GEOTECHNICAL ENGINEERING REPORT

City of Crestview Fire Training Tower
Crestview, Okaloosa County, Florida

PREPARED FOR:
City of Crestview – Department of Public Services
715 North Ferndon Boulevard
Crestview, Florida 32536

NOVA Project Number: 10116-2021328

December 27, 2021

NOVA

PROFESSIONAL | PRACTICAL | PROVEN

December 27, 2021

Mr. Kyle Lusk, E.I.
City of Crestview, Department of Public Services
715 North Ferdon Boulevard
Crestview, Florida 32536

Subject: Geotechnical Engineering Report
CITY OF CRESTVIEW FIRE TRAINING TOWER
Crestview, Okaloosa County, Florida
NOVA Project Number 10116-2021328

Dear Mr. Lusk:

NOVA Engineering and Environmental LLC (NOVA) has completed the authorized Geotechnical Engineering Report for the proposed training facility improvements to be located in Crestview, Okaloosa County, Florida. The work was performed in general accordance with NOVA Proposal Number 016-20216945, dated October 20, 2021. 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, conclusions, and recommendations.

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 James, P.E.
Assistant Branch Manager
Florida Registration No. 90470

WILLIAM LEE LAWRENCE, JR
LICENSE
No. 60147
STATE OF
FLORIDA
PROFESSIONAL ENGINEER

William L. Lawrence, P.E.
Senior Regional Engineer
STATE OF FLORIDA
Professional Engineer No. 60147

This item has been electronically signed and sealed by William L. Lawrence, P.E., using a Digital Signature. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Digitally signed by William L Lawrence
Date: 2021.12.27 10:35:31 -06'00'

Copies Submitted:
via electronic mail service

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1.0 SUMMARY

A brief summary of the pertinent findings, conclusions, and recommendations are presented below. This information should not be utilized in design or construction without reading the report in its entirety and paying particular attention to the recommendations presented in the text and Appendix.

1.1 GENERAL

The Subject Property is located along Gordon Street in Crestview, Okaloosa County, Florida. NOVA understands the project will include constructing a four-story training structure and a stormwater retention basin to treat and dispose of stormwater runoff associated with the planned site improvements.

Our field exploration at the subject site included performing one (1) Standard Penetration Test (SPT) boring (designated B-1) within the proposed structure footprint and two (2) auger borings (designated R-1 and R-2) within the proposed stormwater management system (SMS) area. Drilling, testing and sampling operations for the NOVA field exploration were performed in general accordance with ASTM designations and other industry standards.

The test borings generally encountered mixed strata of very loose to loose fine-grained sands and slightly silty sands (USCS classifications of SP and SP-SM, respectively) from the existing ground surface elevation to depths of about 1½ feet to 9 feet below existing grade (BEG) underlain by loose to medium dense fine-grained silty sands (SM) to the maximum depth explored of about 25 feet BEG.

1.2 SITE PREPARATION

Based on the boring results, following site stripping, the proposed construction appears to be feasible employing conventional site preparation practices as recommended in the Site Preparation section of this report.

A geotechnical engineer should carefully evaluate all subgrades prior to foundation and slab-on-grade construction 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.

1.3 GROUNDWATER CONTROL

Groundwater was not encountered in the test borings within the maximum depth explored of about 25 feet BEG at the time of our field exploration and is not anticipated to adversely impact the development of this property.

1.4 FOUNDATIONS

After the recommended site/subgrade preparation and fill placement, we recommend that the proposed structure be supported on a conventional shallow foundation system bearing upon compacted native soils and/or compacted structural fill. The building foundation may be designed for a maximum soil bearing pressure of **1,500 pounds per square foot (psf)** .

1.5 STORMWATER MANAGEMENT SYSTEM

Based on the results of the test borings, the subsurface conditions encountered in the proposed stormwater management system area are considered marginally to poorly adaptable for the treatment and disposal of stormwater runoff via the desired conventional shallow retention basin due to the presence of relatively low permeability soils encountered at extending to well below the anticipated SMS basin invert elevation.

2.0 INTRODUCTION

2.1 PROJECT INFORMATION

Our understanding of this project is based on discussions with the client, review of the provided drawings, a site reconnaissance performed during the boring layout, review of aerial photography of the site via internet-based GIS software, and our experience with similar geotechnical conditions in the near vicinity to this project site.

2.1.1 Proposed Structures

NOVA understands the project will include constructing a four-story training structure and a stormwater retention basin to treat and dispose of stormwater runoff associated with the planned site improvements.

2.1.2 Maximum Loads

We anticipate that the structure will be supported on a shallow foundation system. Final structural loadings were not available from the design team at the time of the issuance of this report. We have therefore assumed that maximum bearing loads will be on the order of 75 kips for isolated interior columns and 4 kips per lineal foot for perimeter load-bearing walls.

2.1.3 Floor Elevations / Site Grading

Final grading details were not available from the design team at the time of the issuance of this report; we have therefore assumed that finish site grades will not change greater than +/- 2 feet from existing grades within the proposed structure footprint. The proposed stormwater retention basin has been assumed to be on the order of 5 feet or less in depth, relative to current site grade elevations.

2.2 SCOPE OF WORK

The City of Crestview – Department of Public Services engaged NOVA to provide geotechnical engineering consulting services for the planned improvements to the existing fire training facility located in Crestview, 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 objectives of this study were to perform a geotechnical exploration within the areas of the proposed construction and to assess these findings as they relate to geotechnical aspects of the planned site development.

The authorized geotechnical engineering services included a site reconnaissance, a soil test boring and sampling program, laboratory testing, engineering evaluation of the field and laboratory data, and the preparation of this report.

The services were performed substantially as outlined in our proposal number 016-20216945 dated October 20, 2021, and in general accordance with industry standards. As authorized per the above referenced proposal, this completed geotechnical report includes:

- A description of the site, fieldwork, laboratory testing and general soil conditions encountered, including a Boring Location Plan and individual Test Boring Records.
- Site preparation considerations that include geotechnical discussions regarding site stripping and subgrade preparation, recommended cut or fill slopes, and engineered fill/backfill placement.
- Recommendations for controlling groundwater during construction and the need for permanent de-watering systems based on the expected post construction ground water levels.
- Foundation system recommendations for the proposed structure, including an allowable bearing capacity, a recommended bearing depth, and installation considerations.
- SMS design parameters per NWFWMD ERP requirements.
- Suitability of on-site soils for re-use as structural fill and backfill. Additionally, the criteria for suitable fill 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 LOCATION AND LEGAL DESCRIPTION

The Subject Property is located along Gordon Street in Crestview, Okaloosa County, Florida. A Site Location Map is included in Appendix A.

3.2 SUBJECT PROPERTY AND VICINITY GENERAL CHARACTERISTICS

At the time of our field exploration, the vicinity of the Subject Property was observed to be generally developed with residential land uses, and was bordered by the following:

DIRECTION	LAND USE DESCRIPTION/OBSERVATIONS
NORTH	Apartment Complex
EAST	Vacant Property
SOUTH	Vacant Property
WEST	Gordon Street

3.3 CURRENT USE OF THE PROPERTY

At the time of the field exploration, the subject property was vacant and had been recently cleared in preparation of constructing the new training facility.

4.0 FIELD EXPLORATION

NOVA boring locations were established in the field using a handheld GPS unit and the provided site plan. The approximate locations are shown in Appendix B. Consequently, referenced boring locations should be considered approximate. If increased accuracy is desired by the client, NOVA recommends that the boring locations and elevations be surveyed.

Our field exploration was conducted on December 6, 2021, and included:

- One (1) Standard Penetration Test (SPT) boring (designated B-1) drilled to a depth of about 25 feet below existing grade (BEG) within the proposed structure footprint.
- Two (2) continuously sampled auger borings (R-1 and R-2), each drilled to a depth of about 15 feet BEG within the proposed SMS area.

Soil Test Borings: The SPT boring completed by NOVA were performed using the guidelines of ASTM Designation D-1586, "Penetration Test and Split-Barrel Sampling of Soils". A mud rotary drilling process was used to advance the boring. At regular intervals, soil samples were obtained with a standard 1.4-inch I.D., 2.0-inch O.D., split-tube sampler. The sampler was first seated six inches and then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot is designated the "Penetration Resistance". The penetration resistance, when properly interpreted, is an index to the soil strength and density.

The auger borings were performed using a 3-inch diameter hand auger with a bulk sample being acquired continuously for the full depth of the boring. Representative portions of the soil samples, obtained from the sampler, were placed in sealed containers and transported to our laboratory for further evaluation and laboratory testing.

Test Boring Records in Appendix B show the standard penetration test (SPT) resistances, or "N-values" for the structural boring and present the soil conditions encountered in all of the borings. These records represent our interpretation of the subsurface conditions based on the field exploration data, visual examination of the recovered split-barrel samples, laboratory test data, 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.

The groundwater levels reported on the Test Boring Records represent measurements made at the completion of each soil test boring. The soil test borings were subsequently backfilled with the soil cuttings for safety concerns.

5.0 LABORATORY TESTING

A laboratory testing program was conducted to characterize materials which exist at the site using the recovered split-barrel samples. Selected test data are presented in Appendix C of this report. The specific tests are briefly described below. All soil samples will be properly disposed of in accordance with NOVA's General Terms and Conditions, unless you request otherwise.

5.1 SOIL CLASSIFICATION

Soil classification provides a general guide to the engineering properties of various soil types and enable the engineer to apply past experience to current problems. In our explorations, samples obtained during drilling operations are observed in our laboratory and visually classified by an engineer. The soils are classified according to consistency (based on number of blows from standard penetration tests), color and texture. These classification descriptions are included on our Test Boring Records. The classification system discussed above is primarily qualitative; laboratory testing is generally performed for detailed soil classification. Using the test results, the soils were classified using the Unified Soil Classification System. This classification system and the in-place physical soil properties provide an index for estimating the soil's behavior. The soil classification and physical properties obtained are presented in this report.

5.2 FALLING-HEAD LABORATORY PERMEABILITY TEST

A remolded falling head permeability test (ASTM D-5084) is a common laboratory test used to determine the hydraulic conductivity of fine-grained soils. The test involves the flow of water through a re-molded, fully saturated soil sample inside a rigid-wall permeameter connected to a standpipe of constant diameter. Before beginning the flow measurements, the soil sample is saturated, and the standpipe is filled with water to a given level. The test then starts by allowing the water to flow through the sample until the water in the standpipe reaches a lower limit. The time required for the water to flow from the upper to lower limit is recorded.

5.3 MOISTURE CONTENT AND PERCENT FINES

The moisture content is the ratio expressed as a percentage of the weight of water in a given mass of soil to the weight of the solid particles. The percent fines is defined as the percentage of the total dry soil mass which passes a #200 sieve. These tests were conducted in general accordance with ASTM D-2216 and ASTM D-1140, respectively.

6.0 SUBSURFACE CONDITIONS

6.1 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.

6.2 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 Test 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.

The test borings generally encountered mixed strata of very loose to loose fine-grained sands and slightly silty sands (USCS classifications of SP and SP-SM, respectively) from the existing ground surface elevation to depths of about 1½ feet to 9 feet below existing grade (BEG) underlain by loose to medium dense fine-grained silty sands (SM) to the maximum depth explored of about 25 feet BEG.

6.3 GROUNDWATER CONDITIONS

6.3.1 General

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 towards the south.

Groundwater levels vary with changes in season and rainfall, construction activity, surface water runoff and other site-specific factors. Groundwater levels in the greater Crestview 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.

6.3.2 Soil Test Boring Groundwater Conditions

Groundwater was not encountered in the test borings within the maximum depth explored of about 25 feet BEG at the time of the soil exploration, which occurred during a period of relatively normal seasonal rainfall.

Based on comparisons of current annual monthly rainfall data to historical rainfall data extending back 50+ years in time, we estimate that the normal permanent seasonal high groundwater (SHGW) table for this site will remain at a depth greater than 25 feet BEG, during the wet season.

7.0 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are based on our understanding of the proposed construction, our site observations, our evaluation and interpretation of the field and laboratory data obtained during this exploration, our experience with similar subsurface conditions, and generally accepted geotechnical engineering principles and practices.

Subsurface conditions in unexplored locations or at other times may vary from those encountered at the 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 necessary.

As previously noted, boring locations were established in the field using a handheld GPS unit and the provided site plan. If increased accuracy is desired by the client, we recommend that the boring locations and elevations be surveyed.

7.1 SITE PREPARATION

Prior to proceeding with construction, we recommend stripping and grubbing the proposed structure footprint to remove all surficial vegetation and topsoil, trees and/or associated root systems, and any other deleterious non-soil materials that are found to be present. Clean topsoil may be stockpiled and subsequently re-used in landscaped areas. Debris-laden materials should be excavated, transported, and disposed of off-site in accordance with appropriate solid waste rules and regulations. Any existing utility locations should be reviewed to assess their impact on the proposed construction and relocated/grouted in-place as appropriate.

The soils exposed at the stripped grade elevation should be compacted using a large ride-on roller operating in the static mode to a minimum soil density of at least 98 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557). We note that vibratory compaction operations with a large ride-on roller should not be conducted within a clear distance of 50 feet from existing structures.

A geotechnical engineer should carefully evaluate all subgrades prior to foundation and slab-on-grade construction 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.

7.1.1 Soil Suitability

The majority of the on-site near surface soils can be categorized as SP-SM, or fine-grained slightly silty sands based on the Unified Soil Classification System (USCS). This sandy soil type is considered suitable for re-use as structural fill within the proposed structure footprint. The underlying fine-grained silty sand (SM) stratum may also be suitable for re-use as structural fill material, but we note that this material is inherently moisture sensitive and should be within 2 percent of its optimum moisture content at the time of placement and compaction or it will need to be dried back to within this moisture tolerance prior to being used.

All materials to be used for backfill or compacted fill construction should be evaluated and, if necessary, tested by NOVA prior to placement to determine if they are suitable for their intended use. In general, based upon the boring results, the near surface slightly silty sands such as those encountered in the borings can be used as structural fill as well as general subgrade fill and backfill, provided that the fill material is free of rubble, clay, rock, roots and organics. Any off-site materials used as fill should be approved by NOVA prior to acquisition.

Organic and/or debris-laden material is not suitable for re-use as structural fill. Topsoil, mulch, and similar organic materials can be wasted in architectural areas. Debris-laden materials should be excavated, transported, and disposed of off-site in accordance with appropriate solid waste rules and regulations.

7.1.2 Soil Compaction

Additional fill soils should be placed in thin, horizontal loose lifts (i.e., maximum 12-inch) and compacted via non-vibratory methods to a minimum soil density of at least 98 percent of the Modified Proctor maximum dry density (ASTM D-1557). The upper 12 inches of soil beneath the bottoms of all subsequent foundation footing excavations should be compacted to at least 98 percent.

In confined areas, such as utility trenches or behind retaining walls, portable compaction equipment and thinner fill lifts (3 to 4 inches) may be necessary. Fill materials used in structural areas should have a target maximum dry density of at least 95 pounds per cubic foot (pcf). 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 2 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. Moisture control may be difficult during rainy weather.

Filling operations should be observed by a NOVA soils technician, who can confirm suitability of material used and uniformity and appropriateness of compaction efforts.

He/she can also document compliance with the specifications by performing field density tests using thin-walled tube, nuclear, or sand cone testing methods (ASTM D-2937, D-6938, or D-1556, respectively). One test per 400 cubic yards and every 2 feet of placed fill is recommended, with test locations well distributed throughout the fill mass. When filling in small areas, at least one test per day per area should be performed.

7.2 GROUNDWATER CONTROL

As was noted previously, groundwater was not encountered in the test borings within the maximum depth explored of about 25 feet BEG at the time of our field exploration. Depending on the areas of the site under consideration, groundwater levels have differing implications for design and construction. The extent and nature of any dewatering required during construction will be dependent on the actual groundwater conditions prevalent at the time of construction and the effectiveness of construction drainage to prevent run-off into open excavations.

Based on our understanding of the proposed construction, groundwater is not anticipated to adversely impact the planned development of this property. As previously noted, groundwater levels are subject to seasonal, climatic, and other variations and may be different at other times and locations.

7.3 FOUNDATIONS

NOVA understands the project will include constructing a four-story fire training structure. We anticipate that the structure will be supported by a shallow foundation system. Final structural loadings were not available from the design team at the time of the issuance of this report, and we have therefore assumed that maximum bearing loads will be on the order of 75 kips for isolated interior columns and 4 kips per lineal foot for perimeter load-bearing walls for the structure.

7.3.1 Shallow Foundations

Design: After the recommended site/subgrade preparation and fill placement, we recommend that the proposed structure be supported on a conventional shallow foundation system bearing upon compacted native soils and/or compacted structural fill. As noted above, the building foundation may be designed for a maximum soil bearing pressure of **1,500 pounds per square foot (psf).**

We recommend minimum footing widths of 24 inches for ease of construction and to reduce the possibility of localized shear failures. Exterior and interior footing bottoms should be established at least 18 inches below finished surrounding exterior grades.

Settlement: Settlements for spread foundations bearing on compacted sandy native or fill materials were assessed using SPT values to estimate elastic modulus, based on published correlations and previous NOVA experience. We note that the settlements presented are based on the subsoil profile encountered in the SPT borings performed for this project. Conditions may be better or worse in other areas, however, we believe the estimated settlements are reasonably conservative.

Based on column loadings stated previously, the soil bearing capacity provided on the previous page, and the presumed foundation elevations as discussed above, we expect primary total settlement beneath individual foundations to be on the order of 1 inch.

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 foundations will be on the order of ½ inch or less. The final deflected shape of the structure will be dependent on actual foundation locations and loading.

Foundation support conditions are highly erratic and may vary dramatically in short horizontal distances. It is anticipated that the geotechnical engineer may recommend a different bearing capacity upon examination of the actual foundation subgrade at numerous locations. To reduce the differential settlement if lower consistency materials are encountered, a lower bearing capacity should be used, or the foundations should be extended to more competent materials.

We anticipate that timely communication between the geotechnical engineer and the structural engineer, as well as other design and construction team members, will be required.

Construction: 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.

Foundation excavations should be level and free of debris, ponded water, mud, and loose, frozen, 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 frozen or saturated soil.

If a foundation excavation remains open overnight, or if rain or snow is imminent, a 3 to 4-inch thick "mud mat" of lean concrete should be placed in the bottom of the excavation to protect the bearing soils until reinforcing steel and concrete can be placed.

7.4 STORMWATER MANAGEMENT SYSTEM

Based on the results of the SMS test borings, the subsurface conditions encountered in the proposed stormwater management system area of the site appear to be only marginally adaptable for the treatment and disposal of stormwater runoff via the desired conventional shallow retention basin.

We recommend that you consider the soil parameters presented below in Table 1 – SMS Soil Design Parameters, for design of the SMS at the subject project site. Should the soil design parameters provided below prove to be insufficient for design of the SMS, we recommend employing an alternative methods of stormwater treatment and disposal.

Table 1 – SMS Soil Design Parameters	
Corresponding Soil Boring Test Location	R-1, R-2
Approximate Elevation of Confining Layer, BEG	Below 15 feet
Measured Vertical Hydraulic Conductivity (Kv), feet per day	1 ft/day
Measured Horizontal Hydraulic Conductivity (Kh), feet per day	1 ft/day
Estimated Infiltration Rate, DRI	0.3 in/hour
Estimated Fillable Porosity of Soil, percentage	20%
Estimated Depth of Normal Permanent SHGW table, BEG	Below 15 feet*

The estimated normal permanent seasonal high groundwater level provided in Table 1 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).

The actual exfiltration rates from the pond 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. We note that NOVA performs remolded laboratory permeability testing using generally accepted practices of the local engineering community. These types of tests are the quickest and most economical for stormwater retention basin design. However, the user of this information is cautioned that the potential variability of results of these types of tests can be significant and the reproducibility of results can vary by factors of up to 100 percent.

Also, the permeability measured by such tests may not be representative of the total effective aquifer thickness. Factors of safety can compensate for part of the inherent test limitations, but the designer must exercise judgment regarding final selection and applicability of provided soil design input parameters. Should the modeling analysis indicate marginally acceptable compliance with Water Management District design criteria, it may be advisable to perform more extensive and representative in-situ permeability testing by collecting “undisturbed” horizontal and vertical soil samples and/or installing grouted piezometers or wells for slug testing. NOVA can perform these field tests if desired.

8.0 CONSTRUCTION OBSERVATIONS

8.1 SUBGRADE

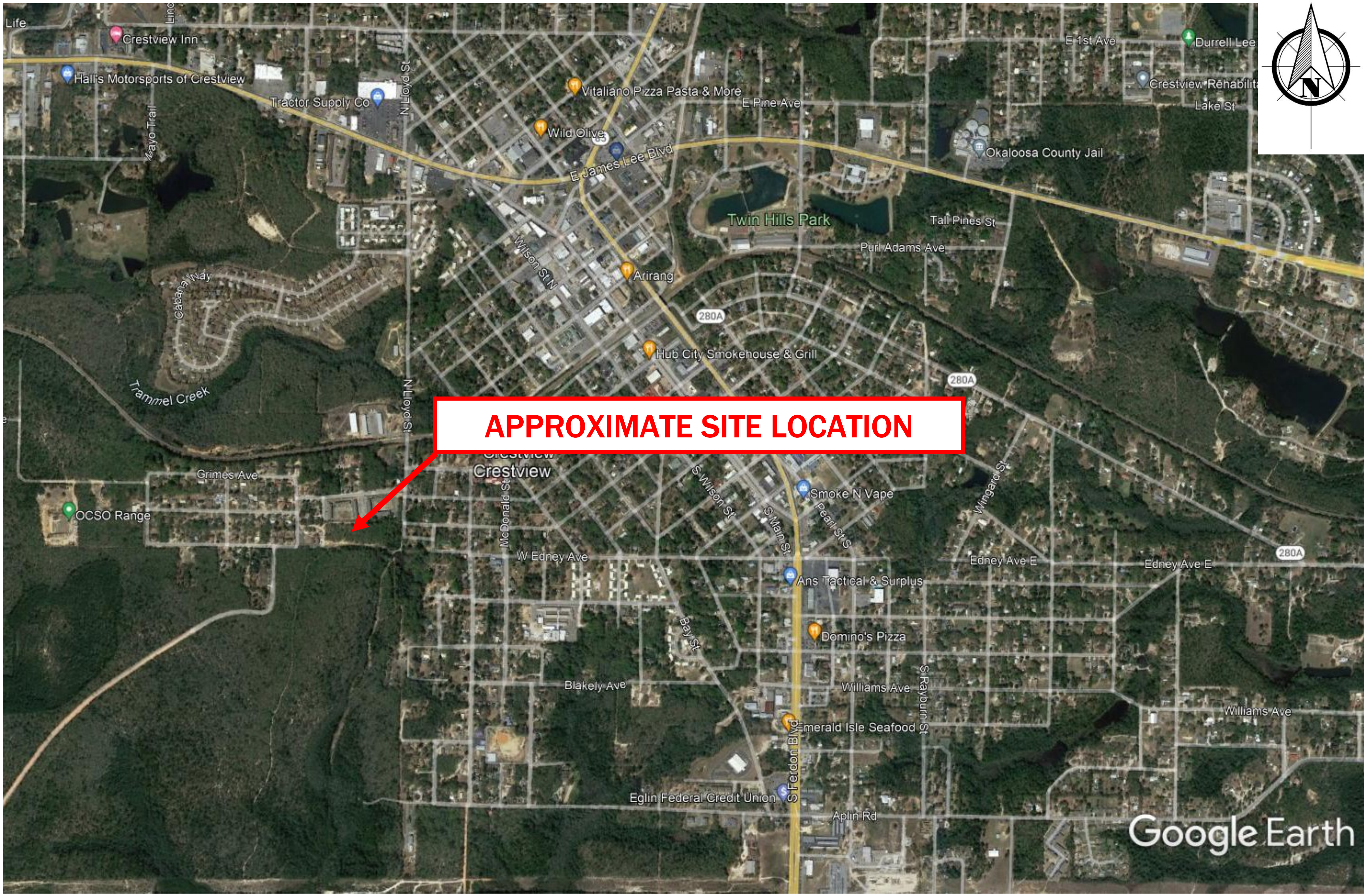
Once site grading is completed, the subgrade may be exposed to adverse construction activities and weather conditions. The subgrade should be well-drained to prevent the accumulation of water. If the exposed subgrade becomes saturated or frozen, the NOVA geotechnical engineer should be consulted.

A final subgrade evaluation should be performed by the NOVA geotechnical engineer immediately prior to pavements or slab-on-grade placement. If practical, proofrolling may be used to re-densify the surface and to detect any soil, which has become excessively wet or otherwise loosened.

8.2 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 and Maps



Scale: Not To Scale	
Date Drawn: December 22, 2021	
Drawn By: N. Turan	
Checked By: W. Lawrence	

NOVA
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PROJECT LOCATION MAP

City of Crestview Fire Training Tower

Crestview, Okaloosa County, Florida

NOVA Project Number 10116-2021328

Soil Map—Okaloosa County, Florida
(CITY OF CRESTVIEW FIRE TRAINING TOWER)

Map Scale: 1:787 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 10, 20, 40, 60

Feet: 0, 35, 70, 140, 210

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

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:
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 20, Sep 7, 2021

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

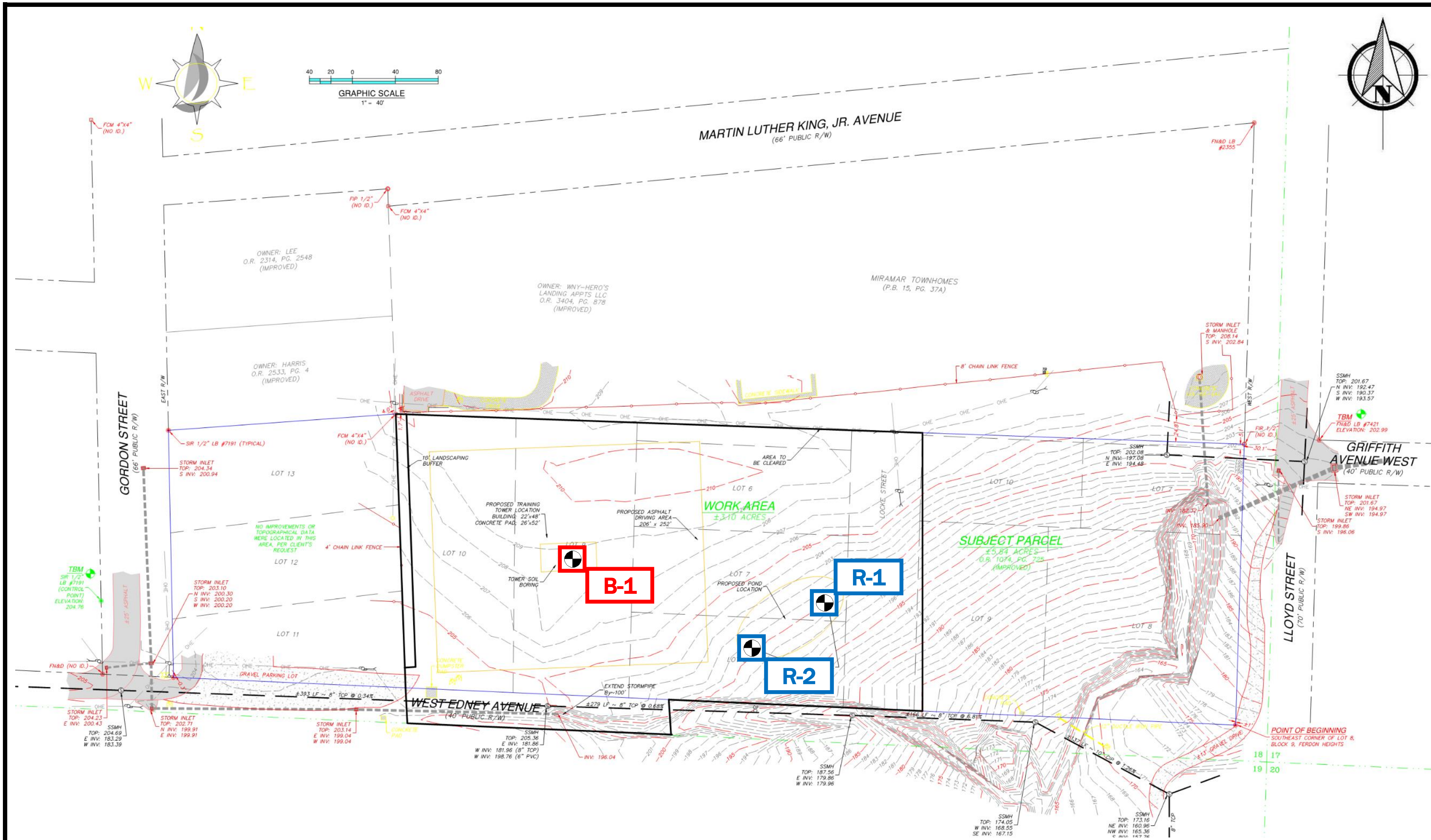
Date(s) aerial images were photographed: Dec 1, 2014—Nov 15, 2017

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

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
12	Lakeland sand, 0 to 5 percent slopes	1.9	68.6%
24	Troup sand, 5 to 8 percent slopes	0.9	31.4%
Totals for Area of Interest		**2.8**	**100.0%**

APPENDIX B
Subsurface Data



LEGEND

B-x = 25-ft. Structural SPT Boring

R-x = 15-ft. SMS Auger Boring

Scale: Not To Scale	NOVA	**BORING LOCATION PLAN**
Date Drawn: November 12, 2021	140-A Lurton Street Pensacola, Florida 32505 850.607.7782 ♦ 850.249.6683	**Fire Training Tower**
Drawn By: J. James		Crestview, Okaloosa County, Florida
Checked By: W. Lawrence		*NOVA Project Number 10116-2021328*

NOVA

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 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%

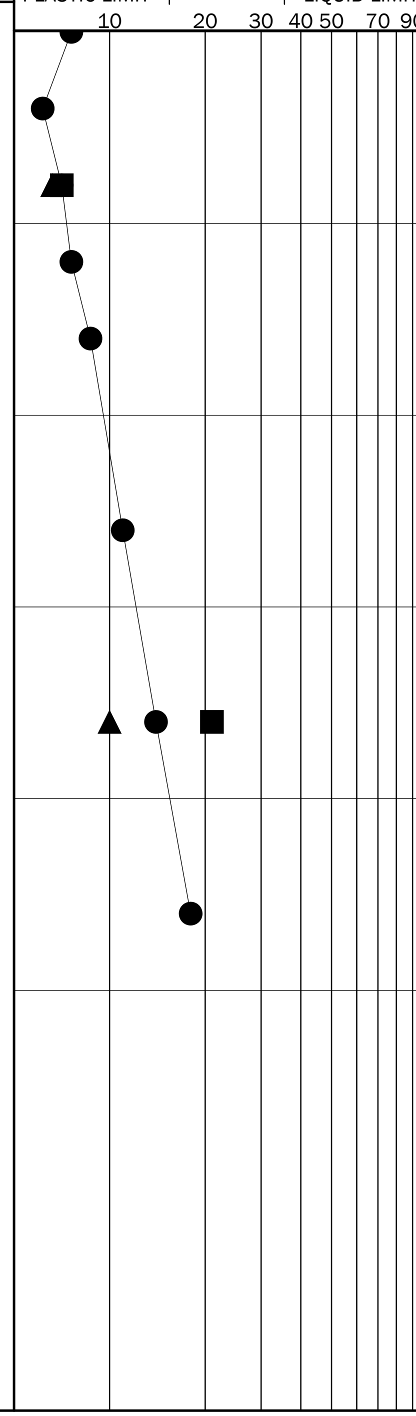
NOVA

TEST BORING RECORD B-1

PROJECT: City of Crestview Fire Training Tower | PROJECT NO.: 10116-2021328
CLIENT: City of Crestview
PROJECT LOCATION: Crestview, Okaloosa County, Florida
LOCATION: Per Boring Location Plan | ELEVATION: Existing Grade
DRILLER: ERG, Inc. | LOGGED BY: N. Turan
DRILLING METHOD: SPT Boring | DATE: December 6, 2021
DEPTH TO - WATER> INITIAL: GNE | AFTER 24 HOURS: | CAVING>

Depth (feet)	Elevation (ft-MSL)	Description	Graphic	Groundwater	Sample Type	N-Value
0		Light brown loose to very loose fine-grained slightly silty SAND (SP-SM)				6
						3
5		Light brown/off-white loose fine-grained SAND (SP)				5
						6
		Light brown/off-white/orange loose fine-grained slightly silty SAND (SP-SM)				8
10		Orange/dark orange loose to medium dense fine-grained silty SAND (SM)				11
15		Light orange medium dense fine-grained silty SAND (SM)				14
20		Light orange/light yellow medium dense fine-grained silty SAND (SM)				18
25		Boring Terminated at 25 ft.				
30						
35						

■ %<#200
● BLOW COUNT
▲ NATURAL MOISTURE
PLASTIC LIMIT |———| LIQUID LIMIT



This information pertains only to this boring and should not be interpreted as being indicative of the site.

NOVA

TEST BORING RECORD R-1

PROJECT: City of Crestview Fire Training Tower	PROJECT NO.: 10116-2021328
CLIENT: City of Crestview	
PROJECT LOCATION: Crestview, Okaloosa County, Florida	
LOCATION: Per Boring Location Plan	ELEVATION: Existing Grade
DRILLER: ERG, Inc.	LOGGED BY: N. Turan
DRILLING METHOD: Auger Boring	DATE: December 6, 2021
DEPTH TO - WATER> INITIAL: GNE	AFTER 24 HOURS: CAVING>

Legend: ■ %<#200 ● BLOW COUNT ▲ NATURAL MOISTURE; PLASTIC LIMIT |———| LIQUID LIMIT; scale 10 20 30 40 50 70 90

Depth (feet)	Elevation (ft-MSL)	Description	Graphic	Groundwater	Sample Type	N-Value
0		Brown to light brown/light orange fine- grained slightly silty SAND (SP-SM)				
		Brown fine-grained silty SAND (SM)				
		Brown/orange fine-grained silty SAND (SM)				
5		Dark orange fine-grained silty SAND (SM)				
10						
		Orange/light orange fine-grained silty SAND (SM)				
15		Boring Terminated at 15 ft.				
20						
25						
30						
35						

This information pertains only to this boring and should not be interpreted as being indicative of the site.

NOVA

TEST BORING RECORD R-2

PROJECT: City of Crestview Fire Training Tower	PROJECT NO.: 10116-2021328
CLIENT: City of Crestview	
PROJECT LOCATION: Crestview, Okaloosa County, Florida	
LOCATION: Per Boring Location Plan	ELEVATION: Existing Grade
DRILLER: ERG, Inc.	LOGGED BY: N. Turan
DRILLING METHOD: Auger Boring	DATE: December 6, 2021
DEPTH TO - WATER> INITIAL: GNE	AFTER 24 HOURS: CAVING>

Depth (feet)	Elevation (ft-MSL)	Description	Graphic	Groundwater	Sample Type	N-Value
0		Brown to light brown fine- grained slightly silty SAND (SP-SM)				
		Brown fine-grained silty SAND (SM)				
5		Light brown fine-grained slightly silty SAND (SP-SM)				
		Light brown/red fine-grained silty SAND (SM)				
		Red fine-grained silty SAND (SM)				
10						
		Light orange fine-grained silty SAND (SM)				
15		Boring Terminated at 15 ft.				
20						
25						
30						
35						

■ %<#200
● BLOW COUNT
▲ NATURAL MOISTURE
PLASTIC LIMIT |———| LIQUID LIMIT
10 20 30 40 50 70 90

This information pertains only to this boring and should not be interpreted as being indicative of the site.

APPENDIX C
Laboratory Data

SUMMARY OF CLASSIFICATION & INDEX TESTING

City of Crestview Fire Training Tower
Crestview, Okaloosa County, Florida
NOVA Project No. 10116-2021328

SUMMARY OF CLASSIFICATION AND INDEX TESTING						
Boring No.	Sample Depth (ft. BEG)	Natural Moisture (%)	Percent Fines (- #200)	Hydraulic Conductivity		USCS Soil Classification
				K_{vs} (ft/day)	Unit Weight of Sample (pcf)	
B-1	4-6	4	5	---	---	SP
B-1	18-20	10	21	---	---	SM
R-1	5-11	9	17	1	111	SM
R-2	0-1.5	9	10	---	---	SP-SM
R-2	5-7	4	6	18	101	SP-SM
R-2	8-11	11	19	---	---	SM

REMOLDED LABORATORY PERMEABILITY TEST DATA SHEET

PROJECT: City of Crestview Fire Training Tower

NOVA PROJECT #: 10116-2021328

DATE: 12/22/2021

ASSIGNED BY: JAJ

TESTED BY: NPT

Sample LOCATION / BORING NO.	R-1
Sample NUMBER / DEPTH	5 ft - 11 ft

PERMEABILITY TESTING SUMMARY			
PERMEABILITY (K_V)	→	1	ft/day
Corresponding K_h	→	1	ft/day
DRY DENSITY	→	111	lbs/ft^3
MOISTURE CONTENT	→	9	%
-200 FINES CONTENT	→	17	%

FALLING HEAD PERMEABILITY (ASTM D 5084)			
No. of LAYERS:	3	Wt. of MOLD (lbs):	4.48
BLOWS/LAYER:	15	Wt. of MOLD/SOIL (lbs):	8.51

HEIGHT (FT)	TRIAL #1 (SEC)	PERMEABILITY
7	0.0	2.31E-04
6	51.5	2.29E-04
5	121.7	2.34E-04
4	214.0	2.61E-04
3	339.8	2.21E-04
2	529.9	
1	841.4	
	2.4E-04	cm/sec

MOISTURE CONTENT (ASTM D 2216)	
Pan NUMBER	C
Wt. of WET SOIL & PAN (g)	180.2
Wt. of DRY SOIL & PAN (g)	170.7
Wt. of PAN (g)	64.2
Wt. of Water (g)	9.5
Wt. of Dry Soil (g)	106.5
MOISTURE CONTENT (%)	8.9

-200 SIEVE WASH (ASTM D 1140)	
Pan NUMBER	C
Wt. of DRY SOIL & PAN (g)	170.7
Wt. of WASH SOIL & PAN (g)	152.7
Wt. of PAN (g)	64.2
Wt. of Original Dry Sample (g)	106.5
Wt. of -200 Material (g)	18.0
Wt. of Washed Dry Sample (g)	88.5
-200 FINES CONTENT (%)	16.9

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

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

NOVA

REMOLDED LABORATORY PERMEABILITY TEST DATA SHEET

PROJECT: City of Crestview Fire Training Tower
NOVA PROJECT #: 10116-2021328

DATE: 12/22/2021
ASSIGNED BY: JAJ
TESTED BY: NPT

Sample LOCATION / BORING NO.	R-2
Sample NUMBER / DEPTH	5 ft - 7 ft

PERMEABILITY TESTING SUMMARY			
PERMEABILITY (K_V)	→	18	ft/day
Corresponding K_h	→	26	ft/day
DRY DENSITY	→	101	lbs/ft^3
MOISTURE CONTENT	→	4	%
-200 FINES CONTENT	→	6	%

FALLING HEAD PERMEABILITY (ASTM D 5084)			
No. of LAYERS:	3	Wt. of MOLD (lbs):	4.48
BLOWS/LAYER:	15	Wt. of MOLD/SOIL (lbs):	8.00

HEIGHT (FT)	TRIAL #1 (SEC)	PERMEABILITY
7	0.0	6.34E-03
6	2.6	6.10E-03
5	5.7	6.04E-03
4	9.5	5.90E-03
3	14.1	6.53E-03
2	20.6	
1	30.7	
	6.2E-03	cm/sec

MOISTURE CONTENT (ASTM D 2216)	
Pan NUMBER	E
Wt. of WET SOIL & PAN (g)	176.1
Wt. of DRY SOIL & PAN (g)	171.8
Wt. of PAN (g)	65.8
Wt. of Water (g)	4.3
Wt. of Dry Soil (g)	106.0
MOISTURE CONTENT (%)	4.1

-200 SIEVE WASH (ASTM D 1140)	
Pan NUMBER	E
Wt. of DRY SOIL & PAN (g)	171.8
Wt. of WASH SOIL & PAN (g)	165.9
Wt. of PAN (g)	65.8
Wt. of Original Dry Sample (g)	106.0
Wt. of -200 Material (g)	5.9
Wt. of Washed Dry Sample (g)	100.1
-200 FINES CONTENT (%)	5.6

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

APPENDIX D
Qualifications of Recommendations

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 observations and testing services.

This report is intended for the sole use of City of Crestview only. The scope of work performed during this study was developed for purposes specifically intended by of City of Crestview 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.

Important Information about This

Geotechnical-Engineering Report

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

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

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 constructor — 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 this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this 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 all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many 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;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the 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 geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this 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 geotechnical-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 confirmation-dependent recommendations included in your report. *Confirmation-dependent 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 confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront 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. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical 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 Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors 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 the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors 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 constructors fail to 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 the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these 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.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental 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 environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold- prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical- engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.

GEOTECHNICAL BUSINESS COUNCIL
of the Geoprofessional Business Association

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