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Technical Memorandum

From: Richard Busche, PE; Kimley-Horn

Date: September 26, 2022

RE: ***Transwestern North PUD***
Karst Feature Geologic Assessment
Kimley-Horn Project Number 142933003

Purpose

The purpose of this technical memorandum is to provide a Karst Feature Geologic Assessment for the Transwestern North PUD Plan (the "Project"), as outlined and required by the Marion County Land Development Code (LDC), Sections 2.12.17 and 6.10.

Background

The Project is located in Marion County, Florida, north of SW Highway 484 and west of Interstate 75. The project area is approximately 228.10 acres in size and consists of proposed industrial buildings.

As with nearly any development project in Marion County, the risk of encountering karst activities is likely. Marion County's geologic profile generally consists of layers of sand and clay, of varying thicknesses, over limestone formations that cap the upper Floridan aquifer. When conditions permit the erosion of the limestone layer and the subsidence of the upper soils, sinkholes can occur. It is our professional opinion that development of this Project poses a normal, not elevated, risk of sinkhole formation.

LDC Section 6.10.3

The following information is included as part of this Technical Memorandum or noted as not applicable.

1. Potentiometric Surface Map. Ground elevations onsite range from 69'-98'. The expected elevation of the potentiometric surface is approximately 50'.
2. There are no geotechnical bulletins or papers specific to the Project area.
3. There are no geotechnical or hydrogeologic reports or studies for the Project area. However, during development permitting, geotechnical borings will be obtained pursuant to the applicable sections of the LDC.
4. There are no known sinkhole locations as depicted on the Project NRCS Soils Map.
5. The evaluation of the planned site area follows:

LDC Section 6.10.4

It shall be a requirement of this Project that no untreated stormwater shall be directed into a karst feature.

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LDC Section 6.10.5

1. This Project will not result in businesses or industries that produce, use or store hazardous materials.
2. There are no known sinkhole locations as depicted on the Project NRCS Soils Map.

LDC Section 6.10.6

It is expected that if any sinkholes are encountered during construction of the Project, they will be remediated. It shall be a requirement of this Project that a remediation plan and final certification must be signed and sealed by an appropriate registered professional.

LDC Section 6.10.7

It is expected that if any sinkholes are encountered during construction of the Project, they will be remediated. It shall be a requirement of this Project that a remediation plan and final certification must be signed and sealed by an appropriate registered professional.

THIS IS TO CERTIFY THAT THE ENCLOSED ENGINEERING MEMORANDUM WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION.

RICHARD V. BUSCHE, P.E.
Florida Registration Number #58568
Registry No. 35106

RICHARD V. BUSCHE, P.E.
STATE OF FLORIDA,
PROFESSIONAL ENGINEER,
LICENSE NO. 58568

THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED BY RICHARD V. BUSCHE, P.E. ON THE DATE INDICATED HERE.

PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SIGNATURE MUST BE VERIFIED ON ANY ELECTRONIC COPIES.

DN: CN=Richard V Busche, dnQualifier=A01410C0000017C13836671000060EA, O=KIMLEY-HORN AND ASSOCIATES INC, C=US
Date: 2022.10.04 10:07:00-04'00'

Attachments: Potentiometric Surface Map
USGS Quad Map
Aquifer Recharge Area Map
NRCS Soils Map

RVB/slb
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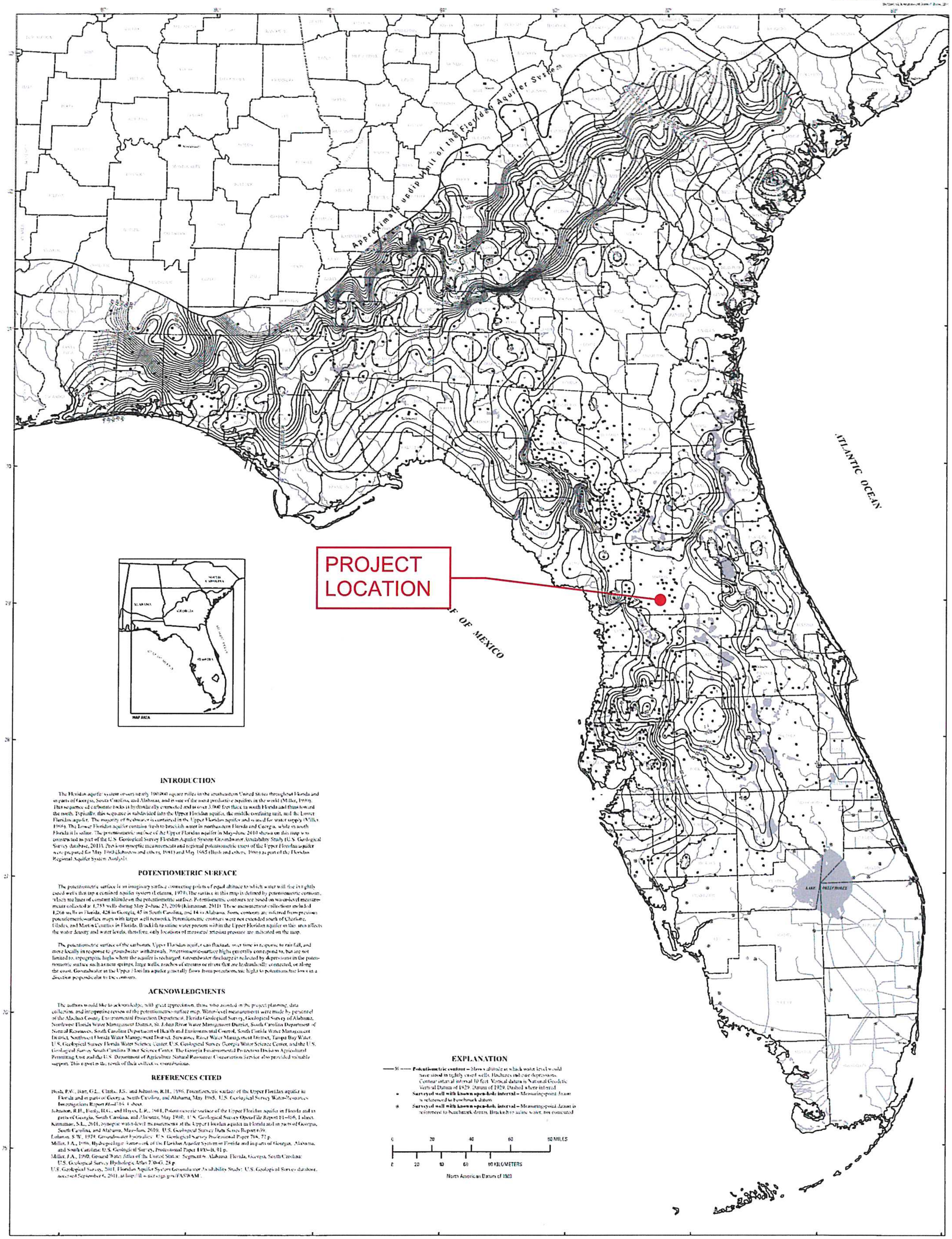
ATTACHMENTS

U.S. Department of the Interior
U.S. Geological Survey

SCIENTIFIC INVESTIGATIONS MAP 3182



INTRODUCTION

The Floridan aquifer system covers nearly 100,000 square miles in the southeastern United States throughout Florida and in parts of Georgia, South Carolina, and Alabama, and is one of the most productive aquifers in the world (Miller, 1990). This sequence of carbonate rocks is hydraulically connected and is over 3,000 feet thick in south Florida and thins toward the north. Typically, this sequence is subdivided into the Upper Floridan aquifer, the middle confining unit, and the Lower Floridan aquifer. The majority of freshwater is contained in the Upper Floridan aquifer and is used for water supply (Miller, 1986). The Lower Floridan aquifer contains fresh to brackish water in northeastern Florida and Georgia, while in south Florida it is saline. The potentiometric surface of the Upper Floridan aquifer in May–June 2010 shown on this map was constructed as part of the U.S. Geological Survey Floridan Aquifer System Groundwater Availability Study (U.S. Geological Survey database, 2011). Previous synoptic measurements and regional potentiometric maps of the Upper Floridan aquifer were prepared for May 1980 (Johnston and others, 1981) and May 1985 (Bush and others, 1986) as part of the Floridan Regional Aquifer System Analysis.

POTENTIOMETRIC SURFACE

The potentiometric surface is an imaginary surface connecting points of equal altitude to which water will rise in tightly cased wells that tap a confined aquifer system (Lohman, 1979). The surface in this map is defined by potentiometric contours, which are lines of constant altitude on the potentiometric surface. Potentiometric contours are based on water-level measurements collected at 1,753 wells during May 2–June 23, 2010 (Kinnaman, 2011). These measurement collections included 1,266 wells in Florida, 428 in Georgia, 45 in South Carolina, and 14 in Alabama. Some contours are inferred from previous potentiometric-surface maps with larger well networks. Potentiometric contours were not extended south of Charlotte, Glades, and Martin Counties in Florida. Brackish to saline water present within the Upper Floridan aquifer in this area affects the water density and water levels; therefore, only locations of measured artesian pressure are indicated on the map.

The potentiometric surface of the carbonate Upper Floridan aquifer can fluctuate over time in response to rainfall, and more locally in response to groundwater withdrawals. Potentiometric-surface highs generally correspond to, but are not limited to, topographic highs where the aquifer is recharged. Groundwater discharge is reflected by depressions in the potentiometric surface such as near springs, large wells, reaches of streams or rivers that are hydraulically connected, or along the coast. Groundwater in the Upper Floridan aquifer generally flows from potentiometric highs to potentiometric lows in a direction perpendicular to the contours.

ACKNOWLEDGMENTS

The authors would like to acknowledge, with great appreciation, those who assisted in the project planning, data collection, and interpretive review of the potentiometric-surface map. Water-level measurements were made by personnel of the Alachua County Environmental Protection Department, Florida Geological Survey, Geological Survey of Alabama, Northwest Florida Water Management District, St. Johns River Water Management District, South Carolina Department of Natural Resources, South Carolina Department of Health and Environmental Control, South Florida Water Management District, Southwest Florida Water Management District, Suwannee River Water Management District, Tampa Bay Water, U.S. Geological Survey Florida Water Science Center, U.S. Geological Survey Georgia Water Science Center, and the U.S. Geological Survey South Carolina Water Science Center. The Georgia Environmental Protection Division Agricultural Permitting Unit and the U.S. Department of Agriculture Natural Resources Conservation Service also provided valuable support. This report is the result of their collective contributions.

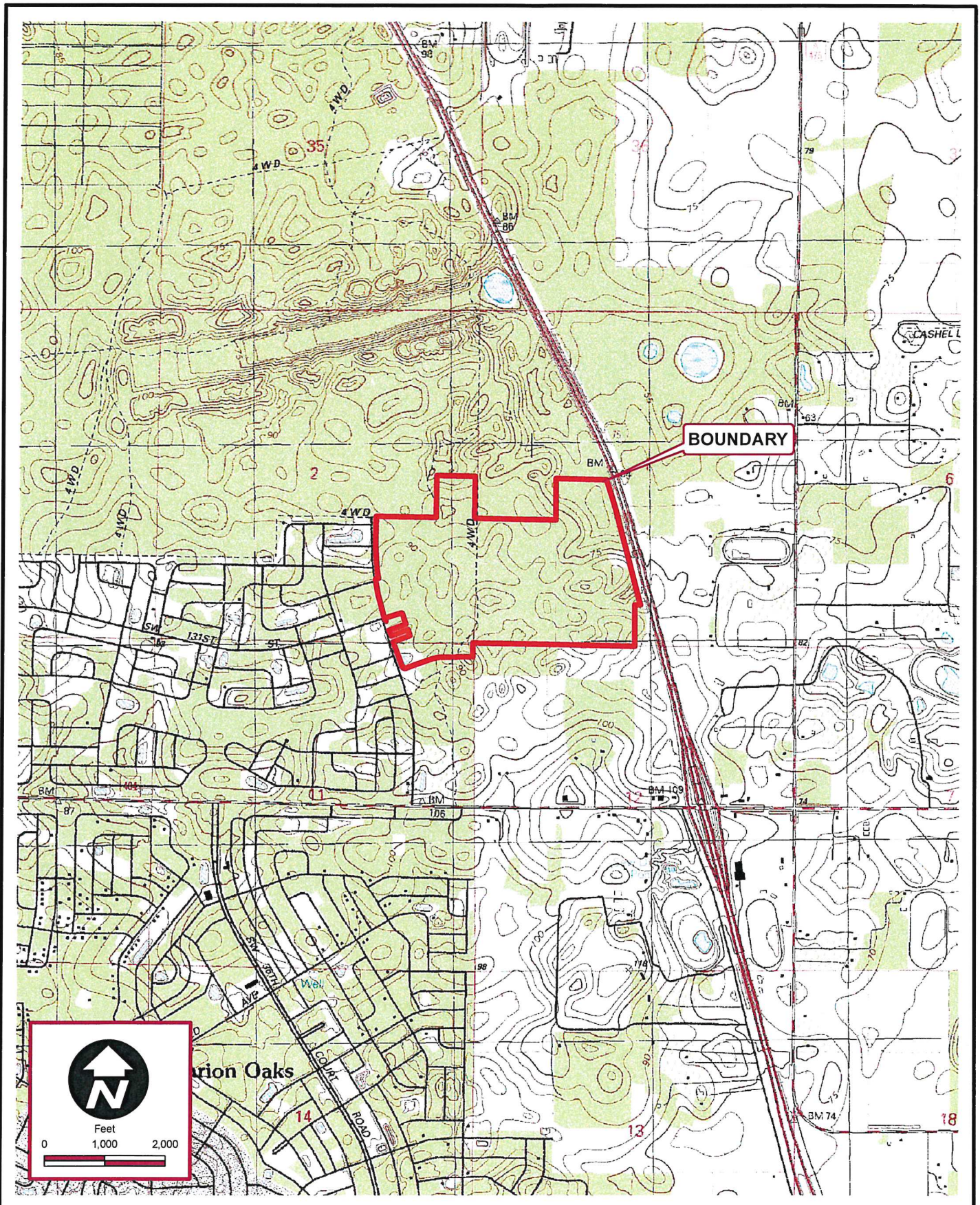
REFERENCES CITED

Bush, P.W., Barr, G.L., Clarke, J.S., and Johnston, R.H., 1986, Potentiometric surface of the Upper Floridan aquifer in Florida and in parts of Georgia, South Carolina, and Alabama, May 1985: U.S. Geological Survey Water-Resources Investigations Report 86–4316, 1 sheet.
Johnston, R.H., Healy, H.G., and Hayes, L.R., 1981, Potentiometric surface of the Upper Floridan aquifer in Florida and in parts of Georgia, South Carolina, and Alabama, May 1980: U.S. Geological Survey Open-File Report 81–486, 1 sheet.
Kinnaman, S.L., 2011, Synoptic water-level measurements of the Upper Floridan aquifer in Florida and in parts of Georgia, South Carolina, and Alabama, May–June 2010: U.S. Geological Survey Data Series Report 639.
Lohman, S.W., 1979, Ground-water hydraulics: U.S. Geological Survey Professional Paper 708, 72 p.
Miller, J.A., 1986, Hydrogeologic framework of the Floridan Aquifer System in Florida and in parts of Georgia, Alabama, and South Carolina: U.S. Geological Survey Professional Paper 1403-B, 91 p.
Miller, J.A., 1990, Ground Water Atlas of the United States: Segment 6, Alabama, Florida, Georgia, South Carolina: U.S. Geological Survey Hydrologic Atlas 730-G, 28 p.
U.S. Geological Survey, 2011, Floridan Aquifer System Groundwater Availability Study: U.S. Geological Survey database, accessed September 6, 2011, at http://fl.water.usgs.gov/FASWAM/.

Potentiometric Surface of the Upper Floridan Aquifer in Florida and Parts of Georgia, South Carolina, and Alabama, May – June 2010

By
Sandra L. Kinnaman and Joann F. Dixon

2011



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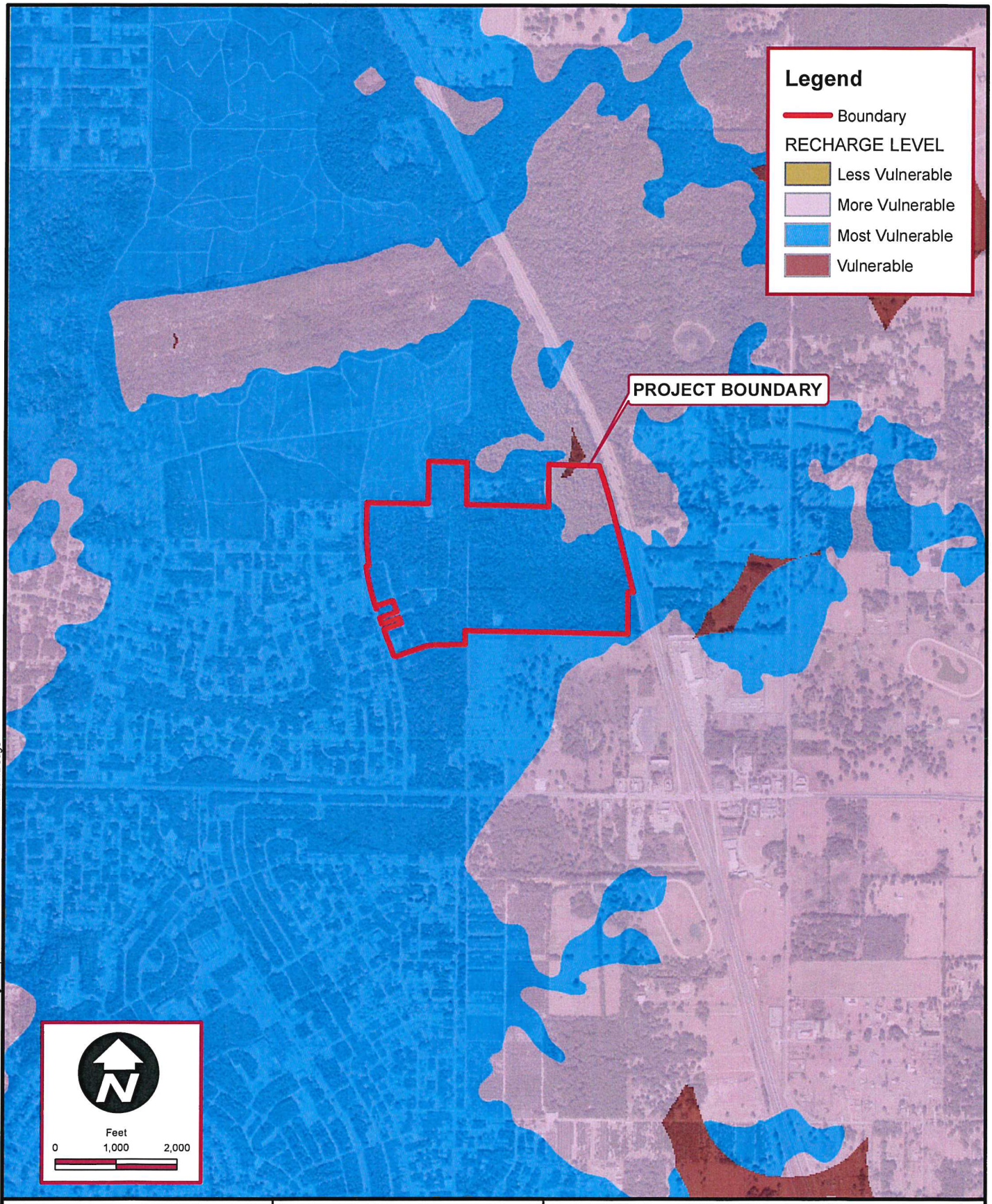
QUADRANGLE MAP

TRANSWESTERN NORTH
MARION COUNTY, FLORIDA

Scale: As Noted	Project No.: 142933003	October 2022	Figure 2



K:\OCA_Civil\142933003-Transwestern North\GIS\Groundwater Recharge Map.mxd - 9/26/2022 2:13:17 PM - Nathan.Dodge

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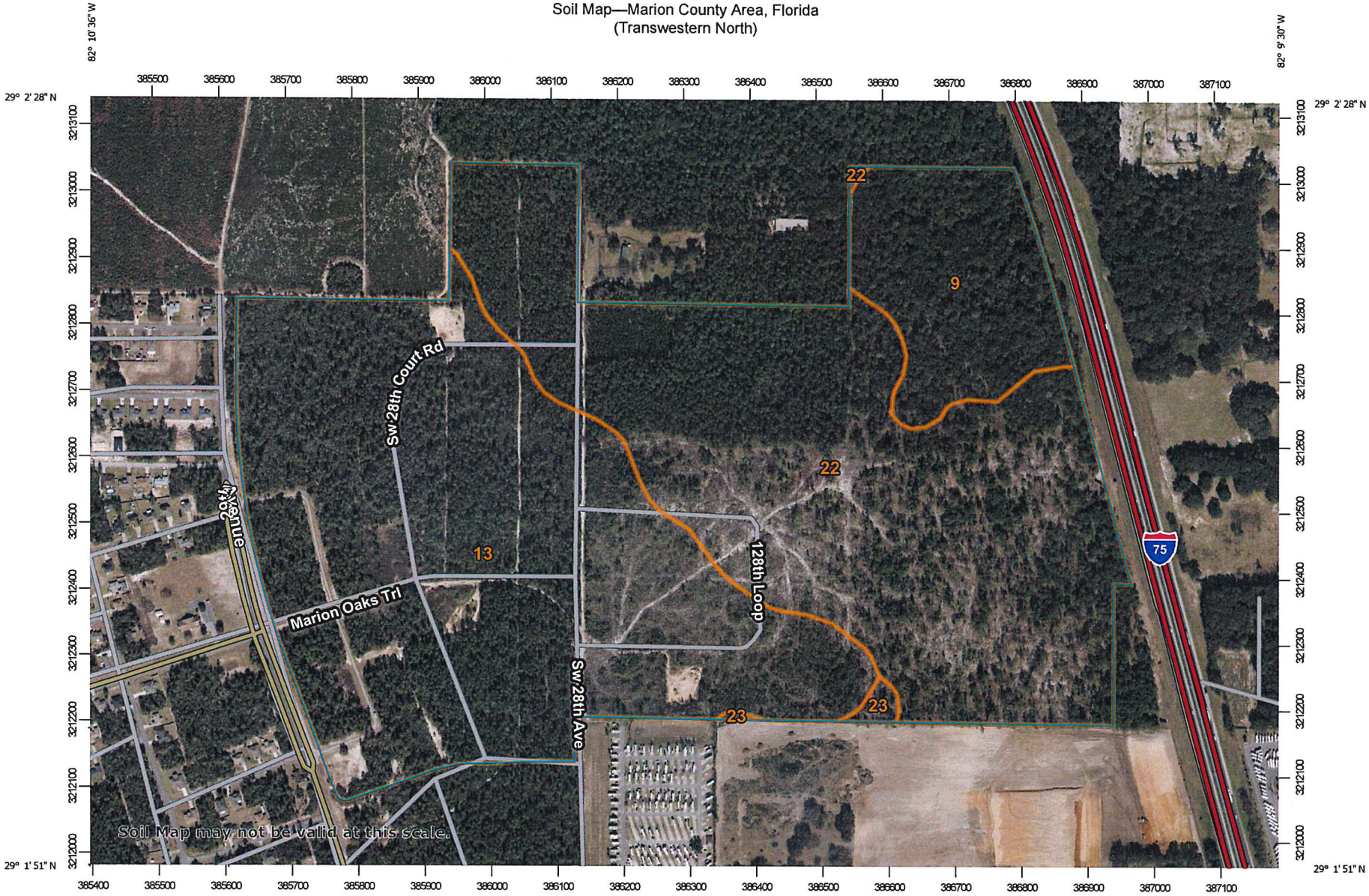
GROUNDWATER RECHARGE MAP

TRANSWESTERN NORTH
MARION COUNTY, FLORIDA

PROJECT: 142933003	Scale: As Noted	September 2022	Figure 3

Soil Map—Marion County Area, Florida
(Transwestern North)



Map Scale: 1:8,190 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 100 200 400 600

Feet
0 350 700 1400 2100

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

Soil Map—Marion County Area, Florida
(Transwestern North)

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 1:15,800.

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: Marion County Area, Florida
Survey Area Data: Version 19, Aug 27, 2021

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

Date(s) aerial images were photographed: Jan 9, 2022—Feb 10, 2022

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
9	Arredondo sand, 0 to 5 percent slopes	23.3	10.0%
13	Astatula sand, 0 to 5 percent slopes	108.8	46.9%
22	Candler sand, 0 to 5 percent slopes	99.2	42.7%
23	Candler sand, 5 to 12 percent slopes	0.9	0.4%
Totals for Area of Interest		**232.2**	**100.0%**