPROVED BY	DATE DRAWN
VERTICAL SCALE: 1"=2'	JEEII/JEEII	6/12/2023

Knight Center

Green Cove Springs, Florida

PROJECT NO. 23-1132 | FIGURE NUMBER

TEST BORING RECORD

LEGACY ENGINEERING

JOB NO. 23-1132
BORING NO. B1
Sheet 1 **of** 2
Boring Begun 06/06/2023
Boring Completed 06/06/2023
Driller Christian R.
Engineer John E. Ellis II

Project Knight Center
Boring Location Green Cove Springs, Florida
Ground Elevation 9.5 Feet **Datum** N/A **Groundwater Depth** 3.7 Feet
Length of Casing Set 5 Feet **Casing Size** 4 Inches

ELEV. (FT)	DEPTH (FT)	MATERIAL DESCRIPTION	SOIL SYMBOL	SAMPLE NO.	STANDARD PENETRATION TEST BLOWS / 6-INCH	STANDARD PENETRATION TEST BLOW COUNT
9.5	0	Topsoil (4 Inches)				
9.2		Loose Grayish Brown Fine SAND with Few Wood Pieces (SP)		1	3 4 6	10
8	1				5	
	2				4	
		Loose Light Brown Fine SAND (SP)		2	3 4	7
6	3				4	
	4				3	
		Loose Light Gray Fine SAND (SP)		3	4 5	9
4	5				5	
	6				3	
		Loose to Firm Light Gray Fine SAND (SP)		4	4 5	9
2	7				7	
	8				4	
				5	5 6	11
0	9				9	
	10					
	11					
-2		Firm to Very Firm Brownish Orange Clayey Fine SAND (SC)				
	12					
	13					
-4					5	
	14			6	7	14
					7	
	15					
-6						

REMARKS:

BORING & SAMPLING: ASTM D1586/CORE DRILLING: ASTM D2113

Ground Water Table

BLOW COUNT IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

LEGACY

ENGINEERING, INC.

Geotechnical & Materials Engineering and Testing

TEST BORING RECORD

JOB NO. 23-1132

BORING NO. B1

Project Knight Center

Sheet 2 **of** 2

ELEV. (FT)	DEPTH (FT)	MATERIAL DESCRIPTION	SOIL SYMBOL	SAMPLE NO.	STANDARD PENETRATION TEST	
					BLOWS / 6-INCH	BLOW COUNT
	16	Firm to Very Firm Brownish Orange Clayey Fine SAND (SC), Continued				
	17					
-8	18					
	19			7	3 4 11	15
-10	20					
	21					
-12	22					
	23					
-14	24			8	10 10 13	23
-15.5	25	Boring Terminated at 25 Feet				
	26					
	27					
	28					
	29					
	30					
	31					

TEST BORING RECORD

LEGACY ENGINEERING

JOB NO. 23-1132
BORING NO. B2
Sheet 1 **of** 2
Boring Begun 06/06/2023
Boring Completed 06/06/2023
Driller Christian R.
Engineer John E. Ellis II

Project Knight Center
Boring Location Green Cove Springs, Florida
Ground Elevation 8.7 Feet **Datum** N/A **Groundwater Depth** 3.7 Feet
Length of Casing Set 5 Feet **Casing Size** 4 Inches

ELEV. (FT)	DEPTH (FT)	MATERIAL DESCRIPTION	SOIL SYMBOL	SAMPLE NO.	STANDARD PENETRATION TEST: BLOWS / 6-INCH	STANDARD PENETRATION TEST: BLOW COUNT
8.7	0	Topsoil (3 Inches)				
8.4		Loose Grayish Brown Fine SAND with Silt (SP-SM)			3	
8	1			1	3	6
					3	
	2				3	
6					3	
5.9	3	Loose to Firm Dark Grayish Brown Fine SAND (SP)		2	5	9
					4	
	4				5	
4		Firm Grayish Brown Fine SAND (SP)			5	
	5			3	6	13
					7	
	6				8	
2					4	
	7			4	5	13
					8	
	8	Firm Light Brown Fine SAND (SP)			10	
					4	
0		Firm Light Grayish Brown Fine SAND (SP)			5	
	9			5	7	12
					8	
	10					
-2						
	11					
	12					
-3.5		Very Firm to Very Dense Grayish Orange Clayey Fine SAND (SC)				
-4						
	13					
					8	
	14			6	12	22
-6					10	
	15					

REMARKS:

BORING & SAMPLING: ASTM D1586/CORE DRILLING: ASTM D2113

Ground Water Table

BLOW COUNT IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

LEGACY
ENGINEERING, INC.
Geotechnical & Materials Engineering and Testing

TEST BORING RECORD

JOB NO. 23-1132

BORING NO. B2

Project Knight Center

Sheet 2 **of** 2

ELEV. (FT)	DEPTH (FT)	MATERIAL DESCRIPTION	SOIL SYMBOL	SAMPLE NO.	STANDARD PENETRATION TEST: BLOWS / 6-INCH	STANDARD PENETRATION TEST: BLOW COUNT
	16	Very Firm to Very Dense Grayish Orange Clayey Fine SAND (SC), Continued				
-8	17					
	18					
-10	19			7	13 21 33	54
	20					
-12	21					
	22	Loose Orange Clayey Fine SAND (SC)				
-14	23					
	24			8	5 5 5	10
-16						
-16.3	25	Boring Terminated at 25 Feet				
	26					
	27					
	28					
	29					
	30					
	31					

TEST BORING RECORD

LEGACY ENGINEERING

JOB NO. 23-1132
BORING NO. PB1
Sheet 1 **of** 1
Boring Begun 06/06/2023
Boring Completed 06/06/2023
Driller Christian R.
Engineer John E. Ellis II

Project Knight Center
Boring Location Green Cove Springs, Florida
Ground Elevation 7.5 Feet **Datum** N/A **Groundwater Depth** 3.6 Feet
Length of Casing Set 5 Feet **Casing Size** 4 Inches

ELEV. (FT)	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE NO.	STANDARD PENETRATION TEST: BLOWS / 6-INCH	STANDARD PENETRATION TEST: BLOW COUNT
7.5	0	Topsoil (4 Inches)			
7.2		Very Loose Grayish Brown Fine SAND (SP)			
	1	Fines Content: 2.3%	1	2 2 2	4
6				3	
	2	Firm Grayish Brown Fine SAND (SP)		3	
	3		2	4	20
4.2				16	
4		Brick		5	
3.5	4	No Return		1	
	5		3	1 3	4
2				4	
1.5	6	Loose Light Grayish Brown Fine SAND (SP)		2	
	7		4	3 4	7
0				4	
	8			2	
	9		5	3 3	6
-2		Loose Grayish Brown Fine SAND (SP)		4	
	10				
	11	Dense Light Gray Brown Fine SAND (SP)			
-4					
	12				
	13				
-6				8	
	14		6	13	31
				18	
-7.5	15	Boring Terminated at 15 Feet			

REMARKS:

BORING & SAMPLING: ASTM D1586/CORE DRILLING: ASTM D2113

Ground Water Table

BLOW COUNT IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

TEST BORING RECORD

LEGACY ENGINEERING

JOB NO. 23-1132
BORING NO. PB2
Sheet 1 **of** 1
Boring Begun 06/06/2023
Boring Completed 06/06/2023
Driller Christian R.
Engineer John E. Ellis II

Project Knight Center
Boring Location Green Cove Springs, Florida
Ground Elevation 6.5 Feet **Datum** N/A **Groundwater Depth** 5 Feet
Length of Casing Set 5 Feet **Casing Size** 4 Inches

ELEV. (FT)	DEPTH (FT)	MATERIAL DESCRIPTION	SOIL SYMBOL	SAMPLE NO.	STANDARD PENETRATION TEST: BLOWS / 6-INCH	STANDARD PENETRATION TEST: BLOW COUNT
6.5	0	Topsoil (4 Inches)				
6.2						
6		Loose to Very Loose Grayish Brown Fine SAND with Trace Roots (SP) Fines Content: 2.3%		1	2 3 3	6
	1				2	
	2				1 2	
4		Very Loose Dark Grayish Brown Fine SAND (SP)		2	1 2	3
	3				1	
	4				2	
2					1	
	5			3	1 2	3
1		Very Loose to Loose Dark Grayish Brown Fine SAND with Silt and Some Organics (SP-SM) Fines Content: 6.2% Organic Content: 4.5%			2	
	6				2	
0					2	
	7			4	1 2	3
	8				2	
-2					2	
	9			5	3 4	7
-3		Loose Grayish Brown Fine SAND (SP)			4	
	10					
-4						
	11					
-5		Firm Light Gray Silty Fine SAND (SM)				
	12					
-6						
	13					
	14			6	7 6	11
-8					5	
-8.5	15	Boring Terminated at 15 Feet				

REMARKS:

BORING & SAMPLING: ASTM D1586/CORE DRILLING: ASTM D2113

Ground Water Table

BLOW COUNT IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

AUGER BORING RECORD

LEGACY ENGINEERING

JOB NO. 23-1132
AUGER NO. A1
Sheet 1 of 1
Auger Begun 06/06/2023
Auger Completed 06/06/2023
Driller Christian R.
Engineer John E. Ellis II

Project Knight Center
Auger Location Green Cove
Groundwater Depth 3.3 Feet

ELEV. (FT)	DEPTH (FT)	MATERIAL DESCRIPTION	SOIL SYMBOL	SAMPLE NO.
	0–1	Grayish Brown Fine SAND with Trace Rock Fragments (SP)		1
	1–4	Dark Gray Fine SAND with Silt (SP-SM)		2
	4–5	Dark Gray Fine SAND with Silt (SP-SM)		3
	5	Auger Terminated at 5 Feet		

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

REMARKS:

AUGERING & SAMPLING: ASTM D1452

Ground Water Table FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

AUGER BORING RECORD

LEGACY ENGINEERING

JOB NO. 23-1132
AUGER NO. A2
Sheet 1 of 1
Auger Begun 06/06/2023
Auger Completed 06/06/2023
Driller Christian R.
Engineer John E. Ellis II

Project Knight Center
Auger Location Green Cove
Groundwater Depth N.E.

ELEV. (FT)	DEPTH (FT)	MATERIAL DESCRIPTION	SOIL SYMBOL	SAMPLE NO.
	0	Topsoil (4 Inches)		1
	1	Grayish Brown Fine SAND (SP)		1
	2	Brown Fine SAND (SP)		2
	3			
	4	Light Brown Fine SAND (SP)		3
	5			
	6	Auger Terminated at 6 Feet		
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			
	16			

REMARKS:

AUGERING & SAMPLING: ASTM D1452

Ground Water Table **FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.**

LEGACY ENGINEERING

AUGER BORING RECORD

JOB NO. 23-1132

AUGER NO. A3

Sheet 1 **of** 1

Auger Begun 06/06/2023

Auger Completed 06/06/2023

Project Knight Center

Auger Location Green Cove

Groundwater Depth N.E.

Driller Christian R.

Engineer John E. Ellis II

ELEV. (FT)	DEPTH (FT)	MATERIAL DESCRIPTION	SOIL SYMBOL	SAMPLE NO.
	0	Grayish Brown Fine SAND with Few Rock Fragments (SP)		1
	1			
	2			
	3	Light Gray Fine SAND (SP)		2
	4			
	5	Grayish Brown Fine SAND with Silt (SP-SM)		3
	6	Auger Terminated at 6 Feet		
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			
	16			

REMARKS:

AUGERING & SAMPLING: ASTM D1452

Ground Water Table **FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.**

AUGER BORING RECORD

LEGACY ENGINEERING

JOB NO. 23-1132
AUGER NO. A4
Sheet 1 **of** 1
Auger Begun 06/06/2023
Auger Completed 06/06/2023
Driller Christian R.
Engineer John E. Ellis II

Project Knight Center
Auger Location Green Cove
Groundwater Depth N.E.

ELEV. (FT)	DEPTH (FT)	MATERIAL DESCRIPTION	SOIL SYMBOL	SAMPLE NO.
	0	Topsoil (6 Inches)		
	1	Grayish Brown Fine SAND (SP)		1
	2	Brown Fine SAND (SP)		2
	3			
	4	Light Brown Fine SAND (SP)		3
	5			
	6	Auger Terminated at 6 Feet		
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			
	16			

REMARKS:

AUGERING & SAMPLING: ASTM D1452

Ground Water Table **FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.**

LEGACY ENGINEERING

AUGER BORING RECORD

JOB NO. 23-1132

AUGER NO. A5

Sheet 1 **of** 1

Auger Begun 06/06/2023

Auger Completed 06/06/2023

Driller Christian R.

Engineer John E. Ellis II

Project Knight Center

Auger Location Green Cove

Groundwater Depth N.E.

ELEV. (FT)	DEPTH (FT)	MATERIAL DESCRIPTION	SOIL SYMBOL	SAMPLE NO.
	0	Topsoil (4 Inches)		
	1	Grayish Brown Fine SAND with Silt (SP-SM)		1
	2	Brown Fine SAND (SP)		2
	3			
	4			
	5	Light Brown Fine SAND (SP)		3
	6	Auger Terminated at 6 Feet		
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			
	16			

REMARKS:

AUGERING & SAMPLING: ASTM D1452

Ground Water Table **FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.**

LEGACY ENGINEERING

SUMMARY OF LABORATORY INDEX TEST RESULTS

Knight Center
Green Cove Springs, Florida
Legacy Engineering Project No. 23-1132.1

Boring No.	Sample No.	Depth Range, Feet		Fines Content[1]	Moisture Content[2]	Organic Content[3]	Unified Soil Classification
		From	To				
PB1	1	0	2	2.3%	3.2%	-	SP
PB2	1	0	2	2.3%	2.7%	-	SP
PB2	3	4	6	6.2%	34.1%	4.5%	SP-SM

Notes:
1. Fines content testing performed in accordance with ASTM D1140
2. Performed in accordance with ASTM D2216
3. Performed in accordance with ASTM D2974

6415 Greenland Road • Jacksonville, Florida 32258 • 904-721-1100

APPENDIX B

KEY TO SOIL CLASSIFICATION

FIELD AND LABORATORY TEST PROCEDURES

LEGACY ENGINEERING

KEY TO SOIL CLASSIFICATION

CORRELATION OF PENETRATION WITH RELATIVE DENSITY & CONSISTENCY

SANDS AND GRAVEL	
BLOW COUNT	RELATIVE DENSITY
0-4	VERY LOOSE
5-10	LOOSE
11-20	FIRM
21-30	VERY FIRM
31-50	DENSE
OVER 50	VERY DENSE

SILTS AND CLAYS	
BLOW COUNT	CONSISTENCY
0-2	VERY SOFT
3-4	SOFT
5-8	FIRM
9-15	STIFF
16-30	VERY STIFF
31-50	HARD
OVER 50	VERY HARD

PARTICLE SIZE IDENTIFICATION (UNIFIED CLASSIFICATION SYSTEM)

CATEGORY	*DIMENSIONS*
Boulders	Diameter exceeds 12 inches
Cobbles	3 to 12 inches
Gravel	Coarse – 0.75 to 3 inches in diameter Fine – 4.76 mm to 0.75 inch diameter
Sand	Coarse – 2.0 mm to 4.76 mm diameter Medium – 0.42 mm to 2.0 mm diameter Fine – 0.074 mm to 0.42 mm diameter
Silt and Clay	Less than 0.074 mm (invisible to the naked eye)

MODIFIERS

These modifiers provide our estimate of the amount of minor constituent (sand, silt, or clay size particles) in the soil sample

PERCENTAGE OF MINOR CONSTITUENT	*MODIFIERS*
0% to 5%	No Modifier
5 % to 12 %	With Silt, With Clay
12% to 30%	Silty, Clayey, Sandy
30% to 50%	Very Silty, Very Clayey, Very Sandy

APPROXIMATE CONTENT OF OTHER COMPONENTS (SHELL, GRAVEL, ETC.)	*MODIFIERS*	*APPROXIMATE CONTENT OF ORGANIC COMPONENTS*
0% to 5%	TRACE	1 to 2%
5% to 12%	FEW	2% to 4%
12% to 30%	SOME	4% to 8%
30% to 50%	MANY	>8%

FIELD AND LABORATORY TEST PROCEDURES

Penetration Borings

The penetration borings were made in general accordance with ASTM D 1586-67, "Penetration Test and Split-Barrel Sampling of Soils". Each boring was advanced to the water table by augering and, after encountering the groundwater table, further advanced with a rotary drilling technique that uses a circulating bentonite fluid for borehole flushing and stability. At two-foot intervals within the upper 10 feet and at five-foot intervals thereafter, the drilling tools were removed from the borehole and a split-barrel sampler inserted to the borehole bottom. The sampler was then driven 18 inches into the material using a 140-pound SPT hammer falling, on the average, 30 inches per hammer blow. The number of hammer blows for the final 12 inches of penetration is termed the "penetration resistance, blow count, or N-value". This value is an index to several in-place geotechnical properties of the material tested, such as relative density and Young's Modulus.

After driving the sampler 18 inches (or less, if in hard rock or rock-like material) at each test interval, the sampler was retrieved from the borehole and a representative sample of the material within the split-barrel was placed in a watertight container and sealed. After completing the drilling operations, the samples for each boring were transported to our laboratory where our Geotechnical Engineer examined them in order to verify the driller's field classifications. The samples will be kept in our laboratory for a period of two months after submittal of formal written report, unless otherwise directed by the Client.

Auger Borings

The auger borings were performed using a continuous flight auger attached to a rotary drill rig or manually using a post-hole auger; and thus in general accordance with ASTM D 1452-80, "Soil Investigation and Sampling by Auger Borings". Representative samples of the soils brought to the ground surface by the augering process were placed in watertight containers and sealed. After completing the drilling operations, the samples for each boring were transported to the laboratory where the Geotechnical Engineer examined them in order to verify the driller's field classifications. The samples will be kept in our laboratory for a period of two months after submittal of formal written report, unless otherwise directed by the Client.

Soil Classification

Soil samples obtained from the performance of the borings were transported to our laboratory for observation and review. An engineer, registered in the State of Florida and familiar with local geological conditions, conducted the review and classified the soils in accordance with ASTM 2488. The results of the soil classification are presented on the boring records.

Moisture Content

The moisture content of the sample tested was determined in general accordance with ASTM D 2216. The moisture content is the actual moisture content of the sample as sampled in the field during the performance of the soil boring.

Fines Content

The percent fines of material passing the No. 200 mesh sieve of the sample tested was determined in general accordance with ASTM D 1140. The percent fines are the soil particles in the silt and clay size range.

Organics Content

The organics content of the sample tested was determined in general accordance with ASTM D 2974. The organics content is the percent of loss of material of an oven-dried sample of material after the sample has been heated in a muffle furnace to 440 °C.

Constant Head Permeability Test

The coefficient of permeability for the laminar flow of water through granular soils was determined in general accordance with the latest revision of ASTM D 2434. The constant head permeability test is a measure of the quantity of water that flows through a sample contained in a cylinder of known height and diameter in a measured time while maintaining a constant head of water on the sample. The coefficient of permeability is determined by application of the Darcy's Law shown below:

$$k = \frac{Q\,L}{hAt}$$

k = Coefficient of permeability

Q = Quantity of water discharge

L = Length of specimen

h = Constant head of water

A = Cross-sectional area of specimen

t = Total time of discharge

Undisturbed Sampling

A relatively undisturbed sample was obtained in general accordance with the latest revision of ASTM A 1587, "Thin-Walled Tube Sampling of Soils". A piston-type sampler was used to advance the 3-inch O.D. – 16 gauge stainless steel sampler tuber into the soils at the borehole bottom. After retrieving the sample from the boring, the ends were sealed with wax and then transported to our laboratory.

Black Creek Engineering, Inc.

SAINT JOHNS RIVER
WATER MANAGEMENT DISTRICT
RETENTION POND
FOR
Knight Center

DATE: 12/01/21
PROJECT NO.: 23-004
MADE BY: CDG

Pre Development

Description	% Imp.	Impervious		Pervious		Total	
Prev Developed Site	5%	0.05	acres	0.95	acres	1.00	acres
Existing Pavement	100%	0.10	acres	0.00	acres	0.10	acres
Total Project		0.15	acres	0.95	acres	1.10	acres

Existing % Impervious = 13.6%

Post Development

Description	% Imp.	Impervious		Pervious		Total	
Site	75.0%	0.77	acres	0.26	acres	1.03	acres
Total to Pond		0.77	acres	0.26	acres	1.03	acres
Pond	0%	0.00		0.07		0.07	
Total Project		0.77	acres	0.33	acres	1.10	acres

Proposed % Impervious = 75.0%
(excluding pond)

Curve Number - Pond 1

Pre Development

Grass Comb. – Fair Condition, A Soils	0.95	acres	CN =	49
Impervious	0.15	acres	CN =	98
Total	1.10	acres		
Weighted CN = 56				

Post Development

Proposed Impervious	0.77	acres	CN =	98
Grass Cover - Good Condition, A Soils	0.33	acres	CN =	39
Total	1.10	acres		
Weighted CN = 80				

Runoff Coefficient - Pond 1

Post Development

Pervious	0.33	acres	c =	0.25
Impervious	0.77	acres	c =	0.95
Total	1.10	acres		

Weighted c = 0.74

Complete Report

Project: Knight Center
Date: 6/21/2023 9:17:59 PM

Site and Catchment Information

Analysis: Net Improvement

Catchment Name	Commercial Center
Rainfall Zone	Florida Zone 2
Annual Mean Rainfall	52.00

Pre-Condition Landuse Information

Landuse	Low-Intensity Commercial: TN=1.13 TP=0.188
Area (acres)	1.10
Rational Coefficient (0-1)	0.05
Non DCIA Curve Number	49.00
DCIA Percent (0-100)	5.00
Nitrogen EMC (mg/l)	1.130
Phosphorus EMC (mg/l)	0.188
Runoff Volume (ac-ft/yr)	0.257
Groundwater N (kg/yr)	0.000
Groundwater P (kg/yr)	0.000
Nitrogen Loading (kg/yr)	0.359
Phosphorus Loading (kg/yr)	0.060

Post-Condition Landuse Information

Landuse	High-Intensity Commercial: TN=2.40 TP=0.345
Area (acres)	1.10
Rational Coefficient (0-1)	0.61
Non DCIA Curve Number	39.00
DCIA Percent (0-100)	75.00
Wet Pond Area (ac)	0.10
Nitrogen EMC (mg/l)	2.400

Phosphorus EMC (mg/l)	0.345
Runoff Volume (ac-ft/yr)	2.638
Groundwater N (kg/yr)	0.000
Groundwater P (kg/yr)	0.000
Nitrogen Loading (kg/yr)	7.807
Phosphorus Loading (kg/yr)	1.122

Catchment Number: 1 Name: Commercial Center

Project: Knight Center
Date: 6/21/2023

Retention Design

Retention Depth (in)	2.300
Retention Volume (ac-ft)	0.192

Watershed Characteristics

Catchment Area (acres)	1.10
Contributing Area (acres)	1.000
Non-DCIA Curve Number	39.00
DCIA Percent	75.00
Rainfall Zone	Florida Zone 2
Rainfall (in)	52.00

Surface Water Discharge

Required TN Treatment Efficiency (%)	95
Provided TN Treatment Efficiency (%)	95
Required TP Treatment Efficiency (%)	95
Provided TP Treatment Efficiency (%)	95

Media Mix Information

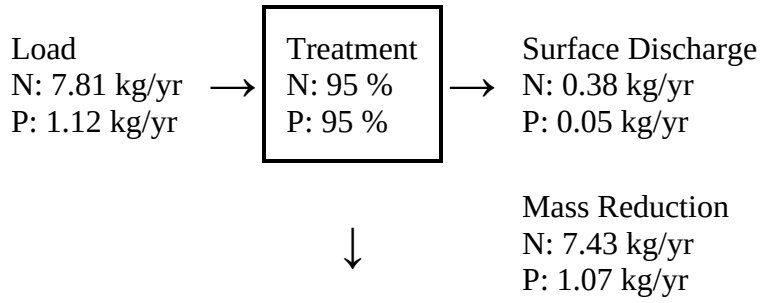
Type of Media Mix	Not Specified
Media N Reduction (%)	
Media P Reduction (%)	

Groundwater Discharge (Stand-Alone)

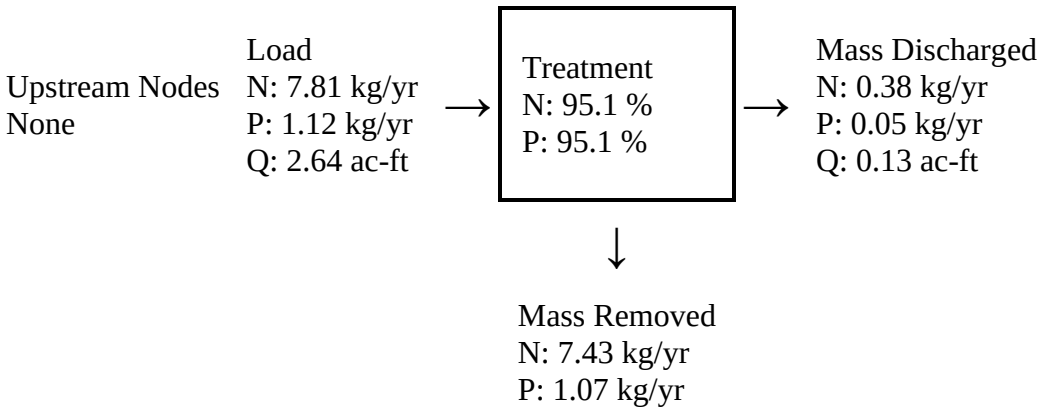
Treatment Rate (MG/yr)	0.000

TN Mass Load (kg/yr)	7.427
TN Concentration (mg/L)	0.000
TP Mass Load (kg/yr)	1.068
TP Concentration (mg/L)	0.000

Load Diagram for Retention (stand-alone)



Load Diagram for Retention (As Used In Routing)



Summary Treatment Report Version: 4.3.5

Project: Knight Center

Analysis Type: Net Improvement

Date:6/21/2023

BMP Types:

Catchment 1 - (Commercial Center) Retention

Based on % removal values to the nearest percent

Routing Summary

Catchment 1 Routed to Outlet

Total nitrogen target removal met? **Yes**

Total phosphorus target removal met? **Yes**

Summary Report

Nitrogen

Surface Water Discharge

Total N pre load	.36 kg/yr	
Total N post load	7.81 kg/yr	
Target N load reduction	95 %	
Target N discharge load	.36 kg/yr	
Percent N load reduction	95 %	
Provided N discharge load	.38 kg/yr	.84 lb/yr
Provided N load removed	7.43 kg/yr	16.38 lb/yr

Phosphorus

Surface Water Discharge

Total P pre load	.06 kg/yr	
Total P post load	1.122 kg/yr	
Target P load reduction	95 %	
Target P discharge load	.06 kg/yr	
Percent P load reduction	95 %	
Provided P discharge load	.055 kg/yr	.12 lb/yr
Provided P load removed	1.068 kg/yr	2.354 lb/yr

Black Creek Engineering, Inc.

SAINT JOHNS RIVER
WATER MANAGEMENT DISTRICT
CHAMBER DESIGN
FOR

MADE BY: CDG
DATE: 12/01/21
CDG NO.: 23-004

Knight Center

PROJECT LOCATION: **Green Cove Springs**
TYPE OF DEVELOPMENT: **COMMERCIAL**

PROJECT AREA (ACRES):	**1.10**	
PERCENT IMPERVIOUS (EXCL POND AREA):	**75.0%**	%
RUNOFF COEFFICIENT:	0.74	
OFF-SITE DRAINAGE AREA (acres):	**0.00**	
PERCENT IMPERVIOUS:	**0.00**	%
RUNOFF COEFFICIENT:	**0.00**	

NORMAL GROUNDWATER ELEVATION AT POND (ft): **4.0**
DESIGN TAILWATER ELEVATION (ft): **0.0**

POND STAGE/STORAGE DATA - Three combined ponds separated into two in model

	STAGE (ft)	AREA (sq ft)	(acres)	VOLUME (acre-ft)	ICPR STORAGE (acre-ft)	
BOTTOM	6.0	2850	0.1	0.0	0.000	O.K.
BOT.+ 1.0	7.0	2850	0.1	0.1	0.100	
T.O.B.	10.0	2850	0.1	0.4	0.400	

IS POND LENGTH >= 2 x POND WIDTH? (Y or N) Y O.K.

TREATMENT VOLUME REQUIRED: **ON** **-LINE SYSTEM**

RUNOFF @ 1 in.X AREA 0.09 ac-ft
(Project area + Offsite area)/12 x
OR
IMPERVIOUS AREA @ 1.25 in. 0.08 ac-ft
(((Project area - Pond area) x % Impervious)
+(Offsite area x % Impervious) x 1.25/12)
PLUS 0.5 in. x AREA 0.05 ac-ft

CONTROLLING VALUE (ac-ft): 0.12 ac-ft

IMPAIRED WATER BODY TREATMENT = 2.3 " / Basin 0.211 ac-ft
(Use BMPTrains to calculate treatment volume)

REQUIRED TREATMENT VOLUME 0.21 ac-ft

CONTROL STRUCTURE

MIN. WEIR ELEVATION (ft): 8.11 USE: **8.1**
((TOB-BOT)xTrtmt Vol/TOB Storage)+BOT

TRTMT VOL DEPTH (ft) 2.1 VOL PROVIDED: 0.21 ac-ft

DRAWDOWN

WEIR ELEV= 8.1 Kh= 6 ft/day

SAINT JOHNS RIVER
WATER MANAGEMENT DISTRICT
CHAMBER DESIGN
FOR

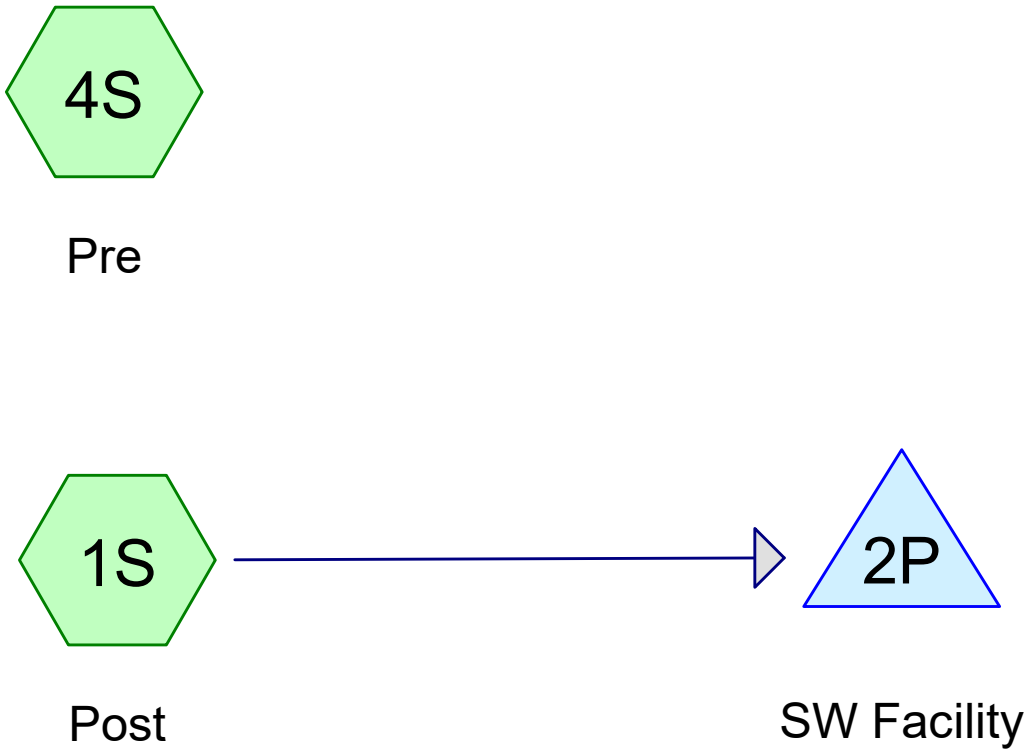
MADE BY: CDG
DATE: 12/01/21
CDG NO.: 23-004

Knight Center

BOTTOM ELEV=	6.0		SAFETY FACTOR (SF)=	2	
WATER TABLE ELEV=	4.0		Kvs=	4.35	ft/day
IMPERV LAYER ELEV=	2.0		*f*=	0.2	
		hu=	0.40	*hv>hu*	
		Kvu=	2.90 ft/day	2/3xKvs	
		Id=	1.45 ft/day	Kvu/SF	
		TIME (tunsat)=	0.3 days		
		fx(BOT-WT)x24hrs/day/Id			
		Vu=	0.03 ac-ft		
		Vs=	0.18 ac-ft		
		d2=	2.04 ft		
		Ht=	4.04 ft		
		Fy=	0.49		
		Fx=	1.40		
		D=	3.00		
		TIME (tsat)=	0.27 days		
		TIME (total)=	0.54 days=	13.0	hrs <72
				Drawdown OK	

DATA FOR HydroCad INPUT

CREST ELEV (ft):	**8.1**
CREST LENGTH (ft):	**0.5**
WEIR COEFFICIENT:	**2.8**
GATE OPENING:	**999**
GATE DISCH COEFF.:	**0**
# IDENTICAL WEIRS:	**1**



Subcat Reach Pond Link

Routing Diagram for 23-004 Hydrocad Model
Prepared by Black Creek Engineering, Inc. , Printed 6/21/2023

Project Notes

Rainfall events imported from "21-011REV1-Mixed Use.hcp"

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1-Year	Type II FL 24-hr		Default	24.00	1	3.89	2
2	2-Year	MSE 24-hr	5	Default	24.00	1	4.45	2
3	5-Year	MSE 24-hr	5	Default	24.00	1	5.49	2
4	10-Year	MSE 24-hr	5	Default	24.00	1	6.47	2
5	25-Year	Type II FL 24-hr		Default	24.00	1	8.02	2
6	50-Year	MSE 24-hr	5	Default	24.00	1	9.35	2
7	100-Year	MSE 24-hr	5	Default	24.00	1	10.81	2
8	Custom	FDOT 24-hr		Default	24.00	1	8.02	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.100	80	Post Development (1S)
1.100	61	Predevelopment (4S)
2.200	**71**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
2.200	Other	1S, 4S
2.200		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	1.100	1.100	Post Development	1S
0.000	0.000	0.000	0.000	1.100	1.100	Predevelopment	4S
0.000	**0.000**	**0.000**	**0.000**	**2.200**	**2.200**	**TOTAL AREA**	

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Post Runoff Area=1.100 ac 0.00% Impervious Runoff Depth>1.78"
Flow Length=150' Slope=0.0100 '/' Tc=2.6 min CN=80 Runoff=1.44 cfs 0.163 af

Subcatchment 4S: Pre Runoff Area=1.100 ac 0.00% Impervious Runoff Depth>0.65"
Flow Length=200' Slope=0.0400 '/' Tc=15.4 min CN=61 Runoff=0.42 cfs 0.060 af

Pond 2P: SW Facility Peak Elev=8.20' Storage=0.144 af Inflow=1.44 cfs 0.163 af
Outflow=0.07 cfs 0.019 af

Total Runoff Area = 2.200 ac Runoff Volume = 0.223 af Average Runoff Depth = 1.22"
100.00% Pervious = 2.200 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: Post

[49] Hint: Tc<2dt may require smaller dt

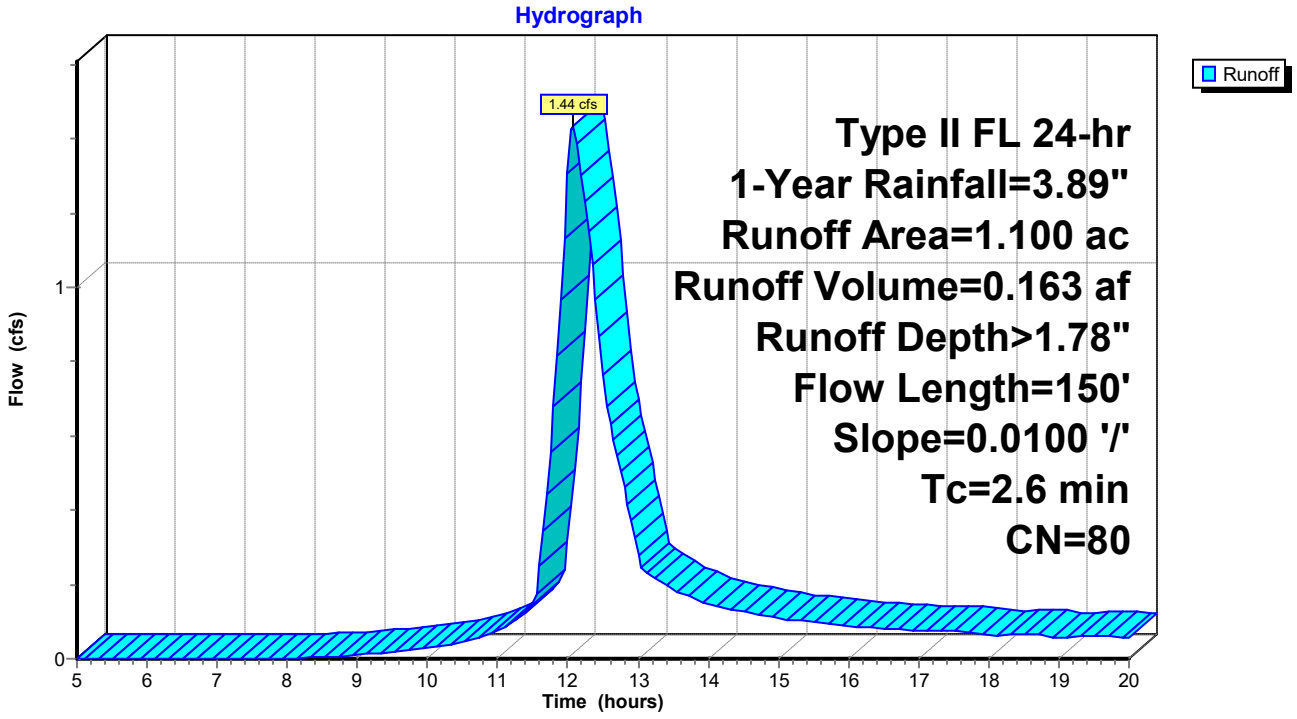
Runoff = 1.44 cfs @ 12.07 hrs, Volume= 0.163 af, Depth> 1.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II FL 24-hr 1-Year Rainfall=3.89"

	Area (ac)	CN	Description
*	1.100	80	Post Development
	1.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	150	0.0100	0.95		**Sheet Flow, Direct Flow to Pond** Smooth surfaces n= 0.011 P2= 2.25"

Subcatchment 1S: Post



Summary for Subcatchment 4S: Pre

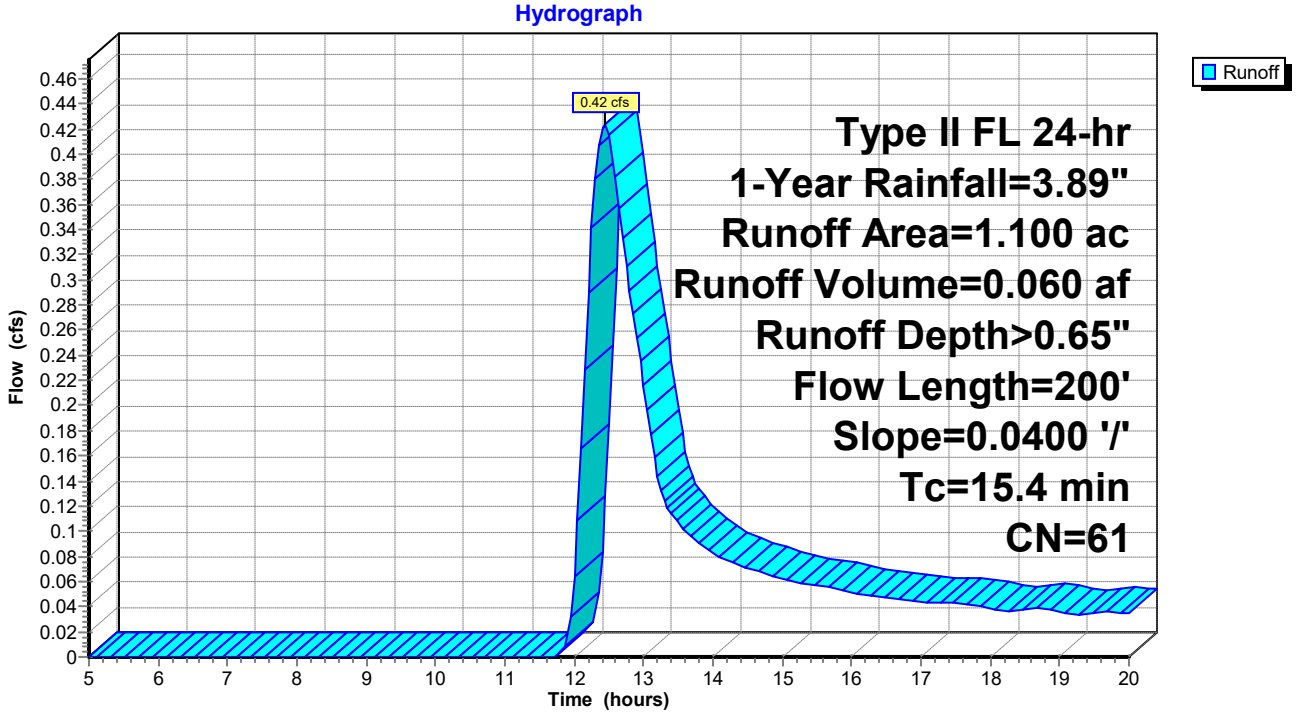
Runoff = 0.42 cfs @ 12.44 hrs, Volume= 0.060 af, Depth> 0.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II FL 24-hr 1-Year Rainfall=3.89"

	Area (ac)	CN	Description
*	1.100	61	Predevelopment
	1.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.4	200	0.0400	0.22		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 2.25"

Subcatchment 4S: Pre



Summary for Pond 2P: SW Facility

Inflow Area = 1.100 ac, 0.00% Impervious, Inflow Depth > 1.78" for 1-Year event
Inflow = 1.44 cfs @ 12.07 hrs, Volume= 0.163 af
Outflow = 0.07 cfs @ 17.86 hrs, Volume= 0.019 af, Atten= 95%, Lag= 347.2 min
Primary = 0.07 cfs @ 17.86 hrs, Volume= 0.019 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 8.20' @ 17.86 hrs Surf.Area= 0.065 ac Storage= 0.144 af
Flood Elev= 10.00' Surf.Area= 0.065 ac Storage= 0.262 af

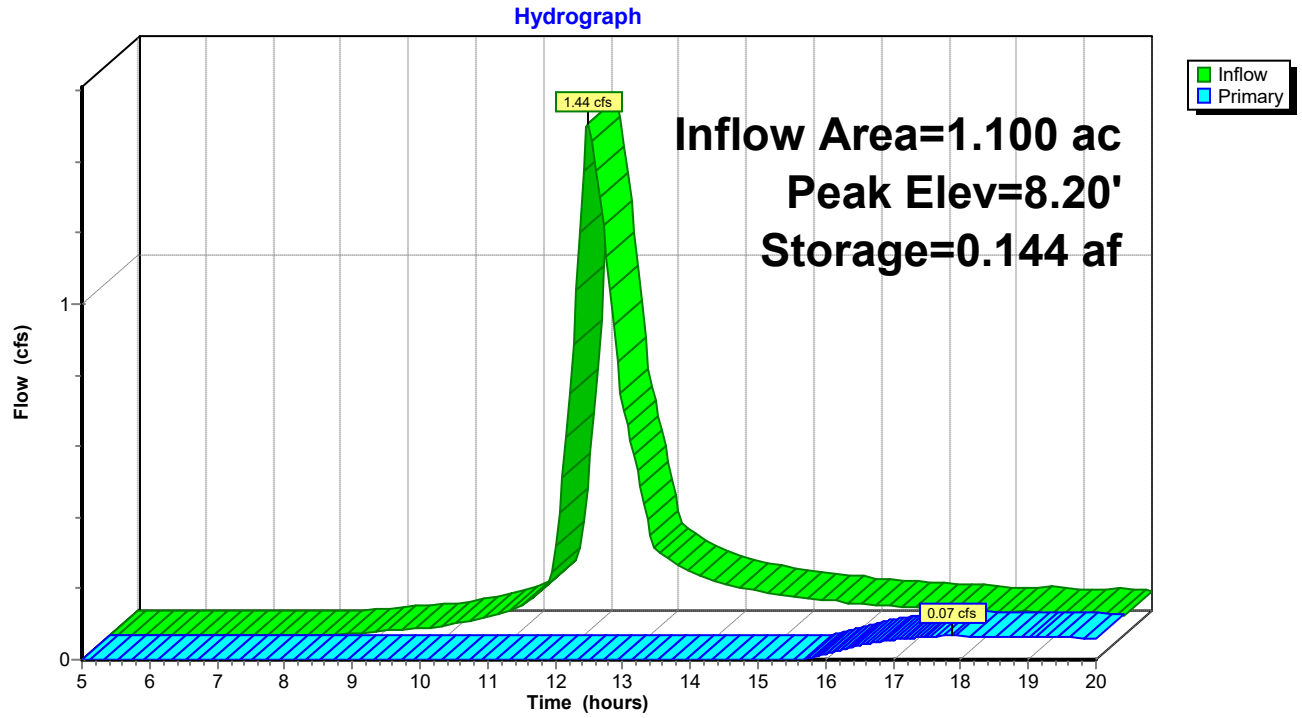
Plug-Flow detention time= 420.0 min calculated for 0.019 af (12% of inflow)
Center-of-Mass det. time= 288.2 min (1,089.7 - 801.4)

Volume	Invert	Avail.Storage	Storage Description
#1	6.00'	0.262 af	**28.50'W x 100.00'L x 4.00'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	8.10'	**0.7' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=0.07 cfs @ 17.86 hrs HW=8.20' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 0.07 cfs @ 0.91 fps)

Pond 2P: SW Facility



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Post Runoff Area=1.100 ac 0.00% Impervious Runoff Depth>5.24"
Flow Length=150' Slope=0.0100 '/' Tc=2.6 min CN=80 Runoff=4.20 cfs 0.480 af

Subcatchment 4S: Pre Runoff Area=1.100 ac 0.00% Impervious Runoff Depth>3.11"
Flow Length=200' Slope=0.0400 '/' Tc=15.4 min CN=61 Runoff=2.28 cfs 0.285 af

Pond 2P: SW Facility Peak Elev=9.18' Storage=0.208 af Inflow=4.20 cfs 0.480 af
Outflow=2.61 cfs 0.331 af

Total Runoff Area = 2.200 ac Runoff Volume = 0.766 af Average Runoff Depth = 4.18"
100.00% Pervious = 2.200 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: Post

[49] Hint: Tc<2dt may require smaller dt

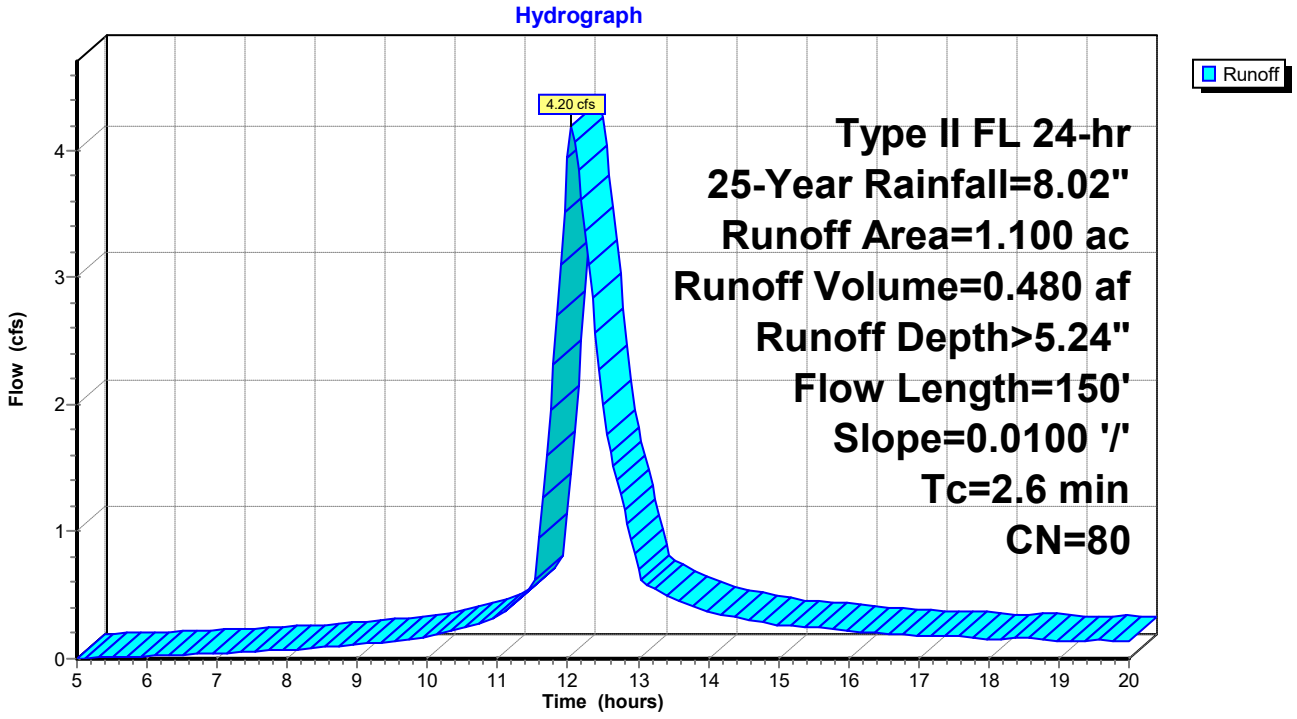
Runoff = 4.20 cfs @ 12.06 hrs, Volume= 0.480 af, Depth> 5.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II FL 24-hr 25-Year Rainfall=8.02"

	Area (ac)	CN	Description
*	1.100	80	Post Development
	1.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	150	0.0100	0.95		**Sheet Flow, Direct Flow to Pond** Smooth surfaces n= 0.011 P2= 2.25"

Subcatchment 1S: Post



Summary for Subcatchment 4S: Pre

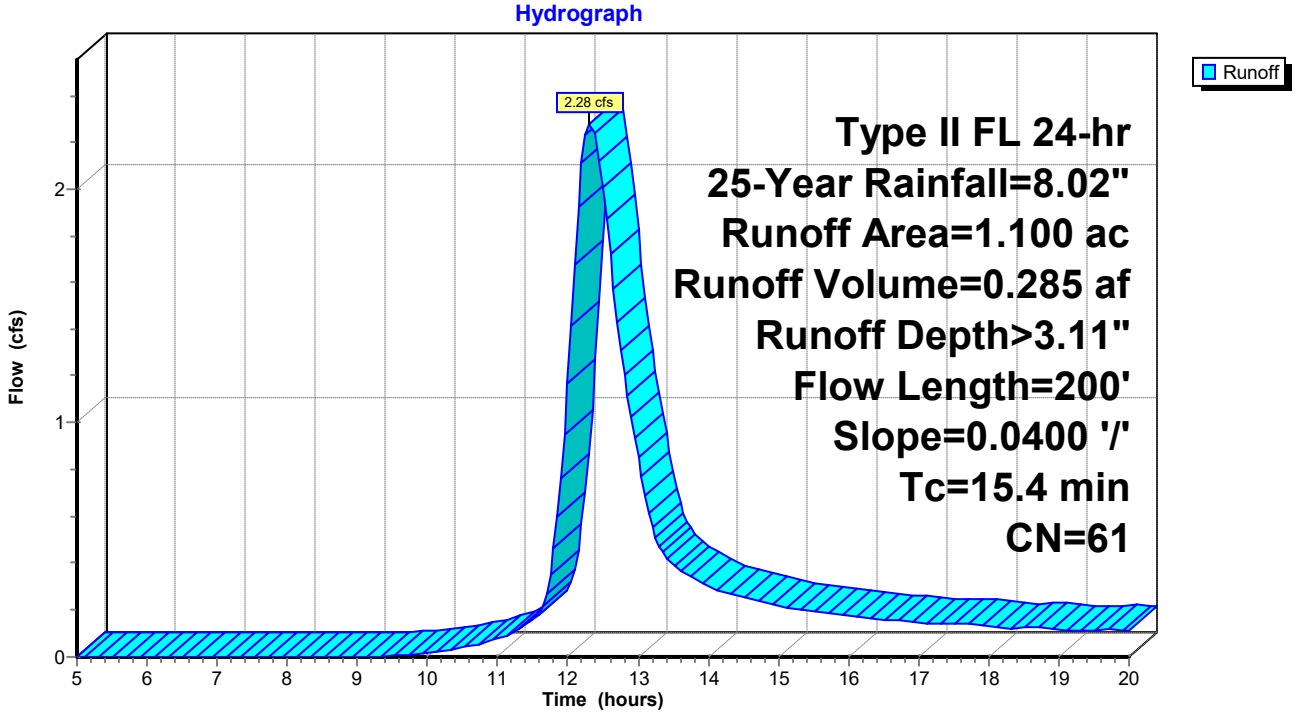
Runoff = 2.28 cfs @ 12.31 hrs, Volume= 0.285 af, Depth> 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II FL 24-hr 25-Year Rainfall=8.02"

	Area (ac)	CN	Description
*	1.100	61	Predevelopment
	1.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.4	200	0.0400	0.22		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 2.25"

Subcatchment 4S: Pre



Summary for Pond 2P: SW Facility

Inflow Area = 1.100 ac, 0.00% Impervious, Inflow Depth > 5.24" for 25-Year event
Inflow = 4.20 cfs @ 12.06 hrs, Volume= 0.480 af
Outflow = 2.61 cfs @ 12.39 hrs, Volume= 0.331 af, Atten= 38%, Lag= 20.1 min
Primary = 2.61 cfs @ 12.39 hrs, Volume= 0.331 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 9.18' @ 12.39 hrs Surf.Area= 0.065 ac Storage= 0.208 af
Flood Elev= 10.00' Surf.Area= 0.065 ac Storage= 0.262 af

Plug-Flow detention time= 137.8 min calculated for 0.330 af (69% of inflow)
Center-of-Mass det. time= 68.1 min (842.2 - 774.1)

Volume	Invert	Avail.Storage	Storage Description
#1	6.00'	0.262 af	**28.50'W x 100.00'L x 4.00'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	8.10'	**0.7' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=2.61 cfs @ 12.39 hrs HW=9.18' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 2.61 cfs @ 3.45 fps)

Pond 2P: SW Facility