Site Narrative

Ginguite – Mixed Use Group Development
6195 N. Croatan Highway
Southern Shores
Dare County, North Carolina

Prepared for:
Ginguite, LLC
P.O. Box 90
Southern Shores, NC 27948

Prepared by:
Quible & Associates, P.C.
PO Drawer 870
Kitty Hawk, NC 27949

05/31/23

Revised 07/31/23

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Overview

The site consists of a 6.96 acre parcel located at 6195 North Croatan Highway (US 158), parcel number 022519064 and PIN number 986606491459. It is bordered to the north by Ginguite Creek Basin, to the south by U.S. 158, to the east by Southern Shores Landing PUD, and to the west by Ginguite Creek. The parcel area not including surface water is 5.19 acres The net acreage of the lot is approximately 4.55 acres, which does not include any areas covered by waterways, wetlands, or marshes.

The developer (Ginguite, LLC) proposes a mixed-use group development that includes residential and commercial areas. The eastern building includes residential dwelling units and parking on the ground floor. The western building includes residential dwelling units, approximately 9,255 sf of office space, approximately 6,985 sf of retail, and restaurant (approximately 4,500 sf). In addition to the main buildings, a marina and the associated infrastructure are included in the proposed development.

Existing Site

The property is a mix of uplands, wetlands, and waterways. The lot is bisected from east to west by a Ginguite Creek Basin. Quible & Associates, P.C. preformed a preliminary water depth survey of the basin. The basin has an average depth of 2' or less in the vicinity of the proposed boat slips. The basin's bottom consists of soft muck that is at least 6' deep in some areas. It should be noted that due to low tides and the soft muck the entire basin was not surveyed.

The area located to the north of the bisection consists entirely of wetlands. The area located to the south of the bisection consists entirely of uplands. The uplands area plus wetlands area is approximately 226,269.21 SF (5.19 acres). The net parcel area (lot area minus any area covered by waterways, marshes, or wetlands) of the lot is 198,177.73 SF (4.55 acres). The site contains 1,618 linear feet of shoreline along the lot lines. Existing elevation within the site ranges from 0.0' to 10.25' (Vertical Datum NAVD 1988). The grade within the site ranges from 0.0% to 30.0% and has an average grade of 4.3%.

The property is in the General Commercial District (C) with a small portion of R-1 north of the basin. The surrounding zoning consists of the General Commercial District (C), Residential District (R1), and the Extra Territorial Martin's Commercial District (C).

A 70' power easement runs along the southern property line. The 70' power easement is located interior to both the property and the US 158 180' right-of-way. Three separate easements are located in the northeast corner of the property. A 5' ingress/egress easement, a kayak storage-picnic area & ingress/egress easement, and a joint-use fit center easement. An existing abandoned recreation center is located within the joint-use fit center easement. In the southeastern corner of the lot there is an access easement. Directly adjacent to the southeastern access easement is a perpetual easement for sewage treatment.

Proposed Development

Ginguite, LLC proposes a mixed-use group development with uses including multi-family, retail, restaurant, offices, and a marina. The proposed development includes two residential buildings, one of which will include retail/restaurant/office areas. The site will include a marina and associated infrastructure.

The proposed site is consistent with the Town of Southern Shores Mixed Use Group Development of Commercial and Residential Building requirements. There is an existing wastewater treatment plant (WWTP) permitted by NC DEQ DWR and a perpetual easement for sewage treatment located to the east of the property. The site is to be served by the existing WWTP and will utilize the perpetual easement for sewage treatment to access the existing WWTP.

The site proposes 36 total dwelling units on 4.55 net acres (7.91 units / net acre) which is less than the maximum allowed 8 dwelling units / acre. The proposed residential building & parking coverage is 54,313.4 sf or 27.4% coverage of the net parcel area. This is within the town required range of "a minimum of 25% and no more than 40% of the net parcel area can be associated with building footprints containing residential uses and the required parking for residential uses."

Dimensional Standards

The following town dimensional standards are met:

- Minimum size of any building shall be 2,500 square feet.
- All buildings constructed within 35 feet of another building within the development are to be connected by a breezeway or covered walkway.
- Minimum front yard (setback): 25 ft.
- Minimum side yard (setback): 15 ft. an additional five-foot-yard adjacent to the street is required for the corner lot.
- Minimum rear yard (setback): 20 ft.
- Maximum building height shall be 35 feet, measured from 8' elevation.
- No building or other facility (such as parking spaces, incinerators, trash collection areas, etc.) shall be located nearer than 50 feet to boundaries of residential districts.
- Maximum allowable lot coverage by principal use and all accessory structures shall be 60 percent except as allowed under the following conditions:
    a. Commercial lots shall be allowed the use of permeable pavement as defined by the NCDENR Stormwater BMP Manual ("Manual"). Employment of this permeable solution shall be granted the Built Upon Area (BUA) Credit as specified in the Manual.
    b. Group Developments which incorporate the use of permeable pavement as outlined above in excess of five percent of the total lot coverage shall be allowed a maximum allowable lot coverage by principal use and all accessory structures of no greater than 67 percent.

Vegetative Buffers

A 5 ft Type C Vegetative Buffer is required where development abuts public or private right of ways. An alternative 5 ft Type C vegetative buffer is proposed along the southern property line which abuts the US 158 180 ft public right of way. Please note per the Town UDO, a Type C buffer requires *"A 50 percent opaque vegetation screening buffer of a minimum width of five feet that will reach a height of three feet in two years… The buffer shall include evergreen trees planted not more than 20 feet on centers and these trees shall reach a height of six feet in three years."* Please note this area is within a 70' wide Power Easement and close to the main power line. As such, plantings are not allowed per Dominion Energy guidance documents within 50' of the power pole structures. The Type C buffer proposed has been modified and does not propose the required 6' tall evergreens within 50' of either side of the two power poles

within the site additional shrubs have been added outside of the 50' radius around Dominion's power poles.

Parking lot landscaping has been proposed to address UDO Section 36-163. (3) h. The parking area of the site is approximately 48,279 sf and this requires a 7,241-sf parking lot land area to be planted with trees or shrubs. Approximately 8,860 sf of planted areas are provided within landscaping islands interior to the parking lot and the 5' vegetated buffer.

A 20 ft Type A Vegetative Buffer is required where a commercial use abuts a residential zone. A 20 ft buffer has been proposed along the northern property line only. Although a buffer is not required along the eastern property since the adjacent parcel is zoned commercial (C), a landscaping buffer consisting of one (1) understory tree and one (1) shrub alternated 10' on centers is proposed. Landscaping buffer along the eastern property line is not required per zoning but provided per owner's discretion.

Access

There are two proposed accesses to the site. One on the south side of the lot from US 158 and one on the southeast corner of the lot from a private right of way that connects to US 158. The access at the southeast corner is within a shared access easement was provided by the original development. A minimum 20' wide all-weather asphalt drive aisle capable of supporting 75,000 pounds is proposed to allow for fire access throughout the site. The drive aisles have been placed to allow fire trucks to come within 200' of all portions of the sprinkler protected buildings. Two (2) refuse collection areas are provided one (1) adjacent to the eastern entrance for trash pickup and one (1) next to the loading zone of the western building. Per the Town of Southern Shores UDO, Retail operations, including restaurant and office buildings with a gross floor area of 20,000 square feet or more require a loading zone. The proposed site includes approx. 20,740 SF of commercial operations. Therefore one (1) 12'x60' loading zone is proposed adjacent to the commercial use area.

There are no proposed changes to the existing ingress/egress easement and joint-use fit center easement located within the northeast portion of the property. The Applicant proposes an elevated walk within the existing access easement to traverse the proposed stormwater control measure.

Pedestrian Access

Most walks are proposed to be open-slotted wood decking at a minimum of 4-feet wide. Internal pedestrian circulation will be provided between residential areas to commercial and marina areas. Three (3) Bicycle racks are proposed at the commercial hub to encourage alternative transportation methods.

Parking

The proposed project includes 200 parking spaces. Calculations for the final parking count are based on the current ordinance using the following standards:

- 2.5 spaces per dwelling unit (Multi-Family Dwelling) per UDO Sec. 36-163 (4)a.2.;
- 1 space per 300 sf retail;
- 1 space per 3 seats in restaurant plus one space for each employee;

- 1 space per 300 sf office space plus one space for each two employees:

The parking summary for the entire development is provided in Table 1 below.

Table 1: Parking Summary

Name	***Building Size (SF)***	***Employees***	***#Units***	***Parking Required***	***Parking Provided***
Residential - 36 Units			36	90	90
Retail	6,985			23	23*
Office	9,255	8		35	35
Restaurant		10	120	50	52
			Total	**198**	**200**
**3 Bicycle racks to count toward retail parking*					

Based on the parking summary above, 198 parking spaces are required. The proposed masterplan has provided 197 spaces and 3 bicycle racks. 14 or 7.0% of the proposed parking spaces are marked compact car spaces, which is less than the maximum allowed 10%. Please note the Town UDU allows for a reduction of required parking for commercial uses within group developments with the use of bicycle racks holding at least four bicycles. The proposed site will include 3 bicycle racks, which equates to 3 additional parking spaces.

Utilities

Dominion

The applicant has preliminarily coordinated with Dominion personnel for review. A preliminary meeting was held with Dominion personnel on 12/1/22. Dominion's initial comments on the site have been addressed to the best of the applicant's ability to meet "Dominion North Carolina Power Guidelines for use of real estate encumbered by electric transmission right-of-way". Dominion has indicated (via the preliminary meeting) that parking, drive aisles, and curbing will be acceptable within the existing 70' power easement. Dominion will need to review the proposed grading, water services, meters, RPZ's and the proposed hydrant in detail during formal submittal. Due to Dominion constraints, the applicant is not proposing trees or shrubs within 50' of the existing dominion power poles, we respectfully request an exemption for the 5' wide type C bufferyard within this area to meet Dominion requirements.

Water

An existing 8" waterline runs along the southern property line. The water service to the site is proposed to be modeled based on the number of approved units to determine the best available connection with regards to available fire protection. All commercial buildings and residential dwellings will be protected by sprinkler systems. The site currently has a conservative layout using two (2) 8" compound meters, each compound meter will feed a 6" fire line to each individual building along with a domestic line. Domestic and fire line sizing shall be confirmed once building design is completed. In addition to the proposed service lines, an additional fire hydrant is proposed adjacent to the new entrance onto US 158 and a second new fire hydrant located further westward. These hydrants will allow all proposed fire department connections (FDC's) to be placed within 100' of a fire hydrant. The proposed fire hydrant and existing fire hydrant allow for coverage within 600' of all portions of the sprinkler protected buildings. The three fire hydrants should help demonstrate that the Needed Fire Flow (NFF) is within the

Available Fire Flow (AFF). A willingness to serve letter from Dare County Water has been included with this site narrative summary within **Appendix A**.

Sanitary Sewer

Sanitary sewer service throughout the development is anticipated to be collected via a gravity sewer network. This system will collect to an off-site lift station that will pump sewage to an existing wastewater treatment plant to the east of the project site on an adjacent property. The adjacent wastewater treatment plant is permitted through NCDEQ and a willingness to serve letter is included with this narrative within **Appendix A**.

Stormwater Management Plan

Per 15A NCAC 02H.1005 (a) (3) (B) High Density Coastal Development is required to meet particular criteria. This development is proposed to have 42.0% of impervious coverage within the entire lot (including waterbodies). This lot coverage calculation includes all open slotted wood decking, but decking has been excluded from stormwater runoff calculations. Permeable parking areas have also been provided within the proposed development, but these are excluded from stormwater calculations. There is an interconnected infiltration basin onsite that is designed in accordance with NCDEQ Requirements to store, control, and treat the stormwater runoff from all surfaces generated by the one and one-half inch of rainfall. In addition to these requirements, it should be noted that impervious coverage has been placed within the typical 50' vegetative buffer from surface waters. To address this coverage within the 50' buffer, all buildings are designed with roof drains to route stormwater runoff out to the permitted infiltration basin prior to discharge outside of the 50' vegetative buffer.

The storage required to completely capture the first 1.5 inch of rainfall is approximately 11,748 cf. The proposed infiltration basin will have a temporary storage capacity of 13,957 cf. The temporary storage capacity has been calculated between the bottom of the basin and the overflow elevation of 5.25'. It should be noted that this storage has been calculated without counting open slotted wood decking towards runoff calculations. Storage calculations have been included within **Appendix B**.

These stormwater management control measures will provide an adequate system to meet and exceed State and local requirements for stormwater storage and treatment.

<u>Soils</u>

The USDA NRCS Soil Survey lists the soils in the vicinity of the proposed development as described below. A copy of the NRCS web soil survey is available within **Appendix C** for reference.

- CuA – Currituck Mucky Peat
  This soil typically has 0 to 1 percent slopes. Currituck Mucky Peat is very poorly drained and has a very high runoff class. This soil is categorized in hydrologic group A/D.

- OuB—Ousley Fine Sand
  This soil typically has 0 to 5 percent slope. Ousley Fine Sand is typically moderately well drained and a very low runoff class. This soil is categorized in Hydrologic Soil Group: A.

- W—Water

Quible and Associates conducted a soil boing test in the vicinity of the wet detention basin. The soils observed were consistent with the NRCS soil description and the seasonal high-water table is located at approximately 1.6'. The NRCS soil survey data soil boring data is available in **Appendix C.**

Appendix A – Utility Willingness to Serve Letters

COUNTY OF DARE
Water Department
600 Mustian Street, Kill Devil Hills, NC 27948

North Reverse Osmosis
Treatment Facility

Phone (252) 475-5990
Fax (252) 441-2239

December 12, 2022

Cathleen M. Saunders, P.E.
Project Manager
Quible & Associates, P.C.
8466 Caratoke Highway, Bldg. 400
Powells Point, NC 27966

RE: Willingness to serve Dare County Water to your project at 6195 N. Croatan Hwy, Southern Shores

Cathleen,

Dare County Water will provide water service to your project located at the 6195 N. Croatan Hwy., Property PIN Number 986606491459.

A connection to Dare County Water requires payment of a System Development Fee, Connection Fee, and Account Deposit based on the meter size selected for the project.

Sincerely,

Patrick Irwin
Dare County, Utilities Director
252 475-5603

SAGA
CONSTRUCTION & DEVELOPMENT

Build Your Story...

June 1, 2023

Mr. Michael W. Strader, Jr., P.E.
Quible & Associates, P.C.
P.O. Drawer 870
Kitty Hawk, NC 27949

Re: Wastewater Utility, Willingness to Serve
Ginguite Creek Mixed Use Group Development
WWTP Located at Ginguite Woods
Southern Shores, Dare County

Mr. Strader,

As you may be aware, GWWTP, LLC provides wastewater treatment service to the Ginguite Creek parcel identified as PIN # 986606491459 by Dare County, located at 6195 N. Croatan Highway, Southern Shores, NC and certain portions of the surrounding vicinity. The subject WWTP and associated permit were previously operated by Ginguite Woods Water Reclamation Association Inc (GWWRA), a regulated public utility company in the State of North Carolina. Transfer of the current utility franchise name from GWWRA to GWWTP, LLC is ongoing.

GWWTP, LLC is willing and able and hereby agrees to accommodate the domestic wastewater utility needs for the Ginguite Creek Mixed Use Development. The property lies within the service area previously defined by GWWRA.

Should you have any questions, please do not hesitate to contact me directly at 252-441-9003 or by email at pgupta@icrsaga.com. Thank you for your attention.

Sincerely,

GWWTP, LLC

From: Tankard, Robert <robert.tankard@deq.nc.gov>
Sent: Friday, May 26, 2023 8:11 AM
To: Bob Howsare <bhowsare@icrsaga.com>
Cc: herdt, victoria c <victoria.herdt@deq.nc.gov>
Subject: RE: [External] Ginguite WWTP

Bob, the Ginguite WWTP, Permit NO. WQ0017224 is permitted for 32,500 gallons per day (gpd) and the average annual flows for the plant is around 6000 gpd as stated in your email below. Therefore the WWTP has capacity for additional development.

If you should have any questions, please let me know.

Thanks!
Robert

Robert Tankard
Assistant Regional Supervisor
Division of Water Resources
North Carolina Department of Environmental Quality
Office: (252) 948-3921 | Cell: (252) 402-5694
Robert.tankard@deq.nc.gov

<image001.png>

From: Bob Howsare <bhowsare@icrsaga.com>
Sent: Thursday, May 25, 2023 9:39 AM
To: Tankard, Robert <robert.tankard@deq.nc.gov>
Subject: [External] Ginguite WWTP

Hi Robert,

I hope all is well with you. We are preparing to submit an application to the Town of Southern Shores for a mixed use development on our parcel adjacent to the sewer plant.
Would you be able to reply to this email stating that our plant there has the capacity to serve our development?
As you know, the plant is 32,500 GPD and the existing residential development uses less than 6,000 GPD.

We need to make this application by June 6th.

Please call as needed to discuss.

Thanks Robert,

Bob Howsare
252-305-2696

Appendix B – Stormwater Calculations including NOAA Precipitation Frequency Data

Ginguite

date 7/31/2023
page 1

NCDEQ Stormwater Calculations

Storage Calculations

	DA #1 (FRONT) (sq.ft.)	(acre)
Drainage Area =	151,828	3.49
Open Space =	55,818	1.28
Permeable Walks/Parking =	7,076	0.16
Building =	41,158	0.94
Parking =	46,852	1.08
Concrete =	5,885	0.14
Offsite Impervious =	2,115	0.05
Impervious =	96,010	2.20
Total Impervious =	96,010	2.20

Runoff generated by Rainfall Event (NCDEQ Simplified Method)

Ia = Impervious Percentage = Impervious Area/Drainage Area
Rv= Runoff Coefficient, 0.05+0.9Ia
Rd= Rain fall depth
V= Runoff Volume, 3630*Rd*Rv*A

	FRONT DA #1 (1.5")
Ia =	63.2%
Rv=	0.62
Rd (in.)=	1.5
A (ac.) =	3.49
V (cf.)=	**11748**

Total Storage Required by NCDEQ = 11748 cf

Infiltration Basin Stormwater Calculations for NCDEQ

Above Grade Storage Provided In Infiltration Basin

1 (FRONT) - Above Grade Storage				
Elev	Area (sf)	Avg area (sf)	Volume (cf)	Cum Vol. (cf)
3.00	3932			
		4981	4981	
4.00	6030			4981
		7181	8976	
5.25	8331			13957 (Vg)

Above Grade Storage Provided = 13957 cf
1.8 in

1 (FRONT)- Below Grade Storage	
Storage Area (A) =	8331.30 sf
Storage Elev. (E)	5.25 ft
Season High Water Table (Wt) =	1.60 ft
Soil Depth Above SWHT (Ds) = B-Wt	3.65 ft
Soil Volume (Sv) = A*Ds-Vg =	16452 cf
Void Ratio (Vr)=	20%
Subsurface Void Vol. (Vss) = A*Ds*Vr=	3290 cf

Below Grade (Voids) Storage Provided = 3290 cf

Total Storage Provided (above & below) = 17248 cf
Total Storage Rainfall Equivalent Storage = 2.2 in

Infiltration Basin 1 Drawdown Calculations

Hydraulic Conductivity = 0.52 in/hr (minimum for permitted basin)
Max Stored Depth = 27 in
Drawdown Time = Stored Depth / Hydraulic Conductivity **days**
Drawdown Time = 51.92 hrs or 2.16

NOAA Atlas 14, Volume 2, Version 3
Location name: Kitty Hawk, North Carolina, USA*
Latitude: 36.0952°, Longitude: -75.7364°
Elevation: 2.65 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

AMS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Annual exceedance probability (1/years)								
	1/2	1/5	1/10	1/25	1/50	1/100	1/200	1/500	1/1000
5-min	**5.82** (5.29-6.38)	**7.08** (6.46-7.76)	**8.15** (7.40-8.92)	**9.24** (8.36-10.1)	**10.1** (9.12-11.1)	**11.0** (9.85-12.0)	**11.8** (10.5-12.9)	**12.8** (11.4-14.0)	**13.8** (12.1-15.1)
10-min	**4.66** (4.24-5.10)	**5.67** (5.18-6.22)	**6.52** (5.92-7.13)	**7.37** (6.67-8.04)	**8.07** (7.27-8.82)	**8.72** (7.83-9.53)	**9.35** (8.35-10.2)	**10.1** (8.98-11.1)	**10.8** (9.52-11.9)
15-min	**3.90** (3.55-4.28)	**4.78** (4.36-5.24)	**5.49** (4.99-6.01)	**6.22** (5.64-6.80)	**6.82** (6.14-7.44)	**7.35** (6.60-8.02)	**7.86** (7.02-8.58)	**8.51** (7.53-9.31)	**9.06** (7.97-9.94)
30-min	**2.69** (2.45-2.95)	**3.40** (3.10-3.72)	**3.98** (3.62-4.36)	**4.61** (4.17-5.03)	**5.13** (4.62-5.60)	**5.63** (5.05-6.15)	**6.12** (5.47-6.68)	**6.77** (5.99-7.41)	**7.34** (6.45-8.04)
60-min	**1.69** (1.54-1.85)	**2.18** (1.99-2.39)	**2.59** (2.36-2.84)	**3.07** (2.78-3.35)	**3.48** (3.13-3.80)	**3.88** (3.48-4.23)	**4.29** (3.83-4.69)	**4.86** (4.30-5.31)	**5.36** (4.71-5.87)
2-hr	**0.964** (0.874-1.06)	**1.27** (1.15-1.40)	**1.54** (1.39-1.69)	**1.86** (1.68-2.04)	**2.15** (1.92-2.35)	**2.44** (2.17-2.66)	**2.74** (2.43-3.00)	**3.16** (2.78-3.46)	**3.53** (3.08-3.87)
3-hr	**0.706** (0.640-0.781)	**0.932** (0.844-1.03)	**1.14** (1.03-1.25)	**1.40** (1.25-1.53)	**1.62** (1.45-1.78)	**1.86** (1.65-2.04)	**2.12** (1.87-2.32)	**2.48** (2.17-2.72)	**2.82** (2.43-3.08)
6-hr	**0.432** (0.392-0.478)	**0.572** (0.518-0.633)	**0.698** (0.630-0.772)	**0.859** (0.770-0.945)	**1.00** (0.896-1.10)	**1.16** (1.02-1.27)	**1.32** (1.16-1.45)	**1.56** (1.35-1.70)	**1.77** (1.52-1.94)
12-hr	**0.256** (0.230-0.286)	**0.339** (0.306-0.379)	**0.416** (0.374-0.464)	**0.516** (0.460-0.572)	**0.608** (0.538-0.672)	**0.704** (0.618-0.778)	**0.811** (0.704-0.896)	**0.964** (0.825-1.06)	**1.11** (0.935-1.22)
24-hr	**0.154** (0.142-0.168)	**0.211** (0.194-0.230)	**0.254** (0.233-0.277)	**0.316** (0.288-0.343)	**0.368** (0.332-0.400)	**0.425** (0.380-0.461)	**0.488** (0.431-0.530)	**0.582** (0.505-0.635)	**0.661** (0.565-0.725)
2-day	**0.089** (0.082-0.098)	**0.122** (0.112-0.134)	**0.147** (0.134-0.161)	**0.183** (0.166-0.200)	**0.214** (0.192-0.233)	**0.248** (0.220-0.271)	**0.286** (0.251-0.313)	**0.344** (0.296-0.378)	**0.393** (0.333-0.435)
3-day	**0.063** (0.058-0.069)	**0.086** (0.079-0.094)	**0.103** (0.094-0.112)	**0.127** (0.115-0.139)	**0.147** (0.133-0.161)	**0.170** (0.151-0.185)	**0.194** (0.171-0.212)	**0.232** (0.200-0.254)	**0.265** (0.226-0.292)
4-day	**0.050** (0.046-0.055)	**0.068** (0.062-0.074)	**0.081** (0.074-0.088)	**0.099** (0.090-0.108)	**0.114** (0.103-0.124)	**0.130** (0.116-0.142)	**0.148** (0.131-0.161)	**0.176** (0.153-0.192)	**0.200** (0.172-0.221)
7-day	**0.033** (0.030-0.036)	**0.044** (0.040-0.048)	**0.052** (0.047-0.056)	**0.063** (0.057-0.068)	**0.072** (0.065-0.078)	**0.081** (0.073-0.089)	**0.092** (0.081-0.100)	**0.107** (0.093-0.117)	**0.119** (0.103-0.131)
10-day	**0.026** (0.024-0.028)	**0.034** (0.031-0.037)	**0.040** (0.037-0.043)	**0.048** (0.044-0.052)	**0.054** (0.050-0.059)	**0.061** (0.055-0.066)	**0.069** (0.062-0.074)	**0.079** (0.070-0.086)	**0.088** (0.077-0.096)
20-day	**0.017** (0.016-0.018)	**0.022** (0.021-0.024)	**0.026** (0.024-0.027)	**0.030** (0.028-0.032)	**0.034** (0.032-0.037)	**0.038** (0.035-0.041)	**0.042** (0.039-0.045)	**0.048** (0.043-0.052)	**0.053** (0.047-0.057)
30-day	**0.014** (0.013-0.015)	**0.018** (0.017-0.019)	**0.020** (0.019-0.022)	**0.024** (0.022-0.025)	**0.027** (0.025-0.028)	**0.029** (0.027-0.031)	**0.032** (0.029-0.034)	**0.036** (0.033-0.039)	**0.039** (0.035-0.042)
45-day	**0.011** (0.011-0.012)	**0.014** (0.014-0.015)	**0.017** (0.016-0.018)	**0.019** (0.018-0.021)	**0.022** (0.020-0.023)	**0.024** (0.022-0.026)	**0.027** (0.024-0.028)	**0.030** (0.027-0.032)	**0.033** (0.029-0.035)
60-day	**0.010** (0.010-0.011)	**0.013** (0.012-0.013)	**0.014** (0.014-0.015)	**0.017** (0.016-0.018)	**0.018** (0.017-0.020)	**0.020** (0.019-0.021)	**0.022** (0.020-0.023)	**0.024** (0.022-0.026)	**0.026** (0.024-0.028)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of annual maxima series (AMS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and annual exceedance probability) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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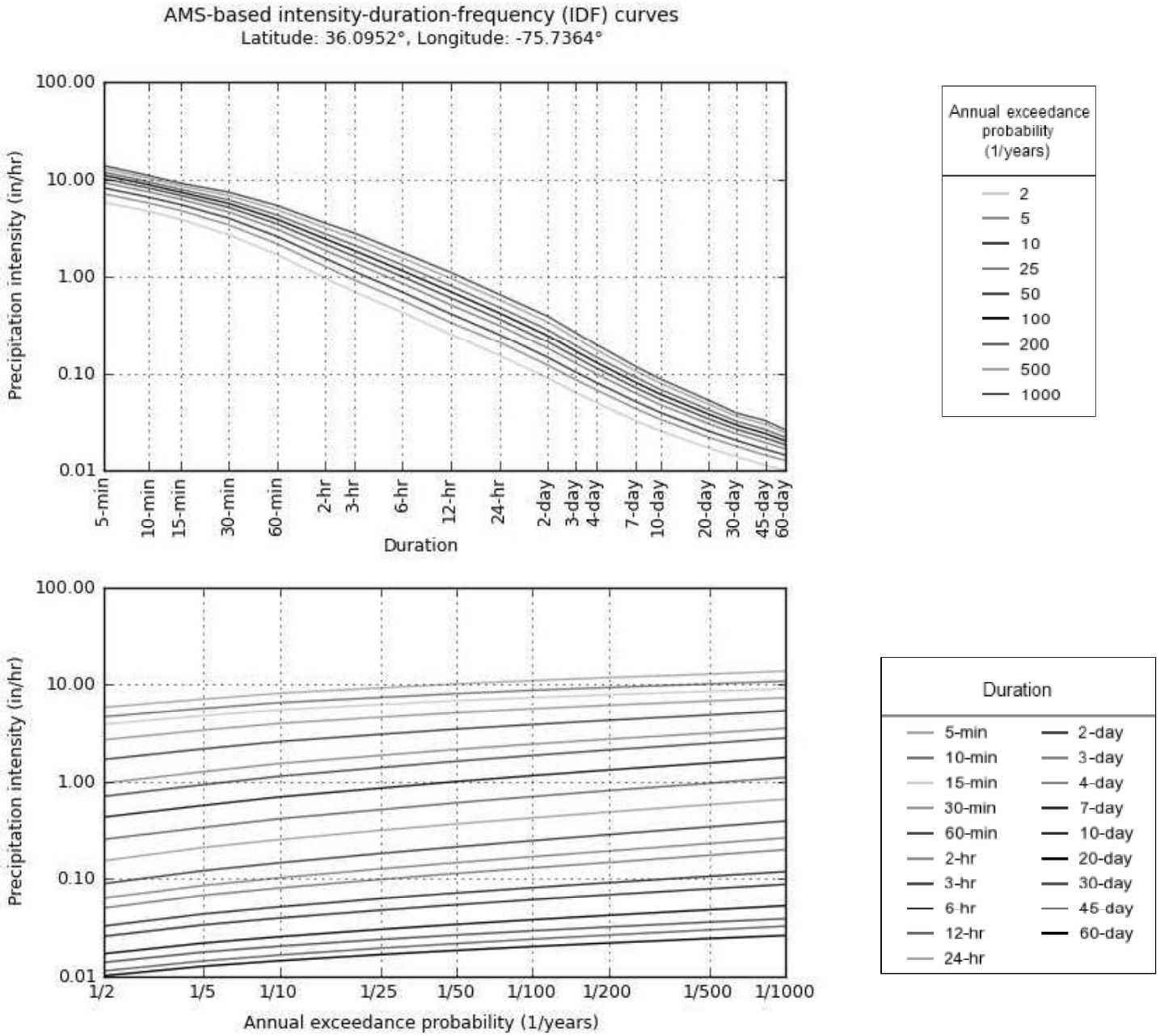
PF graphical



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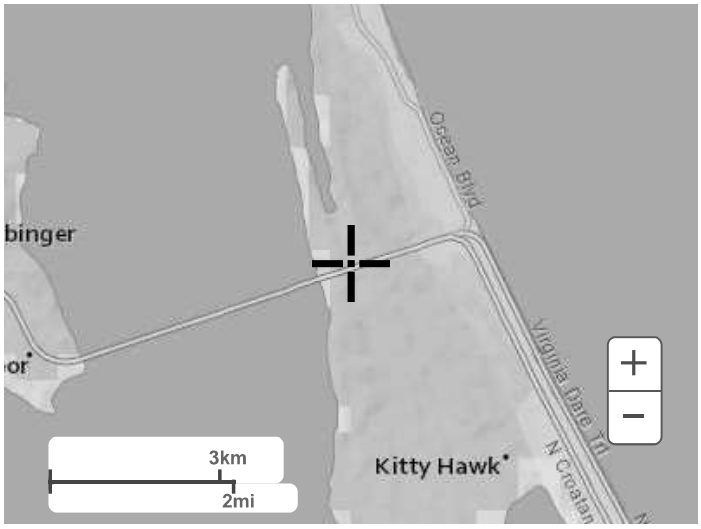
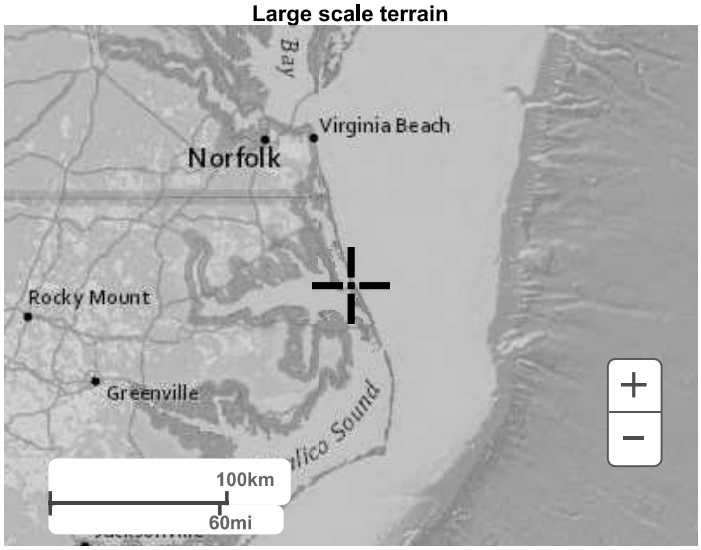
Maps & aerials

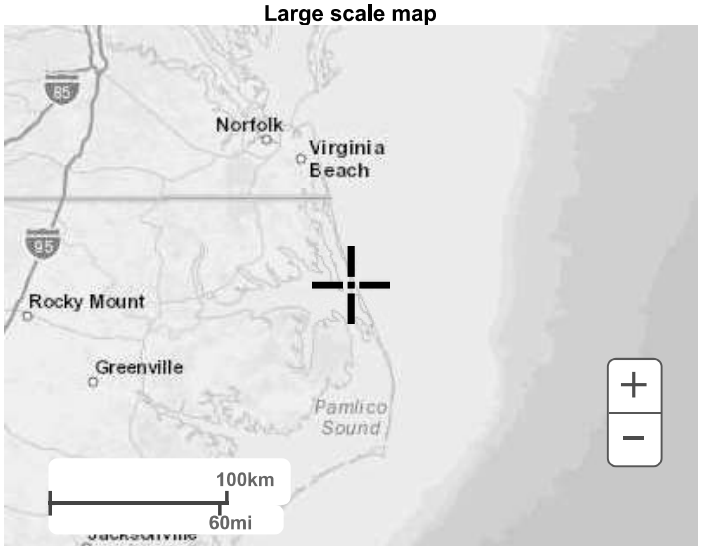
Small scale terrain



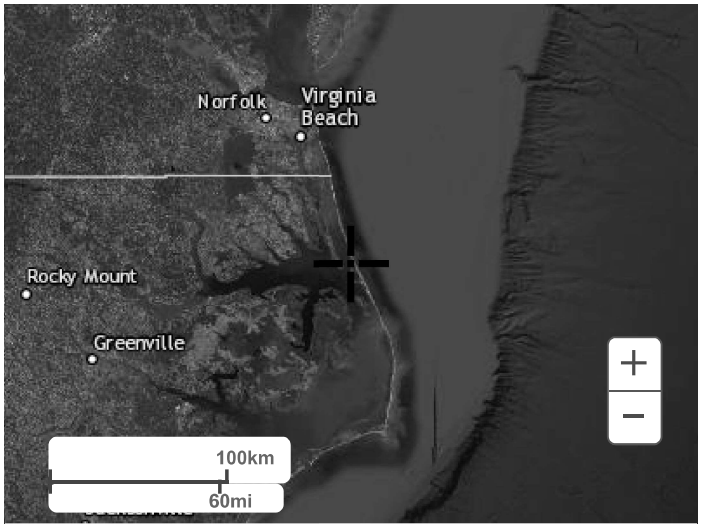
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
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Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Appendix C - On-site Soils Map and Data

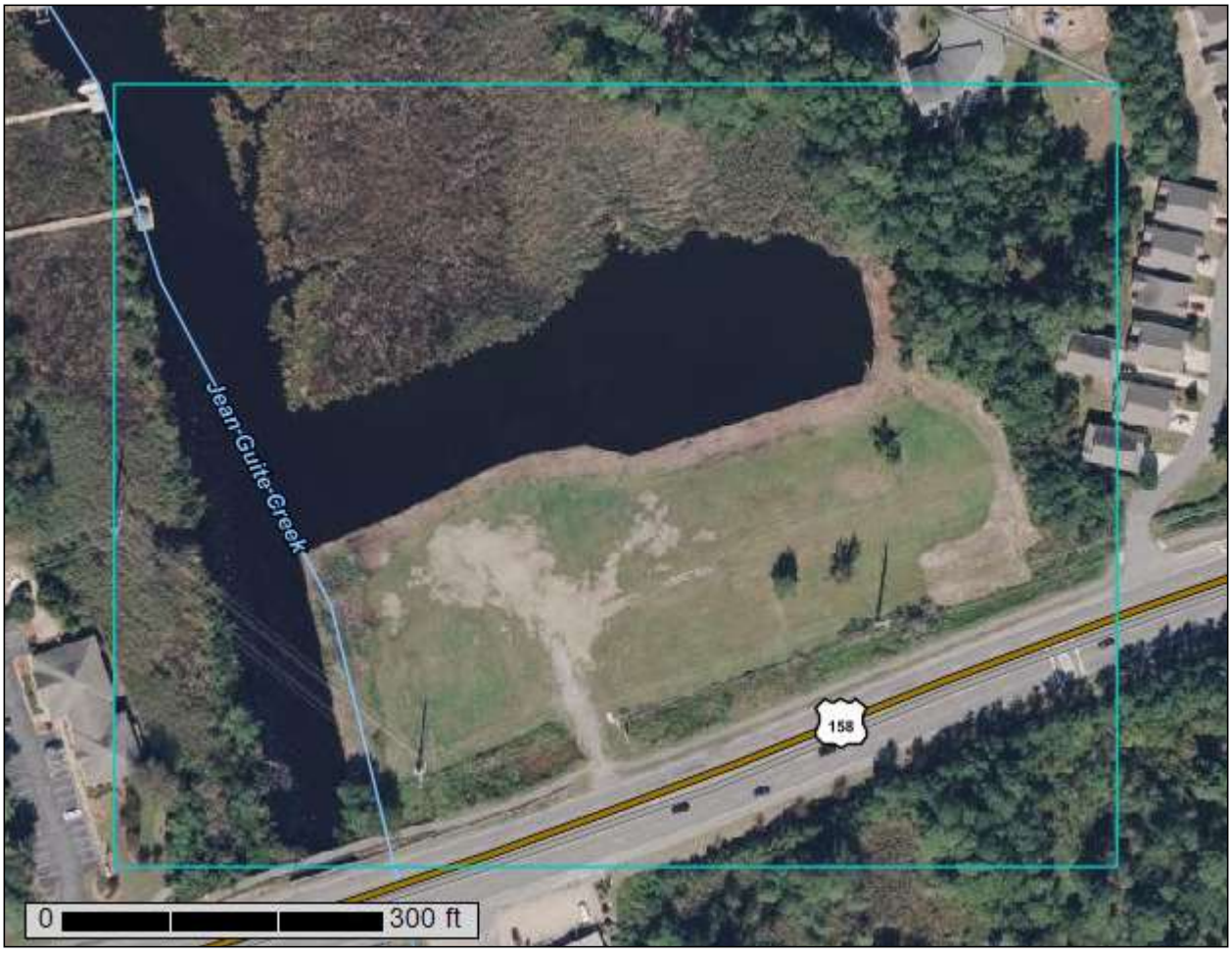
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Dare County, North Carolina



November 29, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,870 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N 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 1:24,000.

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: Dare County, North Carolina
Survey Area Data: Version 23, Sep 8, 2022

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

Date(s) aerial images were photographed: Oct 5, 2020—Oct 7, 2020

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
CuA	Currituck mucky peat, 0 to 1 percent slopes, frequently flooded	10.6	68.1%
FrD	Fripp fine sand, 2 to 30 percent slopes	0.1	0.7%
OsA	Osier fine sand, 0 to 2 percent slopes, rarely flooded	0.4	2.3%
OuB	Ousley fine sand, 0 to 5 percent slopes, rarely flooded	1.9	12.5%
W	Water	2.6	16.4%
Totals for Area of Interest		**15.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Dare County, North Carolina

CuA—Currituck mucky peat, 0 to 1 percent slopes, frequently flooded

Map Unit Setting

National map unit symbol: 3qgv
Elevation: 0 feet
Mean annual precipitation: 42 to 58 inches
Mean annual air temperature: 61 to 64 degrees F
Frost-free period: 190 to 270 days
Farmland classification: Not prime farmland

Map Unit Composition

Currituck, tidal, and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Currituck, Tidal

Setting

Landform: Tidal marshes
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Herbaceous organic material over sandy fluviomarine deposits

Typical profile

Oe - 0 to 14 inches: mucky peat
Oa - 14 to 28 inches: muck
Cg - 28 to 80 inches: sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: Very frequent
Frequency of ponding: None
Maximum salinity: Very slightly saline to slightly saline (2.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 10.0
Available water supply, 0 to 60 inches: High (about 10.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Hydrologic Soil Group: A/D
Hydric soil rating: Yes

FrD—Fripp fine sand, 2 to 30 percent slopes

Map Unit Setting

National map unit symbol: 3qgz
Elevation: 0 to 20 feet
Mean annual precipitation: 42 to 58 inches
Mean annual air temperature: 61 to 64 degrees F
Frost-free period: 190 to 270 days
Farmland classification: Not prime farmland

Map Unit Composition

Fripp and similar soils: 85 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fripp

Setting

Landform: Dunes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Eolian sands and/or beach sand

Typical profile

A - 0 to 4 inches: fine sand
C - 4 to 90 inches: fine sand

Properties and qualities

Slope: 2 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 1.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Conaby, undrained

Percent of map unit: 5 percent
Landform: Pocosins, depressions

Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

OsA—Osier fine sand, 0 to 2 percent slopes, rarely flooded

Map Unit Setting

National map unit symbol: 3qh8
Elevation: 0 to 20 feet
Mean annual precipitation: 42 to 58 inches
Mean annual air temperature: 61 to 64 degrees F
Frost-free period: 190 to 270 days
Farmland classification: Not prime farmland

Map Unit Composition

Osier, undrained, and similar soils: 80 percent
Osier, drained, and similar soils: 10 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Osier, Undrained

Setting

Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Eolian sands and/or beach sand

Typical profile

A - 0 to 3 inches: fine sand
Cg - 3 to 80 inches: fine sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Hydric soil rating: Yes

Description of Osier, Drained

Setting

Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Eolian sands and/or beach sand

Typical profile

A - 0 to 3 inches: fine sand
Cg - 3 to 80 inches: fine sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: A/D
Hydric soil rating: Yes

Minor Components

Conaby, undrained

Percent of map unit: 5 percent
Landform: Depressions, pocosins
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

OuB—Ousley fine sand, 0 to 5 percent slopes, rarely flooded

Map Unit Setting

National map unit symbol: 3qh9
Elevation: 0 to 20 feet
Mean annual precipitation: 42 to 58 inches
Mean annual air temperature: 61 to 64 degrees F
Frost-free period: 190 to 270 days
Farmland classification: Not prime farmland

Map Unit Composition

Ousley and similar soils: 85 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ousley

Setting

Landform: Troughs on dunes
Landform position (two-dimensional): Backslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Eolian sands and/or beach sand

Typical profile

A - 0 to 3 inches: fine sand
C - 3 to 43 inches: fine sand
Cg - 43 to 82 inches: fine sand

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Very high (19.98 to 39.96 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Conaby, undrained

Percent of map unit: 3 percent
Landform: Pocosins, depressions
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Duckston

Percent of map unit: 2 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

W—Water

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Hydric soil rating: No

References

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MEMORANDUM

Quible & Associates, P.C. SINCE 1959
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ENVIRONMENTAL SCIENCES * SURVEYING
Phone: (252) 261-3300
Fax: (252) 261-1260
Web: www.quible.com

To: **Michael W. Strader, Jr., P.E. and Cathleen Saunders, P.E., Quible & Associates**

From: Brian Rubino, P.G.

Date: August 3, 2022

Re: **P14064 Soil and Groundwater Investigation**
Guinguite Creek
6195 N. Croatan Hwy., Southern Shores, Dare County, NC

On Monday August 1, 2022, representatives from Quible visited the Site to conduct shallow soil borings in the locations of potential future stormwater collection basins or infiltration areas. The purpose of our evaluation was to understand lithologic conditions, to determine the depth and elevation of the Static Water Table (WT), Season High Water Table (SHWT), and to evaluate infiltration rates for Stormwater Management System design.

Soils consisted of:

SB-1
- 0-19" bgs: Tan-brown medium grained sand (appears to be recent fill; no organic topsoil); 10YR 5/4
- 19-24" bgs: Gray fine-medium grained sand; 10YR 4/1
- 24-44" bgs: Gray fine-grained sand with some silt and organic streaks; 10YR 4/1
- 44-82" bgs: Organic peat dominated unit (confining unit); 10YR 2/2
- 82-96" bgs: Gray medium-grained sand with organic silts and peat layers; 10YR 3/1

SB-2
- 0-4" bgs: organic topsoil; 10YR 2/2
- 4-36": Gray fine-medium grained sand; 10YR 4/1
- 36-60": Peat with semi-decomposed wood (confining unit); 10YR 2/2

SB-2
- 0-3" bgs: organic topsoil; 10YR 2/2
- 3-38": Gray fine-medium grained sand with organic streaks; 10YR 4/1
- 38-60": Peat with semi-decomposed wood (confining unit); 10YR 2/2

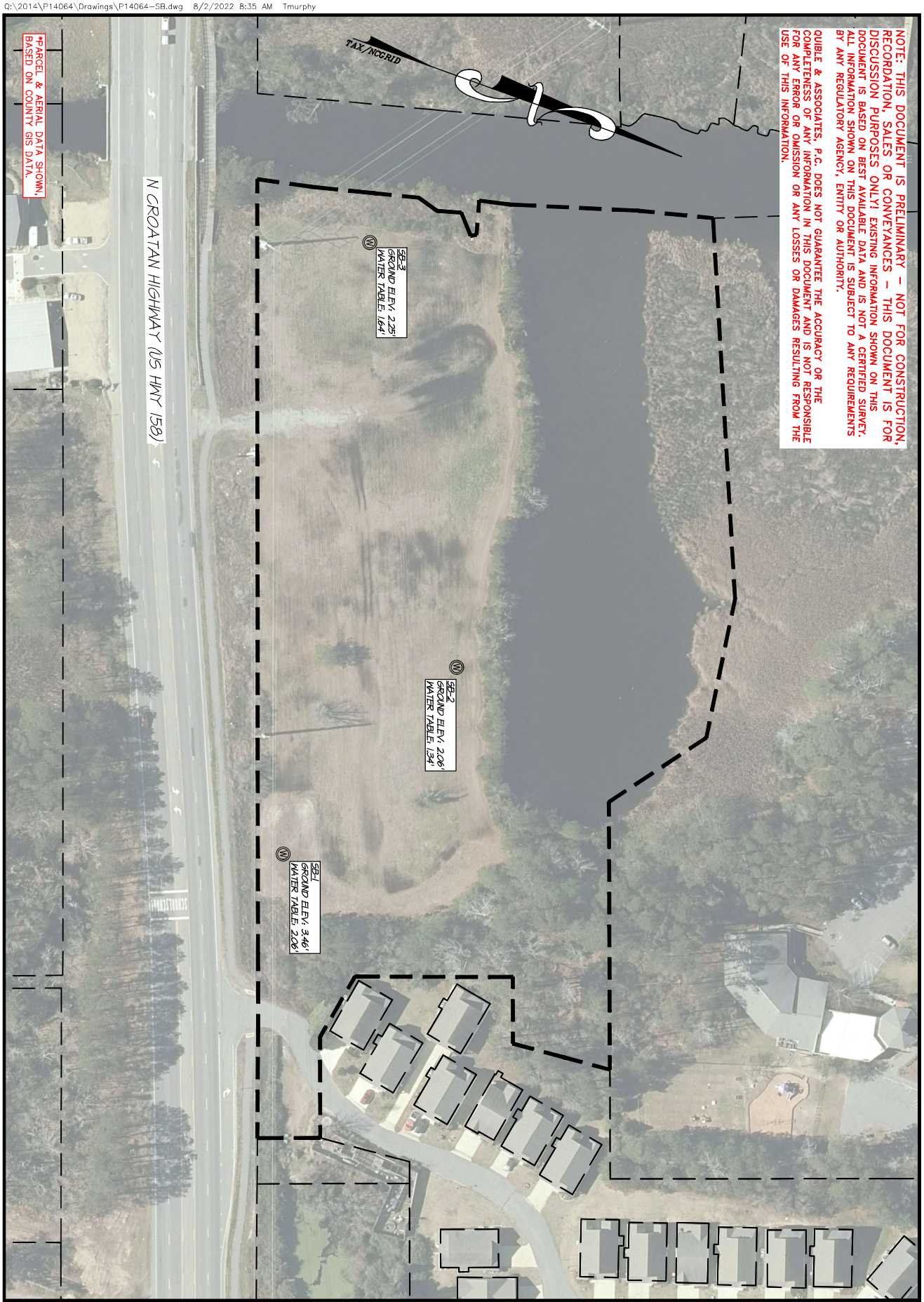
A summary of elevation data collected and observed is as follows:

Soil Boring	Ground Elevation (ft); (NAVD 88)	Groundwater Elevation (ft); (NAVD 88)
SB-1	3.46	2.06'
SB-2	2.06	1.34'
SB-3	2.25	1.64'

Ground elevation data was collected on the date of the soil borings using an RTK GPS system.
Three temporary piezomters, using a two-inch .010 slot pvc well screen were installed at the boring locations and were allowed to recover for a period of at least 1 hour before the depth to groundwater was measured using an electronic water level checker.

There is a significant peat unit that was encountered in all three borings. This is a confining unit and will not allow stormwater infiltration unless the peat is undercut and replaced with suitable sand material. The thickness of the peat unit is approximately 4 ft in SB-1 and not determined in SB-2 or SB-3, but it at least 3 ft thick in those locations. It is unknown whether there is another confining unit below this peat layer. The depth to groundwater was very close to the surface in SB-2 and SB-3 which are the two boring locations that are nearest to the waters' edge. Deeper borings using a drill rill rig should be conducted with a geo-technical engineer to understand not only the vertical extent of this unit, but also the suitability for compaction and foundation support.

Q:\2014\P14064\Drawings\P14064-SB.dwg 8/2/2022 8:35 AM Tmurphy



*PARCEL & AERIAL DATA SHOWN, BASED ON COUNTY GIS DATA.

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PROJECT	P14064
DRAWN BY	JTM
CHECKED BY	BDR
DATE	08/02/22

SOIL BORING EXHIBIT

6195 N CROATAN HIGHWAY
GINGUITE, LLC

SOUTHERN SHORES — DARE COUNTY
NORTH CAROLINA

0 80 160
GRAPHIC SCALE IN FEET 1"=80'

THIS MAP IS NOT A CERTIFIED SURVEY AND HAS NOT BEEN REVIEWED BY A LOCAL GOVERNMENT AGENCY FOR COMPLIANCE WITH ANY APPLICABLE LAND DEVELOPMENT REGULATIONS.

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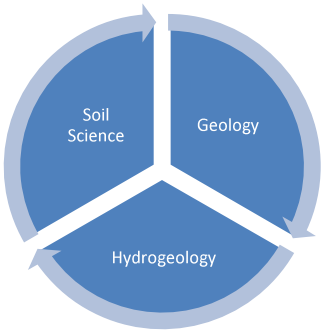

Protocol Sampling Service, Inc.
"Experts in Environmental Compliance"

4114 Laurel Ridge Drive
Raleigh, North Carolina 27612

(919) 210-6547

Protocolsampling@yahoo.com
Environmentalservicesnc.com

May 16, 2023

Mr. David A. Deel, P.E.
Deel Engineering, PLLC
Post Office Box 3901
Kill Devil Hills, North Carolina 27948

Re: **Storm Water Management Soil Investigation**
Guinguite Creek
NC Highway 168
Southern Shores, Dare County, North Carolina
Protocol Project 23-55

Dear Mr. Deel:

The following Soil Investigation is submitted to assist in a site assessment for the proposed storm water management improvements associated with the Guinguite Creek commercial development project located on NC Highway 168, Southern Shores, Dare County, North Carolina.

SITE HISTORY AND PHYSICAL CHARACTERISTICS

The subject property is currently undeveloped open space in Southern Shores, North Carolina. The subject property has been filled with dredge material behind sheet pilings from the deepening of Guinguite Creek in the 1970's. Protocol Sampling Service, Inc. of Raleigh, North Carolina was hired to perform an investigation to identify the depth to seasonal high-water table, if any restrictive layers are present, determine aquifer coefficients and model expected storm water mound height in three (3) interconnected storm water basins to be built throughout the center of the project. Surface elevations range from 2.06 to 3.46 feet msl from west to east across the study area.

SOIL INVESTIGATION

The field survey was conducted on April 12 and 13, 2023 along with a week-long water table elevation monitoring event conducted from April 13 – 20, 2023. Three (3) soil borings were advanced to 60 inches to 96 inches below land surface (bls) with a hand auger by Quible and Associates, P.C. personnel and fitted with shallow hand wells to determine depth to the static and seasonal high water table elevations water prior to this study.

Protocol installed two (2) twenty-two-foot drilled borings to describe subsurface lithology and installed 1 ¼" pvc well screen and riser in the drilled borings to determine depth to water, unsaturated thickness and aquifer coefficients (24-hour aquifer test) across the study area. Information collected from the aquifer test was used to determine transmissivity and run the Colorado Mound Model.

FINDINGS - Soil

- The study area contains soil belonging to the Currituck mucky peat series covered with dredged sands. The Currituck series belongs to the Medisaprists subgroup that contains organic horizons from 16 to 51 inches thick.

- The soil was found to have an apparent depth to seasonal high-water table of 18 to 20-inches bls and an elevation of 1.06'-msl. The static water level was found from 24 to 30-inches bls.

- The restrictive horizons (mucky peat) were encountered from 18 to 36-inches, 44 to 60-inches and from 30 to 66-inches bls. The top of a permeable sand layer which was found below the peat layer extends to a depth of 51-feet bls. The fine sand aquifer has an infiltration rate of 28 inches/hour (236 ft^2/day/51 feet aquifer thickness x 6) and 25% pore space.

FINDINGS – Surficial Aquifer

- The potentiometric surface of the water table was mapped by Protocol as part of this effort. Synoptic water levels were collected on April 12 and 13, 2023. Ground water flow has been calculated to flow north and west towards and into Guinguite Creek and eventually south to the Albemarle Sound. The hydraulic gradient ranges from 0.001 across the study area to 0.007 ft. /ft closer to the Creek showing both a positive drainage impact by the Creek on local ground water flow gradient and direction and a restriction to ground water flow into the Creek by the sheet pilings (Potentiometric Map – Figure 2).

- Aquifer parameters were obtained by conducting a 24-hour aquifer test at 10.5-gallons/minute on the 20 foot deep well (designated PW). The aquifer test was performed on the pumping well (PW) on April 12 & 13, 2023. The observation well (OW), was installed six-feet west of the PW and was screened from 8.5 to 3.5-feet bls. The response in the OW was measured by a HOBO Water Level Logger pressure transducer. Pressure transducers measure pressure changes within the well's water column and the information is stored in the logger, which converted and recorded the pressure reading to changes in the static water level.

- The test data was analyzed using a computer type-curve matching program called Aqtesolve developed by HydroSolve, Inc. (1996-2007). The match was made using the Neuman solution for an unconfined aquifer using the early time data. The transmissivity was calculated to be 236 ft^2/day. Drawdown data and the curve generated from the aquifer test are presented in Appendix A.

- The field data along with a very conservative seasonal high water table elevation of 2.0-feet bls was entered into the Artificial Recharge computer program authored by Dave Molden, D.K. Sunada and Jim Warner with Colorado State University also known as the Colorado Mound Model, (January 1984).

- The attached result printout for a 1.5" rainfall event flow of 102,520 gallons into three (3) basins with a total infiltrative area of 10,0007 ft^2 show that the proposed loading of 0.10 gpd/ft^2 will create a mound height of only 0.058 feet at 1 day. The moderately high transmissivity of the underlying sands accounts for the low mound height.

- A moderate tidal influence is evident on the study area ground water elevation (0.10') (Ground water Tidal Elevation Chart – attached).

Conclusions and Recommendations

- To enhance drainage to the subsurface sand, excavation of and through the peat layer to at least 36 and as much as 66-inches bls will increase the infiltrative area of each basin and backfilling with clean fine to medium (beach) sand is recommended. 24-inches bls is your design SHWT elevation.

- Adding of an interceptor drain immediately in front of the sheet pilings and exiting at the southwest corner of the project and into Guinguite Creek to control ground water mounding in front of the pilings.

The findings presented herein are based on the site conditions observed during performance of the field survey on April 12 and 13, 2023.

Please call me at (919) 210-6547 if you have any questions or need further assistance.

David E. Meyer, N.C.L.S.S.
Soil Scientist/President

Soil Profile Description
Guinguite Creek

SB-1

Ap1 0 – 18 inches; grayish brown (10YR 5/2) loamy sand; granular; friable.

Oe1 18 – 36 inches; very dark brown (10YR 2/2) mucky peat; 55% fiber unrubbed; massive; friable; strong sulfur smell.

Cg2 36 – 60+ inches; dark brown (10YR 3/3) fine sand; single grained; loose.

Soil Series: Currituck variant
Landscape: Coastal Plain
Landform: marsh/flat
Parent Material: Marine sediments
Drainage Class: poorly
Particle Size Class: sandy
Temperature Regime: thermic
Subgroup Classification: Typic Medisaprists
Examination Method: auger boring
Date: April 12, 2023
Weather: Sunny
Investigators: David Meyer
Shwt: 24”
Measured water table depth: 24”

SB-2

Ap1 0 – 20 inches; grayish brown (10YR 5/2) loamy sand; granular; friable.

Ap2 20 – 30 inches; dark grayish brown (10YR 4/2) loamy sand with strong brown (7.5YR 5/6) concentrations and gray (10YR 6/1) depletions; single grained; loose.

Oe1 30 – 66 inches; very dark brown (10YR 2/2) mucky peat with wood fiber; 55% fiber unrubbed; massive; friable; strong sulfur smell.

Cg2 66 – 74+ inches; dark brown (10YR 3/3) fine sand; single grained; loose.

Soil Series: Currituck variant
Landscape: Coastal Plain
Landform: marsh/flat
Parent Material: Marine sediments
Drainage Class: poorly
Particle Size Class: sandy
Temperature Regime: thermic
Subgroup Classification: Typic Medisaprists
Examination Method: auger boring
Date: April 12, 2023
Weather: Sunny
Investigators: David Meyer
Shwt: 20”
Measured water table depth: 22”