27 April 2021

Georgia Department of Natural Resources
Coastal Marshlands Protection Committee
Attn: Commissioner Mark Williams - Chair
mark.williams@dnr.ga.gov

Subject: **Committee Request for Additional Information** **RLC# 08-028**
Polk Street Maintenance
Chatham County, Georgia

Dear Commissioner Williams:

During the 11 December 2020 Coastal Marshlands Protection Committee (CMPC) Meeting, a request was made by the committee to provide seven additional items to facilitate review of the proposed Polk Street Maintenance Project. The following provides a brief outline of each item requested by the committee and a description of the information provided by the applicants.

1. *A current topographic survey of the project corridor*: For review, we have attached the 2010 topographic survey completed by Bert Barrett (retired) and the 2021 topographic survey completed by Atlas Surveying. A brief comparison of the two surveys documents minimal change in site conditions since 2012.
2. *Soil volume calculation need for the driveway*: Using the 2021 survey the volume of fill material required for the project totals 917 cubic yards.
3. *Hydrologic survey updated*: See attached 2021 hydrological and ecological assessment completed by Nutter & Associates, Inc. (NAI). As documented in the report NAI concludes:

    - Road erosion will be mediated by limiting inundation to the marsh area only,
    - Sedimentation within the marshes will decrease due to road repair and stabilization,
    - Marsh hydrology on the west and east sides of the road will be largely unaffected as the primary water sources are independent and not obstructed by the roadway,
    - Marsh ecology will not be adversely affected as the areas west and east of the road are already mostly independent systems and the installation of culverts will provide connectivity between the two areas,
    - Essential Fish Habitat will not be impacted as the footprint of the road is not expanding and,
    - Safe and reliable transportation will be provided to the residents of Tybee Island.

4. *Include 172 feet of western portion of driveway in project impact*. The attached revised permit drawings incorporate the 172 feet of roadway into the overall project.
5. *Identify persons responsible for maintenance*: As documented during the December CMPC meeting, the City of Tybee will be responsible for maintaining their property and Mr. Leonard will be responsible for maintaining his property.
6. *Provide a description of what maintenance will include:* The maintenance plan for the roadway will include maintaining a crown on the gravel drive surface in the center of the road with a surface slope to encourage good surface drainage, maintaining the surface to minimize ruts, potholes and gravel ridges at roadsides that can trap water and maintaining potholes have occurred by excavating and filling the hole with layers of gravel, compacting each layer of gravel as it is added. During any maintenance inspections, side slopes will be reviewed to confirm stability and any areas (outside of CMPA jurisdiction) experiencing erosion will

be stabilized. Lastly, an inspection of the road will occur following major hurricane events. Note any maintenance activities which require disturbance within CMPA jurisdiction will be coordinated with CRD and appropriate authorization will be obtained prior to performing the necessary maintenance activity.

7. *Provide analysis of wooden bridge for all or portions of the project*: Thomas & Hutton was retained to complete a cost assessment for maintenance design alternatives including road fill, concrete bridge and wooden bridge. As documented in the attached exhibits the estimated project costs are as follows:

Maintenance Design	Estimated Unit Cost	Estimated Cost
Road Fill (460 lf)	$3.40/sf	$32,769.00
Concrete Bridge (460 lf)	$250/sf	$1,725,000.00
Timber Bridge (460 lf)	$215/sf	$1,483,500.00
Concrete Bridge (three sections/319 lf)	$325/sf	$1,555,125.00
Timber Bridge (three sections/319 lf)	$275/sf	$1,315,875.00

If you have any questions or require additional information to publish the public notice, please do not hesitate to contact us at (912) 443-5896.

Sincerely,

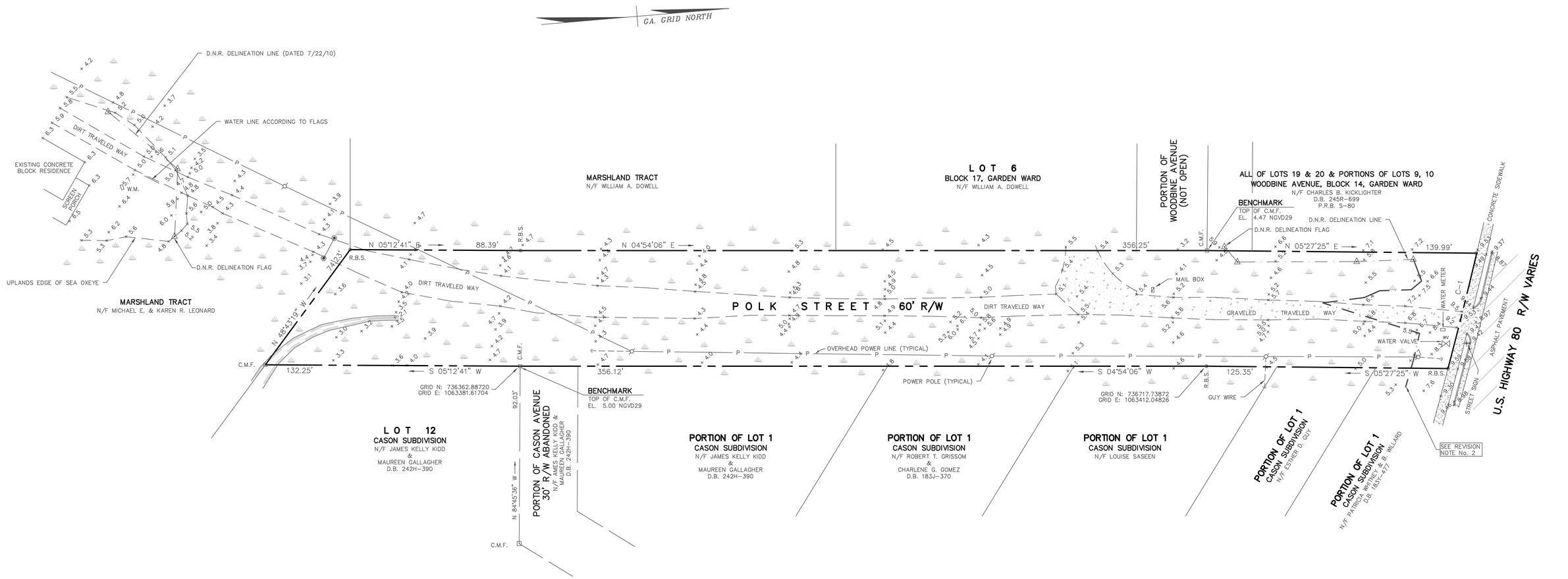
Alton Brown, Jr.
Principal
Resource & Land Consultants

cc: Mr. Zachary Harris
Mr. Chad Barrow
Mr. Brad Brookshire
Mr. Davis Poole
Ms. Deb Barriero
Mr. Shawn Gillen - City of Tybee
Mr. Bubba Hughes – City of Tybee
Mr. Bill Glass – Weiner Shearouse
Mr. Mike Leonard
Mr. Mike Smith
Mr. Cody Hale – Nutter & Associates
Mr. Downer Davis
Mr. John Giordano – Thomas & Hutton

ATTACHMENT A

2012 Barrett Survey & 2021 Atlas Survey

CURVE	RADIUS	LENGTH	TANGENT	CHORD	BEARING	DELTA
C-1	2496.48'	61.69'	30.85'	61.69'	N 71°06'04" W	01°24'57"



REVISIONS			
NO.	DATE	DESCRIPTION	BY
1	11/23/10	SHOW ADDITIONAL ELEVATIONS AND DNR DELINATION LINE ON LEONARD PROPERTY	BBBJR
2	3/27/12	SECTION OF D.N.R. LINE ADDED AS DIRECTED BY JOHN WYNN OF THE D.N.R.	BBBJR
3	1/27/15	REVISED D.N.R. LINE AS DIRECTED BY DEB BARREIRO OF THE D.N.R.	BBBJR

REFERENCES:

1. PLAT OF A RESURVEY OF PORTIONS OF BLOCKS 14,15 & 16, GARDEN WARD BY WRIGHT C. POWERS R.L.S. 933 DATED 7/31/63.
2. PLAT OF REMAINING PORTION OF LOT 1 & ALL OF LOT 2, CASON SUBDIVISION, BY H.M. GARMANY DATED 6/24/64 AND RECORDED IN P.R.B. P-130.
3. PLAT OF CASON SUBDIVISION BY S.P. KEHOE, JR. C.E. 914 DATED 4/12/48 AND RECORDED IN P.R.B. H-132.
4. PLAT OF PORTION OF LOT 8 AND ALL OF LOTS 9-12, CASON SUBDIVISION BY BERT B. BARRETT, SR. R.L.S. 1239 DATED 6/29/92.
5. PLAT OF LOTS 4, 5 & 6, CASON SUBDIVISION BY BERT B. BARRETT, SR. R.L.S. 1239 DATED 5/9/88.
6. PLAT OF LOT 7 & PORTION OF LOT 8, CASON SUBDIVISION BY VINCENT HELMLY R.L.S. 1882 DATED 2/25/82.

THE COORDINATES SHOWN ON THIS PLAT ARE BASED ON GEORGIA GRID COORDINATES EAST ZONE (NAD 83) 1994 ADJUSTMENT.

SPECIAL NOTE: THE SURVEYOR HAS MADE NO ATTEMPT TO LOCATE ANY TREES OR UNDERGROUND UTILITIES ON OR ACROSS THIS SITE. THE UTILITIES THAT ARE SHOWN WERE ABOVE GROUND AND WERE IN PLAIN SITE.

E.O.C. FIELD	1/ 65,902
< ERROR/POINT	
ADJ. METHOD	NONE
E.O.C. PLAT	1/ 96,995
TOTAL STATION	GEODIMETER 610
L1 GPS UNITS	PROMARK 2's

GEORGIA REGISTERED No. 2225 LAND SURVEYOR BERT B. BARRETT, JR.

STATE OF GEORGIA
CHATHAM COUNTY

BOUNDARY & TOPOGRAPHICAL SURVEY OF A PORTION OF POLK STREET SOUTH OF U.S. HIGHWAY 80, LOCATED IN GARDEN WARD, TYBEE ISLAND, GEORGIA.

FOR: CITY OF TYBEE ISLAND

DATE OF SURVEY: MAY 31, 2006

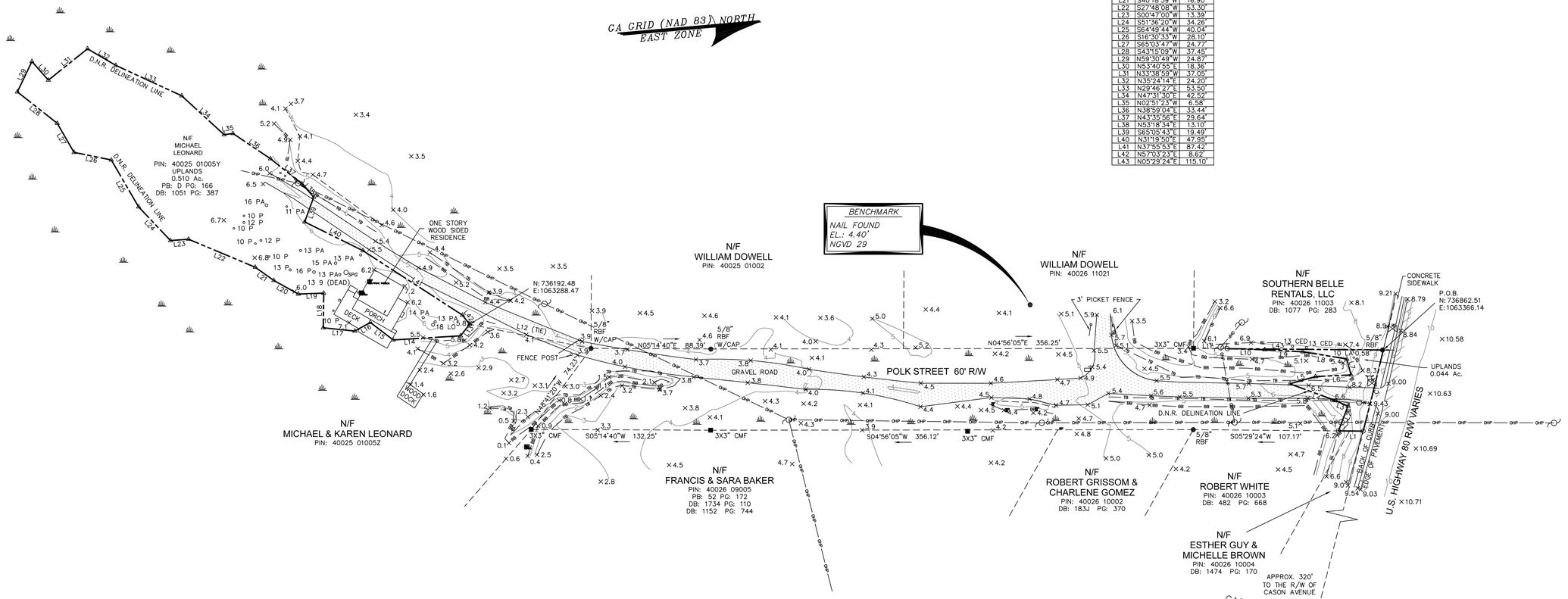
DATE OF PLAT: MAY 31, 2006 (LAST REVISED JANUARY 27, 2015)

SCALE: 1"= 25'

0' 25' 50'

BERT BARRETT, JR. LAND SURVEYING, P.C.
145 RUNNER ROAD
SAVANNAH, GA. 31410
(912) 897-0661

C:\SDSK\PROJECT\POLKSTPDF 1-27-15 3:40:18 pm EST

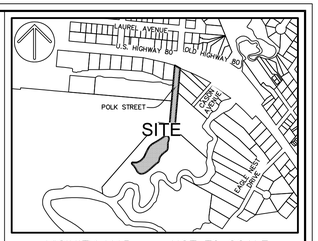


CURVE TABLE					
LABEL	RADIUS	ARC	CHORD	CHORD BEARING	DELTA
C1	2496.48'	61.69'	61.69'	S71°04'05"E	1°24'57"

UPLAND TABLE

PID 40025 01005Y	0.510 AC
POLK STREET	0.044 AC
TOTAL	0.554 AC

LINE TABLE		
LABEL	BEARING	DISTANCE
L1	S05°29'24"W	18.18'
L2	S64°10'45"E	19.57'
L3	N29°03'29"E	9.81'
L4	N25°11'09"E	36.07'
L5	S10°58'15"E	19.61'
L6	S02°24'23"W	26.27'
L7	N79°58'48"E	12.18'
L8	N14°15'35"E	32.82'
L9	N08°14'44"E	28.17'
L10	N06°32'22"E	27.64'
L11	N05°29'24"E	24.89'
L12	S16°14'14"W	91.38'
L13	S46°58'39"E	10.78'
L14	S01°27'41"W	49.84'
L15	S42°29'20"W	21.25'
L16	S24°03'38"E	13.11'
L17	S10°57'53"W	23.37'
L18	N84°12'30"W	25.58'
L19	S03°00'18"W	18.77'
L20	S34°00'13"W	20.69'
L21	S40°18'59"W	16.90'
L22	S27°48'08"W	53.30'
L23	S00°47'00"W	13.39'
L24	S51°36'20"W	34.26'
L25	S64°49'44"W	40.04'
L26	S16°30'33"W	28.10'
L27	S65°03'47"W	24.77'
L28	S43°15'09"W	37.45'
L29	N59°30'49"W	24.87'
L30	N53°40'55"E	18.36'
L31	N33°38'59"W	37.05'
L32	N35°24'14"E	24.20'
L33	N29°46'27"E	53.50'
L34	N47°31'30"E	42.52'
L35	N02°51'23"W	6.58'
L36	N38°59'04"E	33.44'
L37	N43°35'56"E	29.64'
L38	N53°18'34"E	13.10'
L39	S65°05'43"E	19.49'
L40	N31°19'50"E	47.95'
L41	N37°55'53"E	87.42'
L42	N57°03'23"E	8.62'
L43	N05°29'24"E	115.10'



VICINITY MAP NOT TO SCALE

LEGEND

⍋	CALC POINT – CORNER NOT SET
CMF ■	CONC. MONUMENT FOUND
RBF ●	IRON REBAR FOUND
CED	CEDAR
D.N.R.	DEPARTMENT OF NATURAL RESOURCES
FFE	FINISHED FLOOR ELEVATION
LA	LAUREL OAK
LO	LIVE OAK
PIN	PARCEL ID NUMBER
PA	PALMETTO
P	PINE
P.O.B.	POINT OF BEGINNING
	FIRE HYDRANT
×	GUY WIRE
	MAIL BOX
	POWER POLE
×12.9	SPOT ELEVATION
SPIGOT	SPIGOT
	MARSHGRASS
	WETLAND FLAG
W	WATER METER
	WATER VALVE
BB	BOTTOM OF BANK
8	CONTOUR LINE
TB	TOP OF BANK
	CONCRETE
	EDGE OF PAVEMENT
	GRAVEL

NOTES

1. THIS PARCEL APPEARS TO LIE IN FLOOD ZONE AE(10.0'), FIRM PANEL 0213–G COMMUNITY 13051C.
2. CONTOURS ARE IN ONE FOOT INTERVALS. TREE SIZES SHOWN ARE IN INCHES OF DIAMETER.
3. VERTICAL DATUM IS NGVD 29.
4. HORIZONTAL DATUM IS GEORGIA STATE PLANE GRID, EAST ZONE, (NAD 83).
5. POLK STREET RIGHT–OF–WAY IS PER REFERENCE #1.
6. LINES MARKED AS D.N.R. DELINEATION LINES ARE FLAGGED BY D.N.R. AND BASED ON A SKETCH AND RECEIVED FROM RLC ON 04/01/20. SURVEYED BY ATLAS SURVEYING ON 04/13/20.

REFERENCES

1. A BOUNDARY & TOPOGRAPHICAL SURVEY OF A PORTION OF POLK STREET. BY: BERT B. BARRETT, JR. G.A.P.L.S.: 2225 REVISED DATE: 01/27/15
2. PB: 52 PG: 172
3. DB: 452 PG: 688
4. DB: 1474 PG: 170
5. DB: 183J PG: 370
6. DB: 1077 PG: 283
7. DB: 1152 PG: 744
8. DB: 1734 PG: 110

PREPARED FOR:
RESOURCE & LAND CONSULTANTS

A TOPOGRAPHIC SURVEY OF

A PORTION OF POLK STREET & #318 POLK STREET TYBEE ISLAND

PIN: 40025 01005Y

5TH G.M.D.
CHATHAM COUNTY, GEORGIA

FIELD WORK:	NCN
FIELD CHECK:	CJB
DRAWN BY:	CJB
DATE:	02–15–2021
SCALE:	1"=40'
PROJECT No.:	BFT–20098
FILE:	BFT–20098 T1.DWG

THIS TOPOGRAPHIC SURVEY AND ANY CERTIFICATION FOR IT EXTENDS ONLY TO THE TOPOGRAPHIC AND/OR GEOSPATIAL ASPECTS OF THE AREA SHOWN HEREON. THIS TOPOGRAPHIC SURVEY IS LIMITED ONLY TO THE SURFACE VISIBLE FEATURES AT THE TIME AND DATE OF THE SURVEY AND THAT THIS TOPOGRAPHIC SURVEY DOES NOT CONSTITUTE A BOUNDARY SURVEY AND IS NOT TO BE RECORDED OR USED TO CONVEY TITLE OR INTEREST IN PROPERTY.

Colin Jesse Bearden

COLIN JESSE BEARDEN
GA.P.L.S. No. LS003372

ATLAS SURVEYING, INC.
49 BROWN'S COVE ROAD, SUITE #5
RIDGELAND, SC 29936
PHONE: (843) 645–9277
WEBSITE: WWW.ATLASSURVEYING.COM

GEORGIA ATLAS SURVEYING BFT,LLC. No. LSF001282 CERTIFICATE OF AUTHORIZATION

GEORGIA PROFESSIONAL No. 3372 LAND SURVEYOR COLIN JESSE BEARDEN

40 20 0 40 80
GRAPHIC SCALE 1" = 40'

ATTACHMENT B

Nutter & Associates Hydrology Assessment

NUTTER+ASSOCIATES
ENVIRONMENTAL CONSULTANTS

Georgia (Corporate)
360 Hawthorne Lane
Athens, GA 30606
PHONE 706.354.7925
EMAIL info@nutterinc.com

North Carolina
304 New Leicester Hwy., Ste. B
Asheville, NC 28806
PHONE 828.539.3008
WEB nutterinc.com

TECHNICAL MEMORANDUM NO. 21-002

PREPARED FOR: Alton Brown
Resource and Land Consultants

PREPARED BY: V. Cody Hale, Ph.D., PH
Lauren Monda, M.S.

DATE: April 5, 2021

SUBJECT: Update to 2014 hydrological and ecological assessment of proposed Polk Street maintenance project, City of Tybee Island, Georgia.

CONTENTS

LIST OF FIGURES

1.0 INTRODUCTION

Nutter and Associates, Inc (NAI) was contracted by Resource and Land Consultants (RLC) on behalf of the City of Tybee Island, Georgia in response to the Georgia Department of Natural Resources (DNR) Coastal Marshlands and Shore Protection Committee's motion issued on December 11th, 2020. The motion requested an update to the City's Coastal Marshlands Protection Act Application to perform maintenance and improvement to Polk Street, a roadway jointly owned by the City of Tybee Island and Mr. Michael E. Leonard. The roadway connects Highway 80 to Mr. Leonard's private property which consists of two structures, one serving as Mr. Leonard's primary residence.

A previous study was conducted in 2014 by NAI as documented in Technical Memorandum 13-079.01 with subject "Hydrological and ecological assessment of proposed Polk Street maintenance project, City of Tybee Island, Georgia." The December 2021 motion requested the previous study be updated to ensure the analysis reflects current site conditions following recent hurricane activity and adequately evaluates the project's potential to affect the surrounding salt marsh and aquatic ecosystem.

2.0 CURRENT SITE CONDITIONS

Polk Street lies on the northern side of Tybee Island, in Chatham County, Georgia. The roadway extends south from Highway 80, ending where it meets the private driveway that provides access to a hammock occupied by Mr. Leonard's property (Figure 1; Polk Street and the private driveway, together, are referred to as "road" or "roadway" hereafter). Directly south, east, and west of the hammock, Chimney Creek feeds a dendritic network of small tidal creeks that convey water onto and off of the marsh surrounding the Leonard property (Figure 1). The roadway is elevated above the surrounding marsh for approximately 200 feet south of Highway 80. From approximately 200 feet to 700 feet south of Highway 80, the roadway has eroded to elevations at or below the surrounding marsh, allowing near-average high tides to inundate the road up to twice a day (Figure 1). Road erosion has continued since the 2014 study was conducted, exacerbated by several tropical storms and deepening multiple depressions along the road corridor.

Typical salt marsh vegetation consisting primarily of needlegrass rush (*Juncus roemerianus*), smooth cordgrass (*Spartina alterniflora*) and saltwort (*Salicornia sp.*) lies on either side of the roadway with the roadway itself absent of vegetation. Various species of fish and shellfish were observed in the marsh. Other wildlife that depend on salt marshes and estuaries for habitat include birds such as the great blue heron (*Ardea herodius*), bald eagles (*Haliaeetus*

leucocephalus), clapper rails (*Rallus longirostris*), sparrows, and various ducks (Georgiawildlife.com). For more information on general site characteristics, see Section 2 of the 2014 report (Appendix A).

3.0 METHODS

On January 28th, 2021, five stilling wells were installed and instrumented with HOBO® water level sensors to continuously monitor tidal elevations at key locations on the project site (Figure 2). Two stilling wells were deployed east of Polk Street (1E and 2E) while two others were deployed west of the road (1W and 2W). The fifth stilling well (Creek) was installed on the bank of Chimney Creek at the southern end of the Leonard property (Figure 2). Water depths were logged over a five-day period, capturing approximately ten tidal cycles.

A Nikon Total Station® was used to survey elevations for each stilling well, the salt marsh ground surface and the roadway surface. A survey-grade real-time kinematic (RTK) GPS was used to survey a fixed point within the project area to convert relative water levels to a vertical datum (NGVD29) to allow comparison of water surface elevations. Visual observations of site conditions, hydrological dynamics and ecological characteristics were documented within and around the project area during high and low tide.

4.0 PROJECT ASSESSMENT

NAI repeated the hydrological and ecological assessment from 2014, evaluating the potential effect of road maintenance and improvement on the surrounding salt marsh. Polk Street has served as a city road and primary driveway for two Tybee Island residents for over 60 years. The roadway has been subject to significant erosion over the years, resulting in a roadway that becomes inundated during average or greater high tide events.

Higher high (HH) tidal elevations during the 2021 data collection period ranged from a minimum of 4.04 feet to a maximum HH of 5.05 feet relative to MSL (Figure 3). Even though HH tidal elevations for the 2021 data collection period were slightly lower than HH tides recorded during the 2014 data collection period, NOAA gage data at Fort Pulaski, Georgia (Station ID 8670870) indicates the 2021 study captured above average tides (Figure 4). This allowed the study observations to occur during connectivity between the marsh on the west and east side of the roadway.

4.1 Hydrological Considerations

Water level data for ten high tides and nine low tides were recorded over a five-day period between January 28th, 2021 at 17:00 and February 2nd, 2021 at 16:00 (Figure 5). All five wells were subject to tidal fluctuations with Well 1W reflecting persistent inundation throughout the data collection period due to its location within an excavated canal.

Several of the recorded flood tides did not reach an elevation high enough to inundate the marshes adjacent to the roadway (Figure 5). Using corresponding tidal elevations recorded by NOAA at Fort Pulaski (Station ID 8670870), it is estimated that the marsh areas immediately adjacent to the roadway are inundated by approximately 24% to 38% of high tides (as inferred from data collected between January 2020 and February 2021) while the roadway is inundated far more often as a significant portion of the road lies below marsh elevations (as demonstrated in Figure 5).

When peak tidal elevation was high enough to inundate the roadway and marshes, the timing of flood tide arrival was similar for all wells (taking into account the different elevations) with the exception of Well 1W, which showed a consistent one-hour delay behind the initial water surface elevation increases in the creek. This behavior is attributed to the longer flow path and additional water volume required to inundate the canal at Well 1W. Water surface elevations at all other wells showed similar inundation patterns as observed in the 2014 data, where all wells reached peak high tide elevation simultaneously (Figure 6).

Currently, several tidal channels convey water from Chimney Creek onto the marsh, east and west of the road (Figure 7). A western tidal channel feeds a network of smaller channels that distribute tidal water to the marsh west of the road while the marsh east of the road is fed by a single, substantial tidal channel lying northeast of the Leonard property. Tidal water sources feeding the marsh on either side of the roadway act as independent connections to Chimney Creek.

Direct visual observations of tidal dynamics were made at low tide on January 28th and high tide the morning of January 29th, 2021. During low tide, the marshes and roadway were dry with the exception of the excavated canal surrounding Well 1W and a few pools of residual tidal water isolated in depressions along the roadway. In contrast, during high tide, the marsh on either side of the road was inundated with several inches of water and water depths in the roadway ranged up to approximately 24 inches.

The marsh on the west and east side of the road were inundated by tidal waters moving from Chimney Creek. The marsh on the west side of the road was serviced by water moving eastward out of the network of tidal channels to the west. The marsh on the east side of the road received water that was moving north via an arm of Chimney Creek. As the tide reached peak elevation, a minimal amount of flow was observed moving east across the road between approximately 8:45am and 9:00am (Figure 8). For context, the amount of flow observed moving across the road was so minimal that it was difficult to discriminate whether it was due to wind or if it was a result of head gradients. During the ebb tide, the road served as the breakpoint for flow directed south and west. Tidal water from the marsh on the east side of the road receded south via the roadway while the marsh of the west side of the road receded west, further confirming water sources not only inundate the marsh independently, but also drain the marsh independently.

Road improvement and maintenance plans include the installation of three 18-inch culverts under the repaired roadway. Although the marshes have independent tidal sources, the culverts will provide an opportunity for hydrological and ecological connectivity during high tide (Figure 7).

Given the data collected in the field, we do not expect the Polk Street road maintenance and improvement to have a significant impact on the hydrology of the surrounding marsh ecosystem. Simultaneous peak tide arrival indicates the marsh areas are inundated independently as is expected with the different tributary creek networks that service the east and west marsh areas from Chimney Creek. Tide waters do not flow across the roadway except for a short duration during peak high tide (approximately 15 minutes but will vary depending on tide magnitude and wind conditions). Culvert installation will provide opportunities for hydrological connection between the marsh areas east and west side of the road. Further, according to the 2014 NAI study, road improvement is expected to displace less than 0.5% of the total volume of water present within the marsh west and east of the road at high tide.

4.2 Ecological Considerations

Native flora and fauna species characteristic of salt marsh habitat rely on and have adapted to the natural hydrological and water quality variability caused by the semidiurnal tides along the Georgia coast. Tidal marshes provide important ecological functions, such as providing nursery and feeding habitats for terrestrial and aquatic fauna, providing water quality functions, such as carbon export and nutrient and contaminant sequestration, and providing attenuation of high-water events.

The National Oceanic and Atmospheric Administration (NOAA) Essential Fish Habitat Mapper (habitat.NOAA.gov) suggests Essential Fish Habitat (EFH) exists near Chimney Creek and the marshes immediately adjacent to the creek. EFH is defined as habitat necessary for fish and other aquatic species to survive and reproduce, primarily protecting wetlands, coral reefs, seagrasses and rivers. EFH does not exist near the roadway and will not be affected by the road maintenance project.

Another notable consideration is that the current condition of the eroded roadway surface is adversely affecting aquatic life. As the tide recedes, small fish and other organisms become trapped once depressions in the roadway form isolated pools of water. These organisms are then subject to easy predation or death or injury by vehicular traffic or lack of water as it eventually infiltrates and/or evaporates.

Ecological connection between the marshes near the study area and Chimney Creek will be maintained through existing primary flow paths, ensuring habitat isolation will not occur following roadway improvement. As such, fish usage of the marsh areas near the roadway are also not anticipated to change. Further, aquatic life will be protected from increased predation and isolation once the road improvement plan is implemented.

4.3 Other Considerations

Sea level rise could affect the structural integrity of the improved roadway over time. The NOAA Fort Pulaski tide gage has been monitoring sea level since the 1930s and has concluded sea level near this station increases on average 3.39 millimeters per year or 0.13 inches per year. This suggests, over the next century, sea levels near the study area could increase up to 1.1 feet (Figure 9). As we understand, sea level rise has been accounted for in the road maintenance and improvement plan and should not adversely affect the design lifespan or stability of the roadway following plan implementation.

5.0 CONCLUSIONS

Following the completion of the road maintenance plan:

- Road erosion will be mediated by limiting inundation to the marsh area only;
- Sedimentation within the marshes will decrease due to road repair and stabilization;
- Marsh hydrology on the west and east sides of the road will be largely unaffected as the primary water sources are independent and not obstructed by the roadway;

- Marsh ecology will not be adversely affected as the areas west and east of the road are already mostly independent systems and the installation of culverts will provide connectivity between the two areas;
- Essential Fish Habitat will not be impacted as the footprint of the road is not expanding; and,
- Safe and reliable transportation will be provided to the residents of Tybee Island.

FIGURES

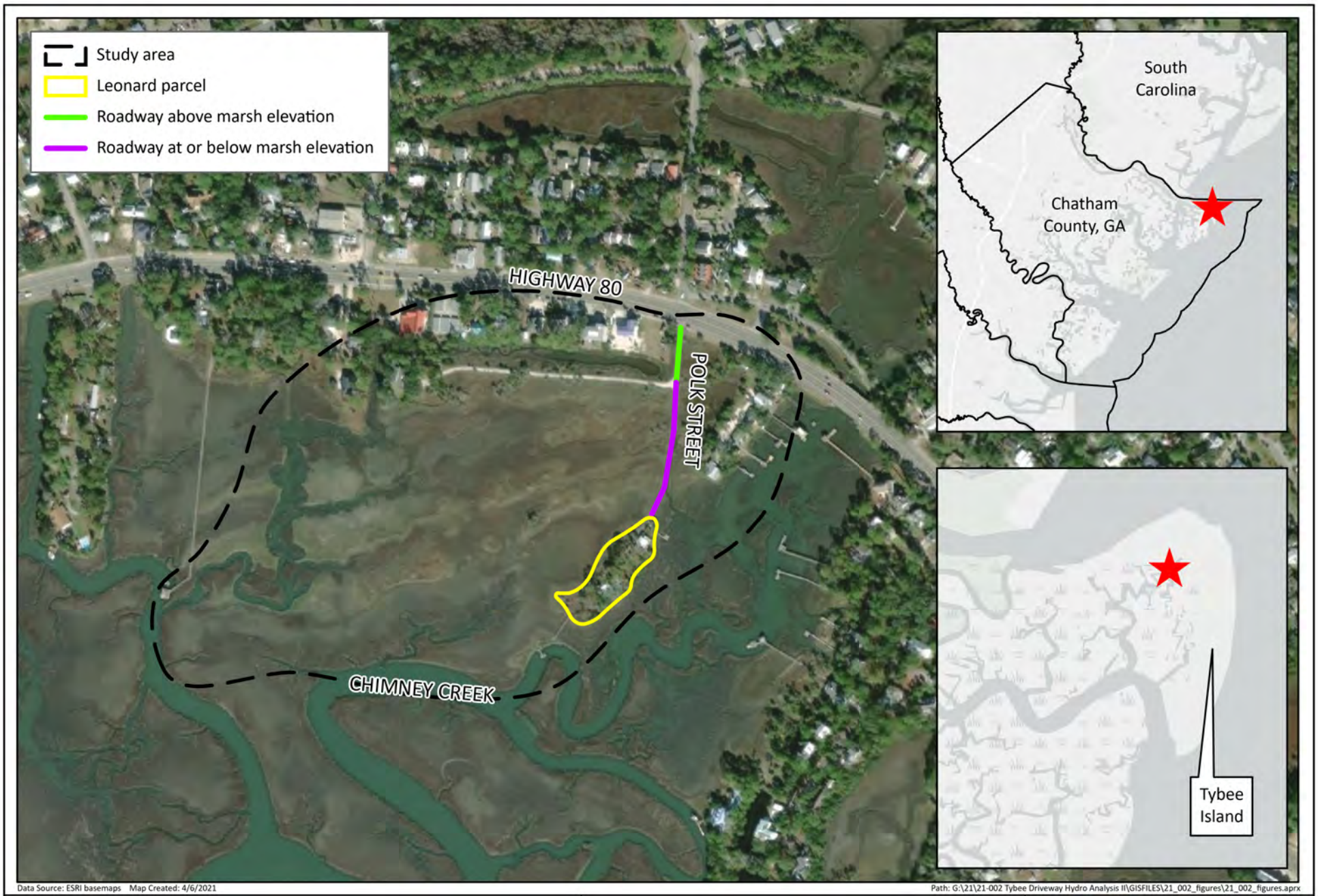


Figure 1. Vicinity map of Polk Street project, Tybee Island, Georgia.

0 250 500 1,000 Feet

N

NUTTER+ASSOCIATES
ENVIRONMENTAL CONSULTANTS

Figure 2. Stilling well locations and RTK base station within the vicinity of the Polk Street study area.

0 100 200 400 Feet

N

NUTTER+ASSOCIATES
ENVIRONMENTAL CONSULTANTS

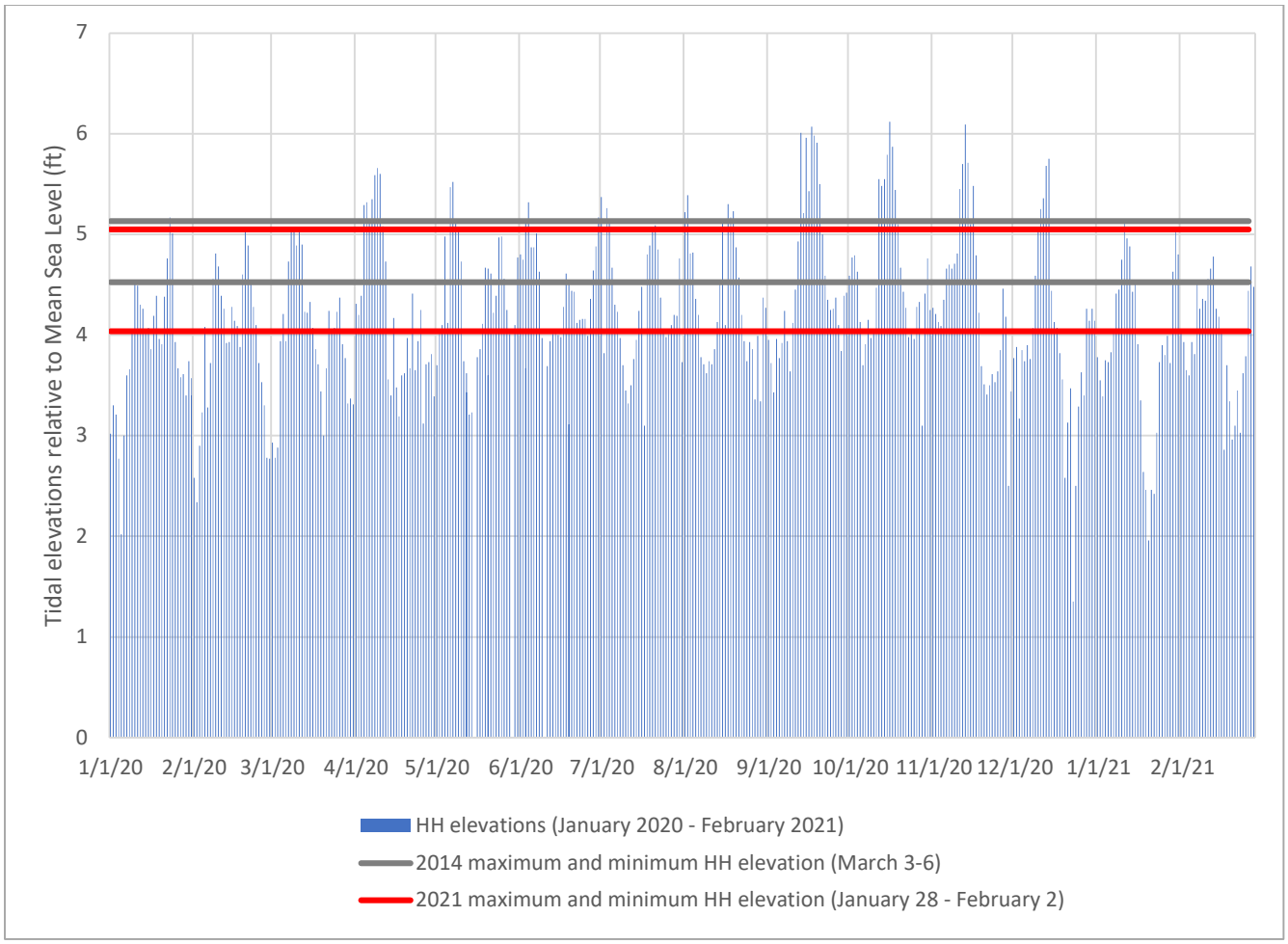


Figure 3. Minimum and maximum HH tides measured at the NOAA Fort Pulaski, Georgia tide gage (Station ID 8670870) during the 2021 data collection period relative to daily HH tide elevations measured in the 14-month period (January 2020 to February 2021) prior to data collection. Minimum and maximum HH tides from the 2014 study are shown in gray for reference.

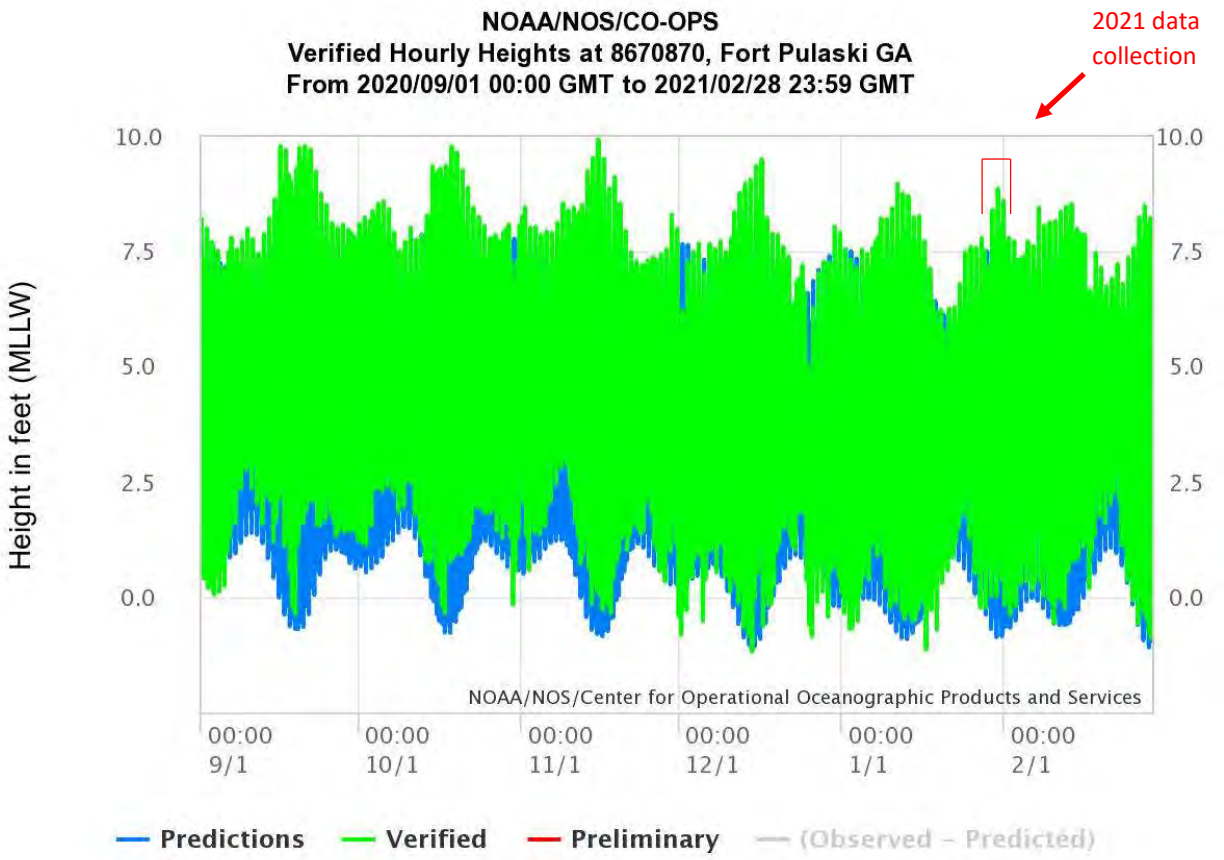


Figure 4. Daily tidal elevations relative to Mean Lower Low Water (MLLW) at the NOAA Fort Pulaski, Georgia tide gage (Station ID 8670870) from September 1st, 2020 to February 28th, 2021.

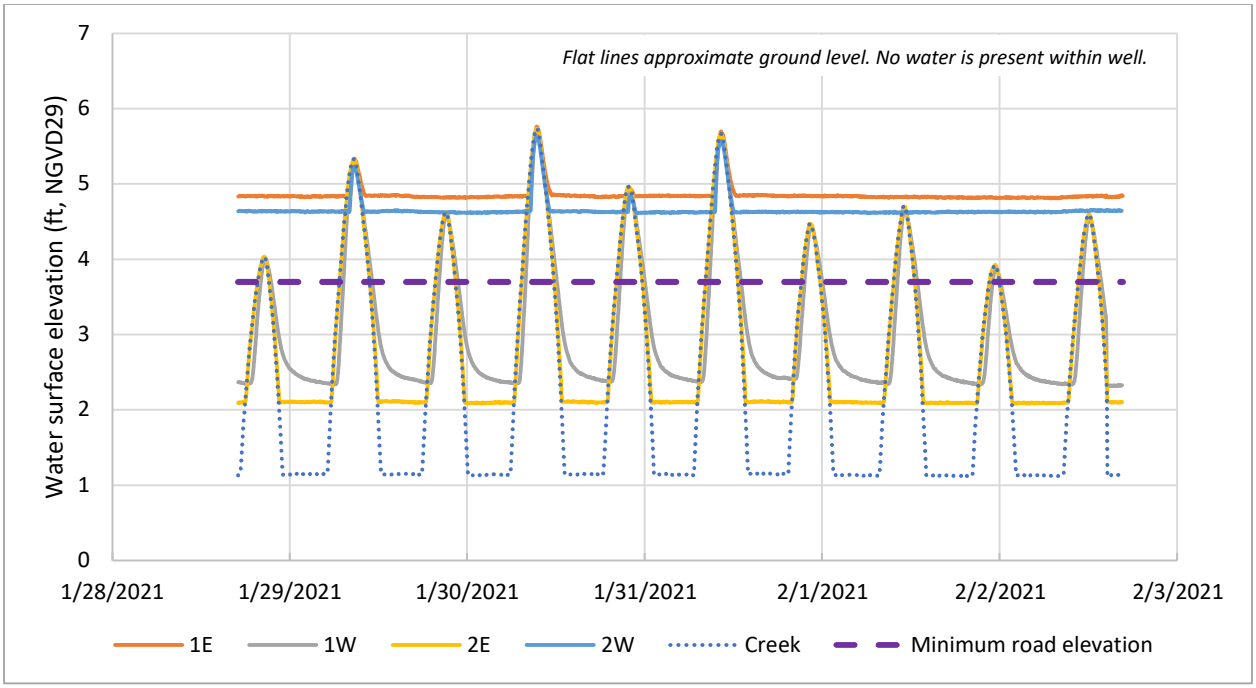


Figure 5. Water surface elevations recorded at Well 1E, 1W, 2E, 2W, and Creek from January 28th, 2021 to February 2nd, 2021.

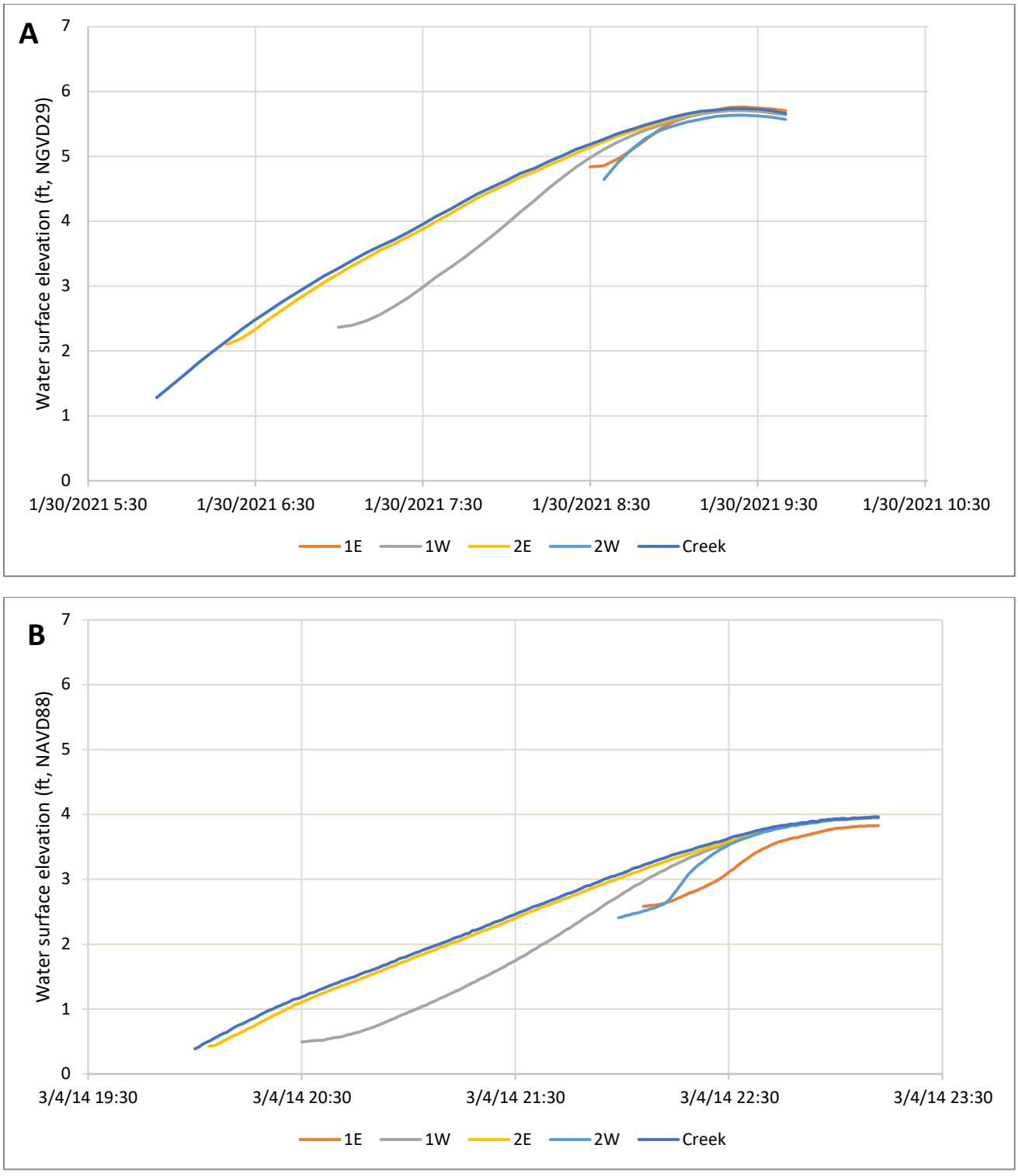


Figure 6. Water surface elevations recorded during the rising limb and peak of the maximum HH tide event recorded during the (A) 2021 and (B) 2014 data collection period at all wells. (Note that the vertical datums are different for 2021 (A) and 2014 (B). This analysis is intended to show timing of the flood tide and is therefore not affected by the different datums.)

Figure 7. Primary water flowpaths into study area under current conditions. Orange arrows indicate areas where connectivity is limited to a small duration of time during high tide. Reference Figure 8 for more detail.

0 125 250 500 Feet

N

NUTTER+ASSOCIATES
ENVIRONMENTAL CONSULTANTS

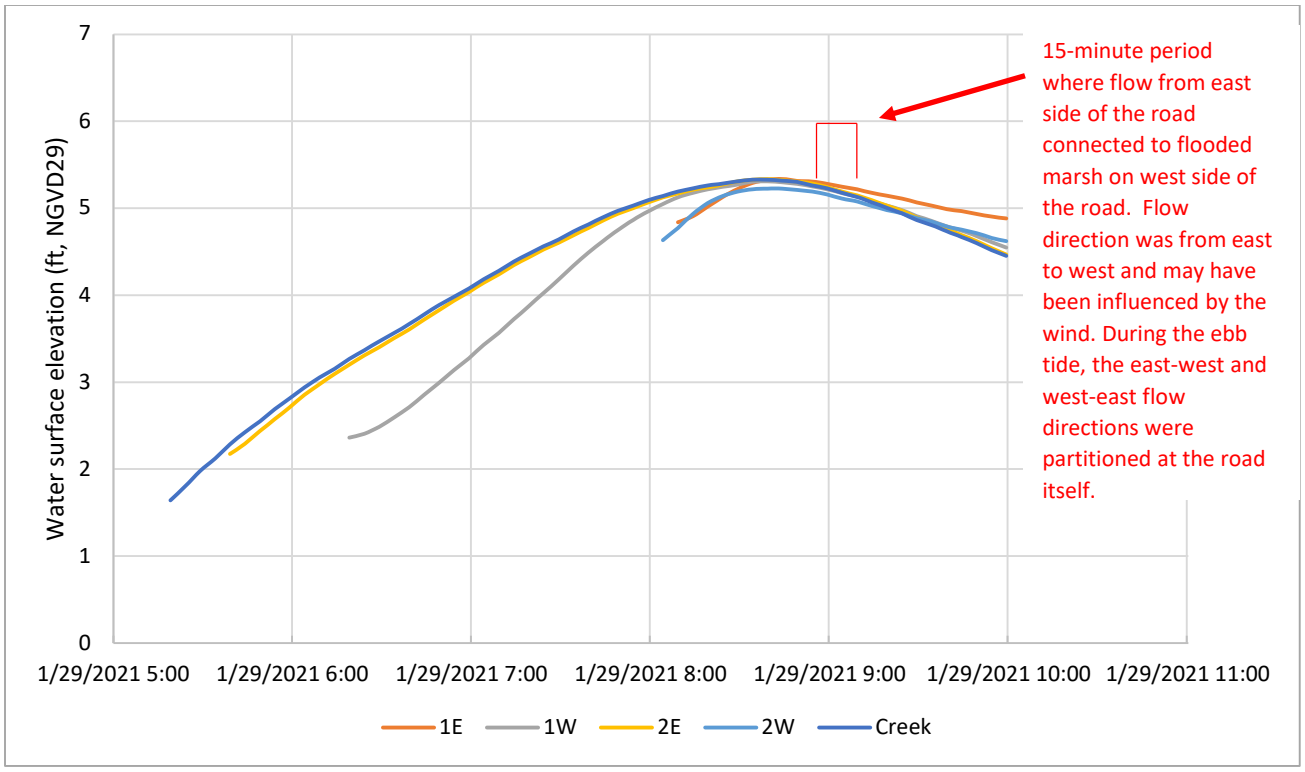


Figure 8. High tide observed and recorded at Well 1E, 1W, 2E, 2W and Creek during data collection on January 29th, 2021. Hydrological connectivity across the road was observed between approximately 8:45am and 9:00am.

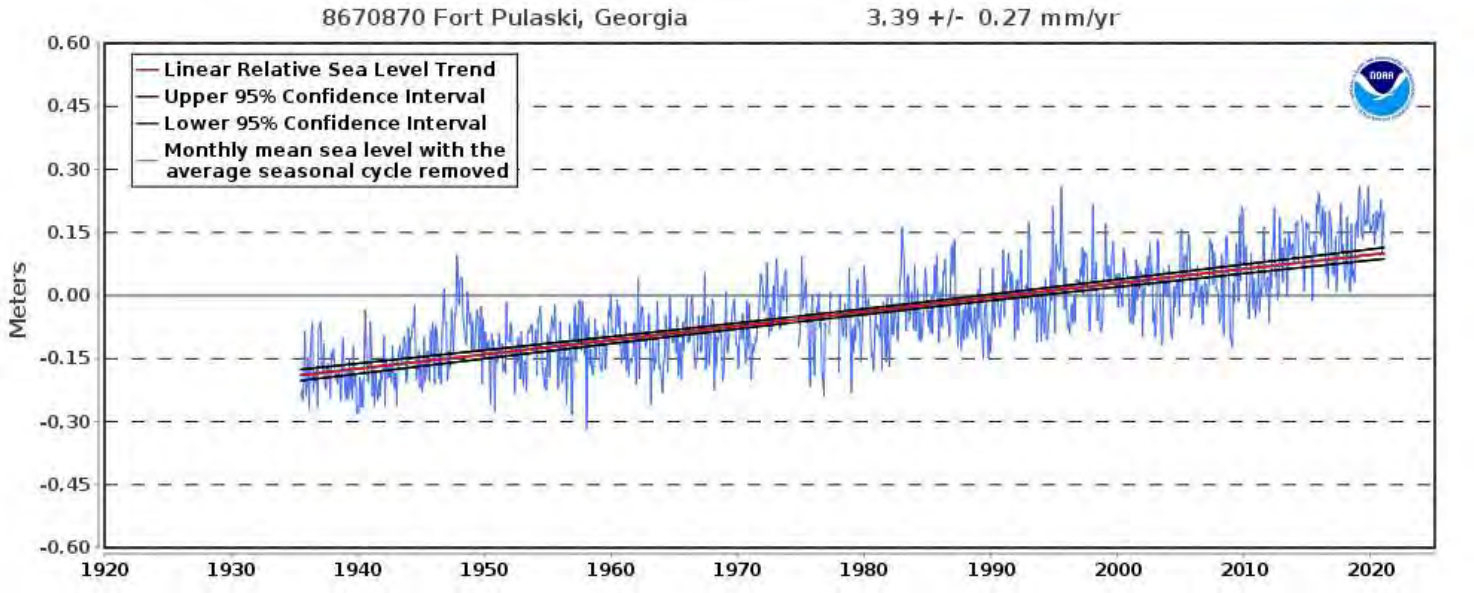


Figure 9. Mean monthly sea level without the regular seasonal fluctuations reported by NOAA at the Fort Pulaski, Georgia tide gage (Station ID 8670870). Average yearly sea level rise is 3.39 mm/year or 0.13 in/year.

APPENDIX A

Nutter & Associates
environmental consultants

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Athens, GA 30606-2152
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TECHNICAL MEMORANDUM NO. 13-079.01

PREPARED FOR:	Alton Brown Resource & Land Consultans	
PREPARED BY:	Cody Hale, Ph.D., PH Principal, Project Scientist	C. Todd Headley Staff Scientist
DATE:	June 9, 2014	
SUBJECT:	Hydrological and ecological assessment of proposed Polk Street maintenance project, City of Tybee Island, Georgia.	

CONTENTS

LIST OF FIGURES

1.0 INTRODUCTION

On behalf of the City of Tybee Island, Georgia, Nutter & Associates (NAI) staff conducted a hydrologic analysis to satisfy Item C within the request for additional information (RAI) (SAS-2012-00089) issued by the US Army Corps Engineers on June 25, 2013. The RAI was in reference to the proposed driveway maintenance project located at the southern end of Polk Street on Tybee Island, Georgia (Figure 1). The unpaved southern end of Polk Street south of Highway 80, also referred to as the driveway in this report, leads to a private hammock with two residences owned by Michael E. Leonard. The unpaved southern end of Polk Street south of Highway 80 serves as the primary driveway for both residences (Figure 1). The elevation of the driveway has decreased over time, allowing tidal waters to overtop it during high tides. The City of Tybee Island and Mr. Leonard have proposed a maintenance project to repair the driveway such that safe vehicular access is possible during most tide conditions.

The primary goal of this hydrologic analysis was to evaluate the project's potential to adversely impact salt marsh, Essential Fish Habitat, and the estuary in the vicinity of the driveway by changing or restricting water flow.

2.0 SITE DESCRIPTION

Chimney Creek forms a dendritic network of tidal channels that surround the periphery of the private hammock to the west, south, and east (Figure 1). The general assessment area for this analysis is defined as the marsh, upland, and developed area contained in the polygon bounded by US 80 on the north, Chimney Creek to the east and south, and the tidal creek that feeds the canal paralleling US 80 immediately north of the Leonard property to the west (Figure 1). The marsh area on the east side of the driveway is referred to as the Eastern Salt Marsh (ESM; Figure 2); likewise, the area to the west of the driveway is referred to as the Western Salt Marsh (WSM). A small, developed peninsula forms a divide between the eastern extent of the ESM and Chimney Creek except for a small area of connection to the south (Figure 2).

The marsh surrounding the proposed driveway maintenance project is a persistent emergent wetland habitat comprised of a mosaic of low and high salt marsh. Cowardin (1979) defines a persistent emergent wetland as a wetland "dominated by species that normally remain standing at least until the beginning of the next growing season." Mitsch and Gosselink (2000) define a low salt marsh as an "intertidal or lower marsh in salt marsh that is located in the intertidal zone and is flooded daily." A high marsh is defined as an "upper zone of a salt marsh that is flooded irregularly and generally is located between mean high water and extreme high water" (Mitsch and Gosselink, 2000). Low marsh habitat is predominant across the assessment area. However, a few higher elevation areas exist within the low marsh that are flooded irregularly and are considered high marsh. The ESM and WSM are mapped by the National Wetland Inventory (NWI) as areas of E2EM1P and E2EM1N habitat [Estuarine (E), Intertidal (2), Emergent (EM), Persistent (1), Irregularly Flooded (P), Regularly flooded (N)] (Figure 3). Chimney Creek is mapped as E1UBL habitat [Estuarine (E), Persistent (1), Unconsolidated Bottom (UB), Subtidal (L)] (Figure 3). Vegetation within the assessment area includes needlegrass rush (*Juncus roemerianus*), smooth cordgrass (*Spartina alterniflora*), and saltwort (*Salicornia* sp).

Salt marshes serve as a primary nursery ground for many fish and shellfish species. Other wildlife that depend on salt marshes and estuary for habitat include birds such as the great blue heron (*Ardea herodius*), bald eagles (*Haliaeetus leucocephalus*), clapper rails (*Rallus longirostris*), sparrows, and various ducks (Georgiawildlife.com).

3.0 METHODS

Five stilling wells were installed and instrumented with HOBO® water level sensors to continuously monitor tidal elevations at key locations on the project site (Figure 2). Two stilling wells (1E and 2E) were deployed within the ESM. A third stilling well (1W) was installed within a canal on the northwestern edge of the WSM. A fourth stilling well (2W) was installed within the WSM. The fifth stilling well (Creek) was installed on Chimney Creek at the southern end of the hammock (Figure 2). Water depths for five high tide and four low tide cycles were logged over a three day period.

A topographic survey of stilling well, salt marsh ground surface, water surface, and driveway elevations was completed using a Topcon Total Station®. The surveyed points were corrected to LiDAR-derived elevations to transform recorded water levels to true water surface elevations. Visual observations of water dynamics over the driveway and in the adjacent salt marsh areas were observed during periods of high and low tide. Daily tidal data from the Fort Pulaski tidal gauge (Gauge 8670870) was downloaded from the National Oceanic and Atmospheric Administration website (NOAA; www.noaa.gov) to characterize the range of tidal amplitudes that occurred before, during, and following hydrologic data collection on the project site.

4.0 HYDROLOGY

Water level data for five high tide and four low tide cycles were recorded over a three day period beginning on March 3, 2014 at 15:00 and ending at 05:00 on March 6, 2014. This measurement period occurred between two spring high tides, which occurred on March 1 and 17, 2014, respectively (Figure 4). The Higher High (HH) tidal elevation ranged from 1.932 feet to 5.721 feet from January 1, 2013 to March 31, 2014 (Figure 5). During the period that water level data was collected on the project site (March 3-6, 2014), the HH ranged between 4.527 feet and 5.134 feet, indicating that above average high tide elevations were present (Figure 5).

The hydrology of the ESM prior to the construction of the driveway appears to have been fed by overland flooding produced from the marsh flats to the west of the driveway and from a tidal channel located in the southern extent of the ESM (but east of the private hammock and the driveway). This tidal channel has a direct connection to Chimney Creek and, as it flows north from well 2E to 1E, branches into numerous small, flow paths that distribute tidal waters to the upper extent of the ESM (Figure 6). Under current conditions, and for the past 60 years, the primary source of hydrology for the ESM is from the tidal channel that enters at the southern extent of the area (see hydrologic signature in Figure 6).

The WSM is inundated from the south and west via Chimney Creek and associated tributaries during high tides (Figure 6). A dredged and hydrologically connected tidal channel is located north of, and directly adjacent to, a private driveway that intersects the southern end of Polk Street (Mr. Leonard's driveway) from the west (Figure 6).

4.1 Monitoring Results

Hydrographs of tidal data from stilling wells 1W, 1E, 2W, 2E, and Creek show that tidal waters inundate the WSM and ESM on either side of the proposed driveway maintenance project nearly simultaneously via the various Chimney Creek tributaries during high tide (Figure 7). Field observations of the rising limb and peak of a high tide cycle on March 7, 2014 revealed that tidal waters inundate the ESM and WSM independently of one another, eventually overtopping the south end of Polk Street from the southeast. The water flooding the driveway flowed northward in a tidal channel paralleling the driveway on the east until the driveway was completely inundated. No significant flow was observed crossing the driveway from west to east, or visa versa, during rising and receding tides; however, water did drain to the south, west and east during the receding tide (Figure 6 – current driveway flow conditions). On average, tidal waters inundate the southern end of Polk Street for approximately five to seven hours per day (i.e., cumulatively over both tide cycles).

Stilling well 1E exhibited a slight temporal lag (17 minutes) in reaching the hydrologic peak of high tide on March 5, 2014 relative to stilling wells 1W, 2W, 2E, and Creek (Figure 8). The maximum temporal lag in reaching the hydrologic peak at 1E coincided with the lowest high tide elevation of the data collection period (Figure 8); however, all stilling wells reached the tidal peak simultaneously and there was no temporal lag at 1E during the highest tide event (Figures 9 and 10). An analysis of lag at 1E as a function of tide height confirmed that as the high tide elevation increased, the temporal lag at 1E decreased (Figure 10). This trend is strongly indicative of hydraulic roughness decreasing with increases in water depth.

Stilling well 1E had the second highest ground elevation (2.132 ft) of all stilling wells based on LiDAR corrected survey data (2W was the highest at 2.302 ft). Additionally, the ESM area in the vicinity of 1E had the densest vegetation based on general site observations (no vegetation measurements were made), resulting in a higher roughness factor. Roughness decreases the inundation and recession rates of rising and receding tidal waters. As previously mentioned, the hydrology supplied to the northern portion of the ESM flows through a diffuse network of small flow paths. When the flow paths are overtopped by the rising tide, the ESM surrounding 1E fills with water relatively quickly. The slightly higher elevation at 1E combined with increased roughness from dense vegetation results in the temporal lag during lower elevation high tides.

4.2 Hydrologic Effects of Proposed Driveway Project

Based on the hydrologic data, interpretation of aerial photography and LiDAR maps, and field observations, repairing the existing driveway to accommodate vehicular travel would not have an appreciable effect on the hydrologic regime of the adjacent ESM and WSM. The volume of water that the driveway would displace following repair, assuming a 520 foot driveway that is 11 feet wide, would be 9,098 cubic feet during a higher than average high tide event as was observed during the data collection period. The percentage of water that the driveway would

displace during high tide relative to the combined volume of water in the ESM and WSM at high tide is 0.42 percent. Though high tide waters currently overtop the driveway, the volume of water moving from the WSM to the ESM during the peak of high tide is minimal and rather insignificant relative to the volume of tidal waters inundating the marshes from the west, south and east via Chimney Creek. If the driveway is built up as proposed, tidal waters will continue to inundate the WSM and ESM with no significant changes in the duration, frequency, height, and volume of tidal waters reaching the ESM and WSM.

5.0 ECOLOGICAL CONSIDERATIONS

5.1 General Ecological Community

Native flora and fauna species characteristic of the marsh habitats located in the vicinity of the project rely on, and are adapted to, the natural hydrologic and water quality variability caused by the semidiurnal tides observed along the Georgia coast. Tidal marshes provide important ecological functions, such as providing nursery and feeding habitats for terrestrial and aquatic fauna, providing water quality functions, such as carbon export and nutrient and contaminant sequestration, and providing attenuation of high water events. Based upon the results of the hydrologic analysis, which indicate that the ESM and WSM flood independently and that the driveway maintenance will not block or divert tidal flows, it is anticipated that the existing hydrologic conditions of the entire marsh will be maintained and thus the driveway improvement will not affect the ecological function of the ESM or WSM.

5.2 Essential Fish Habitat and Passage

The southern extent of the ESM and WSM, and portions of Chimney Creek are mapped as Essential Fish Habitat by the National Oceanic and Atmospheric Administration (NOAA) Essential Fish Habitat Mapper (habitat.NOAA.gov). Though Essential Fish Habitat is mapped within close proximity to the project area, fish usage in the ESM and WSM immediately adjacent to the driveway is likely minimal due to elevation and typical water depths under normal tidal conditions. However, if fish are present, access to possible spawning habitat and nursery grounds within the ESM and WSM adjacent to the driveway should not be adversely impacted. Ecological connection between the ESM and Chimney Creek will be maintained through the existing flow path that parallels the eastern side of the driveway, and habitat isolation will not occur if the proposed driveway maintenance is completed.

6.0 NECESSITY OF CULVERTS

Culverts are closed conduits used to convey water from one area to another, typically from one side of a road to the other side (CPYWMA, 2000). Bottomless culverts, which have a natural surface bottom, are beneficial in situations where fish and wildlife passage may be negatively impacted by a road crossing (CPYWMA, 2000). Installation of a series of 18-inch culverts, or a single bottomless culvert within the driveway has been considered so that tidal waters, fish, and other wildlife will be able to move freely from the WSM to the ESM, and visa versa, during high tides.

Culverts can certainly be beneficial in linear habitats such as stream settings where habitat isolation and fragmentation from road construction is likely. However, installing a bottomless culvert or a series of 18-inch culverts to maintain hydrological and ecological connections between the ESM and WSM would provide very little, if any benefit since both marsh areas are inundated independently of one another during high tides via Chimney Creek's tributaries. If the driveway is filled to an elevation that would not be inundated during high tides, tidal waters will continue to reach the ESM and WSM with no significant change in the volume of water, quality of water, or timing of tidal inundation.

Maintenance issues associated with culverts must also be considered. Possible maintenance issues include obstruction of the culvert(s) with debris and scouring at the entry and exit points of the culvert(s) due to higher water velocities moving through the culverts during rising and receding tides. Additionally, installation of culverts, if falling under the requirements of the Georgia Department of Transportation (GDOT) guidelines, may require building up the driveway to a significantly higher elevation than would be necessary if no culverts were installed. The GDOT requires that roads not designated as state routes must have a minimum of 2 feet of freeboard (vertical clearance between the ceiling of the culvert and flood stage elevation) above the mean spring high tide elevation (GDOT, 2008). Correspondingly, as the elevation of the driveway is increased, the width of the driveway must be increased as well, resulting in the addition of unnecessary fill to the adjacent salt marshes.

7.0 CONCLUSIONS

Based on the findings of the study:

- Hydrological and ecological connectivity between the ESM and WSM will not be adversely impacted since tidal waters inundate the ESM and WSM independently of each other during high tides via Chimney Creek's numerous surrounding tributaries.

- The duration, frequency, height, and volume of tidal water reaching the ESM and WSM during high tide will remain the same if the driveway is filled as proposed.

- Essential Fish Habitat will not be impacted as a result of filling the driveway since fish or other aquatic species will continue to have access to nursery habitat and feeding grounds in the ESM and WSM during high tides as they have in the past.

- Culverts are not necessary for the conveyance of tidal waters to the ESM or WSM and may also result in maintenance issues.

- Installation of culverts would also require raising the elevation of the driveway, which in turn would require that the driveway be widened, resulting in unnecessary fill within the eastern and western salt marshes.

8.0 REFERENCES

Choctawhatchee, Pea, and Yellow Rivers Watershed Management Authority (CPYWMA). (2000). Chapter 3. Culverts. Recommended Practices Manual. A Guideline for Maintenance and Service of Unpaved Roads

Cowardin, L. M., & Golet, F. C. (1995). US Fish and Wildlife Service 1979 Wetland Classification: A review. Vegetation, 118(1-2), 139-152.

Georgia Department of Transportation (2008). Chapter 14. Bridge Hydraulic Design Criteria. Manual On Drainage Design For Highways

Mitsch, W. J., & Gosselink, J. G. (2000). Chapter 9. Tidal Salt Marshes. Wetlands (3rd ed.,). : John Wiley & Sons, Inc.

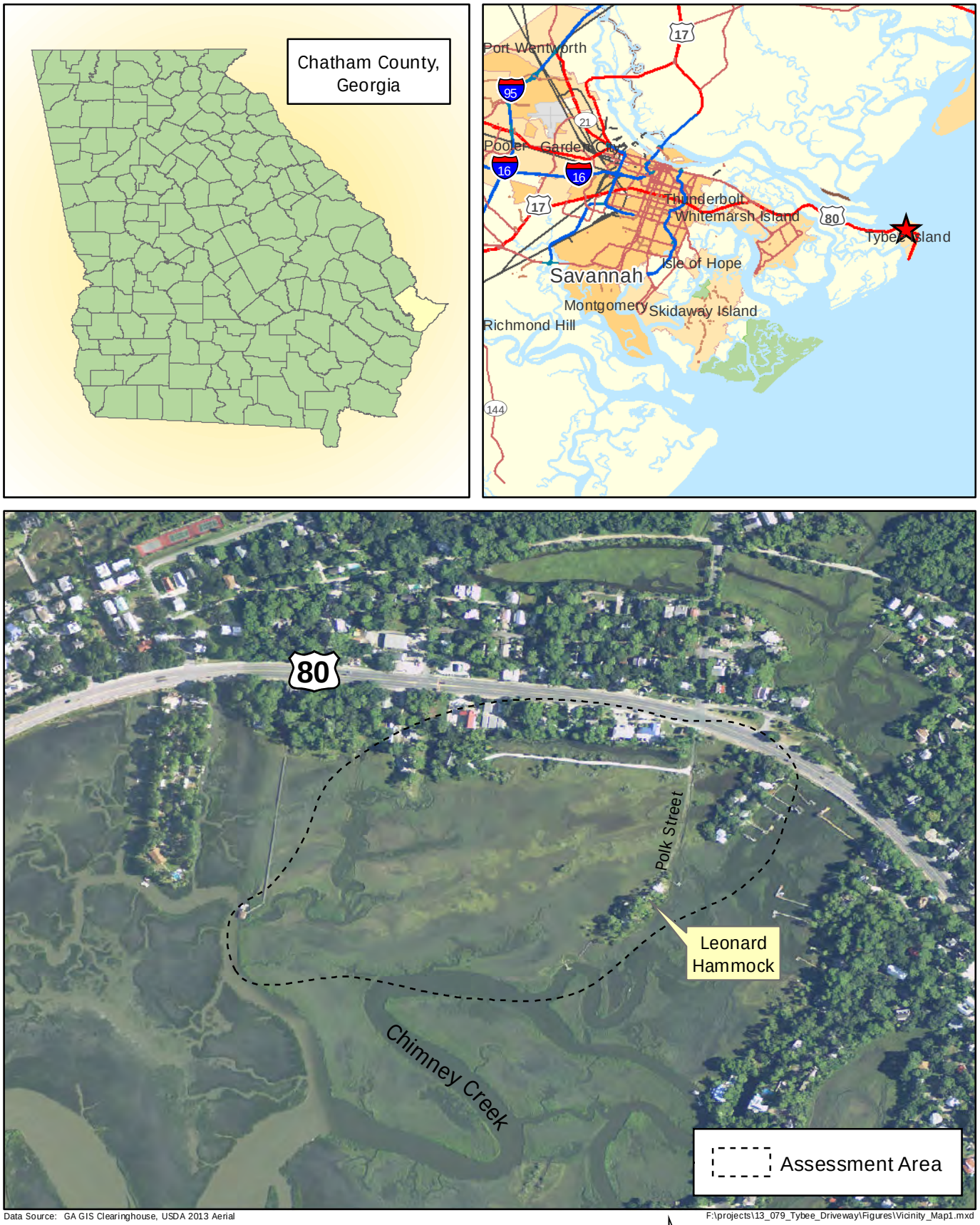

Figure 1. Vicinity map of proposed driveway maintenance project, Tybee Island, GA.

Nutter & Associates
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Figure 2. Stilling well locations and Eastern and Western Salt Marsh boundaries within the vicinity of the proposed driveway maintenance project.

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environmental consultants

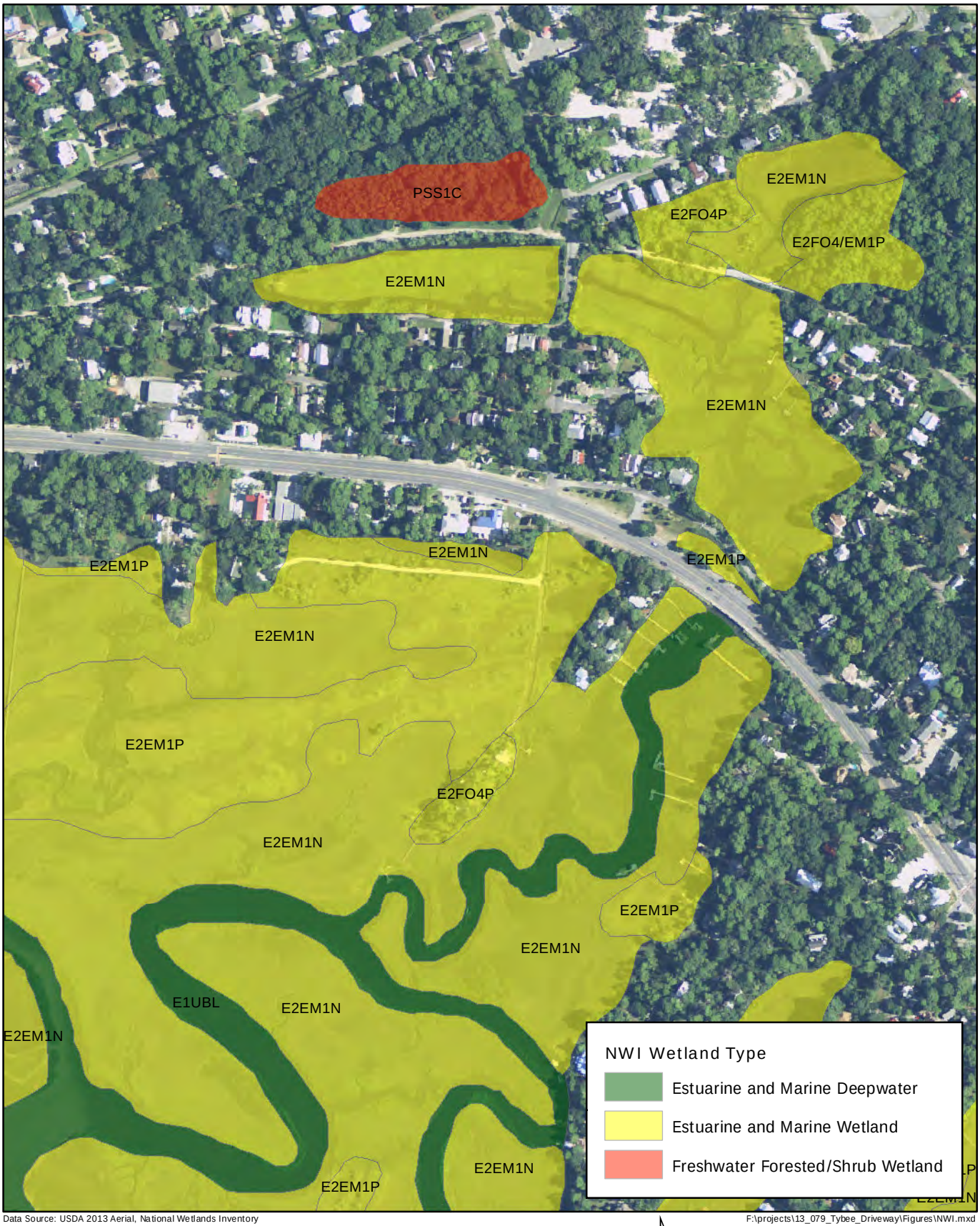

Figure 3. Coastal habitats mapped by the National Wetland Inventory within the vicinity of the proposed driveway maintenance project, Tybee Island, Georgia.

Nutter & Associates
environmental consultants

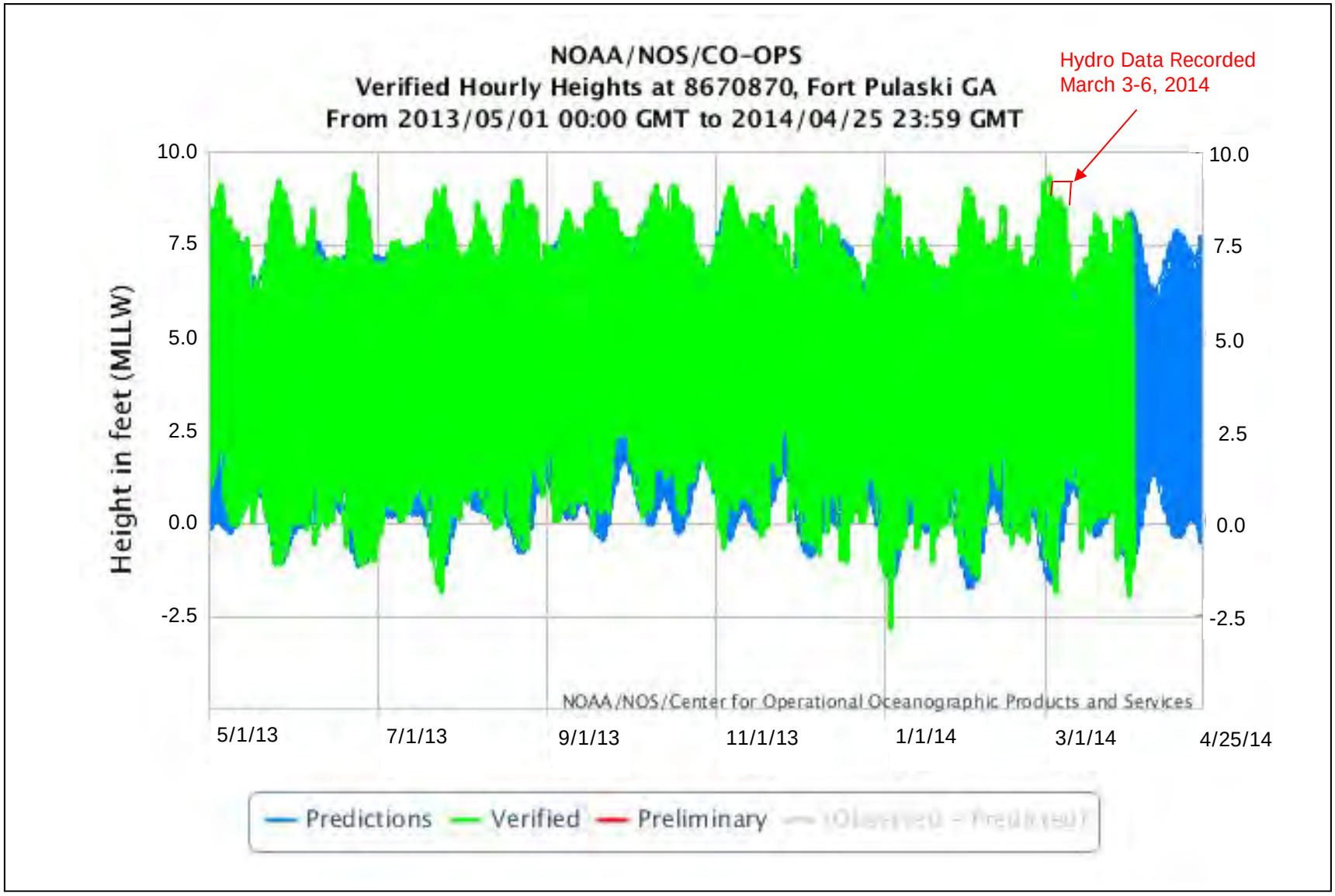

Figure 4. Daily tidal data measured at Fort Pulaski, GA (gage 8670870) from May 1, 2013 to April 25, 2014.

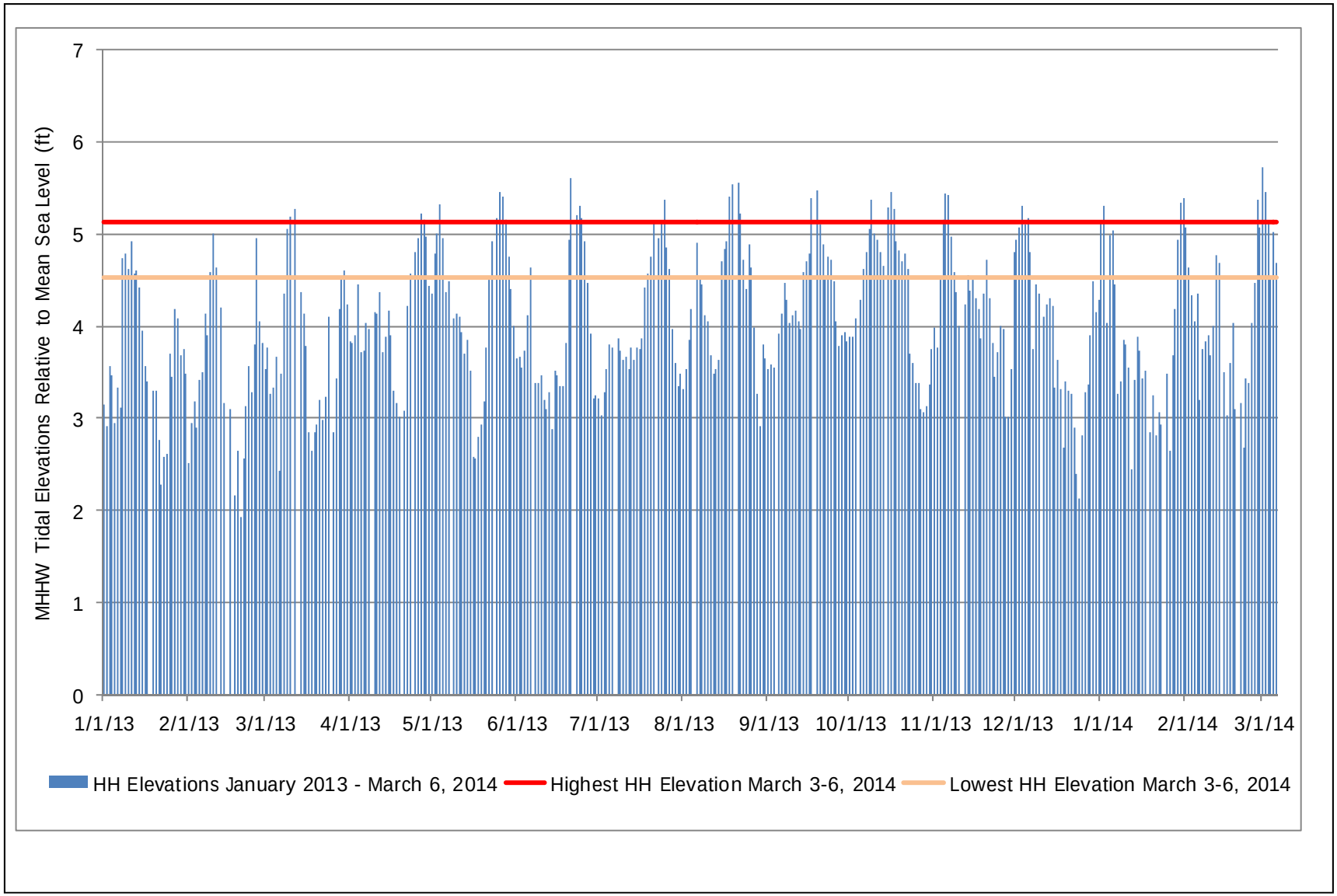

Figure 5. Upper and lower bounds of higher high (HH) tides measured at Fort Pulaski, GA (gage 8670870) during data collection period (March 3-6, 2014) relative to daily higher high tide elevations measured over the 14-month period from January 1, 2013 to March 6, 2014.

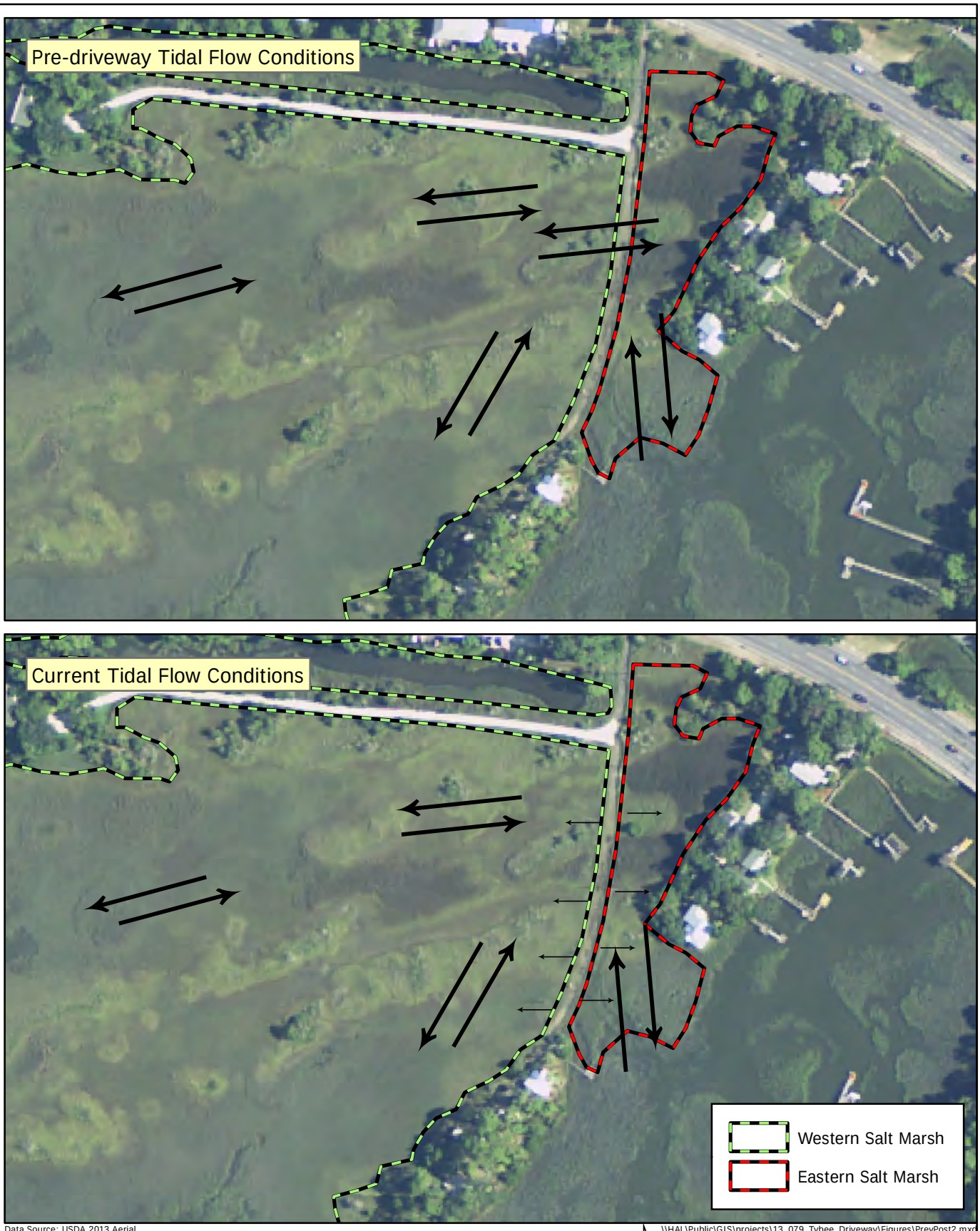

Figure 6. Pre- and post- driveway tidal flow conditions.

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environmental consultants

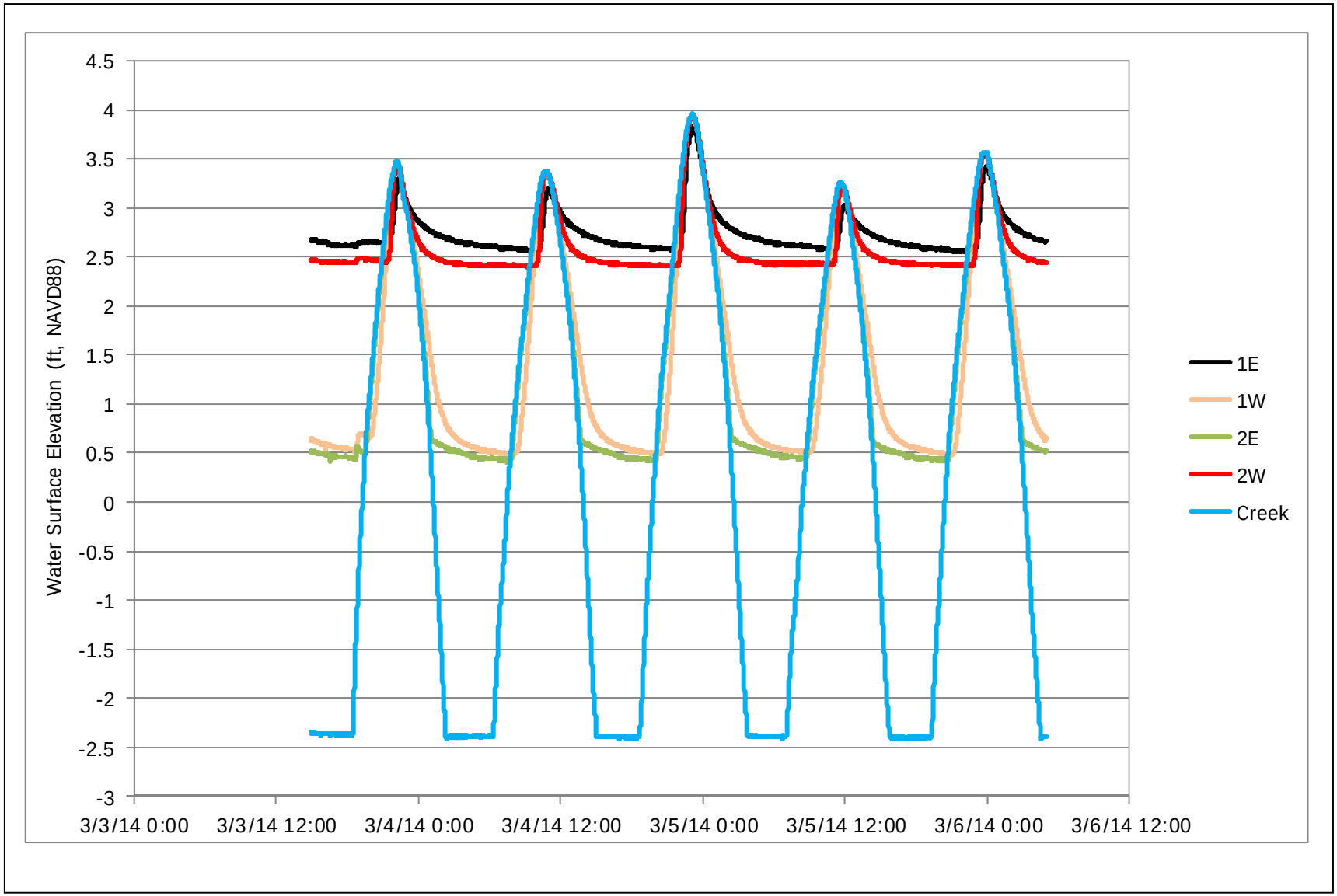


Figure 7. Water surface elevations recorded at stage recorders 1E, 1W, 2E, 2W, and Creek from March 3-6, 2014.

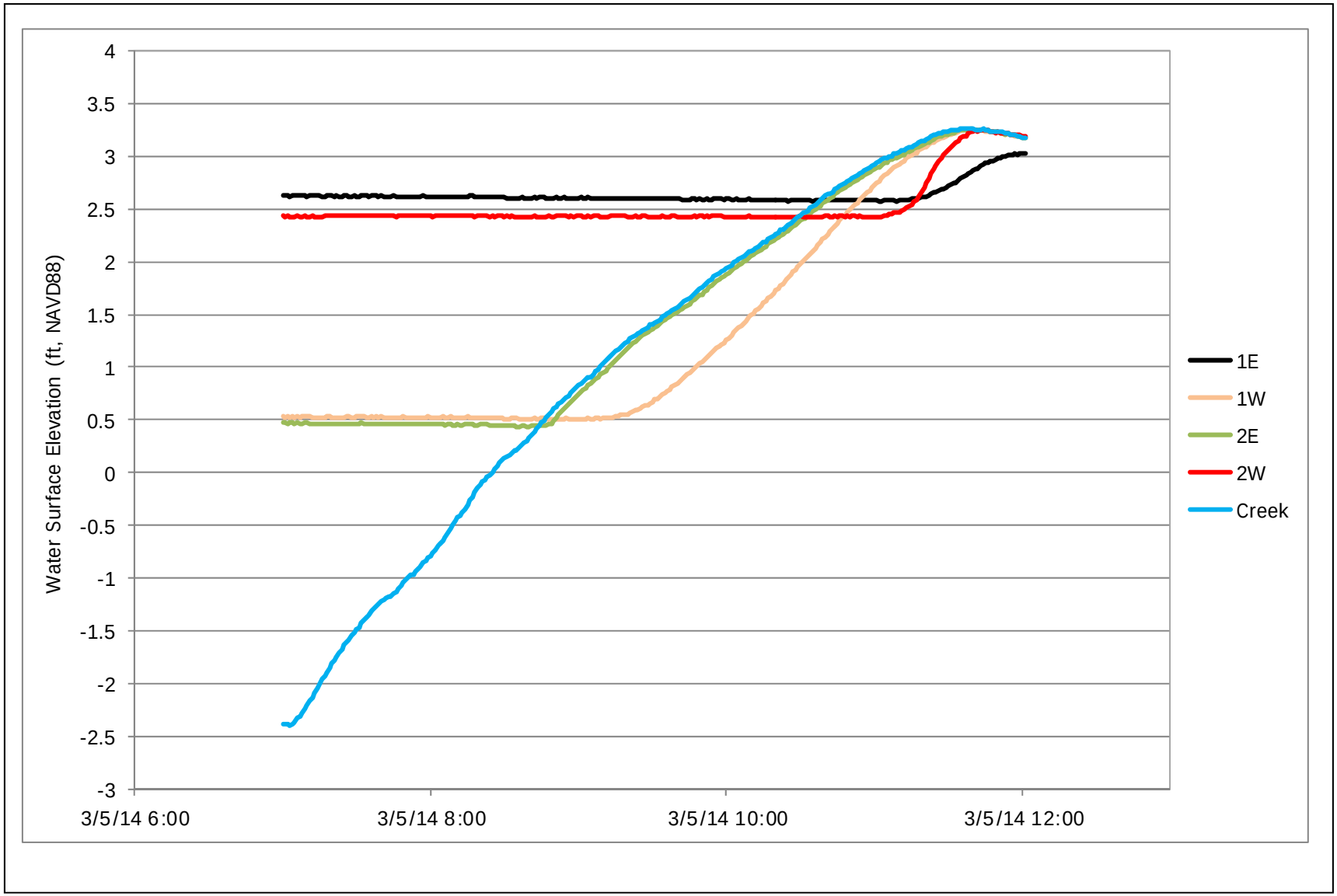


Figure 8. Water surface elevations recorded during the rising limb and peak of the lowest high tide event at stage recorders 1E, 1W, 2E, 2W, and Creek.

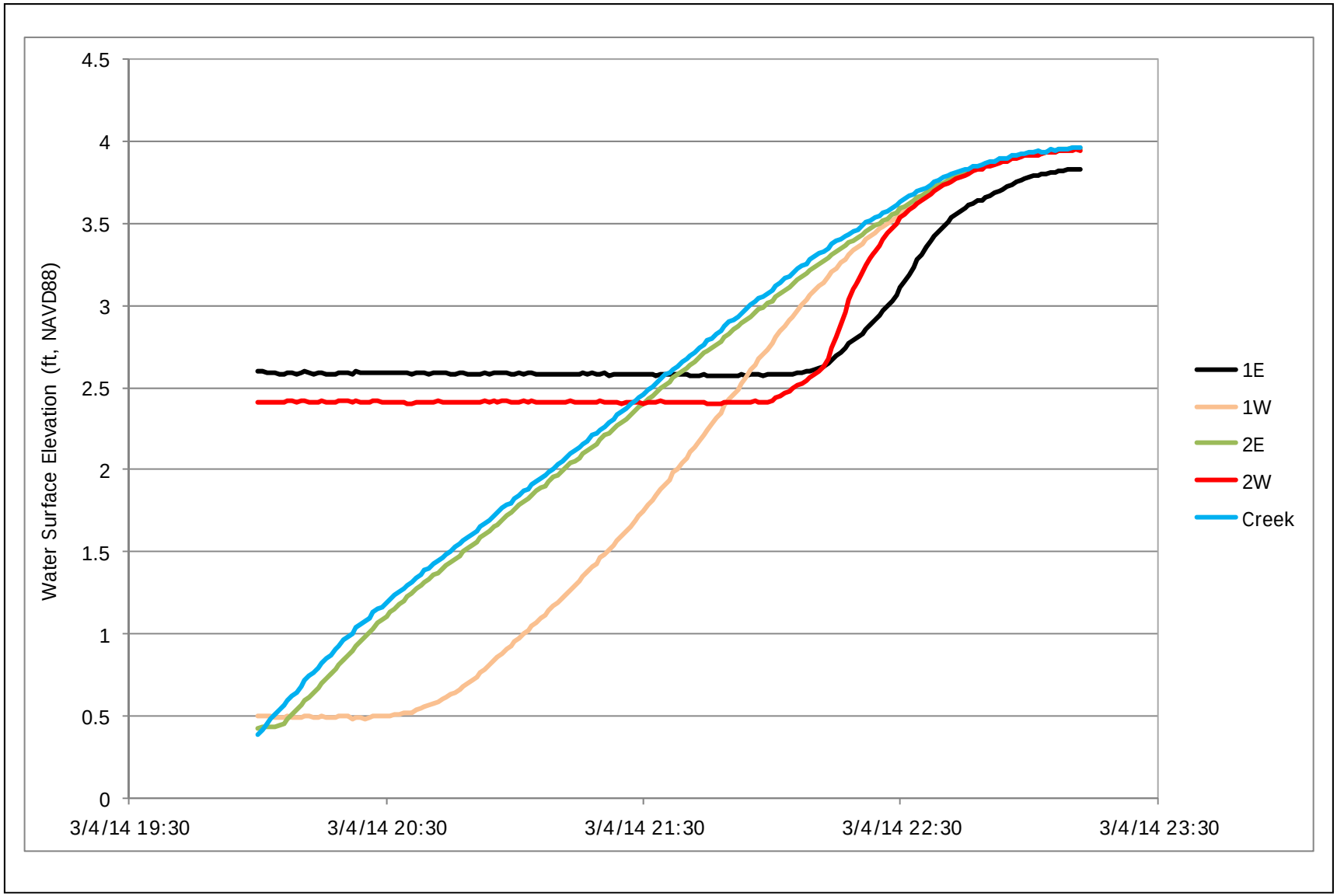


Figure 9. Water surface elevations recorded during the rising limb to peak of the highest tide at stage recorders 1E, 1W, 2E, 2W.

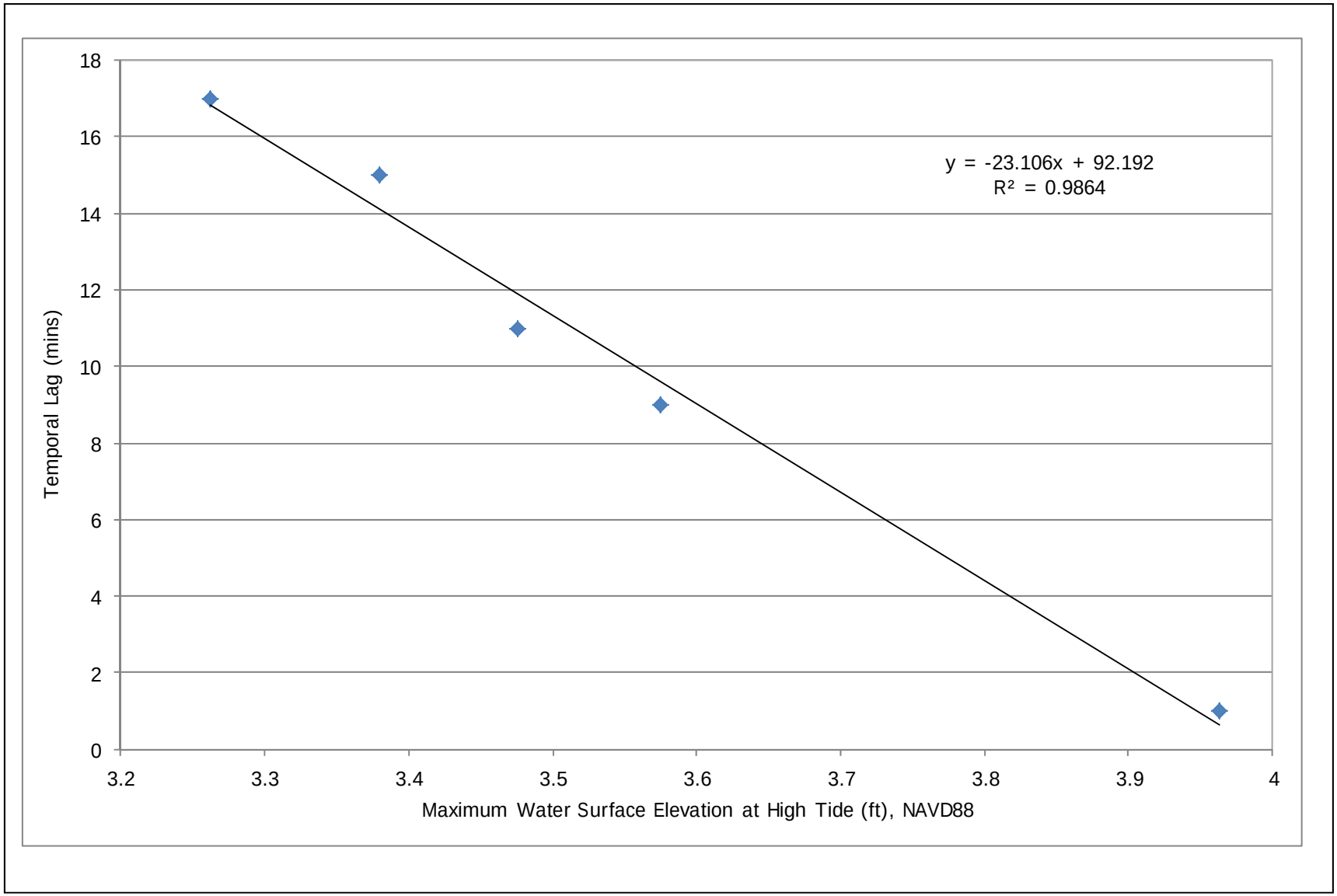
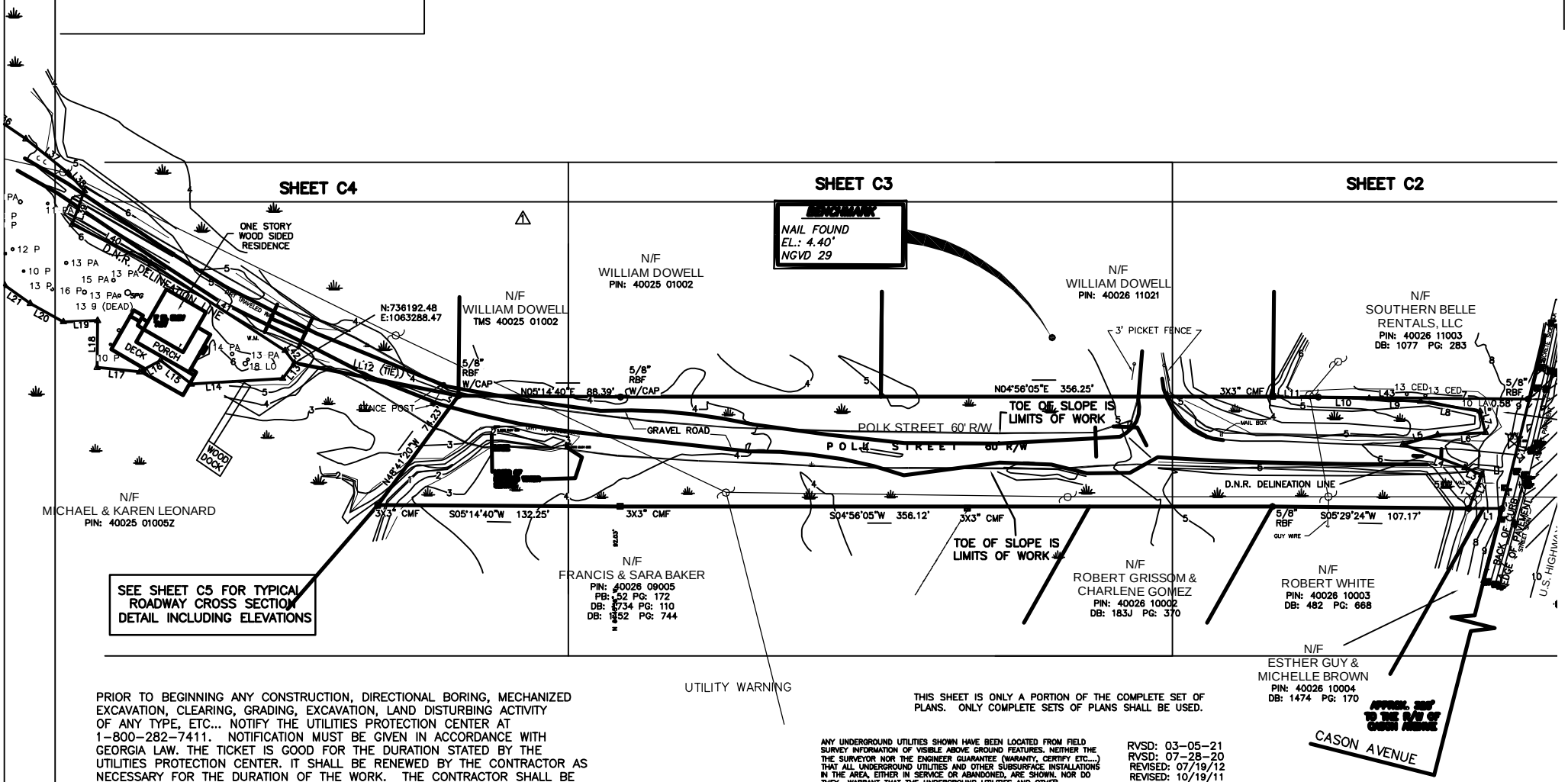


Figure 10. Temporal lag of high tide at 1E relative to Creek as a function of maximum tide elevation.

ATTACHMENT C

Revised Permit Drawings

GA GRID (NAD 83) NORTH
EAST ZONE



SEE SHEET C5 FOR TYPICAL ROADWAY CROSS SECTION DETAIL INCLUDING ELEVATIONS

PRIOR TO BEGINNING ANY CONSTRUCTION, DIRECTIONAL BORING, MECHANIZED EXCAVATION, CLEARING, GRADING, EXCAVATION, LAND DISTURBING ACTIVITY OF ANY TYPE, ETC... NOTIFY THE UTILITIES PROTECTION CENTER AT 1-800-282-7411. NOTIFICATION MUST BE GIVEN IN ACCORDANCE WITH GEORGIA LAW. THE TICKET IS GOOD FOR THE DURATION STATED BY THE UTILITIES PROTECTION CENTER. IT SHALL BE RENEWED BY THE CONTRACTOR AS NECESSARY FOR THE DURATION OF THE WORK. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING WITH UTILITY COMPANIES FOR FIELD LOCATIONS OF UTILITIES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTION OF UTILITIES DURING CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLIANCE WITH THE "HIGH VOLTAGE SAFETY ACT" WHICH GOVERNS ACTIVITIES NEAR HIGH VOLTAGE POWER LINES. THE NOTIFICATION PROCEDURE SHALL BE THE SAME AS STATED ABOVE. IN THE EVENT OF DAMAGE, THE CONTRACTOR SHALL CONTACT BOTH THE UPC AND THE AFFECTED UTILITES. ALL NON-EMERGENCY WORK SHALL BE HALTED IMMEDIATELY UNTIL THE DAMAGE IS REPAIRED TO THE SATISFACTION OF THE UTILITY OWNER AND ALL OTHER GOVERNING AUTHORITIES.

NO WORK SHALL BE DONE IN THE POLK STREET SOUTH R.O.W. WITHOUT ALL REQUIRED APPROVALS AND PERMITS OF ALL GOVERNING AGENCIES, AUTHORITIES, BODIES, ETC... INCLUDING BUT NOT LIMITED TO THE CITY OF TYBEE, CHATHAM COUNTY, ETC...

UTILITY WARNING

THIS SHEET IS ONLY A PORTION OF THE COMPLETE SET OF PLANS. ONLY COMPLETE SETS OF PLANS SHALL BE USED.

ANY UNDERGROUND UTILITIES SHOWN HAVE BEEN LOCATED FROM FIELD SURVEY INFORMATION OF VISIBLE ABOVE GROUND FEATURES. NEITHER THE THE SURVEYOR NOR THE ENGINEER GUARANTEE (WARANTY, CERTIFY ETC....) THAT ALL UNDERGROUND UTILITIES AND OTHER SUBSURFACE INSTALLATIONS IN THE AREA, EITHER IN SERVICE OR ABANDONED, ARE SHOWN. NOR DO THEY WARRANT THAT THE UNDERGROUND UTILITIES AND OTHER SUBSURFACE IMPROVEMENTS SHOWN ARE IN THE EXACT LOCATION INDICATED. THE SURVEYOR HAS MADE NO ATTEMPT TO LOCATE OR SHOW ELECTRIC, GAS TELEPHONE, CABLE OR OTHER UTILITES OTHER THAN WATER, DRAINAGE AND SEWER.

RVSD: 03-05-21
RVSD: 07-28-20
REVISED: 07/19/12
REVISED: 10/19/11

CALL BEFORE YOU DIG

1-800-282-7411
OR 811

0' 40' 80'
GRAPHIC SCALE

GEORGIA REGISTERED No. 14912 PROFESSIONAL ENGINEER CONNER K. DAVIS

POLK STREET SOUTH MAINTENANCE

KEY MAP

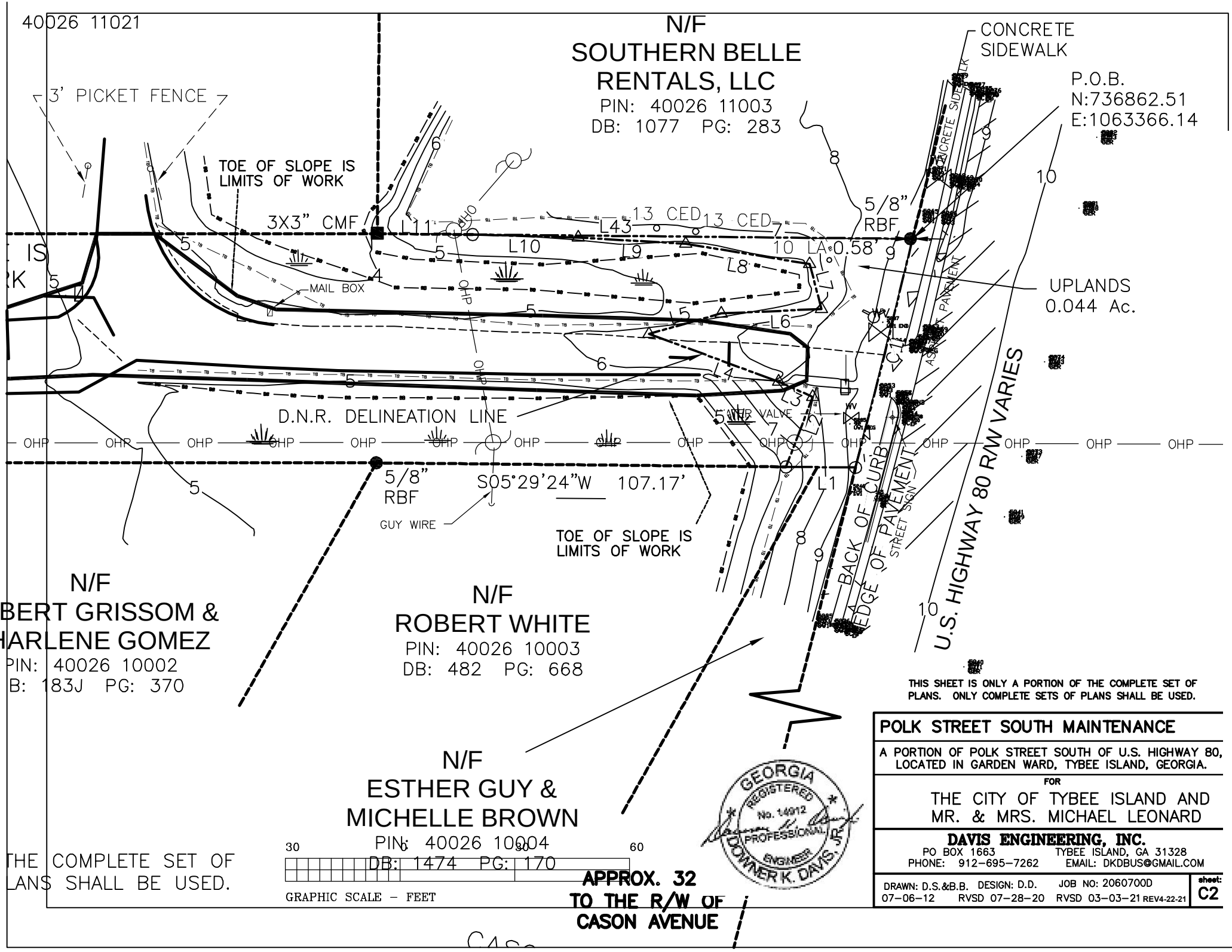
A PORTION OF POLK STREET SOUTH OF U.S. HIGHWAY 80, LOCATED IN GARDEN WARD, TYBEE ISLAND, GEORGIA.

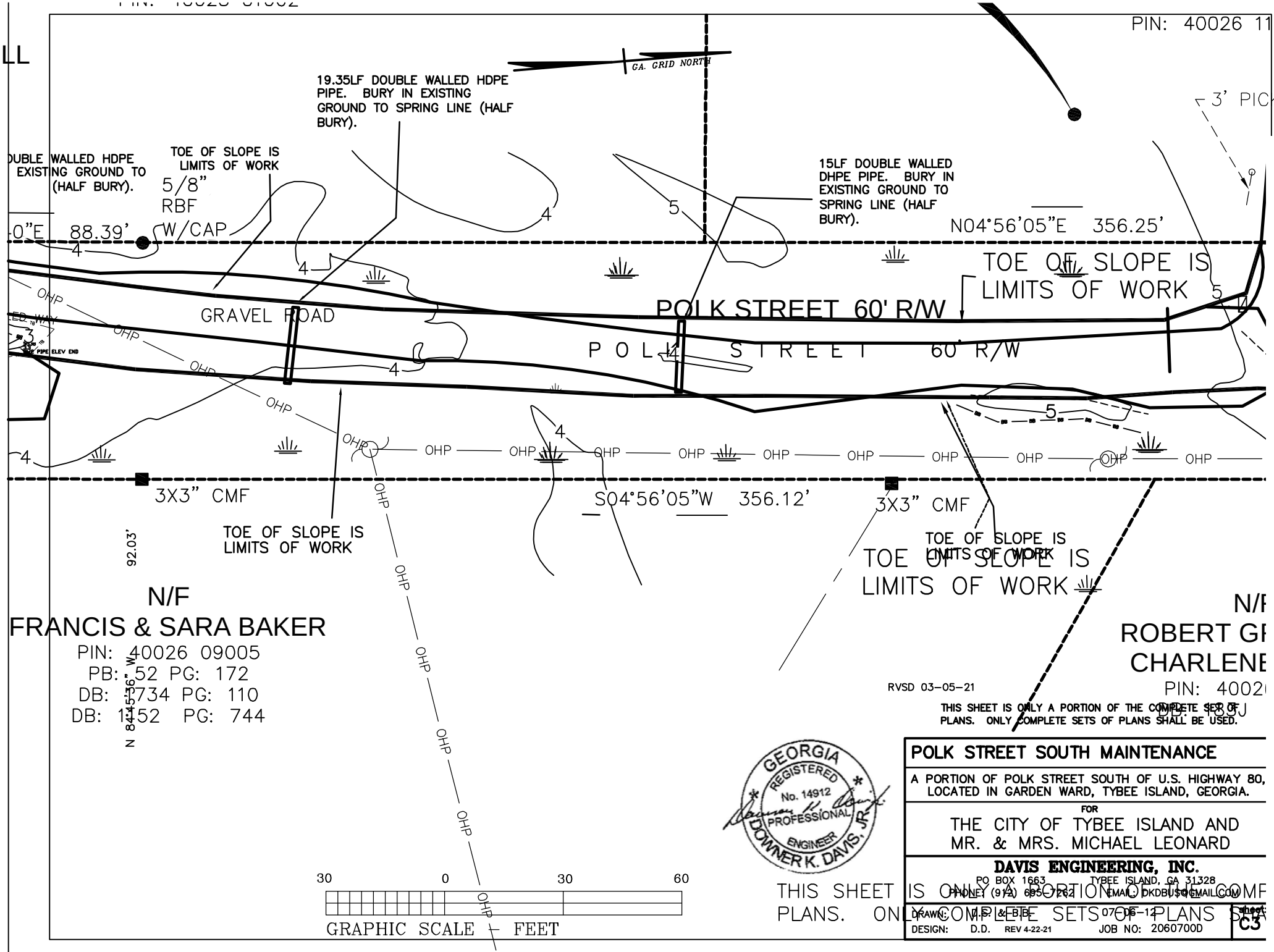
FOR

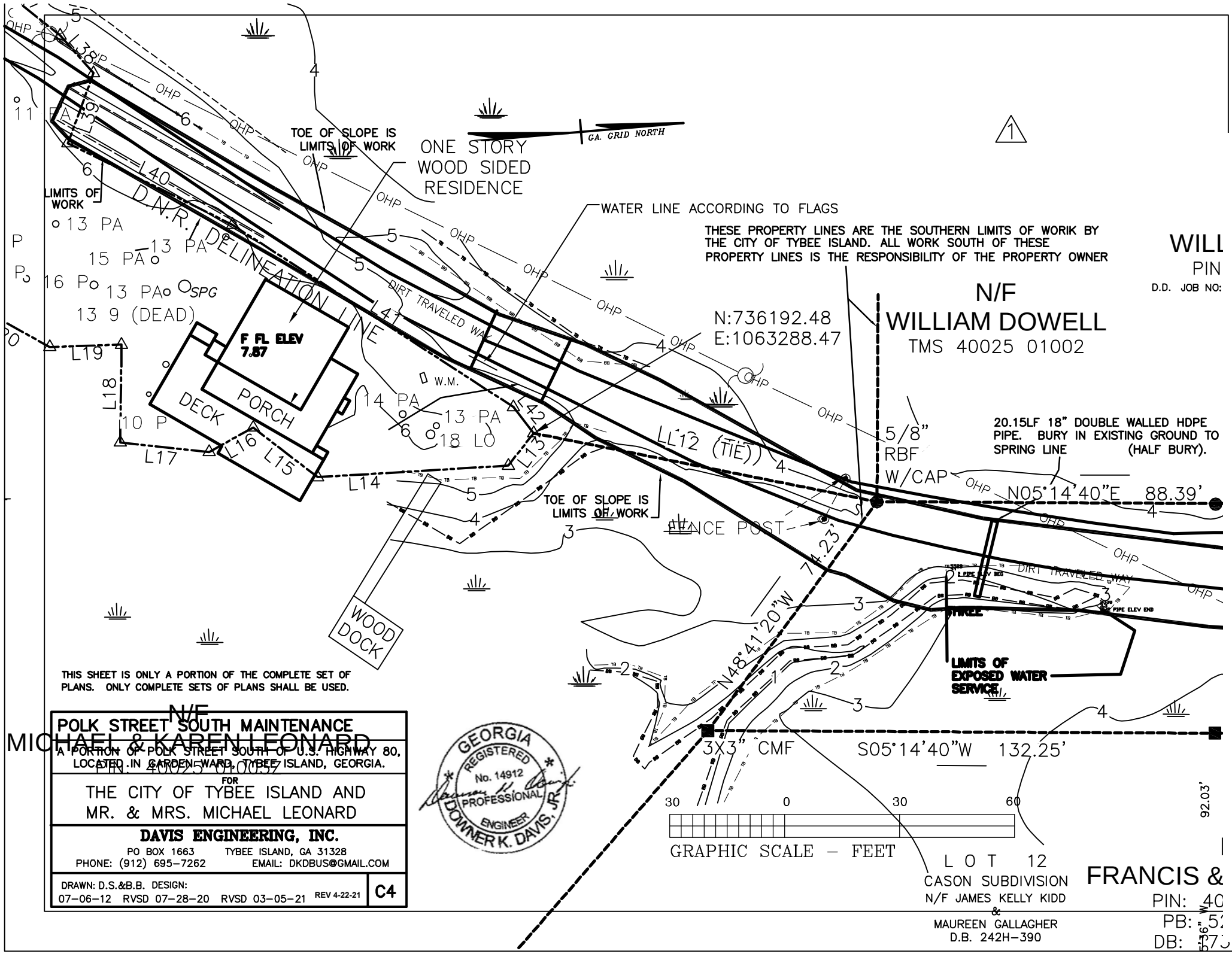
THE CITY OF TYBEE ISLAND &
MR. & MRS. MICHAEL LEONARD

DAVIS ENGINEERING, INC.
PO BOX 1663 TYBEE ISLAND, GA 31328
PHONE: 912-695-7262 E-MAIL: DKDBUS@GMAIL.COM

DRAWN: D.S&B.B. DESIGN: D.D. JOB NO: 2060700D
DATE: 07-06-12 REV 4-22-21
sheet: C1







THIS SHEET IS ONLY A PORTION OF THE COMPLETE SET OF PLANS. ONLY COMPLETE SETS OF PLANS SHALL BE USED.

POLK STREET SOUTH MAINTENANCE

A PORTION OF POLK STREET SOUTH OF U.S. HIGHWAY 80, LOCATED IN GARDEN WARD, TYBEE ISLAND, GEORGIA.

FOR

THE CITY OF TYBEE ISLAND AND
MR. & MRS. MICHAEL LEONARD

DAVIS ENGINEERING, INC.

PO BOX 1663 TYBEE ISLAND, GA 31328
PHONE: (912) 695–7262 EMAIL: DKDBUS@GMAIL.COM

DRAWN: D.S.&B.B. DESIGN:
07–06–12 RVSD 07–28–20 RVSD 03–05–21 REV 4-22-21

C4

GEORGIA REGISTERED No. 14912 PROFESSIONAL ENGINEER DOWNER K. DAVIS, JR.

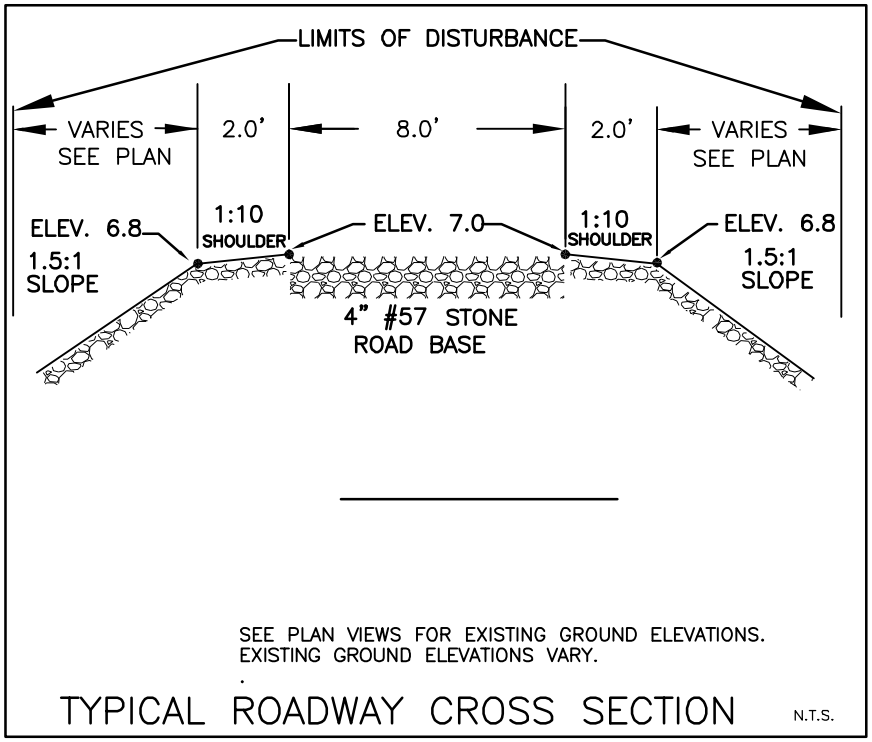
Existing & Proposed Roadway Length			
Property Owner	CMPA Jurisdiction (lf)	Upland (lf)	Total (lf)
Leonard	231	5	236
City of Tybee	22	542	664
		Total	**900**

Existing Roadway Area			
Property Owner	CMPA Jurisdiction (ac)	Upland (ac)	Total (ac)
Leonard	0.047	0.001	0.048
City of Tybee	0.171	0.005	0.176
		Total	**0.224**

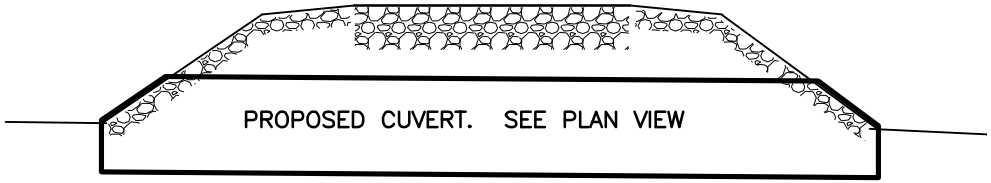
Proposed Roadway Area			
Property Owner	CMPA Jurisdiction (ac)	Upland (ac)	Total (ac)
Leonard	0.095	0.002	0.097
City of Tybee	0.26	0.011	0.271
		Total	**0.368**

Proposed Roadway Fill			
Property Owner	CMPA Jurisdiction (cy)	Upland (cy)	Total (cy)
Leonard	120	1	121
City of Tybee	6	790	796
		Total	**917**

Proposed CMPA Impacts	
Property Owner	CMPA Jurisdiction (ac)
Leonard	0.095
City of Tybee	0.26
Total	**0.355**



TYPICAL ROADWAY CROSS SECTION N.T.S.



THIS SHEET IS ONLY A PORTION OF THE COMPLETE SET OF PLANS. ONLY COMPLETE SETS OF PLANS SHALL BE USED.

GEORGIA REGISTERED No. 14912 PROFESSIONAL ENGINEER DOWNER K. DAVIS, JR.

DETAILS

A PORTION OF POLK STREET SOUTH OF U.S. HIGHWAY 80, LOCATED IN GARDEN WARD, TYBEE ISLAND, GEORGIA.

FOR

THE CITY OF TYBEE ISLAND AND MR. & MRS. MICHAEL LEONARD

DAVIS ENGINEERING, INC.
PO BOX 1663 TYBEE ISLAND, GA 31328
PHONE: (912) 695-7262 EMAIL: DKDBUS@GMAIL.COM

DRAWN: D.S. & B.B. 07-06-12 REV 4-22-21
DESIGN: D.D. JOB NO: 206070D
sheet: C5

GENERAL NOTES

1. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE REQUIREMENTS OF ALL GOVERNING REGULATORY AGENCIES AND CODES. ALL WORK SHALL CONFORM TO THE TECHNICAL SPECIFICATIONS, DETAILS, AND STANDARDS OF THE CITY OF TYBEE ISLAND AND ALL OTHER GOVERNING AGENCIES. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN THESE. LATEST REVISIONS OF ALL CODES, SPECIFICATIONS, ETC... SHALL BE USED.

2. ALL ELEVATIONS ARE BASED ON M.S.L. DATUM

3. NO CONSTRUCTION WORK SHALL BEGIN UNTIL THE COMPLETENESS AND ACCURACY OF THE HORIZONTAL CONTROL HAS BEEN VERIFIED BY THE CONTRACTOR AND ANY DISCREPANCIES FOUND ARE RESOLVED. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING AND REFERENCING THESE POINTS FOR USE DURING CONSTRUCTION AND ANY RE-ESTABLISHMENT OF CONTROL SHALL BE AT THE CONTRACTOR'S EXPENSE.

4. THE CONTRACTOR SHALL RUN A CLOSED LEVEL LOOP TO VERIFY THE COMPLETENESS AND ACCURACY OF THE BENCHMARKS. NO CONSTRUCTION WORK SHALL BEGIN UNTIL THE VERTICAL CONTROL HAS BEEN VERIFIED BY THE CONTRACTOR AND ANY DISCREPANCIES FOUND ARE RESOLVED.

5. LOCATION, ELEVATION, SIZE, ETC... OF THE EXISTING DRAINAGE, UTILITIES, ETC... SHOWN SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO COMMENCEMENT OF WORK. ADDITIONAL FEATURES MAY EXIST WHICH ARE NOT SHOWN ON THE PLANS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE LOCATION OF ALL EXISTING UTILITIES, DRAINAGE, ETC... PRIOR TO COMMENCEMENT OF WORK. THE CONTRACTOR SHALL USE COORDINATION WITH UTILITY COMPANIES, ELECTRONIC/MAGNETIC METHODS, HAND EXCAVATION AND ANY OTHER METHODS NECESSARY TO ACCOMPLISH THIS. ANY DISCOVERIES, DISCREPANCIES, CONFLICTS, ETC... SHALL BE REPORTED TO THE ENGINEER TO ALLOW FOR CONFLICTS TO BE RESOLVED PRIOR TO COMMENCEMENT OF WORK.

6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE ADJUSTMENT, RELOCATION, ETC... OF ANY UTILITIES (SUBSURFACE, POLE MOUNTED OR OTHERWISE) TO ACCOMPLISH THIS WORK. UNLESS STATED OTHERWISE. RELOCATION OF POWER POLES AND GUY WIRES IS THE RESPONSIBILITY OF THE OWNER. (TYP). ALL UTILITY GUY WIRES, POLES, ETC... REQUIRED TO BE RELOCATED SHALL BE COORDINATED BY THE CONTRACTOR

7. ALL AREAS DISTURBED BY THE CONTRACTOR SHALL BE RESTORED TO THEIR ORIGINAL CONDITION UNLESS OTHERWISE NOTED ON THE PLANS. ALL UNPAVED AREAS SHALL BE GRASSED UNLESS OTHER WISE SHOWN ON THE PLANS. ALL AREAS DISTURBED OUTSIDE OF PROJECT LIMITS WILL BE RESTORED UNDER THE DIRECTION & TO THE SATISFACTION OF ALL GOVERNING AUTHORITIES. (CITY OF TYBEE ISLAND, ETC...).

8. THE CONTRACTOR SHALL EXERCISE UTMOST CARE AND PRECAUTION TO PROTECT TREES AND PREVENT DAMAGE TO TREES, ROOTS, ECT. DURING CONSTRUCTION.

9. REFER TO BUILDING PLANS BY OTHERS FOR ALL BUILDING DIMENSIONS AND ALL OTHER BUILDING INFORMATION. ALL BUILDING DESIGN AND SUBMITTALS TO BE BY OTHERS.

10. THE CONTRACTOR SHALL OBTAIN A RIGHT-OF-WAY PERMIT FROM THE CITY OF TYBEE AND PERMITS, PERMISSION, ETC... FROM ALL OTHER ENTITIES, GOVERNING AUTHORITIES, ETC... OWNING ADJACENT EASEMENTS OR R.O.W'S PRIOR TO BEGINNING ANY CONSTRUCTION IN THE ADJACENT EASEMENTS OR RIGHT-OF-WAYS.

11. ALL EXISTING SERVICES, BUILDINGS, STRUCTURES, UTILITIES, CONVENIENCES, ETC... INCLUDING BUT NOT LIMITED TO, DRAINAGE, ACCESS, WATER, SEWER, FIRE PROTECTION, POWER, GAS, AND CABLE, SHALL BE UNINTERRUPTED BY THIS PROJECT. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO ASSURE THIS. THE CONTRACTOR SHALL SCHEDULE CONSTRUCTION AND UTILIZE BRACING, SHORING, WELL POINTS, ETC... AND ANY OTHER PROCEDURES REQUIRED TO ACHIEVE THIS. SHOULD USER'S ACCESS, USE, ETC.. OF THE AFOREMENTIONED BE ALTERED TO ALLOW THE COMPLETION OF THIS WORK, THE CONTRACTOR SHALL PROVIDE WRITTEN NOTICE TO ALL PROPERTY OWNERS AT LEAST TEN WORKING DAYS PRIOR TO ANY ALTERATION, INCONVENIENCE, ETC. TO THEIR USE, ACCESS, ETC...

12. WHERE NECESSARY FOR THE COMPLETION OF THE WORK, THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVAL AND REPLACEMENT OF LANDSCAPING, SIGNS, MAILBOXES, FENCES, ETC...

13. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING FOREIGN BORROW AND FOR THE OFF-SITE DISPOSAL OF MATERIAL AS NECESSARY TO THE COMPLETE THIS WORK. THIS COST SHALL BE INCLUDED IN THE GRADING PRICE.

14. THE CONTRACTOR (OR PROSPECTIVE CONTRACTOR) SHALL VISIT THE SITE AND OBSERVE SITE CONDITIONS. IF THE CONTRACTOR THEN HAS REASON TO SUSPECT UNUSUAL OR OTHER UNDOCUMENTED CONDITIONS, REQUIRING CORRECTION OR ADDITIONAL COST, SUCH AS UNSTABLE SUBSURFACE CONDITIONS, WRITTEN NOTIFICATION SHALL BE MADE TO THE ENGINEER AND OTHER OWNER'S REPRESENTATIVE(S).

15. EXISTING UNDERGROUND UTILITY LOCATIONS MAY CONFLICT WITH THE PROPOSED IMPROVEMENTS AND REQUIRE ADJUSTMENTS OF THOSE UTILITIES OR THE IMPROVEMENTS. ALL TIE-INS AND CONNECTIONS OFF-SITE AND AROUND THE PERIMETER OF THE PROJECT SHALL BE INSTALLED PRIOR TO THE INTERIOR INSTALLATIONS. ALL GRAVITY LINES SHALL BE INSTALLED UPGRADE (FROM THE LOWEST END TOWARDS THE END AT A HIGHER ELEVATION).

16. ANY AND ALL DEVIATIONS FROM OR MODIFICATIONS TO THESE PLANS SHALL REQUIRE THE APPROVAL OF THE ENGINEER AND ALL OTHER GOVERNING AUTHORITIES, AGENCIES, GOVERNMENTS, ETC...

17. ALL DIMENSIONS ARE TO FACE OF CURB, EDGE OF PAVEMENT OR OUTSIDE OF THE BUILDING UNLESS OTHERWISE NOTED. REFER TO BUILDING PLANS BY OTHERS FOR ALL DIMENSIONS AND OTHER BUILDING RELATED INFORMATION.

18. THE CONTRACTOR SHALL PROVIDE ACCESS, DURING AND AT THE COMPLETION OF THE PROJECT, TO ALL IMPROVEMENTS AND CHANGES TO BE FIELD VERIFIED, OBSERVED, INSPECTED, ETC.... BY THE OWNER'S ENGINEER OR SURVEYOR AND ALL GOVERNING AGENCIES.

19. ALL TRAFFIC SIGNAGE & STRIPING TO BE IN ACCORDANCE WITH THE LATEST EDITION OF THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" & ALL OTHER GOVERNING REGULATIONS, STANDARDS & CODES. ALL SIGN ORDERS SHALL BE REVIEWED AND APPROVED BY THE CITY OF TYBEE ISLAND & THE OWNER'S ENGINEER PRIOR TO THE OWNER PLACING THE ORDER.

20. EXCESS SUITABLE MATERIAL FROM GRADING IS TO BE USED FIRST AS BACKFILL FOR MUCKING. ADDITIONAL EXCESS SUITABLE MATERIAL AND MUCK ARE TO BE PLACED IN FILL AREAS SHOWN ON THE PLANS AND IN OTHER AREAS ON THE SITE AS DIRECTED BY THE ENGINEER. WHERE ROADWAY CONSTRUCTION AND LOT FILLING LEAVES AREAS ON A LOT NOT DRAINING, THE CONTRACTOR SHALL INSTALL DRAINAGE SWALES AT THAT LOT TO THE SATISFACTION OF THE ENGINEER. THE WORK SPECIFIED ABOVE SHALL BE CONSIDERED PART OF THE GRADING. THE FILL AREA WILL VARY AND IN PLACES REQUIRE FILL BEYOND THE RIGHT-OF-WAY LINE. THE FILL (ON SITE MATERIAL OR FOREIGN BORROW) BEYOND THE RIGHT-OF-WAY LINE AND GRADING IN THIS AREA SHALL BE INCLUDED IN THE LUMP SUM PRICE FOR GRADING.

21. ALL STREETS, RIGHTS-OF-WAY, EASEMENTS AND ANY SITES FOR PUBLIC USE AS NOTED ON THIS PLAN ARE TO BE DEDICATED FOR THE USE INTENDED.

STANDARD EROSION CONTROL NOTES:

1. THE ESCAPE OF SEDIMENT FROM THE SITE SHALL BE PREVENTED BY THE INSTALLATION OF EROSION AND SEDIMENT CONTROL MEASURES AND PRACTICES PRIOR TO, OR CONCURRENT WITH, LAND DISTURBING ACTIVITIES.

2. EROSION CONTROL MEASURES WILL BE MAINTAINED AT ALL TIMES. IF FULL IMPLEMENTATION OF THE APPROVED PLAN DOES NOT PROVIDE FOR EFFECTIVE EROSION CONTROL, ADDITIONAL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE IMPLEMENTED TO CONTROL OR TREAT THE SEDIMENT SOURCE.

3. ANY DISTURBED AREA LEFT EXPOSED FOR A PERIOD GREATER THAN 14 DAYS SHALL BE STABILIZED WITH MULCH OR TEMPORARY SEEDING.

4. THE PLAN DESIGNER HAS VISITED THE SITE PRIOR TO THE DESIGN OF THE EROSION AND SEDIMENT CONTROL PLANS.

5. SOIL EROSION AND SEDIMENT CONTROL PROCEDURES SHALL COMPLY WITH THE EROSION AND SEDIMENT ACT OF 1975. FOR EXPLANATION CONCERNING DETAILS AS SHOWN ON THESE PLANS, REFER TO "MANUAL STATE SOIL AND WATER CONSERVATION COMMITTEE OF GEORGIA. ALL ITEMS UNDER THE CATEGORY OF SOIL EROSION & SEDIMENT CONTROL SHALL BE PAID FOR IN THE LUMP SUM PRICE FOR GRADING.

6. ONLY DISTURB AREAS AS THEY ARE TO BE WORKED ON TO MINIMIZE AREAS OF UNSTABILIZED (DISTURBED) SURFACE. STABILIZE ALL DISTURBED AREAS UPON COMPLETION OF CONSTRUCTION IN THOSE AREAS OR WHEN NO WORK IS IMMEDIATELY PLANNED. SLOPES ARE EXPECTED TO BE STABILIZED IMMEDIATELY UPON DISTURBANCE DUE TO THE HIGH EROSION POTENTIAL. THIS SHALL BE ACCOMPLISHED BY BOTH TEMPORARY GRASSING DURING CONSTRUCTION AND PERMANENT GRASSING AT COMPLETION.

7. ANY SEDIMENTATION BASINS SHALL BE CONSTRUCTED IN CONJUNCTION WITH AND PRIOR TO ANY OTHER SITE WORK.

8. ALL GRADED AREAS SHALL BE GRASSED, LANDSCAPED OR OTHERWISE STABILIZED TO ENSURE PERMANENT STABILIZATION OF SOIL SURFACE.

9. ANY DEWATERING FOR EXCAVATION SHALL BE DISCHARGED INTO SUMPS TO ALLOW SEDIMENTATION TO OCCUR PRIOR TO RUNOFF LEAVING THE SITE.

10. THE CONTRACTOR WILL BE RESPONSIBLE FOR REMOVAL OF ALL TREES & VEGETATION REQUIRED FOR THE PROPOSED IMPROVEMENTS.

11. SOIL EROSION CONTROL DEVICES AND TREE PROTECTION FOR PRESERVED TREES MUST BE IN PLACE PRIOR TO CONSTRUCTION.

12. SILT FENCE TO REMAIN UNTIL PERMANENT GRASSING AND FINAL STABILIZATION HAS BEEN ESTABLISHED.

13. ANY DISTURBED AREA LEFT IDLE ABOVE THE SLOPES FOR A PERIOD GREATER THAN 7 DAYS SHALL BE STABILIZED WITH TEMPORARY SEEDING; DISTURBED AREAS IDLE 30 DAYS SHALL BE STABILIZED WITH PERMANENT VEGETATION.

14. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSPECTED AT LEAST WEEKLY, AFTER EACH RAIN, AND REPAIRED AS NECESSARY.

15. ADDITIONAL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSTALLED IF DETERMINED NECESSARY BY ON-SITE INSPECTION.

GEORGIA REGISTERED No. 14912 PROFESSIONAL ENGINEER DOWNER K. DAVIS, JR.

NOTES

A PORTION OF POLK STREET SOUTH OF U.S. HIGHWAY 80, LOCATED IN GARDEN WARD, TYBEE ISLAND, GEORGIA.

FOR

THE CITY OF TYBEE ISLAND AND MR. & MRS. MICHAEL LEONARD

DAVIS ENGINEERING, INC.
TEL: 912-355-7262 FAX: 912-352-7787
E-MAIL: DAVISENGINC@GMAIL.COM

DRAWN: D.S.
DESIGN: D.D.
JOB NO: 2060700D
4-22-21
sheet: C6

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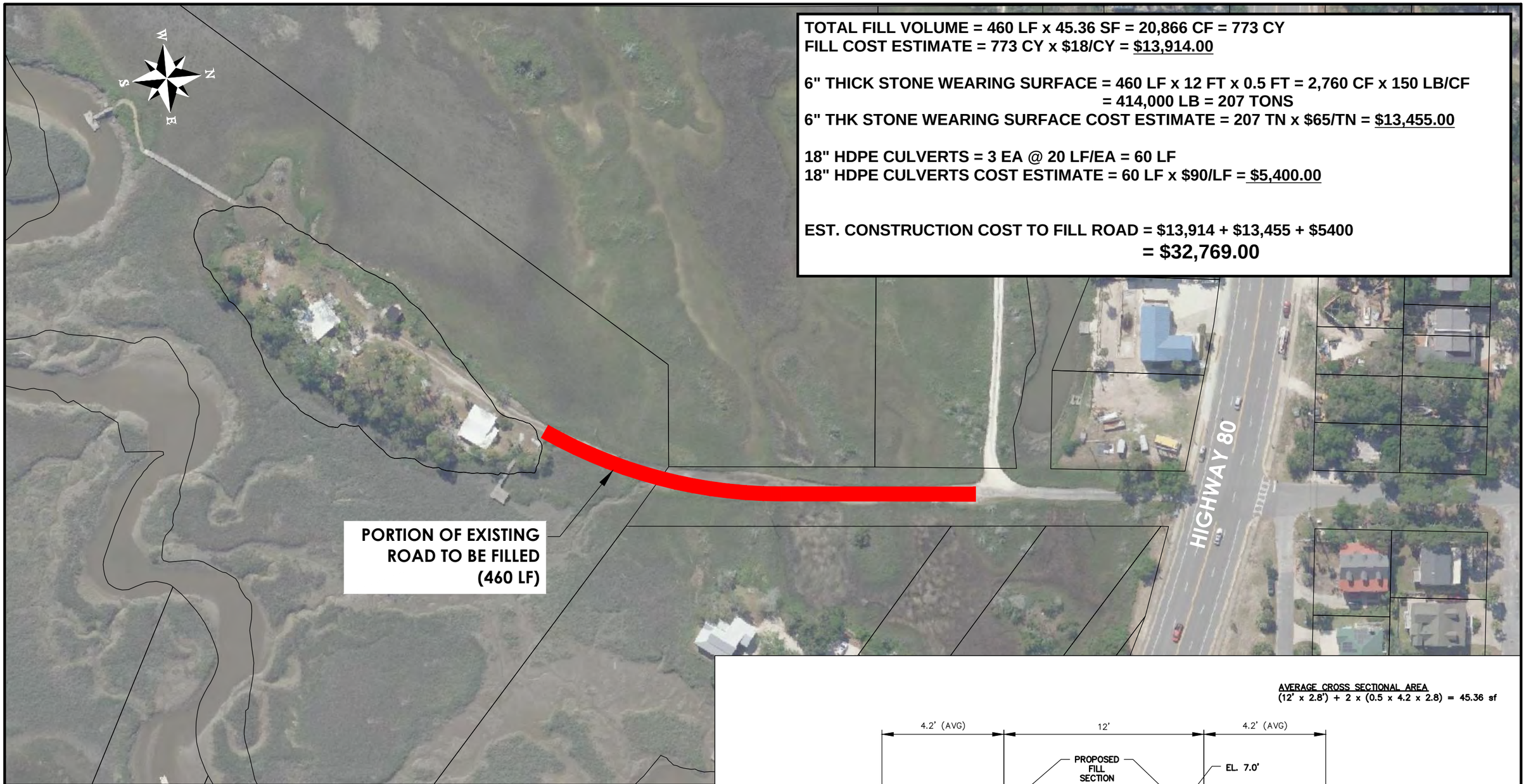
ATTACHMENT D

Thomas & Hutton Bridge Cost Estimates



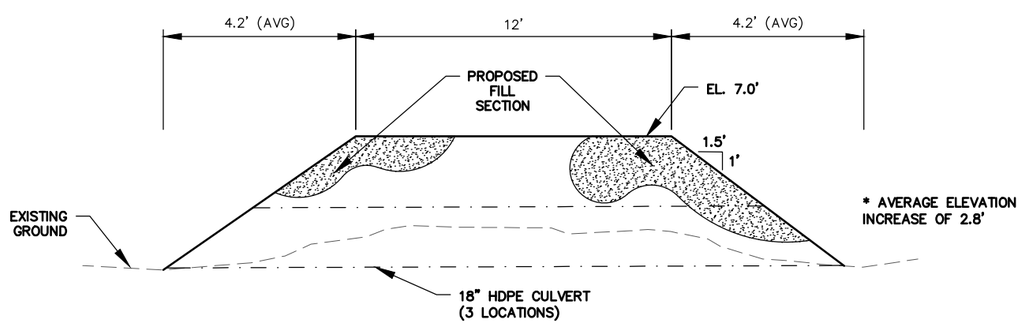
TOTAL FILL VOLUME = 460 LF x 45.36 SF = 20,866 CF = 773 CY
FILL COST ESTIMATE = 773 CY x $18/CY = $13,914.00

6" THICK STONE WEARING SURFACE = 460 LF x 12 FT x 0.5 FT = 2,760 CF x 150 LB/CF
= 414,000 LB = 207 TONS
6" THK STONE WEARING SURFACE COST ESTIMATE = 207 TN x $65/TN = $13,455.00

18" HDPE CULVERTS = 3 EA @ 20 LF/EA = 60 LF
18" HDPE CULVERTS COST ESTIMATE = 60 LF x $90/LF = $5,400.00

EST. CONSTRUCTION COST TO FILL ROAD = $13,914 + $13,455 + $5400
= $32,769.00

AVERAGE CROSS SECTIONAL AREA
(12' x 2.8') + 2 x (0.5 x 4.2 x 2.8) = 45.36 sf



POLK ST. MAINTENANCE PERMIT

SHEET NAME:
FILL SECTION

CLIENT:
RESOURCE + LAND CONSULTANTS

LOCATION: TYBEE ISLAND, GA
DATE: 02/19/2021 DRAWN BY: KHT SHEET: EX1
JOB NUMBER: J-29077 REVIEWED BY: JVG SCALE: 1" = 100'

THOMAS & HUTTON
50 Park of Commerce Way
Savannah, GA 31405 • 912.234.5300
www.thomasandhutton.com

CONCRETE BRIDGE OPTION 1

UNIT COST = $250 / SF

AREA OF BRIDGE = 460 LF X 15 FT = 6,900 SF

EST. BRIDGE COST = $250/SF X 6,900 SF
= $1,725,000.00

460 LF 15' WIDE BRIDGE

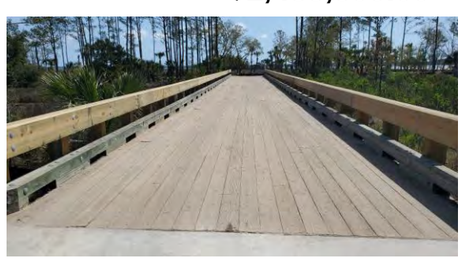
HIGHWAY 80

TIMBER BRIDGE OPTION 1

UNIT COST = $215 / SF

AREA OF BRIDGE = 460 LF X 15 FT = 6,900 SF

EST. BRIDGE COST = $215/SF X 6,900 SF
= $1,483,500.00



POLK ST. MAINTENANCE PERMIT

SHEET NAME:
BRIDGE OPTION #1

CLIENT:
RESOURCE + LAND CONSULTANTS

LOCATION: TYBEE ISLAND, GA
DATE: 02/19/2021 DRAWN BY: KHT SHEET: EX2
JOB NUMBER: J-29077 REVIEWED BY: JVG SCALE: 1" = 100'

THOMAS & HUTTON
50 Park of Commerce Way
Savannah, GA 31405 • 912.234.5300
www.thomasandhutton.com

CONCRETE BRIDGE OPTION 2

UNIT COST = $325 / SF **AREA OF BRIDGE = (111' + 106' + 102') X 15 FT = 4,785 SF**

EST. BRIDGE COST = $325/SF X 4,785 SF
= $1,555,125.00

106 LF 15' WIDE BRIDGE

111 LF 15' WIDE BRIDGE

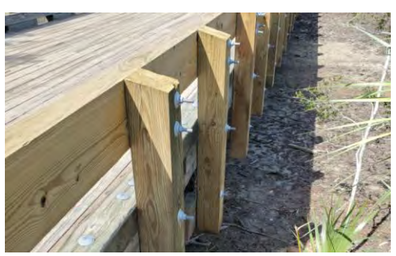
102 LF 15' WIDE BRIDGE

HIGHWAY 80

TIMBER BRIDGE OPTION 2

UNIT COST = $275 / SF **AREA OF BRIDGE = (111' + 106' + 102') X 15 FT = 4,785 SF**

EST. BRIDGE COST = $275/SF X 4,785 SF
= $1,315,875.00



POLK ST. MAINTENANCE PERMIT

SHEET NAME:
BRIDGE OPTION #2

CLIENT:
RESOURCE + LAND CONSULTANTS

LOCATION: TYBEE ISLAND, GA
DATE: 02/19/2021 DRAWN BY: KHT SHEET: EX3
JOB NUMBER: J-29077 REVIEWED BY: JVG SCALE: 1" = 100'

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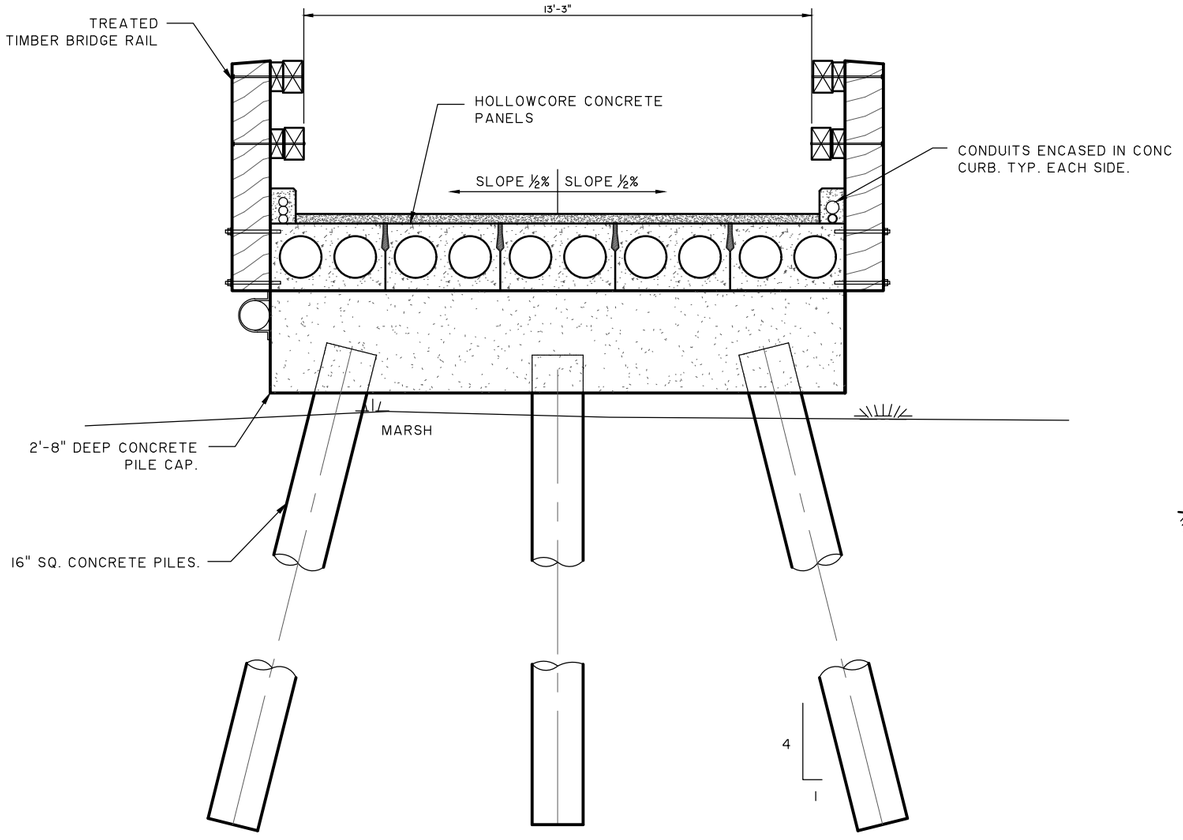
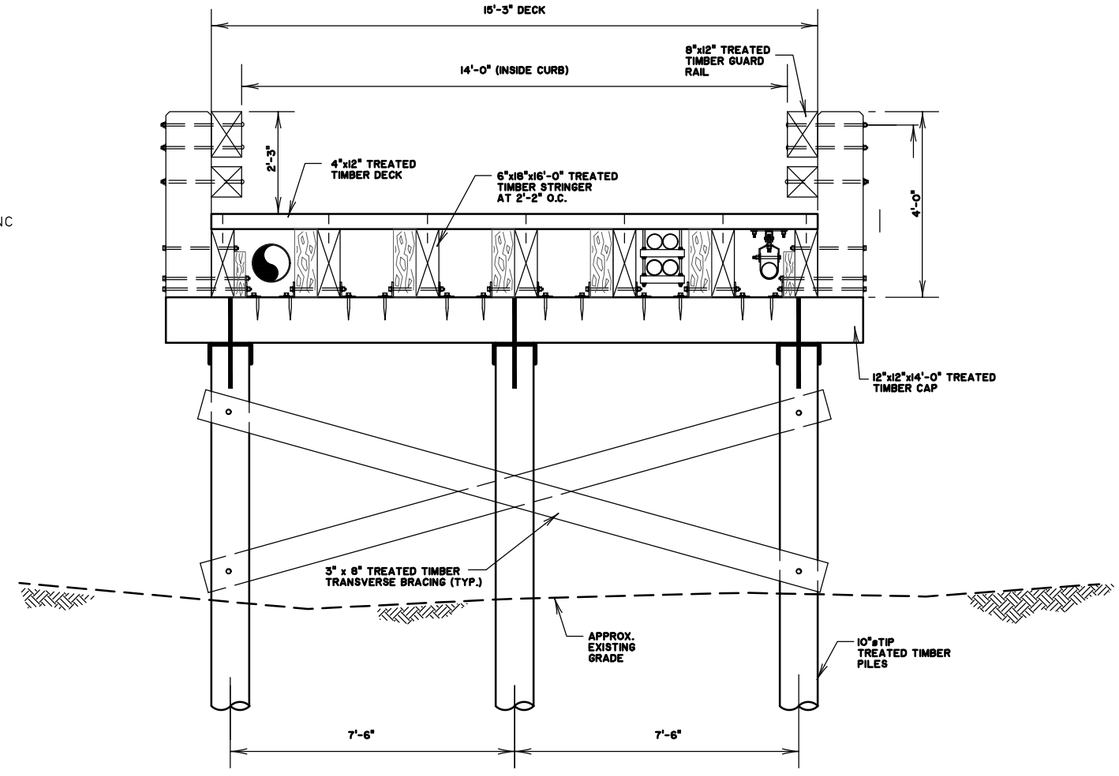


1 EX4 CONCRETE BRIDGE SECTION

SCALE: NOT TO SCALE



2 EX4 TIMBER BRIDGE SECTION

SCALE: NOT TO SCALE

POLK ST. MAINTENANCE PERMIT

SHEET NAME:
BRIDGE TYPICAL SECTIONS

CLIENT:
RESOURCE + LAND CONSULTANTS

LOCATION: TYBEE ISLAND, GA
DATE: 02/19/2021 DRAWN BY: KHT SHEET: EX4
JOB NUMBER: J-29077 REVIEWED BY: JVG SCALE: NTS

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