REPORT OF
SUBSURFACE EXPLORATION AND
GEOTECHNICAL ENGINEERING EVALUATION

FORT WALTON BEACH LANDING PARK IMPROVEMENTS

Fort Walton Beach, Okaloosa County, Florida

Prepared For the Exclusive Use of:

AVCON, INC.
320 Bayshore Drive, Suite A
Niceville, Florida 32578

NOVA Project No. 8215169

December 23, 2015

NOVA ENGINEERING AND ENVIRONMENTAL

December 23, 2015

Ms. Tonia Nation, P.E. – Site Development Manager
AVCON, Inc.
320 Bayshore Drive, Suite A
Niceville, Florida 32578

Subject: Report of Subsurface Exploration & Geotechnical Engineering Evaluation
FORT WALTON BEACH LANDING PARK IMPROVEMENTS
Fort Walton Beach, Okaloosa County, Florida
NOVA Project Number 8215169

Dear Ms. Nation,

NOVA Engineering and Environmental LLC (NOVA) has completed the authorized subsurface exploration and geotechnical engineering evaluation for the proposed improvements to the Fort Walton Beach Landing Park located in Fort Walton Beach, Okaloosa County, Florida. The work was performed in general accordance with NOVA Proposal Number 016-20153108R2 (dated December 14, 2015), and industry standards.

This report briefly discusses our understanding of the project at the time of the subsurface exploration, describes the geotechnical consulting services provided by NOVA, and presents our findings, design recommendations and construction considerations.

We appreciate your selection of NOVA and the opportunity to be of service on this project. If you have any questions, or if we may be of further assistance, please do not hesitate to contact us.

Sincerely,
NOVA ENGINEERING AND ENVIRONMENTAL LLC

Jesse A. James E.I.
Staff Engineer
Florida Certificate No. 1100019359

William L. Lawrence, P.E.
Branch Manager
Florida Registration No. 60147

Copies Submitted: via electronic mail service

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APPENDICES

1.0 EXECUTIVE SUMMARY

A brief summary of pertinent findings, conclusions and recommendations is presented below. This information should not be utilized in design or construction without reading all of the recommendations presented in the text and Appendix of this report.

1.1 GENERAL

- Our field exploration at the subject site included performing five (5), 35-foot deep SPT borings along the proposed seawall alignment and open-air stage area, and four (4) 10-foot deep auger borings in the proposed stormwater management system area. Testing also included one (1) Double Ring Infiltrometer (DRI) test as well as two (2) re-molded falling-head permeability tests. Drilling, testing and sampling operations were performed in general accordance with ASTM designations and other industry standards.

- Beneath approximately 6 inches of topsoil, the test borings generally encountered very loose to loose fine-grained sands (USCS classification of SP) to a depth of about 12 feet below existing grade (BEG) underlain by medium dense to dense fine-grained sands (SP) to the maximum depth explored of about 35 feet. We note that Boring B-4 also encountered a stratum of very soft sandy peat (PT) from about 8 feet to 13 feet BEG.

  Subsurface conditions are described in greater detail on the attached Log of Boring Records.

1.2 SITE PREPARATION

- We recommend stripping and grubbing the proposed construction areas to remove the existing topsoil and surficial vegetation, trees and associated root systems, and any other deleterious materials that are found to be present. The soils exposed at the stripped grade elevation should be compacted to a minimum soil density of at least 95 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557). Resulting or additional excavations should be backfilled with structural fill also compacted to a minimum soil density of at least 95 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557).

1.3 GROUNDWATER CONTROL

- Groundwater was encountered in the test borings at depths varying between about 2½ feet to 7 feet BEG at the time of our subsurface exploration, with the differences in the depth to groundwater being attributed primarily to the differences in ground surface elevations at which the borings were drilled. Groundwater is not expected to impact the planned improvements to the existing park facility.

1.4 FOUNDATION RECOMMENDATIONS

- We recommend that the proposed covered stage structure be supported on a conventional shallow foundation designed for a maximum allowable soil bearing pressure of 2,000 pounds per square foot (psf).

1.5 SHEET PILE SEAWALL

- NOVA has provided geotechnical design parameters for the seawall to be constructed on the property. As requested by the design team, this information includes bulk density, submerged density, angle of internal friction (F), and friction angle between wall and soil (d) parameters for each major soil strata encountered, as well as NOVA's recommendations for Ko, Ka, and Kp for each of the major soil strata encountered for the full depth of the borings. A summary of this information can be found in the *Conclusions and Recommendations* section of this report.

1.6 STORMWATER MANAGEMENT SYSTEM

- We understand that the planned facility improvements will include utilizing or possibly re-designing an existing shallow dry retention pond located in the northern portion of the property and possibly constructing a new retention pond in the same general area for the disposal and treatment of stormwater runoff. Based on the results of the SMS test borings, the subsurface conditions encountered appear to be adaptable for treatment and disposal of stormwater runoff via the desired SMS.

2.0 INTRODUCTION

2.1 PROJECT INFORMATION

Our understanding of this project is based on recent conversations and email exchanges with the client; recent experience providing similar geotechnical services for this locale; our knowledge of current NWFWMD ERP requirements; and review of aerial photography via internet-based GIS software.

NOVA understands that the planned improvements to the existing park facility will include constructing a new sheet pile seawall fronting the Intercoastal Waterway, an open-air, covered stage for concerts and similar events, and a stormwater management system consisting of two (2) conventional shallow dry retention ponds to treat and dispose of stormwater runoff associated with the planned site improvements. The retention ponds are expected to be less than 5 feet in depth, relative to existing site grade elevations.

Please note; this exploration is limited to the stormwater management system and foundation support (for the seawall and covered stage) design aspects of the planned improvements to Fort Walton Beach Landing Park; hence, additional information regarding overall site development is not relevant.

2.2 SCOPE OF WORK

AVCON, Inc., (the "**CLIENT**") engaged NOVA to provide geotechnical engineering consulting services for the planned improvements to the Fort Walton Beach Landing Park facility located in Fort Walton Beach, Okaloosa County, Florida. This report briefly discusses our understanding of the project, describes our exploratory procedures and presents our findings, conclusions, and recommendations.

The primary objective of this study was to provide a geotechnical exploration of the near surface soils within the areas of the proposed construction and to assess these findings as they relate to the geotechnical aspects of the planned site development. The authorized geotechnical engineering services included site reconnaissance, nine (9) soil test borings and sampling, field infiltrometer testing, laboratory testing, engineering evaluation of the field data, and the preparation of this report. The boring locations are shown in the attached Boring Location Plan provided in the Appendix of this report.

As was noted previously, these services were performed in general accordance with NOVA Proposal Number 016-20153108R2 (dated December 14, 2015) and industry standards. As authorized in the referenced proposal, the completed geotechnical report was to include:

- A description of the site, fieldwork, laboratory testing and general soil conditions encountered, as well as a Boring Location Plan, and individual Log of Boring Records.
- Site preparation considerations that include geotechnical discussions regarding site stripping and subgrade preparation, and engineered fill/backfill placement.
- Recommendations for controlling groundwater and/or run-off during construction and, the need for permanent dewatering systems based on the anticipated post construction groundwater levels.
- The estimated seasonal high groundwater table at the test boring locations.
- Recommendations for subgrade preparation behind the planned seawall alignment, and within the proposed covered stage footprint.
- Hydraulic conductivity values and other pertinent geotechnical design parameters to aid in the stormwater retention pond designs.
- Geotechnical design parameters to be used in the seawall design, including bulk density, submerged density, angle of internal friction (F), and friction angle between wall and soil (d) parameters for each major soil strata encountered; recommendations for Ko, Ka, and Kp for each of the major soil strata encountered for the full depth of the borings; and recommendations for soil parameters of cohesive materials if any are encountered in the test borings.
- Suitability of excavated soils for re-use as backfill behind the seawall alignment. Additionally, the criteria for suitable backfill materials will be provided.
- Recommended quality control measures (i.e. sampling, testing, and inspection requirements) for site grading and foundation construction.

The assessment of site environmental conditions, including the presence of wetlands or detection of pollutants in the soil, rock or groundwater, laboratory testing of samples, or a site-specific seismic study was beyond the scope of this geotechnical study. If requested, NOVA can provide these services.

3.0 SITE DESCRIPTION

3.1 GENERAL

The subject 5.45-acre property is located at 139 Brooks Street SE, approximately ¼ mile south of U.S. Highway 98, in downtown Fort Walton Beach, Okaloosa County, Florida. The site is bounded to the south by the Intracoastal Waterway (Santa Rosa Sound) and is currently a municipal park vegetated with short grasses, landscape shrubs, and scattered mature pine and oak trees. The site is bounded to the north, east and west by light commercial and/or retail developments.

Topographic information was not available from the design team at the time of the issuance of this report. Based on visual observations made at the time of our field exploration, the site's topography appeared to gently slope downwards towards the south (i.e., towards the Intracoastal Waterway).

3.2 GEOLOGY / HYDROLOGY

Site and Area Geology

The site is located in the Okaloosa County, Florida area and according to the United States Geological Survey (USGS), is situated within the greater Gulf Coastal Plain region. The site is generally covered with Alluvium sediments of the Pleistocene/Holocene periods underlain by the Citronelle formation of the Pliocene/Pleistocene periods. The alluvial sediments typically consist of siliciclastics that are fine to coarse quartz sand containing clay lenses and gravel in places. Sands consists primarily of very fine to very coarse poorly sorted quartz grains; gravel is composed of quartz, quartzite, and chert pebbles. In areas of the Valley and Ridge province gravels are generally composed of angular to sub-rounded chert, quartz, and quartzite pebbles. Coastal deposits in the Okaloosa County area include fine to medium quartz sand with shell fragments and accessory heavy minerals along Gulf beaches and fine to medium quartz sand, silt, clay, peat, mud and ooze in the Mississippi Sound, Little Lagoon, bays, lakes, streams, and estuaries. The Citronelle formation consists primarily of varicolored/mottled lenticular beds of poorly sorted sand, clayey sand, clay, and clayey gravel. Limonite pebbles and lenses of limonite cemented sand occur locally in weathered Miocene exposures.

Surficial soils in the region are primarily siliciclastic sediments deposited in response to the renewed uplift and erosion in the Appalachian highlands to the north and sea-level fluctuations. The extent and type of deposit is influenced by numerous factors, including mineral composition of the parent rock and meteorological events.

Groundwater

Groundwater in the Gulf Coastal Plain typically occurs as an unconfined aquifer condition. Recharge is provided by the infiltration of rainfall and surface water through the soil overburden. More permeable zones in the soil matrix can affect groundwater conditions. The groundwater table is expected to be a subdued replica of the original surface topography. Based on a review of topographic maps and our visual site observations, we anticipate the groundwater flow at the site to be generally towards the south.

4.0 FIELD AND LABORATORY PROCEDURES

4.1 FIELD EXPLORATION

The boring locations were determined in the field by NOVA personnel. The approximate locations are depicted on the Boring Location Plan provided in the Appendix of this report. Our field exploration included performing five (5), 35-foot deep SPT borings along the proposed seawall alignment and open-air stage area, four (4) 10-foot deep auger borings in the proposed SMS area, and one (1) Double Ring Infiltrometer (DRI) test.

Drilling, testing and sampling operations were performed in general accordance with ASTM designations and other industry standards. The Log of Boring Records provided in the Appendix present the soil conditions encountered at each boring location. These records represent our interpretation of the subsurface conditions based on the field exploration data, visual examination of the samples, and generally accepted geotechnical engineering practices. The stratification lines and depth designations represent approximate boundaries between various subsurface strata. Actual transitions between materials may be gradual. Also, subsurface conditions intermediate of each boring location may vary.

The groundwater levels reported on the Log of Boring Records represent measurements made at the completion of the borings. The borings were backfilled with soil cuttings at the completion of the field exploration for safety concerns. The approximate location of each boring is depicted on the Boring Location Plan provided in the Appendix of this report. Please refer to the Log of Boring Records included in the Appendix for the subsurface conditions encountered at the specific boring locations.

4.2 LABORATORY TESTING

Soil samples were returned to our testing laboratory, where they were classified using visual/manual methods in accordance with the Unified Soil Classification System (USCS) and ASTM designations. Soil samples will be retained for 30 days unless directed otherwise by the client. The descriptions presented in the Log of Boring Records should be considered approximate.

To aid in classifying the soils and determining their engineering properties, laboratory tests were performed on representative soil samples obtained from the soil test borings. Laboratory tests results are presented in the Appendix. All laboratory testing was performed in general accordance with current ASTM standards and included:

- Two (2) Percent Fines (-#200 Sieve) Tests (ASTM D-1140)
- Two (2) Natural Moisture Content Tests (ASTM D-2216)
- Two (2) Re-Molded Falling Head Permeability Tests (ASTM D-5084)

5.0 SUBSURFACE CONDITIONS

5.1 SOIL CONDITIONS

The following paragraph provides a generalized description of the subsurface profiles and soil conditions encountered in the borings conducted during this study. The Log of Boring Records in the Appendix should be reviewed to provide detailed descriptions of the conditions encountered at each boring location. Conditions may vary at other locations and times.

Beneath approximately 6 inches of topsoil, the test borings generally encountered very loose to loose fine-grained sands (USCS classification of SP) to a depth of about 12 feet below existing grade (BEG) underlain by medium dense to dense fine-grained sands (SP) to the maximum depth explored of about 35 feet. We note that Boring B-4 also encountered a stratum of very soft sandy peat (PT) from about 8 feet to 13 feet BEG.

Subsurface conditions are described in greater detail on the attached Log of Boring Records.

5.2 GROUNDWATER CONDITIONS

Groundwater was encountered in the test borings at depths varying between about 2½ feet to 7 feet BEG at the time of our field exploration, which occurred during a period of normal to slightly above normal seasonal rainfall and shortly following several significant rain events. We therefore estimate that the normal permanent seasonal high groundwater (SHGW) table for this site will occur at approximately the depths measured in the test borings, at each test boring location.

Groundwater levels vary with changes in season and rainfall, construction activity, surface water runoff and other site-specific factors. Groundwater levels in the Okaloosa County area are typically lowest in the late fall to winter and highest in the early spring to mid-summer with annual groundwater fluctuations by seasonal rainfall; consequently, the water table may vary at times.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are based on our understanding of the proposed construction, our site observations, our interpretation of the field data obtained during our explorations, our experience with similar projects, and generally accepted geotechnical engineering principles and practices. Subsurface conditions in unexplored locations or at other times may vary from those encountered at specific boring locations. If such variations are noted during construction, or if project development plans are changed, we request the opportunity to review the changes and amend our recommendations, if deemed necessary.

6.1 SITE GRADING

Site Preparation

We recommend stripping the proposed construction areas to remove all trees and associated root systems, topsoil and surficial vegetation, and any other deleterious non-soil materials that are found to be present. The soils exposed at the stripped grade elevation should be compacted to a minimum soil density of at least 95 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557). Resulting or additional excavations should be backfilled with structural fill also compacted to a minimum soil density of at least 95 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557).

A geotechnical engineer should carefully evaluate all subgrades prior to building foundation installation to confirm compliance with this report; evaluate geotechnical sections of the plans and specifications for the overall project; and provide additional recommendations that may be required.

Fill Placement

Fill materials should be relatively clean sands with less than 12 percent fines (material passing the No. 200 sieve), and free of non-soil materials and rock fragments larger than 3 inches in diameter. Based on visual examination, the existing near-surface clean sands (SP, excluding topsoil) encountered during this exploration generally appear to be adaptable for reuse as structural fill. Fill materials that contain organic or construction debris are not suitable for reuse as structural fill. Prior to construction, bulk samples of the proposed fill materials should be laboratory tested to confirm their suitability.

Fill should be placed in thin, horizontal loose lifts (maximum 12-inch) and compacted to a minimum soil density of at least 95 percent of the Modified Proctor maximum dry density (ASTM D-1557). In confined areas, such as utility trenches, portable compaction equipment and thinner loose fill lifts (3 to 4 inches) may be necessary. Fill materials used in structural areas should have a target maximum dry density of 95 pcf or greater. If lighter weight fill materials are used, the NOVA geotechnical engineer should be consulted to assess the impact on design recommendations.

Soil moisture content should be maintained within 3 percent of the optimum moisture content. We recommend that the grading contractor have equipment on site during earthwork for both drying and wetting fill soils. Soils excavated from below the water table will likely require significant efforts to adjust the moisture contents prior to reuse as fill.

A NOVA soils technician, who can assess suitability of materials used, and uniformity and appropriateness of compaction efforts, should observe all filling and subgrade preparation. Field tests, using thin-wall tube, nuclear or sand cone testing methods (ASTM D-2937, D-6938, or D-1556 respectively) should also be performed. When filling in small areas, at least one test per day per area should be required.

6.2 GROUNDWATER CONTROL

As was noted previously, groundwater was encountered in the test borings at a depth ranging between about 2½ feet to 7 feet below existing grade at the time of our subsurface exploration. Groundwater is not expected to impact the planned improvements this this facility.

6.3 BUILDING FOUNDATION RECOMMENDATIONS

NOVA understands that the planned park facility improvements will include new construction of an open-air covered stage. The structure is anticipated to be of structural steel and wood-framed construction. Foundation support for the proposed structure is anticipated to be accomplished via conventional shallow footings and a slab-on-grade system. Structural loadings were not available from the design team at the time of the issuance of this report; we have therefore assumed that maximum loadings for the proposed structure will not exceed 30 kips for individual columns and 3 kips per foot for walls. We assume that finish site grades will not change greater than +/- 2 feet from existing grades within the proposed structure footprint.

After the recommended site and subgrade preparation and fill placement, we recommend a conventional shallow foundation system consisting of isolated interior column footings and perimeter load bearing walls be used to support the proposed structure. Foundations bearing on densified existing soils and/or compacted structural fill, as recommended in this report, may be designed for a maximum allowable soil bearing pressure of **1,500 pounds per square foot (psf)**, which reflects the very loose to loose soil conditions encountered in the upper 10 feet of the soil horizon in the test borings.

We recommend minimum footing widths of 18 inches for ease of construction and to reduce the possibility of localized shear failures. Exterior and interior footing bottoms should be established at least 16 inches below surrounding exterior grades.

Settlements for spread foundations bearing on the aforementioned improved materials have been assessed using SPT values to estimate elastic modulus, published correlations and previous NOVA experience. Based on the provided column loads and the recommended design soil bearing capacity, we expect total settlement beneath individual footings due to structural loading to be on the order of **1 inch or less**. The amount of differential settlement is difficult to predict because the subsurface and foundation loading conditions can vary considerably across the site. However, we anticipate differential settlement between adjacent footings of **½-inch or less**. The final deflected shape of the structure will be dependent on actual footing locations and loading.

Foundation excavations should be level and free of debris, ponded water, mud, loose, or water-softened soils. Concrete should be placed as soon as is practical after the foundation is excavated and the subgrade evaluated. Foundation concrete should not be placed on saturated soil. If a foundation excavation remains open overnight, or if precipitation is imminent, a 3 to 4-inch thick "mud mat" of lean concrete should be placed in the bottom of the footing to protect the bearing soils until reinforcing steel and concrete can be placed.

6.4 SLAB-ON-GRADE

The conditions exposed at subgrade levels will vary across the site and may include structural fill or densified in-situ soils. The slab-on-grade may be adequately supported on these subgrade conditions subject to the recommendations in this report. The slab-on-grade should be jointed around columns and along walls to reduce cracking due to differential movement. An underdrain system is not necessary beneath the slab, provided that the slab is at least 2 feet above the high groundwater level (this is not expected to be an issue for this site). In conformance with Florida Building Code (FBC), an impermeable vapor barrier conforming to ASTM E1745 Class A is recommended beneath finished spaces (building slab) to reduce dampness.

A subgrade modulus of **150 psi per inch** may be used for slab design where the slab bears upon 12 inches of compacted structural fill in accordance with previous fill placement recommendations.

Once grading is completed, the subgrade can be exposed to adverse construction activities and weather conditions during the period of sub-slab utility installation. The subgrade should be well drained to prevent the accumulation of water. If the exposed subgrade becomes unstable, excessively wet or exhibits excessive rutting or pumping, the geotechnical engineer should be consulted.

After utilities have been installed and backfilled, a final subgrade inspection should be performed by the geotechnical engineer immediately prior to slab-on-grade placement. If practical, proofrolling may be used to redensify the surface and to detect any soil that has become excessively wet or otherwise loosened.

6.5 SHEET PILE WALL DESIGN CONSIDERATIONS

The following recommendations are based upon review of the attached soil data, our understanding of the proposed improvements, and experience with similar projects and subsurface conditions. It should be noted that proposed sheet pile retaining wall plans were not available at the time of the issuance of this report; we request the opportunity to review and possibly amend our recommendation with respect to layout and design when these plans can be made available for our review. The discovery of any subsurface conditions during construction which deviate from those encountered in the borings should be reported to NOVA immediately for observation, evaluation, and recommendations.

NOVA recommends the following design information provided below in Table 1- Sheet Pile Seawall Soil Design Parameters be used in the sheet pile seawall design. These parameters are based upon the soil conditions encountered in Boring B-4.

Table 1 – Sheet Pile Seawall Soil Design Parameters

Typical Depth (feet)		Soil Type	Unit Weight (pcf)	Friction Angle (degrees)	Cohesion (psf)	Lateral Earth Pressure Coefficients		
From	To					Active (Ka)	Passive (Kp)	At Rest (Kp)
0	8	Cohesionless	105	28	0	0.36	2.77	0.53
8	13	Cohesive (PT)	100	0	0	1.00	1.00	1.00
13	28	Cohesionless	110	34	0	0.28	3.54	0.44
28	33	Cohesionless	115	38	0	0.24	4.20	0.38
33	35	Cohesionless	110	34	0	0.28	3.54	0.44

Backfill material for the sheet pile retaining wall system should meet the specifications noted above in the section titled *Field Placement*, and should also meet the design parameters presented below in Table 2 – Backfill Soil Parameters.

Table 2– Backfill Soil Parameters	
Backfill Soil Friction Angle	30º
Coefficient of Active Earth Pressure, Ka	0.33
Coefficient of Passive Earth Pressure, Kp	3.00
Coefficient of Earth Pressure At Rest, Ko	0.50
Dry Unit Weight of Soil	110 lb./ft^3
Saturated Unit Weight	50 lb./ft^3

6.6 HYDRAULIC CONDUCTIVITY

We understand that the planned facility improvements will include utilizing or possibly re-designing an existing shallow dry retention pond located in the northern portion of the property and possibly constructing a new retention pond in the same general area for the disposal and treatment of stormwater runoff. Based on the results of the SMS test borings, the subsurface conditions encountered appear to be adaptable for treatment and disposal of stormwater runoff via the desired SMS.

NOVA recommends that you consider the soil parameters presented below in Table 3 – SMS Soil Design Parameters, for design of conventional shallow retention ponds or shallow swales for this project.

Table 3– SMS Soil Design Parameters	
Corresponding Soil Boring Test Locations	R-1
Approximate Depth to Confining Layer, below existing grade	5 ft.
Measured Vertical Hydraulic Conductivity (Kv)	37 ft./day
Calculated Horizontal Hydraulic Conductivity (Kh)	56 ft./day
Measured Vertical Infiltration Rate (DRI)	42 in/hr.
Estimated Fillable Porosity of Soil	25%
Estimated Depth to Normal Permanent SHGW table, below existing grade	5 ft.

We note that the actual exfiltration rates from the SMS may be influenced by pond geometry, natural soil variability, in-situ depositional characteristics and soil density, retention volume, and groundwater mounding effects. Appropriate factors of safety should be incorporated into the design process.

The estimated normal permanent seasonal high groundwater level provided in Table 3 above is based on our experience with projects in this locale; the soil strata encountered in the test borings; the groundwater levels measured at the site; and the published information by the “Web Soil Survey” National database, NRCS division of the United States Department of Agriculture (USDA). Please note that the measured hydraulic conductivity rate and corresponding measured infiltration rate could be adversely impacted if siltation of the SMS bottom is allowed after construction.

7.0 CONSTRUCTION OBSERVATIONS

Subgrade

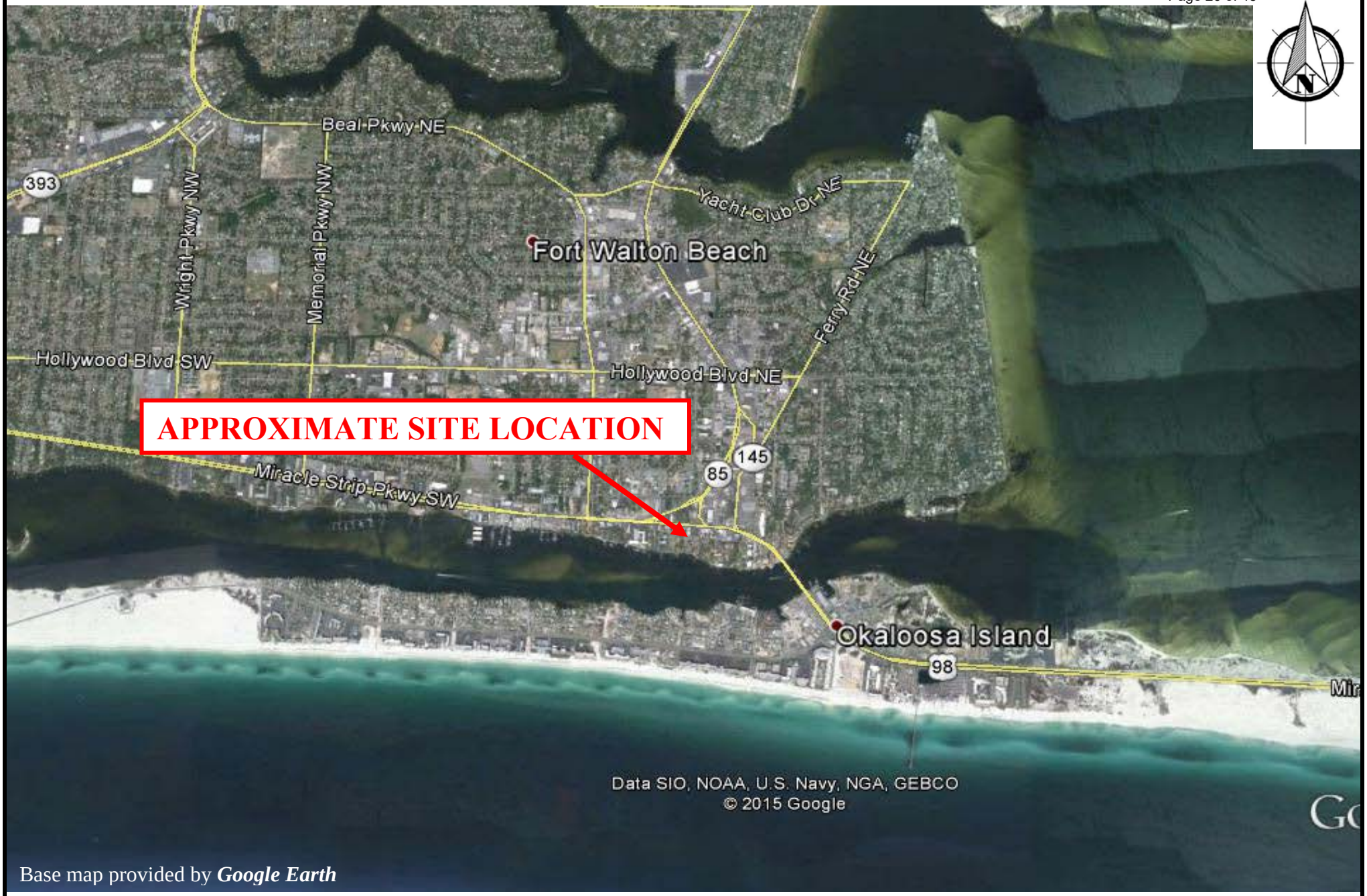
Once site grading is completed, the subgrade may be exposed to adverse construction activities and weather conditions. The subgrade should be well drained to prevent the accumulation of water. If the exposed subgrade becomes unstable, excessively wet or exhibits excessive rutting or pumping, the NOVA geotechnical engineer should be consulted.

A final subgrade evaluation should be performed by the NOVA geotechnical engineer immediately prior to stone base course placement. If practical, proof-rolling may be used to redensify the surface and to detect any soil that has become excessively wet or otherwise loosened and unstable.

Shallow Foundations

Foundation excavations should be level and free of debris, ponded water, mud, and loose, frozen or water-softened soils. All foundation excavations should be evaluated by the NOVA geotechnical engineer prior to reinforcing steel placement to observe foundation subgrade preparation and confirm bearing pressure capacity. Due to variable site subsurface and construction conditions, some adjustments in isolated foundation bearing pressures, depth of foundations or undercutting and replacement with controlled structural fill may be necessary.

APPENDIX A
FIGURES & MAPS



Scale: Not To Scale **Date Drawn:** December 14, 2015 **Drawn By:** J.James **Checked By:** W. Lawrence	NOVA ENGINEERING AND ENVIRONMENTAL	140-A Lurton Street, Suite B Pensacola, Florida 32505 850.607.7782 ♦ 850.249.6683

PROJECT LOCATION MAP
FWB Landing Park Improvements
Fort Walton Beach, Okaloosa County, Florida
NOVA Project Number 8215169

Soil Map—Okaloosa County, Florida

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Okaloosa County, Florida
Survey Area Data: Version 13, Nov 19, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

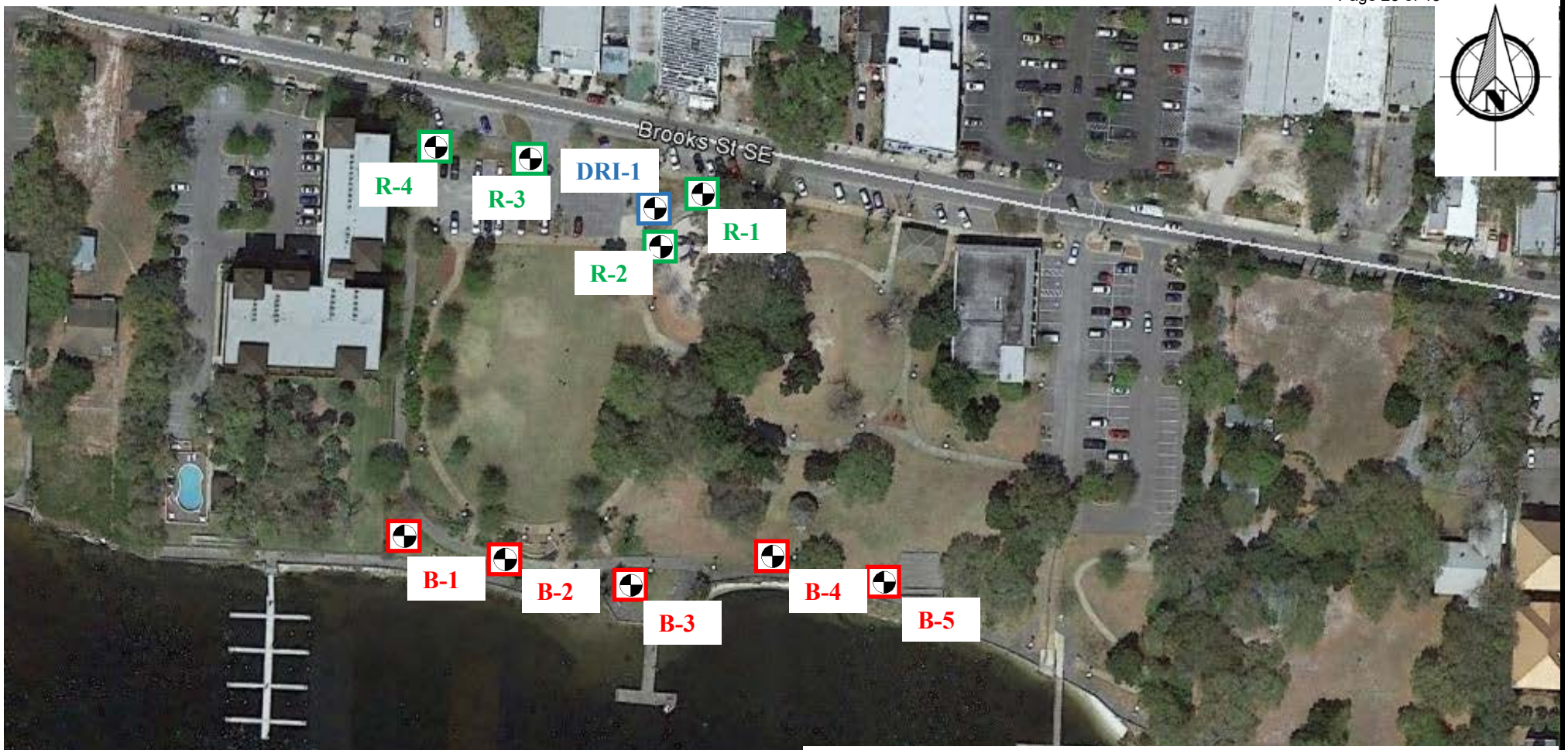
Date(s) aerial images were photographed: Dec 5, 2010—Oct 22, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Okaloosa County, Florida (FL091)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
17	Mandarin sand, 0 to 3 percent slopes	5.2	54.7%
27	Urban land	3.5	36.2%
100	Waters of the Gulf of Mexico	0.9	9.1%
Totals for Area of Interest		**9.5**	**100.0%**

APPENDIX B
SUBSURFACE DATA



Base map provided by ***Google Earth***

LEGEND

35' Structural SPT Boring

10' SMS Auger Boring

Double Ring Infiltrometer Test Location

Base map from Google Earth.

Scale: Not To Scale	
Date Drawn: December 21, 2015	
Drawn By: P. Kauzlarich	
Checked By: W. Lawrence	

NOVA ENGINEERING AND ENVIRONMENTAL

140-A Lurton Street
Pensacola, Florida 32505
850.607.7782 ♦ 850.249.6683

BORING LOCATION PLAN

FWB Landing Park Improvements

Fort Walton Beach, Santa Rosa County, Florida

NOVA Project Number 8215169

NOVA ENGINEERING AND ENVIRONMENTAL

KEY TO BORING LOGS

SYMBOLS AND ABBREVIATIONS

SYMBOL	DESCRIPTION
N-Value	No. of Blows of a 140-lb. Weight Falling 30 Inches Required to Drive a Standard Spoon 1 Foot
WOR	Weight of Drill Rods
WOH	Weight of Drill Rods and Hammer
	Sample from Auger Cuttings
	Standard Penetration Test Sample
	Thin-wall Shelby Tube Sample (Undisturbed Sampler Used)
% REC	Percent Core Recovery from Rock Core Drilling
RQD	Rock Quality Designation
	Stabilized Groundwater Level
	Seasonal High Groundwater Level (also referred to as the W.S.W.T.)
NE	Not Encountered
GNE	Groundwater Not Encountered
BT	Boring Terminated
-200 (%)	Fines Content or % Passing No. 200 Sieve
MC (%)	Moisture Content
LL	Liquid Limit (Atterberg Limits Test)
PI	Plasticity Index (Atterberg Limits Test)
K	Coefficient of Permeability
Org. Cont.	Organic Content
G.S. Elevation	Ground Surface Elevation

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS More than 50% retained on the No. 200 sieve*	GRAVELS 50% or more of coarse fraction retained on No. 4 sieve	CLEAN GRAVELS	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		GRAVELS WITH FINES	GM	Silty gravels and gravel-sand-silt mixtures
			GC	Clayey gravels and gravel-sand-clay mixtures
	SANDS More than 50% of coarse fraction passes No. 4 sieve	CLEAN SANDS 5% or less passing No. 200 sieve	SW**	Well-graded sands and gravelly sands, little or no fines
			SP**	Poorly graded sands and gravelly sands, little or no fines
		SANDS with 12% or more passing No. 200 sieve	SM**	Silty sands, sand-silt mixtures
			SC**	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS 50% or more passes the No. 200 sieve*	SILTS AND CLAYS Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays
			OL	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diamicaceous fine sands or silts, elastic silts
			CH	Inorganic clays or clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
			PT	Peat, muck and other highly organic soils

*Based on the material passing the 3-inch (75 mm) sieve
** Use dual symbol (such as SP-SM and SP-SC) for soils with more than 5% but less than 12% passing the No. 200 sieve

RELATIVE DENSITY
(Sands and Gravels)
Very loose – Less than 4 Blow/Foot
Loose – 4 to 10 Blows/Foot
Medium Dense – 11 to 30 Blows/Foot
Dense – 31 to 50 Blows/Foot
Very Dense – More than 50 Blows/Foot

CONSISTENCY
(Silts and Clays)
Very Soft – Less than 2 Blows/Foot
Soft – 2 to 4 Blows/Foot
Medium Stiff – 5 to 8 Blows/Foot
Stiff – 9 to 15 Blows/Foot
Very Stiff – 16 to 30 Blows/Foot
Hard – More than 30 Blows/Foot

RELATIVE HARDNESS
(Limestone)
Soft – 100 Blows for more than 2 Inches
Hard – 100 Blows for less than 2 Inches

MODIFIERS

These modifiers Provide Our Estimate of the Amount of Minor Constituents (Silt or Clay Size Particles) in the Soil Sample
Trace – 5% or less
With Silt or With Clay – 6% to 11%
Silty or Clayey – 12% to 30%
Very Silty or Very Clayey – 31% to 50%

These Modifiers Provide Our Estimate of the Amount of Organic Components in the Soil Sample
Trace – Less than 3%
Few – 3% to 4%
Some – 5% to 8%
Many – Greater than 8%

These Modifiers Provide Our Estimate of the Amount of Other Components (Shell, Gravel, Etc.) in the Soil Sample
Trace – 5% or less
Few – 6% to 12%
Some – 13% to 30%
Many – 31% to 50%

Project: FWB Landing Park Improvements
Project Location: Fort Walton Beach, Okaloosa County, Florida
Project Number: 8215169

LOG OF BORING
B-1

Page 1 of 1

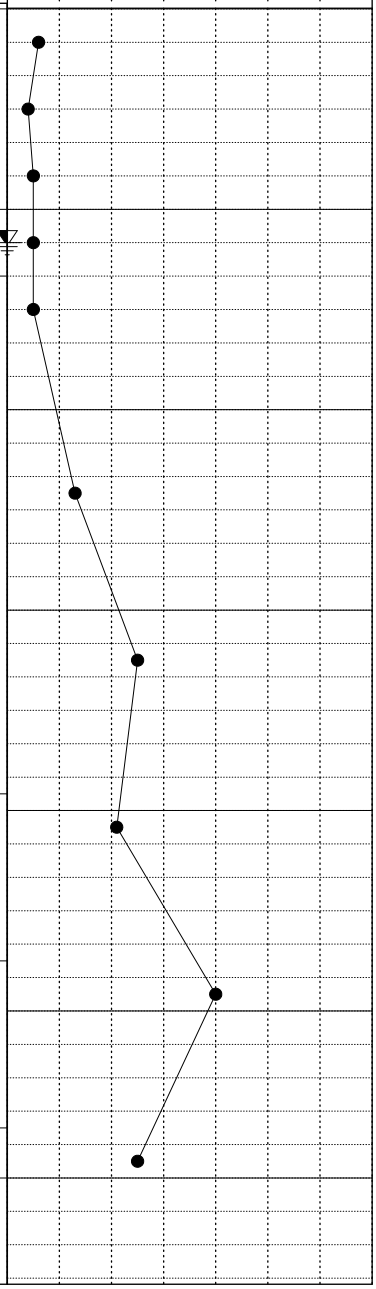
Date(s) Drilled: **12/18/2015**	Drill Bit Size/Type: **2-inch Soil Bit.**	Logged by: **J.James**
Drilled By: **B. Kinsella**	Sampling Method: **Split-Spoon**	Checked by: **W.Lawrence**
Drill Rig Type: **Truck-Mounted B-50**	Total Depth of Boring: **35-foot**	Approximate Surface Elevation: **Existing Grade**
Drilling Method: **SPT**	Boring Backfill: **Soil Cuttings**	Vertical Datum: **Existing Grade**
Hammer Data: Weight **140-lb** Drop **30-in**	Groundwater Level: **7-foot**	Location: **Per Boring Plan**

Elevation, feet MSL	Depth, feet	Sample Type	Sample Number	Sampling Resistance Blows/foot (N-value)	Consistency/ Relative Density	USCS-AASHTO	Graphic Log	Material Description
	0		1	6	LOOSE	SP		Black/Brown Fine-Grained SAND w/ Trace Shell Fragments
			2	4	LOOSE			
			3	5	LOOSE			
	6		4	5	LOOSE	SP		Tan Fine-Grained SAND
			5	5	LOOSE	SP		Off-White Fine-Grained SAND
	12		6	13	MEDIUM DENSE			
	18		7	25	MEDIUM DENSE			
	24		8	21	MEDIUM DENSE	SP		Gray/Off-White Fine-Grained SAND
	30		9	40	DENSE	SP		Brown Fine-Grained SAND
			10	25	MEDIUM DENSE	SP		Black/Brown Fine-Grained SAND
	36							Boring Terminated at 35-foot

TEST RESULTS

N-VALUE ●
PLASTICITY INDEX ├─┤ LIQUID LIMIT
NATURAL MOISTURE % ■
% <200 ▲
ORGANIC % ◇

10 20 30 40 50 60



REMARKS AND OTHER TESTS:

NOVA ENGINEERING AND ENVIRONMENTAL

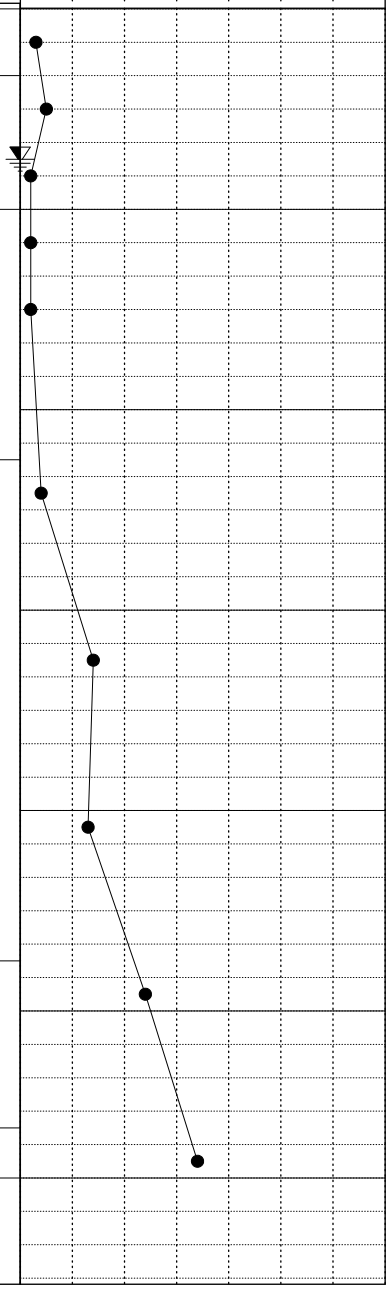
Project: FWB Landing Park Improvements
Project Location: Fort Walton Beach, Okaloosa County, Florida
Project Number: 8215169

LOG OF BORING
B-2
Page 1 of 1

Date(s) Drilled: **12/18/2015**	Drill Bit Size/Type: **2-inch Soil Bit.**	Logged by: **J.James**
Drilled By: **B. Kinsella**	Sampling Method: **Split-Spoon**	Checked by: **W.Lawrence**
Drill Rig Type: **Truck-Mounted B-50**	Total Depth of Boring: **35-foot**	Approximate Surface Elevation: **Existing Grade**
Drilling Method: **SPT**	Boring Backfill: **Soil Cuttings**	Vertical Datum: **Existing Grade**
Hammer Data: Weight **140-lb** Drop **30-in**	Groundwater Level: **4.5-foot**	Location: **Per Boring Plan**

Depth, feet	Sample Type	Sample Number	Sampling Resistance Blows/foot (N-value)	Consistency/ Relative Density	USCS-AASHTO	Material Description
0		1	3	VERY LOOSE	SP	Tan Fine-Grained SAND
		2	5	LOOSE	SP	Black/Brown Fine-Grained SAND
		3	2	VERY LOOSE		
6		4	2	VERY LOOSE	SP	Brown Fine-Grained SAND
		5	2	VERY LOOSE		
12		6	4	LOOSE	SP	Off-White Fine-Grained SAND
18		7	14	MEDIUM DENSE		
24		8	13	MEDIUM DENSE		
		9	24	MEDIUM DENSE	SP	Brown Fine-Grained SAND
30		10	34	DENSE	SP	Black/Brown Fine-Grained SAND
36						Boring Terminated at 35-foot

TEST RESULTS
N-VALUE ●
PLASTICITY INDEX ├─┤ LIQUID LIMIT
NATURAL MOISTURE % ■
% <200 ▲
ORGANIC % ◇
10 20 30 40 50 60



REMARKS AND OTHER TESTS:

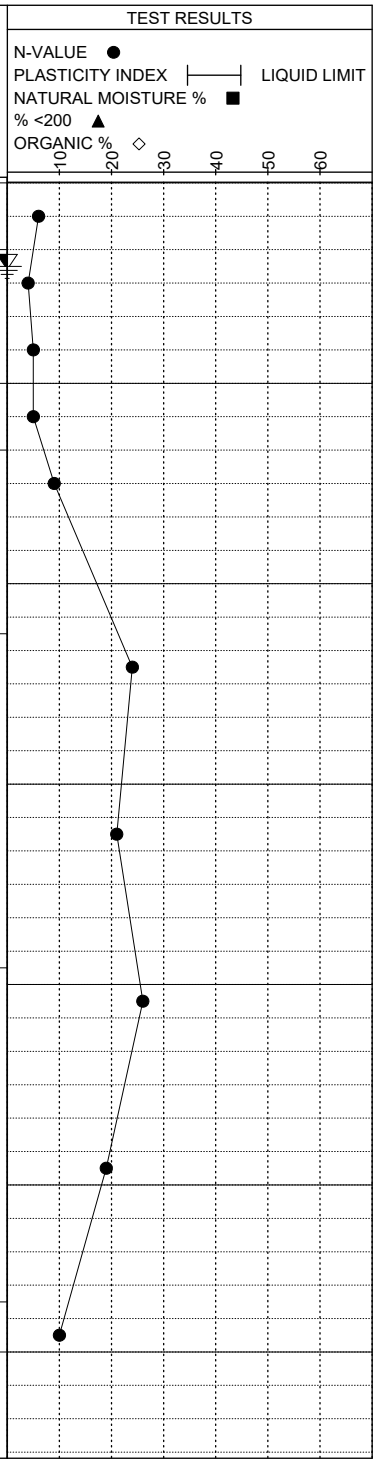
NOVA ENGINEERING AND ENVIRONMENTAL

Project: FWB Landing Park Improvements
Project Location: Fort Walton Beach, Okaloosa County, Florida
Project Number: 8215169

LOG OF BORING
B-3
Page 1 of 1

Date(s) Drilled: **12/18/2015**	Drill Bit Size/Type: **2-inch Soil Bit.**	Logged by: **J.James**
Drilled By: **B. Kinsella**	Sampling Method: **Split-Spoon**	Checked by: **W.Lawrence**
Drill Rig Type: **Truck-Mounted B-50**	Total Depth of Boring: **35-foot**	Approximate Surface Elevation: **Existing Grade**
Drilling Method: **SPT**	Boring Backfill: **Soil Cuttings**	Vertical Datum: **Existing Grade**
Hammer Data: Weight **140-lb** Drop **30-in**	Groundwater Level: **2.5-foot**	Location: **Per Boring Plan**

Elevation, feet MSL / Depth, feet	Sample Type	Sample Number	Sampling Resistance Blows/foot (N-value)	Consistency/ Relative Density	USCS-AASHTO	Graphic Log	Material Description
0		1	6	LOOSE	SP		Black/Brown Fine-Grained SAND
		2	4	LOOSE	SP		Light-Brown Fine-Grained SAND
		3	5	LOOSE			
6		4	5	LOOSE	SP		Brown Fine-Grained SAND
		5	9	LOOSE	SP		Light-Brown Fine-Grained SAND
12		6	24	MEDIUM DENSE	SP		Off-White Fine-Grained SAND
18		7	21	MEDIUM DENSE			
24		8	26	MEDIUM DENSE	SP		Brown Fine-Grained SAND
		9	19	MEDIUM DENSE			
30		10	10	LOOSE	SP		Light-Brown Fine-Grained SAND
36							Boring Terminated at 35-foot



REMARKS AND OTHER TESTS:

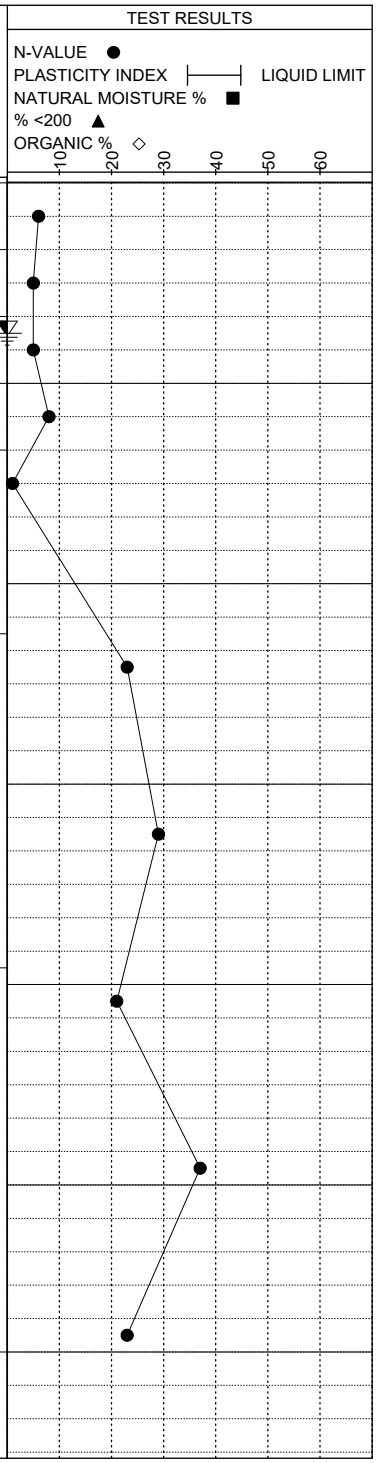
NOVA ENGINEERING AND ENVIRONMENTAL

Project: FWB Landing Park Improvements
Project Location: Fort Walton Beach, Okaloosa County, Florida
Project Number: 8215169

LOG OF BORING
B-4
Page 1 of 1

Date(s) Drilled: **12/18/2015**	Drill Bit Size/Type: **2-inch Soil Bit.**	Logged by: **J.James**
Drilled By: **B. Kinsella**	Sampling Method: **Split-Spoon**	Checked by: **W.Lawrence**
Drill Rig Type: **Truck-Mounted B-50**	Total Depth of Boring: **35-foot**	Approximate Surface Elevation: **Existing Grade**
Drilling Method: **SPT**	Boring Backfill: **Soil Cuttings**	Vertical Datum: **Existing Grade**
Hammer Data: Weight **140-lb** Drop **30-in**	Groundwater Level: **4.5-foot**	Location: **Per Boring Plan**

Depth, feet	Sample Type	Sample Number	Sampling Resistance Blows/foot (N-value)	Consistency/ Relative Density	USCS-AASHTO	Material Description
0		1	6	LOOSE	SP	Black/Brown Fine-Grained SAND w/ Trace Shell Fragments
		2	5	LOOSE	SP	Gray Fine-Grained SAND
		3	5	LOOSE	SP	Tan Fine-Grained SAND
6		4	8	LOOSE	SP	Off-White Fine-Grained SAND
		5	1	VERY LOOSE	PT	Black SANDY PEAT
12		6	23	MEDIUM DENSE	SP	Light-Brown Fine-Grained SAND
18		7	29	MEDIUM DENSE		
24		8	21	MEDIUM DENSE	SP	Black/Brown Fine-Grained SAND
		9	37	DENSE		
30		10	23	MEDIUM DENSE		
36						Boring Terminated at 35-foot



REMARKS AND OTHER TESTS:

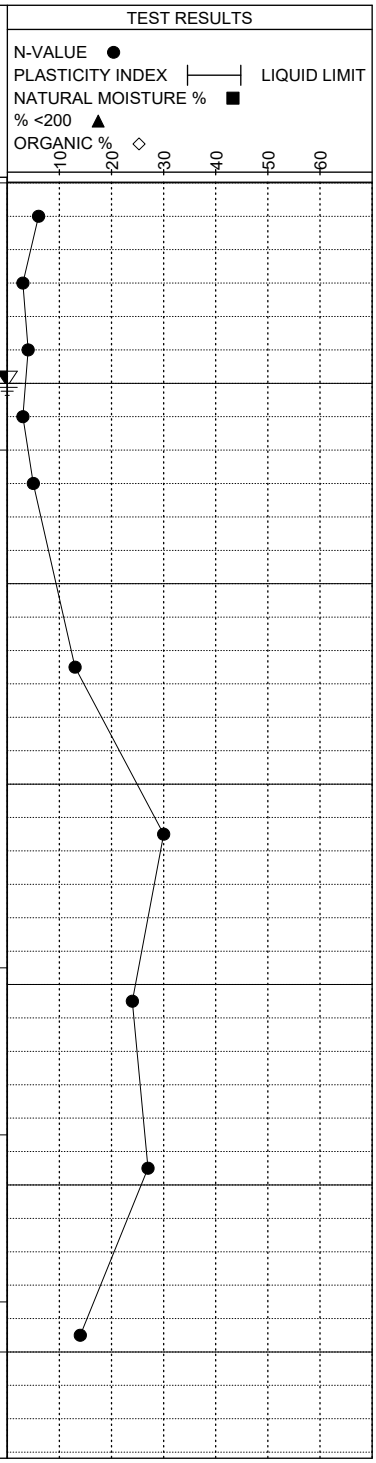
NOVA ENGINEERING AND ENVIRONMENTAL

Project: FWB Landing Park Improvements
Project Location: Fort Walton Beach, Okaloosa County, Florida
Project Number: 8215169

LOG OF BORING
B-5
Page 1 of 1

Date(s) Drilled: **12/18/2015**	Drill Bit Size/Type: **2-inch Soil Bit.**	Logged by: **J.James**
Drilled By: **B. Kinsella**	Sampling Method: **Split-Spoon**	Checked by: **W.Lawrence**
Drill Rig Type: **Truck-Mounted B-50**	Total Depth of Boring: **35-foot**	Approximate Surface Elevation: **Existing Grade**
Drilling Method: **SPT**	Boring Backfill: **Soil Cuttings**	Vertical Datum: **Existing Grade**
Hammer Data: Weight **140-lb** Drop **30-in**	Groundwater Level: **6-foot**	Location: **Per Boring Plan**

Depth, feet	Sample Type	Sample Number	Sampling Resistance Blows/foot (N-value)	Consistency/ Relative Density	USCS-AASHTO	Material Description
0		1	6	LOOSE	SP	Black/Brown Fine-Grained SAND w/ Trace Shell Fragments
		2	3	VERY LOOSE		
		3	4	LOOSE		
6		4	3	VERY LOOSE	SP	Tan Fine-Grained SAND
		5	5	LOOSE	SP	Off-White Fine-Grained SAND
12		6	13	MEDIUM DENSE		
18		7	30	MEDIUM DENSE		
24		8	24	MEDIUM DENSE	SP	Tan Fine-Grained SAND
30		9	27	MEDIUM DENSE	SP	Black/Brown Fine-Grained SAND
		10	14	MEDIUM DENSE	SP	Brown Fine-Grained SAND
36						Boring Terminated at 35-foot



REMARKS AND OTHER TESTS:

NOVA ENGINEERING AND ENVIRONMENTAL

Project: FWB Landing Park Improvements
Project Location: Fort Walton Beach, Okaloosa County, Florida
Project Number: 8215169

LOG OF BORING
R-1
Page 1 of 1

Date(s) Drilled: **12/15/2015**	Drill Bit Size/Type: **3-inch Soil Sampler**	Logged by: **J.James**
Drilled By: **J.James**	Sampling Method: **Grab from Auger Bucket**	Checked by: **W.Lawrence**
Drill Rig Type: **Hand Auger**	Total Depth of Boring: **8-foot**	Approximate Surface Elevation: **Existing Grade**
Drilling Method: **Hand Auger**	Boring Backfill: **Soil Cuttings**	Vertical Datum: **Existing Grade**
Hammer Data: Weight **N/A** Drop **N/A**	Groundwater Level: **5-foot**	Location: **Per Boring Plan**

Elevation, feet MSL	Depth, feet	Sample Type	Sample Number	Sampling Resistance Blows/foot (N-value)	Consistency/ Relative Density	USCS-AASHTO	Graphic Log	Material Description
	0		1			SP-SM		Black/Brown Fine-Grained Slightly Silty SAND
						SP		Tan/Off-White Fine-Grained SAND
	6							Boring Terminated at 8-foot
	12							
	18							
	24							
	30							
	36							

TEST RESULTS
N-VALUE ●
PLASTICITY INDEX ├─┤ LIQUID LIMIT
NATURAL MOISTURE % ■
% <200 ▲
ORGANIC % ◇
10 20 30 40 50 60

REMARKS AND OTHER TESTS: Sampled from Existing Pond Bottom

NOVA ENGINEERING AND ENVIRONMENTAL

Project: FWB Landing Park Improvements
Project Location: Fort Walton Beach, Okaloosa County, Florida
Project Number: 8215169

LOG OF BORING
R-2
Page 1 of 1

Date(s) Drilled: **12/15/2015**	Drill Bit Size/Type: **3-inch Soil Sampler**	Logged by: **J.James**
Drilled By: **J.James**	Sampling Method: **Grab from Auger Bucket**	Checked by: **W.Lawrence**
Drill Rig Type: **Hand Auger**	Total Depth of Boring: **8-foot**	Approximate Surface Elevation: **Existing Grade**
Drilling Method: **Hand Auger**	Boring Backfill: **Soil Cuttings**	Vertical Datum: **Existing Grade**
Hammer Data: Weight **N/A** Drop **N/A**	Groundwater Level: **5-foot**	Location: **Per Boring Plan**

Elevation, feet MSL	Depth, feet	Sample Type	Sample Number	Sampling Resistance Blows/foot (N-value)	Consistency/ Relative Density	USCS-AASHTO	Graphic Log	Material Description
	0		1			SP-SM		Black/Brown Fine-Grained Slightly Silty SAND
						SP		Tan/Off-White Fine-Grained SAND
	6							Boring Terminated at 8-foot
	12							
	18							
	24							
	30							
	36							

TEST RESULTS
N-VALUE ●
PLASTICITY INDEX ├─┤ LIQUID LIMIT
NATURAL MOISTURE % ■
% <200 ▲
ORGANIC % ◇
10 20 30 40 50 60

REMARKS AND OTHER TESTS: Sampled from Existing Pond Bottom

NOVA ENGINEERING AND ENVIRONMENTAL

Project: FWB Landing Park Improvements
Project Location: Fort Walton Beach, Okaloosa County, Florida
Project Number: 8215169

LOG OF BORING
R-3
Page 1 of 1

Date(s) Drilled: **12/15/2015**	Drill Bit Size/Type: **3-inch Soil Sampler**	Logged by: **J.James**
Drilled By: **J.James**	Sampling Method: **Grab from Auger Bucket**	Checked by: **W.Lawrence**
Drill Rig Type: **Hand Auger**	Total Depth of Boring: **8-foot**	Approximate Surface Elevation: **Existing Grade**
Drilling Method: **Hand Auger**	Boring Backfill: **Soil Cuttings**	Vertical Datum: **Existing Grade**
Hammer Data: Weight **N/A** Drop **N/A**	Groundwater Level: **7-foot**	Location: **Per Boring Plan**

Elevation, feet MSL / Depth, feet	Sample Type	Sample Number	Sampling Resistance Blows/foot (N-value)	Consistency/ Relative Density	USCS-AASHTO	Graphic Log	Material Description
0					SP-SM		Brown Fine-Grained Slightly Silty SAND w/ Trace Gravel
		1			SP		Off-White Fine-Grained SAND
6							Boring Terminated at 8-foot
12							
18							
24							
30							
36							

TEST RESULTS
N-VALUE ●
PLASTICITY INDEX ├─┤ LIQUID LIMIT
NATURAL MOISTURE % ■
% <200 ▲
ORGANIC % ◇
10 20 30 40 50 60

REMARKS AND OTHER TESTS: Sampled from Existing Parking Area

NOVA ENGINEERING AND ENVIRONMENTAL

Project: FWB Landing Park Improvements
Project Location: Fort Walton Beach, Okaloosa County, Florida
Project Number: 8215169

LOG OF BORING
R-4

Page 1 of 1

Date(s) Drilled: **12/15/2015**	Drill Bit Size/Type: **3-inch Soil Sampler**	Logged by: **J.James**
Drilled By: **J.James**	Sampling Method: **Grab from Auger Bucket**	Checked by: **W.Lawrence**
Drill Rig Type: **Hand Auger**	Total Depth of Boring: **8-foot**	Approximate Surface Elevation: **Existing Grade**
Drilling Method: **Hand Auger**	Boring Backfill: **Soil Cuttings**	Vertical Datum: **Existing Grade**
Hammer Data: Weight **N/A** Drop **N/A**	Groundwater Level: **7-foot**	Location: **Per Boring Plan**

Elevation, feet MSL / Depth, feet	Sample Type	Sample Number	Sampling Resistance Blows/foot (N-value)	Consistency/ Relative Density	USCS-AASHTO	Graphic Log	Material Description
0					SP-SM		Brown Fine-Grained Slightly Silty SAND w/ Trace Gravel
		1			SP		Off-White Fine-Grained SAND
6							Boring Terminated at 8-foot
12							
18							
24							
30							
36							

TEST RESULTS

N-VALUE ●
PLASTICITY INDEX ├─┤ LIQUID LIMIT
NATURAL MOISTURE % ■
% <200 ▲
ORGANIC % ◇

10 20 30 40 50 60

REMARKS AND OTHER TESTS: Sampled from Existing Parking Area

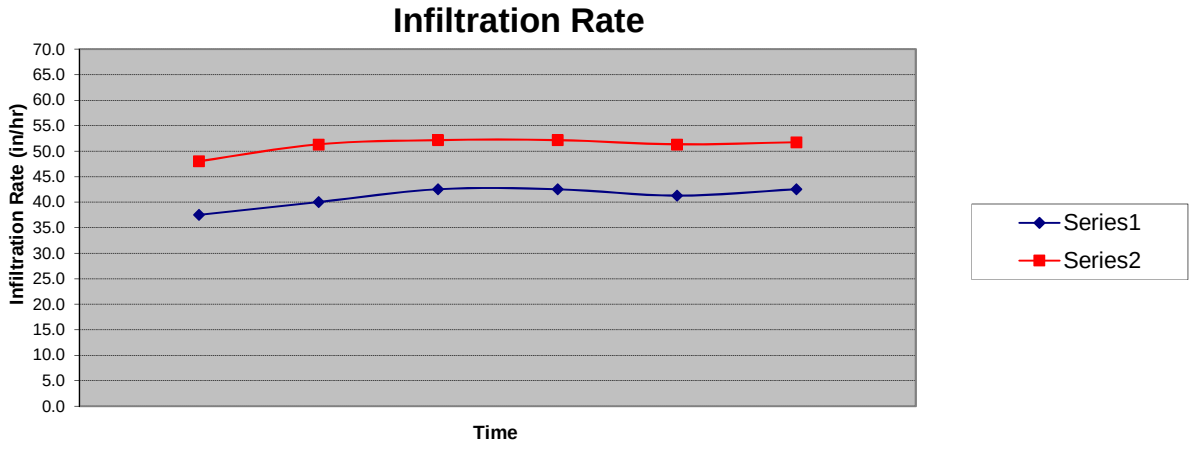
NOVA ENGINEERING AND ENVIRONMENTAL

Project:	**FWB Landing Park Improvements**	**Report of DRI-1**
Project Location:	**Fort Walton Beach, Okaloosa County, Florida**	
Project Number:	**8215169**	

Date(s) of Test	**December 15, 2015**	Logged by	**J. James**	Checked by	**W. Lawrence**
Test Method	**ASTM D 3385**	Weather	**Sunny**	Type of liquid	**Tap Water**
Area Inner Ring	**110.75 sq. in.**	Technician(s)	**J. James**	Liquid Temperature	**70 deg. F**
Area Outer Ring	**447.69 sq. in.**	See Attached Auger Boring Record for Soil Profile		Soil Temperature	**70 deg. F**
Area Annular Space	**334.59 sq. in.**	Approx. Elev. / Location	**4 inches below existing site grade / See Boring Location Plan**		

INCREMENTAL INFILTRATION RATE vs. TOTAL ELAPSED TIME

		Inner Ring		Outer Ring		
Time	**Elapsed Time (minutes)**	**Volume (gal)**	**Infiltration Rate (In/hr)**	**Volume (gal)**	**Infiltration Rate (In/hr)**	**Comments**
14:10	0	0.00	0	0	0.00	Test began after 20 hour saturation period, Unable to maintain head after 14:47.
14:15	5	1.5	37.5	5.8	48.0	
14:20	5	1.6	40.0	6.2	51.3	
14:25	5	1.7	42.5	6.3	52.2	
14:30	5	1.7	42.5	6.3	52.2	
14:40	10	3.3	41.3	12.4	51.3	
14:50	10	3.4	42.5	12.5	51.7	



INFILTRATION RATE = 42 in/hr

NOVA ENGINEERING AND ENVIRONMENTAL

Figure DRI-1

APPENDIX C
LABORATORY DATA

REMOLDED LABORATORY PERMEABILITY TEST DATA SHEET

PROJECT: FWB Landing Park Improvements **NOVA PROJECT #:** 8215169

DATE: 12/17/2015 **ASSIGNED BY:** JAJ **TESTED BY:** JAJ

Sample LOCATION / BORING NO.	**R-1**
Sample NUMBER / DEPTH	**2**

PERMEABILITY TESTING SUMMARY			
PERMEABILITY (K_V)	→	**40**	**ft/day**
Corresponding K_h	→	**60**	**ft/day**
DRY DENSITY	→	**101**	**lbs/ft^3**
MOISTURE CONTENT	→	**3**	**%**
-200 FINES CONTENT	→	**0**	**%**

FALLING HEAD PERMEABILITY (ASTM D 5084)

No. of LAYERS:	**3**	**Wt. of MOLD (lbs):**	**4.43**
BLOWS/LAYER:	**12**	**Wt. of MOLD/SOIL (lbs):**	**7.92**

HEIGHT (FT)	TRIAL #1 (SEC)	TRIAL #2 (SEC)	PERMEABILITY
7	0.0		1.43E-02
6	1.0		1.37E-02
5	2.4		1.38E-02
4	4.0		1.40E-02
3	6.1		1.44E-02
2	9.0		
1	13.6		

Average Permeability **1.4E-02** **cm/sec**

MOISTURE CONTENT (ASTM D 2216)

Pan NUMBER	**LL**
Wt. of WET SOIL & PAN (g)	**490.0**
Wt. of DRY SOIL & PAN (g)	**479.1**
Wt. of PAN (g)	**150.3**
Wt. of Water (g)	10.9
Wt. of Dry Soil (g)	328.8
MOISTURE CONTENT (%)	**3.3**

-200 SIEVE WASH (ASTM D 1140)

Pan NUMBER	**LL**
Wt. of DRY SOIL & PAN (g)	**479.1**
Wt. of WASH SOIL & PAN (g)	**477.6**
Wt. of PAN (g)	**150.3**
Wt. of Original Dry Sample (g)	328.8
Wt. of -200 Material (g)	1.5
Wt. of Washed Dry Sample (g)	327.3
-200 FINES CONTENT (%)	**0.5**

NUMBER OF INCHES MOLD WAS SHORT? **0.000** **INCHES** **(ZERO INCHES IS DEFAULT)**

PERMEABILITY CONSTANT USED WAS → **0.23** **(Includes 3/8"ID tubing)**

NOVA

REMOLDED LABORATORY PERMEABILITY TEST DATA SHEET

PROJECT: FWB Landing Park Improvements **NOVA PROJECT #:** 8215169

DATE: 12/17/2015 **ASSIGNED BY:** JAJ **TESTED BY:** JAJ

Sample LOCATION / BORING NO.	**R-3**
Sample NUMBER / DEPTH	**2**

PERMEABILITY TESTING SUMMARY			
PERMEABILITY (K_V)	→	**37**	**ft/day**
Corresponding K_h	→	**56**	**ft/day**
DRY DENSITY	→	**100**	**lbs/ft^3**
MOISTURE CONTENT	→	**5**	**%**
-200 FINES CONTENT	→	**1**	**%**

FALLING HEAD PERMEABILITY (ASTM D 5084)

No. of LAYERS:	**3**	**Wt. of MOLD (lbs):**	**4.43**
BLOWS/LAYER:	**12**	**Wt. of MOLD/SOIL (lbs):**	**7.92**

HEIGHT (FT)	TRIAL #1 (SEC)	TRIAL #2 (SEC)	PERMEABILITY
7	0.0		1.34E-02
6	0.9		1.29E-02
5	2.5		1.31E-02
4	4.4		1.27E-02
3	6.4		1.37E-02
2	9.4		
1	14.5		
Average Permeability		**1.3E-02**	**cm/sec**

MOISTURE CONTENT (ASTM D 2216)

Pan NUMBER	**TT**
Wt. of WET SOIL & PAN (g)	**440.7**
Wt. of DRY SOIL & PAN (g)	**427.4**
Wt. of PAN (g)	**149.1**
Wt. of Water (g)	13.3
Wt. of Dry Soil (g)	278.3
MOISTURE CONTENT (%)	**4.8**

-200 SIEVE WASH (ASTM D 1140)

Pan NUMBER	**TT**
Wt. of DRY SOIL & PAN (g)	**427.4**
Wt. of WASH SOIL & PAN (g)	**424.9**
Wt. of PAN (g)	**149.1**
Wt. of Original Dry Sample (g)	278.3
Wt. of -200 Material (g)	2.5
Wt. of Washed Dry Sample (g)	275.8
-200 FINES CONTENT (%)	**0.9**

NUMBER OF INCHES MOLD WAS SHORT? **0.000** **INCHES** **(ZERO INCHES IS DEFAULT)**

PERMEABILITY CONSTANT USED WAS → **0.23** **(Includes 3/8"ID tubing)**

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APPENDIX D
ASFE DOCUMENT
QUALIFICATIONS OF RECOMMENDATIONS

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. *No one except you* should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you* – should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it at all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project–Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, *do not rely on a geotechnical engineering report* that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man–made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions *only* at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an *opinion* about subsurface conditions throughout the site. Actual subsurface conditions may differ – sometimes significantly – from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject To Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain specific types on information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce such risks, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations", many of the provisions indicate where geotechnical engineers responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures*. If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else*.

Rely on Your Geotechnical Engineer for Additional Assistance

Membership in ASFE exposes geotechnical engineers to a wide array of risk management techniques than can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE–member geotechnical engineer for more information.

ASFE

8811 Colesville Road Suite G106 Silver Spring, MD 20910
Telephone: 301-565-2733 Facsimile: 301-589-2017
email: info@asfe.org www.asfe.org

QUALIFICATIONS OF RECOMMENDATIONS

The findings, conclusions and recommendations presented in this report represent our professional opinions concerning subsurface conditions at the site. The opinions presented are relative to the dates of our site work and should not be relied on to represent conditions at later dates or at locations not explored. The opinions included herein are based on information provided to us, the data obtained at specific locations during the study, and our previous experience. If additional information becomes available which might impact our geotechnical opinions, it will be necessary for NOVA to review the information, re-assess the potential concerns, and re-evaluate our conclusions and recommendations.

Regardless of the thoroughness of a geotechnical exploration, there is the possibility that conditions between borings may differ from those encountered at specific boring locations, that conditions are not as anticipated by the designers and/or the contractors, or that either natural events or the construction process has altered the subsurface conditions. These variations are an inherent risk associated with subsurface conditions in this region and the approximate methods used to obtain the data. These variations may not be apparent until construction.

The professional opinions presented in this report are not final. Field observations and foundation installation monitoring by the geotechnical engineer, as well as soil density testing and other quality assurance functions associated with site earthwork and foundation construction, are an extension of this report. Therefore, NOVA should be retained by the owner to observe all earthwork and foundation construction to confirm that the conditions anticipated in this study actually exist, and to finalize or amend our conclusions and recommendations. NOVA is not responsible or liable for the conclusions and recommendations presented in this report if NOVA does not perform these observation and testing services.

This report is intended for the sole use of **AVCON, Inc.** only. The scope of work performed during this study was developed for purposes specifically intended by **AVCON, Inc**. only, and may not satisfy other users' requirements. Use of this report or the findings, conclusions or recommendations by others will be at the sole risk of the user. NOVA is not responsible or liable for the interpretation by others of the data in this report, nor their conclusions, recommendations or opinions.

Our professional services have been performed, our findings obtained, our conclusions derived and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices in the State of Florida. This warranty is in lieu of all other statements or warranties, either expressed or implied.